Easergy MiCOM P139

Feeder Management and Bay Control

P139/EN M/R-83-A

Version P139 -315 -423/424/425 -657

Technical Manual

Volume 1 of 2

General Note on the PDF Version of this Technical Manual

All entries in the Table of Contents and all cross-references to other sections, figures etc. in green letters are hyperlinks, i.e. by a single mouse click on the reference one can navigate directly to the referenced part of the manual.

In the Adobe Reader (or the Acrobat Pro), one can return back to the previous view by using the menu point *View / Page Navigation / Previous View* (keyboard shortcut: ALT + Left cursor key). (It might be necessary to do this several times, if the view at the target location has also been changed (e.g. by scrolling or changing the zoom setting).

WARNING

When electrical equipment is in operation dangerous voltage will be present in certain parts of the equipment. Failure to observe warning notices, incorrect use or improper use may endanger personnel and equipment and cause personal injury or physical damage.

Before working in the terminal strip area, the P139 must be isolated. Where stranded conductors are used, insulated crimped wire end ferrules must be employed.

The signals MAIN: Blocked/faulty and SFMON: Warning (LED) (permanently assigned to the LEDs labeled OUT OF SERVICE and ALARM) can be assigned to output relays to indicate the health of the P139. Schneider Electric strongly recommends that these output relays are hardwired into the substation's automation system, for alarm purposes.

Any modifications to this P139 must be in accordance with the manual. If any other modification is made without the express permission of Schneider Electric, it will invalidate the warranty, and may render the product unsafe.

Proper and safe operation of this P139 depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing.

For this reason only qualified personnel may work on or operate this P139.

The User should be familiar with the warnings in the Safety Guide (SFTY/4LM/J11 or later version), with the warnings in Chapter 5, (p. 5-1), Chapter 10, (p. 10-1), Chapter 11, (p. 11-1) and Chapter 12, (p. 12-1) and with the content of Chapter 14, (p. 14-1), before working on the equipment. If the warnings are disregarded, it will invalidate the warranty, and may render the product unsafe.

Installation of the DHMI:

A protective conductor (ground/earth) of at least 1.5 mm² (US: AWG14 or thicker) must be connected to the DHMI protective conductor terminal to link the DHMI and the main relay case; these must be located within the same substation.

To avoid the risk of electric shock the DHMI communication cable must not be in contact with hazardous live parts.

The DHMI communication cable must not be routed or placed alongside high-voltage cables or connections. Currents can be induced in the cable which may result in electromagnetic interference.

Qualified Personnel

are individuals who

- are familiar with the installation, commissioning and operation of the P139 and of the system to which it is being connected;
- are able to perform switching operations in accordance with safety engineering standards and are authorized to energize and de-energize equipment and to isolate, ground and label it;
- are trained in the care and use of safety apparatus in accordance with safety engineering standards;
- are trained in emergency procedures (first aid).

Note

This operating manual gives instructions for installation, commissioning and operation of the P139. However, the manual cannot cover all conceivable circumstances or include detailed information on all topics. In the event of questions or specific problems, do not take any action without proper authorization. Contact the appropriate technical sales office of Schneider Electric and request the necessary information.

Any agreements, commitments, and legal relationships and any obligations on the part of Schneider Electric, including settlement of warranties, result solely from the applicable purchase contract, which is not affected by the contents of the operating manual.

Changes after going to press

Table of Contents

1 Application and Scope

1.1 Overview

The P139 time-overcurrent protection and control device is a one-box solution for protection and control.

Fig. 1-1: P139 in a 40 TE sized case.

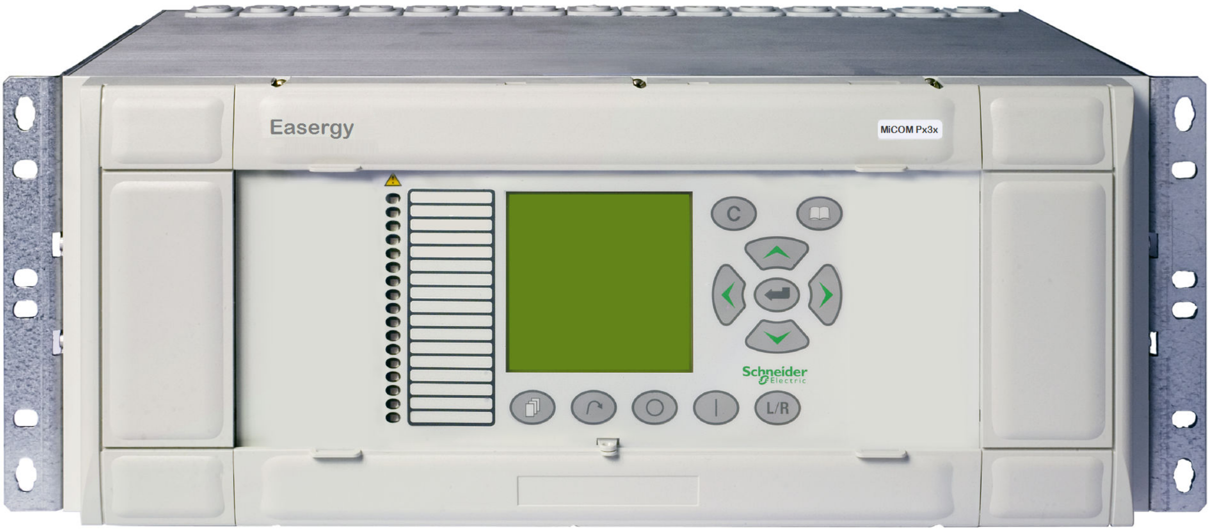


Fig. 1-2: P139 in a 84 TE sized case.

The protection functions available in the P139 provide selective short-circuit protection, ground fault protection, and overload protection in medium- and high-voltage systems.

The systems can be operated as impedance-grounded, resonant-grounded, grounded-neutral or isolated-neutral systems. The multitude of protection functions incorporated into the P139 enable the user to cover a wide range of applications in the protection of cable and line sections, transformers and motors. The relevant protection parameters can be stored in four independent parameter subsets in order to adapt the protection device to different operating and power system management conditions.

The control functions are designed for the control of up to six electrically operated switchgear units equipped with plant status signaling and located in the bay of a medium-voltage substation (or a high-voltage station with basic topology). The P139 has almost 300 predefined Bay Types stored for selection and it is also possible to load user-defined bay templates.

The number of external auxiliary devices required is largely minimized by the integration of binary signal inputs operating from any auxiliary voltage, and versatile relay output contacts, by the direct connection option for current and voltage transformers, and by the comprehensive interlocking capabilities. This simplifies the handling of switch bay protection and control technology from planning to commission.

During operation, the user-friendly interface makes it easy to set the device parameters and allows safe operation of the substation by preventing non-permissible switching operations.

The P139 is equipped with a large number of protection and control functions. These can be individually configured and cancelled.

These features give the user the means to adapt the P139 to the protection and control capacity required in a specific application.

The powerful programmable logic provided by the protection device also makes it possible to accommodate special applications.

Protection functions				P139	
ANSI	**IEC 61850**	**Function group**	**Function**	**w/o VTs**	**with VTs**
50/ 51 P/ Q/ N	DtpPhs- / DtpEft- / DtpNgsPTOCx	DTOC	Definite-time overcurrent protection, four stages, phase selective (includes negative-sequence overcurrent protection)	✓	✓
51 P/ Q/ N	ItpPhs- / ItpEft- / ItpNgsPTOCx	(IDMT1, IDMT2)	Inverse-time overcurrent protection, one stage, phase selective (includes negative-sequence overcurrent protection)	✓	✓
67	DtpPhs- / DtpResRDIRx	SCDD	Short-circuit direction determination		✓
50/ 27	PSOF1	SOTF	Switch on to fault protection	✓	✓
85	PSCH1	PSIG	Protective signaling	✓	✓
79	RREC1	ARC	Auto-reclosing control (three-pole)	✓	✓
25	RSYN1	ASC	Automatic synchronism check		(✓)
67W/ YN	PSDE1	GFDSS	Ground fault direction determination using steady-state values or admittance evaluation		✓
	PTEF1	TGFD	Transient ground fault direction determination		(✓)
37/ 48/ 49/ 49LR/ 50S/ 66	MotPMRI1 / MotPMSS1 / MotPTTR1 / ZMOT1	MP	Motor protection	✓	✓
49	ThmPTTR1	THERM	Thermal overload protection Coolant temperature measuring (using MEASI)	✓ (✓)	✓ (✓)
46	UbpNgsPTOCx	I2>	Unbalance protection	✓	✓
27/ 59/ 47 P/ Q/ N	VtpPhs- / VtpNgs- / VtpPss- / VtpRefPTyVx	V<>	Time-Voltage Protection		✓
81	FrqPTyFx	f<>	Frequency protection		✓
81P	PfPTUF1 / PfPDOP1 / PfPTOV1	Pf<	Active power controlled underfrequency load shedding protection		✓
32/ 37	PdpAct- / PdpRealPDyPx	P<>	Power directional protection		✓

Protection functions				P139	
ANSI	**IEC 61850**	**Function group**	**Function**	**w/o VTs**	**with VTs**
32V	QvPDOP1 / QvPIOC1 / QvPTUV1 / QvPTRC1 / QvPTRC2	QV	Voltage controlled directional reactive power protection		✓
50/ 62 BF	RBRFx	CBF	Circuit breaker failure protection	✓	✓
	XCBR1	CBM	Circuit breaker supervision	✓	✓
30/ 74	AlmGGIO1	MCMON	Measuring-circuit monitoring	✓	✓
		LIMIT	Limit value monitoring	✓	✓
	PHAR1	MAIN	Inrush stabilization	✓	✓
LGC	PloGGIOx	LOGIC / LOG_2	Programmable logic	✓	✓

Control functions				P139
ANSI	**IEC 61850**	**Function group**	**Function**	
52	XCBRx / XSWIx / CSWIx	DEV01 to DEV10	Switchgear control and monitoring with Mimic display	3/(10)
		TPD1 to TPD4	Virtual devices with three position characteristic	4
	CtlGGIO2	CMD_1	Single-pole commands	26
	CtlGGIO1	SIG_1	Single-pole signals	64
LGC		ILOCK	Interlocking logic	32
	CntGGIO1	COUNT	Binary counter	4
		TIMER	Timer	4

Communication functions				P139
ANSI	**IEC 61850**	**Function group**	**Function**	
16S		COMM1, COMM2	2 communication interfaces serial, RS 422 / 485 or fiber optic	(✓)
CLK		IRIGB	Time synchronization IRIG-B	(✓)
		COMM3	InterMiCOM protective interface	(✓)
16E		IEC	Communication interface Ethernet	(✓)
16E	GosGGIOx	GOOSE	IEC 61850	(✓)

Measured value functions, analog inputs and outputs				P139
ANSI	**IEC 61850**	**Function group**	**Function**	
	Mmuxxx		Measuring	✓
26	RtdGGIO1 IdcGGIO1	MEASI	RTD input Measuring data input 20 mA, one settable input value	(✓) (✓)
		MEASO	Measuring data output 20 mA, two settable output values	(✓)

Miscellaneous functions				P139
ANSI	**IEC 61850**	**Function group**	**Function**	
	LLN0.SGCB	PSS	Parameter subset selection	✓
	PTRCx / RDRE1	FT_RC	Fault recording	✓

“w/o VTs” = P139 without voltage transformers (ordering option).
“with VTs” = P139 with voltage transformers (ordering option).
✓ = Standard; (✓) = Ordering option.

For a list of all available function groups see the Appendix.

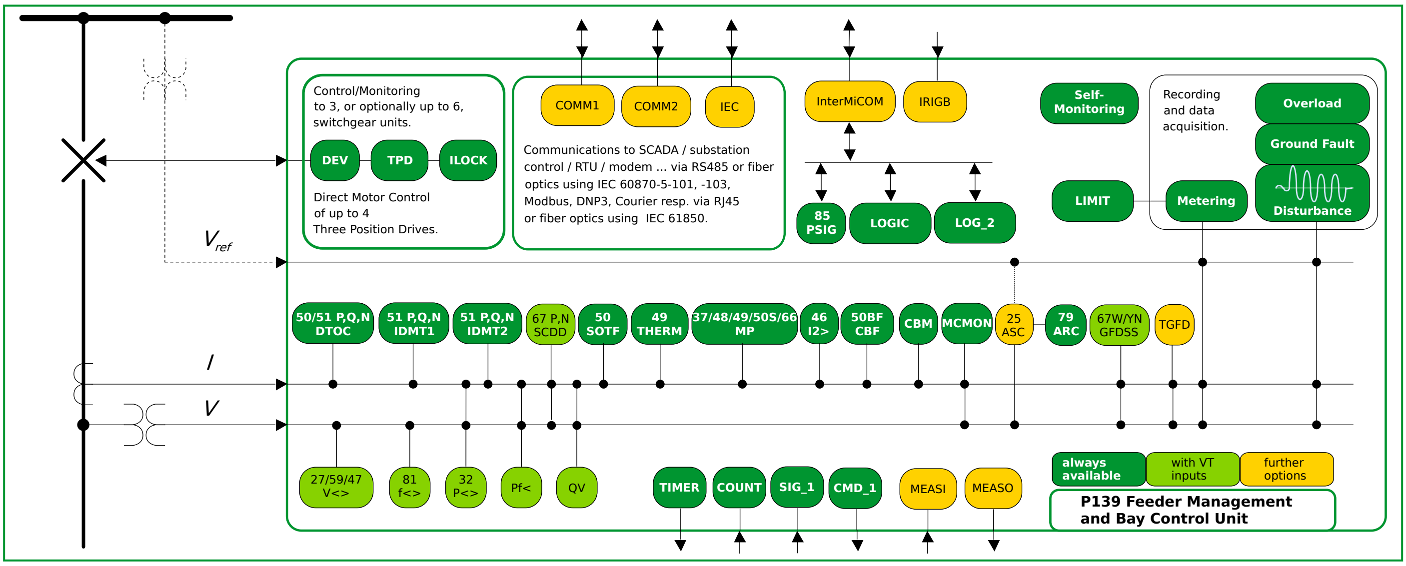


Fig. 1-3: Functional diagram.

1.2 General Functions

Functions listed in the tables above are self-contained function groups and can be individually configured or de-configured according to the specific application requirements. Unused or cancelled function groups are hidden to the user, thus simplifying the menu.

This concept provides a large choice of functions and makes wide-ranging application of the protection device possible, with just one model version. On the other hand simple and clear parameter settings can be made.

In this way the protection and control functions can be included in or excluded from the configuration; they are arranged on the branch “General Functions” of the menu tree.

1.3 Control Functions

Switchgear contact positions are acquired by binary signal inputs, that can signal and process a maximum of 10 two-pole contact positions. Output relays are available to control a maximum of 6 two-pole switchgear units.

The double-command lockout feature is a fixed part of the integrated control logic. All further commands will be refused during control command execution.

Up to 64 operation signals can be acquired though binary signal inputs and they are processed according to their primary significance (e.g. CB readiness). Each binary signal input for signals from switchgear and single-pole operations can have the debouncing and chatter suppression from eight groups assigned, for which the debouncing and chatter time can be individually set.

For the acquisition of binary counters, up to four binary inputs may be configured. The contents of these counters are transmitted cyclically via the serial link. The counter values are stored so that they are not lost if the supply voltage should fail. Counting continues from the stored value as the initial value when the P139 restarts.

The P139 sends control signals only after it has checked the readiness and validity to carry out such commands, and it then monitors the operating time of the switchgear units. If the protection device detects that a switchgear unit has failed, it will signal this information (e.g. by configuration to a LED indicator).

Before a switching command is issued the interlocking logic on the P139 checks if this new switchgear status corresponds with the bay and station topology. The interlocking logic is stored in form of bay interlocking, with and without station interlocking, for each Bay Panel in the default setting. The interlocking conditions can be adapted to the actual bay and station topology. Interlocking display and operation correspond to the programmable logic.

When the P139 is included in a station control system the local interlocking can easily be integrated with the overall system interlocking.

When the P139 is not included in a station control system then bay interlocking is applied without station interlocking.

If the bay and station topology are found to be valid the switching command is issued. If a non-permissible status would result from the switching action then the issuing of such a switching command is refused and an alarm is issued.

If not all binary outputs are required by the bay type then these vacant binary outputs can be freely utilized for other purposes.

Besides issuing switching commands binary outputs may also be triggered by persistent commands.

1.4 Global Functions

In addition to the listed features, and extensive self-monitoring, the P139 is equipped with the following global functions:

- Parameter subset selection
- System measurements to support the user during commissioning, testing and operation
- Operating data recording

  (time-tagged event logging)
- Overload data acquisition
- Overload recording

  (time-tagged event logging)
- Ground fault data acquisition
- Ground fault recording

  (time-tagged event logging)
- Fault recording

  (time-tagged event logging together with fault value recording of the three phase currents, the residual current as well as the three phase-to-ground voltages and the neutral-point displacement voltage).

1.5 Design

The P139 is modular in design. The plug-in modules are housed in a robust aluminum case and electrically interconnected via one analog p/c board and one digital p/c board.

1.6 Inputs and Outputs

The following inputs and outputs are available with the basic device:

- 4 current-measuring inputs
- 14 output relays, freely-configurable, including 6 dedicated to control 3 switchgear units
- 10 binary signal inputs (opto-coupler) including 6 inputs dedicated to monitor 3 switchgear units

Optionally available are:

- 4 or 5 voltage measuring inputs
- additional binary module X(6I 6O) to monitor and control 3 additional switchgear units
- additional binary module X(6O) or X(6I 3O)
- one or two binary modules X(24I) with additional binary signal inputs with user-configurable function assignment

With the maximum number of binary signal inputs and output relays fitted, 10 switchgear units can be controlled and 6 of these can be 2pole controlled by using pre-defined standard bay-types.

The nominal currents and nominal voltages of the standard measuring inputs can be set.

The nominal voltage range of the binary signal inputs (opto-coupler) is 24 to 250 V DC. As an option binary signal input modules with a higher operate threshold are available.

The auxiliary voltage input for the power supply is also designed for an extended range. The nominal voltage ranges are 60 to 250 V DC and 100 to 230 V AC. As an option there is a variant available for the lower nominal voltage range 24 V to 60 V DC.

All output relays can be utilized for signaling and command purposes.

The optional (up to 10) inputs for resistance thermometers (9 on the temperature p/c board, 1 on the analog module Y(4I)) are lead-compensated and balanced.

The optional 0 to 20 mA input provides open-circuit and overload monitoring, zero suppression defined by a setting, plus the option of linearizing the input variable via 20 adjustable interpolation points.

Two selectable measured variables (cyclically updated measured operating data and stored measured fault data) can be output as a burden-independent direct current via the two optional 0 to 20 mA outputs. The characteristics are defined by 3 adjustable interpolation points allowing a minimum output current (4 mA, for example) for slave-side open-circuit monitoring, knee-point definition for fine scaling, and a limitation to lower nominal currents (10 mA, for example). Where sufficient output relays are available, a selectable measured variable can be output in BCD-coded form by contacts.

1.7 Control and Display

- Local control panel with LC-display
  (16 lines of 21 characters each with a resolution of 128 x 128 pixels)
- 17 LED indicators,
  12 with user-definable functional assignment
- PC interface
- Communication interfaces (optional)

1.8 Information Interfaces

Information is exchanged through the local control panel, the PC interface, or two optional communication interfaces (channel 1 and channel 2).

Using the first channel of the communication interfaces (COMM1), the P139 can be wired either to the substation control system or to a telecontrol system. This channel is optionally available with a switchable protocol (per IEC 60870-5-103, IEC 870-5-101, DNP 3.0, MODBUS or Courier).

The second communication interface (COMM2, communication protocol per IEC 60870-5-103 only) is designed for remote control.

As an order option, there is an Ethernet interface for communication per IEC 61850 available instead of channel 1.

External clock synchronization can be accomplished via one of the communication protocols or by using the optional IRIG-B input.

A direct link to another protection device (out of the platform Easergy MiCOM 30) can be set up by applying the optional InterMiCOM interface (COMM3).

2 Technical Data

2.1 Conformity

Notice

Applicable to P139, version -315 -423/424/425 -657.

Declaration of Conformity

The product designated “P139 Feeder Management and Bay Control” has been designed and manufactured in conformance with the European standards EN 60255-26 and EN 60255-27 and with the “EMC Directive” and the “Low Voltage Directive” issued by the Council of the European Community.

2.2 General Data

2.2.1 General Device Data

Design

- Surface-mounted case suitable for wall installation, or
- Flush-mounted case for 19″ cabinets and for control panels.

Installation Position

- Vertical ± 30°.

Degree of Protection

Per DIN VDE 0470 and EN 60529 or IEC 529.

- IP 52 for the front panel.
- Flush-mounted case:
  - IP 50 for the case (excluding the rear connection area)
  - IP 20 for the rear connection area, pin-terminal connection
  - IP 10 for the rear connection area, ring-terminal connection
- Surface-mounted case:
  - IP 50 for the case
  - IP 50 for the fully enclosed connection area with the supplied rubber grommets fitted

Weight

- 40 TE case: Approx. 7 kg
- 84 TE case: Approx. 11 kg

Dimensions and Connections

See dimensional drawings (Section 4.2, (p. 4-4)), and the location and terminal connection diagrams (Section 5.7, (p. 5-27)).

Terminals

PC interface (X6)

- EIA RS232 (DIN 41652) connector, type D-Sub, 9-pin

Communication interfaces COMM1 to COMM3

- Fiber (X7, X8 and X31, X32)
  - F-SMA optical fiber connection per IEC 60874-2 (for plastic fibers), or
  - optical fiber connection BFOC-ST® connector 2.5 per IEC 60874-10-1 (for glass fibers).

    (ST® is a registered trademark of AT&T Lightguide Cable Connectors.)
- Wire leads (X9, X10 and X33)
  - M2 threaded terminal ends for wire cross-sections up to 1.5 mm².
- RS232 (X34) (for COMM3 / InterMiCOM only)
  - EIA RS232 (DIN 41652) connector, type D-Sub, 9-pin.
- IRIG-B Interface (X11)
  - BNC plug

Communication interface IEC 61850

- Fiber (X7, X8)
  - optical fiber connection BFOC-ST® connector 2.5 per IEC 60874-10 (for glass fibers).

    (ST® is a registered trademark of AT&T Lightguide Cable Connectors.)
- Fiber (X13)
  - SC connector per IEC 60874-14-4 (for glass fibers)
- Wire leads (X12)
  - RJ45 connector per ISO/IEC 8877.

Current measuring inputs (conventional inputs)

- Threaded terminal ends, pin-type cable lugs: M5, self-centering with cage clamp to protect conductor cross-sections ≤ 4 mm², or:
- Threaded terminal, ring-terminal connection: M4.

Other inputs and outputs

- Threaded terminal ends, pin-type cable lugs: M3, self-centering with cage clamp to protect conductor cross-sections 0.2 to 2.5 mm², or:
- Threaded terminal ends, ring-type cable lugs: M4.

Creepage Distances and Clearances

- Per EN 60255-27.
- Pollution degree 3, working voltage 250 V,
- overvoltage category III, impulse test voltage 5 kV.

2.3 Tests

2.3.1 Type Tests

Type Tests

All tests per EN 60255-26.

2.3.1.1 Electromagnetic Compatibility (EMC)

Interference Suppression

Per EN 55022 or IEC CISPR 22, Class A.

1 MHz Burst Disturbance Test

Per EN 60255-22-1, Class III.

- Common-mode test voltage: 2.5 kV.
- Differential test voltage: 1.0 kV.
- Test duration: > 2 s.
- Source impedance: 200 Ω.

Immunity to Electrostatic Discharge

Per EN 60255-22-2 and IEC 60255-22-2, severity level 4.

Contact discharge

- Single discharges: > 10.
- Holding time: > 5 s.
- Test voltage: 8 kV.
- Test generator: 50 to 100 MΩ, 150 pF / 330 Ω.

Immunity to Radiated Electromagnetic Energy

Per EN 61000-4-3 and ENV 50204, severity level 3.

- Antenna distance to tested device: > 1 m on all sides.
- Test field strength, frequency band 80 to 1000 MHz: 10 V / m.
- Test using AM: 1 kHz / 80 %.
- Single test at 900 MHz: AM 200 Hz / 100%.

Electrical Fast Transient or Burst Requirements

Per EN 61000-4-4 and IEC 60255-22-4, severity levels 3 and 4.

- Rise time of one pulse: 5 ns.
- Impulse duration (50% value): 50 ns.
- Amplitude: 2 kV / 1 kV or 4 kV / 2 kV.
- Burst duration:15 ms.
- Burst period: 300 ms.
- Burst frequency: 5 kHz.
- Source impedance: 50 Ω.

Power Frequency Immunity

Per IEC 60255-22-7, Class A:

Phase-to-phase

- RMS value 150 V.
- Coupling resistance 100 Ω.
- Coupling capacitor 0.1 µF, for 10 s.

Phase-to-ground

- RMS value 300 V.
- Coupling resistance 220 Ω.
- Coupling capacitor 0.47 µF, for 10 s.

To comply with this standard, it is suggested to set the parameter (010 220) INP: Filter to *6 [steps]*.

Current/Voltage Surge Immunity Test

Per EN 61000-4-5 and EN 60255-22-5, insulation class 4.

Testing of circuits for power supply and asymmetrical or symmetrical lines.

- Open-circuit voltage, front time / time to half-value: 1.2 / 50 µs.
- Short-circuit current, front time / time to half-value: 8 / 20 µs.
- Amplitude: 4 / 2 kV.
- Pulse frequency: > 5 / min.
- Source impedance: 12 / 42 Ω.

Immunity to Conducted Disturbances Induced by Radio Frequency Fields

Per EN 61000-4-6 and EN 60255-22-6, severity level 3.

- Test voltage: 10 V.

Power Frequency Magnetic Field Immunity

Per EN 61000-4-8 or IEC 61000-4-8, severity level 4.

- Test frequency: 50 Hz
- Test field strength: 30 A / m.

Alternating Component (Ripple) in DC Auxiliary Energizing Quantity

Per EN 60255-11.

- 12 %.

2.3.1.2 Insulation

Voltage Test

Per EN 60255-27.

- 2 kV AC, 60 s

Only direct voltage (2.8 kV DC) must be used for the voltage test on the power supply inputs. The PC interface must not be subjected to the voltage test.

Impulse Voltage Withstand Test

Per EN 60255-27.

- Front time: 1.2 µs
- Time to half-value: 50 µs
- Peak value: 5 kV
- Source impedance: 500 Ω

2.3.1.3 Environmental tests

Temperature Stability Test

Per IEC 60068-2-1

- -25°C (-13°F) storage (96 hours)
- -40°C (-40°F) operation (96 hours)

Per IEC 60068-2-2

- +85°C (185°F) storage (96 hours)
- +85°C (185°F) operation (96 hours)

Per IEC 60068-2-14

- Change of temperature, 5 cycles, 1°C / min rate of change

Ambient Humidity Range Test

Per IEC 60068-2-3

- 56 days at ≤ 93% relative humidity and 40°C (104°F)

Per IEC 60068-2-30

- Damp heat, cyclic (12 + 12 hours)
  93 % relative humidity, +25°C ... +55°C (77°F ... 131°F)

Corrosive Environment Tests

Per IEC 60068-2-60: 1995, Part 2, Test Ke, Method (class) 3

Industrial corrosive environment/ poor environmental control, mixed gas flow test.

- 21 days at 75% relative humidity and 30°C (86°F) with exposure to elevated concentrations of H_2S, NO_2, Cl_2 and SO_2.

2.3.1.4 Mechanical Robustness 1

Applicable to the following case variants:

- Flush mounted case, flush-mounting method 1 (without angle brackets and frame)

Vibration Test

Per EN 60255-21-1 or IEC 60255-21-1, test severity class 1.

Frequency range in operation

- 10 to 60 Hz, 0.035 mm, and
- 60 to 150 Hz, 0.5 g

Frequency range during transport

- 10 to 150 Hz, 1 g

Shock Response and Withstand Test, Bump Test

Per EN 60255-21-2 or IEC 60255-21-2.

Acceleration and pulse duration:

- Shock Response tests are carried out to verify full operability (during operation), test severity class 1:
  5 g for 11 ms.
- Shock Withstand tests are carried out to verify the endurance (during transport), test severity class 1:
  15 g for 11 ms.

Seismic Test

Per EN 60255-21-3 or IEC 60255-21-3, test procedure A, class 1.

Frequency range

- 5 to 8 Hz, 3.5 mm / 1.5 mm, 8 to 35 Hz, 10 / 5 m/s², 3 x 1 cycle.

2.3.1.5 Mechanical Robustness 2

Applicable to the following case variants:

- Flush mounted case, flush-mounting method 2 (with angle brackets and frame)
- Surface-mounted case

Vibration Test

Per EN 60255-21-1 or IEC 60255-21-1, test severity class 2.

Frequency range in operation

- 10 to 60 Hz, 0.075 mm, and
- 60 to 150 Hz, 1.0 g

Frequency range during transport

- 10 to 150 Hz, 2 g

Shock Response and Withstand Test, Bump Test

Per EN 60255-21-2 or IEC 60255-21-2.

Acceleration and pulse duration:

- Shock Response tests are carried out to verify full operability (during operation), test severity class 2:

  10 g for 11 ms.
- Shock Withstand tests are carried out to verify the endurance (during transport), test severity class 1:

  15 g for 11 ms.
- Shock bump tests are carried out to verify permanent shock (during transport), test severity class 1:

  10 g for 16 ms.

Seismic Test

Per EN 60255-21-3 or IEC 60255-21-3, test procedure A, class 2.

Frequency range

- 5 to 8 Hz, 7.5 mm / 3.5 mm, 8 to 35 Hz, 20 / 10 m/s², 3 x 1 cycle.

2.3.2 Routine Tests

All tests per EN 60255-1.

Voltage Test

Per EN 60255-27.

- 2.2 kV AC, 1 s

Only direct voltage (2.8 kV DC) must be used for the voltage test on the power supply inputs.

The PC interface must not be subjected to the voltage test.

Additional Thermal Test

- 100% controlled thermal endurance test, inputs loaded.

2.4 Environmental Conditions

Temperatures

Recommended temperature range

- -5°C to +55°C [+23°F to +131°F].

Limit temperature range

- Operation: -25°C to +55°C [-13°F to +131°F].
- Storage and transport: -25°C to +70°C [-13°F to +158°F].

Ambient Humidity Range

- ≤ 75 % relative humidity (annual mean).
- 56 days at ≤ 95 % relative humidity and 40°C [104°F].
- Condensation not permitted.

Solar Radiation

Direct solar radiation on the front of the device must be avoided.

2.5 Inputs and Outputs

2.5.1 Measuring Inputs

Current Measuring Inputs

- Nominal current I_{nom}: 1 and 5 A AC (adjustable).
- Nominal consumption per phase: < 0.1 VA at I_{nom}.
- Load rating:
  - continuous: 20 A,
  - for 10 s: 150 A,
  - for 1 s: 500 A.
- Nominal surge current: 1250 A.

Voltage Measuring Inputs

- Nominal voltage V_{nom}: 50 to 130 V AC (adjustable).
- Nominal consumption per phase: < 0.3 VA at V_{nom} = 130 V AC.
- Load rating:
  - continuous: 150 V AC
  - for 10 s: 300 V AC

Frequency

- Nominal frequency f_{nom}: 50 Hz and 60 Hz (adjustable).
- Operating range: 0.95 to 1.05 f_{nom}.
- Frequency protection: 40 to 70 Hz.

2.5.2 Binary Signal Inputs

Threshold pickup and drop-off points as per ordering option

- Standard variant with switching threshold at 65% of 24 V DC ($V_{A,min}$)

Special variants with switching thresholds from 58% to 72% of the nominal input voltage (i.e. definitively “low” for V_A < 58% of the nominal supply voltage, definitively “high” for V_A > 72% of the nominal supply voltage).

- Special variant with switching threshold at 65% of 110 V DC ($V_{A,nom}$).
- Special variant with switching threshold at 65% of 127 V DC ($V_{A,nom}$).
- Special variant with switching threshold at 65% of 220 V DC ($V_{A,nom}$).
- Special variant with switching threshold at 65% of 250 V DC ($V_{A,nom}$).

Power consumption per input

- 18 V standard variant:

  V_A = 19 to 110 V DC : 0.5 W ± 30%,

  V_A > 110 V DC: V_A ·5 mA ± 30%.
- Special variants:

  V_A > switching threshold: V_A ·5 mA ± 30%.

The standard variant of binary signal inputs (opto couplers) is recommended in most applications, as these inputs operate with any voltage from 19 V. Special versions with higher pick-up/drop-off thresholds are provided for applications where a higher switching threshold is expressly required.

The maximum voltage permitted for all binary signal inputs is 300 V DC.

2.5.3 IRIG-B Interface

- Minimum / maximum input voltage level (peak-peak): 100 mVpp / 20 Vpp
- Input impedance: 33 kΩ at 1 kHz
- Electrical isolation: 2 kV

2.5.4 Direct Current Input

- Input current: 0 to 26 mA
- Value range: 0.00 to 1.20 $I_{DC,nom}$ ($I_{DC,nom}$ = 20 mA)
- Maximum continuous input current permitted: 50 mA
- Maximum input voltage permitted: 17 V DC
- Input load: 100 Ω
- Open-circuit monitoring: 0 to 10 mA (adjustable)
- Overload monitoring: > 24.8 mA
- Zero suppression: 0.000 to 0.200 $I_{DC,nom}$ (adjustable).

2.5.5 Resistance Thermometer

Only PT 100 permitted for analog (I/O) module, mapping curve per IEC 75.1.

PT 100, Ni 100 or Ni 120 permitted for temperature p/c board (the RTD module).

- Value range: -40.0°C to +215.0°C (-40°F to +419°F).
- 3-wire configuration: max. 20 Ω per conductor.
- Open and short-circuited input permitted.
- Open-circuit monitoring: Θ > +215°C and Θ < -40°C (Θ > +419°F and Θ < -40°F).

2.5.6 Direct Current Output

- Output current: 0 to 20 mA
- Maximum permissible load: 500 Ω
- Maximum output voltage: 15 V

2.5.7 Output Relays

	Binary I/O Module X(6I 6O) for switchgear control.	**Binary I/O Modules X(4H), X(6I 6H) with high-break contacts, applicable to DC circuits only.**	**All other modules**
Rated voltage:	250 V DC 250 V AC	250 V DC	250 V DC, 250 V AC.
Continuous current:	8 A	10 A	5 A
Short-duration current:	● 30 A for 0.5 s	● 250 A for 0.03 s, ● 30 A for 3 s	30 A for 0.5 s.
Making capacity:	1000 W (VA) at L/R = 40 ms.	30 A	1000 W (VA) at L/R = 40 ms.
Breaking capacity:	● 0.2 A at 220 V DC and L/R = 40 ms, ● 4 A at 230 V AC and cos φ = 0.4.	● 7500 W resistive or 30 A at 250 V DC, Maximum values: 30 A and 300 V DC. ● 2500 W inductive (L/R = 40 ms) or 10 A at 250 V DC, Maximum values: 10 A and 300 V DC.	● 0.2 A at 220 V DC and L/R = 40 ms, ● 4 A at 230 V AC and cos φ = 0.4.
Operating time:	less than 5 ms	less than 0.2 ms	less than 5 ms
Reset time:	less than 5 ms	less than 8 ms	less than 5 ms

2.5.8 BCD Measured Data Output

Maximum numerical value that can be displayed: 399

2.6 Interfaces

2.6.1 Local Control Panel

Input or output

- With 12 keys and a 128 × 128 pixel (16 × 21 character) graphic liquid crystal display (LCD).

State and fault signals

- 17 LED indicators (12 freely configurable with function assignments for three colors: red, yellow and green).

2.6.2 PC Interface

- Transmission rate: 300 to 115,200 baud (adjustable)

2.6.3 Serial Communication Interface

The communication modules can be provided with up to three communication channels, depending on the module variant. Channel 1 and 3 may either be equipped to connect wire leads or optical fibers and channel 2 is only available to connect wire leads.

For communication interface 1, communication protocols based on IEC 870-5-103, IEC 60870-5-101, MODBUS, DNP 3.0, or Courier can be set.

- Transmission rate: 300 to 64000 baud (adjustable).

Communication interface 2 can only be operated with the interface protocol based on IEC 60870-5-103.

- Transmission rate: 300 or 57600 baud (adjustable).

Communication interface 3 permits end-end channel-aided digital communication schemes to be configured for real time protective signaling between two protection devices (InterMiCOM protective interface).

- Transmission rate: 600 or 19200 baud (adjustable).

Wire Leads

- Per RS 485 or RS 422, 2 kV isolation
- Distance to be bridged
  - Point-to-point connection: max. 1200 m
  - Multipoint connection: max. 100 m

Plastic Fiber Connection

- Optical wavelength: typically 660 nm
- Optical output: min. -7.5 dBm
- Optical sensitivity: min. -20 dBm
- Optical input: max. -5 dBm
- Distance to be bridged: max. 45 m

  (Distance to be bridged given for identical optical outputs and inputs at both ends, a system reserve of 3 dB, and typical fiber attenuation)

Glass Fiber Connection G 50/125

- Optical wavelength: typically 820 nm
- Optical output: min. -19.8 dBm
- Optical sensitivity: min. -24 dBm
- Optical input: max. -10 dBm
- Distance to be bridged: max. 400 m

  (Distance to be bridged given for identical optical outputs and inputs at both ends, a system reserve of 3 dB, and typical fiber attenuation)

Glass Fiber Connection G 62.5/125

- Optical wavelength: typically 820 nm
- Optical output: min. -16 dBm
- Optical sensitivity: min. -24 dBm
- Optical input: max. -10 dBm
- Distance to be bridged: max. 1,400 m

  (Distance to be bridged given for identical optical outputs and inputs at both ends, a system reserve of 3 dB, and typical fiber attenuation)

2.6.4 IEC Communication Interface

Ethernet-based communications per IEC 61850:

Wire Leads

- RJ45, 1.5 kV isolation
- Transmission rate: 100 Mbit/s
- Distance to be bridged: max. 100 m

Optical Fiber (100 Mbit/s)

- Optical wavelength: typically 1300 nm
- ST connector
- Glass fiber G50/125:
  - Optical output: min. −18.85 dBm
  - Optical sensitivity: min. −32.5 dBm
  - Optical input: max. −12 dBm
- Glass fiber G62.5/125:
  - Optical output: min. −15 dBm
  - Optical sensitivity: min. −32.5 dBm
  - Optical input: max. −12 dBm
- SC connector
- Glass fiber G50/125:
  - Optical output: min. −23.5 dBm
  - Optical sensitivity: min. −31 dBm
  - Optical input: max. −14 dBm
- Glass fiber G62.5/125:
  - Optical output: min. −20 dBm
  - Optical sensitivity: min. −31 dBm
  - Optical input: max. −14 dBm

2.6.4.1 Redundant Ethernet Board

2.6.4.1.1 100 Base FX Interface (in Accordance with IEEE 802.3 and IEC 61850)

Optical fibers (-X7, -X8, -X14, -X15):

- BFOC-(ST®)-interface 2.5 per IEC 60874-10-1 per glass fiber

Glass fiber connection G 50/125

- Optical wavelength: typ. 1308 nm
- Optical output: min. −23.5 dBm
- Optical sensitivity: min. −31 dBm
- Optical input: max. −14 dBm

Glass fiber connection G 62.6/125

- Optical wavelength: typ. 1308 nm
- Optical output: min. −20 dBm
- Optical sensitivity: min. −31 dBm
- Optical input: max. −14 dBm

2.6.4.1.2 Serial Interface COMM2

Leads (X10)

- Threaded terminal ends M2 for wire cross sections up to 1.5 mm²

Protocol per IEC 60870-5-103

Transmission rate: 300 … 57600 bit/s (settable)

2.6.4.1.3 Fiber Defect Connector (Watchdog Relay)

- Rated voltage: 250 VDC, 250 VAC
- Continuous current: 5 A
- Short-duration current: 30 A and carry for 3 s
- Breaking capacity AC:
  - 1500 VA resistive (cos φ = 1.0)
  - 1500 VA inductive (cos φ = 0.5)
- Breaking capacity DC:
  - 50 W, 250 VDC resistive
  - 25 W inductive (L/R = 40 ms)

2.6.5 IRIG-B Interface

- B122 format
- Amplitude modulated signal
- Carrier frequency: 1 kHz
- BCD- coded variable data (daily)

2.7 Information Output

Counters, measured data, and indications: see chapter “Information and Control Functions”.

2.8 Settings – Typical Characteristic Data

2.8.1 Main Function

- Minimum output pulse for trip command: 0.1 to 10 s (adjustable)
- Minimum output pulse for close command: 0.1 to 10 s (adjustable)

2.8.2 Definite-Time and Inverse-Time Overcurrent Protection

- Operate time including output relay (measured variable from 0 to 2-fold operate value): ≤ 40 ms, approx. 30 ms
- Reset time (measured variable from 2-fold operate value to 0): ≤ 40 ms, approx. 30 ms
- Starting resetting ratio: approx. 0.95

2.8.3 Short-Circuit Direction Determination

- Nominal acceptance angle for forward decision: ± 90°
- Resetting ratio forward/backward recognition: ≤ 7°
- Base point release for phase currents:0.1 Inom
- Base point release for phase-to-phase voltages: 0.002 V_{nom} at V_{nom} = 100 V
- Base point release for residual currents: 0.01 Inom
- Base point release for neutral displacement voltage: 0.015 to 0.6 $V_{nom}/\sqrt{3}$ (adjustable)

2.8.4 Time-Voltage Protection

- Operate time including output relay (measured variable from nominal value to 1.2-fold operate value or measured variable from nominal value to 0.8-fold operate value):
  - ≤ 40 ms, approx. 30 ms
- Reset time (measured variable from 1.2-fold operate value to nominal value or measured variable from 0.8-fold operate value to nominal value):
  - ≤ 45 ms, approx. 30 ms
- Resetting ratio for V<>:
  - 1% to 10% (adjustable)

2.8.5 Power Directional Protection

- Operate time including output relay (measured variable from nominal value to 1.2-fold operate value or measured variable from nominal value to 0.8-fold operate value): ≤ 60 ms, approx. 50 ms
- Reset time (measured variable from 1.2-fold operate value to nominal value or measured variable from 0.8-fold operate value to nominal value): ≤ 40 ms, approx. 30 ms
- Resetting ratio for $P_>$, $Q_>$: 0.05 to 0.95 (adjustable)
- Resetting ratio for $P_<$, $Q_<$: 1.05 to 20 (adjustable)

2.9 Deviations

2.9.1 Deviations of the Operate Values

2.9.1.1 Definitions

Reference Conditions

- Quasi-stationary sinusoidal signals at nominal frequency f_{nom} (frequency protection excepted), total harmonic distortion ≤ 2 %, ambient temperature 20°C (68°F), and nominal auxiliary voltage $V_{A,nom}$.

Deviation

- Deviation relative to the setting under reference conditions.

2.9.1.2 Measuring-Circuit Monitoring

Operate values $I_{diff>}$, Vmin<

- Deviation: ± 3 %

2.9.1.3 Definite-Time and Inverse-Time Overcurrent Protection

Operate values $I_{>}$, $I_{neg>}$, $I_{N>}$

- Deviation: ± 5% of the setting or ± 1% of the nominal value

2.9.1.4 Short-Circuit Direction Determination

- Deviation: ± 10°

2.9.1.5 Motor Protection and Thermal Overload Protection (Reaction Time)

- Deviation ± 7.5 % when *I/Iref* = 6

2.9.1.6 Thermal Overload Protection

Operate value Θ

- Deviation: ± 5% of the setting or ± 1% of the nominal value

2.9.1.7 Unbalance Protection

- Deviation: ± 5 %

2.9.1.8 Time-Voltage Protection

Operate values

- V<>, Vpos<>: ± 1% (in the range 0.6 to 1.4 Vnom)
- VNG>, Vneg>: ± 1% (in the range > 0.3 Vnom)

2.9.1.9 Frequency Protection

Operate values f<>

- ± 5 mHz

Operate values df/dt

- ± 100 mHz/s

2.9.1.10 Underfrequency Load Shedding Protection (Function Group Pf<)

Operate values

- f<: ± 5 mHz
- Pmin: ± 20% of the setting or ± 2% of the nominal value
- Imin: ± 5% of the setting or ± 1% of the nominal value
- Angle: ± 1°

2.9.1.11 Power Directional Protection

Operate values P<>, Q<>

- Deviation: ± 5% of the setting or ± 2% of the nominal value

2.9.1.12 Voltage Controlled Directional Reactive Power Protection (QV)

Operate values

- V<: ± 1% (in the range 0.6 to 1.4 Vnom)
- Qmin: ± 20% of the setting or ± 2% of the nominal value
- Imin: ± 5% of the setting or ± 1% of the nominal value
- Angle: ± 1°

2.9.1.13 Ground Fault Direction Determination Using Steady-State Values (GFDSS)

Operate values VNG>, IN,act>, IN,reac>, IN>

- Deviation: ± 3% of the setting or ± 0.5% of the nominal value

Sector angle

- Deviation: ± 0.5°

2.9.1.14 Direct Current Input

- Deviation: ± 1 %

2.9.1.15 Resistance Thermometer

- Deviation: ± 2°C (in the range −40°C ... 120°C)

2.9.1.16 Analog Measured Data Output

- Deviation: ± 1 %
- Output residual ripple with max. load: ± 1 %

2.9.2 Deviations of the Timer Stages

2.9.2.1 Definitions

Reference conditions

- Sinusoidal signals at nominal frequency f_{nom}, total harmonic distortion ≤ 2 %, ambient temperature 20°C (68°F), and nominal auxiliary voltage $V_{A,nom}$.

Deviation

- Deviation relative to the setting under reference conditions.

2.9.2.2 Definite-time stages

- Deviation: ± 1% + 20 ms to 40 ms

2.9.2.3 Inverse-time stages

- Deviation when $I \geq 2\ I_{ref}$: ± 5% + 10 to 25 ms
- For “extremely inverse” IEC characteristics and for thermal overload characteristics: ± 7.5% + 10 to 20 ms

2.9.3 Deviations of Measured Data Acquisition

2.9.3.1 Definitions

Reference conditions

- Sinusoidal signals at nominal frequency fnom, total harmonic distortion ≤ 2%, ambient temperature 20°C (68°F), and nominal auxiliary voltage $V_{A,nom}$.

Deviation

- Deviation relative to the setting under reference conditions.

2.9.3.2 Operating Data Measurement

Measuring input currents

- Deviation: ± 1%

Measuring input voltages

- Deviation: ± 0.5%

Internally formed resultant current and negative-sequence system current

- Deviation: ± 2%

Internally formed neutral-point displacement voltage and voltages of positive- and negative-sequence systems

- Deviation: ± 2%

Active power / active energy

- Deviation: ± 2% when cos φ = ± 0.7
- Deviation: ± 5% when cos φ = ± 0.3

Reactive power / reactive energy

- Deviation: ± 5% when cos φ = ± 0.7
- Deviation: ± 2% when cos φ = ± 0.3

Load angle

- Deviation: ± 1°

Frequency

- Deviation: ± 10 mHz

Direct current of measured data input and output

- Deviation: ± 1%

Temperature

- Deviation: ± 2°C [approx. ± 4°F]

2.9.3.3 Fault Data

Short-circuit current and voltage

- Deviation: ± 3%

Short-circuit impedance, reactance, and fault location

- Deviation: ± 5%

2.9.3.4 Internal Clock

With free running internal clock

- Deviation: < 1 min/month

With external synchronization (with a synchronization interval ≤ 1 min)

- Deviation: < 10 ms

With synchronization via IRIG-B interface

- ± 1 ms

2.10 Resolution of the Fault Data Acquisition

2.10.1 Time Resolution

- 20 sampled values per period

2.10.2 Phase Currents System

Dynamic range

- 100 I_{nom}

Amplitude resolution

- at I_{nom} = 1 A: 6.1 mA_{rms}
- at I_{nom} = 5 A: 30.5 mA_{rms}

2.10.3 Neutral Current

Dynamic range

- 16 $I_{N,nom}$

Amplitude resolution

- at I_{nom} = 1 A: 1.0 mA_{rms}
- at I_{nom} = 5 A: 4.9 mA_{rms}

2.10.4 Phase-to-Ground Voltages and Neutral-Point Displacement Voltage

Dynamic range

- 150 V

Amplitude resolution

- 9.2 mV_{rms}

2.11 Recording Functions

2.11.1 Organization of the Recording Memories

Operating Data Memory

Scope for signals

- All signals relating to normal operation; from a total of up to 2048 different logic state signals.

Depth for signals

- The 1000 most recent signals.

Monitoring Signal Memory

Scope for signals

- All self-monitoring logic state signals.

Depth for signals

- Up to 30 signals.

Overload Memory

Number

- The 8 most recent overload events

Scope for signals

- All signals relevant for an overload event from a total of up to 2048 different logic state signals.

Depth for signals

- 200 entries per overload event.

Ground Fault Memory

Number

- The 8 most recent ground fault events

Scope for signals

- All signals relevant for a ground fault event from a total of up to 2048 different logic state signals.

Depth for signals

- 200 entries per ground fault event.

Fault Memory

Number

- The 8 most recent faults.

Scope for signals and fault values

- All fault-relevant signals from a total of up to 2048 different logic state signals.
- Sampled values for all measured currents and voltages

Depth for signals and fault values

- 200 entries per fault event
- max. number of cycles per fault can be set by user;

  820 periods in total for all faults, that is 16.4 s (for fnom = 50 Hz) or 13.7 s (for fnom = 60 Hz).

Resolution of the Recorded Data

- As per Section 2.10, (p. 2-23).

2.12 Power Supply

Nominal auxiliary voltage $V_{A,nom}$

- 24 to 60 V DC or 60 to 250 V DC and 100 to 230 V AC (ordering option).

Operating range for direct voltage

- 0.8 to 1.1 $V_{A,nom}$ with a residual ripple of up to 12 % $V_{A,nom}$.

Operating range for alternating voltage

- 0.9 to 1.1 $V_{A,nom}$.

Nominal burden

- … where V_A = 220 V DC and with maximum module configuration
  - 40 TE case, relays de-energized/energized: approx. 12.6 W / 34.1 W
  - 84 TE case, relays de-energized/energized): approx. 14.5 W / 42.3 W

Start-up peak current

- < 3 A for duration of 0.25 ms

Stored energy time

- ≥ 50 ms for interruption of V_A ≥ 220 V DC (upper range supply)
- ≥ 50 ms for interruption of V_A ≥ 60 V DC (lower range supply)

2.13 Current Transformer Specifications

2.13.1 Symbols

The following symbols are used in accordance with IEC 61869 standards:

I_{pn} Rated primary current (nominal primary current) of the CT

I_{sn} Rated secondary current (nominal secondary current) of the CT

I_{psc} Rated primary (symmetrical) short-circuit current

K_{ssc} Rated symmetrical short-circuit current factor:

$$K_{\mathrm{ssc}} = \frac{I_{\mathrm{psc}}}{I_{\mathrm{pn}}}$$

I_{ref} Reference current of IDMT protection element

R_{bn} Rated resistive burden (secondary connected) of the CT

P_{bn} Equivalent power over the rated resistive burden of the CT for rated secondary current:

$$P_{\mathrm{bn}} = R_{\mathrm{bn}} \cdot I_{\mathrm{sn}}^2$$

R_b Actual resistive burden (secondary connected) of the CT

P_b Equivalent power over the actual resistive burden of the CT for rated secondary current:

$$P_{\mathrm{b}} = R_{\mathrm{b}} \cdot I_{\mathrm{sn}}^2$$

R_{ct} Secondary winding resistance of the CT

P_{ct} Equivalent power over the secondary winding resistance of the CT for secondary rated current:

$$P_{\mathrm{ct}} = R_{\mathrm{ct}} \cdot I_{\mathrm{sn}}^2$$

V_{sal} Secondary accuracy limiting voltage (e.m.f.) of the CT

V_k Rated knee point voltage (e.m.f.) of the CT

n_n Rated accuracy limit factor of the CT

n_b Actual accuracy limit factor of the CT:

$$n_{\mathrm{b}} = n_{\mathrm{n}} \cdot \frac{R_{\mathrm{ct}} + R_{\mathrm{bn}}}{R_{\mathrm{ct}} + R_{\mathrm{b}}} = n_{\mathrm{n}} \cdot \frac{P_{\mathrm{ct}} + P_{\mathrm{bn}}}{P_{\mathrm{ct}} + P_{\mathrm{b}}}$$

R_l One-way lead resistance from CT to relay

R_{rel} Resistive burden of relay's CT input

T_p Primary time constant (primary system time constant)

ω (System) angular frequency

X_p/R_p Primary impedance ratio (system impedance ratio):

$$\frac{X_p}{R_p} = \omega \cdot T_p$$

K_d Dimensioning factor for the CT

K_{emp} Relay specific, empirically determined dimensioning factor for the CT

2.13.2 General Equations

The current transformer can be dimensioned

- either for the minimum required secondary accuracy limiting voltage acc. to IEC 61869, 3.4.209:

  $$V_{sal} \geq K_d \cdot K_{ssc} \cdot I_{sn} \cdot (R_{ct} + R_b)$$

- or for the minimum required rated accuracy limit factor acc. to IEC 61869, 3.4.208, as follows:

  $$n_n \geq K_d \cdot K_{ssc} \cdot \frac{R_{ct} + R_b}{R_{ct} + R_{bn}} = K_d \cdot K_{ssc} \cdot \frac{P_{ct} + P_b}{P_{ct} + P_{bn}}$$

The relation between both methods is given as follows:

$$V_{sal} = n_n \cdot \left(\frac{P_{bn}}{I_{sn}} + I_{sn} \cdot R_{ct}\right)$$

The actual secondary connected burden R_b is given as follows:

- For phase-to-ground faults: $R_b = 2 \cdot R_l + R_{rel}$
- For phase-to-phase faults: $R_b = R_l + R_{rel}$

The wire lead burden is calculated as:

$$R_l = \rho \cdot \frac{l}{A}$$

- ρ = specific conductor resistance

  (e.g. for copper 0.021 Ω mm²/m = $2.1 \cdot 10^{-8}$ Ω m, at 75°C)
- l = wire length
- A = wire cross section

For devices out of the platform Easergy MiCOM 30, the input CT burden R_{rel} is less than 20 mΩ, independent of the set nominal current (1 A or 5 A). Usually this relay burden can be neglected.

The rated knee point voltage V_k according to IEC 61869, 3.4.217 is lower than the secondary accuracy limiting voltage V_{sal} according to IEC 61869, 3.4.209. It is not possible to give a general relation between V_k and V_{sal}, but for standard core material the following relations applies:

- $V_K \approx 0.85 \cdot V_{sal}$ for class 5P CTs, and
- $V_K \approx 0.75 \cdot V_{sal}$ for class 10P CTs, respectively.

Theoretically, the specifications of the current transformer could be calculated to avoid saturation by inserting its maximum value, instead of the required over-dimensioning factor K_d:

$$K_d = K_{max} \approx 1 + \frac{X_p}{R_p} = 1 + \omega \cdot T_p$$

However, this is not necessary. Instead, it is sufficient to consider an empirically determined dimensioning factor K_d=K_{emp} such that the appropriate operation of the protection function is ensured under the given conditions. This factor depends on application and relay type, as outlined in the following.

2.13.3 Overcurrent Protection

When relays are set to operate at high set thresholds (say more than 5 times the nominal current), the accuracy limit factor should be at least as high as the value of the setting current used in order to ensure fast relay operation.

As per IEC 61869-2 the rated CT accuracy limit factor n_n (e.g. class 5P**20** 15VA) describes the highest current magnitude up to which the CT will be within the specified accuracy under defined conditions (e.g. for class 5P20 15VA the total error must be smaller than 5% at 20 times nominal current at nominal burden of 15 VA). The actual accuracy limit factor n_b differs in practice from the rated factor n_n as detailed in section 1.

When relays are set to operate at low set thresholds (say 1 to 2 times nominal current), the saturation of the CT needs not to be considered. With inverse time overcurrent protection a steady state fault current of up to 20 times the reference current (I_{ref}) should not saturate the CT. Due to transient saturation the operation time gets prolonged. This delay should always be considered to be as long as the primary time constant.

For the P139 overcurrent protection application the actual accuracy limit factor n_b should be chosen as follows:

- **DTOC:** n_b = maximum(($I_>/I_n$), 20)
- **IDMT:** n_b = maximum((I_{ref}/I_n), 20)

With resulting rated CT accuracy limit factor n_n:

$$n_n \geq n_b \cdot \frac{R_{ct} + R_b}{R_{ct} + R_{bn}}$$

Alternatively, the required CT knee point voltage V_k can be calculated as follows:

$V_k \geq K_d \cdot K_{ssc} \cdot I_{sn} \cdot (R_{ct} + R_b)$

- With K_d=K_{emp}=0.5 for definite time phase and earth fault overcurrent (DTOC; I>; IN>)
- K_d=K_{emp}=0.5 for inverse time phase overcurrent (IDMT; $I_{ref,P}$)
- K_d=K_{emp}=1.0 for inverse time earth fault overcurrent (IDMT; $I_{ref,N}$)

It is recommended to use at least CT’s of accuracy class 10P (or equivalent).

3 Operation

3.1 Modular Structure

The P139 is a numerical device out of Schneider Electric's family of devices named “Easergy MiCOM 30”. The device types included in this family are built from identical uniform hardware modules. The figure below shows the basic hardware structure of the P139.

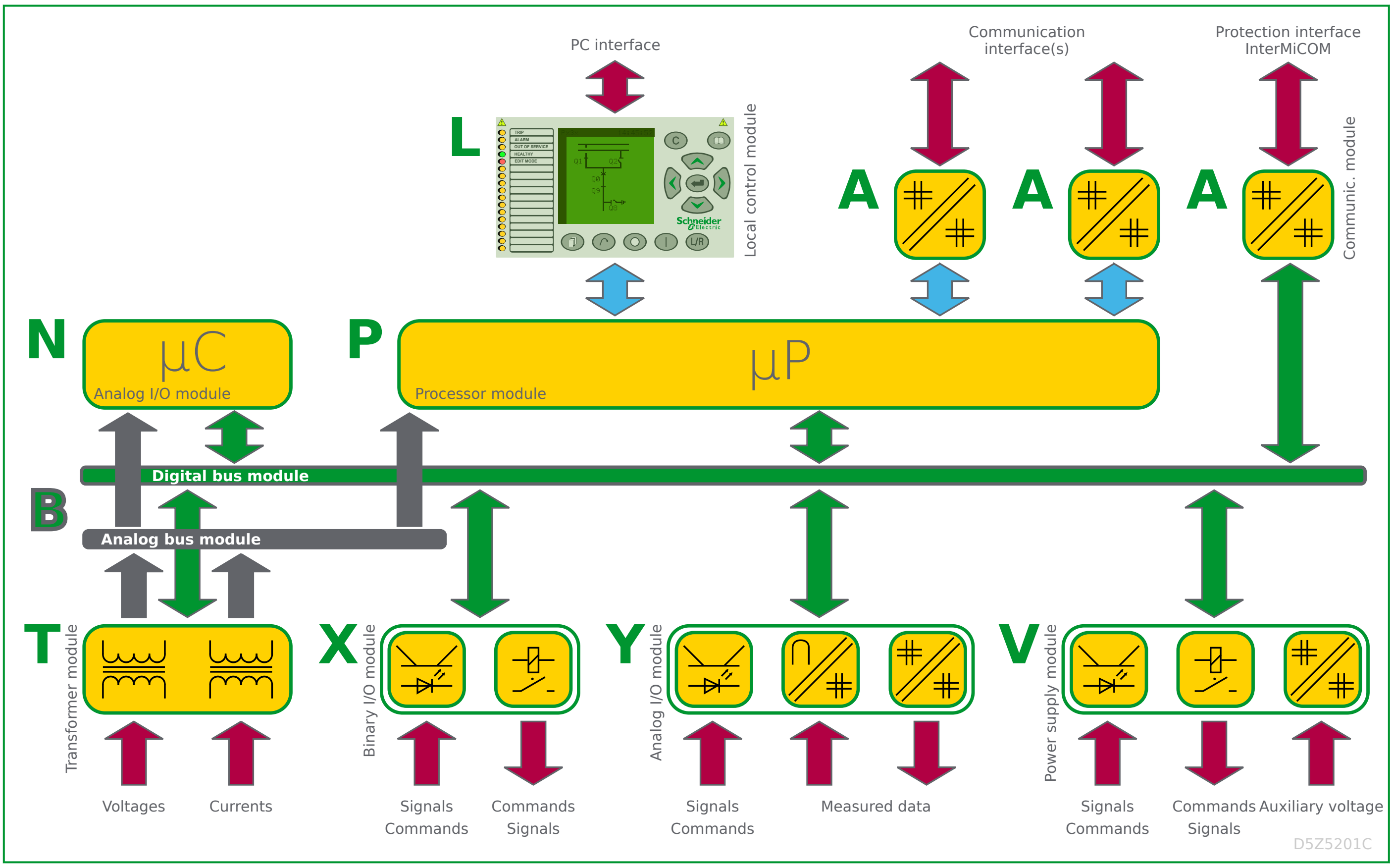


Fig. 3-1: Basic hardware structure.

External analog quantities and binary quantities – electrically isolated – are converted to the internal processing levels by the peripheral modules T, Y, and X.

The optional binary I/O modules X are equipped with optical couplers for binary signal input as well as output relays for the output of signals and commands or combinations of these.

The external auxiliary voltage is applied to the power supply module V, which supplies the auxiliary voltages that are required internally.

Analog data is transferred from the transformer module T via the analog bus module B to the processor module P. The processor module contains all the elements necessary for the conversion of measured analog variables, including multiplexers and analog/digital converters. The analog data conditioned by the analog I/O module Y is transferred to the processor module P via the digital bus module. The optional transient ground fault module N evaluates the measured variables according to the transient ground fault evaluation scheme.

The processor handles the processing of digitized analog variables and of binary signals, generates the protective trip and signals, and transfers them to the binary I/O modules X via the digital bus module. The processor module also handles overall device communication.

The optional communication modules provide one or two serial communication interfaces for the integration of the protection and control unit into a substation control system and for remote access respectively a protection communication interface for the transfer of digital information between two protection devices.

The local control module L is located behind the front panel and connected to the processor module via a ribbon cable. It encompasses all control and display elements as well as a PC interface for running the operating program *S1*.

3.2 Operator-Machine Communication

The following interfaces are available for the exchange of information between the user and the P139:

- Integrated user interface (LOC: local control panel)
- PC interface
- Communication interface

All settings and signals as well as all measurements and control functions are arranged within the branches of the menu tree following a scheme that is uniform throughout the device family. The main branches are:

“Parameters” Branch

All settings are contained in this branch. This branch carries all settings, including the identification data of the P139, the configuration parameters for adapting the P139 interfaces to the system, and the function parameters for adapting the device functions to the process. All values in this group are stored in non-volatile memory, which means that the values will be preserved even if the power supply fails.

“Operation” Branch

This branch includes all information relevant for operation such as measured operating data and binary signal states. This information is updated periodically and consequently is not stored. In addition, various controls are grouped here, for example those for resetting counters, memories and displays.

“Events” Branch

The third branch is reserved for the recording of events. All information in this group is therefore stored. In particular, the start/end signals during a fault, the measured fault data, and the sampled fault waveforms are stored here and can be read out when required.

Display of Settings and Signals

Settings and signals are displayed either in plain text or as addresses, in accordance with the user’s choice. All settings and signals of the P139 are documented in a separate collection of documents, the so-called “DataModelExplorer”. The “Addresses” document (being part of the “DataModelExplorer”) is complete in the sense that it contains all settings, signals and measured variables that are relevant for the user of the P139.

The configuration of the local control panel also permits the installation of Measured Value “Panels” on the LCD display. Different Panels are automatically displayed for specific system operating conditions. Priority increases from normal operation to operation under overload conditions and finally to operation following a short circuit in the system. Thus the P139 provides the measured data relevant for the prevailing conditions.

3.3 Configuration of the Local Control Panel (Function Group LOC)

The configuration of the Local Control Panel includes the configuration of the Bay Panel and of the Measured Value Panels, and the selection of the control point.

On the graphic display, the layout of a bay with its switchgear units will be shown on the Bay Panel. A Bay Panel usually consists of one Bay Panel image as a standard but after applying the bay editor from the PC Access Software MiCOM S1 and having loaded a customized bay type it can be sub-divided into up to eight pages. The graphic display also permits the display of the Event Panel and the configurable Signal Panel.

> *To create customized bay types, the "Bay Type Configurator" (BTC), **version 2.7 or higher**, is needed. Older versions of the BTC can create not compatible hex files and thus can lead to communication failures.*

In addition, the P139 offers Measured Value Panels, which display the measured values relevant at a given time.

During normal power system operation; the Bay Panel or – if activated – the Operation Panel is displayed. If the Operation Panel is activated as an event occurs, the display switches to the appropriate Event Panel – provided that measured values have been selected for the Event Panels. In the event of overload or ground fault conditions, the display will automatically switch to the Operation Panel at the end of the event. In the event of a fault, the Fault Panel remains active until the LED indicators or the fault memories are reset.

If the change enabling command has been issued (LOC: Param. change enabl.) it will be cancelled after the time period, defined by setting LOC: Hold-time for Panels has elapsed and the Bay Panel will be called up.

3.3.1 Bay Panel

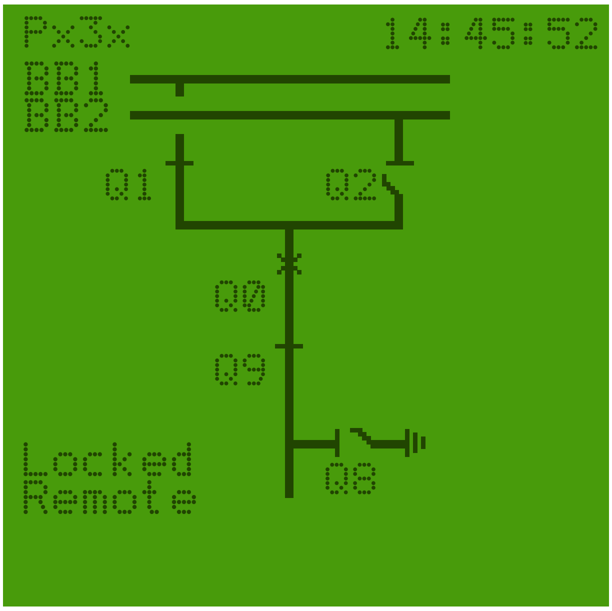


Fig. 3-2: Example of a Bay Panel (with graphic display).

The P139 offers a selection from pre-defined bay types. If the required bay type is not included in the standard selection, the user can contact the manufacturer of the P139 to request the definition of a customized bay type to download into the P139. By applying the bay editor from the PC Access Software MiCOM S1 the user can also define new bay types.

The activation of the Bay Panel display is described in Chapter 6, (p. 6-1).
With the graphic display fitted the Bay Panel displays the up-to-date status of the selected bay as a single (phase) diagram. The user can choose between two character sets to represent switch gear on the bay panel. The character sets are described in Section 6.10.1.1, (p. 6-13).

Each external device represented in the Bay Panel is identified by an external device designation (see Section 3.44.3, (p. 3-401)).

The user can also define the designations for busbars and busbar sections (see descriptions of parameters LOC: Designation busbar 1 or LOC: Designat. bus sect.1, respectively, in the “Settings” chapter).

The display of external device designations can also be disabled. The display of the control point (local or remote control) and interlocking can also be disabled.

The switchgear unit to be controlled needs to be selected first. The selection is cancelled if the return time for illumination (LOC: Return time illumin.) or the return time for selection (LOC: Return time select.) has elapsed.

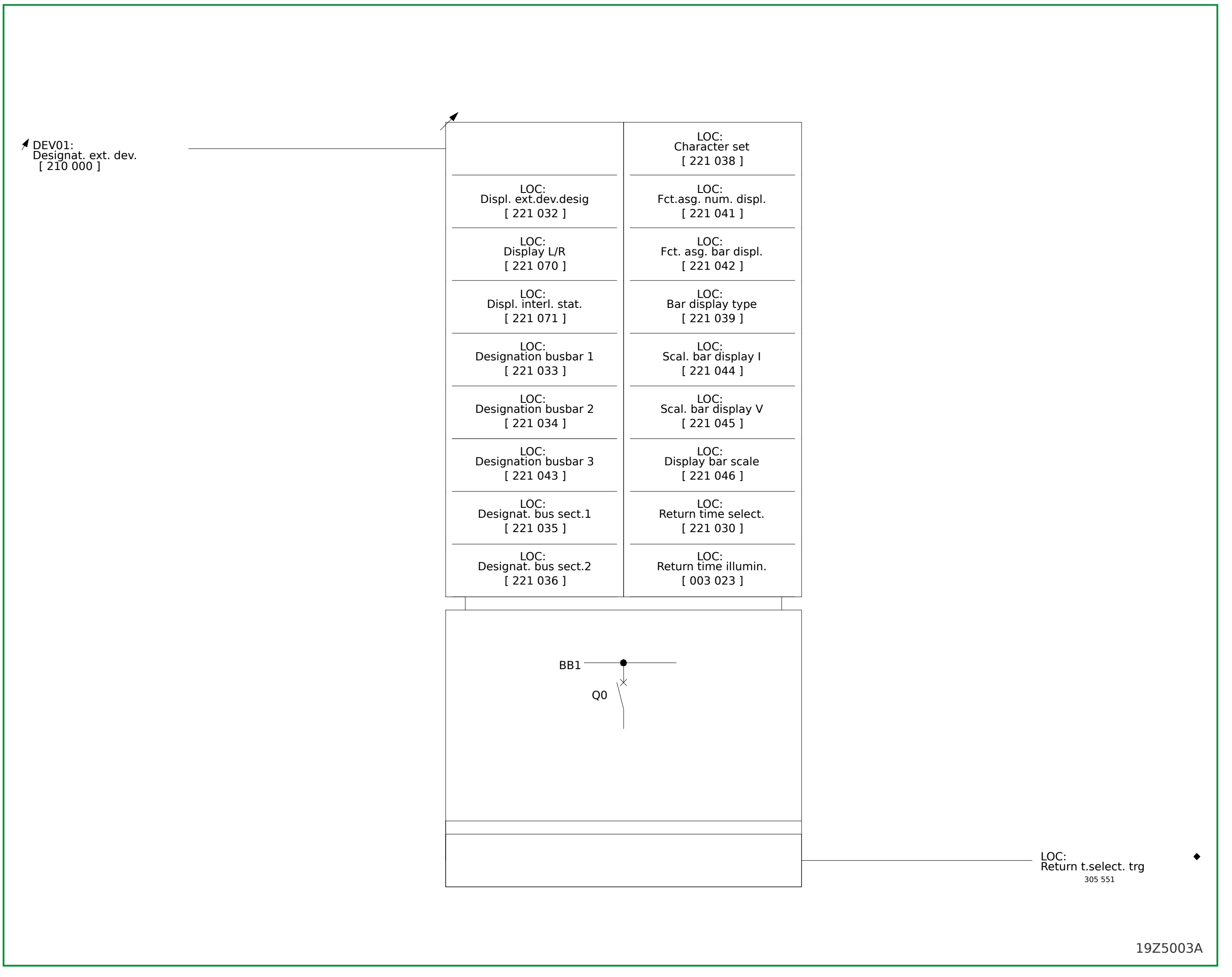


Fig. 3-3: Bay panel.

3.3.1.1 Measured Values Display

The measured values that will be displayed on the Bay Panel can first be selected separately for the numerical and the bar chart display by an “m out of n” parameter. Measured values to be displayed in bar chart form must also be selected for display as numerical measured values. However, not all measured values that can be displayed in numerical form can also be displayed in bar chart form. In such cases, a dummy or placeholder must be included in the selection list for the bar chart display at the same point at which a measured value that cannot be displayed in bar chart form appears in the selection list for numerical measured values. For the bar chart display, the orientation of the bar and the scaling can be selected (the latter separately for the current and voltage data). Display of the scaling can be disabled.

3.3.1.2 Hold-Time Measured Values Display

With the Bay Panel display the next or the previous configured measured value may be selected by pressing the keys “cursor down” or “cursor up”. Furthermore the respective subsequent measured value is displayed when the hold-time period set for LOC: Hold-t. meas.v.displ has elapsed. The standard default for LOC: Hold-t. meas.v.displ is *Blocked*; in this case the automatic change over feature to the subsequent measured value is not available.

3.3.2 Signal Panel

The Signal Panel is displayed when it is selected and when at least one signal has been configured. From all physical and logical binary states that the P139 has available up to 28 signals can be selected for display on the Signal Panel by an “m out of n” parameter. This occurs without influencing the Event Panel, which is additionally available. When more signals are selected for display than the LC display can accommodate, then the display will switch to the next set of signals at intervals defined by the setting for LOC: Hold-time for Panels or when the appropriate key on the local control panel is pressed. If automatic switching to the Signal Panel is configured at LOC: Aut.activ.Sign.Panel then the Signal Panel is automatically selected when there is a change of state for a signal configured in the panel.

With the parameterLOC: Stat.ind.Sign.Panelit is possible to differentiate between the states “signal active/available” and “signal inactive/not available” shown on the Signal Panel. This is shown by the “clear to black” square alone and the simultaneous change over from “normal” display to “highlighting” of text in the lines. The type of signaling and the clearing, which may become necessary is selected by setting LOC: Indicat.Sign.Panel.

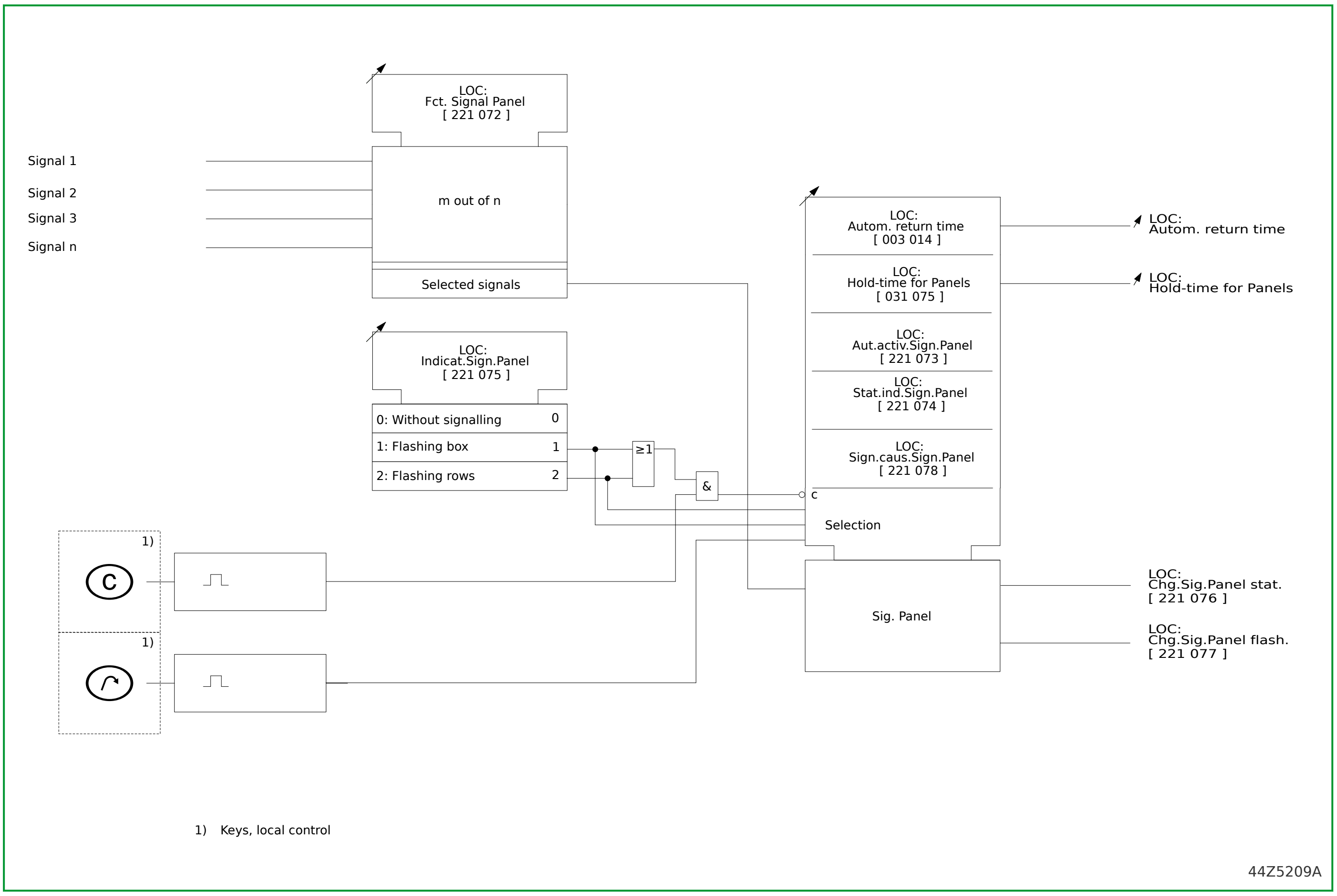


Fig. 3-4: Signal Panel.

3.3.3 Operation Panel

The Operation Panel is displayed after the set return time has elapsed, provided that at least one measured value has been configured.

The user can select which of the measured operating values will be displayed on the Operation Panel by means of an “m out of n” parameter. When more measured operating values are selected for display than the LC display can accommodate, then the display will either switch to the next set of measured operating values at intervals defined by the setting for LOC: Hold-time for Panels or when the appropriate key on the local control panel is pressed.

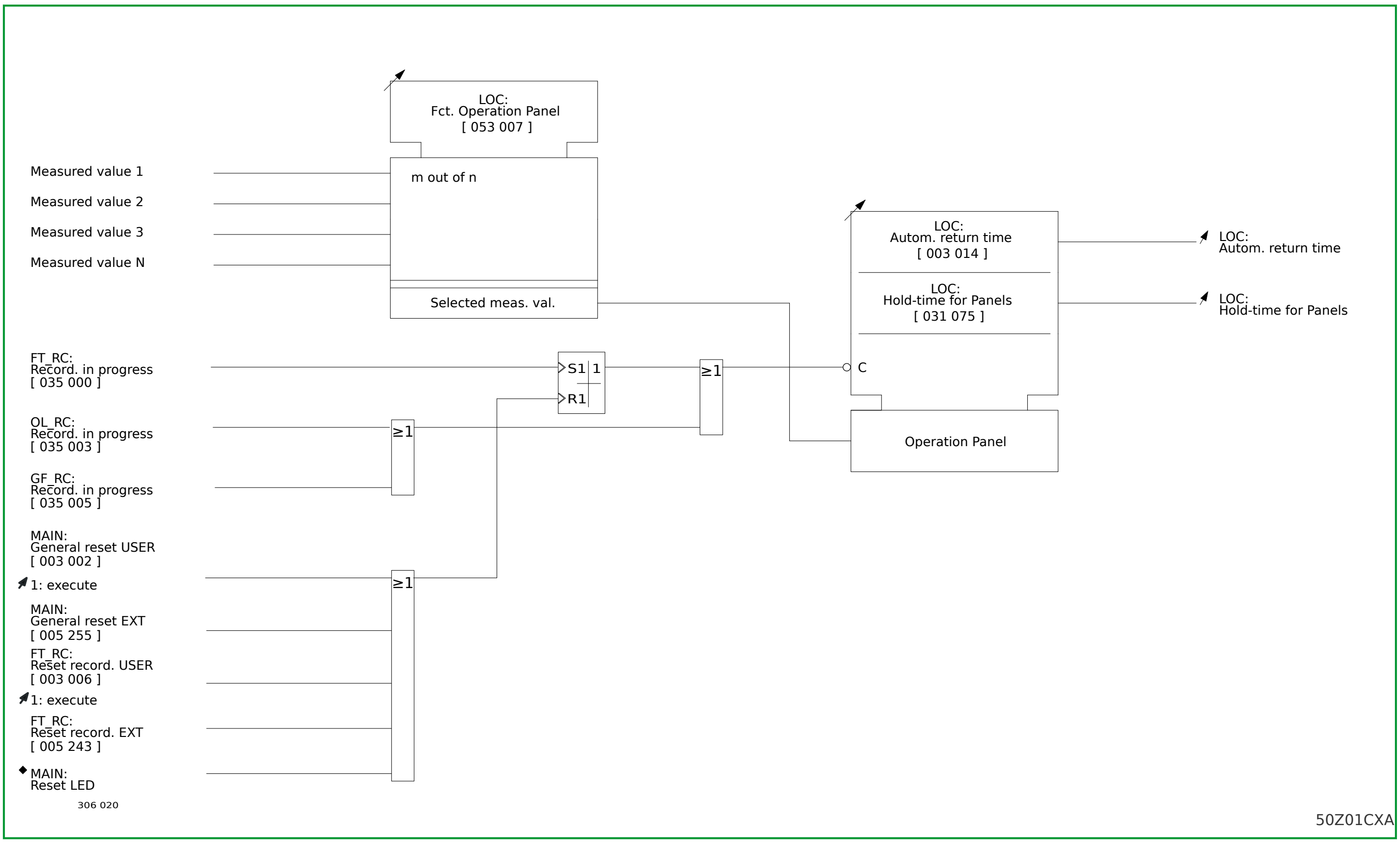


Fig. 3-5: Operation Panel.

3.3.4 Fault Panel

The Fault Panel is displayed in place of another data panel when there is a fault, provided that at least one measured value has been configured. The Fault Panel remains on display until the LED indicators or the fault memories are cleared.

The user can select the measured fault values that will be displayed on the Fault Panel by setting an “m out of n” parameter. When more measured fault values are selected for display than the LC display can accommodate, then the display will either switch to the next set of measured fault values at intervals defined by the setting for LOC: Hold-time for Panels or when the appropriate key on the local control panel is pressed.

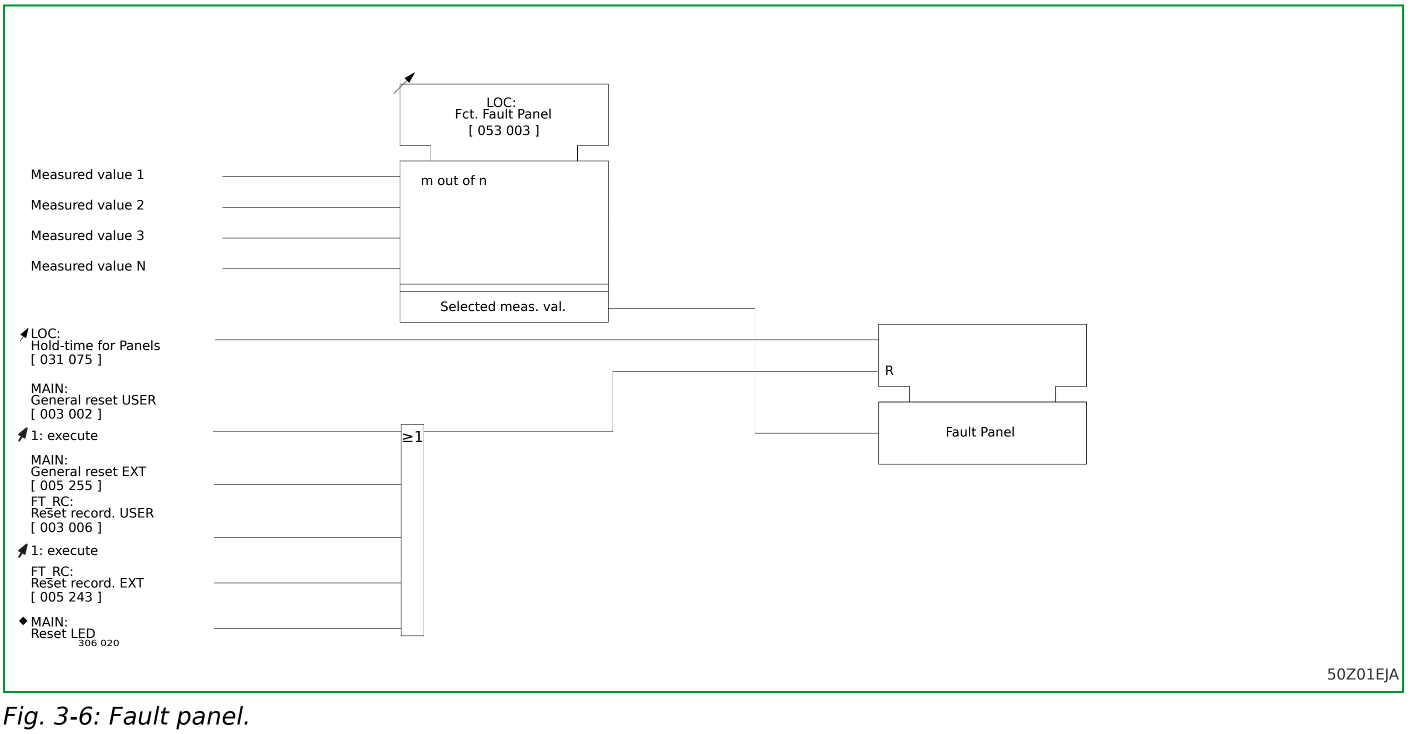


Fig. 3-6: Fault panel.

3.3.5 Ground Fault Panel

The Ground Fault Panel is automatically displayed in place of another data panel when there is a fault, provided that at least one measured value has been configured. The Ground Fault Panel remains on display until the ground fault ends, unless a fault occurs. In this case the display switches to the Fault Panel.

The user can select the measured values that will be displayed on the Ground Fault Panel by setting an “m out of n” parameter. When more measured fault values are selected for display than the LC display can accommodate, then the display will either switch to the next set of measured fault values at intervals defined by the setting for LOC: Hold-time for Panels or when the appropriate key on the local control panel is pressed.

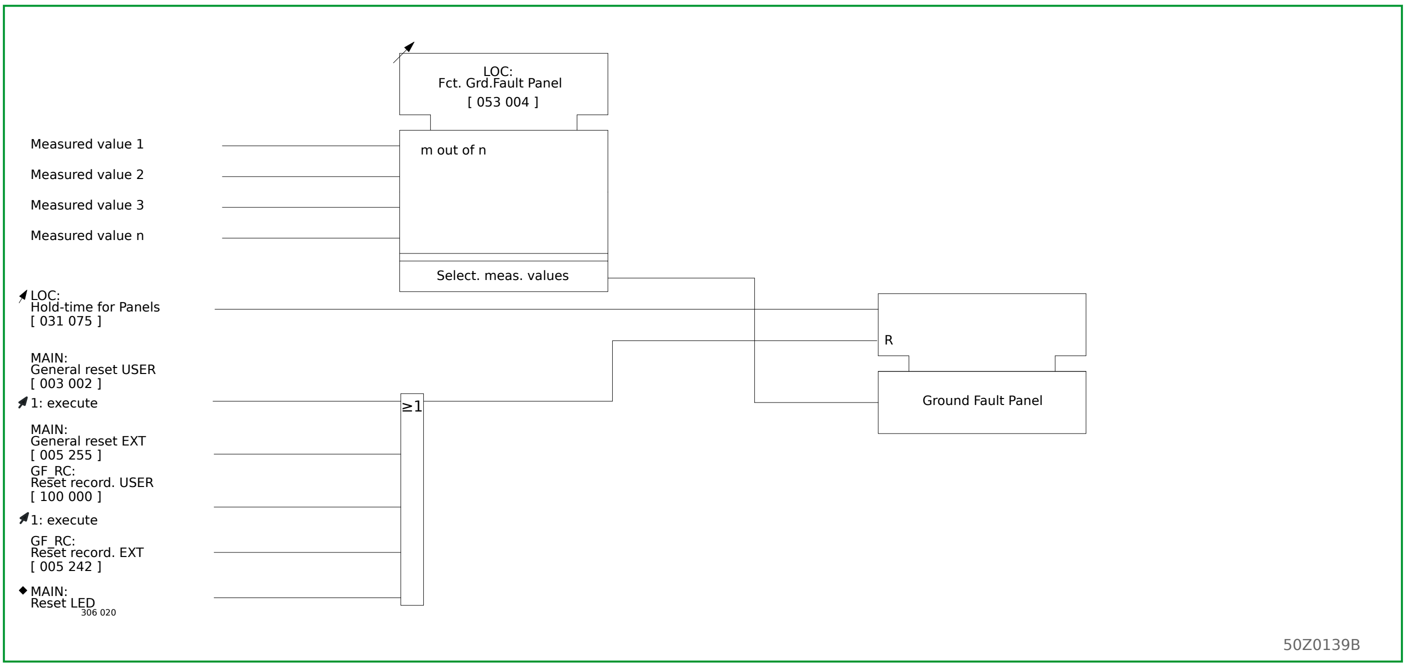


Fig. 3-7: Ground Fault Panel.

3.3.6 Overload Panel

The Overload Panel is automatically displayed in place of another data panel when there is an overload, provided that at least one measured value has been configured. The Overload Panel remains on display until the overload ends, unless a fault occurs. In this case the display switches to the Fault Panel.

The user can select the measured values that will be displayed on the Overload Panel by setting a “m out of n” parameter. When more measured fault values are selected for display than the LC display can accommodate, then the display will either switch to the next set of measured fault values at intervals defined by the setting for LOC: Hold-time for Panels or when the appropriate key on the local control panel is pressed.

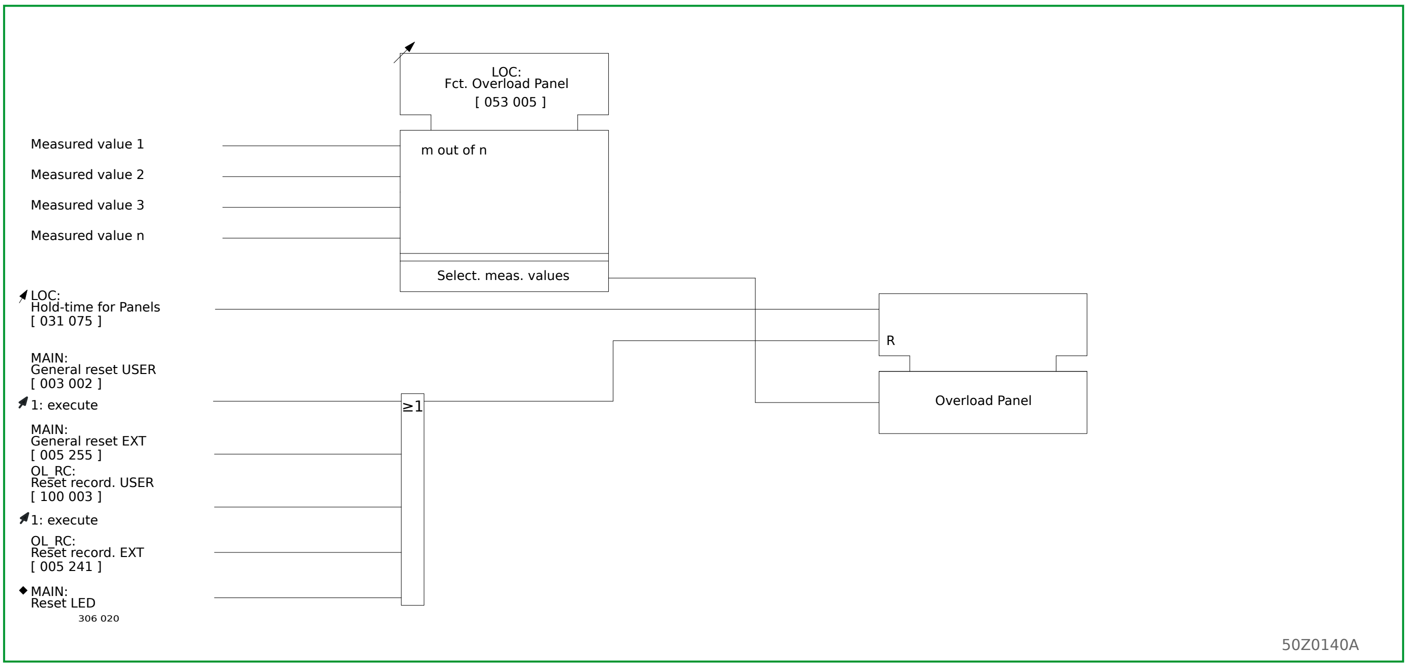


Fig. 3-8: Overload Panel.

3.3.7 Selection of the Control Point

Switchgear units can be controlled from a remote location or locally. Switching between local and remote control is achieved by using either the L/R key on the local control panel or an external key switch. The position of this external key switch is checked by an appropriately configured binary signal input (configuration at `MAIN: Inp.asg. L/R key sw.`).

If the binary signal input is configured to *L/R key switch* then the L/R key on the local control panel is without function when the graphic display is fitted.

This setting for `LOC: Fct. assign. L/R key` determines whether the switching using either the L/R key or the key switch is between local and remote control (L↔R) or between local+remote and local control (R&L↔L).

If only remote control is enabled then there will be a local access blocking. If only local control is enabled then there will be a remote access blocking.

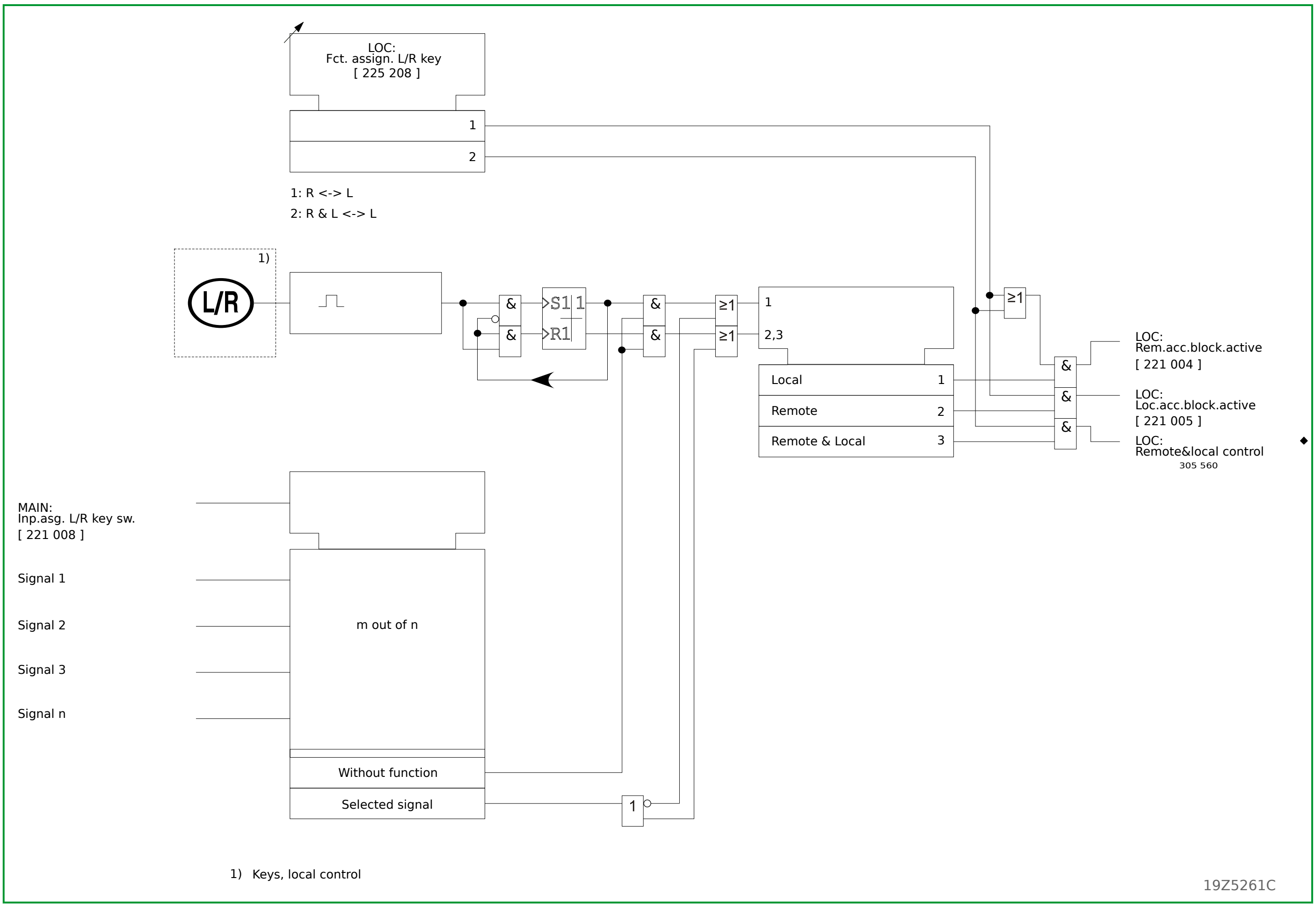


Fig. 3-9: Selection of the control point.

3.3.8 Configurable Clear Key

The P139 has a Clear key – Ⓒ –, to which one or more reset functions can be assigned by selecting the required functions at `LOC: Fct. reset key`. Details on the functions' resetting features are given in Section 3.11.21, (p. 3-122).

3.4 Communication Interfaces

The P139 has a PC interface as a standard component. Communication module A is optional and can be provided with one or two communication channels – depending on the design version. Communication between the P139 and the control station’s computer is through the communication module A. Setting and interrogation is possible through all the P139's interfaces.

If the communication module A with two communication channels is installed, settings for two communication interfaces will be available. The setting of communication interface 1 (COMM1) may be assigned to the physical communication channels 1 or 2 (see Section 3.11.22, (p. 3-124)). If the COMM1 settings have been assigned to communication channel 2, then the settings of communication interface 2 (COMM2) will automatically be active for communication channel 1.

COMM2 can only be used to transmit data to and from the P139 if its PC interface has been de-activated. As soon as the PC interface is used to transmit data, COMM2 becomes “dead”. It will only be enabled again when the “time-out” period for the PC interface has elapsed.

If tests are run on the P139, the user is advised to activate the test mode. In this way the PC or the control system will recognize all incoming test signals accordingly (see Section 3.11.23, (p. 3-125)).

3.4.1 PC Interface (Function Group PC)

Communication between the P139 and a PC is through the PC interface. In order for data transfer between the P139 and the PC to function, several settings must be made in the P139.

There is support software available as an accessory for P139 control.

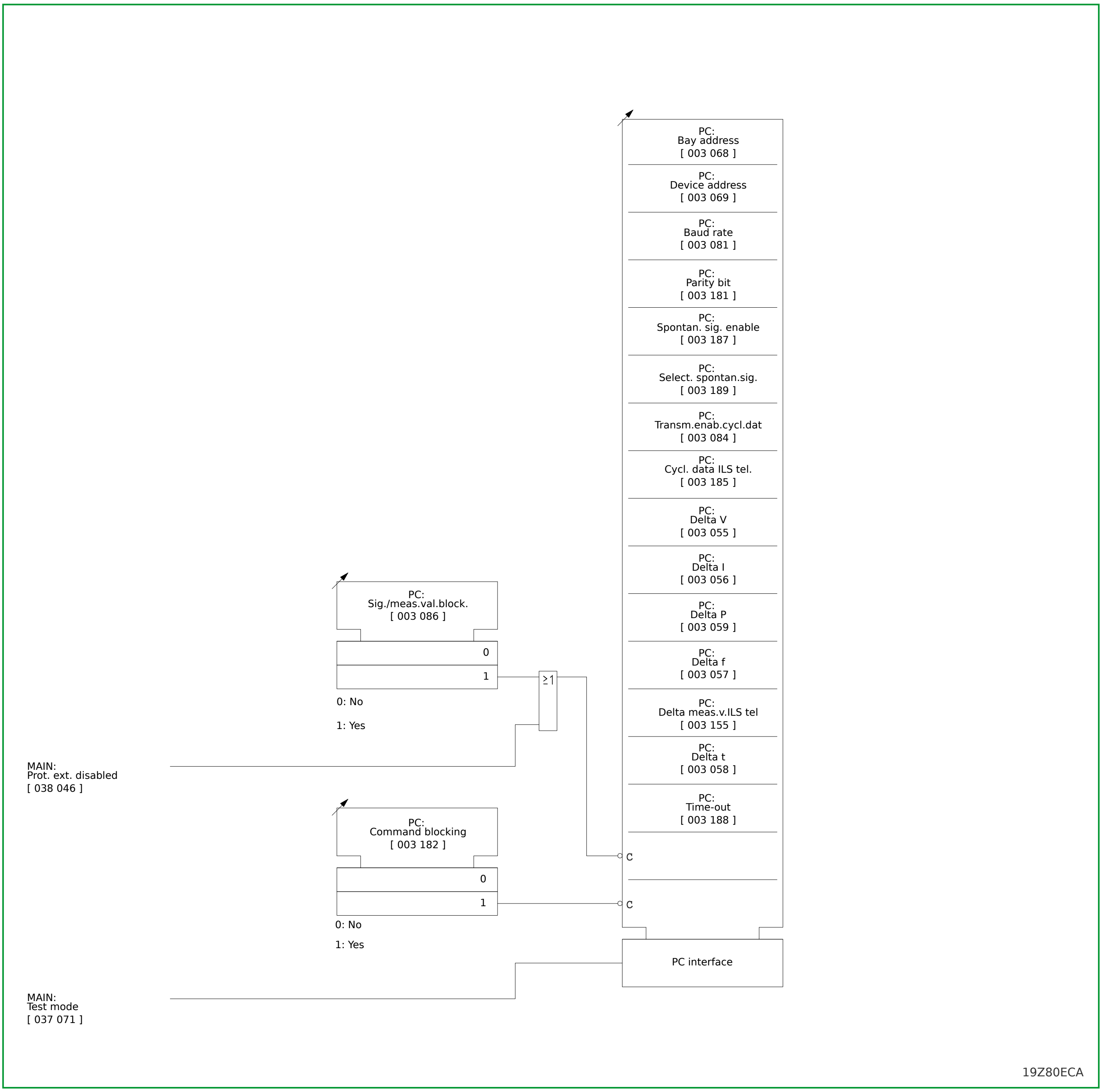


Fig. 3-10: PC interface settings.

3.4.2 Communication Interface 1 (Function Group COMM1)

There are several different interface protocols available at the communication interface 1. The following user-selected interface protocols are available for use with the P139:

- IEC 60870-5-103, "Transmission protocols - Companion standard for the informative interface of protection equipment, first edition, 1997-12 (corresponds to VDEW / ZVEI Recommendation, “Protection communication companion standard 1, compatibility level 2”, February 1995 edition) with additions covering control and monitoring
- IEC 870-5-101, "Telecontrol equipment and systems - Part 5: Transmission protocols - Section 101 Companion standard for basic telecontrol tasks," first edition 1995-11
- ILS-C, proprietary protocol of Schneider Electric
- MODBUS
- DNP 3.0
- COURIER

In order for data transfer to function properly, several settings must be made in the P139.

Communication interface 1 can be blocked through a binary signal input. In addition, a signal or measured-data block can also be imposed through a binary signal input.

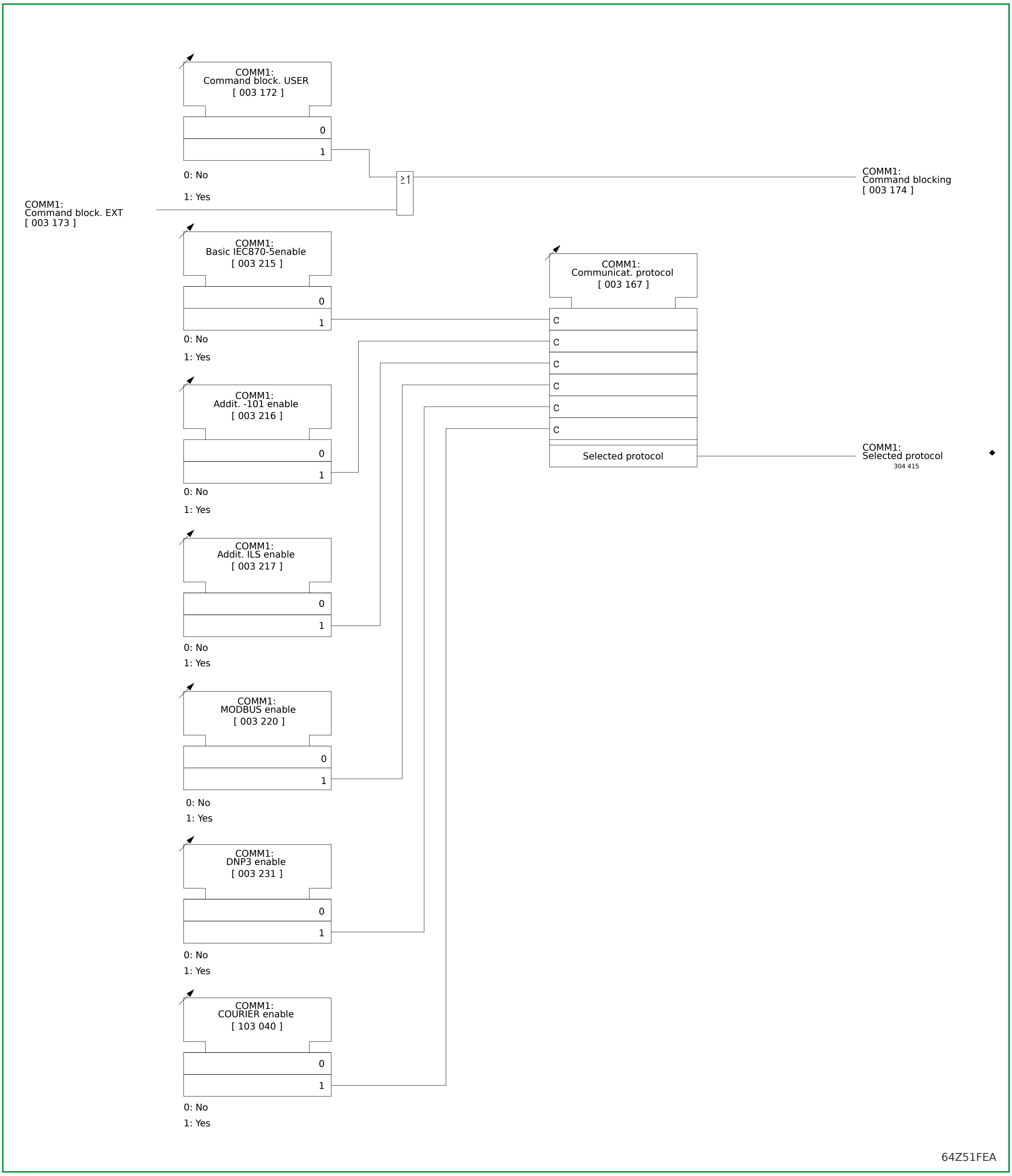


Fig. 3-11: Communication interface 1, selecting the interface protocol.

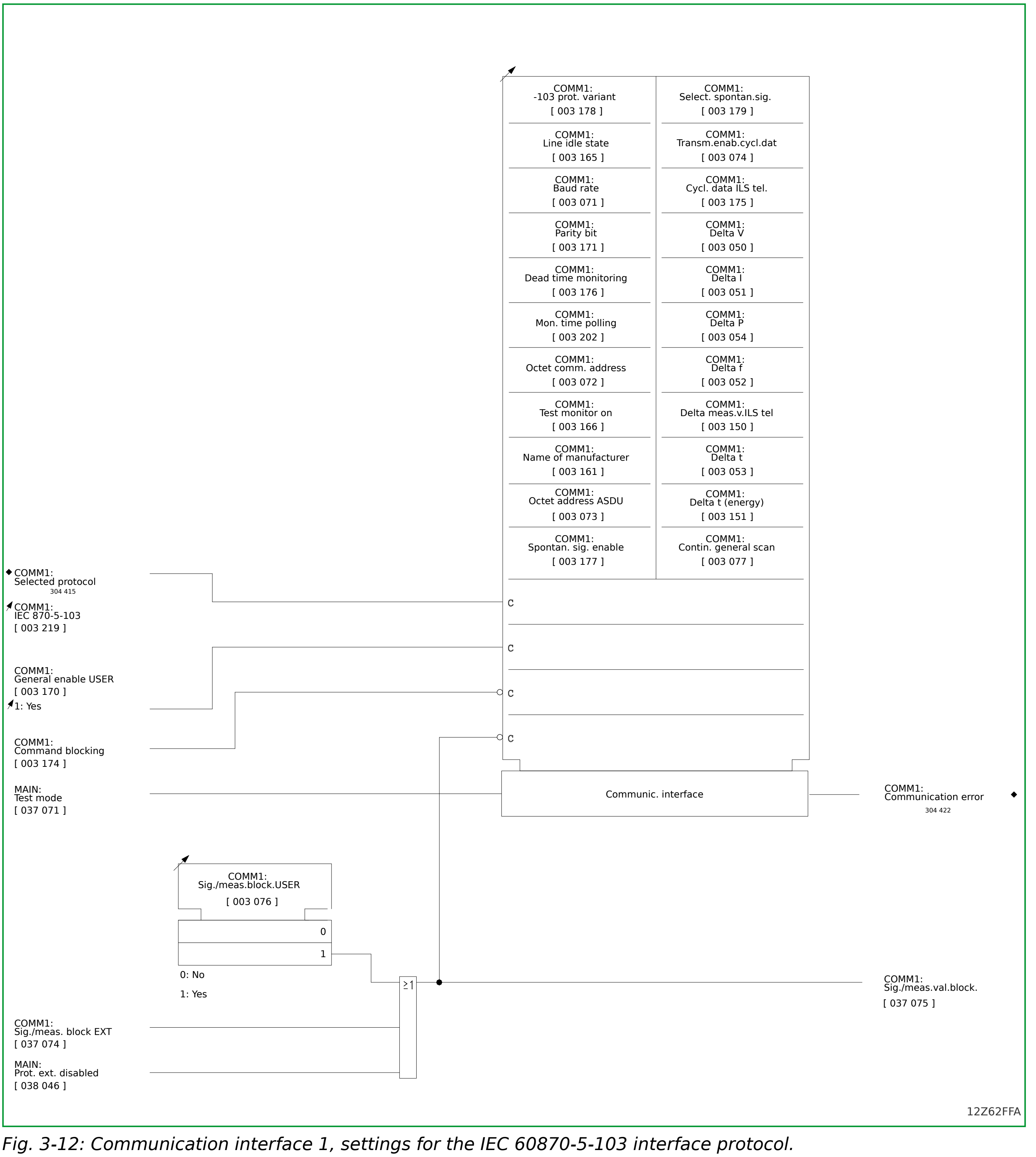


Fig. 3-12: Communication interface 1, settings for the IEC 60870-5-103 interface protocol.

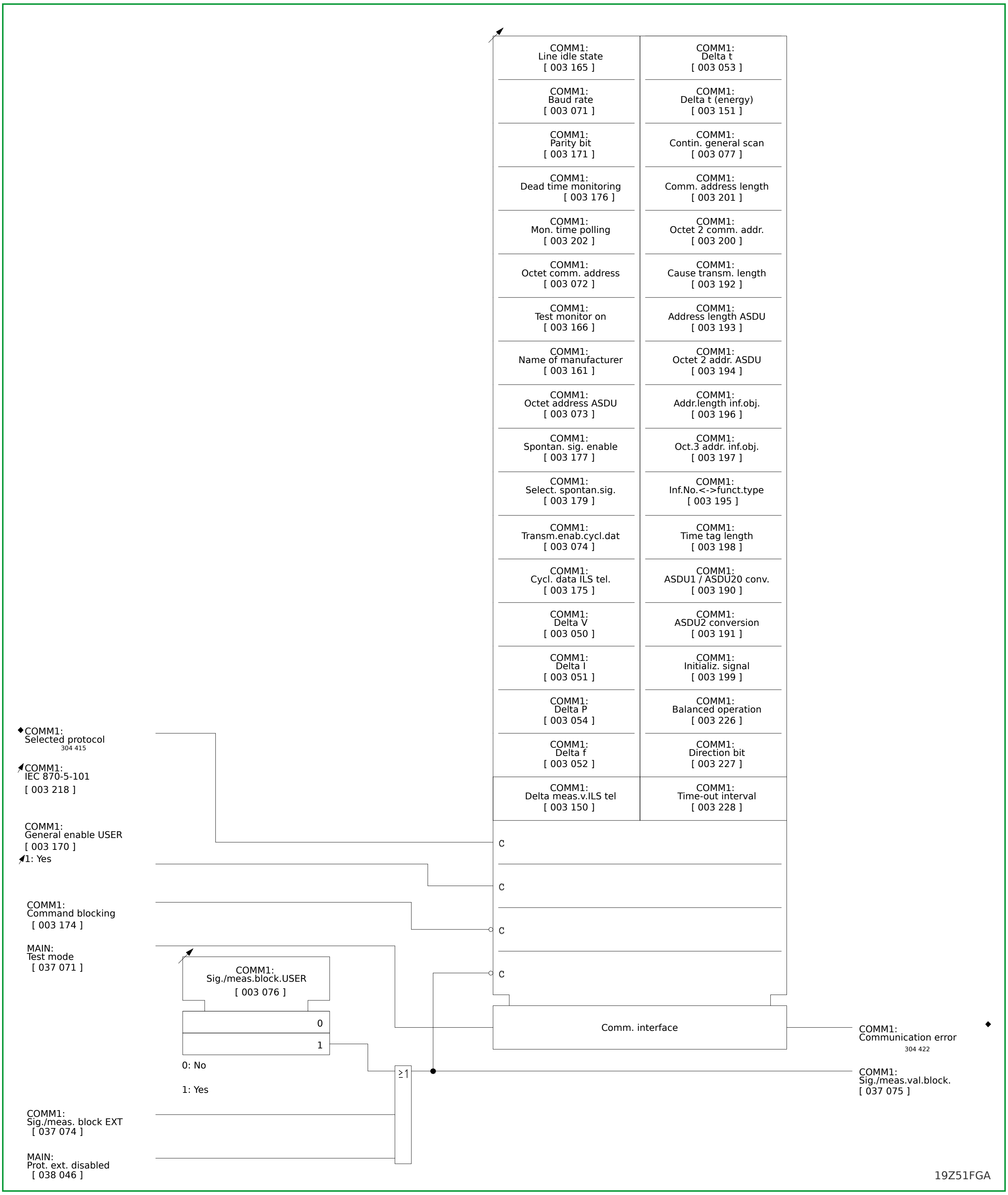


Fig. 3-13: Communication interface 1, settings for the IEC 870-5-101 interface protocol.

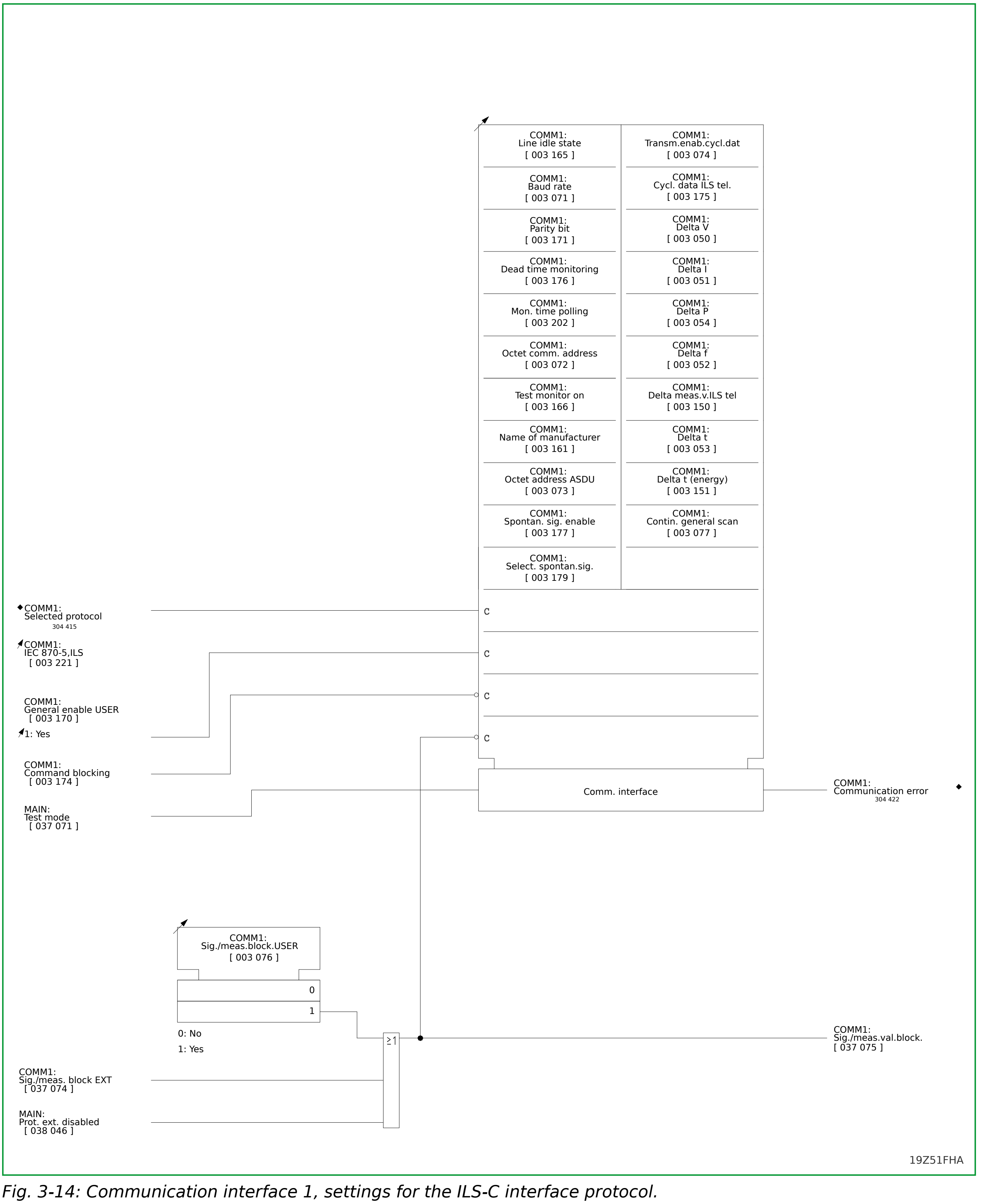


Fig. 3-14: Communication interface 1, settings for the ILS-C interface protocol.

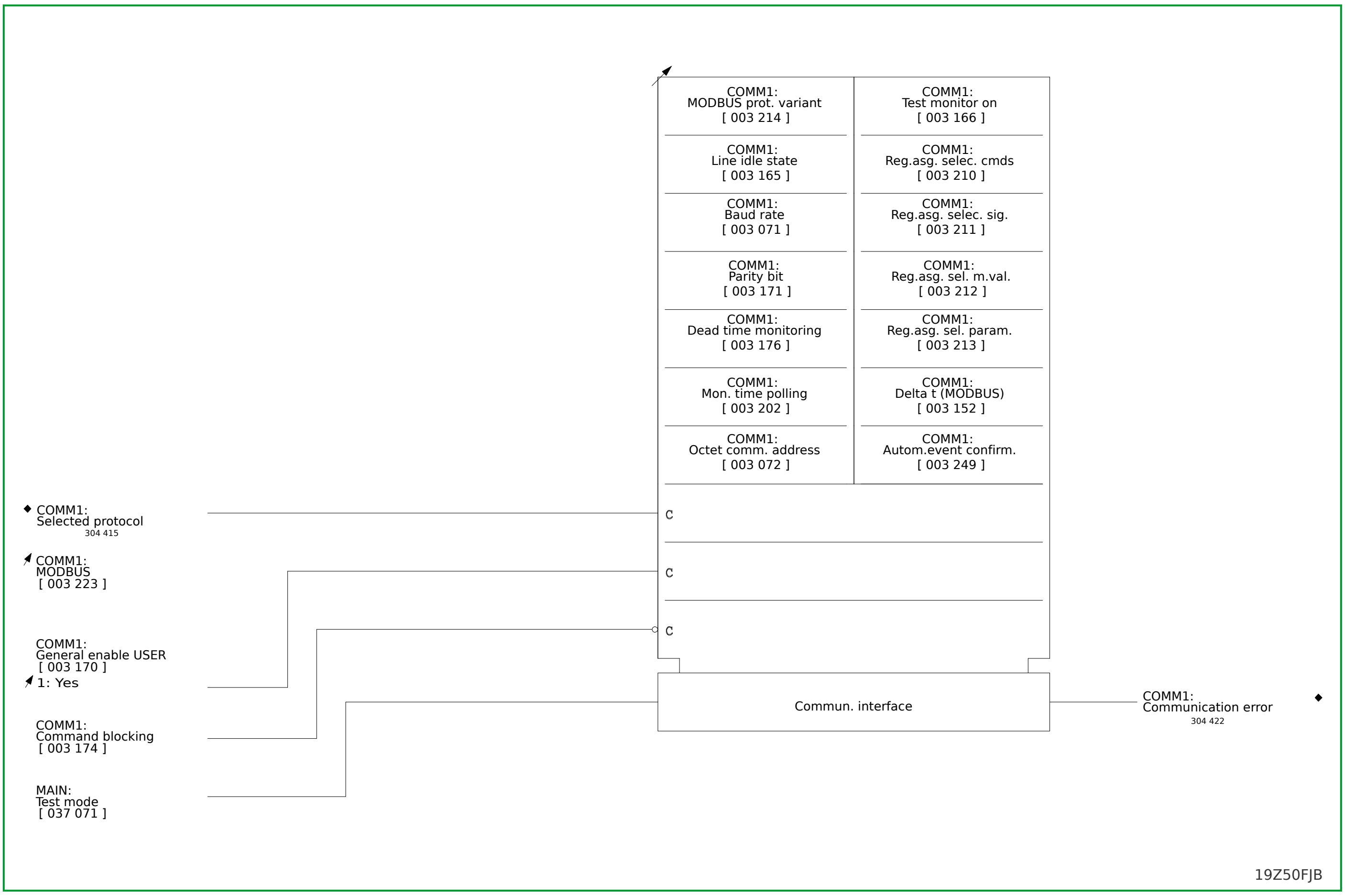


Fig. 3-15: Communication interface 1, settings for the MODBUS protocol.

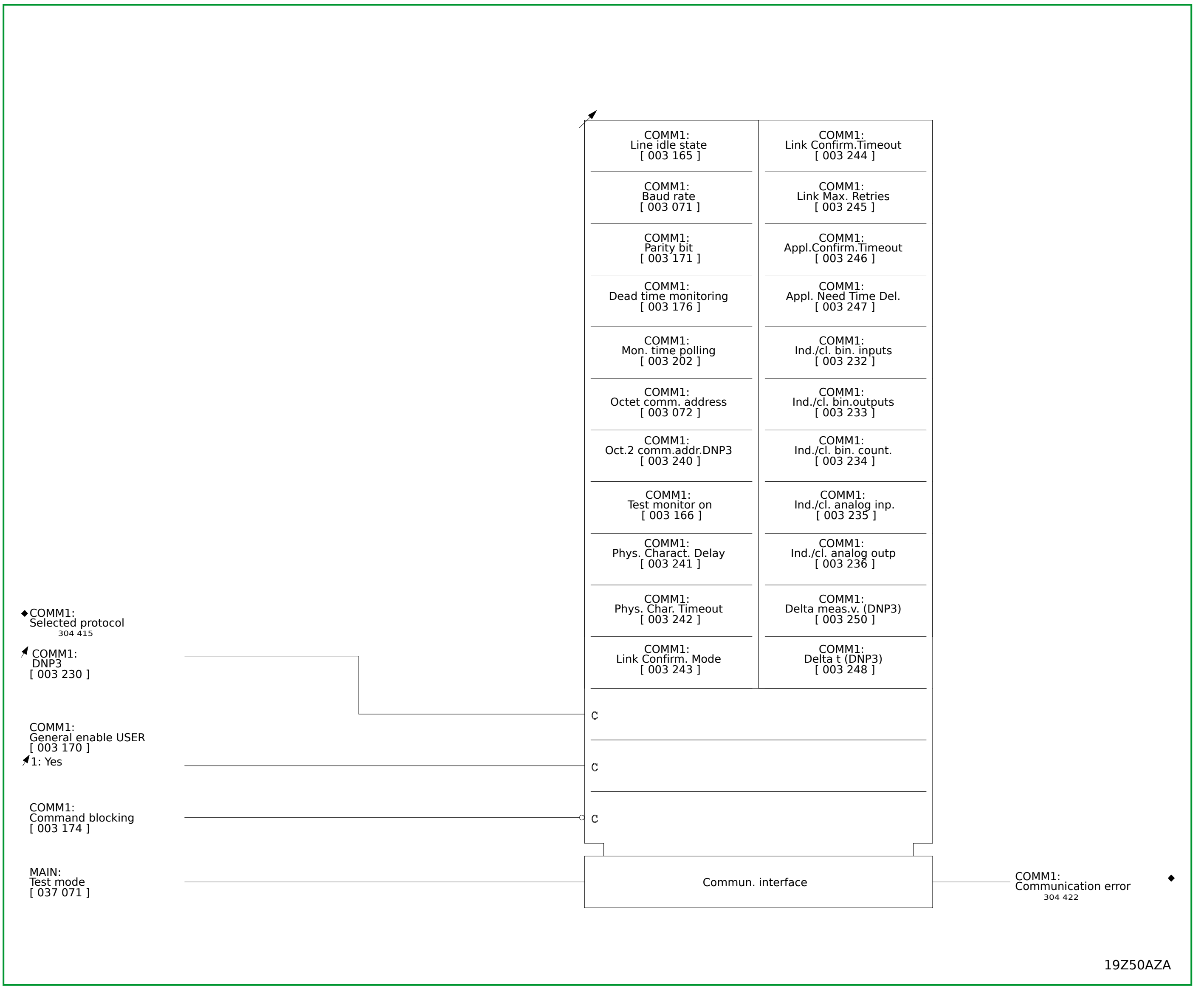


Fig. 3-16: Communication interface 1, settings for the DNP 3.0 protocol.

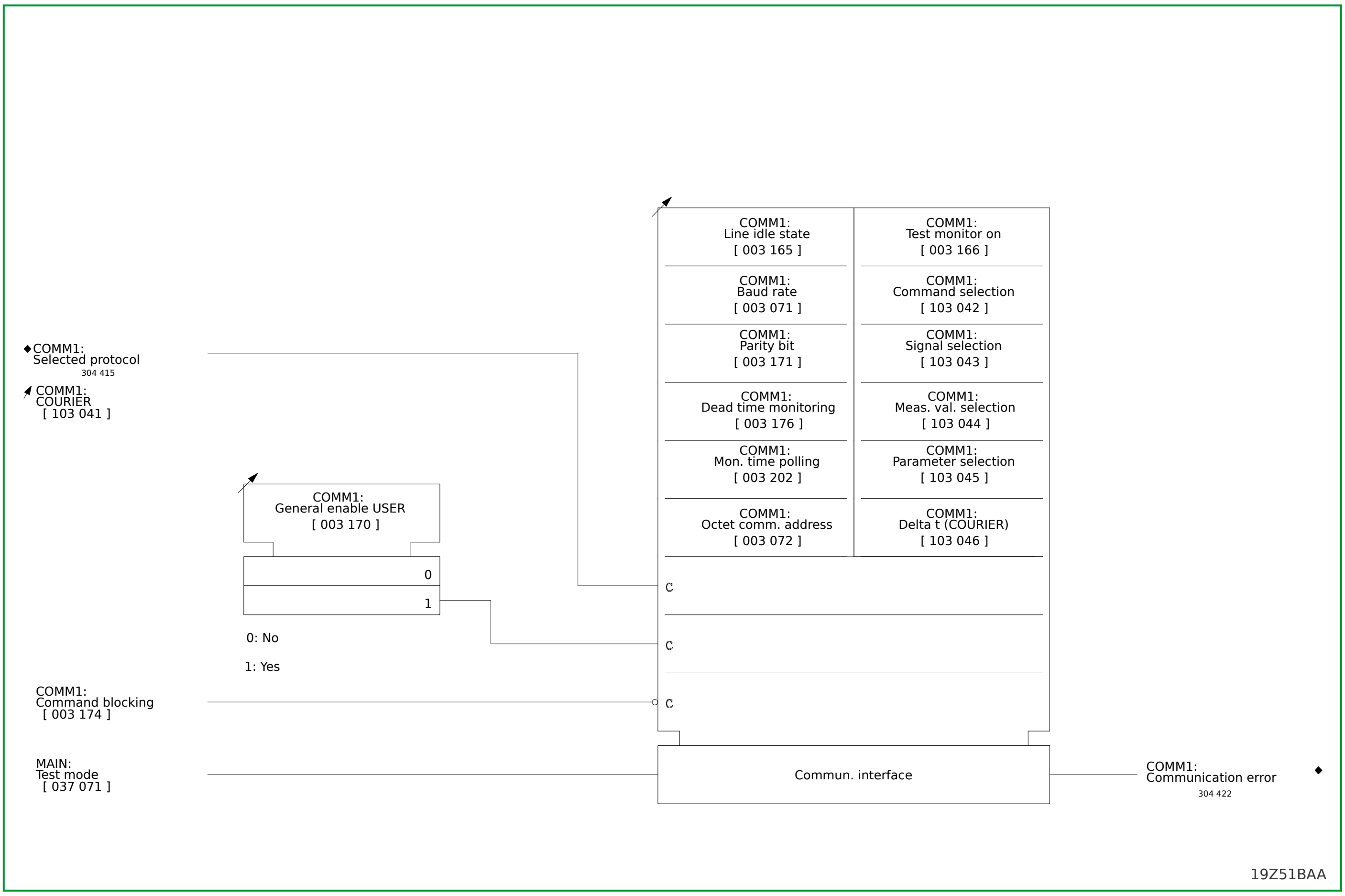


Fig. 3-17: Communication interface 1, settings for the COURIER protocol.

3.4.2.1 COMM1 – Checking Spontaneous Signals

For interface protocols based on IEC 60870-5-103, IEC 870-5-101, or ILS-C it is possible to select a signal for test purposes. The transmission of this signal to the control station as ‘sig. start‘ or ‘sig. end‘ can then be triggered using setting parameters.

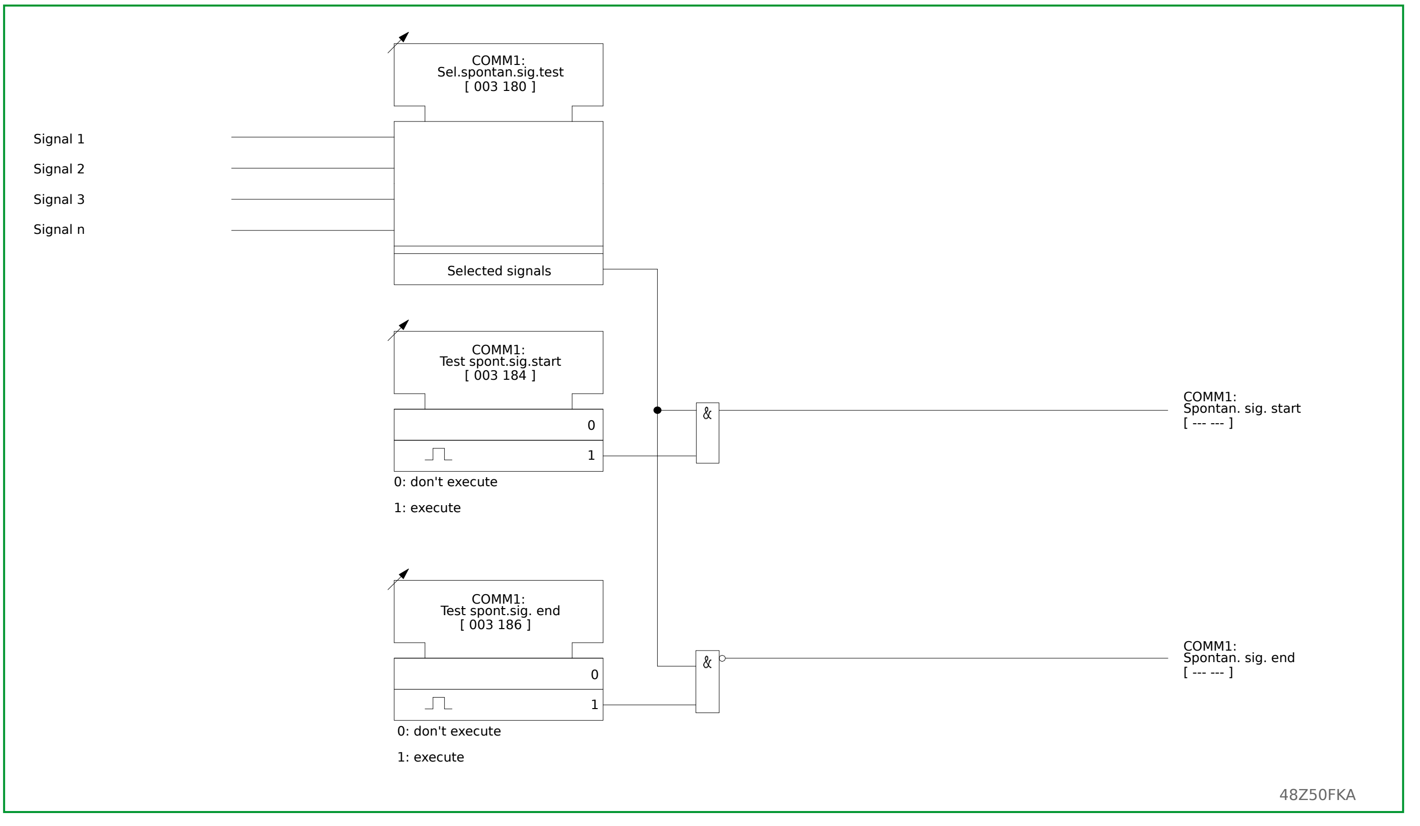


Fig. 3-18: COMM1 – Checking spontaneous signals.

3.4.2.2 Checking Switchgear Contact Positions and Signals

When checking during test operations with the interface protocols based on IEC 60870-5-103 it is possible to trigger signals (SIG) and contact positions (DEV) from the control part.

The following parameters are available:

- (221 105) COMM1: Sel. pos. dev.test

  Selection possibilities:

  - *Not assigned*
  - *DEV01 ... DEV10*
- (221 106) COMM1: Test position dev.

  Selection possibilities:

  - *don't execute*
  - *execute open*
  - *execute close*
  - *execute intermed.*

3.4.3 Communication Interface 2 (Function Group COMM2)

Communication interface 2 supports the IEC 60870-5-103 interface protocol.

In order for data transfer to function properly, several settings must be made in the P139.

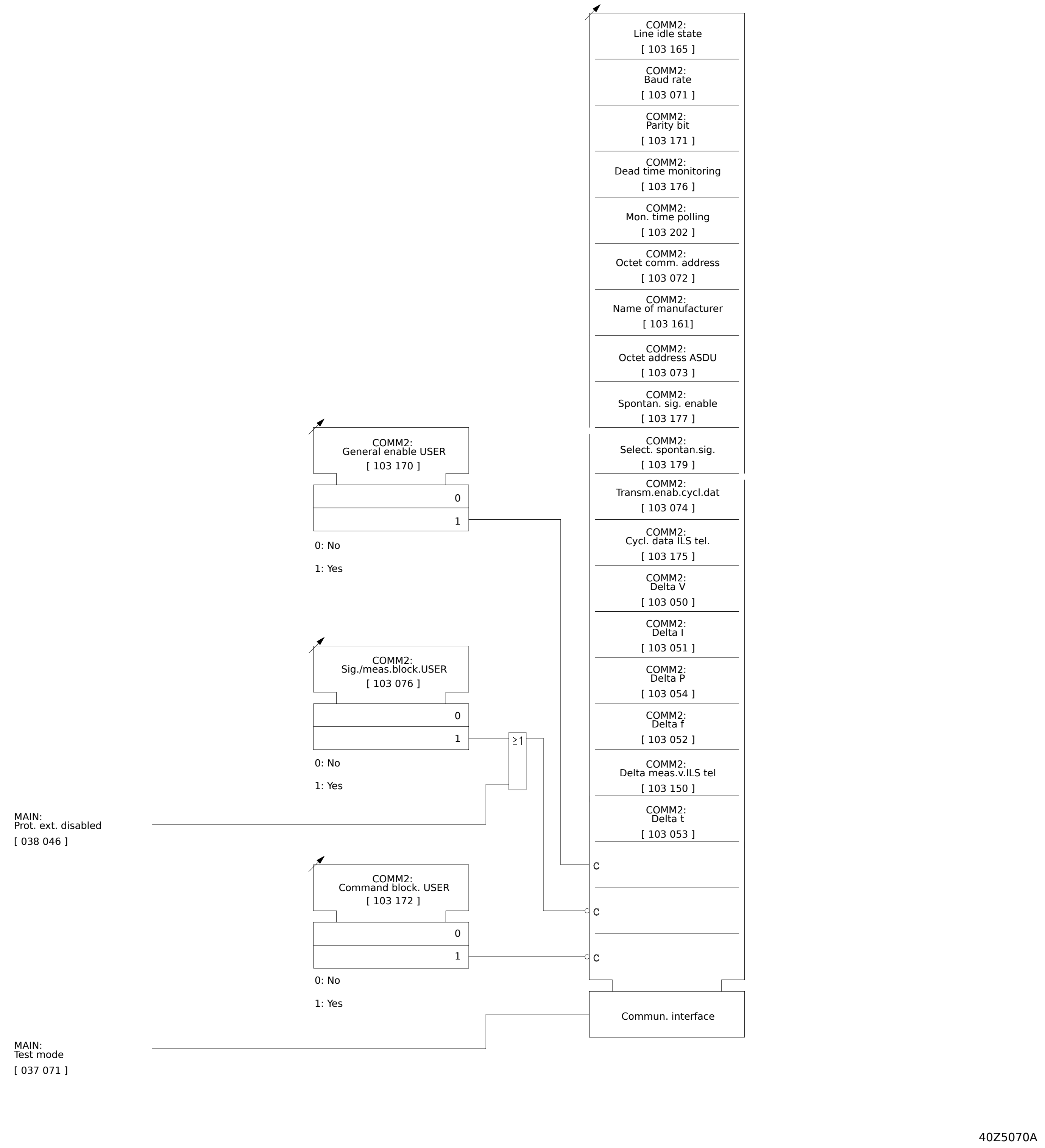


Fig. 3-19: Settings for communication interface 2.

3.4.3.1 COMM2 – Checking Spontaneous Signals

It is possible to select a signal for test purposes. The transmission of this signal to the control station as ‘sig. start‘ or ‘sig. end‘ can then be triggered via the local control panel.

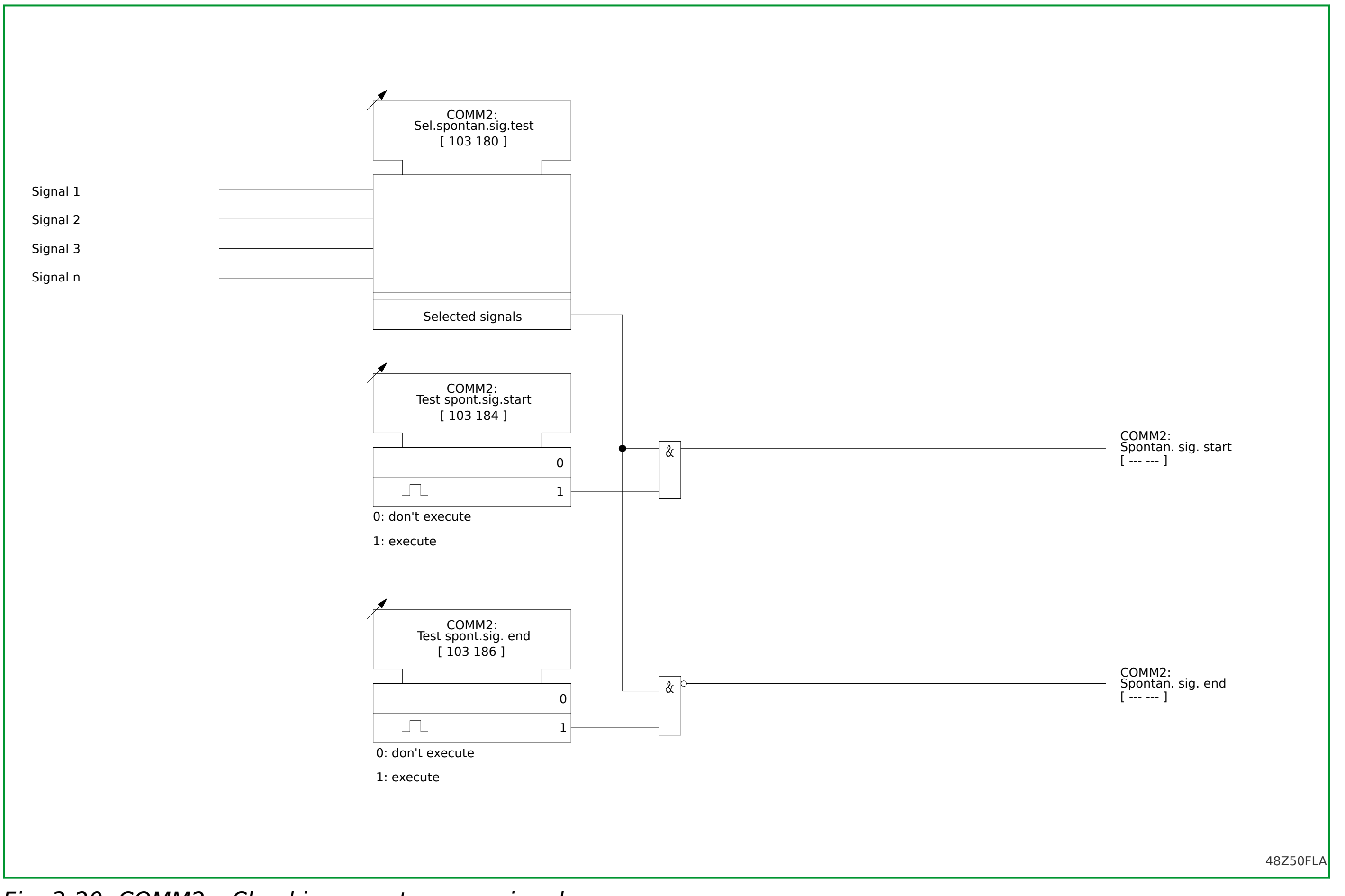


Fig. 3-20: COMM2 – Checking spontaneous signals.

3.4.4 Communication Interface 3 (Function Group COMM3)

3.4.4.1 Application

Communication interface 3 is designed to establish a digital communication link between two devices from Schneider Electric's device family “Easergy MiCOM 30”.

Over this communication link can be transmitted up to 8 binary protection signals. Whereas communication interfaces 1 and 2 are designed as information interfaces to connect to data acquisition subsystems and for remote access, communication interface 3 is designed as a protection signaling interface that will transmit real time signals (InterMiCOM protection signaling interface). Its main application is to transmit signals from protective signaling (function group PSIG). In addition, any other internal or external binary signals may also be transmitted.

3.4.4.2 Physical Medium

COMM3 is provided as an asynchronous, full-duplex communication interface. To transmit data the following physical media are available:

Direct link without use of external supplementary equipment:

- Glass fiber (e.g. via 2 x G62.5/125 up to max. 1.4 km)
- Twisted pair (RS 422 up to max. 1.2 km)

Use of external transmission equipment:

- FO module (e.g. OZD 485 BFOC-1300 / Hirschmann up to max. 8/14/20 km)
- Universal modem (e.g. PZ 511 via twisted pair 2x2x0.5 mm up to max. 10 km)
- Voice frequency modem (e.g. TD-32 DC / Westermo up to max. 20 km)

Digital network:

- Asynchronous data interface of primary multiplexing equipment

3.4.4.3 Configuration and Enabling

In order to use InterMiCOM, the communication interface COMM3 has to be configured using the parameter COMM3: Function group COMM3. This setting parameter is only visible if the relevant optional communication module is fitted. After activation of COMM3, all addresses associated to this function group (setting parameters, binary state signals etc.) become visible.

The function can then be enabled or disabled by setting COMM3: General enable USER.

3.4.4.4 Telegram Configuration

The communication baud rate is settable (COMM3: Baud rate) to adapt to the transmission channel requirements. Sending and receiving addresses COMM3: Source address and COMM3: Receiving address can be set to different values, thus avoiding that the P139 communicates with itself.

The InterMiCOM protection signaling interface provides independent transmission of eight binary signals in each direction. For the send signals COMM3: Fct. assignm. send 1, ...) any signal from the selection table of the binary outputs (OUTP) can be chosen. For the receive signals (COMM3: Fct. assignm. rec. 1, ...) any signal from the selection table of the binary inputs (INP) can be chosen.

For each receive signal, an individual operating mode can be set COMM3: Oper. mode receive 1, ...), thus defining the required checks for accepting the received binary signal. In addition a specifically selected telegram structure subdivides the 8 binary signals into two groups. The signal encoding along with the set operating mode for the telegram check defines the actual balance of “Speed”, “Security” and “Dependability” for each signal:

- Binary signals 1 to 4:

  Operating mode settable to *Blocking* or *Direct intertrip*
- Binary signals 5 to 8:

  Operating mode settable to *Permissive* or *Direct intertrip*

EN 60834-1 classifies 3 categories of command based teleprotection schemes according to their specific requirements (see Fig. 3-21, (p. 3-29)). By selection of a binary signal and by setting its operating mode appropriately, these requirements can be fulfilled as follows:

Direct transfer trip or intertripping:	
Preference:	Security.
Implication:	No spurious pickup in the presence of channel noise.
Recommended setting:	Select binary signal from groups 1 to 4 or 5 to 8 and set operating mode *Direct intertrip*.

Permissive teleprotection scheme:	
Preference:	Dependability.
Implication:	Maximizes probability of signal transmission in the presence of channel noise.
Recommended setting:	Select binary signal from group 5 to 8 and set operating mode *Permissive*.

Blocking teleprotection scheme:	
Preference:	Speed.
Implication:	Fast peer-to-peer signal transfer.
Recommended setting:	Select binary signal from group 1 to 4 and set operating mode *Blocking*.

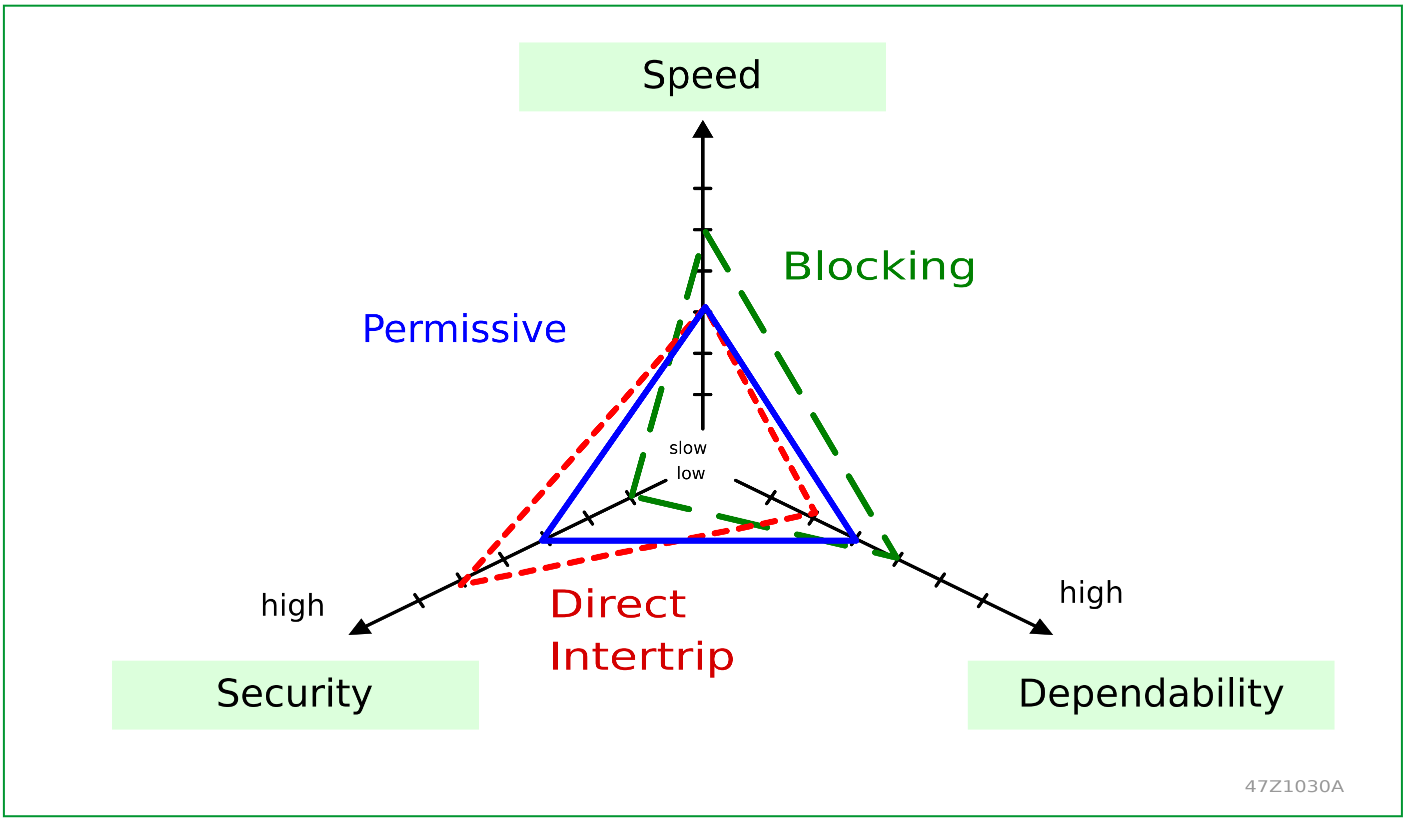


Fig. 3-21: Comparison of speed, security and dependability offered by the three operating modes.

3.4.4.5 Communication Monitoring

Timer stage COMM3: Time-out comm.fault is used for monitoring the transmission channel (this timer is re-triggered with each complete and correct received telegram). The wide setting range allows adaptation to the actual channel transmission times and above all this is needed for time-critical schemes such as the blocking scheme. After the timer has elapsed, signals COMM3: Communications fault and SFMON: Communic.fault COMM3 are issued and the received signals are automatically set to their user-defined default values (COMM3: Default value rec. 1, ..., COMM3: Default value rec. 8). As the main application for this protective signaling the fault signal may be mapped to the corresponding input signal in function group PSIG with the COMM3: Sig.asg. comm.fault setting.

Timer stage COMM3: Time-out link fail.. is used to determine a persistent failure of the data transmission channel. After the timer has elapsed, signals COMM3: Comm. link failure and SFMON: Comm.link fail.COMM3 are issued.

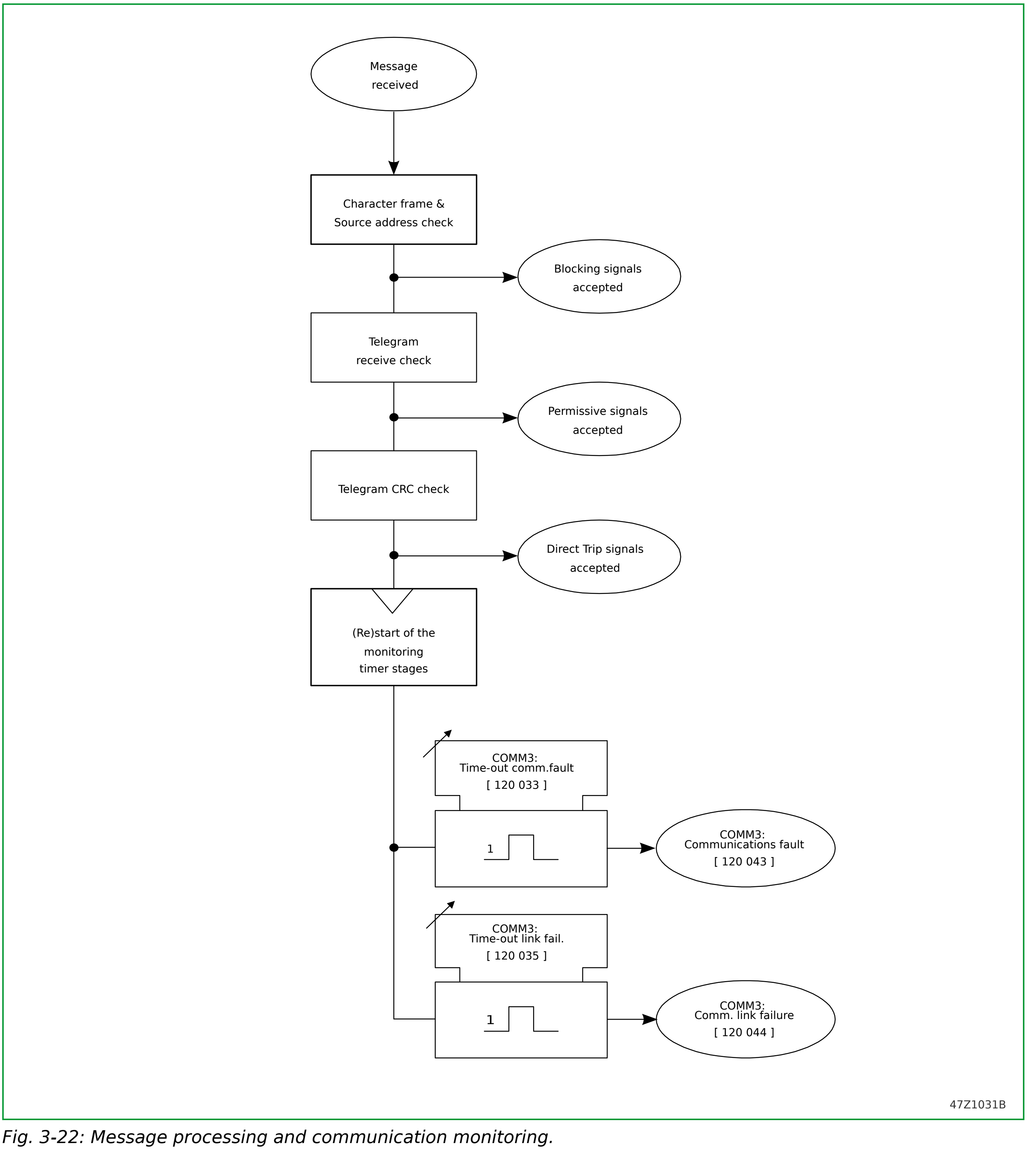


Fig. 3-22: Message processing and communication monitoring.

3.4.4.6 Supervision of Communication Link Quality

After a syntax check of each received message, InterMiCOM updates the ratio of incorrectly received messages, based on a total of the last 1000 received messages. The result is provided as an updating measurand COMM3: No. tel. errors p.u.. and the overall maximum ratio can be read from COMM3: No.t.err.,max,stored.

If the set threshold COMM3: Limit telegr. errors is exceeded the corresponding signals COMM3: Lim.exceed.,tel.err. and SFMON: Lim.exceed.,tel.err. will be issued. All corrupted telegrams are counted (COMM3: No. telegram errors). This counter as well as the stored maximum ratio of corrupted messages can be reset via COMM3: Rset.No.tlg.err.USER (as well as via the binary signal COMM3: Reset No.tlg.err.EXT).

3.4.4.7 Commissioning Tools

The actual values of send and receive signals can be read from the P139 as physical state signals (COMM3: State send 1 and COMM3: State receive 1, with x = 1 to 8). In addition, InterMiCOM provides 2 test facilities for commissioning of the protection interface.

For a loop-back test, the send output is directly linked back to the receive input. After setting the bit pattern wanted (as an equivalent decimal number at COMM3: Loop back send) the test can be triggered via COMM3: Loop back test. This bit pattern is sent for the duration of the hold time set at COMM3: Hold time for test. For this test only, the source address is set to '0'; this value is not used for regular end-to-end communication. The test result can be checked as long as the hold-time is running by reading the measured operating data COMM3: Loop back result and COMM3: Loop back receive. As soon as the hold-time has expired, the loopback test is terminated and InterMiCOM reverts to the normal sending mode (e.g. sending the actual values of the configured send signals, using the set source address).

Thus, in case of problems with the InterMiCOM protection signaling interface, the loopback test can be used to verify or to exclude a defective device. The transmission channel including the receiving device can be checked manually by setting individual binary signals (COMM3: Send signal for test) to user-defined test values (COMM3: Log. state for test). After triggering the test by COMM3: Send signal, test, the preset binary signal is sent with the preset value for the set hold time COMM3: Hold time for test. The 7 remaining binary signals are not affected by this test procedure and remain to be sent with their actual values. During the hold time, a received signal can be checked at the receiving device, e.g. by reading the physical state signal. After the hold time has expired, the test mode is reset automatically and the actual values of all 8 signals are transmitted again.

3.4.5 Communication Interface IEC 61850 (Function Groups IEC and GOOSE)

The IEC 61850 communication protocol is implemented by these function groups and the Ethernet module.

Function group IEC is only available as an alternative to function group COMM1 (hardware ordering option!).

3.4.5.1 Communication Interface IEC 61850 (Function Group IEC)

The P139 offers as an ordering option a communication protocol according to the Ethernet based IEC 61850 protocol.

3.4.5.1.1 IEC 61850

IEC 61850 was created jointly by users and manufacturers as an international standard. The main target of IEC 61850 is interoperability of devices. This includes the capability of two or more intelligent electronic devices (IED), manufactured by the same company or different companies, to exchange data for combined operation.

This communication standard IEC 61850 has now created an open and common basis for communication from the process control level down to the network control level, for the exchange of signals, data, measured values and commands.

For a standardized description of all information and services available in a field device a data model, which lists all visible functions, is created. Such a data model, specifically created for each device, is used as a basis for an exchange of data between the devices and all process control installations interested in such information. In order to facilitate engineering at the process control level a standardized description file of the device, based on XML, is created with the help of the data model. This file can be imported and processed further by the relevant configuration program used by the process control device. This makes possible an automated creation of process variables, substations and signal images.

Available is the following documentation providing the description of the IEC 61850 data model which is used with the P139:

- ICD file based on XML in the SCL (Substation Configuration Description Language) with a description of data, properties and services, available from the P139, that are to be imported into the configuration tool “IED Configurator” or into a system configurator.
- PICS_MICS_ADL file with the following contents:
  - PICS (Protocol Implementation Conformance Statement) with an overview of available services.
  - MICS (Model Implementation Conformance Statement) with an overview of available object types.
  - ADL (Address Assignment List) with an overview of the assignment of parameter addresses (signals, measuring values, commands, etc.) used by the P139 with the device data model as per IEC 61850.

3.4.5.1.2 Ethernet Module

The optional Ethernet module provides an RJ45 connection and a fiber optic interface where an Ethernet network can be connected. The selection which of the two interfaces is to be used to connect to the Ethernet network is made by setting the parameter [IC]: Media.

*Setting parameters labeled with brackets – i. e. “[IC]:...” – instead of a normal function group are set with the “**I**ED **C**onfigurator”. They cannot be modified from the local control panel (HMI), nor with the operating program.*

There is a separate Chapter “IEC 61850 Settings via IED Configurator” with a description of all such setting parameters.

With the Ethernet module there are two ordering variants available for the fiber-optic interface: the ST connector and the SC connector both for 100 Mbit/s and 1300 nm. The RJ45 connector supports 10 Mbit/s and 100 Mbit/s.

The P139 may be equipped with the optional Ethernet module only as an alternative to the standard optional communication module. Therefore the Ethernet-based communication protocol IEC 61850 is available only as an alternative to function group COMM1.

Moreover, a communication module named “Redundant Ethernet Board” can be (optionally) fitted, as an alternative to the single Ethernet board or standard optional communication module. This module makes two fiber-optic interfaces (each with ST connector) available, to assure redundancy at IED level. See *Section 3.4.6, (p. 3-45)* *for more information, and the separately available “Redundant Ethernet Board” Technical Manual for all details.*

Both the Ethernet module and the Redundant Ethernet Board additionally provide an RS485 interface for remote access with the MiCOM S1 support software (function group COMM2).

3.4.5.1.3 Configuration and Enabling

The IEC function group can be included in the configuration by setting the parameter IEC: Function group IEC. This parameter is only visible if the optional Ethernet communication module is fitted to the P139. After activation of IEC, all data points associated with this function group (setting parameters, binary state signals etc.) become visible.

The function can then be enabled or disabled by setting IEC: General enable USER.

The setting parameters from the IEC function group as well as the related GOOSE function group are not automatically active in the P139. The P139 features two memory “banks” one of which includes the active setting parameters. The other memory bank is used with the configuration procedure for parameters from the *IED Configurator* and the operating system. Specific project-related extensions of the IEC 61850 parameters from the *IED Configurator* are loaded into the P139 by downloading a .MCL file. The inactive communication parameters are activated by executing the command IEC: Switch Config. Bank. This command may also be issued from the *IED Configurator*.

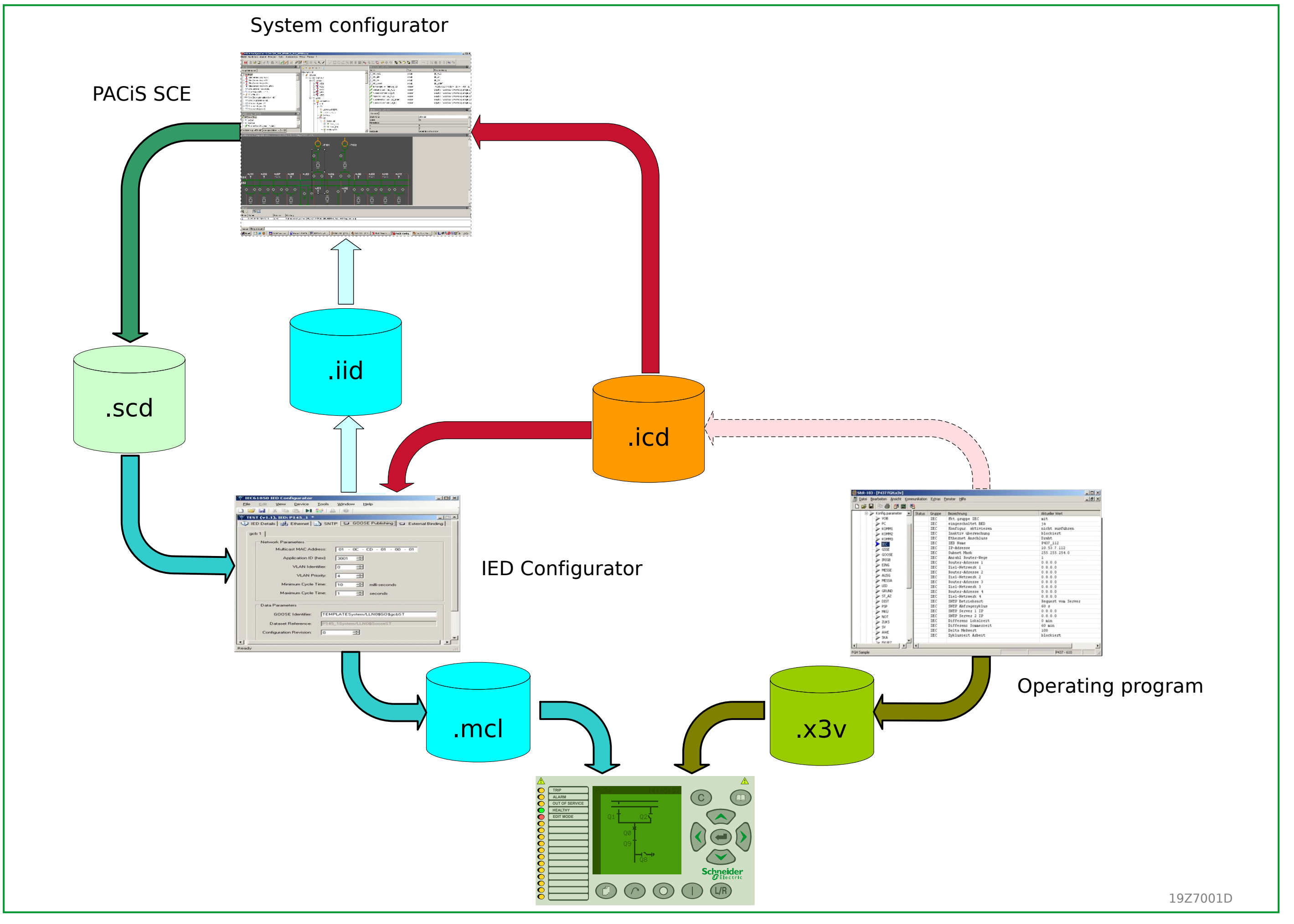


Fig. 3-23: Configuration according to IEC 61850-6.

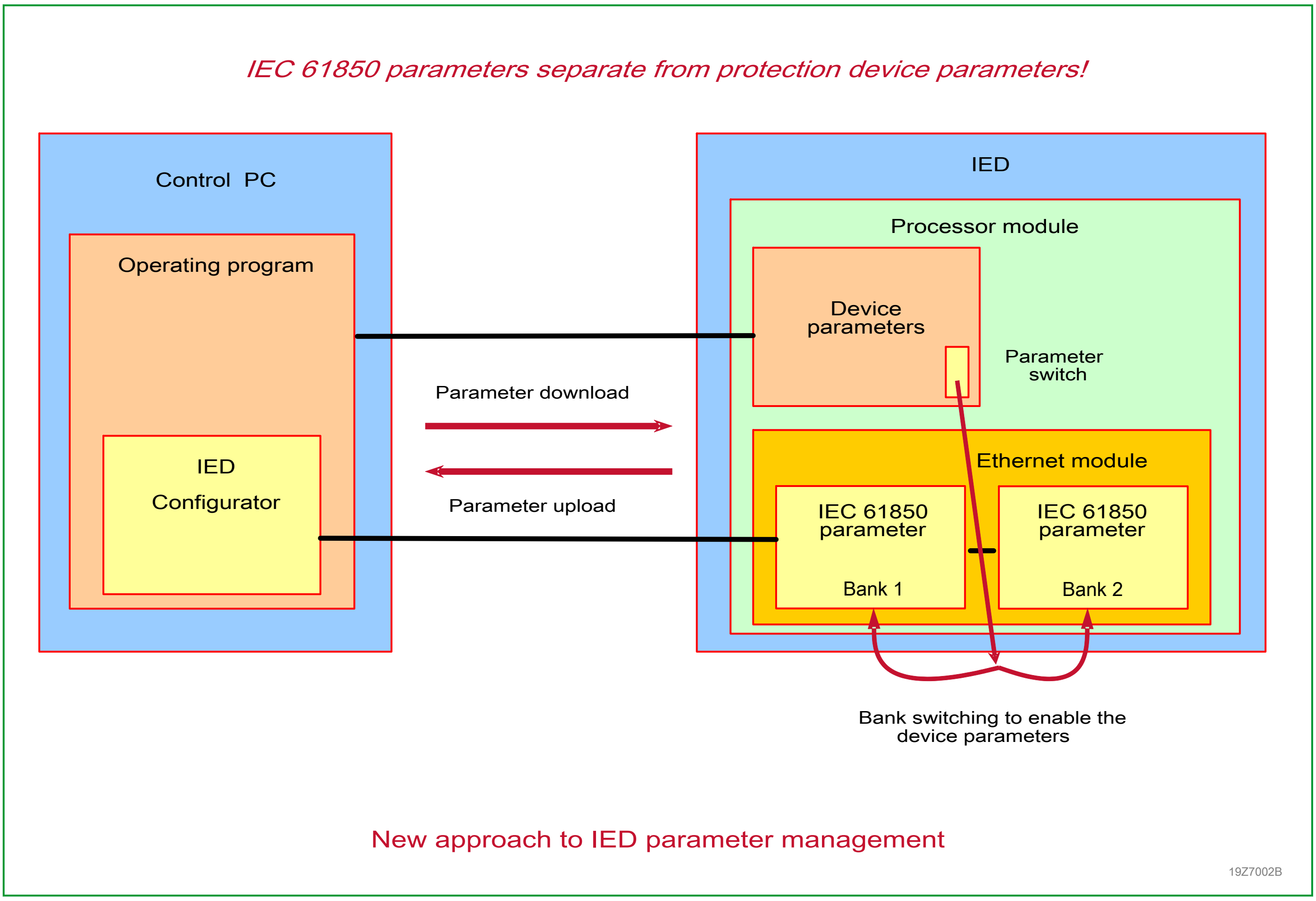


Fig. 3-24: Saving configuration parameters.

3.4.5.1.4 Client Log-on

Communication in Ethernet no longer occurs in a restrictive master slave system, as is common with other protocols. Instead, server or client functionalities, as defined in the “Abstract Communication Service Interface” (ACSI, IEC 61870-7-2), are assigned to the devices. A “server” is always that device which provides information to other devices. A client may log on to this server in order to receive information, for instance “reports”. In its function as server the P139 can supply up to 16 clients, linked into the network, with spontaneous or cyclic information.

3.4.5.1.5 Clock Synchronization

With IEC 61850 clock synchronization is effected via the SNTP protocol, defined as standard for Ethernet. Here the P139 functions as an SNTP client.

For clock synchronization one can choose between the operating modes *Anycast* from SNTP Server or *Request from Server*. With the first operating mode synchronization occurs by a broadcast message sent from the SNTP server to all devices in the network, and in the second operating mode the P139 requests a device-specific time signal during a settable cycle.

Two SNTP servers may be set. In this case, clock synchronization is preferably performed by the first server. The second server is only reverted to if no signal is received from the first server.

When looking at the source priority for clock synchronization, which is set at the MAIN function then, by selecting *COMM1/IEC*, synchronization per IEC 61850 is automatically active but only if this communication protocol is applied.

3.4.5.1.6 Generating Datasets, Reporting

The specific project related feature of the P139's communications behavior is determined by the configuration of datasets, reports and high priority transmission methods. A piece of information must be included in a dataset so as to be transmitted as a signal. A dataset is a list to transmit certain data objects. The selection of data objects and the resulting length of the dataset is determined by the application; merely the GOOSE capacity, i.e. the maximum size of a dataset to be transmitted by GOOSE, is limited to 1500 bytes.

It is not possible to read the IEC configuration back from the P139 if the "Dataset" sizes exceed the GOOSE size limit significantly. Therefore it is recommended to limit the "Dataset" size(s) to 100% of the GOOSE capacity. Too large a dataset can spoil IEC 61850 communication. Hence, the dataset size limit of 100% of the GOOSE capacity should not be exceeded, neither for GOOSE nor for reports.

Data objects provided by the P139 are available for selection with a structure as specified by IEC 61850. Within the quality descriptor for each piece of information the invalid bit and the test bit are served according to the P139's state; the other attributes are not set. Any number of datasets may be created with the IED Configurator. Saving datasets at System\LLN0 is compulsory. The knowledge of dataset content is imperative for decoding and evaluating received signals. Configuration files possess a listing of all datasets with a description of all data objects included.

Next to their use with high priority transmission methods (see Section 3.4.5.1.12, (p. 3-41)) datasets are used mainly for reporting. The P139 provides up to sixteen unbuffered reports and eight buffered reports independent of the number of clients logged-on. Management is arranged into sixteen Unbuffered Report Control Blocks (urcbA to urcbP) and eight Buffered Report Control Blocks (brcbA to brcbH). Whereas with unbuffered reporting pieces of information may be lost during a communications failure, the buffered report control blocks support a buffered transmission which is required for the uninterrupted writing of events. A pre-defined dataset may be assigned to each report which will then determine which data object will be transmitted with the relevant report. Assigning datasets is not limited; the same dataset may be referenced in various reports or even in GOOSEs.

The P139 can serve up to sixteen clients. Each client can log-on to any number of available reports. One unbuffered report can be allocated to max. 8 clients, and one buffered report can be allocated to max. 4 clients. A client is then able to activate the wanted report for himself and to set the transmission behavior to his requirements. The system concept with intended clients must be taken into account when datasets are assigned to the reports.

Reports are not received by the P139.

3.4.5.1.7 Transmitting Modeled Signals Not Provided by the IEC 61850 Data Model

In addition to the information included in the IEC 61850 data model an optional number of up to 16 signals can be selected from all the signals available in the P139 to be transmitted via reporting. A selection of state signals (shuttling to communications) is made by setting `IEC: SigGGIO1 selection`. The data object indexes defined for SigGGIO1 must follow the sequence given for the 'm out of n' selection for the state signals. The indexes SigGGIO1.ST.ind1 to SigGGIO1.ST.ind16 may then be included in the datasets just as the other data objects.

3.4.5.1.8 Single Commands

Single commands (e.g. short command, long command, persistent command) are configured with the operating program. Sending commands to the P139 can be carried out from all clients that have previously logged-on to the P139. But only one command at a time is carried out. The operating mode *Direct control with normal security* is provided for single commands.

3.4.5.1.9 Control and Monitoring of Switchgear Units

Configuration of control of switchgear devices for the IEC 61850 is only possible with a special configuration software, the *IED Configurator*.

Control of switchgear units can be carried out from all clients that have previously logged on to the P139. Only one control command is executed at a time, i.e. further control requests issued by other clients during the execution of such a command are rejected. The following operating modes [IC]: ctlModel are available to control external devices by clients and they can be individually set for each switchgear device:

- *Status only*
- *Direct control with enhanced security*
- *SBO (Select before operate) with enhanced security*

When set to the operating mode *Select before operate* the switchgear unit is selected by the client before the control command is issued. Because of this selection the switchgear unit is reserved for the client. Control requests issued by other clients are rejected. If after a selection no control command is issued by the client the P139 resets this selection after a settable timeout period [IC]: sboTimeout (default: 2 minutes) has elapsed.

If with a system application it must be ensured that only one control command at a time is being processed system wide ("uniqueness") then interlocking of secondary devices among themselves is setup with GOOSE. For further details see description of function group GOOSE.

The switchgear device’s contact positions are signaled to the clients with the reports.

3.4.5.1.10 Originator Category

The *Originator* is an information type defined by IEC 61850, which is sent with switch commands and position signals of switchgear units. This kind of data consists of two information items:

- *Originator Identification*: This is text describing the originator of the switch command. (If unknown, then an empty text string is sent.)
- *Originator Category*: This is the originator of the command according to a list of standardized categories.

The range of values of the *Originator Category*, as listed in the following table, is supported.

	Originator category	Originator Identification	Use Case / Comment
1	*remote-control*	See note [1] (at the end of this table).	The control command is sent by an operator at station level.
2	*automatic-remote*	See note [1].	The control command is sent by an automatic function at station level.
3	*station-control*	See note [1].	The control command is sent by an operator at network level.
4	*automatic-station*	See note [1].	The control command is sent by an automatic function at network level.
5	*bay-control*	*Local HMI Control*	The control command is generated at the local HMI of the P139.
6	*bay-control*	*Local EXT Control*	The control command is sent via binary input (see note [2]) by an operator at an external local control panel, using the setting ● (221 061) MAIN: Electrical control = *Local* and any of the following input signals: ● DEVxx: Inp.asg.el.ctrl.open ● DEVxx: Inp.asg.el.ctr.close.
7	*remote-control*	*Remote EXT Control*	The control command is sent via binary input (see note [2]) by an operator at an external local control panel, using the setting ● (221 061) MAIN: Electrical control = *Remote* and any of the following input signals: ● DEVxx: Inp.asg.el.ctrl.open ● DEVxx: Inp.asg.el.ctr.close.
8	*process*	*Spontaneous Process Event*	A trip or close command which is generated by a protection function. Usually this is a circuit breaker trip or a close command from the ARC function, regardless whether originating from an internal function of the P139, from external devices or a manual command. The internal commands are as follows: ● (035 071) MAIN: Gen. trip command ● (037 009) MAIN: Close command Examples of external signals that can be assigned to these two commands: ● (037 019) MAIN: Parallel trip EXT ● (037 018) MAIN: Man. trip cmd. EXT ● (041 022) MAIN: Man. close cmd. EXT (See also note [2].)

	Originator category	Originator Identification	Use Case / Comment
9	*process*	*Spontaneous Process Event*	There is a spontaneous position change of the switchgear device. Possible causes: ● A manual switch command ● The operation of another protection and control device Further possible causes: ● Loss of supply voltage of electrical input signals ● Faulty wiring ● Faulty switchgear device (However, this usually results in an intermediate position 00 or 11 of the switchgear device.)
10	*process*	*IED Restart*	Power-up or restart of the P139, intentionally or spontaneously. Possible causes: ● Loss of the auxiliary supply voltage of the P139 ● Commissioning activities ● Operation of self-monitoring of the P139
11	*maintenance*	*Test Mode Operation*	The P139 is in test mode. The test mode can be activated either by setting parameter ● (003 012) MAIN: Test mode USER or by the binary signal ● (037 070) MAIN: Test mode EXT (See also note [2].)

[1]: The P139 copies the Originator Identification from the command request into the information report.

[2]: External binary signals can be received via various interfaces:

- Opto-coupler inputs
- InterMiCOM protection communication
- GOOSE substation communication
- Assignment of LOGIC outputs

The P139 does never send the *Originator Category “automatic-bay”*. In all protection devices from the *Easergy MiCOM 30* family, Automatic Reclose is implemented as part of the protection functionality, and therefore it is treated as *process*, see table row No. 8 above.

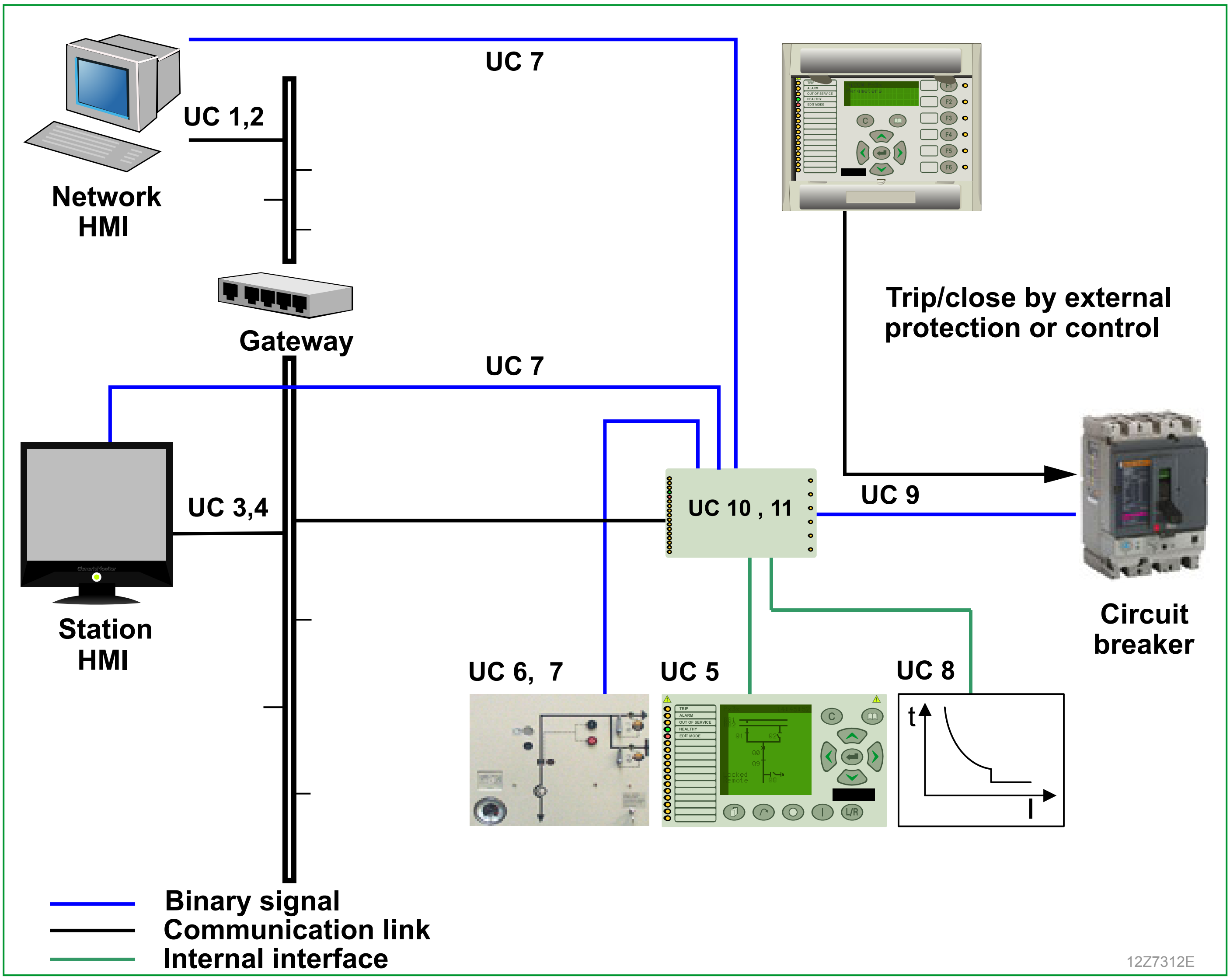


Fig. 3-25: Use cases in the network context. The “UC” numbers refer to Originator Categories in the table above.

3.4.5.1.11 Fault Transmission

Including fault transmission for the IEC 61850 in the configuration is only possible with the *IED Configurator*.

Transmission of fault files is supported per “File Transfer”. COMTRADE fault files in the P139 are transmitted uniformly either as ASCII or binary formatted files. Fault transmission can be cancelled from the configuration.

3.4.5.1.12 High Priority Transmission of Information

Whereas normal server-client services are transmitted at the MMS and TCP/IP level the high priority transmission of information is carried out directly at Ethernet level. Furthermore messages in such a particular form can be received by all participants in the relevant sub-network, independent of their server or client function. They are deployed in instances where high speed transmission of information is wanted between two or more devices. Applications, for example, are reverse interlocking, transfer trip or decentralized substation interlock.

The standard IEC 61850 provides the Generic Object Oriented Substation Event (GOOSE) for high priority transmission of information. The GOOSE enables transmission of all data formats available in the data model, such as binary information, integer values, two-pole contact position signals or analog measured values. The P139 supports receipt and evaluation of GOOSE including binary information and two-pole contact position signals from external devices.

3.4.5.1.13 Communication with the MiCOM S1 Support Software via the Ethernet Interface

Direct access by the MiCOM S1 support software via the Ethernet interface on the P139 may occur through the “tunneling principle”. Transmission is carried out by an Ethernet Standard Protocol, but this is only supported by the associated MiCOM S1 support software (specific manufacturer solution). Such transmission is accomplished over the same hardware for the network, which is used for server-client communication. Available are all the familiar functions offered by the MiCOM S1 support software such as reading/writing of setting parameters or retrieving stored data.

3.4.5.2 Generic Object Oriented Substation Event (Function Group GOOSE)

For high priority exchange of information between individual devices (IEDs) in a local network, the P139 provides the function group GOOSE as defined in the standard IEC 61850. GOOSE features high-speed and secure transmission of information for reverse interlocking, decentralized substation interlock, trip commands, blocking, enabling, contact position signals and other signals.

GOOSE Messages are only transmitted by switches but not by routers. GOOSE messages therefore remain in the local network to which the P139 is connected.

3.4.5.2.1 Configuration and Enabling

Function group GOOSE can be configured by setting the parameter GOOSE: Function group GOOSE This parameter is only visible if the optional Ethernet communication module is fitted to the P139. After having configured the GOOSE all parameters associated to this function group are then visible and ready to be configured.

Further setting parameters from function group GOOSE are set with the IED Configurator, but they cannot be modified from the local control panel (MMI) or with the operating program.

The function can then be enabled or disabled by setting GOOSE: General enable USER.

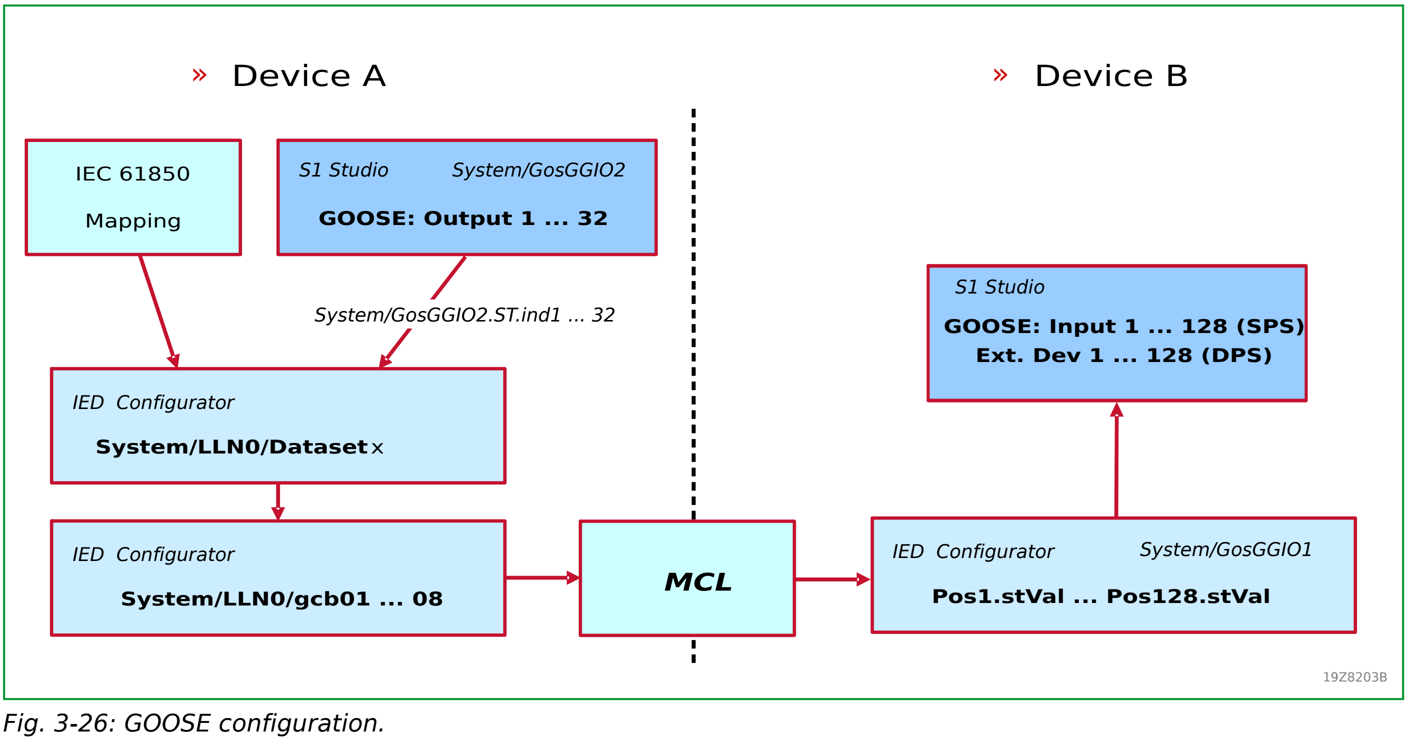


Fig. 3-26: GOOSE configuration.

3.4.5.2.2 Sending GOOSE

The GOOSE can send up to eight different GOOSE messages which are managed in eight GOOSE Control Blocks (gcb01 to gcb08). Information content depends on the respective dataset assigned to GOOSE. The maximum size of a dataset to be sent by GOOSE is limited to 1500 bytes. A control display is shown by the IED Configurator to check this limit.

> *It is not possible to read the IEC configuration back from the P139 if the "Dataset" sizes exceed the GOOSE size limit significantly. Therefore it is recommended to limit the "Dataset" size(s) to 100% of the GOOSE capacity. Too large a dataset can spoil IEC 61850 communication. Hence, the dataset size limit of 100% of the GOOSE capacity should not be exceeded, neither for GOOSE nor for reports.*

When defining the datasets for GOOSE it is advised to select the individual data attributes and not the overlapping data objects. By this the amount of data is kept within a limit and decoding is guaranteed on the receiving end.

In addition to the information included in the IEC 61850 data model an optional number of up to 32 signals can be selected from all the signals available in the P139 to be transmitted via GOOSE, as it is also possible with reporting. Selection of binary state signals (shuttling to communications) is made by setting GOOSE: Output 1 fct.assig.. (or Output 2, ..., Output 32). The data object indexes defined for SigGGIO1 must follow the function assignments for the GOOSE outputs. The indexes GosGGIO2.ST.ind1 to GosGGIO2.ST.ind32 may then be included in the datasets just as the other data objects.

When a state change occurs with a selected state signal or a measured value changes which is greater than the dead band set for the relevant data point then the complete GOOSE is sent. There will be multiple send repetitions at ascending time periods. The first send repetition occurs at the given cycle time set with the parameter [IC]: Minimum Cycle Time. The cycles for the following send repetitions result from a conditional equation with the increment set with the parameter [IC]: Increment. Should no further state changes occur up to the time when the maximum cycle time has elapsed [IC]: Maximum Cycle Time, then GOOSE will be sent cyclically at intervals as set for the maximum cycle time.

In order to have unambiguous identification of a GOOSE sent, characteristics such as [IC]: Multicast MAC Address, [IC]: Application ID (hex), [IC]: VLAN Identifier (hex), [IC]: VLAN Priority and [IC]: GOOSE Identifier must be entered in the *IED Configurator* settings. Further characteristics are [IC]: Dataset Reference and [IC]: Configuration Revision.

Each GOOSE is given the state change index and the number of send repetitions.

3.4.5.2.3 Receiving GOOSE

With GOOSE up to 128 logic binary state signals as well as 128 two-pole contact position signals from external devices (Ext.Devxx) can be received. For each state signal or contact position signal to be received a specific GOOSE message is to be selected, which will contain the information wanted, by setting [IC]: Multicast MAC Address, [IC]: Application ID (hex), [IC]: Source Path, [IC]: GOOSE Identifier and [IC]: DataSet Reference. With the further setting of [IC]: Data Obj Index / Type, which corresponds to the GOOSE position index and the information structure of the sending device, the required information from the chosen GOOSE will be selected. The identification features "VLAN identifier" and [IC]: Configuration Revision that are also included in the GOOSE received will not be evaluated.

These parameters characterizing the information may be taken either from device or project planning documentation of the sending device or from a configuration file which is conform to IEC 61850. The *IED Configurator* will support the import of .IID, .SCD and .MCL files when the "browse function" (virtual key) is applied. The selection and acceptance of parameters from an existing project planning is distinguished by a simplified and very reliable data input.

Each GOOSE includes time information on the duration of validity of its information. This corresponds to the double time period to the next GOOSE repetition. If the duration of validity has elapsed without having received this GOOSE again (i.e. because of a fault in communications), the signals received will automatically be set to their respective default value [IC]: Default Input Value. Which of the possible state values will set the wanted security grade is dependent on the relevant application.

The following configuration (shuttling to the device functions) of the logic state signals received from the logic node GosGGIO1 (GOOSE: Input 1 fct.assig. (or Input 2, …, Input 128)) is made on the basis of the selection table of the binary signal inputs (opto-coupler inputs).

The virtual key "Unmap" may be used to remove the link of a binary signal input to an external data point. In such a case all entries for this binary signal input are deleted.

3.4.5.2.4 Uniqueness of Control within a System

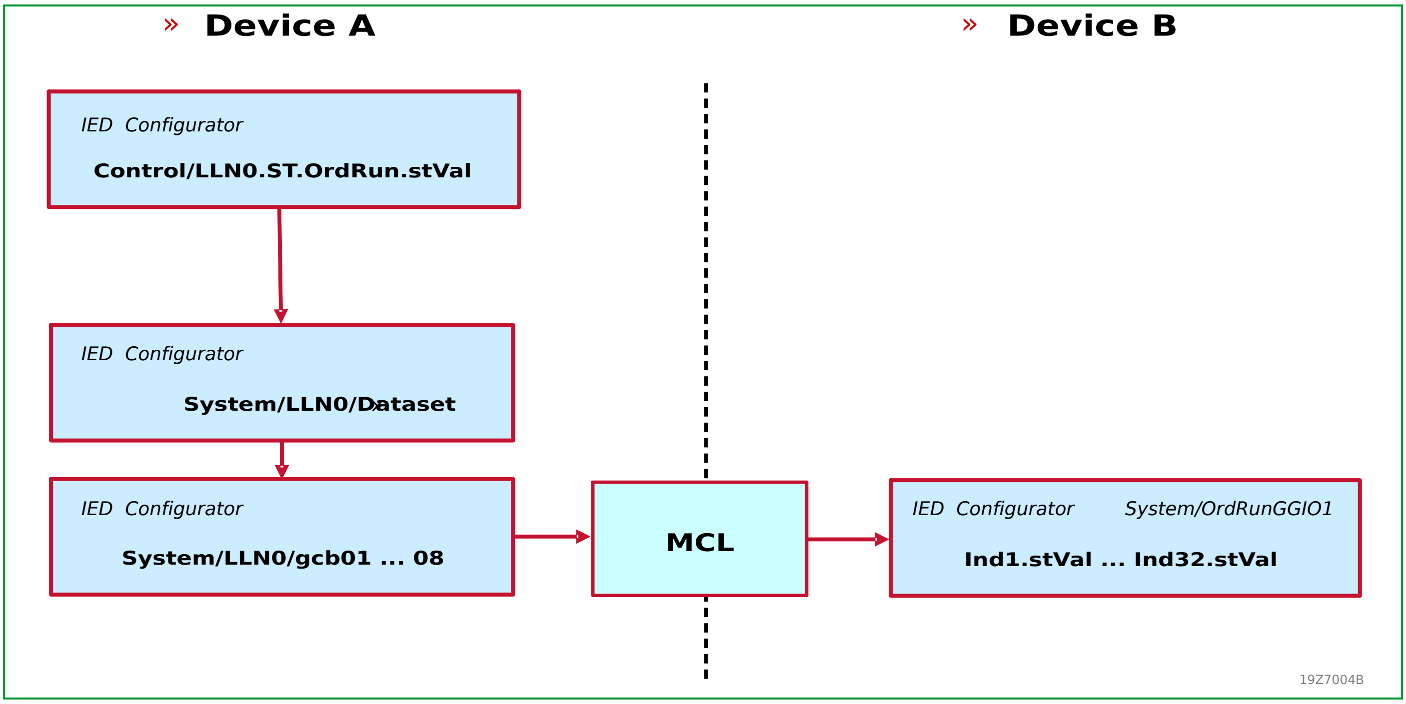


Fig. 3-27: Uniqueness of Control.

If with a system application it must be ensured that only one control command at a time is being processed system wide (“uniqueness”) then interlocking of secondary devices among themselves is setup with GOOSE. The P139 sets the status information Control/LLN0.ST.OrdRun.stVal. when it has received a control command. This information – stored in a dataset – is distributed in the system by GOOSE and is therefore available to all other devices as an interlocking condition. The state information is reset and accordingly signaled after termination of the command sequence.

The P139 is capable to monitor the command status of up to 32 further devices. With the *IED Configurator* OrdRunGGIO1.ind1.stVal to OrdRunGGIO1.ind32.stVal are configured in a similar way to the other GOOSE inputs. A shuttling to the interlocking equations is not necessary as their consideration within command checking is automatically enabled when the first binary signal input is configured. During a signaling receipt phase command effecting will be rejected.

3.4.6 Redundant Ethernet Board

The P139 Feeder Management and Bay Control can be (optionally) fitted with a special communication module named *Redundant Ethernet Board*, as an alternative to the single Ethernet board. (See Chapter 15, (p. 15-1) for the exact order information and Section 5.7, (p. 5-27) for the location and connection diagrams.)

The Redundant Ethernet Board assures redundancy at IED level, which allows an alternative path to be always available, thus providing bumpless redundancy.

Industrial or substation control network failure can be disastrous. Redundancy provides increased safety and reliability, but also devices can be added to or removed from the network without network downtime.

3.4.6.1 Hardware Modules

P30 devices (i. e. devices from the device family *Easergy MiCOM 30*) are constructed from standard hardware modules. The following table lists the item numbers of the Redundant Ethernet board variants:

Type	Item number	Description	Width
A	9651 531	KE Dual Ethernet SHP + RS 485 + IRIG-B	4 TE
A	9651 532	KE Dual Ethernet RSTP + RS 485 + IRIG-B	4 TE
A	9651 533	KE Dual Ethernet DualHoming + RS 485 + IRIG-B	4 TE
A	9652 036	KE Dual Ethernet PRP + RS 485 + IRIG-B	4 TE

Tab. 3-1: Redundant Ethernet board variants.

All of these boards have 1300 nm multi mode 100BaseFx fiber-optic Ethernet ports (ST® connector) and modulated IRIG-B input and furthermore connections for a watchdog relay and an RS485 link (COMM2 interface, see Section 3.4.3, (p. 3-25)).

The Redundant Ethernet board is fitted into Slot 2 of the P139. Each board has two MAC addresses, one for the managed embedded switch and one for the P139.

3.4.6.2 Redundancy Protocols

The following list shows Schneider Electric’s implementation of Ethernet redundancy, which has four variants with embedded IEC 61850, plus SHP, RSTP, DHP and PRP redundancy protocols.

Parallel Redundancy Protocol (PRP IEC 62439-3 (2012))

- The PRP uses two independent Ethernet networks that operate in parallel. The PRP is a “redundancy in the devices” method that provides bumpless switchover in case of failure or reintegration. Furthermore, it provides the shortest Ethernet network reconfiguration time as network reconfiguration is seamless.

Rapid Spanning Tree Protocol (RSTP IEEE 802.1D-2004)

- This board offers compatibility with any RSTP device. RSTP is a standard used to quickly reconnect a network fault by finding an alternative path, allowing loop-free network topology. Although RSTP can recover network faults quickly, the fault recovery time depends on the number of devices and the topology.

  This board offers compatibility with any RSTP device, and in particular with C264 (with the “SWS2x2” Switch Unit fitted).

Self Healing Protocol (SHP)

- Self healing is applied to double ring network topologies and allows a complete network reconfiguration time of less than 1 s.

  When a fiber is broken, both end stations detect the break. Using both the primary and redundant networks the ring is automatically reclosed.

  This board offers compatibility with C264 (with the “SWR2x2” Switch Redundant Unit fitted) and MiCOM H35x multi-mode switches. Self Healing Protocol is a Schneider Electric proprietary solution providing extremely fast recovery time.

Dual Homing Protocol (DHP)

- Dual home is applied to double star architectures and provides bumpless redundancy (0 ms change over time).

  If the optical fiber connection between two devices is broken, the network continues to operate correctly. The dual homing mechanism handles topologies where a device is connected to two independent networks. One is the main link, the other is the backup. Both are active at the same time.

  This board offers compatibility with C264 (with the “SWD2x2” Switch Unit fitted) and MiCOM H36x multi-mode switches. Dual Homing Protocol is a Schneider Electric proprietary solution providing bumpless redundancy to the P139.

3.4.6.3 Generic Functions for All Redundant Ethernet Boards

The following apply to all four redundant Ethernet protocols (SHP, RSTP, DHP and PRP).

Ethernet 100Base Fx

The fiber optic ports are full duplex 100 Mbps ST connectors.

Forwarding

The devices from the families Easergy MiCOM 30, 40, the C264 and the MiCOM H switches support store and forward mode. The MiCOM switch forwards messages with known addresses to the appropriate port. The messages with unknown addresses, the broadcast messages and the multicast messages are forwarded out to all ports except the source port. MiCOM switches do not forward error packets, 802.3x pause frames or local packets.

Priority Tagging

802.1p priority is enabled on all ports.

Simple Network Management Protocol – SNMP

Simple Network Management Protocol (SNMP) is the network protocol developed to manage devices in an IP network. SNMP relies on a Management Information Base (MIB) that contains information about parameters to supervise. The MIB format is a tree structure, with each node in the tree identified by a numerical Object IDentifier (OID). Each OID identifies a variable that can be read or set using SNMP with the appropriate software. The information in the MIBs is standardized.

Various SNMP client software tools can be used with the Series 30, 40, C264 and Hx5x range. Schneider Electric recommends using an SNMP MIB browser which can perform the basic SNMP operations such as *GET*, *GETNEXT*, *RESPONSE*. To access the network using SNMP, use the IP address of the embedded switch in the Redundant Ethernet board.

Simple Network Time Protocol – SNTP

Simple Network Time Protocol is supported by both the P139 and the Redundant Ethernet switch. SNTP is used to synchronize the clocks of computer systems over packet-switched, variable-latency data networks. A jitter buffer is used to reduce the effects of variable latency introduced by queuing in packet switched networks, ensuring a continuous data stream over the network.

The P139 receives the synchronization from the SNTP server. This is done using the IP address of the SNTP server entered into the P139 from the *IED Configurator* software.

3.5 IRIG-B Clock Synchronization (Function Group IRIGB)

If, for example, a GPS receiver with IRIG-B connection is available, the internal clock of the P139 can be synchronized to run on GPS time using the optional IRIG-B interface. It should be noted that the IRIG-B signal holds information on the day only (day of the current year). Using this information and the year set at the P139, the P139 calculates the current date (DD.MM.YY).

Disabling and Enabling the IRIG-B Interface

The IRIG-B interface can be disabled or enabled using a setting parameter.

Synchronization Readiness

If the IRIG-B interface is enabled and receiving a signal, the P139 checks the received signal for plausibility. Implausible signals are rejected by the P139. If the P139 does not receive a correct signal in the long run, synchronization will not be ready any longer.

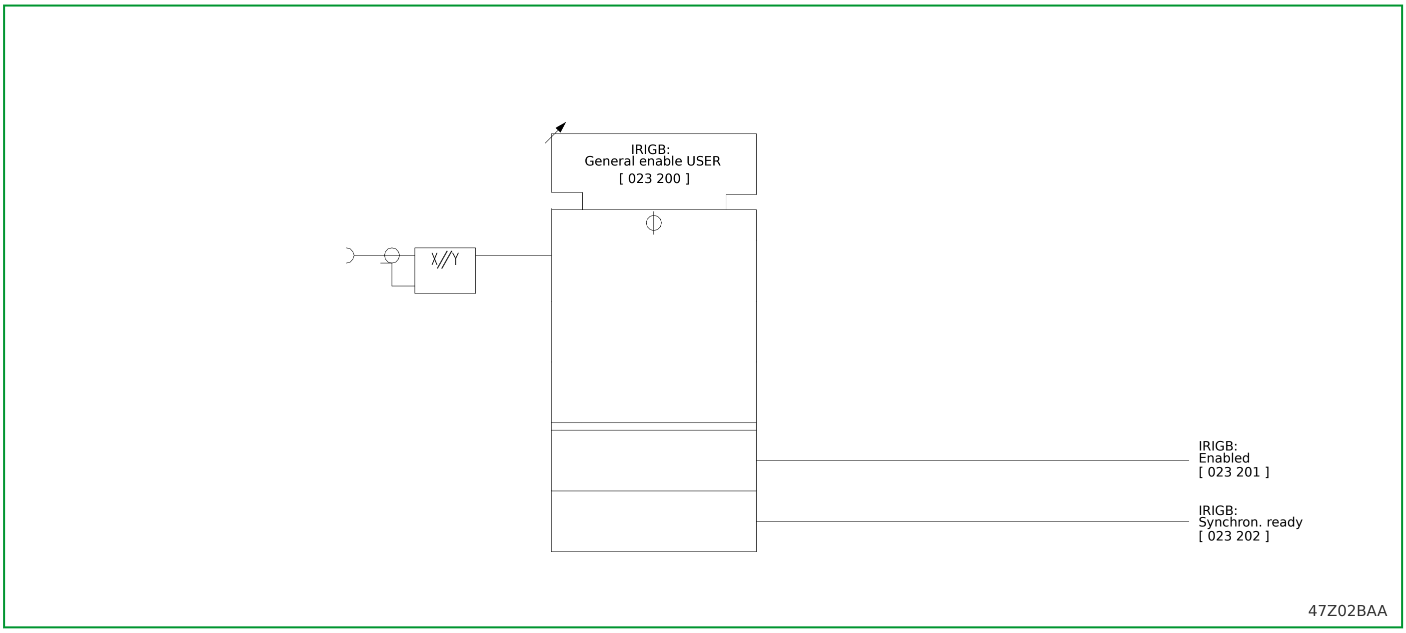


Fig. 3-28: IRIG-B interface.

3.6 Configuration and Operating Mode of the Binary Inputs (Function Group INP)

The P139 has opto coupler inputs for processing binary signals from the substation. The functions that will be activated in the P139 by triggering these binary signal inputs are defined by the configuration of the binary signal inputs. In order to ensure that during normal operation the P139 will recognize an input signal, the input signal must persist for at least 8 ms plus the set filter time (provided that *Active "high", filt.* or *Active "low", filt.* has been selected for INP: Oper. mode U xxx).

Configuring the Binary Inputs

One function can be assigned to each binary signal input by configuration. The same function can be assigned to several signal inputs. Thus one function can be activated from several control points having different signal voltages.

It should be noted that time-critical applications such as time synchronization commands should not be mapped to the binary signal inputs of the analog I/O module as these have an increased reaction time due to internal processing.

In this technical manual, it is assumed that the required functions (marked “EXT” in the address description) have been assigned to binary signal inputs by configuration.

Operating Mode of the Binary Inputs

The operating mode for each binary signal input can be defined. The user can specify whether the presence (*Active "high"* mode) or absence (*Active "low"* mode) of a voltage shall be interpreted as the logic ‘1’ signal. The display of the state of a binary signal input – "low" or "high" – is independent of the setting for the operating mode of the signal input.

Filter Function

An additional filter function may be enabled in order to suppress transient interference peaks at the logic signal inputs (operating modes *Active "high", filt.* or *Active "low", filt.*). With this function enabled a status change at the binary logic input is only signaled when the input signal remains at a steady signal level during a set number of sampling steps (sampling step size = period / 20). The number of sampling steps is set at parameter INP: Filter.

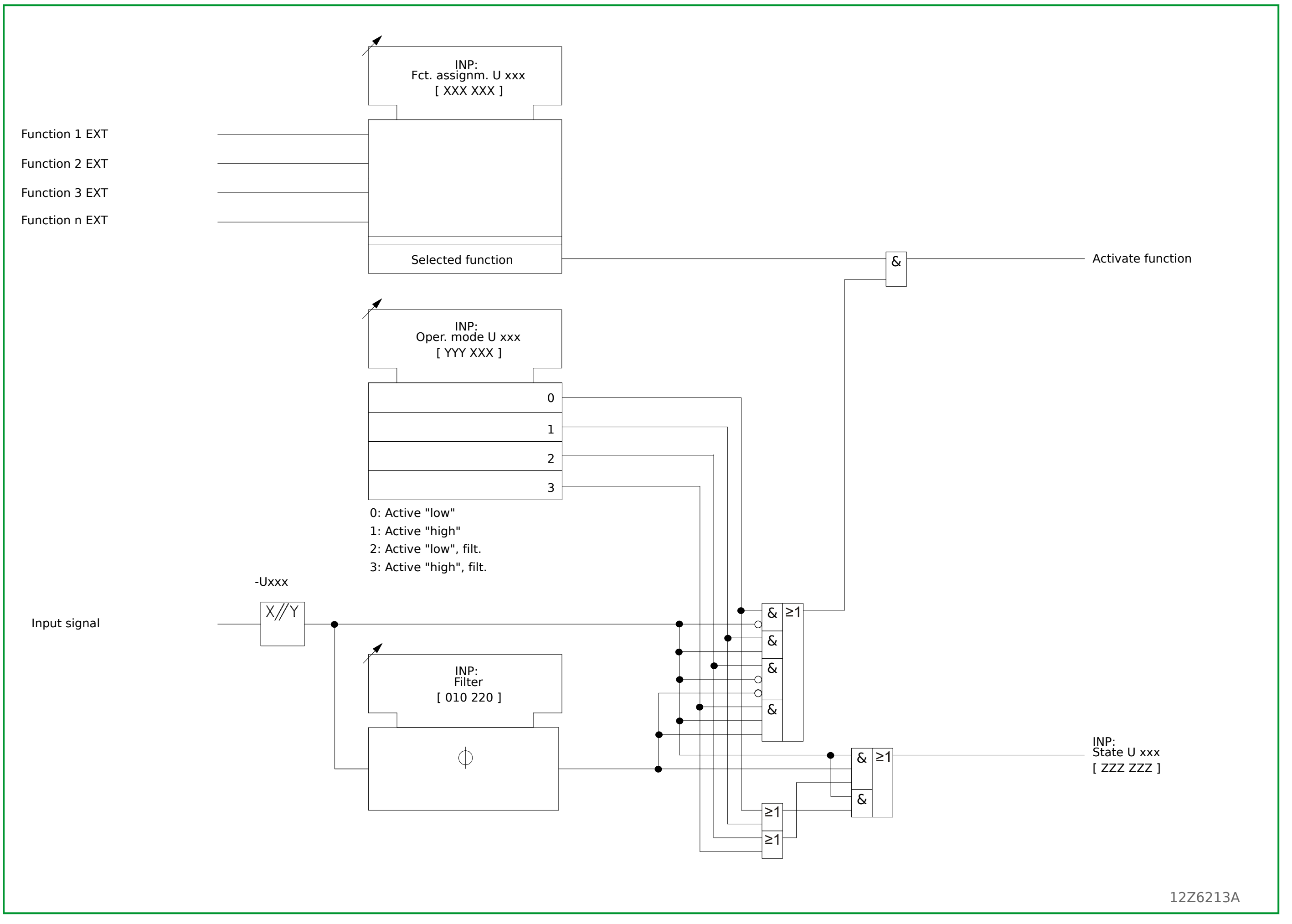


Fig. 3-29: Configuration and operating mode of the binary signal inputs.

3.7 Measured Data Input (Function Group MEASI)

There is a second optional analog module available for the P139. In addition to the analog (I/O) module Y with analog inputs and outputs there is now a second analog module obtainable, the temperature p/c board (also called the RTD module).

When the P139 is equipped with the analog (I/O) module Y it has two analog inputs available for measured data input. Direct current is fed to the P139 through the 20 mA analog input (input channel 1). The other input is designed for connection of a PT 100 resistance thermometer.

The temperature p/c board (the RTD module) mounted in the P139 has 9 analog inputs available to connect temperature sensors T1 to T9. These analog inputs are designed for connection of PT 100, Ni 100 or Ni 120 resistance thermometers.

The input current I_{DC} present at the analog (I/O) module Y is displayed as a measured operating value. The current that is conditioned for monitoring purposes ($I_{DC,lin}$) is also displayed as a measured operating value. In addition, it is monitored by the Limit Value Monitoring function to detect whether it exceeds or falls below set thresholds (see Section 3.42, (p. 3-377)).

The measured temperatures are also displayed as measured operating values and monitored by the Limit Value Monitoring function to determine whether they exceed or fall below set thresholds (see Section 3.42, (p. 3-377)).

All measured variables are also forwarded to the Thermal Overload Protection function. With this protection it is possible to set whether the PT 100 resistance thermometer, the 20 mA analog input or – if configured – one of the temperature sensors T1 to T9 is to be used for the thermal replica (see Section 3.32, (p. 3-303)).

Disabling or Enabling the Measured Data Input Function

The Measured Data Input function can be disabled or enabled via setting parameters.

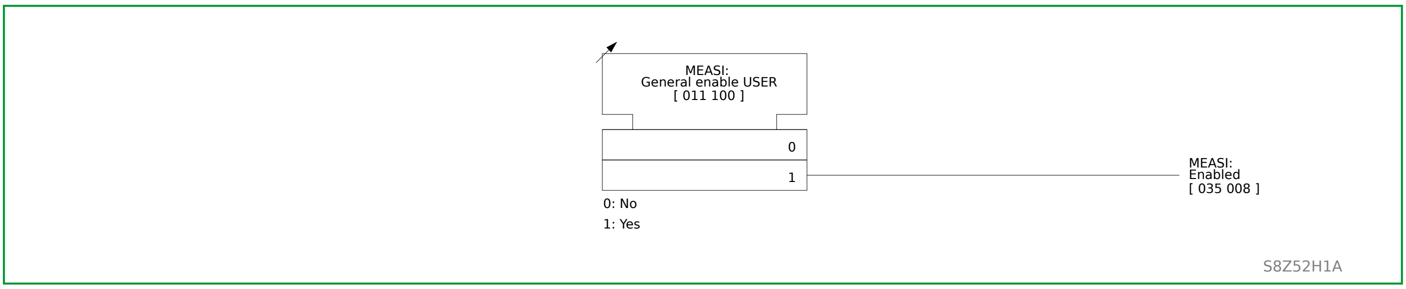


Fig. 3-30: Disabling or enabling the measured data input function.

3.7.1 Direct Current Input on the Analog (I/O) Module Y

External measuring transducers normally supply an output current of 0 to 20 mA that is directly proportional to the physical quantity being measured – the temperature, for example.

If the output current of the measuring transducer is directly proportional to the measured quantity only in certain ranges, linearization can be arranged, provided that the measured data input is set accordingly. Furthermore, for certain applications it may be necessary to limit the range being monitored or to monitor certain parts of the range with a higher or lower sensitivity.

By setting the value pair MEASI: IDC 1 and MEASI: IDC,lin 1, the user specifies which input current I_{DC} will correspond to the current that is monitored by the Limit Value Monitoring function, i.e. $I_{DC,lin}$. (These two setting parameters refer to value pair number 1; setting parameters for value pairs 2 to 20 are available, too.)

The resulting points, called “interpolation points”, are connected by straight lines in an I_{DC}-$I_{DC,lin}$ diagram. In order to implement a simple characteristic, it is sufficient to specify two interpolation points, which are also used as limiting values (see Fig. 3-31, (p. 3-52)). Up to 20 interpolation points are available to implement a complex characteristic.

When setting the characteristic the user must remember that only a rising/rising or falling/falling curve sense is allowed (no peak or vee-shapes). If the setting differs, the signal SFMON: Invalid scaling IDC will be generated.

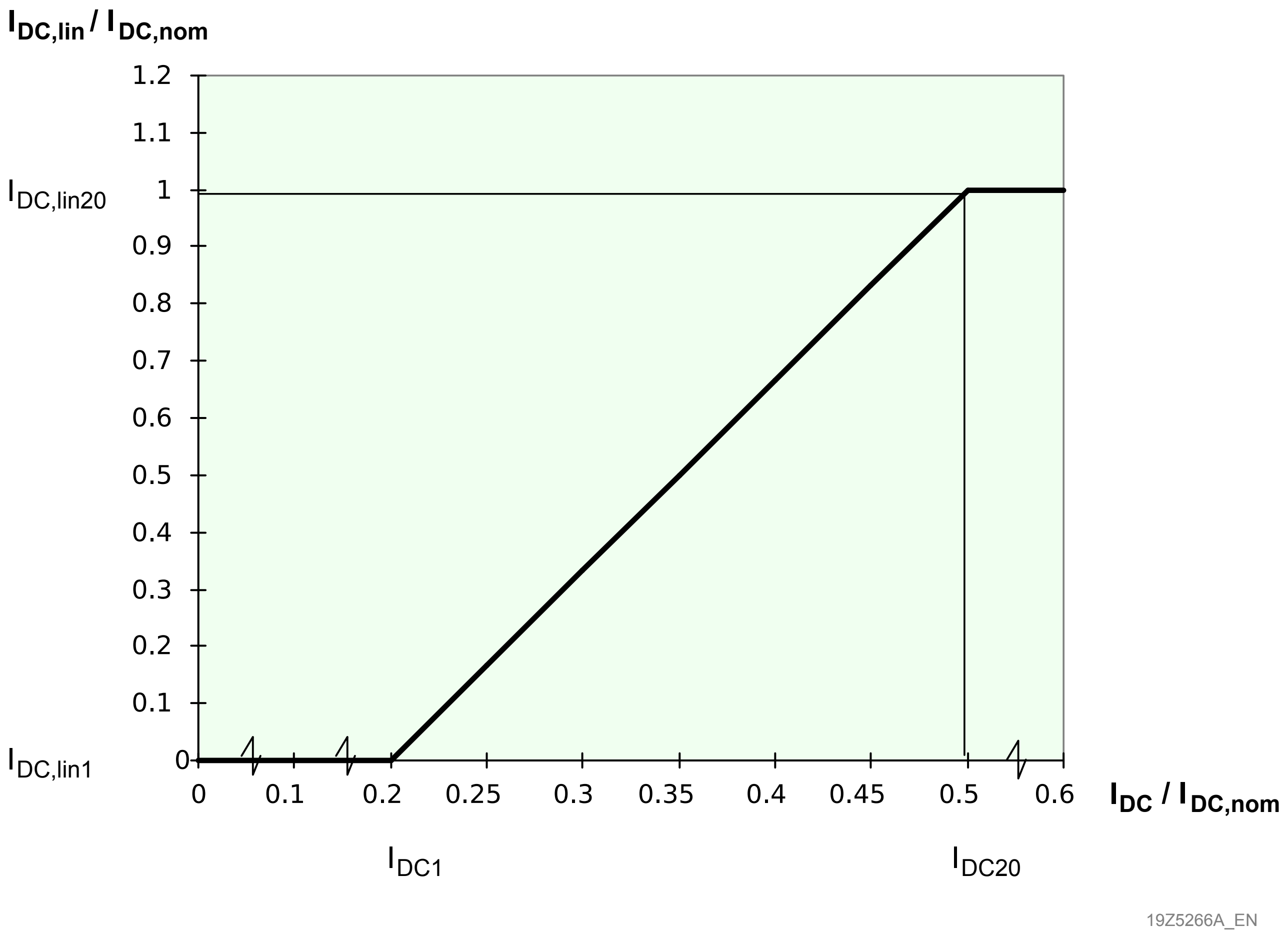


Fig. 3-31: Example of the conversion of 4 to 10 mA input current to 0 to 20 mA monitored current, IDC,lin.

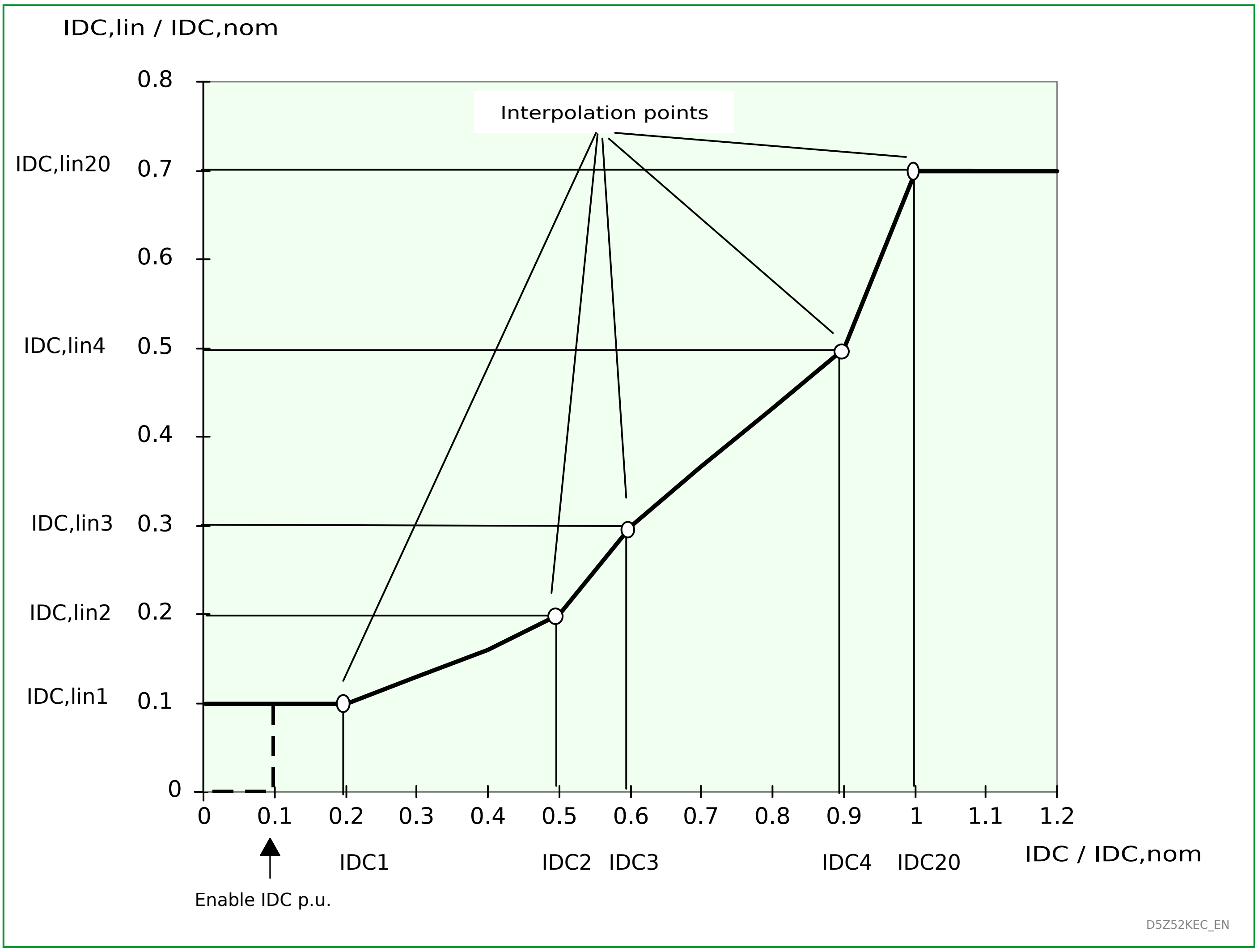


Fig. 3-32: Example of a characteristic with five interpolation points (characteristic with zero suppression setting of 0.1 $I_{DC,nom}$ is shown as a broken line).

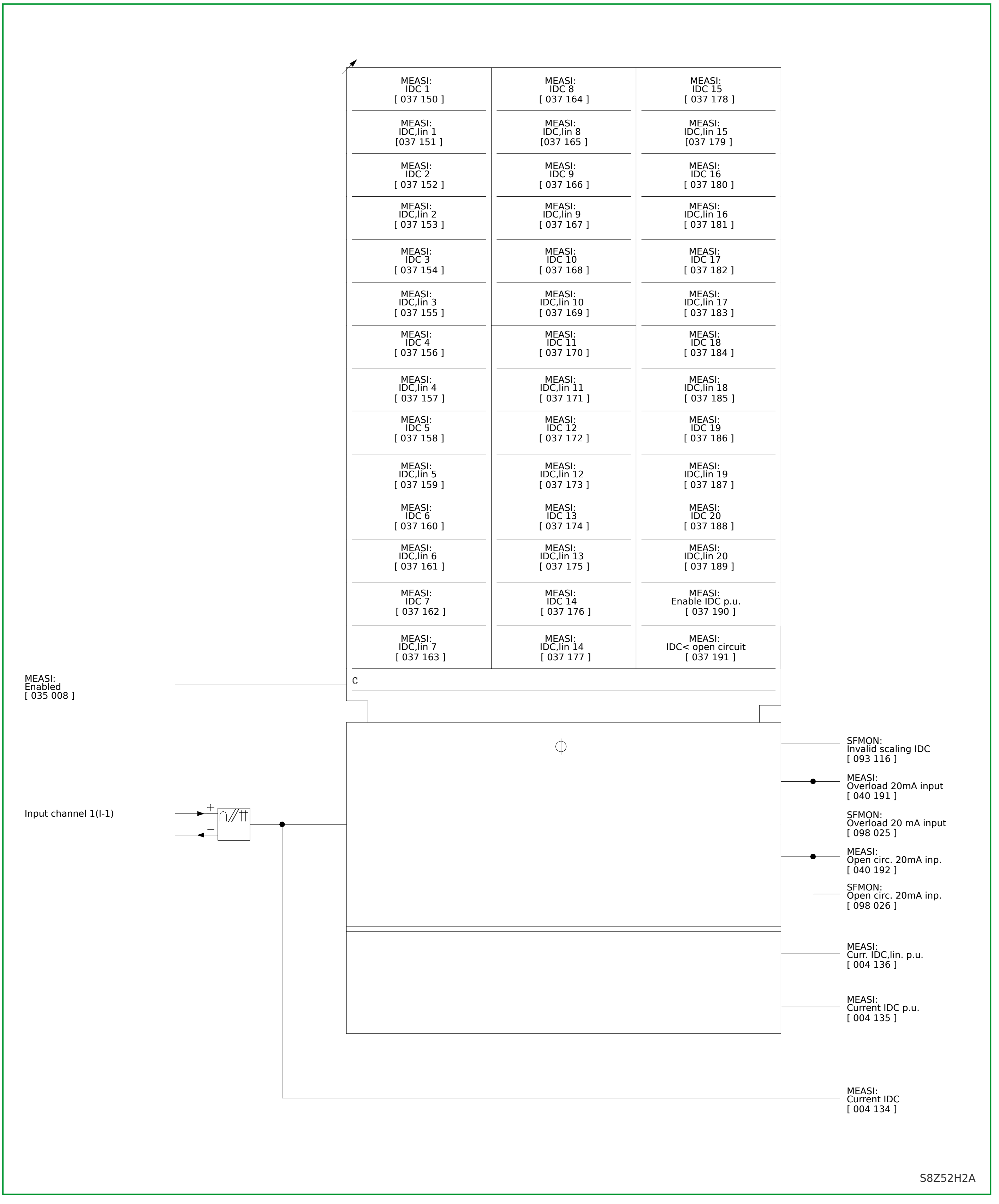


Fig. 3-33: Analog direct current input.

Beyond the linearization described above, the user has the option of scaling the linearized values. Thereby negative values, for example, can be displayed as well and are available for further processing by protection functions.

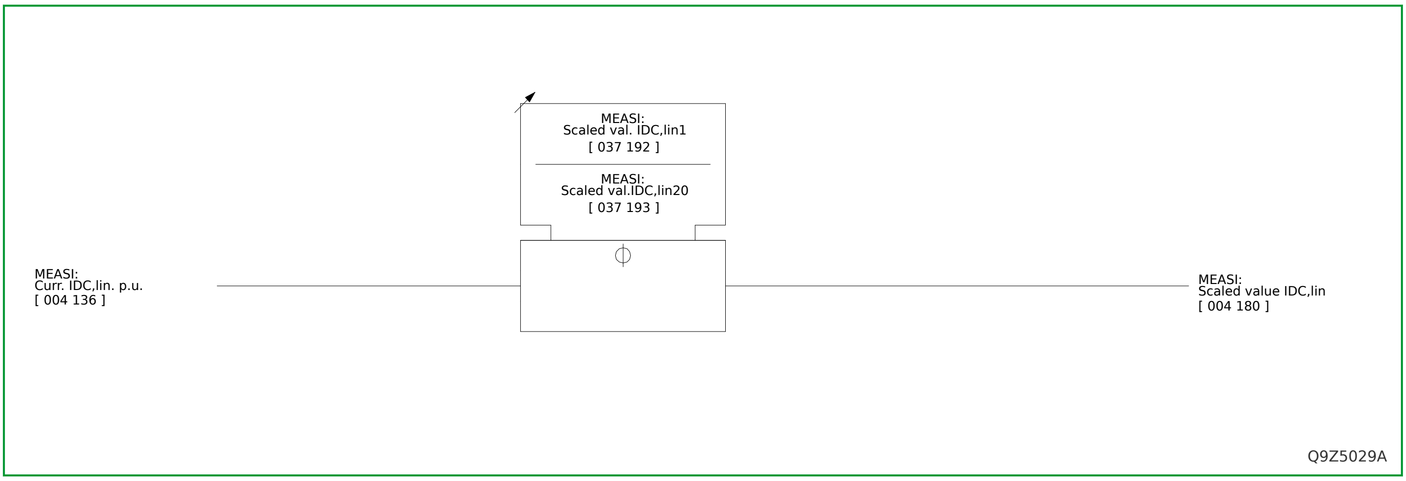


Fig. 3-34: Scaling of the linearized measured value.

3.7.1.1 Zero Suppression

Zero suppression is defined by setting MEASI: Enable IDC p.u. If the direct current does not exceed the set threshold, the per-unit input current $I_{DC\ p.u.}$ and the current $I_{DC,lin}$ will be displayed as having a value of "*0*".

3.7.1.2 Open-Circuit and Overload Monitoring

The P139 is equipped with an open-circuit monitoring function. If current I_{DC} falls below the set threshold MEASI: IDC< open circuit, the signal MEASI: Open circ. 20mA inp. is issued.

The input current is monitored in order to protect the 20 mA analog input against overloading. If it exceeds the set threshold of 24.8 mA, the signal MEASI: Overload 20mA input is issued.

3.7.1.3 Backup Sensors

The open circuit signal on the 20 mA analog input from the function group MEASI is forwarded to the Thermal Overload Protection function. Here it is possible to set whether the resistance thermometer connected to the PT 100 input or – if configured – one of the temperature sensors T1 to T9, connected to the temperature p/c board (the RTD module), is to be used as a backup sensor (see Section 3.32, (p. 3-303)).

3.7.2 Connecting a Resistance Thermometer to the "PT 100 Analog Input" on the Analog (I/O) Module Y

This analog input on the analog (I/O) module Y is designed to connect a PT 100 resistance thermometer. The mapping curve R = f(T) of PT 100 resistance thermometers is defined in standard IEC 751. If the PT 100 resistance thermometer is connected using the 3-wire method, then no further calibration is required.

The result of a temperature measurement can be read out as a direct measurand (temperature T), a normalized value (temperature norm. T), and as the maximum value since the last reset.

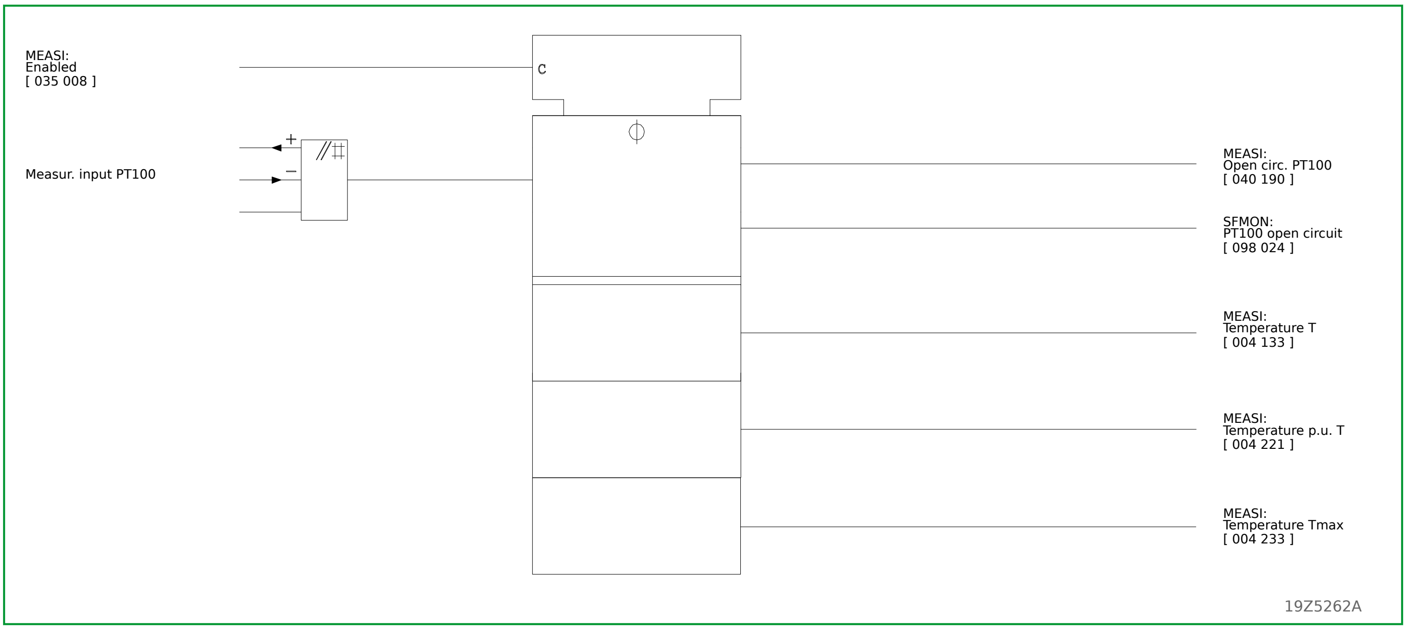


Fig. 3-35: Temperature measurement using a PT 100 resistance thermometer connected to the analog (I/O) module.

3.7.2.1 Open-Circuit Monitoring

If there is an open measuring circuit due to a broken wire, the signal MEASI: Open circ. PT100 is issued.

3.7.2.2 Backup Sensors

The open circuit signal on the PT 100 analog input from the function group MEASI is forwarded to the functions Thermal Overload Protection and Limit Value Monitoring.

In the Thermal Overload Protection it is possible to set whether the 20 mA input or – if configured – one of the temperature sensors T1 to T9, connected to the temperature p/c board (the RTD module), is to be used as a backup (see Section 3.32, (p. 3-303)).

In the Limit Value Monitoring function the limit values assigned to the faulty PT 100 are blocked.

3.7.3 Connecting Temperature Sensors to the Temperature P/C Board (the RTD Module)

The temperature p/c board (the RTD module) mounted in the P139 has 9 analog inputs available to connect temperature sensors T1 to T9. These analog inputs are designed for connection of PT 100, Ni 100 or Ni 120 resistance thermometers.

If the PT 100 resistance thermometer is connected using the 3-wire method, then no further calibration is required.

All nine temperature sensors must be of the same type, which is set under MEASI: Type of TempSensors

The result of a temperature measurement can be read out as a direct measurand (temperature Tx), a normalized value (temperature norm. Tx) and as the maximum value since the last reset (temperature Tx max).

Open-Circuit Monitoring

If one of the measuring circuits is open due to a broken wire, the signal MEASI: Open circ. T1 (or T2, ..., T9, resp.) is issued.

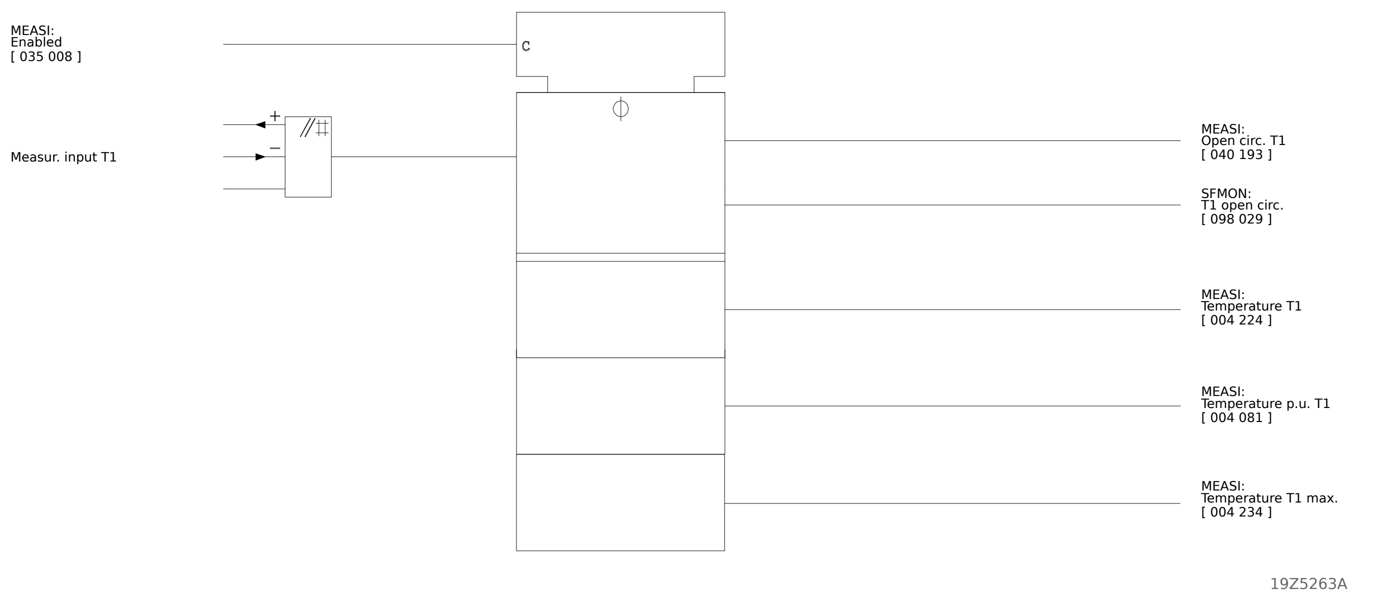


Fig. 3-36: Temperature measurement with temperature sensor T1 connected to the temperature p/c board. The same applies to sensors T2 to T9.

Backup Sensors

The open circuit signals from temperature sensors, issued by function group MEASI, are forwarded to the Thermal Overload Protection function. Should the main temperature sensor (that has been set in the Thermal Overload Protection) fail, it is possible to select in whether the 20 mA input or – if configured – one of the temperature sensors T1 to T9, connected to the temperature p/c board (the RTD module), is to be used as a backup sensor (see Section 3.32, (p. 3-303)).

In addition to this, the open circuit signals from the temperature sensors, issued by the function group MEASI, are forwarded to the Limit Value Monitoring function. The selection of such backup sensors for the Limit Value Monitoring function is made in the function group MEASI.

For this purpose the temperature sensors connected to the temperature p/c board (RTD board) are divided into three groups:

Group 1: T1, T2, T3

Group 2: T4, T5, T6

Group 3: T7, T8, T9

If MEASI: BackupTempSensor PSx is set to *None* the Limit Value Monitoring function will operate without backup sensors.

If MEASI: BackupTempSensor PSx is set to *Group 1 - 2*, the defective temperature sensor from group 1 is replaced by the corresponding sensor from group 2.

If the backup temperature sensor from group 2 also fails it will be replaced by the corresponding sensor from group 3, under the assumption that MEASI: BackupTempSensor PSx is set to *Group 1 - 2/3*.

The association of backup temperature sensors is listed below:

Main sensor	Backup sensor from group 2, with setting: *Group 1 - 2 or Group 1 - 2/3*	Backup sensor from group 3, with setting: *Group 1 - 2/3*
T1	T4	T7
T2	T5	T8
T3	T6	T9

Should temperature sensor T1 fail, with the setting *Group 1 - 2/3*, it will be replaced by T4. Should temperature sensor T4 also fail it will be replaced by T7.

For further details refer to section with the description of the “Limit Value Monitoring” (Section 3.42, (p. 3-377)).

Application Example

A motor protection application is shown in the figure below with temperature sensors T1 to T9 connected to the temperature p/c board (RTD module) and a “PT 100” resistance thermometer connected to the analog (I/O) module Y.

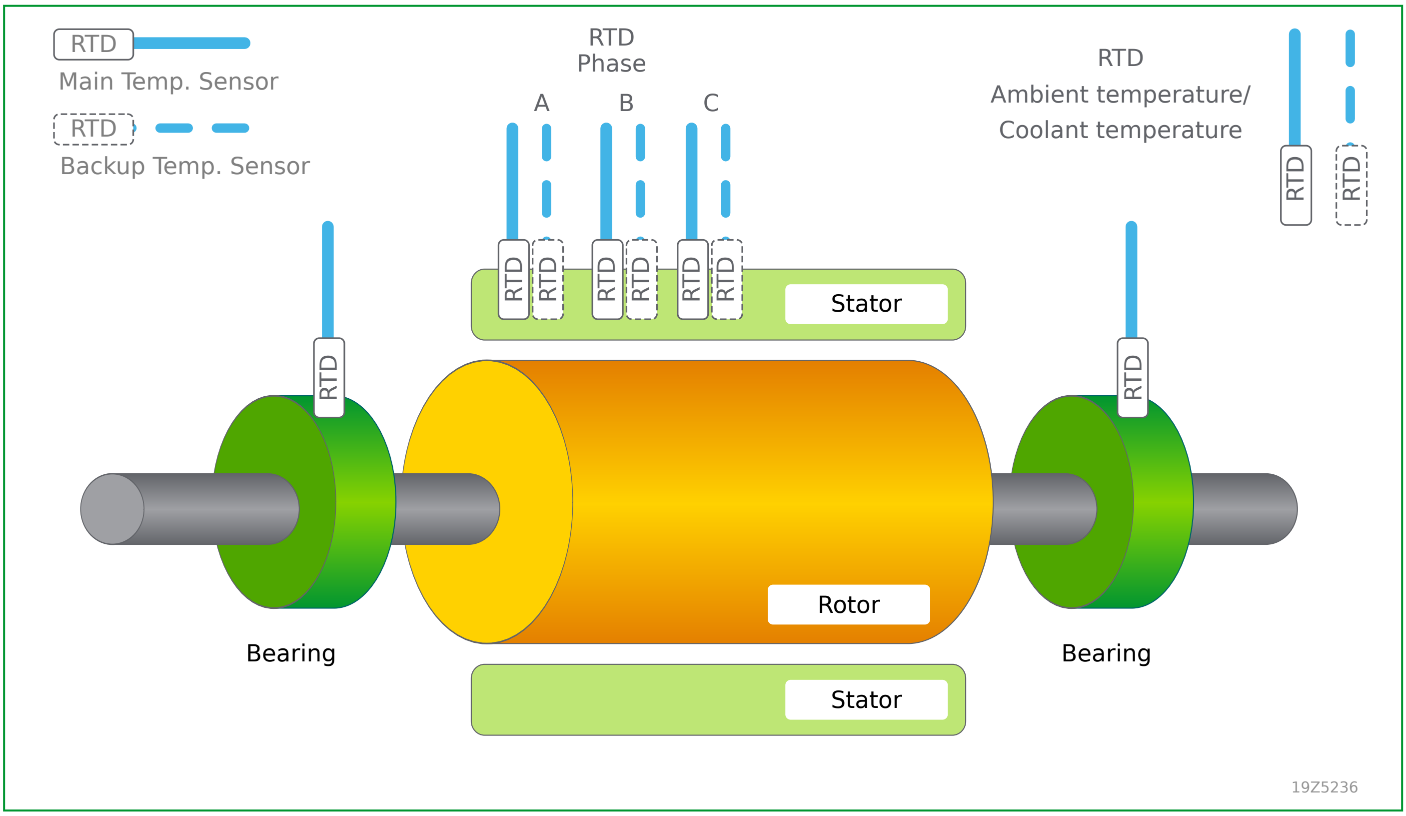


Fig. 3-37: Temperature measurements on a motor to be used with the Limit Value Monitoring function (LIMIT) and the Thermal Overload protection (THERM).

3.8 Configuration, Operating Mode, and Blocking of the Output Relays (Function Group OUTP)

The P139 has output relays for the output of binary signals. The binary signal assignment is freely configurable by the user.

Configuration of the Output Relays

One binary signal can be assigned to each output relay. The same binary signal can be assigned to several output relays by configuration.

Operating Mode of the Output Relays

The user can set an operating mode for each output relay that determines whether the output relay operates in a normally open arrangement (NO) or normally closed arrangement (NC) and whether it operates in latching mode. Depending on the selected operating mode, latching can be disabled, either manually using a setting parameter or by an appropriately configured binary signal input at the start of a new fault, signalized by the onset of a general starting, or of a new system disturbance.

Blocking the Output Relays

The P139 offers the option of blocking all output relays via setting parameters or by way of an appropriately configured binary signal input. The output relays are likewise blocked if the P139 is disabled via appropriately configured binary inputs or if self-monitoring detects a hardware fault. Any output relay configured for MAIN: Blocked/faulty will not be included in the blocking signals.

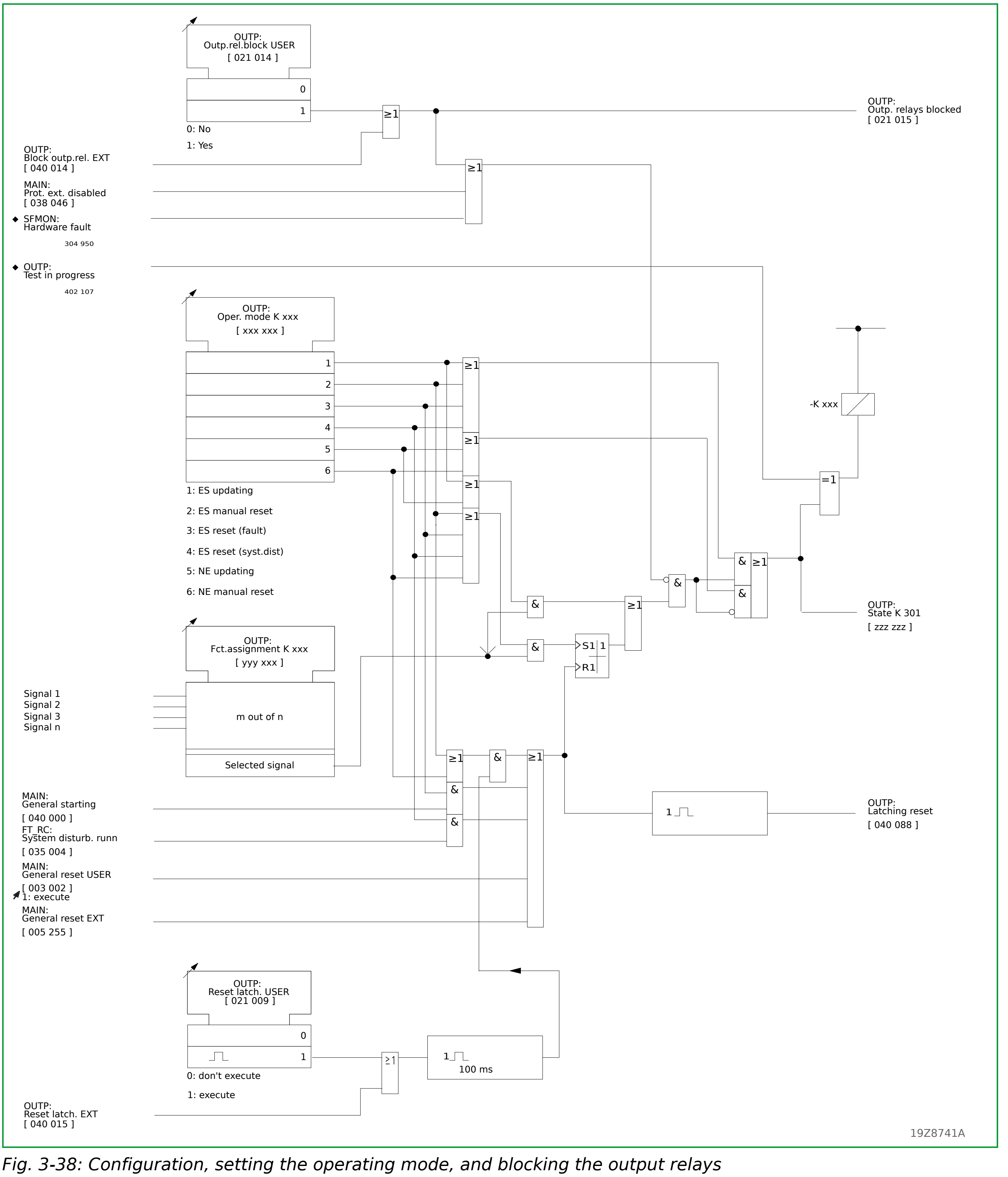


Fig. 3-38: Configuration, setting the operating mode, and blocking the output relays

Testing the Output Relays

For testing purposes, the user can select an output relay and trigger it via setting parameters. At the time when the test is triggered the P139 must be switched to “off-line”. Triggering persists for the duration of the set hold time.

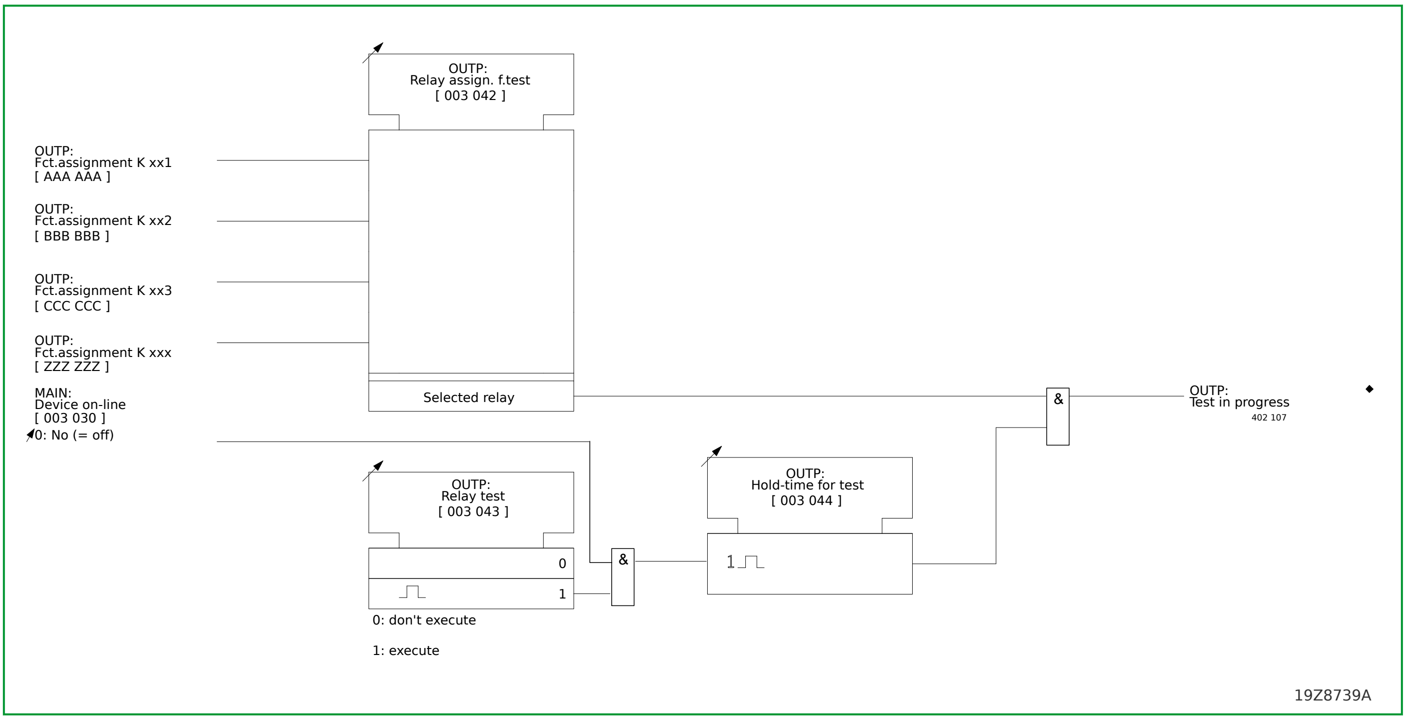


Fig. 3-39: Testing the output relays

3.9 Measured Data Output (Function Group MEASO)

Measurands made available by the P139 can be provided in BCD (binary coded decimal) form through output relays or in analog form as direct current output. Output as direct current can only occur if the P139 is equipped with analog module Y. BCD output is always possible, whether the P139 is equipped with analog module Y or not.

3.9.1 General Settings

3.9.1.1 Disabling or Enabling the Measured Data Output Function

The Measured Data Output function can be disabled or enabled via setting parameters.

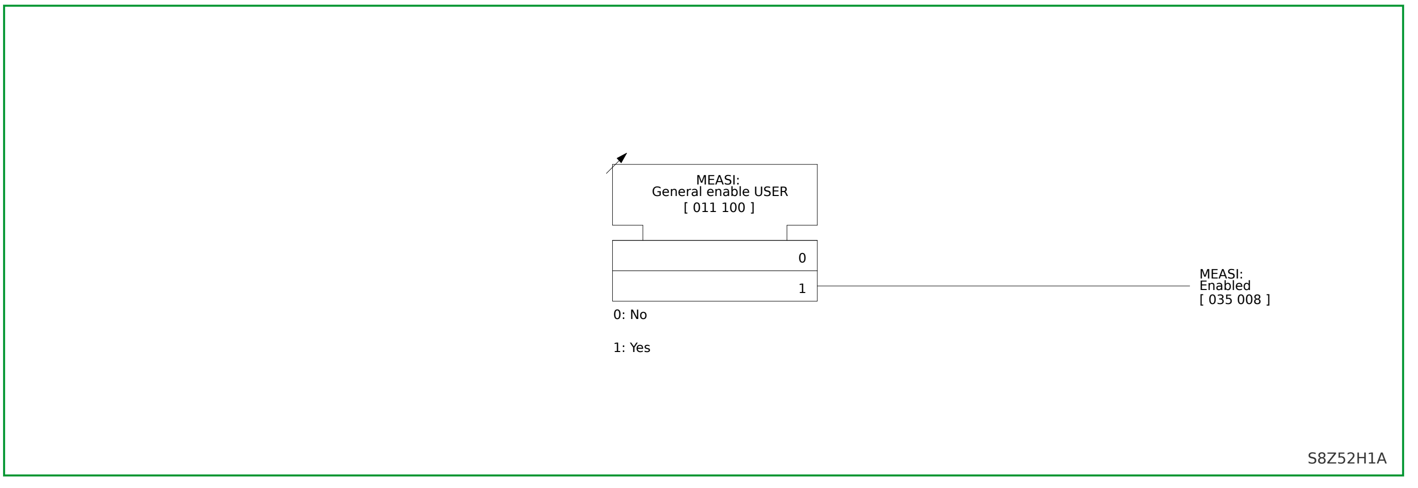


Fig. 3-40: Disabling or enabling the measured data output function.

3.9.1.2 Enabling Measured Data Output

The measured data output can be enabled through a binary signal input, provided that the function MEASO: Outp. enabled EXT has been configured. If the function MEASO: Outp. enabled EXT has not been configured to a binary signal input, then the measured data output is always enabled.

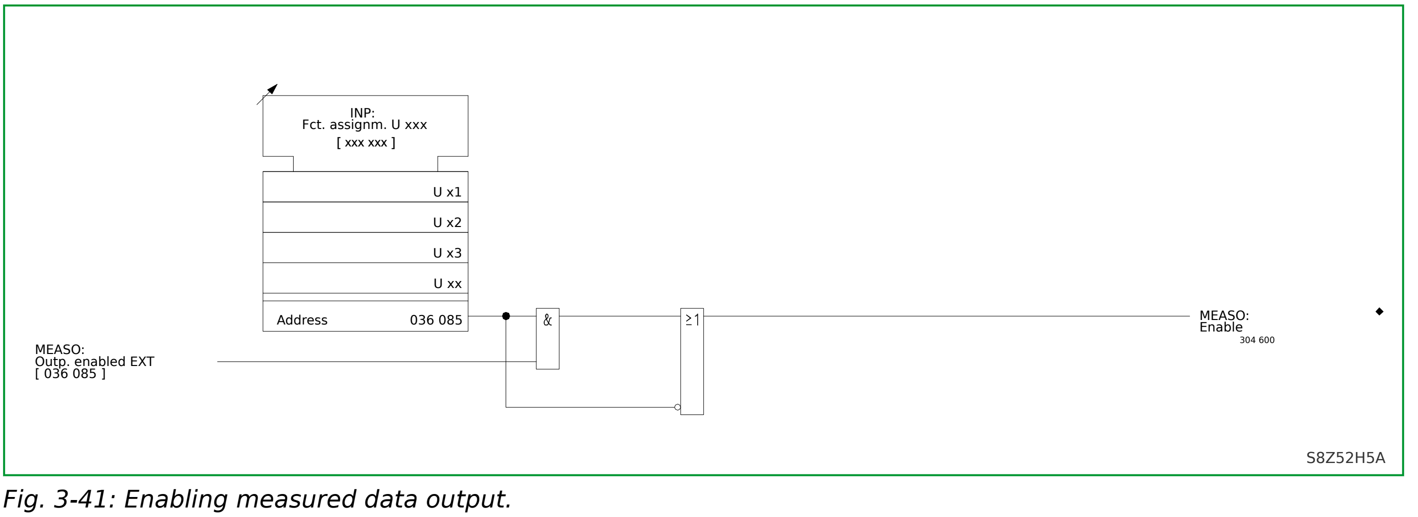


Fig. 3-41: Enabling measured data output.

3.9.1.3 Resetting the Measured Data Output Function

BCD or analog output of measurands is terminated for the duration of the hold time if one of the following conditions is met:

- The measured data output function is reset from the integral local control panel or through an appropriately configured binary signal input.
- There is a general reset.
- LED indicators reset

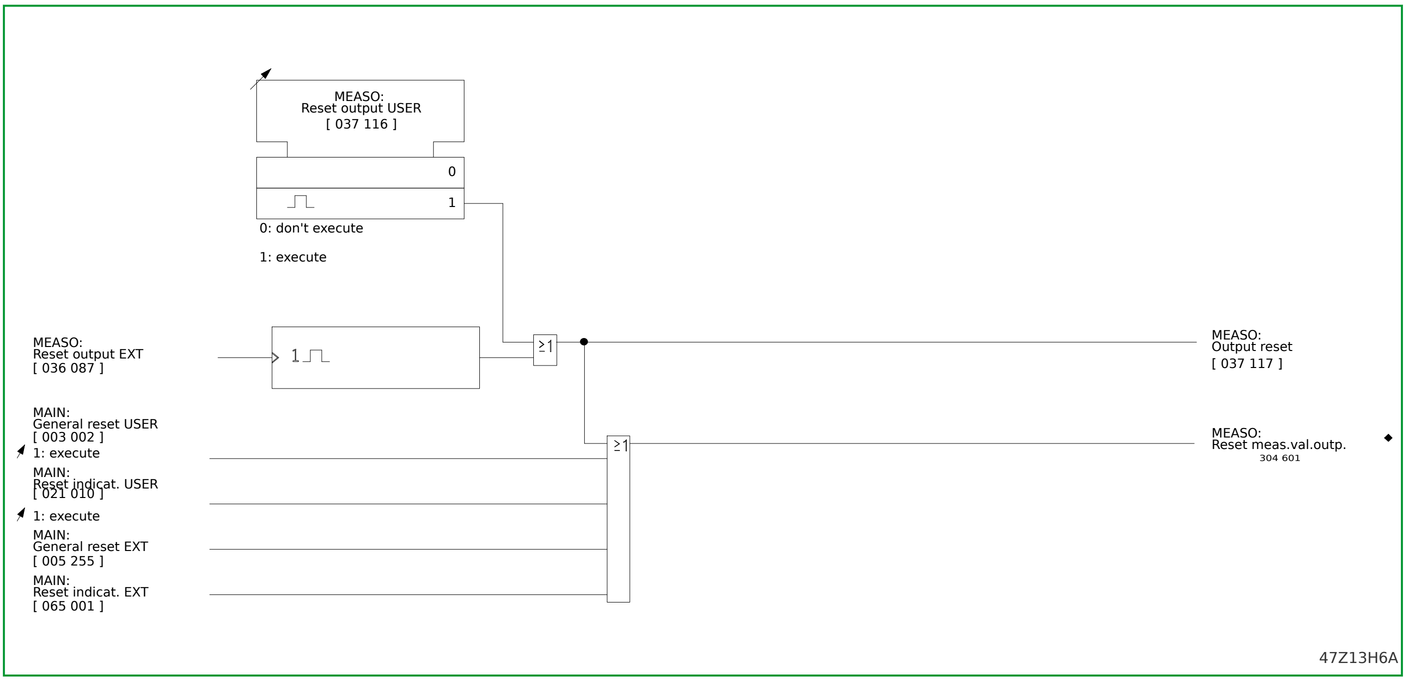


Fig. 3-42: Resetting the measured data output function.

3.9.1.4 Scaling

Scaling is used to map the physical measuring range to the P139 inherent setting range.

Scaling of analog output is also suited for directional-signed output of some fault measurands, in particular fault location in percent.

3.9.2 BCD Measured Data Output

The user can select a measurand for output in BCD form by assigning output relays.

The selected measurand is available in BCD-coded form for the duration of the set hold time MEASO: Hold time output BCD. If the selected variable was not measured, then there is no output of a measurand value.

3.9.2.1 Output of Measured Event Values

If the measured event value is updated during the hold time, the measurand output memory is cleared and the hold time is re-started. This leads to an immediate availability at the output of the updated value.

3.9.2.2 Output of Measured Operating Values

The selected measured operating value is available for the duration of the set hold time. After the hold time has elapsed, the current value is saved and the hold time is re-started. If the hold time has been set to *blocked*, the measured operating value that has been output will be stored until the measured data output function is reset.

3.9.2.3 Scaling of BCD Output

In order to define the resolution for measured data output the measurand range (Mx,min ... Mx,max) in scaled form (as Mx,scal,min ... Mx,scal,max) and the associated BCD display range (BCD,min ... BCD,max) have to be set.

- MEASO: Scaled min. val. BCD
- MEASO: Scaled max. val. BCD
- MEASO: BCD-Out min. value
- MEASO: BCD-Out max. value

The BCD display range should be set so that the value 399 is never exceeded. If this should occur or if the measurand is outside the acceptable measuring range, then the value for "Overflow" (all relays triggered) is transmitted.

Measurands	Range
Measurands of the variable Mx	Mx,RL1 ... Mx,RL2
Associated scaled measurands	0 ... 1

Scaling is made with reference to the complete range of values for the selected measurand (variable Mx). The complete range of values is defined by their end values Mx,RL1 and Mx,RL2. (Mx,RL1 and Mx,RL2 are listed in the operating program S&R-103 - PC Access Software MiCOM S1 - under “minimum” and “maximum”.)

Measurands to be output	Range
Measurands to be output	Mx,min. ... Mx,max.
Scaled measurands to be output	Mx,scal,min ... Mx,scal,max with: Mx,scal,min = (Mx,min - Mx,RL1) / (Mx,RL2 - Mx,RL1 Mx,scal,max = (Mx,max - Mx,RL1) / (Mx,RL2 - Mx,RL1
Designation of the set values in the data model	"Scaled min. val. BCD" ... "Scaled max. val. BCD"

Measurands	BCD display values
Measurands in the range "Measurands to be output"	*BCD-Out min. value ... BCD-Out max. value* (*Valid BCD value*)
Measurands: Mx,RL1 = Mx = Mx,min	*BCD-Out min. value* (BCD value not valid)
Measurands Mx: Mx,max = Mx = Mx,RL2	*BCD-Out max. value* (BCD value not valid)
Measurands Mx: Mx < Mx,RL1 or Mx > Mx,RL2	*BCD-Out max. value* (Overflow)

3.9.2.4 Example for Scaling of BCD Output

The value range for the fault measurand is set from –320.00% to +320.00%.

The PU fault location is given in the range from 0% to 200%.

Measurands	Range
Fault measurand: FT_DA:Fault locat. percent	-320.00% ... +320.00%
Associated scaled measurands	0 ... 1

Measurands to be output	Range
Measurands to be output	0% ... 200%
Scaled measurands to be output	0.5 ... 0.813 with: 0.500 = 320/640 0.813 = 520/640

Measurands	BCD display values
Measurands in the range "Measurands to be output"	0 ... 200

In this example the following P139 settings are selected:
/Parameter/Config. parameters/

Address	Description	Current value
056 020	MEASO: Function group MEASO	*With*
031 074	MEASO: General enable USER	*Yes*
053 002	MEASO: Fct. assignm. BCD	FT_DA: Fault locat. percent
010 010	MEASO: Hold time output BCD	*1.00 s*
037 140	MEASO: Scaled min. val. BCD	*0.500*
037 141	MEASO: Scaled max. val. BCD	*0.813*
037 142	MEASO: BCD-Out min. value	*0*
037 143	MEASO: BCD-Out max. value	*200*

The following figure displays the values output as a function of the fault location. The BCD value and the signal MEASO: Valid BCD value = *Yes* are only issued in the value range 0% to 200%.

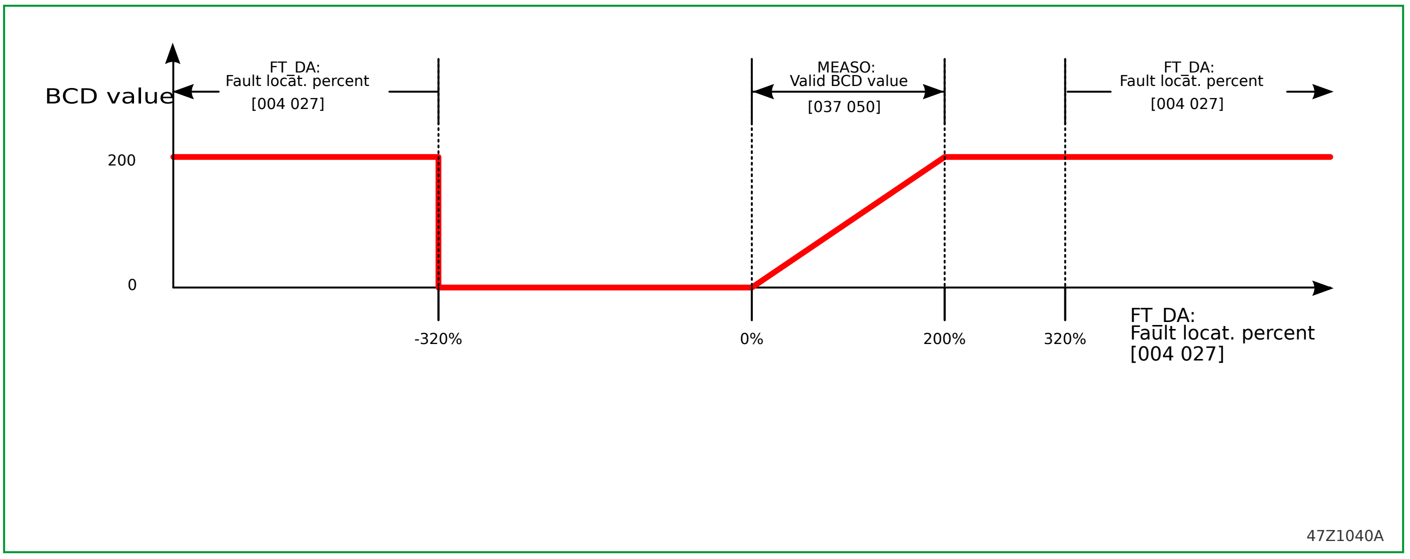
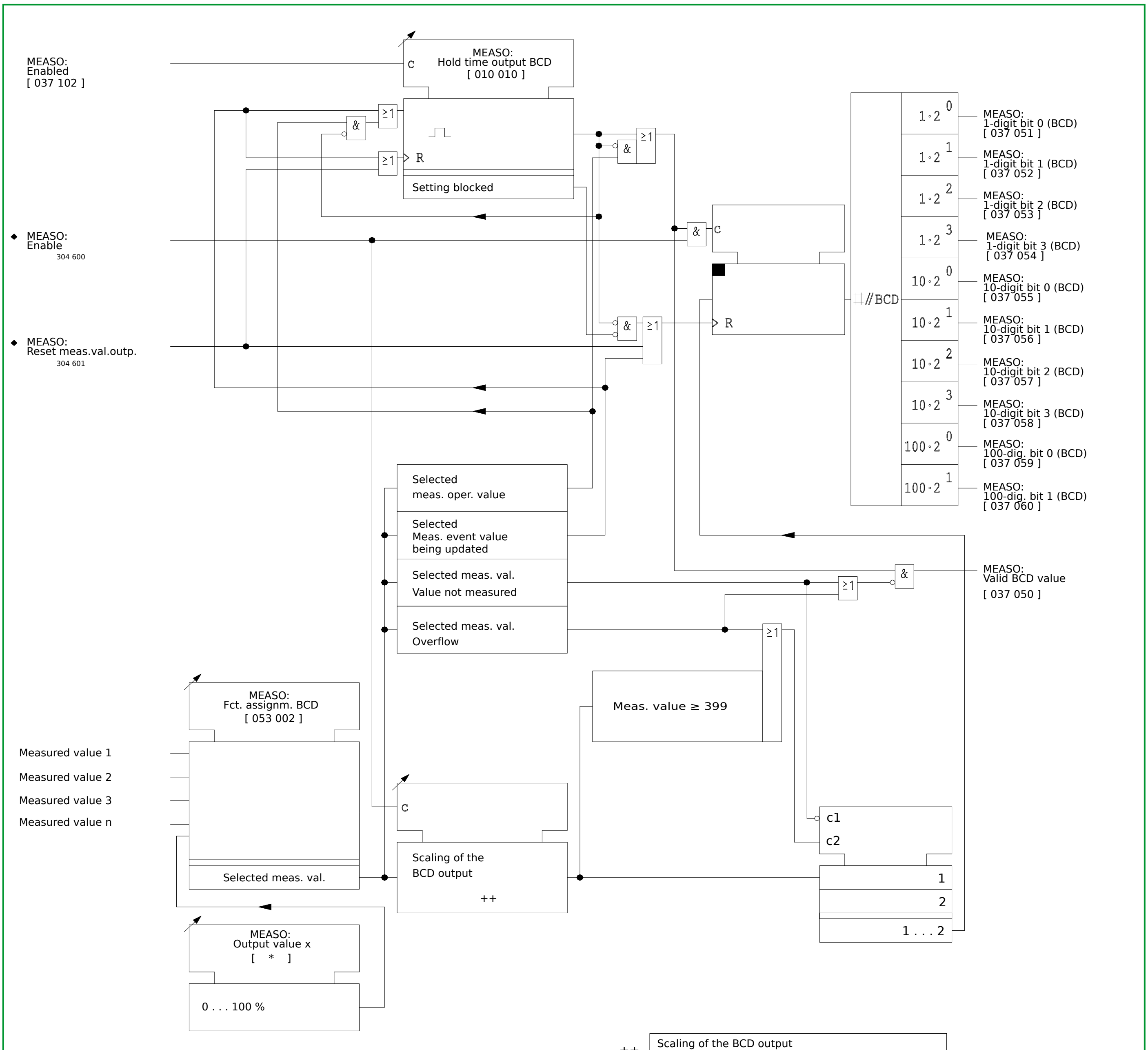


Fig. 3-43: Example of BCD output of fault location.



*

MEASO: Output value x	Address
x: 1	037 120
x: 2	037 121
x: 3	037 122

++

Scaling of the BCD output	
MEASO: Scaled min. val. BCD	037 140
MEASO: Scaled max. val. BCD	037 141
MEASO: BCD-Out min. value	037 142
MEASO: BCD-Out max. value	037 143

Fig. 3-44: BCD measured data output. Overflow behavior is displayed in BCD example (see previous figure).

3.9.3 Analog Measured Data Output

Analog output of measured data is two-channel.

The user can select two of the measurands available in the P139 for output in the form of load-independent direct current. Three interpolation points per channel can be defined for specific adjustments such as adjustment to the scaling of a measuring instrument. The direct current that is output is displayed as a measured operating value.

The selected measurand is output as direct current for the duration of the set hold time MEASO: Hold time output A-1. If the selected variable was not measured, then there is no output of a measurand value.

3.9.3.1 Output of Measured Event Values

If the measured event value is updated during the hold time, the measurand output memory is cleared and the hold time is re-started. This leads to an immediate availability at the output of the updated value.

3.9.3.2 Output of Measured Operating Values

The selected measured operating value is available for the duration of the set hold time. After the hold time has elapsed, the current value is saved and the hold time is re-started. If the hold time has been set to *blocked*, the measured operating value that has been output will be stored until the measured data output function is reset.

3.9.3.3 Configuration of Output Relays Assigned to the Output Channels

The user must keep in mind that direct current output only occurs when the output relays assigned to the output channels are configured for MEASO: Value A-1 output, since the output channels would otherwise remain short-circuited (see the terminal connection diagrams, Section 5.7, (p. 5-27)).

3.9.3.4 Scaling the Analog Display

In order to define the resolution for measured data output the measurand range in scaled form and the associated display range have to be set. One additional value for the knee point must also be defined. In this way the user can obtain an analog output characteristic similar to the characteristic shown in Fig. 3-45, (p. 3-72).

3.9.3.5 Measurand Range to be Output

The measurand range to be output is (Mx,min ... Mx,knee ... Mx,max), with:

- Mx,min: minimum value to be output
- Mx,knee: Knee-point value for the measurand range to be output
- Mx,max: maximum value to be output

This measurand range to be output is defined by setting the following parameters:

- MEASO: Scaled min. val. A-1 or MEASO: Scaled min. val. A-2, resp.
- MEASO: Scaled knee val. A-1 or MEASO: Scaled knee val. A-2, resp.
- MEASO: Scaled max. val. A-1 or MEASO: Scaled max. val. A-2, resp.

Scaling is made with reference to the complete range of values for the selected measurand (variable Mx). The complete range of values is defined by their end values Mx,RL1 and Mx,RL2. (Mx,RL1 and Mx,RL2 are listed in the operating program S&R-103 – PC Access Software MiCOM S1 – under “minimum” and “maximum”.)

Measurands	Range
Measurands of the variable Mx	Mx,RL1 ... Mx,RL2
Associated scaled measurands	0 ... 1

Measurands to be output	Range
Measurands with knee-point to be output	Mx,min ... Mx,knee ... Mx,max
Scaled measurands with a scaled knee-point to be output	Mx,scal,min ... Mx,scal,knee ... Mx,scal,max with: Mx,scal,min = (Mx,min - Mx,RL1) / (Mx,RL2 - Mx,RL1 Mx,scal,knee = (Mx,knee - Mx,RL1) / (Mx,RL2 - Mx,RL1) Mx,scal,max = (Mx,max - Mx,RL1) / (Mx,RL2 - Mx,RL1
Designation of the set values in the data model	"Scal. min. value Ax" ... ... "Scal. knee-point Ax" ... "Scaled max. val. Ax"

3.9.3.6 Associated Display Range

The associated display range is defined by setting the following parameters:

- MEASO: AnOut min. val. A-1 or MEASO: AnOut min. val. A-2, resp.
- MEASO: AnOut knee point A-1 or MEASO: AnOut knee point A-2, resp.
- MEASO: AnOut max. val. A-1 or MEASO: AnOut max. val. A-2, resp.

Measurands	Analog display values
Measurands in the range "Measurands to be output"	"AnOut min. val. A-x" ... ... "AnOut knee point A-x" ... ... "AnOut max. val." (Value A-x valid)
Measurands: Mx,RL1 = Mx = Mx,min	"AnOut min. val." (Value A-x not valid)
Measurands Mx: Mx,max = Mx = Mx,RL2	"AnOut max. val." (Value A-x not valid)
Measurands Mx: Mx < Mx,RL1 or Mx > Mx,RL2	"AnOut max. val." (Overflow)

3.9.3.7 Example for Scaling of Analog Display Ranges

Voltage A-B is selected as the measurand to be transmitted by channel A-1.

The measuring range is from 0 to 1.5 V_{nom} with V_{nom} = 100 V.

The range to be transmitted is from 0.02 to 1 V_{nom} with the associated display range from 4 mA to 18 mA.

The knee-point of the characteristic is 0.1 V_{nom} with an associated display of 16 mA.

Measurands	Range
Measurands of the variable Mx	0 V ... 150 V
Associated scaled measurands	0 ... 1

Measurands to be output	Range
Measurands with knee-point to be output	2 V ...10 V... 100 V
Associated scaled measurands	0.013 ... 0.067 ... 0.67 with: Mx,scal,min = (2 V - 0 V) / (150 V - 0 V) = 0.013 Mx,scal,knee = (10 V - 0 V) / (150 V - 0 V) = 0.067 Mx,scal,max = (100 V - 0 V) / (150 V - 0 V) = 0.67

Measurands	Analog display values
Measurands in the range "Measurands to be output" 0.02 ... 0.1 V_{nom} ... 1 V_{nom}	4 mA ... 16 mA ... 18 mA

In this example the following P139 settings are selected in the menu branch **Parameter/Config. parameters**:

Address	Description	Current value
056 020	MEASO: Function group MEASO	*With*
031 074	MEASO: General enable USER	*Yes*
053 000	MEASO: Fct. assignm. A-1	MAIN: Voltage A-B p.u.
010 114	MEASO: Hold time output A-1	*1.00 s*
037 104	MEASO: Scaled min. val. A-1	0.013 (corresponds with *0.02 Vnom)*
037 105	MEASO: Scaled knee val. A-1	0.067 (corresponds with *0.10 Vnom)*
037 106	MEASO: Scaled max. val. A-1	0.667 (corresponds with *1.00 Vnom)*
037 107	MEASO: AnOut min. val. A-1	*4 mA*
037 108	MEASO: AnOut knee point A-1	*16 mA*
037 109	MEASO: AnOut max. val. A-1	*18 mA*

By setting MEASO: AnOut min. val. A-1, the user can specify the output current that will be output when values are smaller than or equal to the set minimum measured value to be transmitted. The setting at MEASO: AnOut max. val. A-1 defines the output current that is output for the maximum measured value to be transmitted. By defining the knee-point, the user can obtain two characteristic curve sections with different slopes. When entering this setting the user must keep in mind that only a rising/rising or falling/falling curve sense is permitted (peaky or vee shapes not allowed). If the setting was not properly entered, the signal SFMON: Invalid scaling A-1 will be issued.

A check of the set characteristic and its acceptance by the P139, if the setting was properly entered, will only occur after the P139 is switched on-line again (with the setting MAIN: Device on-line).

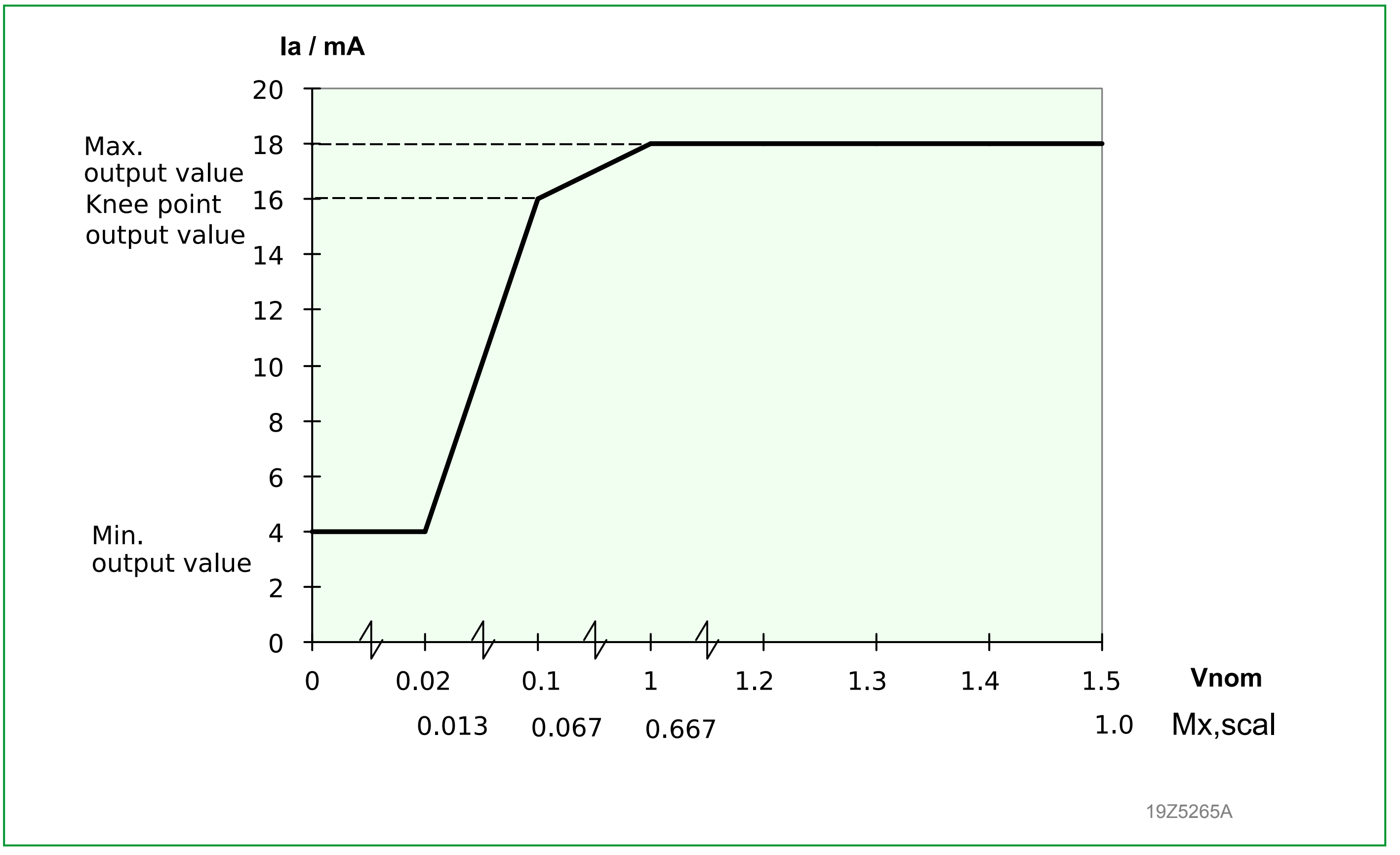
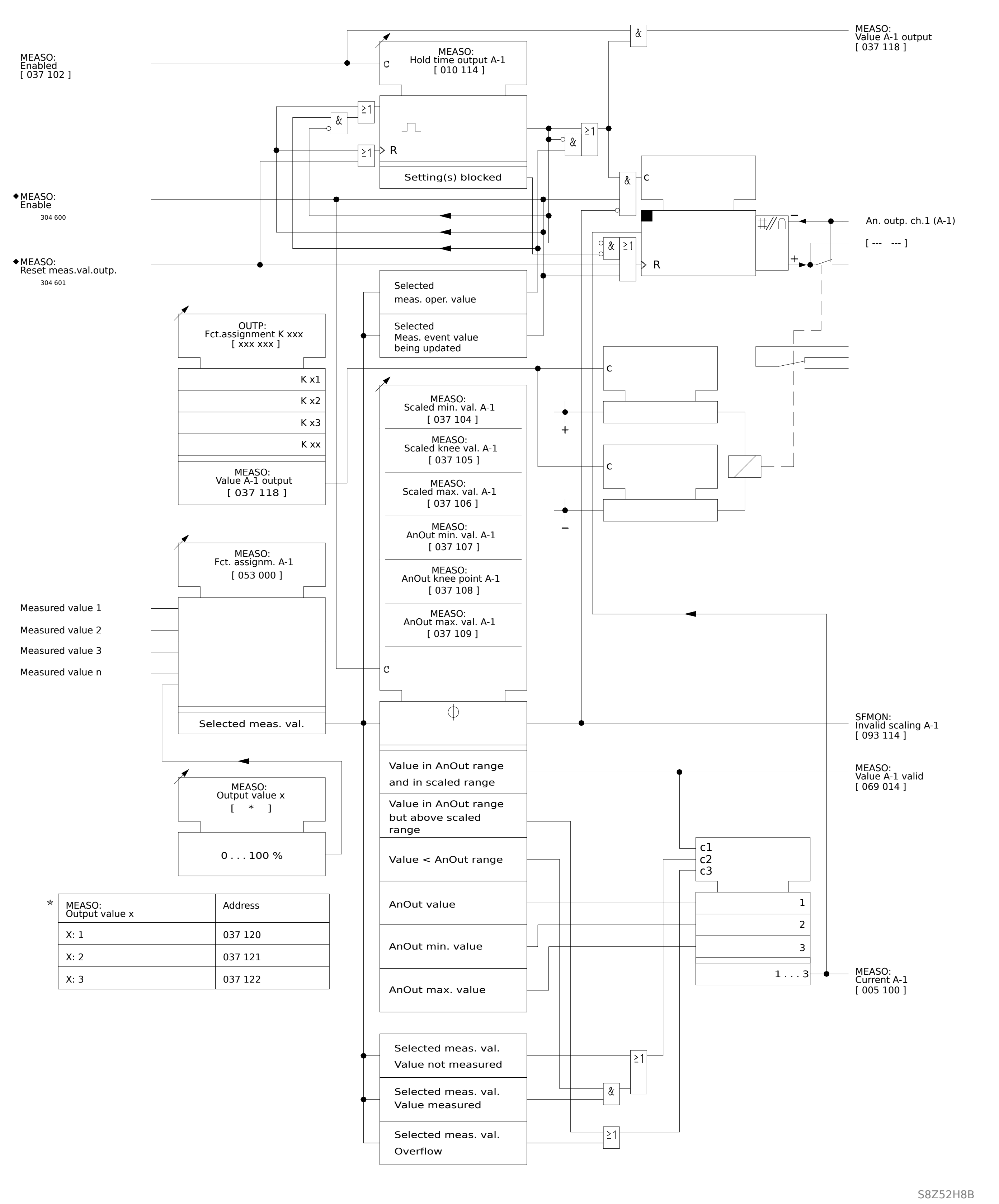


Fig. 3-45: Example of a characteristic curve for analog measured data output . In this example the range starting value is = 0; also possible is directional-signed output (see corresponding example in section BCD Measured Data Output).



* MEASO: Output value x	Address
X: 1	037 120
X: 2	037 121
X: 3	037 122

Fig. 3-46: Analog measured data output.

3.9.4 Output of “External” Measured Data

Measured data from external devices, which must be scaled to 0 ... 100%, can be written to the following parameters of the P139 via the communications interface.

- MEASO: Output value 1
- MEASO: Output value 1
- MEASO: Output value 1

These “external” measured values are output by the P139 either in BCD data form or as load-independent direct current, provided that the BCD measured data output function or the channels of the analog measured data output function are configured accordingly.

3.10 Configuration and Operating Mode of the LED Indicators (Function Group LED)

The P139 has 17 LED indicators for the indication of binary signals. Four of the LED indicators are permanently assigned to fixed functions. The other LED indicators are freely configurable. These freely configurable LEDs will emit either red or green or amber light (amber is made up of red and green light and may not be configured independently).

3.10.1 Configuring the LED Indicators

One binary signal can be assigned to each of the red and green LED color indications. The same binary signal can be assigned to several LED indicators (or colors), if required.

LED indicator	Label	Configuration
H 4 (red)	TRIP	With the P139 this LED indicator is customarily configured with function MAIN: Gen. trip signal, but the configuration may be modified.
H 4 (green)	—	Function assignment to this green LED indicator is freely configurable.
H 3 (amber)	ALARM	Permanently configured with function SFMON: Warning (LED).
H 2 (amber)	OUT OF SERVICE	Permanently configured with function MAIN: Blocked/faulty.
H 1 (green)	HEALTHY	Not configurable. H 1 indicates the operational readiness of the P139 (supply voltage is present).
H 17 (red)	EDIT MODE	Not configurable. H 17 indicates the input (edit) mode. Only when the P139 is in this mode, can parameter settings be changed by pressing the “Up” and “Down” keys. (See Section 6.2, (p. 6-2))
H 5 to H 16	—	For each of these LED indicators both colors (red & green) may be configured freely and independently.

3.10.2 Layout of the LED indicators

The following figure illustrates the layout of LED indicators situated on the local control panel.

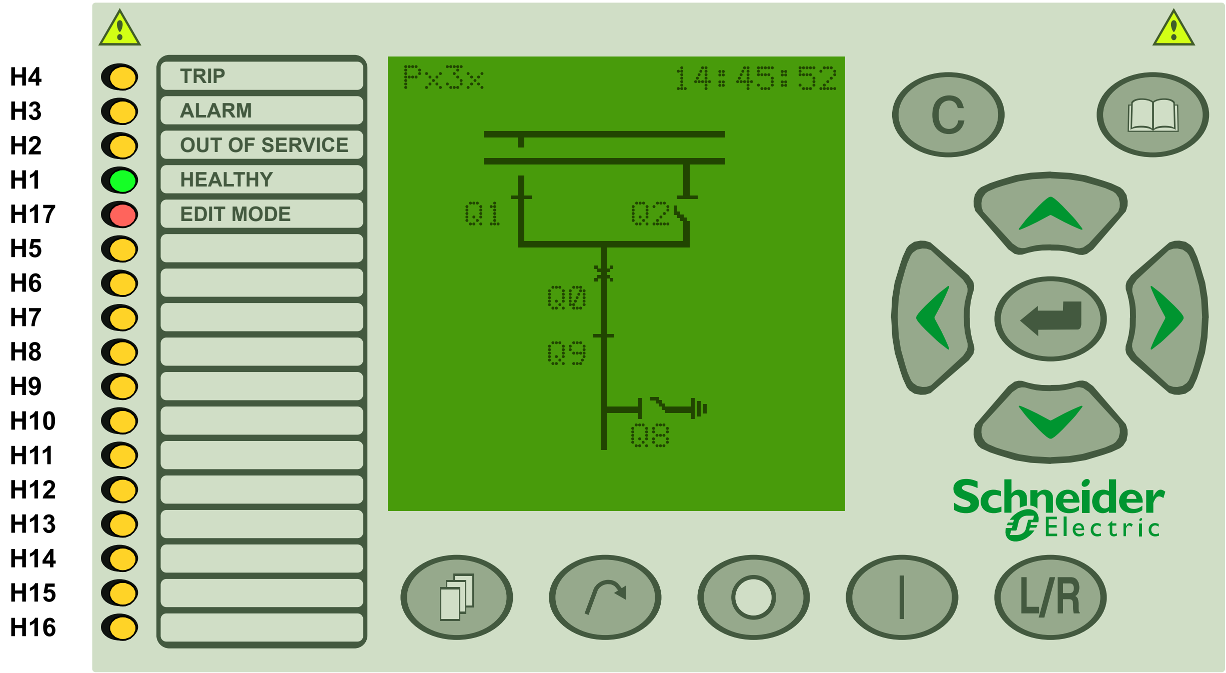


Fig. 3-47: Layout of the LED indicators.

3.10.3 Operating Mode of the LED Indicators

For each of the freely configurable LED indicators, the operating mode can be selected separately. This setting will determine whether the LED indicator will operate either in energize-on-signal (ES) or normally-energized (NE) mode, whether it will be flashing and whether it will be in latching mode.

Latching is disabled, depending on the selected operating mode:

- either manually via setting parameters or by an appropriately configured binary signal input (see Section 3.11.21, (p. 3-122))
- or at the onset of a new fault, signalized by the onset of a general starting or of a new system disturbance.

Therefore there are eight operating modes available, which are built from combinations of the following components:

		updating	**latching with manual reset**
continuous (i.e. not flashing)	**energize-on-signal (ES)**	*ES updating*	*ES manual reset*
	normally-energized (NE)	*NE updating*	*NE manual reset*
flashing	**energize-on-signal (ES)**	*ES updating bl*	*ES manual reset bl*
	normally-energized (NE)	*NE updating bl*	*NE manual reset bl*

In addition to these there are the following 4 operating modes:

	energize-on-signal (ES) with reset after new fault	energize-on-signal (ES) with reset after new system disturbance
continuous (i.e. not flashing)	*ES reset (fault)*	*ES reset (syst.dist)*
flashing	*ES reset (fault) bl*	*ES rst (syst.dst) bl*

Finally, as the 13th operating mode, an LED can be set to the mode "**ES Alarm Unit**" (*ES Alarmunit*). This mode has the following flashing behavior:

- The LED starts flashing with the first starting of the signal that has been assigned to it.

  The LED assumes the color that has been assigned via setting parameter. If both colors (red and green) have been configured to different signals, and these two signals both become active then the LED flashes in amber color.
- If an LED reset is executed and the configured signal is still active the LED changes to continuous light.

  Important: If the LED was flashing in amber color then this color is kept, even if one of the two signals is no longer active.
- If all the configured signals are no longer active at the time of the LED reset, or become inactive at a later time, the LED goes out.
- If later, after the LED has gone out, any of the configured signals becomes active again then the LED starts flashing again (in the assigned color).

  If both colors have been configured and the LED shines continuously in amber color, then it is possible that one of these two signals becomes inactive and active again whilst the other signal stays active all the time. In this case the LED starts flashing again with the starting of that signal. But since the LED permanently keeps the amber color it is no longer possible to tell the two signals from each other. Therefore general caution is recommended whenever two different signals are configured to an LED with this operating mode.

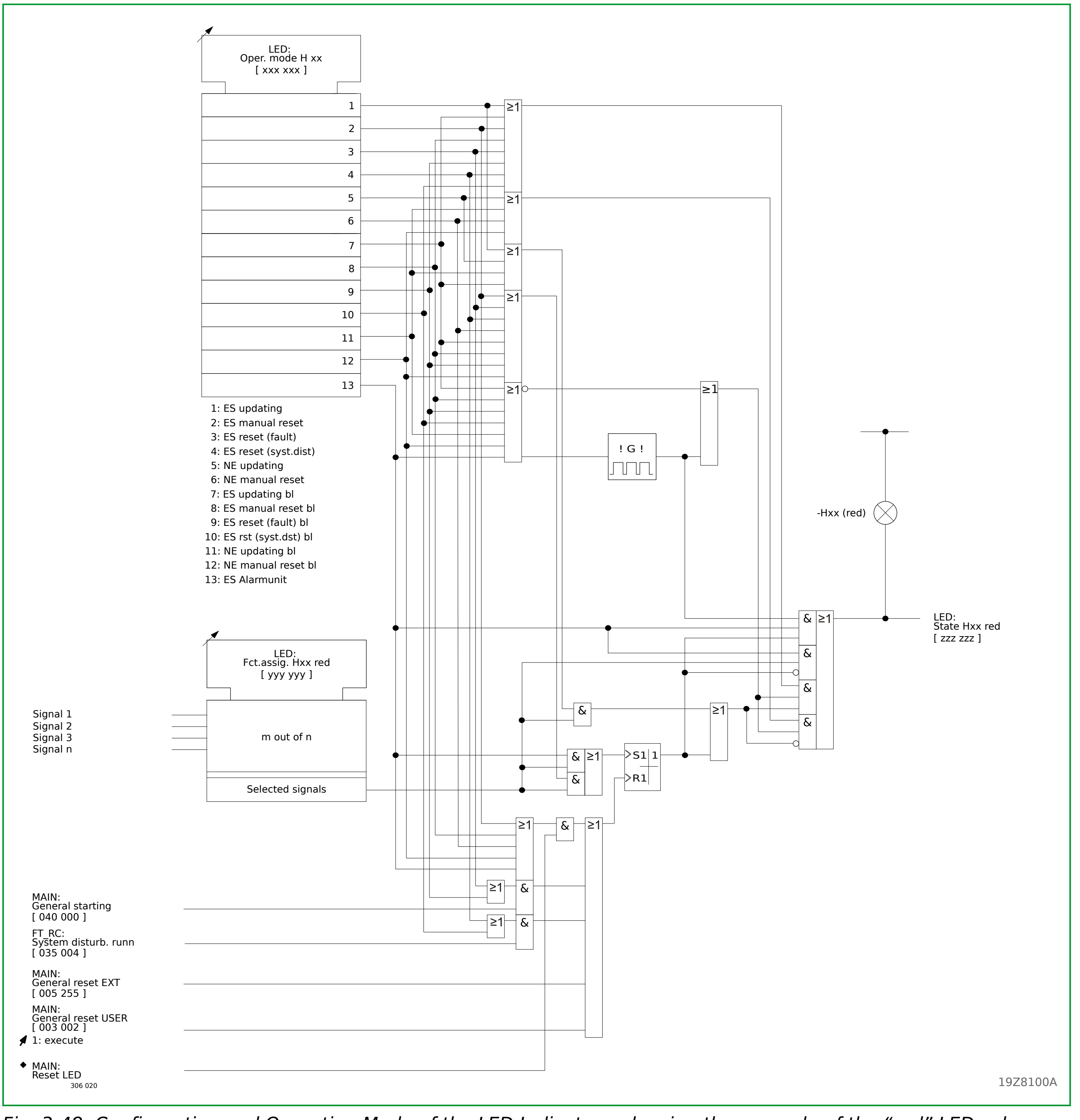


Fig. 3-48: Configuration and Operating Mode of the LED Indicators, showing the example of the “red” LED color.

3.11 Main Functions of the P139 (Function Group MAIN)

3.11.1 Conditioning of the Measured Variables

The secondary phase currents of the system transformers are fed to the P139. There is the option of connecting up to five voltage transformers. The measured variables are – electrically isolated – converted to normalized electronics levels. Air-gap transformers are used in the phase current path to suppress low frequency (DC decays and offsets) signal components. The analog quantities are digitized and are thus available for further processing.

Settings that do not refer to nominal quantities are converted by the P139 to nominal quantities. The user must therefore set the secondary nominal currents and voltages of the system transformers.

The connection direction of the measuring circuits on the P139 must also be set. Fig. 3-49, (p. 3-80) shows the standard connection. By this setting the phase of the digitized currents is rotated by 180°.

If the P139 is to operate with the GFDSS function (ground fault direction determination using steady-state values), current transformer T4 needs to be connected to a current transformer in Holmgreen connection (dashed lines in Fig. 3-49, (p. 3-80)) or to a core balance current transformer.

When the P139 is equipped with the temperature p/c board (RTD module for PT 100, Ni 100 or Ni 120) further resistance thermometers, in addition to the PT 100 resistance thermometer connected to the analog module (I/O), can be connected to the RTD module as described in Section 3.7.2, (p. 3-55).

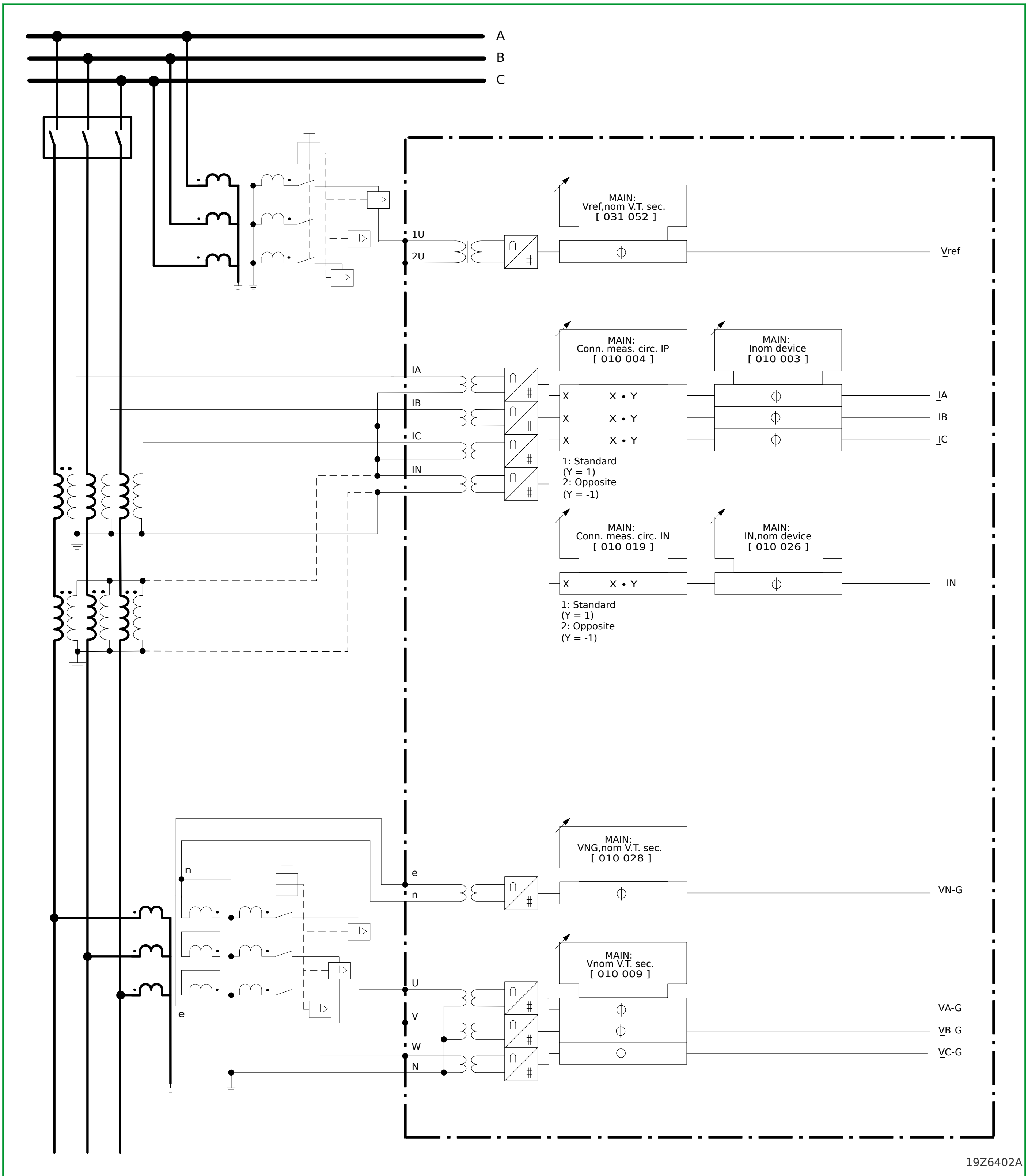


Fig. 3-49: Connecting the P139 measuring circuits (when the P139 is equipped with the RTD module; see references in previous text).

3.11.2 Phase Reversal Function

The phase reversal function is used to protect machines driven by motors with left-/right-hand rotation control by phase reversal with paralleled circuit breakers (one CB with phase reversal). Here the voltage is measured on the busbar side and the current down-stream between CB and motor. Dependent on the operating mode the current can therefore be measured in reverse to the voltage. Because of the phase reversal function the P139 can maintain proper operation of all protection functions even if phase reversal is carried out within the protected zone.

Following directly to the analog to digital conversion the connection between the physical transformer module and the internal numerical signal for the setting is exchanged respectively. (The measured values stored in the respective measured value memories are exchanged by each other.) In this way further processing of measured values will remain unchanged and the implementation of protection functions will continue to be unaffected.

The following setting parameters are available for phase reversal:

Parameter	Value
MAIN: Phase reversal I PSx ● PS1: (010 200) ● PS2: (010 201) ● PS3: (010 202) ● PS4: (010 203)	● *No swap* ● *A-B swapped* ● *B-C swapped* ● *C-A swapped*

By applying the parameter subsets a phase reversal can be activated, without any problems, through one of the interfaces (LOC, PC, COMMx) or via appropriately configured binary signal inputs.

The phase sequence for the current, given by the active parameter subset with the setting for MAIN: Phase reversal I PSx may be reversed by triggering a binary signal input configured at MAIN: Phase reversal I EXT.

3.11.3 Operating Data Measurement

The P139 has an operating data measurement function for the display of currents and voltages measured as well as quantities derived from these measured values. For the display of measured values, set lower thresholds need to be exceeded, to avoid fluctuating small values from noise. If these lower thresholds are not exceeded, the value *Not measured* is displayed. The following measured variables are displayed:

- Phase currents for all three phases
- Delayed and stored phase currents for all three phases – demand values for the three phases
- Minimum and maximum phase current
- Delayed and stored maximum phase current – maximum demand values
- Residual current measured by the P139 at the T 4 transformer, and calculated resultant current
- Calculated unfiltered resultant current
- Phase-to-ground voltages
- Sum of the three phase-to-ground voltages and neutral-point displacement voltage measured by the P139 at the T 90 transformer
- Reference voltage measured by the P139 at the T 15 transformer
- Phase-to-phase voltages
- Minimum and maximum phase-to-phase voltage and minimum and maximum phase-to-ground voltage
- Positive-sequence current and negative-sequence current (in units of I_{nom}), taking into account the set phase sequence
- Positive-sequence voltage and negative-sequence voltage (in units of V_{nom})
- Active, reactive and apparent power
- Active power factor
- Active and reactive energy output and input
- Load angle φ in all three phases
- Angle between measured residual current and measured neutral-point displacement voltage
- Phase relation between measured neutral current and calculated residual current (binary indication of equal or reverse phase)
- System frequency

The measured data are updated at approx. 1 s intervals. Updating is interrupted if the self-monitoring function detects a hardware fault.

3.11.3.1 Measured Current Values

The measured current values are displayed both as per-unit quantities referred to the nominal quantities of the P139 and as primary quantities. To allow display in primary values, the primary nominal current of the system current transformer should be set in the P139.

Phase sequence A-B-C (clockwise rotating field)

- Negative-sequence current:

  $\underline{I}_{\mathrm{neg}} = \frac{1}{3} \cdot \left| (\underline{I}_{\mathrm{A}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{B}} + \underline{a} \cdot \underline{I}_{\mathrm{C}}) \right|$

- Positive-sequence current:

  $\underline{I}_{\mathrm{pos}} = \frac{1}{3} \cdot \left| (\underline{I}_{\mathrm{A}} + \underline{a} \cdot \underline{I}_{\mathrm{B}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{C}}) \right|$

Phase sequence A-C-B (anti-clockwise rotating field)

- Negative-sequence current:

  $\underline{I}_{\mathrm{neg}} = \frac{1}{3} \cdot \left| (\underline{I}_{\mathrm{A}} + \underline{a} \cdot \underline{I}_{\mathrm{B}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{C}}) \right|$

- Positive-sequence current:

  $\underline{I}_{\mathrm{pos}} = \frac{1}{3} \cdot \left| (\underline{I}_{\mathrm{A}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{B}} + \underline{a} \cdot \underline{I}_{\mathrm{C}}) \right|$

- Symbols used:

  $\underline{a} = \mathrm{e}^{2\pi j/3} = \mathrm{e}^{j \cdot 120°}$

  $\underline{a}^2 = \mathrm{e}^{4\pi j/3} = \mathrm{e}^{j \cdot 240°}$

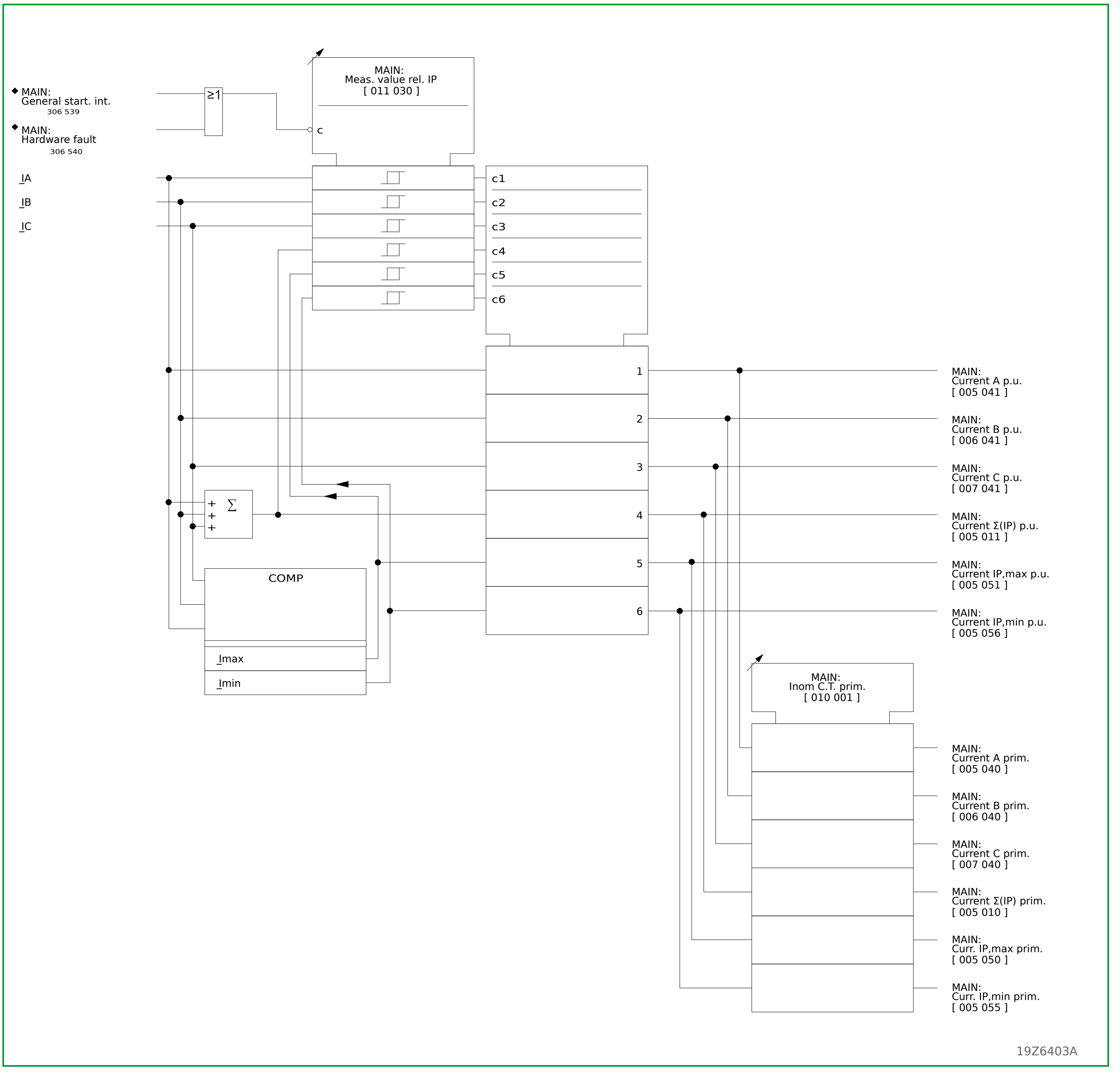


Fig. 3-50: Measured operating data - phase current, part 1.

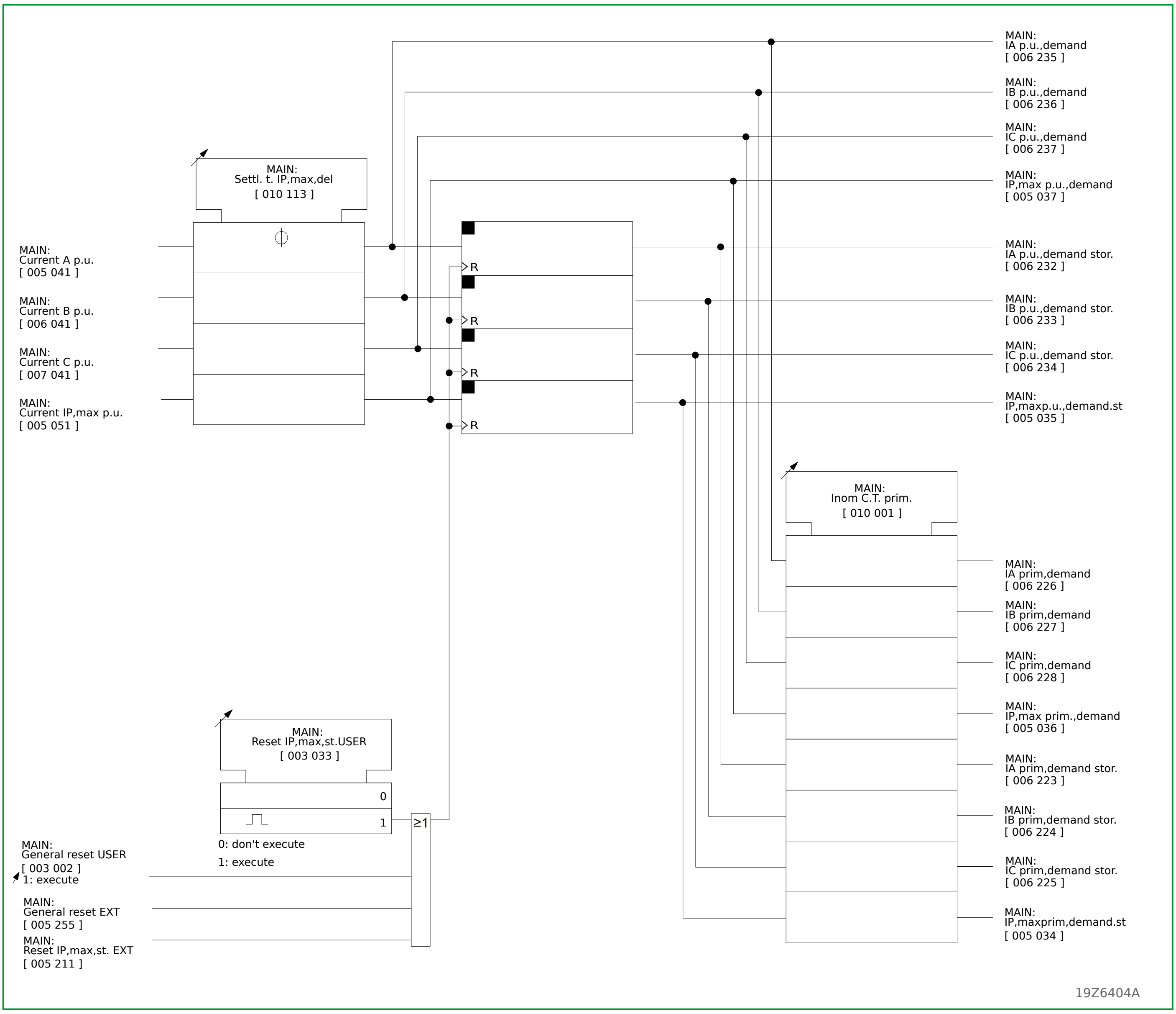


Fig. 3-51: Measured operating data - phase current, part 2: demand values (delayed and stored phase currents and maximum phase current).

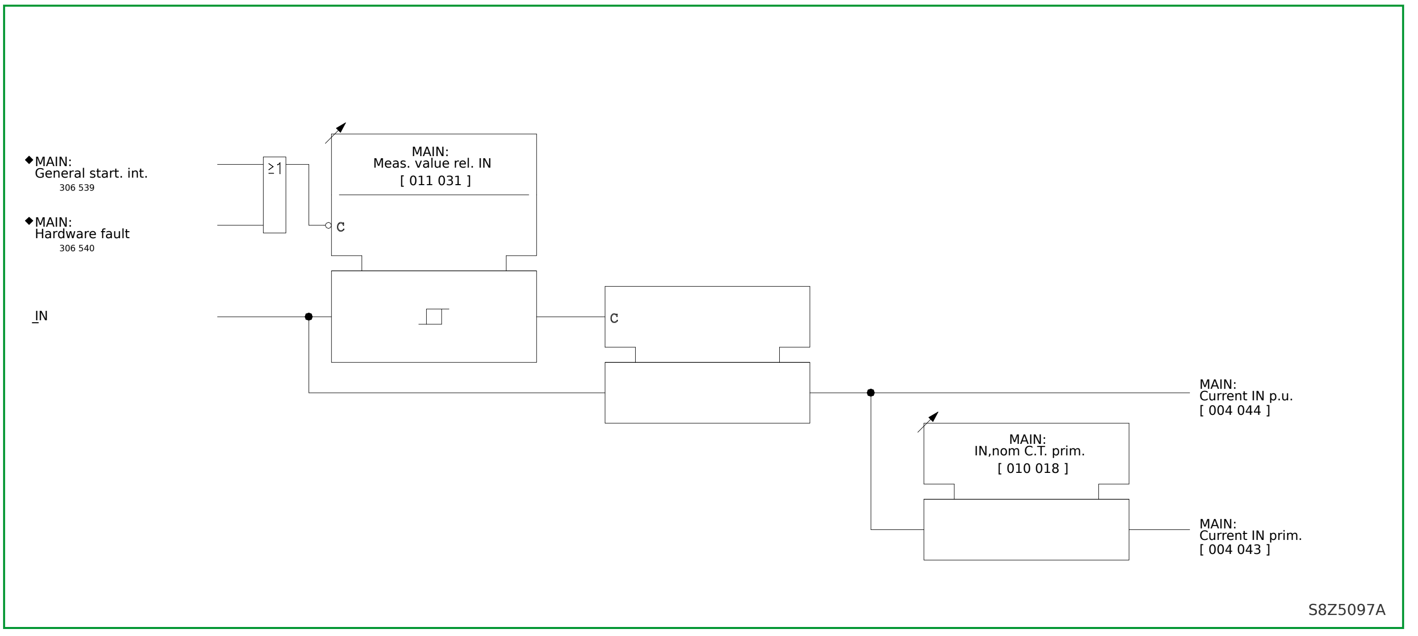


Fig. 3-52: Measured operating data - residual current.

3.11.3.2 Display of Demand Values – Delayed Maximum Phase Current

The P139 offers the option of a delayed display of the maximum value of the three phase currents (thermal ammeter function). The delayed maximum phase current display is an exponential function of the maximum phase current $I_{P,max}$ (see upper curve in Fig. 3-53, (p. 3-87)). The time after which the delayed maximum phase current display will have reached 95 % of maximum phase current $I_{P,max}$ is set at MAIN: Settl. t. IP,max,del.

3.11.3.3 Display of Demand Values – Stored Maximum Phase Current

The stored maximum phase current follows the delayed maximum phase current. If the value of the delayed maximum phase current is declining, then the highest value of the delayed maximum phase current remains stored. The display remains constant until the actual delayed maximum phase current exceeds the value of the stored maximum phase current (see middle curve in Fig. 3-53, (p. 3-87)). The stored maximum phase current to the actual value of the delayed maximum phase current is set at MAIN: Reset IP,max,st.USER (see lower curve in Fig. 3-53, (p. 3-87)).

3.11.3.4 Display of Demand Values – Delayed and Stored Values of the Three Phase Currents

The P139 offers the option of a delayed display of the three phase currents. This functionality is equivalent to the display of the maximum value of the three phase currents (see description above, Fig. 3-53, (p. 3-87) and Fig. 3-51, (p. 3-85)). However, in this case, the delayed phase current display will have reached 90 % (not 95 %) of I_A , I_B or I_C , respectively, after the set delay.

The stored phase currents are implemented as for the stored maximum phase current.

The delay for these six operating data values is set at MAIN: Settl. t. IP,max,del as for the delayed maximum phase current.

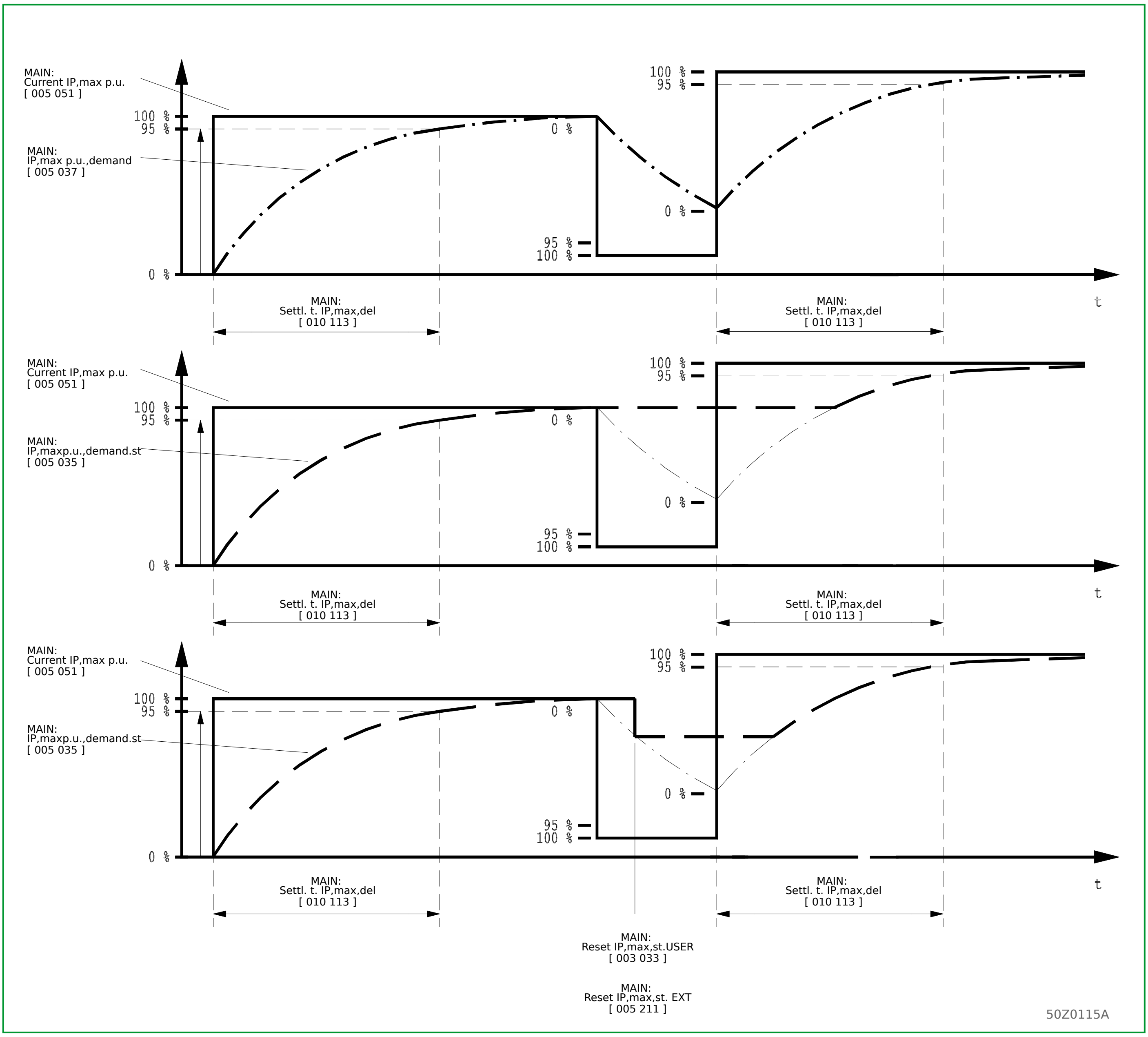


Fig. 3-53: Operation of delayed and stored maximum phase current display – display of demand values.

3.11.3.5 Measured Voltage Values

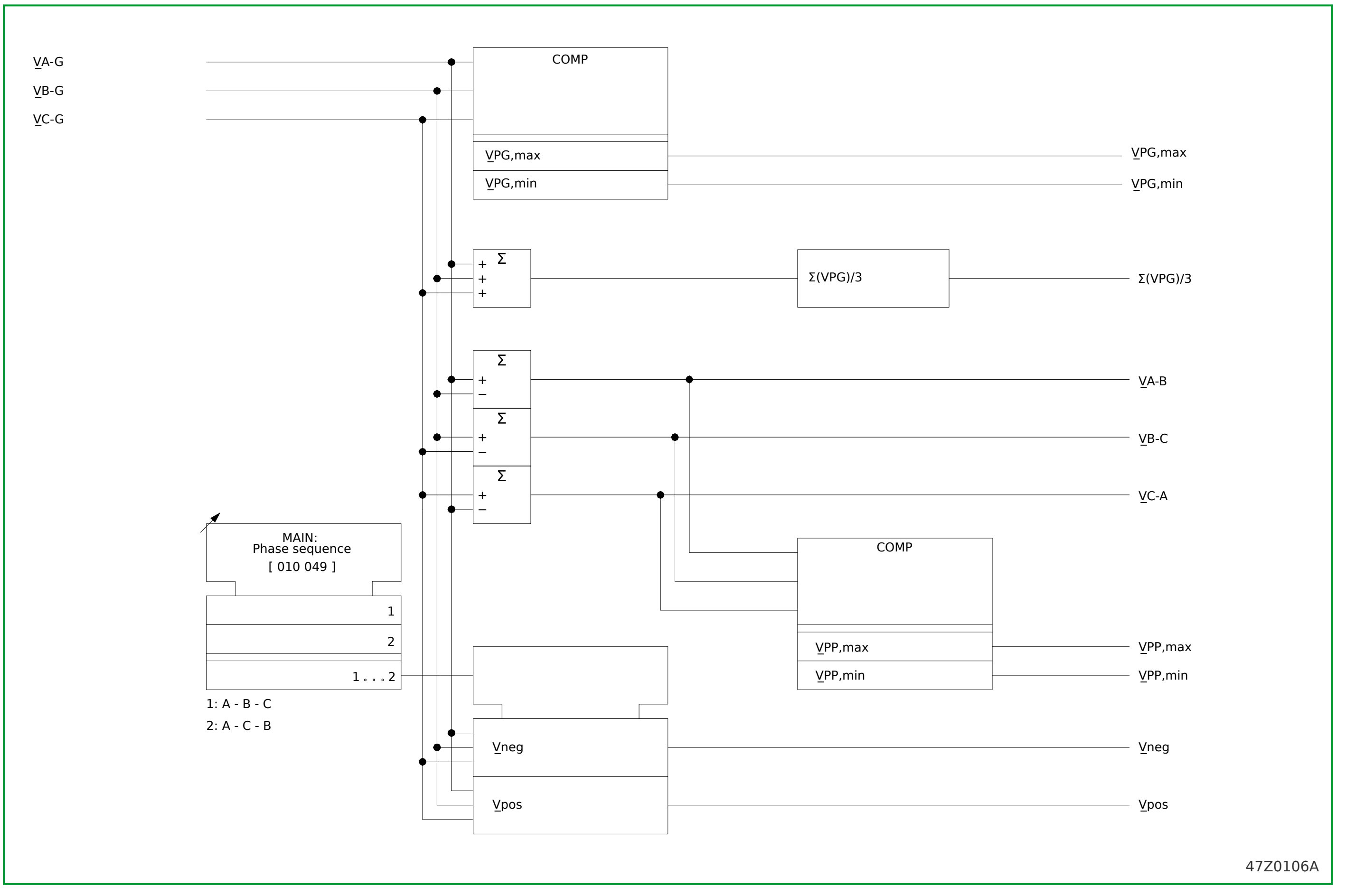


Fig. 3-54: Determining the minimum and maximum phase-to-ground and phase-to-phase voltages as well as the negative-sequence and positive-sequence voltages.

The measured voltage values are displayed both as per-unit quantities referred to the nominal quantities of the P139 and as primary quantities. To allow a display in primary values, the primary nominal voltage of the system transformer needs to be set in the P139.

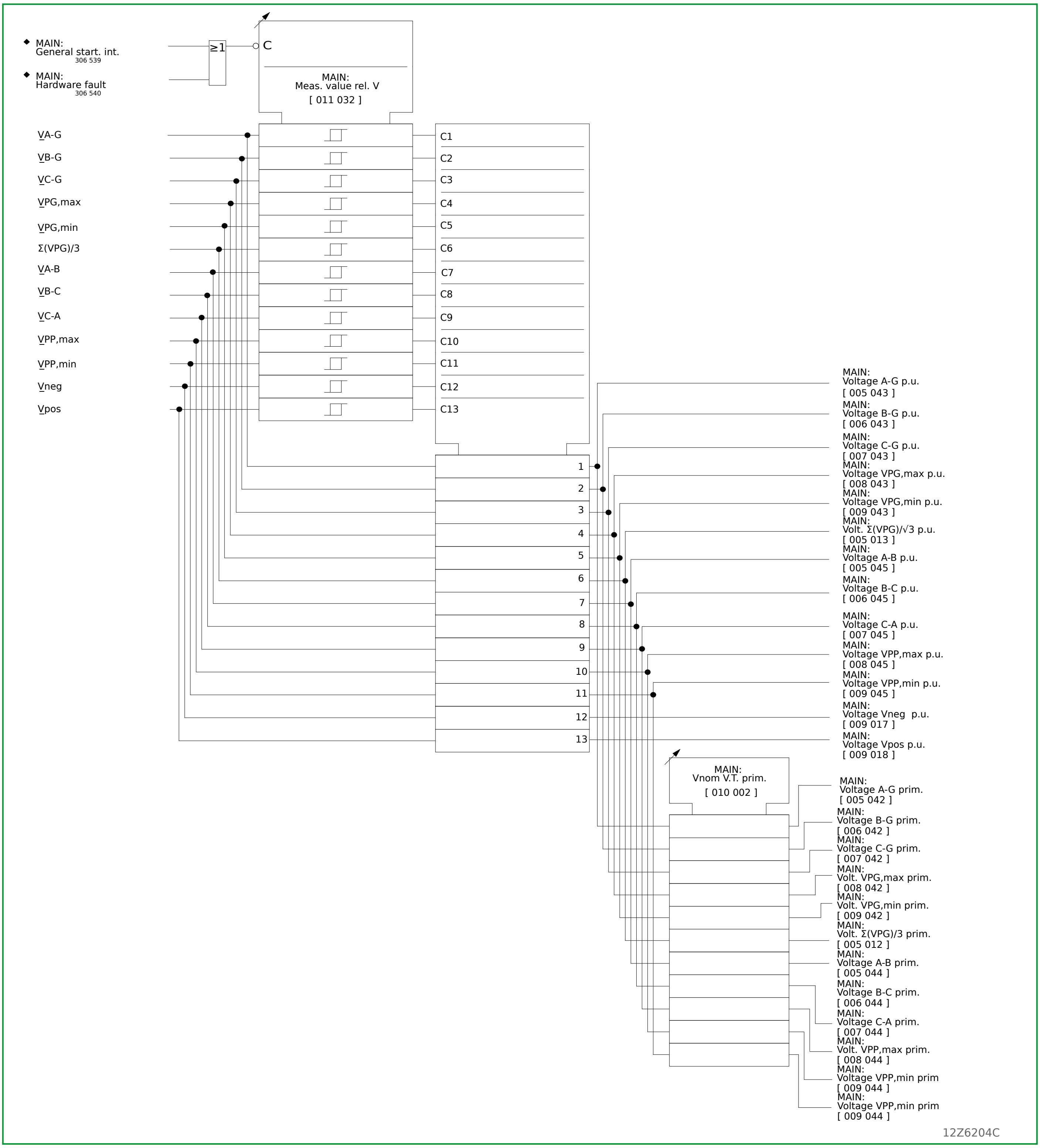


Fig. 3-55: Measured operating data – phase-to-ground and phase-to-phase voltages.

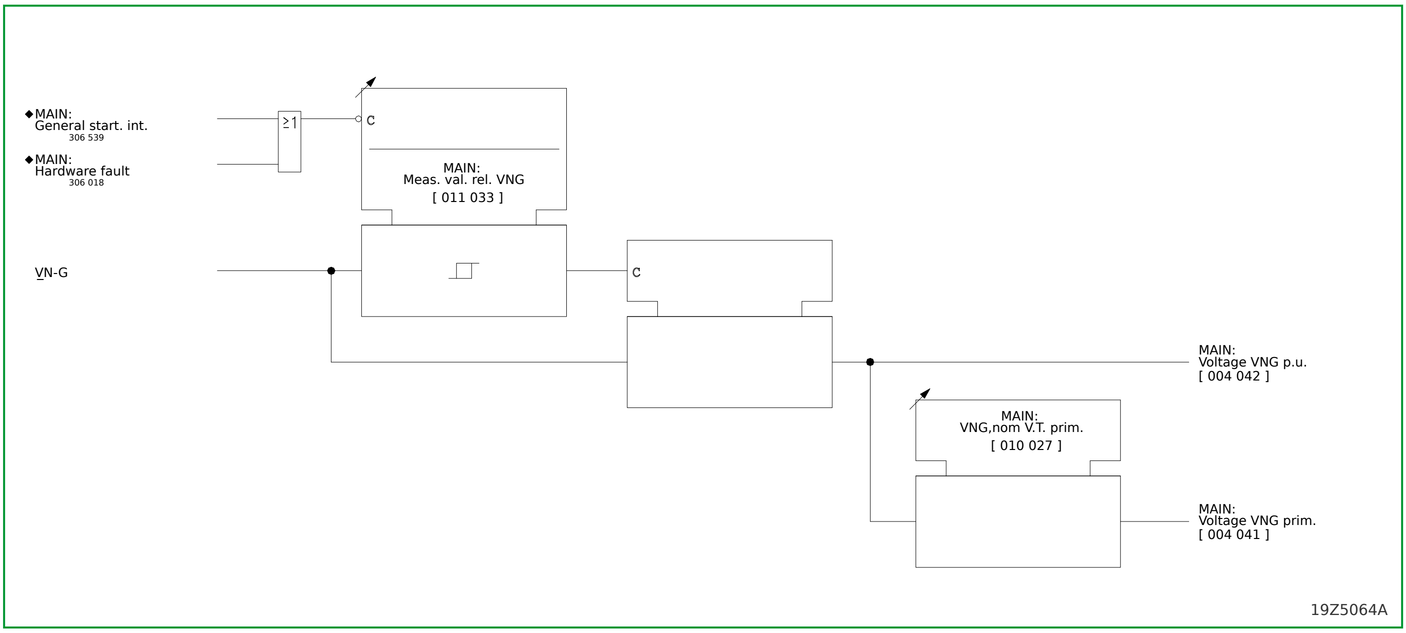


Fig. 3-56: Measured operating data – neutral-point displacement voltage.

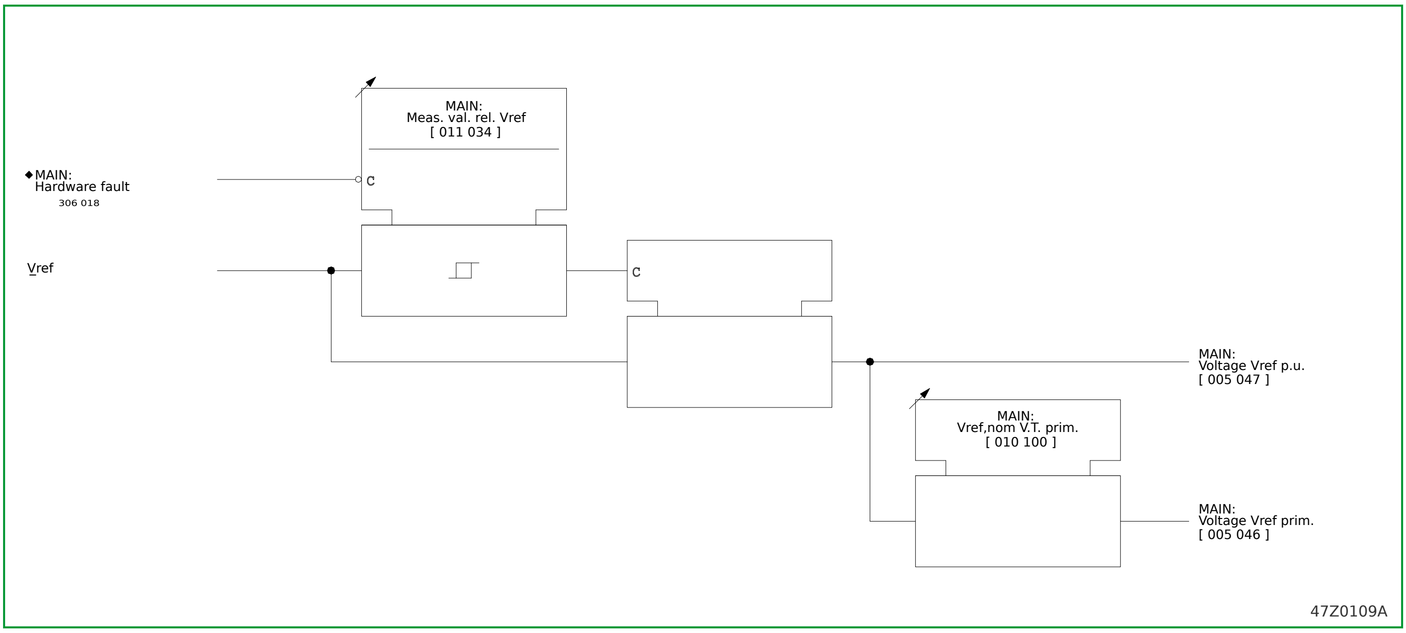


Fig. 3-57: Measured operating data – reference voltage.

3.11.3.6 Measured Values for Power, Active Power Factor, and Angle

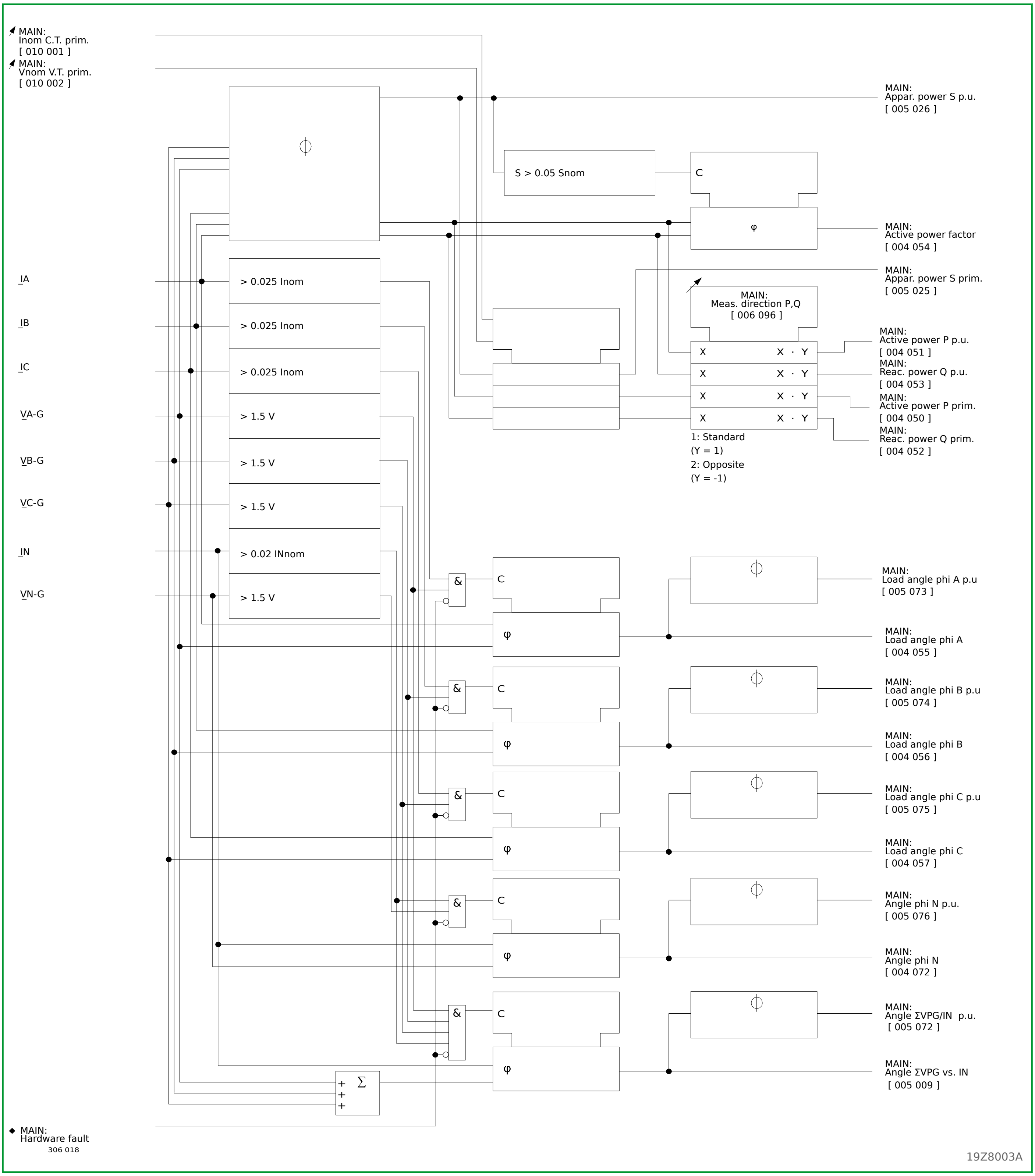


Fig. 3-58: Measured operating data – power, active power factor, and angle.

Calculation of these derived operating quantities is subject to the following conditions:

- Values for active and reactive power will always be calculated and displayed as these quantities are required for the subsequent energy measurement. Greater deviations in measurements may occur with low phase currents or a critical power factor value.
- The active power factor will be calculated only if the apparent power value exceeds 5% of the nominal apparent power S_{nom}.
- Load angles will be displayed only if the respective phase current exceeds $0.1 \cdot I_{nom}$ and if the phase-to-ground voltage exceeds 1.5 V.
- The angle between the measured values for the residual current and the neutral-point displacement voltage will only be displayed if the residual current exceeds $0.02 \cdot I_{N,nom}$ and the neutral-point displacement voltage exceeds 1.5 V.

The setting for MAIN: Meas. direction P,Q may be changed from *Standard* to *Opposite* if the user wishes to have the following measured operating data displayed with the opposite sign (see Fig. 3-58, (p. 3-91)):

- MAIN: Active power P p.u.
- MAIN: Reac. power Q p.u.
- MAIN: Active power P prim.
- MAIN: Reac. power Q prim.

This setting parameter does not influence the remaining measured operating data. It must be noted that inverting the sign will only affect the display of measured operating data, all protection functions will internally use non-inverted measured values.

3.11.3.7 Phase Relation I_N

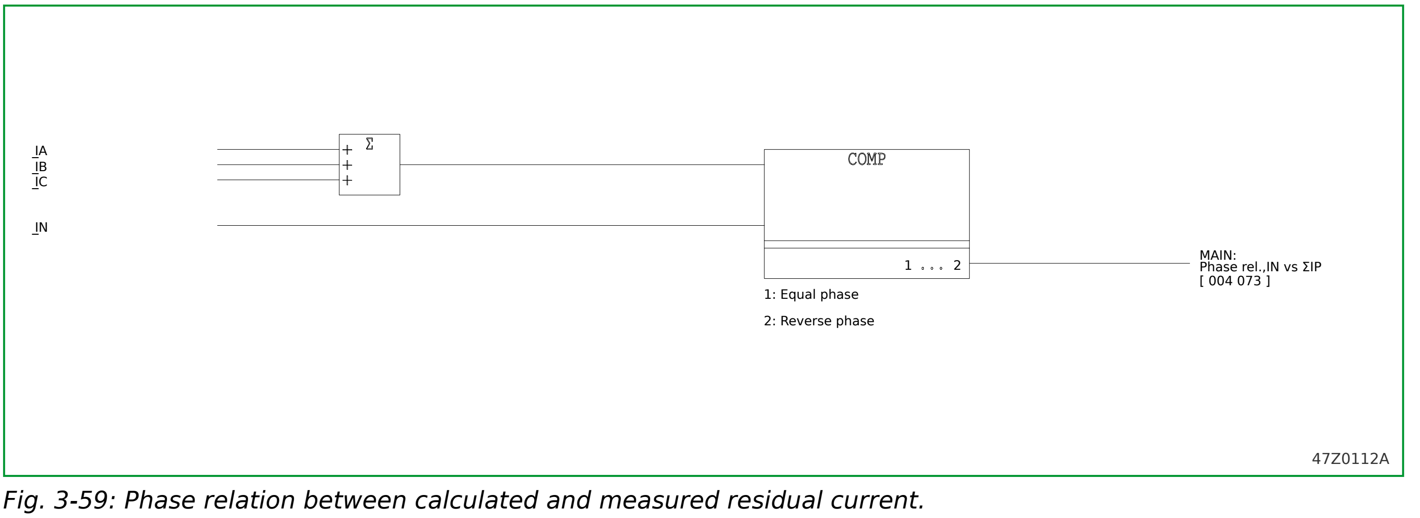


Fig. 3-59: Phase relation between calculated and measured residual current.

The P139 checks if the phase relations of calculated residual current and measured residual current are coherent. If the phase displacement between the two currents is ≤ 45°, then the indication *Equal phase* is displayed.

3.11.3.8 Frequency

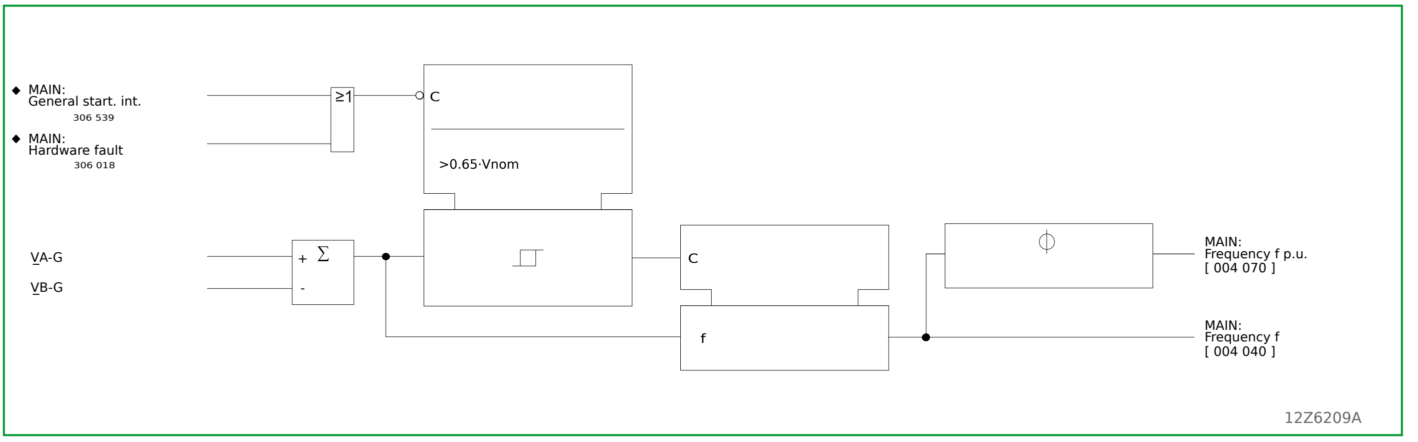


Fig. 3-60: Frequency measurement.

The P139 determines the frequency from the voltage V_{A-B}. This voltage needs to exceed a minimum threshold of 0.65 V_{nom} in order for frequency to be determined.

3.11.3.9 Active and Reactive Energy Output and Input

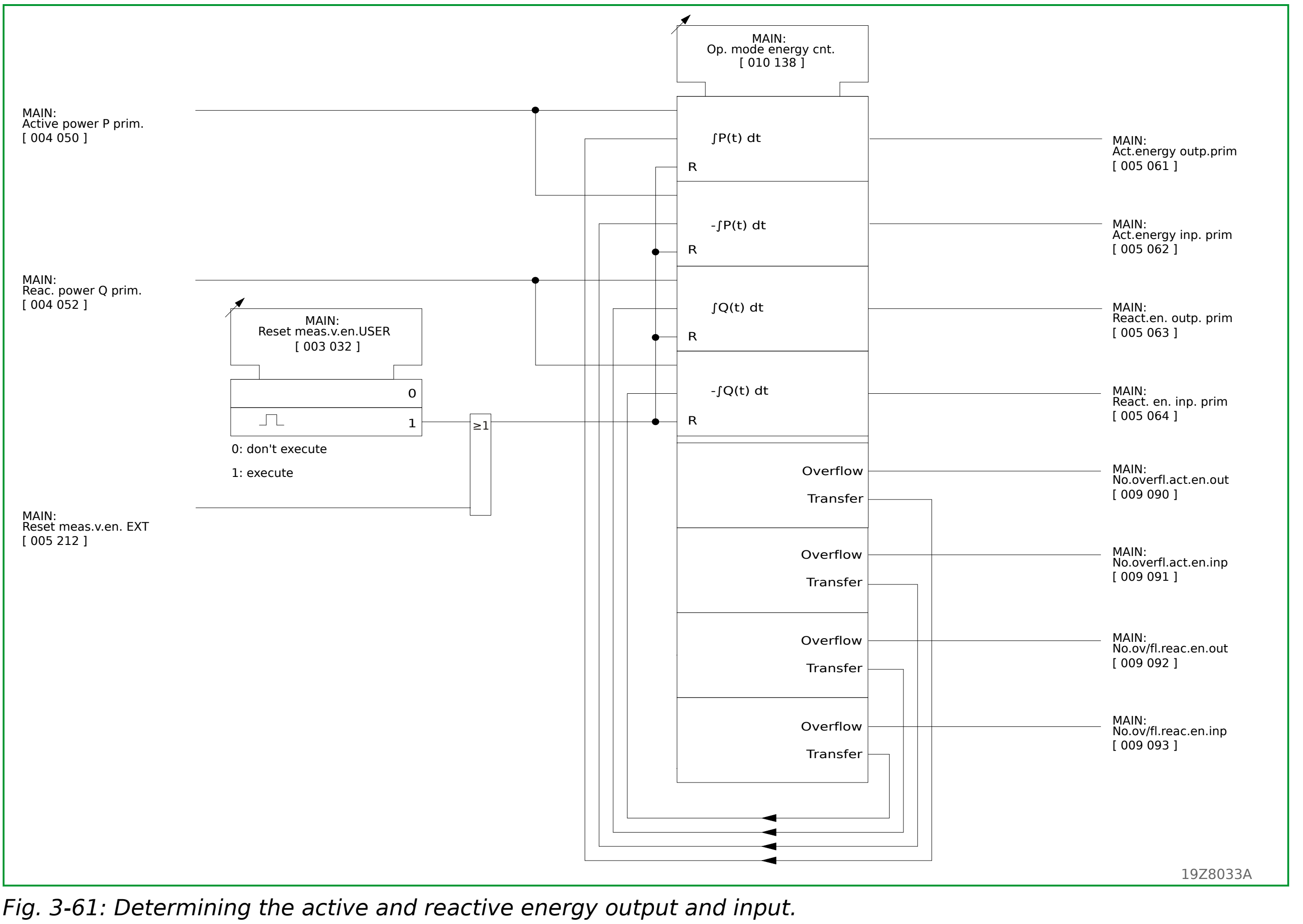


Fig. 3-61: Determining the active and reactive energy output and input.

The P139 determines the active and reactive energy output and input based on the primary active or reactive power.

There are two procedures available to determine active and reactive energy. If procedure 1 is selected, active and reactive energy are determined every 2 s (approximately). If procedure 2 is selected, active and reactive energy are determined every 100 ms (approximately). In this way higher accuracy is achieved.

Measured energy values are presented as text parameters with a value range of about 0 … 6.5 TWh and a resolution of 10 kWh. In addition, 16 bit values and overflow counters are provided, which are needed for transmission via serial protocols (e.g. Modbus, DNP3, Courier).

Energy values as 32 bit / text values **Value range: 0 … 6553500.00 MWh**	**Energy values as 16 bit values** **Value range: 0 … 655,35 MWh**	**Overflow counters for the 16 bit energy values** **Value range: 0 … 10000**
(008 065) MAIN: Act.energy outp.prim	(005 061) MAIN: Act.energy outp.prim	(009 090) MAIN: No.overfl.act.en.out
(008 066) MAIN: Act.energy inp. prim	(005 062) MAIN: Act.energy inp. prim	(009 091) MAIN: No.overfl.act.en.inp
(008 067) MAIN: React.en. outp. prim	(005 063) MAIN: React.en. outp. prim	(009 092) MAIN: No.ov/fl.reac.en.out
(008 068) MAIN: React. en. inp. prim	(005 064) MAIN: React. en. inp. prim	(009 093) MAIN: No.ov/fl.reac.en.inp

The total energy is calculated as follows:

Total energy = number of overflows · 655.35 + current count

For example:

(MAIN: Act.energy outp.prim) = (MAIN: No.overfl.act.en.out) · 655.35 + (MAIN: Act.energy outp.prim)

3.11.3.10 Selection of the Procedure to Determine Energy Output

Procedure	Characteristics	Applications
1	● Determination of the active and reactive energy every 2 s (approximately) ● Reduced system loading	● Constant load and slow load variations (no significant load variations within 1 second). ● Phase angles below 70° (cos φ > 0.3).
2	● Determination of the active and reactive energy every 100 ms (approximately). ● Increased system loading	● Fast load variations ● Phase angles below 70° (cos φ > 0.3).

The maximum phase-angle error of the P139 of 1° leads to greater errors in measurement when the phase angle increases, as shown (for the range 0° ≤ φ < 90°) in the following diagram.

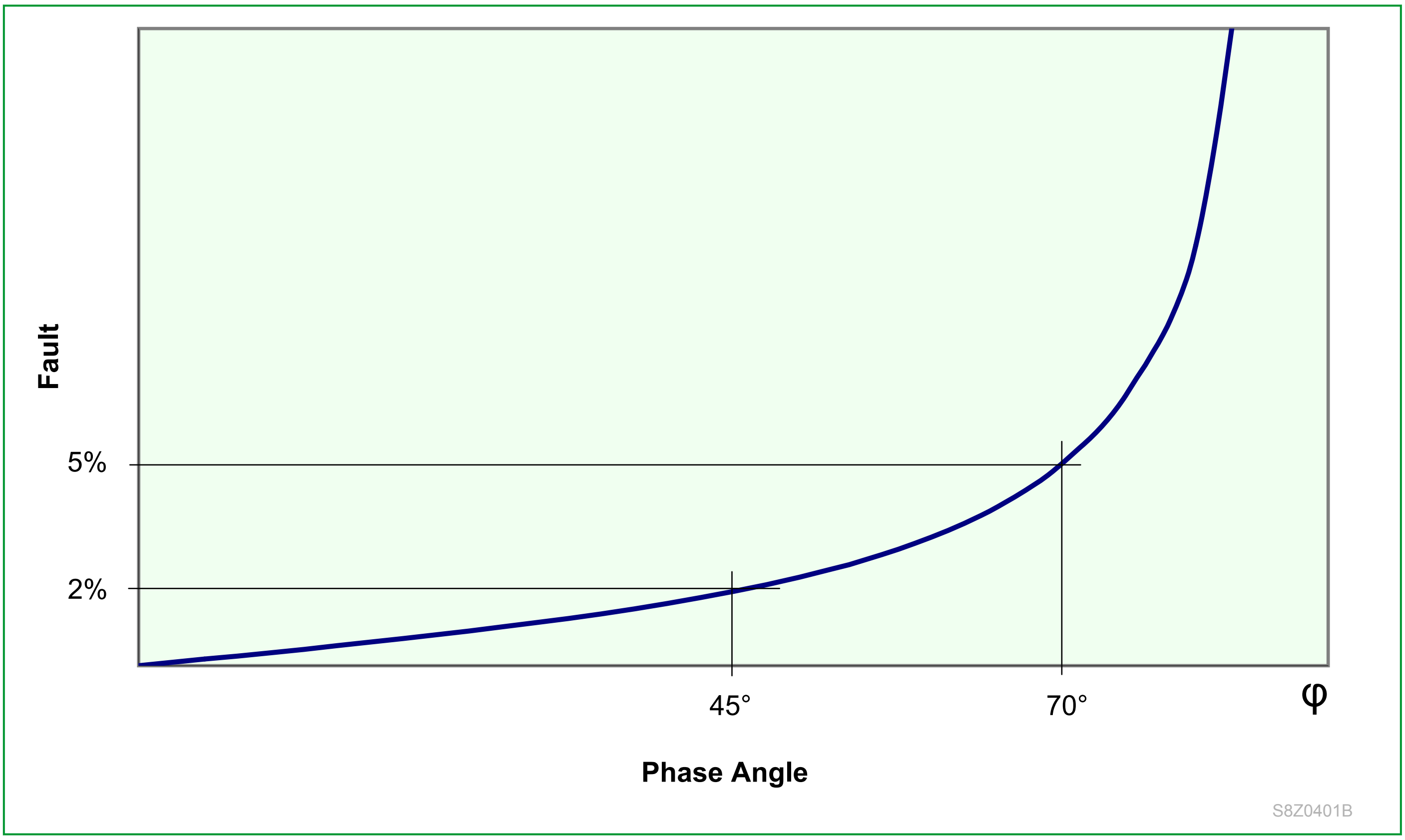


Fig. 3-62: Error of measurement in the determination of energy output resulting from the phase angle error of the P139.

Error of measurement:

- Approx. ±2% of the measured value for |cos φ| ≥ 0.7
- Approx. ±5% of the measured value for |cos φ| ≥ 0.3
- where the whole measuring range is −180° ≤ φ ≤ 180°.

For phase angles φ with |cos φ| < 0.3, or when the error of measurement resulting from the maximum phase-angle error is not acceptable, external counters should be used to determine the energy output.

3.11.4 Configuring and Enabling the Device Functions

The P139 can be adapted to the requirements of a specific high-voltage system by configuring the available function range. By including the desired P139 functions in the configuration and canceling all other, the user creates an individually configured device appropriate to the specific application. Parameters, signals and measured values of cancelled device functions are not displayed on the local control panel. Functions of general applicability such as operating data recording (OP_RC) or main functions (MAIN) cannot be cancelled.

3.11.4.1 Canceling a Device Function

The following conditions must be met before a P139 function can be cancelled or removed:

- The P139 function must be disabled.
- None of the functions of the P139 function to be cancelled can be assigned to a binary input.
- None of the signals of the P139 function can be assigned to a binary output or an LED indicator.
- None of the functions of the P139 function to be cancelled may be selected in a list parameter setting.

If the above conditions are met, proceed through the “Configuration” branch of the menu tree to access the setting relevant for the P139 function to be cancelled. If, for example, the “LIMIT” function group is to be cancelled, the setting of LIMIT: Function group LIMIT is set to *Without*. To re-include the “LIMIT” function in the P139 configuration, the same setting is accessed and its value is changed to *With*.

The P139 function to which a setting, a signal, or a measured value belongs is defined by the function group designation (example: “LIMIT”). In the following description of the P139 functions, it is presumed that the corresponding P139 function is included in the configuration.

3.11.4.2 Enabling or Disabling a Device Function

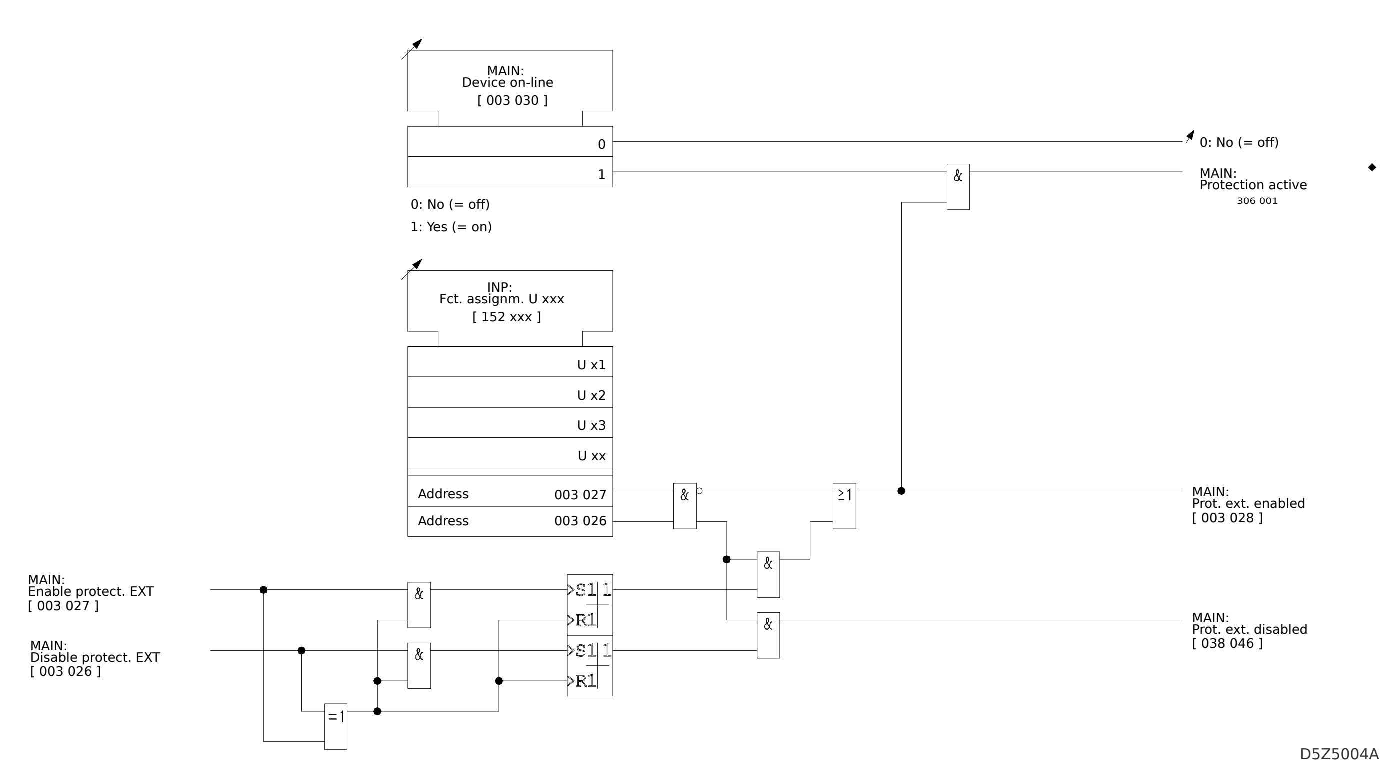


Fig. 3-63: Enabling or disabling a device function.

Besides cancelling P139 functions from the configuration, it is also possible to disable protection via a function parameter or binary signal inputs. Protection can only be disabled or enabled through binary signal inputs if the MAIN: Disable protect. EXT and MAIN: Enable protect. EXT functions are both configured. When neither or only one of the two functions is configured, the condition is interpreted as “Protection externally enabled”. If the triggering signals of the binary signal inputs are implausible – i.e. both are at logic level = “1” – then the last plausible state remains stored in memory.

If the protection is disabled via a binary signal input that is configured for MAIN: Disable protect. EXT, the signal MAIN: Blocked/faulty is not issued.

3.11.4.3 Enabling or Disabling the Residual Current Systems of the DTOC/IDMT Protection

Disabling or enabling may be carried out with parameters or binary signal inputs.

Enabling of the residual current systems of the DTOC/IDMT protection depends on the setting at MAIN: Syst.IN enabled USER. If this enabling function has been activated, the residual current systems of the DTOC/IDMT protection can be disabled or enabled with parameters or through appropriately configured binary signal inputs. Parameters and configured binary signal inputs have equal status. If only the MAIN: System IN enable EXT function is assigned to a binary signal input, then the residual current systems of the DTOC/IDMT protection will be enabled by a positive edge of the input signal and disabled by a negative edge. If only the MAIN: Syst. IN disable EXT function has been assigned to a binary signal input, then a signal at this input will have no effect.

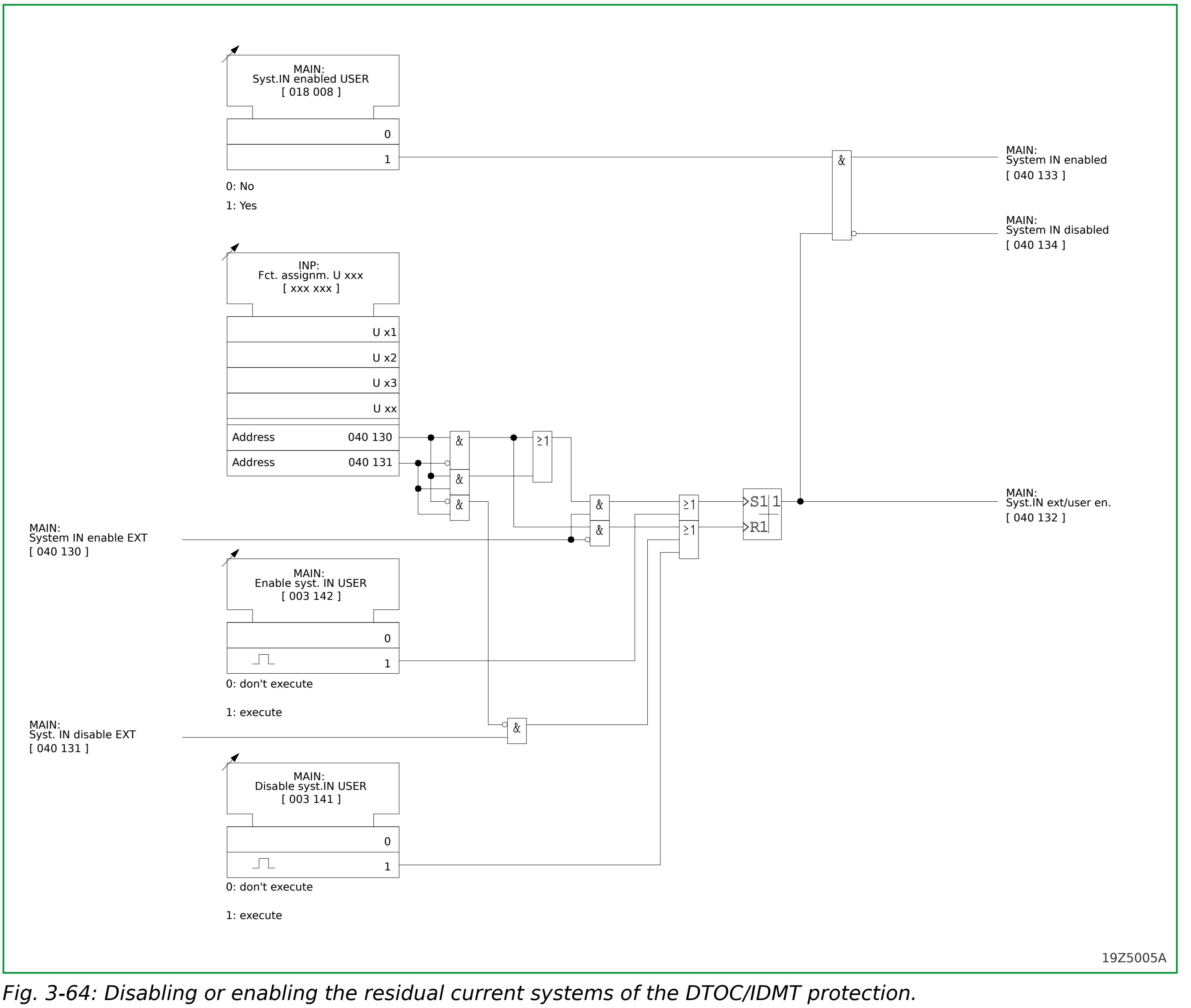
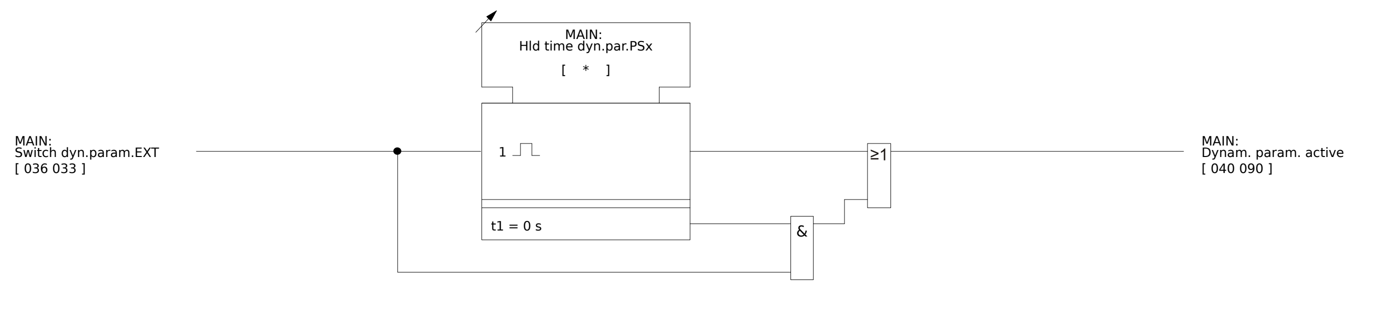


Fig. 3-64: Disabling or enabling the residual current systems of the DTOC/IDMT protection.

3.11.5 Activation of “Dynamic Parameters”

For several of the protection functions, it is possible for the duration of the set hold time to switch over to other settings – the “dynamic parameters” – via an appropriately configured binary signal input. If the hold time is set to 0 s, switching is effective as long as the binary signal input is being triggered.



*

Parameter	MAIN: Hld time dyn.par.PSx
set 1	018 009
set 2	001 211
set 3	001 212
set 4	001 213

12Z6205A

Fig. 3-65: Activation of “Dynamic Parameters”.

3.11.6 Current Flow Monitoring

Fig. 3-66: Current flow monitoring.

The current flow is monitored continuously and pole-selectively, independent of the current flow monitoring performed by the CBF function. The sampled current values are continuously compared with the fixed threshold value $0.05 \cdot I_{nom}$.

As long as current flow criteria are met the monitoring function will continuously issue the phase selective signals MAIN: Current flow A, MAIN: Current flow B, MAIN: Current flow C.

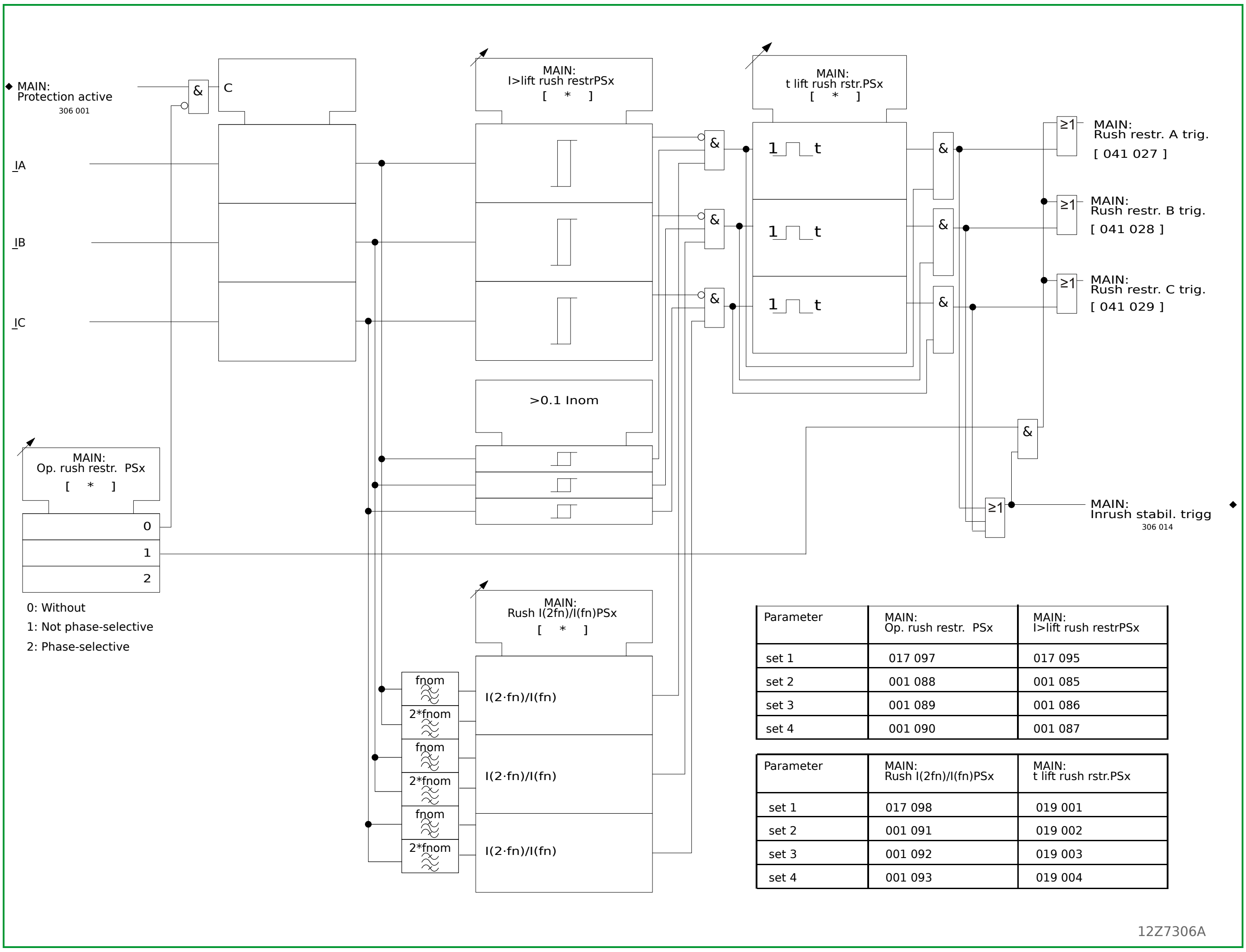
3.11.7 Inrush Stabilization (Harmonic Restraint)

The inrush stabilization function detects high inrush current flows that occur when transformers or machines are switched on. For all selected overcurrent stages of the Definite-Time Overcurrent Protection (DTOC), the Inverse-Time Overcurrent Protection (IDMT1 and IDMT2) and of Voltage Controlled Directional Reactive Power Protection (QV), the selective starting will be blocked if an inrush current flow is detected.

The inrush stabilization function detects an inrush current by evaluating the ratio of the second harmonic current component to the fundamental. If this ratio exceeds the threshold that can be set with the parameter MAIN: Rush I(2fn)/I(fn)PSx, then the inrush stabilization operates.

The current trigger MAIN: I>lift rush restrPSx and a fixed threshold of 0.1 Inom define the range in which the inrush stabilization operates. If the current is outside of this range then the inrush stabilization is blocked.

The parameter MAIN: t lift rush rstr.PSx defines the maximum hold-time for the inrush stabilization.



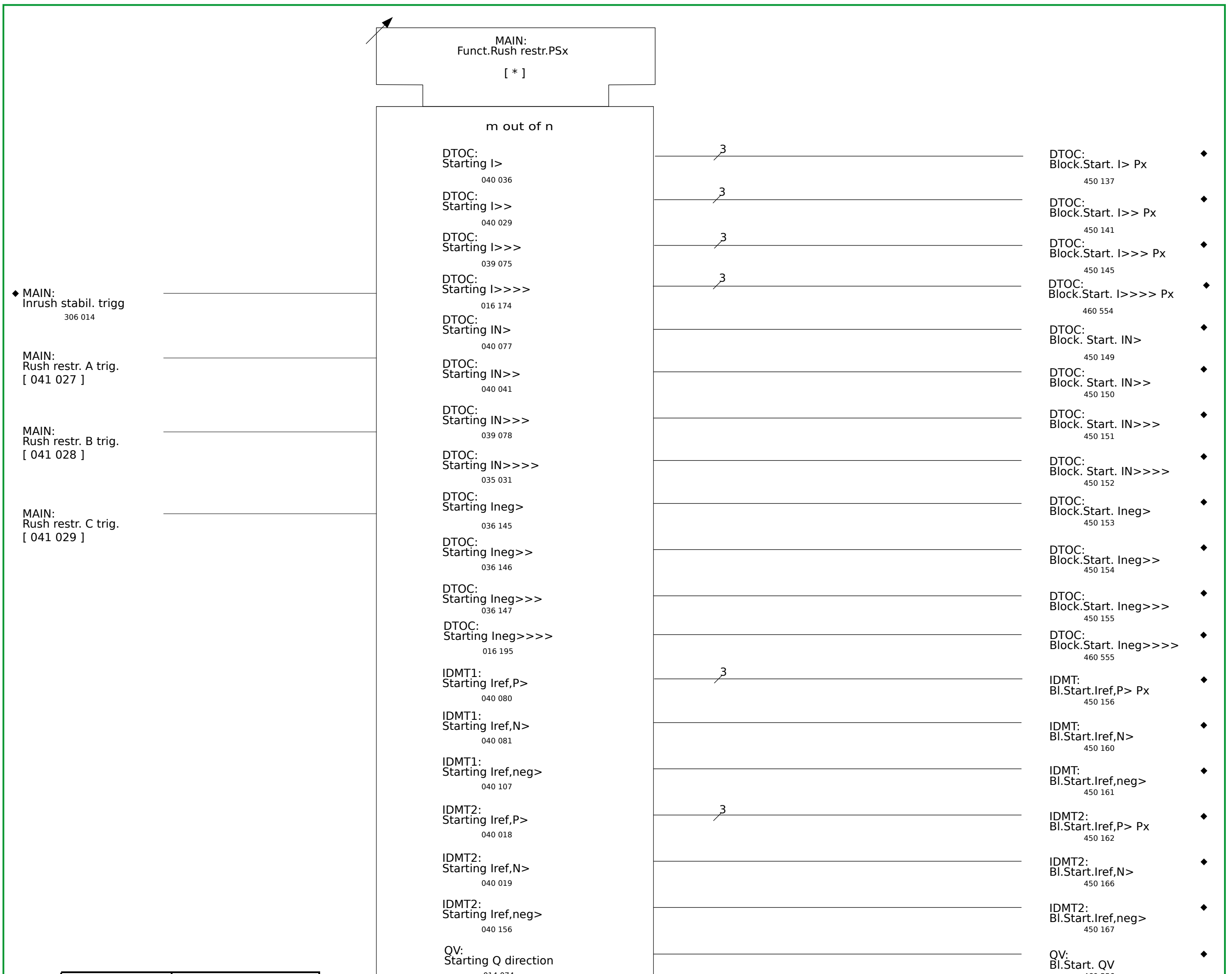
Parameter	MAIN: Op. rush restr. PSx	MAIN: I>lift rush restrPSx
set 1	017 097	017 095
set 2	001 088	001 085
set 3	001 089	001 086
set 4	001 090	001 087

Parameter	MAIN: Rush I(2fn)/I(fn)PSx	MAIN: t lift rush rstr.PSx
set 1	017 098	019 001
set 2	001 091	019 002
set 3	001 092	019 003
set 4	001 093	019 004

Fig. 3-67: Inrush stabilization.

3.11.7.1 Selection of Functions

The inrush stabilization is designed with respect to function groups DTOC, IDMT1, IDMT2 and QV. Depending on the parameter MAIN: Funct.Rush restr.PSx the starting of these function groups is blocked selectively.



Parameter	MAIN: Funct.Rush restr.PSx
set 1	017 093
set 2	017 064
set 3	017 082
set 4	017 083

Fig. 3-68: Selection of the stabilization criteria for the inrush stabilization.

3.11.8 Measurement of Frequency

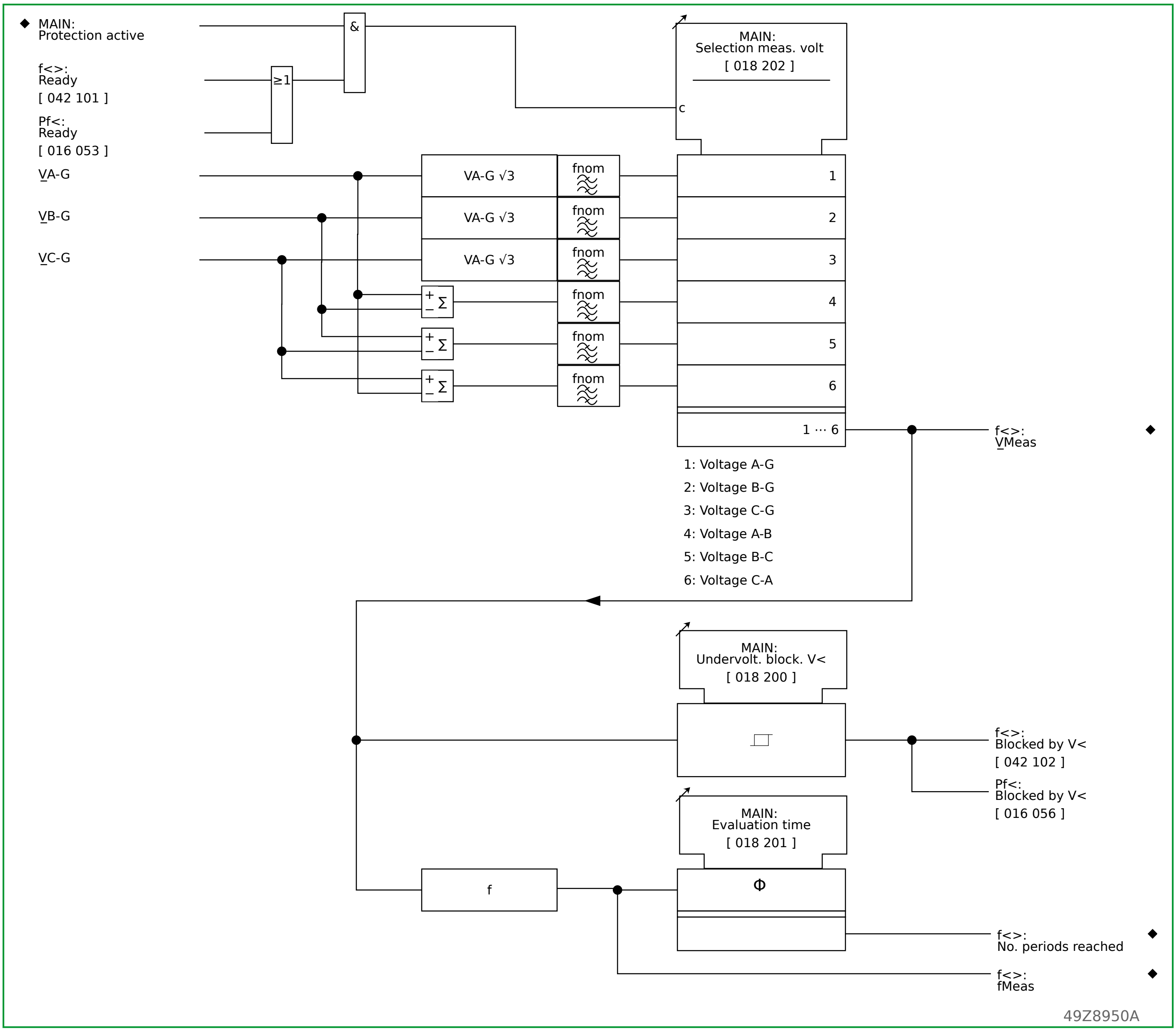


Fig. 3-69: Measurement of frequency: measuring voltage, evaluation time, undervoltage blocking.

The over-/underfrequency protection f<> and the underfrequency load shedding protection Pf< share some common settings which are used for the frequency measurement:

- the selection of measuring voltage
- the evaluation time
- the undervoltage blocking

By selecting a measuring voltage setting, the user defines the voltage that is used by the over-/underfrequency protection function and underfrequency load shedding function for measurement purposes. This can be either a phase-to-ground voltage or a phase-to-phase voltage.

Over-/underfrequency protection and underfrequency load shedding function requires a measuring voltage of sufficient magnitude. Over-/underfrequency protection and underfrequency load shedding function will be blocked instantaneously if the measuring voltage falls below the set threshold of the undervoltage stage.

In order to avoid frequency stage starting caused by brief frequency fluctuations or interference, the evaluation time can be set by the user. The operate conditions must be satisfied for at least the duration of the set evaluation time in order for a signal to be issued.

3.11.9 Function Blocks

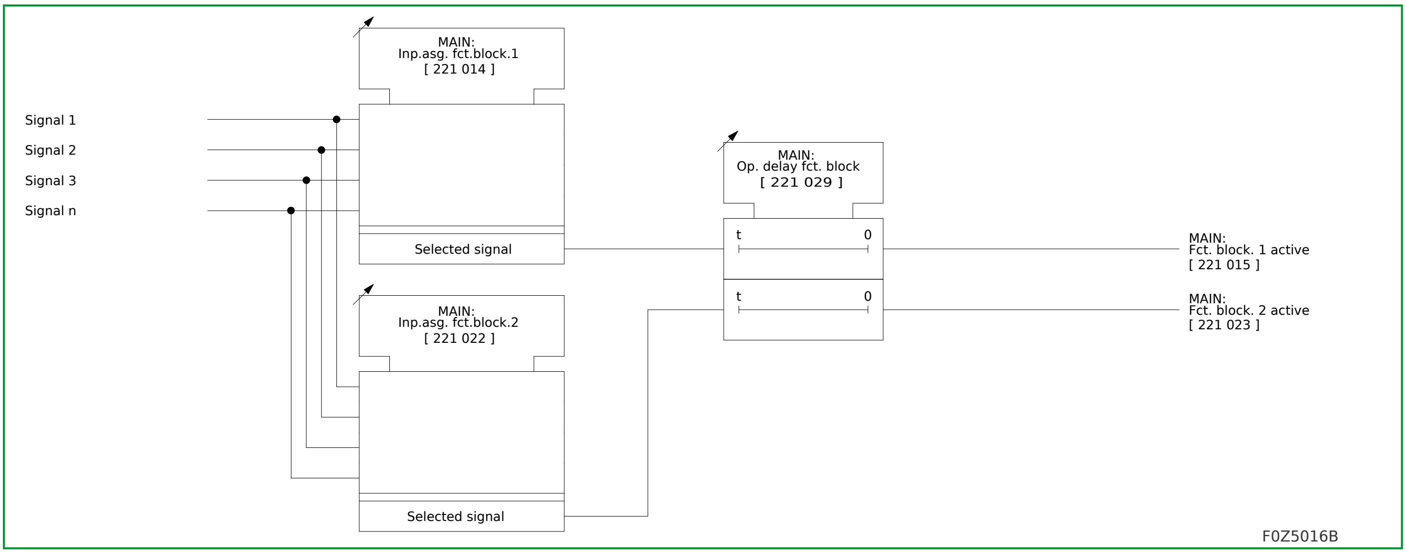


Fig. 3-70: Function blocks.

By including function blocks in the bay interlock conditions, switching operations can be prevented independent of the switching status at the time, for example, by an external signal “CB drive not ready” or by the trip command from an external protection device.

Binary input signals conditioned by debouncing and chatter suppression or output signals from the programmable logic function can be assigned to the function blocks 1 and 2 by setting a “1 out of n” parameter. The input signal from the function blocks starts a timer stage and after it has elapsed, the signal MAIN: Fct. block. 1 active is issued.

3.11.10 Multiple Blocking

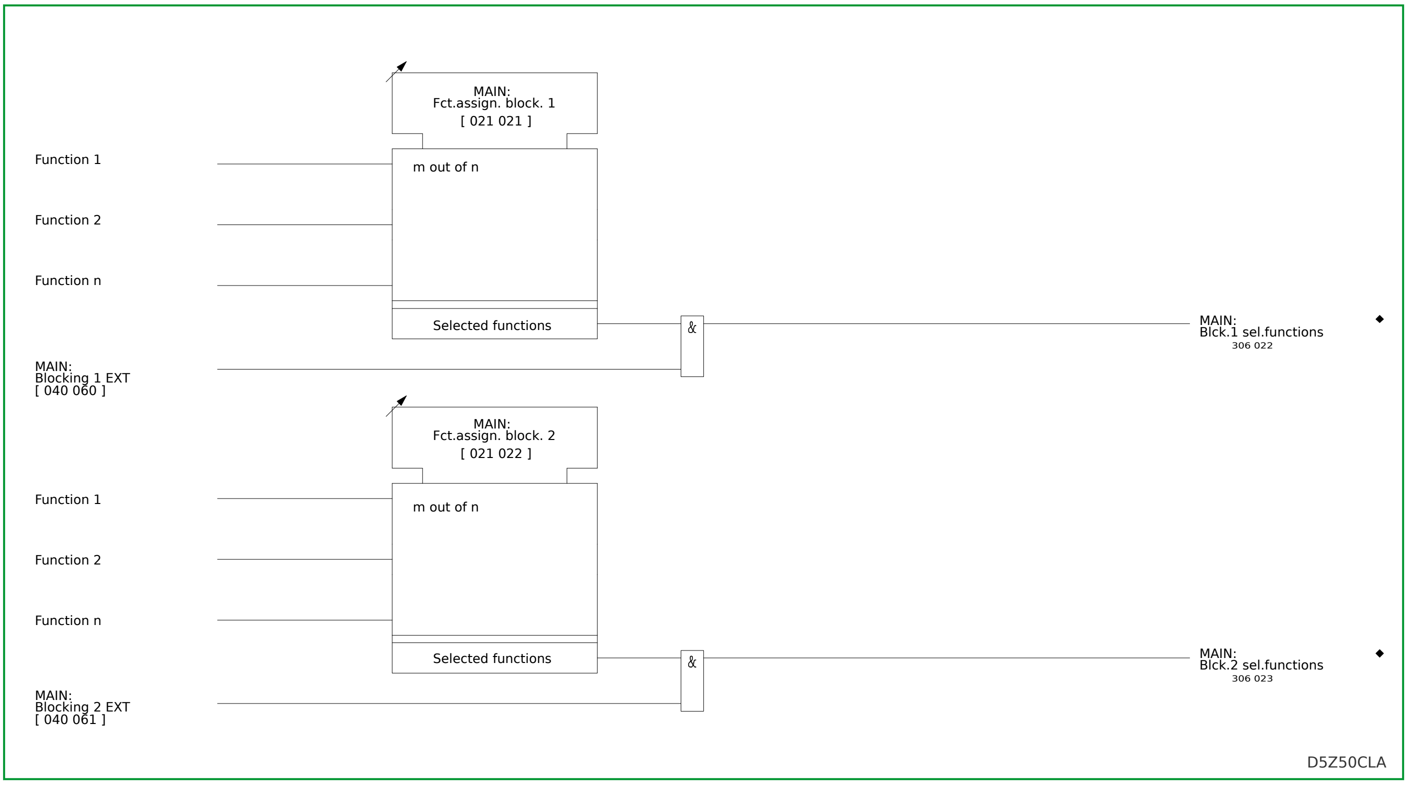


Fig. 3-71: Multiple blocking.

Two multiple blocking conditions can be defined via “m out of n” parameters. The functions defined by selection may be blocked via an appropriately configured binary signal input.

3.11.11 Blocked/Faulty

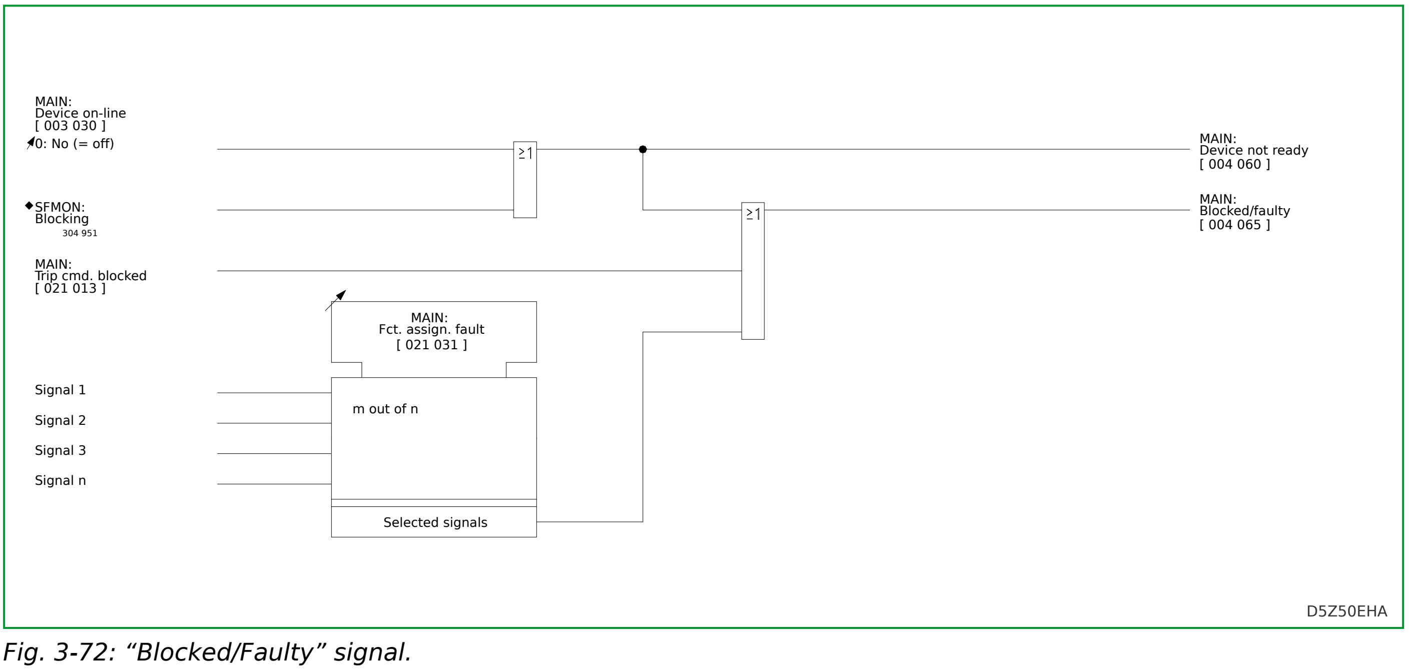


Fig. 3-72: “Blocked/Faulty” signal.

If the protective functions are blocked, the condition is signaled by continuous illumination of the amber LED indicator H 2 on the local control panel and by a signal from an output relay configured MAIN: Blocked/faulty. In addition functions can be selected that will issue the MAIN: Blocked/faulty signal by setting a “m out of n” parameter.

3.11.12 Coupling between Control and Protection for the CB Closed Signal

Bay type selection defines the external device (DEV01 or DEV02 or ...) that represents the circuit breaker. Coupling between control and protection for the “Closed” position signal is made by the setting MAIN: Sig. asg. CB closed. As a result, the CB status signal needs to be assigned to one binary signal input only if this coupling is implemented.

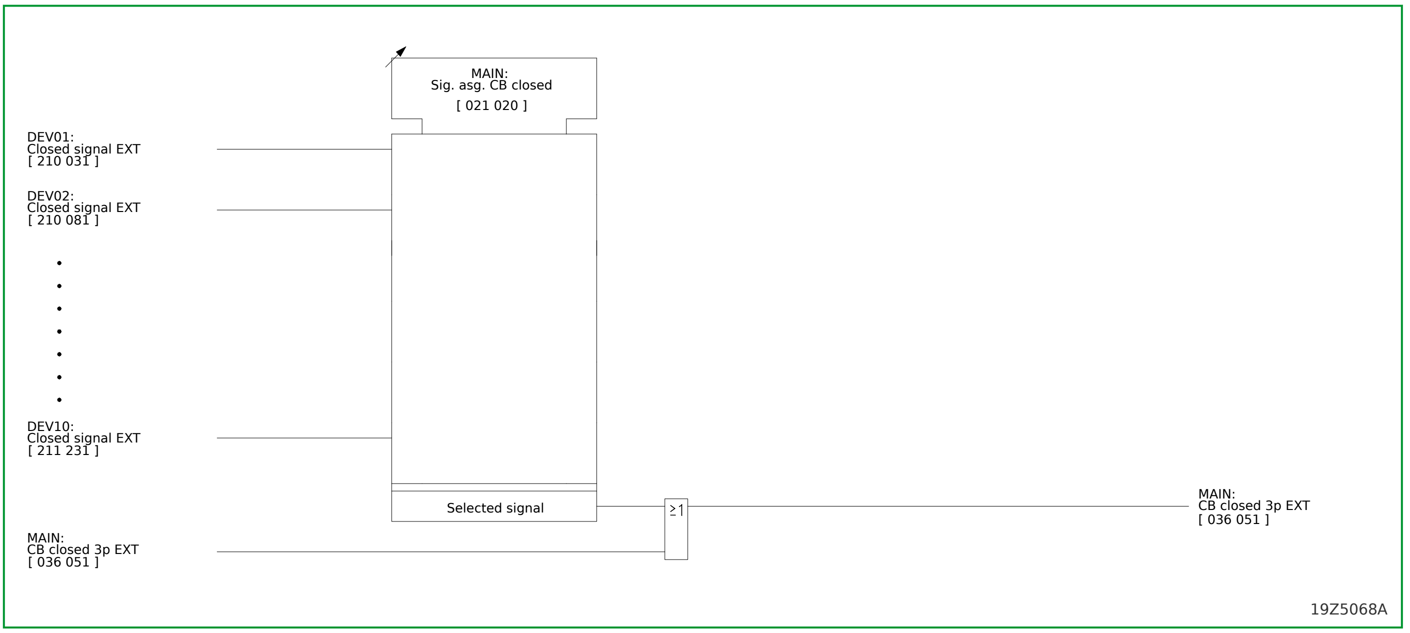


Fig. 3-73: Coupling between control and protection for the CB closed signal.

3.11.13 Monitoring and Processing of CB Status Signals

Extended CB Status Signals

An extended monitoring of the circuit breaker (CB) status signals is available in the main function group. It is possible to select whether the multiple signals “MAIN: CB closed 3p” / “MAIN: CB open 3p” or pole selective “*Closed*” status signals will be monitored. Simultaneous monitoring of all status signals is not feasible and should therefore not be undertaken.

If only the MAIN: CB closed 3p EXT binary signal input has been configured then the MAIN: CB open 3p signal will also be issued (see Fig. 3-74, (p. 3-107)).

Fig. 3-74, (p. 3-107) shows the logical processing of the various input signals. The plausibility logic will be triggered should one of the following discrepancies be detected:

- A minimum of one 3-pole monitoring signal and one 1-pole monitoring signal are configured at the same time.
- Both multiple signals MAIN: CB closed 3p EXT and MAIN: CB open 3p EXT are present simultaneously.
- There is no pole-selective status signal MAIN: CB closed A EXT (for A, B or C)) present (i.e. CB contact is open) but at the same time there is a current flow exceeding $0.05 \cdot I_{nom}$ in this conductor.

The plausibility logic has been modified accordingly to permit that the binary signal input only be configured at MAIN: CB closed 3p EXT. This makes a backward compatible operation possible (for example in an existing plant where only this signal has been wired).

In order to suppress triggering during transient actions, the signal issued when a plausibility discrepancy is detected has a generally delayed pickup of 100 ms.

Besides monitoring for signaling purposes, status signals are also processed in these functions:

- **ARC: Ready indication**

  If the ARC should only be available when the circuit breaker has already been closed (setting at ARC: CB clos.pos.sig. PSx = *With*) then the resulting signal MAIN: CB closed 3p will now be interrogated (instead of the input signal MAIN: CB closed 3p EXT previously interrogated).

- **PSIG: Un-delayed echo if CB is open**

  If the CB is open, the echo signal (if enabled) is issued without additional delay. For this the MAIN: CB open 3p signal is now used instead of the previously used inverted MAIN: CB closed 3p EXT input signal.

- **MCMON: Release of voltage protection using CB status indication**

  With the operating mode set to *Vmin< w.CB cont.enab* the internally generated MAIN: CB closed 3p signal is now used instead of the MAIN: CB closed 3p EXT input signal.

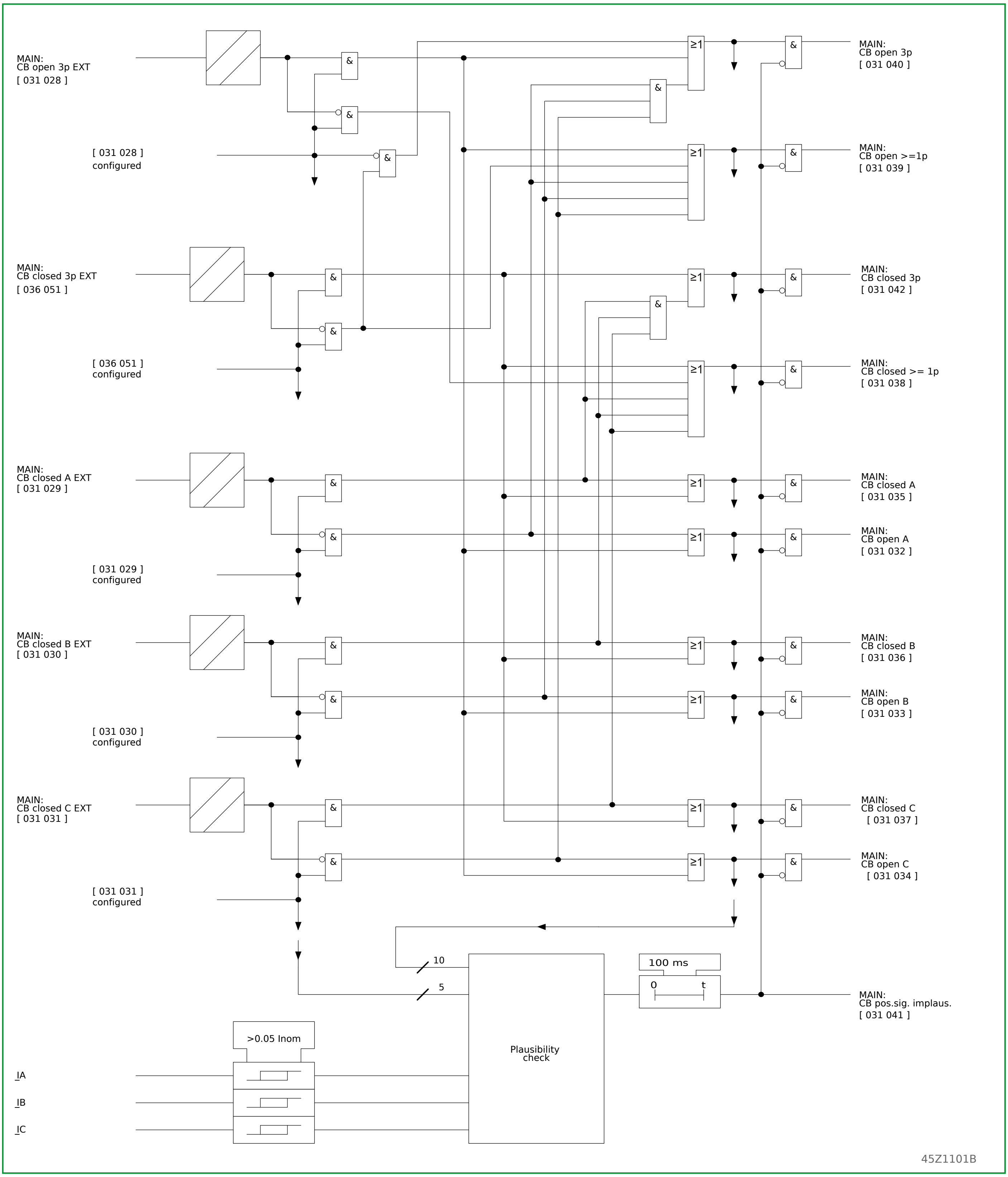


Fig. 3-74: Monitoring of CB status signals.

3.11.14 Close Command

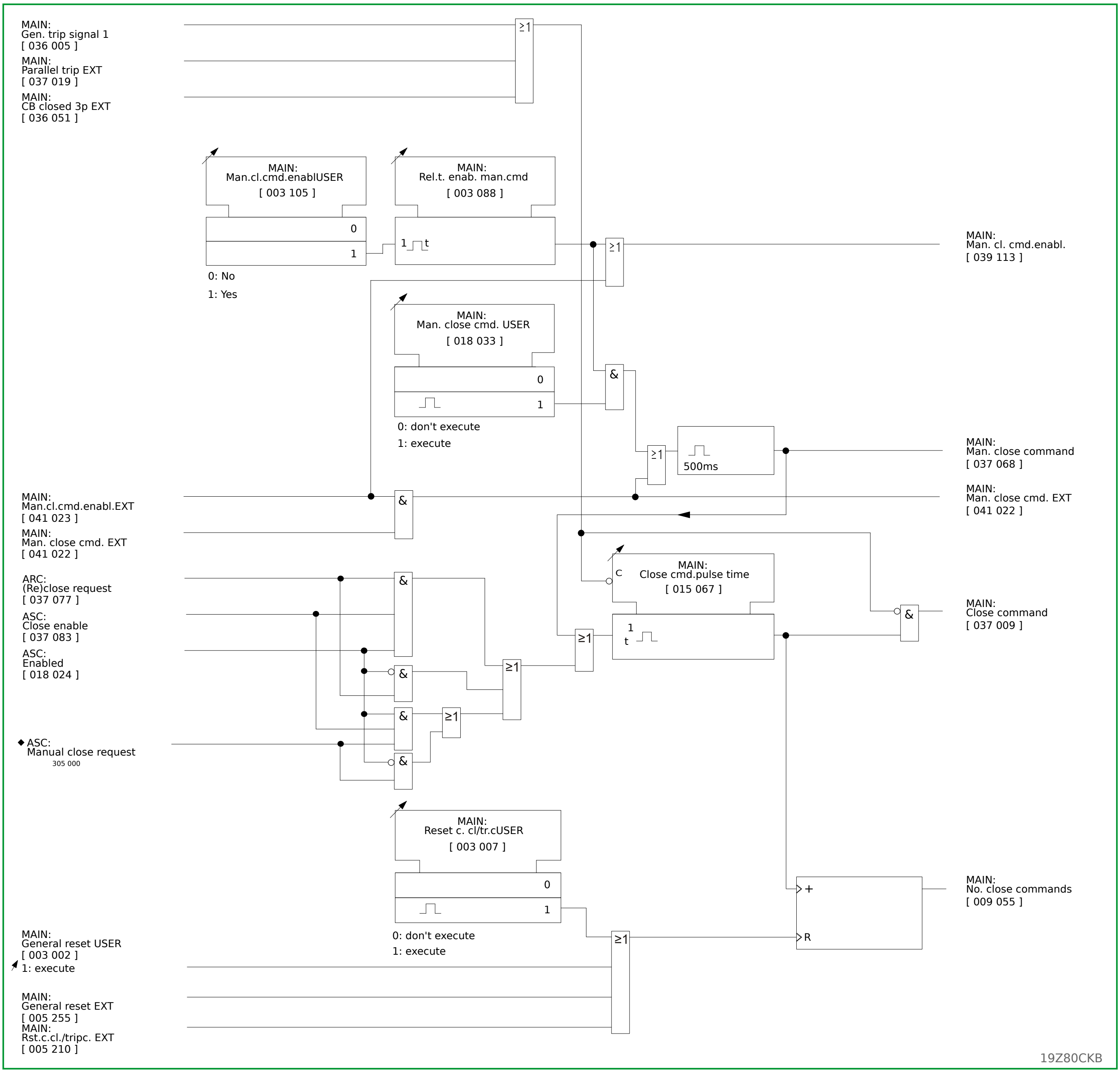


Fig. 3-75: Close command.

The circuit breaker can be closed by the auto-reclosing control function (ARC), by the automatic synchronism check (ASC), by parameters or via an appropriately configured binary signal input. The close command by parameters or a binary signal input is only executed if there is no trip command 1 present and no trip has been issued by a protection device operating in parallel. Moreover, the close command is not executed if there is a “CB closed” position signal present. The duration of the close command can be set.

If the ARC function issues a close request while the ASC function is enabled, then the close command requires a close enable by the ASC function.

Close Command Counter

The number of close commands are counted. This counter may be reset individually or together with other counters (see Section 3.11.21, (p. 3-122)).

3.11.15 Multiple Signaling

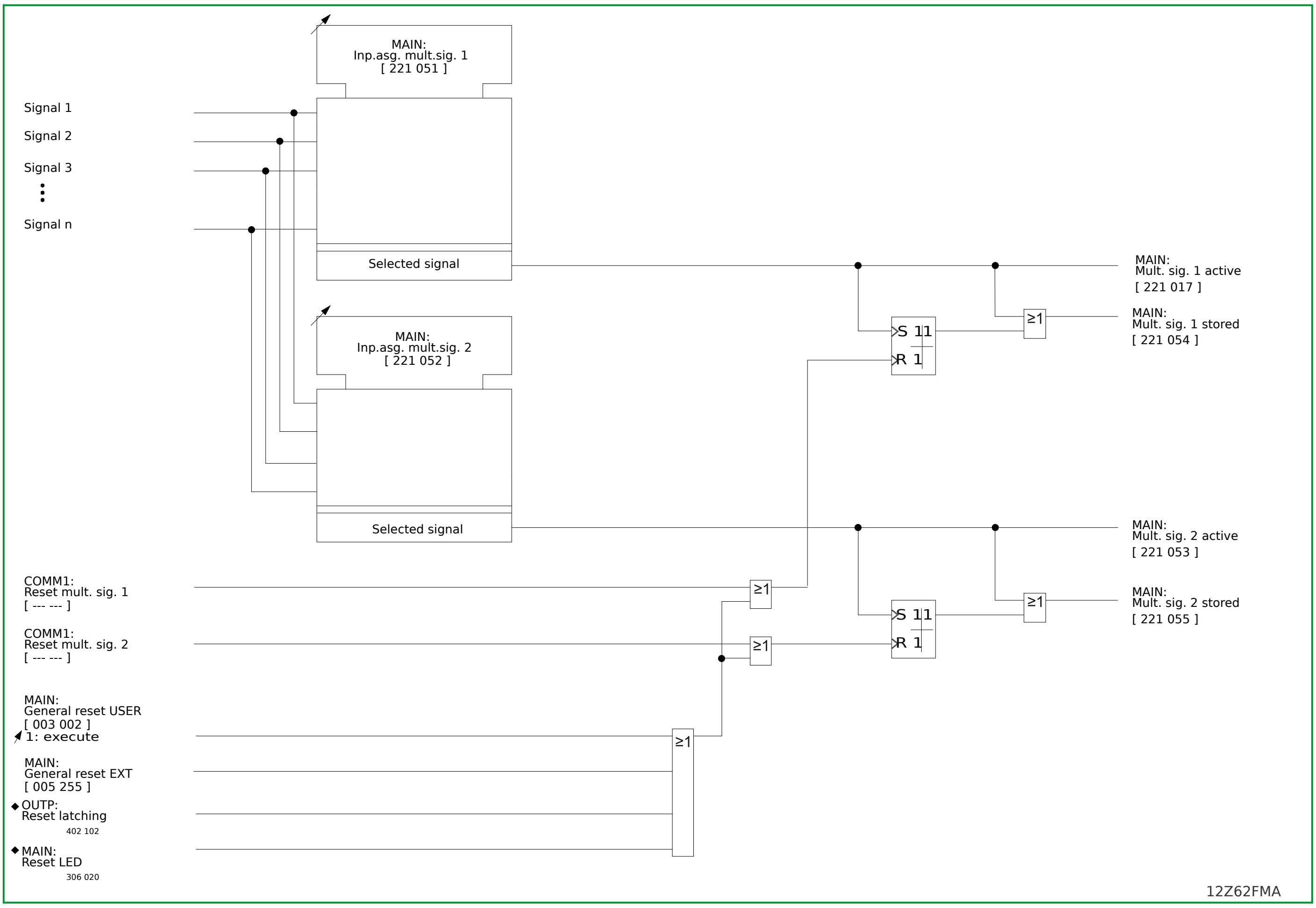


Fig. 3-76: Multiple signaling.

The multiple signals 1 and 2 are formed by the programmable logic function using *OR* operators. The programmable logic output to be interpreted as multiple signaling is defined by the configuration of the binary signal input assignment with the corresponding multiple signaling. Both an updated and a stored signal are generated. The stored signal is reset by the following actions:

- General reset
- Latching reset
- LED indicators reset
- A command received through the communication interface

If the multiple signaling is still present at the time of a reset, the stored signal will follow the updated signal.

Additionally 8 user configurable group signals are available (MAIN: Group signal 01 to MAIN: Group signal 08). For each of these signals the user can select up to 32 internal signals and freely combine them using Boolean operators NOT, AND, OR (settings MAIN: Fct.asg. grp.sig. 01 to MAIN: Fct.asg. grp.sig. 08), as described for configuration of LOGIC outputs (see Fig. 3-318, (p. 3-391)).

These state signals are continuously updated. They provide no latching and no settable pick up/ release delay timers. If such timed signaling is required, the function groups LOGIC or LOG_2 shall be used.

3.11.16 Ground Fault Signaling

If a ground fault has been detected by either the GFDSS function (ground fault direction determination by steady-state values) or the TGFD function (transient ground fault direction determination), the P139 analyzes the phase-to-ground voltages and identifies the phase on which the ground fault has occurred.

During a ground fault, the P139 determines the lowest phase-to-ground voltage and checks if the two other phase-to-ground voltages exceed the threshold of 0.2 V_{nom}. In addition, the two higher phase-to-ground voltages must exceed the lowest phase-to-ground voltage by a factor of 1.5. If these conditions are met, a ground fault signal is issued for the phase with the lowest phase-to-ground voltage.

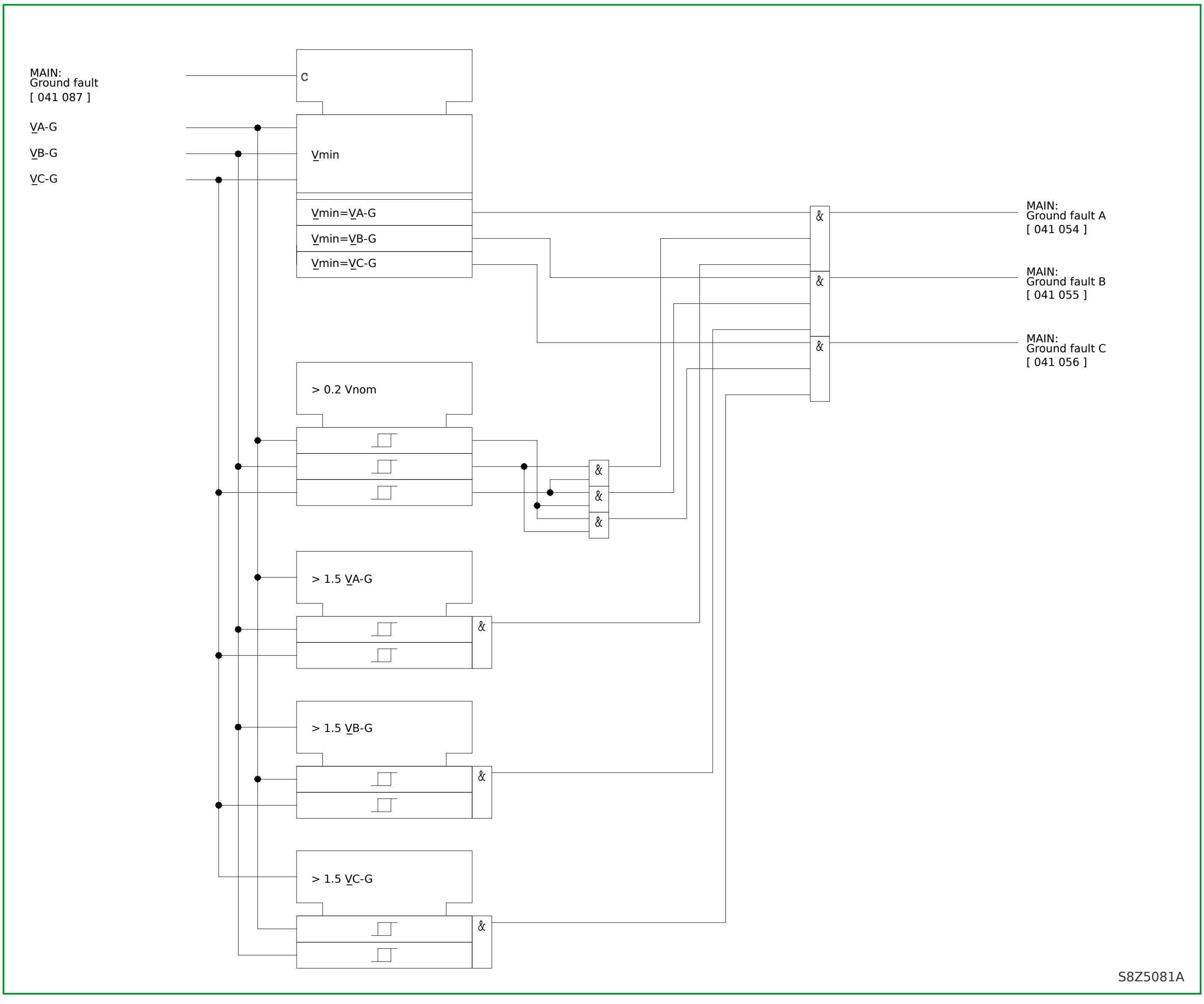


Fig. 3-77: Phase-selective ground fault signaling.

Ground fault signals generated either by ground fault direction determination using steady-state values (GFDSS) or transient ground fault direction determination (TGFD) are grouped together to form multiple signaling.

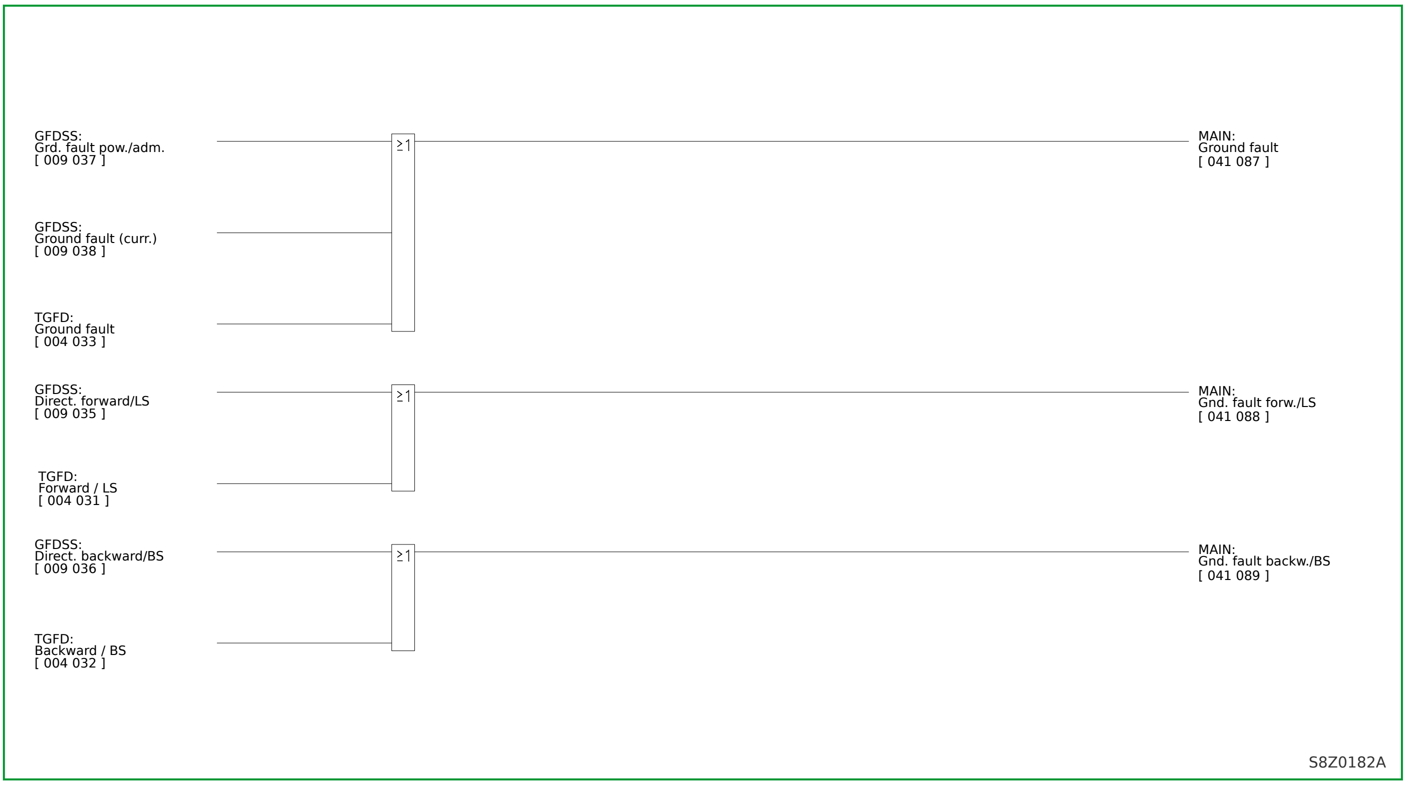


Fig. 3-78: Multiple Signaling of ground faults.

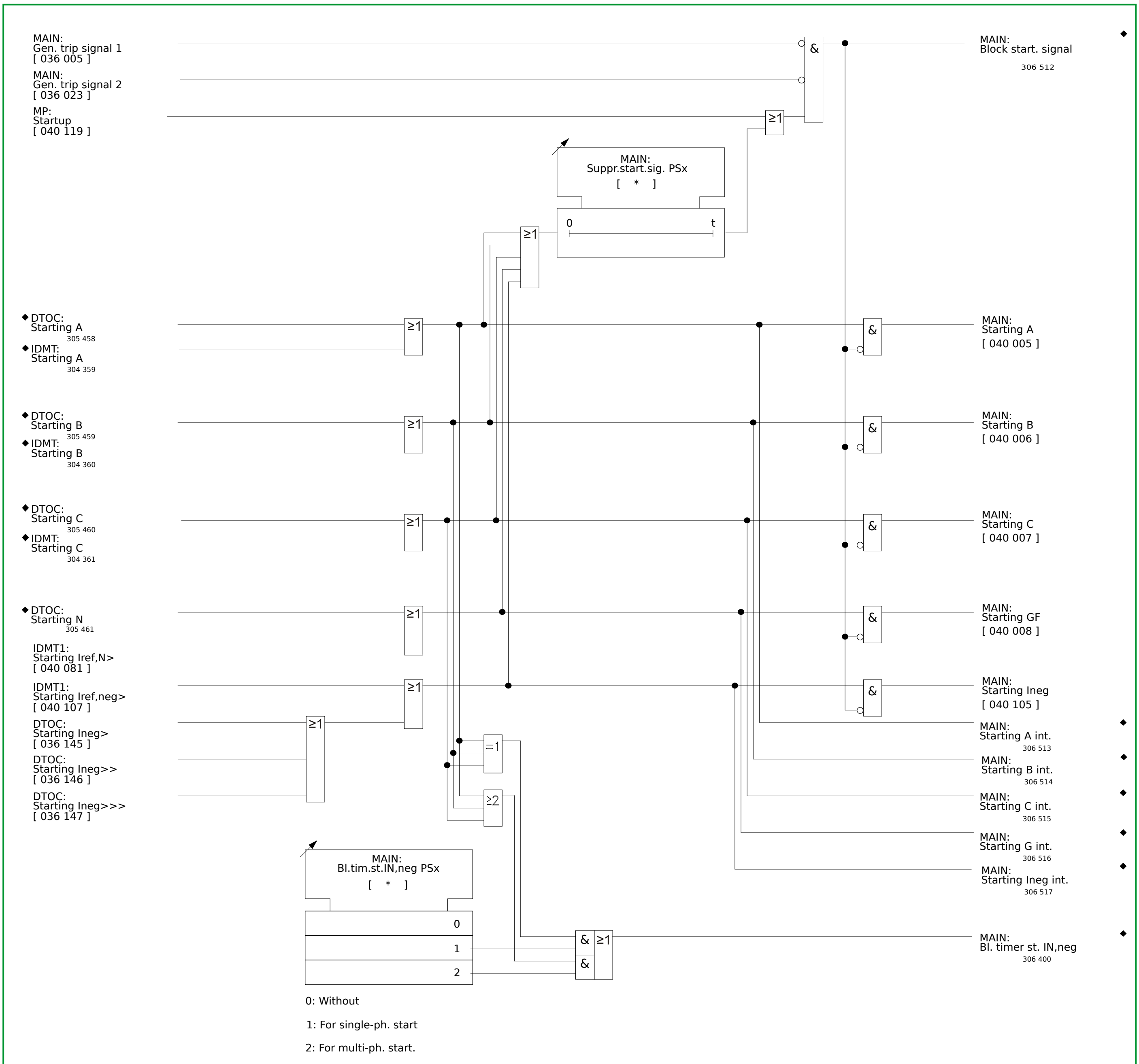
3.11.17 Starting Signals and Tripping Logic

3.11.17.1 Phase-Selective Starting Signals

Common phase-selective starting signals are formed from the internal phase-selective starting signals of definite-time overcurrent protection and of inverse-time overcurrent protection.

An adjustable timer stage is started by the phase-selective starting signals, the residual current starting signal and the negative-sequence starting signal. While this timer stage is running, the starting signals are blocked. The starting signals are also blocked directly by the motor protection if the startup of a motor has been detected. Blocking is suspended if a trip signal is present.

The operate delays for the residual current and negative-sequence current stages of the DTOC and IDMT protection functions can be blocked for a single-pole or multi-pole starting (depending on the setting).



*

Parameter	MAIN: Suppr.start.sig. PSx	MAIN: Bl.tim.st.IN,neg PSx
set 1	017 054	017 015
set 2	001 222	001 214
set 3	001 223	001 215
set 4	001 224	001 216

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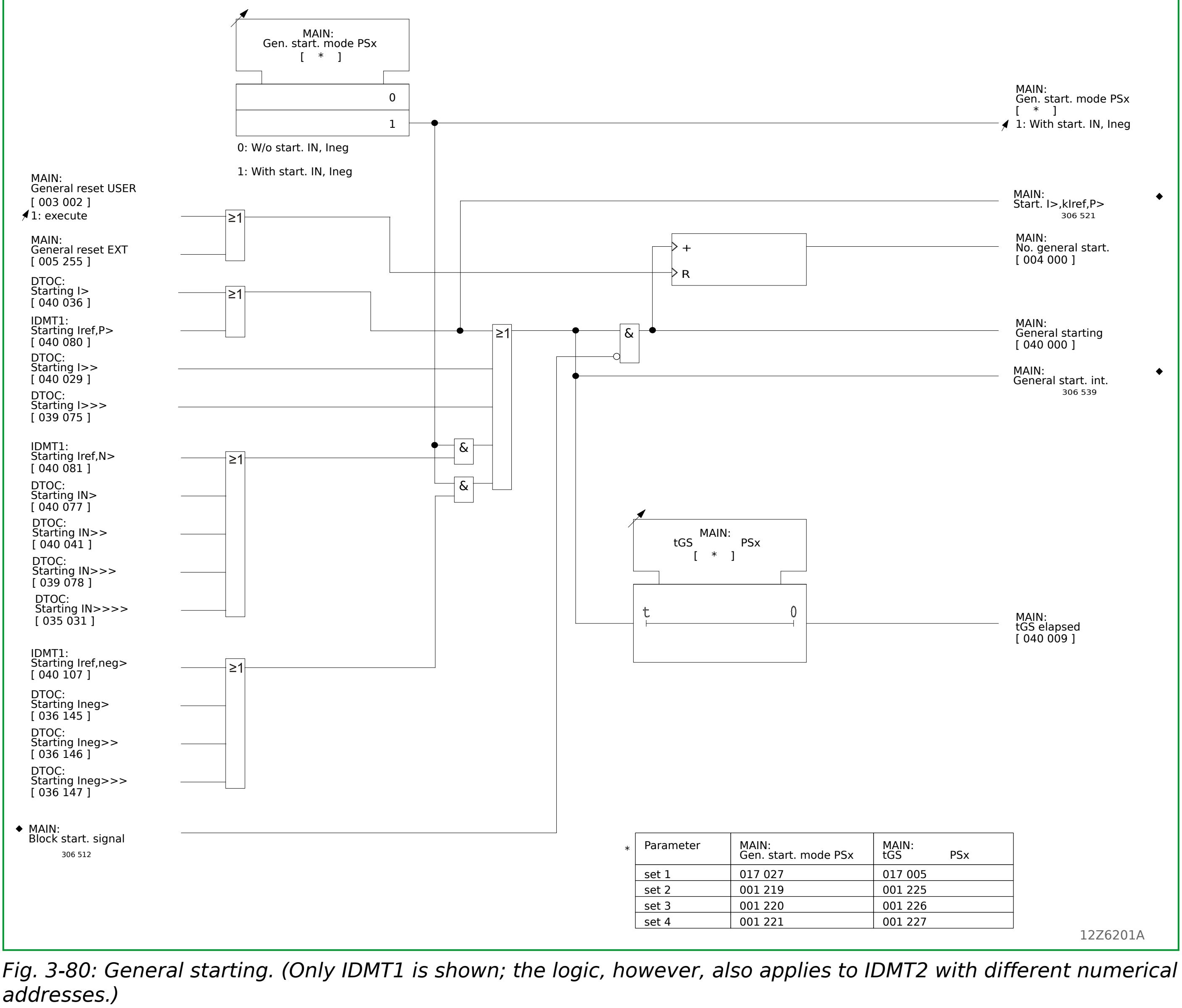
Fig. 3-79: Phase-selective starting signals. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

3.11.17.2 General Starting

The general starting signal is formed from the starting signals of the DTOC and IDMT protection functions. A setting governs whether the residual current stages and the negative-sequence current stage will be involved in forming the general starting signal. If the operate signal from one of the residual current stages and the negative-sequence current stage does not cause a general starting (due to the setting) then the associated operate delays will be blocked. As a result, a trip command cannot be issued by residual current and negative-sequence current stages.



* Parameter	MAIN: Gen. start. mode PSx	MAIN: tGS PSx
set 1	017 027	017 005
set 2	001 219	001 225
set 3	001 220	001 226
set 4	001 221	001 227

Fig. 3-80: General starting. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

3.11.17.3 Counter for General Starting Signals

The number of general starts is counted.

3.11.17.4 Multiple Signaling by the DTOC and IDMT Protection Functions

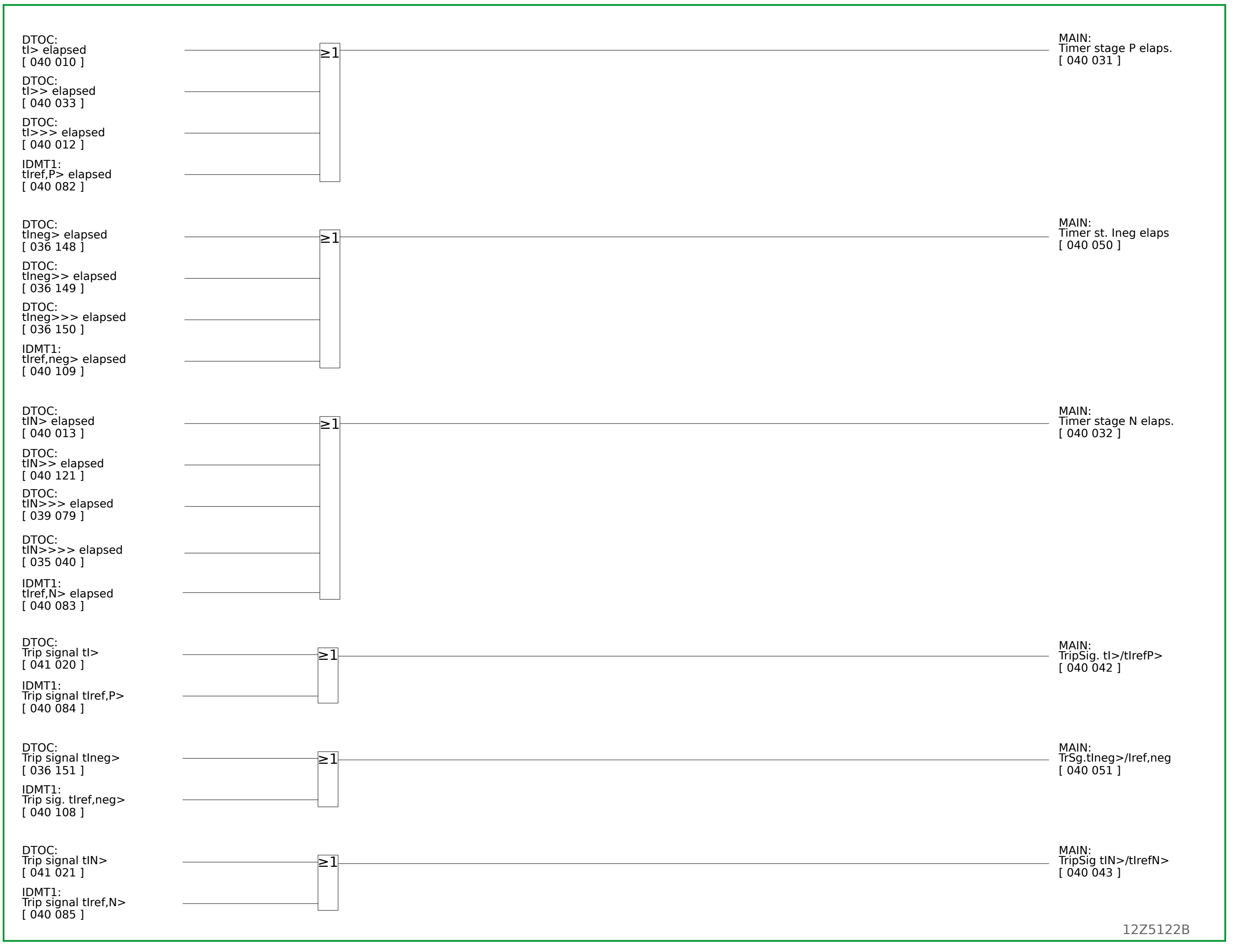


Fig. 3-81: Multiple signaling by the DTOC and IDMT protection functions. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

The trip signals generated by the DTOC and IDMT protection functions are grouped together to form multiple signaling.

3.11.17.5 Trip Command

The P139 provides two trip commands. The functions required to issue a trip can be selected by setting an "m out of n" parameter independently for each of the two trip commands. The minimum trip command closure time may be set. The trip signals are present only as long as the conditions for the signal are met.

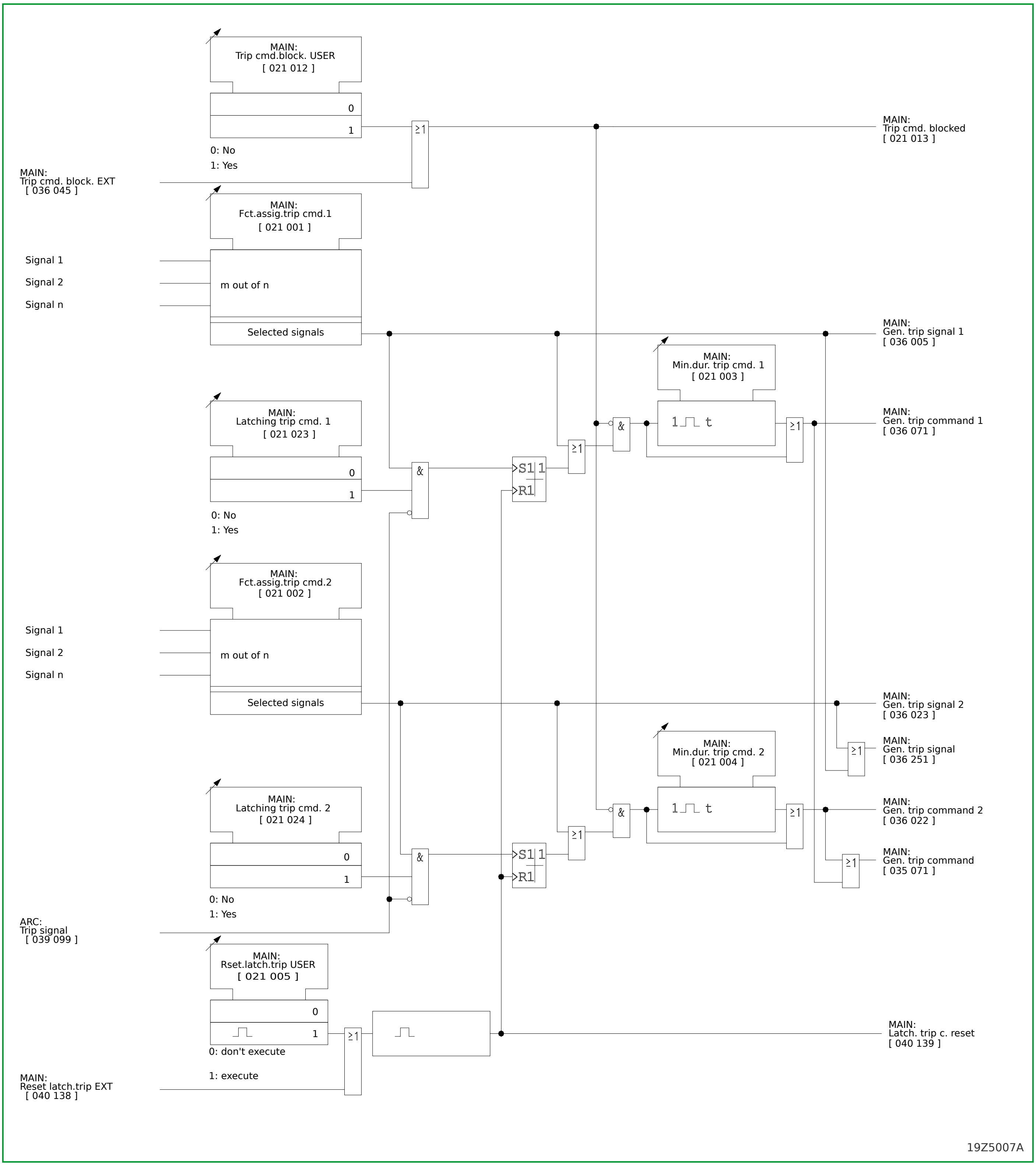


Fig. 3-82: Forming the trip commands.

3.11.17.5.1 Latching of the Trip Commands

Each of the trip commands can be individually set to operate in the latching mode (via MAIN: Latching trip cmd. 1 or MAIN: Latching trip cmd. 2, respectively).

The trip command, set to latch mode, will remain active until reset by parameter (MAIN: Rset.latch.trip USER) or reset through an appropriately configured binary signal input (MAIN: Reset latch.trip EXT).

Latching is ineffective if a trip command has been issued by the ARC function.

3.11.17.5.2 Blocking of the Trip Commands

The trip commands can be blocked via parameters or an appropriately configured binary signal input. This blocking is then effective for both trip commands. The trip signals are not affected by this blocking. If the trip commands are both blocked, it is indicated by the continuously illuminated amber LED indicator H 2 on the local control panel and by a signal from an output relay configured to “Blocked/Faulty”.

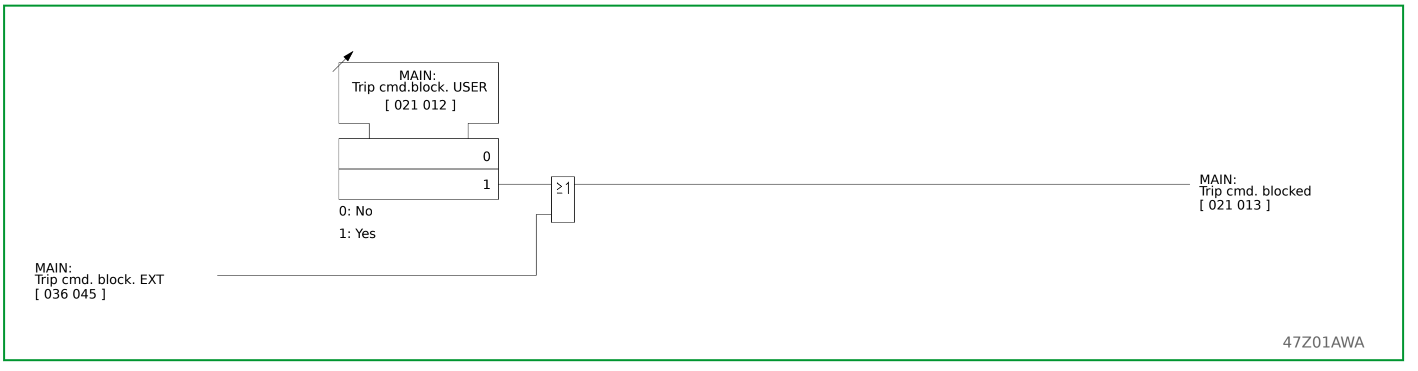


Fig. 3-83: Blocking of the trip commands.

3.11.17.5.3 Counter of Trip Commands

The number of trip commands is counted. The counters can be reset either individually or as a group.

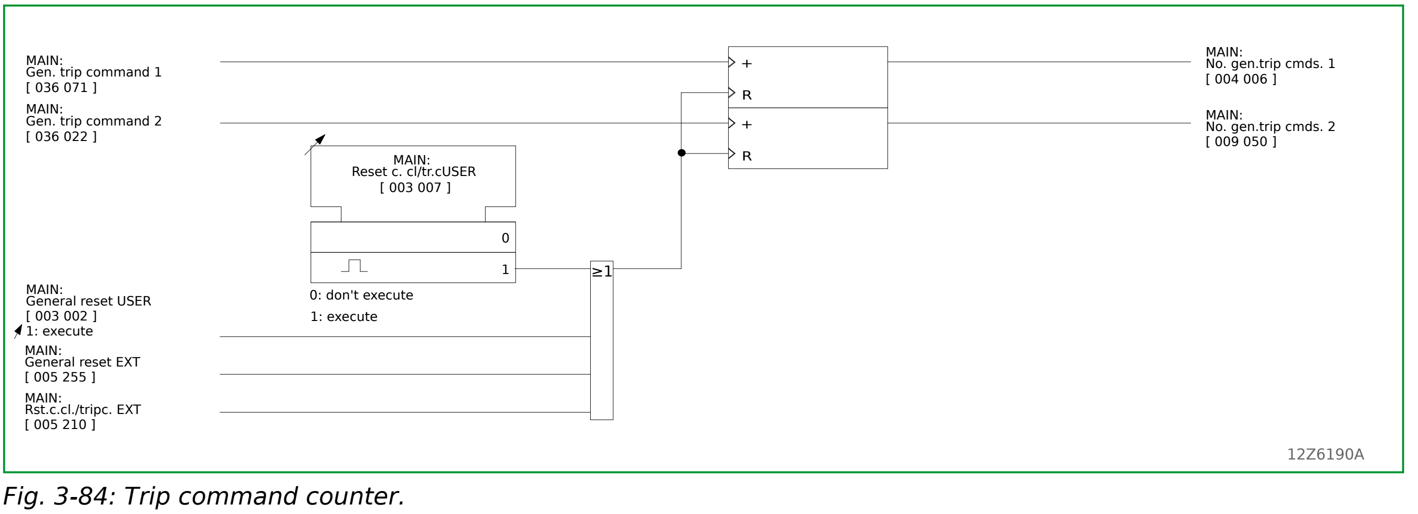


Fig. 3-84: Trip command counter.

3.11.17.6 Manual Trip Command

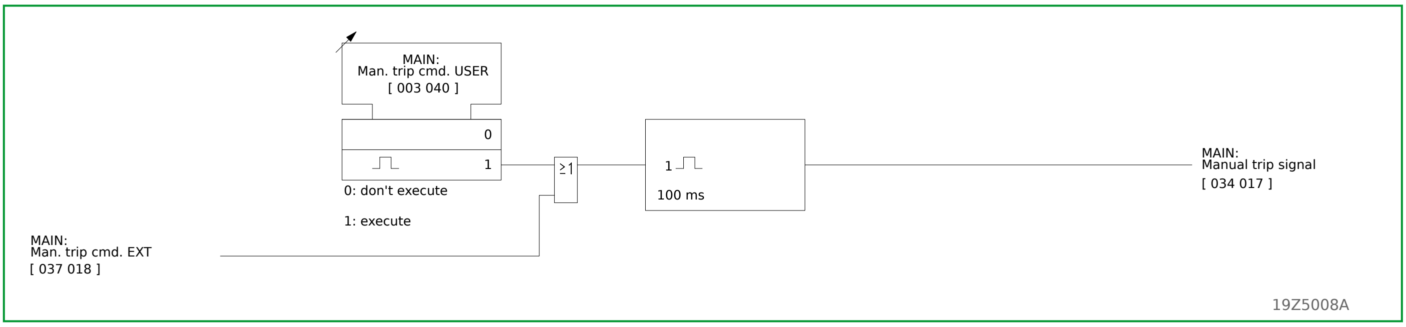


Fig. 3-85: Manual trip command.

A manual trip command may be issued via a parameter or a binary signal input configured accordingly, but it is not executed unless the manual trip is included in the selection of possible functions to cause a trip.

3.11.18 CB Trip Signal

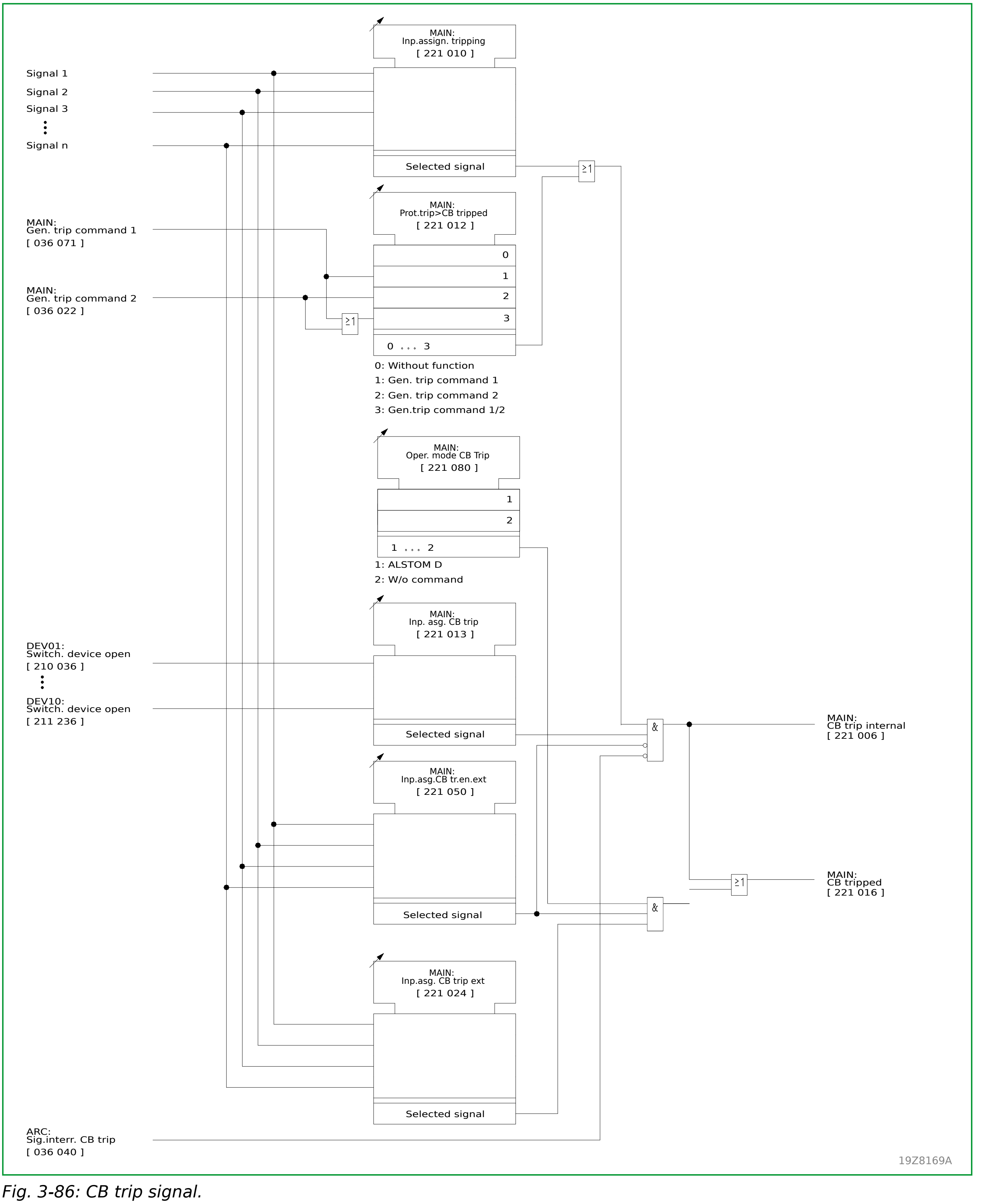


Fig. 3-86: CB trip signal.

The signal “CB Trip” depends on the mode of operation and is based on different events:

Mode of operation: “*ALSTOM D*” (MAIN: Oper. mode CB Trip, 221 080):

In this mode of operation, in addition the MAIN: CB trip internal (221 006) signal is formed.

The signal MAIN: CB trip internal is issued if the following conditions are met simultaneously:

- The binary signal input configured for “tripping” is set to a logic value of “1” or the selected trip command from the P139 is present.
- At the binary signal input configured as “CB trip” a logic value of “1” is present.

Mode of operation: “*W/o command*” (MAIN: Oper. mode CB Trip, 221 080):

The MAIN: CB tripped signal will only be issued, if the circuit breaker is tripping without any command issued by the P139. Commands via communication interfaces, local control panel or binary inputs are treated in the same manner. This mode of operation disables the MAIN: CB trip internal signal.

The CB trip signal of an external device can also be signaled. For this task, one input needs to be configured for “MAIN: Inp.asg.CB tr.en.ext“, a further input for “MAIN: Inp.asg. CB trip ext“.

3.11.19 Communication Error

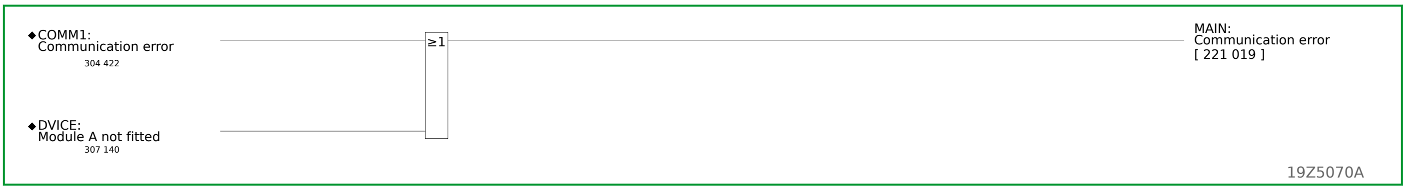


Fig. 3-87: Communication Error.

If a link to the control station cannot be established or if the link is interrupted, the signal *“Communication error”* will be issued. This signal will also be issued if communication module A is not fitted.

3.11.20 Time Tagging and Clock Synchronization

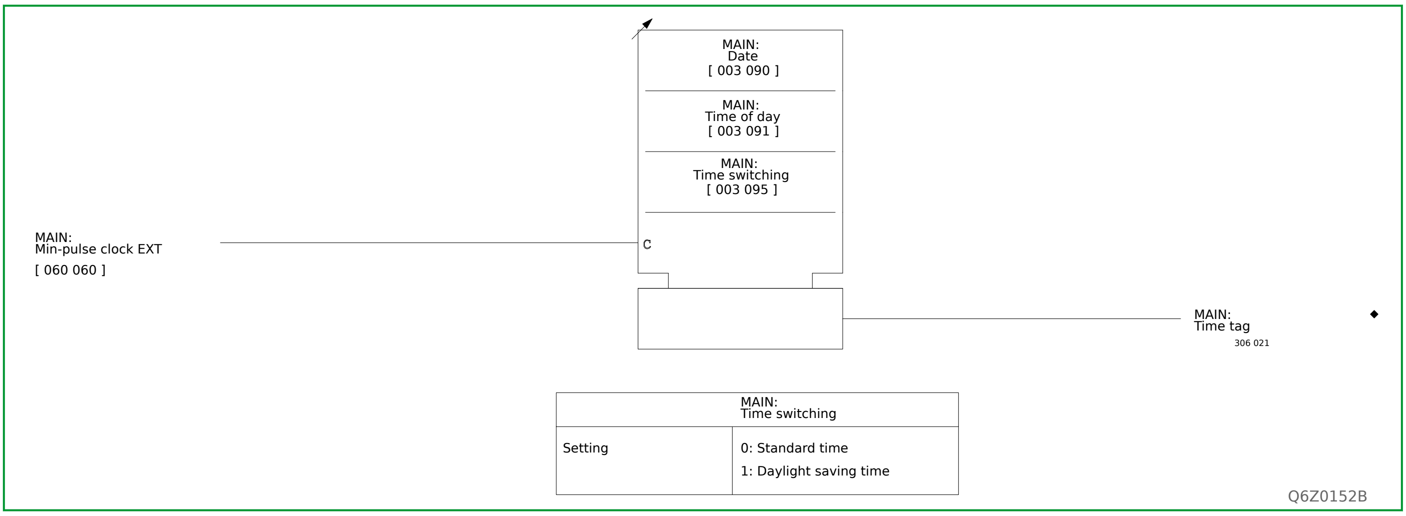


Fig. 3-88: Date/time setting and clock synchronization with minute pulses presented at a binary signal input.

Switching from standard to daylight saving time or back requires correct time setting frames from the time synchronization master (according the applied communication protocol).

The data stored in the operating data memory, the monitoring signal memory and the event memories are date- and time-tagged. For correct tagging, the date and time need to be set in the P139.

The time of different devices may be synchronized by a pulse given to an appropriately configured binary signal input. The P139 evaluates the rising edge. This will set the clock to the nearest full minute, rounding either up or down. If several start/end signals occur (bouncing of a relay contact), only the last edge is evaluated.

3.11.20.1 Synchronization Source

The P139 provides numerous options to synchronize the internal clock:

- Telegram with the time of day via the communication interface COMM1/IEC (full time)
- Telegram with the time of day via the communication interface COMM2/PC (full time)
- IRIG-B Signal (IRIGB; time of day only)
- Minute pulse presented at a binary signal input (MAIN), see Fig. 3-88, (p. 3-119) and previous paragraph

With older P139 versions these interfaces had equal ranking i.e. clock synchronization was carried out regardless of which sub-function initiated triggering. No conflicts have to be taken into account as long as synchronization sources (communication master, IRIG-B and minute pulse source) operate at the same time of day. Should the synchronization sources operate with a different time basis unwanted step changes in the internal clock may occur. On the other hand a redundant time of day synchronization is often used so as to sustain time synchronization via IRIG-B interface even if and while the SCADA communication is out of service.

With the current P139 versions a primary and a backup source for time of day synchronization may now be set, where both provide the four options listed in the above.

MAIN: Prim.Source TimeSync

MAIN: BackupSourceTimeSync

With this feature synchronization occurs continuously from the primary source as long as time synchronization telegrams are received within a time-out period set at MAIN: Time sync. time-out The backup source is required if after the set time-out there is no synchronization through the primary source.

When selecting the time telegram via IEC as the primary source the P139 will expect time synchronization telegrams from server SNTP2 after server SNTP 1 has become defective, before it will switch over to the backup source.

Time synchronization occurs solely from the primary source when the time-out stage is blocked.

3.11.21 Resetting Actions

Stored data such as event logs, measured fault data etc, can be cleared in several ways. The following types of resetting actions are possible:

- Automatic resetting of the event signals provided by LED indicators (given that the LED operating mode has been set accordingly) and of the display of measured event data on the local control panel LCD whenever a new event occurs. In this case only the displays on the local control panel LCD are cleared but not the internal memories such as the fault memory.
- Resetting of LED indicators and measured event data displayed on the local control panel LCD by pressing the “Clear” key ⓒ located on the local control panel. By selecting the required function at LOC: Fct. reset key further memories may be assigned which will then also be cleared when the “Clear” key is pressed.
- Selective resetting of a particular memory type (e.g. only the fault memory) via setting parameters. (For this example: Navigate to menu point FT_RC: Reset record. USER and set to *execute*, see also the exact step-by-step description in Section 6.11.7, (p. 6-40).)
- Selective resetting of a particular memory type (e.g. only the fault memory) through appropriately configured binary signal inputs. (For this example: Assign parameter FT_RC: Reset record. EXT to the relevant binary signal input e.g. INP: Fct. assignm. U 301 .)
- Group resetting by setting parameters, by navigating to menu point MAIN: Group reset 1 USER (or MAIN: Group reset 2 USER) and setting it to *execute*. For this the relevant memories (i.e. those to be reset) must be assigned to parameter MAIN: Fct.assign. reset 1 (or MAIN: Fct.assign. reset 2, resp.)
- Group resetting through appropriately configured binary signal inputs. (That is assign parameter MAIN: Group reset 1 EXT (or MAIN: Group reset 2 EXT) to the relevant binary signal input, e.g. INP: Fct. assignm. U 301 after memories to be reset have been assigned to parameter MAIN: Fct.assign. reset 1 (or MAIN: Fct.assign. reset 2).
- General resetting by setting parameters (menu point MAIN: General reset USER). All memories, counters, events etc. are reset without any special configuration options.
- General resetting through appropriately configured binary signal inputs. (MAIN: General reset EXT is assigned to the relevant binary signal input.) All memories, counters, events etc. are reset without any special configuration options.

Should several resetting actions have been configured for one particular memory then they all have equal priority.

In the event of a cold restart or simultaneous failure of both internal battery and substation auxiliary supply, all stored counter values will be lost.

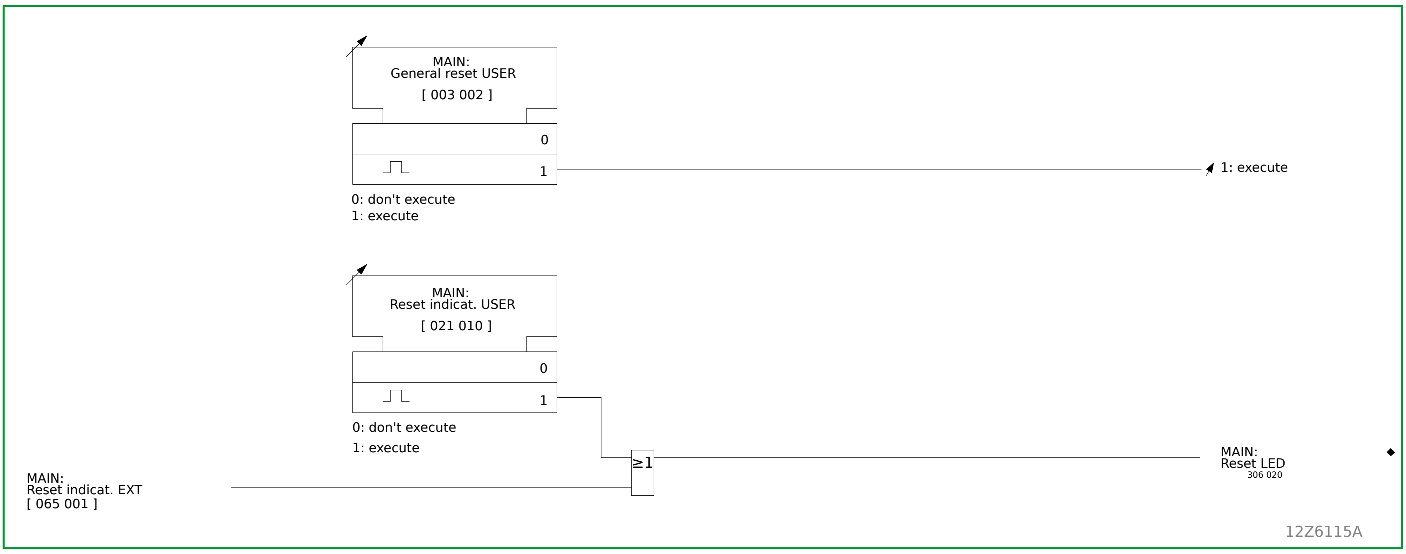


Fig. 3-89: General reset, LED reset and measured event data reset from the local control panel.

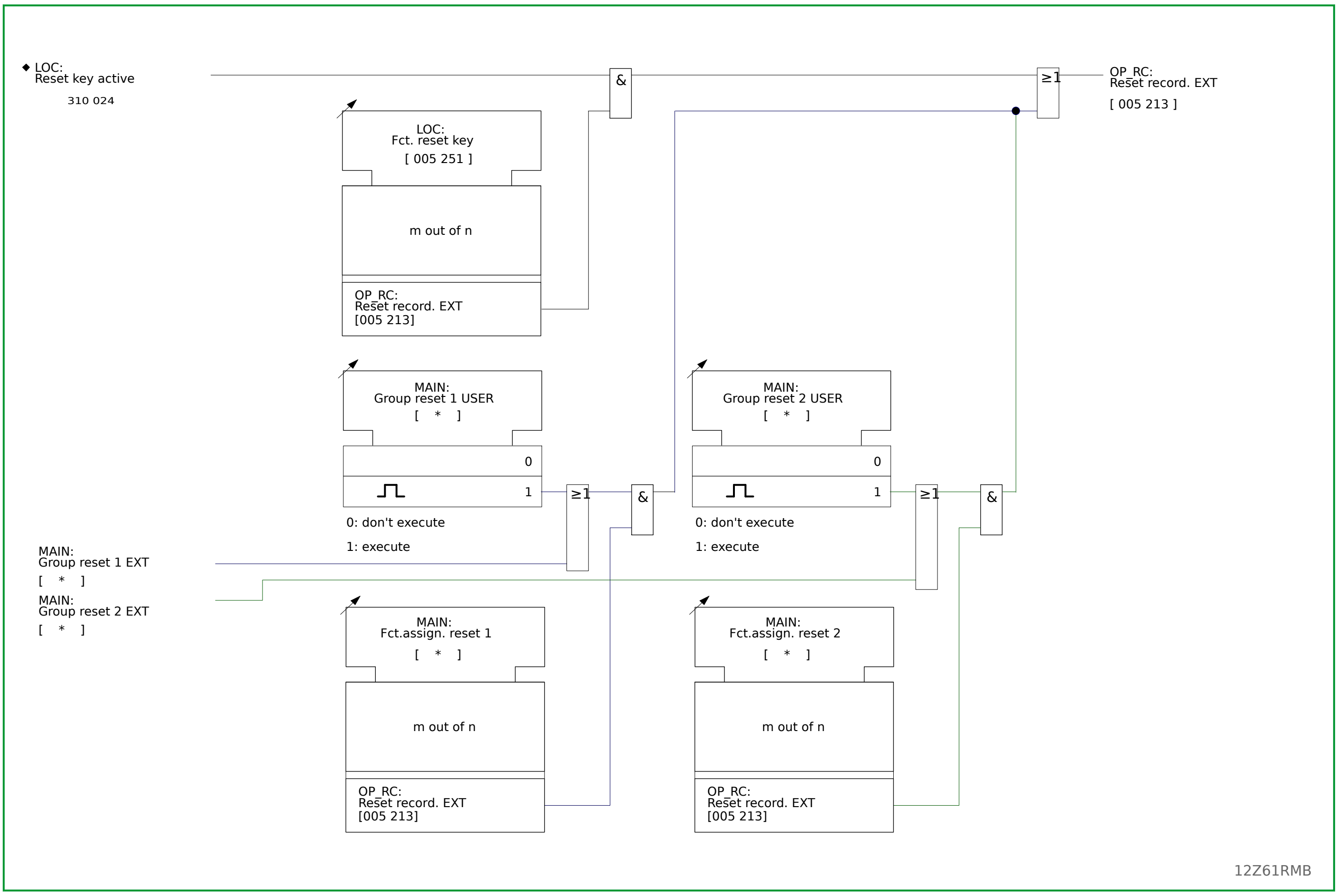


Fig. 3-90: “CLEAR” key on the local control panel and, as an example, group resetting of the operating data recording (e.g. as an example for the reset signal OP_RC: Reset record. EXT.

A complete list of all resetting parameters that can be used in the way shown in Fig. 3-90, (p. 3-123) can be obtained from the separately available DataModelExplorer: Look up the setting parameter MAIN: Fct.assign. reset 1 in the file *P139-657_en_Addresses.pdf*, and there follow the link to the referenced config. table.

3.11.21.1 Resetting Actions through Keys on the Local Control Panel

Further resetting possibilities are basically not distinct resetting actions but make access especially easy to one of the resetting actions described above i.e. by configuring them to a configurable key.

- One can include the relevant resetting action in the configuration of the “READ” (⓪) key (through LOC: Fct. read key).

3.11.22 Assigning Communications Interfaces to Physical Communications Channels

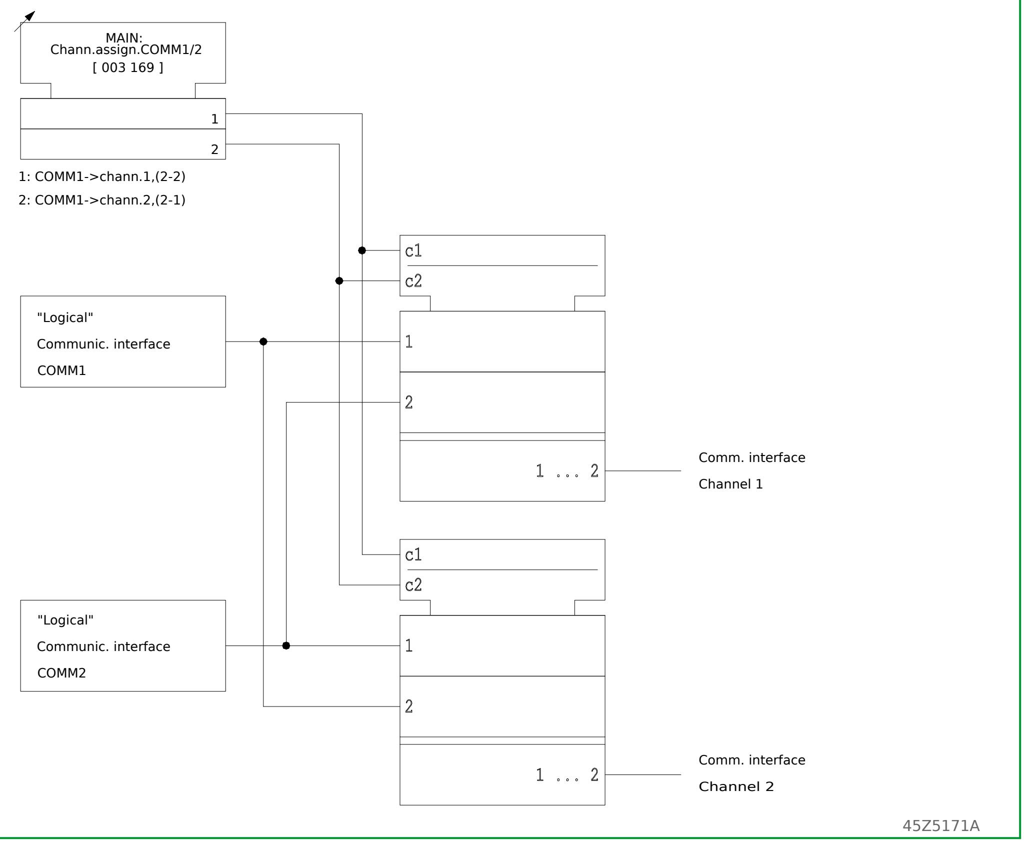


Fig. 3-91: Assignment of communication interfaces to physical communication channels.

Depending on the design version of the communications module A there are up to two communications channels available (see “Technical Data”, Chapter 2, (p. 2-1)). These physical communications channels may be assigned to communications interfaces COMM1 and COMM2.

If communications interface COMM1 is assigned to communications channel 2, then the settings of communications interface COMM2 are automatically assigned to communications channel 1.

COMM2 can only be used to transmit data to and from the P139 if its PC interface has been de-activated. As soon as the PC interface is used to transmit data, COMM2 becomes “dead”. It will only be enabled again when the “time-out” period for the PC interface has elapsed.

3.11.23 Test Mode

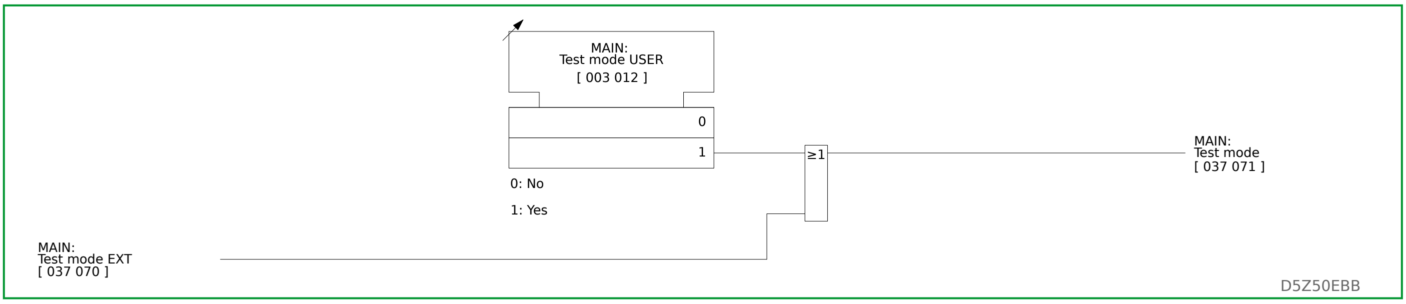


Fig. 3-92: Setting the test mode.

If tests are run on the P139, the user is advised to activate the test mode so that all incoming signals via the serial interfaces will be identified accordingly.

3.12 Parameter Subset Selection (Function Group PSS)

With the P139, four independent parameter subsets may be pre-set. The user may switch between parameter subsets during operation without interrupting the protection function.

Selecting the Parameter Subset

The control path determining the active parameter subset (function setting or binary signal input) may be selected via the function setting PSS: Control via USER or via the external signal PSS: Control via user EXT. Correspondingly, the parameter subset is selected either in accordance with the pre-set function setting PSS: Param.subs.sel. USER or in accordance with external signals. Which parameter subset is actually active at a particular time may be determined by scanning the logic state signals PSS: Actual param. subset or PSS: PS 1 active.

Selecting the Parameter Subset via Binary Inputs

If the binary signal inputs are to be used for parameter subset selection, then the P139 first checks to determine whether at least two binary inputs are configured for parameter subset selection. If this is not the case, then the parameter subset selected via the function setting will be active. The P139 also checks whether the signals present at the binary signal inputs allow an unambiguous parameter subset selection. This is only true when only one binary signal input is set to a logic level of “1”. If more than one signal input is set to a logic level of “1”, then the parameter subset previously selected remains active. Should a dead interval occur while switching between parameter subsets (this is the case if all binary signal inputs have a logic level of “0”), then the stored hold time is started. While this timer stage is running, the previously selected parameter subset remains active. As soon as a signal input has a logic level of “1”, the associated parameter subset becomes active. If, after the stored time has elapsed, there is still no signal input with a logic level of “1”, the parameter subset selected via the function parameter becomes active.

If, after the supply voltage is turned on, no logic level of “1” is present at any of the binary signal inputs selected for the parameter subset selection, then the parameter subset selected via the function parameter will become active once the stored time has elapsed. The previous parameter subset remains active while the stored hold timer stage is running.

Parameter subset selection may also occur during a starting condition. When subset selection is handled via binary signal inputs, a maximum inherent delay of approximately 100 ms must be taken into account.

Settings for which only one address is given in the following sections are equally effective for all four parameter subsets.

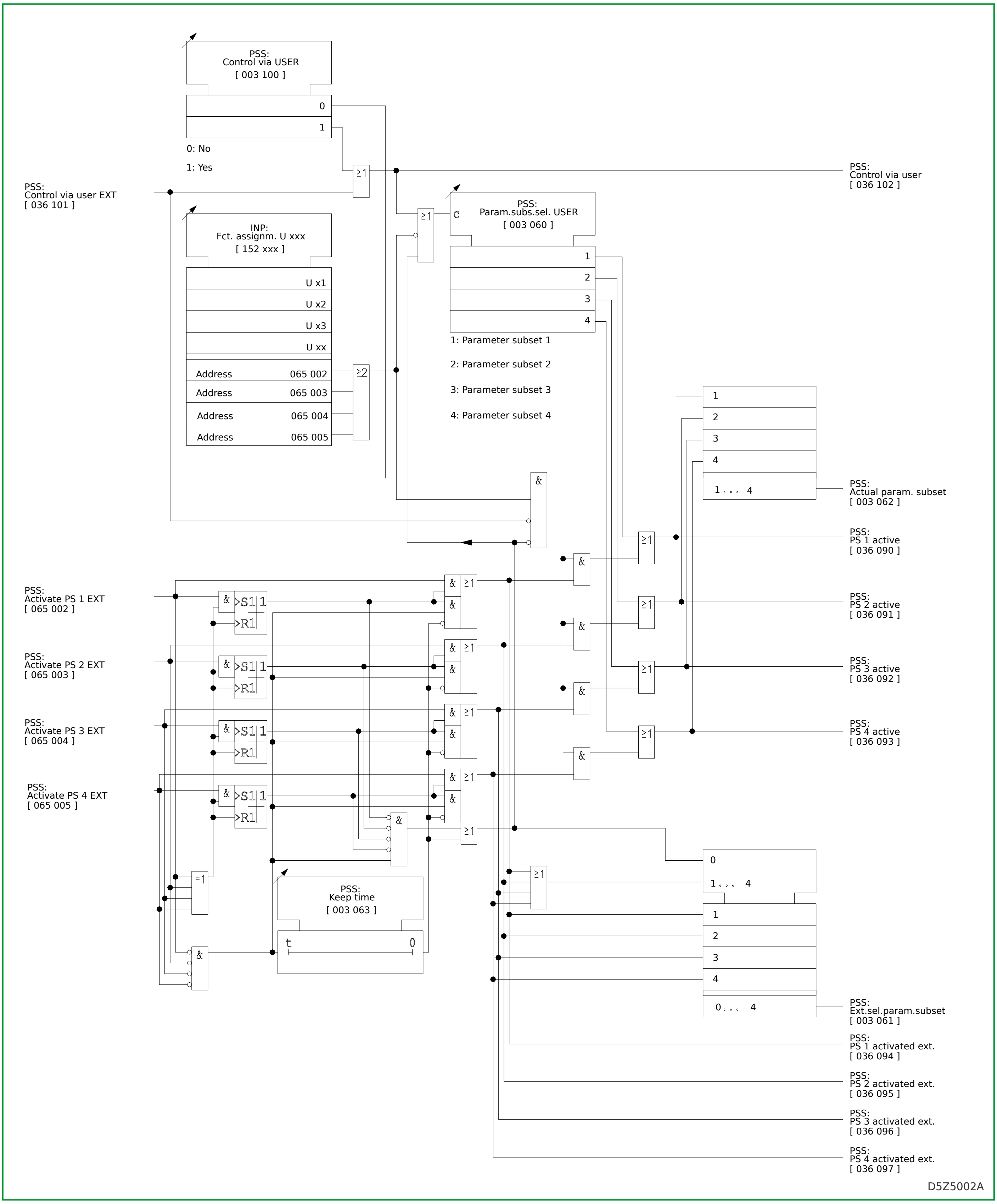


Fig. 3-93: Activating the parameter subsets.

3.13 Self-Monitoring (Function Group SFMON)

Comprehensive monitoring routines in the P139 ensure that internal faults are detected and do not lead to malfunctions. The selection of function assignments to the alarm signal includes, among others, self-monitoring signals from the communications monitor, measuring-circuit monitoring, open-circuit monitoring and the logic outputs.

3.13.1 Tests During Start-up

After the supply voltage has been turned on, various tests are carried out to verify full operability of the P139. If the P139 detects a fault in one of the tests, then start-up is terminated. The display shows which test was running when termination occurred. No control actions may be carried out. A new attempt to start up the P139 can only be initiated by turning the supply voltage off and then on again.

3.13.2 Cyclic Tests

After start-up has been successfully completed, cyclic self-monitoring tests will be run during operation. In the event of a positive test result, a specified monitoring signal will be issued and stored in a non-volatile(NV) memory – the monitoring signal memory – along with the assigned date and time (see Section 3.15, (p. 3-132)).

The self-monitoring function monitors the built-in battery for any drop below the minimum acceptable voltage level. If the associated monitoring signal is displayed, then the power supply module should be replaced within a month, since otherwise there is the danger of data loss if the supply voltage should fail. Section 12.1, (p. 12-2) gives further information on maintenance procedures.

3.13.3 Signals

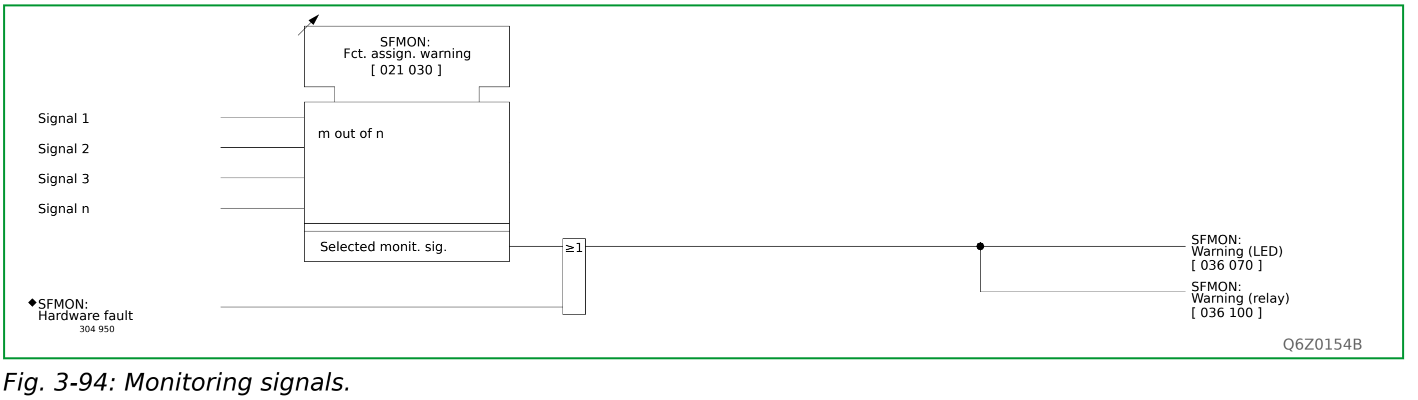


Fig. 3-94: Monitoring signals.

The monitoring signals are also signaled via the output relay configured SFMON: Warning (relay). The output relay operates as long as an internal fault is detected.

3.13.4 Device Response

The response of the P139 is dependent on the type of monitoring signal. The following responses are possible:

- Signaling Only

  If there is no malfunction associated with the monitoring signal, then only a signal is issued, and there are no further consequences. This situation exists, for example, when internal data acquisition memories overflow.

- Selective Blocking

  If a fault is diagnosed solely in an area that does not affect the protective functions, then only the affected area is blocked. This would apply, for example, to the detection of a fault on the communication module or in the area of the PC interface.

- Warm Restart

  If the self-monitoring function detects a fault that might be eliminated by a system restart – such as a fault caused by excessive electro-magnetic interference –, then a procedure called a warm restart is automatically initiated. During this procedure, as with any start-up, the computer system is reset to a defined state. A warm restart is characterized by the fact that no stored data and, in particular, no setting parameters are affected by the procedure. A warm restart can also be triggered manually by control action. During a warm restart sequence the protective functions and the communication through serial interfaces will be blocked.

  If the same fault is detected after a warm restart has been triggered by the self-monitoring system within the set SFMON: Mon.sig. retention, then the protective functions remain blocked but communication through the serial interfaces will usually be possible again.

  If a corrupted setting is diagnosed during the checksum test, which is part of the self-monitoring procedure, settings are restored from an internal back-up memory. Nevertheless, in order to get the device back to well defined operation conditions a warm restart is executed.

  For any warm restart initiated by self-monitoring, the root cause (alarm event) is logged in the monitoring buffer.

- Cold Restart

  In case the recovery of corrupted settings failed (e.g. because of an electrical defect of the memory chip), then a cold restart is carried out. This is necessary because the P139 cannot identify which parameter in the subset is corrupted. A cold restart causes all internal memories to be reset to a defined state. This means that all the protection device settings are also erased after a cold restart. In order to establish a safe initial state, the default values have been selected so that the protective functions are blocked. Both the monitoring signal that triggered the cold restart and the value indicating parameter loss are entered in the monitoring signal memory.

  A cold restart can also be triggered manually by control action (to intentionally erase all memories and reset the device to default settings).

3.13.5 Monitoring Signal Memory

Depending on the type of internal fault detected the P139 will respond by trying to eliminate the problem with a warm restart. (See above; for further details read also about P139 behavior with problems in Chapter 11, (p. 11-1).) Whether or not this measure will suffice can only be determined if the monitoring signal has not already been stored in the monitoring signal memory because of a previous fault. If it was already stored and a second fault is detected then, depending on the type of fault detected, the P139 will be blocked after the second warm restart.

In order to better monitor this behavior the parameter at SFMON: Mon.sig. retention is applied. This parameter may either be set to *'Blocked'* or to a time duration (in hours). (It is, however, discouraged to set it to 0, because in this case, there would be no blocking at all, so that there would be the danger of maloperation in case of a permanent failure.)

The default for this timer stage is *Blocked*, i.e. blocking of the protection device with two identical faults occurs independently of the time elapsed since the first fault monitoring signal was issued.

The behavior caused by sporadic faults could lead to an unwanted blocking of the P139 if the monitoring signal memory had not been reset in the interim, for example, because the substation is difficult to reach in wintertime or reading-out and clearing of the monitoring signal memory via the communication interfaces was not enabled. To defuse this problem it is suggested to set the function parameter to a specific time period so that blocking will only occur if the same fault occurs again within this time period. Otherwise, the P139 will continue to operate normally after a warm restart.

3.13.6 Monitoring Signal Memory Time Tag

The time when the device fault occurred last is recorded.

3.14 Operating Data Recording (Function Group OP_RC)

For the continuous recording of processes in system operation as well as of events, a non-volatile memory is provided (cyclic buffer). The “operationally relevant” signals, each fully tagged with date and time at signal start and signal end, are entered in chronological order. The signals relevant for operation include control actions such as function disabling and enabling and triggers for testing and resetting. The start and end of system events that represent a deviation from normal operation such as overloads, ground faults or short-circuits are also recorded. The operating data memory can be cleared/reset.

Counter for Signals Relevant to System Operation

The signals stored in the operating data memory are counted.

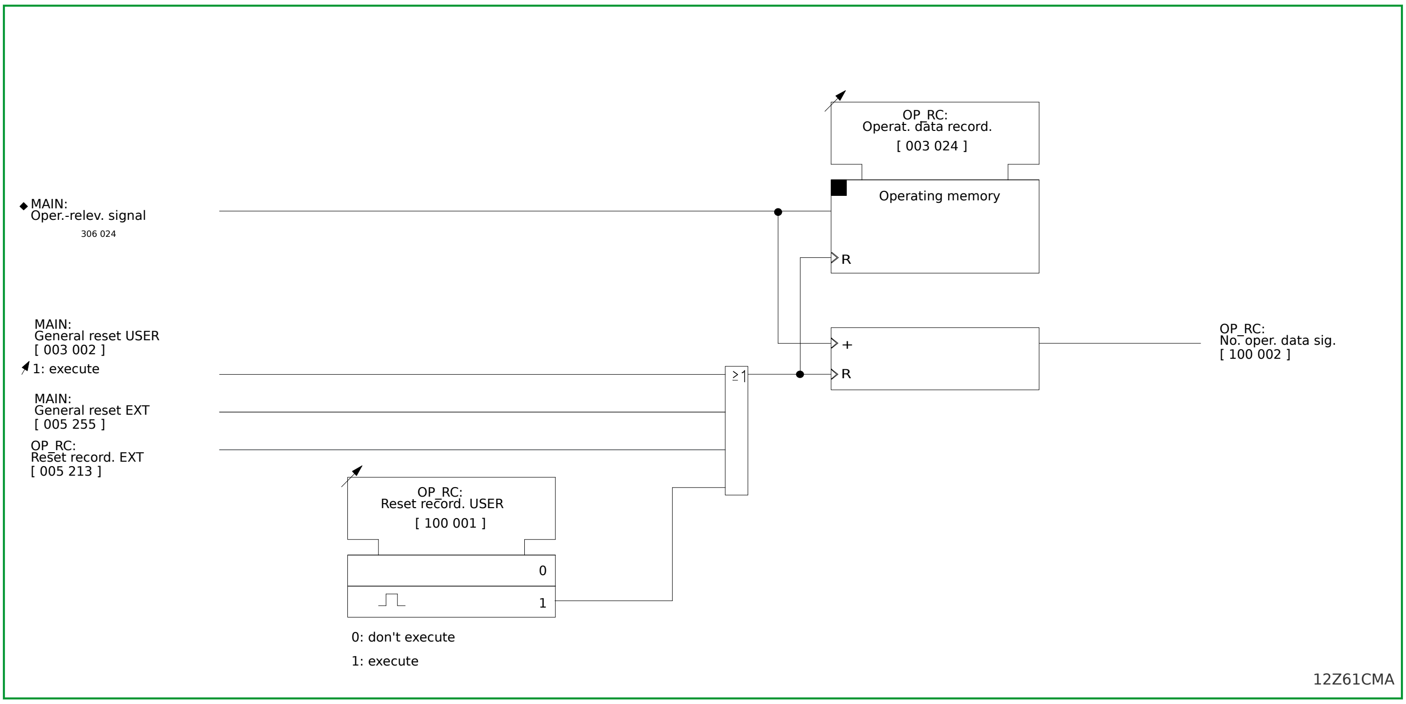


Fig. 3-95: Operating data recording and counter for signals relevant to system operation.

3.15 Monitoring Signal Recording (Function Group MT_RC)

The monitoring signals generated by the self-monitoring function are recorded in the monitoring signal memory. The memory buffer allows for a maximum of 30 entries. If more than 29 monitoring signals occur without interim memory clearance, the SFMON: Overflow MT_RC signal is entered as the last entry. Monitoring signals prompted by a hardware fault in the unit are always entered in the monitoring signal memory. Monitoring signals prompted by a peripheral fault can be entered into the monitoring signal memory, if desired. The user can select this option by setting an “m out of n” parameter (see Section 3.13, (p. 3-128)).

If at least one entry is stored in the monitoring signal memory, this fact is signaled by the red LED indicator H 3 on the local control panel. Each new entry causes the LED to flash (on/off/on....).

The monitoring signal memory can only be cleared manually by a control action. Entries in the monitoring signal memory are not cleared automatically, even if the corresponding test in a new test cycle now shows the P139 to be healthy. The contents of the monitoring signal memory can be read from the local control panel or through the PC or communication interface. The time and date information assigned to the individual entries can be read out through the PC or communication interface or from the local control panel.

Monitoring Signal Counter

The number of entries stored in the monitoring signal memory is displayed on the monitoring signal counter (MT_RC: No. monit. signals).

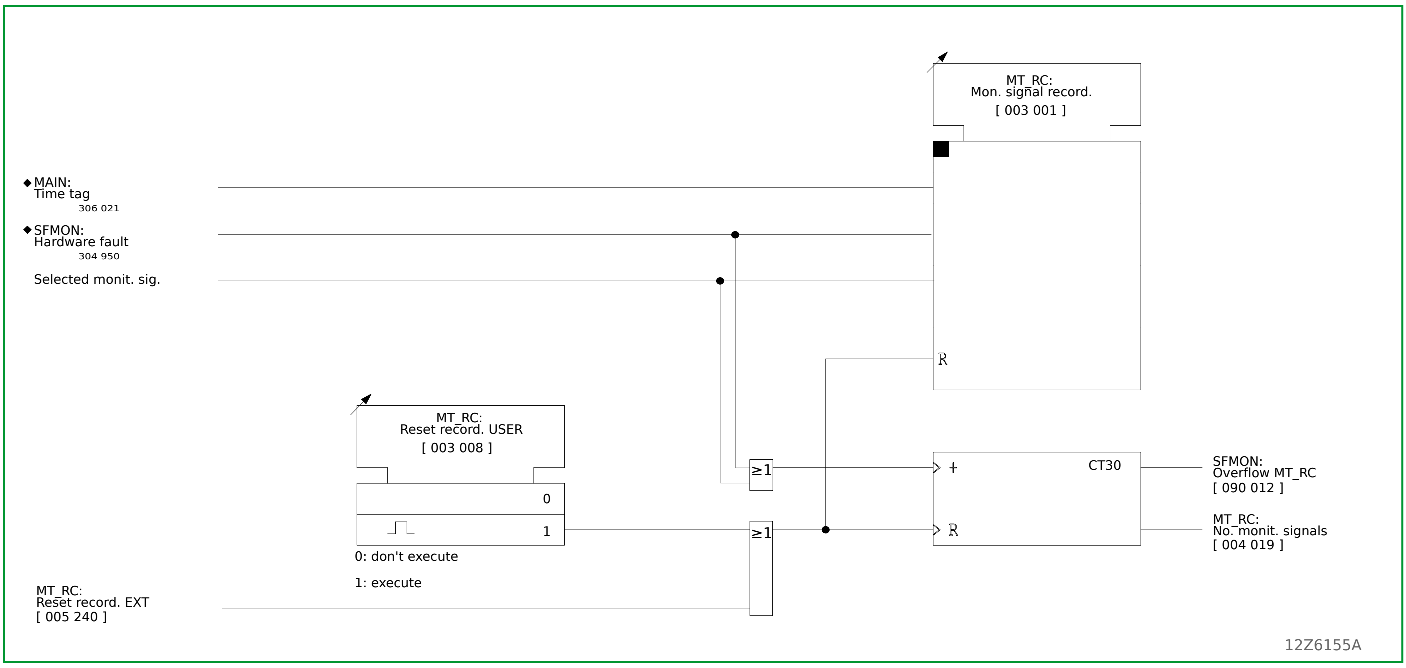


Fig. 3-96: Monitoring signal recording and the monitoring signal counter.

3.16 Overload Data Acquisition (Function Group OL_DA)

3.16.1 Overload Duration

In the event of an overload, the P139 determines the overload duration. The overload duration is defined as the time between the start and end of the OL_RC: Record. in progress signal.

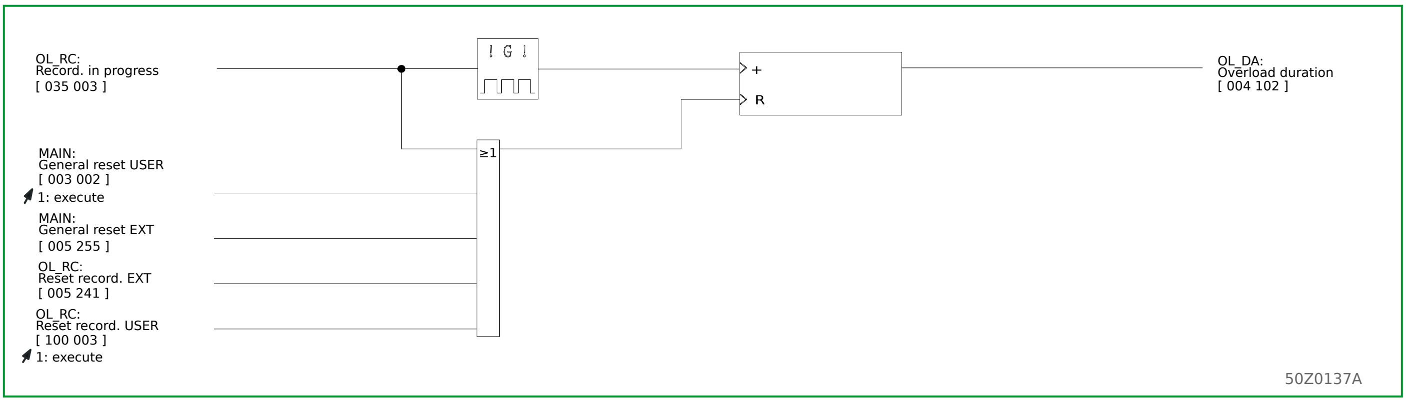


Fig. 3-97: Overload duration.

3.16.2 Acquiring Measured Overload Data from the Motor Protection

During a motor startup the measured values for the startup time, the maximum startup current and heating during startup are determined and stored at the end of the startup period.

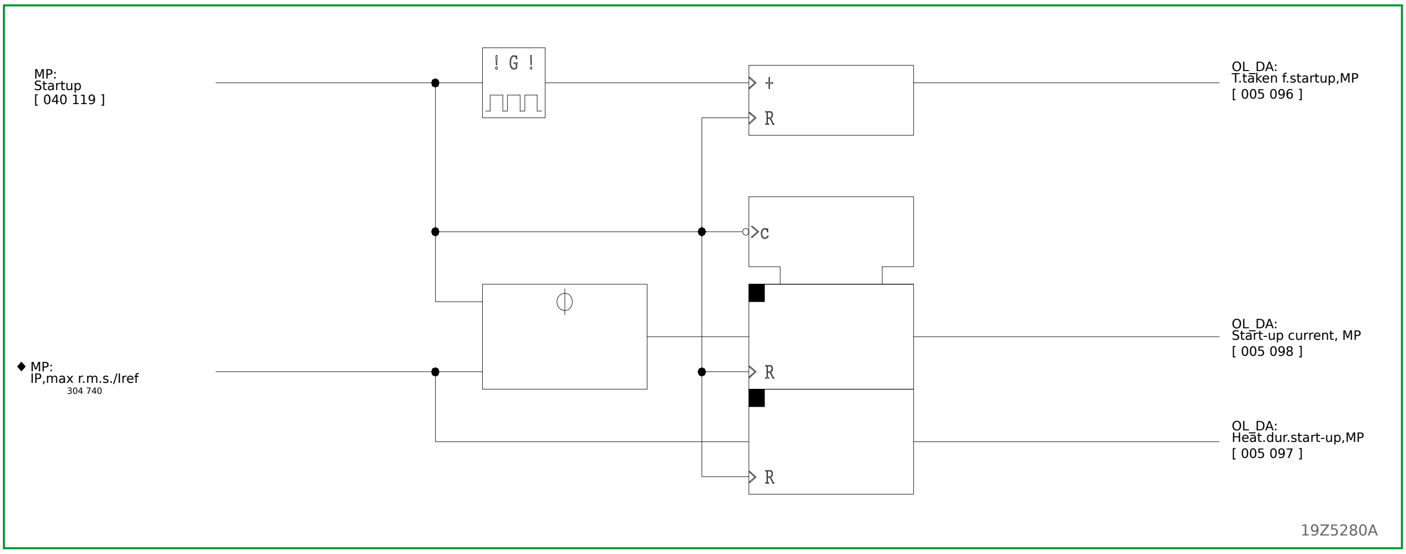


Fig. 3-98: Measured overload values from the motor protection.

3.16.3 Acquiring Measured Overload Data from the Thermal Overload Protection

Measured overload values are derived from the thermal overload protection's measured operating data. They are stored at the end of an overload event.

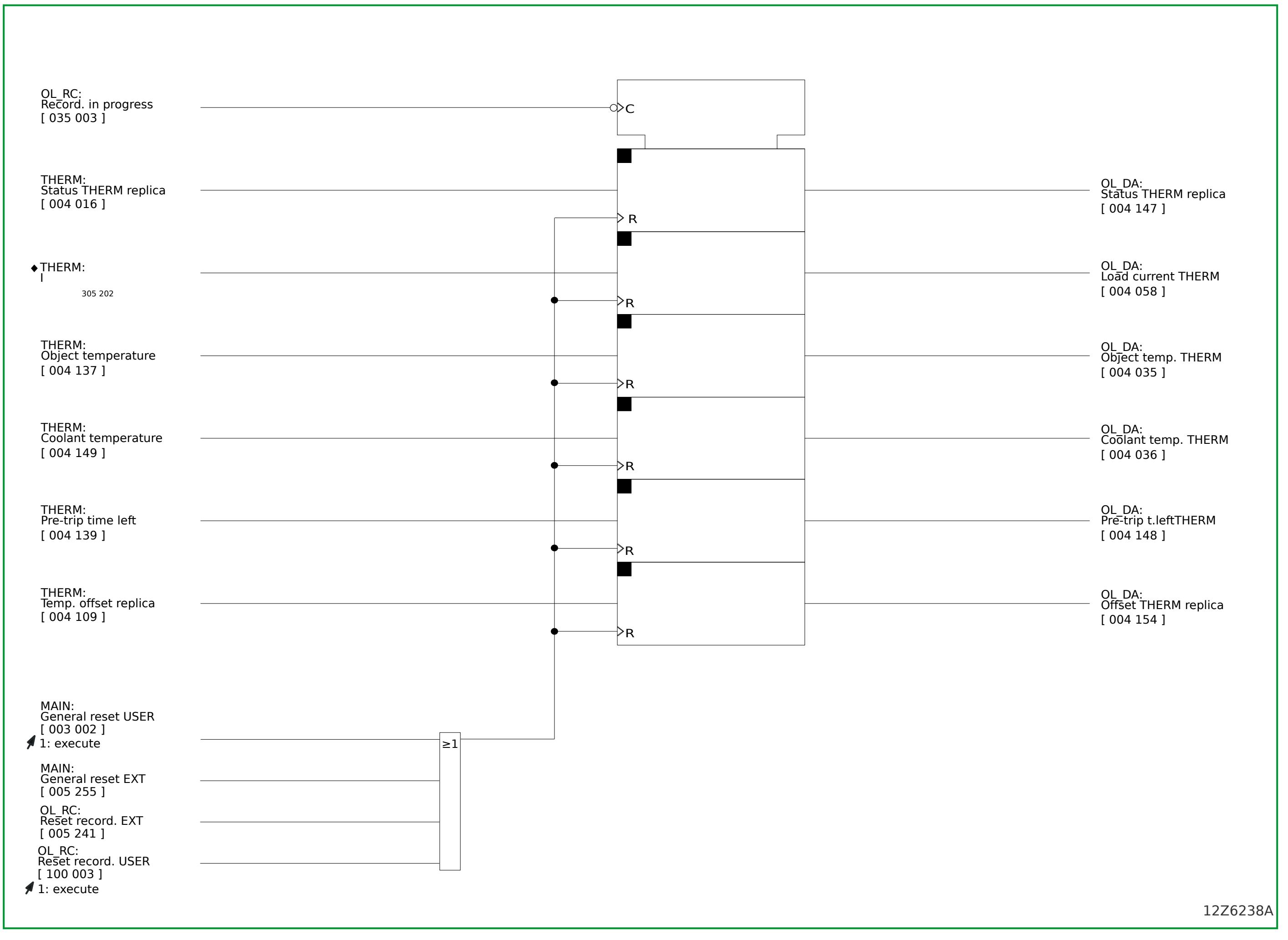


Fig. 3-99: Measured overload values from the thermal overload protection.

3.17 Overload Recording (Function Group OL_RC)

3.17.1 Start of Overload Recording

An overload exists – and consequently overload recording begins – if at least the signal THERM: Starting k*Iref> or MP: Starting k*Iref> is issued.

3.17.2 Counting Overload Events

Overload events are counted and identified by sequential numbers.

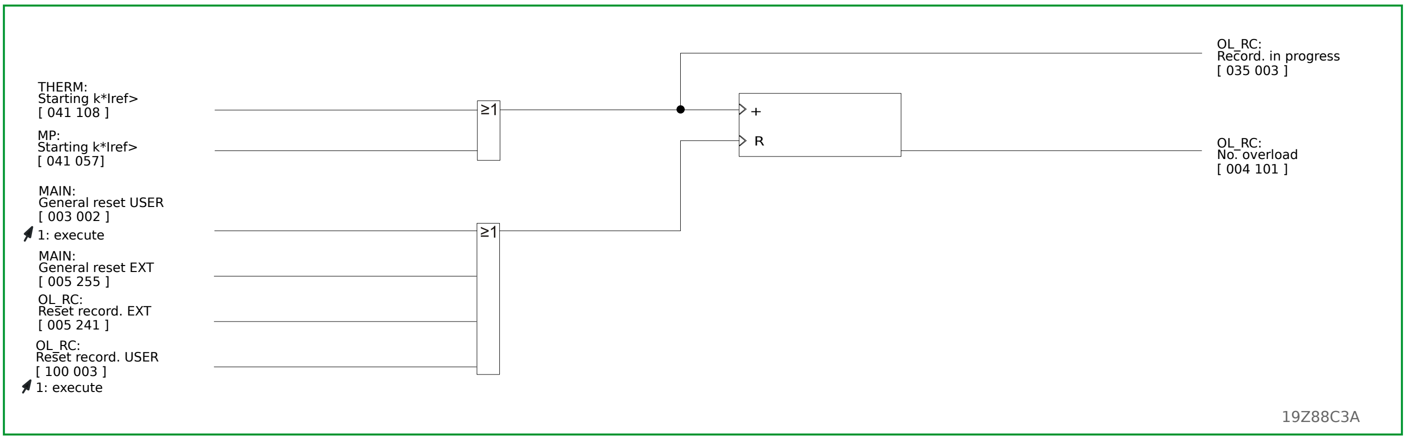


Fig. 3-100: Counting overload events.

3.17.3 Time Tagging

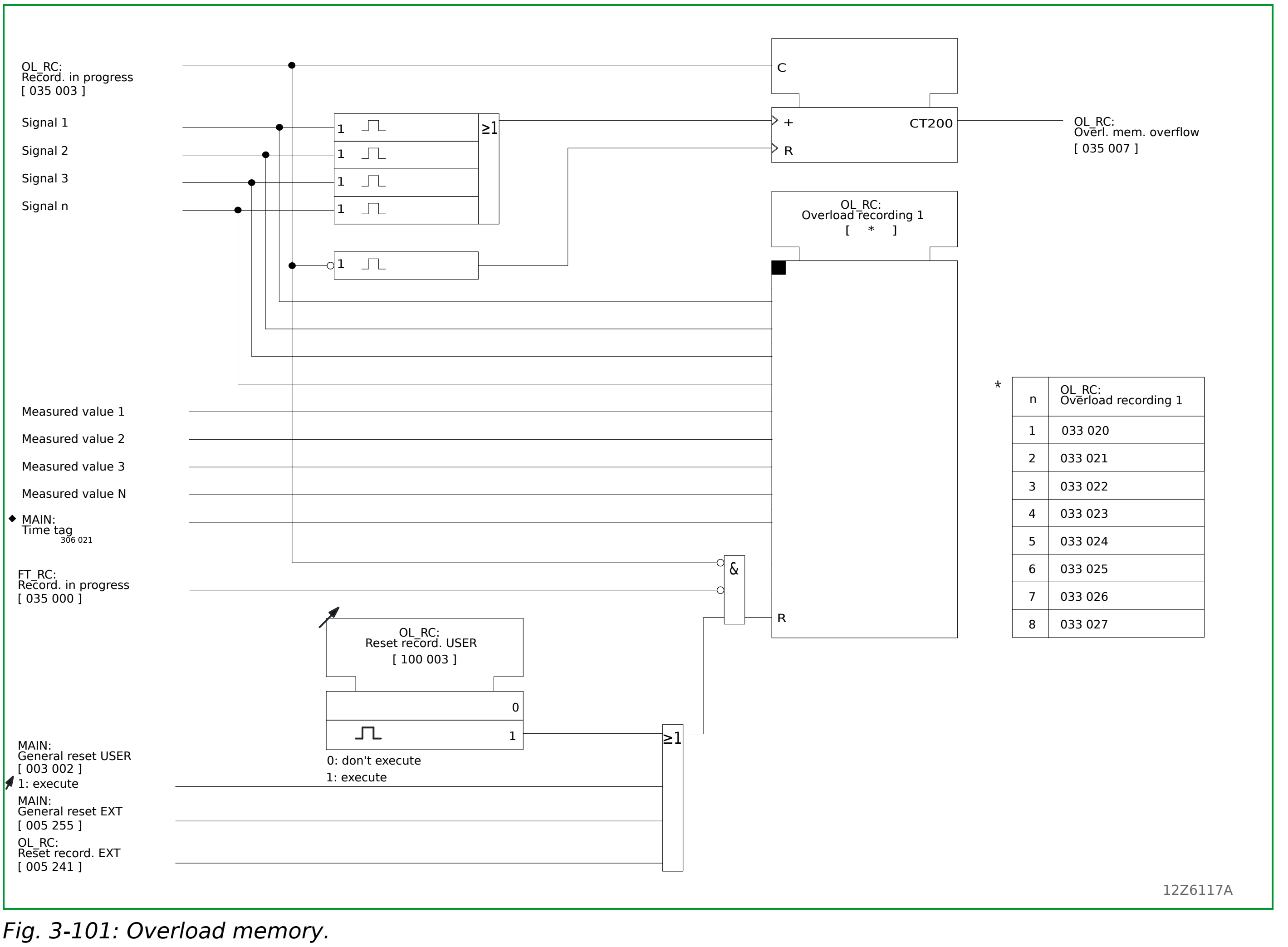
The date of each overload event is stored. The overload start or end signals are likewise time-tagged by the internal clock. The date and time assigned to an overload event when the event begins can be read out from the overload memory on the local control panel or through the PC and communication interfaces. The time information (relative to the onset of the overload) can be retrieved from the overload memory or through the PC or one of the communication interfaces.

3.17.4 Overload Logging

Protection signals during an overload event are logged in chronological order with reference to the specific event. A total of eight overload events, each involving a maximum of 200 start or end signals, can be stored in the non-volatile overload memories. After eight overload events have been logged, the oldest overload log will be overwritten, unless memories have been cleared in the interim. If more than 199 start or end signals have occurred during a single overload event, then OL_RC: Overl. mem. overflow will be entered as the last signal.

In addition to the signals, the measured overload data will also be entered in the overload memory.

The overload logs can be read from the local control panel or through the PC or communication interfaces.



n	OL_RC: Overload recording 1
1	033 020
2	033 021
3	033 022
4	033 023
5	033 024
6	033 025
7	033 026
8	033 027

Fig. 3-101: Overload memory.

3.18 Ground Fault Data Acquisition (Function Group GF_DA)

In the event of a ground fault, the P139 acquires the following measured ground fault data:

- Duration of ground fault recording
- When ground fault direction determination using steady-state values (GFDSS) is enabled
  - Duration of the ground fault with steady state value evaluation, steady state power evaluation or admittance evaluation
  - Neutral-point displacement voltage V_{NG} with steady state value evaluation or admittance evaluation
  - Residual current I_N
  - Active component of the residual current as determined by steady state power evaluation
  - Reactive component of the residual current as determined by steady state power evaluation
  - Filtered ground fault from steady state power evaluation
  - Admittance, conductance and susceptance with admittance evaluation.

3.18.1 Resetting Measured Ground Fault Data

After pressing the reset key Ⓒ on the local control panel, the measured ground fault data value is displayed as *Not measured*. However, the values are not erased and can continue to be read out through the PC and communication interfaces.

3.18.2 Duration of Ground Fault Recording

The duration of ground fault recording is defined as the time between the start and end of the GF_RC: Record. in progress signal.

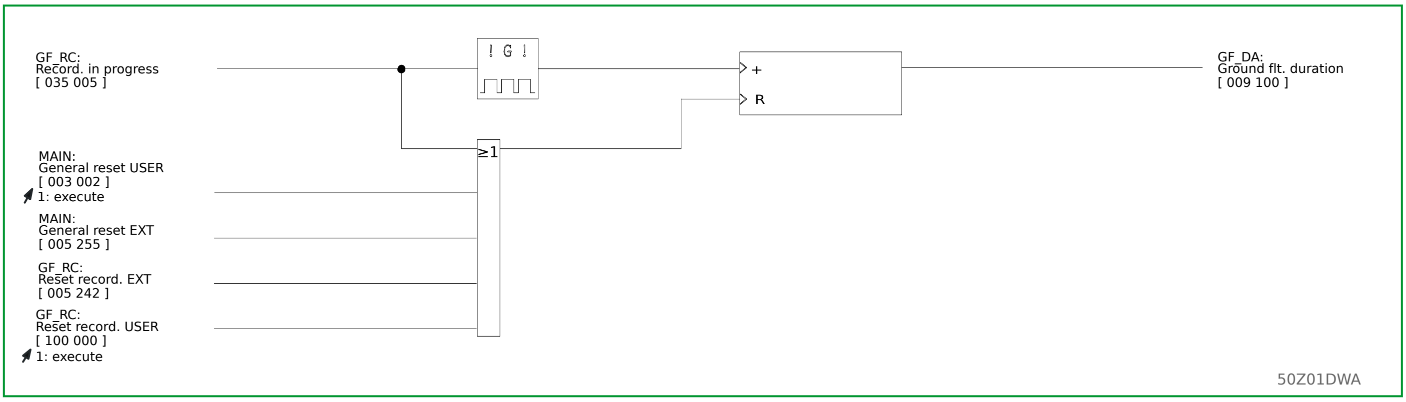


Fig. 3-102: Duration of ground fault recording.

3.18.3 Measured Ground Fault Data from Steady-State Value Evaluation

3.18.3.1 Ground Fault Duration

The ground fault duration is defined as the time between operation and dropout of the GFDSS: VNG> PSx trigger. However, a time is only output after the end of the ground fault if the GFDSS: VNG> PSx trigger has operated for at least the duration of set timer stage GFDSS: tVNG> PSx. Once GFDSS: tVNG> PSx has elapsed the display of the ground fault duration for the last ground fault is cleared automatically.

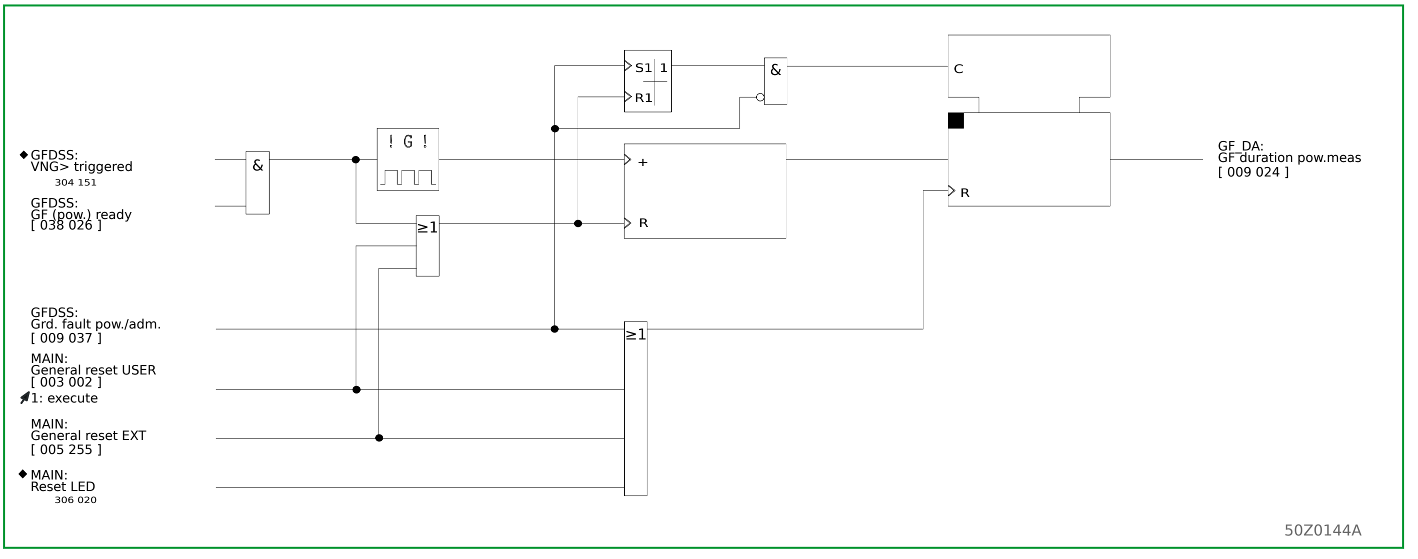


Fig. 3-103: Measurement and storage of the ground fault duration from steady state power evaluation.

3.18.3.2 Residual Current

The residual current flowing when timer stage GFDSS: tVNG> PSx elapses is stored in memory. Also stored is the active and reactive component of the residual current determined at the time when the directional decision is output. All measured values are output as per-unit quantities referred to the P139's nominal current I_{nom}.

3.18.3.3 Neutral-Point Displacement Voltage

The neutral-point displacement voltage present when timer stage GFDSS: tVNG> PSx elapses is stored in memory.

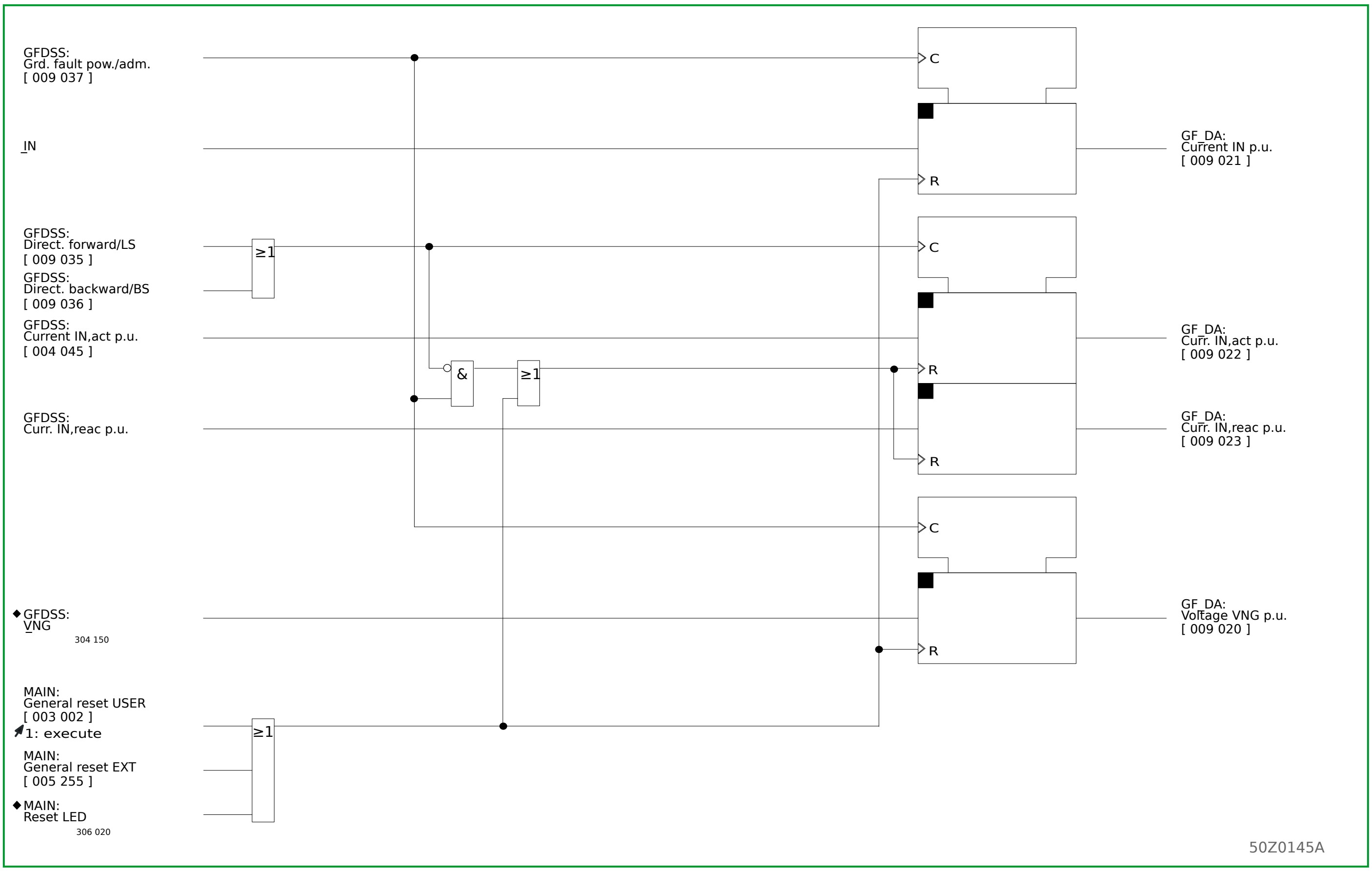


Fig. 3-104: Residual current and neutral-point displacement voltage from steady state value evaluation.

3.18.4 Measured Ground Fault Data from Steady-State Power Evaluation

3.18.4.1 Ground Fault Duration

The ground fault duration is defined as the time between operation and dropout of the GFDSS: IN> PSx trigger. However, a time is only output after the end of the ground fault if the GFDSS: IN> PSx trigger has operated for at least the duration of the set operate delay (GFDSS: Operate delay IN PSx). Once the operate delay has elapsed, the display of the ground fault duration of the last ground fault is automatically cleared.

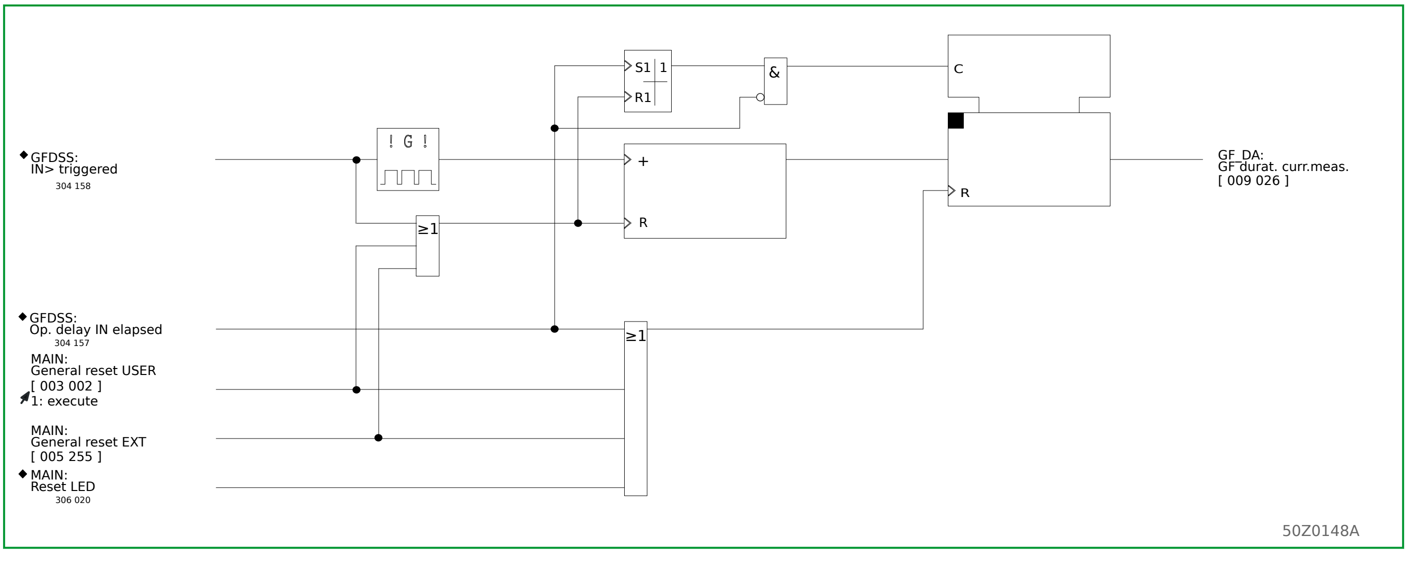


Fig. 3-105: Measurement and storing the ground fault duration as determined by steady state current evaluation.

3.18.4.2 Residual Current

The unfiltered and filtered residual currents that are present when the operate delay elapses (GFDSS: Operate delay IN PSx) are stored.

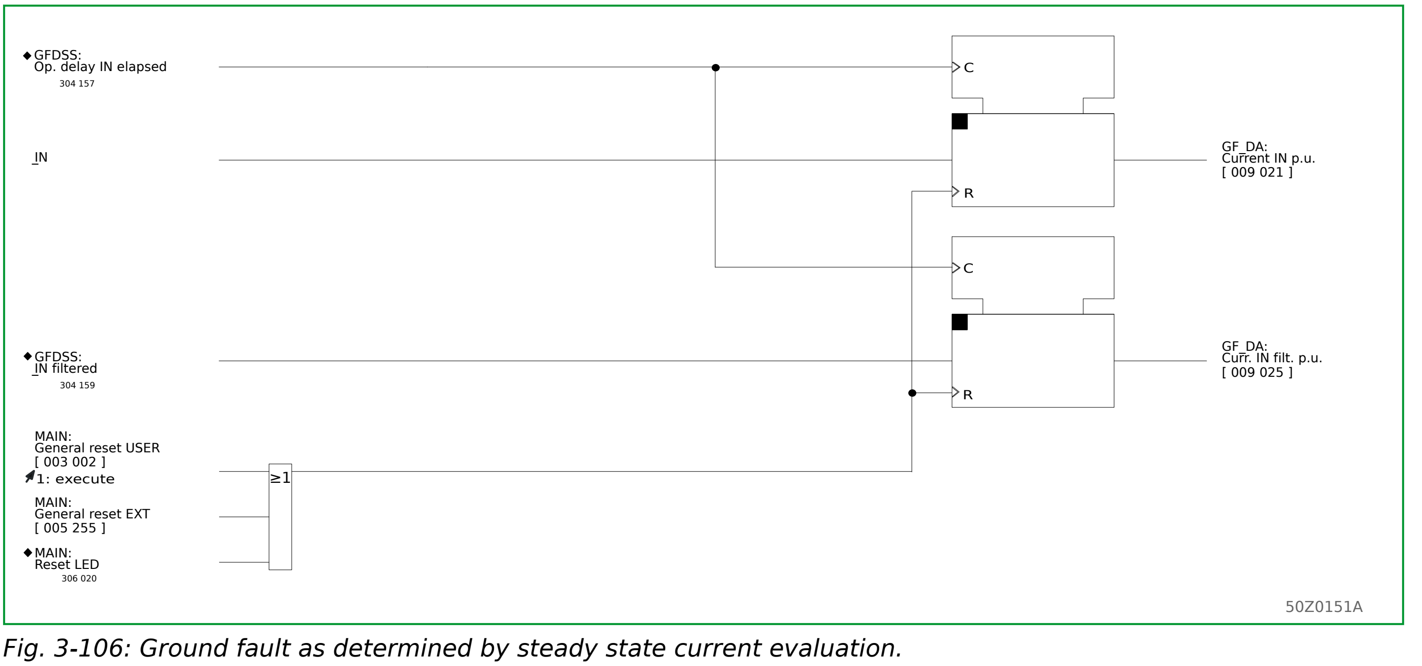


Fig. 3-106: Ground fault as determined by steady state current evaluation.

3.18.5 Measured Ground Fault Data from Admittance Evaluation

Ground Fault Duration

The ground fault duration is defined as the time between operation and dropout of the GFDSS: VNG> PSx trigger. A time value will only be issued if the trigger GFDSS: VNG> PSx has operated for at least the timer period set at GFDSS: tVNG> PSx. Once GFDSS: tVNG> PSx has elapsed the display of the ground fault duration for the last ground fault is cleared automatically.

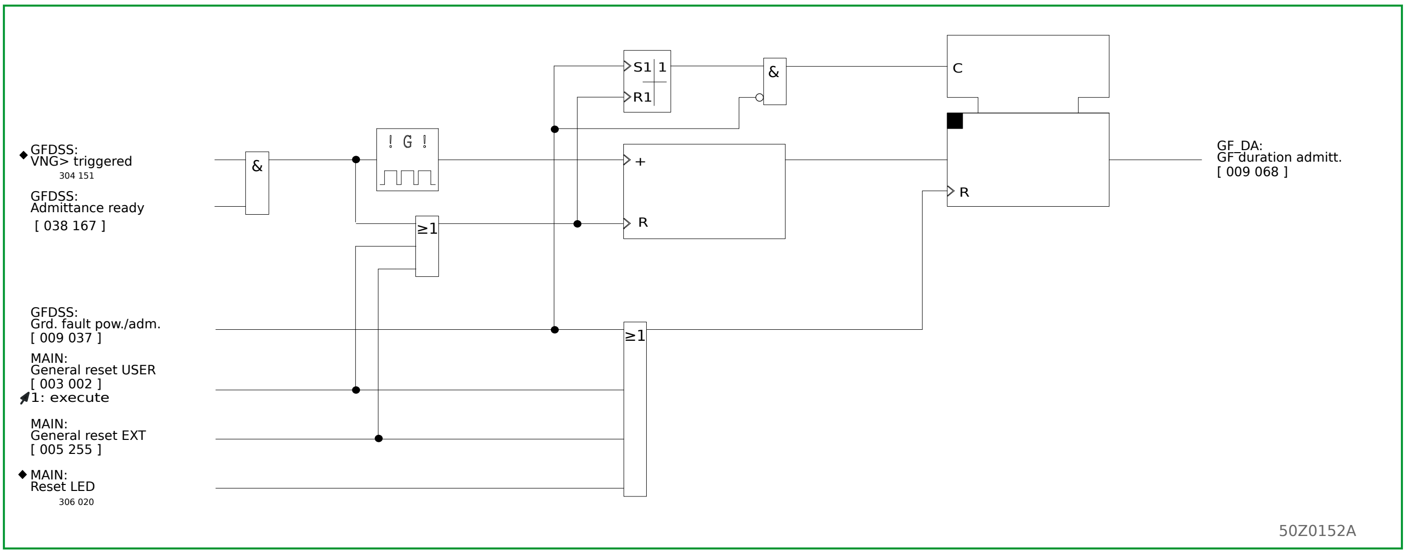


Fig. 3-107: Measurement and storing the ground fault duration from admittance evaluation.

3.18.5.1 Admittance, Conductance and Susceptance

Conductance and susceptance are stored at the time when the directional decision is issued. The admittance value is measured at the time when the timer period set at GFDSS: Oper.delay Y(N)> PSx has elapsed.

3.18.5.2 Residual Current

The residual current flowing when timer stage GFDSS: tVNG> PSx elapses is stored in memory. This measured value is issued as a per-unit quantity referred to the P139’s nominal current I_{nom}.

3.18.5.3 Neutral-Point Displacement Voltage

The neutral-point displacement voltage present when timer stage GFDSS: tVNG> PSx elapses is stored in memory.

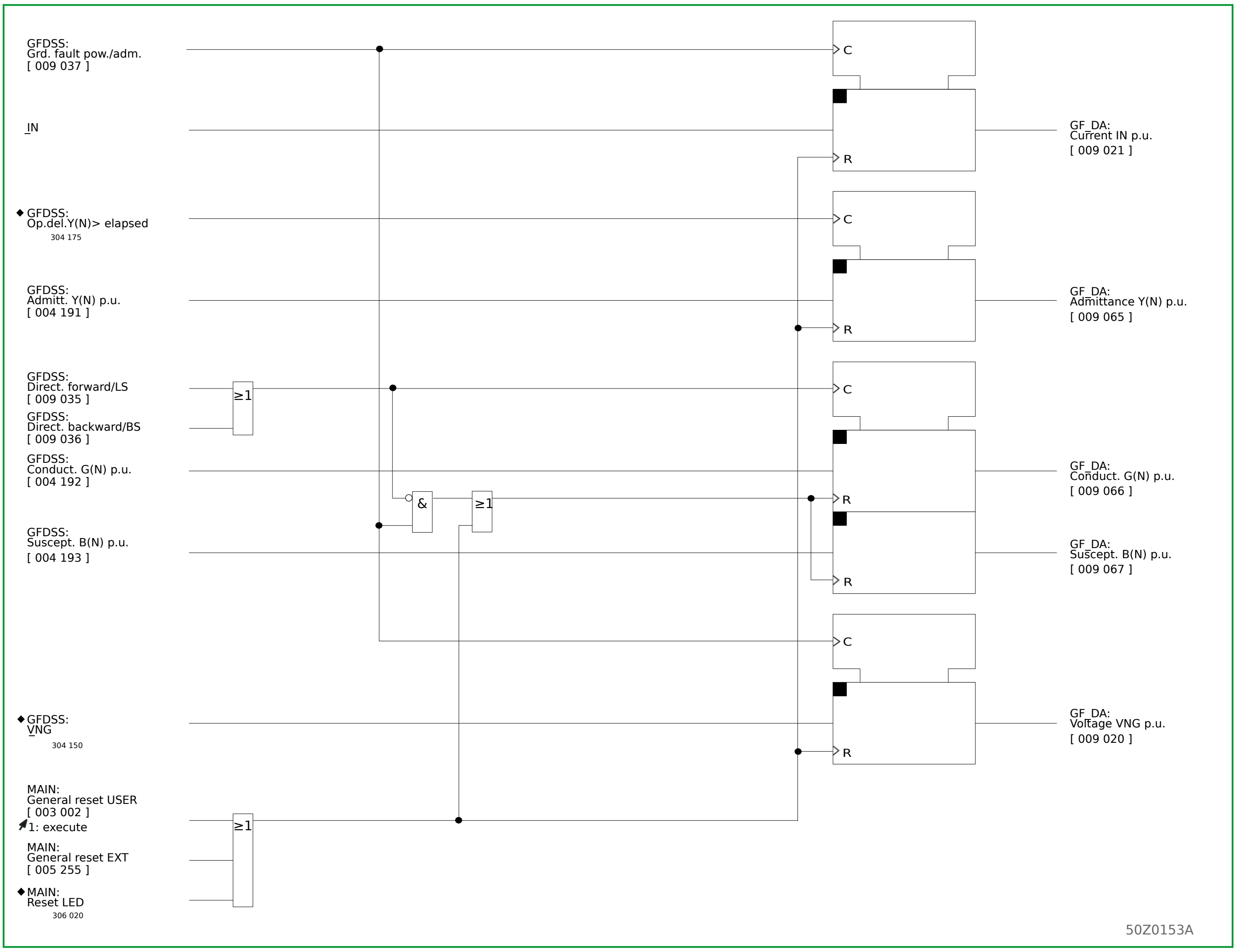


Fig. 3-108: Measured ground fault data from admittance evaluation.

3.19 Ground Fault Recording (Function Group GF_RC)

3.19.1 Start Ground Fault Recording

A ground fault exists and ground fault recording begins if at least one of the following conditions is met:

- A ground fault has been detected by ground fault direction determination using steady-state values (GFDSS).
- A ground fault has been detected by transient ground fault direction determination (TGFD).

3.19.2 Counting Ground Fault Events

Ground fault events are counted and identified by sequential numbers.

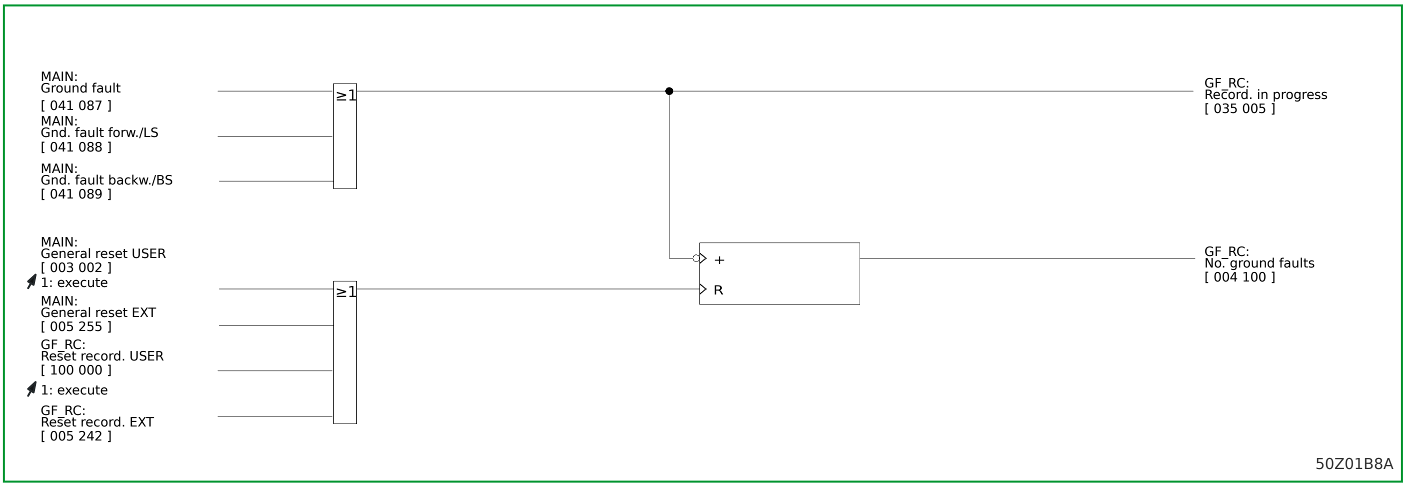


Fig. 3-109: Counting ground fault events.

3.19.3 Time Tagging

The date of each ground fault event is stored. A ground fault’s individual start or end signals are likewise time-tagged. The date and time assigned to a ground fault event when the event begins can be read out from the ground fault memory on the local control panel or through the PC and communication interfaces. The time information (relative to the onset of the ground fault) that is assigned to the signals can be retrieved from the ground fault memory or through the PC or communication interfaces.

3.19.4 Ground Fault Logging

Protection signals during a ground fault event are logged in chronological order with reference to the specific ground fault event. A total of eight ground fault logs, each involving a maximum of 200 start or end signals, can be stored in the non-volatile ground fault memories. After eight ground fault events have been logged, the oldest ground fault log will be overwritten, unless memories have been cleared in the interim. If more than 199 start or end signals have occurred during a single ground fault, then GF_RC: GF memory overflow is stored as the final signal.

In addition to the signals, the measured ground fault data will also be entered in the ground fault memory.

The ground fault logs can be read from the local control panel or through the PC or communication interfaces.

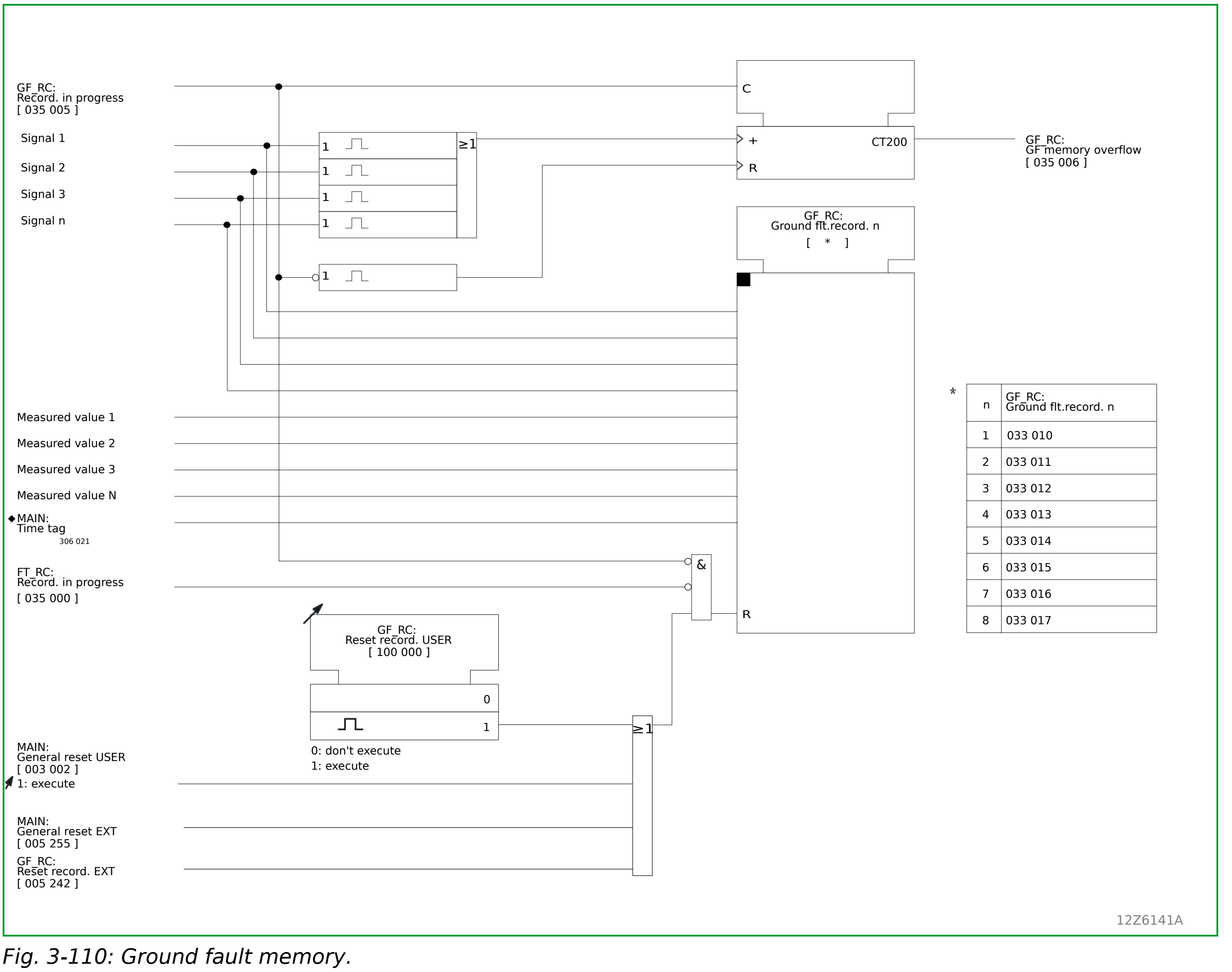


Fig. 3-110: Ground fault memory.

3.20 Fault Data Acquisition (Function Group FT_DA)

When there is a primary system fault, the P139 collects the following measured fault data:

- Running time
- Fault duration
- Fault current (short-circuit current)
- Fault voltage (short-circuit voltage)
- Fault impedance (short-circuit impedance)
- Fault reactance (short-circuit reactance) in percent of the line reactance and in Ω
- Line fault loop angle
- Fault distance
- Ground fault (short-circuit) current
- Ground fault loop angle
- Relative fault location
- Fault location in km

3.20.1 Running Time and Fault Duration

The running time is defined as the time between the start and end of the general starting signal, and the fault duration is defined as the time between the start and end of the FT_RC: Record. in progress signal.

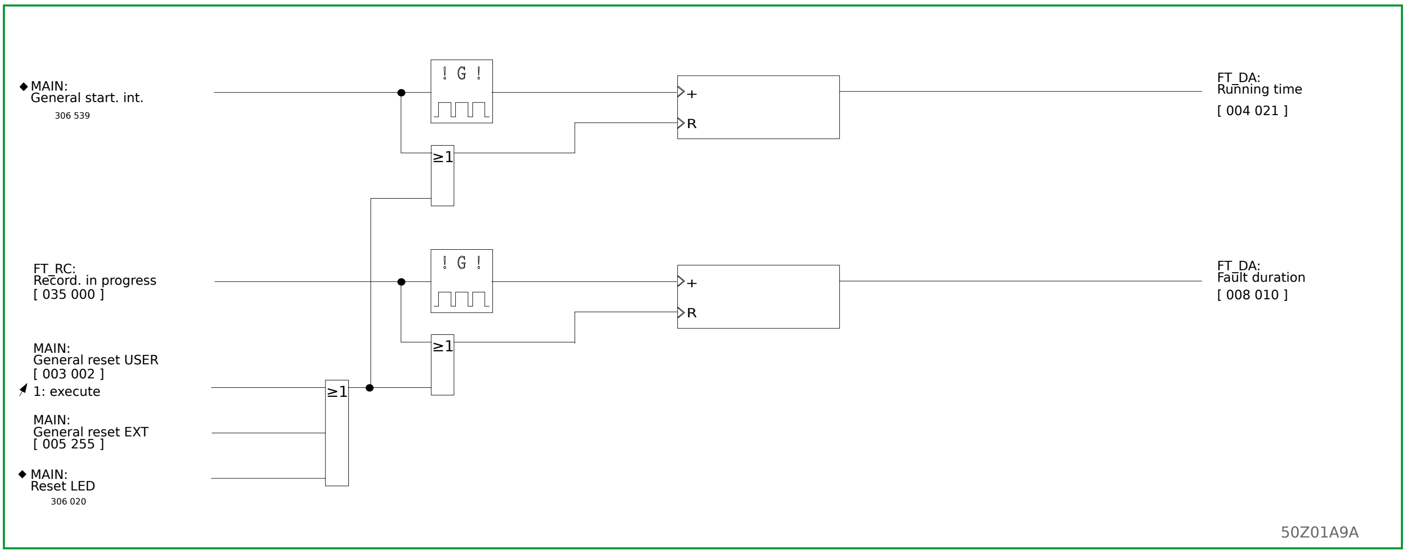


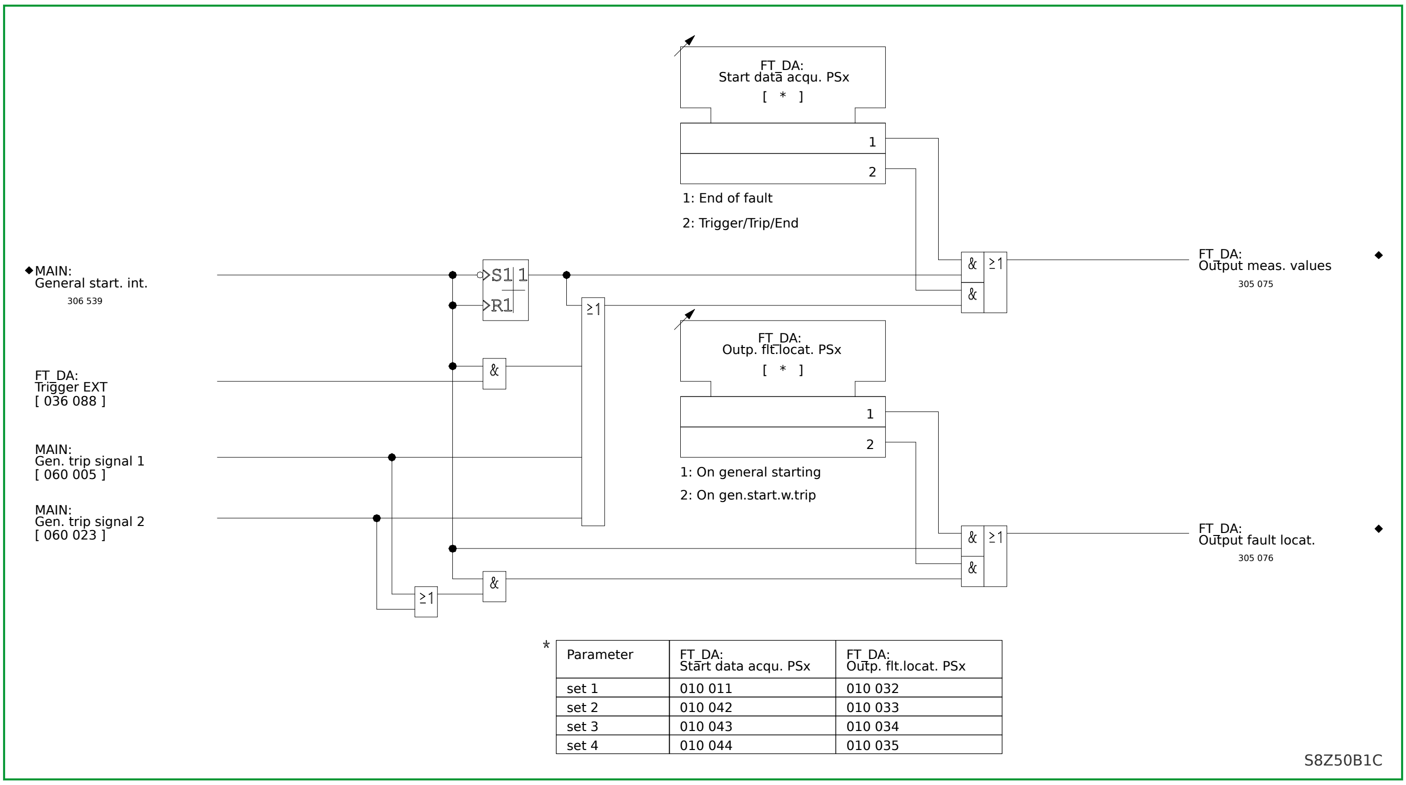
Fig. 3-111: Running time and fault duration.

3.20.2 Fault Data Acquisition Time

The setting at FT_DA: Start data acqu. PSx determines at which time during a fault the acquisition of fault data takes place. The following settings are possible:

- *End of fault* – Acquisition at the end of the fault.
- *Trigger/Trip/End* – Acquisition at the time.
    - when an appropriately configured binary signal input is triggered during a general starting state,
    - when a general trip signal is issued,
    - when a general starting state ends.

Depending on the setting a fault location output will occur during a general starting state or during a general starting state with a simultaneous general trip signal.



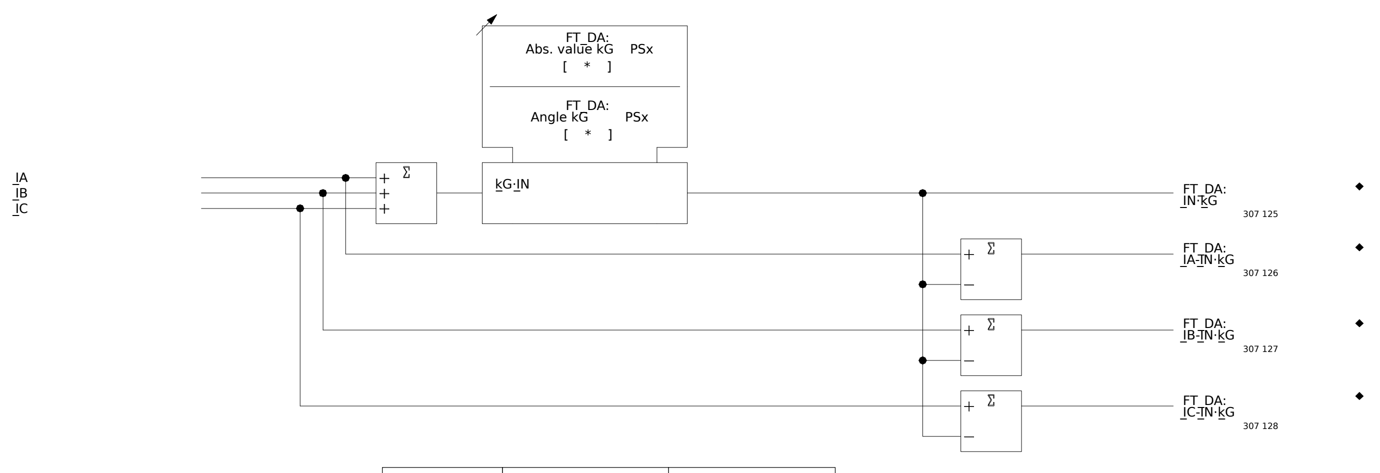
Parameter	FT_DA: Start data acqu. PSx	FT_DA: Outp. flt.locat. PSx
set 1	010 011	010 032
set 2	010 042	010 033
set 3	010 043	010 034
set 4	010 044	010 035

Fig. 3-112: Enabling of measured fault data acquisition and fault location output.

3.20.3 Acquisition of Fault Data

The P139 determines from the phase-selective starting decision the fault type, which is then signaled via FT_DA: Fault type. Moreover, the P139 selects a measuring loop based on the fault type. The fault impedance (short-circuit impedance) and the fault direction are determined from the voltage and current values collected from these measuring loops. With single-phase starting signals with ground the current values, corrected by the ground factor, are used for the selected measured variables. For three-phase starting signals with or without ground the minimum voltage value and the associated phase-to-phase current are selected from the phase-to-phase voltages as measured values.

Starting (FT_DA: Fault type)	Selected measured variables
A	IA-kG / VA-G
B	IB-kG / VB-G
C	IC-kG / VC-G
A-N	IA-kG / VA-G
B-N	IB-kG / VB-G
C-N	IC-kG / VC-G
A-B	IA-B / VA-B
B-C	IB-C / VB-C
C-A	IC-A / VC-A
A-B-N	IA-B / VA-B
B-C-N	IB-C / VB-C
C-A-N	IC-A / VC-A
A-B-C	IP-P(min) / VP-P(min)
A-B-C-N	IP-P(min) / VP-P(min)



* Parameter	FT_DA: Abs. value kG PSx	FT_DA: Angle kG PSx
set 1	012 037	012 036
set 2	012 087	012 086
set 3	013 037	013 036
set 4	013 087	013 086

Fig. 3-113: Formation of currents corrected by the ground factor.

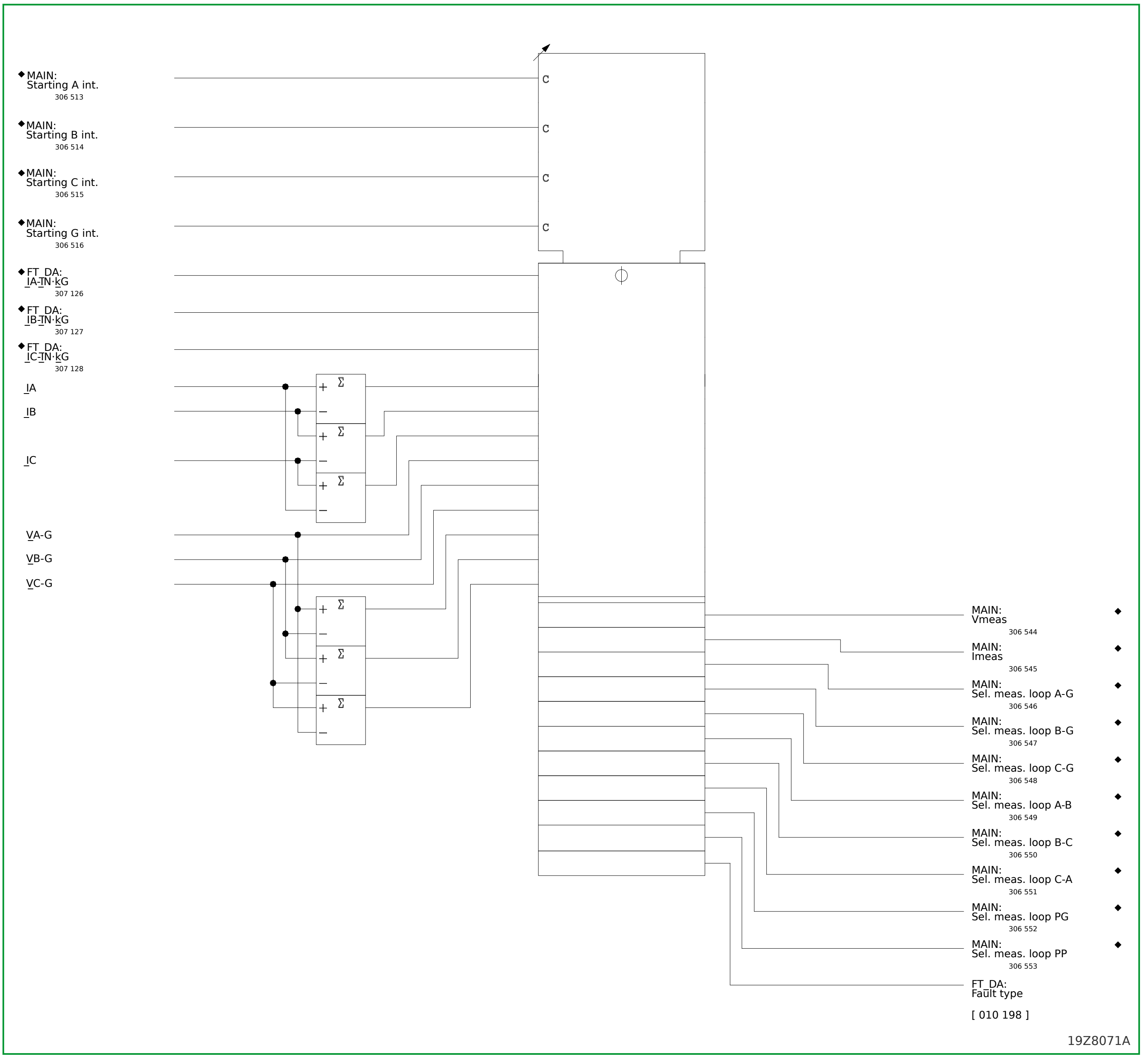


Fig. 3-114: Selecting measured variables to collect short-circuit data.

The fault must be present for at least 60 ms so that fault measured variables (short-circuit data) may be determined.

To determine short-circuit data the selected measured variables I_{meas} and V_{meas} are applied when the fault was identified by the fault data acquisition function. One phase current is selected as the fault current corresponding to the measuring loop selected. In the case of multi-phase starting, this is the current of the leading phase in the cycle. The primary fault reactance is calculated from the per-unit fault reactance using the nominal data for the set primary current and voltage transformers.

The ground fault data are only determined if a phase-to-ground loop has been selected for the measurement by the fault data acquisition function. The geometric sum of the three phase currents is displayed as the ground fault current. The ground fault angle is the phase displacement between ground fault current and the selected measuring voltage.

Only the short-circuit current is determined should an m.c.b. trip signal be present or the transformer module fitted not include voltage transformers and the maximum phase current is displayed.

Fault current and voltage are displayed as per-unit quantities referred to I_{nom} and V_{nom}. If the measured or calculated values are outside of the acceptable measuring range, *overflow* is displayed.

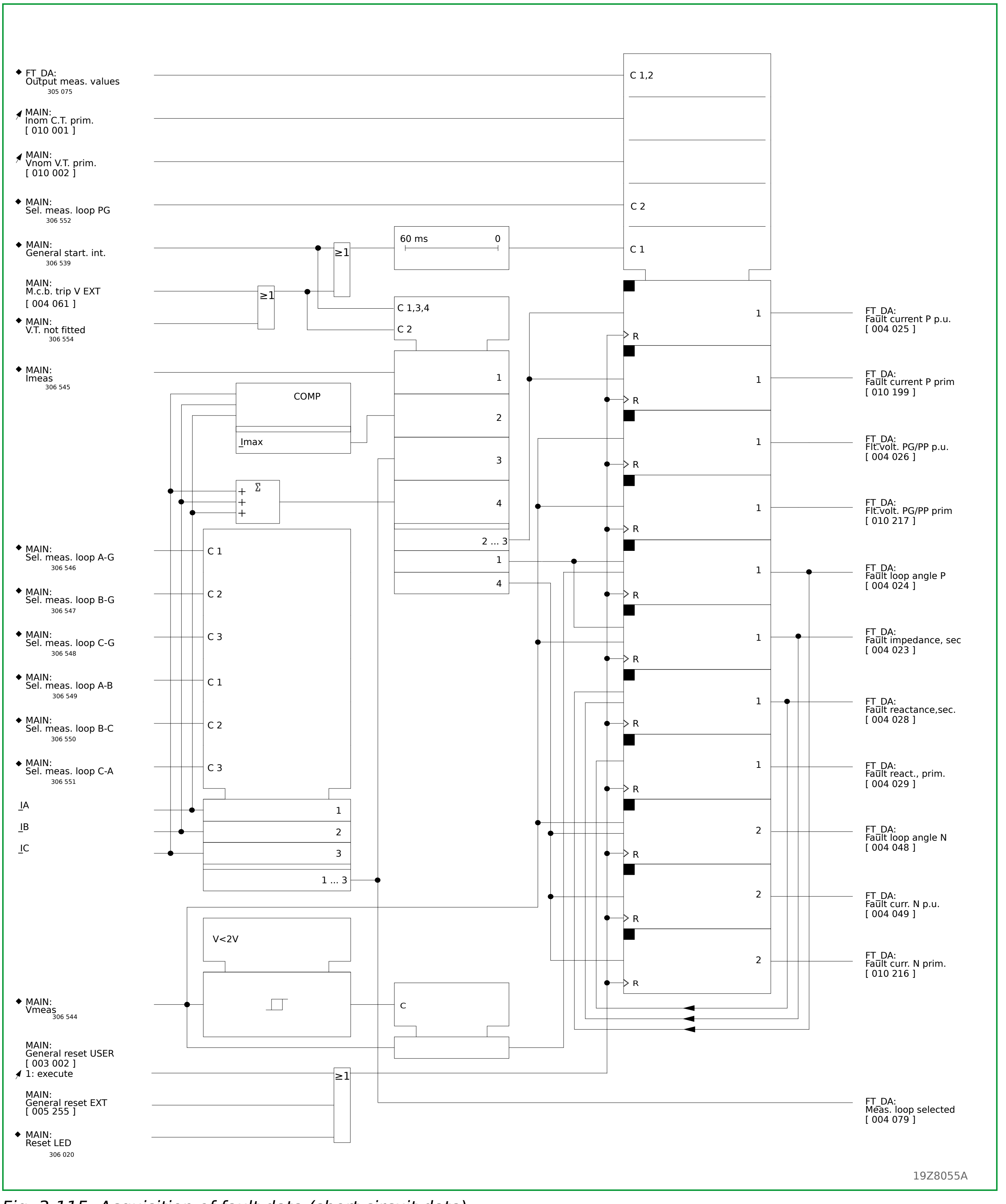
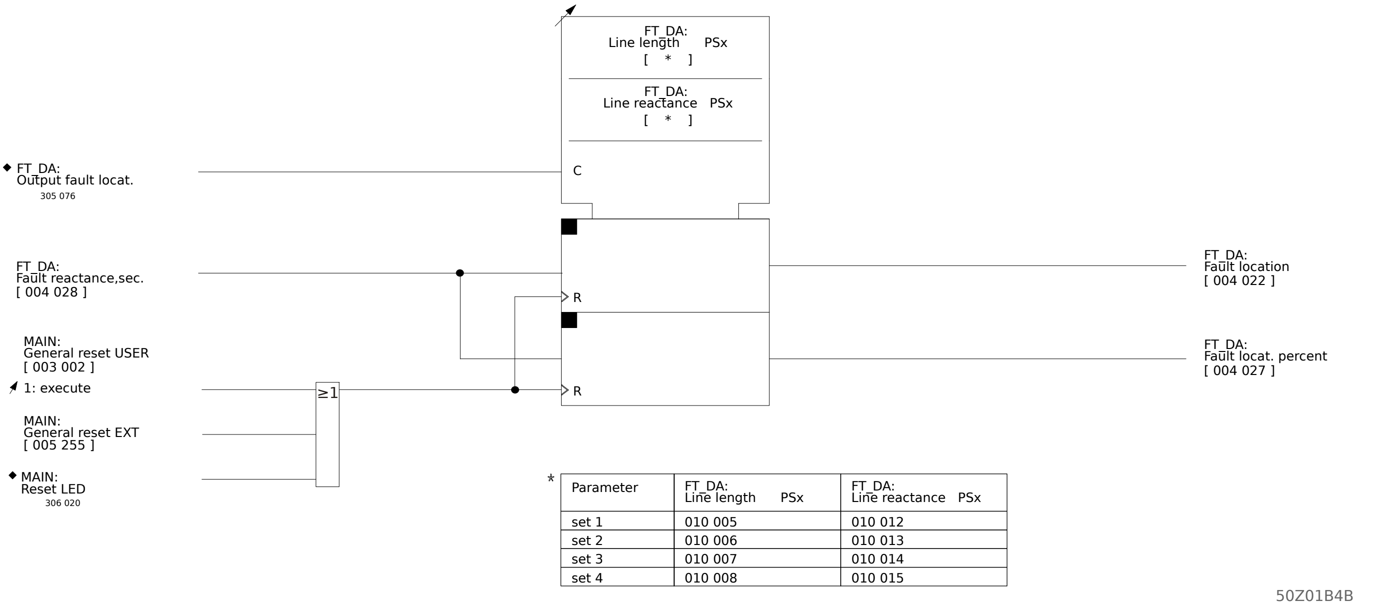


Fig. 3-115: Acquisition of fault data (short circuit data).

3.20.4 Acquisition of Fault Location

In order to determine the fault location as a percentage of the line length and in km, the value of the line reactance, which corresponds to 100% of the monitored line section, as well as the corresponding line length in km, must be set.



Parameter	FT_DA: Line length PSx	FT_DA: Line reactance PSx
set 1	010 005	010 012
set 2	010 006	010 013
set 3	010 007	010 014
set 4	010 008	010 015

Fig. 3-116: Acquisition of fault location.

3.20.5 Fault Data Reset

After pressing the clear key Ⓒ on the local control panel, the fault data value is displayed as *Not measured*. However, the values are not erased and can still be read out through the PC and communication interfaces.

3.21 Fault Recording (Function Group FT_RC)

3.21.1 Start of Fault Recording

A fault exists and fault recording begins if at least one of the following signals is present:

- MAIN: General starting
- MAIN: Gen. trip signal 1
- MAIN: Gen. trip signal 2
- FT_RC: Trigger
- FT_RC: I> triggered

In addition, the user can set a logical “OR” combination of logic signals (*m out of n* parameter) whose appearance will trigger fault recording.

3.21.2 Fault Counting

Faults are counted and identified by sequential numbers.

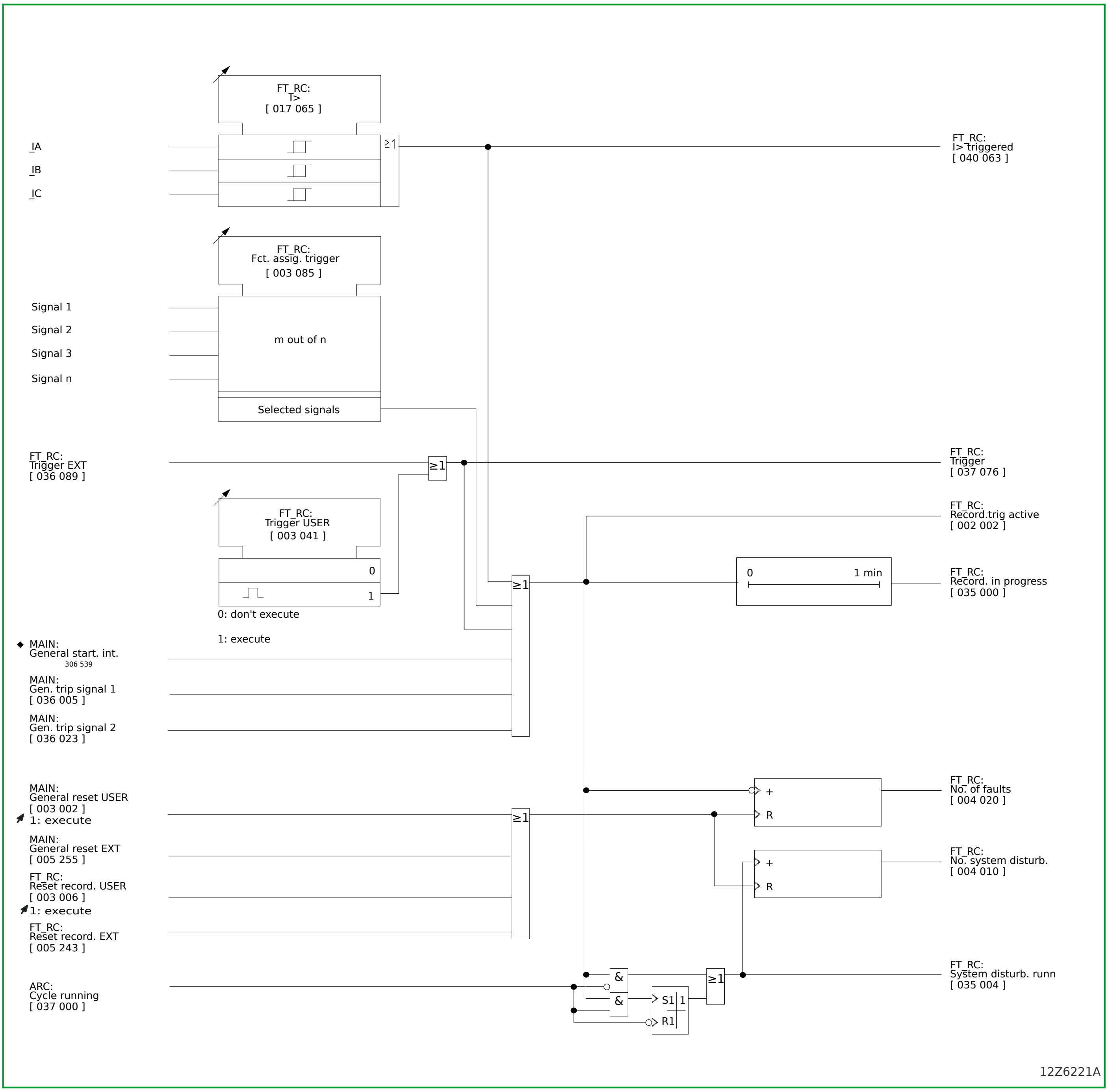


Fig. 3-117: Start of fault recording and fault counter.

3.21.3 Time Tagging

The date that is assigned to each fault by the internal clock is stored. A fault’s individual start or end signals are likewise time-tagged. The date and time assigned to a fault when the fault begins can be read out from the fault memory on the local control panel or through the PC and communication interfaces. The time information (relative to the onset of the fault) that is assigned to the signals can be retrieved from the fault memory or through the PC or communication interfaces.

3.21.4 Fault Recordings

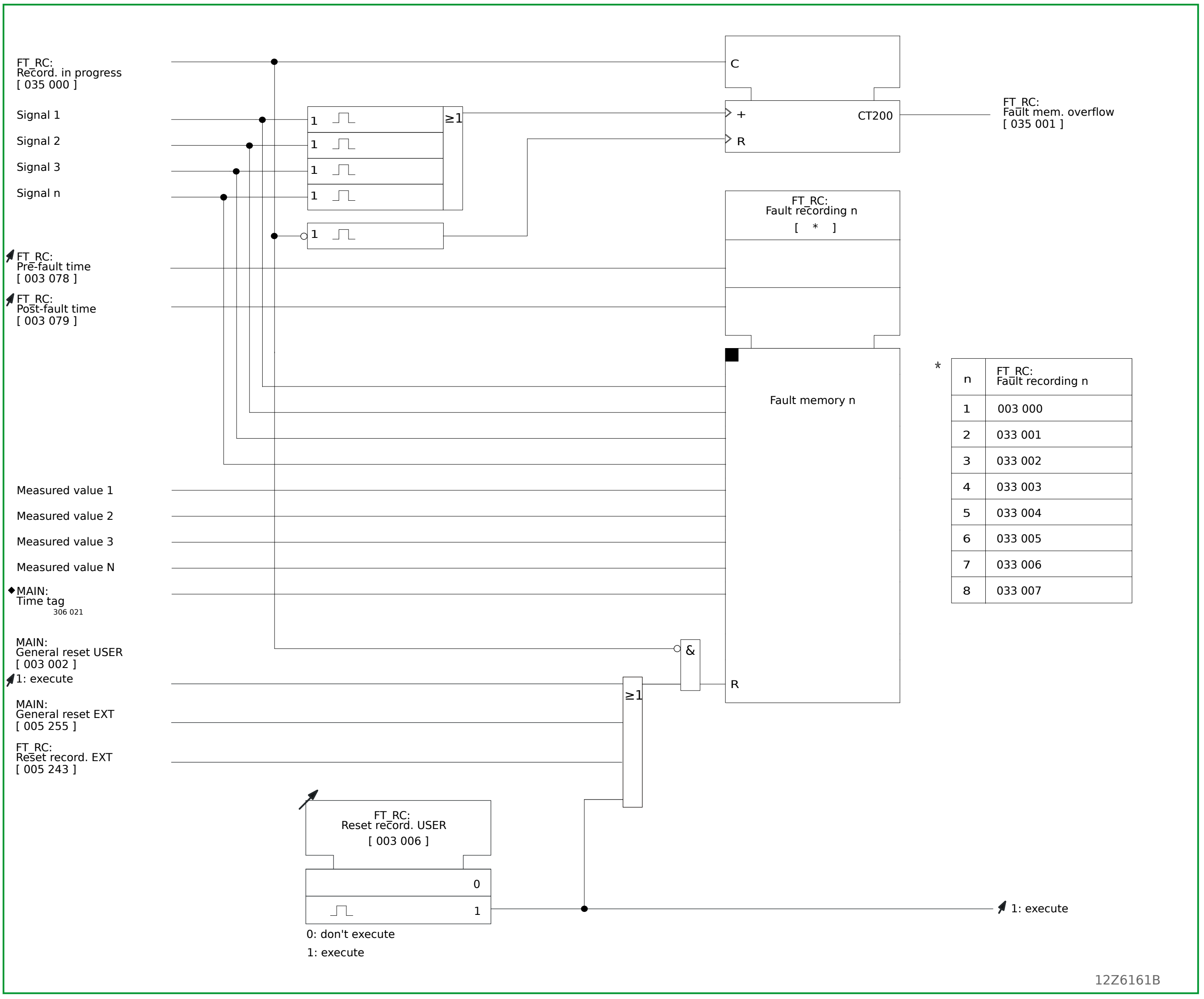


Fig. 3-118: Fault memory.

Protection signals, including the signals during the settable pre-fault and post-fault times, are logged in chronological order with reference to the specific fault. A total of eight faults, each involving a maximum of 200 start or end signals, can be stored in the non-volatile fault memories. After eight faults have been recorded, the oldest fault recording will be overwritten, unless memories have been cleared in the interim. If more than 199 start or end signals have occurred during a single fault, then FT_RC: Fault mem. overflow will be entered as the last signal. If the time and date are changed during the pre-fault time, the signal FT_RC: Faulty time tag is generated.

In addition to the fault signals, the measured fault data will also be entered in the fault memory.

The fault recordings can be read from the local control panel or through the PC or communication interfaces.

3.21.5 Fault Value Recording

The following analog signals are recorded:

- Phase currents
- Phase-to-ground voltages
- Residual current measured by the P139 at the T 4 transformer
- Neutral-point displacement voltage measured by the P139 at the T 90 transformer
- Reference voltage V_{ref} (when a synchrocheck VT is fitted).
- Frequency.

The signals are recorded before, during and after a fault. The window length for oscillography recording before and after the fault can be set. A maximum time period of 16.4 s is available for recording. This period can be divided among a maximum of eight faults. The maximum recording time per fault can be set. If a fault, including the set pre-fault and post-fault times, lasts longer than the set maximum recording time, then recording will terminate when the set maximum recording time is reached.

The pre-fault time is exactly adhered to if it is shorter than the set maximum recording time. Otherwise the pre-fault time is set to the maximum recording time minus a sampling increment, and the post-fault time is set to zero.

If the maximum recording time of 16.4 s is exceeded, the analog values for the oldest fault are overwritten, but not the binary values. If more than eight faults have occurred since the last reset, then all data for the oldest fault are overwritten.

The analog oscillography data of the fault record can only be read out through the PC or communication interfaces.

When the supply voltage is interrupted or after a warm restart, the values of all faults remain stored.

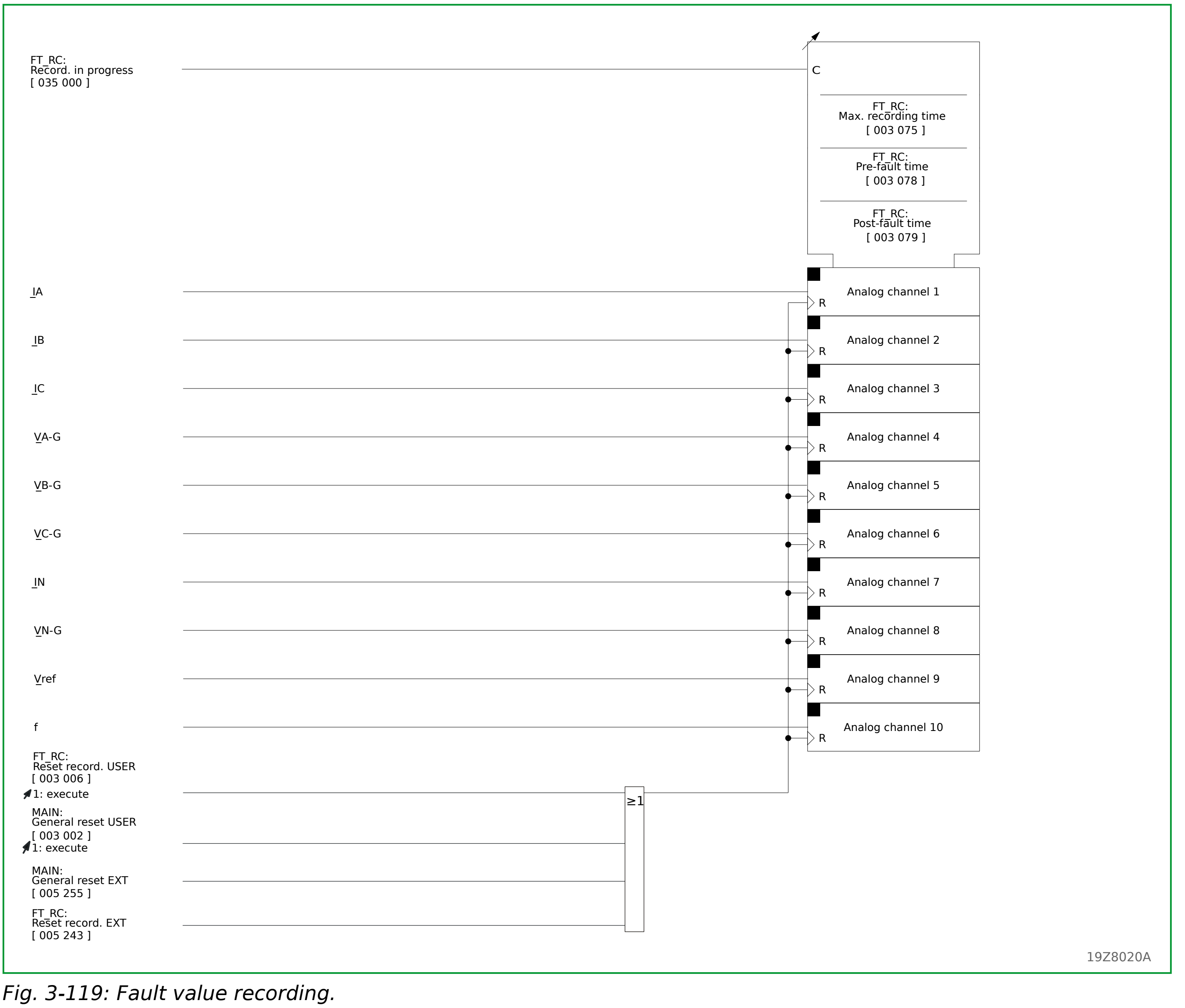


Fig. 3-119: Fault value recording.

3.22 Definite-Time Overcurrent Protection (Function Group DTOC)

A four-stage definite-time overcurrent protection function (DTOC protection) is available in the P139. Three separate measuring systems are available for this purpose for:

- Phase currents system
- Negative-sequence current system
- Residual currents system

Either the inrush stabilization function, the short-circuit direction determination function (SCDD) or the auto-reclosing control may intervene in the functional sequence of the DTOC function.

3.22.1 Enabling or Disabling DTOC Protection

DTOC protection can be disabled or enabled via parameter settings. Moreover, enabling can be carried out separately for each parameter subset.

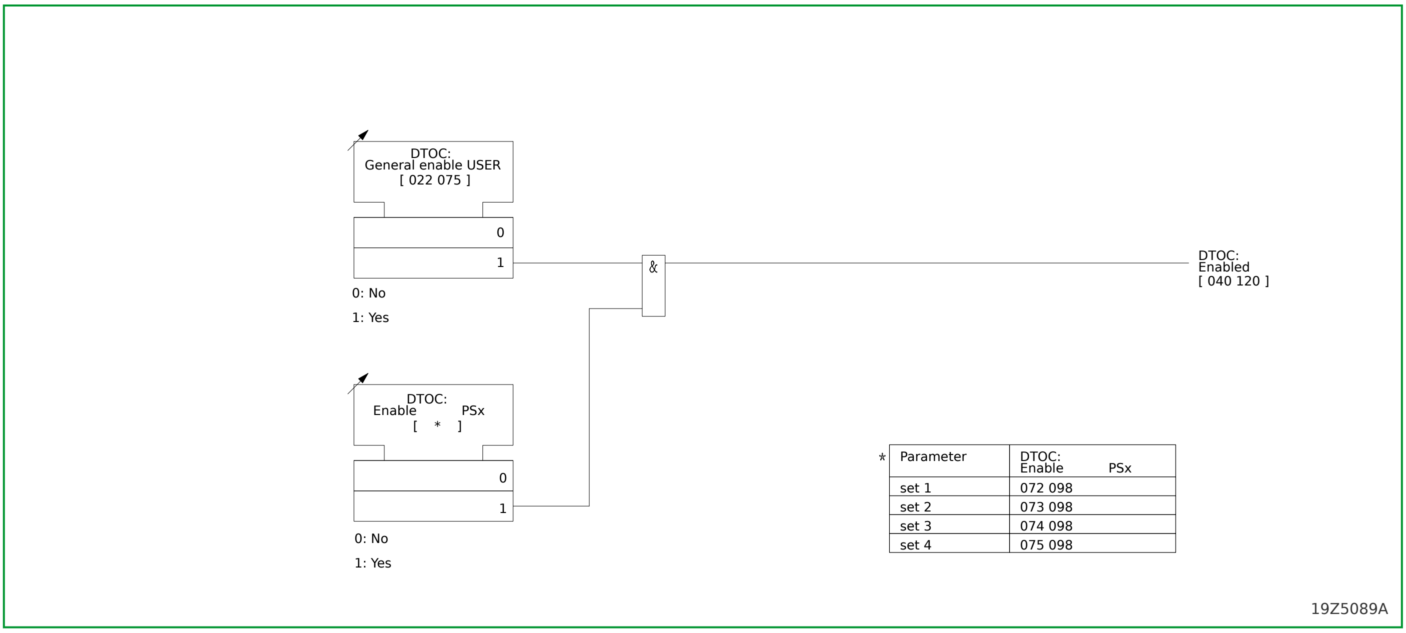


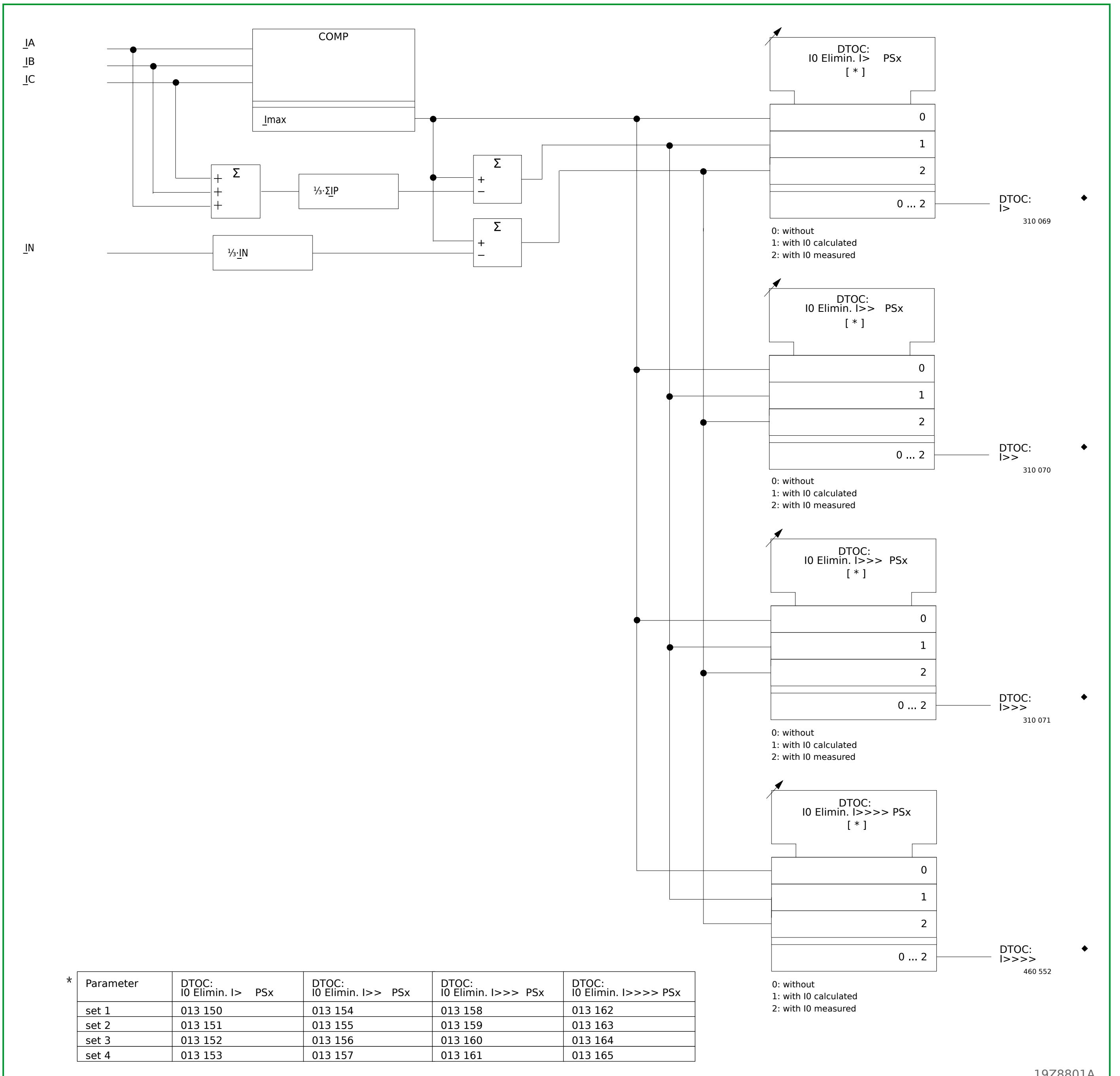
Fig. 3-120: Disabling or enabling DTOC protection.

3.22.2 Selecting the Measured Variable for the Phase Current Stage

A setting specifies which current will be used by the P139 phase overcurrent stages: either the measured phase current is used, or a value where the residual current has been eliminated (I0 elimination).

That is, one of the following currents is used:

- The measured phase current
- The measured phase current shifted by one third of the calculated residual current ($\underline{I}_{max} - \frac{1}{3}\cdot\Sigma\underline{I}_{P}$)
- The measured phase current shifted by one third of the residual current measured at the fourth transformer (T4), i. e. ($\underline{I}_{max} - \frac{1}{3}\cdot\underline{I}_{N}$)



* Parameter	DTOC: I0 Elimin. I> PSx	DTOC: I0 Elimin. I>> PSx	DTOC: I0 Elimin. I>>> PSx	DTOC: I0 Elimin. I>>>> PSx
set 1	013 150	013 154	013 158	013 162
set 2	013 151	013 155	013 159	013 163
set 3	013 152	013 156	013 160	013 164
set 4	013 153	013 157	013 161	013 165

Fig. 3-121: Selecting the measured variable

3.22.3 Phase Current Stages

The three phase currents are monitored by the P139 with four-stage functions to detect when they exceed the set thresholds. Alternatively, two different threshold types can be active. The “dynamic” thresholds are active for the set hold time (see Section 3.11.5, (p. 3-99)) and the “normal” thresholds are active when no hold time is running. If DTOC: Start w. Direct. PSx is set to yes, measured direction should match the set direction, or the starting signal will not issued. If the current exceeds the set thresholds in at least one phase, timer stages are started and after the time periods have elapsed, a signal is issued. The timer stages can be blocked by appropriately configured binary signal inputs.

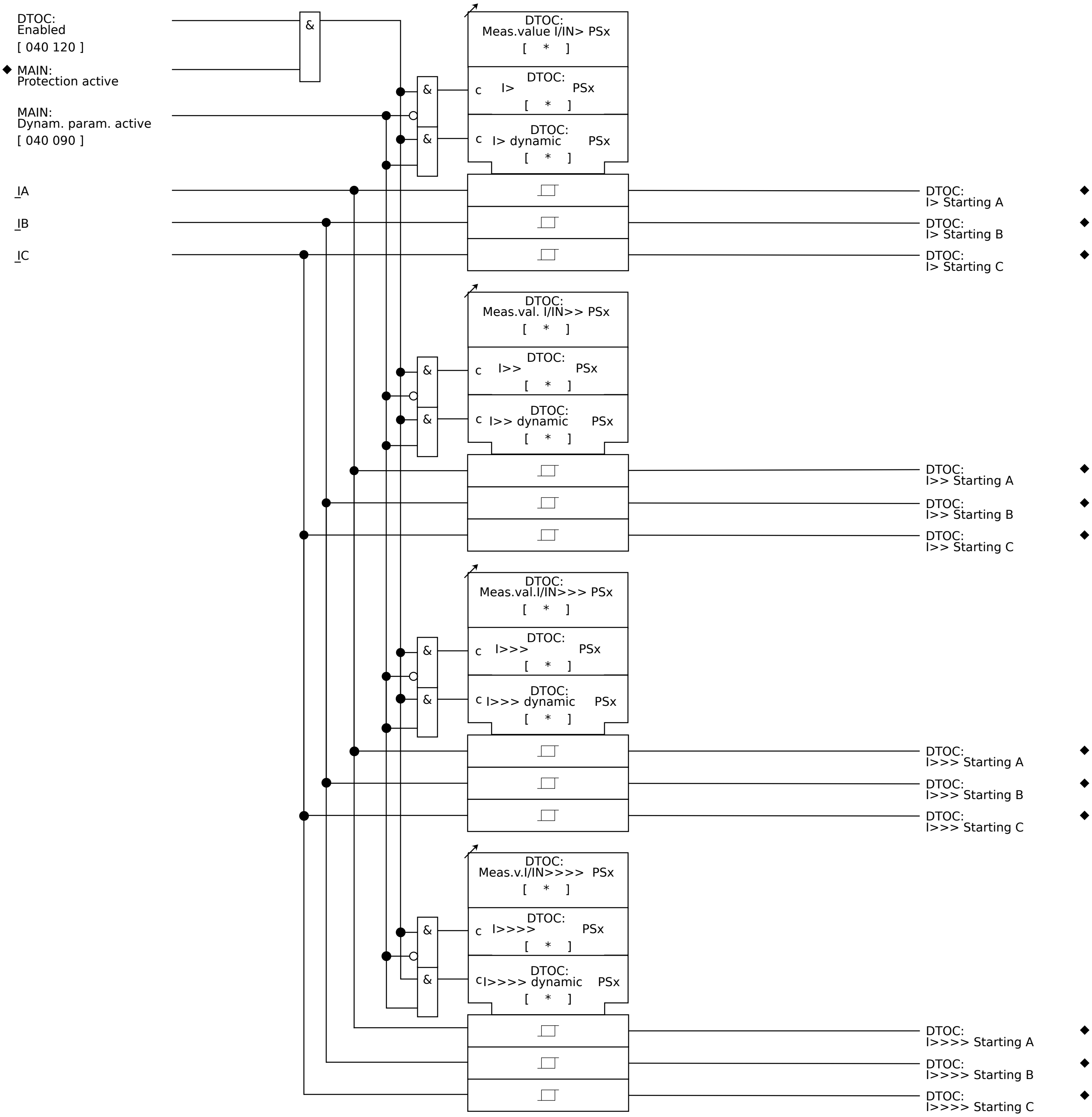
Moreover, an additional voltage check can be optionally activated (except for stage $I_{>>>>}$), which means that in addition to a phase current exceeding its threshold also the voltage in an appropriate measuring loop must fall below a set threshold. This voltage threshold can be set independently for the stages $I_{>}$, $I_{>>}$, $I_{>>>}$, via setting parameters DTOC: V< (I>) PSx or DTOC: V< (I>>) PSx or DTOC: V< (I>>>) PSx, respectively. The setting value Blocked deactivates this type of voltage check for the associated overcurrent stage. Furthermore the voltage check is deactivated if no VTs are fitted to the device or if the voltage measurement circuit is faulty. There is also a settable timer, which is common for the three stages: If the voltage in any of the phase-ground measuring loops falls below its threshold then this timer is started, and the overcurrent starting is not enabled before this timer has elapsed.

There is also a separate setting for each overcurrent stage whether the starting decision shall be based on the fundamental or on the r.m.s. value.

When the inrush stabilization function is triggered, the selected stages of the DTOC function are blocked (see Section 3.11.7.1, (p. 3-101)).

The trip signals from all phase current stages are blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

The trip signals from the DTOC function (stages $I_{>}$, $I_{>>}$, $I_{>>>}$, $I_{>>>>}$, $I_{N>}$, $I_{N>>}$, $I_{N>>>}$, $I_{N>>>>}$) are blocked by the short-circuit direction determination function, if the measured short-circuit direction does not match the set operation direction of stage.



Parameter	DTOC: Meas.value I/IN> PSx	DTOC: I> PSx	DTOC: I> dynamic PSx	DTOC: Meas.val. I/IN>> PSx	DTOC: I>> PSx	DTOC: I>> dynamic PSx
set 1	060 002	017 000	017 080	060 006	017 001	017 084
set 2	060 003	073 007	073 032	060 007	073 008	073 033
set 3	060 004	074 007	074 032	060 008	074 008	074 033
set 4	060 005	075 007	075 032	060 009	075 008	075 033

Parameter	DTOC: Meas.val.I/IN>>> PSx	DTOC: I>>> PSx	DTOC: I>>> dynamic PSx	DTOC: Meas.v.I/IN>>>> PSx	DTOC: I>>>> PSx	DTOC: I>>>> dynamic PSx
set 1	060 010	017 002	017 085	060 014	016 149	016 153
set 2	060 011	073 009	073 034	060 015	016 150	016 154
set 3	060 012	074 009	074 034	060 016	016 151	016 155
set 4	060 013	075 009	075 034	060 017	016 152	016 156

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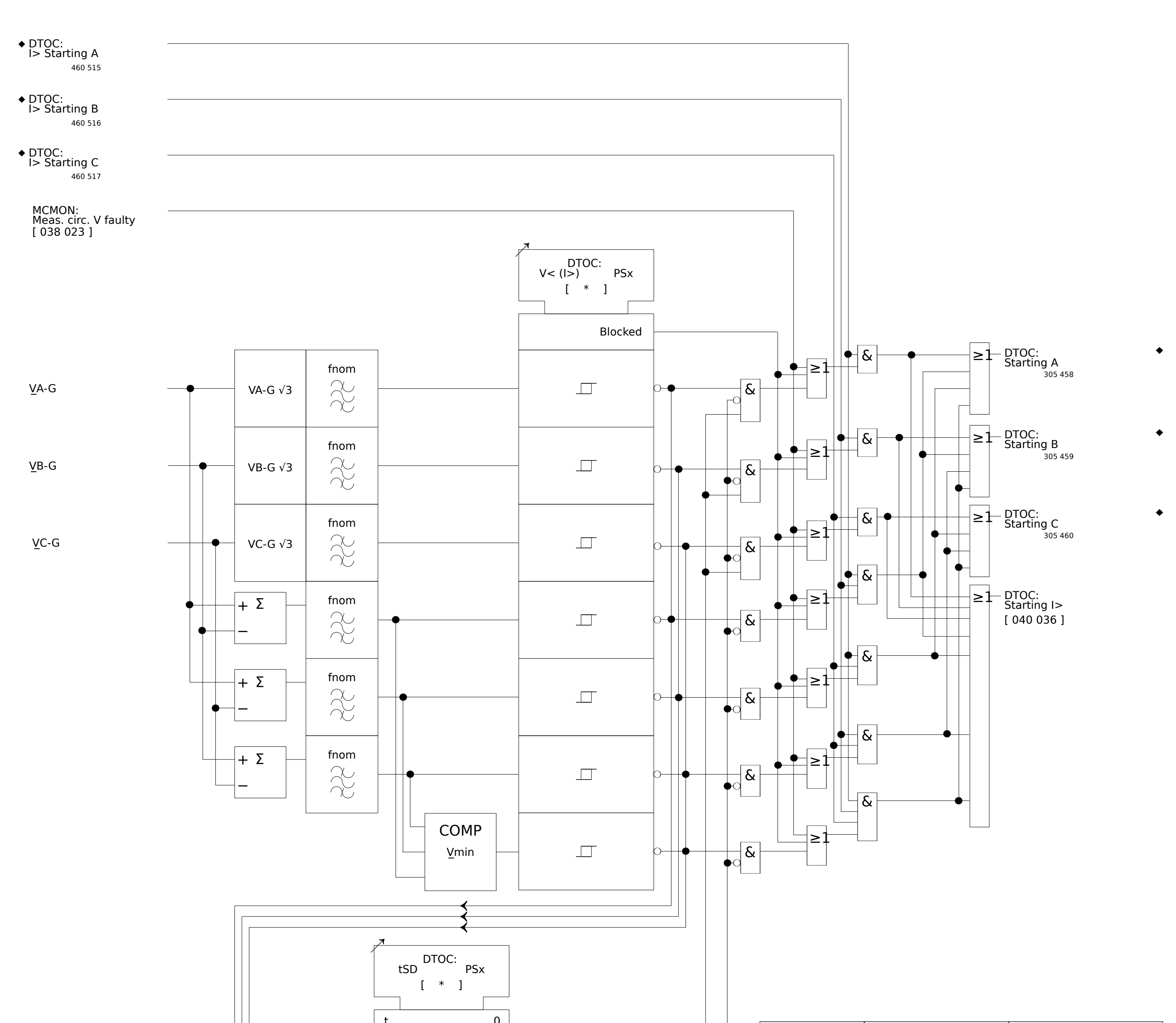
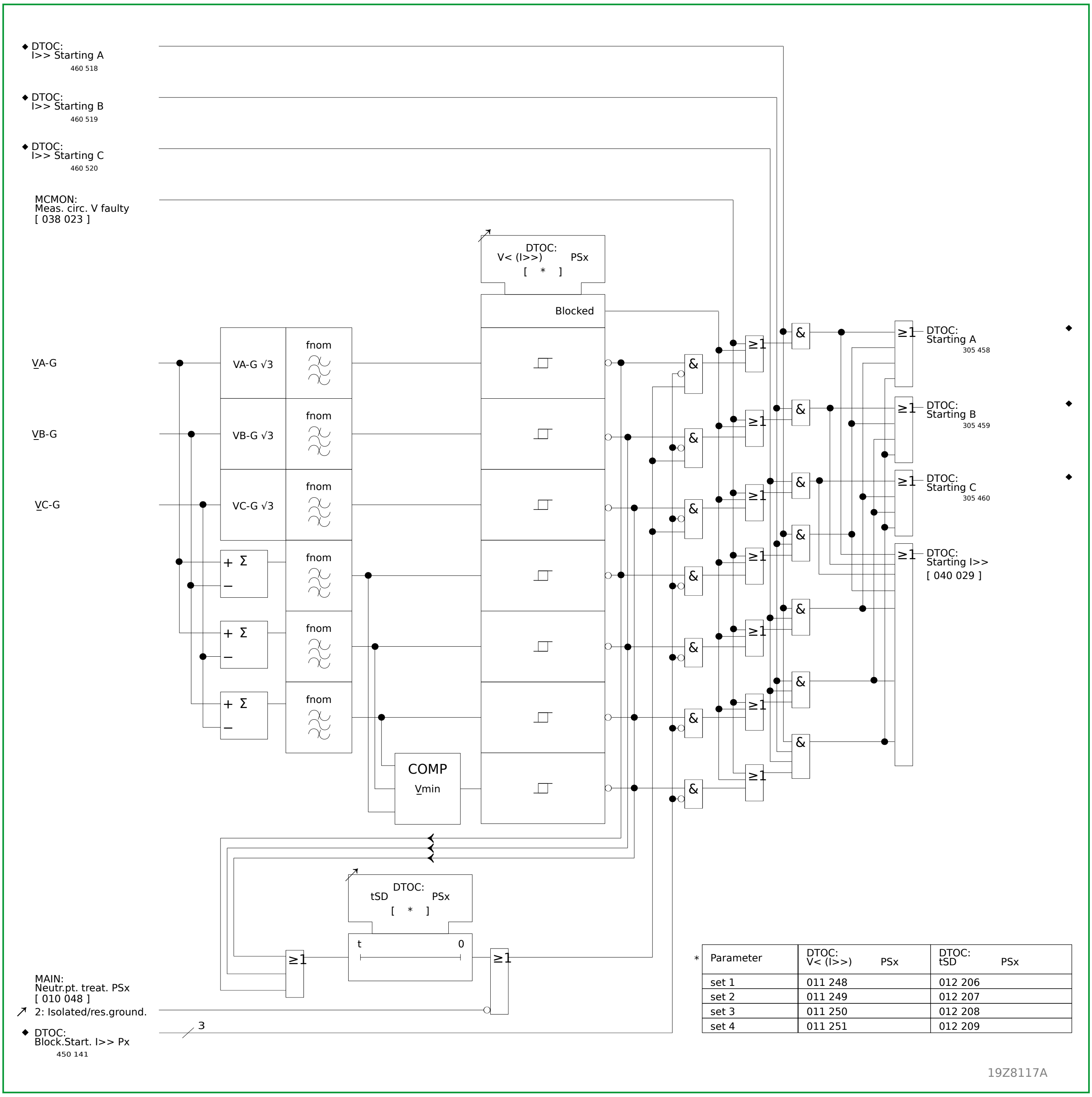
Fig. 3-122: Phase current stages, internal overcurrent startings.



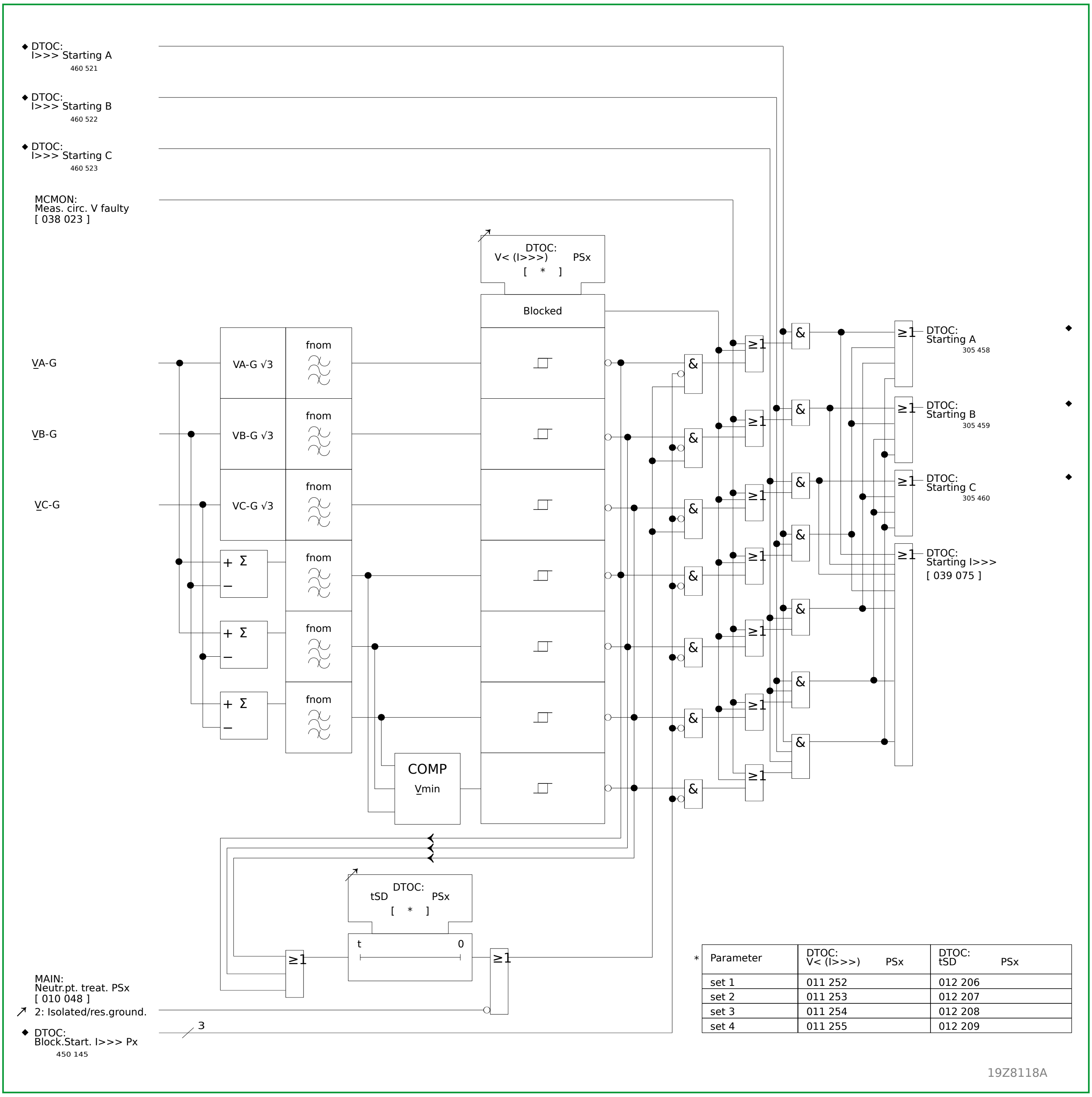
* Parameter	DTOC: V< (I>) PSx	DTOC: tSD PSx
set 1	011 244	012 206
set 2	011 245	012 207
set 3	011 246	012 208
set 4	011 247	012 209

Fig. 3-123: Phase current stages, optional voltage check and blocking by inrush stabilization, stage I>.



* Parameter	DTOC: V< (I>>) PSx	DTOC: tSD PSx
set 1	011 248	012 206
set 2	011 249	012 207
set 3	011 250	012 208
set 4	011 251	012 209

Fig. 3-124: Phase current stages, optional voltage check and blocking by inrush stabilization, stage I>>.



* Parameter	DTOC: V< (I>>>) PSx	DTOC: tSD PSx
set 1	011 252	012 206
set 2	011 253	012 207
set 3	011 254	012 208
set 4	011 255	012 209

Fig. 3-125: Phase current stages, optional voltage check and blocking by inrush stabilization, stage I>>>.

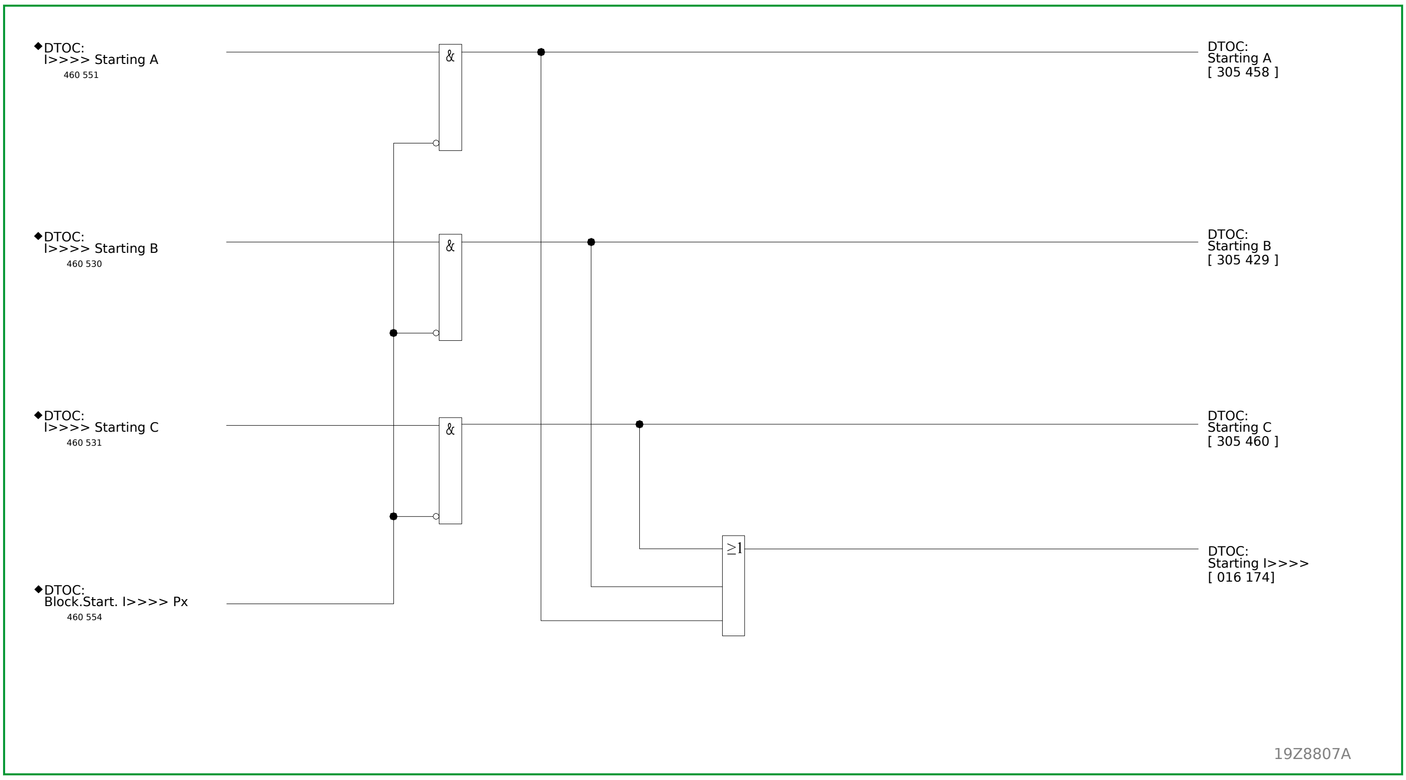
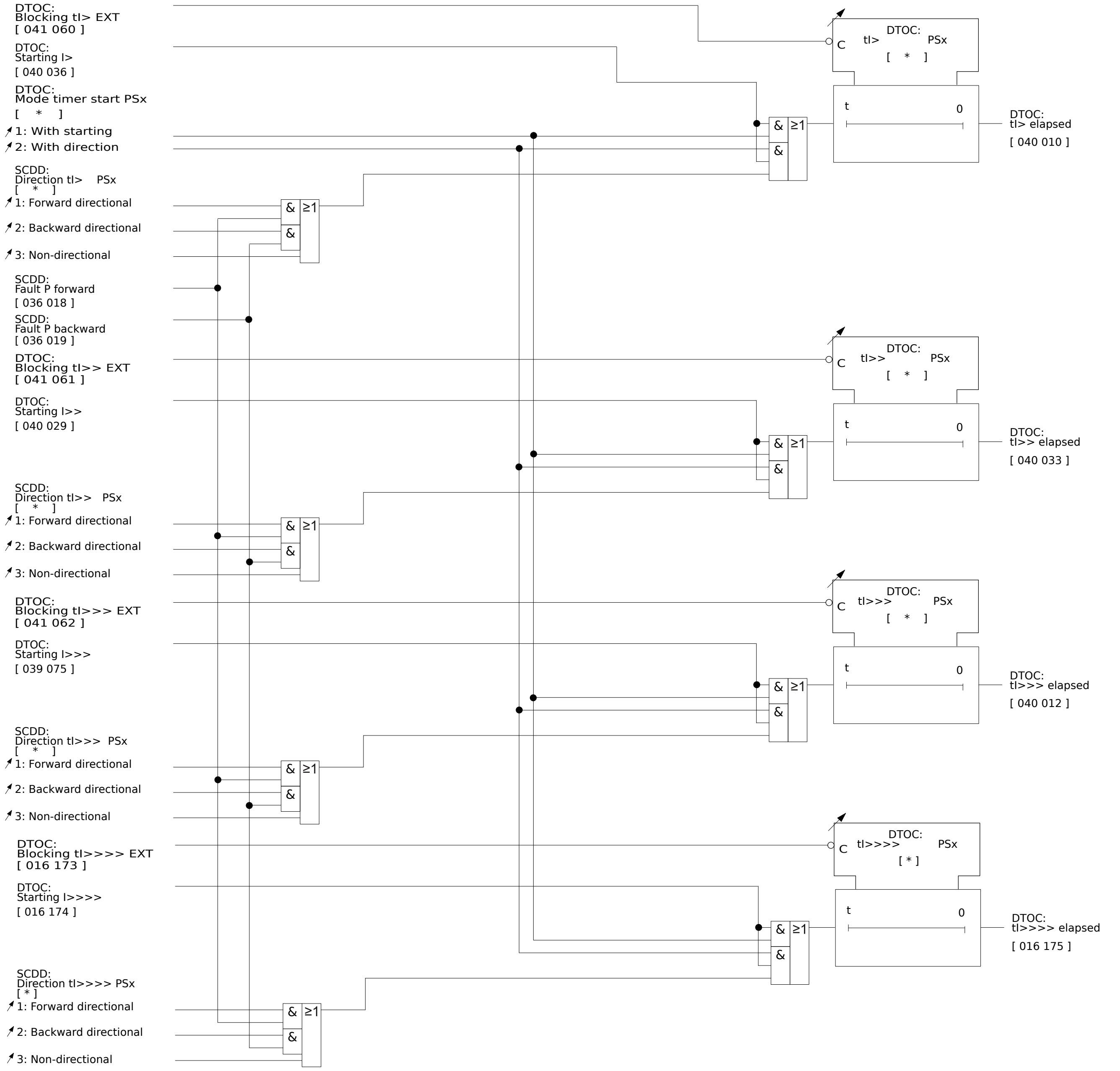


Fig. 3-126: Phase current stages, blocking by inrush stabilization, stage I>>>>.



* Parameter	DTOC: tI> PSx	DTOC: Mode timer start PSx	SCDD: Direction tI> PSx	DTOC: tI>> PSx	SCDD: Direction tI>> PSx
set 1	017 004	002 138	017 071	017 006	017 072
set 2	073 019	002 139	077 237	073 020	077 238
set 3	074 019	002 142	078 237	074 020	078 238
set 4	075 019	002 143	079 237	075 020	079 238

* Parameter	DTOC: tI>>> PSx	SCDD: Direction tI>>> PSx	DTOC: tI>>>> PSx	SCDD: Direction tI>>>> PSx
set 1	017 007	007 230	016 157	016 177
set 2	073 021	007 231	016 158	016 178
set 3	074 021	007 232	016 159	016 179
set 4	075 021	007 233	016 160	016 180

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Fig. 3-127: Phase current stages, timers and SCDD dependency.

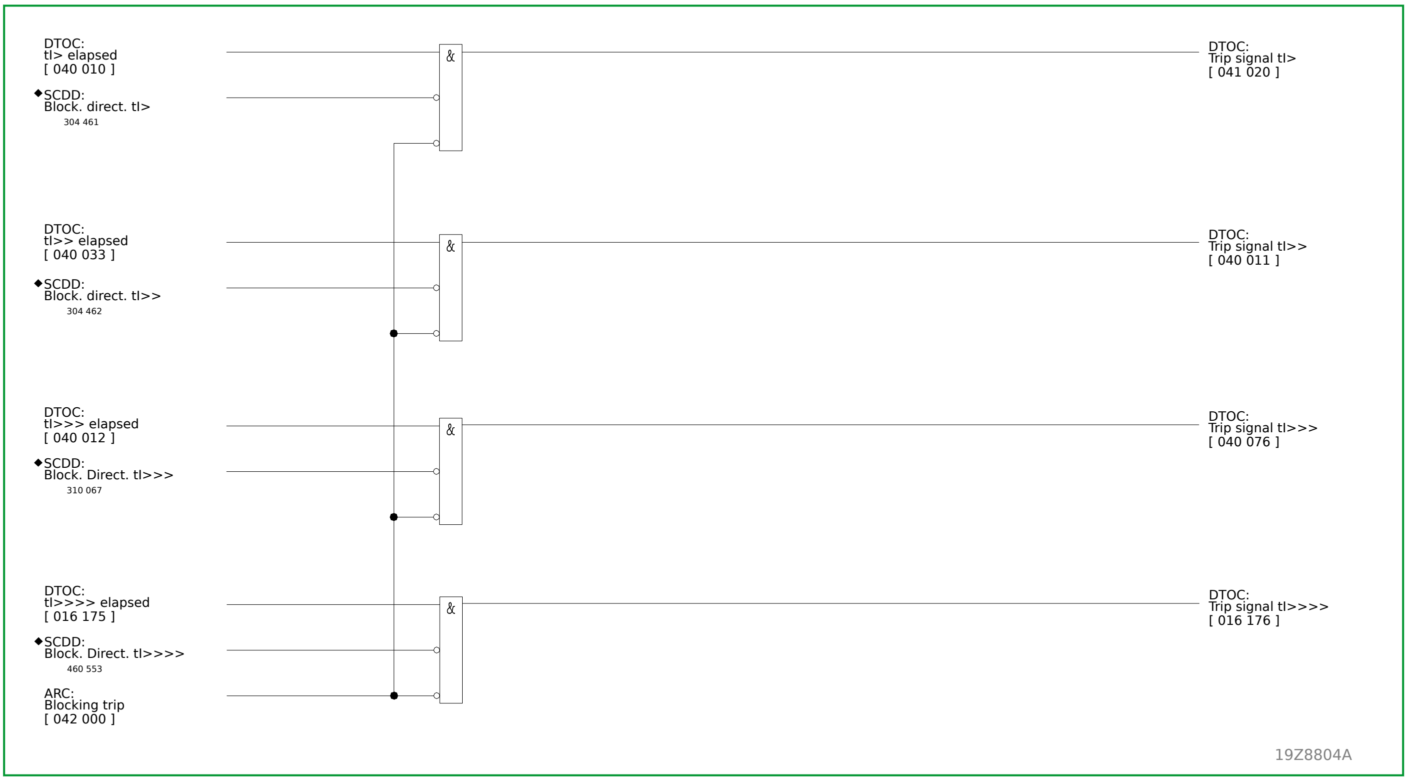


Fig. 3-128: Trip signals from the DTOC phase current stages.

3.22.4 Negative-Sequence Current Stages

The P139 calculates the negative-sequence current from the three phase current values according to this formula. The result depends on the MAIN: Phase sequence setting.

Phase sequence A-B-C

- (Alternative terminology: clockwise rotating field)

  $$\underline{I}_{\text{neg}} = \frac{1}{3} \cdot \left| (\underline{I}_{\text{A}} + \underline{a}^2 \cdot \underline{I}_{\text{B}} + \underline{a} \cdot \underline{I}_{\text{C}}) \right|$$

Phase sequence A-C-B

- (Alternative terminology: anti-clockwise rotating field)

  $$\underline{I}_{\text{neg}} = \frac{1}{3} \cdot \left| (\underline{I}_{\text{A}} + \underline{a} \cdot \underline{I}_{\text{B}} + \underline{a}^2 \cdot \underline{I}_{\text{C}}) \right|$$

- Symbols used:

  $$\underline{a} = e^{2\pi j/3} = e^{j \cdot 120°}$$

  $$\underline{a}^2 = e^{4\pi j/3} = e^{j \cdot 240°}$$

The negative-sequence current is monitored by the P139 with four-stage functions to detect when it exceeds the set thresholds. Alternatively, two different threshold types can be active. The “dynamic” thresholds are active for the set hold time for the “dynamic parameters” (see Section 3.11.5, (p. 3-99)) and the “normal” thresholds are active when no hold time is running. If the current exceeds the set thresholds, timer stages are started and after the time periods have elapsed, a trip signal is issued.

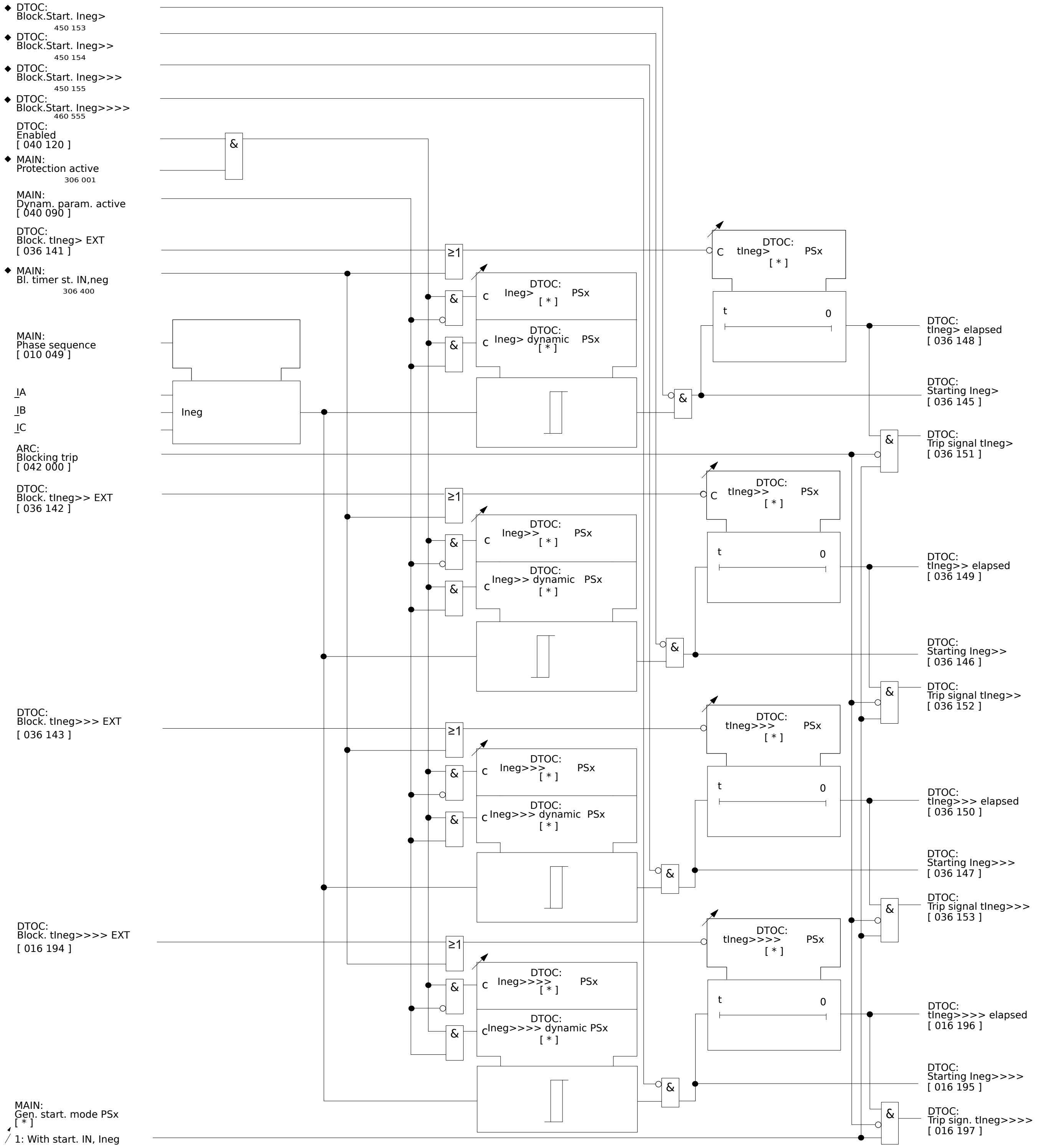
The timer stages can be blocked by appropriately configured binary signal inputs. In addition these timer stages can also be automatically blocked by single-pole or multi-pole starting (depending on the setting).

The trip signals from the negative-sequence current stages are only enabled if the operating mode for the general starting has been set to *With start. IN, Ineg*.

When the inrush stabilization function (see Section 3.11.7, (p. 3-100)) is triggered, the 1st stage of the negative-sequence current function is blocked.

When the short-circuit direction determination function (SCDD) is active, trip signals from the DTOC negative-sequence current stages have no directional dependence.

The trip signals from all negative-sequence current stages are blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.



* Parameter	DTOC: Ineg> PSx	DTOC: Ineg> dynamic PSx	DTOC: tIneg> PSx	DTOC: Ineg>> PSx	DTOC: Ineg>> dynamic PSx	DTOC: tIneg>> PSx	MAIN: Gen. start. mode PSx
set 1	072 011	076 200	072 023	072 012	076 201	072 024	017 027
set 2	073 011	077 200	073 023	073 012	077 201	073 024	001 219
set 3	074 011	078 200	074 023	074 012	078 201	074 024	001 220
set 4	075 011	079 200	075 023	075 012	079 201	075 024	001 221

* Parameter	DTOC: Ineg>>> PSx	DTOC: Ineg>>> dynamic PSx	DTOC: tIneg>>> PSx	DTOC: Ineg>>>> PSx	DTOC: Ineg>>>> dynamic PSx	DTOC: tIneg>>>> PSx
set 1	072 013	076 202	072 025	016 161	016 165	016 169
set 2	073 013	077 202	073 025	016 162	016 166	016 170
set 3	074 013	078 202	074 025	016 163	016 167	016 171
set 4	075 013	079 202	075 025	016 164	016 168	016 172

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Fig. 3-129: Negative-sequence current stages.

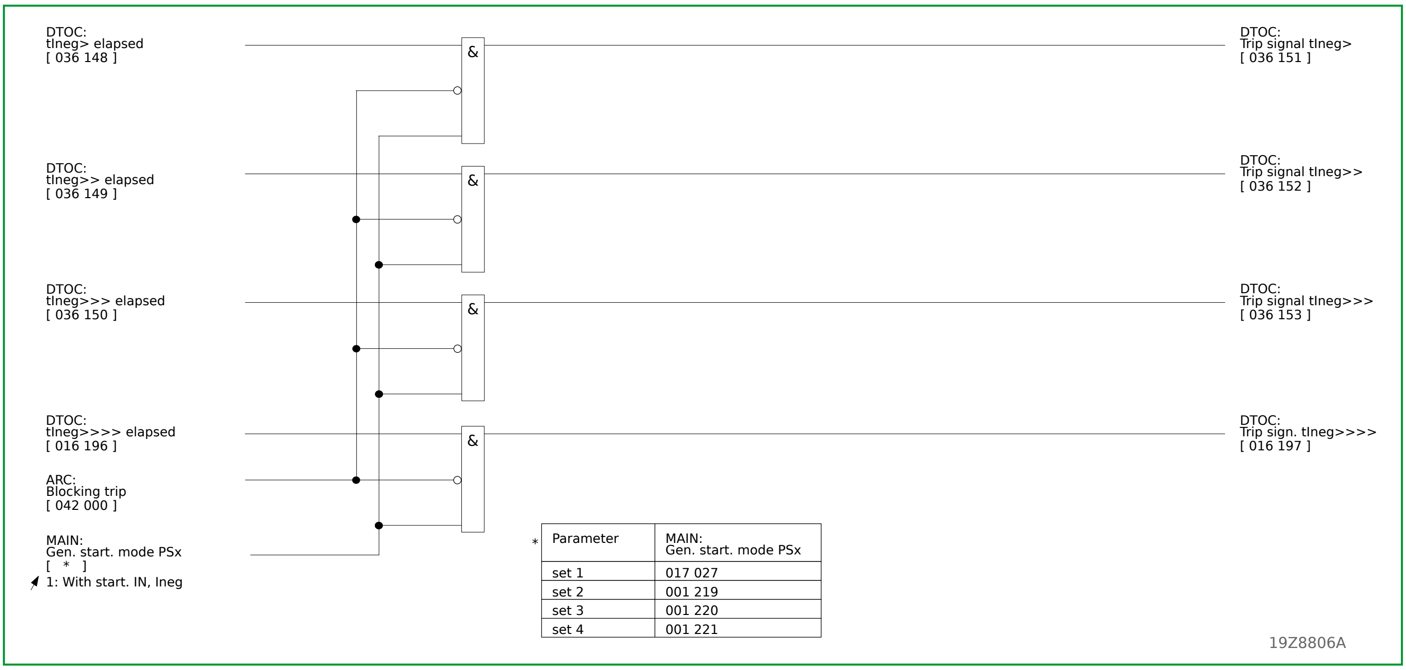


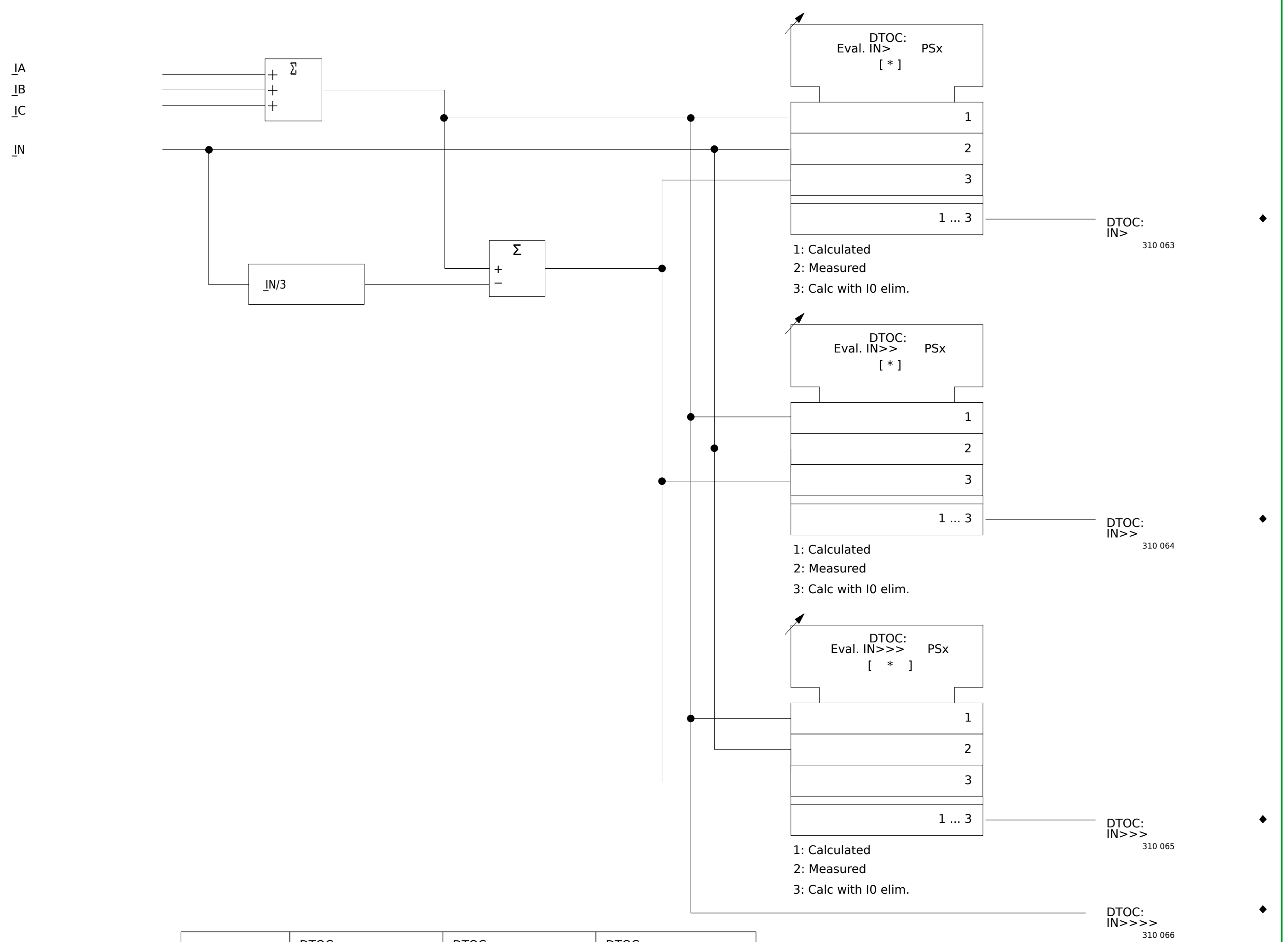
Fig. 3-130: Trip signals from the DTOC negative-sequence current stages.

3.22.5 Enabling or Disabling DTOC Residual Current Stages

DTOC residual current stages can be disabled or enabled via setting parameters or through binary signal inputs.

3.22.6 Selecting the Measured Variable for the Residual Current Stage

A setting specifies which current will be used by the P139 as the residual current of the stages IN>, IN>> and IN>>>: either the residual current calculated from the three phase currents or the residual current directly measured at the fourth transformer (T 4), or the residual current calculated with I0 elimination ($\Sigma \underline{I}_P - ⅓\cdot\underline{I}_N$). For the IN>>>> stage, always the calculated residual current is used.



* Parameter	DTOC: Eval. IN> PSx	DTOC: Eval. IN>> PSx	DTOC: Eval. IN>>> PSx
set 1	072 128	007 239	007 243
set 2	073 128	007 240	007 244
set 3	074 128	007 241	007 245
set 4	075 128	007 242	007 246

Fig. 3-131: Selecting the measured variable

3.22.7 Residual Current Stages

The residual current is monitored by the P139 with four-stage functions to detect when it exceeds the set thresholds. Alternatively, two different threshold types can be active. The “dynamic” thresholds are active for the set hold time (see Section 3.11.5, (p. 3-99)) and the “normal” thresholds are active when no hold time is running. If the residual current exceeds the set thresholds, timer stages are started and after the time periods have elapsed, a signal is issued.

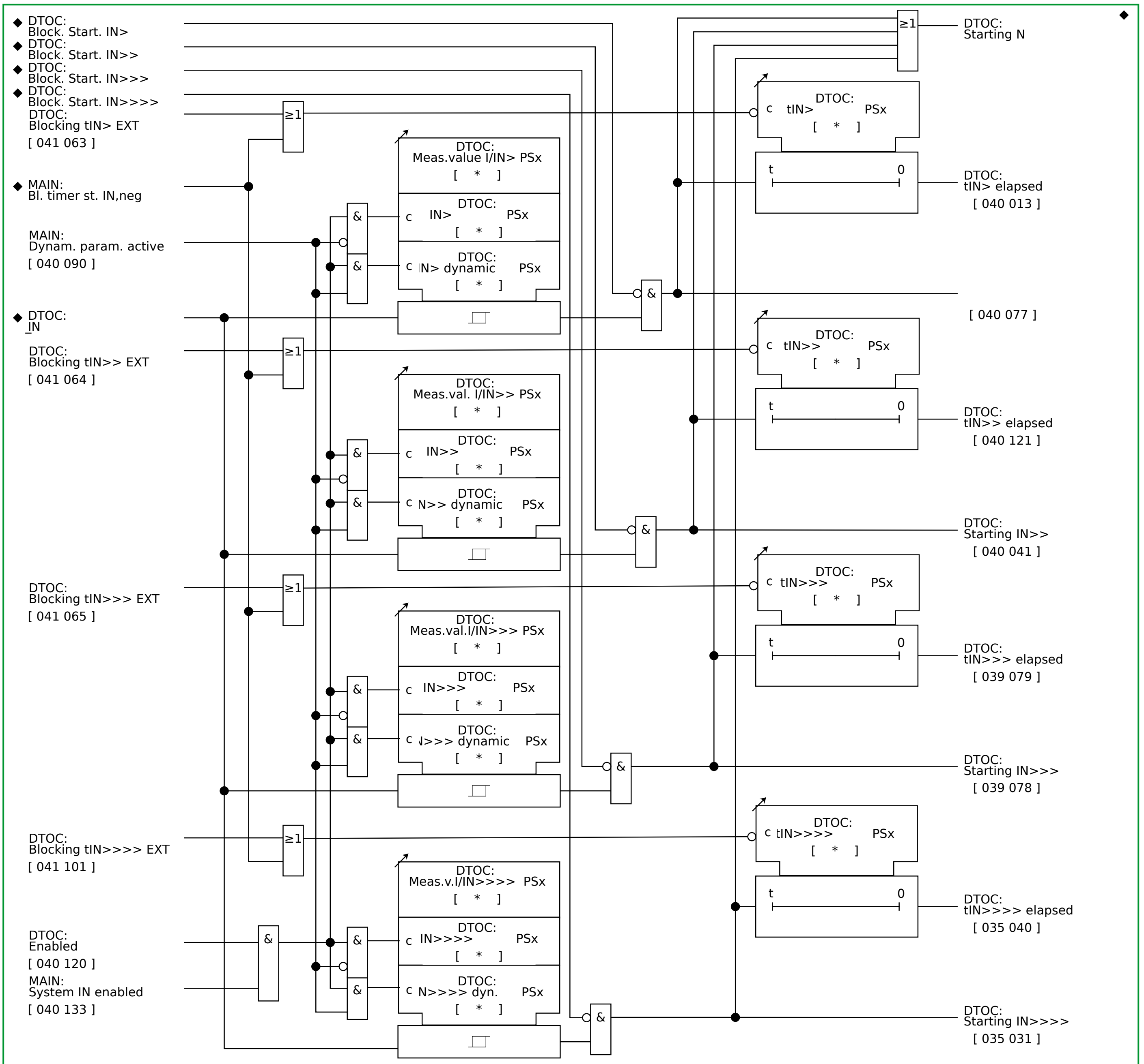
The timer stages can be blocked by appropriately configured binary signal inputs. In addition these timer stages can also be automatically blocked by single-pole or multi-pole starting (depending on the setting).

There is also a separate setting for each residual current stage whether the starting decision shall be based on the fundamental or on the r.m.s. value.

The trip signals from the residual current stages are only enabled if the operating mode for the general starting has been set to *With start. IN, Ineg*.

The trip signals from all residual current stages are blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

The trip signals from the DTOC function (stages IN> and IN>> only) can be blocked by the short-circuit direction determination function (SCDD). Depending on the setting of the short-circuit direction determination function, the trip signal of stages IN> or IN>> will be enabled.



Parameter	DTOC: tIN> PSx	DTOC: Meas.value I/IN> PSx	DTOC: IN> PSx	DTOC: IN> dynamic PSx	DTOC: tIN>> PSx	DTOC: Meas.val. I/IN>> PSx
set 1	017 008	060 002	017 003	017 081	017 010	060 006
set 2	073 027	060 003	073 015	073 035	073 028	060 007
set 3	074 027	060 004	074 015	074 035	074 028	060 008
set 4	075 027	060 005	075 015	075 035	075 028	060 009

Parameter	DTOC: IN>> PSx	DTOC: IN>> dynamic PSx	DTOC: tIN>>> PSx	DTOC: Meas.val.I/IN>>> PSx	DTOC: IN>>> PSx	DTOC: IN>>> dynamic PSx
set 1	017 009	017 086	017 019	060 010	017 018	017 087
set 2	073 016	073 036	073 029	060 011	073 017	073 037
set 3	074 016	074 036	074 029	060 012	074 017	074 037
set 4	075 016	075 036	075 029	060 013	075 017	075 037

Parameter	DTOC: tIN>>>> PSx	DTOC: Meas.v.I/IN>>>> PSx	DTOC: IN>>>> PSx	DTOC: IN>>>> dyn. PSx
set 1	072 030	060 014	072 018	072 036
set 2	073 030	060 015	073 018	072 105
set 3	074 030	060 016	074 018	072 202
set 4	075 030	060 017	075 018	072 219

19Z8383A

Fig. 3-132: Residual current stages.

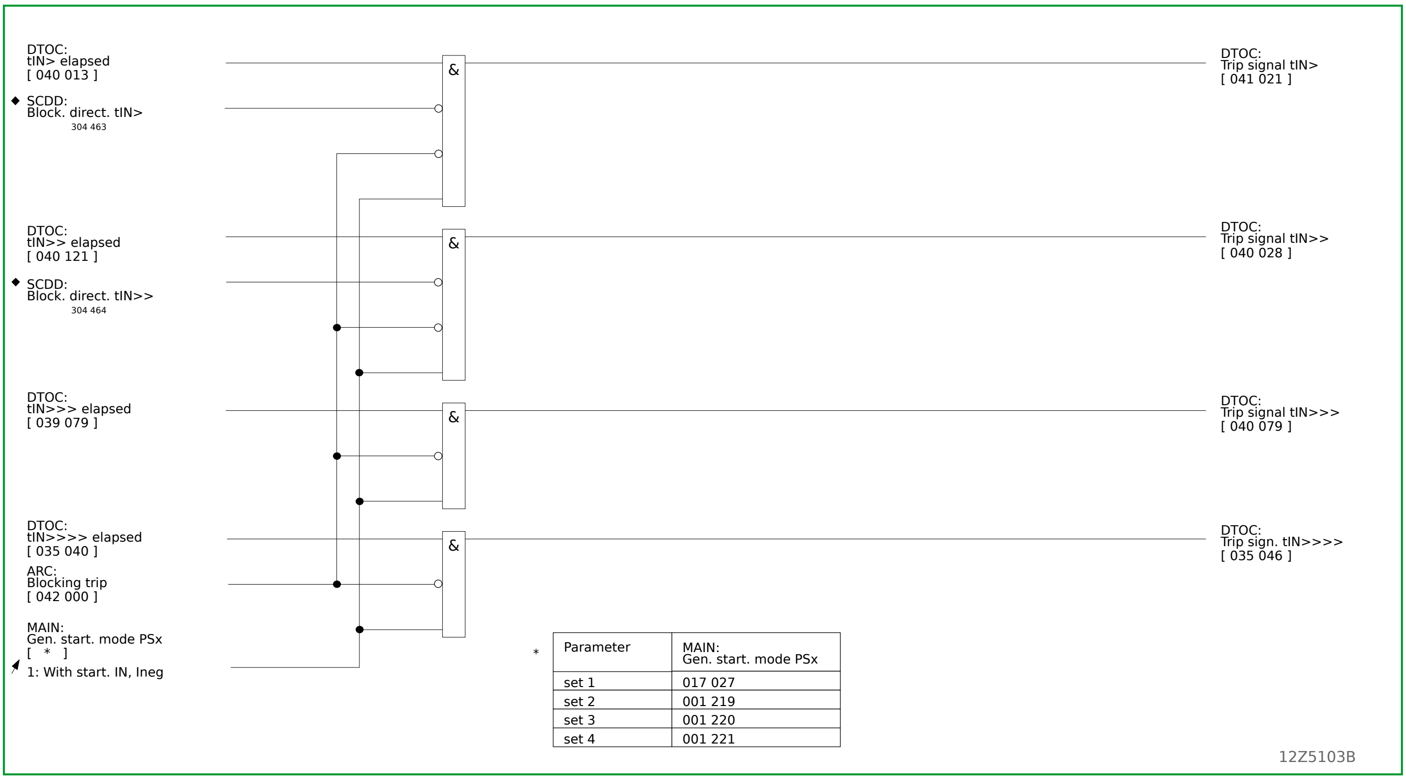


Fig. 3-133: Trip signal from the DTOC residual current stages.

3.22.8 Sensitive Ground Fault Protection (SEF) in Systems with High Ground Fault Resistance

The P139 digitizes the measured neutral current twice, with standard dynamic range ($16 \cdot I_{N,nom}$) and with sensitive dynamic range ($2 \cdot I_{N,nom}$). The latter range is specifically designed for highly sensitive ground fault current detection.

This sensitive neutral current input is managed by the protection firmware, depending on the threshold settings of the ground fault stages (see table below).

However, two setting-related constraints have to be considered for SEF applications:

- The settings for the evaluation of the ground fault current (DTOC: Eval. IN> PSx, DTOC: Eval. IN>> PSx, DTOC: Eval. IN>>> PSx) must be set to *Measured*.

  The SEF characteristic will not be achieved with calculated values, even if threshold settings are low.
- The threshold setting of earth fault stages must be below the maximum values listed in the table below. For threshold settings above this maximum limit, the standard ground fault characteristic will be dynamically adapted.

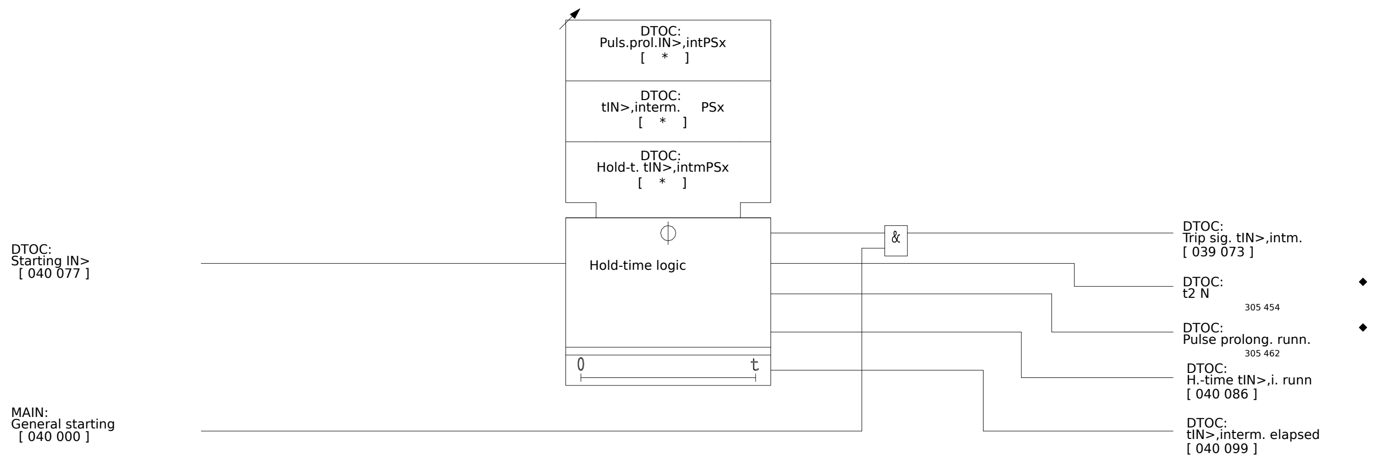
Stage	Time Characteristic	Setting Range for the SEF Application	
		Minimum	Maximum
DTOC: Eval. IN> PSx	definite	$0.002 \cdot I_{N,nom}$	$2.00 \cdot I_{N,nom}$
DTOC: Eval. IN>> PSx	definite	$0.002 \cdot I_{N,nom}$	$2.00 \cdot I_{N,nom}$
DTOC: Eval. IN>>> PSx	definite	$0.002 \cdot I_{N,nom}$	$2.00 \cdot I_{N,nom}$

Independent of the specific sensitive current measurement for SEF application, the ground fault stages maintain all capabilities of standard short-circuit protection functions, as previously described (Section 3.22.7, (p. 3-170)).

3.22.9 Hold-Time Logic for Intermittent Ground Faults

A hold-time logic for the treatment of intermittent ground faults is available in the P139.

- As the IN> starting in the residual current stage commences, the hold time is reset. At the same time, the starting time is accumulated when IN> starting commences.
- As IN> starting ends, the timer stage DTOC: Puls.prol.IN>,intPSx is started and the charging of the accumulation buffer is thereby lengthened by the set value of the timer stage.
- The accumulation result is compared to the settable limit value at DTOC: tIN>,interm. PSx.
- If the limit value is reached and a general starting is present, then a trip results, provided that it is permitted by the relevant MAIN settings:
  - MAIN: Bl.tim.st.IN,neg PSx (Address 017 015)
  - MAIN: Gen. start. mode PSx (Address 017 027)
  - MAIN: Fct.assig.trip cmd.1 (Address 021 001)
  - MAIN: Fct.assig.trip cmd.2 (Address 021 002)
- If the limit value is reached while the timer stage DTOC: Puls.prol.IN>,intPSx is running, then a trip will occur when the next general starting phase commences.
- With each release of the trigger stage IN>, the set hold-time DTOC: Hold-t. tIN>,intmPSx is restarted. When the hold time has elapsed or after the hold-time logic has issued a trip (DTOC: Trip sig. tIN>,intm.) accumulation is stopped and the accumulation buffer is cleared.



* Parameter	DTOC: Puls.prol.IN>,intPSx	DTOC: tIN>,interm. PSx	DTOC: Hold-t. tIN>,intmPSx
set 1	017 055	017 056	017 057
set 2	073 042	073 038	073 039
set 3	074 042	074 038	074 039
set 4	075 042	075 038	075 039

19Z5019A

Fig. 3-134: Hold-time logic for definite-time characteristics.

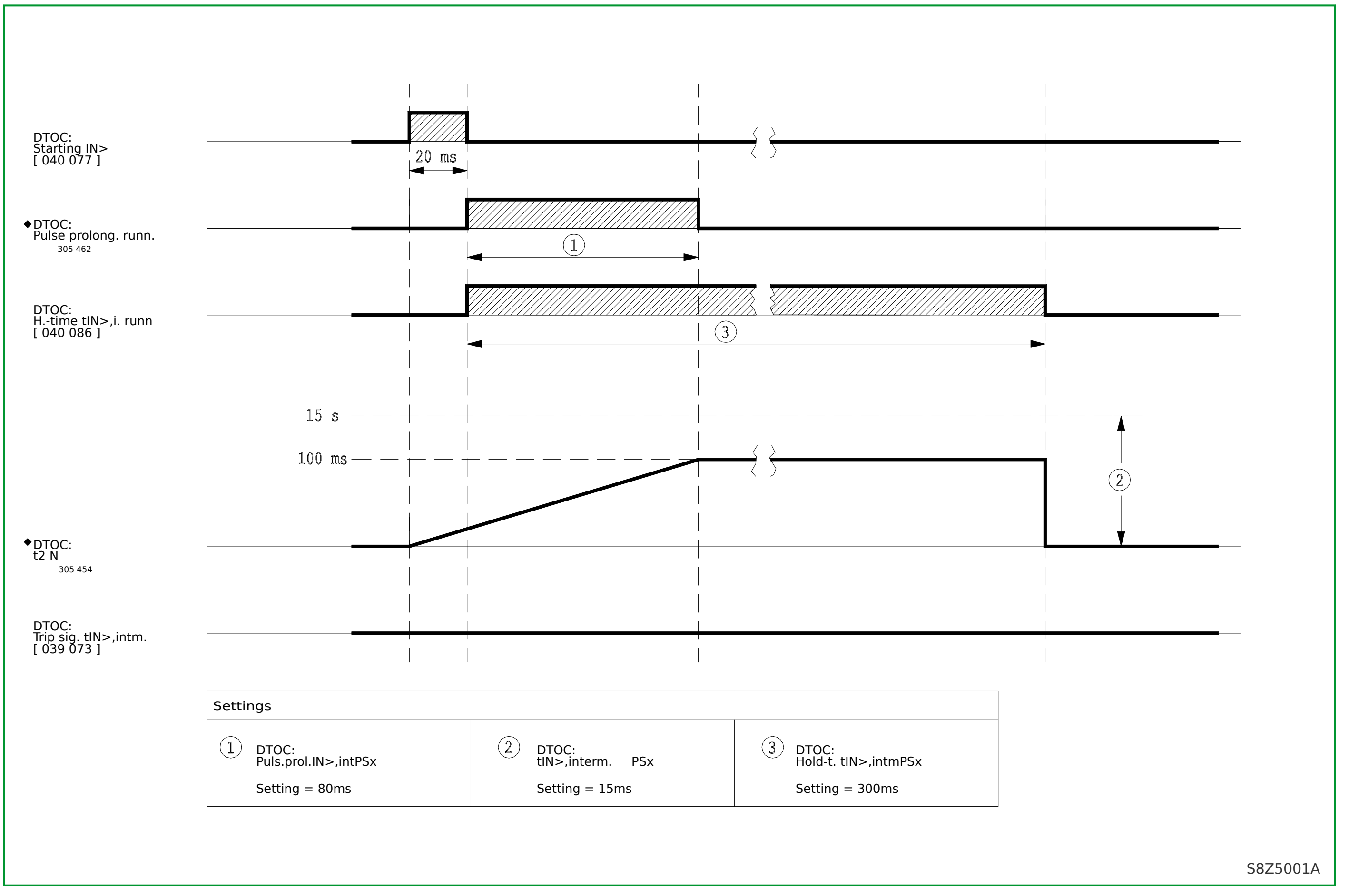
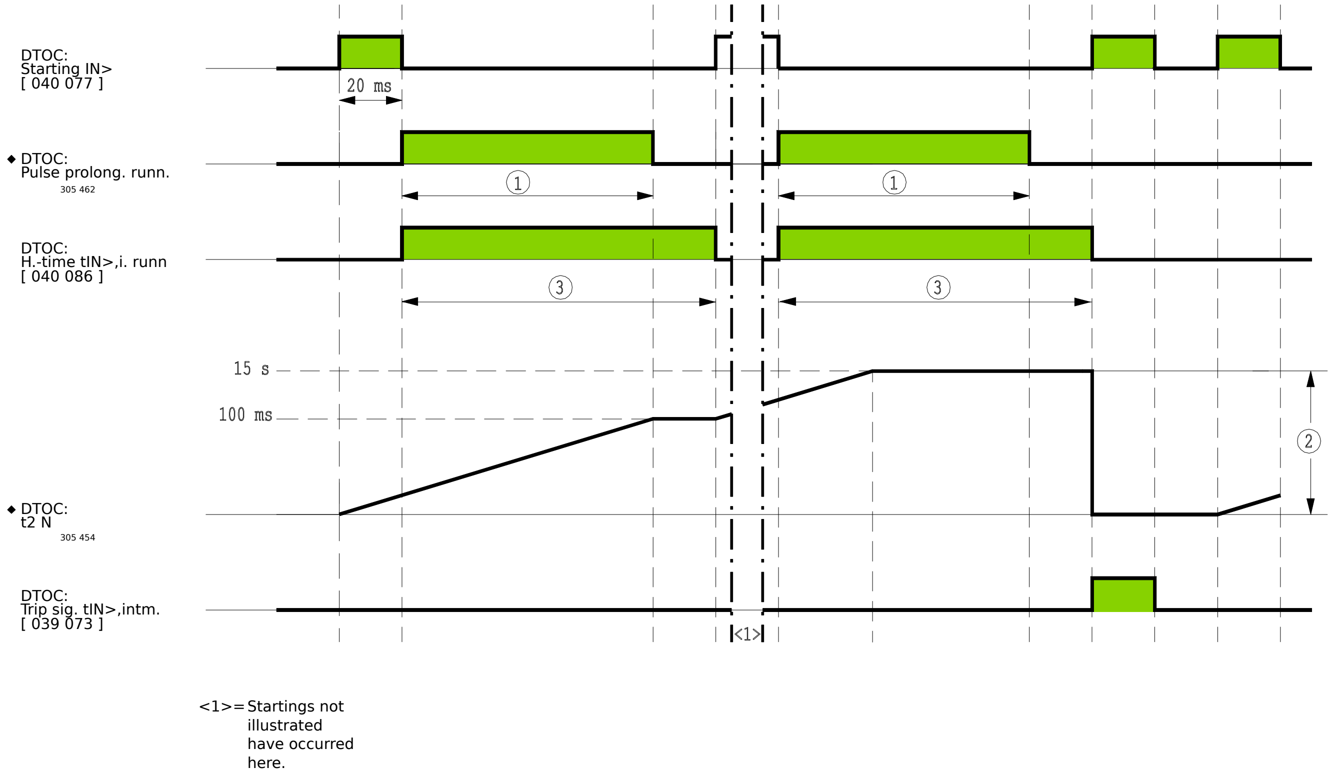


Fig. 3-135: Signal flow for values below the accumulation limit value.



Settings		
1	2	3
DTOC: Puls.prol.IN>,intPSx Setting = 80ms	DTOC: tIN>,interm. PSx Setting = 15ms	DTOC: Hold-t. tIN>,intmPSx Setting = 300ms

19Z5243A

Fig. 3-136: Signal flow for values at the accumulation limit value.

3.23 Inverse-Time Overcurrent Protection (Function Groups IDMT1 and IDMT2)

In this section IDMT represents IDMT1.

This description is also valid for IDMT2 (if there is no indication to the contrary).

The addresses given apply to IDMT1. The addresses for function group IDMT2 are given in Chapter 7, (p. 7-1) and Chapter 8, (p. 8-1).

For example, the address for IDMT1: General enable USER is (017 096) (given in Fig. 3-137, (p. 3-178)), but the address for IDMT2: General enable USER is (017 052).

The inverse-time overcurrent protection function (IDMT) operates with three separate measuring systems for:

- Phase currents system
- Negative-sequence current
- Residual current.

Either the short-circuit direction determination function (SCDD) or the auto-reclosing control function may intervene in the functional sequence of the IDMT function.

3.23.1 Disabling and Enabling IDMT Protection

IDMT protection can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

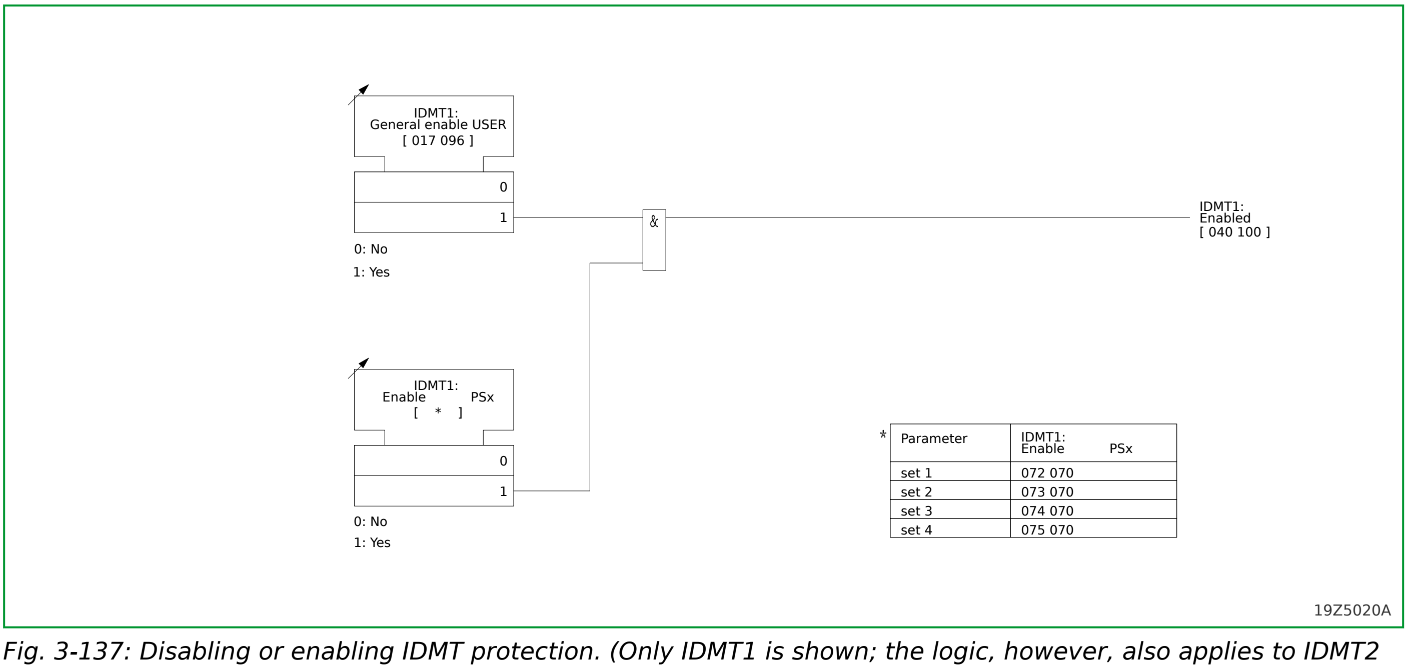


Fig. 3-137: Disabling or enabling IDMT protection. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

3.23.2 Time-Dependent Characteristics

The measuring systems for phase currents, residual current and negative-sequence current operate independently of each other and can be set separately. The user can select from a large number of characteristics (see table below). The measured variable is the maximum phase current, the negative-sequence current, or the residual current, depending on the measuring system. The tripping characteristics available for selection are shown in the following figures (Fig. 3-138, (p. 3-181) to Fig. 3-141, (p. 3-183)).

Time calculation begins with the starting of the respective IDMT stage. The setting IDMT1: Time Correction PSx (only for IDMT1) allows for correcting the tripping time by the duration that has been needed to measure and recognize the starting. This can optimize the accuracy of time in case the tripping characteristic leads to short tripping times (< 200 ms).

As an alternative, it is also possible to set IDMT1: Time Correction PSx to some negative value. This extends the tripping time accordingly, which might be required to synchronize tripping with other devices needing more time for the starting.

No.	Tripping Characteristic Characteristic settable factor: k = 0.05 ... 10.00	Formula for the Tripping Characteristic	Constants a	b	c	Formula for the Reset Characteristic	R
0	Definite Time	$t = k$					
	Per IEC 255–3	$t = k \cdot \frac{a}{(\frac{I}{I_{ref}})^b - 1}$					
1	Standard Inverse		0.14	0.02			
2	Very Inverse		13.50	1.00			
3	Extremely Inverse		80.00	2.00			
4	Long Time Inverse		120.00	1.00			
	Per IEEE C37.112	$t = k \cdot (\frac{a}{(\frac{I}{I_{ref}})^b - 1} + c)$				$t_r = \frac{k \cdot R}{(\frac{I}{I_{ref}})^2 - 1}$	
5	Moderately Inverse		0.0515	0.0200	0.1140		4.85
6	Very Inverse		19.6100	2.0000	0.4910		21.60
7	Extremely Inverse		28.2000	2.0000	0.1217		29.10
	Per ANSI	$t = k \cdot (\frac{a}{(\frac{I}{I_{ref}})^b - 1} + c)$				$t_r = \frac{k \cdot R}{(\frac{I}{I_{ref}})^2 - 1}$	
8	Normally Inverse		8.9341	2.0938	0.17966		9.00
9	Short Time Inverse		0.2663	1.2969	0.03393		0.50
10	Long Time Inverse		5.6143	1.0000	2.18592		15.75
11	RI-Type Inverse	$t = k \cdot \frac{1}{0.339 - \frac{0.236}{(\frac{I}{I_{ref}})}}$					
12	RXIDG-Type Inverse	$t = k \cdot (5.8 - 1.35 \cdot \ln \frac{I}{I_{ref}})$					

Once a ratio I/I_{ref} greater than 20 is reached, the tripping time is bounded on the lower end.

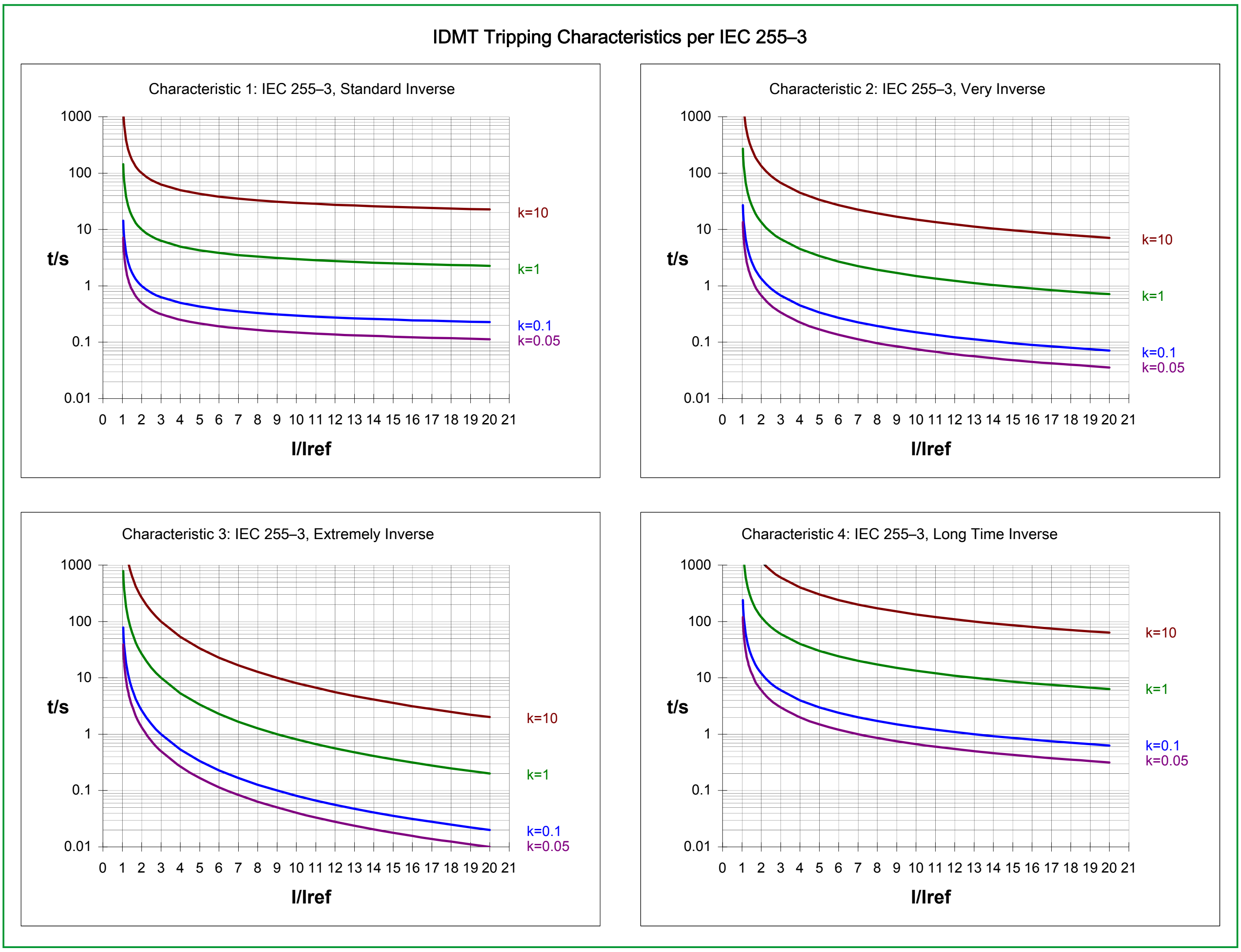


Fig. 3-138: Tripping characteristics as per IEC 255-3.

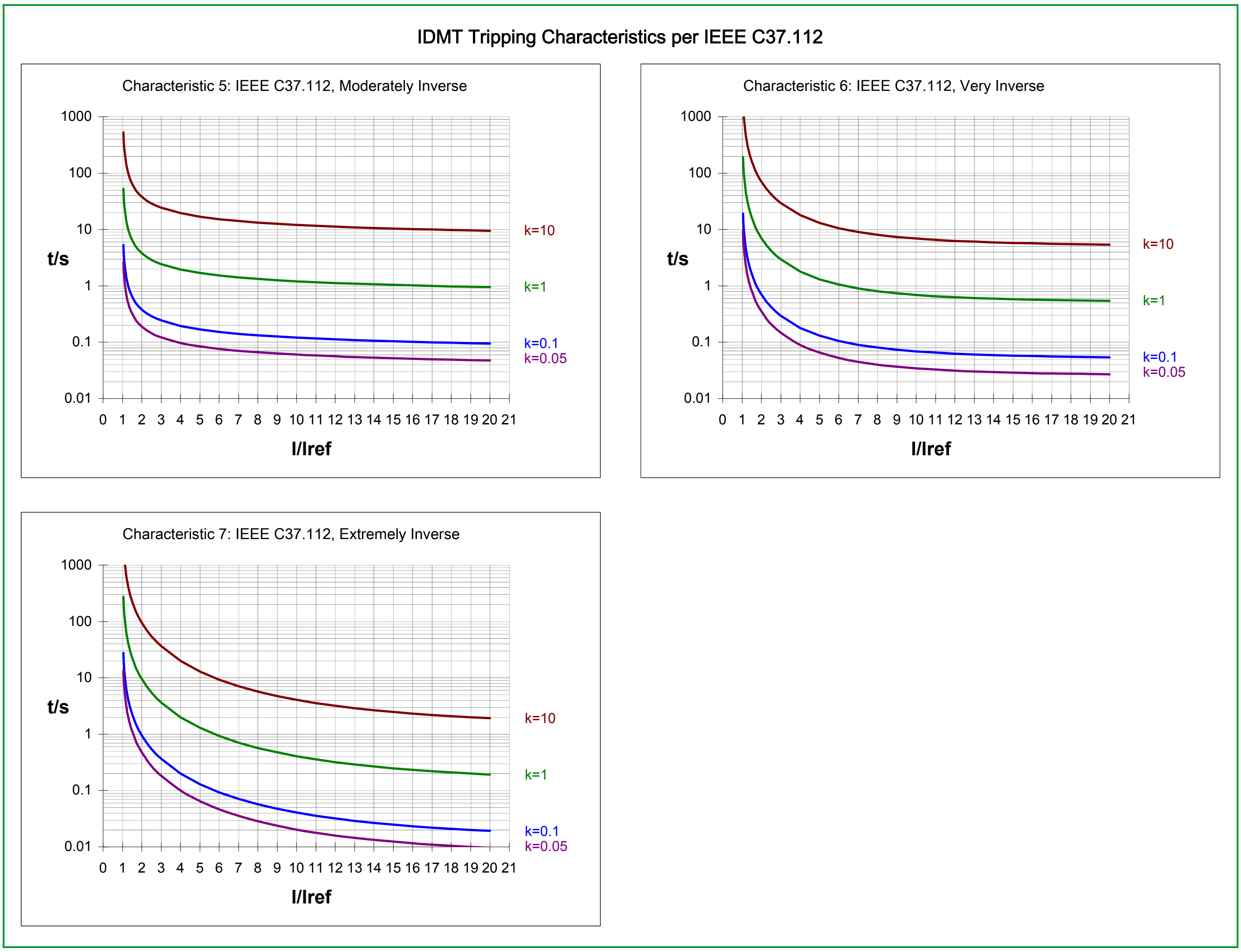


Fig. 3-139: Tripping characteristics as per IEEE C37.112.

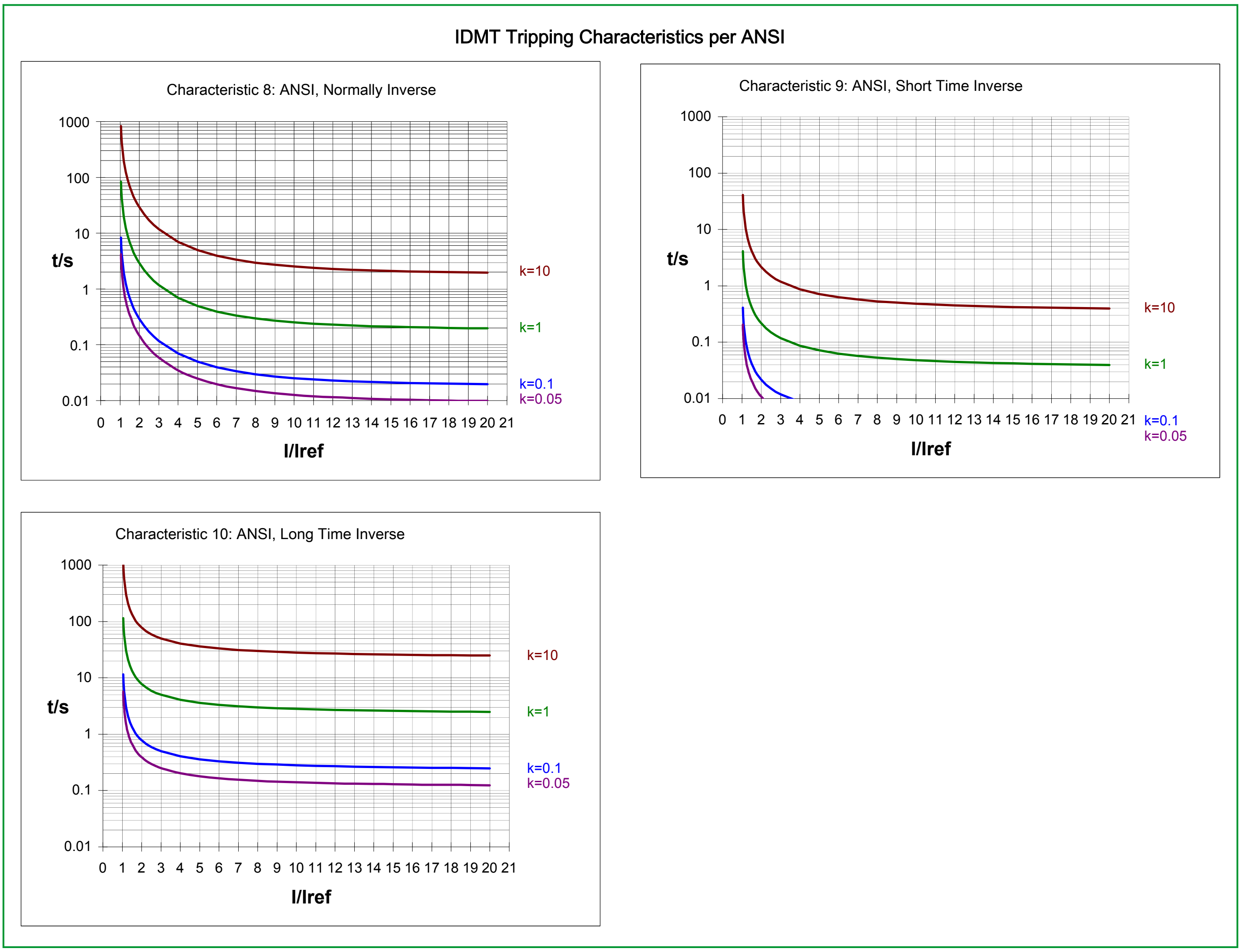


Fig. 3-140: Tripping characteristics as per ANSI.

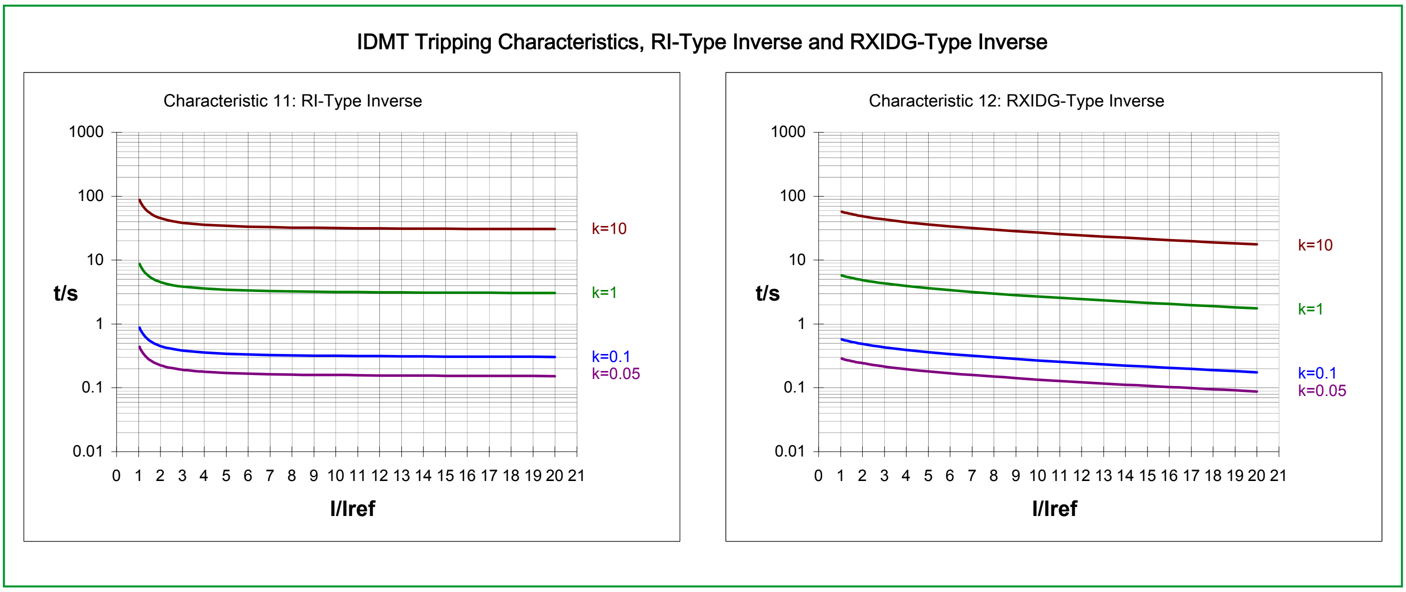


Fig. 3-141: RI-type inverse and RXIDG-type inverse tripping characteristics.

3.23.3 Enable Thresholds

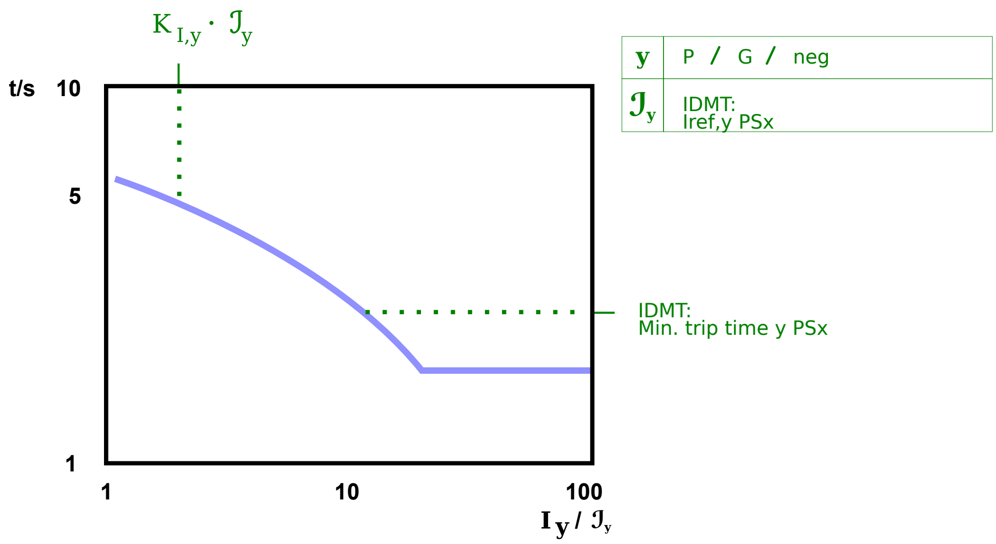
Minimum Operate Value

A minimum operate value (threshold) may be defined for each of the phase currents, the residual current and the negative-sequence current, valid for function group IDMT1. Each factor IDMT1: Factor I,y (y="P" for the phase currents, y="N" for the residual current, y="neg" for the negative-sequence current) is multiplied by the reference quantity ($I_{ref,P}$ or $I_{ref,N}$ or $I_{ref,neg}$, respectively) in order to form the minimum operate value. The timer stage is triggered only when the current exceeds the set threshold.

> *There is no KI factor available for IDMT2 protection.*

Minimum Trip Time

A minimum trip time IDMT1: Min. trip time y PSx (or IDMT2: Min. trip time y PSx) may be defined for the phase currents (y="P"), the residual current (y="N") and the negative-sequence current (y="neg"). The respective timer stage is started as soon as the associated minimum operate value is exceeded. After the timer has elapsed, the trip signal is issued, regardless of the value of the current.



y	P	G	neg
Parameter	IDMT1: Factor KI,P PSx	IDMT1: Factor KI,N PSx	IDMT1: Factor KI,neg PSx
set 1	007 250	001 173	007 254
set 2	007 251	001 174	007 255
set 3	007 252	001 175	008 002
set 4	007 253	001 176	008 005

y	P	G	neg
Parameter	IDMT1: Min. trip time P PSx	IDMT1: Min. trip time N PSx	IDMT1: Min.trip time negPSx
set 1	072 077	072 079	072 078
set 2	073 077	073 079	073 078
set 3	074 077	074 079	074 078
set 4	075 077	075 079	075 078

y	P	G	neg
Parameter	IDMT2: Min. trip time P PSx	IDMT2: Min. trip time N PSx	IDMT2: Min.trip time negPSx
set 1	071 044	071 052	071 048
set 2	071 045	071 053	071 049
set 3	071 046	071 054	071 050
set 4	071 047	071 055	071 051

12Z6303B

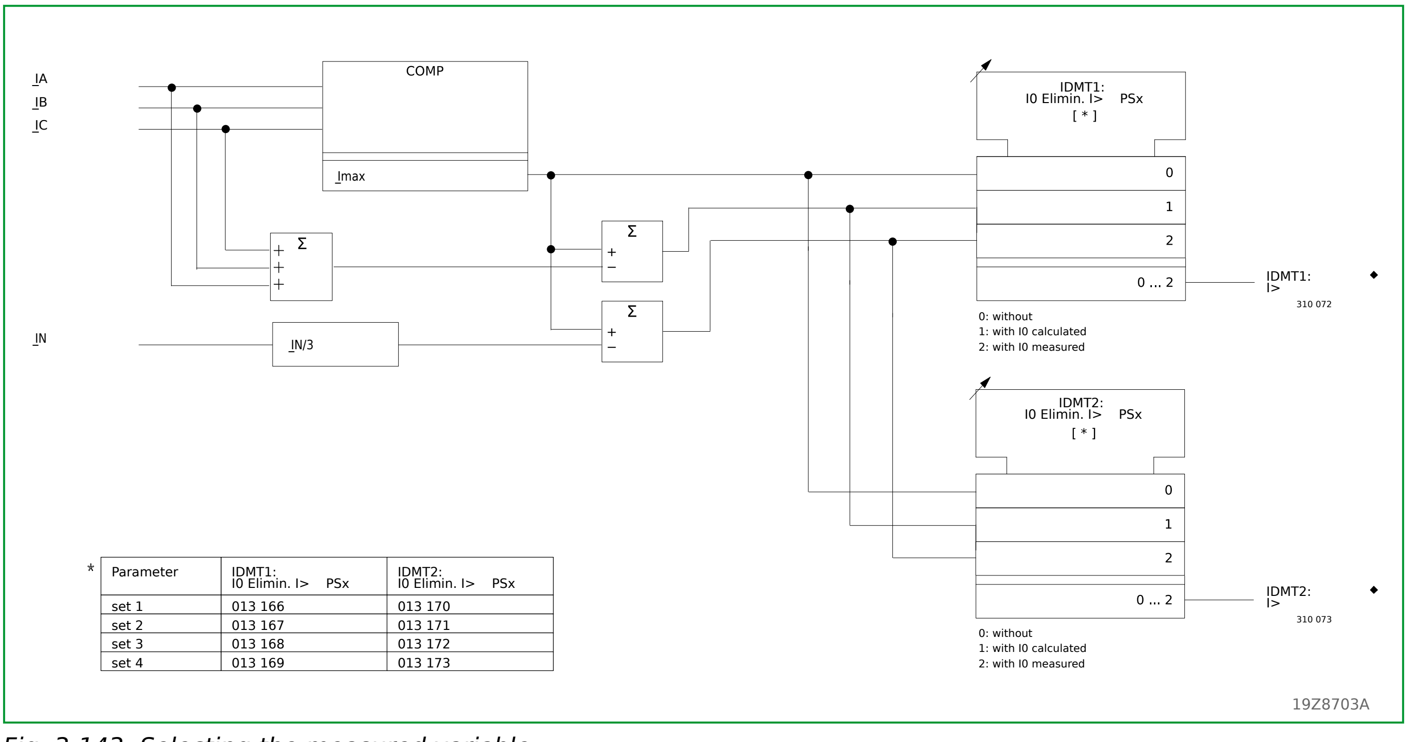
Fig. 3-142: Influence of the minimum operate value and the minimum trip time on the IDMT characteristics.

3.23.4 Selecting the Measured Variable for the Phase Current Stage

In each of the function groups IDMT1 and IDMT2, a setting specifies which current will be used by the P139 as the phase current of the stage I>: either the maximum phase current is used, or a value where the residual current has been eliminated (I0 elimination).

That is, one of the following currents is used:

- The maximum phase current
- The maximum phase current shifted by one third of the calculated residual current ($\underline{I}_{max} - \frac{1}{3} \cdot \Sigma \underline{I}_P$)
- The maximum phase current shifted by one third of the residual current measured at the fourth transformer (T4), i. e. ($\underline{I}_{max} - IN/3$)



Parameter	IDMT1: I0 Elimin. I> PSx	IDMT2: I0 Elimin. I> PSx
set 1	013 166	013 170
set 2	013 167	013 171
set 3	013 168	013 172
set 4	013 169	013 173

Fig. 3-143: Selecting the measured variable

3.23.5 Phase Current Stage

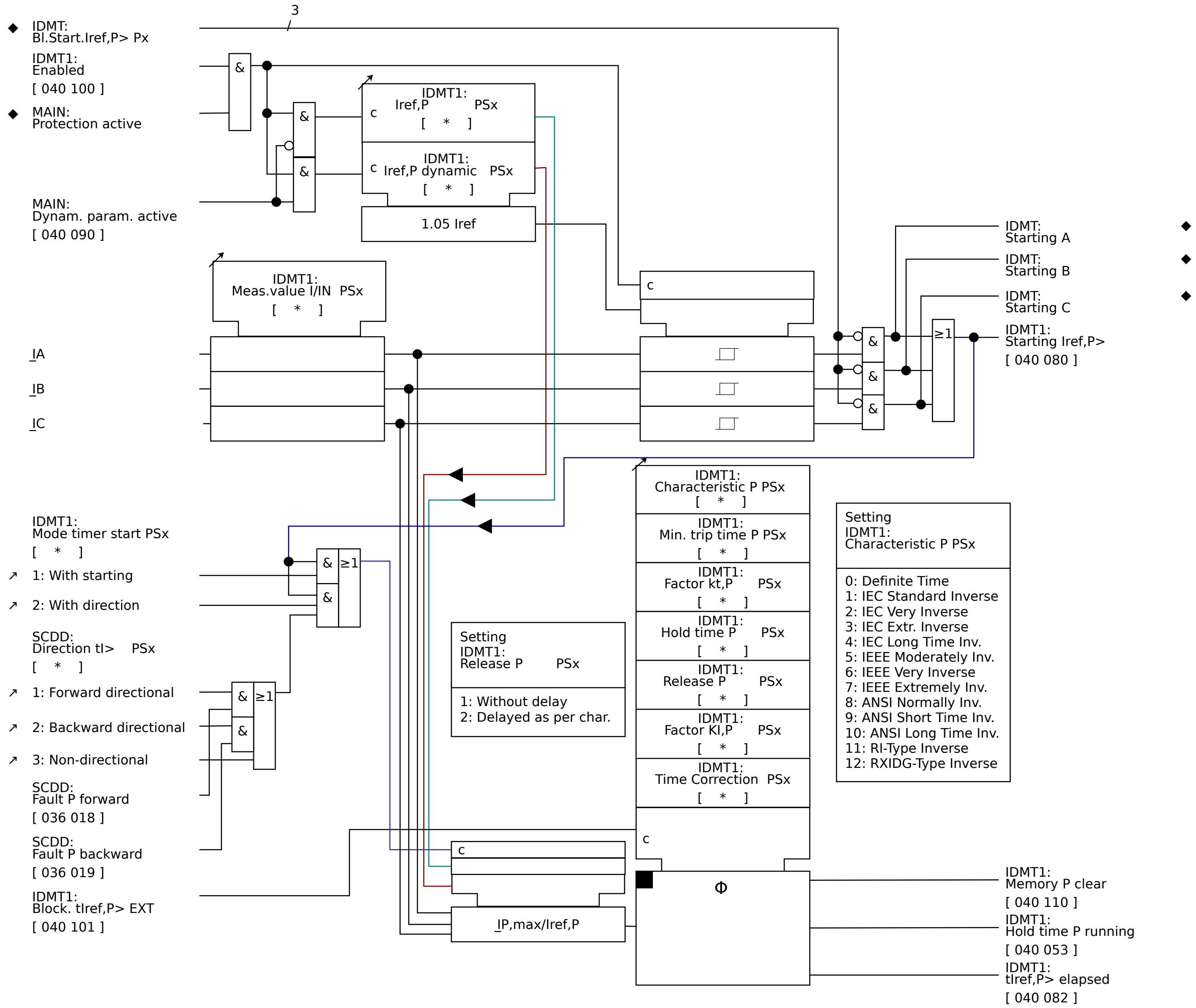
The three phase currents are monitored by the P139 to detect when they exceed the set thresholds. Alternatively, two different thresholds can be active. The “dynamic” threshold is active for the set hold time for the “dynamic parameters” (see Section 3.11.5, (p. 3-99)) and the “normal” threshold is active when no hold time is running. The IDMT protection will trigger when the 1.05-fold of the set reference current value is exceeded in one phase. The P139 will then determine the maximum current flowing in the three phases and this value is used for further processing. Depending on the characteristic selected and the current magnitude the P139 will determine the tripping time. Moreover the tripping time will under no circumstances fall below a settable minimum time threshold irrespective of the current flow magnitude.

It is also possible to select whether the starting decision shall be based on the fundamental or on the r.m.s. value.

When the inrush stabilization function (see Section 3.11.7, (p. 3-100)) is triggered, the phase current stage as well as the residual current stage is blocked. However, when a phase starting is present then no subsequent triggering of the inrush stabilization will be taken into account. (When a change from a single-phase fault to a two-phase fault or from a two-phase fault to a three-phase fault had occurred, it was possible that, because of transients during the change, the inrush stabilization was momentarily triggered which would reset the starting and the timer.)

The inverse-time stage can be blocked by an appropriately configured binary signal input.

The trip signal from the IDMT1 protection may also be blocked by the short-circuit direction determination or the auto-reclosing control function. Depending on the setting of the short-circuit direction determination the trip signal will be enabled. The trip signals of the phase current stages IDMT1 and IDMT2 are blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.



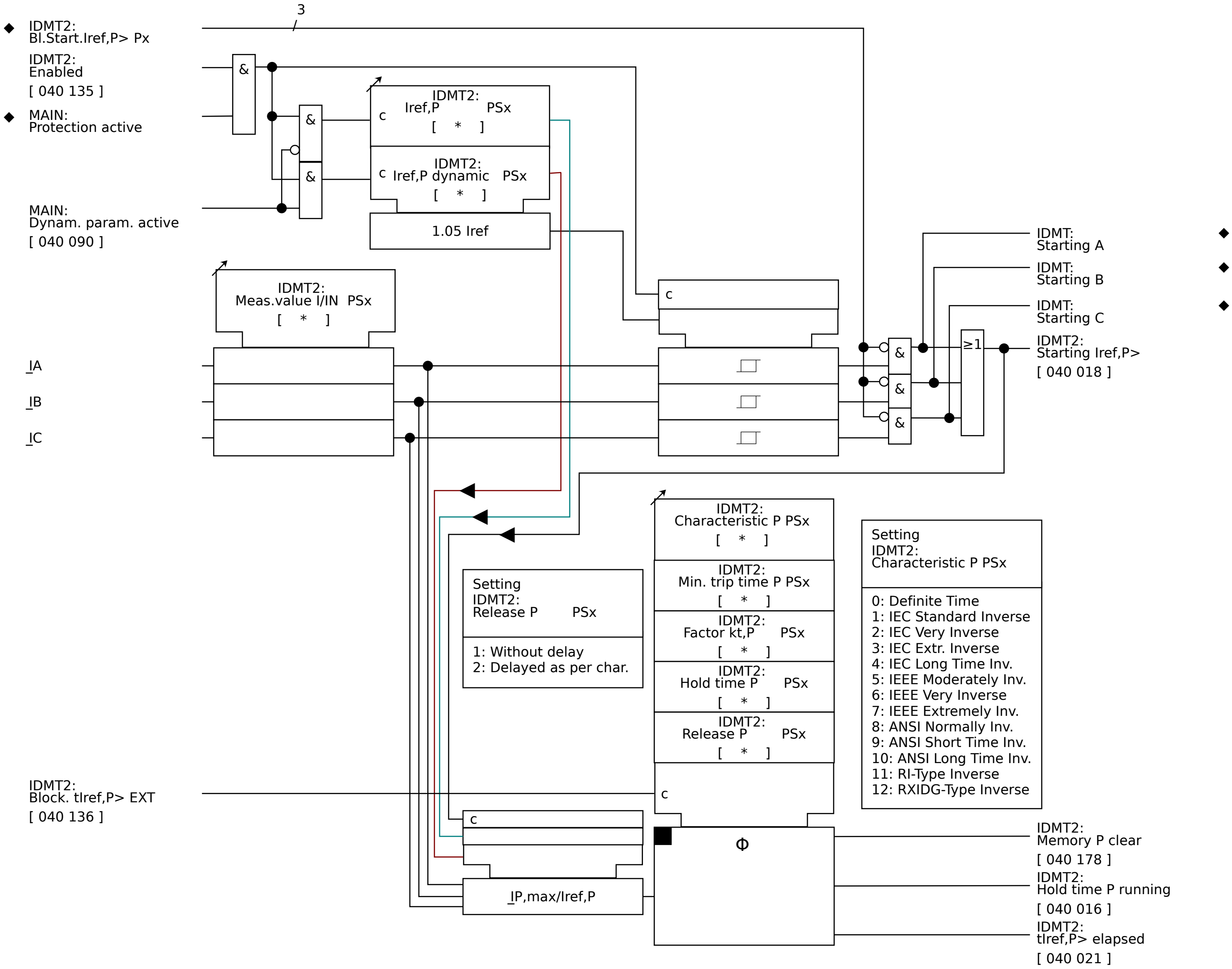
Parameter	IDMT1: Iref,P PSx	IDMT1: Iref,P dynamic PSx	IDMT1: Meas.value I/IN PSx	IDMT1: Characteristic P PSx	IDMT1: Mode timer start PSx	IDMT1: Min. trip time P PSx
set 1	072 050	072 003	060 018	072 056	007 226	072 077
set 2	073 050	073 003	060 019	073 056	007 227	073 077
set 3	074 050	074 003	060 020	074 056	007 228	074 077
set 4	075 050	075 003	060 021	075 056	007 229	075 077

Parameter	IDMT1: Factor kt,P PSx	SCDD: Direction tI> PSx	IDMT1: Hold time P PSx	IDMT1: Release P PSx	IDMT1: Factor KI,P PSx	IDMT1: Time Correction PSx
set 1	072 053	017 071	072 071	072 059	007 250	013 143
set 2	073 053	077 237	073 071	073 059	007 251	013 144
set 3	074 053	078 237	074 071	074 059	007 252	013 145
set 4	075 053	079 237	075 071	075 059	007 253	013 146

19Z8834A

Fig. 3-144: Phase current stage for IDMT1. Note: The logic displayed here is not valid for IDMT2 as the parameters IDMT1: Factor KI,P PSx, IDMT1: Time Correction PSx and IDMT1: Mode timer start PSx do not exist with IDMT2.

The phase current stage or IDMT2 is displayed in Fig. 3-145, (p. 3-189). (Trip signal: see Fig. 3-146, (p. 3-190).)



Parameter	IDMT2: Iref,P PSx	IDMT2: Iref,P dynamic PSx	IDMT2: Meas.value I/IN PSx	IDMT2: Characteristic P PSx
set 1	076 236	076 030	060 022	071 004
set 2	076 237	076 031	060 023	071 005
set 3	076 238	076 032	060 024	071 006
set 4	076 239	076 033	060 025	071 007

Parameter	IDMT2: Min. trip time P PSx	IDMT2: Factor kt,P PSx	IDMT2: Hold time P PSx	IDMT2: Release P PSx
set 1	071 044	078 250	071 028	071 016
set 2	071 045	078 251	071 029	071 017
set 3	071 046	078 252	071 030	071 018
set 4	071 047	078 253	071 031	071 019

19Z8338A

Fig. 3-145: Phase current stage for IDMT2. IDMT represents IDMT2. (Note: The logic displayed here is not valid for IDMT1.)

The phase current stage for IDMT1 is displayed in Fig. 3-144, (p. 3-188). (Trip signal: see Fig. 3-147, (p. 3-190).)

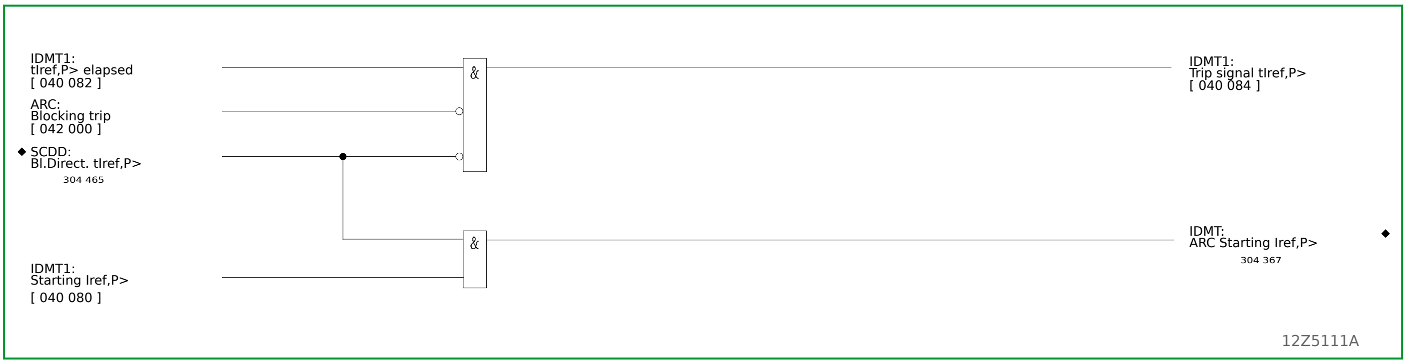


Fig. 3-146: Trip signal of the phase current stage for IDMT1.

Fig. 3-147: Trip signal of the phase current stages for IDMT2.

3.23.6 Negative-Sequence Current Stage

According to the following formulas the P139 will determine the negative-sequence current and positive-sequence current, taking into account the set phase sequence (alternative terminology: Rotary field):

Phase sequence A-B-C (alternative terminology: clockwise rotating field):

$$\underline{I}_{\mathrm{neg}} = \frac{1}{3} \cdot \left| \left(\underline{I}_{\mathrm{A}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{B}} + \underline{a} \cdot \underline{I}_{\mathrm{C}} \right) \right|$$

Phase sequence A-C-B (alternative terminology: anti-clockwise rotating field):

$$\underline{I}_{\mathrm{neg}} = \frac{1}{3} \cdot \left| \left(\underline{I}_{\mathrm{A}} + \underline{a} \cdot \underline{I}_{\mathrm{B}} + \underline{a}^2 \cdot \underline{I}_{\mathrm{C}} \right) \right|$$

$$\underline{a} = \mathrm{e}^{2\pi j/3} = \mathrm{e}^{j \cdot 120°}$$

$$\underline{a}^2 = \mathrm{e}^{4\pi j/3} = \mathrm{e}^{j \cdot 240°}$$

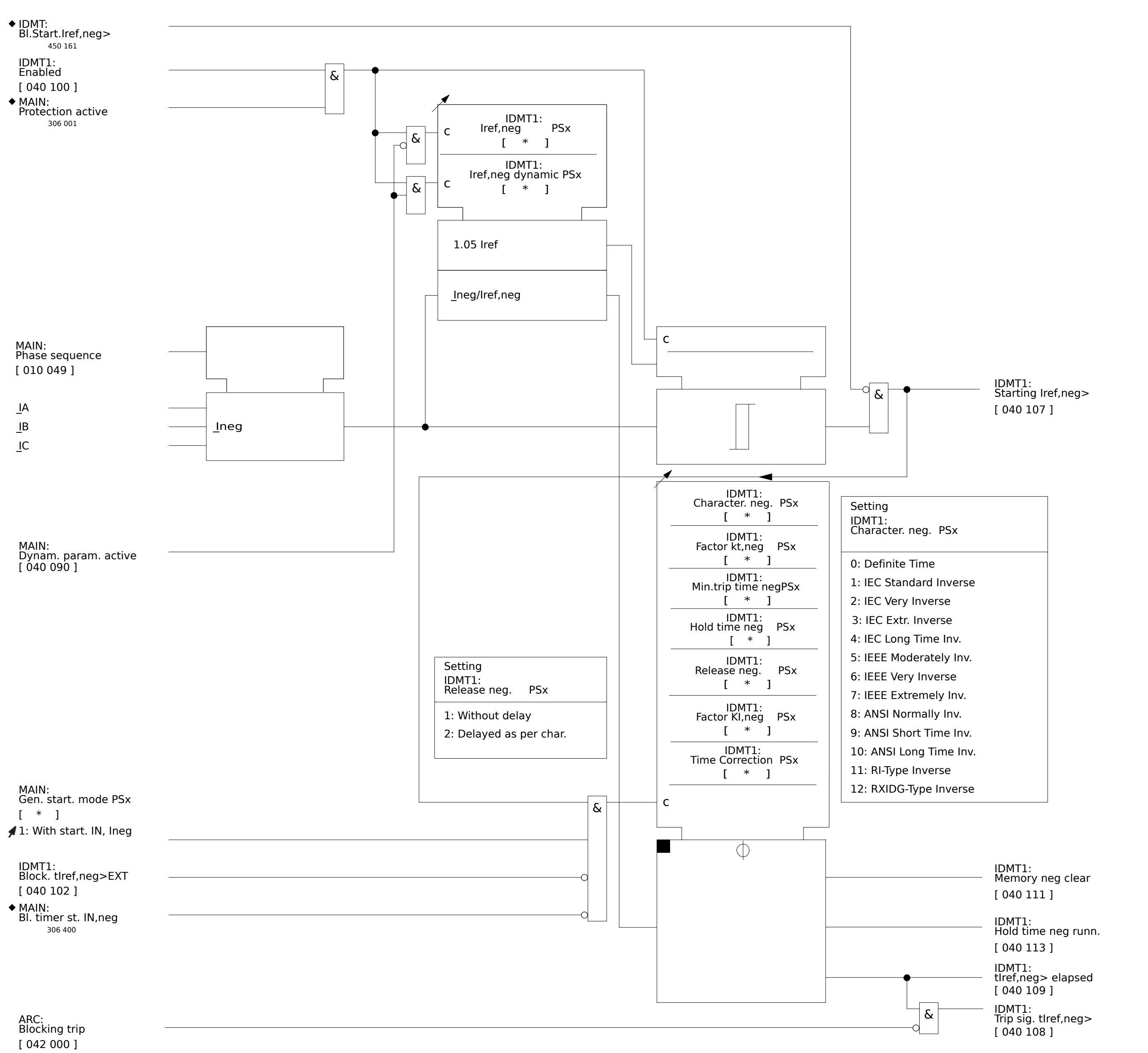
The negative-sequence current is monitored by the P139 to detect when it exceeds the set thresholds. Alternatively, two different thresholds can be active. The “dynamic” threshold is active for the set hold time for the “dynamic parameters” (see Section 3.11.5, (p. 3-99)) and the “normal” threshold is active when no hold time is running. The IDMT protection will trigger when the 1.05-fold of the set reference current value is exceeded by the negative-sequence current. Depending on the characteristic selected and the residual current magnitude the P139 will determine the tripping time. Moreover the tripping time will under no circumstances fall below a settable minimum time threshold irrespective of the negative-sequence current flow magnitude.

When the inrush stabilization function (see Section 3.11.7, (p. 3-100)) is triggered, the negative-sequence current stage is blocked.

The inverse-time stage can be blocked by an appropriately configured binary signal input. In addition the inverse-time stage can also be automatically blocked by single-pole or multi-pole starting (depending on the setting).

When the short-circuit direction determination function (SCDD) is enabled, a trip signal from the IDMT negative-sequence current stage is always non-directional.

The trip signal from the negative-sequence current stage is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.



* Parameter	MAIN: Gen. start. mode PSx	IDMT1: Iref,neg PSx	IDMT1: Iref,neg dynamic PSx	IDMT1: Character. neg. PSx	IDMT1: Time Correction PSx
set 1	017 027	072 051	072 004	072 057	013 143
set 2	001 219	073 051	073 004	073 057	013 144
set 3	001 220	074 051	074 004	074 057	013 145
set 4	001 221	075 051	075 004	075 057	013 146

* Parameter	IDMT1: Factor kt,neg PSx	IDMT1: Min.trip time negPSx	IDMT1: Hold time neg PSx	IDMT1: Release neg. PSx	IDMT1: Factor KI,neg PSx
set 1	072 054	072 078	072 072	072 060	007 254
set 2	073 054	073 078	073 072	073 060	007 255
set 3	074 054	074 078	074 072	074 060	008 002
set 4	075 054	075 078	075 072	075 060	008 005

19Z8835A

Fig. 3-148: Negative-sequence current stage. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses, and with the exception of parameters IDMT1: Factor KI,neg PSx and IDMT1: Time Correction PSx that do not exist for IDMT2.)

3.23.7 Selecting the Measured Variable for the Residual Current Stage

A setting specifies which current will be used by the P139 as the residual current: either the residual current calculated from the three phase currents or the residual current directly measured at the fourth current transformer (T 4), or the residual current calculated with I0 elimination, i.e. the calculated current shifted by one third of the residual current (Σ I P − ⅓·I N).

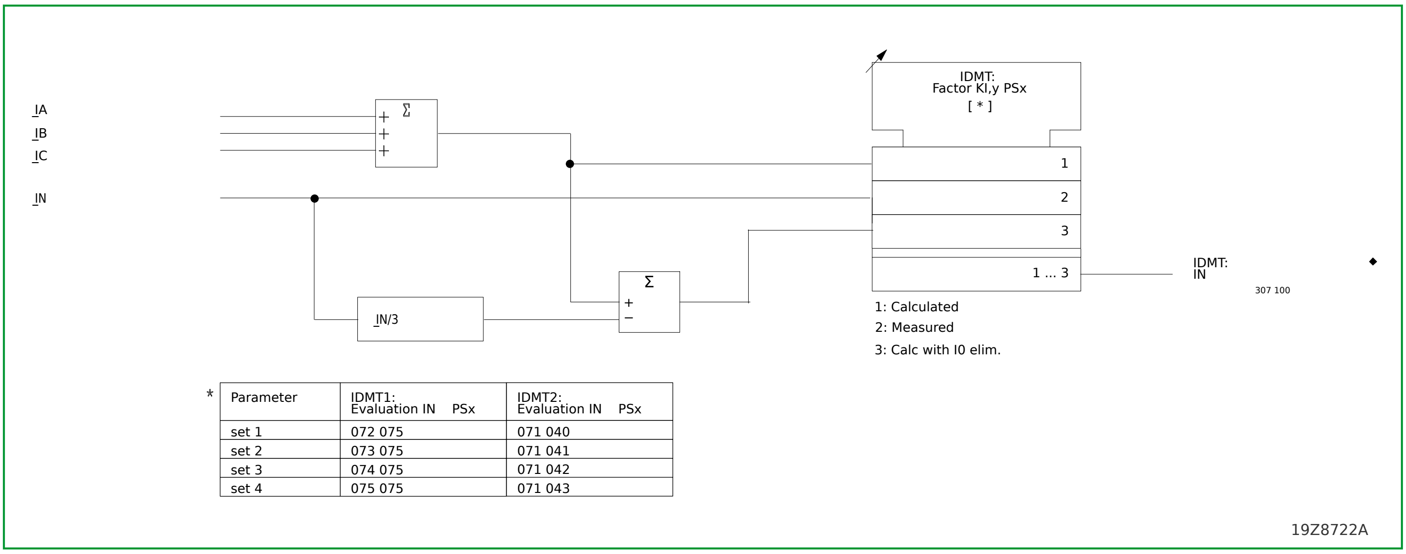


Fig. 3-149: Selecting the measured variable

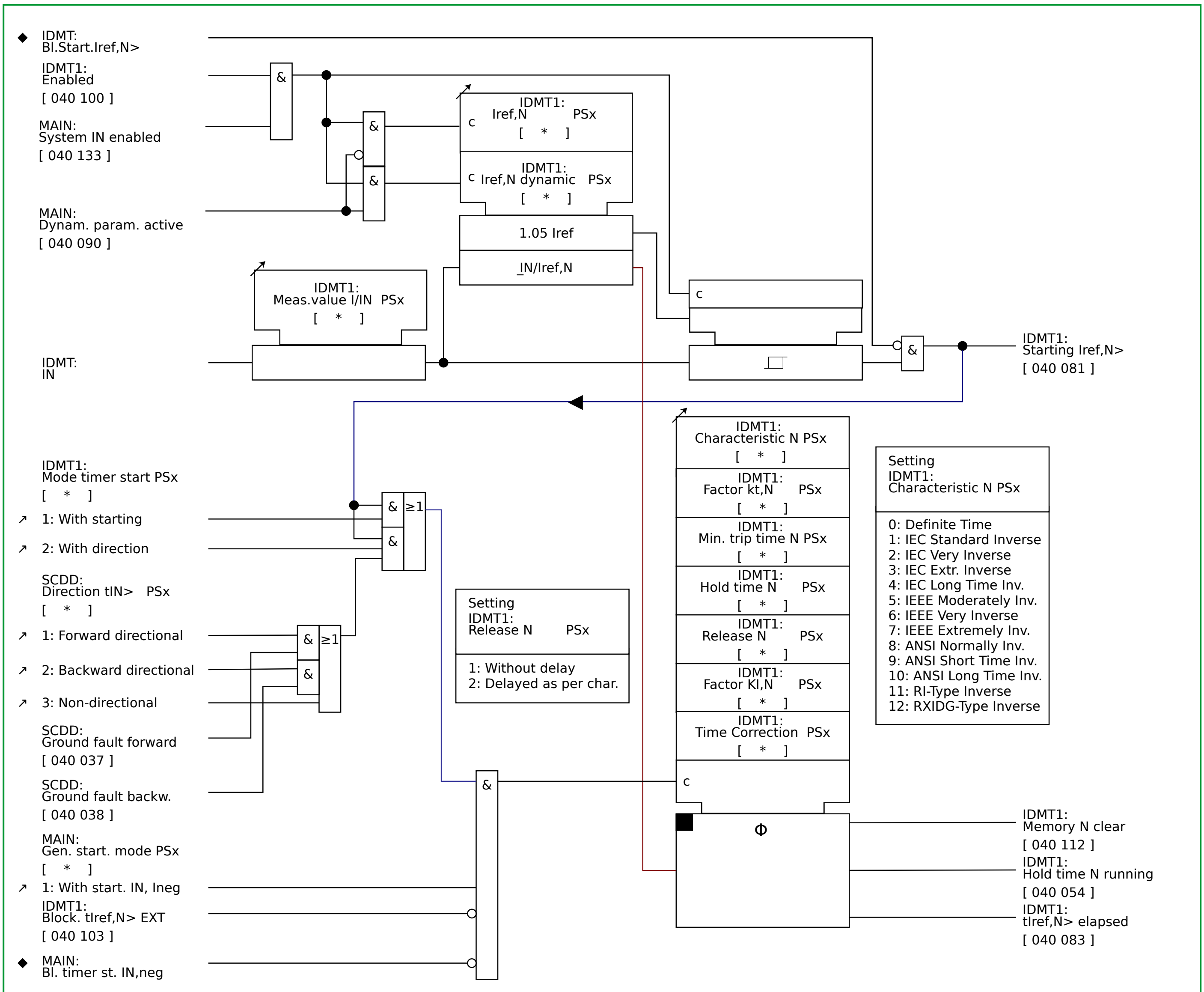
3.23.8 Residual Current Stage

The residual current is monitored by the P139 to detect when it exceeds the set thresholds. Alternatively, two different thresholds can be active. The “dynamic” threshold is active for the set hold time for the “dynamic parameters” (see Section 3.11.5, (p. 3-99)) and the “normal” threshold is active when no hold time is running. The IDMT protection will trigger when the 1.05-fold of the set reference current value is exceeded by the residual current. Depending on the characteristic selected and the residual current magnitude the P139 will determine the tripping time. Moreover the tripping time will under no circumstances fall below a settable minimum time threshold irrespective of the residual current flow magnitude.

It is also possible to select whether the starting decision shall be based on the fundamental or on the r.m.s. value.

The inverse-time stage can be blocked by an appropriately configured binary signal input. In addition the inverse-time stage can also be automatically blocked by single-pole or multi-pole starting (depending on the setting).

The trip signal from the IDMT1 protection may also be blocked by the short-circuit direction determination or the auto-reclosing control function. Depending on the setting of the short-circuit direction determination the trip signal will be enabled. The trip signals of the residual current stages IDMT1 and IDMT2 are blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.



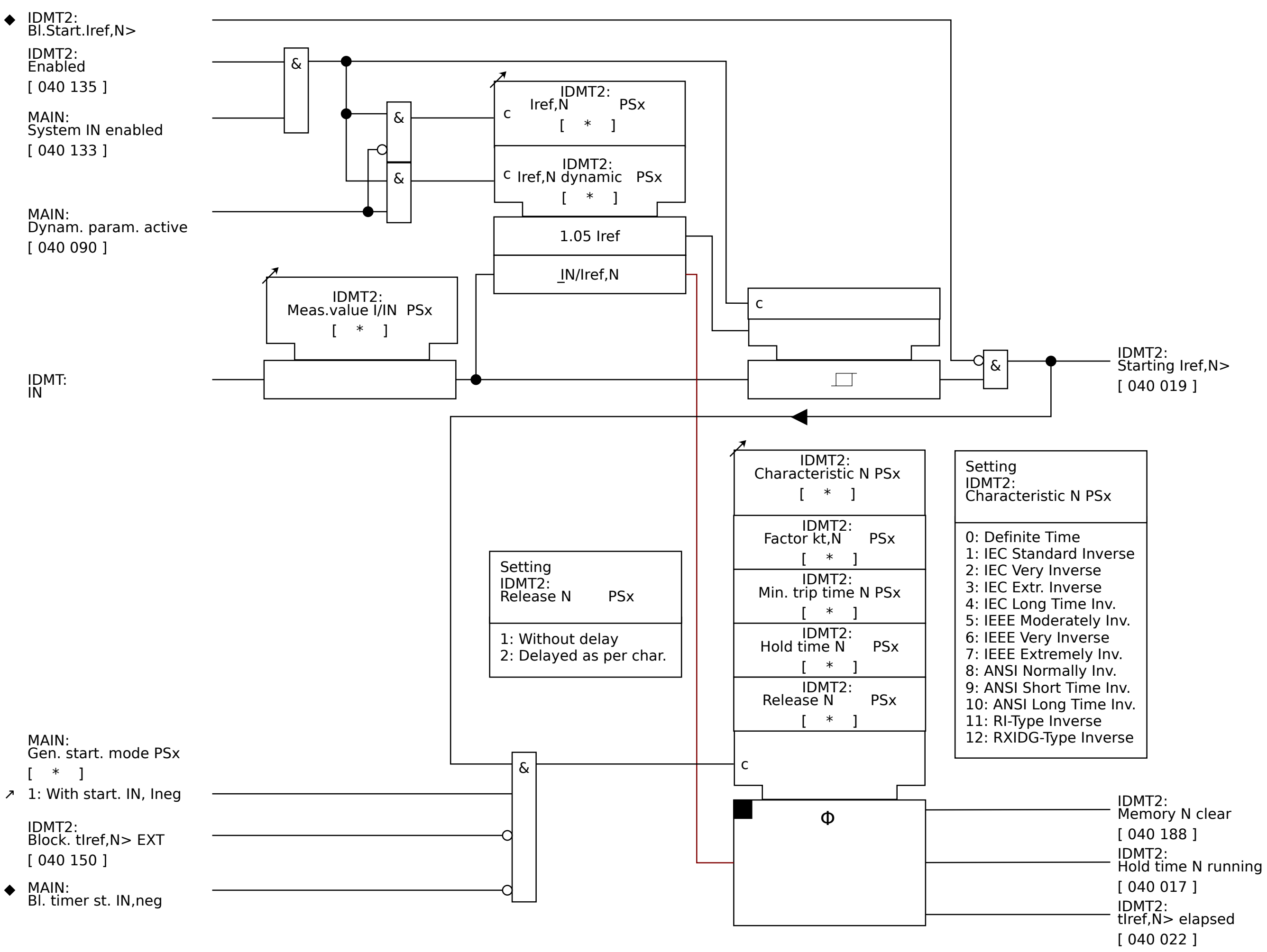
Parameter	IDMT1: Iref,N PSx	IDMT1: Iref,N dynamic PSx	IDMT1: Meas.value I/IN PSx	IDMT1: Characteristic N PSx	IDMT1: Mode timer start PSx	IDMT1: Factor kt,N PSx	IDMT1: Time Correction PSx
set 1	072 052	072 005	060 018	072 058	007 226	072 055	013 143
set 2	073 052	073 005	060 019	073 058	007 227	073 055	013 144
set 3	074 052	074 005	060 020	074 058	007 228	074 055	013 145
set 4	075 052	075 005	060 021	075 058	007 229	075 055	013 146

Parameter	IDMT1: Min. trip time N PSx	SCDD: Direction tIN> PSx	IDMT1: Hold time N PSx	IDMT1: Release N PSx	IDMT1: Factor Kl,N PSx	MAIN: Gen. start. mode PSx
set 1	072 079	017 073	072 073	072 061	001 173	017 027
set 2	073 079	077 240	073 073	073 061	001 174	001 219
set 3	074 079	078 240	074 073	074 061	001 175	001 220
set 4	075 079	079 240	075 073	075 061	001 176	001 221

19Z8836A

Fig. 3-150: Residual current stage for IDMT1. (Note: The logic displayed here is not valid for IDMT2 as the parameters IDMT1: Factor Kl,N PSx, IDMT1: Time Correction PSx and IDMT1: Mode timer start PSx do not exist with IDMT2.)

The phase current stage for IDMT2 is displayed in Fig. 3-151, (p. 3-195). (Trip signal: see Fig. 3-152, (p. 3-196).)



Parameter	IDMT2: Iref,N PSx	IDMT2: Iref,N dynamic PSx	IDMT2: Meas.value I/IN PSx	IDMT2: Characteristic N PSx	IDMT2: Factor kt,N PSx
set 1	077 250	076 038	060 022	071 012	071 000
set 2	077 251	076 039	060 023	071 013	071 001
set 3	077 252	076 040	060 024	071 014	071 002
set 4	077 253	076 041	060 025	071 015	071 003

Parameter	IDMT2: Min. trip time N PSx	IDMT2: Hold time N PSx	IDMT2: Release N PSx	MAIN: Gen. start. mode PSx
set 1	071 052	071 036	071 024	017 027
set 2	071 053	071 037	071 025	001 219
set 3	071 054	071 038	071 026	001 220
set 4	071 055	071 039	071 027	001 221

19Z8337A

Fig. 3-151: Residual current stage for IDMT2. Note: The logic displayed here is not valid for IDMT1.

The residual current stage for IDMT1 is displayed in Fig. 3-150, (p. 3-194). (Trip signal: see Fig. 3-153, (p. 3-196).)

Fig. 3-152: Trip signal from the residual current stage for IDMT1.

Fig. 3-153: Trip signal from the residual current stage for IDMT2.

3.23.9 Sensitive Ground Fault Protection (SEF) in Systems with High Ground Fault Resistance

The P139 digitizes the measured neutral current twice, with standard dynamic range ($16 \cdot I_{N,nom}$) and with sensitive dynamic range ($2 \cdot I_{N,nom}$). The latter range is specifically designed for highly sensitive ground fault current detection.

This sensitive neutral current input is managed by the protection firmware, depending on the threshold settings of the ground fault stages (see table below).

However, two setting-related constraints have to be considered for SEF applications:

- The settings for the evaluation of the ground fault current (IDMT1: Evaluation IN PSx, IDMT2: Evaluation IN PSx) must be set to *Measured*.

  The SEF characteristic will not be achieved with calculated values, even if threshold settings are low.

- The threshold setting of earth fault stages must be below the maximum values listed in the table below. For threshold settings above this maximum limit, the standard ground fault characteristic will be dynamically adapted.

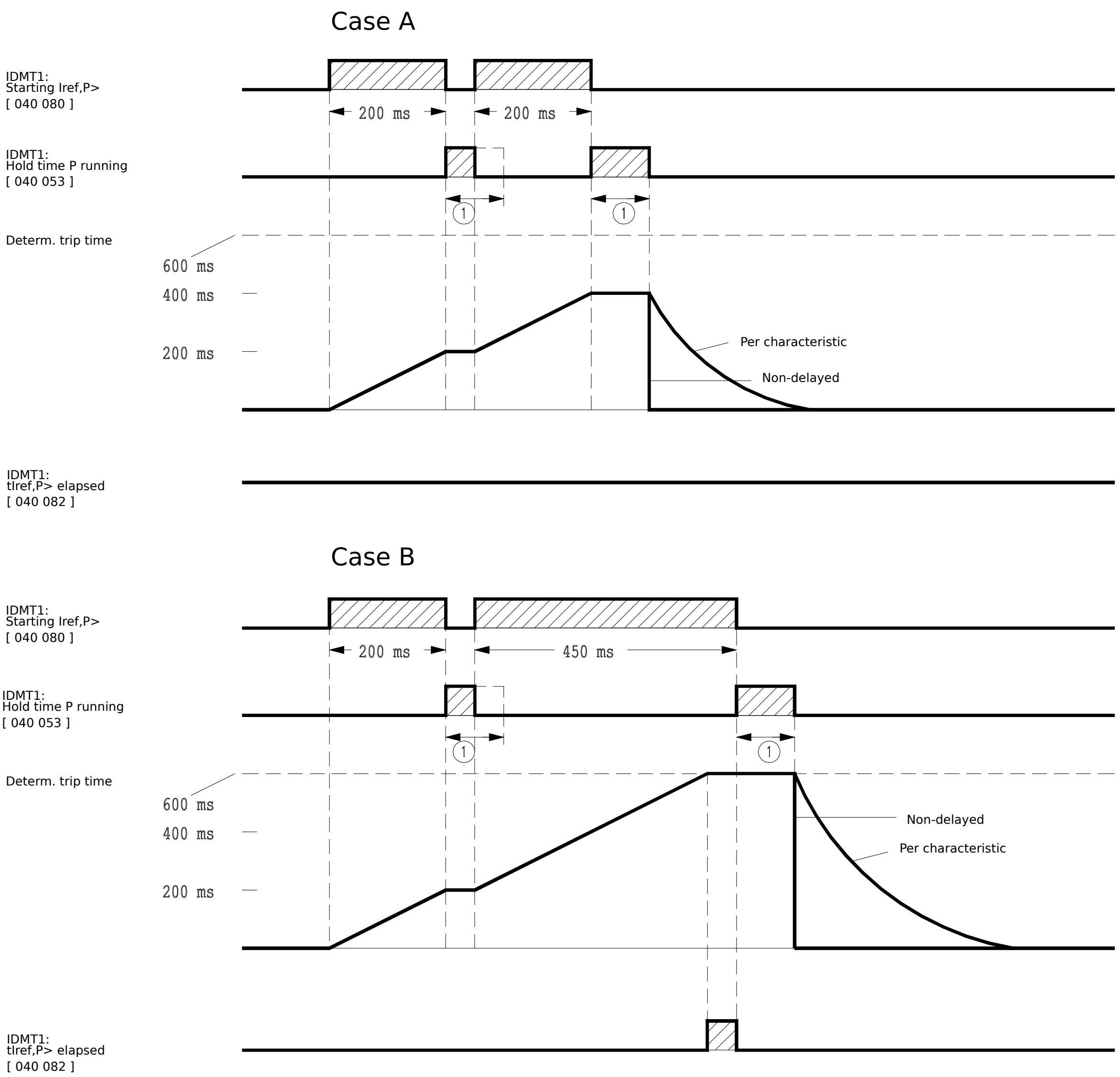
Stage	Time Characteristic	Setting Range for the SEF Application	
		Minimum	Maximum
IDMT1: Iref,N PSx	definite + inverse	$0.01 \cdot I_{N,nom}$	$0.10 \cdot I_{N,nom}$
IDMT2: Iref,N PSx	definite + inverse	$0.01 \cdot I_{N,nom}$	$0.10 \cdot I_{N,nom}$

Independent of the specific sensitive current measurement for SEF application, the ground fault stages maintain all capabilities of standard short-circuit protection functions, as previously described (Section 3.23.8, (p. 3-193)).

It is worth mentioning for SEF application that the IDMT stages can be set up with any of the 12 available inverse-time characteristics. Moreover, IDMT1 (but not IDMT2) can be set to operate in a directional way if voltage measurement is available.

3.23.10 Holding Time

Depending on the current flow the P139 will determine the tripping time and a timer stage is started. The setting of the hold time defines the time period during which the IDMT protection starting time is stored after the starting has dropped out. Should starting recur during the hold time period then the time of the renewed starting will be added to the time period stored. When the starting times sum reach the tripping time value determined by the P139 then the corresponding signal will be issued. Should starting not recur during the hold time period then, depending on the setting, the memory storing the accumulated starting times value will either be cleared without delay or according to the characteristic set. In Fig. 3-154, (p. 3-198), the effect of hold time is shown by the example of a phase current stage.



	1
* Parameter	IDMT1: Hold time P PSx
set 1	072 071
set 2	073 071
set 3	074 071
set 4	075 071

19Z5025A

Fig. 3-154: Effect of hold time shown with a phase current stage as an example. Example A: Hold time determined is not reached. Example B: Hold time determined is reached. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

3.24 Short-Circuit Direction Determination (Function Group SCDD)

The P139 provides short circuit direction determination (SCDD). With this feature it is possible to apply the P139 for directional definite-time overcurrent protection and directional inverse-time overcurrent protection. Two separate measuring systems are available for this purpose for:

- Phase currents system
- Residual currents system

3.24.1 Enable/disable the Short-Circuit Direction Determination

The short-circuit direction determination can be disabled or enabled via setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

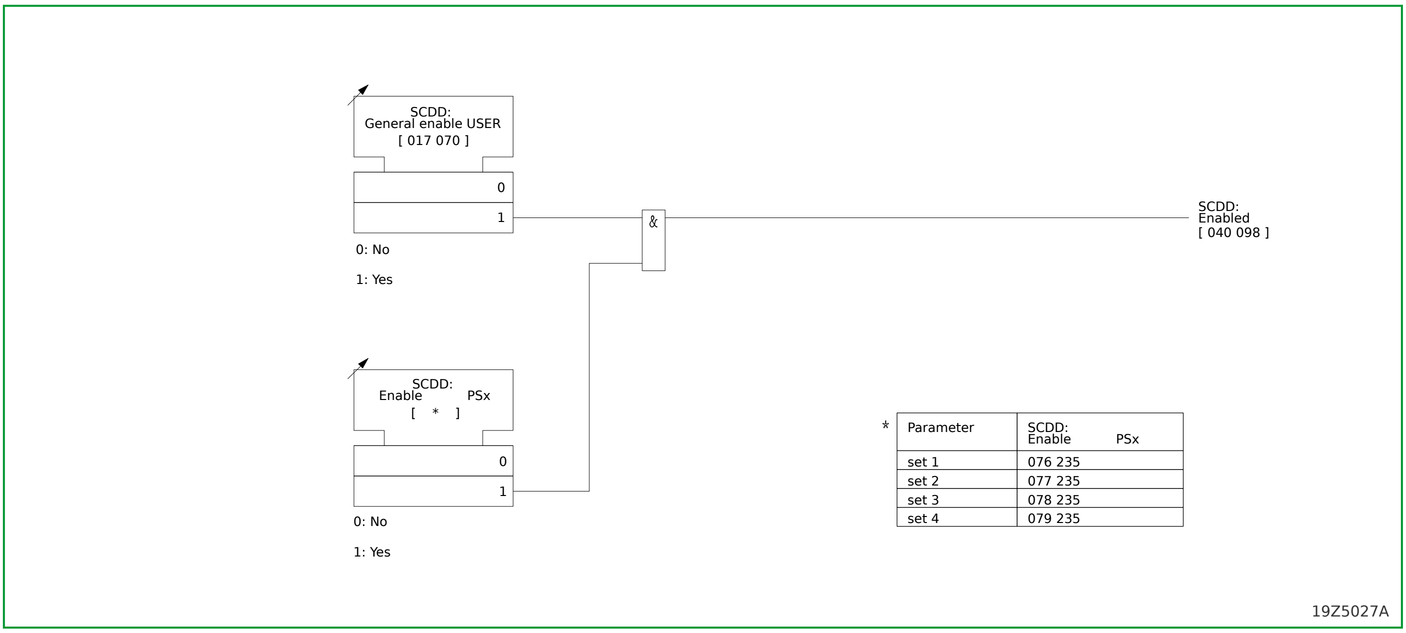


Fig. 3-155: Enable/disable the short-circuit direction determination.

3.24.2 Phase Current Stages

To determine direction in the phase current stages and depending on the type of fault a phase current and the opposed phase-to-phase voltage as well as the respective optimum characteristic angle are used.

As an example for a single-pole fault in phase A to ground the phase A current value (I_A), the phase B to phase C voltage value ($V_{B\text{-}C}$) and the characteristic angle α_P = +45° are selected as measured variables (see Fig. 3-156, (p. 3-200)).

The vector of the selected phase-to-phase voltage is the reference quantity. Beginning with the reference quantity the characteristic angle α_P will determine the measuring relation. Depending on the type of fault the P139 will present various characteristic angles. The measuring relation is defined as the angle bisector for the directional zone “Forward”. Forward directional is apparent if the vector of the selected phase current lies in the range ≤ ± 90° of the measuring relation.

Backward directional is apparent if the vector of the selected phase current lies in the range > ± 90° of the measuring relation.

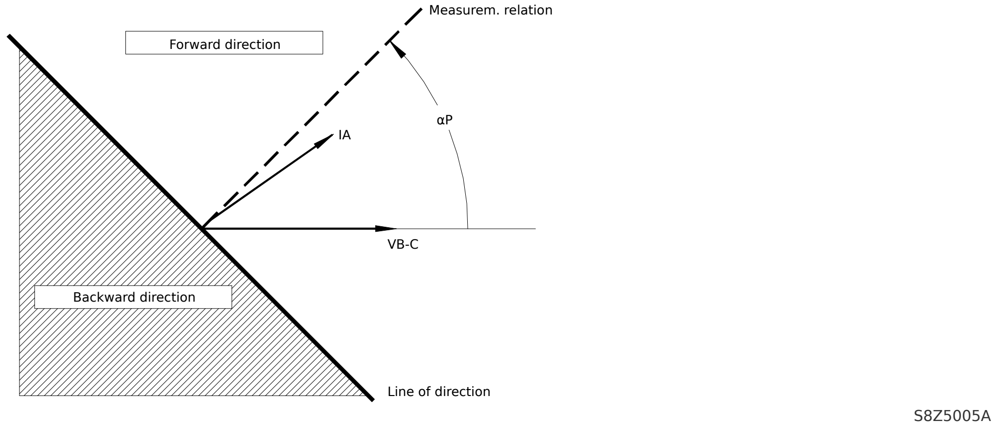


Fig. 3-156: Example for the forming of a directional phase current stage decision with a single-pole fault in phase A to ground (A-G) and with an inductive system and a phase sequence A-B-C (or clockwise rotary field direction).

3.24.3 Enabling for Phase Current Stages

Direction determination for phase current stages is only enabled if the following conditions are met simultaneously:

- The short-circuit direction determination is enabled.
- Measuring-circuit monitoring has detected no faults in the voltage measuring loop (see Section 3.41, (p. 3-372)).
- A phase current starting signal is present.
- At least two phase-to-phase voltages exceed 200 mV.
- All three phase current values exceed 0.1 I_{nom}.
- The external signal MAIN: M.c.b. trip V EXT is not present.

If the short-circuit direction determination is disabled the internal signal SCDD: Phase curr.stage bl. is generated.

Voltage memory can be applied when 3-pole faults have occurred (see Section 3.24.10, (p. 3-210)).

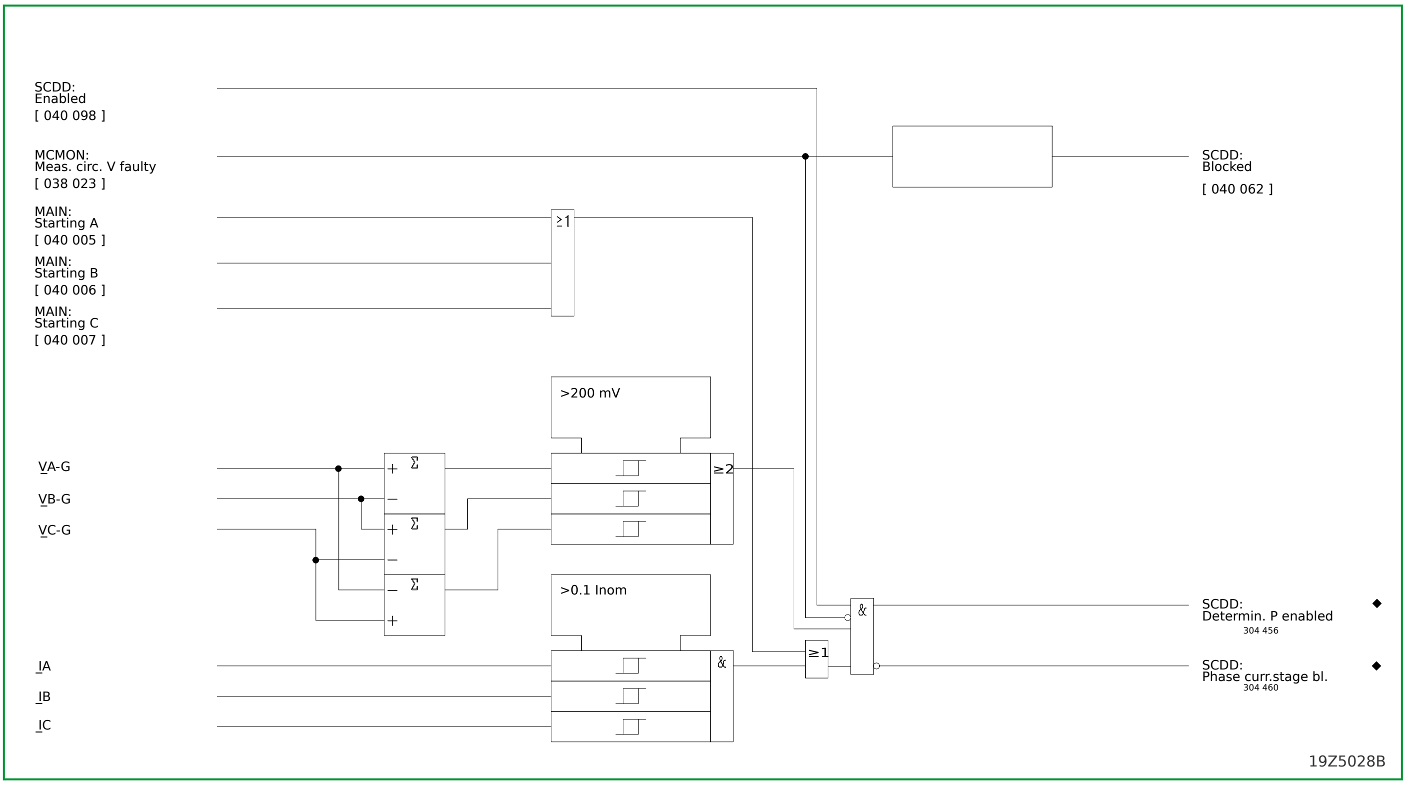


Fig. 3-157: Enabling direction determination for phase current stages.

After being enabled and depending on the direction determination decision one of the following signals will be issued:

- With a fault in forward direction, SCDD: Fault P forward
- With a fault in backward (reverse) direction, SCDD: Fault P backward

To inhibit transient contention problems starting and dropping out of a direction determination decision in both directions is delayed for 30 ms.

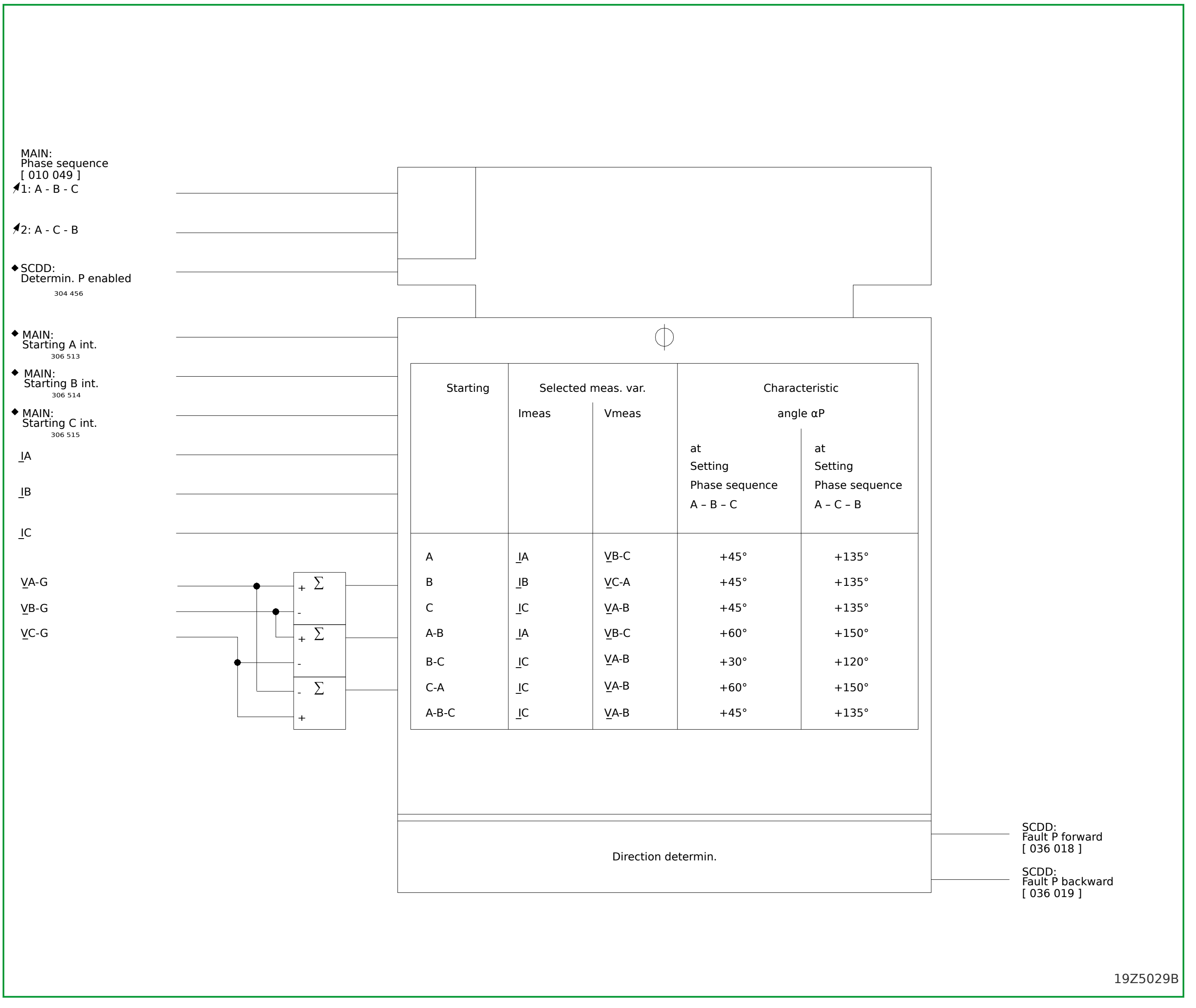


Fig. 3-158: Direction determination for phase current stages. (Note: Previous terminology of MAIN: Phase sequence was MAIN: Rotary field.)

3.24.4 Forming the Blocking Signal for the Phase Current Stages

To form the blocking signal for the two DTOC phase current stages and the IDMT phase current stage the fault direction to evaluate the measuring decision may be set separately for each of the stages to either “Forward directional”, “Backward directional” or “Non-directional”.

A blocking signal for the first DTOC phase current stage is formed when one of the following conditions is met:

- The direction for $t_{I>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for tI> is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

A blocking signal for the second DTOC phase current stage is formed when one of the following conditions is met:

- The direction for $t_{I>>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{I>>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

A blocking signal for the third DTOC phase current stage is formed when one of the following conditions is met:

- The direction for $t_{I>>>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{I>>>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

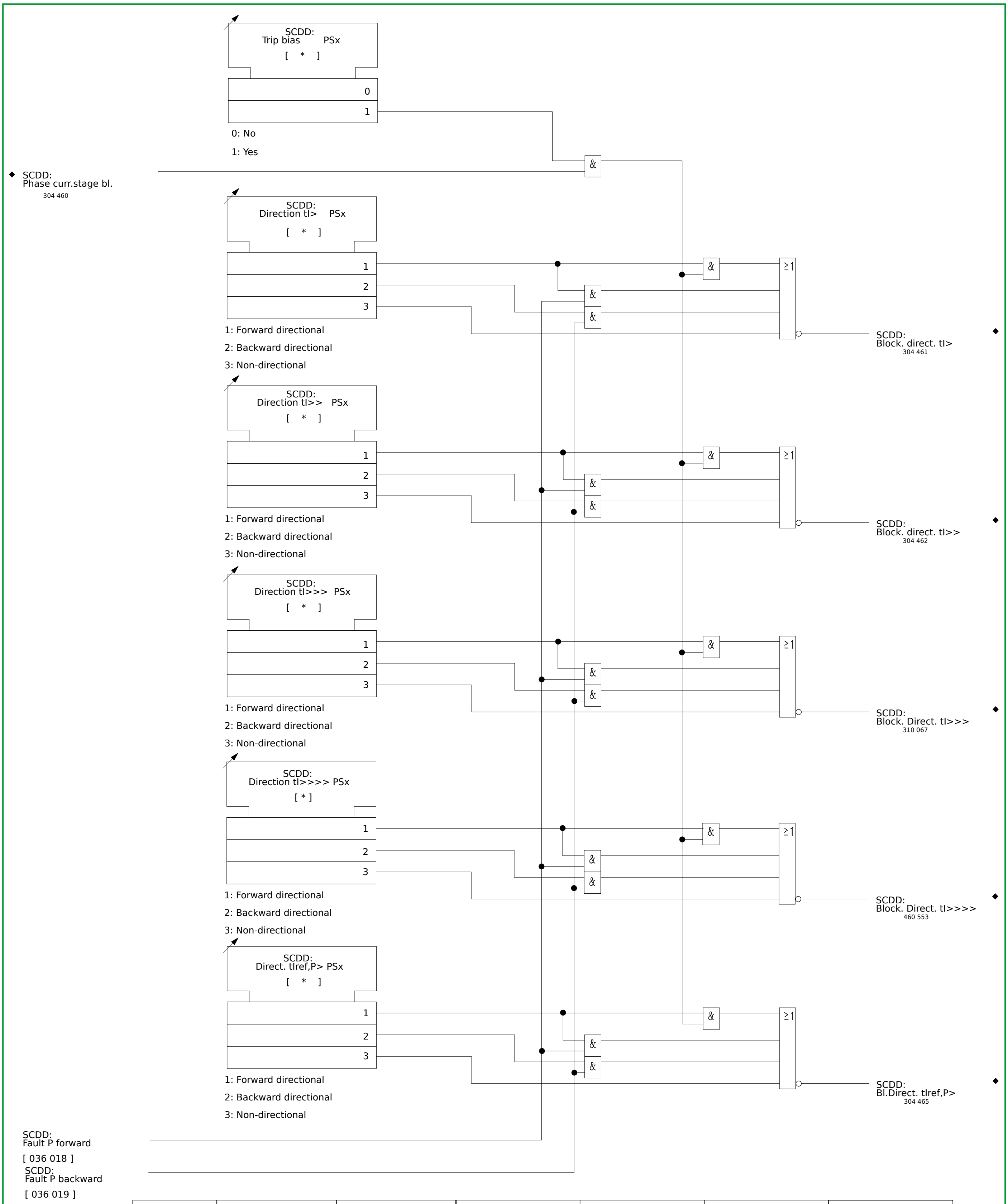
A blocking signal for the fourth DTOC phase current stage is formed when one of the following conditions is met:

- The direction for $t_{I>>>>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{I>>>>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

A blocking signal for the IDMT phase current stage is formed when one of the following conditions is met:

- The direction for $t_{Iref,P>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{Iref,P>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

In case the direction determination function is not enabled (e.g. with a M.c.b. trip) it is possible to select whether stages set to *Forward directional* may be operated with biased tripping by enabling SCDD: Trip bias PSx.



*

Parameter	SCDD: Trip bias PSx	SCDD: Direction tI> PSx	SCDD: Direction tI>> PSx	SCDD: Direction tI>>> PSx	SCDD: Direction tI>>>> PSx	SCDD: Direct. tIref,P> PSx
set 1	017 074	017 071	017 072	007 230	016 177	017 066
set 2	077 236	077 237	077 238	007 231	016 178	077 233
set 3	078 236	078 237	078 238	007 232	016 179	078 233
set 4	079 236	079 237	079 238	007 233	016 180	079 233

19Z8809A

Fig. 3-159: Forming the blocking signals for the phase current stages.

3.24.5 Residual Current Stages

To determine direction in the residual current stages the residual current measured (I_N) and the neutral-point displacement voltage ($V_{N\text{-}G} = -V_{G\text{-}N}$) are used. The specification of a good characteristic angle is carried out by the user according to the neutral-point treatment of the system. The characteristic angle α_N may be set in the range: −90° to +90°.

The reference quantity is the neutral-point displacement vector. Beginning with the reference quantity the characteristic angle will determine the measuring relation. The measuring relation is defined as the angle bisector for the directional zone “Forward”. Forward directional is apparent if the vector of the residual current lies in the range ≤ ± 90° of the measuring relation.

Backward directional is apparent if the vector of the residual current lies in the range > ± 90° of the measuring relation.

In the following example the system neutral is grounded with a relatively low resistance. Here the residual current apparent with a single-pole fault in phase A to ground (A-G) and a forward directional fault will take up the approximate position as shown in Fig. 3-160, (p. 3-205). With the characteristic angle α_N = −45° a forward directional decision will be issued.

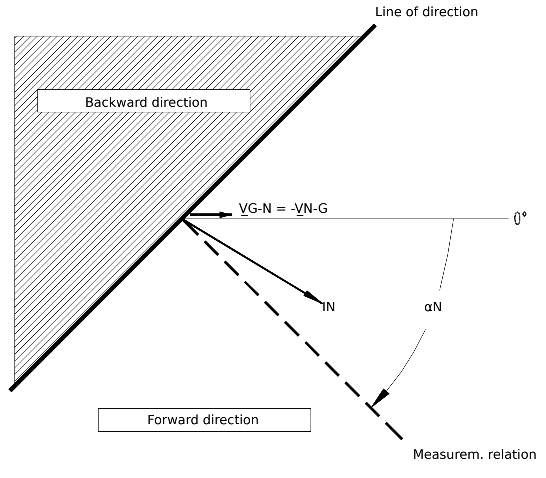


Fig. 3-160: Example for forming a directional decision in the residual current stage.

3.24.6 Conditioning and Selecting the Measured Variables

For the short-circuit direction determination it is possible to use either the neutral-point displacement voltage calculated by the P139 from the three phase-to-ground voltages or the displacement voltage measured at the T 90 transformer.

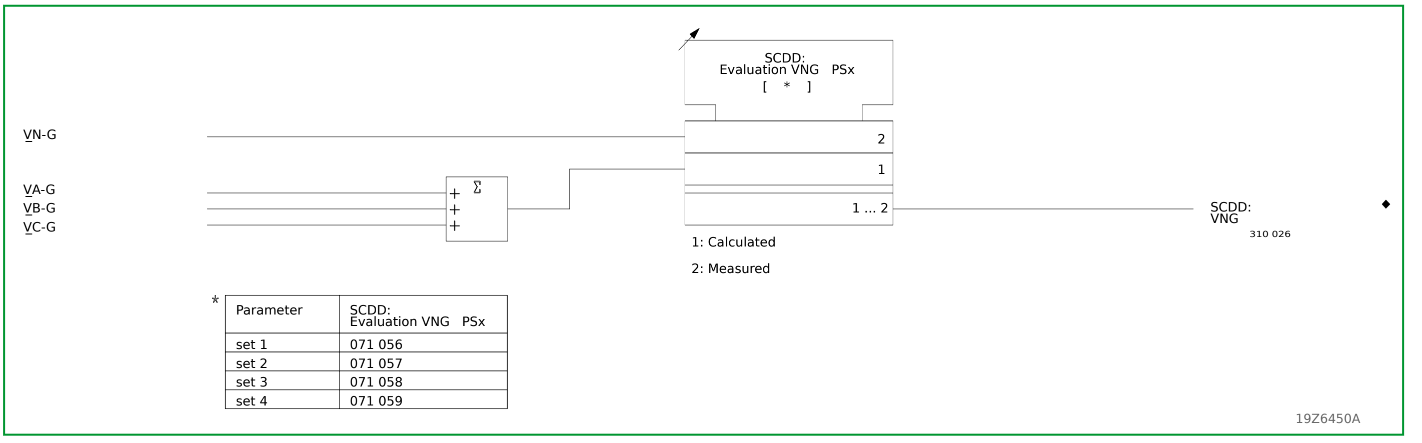


Fig. 3-161: Selecting the measuring voltage.

3.24.7 Enabling for Residual Current Stages

Direction determination for residual current stages is only enabled if the following conditions are met simultaneously:

- The short-circuit direction determination is enabled
- The short-circuit direction determination is not blocked by the measuring-circuit monitoring (see Section 3.41, (p. 3-372))
- A residual current starting signal is present
- The residual current exceeds 0.01 I_{nom}
- The external signal MAIN: M.c.b. trip V EXT is not present.
- The neutral-point displacement voltage exceeds the threshold value set at SCDD: VNG> PSx.

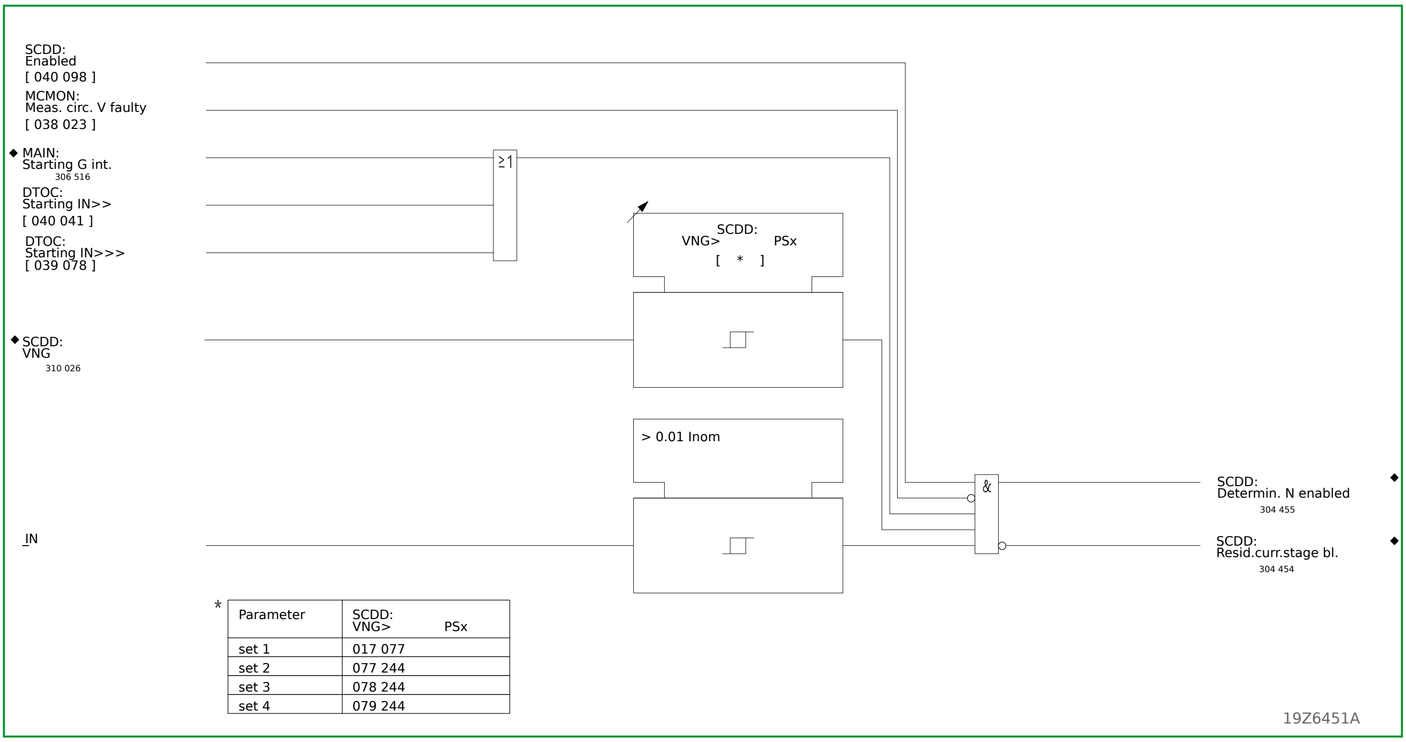


Fig. 3-162: Enabling direction determination for residual current stages.

After being enabled and depending on the direction determination decision one of the following signals will be issued:

- With a fault in forward direction: SCDD: Ground fault forward
- With a fault in backward direction: SCDD: Ground fault backw.

To inhibit transient contention problems starting and dropping out of a direction determination decision in both directions is delayed for 30 ms.

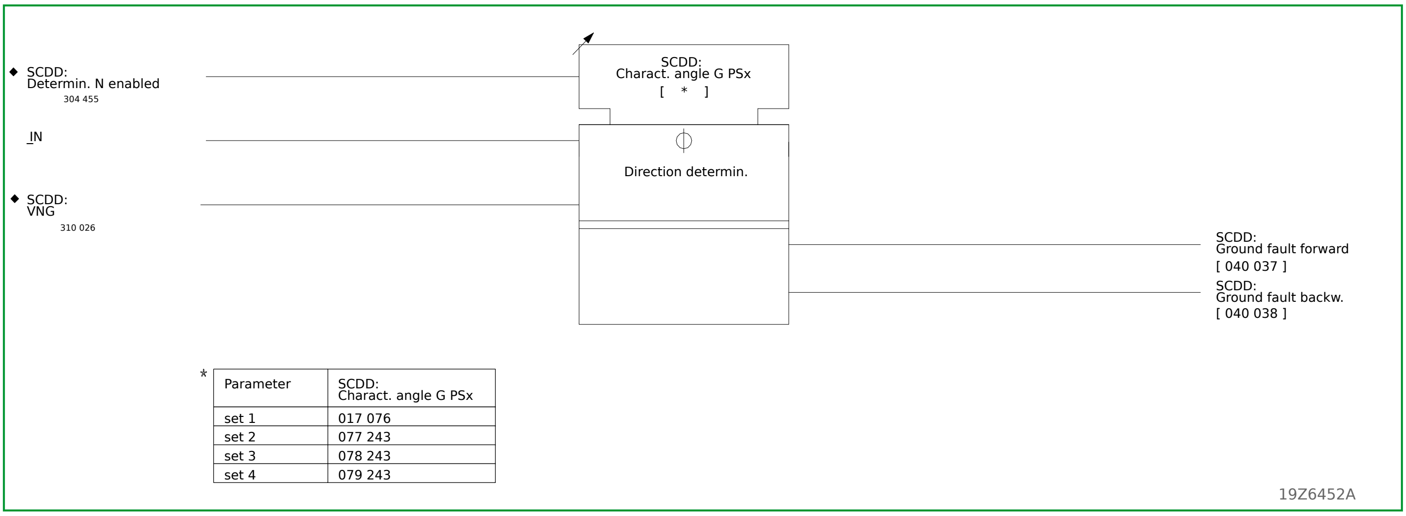


Fig. 3-163: Direction determination for residual current stages.

3.24.8 Forming the Blocking Signal for the Residual Current Stages

To form the blocking signal for the two DTOC residual current stages and the IDMT residual current stage the fault direction to evaluate the measuring decision may be set separately for each of the stages to either *Forward directional*, *Backward directional* or *Non-directional*.

A blocking signal for the first DTOC residual current stage is formed when one of the following conditions is met:

- The direction for $t_{IN>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{IN>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

A blocking signal for the second DTOC residual current stage is formed when one of the following conditions is met:

- The direction for $t_{IN>>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{IN>>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

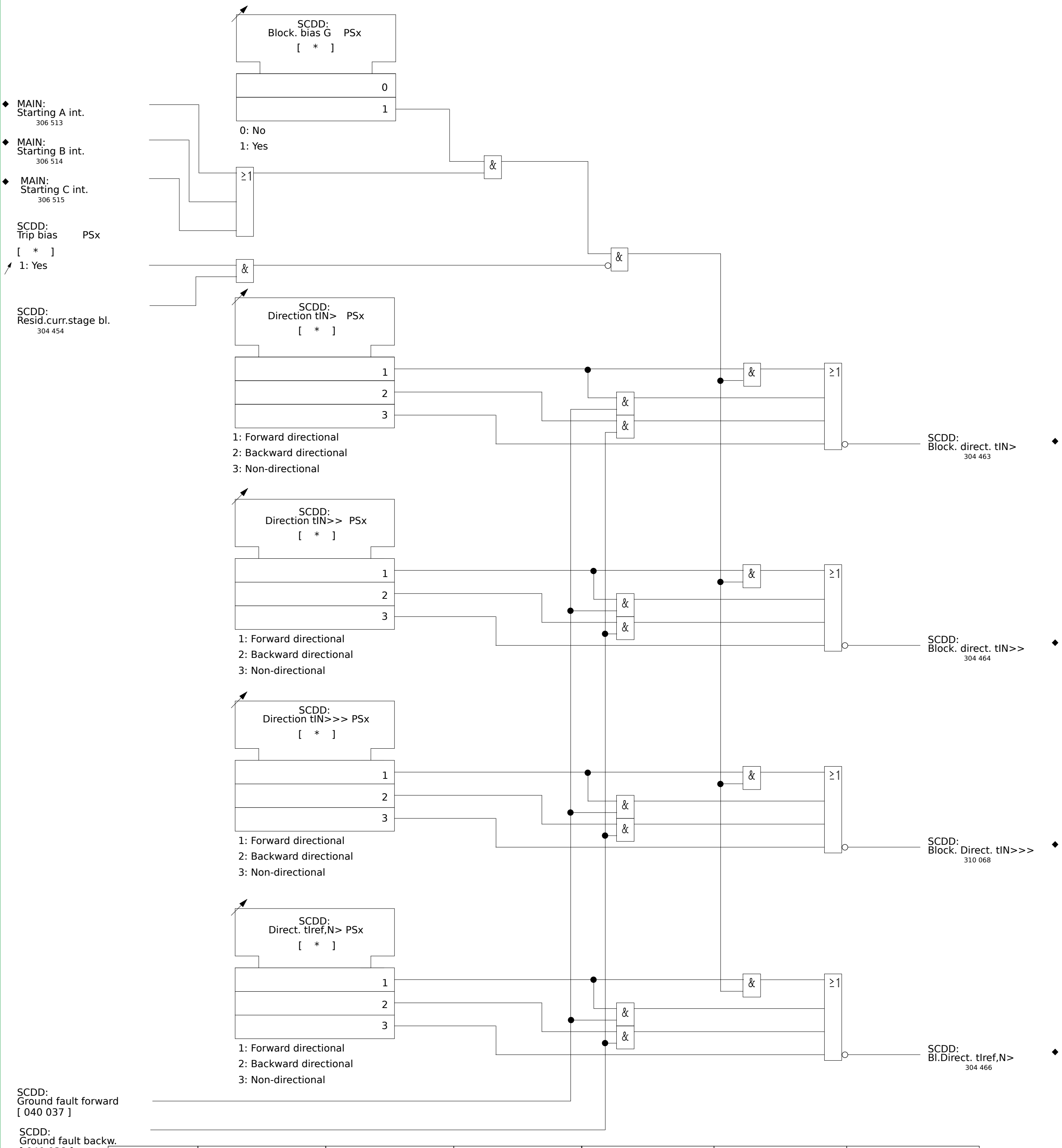
A blocking signal for the third DTOC residual current stage is formed when one of the following conditions is met:

- The direction for $t_{IN>>>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{IN>>>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

A blocking signal for the IDMT residual current stage is formed when one of the following conditions is met:

- The direction for $t_{Iref,N>}$ is set to *Forward directional* and the short-circuit direction determination detects a fault in backward direction.
- The direction for $t_{Iref,N>}$ is set to *Backward directional* and the short-circuit direction determination detects a fault in forward direction.

In case the direction determination function is not enabled (e.g. with a M.c.b. trip) it is possible to select whether stages set to *Forward directional* may be operated with biased tripping by enabling SCDD: Trip bias PSx. In case of a phase current starting bias tripping in the residual current stage may be suppressed by enabling SCDD: Block. bias G PSx.



* Parameter	SCDD: Block. bias G PSx	SCDD: Trip bias PSx	SCDD: Direction tIN> PSx	SCDD: Direction tIN>> PSx	SCDD: Direction tIN>>> PSx	SCDD: Direct. tIref,N> PSx
set 1	017 078	017 074	017 073	017 075	007 235	017 067
set 2	077 245	077 236	077 240	077 241	007 236	077 242
set 3	078 245	078 236	078 240	078 241	007 237	078 242
set 4	079 245	079 236	079 240	079 241	007 238	079 242

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Fig. 3-164: Forming the blocking signals for the residual current stages.

3.24.9 Signaling Logic

Fault directional signals generated by the directional determination function of the phase and residual current stages are grouped together to a combined function.

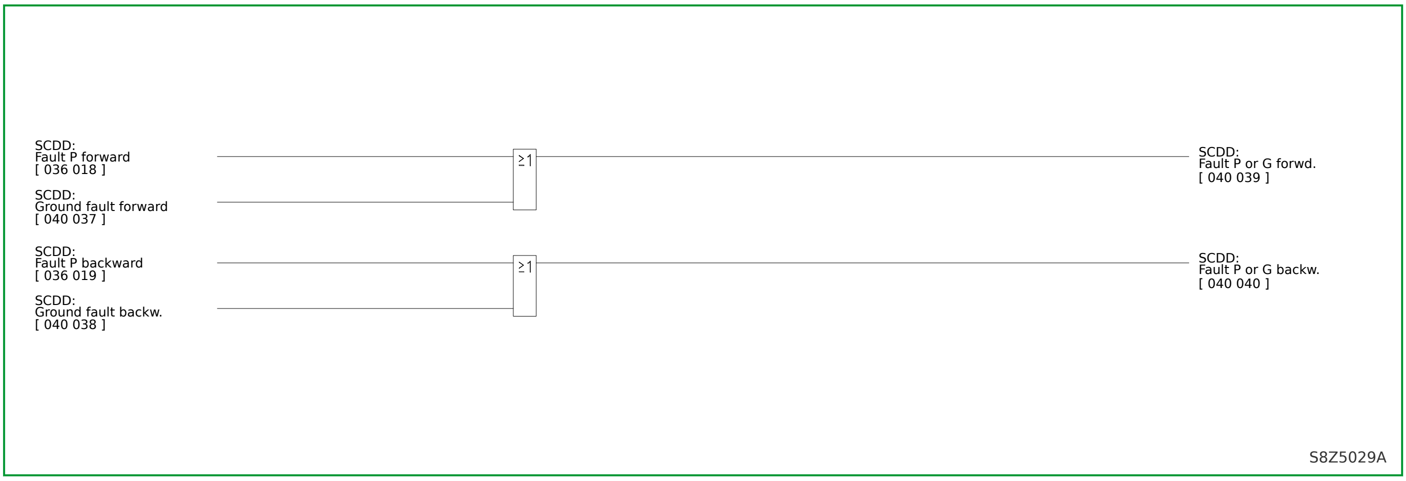


Fig. 3-165: Fault signals from phase or residual current stages forward or backward directional.

3.24.10 Short-Circuit Direction Determination Using Voltage Memory

The short-circuit direction determination (SCDD) function group is subdivided into two subsets.

Direction determination in a residual current system

- For direction determination in a residual current system the measured residual current IN and the vector addition of the phase-ground voltages are applied.

  In this case voltage memory is not used.

Direction determination in a phase system

- For direction determination in a phase system the SCDD function uses the fault-dependent short-circuit current and – in general – the phase-to-phase, un-faulted voltages (not involved in the short-circuit) assigned to the type of fault. This ensures that with single-pole and two-pole faults there is always sufficient voltage available for direction determination.

  This procedure can also be applied to three-pole faults with a phase-to-phase voltage > 200 mV.

  Should a three-pole fault occur close to the point of measurement, there could be such a large 3-phase voltage drop, that direction determination on above basis is no longer possible. For such fault occurrences there is a voltage memory available from which the SCDD function can obtain the necessary voltage information for direction determination.

With a three-pole fault in the phase-current stage the measurement loop voltage (V_{ABmeas}) is compared to the selected operate value ($V_{op.Val.}$) of the voltage memory set by the user at SCDD: Oper.val.Vmemory PSx. If $V_{ABmeas} < V_{op.Val.}$ then the SCDD function will not use V_{ABmeas} but will revert to the voltage memory, if it has been enabled. The following signal is issued: SCDD: Direct. using memory

If the voltage memory has not been enabled (i.e. |Delta f| > 2.5 Hz) the SCDD function will check if V_{ABmeas} is sufficient for direction determination.

Should the result with a disabled voltage memory be V_{ABmeas} > 200 mV the direction will be determined on the basis of V_{ABmeas}. The following signal is issued: SCDD: Direct. using Vmeas

If V_{ABmeas} < 200 mV, a forward fault is detected if the voltage memory is disabled and if the pre-orientation is active (set under SCDD: Trip bias PSx), otherwise the directional decision is blocked. The following signal is issued: SCDD: Forw. w/o measurem.

These signals are additionally delivered to the following signals:

- SCDD: Fault P forward
- SCDD: Fault P backward
- SCDD: Fault P or G forwd.
- SCDD: Fault P or G backw.

3.25 Switch on to Fault Protection (Function Group SOTF)

When the circuit breaker is closed manually, it is possible to switch on to an existing fault. This is especially critical as the overcurrent protection will only clear the fault after the set time delay period has elapsed. In this situation, however, the fastest possible fault clearance is desired.

To ensure fast fault clearance with manual closing, the manual close signal must be applied not only to the circuit breaker but at the same time also to the P139. With the manual close command a settable timer stage will be triggered, as long as there is no close request present from the ARC and no HSR cycle from an external auto reclose control is operating. By setting a parameter it is possible to choose which starting decisions from the overcurrent protection will generate a trip signal while the timer stage is running.

An internal blocking signal is generated together with the trigger signal for the timer stage. This internal blocking signal will prevent that ARC is activated during an existing fault when a manual close signal is issued.

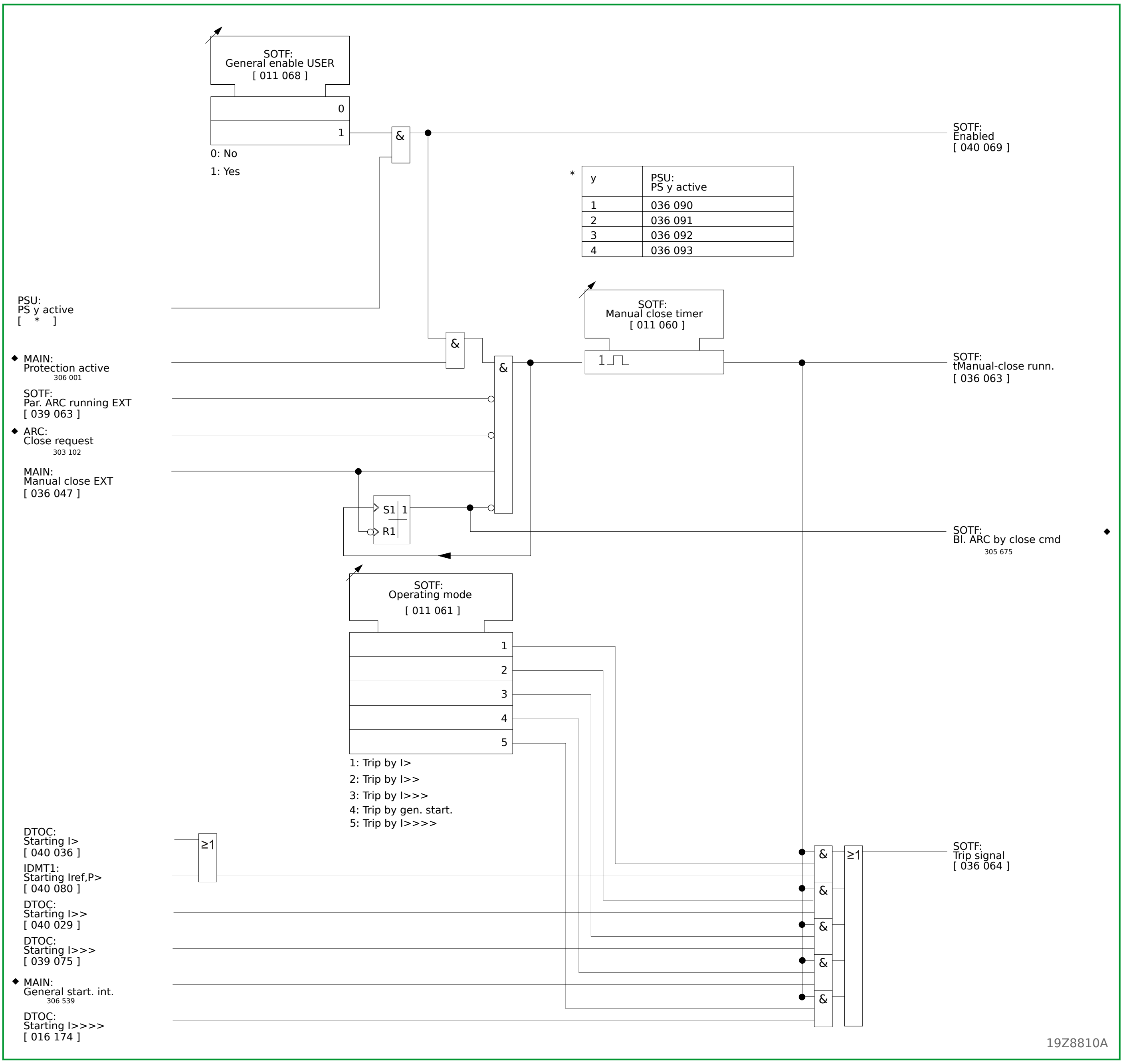


Fig. 3-166: Switch on to fault protection. (Only IDMT1 is shown; the logic, however, also applies to IDMT2 with different numerical addresses.)

3.26 Protective Signaling (Function Group PSIG)

Protective signaling is used together with the short-circuit direction determination in power systems with single-end infeed and a subsequent parallel line configuration (line section). Selective instantaneous clearing of the line section affected by the fault is initiated by this function, while the DTOC or IDMT tripping times are bypassed.

3.26.1 Disabling and Enabling Protective Signaling

The function can be disabled or enabled using setting parameters or through binary signal inputs.

The function is enabled independently of parameter subsets via PSIG: General enable USER. It is enabled as a function of a parameter subset via PSIG: Enable PSx. If these enabling functions have been activated, protective signaling can be disabled or enabled using setting parameters or through appropriately configured binary signal inputs. Parameters and configured binary signal inputs have equal status. If only the PSIG: Enable EXT function is assigned to a binary signal input, then protective signaling is enabled by a positive edge of the input signal and it is disabled by a negative edge. If only the PSIG: Disable EXT function is assigned to a binary signal input, then a signal at this input will have no effect.

3.26.2 Readiness of Protective Signaling

In order for protective signaling (PSIG) to function, the following requirements must be satisfied:

- It must be enabled.
- There must be no external blocking.
- There must be no transmission fault.

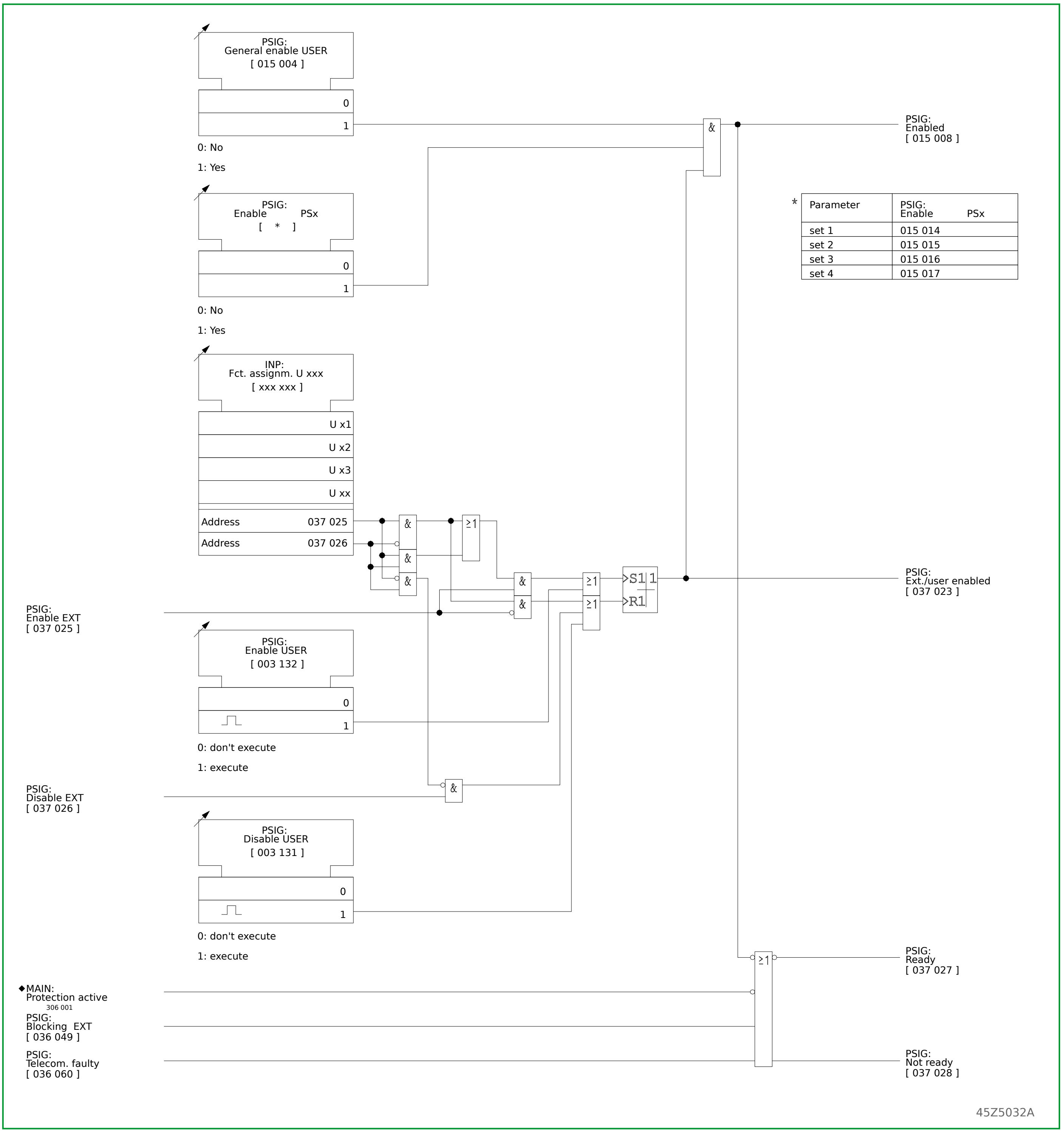


Fig. 3-167: Protective signaling is ready.

3.26.3 Setting up a Communications Link

When setting up a communications link the make contact or the break contact (dependent on the selected transmission relay operating mode *Transm.rel.make con.* or *Transm.rel.break con*) is to be connected by pilot wires to the input labeled PSIG: Receive EXT at the remote station (see Chapter 5 “Installation and Connection” and Fig. 3-168, (p. 3-216)). With both operating modes and in the idle state there is a receive signal (DC loop closed) present at the local and at the remote station.

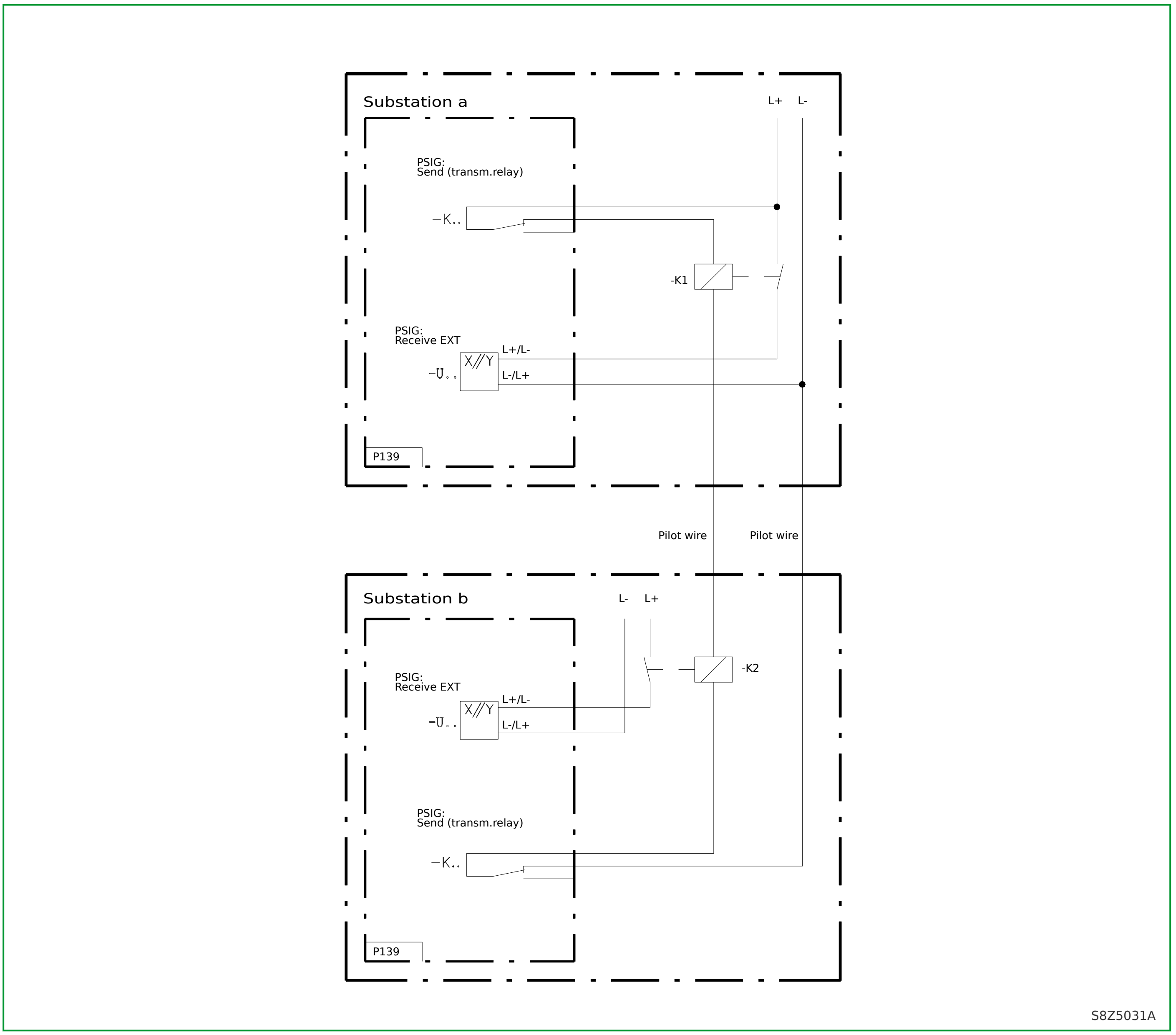


Fig. 3-168: Protective signaling over pilot wires, operating mode selected Transm.rel.break con.

3.26.4 Operation of Protective Signaling

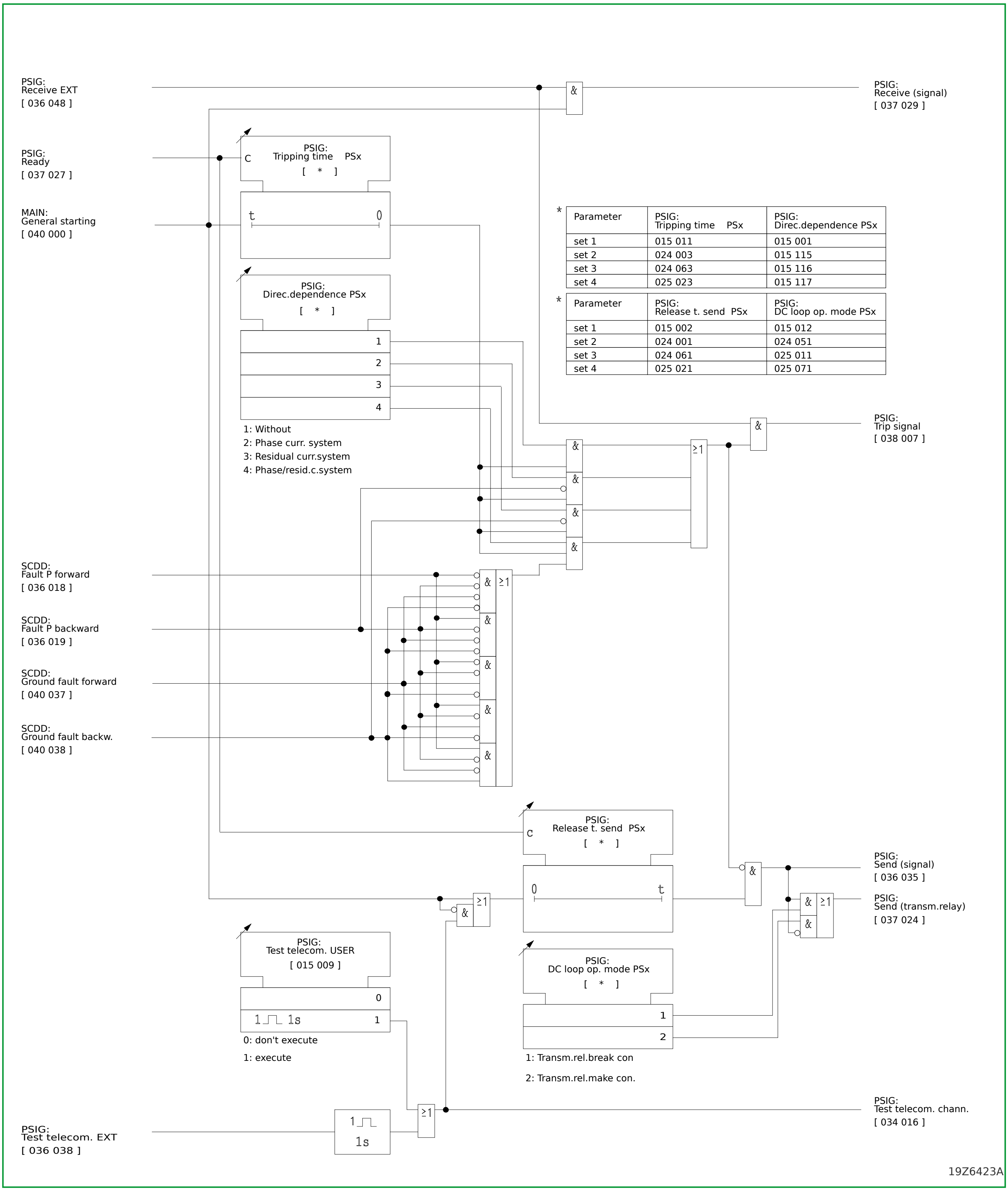
When a general starting condition is issued the DC loop is opened without delay (Send). Closing again of the DC loop with the general starting condition present after the set tripping time has elapsed occurs according to the operating mode selected at PPSIG: Direc.dependence PSx and dependent on the directional decisions:

- Independently of a directional decision
- Dependent on the condition that no directional decision by the phase current stage in backward (reverse) direction is present
- Dependent on the condition that no directional decision by the residual current stage in backward (reverse) direction is present
- Dependent that one of the conditions in below table is met:

SCDD: Ground fault backw. Fault residual current stage backward (reverse)	SCDD: Ground fault forward Fault residual current stage forward	SCDD: Fault P backward Fault phase current stage backward (reverse)	SCDD: Fault P forward Fault phase current stage forward
No	*No*	*No*	*No*
No	*No*	*No*	*Yes*
No	*Yes*	*No*	*No*
No	*Yes*	*No*	*Yes*
Yes	*No*	*No*	*Yes*

The signal PSIG: Trip signal is generated without delay after the DC loop is closed again with the general starting condition present and the status signal for a closed DC loop was issued to the binary signal input labeled PSIG: Receive EXT. Delayed by the release time set at PSIG: Release t. send PSx the DC loop is closed again after the general starting condition has dropped out.

When protective signaling is not ready the DC loop is open when the operating mode is set to *Transm.rel.make con.* and it is closed when the operating mode is set to *Transm.rel.break con*.



*

Parameter	PSIG: Tripping time PSx	PSIG: Direc.dependence PSx
set 1	015 011	015 001
set 2	024 003	015 115
set 3	024 063	015 116
set 4	025 023	015 117

*

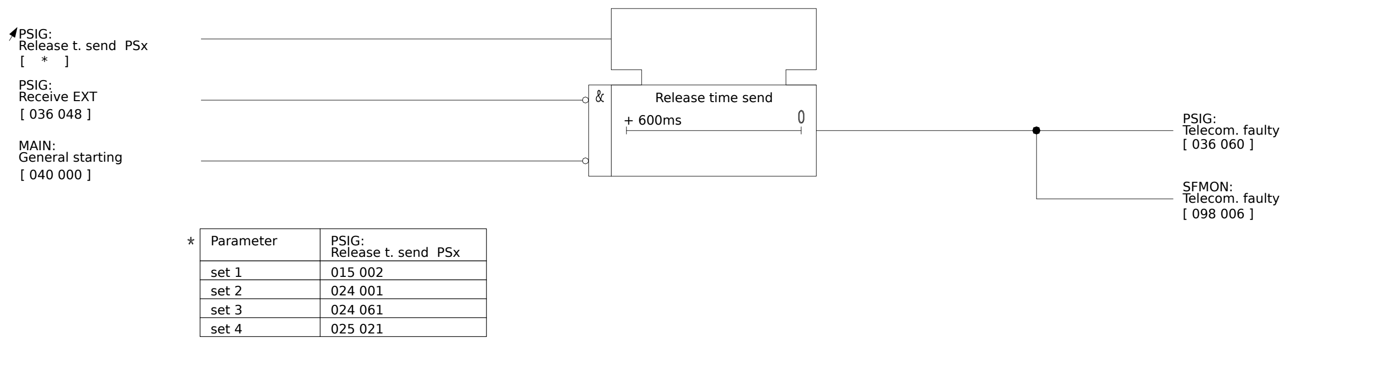
Parameter	PSIG: Release t. send PSx	PSIG: DC loop op. mode PSx
set 1	015 002	015 012
set 2	024 001	024 051
set 3	024 061	025 011
set 4	025 021	025 071

Fig. 3-169: Protective signaling logic.

3.26.5 Monitoring and Testing the DC Loop for PSIG

The pilot wires are monitored for interruptions. If during a faultless operation, e.g. with no general starting condition present, there is no signal received from the DC loop after the set release time period for the transmit relay (+ 600 ms) has elapsed, then the signal PSIG: Telecom. faulty is issued (see Fig. 3-170, (p. 3-219)). A transmission fault leads to a blocking of the protective signaling function.

In order to test the DC loop the communications link may be broken by setting the parameter at PSIG: Test telecom. USER to *execute*.



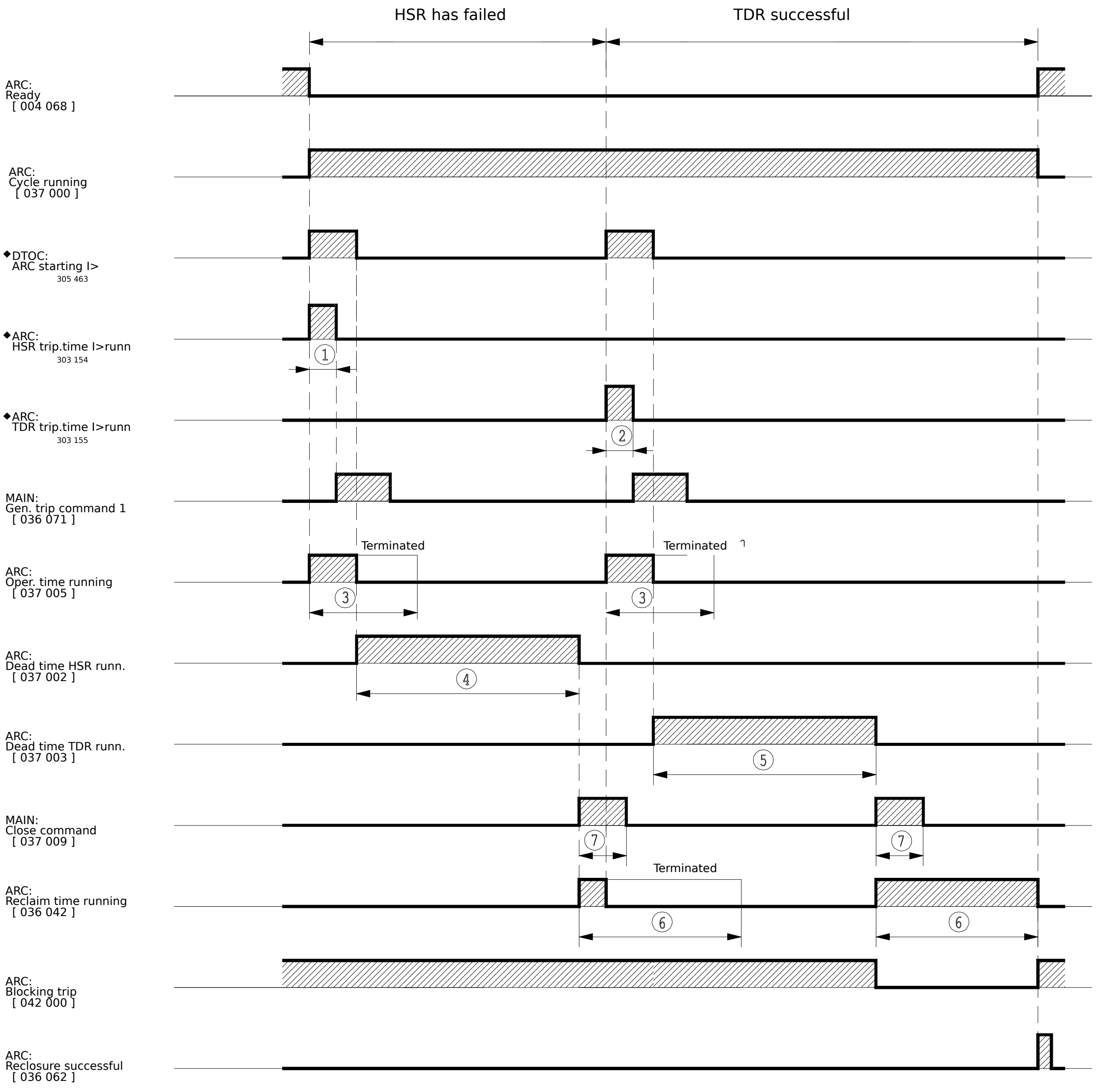
* Parameter	PSIG: Release t. send PSx
set 1	015 002
set 2	024 001
set 3	024 061
set 4	025 021

Fig. 3-170: Protective signaling transmission fault.

3.27 Auto-Reclosure Control (Function Group ARC)

Under certain conditions the automatic reclosure control function (ARC) will cause a line section to be cleared and then, when the dead time has elapsed, automatic reclosure of the line section will occur.

Fig. 3-171, (p. 3-221) shows an example for the usual sequence of a failed high-speed reclosure (HSR) followed by a subsequent successful time-delay reclosure (TDR).



* Parameter	1 ARC: HSR trip.time I> PSx	2 ARC: TDR trip.time I> PSx	3 ARC: Operative time PSx	4 ARC: HSR dead time PSx	5 ARC: TDR dead time PSx	6 ARC: Reclaim time PSx
set 1	015 072	015 073	015 066	015 056	015 057	015 054
set 2	024 040	024 041	024 035	024 030	024 031	024 028
set 3	025 000	025 001	024 095	024 090	024 091	024 088
set 4	025 060	025 061	025 055	025 050	025 051	028 048

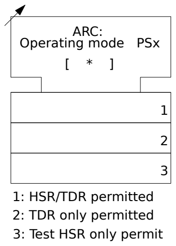
7 MAIN:
Close cmd.pulse time [015 067]
ARC:
No. permit. TDR PSx Setting: 1

19Z5041A

Fig. 3-171: Example for an ARC sequence.

3.27.1 ARC Operating Modes

The ARC function available in the P139 offers the possibility of triggering starting times with different starting signals. Once the starting times have elapsed, a trip signal is generated. Multiple reclosures are possible with the ARC function available in the P139. When the ARC operating mode has been set accordingly, multiple reclosures first begin with a high-speed reclosure (HSR). If the fault is not cleared after reclosure by a HSR, then another attempt can be made to clear the fault with a time-delay reclosure (TDR). Multiple reclosures using only TDRs are also possible if the ARC operating mode is set accordingly.



* Parameter	ARC: Operating mode PSx
set 1	015 051
set 2	024 025
set 3	024 085
set 4	025 045

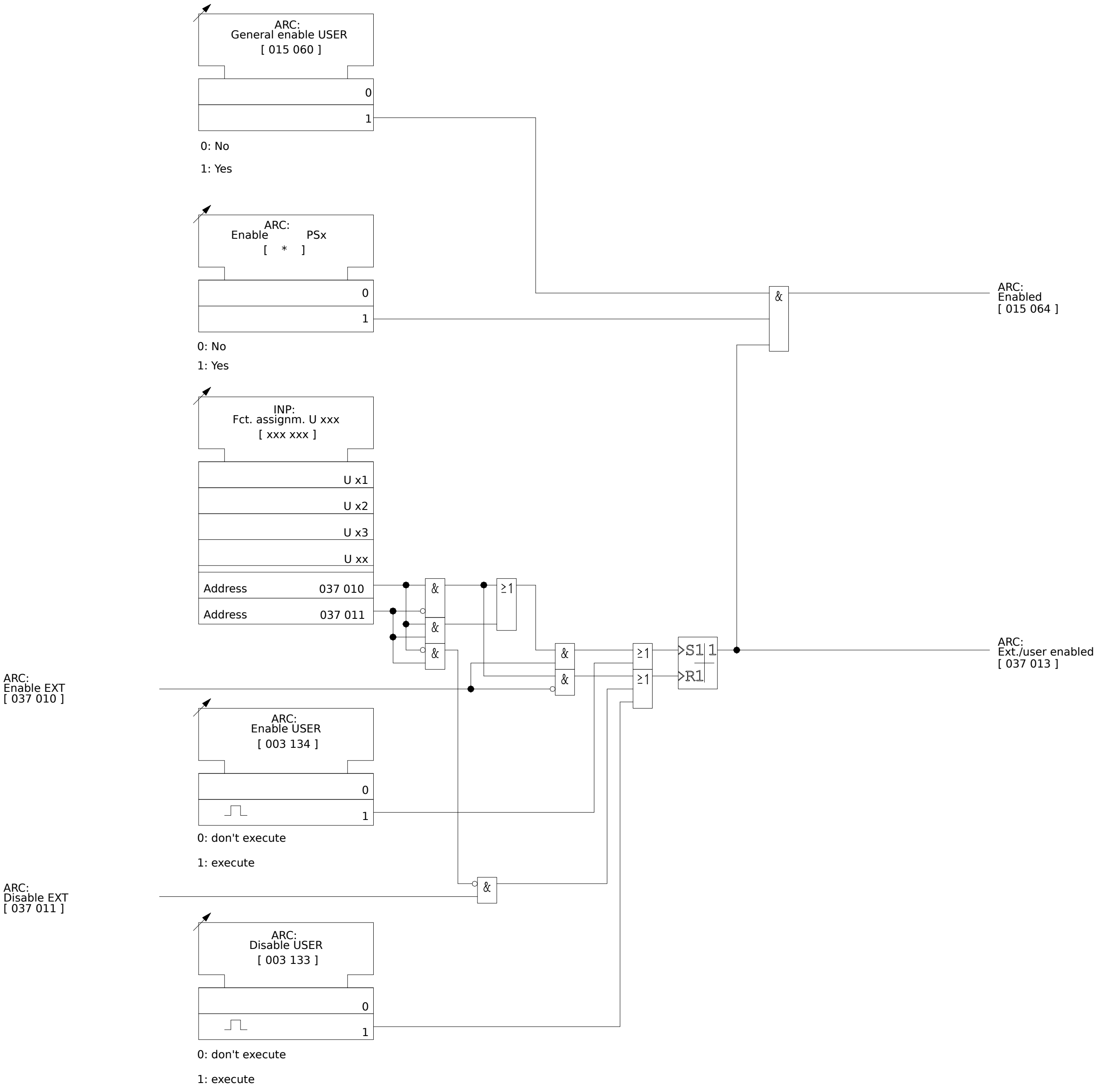
19Z5037A

Fig. 3-172: Setting the operating mode of the ARC function.

3.27.2 Enabling and Disabling the ARC Function

Disabling or enabling may be carried out with parameters or binary signal inputs.

The activation of the function is enabled generally (independent of parameter subsets) via ARC: General enable USER. It is enabled as a function of a parameter subset via ARC: General enable USER. If these enabling functions have been activated, the Auto-reclose control function can be disabled or enabled by setting parameters or through appropriately configured binary signal inputs. Parameters and configured binary signal inputs have equal status. If only the ARC: Enable EXT function is assigned to a binary signal input, then ARC will be enabled by a positive edge of the input signal and disabled by a negative edge. If only the parameter ARC: Disable EXT has been assigned to a binary signal input, then a signal at this input will have no effect.



* Parameter	ARC: Enable PSx
set 1	015 046
set 2	015 047
set 3	015 048
set 4	015 049

19Z5038A

Fig. 3-173: Enabling or disabling auto-reclosure control.

3.27.3 ARC Blocking

Under certain conditions the ARC will be blocked and the signal ARC: Blocked will be issued, provided that one of the following conditions is met:

- A blocking signal is present because of a manual close.
- An external signal ARC: Blocking EXT is present.
- ARC is disabled.
- Protection is disabled (off).
- A manual trip command is issued via setting parameter.

When all blocking conditions have been removed, the blocking time is started. When the blocking time has elapsed, ARC blocking is canceled.

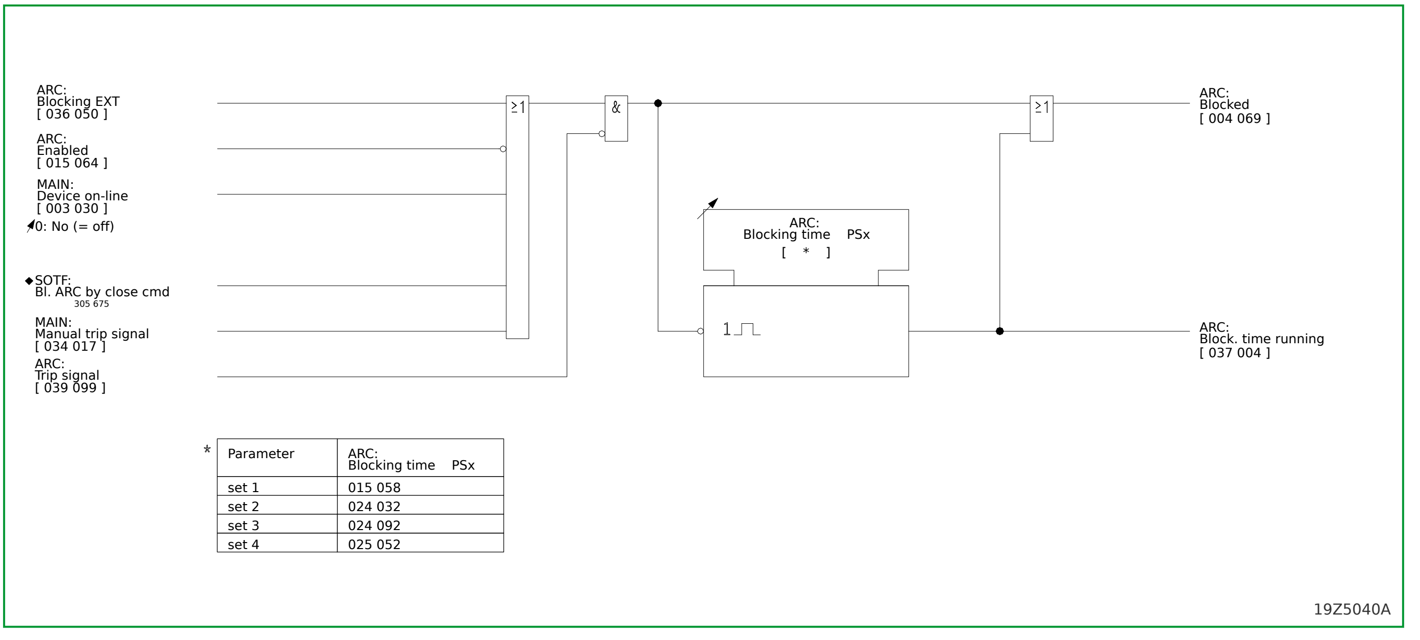


Fig. 3-174: ARC blocking.

3.27.4 ARC Ready to Operate

An ARC cycle can only start if the ARC is ready. For this purpose the following conditions need to be met simultaneously:

- Protection is activated (on).
- ARC is not blocked.
- The circuit breaker must be capable of opening and closing again (CB opening & closing drive is ready).
- The circuit breaker contacts must be in closed position (closed position scanning is optional).
- No ARC cycle is running.

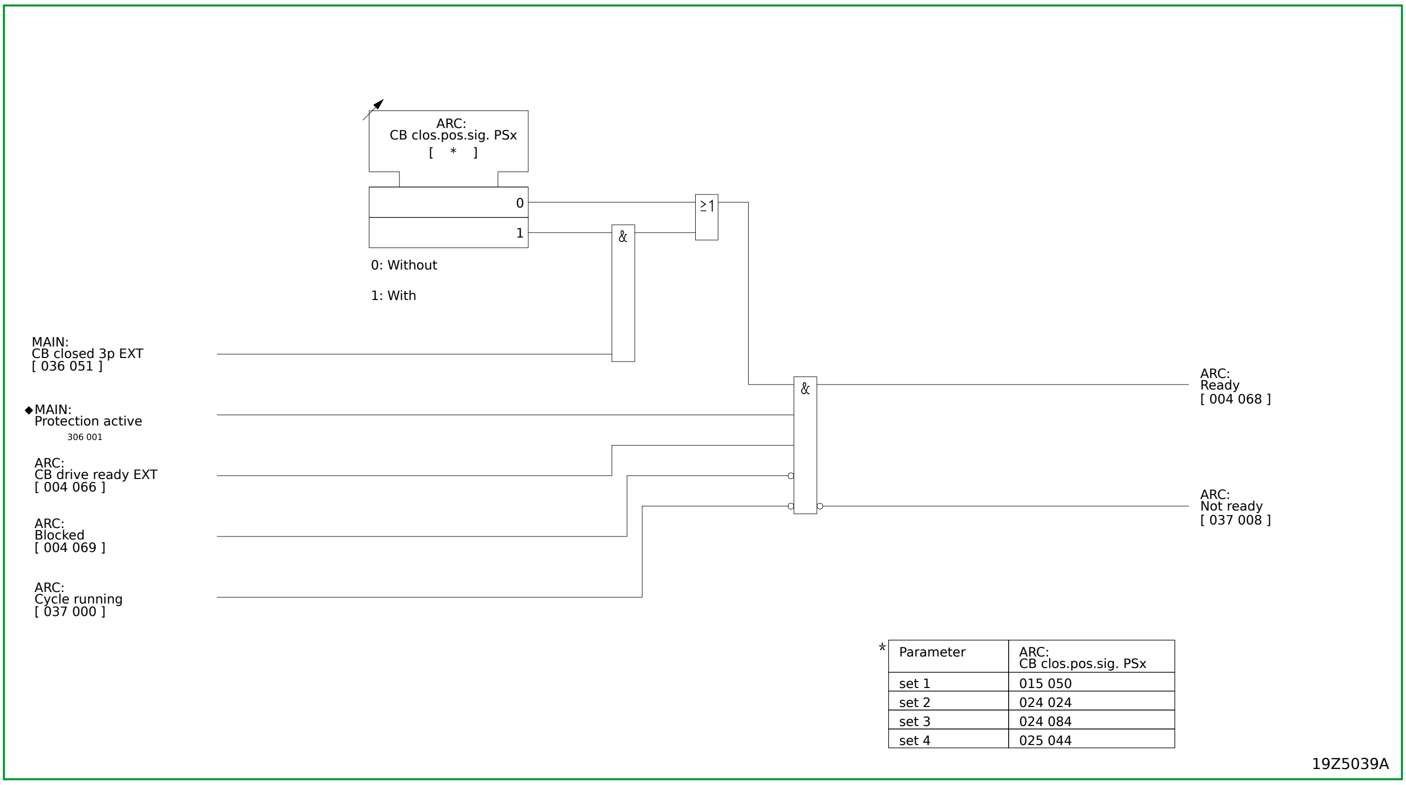


Fig. 3-175: ARC ready to operate.

3.27.5 Tripping Times

When protection functions operating with auto-reclosure control are started, the tripping times (HSR or TDR) are started together with the operative time. If the tripping time has elapsed during an active ARC cycle while the operative time is still running, a trip signal is issued. The HSR or TDR trip time having caused the trip signal also determines which dead time (HSR or TDR) is to be triggered. Once the dead time commences, all tripping times already triggered and the operative time will be terminated.

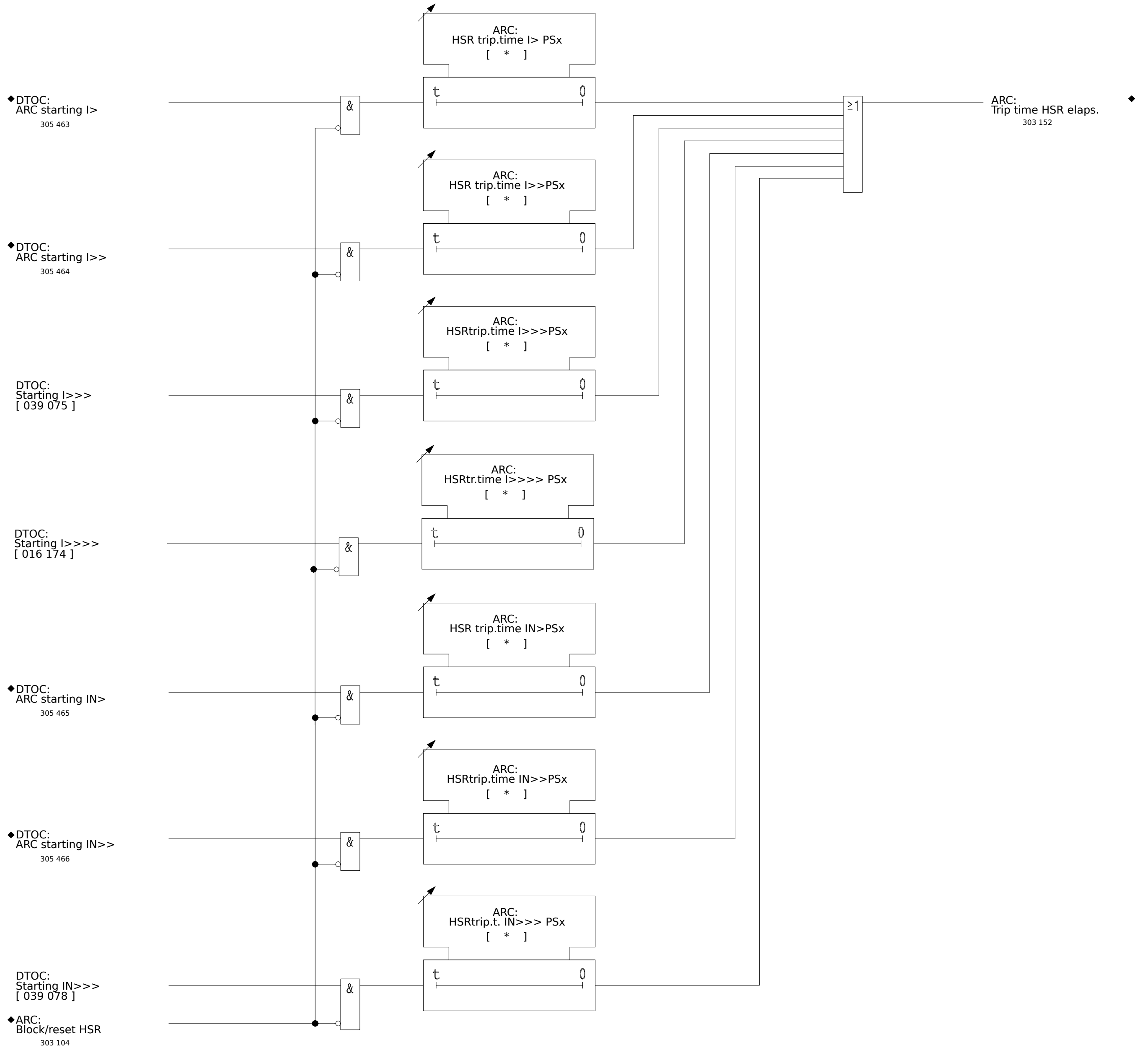
The beginning of the following starts or input signals trigger the tripping times provided that the starting conditions are met and the respective tripping times are not *blocked*. If short-circuit direction determination (SCDD) is enabled, then some of the starting signals are directional:

- General starting
- DTOC: Starting I> (directional)
- DTOC: Starting I>> (directional)
- DTOC: Starting I>>> (directional)
- DTOC: Starting I>>>> (directional)
- DTOC: Starting IN> (directional)
- DTOC: Starting IN>> (directional)
- DTOC: Starting IN>>> (directional)
- IDMT1: Starting Iref,P> (directional)
- IDMT1: Starting Iref,N> (directional)
- IDMT1: Starting Iref,neg>
- GFDSS: Start.forward/LS pow
- GFDSS: Start.forward/LS adm or GFDSS: Starting Y(N)>, depending on setting (015 105) ARC: Sig.asg.trip t.Adm.
- Start by programmable logic

If – in the operating mode *HSR/TDR permitted* – only one of the starting conditions listed above applies, then the first trip signal is always generated by the HSR trip time stage, regardless of the duration of the HSR or TDR tripping time setting. HSR precedes TDR. If more than one starting is present then the trip signal will be issued after the HSR tripping time that has elapsed first. As an exception, a TDR will be triggered first after having elapsed first, if the associated HSR tripping time is set to *Blocked*.

If the trip signal has been generated by a TDR tripping time stage, then no HSR will be initiated within the same ARC cycle.

The ARC trip signal must be included in the “m out of n” selection of the trip commands.

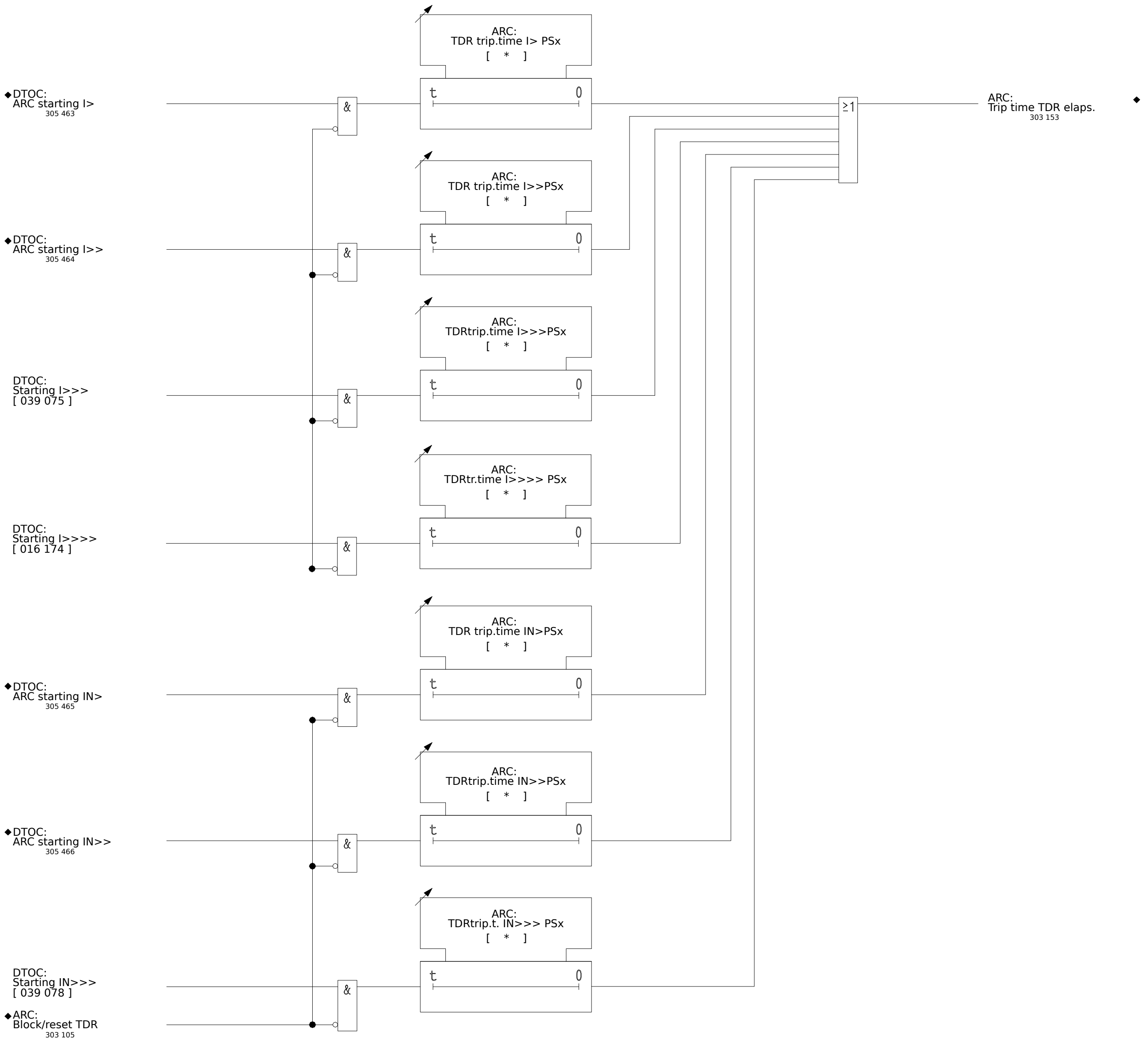


*

Parameter	ARC: HSR trip.time I> PSx	ARC: HSR trip.time I>>PSx	ARC: HSRtrip.time I>>>PSx	ARC: HSRtr.time I>>>> PSx	ARC: HSR trip.time IN>PSx	ARC: HSRtrip.time IN>>PSx	ARC: HSRtrip.t. IN>>> PSx
set 1	015 072	015 074	014 096	016 181	015 076	015 031	014 098
set 2	024 040	024 101	024 102	016 182	024 103	024 104	024 105
set 3	025 000	025 151	024 152	016 183	024 153	024 154	024 155
set 4	025 060	025 101	025 102	016 184	025 103	025 104	025 105

19Z8850A

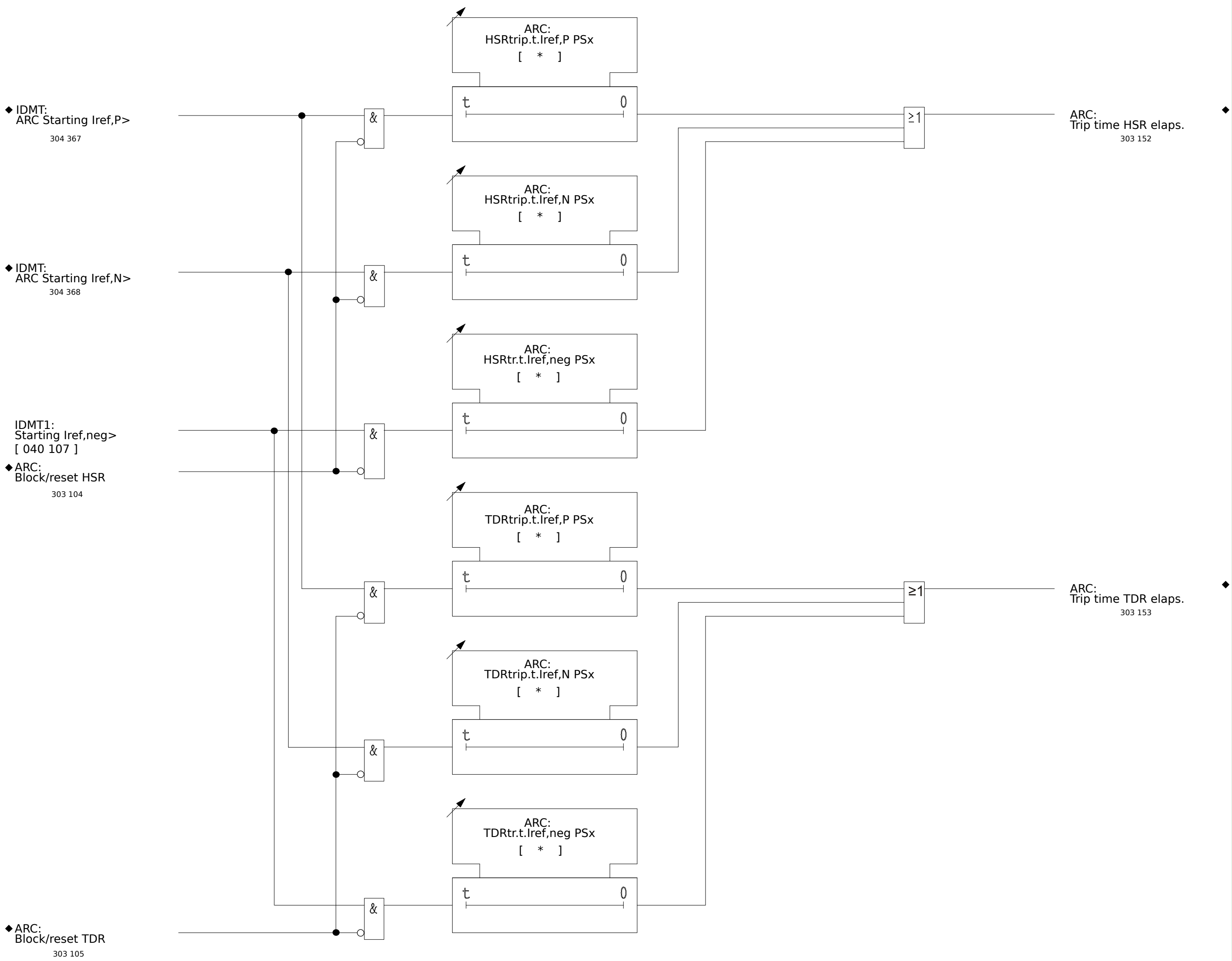
Fig. 3-176: Tripping time, part 1.



* Parameter	ARC: TDR trip.time I> PSx	ARC: TDR trip.time I>>PSx	ARC: TDRtrip.time I>>>PSx	ARC: TDRtr.time I>>>> PSx	ARC: TDR trip.time IN>PSx	ARC: TDRtrip.time IN>>PSx	ARC: TDRtrip.t. IN>>> PSx
set 1	015 073	015 075	014 097	016 189	015 077	015 032	014 099
set 2	024 041	024 113	024 114	016 186	024 115	024 116	024 117
set 3	025 001	025 163	024 164	016 187	024 165	024 166	024 167
set 4	025 061	025 113	025 114	016 188	025 115	025 116	025 117

19Z8851A

Fig. 3-177: Tripping time, part 2.

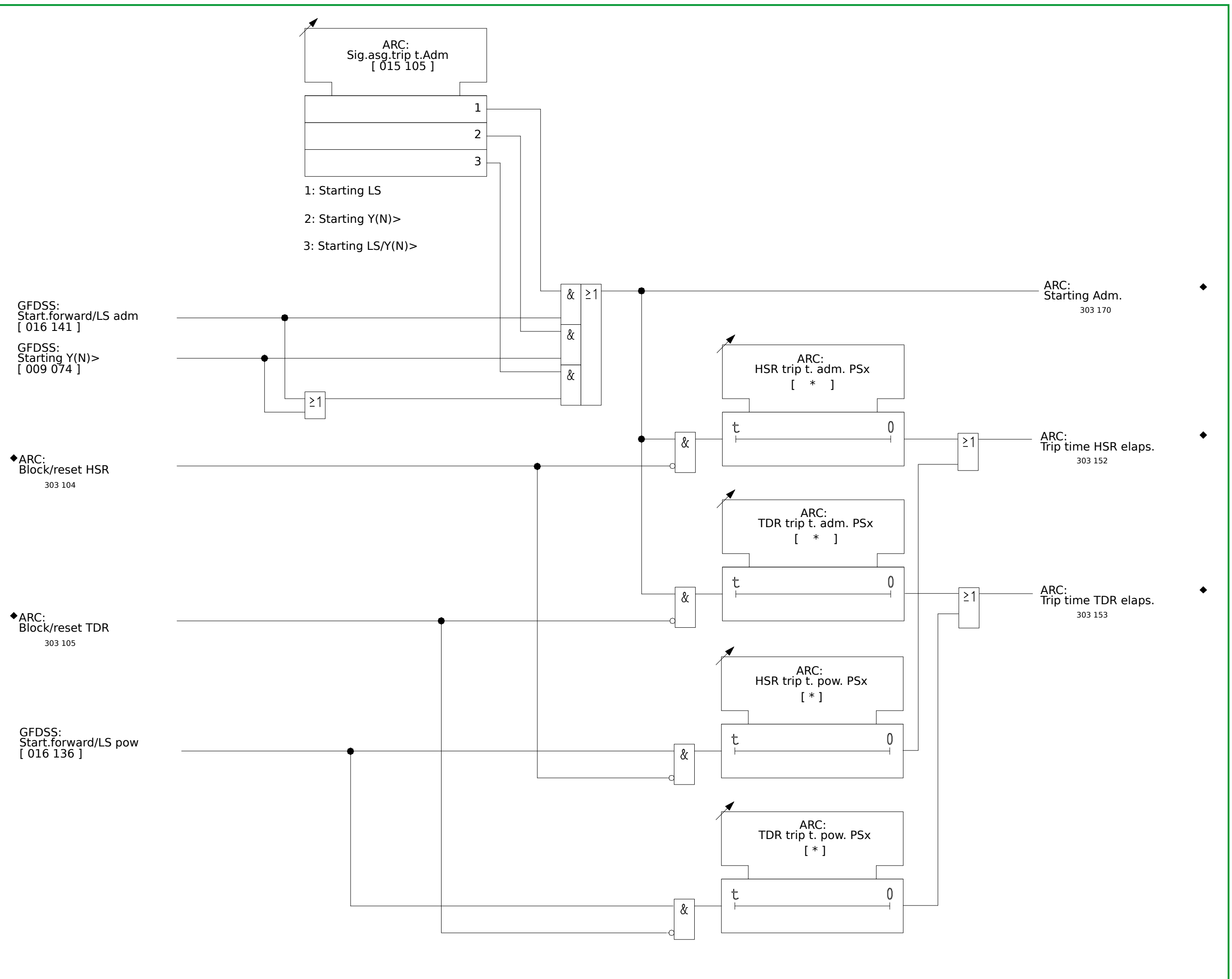


*

Parameter	ARC: HSRtrip.t.Iref,P PSx	ARC: HSRtrip.t.Iref,N PSx	ARC: HSRtr.t.Iref,neg PSx	ARC: TDRtrip.t.Iref,P PSx	ARC: TDRtrip.t.Iref,N PSx	ARC: TDRtr.t.Iref,neg PSx
set 1	015 094	015 096	015 034	015 095	015 097	015 035
set 2	024 106	024 107	024 108	024 118	024 119	024 120
set 3	024 156	024 157	024 158	024 168	024 169	024 170
set 4	025 106	025 107	025 108	025 118	025 119	025 120

12Z6230A

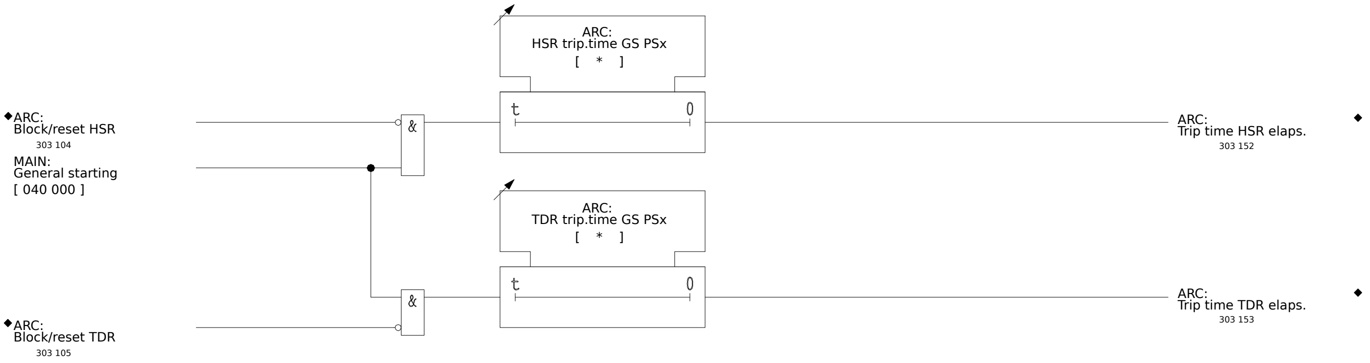
Fig. 3-178: Tripping time, part 3.



*

Parameter	ARC: HSR trip t. pow. PSx	ARC: TDR trip t. pow. PSx	ARC: HSR trip t. adm. PSx	ARC: TDR trip t. adm. PSx
set 1	015 078	015 079	021 059	021 069
set 2	024 109	024 121	021 066	021 070
set 3	024 159	024 171	021 067	021 071
set 4	025 109	025 121	021 068	021 072

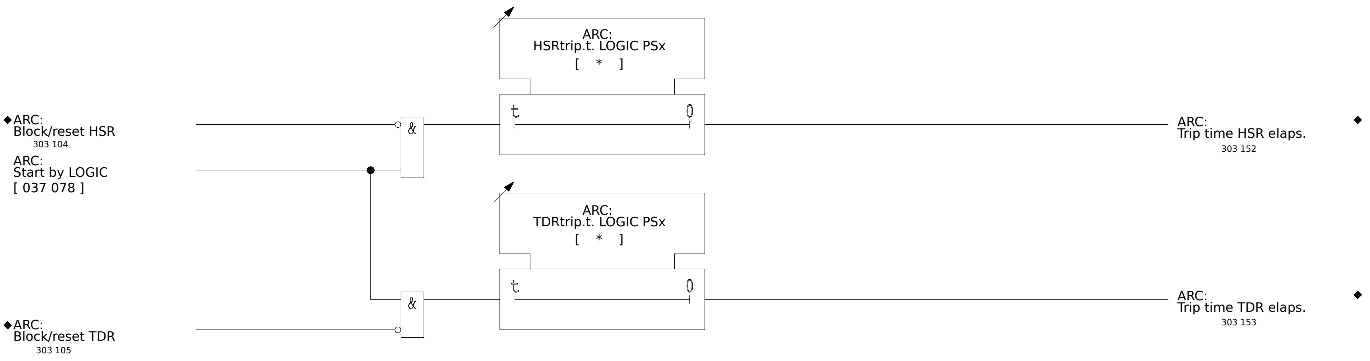
Fig. 3-179: Tripping time, part 4.



* Parameter	ARC: HSR trip.time GS PSx	ARC: TDR trip.time GS PSx
set 1	015 038	015 039
set 2	024 100	024 112
set 3	024 150	024 162
set 4	025 100	025 112

19Z5046A

Fig. 3-180: Tripping time, part 5.



* Parameter	ARC: HSRtrip.t. LOGIC PSx	ARC: TDRtrip.t. LOGIC PSx
set 1	015 098	015 099
set 2	024 110	024 122
set 3	024 160	024 172
set 4	025 110	025 122

19Z5047A

Fig. 3-181: Tripping time, part 6.

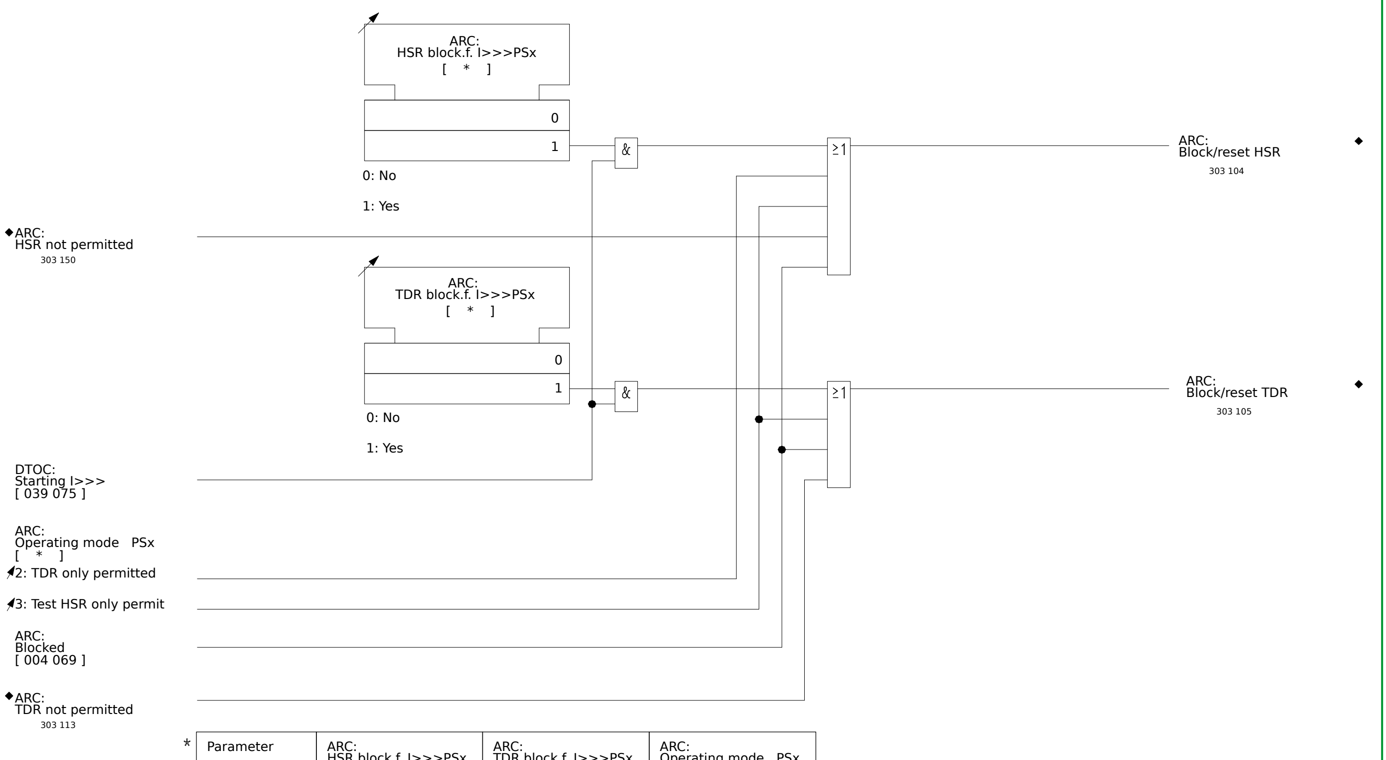
3.27.6 Blocking and Resetting the Tripping Times

Except by the setting value *Blocked* the HSR tripping time stages are blocked or reset by one of the following conditions:

- ARC: Operating mode PSxis set to *Test HSR only permit*.
- I>>> starting is present and ARC: HSR block.f. I>>>PSx has been selected.
- ARC: Operating mode PSx is set to *TDR only permitted*.
- An HSR is not permitted because an HSR or TDR has already occurred within the current ARC cycle.
- The ARC is blocked.

Except by the setting value *Blocked* the TDR tripping time stages are blocked or reset by one of the following conditions:

- ARC: Operating mode PSx is set to *Test HSR only permit*.
- I>>> starting is present and ARC: TDR block.f. I>>>PSx has been selected.
- The ARC is blocked.
- The number of permitted TDRs (ARC: No. permit. TDR PSx) has been set to 0 or has been reached, and thus no further TDRs are permitted.



* Parameter	ARC: HSR block.f. I>>>PSx	ARC: TDR block.f. I>>>PSx	ARC: Operating mode PSx
set 1	015 080	015 081	015 051
set 2	024 111	024 124	024 125
set 3	024 161	024 174	024 185
set 4	025 111	025 124	025 145

Fig. 3-182: Blocking and resetting the tripping time stages.

3.27.7 ARC Cycle

When the ARC function is ready, an ARC cycle is started by one of the following functions:

- The ARC: Trip signal is raised upon elapsing of a starting time.
- A trip signal selected at ARC: Fct.assig.start ARC occurs.
- A test HSR is initiated.

As the ARC cycle proceeds, the signal ARC: Ready is no longer taken into account.

An ARC cycle is running if the ARC is not blocked and one of the following conditions is met:

- The operative time is running.
- A dead time is running.
- The reclaim time is running.

3.27.8 Blocking the DTOC or IDMT Protection Function, the GFDSS Function, and Programmable Logic

If the ARC is ready, it will block the trip signals of DTOC and IDMT1 and IDMT2 protection as well as the GFDSS function and the programmable logic via the signal ARC: Blocking trip. ARC permits the generation of a trip command by the other protection functions if one of the following conditions is met:

- ARC cycle running is not applicable, and ARC is not ready.
- The final reclaim time is running.
- Only an HSR test is permitted (*Test HSR only permit*).
- ARC is blocked.
- The operative time is running during a running tripping time.
- A relevant starting type begins while a dead time is running.

One or more starts do not trigger a tripping time stage because the relevant tripping time stages are disabled (t set to *Blocked*). If a tripping time stage is started in this condition by an additional starting and as long as no final trip command has been issued, the ARC again generates a trip command.

3.27.9 Example of Programmable Logic in the ARC

This example (see Fig. 3-183, (p. 3-234)) illustrates the possible interconnection and the binary signal output for starting the tripping time stage via a binary signal input.

By using the programmable logic a binary signal input with serial operate delay and an AND element is implemented. The function ARC: Blocking trip *NOT* has been assigned to the second input on this AND element. The output from the AND element must be included in the configuration of the “m out of n” selection for the general trip command. The tripping time can be started by the output signal ARC: Start by LOGIC.

For this example the following list parameters need to be set from the local control panel (see Section 6.11.5.1, (p. 6-34)).

	List parameter	
LOGIC: Fct.assignm. outp. 1 (030 000)	OR	e.g. LOGIC: Input 04 EXT (034 003)
LOGIC: Fct.assignm. outp. 2 (030 004)	OR	LOGIC: Output 01 (t) (042 033)
	AND NOT	ARC: Blocking trip (042 000)

In general, any equation within the programmable logic function can be used to start the ARC tripping time.

One of the options offered by the programmable logic is the triggering of the ARC by an external protection device.

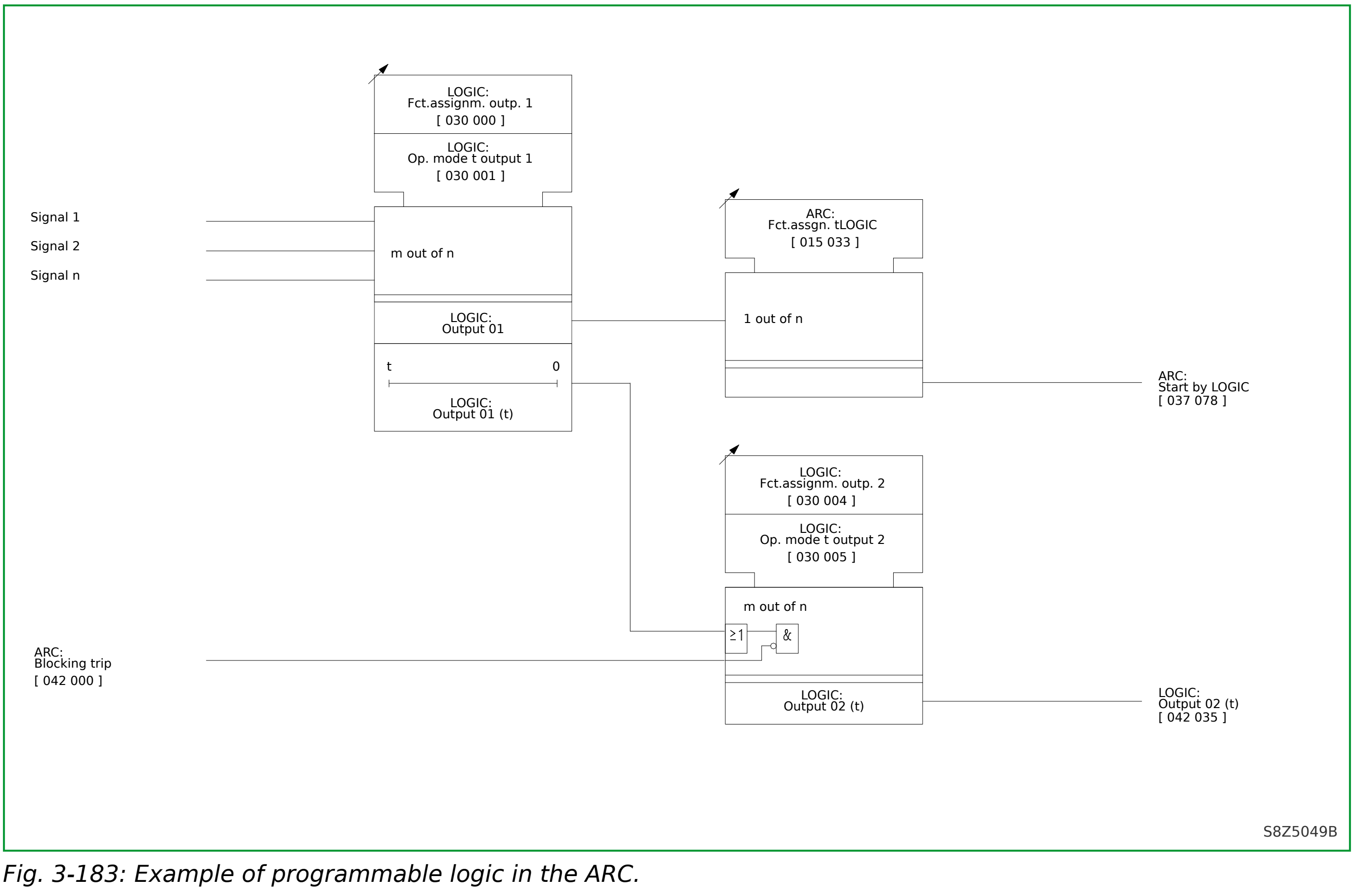
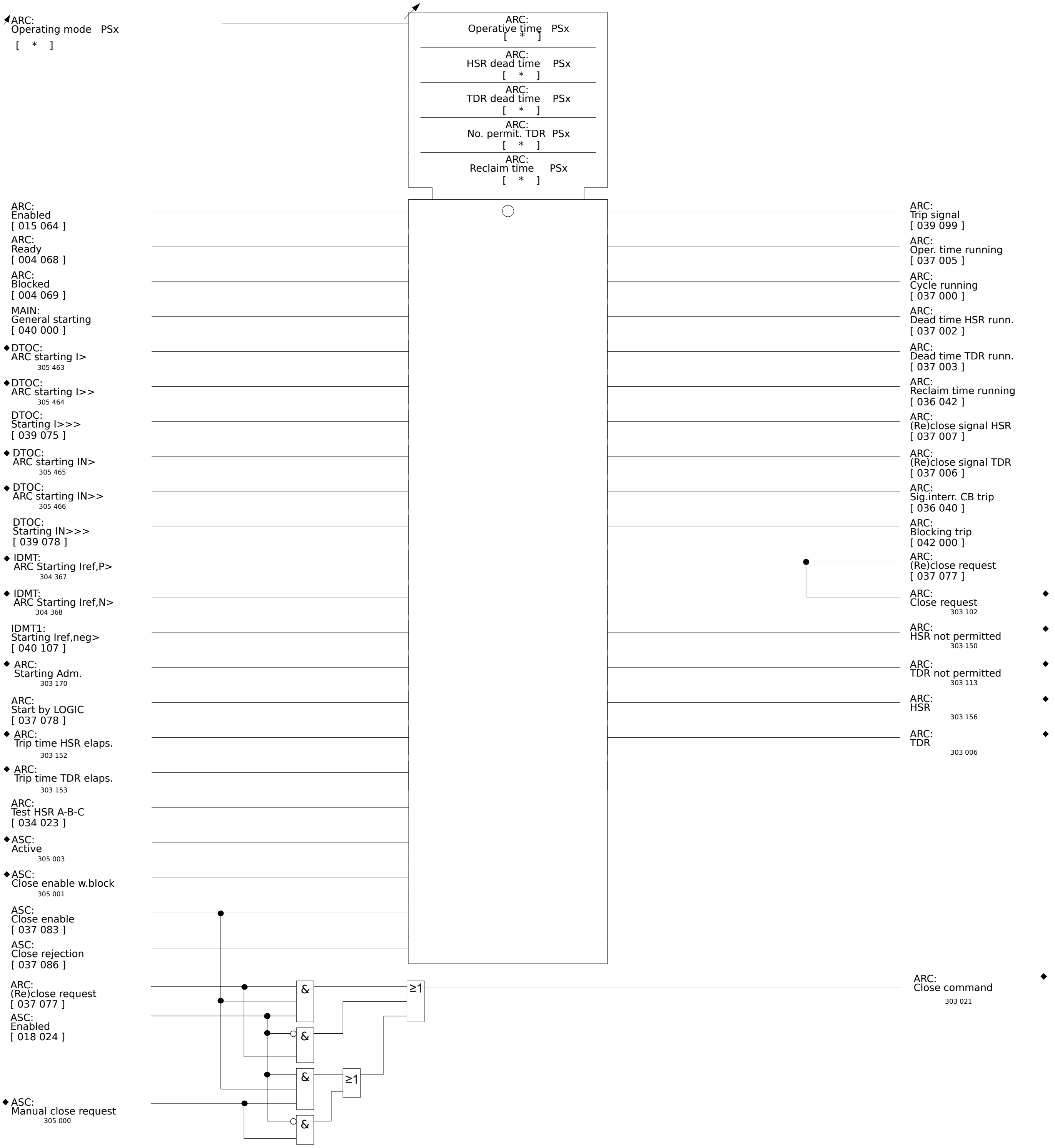


Fig. 3-183: Example of programmable logic in the ARC.

3.27.10 General Control Functions

The entire ARC sequence is monitored and controlled by a sequence control function.

While the ASC function is enabled for HSR or TDR reclosing (settings 018 001 ASC: Active for HSR PSx and 018 002 ASC: Active for TDR PSx, respectively), reclosure requires a close enable by the ASC function, which implements a check of the set voltage or synchronism conditions.



*

Parameter	ARC: Operating mode PSx	ARC: Operative time PSx	ARC: HSR dead time PSx	ARC: TDR dead time PSx	ARC: No. permit. TDR PSx	ARC: Reclaim time PSx
set 1	015 051	015 066	015 056	015 057	015 068	015 054
set 2	024 025	024 035	024 030	024 031	024 037	024 028
set 3	024 085	024 095	024 090	024 091	024 097	024 088
set 4	025 045	025 055	025 050	025 051	025 057	025 048

19Z8049A

Fig. 3-184: ARC sequence control.

3.27.11 High-Speed Reclosure (HSR)

If the starting conditions are met then any ARC-relevant protection startings will trigger an ARC cycle. The startings set off the associated tripping time stages and the operative time. If an HSR tripping time is running during the operative time then the signal ARC: Trip signal is issued and this signal can lead to a trip command if the function assignment for the trip commands is configured appropriately. With the release of the starting, the operative time is terminated and the HSR dead time begins. If there is no starting during the dead time, a reclosure command is issued once the dead time has elapsed. The reclaim time is started simultaneously. If during the reclaim time there is no starting with trip command, the signal ARC: ARC: Reclosure successful is issued and the ARC cycle is terminated once the reclaim time has elapsed.

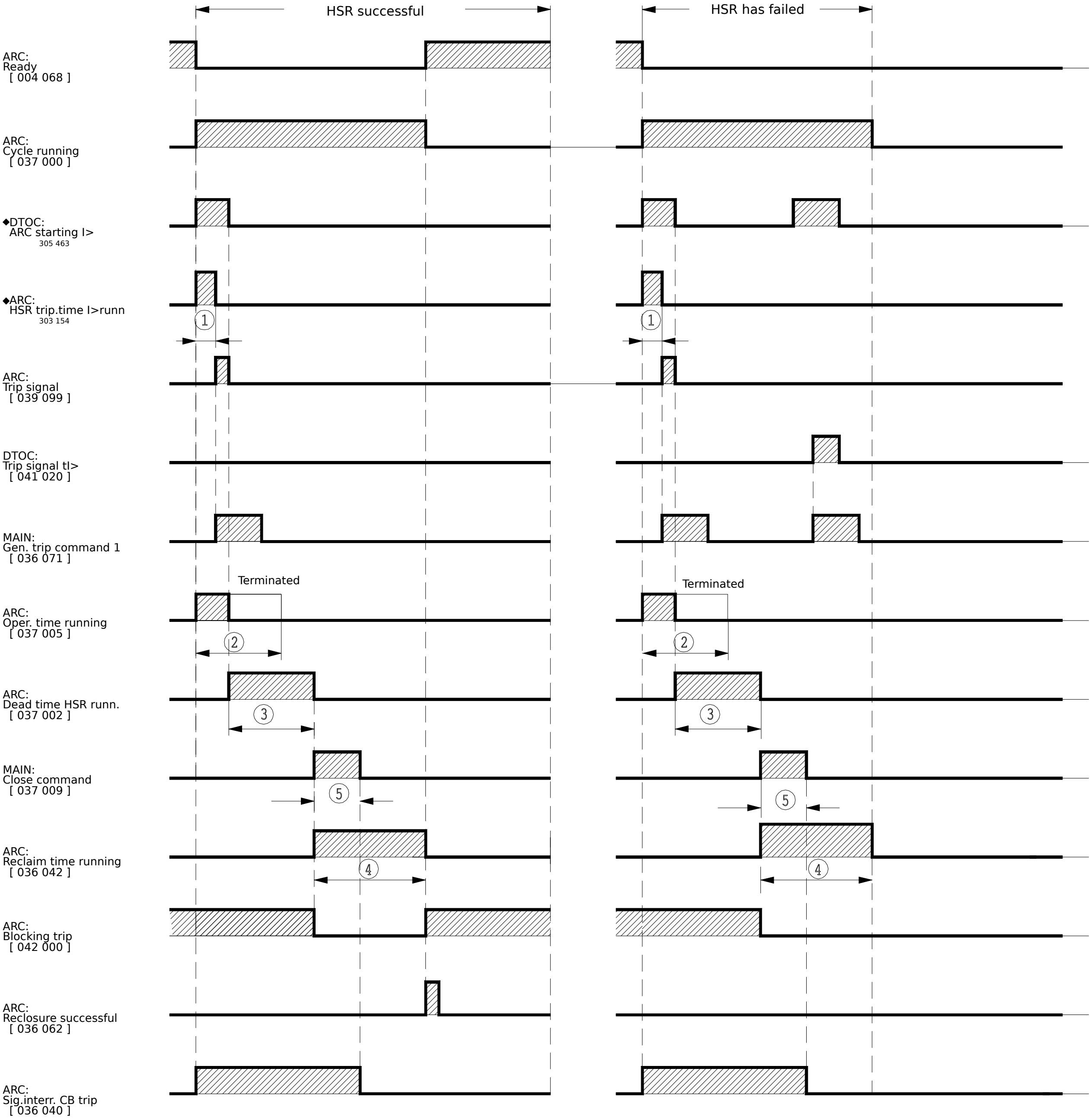
If the HSR does not succeed and another starting occurs then a TDR is started if at least one TDR is permitted. If TDR after HSR is not permitted then the current reclaim time will be the last reclaim time of the ARC cycle. If the last reclaim time has elapsed and another starting occurs then the tripping time stages are no longer started. Instead the signal ARC: Blocking trip is set to a logic value of “0” and a trip by other protection functions is enabled. If a trip signal occurs during the last reclaim time then it will be regarded as a final trip. The ARC cycle is completed after the last reclaim time has elapsed.

When the signal ARC: Cycle running appears, the signal ARC: Sig.interr. CB trip (interruption breaker trip signal) is issued and it is reset after the final HSR or TDR of the current ARC cycle, once the close command pulse time has elapsed. This signal is also reset immediately when the signal ARC: Blocked appears during an ARC cycle.

If the operative time has elapsed before the starting drops out, the last reclaim time will be started directly and the blocking of protection trip signals is cancelled.

During the dead time, the P139 keeps checking whether any ARC-relevant startings occur. If this is the case, the last reclaim time is started and the blocking of protection trip signals is cancelled.

While the ASC function is enabled, the procedures described in the section “Joint Operation of the ARC and ASC Functions” are also applicable.



* Parameter	1 ARC: HSR trip.time I> PSx	2 ARC: Operative time PSx	3 ARC: HSR dead time PSx	4 ARC: Reclaim time PSx
set 1	015 072	015 066	015 056	015 054
set 2	024 040	024 035	024 030	024 028
set 3	025 000	024 095	024 090	024 088
set 4	025 060	025 055	025 050	025 048

5
MAIN: Close cmd.pulse time [015 067]
ARC: No. permit. TDR PSx Setting: 0

19Z5050A

Fig. 3-185: HSR signal sequence (example shown is with ASC disabled – see also section “Joint Operation of the ARC and ASC Functions”).

3.27.12 Joint Operation of the ARC and ASC Functions

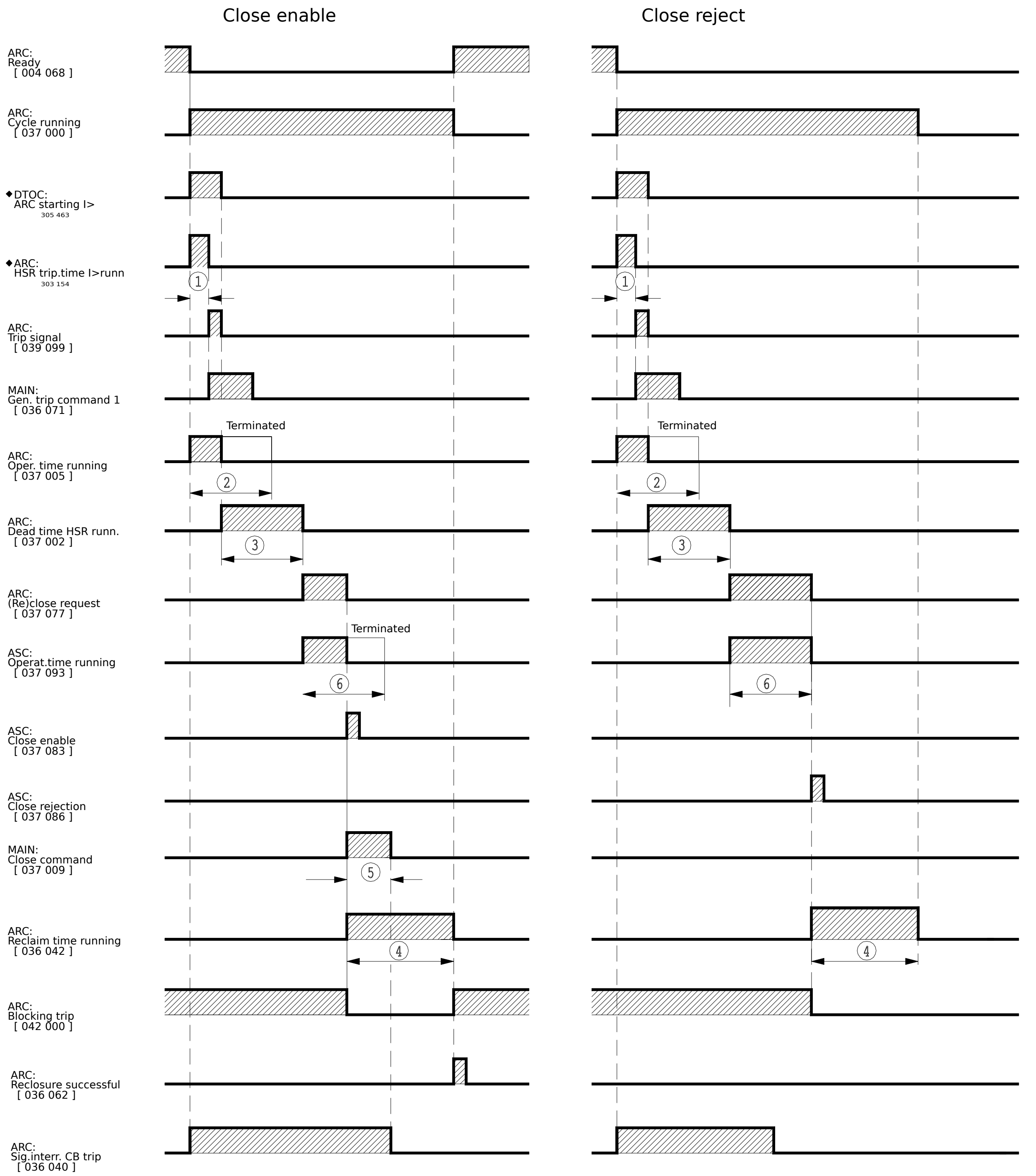
Fig. 3-186, (p. 3-239) shows the joint operation of the ARC and ASC functions, illustrated for a high-speed reclosure (HSR).

If the starting conditions are met then any ARC-relevant protection startings will trigger an ARC cycle. The startings set off the associated tripping time stages and the operative time. If a HSR tripping time is running during the operative time then the signal ARC: Trip signal is issued, and this signal can lead to a trip command if the function assignment for the trip commands is configured appropriately. With the release of the starting, the operative time is terminated and the HSR dead time begins. After the dead time has elapsed, a close request is sent to the ASC. The ASC checks to determine whether reclosure is possible. If a positive decision is reached during the ASC operative time, then there is a close enable, and the close command is issued.

If the ASC is disabled or deactivated, or if its decisions are to be ignored, then a close command is issued immediately.

Moreover, the reclaim time is started. If during the reclaim time there is no starting with trip command, the signal ARC: Reclosure successful is issued and the ARC cycle is terminated once the reclaim time has elapsed.

If the ASC function decides against a reclosure then the reclaim time is started and the ARC cycle is completed after the reclaim time has elapsed.



*		1	2	3	4	6
	Parameter	ARC: HSR trip.time I> PSx	ARC: Operative time PSx	ARC: HSR dead time PSx	ARC: Reclaim time PSx	ASC: Operative time PSx
	set 1	015 072	015 066	015 056	015 054	018 010
	set 2	024 040	024 035	024 030	024 028	077 034
	set 3	025 000	024 095	024 090	024 088	078 034
	set 4	025 060	025 055	025 050	025 048	079 034

5
MAIN: Close cmd.pulse time [015 067]
ARC: No. permit. TDR PSx Setting: 0

19Z51BHA

Fig. 3-186: HSR signal sequence (example shown is with ASC enabled).

3.27.13 Test HSR

A test HSR can only be triggered when the ARC is ready to operate and if the operating mode has been set to *Test HSR only permit*. In this operating mode, the blocking of the trip signals from the DTOC, IDMT and other protection functions is cancelled so that any system fault can be properly cleared.

Once a test HSR has been triggered, a trip signal of defined duration is issued. The subsequent sequence corresponds to a successful HSR (open and reclose command when the HSR dead time has elapsed). Once the close command pulse time has elapsed, further triggering during the reclaim time does not result in a further HSR.

A test HSR can be triggered either via setting parameter or via a binary signal input and adds an increment to the ARC: Number HSR A-B-C counter.

Each “Test HSR” request that does not result in a test HSR generates the signal ARC: Reject test HSR.

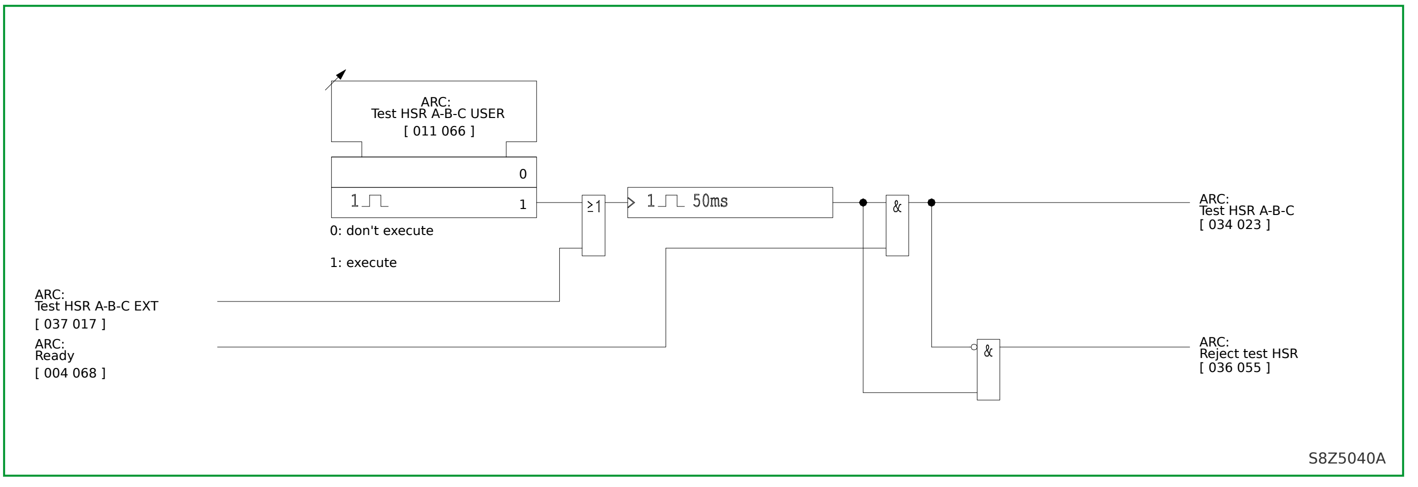


Fig. 3-187: Test HSR.

3.27.14 Time-Delay Reclosure (TDR)

Multiple reclosures using TDRs are possible if the operating mode is set accordingly. A TDR may occur after a HSR if reclosure has occurred as the result of the HSR or if the operating mode set for the ARC allows only TDRs. This is only possible if the setting for ARC: No. permit. TDR PSx (number of permitted TDRs) is not zero.

If the starting conditions are met then any ARC-relevant protection startings will trigger the associated tripping times. The operative time is started simultaneously. If a TDR tripping time is running during the operative time then the signal ARC: Trip signal is issued and this signal can lead to a trip command if the function assignment for the trip commands is configured appropriately. With the release of the starting, the operative time is terminated and the TDR dead time begins. If there is no starting during the dead time, a reclosure command is issued once the dead time has elapsed. The reclaim time is started simultaneously. If no further TDR is permitted during the current ARC cycle then this will be the last reclaim time. If the last reclaim time has elapsed and another starting occurs then the tripping time stages are no longer started. Instead the signal ARC: Blocking trip is set to a logic value of “0” and a final trip by other protection functions is enabled. If a trip signal occurs during the last reclaim time then it will be regarded as a final trip. The ARC cycle is completed after the last reclaim time has elapsed. If during the last reclaim time there is no starting with trip command, the signal ARC: Reclosure successful will be issued.

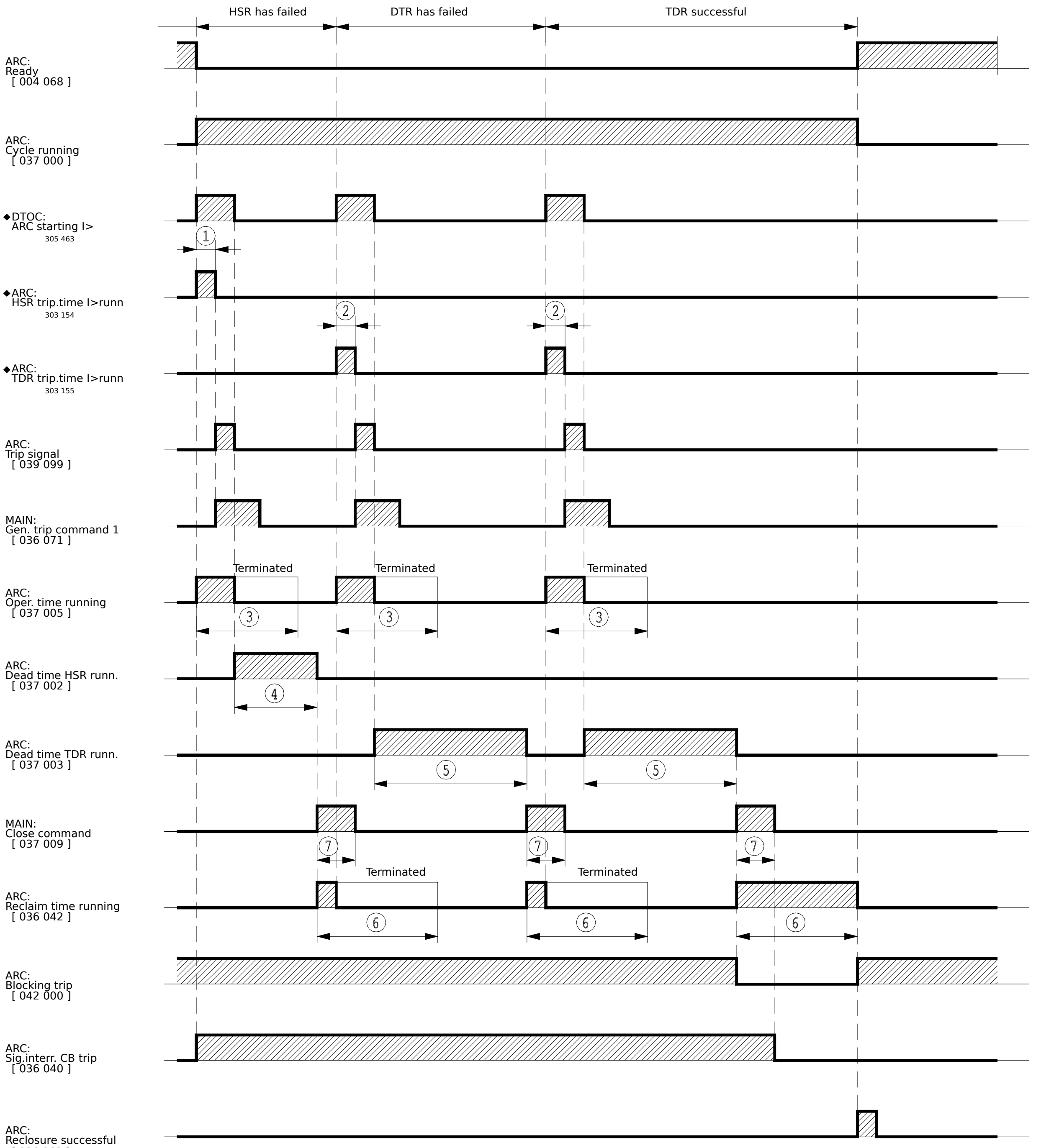
If there is a new starting during the reclaim time and at least one TDR is still permitted then the reclaim time is terminated and another trip is issued when the tripping time has elapsed. Once the dead time has elapsed, a further reclosure command is issued.

When the signal ARC: Cycle running appears, the signal ARC: Sig.interr. CB trip (interruption breaker trip signal) is issued automatically and it is reset after the final HSR or TDR of the current ARC cycle, once the close command pulse time has elapsed. This signal is also reset immediately when the signal ARC: Blocked appears during an ARC cycle.

If the operative time has elapsed before the starting drops out, the last reclaim time will be started directly and the blocking of protection trip signals is cancelled.

During the dead time, the P139 keeps checking whether any ARC-relevant startings occur. If this is the case, the last reclaim time is started and the blocking of protection trip signals is cancelled.

While the ASC function is enabled, the procedures described in the section “Joint Operation of the ARC and ASC Functions” are also applicable.



*	1	2	3	4	5	6
Parameter	ARC: HSR trip.time I> PSx	ARC: TDR trip.time I> PSx	ARC: Operative time PSx	ARC: HSR dead time PSx	ARC: TDR dead time PSx	ARC: Reclaim time PSx
set 1	015 072	015 073	015 066	015 056	015 057	015 054
set 2	024 040	024 041	024 035	024 030	024 031	024 028
set 3	025 000	025 001	024 095	024 090	024 091	024 088
set 4	025 060	025 061	025 055	025 050	025 051	028 048

7 MAIN:
Close cmd.pulse time [015 067]
ARC:
No. permit. TDR PSx   Setting: 2

19Z5051A

Fig. 3-188: Signal sequence of a failed HSR followed by a failed TDR and then by a final successful TDR (example shown is with ASC disabled).

3.27.15 ARC Counters

The following events are counted:

- Number of high-speed reclosures (HSR) that have been carried out
- Number of time-delay reclosures (TDR) that have been carried out.

For each ARC cycle, only one of the following counters is incremented.

- Counter OC = open then close - (ARC: No. HSR successful) -> incremented if HSR executed and TDR not executed and CB closed.
- Counter OCO = open then close then open - (ARC: No. HSR unsuccessful) -> incremented if HSR executed and TDR not executed and CB open.
- Counter OCOC = open then close then open then close - (ARC: No. TDR successful) -> incremented if TDR executed and CB closed.
- Counter OCOCO = open then close then open then close then open - (ARC: No. TDR unsuccessful) -> incremented if TDR executed and CB open.

The associated counters can be reset either individually or as a group.

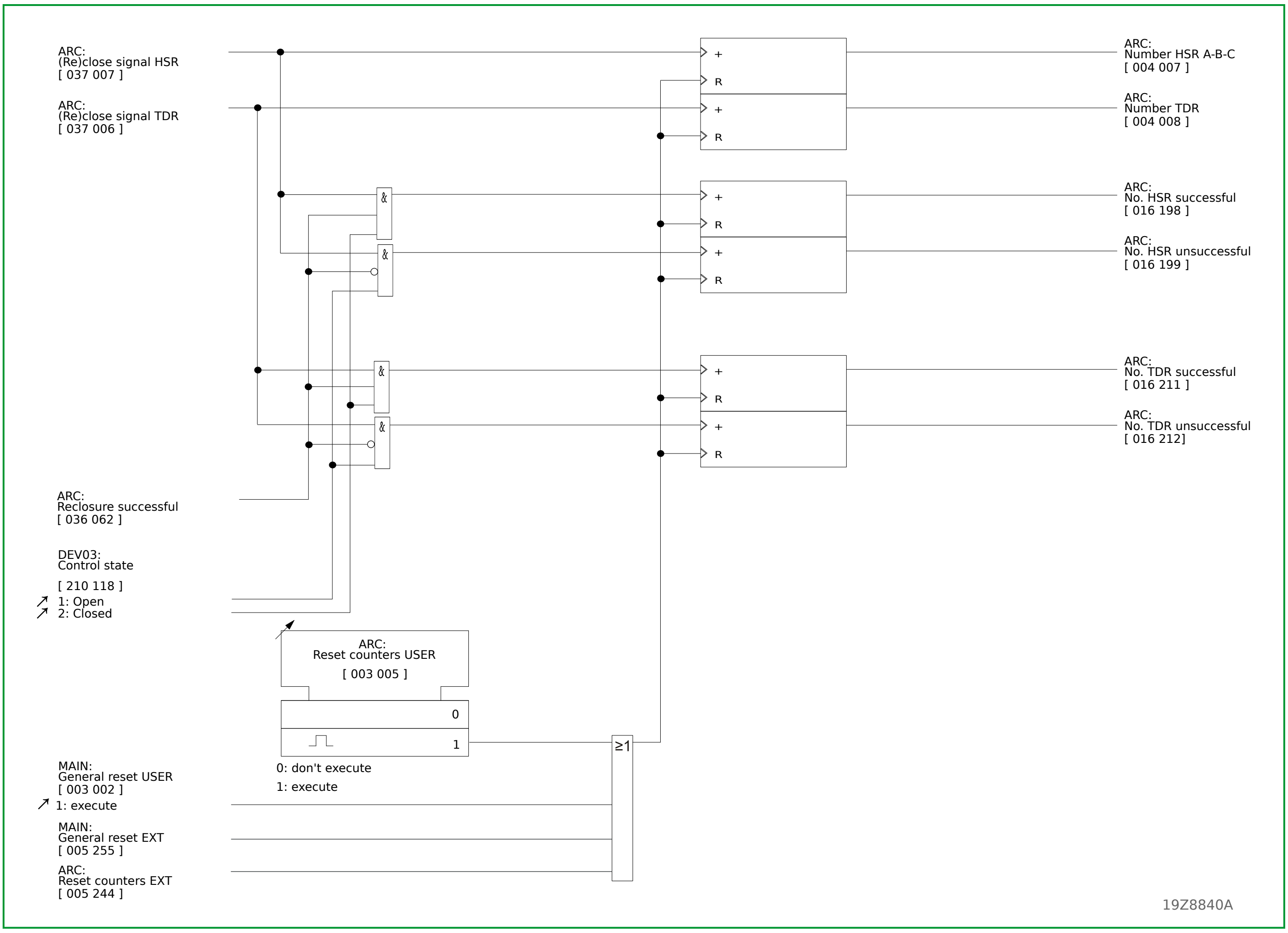


Fig. 3-189: ARC counters.

3.27.16 Counter for Number of CB Operations

The maximum number of CB operations within an ARC cycle (or within a specific time period) may be set with parameter MAIN: CB1 max. oper. cap. Associated with this parameter is the counter at MAIN: CB1 act. oper. cap. to which the maximum number of CB operations permitted is assigned as soon as the positive edge of an event is present that has been selected by a “1 out of n” parameter at MAIN: CB1 ready fct.assign

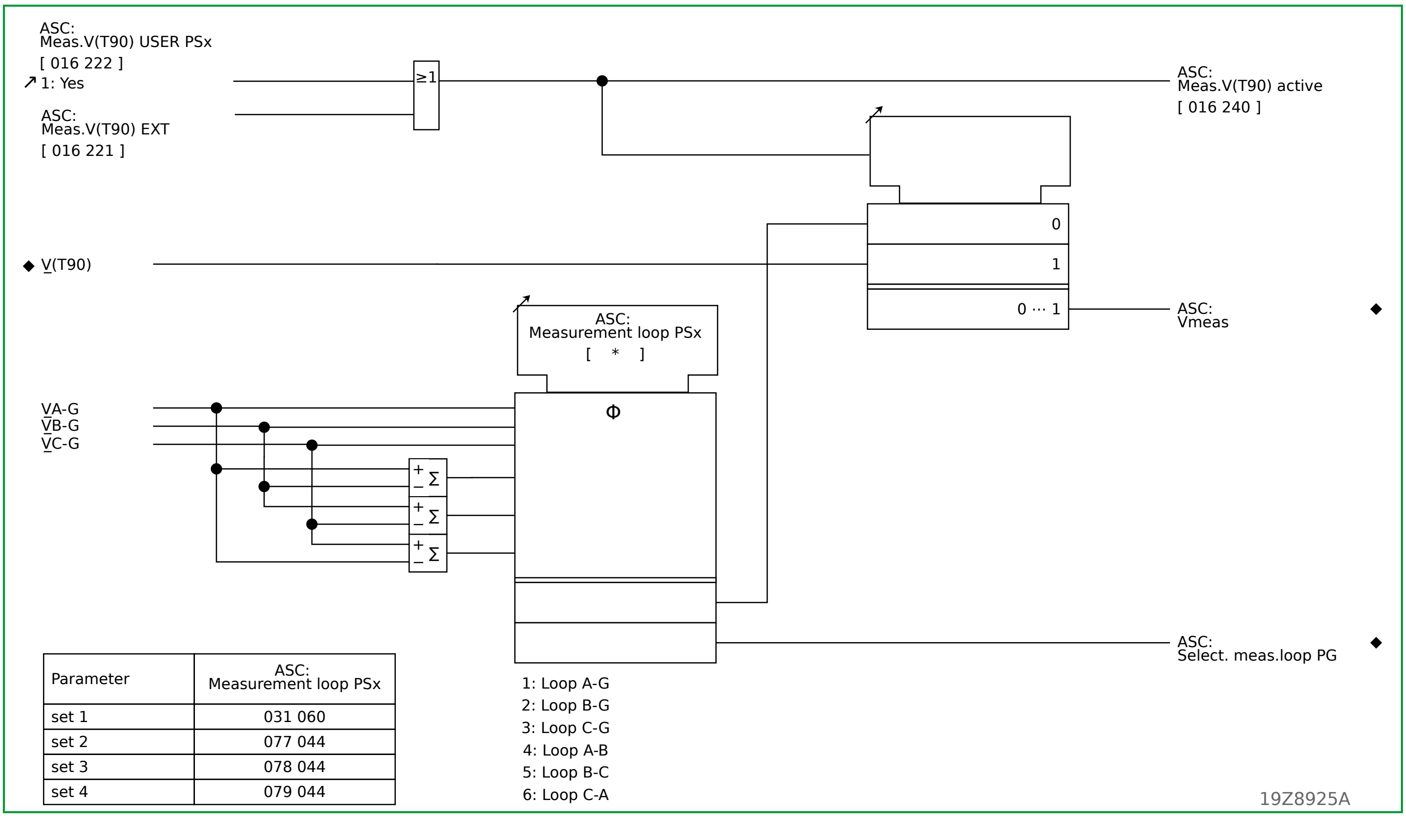
The number of CB operations permitted, set with the counter at MAIN: CB1 act. oper. cap. are then decremented by 1 with each CB operation. Operation of the CB is recognized from the contact position signals DEV01: Switch. device open and DEV01: Switch.device closed.

The counter at MAIN: CB1 act. oper. cap. may only be decremented to a value of 1. Reaching a value of 1 will in no way effect the protection or control functionality, in particular there will be no blocking of CB operation! When a CB fault has occurred (i.e. MAIN: CB1 faulty EXT is set to *Yes*) the counter MAIN: CB1 act. oper. cap. is immediately set to 1.

3.28 Automatic Synchronism Check (Function Group ASC)

The automatic synchronism check (ASC) function allows the P139 to verify that before a close or reclose command is issued synchronism exists between system sections that are to be synchronized (paralleled) or whether one of the system sections is de-energized. In order to check for synchronism, two voltages – generally the voltages on the line and busbar sides – are compared for differences in frequency, angle, and voltage. Connecting the reference voltage transformer will determine which of the system sections will provide the reference voltage (e.g. the line side or the busbar side). The measurement loop must be set to correspond to the reference voltage connection (ASC: Measurement loop PSx) so that the correct measuring voltage is selected for the comparison. In the connection example shown in section “Conditioning of the Measured values” (see Section 3.11, (p. 3-79)), the busbar voltage $V_{A\text{-}B}$ is the reference voltage.

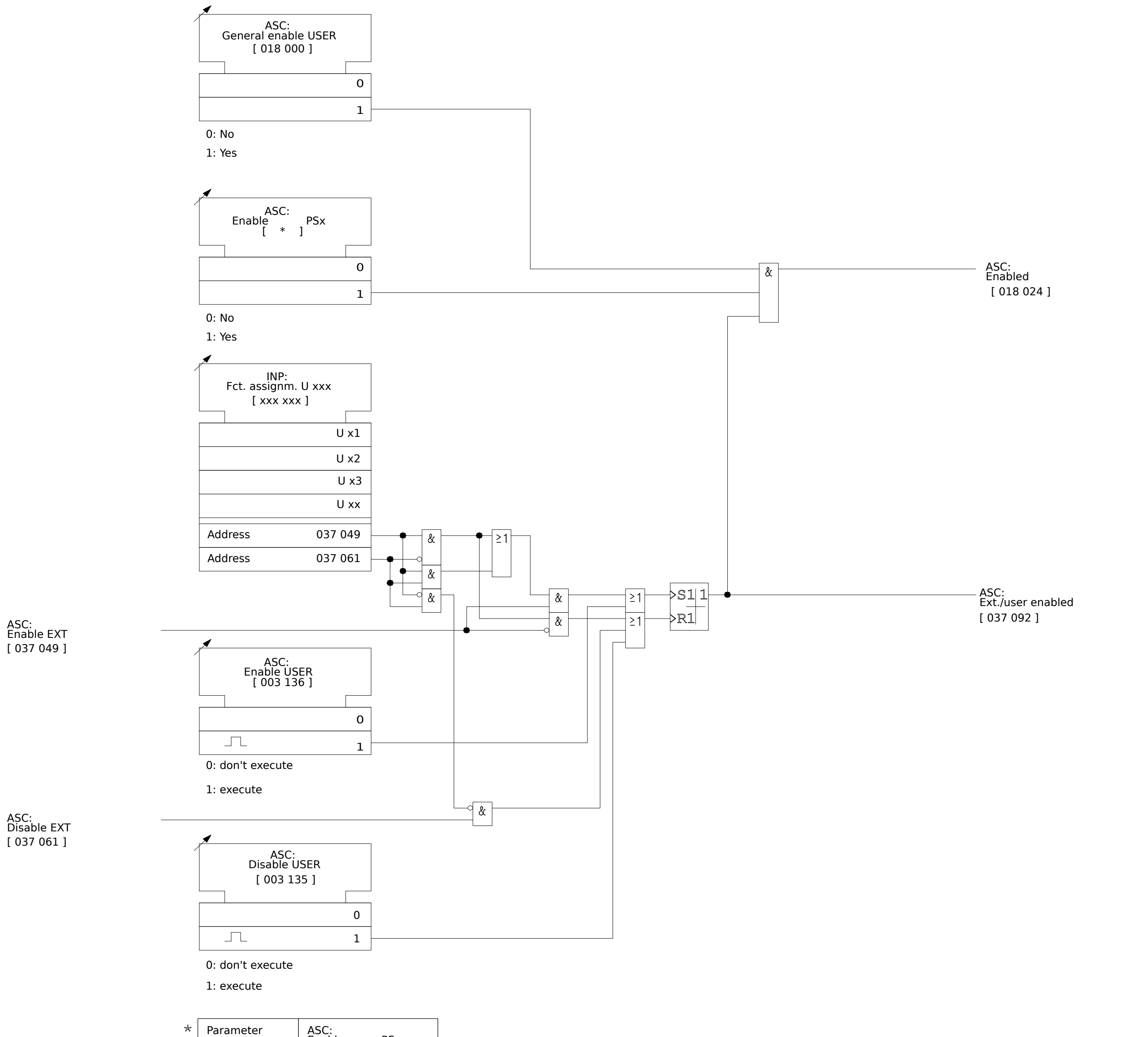
Alternatively the P139 can be set to compare the voltage measured at the T90 voltage transformer against the reference voltage. This is enabled by setting ASC: Meas.V(T90) USER PSx to *Yes*, or by configuring the parameter ASC: Meas.V(T90) EXT to some binary input, or a communication protocol signal or programmable logic. Note, however, that in this case it is still the responsibility of the system engineering to make sure that the proper voltage (according to the setting ASC: Measurement loop PSx, see Fig. 3-190, (p. 3-245)) is indeed connected to transformer T90. Of course, monitoring T90 instead of the three phase-to-ground voltages means to have a single-phase-check instead of three phases.



Parameter	ASC: Measurement loop PSx
set 1	031 060
set 2	077 044
set 3	078 044
set 4	079 044

Fig. 3-190: Selecting the measurement loop.

3.28.1 Disabling and Enabling the ASC Function



* Parameter	ASC: Enable PSx
set 1	018 020
set 2	018 021
set 3	018 022
set 4	018 023

Fig. 3-191: Enabling/disabling the Automatic Synchronism Check function.

The function can be disabled or enabled using setting parameters or through binary signal inputs.

The function is enabled generally (independently of the parameter subsets) at ASC: General enable USER. It is enabled as a function of a parameter subset via ASC: Enable PSx. If these enabling functions have been activated, ASC can be disabled or enabled using setting parameters or through appropriately configured binary signal inputs. Parameters and configured binary signal inputs have equal status. If only the ASC: Enable EXT function is assigned to a binary signal input, then the ASC will be enabled by a positive edge of the input signal and disabled by a negative edge. If only the ASC: Disable EXT function has been assigned to a binary signal input, then a signal at this input will have no effect.

If the ASC function is disabled an activation enable will always be issued.

3.28.2 ASC Readiness and Blocking

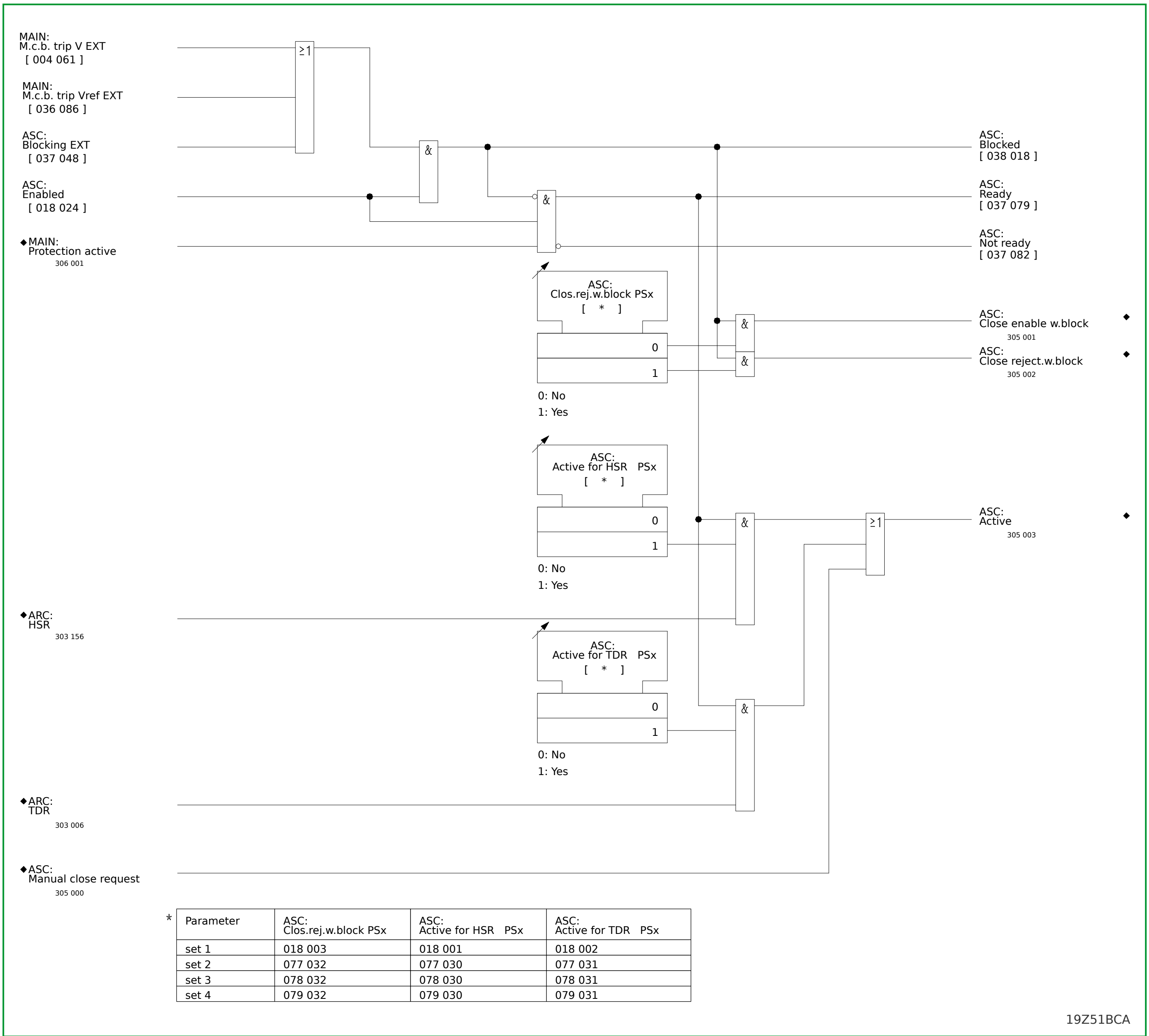


Fig. 3-192: ASC readiness and blocking.

The ASC function is ready if it is activated and enabled and if there is no blocking. Blocking can be brought about if a voltage transformer m.c.b. was tripped or by an appropriately configured binary signal input. The user can specify whether closing or reclosing will always be enabled or not (reclosure with or without a check) when the ASC function is blocked.

The user can also specify separately for high-speed reclosures (HSR) and time-delayed reclosures (TDR) whether reclosure will be carried out with or without a check.

3.28.3 Close Request

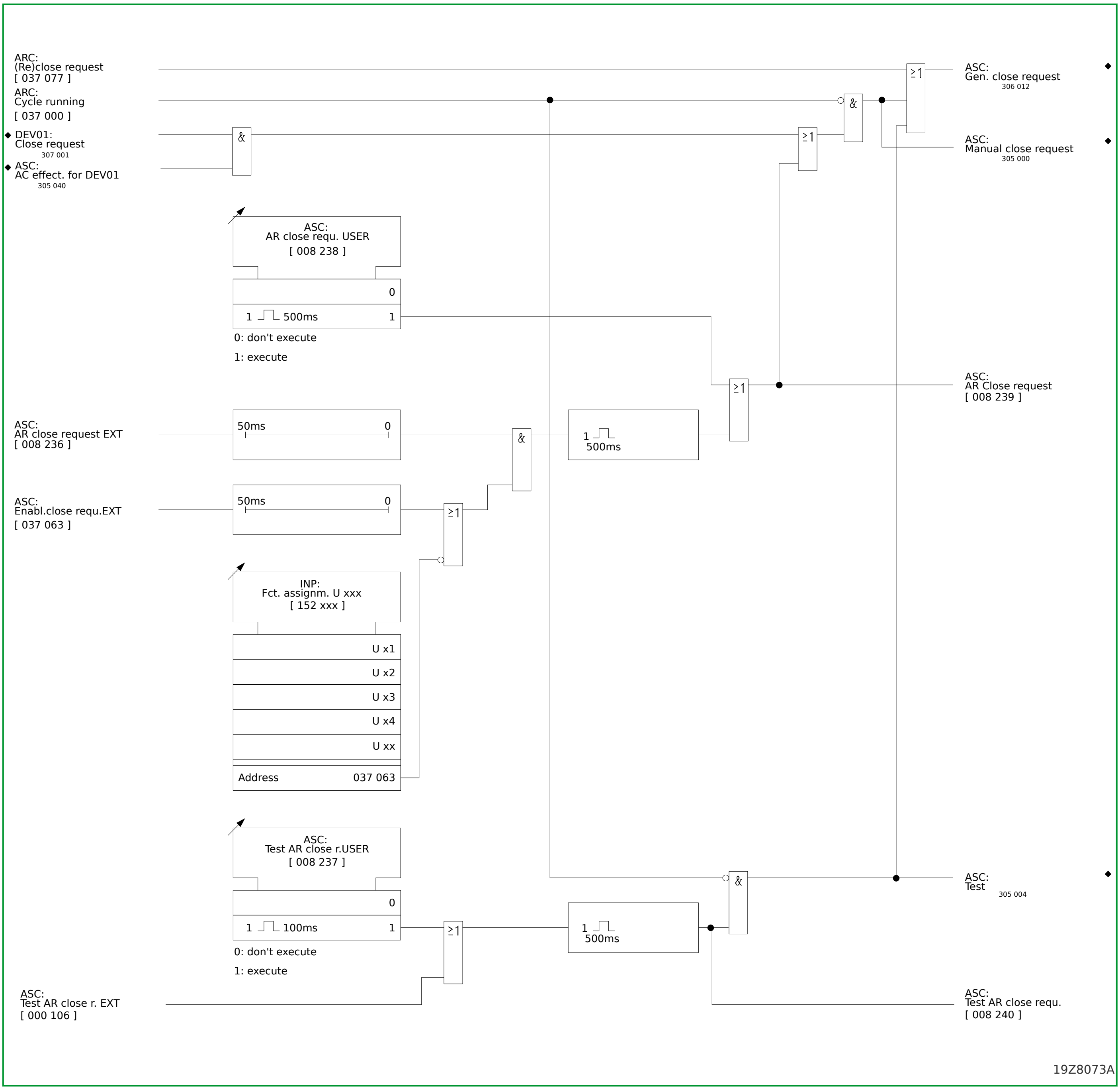


Fig. 3-193: Close request for autoreclose control.

The ASC function can be triggered by ARC, via setting parameters, from an appropriately configured binary signal input (ASC: Enabl.close requ.EXT), or via a close request from the control function. Close requests via a setting parameter, the binary signal input or the control function are accepted only if no ARC cycle is running.

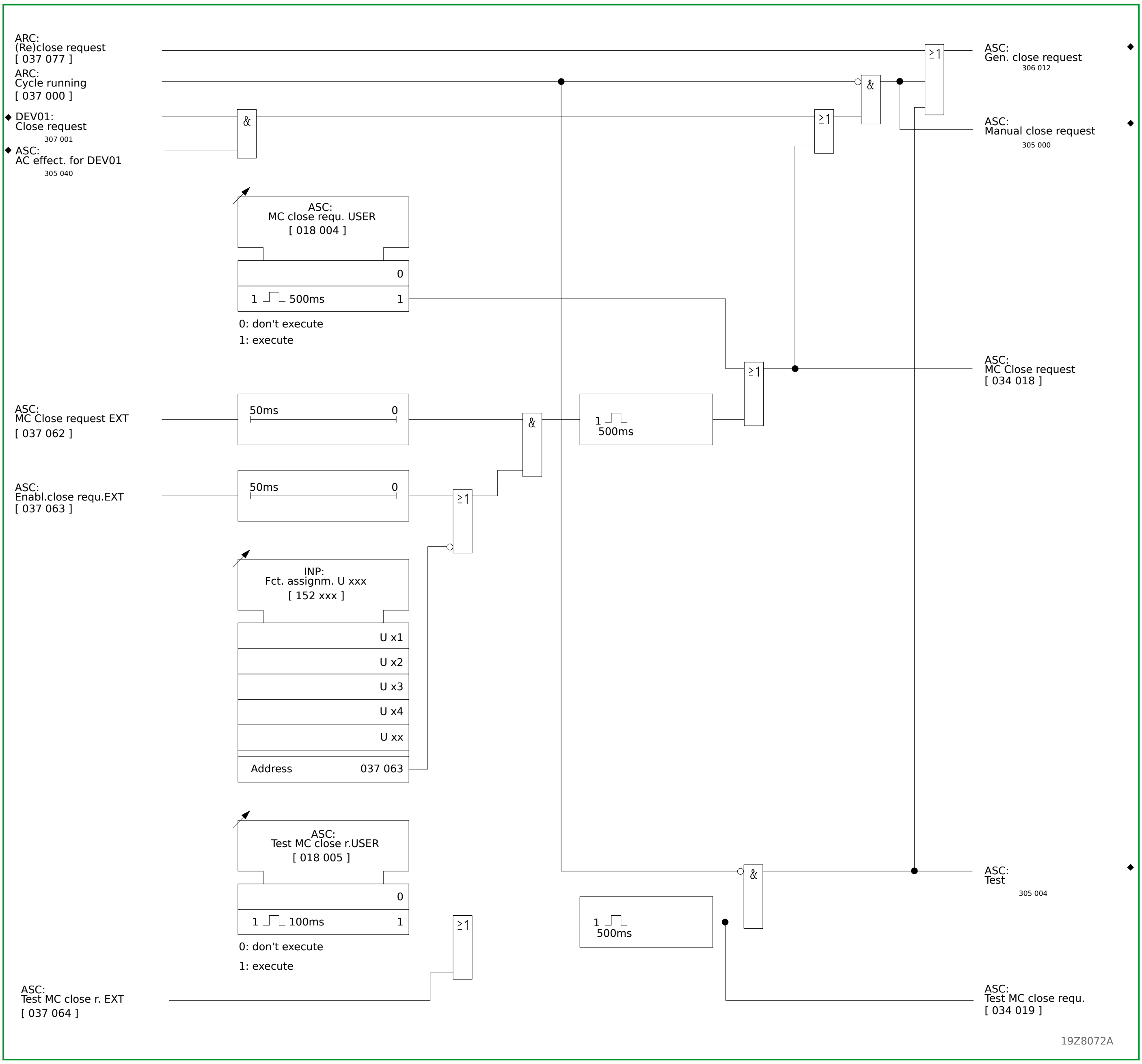
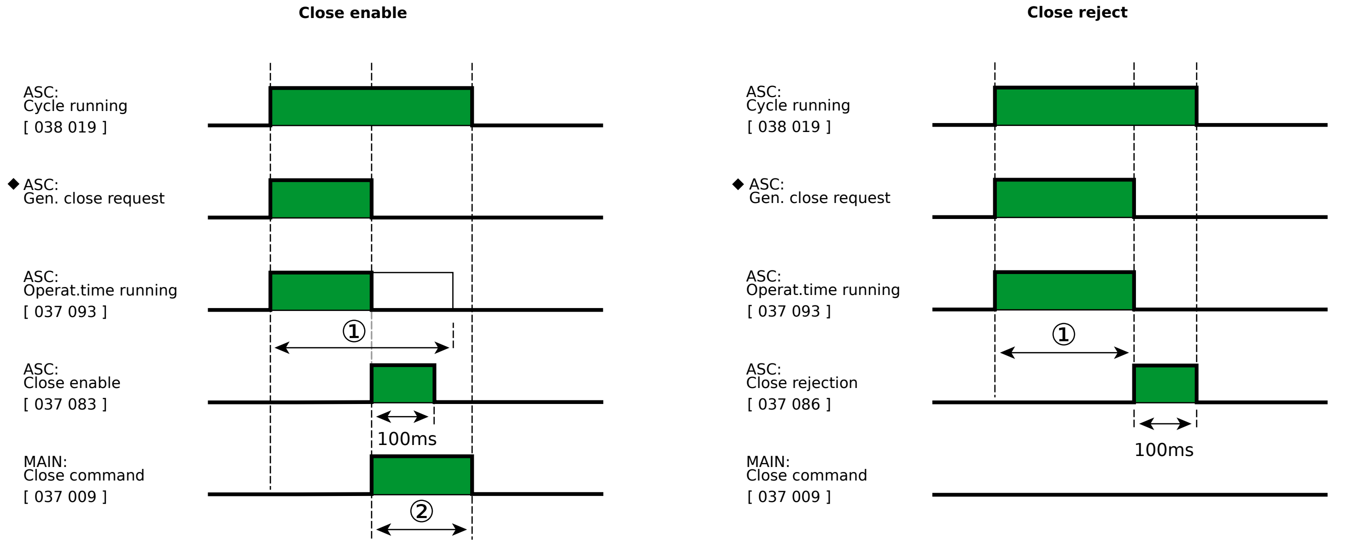


Fig. 3-194: Close request for manual close command.

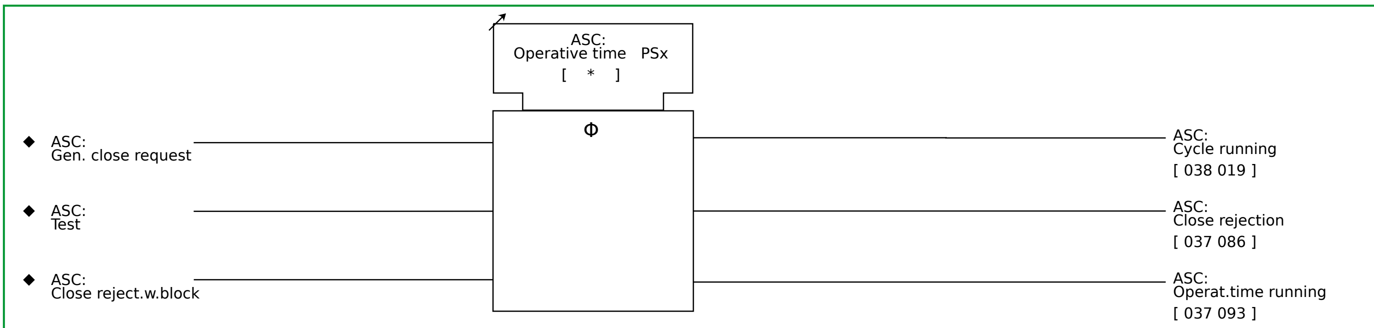
The ASC operative time is started with the close request. If the close enable is issued before the ASC operative time has elapsing, the close command is issued. Otherwise an ASC: Close rejection signal is generated for 100 ms.



	①	②
Parameter	ASC: Operative time PSx	MAIN: Close cmd.pulse time [015 067]
set 1	018 010	
set 2	077 034	
set 3	078 034	
set 4	079 034	

D5Z5073C

Fig. 3-195: Signal flow for a close enable and a close rejection.



Parameter	ASC: Operative time PSx
set 1	018 010
set 2	077 034
set 3	078 034
set 4	079 034

D5Z5076B

Fig. 3-196: ASC sequence control.

3.28.4 Extended Settings for the Close Enable Conditions

The close enable conditions can now be set separately for auto-reclose control and manual close command. This makes it possible to select different operating modes as well as different tolerance ranges.

Close enable conditions for Auto-reclose control	Close enable conditions for Manual close command
ASC: AR op. mode PSx	ASC: MC op. mode PSx
ASC: AR with tCB PSx	ASC: MC with tCB PSx
ASC: AR Op.mode v-chk.PSx	ASC: MC op.mode v-chk.PSx
ASC: AR V> volt.check PSx	ASC: MC V> volt.check PSx
ASC: AR V< volt.check PSx	ASC: MC V< volt.check PSx
ASC: AR tmin v-check PSx	ASC: MC tmin v-check PSx
ASC: AR V> sync.check PSx	ASC: MC V> sync.check PSx
ASC: AR Delta Vmax PSx	ASC: MC Delta Vmax PSx
ASC: AR Delta f max PSx	ASC: MC Delta f max PSx
ASC: AR Delta phi max PSx	ASC: MC Delta phi max PSx
ASC: AR tmin sync.chk PSx	ASC: MC tmin sync.chk PSx

The automatic reclosure setting parameters become active when a close request is issued by the integrated ARC (for an RRC, HSR or TDR) or by a close request from an external ARC device sent to the binary signal input function ASC: AR close request EXT.

3.28.5 Considering the CB Close Time

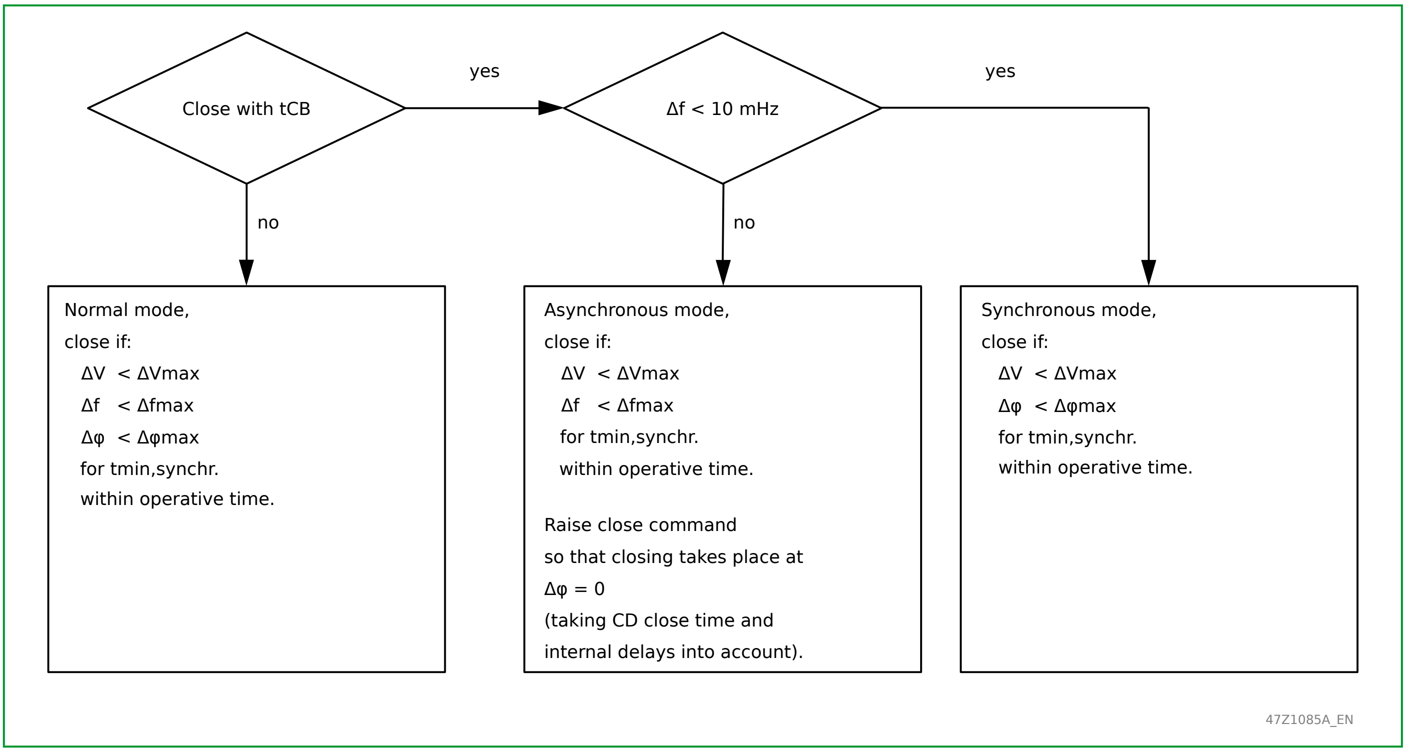


Fig. 3-197: Functional sequence and close conditions for the Synchronism check.

In slightly asynchronous power systems, setting ASC: AR with tCB PSx to *Yes* makes it possible to consider the circuit breaker closing time when issuing a close command.

The condition for “slightly asynchronous power systems” is given if the difference in frequencies lies within the range of 10 mHz < $\Delta f < \Delta f_{max}$. If this condition and the voltage condition ($\Delta V < \Delta V_{max}$) are met then the next point in time is continuously calculated at which the phasors for V_{ref} and the corresponding voltage of the three-phase system are in phase (e.g. difference in voltage phase angles approaches 0°). The close command, allowing for the set CB close time MAIN: tCB,close is then issued sooner.

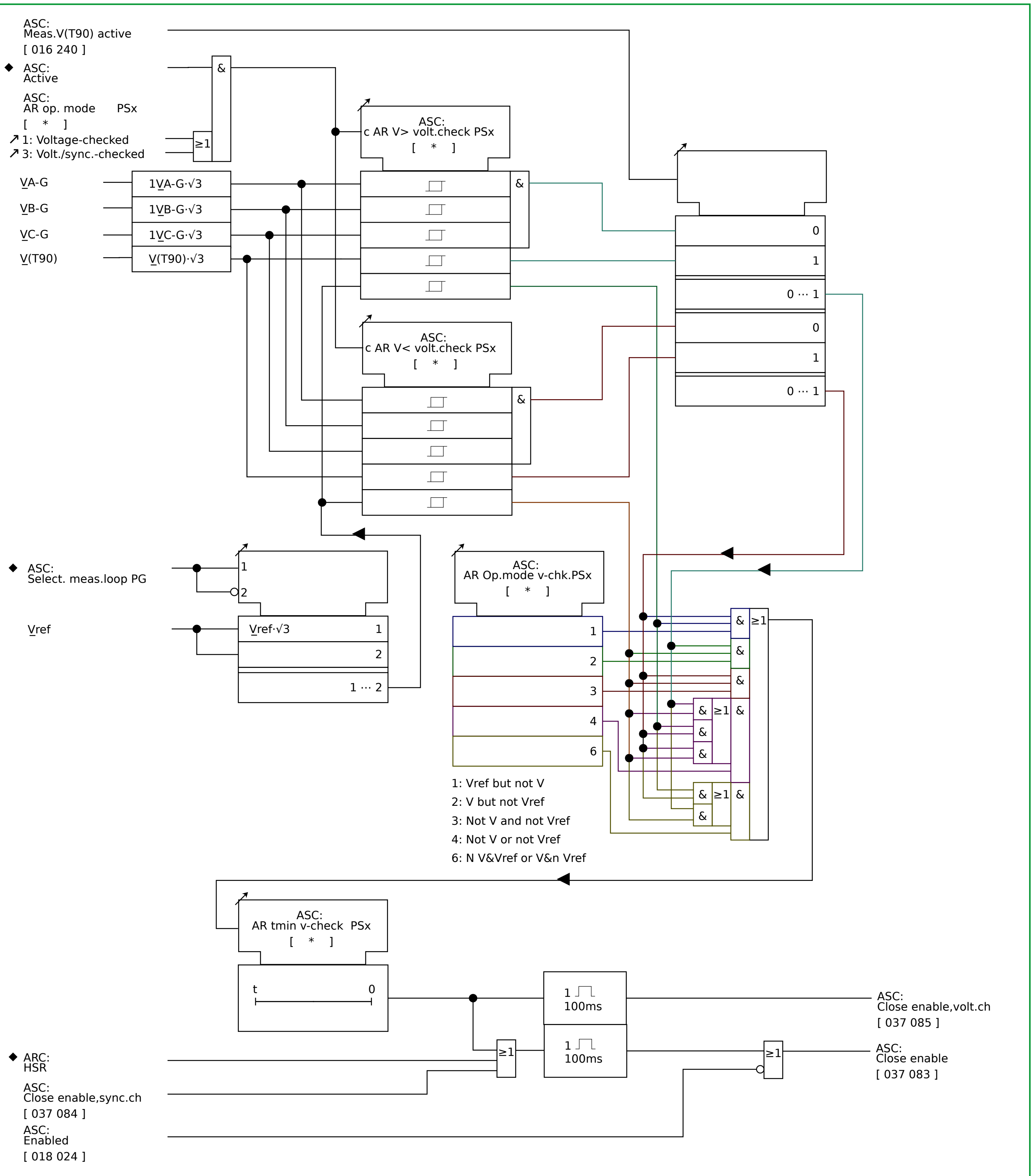
3.28.6 ASC Operating Modes

The criteria for a close enable are determined by the ASC operating mode setting – (018 025) ASC: AR op. mode PSx or (000 056) ASC: MC op. mode PSx, resp.

The following operating mode settings are possible:

- *Voltage-checked* (see Section 3.28.6.1, (p. 3-254))
- *Synchronism-checked* (see Section 3.28.6.2, (p. 3-257))
- *Voltage/synchronism-checked* (see Section 3.28.6.3, (p. 3-260))

3.28.6.1 Voltage-Checked Close Enable



Parameter	ASC: AR op. mode PSx	ASC: AR V> volt.check PSx	ASC: AR V< volt.check PSx	ASC: AR Op.mode v-chk.PSx	ASC: AR tmin v-check PSx
set 1	018 025	026 017	018 017	018 029	018 018
set 2	018 026	077 043	077 040	018 030	077 041
set 3	018 027	078 043	078 040	018 031	078 041
set 4	018 028	079 043	079 040	018 032	079 041

19Z8980A

Fig. 3-198: Voltage-checked close enable for autoreclose control.

The synchronism-checked close enable can be bypassed using the voltage-checked close enable without affecting the former.

For this purpose the voltages are monitored to determine whether they exceed or fall below the set threshold values.

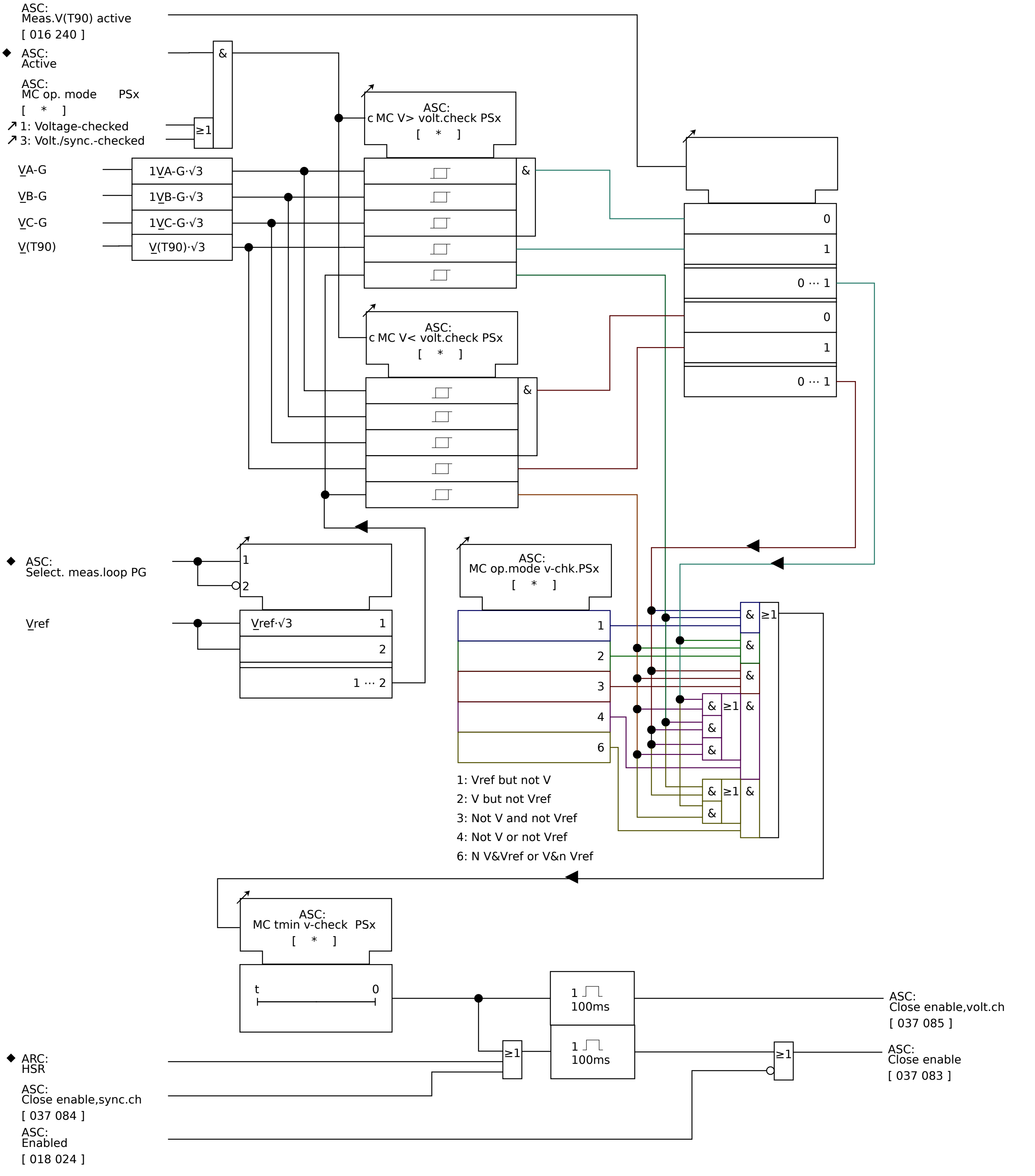
ASC: AR V> volt.check PSx	ASC: MC V> volt.check PSx
ASC: AR V< volt.check PSx	ASC: MC V< volt.check PSx

Depending on the operating mode selected for the voltage check, all three phase-to-ground voltages (or – alternatively, see above – the voltage measured at T90) need to exceed or fall below the set value in order to meet the condition for voltage-checked closing. If the conditions corresponding to the set operating mode for the voltage synchronism check are met, then the close enable is issued after the set minimum time has elapsed.

ASC: AR tmin v-check PSx	ASC: MC tmin v-check PSx

The following operating modes for voltage checking can be selected separately for each parameter subset:

- *Vref but not V*
- *V but not Vref*
- *Not V and not Vref*
- *Not V or not Vref*
- *N V&Vref or V&n Vref*

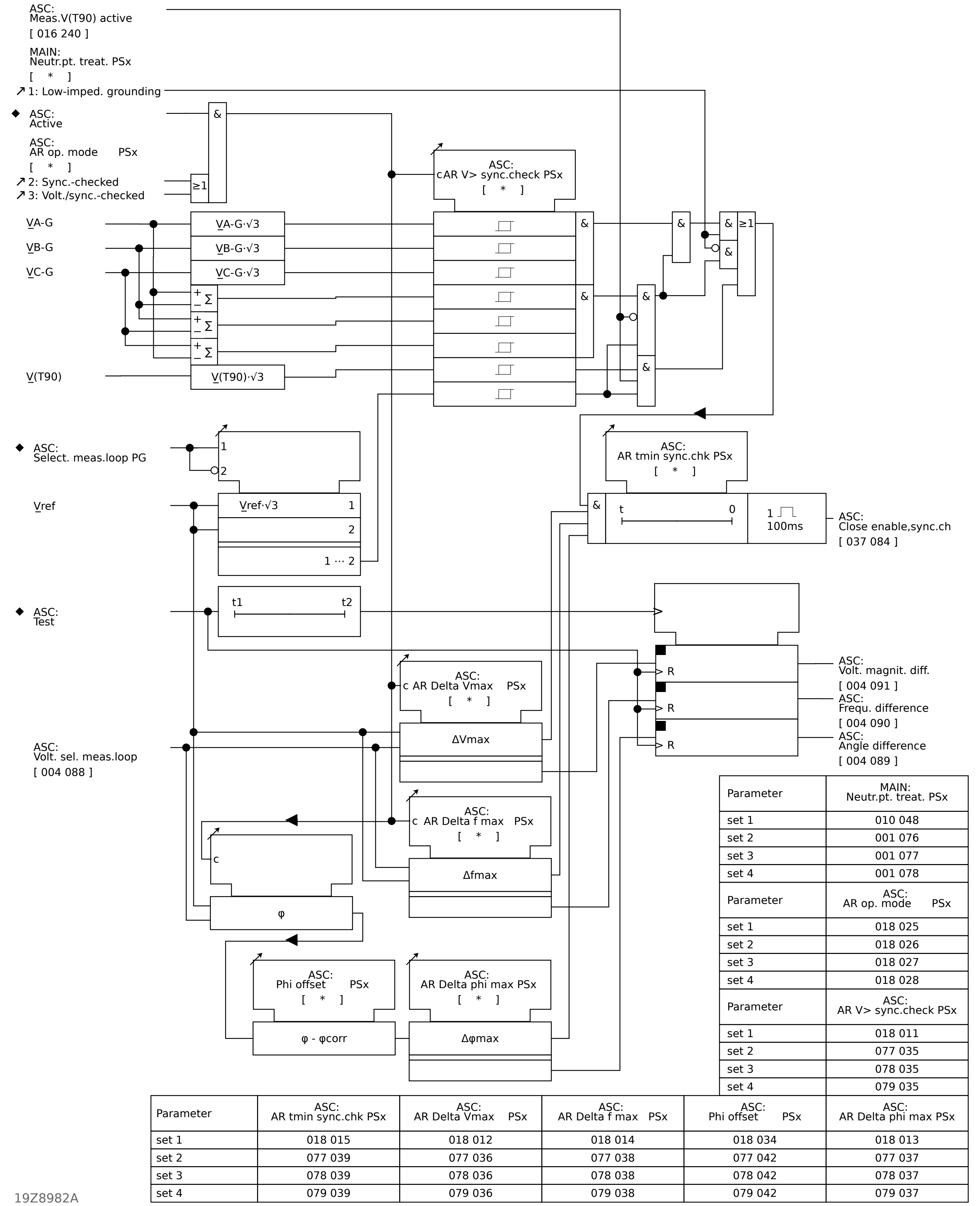


Parameter	ASC: MC op. mode PSx	ASC: MC V> volt.check PSx	ASC: MC V< volt.check PSx	ASC: MC op.mode v-chk.PSx	ASC: MC tmin v-check PSx
set 1	000 056	000 064	000 068	000 060	000 072
set 2	000 057	000 065	000 069	000 061	000 073
set 3	000 058	000 066	000 070	000 062	000 074
set 4	000 059	000 067	000 071	000 063	000 075

19Z8981A

Fig. 3-199: Voltage-checked close enable for autoreclose control for manual close control.

3.28.6.2 Synchronism-Checked Close Enable



Parameter	MAIN: Neutr.pt. treat. PSx
set 1	010 048
set 2	001 076
set 3	001 077
set 4	001 078

Parameter	ASC: AR op. mode PSx
set 1	018 025
set 2	018 026
set 3	018 027
set 4	018 028

Parameter	ASC: AR V> sync.check PSx
set 1	018 011
set 2	077 035
set 3	078 035
set 4	079 035

Parameter	ASC: AR tmin sync.chk PSx	ASC: AR Delta Vmax PSx	ASC: AR Delta f max PSx	ASC: Phi offset PSx	ASC: AR Delta phi max PSx
set 1	018 015	018 012	018 014	018 034	018 013
set 2	077 039	077 036	077 038	077 042	077 037
set 3	078 039	078 036	078 038	078 042	078 037
set 4	079 039	079 036	079 038	079 042	079 037

Fig. 3-200: Synchronism-checked close enable for auto-reclose control.

Before a close enable signal is issued, the ASC checks the voltages for synchronism. Synchronism is recognized if the following conditions are met simultaneously:

- The three phase voltages and the reference voltage must exceed the set threshold value.

  When with a three-phase voltage the setting of MAIN: Neutr.pt. treat. PSx is *Low-imped. grounding* both the phase-to-ground and the phase-to-phase voltages are checked.

  If the setting is *Isolated/res.ground.* only the phase-to-phase voltages are checked.

  If the ASC is set to use the T90 voltage instead of the phase voltages (see Fig. 3-190, (p. 3-245), Section 3.28.6.1, (p. 3-254)), then the voltage measured at T90 and the reference voltage must exceed the set threshold value.

ASC: AR V> sync.check PSx	ASC: MC V> sync.check PSx

- The difference in magnitude between measuring voltage and reference voltage must not exceed the set threshold value.

ASC: AR Delta Vmax PSx	ASC: MC Delta Vmax PSx

- The frequency difference between measuring voltage and reference voltage must not exceed the set threshold value.

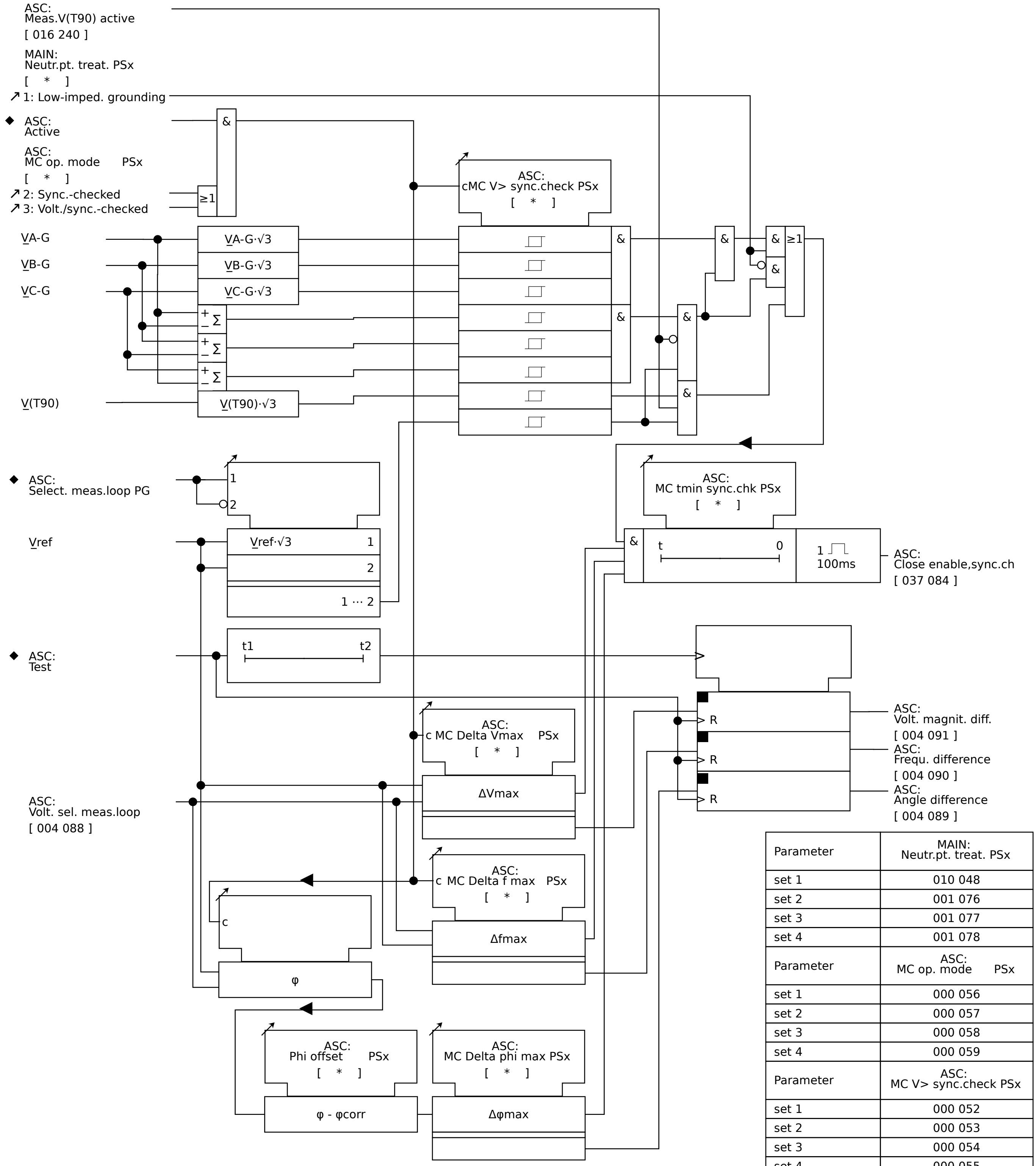
ASC: AR Delta f max PSx	ASC: MC Delta f max PSx

- The angle difference between measuring voltage and reference voltage must not exceed the set threshold value. (In these comparisons the set offset angle ASC: Phi offset PSx is taken into account.)

ASC: AR Delta phi max PSx	ASC: MC Delta phi max PSx

If these conditions are met for at least the set time ASC: AR tmin sync.chk PSx or ASC: MC tmin sync.chk PSx, respectively, then a close enable signal is issued. The ASC operating time for the determination of differences in voltage, angle, and frequency is approximately 100 ms.

The voltage magnitude difference, angle difference, and frequency difference are stored as measured synchronism data at the time the close request is issued. In the event of another close request, they are automatically overwritten by the new data.



Parameter	MAIN: Neutr.pt. treat. PSx
set 1	010 048
set 2	001 076
set 3	001 077
set 4	001 078

Parameter	ASC: MC op. mode PSx
set 1	000 056
set 2	000 057
set 3	000 058
set 4	000 059

Parameter	ASC: MC V> sync.check PSx
set 1	000 052
set 2	000 053
set 3	000 054
set 4	000 055

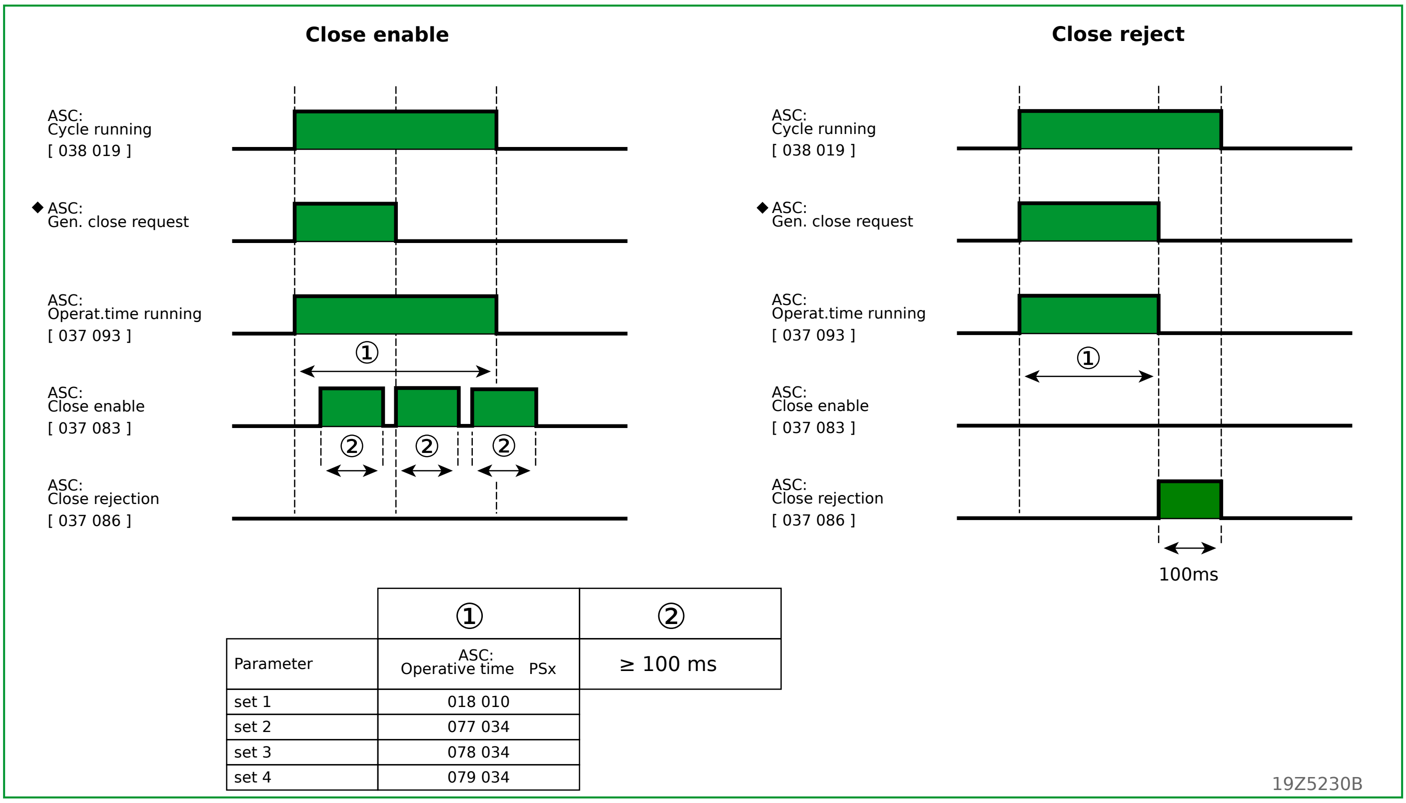
Parameter	ASC: MC tmin sync.chk PSx	ASC: MC Delta Vmax PSx	ASC: MC Delta f max PSx	ASC: Phi offset PSx	ASC: MC Delta phi max PSx
set 1	000 098	000 080	000 084	018 034	000 089
set 2	000 099	000 081	000 086	077 042	000 091
set 3	000 100	000 082	000 087	078 042	000 092
set 4	000 101	000 083	000 088	079 042	000 093

Fig. 3-201: Synchronism-checked close enable for manual close command.

3.28.6.3 Voltage/Synchronism-Checked Close Enable

If this setting has been selected, then the close enable signal is issued if the conditions for voltage- or synchronism-checked closing are met.

3.28.7 Testing the ASC Function



	①	②
Parameter	ASC: Operative time PSx	≥ 100 ms
set 1	018 010	
set 2	077 034	
set 3	078 034	
set 4	079 034	

Fig. 3-202: ASC sequence during testing.

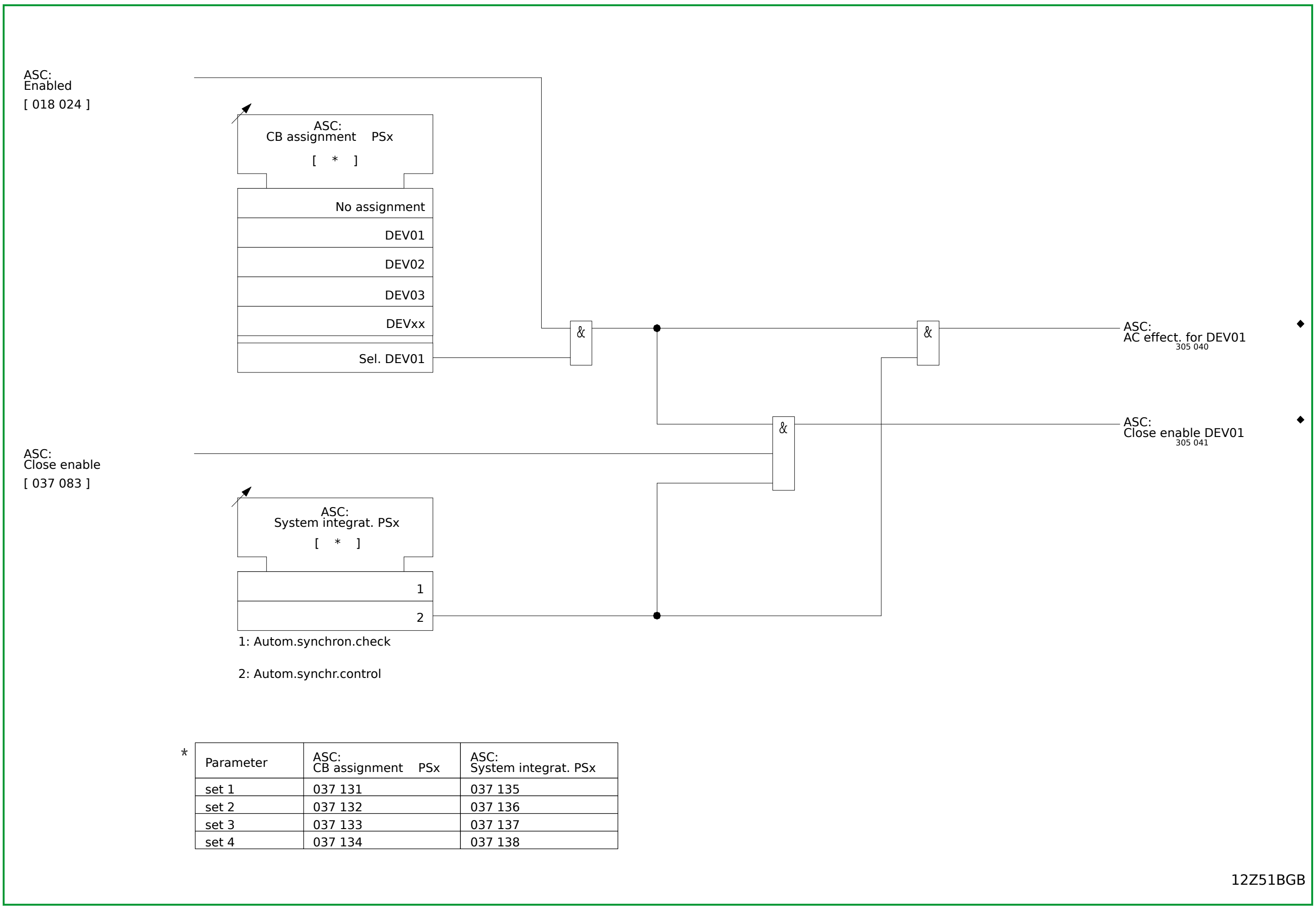
For test purposes a close request can be issued via a setting parameters or an appropriately configured binary signal input (see Fig. 3-202, (p. 3-260)). In this case no close command is issued and it is not counted.

Separate triggering parameters are available for testing the function with parameters for manual (MC) and automatic (AR) reclosure.

Triggering parameter for auto-reclose control	Triggering parameter for manual close command
ASC: AR close requ. USER	ASC: MC close requ. USER
ASC: AR close request EXT	ASC: MC Close request EXT
ASC: AR Close request	ASC: MC Close request
ASC: Test AR close r.USER	ASC: Test MC close r.USER
ASC: Test AR close r. EXT	ASC: Test MC close r. EXT
ASC: Test AR close requ.	ASC: Test MC close requ.

The ASC cycle and the operating time are started by the test close request. The network synchronism is checked during the whole operating time and ASC: Close enable is set accordingly. If at the end of the operate time no network synchronism is registered, a 100 ms signal ASC: Close rejection is issued.

3.28.8 Integrating the ASC Function into the Control and Monitoring of Switchgear Units



Parameter	ASC: CB assignment PSx	ASC: System integrat. PSx
set 1	037 131	037 135
set 2	037 132	037 136
set 3	037 133	037 137
set 4	037 134	037 138

Fig. 3-203: Integrating the ASC function into the control and monitoring of switchgear units.

ASC triggering by a close request from the control functions is also possible. This requires that the circuit breaker is assigned to an external device and that the ASC system integration is set to *Autom.synchr.control*. If the control function issues a close request then the close command for the circuit breaker requires the ASC: Close enable (see Section 3.44.6.6, (p. 3-409)).

However if ASC: System integrat. PSx is set to *Autom.synchron.check* ASC will not interfere with any switching commands. Data generated and continuously updated by the ASC function is transmitted – when configurations have been set accordingly – to the central control station, where operators may make decisions as to which external device is to be given a switching command.

3.28.9 Measured Values Obtained by ASC

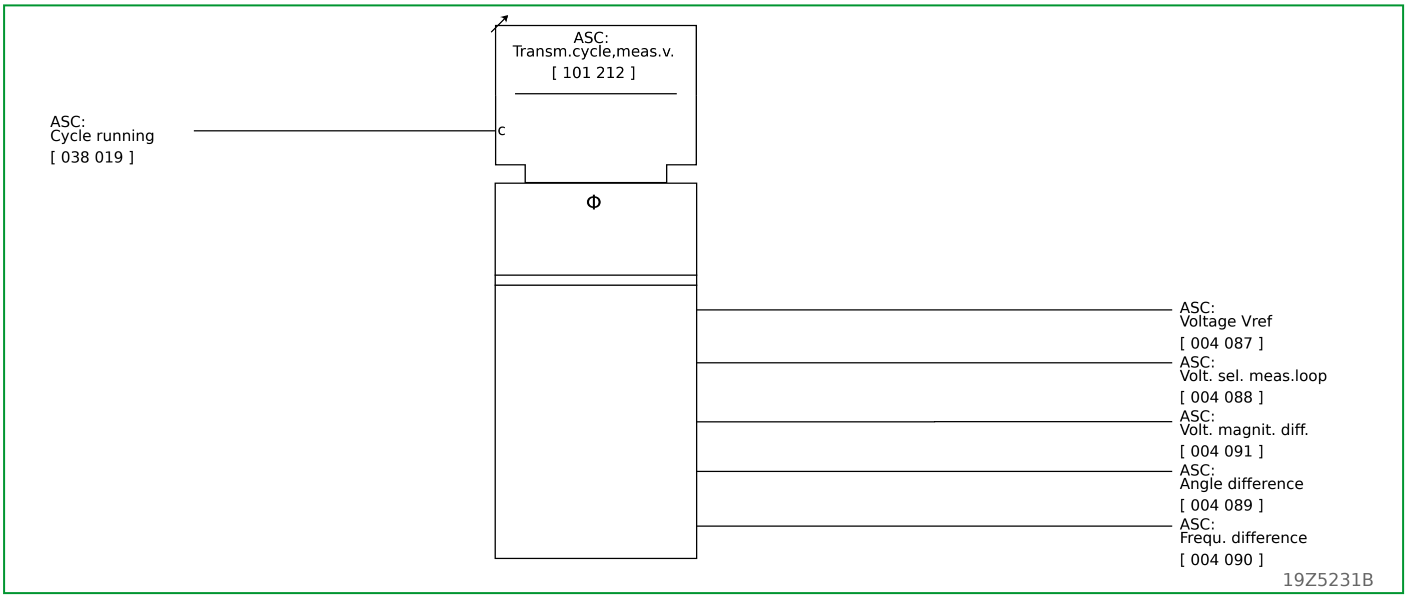


Fig. 3-204: Measured values obtained by ASC.

The following measured values are obtained and calculated during an ASC cycle and are transmitted during a set cycle time:

- Voltage from the reference voltage channel
- Voltage from the selected measuring loop
- Difference in phase voltage magnitudes
- Difference in phase angles
- Frequency difference

Outside of the ASC cycle the measured values have the status of *Not measured*.

3.28.10 ASC Counters

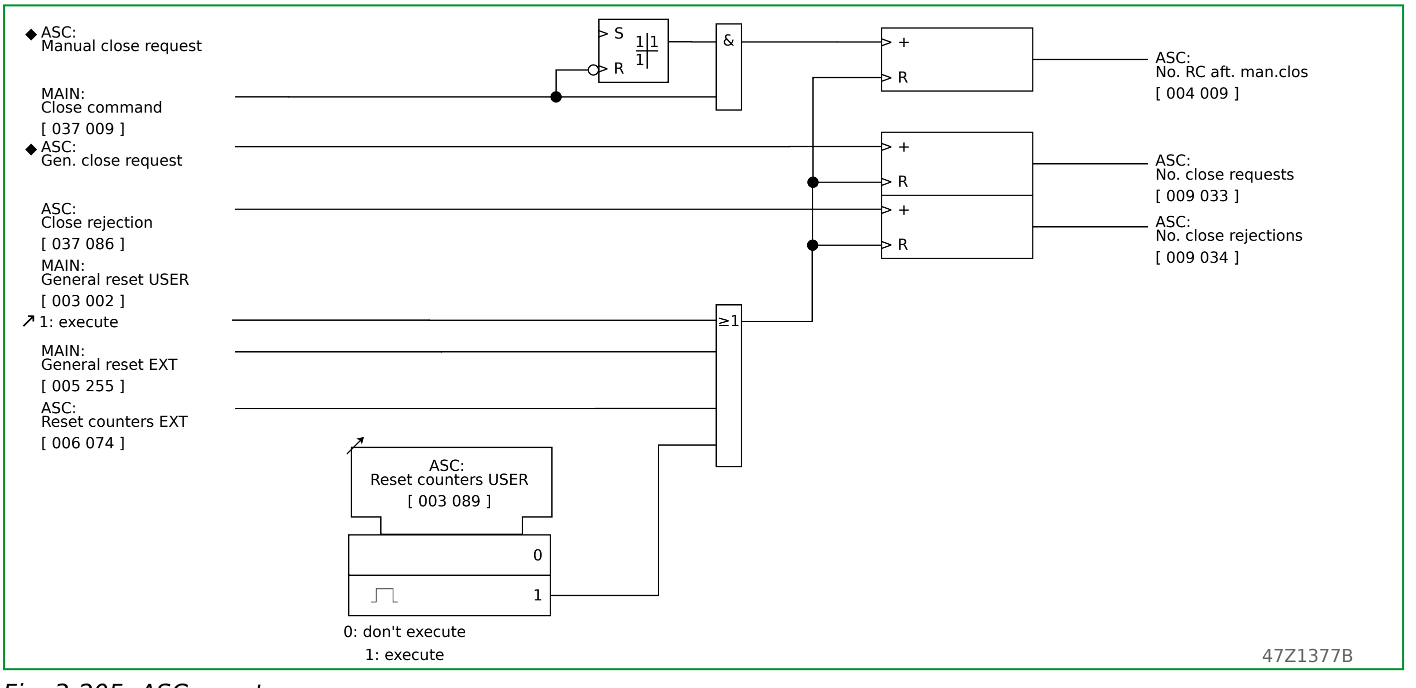


Fig. 3-205: ASC counters.

The following ASC signals are counted:

- Number of reclosures after a close request via setting parameters or an appropriately configured binary signal input
- Number of close requests
- Number of close rejections

The counters can either be reset individually (at the address at which they are displayed) or as a group.

3.29 Ground Fault Direction Determination Using Steady-State Values (Function Group GFDSS)

Ground fault direction determination is carried out by evaluating the neutral-point displacement voltage and the residual current using the steady-state power evaluation mode, the admittance evaluation mode, or steady-state power and admittance evaluation running in parallel. Also possible is a steady-state current evaluation only. In this case only the filtered residual current is used as a criterion for a ground fault. Ground fault direction determination is then not possible.

By using the ARC function it is possible to intervene in the functional sequence of ground fault direction determination using steady-state values.

3.29.1 Disabling and Enabling Ground Fault Direction Determination Using Steady-State Values

The ground fault direction determination using steady-state values can be disabled or enabled using setting parameters. Switching over to *Steady-state current* evaluation is made by setting parameters or an appropriately configured binary signal input. Moreover, enabling can be carried out separately for each parameter set.

3.29.2 Ground Fault Direction Determination Using Steady-State Values Is Ready

A ready signal is issued for the evaluation mode selected if the protection and the ground fault direction determination using steady-state values are enabled.

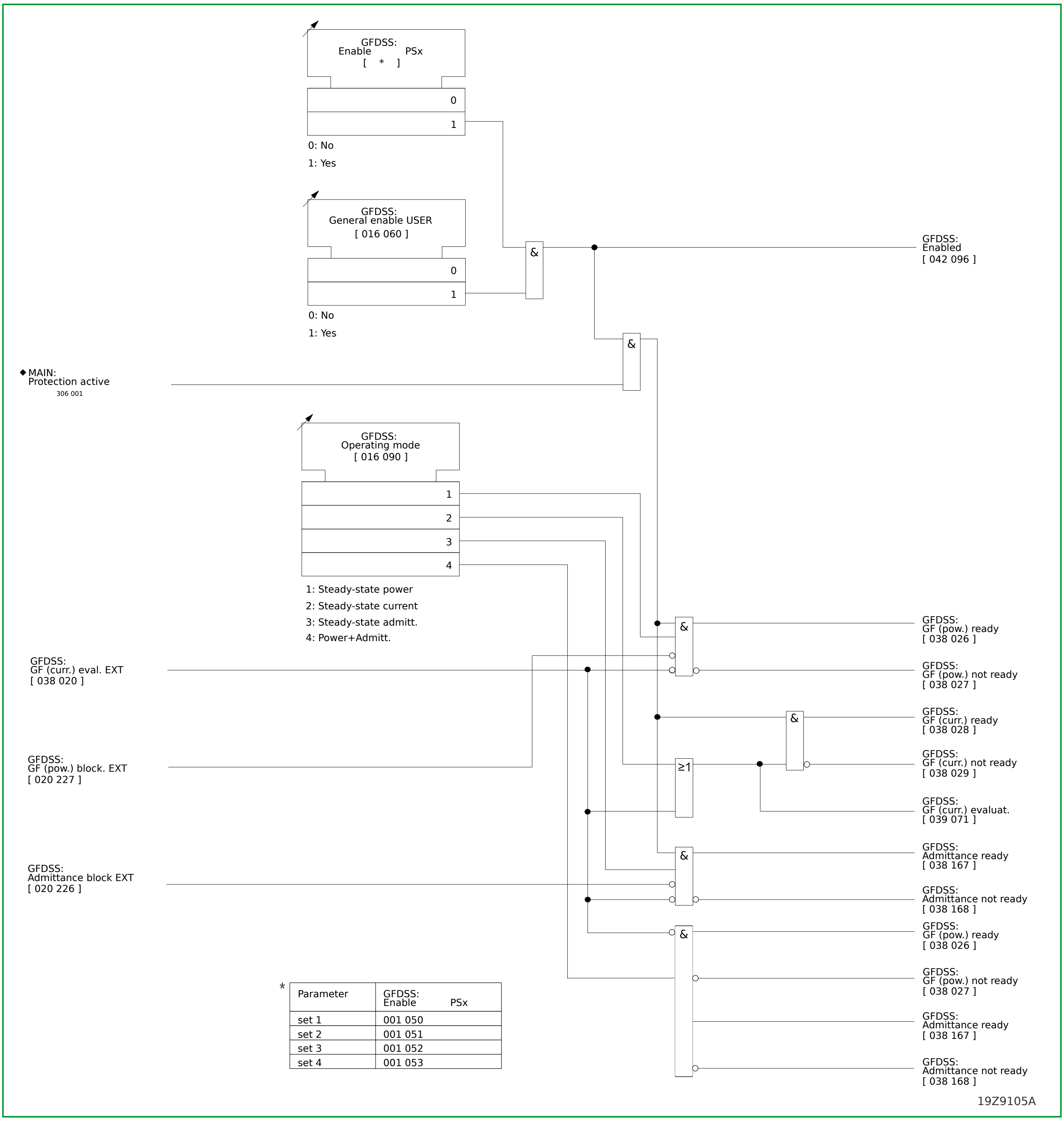


Fig. 3-206: Enabling, disabling and readiness of the ground fault direction determination using steady-state values.

3.29.3 Conditioning and Selecting the Measured Values

For the conditioning of measured values the P139 is fitted with integrated transformers. As an alternative it is possible to use the neutral-point displacement voltage calculated by the P139 from the three phase-to-ground voltages or the displacement voltage measured at the T 90 transformer for steady-state power evaluation. The current transformer has been especially designed for this application so that it will perform with a very small phase-angle error.

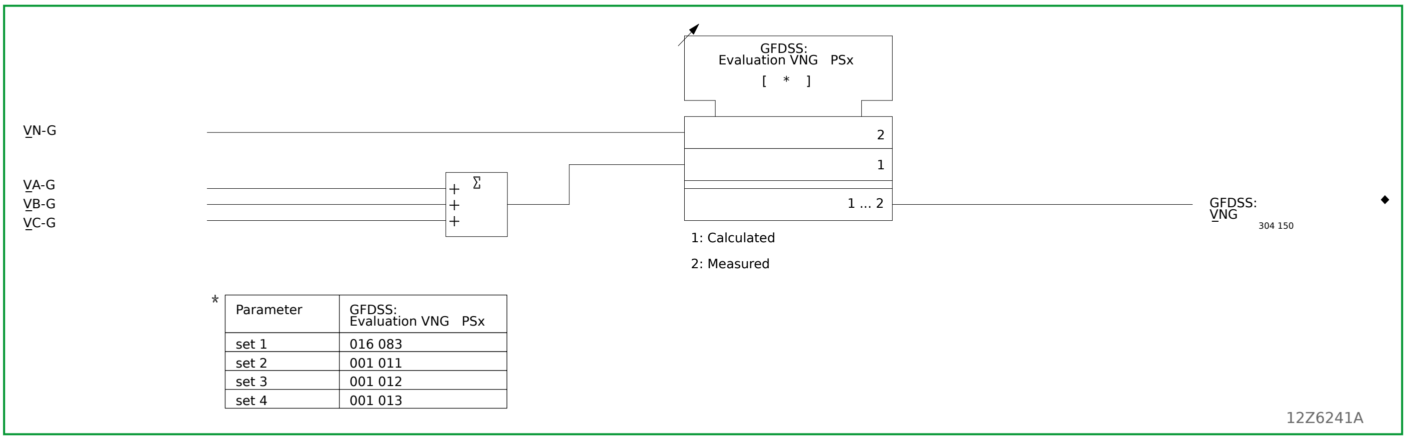
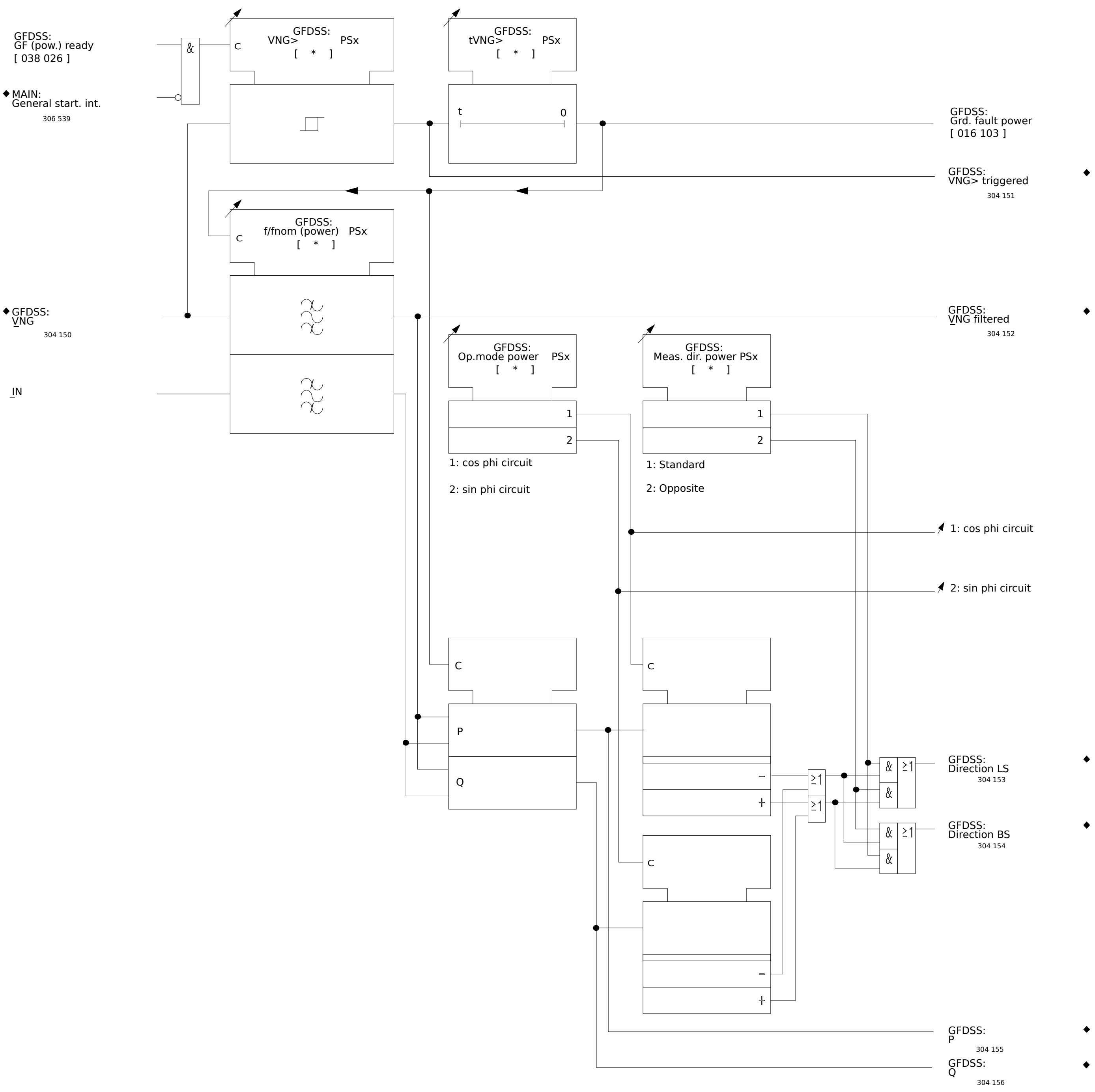


Fig. 3-207: Selecting the measuring voltage.

3.29.4 Steady-State Power Evaluation

Ground fault direction determination using steady-state values requires the neutral-point displacement voltage and the residual current values to be able to determine a ground fault direction. The frequency provided by the setting f/f_{nom} is filtered from these values by using a Fourier analysis. Three periods are used for evaluation if the time stage GFDSS: tVNG> PSx has been set to a time delay equal to or greater than 60 ms. This will result in the suppression of typical ripple-control frequencies in addition to all integer-frequency harmonics. If the time stage was set to a time delay less than 60 ms only one period will be used for filtering.

The measurement is enabled when the time delay set at GFDSS: tVNG> PSx and which was triggered by VNG> has elapsed. Depending on the selected operating mode (*cos phi circuit* or *sin phi circuit*) the sign of the active power (GFDSS: Op.mode power PSx = *cos phi circuit*) or of the reactive power (GFDSS: Op.mode power PSx = *sin phi circuit*) is used to determine the direction. The connection of the measuring circuits is taken into account by the setting at GFDSS: Meas. dir. power PSx. When the *Standard* connection has been made a ground fault on the line side will issue the decision “LS” and a ground fault on the busbar side will issue the decision “BS”.



* Parameter	GFDSS: VNG> PSx	GFDSS: f/fnom (power) PSx	GFDSS: tVNG> PSx	GFDSS: Op.mode power PSx	GFDSS: Meas. dir. power PSx
set 1	016 062	016 091	016 061	016 063	016 070
set 2	000 233	001 044	000 230	000 236	001 002
set 3	000 234	001 045	000 231	000 237	001 003
set 4	000 235	001 046	000 232	000 238	001 004

Fig. 3-208: Direction determination with the “Steady-state power” operating mode.

3.29.4.1 cos φ Circuit

The directional decision is not enabled until the active component of the residual current exceeds the set threshold and the phase displacement between residual current and neutral-point displacement voltage is smaller than the set sector angle. The sector angle makes it possible to extend the "dead zone" to take into account the expected phase-angle errors of the measured variables. These settings make it possible to achieve the characteristic shown in Fig. 3-209, (p. 3-268).

Output of the direction decisions is operate- and reset-delayed.

The trip signal *"forward directional"* issued by the ground fault direction determination using steady-state values (GFDSS) is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

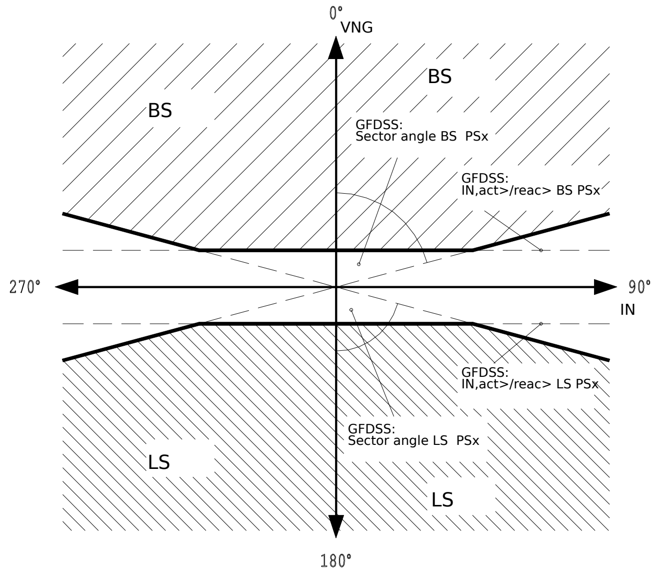


Fig. 3-209: Characteristic of the ground fault direction determination using steady-state values, "cos φ" operating mode.

3.29.4.2 sin φ Circuit

The direction decision is enabled if the reactive component of the residual current has exceeded the set threshold operate value. This setting makes it possible to achieve the characteristic shown in Fig. 3-210, (p. 3-269).

If the ground fault is intermittent, hold time logic is to continues timing during gaps of starting signal (gaps shorter than hold time). Output of the direction decisions is operate- and reset-delayed.

The *"forward directional"* trip signal issued by the ground fault direction determination using steady-state values (GFDSS) is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

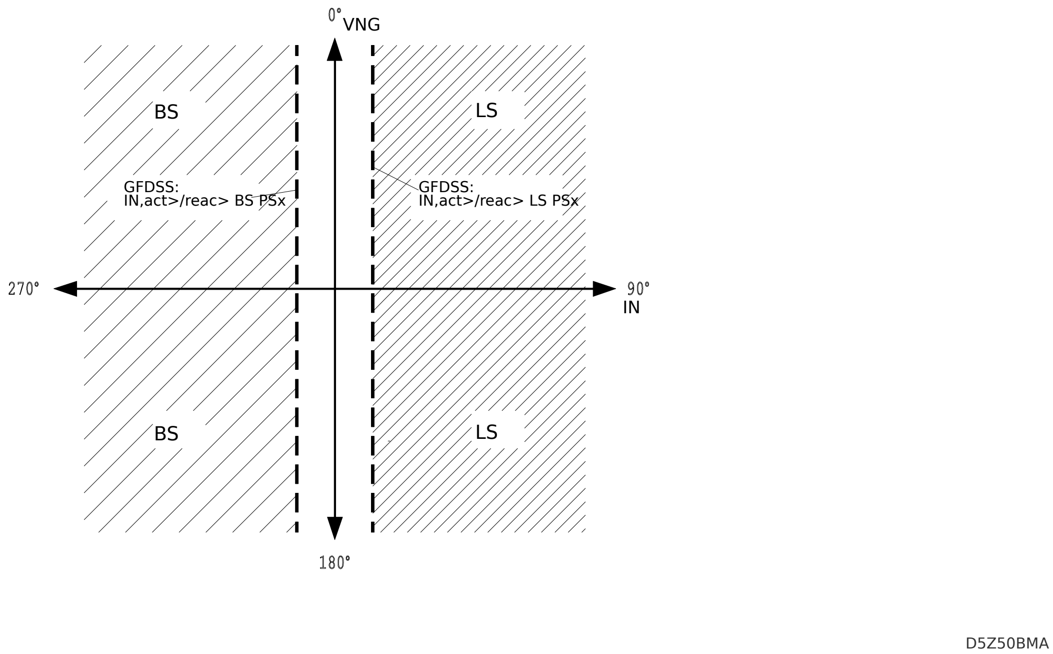
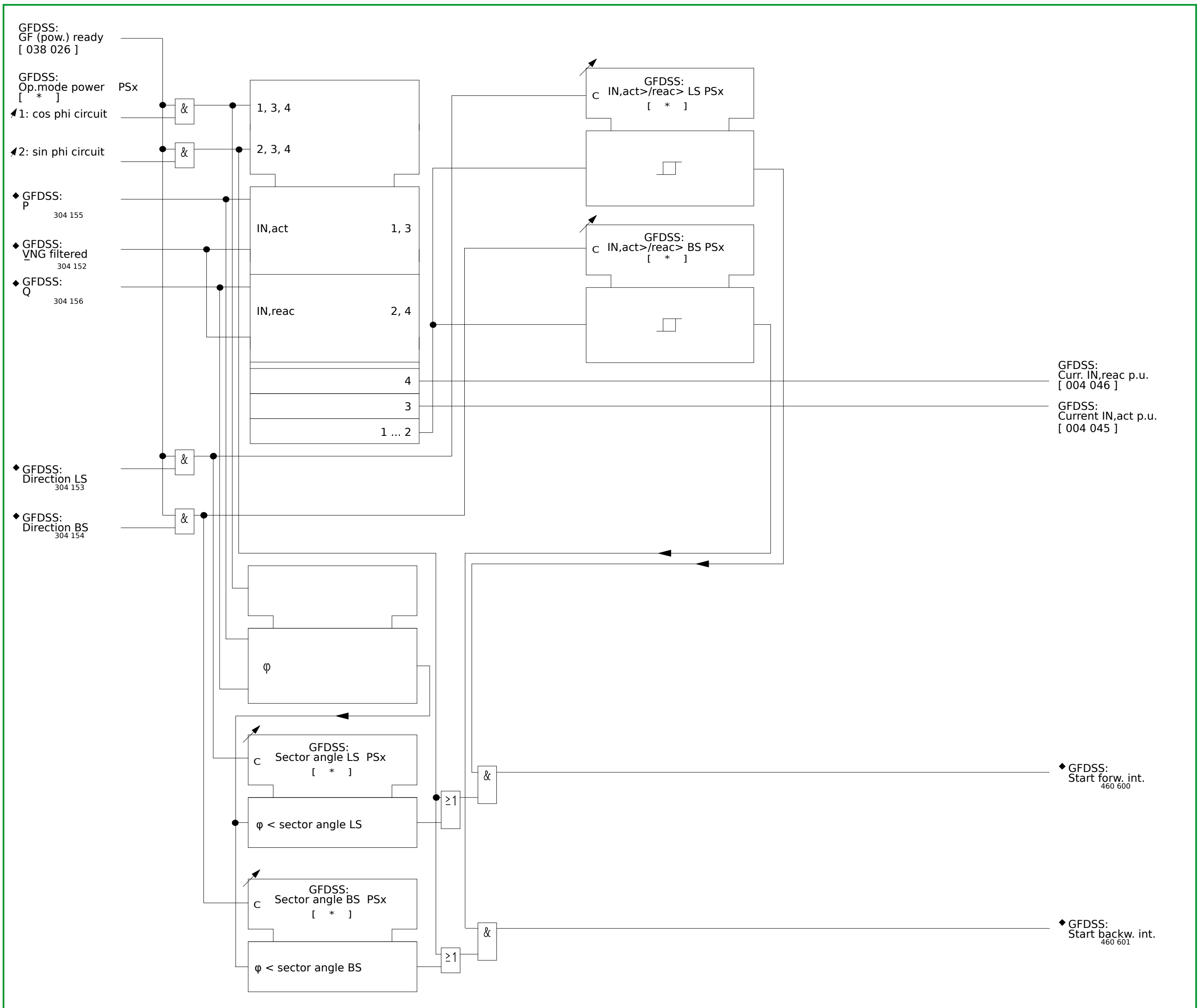


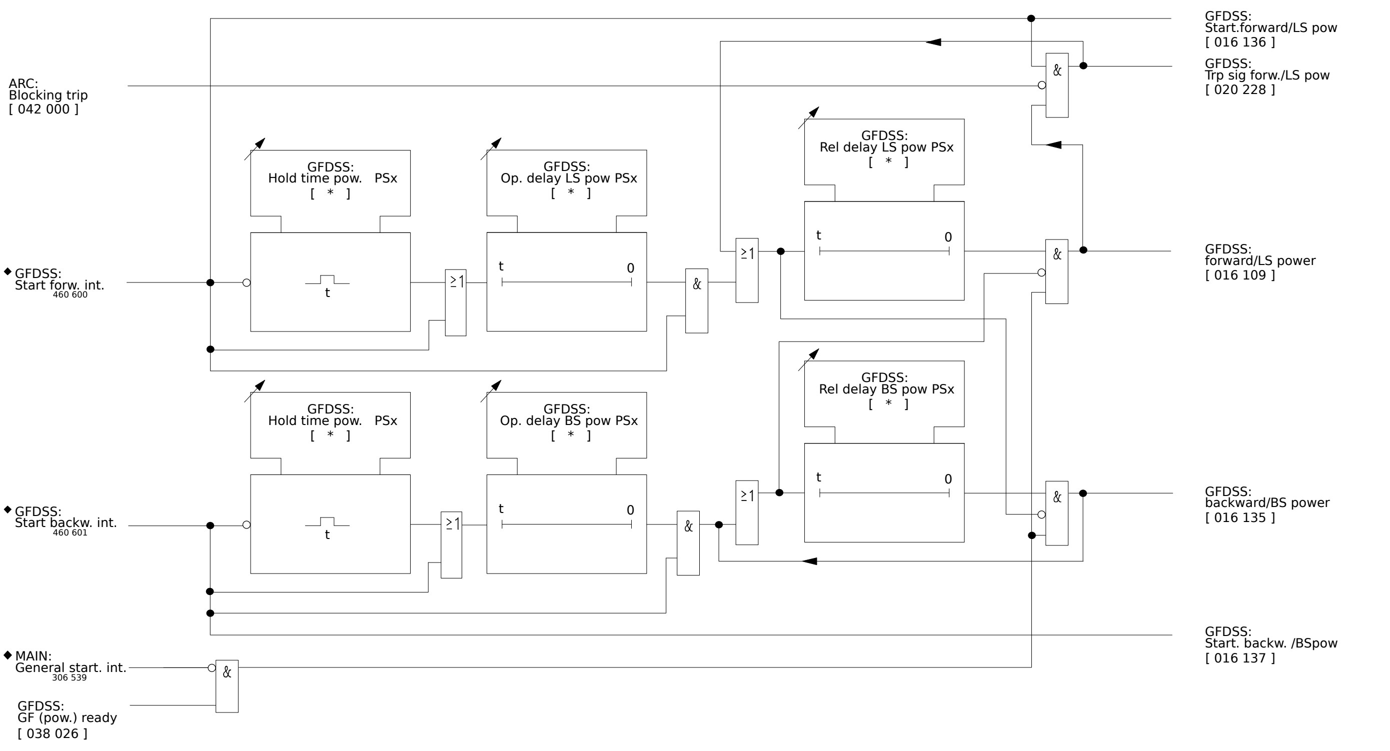
Fig. 3-210: Characteristic of the ground fault direction determination using steady-state values, "sin φ" operating mode.



* Parameter	GFDSS: Sector angle LS PSx	GFDSS: Sector angle BS PSx	GFDSS: IN,act>/reac> LS PSx	GFDSS: IN,act>/reac> BS PSx
set 1	016 065	016 068	016 064	016 067
set 2	000 242	000 248	000 239	000 251
set 3	000 243	000 249	000 240	000 252
set 4	000 244	000 250	000 241	000 253

19Z9104A

Fig. 3-211: Output of the direction decisions with the “steady-state power” operating mode, part 1.



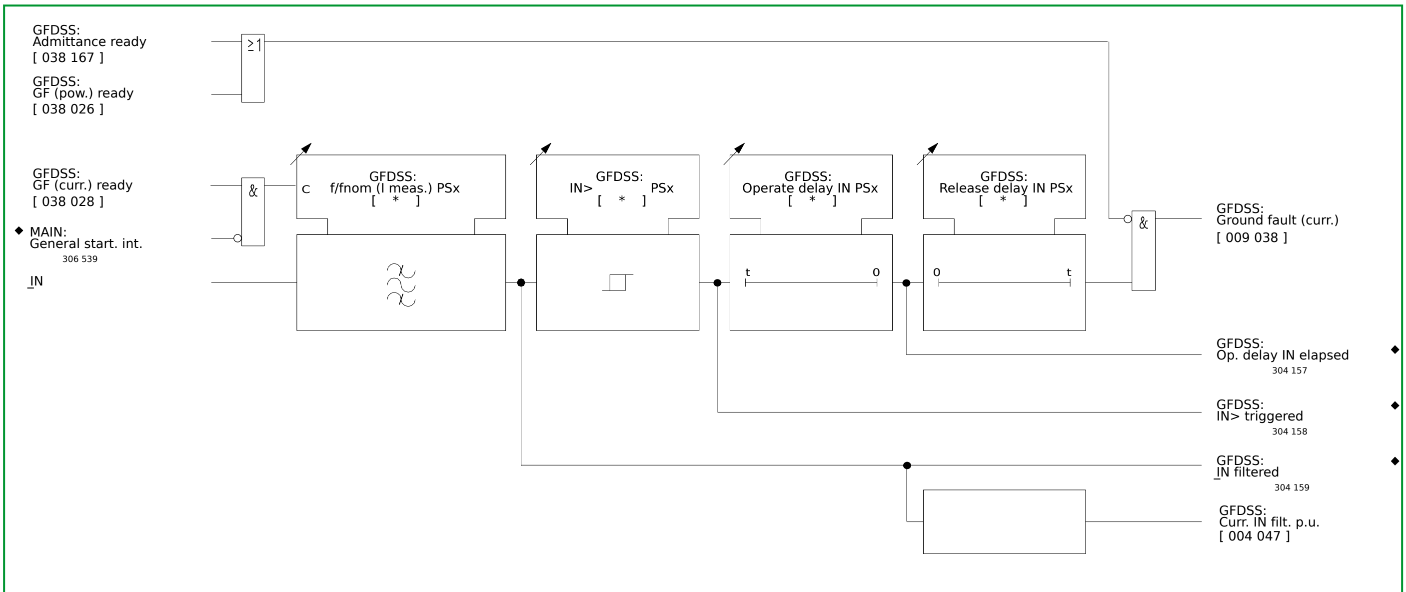
* Parameter	GFDSS: Op. delay LS pow PSx	GFDSS: Op. delay BS pow PSx	GFDSS: Rel delay LS pow PSx	GFDSS: Rel delay BS pow PSx	GFDSS: Hold time pow. PSx
set 1	016 066	016 069	016 072	016 073	020 172
set 2	000 245	001 044	001 005	001 008	020 173
set 3	000 246	001 045	001 006	001 009	020 174
set 4	000 247	001 046	001 007	001 010	020 175

19Z9107A

Fig. 3-212: Output of the direction decisions with the “steady-state power” operating mode, part 2.

3.29.5 Steady-State Current Evaluation

The frequency provided by the setting f/f_{nom} is filtered from the residual current value by using a Fourier analysis. Three periods are used for evaluation. If the residual current value exceeds the set threshold a ground fault signal is issued after the settable operate delay has elapsed.



* Parameter	GFDSS: f/fnom (I meas.) PSx	GFDSS: IN> PSx	GFDSS: Operate delay IN PSx	GFDSS: Release delay IN PSx
set 1	016 092	016 093	016 094	016 095
set 2	001 047	001 017	001 020	001 023
set 3	001 048	001 018	001 021	001 024
set 4	001 049	001 019	001 022	001 025

12Z6244A

Fig. 3-213: Evaluation of the residual current.

Counting Ground Faults

The number of ground faults is counted. The counter may be reset either individually or together with other counters.

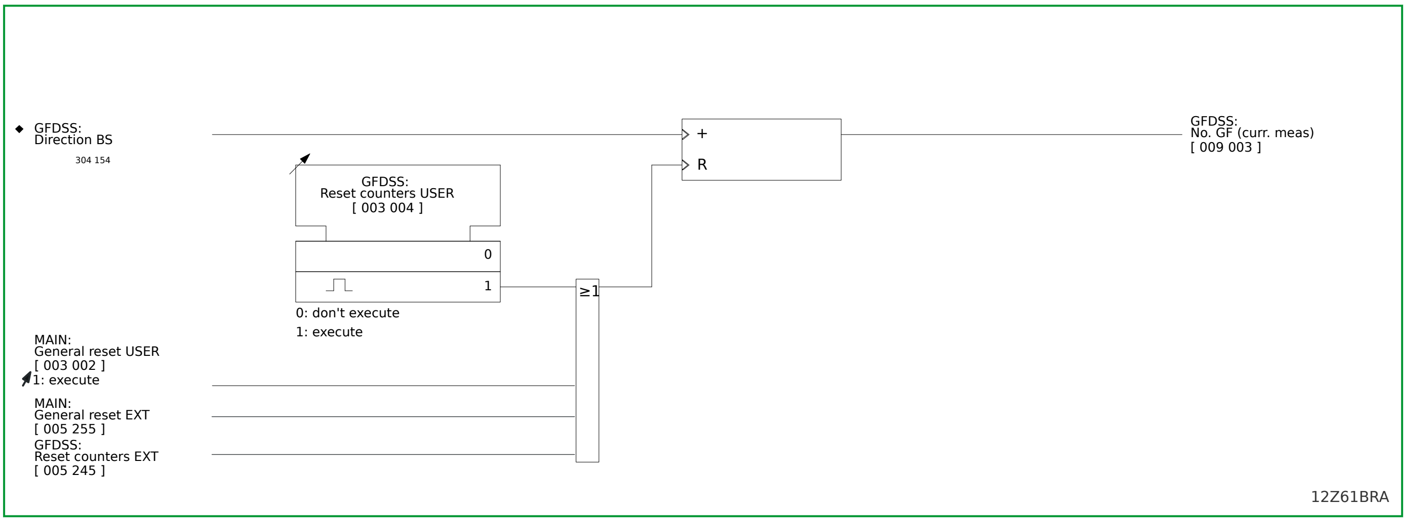
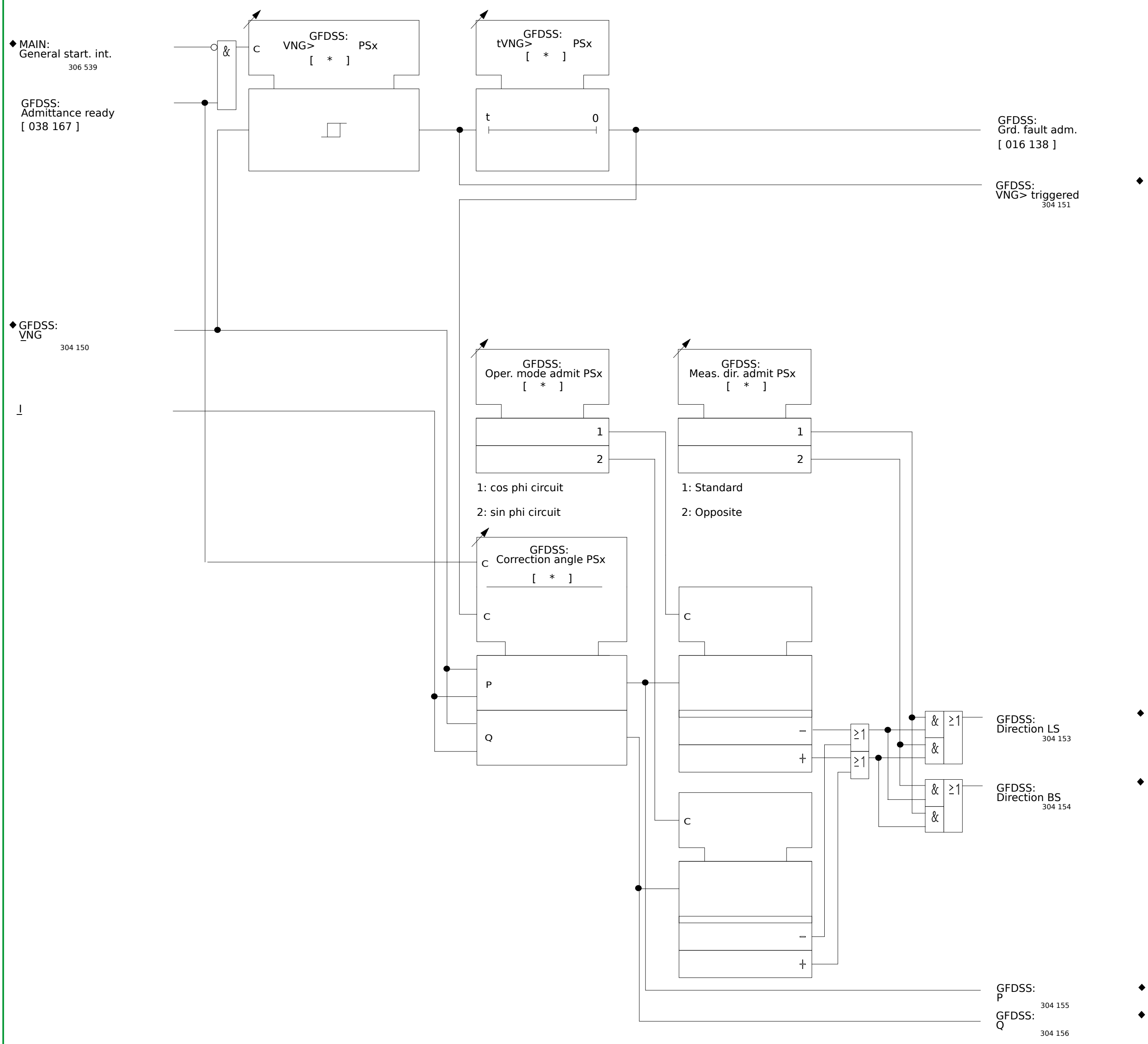


Fig. 3-214: Counting ground faults.

3.29.6 Steady-State Admittance Evaluation



*

Parameter	GFDSS: VNG> PSx	GFDSS: tVNG> PSx	GFDSS: Oper. mode admit PSx	GFDSS: Correction angle PSx	GFDSS: Meas. dir. admit PSx
set 1	016 062	016 061	020 176	016 110	020 180
set 2	000 233	000 230	020 177	001 026	020 181
set 3	000 234	000 231	020 178	001 027	020 182
set 4	000 235	000 232	020 179	001 028	020 183

19Z9101A

Fig. 3-215: Direction determination with the “Steady-state admittance” operating mode.

To determine a ground fault direction the steady-state admittance evaluation requires the neutral-point displacement voltage and the residual current values.

The measurement is enabled when the time delay set at GFDSS: tVNG> PSx and which was triggered by VNG> has elapsed. Depending on the selected operating mode (*cos phi circuit* or *sin phi circuit*) the sign of the active power (GFDSS: Oper. mode admit PSx = *cos phi circuit*) or of the reactive power (GFDSS: Oper. mode admit PSx = *sin phi circuit*) is used to determine the direction. The connection of the measuring circuits is taken into account by the setting at GFDSS: Meas. dir. admit PSx. When the *Standard* connection has been made a ground fault on the line side will issue the decision “LS” and a ground fault on the busbar side will issue the decision “BS”. Phase-angle errors of the system transformers can be compensated with the setting at GFDSS: Correction angle PSx.

From version -657, the steady-state admittance mode and steady-state power mode are in parallel. The settings (GFDSS: Oper. mode admit PSx, GFDSS: Meas. dir. admit PSx, GFDSS: Op. delay LS adm PSx, GFDSS: Rel delay LS adm PSx, GFDSS: Op. delay BS adm PSx and GFDSS: Rel delay BS adm PSx) are separated from steady-state power mode. Please reconfigure these settings when converting existing (old) setting files.

3.29.6.1 cos φ Circuit

Direction determination is enabled when the conductance value (conductance G(N)) on the ground return exceeds the set threshold. This setting makes it possible to achieve the characteristic shown in Fig. 3-216, (p. 3-274).

Output of the direction decisions is operate- and reset-delayed.

The trip signal in forward direction issued by the ground fault direction determination using steady-state values (GFDSS) is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

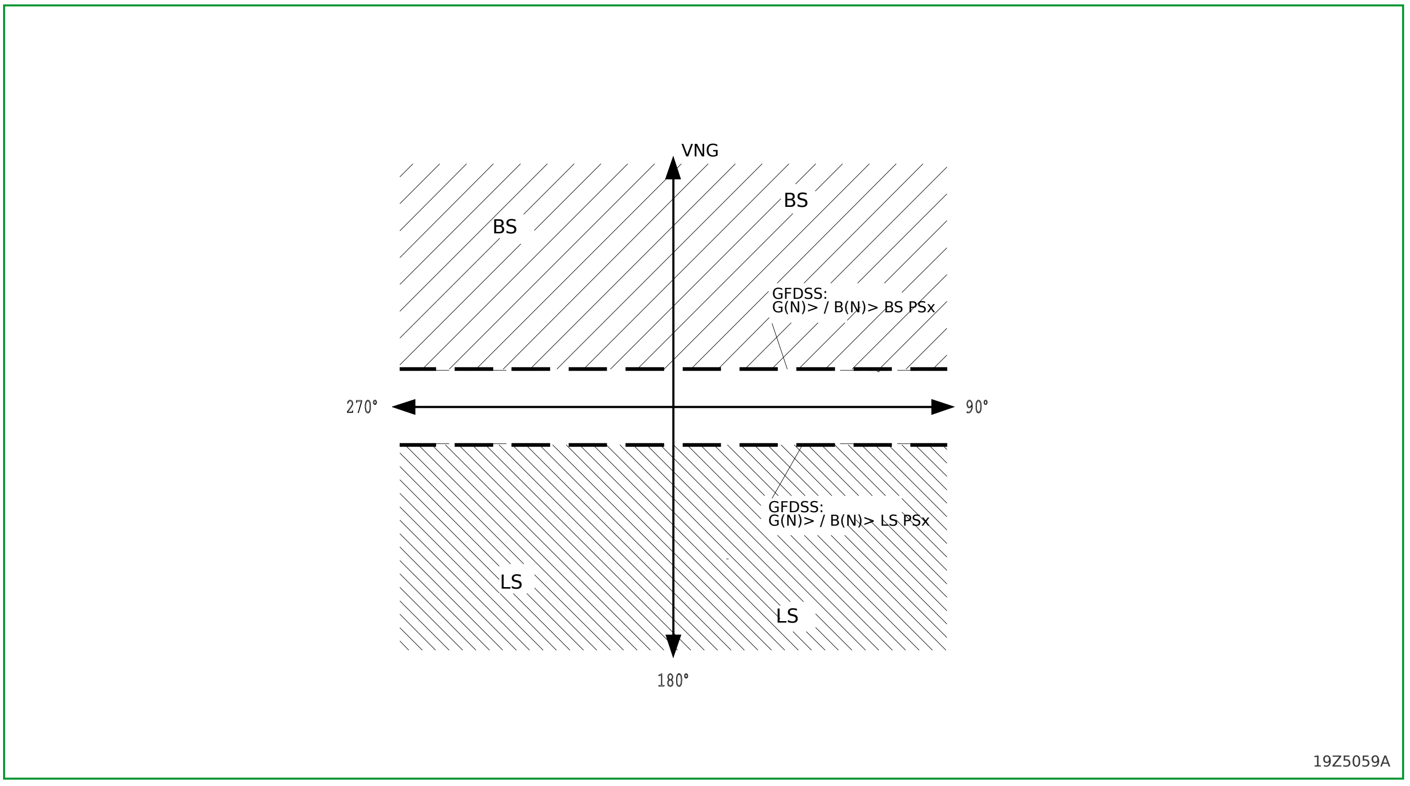


Fig. 3-216: Characteristic for ground fault direction determination using steady-state admittance, “cos φ” operating mode.

3.29.6.2 sin φ Circuit

Direction determination is enabled when the conductance value (susceptance B(N)) on the ground return exceeds the set threshold. This setting makes it possible to achieve the characteristic shown in Fig. 3-217, (p. 3-275).

If the ground fault is intermittent, hold time logic is to continues timing during gaps of starting signal (gaps shorter than hold time). Output of the direction decisions is operate- and reset-delayed.

The trip signal in forward direction issued by the ground fault direction determination using steady-state values (GFDSS) is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

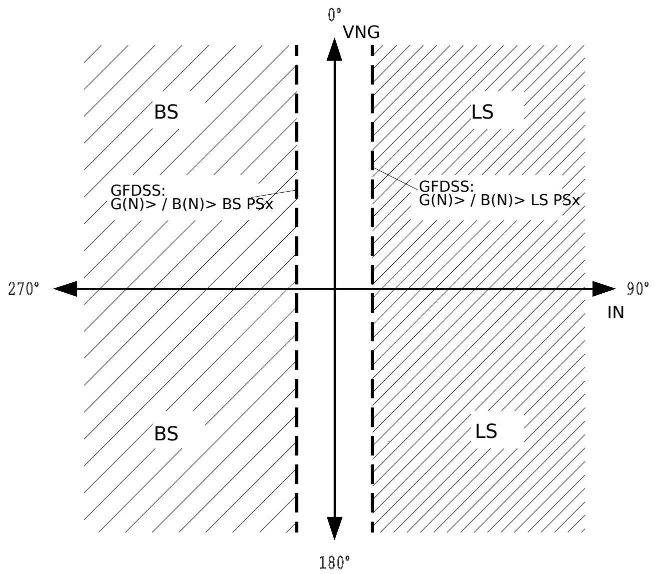
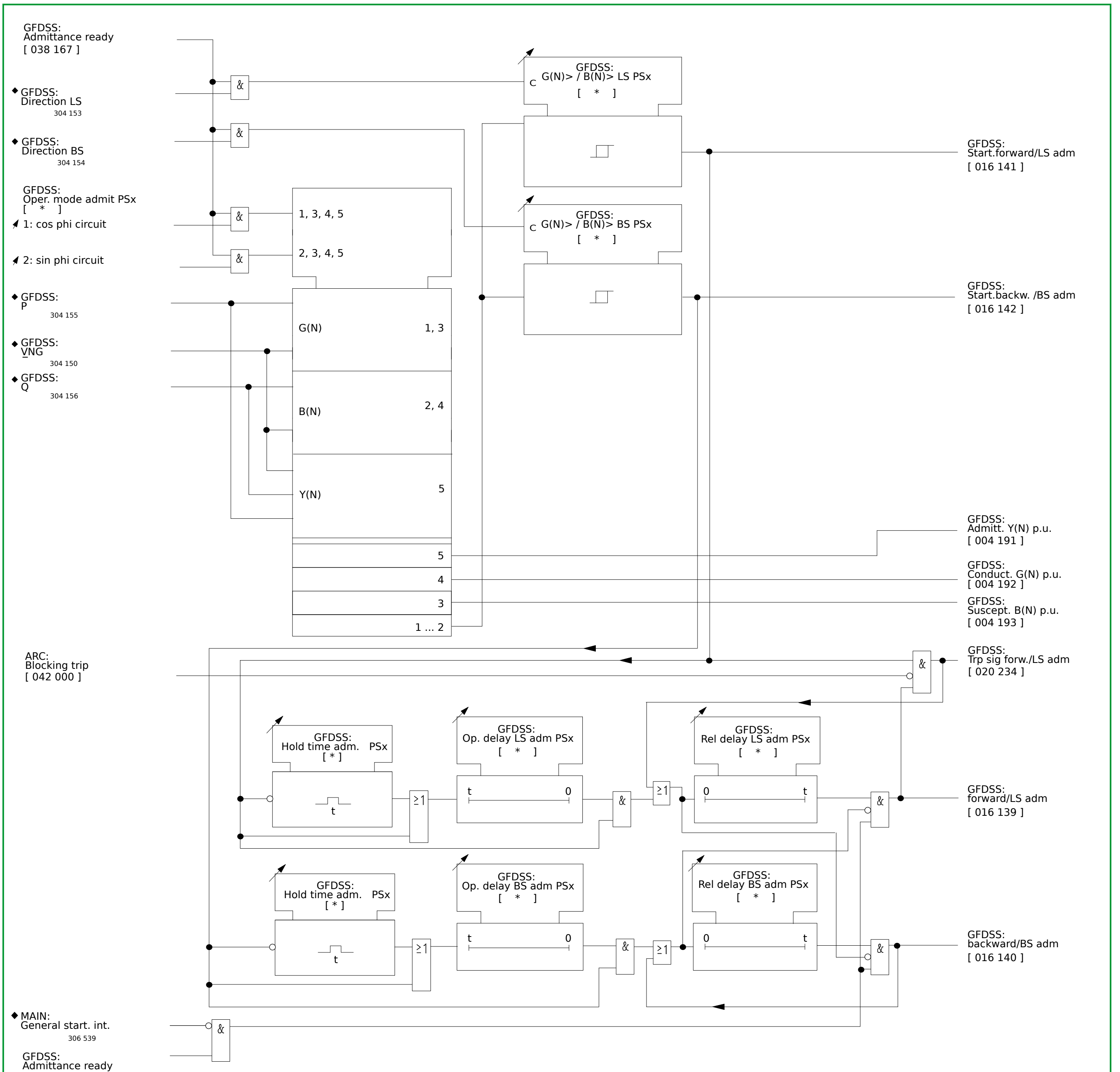


Fig. 3-217: Characteristic for ground fault direction determination using Steady-state admittance, “sin φ” operating mode.



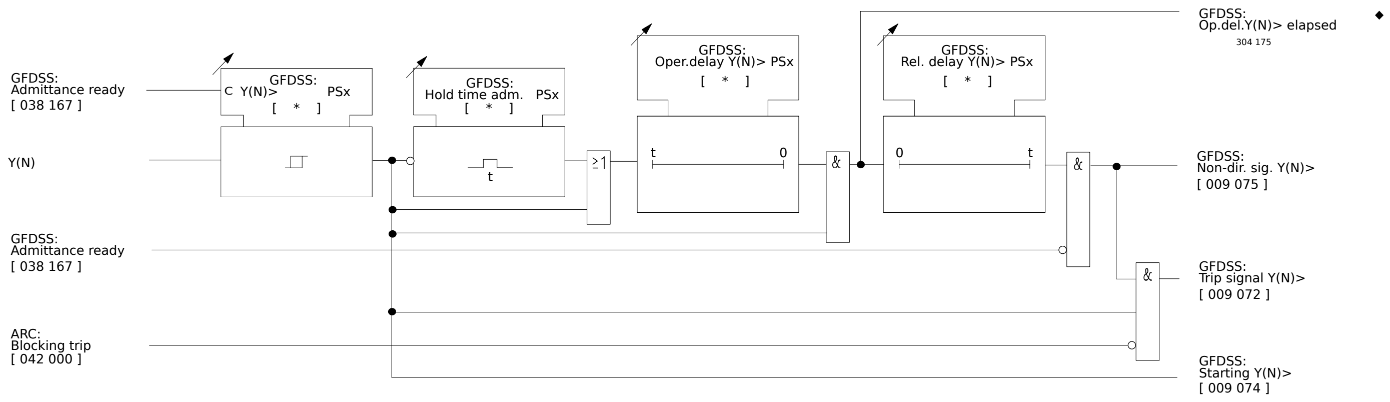
* Parameter	GFDSS: Oper. mode admit PSx	GFDSS: G(N)> / B(N)> LS PSx	GFDSS: G(N)> / B(N)> BS PSx	GFDSS: Hold time adm. PSx
set 1	020 176	016 111	016 112	020 222
set 2	020 177	001 029	001 032	020 223
set 3	020 178	001 030	001 033	020 224
set 4	020 179	001 031	001 034	020 225

* Parameter	GFDSS: Op. delay LS adm PSx	GFDSS: Op. delay BS adm PSx	GFDSS: Rel delay LS adm PSx	GFDSS: Rel delay BS adm PSx
set 1	020 184	020 192	020 188	020 200
set 2	020 185	020 193	020 189	020 201
set 3	020 186	020 194	020 190	020 202
set 4	020 187	020 195	020 191	020 221

19Z9102A

Fig. 3-218: Output of the direction decisions with the “Steady-state admittance” operating mode.

3.29.6.3 Non-Directional Ground Fault Determination



* Parameter	GFDSS: Y(N)> PSx	GFDSS: Oper.delay Y(N)> PSx	GFDSS: Rel. delay Y(N)> PSx	GFDSS: Hold time adm. PSx
set 1	016 113	016 114	016 115	020 222
set 2	001 035	001 038	001 041	020 223
set 3	001 036	001 039	001 042	020 224
set 4	001 037	001 040	001 043	020 225

19Z9103A

Fig. 3-219: Evaluating admittance.

The admittance value from the ground return is used for evaluation. If the admittance value exceeds the set threshold a ground fault signal is issued after the settable operate delay has elapsed.

The trip signal from the non-directional ground fault determination is blocked by the auto-reclosing control function (ARC) when this function is able to issue a trip command.

3.29.7 Steady-State Power and Admittance Evaluation

In this mode steady-state power and admittance evaluation are executed in parallel.

Both individual evaluation functions and their settings are described in Section 3.29.4, (p. 3-266) and Section 3.29.6, (p. 3-273).

This combined operating mode provides two additional sets of signals for ground fault, forward and backward direction and starting, as one or both methods may operate during a ground fault.

Accordingly, new signals for each method alone plus one combined signal are available:

- GFDSS: Grd. fault pow./adm.
  = GFDSS: Grd. fault power OR GFDSS: Grd. fault adm.
- GFDSS: Direct. forward/LS
  = GFDSS: forward/LS power OR GFDSS: forward/LS adm
- GFDSS: Direct. backward/BS
  = GFDSS: backward/BS power OR GFDSS: backward/BS adm
- GFDSS: Starting forward/LS
  = GFDSS: Start.forward/LS pow OR GFDSS: Start.forward/LS adm
- GFDSS: Starting backw. /BS
  = GFDSS: Start. backw. /BSpow OR GFDSS: Start.backw. /BS adm
- GFDSS: Trip signal forw./LS
  = GFDSS: Trp sig forw./LS pow OR GFDSS: Trp sig forw./LS adm

Note 1: GFDSS: Grd. fault power is set active while the steady-state power evaluation function determines a ground fault; GFDSS: Grd. fault adm. is set active while the steady-state admittance evaluation function determines a ground fault. Although both functions use the same condition to determine a ground fault (i.e. neutral displacement voltage exceeds threshold GFDSS: VNG> PSx for the set operate delay GFDSS: tVNG> PSx), this evaluation is done separately in both functions and accordingly result is individually signaled.

Note 2: All combined power and admittance evaluation based signals are also activated together with the individual signals, if the GFDSS operating mode is set to either only power or only admittance evaluation or both in parallel.

3.29.8 Counting the Ground Faults Detected by Steady-State Power and Admittance Evaluation

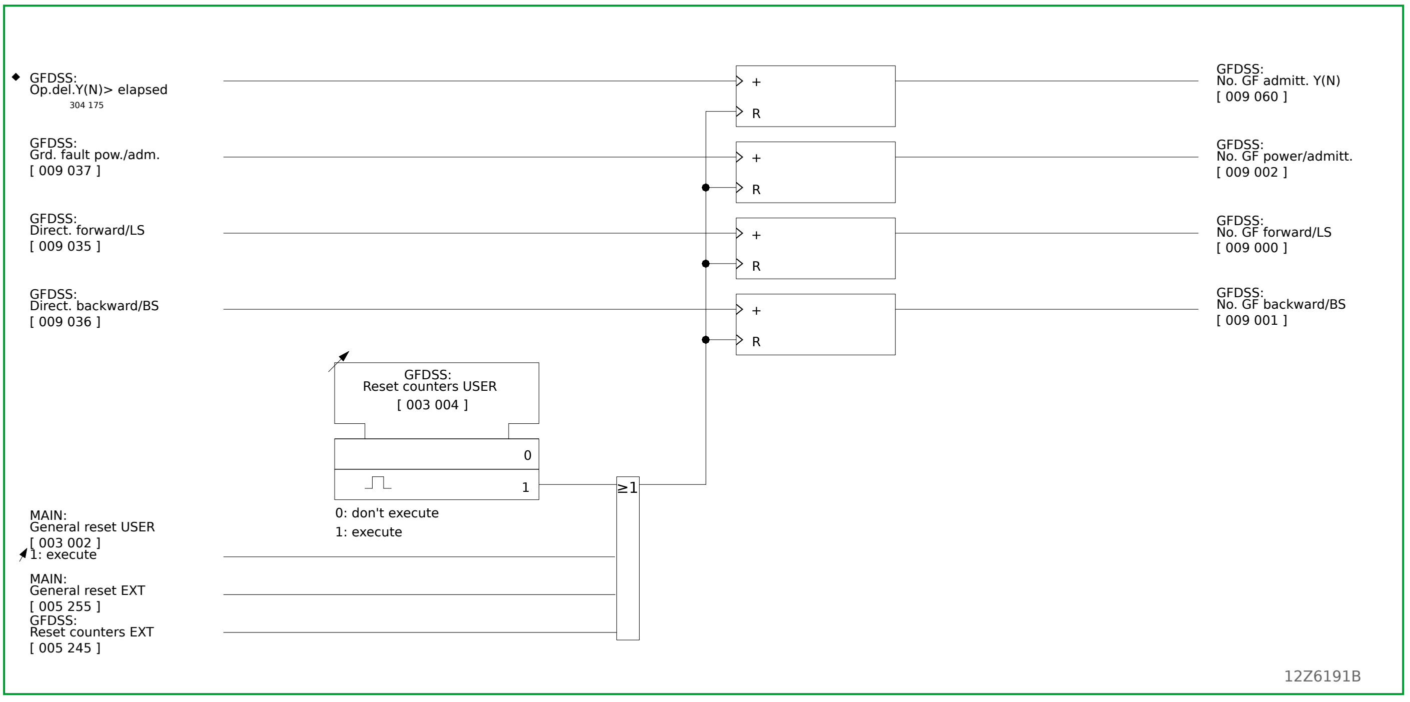


Fig. 3-220: Counting ground faults.

The number of ground faults and directional decisions are counted. The counters may be reset individually or together with other counters (see Section 3.11.21, (p. 3-122)).

3.30 Transient Ground Fault Detection (Function Group TGFD)

Ground fault direction is determined by evaluating the neutral-point displacement voltage and the residual current using the transient ground fault measurement method.

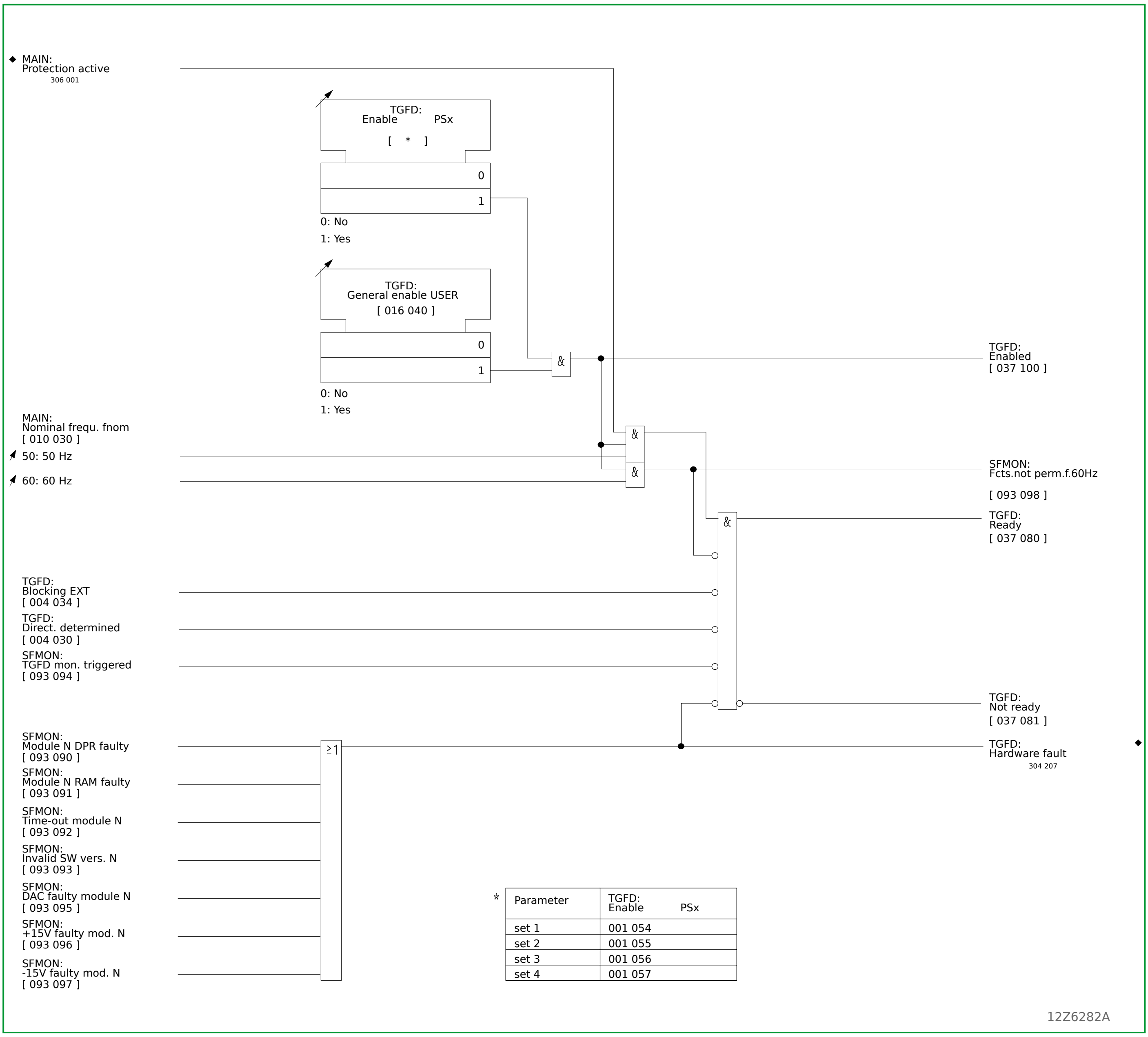
3.30.1 Disabling and Enabling the Transient Ground Fault Detection Function

The transient ground fault detection function is available where the P139 has been fitted with voltage transformers and with the transient ground fault evaluation module. In this case, the transient ground fault detection function can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter set.

3.30.2 Readiness of the Transient Ground Fault Detection Function

A ready signal is issued if the following conditions are met:

- Protection is enabled.
- The transient ground fault detection function is enabled.
- The nominal frequency is set to 50 Hz.
- There is no external blocking.
- Transient ground fault detection has issued no directional decisions.
- Self-monitoring has detected no faults with transient ground fault detection.



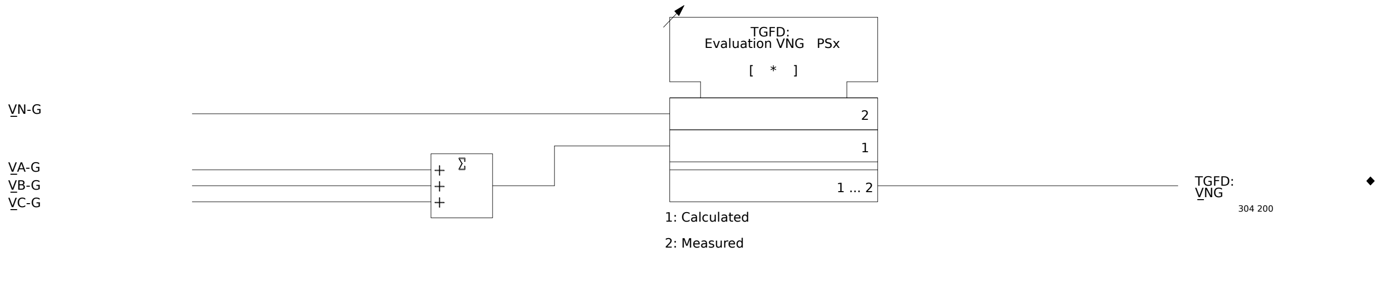
Parameter	TGFD: Enable PSx
set 1	001 054
set 2	001 055
set 3	001 056
set 4	001 057

Fig. 3-221: Enabling, disabling and readiness of the transient ground fault detection function.

3.30.3 Conditioning and Selecting the Measured Values

To condition measured values V_{NG} and I_N the P139 is fitted with integrated transformers. As an alternative it is possible to use the neutral-point displacement voltage derived by the P139 from the three phase-to-ground voltages.

The connection of the measuring circuits is taken into account by the setting for TGFD: Measurem. direc. PSx. A pole reversal of the residual current measuring circuit through the global setting at MAIN: Conn. meas. circ. IN will in no way influence direction determination by the transient ground fault detection function.



* Parameter	TGFD: Evaluation VNG PSx
set 1	016 048
set 2	001 058
set 3	001 059
set 4	001 060

Fig. 3-222: Selecting the neutral-point displacement voltage.

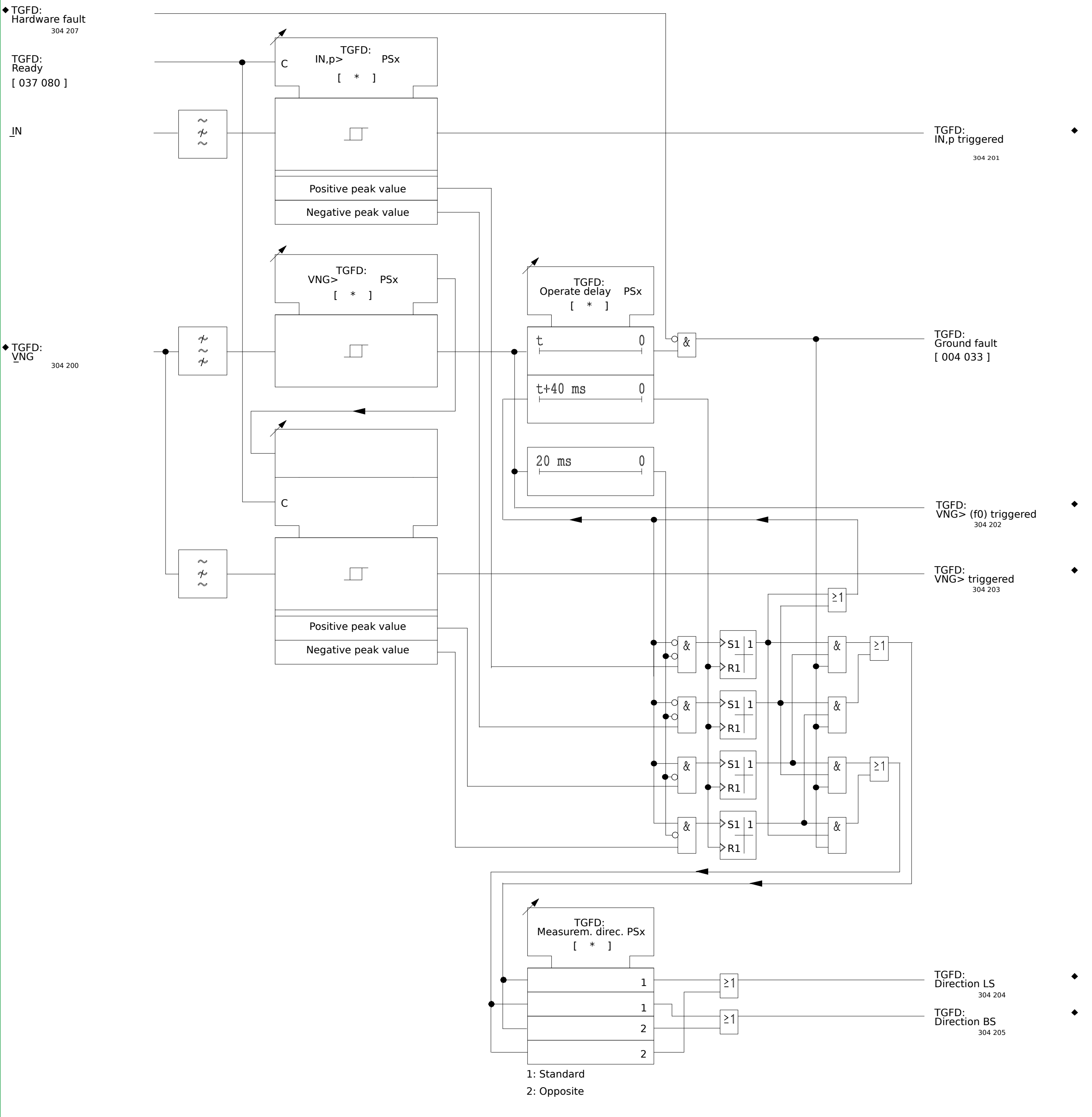
3.30.4 Determining the Ground Fault Direction

A ground fault's direction can only be determined if the TGFD function is ready.

Higher frequency components are filtered out of the measured values for residual current and neutral-point displacement voltage. Settable triggers monitor the magnitudes of the residual current and neutral-point displacement voltage harmonics as well as the neutral-point displacement voltage fundamental. To determine the ground fault direction the P139 will evaluate trigger decisions by the harmonics monitoring function, separately for the positive and negative half-waves.

The sign of the neutral-point displacement voltage's harmonic component is determined immediately after the current harmonic has exceeded the positive or negative threshold value. Trigger decisions for current and voltage are compared to determine the ground fault direction where, as a rule, evaluation depends on the connection of the measuring circuits. The connection of the measuring circuits is taken into account by the setting at TGFD: Measurem. direc. PSx. When the *Standard* connection has been made a ground fault on the line side will issue the decision “LS” and a ground fault on the busbar side will issue the decision “BS”. The directional decision is enabled after the operate delay has elapsed, which follows monitoring of the neutral-point displacement voltage's fundamental.

Furthermore the operation of a current trigger will start a timer stage that, after it has elapsed, will enable the TGFD function to detect further transient ground faults. The time period after which a new transient ground fault may be detected is given by the setting of the operate delay +40 ms.



* Parameter	TGFD: IN,p> PSx	TGFD: VNG> PSx	TGFD: Operate delay PSx	TGFD: Measurem. direc. PSx
set 1	016 042	016 041	016 044	016 045
set 2	001 064	001 061	001 067	001 073
set 3	001 065	001 062	001 068	001 074
set 4	001 066	001 063	001 069	001 075

12Z62EUA

Fig. 3-223: Direction determination.

Directional decisions are output for the duration of the set buffer time. If buffer time is set to 0 s, directional decisions are output until the neutral-point displacement voltage's fundamental component no longer exceeds the trigger threshold set at TGFD: VNG> PSx.

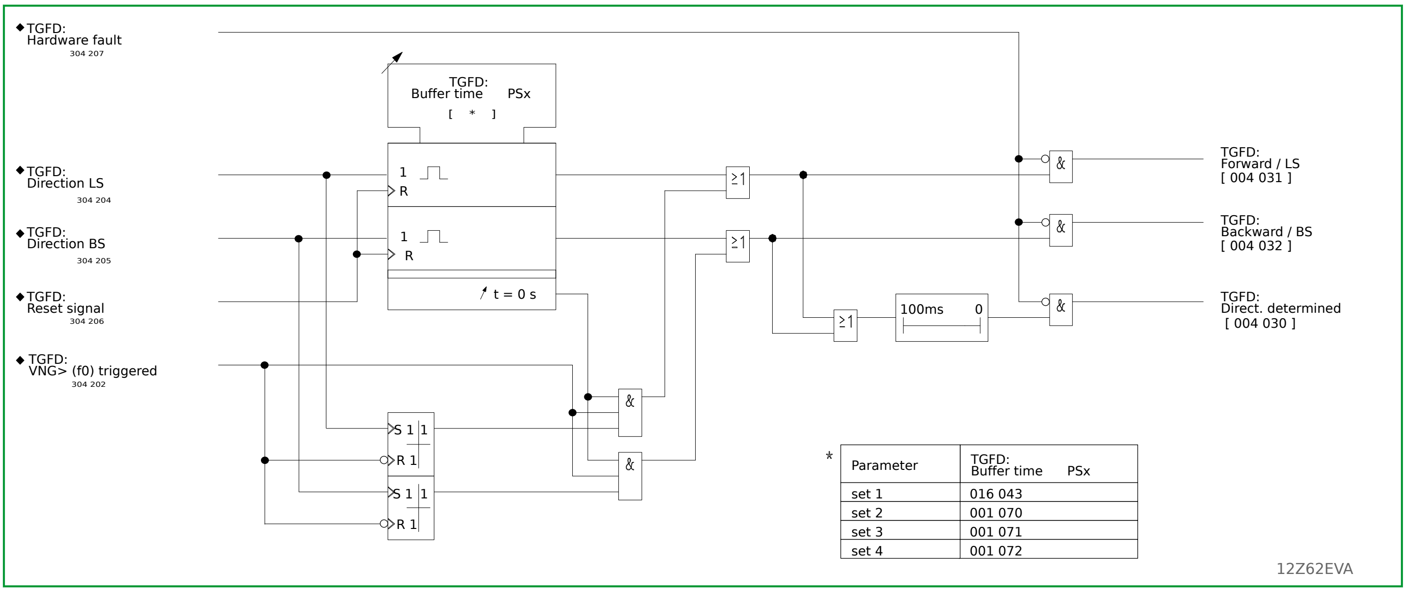


Fig. 3-224: Output of directional decisions.

3.30.5 Resetting a Directional Decision

While the buffer time is elapsing the directional decisions can be reset from the integrated local control panel, a setting parameter or through an appropriately configured binary signal input. Should the buffer time be set to ∞ (“infinity”) the directional decision must be reset so that a new transient ground fault can be detected.

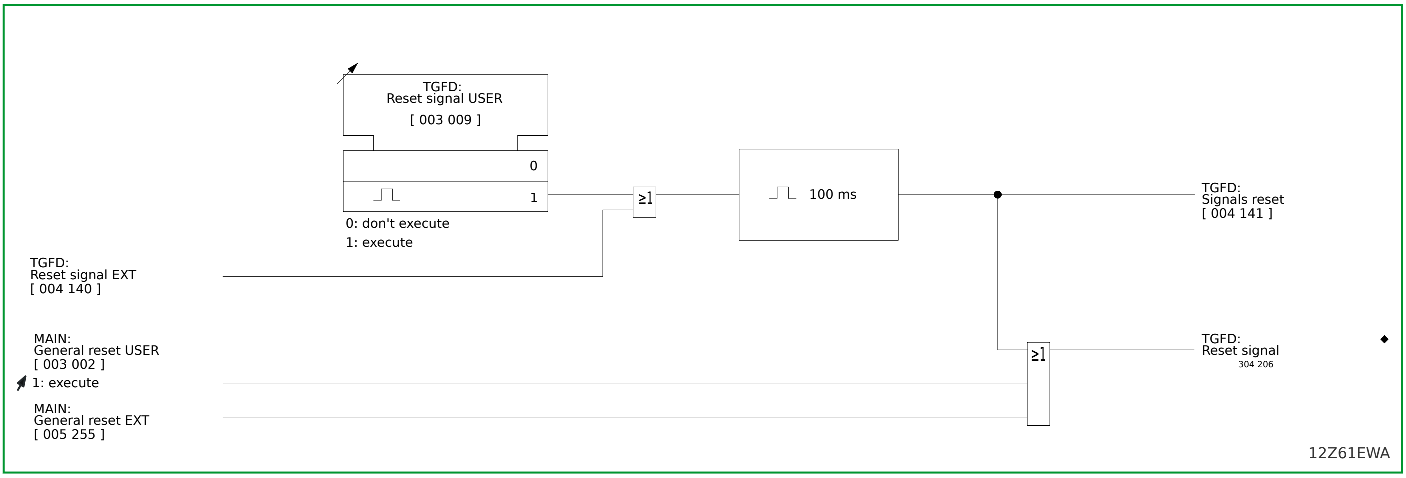


Fig. 3-225: Resetting directional decisions.

3.30.6 Monitoring the Measured Values

TGFD is blocked after 65 s if the respective set threshold value is exceeded by the current or the higher frequency content of the neutral-point displacement voltage in the absence of a ground fault (that is while the neutral-point displacement voltage fundamental stays below the set trigger threshold).

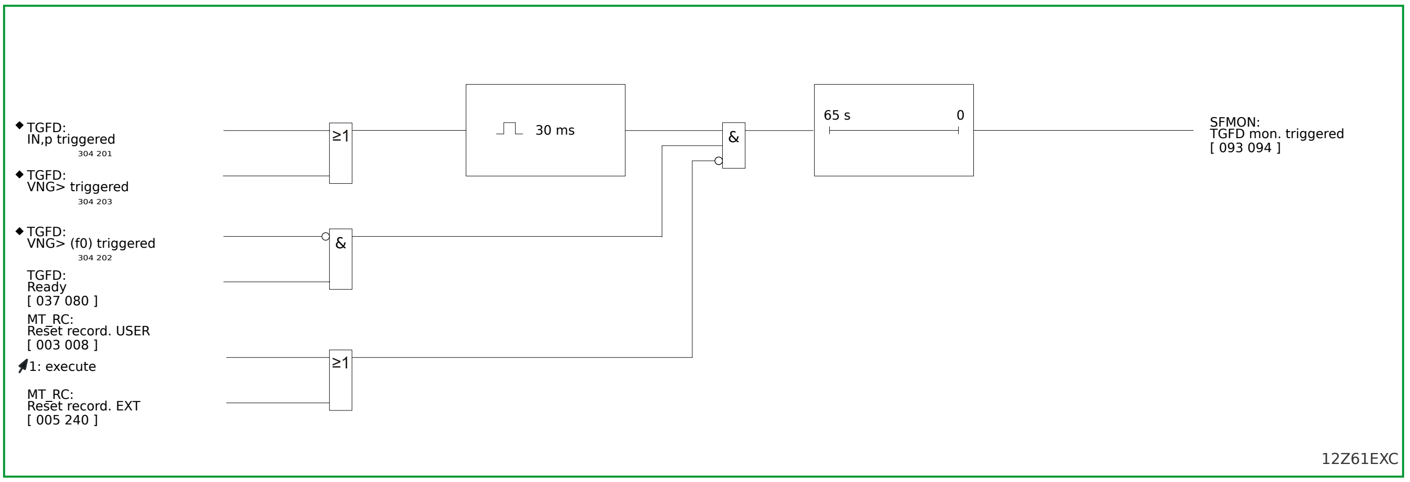


Fig. 3-226: Monitoring the measured values.

3.30.7 Counting the Transient Ground Faults

The number of transient ground faults and directional decisions are counted. The counters can be reset either individually or as a group.

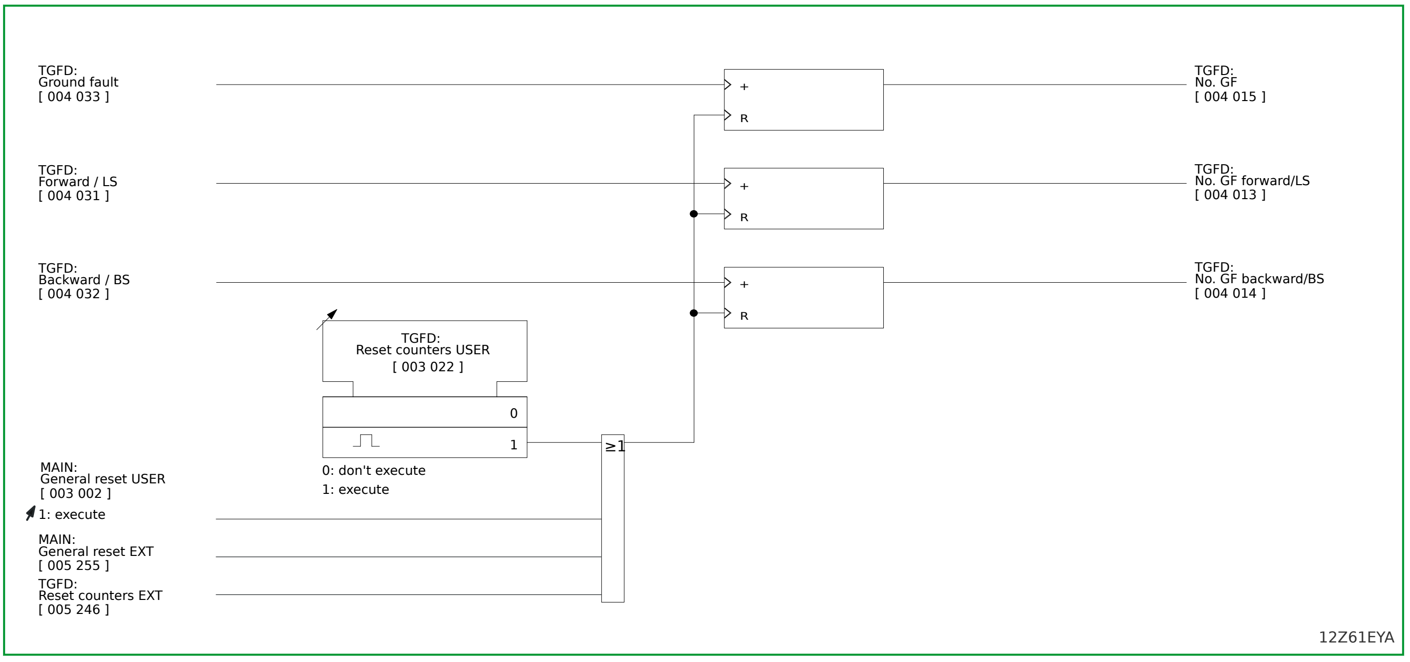


Fig. 3-227: Counting the transient ground faults.

3.31 Motor Protection (Function Group MP)

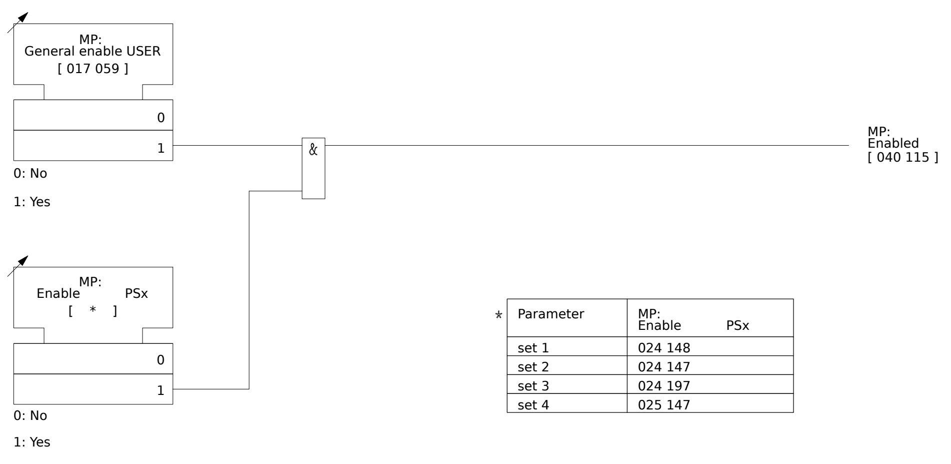
The P139 features a motor protection function (MP function). This motor protection function is specifically designed to protect directly switched high-voltage asynchronous motors with thermally critical rotors. Protection functions specially adapted for this application are available:

- Overload protection including a thermal replica of the motor (complete memory)
- Taking into account heat dispersion processes in the rotor after several startups
- Separate cooling time constants for running and stopped motors
- Monitoring of startup frequency including re-start blocking
- Heavy starting logic
- Locked rotor protection
- Logic function for the operating mode including thermal overload protection (THERM)
- Special startup measured values during commissioning
- Running Time Meter

The definite-time overcurrent protection stages required for global motor protection operation as well as the necessary unbalance protection are described in sections “DTOC Protection” (Section 3.22, (p. 3-157)) and “Unbalance Protection (I2>, Section 3.33, (p. 3-314))”, respectively.

3.31.1 Enable/Disable the Motor Protection Function

The motor protection function can be enabled or disabled via a parameter setting. Moreover, enabling can be carried out separately for each parameter subset.



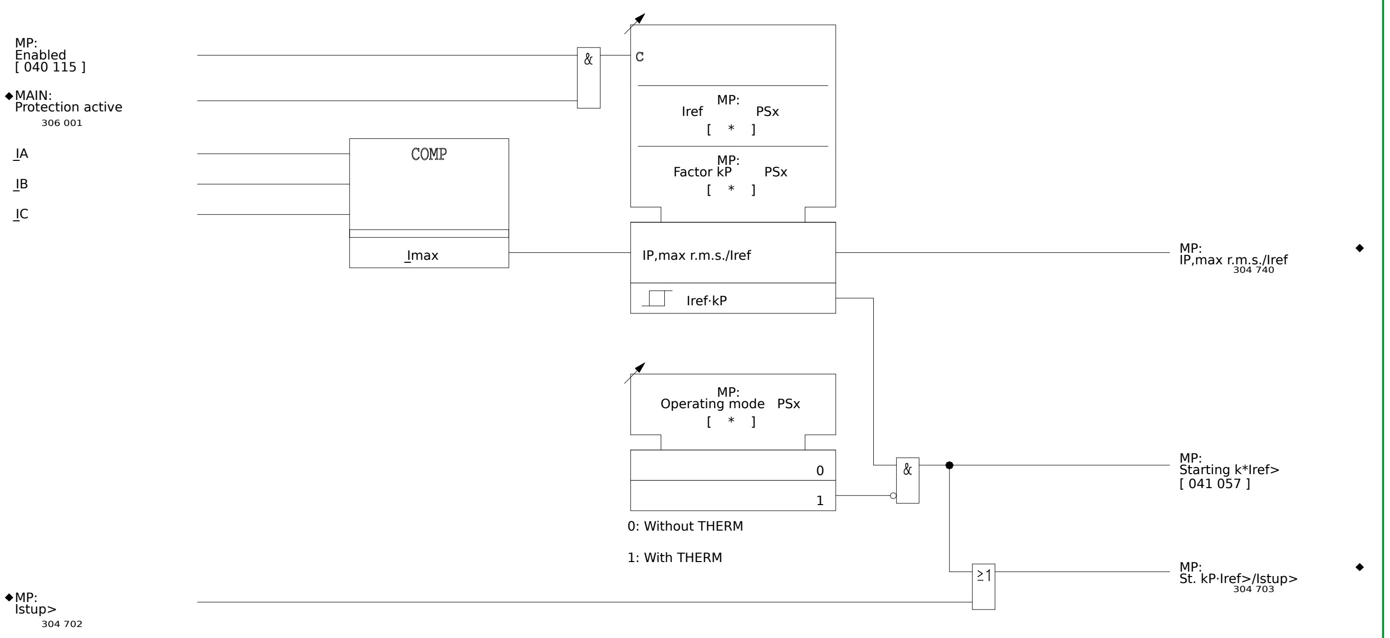
* Parameter	MP: Enable PSx
set 1	024 148
set 2	024 147
set 3	024 197
set 4	025 147

Fig. 3-228: Enable/disable the motor protection function.

3.31.2 Starting Conditions

The overcurrent stage $I_{ref,P>}$ is used as a starting stage for overload protection. For this the maximum value of the three phase currents is evaluated. The settable reference current I_{ref} is used as the reference quantity for the operate value and the tripping time. When the threshold $kP \cdot I_{ref}$ is exceeded then the current stage operates.

The output signal from the current stage $I_{ref,P>}$ is used as the starting signal.



* Parameter	MP: Iref PSx	MP: Factor kP PSx	MP: Operating mode PSx
set 1	017 012	017 040	018 041
set 2	024 131	024 132	024 142
set 3	024 181	024 182	024 192
set 4	025 131	025 132	025 142

19Z5074A

Fig. 3-229: Starting conditions.

3.31.3 Overload Protection

3.31.3.1 Operating State Recognition

The P139 features an operating state recognition function with which the overload protection function is controlled, e.g. the thermal replica is plotted as precisely as possible. The possible individual operating states with a directly switched asynchronous motor are detected via various trigger stages as listed below:

- Machine stopped:

  If the measured maximum RMS phase current value has dropped below the threshold of $0.1 \cdot I_{ref}$ the function will decide on “machine stopped” (signaled by MP: Machine stopped). No-load currents for asynchronous motors lie significantly above the current threshold value of $0.1\ I_{ref}$.

- Machine running:

  If the measured maximum RMS phase current value exceeds the threshold of $0.1 \cdot I_{ref}$ the function will decide on “machine running” (signaled by MP: Machine running).

- Overload range:

  For a machine the overload range starts with current values exceeding the maximum permissible continuous thermal current of the machine. The overload memory will be incremented if the measured maximum RMS phase current value exceeds the threshold value of $I_{ref,P>}$.

- Startup:

  The onset of startup in a directly switched asynchronous motor is detected when the measured maximum RMS phase current value exceeds the threshold value set at MP: IStUp> PSx for a minimum time duration period set at MP: tIStUp> PSx. The end of a startup process is detected when, after the onset of startup has been identified, the measured maximum RMS phase current value falls below the threshold value of $0.6 \cdot I_{StUp>}$.

3.31.3.2 Overload Memory

The thermal overload protection function featured by the P139 is specifically suited for protection of high-voltage asynchronous motors with thermally critical rotors, a very common motor type. For this there is a specific overload memory available that presents a replica of the protected object’s relative over-temperature based on the coolant temperature and with a values range from 0 to 100 %. The following values stored in the overload memory have particular significance within the range of this model:

- 0%:

  The value 0% represents the cold state of a protected object, e.g. it has cooled down to ambient temperature.
- 20%:

  The value 20% represents the minimum value stored by the overload memory when the protected object is at operating temperature or after initial startup. A running machine is always considered as being at operating temperature.
- 40%:

  The value 40% temporarily represents the minimum value stored by the overload memory after two consecutive startups of the machine.
- 60%:

  The value 60% temporarily represents the minimum value stored by the overload memory after three consecutive startups of the machine.
- 100%:

  The instant when the overload memory reaches the value of 100% (trip threshold) an overload protection trip will be issued. The hysteresis for a defined release of the trip signal is 1%.

The overload memory mapping process that results in a replica of the actual thermal conditions existing in the protected object includes the following operations:

- Mapping of heating:

  Basically the overload memory is continuously incremented when the maximum RMS phase current value measured will have exceeded the threshold value of $kP \cdot I_{ref}$ (overload range). The rate of this increase of the storing value depends on the magnitude of the maximum RMS phase current value and, to a certain extent, on the selected tripping characteristic (MP: Character.type P PSx).

- Mapping of heat transfer:

  After a startup has been identified and the maximum RMS phase current value has fallen below the current threshold of $0.6 \cdot I_{StUp>}$ (load range), then the stored value is continuously and automatically pre-decreased, governed by the settable heat dispersion time constant MP: Tau after st.-up PSx of the overload memory. This time constant is used to map the heat transfer in the asynchronous motor from the copper of the rotor to the rotor’s iron core. This continuous pre-decreasing of the stored value is carried out linearly up to the minimum value stored after initial startup (mentioned above) and depending on the count of the startup frequency monitor. The rate for this pre-decreasing of the stored value is constant and ranges at about 40% of the discharge ($\tau_{\text{after startup}} = 20$) within a time duration of 60 s, for example.

- Mapping of cooling:

  When the measured maximum RMS phase current value has fallen below the current threshold of $I_{kIref,P>}$ and when the mapping of heat transfer, if applicable, has been completed, then cooling of the protected object is simulated by a continuous decreasing of the value stored in the overload memory. If the machine is running, decreasing of the stored value will be governed by the cooling time constant MP: Tau mach.running PSx and will continue until the minimum loading state of 20% is reached. If the machine is stopped, decreasing of the stored value will be governed by the constant MP: Tau mach.stopped PSx and will continue until the minimum loading state of 0% is reached. Decreasing of the stored value is an exponential function of time. The cooling time duration from an initial value m_0 to an interim value of m(t) can be determined as follows:

- Machine running:

  $$t = \tau_{\text{rotating machine}} \cdot \ln \frac{m_0 - 0.2}{m(t) - 0.2}$$

- Machine stopped:

  $$t = \tau_{\text{machine stopped}} \cdot \ln \frac{m_0}{m(t)}$$

3.31.3.3 Startup Frequency Monitoring

The P139 features a startup counter in “count down” circuit configuration for startup frequency monitoring. Depending on the setting of MP: Perm. No.st.-ups PSx, the permissible number of consecutive startups is either “three from cold or two from warm” or “two from cold or one from warm”. The counter reading at any given time indicates the number of consecutive startups that are still permitted. The startup counter is controlled as follows (see Fig. 3-230, (p. 3-290)):

- Decrementing the startup counter (number of startups still permitted):

  As the end of a startup is detected, the startup counter is decremented by “1 ”. When the counter reading reaches its minimum value of “0”, then the signal MP: Reclosure blocked is issued and can – and indeed should – be configured to an output relay with which CB closure is blocked.

- Incrementing the startup counter (number of startups still permitted):

  When the setting for the permissible number of consecutive startups is “three from cold or two from warm” and the machine is running, then the startup counter is incremented by “1” if the stored value in the overload memory drops below a threshold value of 40% or 22%, respectively, in conjunction with “mapping of cooling” of the protected object. When the machine is stopped then the startup counter will be incremented by “1” if the stored value in the overload memory drops below the threshold of 40%, 20% or 2%, respectively, in conjunction with “mapping of cooling” of the protected object.

  When the setting for the permissible number of consecutive startups is “two from cold or one from warm” and the machine is running, then the startup counter is incremented by “1” if the stored value in the overload memory drops below a threshold value of 22%, in conjunction with “mapping of cooling” of the protected object. When the machine is stopped then the startup counter will be incremented by “1” if the stored value in the overload memory drops below the threshold of 20% or 2%, respectively, in conjunction with “mapping of cooling” of the protected object.

  The signal MP: Reclosure blocked is withdrawn if the stored value in the overload memory drops below the threshold of 40% (for “three from cold or two from warm”) or 22% (for “two from cold or one from warm”).

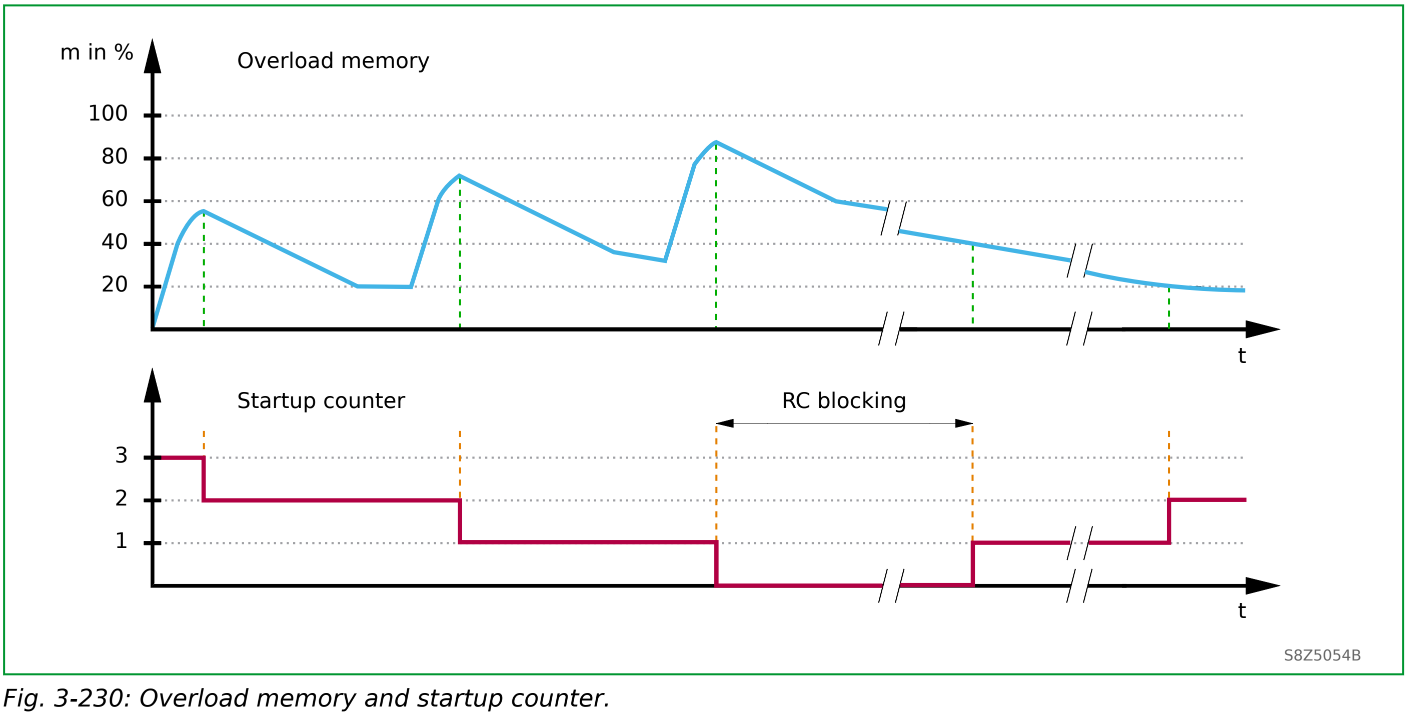


Fig. 3-230: Overload memory and startup counter.

3.31.3.4 Heavy Starting Logic

The heavy starting application involves a situation in which a machine’s startup time t_{StUp} exceeds its maximum possible blocking time t_E from operating temperature. For this application the P139 features a specific logic function that can be activated by the following two settings:

- The permissible number of consecutive startups is limited to “two from cold or one from warm” (MP: Perm. No.st.-ups PSx)h.
- For the permissible startup time t_{StUp} (MP: St.-up time tStUpPSx), a higher value is set than for the maximum permissible blocking time t_E from operating temperature (MP: Blocking time tE PSx). These two setting values are only relevant for this particular application; if both settings are identical, they have no effect on the protective function and the heavy starting logic is not active.

When this logic function has been activated, then the two timer stages t_E and t_{StUp} are triggered at the time when the onset of a startup is detected, corrected by the discrimination time $t_{StUp>}$. Once the set time t_E has elapsed, the logic function checks to see whether the machine is actually running. The presence of an external signal - from an overspeed monitor, for example - serves as the criterion for a running machine.

When a running machine is detected once the set time t_E has elapsed, then the stored value in the overload memory is automatically frozen and tracking is only restarted after the set startup time t_{StUp} has elapsed. When a locked rotor state is detected after the set time t_E has elapsed, the overload memory is automatically set to a value of 100%, which leads to an immediate trip decision.

3.31.3.5 Tripping Time Characteristics

The P139 user can choose between the following two tripping time characteristics:

- Reciprocally squared:

$$t = (1 - m_0) \cdot t_{6I_{\mathrm{ref}}} \cdot \frac{36}{(I / I_{\mathrm{ref}})^2}$$

- Logarithmic:

$$t = (1 - m_0) \cdot t_{6I_{\mathrm{ref}}} \cdot 36 \cdot \ln \frac{(I / I_{\mathrm{ref}})^2}{(I / I_{\mathrm{ref}})^2 - 1}$$

where m_0 in each case signifies the pre-charging of the overload memory at time t = 0. With reference to the basic physical model (two-body model), the logarithmic characteristic in the overload range also takes into account heat transfer to the coolant, but this heat transfer becomes less significant as the overcurrent increases. At $I = 6 \cdot I_{ref}$, for example, the tripping time increase is only about 1.4% and is thus below the specified accuracy of the protection device. For a low overcurrent range, selection of the logarithmic characteristic provides significantly higher tripping times than selection of the reciprocally squared characteristic (see Fig. 3-232, (p. 3-294)), since the latter characteristic neglects any heat transfer to the cooling medium in the overload range. The possibility of choosing between two different tripping time characteristics takes into account the fact that the user or the application may require a more restrictive or a less restrictive type of protection. For currents in excess of 10 I_{ref}, the tripping times are limited in the direction of lower values.

The equation for determining the setting value t_{6Iref} can be derived from the above equations for tripping time t. For this the startup current $I_{startup}$ and the maximum permissible blocking time from cold $t_{block,cold}$ for the asynchronous motor must be known. Setting the overload protection function on the basis of the “cold” tripping time where m_0 = 0 % (“cold curve”) is permitted since the conditions for a machine at operating temperature are automatically taken into account. The conditional equations for the setting value t_{6Iref} are therefore the following:

- Reciprocally squared:

$$t_{6I_{\mathrm{ref}}} = t_{\mathrm{block,cold}} \cdot \frac{(I_{\mathrm{startup}} / I_{\mathrm{ref}})^2}{36}$$

- Logarithmic:

$$t_{6I_{\mathrm{ref}}} = t_{\mathrm{block,cold}} \cdot \frac{1}{36 \cdot \ln \frac{(I_{\mathrm{startup}} / I_{\mathrm{ref}})^2}{(I_{\mathrm{startup}} / I_{\mathrm{ref}})^2 - 1}}$$

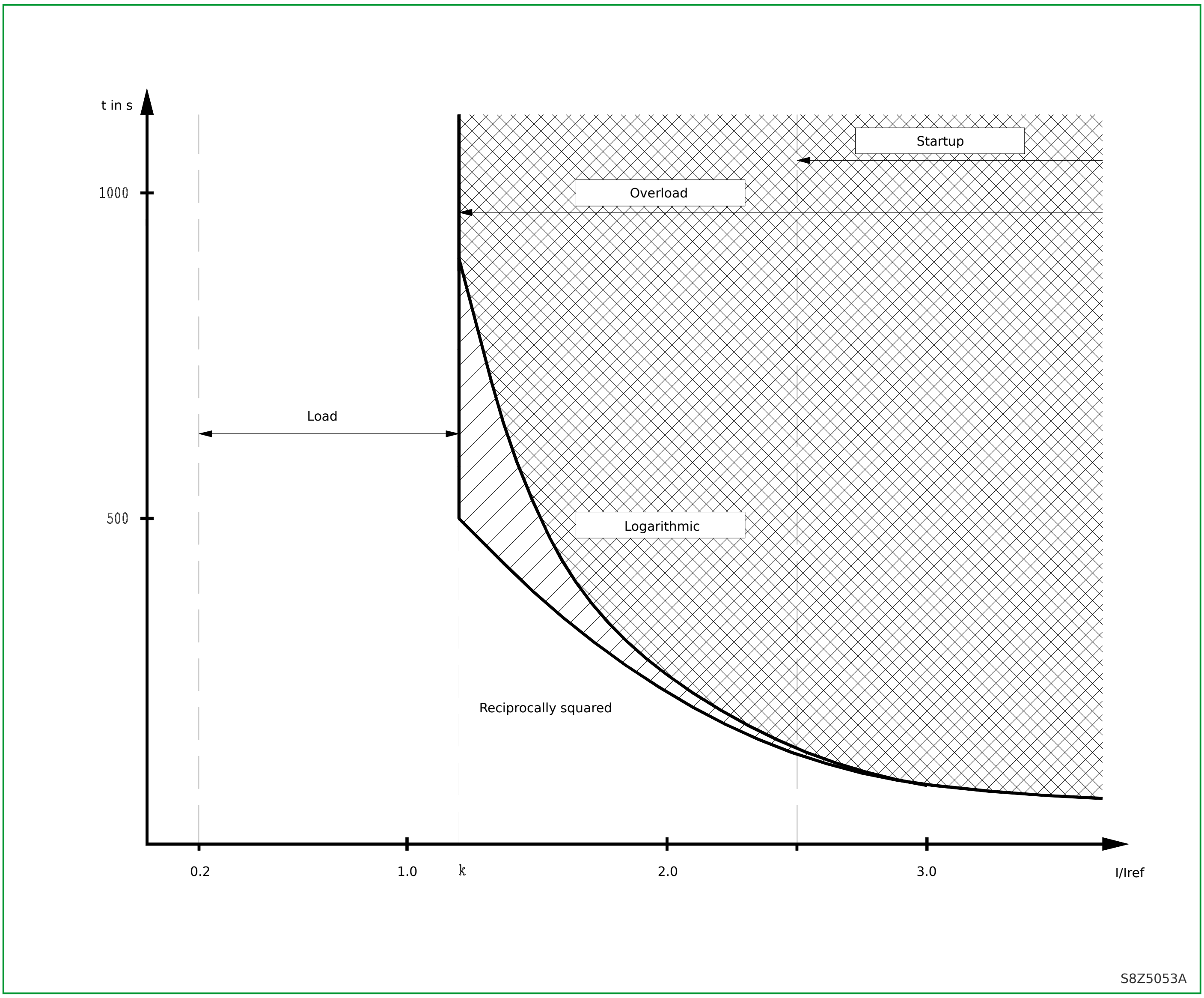


Fig. 3-231: Tripping time characteristics.

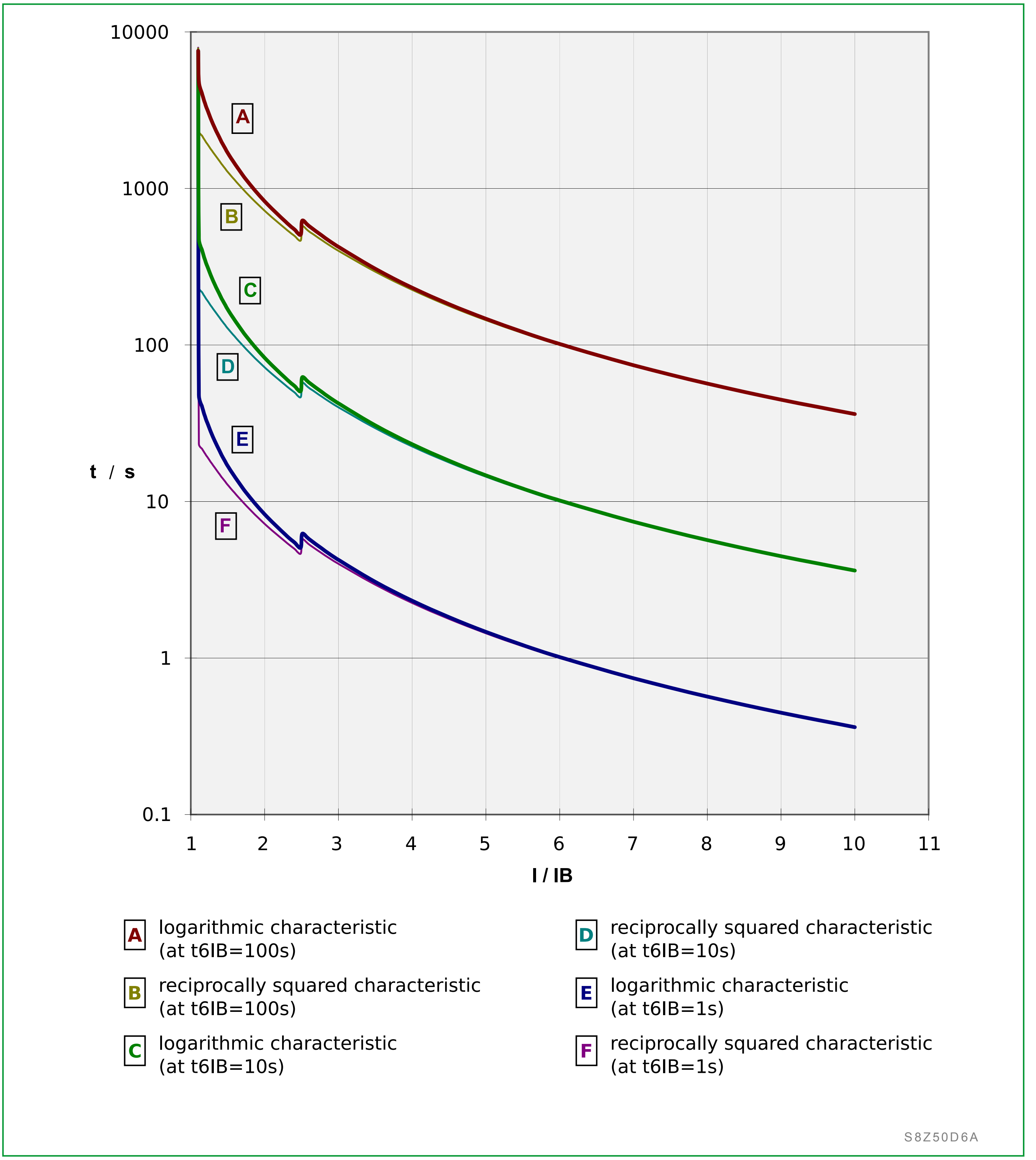


Fig. 3-232: Tripping characteristic of motor protection (at I/Iref = 2.5 we have m=0.2, at I/Iref > 2.5 we have m=0).

3.31.3.6 Plausibility Conditions

A number of plausibility conditions need to be observed in order to ensure that the protected object is given optimum protection and that unintended tripping is prevented.

- When the permissible number of consecutive startups is set for the sequence 'three from cold or two from warm' and if this set permissible number of consecutive startups is also intended to be used up during operation, then the heating during startup in the overload memory (OL_DA: Heat.dur.start-up,MP) must not exceed 60%. When the calculation is based on a constant startup current

  (OL_DA: Start-up current, MP) over the entire startup period, then this will result in the plausibility condition $t_{startup} = 0.6 \cdot t_{block,cold}$. However, since the startup current decreases during the course of the startup time (OL_DA: T.taken f.startup,MP), thereby causing the rate of value storing into the memory to decrease as well, it can therefore be assumed that there is a corresponding extra margin available.
- The setting value for the overload protection function is determined on the basis of the stated maximum permissible blocking time from the cold state $t_{block,cold}$. However, when a machine at operating temperature is connected, a protective trip during the t_E period must be guaranteed. Therefore, it is always necessary to check and ensure that the plausibility condition $t_{block,cold} = 1.25 \cdot t_E$ is met.

3.31.3.7 Initialization or Plausibility Check of the Thermal Replica

Under the following conditions, the P139 will not be able to track the thermal replica of the protected object, and re-initialization of the thermal replica will be triggered:

- The power supply has been interrupted
- Protection has been disabled (off)
- Motor protection has been disabled (off)

If the above conditions no longer apply, a plausibility check of the thermal replica is automatically performed prior to cyclic processing.

- Operation condition “machine running” but not “starting up”:

  A cyclic plausibility check of the thermal replica is carried out such that if the stored value in the overload memory is below 20% it is increased to the minimum value of 20% (= machine at operating temperature).
- Operation condition “machine starting up”:

  Once the end of a startup is detected and the startup counter is decremented as a result, the stored value in the overload memory is increased, if appropriate, to the associated minimum value.

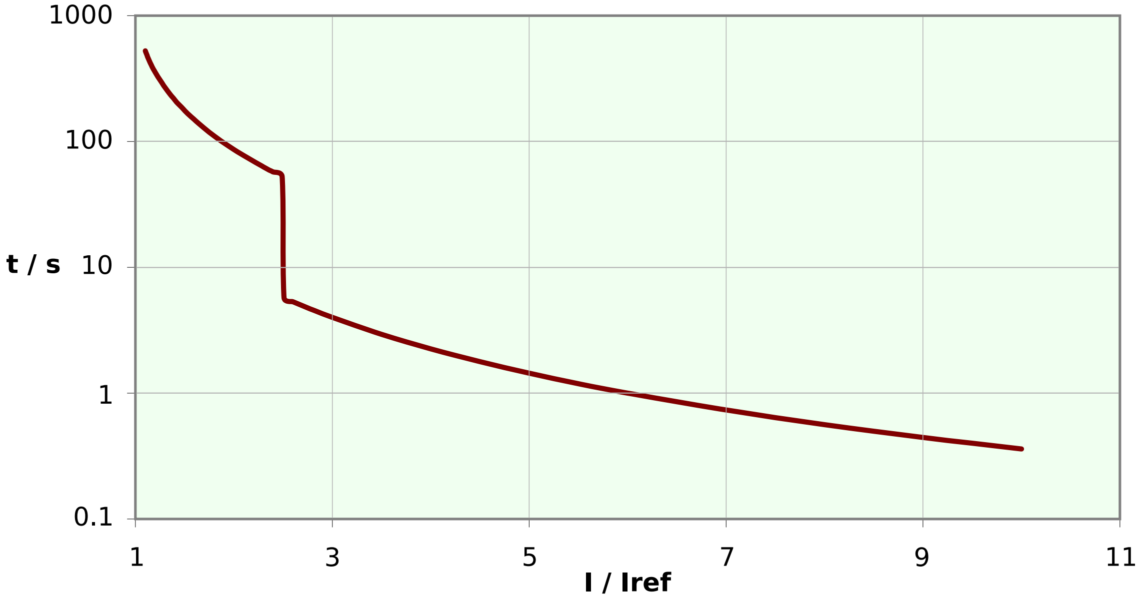
For each of the above procedures involving initialization or a plausibility check of the thermal replica, the stored value status in the overload memory is always coupled to the reading of the counter MP: St-ups still permitt. Therefore, if the value in the overload memory is set automatically, the counter reading is also changed to a plausible value as a function of the protection setting.

3.31.4 Exceptional Overload Protection Cases

3.31.4.1 Logic Function for the Operating Mode with Thermal Overload Protection (THERM)

For particular applications, the machine may be operated in the overload range for a longer period of time. In such cases the motor protection function (MP) is too restrictive. For such applications the MP and THERM protection functions are combined. The MP protection function then serves as rotor protection and the THERM protection function as stator protection.

When MP: Operating mode PSx is set to *With THERM*, the overload memory will be incremented when the maximum RMS phase current is above the current threshold set at MP: IStUp> PSx. If this threshold is not exceeded, the stored value in the memory after a startup will initially be decremented until the mapping of the heat transfer from the copper of the rotor to the rotor core is complete. Thereafter, the value stored in the overload memory will remain constant and the thermal model of the thermal overload protection function (THERM) will become active. With the onset of another startup of the asynchronous motor (not the first startup), the thermal model of the THERM protection function will be temporarily blocked during the startup time.



Setting MP protection: reciprocally squared characteristic, t6Iref = 1s

Setting THERM protection: time constant 1 = 300 s, trip limit value = 100%

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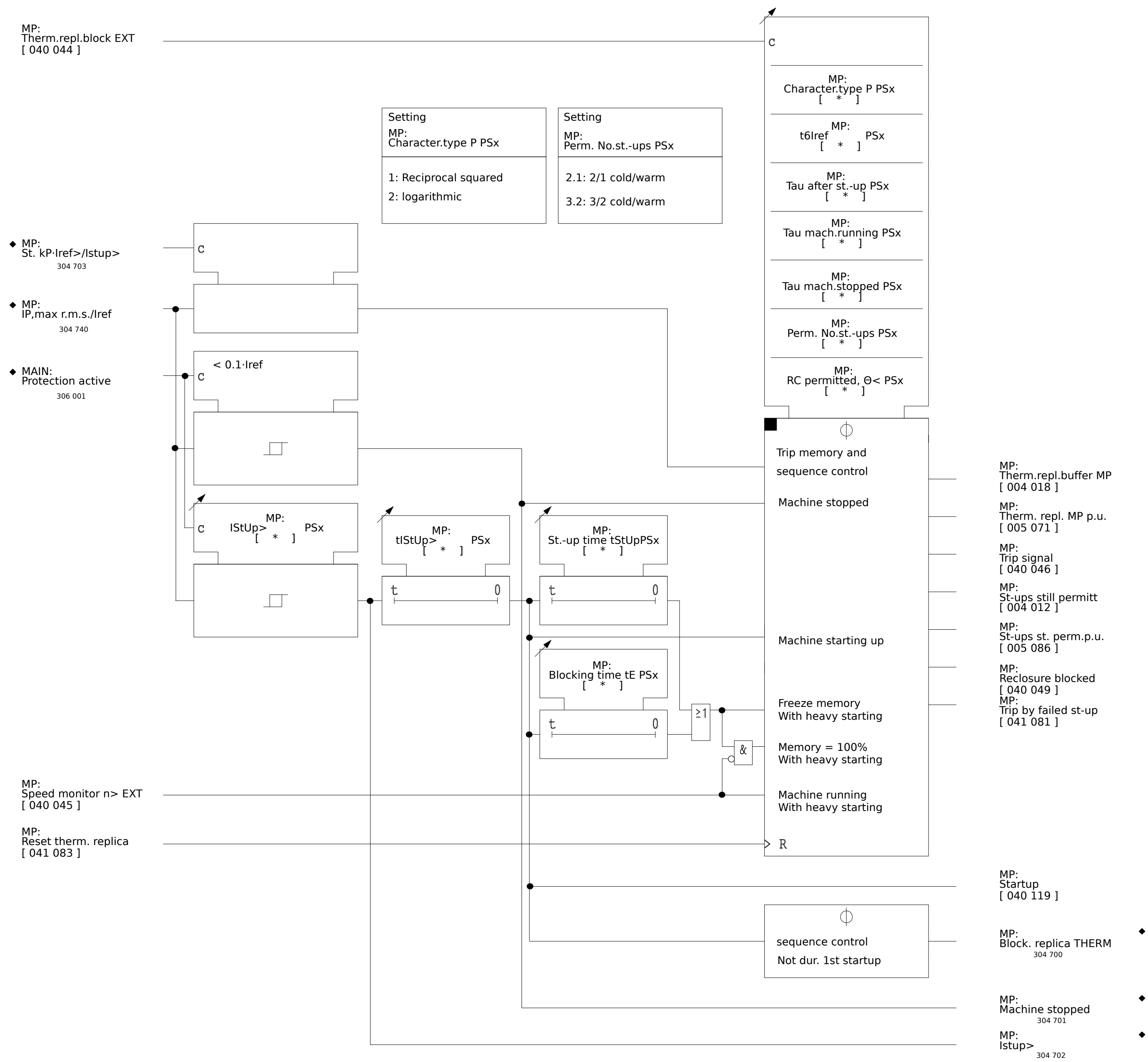
Fig. 3-233: Tripping characteristic of motor protection with operating mode With THERM (“cold” characteristic).

3.31.4.2 Change of Threshold for “Reclosure Permitted”

Depending on the particular application, it is possible to change the overload memory threshold value assumed for general use, when mapping protected object cooling, to either 40 % (with “three startups from cold or two from warm”) or 22 % (with “two startups from cold or one from warm”). This threshold value set at MP: RC permitted, Θ< PSx can differ from these average values so as to be more restrictive or less restrictive.



*

Parameter	MP: Character.type P PSx	MP: t6Iref PSx	MP: Tau after st.-up PSx	MP: Tau mach.running PSx	MP: Tau mach.stopped PSx	MP: Perm. No.st.-ups PSx
set 1	017 029	017 041	018 042	017 088	017 089	017 047
set 2	024 135	024 136	024 137	024 138	024 139	024 140
set 3	024 185	025 186	024 187	024 188	024 189	024 190
set 4	025 135	025 136	025 137	025 138	025 139	025 140

*

Parameter	MP: RC permitted, Θ< PSx	MP: IStUp> PSx	MP: tIStUp> PSx	MP: St.-up time tStUpPSx	MP: Blocking time tE PSx
set 1	018 043	017 053	017 042	017 043	017 044
set 2	024 141	024 133	024 134	024 143	024 144
set 3	024 191	024 183	024 184	024 193	024 194
set 4	025 141	025 133	025 134	025 143	025 144

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Fig. 3-234: Overload protection in motor protection.

3.31.4.3 Startup Counter

The motor startups are counted. The counter can be reset either individually or with others as a group.

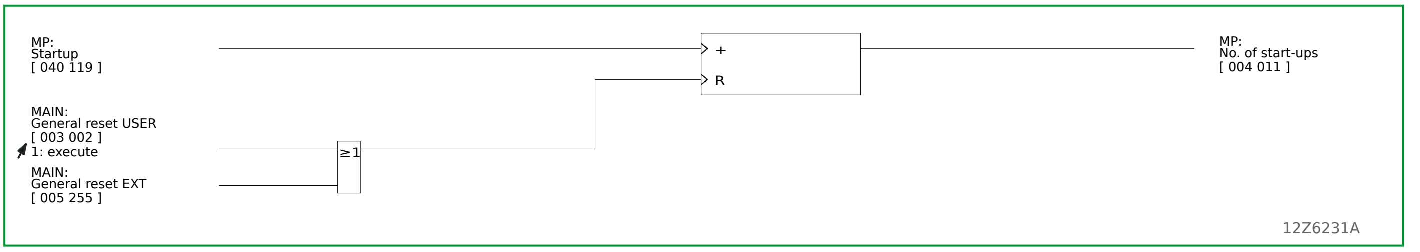


Fig. 3-235: Startup counter.

3.31.4.4 Resetting the Thermal Replica

The thermal replica for motor heating can be reset at the local control panel or via an appropriately configured binary signal input.

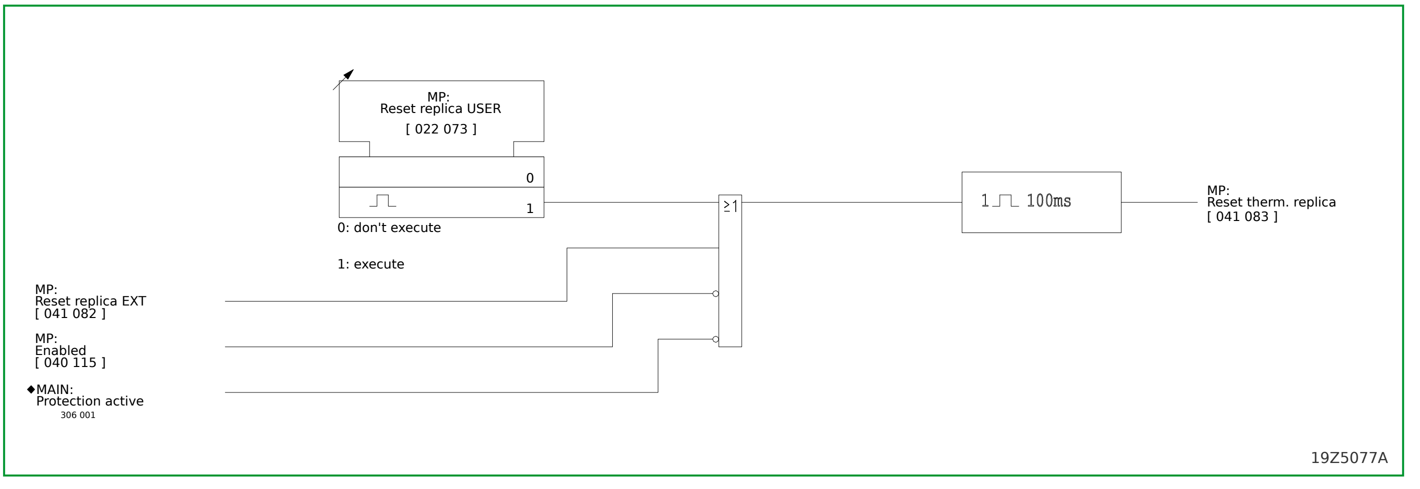
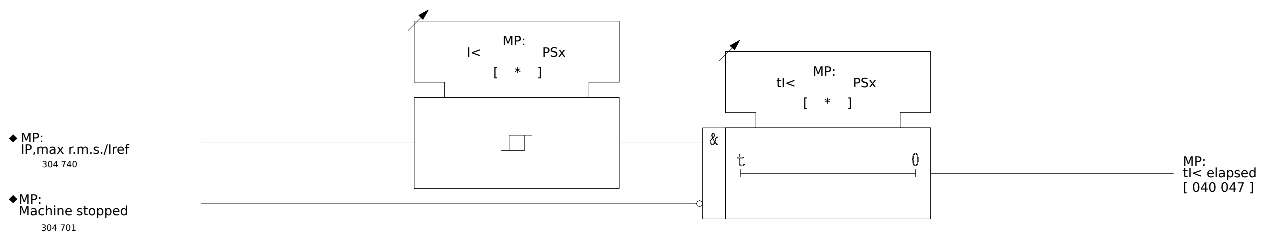


Fig. 3-236: Resetting the thermal replica.

3.31.5 Low Load Protection

The low load protection function makes it possible to monitor the load torque of a motor drive for a minimum level. If the operating state recognition function detects a running machine and the measured maximum RMS phase current falls below the set operate value for a set time, then an appropriate signal is issued. The signal needs to be configured to a separate output relay, as it cannot be linked directly to either the general starting signal or the trip command.



* Parameter	MP: I< PSx	MP: tI< PSx
set 1	017 048	017 050
set 2	024 145	024 146
set 3	024 195	024 196
set 4	025 145	025 146

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Fig. 3-237: Low load protection in motor protection.

3.31.6 Protection of Increased-Safety Machines

Motors that are operated in hazardous areas must not reach a temperature level in the case of overload or blocking that would be critical for the existing air-gas mixture.

The P139 is suitable for this type of application, which requires increased-safety protection (type “Ex e”.), but the P139 must be installed outside the hazardous area.

General

The P139 was subjected to risk analysis based on the DIN V 19 250 standard of May 1994 (on basic safety considerations for measuring and protection relays) as well as DIN V 19 251 of February 1995 (on measuring and protection relays, specifications and measures for their fail-safe functioning) and owing to a lack of more specific standards also based on DIN V VDE 0801 (on computers in safety systems).

Based on this risk analysis involving the examination of extensive measures for prevention and management of malfunction, the P139 has been classified in specifications class 3. According to NAMUR NE 31 (NAMUR: German committee on standards for measuring and control engineering), specifications class 3 corresponds to risk area 1. For this risk area, a protection device of single-channel design with alarm signal and/or normally-energized arrangement (“closed-circuit principle”) will normally suffice. In special cases, a requirement for a higher specifications class can be met by a customized “1 out of 2” or “2 out of 3” circuit.

By connection and configuration of the output relay MAIN: Blocked/faulty, the increased-safety machine can be switched off immediately or, alternatively, an alarm signal can be given for delayed switch-off based on an assessment of the operational conditions by trained staff.

Restrictive Safety-Oriented Configuration

For the P139 to operate in a restrictive safety-oriented mode under all operational conditions, the output relays must be operated in a normally-energized arrangement (“closed-circuit principle”). In this arrangement, the relevant output relay is energized during normal operation and drops out in the event of an activation of the associated function or in the event of a malfunction.

On the configuration of functions, please see Chapter 6, (p. 6-1).

Essential General Configuration:

Function	Address	Path in Menu Tree	Setting
MAIN: Device on-line	003 030	*Par/Func/Glob*	*Yes (= on)*
MAIN: Trip cmd.block. USER	021 012	*Par/Func/Glob*	*No*
OUTP: Outp.rel.block USER	021 014	*Par/Func/Glob*	*No*
DTOC: Function group DTOC	056 008	*Par/Conf*	*With*
MP: Function group MP	056 022	*Par/Conf*	*With*
I2>: Function group I2>	056 024	*Par/Conf*	*With*
DTOC: General enable USER	022 075	*Par/Func/Gen*	*Yes*
MP: General enable USER	017 059	*Par/Func/Gen*	*Yes*
I2>: General enable USER	018 090	*Par/Func/Gen*	*Yes*

In order to implement a restrictive safety-oriented configuration for the protection of electrical increased-safety machines, the configuration should be equivalent to the example shown in the table below:

Relay	Function	Address	Path in Menu Tree	Associated Function
K 902	OUTP: Fct. assignm. K 902	150 196	*Par/Conf*	MAIN: Gen. trip command 1
	OUTP: Oper. mode K 902	150 197	*Par/Conf*	*NE updating*
	MAIN: Fct.assig.trip cmd.1	021 001	*Par/Func/Glob*	MP: Trip signal
				DTOC: Trip signal tI>
				I2>: tIneg> elapsed

During startup of the P139 and during its operation, cyclic self-monitoring tests are run. In the event of a positive test result, a specified monitoring signal will be issued and stored in a non-volatile (NV) memory – the monitoring signal memory (see Chapter 11, (p. 11-1)). Monitoring signals prompted by a serious hardware or software fault in the unit are always entered in the monitoring signal memory. The entry of monitoring signals of lesser significance into the monitoring signal memory is optional. The user can select this option by setting a “m out of n” parameter.

The blocking of the protection device is governed by similar principles, that is, signals prompted by a serious hardware or software fault in the unit always lead to a blocking of the unit. The assignment of signals of lesser significance to the signal MAIN: Fct. assign. fault by an “m out of n” parameter (MAIN: Blocked/faulty) is optional.

Relay	Function	Address	Path in Menu Tree	Associated Function
K 908	OUTP: Fct. assignm. K 908	150 214	*Par/Conf*	MAIN: Fct. assign. fault
	OUTP: Oper. mode K 908	150 215	*Par/Conf*	*NE updating*
	MAIN: Fct. assign. fault	021 031	*Par/Func/Glob*	SFMON: Error K 902
				SFMON: Defect.module slot 1
				SFMON: Defect.module slot 4
				SFMON: Defect.module slot 9

For safety-oriented operation, the “Warning” can be configured onto an output relay as in the following example:

Relay	Function	Address	Path in Menu Tree	Associated Function
z.B. K 901	OUTP: Fct. assignm. K 901	150 193	*Par/Conf*	SFMON: Warning (relay)
	SFMON: Fct. assign. warning	021 030	*Par/Func/Glob*	SFMON: Phase sequ. V faulty
				SFMON: Undervoltage

3.31.7 Running Time Meter

The P139 features a running time meter MP: No. of hours run to monitor the number of hours a protected machine has operated. The time period (in hours) is measured during which the P139 has detected “Machine running” (compare with signal MP: Machine stopped and this value is compared with the maximum number to be set at MP: Machine stopped When the time period value measured exceeds the set value at the value for MP: Sig. Hours_Run > is set to *Yes*.

Additionally the number of hours run may be defaulted to any desired initial value ranging from *0* to *65000* hours. This value is defined at MP: Init. val. Hours_Run. The default is initialized by setting MP: Initialize Hours_Run to *execute*.

3.32 Thermal Overload Protection (Function Group THERM)

Using this function, thermal overload protection can be implemented.

Disabling and Enabling Thermal Overload Protection

Thermal overload protection may be disabled or enabled by setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

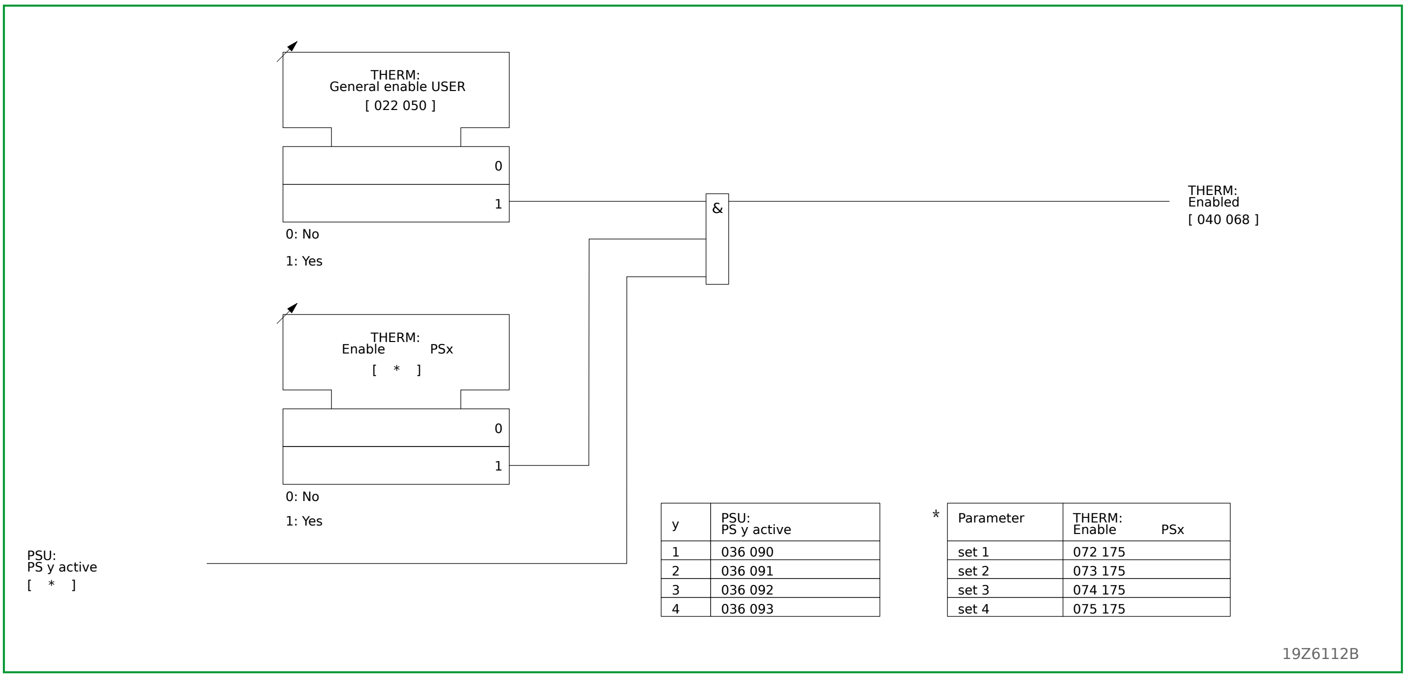


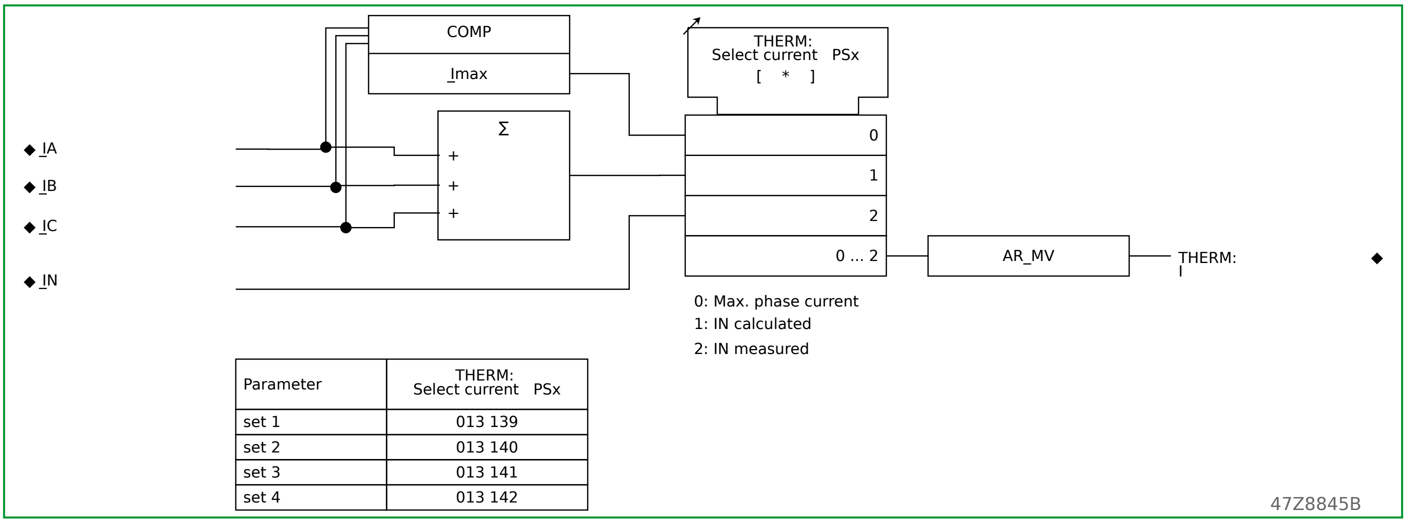
Fig. 3-238: Disabling or enabling thermal overload protection.

3.32.1 Readiness of Thermal Overload Protection

Thermal overload protection is not ready (THERM: Not ready) if one of the following conditions applies:

- Thermal overload protection is disabled.
- Thermal overload protection is blocked because of a fault in the coolant temperature (ambient) acquisition.
- Thermal overload protection is blocked because of an incorrect setting.
- The thermal replica is blocked via an appropriately configured binary signal input.
- In operation together with Motor Protection, Thermal overload protection is temporarily blocked during consecutive motor startups (see Section 3.32.12, (p. 3-313)).

3.32.2 Selection of Current



Parameter	THERM: Select current PSx
set 1	013 139
set 2	013 140
set 3	013 141
set 4	013 142

A setting specifies which current will be used by the P139 for the Thermal Overload Protection: either the maximum RMS phase current, or the residual current calculated from the three phase currents or the residual current directly measured at the fourth current transformer (T 4).

3.32.3 Operating Modes

Two operating modes can be selected for thermal overload protection.

- Relative replica
- Absolute replica

Either operating mode can be enabled or disabled individually. Only one of the operating modes may be enabled for thermal overload protection. However, if both operating modes are enabled at the same time, the thermal overload protection is blocked and the error message THERM: Setting error,block. is generated by the P139.

3.32.4 Coolant Temperature Effect

To permit coolant temperature (ambient) acquisition, the analog (I/O) module Y with a 20 mA current input and the “PT100” input or the temperature p/c board (the RTD module) with the temperature sensor inputs T1 to T9 must be fitted. Thus, up to 11 measuring inputs are available.

One of these measuring inputs is selected for the primary measurement of coolant temperature by setting the parameter THERM: Select meas.inputPSx.

If the parameters THERM: Select meas.inputPSx have been set incorrectly the thermal overload protection is blocked and the error message THERM: Setting error,block. is generated.

An open measuring circuit, due to a broken wire, is determined by the measured value inputs (function group MEASI). This will result in the issuance of these signals:

- MEASI: Open circ. 20mA inp.
- MEASI: Open circ. PT100
- MEASI: Open circ. T1
- ⋮
- MEASI: Open circ. T9

The thermal model uses these signals as a criterion to determine a fault in the coolant temperature measurement. A fault at both measured value inputs selected will lead to the issuance of the signal THERM: CTA error.

The setting for THERM: Funct.f.CTA fail.PSx determines how the thermal overload protection is to continue functioning when the coolant temperature measurement has failed. The following functions can be selected to guarantee continued and stable performance of the thermal overload protection when the coolant temperature measurement has failed.

- Default temperature value:

  The coolant temperature set at THERM: Default CTA PSx is applied. The thermal overload protection function is not blocked.

  As a rule there is an erratic change of the measured value when a fault has occurred in the coolant temperature measurement. The temperature measured before such an erratic change is stored and applied. The thermal overload protection function is not blocked.

- Last measured temperature:

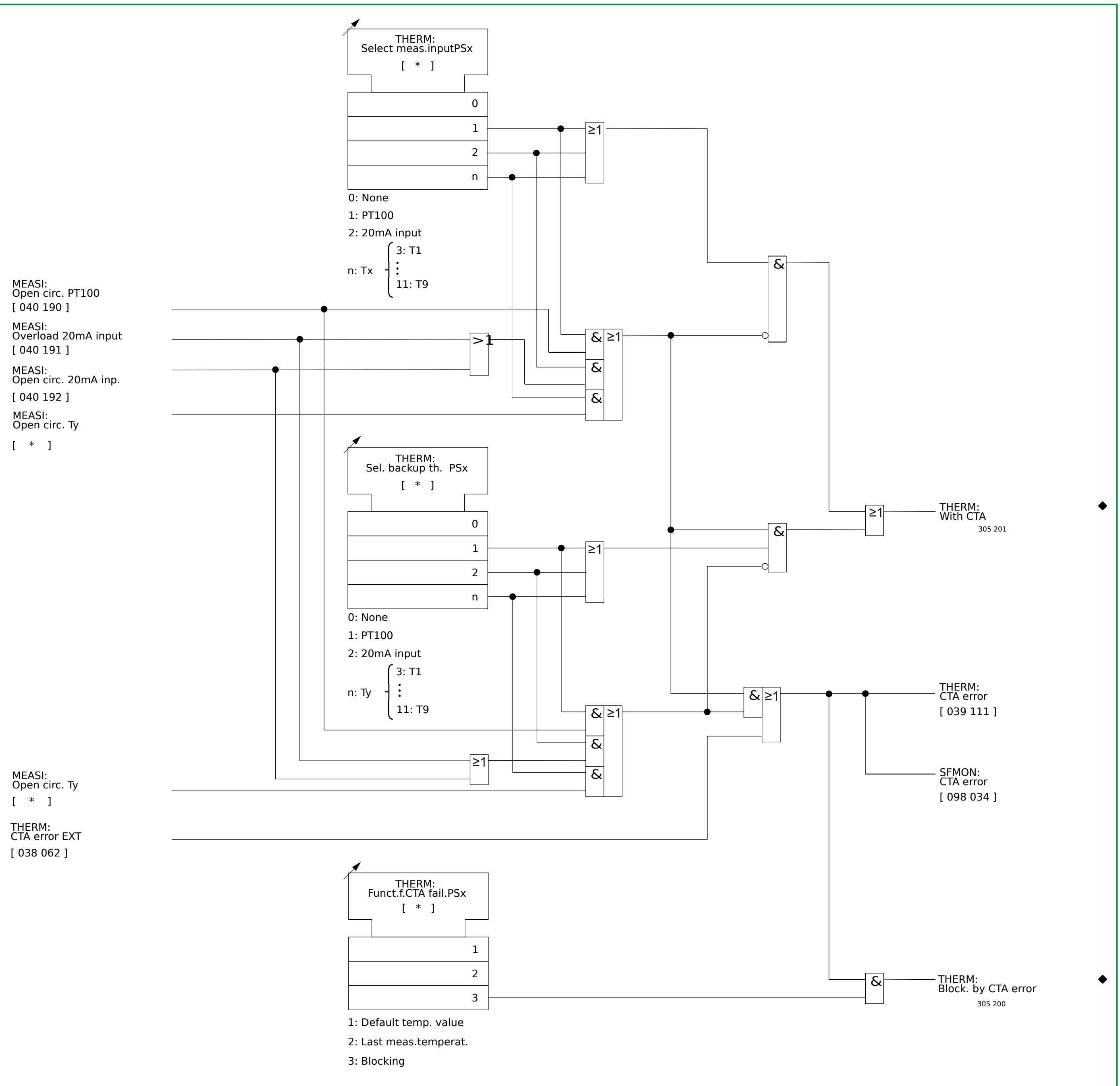
  The coolant temperature set at THERM: Default CTA PSx is applied if no last measured values are available because a device warm restart or a parameter subset selection was carried out.

- Blocking:

  The signals THERM: Warning and THERM: Trip signal are reset and blocked. The thermal model will then be continued and displayed on the basis of the measured current alone. All further measured values are issued as *Not measured*.

All parameters relevant to coolant temperature (ambient) acquisition are hidden if the analog module Y has not been fitted in the P139. The tripping time is calculated by including the setting for THERM: Default CTA PSx.

3.32.5 THERM Operation without Coolant Temperature (Ambient) Acquisition



*

Tx, Ty			
MEASI: Open circ. T1	040 193	MEASI: Open circ. T2	040 194
MEASI: Open circ. T3	040 195	MEASI: Open circ. T4	040 208
MEASI: Open circ. T5	040 209	MEASI: Open circ. T6	040 218
MEASI: Open circ. T7	040 219	MEASI: Open circ. T8	040 252
MEASI: Open circ. T9	040 253		

*

Parameter	THERM: Select meas.inputPSx	THERM: Sel. backup th. PSx	THERM: Funct.f.CTA fail.PSx
set 1	072 177	072 080	076 177
set 2	073 177	073 080	077 177
set 3	074 177	074 200	078 177
set 4	075 177	075 200	079 177

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Fig. 3-239: Coolant temperature monitoring.

In order to ensure thermal overload protection, without taking into account an offset due to a variable coolant temperature, it is recommended to set the

THERM: Default CTA PSx parameter to the maximum permitted coolant temperature.

3.32.6 Relative Replica

The rated operating current of the protected object and its overload tolerance for maximum coolant (ambient) temperature are the basis of the relative thermal replica.

In the *Relative replica* operating mode, the following settings have to be made for thermal overload protection:

- The rated operating current of the protected object: THERM: Iref PSx
- The tripping threshold $\Delta\vartheta_{trip}$ is set at THERM: Rel. O/T trip PSx.

If coolant temperature (ambient) acquisition is used, the following parameters must be set:

- The maximum permissible temperature of the protected object Θ_{max}, THERM: Max.perm.obj.tmp.PSx
- The maximum coolant temperature (maximum ambient) $\Theta_{c,max}$, THERM: Max.perm.cool.tmpPSx

3.32.7 Absolute Replica

The thermal limit current of the protected object is the reference current of the absolute thermal replica. For this limit current, an overtemperature results at the maximum coolant temperature.

In the *Absolute replica* operating mode, the following parameters have to be set for thermal overload protection:

- The thermal limit current of the protected object: IDMT1: Min. trip time N PSx
- The limit temperature for tripping Θ_{max}, THERM: Max.perm.obj.tmp.PSx
- The overtemperature as a result of a persistent limit current (Θ_{max} - $\Theta_{c,max}$), THERM: O/T f.Iref pers. PSx

The maximum permitted coolant temperature $\Theta_{c,max}$ is derived from the difference between the THERM: Max.perm.obj.tmp.PSx and THERM: O/T f.Iref pers. PSx settings.

3.32.8 Tripping Characteristics

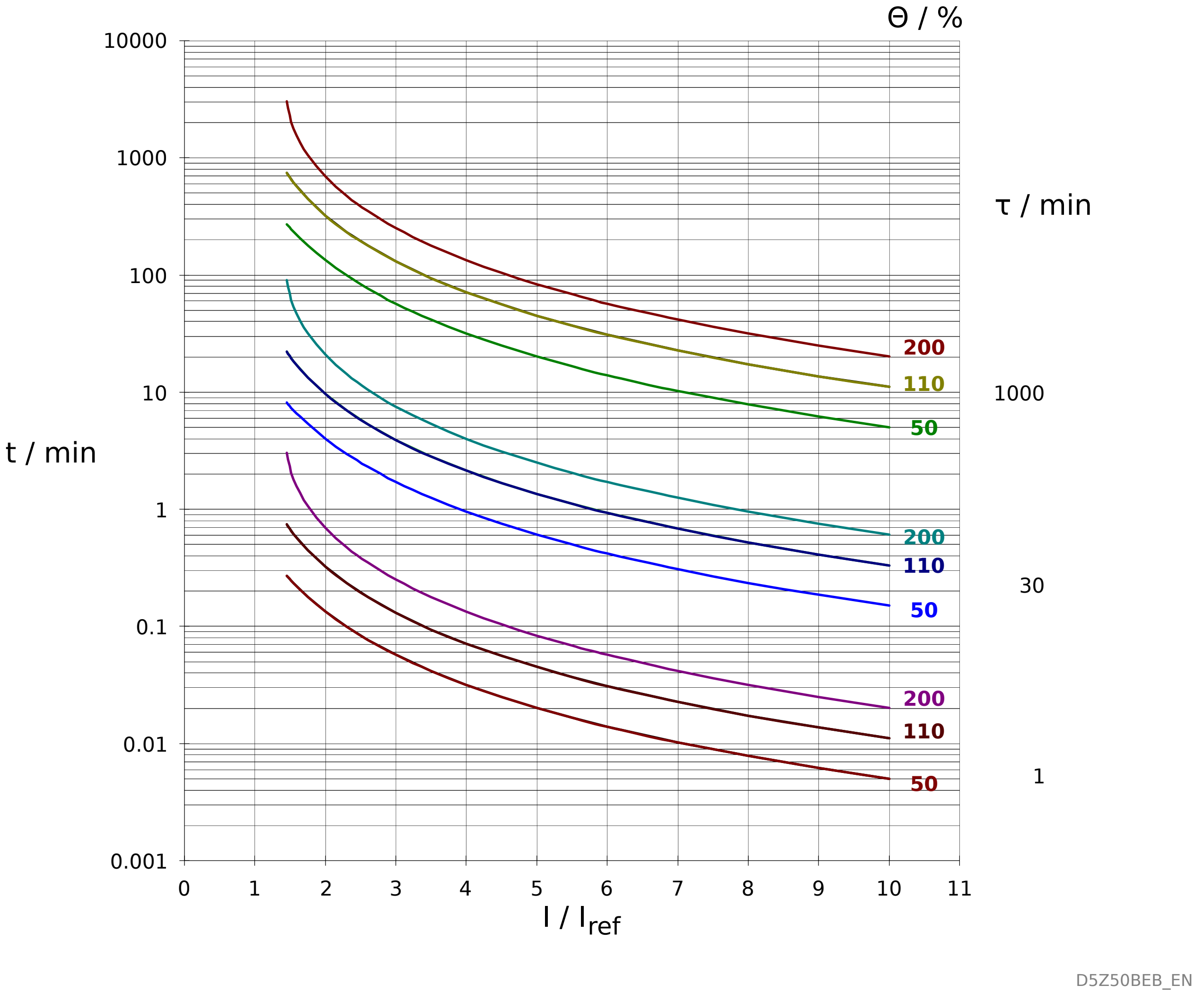


Fig. 3-240: Tripping characteristics of thermal overload protection (tripping characteristics apply to $\Delta\vartheta_P$ = 0 % and identical settings for the maximum permissible coolant temperature and coolant temperature).

The selected current (THERM: I, see Section 3.32.2, (p. 3-304)) is used to track a first-order thermal replica as specified in IEC 255-8. Other than the operating mode dependent settings the following parameters will govern the tripping time:

- The set thermal time constant τ of the protected object, THERM: Tim.const.1,>Ibl PSx
- The accumulated thermal load $\Delta\vartheta_0$
- The current measured coolant temperature Θ_c
- If the value of the selected current (THERM: I) is greater than $10 \cdot I_{ref}$ then only the fixed maximum value $10 \cdot I_{ref}$ is used for calculating the tripping time.

The tripping threshold in the two operating modes is calculated as follows:

$$t = \tau \cdot \ln \frac{\left(\frac{I}{I_{ref}}\right)^2 - \Delta\vartheta_0}{\left(\frac{I}{I_{ref}}\right)^2 - \Delta\vartheta_{trip} \cdot \left(1 - \frac{\Theta_a - \Theta_{a,max}}{\Theta_{max} - \Theta_{a,max}}\right)}$$

The $\Delta\vartheta_{trip}$ tripping threshold is set to a fixed value of 100% if the operating mode is *Absolute replica*.

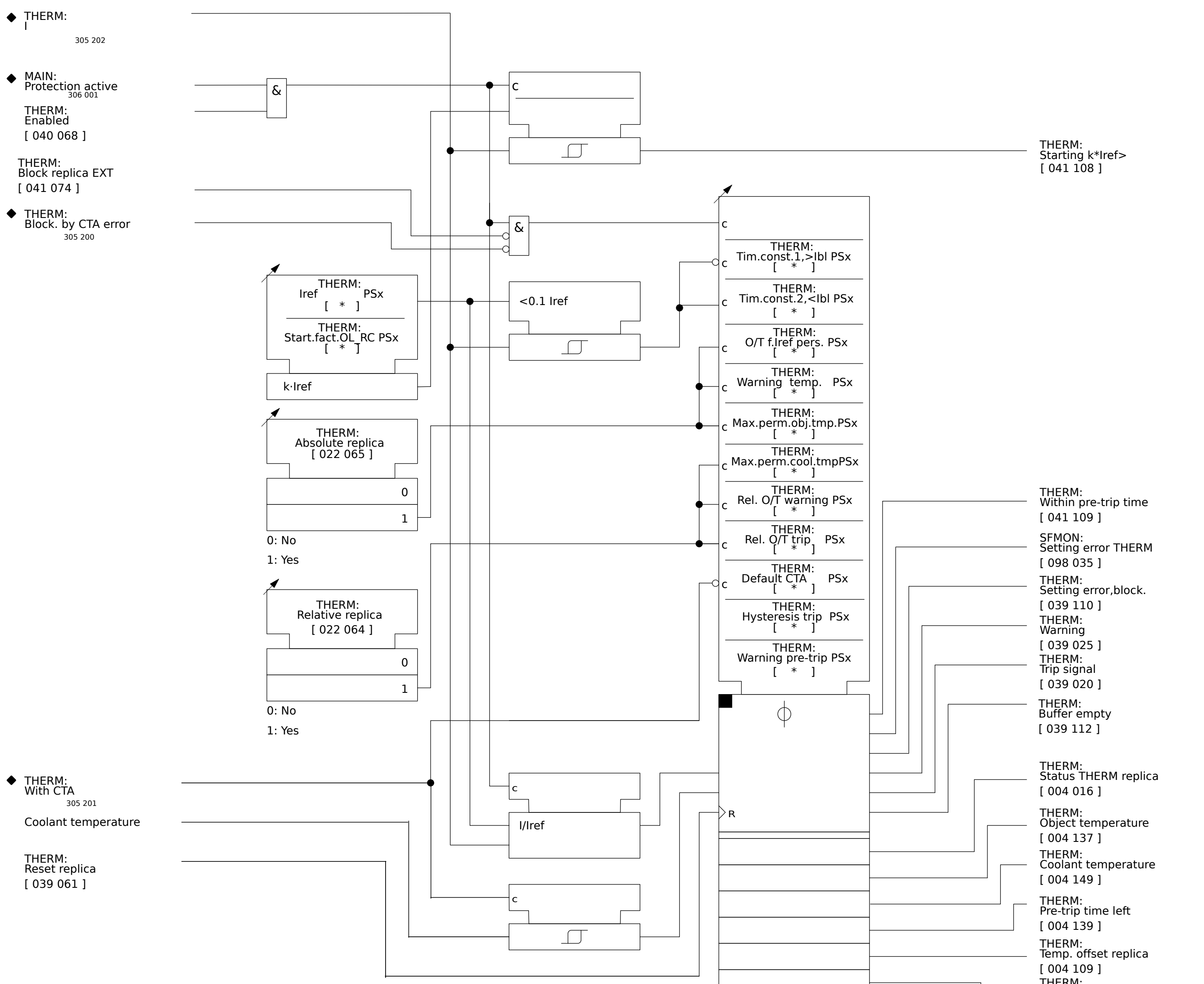
3.32.9 Warning Signal

Depending on the selected operating mode, a warning signal can be set at one of the following parameters:

- Relative replica: THERM: Rel. O/T warning PSx
- Absolute replica: THERM: Warning temp. PSx

Additionally, a time-to-tripping threshold (pre-trip time) can be set. When the time left until tripping falls below this setting, a warning signal will be issued.

3.32.10 Trip



*

Parameter	THERM: Iref PSx	THERM: Start.fact.OL_RC PSx	THERM: Tim.const.1,>Ibl PSx
set 1	072 179	072 180	072 187
set 2	073 179	073 180	073 187
set 3	074 179	074 180	074 187
set 4	075 179	075 180	075 187

*

Parameter	THERM: Tim.const.2,<Ibl PSx	THERM: O/T f.Iref pers. PSx	THERM: Warning temp. PSx	THERM: Max.perm.obj.tmp.PSx
set 1	072 188	072 167	072 153	072 182
set 2	073 188	073 167	073 153	073 182
set 3	074 188	074 167	074 153	074 182
set 4	075 188	075 167	075 153	075 182

*

Parameter	THERM: Max.perm.cool.tmpPSx	THERM: Rel. O/T warning PSx	THERM: Rel. O/T trip PSx	THERM: Default CTA PSx	THERM: Hysteresis trip PSx	THERM: Warning pre-trip PSx
set 1	072 185	072 184	072 181	072 186	072 183	072 191
set 2	073 185	073 184	073 181	073 186	073 183	073 191
set 3	074 185	074 184	074 181	074 186	074 183	074 191
set 4	075 185	075 184	075 181	075 186	075 183	075 191

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Fig. 3-241: Thermal overload protection.

The trip threshold is set according to the selected operating mode with the following parameters:

- Relative replica: THERM: Rel. O/T trip PSx
- Absolute replica: THERM: Max.perm.obj.tmp.PSx

If a trip command is issued, the trip signal is maintained until the status of the thermal replica has decreased by the value set at THERM: Hysteresis trip PSx, at least for a fixed time of 5 s.

3.32.11 Cooling

If the current falls below the default threshold of 0.1 I_{ref}, the thermal replica is applied with the time constant set at THERM: Tim.const.2,<Ibl PSx. This element in the thermal model takes account of the cooling characteristics of stopped motors.

The two time constants THERM: Tim.const.1,>Ibl PSx and THERM: Tim.const.2,<Ibl PSx should be set to identical values for transformers and power lines.

3.32.12 Operation Together with the Motor Protection Function

If the thermal overload protection function is operated together with the motor protection function (function group MP) and if another startup of an asynchronous motor occurs (other than the first startup), then the thermal overload protection function will be temporarily blocked during the startup time.

The motor protection will effect the thermal overload protection and not vice versa if both protection functions are applied simultaneously.

3.32.13 Resetting

The thermal replica may be reset either via a setting parameter or via an appropriately configured binary signal input. Resetting is possible even when thermal overload protection is disabled. Thermal overload protection can be blocked via an appropriately configured binary signal input.

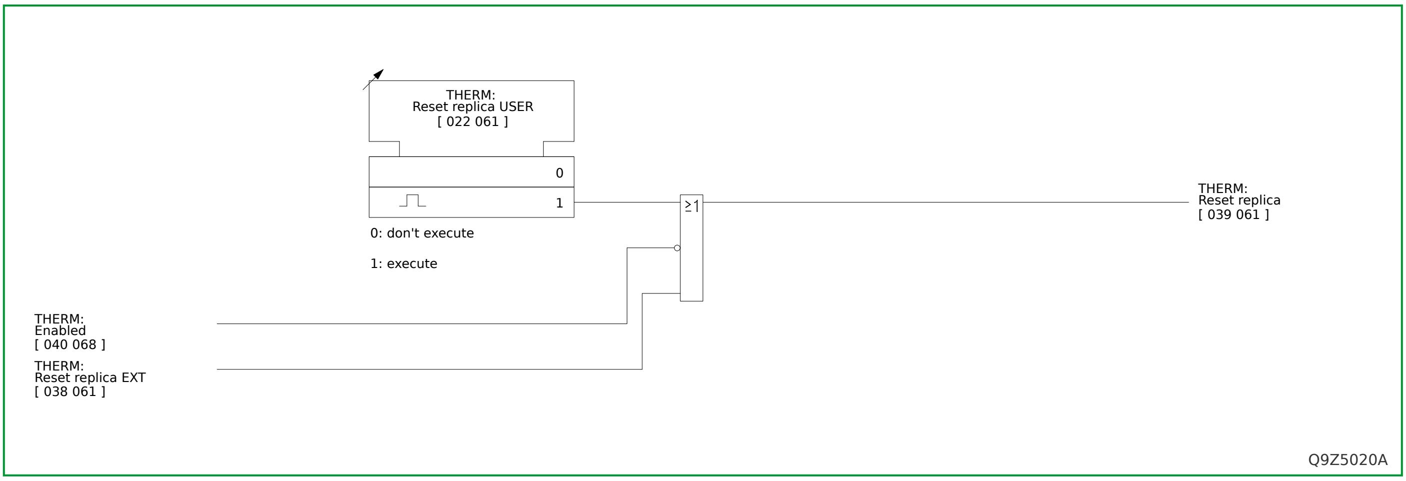


Fig. 3-242: Resetting the thermal replica.

3.33 Unbalance Protection (Function Group I2>)

The P139 features an unbalance protection function (I2> protection).

3.33.1 Disabling and Enabling the Unbalance Protection Function

The unbalance protection function can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

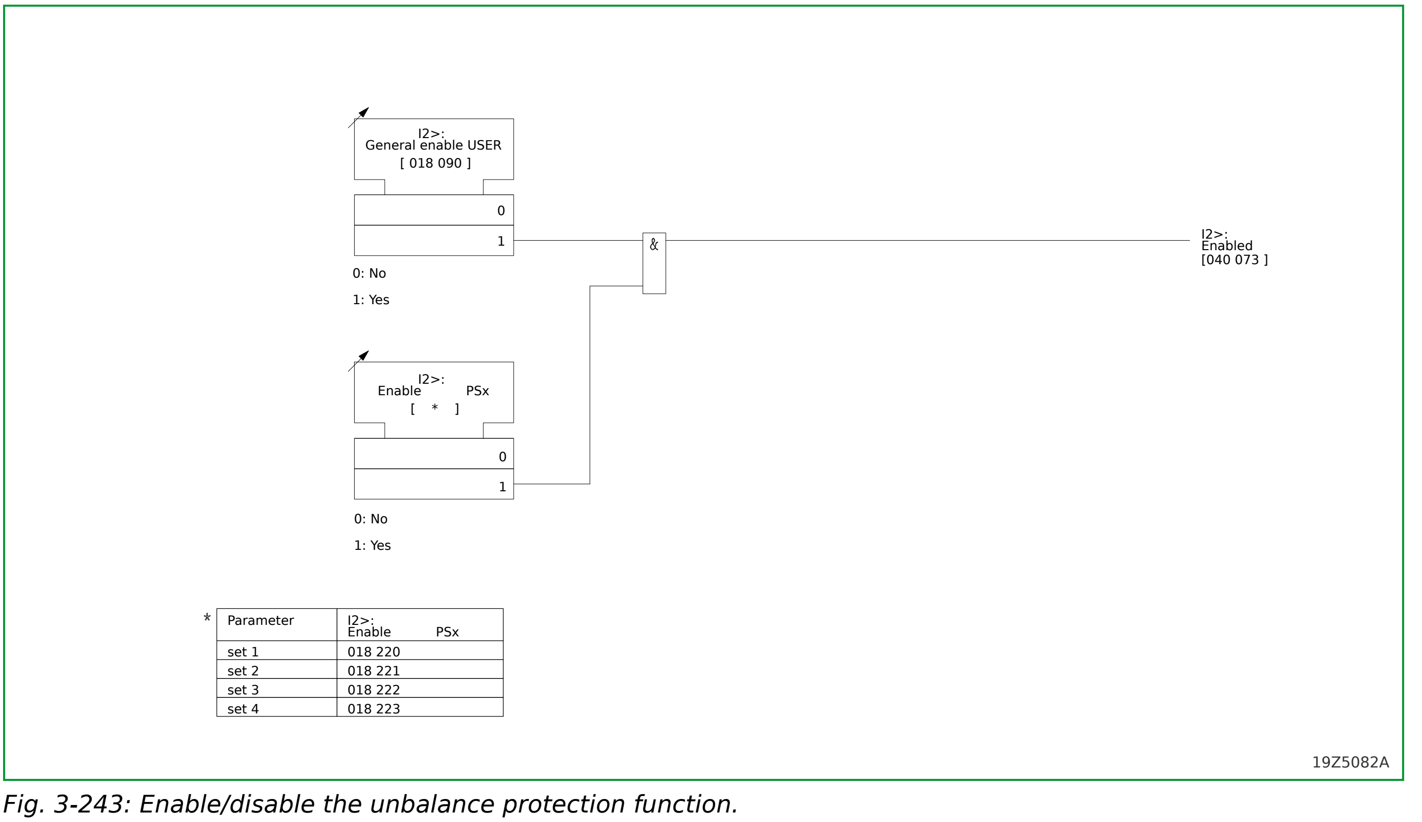


Fig. 3-243: Enable/disable the unbalance protection function.

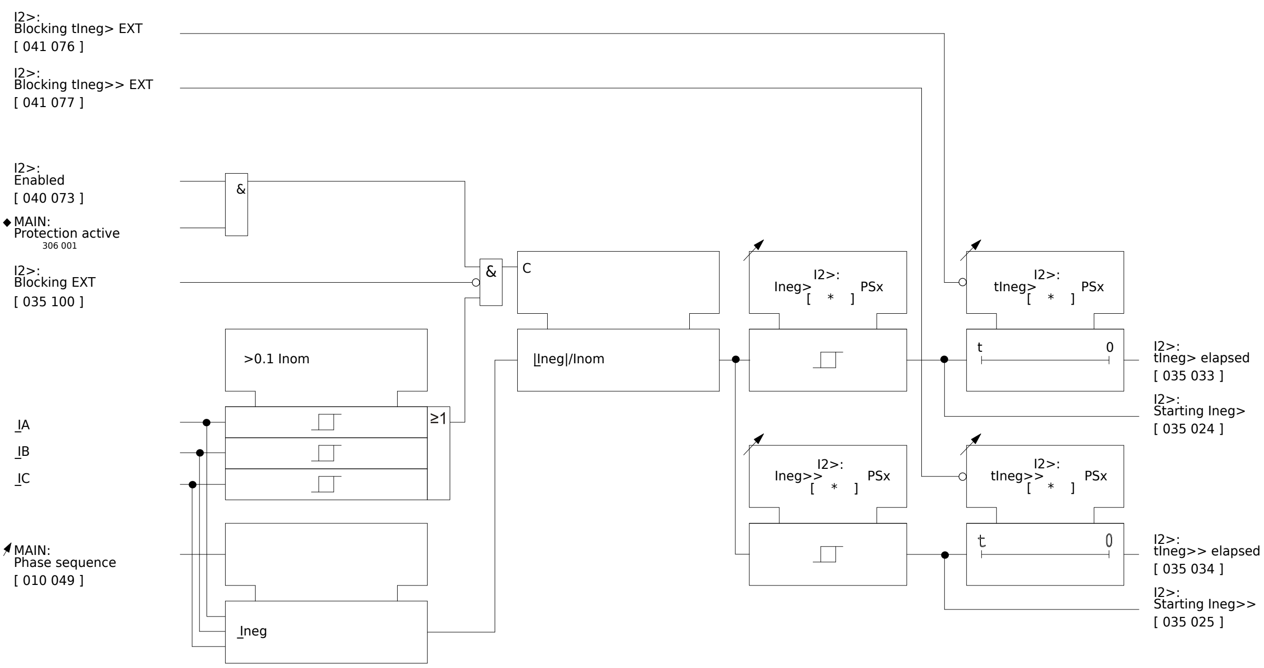
3.33.2 Functional Description

The presence or absence of unbalance is assessed on the basis of the negative-sequence system current. The negative-sequence current is monitored to determine whether it exceeds the set thresholds. After the set operate delays have elapsed, a signal is issued. The following stages are available for the negative-sequence current:

- Unbalance stage $I_{neg>}$ with time delay $t_{Ineg>}$
- Unbalance stage $I_{neg>>}$ with time delay $t_{Ineg>>}$

The elapsing of all operate delays may be blocked via appropriately configured binary signal inputs.

The unbalance protection signals can be configured to separate output relays. These signals cannot be linked to the general starting signal but can be configured to the trip command.



* Parameter	I2>: Ineg> PSx	I2>: tIneg> PSx	I2>: Ineg>> PSx	I2>: tIneg>> PSx
set 1	018 091	018 093	018 092	018 094
set 2	018 224	018 230	018 227	018 233
set 3	018 225	018 231	018 228	018 234
set 4	018 226	018 232	018 229	018 235

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Fig. 3-244: Unbalance protection.

3.34 Under and Overvoltage Protection (Function Group V<>)

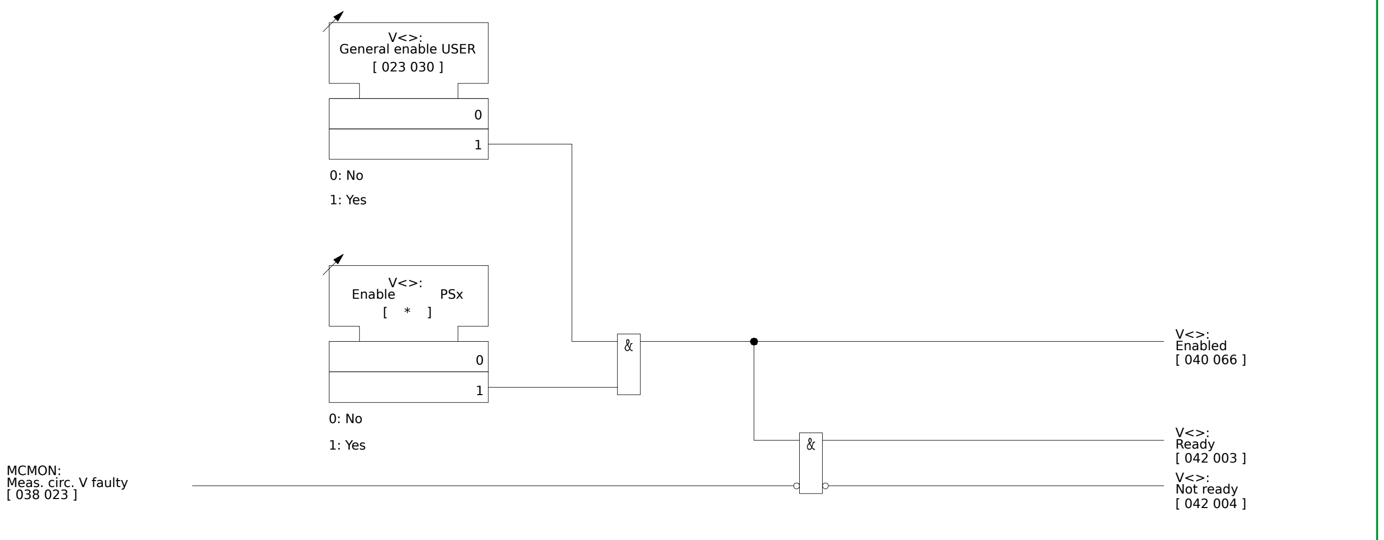
The time-voltage protection function evaluates the fundamental wave of the phase voltages and of the neutral-point displacement voltage as well as the positive-sequence voltage and negative-sequence voltage obtained from the fundamental waves of the three phase-to-ground voltages.

3.34.1 Disabling and Enabling V<> Protection

V<> protection can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

3.34.2 V<> Protection Readiness

V<> protection is ready if it is enabled and no fault has been detected in the voltage-measuring circuit by the measuring-circuit monitoring function.



* Parameter	V<>: Enable PSx
set 1	076 246
set 2	077 246
set 3	078 246
set 4	079 246

Fig. 3-245: Enabling, disabling and readiness of V<> protection.

3.34.3 Minimum Current Monitoring

There is an optional enabling threshold available with the V<> element which is based on minimum current monitoring for the undervoltage stages (V<, V<<, V<<<, Vpos<, Vpos<<).

The following two settings may be used to activate the operating mode for minimum current monitoring and to set the enabling threshold:

- V<>: I enable V< PSx
- V<>: Op. mode V< mon. PSx

The undervoltage stages are blocked if during active monitoring the set threshold of at least one phase is not exceeded by the phase currents.

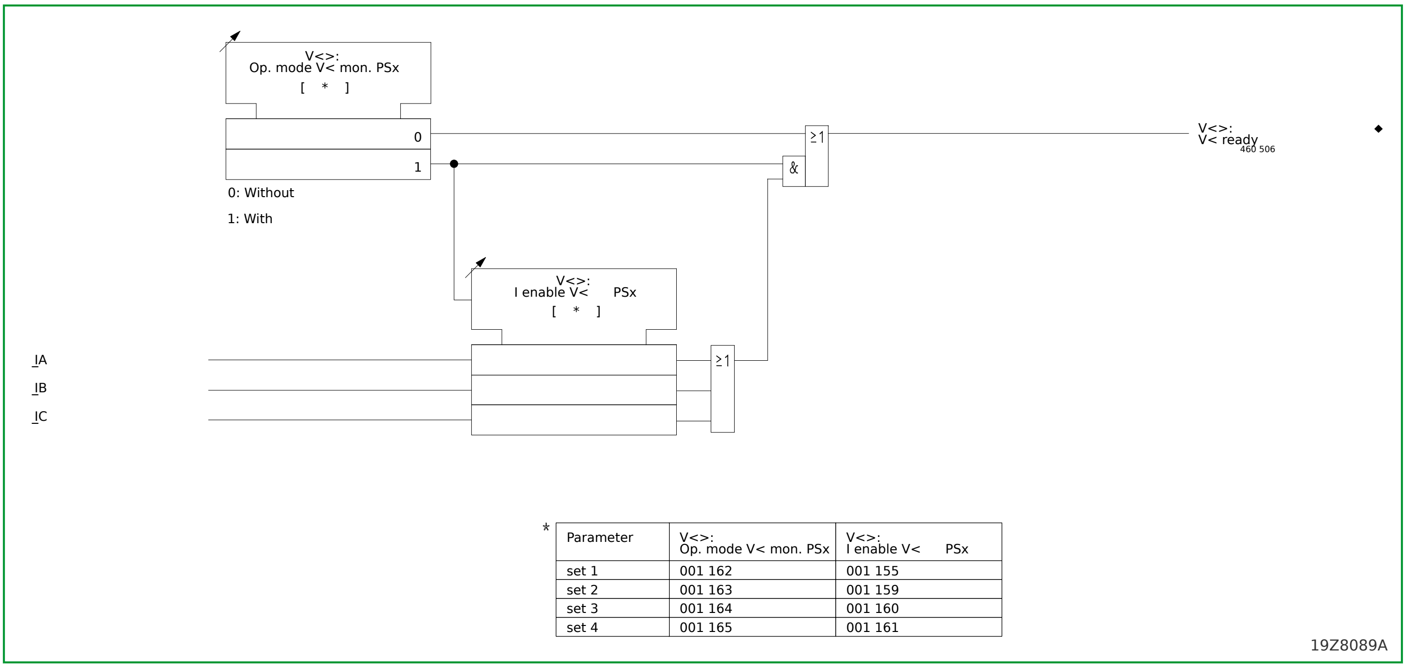


Fig. 3-246: Enabling threshold for the undervoltage stages.

3.34.4 Monitoring the Phase Voltages

The P139 checks the voltages to determine whether they exceed or fall below set thresholds. Dependent on the set operating mode of V<> protection, either the phase-to-ground voltages (*Star* operating mode) or the phase-to-phase voltages (*Delta* operating mode) are monitored. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs.

If undervoltage monitoring decisions are to be included in the trip commands, then it is recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and it would therefore not be possible to close the circuit breaker again.

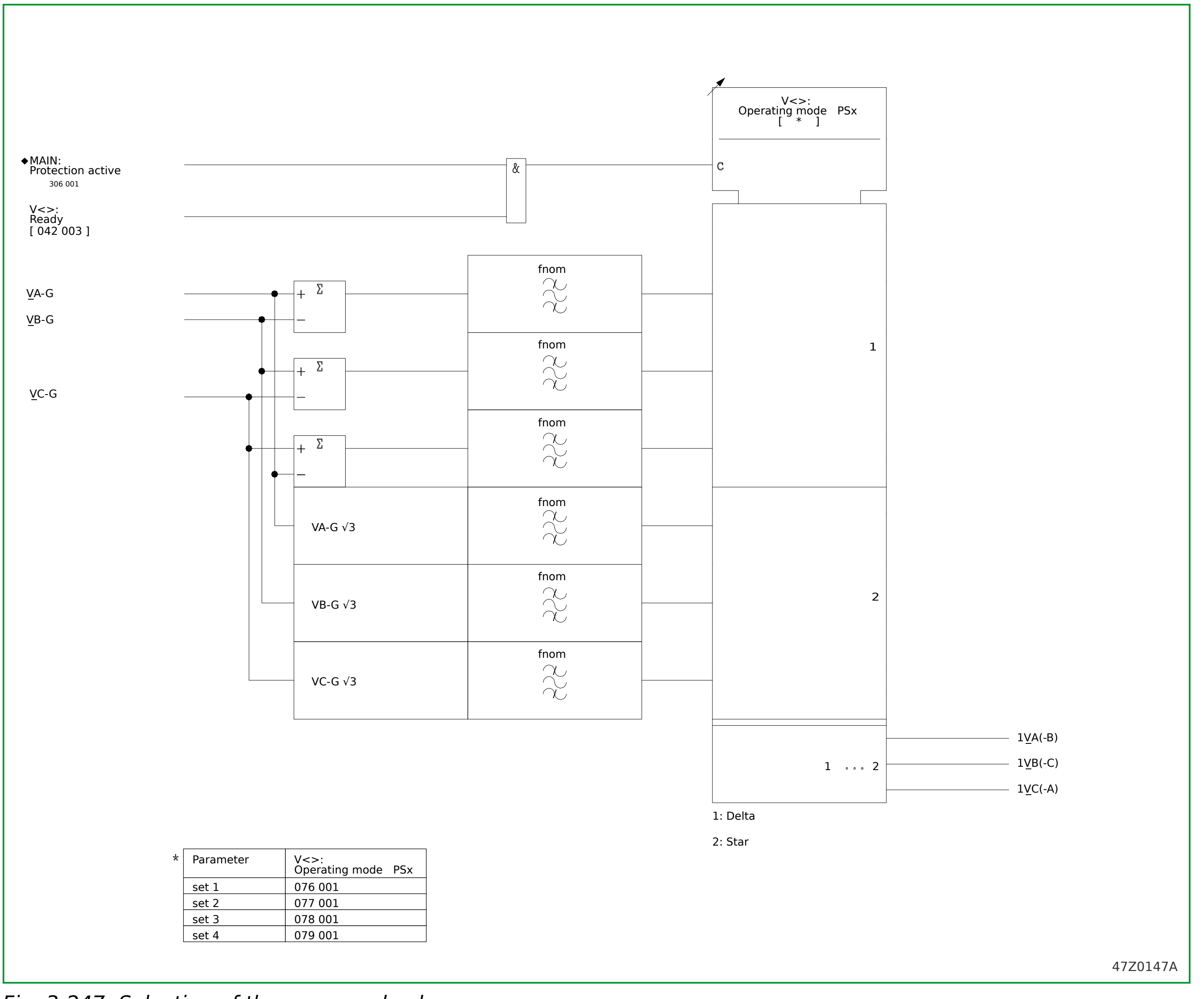
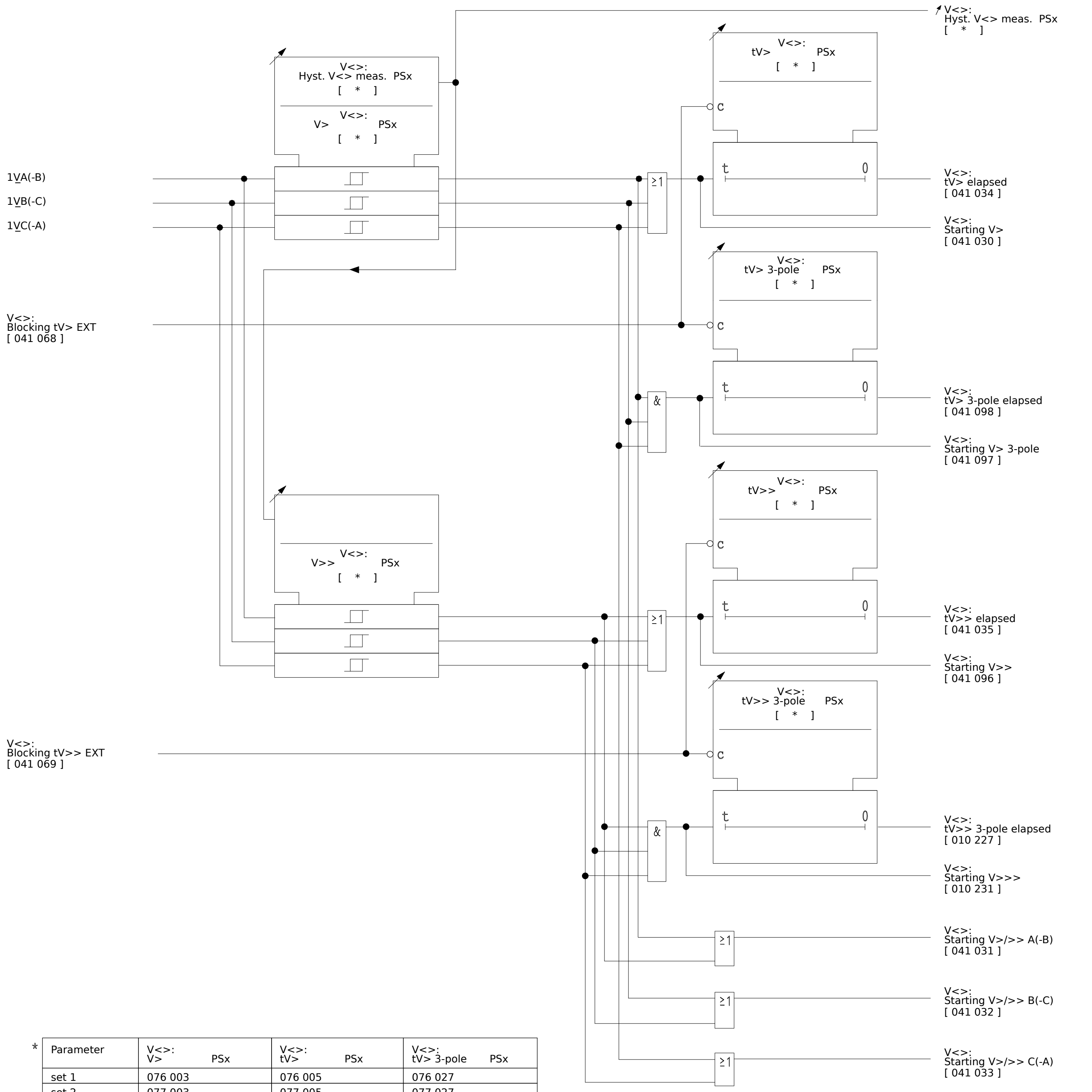


Fig. 3-247: Selection of the measured values.



*

Parameter	V<>: V> PSx	V<>: tV> PSx	V<>: tV> 3-pole PSx
set 1	076 003	076 005	076 027
set 2	077 003	077 005	077 027
set 3	078 003	078 005	078 027
set 4	079 003	079 005	079 027

*

Parameter	V<>: V>> PSx	V<>: tV>> PSx	V<>: tV>> 3-pole PSx	V<>: Hyst. V<> meas. PSx
set 1	076 004	076 006	011 092	076 048
set 2	077 004	077 006	011 094	077 048
set 3	078 004	078 006	011 095	078 048
set 4	079 004	079 006	011 096	079 048

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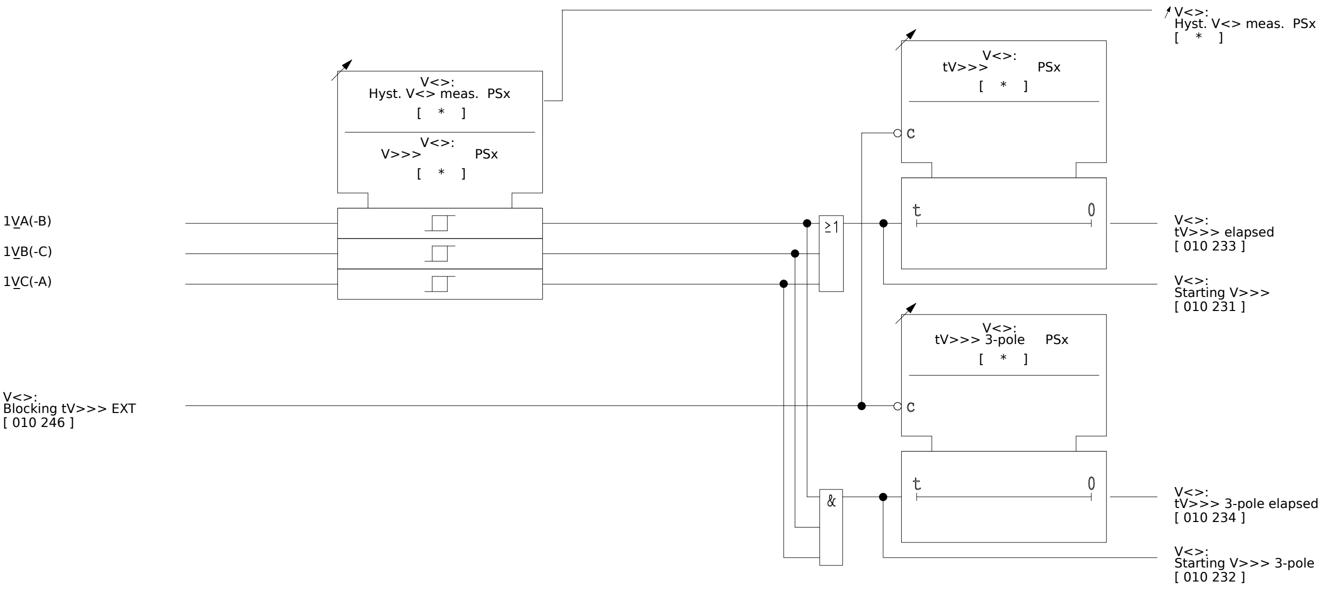
Fig. 3-248: Overvoltage monitoring, Part 1: stages V> and V>>.



*

Parameter	V<>: V>>> PSx	V<>: tV>>> PSx	V<>: tV>>> 3-pole PSx	V<>: Hyst. V<> meas. PSx
set 1	011 075	011 079	011 099	076 048
set 2	011 076	011 080	011 105	077 048
set 3	011 077	011 081	011 117	078 048
set 4	011 078	011 082	011 118	079 048

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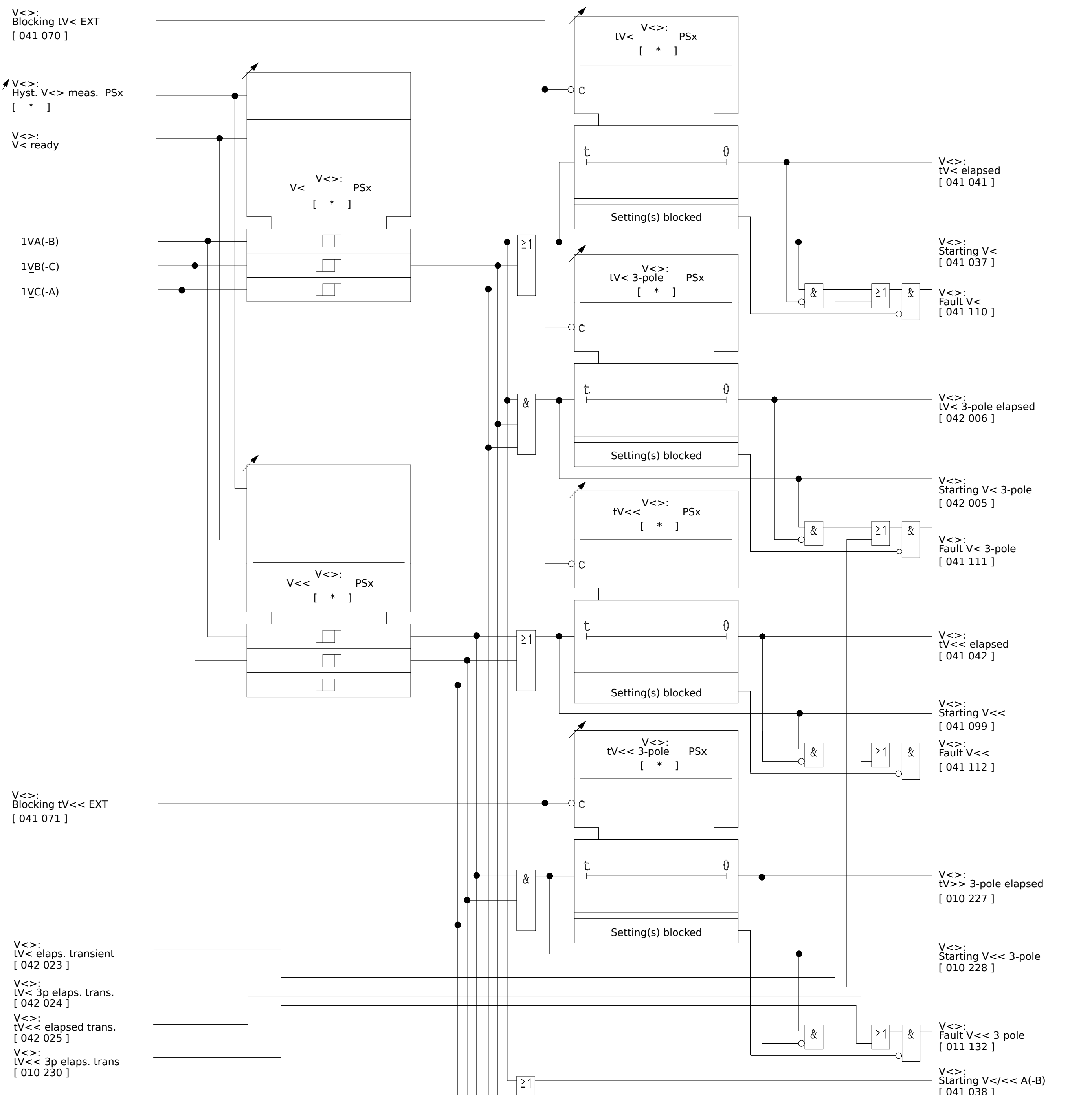
Fig. 3-249: Overvoltage monitoring, Part 2: stage V>>>.



*

Parameter	V<>: Hyst. V<> meas. PSx
set 1	076 048
set 2	077 048
set 3	078 048
set 4	079 048

*

Parameter	V<>: V< PSx	V<>: tV< PSx	V<>: tV< 3-pole PSx	V<>: V<< PSx	V<>: tV<< PSx	V<>: tV<< 3-pole PSx
set 1	076 007	076 009	076 028	076 008	076 010	011 119
set 2	077 007	077 009	077 028	077 008	077 010	011 124
set 3	078 007	078 009	078 028	078 008	078 010	011 125
set 4	079 007	079 009	079 028	079 008	079 010	011 126

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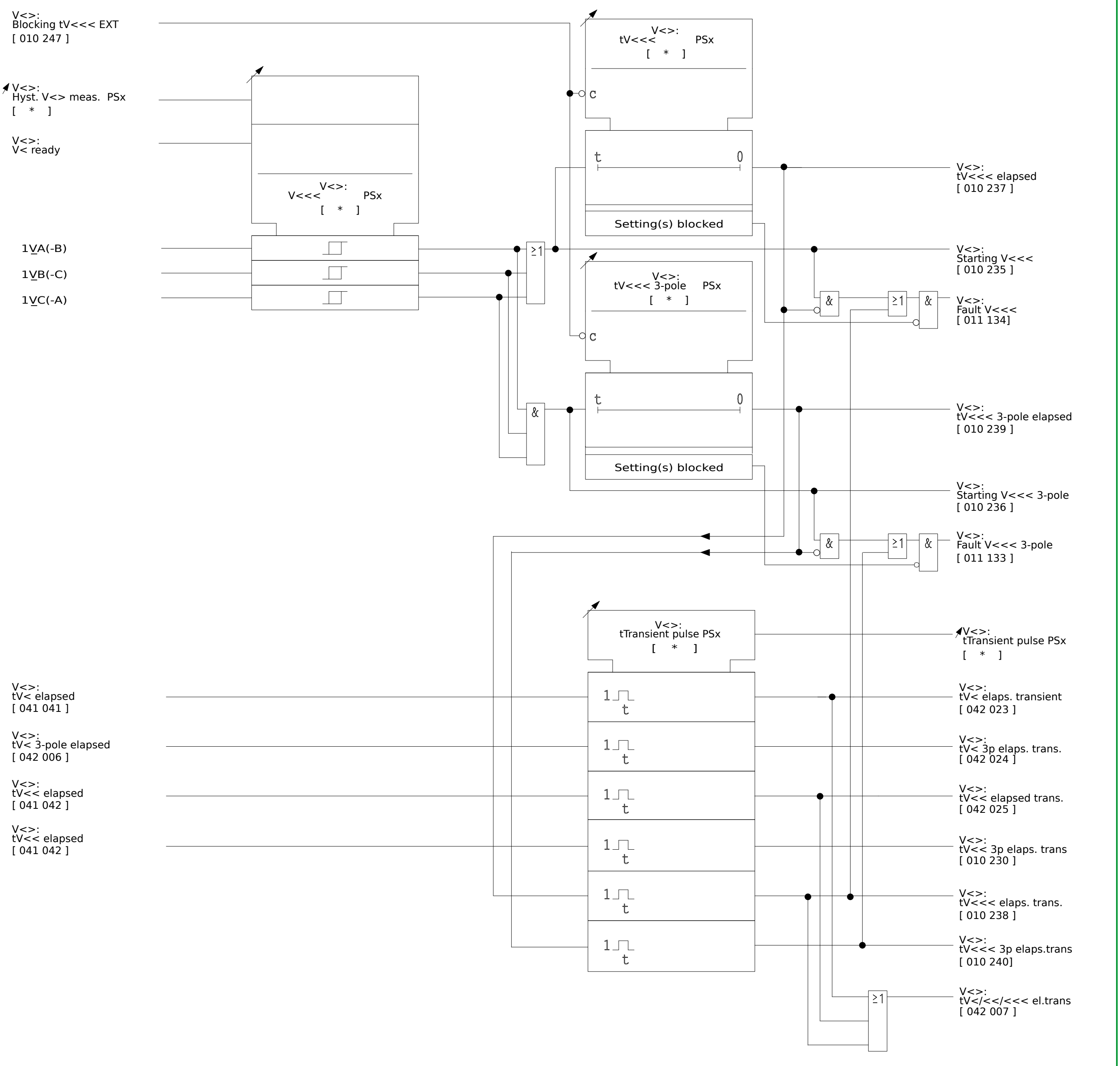
Fig. 3-250: Undervoltage monitoring, Part 1: stages V< and V<<. (Transient pulse: See following diagram.)



* Parameter	V<>: V<<< PSx	V<>: tV<<< PSx	V<>: tV<<< 3-pole PSx	V<>: Hyst. V<> meas. PSx	V<>: tTransient pulse PSx
set 1	011 083	011 088	011 127	076 048	076 029
set 2	011 083	011 088	011 127	077 048	077 029
set 3	011 083	011 088	011 127	078 048	078 029
set 4	011 083	011 088	011 127	079 048	079 029

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Fig. 3-251: Undervoltage monitoring, Part 2: stage V<<< and transient pulse for stages V</<</<<<.

3.34.5 Monitoring the Positive- and Negative-Sequence Voltages

The P139 determines the positive-sequence and negative-sequence voltages from the fundamental components of the phase-to-ground voltages according to the formulas given below. This is based on the MAIN: Phase sequence setting (alternative terminology: Rotary field).

Phase sequence A-B-C (clockwise rotating field)

- Negative-sequence voltage:

  $\underline{V}_{neg} = \frac{1}{3} \cdot \mid (\underline{V}_{A-G} + \underline{a}^2 \cdot \underline{V}_{B-G} + \underline{a} \cdot \underline{V}_{C-G}) \mid$

- Positive-sequence voltage:

  $\underline{V}_{pos} = \frac{1}{3} \cdot \mid (\underline{V}_{A-G} + \underline{a} \cdot \underline{V}_{B-G} + \underline{a}^2 \cdot \underline{V}_{C-G}) \mid$

Phase sequence A-C-B (anti-clockwise rotating field)

- Negative-sequence voltage:

  $\underline{V}_{neg} = \frac{1}{3} \cdot \left| (\underline{V}_{A-G} + \underline{a} \cdot \underline{V}_{B-G} + \underline{a}^2 \cdot \underline{V}_{C-G}) \right|$

- Positive-sequence voltage:

  $\underline{V}_{pos} = \frac{1}{3} \cdot \left| (\underline{V}_{A-G} + \underline{a}^2 \cdot \underline{V}_{B-G} + \underline{a} \cdot \underline{V}_{C-G}) \right|$

- Symbols used:

  $\underline{a} = e^{2\pi j/3} = e^{j \cdot 120°}$

  $\underline{a}^2 = e^{4\pi j/3} = e^{j \cdot 240°}$

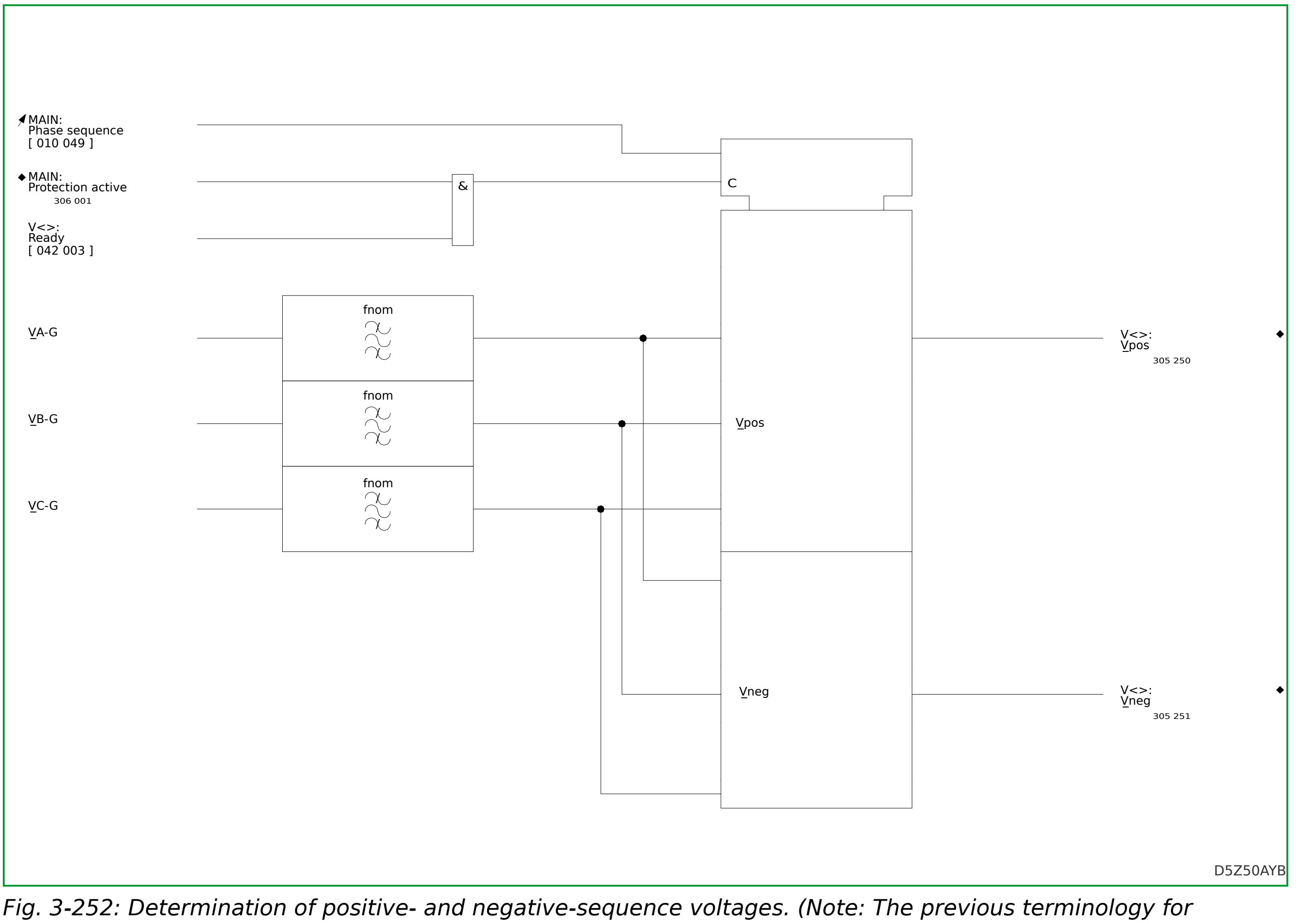
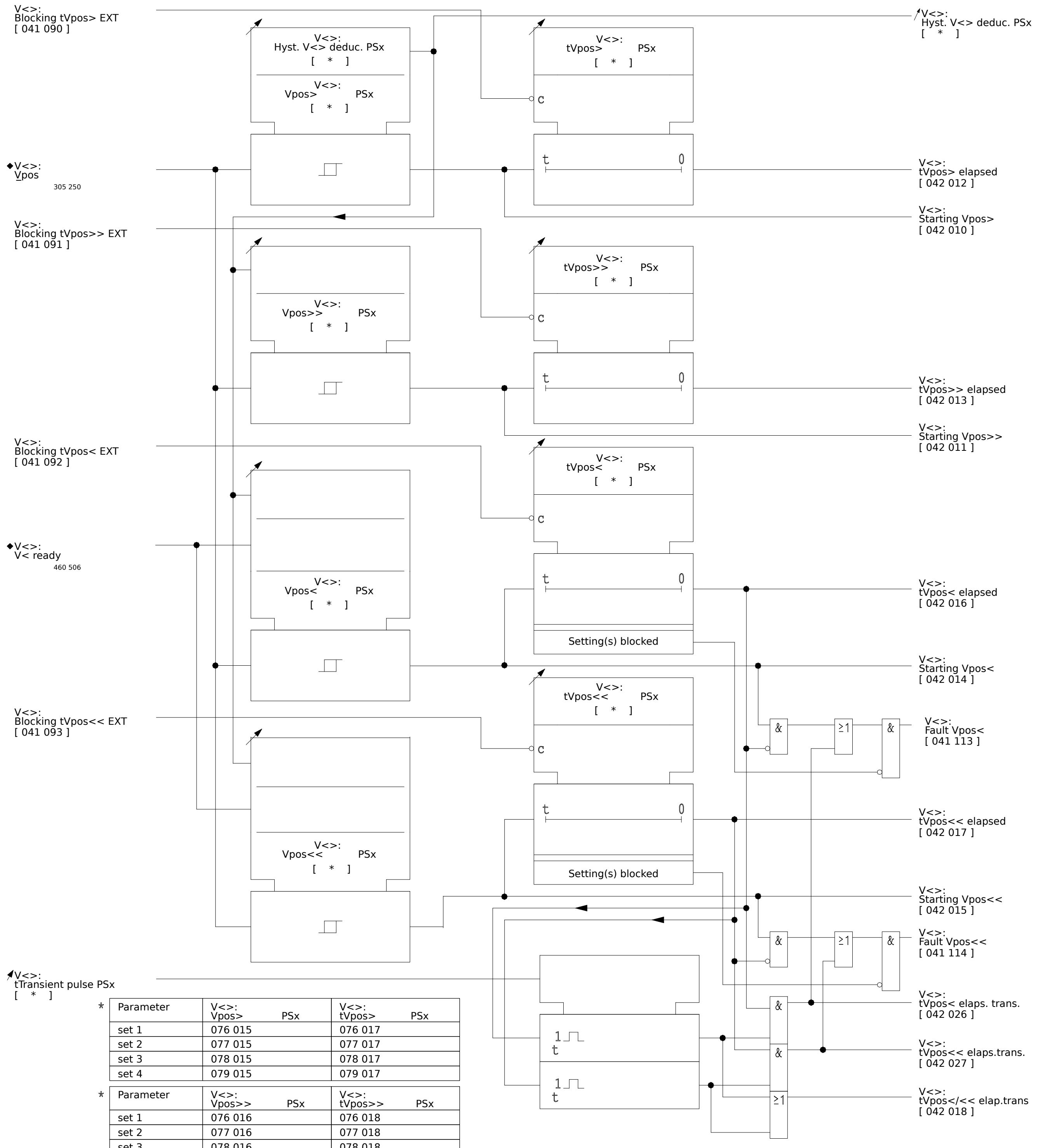


Fig. 3-252: Determination of positive- and negative-sequence voltages. (Note: The previous terminology for MAIN: Phase sequence was MAIN: Rotary field.)

The positive-sequence voltage is monitored to determine whether it exceeds or falls below set thresholds, and the negative-sequence voltage is monitored to determine whether it exceeds set thresholds. If the voltage exceeds or falls below the set thresholds, then a signal is issued once the set operate delays have elapsed. The timer stages can be blocked by appropriately configured binary signal inputs.

If undervoltage monitoring decisions are to be included in the trip commands, then it is recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and it would therefore not be possible to close the circuit breaker again.



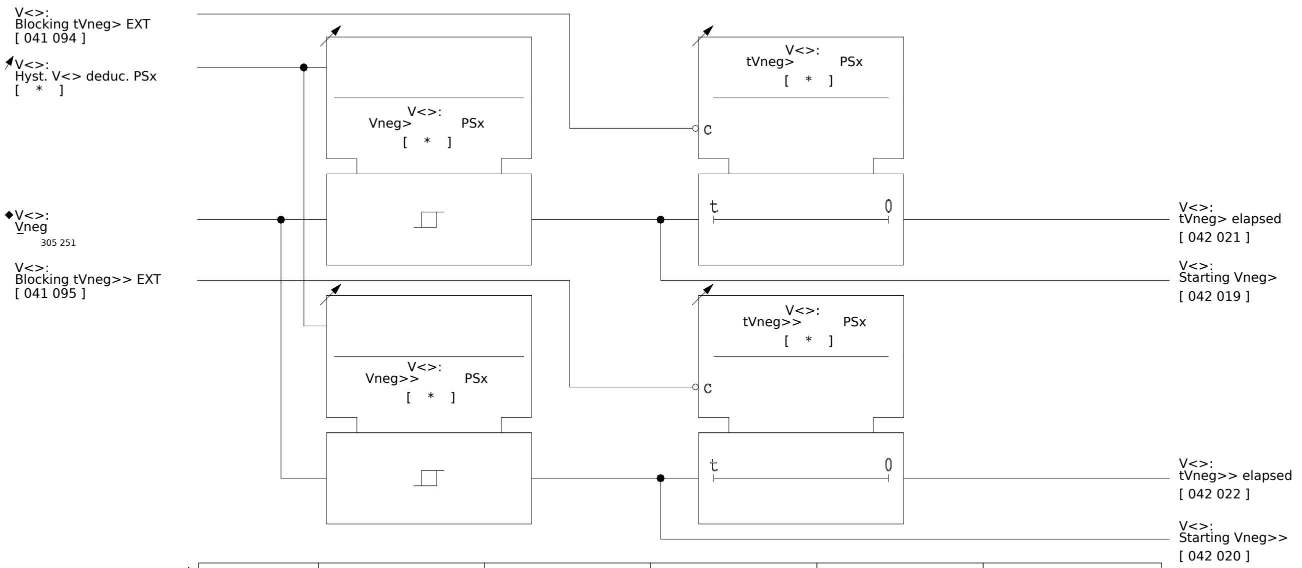
* Parameter	V<>: Vpos> PSx	V<>: tVpos> PSx
set 1	076 015	076 017
set 2	077 015	077 017
set 3	078 015	078 017
set 4	079 015	079 017

* Parameter	V<>: Vpos>> PSx	V<>: tVpos>> PSx
set 1	076 016	076 018
set 2	077 016	077 018
set 3	078 016	078 018
set 4	079 016	079 018

* Parameter	V<>: Vpos< PSx	V<>: tVpos< PSx	V<>: Vpos<< PSx	V<>: tVpos<< PSx	V<>: tTransient pulse PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 019	076 021	076 020	076 022	076 029	076 049
set 2	077 019	077 021	077 020	077 022	077 029	077 049
set 3	078 019	078 021	078 020	078 022	078 029	078 049
set 4	079 019	079 021	079 020	079 022	079 029	079 049

19Z80AZA

Fig. 3-253: Monitoring the positive-sequence voltage.



*

Parameter	V<>: Vneg> PSx	V<>: tVneg> PSx	V<>: Vneg>> PSx	V<>: tVneg>> PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 023	076 025	076 024	076 026	076 049
set 2	077 023	077 025	077 024	077 026	077 049
set 3	078 023	078 025	078 024	078 026	078 049
set 4	079 023	079 025	079 024	079 026	079 049

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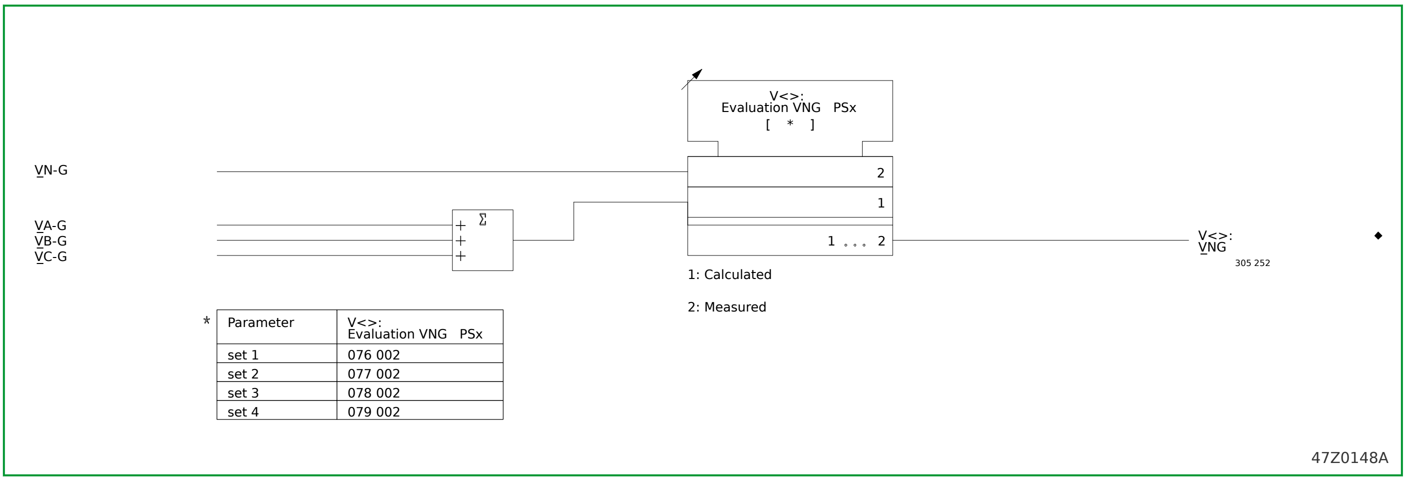
Fig. 3-254: Monitoring the negative-sequence voltage.

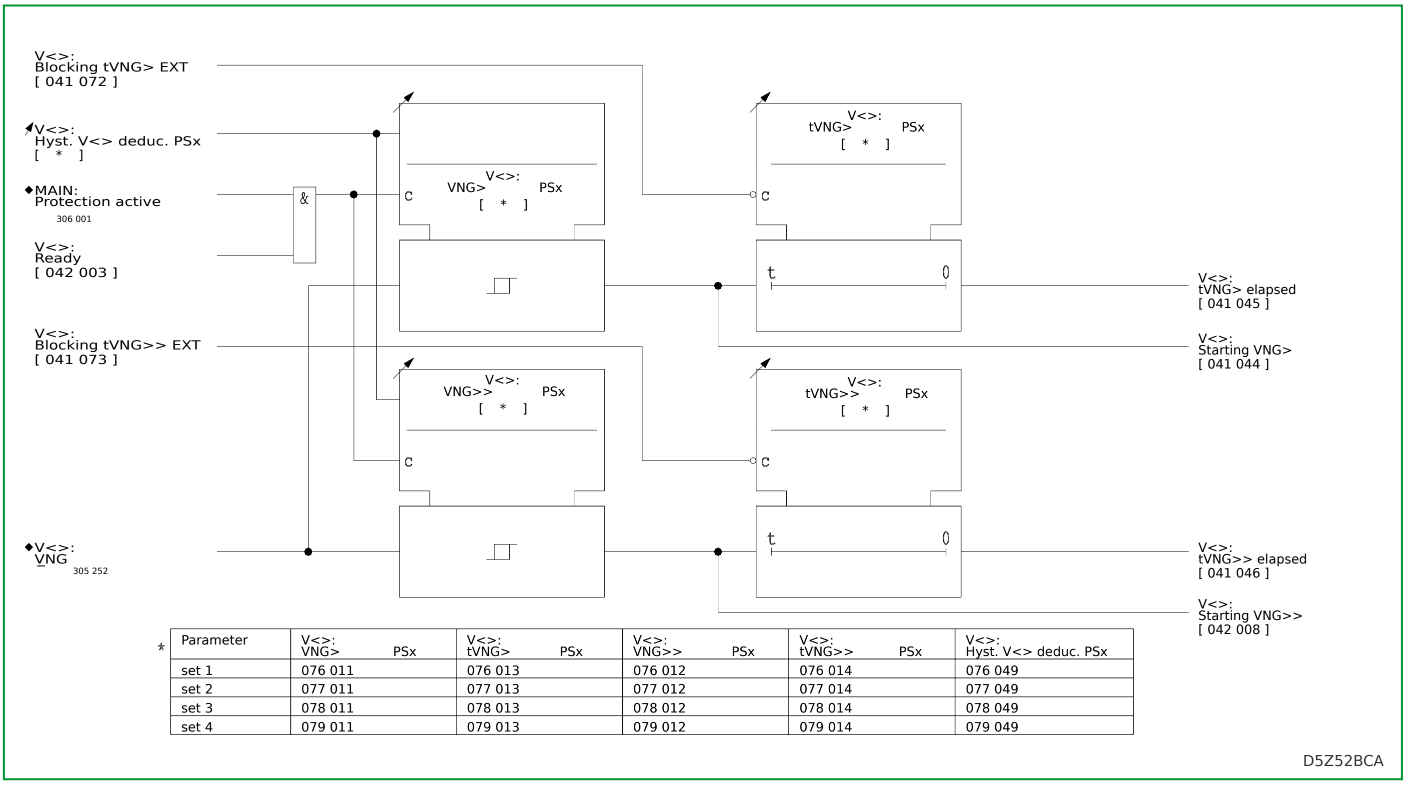
3.34.6 Monitoring the Neutral-Point Displacement Voltage

Depending on the setting, the V<> function monitors either the neutral-point displacement voltage calculated by the P139 from the three phase-to-ground voltages or the neutral-point displacement voltage formed externally via the fourth voltage measuring input, for example the neutral-point displacement voltage from the open delta winding of the voltage transformers (see Section 3.11, (p. 3-79)). The neutral-point displacement voltage is monitored to determine whether it exceeds set thresholds. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs.



Parameter	V<>: Evaluation VNG PSx
set 1	076 002
set 2	077 002
set 3	078 002
set 4	079 002

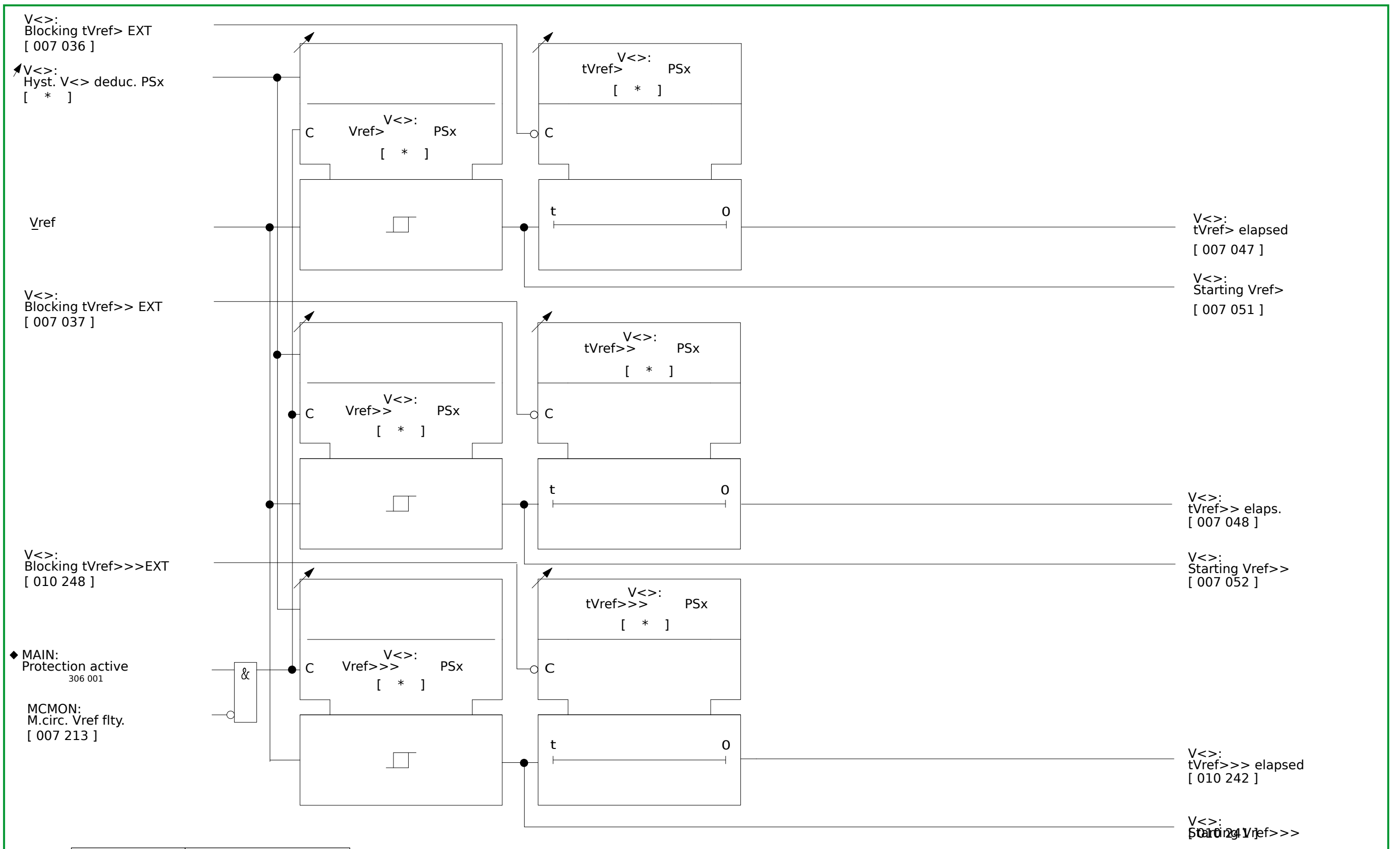
Fig. 3-255: Selecting the measured value.



Parameter	V<>: VNG> PSx	V<>: tVNG> PSx	V<>: VNG>> PSx	V<>: tVNG>> PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 011	076 013	076 012	076 014	076 049
set 2	077 011	077 013	077 012	077 014	077 049
set 3	078 011	078 013	078 012	078 014	078 049
set 4	079 011	079 013	079 012	079 014	079 049

Fig. 3-256: Monitoring the neutral-point displacement voltage.

3.34.7 Monitoring the Reference Voltage



* Parameter	V<>: Hyst. V<> deduc. PSx
set 1	076 049
set 2	077 049
set 3	078 049
set 4	079 049

* Parameter	V<>: Vref> PSx	V<>: tVref> PSx	V<>: Vref>> PSx	V<>: tVref>> PSx	V<>: Vref>>> PSx	V<>: tVref>>> PSx
set 1	007 064	007 066	007 065	007 067	007 065	007 067
set 2	007 071	007 069	007 068	007 070	007 068	007 070
set 3	007 075	007 073	007 072	007 074	007 072	007 074
set 4	007 079	007 077	007 076	007 078	007 076	007 078

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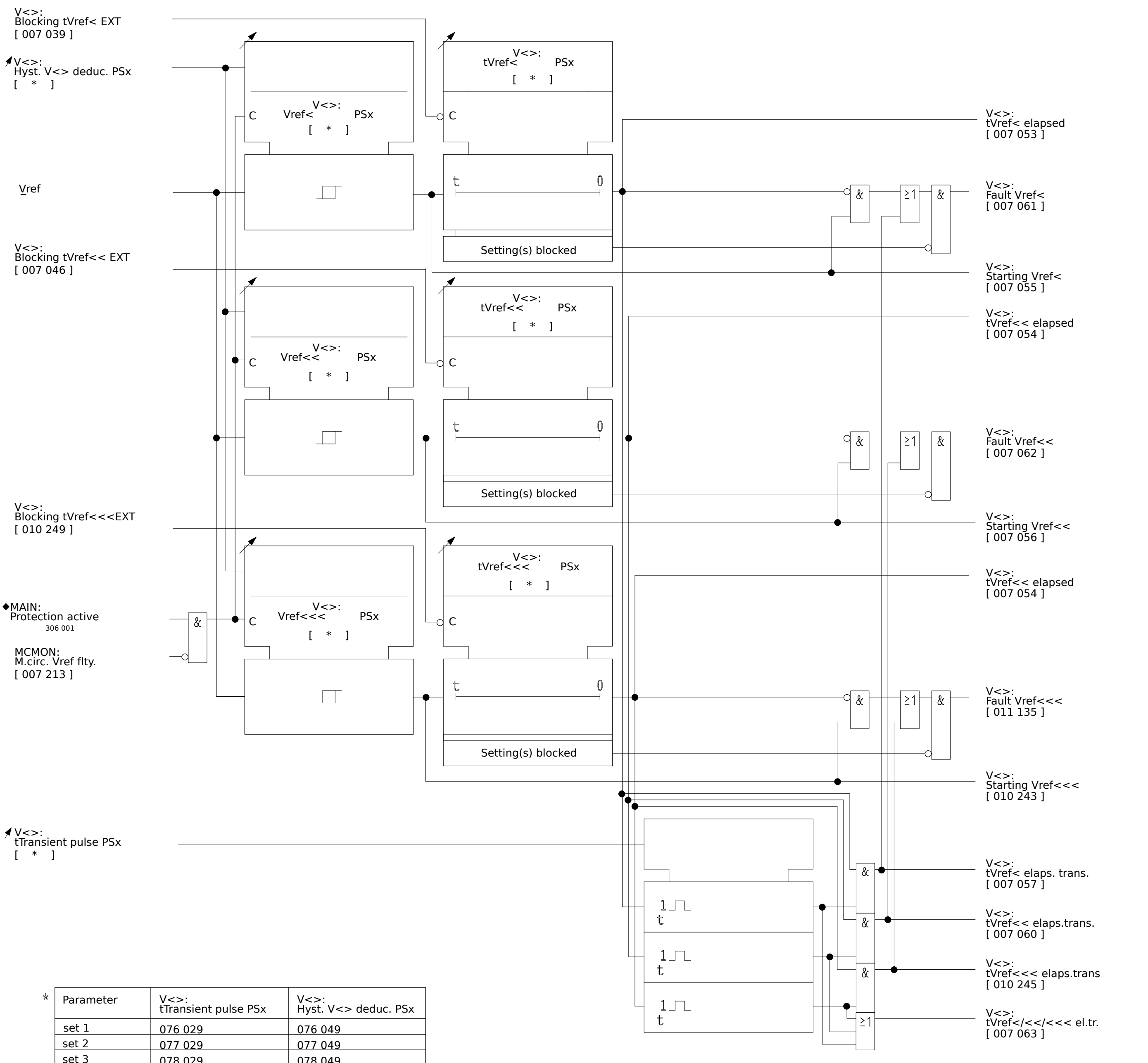
Fig. 3-257: Monitoring the reference voltage, part 1: stages Vref>/>>/>>>.

The reference voltage is monitored to determine whether it exceeds or falls below set thresholds. The triggers are followed by respective timer stages that can be blocked via appropriately configured binary signal inputs.



* Parameter	V<>: tTransient pulse PSx	V<>: Hyst. V<> deduc. PSx
set 1	076 029	076 049
set 2	077 029	077 049
set 3	078 029	078 049
set 4	079 029	079 049

* Parameter	V<>: Vref< PSx	V<>: tVref< PSx	V<>: Vref<< PSx	V<>: tVref<< PSx	V<>: Vref<<< PSx	V<>: tVref<<< PSx
set 1	007 086	007 088	007 087	007 096	011 059	011 071
set 2	007 097	007 099	007 098	007 100	011 062	011 072
set 3	007 101	007 103	007 102	007 104	011 069	011 073
set 4	007 105	007 107	007 106	007 108	011 070	011 074

19Z8096A

Fig. 3-258: Monitoring the reference voltage, part 2: stages Vref</<</<<<.

3.35 Over-/Underfrequency Protection (Function Group f<>)

The P139 monitors the voltage to determine whether it exceeds or falls below set frequencies.

The frequency is determined from the difference in time between the zero crossings of the voltage (voltage zeroes). The evaluation time and the measurement loop on which the frequency determination is based are settable. The evaluation is blocked if the voltage in the selected loop falls below a settable threshold, see Section 3.11.8, (p. 3-102).

The over-/underfrequency protection function has five stages. The operation of over-/underfrequency protection will be explained below using the first stage as an example.

3.35.1 Disabling or Enabling Over-/Underfrequency Protection

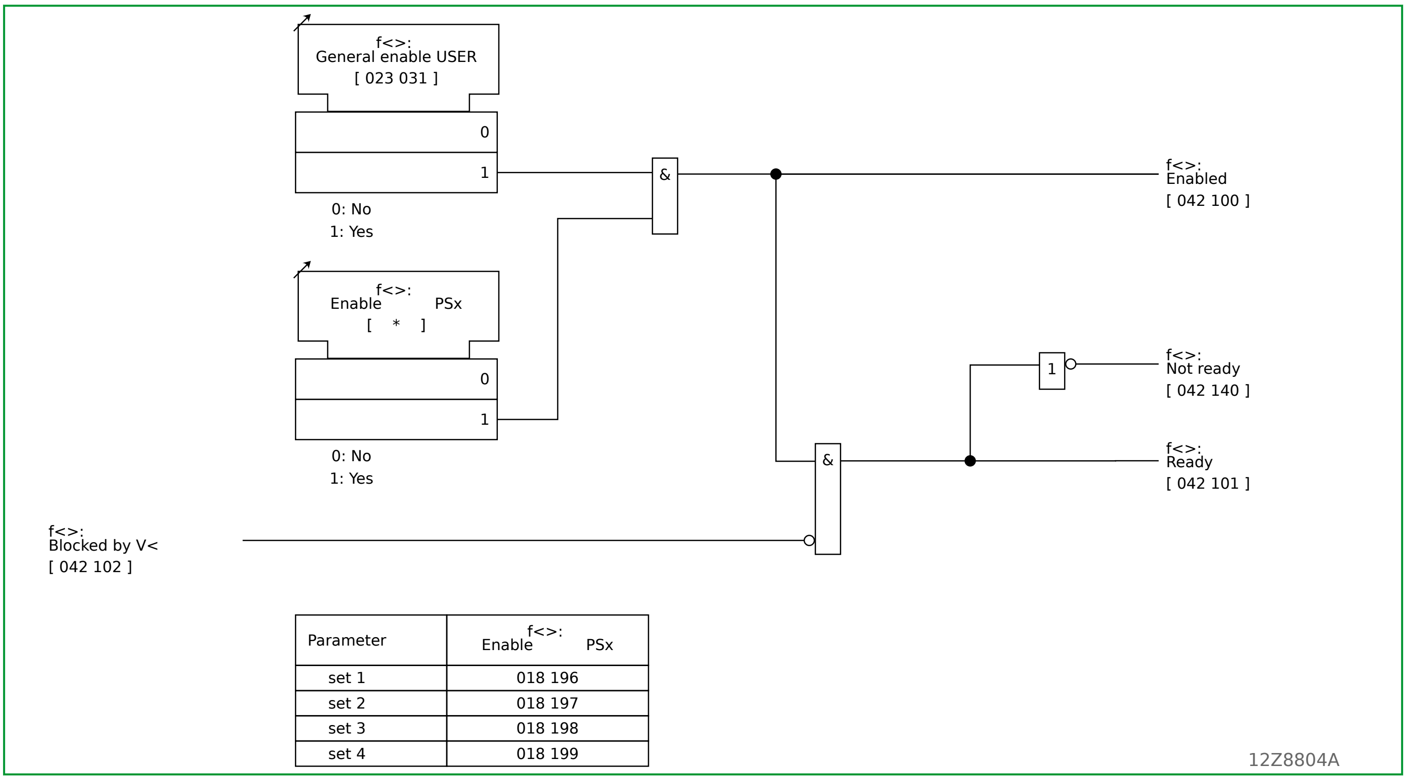


Fig. 3-259: Enabling, disabling and readiness of f<> protection.

The frequency protection can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

3.35.2 Operating Modes of Over-/Underfrequency Protection

For each stage of the over-/underfrequency protection function, the user can choose between the following operating modes:

- Frequency monitoring
- Frequency monitoring combined with differential frequency gradient monitoring (df/dt)
- Frequency monitoring combined with mean frequency gradient monitoring (Δf/Δt)

3.35.3 Frequency Monitoring

Depending on the setting, the P139 monitors the frequency to determine whether it exceeds or falls below set thresholds. If an operate threshold in excess of the set nominal frequency is set, the P139 checks to determine whether the frequency exceeds the operate threshold. If an operate threshold below the set nominal frequency is set, the P139 checks to determine whether the frequency falls below the operate threshold. If it exceeds or falls below the set threshold, a set timer stage is started. The timer stage can be blocked by way of an appropriately configured binary signal input.

3.35.4 Frequency Monitoring Combined with Differential Frequency Gradient Monitoring (df/dt)

In this operating mode of the over-/ underfrequency protection function, the frequency is also checked to determine whether the set frequency gradient is reached (in addition to being monitored for exceeding or falling below the set threshold). Monitoring for overfrequency is combined with monitoring for a frequency increase; monitoring for underfrequency is combined with monitoring for a frequency decrease. If both operate conditions are satisfied, a set timer stage is started. The timer stage can be blocked by way of an appropriately configured binary signal input.

3.35.5 Frequency Monitoring Combined with Mean Frequency Gradient Monitoring (Δf/Δt)

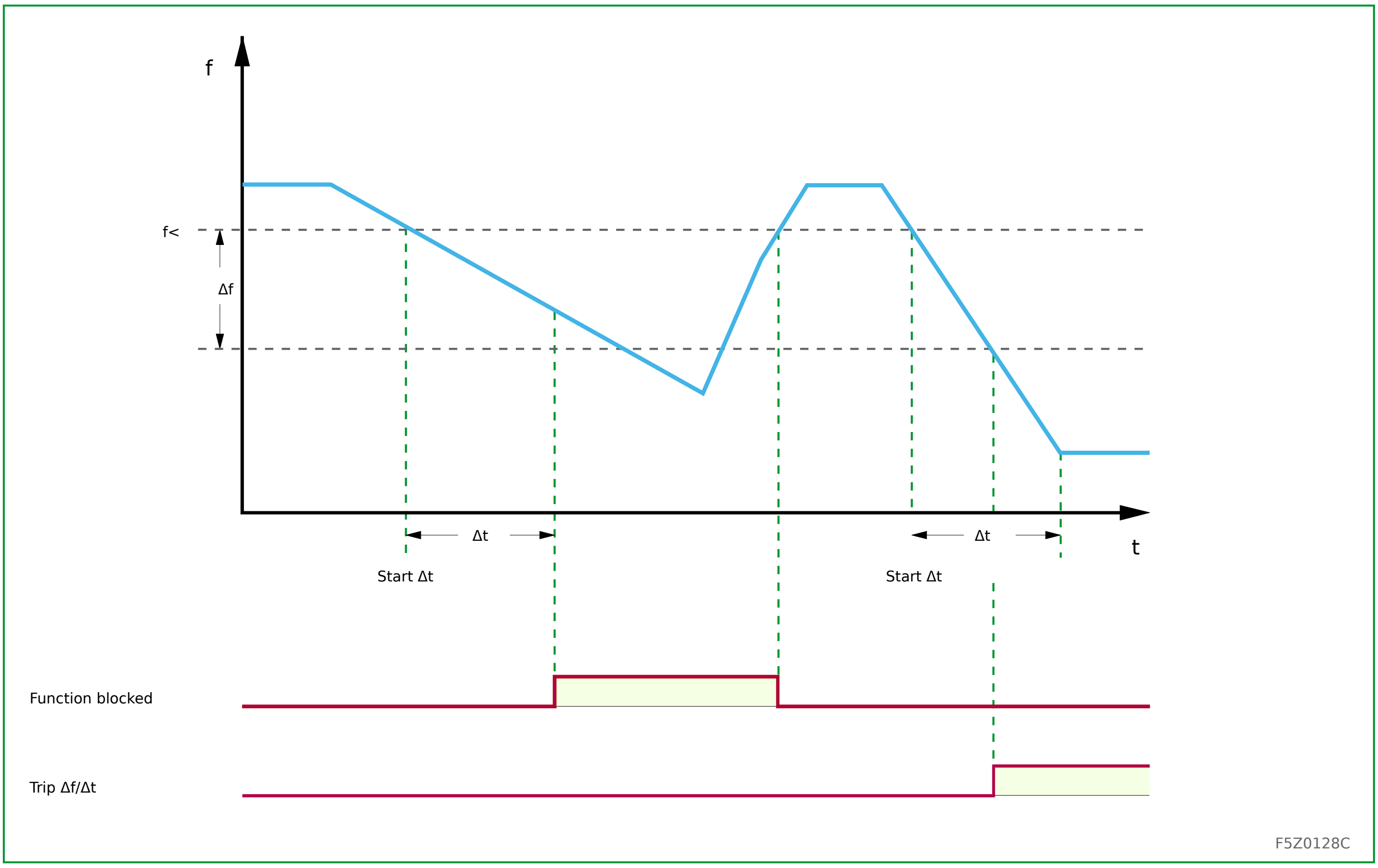
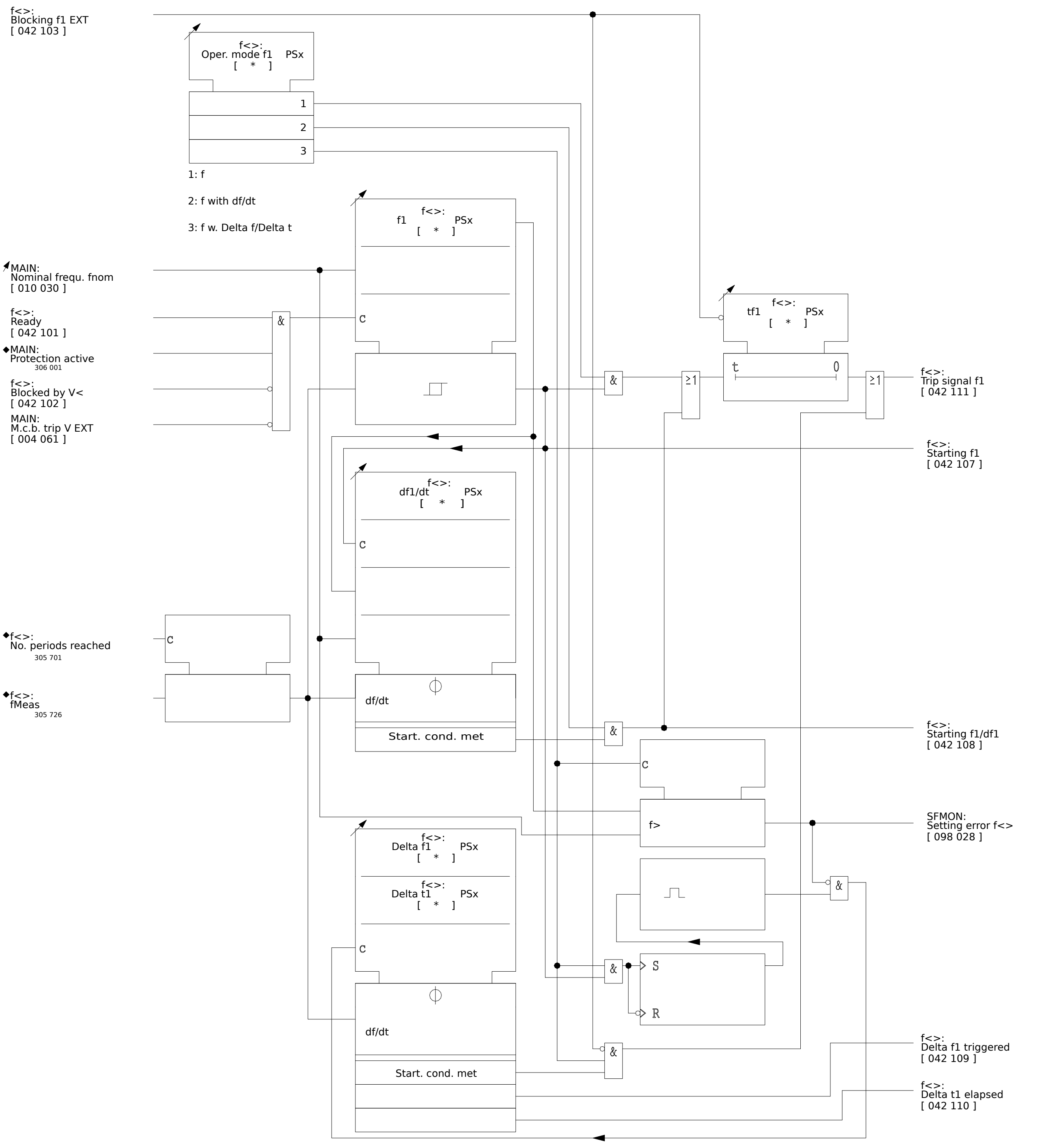


Fig. 3-260: Operation of frequency monitoring combined with Δf/Δt monitoring.

The frequency gradient can differ for system disturbances in individual substations and may vary over time due to power swings. Therefore it makes sense to take the mean value of the frequency gradient into account for load-shedding systems.

In this operating mode of over-/underfrequency protection, frequency monitoring must be set for “underfrequency monitoring”.

Monitoring the mean value of the frequency gradient is started with the starting of frequency monitoring. If the frequency decreases by the set value Δf within the set time Δt, then the Δf/Δt monitoring function operates instantaneously and generates a trip signal. If a frequency change does not lead to an operate decision of the monitoring function, then the Δf/Δt monitoring function will be blocked until the underfrequency monitoring function drops out. The trip signal can be blocked by way of an appropriately configured binary signal input.



* Parameter	f<>: Oper. mode f1 PSx	f<>: f1 PSx	f<>: df1/dt PSx	f<>: Delta f1 PSx	f<>: Delta t1 PSx	f<>: tf1 PSx
set 1	018 120	018 100	018 108	018 112	018 116	018 104
set 2	018 121	018 101	018 109	018 113	018 117	018 105
set 3	018 122	018 102	018 110	018 114	018 118	018 106
set 4	018 123	018 103	018 111	018 115	018 119	018 107

47Z0152A

Fig. 3-261: First stage of the over-/ underfrequency protection function.

3.35.6 f_{min}-/f_{max} Measurement

For the acquisition of the minimum frequency during an underfrequency condition and for the acquisition of the maximum frequency during an overfrequency condition, the two following measured event values are available:

- f<>: Max. frequ. for f>
- f<>: Min. frequ. for f<

Both measured event values are reset automatically at the onset of a new overfrequency or underfrequency situation. A manual reset is also possible:

- f<>: Reset meas.val. USER

3.36 Underfrequency Load Shedding Protection (Function Group Pf<)

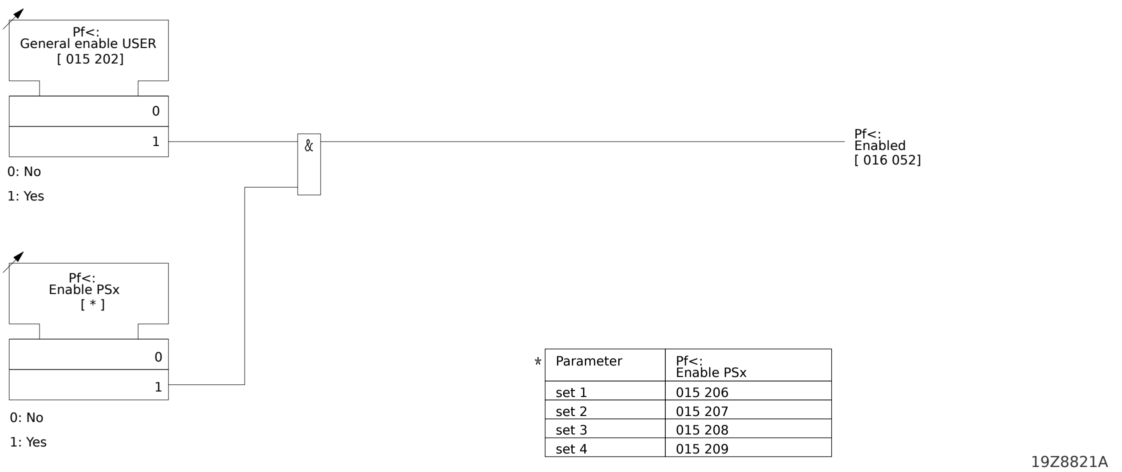
Underfrequency load shedding is used to prevent an electrical network from outages (blackouts). If the system frequency is below a certain threshold, the connected loads are disconnected to prevent further frequency decay. The P139 monitors the frequency and active power to determine whether underfrequency load shedding will be operate.

The evaluation time and the measurement loop on which the frequency determination is based are settable. The evaluation is blocked if the voltage in the selected loop falls below a settable threshold, see Section 3.11.8, (p. 3-102).

The Pf< function has ten underfrequency stages. The operation of the Pf< function will be explained below using the first stage as an example.

3.36.1 Disabling or Enabling Pf< Protection

The underfrequency load shedding protection can be disabled or enabled using setting parameters. Moreover, enabling can be carried out separately for each parameter subset.



* Parameter	Pf<: Enable PSx
set 1	015 206
set 2	015 207
set 3	015 208
set 4	015 209

Fig. 3-262: Enabling or disabling Pf< protection.

3.36.2 Pf< Readiness and Blocking

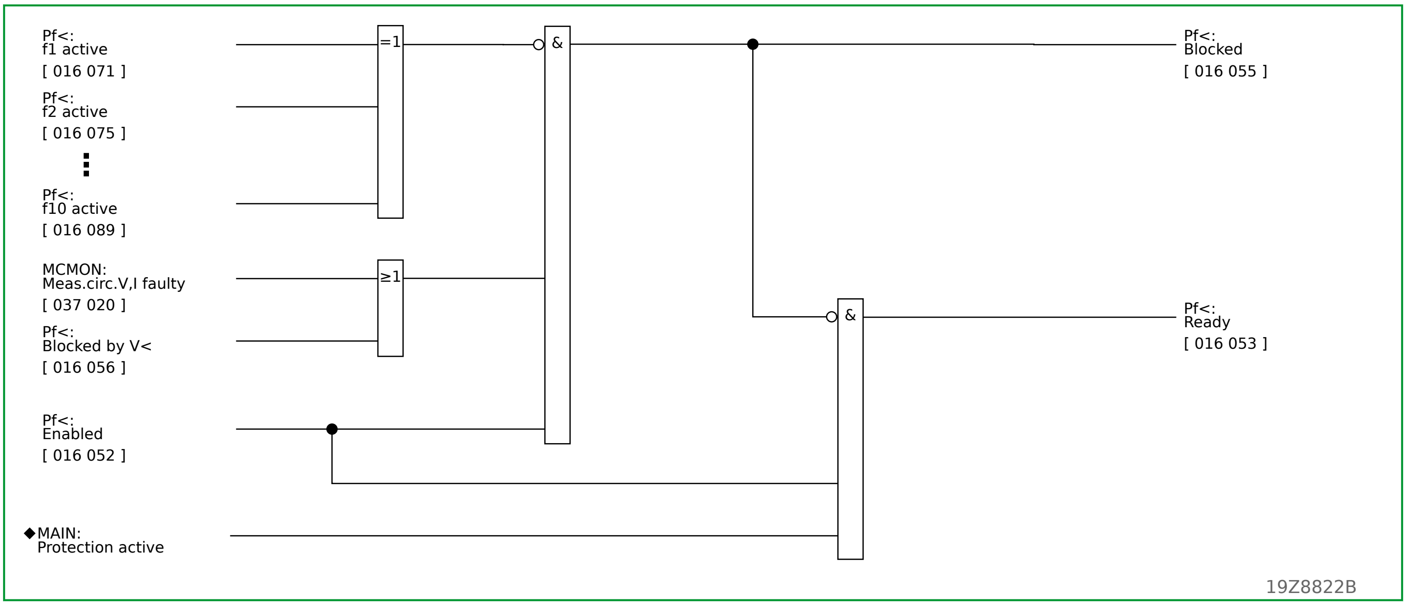


Fig. 3-263: Pf< readiness and blocking.

The frequency calculation depends on the measured voltages. The active power calculation depends on the measured voltages and currents. Therefore the function group Pf< can only be configured in devices with voltage and current inputs.

Under certain conditions the Pf< will be blocked and the signal Pf<: Blocked will be issued, provided that one of the following conditions is met:

- Frequency measurement is not possibe. Pf<: Blocked by V< is issued.
- A voltage or current measuring circuits defect has been identified (by internal functions MCMON: Meas.circ.V,I faulty).
- No frequency stage has been activated.

Pf< protection can only start if the Pf< is ready. For the purpose the following conditions need to be met simultaneously:

- Protection is activated (on).
- Pf< is enabled.
- Pf< is not blocked.

3.36.3 Active Power Characteristic

The Pf< function monitors the system frequency and active power.

If the frequency drops below the active threshold the active power is evaluated.

The active power check is bypassed, if Pf<: Pmin PSx is set to blocked. Then underfrequency load shedding will operate evaluating frequency threshold only.

The directional active power decision blocks Pf<: Trip signal Pf<, if all 3 following conditions are present, as sketched in Fig. 3-264, (p. 3-337):

- All three phase currents exceed Pf<: Imin PSx.
- The active power is above Pf<: Pmin PSx.
- The angle of the apparent power is within the set Pf<: Sector angle PSx for the set operation direction. (Power direction check see Section 10.2.6, (p. 10-7))

  For forward directional setting: $-90^{\circ}+\varphi \leq \varphi_S \leq 90^{\circ}-\varphi$

  For backward directional setting:

  $90^{\circ}+\varphi \leq \varphi_S \leq 180^{\circ} or -180^{\circ} \leq \varphi_S \leq -90^{\circ}-\varphi$

  Sector angle: φ

  Measured apparent power angle: φ_S

Pf<: Starting Pf< is released, if no blocking by active power is evaluated.

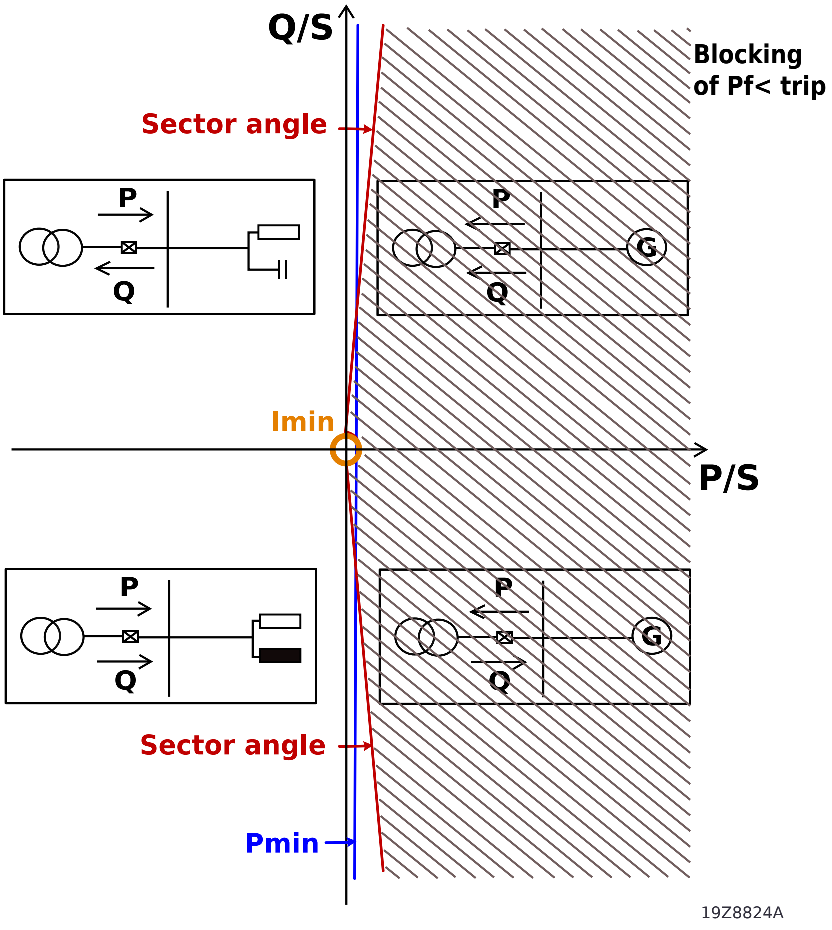
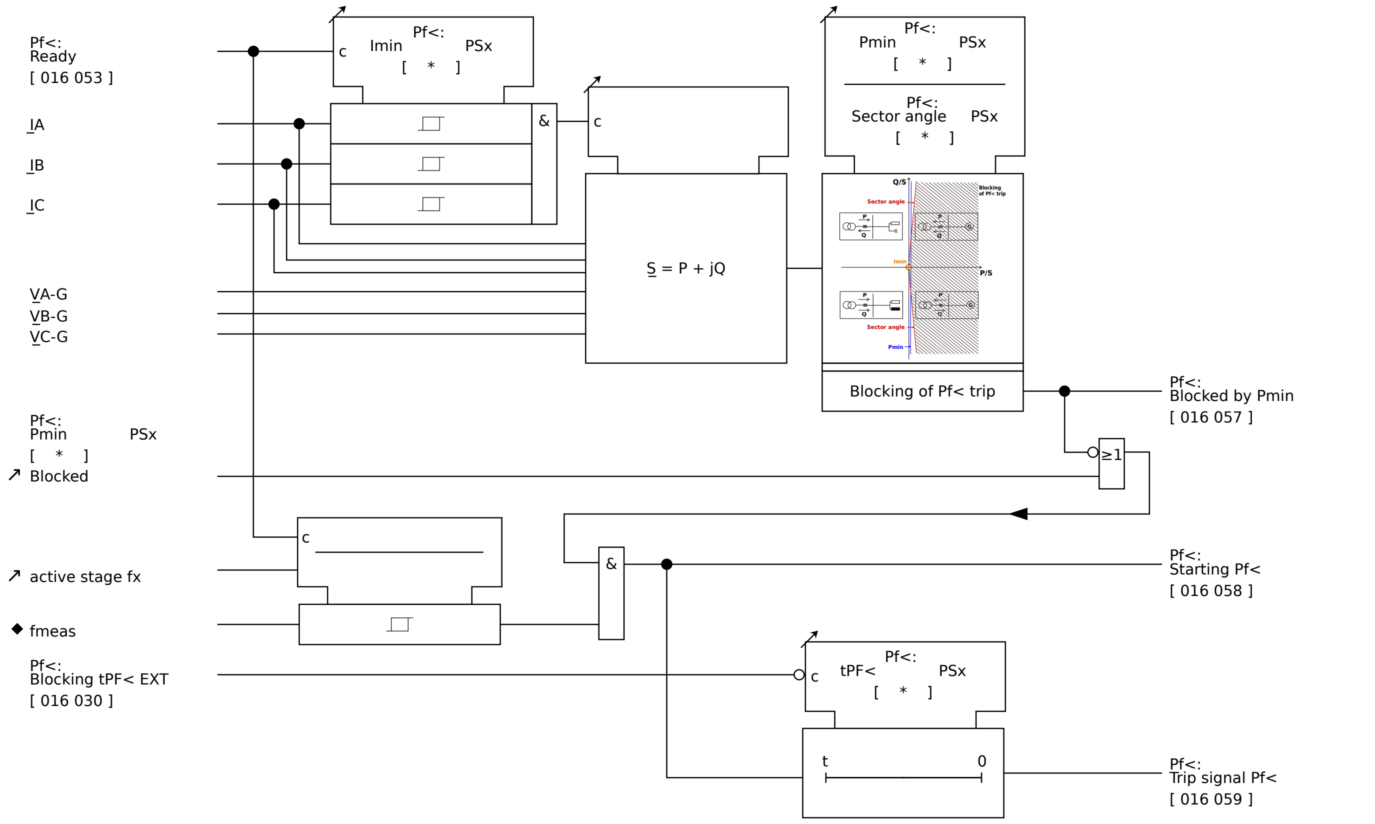


Fig. 3-264: Blocking of forward directional active power.

If the active power check generates a trip enabling decision then the starting of the underfrequency stage triggers the timer stage (016 004) Pf<: tPF< PSx. After the timer has elapsed the trip signal (016 059) Pf<: Trip signal Pf< is issued. The timer stage can be blocked by the binary input signal (016 030) Pf<: Blocking tPF< EXT. Moreover, it is reset if the underfrequency decision or the active power decision is dropped.



Parameter	Pf<: Pmin PSx	Pf<: Imin PSx	Pf<: Sector angle PSx	Pf<: tPF< PSx
set 1	016 012	016 022	016 026	016 004
set 2	016 016	016 023	016 027	016 005
set 3	016 020	016 024	016 028	016 006
set 4	016 021	016 025	016 029	016 007

19Z8823B

Fig. 3-265: Pf< tripping logic.

3.36.4 Remote and Local Choice of Active Frequency Stage

The active frequency stage can be selected using local inputs (e. g. function keys, binary inputs) or using remote access via communication (e. g. IEC 60870-5-103 controls, IEC 61850 GOOSE, ...).

The rising edge of an “Activate”-signal `Pf<: Activate fx EXT` or execution of a `Pf<: Trigger fx` command will trigger the activation. A permanently active binary input signal does not affect the selection. This is also true if there is already any number of “Activate”-signals present, i. e. only the last rising edge is processed. Only if several frequency stages get selected via binary inputs at the same time then all these selections are ignored and the last correctly enabled stage remains active.

In the same way does the rising edge of the input signal (016 051) `Pf<: Deactivate fn EXT` or execution of the command (016 200) `Pf<: Trigger Deactivate` deselect the selection, with the consequence that then no frequency stage is active and the signal (016 055) `Pf<: Blocked` is issued.

The information about the active stage is permanently stored by the P139 (i. e. in non-volatile memory) so that it gets activated again automatically after a warm restart.

3.37 Directional Power Protection (Function Group P<>)

The power directional protection function determines the active and reactive power from the fundamental currents and voltages. The sign of the active or the reactive power, respectively, is evaluated for direction determination

3.37.1 Disabling and Enabling P<> Protection

The power directional protection can be disabled or enabled via setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

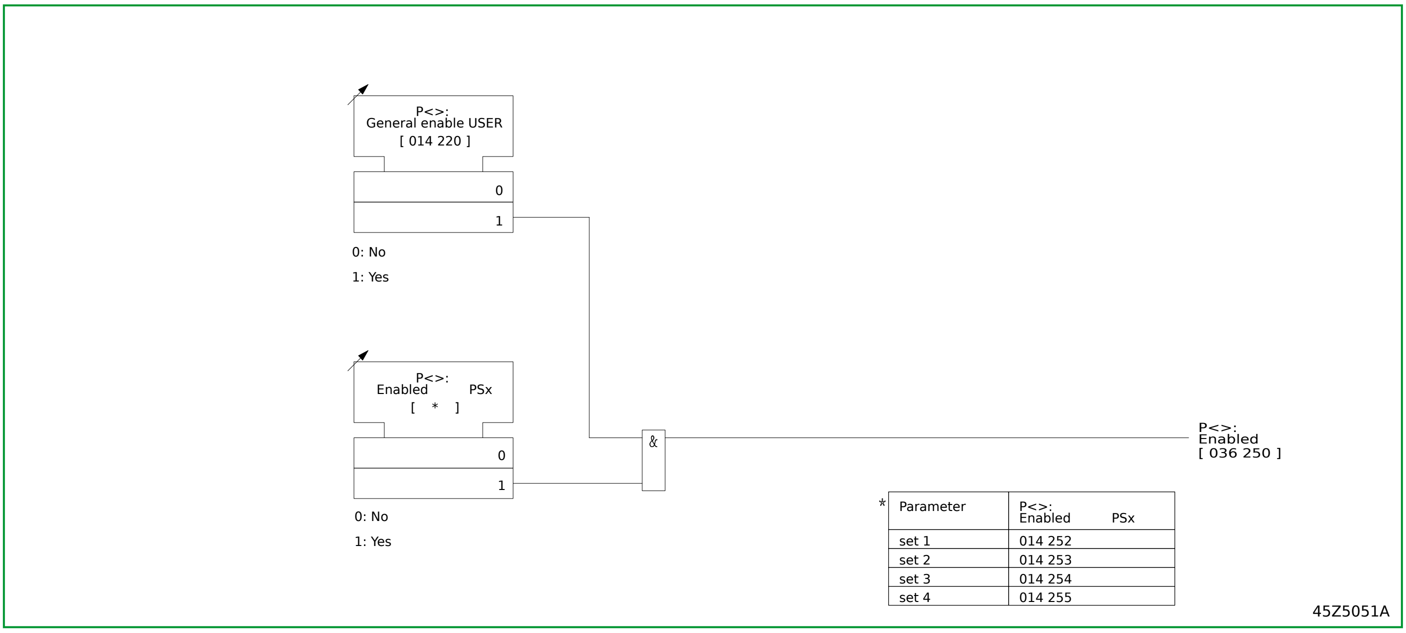


Fig. 3-266: Enabling or disabling power directional protection.

3.37.2 Power Determination

The P139 determines the active and reactive power from the three phase currents and the phase-to-ground voltages. If the measuring-circuit monitoring function detects malfunctioning in the voltage measuring circuit, power determination will be blocked.

3.37.3 Power Monitoring

The P139 checks the determined power values to detect whether they exceed or fall below set thresholds. The triggers are followed by timer stages that can be blocked via appropriately configured binary signal inputs.

If the decisions of power monitoring are to be included in the trip commands when values have fallen below set thresholds, then it is recommended that transient signals be used. Otherwise the trip command would always be present when the system voltage was disconnected, and it would therefore not be possible to close the circuit breaker again.

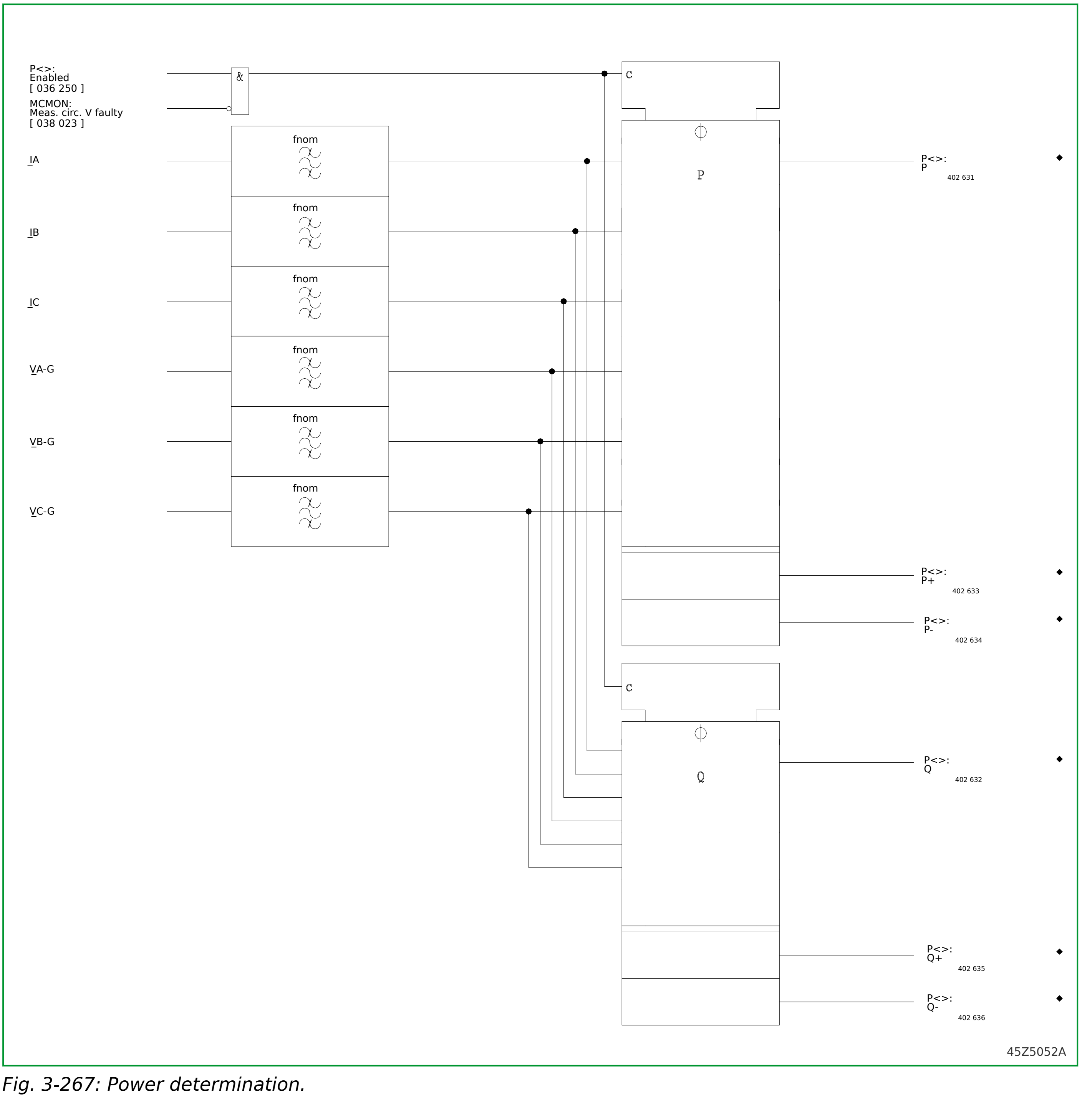
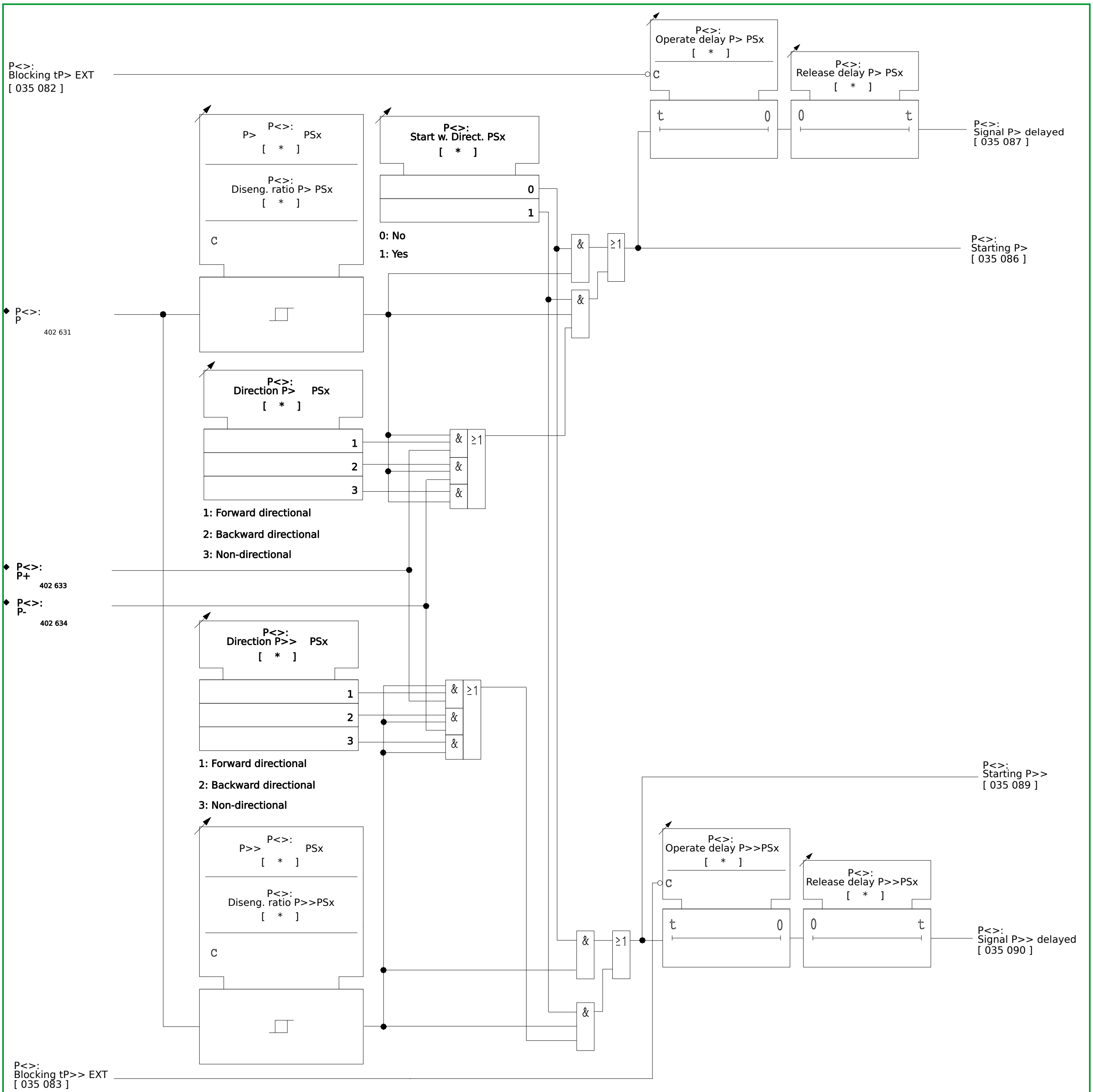


Fig. 3-267: Power determination.

3.37.4 Active Power P> Starting



*

Parameter	P<>: P> PSx	P<>: Diseng. ratio P> PSx	P<>: Operate delay P> PSx	P<>: Release delay P> PSx	P<>: Direction P> PSx	P<>: Start w. Direct. PSx
set 1	017 120	017 124	017 128	017 132	017 136	021 074
set 2	017 200	017 125	017 129	017 133	017 137	021 075
set 3	017 201	017 126	017 130	017 134	017 138	021 076
set 4	017 202	017 127	017 131	017 135	017 139	021 077

Parameter	P<>: P>> PSx	P<>: Diseng. ratio P>>PSx	P<>: Operate delay P>>PSx	P<>: Release delay P>>PSx	P<>: Direction P>> PSx
set 1	017 140	017 144	017 148	017 152	017 156
set 2	017 141	017 145	017 149	017 153	017 157
set 3	017 142	017 146	017 150	017 154	017 158
set 4	017 143	017 147	017 151	017 155	017 159

19Z9101A

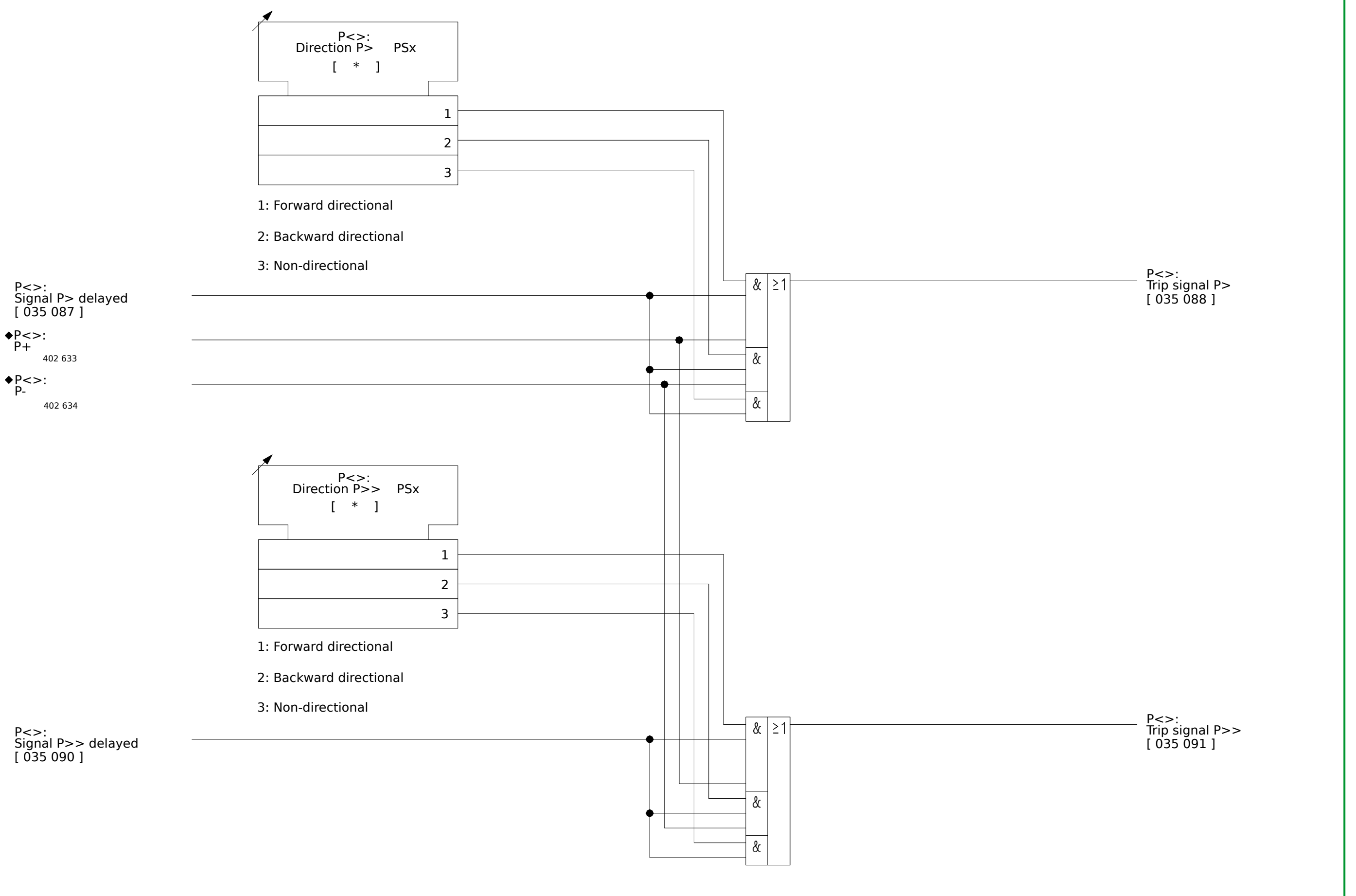
Fig. 3-268: Active power monitoring when the set thresholds are exceeded.

The P139 monitors the active power with two-stage functions to detect when it exceeds the set thresholds. The resetting ratio of the threshold stages can be set.

When the active power exceeds the set thresholds, a starting signal depends on the P<>: Start w. Direct. PSx. If P<>: Start w. Direct. PSx is set to yes, measured direction should match the set direction, or the starting signal will not issued. The starting signal is followed by the set operate and resetting delays.

3.37.5 Active Power P> Tripping

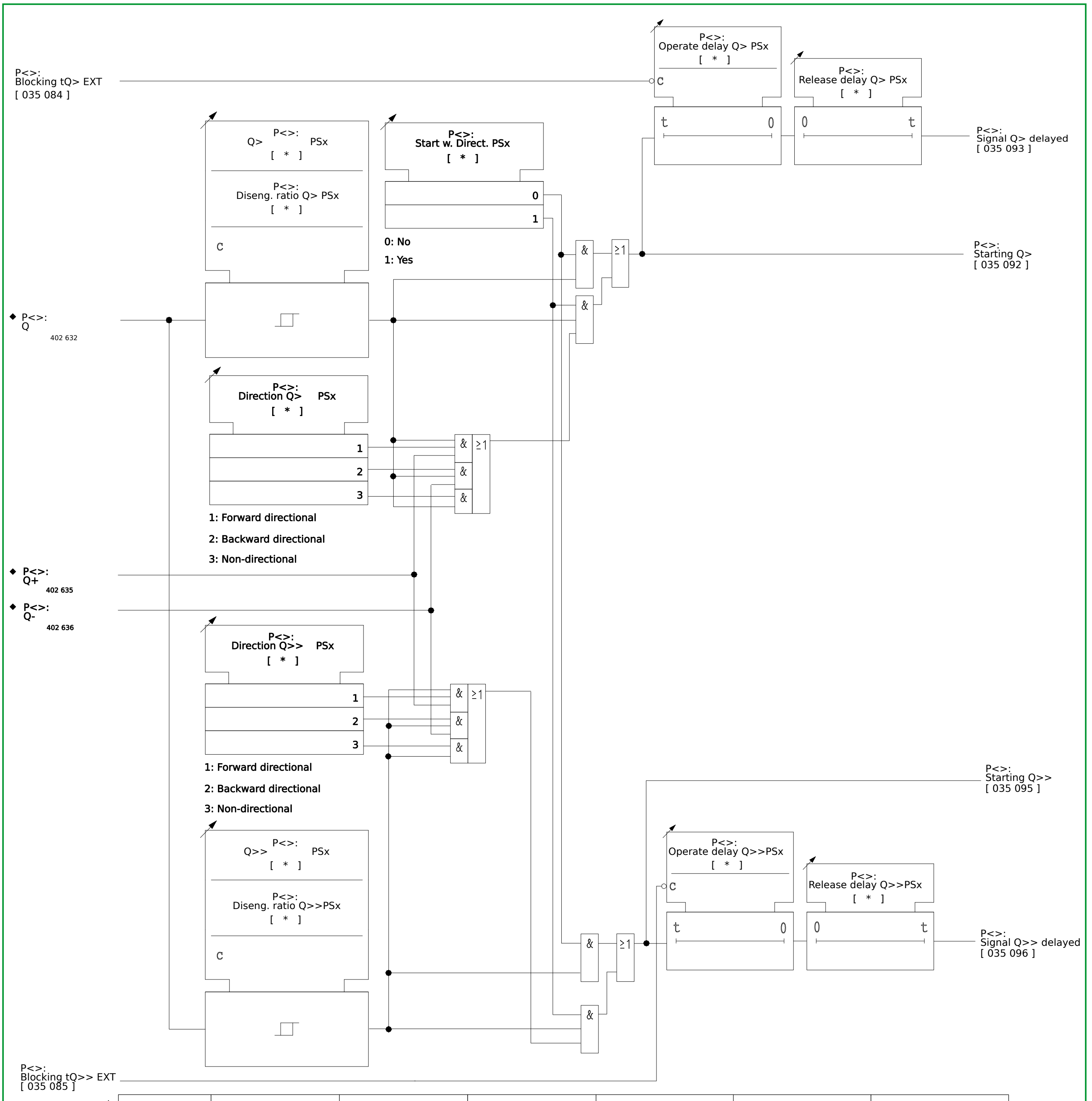
The P139 determines the sign of the active power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward- (reverse-) directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward- (reverse-) directional or a non-directional decision.



* Parameter	P<>: Direction P> PSx	P<>: Direction P>> PSx
set 1	017 136	017 156
set 2	017 137	017 157
set 3	017 138	017 158
set 4	017 139	017 159

Fig. 3-269: Direction-dependent trip signal of the active power protection function when the set thresholds are exceeded.

3.37.6 Reactive Power Q> Starting



*

Parameter	P<>: Q> PSx	P<>: Diseng. ratio Q> PSx	P<>: Operate delay Q> PSx	P<>: Release delay Q> PSx	P<>: Direction Q> PSx	P<>: Start w. Direct. PSx
set 1	017 160	017 164	017 168	017 172	017 176	021 074
set 2	017 161	017 165	017 169	017 173	017 177	021 075
set 3	017 162	017 166	017 170	017 174	017 178	021 076
set 4	017 163	017 167	017 171	017 175	017 179	021 07

Parameter	P<>: Q>> PSx	P<>: Diseng. ratio Q>>PSx	P<>: Operate delay Q>>PSx	P<>: Release delay Q>>PSx	P<>: Direction Q>> PSx
set 1	017 180	017 184	017 188	017 192	017 196
set 2	017 181	017 185	017 189	017 193	017 197
set 3	017 182	017 186	017 190	017 194	017 198
set 4	017 183	017 187	017 191	017 195	017 199

19Z9102A

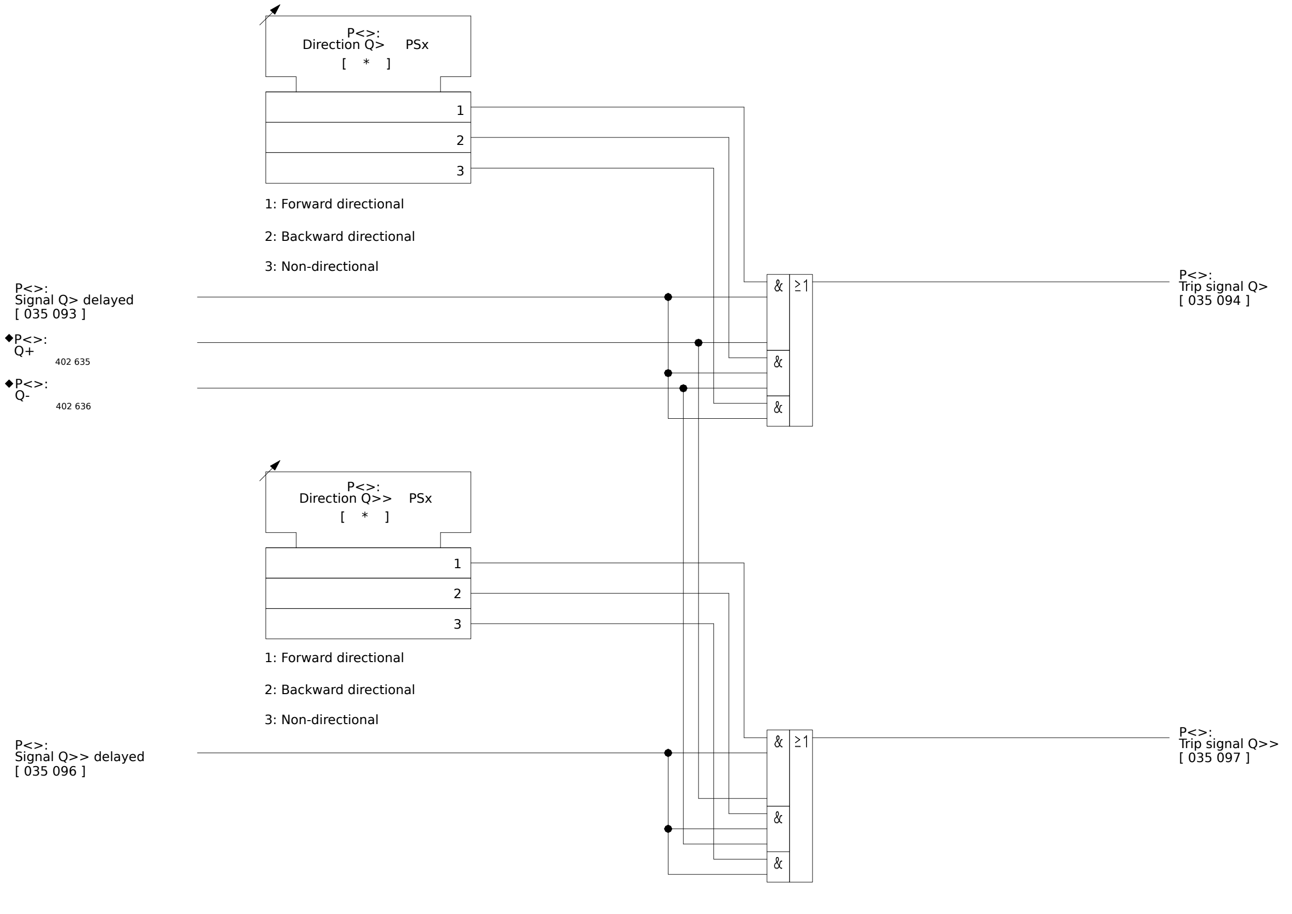
Fig. 3-270: Reactive power monitoring when the set thresholds are exceeded.

The P139 monitors the reactive power with two-stage functions to detect when it exceeds the set thresholds. The resetting ratio of the threshold stages can be set.

When the reactive power exceeds the set thresholds, a starting signal depends on the `P<>: Start w. Direct. PSx`. If `P<>: Start w. Direct. PSx` is set to yes, measured direction should match the set direction, or the starting signal will not issued. The starting signal is followed by the set operate and resetting delays.

3.37.7 Reactive Power Q> Tripping

The P139 determines the sign of the reactive power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward- (reverse-) directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward- (reverse-) directional or a non-directional decision.

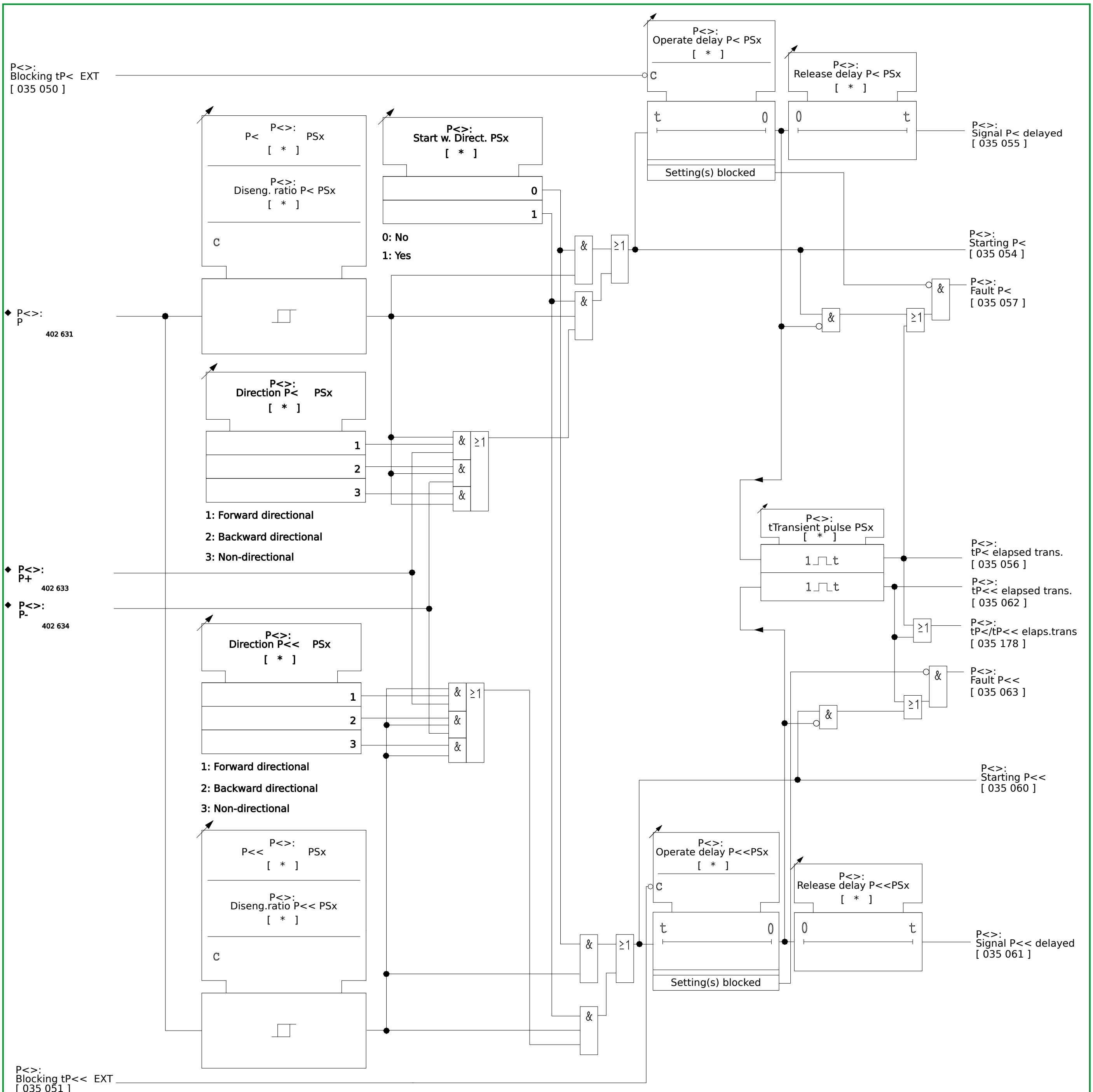


* Parameter	P<>: Direction Q> PSx	P<>: Direction Q>> PSx
set 1	017 176	017 196
set 2	017 177	017 197
set 3	017 178	017 198
set 4	017 179	017 199

45Z5056A

Fig. 3-271: The direction-dependent trip signal of the reactive power protection function when the set thresholds are exceeded.

3.37.8 Active Power P< Starting



* Parameter	P<>: P< PSx	P<>: Diseng. ratio P< PSx	P<>: Operate delay P< PSx	P<>: Release delay P< PSx	P<>: Direction P< PSx	P<>: Start w. Direct. PSx
set 1	017 030	017 034	017 060	017 226	017 230	021 074
set 2	017 031	017 035	017 061	017 227	017 231	021 075
set 3	017 032	017 036	017 062	017 228	017 232	021 076
set 4	017 033	017 037	017 063	017 229	017 233	021 077

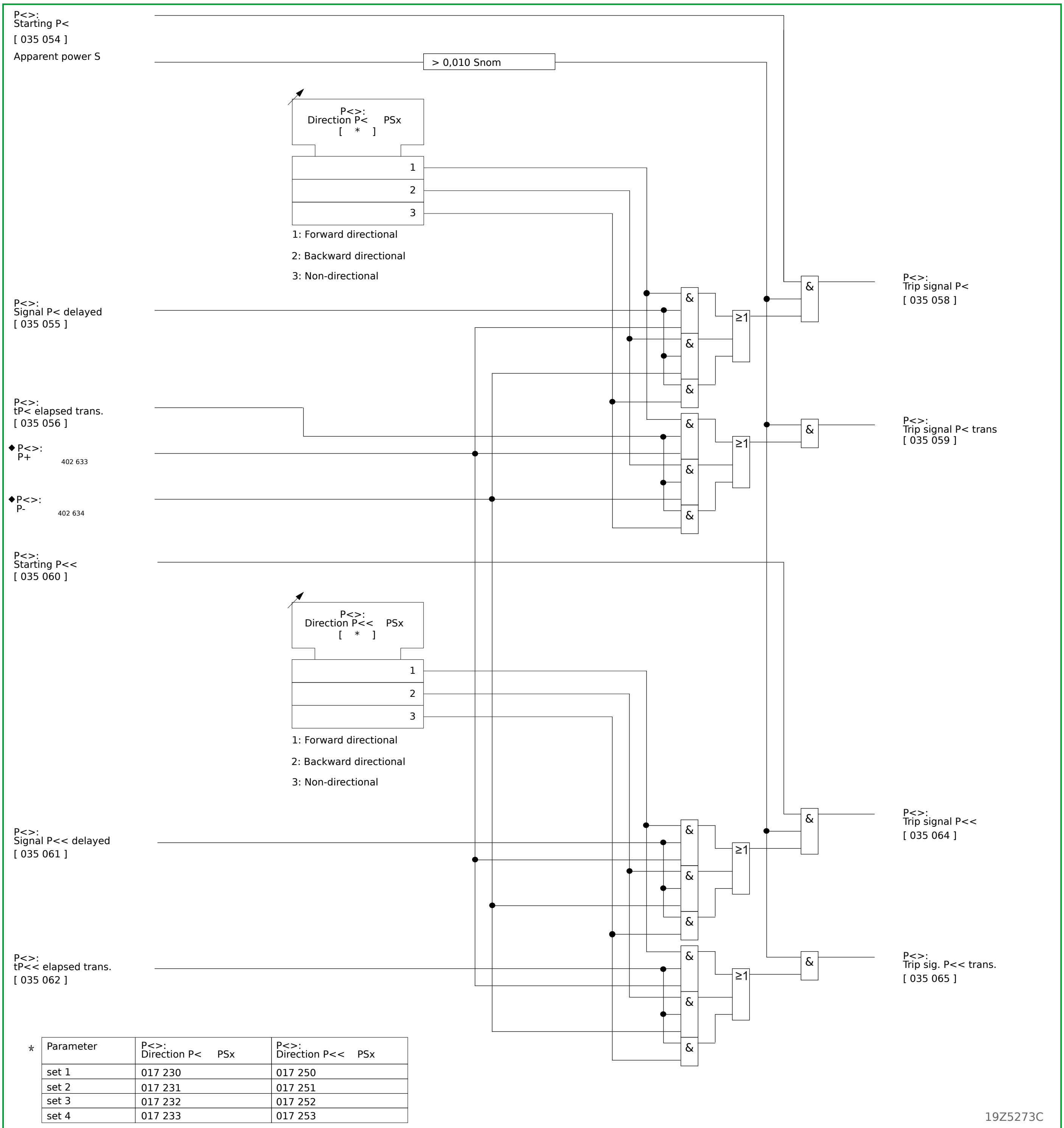
* Parameter	P<>: P<< PSx	P<>: Diseng.ratio P<< PSx	P<>: Operate delay P<<PSx	P<>: Release delay P<<PSx	P<>: Direction P<< PSx	P<>: tTransient pulse PSx
set 1	017 234	017 238	017 242	017 246	017 250	018 246
set 2	017 235	017 239	017 243	017 247	017 251	018 247
set 3	017 236	017 240	017 244	017 248	017 252	018 248
set 4	017 237	017 241	017 245	017 249	017 253	018 249

19Z9103A

Fig. 3-272: Active power monitoring when values fall below set thresholds.

The P139 monitors the active power with two-stage functions to detect when it falls below the set thresholds. The resetting ratio of the threshold stages can be set. When the active power falls below the set thresholds, a starting signal depends on the P<>: Start w. Direct. PSx. If P<>: Start w. Direct. PSx is set to yes, measured direction should match the set direction, or the starting signal will not issued. The starting signal is followed by the set operate and resetting delays.

3.37.9 Active Power P< Tripping

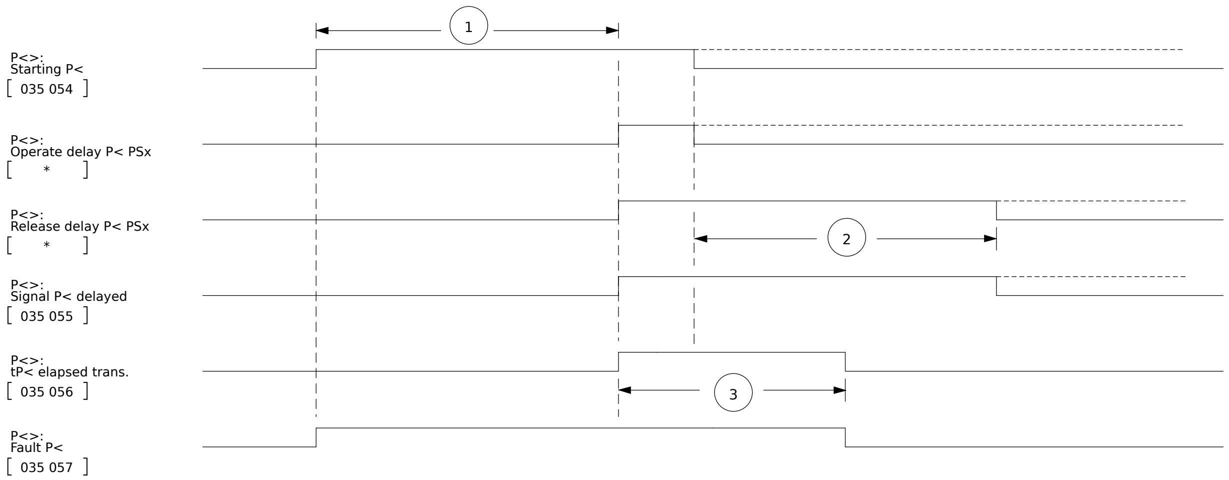


Parameter	P<>: Direction P< PSx	P<>: Direction P<< PSx
set 1	017 230	017 250
set 2	017 231	017 251
set 3	017 232	017 252
set 4	017 233	017 253

Fig. 3-273: The direction-dependent trip signal of the active power protection function when values fall below set thresholds.

The P139 determines the sign of the active power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward- (reverse-)

directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward- (reverse-) directional or a non-directional decision.



	1	2	3
* Parameter	P<>: Operate delay P< PSx	P<>: Release delay P< PSx	P<>: tTransient pulse PSx
set 1	017 060	017 226	018 246
set 2	017 061	017 227	018 247
set 3	017 062	017 228	018 248
set 4	017 063	017 229	018 249

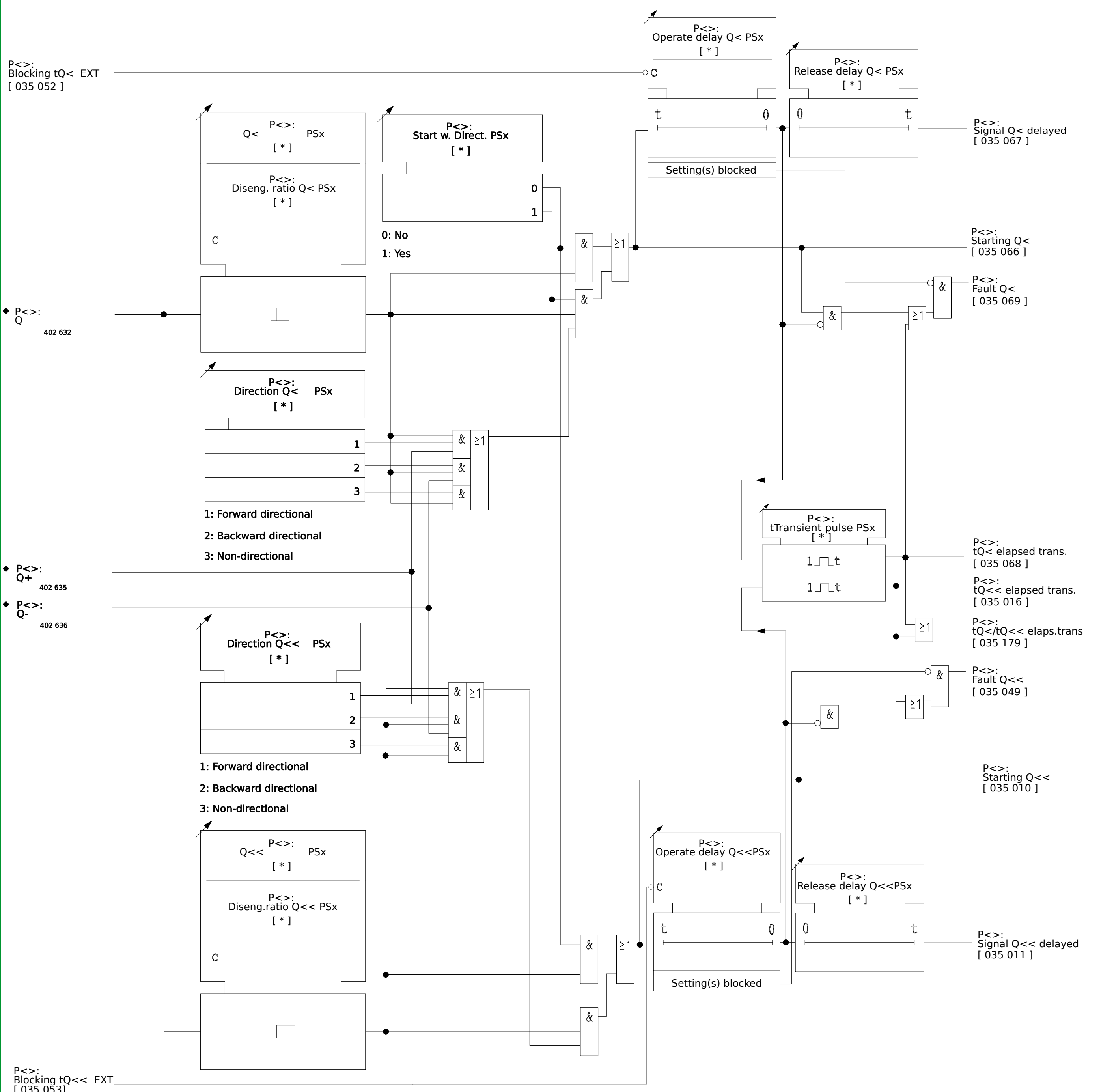
19Z5278A

Fig. 3-274: Performance of the transient signal and the fault signal issued by the active power monitoring.

3.37.10 Reactive Power Q< Starting

The P139 monitors the reactive power with two-stage functions to detect when it falls below the set thresholds. The resetting ratio of the threshold stages can be set.

When the reactive power falls below the set thresholds, a starting signal depends on the P<>: Start w. Direct. PSx. If P<>: Start w. Direct. PSx is set to yes, measured direction should match the set direction, or the starting signal will not issued. The starting signal is followed by the set operate and resetting delays.



* Parameter	P<>: Q< PSx	P<>: Diseng. ratio Q< PSx	P<>: Operate delay Q< PSx	P<>: Release delay Q< PSx	P<>: Direction Q< PSx	P<>: Start w. Direct. PSx
set 1	018 035	018 044	018 052	018 056	018 081	021 074
set 2	018 036	018 045	018 053	018 057	018 082	021 075
set 3	018 037	018 046	018 054	018 058	018 083	021 076
set 4	018 038	018 047	018 055	018 059	018 084	021 077

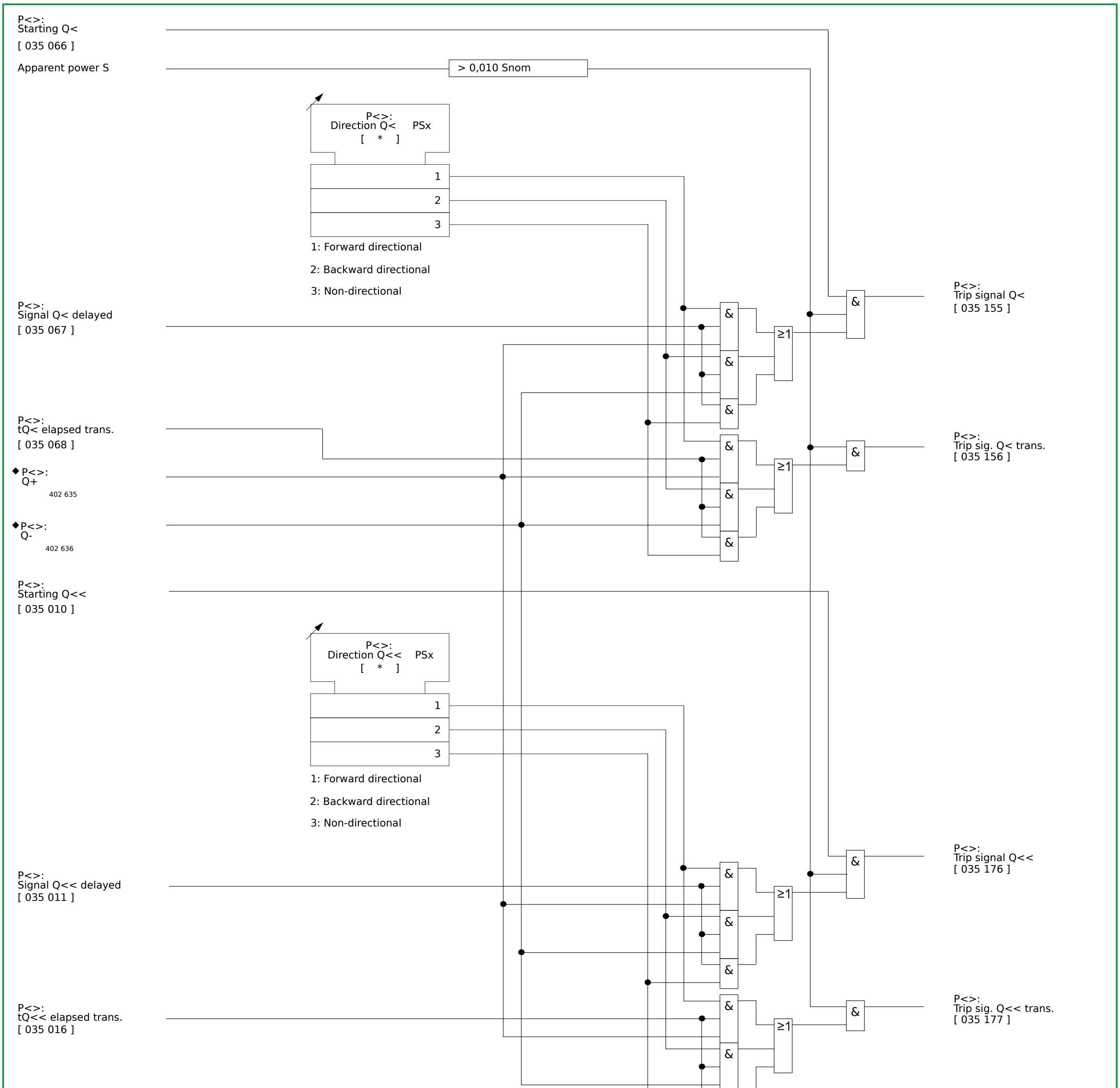
* Parameter	P<>: Q<< PSx	P<>: Diseng.ratio Q<< PSx	P<>: Operate delay Q<<PSx	P<>: Release delay Q<<PSx	P<>: Direction Q<< PSx	P<>: tTransient pulse PSx
set 1	018 085	018 095	018 213	018 236	018 242	018 246
set 2	018 086	018 096	018 214	018 237	018 243	018 247
set 3	018 087	018 097	018 215	018 238	018 243	018 248
set 4	018 088	018 098	018 216	018 239	018 245	018 249

19Z9104A

Fig. 3-275: Reactive power monitoring when values fall below set thresholds.

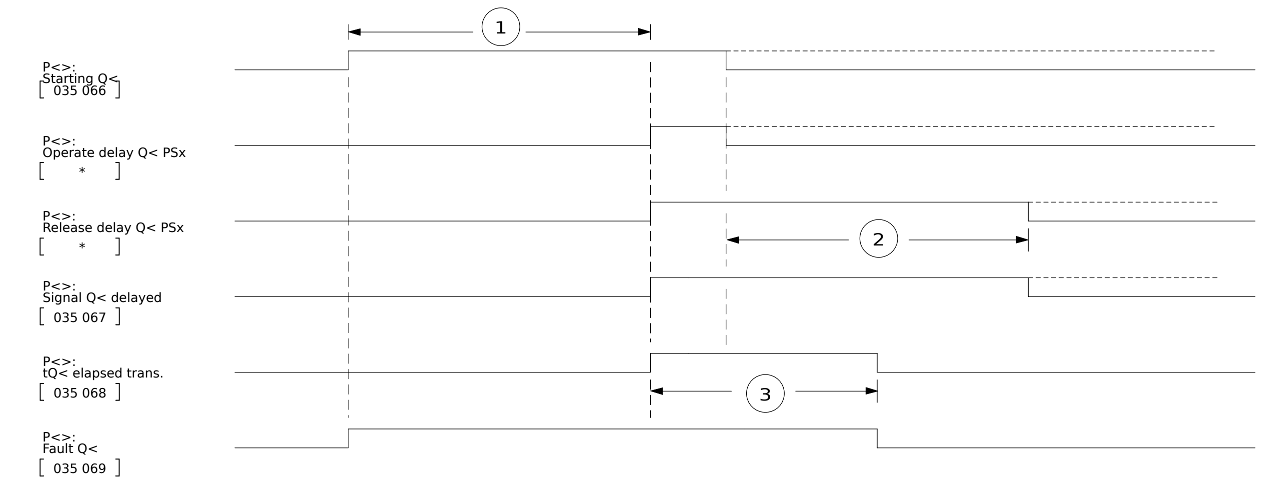
3.37.11 Reactive Power Q< Tripping

The P139 determines the sign of the reactive power. If the sign is positive, a forward-directional decision is issued; if it is negative, a backward- (reverse-) directional decision results. A setting determines whether a trip signal is triggered by a forward-directional, a backward- (reverse-) directional or a non-directional decision.



* Parameter	P<>: Direction Q< PSx	P<>: Direction Q<< PSx
set 1	018 081	018 242
set 2	018 082	018 243
set 3	018 083	018 244
set 4	018 084	018 245

Fig. 3-276: Direction-dependent trip signal of the reactive power protection function when values fall below set thresholds.



*	1	2	3
Parameter	P<>: Operate delay Q< PSx	P<>: Release delay Q< PSx	P<>: tTransient pulse PSx
set 1	018 052	018 056	018 246
set 2	018 053	018 057	018 247
set 3	018 054	018 058	018 248
set 4	018 055	018 059	018 249

19Z5279A

Fig. 3-277: Performance of the transient signal and the fault signal issued by the reactive power monitoring.

3.37.12 Direction Signaling

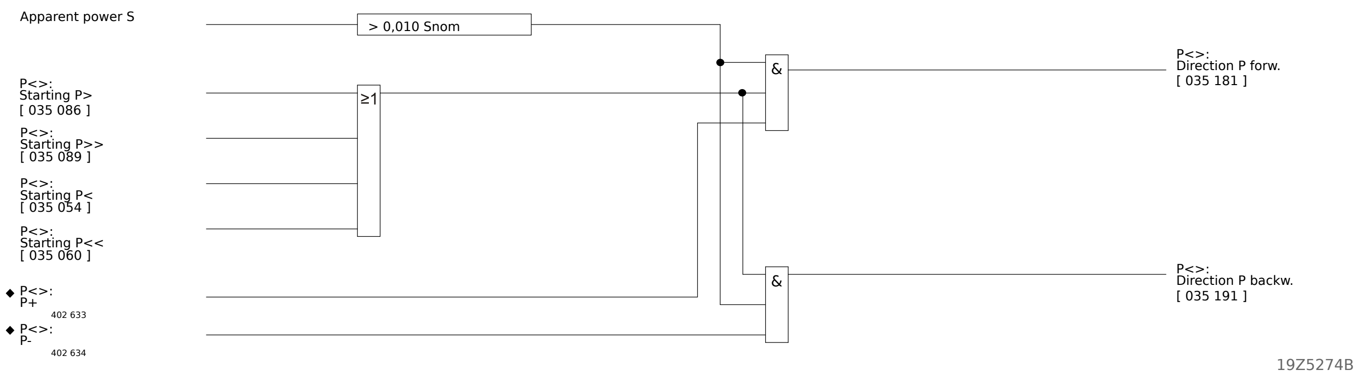


Fig. 3-278: Directional starting signal issued by the active power monitoring.

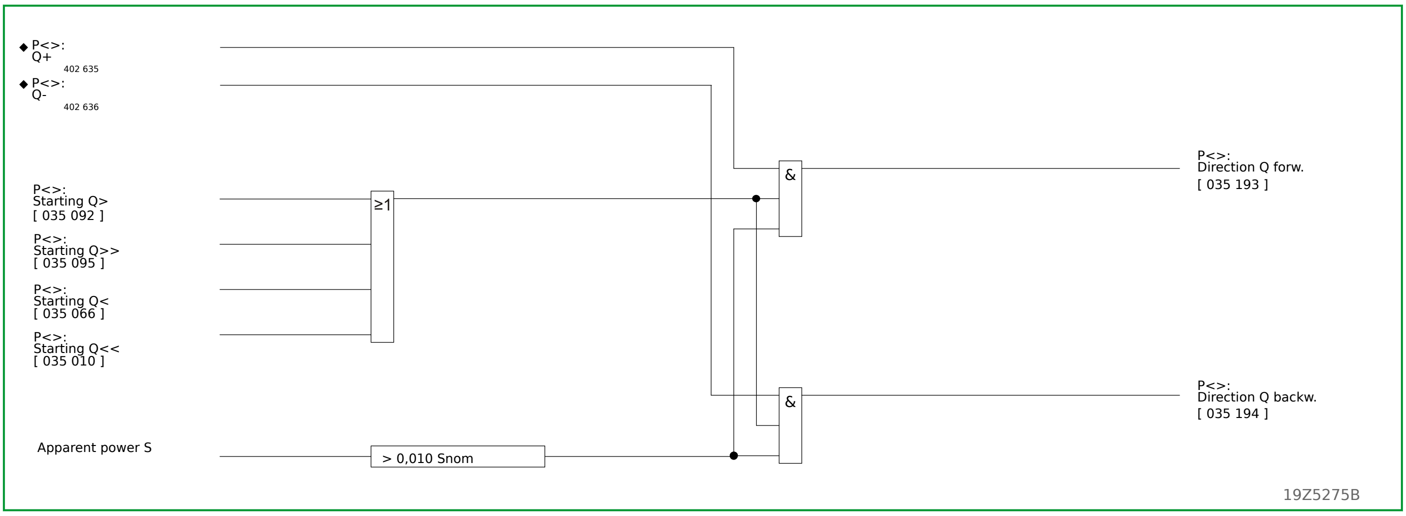


Fig. 3-279: Directional starting signal issued by the reactive power monitoring.

3.38 Voltage Controlled Directional Reactive Power Protection (Function Group QV)

QV protection is carried out by evaluating the directional reactive power and three phase-phase voltages. The function provides delayed disconnection from the power system and thus allows temporary support by means of longer feed-in on a defective power system. It is a disconnection protection system which not only takes into account voltage and current, but also assesses the reactive power direction of the distributed generation plant.

3.38.1 Disabling and Enabling QV Protection

The QV protection can be disabled or enabled via setting parameters. Moreover, enabling can be carried out separately for each parameter subset.

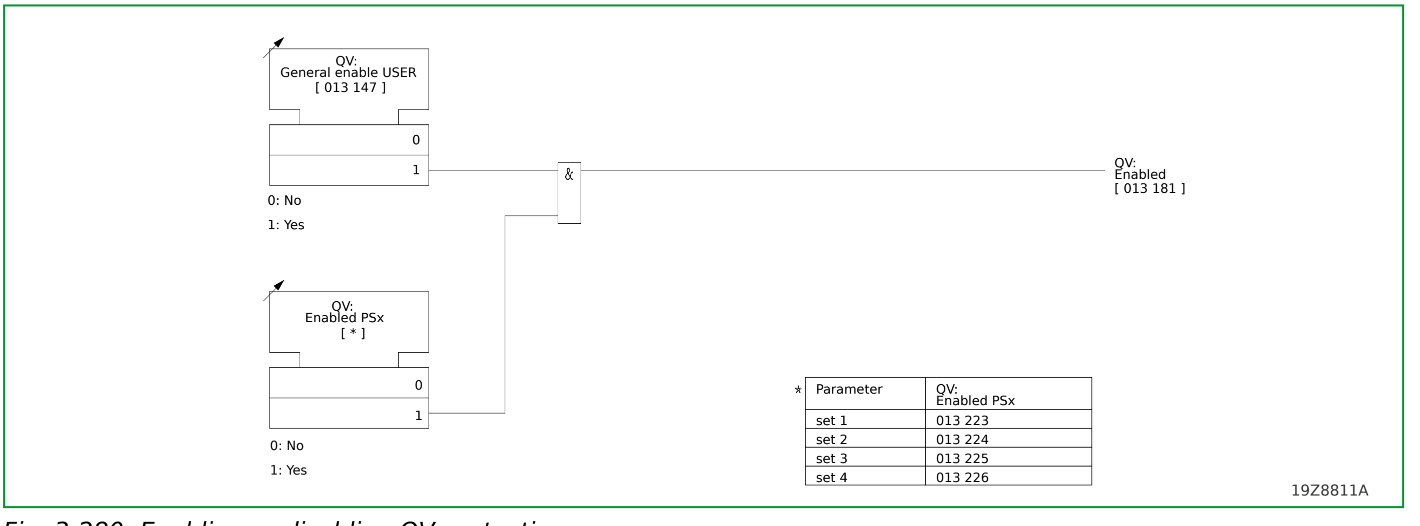


Fig. 3-280: Enabling or disabling QV protection.

3.38.2 QV Readiness and Blocking

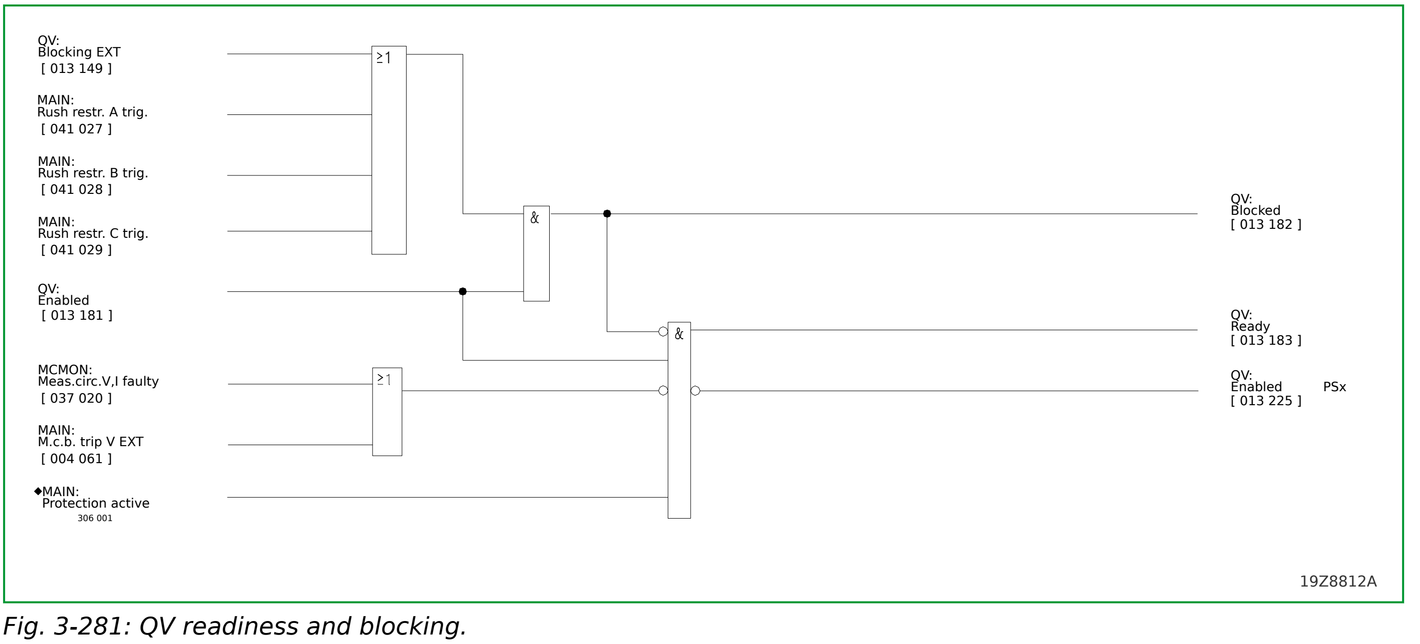


Fig. 3-281: QV readiness and blocking.

Under certain conditions the QV will be blocked and the signal QV: Blocked will be issued, provided that one of the following conditions is met:

- An external signal. QV: Blocking EXT is present.
- Inrush stabilization (QV protection should be selected in the list of MAIN: Funct.Rush restr.PSx).

QV protection can only start if the QV is ready. For this purpose the following conditions need to be present simultaneously:

- Protection is activated (on).
- QV is enabled.
- QV is not blocked.
- No voltage or current measuring circuits defect is either identified (by internal functions MCMON: Meas.circ.V,I faulty) nor signaled (through MAIN: M.c.b. trip V EXT).

3.38.3 Phase-Phase Undervoltage Monitoring

QV function monitors all three phase-phase voltages with an undervoltage threshold. When all three voltages drop below the set threshold, QV: Starting V< 3p is issued. The resetting ratio of the threshold can be set.

3.38.4 Directional Reactive Power Characteristic

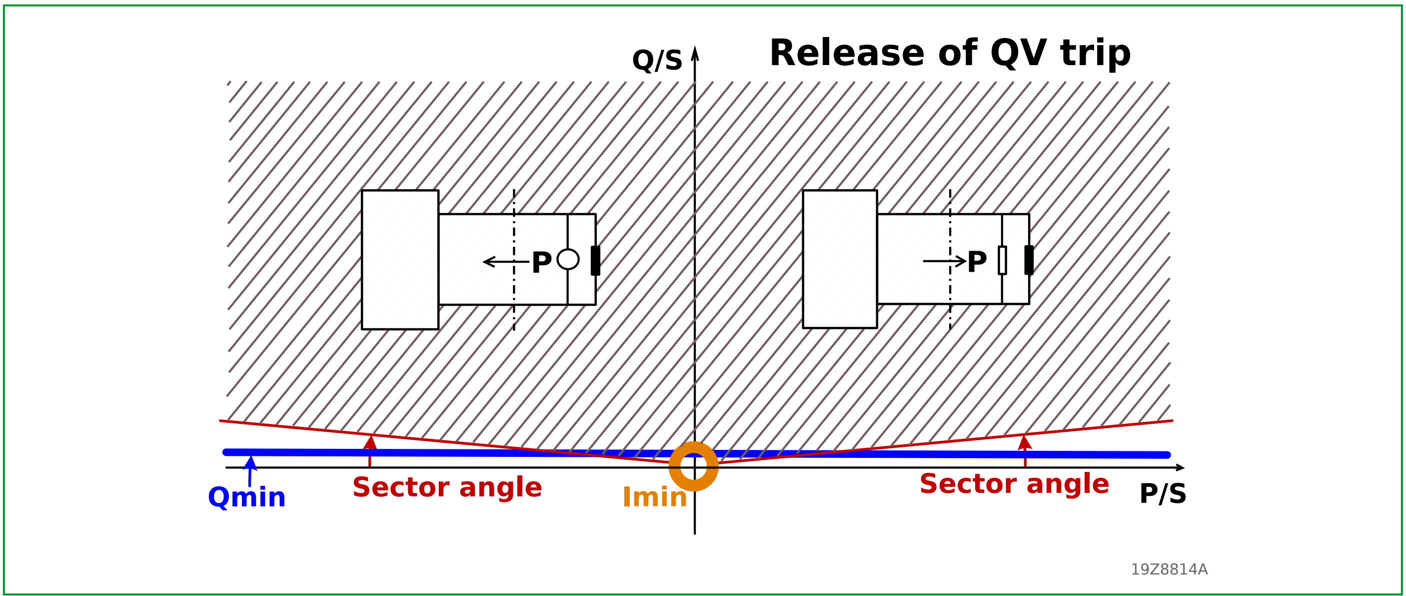


Fig. 3-282: Release of forward directional reactive power.

Reactive power is calculated based on all three phase currents and voltages. The reactive power threshold and reactive power flow are monitored to determine whether the reactive power is in operation area.

There are in total three conditions which must be present at the same time to release the directional reactive power condition.

- All three phase currents exceed QV: Imin PSx.
- The reactive power exceeds QV: Qmin PSx.
- The angle of the apparent power is within the set operation direction. (Power direction check see Section 10.2.6, (p. 10-7))

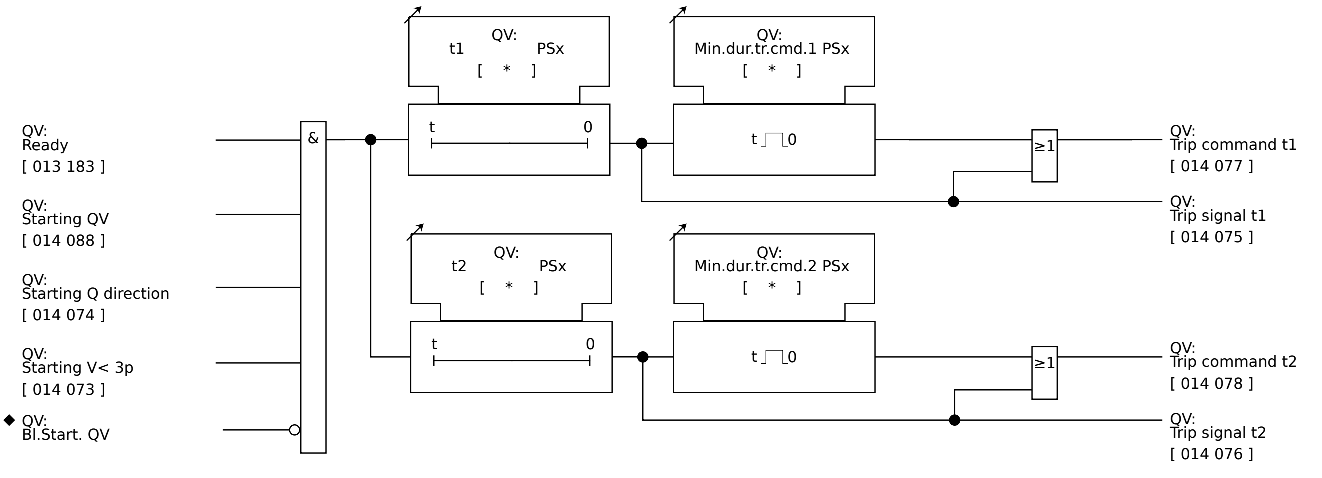
  For forward directional setting: $\varphi \leq \varphi_S \leq 180^\circ - \varphi$

  For backward directional setting: $-180^\circ + \varphi \leq \varphi_S \leq -\varphi$

  with set sector angle: φ

  Measured apparent power angle: φ_S

3.38.5 Timer and Trip Logic



Parameter	QV: t1 PSx	QV: Min.dur.tr.cmd.1 PSx	QV: t2 PSx	QV: Min.dur.tr.cmd.2 PSx
set 1	013 247	014 065	013 251	014 069
set 2	013 248	014 066	013 252	014 070
set 3	013 249	014 067	013 253	014 071
set 4	013 250	014 068	013 254	014 072

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Fig. 3-283: QV timer and trip logic.

If the condition of undervoltage starting and directional reactive power characteristic are fulfilled and no blocking condition is present, the function operate delay timers are triggered.

There are two timer elements which provide trip signals and trip commands after settable operate delay time. (Usual application: the first trip is used to open the wind generator CB, the second is used to open the CB at the grid connection point).

The trip commands are provided to allow dedicated command outputs for the QV protection (like for example for CBF function). The trip commands are provided with settable minimum pulse timers. In addition, the trip signals are available for configuration in the general trip commands 1 and 2 of the global function.

3.39 Circuit Breaker Failure Protection (Function Group CBF)

The P139 features the CB failure protection function. After a trip command has been issued the CBF function checks that the circuit breaker has actually been opened.

3.39.1 Disabling and Enabling Circuit Breaker Failure Protection

The function is enabled at CBF: General enable USER. If this parameter has been activated the CBF function may be enabled or disabled using setting parameters or through appropriately configured binary signal inputs. Parameters and configured binary signal inputs have equal status. If CBF: Enable USER is the only function assigned to a binary signal input, then circuit breaker protection will be enabled by a positive edge of the input signal and disabled by a negative edge. If CBF: Disable EXT is the only function assigned to a binary signal input, then a signal at this input will have no effect.

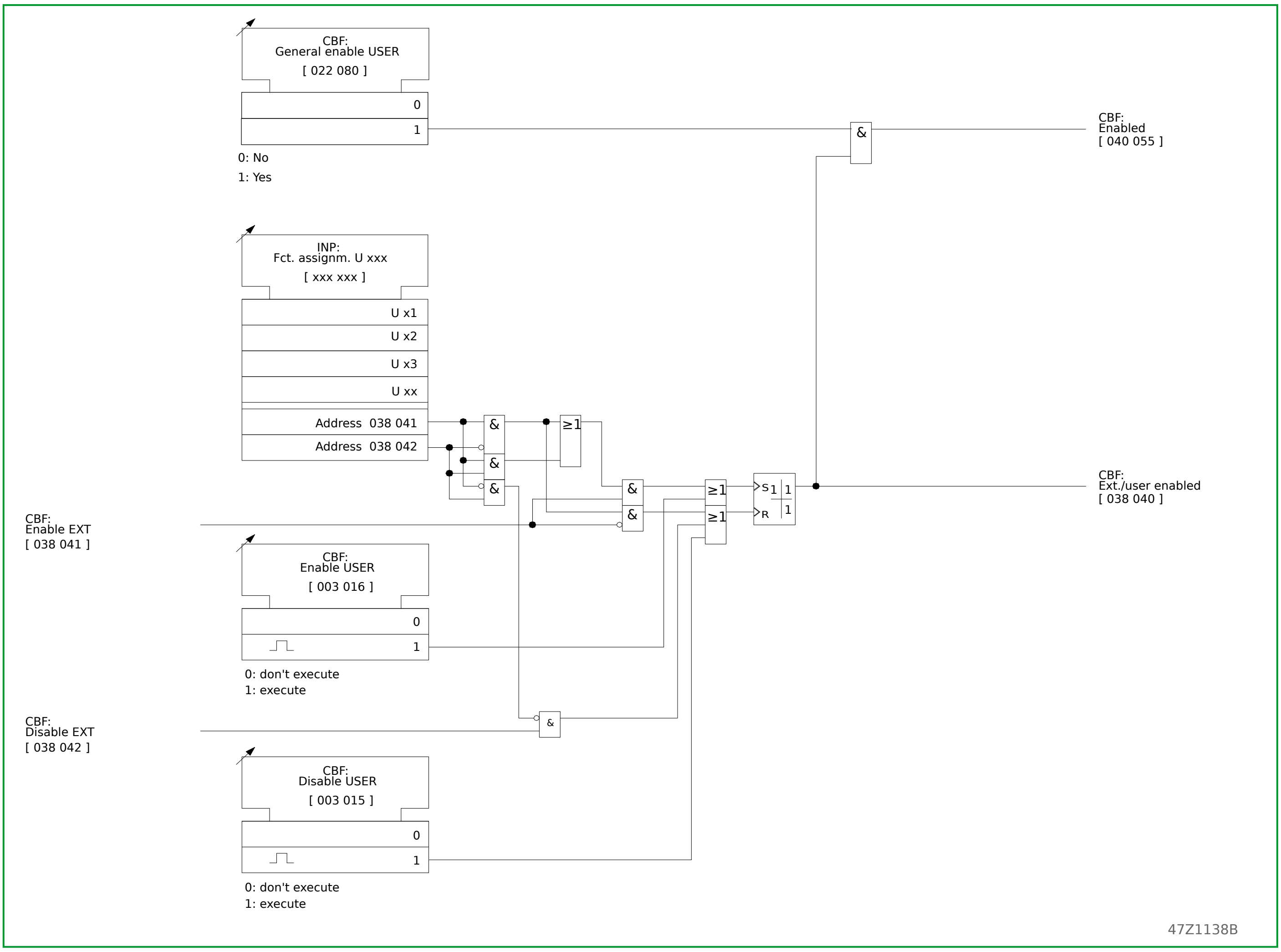


Fig. 3-284: Disabling or enabling circuit breaker failure protection.

3.39.2 Readiness of Circuit Breaker Protection

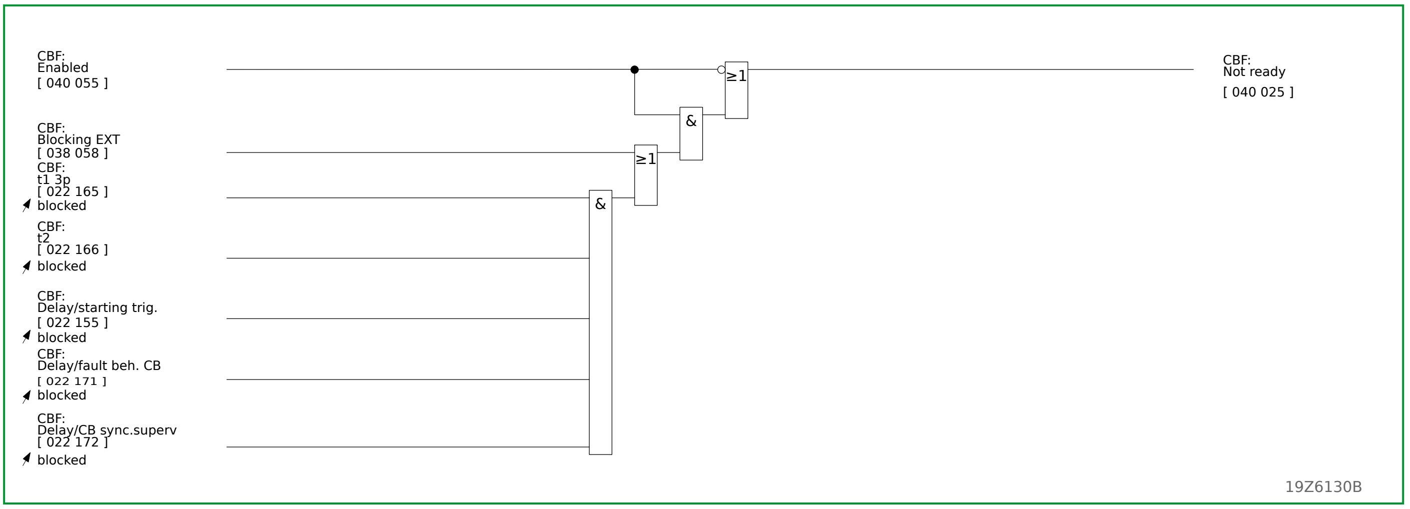


Fig. 3-285: Signal CBF: Not ready.

Circuit breaker failure protection will be unavailable under the following conditions:

- The CBF function is not activated.
- Circuit breaker protection is being blocked by an appropriately configured binary signal input.
- All CBF timer stages have been set to *blocked*.

3.39.3 Detecting a CB Tripping

A break in current flow is the preferred criterion to detect a successful CB tripping.

Protection functions that have tripping criteria not directly dependent on current flow may additionally be provided with status signals from CB auxiliary contacts for evaluation.

3.39.4 Current Flow Monitoring

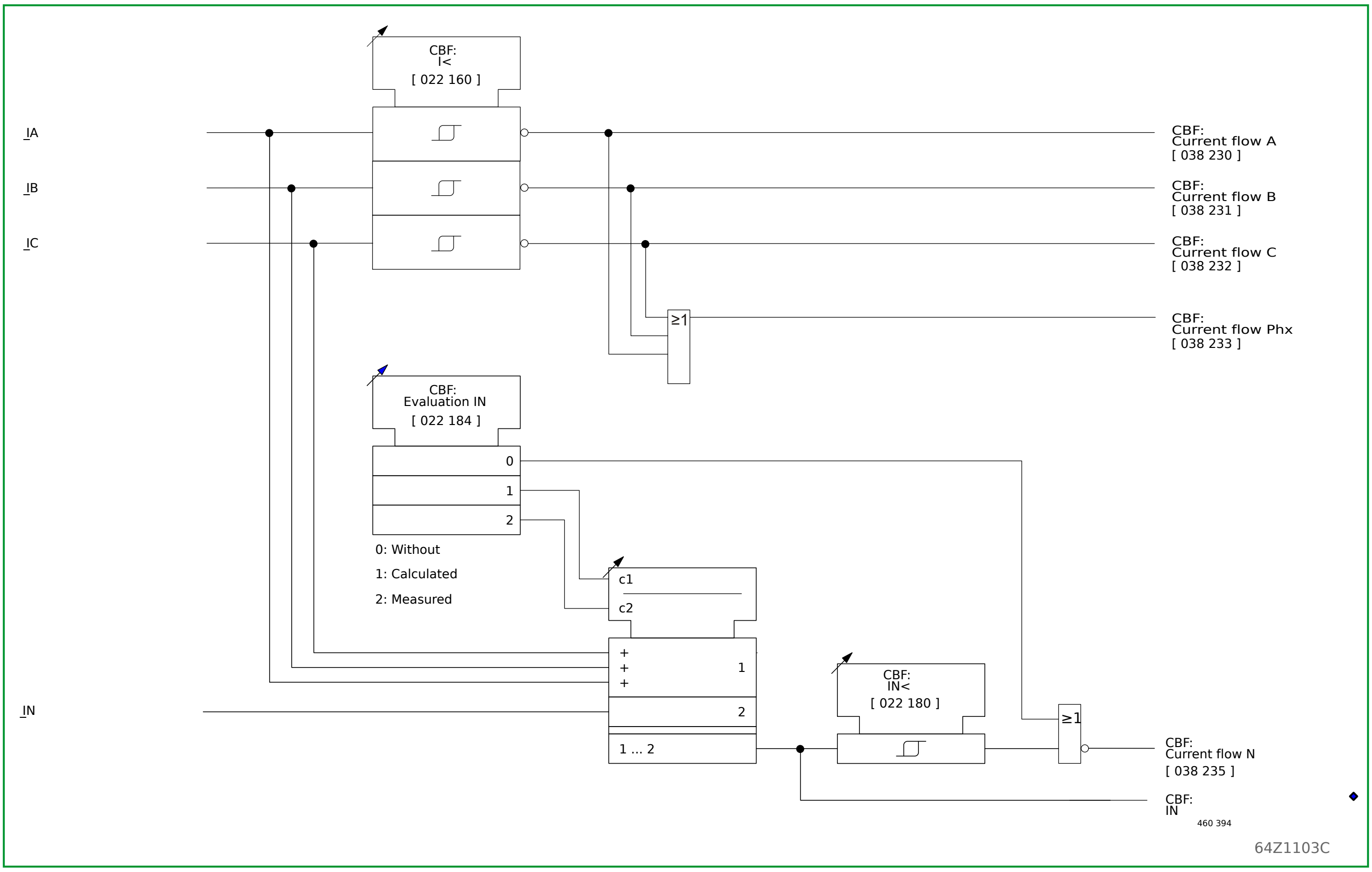


Fig. 3-286: Current flow monitoring.

This function is used to detect a break in current flow safely, immediately and pole-selectively. The CBF function continuously compares sampled current values with the set threshold value CBF: I<.

As long as current flow criteria are met the monitoring function will continuously issue the phase selective signals CBF: Current flow A, CBF: Current flow B, CBF: Current flow C and the multiple signal CBF: Current flow Phx.

Moreover, there is a residual current monitoring function which can be enabled/ disabled. For this either the residual current value measured directly at the CT or the value derived from the three phase currents may be used.

As long as a residual current exceeding the comparator threshold is flowing, the current flow criterion is not met and the corresponding signal (CBF: Current flow N) is issued. When the residual current monitoring function is disabled, no monitoring is carried out and the CBF: Current flow N = *No* signal is issued continuously.

3.39.5 Evaluation of CB Status Signals

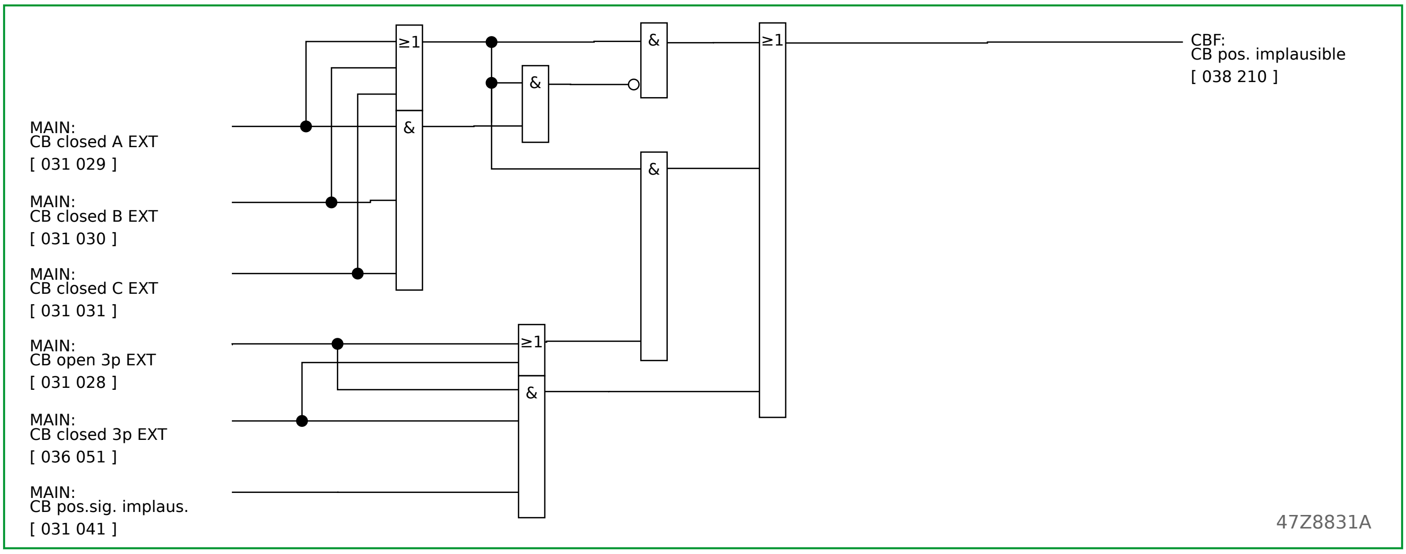


Fig. 3-287: Plausibility check of CB status signals.

Trip signals included in MAIN: Gen. trip command 1, which use CB status signals in addition to current flow monitoring, can be selected with the parameter CBF: Fct.assignm. CBAux..

Applying CB status signals depends on the type of auxiliary contacts available. The P139 can check the following CB status signals for plausibility and evaluate them:

- The open signal from the circuit breaker, MAIN: CB open 3p EXT
- The closed signal from the circuit breaker, MAIN: CB closed 3p EXT
- The phase-selective CB status signals

The evaluation of the CB status signals is blocked, if the configuration of the respective binary signal inputs or the signal levels are not plausible. As a result, the P139 will issue the CBF: CB pos. implausible signal. The evaluation of current criteria is not affected by this blocking.

The configuration or the CB status signals are considered not plausible, if:

- if at least one phase-selective CB status signal and a 3-pole CB status signal (e.g. MAIN: CB closed A EXT and MAIN: CB open 3p EXT) have been assigned to binary inputs
- or if only one or two phase-selective CB status signals have been assigned to binary inputs
- or if both MAIN: CB closed 3p EXT and MAIN: CB open 3p EXT have been configured and the signal MAIN: CB pos.sig. implaus. is issued.

As an alternative the status signals from the external device may be used by the P139. Assigning necessary for this is made with the parameters MAIN: Sig. asg. CB open or MAIN: Sig. asg. CB closed. Status signals from external devices are processed similarly to the MAIN: CB open 3p EXT and MAIN: CB closed 3p EXT CB status signals.

3.39.6 Startup Criteria

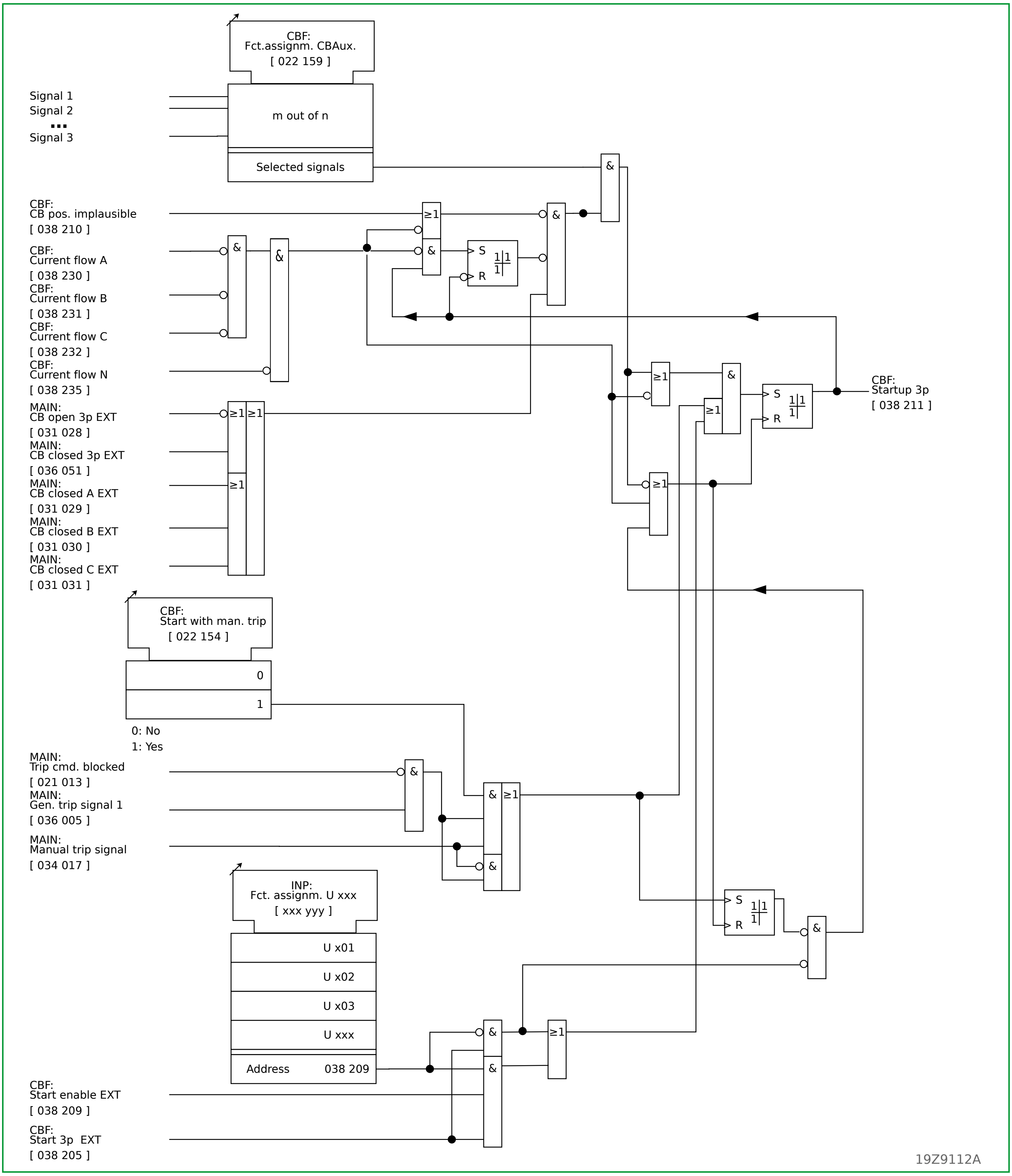


Fig. 3-288: 3-pole starting of circuit breaker failure protection.

Startup of the circuit breaker failure protection function will occur when the CB is recognized as closed during a startup criterion. The following criteria are evaluated as a startup criterion:

Internal startup criterion

- Generating the Gen. Trip signal 1 is considered a start criterion. In addition it may be selected, by setting the parameter CBF: Start with man. trip, that a manual trip signal will be used as a start criterion.

  Current flow monitoring is the primary evaluation criterion. The CB auxiliary contacts are evaluated when no current flow is registered and the respective trip signal, included in the Gen. Trip command 1, has been selected from the protection function in parameter CBF: Fct.assignm. CBAux. for the evaluation of the CB auxiliary contacts.

External startup criterion

- Triggering by a protection device operating in parallel (CBF: Start 3p EXT) may be used as a start criterion. A false CBF operation due to spurious pick-up of this binary input signal is prevented as follows:

  – If only one input signal is available as trigger, this input must be active as long as the CBF timer is running. Otherwise CBF resets as soon as the trigger input signal resets.

  – Alternatively a two-pole trigger control may be implemented by applying the additional signal CBF: Start enable EXT.

Once started from internal trigger or external two-pole inputs, the CBF function will only drop out when a successful opening has been detected from the current flow monitoring (current values to fall below $I_<$ with all three phases) or, in some cases, when the CB signals that its contacts are open.

3.39.7 Timer Stages and Output Logic

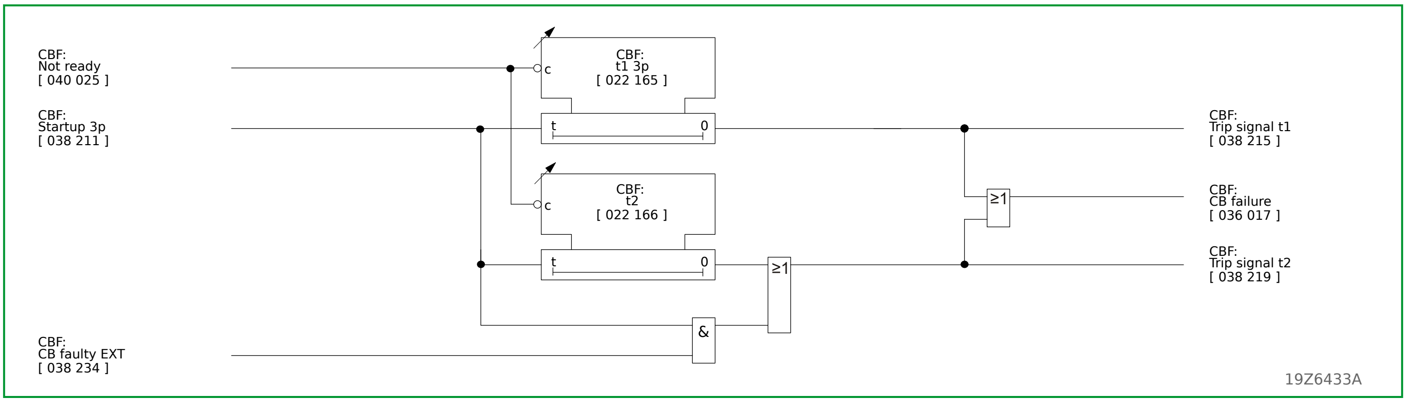


Fig. 3-289: Timer stages of circuit breaker failure protection.

Associated timer stages are started when a startup criterion is met.

- The CBF: Trip signal t1 signal will be issued if the startup criterion is still present when the time delay set at timer stage CBF: t1 3p, has elapsed. The output command from this timer stage is intended for a second CB trip coil.
- The CBF: Trip signal t2 signal will be issued if the startup criterion is still present when the time delay set at timer stage CBF: t2, has elapsed. The output command from this timer stage is intended for a backup circuit breaker or protection system.

The trip signals will be issued as long as the current criterion is not met or the CB's state is signaled as closed. Should a loss of gas pressure occur in the arcing chambers of installed type *SF-6* circuit breakers then all surrounding circuit breakers must be immediately tripped without waiting for a reaction from the damaged switch. In case of an external CB fault the elapsing of timer stage t2 may be interrupted by a signal to a binary signal input appropriately configured at CBF: CB faulty EXT.

3.39.8 Trip Commands

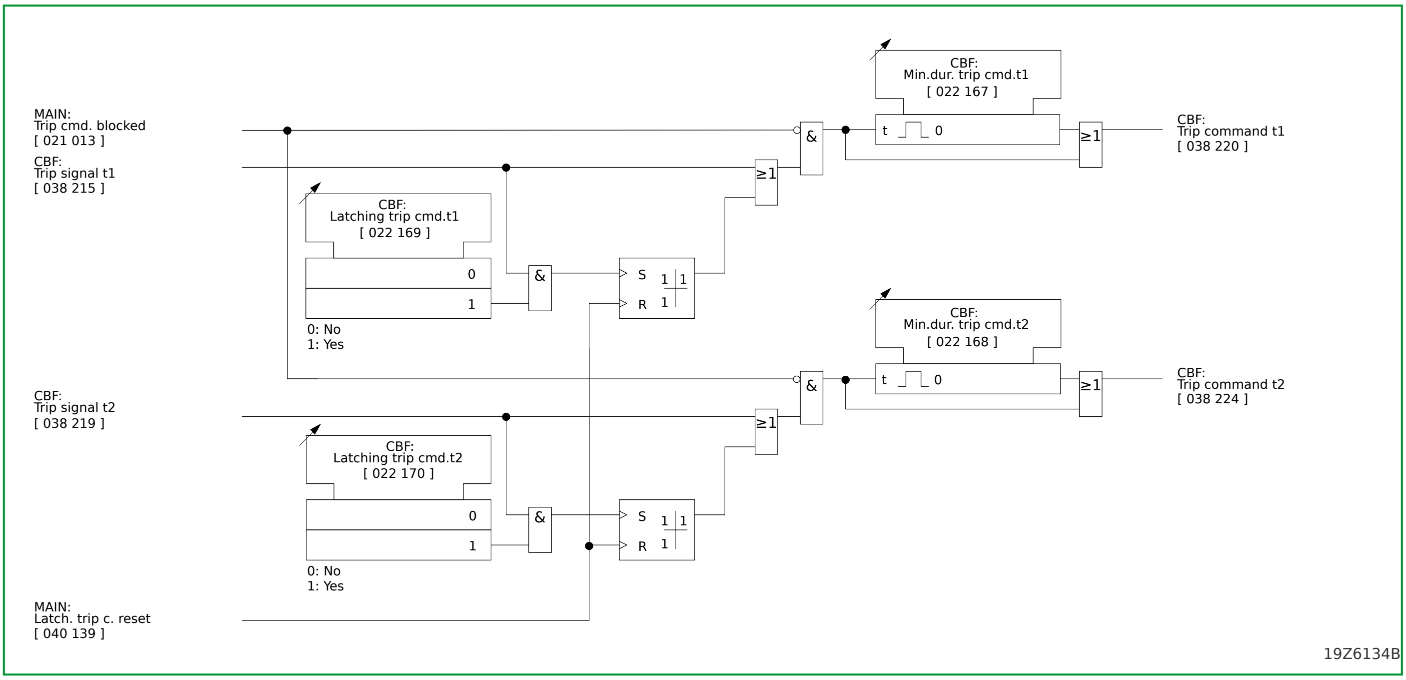


Fig. 3-290: CBF trip commands.

While trip signals issued by the CB failure protection have no timer stages available, the user can set minimum time-delays for trip commands.

By appropriate setting it can be selected that trip commands, issued by the CB failure protection function, will operate in latching mode. The corresponding trip command, set to latch mode, will remain active until reset by operating parameters or through an appropriately configured binary signal input.

3.39.9 Starting Trigger

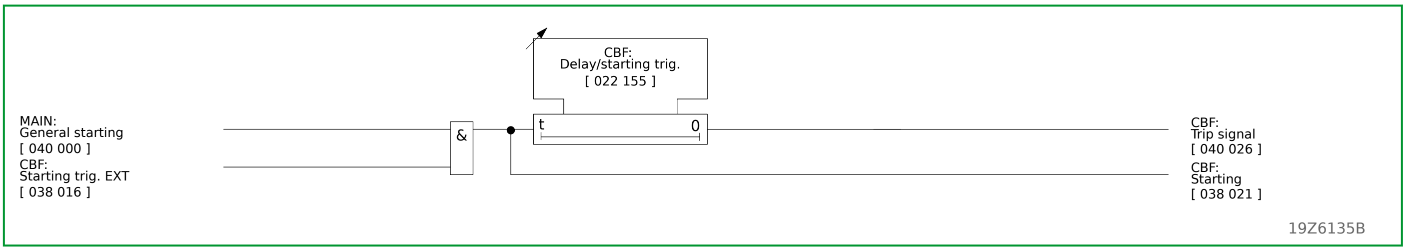


Fig. 3-291: Starting trigger.

The signal CBF: Starting will be issued when the signal CBF: Starting trig. EXT is presented to an appropriately configured binary signal input and a general starting condition is present. The signal CBF: Delay/starting trig. will be issued after timer stage CBF: Trip signal. has elapsed.

3.39.10 Fault Behind CB Protection

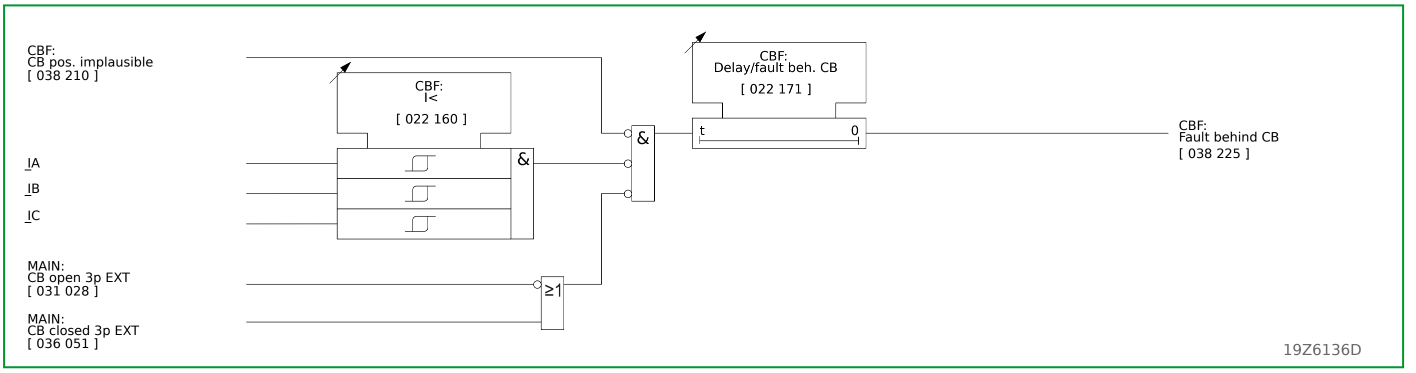


Fig. 3-292: Fault behind CB protection.

A fault behind a CB (downstream) is a fault that may occur between a circuit breaker already open and a CT, which is fed from the remote end.

Fault behind CB protection recognizes such faults through the current criterion if the circuit breaker does not indicate that it is closed after the time delay set at CBF: Delay/fault beh. CB has elapsed.

When such a fault is detected behind the CB the CBF: Fault behind CB signal is issued. In such a case the far end circuit breaker may be triggered by an InterMiCOM protective interface. This may also prevent unwanted triggering of the circuit breaker failure function.

3.39.11 CB Synchronization Supervision

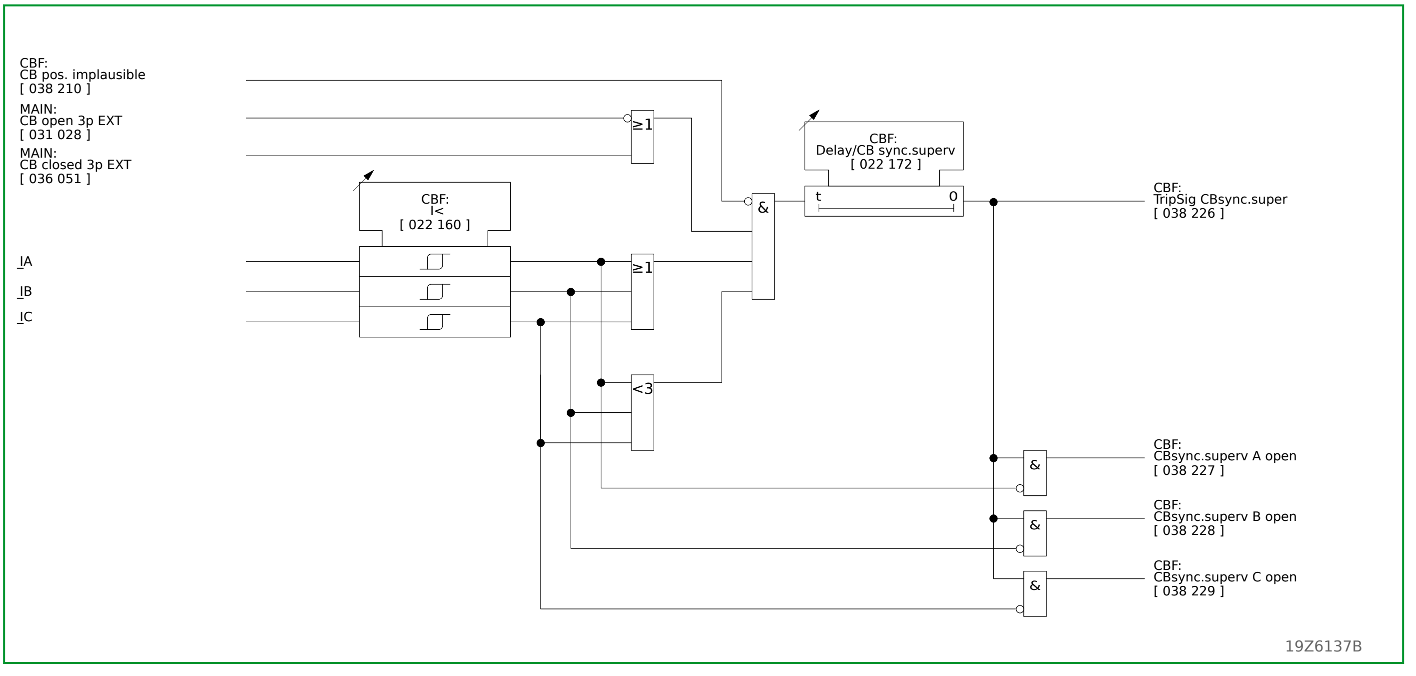


Fig. 3-293: CB synchronization supervision.

CB synchronization supervision recognizes states where not all circuit breaker contacts are open or closed. This function uses both current flow monitoring and evaluation of CB state signals to detect CB synchronization. In order to bridge CB operating times the time-delay CBF: Delay/CB sync.superv can be used. When this time-delay has elapsed the signal CBF: TripSig CBsync.super is issued. Poles that are recognized as being *open* will still be signaled.

3.40 Circuit Breaker Monitoring (Function Group CBM)

The P139 features a circuit breaker monitoring function. This function supports state-controlled maintenance of circuit breakers.

3.40.1 Disabling and Enabling Circuit Breaker Monitoring

Circuit breaker monitoring may be disabled or enabled using setting parameters.

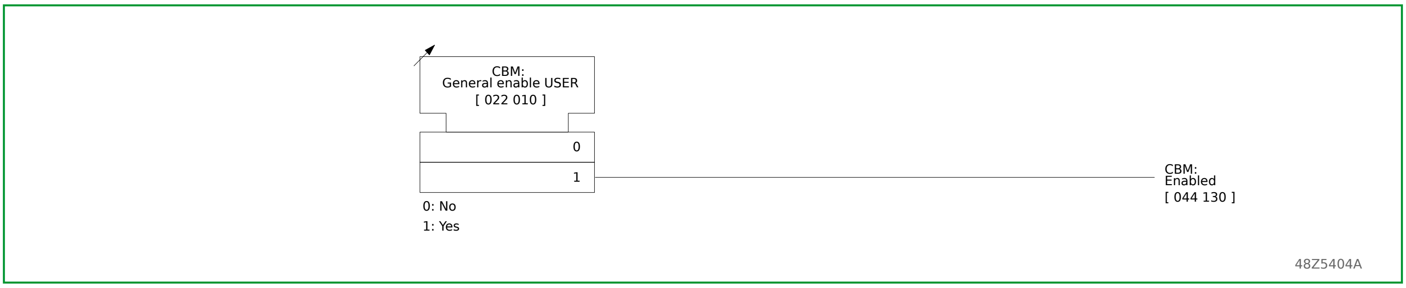


Fig. 3-294: Enabling or disabling circuit breaker monitoring.

3.40.2 Variants

The wear condition of a circuit breaker may be determined using a variety of methods:

- Monitoring the mechanical switching operations
- Accumulating ruptured current values
- Accumulating the squared ruptured current values
- Calculating the current-time integral of ruptured and accumulated current values
- Calculating the remaining switching operations with reference to the CB wear characteristic.

3.40.3 CB Wear Characteristic

Manufacturers of circuit breakers usually provide wear characteristics displaying the maximum number of permissible CB operations in relation to the ruptured current.

Fig. 3-295, (p. 3-364) displays the wear characteristics for a circuit breaker with a nominal current of 2000 A and a maximum ruptured current of 63 kA. The mean ruptured current is 48 kA.

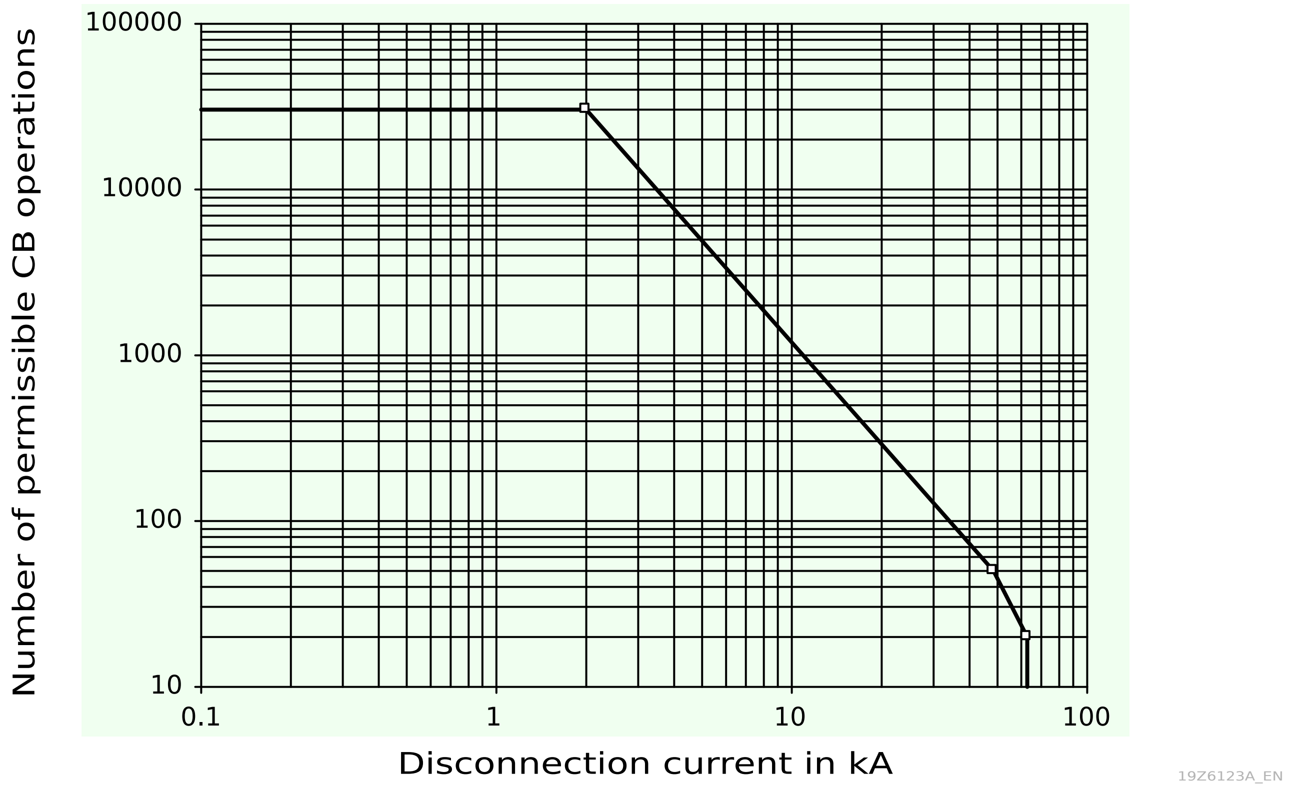


Fig. 3-295: Circuit breaker wear characteristic.

The knee points in Fig. 3-295, (p. 3-364) are necessary to set the wear characteristic for the circuit breaker:

- The circuit breaker's nominal current (CBM: Inom,CB) and the permitted number of CB operations at nominal current (CBM: Perm. CB op. Inom,CB)
- The circuit breaker's mean ruptured current (CBM: Med. curr. Itrip,CB) and the permitted number of CB operations at mean ruptured current (CBM: Perm. CB op. Imed,CB)
- The circuit breaker's maximum ruptured current (CBM: Max. curr. Itrip,CB) and the permitted number of CB operations at maximum ruptured current (CBM: Perm. CB op. Imax,CB)

The mean ruptured current is not available for all types of circuit breakers. In such a case the parameters for this knee point are to be set to *Blocked*. A knee point is not considered in the characteristic when at least one of the parameters for the knee point is set to *Blocked*.

For proper performance of circuit breaker monitoring it should be observed that the knee points must be applied in a logically correct sequence (continuously descending). When set currents and numbers of CB operations are not plausible according to the characteristic the P139 will issue an error message and block circuit breaker monitoring.

3.40.4 Calculating the CB Wear State

The current wear state of the circuit breaker is given as the number of remaining CB operations at nominal current conditions. The number of remaining CB operations $n_{rem}(I_{nom,CB})$ is calculated and displayed phase selectively after each disconnection by the P139.

Calculation is per this equation:

$$n_{rem}(I_{nom,CB}) = n_{rem,0}(I_{nom,CB}) - \frac{n(I_{nom,CB})}{n(I_{d,CB})}$$

Where:

- $I_{nom,CB}$: Nominal current for the CB
- $n(I_{nom,CB})$: Max permitted number of CB operations at $I_{nom,CB}$
- $I_{d,CB}$: Ruptured current
- $n(I_{d,CB})$: Permitted number of CB operations at $I_{d,CB}$ according to wear characteristics
- $n_{rem,0}(I_{nom,CB})$: Remaining permitted number of CB operations at $I_{nom,CB}$ before disconnection
- $n_{rem,}(I_{nom,CB})$: Remaining permitted number of CB operations at $I_{nom,CB}$ after disconnection

3.40.5 Operating Modes

Setting the parameter CBM: Operating mode will select the condition under which the function will be triggered:

- *With trip cmd. only*: Function triggered only by the general trip command 1
- *With CB sig.EXT only*: Function triggered by the CB open signal generated by an auxiliary contact
- *CB sig. EXT or trip*: Function triggered by the general trip command 1 or CB open signal generated by an auxiliary contact

Measured values and counters are re-determined with each triggering and compared with set threshold values.

A correction value can be set in order to determine the trip time at CBM: Corr. acqu.time trip to be triggered by the open command. Another correction value can be set at CBM: Corr.acqu.t. CB sig. to be triggered by the position signal issued by the CB auxiliary contacts. This enables to correctly evaluate the leading or lagging auxiliary contacts or the delay between issuing the trip command and opening of the CB contacts. In addition differing inherent time delays from the two command chains can be configured independently of each other so as to achieve optimum time adjustment.

3.40.6 Cycle for Circuit Breaker Monitoring

The circuit breaker monitoring cycle is defined pole-selectively. During an active cycle the signals CBM: Cycle running A, CBM: Cycle running B or CBM: Cycle running C are issued.

The cycle is started by a trigger criterion. Definition for the end of a cycle: The remaining time of a power cycle duration has elapsed after the last detected current zero crossing. The CBM: Curr. flow ended A (CBM: Curr. flow ended B, CBM: Curr. flow ended C) signal is then issued.

The maximum cycle time duration is defined with 220 milliseconds. The start of the cycle time is corrected by the settable correction times. A fault on a CB pole is considered to be apparent if further current zero crossings are detected after the maximum cycle time has elapsed. Measured values from the respective CB tripping are canceled and the CBM: tmax> A (CBM: tmax> B, CBM: tmax> C) signal is issued.

3.40.7 Linking Control Functions with the Trip Command

With the P139, the trip command from the optional control function can be linked with the general trip command 1 of the protection, when setting external devices. In such a case the trip command from the control function must be associated by the parameter CBM: Sig. asg. trip cmd. so that operational trip commands, issued to the circuit breaker by the control function, are considered additionally to the general trip command 1.

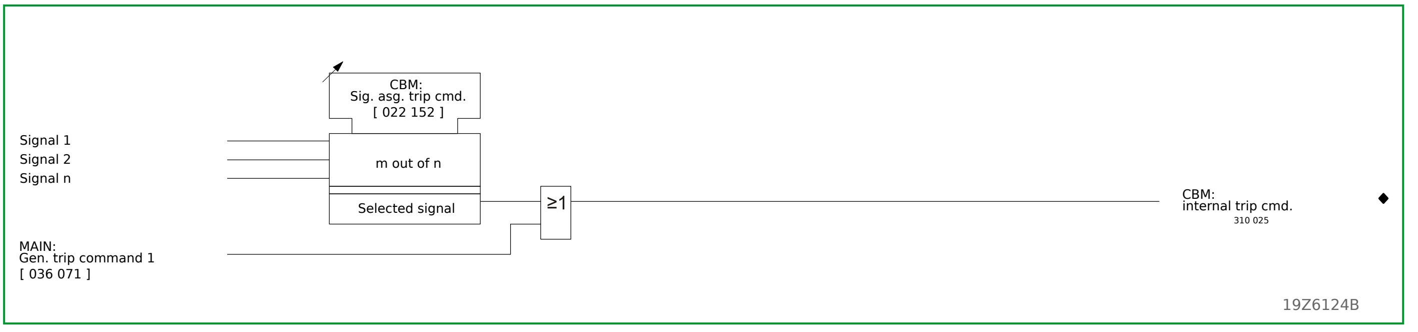


Fig. 3-296: Forming the linked trip commands.

The external devices' “open” state signal may be linked to the control function's “open” state signal by setting the CBM: Sig. asg. trip cmd.. parameter so that the function in the P139 will be triggered by CB auxiliary contacts.

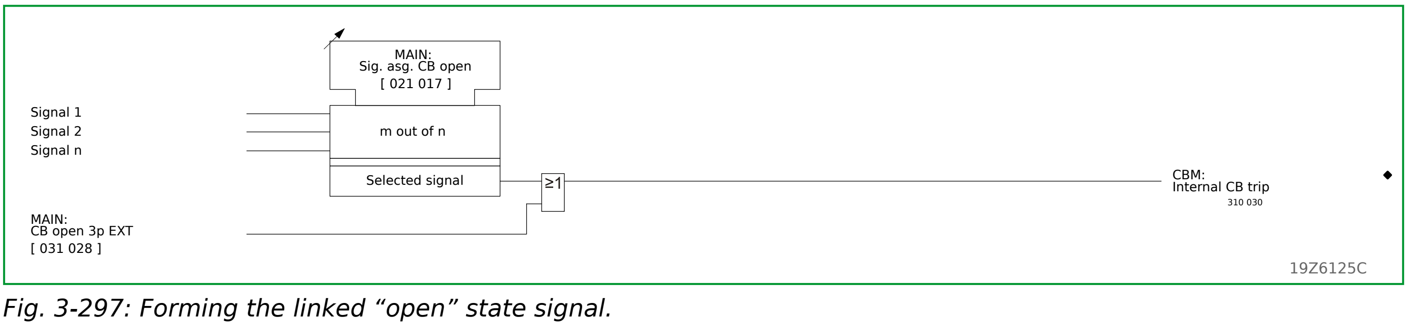


Fig. 3-297: Forming the linked “open” state signal.

3.40.8 Pole-Selective Counter Values and Measured Values

The P139 separately evaluates each phase current and generates an individual wear presentation for each CB pole.

The following counter values are presented pole-selectively:

- The number of mechanical switching operations made
- The number of remaining CB operations at CB nominal current

  This value is derived by evaluating wear with reference to the CB's wear characteristic.

The following measured values are presented pole-selectively, and per-unit values refer to the CB's nominal current:

- Primary ruptured current

  This value is applied to evaluate wear with reference to the CB's wear characteristic.
- Per-unit ruptured current
- Squared per-unit ruptured current
- Sum of the per-unit ruptured currents
- Sum of the squared per-unit ruptured currents
- Current-time integral of the per-unit ruptured current
- Sum of the current-time integrals of the per-unit ruptured currents

The ruptured current is derived from the RMS current value detected before a last zero crossing.

The integral of the current-time area is calculated between the trip time and the current's disappearance. The current's disappearance is recognized when no further current zero crossings are detected. An example for calculation of the current-time integral is displayed in Fig. 3-298, (p. 3-367).

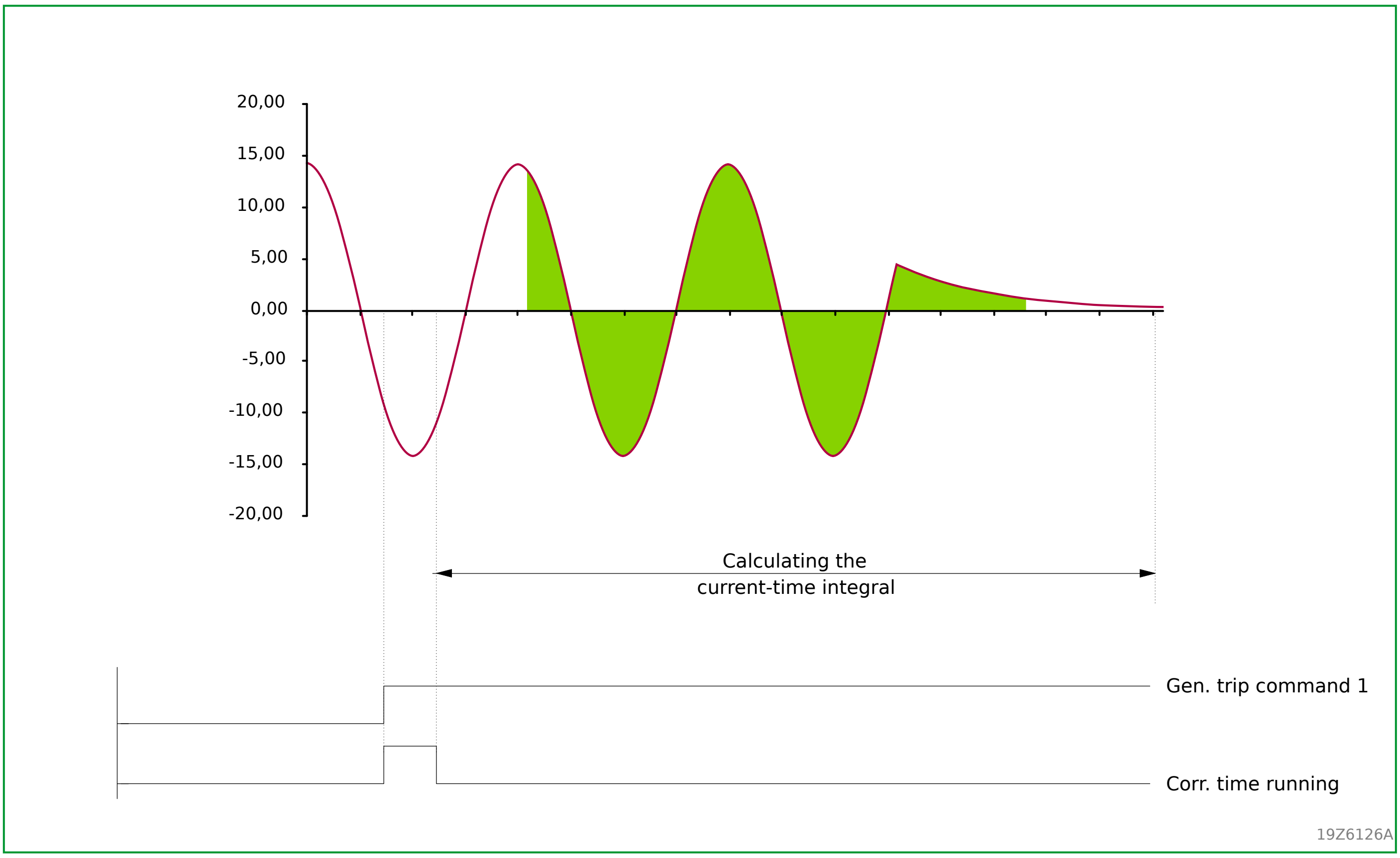
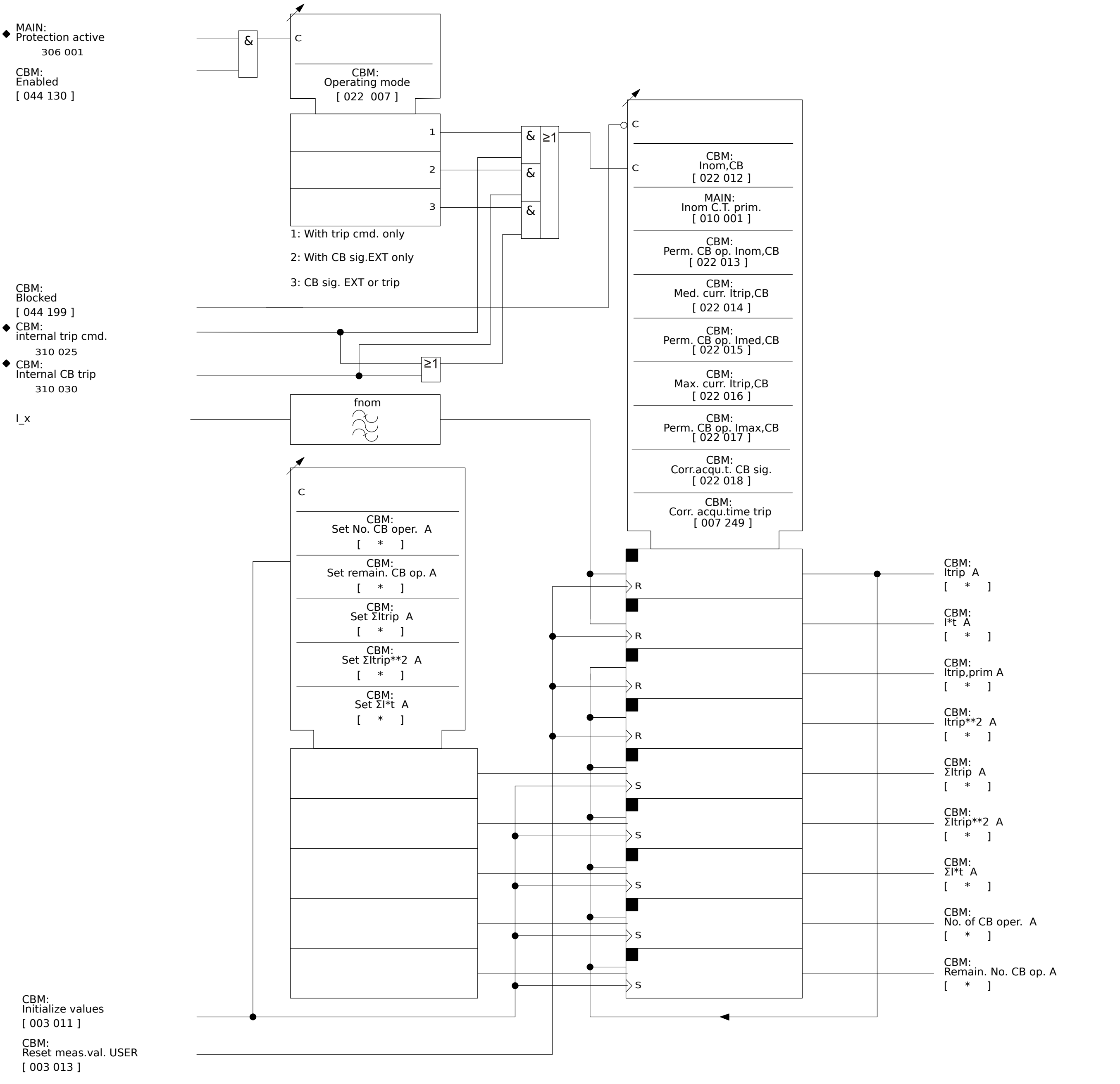


Fig. 3-298: Calculation of the current-time integral when CBM is triggered by a general trip command 1.

3.40.9 Resetting Measured Values

Measured values from the respective last CB trip may be reset via the interfaces on the P139. Accumulated measured values are not affected by such a reset operation.

3.40.10 Setting Measured Values



Phase x / Current Ix	CBM: Set No. CB oper. A	CBM: Set remain. CB op. A	CBM: Set ΣItrip A	CBM: Set ΣItrip**2 A	CBM: Set ΣI*t A	CBM: No. of CB oper. A	CBM: Remain. No. CB op. A
A / IA	022 131	022 134	022 137	022 140	022 143	008 011	008 014
B / IB	022 132	022 135	022 138	022 141	022 144	008 012	008 015
C / IC	022 133	022 136	022 139	022 142	022 145	008 013	008 016

Phase x / Current Ix	CBM: Itrip A	CBM: I*t A	CBM: Itrip,prim A	CBM: Itrip**2 A	CBM: ΣItrip A	CBM: ΣItrip**2 A	CBM: ΣI*t A
A / IA	009 047	009 061	009 212	009 051	009 071	009 077	009 087
B / IB	009 048	009 062	009 213	009 052	009 073	009 078	009 088
C / IC	009 049	009 063	009 214	009 053	009 076	009 079	009 089

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Fig. 3-299: Triggering and calculating circuit breaker monitoring.

Setting measured values in the circuit breaker monitoring function is necessary when the respective CB has already been exposed to operating conditions or has been replaced. The available interfaces on the P139 may be used to set measured values in the circuit breaker monitoring function.

> *Only such measured values and counter values in the P139 may be set to new values that do not have their default values set to Blocked.*
>
> *The stored value will remain unchanged if the default value is set to Blocked. Executing the set command results in initializing all default values in the P139 to Blocked.*

3.40.11 Monitoring the Number of CB Operations

Depending on the selected operating mode the P139 will calculate the current wear state of the circuit breaker after each disconnection. The number of remaining CB operations at CB nominal current are calculated and displayed. A threshold value can be set with the parameter CBM: Remain No. CB op. <. An alarm is issued should the number of remaining CB operations drop below this threshold.

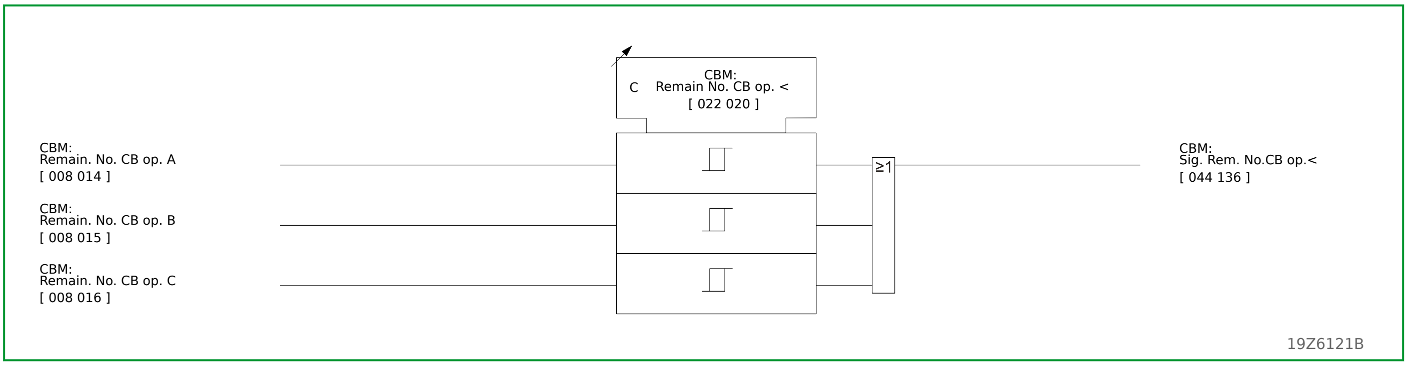


Fig. 3-300: Monitoring the remaining number of CB operations at nominal current.

At the same time each switching operation will increment the P139's counter for the number of CB operations. The number of CB operations performed is displayed. A threshold value can be set with the parameter CBM: No. CB operations >. An alarm is issued should the number of CB operations performed exceed this threshold.

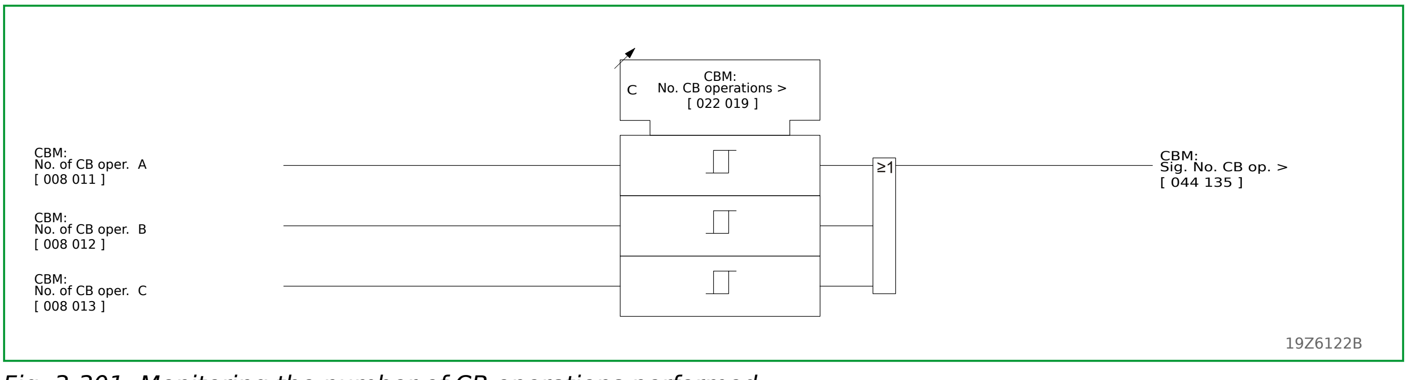


Fig. 3-301: Monitoring the number of CB operations performed.

3.40.12 Monitoring Ruptured Currents

In addition to the evaluation of the CB wear state and monitoring of the number of CB operations performed, the P139 features the means to accumulate and display the ruptured current values and the square of these values. Threshold values can be set with the parameters CBM: ΣItrip>, CBM: ΣItrip**2> and CBM: ΣI*t>. An alarm is issued should the accumulated current values exceed any of these thresholds.

3.40.13 Blocking Circuit Breaker Monitoring

When protection injection testing is carried out the circuit breaker monitoring function should be blocked, so that such testing does not corrupt monitoring results. CBM protection is blocked if one of the following conditions is met:

- Circuit breaker monitoring is blocked by parameters.
- Circuit breaker monitoring is blocked by an appropriately configured binary signal input.

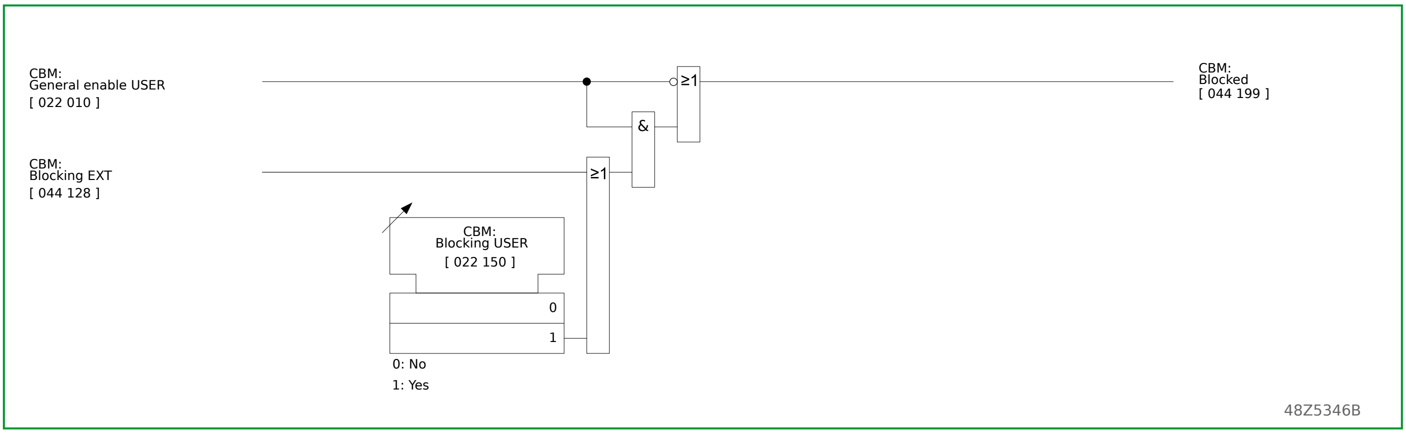


Fig. 3-302: Blocking circuit breaker monitoring.

3.41 Measuring-Circuit Monitoring (Function Group MCMON)

During healthy system operation, the P139 monitors the phase currents and, if VTs are fitted, the voltages as well as the reference voltage for balance. If either unbalance or the lack of measuring voltage is detected, action is taken to prevent the unit from malfunctioning.

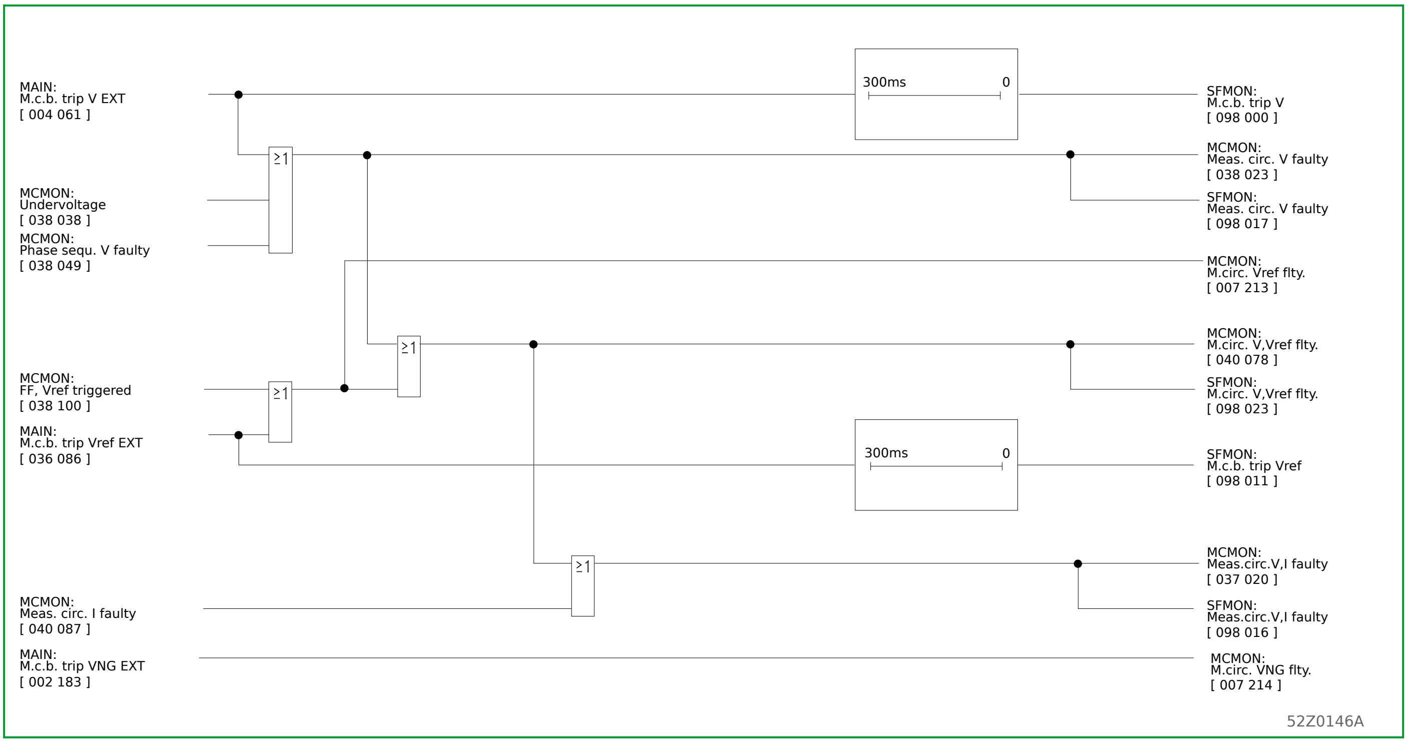


Fig. 3-303: Monitoring signals.

Measuring-circuit monitoring can be disabled by the appropriate setting. In the event of a fault, measuring-circuit monitoring is blocked.

3.41.1 Current Monitoring

Current monitoring is only enabled if the following conditions are simultaneously met:

- Measuring-circuit monitoring is enabledMCMON: General enable USER.
- The difference between the maximum and the minimum phase current exceeds $0.05 \cdot I_{nom}$.
- No general starting signal is present.

Current monitoring is based on checking the difference in the phase current magnitudes under the following operate condition:

$$\frac{I_{P,max} - I_{P,min}}{I_{P,max}} \geq I_{diff>}$$

where $I_{P,max}$ is the highest of the three phase currents and $I_{P,min}$ is the lowest; $I_{diff>}$ is the set operate value MCMON: Idiff>. In order to suppress short-term transients, the measuring stage *Idiff>* is followed by a set operate-delayed timer stage MCMON: Operate delay.

If connection is to two current transformers only (phase ANC connection only) evaluation of current I_B can be disabled by an appropriate selection for the operating mode.

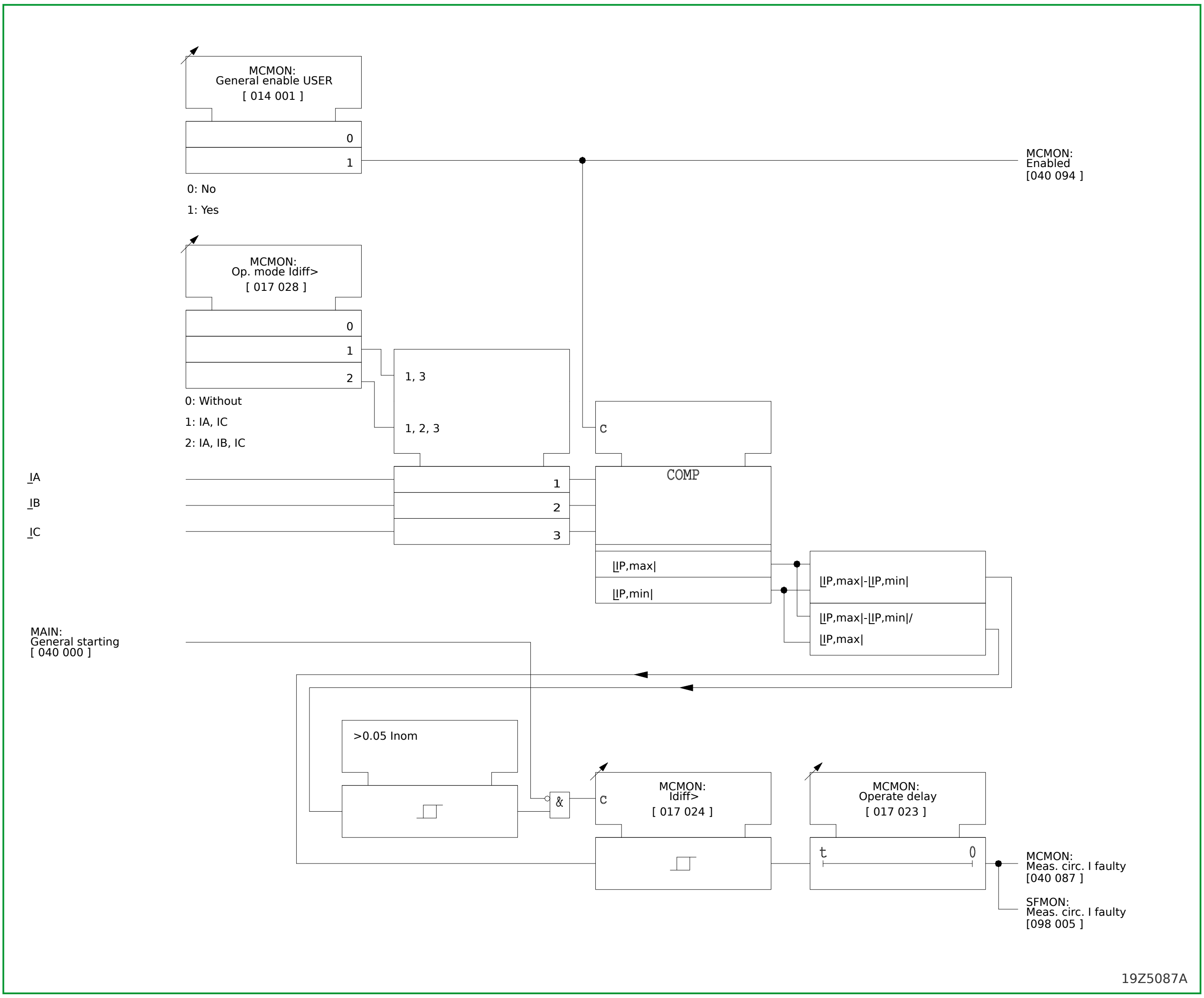


Fig. 3-304: Monitoring the current-measuring circuits.

3.41.2 Voltage Monitoring

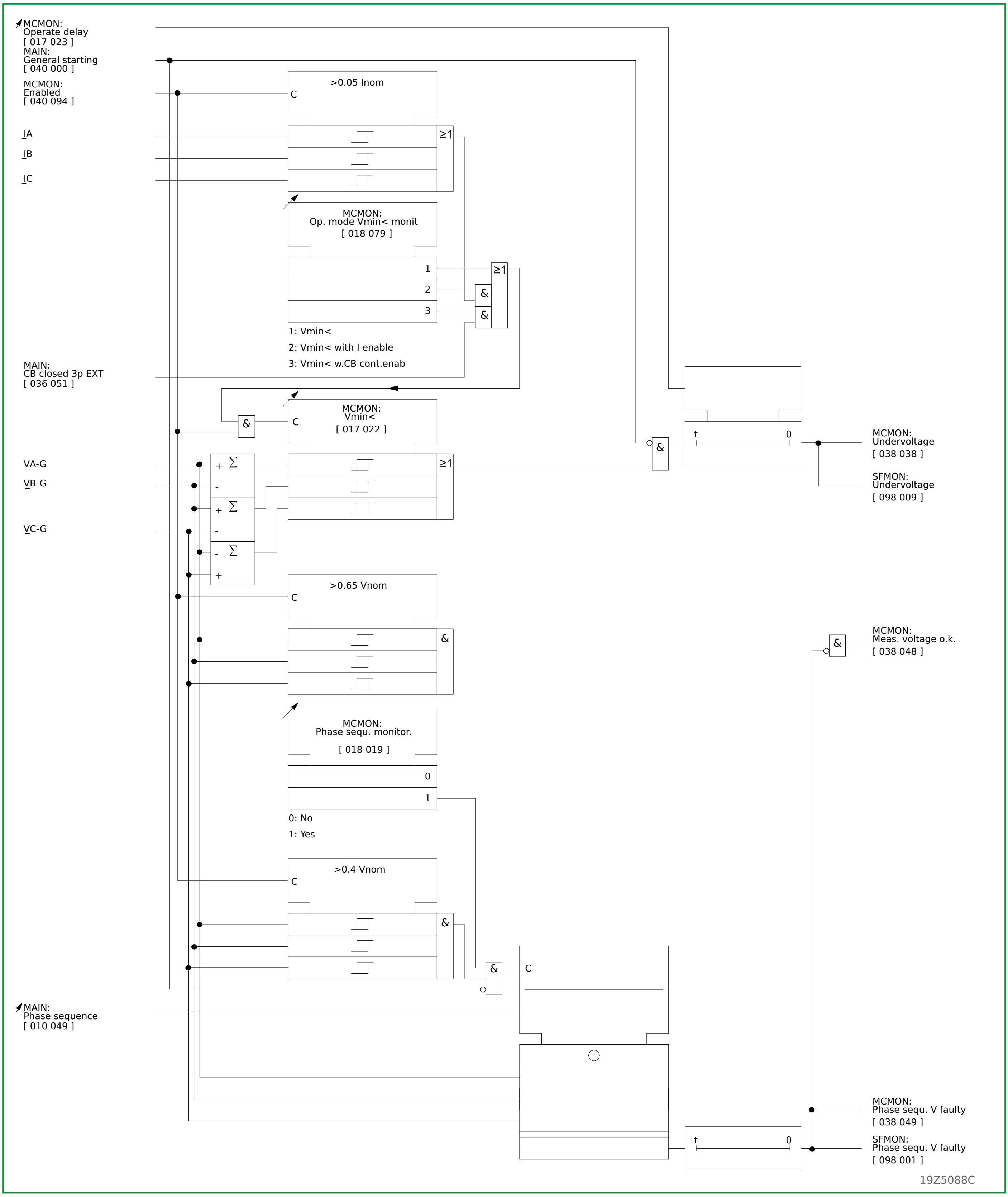


Fig. 3-305: Monitoring the voltage-measuring circuits.

Voltage monitoring is only enabled if the following conditions are met simultaneously:

- The P139 is fitted with voltage transformers.
- Measuring circuit monitoring is enabled.
- A general starting signal is absent.

In addition to these conditions, either a minimum current having the default threshold setting of $I>0.05 \cdot I_{nom}$ or the closed position of the circuit breaker contacts can be used as enabling criteria. If at least one of the phase-to-phase voltages falls below the set trigger value MCMON: Vmin< for the duration of the time-delay MCMON: Operate delay, then the MCMON: Undervoltage signal is issued.

The signal MCMON: Meas. voltage o.k. is generated if all three phase-to-phase voltages exceed the fixed threshold of 0.65 V_{nom} and there is no incorrect phase sequence.

3.41.3 Phase-Sequence Monitoring

Phase-sequence monitoring is enabled only if the following conditions are simultaneously met:

- Measuring circuit monitoring is enabled.
- Phase-sequence monitoring is enabled.
- All three phase-to-ground voltages exceed $0.4 \cdot V_{nom}$.
- No general starting signal is present.

In order to suppress short-term transients, the phase-sequence monitoring trigger is followed by a set time-delay of 1 s. Once the time-delay has elapsed, the signal MCMON: Phase sequ. V faulty is issued.

3.41.4 “Fuse Failure” Monitoring of the Reference Voltage

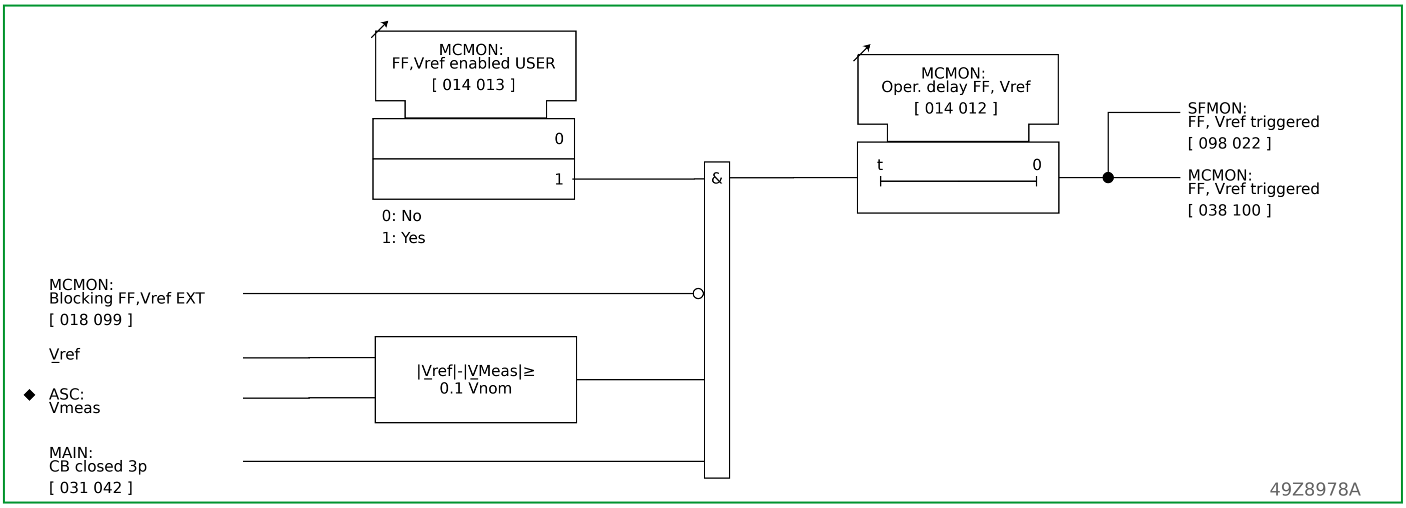


Fig. 3-306: “Fuse Failure” monitoring of the reference voltage.

The P139 includes “Fuse Failure” monitoring of the reference voltage function, which is required by the “Automatic Synchronism Check” (ASC).

Fuse Failure monitoring of the reference voltage is only possible if the ASC function has been configured. This is specifically applied when no auxiliary contact is available on the voltage transformer m.c.b. If fuse failure monitoring is not desired it can be disabled by setting parameters.

Fuse Failure monitoring must be able to discriminate between a short circuit in the three-phase network being monitored and a reference voltage missing because of a short circuit or an open circuit in the secondary circuits of the reference voltage.

A short circuit or an open circuit in the secondary circuits of the reference voltage is present when the following conditions are met:

- The circuit breaker is closed.
- The voltage difference between the line side and the busbar must exceed $0.1 \cdot V_{nom}$.

3.42 Limit Value Monitoring (Function Group LIMIT)

Limit Value Monitoring is not designed to be a high-speed protection function; it is only applied for monitoring and signaling purposes as well as to monitor temperature limits.

3.42.1 Enable/Disable the Limit Value Monitoring Function

The Limit Value Monitoring function can be disabled or enabled via setting parameters.

3.42.2 Monitoring Phase Currents and Phase Voltages

With the P139 monitoring of the following measured values is possible in order to determine if they exceed set upper limit values or fall below set lower limit values:

- Maximum phase current
- Minimum phase current
- Maximum phase-to-phase voltage
- Minimum phase-to-phase voltage
- Maximum phase-to-ground voltage
- Minimum phase-to-ground voltage

If any of the measured values exceeds or falls below the corresponding upper or lower limit values, then a signal is issued after the associated time period has elapsed.

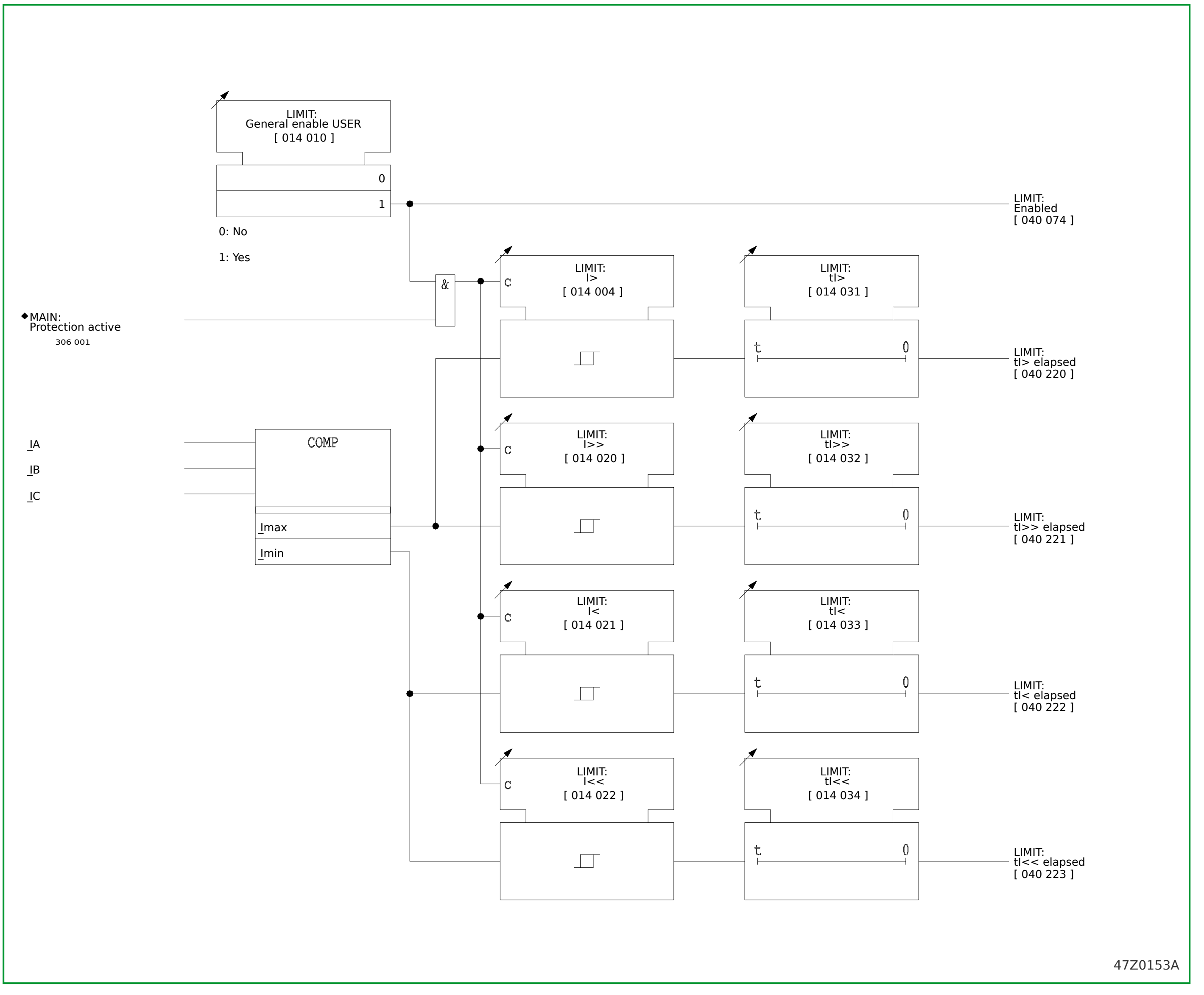


Fig. 3-307: Limit Value Monitoring of minimum and maximum phase current.

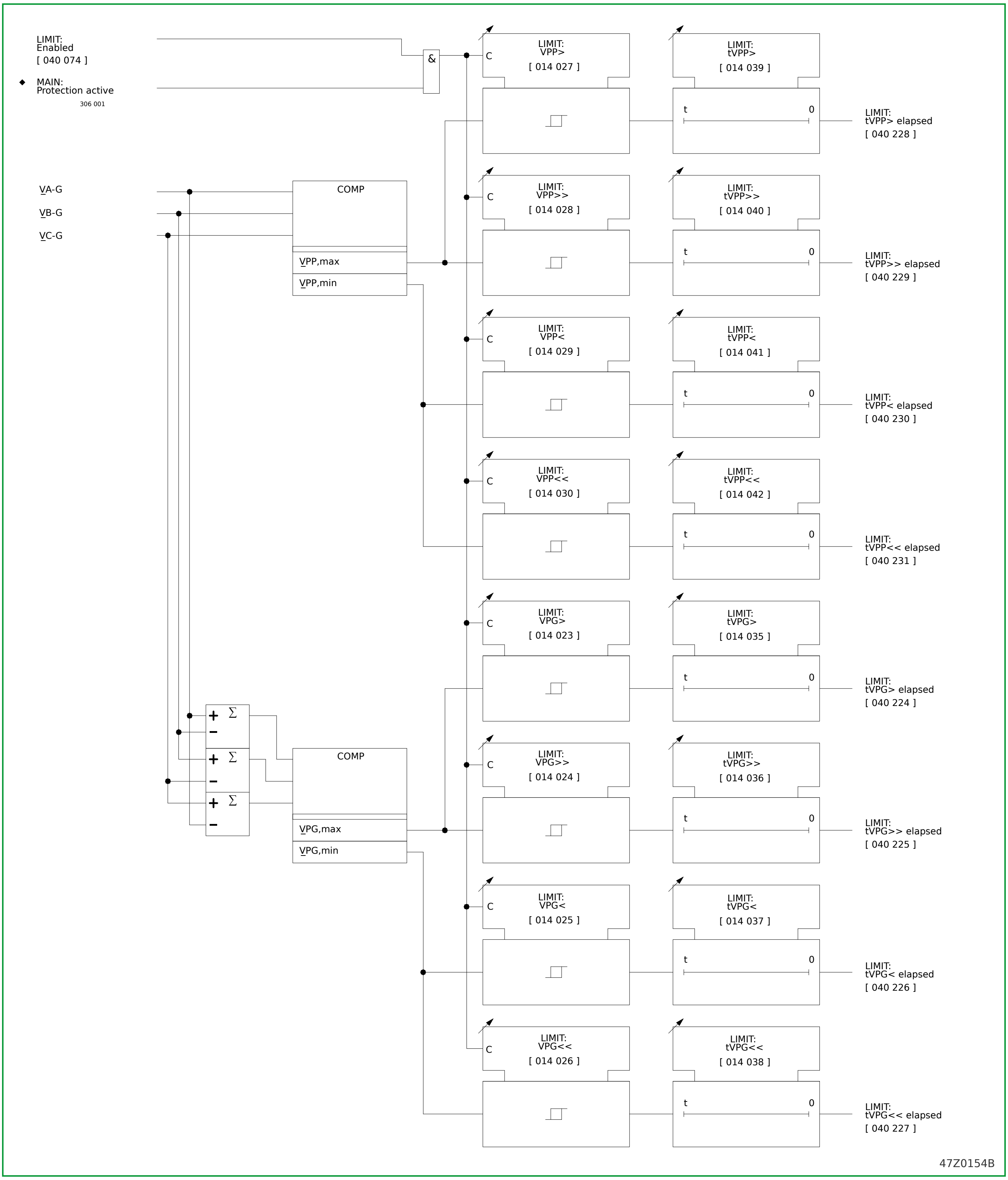


Fig. 3-308: Limit Value Monitoring of maximum and minimum phase-to-phase voltage and maximum and minimum phase-to-ground voltage.

3.42.3 Monitoring the Neutral-Point Displacement Voltage

The neutral displacement voltage, calculated from the three phase-to-ground voltages, is monitored by two stages to determine whether it exceeds set thresholds. If any of the thresholds are exceeded, then a signal is issued after the associated time period has elapsed.

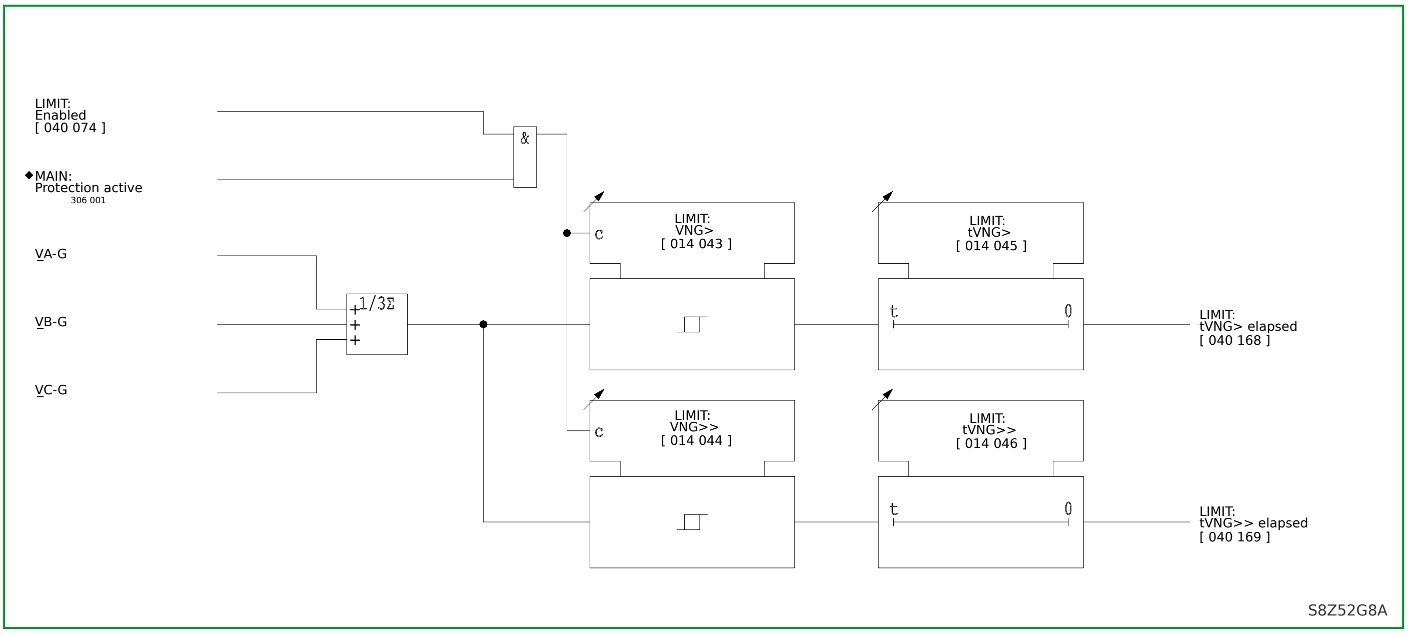


Fig. 3-309: Monitoring the neutral-point displacement voltage.

3.42.4 Monitoring the Linearized Measured DC Values

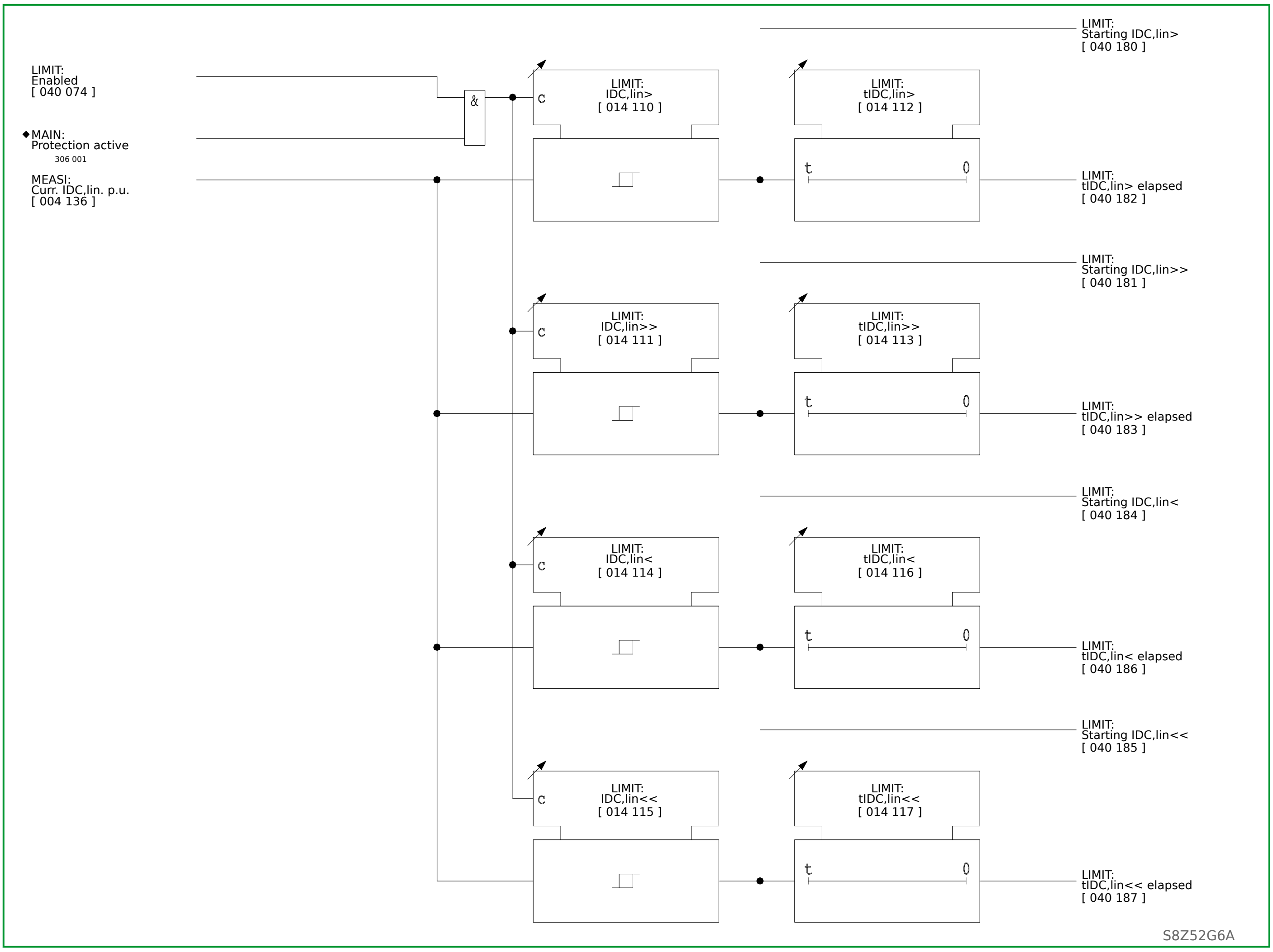


Fig. 3-310: Monitoring the linearized measured DC values.

The direct current, linearized by the analog measured data input, is monitored by two stages to determine if it exceeds or falls below set thresholds. If any of the measured values exceed or fall below the corresponding upper or lower limit values then a signal is issued after the associated time period has elapsed.

3.42.5 Monitoring the Reference Voltage

The reference voltage V_{ref} (when synchrocheck VT is fitted) is monitored by two stages to determine whether it exceeds or falls below the corresponding upper or lower limit values. If the measured value exceeds or falls below the corresponding upper or lower limit values then a signal is issued after the associated time period has elapsed.

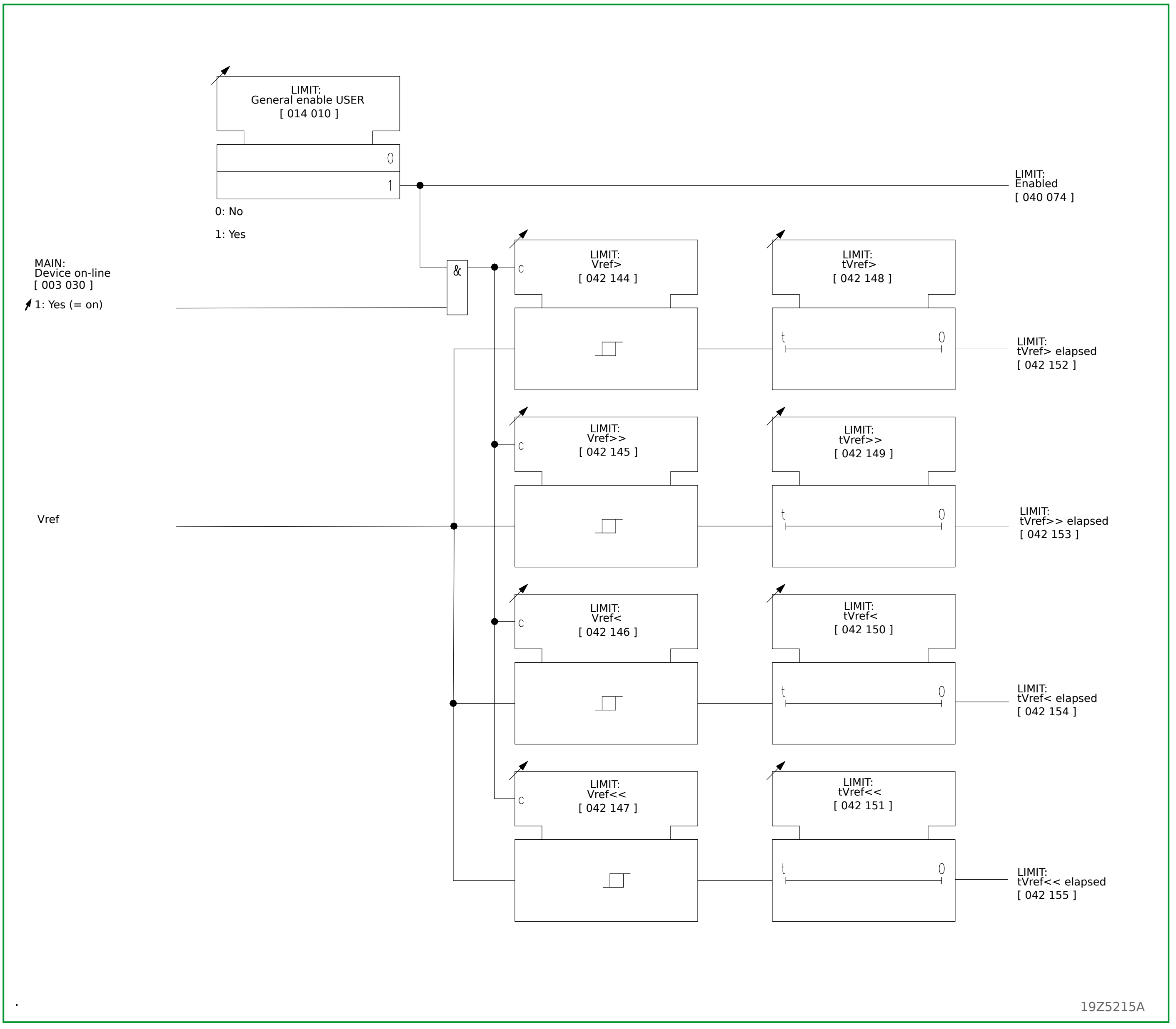


Fig. 3-311: Monitoring the reference voltage.

3.42.6 Monitoring the Measured “PT 100” Temperature Value

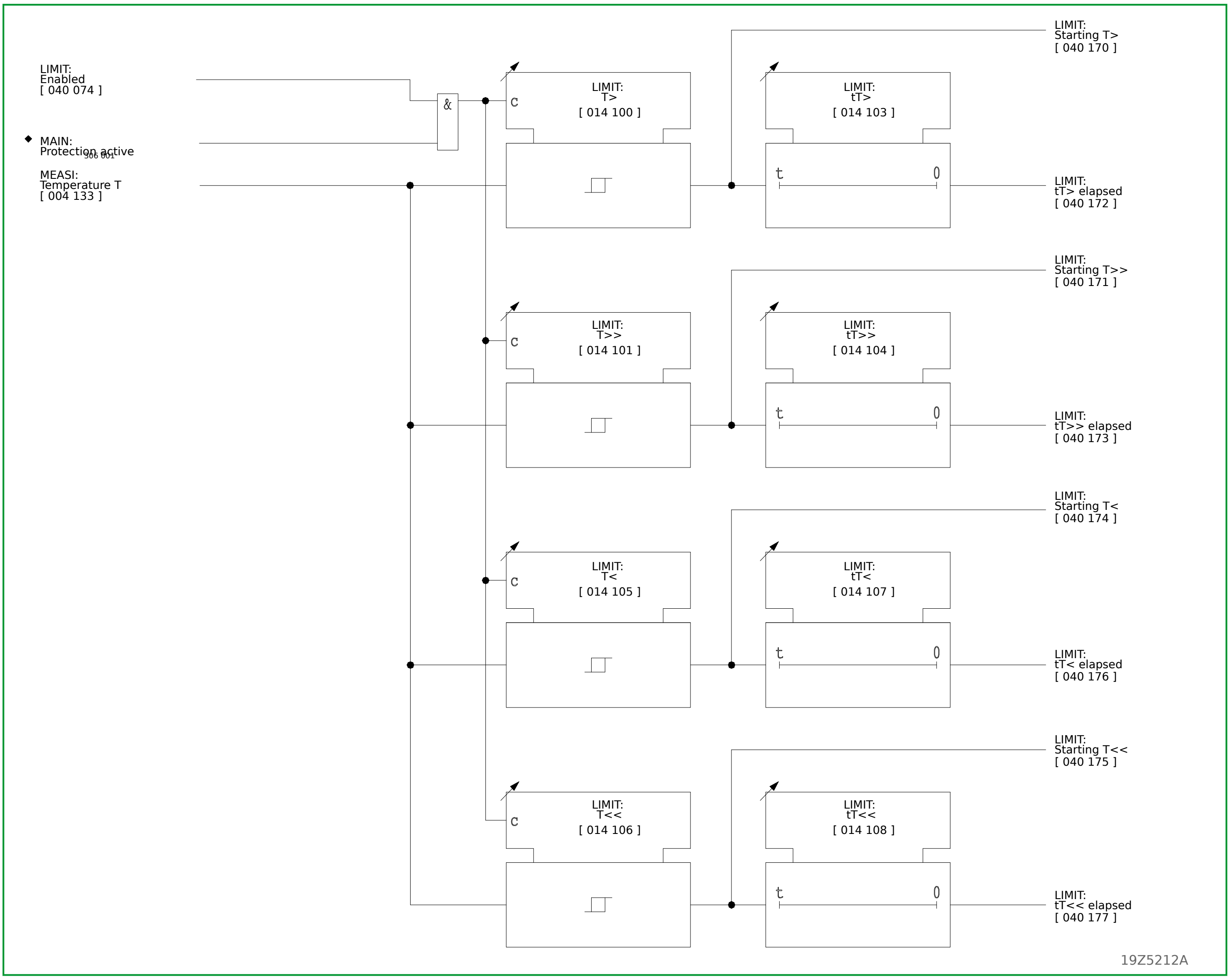


Fig. 3-312: Monitoring the measured “PT 100” temperature value.

The temperature value that is measured by the P139 with a resistance thermometer (PT 100) connected to the analog (I/O) module Y, is monitored by two stages to determine whether it exceeds or falls below the corresponding upper or lower limit values. If any of the measured values exceed or fall below the corresponding upper or lower limit values then a signal is issued after the associated time period has elapsed.

3.42.7 Monitoring the Measured Temperature Values T1 to T9

The temperatures that are measured by the P139 using temperature sensors connected to the temperature p/c board (RTD module) are each monitored by two stages to determine if they exceed or fall below set thresholds. If any of the measured values exceed or fall below the corresponding upper or lower limit values then a signal is issued after the associated time period has elapsed.

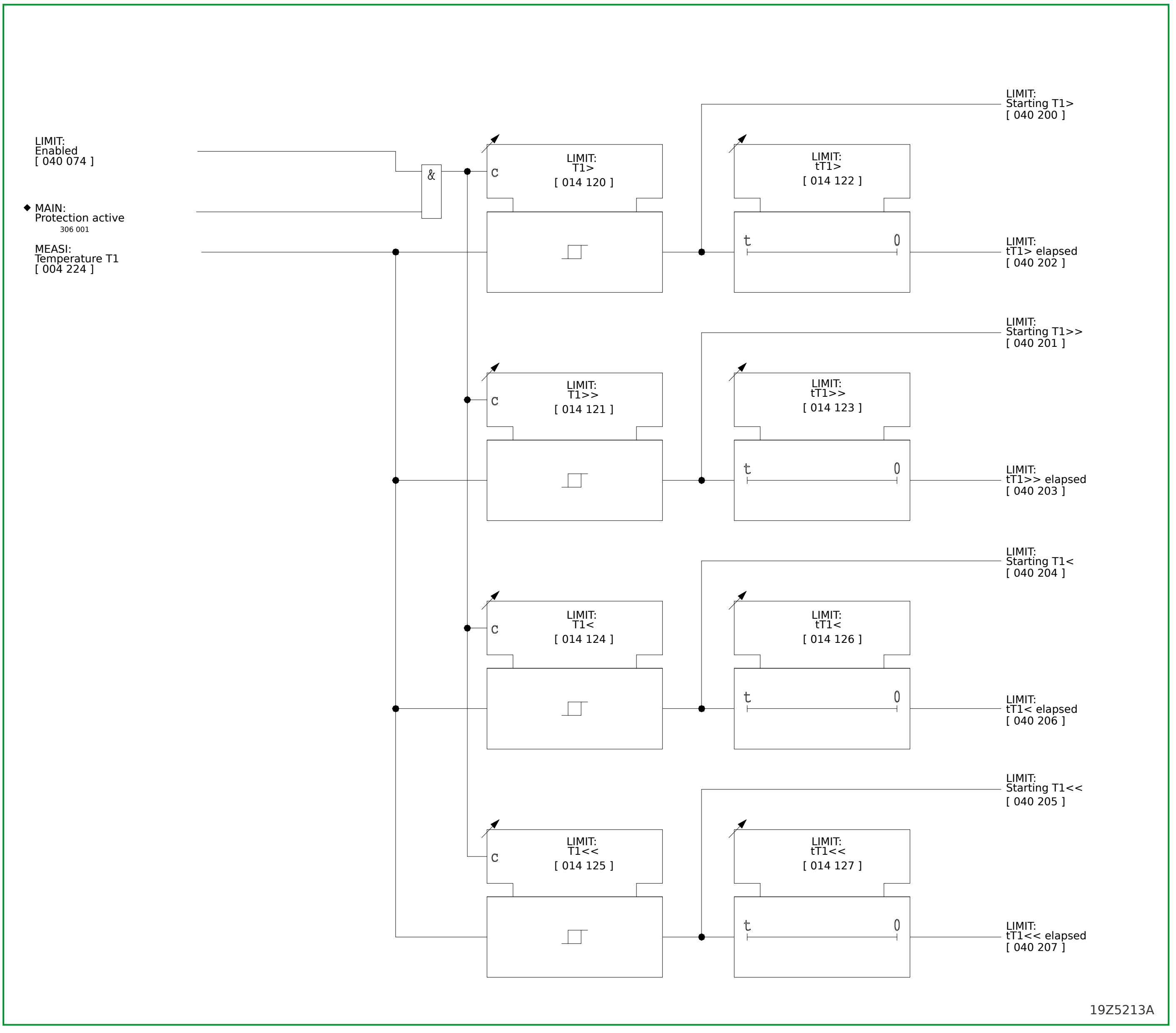


Fig. 3-313: Monitoring the measured temperature value T1 as an example for measured temperature values T1 to T9.

3.42.8 Open Circuit PT 100

The open circuit signals from the temperature sensors, issued by the function group MEASI (see Section 3.7, (p. 3-51)) are forwarded to the Limit Value Monitoring function. An open circuit signal MEASI: Open circ. T1 (or MEASI: Open circ. T2, ...) will lead to blocking of these signals:

- LIMIT: Starting T1>
- LIMIT: Starting T1>>
- LIMIT: Starting T1<
- LIMIT: Starting T1<<
- LIMIT: tT1> elapsed
- LIMIT: tT1>> elapsed
- LIMIT: tT1< elapsed
- LIMIT: tT1<< elapsed

3.42.9 Backup Sensors

When an open circuit has occurred the 2-out-of-3 logic available with the Limit Value Monitoring function will revert to backup sensors.

The selection of such backup sensors for the Limit Value Monitoring function is made in the function group MEASI.

For this purpose the temperature sensors connected to the temperature p/c board (RTD module) are divided into three groups:

- Group 1: T1, T2, T3
- Group 2: T4, T5, T6
- Group 3: T7, T8, T9

If MEASI: BackupTempSensor PSx is set to *None* the Limit Value Monitoring function will operate without backup sensors.

If MEASI: BackupTempSensor PSx is set to *Group 1 - 2*,

the defective temperature sensor from group 1 is replaced by the corresponding sensor from group 2.

If the backup temperature sensor from group 2 also fails it will be replaced by the corresponding sensor from group 3, under the assumption that MEASI: BackupTempSensor PSx is set to *Group 1 - 2/3*.

The association of backup temperature sensors is listed below:

Main sensor	Backup sensor from group 2, with setting: *Group 1 - 2* or *Group 1 - 2/3*	Backup sensor from group 3, with setting: *Group 1 - 2/3*
T1	T4	T7
T2	T5	T8
T3	T6	T9

Should temperature sensor T1 fail, with the setting *Group 1 - 2/3*, it will replaced by T4. Should temperature sensor T4 also fail it will replaced by T7.

3.42.10 2-out-of-3 Monitoring

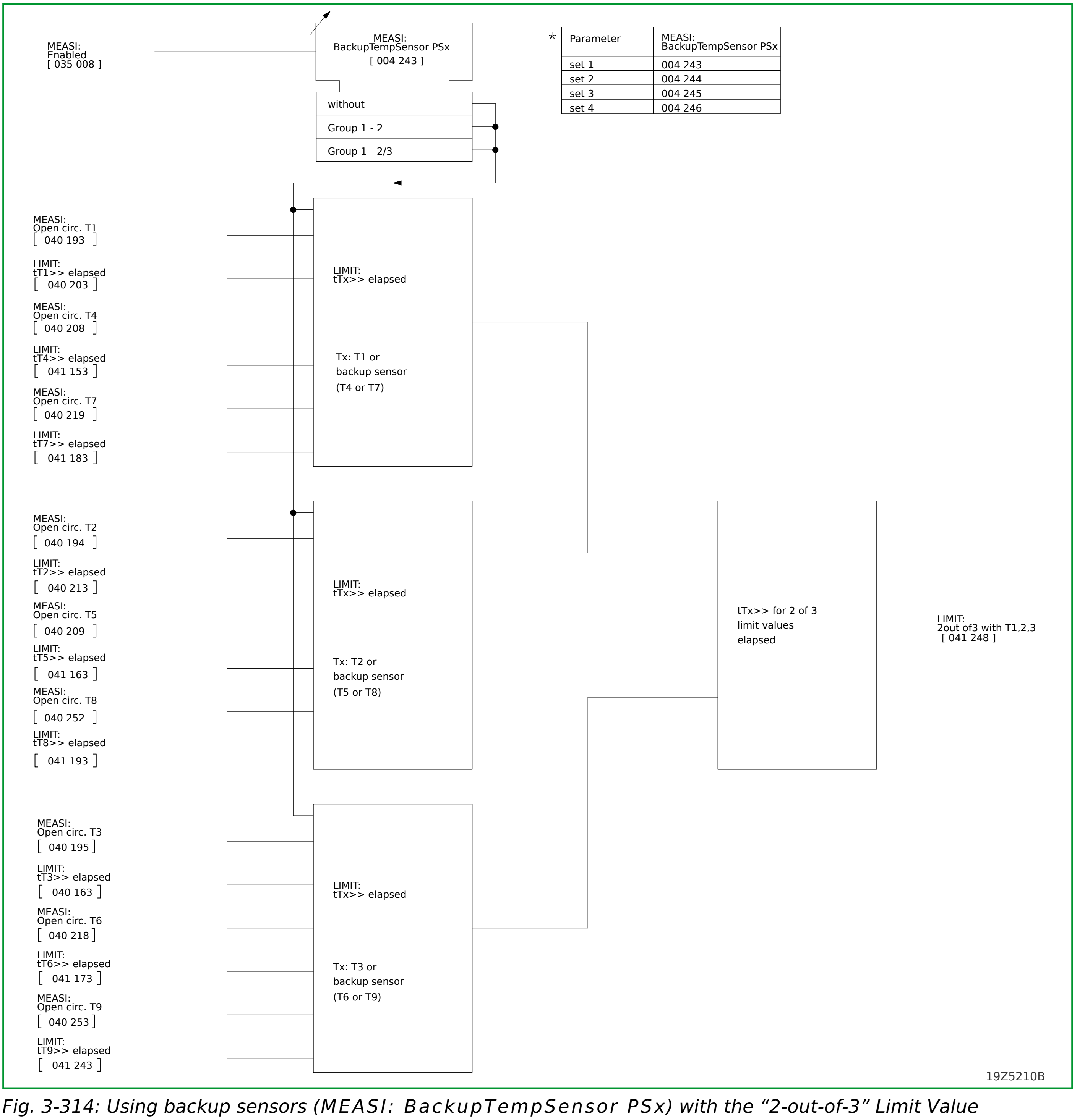


Fig. 3-314: Using backup sensors (MEASI: BackupTempSensor PSx) with the “2-out-of-3” Limit Value Monitoring function.

Limit values resulting from temperature values measured by main sensors (from group 1) or their corresponding backup sensors are processed by the “2-out-of-3” Limit Value Monitoring function, LIMIT: 2out of3 with T1,2,3. This is displayed in the diagram above.

All functions associated with temperature sensors operate in a parallel mode. In this way the “2-out-of-3” Limit Value Monitoring function, LIMIT: 2out of3 with T4,5,6 may use temperature sensors from group 2 even though these backup sensors are configured to group 1.

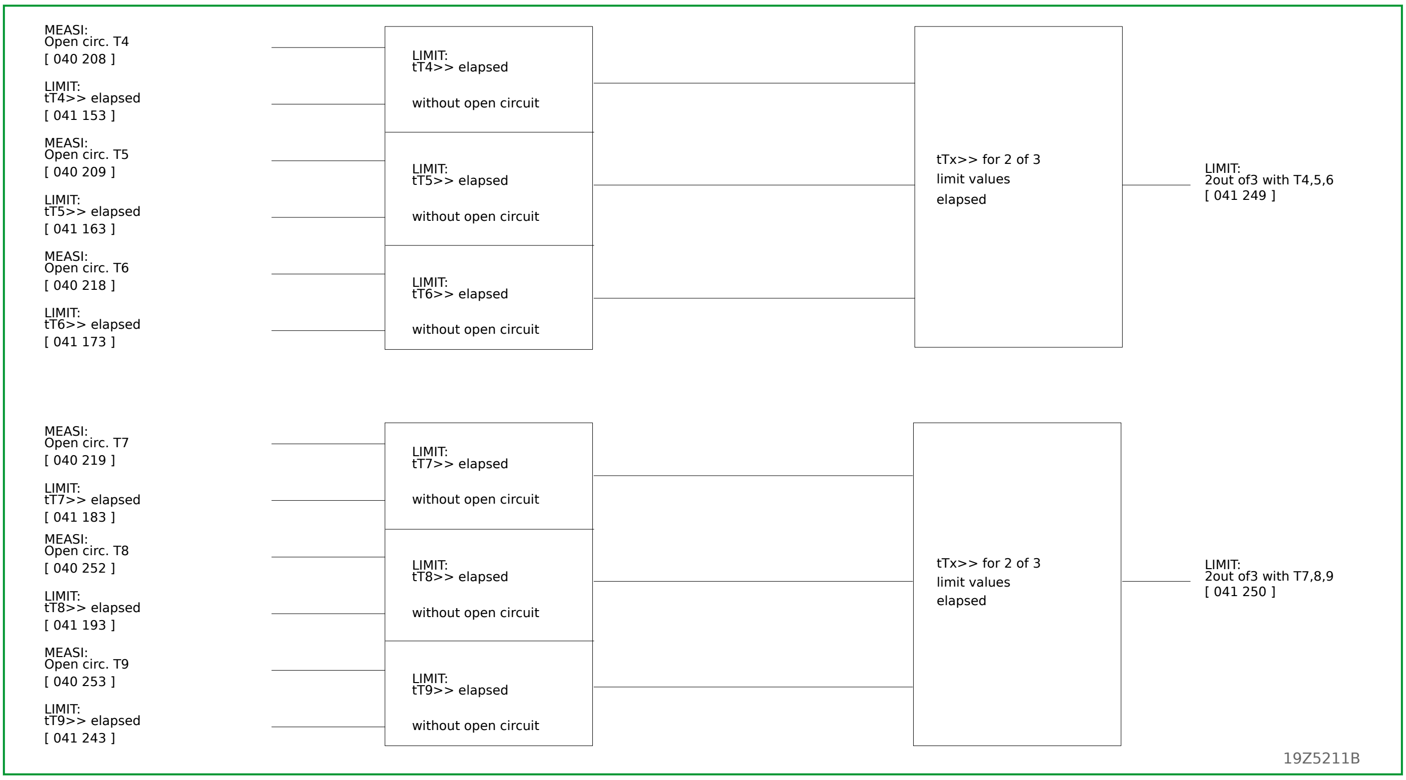


Fig. 3-315: Limit Value Monitoring function “2-out-of-3” for temperature sensors T4 to T6 and T7 to T9. If MEASI: BackupTempSensor PSx is set to None this scheme will also apply to temperature sensors T1 to T4.

3.42.11 Application Example

A motor protection application is shown in the figure below with temperature sensors T1 to T9 connected to the temperature p/c board (RTD module) and a “PT 100” resistance thermometer connected to the analog (I/O) module Y.

These temperature sensors, for example, can be distributed as follows:

- On the stator there are three temperature sensors as the main sensors (group 1: T1, T2, T3) and three backup sensors (group 2: T4, T5, T6) used by the “2-out-of-3” Limit Value Monitoring function
- One temperature sensor on each of the bearings is used for individual Limit Value signaling
- One main and one backup sensor inside the coolant are used by the thermal replica in the Thermal Overload protection

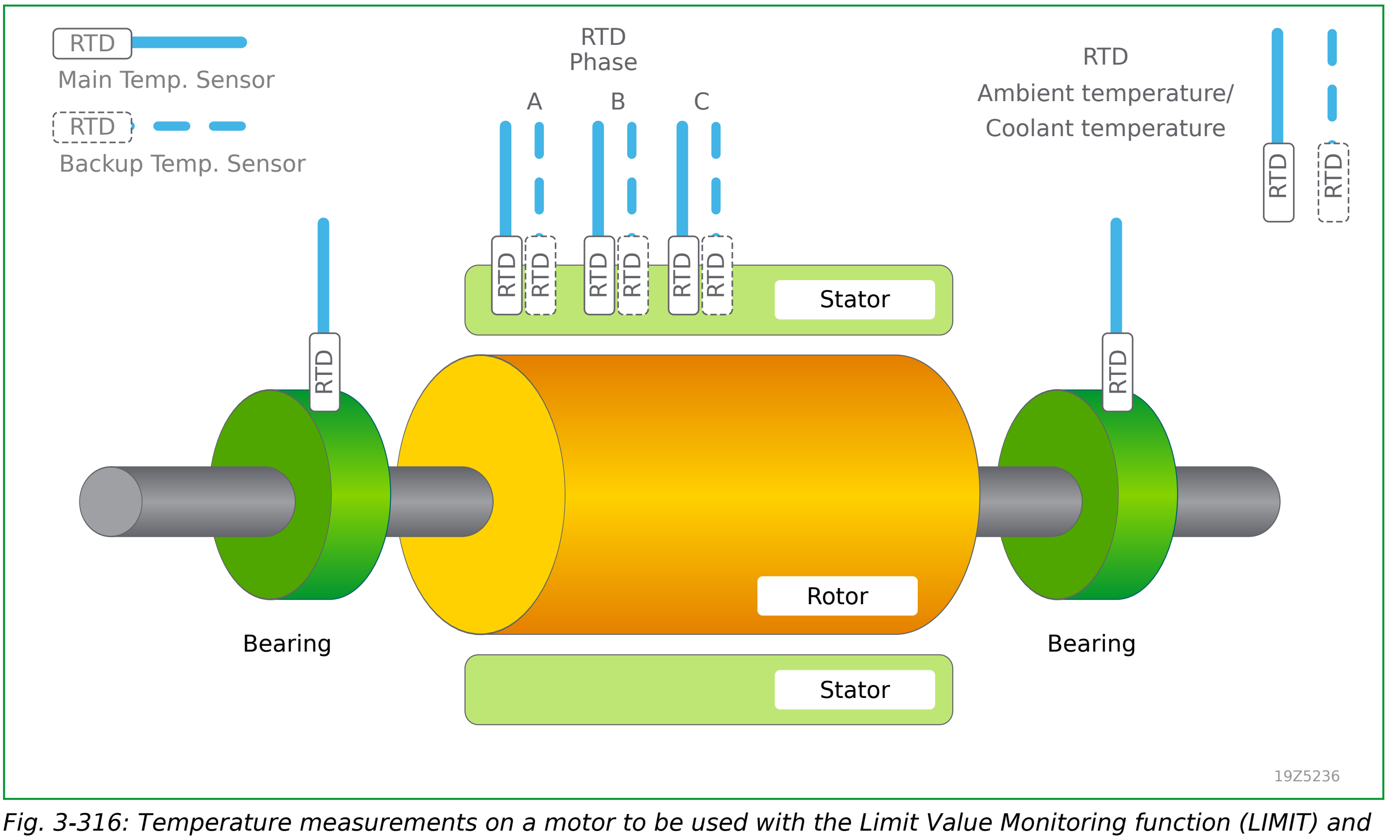


Fig. 3-316: Temperature measurements on a motor to be used with the Limit Value Monitoring function (LIMIT) and the Thermal Overload protection (THERM).

3.43 Programmable Logic (Function Groups LOGIC and LOG_2)

Programmable (or user-configurable) logic enables the user to link binary signals within a framework of Boolean equations.

Two function groups for programmable logic are available, that can be used independently of each other. There are only two differences between these two function groups:

- LOGIC offers 128 logical equations.

  LOG_2 offers only 4 logical equations.
- On the other hand, LOG_2 features long-term timers.

  For example for output 1:
  - LOGIC: Time t1 output 1 and LOGIC: Time t2 output 1: settable from 0 to 600 s.
  - LOG_2: Time t1 output 1 and LOG_2: Time t2 output 1: settable from 0 to 60,000 s.

The following description concentrates on the function group LOGIC. Where applicable, any differences to LOG_2 are mentioned.

Binary signals in the P139 may be linked by logical “OR” or “AND” operations with the option of additional NOT operations by setting LOGIC: Fct.assignm. outp. 1 (or LOGIC: Fct.assignm. outp. 2 to LOGIC: Fct.assignm. outp. 32, or LOG_2: Fct.assignm. outp. 1 to LOG_2: Fct.assignm. outp. 4). The Boolean equations need to be defined without the use of brackets. The following rule applies to the operators: “NOT” before “AND” before “OR”.

A maximum of 32 elements can be processed in one Boolean equation. In addition to the signals generated by the P139, initial conditions for governing the equations can be set using setting parameters, through binary signal inputs, or through the serial interfaces.

Logical operations of the function group LOGIC can be controlled through the binary signal inputs in different ways.

The binary input signals LOGIC: Input 01 EXT (or LOGIC: Input 02 EXT, ..., LOGIC: Input 40 EXT) have an updating function, whereas the input signals LOGIC: Set 1 EXT (or LOGIC: Set 2 EXT, ..., LOGIC: Set 8 EXT) are latched. The logic can only be controlled from the binary signal inputs configured for LOGIC: Set 1 EXT if the corresponding reset input LOGIC: Reset 1 EXT) has been configured for a binary signal input. If only one or neither of the two functions is configured, then this is interpreted as “Logic externally set”. If the input signals of the two binary signal inputs are implausible (such as when they both have a logic value of “1”), then the last plausible state remains stored in memory. (For LOG_2, there are no such parameters for assigning binary input signals.)

WARNING

When using the programmable logic, the user must carry out a functional type test to conform with the requirements of the relevant protection/control application. In particular, it is necessary to verify that the requirements for the implementation of logic linking (by setting) as well as the time performance during startup of the P139, during operation and when there is a fault (blocking of the P139) are fulfilled.

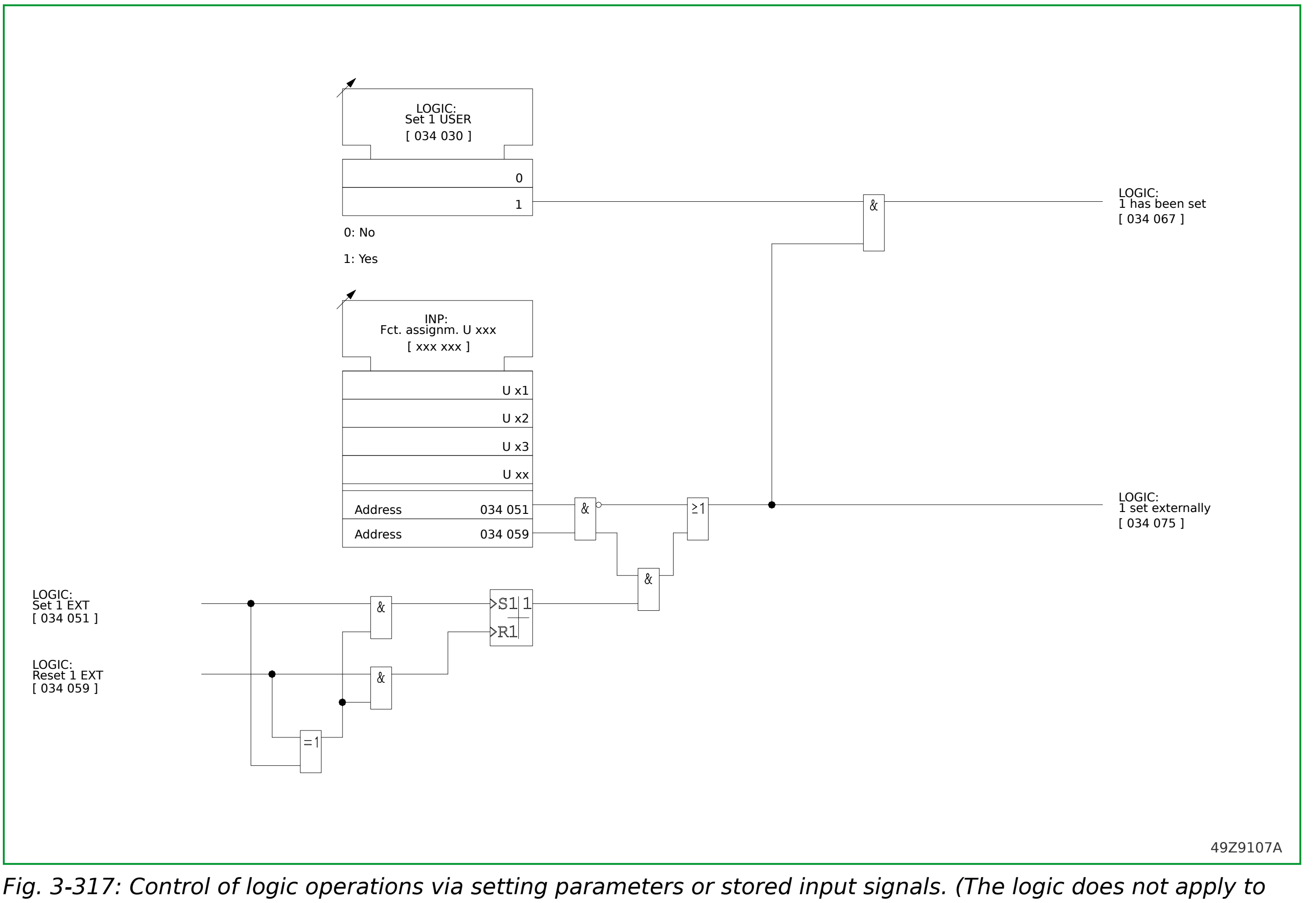


Fig. 3-317: Control of logic operations via setting parameters or stored input signals. (The logic does not apply to LOG_2.)

The LOGIC: Trigger 1 signal is a “triggering function” that causes a 100 ms pulse to be issued.

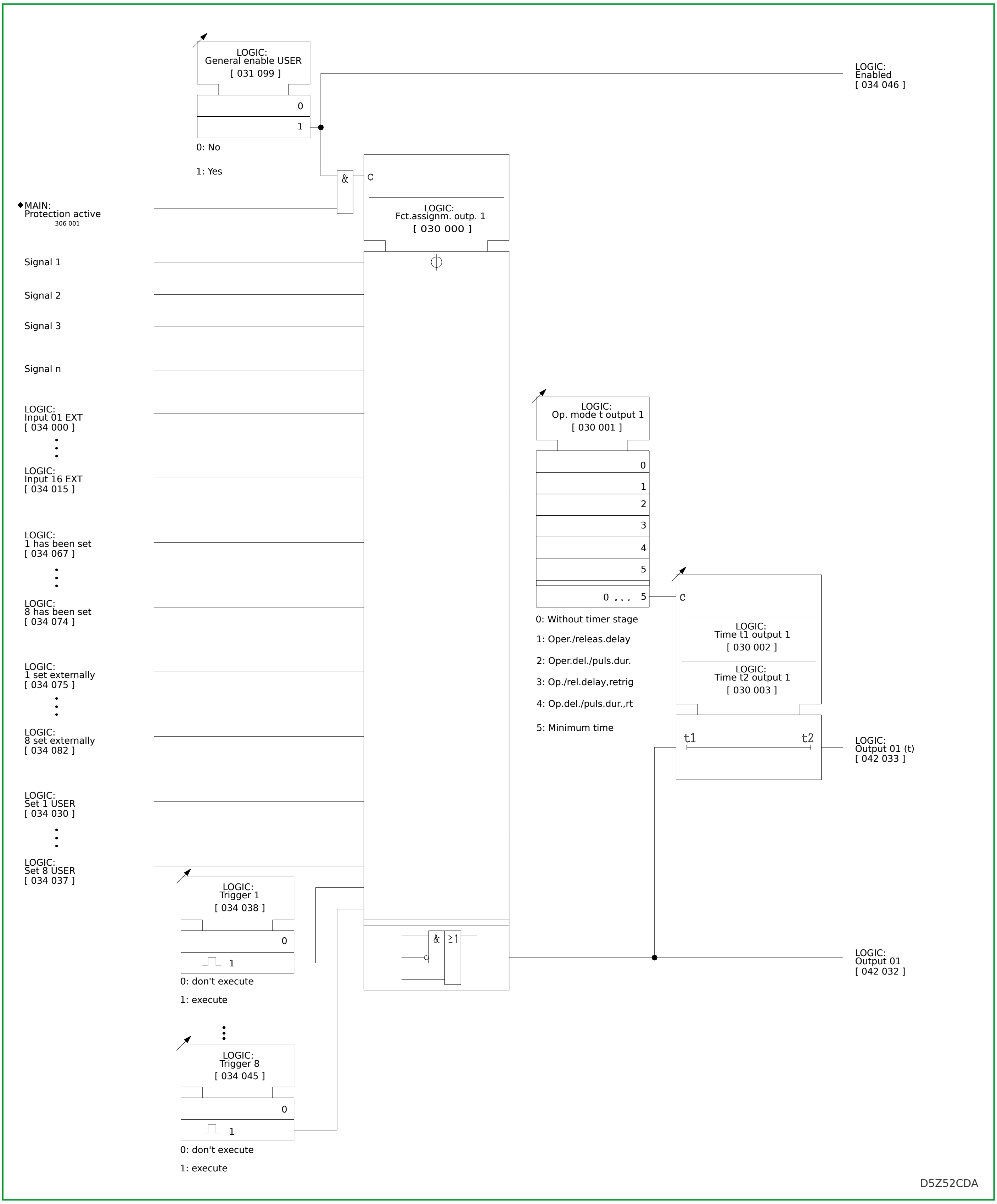


Fig. 3-318: Setting options for programmable logic, function group LOGIC (shown here for output 1).

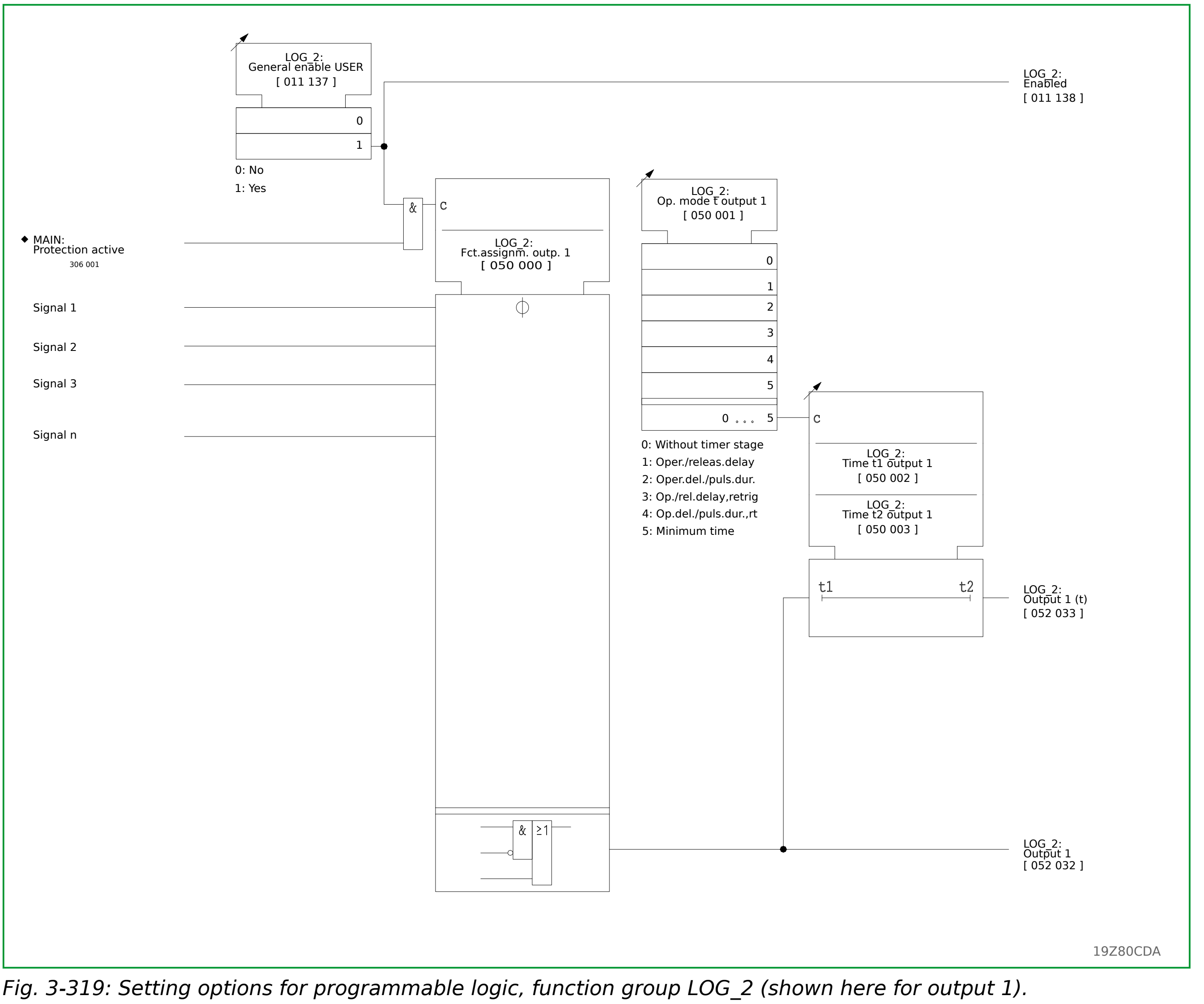


Fig. 3-319: Setting options for programmable logic, function group LOG_2 (shown here for output 1).

The output signal of an equation can be fed into a further, higher order, equation as an input signal thus creating a sequence of interlinked Boolean equations. The equations are processed in the sequence defined by the order of each equation. It should be noted that in the case of overlapping equations, the result is provided by the equation with the highest order.

The output signal of each equation is fed to a separate timer stage with two timer elements and a choice of operating modes. This offers the possibility of assigning a freely configurable time characteristic to the output signal of each Boolean equation. In the *Minimum time* operating mode, the setting of timer stage t2 has no effect. The following diagrams (Fig. 3-320, (p. 3-393) to Fig. 3-324, (p. 3-395)) show the time characteristics for the various timer stage operating modes.

If the P139 is switched to offline the equations are not processed and all outputs are set to the “0” logic level.

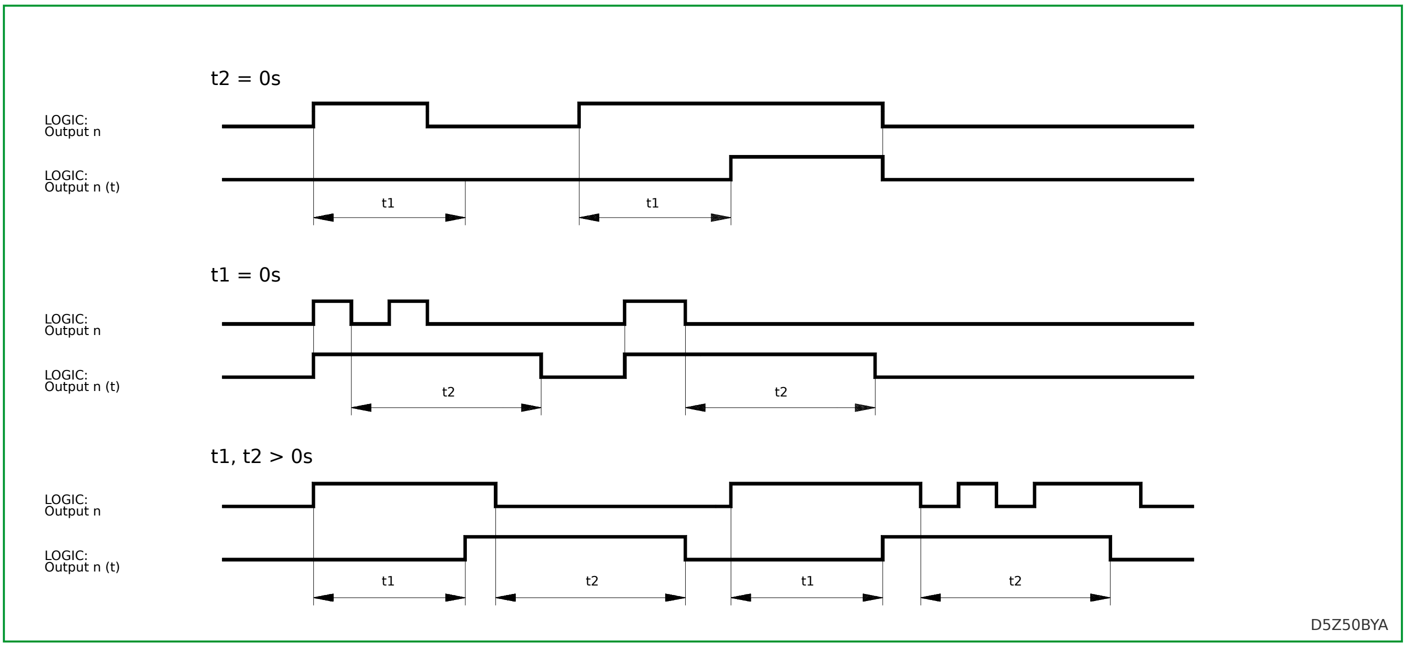


Fig. 3-320: Operating mode 1: Pickup/reset delay (Oper./releas.delay). (This diagram is also valid for LOG_2, if the signal parameters are replaced by the corresponding ones from LOG_2 .)

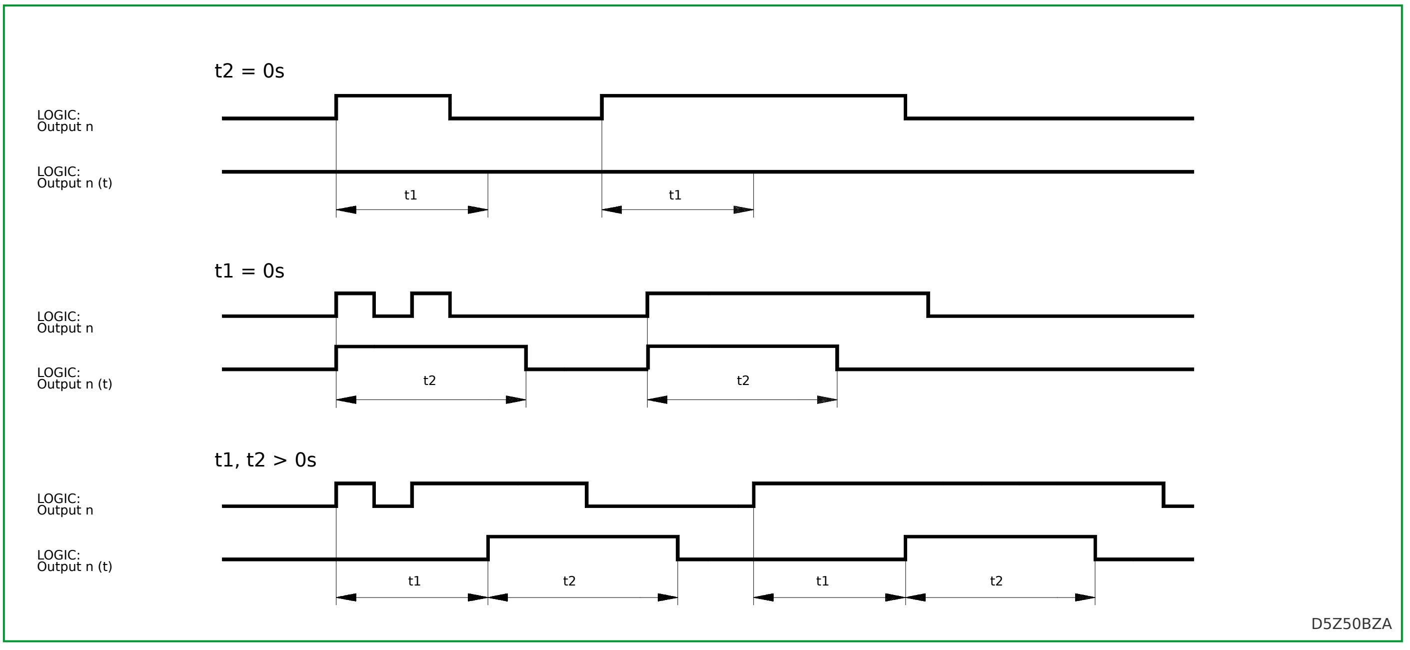


Fig. 3-321: Operating mode 2: Pulse, delayed pickup (Oper.del./puls.dur.). (This diagram is also valid for LOG_2, if the signal parameters are replaced by the corresponding ones from LOG_2 .)

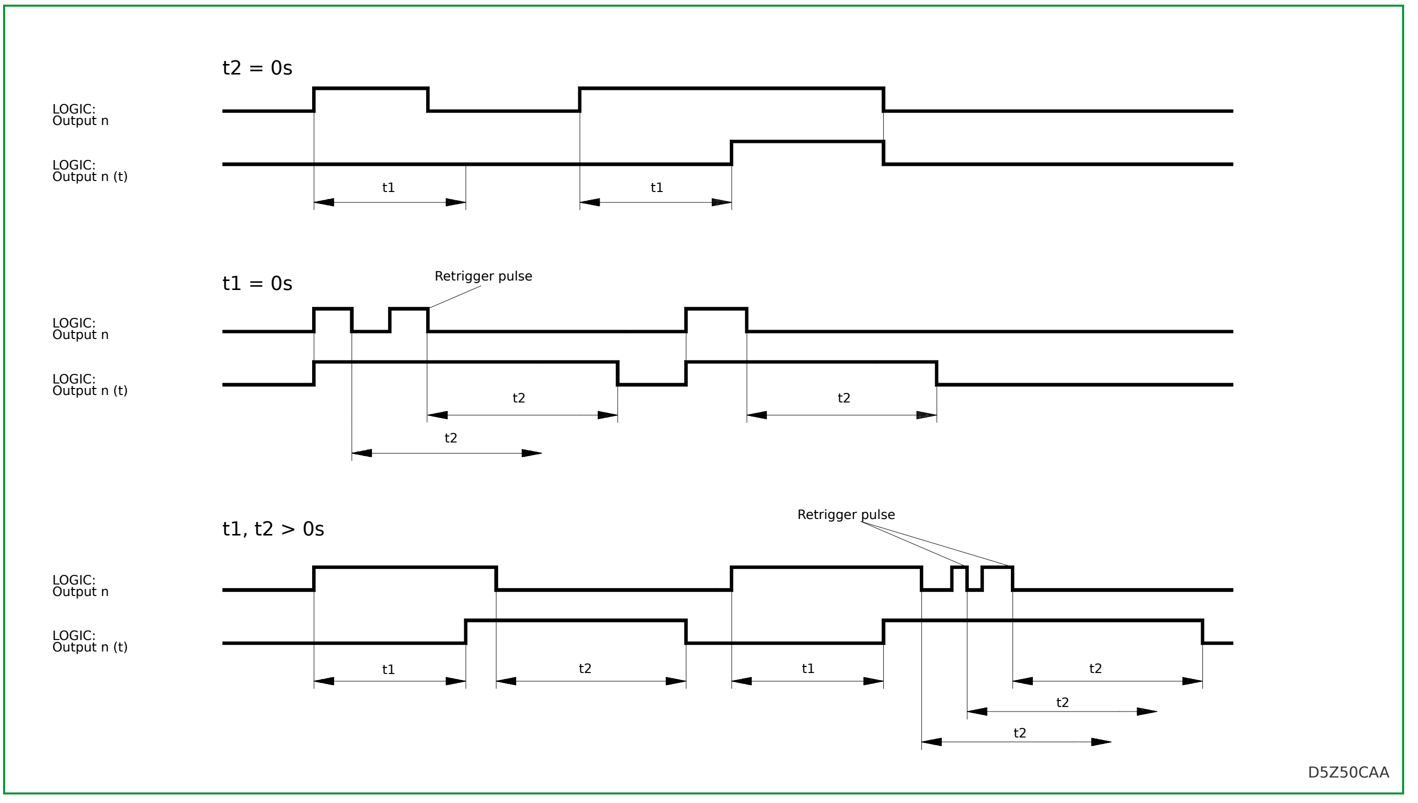


Fig. 3-322: Operating mode 3: Pickup/reset delay, retriggerable (Op./rel.delay,retrig). (This diagram is also valid for LOG_2, if the signal parameters are replaced by the corresponding ones from LOG_2 .)

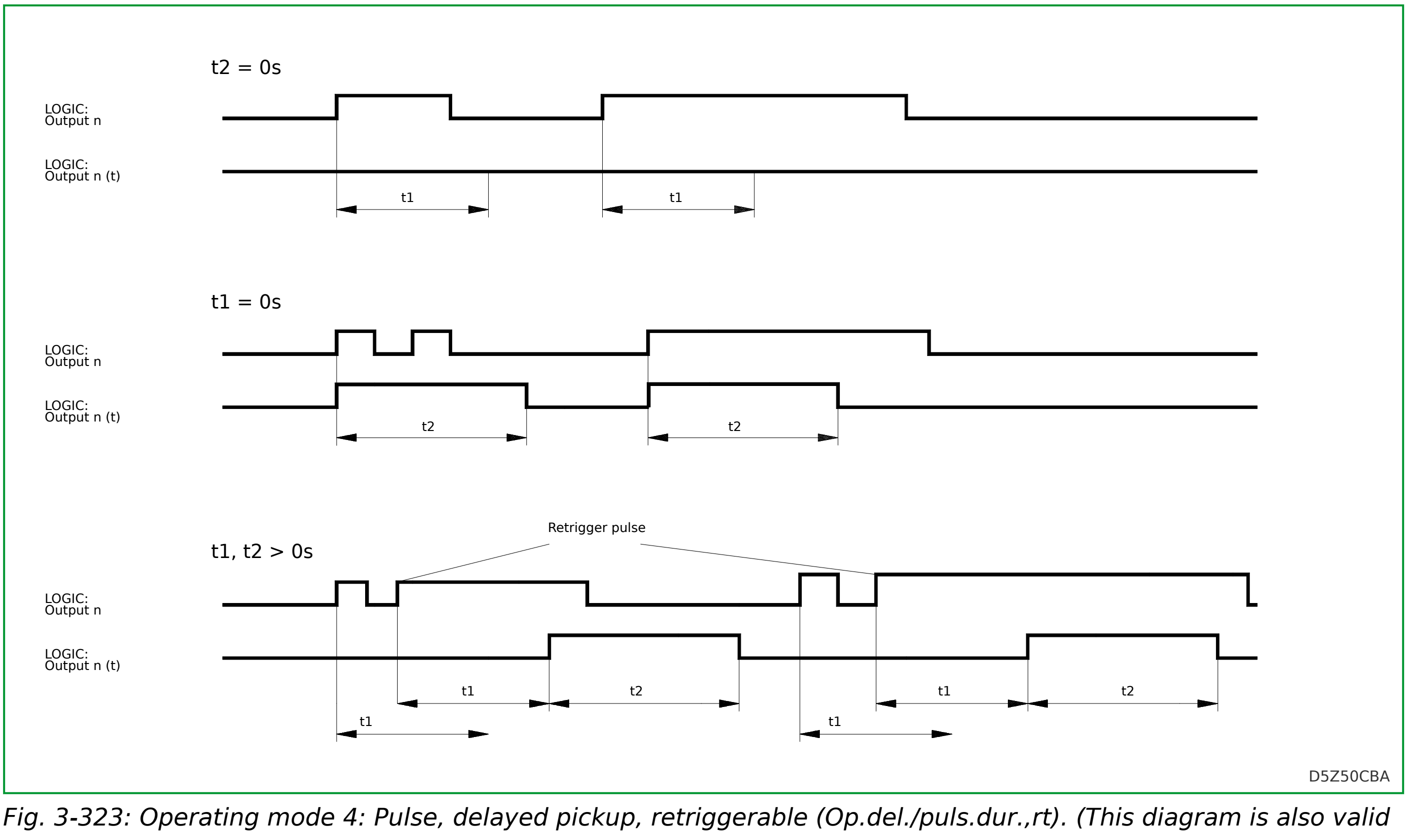


Fig. 3-323: Operating mode 4: Pulse, delayed pickup, retriggerable (Op.del./puls.dur.,rt). (This diagram is also valid for LOG_2, if the signal parameters are replaced by the corresponding ones from LOG_2 .)

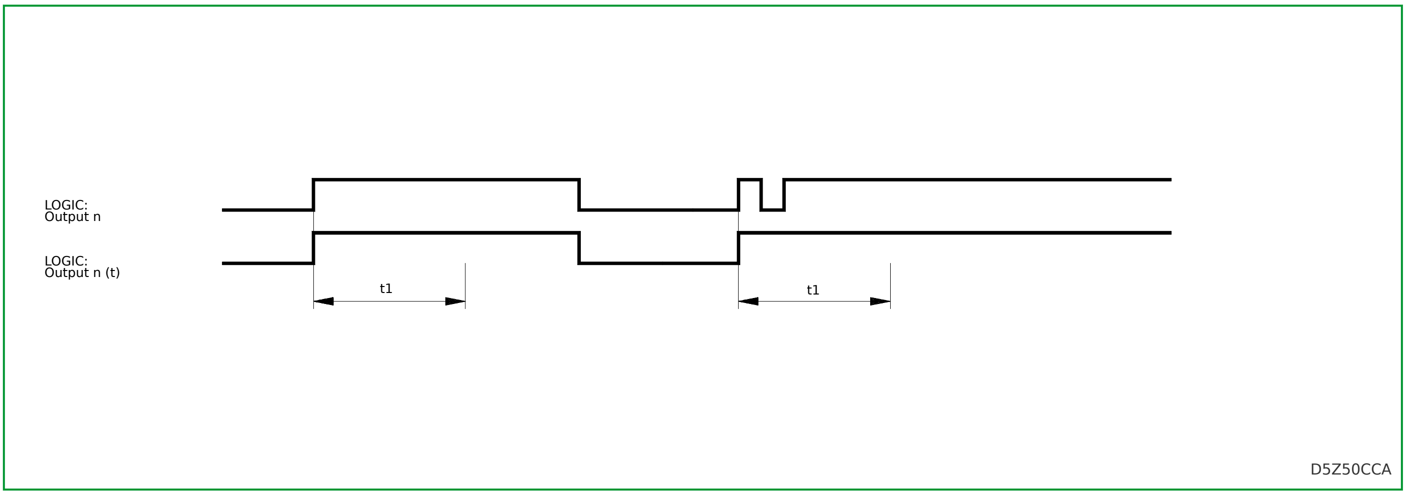


Fig. 3-324: Operating mode 5: Minimum time (Minimum time). (This diagram is also valid for LOG_2, if the signal parameters are replaced by the corresponding ones from LOG_2 .)

Through appropriate configuration, it is possible to assign the function of a binary input signal to each output of a logic operation. The output of the logic operation then has the same effect as if the binary signal input to which this function has been assigned were triggered.

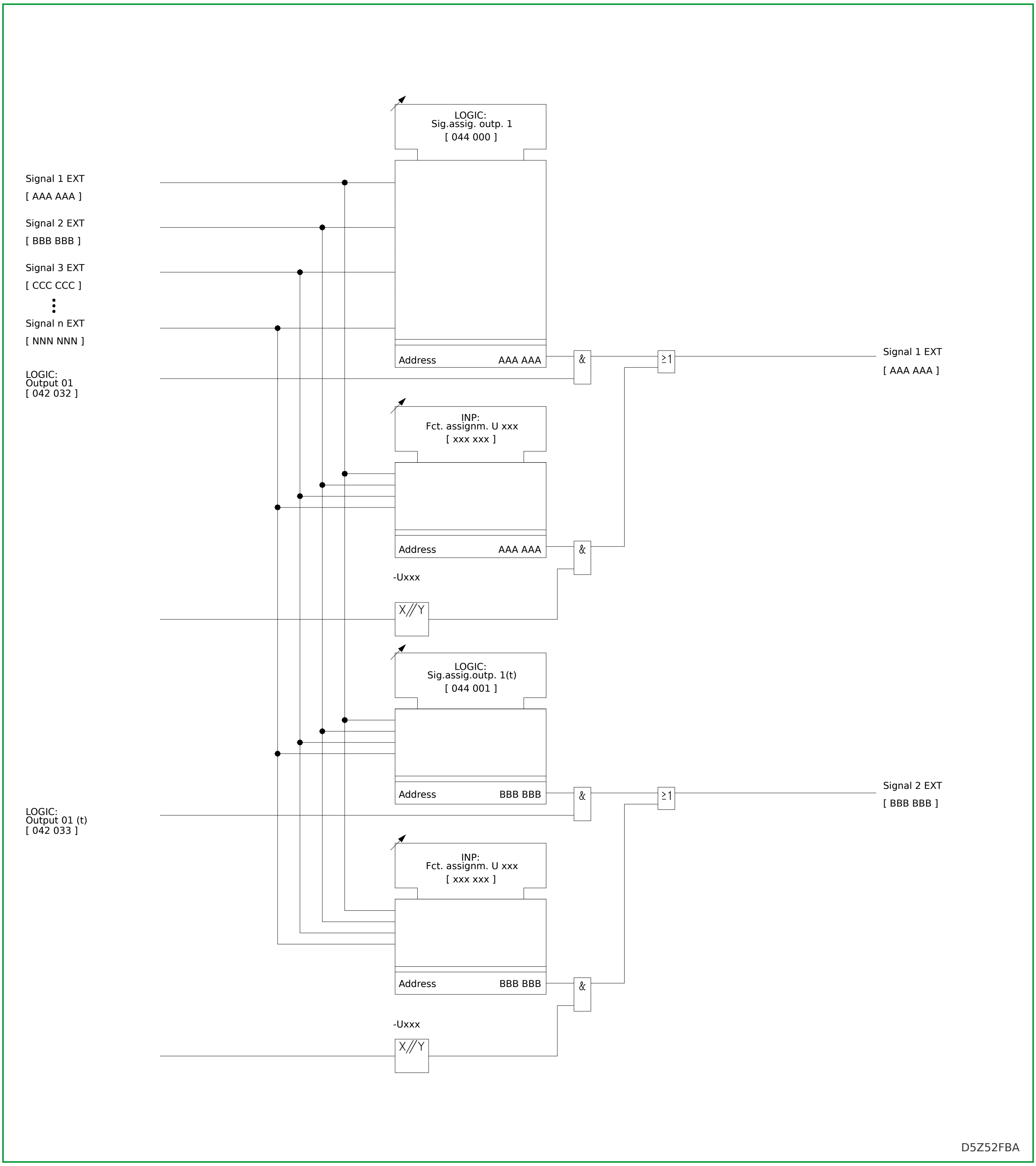


Fig. 3-325: Signal assignment to outputs of Boolean equations. (This diagram is also valid for LOG_2, if the parameters from LOGIC are replaced by the corresponding ones from LOG_2 .)

3.44 Control and Monitoring of Switchgear Units (Function Groups DEV01 to DEV10)

The P139 is designed to control up to 10 switchgear units. The two-pole forcibly guided termination contacts on the binary module X(6I 6O) are available for up to 6 of these.

For the remaining 4 switchgear units binary inputs and outputs on the power supply module can be used in combination with external high-break relays, or further binary modules with high-break contacts (ordering option).

See the table in Section 4.3, (p. 4-9) for the slots that have to be used for a particular set of ordered modules.

The P139 provides a bay panel concept to simplify the configuration of the switchgear control functions. The bay panel type defines the layout of a bay with its switchgear units on the HMI, an automated I/O assignment and the system/bay interlocking equations for all required switchgear units. Vol. 2, Chapter A5, (p. A5-1) provides a description of all bay types which are pre-defined (generally for all Easergy MiCOM 30 devices) and therefore immediately available. The selection of a bay type can be done with the parameter (220 000) MAIN: Type of bay. It is also possible to create a customized bay type and upload it to the P139. (See Section 3.44.1, (p. 3-397) for some more information.)

3.44.1 Bay Type Selection

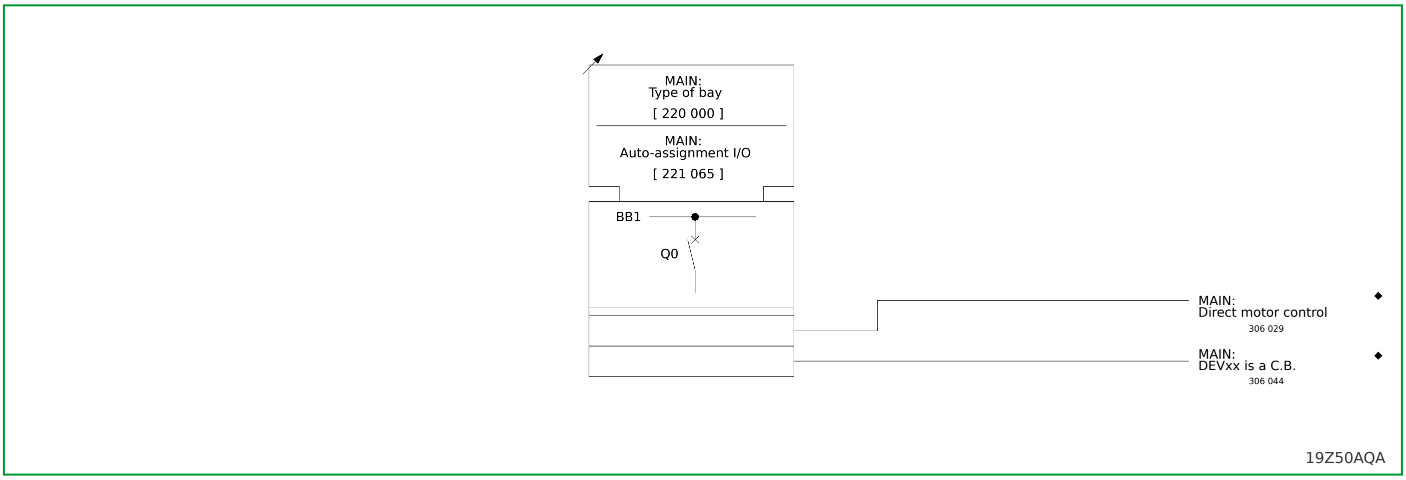


Fig. 3-326: Bay type selection.

The bay type defines the layout of a bay with its switchgear units on the HMI, an automated I/O assignment and the system/bay interlocking equations for all required switchgear units. Vol. 2, Chapter A5, (p. A5-1) provides a description of all bay types which are pre-defined (generally for all Easergy MiCOM 30 devices) and therefore immediately available. The selection of a bay type can be done with the parameter (220 000) MAIN: Type of bay.

Once the user has selected a bay type, the P139 can automatically configure the binary inputs and output relays with function assignments for the control of switchgear units. This automatic assignment is defined via the parameter MAIN: Auto-assignment I/O.

The assignment of inputs and outputs for an automatic configuration is shown in the List of Bay Types (Vol. 2, Chapter A5, (p. A5-1)).

Should the required bay type be missing from the standard selection then the user can contact the manufacturer of the P139 to request the definition of a customized bay type to load into the P139.

It is also possible – using a special *Bay Configuration Tool* (BTC) being part of MiCOM S1 Studio – to create a customized bay type and upload it to the P139.

> *To create customized bay types, the "Bay Type Configurator" (BTC),* ***version 2.7 or higher****, is needed. Older versions of the BTC can create not compatible hex files and thus can lead to communication failures.*

The same parameter – MAIN: Type of bay – can then be used to select (i. e. activate) this user-defined bay type. Note that there is no restriction to only one user-defined bay type: In fact, multiple customized bay types can be created with different IDs and be loaded into the P139. When using the BTC to create a bay type, it is recommended to always use an ID number in the range of 5000 … 9999 for any customized bay type, because the pre-defined standard bay types use IDs in the reserved range of 0001 … 4999. If the user tries to select a non-existing ID via (220 000) MAIN: Type of bay (i. e. an ID for which neither a standard nor a customized bay type is defined), then the selection will be rejected and an error message "Signal from device: Bay type not assigned (0x8073)" will be reported in the "`kommprot.txt`" log file.

> *In general, the selection of a bay type (via MAIN: Type of bay) is accepted by the P139 only if all of the following requirements are fulfilled:*
>
> - The selected ID number is known by the P139, i. e. is either available as a pre-defined standard bay type, or matches a bay type definition that has been loaded as a customized bay type into the P139 memory in file transfer mode.
> - A binary I/O module has been fitted to slot 6 (40 TE case) or 12 (84 TE case).
> - The hardware (in particular the set of all binary I/O modules and power supply) has got a sufficient number of inputs and outputs as required by the selected bay type.
> - None of the inputs/outputs required by the selected bay type has been previously assigned to a non-control function.
>
> *In case of the setting MAIN: Auto-assignment I/O = Yes, the following two constraints must be noted:*
>
> - The activation of a new bay type overwrites all DEVxx / SIG_1 / CMD_1 assignments to I/O elements that have been previously made (for the previous bay type definition).
> - If the automatic I/O assignment fails because some required inputs and outputs have been assigned to a non-control function, or because the number of I/O elements available is not sufficient, then the previously selected bay type remains active and an error message "Signal from device: Hardware module not fitted (0x8063)" is reported in the "`kommprot.txt`" log file.

3.44.2 Enable for Switch Commands Issued by the Control Functions

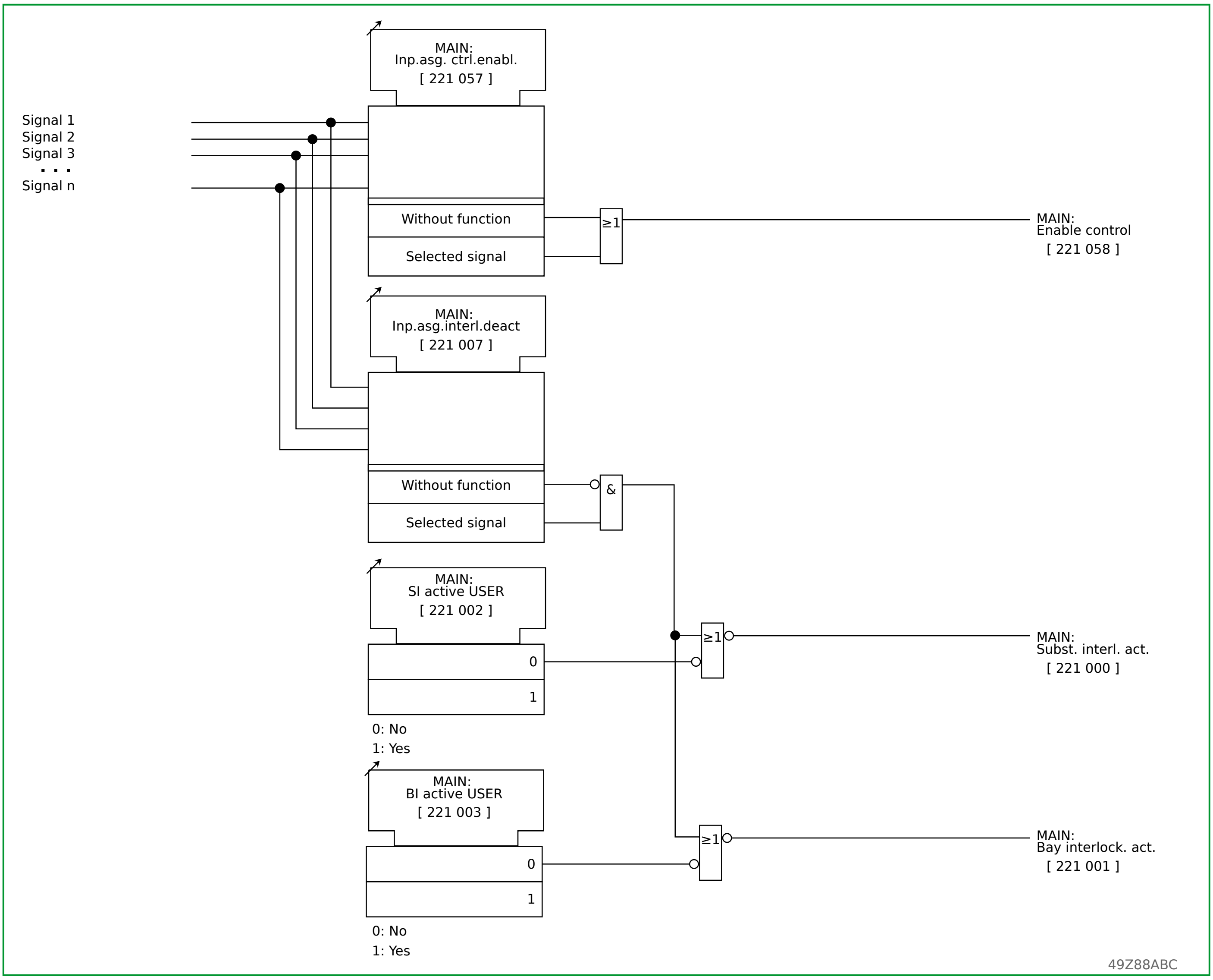


Fig. 3-327: General enable for switch commands issued by the control functions; activating or canceling the interlocks.

Before a switching unit within the bay is closed or opened by the control functions of the P139, the P139 first checks whether the switch command may be executed. A switch command will be executed if the optional control enable has been issued and the interlock conditions are met. The interlock conditions are defined in the interlocking logic for each switching unit within the bay that is subject to control actions and for each control direction (Open/Close). Different conditions are defined for the bay interlock equations to operate with or without station interlock. The check of bay or station interlock equations can be cancelled for all electrically controllable switchgear units within a bay. If the station interlock is active, it may be cancelled selectively for each switching unit and each control direction.

The bay and station interlocks may be cancelled through an appropriately configured binary signal input. This cancellation is effective for all of the operating modes "*Local*", "*Remote*" and "*Remote & Local*" (setting `LOC: Fct. assign. L/R key` = *R & L <-> L*). In other words, the functionality of the binary input for cancelling the bay and station interlocks is independent of the operating mode of the control point for switching between local and remote control.

All station interlock functionality (e.g. the parameter MAIN: SI active USER) is active and available only if a communication module (i. e. a module of type “A”) with 2 serial interfaces is fitted and either the IEC 60870-5-101 or -103 communication protocol is configured.

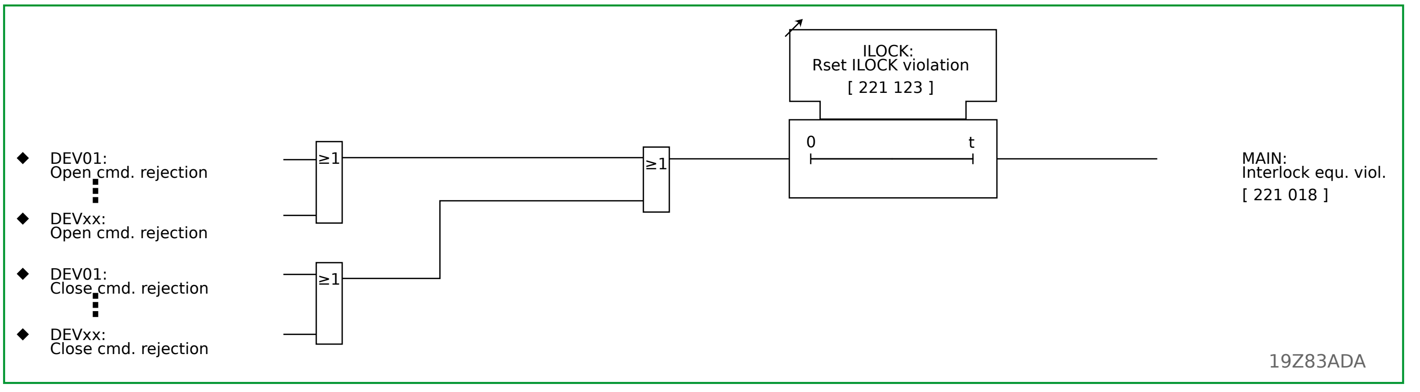


Fig. 3-328: Rejection of the switching commands.

During a switch command is being executed, any further switch command is rejected (“Double Command Lockout”). This includes interlocking of parallel switching operations and further switch commands to the currently selected switching unit.

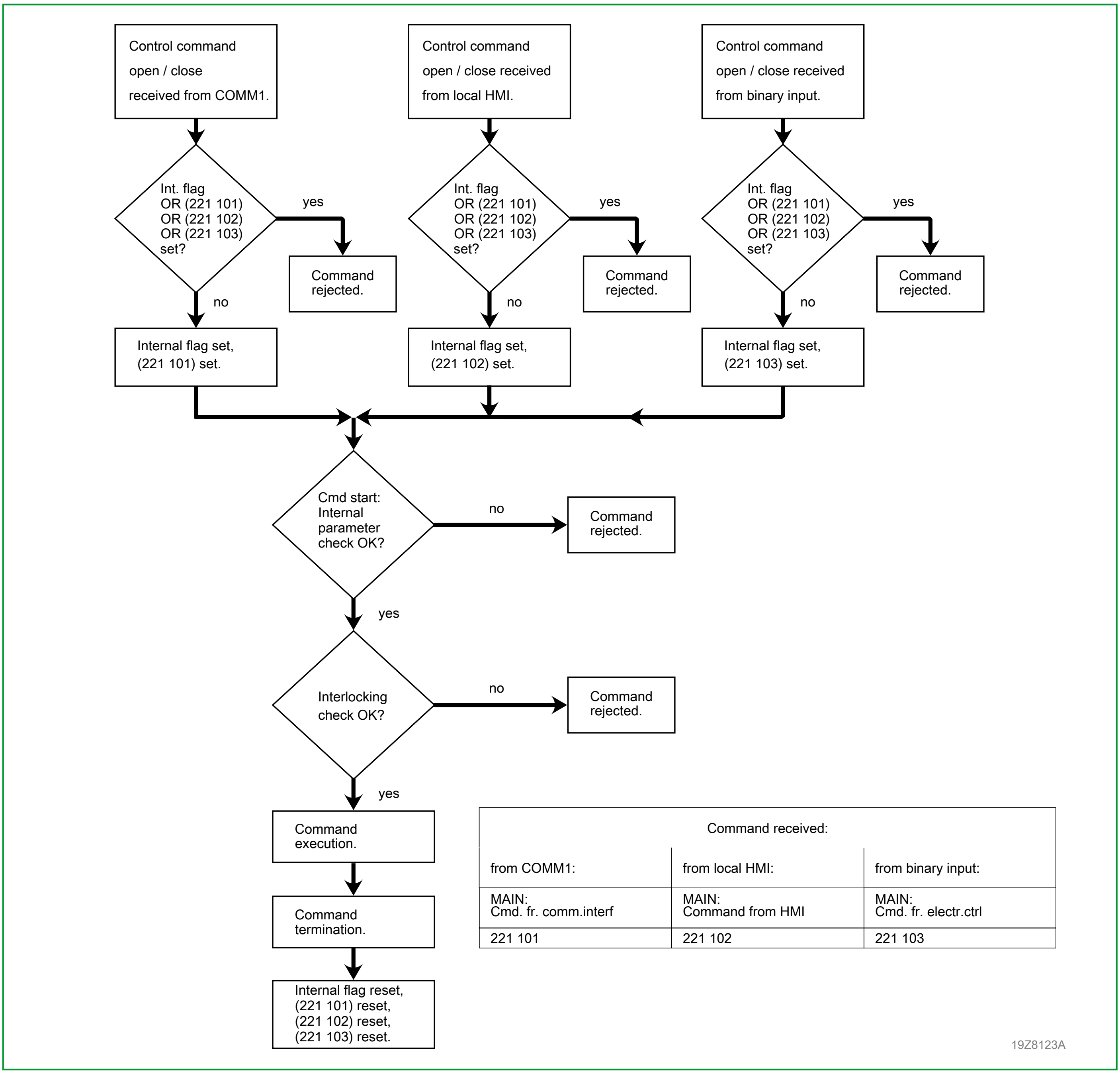


Fig. 3-329: “Double Command Lockout”.

3.44.3 Designation of External Devices

Each external device represented in the Bay Panel is identified by an external device designation. The user can either select this designation from a list of over 70 pre-defined names (via the parameter DEV01: Designat. ext. dev. in case of DEV01, for example), or this parameter is set to *Device Name User*. With this selection, a user-defined text for the name of the external device will be used as the designation. This user-defined text has to be entered at DEV01: DEV-Name User (in case of DEV01, for example).

(The maximum length is 4 characters, as with the fixed identifiers. Longer text entries are truncated to 4 characters internally.)

3.44.4 Defining a Bay Panel Type

With the selection of a Bay Panel type, the following definitions are made:

- Manually operated switchgear units with status signals to be processed.
- Switchgear units to be controlled and signaled by the P139.
- The bay interlock conditions for the “Open” / “Close” command control of the switchgear units, for operation with or without the station interlock function.
- Binary inputs required for switchgear units with direct motor control.
- Binary outputs required for switchgear units with direct motor control.

When a Bay Panel type is selected, the binary inputs for switchgear status signals and the output relays for control commands are configured automatically if MAIN: Auto-assignment I/O is set to *Yes*. If set to *No*, the user will need to carry out this configuration. The list of Bay Panel types in the Appendix shows which binary inputs and output relays have been assigned signals or commands for control of switchgear units in the case of automatic configuration.

Setting options for the P139 and the different possibilities to integrate a switchgear unit into the functional sequence of the P139 (processing of status signals only or controlling and signaling) will be explained below, using one switchgear unit as an example. Function group DEV01 will be used throughout in this example. If a signal is identified in the function diagrams by function group “COMM1:” with a blank address [--- ---], it will indicate that it is a signal to or from the communication interface and that it has not been assigned an address.

3.44.5 Processing Status Signals from Manually Operated Switchgear Units

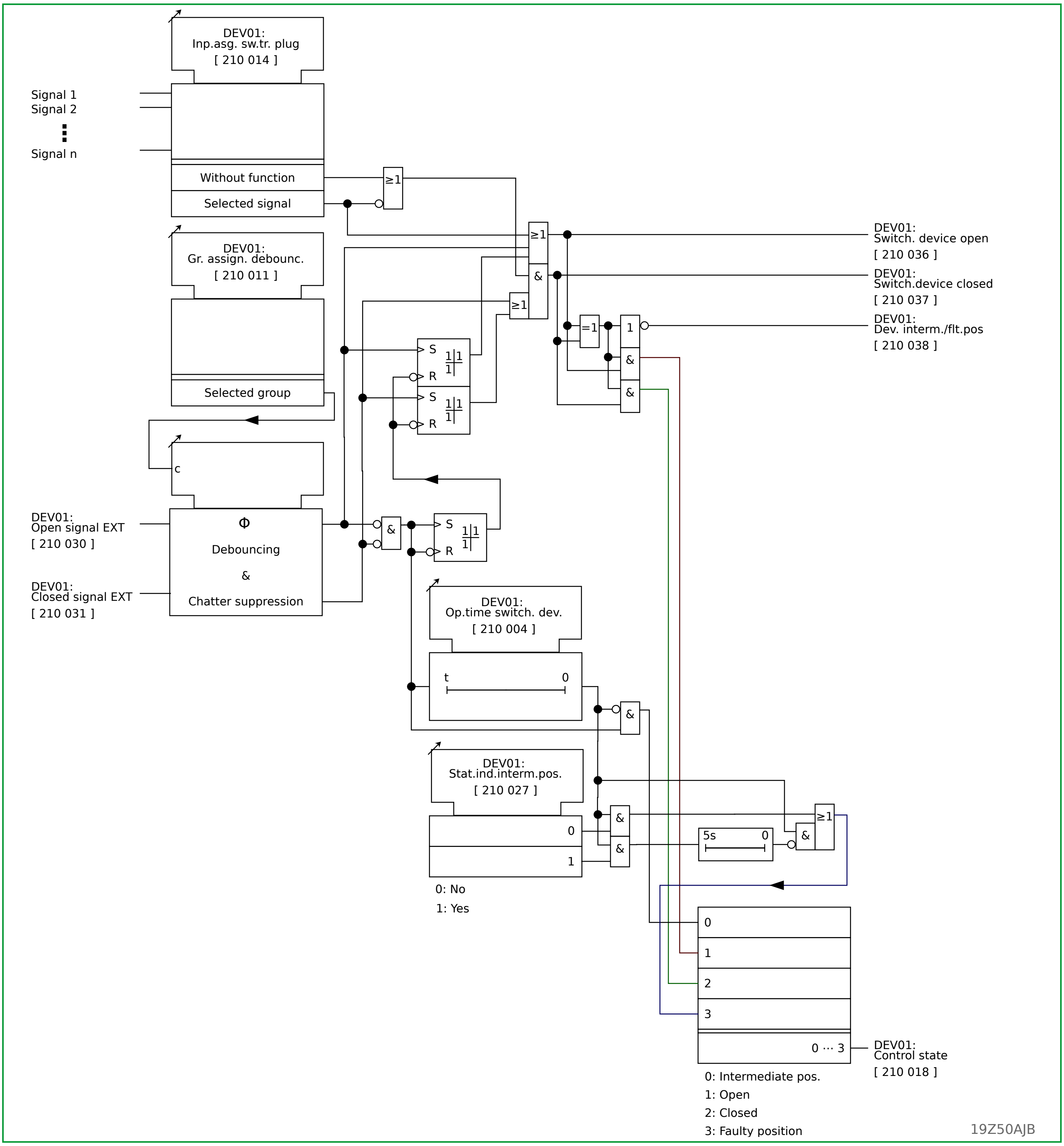


Fig. 3-330: Processing Status Signals from Manually Operated Switchgear Units.

3.44.5.1 Status Signals

The status signals “Open” and “Closed” are assigned to binary signal inputs. The signals conditioned by debouncing and chatter suppression (see Section 3.48.1.1, (p. 3-433)) are used for further processing. If no logic value of “1” is present at any of the two binary signal inputs, the running time monitoring function is started. For the duration of the set time period for running time monitoring or until the contacts on the switchgear unit are back to a defined position – either “Open” or “Closed” – the signal “Intermediate position” is issued.

If DEV01: Interm. pos. suppr. is set to *Yes*, the previous switchgear unit status will continue to be signaled to the communication interfaces while the switchgear unit is operating. Once the contacts on the switchgear unit have reached their new position, the updated status is signaled accordingly to the communication interfaces. This parameter has no impact to internal signals, such as DEV01: Switch. device open, DEV01: Switch.device closed or DEV01: Dev. interm./flt.pos.

The signal “Faulty position” is issued if the contacts on the switchgear unit have not reached either their “Open” or “Closed” position after the set time period for running time monitoring and the delay time set in MAIN: Delay Man.Op.Superv. have elapsed. If DEV01: Stat.ind.interm.pos. is set to *Yes*, a delay time of 5 s is started. Once this time period has elapsed and there is no status signal for the position, the state actually present at the binary inputs will be signaled.

3.44.5.2 Switch Truck

For switchgear units mounted on switch trucks with switch truck plugs, it is possible to configure a single-pole status signal from the switch truck plug. If such a configuration has been assigned, the status signal for the position of the associated switchgear unit is set to “Open” while the input has a logic value of “1”.

3.44.6 Functional Sequence for Controllable Switchgear Units

3.44.6.1 Local or Remote Control of External Devices

Switchgear units can be controlled from a remote location or locally. The selection of the control point is described in Section 3.3.7, (p. 3-13). Usually, remote control is carried out via the communication interface, local control via the keys on the local control panel. Moreover, switchgear units can be controlled via binary inputs configured appropriately (configuration via DEV01: Inp.asg.el.ctrl.open or DEV01: Inp.asg.el.ctr.close). The setting MAIN: Electrical control determines whether the inputs function as remote or local control points.

Dependent on the respective position of control the P139 will issue the following logic state signals:

- MAIN: Cmd. fr. comm.interf, or
- MAIN: Command from HMI, or
- MAIN: Cmd. fr. electr.ctrl

Additionally the following state signals are issued and entered into the operating data memory:

- DEV01: Open cmd. received
- DEV01: Close cmd. received

The operating mode of the control point is signaled as follows:

	“Remote”	*“Local”*	*“Remote & Local”*
LOC: Rem.acc.block.active	*No*	*Yes*	*No*
LOC: Loc.acc.block.active	*Yes*	*No*	*No*

3.44.6.2 Selection of the Switchgear Unit to be Controlled and Generating a Switching Request

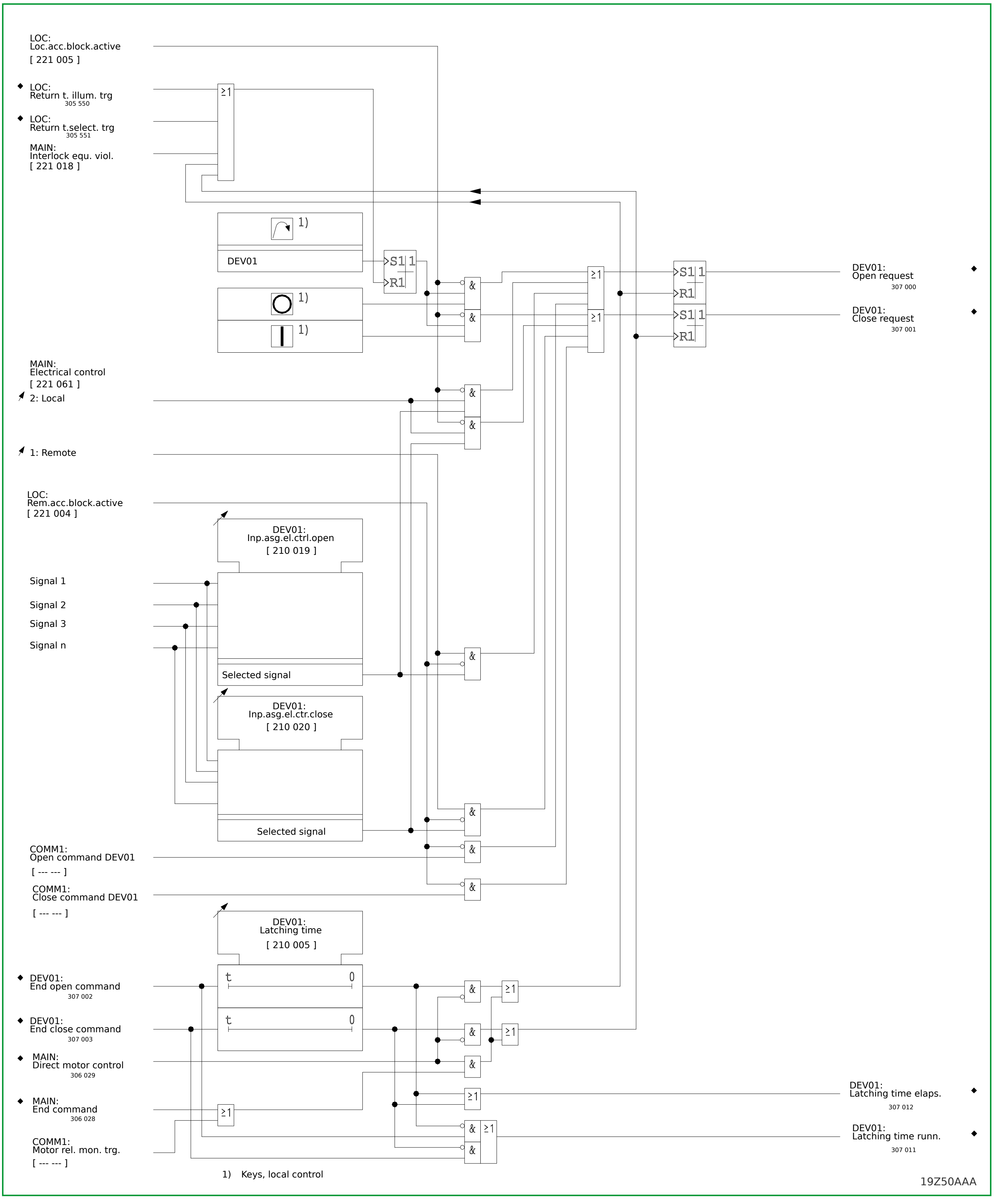


Fig. 3-331: Generating a switching request.

The switchgear unit to be controlled is selected and the switching command is sent to this selected switchgear unit. This can be carried out via the local control panel using the selection key and pressing the “Open” or “Close” key to generate the switching request. For control via binary inputs, the appropriate control inputs need to be configured for switchgear units selected to be controlled. For control via the communication interface, the control commands “Open” or “Close” will also address the switchgear unit to be controlled.

3.44.6.3 Enabling Switching Commands

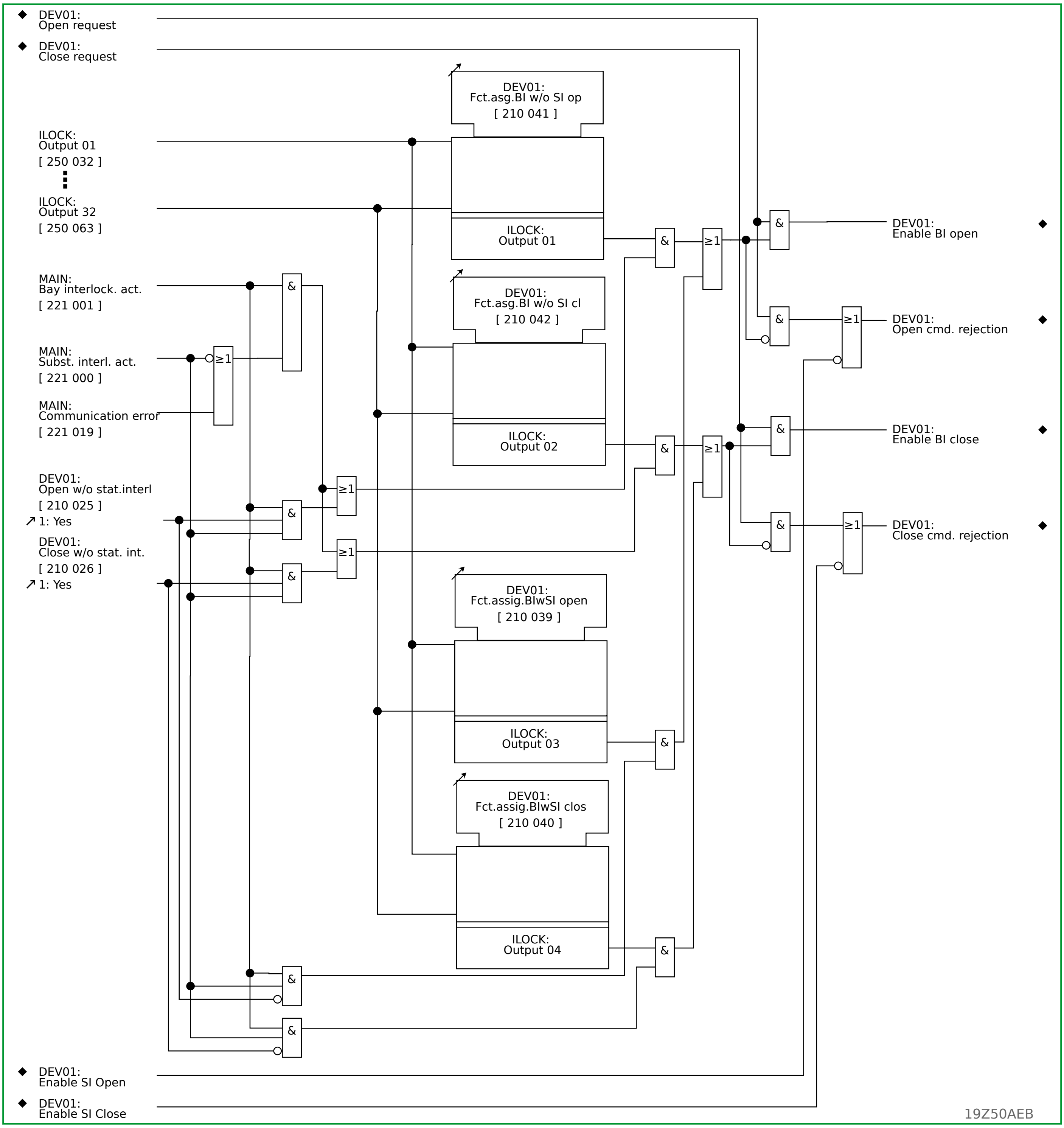


Fig. 3-332: Assignment of the equations of the interlocking logic to the switching commands; enabling of switching commands by the bay interlock function.

Before a switching command is executed, the P139 checks the interlocking conditions defined in the interlocking logic to determine whether a switching command is permitted or not. Bay interlock conditions for operation with or without the station interlock function can be defined. The assignment of an output relay from the interlocking logic to a switching command determines the interlocking conditions that define, for example, the conditions for the “Open” command for operation without the station interlock function.

3.44.6.4 Bay Interlock for Operation with the Station Interlock Function

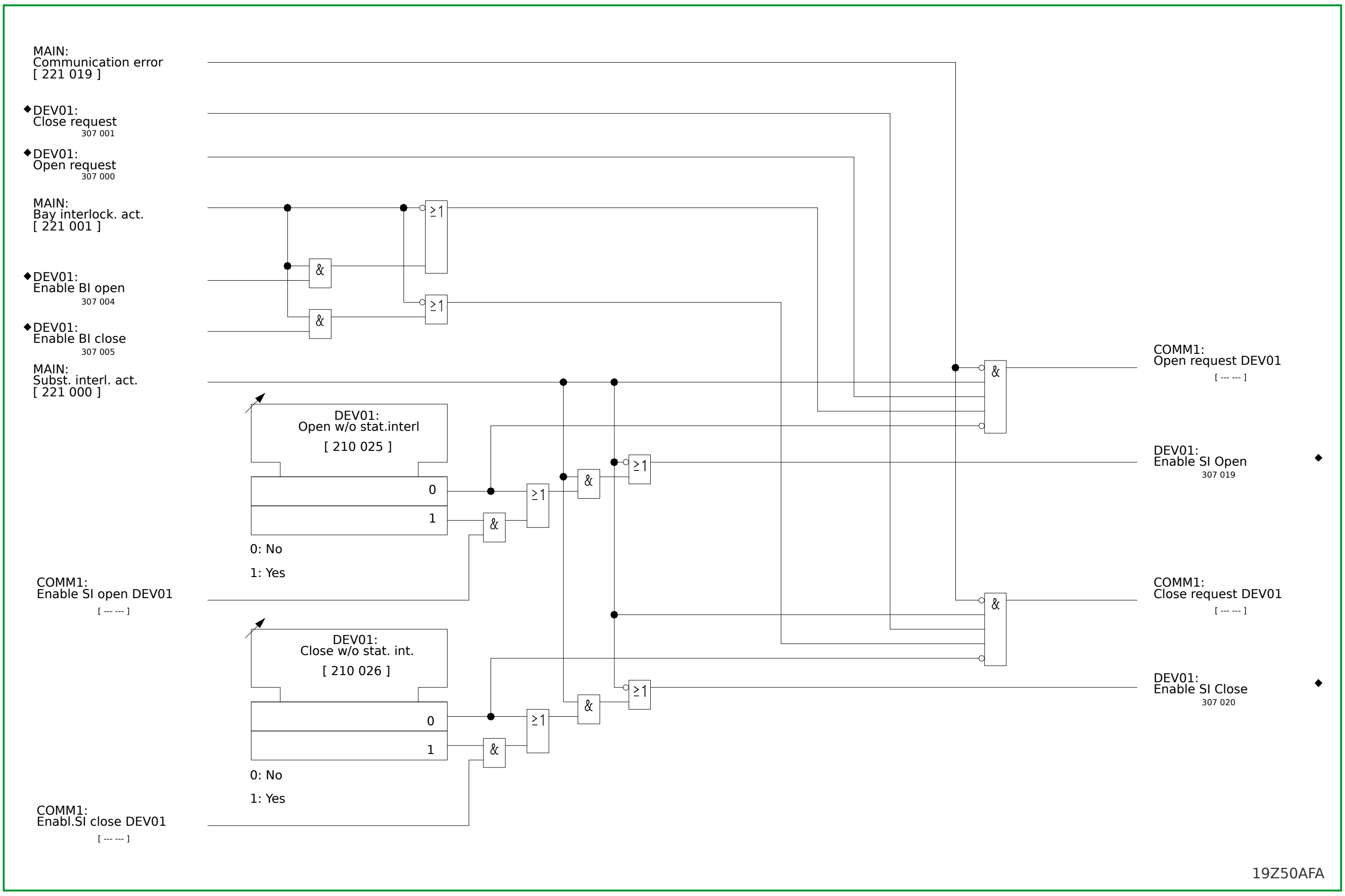


Fig. 3-333: Enabling of the switching commands by the station interlock.

For the station interlock function conditions to be interrogated, there needs to be a communication link with the substation control level. If the P139 detects a communication error or if there is no communication interface available, there will be an automatic switch to bay interlock without the station interlock function.

If there is to be a check on the bay interlock and the station interlock function, the bay interlock will be checked first. If bay interlocking issues a switching enable, a switching request will be sent to the substation control level. At substation control level, there will then be a check – taking into account the station interlock functions – as to whether switching is permitted or not. If the substation control level also issues an enabling command, the switching operation is carried out provided that the enable from the bay interlock is still present. Optionally, the “Open” or “Close” switching operation can be carried out without checking the station interlock function conditions. In this case, the bay interlock conditions defined for operation without station interlock functions will be considered.

3.44.6.5 Linking Protection Commands to Switching Commands

For circuit breakers, the “Open” command can be linked to the protection trip signals. The “Close” command can also be linked to the close command of the protection functions. The Bay Panel type defines which of the switchgear units are circuit breakers. The trip (open) or close commands of the protection functions are executed directly without a check of the interlocking conditions.

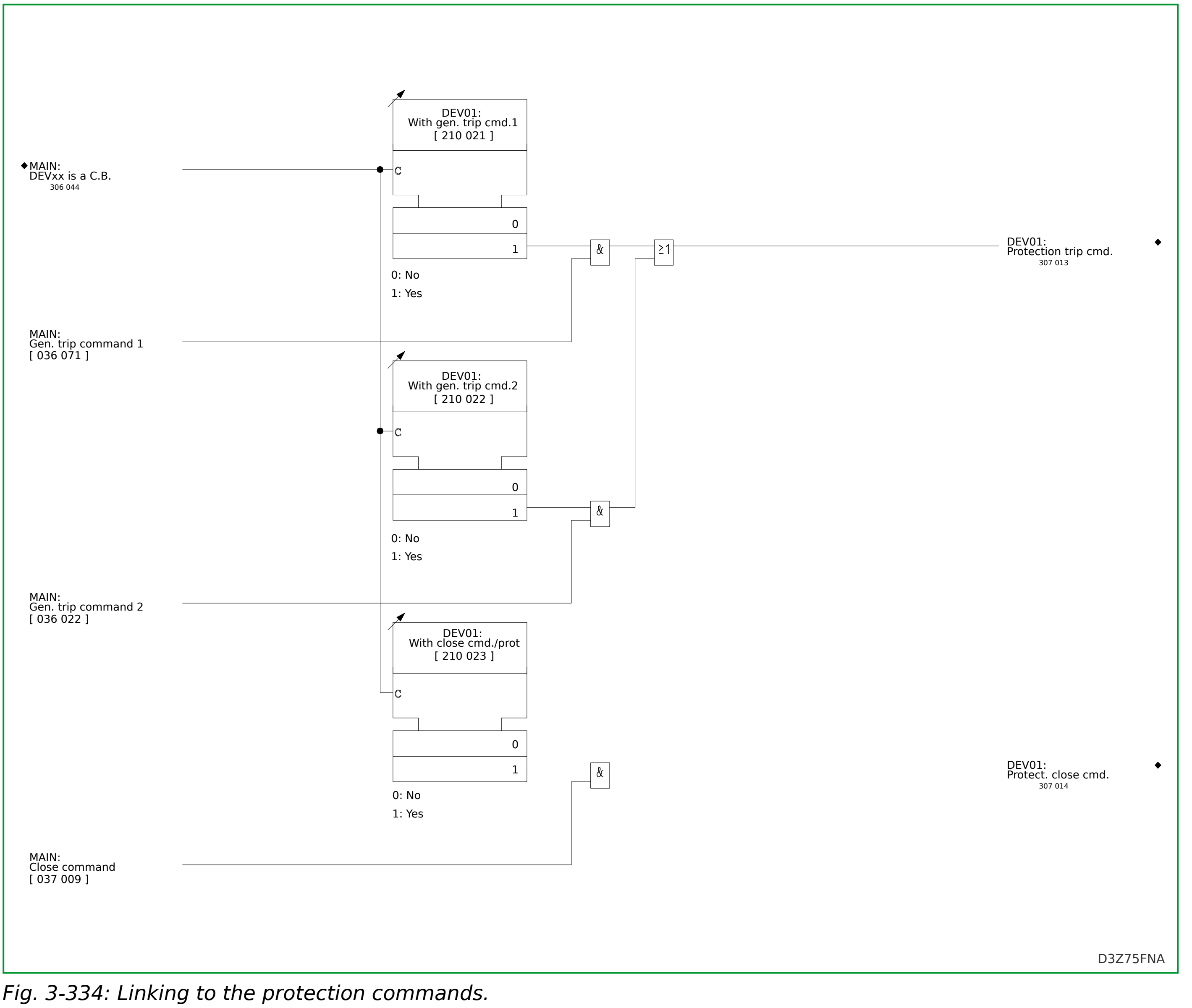


Fig. 3-334: Linking to the protection commands.

3.44.6.6 Issue of Switching Commands

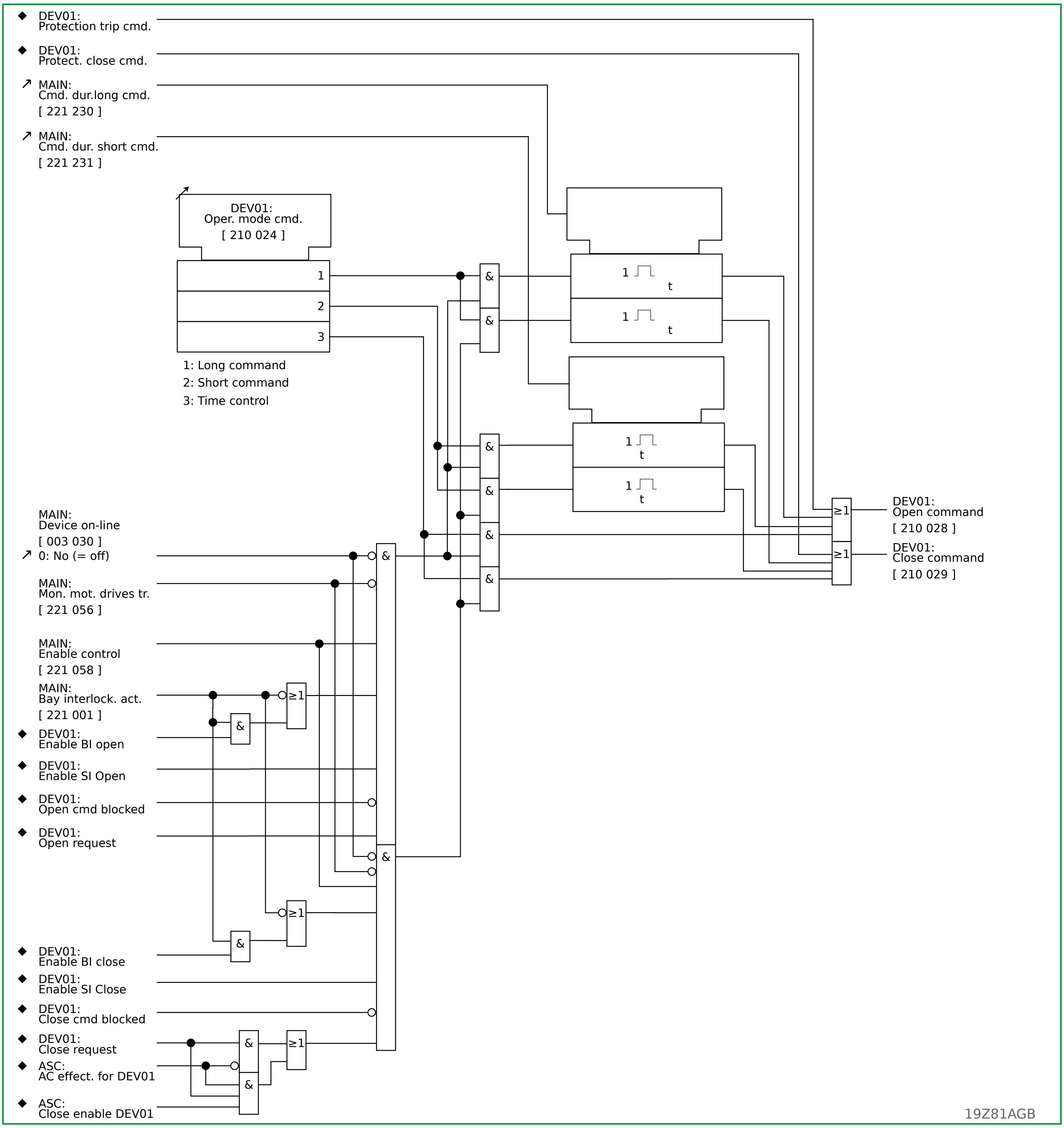


Fig. 3-335: Issue of switching commands.

Dependent on the operating mode (set at DEV01: Oper. mode cmd.) set for commands, switching commands are issued for the set timer durations or according to time control.

When the automatic synchronism check (ASC) is active and the parameter ASC: System integrat. PSx is set to *Autom.synchr.control* a “Close” request will automatically issue a “Close” command for the circuit breaker after a *close enable* was issued by the ASC.

However if ASC: System integrat. PSx is set to *Autom.synchron.check* ASC will not interfere with any switching commands. Data generated and continuously updated by the ASC function is transmitted – when configurations have been set accordingly – to the central control station, where operators may make decisions as to which external device is to be given a switching command.

3.44.6.6.1 Blocking of Switchgear Device Operation

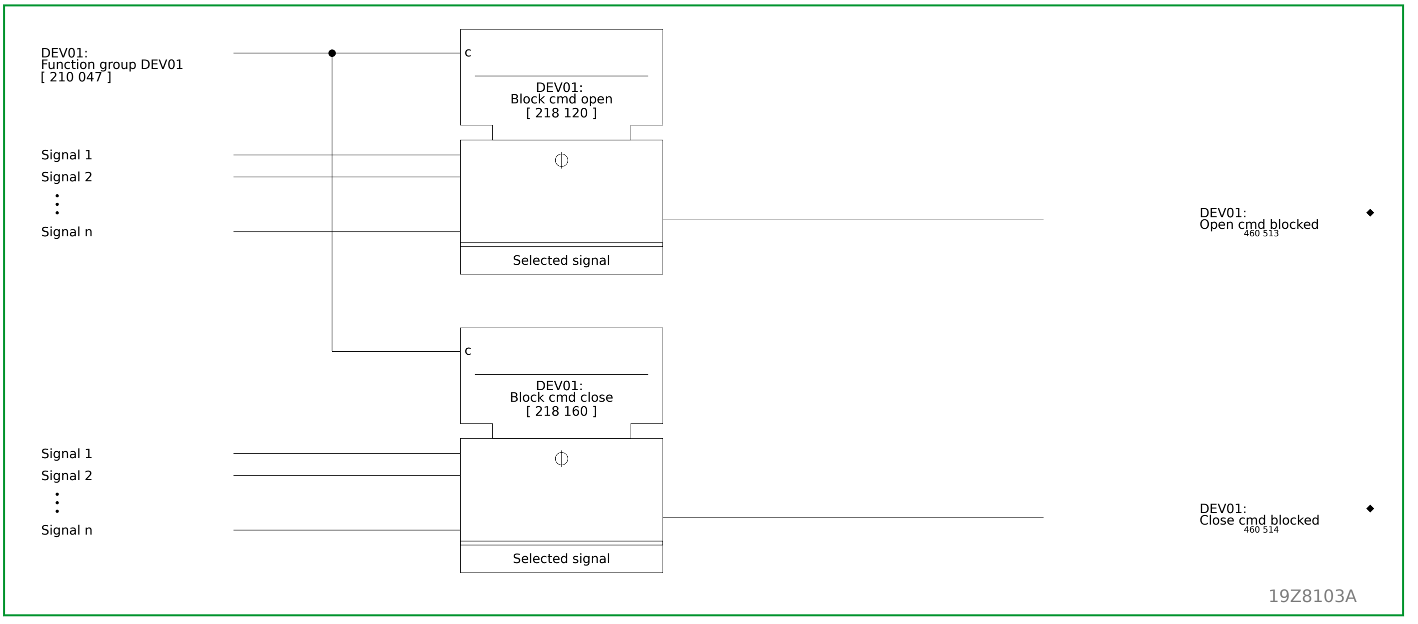


Fig. 3-336: Blocking of switchgear device operation.

It is possible to generally block open and / or close commands to a switchgear device. Setting parameters DEV01: Block cmd open and DEV01: Block cmd close (and correspondent parameters for the other DEVxx) are available for this purpose. Due to safety reasons the blocking inputs are effective only if no command is active. During a switching operation the blocking is disabled to secure that the switch will move always into a safe position.

To each of these setting parameters can be signals assigned; each of these signals then activate the blocking of the switching command appropriate to this setting parameter. In this case the signal MAIN: Interlock equ. viol. is issued, just like with a breach of the interlocking conditions.

3.44.6.6.2 External Termination Control

If the operating mode *Time control* was selected it is possible to intervene in the control process of external switchgear units by using external termination contacts. It will then be necessary to set the P139 at MAIN: W. ext. cmd. termin. to *Yes* and binary signal inputs must be configured so they can be connected to the external termination contacts. The input configuration has to be done for each device separately. Be aware that an external command termination does not make sense for a fast switch as a circuit breaker, as its operation is edge-controlled and involves no motor being directly time-controlled (contrast to a disconnector drive).

3.44.6.7 Switch Truck

For switchgear units mounted on switch trucks with switch truck plugs, it is possible to configure a single-pole status signal from the switch truck plug. If such a configuration has been assigned, the status signal for the position of the associated switchgear unit is set to ‘Open’ while the input has a logic value of “1”.

3.44.6.8 Time Control of Switching Commands

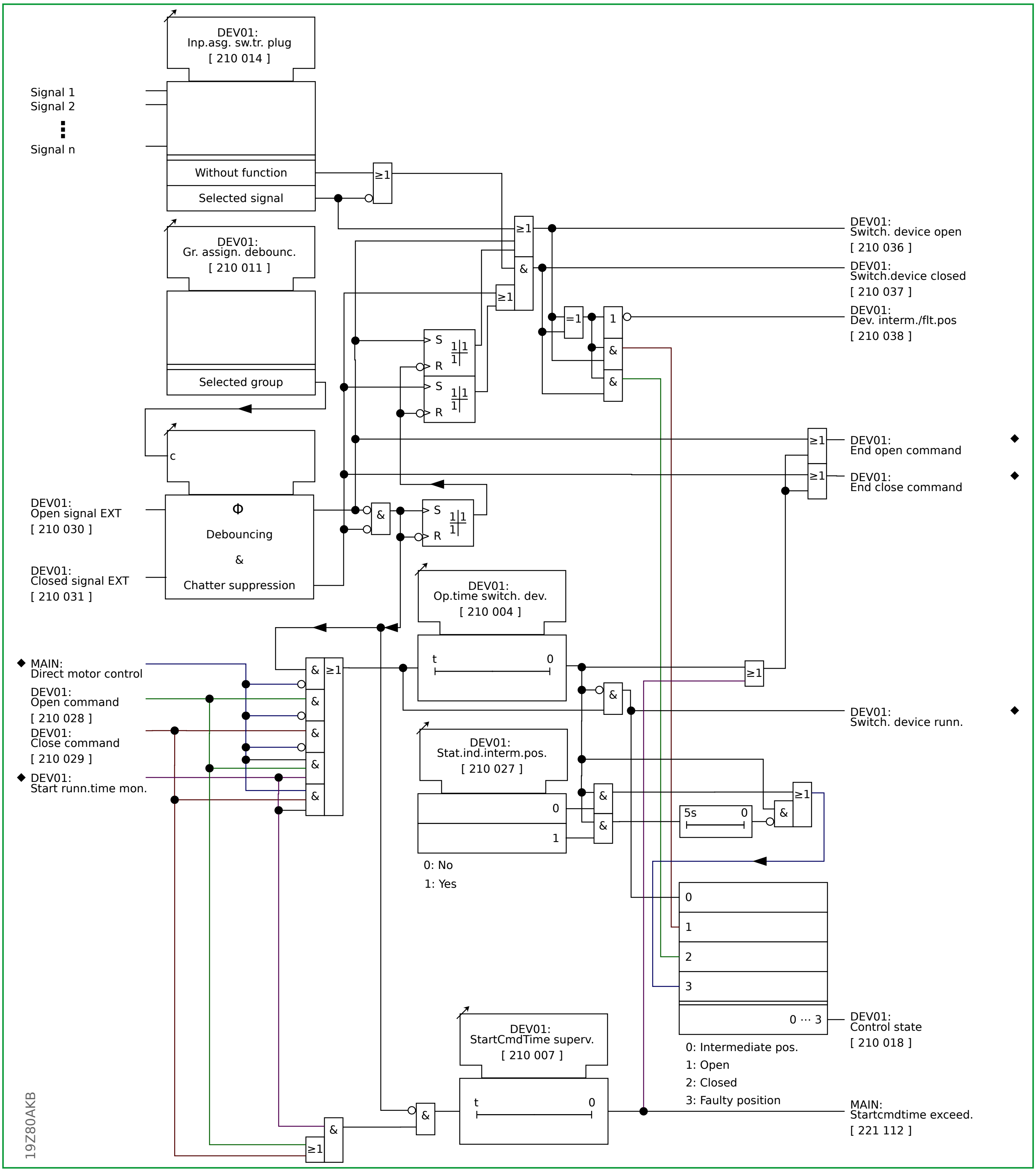


Fig. 3-337: Monitoring of switching commands.

After sending an Open / Close command, running time monitoring for the switchgear unit is started.

The P139 expects that the switchgear unit has reached its intermediate position within a period of time that can be configured via `DEV01: StartCmdTime superv.` (for DEV01, respective setting parameters exist for the other DEVxx). If the switchgear unit has not reached its intermediate position after this time has elapsed then the command is deactivated and an exceeded timer is flagged by the signal MAIN: Startcmdtime exceed.. In case of a switchgear unit for which it is (almost) impossible to detect the intermediate position (for example a Circuit Breaker) it is recommended to switch off this monitoring by setting the parameter to Blocked.

Moreover, the P139 expects a status signal – “Open” or “Closed” to be issued by the switchgear unit within the duration of running time monitoring. The status signal for the position of the contacts on the switchgear unit is present at appropriately configured binary inputs on the P139, which can be set to debouncing and chatter suppression mode (see Section 3.48.1.1, (p. 3-433)). For the duration of running time monitoring or until the contacts on the switchgear unit are back to a defined position – either “Open” or “Closed” – the signal “Intermediate position” is issued.

If DEV01: Interm. pos. suppr. is set to *Yes*, the previous switchgear unit status will continue to be signaled to the communication interfaces while the switchgear unit is operating. Once the contacts on the switchgear unit have reached their new position, the updated status is signaled accordingly to the communication interfaces. This parameter has no impact to internal signals, such as DEV01: Switch. device open, DEV01: Switch.device closed or DEV01: Dev. interm./flt.pos.

If the contacts on the switchgear unit have not reached either their “Open” or “Closed” position after the set time period for running time monitoring has elapsed the signal *Faulty position* is issued. If DEV01: Stat.ind.interm.pos. is set to *Yes*, a delay time of 5 s is started. Once this time period has elapsed and there is no status signal for the position, the state actually present at the binary inputs will be signaled.

If the operating mode **without** external termination contacts was selected (MAIN: W. ext. cmd. termin.. is set to *No*) the switching command is terminated after the set latching time has elapsed, when either the ‘Open’ or ‘Closed’ position status signal is received or the set time period for running time monitoring has elapsed (see Fig. 3-331, (p. 3-405)).

If the operating mode **with** external termination contacts was selected (MAIN: W. ext. cmd. termin.. is set to *Yes*) the switching command is terminated, after the set latching time has elapsed, when a termination command is issued while the set time period for running time monitoring is active.

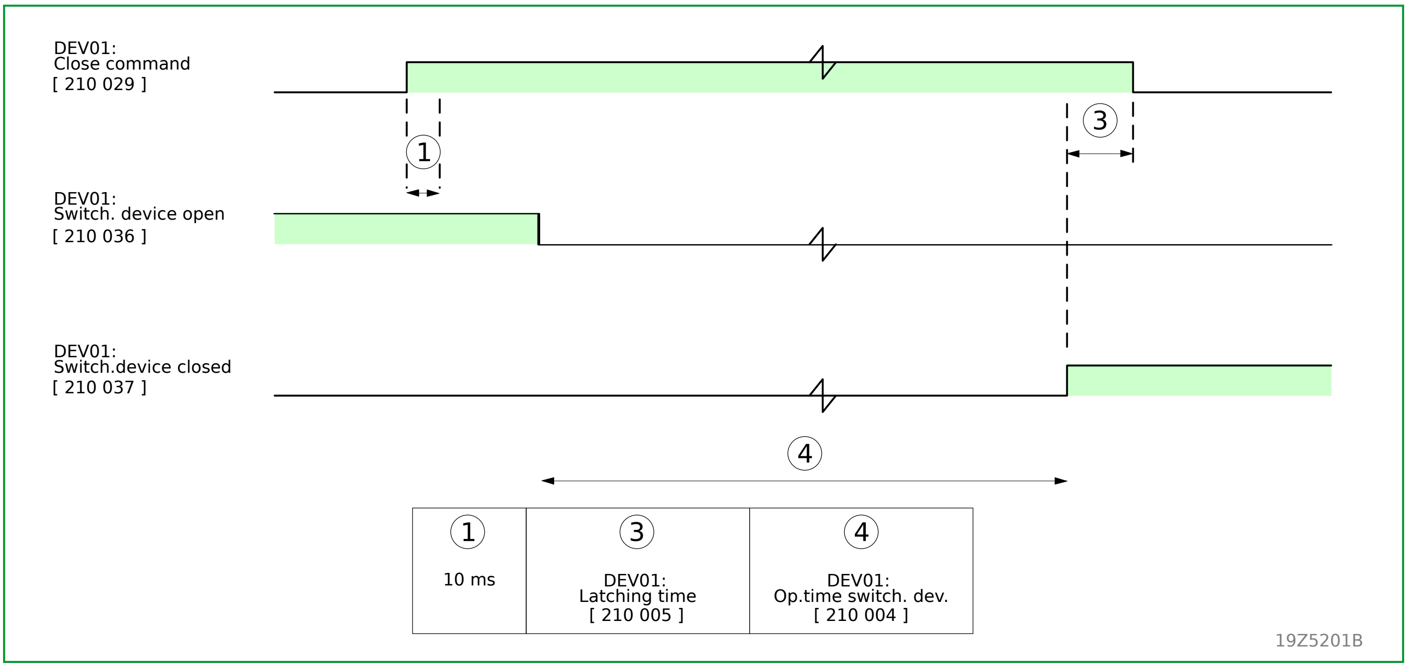


Fig. 3-338: Sequence for time control of switching commands without external termination control, example for switching operation “close”.

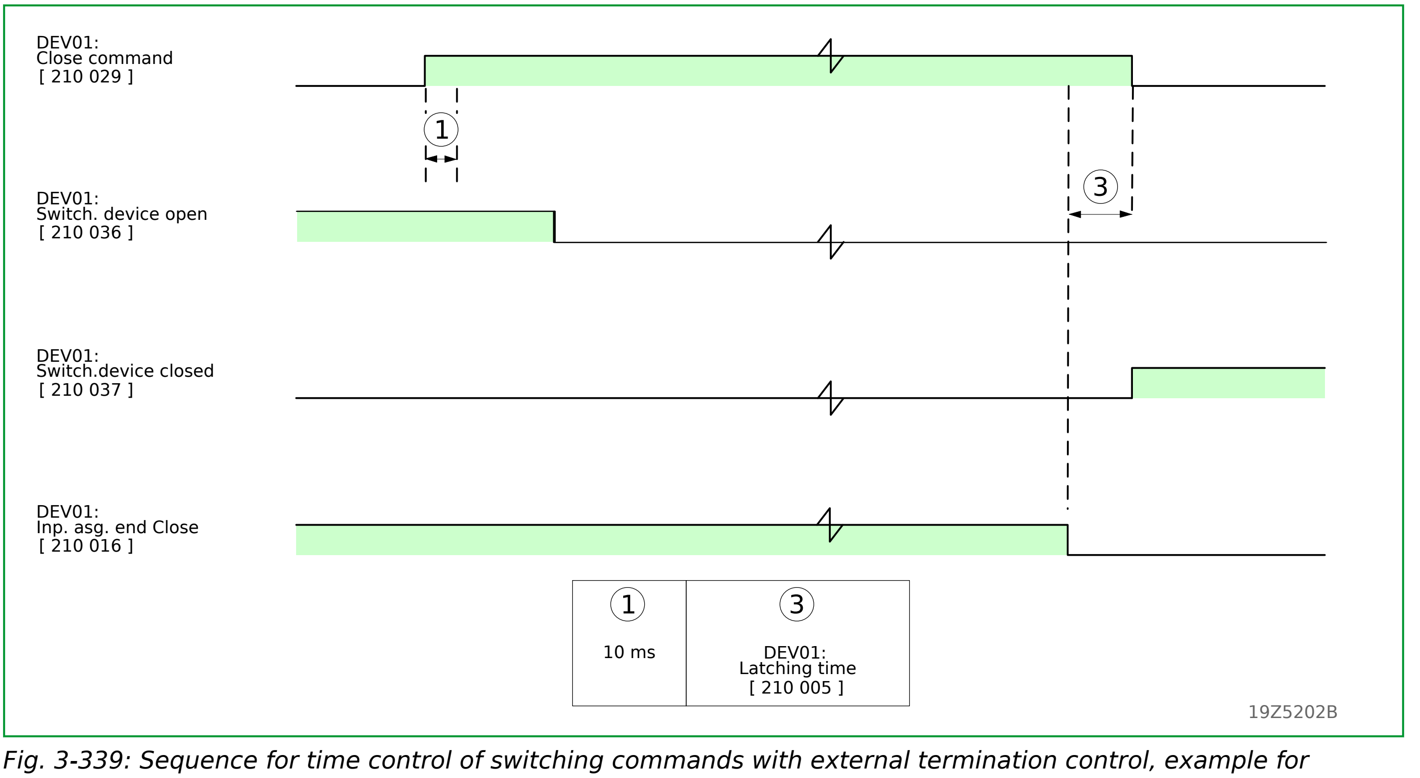


Fig. 3-339: Sequence for time control of switching commands with external termination control, example for switching operation “close”.

3.44.6.9 Monitoring the Number of CB Operations Permitted

The maximum number of CB operations within an ARC cycle (or within a specific time period) may be set with parameter MAIN: CB1 max. oper. cap. Associated with this parameter is the counter at MAIN: CB1 act. oper. cap. to which the maximum number of CB operations permitted is assigned as soon as the positive edge of an event is present that has been selected by a “1 out of n” parameter at MAIN: CB1 ready fct.assign.

The number of CB operations permitted, set with the counter at MAIN: CB1 act. oper. cap. are then decremented by 1 with each CB operation. Operation of the CB is recognized from the contact position signals DEV01: Switch. device open and DEV01: Switch.device closed.

The counter at MAIN: CB1 act. oper. cap. may only be decremented to a value of 1. Reaching a value of 1 will in no way effect the protection or control functionality, in particular there will be no blocking of CB operation! When a CB fault has occurred (i.e. MAIN: CB1 faulty EXT is set to *Yes*) the counter MAIN: CB1 act. oper. cap. is immediately set to 1.

3.44.7 Direct Motor Control

3.44.7.1 Monitoring the Motor Drives in Case of Direct Motor Control

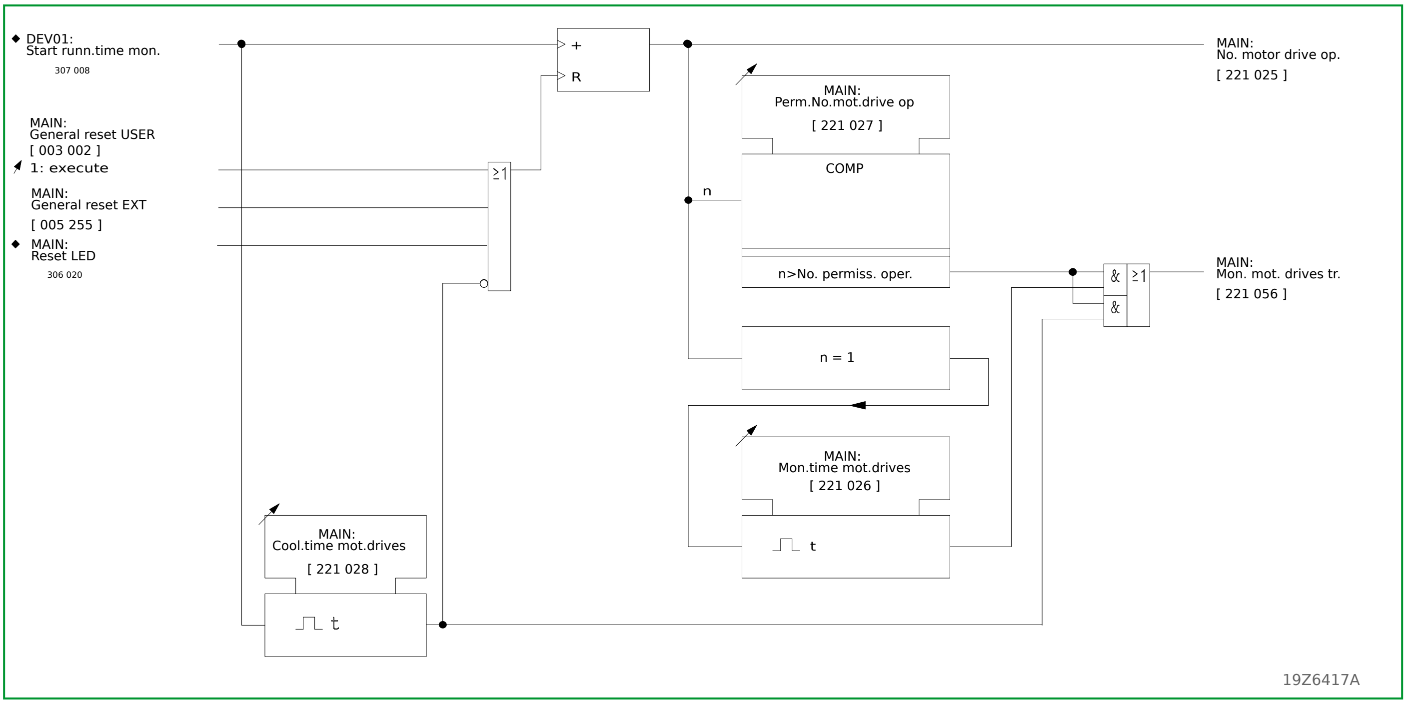


Fig. 3-340: Monitoring the Motor Drives in Case of Direct Motor Control.

For bays with direct motor drive control of load disconnecting switches, isolating links or grounding switches, a monitoring function is provided to protect motors from overheating.

The number of switching operations within a set monitoring period is counted. If the number of switching operations within the monitoring period exceeds the set limit, the signal MAIN: Mon. mot. drives tr. is issued. For the duration of the set cooling time, no control commands to motor-driven switchgear units will be executed. Once the set cooling time has elapsed, the control commands are enabled again.

3.44.7.2 Counter for the Open / Close Commands

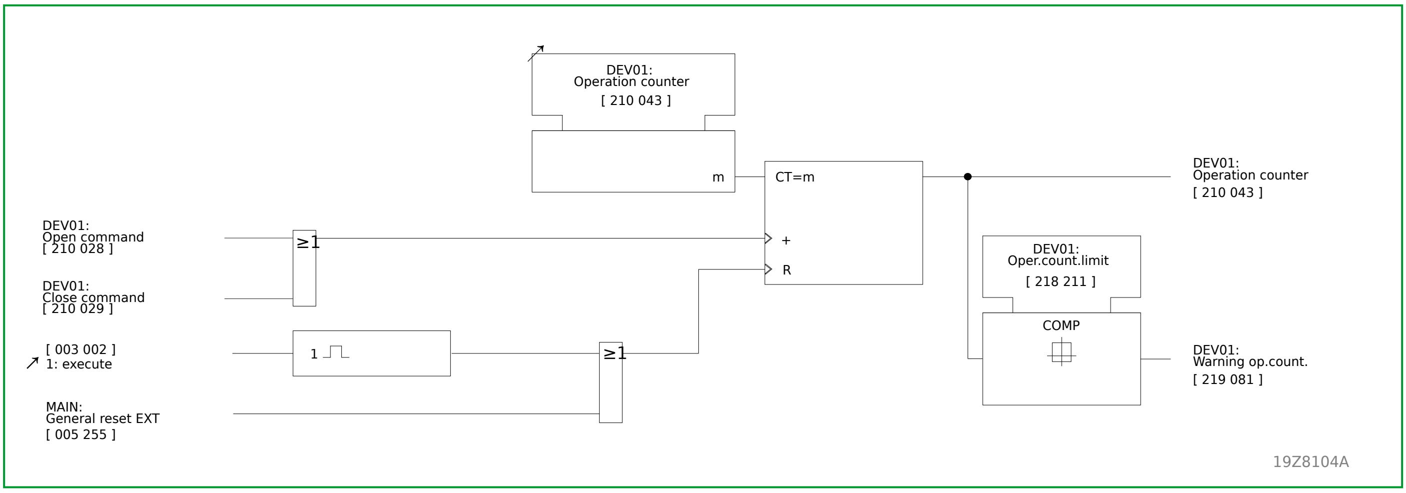


Fig. 3-341: Counter for the Open / Close Commands.

The diagram above shows the example of function group DEV01. The logic, however, is valid for all DEVxx with the appropriate parameters.

All Open and Close commands to the switchgear unit are counted. One counter per DEVxx function group is available for this purpose.

Moreover, a limit value can optionally be set for the counter value. If the counter value reaches the set limit a warning signal is issued. Due to safety reasons the switchgear control will **not** be blocked when the set limit has been reached.

3.44.7.3 Time Control for Direct Motor Control

The control sequence described above applies to all switchgear units operated via an “Open” contact or a “Close” contact. For bays with direct motor control of load disconnecting switches, isolating links or grounding switches, the following modified control sequence described below applies to motor-operated switchgear units. The list of Bay Panel types shows which bay types are defined for direct motor control. An example for the connection of a bay with direct motor control is illustrated in Chapter “Installation and Connection”.

If a Bay Panel type with direct motor control is selected, a binary input for the status signal of the motor relay and one output relay each to trigger the motor relay and the shunt windings will have to be configured. In the example illustrated in Fig. 3-342, (p. 3-419), the single-pole command CMD_1: Command C012 is defined for control of the motor relay, the single-pole command CMD_1: Command C011 is defined for control of the shunt windings and the single-pole signal SIG_1: Signal S012 EXT (debounced and conditioned by chatter suppression) is defined for the status signal to the motor relay.

After triggering the motor relay, a set monitoring time period is started during which the status signal must be issued by the motor relay. If the status signal is not received during this time period a signal is transferred to the substation control level. In addition, the “Close” command issued to the output relays, configured to *Motor relay Cmd* or *Shunt winding*, is terminated if MAIN: Cmd.end f. DC fail. is set to its default value *Yes*. This results in interrupting the motor control command circuit and thereby preventing an undefined switch position. However, this would involve the danger of contact burn.

A different type of monitoring is active if MAIN: Cmd.end f. DC fail. is set to *No*: In this case the direction control contacts will remain closed. (Note: This feature bears the danger of an undefined switch position!) Moreover, the P139 issues the following signals (depending on the type of fault) when the monitoring time delay has expired:

- (221 108) MAIN: DC fail. cmd. End – This signal is issued if the K200 contacts have not opened after the set monitoring time-delay has elapsed.
- (221 109) MAIN: DC fail. cmd.start – This signal is issued if the K200 contacts have not closed after the set monitoring time-delay has elapsed.
- (221 110) MAIN: DEV op.time exceeded – This fault signal is issued (as a group signal) when no positive position signal (status signal) has been received from the external device after a command has been issued and the set running time-delay has elapsed.

For further processing each of these fault signals may be configured to selection parameters from the function groups LED (assignment to LED indicators), OUTP (assignment to output relays), LOGIC (processing by the programmable logic function), COMMx / IEC / GOOSE (signaling via the control system) or they may be mapped to the signal panel as an alarm signal. Acknowledging from the local control panel HMI is done by pressing the CLEAR (C) key.

If the status signal from the motor relay is issued during the monitoring time period, the running time monitoring of the motor relay is started simultaneously with this status signal. Monitoring of the switching command is then the same as with electromechanically operated switchgear units.

If the operating mode external termination contacts was selected (MAIN: W. ext. cmd. termin. is set to *No*) the “Close” command to the motor relay is terminated after the set latching time has elapsed, when either the “Open” or “Closed” position status signal is received or the set time period for running time monitoring has elapsed (see Fig. 3-331, (p. 3-405)). The monitoring time period is again started with the termination of the “Close” command to the motor relay and after it has elapsed the control commands “Open” or “Close” are also terminated. The same is valid for the shunt windings.

If the operating mode with external termination contacts was selected (MAIN: W. ext. cmd. termin. is set to *Yes*) the switching command to the motor relay is terminated after the set latching time has elapsed, when a termination command is issued while the set time period for running time monitoring is active. With the setting MAIN: ext.cmd.term. w/o PI = *No*, the switching command is also terminated when either the “Open” or “Closed” position status signal is received. The switching command to the motor relay is always terminated after the set latching time has elapsed. The monitoring time period is again started with the termination of the “Close” command to the motor relay and after it has elapsed the control commands “Open” or “Close” are also terminated.

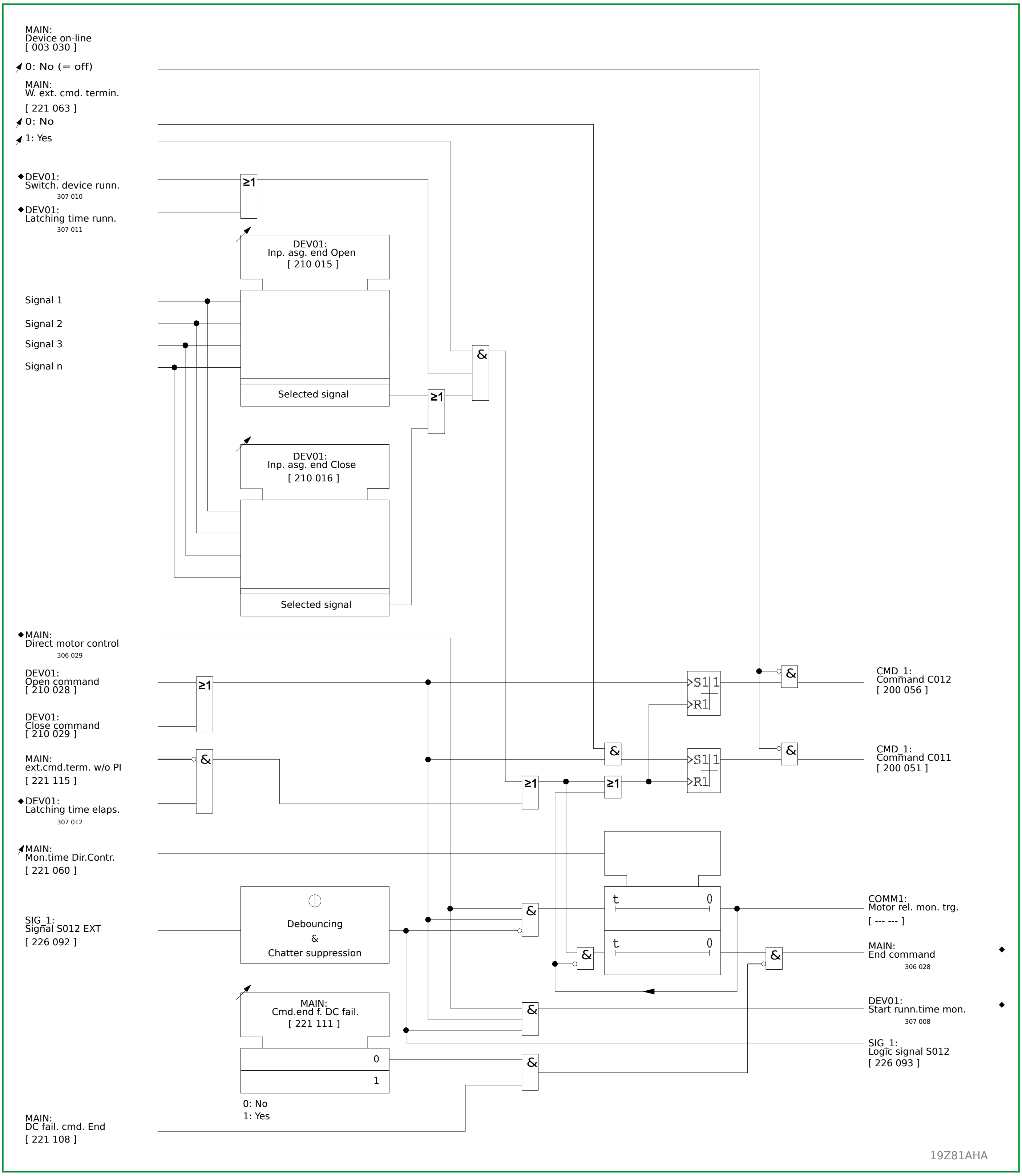
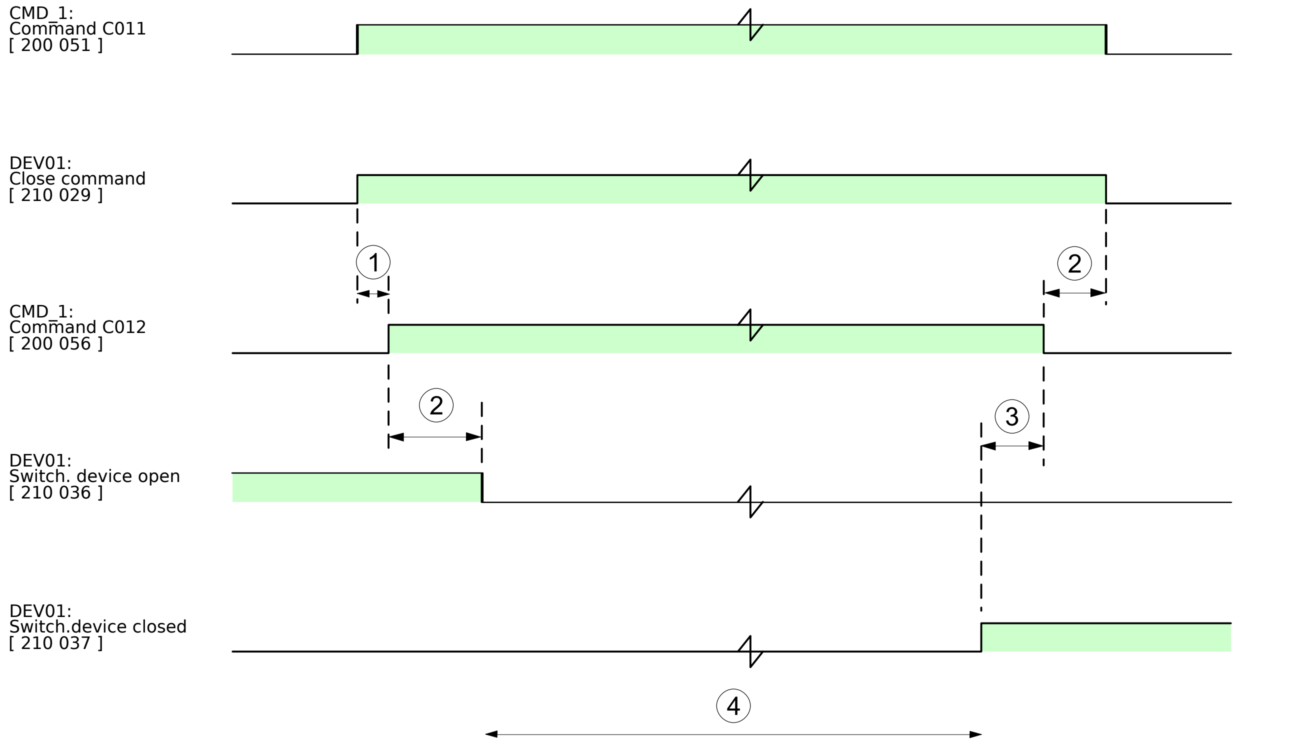


Fig. 3-342: Control and monitoring of the motor relay.



1	2	3	4
10 ms	MAIN: Mon.time Dir.Contr. [221 060]	DEV01: Latching time [210 005]	DEV01: Op.time switch. dev. [210 004]

Fig. 3-343: Sequence of time monitoring for direct motor control without external termination, example for switching operation “close”.

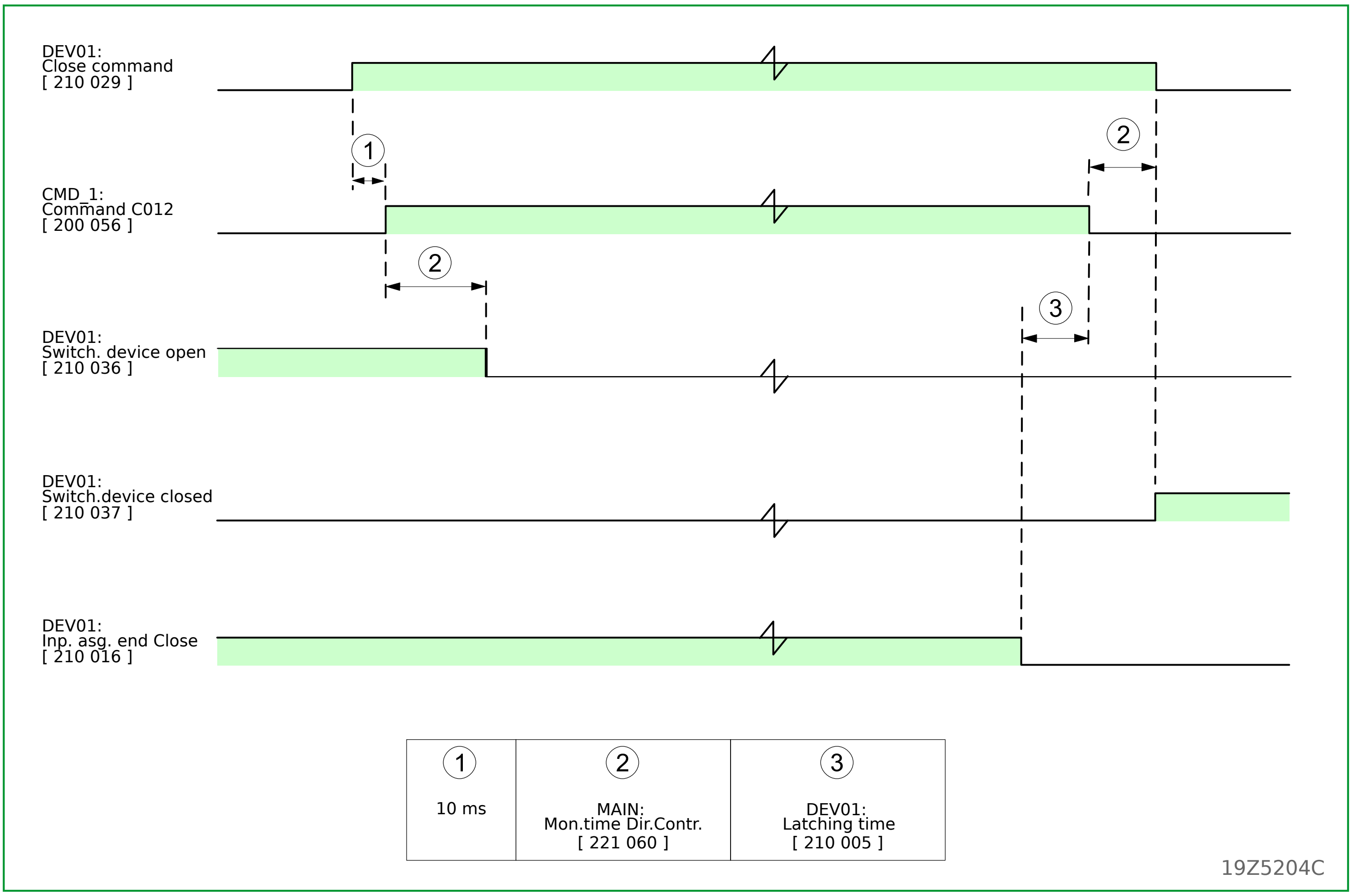


Fig. 3-344: Sequence of time monitoring for direct motor control with external termination, example for switching operation “close”.

3.44.7.4 Single-Pole Commands for Integrated Direct Motor Control

The P139 has an integrated logic for direct motor control. Three single-pole commands (see also function group CMD_1, Section 3.47, (p. 3-429)), together with a single-pole signal (see also function group SIG_1, Section 3.48, (p. 3-430), are available for this purpose.

CMD_1: CMD_DC1

- Direct control of starting sequence with impulse command.

  This is applicable only to Three Position Drives (see function group TPDx, Section 3.45, (p. 3-425), not to 2-pole standard devices. Moreover, this requires external high-precision contacts for command reset and for breaking the power circuit of the motor drive.

  The operation of this command is delayed by the set value MAIN: DC op. delay t1.

  The command is reset either when the timer MAIN: DC1 impulse t2 has elapsed, or with positive indication of the final switchgear position.

CMD_1: CMD_DC2

- Direct control without check back signal.

  The operation of this command is delayed by the set value MAIN: DC op. delay t1.

  The command is reset with positive indication of the final switchgear position, but this reset is delayed by the set value MAIN: DC2/3 release delay.

CMD_1: CMD_DC3

- Direct control with check back signal.

  The operation of this command is delayed by the set value MAIN: DC op. delay t1.

  The command is reset…:

  - with positive indication of the final switchgear position, if MAIN: ext.cmd.term. w/o PI = *No*, or
  - with the single-pole signal “SIG_DC3” (SIG_1: Logic SIG_DC3).

  In either case the reset is delayed by the set value MAIN: DC2/3 release delay.

  If none of these reset conditions is met after the set monitoring time-delay has elapsed the reaction of the P139 depends on the setting MAIN: Cmd.end f. DC fail.:

- If MAIN: Cmd.end f. DC fail. is set to its default value *Yes* the command is terminated.
- If MAIN: Cmd.end f. DC fail. is set to *No* the contacts of the assigned output relays remain closed and the P139 issues the following signals (depending on the type of fault) when the monitoring time delay has expired:

  (221 108) MAIN: DC fail. cmd. End

  (221 109) MAIN: DC fail. cmd.start

  (221 110) MAIN: DEV op.time exceeded

  This behavior is comparable to the time-monitoring described in Section 3.44.7.3, (p. 3-417).

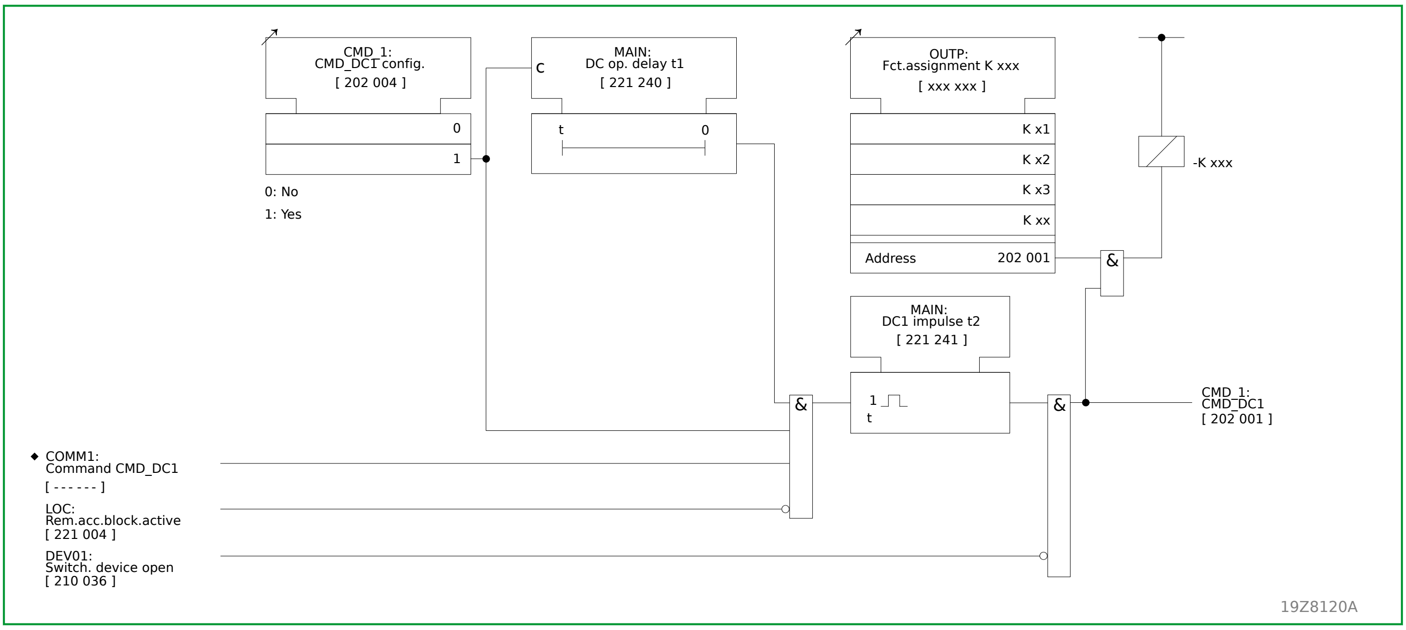


Fig. 3-345: Direct control of starting sequence with impulse command (CMD_1: CMD_DC1).

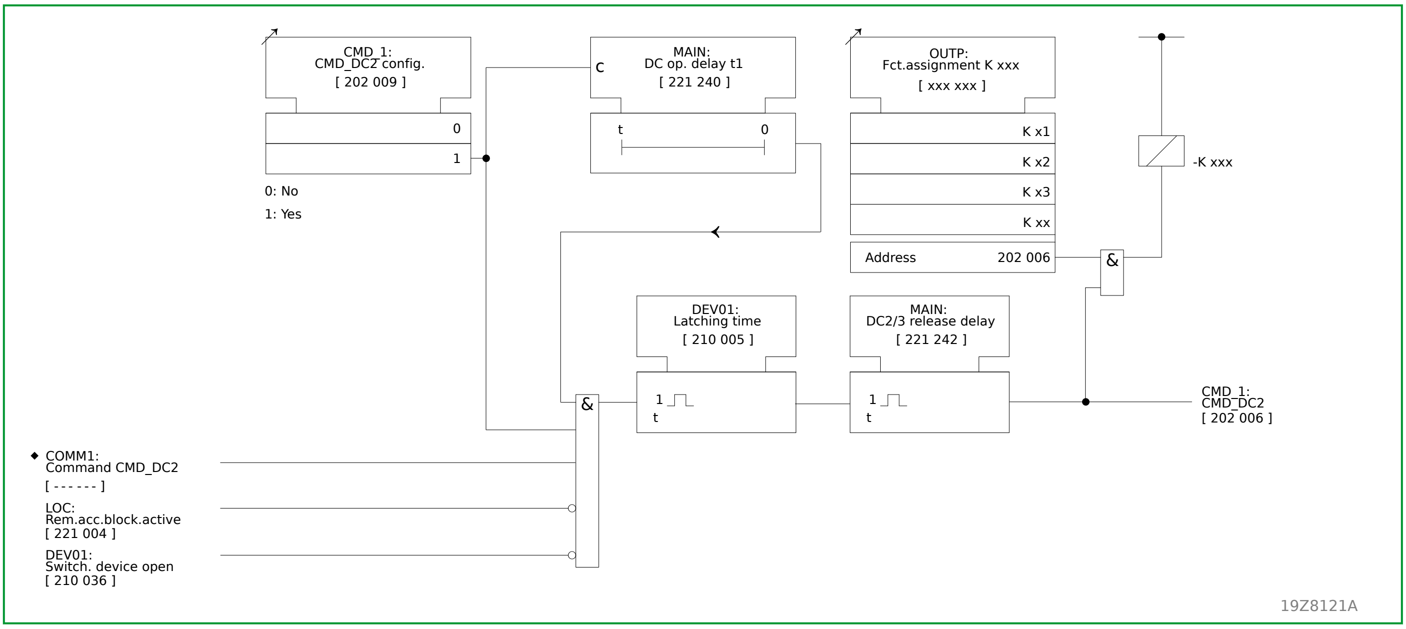


Fig. 3-346: Direct control without check back signal (CMD_1: CMD_DC2).

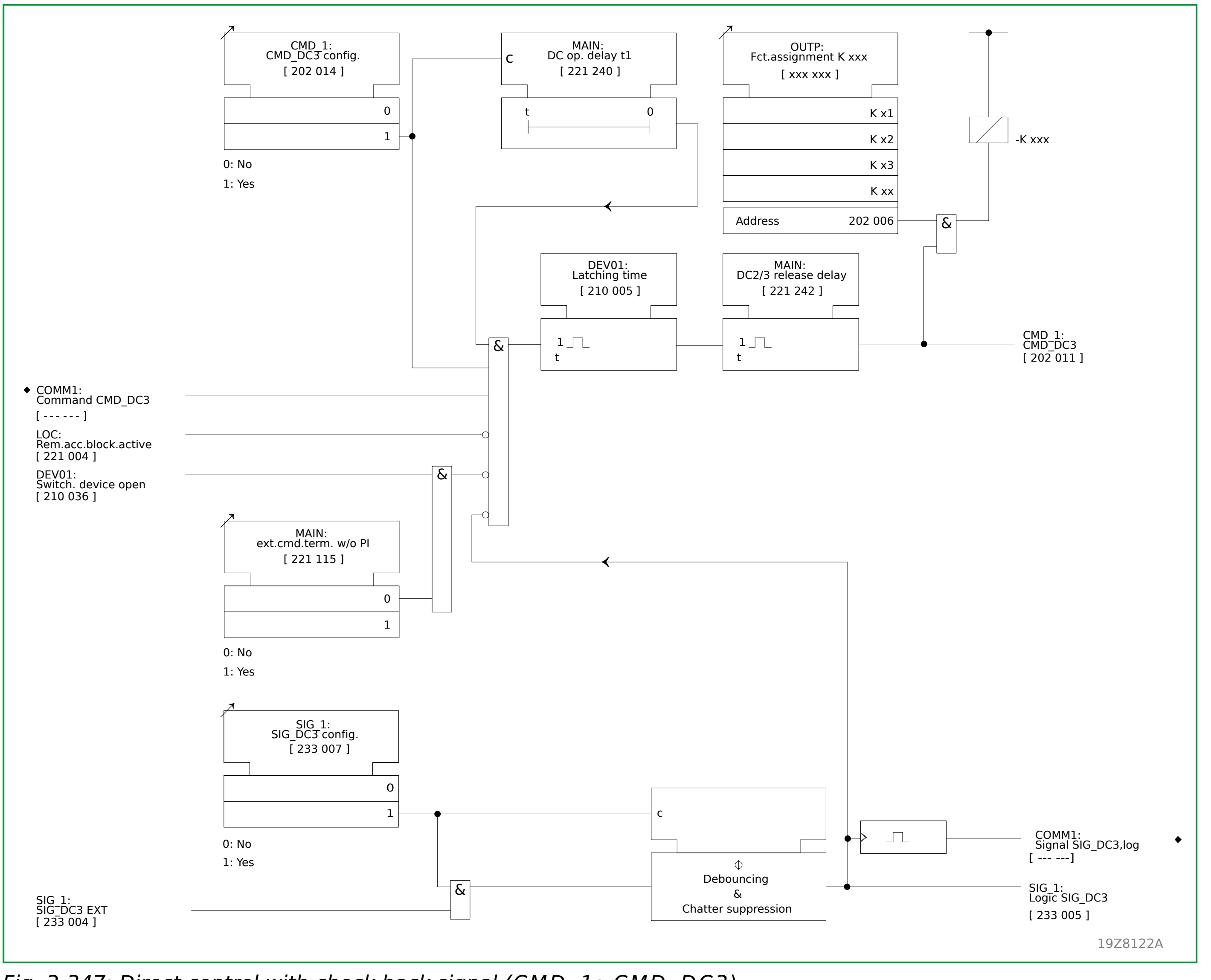


Fig. 3-347: Direct control with check back signal (CMD_1: CMD_DC3).

3.45 Three Position Drive (Function Groups TPDx)

For the direct motor control via three-position switches, up to four “virtual” switching units can be defined. Each such virtual switching unit is composed of two “real” switches, a disconnector and a grounding switch. The function groups TPD1 to TPD4 allow for comfortably setting up, monitoring and control of such combinations of disconnecting and grounding switches.

3.45.1 Setting up a Three Position Drive

Function groups TPDx can be disabled or enabled using the following setting parameters:

- (219 000) TPD1: Function group TPD1 = *Without* / *With*
- (219 020) TPD2: Function group TPD2 = *Without* / *With*
- (219 040) TPD3: Function group TPD3 = *Without* / *With*
- (219 060) TPD4: Function group TPD4 = *Without* / *With*

For every required TPDx it must then be set which switching unit is the disconnector and which is the grounding switch. For example for TDP1 this is done using the settings below. (Corresponding settings exist for TPD2…TPD4.)

- (219 003) TPD1: TPD1 Disconnector = *Not assigned* / *DEV01* … *DEV10*
- (219 004) TPD1: TPD1 ground. switch = *Not assigned* / *DEV01* … *DEV10*

For these settings, the following conditions must be fulfilled

- It must be a combination of two 2-pole standard switches, a disconnector and a grounding switch, operating one common motor drive.
- Each switchgear unit must be assigned only once. (Otherwise, the warning message SFMON: Invalid config.TPDx will be issued.)
- No bay type must be selected that controls any of these switchgear units; this would be a multiple configuration of a switchgear unit and is not permitted.
- Indication of the switchgear positions must be available, otherwise no monitoring would be possible.

3.45.2 Monitoring and Control

Checking the control commands and the switchgear positions of the assigned switching units the P139 determines into which of the two possible rotating directions (clockwise or counter-clockwise) the motor is changing, and this is signaled with the following logical state signals:

- (219 001) TPD1: Cmd. clockwise = *No* / *Yes*
- (219 002) TPD1: Cmd. counter-clockw. = *No* / *Yes*

The operation commands are counted (TPD1: Operation counter for TPD1). If the counter value exceeds a settable limit (TPD1: Oper.count.limit for TPD1), a warning signal (TPD1: Warning op.count. for TPD1) is issued.

After termination of the switching command, a 3-position switch must be in a well-defined position, either open or closed, or a medium position which corresponds to both the disconnector and the grounding switch being open. If any of the assigned switching units, disconnector or the grounding switch, happens to end up in a faulty position any further motor operation has to be blocked. The signal MAIN: Shunt trip overrun can be used for this. (This is a common signal for all four TPDx function groups.)

The logic shown here is an example for the case of TPD1 with the setting DEV02 for the disconnector and DEV03 for the grounding switch. The logic, however, also applies to other configurations with different parameter addresses.

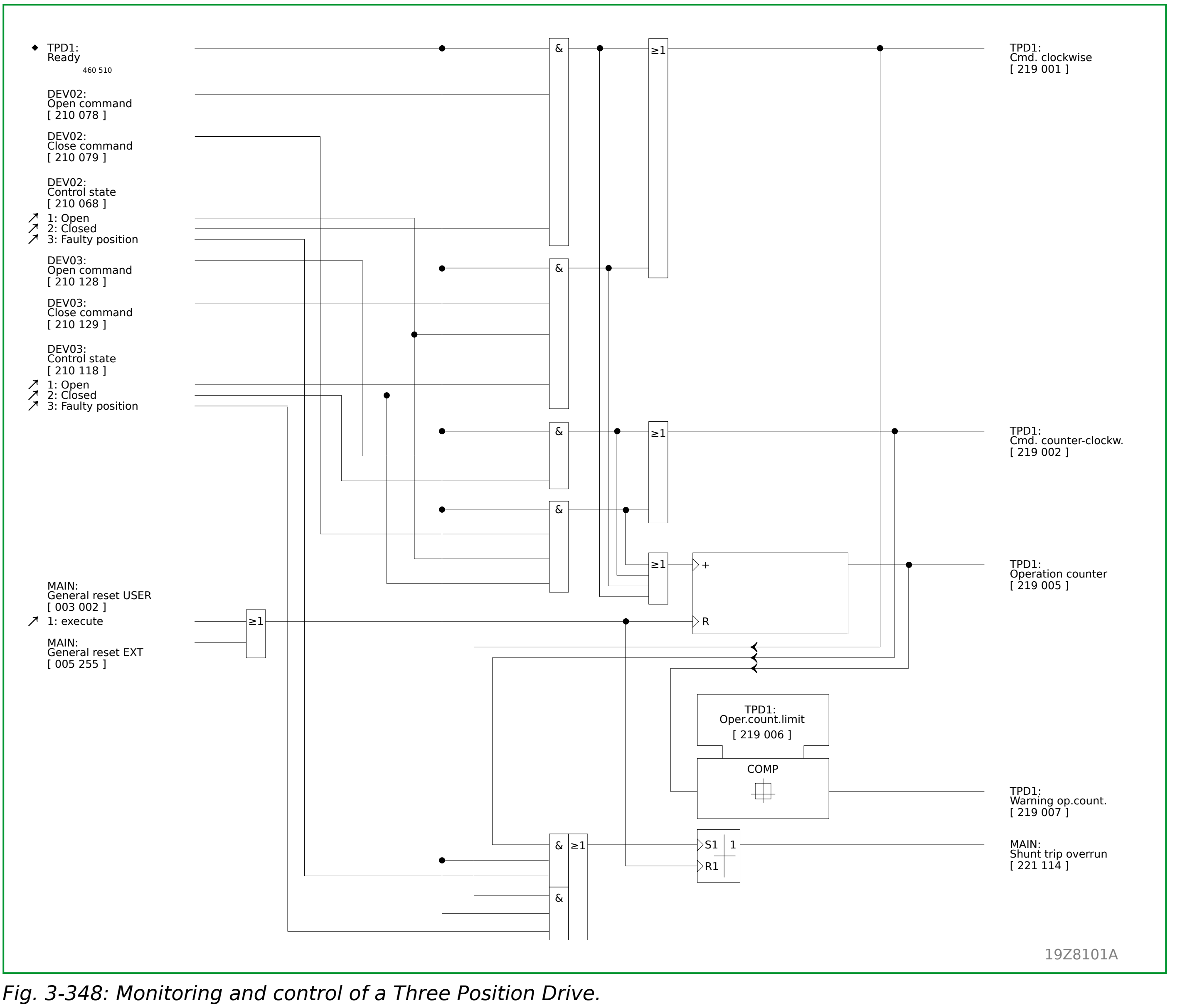


Fig. 3-348: Monitoring and control of a Three Position Drive.

3.46 Interlocking Logic (Function Group ILOCK)

The switching commands to the controllable switchgear units in the bay are enabled only after interlock conditions have been checked. The interlock conditions are defined in the form of Boolean equations in the interlocking logic function.

The choice of the bay type automatically defines the bay interlock conditions (or equations) for the 'Open' and 'Close' operations of the individual switchgear units in the bay. The bay interlock equations for operation with station interlock differ from the bay interlock equations for operation without station interlock (see Vol. 2, Chapter A5, (p. A5-1)). These automatically defined interlock conditions – determined by the choice of bay type – can be modified by the user at any time to fit particular station requirements. The following signals acquired by the P139 are linked by logic operations for the bay interlock:

- Function blocks 1 and 2
- Programmable logic outputs
- Switchgear position signals, after debouncing and chatter suppression
- Single-pole signals, after debouncing and chatter suppression

A maximum of 32 equations with 32 equation elements each are available to define interlock conditions. The Boolean equations need to be defined without the use of brackets. The following rule applies to the operators: "NOT" before "AND" before "OR". The output signal of one equation can be fed into a higher-order equation as an input thus creating a sequence of interlinked Boolean equations.

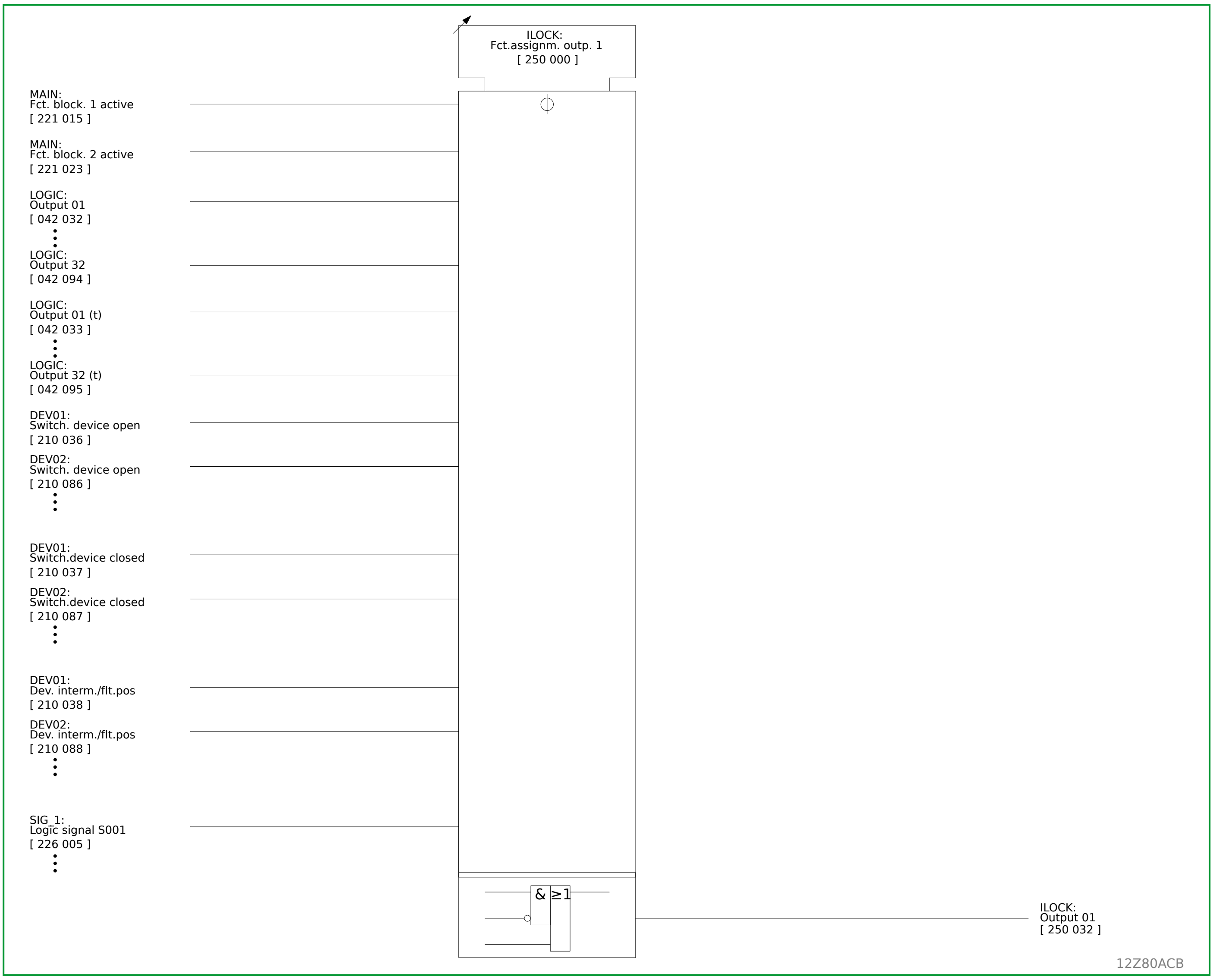


Fig. 3-349: Interlocking logic as illustrated for equation 1.

3.46.1 IEC 61850 Reporting

As the interlock conditions are also transmitted together with reporting in the IEC 61850 communication protocol it is a requirement that these interlock conditions are cyclically checked and not only with the request for a switching operation.

Therefore the parameter (221 104) ILOCK: Cycle t interl.check allows for setting the cycle time (range from 100 ms to 10 s), after which a check of the interlock conditions is carried out. If this parameter is set to *blocked* (default value), the ILOCK signals over IEC 61850 will be updated only if a control command gets executed. If the DEV state changes without a control command these signals remain unchanged. As additional processor capacity must be provided for each of these checks it must be ensured that a favorable compromise is found for the cycle time setting value. On the one hand it is desirable to select a cycle time value which is as short as possible so that changes in the interlock conditions are updated without any notable delays, but on the other hand this cycle time value should not be so short that the P139 system will be under too much strain. As the P139 CPU load is dependent on the total number of function groups having been configured it is not possible to suggest a generally acceptable cycle time value.

3.47 Single-Pole Commands (Function Group CMD_1)

Commands may be transmitted to the P139 via the communications interface. When the P139 receives such a command, and if the remote control mode is enabled, an appropriately configured output relay will be triggered and a signal issued.

The user can select the operating mode for each 1-pole command. The following settings are possible:

- *Long command*
- *Short command*
- *Persistent command*

If the operating mode *Long command* or *Short command* has been selected the output relay will be triggered for the time period set at MAIN: Cmd. dur.long cmd. or MAIN: Cmd. dur. short cmd..

The setting options and the functional sequence are shown in the example for Command C001. This will apply accordingly to all other single-pole commands.

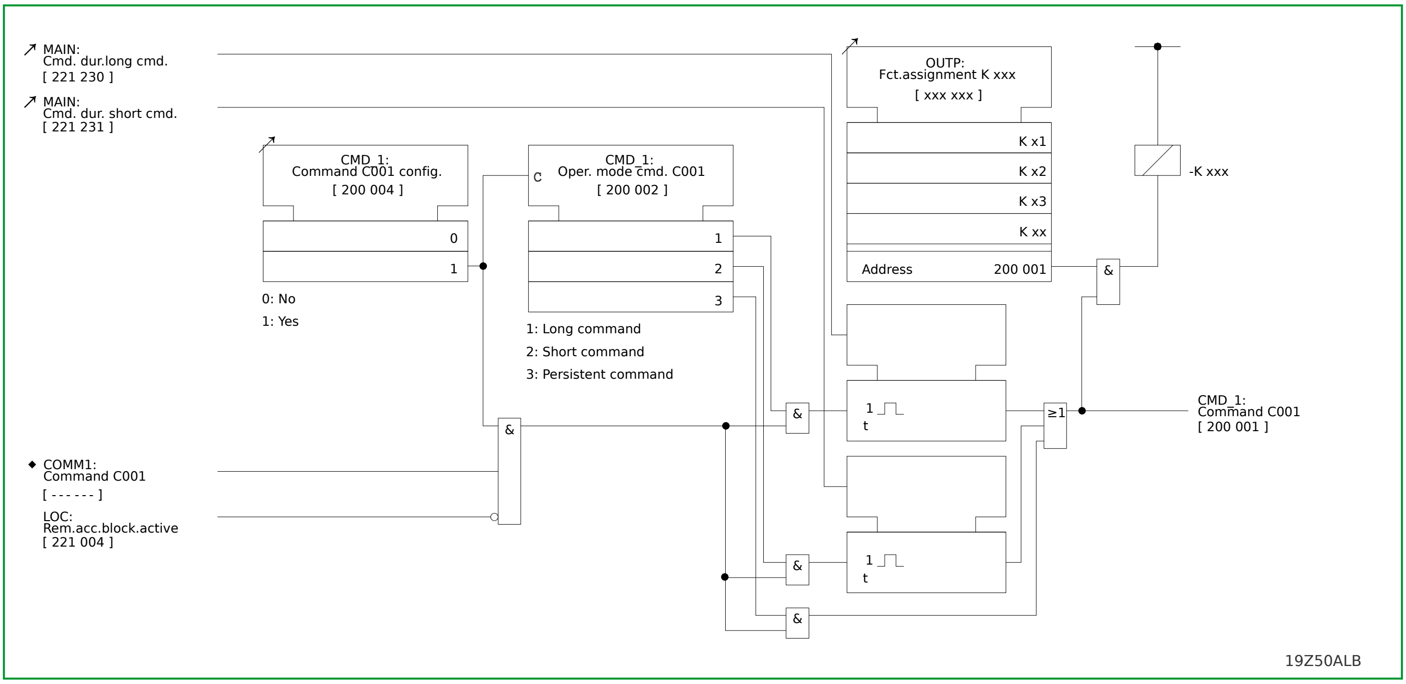


Fig. 3-350: Functional sequence for single-pole commands, as illustrated for Command C001.

3.48 Single-Pole Signals (Function Group SIG_1)

Binary, single-pole signals issued by the system may be transmitted by the P139 via its appropriately configured binary signal inputs to the control station.

Such single-pole input signals are conditioned by debouncing and chatter suppression (see Section 3.48.1.1, (p. 3-433)). This conditioned signal is then presented as SIG_1: Logic signal S001 (to SIG_1: Logic signal S064).

Signaling behavior via the communications interface is determined by selecting the operating mode. The following settings are possible:

- *Without function*
- *Start/end signal*
- *Transient signal*

If setting *Without function* has been selected then no message is transmitted when the signal state at the binary signal input changes. If setting *Start/end signal* has been selected then a message is transmitted every time the signal state at the binary signal input changes. A requirement for transmission of the *“Start signal”* message is that the logic “1” signal is present for the set minimum time period. If setting *Transient signal* has been selected then a message is transmitted every time the signal state at the binary signal input changes form logic “0” to logic “1”.

The following figure displays setting modes and the functional sequence with the example for logic signal S001. This will apply accordingly to all other single-pole signals.

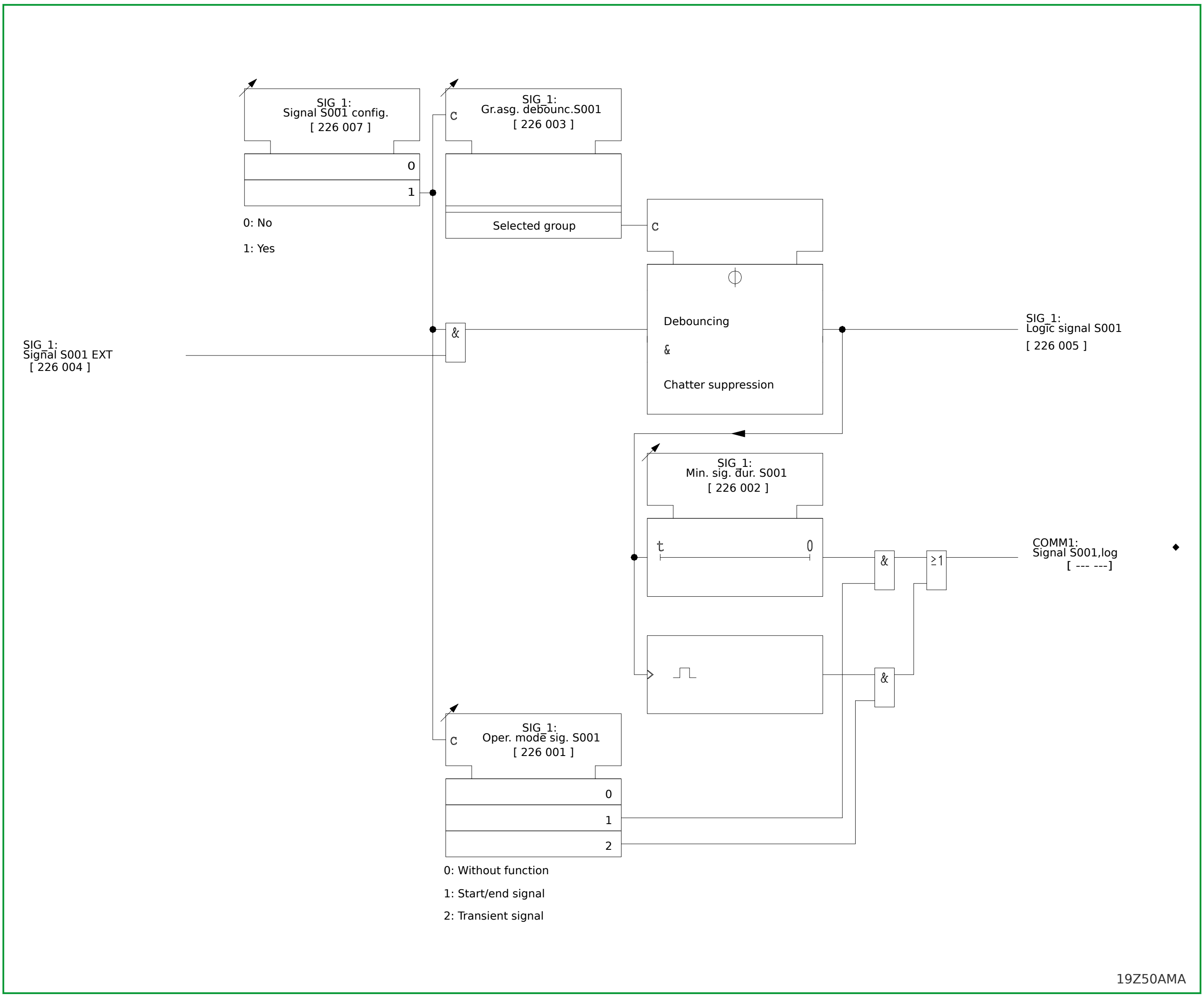


Fig. 3-351: Functional sequence for single-pole signals with the example for logic signal S001.

3.48.1 Acquisition of Binary Signals for Control

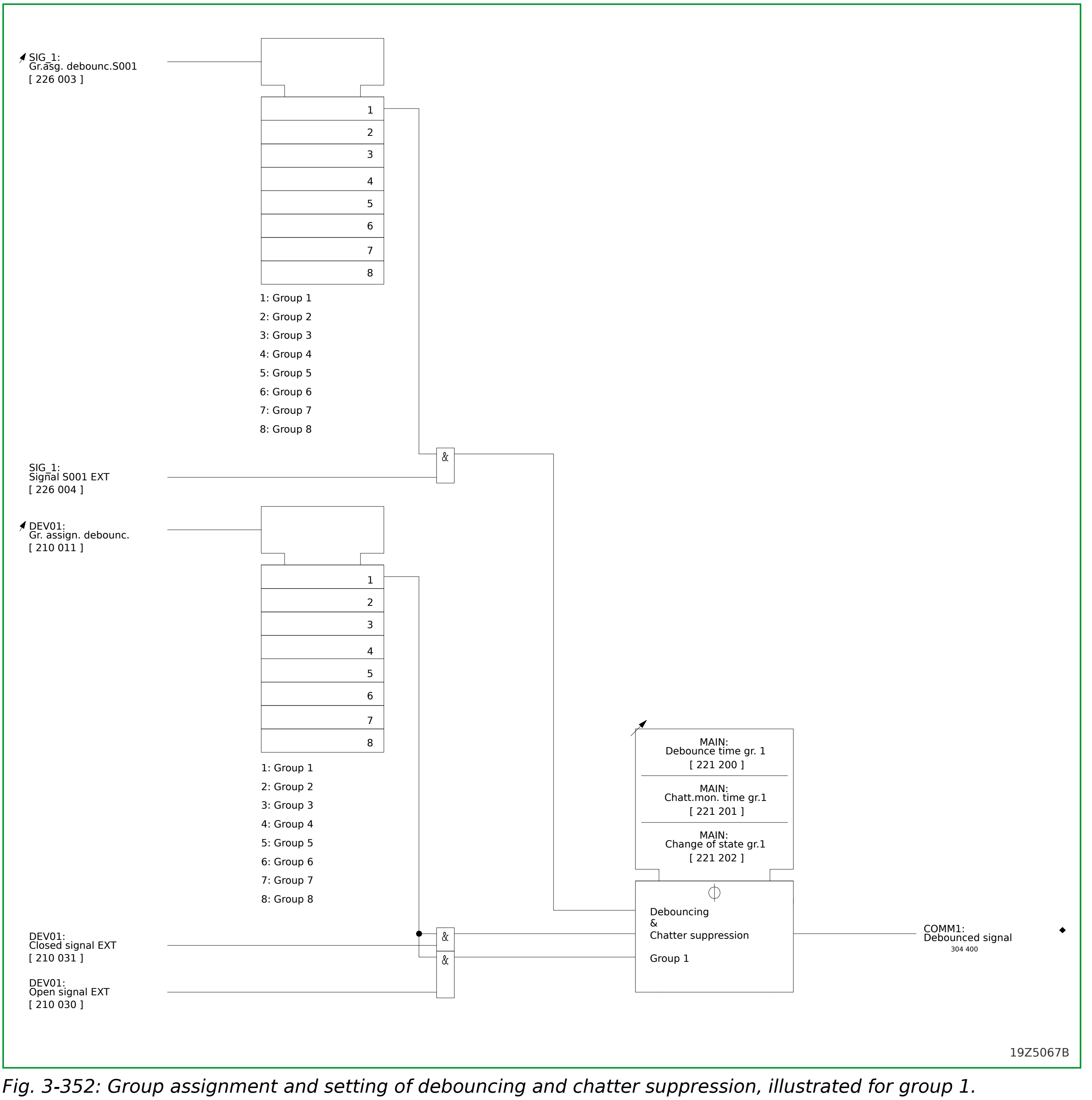


Fig. 3-352: Group assignment and setting of debouncing and chatter suppression, illustrated for group 1.

In the acquisition of signals for control purposes, the functions real time acquisition (time tagging), debouncing and chatter suppression are included as standard. Each of these signals can be assigned to one of eight groups and for each of these groups the debouncing time and chatter suppression can be set. Matching of these two parameters achieves the suppression of multiple spurious pickups.

3.48.1.1 Debouncing and Chatter Suppression

3.48.1.1.1 Debouncing

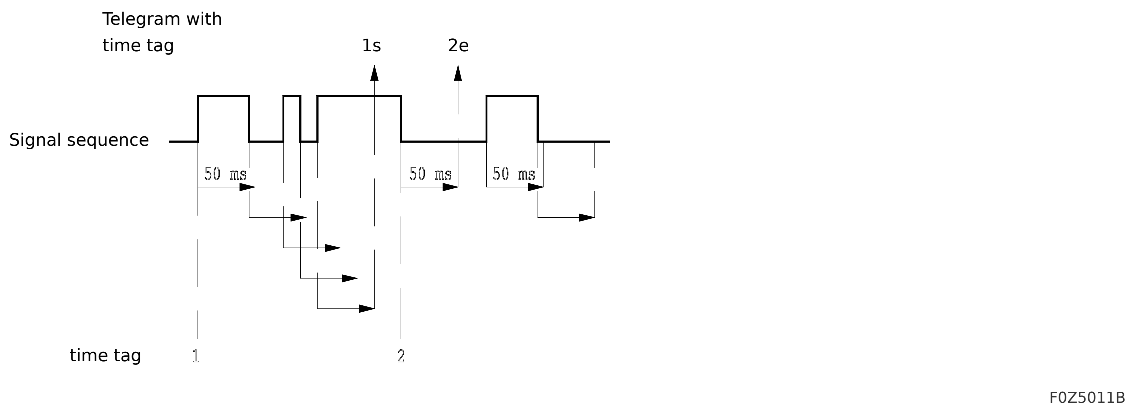


Fig. 3-353: Signal flow with debouncing when time tagging occurs with the 1st pulse edge (e.g. parameter MAIN: Time tag set to the value 1stEdge,OpMem unsort or 1stEdge,OpMem sorted.) Example: Set debouncing time: 50 ms, s: start, e: end.

The first pulse edge of a signal starts a timer stage running for the duration of the set debouncing time. Each pulse edge during the debouncing time re-triggers the timer stage.

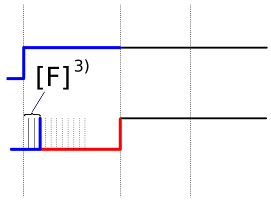
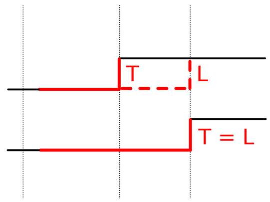
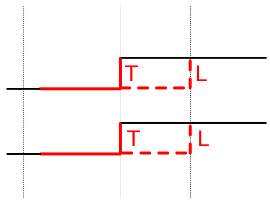
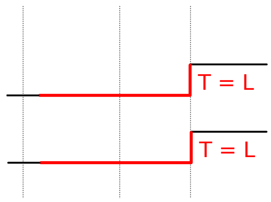
If the signal is stable until the set debouncing time elapses, a telegram containing the time tag of the first pulse edge is generated. As an alternative the time tag may be generated after debouncing by setting parameter MAIN: Time tag to the value *After debounce time*.

After the set debouncing time has elapsed, the state of the signal is checked. If it is the same as prior to the occurrence of the first pulse edge, no telegram is generated.

Time-tagged entries of the first pulse edge are only generated after debounce time has elapsed. If these entries are saved without delay (setting of MAIN: Time tag to the value *1stEdge,OpMem unsort*) they are not necessarily saved in chronological order in the operating data memory. If above parameter has been set to the value *1stEdge,OpMem sorted* then all entries are always saved in chronological order in the operating data memory.

Time Tag

The following overview illustrates how the (221 098) MAIN: Time tag setting is operating.

Acquisition of binary signals for control	0 T_1 1) T_2 1)
Voltage present at input terminals: Filter function to suppress transient interferences (required number of steps with active signal) (226 004) SIG_1: Signal S001 EXT (no time tag, internal signal to start debouncing)[2]	
1stEdge,OpMem sorted: (226 005) SIG_1: Logic signal S001 ● on COMM1/IEC (Signaling at T_2 with time tag T_1 ● internal on operating memory (Entry in operating memory at T_2 with time tag T_2	
1stEdge,OpMem unsort: (226 005) SIG_1: Logic signal S001 ● on COMM1/IEC (Signaling at T_2 with time tag T_1 ● internal on operating memory (Entry in operating memory at T_2 with time tag T_1	
After debounce time: (226 005) SIG_1: Logic signal S001 ● on COMM1/IEC (Signaling at T_2 with time tag T_2 ● internal on operating memory (Entry in operating memory at T_2 with time tag T_2	
	T = Time tag L = Log of state

1) $T_2 = T_1$ (cycle time) + debounce time

2) SIG_1: Signal S001 EXT is not foreseen for any further transmission via communication interface, neither for assigning to functions nor LOGIC.

3) Filter (e. g. 3 sampling steps)

3.48.1.1.2 Chatter Suppression

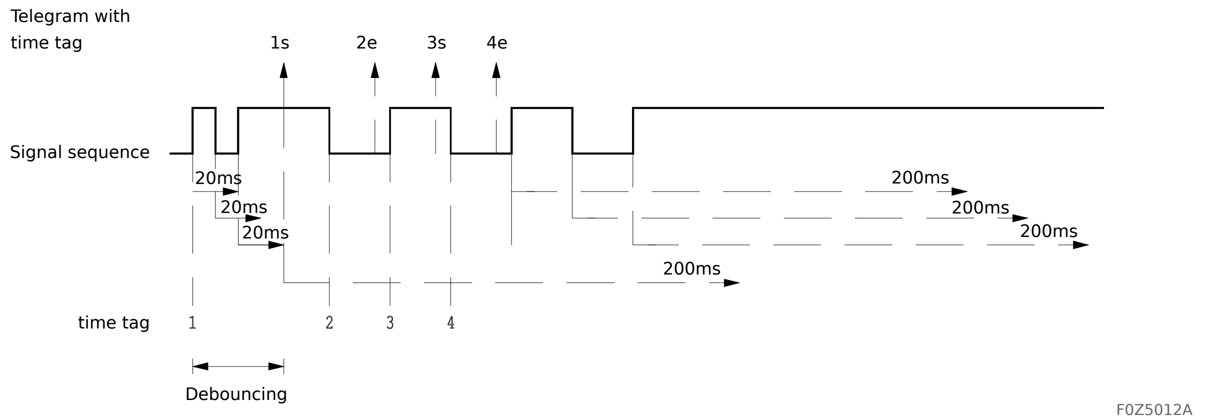


Fig. 3-354: Signal flow for debouncing and chatter suppression. Set debouncing time: 20 ms, set chatter monitoring time: 200 ms, number of admissible signal changes: 4, s: start, e: end.

Sending of the first telegram starts a timer stage running for the duration of the set monitoring time. While the timer stage is elapsing, telegrams are generated for the admissible signal changes. The number of admissible signal changes can be set. After the first “inadmissible” signal change, no further telegrams are generated and the timer stage is re-triggered. While the timer stage is elapsing, it is re-triggered by each new signal change. Once the timer stage has elapsed, each signal change triggers a telegram.

3.49 Binary Counts (Function Group COUNT)

The P139 features four binary counters. Each of these can count the positive pulse edges of a binary signal present at an appropriately configured binary signal input. Such a binary signal can be provided with debouncing.

3.49.1 Enable/Disable the Counting Function

The counting function (COUNT) can be disabled or enabled via setting parameters.

3.49.2 Debouncing

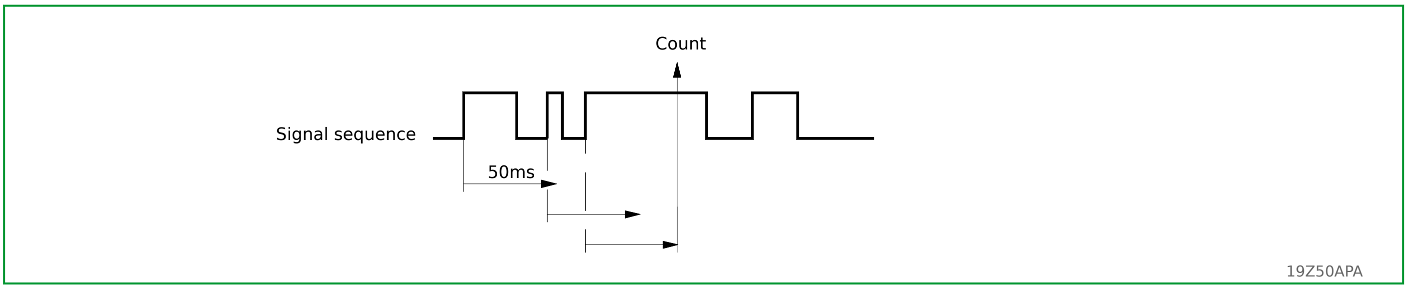


Fig. 3-355: Debouncing signal flow. Set debouncing time: 50 ms.

The first positive pulse edge of the binary input signal to be counted will trigger a timer stage which will continue to run for the set debouncing time period. Each positive pulse edge during the debouncing time re-triggers the timer stage. The binary input signal will be counted if it is stable during the set debouncing time period.

The debouncing time can be set separately for each of the four counters.

After the set debouncing time has elapsed, the state of the signal is checked. If it is the same as prior to the occurrence of the first pulse edge, it will not be counted.

3.49.3 Counting Function

The debounced binary signal is counted by a 16 bit counter. The counters may be set to a specific count value (preload function) by setting a parameter or via the serial interfaces. The values of the counters can be shown on the LC-display and read out via the PC interface or the communications interface.

For each of the four counters, there is a limit value that can be optionally set:

- COUNT: Limit counter 1 (and the same way for counters 2 to 4),
- settable from 1 to 65000,
- setting “Blocked” disables the limit check. (This setting is the default value.)

A warning signal (COUNT: Warning count 1 and the same way for counters 2 to 4) is issued if the associated counter value exceeds the set limit.

3.49.4 Transmitting the Counter Values via Communications Interface

The counter values are transmitted via the communications interface when a signal is presented to an appropriately configured binary signal input, a trigger signal is issued by a setting parameter or at cyclic intervals as set at the cycle time stage COUNT: Cycle t.count transm. When the counter value is transmitted at cyclic intervals, then transmission is time synchronized if the ratio

60/(set cycle time) comes to an integer. In all other cases the counter values are transmitted at time intervals determined by a free running internal clock.

3.49.5 Counter Values Reset

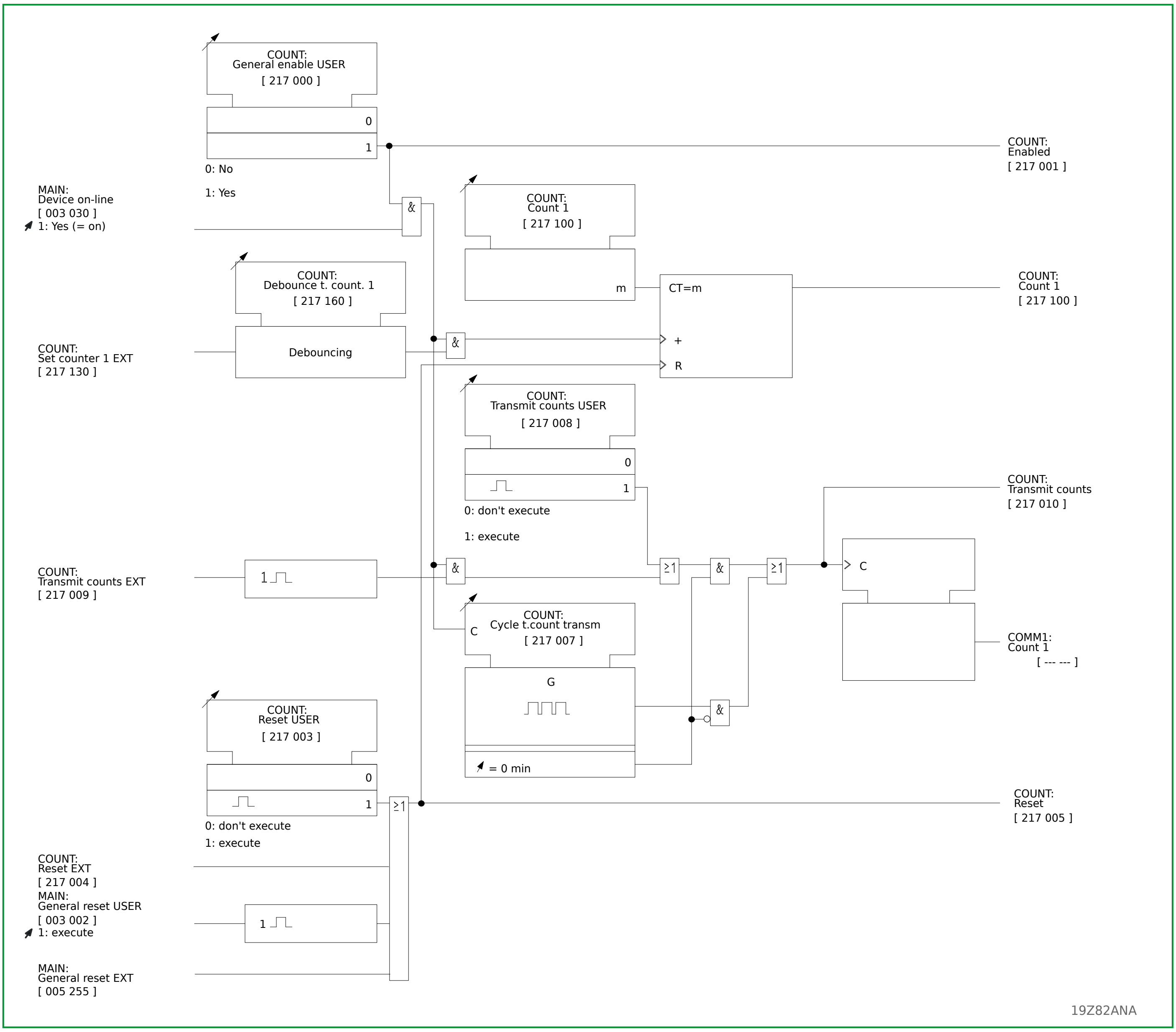


Fig. 3-356: Binary Count. (This diagram shows counter 1 as an example. The displayed logic is also valid for counters 2 to 4, where COUNT: Set counter 1 EXT and COUNT: Count 1 have to be replaced by the respective parameters.

The counter values may be reset – all at once – by setting parameter COUNT: Reset USER or via an appropriately configured binary signal input as well as by the general reset action.

3.50 TIMER (Function Group TIMER)

Four groups of timer are available in the P139. The timer can set time for starting and ending automatically with start time (TIMER: Start hour 1, TIMER: Start minute 1) and end time (TIMER: End hour 1, TIMER: End minute 1). Each of the timer can set one or more repeat days in a week TIMER: Calendar 1 (from Monday to Sunday).

For example, it is able to set time for automatic's activation (e.g. keeping the output relay closed) between 12 PM and 18 PM from Monday to Friday for timer stage1 and between 16 PM and 19 PM on Saturday and Sunday for timer stage 2.

From version -655 the timer settings allow more flexibility.

If the end time is before (smaller than) start time, the "active" window will end on the next day. For example, timer stage 1 is set for Saturday with start time 18 p.m. and end time 12 p.m., then it will be active from Saturday 18 p.m. until Sunday 12 p.m.

If start and end timers are set to the same value, the timer stage gets active for 24h. For example, timer stage 1 is set for Saturday with start time 12 p.m. and end time 12 p.m., then it will be active from Saturday 12 p.m. until Sunday 12 p.m.

The internal clock is the source of the Timer function. It is also possible to use the time synchronised clock signal (GPS, DCF77, SNTP).

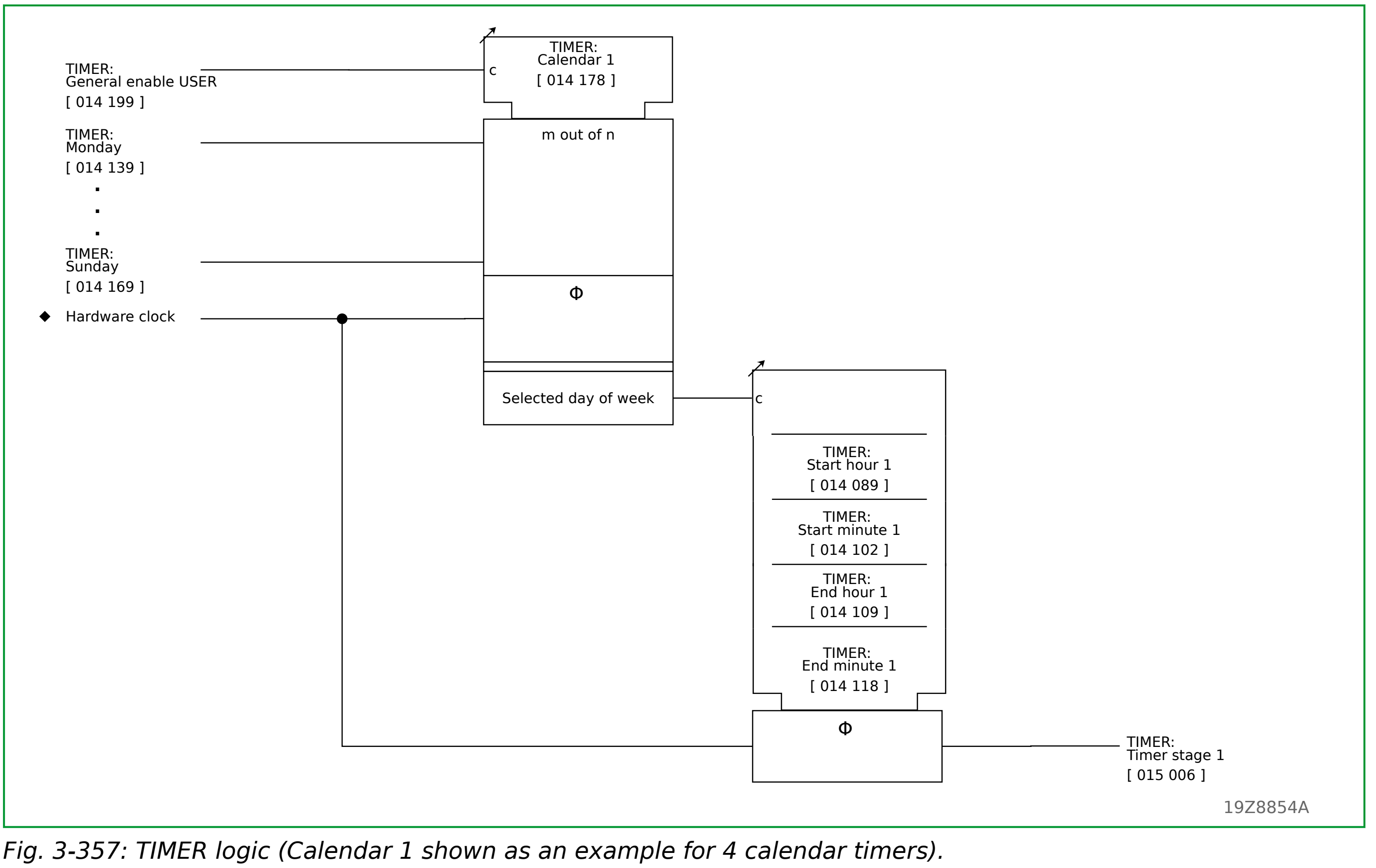


Fig. 3-357: TIMER logic (Calendar 1 shown as an example for 4 calendar timers).

4 Design

The P139 is available in different types of cases and with different combinations of modules.

Irrespective of the type a P139 is equipped with a detachable HMI or a fixed local control panel. The local control panel is covered with a tough film so that the specified degree of IP protection will be maintained. In addition to the essential control and display elements, a parallel display consisting of multi-colored LED indicators is also incorporated (see Section 6.2, (p. 6-2)). The meaning of the various LED indications is shown in plain text on a label strip.

The PC interface (9-pin D-Sub female connector) is located under the hinged cover at the bottom of the local control panel.

4.1 Designs

The P139 is available in a surface-mounted and a flush-mounted case. Depending on the connection type – pin-terminal or ring-terminal connection – the case sizes differ. The location diagrams (Section 5.7, (p. 5-27)) show the available combinations of case widths and connection types.

Electrical connections are made via plug-in threaded terminal blocks. The threaded terminal blocks in the surface-mounted case are accessible from the front of the device after unscrewing the torx head steal screws on the sides (see Fig. 4-1, (p. 4-3), ①) and removing the local control panel. The local control panel can then be secured by inserting the tabs in the slots in the left side wall (see Fig. 4-1, (p. 4-3), ②). The flush-mounted case is connected at the back of the case.

⚠ WARNING

The local control panel is connected to processor module P by a plug-in connecting cable. Do not bend the connecting cable! Secure the local control panel by inserting it in the slots provided on the left.

⚠ WARNING

The secondary circuit of live system current transformers must not be opened! If the secondary circuit of a live CT is opened, there is the danger that the resulting voltages will endanger personnel and damage the insulation.

⚠ WARNING

For pin-terminal connection devices, the terminal block for system current transformer connection is not a shorting block! Therefore always short-circuit the system current transformers before loosening the threaded terminals.

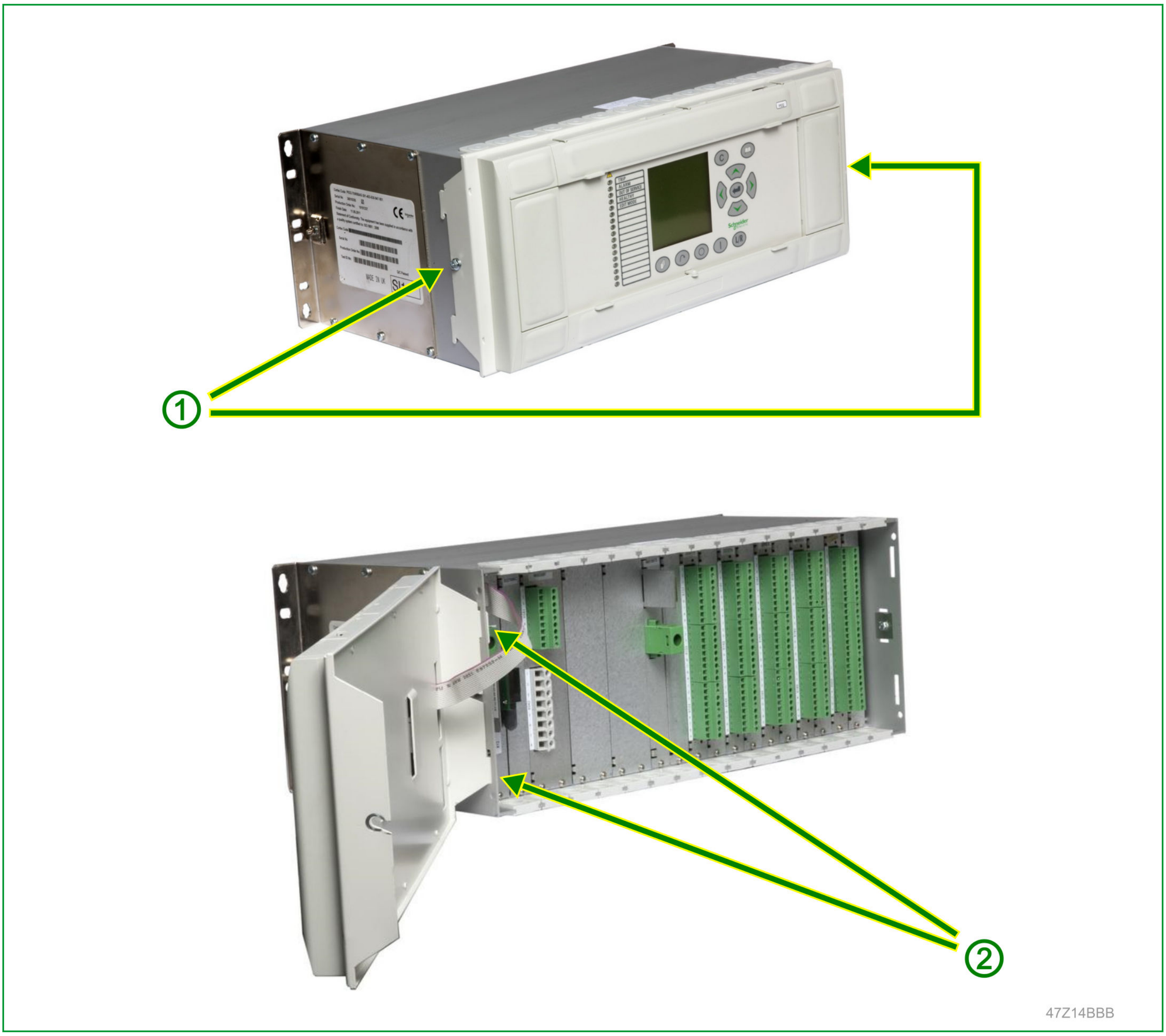


Fig. 4-1: Surface-mounted case, removal of local control panel (or – in case of a detachable HMI – the case front panel). The illustration shows the 84TE case with (fixed) local control panel.

4.2 Dimensional Drawings

4.2.1 Dimensional Drawings for the 40 TE Case

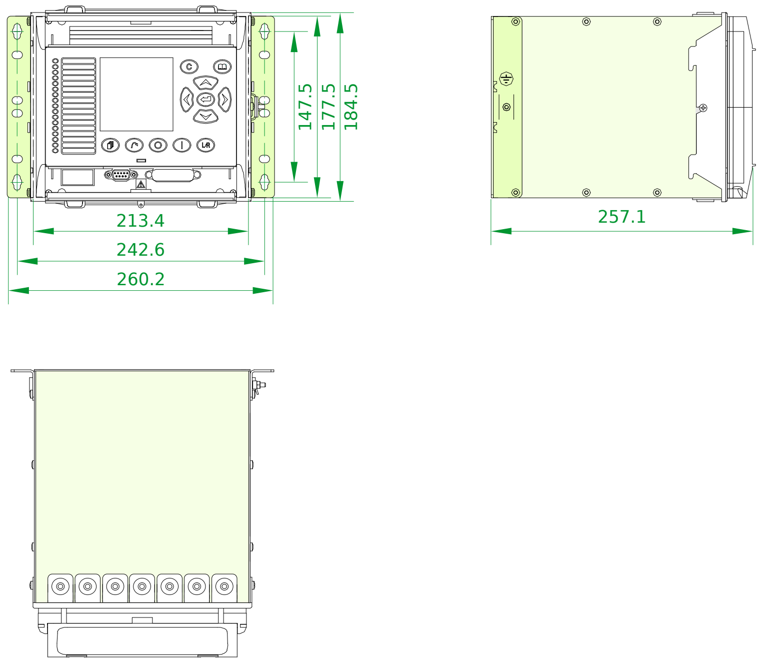


Fig. 4-2: Surface-mounted 40 TE case. (Dimensions in mm.)

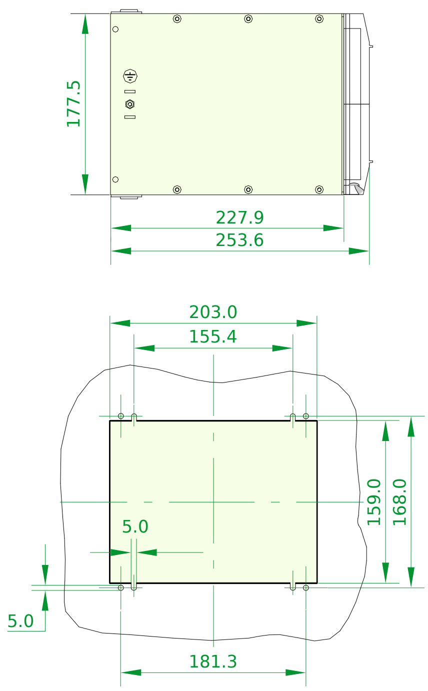


Fig. 4-3: Flush-mounted case 40 TE with panel opening, flush-mount method 1 (without angle brackets). (Dimensions in mm.)

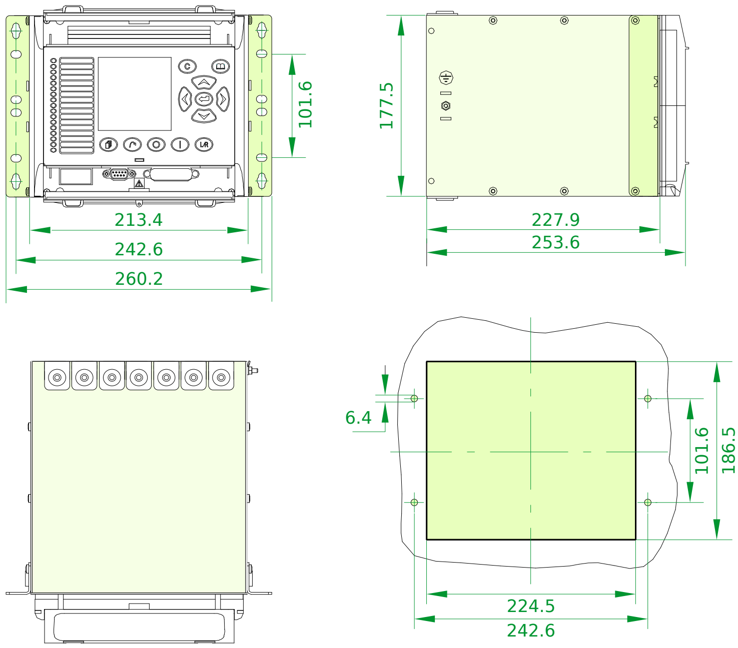


Fig. 4-4: Flush-mounted case 40 TE with panel opening, flush-mount method 2 (with angle brackets and frame). (Dimensions in mm.)

The device has increased mechanical robustness if flush-mount method 2 (with angle brackets and frame) is used for the flush-mounted case.

4.2.2 Dimensional Drawings for the 84 TE Case

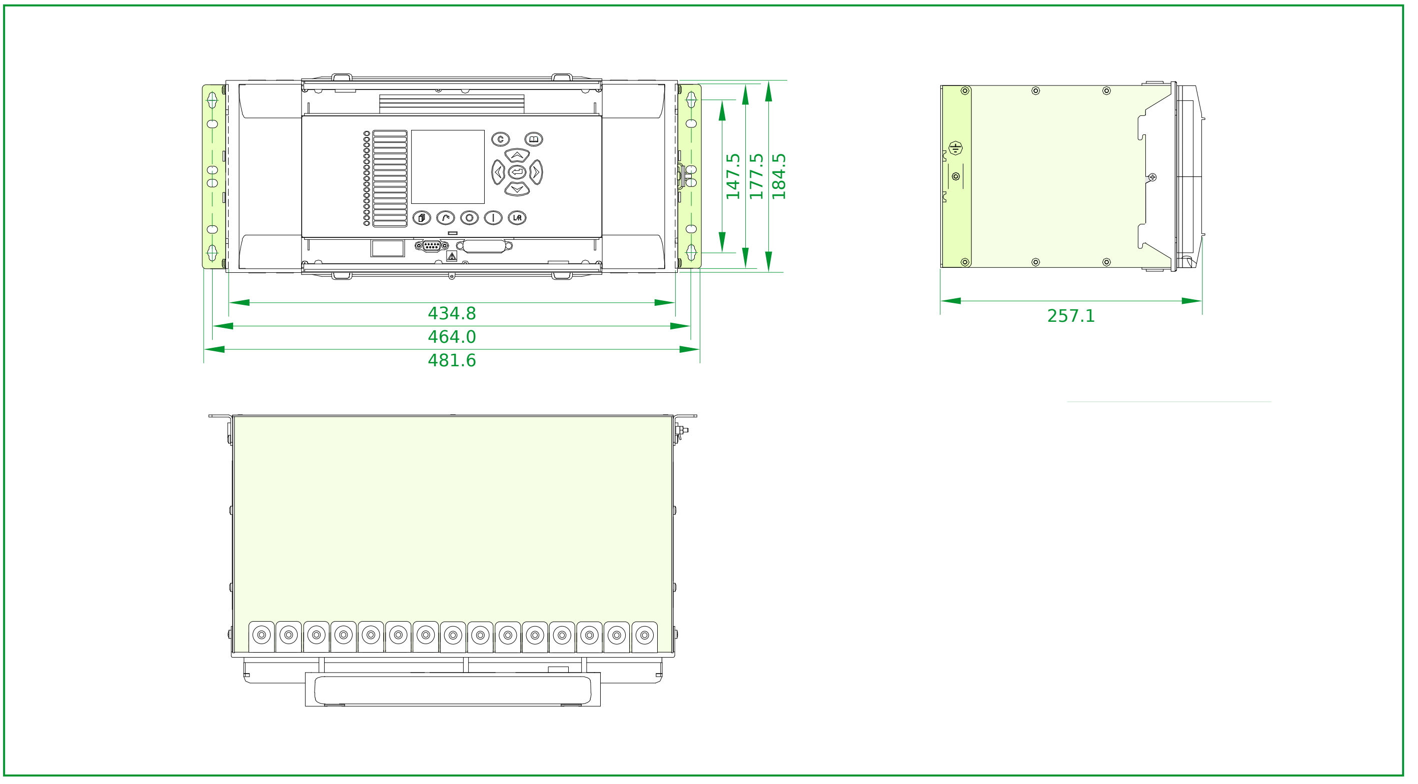


Fig. 4-5: Surface-mounted 84 TE case. (Dimensions in mm.)

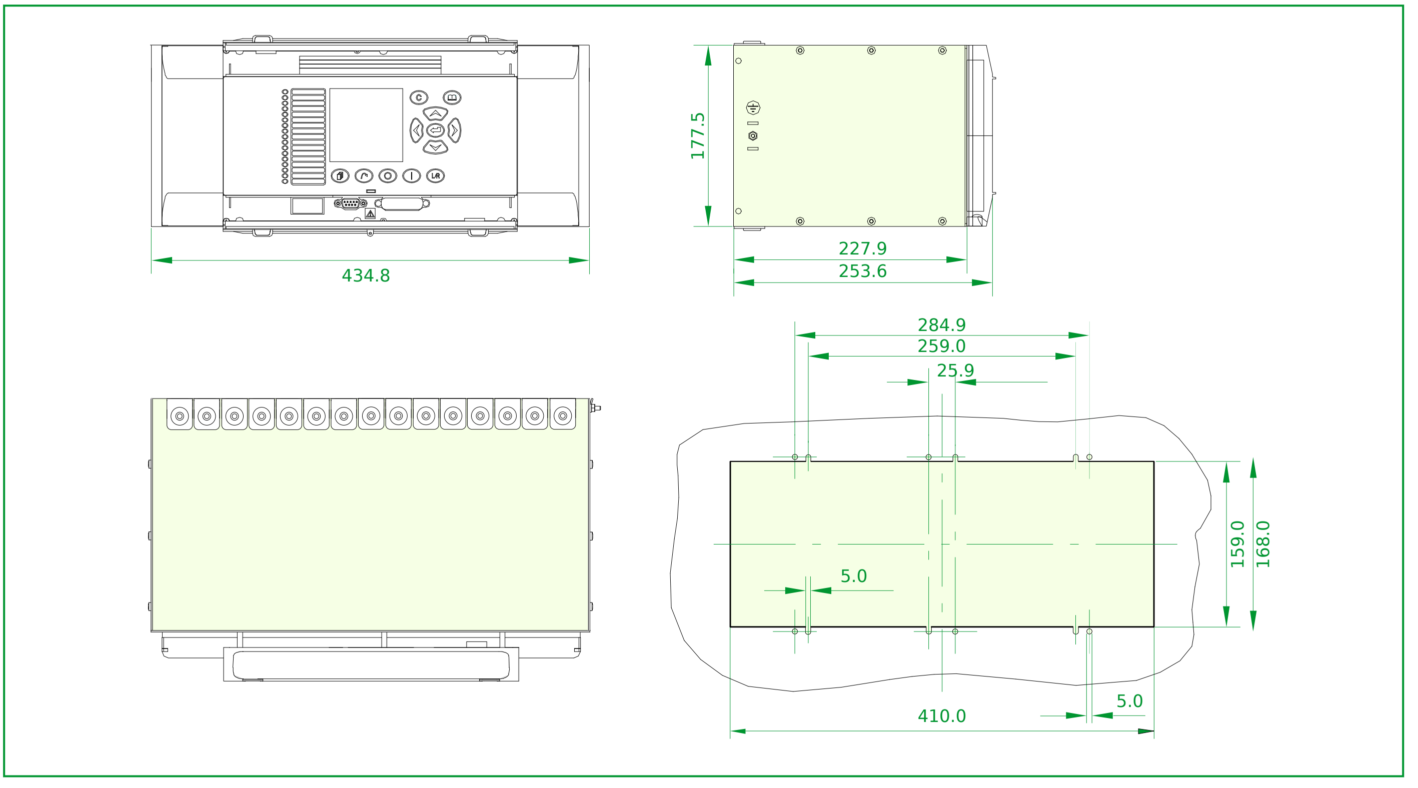


Fig. 4-6: Flush-mounted case 84 TE with panel opening, flush-mount method 1 (without angle brackets). (Dimensions in mm.)

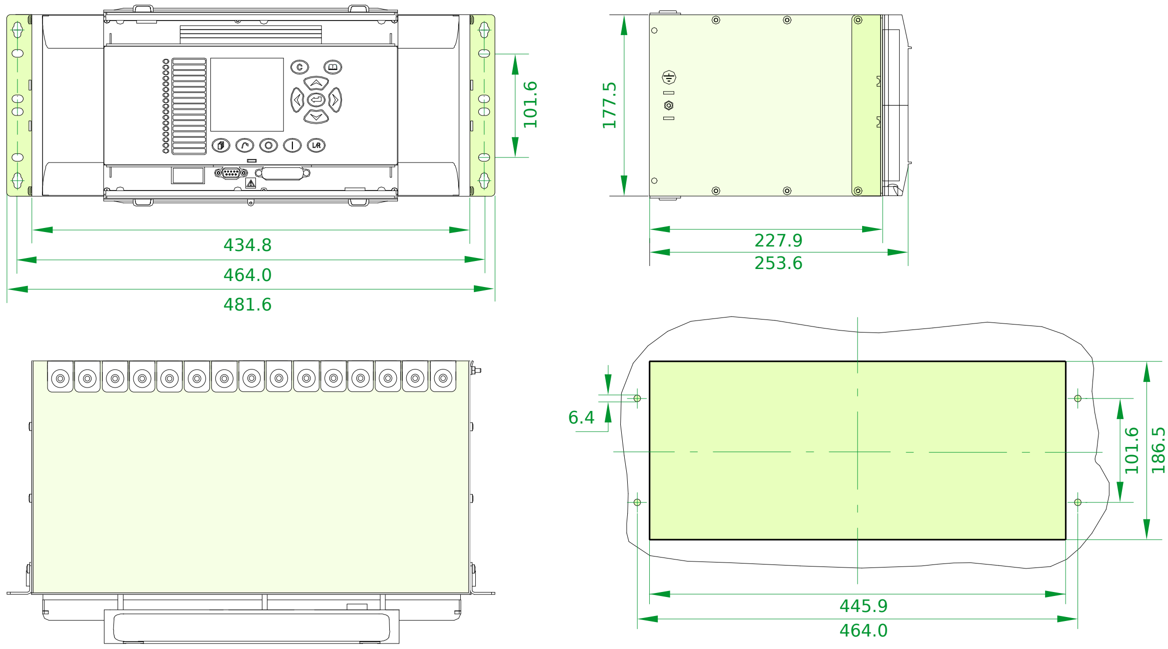


Fig. 4-7: Flush-mounted case 84 TE with panel opening, flush-mount method 2 (with angle brackets and frame). (Dimensions in mm.)

> *The device has increased mechanical robustness if flush-mount method 2 (with angle brackets and frame) is used for the flush-mounted case.*

4.2.3 Detachable HMI

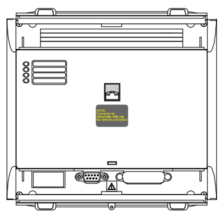


Fig. 4-8: View of case 40TE for connection of detachable HMI.

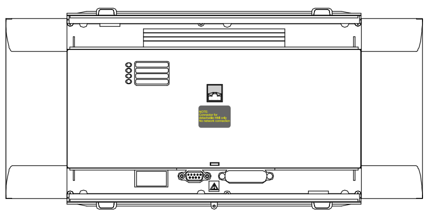


Fig. 4-9: View of case 84TE for connection of detachable HMI.

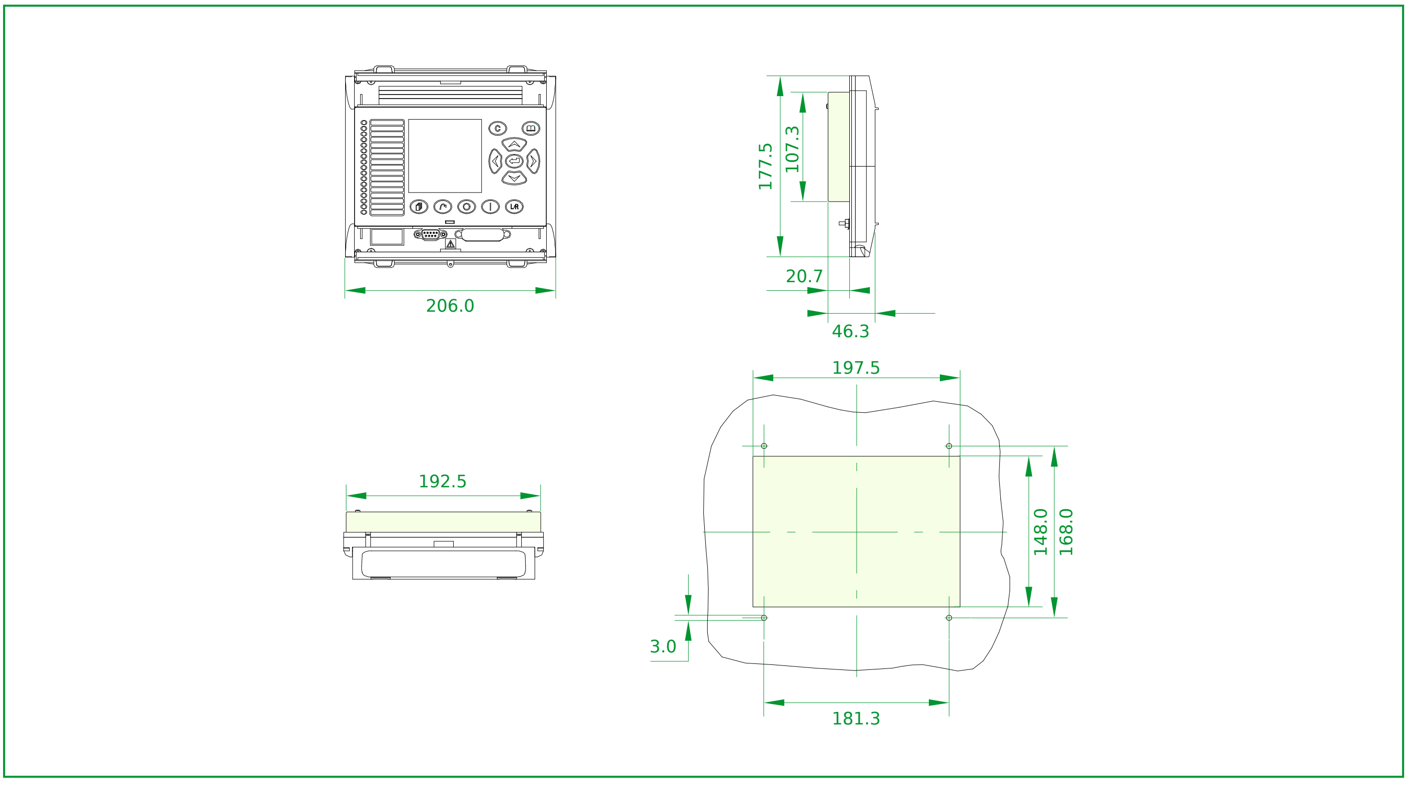


Fig. 4-10: Detachable HMI with panel opening.

4.3 Hardware Modules

The P139 is constructed from standard hardware modules. The following table gives an overview of the modules relevant for the P139.

Key:

- ●: standard equipment,
- ○: optional,
- ☐: depending on order,
- *: Module is not depicted in the terminal connection diagrams (Section 5.7, (p. 5-27)).
- →*xx*: Module has to be fitted into slot number *xx*.
- 1st→*xx*, 2nd→*yy* [etc.]: If several modules of the same type may be ordered, these must be fitted into the appropriate slots in a particular order: If only one has been ordered it must be fitted into slot *xx* (i. e. slot *yy* is **not** permitted). If two modules have been ordered these must be fitted into slots *xx* and *yy*, etc.

Item Number			Description	Type	Width	P139 -423	P139 -424	P139 -425
9650356	A ff		Communication module (for RS 485 wire connection)	A(CH1 CH2)	4TE	○ →02	○ →02	○ →02
9650355	A ff		Communication module (for plastic fiber)					
9650354	A ff		Communication module (for glass fiber, ST connector)					
9651427	A ff		Ethernet module (for 100 Mbit/s Ethernet, glass fiber, SC connector and RJ45 wire)	A(ETH CH2)	4TE	○ →02	○ →02	○ →02
9651471	A ff		Ethernet module (for 100 Mbit/s Ethernet, glass fiber, ST connector and RJ45 wire)					
9651531	B ff		Redundant Ethernet Board (100 Mbit/s, SHP Protocol, glass fiber, ST connector)	A(Red. ETH CH2)	4TE	○ →02	○ →02	○ →02
9651532	B ff		Redundant Ethernet Board (100 Mbit/s, RSTP Protocol, glass fiber, ST connector)					
9651533	B ff		Redundant Ethernet Board (100 Mbit/s, DHP Protocol, glass fiber, ST connector)					
9652036	A ff		Redundant Ethernet Board (100 Mbit/s, PRP Protocol, glass fiber, ST connector)					
9651567	D ff		InterMiCOM Module COMM3 (RS 485)	A(CH3)	4TE	○ →03	○ →03	○ →03
9651569	D ff		InterMiCOM Module COMM3 (for glass fiber)					
9651566	D ff		InterMiCOM Module COMM3 (RS 232)					
0336187	D ff	*	Bus module (digital, for 40 TE device)	B		●	●	
0336188	C ff	*	Bus module (digital, for 84 TE device)	B				●
0336421	B ff	*	Bus module (analog)	B		●	●	●

Item Number		Description	Type	Width	P139 -423	P139 -424	P139 -425
9650319		Local control module (graphical HMI, 40 TE)	L		☐	☐	
9650257		Local control module (graphical HMI, 84 TE)	L				☐
9651470	D ff	* Graphic Serial DHMI 40 TE	L		☐	☐	☐
9650561	D ff	* DHMI Adapter Board	L		☐	☐	
9650563	F ff	* Processor Unit Adapter Board	L		☐	☐	☐
9651571	E ff	* Processor Unit	P	4TE	● →01	● →01	● →01
9650309	A ff	Transformer module 4 × I (pin connection)	T(4J)	8TE	☐ →04		
9650323	A ff	Transformer module 4 × I (ring connection)	T(4J)	8TE		☐ →04	☐ →04
9650307	A ff	Transformer module 4 × I, 4 × V (pin connection)	T(4J 4V)	8TE	☐ →04		
9650321	A ff	Transformer module 4 × I, 4 × V (ring connection)	T(4J 4V)	8TE		☐ →04	☐ →04
9650308	A ff	Transformer module 4 × I, 5 × V (pin connection)	T(4J 5V)	8TE	☐ →04		
9650322	A ff	Transformer module 4 × I, 5 × V (ring connection)	T(4J 5V)	8TE		☐ →04	☐ →04
0337086	B ff	* Transient ground fault evaluation module	N	4TE	☐ →03	☐ →03	☐ →03
9651534	B ff	Power supply module 24 – 60 V DC, standard variant (switching threshold 18 V)	V(4I 8O)	4TE	☐ →09	☐ →09	☐ →20
9651536	B ff	Power supply module 24 – 60 V DC, switching threshold 73 V					
9651537	B ff	Power supply module 24 – 60 V DC, switching threshold 90 V					
9651539	B ff	Power supply module 24 – 60 V DC, switching threshold 155 V					
9651538	B ff	Power supply module 24 – 60 V DC, switching threshold 146 V					

Item Number		Description	Type	Width	P139 -423	P139 -424	P139 -425
9651544	B ff	Power supply module 60 – 250 V DC / 100 – 230 V AC, Standard variant with switching threshold at 65% of 24 VDC (VA,min)	V(4I 8O)	4TE	☐ →09	☐ →09	☐ →20
9651546	B ff	Power supply module 60 – 250 V DC / 100 – 230 V AC, Special variant with switching threshold at 65% of 110 VDC (VA,nom)					
9651547	B ff	Power supply module 60 – 250 V DC / 100 – 230 V AC, Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
9651549	B ff	Power supply module 60 – 250 V DC / 100 – 230 V AC, Special variant with switching threshold at 65% of 220 VDC (VA,nom)					
9651548	B ff	Power supply module 60 – 250 V DC / 100 – 230 V AC, Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
0337612	A ff	Binary I/O module (24 binary inputs), Standard variant with switching threshold at 65% of 24 VDC (VA,min)	X(24I)	4TE	○ 1st→08 2nd→03	○ 1st→08 2nd→03	○ 1st→16 2nd→03
9651304	A ff	Binary I/O module (24 binary inputs), Special variant with switching threshold at 65% of 110 VDC (VA,nom)					
9651332	A ff	Binary I/O module (24 binary inputs), Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
9651443	A ff	Binary I/O module (24 binary inputs), Special variant with switching threshold at 65% of 220 VDC (VA,nom)					
9651360	A ff	Binary I/O module (24 binary inputs), Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
9651493	B ff	Binary module (4 high-break contacts)	X(4H)	4TE	○→10	○→10	○→18

Item Number		Description	Type	Width	P139 -423	P139 -424	P139 -425
9651512	B ff	Binary I/O module (6 binary inputs, 3 output relays), Standard variant with switching threshold at 65% of 24 VDC (VA,min)	X(6I 3O)	4TE	○ →10	○ →10	○ →18
9651513	B ff	Binary I/O module (6 binary inputs, 3 output relays), Special variant with switching threshold at 65% of 110 VDC (VA,nom)					
9651514	B ff	Binary I/O module (6 binary inputs, 3 output relays), Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
9651516	B ff	Binary I/O module (6 binary inputs, 3 output relays), Special variant with switching threshold at 65% of 220 VDC (VA,nom)					
9651515	B ff	Binary I/O module (6 binary inputs, 3 output relays), Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
0337377	E ff	Binary I/O module (6 binary inputs, 6 output relays), Standard variant with switching threshold at 65% of 24 VDC (VA,min)	X(6I 6O)	4TE	○ 1st→06 2nd→07	○ 1st→06 2nd→07	○ 1st→12 2nd→14
9651305	A ff	Binary I/O module (6 binary inputs, 6 output relays), Special variant with switching threshold at 65% of 110 VDC (VA,nom)					
9651333	A ff	Binary I/O module (6 binary inputs, 6 output relays), Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
9651444	A ff	Binary I/O module (6 binary inputs, 6 output relays), Special variant with switching threshold at 65% of 220 VDC (VA,nom)					

Item Number		Description	Type	Width	P139 -423	P139 -424	P139 -425
9651361	A ff	Binary I/O module (6 binary inputs, 6 output relays), Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
9651517	D ff	Binary I/O module (6 binary inputs, 6 high-break contacts), Standard variant with switching threshold at 65% of 24 VDC (VA,min)	X(6I 6H)	4TE	○ 1st→06 2nd→07	○ 1st→06 2nd→07	○ 1st→12 2nd→14
9651518	A ff	Binary I/O module (6 binary inputs, 6 high-break contacts), Special variant with switching threshold at 65% of 110 VDC (VA,nom)					
9651519	A ff	Binary I/O module (6 binary inputs, 6 high-break contacts), Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
9651520	A ff	Binary I/O module (6 binary inputs, 6 high-break contacts), Special variant with switching threshold at 65% of 220 VDC (VA,nom)					
9651521	A ff	Binary I/O module (6 binary inputs, 6 high-break contacts), Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
000336971	D ff	Binary I/O module (6 binary inputs, 8 output relays), Standard variant with switching threshold at 65% of 24 VDC (VA,min)	X(6I 8O)	4TE	○ →08	○ →08	○ →16
009651306	A ff	Binary I/O module (6 binary inputs, 8 output relays), Special variant with switching threshold at 65% of 110 VDC (VA,nom)					

Item Number		Description	Type	Width	P139 -423	P139 -424	P139 -425
009651334	A ff	Binary I/O module (6 binary inputs, 8 output relays), Special variant with switching threshold at 65% of 127 VDC (VA,nom)					
009651445	A ff	Binary I/O module (6 binary inputs, 8 output relays), Special variant with switching threshold at 65% of 220 VDC (VA,nom)					
009651362	A ff	Binary I/O module (6 binary inputs, 8 output relays), Special variant with switching threshold at 65% of 250 VDC (VA,nom)					
0336973	B/D ff	Binary module (6 output relays)	X(6O)	4TE	○ →10	○ →10	○ →18
0337406	D ff	Analog I/O module, standard variant (switching threshold 18 V)	Y(4I)	4TE	○ →08 or 03	○ →08 or 03	○ →16 or 03
9651307	A ff	Analog I/O module, switching threshold 73 V					
9651335	A ff	Analog I/O module, switching threshold 90 V					
9651446	A ff	Analog I/O module, switching threshold 146 V					
9651363	A ff	Analog I/O module, switching threshold 155 V					
9650735	C ff	Temperature Sensor Board 9xRTD	Y(9T)	4TE	○ →03	○ →03	○ →03

The space available for the modules measures 4 HE in height by 40 TE or 84 TE in width (HE = 44.45 mm, TE = 5.08 mm).

The location of the individual modules and the position of the threaded terminal blocks in the P139 are shown in the location figures and terminal connection diagrams (Section 5.7, (p. 5-27)).

5 Installation and Connection

When electrical equipment is in operation, dangerous voltage will be present in certain parts of the equipment.

Proper and safe operation of this device depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel shall work on or operate this device.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Switch off the auxiliary power supply before any work in the terminal strip area.
- Switch off all the power supplies in connection to the equipment before any work in the terminal strip area to isolate the device.
- Do not touch the terminal strip area when equipment is in operation.
- Do not remove or add wires in the terminal strip area when equipment is in operation.
- Short-circuit the system current transformers before disconnecting wires to the transformer board (valid only for pin terminals, not required for ring terminals which have a shortening block).
- A protective conductor (ground/earth) of at least 1.5 mm^2 must be connected to the protective conductor terminal on the power supply board and on the main relay case.
- Do never remove the protective conductor connection to the device casing as long as other wires are connected to it.
- Where stranded conductors are used, insulated crimped wire end ferrules must be employed.

Failure to follow these instructions can result in death, serious injury or equipment damage.

Note: Regarding the appropriate wiring connections of the equipment refer to the document Px3x_Grounding_Application_Guide_EN_h.pdf.

WARNING

HAZARD OF UNSAFE OPERATION

- The user should be familiar with the warnings in the Safety Guide (SFTY/4LM/G11 or later version) before working on the equipment.
- The user should be familiar with the safety messages in Chapter 5, (p. 5-1), Chapter 10, (p. 10-1), Chapter 11, (p. 11-1) and Chapter 12, (p. 12-1) and with the content of Chapter 14, (p. 14-1) of this technical manual, before working on the equipment.
- Proper and safe operation of this device depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel shall work on or operate this device.
- Any modifications to this device must be in accordance with the manual. If any other modification is made without the express permission of Schneider Electric, it will invalidate the warranty, and may render the product unsafe.

Failure to follow these instructions can result in unintended equipment operation.

The signals MAIN: Blocked/faulty and SFMON: Warning (LED) are permanently assigned to the LEDs labeled OUT OF SERVICE and ALARM and can be assigned to output relays to indicate the health of the device.

It is recommended that the signals MAIN: Blocked/faulty and SFMON: Warning (LED) are communicated to the substation automation system for alarm purposes, using hardwiring via output relays or the communication interface.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

In case of usage of the equipment **with DHMI**:

- A protective conductor (ground/earth) of at least 1.5 mm^2 (US: AWG14 or thicker) must be connected to the DHMI protective conductor terminal to link the DHMI and the main relay case; these must be located within the same substation.
- The DHMI communication cable must not be in contact with hazardous live parts.
- The DHMI communication cable must not be routed or placed alongside high-voltage cables or connections. Currents can be induced in the cable which may result in electromagnetic interference.
- We recommend to use only cables of category CAT6 (or better), which has been tested up to a length of 10 m.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE OR LIFETIME REDUCTION

- The instructions given in the Section 5.5, (p. 5-13) (“Protective and Operational Grounding”) should be noted. In particular, check that the protective ground connection is secured with a tooth lock washer, as per the diagram “Installing the protective grounding conductor terminal” (Fig. 5-8, (p. 5-13)).
- If a cable screen is added to this connection or removed from it, then the protective grounding should be checked again.

Failure to follow these instructions can result in death, serious injury or equipment damage.

⚠ WARNING

HAZARD OF EQUIPMENT DAMAGE OR LIFETIME REDUCTION

- Do not sustain exposure to high humidity during storage, the value shall not exceed 75 % relative humidity.
- Once the device has been unpacked, it is recommended to energize it within the three following months.
- The device has to be energized at least once in 4 years, if it is not in permanent operation.
- Where electrical equipment is being installed, sufficient time should be allowed for acclimatization to the ambient temperature of the environment before energization.

Failure to follow these instructions can result in equipment damage, unintended equipment operation or reduction of equipment lifetime.

5.1 Unpacking and Packing

All P139 overcurrent and control devices are packaged separately into dedicated cartons and shipped with outer packaging. Use special care when opening cartons and unpacking devices, and do not use force. In addition, make sure to remove supporting documents and the type identification label supplied with each individual device from the inside carton. The design revision level of each module included in the device when shipped can be determined from the list of components (assembly list). This list of components should be filed carefully.

After unpacking, each device should be inspected visually to confirm it is in proper mechanical condition.

If the P139 needs to be shipped, both inner and outer packaging must be used. If the original packaging is no longer available, make sure that packaging conforms to DIN ISO 2248 specifications for a drop height ≤ 0.8 m.

5.2 Checking Nominal Data and Design Type

The nominal data and design type of the P139 can be determined by checking the type identification label (see below). One type identification label is located under the upper hinged cover on the front panel and a second label can be found on the inside of the device. Another copy of the type identification label is fixed to the outside of the P139 packaging.

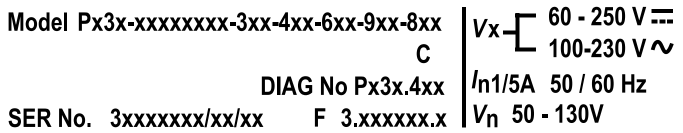


Fig. 5-1: Example of the type identification label of a device from the Easergy MiCOM 30 family.

The P139 design version can be determined from the order number. A breakdown of the order number is given in Chapter “Order Information” (Chapter 15, (p. 15-1)).

5.3 Location Requirements

The P139 has been designed to conform to EN 60255-6. Therefore it is important when choosing the installation location to make certain that it provides the operating conditions as specified in above DIN norm sections 3.2 to 3.4. Several of these important operating conditions are listed below.

5.3.1 Environmental Conditions

Ambient temperature:	-5 °C to +55 °C [+23 °F to +131 °F]
Air pressure:	800 to 1100 hPa
Relative humidity:	The relative humidity must not result in the formation of either condensed water or ice in the P139.
Ambient air:	The ambient air must not be significantly polluted by dust, smoke, gases or vapors, or salt.
Solar Radiation:	Direct solar radiation on the front of the device must be avoided to ensure that the LC-Display remains readable.

5.3.2 Mechanical Conditions

Vibration stress:	10 to 60 Hz, 0.035 mm and 60 to 150 Hz, 0.5 g
Earth quake resistance:	5 ... 8 Hz, 3.5 mm / 1.5 mm, 8 ... 35 Hz, 5 m/s², 3 x 1 cycle

5.3.3 Electrical Conditions for Auxiliary Voltage of the Power Supply

Operating range: 0.8 to 1.1 $V_{A,nom}$ with a residual ripple of up to 12 % $V_{A,nom}$

5.3.4 Electromagnetic Conditions

Substation secondary system design must follow the best of modern practices, especially with respect to grounding and EMC.

5.4 Installation

The dimensions and mounting dimensions for surface-mounted cases are given in Section 4.2, (p. 4-4). When the P139 is surface-mounted on a panel, the wiring to the P139 is normally run along the front side of the mounting plane. If the wiring is to be at the back, an opening can be provided above or below the surface-mounted case. Fig. 5-2, (p. 5-7) shows such an opening.

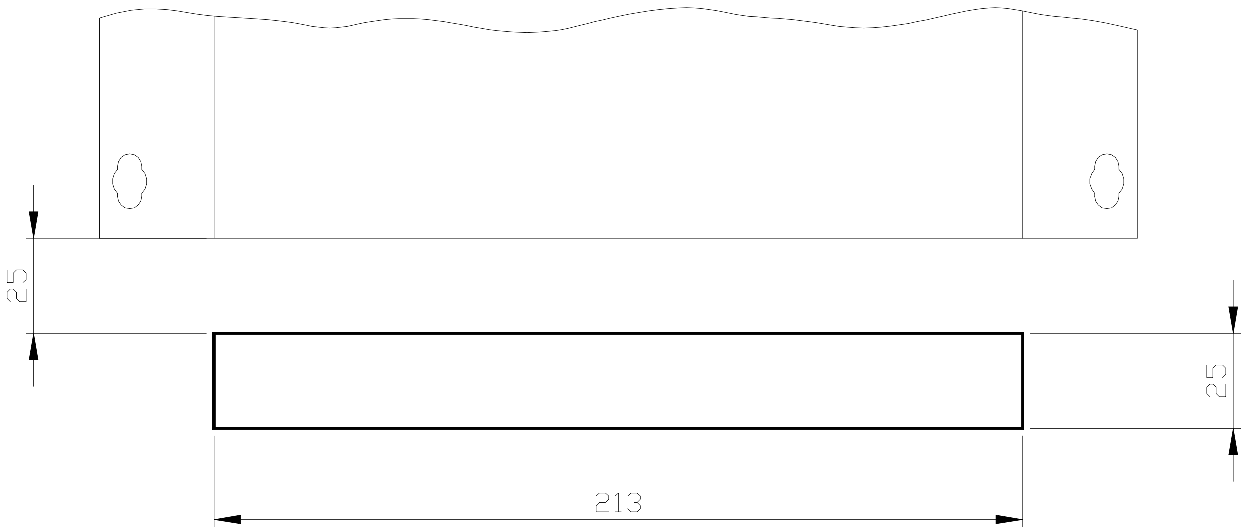


Fig. 5-2: Opening (cutout) for running the connecting leads to an 40 TE surface-mounted case.

The opening width for the 40 TE surface-mounted case: 213 mm (shown in this figure), for the 84 TE surface-mounted case: 435 mm. The other dimensions are the same for all cases.

Flush-mounted cases are designed for control panels. The dimensions and mounting dimensions are given in Chapter “Design”. When the P139 is mounted on a cabinet door, special sealing measures are necessary to provide the degree of protection required for the cabinet (IP 51).

Connection of protective grounding conductor: See “Protective and Operational Grounding” (Section 5.5, (p. 5-13))

Instructions for selecting the flush-mount method:
The P139 has increased mechanical robustness if either the surface-mounted case or – for the flush-mounted case – flush-mount method 2 (with angle brackets and frame) is used. In this case, test severity class 2 of the vibration test, test severity class of the shock resistance test on operability as well as test severity class 1 of the shock resistance test on permanent shock are applied additionally.

Dimensions of the panel cutouts:
Dimensional drawings of the panel cutouts for all cases and for the detachable HMI can be found in Section 4.2, (p. 4-4).

For flush-mount method 1 (without angle brackets and frame), the procedure is as follows:

Before the P139 can be installed into a control panel, the local control panel (or the front element of the case for devices with detachable display) must be taken down. The local control panel is removed as described below:

1. Remove both top and bottom hinged flaps from the device. (Lift/lower both hinged flaps 180° up/down. Hold them in the middle and bend them slightly. The side mountings of both hinged flaps can then be disengaged.)
2. Remove the M3.5 screws (see Fig. 5-3, (p. 5-9)).
3. Then remove the local control panel.

WARNING

The local control panel (or front element) is connected to processor module P by a plug-in connecting cable. Make sure the connector position is correct. Do not bend the connecting cable!

Then remove the lower M4 screws and only loosen the upper M4 screws (see Fig. 5-3, (p. 5-9)). Now insert the P139 into the panel opening from the rear so that the upper M4 screws fit into the corresponding holes. Then tighten all the M4 screws. After this, replace the local control panel.

WARNING

When replacing the local control panel, take care not to tighten the M3.5 screws with too much strength! (Fastening torque 1.5 to 1.8 Newton meters.)

If the control panel thickness is ≥ 2 mm, the longer M3.5 and M4 bolts must be used. Longer screws are enclosed within the device packing.

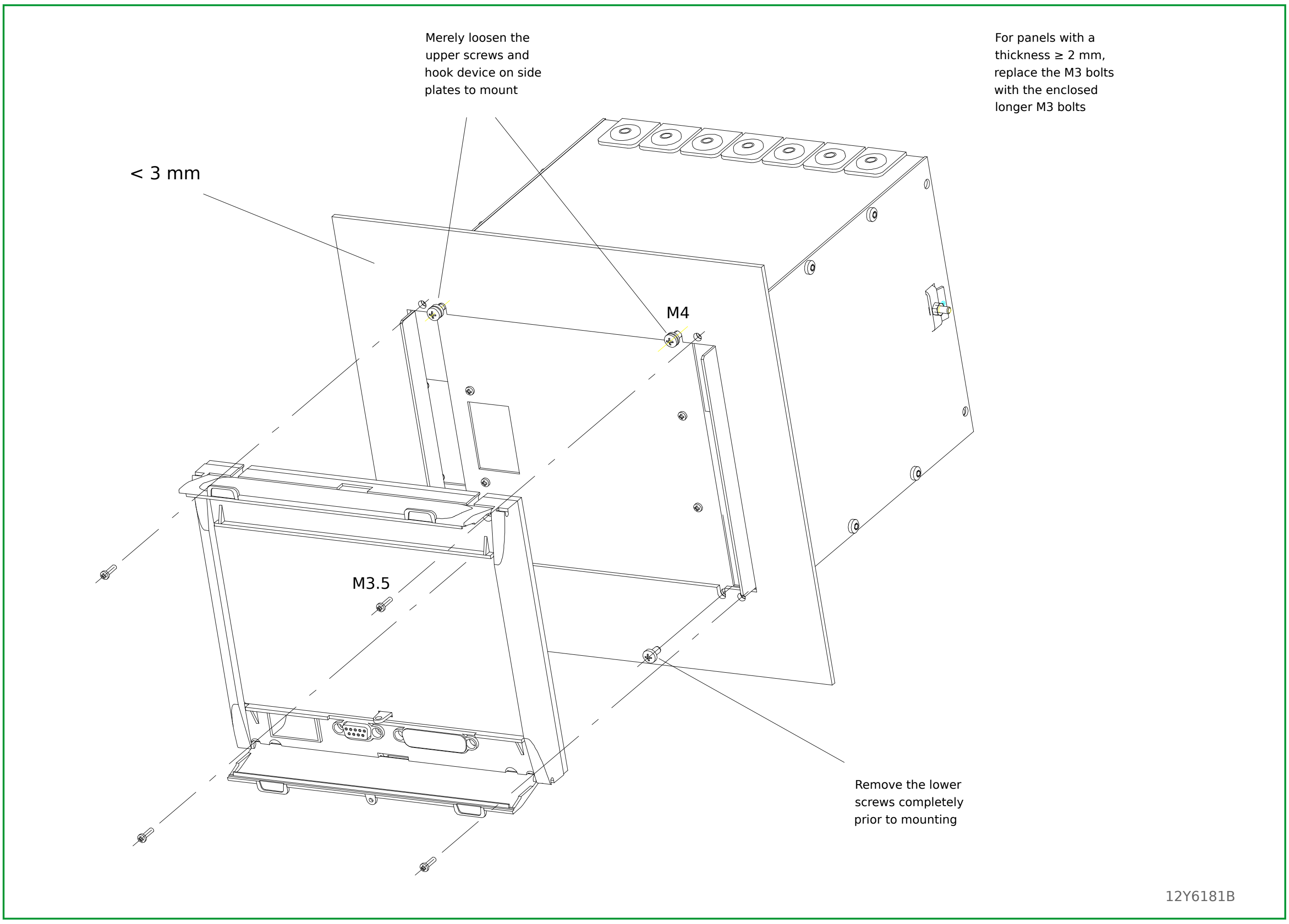


Fig. 5-3: Installation of a case into a control panel. Flush-mount method 1 (without the angle brackets and frame). Example for a device with a 40 TE case.

⚠ WARNING

The P139 has increased mechanical robustness if either the surface-mounted case or for the flush-mounted case flush-mount method 2 (with angle brackets and frame, see Fig. 5-5, (p. 5-10)) is used.

Connection of protective grounding conductor: See Section 5.5, (p. 5-13).

For flush-mount method 2 (using the angle brackets and frame), the procedure is as follows:

1. Remove the screws as shown in Fig. 5-4, (p. 5-10), ① and mount the enclosed angle brackets using these same screws.
2. Then push the device into the control panel cutout from the front.
3. Secure the device to the control panel by using the enclosed M6 screws (see Fig. 5-5, (p. 5-10)).
4. Assemble the cover frame and snap-fasten onto the fixing screws.

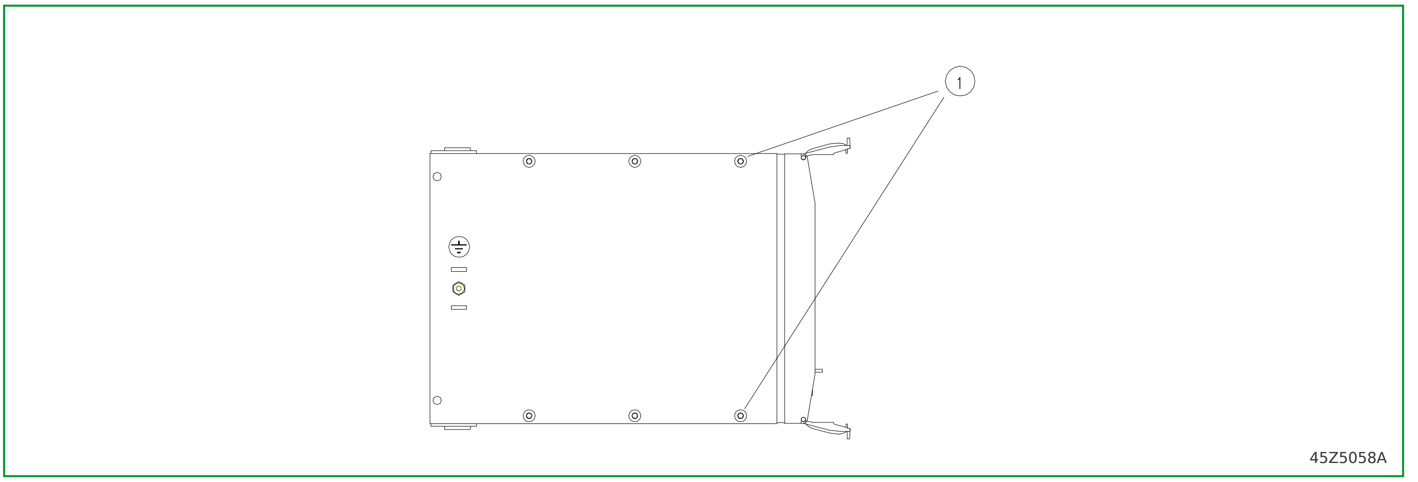


Fig. 5-4: Mounting the angle brackets.

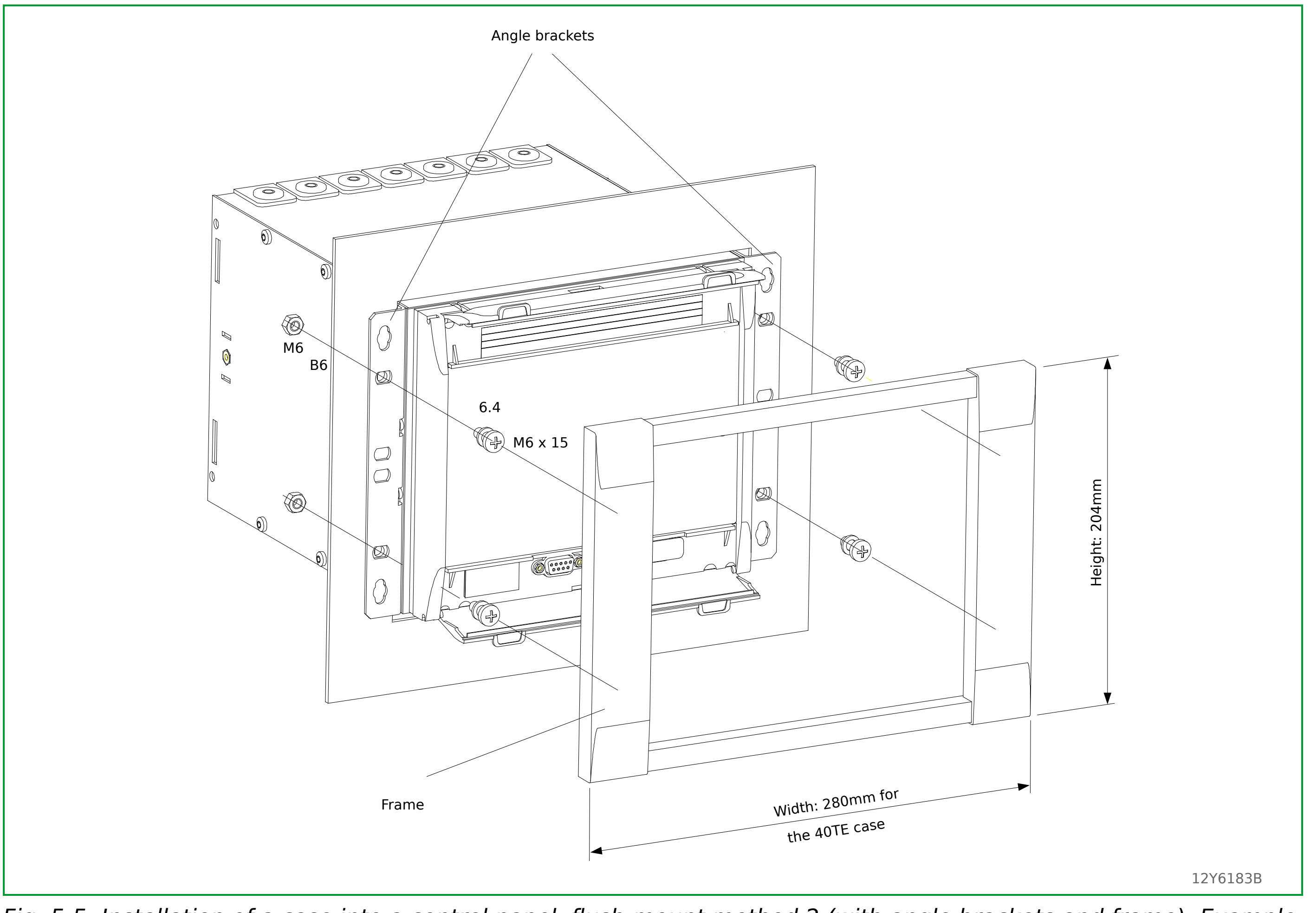


Fig. 5-5: Installation of a case into a control panel, flush-mount method 2 (with angle brackets and frame). Example for a device in a 40 TE case.

The cover frame width of the 40 TE surface-mounted case is: 280 mm, of the 84 TE case is: 486 mm. The cover frame height is for all cases: 204 mm.

⚠ WARNING

The P139 has increased mechanical robustness if either the surface-mounted case or for the flush-mounted case flush-mount method 2 (with angle brackets and frame, see Fig. 5-5, (p. 5-10)) is used.

Connection of protective grounding conductor: See Section 5.5, (p. 5-13).

A rack mounting kit can be used to combine a flush-mounted 40 TE case with a second sub-rack to form a 19″ mounting rack (see Fig. 5-6, (p. 5-11)). The second sub-rack can be another device, for example, or an empty sub-rack with a blank front panel. Fit the 19″ mounting rack to a cabinet as shown in Fig. 5-7, (p. 5-12).

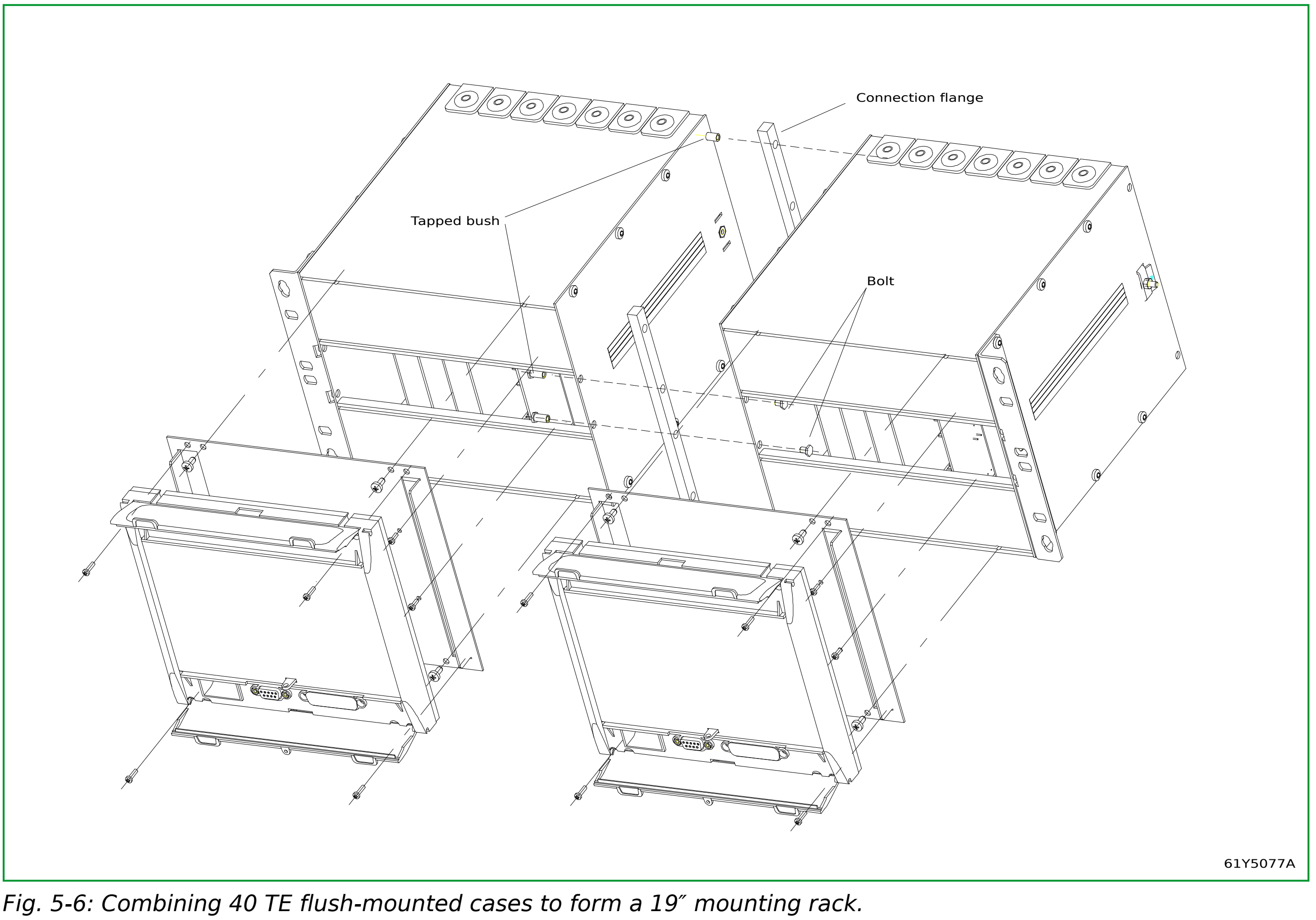


Fig. 5-6: Combining 40 TE flush-mounted cases to form a 19″ mounting rack.

⚠ WARNING

Connection of protective grounding conductor: See Section 5.5, (p. 5-13).

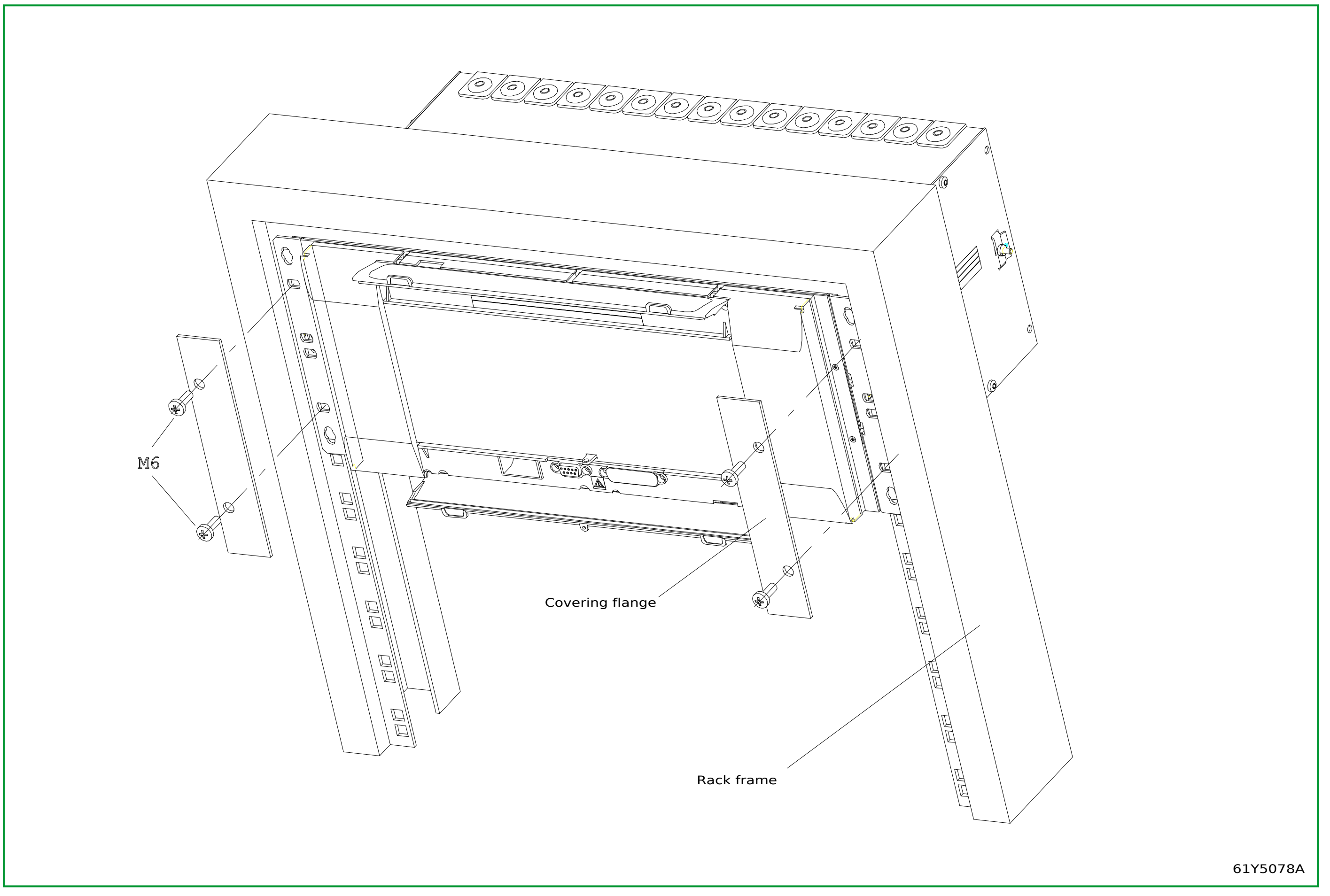


Fig. 5-7: Installing the P139 in a cabinet with a 19″ mounting rack.

⚠ WARNING

Connection of protective grounding conductor: See Section 5.5, (p. 5-13).

5.5 Protective and Operational Grounding

The device must be reliably grounded to meet protective equipment grounding requirements. The surface-mounted case is grounded using the bolt and nut, appropriately marked, as the ground connection. The flush-mounted case must be grounded in the area of the rear sidepieces at the location provided.

The bracket is marked with the protective ground symbol: ⏚

The cross-section of the ground conductor must conform to applicable national standards. A minimum cross section of 2.5 mm² (≤ AWG12) is required.

In addition, a protective ground connection at the terminal contact on the power supply module (identified by the letters “PE” on the terminal connection diagram) is also required for proper operation of the device. The cross-section of this ground conductor must also conform to applicable national standards. A minimum cross section of 1.5 mm² (US: AWG14 or thicker) is required.

If a detachable HMI is installed, a further protective conductor (ground/earth) of at least 1.5 mm² (US: AWG14 or thicker) must be connected to the DHMI protective conductor terminal to link the DHMI and the main relay case; these must be located within the same substation.

All grounding connections must be low-inductance, i.e. it must be kept as short as possible.

PE terminal surface-mount. case	
Pos.	Description
1	Nut M4
2	Tooth lock wash.A4.3
3	Clamp bracket
4	Bolt M4

PE terminal flush-mount. case	
Pos.	Description
1	Nut M4
2	Tooth lock wash.A4.3
3	Clamp bracket
4	Bolt M4

19Y5220B

Fig. 5-8: Installing the protective grounding conductor terminal.

The protective conductor (earth) must always be connected to the protective grounding conductor terminal in order to guarantee the safety given by this set-up.

5.6 Connection

The P139 Feeder Management and Bay Control must be connected in accordance with the terminal connection diagram as indicated on the type identification label. The relevant terminal connection diagrams that apply to the P139 are to be found either in the supporting documents supplied with the device, or in Section 5.7, (p. 5-27).

In general copper conductors with a cross section of 2.5 mm² (US: AWG12) are sufficient to connect a system current transformer to a current input on the P139. To reduce CT knee-point voltage requirements, it may be necessary to install shorter copper conductors with a greater cross section between the system current transformers and the current inputs on the P139. Copper conductors having a cross section of 1.5 mm² (US: AWG14) are adequate to connect binary signal inputs, the output relays and the power supply input.

All connections run into the system must always have a defined potential. Connections that are pre-wired but not used should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

5.6.1 Connecting Measuring and Auxiliary Circuits

5.6.1.1 Power Supply

Before connecting the auxiliary voltage V_A for the P139 power supply, it must be ensured that the nominal value of the auxiliary device voltage corresponds with the nominal value of the auxiliary system voltage.

5.6.1.2 Current-Measuring Inputs

When connecting the system transformers, it must be ensured that the secondary nominal currents of the system and the device correspond.

⚠ WARNING

The secondary circuit of live system current transformers must not be opened! If the secondary circuit of a live CT is opened, there is the danger that the resulting voltages will endanger personnel and damage the insulation.

⚠ WARNING

For pin-terminal connection devices, the terminal block for system current transformer connection is not a shorting block! Therefore always short-circuit the system current transformers before loosening the threaded terminals.

5.6.1.3 Connecting the Time-Overcurrent Protection Measuring Circuits

The system current and voltage transformers must be connected in accordance with the standard schematic diagram shown in Fig. 5-9, (p. 5-15). It is essential that the grounding configuration shown in the diagram be followed. If the CT or VT connection is reversed, this can be taken into account when making settings (see Chapter “Settings”).

The P139 is generally fitted with four current-measuring inputs. Three-pole or two-pole connection is possible to suit the individual power system and substation.

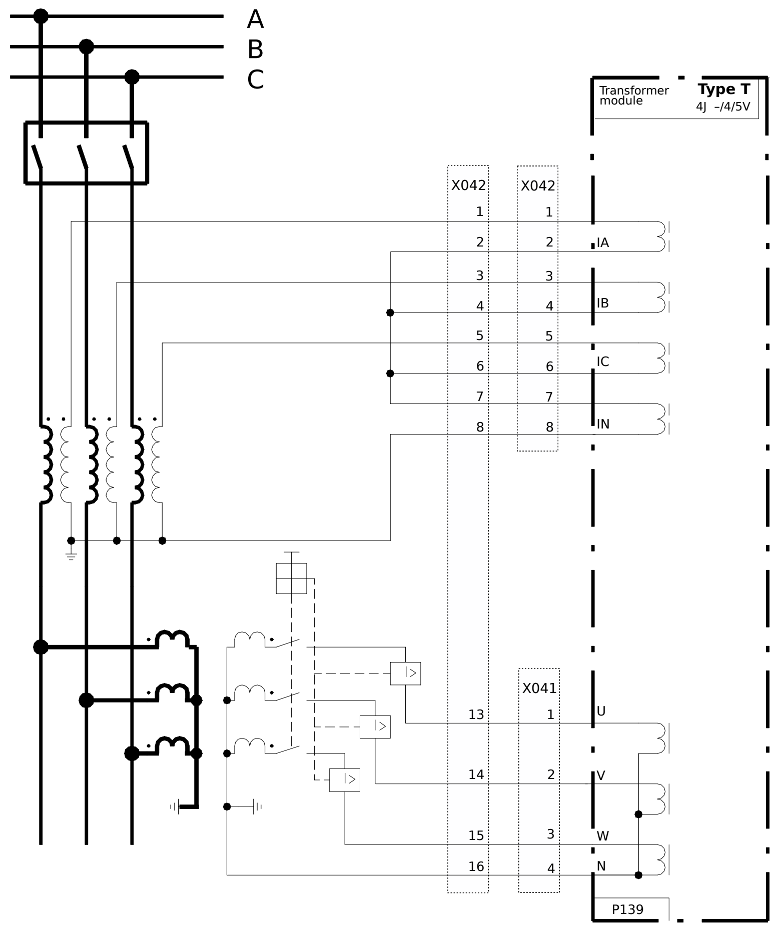


Fig. 5-9: Standard schematic diagram for time-overcurrent protection.

5.6.1.4 Connecting the Measuring Circuits for Ground Fault Direction Determination

If the P139 is to function using ground fault direction determination by steady-state values (the GFDSS function), then the T 4 current transformer must be connected to a core balance current transformer or a current transformer in Holmgreen configuration. If the metal shield of the cable is routed through the core balance transformer, the ground wire must be fed through the core again before it is connected to ground. The cable sealing end must be attached so that it is isolated from ground. This ensures that any currents flowing through the shield will not affect measurement.

The steady-state ground fault direction determination requires either the three phase-to-ground voltages or, alternatively, the neutral-point displacement voltage from the open delta winding of a voltage transformer assembly as the measured voltage. The phase voltages are drawn from the same transformers like the measured variables for the time voltage protection. An additional voltage transformer (T 90) is available in the P139 to connect an open delta winding. When setting the protection function, the selected voltage needs to be taken into account.

Fig. 5-10, (p. 5-16) shows the standard connection for ground fault direction determination by steady-state values where the voltage measuring circuit is connected to an open delta winding. With this connection configuration, “forward/LS” is displayed if a ground fault occurs on the line side. A reversed connection is possible for the system current or voltage transformer if the appropriate setting is configured.

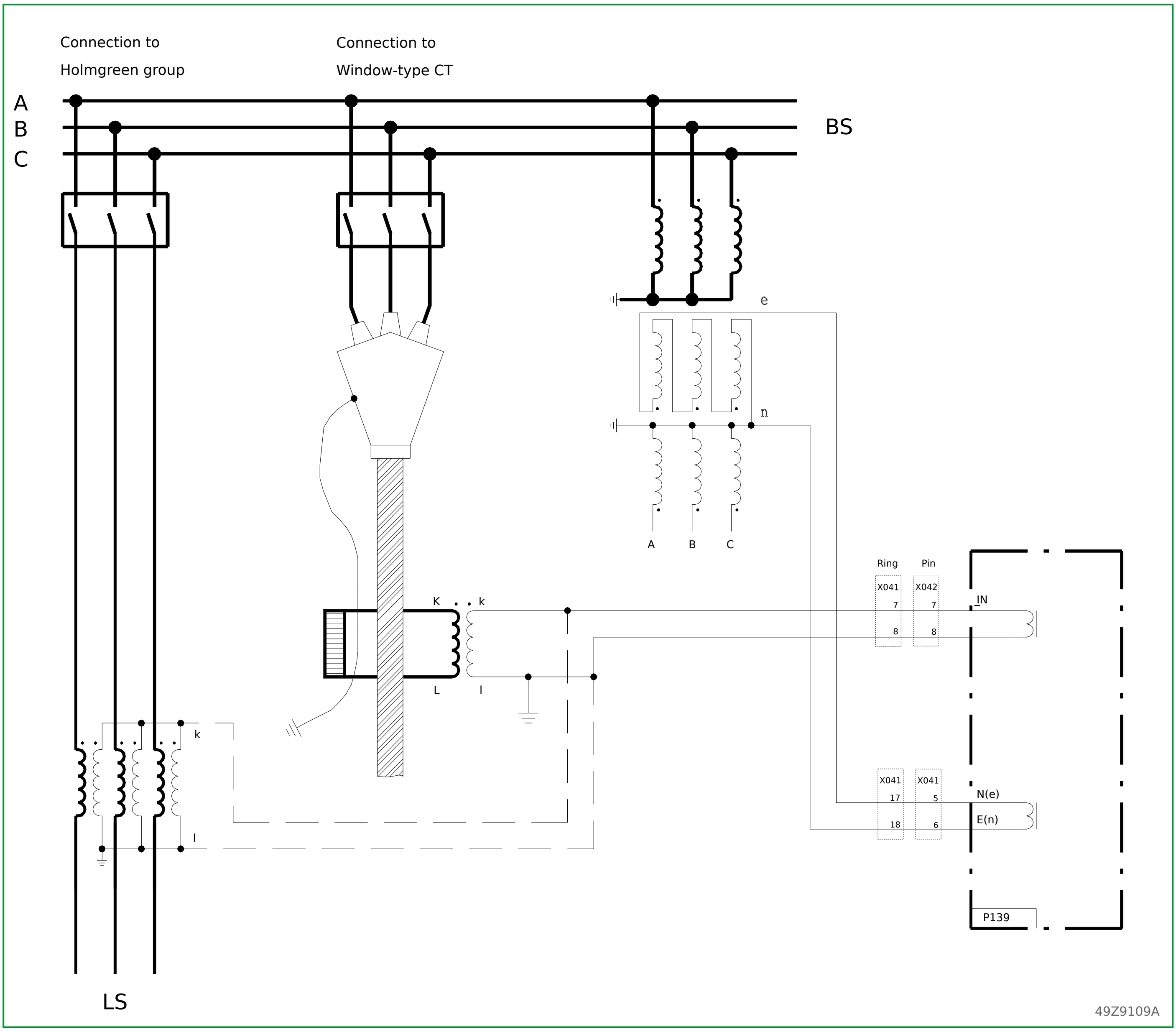


Fig. 5-10: Connecting the steady-state ground fault direction determination function to Holmgreen-configuration and core balance transformers.

5.6.1.5 Connecting Protective Signaling

Either a transmission device or pilot wires are required for signal transmission, depending on the operating mode selected. Twisted pair cores should be used as pilot wires. Two or four cores are required. If only two cores are available, there must be an all-or-nothing relay in each station for coupling received and transmitted signals. The coils of the all-or-nothing relays must be designed for half the loop voltage. Fig. 5-11, (p. 5-17) shows the connection with two cores and Fig. 5-12, (p. 5-18) the connection with four cores.

The protective signaling transmitting relay can be set to either *Transm. rel. break con.* or *Transm. rel. make con.* In the first case the break contact of the transmitting relay must be wired, and in the second case the make contact must be wired. The figures show the connection for the setting *Transm. rel. break con*.

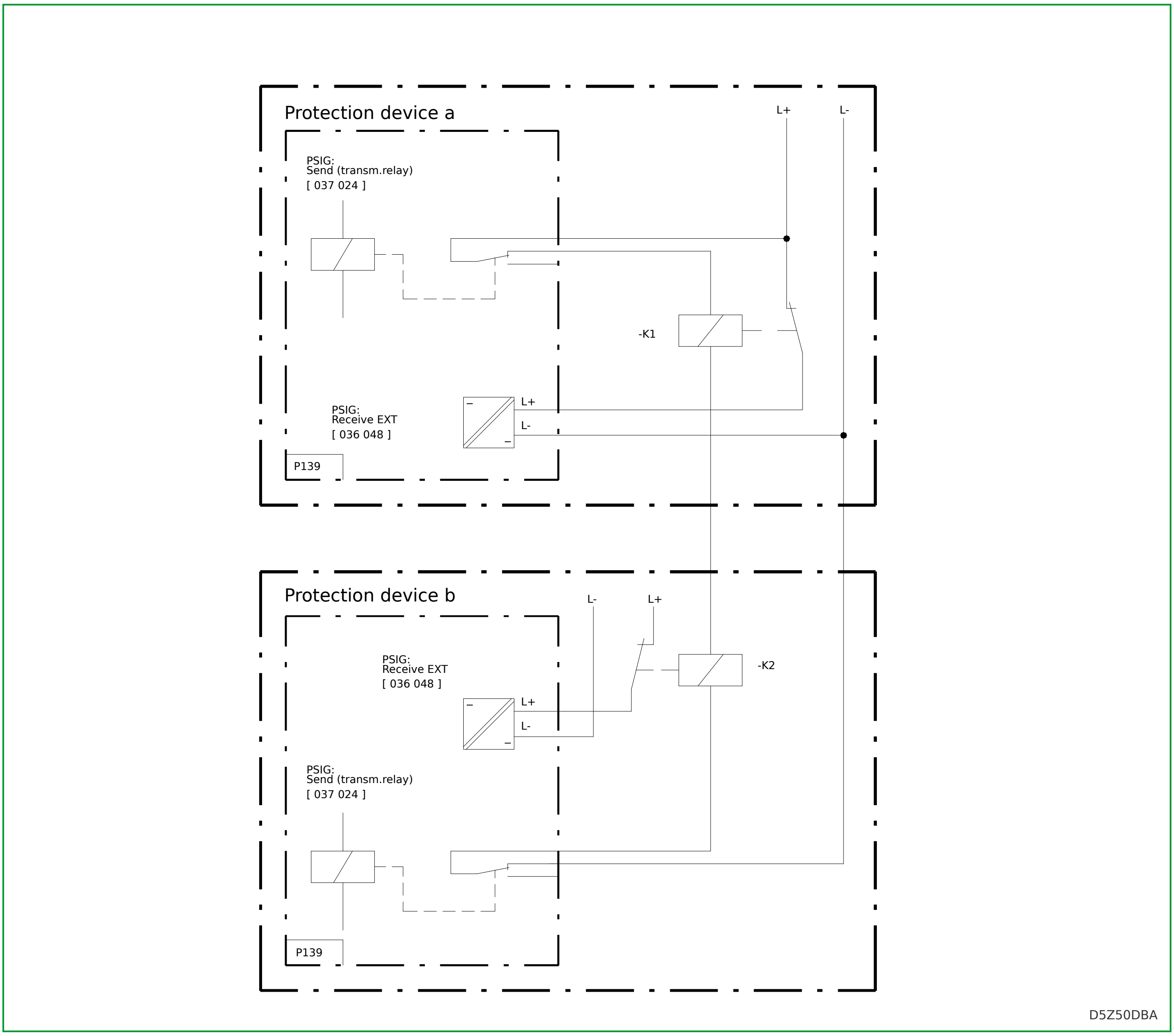


Fig. 5-11: Connection of protective signaling with two cores.

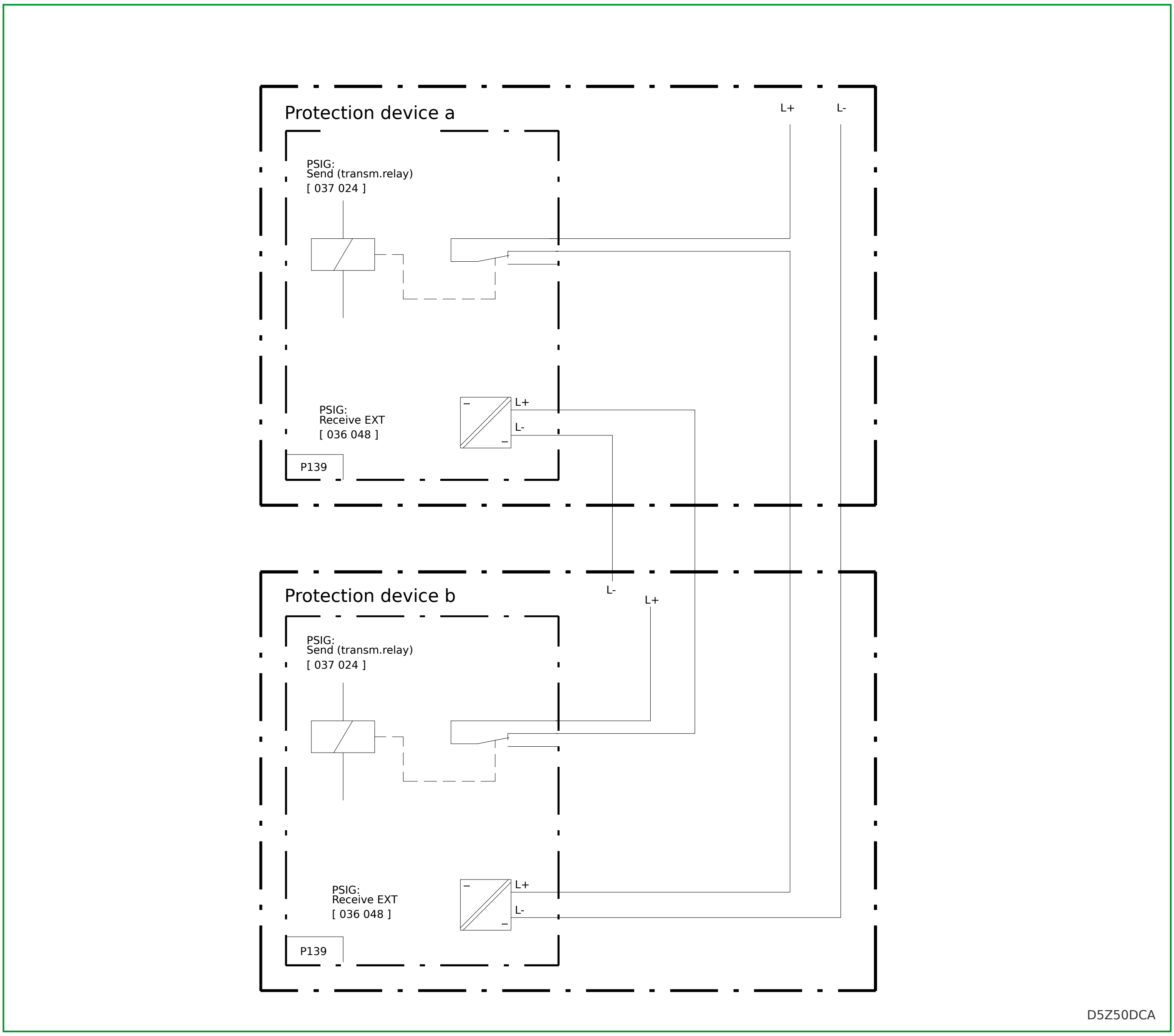


Fig. 5-12: Connection of protective signaling with four cores.

5.6.1.6 Connecting a Resistance Thermometer

A resistance thermometer can be connected if the device is fitted with analog module Y. This analog I/O module input is designed to connect a PT 100 resistance thermometer. The PT 100 should be connected using the 3-wire method (see Fig. 5-13, (p. 5-19)). No supply conductor compensation is required in this case.

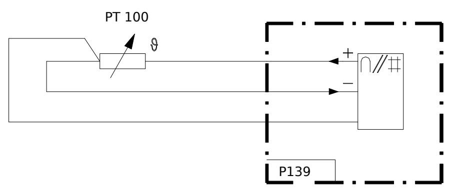


Fig. 5-13: Connecting a PT 100 using the 3-wire method.

5.6.1.7 Connecting Binary Inputs and Output Relays

The binary inputs and output relays are freely configurable. When configuring these components it is important to note that the contact rating of the binary I/O modules (X) varies (see Section 2.5.7, (p. 2-13)).

Once the user has selected a bay type, the P139 can automatically configure the binary inputs and output relays with function assignments for the control of switchgear units. The standard configuration of binary inputs and output relays for each bay type is given in the list of bay types to be found in the Appendix (see Vol. 2, Chapter A5, (p. A5-1)).

The polarity for connected binary signal inputs is to be found in the terminal connection diagrams (see supporting documents supplied with the device or in Section 5.7, (p. 5-27)). This is to be understood as a recommendation only. Connection to binary inputs can be made as desired.

5.6.1.8 Connecting Trip and Close Command Relays

Standard outputs of Px30 aren't supposed to open DC current flowing through inductive CB coil. This task has to be addressed by properly applied CB auxiliary contacts (52a/b).

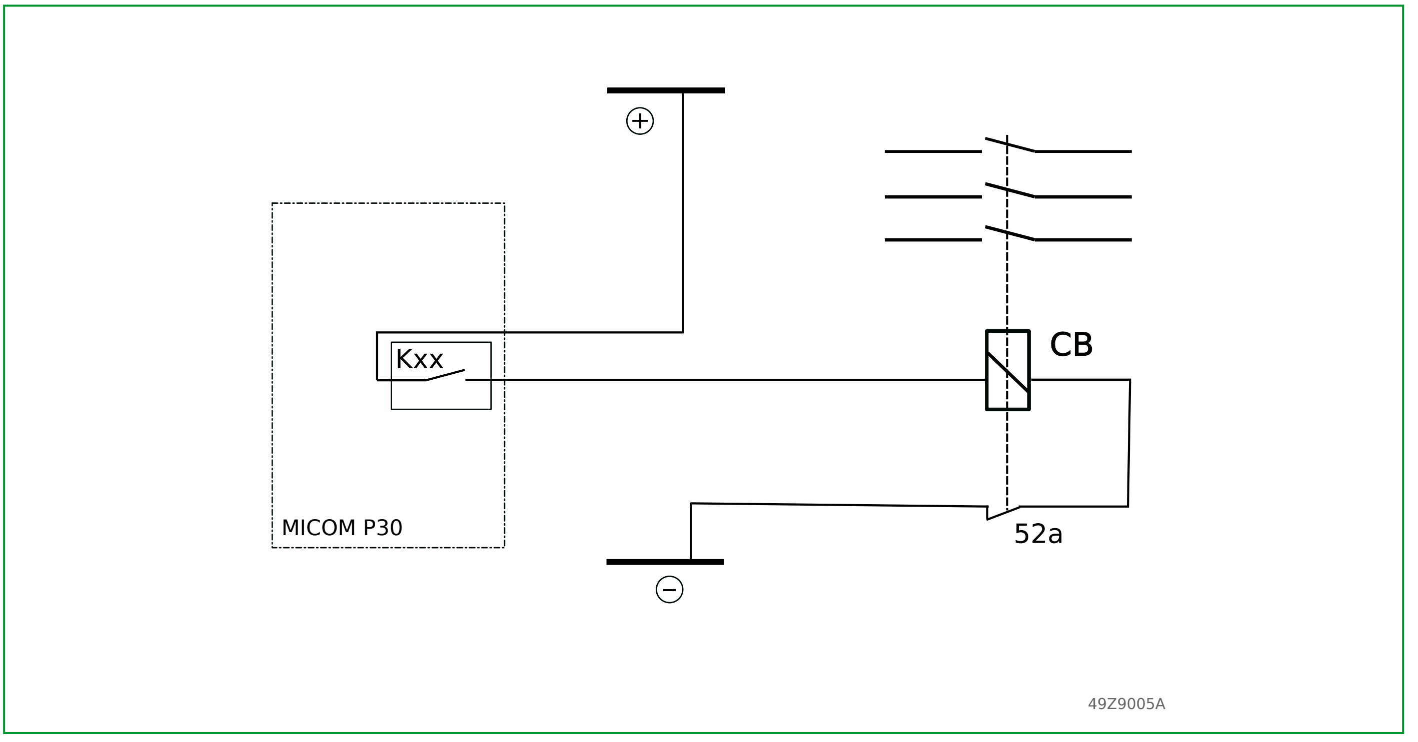


Fig. 5-14: Example of trip circuit wiring.

In order to ascertain that the inductive coil current is switched off from the CB auxiliary contacts, the setting of minimum pulse duration for trip commands (MAIN: Min.dur. trip cmd. 1 etc.) and close command need to consider the operating times of the circuit breaker and its auxiliary contacts. Sufficient margin has to be applied for pulse duration. A common setting is to double operating time of the circuit breaker, e.g. for a CB trip operation time top of 100 ms, the minimum trip pulse time should be 0.2 s (see the following figure).

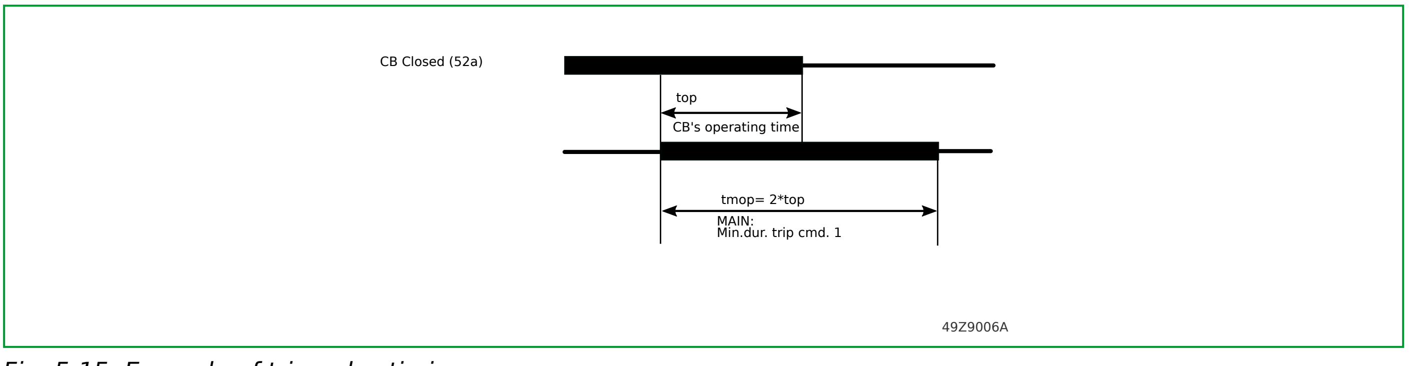


Fig. 5-15: Example of trip pulse timing.

This of course also applies to device open/close command outputs operated with fix (short or long) command duration (e.g. DEVxx Oper. mode cmd. = Short command).

If the Px30 output contact triggers an auxiliary relay which opens or closes the CB consecutively, then it should be verified, that the make/continuous/break coil currents of this auxiliary relay are within the limit values given in Section 2.5.7, (p. 2-13).

Note: Upon testing such command outputs, the CB (or equivalent auxiliary components) must not be mechanically locked, so that the auxiliary 52a/b contact could operate and break the DC current. If the CB has to stay locked, tripping or closing circuit has to be opened by terminal disconnection or test switch.

5.6.1.9 Connection of Switchgear Units Having Direct Motor Control

In the case of bay types having direct motor control, one binary input is configured for the status signal and one output relay is configured for triggering and resetting the motor relay. Configuration of appropriate output relays to trigger the armature and shunt windings of motors on load disconnect switches, isolating links or grounding switches is in accordance with the “List of Bay Types” (see Appendix). A connection example for a direct motor control is shown in the following diagram.

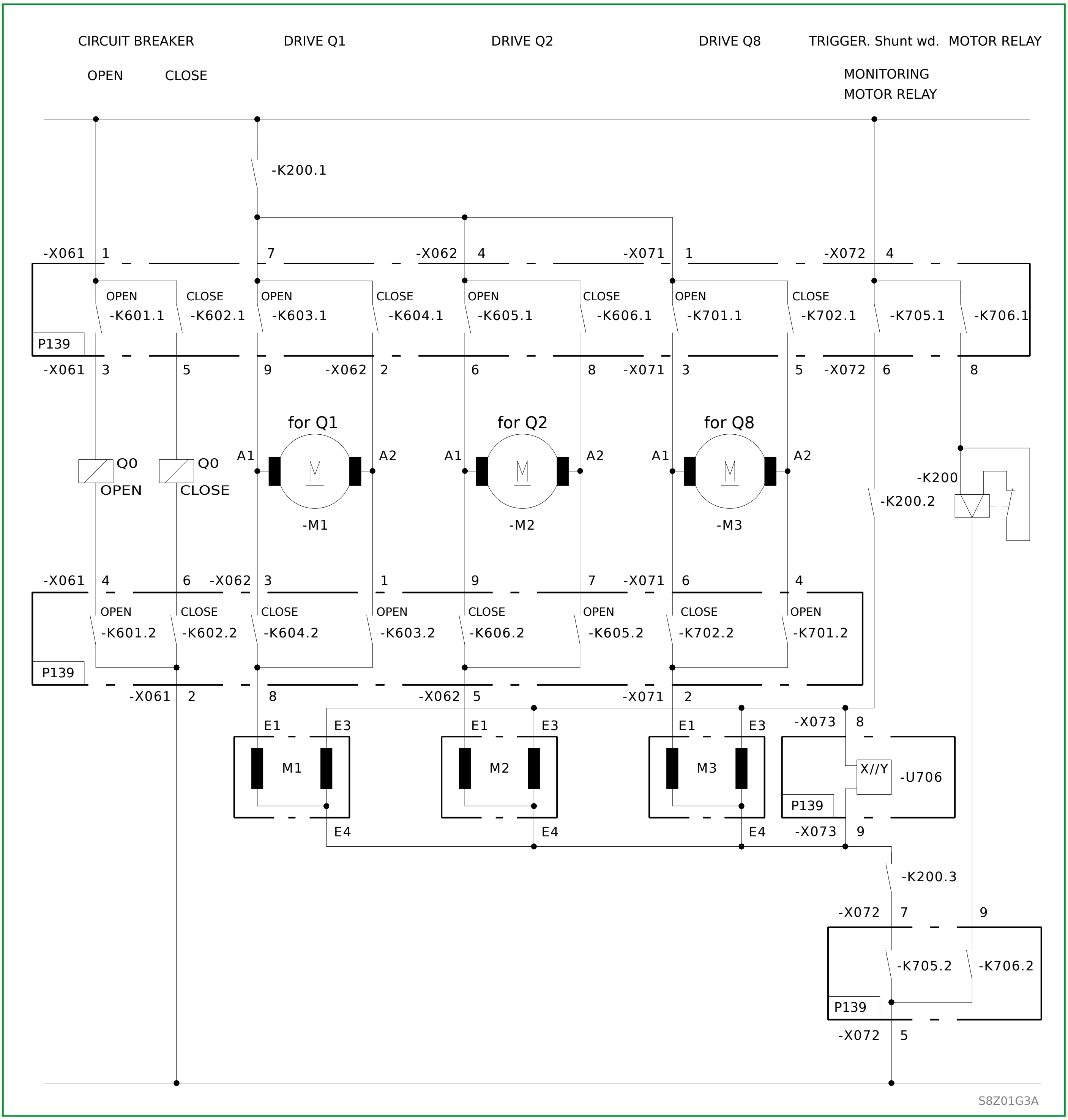


Fig. 5-16: Connection example, motor with shunt winding for a direct motor control, bay type No. 89 (A23.105.M04), feeder bay with circuit breaker, double busbar.

5.6.2 Connecting the IRIG-B Interface

An IRIG-B interface for time synchronization may be installed as an optional feature. It is connected by a BNC connector. A coaxial cable having a characteristic impedance of 50 Ω must be used as the connecting cable.

5.6.3 Connecting the Communication Interfaces

5.6.3.1 PC Interface

The PC interface is provided so that personnel can operate the device from a personal computer (PC).

⚠ WARNING
The PC interface is not designed as a permanent connection. Consequently, the female connector does not have the extra insulation from circuits connected to the system that is required per VDE 0106, part 101.

5.6.3.2 Communication Interfaces

The communication interfaces are provided as a permanent connection of the device to a control system for substations or to a central substation unit. Depending on the type, communication interface 1 on the device is connected either by a special fiber-optic connector or an RS 485 interface with twisted pair copper wires. Communication interface 2 is only available as an RS 485 interface.

The selection and assembly of a properly cut fiber-optic connecting cable requires special knowledge and expertise and is therefore not covered in this operating manual.

⚠ WARNING
The fiber-optic interface may only be connected or disconnected when the supply voltage for the device is shut off.

An RS 485 data transmission link between a master and several slave devices can be established by using the optional communication interface. The communication master could be, for instance, a central control station. Devices linked to the communication master, e.g. P139, are set-up as slave devices.

The RS 485 interface available on the P139 was designed so that data transfer in a full duplex transmission mode is possible using a 4-wire data link between devices. Data transfer between devices using the RS 485 interface is set up only for a half duplex transmission mode. To connect the RS 485 communication interface the following must be observed:

- Only twisted pair shielded cables must be used, that are common in telecommunication installations.
- At least one symmetrical twisted pair of wires is necessary.
- Conductor insulation and shielding must only be removed from the core in the immediate vicinity of the terminal strips and connected according to national standards.
- All shielding must be connected to an effective protective ground surface at both ends.
- Unused conductors must all be grounded at one end.

A 4-wire data link as an alternative to a 2-wire communications link is also possible. A cable with two symmetrical twisted pair wires is required for a 4-wire data link. A 2-wire data link is shown in Fig. 5-17, (p. 5-24), and a 4-wire data link is shown in Fig. 5-18, (p. 5-25) as an example for channel 2 on the communication module. The same is valid if channel 1 on the communication module is available as a RS 485 interface.

2-wire data link:

The transmitter must be bridged with the receiver on all devices equipped electrically with a full duplex communication interface, e.g. the P139. The two devices situated at either far end must have a 200 to 220 Ω resistor installed to terminate the data transmission conductor. In devices from the *Easergy MiCOM 30* family, and also in the P139, a 220 Ω resistor is integrated into the RS 485 interface hardware and can be connected with a wire jumper. An external resistor is therefore not necessary.

4-wire data link:

Transmitter and receiver must be bridged in the device situated on one far end of the data transmission conductor. The receivers of slave devices, that have an electrically full-duplex communication interface as part of their electrical system, e.g. the P139, are connected to the transmitter of the communication master device, and the transmitters of slave devices are connected to the receiver of the master device. Devices equipped electrically with only a half duplex RS 485 communication interface are connected to the transmitter of the communication master device. The last device in line (master or slave device) on the data transmission conductor must have the transmitter and receiver terminated with a 200 to 220 Ω resistor each. In devices from the *Easergy MiCOM 30* family, and also in the P139, a 220 Ω resistor is integrated into the RS 485 interface hardware and can be connected with a wire jumper. An external resistor is therefore not necessary. The second resistor must be connected externally to the device (resistor order number see Chapter “Accessories and Spare Parts”).

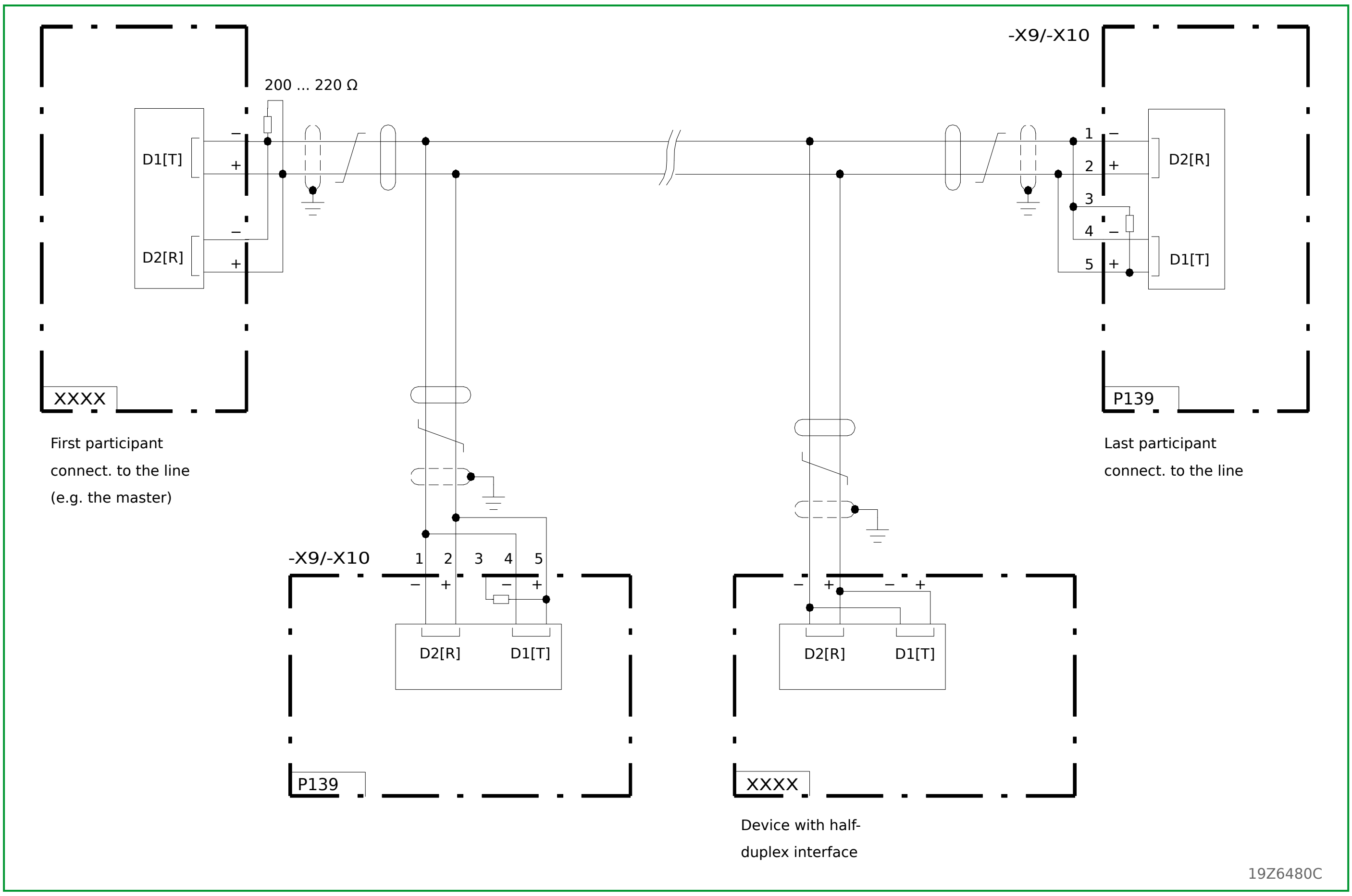


Fig. 5-17: 2-wire data link. (Note: the setting MAIN: Chann.assign.COMM1/2 decides about whether -X9 (=channel 1) or -X10 (=channel 2) is used.)

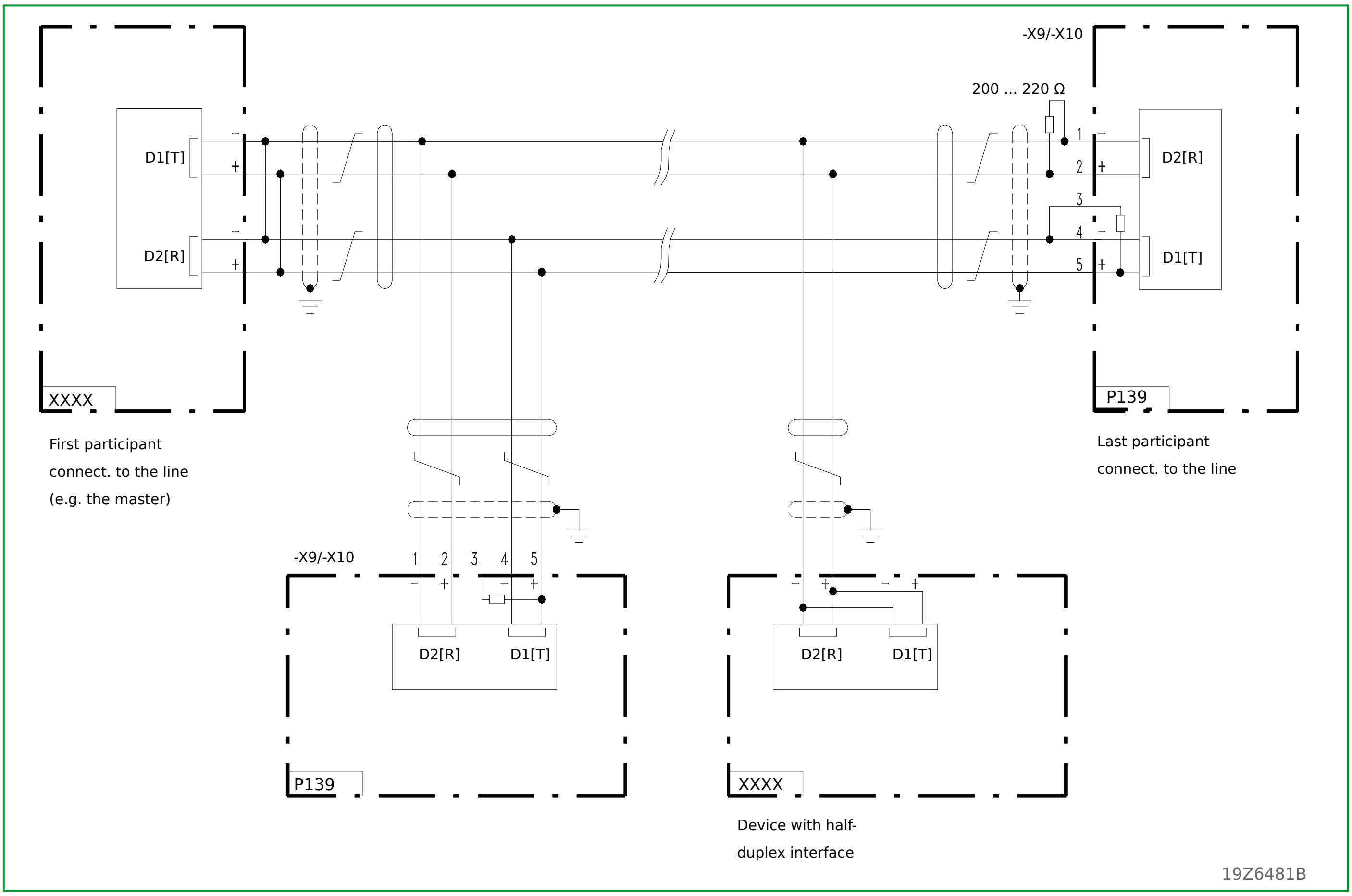


Fig. 5-18: 4-wire data link. (Note: the setting MAIN: Chann.assign.COMM1/2 decides about whether -X9 (=channel 1) or -X10 (=channel 2) is used.)

For CH1/CH2 connection diagram, please refer to Section 5.7, (p. 5-27)

5.6.3.3 Redundant Ethernet Board Connection

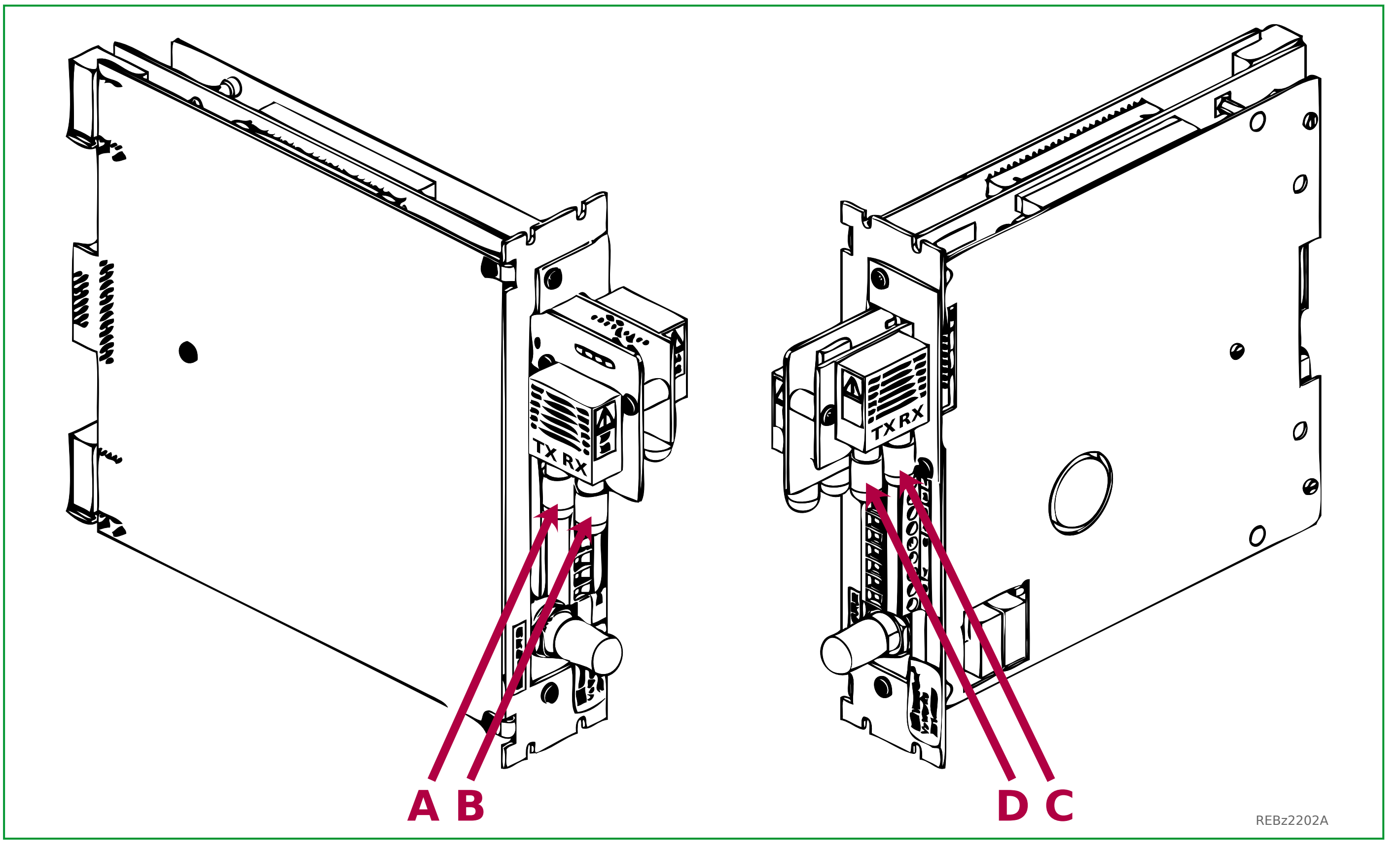


Fig. 5-19: Redundant Ethernet Board connectors.

The diagram above and the related tables below show the global Interface arrangement of all board connectors, as they are the fiber optic connectors, the serial interface and the watchdog relay contacts. The available IRIG-B connector is designed as a modulated input.

Connector	SHP	RSTP	DHP	PRP
A (-X8)	E_S	T_{X1}	T_{XA}	T_{XA}
B (-X7)	R_P	R_{X1}	R_{XA}	R_{XA}
C (-X14)	R_S	R_{X2}	R_{XB}	R_{XB}
D (-X15)	E_P	T_{X2}	T_{XB}	T_{XB}

Tab. 5-1: Optical fiber connector functionality.

LED	Function	On	Off	Flashing
Green	Link	Link o.k.	Link broken	
Yellow	Activity	SHP running		PRP / RSTP or DHP traffic

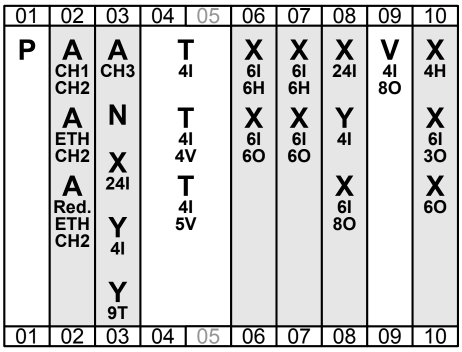
Tab. 5-2: LED functionality.

5.7 Location and Connection Diagrams

5.7.1 Location Diagrams P139 -423/424/425

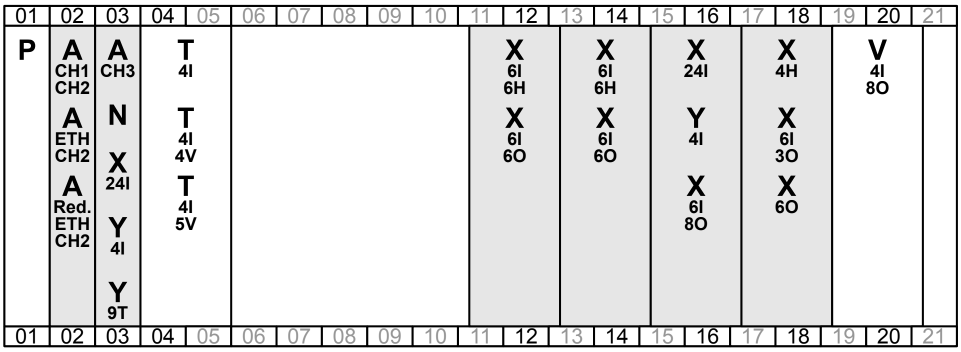
Location diagrams for P139 in 40 TE case

- Pin-terminal connection (P139 -423)
- Transformer module: Ring terminal connection, other modules pin-terminal connection (P139 -424)



Location diagram for P139 in 84 TE case

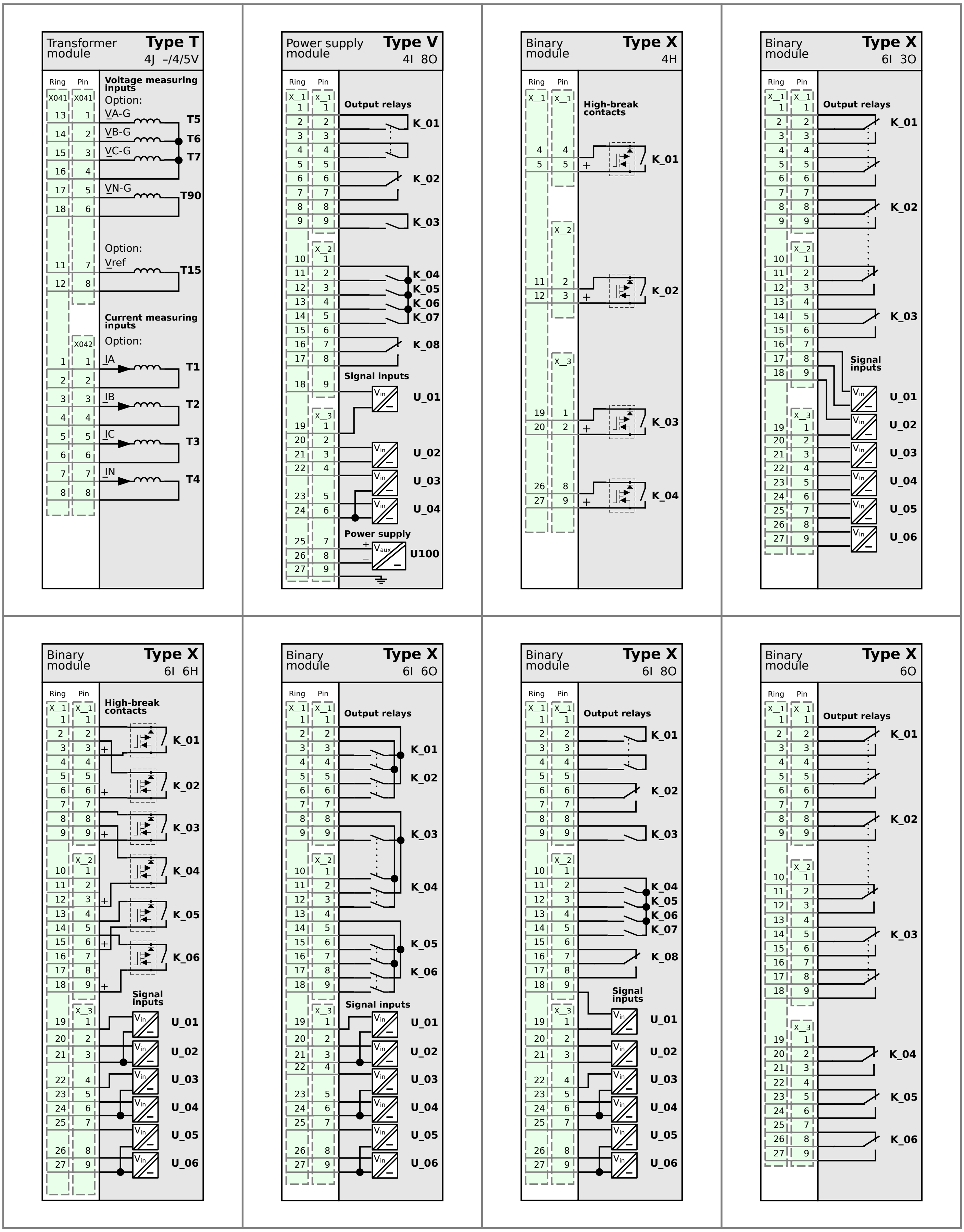
- Ring terminal connection (P139 -425)



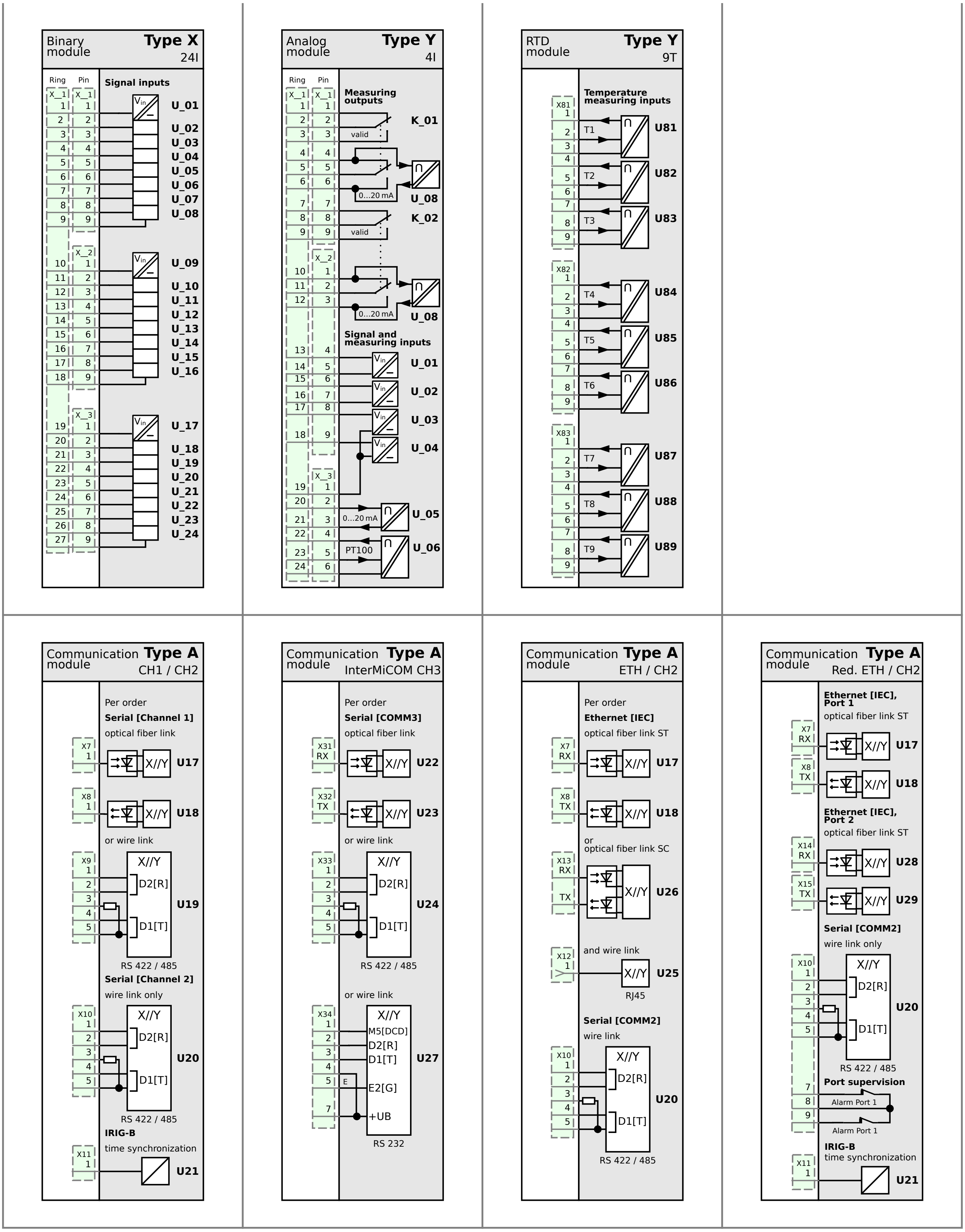
Each of the numbered slots can be fitted with max. 1 module.
If a location diagram shows several modules for a particular slot, then these are alternatives, depending on the ordering options.

5.7.2 Terminal Connection Diagrams P139-423/424/425

"_" is a placeholder for the slot.
The RTD module is equipped with a grounding bar providing connectors for the 9 cable shields.
See also *Section 5.5, (p. 5-13)**, "Protection Conductor Terminal (PCT) / Case Grounding / Protective Earth"*



Transformer module Type T 4J –/4/5V
Ring Pin X041 X041
Voltage measuring inputs
Option:
VA-G T5
VB-G T6
VC-G T7
VN-G T90
Option:
Vref T15
X042
Current measuring inputs
Option:
IA T1
IB T2
IC T3
IN T4
Power supply module Type V 4I 8O
Ring Pin X_1 X_2 X_3
Output relays
K_01 K_02 K_03 K_04 K_05 K_06 K_07 K_08
Signal inputs
U_01 U_02 U_03 U_04
Power supply
U100
Binary module Type X 4H
High-break contacts
K_01 K_02 K_03 K_04
Binary module Type X 6I 3O
Output relays
K_01 K_02 K_03
Signal inputs
U_01 U_02 U_03 U_04 U_05 U_06
Binary module Type X 6I 6H
High-break contacts
K_01 K_02 K_03 K_04 K_05 K_06
Signal inputs
U_01 U_02 U_03 U_04 U_05 U_06
Binary module Type X 6I 6O
Output relays
K_01 K_02 K_03 K_04 K_05 K_06
Signal inputs
U_01 U_02 U_03 U_04 U_05 U_06
Binary module Type X 6I 8O
Output relays
K_01 K_02 K_03 K_04 K_05 K_06 K_07 K_08
Signal inputs
U_01 U_02 U_03 U_04 U_05 U_06
Binary module Type X 6O
Output relays
K_01 K_02 K_03 K_04 K_05 K_06


Binary module
Type X
24I
Ring
Pin
X_1
X_2
X_3
Signal inputs
V_{in}
U_01
U_02
U_03
U_04
U_05
U_06
U_07
U_08
U_09
U_10
U_11
U_12
U_13
U_14
U_15
U_16
U_17
U_18
U_19
U_20
U_21
U_22
U_23
U_24
Analog module
Type Y
4I
Ring
Pin
X_1
X_2
X_3
Measuring outputs
K_01
valid
0...20 mA
U_08
K_02
valid
0...20 mA
U_08
Signal and measuring inputs
U_01
U_02
U_03
U_04
0...20 mA
U_05
PT100
U_06
RTD module
Type Y
9T
X81
X82
X83
Temperature measuring inputs
T1
U81
T2
U82
T3
U83
T4
U84
T5
U85
T6
U86
T7
U87
T8
U88
T9
U89
Communication module
Type A
CH1 / CH2
Per order
Serial [Channel 1]
optical fiber link
X7
U17
X8
U18
or wire link
X9
X//Y
D2[R]
D1[T]
U19
RS 422 / 485
Serial [Channel 2]
wire link only
X10
X//Y
D2[R]
D1[T]
U20
RS 422 / 485
IRIG-B
time synchronization
X11
U21
Communication module
Type A
InterMiCOM CH3
Per order
Serial [COMM3]
optical fiber link
X31 RX
U22
X32 TX
U23
or wire link
X33
X//Y
D2[R]
D1[T]
U24
RS 422 / 485
or wire link
X34
X//Y
M5[DCD]
D2[R]
D1[T]
E
E2[G]
+UB
U27
RS 232
Communication module
Type A
ETH / CH2
Per order
Ethernet [IEC]
optical fiber link ST
X7 RX
U17
X8 TX
U18
or
optical fiber link SC
X13 RX
TX
U26
and wire link
X12
X//Y
U25
RJ45
Serial [COMM2]
wire link
X10
X//Y
D2[R]
D1[T]
U20
RS 422 / 485
Communication module
Type A
Red. ETH / CH2
Ethernet [IEC], Port 1
optical fiber link ST
X7 RX
U17
X8 TX
U18
Ethernet [IEC], Port 2
optical fiber link ST
X14 RX
U28
X15 TX
U29
Serial [COMM2]
wire link only
X10
X//Y
D2[R]
D1[T]
U20
RS 422 / 485
Port supervision
Alarm Port 1
Alarm Port 1
IRIG-B
time synchronization
X11
U21

6 Local Control (HMI)

6.1 Local Control Panel (HMI)

Switchgear installed in the bay can be controlled from the local control panel (HMI). All the data required for operation of the protection device is entered from the local control panel, and the data important for system management is read out there as well. The following tasks can be handled from the local control panel:

- Controlling switchgear units
- Readout and modification of settings
- Readout of cyclically updated measured operating data and logic status signals
- Readout of operating data logs and of monitoring signal logs
- Readout of event logs after overload situations, ground faults, or short circuits in the power system
- Device resetting and triggering of additional control functions used in testing and commissioning

Control is also possible through the PC interface. This requires a suitable PC and a specific operating program.

6.2 Display and Keypad

6.2.1 Graphic Display

The local control panel is a graphic LC display with a resolution of 128 × 128 pixels (divided semi-graphically into 16 lines of 21 characters each).

Moreover, there are twelve keys and 17 LED indicators. (The configuration of the LED indicators is described in Section 3.10, (p. 3-75).)

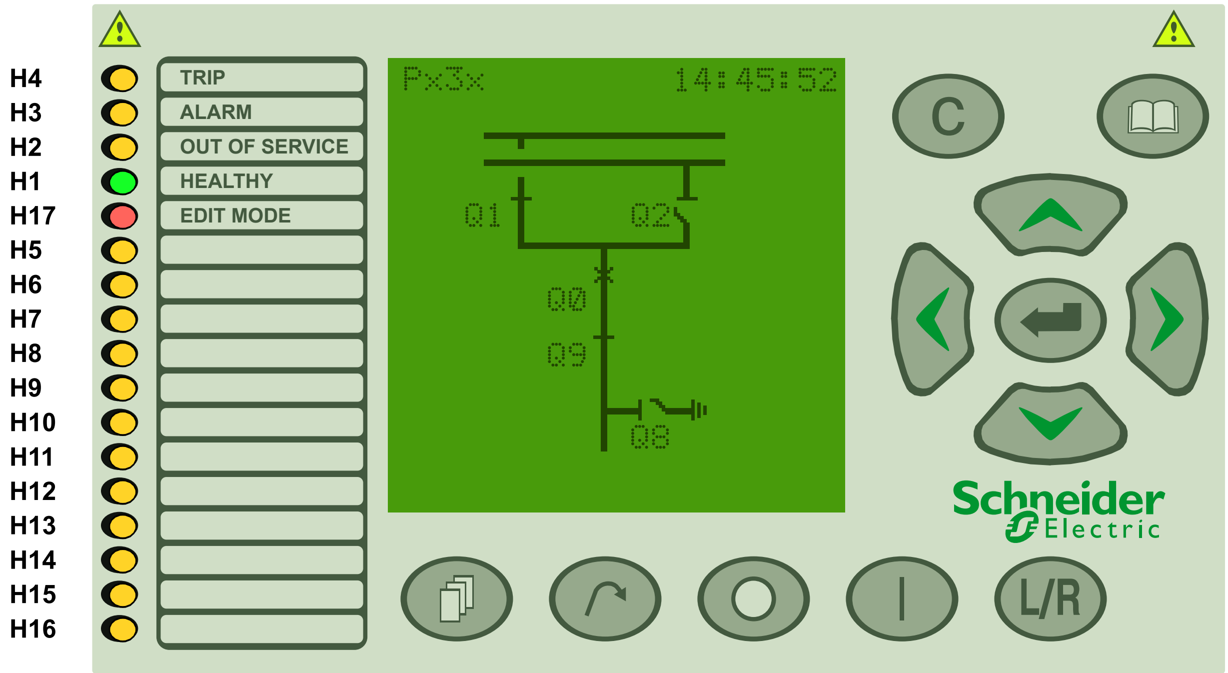


Fig. 6-1: View of the local control panel and layout of the LED indicators for the graphic display.

6.2.2 Display Illumination

If none of the control keys are pressed, the display illumination will switch off once the set “return time illumination” (setting in menu tree: “Par/Conf/LOC”) has elapsed. Pressing any of the control keys will turn the display illumination on again. In this case the control action that is normally triggered by that key will not be executed. Reactivation of the display illumination is also possible by using a binary input.

If continuous display illumination is required, the function “return time illumination” (LOC: Return time illumin.) is set to *blocked*.

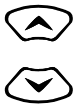
6.2.3 Contrast of the Display

The contrast of the LC display can be adjusted by pressing 3 keys on the local control panel at the same time, as follows:

Keep the Enter key (↵) and the Clear key (ⓒ) pressed simultaneously, then you can press “Up” or “Down” (⌃, ⌄) to raise or lower the contrast, respectively.

6.2.4 Short Description of Keys

6.2.4.1 “Up” and “Down” Keys



Panel Level: The “up”/“down” keys switch between the pages of the Measured Value Panel.

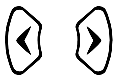
Menu Tree Level: Press the “up” and “down” keys to navigate up and down through the menu tree in a vertical direction. If the unit is in input mode, the “up” and “down” keys have a different function.

Input mode: Settings can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. Press the “up” and “down” keys in this mode to change the setting value.

- “Up” key: the next higher value is selected.
- “Down” key: the next lower value is selected.

With list settings, press the “up” and “down” key to change the logic operator of the value element.

6.2.4.2 “Left” and “Right” Keys



Menu Tree Level: Press the “left” and “right” keys to navigate through the menu tree in a horizontal direction. If the unit is in input mode, the “left” and “right” keys have a different function.

Input mode: Settings can only be changed in the input mode, which is signaled by the LED indicator labeled EDIT MODE. When the “left” and “right” keys are pressed, the cursor positioned below one of the digits in the change-enabled value moves one digit to the right or left.

- “Left” key: the cursor moves to the next digit on the left.
- “Right” key: the cursor moves to the next digit on the right.

In the case of a list setting, press the “left” and “right” keys to navigate through the list of items available for selection.

6.2.4.3 ENTER Key

Panel Level: Press the ENTER key at the Panel level to go to the menu tree.

Menu Tree Level: Press the ENTER key to enter the input mode. Press the ENTER key a second time to accept the changes as entered and exit the input mode. The LED indicator labeled EDIT MODE signals that the input mode is active.

6.2.4.4 CLEAR Key

Press the CLEAR key to reset the LED indicators and clear all measured event data. The records in the recording memories are not affected by this action.

Input mode: When the CLEAR key is pressed all changes entered are rejected and the input mode is exited.

6.2.4.5 READ Key

Press the READ key to access a selected event recording from either the Panel level or from any other point in the menu tree.

6.2.4.6 „Local/Remote“ Key

The local/remote key is effective in the Bay Panel except where a binary signal input has been configured for this function.

The local/remote key is the transfer switch between remote and local control (setting *R <-> L*), or between remote&local and local control (setting *R & L <-> L*). If the “Local/Remote” key is set to switch from *Remote* control to *Local* control, then this can only occur if the password has first been entered first. Switching from *Local* to *Remote* control will occur without checking the password.

6.2.4.7 Page Key

Panel Level: Pressing the page key shows the next panel.

Menu Tree Level: When the page key is pressed the Menu Tree Level is exited and the Bay Panel is accessed.

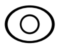
6.2.4.8 Selection Key

Bay Panel: The Selection key is effective only in the Bay Panel and only if local control is activated.

If local control has been selected, pressing the selection key selects the switchgear unit to be controlled. The selected external device will be marked by an asterisk (*****) – as long as no external device names are displayed. Otherwise the external device name will flash and will be displayed in the status line.

Signal Panel: The Selection key is used to select a flashing signal (not yet acknowledged) and will also automatically switch to pages that might be available. When the last flashing signal has been reached pressing the Selection key again will start with the first flashing signal.

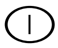
6.2.4.9 OPEN Key



The OPEN key is effective in the Bay Panel only.

Pressing the OPEN key controls the selected switchgear unit – taking into account the interlock equation – to assume the “open” status.

6.2.4.10 CLOSE Key



The CLOSE key is effective in the Bay Panel only.

Pressing the CLOSE key controls the selected switchgear unit – taking into account the interlock equation – to assume the “closed” status.

6.3 Display Levels

All data relevant for operation and all device settings are displayed on two levels. At the Panel level, data such as measurements are displayed in Panels that provide a quick overview of the current state of the bay. The *“menu tree”* level below the panel level allows the user to select all data points (settings, signals, measured variables, etc.) and to change them, if appropriate. To access a selected event recording from either the panel level or from any other point in the menu tree, press the “READ” key: Ⓜ

6.4 Availability of the Bay Panel

The Bay Panel is only available under these conditions:

1. On the hardware side the protection unit must be fitted with the binary module X(6I 6O) to a slot supporting this module.
2. By selecting and sending a bay type (with parameter MAIN: Type of bay) a bay type has been generated.

To access a selected event recording from either the panel level or from any other point in the menu tree, press the “READ” key ⓜ.

From the control and display panels (e.g. measured value panels or the bay panel) the user can access the menu tree level by pressing the “ENTER” key.

To return to the previously selected control and display panel from the menu tree level the user must simultaneously press the keys “Cursor up” and “RESET”. (If previously no panel was selected, i.e. after a system restart, then the bay panel, if available, is accessed.)

After the set LOC: Autom. return time has elapsed the protection unit will also return automatically from the menu tree level to the control and display panel last selected.

The user can move from a bay panel to a measured value panel by pressing the key “Cursor left” and back again by pressing the key “Cursor right”.

6.5 Display Panels on the Graphic Display

The following display panels are available with the graphic display:

- Bay Panel
- Signal Panel
- Measured Value Panels, which are called up according to system conditions
- Event Panel

The Bay Panel displays the up-to-date switching status of the selected bay as a one line diagram. If user-defined bay types are applied, resulting information may be sub-divided into up to eight pages. A maximum of 28 physical and logic binary status may be configured to one Signal Panel and, depending on the operating mode, acknowledged. Selected measured values are displayed on the Measured Value Panels. Only the Measured Value Panels relevant for the particular design version of the given device and its associated range of functions are actually available.

The Event Panel displays the most recent events, each with a time tag, such as the opening of a switchgear unit.

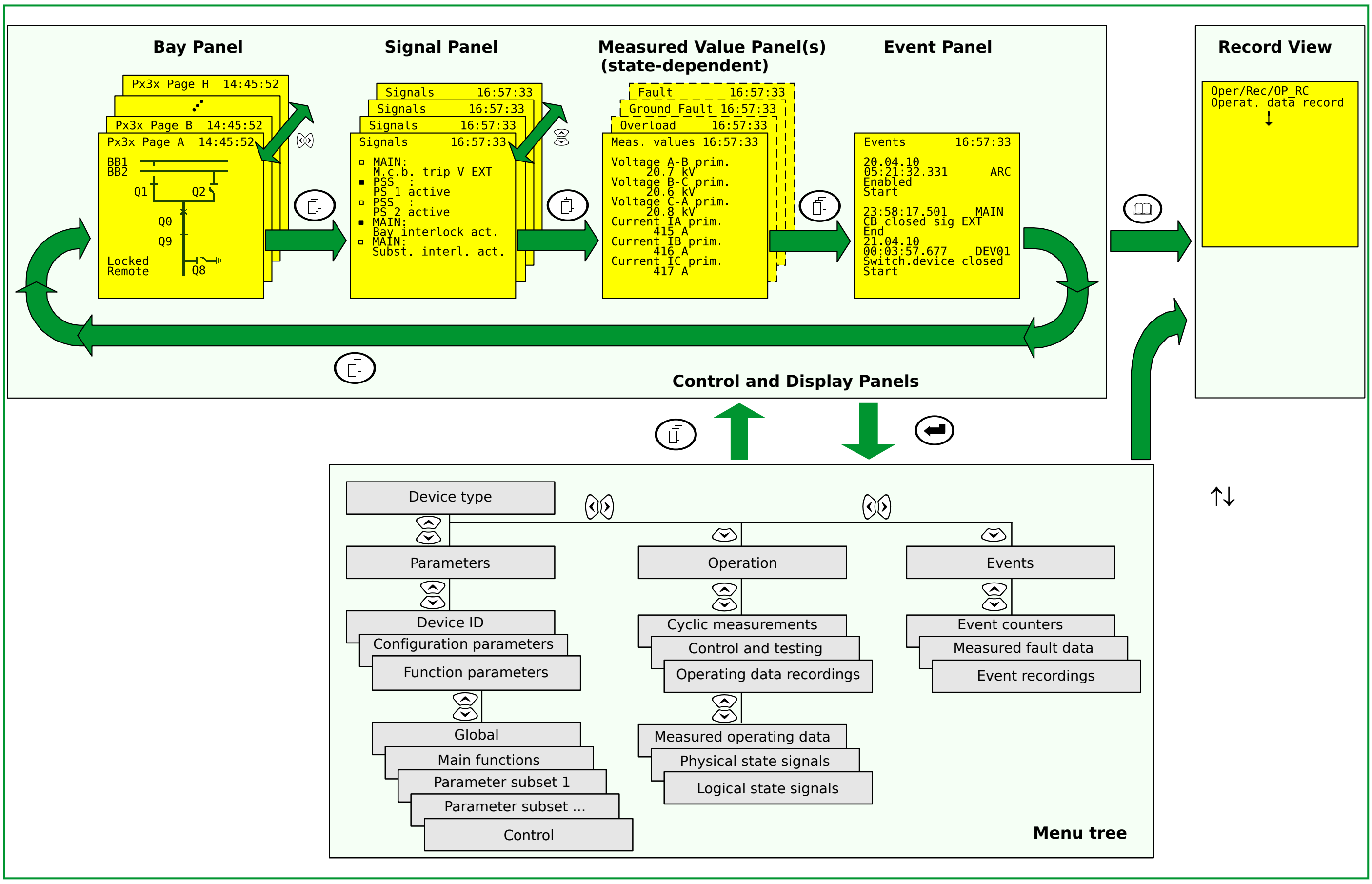


Fig. 6-2: Display panels and menu tree.

6.6 Menu Tree and Data Points

All *data points* (setting values, signals, measured values, etc.) are selected using a *menu tree*. When navigating through the *menu tree*, the first two lines of the LC-Display always show the branch of the *menu tree* that is active, as selected by the user. The *data points* are found at the lowest level of a *menu tree* branch and they are displayed either with their plain text description or in numerically encoded form, as selected by the user. The value associated with the selected *data point*, its meaning, and its unit of measurement are displayed in the line below.

6.7 List Data Points

List data points are a special category. In contrast to other data points, *list data points* generally have more than one associated value element. This category includes tripping matrices, programmable logic functions, and event logs. When a *list data point* is selected, the symbol ‘↓‘ is displayed in the bottom line of the LCD, indicating that a sub-level is situated below this displayed level. The individual value elements of a *list data point* are found at this sub-level. In the case of a list *parameter*, the individual value elements are linked by operators such as “OR”.

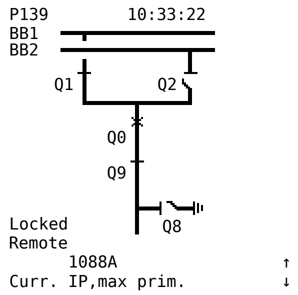
6.8 Note Concerning the Step-by-Step Descriptions

The following presentation of the individual control steps shows which displays can be changed in each case by pressing keys. A small black square to the right of the enter key indicates that the LED indicator labeled Edit Mode is illuminated. The examples used here are not necessarily valid for the device type described in this manual; they merely serve to illustrate the control principles involved.

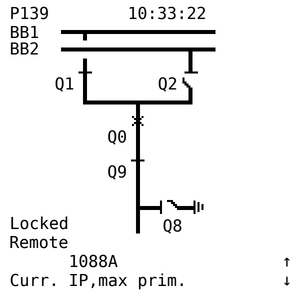
6.9 Changing Between Display Levels

Jumping from Panel Level to Menu Tree Level

After start-up of the device, the display is at the **Panel Level**. The Bay Panel is displayed.

	Control Step / Description	Control Action	Display
Step 0	Example of a display after start-up of the device. **Note:** When the device is delivered, it is set for a dummy bay without switchgear units. Therefore only the name of the device appears on the Bay Panel. The display shown in the example will not appear until a “real” bay type has been selected.		
Step 1	Press the Enter key to go from the Panel Level to the Menu Tree Level.		P139 Parameters

Jumping from Menu Tree Level to Panel Level

	Control Step / Description	Control Action	Display
Step 0	From the Menu Tree Level, the user can jump to the Panel Level from any position within the menu tree.		Par/Func/Glob/MAIN Device on-line No (=off)
Step 1	Press the Page key. Alternatively first press the “up” key and hold it down while pressing the CLEAR key. **Note:** It is important to press the “up” key first and release it last in order to avoid unintentional resetting of stored data.	or + C	

After the set return time has elapsed (setting in menu tree: “Par/Conf/LOC”), the display will switch automatically to the Bay Panel.

6.10 Control at Panel Level

At Panel Level, the user can move from one Panel type to another by pressing the Page key (in one direction only) or the “left”/”right” keys (in both directions).

6.10.1 Bay Panel

6.10.1.1 Information Displayed on the Bay Panel

Fig. 6-3, (p. 6-13) shows an example of a Bay Panel. The top line shows the device type on the left and the current time of day on the right. Together with a customized Bay Type with more than one Bay Panel page the top line will include a page marker in the center. The page markers run from “PAGE A” (first page) to “PAGE H” (eighth page).

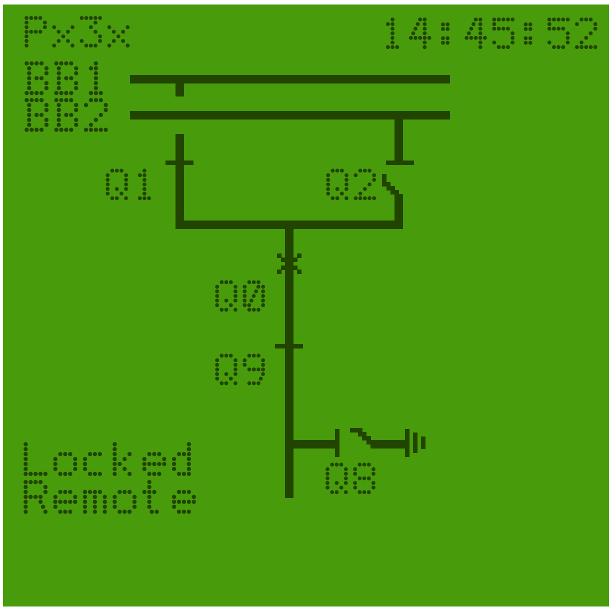


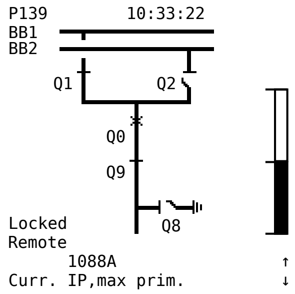
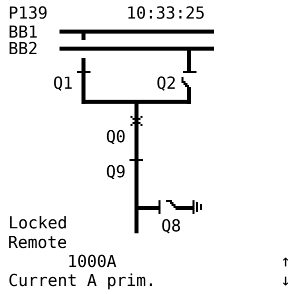
Fig. 6-3: Example of a Bay Panel.

The Bay Panel shown below in one-line diagram representation is a function of the set bay type. The symbols shown in the following table are used to represent the switchgear units and other external devices as well as the status of switchgear units. The user can switch between character sets 1, 2, and 3. Character set 3 is identical to character set 1 in as-delivered condition but can be replaced by a user-defined character set – by using a special ancillary tool. The symbols of character set 1 are used in the following description.

The fourth line from the bottom shows (in abbreviated form) whether a bay interlock is active. The third line from the bottom indicates whether remote or local control is permitted. In the example shown here, remote control is activated. The two lines at the bottom contain measured value data. The arrows to the right of the measured value data indicate that additional measured values can be called up by pressing the “up” or ”down” keys.

External device	Position, e.g.: DEV01: Control state	Setting LOC: Character set 1: Character set 1	2: Character set 2
Circuit breaker	1: Open		
	2: Closed		
	3: Faulty position 0: Intermediate pos.		
Switch disconnector	1: Open		
	2: Closed		
	3: Faulty position 0: Intermediate pos.		
Disconnector	1: Open		
	2: Closed		
	3: Faulty position 0: Intermediate pos.		
Switch truck	1: Open		
	2: Closed		
	3: Faulty position 0: Intermediate pos.		
Fuse unit	1: Open		
	2: Closed		

6.10.1.2 Measured Value Display in the Bay Panel

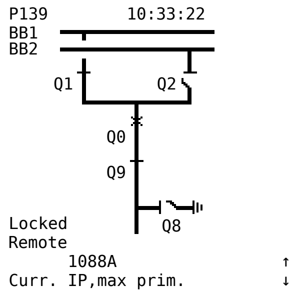
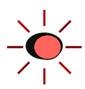
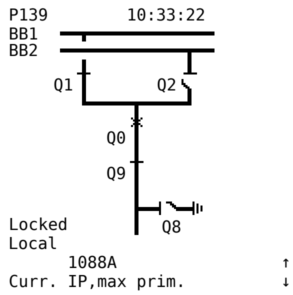
	Control Step / Description	Control Action	Display
Step 0	Measured values are shown one at a time. A configuration step determines whether the measured value will also be displayed in bar chart form. A configuration step determines whether the measured value will also be displayed in bar chart form. The position of the bar chart can also be set for horizontal or vertical display (the setting applies to all measured values). The arrows under the bar chart indicate that additional measured values can also be displayed.		
Step 1	By pressing the “up” or “down” key the next measured value is displayed. In the example shown, no bar chart display has been configured for the measured value.	 or 	

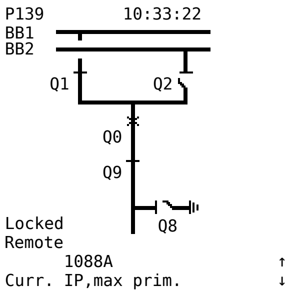
6.10.1.3 Controlling Switchgear Units

Switchgear units can be controlled from the local control panel, provided that the unit has been set for “local control”. If the local/remote key is set to switch between remote and local control (R↔L), then the switch from “remote” to “local” operation requires a password. When more than one Bay Panel page is used only joint “local/remote” switching is available.

The following example is based on the (R↔L) setting for the local/remote key and the factory-set L/R password. If the password has been changed by the user (see Section 6.11.9.4, (p. 6-47)) the following description will apply accordingly.

Some action steps and the behavior of the P139 depend on the setting LOC: Operation mode.

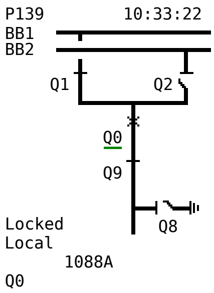
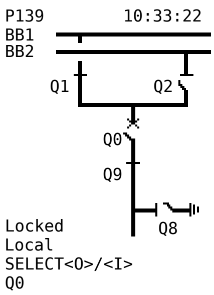
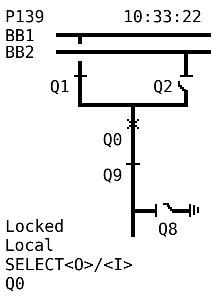
	Control Step / Description	Control Action	Display
Step 0	Select the Bay Panel.		
Step 1	Press the “local/remote” key (L/R) to switch the device to local operation. The Bay Panel is no longer displayed. The device type appears in the first line and eight asterisks (*) appear in the fourth line as a prompt to enter the password.		P139 10:33:22 ********
Step 2a	Press the following keys in sequence: “Left”		P139 10:33:22 *
	“Down”		P139 10:33:22 *
	“Right”		P139 10:33:22 *
	“Up” The display will change as shown in the column on the right.		P139 10:33:22 *
	Now press the Enter key. If the correct password has been entered, the Bay Panel will re-appear. The third line from the bottom will display “Local”. If an invalid password has been entered, the display shown above in Step 1 will appear.	 	

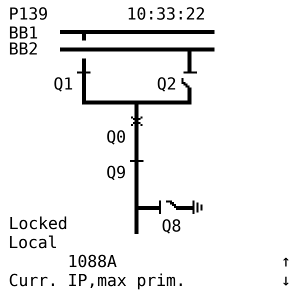
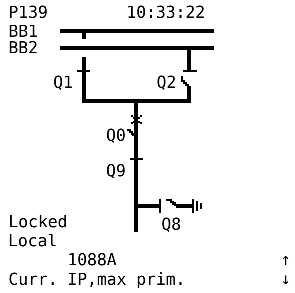
<table>
<tr><th></th><th>Control Step / Description</th><th>Control Action</th><th>Display</th></tr>
<tr><td>Step 2b</td><td>This control step can be canceled at any time by pressing the CLEAR key before the Enter key is pressed.</td><td>C</td><td></td></tr>
<tr><td>Step 3a</td><td>Press the Selection key to select a switchgear unit. (Pressing the key again selects the next switchgear unit, etc.) Only switchgear units that are electrically controllable can be selected.

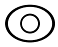
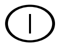
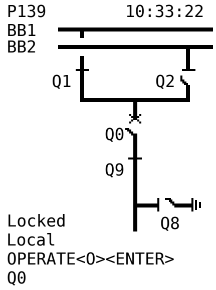
The external device designation for the selected switchgear unit –“Q0”, for example – is displayed in flashing characters. If the display of external device designations has been disabled, the selected switchgear unit will be marked by a flashing asterisk (*).

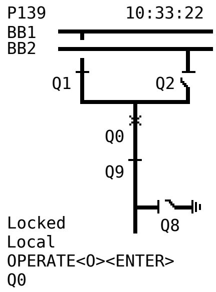
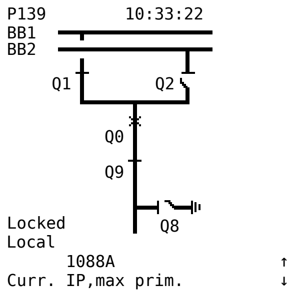
If LOC: Operation mode is set to LOC SBO option 2, the switchgear unit's position also changes; the position is displayed that will be assumed by a successful operation. If, however, LOC: Operation mode is set to LOC Direct or to LOC SBO option 1 then still the current position is displayed.

The external device designation for the selected switchgear unit also appears in the bottom line of the display. (For this line, no flashing characters are used.)

If LOC: Operation mode is set to LOC SBO option 1 or to LOC SBO option 2 the symbols [O] („open“) and [I] („close“) are displayed as flashing characters in the next-to-last line. This is a signal for the user, that the “Open” (or “Close”) key may now be pressed.</td><td></td><td>LOC: Operation mode = LOC Direct:

LOC: Operation mode = LOC SBO option 2:

LOC: Operation mode = LOC SBO option 1:
</td></tr>
</table>

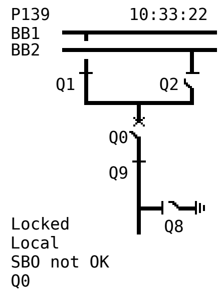
	Control Step / Description	Control Action	Display
Step 3b	To cancel the selection of a switchgear unit, press the CLEAR key. Pressing the Selection key selects another switchgear unit.	C	
Step 4	After selecting a switchgear unit, press the keys “Open” or “Close” to control the switchgear unit. Before this switching action is executed, compliance with bay interlock conditions – if applicable – is checked.	O or I	
Step 4a	For the setting LOC: Operation mode = *LOC Direct*, there is a simplified operation: If the check of bay interlock conditions determines that an operation can be carried out, then the switch command is executed. The “off-end” (intermediate position) symbol is displayed while the switchgear unit is operating. While the switch command is being executed, no further switchgear unit can be selected.		LOC: Operation mode = *LOC Direct*: 
Step 4b	If LOC: Operation modeis set to *LOC SBO option 1* or *LOC SBO option 2*, there is one more operation step:		

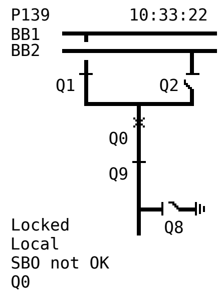
<table>
<tr><th></th><th>Control Step / Description</th><th>Control Action</th><th>Display</th></tr>
<tr><td></td><td>If the check of bay interlock conditions determines that an operation can be carried out, then the next-to-last line displays the symbol of the the selected switching operation (e.g. [O]) together with a prompt to the Enter key (in flashing characters).</td><td>
or
</td><td>LOC: Operation mode = LOC SBO option 1:


LOC: Operation mode = LOC SBO option 2:

</td></tr>
<tr><td>Step 4c</td><td>For LOC: Operation mode = LOC Direct:
If the check of interlock conditions determines that switching is not allowed, then the selected switchgear unit is no longer highlighted.
If the LED indicators have been configured accordingly, the LED indicator for MAIN: Interlock equ. viol. will be illuminated.</td><td></td><td>LOC: Operation mode = LOC Direct:

</td></tr>
</table>

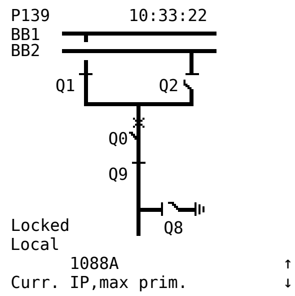
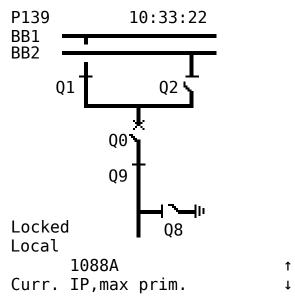
<table>
<tr><th></th><th>Control Step / Description</th><th>Control Action</th><th>Display</th></tr>
<tr><td>Step 4d</td><td>For LOC: Operation mode = LOC SBO option 1 or LOC SBO option 2:

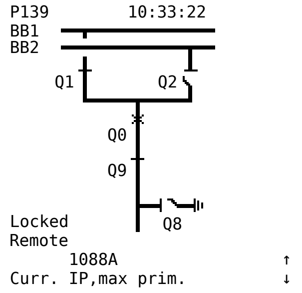
If the check of bay interlock conditions determines that an operation cannot be carried out, then the next-to-last line displays the error message “SBO not OK” for 5 seconds, using flashing letters.

After these 5 seconds the P139 cancels the selection of the switchgear unit and displays the Bay Panel as at the end of step 2.</td><td></td><td>LOC: Operation mode = LOC SBO option 2:


LOC: Operation mode = LOC SBO option 1:

</td></tr>
<tr><td>Step 5</td><td>For LOC: Operation mode = LOC SBO option 1 or LOC SBO option 2:

If the operation can be carried out, the Enter key can be pressed. After this, the switch command is executed.

The “off-end” (intermediate position) symbol is displayed while the switchgear unit is operating. No new switchgear unit can be selected until the execution of the current command has been finished.</td><td></td><td>
</td></tr>
<tr><td>Step 6</td><td>Once the operating time of the switchgear unit has elapsed, the resulting switching status is displayed.</td><td></td><td>
</td></tr>
</table>

	Control Step / Description	Control Action	Display
Step 7	If no control action takes place within a set time period after selection of a switchgear unit or if the return time for illumination (LOC: Return time illumin.) or the return time for selection (LOC: Return time select.) has elapsed, then the selection is canceled.		
Step 8	Press the local/remote key (L/R) to switch to remote control; this is accomplished without a password prompt.	L/R	

6.10.2 Signal Panel(s)

The Signal Panel is used to display the up to 28 different physical and logical binary states that the device has available. The top line in the display shows the panel designation “Signals” and the current time of day. The following empty line separates the heading from actual signals. This gives display capacity of up to seven signals to one Signal Panel. Additional pages are created when more than seven signals have been configured. As with all other panels, switching between pages is carried out automatically, after the parameter panel hold-time (LOC: Hold-time for Panels) has elapsed, or manually by pressing the “Up”/ “Down” keys.

Each signal consists of two lines. The first line shows a status marker (square).

□	clear	Signal inactive / not powered.
■	black	Signal active / powered.
▣	flashing	Signaling.

Moreover, the first line shows the associated function group. The second line shows the full text for this signal.

6.10.2.1 Automatic Activation

When automatic activation of the Signal Panel is set (LOC: Aut.activ.Sign.Panel) each status change of signals, configured to a panel, is automatically switched from the Bay Panel page or the Operation Panel/ Event Panel (depending on the actual selection) to the Signal Panel. Depending on the range of functions available in the device, the displays of Overload Panels, Ground Fault Panels or Fault Panels have a higher priority and will be shown when an event has occurred. Using the Page key will make the display jump to the other panels at any time.

6.10.2.2 Status Display and Signaling

To differentiate between the states “signal active / powered” and “signal inactive / not powered” shown on the Signal Panel the parameter (LOC: Stat.ind.Sign.Panel) is used. This will distinguish between a clear/black square alone and the simultaneous change over from normal display to highlighting of text in both lines (the first line with the status marker will remain unchanged).

By using the parameter (LOC: Indicat.Sign.Panel) the signaling of status changes of signals in the Signal Panel is controlled. There is a difference between no signaling (acknowledgement is not necessary, but, if so configured, the Signal Panel is switched on at any status change), signaling by the flashing status marker “▣” alone or by flashing of the two lines (change over from normal display to highlighting of text and the status marker). The flashing frequency is fixed and may not be changed.

Each status change of signals, configured to a panel of the Bay Panel page can be set to call for user attention either by having the status marker or both signal lines flash when a new event has occurred. The switching control will then automatically switch to the page, which includes the first signal that has experienced a status change. After pressing the Selection key ◠ this flashing signal is selected on the current page (signal preceded by a flashing cursor “**>**”). The next flashing signal can be called up by pressing the Selection key again. At this point it may occur that the display will automatically jump to the next page. When the last flashing signal has been reached pressing the Selection key again will start with the first flashing signal.

Depending on LOC: Sign.caus.Sign.Panelthe cause of a flashing signal may be set. Either each status change of the binary information or only “incoming” edges for transient signals will lead to a flashing signal. The status change is generally shown as ’storing” i.e. the flashing signal will remain until it has been acknowledged.

6.10.2.3 Acknowledging Flashing Signals

Acknowledging a flashing signal that has been selected will occur by pressing the CLEAR key ©. This will not reset illuminated LED indicators but will only acknowledge the display. The flashing will stop when the CLEAR key is pressed and a static status display will appear. Then the display will automatically jump to the next flashing signal. This will enable the user to acknowledge any flashing signals by multiple pressing of the CLEAR key. As long as the Selection key is pressed and no resetting has occurred the current page will be continuously displayed (no automatic switching to the next page). The selection will remain active until the time set for LOC: Return time select. has elapsed. When the time has elapsed the display will jump to the next page. During an active selection the user may at any time jump to the next or the previous page by pressing the “up” or “down” keys (similar to the Measured Value Panel and the Event Panel).

6.10.2.4 Status Change Signaling

As long as at least one status change signal in the Signal Panel has not been acknowledged, LOC: Chg.Sig.Panel stat. will show the status change of the Signal Panel as a static signal. This signal is made available in the selection tables for the function groups LED, OUTP, LOGIC, PC, COMM1 and COMM2.

The second internal logic signal LOC: Chg.Sig.Panel flash.. shows the status change of the Signal Panel as an alternating signal with a frequency of about 0.5 Hz. This signal is only made available in the selection tables for the function groups LED, OUTP and LOGIC. It is generated independent of the operating mode as set in LOC: Sign.caus.Sign.Panel; for example a LED configured to this signal will also be triggered as flashing even if the operating mode is set to *Without signalling*.

In order to be able to continue with the processing of flashing signals the device has two internal logic signals available.

	Description	Display
Step 1	Example of a Signal Panel with status display by status markers (squares)	Signals 23:56:10 ■INP: State U 1604 □MAIN: M.c.b. trip Vref EXT ■FT_RC: Fault mem. overflow ■LOC: Rem.acc.block.active ■OUTP: Outp. relays blocked □PSS: Activate PS 3 EXT ■LOGIC: Reset 3 EXT
Step 2	Example of a Signal Panel with status display by status markers (squares) and highlighting of lines	Signals 23:56:10 ■INP: State U 1604 □MAIN: M.c.b. trip Vref EXT ■FT_RC: Fault mem. overflow ■LOC: Rem.acc.block.active ■OUTP: Outp. relays blocked □PSS: Activate PS 3 EXT ■LOGIC: Reset 3 EXT
Step 3a	Example of the selection of a status display with status markers.	>SFMON: Battery failure
	Cursor “>” is flashing.	>SFMON: Battery failure
Step 3b	Example of the selection of a status display with status markers and highlighting of text.	>SFMON: Battery failure
	Cursor “>” and highlighted text are flashing.	>SFMON: Battery failure

6.10.3 Measured Value Panels on the Graphic Display

The measured values that will be displayed on the Measured Value Panels can first be selected in the menu tree under Par/Conf/LOC. The user can select different sets of measured values for the Operation Panel, the Overload Panel, the Ground Fault Panel, and the Fault Panel. Only the Measured Value Panels relevant for the particular design version of the given device and its associated range of functions are actually available. The selected set of values for the Operation Panel is always available. Please see the section entitled “Setting a List Parameter” (Section 6.11.5, (p. 6-34)) for instructions regarding selection. The measured value display can be structured by inserting a dummy or placeholder in the list of selected measured values. If the `MAIN: Without function` setting has been selected for a given panel, then that panel is disabled.

The Measured Value Panels are called up according to system conditions. If, for example, the device detects an overload or a ground fault, then the corresponding Measured Value Panel will be displayed as long as the overload or ground fault situation exists. If the device detects a fault, then the Fault Panel is displayed and remains active until the measured fault values are reset, by pressing the CLEAR key ⓒ, for example.

	Control Step / Description	Control Action	Display

Step 0	The uppermost line of the display shows the type of measured values being displayed. In this example, the display shows measured operating values (abbreviated as “Meas. values”). The time of day is shown at the upper right of the display.
	Up to six selected measured values can be displayed on the Panel simultaneously.
			`Meas.values 16:57:33`
			
			`Voltage A-B prim.`
			`20.7 kV`
			`Voltage B-C prim.`
			`20.6 kV`
			`Voltage C-A prim.`
			`20.8 kV`
			`Current A prim.`
			`415 A`
			`Current B prim.`
			`416 A`
			`Current C prim.`
			`417 A`
			`↓↑`

Step 1	If more than six measured values have been selected, they can be viewed one page at a time by pressing the “up” or ”down” keys. The device will also show the next page of the Measured Value Panel after the set Hold-time for Panels (setting in menu tree: “Par/Conf/ LOC”) has elapsed.	or	`Meas.values 16:57:35`
			
			`Voltage A-B norm.`
			`0.7 kV`
			`Voltage B-C norm.`
			`0.6 kV`
			`Voltage C-A norm.`
			`0.8 kV`
			`Current A norm.`
			`1.5 A`
			`Current B norm.`
			`1.6 A`
			`Current C norm.`
			`1.7 A`
			`↓↑`

6.10.4 Event Panel on the Graphic Display

The Event Panel shows the signals relevant for operation, each with the complete time tag (date and time of day). A maximum of three signals are displayed. The Event Panel is based on entries in the operating data memory (menu tree: “Oper/Rec/OP_RC”).

	Control Step / Description	Control Action	Display
Step 0	The uppermost line of the display shows the panel designation and the current time of day. Below this line, the signals are shown in chronological order. The arrows at the bottom of the display area indicate that additional signals can also be displayed.		Events 16:57:33 20.04.13 05:21:32.331 MAIN Trip command Start 05:21:35.501 MAIN Trip command End 21.04.13 00:03:57.677 MAIN Blocked/faulty Start ↓↑
Step 1	Pressing the “up” or “down” keys will display the signals one at a time.	 or 	Events 16:57:35 05:21:35.501 MAIN Trip command End 21.04.13 00:03:57.677 MAIN Blocked/faulty Start 08:10:59.688 GRUND Blocked/faulty End ↓↑

6.11 Control at the Menu Tree Level

6.11.1 Navigation in the Menu Tree

Folders and Function Groups

All data points are organized in different folders based on practical control requirements.

At the root of the menu tree is the unit type; the tree branches into the three main folders “Settings”, “Measurements & Tests” and “Fault & Event Records”, which form the first folder level. Up to two further folder levels follow so that the entire folder structure consists of three main branches and a maximum of three folder levels.

At the end of each branch of folders are the various function groups in which the individual data points (settings) are combined.

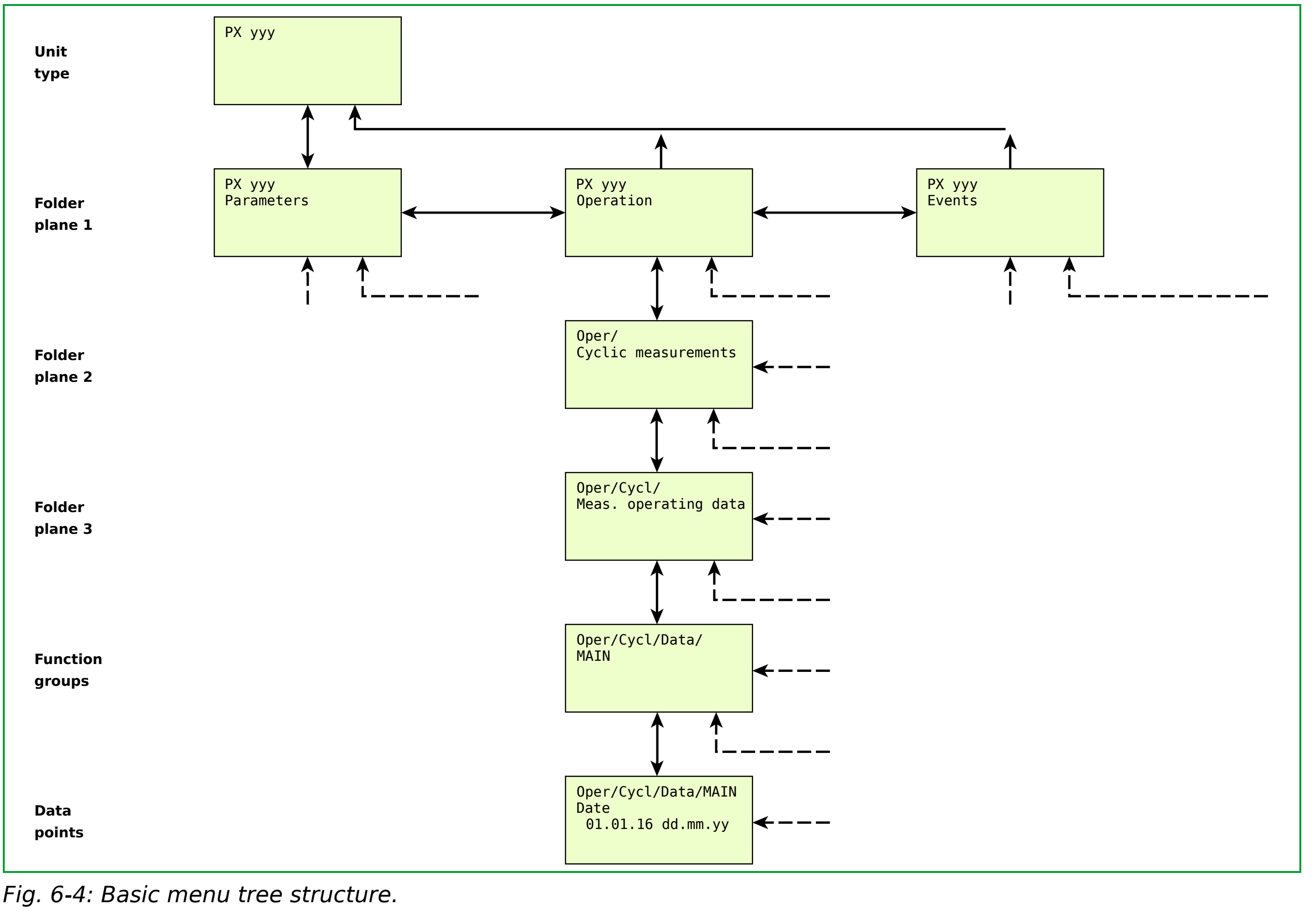


Fig. 6-4: Basic menu tree structure.

6.11.2 Switching Between Address Mode and Plain Text Mode

The display on the local control panel can be switched between address mode and plain text mode. In the address mode the display shows settings, signals, and measured values in numerically coded form, that is, as addresses. In plain text mode the settings, signals, and measured values are displayed in the form of plain text descriptions. In either case, control is guided by the menu tree. The active branch of the menu tree is displayed in plain text in both modes. In the following examples, the display is shown in plain text mode only.

	Control Step / Description	Control Action	Display

Step 0	In this example, the user switches from plain text mode to address mode.		`Par/Func/Glob/MAIN`
			`Device online`
			`No (=off)`

Step 1	To switch from address mode to plain text mode or vice versa, press the CLEAR key and either the “left” key or the “right” key simultaneously. This can be done at any point in the menu tree.	
		+
		
		or
		
			`Par/Func/Glob/MAIN`
			`003.030`
			`0`

6.11.3 Change-Enabling Function

Although it is possible to select any data point in the menu tree and read the associated value by pressing the keys, it is not possible to switch directly to the input mode. This safeguard prevents unintended changes in the settings.

There are two ways to enter the input mode.

- **Global change-enabling function:** To activate the global change-enabling function, set the LOC: Param. change enabl. parameter to *Yes* (menu tree: Oper/CtrlTest/LOC).

  The change can only be made after the password has been entered. Thereafter, all further changes – with the exception of specially protected control actions (see Section 6.11.8, (p. 6-41)) – are enabled without entering the password.

- **Selective change-enabling function**: Password input prior to any setting change.

  This setup is designed to prevent accidental output and applies even when the global change-enabling function has been activated. The following example is based on the factory-set password. If the password has been changed by the user (see Section 6.11.9, (p. 6-43)), the following description will apply accordingly.

	Control Step / Description	Control Action	Display

Step 0	In the menu tree Oper/CtrlTest/LOC, select the `LOC: Param. change enabl.` parameter.		`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`

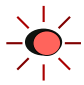
Step 1	Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`
			`********`

Step 2	Press the following keys in sequence:
	“Left”
			`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`
			`*`

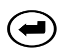
	“Right”		`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`
			` *`

	“Up”		`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`
			`  *`

	“Down”
	The display will change as shown in the column on the right.
			`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`
			`   *`

	Now press the enter key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the “up” or “down” keys.
	If an invalid password has been entered, the display shown in Step 1 appears.
		
		
			`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`No`

Step 3	Change the setting to *Yes*.	
		
			`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`Yes`

Step 4	Press the enter key again. The LED indicator will go out. The unit is enabled for further setting changes.		`Oper/CtrlTest/LOC`
			`Param. change enabl.`
			`Yes`

The same procedure applies to any setting change unless the global change-enabling function has been activated. This method is recommended for a single setting change only. If several settings are to be changed, then the global change-enabling function is preferable. In the following examples, the global change-enabling function has been activated.

6.11.3.1 Automatic Return

The automatic return function prevents the change-enabling function from remaining activated after a change of settings has been completed. Once the set return time (`LOC: Autom. return time`, menu tree “Par/Conf/LOC”) has elapsed, the change-enabling function is automatically deactivated, and the display switches to a Measured Value Panel corresponding to the current system condition. The return time is restarted when any of the control keys is pressed.

6.11.3.2 Forced Return

The return described above can be forced from the local control panel by first pressing the “up” key and then holding it down while pressing the CLEAR key.

It is important to press the “up” key first and release it last in order to avoid unintentional deletion of stored data.

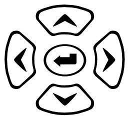
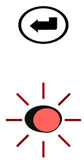
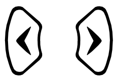
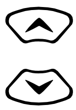
Even when the change-enabling function is activated, not all settings can be changed. For some settings it is also necessary to disable the protective function (MAIN: Device on-line, menu tree: Par/Func/Glob/MAIN). Such settings include the configuration settings, by means of which the device interfaces can be adapted to the system. The following entries in the “Change” column of the “Telegram Documentation” (part of the separately available “DataModelExplorer”) indicate whether values can be changed or not:

- **“on”**: The value can be changed even when the protective function is enabled.
- **“off”**: The value can only be changed when the protective function is disabled.
- **“–”**: The value can be read out but cannot be changed.

The device is factory-set so that the protective function is disabled.

6.11.4 Changing Parameters

If all the conditions for a value change are satisfied, the desired setting can be entered.

	Control Step / Description	Control Action	Display
Step 0	Example of a display. In this example, the change-enabling function is activated and the protective function is disabled, if necessary.		Oper/CtrlTest/LOC Param. change enabl. Yes
Step 1	Select the desired setting by pressing the keys.		Par/Conf/LOC Autom. return time 50000 s
Step 2	Press the ENTER key. The LED indicator labeled EDIT MODE will light up. The last digit of the value is highlighted by a cursor (underlined).		Par/Conf/LOC Autom. return time 50000_ s
Step 3	Press the “left” or “right” keys to move the cursor to the left or right.		Par/Conf/LOC Autom. return time 5000_0 s
Step 4	Change the value highlighted by the cursor by pressing the “up” and “down” keys. In the meantime the device will continue to operate with the old value.		Par/Conf/LOC Autom. return time 5001_0 s
Step 5	Press the ENTER key. The LED indicator labeled EDIT MODE will go out and the device will now operate with the new value. Press the keys to select another setting for a value change.		Par/Conf/LOC Autom. return time 50010 s
Step 6	If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will go out and the device will continue to operate with the old value. A further setting can be selected for a value change by pressing the keys.		Par/Conf/LOC Autom. return time 50000 s

6.11.5 List Parameters

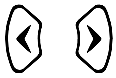
6.11.5.1 Setting a List Parameter

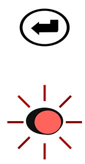
Using list settings, the user is able to select several elements from a list in order to perform tasks such as defining a trip command or defining the measurements that will be displayed on Measured Value Panels. As a rule, the selected elements are linked by an “OR” operator. Other operators (NOT, OR, AND, NOT OR and NOT AND) are available in the LOGIC function group for linking the selected list items. In this way binary signals and binary input signals can be processed in a Boolean equation tailored to meet user requirements. For the DNP 3.0 communication protocol, the user defines the class of a setting instead of assigning operators. The definition of a trip command shall be used here as an illustration.

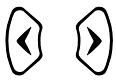
	Control Step / Description	Control Action	Display

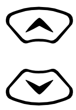
Step 0	Select a list setting (in this example, the parameter `MAIN: Fct.assig.trip cmd.1` at “Par/Func/Glob/ MAIN” in the menu tree). The down arrow (↓) indicates that a list setting has been selected.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			
			`↓`

Step 1	Press the “down” key. The first function and the first selected signal will appear in the third and fourth lines, respectively. The symbol “#01” in the display indicates the first item of the selection. If `MAIN: Without function` appears for the first item, then this means that no function assignment has yet been made.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`#01 DIST`
			`Trip zone 1`

Step 2	Scroll through the list of assigned functions by pressing the “right” and “left” keys.
	
	Once the end of the list is reached, the display shown on the right will appear.
			`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`OR #02 DIST`
			`Trip zone 2`
			
			`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`#05 MAIN`
			`?????`

Step 3	Press the ENTER key at any position in the list. The LED indicator labeled EDIT MODE will light up.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`#02 DIST`
			`Trip zone 2`

Step 4	Scroll through the assignable functions by pressing the “right” and “left” keys in the input mode.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`#02 DIST`
			`Trip zone 4`

Step 5	Select the operator or the class using the “up” and “down“ keys. In this particular case, only the “OR” operator can be selected. There is no limitation on the selection of classes.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`OR #02 DIST`
			`Trip zone 4`

Step 6	Press the ENTER key. The LED indicator will go out. The assignment has been made. The unit will now operate with the new settings.
	If no operator has been selected, the “OR” operator is **always** assigned automatically when the ENTER key is pressed. There is no automatic assignment of classes.
			`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`OR #02 DIST`
			`Trip zone 4`

Step 7	Press the “up” key to exit the list at any point in the list.		`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			
			`↓`

Step 8	If you wish to reject the new setting while you are still entering it (LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator labeled EDIT MODE will be extinguished.	
		C
			`Par/Func/Glob/MAIN`
			`Fct.assign.trip cmd.`
			`OR #02 DIST`
			`Trip zone 2`

6.11.5.2 Deleting a List Parameter

If MAIN: Without function is assigned to a given item, then all the following items are deleted. If this occurs for item #01, everything is deleted.

6.11.6 Memory Readout

Memories can be read out after going to the corresponding entry point. This does not necessitate activating the change-enabling function or even disabling the protective functions. Inadvertent clearing of a memory at the entry point is not possible.

The following memories are available:

- In the menu tree “Oper/Rec/OP_RC”: Operating data memory
- In the menu tree “Oper/Rec/MT_RC”: Monitoring signal memory
- Event memories
  - In the menu tree “Events/Rec/FT_RC”: Fault memories 1 to 8
  - In the menu tree “Events/Rec/OL_RC”: Overload memories 1 to 8
  - In the menu tree “Events/Rec/GF_RC”: Ground fault memories 1 to 8

Not all of these event memories are present in each unit.

6.11.6.1 Readout of the Operating Data Memory

The operating data memory contains stored signals of actions that occur during operation, such as the enabling or disabling of a device function. A maximum of 100 entries is possible, after which the oldest entry is overwritten.

	Control Step / Description	Control Action	Display

Step 0	Select the entry point for the operating data memory.		`Oper/Rec/OP_RC`
			`Operat. data record.`
			`↓`

Step 1	Press the “down” key to enter the operating data memory. The latest entry is displayed.		`Oper/Rec/OP_RC`
			`01.01.13 11:33 ARC`
			`Enabled USER`
			`No`

Step 2	Press the “left” key repeatedly to display the entries one after the other in chronological order. Once the end of the operating data memory has been reached, pressing the “left” key again will have no effect.		`Oper/Rec/OP_RC`
			`01.01.13 11:33 PSIG`
			`Enabled USER`
			`Yes`

Step 3	Press the “right” key to display the previous entry.		`Oper/Rec/OP_RC`
			`01.01.13 11:33 ARC`
			`Enabled USER`
			`No`

Step 4	Press the “up” key at any point within the operating data memory to return to the entry point.		`Oper/Rec/OP_RC`
			`Operat. data record.`
			`↓`

6.11.6.2 Readout of the Monitoring Signal Memory

If the unit detects an internal fault in the course of internal self-monitoring routines or if it detects power system conditions that prevent flawless functioning of the unit, then an entry is made in the monitoring signal memory. A maximum of 30 entries is possible. After that an “overflow” signal is issued.

	Control Step / Description	Control Action	Display

Step 0	Select the entry point for the monitoring signal memory.		`Oper/Rec/MT_RC`
			`Mon. signal record.`
			`↓`

Step 1	Press the “down” key to enter the monitoring signal memory. The oldest entry is displayed.		`Mon. signal record.`
			`01.01.13 13:33 SFMON`
			`Checksum error param`

Step 2	Press the “right” key repeatedly to display the entries one after the other in chronological order. If more than 30 monitoring signals have been entered since the last reset, the “overflow” signal is displayed as the last entry.		`Mon. signal record.`
			`01.01.13 10:01 SFMON`
			`Exception oper. syst.`

Step 3	Press the “left” key to display the previous entry.		`Mon. signal record.`
			`01.01.13 13:33 SFMON`
			`Checksum error param`

Step 4	If the “down” key is held down while a monitoring signal is being displayed, the following additional information will be displayed:
	● **First**
	Time when the signal first occurred
	● **Updated**
	The fault is still being detected (Yes) or is no longer detected (No) by the self-monitoring function.
	● **Acknowledged**
	The fault was no longer detected by the self-monitoring function and has been reset (Yes).
	● **Number**
	The signal occurred x times.
			`Mon. signal record.`
			`01.01.13 13:33 SFMON`
			`Checksum error param`

			`First:   13:33:59.744`
			`Updated: Yes`
			`Acknowledged:   No`
			`Number:    5`

Step 5	Press the “up” key at any point within the monitoring signal memory to return to the entry point.		`Oper/Rec/MT_RC`
			`Mon. signal record.`
			`↓`

6.11.6.3 Readout of the Event Memories (Records)

There are eight event memories for each type of event. The latest event is stored in event memory 1, the previous one in event memory 2, and so forth.

Readout of event memories is illustrated using the fault memory as an example.

	Control Step / Description	Control Action	Display

Step 0	Select the entry point for the first fault memory, for example. If the memory contains entries, the third line of the display will show the date and time the fault began. If the third line is blank, then there are no entries in the fault memory.		`Events/Rec/FT_RC`
			`Fault recording 1`
			`01.01.13  10:00:33`
			`↓`

Step 1	Press the “down” key to enter the fault memory. First, the fault number is shown. In this example it is the 22nd fault since the last reset.		`Fault recording 1`
			`FT_RC`
			`Event`
			`22`

Step 2	Press the “right” key repeatedly to see first the measured fault data and then the binary signals in chronological order. The time shown in the second line is the time, measured from the onset of the fault, at which the value was measured or the binary signal started or ended.
	Once the end of the fault has been reached (after the “right” key has been pressed repeatedly), pressing the “right” key again will have no effect.
			`Fault recording 1`
			`200 ms    FT_DA`
			`Running time`
			`0.17 s`

			`Fault recording 1`
			`0 ms    FT_RC`
			`Record. in progress`
			`Start`

			`Fault recording 1`
			`241 ms    FT_RC`
			`Record. in progress`
			`End`

Step 3	Press the “left” key to see the previous measured value or the previous signal.		`Fault recording 1`
			`0 ms    FT_RC`
			`Record. in progress`
			`Start`

Step 4	Press the “up” key at any point within the fault memory to return to the entry point.		`Events/Rec/FT_RC`
			`Fault recording 1`
			`01.01.13  10:00:33`
			`↓`

6.11.7 Resetting

All information memories – including the event memories and the monitoring signal memory – as well as the LED indicators can be reset manually. In addition, the LED indicators are automatically cleared and initialized at the onset of a new fault – provided that the appropriate operating mode has been selected – so that they always indicate the latest fault.

The LED indicators can also be reset manually by pressing the CLEAR key, which is always possible in the standard control mode. This action also triggers an LED indicator test and an LCD display test. The event memories are not affected by this action, so that inadvertent deletion of the records associated with the reset signal pattern is reliably prevented.

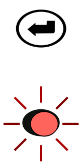
Because of the ring structure of the event memories, the data for eight consecutive events are updated automatically so that manual resetting should not be necessary, in principle.

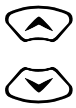
Deleting the event memories completely (e.g. after a function test), can be accomplished by various resetting actions including the configuration of a group resetting for several memories. An overview of all resetting actions can be found in section “Resetting Actions” in Chapter “Operation”.

Resetting a single memory from the local control panel is described in the following with the example of a fault memory. In this example the global change-enabling function has already been activated.

	Control Step / Description	Control Action	Display

Step 0	Select the reset setting. Line 3 of the display shows the number of faults since the last reset, 10 in this example.		`Oper/CtrlTest/FT_RC`
			`Reset recording`
			`10`

Step 1	Press the ENTER key. The LED indicator labeled EDIT MODE will light up.		`Oper/CtrlTest/FT_RC`
			`Reset recording`
			`10`
			`Don't execute`

Step 2	Press the “Up” or “Down” keys to change the setting to *Execute*.		`Oper/CtrlTest/FT_RC`
			`Reset recording`
			`10`
			`Execute`

Step 3	Press the ENTER key. The LED indicator labeled EDIT MODE will be extinguished. The value in line 3 is reset to *0*.		`Oper/CtrlTest/FT_RC`
			`Reset recording`
			`0`

Step 4	To cancel the intended clearing of the fault recordings after leaving the standard control mode (the LED indicator labeled EDIT MODE is on), press the CLEAR key. The LED indicator will be extinguished, and the fault recordings remain stored unchanged in the protection unit’s memory. Any setting can be selected again for a value change by pressing the keys.		`Oper/CtrlTest/FT_RC`
			`Reset recording`
			`10`

6.11.8 Password-Protected Control Actions

Certain actions from the local control panel such as a manual trip command for testing purposes can only be carried out by entering a password so as to prevent unwanted output even though the global change-enabling function has been activated (see Section 6.11.3, (p. 6-30)).

This setup is designed to prevent accidental output and applies even when the global change-enabling function has been activated. The password consists of a pre-defined sequential key combination entered within a specific time interval. If the password has been changed by the user (see Section 6.11.9, (p. 6-43)), the following description will apply accordingly.

	Control Step / Description	Control Action	Display

Step 0	In the menu tree “Oper/CtrlTest/MAIN”, select the parameter `MAIN: Man. trip cmd. USER`.		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`

Step 1	Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`
			`********`

Step 2	Press the following keys in sequence:
	“Left”
			`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`
			`*`

	“Right”		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`
			` *`

	“Up”		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`
			`  *`

	“Down”
	The display will change as shown in the column on the right.
			`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`
			`   *`

	Now press the enter key. The LED indicator labeled EDIT MODE will light up. This indicates that the setting can now be changed by pressing the “up” or “down” keys.		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`

Step 3	Change the setting to *execute*.		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Execute`

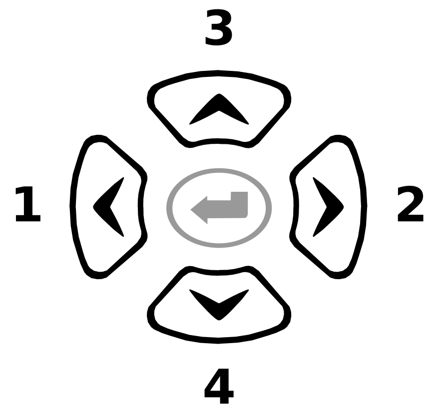
Step 4	Press the enter key again. The LED indicator labeled EDIT MODE will go out. The unit will execute the command.		`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`

Step 5	As long as the LED indicator labeled EDIT MODE is on, the control action can be terminated by pressing the CLEAR key. The LED indicator labeled EDIT MODE will be extinguished.	C	`Oper/CtrlTest/MAIN`
			`Man. trip cmd. USER`
			`Don't execute`

6.11.9 Changing the Password

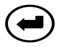
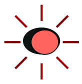
6.11.9.1 Local Control Panel with Password Protection

The password consists of a combination of keys that must be entered sequentially within a specific time interval. The “left”, “right”, “up” and “down” keys may be used to define the password and represent the numbers 1, 2, 3 and 4, respectively:



The password can be changed by the user at any time. The procedure for this change is described below. The starting point is the factory-set password.

	Control Step / Description	Control Action	Display
Step 0	In the menu tree “Par/Conf/LOC”, select the LOC: Password setting.		Par/Conf/LOC Password ********
Step 1	Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Par/Conf/LOC Password ******** ********
Step 2	Press the “left”, “right”, “up” and “down” keys to enter the valid password. The display will change as shown in the column on the right.		Par/Conf/LOC Password ******** *
			Par/Conf/LOC Password ******** *
			Par/Conf/LOC Password ******** *
			Par/Conf/LOC Password ******** *
Step 3	Now press the enter key. The LED indicator labeled EDIT MODE will light up. The third line shows an underscore character (_) as the prompt for entering a new password.		Par/Conf/LOC Password _
Step 4	Enter the new password, which in this example is done by pressing the “up” key followed by the “down” key.		Par/Conf/LOC Password *
			Par/Conf/LOC Password **
Step 5	Press the enter key again. Asterisks appear in the third line, and a cursor (underscore) in the fourth line prompts the user to enter the new password again.		Par/Conf/LOC Password ** _
Step 6	Re-enter the password.		Par/Conf/LOC Password ** *
			Par/Conf/LOC Password ** **

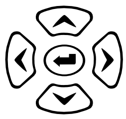
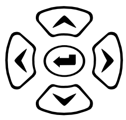
	Control Step / Description	Control Action	Display
Step 7a	Press the ENTER key again. If the password has been re-entered correctly, the LED indicator labeled EDIT MODE goes out and the display appears as shown on the right. The new Password is now valid.		Par/Conf/LOC Password ********
Step 7b	If the password has been re-entered incorrectly, the LED indicator labeled EDIT MODE remains on and the display shown on the right appears. The password has to be re-entered. It is also possible to cancel the change of the Password by pressing the CLEAR key (see Step 8).		Par/Conf/LOC Password ** _
Step 8	The change in password can be canceled at any time before Step 7 by pressing the CLEAR key. If this is done, the original Password continues to be valid.		Par/Conf/LOC Password ********

6.11.9.2 Local Control Panel without Password Protection

Operation from the local control panel without password protection is also possible. To select this option, immediately press the ENTER key a second time in steps 4 and 6 of Table, (p. 6-44), without entering anything else. This will configure the local control panel without password protection, and no control actions involving changes will be possible until the global change-enabling function has been activated (see “Change-Enabling Function”, Section 6.11.3, (p. 6-30)).

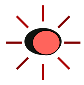
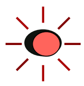
6.11.9.3 Display the Password

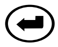
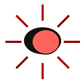
If the configured password has been forgotten, it can be called up on the LCD display as described below. The procedure involves turning the device off and then on again.

	Control Step / Description	Control Action	Display
Step 0	Turn off the device.		
Step 1	Turn the device on again. At the very beginning of device startup, press the four directional keys (“left”, “right”, “up” and “down”) at the same time and hold them down.		TEST
Step 2	When this condition is detected during startup, the password is displayed.		Password 1234
Step 3	After the four keys are released, startup will continue.		TEST

6.11.9.4 Changing and Displaying the L/R Password

In order to enable local control on devices fitted with the graphic display HMI (ordering option) the L/R password has to be entered.

	Control Step / Description	Control Action	Display
Step 0	In the menu tree “Par/Conf/LOC”, select the `LOC: Password L/R` setting.		Par/Conf/LOC Password L/R ********
Step 1	Press the ENTER key. Eight asterisks (*) appear in the fourth line of the display.		Par/Conf/LOC Password L/R ******** ********
Step 2	Press the “left”, “right”, “up” and “down” keys to enter the valid **general** password. The display will change as shown in the column on the right.		Par/Conf/LOC Password L/R ******** *
			Par/Conf/LOC Password L/R ******** *
			Par/Conf/LOC Password L/R ******** *
			Par/Conf/LOC Password L/R ******** *
Step 3	Now press the enter key. The red LED indicator labeled EDIT MODE will be illuminated. The current Password L/R will appear in the third line.	 	Par/Conf/LOC Password L/R 1423
Step 4	Enter the new password, which in this example is done by pressing the “up” key followed by the “down” key.		Par/Conf/LOC Password L/R *
			Par/Conf/LOC Password L/R **
Step 5	Press the enter key again. Asterisks appear in the third line, and a cursor (underscore) in the fourth line prompts the user to enter the new Password L/R again.	 	Par/Conf/LOC Password L/R ** _
Step 6	Re-enter the new Password L/R.		Par/Conf/LOC Password L/R ** *

	Control Step / Description	Control Action	Display
			Par/Conf/LOC Password L/R ** **
Step 7a	Press the ENTER key again. If the new Password L/R has been re-entered correctly, the red LED indicator labeled EDIT MODE will be extinguished and the display appears as shown on the right. The new Password L/R is now valid.		Par/Conf/LOC Password L/R ********
Step 7b	If the new Password L/R has been re-entered incorrectly, the red LED indicator labeled EDIT MODE remains illuminated and the display shown on the right hand side appears. The new Password L/R needs to be re-entered. It is also possible to cancel the change of the Password L/R by pressing the CLEAR key (see Step 8).		Par/Conf/LOC Password L/R ** _
Step 8	The change of the Password L/R can be canceled at any time before Step 7 by pressing the CLEAR key. If this is done, the original Password L/R continues to be valid.		Par/Conf/LOC Password L/R ********

7 Settings

7.1 Parameters

The P139 must be adjusted to the system and to the protected equipment by appropriate settings. This chapter gives instructions for determining the settings, which are located in the folder titled “Parameters” in the menu tree. The sequence in which the settings are listed and described in this chapter corresponds to their sequence in the menu tree.

The P139 devices are supplied with a factory-set standard configuration of settings that, in most cases, correspond to the default settings or become apparent after a “cold restart”. The P139 is blocked in that case. All settings must be re-entered after a cold restart.

Note

Detailed information about all parameters, including complete selection tables and IEC 60870-5-103 protocol properties, are separately available as a set of interlinked PDF files for user-friendly navigation, packed in one ZIP archive named DataModelExplorer_P139_en_P01.zip.

*In contrast to P139 versions before P139-630, the implementation of the IEC 61850 protocol now features parameters that can**not** be modified from the local control panel (HMI) or with the operating program. Instead, these parameters are set with a special IEC 61850 operating software, named “IED Configurator”.*

Therefore these settings are not listed in this chapter or the following chapter. These parameters are described in Chapter “IEC 61850 Settings via IED Configurator”.

Cancelling a Protection or Control Function

The user can adapt the device to the requirements of a particular high-voltage system by including the relevant protection or control functions in the device configuration and cancelling all others (removing them from the device configuration).

The following conditions must be met before cancelling a protection or control function:

- The protection or control function in question must be disabled.
- None of the functions of the protection or control function to be cancelled may be assigned to a binary input.
- None of the signals of the protection or control function may be assigned to a binary output or an LED indicator.
- No functions of the device function being cancelled can be selected in a list setting.
- None of the signals of the protection or control function may be linked to other signals by way of an “m out of n” parameter.

The protection or control function to which a parameter, a signal, or a measured value belongs is defined by the function group designation (example: “LIMIT:”).

General Notes on the Configuration of Function Group “Binary Input” (INP)

The P139 has optical coupler inputs for processing binary signals from the system. The number and connection schemes for the available binary inputs are shown in the terminal connection diagrams. The “*DataModelExplorer*” (available as a separate ZIP archive file) gives information about the configuration options for all binary inputs.

The P139 identifies the installed modules during startup. If a given binary I/O module is not installed or has fewer binary signal inputs than the maximum number possible at this slot, then the configuration addresses for the missing binary signal inputs are automatically hidden in the menu tree.

When configuring binary inputs, one should keep in mind that the same function can be assigned to several signal inputs. Thus one function can be activated from several control points having different signal voltages.

The configuration in slots A and B and the configuration for the binary inputs U C01 to U C08 will be changed with the selection of a new bay type. (Whether automatic configuration occurs, is defined in the setting MAIN: Auto-assignment I/O.) Depending on the connection type chosen for the P139 – pin-type or ring-type cable socket terminals – the symbolic slots A, B and C refer to the following slots:

Symbolic slot	Pin-type cable socket terminals	Ring-type cable socket terminals
A	06	12
B	07	14
C	08	16

The configuration of binary inputs for each bay type – in the case of auto-assignment – is given in the List of Bay Types in the Appendix.

In the case of auto-assignment, the following notes apply:

Before selecting a new bay type, make sure that the binary inputs at slots A and B as well as the binary inputs U C01 to U C08 are configured for functions from the DEVxx function groups only. Otherwise there will be an error message, and the new bay type will not be activated.

Before selecting a new bay type, make sure that all binary inputs specified in the List of Bay types for the selected bay type are actually available in the device. Otherwise there will be an error message, and the new bay type will not be activated.

In order to ensure that the device will recognize the input signals, the triggering signals must persist for at least 30 ms. The operating mode for each binary signal input can be defined.

The user can specify whether the presence (*active 'high'* mode) or absence (*active 'low'* mode) of a voltage shall be interpreted as the logic "1" signal.

General Notes on the Configuration of Function Group "Binary Output" (OUTP)

The P139 has output relays for the output of binary signals. The number and connection schemes for the available binary output relays are shown in the terminal connection diagrams. The "*DataModelExplorer*" (available as a separate ZIP archive file) gives information about the configuration options for all binary outputs.

The P139 identifies the installed modules during startup. If a given binary I/O module is not installed or has fewer output relays than the maximum number possible at this slot, then the configuration addresses for the missing output relays are automatically hidden in the menu tree.

The contact data for the all-or-nothing relays permits them to be used either as command relays or as signal relays. It is important to note that the contact rating of the binary I/O modules (X) varies (see Chapter “Technical Data”). One signal can also be assigned simultaneously to several output relays for the purpose of contact multiplication.

Selecting a new bay type can change the configuration for slots A and B. (Whether automatic configuration occurs, is defined in the setting MAIN: Auto-assignment I/O.) Depending on the connection type chosen for the P139 – pin-type or ring-type cable socket terminals – the symbolic slots A and B correspond to the following slots:

Symbolic slot	Pin-type cable socket terminals	Ring-type cable socket terminals
A	06	12
B	07	14

The configuration of output relays for each bay type – in the case of auto-assignment – is given in the List of Bay Types in the Appendix.

In the case of auto-assignment, the following notes apply:

Before selecting a new bay type, make sure that the output relays at slots A and B are configured for functions from the DEVxx function groups only. Otherwise there will be an error message, and the new bay type will not be activated.

Before selecting a new bay type, make sure that all output relays specified in the List of Bay types for the selected bay type are actually available in the device. Otherwise there will be an error message, and the new bay type will not be activated.

An operating mode can be defined for each output relay. Depending on the selected operating mode, the output relay will operate in either an energize-on-signal (ES) mode or a normally-energized (NE) mode and in either a latching or non-latching mode. For output relays operating in latching mode, the operating mode setting also determines when latching will be cancelled.

General Notes on the Configuration of the LED Indicators

The P139 has LED indicators for parallel display of binary signals. LED indicator H 1 is not configurable. It is labeled “HEALTHY” and signals the operational readiness of the protection unit (supply voltage present). LED indicators H 2 and H 3 are not configurable either. H 2 is labeled “OUT OF SERVICE” and signals a blocking or malfunction; H 3 is labeled “ALARM” and signals a warning alarm. LED indicator H 17 indicates that the user is in the “EDIT MODE”. Section “Configuration and Operating Mode of the LED Indicators (Function Group LED)” in Chapter “Operation” describes the layout of the LED indicators and the factory setting for LED indicator H 4.

An operating mode can be defined for each LED indicator. Depending on the set operating mode, the LED indicator will operate in either energize-on-signal (ES) mode (“open-circuit principle”) or normally-energized (NE) mode (“closed-circuit principle”) and in either latching or non-latching mode. For LED indicators operating in latching mode, the operating mode setting also determines when latching will be cancelled.

With the multi-color LED indicators (H 4 – H 16) the colors red and green can be independently assigned with functions. The third color amber results as a mixture of red and green, i.e. when both functions assigned to the LED indicator are simultaneously present.

7.1.1 Device Identification

The device identification settings are used to record the ordering information and the design version of the P139. They have no effect on the device functions. These settings should only be changed if the design version of the P139 is modified.

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**

Device

DVICE: Device type				000 000
139	0	65535		

The device type is displayed. This display cannot be altered.

DVICE: SW date				002 122
1997-01-01	1997-01-01	2098-11-08	dd.mm.yy	

Date the software was created. This display cannot be altered.

Note: The centuries are not displayed. The supported dates range from January 1st, 1997, until November 7th, 2098.

DVICE: SW version communic.				002 103
Not measured	0.00	655.35		

Software version for the device's communication software. This display cannot be altered.

DVICE: DM IEC 61850 version				002 059
Not measured	0	65535		

Software version of the communication software based on the device's protocol per IEC 61850. This display cannot be altered.

DVICE: Language version				002 123
0.0	0.0	899.9		

Identification of the change level of the texts of the data model. This display cannot be altered.

DVICE: Text vers.data model				002 121
0	0	255		

Using the ‘text replacement tool' provided by the operating program, the user can change the parameter descriptors (plain text designations) and load them into the device. These customized data models contain an identifier defined by the user while preparing the data model. This identifier is displayed at this point in the menu tree. Standard data models have the identifier ‘0' (factory-set default).

DVICE: F number				002 124
0	0	9999		

The F number is the serial number of the device. The display cannot be altered.

DVICE: AFS Order No.				001 000
0:				

DVICE: PCS Order No.				001 200
0:				

Order numbers for the device. The user cannot alter this number.

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DVICE: Order ext. No. 1				000 003
0	0	999		
DVICE: Order ext. No. 2				000 004
0	0	999		
DVICE: Order ext. No. 3				000 005
0	0	999		
DVICE: Order ext. No. 4				000 006
0	0	999		
DVICE: Order ext. No. 5				000 007
0	0	999		
DVICE: Order ext. No. 6				000 008
0	0	999		
DVICE: Order ext. No. 7				000 009
0	0	999		
DVICE: Order ext. No. 8				000 010
0	0	999		
DVICE: Order ext. No. 9				000 011
0	0	999		
DVICE: Order ext. No. 10				000 012
0	0	999		
DVICE: Order ext. No. 11				000 013
0	0	999		
DVICE: Order ext. No. 12				000 014
0	0	999		
DVICE: Order ext. No. 13				000 015
0	0	999		
DVICE: Order ext. No. 14				000 016
0	0	999		
DVICE: Order ext. No. 15				000 017
0	0	999		
DVICE: Order ext. No. 16				000 018
0	0	999		
DVICE: Order ext. No. 17				000 019
0	0	999		
DVICE: Order ext. No. 18				000 020
0	0	999		
DVICE: Order ext. No. 19				000 021
0	0	999		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DVICE: Order ext. No. 20				000 022
0	0	999		
DVICE: Order ext. No. 21				000 023
0	0	999		
DVICE: Order ext. No. 22				000 024
0	0	999		
DVICE: Order ext. No. 23				000 025
0	0	999		
DVICE: Order ext. No. 24				000 026
0	0	999		
DVICE: Order ext. No. 25				000 027
0	0	999		
DVICE: Order ext. No. 26				000 028
0	0	999		
DVICE: Order ext. No. 27				000 029
0	0	999		
Order extension numbers for the device.				
DVICE: Module var. slot 1				086 050
65535: Not fitted				
DVICE: Module var. slot 2				086 051
65535: Not fitted				
DVICE: Module var. slot 3				086 052
65535: Not fitted				
DVICE: Module var. slot 4				086 053
65535: Not fitted				
DVICE: Module var. slot 5				086 054
65535: Not fitted				
DVICE: Module var. slot 6				086 055
65535: Not fitted				
DVICE: Module var. slot 7				086 056
65535: Not fitted				
DVICE: Module var. slot 8				086 057
65535: Not fitted				
DVICE: Module var. slot 9				086 058
65535: Not fitted				
DVICE: Module var. slot 10				086 059
65535: Not fitted				

Parameter						Address
Default	Min	Max	Unit			Logic Diagram
DVICE: Module var. slot 11						086 060
65535: Not fitted						
DVICE: Module var. slot 12						086 061
65535: Not fitted						
DVICE: Module var. slot 13						086 062
65535: Not fitted						
DVICE: Module var. slot 14						086 063
65535: Not fitted						
DVICE: Module var. slot 15						086 064
65535: Not fitted						
DVICE: Module var. slot 16						086 065
65535: Not fitted						
DVICE: Module var. slot 17						086 066
65535: Not fitted						
DVICE: Module var. slot 18						086 067
65535: Not fitted						
DVICE: Module var. slot 19						086 068
65535: Not fitted						
DVICE: Module var. slot 20						086 069
65535: Not fitted						
DVICE: Module var. slot 21						086 070
65535: Not fitted						
Item number of the module inserted in the respective slot 1 to 21. The display always shows the actual component configuration at any given time.						
DVICE: Module vers. slot 1						086 193
27: Not fitted						
DVICE: Module vers. slot 2						086 194
27: Not fitted						
DVICE: Module vers. slot 3						086 195
27: Not fitted						
DVICE: Module vers. slot 4						086 196
27: Not fitted						
DVICE: Module vers. slot 5						086 197
27: Not fitted						
DVICE: Module vers. slot 6						086 198
27: Not fitted						
DVICE: Module vers. slot 7						086 199
27: Not fitted						

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DVICE: Module vers. slot 8				086 200
27: Not fitted				
DVICE: Module vers. slot 9				086 201
27: Not fitted				
DVICE: Module vers. slot 10				086 202
27: Not fitted				
DVICE: Module vers. slot 11				086 203
27: Not fitted				
DVICE: Module vers. slot 12				086 204
27: Not fitted				
DVICE: Module vers. slot 13				086 205
27: Not fitted				
DVICE: Module vers. slot 14				086 206
27: Not fitted				
DVICE: Module vers. slot 15				086 207
27: Not fitted				
DVICE: Module vers. slot 16				086 208
27: Not fitted				
DVICE: Module vers. slot 17				086 209
27: Not fitted				
DVICE: Module vers. slot 18				086 210
27: Not fitted				
DVICE: Module vers. slot 19				086 211
27: Not fitted				
DVICE: Module vers. slot 20				086 212
27: Not fitted				
DVICE: Module vers. slot 21				086 213
27: Not fitted				
Index letter specifying the version of the module fitted in the respective slot.				
DVICE: Variant of module A				086 047
65535: Not fitted				
Item number of module A in this design version.				
DVICE: Version of module A				086 190
27: Not fitted				
Index letter specifying the version of module A.				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DVICE: MAC address module A				104 061
2:				
MAC address for the network hardware of the Ethernet module. This address is introduced during manufacture and can only be read.				
DVICE: Variant of module L				086 048
65535: Not fitted				
Item number of module L in this design version.				
DVICE: Version of module L				086 191
27: Not fitted				
Index letter specifying the version of module L.				
DVICE: Variant of module B				086 049
65535: Not fitted				
Item number of module B in this design version.				
DVICE: Version of module B				086 192
27: Not fitted				
Index letter specifying the version of the digital bus module B.				
DVICE: Variant module B (a)				086 046
65535: Not fitted				
Item number of the analog bus module B in this design version.				
DVICE: Version module B (a)				086 189
27: Not fitted				
Index letter specifying the version of the digital bus module B.				
DVICE: IP address				111 000
2:				
DVICE: Subnet mask				111 001
2:				
DVICE: MAC address				111 003
2:				
Display of the IP address (or subnet mask, MAC address, respectively) of the Ethernet interface of the processor module. This can be useful for network analysis, especially if these settings have been retrieved via DHCP.				
DVICE: Customer ID data 1				000 040
0.00	0.00	99.99		
DVICE: Customer ID data 2				000 041
0.00	0.00	99.99		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DVICE: Customer ID data 3				000 042
0.00	0.00	99.99		
DVICE: Customer ID data 4				000 043
0.00	0.00	99.99		
DVICE: Customer ID data 5				000 044
0.00	0.00	99.99		
DVICE: Customer ID data 6				000 045
0.00	0.00	99.99		
DVICE: Customer ID data 7				000 046
0.00	0.00	99.99		
DVICE: Customer ID data 8				000 047
0.00	0.00	99.99		
Set your numerically coded user data here for your records.				
DVICE: Location				001 201
0:				
Reference input for the device's location as selected by user.				
DVICE: Device ID				000 035
0	0	9999		
ID code for use by the PC programs for operating and setting. Further instructions on this setting are given in the description of the respective operating program.				
DVICE: Substation ID				000 036
0	0	9999		
ID code for use by the PC programs for operating and setting. Further instructions on this setting are given in the description of the respective operating program.				
DVICE: Feeder ID				000 037
0	0	9999		
ID code for use by the PC programs for operating and setting. Further instructions on this setting are given in the description of the respective operating program.				
DVICE: Device password 1				000 048
0	0	9999		
DVICE: Device password 2				000 049
0	0	9999		
ID code used by the operating program for identification purposes. See description of the respective operating program for more detailed setting instructions.				

Parameter								Address
Default	**Min**	**Max**	**Unit**					**Logic Diagram**
DVICE: SW version DHMI								002 131
Not measured	0.00	655.35						
DVICE: SW version DHMI DM								002 132
1.10	0.00	655.35						
DVICE: SW vers.Chin.DHMI DM								008 233
1.17	0.00	655.35						

Internal software version numbers.

Local control panel

Parameter								Address
Default	**Min**	**Max**	**Unit**					**Logic Diagram**
LOC: Local HMI exists								221 099
1: Yes								

When set to *Yes* it is apparent that the device is fitted with the local control panel (HMI).

7.1.2 Configuration Parameters

Local control panel

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LOC: Language					003 020
2: Reference language					
Language in which texts will be displayed on the user interface (HMI).					
LOC: Decimal delimiter					003 021
1: Dot					
Character to be used as decimal delimiter on the local control panel.					
LOC: Password					003 035
1234	0	4444			
The password to be used for changing settings from the local control panel can be defined here.					
LOC: Password L/R					221 040
1423	0	4444			
The password used to change the setting from “Remote” to “Local” control can be defined here. (Switching from “Local” to “Remote” control occurs without checking the password.)					
LOC: Displ. ext.dev.desig					221 032
1: With				Fig. 3-3, (p. 3-6)	
This setting defines whether the external device designations shall be displayed on the Bay Panel.					
LOC: Display L/R					221 070
1: With				Fig. 3-3, (p. 3-6)	
This setting defines whether the control site – “Local” or “Remote” – shall be displayed on the bay panel.					
LOC: Displ. interl. stat.					221 071
1: With				Fig. 3-3, (p. 3-6)	
This setting defines whether the “Locked” or “Unlocked” status shall be displayed on the bay panel.					
LOC: Operation mode					011 240
0: LOC Direct					
This setting defines which of the three implemented operating modes the P139 shall use for the local control of switchgear units via LOC.					
LOC: Busbar1 Name by User					218 191
0:					
LOC: Designation busbar 1					221 033
1: BB1				Fig. 3-3, (p. 3-6)	

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOC: Busbar2 Name by User					218 192
0:					
LOC: Designation busbar 2					221 034
2: BB2				Fig. 3-3, (p. 3-6)	
LOC: Busbar3 Name by User					218 193
0:					
LOC: Designation busbar 3					221 043
3: BB3				Fig. 3-3, (p. 3-6)	
Setting for the busbar designations to be displayed on the Bay Panel. At **LOC: Busbar1 Name by User** any text (max. 3 characters) may be entered which will then be used as the designation, if the associated parameter **LOC: Designation busbar 1** has been set to *BB-User Name*. When instead one of the pre-defined designations is selected at **LOC: Designation busbar 1** it will be used and **LOC: Busbar1 Name by User** will be ignored. A designation with more than 3 characters is internally truncated. (The same is true of BB2,...)					
LOC: BB Sect.1-NameUser					218 195
0:					
LOC: Designat. bus sect.1					221 035
1: BSa				Fig. 3-3, (p. 3-6)	
LOC: BB Sect.2-NameUser					218 196
0:					
LOC: Designat. bus sect.2					221 036
2: BSb				Fig. 3-3, (p. 3-6)	
Setting for the busbar section designations to be displayed on the Bay Panel. At **LOC: BB Sect.1-NameUser** any text (max 3 characters) may be entered which will then be used as the designation, if the associated parameter **LOC: Designat. bus sect.1** has been set to *BB-Sect.User Name*. When one of the pre-defined designations is selected at **LOC: Designat. bus sect.1** it will be used and **LOC: BB Sect.1-NameUser** will be ignored. A designation with more than 3 characters is internally truncated. (The same is true of busbar section 2.)					
LOC: Character set					221 038
1: Character set 1				Fig. 3-3, (p. 3-6)	
The user can choose between several character sets to represent switchgear and their switching states on the Bay Panel. **Note:** Character set 3 is identical to character set 1 in the factory default setting, but can be replaced by an user-defined character set, by applying an accessory tool to the operating program.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LOC: Fct. assign. L/R key					225 208
1: R <-> L				Fig. 3-9, (p. 3-13)	
This setting defines whether the (electric) key-operated switch switches between remote / local control (L↔R) or between remote+local control / local control (R&L↔L).					
LOC: Fct. reset key					005 251
060 000: MAIN: Without function				Fig. 3-90, (p. 3-123)	
Selection of counters and memories that are reset by pressing the RESET key on the local control panel. (Resetting LED indicators and measured event values is permanently assigned internally, so that they are always reset when the RESET key is pressed.)					
LOC: Fct. read key					080 110
060 000: MAIN: Without function					
Selection of up to 16 functions to be triggered when pressing the read key. Event counters and event recordings are offered for selection. If several functions have been selected then they will be sequentially triggered by repeated pressing of the read key.					
LOC: Fct. menu jmp list 1					030 238
060 000: MAIN: Without function					
LOC: Fct. menu jmp list 2					030 239
060 000: MAIN: Without function					
Selection of specified functions which will be sequentially displayed by repeated reading of the menu jump list 1 (or 2).					
LOC: Fct. Operation Panel					053 007
060 000: MAIN: Without function				Fig. 3-5, (p. 3-9)	
Definition of the values to be displayed on the Measured Value Panel also referred to as the Operation Panel.					
LOC: Fct. Overload Panel					053 005
060 000: MAIN: Without function				Fig. 3-8, (p. 3-12)	
Definition of the values to be displayed on the Overload Panel.					
LOC: Fct. Grd.Fault Panel					053 004
060 000: MAIN: Without function				Fig. 3-7, (p. 3-11)	
Definition of the values to be displayed on the Ground Fault Panel.					
LOC: Fct. Fault Panel					053 003
060 000: MAIN: Without function				Fig. 3-6, (p. 3-10)	
Definition of the values to be displayed on the Fault Panel.					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOC: Fct. Signal Panel				221 072
060 000: MAIN: Without function				Fig. 3-4, (p. 3-8)
Definition of the values to be displayed on the Signal Panel.				
LOC: Aut.activ.Sign.Panel				221 073
0: Activation off				Fig. 3-4, (p. 3-8)
Activation of the automatic switching to the Signal Panel at every change of state of a configured signal.				
LOC: Stat.ind.Sign.Panel				221 074
1: Filled box				Fig. 3-4, (p. 3-8)
Definition of display type of active / inactive signals on the Signal Panel.				
LOC: Indicat.Sign.Panel				221 075
0: Without signalling				Fig. 3-4, (p. 3-8)
Definition of signal type at change of state and response to an acknowledge command.				
LOC: Sign.caus.Sign.Panel				221 078
1: All status changes				Fig. 3-4, (p. 3-8)
Definition of cause for signaling (every change of state / incoming signals only).				
LOC: Fct.asg. num. displ.				221 041
060 000: MAIN: Without function				Fig. 3-3, (p. 3-6)
Definition of the measured values to be displayed on the Bay Panel in numerical form.				
LOC: Fct. asg. bar displ.				221 042
060 000: MAIN: Without function				Fig. 3-3, (p. 3-6)
Definition of the measured values to be displayed on the Bay Panel in bar form. **Note:** Measured values to be displayed in bar chart form must also be selected for display as numerical measured values. However, not all measured values that can be displayed in numerical form can also be displayed in bar chart form! In such cases, a dummy or placeholder must be included in the selection list for the bar chart display at the same point at which a measured value that cannot be displayed in bar chart form appears in the selection list for numerical measured values. **Example:** Current IB is to be displayed. In this case, either the primary current IB or the per-unit current IB shall be selected for the numerical display. The per-unit current IB shall be entered at the same position in the selection list for the bar chart display.				
LOC: Bar display type				221 039
0: No bar display				Fig. 3-3, (p. 3-6)
Disabling the bar chart display or definition of the orientation of the bar chart to display measured values on the Bay Panel.				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOC: Scal. bar display I					221 044
1: 1.2 Inom				Fig. 3-3, (p. 3-6)	
Scaling of measured current values to be displayed in bar chart form.					
LOC: Scal. bar display V					221 045
1: 1.2 Vnom				Fig. 3-3, (p. 3-6)	
Scaling of measured voltage values to be displayed in bar chart form.					
LOC: Display bar scale					221 046
1: Yes				Fig. 3-3, (p. 3-6)	
Setting this window can disable the scalable bar chart.					
LOC: Hold-time for Panels					031 075
5	1	10	s	Fig. 3-4, (p. 3-8) Fig. 3-5, (p. 3-9)	
Setting for the time period during which a panel is displayed, before switching to the next panel. This setting is only relevant if more values are selected than can be shown on the LC-Display.					
LOC: Hold-t. meas.v.displ					031 072
Blocked	1	60	s		
Always when the time period set here has elapsed the next value will be shown on the Bay Panel display. With a setting to *Blocked* this automatic switching forward to the next measured value will be deactivated. Independent of this the next or the previous configured measured value may be selected by pressing the keys “cursor down” or “cursor up”.					
LOC: Autom. return time					003 014
60	60	60000	s	Fig. 3-4, (p. 3-8) Fig. 3-5, (p. 3-9)	
If the user does not press a key on the local control panel during this set time period, the change-enabling function is deactivated.					
LOC: Return time select.					221 030
60	60	60000	s	Fig. 3-3, (p. 3-6)	
If the user does not press a key on the local control panel during this set time period, then the selection of a switchgear unit is cancelled.					
LOC: Return time illumin.					003 023
60	60	60000	s	Fig. 3-3, (p. 3-6)	
If the user does not press a key on the local control panel during this set time period, then the backlighting of the LCD display is switched off, and any switchgear selection that might have been made is cancelled.					

PC link

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
PC: Bay address					003 068
1	0	254		Fig. 3-10, (p. 3-15)	
PC: Device address					003 069
1	0	255		Fig. 3-10, (p. 3-15)	
Bay and device addresses are used to address the device in communication via the PC interface. An identical setting must be selected for both addresses.					
PC: Baud rate					003 081
115.2: 115.2 kBaud			Baud	Fig. 3-10, (p. 3-15)	
Baud rate of the PC interface.					
PC: Parity bit					003 181
1: Even				Fig. 3-10, (p. 3-15)	
Set the same parity that is set at the interface of the PC connected to the P139.					
PC: Spontan. sig. enable					003 187
0: None				Fig. 3-10, (p. 3-15)	
Enable for the transmission of spontaneous signals via the PC interface.					
PC: Select. spontan.sig.					003 189
060 000: MAIN: Without function				Fig. 3-10, (p. 3-15)	
Selection of spontaneous signals for transmission via the PC interface.					
PC: Transm.enab.cycl.dat					003 084
0: Without				Fig. 3-10, (p. 3-15)	
Enable for the cyclic transmission of measured values via the PC interface.					
PC: Cycl. data ILS tel.					003 185
060 000: MAIN: Without function				Fig. 3-10, (p. 3-15)	
Selection of the measured values that are transmitted in a user-defined telegram via the PC interface.					
PC: Delta V					003 055
3.0	0.0	15.0	%Vnom	Fig. 3-10, (p. 3-15)	
A measured voltage value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.					
PC: Delta I					003 056
3.0	0.0	15.0	%Inom	Fig. 3-10, (p. 3-15)	
A measured current value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.					
PC: IP address					111 004
192	0	255			

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
PC: IP address 1				111 005
168	0	255		
PC: IP address 2				111 006
1	0	255		
PC: IP address 3				111 007
2	0	255		

IP address of the Ethernet interface of the P139's processor module.

This is the Ethernet interface of the processor module and can be used for special service activities, e.g. for uploading new firmware.

Note: In the operating program, the complete IP address is displayed at **PC: IP address**. The device’s front panel display only displays the IP address distributed to these four data model addresses:

- **PC: IP address**,
- **PC: IP address 1**,
- **PC: IP address 2**,
- **PC: IP address 3**.

Note: This interface can only be used if it has been configured (**PC: IP address**, **PC: Subnet mask**, **PC: IP address mode**) and activated via **PC: IP Enable config.**.

PC: Subnet mask				111 008
255	0	255		
PC: Subnet mask 1				111 009
255	0	255		
PC: Subnet mask 2				111 010
255	0	255		
PC: Subnet mask 3				111 011
0	0	255		

Subnet mask of the Ethernet interface of the processor module.

Note: In the operating program, the complete mask is displayed at **PC: Subnet mask**. The device’s front panel display only displays the mask distributed to these four data model addresses:

- **PC: Subnet mask**,
- **PC: Subnet mask 1**,
- **PC: Subnet mask 2**,
- **PC: Subnet mask 3**.

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
PC: IP address mode					111 016
1: DHCP					
Setting of the method how the IP address of the Ethernet interface of the processor module shall be defined. ● *DHCP*: The IP address shall be retrieved from a DHCP server. ● *Fix*: The setting of **PC: IP address** shall be used. ● *Device address*: The setting of **PC: IP address** shall be used for the first three number values of the IP address, the fourth number value of the IP address shall be the value of **PC: Device address**.					
PC: IP Enable config.					111 017
0: don't execute					
Activating the Ethernet interface of the processor module.					
PC: Delta P					003 059
15.0	0.0	15.0	%Snom	Fig. 3-10, (p. 3-15)	
The active power value is transmitted via the PC interface if it differs by the set delta quantity from the last measured value transmitted.					
PC: Delta f					003 057
2.0	0.0	2.0	%fnom	Fig. 3-10, (p. 3-15)	
The measured frequency value is transmitted via the PC interface if it differs by the set delta from the last measured value transmitted.					
PC: Delta meas.v.ILS tel					003 155
3.0	0.0	15.0		Fig. 3-10, (p. 3-15)	
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.					
PC: Delta t					003 058
1	0	15	min	Fig. 3-10, (p. 3-15)	
All measured values are transmitted again via the PC interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.					
PC: Time-out					003 188
1	1	60	min	Fig. 3-10, (p. 3-15)	
Setting for the time to elapse after the last telegram exchange via the PC interface before activating the second communication channel of communication module A.					

"Logical" communication interface 1

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM1: Function group COMM1				056 026
0: Without				
Cancelling function group COMM1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				
COMM1: General enable USER				003 170
0: No				
Disabling or enabling communication interface 1.				
COMM1: Basic IEC870-5enable				003 215
0: No				Fig. 3-11, (p. 3-17)
Common settings for enabling all protocols based on IEC 870-5-xxx.				
COMM1: Addit. -101 enable				003 216
0: No				Fig. 3-11, (p. 3-17)
Enabling additional settings that are relevant for the protocol based on IEC 870-5-101.				
COMM1: Addit. ILS enable				003 217
0: No				Fig. 3-11, (p. 3-17)
Enabling additional settings that are relevant for the ILS protocol.				
COMM1: MODBUS enable				003 220
0: No				Fig. 3-11, (p. 3-17)
Enabling settings relevant for the MODBUS protocol.				
COMM1: DNP3 enable				003 231
0: No				Fig. 3-11, (p. 3-17)
Enabling settings relevant for the DNP 3.0 protocol.				
COMM1: COURIER enable				103 040
0: No				Fig. 3-11, (p. 3-17)
Enabling settings relevant for the COURIER protocol.				
COMM1: Communicat. protocol				003 167
060 000: MAIN: Without function				Fig. 3-11, (p. 3-17)
Select the communication protocol that shall be used for the communication interface.				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: -103 prot. variant				003 178
1: Private				Fig. 3-12, (p. 3-18)
The user may select between two variants of the 103 protocol. **Note:** This setting is hidden unless the IEC 870-5-xxx protocol is enabled.				
COMM1: MODBUS prot. variant				003 214
1: Compatible				Fig. 3-15, (p. 3-21)
The user may select between two variants of the MODBUS protocol. **Note:** This setting is hidden unless the MODBUS protocol is enabled.				
COMM1: Line idle state				003 165
1: Light on / high				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
Setting for the line idle state indication.				
COMM1: Baud rate				003 071
19.2: 19.2 kBaud				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
Baud rate of the communication interface.				
COMM1: Parity bit				003 171
2: Even				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
Set the same parity that is set at the interface of the control system connected to the P139.				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: Dead time monitoring				003 176
1: Yes				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
The P139 monitors telegram transmission to make sure that no excessive pause occurs within a telegram. This monitoring function can be disabled if it is not required. **Note:** This setting is only necessary for modem transmission.				
COMM1: Mon. time polling				003 202
25	3	254	s	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
The time between two polling calls from the communication master must be less than the time set here.				
COMM1: Octet comm. address				003 072
1	0	254		Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20) Fig. 3-15, (p. 3-21) Fig. 3-16, (p. 3-22) Fig. 3-17, (p. 3-23)
The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses. “ASDU”: Application Service Data Unit				
COMM1: Oct.2 comm.addr.DNP3				003 240
0	0	255		Fig. 3-16, (p. 3-22)
In the DNP 3.0 protocol, a 16-bit address is used to identify devices. The address that can be set here is the higher-order octet, whereas the address set at **COMM1: Octet comm. address** is the lower-order octet of the DNP address. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**

COMM1: Pos. acknowledgement — 103 060

1: Single character E5

The following transmission frame formats are available (according to the standard):

- *Short message FT 1.2*: short message with a fixed block length of 5 characters
- *Single character E5*: single control character

COMM1: Test monitor on — 003 166

0: No

Fig. 3-12, (p. 3-18)
Fig. 3-13, (p. 3-19)
Fig. 3-14, (p. 3-20)
Fig. 3-15, (p. 3-21)
Fig. 3-16, (p. 3-22)
Fig. 3-17, (p. 3-23)

Setting specifying whether data shall be recorded for service activities.

COMM1: Name of manufacturer — 003 161

1: SE

Fig. 3-12, (p. 3-18)
Fig. 3-13, (p. 3-19)
Fig. 3-14, (p. 3-20)

Setting for the name of the manufacturer.

Note:

- This setting can be changed to ensure compatibility.
- This setting is hidden unless an IEC 870-5 protocol is enabled.

COMM1: Octet address ASDU — 003 073

Default	Min	Max	Unit
1	0	255	

Fig. 3-12, (p. 3-18)
Fig. 3-13, (p. 3-19)
Fig. 3-14, (p. 3-20)

The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

“ASDU”: Application Service Data Unit

COMM1: Spontan. sig. enable — 003 177

65535: All

Fig. 3-12, (p. 3-18)
Fig. 3-13, (p. 3-19)
Fig. 3-14, (p. 3-20)

Enable for the transmission of spontaneous signals via the communication interface.

Note: This setting is hidden unless an IEC 870-5 protocol is enabled.

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM1: Select. spontan.sig.					003 179
060 000: MAIN: Without function				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
Selection of spontaneous signals for transmission via “logical” communication interface 1.					
COMM1: Transm.enab.cycl.dat					003 074
0: Without				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
Enabling of cyclic transmission of measured values via the communication interface. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.					
COMM1: Cycl. data ILS tel.					003 175
060 000: MAIN: Without function				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
Selection of the measured values that are transmitted in a user-defined telegram via the communication interface. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.					
COMM1: Delta V					003 050
3.0	0.0	15.0	%Vnom	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.					
COMM1: Delta I					003 051
3.0	0.0	15.0	%Inom	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.					
COMM1: Delta P					003 054
15.0	0.0	15.0	%Snom	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)	
The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: Delta f				003 052
2.0	0.0	2.0	%fnom	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
The measured frequency value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.				
COMM1: Delta meas.v.ILS tel				003 150
3.0	0.0	15.0		Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.				
COMM1: Delta t				003 053
1	0	15	min	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
All measured values are transmitted again via the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.				
COMM1: Delta t (energy)				003 151
Blocked	0	15	min	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
The measured values for active energy and reactive energy are transmitted via the communication interface after this time has elapsed. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.				
COMM1: Contin. general scan				003 077
Blocked	10	9000	s	Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
A continuous or background general scan means that the P139 transmits all settings, signals, and monitoring signals through the communication interface during slow periods when there is not much activity. This ensures that there will be data consistency with a connected control system. The time to be set defines the minimum time difference between two telegrams. **Note:** This setting is hidden unless an IEC 870-5 protocol is enabled.				

Parameter / Default	Min	Max	Unit	Logic Diagram	Address
COMM1: Comm. address length					003 201
1	1	2	Byte	Fig. 3-13, (p. 3-19)	
Setting for the communication address length. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					
COMM1: Octet 2 comm. addr.					003 200
0	0	255		Fig. 3-13, (p. 3-19)	
Setting for the length of the higher-order communication address. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					
COMM1: Cause transm. length					003 192
1: W/o source address				Fig. 3-13, (p. 3-19)	
Setting for the length of the cause of transmission. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					
COMM1: Address length ASDU					003 193
1	1	2	Byte	Fig. 3-13, (p. 3-19)	
Setting for the length of the common address for identification of telegram structures. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set. “ASDU”: Application Service Data Unit					
COMM1: Octet 2 addr. ASDU					003 194
0	0	255		Fig. 3-13, (p. 3-19)	
Setting for the length of the common higher-order address for identification of telegram structures. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set. “ASDU”: Application Service Data Unit					
COMM1: Addr.length inf.obj.					003 196
2	2	3	Byte	Fig. 3-13, (p. 3-19)	
Setting for the length of the address for information objects. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					
COMM1: Oct.3 addr. inf.obj.					003 197
0	0	255		Fig. 3-13, (p. 3-19)	
Setting for the length of the higher-order address for information objects. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					
COMM1: Inf.No.<->funct.type					003 195
0: No				Fig. 3-13, (p. 3-19)	
Setting specifying whether information numbers and function type shall be reversed in the object address. **Note:** This setting is hidden unless the IEC 870-5-101 protocol is set.					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
COMM1: Time tag length					003 198
3: 3			Byte	Fig. 3-13, (p. 3-19)	

Setting for the time tag length.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: ASDU1 / ASDU20 conv.					003 190
1: Single signal				Fig. 3-13, (p. 3-19)	

Setting specifying whether telegram structure 1 or 20 shall be converted as a single signal or double signal.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

“ASDU”: Application Service Data Unit

COMM1: ASDU2 conversion					003 191
1: Single signal				Fig. 3-13, (p. 3-19)	

Setting specifying whether telegram structure 2 shall be converted as a single signal or double signal.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

“ASDU”: Application Service Data Unit

COMM1: Initializ. signal					003 199
1: Yes				Fig. 3-13, (p. 3-19)	

Setting specifying whether an initialization signal shall be issued.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Balanced operation					003 226
0: No				Fig. 3-13, (p. 3-19)	

Setting that determines whether communication takes place on a balanced basis (full duplex operation).

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

COMM1: Direction bit					003 227
0	0	1		Fig. 3-13, (p. 3-19)	

Setting for the transmission direction. Normally this value will be set to '1' at the control center and to '0' at the substation.

Note: This setting is hidden unless the IEC 870-5-101 protocol is enabled.

COMM1: Time-out interval					003 228
0.40	0.10	2.55	s	Fig. 3-13, (p. 3-19)	

Setting for the maximum time that will elapse until the status signal for the acknowledgment command is issued.

Note: This setting is hidden unless the IEC 870-5-101 protocol is set.

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM1: Reg.asg. selec. cmds					003 210
060 000: MAIN: Without function				Fig. 3-15, (p. 3-21)	
MODBUS registers in the range 00301 to 00400 are assigned to the selected commands. Assignment is made in the order of selection. This means that the first command is given the register no. 00301, the second the register no. 00302, etc. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					
COMM1: Reg.asg. selec. sig.					003 211
060 000: MAIN: Without function				Fig. 3-15, (p. 3-21)	
MODBUS registers in the range 10301 to 10400 are assigned to the selected signals. Assignment is made in the order of selection. This means that the first signal is given the register no. 10301, the second the register no. 10302, etc. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					
COMM1: Reg.asg. sel. m.val.					003 212
060 000: MAIN: Without function				Fig. 3-15, (p. 3-21)	
MODBUS registers in the range 30301 to 30400 are assigned to the selected measured values. Assignment is made in the order of selection. This means that the first measured value is given the register no. 30301, the second the register no. 30302, etc. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					
COMM1: Reg.asg. sel. param.					003 213
060 000: MAIN: Without function				Fig. 3-15, (p. 3-21)	
MODBUS registers in the range 40301 to 40400 are assigned to the selected parameters. Assignment is made in the order of selection. This means that the first parameter is given the register no. 40301, the second the register no. 40302, etc. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					
COMM1: Delta t (MODBUS)					003 152
5	1	120	s	Fig. 3-15, (p. 3-21)	
All MODBUS registers are transmitted again through the communication interface after this time has elapsed. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					
COMM1: Autom.event confirm.					003 249
0: Without				Fig. 3-15, (p. 3-21)	
Setting specifying whether an event must be confirmed by the master in order for an event to be deleted from the 'event queue'. **Note:** This setting is hidden unless the MODBUS protocol is enabled.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM1: Phys. Charact. Delay					003 241
0	0	254	Bit	Fig. 3-16, (p. 3-22)	
Number of bits that must pass between the receipt of the 'request' and the start of sending the 'response'. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Phys. Char. Timeout					003 242
40	0	254	Bit	Fig. 3-16, (p. 3-22)	
Number of bits that may be missing from the telegram before receipt is terminated. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Link Confirm. Mode					003 243
1: Multi-frame fragment				Fig. 3-16, (p. 3-22)	
Setting for the acknowledgment mode of the link layer. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Link Confirm.Timeout					003 244
0.10	0.05	2.54	s	Fig. 3-16, (p. 3-22)	
Setting for the time period within which the master must acknowledge at the link layer. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Link Max. Retries					003 245
2	1	10		Fig. 3-16, (p. 3-22)	
Number of repetitions that are carried out on the link layer if errors have occurred during transmission (such as failure to acknowledge). **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Appl.Confirm.Timeout					003 246
5.0	0.5	25.4	s	Fig. 3-16, (p. 3-22)	
Setting for the time period within which the master must acknowledge at the application layer. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					
COMM1: Appl. Need Time Del.					003 247
60	5	254	s	Fig. 3-16, (p. 3-22)	
Time interval within which the slave requests time synchronization cyclically from the master. **Note:** This setting is hidden unless the DNP 3.0 protocol is enabled.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: Ind./cl. bin. inputs				003 232
060 000: MAIN: Without function				Fig. 3-16, (p. 3-22)

Selection of data points and data classes for object 1 – binary inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin.outputs				003 233
060 000: MAIN: Without function				Fig. 3-16, (p. 3-22)

Selection of data points and data classes for object 10 – binary outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. bin. count.				003 234
060 000: MAIN: Without function				Fig. 3-16, (p. 3-22)

Selection of data points and data classes for object 20 – binary counters. Assignment of indexes is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog inp.				003 235
060 000: MAIN: Without function				Fig. 3-16, (p. 3-22)

Selection of data points and data classes for object 30 – analog inputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Ind./cl. analog outp				003 236
060 000: MAIN: Without function				Fig. 3-16, (p. 3-22)

Selection of data points and data classes for object 40 – analog outputs. Assignment of indices is made in the order of selection, beginning with 0.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta meas.v. (DNP3)				003 250
16	0	255		Fig. 3-16, (p. 3-22)

Initialization value of threshold values for transmission of measured values in object 30. The threshold values can be changed separately by the master for each measured value by writing to object 34, 'analog input reporting deadband'.

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

COMM1: Delta t (DNP3)				003 248
5	1	120	s	Fig. 3-16, (p. 3-22)

Cycle time for updating DNP object 30 (analog inputs).

Note: This setting is hidden unless the DNP 3.0 protocol is enabled.

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: Command selection				103 042
060 000: MAIN: Without function				Fig. 3-17, (p. 3-23)
Selection of commands to be issued via the COURIER protocol. **Note:** This setting is hidden unless the COURIER protocol is enabled.				
COMM1: Signal selection				103 043
060 000: MAIN: Without function				Fig. 3-17, (p. 3-23)
Selection of signals to be transmitted via the COURIER protocol. **Note:** This setting is hidden unless the COURIER protocol is enabled.				
COMM1: Meas. val. selection				103 044
060 000: MAIN: Without function				Fig. 3-17, (p. 3-23)
Selection of measured values to be transmitted via the Courier protocol. **Note:** This setting is hidden unless the Courier protocol is enabled.				
COMM1: Parameter selection				103 045
060 000: MAIN: Without function				Fig. 3-17, (p. 3-23)
Selection of settings to be altered via the Courier protocol. **Note:** This setting is hidden unless the Courier protocol is enabled.				
COMM1: Delta t (COURIER)				103 046
5	1	120	s	Fig. 3-17, (p. 3-23)
Cycle time at the conclusion of which the selected measured values are again transmitted. **Note:** This setting is hidden unless the COURIER protocol is enabled.				

"Logical" communication interface 2

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM2: Function group COMM2					056 057
0: Without					
Cancelling function group COMM2 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.					
COMM2: General enable USER					103 170
0: No				Fig. 3-19, (p. 3-25)	
Disabling or enabling communication interface 2.					
COMM2: Line idle state					103 165
1: Light on / high				Fig. 3-19, (p. 3-25)	
Setting for the line idle state indication.					
COMM2: Baud rate					103 071
19.2: 19.2 kBaud			Baud	Fig. 3-19, (p. 3-25)	
Baud rate of the communication interface.					
COMM2: Parity bit					103 171
2: Even				Fig. 3-19, (p. 3-25)	
Set the same parity that is set at the interface of the control system connected to the P139.					
COMM2: Dead time monitoring					103 176
1: Yes				Fig. 3-19, (p. 3-25)	
The P139 monitors telegram transmission to make sure that no excessive pause occurs within a telegram. This monitoring function can be disabled if it is not required. **Note:** This setting is only necessary for modem transmission.					
COMM2: Mon. time polling					103 202
25	3	254	s	Fig. 3-19, (p. 3-25)	
The time between two polling calls from the communication master must be less than the time set here.					
COMM2: Positive ackn. fault					103 203
0: No					
It is possible to set whether or not faults can be acknowledged positively after transmission (and consequently deleted from the fault overview at the COMM2/PC interface).					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM2: Octet comm. address				103 072
1	0	254		Fig. 3-19, (p. 3-25)
The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses. “ASDU”: Application Service Data Unit				
COMM2: Name of manufacturer				103 161
1: SE				Fig. 3-19, (p. 3-25)
Setting for the name of the manufacturer. **Note:** This setting can be changed to ensure compatibility.				
COMM2: Octet address ASDU				103 073
1	0	255		Fig. 3-19, (p. 3-25)
The communication address and the ASDU address are used to identify the device in communication via the interface. An identical setting must be selected for both addresses. “ASDU”: Application Service Data Unit				
COMM2: Spontan. sig. enable				103 177
0: None				Fig. 3-19, (p. 3-25)
Enable for the transmission of spontaneous signals via the communication interface.				
COMM2: Select. spontan.sig.				103 179
060 000: MAIN: Without function				Fig. 3-19, (p. 3-25)
Selection of spontaneous signals for transmission via communication interface 2.				
COMM2: Transm.enab.cycl.dat				103 074
0: Without				Fig. 3-19, (p. 3-25)
Enable for the cyclic transmission of measured values via the communication interface.				
COMM2: Cycl. data ILS tel.				103 175
060 000: MAIN: Without function				Fig. 3-19, (p. 3-25)
Selection of the measured values transmitted in a user-defined telegram via the communication interface.				
COMM2: Delta V				103 050
3.0	0.0	15.0	%Vnom	Fig. 3-19, (p. 3-25)
A measured voltage value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM2: Delta I					103 051
3.0	0.0	15.0	%Inom	Fig. 3-19, (p. 3-25)	
A measured current value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.					
COMM2: Delta P					103 054
15.0	0.0	15.0	%Snom	Fig. 3-19, (p. 3-25)	
The active power value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.					
COMM2: Delta f					103 052
2.0	0.0	2.0	%fnom	Fig. 3-19, (p. 3-25)	
The measured frequency value is transmitted via the communication interface if it differs by the set delta quantity from the last measured value transmitted.					
COMM2: Delta meas.v.ILS tel					103 150
3.0	0.0	15.0		Fig. 3-19, (p. 3-25)	
The telegram is transmitted if a measured value differs by the set delta quantity from the last measured value transmitted.					
COMM2: Delta t					103 053
1	0	15	min	Fig. 3-19, (p. 3-25)	
All measured values are transmitted again via the communication interface after this time period has elapsed – provided that transmission has not been triggered by the other delta conditions.					

InterMiCOM interface

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM3: Function group COMM3				056 058
0: Without				
Cancelling function group COMM3 or including it in the configuration. This setting parameter is only visible if the relevant optional communication module is fitted. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				
COMM3: General enable USER				120 030
0: No				
Disabling or enabling communication interface 3.				
COMM3: Baud rate				120 038
9600: 9600 baud			Baud	
Adjustment of the baud rate for telegram transmission via the guidance interface (InterMiCOM interface) so as to meet the requirements of the transmission carrier.				
COMM3: Source address				120 031
1: 1				
Address for send signals.				
COMM3: Receiving address				120 032
2: 2				
Address for receive signals.				
COMM3: Fct. assignm. send 1				121 001
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 2				121 003
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 3				121 005
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 4				121 007
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 5				121 009
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 6				121 011
060 000: MAIN: Without function				
COMM3: Fct. assignm. send 7				121 013
060 000: MAIN: Without function				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COMM3: Fct. assignm. send 8					121 015
060 000: MAIN: Without function					
Assignment of functions for the 8 send signals.					
COMM3: Fct. assignm. rec. 1					120 001
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 2					120 004
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 3					120 007
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 4					120 010
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 5					120 013
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 6					120 016
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 7					120 019
061 000: MAIN: Without function					
COMM3: Fct. assignm. rec. 8					120 022
061 000: MAIN: Without function					
Configuration (assignment of functions) for the 8 receive signals					
COMM3: Oper. mode receive 1					120 002
1: Direct intertrip					
COMM3: Oper. mode receive 2					120 005
1: Direct intertrip					
COMM3: Oper. mode receive 3					120 008
1: Direct intertrip					
COMM3: Oper. mode receive 4					120 011
1: Direct intertrip					
Selection of *Blocking* or *Direct intertrip* for the operating mode of receive signals 1 to 4 (single-pole transmission).					
COMM3: Oper. mode receive 5					120 014
1: Direct intertrip					
COMM3: Oper. mode receive 6					120 017
1: Direct intertrip					
COMM3: Oper. mode receive 7					120 020
1: Direct intertrip					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM3: Oper. mode receive 8				120 023
1: Direct intertrip				
Selection of *Permissive* or *Direct intertrip* for the operating mode of receive signals 5 to 8 (two-pole transmission).				
COMM3: Default value rec. 1				120 060
0: 0				
COMM3: Default value rec. 2				120 061
0: 0				
COMM3: Default value rec. 3				120 062
0: 0				
COMM3: Default value rec. 4				120 063
0: 0				
COMM3: Default value rec. 5				120 064
0: 0				
COMM3: Default value rec. 6				120 065
0: 0				
COMM3: Default value rec. 7				120 066
0: 0				
COMM3: Default value rec. 8				120 067
0: 0				
Definition of the default value for the 8 receive signals.				
COMM3: Time-out comm.fault				120 033
50	10	60000	ms	
This timer triggers the alarm signals **COMM3: Communications fault** and **SFMON: Communic.fault COMM3** the received signals to their user-defined default values. Time-out occurs when the set time has elapsed since the most recent 100% valid telegram was received.				
COMM3: Sig.asg. comm.fault				120 034
0: None				
Using this setting, the alarm signal can be configured (assigned) to the corresponding PSIG input signal.				
COMM3: Time-out link fail.				120 035
5	0	600	s	
Time indicating a persistent failure of the transmission channel. After this timer stage has elapsed, alarm signals **COMM3: Comm. link failure** and **SFMON: Comm.link fail.COMM3** are raised. These can be mapped to give the operator a warning LED or contact to indicate that maintenance attention is required.				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
COMM3: Limit telegr. errors							120 036
Blocked	1	100	%				

Percentage of corrupted messages compared to total messages transmitted before an alarm is raised (**COMM3: Lim.exceed.,tel.err.** and **SFMON: Lim.exceed.,tel.err.**). When this threshold is exceeded, the receive signals are set to their user-defined default values.

IEC 61850 Communication

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IEC: Function group IEC				056 059
0: Without				
Cancelling function group IEC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden. **Important notice:** Some of the parameters in function group IEC are set with the IEC 61850 configuration tool “IED Configurator”, they cannot be modified from the local control panel (HMI) or with the operating program, and therefore these parameters are listed separately.				
IEC: General enable USER				104 000
0: No				
Enabling and disabling function group IEC.				
IEC: Switch Config. Bank				104 043
0: don't execute				
This parameter can only be sent individually. Accepting the previously set communication parameters as the active communication settings.				
IEC: Active Config. Name				104 045
2:				
Name of the configuration bank currently valid. Setting is carried out with the IED Configurator.				
IEC: Active Config. Vers.				104 046
2:				
Version number of the configuration bank currently valid. Setting is carried out with the IED Configurator.				
IEC: Inact. Config. Name				104 047
2:				
Name of the inactive configuration bank. Setting is carried out with the IED Configurator.				
IEC: Inact. Config. Vers.				104 048
2:				
Version number of the inactive configuration bank. Setting is carried out with the IED Configurator.				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
IEC: IED name					104 057
2:					

Explicitly assigned unit name for the function in the system (IED); is part of the Logical Device Name.

Setting is carried out with the IED Configurator.

Important note: According to the IEC standard the name must consist of only letters (**A**..**Z**, **a**..**z**), digits (**0**..**9**) and underscore characters (_), and neither a digit nor the underscore character must be the first character. Note that a non-standard name causes problems with the IEC 61850 communication.

IEC: IP address					104 001
2:					

Assigned IP address of the device for the server function in the system.

Note: This is an information parameter ('read only') and its value is set from the "IED Configurator" with *Communications: IP Address*.

IEC: Subnet mask					104 005
2:					

The subnet mask defines which part of the IP address is addressed by the sub-network and which part by the device that is logged-on to the network.

Note: This is an information parameter ('read only') and its value is set from the "IED Configurator" with *Communications: SubNet Mask*.

IEC: Gateway address					104 011
2:					

This parameter shows the IPv4 address of the network gateway for communication links to clients outside of the local network.

Note: This is an information parameter ('read only') and its value is set from the "IED Configurator" with *Communications: Gateway Address*.

IEC: SNTP server 1 IP					104 202
2:					

IP address of the preferred server used for clock synchronization.

Note: This is an information parameter ('read only') and its value is set from the "IED Configurator".

IEC: SNTP server 2 IP					104 210
2:					

IP address of the backup server used for clock synchronization.

Note: This is an information parameter ('read only') and its value is set from the "IED Configurator".

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
IEC: SigGGIO1 selection				104 064
060 000: MAIN: Without function				
Optional signal assignment for a transmission per communication protocol IEC 61850 based on the selection table of the binary inputs (opto coupler inputs).				
IEC: Diff. local time				104 206
0	-1440	1440	min	
Time difference between UTC and local time at the devices' substation (IED).				
IEC: Diff. dayl.sav. time				104 207
60	-1440	1440	min	
Time difference of the daylight saving time to standard time.				
IEC: Switch.dayl.sav.time				104 219
1: Yes				
This setting defines whether an automatic switching to daylight saving time is wanted. If it is wanted, the time switching is executed upon receiving a related SNTP frame.				
IEC: Dayl.sav.time start				104 220
5: Last				
IEC: Dayl.sav.time st. d				104 221
7: Sunday				
IEC: Dayl.sav.time st. m				104 222
3: March				
These three parameters define the date (e.g. at what day of the year) for switching from standard time over to daylight saving time. Available for **IEC: Dayl.sav.time start** are the values *First*, *Second*, *Third*, *Fourth*, and *Last*. For **IEC: Dayl.sav.time st. d** the seven weekdays are available so that for example a setting like “on the last Sunday in March” may be used.				
IEC: Dayl.sav.t.st.0:00 +				104 223
120	0	1440	min	
Time period in minutes after midnight when daylight saving time is switched to standard time. If for example the clock is advanced one hour from 2:00 AM to 3:00 AM the parameter **IEC: Dayl.sav.t.st.0:00 +** is set to 120 (minutes).				
IEC: Dayl.sav.time end				104 225
5: Last				
IEC: Dayl.sav.time end d				104 226
7: Sunday				
IEC: Dayl.sav.time end m				104 227
10: October				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IEC: Dayl.sav.t.end 0:00+				104 228
180	0	1440	min	

This parameter defines the date and time of day for the clock changeover from daylight saving time to standard time. The setting is similar to that for the clock changeover to daylight saving time.

Generic Object Orientated Substation Events

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Function group GOOSE				056 068
0: Without				
Cancelling function group GOOSE or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden. Parameters included in this function group are only effective when function group IEC is configured and enabled and when the parameters in this function group have been activated by setting the parameter **IEC: Switch Config. Bank**.				
GOOSE: General enable USER				106 001
0: No				
Enabling and disabling function group GOOSE.				
GOOSE: Output 1 fct.assig.				106 011
060 000: MAIN: Without function				
GOOSE: Output 2 fct.assig.				106 013
060 000: MAIN: Without function				
GOOSE: Output 3 fct.assig.				106 015
060 000: MAIN: Without function				
GOOSE: Output 4 fct.assig.				106 017
060 000: MAIN: Without function				
GOOSE: Output 5 fct.assig.				106 019
060 000: MAIN: Without function				
GOOSE: Output 6 fct.assig.				106 021
060 000: MAIN: Without function				
GOOSE: Output 7 fct.assig.				106 023
060 000: MAIN: Without function				
GOOSE: Output 8 fct.assig.				106 025
060 000: MAIN: Without function				
GOOSE: Output 9 fct.assig.				106 027
060 000: MAIN: Without function				
GOOSE: Output 10 fct.assig.				106 029
060 000: MAIN: Without function				
GOOSE: Output 11 fct.assig.				106 031
060 000: MAIN: Without function				
GOOSE: Output 12 fct.assig.				106 033
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Output 13 fct.assig.				106 035
060 000: MAIN: Without function				
GOOSE: Output 14 fct.assig.				106 037
060 000: MAIN: Without function				
GOOSE: Output 15 fct.assig.				106 039
060 000: MAIN: Without function				
GOOSE: Output 16 fct.assig.				106 041
060 000: MAIN: Without function				
GOOSE: Output 17 fct.assig.				106 043
060 000: MAIN: Without function				
GOOSE: Output 18 fct.assig.				106 045
060 000: MAIN: Without function				
GOOSE: Output 19 fct.assig.				106 047
060 000: MAIN: Without function				
GOOSE: Output 20 fct.assig.				106 049
060 000: MAIN: Without function				
GOOSE: Output 21 fct.assig.				106 051
060 000: MAIN: Without function				
GOOSE: Output 22 fct.assig.				106 053
060 000: MAIN: Without function				
GOOSE: Output 23 fct.assig.				106 055
060 000: MAIN: Without function				
GOOSE: Output 24 fct.assig.				106 057
060 000: MAIN: Without function				
GOOSE: Output 25 fct.assig.				106 059
060 000: MAIN: Without function				
GOOSE: Output 26 fct.assig.				106 061
060 000: MAIN: Without function				
GOOSE: Output 27 fct.assig.				106 063
060 000: MAIN: Without function				
GOOSE: Output 28 fct.assig.				106 065
060 000: MAIN: Without function				
GOOSE: Output 29 fct.assig.				106 067
060 000: MAIN: Without function				
GOOSE: Output 30 fct.assig.				106 069
060 000: MAIN: Without function				
GOOSE: Output 31 fct.assig.				106 071
060 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Output 32 fct.assig.					106 073
060 000: MAIN: Without function					
Function assignment of a binary logical state signal to the virtual GOOSE outputs. Signals configured here can be included as GosGGIO2.ST.ind1, GosGGIO2.ST.ind2, ... in the datasets.					
GOOSE: Input 1 fct.assig.					107 006
061 000: MAIN: Without function					
GOOSE: Input 2 fct.assig.					107 016
061 000: MAIN: Without function					
GOOSE: Input 3 fct.assig.					107 026
061 000: MAIN: Without function					
GOOSE: Input 4 fct.assig.					107 036
061 000: MAIN: Without function					
GOOSE: Input 5 fct.assig.					107 046
061 000: MAIN: Without function					
GOOSE: Input 6 fct.assig.					107 056
061 000: MAIN: Without function					
GOOSE: Input 7 fct.assig.					107 066
061 000: MAIN: Without function					
GOOSE: Input 8 fct.assig.					107 076
061 000: MAIN: Without function					
GOOSE: Input 9 fct.assig.					107 086
061 000: MAIN: Without function					
GOOSE: Input 10 fct.assig.					107 096
061 000: MAIN: Without function					
GOOSE: Input 11 fct.assig.					107 106
061 000: MAIN: Without function					
GOOSE: Input 12 fct.assig.					107 116
061 000: MAIN: Without function					
GOOSE: Input 13 fct.assig.					107 126
061 000: MAIN: Without function					
GOOSE: Input 14 fct.assig.					107 136
061 000: MAIN: Without function					
GOOSE: Input 15 fct.assig.					107 146
061 000: MAIN: Without function					
GOOSE: Input 16 fct.assig.					107 156
061 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 17 fct.assig.				107 157
061 000: MAIN: Without function				
GOOSE: Input 18 fct.assig.				107 158
061 000: MAIN: Without function				
GOOSE: Input 19 fct.assig.				107 159
061 000: MAIN: Without function				
GOOSE: Input 20 fct.assig.				107 160
061 000: MAIN: Without function				
GOOSE: Input 21 fct.assig.				107 161
061 000: MAIN: Without function				
GOOSE: Input 22 fct.assig.				107 162
061 000: MAIN: Without function				
GOOSE: Input 23 fct.assig.				107 163
061 000: MAIN: Without function				
GOOSE: Input 24 fct.assig.				107 164
061 000: MAIN: Without function				
GOOSE: Input 25 fct.assig.				107 165
061 000: MAIN: Without function				
GOOSE: Input 26 fct.assig.				107 166
061 000: MAIN: Without function				
GOOSE: Input 27 fct.assig.				107 167
061 000: MAIN: Without function				
GOOSE: Input 28 fct.assig.				107 168
061 000: MAIN: Without function				
GOOSE: Input 29 fct.assig.				107 169
061 000: MAIN: Without function				
GOOSE: Input 30 fct.assig.				107 170
061 000: MAIN: Without function				
GOOSE: Input 31 fct.assig.				107 171
061 000: MAIN: Without function				
GOOSE: Input 32 fct.assig.				107 172
061 000: MAIN: Without function				
GOOSE: Input 33 fct.assig.				112 000
061 000: MAIN: Without function				
GOOSE: Input 34 fct.assig.				112 001
061 000: MAIN: Without function				
GOOSE: Input 35 fct.assig.				112 002
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 36 fct.assig.				112 003
061 000: MAIN: Without function				
GOOSE: Input 37 fct.assig.				112 004
061 000: MAIN: Without function				
GOOSE: Input 38 fct.assig.				112 005
061 000: MAIN: Without function				
GOOSE: Input 39 fct.assig.				112 006
061 000: MAIN: Without function				
GOOSE: Input 40 fct.assig.				112 007
061 000: MAIN: Without function				
GOOSE: Input 41 fct.assig.				112 008
061 000: MAIN: Without function				
GOOSE: Input 42 fct.assig.				112 009
061 000: MAIN: Without function				
GOOSE: Input 43 fct.assig.				112 010
061 000: MAIN: Without function				
GOOSE: Input 44 fct.assig.				112 011
061 000: MAIN: Without function				
GOOSE: Input 45 fct.assig.				112 012
061 000: MAIN: Without function				
GOOSE: Input 46 fct.assig.				112 013
061 000: MAIN: Without function				
GOOSE: Input 47 fct.assig.				112 014
061 000: MAIN: Without function				
GOOSE: Input 48 fct.assig.				112 015
061 000: MAIN: Without function				
GOOSE: Input 49 fct.assig.				112 016
061 000: MAIN: Without function				
GOOSE: Input 50 fct.assig.				112 017
061 000: MAIN: Without function				
GOOSE: Input 51 fct.assig.				112 018
061 000: MAIN: Without function				
GOOSE: Input 52 fct.assig.				112 019
061 000: MAIN: Without function				
GOOSE: Input 53 fct.assig.				112 020
061 000: MAIN: Without function				
GOOSE: Input 54 fct.assig.				112 021
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 55 fct.assig.				112 022
061 000: MAIN: Without function				
GOOSE: Input 56 fct.assig.				112 023
061 000: MAIN: Without function				
GOOSE: Input 57 fct.assig.				112 024
061 000: MAIN: Without function				
GOOSE: Input 58 fct.assig.				112 025
061 000: MAIN: Without function				
GOOSE: Input 59 fct.assig.				112 026
061 000: MAIN: Without function				
GOOSE: Input 60 fct.assig.				112 027
061 000: MAIN: Without function				
GOOSE: Input 61 fct.assig.				112 028
061 000: MAIN: Without function				
GOOSE: Input 62 fct.assig.				112 029
061 000: MAIN: Without function				
GOOSE: Input 63 fct.assig.				112 030
061 000: MAIN: Without function				
GOOSE: Input 64 fct.assig.				112 031
061 000: MAIN: Without function				
GOOSE: Input 65 fct.assig.				112 032
061 000: MAIN: Without function				
GOOSE: Input 66 fct.assig.				112 033
061 000: MAIN: Without function				
GOOSE: Input 67 fct.assig.				112 034
061 000: MAIN: Without function				
GOOSE: Input 68 fct.assig.				112 035
061 000: MAIN: Without function				
GOOSE: Input 69 fct.assig.				112 036
061 000: MAIN: Without function				
GOOSE: Input 70 fct.assig.				112 037
061 000: MAIN: Without function				
GOOSE: Input 71 fct.assig.				112 038
061 000: MAIN: Without function				
GOOSE: Input 72 fct.assig.				112 039
061 000: MAIN: Without function				
GOOSE: Input 73 fct.assig.				112 040
061 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 74 fct.assig.					112 041
061 000: MAIN: Without function					
GOOSE: Input 75 fct.assig.					112 042
061 000: MAIN: Without function					
GOOSE: Input 76 fct.assig.					112 043
061 000: MAIN: Without function					
GOOSE: Input 77 fct.assig.					112 044
061 000: MAIN: Without function					
GOOSE: Input 78 fct.assig.					112 045
061 000: MAIN: Without function					
GOOSE: Input 79 fct.assig.					112 046
061 000: MAIN: Without function					
GOOSE: Input 80 fct.assig.					112 047
061 000: MAIN: Without function					
GOOSE: Input 81 fct.assig.					112 048
061 000: MAIN: Without function					
GOOSE: Input 82 fct.assig.					112 049
061 000: MAIN: Without function					
GOOSE: Input 83 fct.assig.					112 050
061 000: MAIN: Without function					
GOOSE: Input 84 fct.assig.					112 051
061 000: MAIN: Without function					
GOOSE: Input 85 fct.assig.					112 052
061 000: MAIN: Without function					
GOOSE: Input 86 fct.assig.					112 053
061 000: MAIN: Without function					
GOOSE: Input 87 fct.assig.					112 054
061 000: MAIN: Without function					
GOOSE: Input 88 fct.assig.					112 055
061 000: MAIN: Without function					
GOOSE: Input 89 fct.assig.					112 056
061 000: MAIN: Without function					
GOOSE: Input 90 fct.assig.					112 057
061 000: MAIN: Without function					
GOOSE: Input 91 fct.assig.					112 058
061 000: MAIN: Without function					
GOOSE: Input 92 fct.assig.					112 059
061 000: MAIN: Without function					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 93 fct.assig.					112 060
061 000: MAIN: Without function					
GOOSE: Input 94 fct.assig.					112 061
061 000: MAIN: Without function					
GOOSE: Input 95 fct.assig.					112 062
061 000: MAIN: Without function					
GOOSE: Input 96 fct.assig.					112 063
061 000: MAIN: Without function					
GOOSE: Input 97 fct.assig.					112 064
061 000: MAIN: Without function					
GOOSE: Input 98 fct.assig.					112 065
061 000: MAIN: Without function					
GOOSE: Input 99 fct.assig.					112 066
061 000: MAIN: Without function					
GOOSE: Input 100 fct.assig.					112 067
061 000: MAIN: Without function					
GOOSE: Input 101 fct.assig.					112 068
061 000: MAIN: Without function					
GOOSE: Input 102 fct.assig.					112 069
061 000: MAIN: Without function					
GOOSE: Input 103 fct.assig.					112 070
061 000: MAIN: Without function					
GOOSE: Input 104 fct.assig.					112 071
061 000: MAIN: Without function					
GOOSE: Input 105 fct.assig.					112 072
061 000: MAIN: Without function					
GOOSE: Input 106 fct.assig.					112 073
061 000: MAIN: Without function					
GOOSE: Input 107 fct.assig.					112 074
061 000: MAIN: Without function					
GOOSE: Input 108 fct.assig.					112 075
061 000: MAIN: Without function					
GOOSE: Input 109 fct.assig.					112 076
061 000: MAIN: Without function					
GOOSE: Input 110 fct.assig.					112 077
061 000: MAIN: Without function					
GOOSE: Input 111 fct.assig.					112 078
061 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 112 fct.assig.				112 079
061 000: MAIN: Without function				
GOOSE: Input 113 fct.assig.				112 080
061 000: MAIN: Without function				
GOOSE: Input 114 fct.assig.				112 081
061 000: MAIN: Without function				
GOOSE: Input 115 fct.assig.				112 082
061 000: MAIN: Without function				
GOOSE: Input 116 fct.assig.				112 083
061 000: MAIN: Without function				
GOOSE: Input 117 fct.assig.				112 084
061 000: MAIN: Without function				
GOOSE: Input 118 fct.assig.				112 085
061 000: MAIN: Without function				
GOOSE: Input 119 fct.assig.				112 086
061 000: MAIN: Without function				
GOOSE: Input 120 fct.assig.				112 087
061 000: MAIN: Without function				
GOOSE: Input 121 fct.assig.				112 088
061 000: MAIN: Without function				
GOOSE: Input 122 fct.assig.				112 089
061 000: MAIN: Without function				
GOOSE: Input 123 fct.assig.				112 090
061 000: MAIN: Without function				
GOOSE: Input 124 fct.assig.				112 091
061 000: MAIN: Without function				
GOOSE: Input 125 fct.assig.				112 092
061 000: MAIN: Without function				
GOOSE: Input 126 fct.assig.				112 093
061 000: MAIN: Without function				
GOOSE: Input 127 fct.assig.				112 094
061 000: MAIN: Without function				
GOOSE: Input 128 fct.assig.				112 095
061 000: MAIN: Without function				
Function assignment of the virtual binary GOOSE inputs (GosGGIO1/Pos1.stVal, GosGGIO1/Pos2.stVal, ...) to a binary logical state signal on the device so that they can be processed further by the protection, control or logic functions. Signals configured here contain the received and pre-processed state of data attributes configured for GOOSE receipt.				

IRIG-B interface

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
IRIGB: Function group IRIGB					056 072
0: Without					
Cancelling function group IRIGB or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					
IRIGB: General enable USER					023 200
0: No				Fig. 3-28, (p. 3-48)	
Disabling or enabling the IRIG-B interface.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
INP: Filter					010 220
6	0	20		Fig. 3-29, (p. 3-50)	
Input filter which is activated when either the mode *Active "high", filt.* or *Active "low", filt.* has been selected for **INP: Oper. mode U xxx**. In order to suppress transient interference peaks at the logic signal inputs it is suggested to set this parameter to *6 [steps]*.					
INP: Fct. assignm. U 301					152 217
061 000: MAIN: Without function					
INP: Fct. assignm. U 302					152 220
061 000: MAIN: Without function					
INP: Fct. assignm. U 303					152 223
061 000: MAIN: Without function					
INP: Fct. assignm. U 304					152 226
061 000: MAIN: Without function					
INP: Fct. assignm. U 305					186 118
061 000: MAIN: Without function					
INP: Fct. assignm. U 306					186 122
061 000: MAIN: Without function					
INP: Fct. assignm. U 307					186 126
061 000: MAIN: Without function					
INP: Fct. assignm. U 308					186 130
061 000: MAIN: Without function					
INP: Fct. assignm. U 309					186 134
061 000: MAIN: Without function					
INP: Fct. assignm. U 310					186 138
061 000: MAIN: Without function					
INP: Fct. assignm. U 311					186 142
061 000: MAIN: Without function					
INP: Fct. assignm. U 312					186 146
061 000: MAIN: Without function					
INP: Fct. assignm. U 313					186 150
061 000: MAIN: Without function					
INP: Fct. assignm. U 314					186 154
061 000: MAIN: Without function					
INP: Fct. assignm. U 315					186 158
061 000: MAIN: Without function					
INP: Fct. assignm. U 316					186 162
061 000: MAIN: Without function					

Binary input

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: Fct. assignm. U 317				186 166
061 000: MAIN: Without function				
INP: Fct. assignm. U 318				186 170
061 000: MAIN: Without function				
INP: Fct. assignm. U 319				186 174
061 000: MAIN: Without function				
INP: Fct. assignm. U 320				186 178
061 000: MAIN: Without function				
INP: Fct. assignm. U 321				186 182
061 000: MAIN: Without function				
INP: Fct. assignm. U 322				186 186
061 000: MAIN: Without function				
INP: Fct. assignm. U 323				186 190
061 000: MAIN: Without function				
INP: Fct. assignm. U 324				186 194
061 000: MAIN: Without function				
INP: Fct. assignm. U 601				152 091
061 000: MAIN: Without function				
INP: Fct. assignm. U 602				152 094
061 000: MAIN: Without function				
INP: Fct. assignm. U 603				152 097
061 000: MAIN: Without function				
INP: Fct. assignm. U 604				152 100
061 000: MAIN: Without function				
INP: Fct. assignm. U 605				152 103
061 000: MAIN: Without function				
INP: Fct. assignm. U 606				152 106
061 000: MAIN: Without function				
INP: Fct. assignm. U 701				152 109
061 000: MAIN: Without function				
INP: Fct. assignm. U 702				152 112
061 000: MAIN: Without function				
INP: Fct. assignm. U 703				152 115
061 000: MAIN: Without function				
INP: Fct. assignm. U 704				152 118
061 000: MAIN: Without function				
INP: Fct. assignm. U 705				152 121
061 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
INP: Fct. assignm. U 706					152 124
061 000: MAIN: Without function					
INP: Fct. assignm. U 801					184 002
061 000: MAIN: Without function					
INP: Fct. assignm. U 802					184 006
061 000: MAIN: Without function					
INP: Fct. assignm. U 803					184 010
061 000: MAIN: Without function					
INP: Fct. assignm. U 804					184 014
061 000: MAIN: Without function					
INP: Fct. assignm. U 805					184 018
061 000: MAIN: Without function					
INP: Fct. assignm. U 806					184 022
061 000: MAIN: Without function					
INP: Fct. assignm. U 807					184 026
061 000: MAIN: Without function					
INP: Fct. assignm. U 808					184 030
061 000: MAIN: Without function					
INP: Fct. assignm. U 809					184 034
061 000: MAIN: Without function					
INP: Fct. assignm. U 810					184 038
061 000: MAIN: Without function					
INP: Fct. assignm. U 811					184 042
061 000: MAIN: Without function					
INP: Fct. assignm. U 812					184 046
061 000: MAIN: Without function					
INP: Fct. assignm. U 813					184 050
061 000: MAIN: Without function					
INP: Fct. assignm. U 814					184 054
061 000: MAIN: Without function					
INP: Fct. assignm. U 815					184 058
061 000: MAIN: Without function					
INP: Fct. assignm. U 816					184 062
061 000: MAIN: Without function					
INP: Fct. assignm. U 817					184 066
061 000: MAIN: Without function					
INP: Fct. assignm. U 818					184 070
061 000: MAIN: Without function					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
INP: Fct. assignm. U 819				184 074
061 000: MAIN: Without function				
INP: Fct. assignm. U 820				184 078
061 000: MAIN: Without function				
INP: Fct. assignm. U 821				184 082
061 000: MAIN: Without function				
INP: Fct. assignm. U 822				184 086
061 000: MAIN: Without function				
INP: Fct. assignm. U 823				184 090
061 000: MAIN: Without function				
INP: Fct. assignm. U 824				184 094
061 000: MAIN: Without function				
INP: Fct. assignm. U 901				152 145
061 000: MAIN: Without function				
INP: Fct. assignm. U 902				152 148
061 000: MAIN: Without function				
INP: Fct. assignm. U 903				152 151
061 000: MAIN: Without function				
INP: Fct. assignm. U 904				152 154
061 000: MAIN: Without function				
INP: Fct. assignm. U 1001				152 163
061 000: MAIN: Without function				
INP: Fct. assignm. U 1002				152 166
061 000: MAIN: Without function				
INP: Fct. assignm. U 1003				152 169
061 000: MAIN: Without function				
INP: Fct. assignm. U 1004				152 172
061 000: MAIN: Without function				
INP: Fct. assignm. U 1005				152 175
061 000: MAIN: Without function				
INP: Fct. assignm. U 1006				152 178
061 000: MAIN: Without function				
INP: Fct. assignm. U 1201				152 199
061 000: MAIN: Without function				
INP: Fct. assignm. U 1202				152 202
061 000: MAIN: Without function				
INP: Fct. assignm. U 1203				152 205
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: Fct. assignm. U 1204				152 208
061 000: MAIN: Without function				
INP: Fct. assignm. U 1205				152 211
061 000: MAIN: Without function				
INP: Fct. assignm. U 1206				152 214
061 000: MAIN: Without function				
INP: Fct. assignm. U 1401				190 002
061 000: MAIN: Without function				
INP: Fct. assignm. U 1402				190 006
061 000: MAIN: Without function				
INP: Fct. assignm. U 1403				190 010
061 000: MAIN: Without function				
INP: Fct. assignm. U 1404				190 014
061 000: MAIN: Without function				
INP: Fct. assignm. U 1405				190 018
061 000: MAIN: Without function				
INP: Fct. assignm. U 1406				190 022
061 000: MAIN: Without function				
INP: Fct. assignm. U 1601				192 002
061 000: MAIN: Without function				
INP: Fct. assignm. U 1602				192 006
061 000: MAIN: Without function				
INP: Fct. assignm. U 1603				192 010
061 000: MAIN: Without function				
INP: Fct. assignm. U 1604				192 014
061 000: MAIN: Without function				
INP: Fct. assignm. U 1605				192 018
061 000: MAIN: Without function				
INP: Fct. assignm. U 1606				192 022
061 000: MAIN: Without function				
INP: Fct. assignm. U 1607				192 026
061 000: MAIN: Without function				
INP: Fct. assignm. U 1608				192 030
061 000: MAIN: Without function				
INP: Fct. assignm. U 1609				192 034
061 000: MAIN: Without function				
INP: Fct. assignm. U 1610				192 038
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: Fct. assignm. U 1611				192 042
061 000: MAIN: Without function				
INP: Fct. assignm. U 1612				192 046
061 000: MAIN: Without function				
INP: Fct. assignm. U 1613				192 050
061 000: MAIN: Without function				
INP: Fct. assignm. U 1614				192 054
061 000: MAIN: Without function				
INP: Fct. assignm. U 1615				192 058
061 000: MAIN: Without function				
INP: Fct. assignm. U 1616				192 062
061 000: MAIN: Without function				
INP: Fct. assignm. U 1617				192 066
061 000: MAIN: Without function				
INP: Fct. assignm. U 1618				192 070
061 000: MAIN: Without function				
INP: Fct. assignm. U 1619				192 074
061 000: MAIN: Without function				
INP: Fct. assignm. U 1620				192 078
061 000: MAIN: Without function				
INP: Fct. assignm. U 1621				192 082
061 000: MAIN: Without function				
INP: Fct. assignm. U 1622				192 086
061 000: MAIN: Without function				
INP: Fct. assignm. U 1623				192 090
061 000: MAIN: Without function				
INP: Fct. assignm. U 1624				192 094
061 000: MAIN: Without function				
INP: Fct. assignm. U 1801				194 002
061 000: MAIN: Without function				
INP: Fct. assignm. U 1802				194 006
061 000: MAIN: Without function				
INP: Fct. assignm. U 1803				194 010
061 000: MAIN: Without function				
INP: Fct. assignm. U 1804				194 014
061 000: MAIN: Without function				
INP: Fct. assignm. U 1805				194 018
061 000: MAIN: Without function				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
INP: Fct. assignm. U 1806					194 022
061 000: MAIN: Without function					
INP: Fct. assignm. U 2001					153 087
061 000: MAIN: Without function					
INP: Fct. assignm. U 2002					153 090
061 000: MAIN: Without function					
INP: Fct. assignm. U 2003					153 093
061 000: MAIN: Without function					
INP: Fct. assignm. U 2004					153 096
061 000: MAIN: Without function					
Assignment of functions to binary signal inputs.					
INP: Oper. mode U 301					152 218
1: Active "high"					
INP: Oper. mode U 302					152 221
1: Active "high"					
INP: Oper. mode U 303					152 224
1: Active "high"					
INP: Oper. mode U 304					152 227
1: Active "high"					
INP: Oper. mode U 305					186 119
1: Active "high"					
INP: Oper. mode U 306					186 123
1: Active "high"					
INP: Oper. mode U 307					186 127
1: Active "high"					
INP: Oper. mode U 308					186 131
1: Active "high"					
INP: Oper. mode U 309					186 135
1: Active "high"					
INP: Oper. mode U 310					186 139
1: Active "high"					
INP: Oper. mode U 311					186 143
1: Active "high"					
INP: Oper. mode U 312					186 147
1: Active "high"					
INP: Oper. mode U 313					186 151
1: Active "high"					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: Oper. mode U 314				186 155
1: Active "high"				
INP: Oper. mode U 315				186 159
1: Active "high"				
INP: Oper. mode U 316				186 163
1: Active "high"				
INP: Oper. mode U 317				186 167
1: Active "high"				
INP: Oper. mode U 318				186 171
1: Active "high"				
INP: Oper. mode U 319				186 175
1: Active "high"				
INP: Oper. mode U 320				186 179
1: Active "high"				
INP: Oper. mode U 321				186 183
1: Active "high"				
INP: Oper. mode U 322				186 187
1: Active "high"				
INP: Oper. mode U 323				186 191
1: Active "high"				
INP: Oper. mode U 324				186 195
1: Active "high"				
INP: Oper. mode U 601				152 092
1: Active "high"				
INP: Oper. mode U 602				152 095
1: Active "high"				
INP: Oper. mode U 603				152 098
1: Active "high"				
INP: Oper. mode U 604				152 101
1: Active "high"				
INP: Oper. mode U 605				152 104
1: Active "high"				
INP: Oper. mode U 606				152 107
1: Active "high"				
INP: Oper. mode U 701				152 110
1: Active "high"				
INP: Oper. mode U 702				152 113
1: Active "high"				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
INP: Oper. mode U 703				152 116
1: Active "high"				
INP: Oper. mode U 704				152 119
1: Active "high"				
INP: Oper. mode U 705				152 122
1: Active "high"				
INP: Oper. mode U 706				152 125
1: Active "high"				
INP: Oper. mode U 801				184 003
1: Active "high"				
INP: Oper. mode U 802				184 007
1: Active "high"				
INP: Oper. mode U 803				184 011
1: Active "high"				
INP: Oper. mode U 804				184 015
1: Active "high"				
INP: Oper. mode U 805				184 019
1: Active "high"				
INP: Oper. mode U 806				184 023
1: Active "high"				
INP: Oper. mode U 807				184 027
1: Active "high"				
INP: Oper. mode U 808				184 031
1: Active "high"				
INP: Oper. mode U 809				184 035
1: Active "high"				
INP: Oper. mode U 810				184 039
1: Active "high"				
INP: Oper. mode U 811				184 043
1: Active "high"				
INP: Oper. mode U 812				184 047
1: Active "high"				
INP: Oper. mode U 813				184 051
1: Active "high"				
INP: Oper. mode U 814				184 055
1: Active "high"				
INP: Oper. mode U 815				184 059
1: Active "high"				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
INP: Oper. mode U 816				184 063
1: Active "high"				
INP: Oper. mode U 817				184 067
1: Active "high"				
INP: Oper. mode U 818				184 071
1: Active "high"				
INP: Oper. mode U 819				184 075
1: Active "high"				
INP: Oper. mode U 820				184 079
1: Active "high"				
INP: Oper. mode U 821				184 083
1: Active "high"				
INP: Oper. mode U 822				184 087
1: Active "high"				
INP: Oper. mode U 823				184 091
1: Active "high"				
INP: Oper. mode U 824				184 095
1: Active "high"				
INP: Oper. mode U 901				152 146
1: Active "high"				
INP: Oper. mode U 902				152 149
1: Active "high"				
INP: Oper. mode U 903				152 152
1: Active "high"				
INP: Oper. mode U 904				152 155
1: Active "high"				
INP: Oper. mode U 1001				152 164
1: Active "high"				
INP: Oper. mode U 1002				152 167
1: Active "high"				
INP: Oper. mode U 1003				152 170
1: Active "high"				
INP: Oper. mode U 1004				152 173
1: Active "high"				
INP: Oper. mode U 1005				152 176
1: Active "high"				
INP: Oper. mode U 1006				152 179
1: Active "high"				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
INP: Oper. mode U 1201					152 200
1: Active "high"					
INP: Oper. mode U 1202					152 203
1: Active "high"					
INP: Oper. mode U 1203					152 206
1: Active "high"					
INP: Oper. mode U 1204					152 209
1: Active "high"					
INP: Oper. mode U 1205					152 212
1: Active "high"					
INP: Oper. mode U 1206					152 215
1: Active "high"					
INP: Oper. mode U 1401					190 003
1: Active "high"					
INP: Oper. mode U 1402					190 007
1: Active "high"					
INP: Oper. mode U 1403					190 011
1: Active "high"					
INP: Oper. mode U 1404					190 015
1: Active "high"					
INP: Oper. mode U 1405					190 019
1: Active "high"					
INP: Oper. mode U 1406					190 023
1: Active "high"					
INP: Oper. mode U 1601					192 003
1: Active "high"					
INP: Oper. mode U 1602					192 007
1: Active "high"					
INP: Oper. mode U 1603					192 011
1: Active "high"					
INP: Oper. mode U 1604					192 015
1: Active "high"					
INP: Oper. mode U 1605					192 019
1: Active "high"					
INP: Oper. mode U 1606					192 023
1: Active "high"					
INP: Oper. mode U 1607					192 027
1: Active "high"					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: Oper. mode U 1608				192 031
1: Active "high"				
INP: Oper. mode U 1609				192 035
1: Active "high"				
INP: Oper. mode U 1610				192 039
1: Active "high"				
INP: Oper. mode U 1611				192 043
1: Active "high"				
INP: Oper. mode U 1612				192 047
1: Active "high"				
INP: Oper. mode U 1613				192 051
1: Active "high"				
INP: Oper. mode U 1614				192 055
1: Active "high"				
INP: Oper. mode U 1615				192 059
1: Active "high"				
INP: Oper. mode U 1616				192 063
1: Active "high"				
INP: Oper. mode U 1617				192 067
1: Active "high"				
INP: Oper. mode U 1618				192 071
1: Active "high"				
INP: Oper. mode U 1619				192 075
1: Active "high"				
INP: Oper. mode U 1620				192 079
1: Active "high"				
INP: Oper. mode U 1621				192 083
1: Active "high"				
INP: Oper. mode U 1622				192 087
1: Active "high"				
INP: Oper. mode U 1623				192 091
1: Active "high"				
INP: Oper. mode U 1624				192 095
1: Active "high"				
INP: Oper. mode U 1801				194 003
1: Active "high"				
INP: Oper. mode U 1802				194 007
1: Active "high"				

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
INP: Oper. mode U 1803							194 011
1: Active "high"							
INP: Oper. mode U 1804							194 015
1: Active "high"							
INP: Oper. mode U 1805							194 019
1: Active "high"							
INP: Oper. mode U 1806							194 023
1: Active "high"							
INP: Oper. mode U 2001							153 088
1: Active "high"							
INP: Oper. mode U 2002							153 091
1: Active "high"							
INP: Oper. mode U 2003							153 094
1: Active "high"							
INP: Oper. mode U 2004							153 097
1: Active "high"							
Selection of operating mode for binary signal inputs.							

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASI: Function group MEASI					056 030
0: Without					
Cancelling function group MEASI or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					
MEASI: General enable USER					011 100
0: No				Fig. 3-30, (p. 3-51) Fig. 3-40, (p. 3-62)	
Disabling or enabling analog measured data input.					
MEASI: Enable IDC p.u.					037 190
0.000	0.000	0.200	IDC,nom	Fig. 3-33, (p. 3-54)	
Setting for the minimum current that must flow in order for the P139 to display a measured value > 0 (zero suppression).					
MEASI: IDC< open circuit					037 191
3.0	0.0	10.0	mA	Fig. 3-33, (p. 3-54)	
If the input current falls below the set threshold, the P139 will issue an “open circuit” signal.					
MEASI: IDC 1					037 150
0.000	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 2					037 152
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 3					037 154
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 4					037 156
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 5					037 158
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 6					037 160
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 7					037 162
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 8					037 164
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 9					037 166
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 10					037 168
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	

Measured data input

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASI: IDC 11					037 170
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 12					037 172
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 13					037 174
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 14					037 176
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 15					037 178
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 16					037 180
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 17					037 182
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 18					037 184
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 19					037 186
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC 20					037 188
1.200	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
Setting for the input current that will correspond to a linearized value that has been set accordingly.					
MEASI: IDC,lin 1					037 151
0.000	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 2					037 153
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 3					037 155
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 4					037 157
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 5					037 159
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 6					037 161
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 7					037 163
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 8					037 165
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASI: IDC,lin 9					037 167
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 10					037 169
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 11					037 171
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 12					037 173
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 13					037 175
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 14					037 177
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 15					037 179
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 16					037 181
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 17					037 183
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 18					037 185
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 19					037 187
Blocked	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
MEASI: IDC,lin 20					037 189
1.200	0.000	1.200	IDC,nom	Fig. 3-33, (p. 3-54)	
Setting for the linearized current that will correspond to an input current that has been set accordingly.					
MEASI: Scaled val. IDC,lin1					037 192
0	-32768	32767		Fig. 3-34, (p. 3-55)	
Setting for the scaled value of IDC,lin1.					
MEASI: Scaled val.IDC,lin20					037 193
1200	-32768	32767		Fig. 3-34, (p. 3-55)	
Setting for the scaled value of IDC,lin20.					
MEASI: Type of TempSensors					004 254
0: PT 100					
Selection of the temperature sensor type (PT 100, NI 100 or NI 120).					

Binary and analog output

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: Fct. assignm. K 301				151 045
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 302				151 048
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 601				150 121
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 602				150 124
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 603				150 127
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 604				150 130
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 605				150 133
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 606				150 136
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 607				150 139
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 608				150 142
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 701				150 145
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 702				150 148
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 703				150 151
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 704				150 154
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 705				150 157
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 706				150 160
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 707				150 163
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 708				150 166
060 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
OUTP: Fct. assignm. K 801					150 169
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 802					150 172
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 803					150 175
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 804					150 178
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 805					150 181
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 806					150 184
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 807					150 187
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 808					150 190
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 901					150 193
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 902					150 196
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 903					150 199
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 904					150 202
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 905					150 205
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 906					150 208
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 907					150 211
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 908					150 214
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 1001					150 217
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 1002					150 220
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 1003					150 223
060 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: Fct. assignm. K 1004				150 226
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1005				150 229
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1006				150 232
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1007				150 235
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1008				150 238
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1201				151 009
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1202				151 012
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1203				151 015
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1204				151 018
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1205				151 021
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1206				151 024
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1207				151 027
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1208				151 030
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1401				169 002
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1402				169 006
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1403				169 010
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1404				169 014
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1405				169 018
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1406				169 022
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: Fct. assignm. K 1407				169 026
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1408				169 030
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1601				171 002
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1602				171 006
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1603				171 010
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1604				171 014
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1605				171 018
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1606				171 022
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1607				171 026
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1608				171 030
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1801				173 002
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1802				173 006
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1803				173 010
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1804				173 014
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1805				173 018
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 1806				173 022
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 2001				151 201
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 2002				151 204
060 000: MAIN: Without function				
OUTP: Fct. assignm. K 2003				151 207
060 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
OUTP: Fct. assignm. K 2004					151 210
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 2005					151 213
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 2006					151 216
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 2007					151 219
060 000: MAIN: Without function					
OUTP: Fct. assignm. K 2008					151 222
060 000: MAIN: Without function					
Assignment of functions to output relays.					
OUTP: Oper. mode K 301					151 046
1: ES updating					
OUTP: Oper. mode K 302					151 049
1: ES updating					
OUTP: Oper. mode K 601					150 122
1: ES updating					
OUTP: Oper. mode K 602					150 125
1: ES updating					
OUTP: Oper. mode K 603					150 128
1: ES updating					
OUTP: Oper. mode K 604					150 131
1: ES updating					
OUTP: Oper. mode K 605					150 134
1: ES updating					
OUTP: Oper. mode K 606					150 137
1: ES updating					
OUTP: Oper. mode K 607					150 140
1: ES updating					
OUTP: Oper. mode K 608					150 143
1: ES updating					
OUTP: Oper. mode K 701					150 146
1: ES updating					
OUTP: Oper. mode K 702					150 149
1: ES updating					
OUTP: Oper. mode K 703					150 152
1: ES updating					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
OUTP: Oper. mode K 704				150 155
1: ES updating				
OUTP: Oper. mode K 705				150 158
1: ES updating				
OUTP: Oper. mode K 706				150 161
1: ES updating				
OUTP: Oper. mode K 707				150 164
1: ES updating				
OUTP: Oper. mode K 708				150 167
1: ES updating				
OUTP: Oper. mode K 801				150 170
1: ES updating				
OUTP: Oper. mode K 802				150 173
1: ES updating				
OUTP: Oper. mode K 803				150 176
1: ES updating				
OUTP: Oper. mode K 804				150 179
1: ES updating				
OUTP: Oper. mode K 805				150 182
1: ES updating				
OUTP: Oper. mode K 806				150 185
1: ES updating				
OUTP: Oper. mode K 807				150 188
1: ES updating				
OUTP: Oper. mode K 808				150 191
1: ES updating				
OUTP: Oper. mode K 901				150 194
1: ES updating				
OUTP: Oper. mode K 902				150 197
1: ES updating				
OUTP: Oper. mode K 903				150 200
1: ES updating				
OUTP: Oper. mode K 904				150 203
1: ES updating				
OUTP: Oper. mode K 905				150 206
1: ES updating				
OUTP: Oper. mode K 906				150 209
1: ES updating				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
OUTP: Oper. mode K 907				150 212
1: ES updating				
OUTP: Oper. mode K 908				150 215
1: ES updating				
OUTP: Oper. mode K 1001				150 218
1: ES updating				
OUTP: Oper. mode K 1002				150 221
1: ES updating				
OUTP: Oper. mode K 1003				150 224
1: ES updating				
OUTP: Oper. mode K 1004				150 227
1: ES updating				
OUTP: Oper. mode K 1005				150 230
1: ES updating				
OUTP: Oper. mode K 1006				150 233
1: ES updating				
OUTP: Oper. mode K 1007				150 236
1: ES updating				
OUTP: Oper. mode K 1008				150 239
1: ES updating				
OUTP: Oper. mode K 1201				151 010
1: ES updating				
OUTP: Oper. mode K 1202				151 013
1: ES updating				
OUTP: Oper. mode K 1203				151 016
1: ES updating				
OUTP: Oper. mode K 1204				151 019
1: ES updating				
OUTP: Oper. mode K 1205				151 022
1: ES updating				
OUTP: Oper. mode K 1206				151 025
1: ES updating				
OUTP: Oper. mode K 1207				151 028
1: ES updating				
OUTP: Oper. mode K 1208				151 031
1: ES updating				
OUTP: Oper. mode K 1401				169 003
1: ES updating				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
OUTP: Oper. mode K 1402					169 007
1: ES updating					
OUTP: Oper. mode K 1403					169 011
1: ES updating					
OUTP: Oper. mode K 1404					169 015
1: ES updating					
OUTP: Oper. mode K 1405					169 019
1: ES updating					
OUTP: Oper. mode K 1406					169 023
1: ES updating					
OUTP: Oper. mode K 1407					169 027
1: ES updating					
OUTP: Oper. mode K 1408					169 031
1: ES updating					
OUTP: Oper. mode K 1601					171 003
1: ES updating					
OUTP: Oper. mode K 1602					171 007
1: ES updating					
OUTP: Oper. mode K 1603					171 011
1: ES updating					
OUTP: Oper. mode K 1604					171 015
1: ES updating					
OUTP: Oper. mode K 1605					171 019
1: ES updating					
OUTP: Oper. mode K 1606					171 023
1: ES updating					
OUTP: Oper. mode K 1607					171 027
1: ES updating					
OUTP: Oper. mode K 1608					171 031
1: ES updating					
OUTP: Oper. mode K 1801					173 003
1: ES updating					
OUTP: Oper. mode K 1802					173 007
1: ES updating					
OUTP: Oper. mode K 1803					173 011
1: ES updating					
OUTP: Oper. mode K 1804					173 015
1: ES updating					

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OUTP: Oper. mode K 1805							173 019
1: ES updating							
OUTP: Oper. mode K 1806							173 023
1: ES updating							
OUTP: Oper. mode K 2001							151 202
1: ES updating							
OUTP: Oper. mode K 2002							151 205
1: ES updating							
OUTP: Oper. mode K 2003							151 208
1: ES updating							
OUTP: Oper. mode K 2004							151 211
1: ES updating							
OUTP: Oper. mode K 2005							151 214
1: ES updating							
OUTP: Oper. mode K 2006							151 217
1: ES updating							
OUTP: Oper. mode K 2007							151 220
1: ES updating							
OUTP: Oper. mode K 2008							151 223
1: ES updating							
Selection of operating mode for output relays.							

Measured data output

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASO: Function group MEASO					056 020
0: Without					
Cancelling function group MEASI or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					
MEASO: General enable USER					031 074
0: No					
Disabling or enabling the measured data output function.					
MEASO: Fct. assignm. BCD					053 002
060 000: MAIN: Without function				Fig. 3-44, (p. 3-67)	
Selection of the measured value to be transmitted in BCD form.					
MEASO: Hold time output BCD					010 010
0.10	0.10	10.00	s	Fig. 3-44, (p. 3-67)	
Setting for the transmission time of the selected measured value in BCD form.					
MEASO: Scaled min. val. BCD					037 140
0.000	0.000	1.000			
MEASO: Scaled max. val. BCD					037 141
1.000	0.000	1.000			
MEASO: BCD-Out min. value					037 142
0	0	399			

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASO: BCD-Out max. value					037 143
399	0	399			

The variable Mx is to be issued in BCD form.

For measured values in the range “measured values to be issued” the output value should change linearly with the measured value.

- Range of measured values for the variable Mx: Mx,RL1 ... Mx,RL2
- Range of associated scaled measured values: 0 ... 1
- Range of measured values to be issued: Mx,min ... Mx,max
- Range of scaled measured values to be issued: Mx,scal,min ... Mx,scal,max
- Designation of the set values in the data model: “Scaled min. val. BCD” ... “Scaled max. val. BCD”

with:

Mx,scal,min = (Mx,min - Mx,RL1)/(Mx,RL2 - Mx,RL1)

Mx,scal,max = (Mx,max - Mx,RL1)/(Mx,RL2 - Mx,RL1)

BCD display values for measured values in the range “measured values to be issued”; range: “BCD-Out min. value” ... “BCD-Out max. value”

BBCD display values for measured values ≤ Mx,min; range: “BCD-Out min. value”

BCD display values for measured values ≥ Mx,max; range: “BCD-Out max. value”

MEASO: Fct. assignm. A-1					053 000
060 000: MAIN: Without function				Fig. 3-46, (p. 3-73)	
MEASO: Fct. assignm. A-2					053 001
060 000: MAIN: Without function					

Selection of the measured value to be transmitted in analog form.

MEASO: Hold time output A-1					010 114
0.10	0.10	10.00	s	Fig. 3-46, (p. 3-73)	
MEASO: Hold time output A-2					010 115
0.10	0.10	10.00	s		

Setting for the time delay for output of the selected measured value.

MEASO: Scaled min. val. A-1					037 104
0.000	0.000	1.000		Fig. 3-46, (p. 3-73)	
MEASO: Scaled knee val. A-1					037 105
Blocked	0.000	1.000		Fig. 3-46, (p. 3-73)	
MEASO: Scaled max. val. A-1					037 106
1.000	0.000	1.000		Fig. 3-46, (p. 3-73)	
MEASO: Scaled min. val. A-2					037 110
0.000	0.000	1.000			

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASO: Scaled knee val. A-2					037 111
Blocked	0.000	1.000			
MEASO: Scaled max. val. A-2					037 112
1.000	0.000	1.000			

After conversion via a characteristic the selected measured value Ax (x = 1, 2) is to be issued as an output current. For this purpose a range “measured values to be issued” is defined. In this range the characteristic has two linear sections, which are separated by a knee point.

- Range of measured values for the variable Mx: Mx,RL1 ... Mx,RL2
- Range of associated scaled measured values: 0 ... 1
- Range of measured values to be issued: Mx,min ... Mx,max
- Range of scaled measured values to be output: Mx,scal,min ... Mx,scal,max
- Designation of the set values in the data model: „Scaled min. val. Ax“ ... „Scaled max. val. Ax“

with:

Mx,scal,min = (Mx,min - Mx,RL1)/(Mx,RL2 - Mx,RL1)

Mx,scal,max = (Mx,max - Mx,RL1)/(Mx,RL2 - Mx,RL1)

- Designation of value for knee point: Mx,knee
- Designation of scaled knee point value: Mx,scaled,knee
- Designation of this set value in the data model: „Scaled knee val. Ax“

with:

Mx,scaled,knee = (Mx,knee - Mx,RL1)/(Mx,RL2 - Mx,RL1)

MEASO: AnOut min. val. A-1					037 107
0.00	0.00	20.00	mA	Fig. 3-46, (p. 3-73)	
MEASO: AnOut knee point A-1					037 108
Blocked	0.00	20.00	mA	Fig. 3-46, (p. 3-73)	
MEASO: AnOut max. val. A-1					037 109
20.00	0.00	20.00	mA	Fig. 3-46, (p. 3-73)	
MEASO: AnOut min. val. A-2					037 113
0.00	0.00	20.00	mA		
MEASO: AnOut knee point A-2					037 114
Blocked	0.00	20.00	mA		

Parameter								Address
Default	**Min**	**Max**	**Unit**					**Logic Diagram**
MEASO: AnOut max. val. A-2								037 115
20.00	0.00	20.00	mA					

Output current range for measured values in the range “measured values to be issued”; designation in the data model: “An-Out min. val. Ax” ... “An-Out max. val. Ax”

Output current to be set for measured values ≤ Mx,min; designation in the data model: “An-Out min. val. Ax”

Output current to be set for measured values ≥ Mx,max; designation in the data model: “An-Out max. val. Ax”

Output current to be set for measured values = Mx,knee; designation in the data model: “AnOut knee point Ax”

with:

Mx,min ... Mx,max: measured values to be issued

MEASO: Output value 1								037 120
0.00	0.00	100.00	%					
MEASO: Output value 2								037 121
0.00	0.00	100.00	%					
MEASO: Output value 3								037 122
0.00	0.00	100.00	%					

Measured values of external devices, which must be scaled to 0 to 100%, can be issued.

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**

LED indicators

Parameter / Default				Address
LED: Fct.assig. H 1 green				085 184
060 001: MAIN: Healthy				
Display of the operational readiness of the protection device. The function **MAIN: Healthy** is permanently assigned.				
LED: Fct.assig. H 2 yell.				085 001
004 065: MAIN: Blocked/faulty				
Display of the function assigned to LED indicator H 2. The function **MAIN: Blocked/faulty** is permanently assigned.				
LED: Fct.assig. H 3 yell.				085 004
036 070: SFMON: Warning (LED)				
Display of the function assigned to LED indicator H 3. The function **SFMON: Warning (LED)** is permanently assigned.				
LED: Fct.assig. H 4 red				085 007
036 251: MAIN: Gen. trip signal				
LED: Fct.assig. H 4 green				085 057
060 000: MAIN: Without function				
LED: Fct.assig. H 5 red				085 010
060 000: MAIN: Without function				
LED: Fct.assig. H 5 green				085 060
060 000: MAIN: Without function				
LED: Fct.assig. H 6 red				085 013
060 000: MAIN: Without function				
LED: Fct.assig. H 6 green				085 063
060 000: MAIN: Without function				
LED: Fct.assig. H 7 red				085 016
060 000: MAIN: Without function				
LED: Fct.assig. H 7 green				085 066
060 000: MAIN: Without function				
LED: Fct.assig. H 8 red				085 019
060 000: MAIN: Without function				
LED: Fct.assig. H 8 green				085 069
060 000: MAIN: Without function				
LED: Fct.assig. H 9 red				085 022
060 000: MAIN: Without function				
LED: Fct.assig. H 9 green				085 072
060 000: MAIN: Without function				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LED: Fct.assig. H10 red				085 025
060 000: MAIN: Without function				
LED: Fct.assig. H10 green				085 075
060 000: MAIN: Without function				
LED: Fct.assig. H11 red				085 028
060 000: MAIN: Without function				
LED: Fct.assig. H11 green				085 078
060 000: MAIN: Without function				
LED: Fct.assig. H12 red				085 031
060 000: MAIN: Without function				
LED: Fct.assig. H12 green				085 081
060 000: MAIN: Without function				
LED: Fct.assig. H13 red				085 034
060 000: MAIN: Without function				
LED: Fct.assig. H13 green				085 084
060 000: MAIN: Without function				
LED: Fct.assig. H14 red				085 037
060 000: MAIN: Without function				
LED: Fct.assig. H14 green				085 087
060 000: MAIN: Without function				
LED: Fct.assig. H15 red				085 040
060 000: MAIN: Without function				
LED: Fct.assig. H15 green				085 090
060 000: MAIN: Without function				
LED: Fct.assig. H16 red				085 043
060 000: MAIN: Without function				
LED: Fct.assig. H16 green				085 093
060 000: MAIN: Without function				
Assignment of functions to LED indicators.				
LED: Fct.assig. H17 red				085 185
080 111: LOC: Edit mode				
Display of the function assigned to LED indicator H 17. The function **LOC: Edit mode** is permanently assigned.				
LED: Operating mode H 1				085 182
1: ES updating				
The operating mode *ES updating* is permanently assigned.				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LED: Operating mode H 2				085 002
1: ES updating				
The operating mode *ES updating* is permanently assigned.				
LED: Operating mode H 3				085 005
1: ES updating				
The *ES updating* operating mode is permanently assigned.				
LED: Operating mode H 4				085 008
3: ES reset (fault)				
LED: Operating mode H 5				085 011
1: ES updating				
LED: Operating mode H 6				085 014
1: ES updating				
LED: Operating mode H 7				085 017
1: ES updating				
LED: Operating mode H 8				085 020
1: ES updating				
LED: Operating mode H 9				085 023
1: ES updating				
LED: Operating mode H 10				085 026
1: ES updating				
LED: Operating mode H 11				085 029
1: ES updating				
LED: Operating mode H 12				085 032
1: ES updating				
LED: Operating mode H 13				085 035
1: ES updating				
LED: Operating mode H 14				085 038
1: ES updating				
LED: Operating mode H 15				085 041
1: ES updating				
LED: Operating mode H 16				085 044
1: ES updating				
Selection of operating mode for LED indicators.				
LED: Operating mode H 17				085 183
1: ES updating				
The operating mode *ES updating* is permanently assigned.				

Main function

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Chann.assign.COMM1/2				003 169
1: COMM1->chann.1,(2-2)				Fig. 3-91, (p. 3-124)
Assignment of communication interfaces to physical communication channels.				
MAIN: Auto-assignment I/O				221 065
1: Yes				Fig. 3-326, (p. 3-397)
Disabling or enabling of automatic assignment of binary inputs and outputs to the set bay type.				
MAIN: Type of bay				220 000
1	1	9999		Fig. 3-326, (p. 3-397)
Configuration of a bay type.				
MAIN: Prim.Source TimeSync				103 210
0: COMM1/IEC				
Selection of the primary source for date and time synchronization. Available are *COMM1/IEC*, *COMM2/PC*, *IRIG-B* or a binary input for minute signal pulses.				
MAIN: BackupSourceTimeSync				103 211
1: COMM2/PC				
Selection of the backup source for date and time synchronization. Available are *COMM1/IEC*, *COMM2/PC*, *IRIG-B* or a binary input for minute signal pulses. The backup source is used when there is no synchronization generated by the primary source after **MAIN: Time sync. time-out** has elapsed.				
MAIN: Time sync. time-out				103 212
Blocked	1	60	min	
Time-out setting for the time synchronization generated by the primary source.				

Fault recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
FT_RC: Rec. analog chann. 1				035 160
1: Current IA				
FT_RC: Rec. analog chann. 2				035 161
2: Current IB				
FT_RC: Rec. analog chann. 3				035 162
3: Current IC				
FT_RC: Rec. analog chann. 4				035 163
5: Voltage A-G				
FT_RC: Rec. analog chann. 5				035 164
6: Voltage B-G				
FT_RC: Rec. analog chann. 6				035 165
7: Voltage C-G				
FT_RC: Rec. analog chann. 7				035 166
4: Current IN				
FT_RC: Rec. analog chann. 8				035 167
8: Voltage VNG				
FT_RC: Rec. analog chann. 9				035 168
210: Voltage Vref				
FT_RC: Rec. analog chann.10				035 169
0: Without				
The user specifies the channel on which each physical variable is recorded.				

Definite-time over-current protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DTOC: Function group DTOC				056 008
0: Without				
Cancelling function group DTOC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Inverse-time overcurrent protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IDMT1: Function group IDMT1				056 009
0: Without				
Cancelling function group IDMT1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Inverse-time overcurrent protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IDMT2: Function group IDMT2				056 013
0: Without				
Cancelling function group IDMT2 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Short-circuit direction determination

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SCDD: Function group SCDD				056 021
0: Without				
Canceling function group SCDD or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Switch on to fault protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SOTF: Function group SOTF				056 003
0: Without				
Cancelling function group SOTF or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Protective signaling

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
PSIG: Function group PSIG					056 004
0: Without					
Cancelling function group PSIG or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					

Auto-reclosing control

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
ARC: Function group ARC					056 005
0: Without					
Cancelling function group ARC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					

Automatic synchronism check

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
ASC: Function group ASC					056 006
0: Without					
Cancelling function group ASC or including it in the configuration. If any function group is cancelled from the configuration, then all associated settings and signals are hidden.					

Ground fault direction determination using steady-state values

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GFDSS: Function group GFDSS					056 012
0: Without					
Cancelling function group GFDSS or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.					

Transient ground fault direction determination

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
TGFD: Function group TGFD				056 019
0: Without				
Cancelling function group TGFD or including it in the configuration. If any function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Motor protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MP: Function group MP				056 022
0: Without				
Cancelling function group MP or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Thermal overload protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
THERM: Function group THERM				056 023
0: Without				
Cancelling function group THERM or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Unbalance protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
I2>: Function group I2>				056 024
0: Without				
Cancelling function group I2> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Time-voltage protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
V<>: Function group V<>				056 010
0: Without				
Cancelling function group V<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Over-/ underfrequency protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
f<>: Function group f<>				056 033
0: Without				
Canceling function group f<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				

Underfrequency load shedding

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
Pf<: Function group Pf<				056 094
0: Without				
Cancelling function group Pf< or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Power directional protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
P<>: Function group P<>				056 045
0: Without				
Cancelling function group P<> or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

Voltage controlled directional reactive power protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
QV: Function group QV					056 092
0: Without					

Cancelling function group QV or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.

Circuit breaker failure protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBF: Function group CBF					056 007
0: Without					

Cancelling function group CBF or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Circuit breaker condition monitoring

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBM: Function group CBM					056 062
0: Without					

Cancelling function group CBM or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.

Measuring-circuit monitoring

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MCMON: Function group MCMON					056 015
0: Without					

Cancelling function group MCMON or including it in the configuration.
If the function group is cancelled from the configuration, then all associated settings and signals are hidden.

Limit value monitoring

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
LIMIT: Function group LIMIT							056 025
0: Without							
Cancelling function group LIMIT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.							

Programmable Logic

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
LOGIC: Function group LOGIC							056 017
0: Without							
Cancelling function group LOGIC or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.							

Programmable Logic

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
LOG_2: Function group LOG_2							056 089
0: Without							
Cancelling function group LOG_2 (“Logic 2”) or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.							

External device

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DEV01: Function group DEV01				210 047
0: Without				
DEV02: Function group DEV02				210 097
0: Without				
DEV03: Function group DEV03				210 147
0: Without				
DEV04: Function group DEV04				210 197
0: Without				
DEV05: Function group DEV05				210 247
0: Without				
DEV06: Function group DEV06				211 047
0: Without				
DEV07: Function group DEV07				211 097
0: Without				
DEV08: Function group DEV08				211 147
0: Without				
DEV09: Function group DEV09				211 197
0: Without				
DEV10: Function group DEV10				211 247
0: Without				
Cancelling function groups DEV01 to DEV03 or including them in the configuration. If any function group is cancelled from the configuration, then all associated settings and signals are hidden.				
DEV01: Funct. type, signal				210 034
242	1	254		
DEV02: Funct. type, signal				210 084
242	1	254		
DEV03: Funct. type, signal				210 134
242	1	254		
DEV04: Funct. type, signal				210 184
242	1	254		
DEV05: Funct. type, signal				210 234
242	1	254		
DEV06: Funct. type, signal				211 034
242	1	254		
DEV07: Funct. type, signal				211 084
242	1	254		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DEV08: Funct. type, signal				211 134
242	1	254		
DEV09: Funct. type, signal				211 184
242	1	254		
DEV10: Funct. type, signal				211 234
242	1	254		

Setting the function type of the signal.

Note: If the IEC 870-5-101 communication protocol has been set, then the 'low address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN2.

Parameter				Address
DEV01: Inform. No., signal				210 035
1	0	254		
DEV02: Inform. No., signal				210 085
3	0	254		
DEV03: Inform. No., signal				210 135
5	0	254		
DEV04: Inform. No., signal				210 185
7	0	254		
DEV05: Inform. No., signal				210 235
9	0	254		
DEV06: Inform. No., signal				211 035
11	0	254		
DEV07: Inform. No., signal				211 085
13	0	255		
DEV08: Inform. No., signal				211 135
15	0	254		
DEV09: Inform. No., signal				211 185
17	0	254		
DEV10: Inform. No., signal				211 235
19	0	254		

Setting the information number of the signal.

Note: If the IEC 870-5-101 communication protocol has been set, then the 'high address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN3.

Parameter				Address
DEV01: Funct. type, command				210 032
242	1	254		
DEV02: Funct. type, command				210 082
242	1	254		

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
DEV03: Funct. type, command							210 132
242	1	254					
DEV04: Funct. type, command							210 182
242	1	254					
DEV05: Funct. type, command							210 232
242	1	254					
DEV06: Funct. type, command							211 032
242	1	254					
DEV07: Funct. type, command							211 082
242	1	254					
DEV08: Funct. type, command							211 132
242	1	254					
DEV09: Funct. type, command							211 182
242	1	254					
DEV10: Funct. type, command							211 232
242	1	254					

Setting for the function type of the command.

Note: If the IEC 870-5-101 communication protocol has been set, then the “low address” of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN2.

DEV01: Inform. No., command							210 033
65	0	254					
DEV02: Inform. No., command							210 083
67	0	254					
DEV03: Inform. No., command							210 133
69	0	254					
DEV04: Inform. No., command							210 183
71	0	254					
DEV05: Inform. No., command							210 233
73	0	254					
DEV06: Inform. No., command							211 033
75	0	254					
DEV07: Inform. No., command							211 083
77	0	254					
DEV08: Inform. No., command							211 133
79	0	254					
DEV09: Inform. No., command							211 183
81	0	254					

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
DEV10: Inform. No., command							211 233
83	0	254					

Setting the information number of the command.

Note: If the IEC 870-5-101 communication protocol has been set, then the 'high address' of the information object will be defined by this setting. If the ILS-C protocol has been set, then this setting will correspond to DN3.

Parameter					Address
Default	Min	Max	Unit		Logic Diagram

Three Position Drive

TPD1: Function group TPD1				219 000
0: Without				
TPD2: Function group TPD2				219 020
0: Without				
TPD3: Function group TPD3				219 040
0: Without				
TPD4: Function group TPD4				219 060
0: Without				

Cancelling function group TPDx or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.

TPD1: TPD1 Disconnector				219 003
0: Not assigned				
TPD1: TPD1 ground. switch				219 004
0: Not assigned				
TPD2: TPD2 Disconnector				219 023
0: Not assigned				
TPD2: TPD2 ground. switch				219 024
0: Not assigned				
TPD3: TPD3 Disconnector				219 043
0: Not assigned				
TPD3: TPD3 ground. switch				219 044
0: Not assigned				
TPD4: TPD4 Disconnector				219 063
0: Not assigned				
TPD4: TPD4 ground. switch				219 064
0: Not assigned				

Every function group TPDx defines a virtual device, each of which consists of a disconnecting and a grounding switch. This setting selects which of the connected ordinary 2-pole devices is the disconnector and which is the grounding switch.

Single-pole signals

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SIG_1: Function group SIG_1				249 250
1: With				
Cancelling function group SIG_1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				
SIG_1: Signal S001 config.				226 007
0: No				Fig. 3-351, (p. 3-431)
SIG_1: Signal S002 config.				226 015
0: No				
SIG_1: Signal S003 config.				226 023
0: No				
SIG_1: Signal S004 config.				226 031
0: No				
SIG_1: Signal S005 config.				226 039
0: No				
SIG_1: Signal S006 config.				226 047
0: No				
SIG_1: Signal S007 config.				226 055
0: No				
SIG_1: Signal S008 config.				226 063
0: No				
SIG_1: Signal S009 config.				226 071
0: No				
SIG_1: Signal S010 config.				226 079
0: No				
SIG_1: Signal S011 config.				226 087
0: No				
SIG_1: Signal S012 config.				226 095
0: No				
SIG_1: Signal S013 config.				226 103
0: No				
SIG_1: Signal S014 config.				226 111
0: No				
SIG_1: Signal S015 config.				226 119
0: No				
SIG_1: Signal S016 config.				226 127
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Signal S017 config.				226 135
0: No				
SIG_1: Signal S018 config.				226 143
0: No				
SIG_1: Signal S019 config.				226 151
0: No				
SIG_1: Signal S020 config.				226 159
0: No				
SIG_1: Signal S021 config.				226 167
0: No				
SIG_1: Signal S022 config.				226 175
0: No				
SIG_1: Signal S023 config.				226 183
0: No				
SIG_1: Signal S024 config.				226 191
0: No				
SIG_1: Signal S025 config.				226 199
0: No				
SIG_1: Signal S026 config.				226 207
0: No				
SIG_1: Signal S027 config.				226 215
0: No				
SIG_1: Signal S028 config.				226 223
0: No				
SIG_1: Signal S029 config.				226 231
0: No				
SIG_1: Signal S030 config.				226 239
0: No				
SIG_1: Signal S031 config.				226 247
0: No				
SIG_1: Signal S032 config.				226 255
0: No				
SIG_1: Signal S033 config.				227 007
0: No				
SIG_1: Signal S034 config.				227 015
0: No				
SIG_1: Signal S035 config.				227 023
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Signal S036 config.				227 031
0: No				
SIG_1: Signal S037 config.				227 039
0: No				
SIG_1: Signal S038 config.				227 047
0: No				
SIG_1: Signal S039 config.				227 055
0: No				
SIG_1: Signal S040 config.				227 063
0: No				
SIG_1: Signal S041 config.				227 071
0: No				
SIG_1: Signal S042 config.				227 079
0: No				
SIG_1: Signal S043 config.				227 087
0: No				
SIG_1: Signal S044 config.				227 095
0: No				
SIG_1: Signal S045 config.				227 103
0: No				
SIG_1: Signal S046 config.				227 111
0: No				
SIG_1: Signal S047 config.				227 119
0: No				
SIG_1: Signal S048 config.				227 127
0: No				
SIG_1: Signal S049 config.				227 135
0: No				
SIG_1: Signal S050 config.				227 143
0: No				
SIG_1: Signal S051 config.				227 151
0: No				
SIG_1: Signal S052 config.				227 159
0: No				
SIG_1: Signal S053 config.				227 167
0: No				
SIG_1: Signal S054 config.				227 175
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SIG_1: Signal S055 config.				227 183
0: No				
SIG_1: Signal S056 config.				227 191
0: No				
SIG_1: Signal S057 config.				227 199
0: No				
SIG_1: Signal S058 config.				227 207
0: No				
SIG_1: Signal S059 config.				227 215
0: No				
SIG_1: Signal S060 config.				227 223
0: No				
SIG_1: Signal S061 config.				227 231
0: No				
SIG_1: Signal S062 config.				227 239
0: No				
SIG_1: Signal S063 config.				227 247
0: No				
SIG_1: Signal S064 config.				227 255
0: No				
Cancelling the signal or including it in the configuration. If a signal is cancelled, then all associated settings and signals are hidden.				
SIG_1: SIG_DC3 config.				233 007
0: No				Fig. 3-347, (p. 3-424)
Cancelling the signal SIG_DC3 or including it in the configuration. This signal is used to terminate a direct motor control command in combination with the single-pole command **CMD_1: CMD_DC3**. If this signal is cancelled, then all associated settings are hidden.				

Single-pole commands

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CMD_1: Function group CMD_1				249 252
1: With				
Cancelling function group CMD_1 or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.				
CMD_1: Command C001 config.				200 004
0: No				Fig. 3-350, (p. 3-429)
CMD_1: Command C002 config.				200 009
0: No				
CMD_1: Command C003 config.				200 014
0: No				
CMD_1: Command C004 config.				200 019
0: No				
CMD_1: Command C005 config.				200 024
0: No				
CMD_1: Command C006 config.				200 029
0: No				
CMD_1: Command C007 config.				200 034
0: No				
CMD_1: Command C008 config.				200 039
0: No				
CMD_1: Command C009 config.				200 044
0: No				
CMD_1: Command C010 config.				200 049
0: No				
CMD_1: Command C011 config.				200 054
0: No				
CMD_1: Command C012 config.				200 059
0: No				
CMD_1: Command C013 config.				200 064
0: No				
CMD_1: Command C014 config.				200 069
0: No				
CMD_1: Command C015 config.				200 074
0: No				
CMD_1: Command C016 config.				200 079
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CMD_1: Command C017 config.				200 084
0: No				
CMD_1: Command C018 config.				200 089
0: No				
CMD_1: Command C019 config.				200 094
0: No				
CMD_1: Command C020 config.				200 099
0: No				
CMD_1: Command C021 config.				200 104
0: No				
CMD_1: Command C022 config.				200 109
0: No				
CMD_1: Command C023 config.				200 114
0: No				
CMD_1: Command C024 config.				200 119
0: No				
CMD_1: Command C025 config.				200 124
0: No				
CMD_1: Command C026 config.				200 129
0: No				
Cancelling the command or including it in the configuration. If the command is cancelled, then all associated settings and signals are hidden, with the exception of this setting.				
CMD_1: CMD_DC1 config.				202 004
0: No				Fig. 3-345, (p. 3-423)
Cancelling command CMD_DC1 or including it in the configuration. This command is used for Three Position Drives, the operation is delayed by the set value **MAIN: DC op. delay t1**, and it is terminated either with positive indication of the final switchgear position, or when the timer **MAIN: DC1 impulse t2** has elapsed. If the command is cancelled, then all associated settings and signals are hidden, with the exception of this setting.				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
CMD_1: CMD_DC2 config.							202 009
0: No				Fig. 3-346, (p. 3-423)			

Cancelling command CMD_DC2 or including it in the configuration. This command is used for direct motor control, the operation is delayed by the set value **MAIN: DC op. delay t1**, and it is terminated with positive indication of the final switchgear position, but this reset is delayed by the set value **MAIN: DC2/3 release delay**.

If the command is cancelled, then all associated settings and signals are hidden, with the exception of this setting.

Parameter							Address
CMD_1: CMD_DC3 config.							202 014
0: No				Fig. 3-347, (p. 3-424)			

Cancelling command CMD_DC3 or including it in the configuration. This command is used for direct motor control, the operation is delayed by the set value **MAIN: DC op. delay t1**, and it is terminated with the signal **SIG_1: Logic SIG_DC3** or – if **MAIN: ext.cmd.term. w/o PI** = *No* – with positive indication of the final switchgear position; in any case this reset is delayed by the set value **MAIN: DC2/3 release delay**.

If the command is cancelled, then all associated settings and signals are hidden, with the exception of this setting.

Interlocking logic

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
ILOCK: Function group ILOCK				250 102
1: With				

Cancelling function group ILOCK or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Binary counts

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COUNT: Function group COUNT				217 047
0: Without				

Cancelling function group COUNT or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden, with the exception of this setting.

Real Timer

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
TIMER: Function group TIMER				056 093
0: Without				
Cancelling function group TIMER or including it in the configuration. If the function group is cancelled from the configuration, then all associated settings and signals are hidden.				

7.1.3 Function Parameters

7.1.3.1 Global

PC link

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
PC: Command blocking				003 182
0: No				Fig. 3-10, (p. 3-15)
When command blocking is activated, commands are rejected at the PC interface.				
PC: Sig./meas.val.block.				003 086
0: No				Fig. 3-10, (p. 3-15)
When signal and measured value blocking is activated, no signals or measured data are transmitted through the PC interface.				

“Logical” communication interface 1

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM1: Command block. USER				003 172
1: Yes				Fig. 3-11, (p. 3-17)
When command blocking is activated, commands are rejected at communication interface 1.				
COMM1: Sig./meas.block.USER				003 076
0: No				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
When signal and measured value blocking user is activated, no signals or measured data are transmitted through communication interface COMM1.				

Parameter						Address
Default	Min	Max	Unit			Logic Diagram

“Logical” communication interface 2

COMM2: Command block. USER				103 172
0: No	Fig. 3-19, (p. 3-25)			
When command blocking is activated, commands are rejected at communication interface 2.				
COMM2: Sig./meas.block.USER				103 076
0: No	Fig. 3-19, (p. 3-25)			
When signal and measured value blocking user is activated, no signals or measured data are transmitted through communication interface COMM2.				

Parameter						Address
Default	Min	Max	Unit			Logic Diagram

Binary and analog output

OUTP: Outp.rel.block USER				021 014
0: No	Fig. 3-38, (p. 3-60)			
When this blocking is activated, all output relays are blocked.				

Main function

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Device on-line					003 030
0: No (= off)				Fig. 3-63, (p. 3-97)	
Switching the device off-line or on-line. Some parameters can only be changed when protection is disabled.					
MAIN: Test mode USER					003 012
0: No				Fig. 3-92, (p. 3-125)	
When the test mode user is activated, signals or measured data for PC and communication interfaces are labeled 'test mode'.					
MAIN: Nominal frequ. fnom					010 030
50: 50 Hz			Hz		
Setting for the nominal frequency of the protected system.					
MAIN: Phase sequence					010 049
1: A - B - C				Fig. 3-54, (p. 3-88)	
Setting the phase sequence A-B-C or A-C-B. (Alternative terminology: Setting for the rotary field's direction, either clockwise or anticlockwise.)					
MAIN: Time tag					221 098
1: 1stEdge,OpMem sorted					
For bay control function signals detected via binary signal inputs and conditioned with debouncing it is now possible to select whether the time tag for the signal is to be issued after debouncing or when the first pulse edge is detected. Furthermore it is defined whether entries in the operating data memory are made in chronological order or not.					
MAIN: Inom C.T. prim.					010 001
1000	1	50000	A	Fig. 3-50, (p. 3-84) Fig. 3-51, (p. 3-85) Fig. 3-299, (p. 3-368)	
Setting for the primary nominal current of the main current transformers for measurement of phase currents.					
MAIN: DTOC/IDMT 2phase					011 226
0: No					
If this parameter is set to *w/o starting*, then the protection functions DTOC and IDMT ignore current IB, as if it were constantly equal 0, and only the currents IA and IC are analyzed. If it is set to *with starting*, 3 phase currents will be analyzed. For Phase B, only the starting signal will be issued but not a tripping.					
MAIN: IN,nom C.T. prim.					010 018
1000	1	50000	A	Fig. 3-52, (p. 3-86)	
Setting for the primary nominal current of the main current transformer for measurement of residual current.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Vnom V.T. prim.					010 002
100.0	0.1	1000.0	kV	Fig. 3-55, (p. 3-89)	
Setting for the primary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.					
MAIN: VNG,nom V.T. prim.					010 027
100.0	0.1	1000.0	kV	Fig. 3-56, (p. 3-90)	
Setting for the primary nominal voltage of the system transformer for measurement of neutral-point displacement voltage.					
MAIN: Vref,nom V.T. prim.					010 100
100.0	0.1	1000.0	kV	Fig. 3-57, (p. 3-90)	
Setting for the primary nominal voltage of the system transformer for measurement of reference voltage for automatic synchronism check.					
MAIN: Inom device					010 003
1.0: 1.0 A			A	Fig. 3-49, (p. 3-80)	
Setting for the secondary nominal current of the system transformer for measurement of phase currents. This also corresponds to the nominal device current.					
MAIN: IN,nom device					010 026
1.0: 1.0 A			A	Fig. 3-49, (p. 3-80)	
Setting for the secondary nominal current of the system transformer for measurement of residual current. This also corresponds to the nominal device current.					
MAIN: Vnom V.T. sec.					010 009
100	50	130	V	Fig. 3-49, (p. 3-80)	
Setting for the secondary nominal voltage of the system transformer for measurement of phase-to-ground and phase-to-phase voltages.					
MAIN: VNG,nom V.T. sec.					010 028
100	50	130	V	Fig. 3-49, (p. 3-80)	
Setting for the secondary nominal voltage of the system transformer for measurement of neutral-point displacement voltage.					
MAIN: Vref,nom V.T. sec.					031 052
100	30	130	V	Fig. 3-49, (p. 3-80)	
Setting for the secondary nominal voltage of the system transformer for measurement of reference voltage for automatic synchronism check.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Conn. meas. circ. IP				010 004
1: Standard				Fig. 3-49, (p. 3-80)
Short-circuit direction determination depends on the connection of the measuring circuits. If the connection is as shown in Chapter “Installation and Connection”, then the setting must be *Standard*, if the P139's '*forward*' decision is to be in the direction of the outgoing feeder. If the connection direction is reversed or – given a connection scheme according to Chapter “Installation and Connection” – if the '*forward*' decision is to be in the busbar direction, then the setting must be *Opposite*.				
MAIN: Conn. meas. circ. IN				010 019
1: Standard				Fig. 3-49, (p. 3-80)
Direction determination of the ground fault measuring systems depends on the connection of the measuring circuits. If the connection is as shown in Chapter “Installation and Connection”, then the setting must be *Standard*, if the P139's '*forward*' decision is to be in the direction of the outgoing feeder. If the connection direction is reversed or – given a connection scheme according to Chapter “Installation and Connection” – if the '*forward*' decision is to be in the busbar direction, then the setting must be *Opposite*.				
MAIN: Meas. direction P,Q				006 096
1: Standard				Fig. 3-58, (p. 3-91)
This parameter allows inverting the sign for the following measured operating values: ● **MAIN: Active power P prim.** ● **MAIN: Reac. power Q prim.** ● **MAIN: Active power P p.u.** ● **MAIN: Reac. power Q p.u.**				
MAIN: Meas. value rel. IP				011 030
0.000	0.000	0.200	Inom	Fig. 3-50, (p. 3-84)
Setting for the minimum current that must be exceeded so that measured operating values of the phase currents and, if applicable, derived currents are displayed.				
MAIN: Meas. value rel. IN				011 031
0.000	0.000	0.200	IN,nom	Fig. 3-52, (p. 3-86)
Setting for the minimum current that must be exceeded so that the measured operating value of the residual current is displayed.				
MAIN: Meas. value rel. V				011 032
0.000	0.000	0.200	Vnom	Fig. 3-55, (p. 3-89)
Setting for the minimum voltage that must be exceeded so that measured operating values of the phase-to-ground voltages, phase-to-phase voltages, and, if applicable, derived voltages are displayed.				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Meas. val. rel. VNG					011 033
0.000	0.000	0.200	VNG,nom	Fig. 3-56, (p. 3-90)	
Setting for the minimum voltage that must be exceeded so that the measured operating value of the neutral-point displacement voltage is displayed.					
MAIN: Meas. val. rel. Vref					011 034
0.000	0.000	0.200	Vref,nom	Fig. 3-57, (p. 3-90)	
Setting for the minimum voltage that must be exceeded so that the measured operating value of the reference voltage for the automatic synchronism check is displayed.					
MAIN: Op. mode energy cnt.					010 138
1: Procedure 1				Fig. 3-61, (p. 3-93)	
Selection of the procedure to determine the active and reactive energy output. 1st procedure: Data acquisition every 2s (approximately). 2nd procedure: Data acquisition every 100ms (approximately)					
MAIN: Settl. t. IP,max,del					010 113
15.0	0.1	60.0	min	Fig. 3-51, (p. 3-85)	
Setting for the time after which the delayed maximum current display shall reach 95% of the maximum current $I_{P,max}$.					
MAIN: Fct.assign. reset 1					005 248
060 000: MAIN: Without function				Fig. 3-90, (p. 3-123)	
Assigning specific memories and counters which are to be reset jointly if **MAIN: Group reset 1 USER** is enabled.					
MAIN: Fct.assign. reset 2					005 249
060 000: MAIN: Without function				Fig. 3-90, (p. 3-123)	
Assigning specific memories and counters which are to be reset jointly if **MAIN: Group reset 2 USER** is enabled.					
MAIN: Fct.assign. block. 1					021 021
060 000: MAIN: Without function				Fig. 3-71, (p. 3-104)	
Assignment of functions that will be blocked simultaneously when blocking input 1 (**MAIN: Blocking 1 EXT**) is activated.					
MAIN: Fct.assign. block. 2					021 022
060 000: MAIN: Without function				Fig. 3-71, (p. 3-104)	
Assignment of functions that will be blocked simultaneously when blocking input 2 (**MAIN: Blocking 2 EXT**) is activated.					
MAIN: Trip cmd.block. USER					021 012
0: No				Fig. 3-82, (p. 3-115) Fig. 3-83, (p. 3-116)	
Blocking the trip commands from the local control panel.					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Fct.assig.trip cmd.1					021 001
060 000: MAIN: Without function				Fig. 3-82, (p. 3-115)	
Assignment of signals that trigger trip command 1.					
MAIN: Fct.assig.trip cmd.2					021 002
060 000: MAIN: Without function				Fig. 3-82, (p. 3-115)	
Assignment of the signals that trigger trip command 2.					
MAIN: Min.dur. trip cmd. 1					021 003
0.25	0.10	10.00	s	Fig. 3-82, (p. 3-115) Fig. 5-15, (p. 5-20)	
Setting for the minimum duration of trip command 1.					
MAIN: Min.dur. trip cmd. 2					021 004
0.25	0.10	10.00	s	Fig. 3-82, (p. 3-115)	
Setting for the minimum duration of trip command 2.					
MAIN: Latching trip cmd. 1					021 023
0: No				Fig. 3-82, (p. 3-115)	
Specification as to whether trip command 1 should latch.					
MAIN: Latching trip cmd. 2					021 024
0: No				Fig. 3-82, (p. 3-115)	
Specification as to whether trip command 2 should latch.					
MAIN: Close cmd.pulse time					015 067
0.25	0.10	10.00	s	Fig. 3-75, (p. 3-108)	
Setting for the duration of the close command.					
MAIN: tCB,close					000 032
0.060	0.000	1.000	s		
This setting determines the CB closing time. In slightly asynchronous power systems, the CB closing time is taken into account by the automatic synchronism check (ASC) to issue of a close command. This is possible only if **ASC: AR with tCB PSx** = *Yes*.					
MAIN: Rel.t. enab. man.cmd					003 088
60	1	3600	s	Fig. 3-75, (p. 3-108)	
Setting for the release time of the enable for the manual close command.					
MAIN: Fct. assign. fault					021 031
060 000: MAIN: Without function				Fig. 3-72, (p. 3-104)	
Selection of the signals to be signaled as Blocked/Faulty in addition to the messages that always result in the message Blocked/Faulty.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Sig. asg. CB open				021 017
061 000: MAIN: Without function				Fig. 3-297, (p. 3-366)
Definition of the binary signal used by the P139 to evaluate the “CB open” position signal.				
MAIN: Sig. asg. CB closed				021 020
061 000: MAIN: Without function				Fig. 3-73, (p. 3-105)
Definition of the binary signal used by the P139 to evaluate the “CB closed” position signal.				
MAIN: Debounce time gr. 1				221 200
0.02	0.01	2.54	s	Fig. 3-352, (p. 3-432)
MAIN: Debounce time gr. 2				221 203
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 3				221 206
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 4				221 209
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 5				221 212
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 6				221 215
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 7				221 218
0.02	0.01	2.54	s	
MAIN: Debounce time gr. 8				221 221
0.02	0.01	2.54	s	
Setting for the debouncing time.				
MAIN: Chatt.mon. time gr.1				221 201
0.0	0.0	25.4	s	Fig. 3-352, (p. 3-432)
MAIN: Chatt.mon. time gr.2				221 204
0.0	0.0	25.4	s	
MAIN: Chatt.mon. time gr.3				221 207
0.0	0.0	25.4	s	
MAIN: Chatt.mon. time gr.4				221 210
0.0	0.0	25.4	s	
MAIN: Chatt.mon. time gr.5				221 213
0.0	0.0	25.4	s	
MAIN: Chatt.mon. time gr.6				221 216
0.0	0.0	25.4	s	

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Chatt.mon. time gr.7					221 219
0.0	0.0	25.4	s		
MAIN: Chatt.mon. time gr.8					221 222
0.0	0.0	25.4	s		
Setting for the chatter monitoring time.					
MAIN: Change of state gr.1					221 202
0	0	254		Fig. 3-352, (p. 3-432)	
MAIN: Change of state gr.2					221 205
0	0	254			
MAIN: Change of state gr.3					221 208
0	0	254			
MAIN: Change of state gr.4					221 211
0	0	254			
MAIN: Change of state gr.5					221 214
0	0	254			
MAIN: Change of state gr.6					221 217
0	0	254			
MAIN: Change of state gr.7					221 220
0	0	254			
MAIN: Change of state gr.8					221 223
0	0	254			
Setting the number of signal changes allowed during the chatter monitoring time before chatter suppression operates.					
MAIN: Cmd. dur.long cmd.					221 230
20	1	254	s		
Setting for the command duration for a long command.					
MAIN: Cmd. dur. short cmd.					221 231
1	1	254	s		
Setting for the command duration for a short command.					
MAIN: Oper. mode CB Trip					221 080
1: ALSTOM D				Fig. 3-86, (p. 3-118)	
Definition of the operating mode of the CB trip.					
MAIN: Inp.asg. ctrl.enabl.					221 057
060 000: MAIN: Without function				Fig. 3-327, (p. 3-399)	
Definition of the binary signal used to issue a general command output enable.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Inp.asg.interl.deact				221 007
060 000: MAIN: Without function				Fig. 3-327, (p. 3-399)
Definition of the binary signal used to disable interlocking of control commands for switchgear.				
MAIN: Inp.asg. L/R key sw.				221 008
060 000: MAIN: Without function				
Definition of the binary signal used to switch from remote control to local control.				
MAIN: Electrical control				221 061
1: Remote				
This setting determines whether the binary inputs, that are configured to control switchgear, will be active with remote control or local control.				
MAIN: Delay Man.Op.Superv.				221 079
3	0	255	s	
After the delay time period, to be set in this window, has elapsed (with the signal “Sw. dev. interm. pos.” already present and the status signal continuously absent), the actual switchgear status signal, as obtained from the respective binary inputs, will be issued. (See also “Processing status signals from manually operated switchgear”.)				
MAIN: Inp.assign. tripping				221 010
060 000: MAIN: Without function				Fig. 3-86, (p. 3-118)
Definition of the binary signal used to signal the tripping of an external protection device. This signal is used to form the CB trip signal.				
MAIN: Prot.trip>CB tripped				221 012
0: Without function				Fig. 3-86, (p. 3-118)
Selection of the protection function trip command that will be used to form the CB trip signal.				
MAIN: Inp. asg. CB trip				221 013
060 000: MAIN: Without function				Fig. 3-86, (p. 3-118)
Definition of the binary signal used by the P139 to signal the “CB open” position signal.				
MAIN: Inp.asg.CB tr.en.ext				221 050
060 000: MAIN: Without function				Fig. 3-86, (p. 3-118)
Definition of the binary signal used to enable the CB trip signal of an external device.				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Inp.asg. CB trip ext					221 024
060 000: MAIN: Without function				Fig. 3-86, (p. 3-118)	
Definition of the binary signal used to carry the CB trip signal of an external device.					
MAIN: Inp.asg. mult.sig. 1					221 051
060 000: MAIN: Without function				Fig. 3-76, (p. 3-109)	
MAIN: Inp.asg. mult.sig. 2					221 052
060 000: MAIN: Without function				Fig. 3-76, (p. 3-109)	
Definition of the function that will be interpreted as a multiple signal (group signal).					
MAIN: Fct.asg. grp.sig. 01					019 184
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 02					019 185
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 03					019 186
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 04					019 187
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 05					019 188
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 06					019 189
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 07					019 190
060 000: MAIN: Without function					
MAIN: Fct.asg. grp.sig. 08					019 191
060 000: MAIN: Without function					
Selection up to 32 internal signals to be grouped using Boolean operators NOT, AND, OR.					

Parameter subset selection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
PSS: Control via USER				003 100
0: No				Fig. 3-93, (p. 3-127)
If parameter subset selection is to be handled from the integrated local control panel rather than via binary signal inputs, choose the setting *Yes*.				
PSS: Param.subs.sel. USER				003 060
1: Parameter subset 1				Fig. 3-93, (p. 3-127)
Selection of the parameter subset from the local control panel.				
PSS: Keep time				003 063
Blocked	0.000	65.000	s	Fig. 3-93, (p. 3-127)
The setting of this timer stage is relevant only if parameter subset selection is carried out via the binary signal inputs. Any voltage-free pause that may occur during selection is bridged. If, after this time period has elapsed, no binary signal input has yet been set, then the parameter subset selected from the local control panel shall apply.				

Self-monitoring

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Fct. assign. warning				021 030
060 000: MAIN: Without function				Fig. 3-94, (p. 3-128)
Selection of the signals whose appearance shall result in the signals “Warning (LED)” and “Warning (relay)” and in the activation of the LED indicator labeled “ALARM”. Signals caused by faulty hardware and leading to blocking of the device are not configurable. They always result in the above signals and indication.				
SFMON: Mon.sig. retention				021 018
Blocked	0	240	h	
This setting defines the duration (in hours) for which a device-internal fault is stored, so that a decision may be taken between an automatic warm restart and an automatic device blocking. (Setting to *Blocked* may be considered the same as unlimited storage.)				

Fault recording

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
FT_RC: Fct. assig. trigger					003 085
060 000: MAIN: Without function				Fig. 3-117, (p. 3-153)	
This setting defines the signals that will trigger fault recording.					
FT_RC: I>					017 065
Blocked	0.01	40.00	Inom	Fig. 3-117, (p. 3-153)	
This setting defines the threshold value of the phase currents that will trigger fault recording and fault data acquisition.					
FT_RC: Pre-fault time					003 078
5	1	50	Periods	Fig. 3-119, (p. 3-156)	
Setting for the time during which data will be recorded before the onset of a fault (pre-fault recording time).					
FT_RC: Post-fault time					003 079
5	1	750	Periods	Fig. 3-119, (p. 3-156)	
Setting for the time during which data will be recorded after the end of a fault (post-fault recording time).					
FT_RC: Max. recording time					003 075
50	5	750	Periods	Fig. 3-119, (p. 3-156)	
Setting for the maximum recording time per fault. This includes pre-fault and post-fault recording times.					

7.1.3.2 General Functions

Main function

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Syst.IN enabled USER					018 008
0: No				Fig. 3-64, (p. 3-98)	
Enable/disable the DTOC and IDMTx residual current stages. (IDMTx: IDMT1, IDMT2)					
MAIN: Selection meas. volt					018 202
4: Voltage A-B				Fig. 3-69, (p. 3-102)	
Setting for the voltage that shall be used for frequency measurement.					
MAIN: Evaluation time					018 201
5	3	6	Periods	Fig. 3-69, (p. 3-102)	
Setting for the evaluation time. The operate conditions must be met for the duration of the set evaluation time in order for a signal to be issued.					
MAIN: Undervolt. block. V<					018 200
0.65	0.20	1.00	Vnom(/√3)	Fig. 3-69, (p. 3-102)	
Setting for the threshold of undervoltage blocking. If the voltage falls below this threshold, the over-/underfrequency protection function and underfrequency load shedding function will be blocked.					

Definite-time overcurrent protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DTOC: General enable USER					022 075
0: No				Fig. 3-120, (p. 3-157)	
Disabling or enabling the definite-time overcurrent protection function.					

Inverse-time overcurrent protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
IDMT1: General enable USER					017 096
0: No				Fig. 3-137, (p. 3-178)	
IDMT2: General enable USER					017 052
0: No					
Enabling or disabling the inverse-time overcurrent protection function.					

Short-circuit direction determination

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SCDD: General enable USER				017 070
0: No				Fig. 3-155, (p. 3-199)
Enable/disable the short-circuit direction determination.				

Switch on to fault protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SOTF: General enable USER				011 068
0: No				Fig. 3-166, (p. 3-213)
Enabling or disabling the switch on to fault (short circuit) protection.				
SOTF: Operating mode				011 061
2: Trip by I>>				Fig. 3-166, (p. 3-213)
The setting of the operating mode defines whether, while the timer is running, a general starting will lead to a trip command (*Trip by gen. start.*) or exceeding the thresholds of the first, second, third or fourth overcurrent stages (*Trip by I>*, *Trip by I>>*, *Trip by I>>>*, *Trip by I>>>>*).				
SOTF: Manual close timer				011 060
1.00	0.00	10.00	s	Fig. 3-166, (p. 3-213)
Setting for the timer stage that will be started by a manual close.				

Protective signaling

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
PSIG: General enable USER				015 004
0: No				Fig. 3-167, (p. 3-215)
Disabling or enabling protective signaling.				

Auto-reclosing control

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
ARC: General enable USER				015 060
0: No				Fig. 3-173, (p. 3-223)
Disabling or enabling auto-reclosing control.				
ARC: Sig.asg.trip t.Adm				015 105
1: Starting LS				Fig. 3-179, (p. 3-230)
Selection of the GFDSS starting of steady-state admittance evaluation to trigger the auto-reclosing control function.				
ARC: Fct.assig.start ARC				015 203
060 000: MAIN: Without function				
Function assignment to start auto-reclosing control function.				
ARC: Fct.assgn. tLOGIC				015 033
060 000: MAIN: Without function				Fig. 3-183, (p. 3-234)
Function assignment to tLOGIC.				

Automatic synchronism check

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
ASC: General enable USER				018 000
0: No				Fig. 3-191, (p. 3-246)
Enabling or disabling the automatic synchronism check.				
ASC: Transm.cycle,meas.v.				101 212
3	0	10	s	Fig. 3-204, (p. 3-262)
Cycle period for transmission of ASC measured values.				

Ground fault direction determination using steady-state values

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GFDSS: General enable USER				016 060
0: No				Fig. 3-206, (p. 3-265)
Enabling or disabling ground fault direction determination by steady-state values.				
GFDSS: Operating mode				016 090
1: Steady-state power				Fig. 3-206, (p. 3-265)
This setting specifies which of the following evaluation mode will be performed. ● Steady-state power evaluation. ● Steady-state current evaluation. ● Steady-state admittance evaluation. ● Steady-state power and admittance evaluation.				

Transient ground fault direction determination

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TGFD: General enable USER				016 040
0: No				Fig. 3-221, (p. 3-280)
Enabling or disabling the transient ground fault direction determination.				

Motor protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MP: General enable USER				017 059
0: No				Fig. 3-228, (p. 3-285)
Enabling or disabling motor protection				
MP: Hours_Run >				025 156
10000	1	65000	h	
Setting the maximum hours for running time.				

Thermal overload protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
THERM: General enable USER				022 050
0: No				Fig. 3-238, (p. 3-303)

Disabling or enabling thermal overload protection.

Parameter				Address
THERM: Relative replica				022 064
1: Yes				Fig. 3-241, (p. 3-311)

Disabling or enabling the *Relative replica* mode of operation.

Note that it is not permitted to enable both *Absolute replica* and *Relative replica* modes.

Parameter				Address
THERM: Absolute replica				022 065
0: No				Fig. 3-241, (p. 3-311)

Enabling or disabling the *Absolute replica* mode of operation.

Note that it is not permitted to enable both *Absolute replica* and *Relative replica* modes.

Unbalance protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
I2>: General enable USER				018 090
0: No				Fig. 3-243, (p. 3-314)

Enabling or disabling unbalance protection.

Time-voltage protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
V<>: General enable USER				023 030
0: No				Fig. 3-245, (p. 3-316)

Disabling or enabling time-voltage protection.

Over-/underfrequency protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
f<>: General enable USER				023 031
0: No				Fig. 3-259, (p. 3-330)

Disabling or enabling over-/underfrequency protection.

Underfrequency load shedding

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
Pf<: General enable USER					015 202
0: No				Fig. 3-262, (p. 3-335)	
Disabling or enabling underfrequency load shedding protection.					

Power directional protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
P<>: General enable USER					014 220
0: No				Fig. 3-266, (p. 3-339)	
Disabling or enabling the power directional protection function.					

Voltage controlled directional reactive power protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
QV: General enable USER					013 147
0: No				Fig. 3-280, (p. 3-352)	
Disabling or enabling QV protection.					

Circuit breaker failure protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBF: General enable USER					022 080
0: No				Fig. 3-284, (p. 3-355)	
Disabling or enabling circuit breaker failure protection.					
CBF: Start with man. trip					022 154
0: No				Fig. 3-288, (p. 3-359)	
Setting that permit a manual trip signal to also be used as a start criterion.					
CBF: Fct.assignm. CBAux.					022 159
060 000: MAIN: Without function				Fig. 3-288, (p. 3-359)	
Selection of trip signals – assigned to Gen. trip command 1 – for which, in addition to current flow monitoring, status signals from CB auxiliary contacts are evaluated.					
CBF: I<					022 160
1.00	0.05	20.00	Inom	Fig. 3-286, (p. 3-357) Fig. 3-292, (p. 3-362) Fig. 3-293, (p. 3-362)	
Setting for the threshold to detect a break in current flow.					
CBF: Evaluation IN					022 184
0: Without				Fig. 3-286, (p. 3-357)	
Select whether the measured or the calculated residual current shall be used for residual current monitoring function. This choice is only possible when a measuring input for the residual current is available, otherwise the internally derived value of the residual current is always used, regardless of the setting.					
CBF: IN<					022 180
1.00	0.05	20.00	Inom		
Setting of the comparator threshold for residual current monitoring function.					
CBF: t1 3p					022 165
0.15	0.00	100.00	s	Fig. 3-289, (p. 3-360)	
Setting the 1st CBF timer stage to 3-pole operating mode.					
CBF: t2					022 166
0.25	0.00	100.00	s	Fig. 3-289, (p. 3-360)	
Setting for the 2nd CBF timer stage.					
CBF: Min.dur. trip cmd.t1					022 167
0.25	0.10	10.00	s	Fig. 3-290, (p. 3-361)	
Setting the 1st timer stage for minimum duration of trip command.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBF: Min.dur. trip cmd.t2					022 168
0.25	0.10	10.00	s	Fig. 3-290, (p. 3-361)	
Setting the 2nd timer stage for minimum duration of trip command.					
CBF: Latching trip cmd.t1					022 169
0: No				Fig. 3-290, (p. 3-361)	
The 1st timer stage trip command, set to latch mode, will remain active until reset by operating parameters or through an appropriately configured binary signal input.					
CBF: Latching trip cmd.t2					022 170
0: No				Fig. 3-290, (p. 3-361)	
The 2nd timer stage trip command, set to latch mode, will remain active until reset by operating parameters or through an appropriately configured binary signal input.					
CBF: Delay/starting trig.					022 155
0.00	0.00	100.00	s	Fig. 3-291, (p. 3-361)	
The signal **CBF: Trip signal** is issued when this timer stage's time duration has elapsed.					
CBF: Delay/fault beh. CB					022 171
0.12	0.00	100.00	s	Fig. 3-292, (p. 3-362)	
If during this delay time period the circuit breaker does not provide a signal from its auxiliary contacts that it is closed, then faults behind the CB are recognized through the current criterion (see section “Fault behind CB protection”).					
CBF: Delay/CB sync.superv					022 172
Blocked	0.00	100.00	s	Fig. 3-293, (p. 3-362)	
Setting for the time delay to bridge circuit breaker operate times during CB synchronization supervision.					

Circuit breaker condition monitoring

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBM: General enable USER					022 010
0: No				Fig. 3-294, (p. 3-363)	
Enabling or disabling circuit breaker monitoring.					
CBM: Blocking USER					022 150
0: No				Fig. 3-302, (p. 3-371)	
Setting for temporary blocking of circuit breaker monitoring during protection injection testing.					
CBM: Sig. asg. trip cmd.					022 152
060 000: MAIN: Without function				Fig. 3-296, (p. 3-366)	
Using the setting for external devices the trip command issued by the control function may be linked to the trip command 1 issued by the protection by assigning the trip command issued by the control function by this parameter.					
CBM: Operating mode					022 007
3: CB sig. EXT or trip				Fig. 3-299, (p. 3-368)	
This setting defines starting criteria for circuit breaker monitoring. To evaluate all trip commands issued by the protection device *With trip cmd. only* must be selected. For further evaluation of operational trip commands the additional CB auxiliary contact *CB sig. EXT or trip* is used.					
CBM: Inom,CB					022 012
2000	1	65000	A	Fig. 3-299, (p. 3-368)	
Setting for the CB nominal current.					
CBM: Perm. CB op. Inom,CB					022 013
30000	1	65000		Fig. 3-299, (p. 3-368)	
Setting for the maximum number of CB operations at nominal current.					
CBM: Med. curr. Itrip,CB					022 014
Blocked	1	65000	A	Fig. 3-299, (p. 3-368)	
Setting for the average CB disconnection current. **Note:** In general valid only for pneumatically operated CBs.					
CBM: Perm. CB op. Imed,CB					022 015
Blocked	1	65000		Fig. 3-299, (p. 3-368)	
Setting for the maximum number of CB operations at average disconnection (ruptured) current. **Note:** In general valid only for pneumatically operated CBs.					
CBM: Max. curr. Itrip,CB					022 016
63000	1	65000	A	Fig. 3-299, (p. 3-368)	
Setting for the maximum CB disconnection (ruptured) current.					

Parameter					Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**	
CBM: Perm. CB op. Imax,CB					022 017
20	1	65000		Fig. 3-299, (p. 3-368)	
Setting for the maximum number of CB operations permitted at maximum CB disconnection (ruptured) current.					
CBM: No. CB operations >					022 019
10000	1	65000		Fig. 3-301, (p. 3-370)	
Setting for the maximum number of mechanical CB switching operations.					
CBM: Remain No. CB op. <					022 020
1000	1	65000		Fig. 3-300, (p. 3-370)	
Setting for the warning stage with the number of remaining CB operations at CB nominal current.					
CBM: ΣItrip>					022 022
1000	1	65000	Inom,CB		
Setting for the warning stage with the accumulated CB disconnection (ruptured) current values.					
CBM: ΣItrip2>**					022 081
1000	1	65000	Inom,CB**2		
Setting for the warning stage with the accumulated CB disconnection (ruptured) current values to the second power.					
CBM: ΣI*t>					022 096
1000.0	1.0	4000.0	kAs		
Setting for the warning stage with the sum of the current-time integrals of the CB disconnection (ruptured) current values					
CBM: Corr. acqu.time trip					007 249
0.000	0.000	0.200	s	Fig. 3-299, (p. 3-368)	
Correction of the time tolerances permissible for leading or lagging CB auxiliary contacts in case of a triggering by the open command.					
CBM: Corr.acqu.t. CB sig.					022 018
0.000	-0.200	0.200	s	Fig. 3-299, (p. 3-368)	
Correction of the time tolerances permissible for leading or lagging CB auxiliary contacts in case of a triggering by the position signal issued by the CB auxiliary contacts.					

Measuring-circuit monitoring

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MCMON: General enable USER				014 001
0: No				Fig. 3-304, (p. 3-373)
Enabling or disabling the measuring-circuit monitoring function.				
MCMON: Op. mode Idiff>				017 028
2: IA, IB, IC				Fig. 3-304, (p. 3-373)
Adaptation of measuring-circuit monitoring to the system current transformers.				
MCMON: Idiff>				017 024
0.30	0.25	0.50	IP,max	Fig. 3-304, (p. 3-373)
Setting the operate value of measuring-circuit monitoring.				
MCMON: Op. mode Vmin< monit				018 079
1: Vmin<				Fig. 3-305, (p. 3-374)
Selection of the monitoring mode in the voltage-measuring circuit.				
MCMON: Vmin<				017 022
Blocked	0.40	0.90	Vnom	Fig. 3-305, (p. 3-374)
Setting the operate value for the voltage trigger Vmin< of measuring circuit monitoring.				
MCMON: Operate delay				017 023
5.00	0.50	10.00	s	Fig. 3-304, (p. 3-373)
Setting of the time delay for current and voltage monitoring.				
MCMON: Phase sequ. monitor.				018 019
1: Yes				Fig. 3-305, (p. 3-374)
Enabling or disabling phase sequence monitoring.				
MCMON: FF,Vref enabled USER				014 013
0: No				Fig. 3-306, (p. 3-375)
Enabling or disabling the “Fuse Failure” monitoring function of the reference voltage Vref.				
MCMON: Oper. delay FF, Vref				014 012
0.00	0.00	10.00	s	Fig. 3-306, (p. 3-375)
Setting for the time delay for “Fuse Failure” monitoring of the reference voltage Vref.				

Limit value monitoring

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LIMIT: General enable USER				014 010
0: No				Fig. 3-311, (p. 3-382)
Disabling or enabling limit value monitoring.				
LIMIT: I>				014 004
1.10	0.10	2.40	Inom	Fig. 3-307, (p. 3-378)
Setting for the operate value of the first overcurrent stage for limit value monitoring.				
LIMIT: I>>				014 020
1.20	0.10	2.40	Inom	Fig. 3-307, (p. 3-378)
Setting for the operate value of the second overcurrent stage for limit value monitoring.				
LIMIT: tI>				014 031
1	1	1000	s	Fig. 3-307, (p. 3-378)
Setting for the operate delay of the first overcurrent stage of limit value monitoring.				
LIMIT: tI>>				014 032
1	1	1000	s	Fig. 3-307, (p. 3-378)
Setting for the operate delay of the second overcurrent stage of limit value monitoring.				
LIMIT: I<				014 021
0.90	0.10	2.40	Inom	Fig. 3-307, (p. 3-378)
Setting for the operate value of the first undercurrent stage of limit value monitoring.				
LIMIT: I<<				014 022
0.80	0.10	2.40	Inom	Fig. 3-307, (p. 3-378)
Setting for the operate value of the second undercurrent stage of limit value monitoring.				
LIMIT: tI<				014 033
1	1	1000	s	Fig. 3-307, (p. 3-378)
Setting for the operate delay of the first undercurrent stage of limit value monitoring.				
LIMIT: tI<<				014 034
1	1	1000	s	Fig. 3-307, (p. 3-378)
Setting for the operate delay of the second undercurrent stage of limit value monitoring.				

Parameter / Default	Min	Max	Unit	Logic Diagram	Address
LIMIT: VPG>					014 023
1.10	0.10	2.50	Vnom/√3	Fig. 3-308, (p. 3-379)	
Setting for the operate value of overvoltage stage VPG> of limit value monitoring.					
LIMIT: VPG>>					014 024
1.20	0.10	2.50	Vnom/√3	Fig. 3-308, (p. 3-379)	
Setting for the operate value of overvoltage stage VPG>> of limit value monitoring.					
LIMIT: tVPG>					014 035
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of overvoltage stage VPG> of limit value monitoring.					
LIMIT: tVPG>>					014 036
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of overvoltage stage VPG>> of limit value monitoring.					
LIMIT: VPG<					014 025
0.90	0.10	2.50	Vnom/√3	Fig. 3-308, (p. 3-379)	
Setting for the operate value of undervoltage stage VPG< of limit value monitoring.					
LIMIT: VPG<<					014 026
0.80	0.10	2.50	Vnom/√3	Fig. 3-308, (p. 3-379)	
Setting for the operate value of undervoltage stage VPG<< of limit value monitoring.					
LIMIT: tVPG<					014 037
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of undervoltage stage VPG< of limit value monitoring.					
LIMIT: tVPG<<					014 038
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of undervoltage stage VPG<< of limit value monitoring.					
LIMIT: VPP>					014 027
1.10	0.10	1.50	Vnom	Fig. 3-308, (p. 3-379)	
Setting for the operate value of overvoltage stage VPP> of limit value monitoring.					

Parameter					Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**	
LIMIT: VPP>>					014 028
1.20	0.10	1.50	Vnom	Fig. 3-308, (p. 3-379)	
Setting for the operate value of overvoltage stage VPP>> of limit value monitoring.					
LIMIT: tVPP>					014 039
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of overvoltage stage VPP> of limit value monitoring.					
LIMIT: tVPP>>					014 040
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of overvoltage stage VPP>> of limit value monitoring.					
LIMIT: VPP<					014 029
0.90	0.10	1.50	Vnom	Fig. 3-308, (p. 3-379)	
Setting for the operate value of undervoltage stage VPP< of limit value monitoring.					
LIMIT: VPP<<					014 030
0.80	0.10	1.50	Vnom	Fig. 3-308, (p. 3-379)	
Setting for the operate value of undervoltage stage VPP<< of limit value monitoring.					
LIMIT: tVPP<					014 041
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of undervoltage stage VPP< of limit value monitoring.					
LIMIT: tVPP<<					014 042
1	1	1000	s	Fig. 3-308, (p. 3-379)	
Setting for the operate delay of undervoltage stage VPP<< of limit value monitoring.					
LIMIT: VNG>					014 043
0.050	0.010	1.000	Vnom	Fig. 3-309, (p. 3-380)	
Setting for the operate value of overvoltage stage VNG> of limit value monitoring.					
LIMIT: VNG>>					014 044
0.100	0.010	1.000	Vnom	Fig. 3-309, (p. 3-380)	
Setting for the operate value of overvoltage stage VNG>> of limit value monitoring.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LIMIT: tVNG>				014 045
1	1	1000	s	Fig. 3-309, (p. 3-380)
Setting for the operate delay of overvoltage stage VNG> of limit value monitoring.				
LIMIT: tVNG>>				014 046
1	1	1000	s	Fig. 3-309, (p. 3-380)
Setting for the operate delay of overvoltage stage VNG>> of limit value monitoring.				
LIMIT: Vref>				042 144
1.10	0.10	2.50	Vref,nom	Fig. 3-311, (p. 3-382)
Setting for the operate value of overvoltage stage Vref> for limit value monitoring.				
LIMIT: Vref>>				042 145
1.20	0.10	2.50	Vref,nom	Fig. 3-311, (p. 3-382)
Setting for the operate value of overvoltage stage Vref>> for limit value monitoring.				
LIMIT: tVref>				042 148
1	1	1000	s	Fig. 3-311, (p. 3-382)
Setting for the operate delay of overvoltage stage Vref> for limit value monitoring.				
LIMIT: tVref>>				042 149
1	1	1000	s	Fig. 3-311, (p. 3-382)
Setting for the operate delay of overvoltage stage Vref>> for limit value monitoring.				
LIMIT: Vref<				042 146
0.90	0.10	2.50	Vref,nom	Fig. 3-311, (p. 3-382)
Setting for the operate value of undervoltage stage Vref< for limit value monitoring.				
LIMIT: Vref<<				042 147
0.80	0.10	2.50	Vref,nom	Fig. 3-311, (p. 3-382)
Setting for the operate value of undervoltage stage Vref<< for limit value monitoring.				
LIMIT: tVref<				042 150
1	1	1000	s	Fig. 3-311, (p. 3-382)
Setting for the operate delay of undervoltage stage Vref< for limit value monitoring.				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LIMIT: tVref<<					042 151
1	1	1000	s	Fig. 3-311, (p. 3-382)	
Setting for the operate delay of undervoltage stage Vref<< for limit value monitoring.					
LIMIT: IDC,lin>					014 110
Blocked	0.100	1.100	IDC,nom	Fig. 3-310, (p. 3-381)	
Setting for the operate value IDC,lin> for monitoring the linearized direct current.					
LIMIT: IDC,lin>>					014 111
Blocked	0.100	1.100	IDC,nom	Fig. 3-310, (p. 3-381)	
Setting for the operate value IDC,lin>> for monitoring the linearized direct current.					
LIMIT: tIDC,lin>					014 112
Blocked	0.00	20.00	s	Fig. 3-310, (p. 3-381)	
Setting for the operate delay of overcurrent stage IDC,lin>.					
LIMIT: tIDC,lin>>					014 113
Blocked	0.00	20.00	s	Fig. 3-310, (p. 3-381)	
Setting for the operate delay of overcurrent stage IDC,lin>>.					
LIMIT: IDC,lin<					014 114
Blocked	0.100	1.100	IDC,nom	Fig. 3-310, (p. 3-381)	
Setting for the operate value IDC,lin< for monitoring the linearized direct current.					
LIMIT: IDC,lin<<					014 115
Blocked	0.100	1.100	IDC,nom	Fig. 3-310, (p. 3-381)	
Setting for the operate value IDC,lin<< for monitoring the linearized direct current.					
LIMIT: tIDC,lin<					014 116
Blocked	0.00	20.00	s	Fig. 3-310, (p. 3-381)	
Setting for the operate delay of undercurrent stage IDC,lin<.					
LIMIT: tIDC,lin<<					014 117
Blocked	0.00	20.00	s	Fig. 3-310, (p. 3-381)	
Setting for the operate delay of undercurrent stage IDC,lin<<.					
LIMIT: T>					014 100
200	-20	200	°C	Fig. 3-312, (p. 3-383)	
Setting for the operate value of temperature monitoring T>.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LIMIT: T>>					014 101
200	-20	200	°C	Fig. 3-312, (p. 3-383)	
Setting for the operate value of temperature monitoring T>>.					
LIMIT: tT>					014 103
Blocked	0	1000	s	Fig. 3-312, (p. 3-383)	
Setting for the operate delay of temperature monitoring T>.					
LIMIT: tT>>					014 104
Blocked	0	1000	s	Fig. 3-312, (p. 3-383)	
Setting for the operate delay of temperature monitoring T>>.					
LIMIT: T<					014 105
-20	-20	200	°C	Fig. 3-312, (p. 3-383)	
Setting for the operate value of temperature monitoring T<.					
LIMIT: T<<					014 106
-20	-20	200	°C	Fig. 3-312, (p. 3-383)	
Setting for the operate value of temperature monitoring T<<.					
LIMIT: tT<					014 107
Blocked	0	1000	s	Fig. 3-312, (p. 3-383)	
Setting for the operate delay of temperature monitoring T<.					
LIMIT: tT<<					014 108
Blocked	0	1000	s	Fig. 3-312, (p. 3-383)	
Setting for the operate delay of temperature monitoring T<<.					
LIMIT: T1>					014 120
200	-20	200	°C	Fig. 3-313, (p. 3-384)	
LIMIT: T2>					014 130
200	-20	200	°C		
LIMIT: T3>					014 140
200	-20	200	°C		
LIMIT: T4>					014 150
200	-20	200	°C		
LIMIT: T5>					014 160
200	-20	200	°C		
LIMIT: T6>					014 170
200	-20	200	°C		
LIMIT: T7>					014 180
200	-20	200	°C		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LIMIT: T8>				014 190
200	-20	200	°C	
LIMIT: T9>				015 130
200	-20	200	°C	
Setting the operate value of temperature monitoring Tn> for temperature sensor Tn.				
LIMIT: T1>>				014 121
200	-20	200	°C	Fig. 3-313, (p. 3-384)
LIMIT: T2>>				014 131
200	-20	200	°C	
LIMIT: T3>>				014 141
200	-20	200	°C	
LIMIT: T4>>				014 151
200	-20	200	°C	
LIMIT: T5>>				014 161
200	-20	200	°C	
LIMIT: T6>>				014 171
200	-20	200	°C	
LIMIT: T7>>				014 181
200	-20	200	°C	
LIMIT: T8>>				014 191
200	-20	200	°C	
LIMIT: T9>>				015 131
200	-20	200	°C	
Setting the operate value of temperature monitoring Tn>> for temperature sensor Tn.				
LIMIT: tT1>				014 122
Blocked	0	1000	s	Fig. 3-313, (p. 3-384)
LIMIT: tT2>				014 132
Blocked	0	1000	s	
LIMIT: tT3>				014 142
Blocked	0	1000	s	
LIMIT: tT4>				014 152
Blocked	0	1000	s	
LIMIT: tT5>				014 162
Blocked	0	1000	s	
LIMIT: tT6>				014 172
Blocked	0	1000	s	

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LIMIT: tT7>					014 182
Blocked	0	1000	s		
LIMIT: tT8>					014 192
Blocked	0	1000	s		
LIMIT: tT9>					015 132
Blocked	0	1000	s		
Setting the operate delay of temperature monitoring Tn> for temperature sensor Tn.					
LIMIT: tT1>>					014 123
Blocked	0	1000	s	Fig. 3-313, (p. 3-384)	
LIMIT: tT2>>					014 133
Blocked	0	1000	s		
LIMIT: tT3>>					014 143
Blocked	0	1000	s		
LIMIT: tT4>>					014 153
Blocked	0	1000	s		
LIMIT: tT5>>					014 163
Blocked	0	1000	s		
LIMIT: tT6>>					014 173
Blocked	0	1000	s		
LIMIT: tT7>>					014 183
Blocked	0	1000	s		
LIMIT: tT8>>					014 193
Blocked	0	1000	s		
LIMIT: tT9>>					015 133
Blocked	0	1000	s		
Setting the operate delay of temperature monitoring Tn>> for temperature sensor Tn.					
LIMIT: T1<					014 124
-20	-20	200	°C	Fig. 3-313, (p. 3-384)	
LIMIT: T2<					014 134
-20	-20	200	°C		
LIMIT: T3<					014 144
-20	-20	200	°C		
LIMIT: T4<					014 154
-20	-20	200	°C		
LIMIT: T5<					014 164
-20	-20	200	°C		

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LIMIT: T6<				014 174
-20	-20	200	°C	
LIMIT: T7<				014 184
-20	-20	200	°C	
LIMIT: T8<				014 194
-20	-20	200	°C	
LIMIT: T9<				015 134
-20	-20	200	°C	
Setting the operate value of temperature monitoring Tn< for temperature sensor Tn.				
LIMIT: T1<<				014 125
-20	-20	200	°C	Fig. 3-313, (p. 3-384)
LIMIT: T2<<				014 135
-20	-20	200	°C	
LIMIT: T3<<				014 145
-20	-20	200	°C	
LIMIT: T4<<				014 155
-20	-20	200	°C	
LIMIT: T5<<				014 165
-20	-20	200	°C	
LIMIT: T6<<				014 175
-20	-20	200	°C	
LIMIT: T7<<				014 185
-20	-20	200	°C	
LIMIT: T8<<				014 195
-20	-20	200	°C	
LIMIT: T9<<				015 135
-20	-20	200	°C	
Setting the operate value of temperature monitoring Tn<< for temperature sensor Tn.				
LIMIT: tT1<				014 126
Blocked	0	1000	s	Fig. 3-313, (p. 3-384)
LIMIT: tT2<				014 136
Blocked	0	1000	s	
LIMIT: tT3<				014 146
Blocked	0	1000	s	
LIMIT: tT4<				014 156
Blocked	0	1000	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LIMIT: tT5<				014 166
Blocked	0	1000	s	
LIMIT: tT6<				014 176
Blocked	0	1000	s	
LIMIT: tT7<				014 186
Blocked	0	1000	s	
LIMIT: tT8<				014 196
Blocked	0	1000	s	
LIMIT: tT9<				015 136
Blocked	0	1000	s	
Setting the operate delay of temperature monitoring Tn< for temperature sensor Tn.				
LIMIT: tT1<<				014 127
Blocked	0	1000	s	Fig. 3-313, (p. 3-384)
LIMIT: tT2<<				014 137
Blocked	0	1000	s	
LIMIT: tT3<<				014 147
Blocked	0	1000	s	
LIMIT: tT4<<				014 157
Blocked	0	1000	s	
LIMIT: tT5<<				014 167
Blocked	0	1000	s	
LIMIT: tT6<<				014 177
Blocked	0	1000	s	
LIMIT: tT7<<				014 187
Blocked	0	1000	s	
LIMIT: tT8<<				014 197
Blocked	0	1000	s	
LIMIT: tT9<<				015 137
Blocked	0	1000	s	
Setting the operate delay of temperature monitoring Tn<< for temperature sensor Tn.				

Programmable Logic

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: General enable USER					031 099
0: No				Fig. 3-318, (p. 3-391)	
Enable/disable the logic function.					
LOGIC: Set 1 USER					034 030
0: No				Fig. 3-317, (p. 3-390)	
LOGIC: Set 2 USER					034 031
0: No					
LOGIC: Set 3 USER					034 032
0: No					
LOGIC: Set 4 USER					034 033
0: No					
LOGIC: Set 5 USER					034 034
0: No					
LOGIC: Set 6 USER					034 035
0: No					
LOGIC: Set 7 USER					034 036
0: No					
LOGIC: Set 8 USER					034 037
0: No					
These settings define the static input conditions for the logic function.					
LOGIC: Fct.assignm. outp. 1					030 000
060 000: MAIN: Without function				Fig. 3-183, (p. 3-234) Fig. 3-318, (p. 3-391)	
LOGIC: Fct.assignm. outp. 2					030 004
060 000: MAIN: Without function			s	Fig. 3-183, (p. 3-234)	
LOGIC: Fct.assignm. outp. 3					030 008
060 000: MAIN: Without function					
LOGIC: Fct.assignm. outp. 4					030 012
060 000: MAIN: Without function					
LOGIC: Fct.assignm. outp. 5					030 016
060 000: MAIN: Without function					
LOGIC: Fct.assignm. outp. 6					030 020
060 000: MAIN: Without function					
LOGIC: Fct.assignm. outp. 7					030 024
060 000: MAIN: Without function					
LOGIC: Fct.assignm. outp. 8					030 028
060 000: MAIN: Without function					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Fct.assignm. outp. 9				030 032
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.10				030 036
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.11				030 040
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.12				030 044
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.13				030 048
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.14				030 052
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.15				030 056
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.16				030 060
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.17				030 064
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.18				030 068
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.19				030 072
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.20				030 076
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.21				030 080
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.22				030 084
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.23				030 088
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.24				030 092
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.25				030 096
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.26				031 000
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.27				031 004
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Fct.assignm. outp.28				031 008
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.29				031 012
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.30				031 016
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.31				031 020
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.32				031 024
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.33				030 100
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.34				030 104
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.35				030 108
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.36				030 112
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.37				030 116
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.38				030 120
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.39				030 124
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.40				030 128
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.41				030 132
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.42				030 136
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.43				030 140
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.44				030 144
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.45				030 148
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.46				030 152
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Fct.assignm. outp.47				030 156
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.48				030 160
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.49				030 164
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.50				030 168
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.51				030 172
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.52				030 176
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.53				030 180
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.54				030 184
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.55				030 188
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.56				030 192
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.57				030 196
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.58				030 200
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.59				030 204
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.60				030 208
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.61				030 212
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.62				030 216
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.63				030 220
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.64				030 224
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.65				046 000
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Fct.assignm. outp.66				045 004
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.67				045 008
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.68				045 012
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.69				045 016
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.70				045 020
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.71				045 024
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.72				045 028
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.73				045 032
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.74				045 036
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.75				045 040
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.76				045 044
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.77				045 048
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.78				045 052
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.79				045 056
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.80				045 060
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.81				045 064
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.82				045 068
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.83				045 072
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.84				045 076
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Fct.assignm. outp.85				045 080
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.86				045 084
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.87				045 088
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.88				045 092
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.89				045 096
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.90				045 100
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.91				045 104
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.92				045 108
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.93				045 112
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.94				045 116
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.95				045 120
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.96				045 124
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.97				045 128
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.98				045 132
060 000: MAIN: Without function				
LOGIC: Fct.assignm. outp.99				045 136
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.100				045 140
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.101				045 144
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.102				045 148
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.103				045 152
060 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Fct.assignm.outp.104				045 156
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.105				045 160
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.106				045 164
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.107				045 168
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.108				045 172
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.109				045 176
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.110				045 180
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.111				045 184
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.112				045 188
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.113				045 192
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.114				045 196
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.115				045 200
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.116				045 204
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.117				045 208
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.118				045 212
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.119				045 216
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.120				045 220
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.121				045 224
060 000: MAIN: Without function				
LOGIC: Fct.assignm.outp.122				045 228
060 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Fct.assignm.outp.123					045 232
060 000: MAIN: Without function					
LOGIC: Fct.assignm.outp.124					045 236
060 000: MAIN: Without function					
LOGIC: Fct.assignm.outp.125					045 240
060 000: MAIN: Without function					
LOGIC: Fct.assignm.outp.126					045 244
060 000: MAIN: Without function					
LOGIC: Fct.assignm.outp.127					045 248
060 000: MAIN: Without function					
LOGIC: Fct.assignm.outp.128					045 252
060 000: MAIN: Without function					
These settings assign functions to the outputs.					
LOGIC: Op. mode t output 1					030 001
0: Without timer stage				Fig. 3-183, (p. 3-234) Fig. 3-318, (p. 3-391)	
LOGIC: Op. mode t output 2					030 005
0: Without timer stage				Fig. 3-183, (p. 3-234)	
LOGIC: Op. mode t output 3					030 009
0: Without timer stage					
LOGIC: Op. mode t output 4					030 013
0: Without timer stage					
LOGIC: Op. mode t output 5					030 017
0: Without timer stage					
LOGIC: Op. mode t output 6					030 021
0: Without timer stage					
LOGIC: Op. mode t output 7					030 025
0: Without timer stage					
LOGIC: Op. mode t output 8					030 029
0: Without timer stage					
LOGIC: Op. mode t output 9					030 033
0: Without timer stage					
LOGIC: Op. mode t output 10					030 037
0: Without timer stage					
LOGIC: Op. mode t output 11					030 041
0: Without timer stage					
LOGIC: Op. mode t output 12					030 045
0: Without timer stage					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Op. mode t output 13				030 049
0: Without timer stage				
LOGIC: Op. mode t output 14				030 053
0: Without timer stage				
LOGIC: Op. mode t output 15				030 057
0: Without timer stage				
LOGIC: Op. mode t output 16				030 061
0: Without timer stage				
LOGIC: Op. mode t output 17				030 065
0: Without timer stage				
LOGIC: Op. mode t output 18				030 069
0: Without timer stage				
LOGIC: Op. mode t output 19				030 073
0: Without timer stage				
LOGIC: Op. mode t output 20				030 077
0: Without timer stage				
LOGIC: Op. mode t output 21				030 081
0: Without timer stage				
LOGIC: Op. mode t output 22				030 085
0: Without timer stage				
LOGIC: Op. mode t output 23				030 089
0: Without timer stage				
LOGIC: Op. mode t output 24				030 093
0: Without timer stage				
LOGIC: Op. mode t output 25				030 097
0: Without timer stage				
LOGIC: Op. mode t output 26				031 001
0: Without timer stage				
LOGIC: Op. mode t output 27				031 005
0: Without timer stage				
LOGIC: Op. mode t output 28				031 009
0: Without timer stage				
LOGIC: Op. mode t output 29				031 013
0: Without timer stage				
LOGIC: Op. mode t output 30				031 017
0: Without timer stage				
LOGIC: Op. mode t output 31				031 021
0: Without timer stage				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Op. mode t output 32				031 025
0: Without timer stage				
LOGIC: Op. mode t output 33				030 101
0: Without timer stage				
LOGIC: Op. mode t output 34				030 105
0: Without timer stage				
LOGIC: Op. mode t output 35				030 109
0: Without timer stage				
LOGIC: Op. mode t output 36				030 113
0: Without timer stage				
LOGIC: Op. mode t output 37				030 117
0: Without timer stage				
LOGIC: Op. mode t output 38				030 121
0: Without timer stage				
LOGIC: Op. mode t output 39				030 125
0: Without timer stage				
LOGIC: Op. mode t output 40				030 129
0: Without timer stage				
LOGIC: Op. mode t output 41				030 133
0: Without timer stage				
LOGIC: Op. mode t output 42				030 137
0: Without timer stage				
LOGIC: Op. mode t output 43				030 141
0: Without timer stage				
LOGIC: Op. mode t output 44				030 145
0: Without timer stage				
LOGIC: Op. mode t output 45				030 149
0: Without timer stage				
LOGIC: Op. mode t output 46				030 153
0: Without timer stage				
LOGIC: Op. mode t output 47				030 157
0: Without timer stage				
LOGIC: Op. mode t output 48				030 161
0: Without timer stage				
LOGIC: Op. mode t output 49				030 165
0: Without timer stage				
LOGIC: Op. mode t output 50				030 169
0: Without timer stage				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Op. mode t output 51					030 173
0: Without timer stage					
LOGIC: Op. mode t output 52					030 177
0: Without timer stage					
LOGIC: Op. mode t output 53					030 181
0: Without timer stage					
LOGIC: Op. mode t output 54					030 185
0: Without timer stage					
LOGIC: Op. mode t output 55					030 189
0: Without timer stage					
LOGIC: Op. mode t output 56					030 193
0: Without timer stage					
LOGIC: Op. mode t output 57					030 197
0: Without timer stage					
LOGIC: Op. mode t output 58					030 201
0: Without timer stage					
LOGIC: Op. mode t output 59					030 205
0: Without timer stage					
LOGIC: Op. mode t output 60					030 209
0: Without timer stage					
LOGIC: Op. mode t output 61					030 213
0: Without timer stage					
LOGIC: Op. mode t output 62					030 217
0: Without timer stage					
LOGIC: Op. mode t output 63					030 221
0: Without timer stage					
LOGIC: Op. mode t output 64					030 225
0: Without timer stage					
LOGIC: Op. mode t output 65					046 001
0: Without timer stage					
LOGIC: Op. mode t output 66					045 005
0: Without timer stage					
LOGIC: Op. mode t output 67					045 009
0: Without timer stage					
LOGIC: Op. mode t output 68					045 013
0: Without timer stage					
LOGIC: Op. mode t output 69					045 017
0: Without timer stage					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Op. mode t output 70				045 021
0: Without timer stage				
LOGIC: Op. mode t output 71				045 025
0: Without timer stage				
LOGIC: Op. mode t output 72				045 029
0: Without timer stage				
LOGIC: Op. mode t output 73				045 033
0: Without timer stage				
LOGIC: Op. mode t output 74				045 037
0: Without timer stage				
LOGIC: Op. mode t output 75				045 041
0: Without timer stage				
LOGIC: Op. mode t output 76				045 045
0: Without timer stage				
LOGIC: Op. mode t output 77				045 049
0: Without timer stage				
LOGIC: Op. mode t output 78				045 053
0: Without timer stage				
LOGIC: Op. mode t output 79				045 057
0: Without timer stage				
LOGIC: Op. mode t output 80				045 061
0: Without timer stage				
LOGIC: Op. mode t output 81				045 065
0: Without timer stage				
LOGIC: Op. mode t output 82				045 069
0: Without timer stage				
LOGIC: Op. mode t output 83				045 073
0: Without timer stage				
LOGIC: Op. mode t output 84				045 077
0: Without timer stage				
LOGIC: Op. mode t output 85				045 081
0: Without timer stage				
LOGIC: Op. mode t output 86				045 085
0: Without timer stage				
LOGIC: Op. mode t output 87				045 089
0: Without timer stage				
LOGIC: Op. mode t output 88				045 093
0: Without timer stage				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Op. mode t output 89				045 097
0: Without timer stage				
LOGIC: Op. mode t output 90				045 101
0: Without timer stage				
LOGIC: Op. mode t output 91				045 105
0: Without timer stage				
LOGIC: Op. mode t output 92				045 109
0: Without timer stage				
LOGIC: Op. mode t output 93				045 113
0: Without timer stage				
LOGIC: Op. mode t output 94				045 117
0: Without timer stage				
LOGIC: Op. mode t output 95				045 121
0: Without timer stage				
LOGIC: Op. mode t output 96				045 125
0: Without timer stage				
LOGIC: Op. mode t output 97				045 129
0: Without timer stage				
LOGIC: Op. mode t output 98				045 133
0: Without timer stage				
LOGIC: Op. mode t output 99				045 137
0: Without timer stage				
LOGIC: Op. mode t output100				045 141
0: Without timer stage				
LOGIC: Op. mode t output101				045 145
0: Without timer stage				
LOGIC: Op. mode t output102				045 149
0: Without timer stage				
LOGIC: Op. mode t output103				045 153
0: Without timer stage				
LOGIC: Op. mode t output104				045 157
0: Without timer stage				
LOGIC: Op. mode t output105				045 161
0: Without timer stage				
LOGIC: Op. mode t output106				045 165
0: Without timer stage				
LOGIC: Op. mode t output107				045 169
0: Without timer stage				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Op. mode t output108				045 173
0: Without timer stage				
LOGIC: Op. mode t output109				045 177
0: Without timer stage				
LOGIC: Op. mode t output110				045 181
0: Without timer stage				
LOGIC: Op. mode t output111				045 185
0: Without timer stage				
LOGIC: Op. mode t output112				045 189
0: Without timer stage				
LOGIC: Op. mode t output113				045 193
0: Without timer stage				
LOGIC: Op. mode t output114				045 197
0: Without timer stage				
LOGIC: Op. mode t output115				045 201
0: Without timer stage				
LOGIC: Op. mode t output116				045 205
0: Without timer stage				
LOGIC: Op. mode t output117				045 209
0: Without timer stage				
LOGIC: Op. mode t output118				045 213
0: Without timer stage				
LOGIC: Op. mode t output119				045 217
0: Without timer stage				
LOGIC: Op. mode t output120				045 221
0: Without timer stage				
LOGIC: Op. mode t output121				045 225
0: Without timer stage				
LOGIC: Op. mode t output122				045 229
0: Without timer stage				
LOGIC: Op. mode t output123				045 233
0: Without timer stage				
LOGIC: Op. mode t output124				045 237
0: Without timer stage				
LOGIC: Op. mode t output125				045 241
0: Without timer stage				
LOGIC: Op. mode t output126				045 245
0: Without timer stage				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Op. mode t output127					045 249
0: Without timer stage					
LOGIC: Op. mode t output128					045 253
0: Without timer stage					
These settings define the operating modes for the output timer stages.					
LOGIC: Time t1 output 1					030 002
0.00	0.00	600.00	s	Fig. 3-318, (p. 3-391)	
LOGIC: Time t1 output 2					030 006
0.00	0.00	600.00	s		
LOGIC: Time t1 output 3					030 010
0.00	0.00	600.00	s		
LOGIC: Time t1 output 4					030 014
0.00	0.00	600.00	s		
LOGIC: Time t1 output 5					030 018
0.00	0.00	600.00	s		
LOGIC: Time t1 output 6					030 022
0.00	0.00	600.00	s		
LOGIC: Time t1 output 7					030 026
0.00	0.00	600.00	s		
LOGIC: Time t1 output 8					030 030
0.00	0.00	600.00	s		
LOGIC: Time t1 output 9					030 034
0.00	0.00	600.00	s		
LOGIC: Time t1 output 10					030 038
0.00	0.00	600.00	s		
LOGIC: Time t1 output 11					030 042
0.00	0.00	600.00	s		
LOGIC: Time t1 output 12					030 046
0.00	0.00	600.00	s		
LOGIC: Time t1 output 13					030 050
0.00	0.00	600.00	s		
LOGIC: Time t1 output 14					030 054
0.00	0.00	600.00	s		
LOGIC: Time t1 output 15					030 058
0.00	0.00	600.00	s		
LOGIC: Time t1 output 16					030 062
0.00	0.00	600.00	s		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t1 output 17				030 066
0.00	0.00	600.00	s	
LOGIC: Time t1 output 18				030 070
0.00	0.00	600.00	s	
LOGIC: Time t1 output 19				030 074
0.00	0.00	600.00	s	
LOGIC: Time t1 output 20				030 078
0.00	0.00	600.00	s	
LOGIC: Time t1 output 21				030 082
0.00	0.00	600.00	s	
LOGIC: Time t1 output 22				030 086
0.00	0.00	600.00	s	
LOGIC: Time t1 output 23				030 090
0.00	0.00	600.00	s	
LOGIC: Time t1 output 24				030 094
0.00	0.00	600.00	s	
LOGIC: Time t1 output 25				030 098
0.00	0.00	600.00	s	
LOGIC: Time t1 output 26				031 002
0.00	0.00	600.00	s	
LOGIC: Time t1 output 27				031 006
0.00	0.00	600.00	s	
LOGIC: Time t1 output 28				031 010
0.00	0.00	600.00	s	
LOGIC: Time t1 output 29				031 014
0.00	0.00	600.00	s	
LOGIC: Time t1 output 30				031 018
0.00	0.00	600.00	s	
LOGIC: Time t1 output 31				031 022
0.00	0.00	600.00	s	
LOGIC: Time t1 output 32				031 026
0.00	0.00	600.00	s	
LOGIC: Time t1 output 33				030 102
0.00	0.00	600.00	s	
LOGIC: Time t1 output 34				030 106
0.00	0.00	600.00	s	
LOGIC: Time t1 output 35				030 110
0.00	0.00	600.00	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Time t1 output 36				030 114
0.00	0.00	600.00	s	
LOGIC: Time t1 output 37				030 118
0.00	0.00	600.00	s	
LOGIC: Time t1 output 38				030 122
0.00	0.00	600.00	s	
LOGIC: Time t1 output 39				030 126
0.00	0.00	600.00	s	
LOGIC: Time t1 output 40				030 130
0.00	0.00	600.00	s	
LOGIC: Time t1 output 41				030 134
0.00	0.00	600.00	s	
LOGIC: Time t1 output 42				030 138
0.00	0.00	600.00	s	
LOGIC: Time t1 output 43				030 142
0.00	0.00	600.00	s	
LOGIC: Time t1 output 44				030 146
0.00	0.00	600.00	s	
LOGIC: Time t1 output 45				030 150
0.00	0.00	600.00	s	
LOGIC: Time t1 output 46				030 154
0.00	0.00	600.00	s	
LOGIC: Time t1 output 47				030 158
0.00	0.00	600.00	s	
LOGIC: Time t1 output 48				030 162
0.00	0.00	600.00	s	
LOGIC: Time t1 output 49				030 166
0.00	0.00	600.00	s	
LOGIC: Time t1 output 50				030 170
0.00	0.00	600.00	s	
LOGIC: Time t1 output 51				030 174
0.00	0.00	600.00	s	
LOGIC: Time t1 output 52				030 178
0.00	0.00	600.00	s	
LOGIC: Time t1 output 53				030 182
0.00	0.00	600.00	s	
LOGIC: Time t1 output 54				030 186
0.00	0.00	600.00	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t1 output 55				030 190
0.00	0.00	600.00	s	
LOGIC: Time t1 output 56				030 194
0.00	0.00	600.00	s	
LOGIC: Time t1 output 57				030 198
0.00	0.00	600.00	s	
LOGIC: Time t1 output 58				030 202
0.00	0.00	600.00	s	
LOGIC: Time t1 output 59				030 206
0.00	0.00	600.00	s	
LOGIC: Time t1 output 60				030 210
0.00	0.00	600.00	s	
LOGIC: Time t1 output 61				030 214
0.00	0.00	600.00	s	
LOGIC: Time t1 output 62				030 218
0.00	0.00	600.00	s	
LOGIC: Time t1 output 63				030 222
0.00	0.00	600.00	s	
LOGIC: Time t1 output 64				030 226
0.00	0.00	600.00	s	
LOGIC: Time t1 output 65				046 002
0.00	0.00	600.00	s	
LOGIC: Time t1 output 66				045 006
0.00	0.00	600.00	s	
LOGIC: Time t1 output 67				045 010
0.00	0.00	600.00	s	
LOGIC: Time t1 output 68				045 014
0.00	0.00	600.00	s	
LOGIC: Time t1 output 69				045 018
0.00	0.00	600.00	s	
LOGIC: Time t1 output 70				045 022
0.00	0.00	600.00	s	
LOGIC: Time t1 output 71				045 026
0.00	0.00	600.00	s	
LOGIC: Time t1 output 72				045 030
0.00	0.00	600.00	s	
LOGIC: Time t1 output 73				045 034
0.00	0.00	600.00	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Time t1 output 74				045 038
0.00	0.00	600.00	s	
LOGIC: Time t1 output 75				045 042
0.00	0.00	600.00	s	
LOGIC: Time t1 output 76				045 046
0.00	0.00	600.00	s	
LOGIC: Time t1 output 77				045 050
0.00	0.00	600.00	s	
LOGIC: Time t1 output 78				045 054
0.00	0.00	600.00	s	
LOGIC: Time t1 output 79				045 058
0.00	0.00	600.00	s	
LOGIC: Time t1 output 80				045 062
0.00	0.00	600.00	s	
LOGIC: Time t1 output 81				045 066
0.00	0.00	600.00	s	
LOGIC: Time t1 output 82				045 070
0.00	0.00	600.00	s	
LOGIC: Time t1 output 83				045 074
0.00	0.00	600.00	s	
LOGIC: Time t1 output 84				045 078
0.00	0.00	600.00	s	
LOGIC: Time t1 output 85				045 082
0.00	0.00	600.00	s	
LOGIC: Time t1 output 86				045 086
0.00	0.00	600.00	s	
LOGIC: Time t1 output 87				045 090
0.00	0.00	600.00	s	
LOGIC: Time t1 output 88				045 094
0.00	0.00	600.00	s	
LOGIC: Time t1 output 89				045 098
0.00	0.00	600.00	s	
LOGIC: Time t1 output 90				045 102
0.00	0.00	600.00	s	
LOGIC: Time t1 output 91				045 106
0.00	0.00	600.00	s	
LOGIC: Time t1 output 92				045 110
0.00	0.00	600.00	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t1 output 93				045 114
0.00	0.00	600.00	s	
LOGIC: Time t1 output 94				045 118
0.00	0.00	600.00	s	
LOGIC: Time t1 output 95				045 122
0.00	0.00	600.00	s	
LOGIC: Time t1 output 96				045 126
0.00	0.00	600.00	s	
LOGIC: Time t1 output 97				045 130
0.00	0.00	600.00	s	
LOGIC: Time t1 output 98				045 134
0.00	0.00	600.00	s	
LOGIC: Time t1 output 99				045 138
0.00	0.00	600.00	s	
LOGIC: Time t1 output100				045 142
0.00	0.00	600.00	s	
LOGIC: Time t1 output101				045 146
0.00	0.00	600.00	s	
LOGIC: Time t1 output102				045 150
0.00	0.00	600.00	s	
LOGIC: Time t1 output103				045 154
0.00	0.00	600.00	s	
LOGIC: Time t1 output104				045 158
0.00	0.00	600.00	s	
LOGIC: Time t1 output105				045 162
0.00	0.00	600.00	s	
LOGIC: Time t1 output106				045 166
0.00	0.00	600.00	s	
LOGIC: Time t1 output107				045 170
0.00	0.00	600.00	s	
LOGIC: Time t1 output108				045 174
0.00	0.00	600.00	s	
LOGIC: Time t1 output109				045 178
0.00	0.00	600.00	s	
LOGIC: Time t1 output110				045 182
0.00	0.00	600.00	s	
LOGIC: Time t1 output111				045 186
0.00	0.00	600.00	s	

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LOGIC: Time t1 output112					045 190
0.00	0.00	600.00	s		
LOGIC: Time t1 output113					045 194
0.00	0.00	600.00	s		
LOGIC: Time t1 output114					045 198
0.00	0.00	600.00	s		
LOGIC: Time t1 output115					045 202
0.00	0.00	600.00	s		
LOGIC: Time t1 output116					045 206
0.00	0.00	600.00	s		
LOGIC: Time t1 output117					045 210
0.00	0.00	600.00	s		
LOGIC: Time t1 output118					045 214
0.00	0.00	600.00	s		
LOGIC: Time t1 output119					045 218
0.00	0.00	600.00	s		
LOGIC: Time t1 output120					045 222
0.00	0.00	600.00	s		
LOGIC: Time t1 output121					045 226
0.00	0.00	600.00	s		
LOGIC: Time t1 output122					045 230
0.00	0.00	600.00	s		
LOGIC: Time t1 output123					045 234
0.00	0.00	600.00	s		
LOGIC: Time t1 output124					045 238
0.00	0.00	600.00	s		
LOGIC: Time t1 output125					045 242
0.00	0.00	600.00	s		
LOGIC: Time t1 output126					045 246
0.00	0.00	600.00	s		
LOGIC: Time t1 output127					045 250
0.00	0.00	600.00	s		
LOGIC: Time t1 output128					045 254
0.00	0.00	600.00	s		
Settings of timer stage t1 for the respective outputs.					
LOGIC: Time t2 output 1					030 003
0.00	0.00	600.00	s	Fig. 3-318, (p. 3-391)	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t2 output 2				030 007
0.00	0.00	600.00	s	
LOGIC: Time t2 output 3				030 011
0.00	0.00	600.00	s	
LOGIC: Time t2 output 4				030 015
0.00	0.00	600.00	s	
LOGIC: Time t2 output 5				030 019
0.00	0.00	600.00	s	
LOGIC: Time t2 output 6				030 023
0.00	0.00	600.00	s	
LOGIC: Time t2 output 7				030 027
0.00	0.00	600.00	s	
LOGIC: Time t2 output 8				030 031
0.00	0.00	600.00	s	
LOGIC: Time t2 output 9				030 035
0.00	0.00	600.00	s	
LOGIC: Time t2 output 10				030 039
0.00	0.00	600.00	s	
LOGIC: Time t2 output 11				030 043
0.00	0.00	600.00	s	
LOGIC: Time t2 output 12				030 047
0.00	0.00	600.00	s	
LOGIC: Time t2 output 13				030 051
0.00	0.00	600.00	s	
LOGIC: Time t2 output 14				030 055
0.00	0.00	600.00	s	
LOGIC: Time t2 output 15				030 059
0.00	0.00	600.00	s	
LOGIC: Time t2 output 16				030 063
0.00	0.00	600.00	s	
LOGIC: Time t2 output 17				030 067
0.00	0.00	600.00	s	
LOGIC: Time t2 output 18				030 071
0.00	0.00	600.00	s	
LOGIC: Time t2 output 19				030 075
0.00	0.00	600.00	s	
LOGIC: Time t2 output 20				030 079
0.00	0.00	600.00	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t2 output 21				030 083
0.00	0.00	600.00	s	
LOGIC: Time t2 output 22				030 087
0.00	0.00	600.00	s	
LOGIC: Time t2 output 23				030 091
0.00	0.00	600.00	s	
LOGIC: Time t2 output 24				030 095
0.00	0.00	600.00	s	
LOGIC: Time t2 output 25				030 099
0.00	0.00	600.00	s	
LOGIC: Time t2 output 26				031 003
0.00	0.00	600.00	s	
LOGIC: Time t2 output 27				031 007
0.00	0.00	600.00	s	
LOGIC: Time t2 output 28				031 011
0.00	0.00	600.00	s	
LOGIC: Time t2 output 29				031 015
0.00	0.00	600.00	s	
LOGIC: Time t2 output 30				031 019
0.00	0.00	600.00	s	
LOGIC: Time t2 output 31				031 023
0.00	0.00	600.00	s	
LOGIC: Time t2 output 32				031 027
0.00	0.00	600.00	s	
LOGIC: Time t2 output 33				030 103
0.00	0.00	600.00	s	
LOGIC: Time t2 output 34				030 107
0.00	0.00	600.00	s	
LOGIC: Time t2 output 35				030 111
0.00	0.00	600.00	s	
LOGIC: Time t2 output 36				030 115
0.00	0.00	600.00	s	
LOGIC: Time t2 output 37				030 119
0.00	0.00	600.00	s	
LOGIC: Time t2 output 38				030 123
0.00	0.00	600.00	s	
LOGIC: Time t2 output 39				030 127
0.00	0.00	600.00	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Time t2 output 40				030 131
0.00	0.00	600.00	s	
LOGIC: Time t2 output 41				030 135
0.00	0.00	600.00	s	
LOGIC: Time t2 output 42				030 139
0.00	0.00	600.00	s	
LOGIC: Time t2 output 43				030 143
0.00	0.00	600.00	s	
LOGIC: Time t2 output 44				030 147
0.00	0.00	600.00	s	
LOGIC: Time t2 output 45				030 151
0.00	0.00	600.00	s	
LOGIC: Time t2 output 46				030 155
0.00	0.00	600.00	s	
LOGIC: Time t2 output 47				030 159
0.00	0.00	600.00	s	
LOGIC: Time t2 output 48				030 163
0.00	0.00	600.00	s	
LOGIC: Time t2 output 49				030 167
0.00	0.00	600.00	s	
LOGIC: Time t2 output 50				030 171
0.00	0.00	600.00	s	
LOGIC: Time t2 output 51				030 175
0.00	0.00	600.00	s	
LOGIC: Time t2 output 52				030 179
0.00	0.00	600.00	s	
LOGIC: Time t2 output 53				030 183
0.00	0.00	600.00	s	
LOGIC: Time t2 output 54				030 187
0.00	0.00	600.00	s	
LOGIC: Time t2 output 55				030 191
0.00	0.00	600.00	s	
LOGIC: Time t2 output 56				030 195
0.00	0.00	600.00	s	
LOGIC: Time t2 output 57				030 199
0.00	0.00	600.00	s	
LOGIC: Time t2 output 58				030 203
0.00	0.00	600.00	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t2 output 59				030 207
0.00	0.00	600.00	s	
LOGIC: Time t2 output 60				030 211
0.00	0.00	600.00	s	
LOGIC: Time t2 output 61				030 215
0.00	0.00	600.00	s	
LOGIC: Time t2 output 62				030 219
0.00	0.00	600.00	s	
LOGIC: Time t2 output 63				030 223
0.00	0.00	600.00	s	
LOGIC: Time t2 output 64				030 227
0.00	0.00	600.00	s	
LOGIC: Time t2 output 65				046 003
0.00	0.00	600.00	s	
LOGIC: Time t2 output 66				045 007
0.00	0.00	600.00	s	
LOGIC: Time t2 output 67				045 011
0.00	0.00	600.00	s	
LOGIC: Time t2 output 68				045 015
0.00	0.00	600.00	s	
LOGIC: Time t2 output 69				045 019
0.00	0.00	600.00	s	
LOGIC: Time t2 output 70				045 023
0.00	0.00	600.00	s	
LOGIC: Time t2 output 71				045 027
0.00	0.00	600.00	s	
LOGIC: Time t2 output 72				045 031
0.00	0.00	600.00	s	
LOGIC: Time t2 output 73				045 035
0.00	0.00	600.00	s	
LOGIC: Time t2 output 74				045 039
0.00	0.00	600.00	s	
LOGIC: Time t2 output 75				045 043
0.00	0.00	600.00	s	
LOGIC: Time t2 output 76				045 047
0.00	0.00	600.00	s	
LOGIC: Time t2 output 77				045 051
0.00	0.00	600.00	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Time t2 output 78				045 055
0.00	0.00	600.00	s	
LOGIC: Time t2 output 79				045 059
0.00	0.00	600.00	s	
LOGIC: Time t2 output 80				045 063
0.00	0.00	600.00	s	
LOGIC: Time t2 output 81				045 067
0.00	0.00	600.00	s	
LOGIC: Time t2 output 82				045 071
0.00	0.00	600.00	s	
LOGIC: Time t2 output 83				045 075
0.00	0.00	600.00	s	
LOGIC: Time t2 output 84				045 079
0.00	0.00	600.00	s	
LOGIC: Time t2 output 85				045 083
0.00	0.00	600.00	s	
LOGIC: Time t2 output 86				045 087
0.00	0.00	600.00	s	
LOGIC: Time t2 output 87				045 091
0.00	0.00	600.00	s	
LOGIC: Time t2 output 88				045 095
0.00	0.00	600.00	s	
LOGIC: Time t2 output 89				045 099
0.00	0.00	600.00	s	
LOGIC: Time t2 output 90				045 103
0.00	0.00	600.00	s	
LOGIC: Time t2 output 91				045 107
0.00	0.00	600.00	s	
LOGIC: Time t2 output 92				045 111
0.00	0.00	600.00	s	
LOGIC: Time t2 output 93				045 115
0.00	0.00	600.00	s	
LOGIC: Time t2 output 94				045 119
0.00	0.00	600.00	s	
LOGIC: Time t2 output 95				045 123
0.00	0.00	600.00	s	
LOGIC: Time t2 output 96				045 127
0.00	0.00	600.00	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Time t2 output 97				045 131
0.00	0.00	600.00	s	
LOGIC: Time t2 output 98				045 135
0.00	0.00	600.00	s	
LOGIC: Time t2 output 99				045 139
0.00	0.00	600.00	s	
LOGIC: Time t2 output100				045 143
0.00	0.00	600.00	s	
LOGIC: Time t2 output101				045 147
0.00	0.00	600.00	s	
LOGIC: Time t2 output102				045 151
0.00	0.00	600.00	s	
LOGIC: Time t2 output103				045 155
0.00	0.00	600.00	s	
LOGIC: Time t2 output104				045 159
0.00	0.00	600.00	s	
LOGIC: Time t2 output105				045 163
0.00	0.00	600.00	s	
LOGIC: Time t2 output106				045 167
0.00	0.00	600.00	s	
LOGIC: Time t2 output107				045 171
0.00	0.00	600.00	s	
LOGIC: Time t2 output108				045 175
0.00	0.00	600.00	s	
LOGIC: Time t2 output109				045 179
0.00	0.00	600.00	s	
LOGIC: Time t2 output110				045 183
0.00	0.00	600.00	s	
LOGIC: Time t2 output111				045 187
0.00	0.00	600.00	s	
LOGIC: Time t2 output112				045 191
0.00	0.00	600.00	s	
LOGIC: Time t2 output113				045 195
0.00	0.00	600.00	s	
LOGIC: Time t2 output114				045 199
0.00	0.00	600.00	s	
LOGIC: Time t2 output115				045 203
0.00	0.00	600.00	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Time t2 output116				045 207
0.00	0.00	600.00	s	
LOGIC: Time t2 output117				045 211
0.00	0.00	600.00	s	
LOGIC: Time t2 output118				045 215
0.00	0.00	600.00	s	
LOGIC: Time t2 output119				045 219
0.00	0.00	600.00	s	
LOGIC: Time t2 output120				045 223
0.00	0.00	600.00	s	
LOGIC: Time t2 output121				045 227
0.00	0.00	600.00	s	
LOGIC: Time t2 output122				045 231
0.00	0.00	600.00	s	
LOGIC: Time t2 output123				045 235
0.00	0.00	600.00	s	
LOGIC: Time t2 output124				045 239
0.00	0.00	600.00	s	
LOGIC: Time t2 output125				045 243
0.00	0.00	600.00	s	
LOGIC: Time t2 output126				045 247
0.00	0.00	600.00	s	
LOGIC: Time t2 output127				045 251
0.00	0.00	600.00	s	
LOGIC: Time t2 output128				045 255
0.00	0.00	600.00	s	
Settings for timer stage t2 for the respective outputs. **Note:** This setting has no effect in the “minimum time” operating mode.				
LOGIC: Sig.assig. outp. 1				044 000
061 000: MAIN: Without function				Fig. 3-325, (p. 3-396)
LOGIC: Sig.assig. outp. 2				044 002
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 3				044 004
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 4				044 006
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 5				044 008
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp. 6				044 010
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 7				044 012
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 8				044 014
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 9				044 016
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 10				044 018
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 11				044 020
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 12				044 022
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 13				044 024
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 14				044 026
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 15				044 028
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 16				044 030
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 17				044 032
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 18				044 034
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 19				044 036
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 20				044 038
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 21				044 040
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 22				044 042
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 23				044 044
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 24				044 046
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp. 25				044 048
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 26				044 050
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 27				044 052
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 28				044 054
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 29				044 056
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 30				044 058
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 31				044 060
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 32				044 062
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 33				044 064
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 34				044 066
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 35				044 068
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 36				044 070
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 37				044 072
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 38				044 074
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 39				044 076
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 40				044 078
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 41				044 080
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 42				044 082
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 43				044 084
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp. 44				044 086
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 45				044 088
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 46				044 090
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 47				044 092
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 48				044 094
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 49				044 096
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 50				044 098
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 51				044 100
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 52				044 102
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 53				044 104
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 54				044 106
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 55				044 108
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 56				044 110
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 57				044 112
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 58				044 114
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 59				044 116
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 60				044 118
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 61				044 120
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 62				044 122
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp. 63				044 124
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 64				044 126
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 65				048 128
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 66				048 002
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 67				048 004
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 68				048 006
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 69				048 008
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 70				048 010
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 71				048 012
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 72				048 014
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 73				048 016
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 74				048 018
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 75				048 020
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 76				048 022
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 77				048 024
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 78				048 026
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 79				048 028
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 80				048 030
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 81				048 032
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp. 82				048 034
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 83				048 036
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 84				048 038
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 85				048 040
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 86				048 042
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 87				048 044
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 88				048 046
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 89				048 048
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 90				048 050
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 91				048 052
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 92				048 054
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 93				048 056
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 94				048 058
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 95				048 060
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 96				048 062
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 97				048 064
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 98				048 066
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp. 99				048 068
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.100				048 070
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig. outp.101				048 072
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.102				048 074
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.103				048 076
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.104				048 078
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.105				048 080
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.106				048 082
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.107				048 084
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.108				048 086
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.109				048 088
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.110				048 090
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.111				048 092
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.112				048 094
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.113				048 096
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.114				048 098
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.115				048 100
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.116				048 102
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.117				048 104
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.118				048 106
061 000: MAIN: Without function				
LOGIC: Sig.assig. outp.119				048 108
061 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Sig.assig. outp.120					048 110
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.121					048 112
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.122					048 114
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.123					048 116
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.124					048 118
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.125					048 120
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.126					048 122
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.127					048 124
061 000: MAIN: Without function					
LOGIC: Sig.assig. outp.128					048 126
061 000: MAIN: Without function					
These settings assign the function of a binary input signal to the output of the logic equation.					
LOGIC: Sig.assig.outp. 1(t)					044 001
061 000: MAIN: Without function				Fig. 3-325, (p. 3-396)	
LOGIC: Sig.assig.outp. 2(t)					044 003
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 3(t)					044 005
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 4(t)					044 007
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 5(t)					044 009
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 6(t)					044 011
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 7(t)					044 013
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 8(t)					044 015
061 000: MAIN: Without function					
LOGIC: Sig.assig.outp. 9(t)					044 017
061 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp.10(t)				044 019
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.11(t)				044 021
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.12(t)				044 023
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.13(t)				044 025
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.14(t)				044 027
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.15(t)				044 029
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.16(t)				044 031
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.17(t)				044 033
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.18(t)				044 035
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.19(t)				044 037
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.20(t)				044 039
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.21(t)				044 041
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.22(t)				044 043
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.23(t)				044 045
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.24(t)				044 047
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.25(t)				044 049
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.26(t)				044 051
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.27(t)				044 053
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.28(t)				044 055
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp.29(t)				044 057
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.30(t)				044 059
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.31(t)				044 061
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.32(t)				044 063
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.33(t)				044 065
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.34(t)				044 067
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.35(t)				044 069
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.36(t)				044 071
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.37(t)				044 073
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.38(t)				044 075
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.39(t)				044 077
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.40(t)				044 079
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.41(t)				044 081
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.42(t)				044 083
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.43(t)				044 085
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.44(t)				044 087
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.45(t)				044 089
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.46(t)				044 091
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.47(t)				044 093
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp.48(t)				044 095
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.49(t)				044 097
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.50(t)				044 099
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.51(t)				044 101
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.52(t)				044 103
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.53(t)				044 105
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.54(t)				044 107
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.55(t)				044 109
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.56(t)				044 111
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.57(t)				044 113
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.58(t)				044 115
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.59(t)				044 117
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.60(t)				044 119
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.61(t)				044 121
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.62(t)				044 123
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.63(t)				044 125
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.64(t)				044 127
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.65(t)				048 129
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.66(t)				048 003
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp.67(t)				048 005
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.68(t)				048 007
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.69(t)				048 009
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.70(t)				048 011
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.71(t)				048 013
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.72(t)				048 015
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.73(t)				048 017
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.74(t)				048 019
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.75(t)				048 021
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.76(t)				048 023
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.77(t)				048 025
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.78(t)				048 027
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.79(t)				048 029
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.80(t)				048 031
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.81(t)				048 033
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.82(t)				048 035
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.83(t)				048 037
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.84(t)				048 039
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.85(t)				048 041
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp.86(t)				048 043
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.87(t)				048 045
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.88(t)				048 047
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.89(t)				048 049
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.90(t)				048 051
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.91(t)				048 053
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.92(t)				048 055
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.93(t)				048 057
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.94(t)				048 059
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.95(t)				048 061
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.96(t)				048 063
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.97(t)				048 065
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.98(t)				048 067
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp.99(t)				048 069
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp100(t)				048 071
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp101(t)				048 073
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp102(t)				048 075
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp103(t)				048 077
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp104(t)				048 079
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp105(t)				048 081
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp106(t)				048 083
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp107(t)				048 085
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp108(t)				048 087
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp109(t)				048 089
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp110(t)				048 091
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp111(t)				048 093
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp112(t)				048 095
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp113(t)				048 097
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp114(t)				048 099
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp115(t)				048 101
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp116(t)				048 103
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp117(t)				048 105
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp118(t)				048 107
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp119(t)				048 109
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp120(t)				048 111
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp121(t)				048 113
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp122(t)				048 115
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp123(t)				048 117
061 000: MAIN: Without function				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Sig.assig.outp124(t)				048 119
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp125(t)				048 121
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp126(t)				048 123
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp127(t)				048 125
061 000: MAIN: Without function				
LOGIC: Sig.assig.outp128(t)				048 127
061 000: MAIN: Without function				
These settings assign the function of a binary input signal to the output of the logic equation.				

Programmable Logic

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOG_2: General enable USER					011 137
0: No				Fig. 3-319, (p. 3-392)	
Enable/disable the function group LOG_2 (Programmable Logic 2).					
LOG_2: Fct.assignm. outp. 1					050 000
060 000: MAIN: Without function				Fig. 3-319, (p. 3-392)	
LOG_2: Fct.assignm. outp. 2					050 004
060 000: MAIN: Without function			s		
LOG_2: Fct.assignm. outp. 3					050 008
060 000: MAIN: Without function					
LOG_2: Fct.assignm. outp. 4					050 012
060 000: MAIN: Without function					
These settings assign functions to the outputs.					
LOG_2: Op. mode t output 1					050 001
0: Without timer stage				Fig. 3-319, (p. 3-392)	
LOG_2: Op. mode t output 2					050 005
0: Without timer stage					
LOG_2: Op. mode t output 3					050 009
0: Without timer stage					
LOG_2: Op. mode t output 4					050 013
0: Without timer stage					
These settings define the operating modes for the output timer stages.					
LOG_2: Time t1 output 1					050 002
0	0	60000	s	Fig. 3-319, (p. 3-392)	
LOG_2: Time t1 output 2					050 006
0	0	60000	s		
LOG_2: Time t1 output 3					050 010
0	0	60000	s		
LOG_2: Time t1 output 4					050 014
0	0	60000	s		
Settings of timer stage t1 for the respective outputs.					
LOG_2: Time t2 output 1					050 003
0	0	60000	s	Fig. 3-319, (p. 3-392)	
LOG_2: Time t2 output 2					050 007
0	0	60000	s		
LOG_2: Time t2 output 3					050 011
0	0	60000	s		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOG_2: Time t2 output 4				050 015
0	0	60000	s	
Settings for timer stage t2 for the respective outputs. **Note:** This setting has no effect in the “minimum time” operating mode.				
LOG_2: Sig.assig. outp. 1				064 000
061 000: MAIN: Without function				
LOG_2: Sig.assig. outp. 2				064 002
061 000: MAIN: Without function				
LOG_2: Sig.assig. outp. 3				064 004
061 000: MAIN: Without function				
LOG_2: Sig.assig. outp. 4				064 006
061 000: MAIN: Without function				
These settings assign the function of a binary input signal to the output of the logic equation.				
LOG_2: Sig.assig.outp. 1(t)				064 001
061 000: MAIN: Without function				
LOG_2: Sig.assig.outp. 2(t)				064 003
061 000: MAIN: Without function				
LOG_2: Sig.assig.outp. 3(t)				064 005
061 000: MAIN: Without function				
LOG_2: Sig.assig.outp. 4(t)				064 007
061 000: MAIN: Without function				
These settings assign the function of a binary input signal to the output of the logic equation.				

Single-pole signals

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Designat. sig. S001				226 000
1: S001				
SIG_1: Designat. sig. S002				226 008
2: S002				
SIG_1: Designat. sig. S003				226 016
3: S003				
SIG_1: Designat. sig. S004				226 024
4: S004				
SIG_1: Designat. sig. S005				226 032
5: S005				
SIG_1: Designat. sig. S006				226 040
6: S006				
SIG_1: Designat. sig. S007				226 048
7: S007				
SIG_1: Designat. sig. S008				226 056
8: S008				
SIG_1: Designat. sig. S009				226 064
9: S009				
SIG_1: Designat. sig. S010				226 072
10: S010				
SIG_1: Designat. sig. S011				226 080
11: S011				
SIG_1: Designat. sig. S012				226 088
12: S012				
SIG_1: Designat. sig. S013				226 096
13: S013				
SIG_1: Designat. sig. S014				226 104
14: S014				
SIG_1: Designat. sig. S015				226 112
15: S015				
SIG_1: Designat. sig. S016				226 120
16: S016				
SIG_1: Designat. sig. S017				226 128
17: S017				
SIG_1: Designat. sig. S018				226 136
18: S018				
SIG_1: Designat. sig. S019				226 144
19: S019				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Designat. sig. S020				226 152
20: S020				
SIG_1: Designat. sig. S021				226 160
21: S021				
SIG_1: Designat. sig. S022				226 168
22: S022				
SIG_1: Designat. sig. S023				226 176
23: S023				
SIG_1: Designat. sig. S024				226 184
24: S024				
SIG_1: Designat. sig. S025				226 192
25: S025				
SIG_1: Designat. sig. S026				226 200
26: S026				
SIG_1: Designat. sig. S027				226 208
27: S027				
SIG_1: Designat. sig. S028				226 216
28: S028				
SIG_1: Designat. sig. S029				226 224
29: S029				
SIG_1: Designat. sig. S030				226 232
30: S030				
SIG_1: Designat. sig. S031				226 240
31: S031				
SIG_1: Designat. sig. S032				226 248
32: S032				
SIG_1: Designat. sig. S033				227 000
33: S033				
SIG_1: Designat. sig. S034				227 008
34: S034				
SIG_1: Designat. sig. S035				227 016
35: S035				
SIG_1: Designat. sig. S036				227 024
36: S036				
SIG_1: Designat. sig. S037				227 032
37: S037				
SIG_1: Designat. sig. S038				227 040
38: S038				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Designat. sig. S039					227 048
39: S039					
SIG_1: Designat. sig. S040					227 056
40: S040					
SIG_1: Designat. sig. S041					227 064
41: S041					
SIG_1: Designat. sig. S042					227 072
42: S042					
SIG_1: Designat. sig. S043					227 080
43: S043					
SIG_1: Designat. sig. S044					227 088
44: S044					
SIG_1: Designat. sig. S045					227 096
45: S045					
SIG_1: Designat. sig. S046					227 104
46: S046					
SIG_1: Designat. sig. S047					227 112
47: S047					
SIG_1: Designat. sig. S048					227 120
48: S048					
SIG_1: Designat. sig. S049					227 128
49: S049					
SIG_1: Designat. sig. S050					227 136
50: S050					
SIG_1: Designat. sig. S051					227 144
51: S051					
SIG_1: Designat. sig. S052					227 152
52: S052					
SIG_1: Designat. sig. S053					227 160
53: S053					
SIG_1: Designat. sig. S054					227 168
54: S054					
SIG_1: Designat. sig. S055					227 176
55: S055					
SIG_1: Designat. sig. S056					227 184
56: S056					
SIG_1: Designat. sig. S057					227 192
57: S057					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Designat. sig. S058				227 200
58: S058				
SIG_1: Designat. sig. S059				227 208
59: S059				
SIG_1: Designat. sig. S060				227 216
60: S060				
SIG_1: Designat. sig. S061				227 224
61: S061				
SIG_1: Designat. sig. S062				227 232
62: S062				
SIG_1: Designat. sig. S063				227 240
63: S063				
SIG_1: Designat. sig. S064				227 248
64: S064				
SIG_1: Designat. SIG_DC3				233 000
234: SIGNAL DC3				
Selection of the signal designation.				
SIG_1: Oper. mode sig. S001				226 001
1: Start/end signal				Fig. 3-351, (p. 3-431)
SIG_1: Oper. mode sig. S002				226 009
1: Start/end signal				
SIG_1: Oper. mode sig. S003				226 017
1: Start/end signal				
SIG_1: Oper. mode sig. S004				226 025
1: Start/end signal				
SIG_1: Oper. mode sig. S005				226 033
1: Start/end signal				
SIG_1: Oper. mode sig. S006				226 041
1: Start/end signal				
SIG_1: Oper. mode sig. S007				226 049
1: Start/end signal				
SIG_1: Oper. mode sig. S008				226 057
1: Start/end signal				
SIG_1: Oper. mode sig. S009				226 065
1: Start/end signal				
SIG_1: Oper. mode sig. S010				226 073
1: Start/end signal				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Oper. mode sig. S011					226 081
1: Start/end signal					
SIG_1: Oper. mode sig. S012					226 089
1: Start/end signal					
SIG_1: Oper. mode sig. S013					226 097
1: Start/end signal					
SIG_1: Oper. mode sig. S014					226 105
1: Start/end signal					
SIG_1: Oper. mode sig. S015					226 113
1: Start/end signal					
SIG_1: Oper. mode sig. S016					226 121
1: Start/end signal					
SIG_1: Oper. mode sig. S017					226 129
1: Start/end signal					
SIG_1: Oper. mode sig. S018					226 137
1: Start/end signal					
SIG_1: Oper. mode sig. S019					226 145
1: Start/end signal					
SIG_1: Oper. mode sig. S020					226 153
1: Start/end signal					
SIG_1: Oper. mode sig. S021					226 161
1: Start/end signal					
SIG_1: Oper. mode sig. S022					226 169
1: Start/end signal					
SIG_1: Oper. mode sig. S023					226 177
1: Start/end signal					
SIG_1: Oper. mode sig. S024					226 185
1: Start/end signal					
SIG_1: Oper. mode sig. S025					226 193
1: Start/end signal					
SIG_1: Oper. mode sig. S026					226 201
1: Start/end signal					
SIG_1: Oper. mode sig. S027					226 209
1: Start/end signal					
SIG_1: Oper. mode sig. S028					226 217
1: Start/end signal					
SIG_1: Oper. mode sig. S029					226 225
1: Start/end signal					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Oper. mode sig. S030				226 233
1: Start/end signal				
SIG_1: Oper. mode sig. S031				226 241
1: Start/end signal				
SIG_1: Oper. mode sig. S032				226 249
1: Start/end signal				
SIG_1: Oper. mode sig. S033				227 001
1: Start/end signal				
SIG_1: Oper. mode sig. S034				227 009
1: Start/end signal				
SIG_1: Oper. mode sig. S035				227 017
1: Start/end signal				
SIG_1: Oper. mode sig. S036				227 025
1: Start/end signal				
SIG_1: Oper. mode sig. S037				227 033
1: Start/end signal				
SIG_1: Oper. mode sig. S038				227 041
1: Start/end signal				
SIG_1: Oper. mode sig. S039				227 049
1: Start/end signal				
SIG_1: Oper. mode sig. S040				227 057
1: Start/end signal				
SIG_1: Oper. mode sig. S041				227 065
1: Start/end signal				
SIG_1: Oper. mode sig. S042				227 073
1: Start/end signal				
SIG_1: Oper. mode sig. S043				227 081
1: Start/end signal				
SIG_1: Oper. mode sig. S044				227 089
1: Start/end signal				
SIG_1: Oper. mode sig. S045				227 097
1: Start/end signal				
SIG_1: Oper. mode sig. S046				227 105
1: Start/end signal				
SIG_1: Oper. mode sig. S047				227 113
1: Start/end signal				
SIG_1: Oper. mode sig. S048				227 121
1: Start/end signal				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Oper. mode sig. S049				227 129
1: Start/end signal				
SIG_1: Oper. mode sig. S050				227 137
1: Start/end signal				
SIG_1: Oper. mode sig. S051				227 145
1: Start/end signal				
SIG_1: Oper. mode sig. S052				227 153
1: Start/end signal				
SIG_1: Oper. mode sig. S053				227 161
1: Start/end signal				
SIG_1: Oper. mode sig. S054				227 169
1: Start/end signal				
SIG_1: Oper. mode sig. S055				227 177
1: Start/end signal				
SIG_1: Oper. mode sig. S056				227 185
1: Start/end signal				
SIG_1: Oper. mode sig. S057				227 193
1: Start/end signal				
SIG_1: Oper. mode sig. S058				227 201
1: Start/end signal				
SIG_1: Oper. mode sig. S059				227 209
1: Start/end signal				
SIG_1: Oper. mode sig. S060				227 217
1: Start/end signal				
SIG_1: Oper. mode sig. S061				227 225
1: Start/end signal				
SIG_1: Oper. mode sig. S062				227 233
1: Start/end signal				
SIG_1: Oper. mode sig. S063				227 241
1: Start/end signal				
SIG_1: Oper. mode sig. S064				227 249
1: Start/end signal				
Selection of the signal operating mode.				
SIG_1: Gr.asg. debounc.S001				226 003
1: Group 1				Fig. 3-351, (p. 3-431)
SIG_1: Gr.asg. debounc.S002				226 011
1: Group 1				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Gr.asg. debounc.S003					226 019
1: Group 1					
SIG_1: Gr.asg. debounc.S004					226 027
1: Group 1					
SIG_1: Gr.asg. debounc.S005					226 035
1: Group 1					
SIG_1: Gr.asg. debounc.S006					226 043
1: Group 1					
SIG_1: Gr.asg. debounc.S007					226 051
1: Group 1					
SIG_1: Gr.asg. debounc.S008					226 059
1: Group 1					
SIG_1: Gr.asg. debounc.S009					226 067
1: Group 1					
SIG_1: Gr.asg. debounc.S010					226 075
1: Group 1					
SIG_1: Gr.asg. debounc.S011					226 083
1: Group 1					
SIG_1: Gr.asg. debounc.S012					226 091
1: Group 1					
SIG_1: Gr.asg. debounc.S013					226 099
1: Group 1					
SIG_1: Gr.asg. debounc.S014					226 107
1: Group 1					
SIG_1: Gr.asg. debounc.S015					226 115
1: Group 1					
SIG_1: Gr.asg. debounc.S016					226 123
1: Group 1					
SIG_1: Gr.asg. debounc.S017					226 131
1: Group 1					
SIG_1: Gr.asg. debounc.S018					226 139
1: Group 1					
SIG_1: Gr.asg. debounc.S019					226 147
1: Group 1					
SIG_1: Gr.asg. debounc.S020					226 155
1: Group 1					
SIG_1: Gr.asg. debounc.S021					226 163
1: Group 1					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Gr.asg. debounc.S022				226 171
1: Group 1				
SIG_1: Gr.asg. debounc.S023				226 179
1: Group 1				
SIG_1: Gr.asg. debounc.S024				226 187
1: Group 1				
SIG_1: Gr.asg. debounc.S025				226 195
1: Group 1				
SIG_1: Gr.asg. debounc.S026				226 203
1: Group 1				
SIG_1: Gr.asg. debounc.S027				226 211
1: Group 1				
SIG_1: Gr.asg. debounc.S028				226 219
1: Group 1				
SIG_1: Gr.asg. debounc.S029				226 227
1: Group 1				
SIG_1: Gr.asg. debounc.S030				226 235
1: Group 1				
SIG_1: Gr.asg. debounc.S031				226 243
1: Group 1				
SIG_1: Gr.asg. debounc.S032				226 251
1: Group 1				
SIG_1: Gr.asg. debounc.S033				227 003
1: Group 1				
SIG_1: Gr.asg. debounc.S034				227 011
1: Group 1				
SIG_1: Gr.asg. debounc.S035				227 019
1: Group 1				
SIG_1: Gr.asg. debounc.S036				227 027
1: Group 1				
SIG_1: Gr.asg. debounc.S037				227 035
1: Group 1				
SIG_1: Gr.asg. debounc.S038				227 043
1: Group 1				
SIG_1: Gr.asg. debounc.S039				227 051
1: Group 1				
SIG_1: Gr.asg. debounc.S040				227 059
1: Group 1				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Gr.asg. debounc.S041				227 067
1: Group 1				
SIG_1: Gr.asg. debounc.S042				227 075
1: Group 1				
SIG_1: Gr.asg. debounc.S043				227 083
1: Group 1				
SIG_1: Gr.asg. debounc.S044				227 091
1: Group 1				
SIG_1: Gr.asg. debounc.S045				227 099
1: Group 1				
SIG_1: Gr.asg. debounc.S046				227 107
1: Group 1				
SIG_1: Gr.asg. debounc.S047				227 115
1: Group 1				
SIG_1: Gr.asg. debounc.S048				227 123
1: Group 1				
SIG_1: Gr.asg. debounc.S049				227 131
1: Group 1				
SIG_1: Gr.asg. debounc.S050				227 139
1: Group 1				
SIG_1: Gr.asg. debounc.S051				227 147
1: Group 1				
SIG_1: Gr.asg. debounc.S052				227 155
1: Group 1				
SIG_1: Gr.asg. debounc.S053				227 163
1: Group 1				
SIG_1: Gr.asg. debounc.S054				227 171
1: Group 1				
SIG_1: Gr.asg. debounc.S055				227 179
1: Group 1				
SIG_1: Gr.asg. debounc.S056				227 187
1: Group 1				
SIG_1: Gr.asg. debounc.S057				227 195
1: Group 1				
SIG_1: Gr.asg. debounc.S058				227 203
1: Group 1				
SIG_1: Gr.asg. debounc.S059				227 211
1: Group 1				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Gr.asg. debounc.S060					227 219
1: Group 1					
SIG_1: Gr.asg. debounc.S061					227 227
1: Group 1					
SIG_1: Gr.asg. debounc.S062					227 235
1: Group 1					
SIG_1: Gr.asg. debounc.S063					227 243
1: Group 1					
SIG_1: Gr.asg. debounc.S064					227 251
1: Group 1					
Group assignment for the debouncing time and the chatter suppression.					
SIG_1: Min. sig. dur. S001					226 002
0	0	254	s	Fig. 3-351, (p. 3-431)	
SIG_1: Min. sig. dur. S002					226 010
0	0	254	s		
SIG_1: Min. sig. dur. S003					226 018
0	0	254	s		
SIG_1: Min. sig. dur. S004					226 026
0	0	254	s		
SIG_1: Min. sig. dur. S005					226 034
0	0	254	s		
SIG_1: Min. sig. dur. S006					226 042
0	0	254	s		
SIG_1: Min. sig. dur. S007					226 050
0	0	254	s		
SIG_1: Min. sig. dur. S008					226 058
0	0	254	s		
SIG_1: Min. sig. dur. S009					226 066
0	0	254	s		
SIG_1: Min. sig. dur. S010					226 074
0	0	254	s		
SIG_1: Min. sig. dur. S011					226 082
0	0	254	s		
SIG_1: Min. sig. dur. S012					226 090
0	0	254	s		
SIG_1: Min. sig. dur. S013					226 098
0	0	254	s		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SIG_1: Min. sig. dur. S014				226 106
0	0	254	s	
SIG_1: Min. sig. dur. S015				226 114
0	0	254	s	
SIG_1: Min. sig. dur. S016				226 122
0	0	254	s	
SIG_1: Min. sig. dur. S017				226 130
0	0	254	s	
SIG_1: Min. sig. dur. S018				226 138
0	0	254	s	
SIG_1: Min. sig. dur. S019				226 146
0	0	254	s	
SIG_1: Min. sig. dur. S020				226 154
0	0	254	s	
SIG_1: Min. sig. dur. S021				226 162
0	0	254	s	
SIG_1: Min. sig. dur. S022				226 170
0	0	254	s	
SIG_1: Min. sig. dur. S023				226 178
0	0	254	s	
SIG_1: Min. sig. dur. S024				226 186
0	0	254	s	
SIG_1: Min. sig. dur. S025				226 194
0	0	254	s	
SIG_1: Min. sig. dur. S026				226 202
0	0	254	s	
SIG_1: Min. sig. dur. S027				226 210
0	0	254	s	
SIG_1: Min. sig. dur. S028				226 218
0	0	254	s	
SIG_1: Min. sig. dur. S029				226 226
0	0	254	s	
SIG_1: Min. sig. dur. S030				226 234
0	0	254	s	
SIG_1: Min. sig. dur. S031				226 242
0	0	254	s	
SIG_1: Min. sig. dur. S032				226 250
0	0	254	s	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SIG_1: Min. sig. dur. S033				227 002
0	0	254	s	
SIG_1: Min. sig. dur. S034				227 010
0	0	254	s	
SIG_1: Min. sig. dur. S035				227 018
0	0	254	s	
SIG_1: Min. sig. dur. S036				227 026
0	0	254	s	
SIG_1: Min. sig. dur. S037				227 034
0	0	254	s	
SIG_1: Min. sig. dur. S038				227 042
0	0	254	s	
SIG_1: Min. sig. dur. S039				227 050
0	0	254	s	
SIG_1: Min. sig. dur. S040				227 058
0	0	254	s	
SIG_1: Min. sig. dur. S041				227 066
0	0	254	s	
SIG_1: Min. sig. dur. S042				227 074
0	0	254	s	
SIG_1: Min. sig. dur. S043				227 082
0	0	254	s	
SIG_1: Min. sig. dur. S044				227 090
0	0	254	s	
SIG_1: Min. sig. dur. S045				227 098
0	0	254	s	
SIG_1: Min. sig. dur. S046				227 106
0	0	254	s	
SIG_1: Min. sig. dur. S047				227 114
0	0	254	s	
SIG_1: Min. sig. dur. S048				227 122
0	0	254	s	
SIG_1: Min. sig. dur. S049				227 130
0	0	254	s	
SIG_1: Min. sig. dur. S050				227 138
0	0	254	s	
SIG_1: Min. sig. dur. S051				227 146
0	0	254	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Min. sig. dur. S052				227 154
0	0	254	s	
SIG_1: Min. sig. dur. S053				227 162
0	0	254	s	
SIG_1: Min. sig. dur. S054				227 170
0	0	254	s	
SIG_1: Min. sig. dur. S055				227 178
0	0	254	s	
SIG_1: Min. sig. dur. S056				227 186
0	0	254	s	
SIG_1: Min. sig. dur. S057				227 194
0	0	254	s	
SIG_1: Min. sig. dur. S058				227 202
0	0	254	s	
SIG_1: Min. sig. dur. S059				227 210
0	0	254	s	
SIG_1: Min. sig. dur. S060				227 218
0	0	254	s	
SIG_1: Min. sig. dur. S061				227 226
0	0	254	s	
SIG_1: Min. sig. dur. S062				227 234
0	0	254	s	
SIG_1: Min. sig. dur. S063				227 242
0	0	254	s	
SIG_1: Min. sig. dur. S064				227 250
0	0	254	s	
The logic “1” signal must be available for this minimum time setting so that a telegram can be sent in the *Start/end signal* mode.				

Single-pole commands

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CMD_1: Design. command C001				200 000
1: C001				
CMD_1: Design. command C002				200 005
2: C002				
CMD_1: Design. command C003				200 010
3: C003				
CMD_1: Design. command C004				200 015
4: C004				
CMD_1: Design. command C005				200 020
5: C005				
CMD_1: Design. command C006				200 025
6: C006				
CMD_1: Design. command C007				200 030
7: C007				
CMD_1: Design. command C008				200 035
8: C008				
CMD_1: Design. command C009				200 040
9: C009				
CMD_1: Design. command C010				200 045
10: C010				
CMD_1: Design. command C011				200 050
11: C011				
CMD_1: Design. command C012				200 055
12: C012				
CMD_1: Design. command C013				200 060
13: C013				
CMD_1: Design. command C014				200 065
14: C014				
CMD_1: Design. command C015				200 070
15: C015				
CMD_1: Design. command C016				200 075
16: C016				
CMD_1: Design. command C017				200 080
17: C017				
CMD_1: Design. command C018				200 085
18: C018				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CMD_1: Design. command C019					200 090
19: C019					
CMD_1: Design. command C020					200 095
20: C020					
CMD_1: Design. command C021					200 100
21: C021					
CMD_1: Design. command C022					200 105
22: C022					
CMD_1: Design. command C023					200 110
23: C023					
CMD_1: Design. command C024					200 115
24: C024					
CMD_1: Design. command C025					200 120
25: C025					
CMD_1: Design. command C026					200 125
26: C026					
CMD_1: Design. CMD_DC1					202 000
232: CMD_DC1					
CMD_1: Design. CMD_DC2					202 005
233: CMD_DC2					
CMD_1: Design. CMD_DC3					202 010
234: CMD_DC3					
Selection of the command designation.					
CMD_1: Oper. mode cmd. C001					200 002
3: Persistent command				Fig. 3-350, (p. 3-429)	
CMD_1: Oper. mode cmd. C002					200 007
3: Persistent command					
CMD_1: Oper. mode cmd. C003					200 012
3: Persistent command					
CMD_1: Oper. mode cmd. C004					200 017
3: Persistent command					
CMD_1: Oper. mode cmd. C005					200 022
3: Persistent command					
CMD_1: Oper. mode cmd. C006					200 027
3: Persistent command					
CMD_1: Oper. mode cmd. C007					200 032
3: Persistent command					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CMD_1: Oper. mode cmd. C008				200 037
3: Persistent command				
CMD_1: Oper. mode cmd. C009				200 042
3: Persistent command				
CMD_1: Oper. mode cmd. C010				200 047
3: Persistent command				
CMD_1: Oper. mode cmd. C011				200 052
3: Persistent command				
CMD_1: Oper. mode cmd. C012				200 057
3: Persistent command				
CMD_1: Oper. mode cmd. C013				200 062
3: Persistent command				
CMD_1: Oper. mode cmd. C014				200 067
3: Persistent command				
CMD_1: Oper. mode cmd. C015				200 072
3: Persistent command				
CMD_1: Oper. mode cmd. C016				200 077
3: Persistent command				
CMD_1: Oper. mode cmd. C017				200 082
3: Persistent command				
CMD_1: Oper. mode cmd. C018				200 087
3: Persistent command				
CMD_1: Oper. mode cmd. C019				200 092
3: Persistent command				
CMD_1: Oper. mode cmd. C020				200 097
3: Persistent command				
CMD_1: Oper. mode cmd. C021				200 102
3: Persistent command				
CMD_1: Oper. mode cmd. C022				200 107
3: Persistent command				
CMD_1: Oper. mode cmd. C023				200 112
3: Persistent command				
CMD_1: Oper. mode cmd. C024				200 117
3: Persistent command				
CMD_1: Oper. mode cmd. C025				200 122
3: Persistent command				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
CMD_1: Oper. mode cmd. C026							200 127
3: Persistent command							

Selection of the command operating mode.

Binary counts

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COUNT: General enable USER					217 000
0: No				Fig. 3-356, (p. 3-437)	
Disabling or enabling binary counts.					
COUNT: Debounce t. count. 1					217 160
3	0	1000	ms	Fig. 3-356, (p. 3-437)	
COUNT: Debounce t. count. 2					217 161
3	0	1000	ms		
COUNT: Debounce t. count. 3					217 162
3	0	1000	ms		
COUNT: Debounce t. count. 4					217 163
3	0	1000	ms		
Setting for the debounce time of the binary signal to be counted.					
COUNT: Limit counter 1					217 221
Blocked	1	65000			
COUNT: Limit counter 2					217 222
Blocked	1	65000			
COUNT: Limit counter 3					217 223
Blocked	1	65000			
COUNT: Limit counter 4					217 224
Blocked	1	65000			
Setting a limit for the counter value. A warning signal is issued if the counter value exceeds the set limit. Setting this parameter to *Blocked* disables the limit check.					
COUNT: Cycle t.count transm					217 007
0: No transmission				Fig. 3-356, (p. 3-437)	
Setting the cycle time for the periodic transmission of the counts.					
COUNT: IEC61850 pulsQty					221 096
1	0	1000			
Setting the scaling factor to transmit the counter value via IEC 61850. According to the standard the resulting value is calculated as: Value transmitted = actual value · pulsQty (see IEC 61850: Value = actVal · pulsQty).					

Real Timer

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
TIMER: General enable USER				014 199
0: No				Fig. 3-357, (p. 3-438)
Disabling or enabling TIMER protection.				
TIMER: Calendar 1				014 178
060 000: MAIN: Without function				Fig. 3-357, (p. 3-438)
TIMER: Calendar 2				014 179
060 000: MAIN: Without function				
TIMER: Calendar 3				014 189
060 000: MAIN: Without function				
TIMER: Calendar 4				015 005
060 000: MAIN: Without function				
The setting defines the calender day of week for the TIMER. One or more of the seven weekdays can be selected.				
TIMER: Start hour 1				014 089
0	0	23	h	Fig. 3-357, (p. 3-438)
TIMER: Start hour 2				014 119
0	0	23	h	
TIMER: Start hour 3				015 030
0	0	23	h	
TIMER: Start hour 4				015 063
0	0	23	h	
The parameter defines the start hour of the TIMER.				
TIMER: Start minute 1				014 102
0	0	59	min	Fig. 3-357, (p. 3-438)
TIMER: Start minute 2				014 128
0	0	59	min	
TIMER: Start minute 3				015 052
0	0	59	min	
TIMER: Start minute 4				015 089
0	0	59	min	
The parameter defines the start minute of the TIMER.				
TIMER: End hour 1				014 109
0	0	23	h	Fig. 3-357, (p. 3-438)
TIMER: End hour 2				014 129
0	0	23	h	
TIMER: End hour 3				015 061
0	0	23	h	

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
TIMER: End hour 4							015 200
0	0	23	h				
The parameter defines the end hour of the TIMER.							
TIMER: End minute 1							014 118
0	0	59	min	Fig. 3-357, (p. 3-438)			
TIMER: End minute 2							014 138
0	0	59	min				
TIMER: End minute 3							015 062
0	0	59	min				
TIMER: End minute 4							015 201
0	0	59	min				
The parameter defines the end minute of the TIMER.							

7.1.3.3 Parameter Subsets

Measured data input

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
MEASI: BackupTempSensor PSx				004 243	004 244	004 245	004 246
0: None				Fig. 3-314, (p. 3-386)			
Selection of backup temperature sensor groups for parameter subset PSx.							

Main function

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Neutr.pt. treat. PSx				010 048 / 001 076 / 001 077 / 001 078
1: Low-imped. grounding				
The neutral-point treatment of the system must be set here.				
MAIN: Gen. start. mode PSx				017 027 / 001 219 / 001 220 / 001 221
1: With start. IN, Ineg				Fig. 3-80, (p. 3-113)
This setting defines whether the triggering of the residual current stages $I_{N>}$, $I_{ref,N>}$, $I_{N>>}$ or $I_{N>>>}$ as well as the negative-sequence current stage $I_{ref,neg>}$ should result in the formation of the general starting signal. If the setting is *W/o start. IN, Ineg* then the associated time delays $t_{IN>}$, $t_{Iref,N>}$, $t_{IN>>}$, $t_{IN>>>}$, $t_{Iref,neg>}$are automatically excluded from the formation of the trip command.				
MAIN: Bl.tim.st.IN,neg PSx				017 015 / 001 214 / 001 215 / 001 216
0: Without				Fig. 3-79, (p. 3-112)
This setting defines whether a blocking of the residual and negative-sequence current stages should take place for single-pole startings or multi-pole phase current startings.				
MAIN: Suppr.start.sig. PSx				017 054 / 001 222 / 001 223 / 001 224
0.00	0.00	100.00	s	Fig. 3-79, (p. 3-112)
Setting of the timer stage for the suppression of the phase-selective startings and of the residual and negative-sequence system starting.				
MAIN: tGS PSx				017 005 / 001 225 / 001 226 / 001 227
0.00	0.00	100.00	s	Fig. 3-80, (p. 3-113)
Setting for the time delay of the general starting signal.				
MAIN: Op. rush restr. PSx				017 097 / 001 088 / 001 089 / 001 090
0: Without				Fig. 3-67, (p. 3-100)
Setting for the operating mode of the inrush stabilization function.				
MAIN: Funct.Rush restr.PSx				017 093 / 017 064 / 017 082 / 017 083
060 000: MAIN: Without function				Fig. 3-68, (p. 3-101)
Select the protection elements that shall be blocked when the inrush stabilization is triggered.				
MAIN: Rush I(2fn)/I(fn)PSx				017 098 / 001 091 / 001 092 / 001 093
20	10	35	%	Fig. 3-67, (p. 3-100)
Setting for the operate value of inrush stabilization.				
MAIN: I>lift rush restrPSx				017 095 / 001 085 / 001 086 / 001 087
10.0	1.0	20.0	Inom	Fig. 3-67, (p. 3-100)
Setting for the current threshold for disabling the inrush stabilization.				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MAIN: t lift rush rstr.PSx				019 001	019 002	019 003	019 004
Blocked	0.01	10.00	s	Fig. 3-67, (p. 3-100)			
Setting for the maximum duration of inrush stabilization.							
MAIN: Hld time dyn.par.PSx				018 009	001 211	001 212	001 213
Blocked	0.00	100.00	s	Fig. 3-65, (p. 3-99)			
Setting the hold time of the “dynamic parameters”. After switching to the “dynamic” thresholds, the latter will remain active in place of the “normal” thresholds during this period.							
MAIN: Phase reversal I PSx				010 200	010 201	010 202	010 203
0: No swap							
The phase sequence for the current, given by the active parameter subset with the setting at **MAIN: Phase reversal I PSx** may be reversed by triggering a binary signal input configured at **MAIN: Phase reversal I EXT**. To enable the function a phase sequence for normal operation must be set in the parameter. (Setting selection: *A-B swapped*, *B-C swapped*, *C-A swapped*). The default setting is *No swap*, which disables the function. **Note:** Designed for motor protection applications with 'left/right' motor rotation control by phase reversal with parallel circuit breakers (one CB with phase reversal). Here the voltage is measured on the busbar side and the current down-stream between CB and motor. Dependent on the operating mode the current can therefore be measured in phase reversal to the voltage.							

Fault data acquisition

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
FT_DA: Line length PSx				010 005	010 006	010 007	010 008
10.00	0.01	500.00	km	Fig. 3-116, (p. 3-151)			
This setting defines the distance in km that the fault locator interprets as 100 % when calculating the fault distance.							
FT_DA: Line reactance PSx				010 012	010 013	010 014	010 015
10 | 2 (For MAIN: Inom device=1.0A | 5.0A)	0.1 | 0.02	200 | 40	Ω	Fig. 3-116, (p. 3-151)			
This setting defines the reactance X that the fault locator interprets as 100 % when calculating the fault distance.							
FT_DA: Start data acqu. PSx				010 011	010 042	010 043	010 044
1: End of fault				Fig. 3-112, (p. 3-146)			
This setting determines at what point during a fault the acquisition of fault data should take place.							
FT_DA: Outp. flt.locat. PSx				010 032	010 033	010 034	010 035
1: On general starting				Fig. 3-112, (p. 3-146)			
Setting for the conditions under which a fault location is output.							
FT_DA: Abs. value kG PSx				012 037	012 087	013 037	013 087
1.00	0.00	8.00		Fig. 3-113, (p. 3-147)			
FT_DA: Angle kG PSx				012 036	012 086	013 036	013 086
0	-180	180	°	Fig. 3-113, (p. 3-147)			

Setting for the absolute value and angle of the complex ground factor $\underline{k}_G$.

$$\underline{k}_G = \frac{\underline{Z}_0 - \underline{Z}_{pos}}{3 \cdot \underline{Z}_{pos}}$$

$\underline{Z}_0$: zero-sequence impedance

$\underline{Z}_{pos}$: positive-sequence impedance

$$\text{Angle}(\underline{k}_G) = \arctan\frac{X_0 - X_{pos}}{R_0 - R_{pos}} - \arctan\frac{X_{pos}}{R_{pos}}$$

$$|\,\underline{k}_G\,| = \frac{\sqrt{(X_0 - X_{pos})^2 + (R_0 - R_{pos})^2}}{3 \cdot \sqrt{X_{pos}^2 + R_{pos}^2}}$$

R_0: resistance component of zero-sequence impedance

R_{pos}: resistance component of positive-sequence impedance

X_0: reactance component of zero-sequence impedance

X_{pos}: reactance component of positive-sequence impedance

If the calculated value cannot be set exactly, then a next smaller value should be set.

Definite-time overcurrent protection

Parameter					Address		
Default	Min	Max	Unit			Logic Diagram	
DTOC: Enable PSx				072 098	073 098	074 098	075 098
0: No				Fig. 3-120, (p. 3-157)			
This setting defines the parameter subset in which definite-time overcurrent protection is enabled.							
DTOC: Start w. Direct. PSx				016 105	016 106	016 107	016 108
0: No							
If this parameter is set to *Yes*, then starting of P139 will issue only if measured direction is equal to set direction. Otherwise the P139 will not perform a "starting" when a fault occurs.							
DTOC: Mode timer start PSx				002 138	002 139	002 142	002 143
1: With starting							
This parameter permits the selection whether the timer stages for phase or residual current stages are triggered with the start (*With starting*) or are direction-dependent (*With direction*).							
DTOC: Meas.value I/IN> PSx				060 002	060 003	060 004	060 005
0: Fundamental				Fig. 3-122, (p. 3-160) Fig. 3-132, (p. 3-172)			
DTOC: Meas.val. I/IN>> PSx				060 006	060 007	060 008	060 009
0: Fundamental				Fig. 3-122, (p. 3-160) Fig. 3-132, (p. 3-172)			
DTOC: Meas.val.I/IN>>> PSx				060 010	060 011	060 012	060 013
0: Fundamental				Fig. 3-122, (p. 3-160) Fig. 3-132, (p. 3-172)			
DTOC: Meas.v.I/IN>>>> PSx				060 014	060 015	060 016	060 017
0: Fundamental				Fig. 3-122, (p. 3-160) Fig. 3-132, (p. 3-172)			
These settings allow to select for the respective overcurrent stage whether the starting decision shall be based on the fundamental or on the r.m.s. value. Remark: For the negative-sequence stages, the starting decision is always based on the fundamental.							
DTOC: I0 Elimin. I> PSx				013 150	013 151	013 152	013 153
0: without				Fig. 3-121, (p. 3-158)			
DTOC: I0 Elimin. I>> PSx				013 154	013 155	013 156	013 157
0: without				Fig. 3-121, (p. 3-158)			
DTOC: I0 Elimin. I>>> PSx				013 158	013 159	013 160	013 161
0: without				Fig. 3-121, (p. 3-158)			

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**

DTOC: I0 Elimin. I>>>> PSx				013 162	013 163	013 164	013 165
0: without				Fig. 3-121, (p. 3-158)			

Depending on this setting the respective phase overcurrent stage uses either the measured phase current or a value where the residual current has been eliminated.

- Setting *without*: The respective phase current is used.
- Setting *with I0 calculated*: The respective phase current I_x is shifted by one third of the calculated residual current (derived from the sum of the phase currents), i. e. instead of $\underline{I}_x$ the value ($\underline{I}_x - ⅓\cdot\sum\underline{I}_P$) is used.
- Setting *with I0 measured*: The respective phase current I_x is shifted by one third of the residual current measured at the fourth transformer, i. e. instead of $\underline{I}_x$ the value ($\underline{I}_x - ⅓\cdot\underline{I}_N$) is used.

DTOC: I> PSx				017 000	073 007	074 007	075 007
1.00	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			

Setting for the operate value of the first overcurrent stage (phase current stage).

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).

DTOC: I> dynamic PSx				017 080	073 032	074 032	075 032
1.00	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			

Setting for the operate value of the first overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).

DTOC: I>> PSx				017 001	073 008	074 008	075 008
4.00	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			

Setting for the operate value of the second overcurrent stage (phase current stage).

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).

DTOC: I>> dynamic PSx				017 084	073 033	074 033	075 033
4.00	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			

Setting for the operate value of the second overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.

Caution! The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
DTOC: I>>> PSx				017 002	073 009	074 009	075 009
Blocked	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			
Setting for the operate value of the third overcurrent stage (phase current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: I>>> dynamic PSx				017 085	073 034	074 034	075 034
Blocked	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			
Setting for the operate value of the third overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: I>>>> PSx				016 149	016 150	016 151	016 152
Blocked	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			
Setting for the operate value of the fourth overcurrent stage (phase current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: I>>>> dynamic PSx				016 153	016 154	016 155	016 156
Blocked	0.10	40.00	Inom	Fig. 3-122, (p. 3-160)			
Setting for the operate value of the fourth overcurrent stage in dynamic mode (phase current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: tI> PSx				017 004	073 019	074 019	075 019
1.00	0.00	100.00	s	Fig. 3-127, (p. 3-165)			
Setting for the operate delay of the first overcurrent stage.							
DTOC: tI>> PSx				017 006	073 020	074 020	075 020
0.50	0.00	100.00	s	Fig. 3-127, (p. 3-165)			
Setting for the operate delay of the second overcurrent stage.							
DTOC: tI>>> PSx				017 007	073 021	074 021	075 021
0.50	0.00	100.00	s	Fig. 3-127, (p. 3-165)			
Setting for the operate delay of the third overcurrent stage.							
DTOC: tI>>>> PSx				016 157	016 158	016 159	016 160
0.50	0.00	100.00	s	Fig. 3-127, (p. 3-165)			
Setting for the operate delay of the fourth overcurrent stage.							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
DTOC: V< (I>) PSx				011 244	011 245	011 246	011 247
Blocked	0.20	1.00	Vnom(/√3)	Fig. 3-123, (p. 3-161)			
DTOC: V< (I>>) PSx				011 248	011 249	011 250	011 251
Blocked	0.20	1.00	Vnom(/√3)	Fig. 3-124, (p. 3-162)			
DTOC: V< (I>>>) PSx				011 252	011 253	011 254	011 255
Blocked	0.20	1.00	Vnom(/√3)	Fig. 3-125, (p. 3-163)			
DTOC: tSD PSx				012 206	012 207	012 208	012 209
0.100	0.000	1.000	s	Fig. 3-123, (p. 3-161) Fig. 3-124, (p. 3-162) Fig. 3-125, (p. 3-163)			
Setting a voltage threshold for the respective phase current stage. This criterion means that in addition to a phase current exceeding its threshold also the voltage in an appropriate measuring loop must fall below the threshold that is set here. For the phase-ground measuring loops, an overcurrent starting is only enabled when the voltage falls below this threshold for at least the time duration that set at **DTOC: tSD PSx**. Setting the threshold to *Blocked* deactivates this type of voltage check (for the respective overcurrent stage).							
DTOC: Ineg> PSx				072 011	073 011	074 011	075 011
1.00	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
DTOC: Ineg>> PSx				072 012	073 012	074 012	075 012
4.00	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
DTOC: Ineg>>> PSx				072 013	073 013	074 013	075 013
Blocked	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
DTOC: Ineg>>>> PSx				016 161	016 162	016 163	016 164
Blocked	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
Setting for the operate value of the overcurrent stage of the negative-sequence system.							
DTOC: Ineg> dynamic PSx				076 200	077 200	078 200	079 200
1.00	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
Setting for operate value Ineg> dynamic. (Ineg = negative-sequence current) This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.							
DTOC: Ineg>> dynamic PSx				076 201	077 201	078 201	079 201
4.00	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			
Setting for operate value Ineg>> dynamic. (Ineg = negative-sequence current) This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
DTOC: Ineg>>> dynamic PSx				076 202	077 202	078 202	079 202
Blocked	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			

Setting for operate value Ineg>>> dynamic. (Ineg = negative-sequence current)

This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.

DTOC: Ineg>>>> dynamic PSx				016 165	016 166	016 167	016 168
Blocked	0.10	25.00	Inom	Fig. 3-129, (p. 3-168)			

Setting for operate value Ineg>>>> dynamic. (Ineg = negative-sequence current)

This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.

DTOC: tIneg> PSx				072 023	073 023	074 023	075 023
1.00	0.00	100.00	s	Fig. 3-129, (p. 3-168)			
DTOC: tIneg>> PSx				072 024	073 024	074 024	075 024
0.50	0.00	100.00	s	Fig. 3-129, (p. 3-168)			
DTOC: tIneg>>> PSx				072 025	073 025	074 025	075 025
Blocked	0.00	100.00	s	Fig. 3-129, (p. 3-168)			
DTOC: tIneg>>>> PSx				016 169	016 170	016 171	016 172
Blocked	0.00	100.00	s	Fig. 3-129, (p. 3-168)			

Setting for the operate delay of the overcurrent stage of the negative-sequence system.

DTOC: Eval. IN> PSx				072 128	073 128	074 128	075 128
2: Measured				Fig. 3-131, (p. 3-170)			
DTOC: Eval. IN>> PSx				007 239	007 240	007 241	007 242
2: Measured				Fig. 3-131, (p. 3-170)			
DTOC: Eval. IN>>> PSx				007 243	007 244	007 245	007 246
2: Measured				Fig. 3-131, (p. 3-170)			

This setting determines which current will be monitored:

- Setting *Calculated*: The current calculated by the P139 is used.
- Setting *Measured*: The residual current measured at the T 4 current transformer is used.
- Setting *Calc with I0 elim.*: The calculated current shifted by one third of the residual current ($\sum \underline{I}_P - ⅓\cdot\underline{I}_N$) is used.

Note: Stage $I_{N>>>>}$ always uses the calculated current.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
DTOC: IN> PSx				017 003	073 015	074 015	075 015
0.250	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the first overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: IN> dynamic PSx				017 081	073 035	074 035	075 035
0.250	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the dynamic first overcurrent stage (residual current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see Chapter “Technical Data”).							
DTOC: IN>> PSx				017 009	073 016	074 016	075 016
Blocked	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the second overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: IN>> dynamic PSx				017 086	073 036	074 036	075 036
Blocked	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the second overcurrent stage in dynamic mode (residual current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see Chapter “Technical Data”).							
DTOC: IN>>> PSx				017 018	073 017	074 017	075 017
Blocked	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the third overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							
DTOC: IN>>> dynamic PSx				017 087	073 037	074 037	075 037
Blocked	0.002	8.000	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the dynamic third overcurrent stage (residual current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see “Technical Data”).							

Parameter							Address
Default	Min	Max	Unit	Logic Diagram			
DTOC: IN>>>> PSx				072 018	073 018	074 018	075 018
Blocked	0.10	40.00	Inom	Fig. 3-132, (p. 3-172)			
Setting the operate value of the fourth overcurrent stage (residual current stage). **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see Chapter “Technical Data”).							
DTOC: IN>>>> dyn. PSx				072 036	072 105	072 202	072 219
Blocked	0.10	40.00	Inom	Fig. 3-132, (p. 3-172)			
Setting for the operate value of the dynamic fourth overcurrent stage (residual current stage). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing. **Caution!** The range of setting values includes operate values that are not permitted as continuous current values (see Chapter “Technical Data”).							
DTOC: tIN> PSx				017 008	073 027	074 027	075 027
1.00	0.00	100.00	s	Fig. 3-132, (p. 3-172)			
Setting for the operate delay of the first overcurrent stage (residual current stage).							
DTOC: tIN>> PSx				017 010	073 028	074 028	075 028
0.50	0.00	100.00	s	Fig. 3-132, (p. 3-172)			
Setting for the operate delay of the second overcurrent stage (residual current stage).							
DTOC: tIN>>> PSx				017 019	073 029	074 029	075 029
0.50	0.00	100.00	s	Fig. 3-132, (p. 3-172)			
Setting for the operate delay of the third overcurrent stage (residual current stage).							
DTOC: tIN>>>> PSx				072 030	073 030	074 030	075 030
0.50	0.00	100.00	s	Fig. 3-132, (p. 3-172)			
Setting for the operate delay of overcurrent stage IN>>>>.							
DTOC: Puls.prol.IN>,intPSx				017 055	073 042	074 042	075 042
0.08	0.00	10.00	s	Fig. 3-134, (p. 3-175)			
Setting for the pulse prolongation time of the hold-time logic for intermittent ground faults.							
DTOC: tIN>,interm. PSx				017 056	073 038	074 038	075 038
Blocked	0.00	100.00	s	Fig. 3-134, (p. 3-175)			
Setting for the tripping time of the hold-time logic for intermittent ground faults.							
DTOC: Hold-t. tIN>,intmPSx				017 057	073 039	074 039	075 039
0.0	0.0	600.0	s	Fig. 3-134, (p. 3-175)			
Setting for the hold-time for intermittent ground faults.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram

Inverse-time overcurrent protection

IDMT1: Enable PSx				072 070	073 070	074 070	075 070
0: No				Fig. 3-137, (p. 3-178)			

This setting defines the parameter subset in which IDMT protection is enabled.

IDMT1: Mode timer start PSx				007 226	007 227	007 228	007 229
1: With starting							

This parameter permits the selection whether the timer stages for phase or residual current stages are triggered with the start (*With starting*) or are direction-dependent (*With direction*).

IDMT1: Meas.value I/IN PSx				060 018	060 019	060 020	060 021
0: Fundamental				Fig. 3-144, (p. 3-188) Fig. 3-150, (p. 3-194)			
IDMT2: Meas.value I/IN PSx				060 022	060 023	060 024	060 025
0: Fundamental				Fig. 3-145, (p. 3-189) Fig. 3-151, (p. 3-195)			

These settings allow to select for the respective overcurrent stage whether the starting decision shall be based on the fundamental or on the r.m.s. value.

Remark: For the negative-sequence stage of each IDMTx, the starting decision is always based on the fundamental.

IDMT1: I0 Elimin. I> PSx				013 166	013 167	013 168	013 169
0: without				Fig. 3-143, (p. 3-186)			
IDMT2: I0 Elimin. I> PSx				013 170	013 171	013 172	013 173
0: without				Fig. 3-143, (p. 3-186)			

Depending on this setting the respective phase overcurrent stage uses either the measured phase current or a value where the residual current has been eliminated.

- Setting *without*: The respective phase current is used.
- Setting *with I0 calculated*: The respective phase current I_x is shifted by one third of the calculated residual current (derived from the sum of the phase currents), i. e. instead of $\underline{I}_x$ the value ($\underline{I}_x$ - ⅓·$\sum \underline{I}_P$) is used.
- Setting *with I0 measured*: The respective phase current I_x is shifted by one third of the residual current measured at the fourth transformer, i. e. instead of $\underline{I}_x$ the value ($\underline{I}_x$ - ⅓·$\underline{I}_N$) is used.

IDMT1: Time Correction PSx				013 143	013 144	013 145	013 146
0.000	-0.100	0.100	s	Fig. 3-144, (p. 3-188) Fig. 3-148, (p. 3-192) Fig. 3-150, (p. 3-194)			

Parameter to compensate the IDMT starting time. Negative values reduce the IDMT starting time by the set value. Positive values extend the IDMT starting time by the set value.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
IDMT1: Iref,P PSx				072 050	073 050	074 050	075 050
1.00	0.10	4.00	Inom	Fig. 3-144, (p. 3-188)			
IDMT2: Iref,P PSx				076 236	076 237	076 238	076 239
1.00	0.10	4.00	Inom	Fig. 3-145, (p. 3-189)			
Setting for the reference current (phase current system).							
IDMT1: Iref,P dynamic PSx				072 003	073 003	074 003	075 003
1.00	0.10	4.00	Inom	Fig. 3-144, (p. 3-188)			
IDMT2: Iref,P dynamic PSx				076 030	076 031	076 032	076 033
1.00	0.10	4.00	Inom	Fig. 3-145, (p. 3-189)			
Setting for the reference current in dynamic mode (phase current system). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.							
IDMT1: Factor KI,P PSx				007 250	007 251	007 252	007 253
1.00	1.00	10.00		Fig. 3-144, (p. 3-188)			
Enable threshold for the IDMT1 protection starting for all IP types of characteristics. This factor KI will result in a linear shifting of the enable threshold along the X axis of the respective characteristic. The factor will not result in a shifting of the characteristic itself.							
IDMT1: Characteristic P PSx				072 056	073 056	074 056	075 056
0: Definite Time				Fig. 3-144, (p. 3-188)			
IDMT2: Characteristic P PSx				071 004	071 005	071 006	071 007
0: Definite Time				Fig. 3-145, (p. 3-189)			
Setting for the tripping characteristic (phase current system).							
IDMT1: Factor kt,P PSx				072 053	073 053	074 053	075 053
1.00	0.05	10.00		Fig. 3-144, (p. 3-188)			
IDMT2: Factor kt,P PSx				078 250	078 251	078 252	078 253
1.00	0.05	10.00		Fig. 3-145, (p. 3-189)			
Setting for the factor kt,P of the starting characteristic (phase current system).							
IDMT1: Min. trip time P PSx				072 077	073 077	074 077	075 077
0.00	0.00	10.00	s	Fig. 3-144, (p. 3-188)			
IDMT2: Min. trip time P PSx				071 044	071 045	071 046	071 047
0.00	0.00	10.00	s	Fig. 3-145, (p. 3-189)			
Setting for the minimum trip time (phase current system). As a rule, this value should be set as for the first DTOC stage (I>).							
IDMT1: Hold time P PSx				072 071	073 071	074 071	075 071
0.00	0.00	600.00	s	Fig. 3-144, (p. 3-188)			

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
IDMT2: Hold time P PSx				071 028	071 029	071 030	071 031
0.00	0.00	600.00	s	Fig. 3-145, (p. 3-189)			
Setting for the holding time for intermittent short circuits (phase current system).							
IDMT1: Release P PSx				072 059	073 059	074 059	075 059
1: Without delay				Fig. 3-144, (p. 3-188)			
IDMT2: Release P PSx				071 016	071 017	071 018	071 019
1: Without delay				Fig. 3-145, (p. 3-189)			
Setting for the release or reset characteristic (phase current system).							
IDMT1: Iref,neg PSx				072 051	073 051	074 051	075 051
1.00	0.01	4.00	Inom	Fig. 3-148, (p. 3-192)			
IDMT2: Iref,neg PSx				076 250	076 251	076 252	076 253
1.00	0.01	4.00	Inom				
Setting for the reference current (negative-sequence current system).							
IDMT1: Iref,neg dynamic PSx				072 004	073 004	074 004	075 004
Blocked	0.01	4.00	Inom	Fig. 3-148, (p. 3-192)			
IDMT2: Iref,neg dynamic PSx				076 034	076 035	076 036	076 037
Blocked	0.01	4.00	Inom				
Setting for the reference current in dynamic mode (negative-sequence current system). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.							
IDMT1: Factor KI,neg PSx				007 254	007 255	008 002	008 005
1.00	1.00	10.00		Fig. 3-148, (p. 3-192)			
Enable threshold for the IDMT1 protection starting for all Ineg types of characteristics. This factor KI will result in a linear shifting of the enable threshold along the X axis of the respective characteristic. The factor will not result in a shifting of the characteristic itself.							
IDMT1: Character. neg. PSx				072 057	073 057	074 057	075 057
0: Definite Time				Fig. 3-148, (p. 3-192)			
IDMT2: Character. neg. PSx				071 008	071 009	071 010	071 011
0: Definite Time							
Setting for the tripping characteristic (negative-sequence current system).							
IDMT1: Factor kt,neg PSx				072 054	073 054	074 054	075 054
1.00	0.05	10.00		Fig. 3-148, (p. 3-192)			
IDMT2: Factor kt,neg PSx				079 250	079 251	079 252	079 253
1.00	0.05	10.00					
Setting for the factor kt,neg of the starting characteristic (negative-sequence current system).							

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
IDMT1: Min.trip time negPSx				072 078	073 078	074 078	075 078
0.00	0.00	10.00	s	Fig. 3-148, (p. 3-192)			
IDMT2: Min.trip time negPSx				071 048	071 049	071 050	071 051
0.00	0.00	10.00	s				
Setting for the minimum trip time (negative-sequence current system). As a rule, this value should be set as for the first DTOC stage (I>).							
IDMT1: Hold time neg PSx				072 072	073 072	074 072	075 072
0.00	0.00	600.00	s	Fig. 3-148, (p. 3-192)			
IDMT2: Hold time neg PSx				071 032	071 033	071 034	071 035
0.00	0.00	600.00	s				
Setting the holding time for intermittent short circuits (negative-sequence current system).							
IDMT1: Release neg. PSx				072 060	073 060	074 060	075 060
1: Without delay				Fig. 3-148, (p. 3-192)			
IDMT2: Release neg. PSx				071 020	071 021	071 022	071 023
1: Without delay							
Setting for the release or reset characteristic (negative-sequence current system).							
IDMT1: Evaluation IN PSx				072 075	073 075	074 075	075 075
2: Measured							
IDMT2: Evaluation IN PSx				071 040	071 041	071 042	071 043
2: Measured							
This setting determines which current will be monitored: ● Setting *Calculated*: The current calculated by the P139 is used. ● Setting *Measured*: The residual current measured at the T 4 current transformer is used. ● Setting *Calc with I0 elim.*: The calculated current shifted by one third of the residual current ($\sum \underline{I}_P - \frac{1}{3}\underline{I}_N$) is used.							
IDMT1: Iref,N PSx				072 052	073 052	074 052	075 052
1.00	0.01	4.00	Inom	Fig. 3-150, (p. 3-194)			
IDMT2: Iref,N PSx				077 250	077 251	077 252	077 253
1.00	0.01	4.00	Inom	Fig. 3-151, (p. 3-195)			
Setting for the reference current (residual current system).							
IDMT1: Iref,N dynamic PSx				072 005	073 005	074 005	075 005
Blocked	0.01	4.00	Inom	Fig. 3-150, (p. 3-194)			

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
IDMT2: Iref,N dynamic PSx				076 038	076 039	076 040	076 041
Blocked	0.01	4.00	Inom	Fig. 3-151, (p. 3-195)			
Setting the reference current in dynamic mode (residual current system). This operate value is effective only while the timer stage **MAIN: Hld time dyn.par.PSx** is elapsing.							
IDMT1: Factor KI,N PSx				001 173	001 174	001 175	001 176
1.00	1.00	10.00		Fig. 3-150, (p. 3-194)			
The enable threshold for the IDMT1 protection starting for all IN types of characteristics. This factor KI will result in a linear shifting of the enable threshold along the X axis of the respective characteristic. The factor will not result in a shifting of the characteristic itself.							
IDMT1: Characteristic N PSx				072 058	073 058	074 058	075 058
0: Definite Time				Fig. 3-150, (p. 3-194)			
IDMT2: Characteristic N PSx				071 012	071 013	071 014	071 015
0: Definite Time				Fig. 3-151, (p. 3-195)			
Setting for the tripping characteristic (residual current system).							
IDMT1: Factor kt,N PSx				072 055	073 055	074 055	075 055
1.00	0.05	10.00		Fig. 3-150, (p. 3-194)			
IDMT2: Factor kt,N PSx				071 000	071 001	071 002	071 003
1.00	0.05	10.00		Fig. 3-151, (p. 3-195)			
Setting for the factor kt,N of the starting characteristic (residual current system).							
IDMT1: Min. trip time N PSx				072 079	073 079	074 079	075 079
0.00	0.00	10.00	s	Fig. 3-150, (p. 3-194)			
IDMT2: Min. trip time N PSx				071 052	071 053	071 054	071 055
0.00	0.00	10.00	s	Fig. 3-151, (p. 3-195)			
Setting for the minimum trip time (residual current system). As a rule, this value should be set as for the first DTOC stage (IN>).							
IDMT1: Hold time N PSx				072 073	073 073	074 073	075 073
0.00	0.00	600.00	s	Fig. 3-150, (p. 3-194)			
IDMT2: Hold time N PSx				071 036	071 037	071 038	071 039
0.00	0.00	600.00	s	Fig. 3-151, (p. 3-195)			
Setting for the holding time for intermittent short circuits (residual current system).							
IDMT1: Release N PSx				072 061	073 061	074 061	075 061
1: Without delay				Fig. 3-150, (p. 3-194)			
IDMT2: Release N PSx				071 024	071 025	071 026	071 027
1: Without delay				Fig. 3-151, (p. 3-195)			
Setting for for the reset characteristic (residual current system).							

Inverse-time overcurrent protection

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
IDMT2: Enable PSx				076 042	076 043	076 044	076 045
0: No							
This setting defines the parameter subset in which IDMTx protection is enabled.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram

Short-circuit direction determination

SCDD: Enable PSx	076 235	077 235	078 235	079 235
0: No	Fig. 3-155, (p. 3-199)			

This setting defines the parameter subset in which short-circuit direction determination is enabled.

SCDD: Trip bias PSx	017 074	077 236	078 236	079 236
1: Yes	Fig. 3-159, (p. 3-204)			

This setting determines whether an overcurrent direction determination in forward direction shall be formed when the direction determination of the phase current and residual current stage is blocked.

SCDD: Direction tI> PSx	017 071	077 237	078 237	079 237
1: Forward directional	Fig. 3-159, (p. 3-204)			
SCDD: Direction tI>> PSx	017 072	077 238	078 238	079 238
1: Forward directional	Fig. 3-159, (p. 3-204)			
SCDD: Direction tI>>> PSx	007 230	007 231	007 232	007 233
1: Forward directional	Fig. 3-159, (p. 3-204)			
SCDD: Direction tI>>>> PSx	016 177	016 178	016 179	016 180
1: Forward directional	Fig. 3-159, (p. 3-204)			

This setting for the measuring direction determines whether a trip signal in the DTOC phase current stage will be issued for forward, backward or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.

SCDD: Direct. tIref,P> PSx	017 066	077 239	078 239	079 239
1: Forward directional	Fig. 3-159, (p. 3-204)			

This setting for the measuring direction determines whether a tIref,P> trip signal in the IDMT1 phase current stage will be issued for forward, backward or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.

SCDD: Direction tIN> PSx	017 073	077 240	078 240	079 240
1: Forward directional	Fig. 3-164, (p. 3-209)			

This setting for the measuring direction determines whether a tIN> trip signal in the DTOC residual current stage will be issued for forward, backward or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
SCDD: Direction tIN>> PSx				017 075	077 241	078 241	079 241
1: Forward directional				Fig. 3-164, (p. 3-209)			
This setting for the measuring direction determines whether a tIN>> trip signal in the DTOC residual current stage will be issued for forward, backward or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.							
SCDD: Direction tIN>>> PSx				007 235	007 236	007 237	007 238
1: Forward directional				Fig. 3-164, (p. 3-209)			
This setting for the measuring direction determines whether a tIN>>> trip signal in the DTOC residual current stage will be issued for forward, backward (reverse) or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.							
SCDD: Direct. tIref,N> PSx				017 067	077 242	078 242	079 242
1: Forward directional				Fig. 3-164, (p. 3-209)			
This setting for the measuring direction determines whether a tIref,N> trip signal in the IDMT1 residual current stage will be issued for forward, backward or non-directional fault decisions. If the ARC is enabled and has been set accordingly then a starting will trigger the associated ARC tripping time.							
SCDD: Charact. angle G PSx				017 076	077 243	078 243	079 243
-45	-90	90	°	Fig. 3-163, (p. 3-207)			
Setting for the characteristic angle of the residual current stage in correspondence to the measuring relation. Using this setting, a wide range of conditions can be accommodated, depending on the system's neutral grounding impedance. Examples: ● System neutral with relatively high resistance $\alpha_G = 0°$ ● System neutral with relatively low resistance $\alpha_G = -45°$ ● System neutral effectively grounded $\alpha_G = -75°$ ● System neutral reactance-grounded $\alpha_G = -90°$ ● System with isolated neutral $\alpha_G = +90°$							
SCDD: Evaluation IN PSx				008 105	008 106	008 107	008 108
1: Calculated							
This parameter is used to select whether the measured or the calculated residual current value is to be used for the SCDD residual current stages.							
SCDD: VNG> PSx				017 077	077 244	078 244	079 244
0.100	0.015	0.600	Vnom(/√3)	Fig. 3-162, (p. 3-207)			
Setting the operate value VNG>. This setting value is an enabling criterion of the base point release of short-circuit direction determination. In choosing this setting, the set nominal voltage **MAIN: VNG,nom V.T. sec.** should be taken into account.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
SCDD: Evaluation VNG PSx				071 056	071 057	071 058	071 059
1: Calculated				Fig. 3-161, (p. 3-206)			
User may select between *Measured* and *Calculated* (standard default).							
SCDD: Oper.val.Vmemory PSx				010 109	010 116	010 117	010 118
0.15	0.01	1.00	Vnom				
In the event of a three-phase fault in the phase current stage, the measured voltage VABmeas is compared with the selected operate value, Vop.Val., of the voltage memory. If VABmeas < Vop.Val. then the SCDD function will not use VABmeas but will revert to the voltage memory, if it has been enabled.							
SCDD: Block. bias G PSx				017 078	077 245	078 245	079 245
1: Yes				Fig. 3-164, (p. 3-209)			
This setting defines whether the trip bias of the residual current stage should be blocked in the event of a phase current starting.							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**

Protective signaling

PSIG: Enable PSx				015 014	015 015	015 016	015 017
0: No				Fig. 3-167, (p. 3-215)			
This setting defines the parameter subset in which protective signaling is enabled.							
PSIG: Tripping time PSx				015 011	024 003	024 063	025 023
0.08	0.00	10.00	s	Fig. 3-169, (p. 3-218)			
Setting for the time delay of protective signaling. With blocking schemes this time must be set to the channel transmission delay +30 ms.							
PSIG: Release t. send PSx				015 002	024 001	024 061	025 021
0.25	0.00	10.00	s	Fig. 3-169, (p. 3-218)			
This setting determines the duration of the send signal.							
PSIG: DC loop op. mode PSx				015 012	024 051	025 011	025 071
1: Transm.rel.break con				Fig. 3-169, (p. 3-218)			
This setting defines whether the transmitting relay will be operated in energize-on-signal mode (“open-circuit principle”) or normally-energized mode (“closed-circuit principle”), i.e., *Transm.rel.make con.* or *Transm.rel.break con*,respectively.							
PSIG: Direc.dependence PSx				015 001	015 115	015 116	015 117
1: Without				Fig. 3-169, (p. 3-218)			
Setting for the directional dependence evaluation of protective signaling. The following settings are possible: ● *Without* ● *Phase curr. system* ● *Residual curr.system* ● *Phase/resid.c.system*							

Auto-reclosing control

Parameter								Address
Default	**Min**	**Max**	**Unit**					**Logic Diagram**
ARC: Enable PSx					015 046	015 047	015 048	015 049
0: No				Fig. 3-173, (p. 3-223)				
This setting defines the parameter subset in which ARC is enabled.								
ARC: CB clos.pos.sig. PSx					015 050	024 024	024 084	025 044
0: Without				Fig. 3-175, (p. 3-225)				
This setting defines whether the CB closed position will be taken into account or not. If the setting is *With*, a binary signal input must be configured accordingly. Then the ARC function is ready only if the CB is closed.								
ARC: Operating mode PSx					015 051	024 025	024 085	025 045
3: Test HSR only permit				Fig. 3-172, (p. 3-222)				
The operating mode setting defines which of the following reclosure types is permitted. ● TDR only. ● HSR or TDR. ● Test HSR only.								
ARC: Operative time PSx					015 066	024 035	024 095	025 055
0.30	0.00	10.00	s	Fig. 3-184, (p. 3-235)				
Setting for operative time 1. If the fault is cleared within this time, the fixed dead time 1p or 3p (depending on the trip condition and HSR operating mode) is started.								
ARC: HSR trip.time GS PSx					015 038	024 100	024 150	025 100
0.00	0.00	10.00	s	Fig. 3-180, (p. 3-231)				
Setting for the HSR tripping time and start via a general starting condition.								
ARC: HSR trip.time I> PSx					015 072	024 040	025 000	025 060
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)				
The HSR tripping time replaces timer stage t1,ze of distance protection or the operate delay of backup overcurrent-time protection – provided that the BUOC operating mode is set accordingly – if a HSR is permitted and protective signaling is not ready.								
ARC: HSR trip.time I>>PSx					015 074	024 101	024 151	025 101
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)				
Setting for the HSR tripping time and start via a phase current starting in the second DTOC overcurrent stage.								
ARC: HSRtrip.time I>>>PSx					014 096	024 102	024 152	025 102
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)				
Setting for the HSR tripping time and start via a phase current starting in the third DTOC overcurrent stage.								

Parameter							Address
Default	Min	Max	Unit	Logic Diagram			
ARC: HSRtr.time I>>>> PSx				016 181	016 182	016 183	016 184
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)			
Setting for the HSR tripping time and start via a phase current starting in the fourth DTOC overcurrent stage.							
ARC: HSR trip.time IN>PSx				015 076	024 103	024 153	025 103
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)			
Setting for the HSR tripping time and start via a residual current starting in the first DTOC overcurrent stage.							
ARC: HSRtrip.time IN>>PSx				015 031	024 104	024 154	025 104
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)			
Setting for the HSR tripping time and start via a residual current starting in the second DTOC overcurrent stage.							
ARC: HSRtrip.t. IN>>> PSx				014 098	024 105	024 155	025 105
Blocked	0.00	10.00	s	Fig. 3-176, (p. 3-227)			
Setting for the HSR tripping time and start via a residual current starting in the third DTOC overcurrent stage.							
ARC: HSRtrip.t.Iref,P PSx				015 094	024 106	024 156	025 106
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the HSR tripping time and start via a starting in the IDMT1 phase current system.							
ARC: HSRtrip.t.Iref,N PSx				015 096	024 107	024 157	025 107
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the HSR tripping time and start via a starting in the IDMT1 residual current system.							
ARC: HSRtr.t.Iref,neg PSx				015 034	024 108	024 158	025 108
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the HSR tripping time and start via a starting in the IDMT1 negative-sequence current system.							
ARC: HSR trip t. pow. PSx				015 078	024 109	024 159	025 109
Blocked	0.00	10.00	s	Fig. 3-179, (p. 3-230)			
Setting for the HSR tripping time and start via ‘ground fault direction determination using steady-state values' of steady-state power evaluation.							
ARC: HSR trip t. adm. PSx				021 059	021 066	021 067	021 068
Blocked	0.00	10.00	s	Fig. 3-179, (p. 3-230)			
Setting for the HSR tripping time and start via ‘ground fault direction determination using steady-state values' of steady-state admittance evaluation.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ARC: HSRtrip.t. LOGIC PSx				015 098	024 110	024 160	025 110
Blocked	0.00	10.00	s	Fig. 3-181, (p. 3-231)			
Setting for the HSR tripping time and start via programmable logic.							
ARC: HSR block.f. I>>>PSx				015 080	024 111	024 161	025 111
0: No				Fig. 3-182, (p. 3-232)			
The selection of the HSR blocking by I>>> defines whether an HSR is blocked during an I>>> starting.							
ARC: HSR dead time PSx				015 056	024 030	024 090	025 050
0.30	0.15	600.00	s	Fig. 3-184, (p. 3-235)			
Dead time setting for a three-pole HSR.							
ARC: No. permit. TDR PSx				015 068	024 037	024 097	025 057
0	0	9		Fig. 3-184, (p. 3-235)			
Setting for the number of time-delayed reclosures permitted. With the *0* setting, only one HSR is carried out.							
ARC: TDR trip.time GS PSx				015 039	024 112	024 162	025 112
0.00	0.00	10.00	s	Fig. 3-180, (p. 3-231)			
Setting for the TDR tripping time and start via a general starting condition.							
ARC: TDR trip.time I> PSx				015 073	024 041	025 001	025 061
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
The TDR tripping time replaces timer stage t1,ze of distance protection or the operate delay of backup overcurrent-time protection – provided that the BUOC operating mode is set accordingly – if a TDR is permitted and protective signaling is not ready.							
ARC: TDR trip.time I>>PSx				015 075	024 113	024 163	025 113
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a phase current starting in the second DTOC overcurrent stage.							
ARC: TDRtrip.time I>>>PSx				014 097	024 114	024 164	025 114
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a phase current starting in the third DTOC overcurrent stage.							
ARC: TDRtr.time I>>>> PSx				016 189	016 186	016 187	016 188
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a phase current starting in the fourth DTOC overcurrent stage.							

Parameter							Address
Default	Min	Max	Unit	Logic Diagram			
ARC: TDR trip.time IN>PSx				015 077	024 115	024 165	025 115
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a residual current starting in the first DTOC overcurrent stage.							
ARC: TDRtrip.time IN>>PSx				015 032	024 116	024 166	025 116
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a residual current starting in the second DTOC overcurrent stage.							
ARC: TDRtrip.t. IN>>> PSx				014 099	024 117	024 167	025 117
Blocked	0.00	10.00	s	Fig. 3-177, (p. 3-228)			
Setting for the TDR tripping time and start via a residual current starting in the third DTOC overcurrent stage.							
ARC: TDRtrip.t.Iref,P PSx				015 095	024 118	024 168	025 118
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the TDR tripping time and start via a starting in the IDMT1 phase current system.							
ARC: TDRtrip.t.Iref,N PSx				015 097	024 119	024 169	025 119
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the TDR tripping time and start via a starting in the IDMT1 residual current system.							
ARC: TDRtr.t.Iref,neg PSx				015 035	024 120	024 170	025 120
Blocked	0.00	10.00	s	Fig. 3-178, (p. 3-229)			
Setting for the TDR tripping time and start via a starting in the IDMT1 negative-sequence current system.							
ARC: TDR trip t. pow. PSx				015 079	024 121	024 171	025 121
Blocked	0.00	10.00	s	Fig. 3-179, (p. 3-230)			
Setting for the TDR tripping time and start via ‘ground fault direction determination using steady-state values' of steady-state power evaluation.							
ARC: TDR trip t. adm. PSx				021 069	021 070	021 071	021 072
Blocked	0.00	10.00	s	Fig. 3-179, (p. 3-230)			
Setting for the TDR tripping time and start via ‘ground fault direction determination using steady-state values' of steady-state admittance evaluation.							
ARC: TDRtrip.t. LOGIC PSx				015 099	024 122	024 172	025 122
Blocked	0.00	10.00	s	Fig. 3-181, (p. 3-231)			
Setting for the TDR tripping time and start via programmable logic.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ARC: TDR block.f. I>>>PSx				015 081	024 124	024 174	025 124
0: No				Fig. 3-182, (p. 3-232)			
The selection of the TDR blocking by I>>> defines whether an TDR is blocked during an I>>> starting.							
ARC: TDR dead time PSx				015 057	024 031	024 091	025 051
0.30	0.15	600.00	s	Fig. 3-184, (p. 3-235)			
Setting for the TDR dead time.							
ARC: Reclaim time PSx				015 054	024 028	024 088	025 048
10	1	600	s	Fig. 3-184, (p. 3-235)			
Setting for the reclaim time.							
ARC: Blocking time PSx				015 058	024 032	024 092	025 052
5	0	600	s	Fig. 3-174, (p. 3-224)			
Setting for the time that will elapse before the ARC will be ready again after blocking by a binary signal input.							

Automatic synchronism check

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
ASC: Enable PSx				018 020	018 021	018 022	018 023
0: No				Fig. 3-191, (p. 3-246)			
This setting defines the parameter subset in which automatic synchronism check (ASC) is enabled.							
ASC: CB assignment PSx				037 131	037 132	037 133	037 134
0: Not assigned				Fig. 3-203, (p. 3-261)			
This setting defines the function group DEVxx that will control the circuit breaker.							
ASC: System integrat. PSx				037 135	037 136	037 137	037 138
1: Autom.synchron.check				Fig. 3-203, (p. 3-261)			
This setting defines whether ASC will operate in “Autom. synchron. check” or “Autom. synchr. control” mode.							
ASC: Active for HSR PSx				018 001	077 030	078 030	079 030
0: No				Fig. 3-192, (p. 3-248)			
This setting defines whether reclosing after a three-pole HSR will occur only after being enabled by ASC.							
ASC: Active for TDR PSx				018 002	077 031	078 031	079 031
0: No				Fig. 3-192, (p. 3-248)			
This setting defines whether reclosing after a three-pole TDR will occur only after being enabled by ASC.							
ASC: Clos.rej.w.block PSx				018 003	077 032	078 032	079 032
0: No				Fig. 3-192, (p. 3-248)			
This setting defines whether reclosing is rejected after being blocked by ASC.							
ASC: Operative time PSx				018 010	077 034	078 034	079 034
100.0	0.0	6000.0	s	Fig. 3-196, (p. 3-251)			
Setting for the operative time for ASC.							
ASC: Meas.V(T90) USER PSx				016 222	016 223	016 224	016 225
0: No							

This setting decides which voltage(s) the ASC function shall use for the operating modes “voltage-checked close enable” and “voltage/synchronism-checked close enable”:

- If set to *No* then the three phase-to-ground voltages are checked.
- If set to *Yes* then the (single-phase) voltage measured at transformer T90 is checked. (Note that it is left to system engineering that the proper voltage – matching the setting **ASC: Measurement loop PSx** – is connected to the T90 input.)

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
ASC: Measurement loop PSx				031 060	077 044	078 044	079 044
4: Loop A-B				Fig. 3-190, (p. 3-245)			
The voltage measurement loop, corresponding to the reference voltage, must be selected so that determination of differential values is correct. **Example:** Connect transformer T 15 to measure the reference voltage to phases A & B. The measurement loop should be set to *Loop A-B*.							
ASC: Phi offset PSx				018 034	077 042	078 042	079 042
0	-180	180	°	Fig. 3-200, (p. 3-257) Fig. 3-201, (p. 3-259)			
Setting for a Phi offset that may be necessary so that determination of the differential angle is correct.							
ASC: AR op. mode PSx				018 025	018 026	018 027	018 028
1: Voltage-checked							
Auto-reclosing control: Criteria for a close enable are defined by setting for the operating mode.							
ASC: AR with tCB PSx				000 038	000 039	000 050	000 051
0: No							
Function ASC provides a choice as to whether the CB operating time (tCB), as configured at **MAIN: tCB,close** is to be taken into account for the precisely synchronized reclosure (AR) or not.							
ASC: AR Op.mode v-chk.PSx				018 029	018 030	018 031	018 032
1: Vref but not V				Fig. 3-198, (p. 3-254)			
Auto-reclosing control: This setting defines the logic linking of trigger decisions for a voltage controlled close enable.							
ASC: AR V> volt.check PSx				026 017	077 043	078 043	079 043
0.80	0.10	1.20	Vnom(/√3)	Fig. 3-198, (p. 3-254)			
Auto-reclosing control: Setting the voltage threshold that the phase-to-ground voltages and the reference voltage must exceed so that they are recognized as “Voltage present”. **Note:** The logic linking of trigger decisions is defined by setting **ASC: AR Op.mode v-chk.PSx**.							
ASC: AR V< volt.check PSx				018 017	077 040	078 040	079 040
0.20	0.10	0.80	Vnom(/√3)	Fig. 3-198, (p. 3-254)			
Auto-reclosing control: Setting the voltage threshold that the phase-to-ground voltages and the reference voltage must fall below so that they are recognized as “No voltage”. **Note:** The logic linking of trigger decisions is defined by setting **ASC: AR Op.mode v-chk.PSx**.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ASC: AR tmin v-check PSx				018 018	077 041	078 041	079 041
0.10	0.00	10.00	s	Fig. 3-198, (p. 3-254)			
Auto-reclosing control: Setting for the operate delay value to define the minimum time period during which voltage conditions must be met so that the close enable of the ASC is effected.							
ASC: AR V> sync.check PSx				018 011	077 035	078 035	079 035
0.80	0.40	1.20	Vnom(/√3)	Fig. 3-200, (p. 3-257)			
Auto-reclosing control: Setting for the threshold of the minimum voltage to obtain a synchronism checked close enable.							
ASC: AR Delta Vmax PSx				018 012	077 036	078 036	079 036
0.10	0.02	0.40	Vnom	Fig. 3-200, (p. 3-257)			
Auto-reclosing control: Setting the maximum differential voltage between measured and reference voltages to obtain a synchronism checked close enable.							
ASC: AR Delta f max PSx				018 014	077 038	078 038	079 038
0.20	0.01	1.00	Hz	Fig. 3-200, (p. 3-257)			
Auto-reclosing control: Setting the maximum differential frequency between measured and reference voltages to obtain a synchronism checked close enable.							
ASC: AR Delta phi max PSx				018 013	077 037	078 037	079 037
15	5	100	°	Fig. 3-200, (p. 3-257)			
Auto-reclosing control: Setting the maximum differential angle between measured and reference voltages to obtain a synchronism checked close enable.							
ASC: AR tmin sync.chk PSx				018 015	077 039	078 039	079 039
0.10	0.00	10.00	s	Fig. 3-200, (p. 3-257)			
Auto-reclosing control: Setting for the operate delay value to define the minimum time period during which synchronism conditions must be met so that the close enable of the ASC is effected.							
ASC: MC op. mode PSx				000 056	000 057	000 058	000 059
1: Voltage-checked							
Manual close command: Criteria for a close enable are defined by setting for the operating mode.							
ASC: MC with tCB PSx				000 102	000 103	000 104	000 105
0: No							
Manual close command: In slightly asynchronous power systems, setting this parameter to *Yes* ensures that the circuit breaker closing time is taken into account by the automatic synchronism check (ASC) to issue of a close command.							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
ASC: MC op.mode v-chk.PSx				000 060	000 061	000 062	000 063
1: Vref but not V				Fig. 3-199, (p. 3-256)			
Manual close command: This setting defines the logic linking of trigger decisions for a voltage controlled close enable.							
ASC: MC V> volt.check PSx				000 064	000 065	000 066	000 067
0.80	0.10	1.20	Vnom(/√3)	Fig. 3-199, (p. 3-256)			
Manual close command: Setting the voltage threshold that the phase-to-ground voltages and the reference voltage must exceed so that they are recognized as “Voltage present”. **Note:** The logic linking of trigger decisions is defined by setting **ASC: MC op.mode v-chk.PSx**.							
ASC: MC V< volt.check PSx				000 068	000 069	000 070	000 071
0.20	0.10	1.20	Vnom(/√3)	Fig. 3-199, (p. 3-256)			
Manual close command: Setting the voltage threshold that the phase-to-ground voltages and the reference voltage must fall below so that they are recognized as “No voltage”. **Note:** The logic linking of trigger decisions is defined by setting **ASC: MC op.mode v-chk.PSx**.							
ASC: MC tmin v-check PSx				000 072	000 073	000 074	000 075
0.10	0.00	10.00	s	Fig. 3-199, (p. 3-256)			
Manual close command: Setting for the operate delay value to define the minimum time period during which voltage conditions must be met so that the close enable of the ASC is effected.							
ASC: MC V> sync.check PSx				000 052	000 053	000 054	000 055
0.80	0.40	1.20	Vnom(/√3)	Fig. 3-201, (p. 3-259)			
Manual close command: Setting for the threshold of the minimum voltage to obtain a synchronism checked close enable.							
ASC: MC Delta Vmax PSx				000 080	000 081	000 082	000 083
0.10	0.02	0.40	Vnom	Fig. 3-201, (p. 3-259)			
Manual close command: Setting the maximum differential voltage between measured and reference voltages to obtain a synchronism checked close enable.							
ASC: MC Delta f max PSx				000 084	000 086	000 087	000 088
0.20	0.01	2.00	Hz	Fig. 3-201, (p. 3-259)			
Manual close command: Setting the maximum differential frequency between measured and reference voltages to obtain a synchronism checked close enable.							
ASC: MC Delta phi max PSx				000 089	000 091	000 092	000 093
15	5	100	°	Fig. 3-201, (p. 3-259)			
Manual close command: Setting the maximum differential angle between measured and reference voltages to obtain a synchronism checked close enable.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ASC: MC tmin sync.chk PSx				000 098	000 099	000 100	000 101
0.10	0.00	10.00	s	Fig. 3-201, (p. 3-259)			
Manual close command: Setting for the operate delay value to define the minimum time period during which synchronism conditions must be met so that the close enable of the ASC is effected.							

Parameter								Address
Default	**Min**	**Max**	**Unit**					**Logic Diagram**

Ground fault direction determination using steady-state values

Parameter							
GFDSS: Enable PSx				001 050	001 051	001 052	001 053
0: No				Fig. 3-206, (p. 3-265)			
This setting defines the parameter subset in which the GFDSS function is enabled.							
GFDSS: Evaluation VNG PSx				016 083	001 011	001 012	001 013
1: Calculated				Fig. 3-207, (p. 3-266)			
This setting specifies which neutral-point displacement voltage will be used for direction determination: The displacement voltage calculated from the phase-to-ground voltages or the displacement voltage measured at the T 90 transformer of the P139.							
GFDSS: VNG> PSx				016 062	000 233	000 234	000 235
0.25	0.02	1.00	Vnom(/√3)	Fig. 3-208, (p. 3-267) Fig. 3-215, (p. 3-273)			
Setting for the operate value of the neutral-point displacement voltage.							
GFDSS: tVNG> PSx				016 061	000 230	000 231	000 232
1.00	0.02	10.00	s	Fig. 3-208, (p. 3-267) Fig. 3-215, (p. 3-273)			
Setting for the operate delay of the VNG> trigger.							
GFDSS: f/fnom (power) PSx				016 091	001 044	001 045	001 046
1: 1				Fig. 3-208, (p. 3-267)			
Setting for the frequency of the measured variables evaluated in steady-state power evaluation.							
GFDSS: Op.mode power PSx				016 063	000 236	000 237	000 238
1: cos phi circuit				Fig. 3-208, (p. 3-267)			
Setting for the operating mode of the steady-state power evaluation. The following settings are possible: ● “cos φ circuit” for resonant-grounded systems, ● “sin φ circuit” for isolated neutral-point systems.							
GFDSS: Meas. dir. power PSx				016 070	001 002	001 003	001 004
1: Standard				Fig. 3-208, (p. 3-267)			
This setting defines the measuring direction for the “forward” or “backward” decision of steady-state power evaluation.							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
GFDSS: IN,act>/reac> LS PSx				016 064	000 239	000 240	000 241
0.050	0.003	1.000	IN,nom	Fig. 3-211, (p. 3-270)			
Setting for the threshold of the active or reactive power component of residual current that must be exceeded so that the “LS” (line side) directional decision is enabled.							
GFDSS: Sector angle LS PSx				016 065	000 242	000 243	000 244
86	80	89	°	Fig. 3-211, (p. 3-270)			
Setting for the sector angle for measurement in the line side direction. **Note:** This setting is only effective in the “cos φ circuit” operating mode.							
GFDSS: Op. delay LS pow PSx				016 066	000 245	000 246	000 247
0.10	0.00	100.00	s	Fig. 3-212, (p. 3-271)			
Setting for the operate delay of the direction decision in the forward direction of steady-state power evaluation.							
GFDSS: Rel delay LS pow PSx				016 072	001 005	001 006	001 007
0.00	0.00	10.00	s	Fig. 3-212, (p. 3-271)			
Setting for the release delay (reset time) of the direction decision in the forward direction of steady-state power evaluation.							
GFDSS: IN,act>/reac> BS PSx				016 067	000 251	000 252	000 253
0.050	0.003	1.000	IN,nom	Fig. 3-211, (p. 3-270)			
Setting for the threshold of the active or reactive power component of residual current that must be exceeded so that the “BS” (busbar side) directional decision is enabled.							
GFDSS: Sector angle BS PSx				016 068	000 248	000 249	000 250
86	80	89	°	Fig. 3-211, (p. 3-270)			
Setting for the sector angle for measurement in the direction of the busbar side. **Note:** This setting is only effective in the “cos φ circuit” operating mode.							
GFDSS: Op. delay BS pow PSx				016 069	000 254	000 255	001 001
0.10	0.00	100.00	s	Fig. 3-212, (p. 3-271)			
Setting for the operate delay of the direction decision in the backward (reverse) direction of steady-state power evaluation.							
GFDSS: Rel delay BS pow PSx				016 073	001 008	001 009	001 010
0.00	0.00	10.00	s	Fig. 3-212, (p. 3-271)			
Setting for the release delay (reset time) of the direction decision in the backward direction of steady-state power evaluation.							
GFDSS: Hold time pow. PSx				020 172	020 173	020 174	020 175
0.00	0.00	10.00	s	Fig. 3-212, (p. 3-271)			
Setting for the hold time of steady-state power operating evaluation.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GFDSS: Oper. mode admit PSx				020 176	020 177	020 178	020 179
1: cos phi circuit				Fig. 3-215, (p. 3-273)			
Setting for the operating mode of the steady-state admittance evaluation. The following settings are possible: ● “cos φ circuit” for resonant-grounded systems, ● “sin φ circuit” for isolated neutral-point systems.							
GFDSS: Meas. dir. admit PSx				020 180	020 181	020 182	020 183
1: Standard				Fig. 3-215, (p. 3-273)			
This setting defines the measuring direction for the “forward” or “backward” decision of steady-state admittance evaluation.							
GFDSS: G(N)> / B(N)> LS PSx				016 111	001 029	001 030	001 031
0.05	0.01	1.00	YN,nom	Fig. 3-218, (p. 3-276)			
Setting for the threshold of the active or reactive susceptance component of residual current that must be exceeded so that the “LS” (line side) directional decision is enabled.							
GFDSS: Op. delay LS adm PSx				020 184	020 185	020 186	020 187
0.10	0.00	100.00	s	Fig. 3-218, (p. 3-276)			
Setting for the operate delay of the direction decision in the forward direction of steady-state admittance evaluation.							
GFDSS: Rel delay LS adm PSx				020 188	020 189	020 190	020 191
0.00	0.00	10.00	s	Fig. 3-218, (p. 3-276)			
Setting for the release delay (reset time) of the direction decision in the forward direction of steady-state admittance evaluation.							
GFDSS: G(N)> / B(N)> BS PSx				016 112	001 032	001 033	001 034
0.05	0.01	1.00	YN,nom	Fig. 3-218, (p. 3-276)			
Setting for the threshold of the active or reactive susceptance component of residual current that must be exceeded so that the “BS” (busbar side) directional decision is enabled.							
GFDSS: Op. delay BS adm PSx				020 192	020 193	020 194	020 195
0.10	0.00	100.00	s	Fig. 3-218, (p. 3-276)			
Setting for the operate delay of the direction decision in the backward (reverse) direction of steady-state admittance evaluation.							
GFDSS: Rel delay BS adm PSx				020 200	020 201	020 202	020 221
0.00	0.00	10.00	s	Fig. 3-218, (p. 3-276)			
Setting for the release delay (reset time) of the direction decision in the backward direction of steady-state admittance evaluation.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GFDSS: Y(N)> PSx				016 113	001 035	001 036	001 037
0.50	0.01	2.00	YN,nom	Fig. 3-219, (p. 3-277)			
Setting for the operate value of the admittance for non-directional ground fault determination (in operating mode “*admittance evaluation*”).							
GFDSS: Correction angle PSx				016 110	001 026	001 027	001 028
0	-30	30	°				
This setting is provided to compensate for phase-angle errors of the system transformers (in operating mode “*admittance evaluation*”).							
GFDSS: Oper.delay Y(N)> PSx				016 114	001 038	001 039	001 040
0.10	0.00	100.00	s	Fig. 3-219, (p. 3-277)			
Setting for the operate delay value of the admittance for non-directional ground fault determination (in operating mode “*admittance evaluation*”).							
GFDSS: Rel. delay Y(N)> PSx				016 115	001 041	001 042	001 043
0.00	0.00	10.00	s	Fig. 3-219, (p. 3-277)			
Setting for the release delay (reset time) of the admittance for non-directional ground fault determination (in operating mode “*admittance evaluation*”).							
GFDSS: Hold time adm. PSx				020 222	020 223	020 224	020 225
0.00	0.00	10.00	s	Fig. 3-218, (p. 3-276) Fig. 3-219, (p. 3-277)			
Setting for the hold time of steady-state admittance evaluation.							
GFDSS: f/fnom (I meas.) PSx				016 092	001 047	001 048	001 049
1: 1				Fig. 3-213, (p. 3-272)			
Setting for the frequency of the measured variables evaluated in steady-state current evaluation.							
GFDSS: IN> PSx				016 093	001 017	001 018	001 019
0.050	0.003	1.000	IN,nom	Fig. 3-213, (p. 3-272)			
Setting for the operate value of steady-state current evaluation.							
GFDSS: Operate delay IN PSx				016 094	001 020	001 021	001 022
0.10	0.00	100.00	s	Fig. 3-213, (p. 3-272)			
Setting for the operate delay of steady-state current evaluation.							
GFDSS: Release delay IN PSx				016 095	001 023	001 024	001 025
0.00	0.00	10.00	s	Fig. 3-213, (p. 3-272)			
Setting for the release delay (reset time) of steady-state current evaluation.							

Transient ground fault direction determination

Parameter				Address			
Default	Min	Max	Unit	Logic Diagram			
TGFD: Enable PSx				001 054	001 055	001 056	001 057
0: No				Fig. 3-221, (p. 3-280)			
This setting defines the parameter subset in which the TGFD function is enabled.							
TGFD: Evaluation VNG PSx				016 048	001 058	001 059	001 060
1: Calculated				Fig. 3-222, (p. 3-281)			
This setting specifies which neutral-point displacement voltage will be used for evaluation: The displacement voltage from the open delta winding of a voltage transformer assembly or the displacement voltage calculated from the three phase-to-ground voltages.							
TGFD: Measurem. direc. PSx				016 045	001 073	001 074	001 075
1: Standard				Fig. 3-223, (p. 3-282)			
The direction measurement of the transient ground fault direction determination function depends on the connection of the measuring circuits. If the connection is as shown in Chapter “Installation and Connection”, then the setting must be *Standard*, if the P139's “*forward*” decision is to be in the direction of the outgoing feeder. If the connection direction is reversed or – given a connection scheme according to Chapter “Installation and Connection” – if the “*forward*” decision is to be in the busbar direction, then the setting must be *Opposite*. **Note**: The global setting **MAIN: Conn. meas. circ. IN** does not affect the direction determination feature of the transient ground fault direction determination function.							
TGFD: VNG> PSx				016 041	001 061	001 062	001 063
0.30	0.05	0.50	Vnom(/√3)	Fig. 3-223, (p. 3-282)			
Setting for the neutral-point displacement voltage threshold.							
TGFD: IN,p> PSx				016 042	001 064	001 065	001 066
0.15	0.03	0.50	Inom	Fig. 3-223, (p. 3-282)			
Setting for the residual current threshold. A peak value is evaluated.							
TGFD: Operate delay PSx				016 044	001 067	001 068	001 069
0.05	0.05	1.60	s	Fig. 3-223, (p. 3-282)			
Setting for the operate delay.							
TGFD: Buffer time PSx				016 043	001 070	001 071	001 072
1	0	1200	s	Fig. 3-224, (p. 3-283)			
Setting for the signal buffer time for transient ground fault direction determination. Buffer time = 0 keeps the directional decision stored as long as VNG(50Hz) exceeds the threshold VNG>. Buffer time = blocked keeps the directional decision stored until (manual) reset through **TGFD: Reset signal USER** or **TGFD: Reset signal EXT**.							

Motor protection

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MP: Enable PSx				024 148	024 147	024 197	025 147
0: No				Fig. 3-228, (p. 3-285)			
This setting defines the parameter subset in which motor protection is enabled.							
MP: Iref PSx				017 012	024 131	024 181	025 131
1.00	0.10	4.00	Inom	Fig. 3-229, (p. 3-286)			

For the determination of the reference current, the nominal motor current needs to be calculated first from the motor data.

$$I_{\text{nom,motor}} = \frac{P_{\text{nom}}}{\sqrt{3} \cdot V_{\text{nom}} \cdot \eta \cdot \cos\varphi}$$

The reference current is the nominal motor current as projected onto the transformer secondary side and is thus calculated as follows:

$$\frac{I_{\text{ref}}}{I_{\text{nom,(relay)}}} = \frac{I_{\text{nom,motor}} / T_{\text{nom}}}{I_{\text{nom,(relay)}}}$$

Example:

Motor and System Data

Nominal motor voltage V_{nom}: 10 kV

Nominal motor power P_{nom}: 1500 kW

Efficiency η: 96.6%

Active power factor cos φ: 0.86

Nominal transformation ratio T_{nom} of the main current transformer: 1 A

Determination of the Nominal Motor Current

$$I_{\text{nom,motor}} = \frac{1500\text{kW}}{\sqrt{3} \cdot 10\text{kV} \cdot 0.966 \cdot 0.86} = 104\text{A}$$

Determination of the reference current

$$\frac{I_{\text{ref}}}{I_{\text{nom,(relay)}}} = \frac{104\text{A} / 100}{1\text{A}} = 1.04$$

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MP: Factor kP PSx				017 040	024 132	024 182	025 132
1.15	1.05	1.50		Fig. 3-229, (p. 3-286)			

The starting factor k should be set according to the maximum permissible thermal continuous current:

$$k = \frac{I_{\text{therm,motor}}}{I_{\text{nom,motor}}}$$

Example:

Motor Data:

Maximum permissible continuous thermal motor current $I_{\text{therm,motor}} = 1.1\ I_{\text{nom,motor}}$

Determination of the Starting Factor:

$$k = \frac{1.1 \cdot I_{\text{nom,motor}}}{I_{\text{nom,motor}}} = 1.1$$

MP: IStUp> PSx				017 053	024 133	024 183	025 133
2.5	1.8	3.0	Iref	Fig. 3-234, (p. 3-297)			

Setting for the current threshold for the operational status determination “machine starting up”.

MP: tIStUp> PSx				017 042	024 134	024 184	025 134
0.5	0.1	1.9	s	Fig. 3-234, (p. 3-297)			

Setting for the operate delay for the operational status determination “machine starting up”. Usually, the default setting can be retained.

MP: Character.type P PSx				017 029	024 135	024 185	025 135
1: Reciprocal squared				Fig. 3-234, (p. 3-297)			

The selection of the tripping characteristic defines the restrictiveness of the motor protection function. For low overcurrents, the logarithmic characteristic provides significantly higher tripping times than the reciprocally squared characteristic, since the latter neglects any heat transfer to the cooling medium in the overload range.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MP: t6Iref PSx				017 041	024 136	024 186	025 136
10.0	1.0	100.0	s	Fig. 3-234, (p. 3-297)			

This setting for the overload tripping time t_{6Iref} is determined from the cold machine data, using $I_{ref} = I_{nom,motor}$.

For the reciprocally squared characteristic we set:

$$t_{6I_{ref}} = t_{block,cold} \cdot \frac{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2}{36}$$

For the logarithmic characteristic we set:

$$t_{6I_{ref}} = t_{block,cold} \cdot \frac{1}{36 \cdot \ln \frac{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2}{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2 - 1}}$$

Based on the setting value thus determined, the tripping time for a warm machine is now defined as follows.

For the reciprocally squared characteristic we have:

$$t = (1 - 0.2) \cdot t_{6I_{ref}} \cdot \frac{36}{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2}$$

For the logarithmic characteristic we have:

$$t = (1 - 0.2) \cdot t_{6I_{ref}} \cdot 36 \cdot \ln \frac{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2}{\left(\frac{I_{startup}}{I_{nom,motor}}\right)^2 - 1}$$

Example:

Motor Data

Motor startup current: $I_{startup} = 5.7\ I_{nom,motor}$

Max. permissible locked-rotor time with cold machine: $t_{block,cold} = 18$ s

Max. permissible locked-rotor time with warm machine: $t_{block,warm} = 16$ s

Determination of the Setting Value for the Reciprocally Squared Characteristic:

$t_{6Iref} = 18s \bullet 5.7^2/36 = 16.2s$

Control of Tripping Time with Warm Machine:

$t = 0.8 \bullet 16.2s \bullet 36/5.7^2 = 14.4s \leq 16s$ (o.k.)

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
MP: Tau after st.-up PSx				018 042	024 137	024 187	025 137
20	1	60	s	Fig. 3-234, (p. 3-297)			

Setting for the heat dispersion time constant after startup. Usually, the default setting can be retained.

Pre-decreasing of the stored value thermal replica is carried out linearly up to the minimum value stored after initial startup and depending on the count of the startup frequency monitor. The rate for this pre-decreasing of the stored value is constant and ranges at about 40% of the discharge (τ after startup = 20) within a time duration of 60 s, for example. The relation between "**MP: Tau after st.-up PSx** = 20 s" and 60 s is based on the approximation that this heat transfer is practically finished after three times its time constant. The linear decrease of the replica at this stage is done for simplification of data processing, which looks appropriate with regard to its relatively short time constant "(018 042) **MP: Tau after st.-up PSx**" compared to "(017 088) **MP: Tau mach.running PSx**".

Under the assumption that the first machine start yields to a thermal replica value of 60% (ideal value, for "(017 047) **MP: Perm. No.st.-ups PSx** = *3/2 cold/warm*"), this linear heat transfer takes place until replica goes down to 20%, hence the thermal replica change is 60% − 20% = 40%.

The same calculation applies to the 2nd start from warm machine: 80% − 40% = 40% (where 80% are reached because of 20% heat from running machine before start plus 60% from the start); or for 3rd consecutive start: 100% − 60% =40%.

MP: Tau mach.running PSx				017 088	024 138	024 188	025 138
30	1	1000	min	Fig. 3-234, (p. 3-297)			
MP: Tau mach.stopped PSx				017 089	024 139	024 189	025 139
90	1	1000	min	Fig. 3-234, (p. 3-297)			

Setting for the cooling time constant with a running or stopped machine, respectively.

If the thermal time constants of the motor are unknown, the cooling time constant with machine running is best set to 50 minutes and the cooling time with machine stopped to the five-fold value of that with machine running.

MP: Perm. No.st.-ups PSx				017 047	024 140	024 190	025 140
3.2: 3/2 cold/warm				Fig. 3-234, (p. 3-297)			

Setting for the startup sequence of the motor as permitted by thermal considerations.

Note: The heavy starting logic (**MP: St.-up time tStUpPSx**, **MP: Blocking time tE PSx**) can only be activated if the permissible startup sequence is set to two startups from cold and one startup from warm.

MP: RC permitted, Θ< PSx				018 043	024 141	024 191	025 141
Blocked	22	60	%	Fig. 3-234, (p. 3-297)			

Setting for the threshold value of the overload memory for reclosure permission. Usually, the default setting can be retained.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MP: Operating mode PSx				018 041	024 142	024 192	025 142
0: Without THERM				Fig. 3-229, (p. 3-286)			
This setting defines whether motor protection will be operated together with thermal overload protection (THERM).							
MP: St.-up time tStUpPSx				017 043	024 143	024 193	025 143
5.0	2.0	100.0	s	Fig. 3-234, (p. 3-297)			
MP: Blocking time tE PSx				017 044	024 144	024 194	025 144
5.0	2.0	100.0	s	Fig. 3-234, (p. 3-297)			
Using an overspeed monitor, the heavy starting logic can be activated if necessary. For this purpose, the load-torque-dependent operational startup time needs to be set for tStUp and the maximum permissible locked-rotor time (the “tE time”) with a machine at operating temperature needs to be set for tE. If the heavy starting logic is not used then the set startup time tStUp and the tE-time should be set to the same value; the default values can be retained. **Note:** The heavy starting logic (**MP: Perm. No.st.-ups PSx**) can only be activated if the permissible startup sequence is set to two startups from cold and one startup from warm.							
MP: Retain replica PSx				009 046	009 250	009 251	009 252
0: No							
With this parameter it can be configured whether the thermal replica is retained in the non-volatile section of the device's memory so that it will still be available after an interruption of the supply voltage.							
MP: I< PSx				017 048	024 145	024 195	025 145
Blocked	0.2	0.9	Iref	Fig. 3-237, (p. 3-299)			
Setting for the operate value of the minimum current stage of the underload protection function of motor protection.							
MP: tI< PSx				017 050	024 146	024 196	025 146
20.0	0.1	20.0	s	Fig. 3-237, (p. 3-299)			
Setting for the operate delay of the minimum current stage of the underload protection function of motor protection.							

Thermal overload protection

Parameter				Address			
Default	Min	Max	Unit	Logic Diagram			
THERM: Enable PSx				072 175	073 175	074 175	075 175
0: No				Fig. 3-238, (p. 3-303)			
This setting defines the parameter subset in which thermal overload protection is enabled.							
THERM: Select current PSx				013 139	013 140	013 141	013 142
0: Max. phase current				Fig., (p. 3-304)			
Depending on this setting the thermal replica is calculated based on either the maximum phase current, or based on the calculated residual current derived from the sum of the phase currents (setting *IN calculated*), or based on the residual current measured at the fourth transformer (setting *IN measured*).							
THERM: Sel. backup th. PSx				072 080	073 080	074 080	075 080
0: None				Fig. 3-239, (p. 3-306)			
Selecting the backup temperature sensor for the parameter subset PSx.							
THERM: Iref PSx				072 179	073 179	074 179	075 179
1.00	0.05	4.00	Inom	Fig. 3-241, (p. 3-311)			
Setting for the reference current.							
THERM: Start.fact.OL_RC PSx				072 180	073 180	074 180	075 180
1.15	1.05	1.50		Fig. 3-241, (p. 3-311)			
Setting for the starting factor to trigger overload recording.							
THERM: Tim.const.1,>Ibl PSx				072 187	073 187	074 187	075 187
30.0	1.0	1000.0	min	Fig. 3-241, (p. 3-311)			
Setting for the thermal time constants of the protected object with current flow (Ibl: base line current).							
THERM: Tim.const.2,<Ibl PSx				072 188	073 188	074 188	075 188
30.0	1.0	1000.0	min	Fig. 3-241, (p. 3-311)			
Setting for the thermal time constants of the protected object without current flow (cooling time constant). **Note:** This setting option is only relevant when machines are running. In all other cases, time constant 2 must be set equal to time constant 1.							
THERM: Max.perm.obj.tmp.PSx				072 182	073 182	074 182	075 182
120	0	300	°C	Fig. 3-241, (p. 3-311)			
Setting for the maximum permissible temperature of the protected object.							
THERM: O/T f.Iref pers. PSx				072 167	073 167	074 167	075 167
80	0	300	K	Fig. 3-241, (p. 3-311)			
Setting for overtemperature resulting from a persistent limit current (Θ_{max} - $\Theta_{a,max}$).							

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
THERM: Max.perm.cool.tmpPSx				072 185	073 185	074 185	075 185
40	0	70	°C	Fig. 3-241, (p. 3-311)			
Setting for the maximum permissible coolant temperature. **Note:** This setting is active only if the coolant temperature is measured via the PT 100 or the 20 mA input.							
THERM: Default CTA PSx				072 186	073 186	074 186	075 186
40	-40	70	°C	Fig. 3-241, (p. 3-311)			
Setting for the coolant temperature to be used for calculation of the trip time if coolant temperature is not measured.							
THERM: Warning temp. PSx				072 153	073 153	074 153	075 153
95	0	300	°C	Fig. 3-241, (p. 3-311)			
Setting for the temperature (in °C) to trigger a warning alarm. **Note:** This setting is only enabled in the *Absolute replica* mode of operation.							
THERM: Rel. O/T warning PSx				072 184	073 184	074 184	075 184
95	50	200	%	Fig. 3-241, (p. 3-311)			
Setting for the operate threshold of the warning stage. **Note:** This setting is enabled only in the *Relative replica* operating mode.							
THERM: Rel. O/T trip PSx				072 181	073 181	074 181	075 181
100	50	200	%	Fig. 3-241, (p. 3-311)			
Setting for the operate value of the trip stage. **Note:** If the operating mode has been set to *Absolute replica*, the setting here will be automatically set to 100% and this parameter will be hidden as far as the local control panel is concerned.							
THERM: Hysteresis trip PSx				072 183	073 183	074 183	075 183
2	2	30	%	Fig. 3-241, (p. 3-311)			
Setting for the hysteresis of the trip stage.							
THERM: Warning pre-trip PSx				072 191	073 191	074 191	075 191
30.0	0.0	1000.0	min	Fig. 3-241, (p. 3-311)			
A warning will be given in advance of the trip. The time difference between the warning time and the trip time is set here.							
THERM: Retain replica PSx				009 019	009 030	009 032	009 039
0: No							
With this parameter it can be configured whether the thermal replica is retained in the non-volatile section of the device's memory so that it will still be available after an interruption of the supply voltage.							

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
THERM: Select meas.inputPSx				072 177	073 177	074 177	075 177
0: None				Fig. 3-239, (p. 3-306)			
Selecting if and how the coolant temperature is measured: Via the PT100, the 20mA input or Tx (x = 1 to 9).							
THERM: Funct.f.CTA fail.PSx				076 177	077 177	078 177	079 177
3: Blocking				Fig. 3-239, (p. 3-306)			
The setting defines how the thermal overload protection function will continue to operate in the event of faulty coolant temperature acquisition. User can select between *Default temp. value*, *Last meas.temperat.* and *Blocking*.							

Unbalance protection

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
I2>: Enable PSx				018 220	018 221	018 222	018 223
0: No				Fig. 3-243, (p. 3-314)			
This setting defines the parameter subset in which unbalance protection is enabled.							
I2>: Ineg> PSx				018 091	018 224	018 225	018 226
0.30	0.02	0.80	Inom	Fig. 3-244, (p. 3-315)			
Setting for the operate value of the first overcurrent stage.							
I2>: Ineg>> PSx				018 092	018 227	018 228	018 229
Blocked	0.02	0.80	Inom	Fig. 3-244, (p. 3-315)			
Setting for the operate value of the second overcurrent stage.							
I2>: tIneg> PSx				018 093	018 230	018 231	018 232
4.00	0.00	100.00	s	Fig. 3-244, (p. 3-315)			
Setting for the operate delay of the first overcurrent stage.							
I2>: tIneg>> PSx				018 094	018 233	018 234	018 235
Blocked	0.00	100.00	s	Fig. 3-244, (p. 3-315)			
Setting for the operate delay of the second overcurrent stage.							

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**

Time-voltage protection

V<>: Enable PSx				076 246	077 246	078 246	079 246
0: No				Fig. 3-245, (p. 3-316)			

This setting defines the parameter subset in which time-voltage protection is enabled.

V<>: Operating mode PSx				076 001	077 001	078 001	079 001
1: Delta				Fig. 3-247, (p. 3-318)			

This setting specifies whether the phase-to-ground voltages ('*Star*' operating mode) or the phase-to-phase voltages ('*Delta*' operating mode) will be monitored.

Note: In the settings for the operate values of the time-voltage protection function, the reference quantity is V_{nom} in the *Delta* operating mode, but $V_{nom}/\sqrt{3}$ in the *Star* operating mode.

To work out the settings for the over/undervoltage stages, consider the following example for V_{nom} = 100 V:

Setting in the *Delta* operating mode for an operate value of 80 V (phase-to-phase):

$$\text{Setting value} = \frac{\text{operate value}}{V_{\text{nom}}} = \frac{80\text{V}}{100\text{V}} = 0.80$$

Setting in the *Star* operating mode for an operate value of 46.2 V (phase-to-phase):

$$\text{Setting value} = \frac{\text{operate value}}{\frac{V_{\text{nom}}}{\sqrt{3}}} = \frac{46.2\text{V}}{\frac{100\text{V}}{\sqrt{3}}} = \frac{46.2\text{V}\cdot\sqrt{3}}{100\text{V}} = 0.80$$

V<>: V> PSx				076 003	077 003	078 003	079 003
1.10	0.20	1.50	Vnom(/√3)	Fig. 3-248, (p. 3-319)			

Setting for operate value V>.

V<>: V>> PSx				076 004	077 004	078 004	079 004
1.10	0.20	1.50	Vnom(/√3)	Fig. 3-248, (p. 3-319)			

Setting for operate value V>>.

V<>: V>>> PSx				011 075	011 076	011 077	011 078
1.10	0.20	1.50	Vnom(/√3)	Fig. 3-249, (p. 3-320)			

Setting for operate value V>>>.

V<>: tV> PSx				076 005	077 005	078 005	079 005
1.00	0.00	100.00	s	Fig. 3-248, (p. 3-319)			

Setting for the operate delay of overvoltage stage V>.

Parameter					Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**				
V<>: tV>> PSx					076 006	077 006	078 006	079 006
1.00	0.00	100.00	s	Fig. 3-248, (p. 3-319)				
Setting for the operate delay of overvoltage stage V>>.								
V<>: tV>>> PSx					011 079	011 080	011 081	011 082
1.00	0.00	100.00	s	Fig. 3-249, (p. 3-320)				
Setting for the operate delay of overvoltage stage V>>>.								
V<>: tV> 3-pole PSx					076 027	077 027	078 027	079 027
1.00	0.00	100.00	s	Fig. 3-248, (p. 3-319)				
Setting for the operate delay of overvoltage stage V> when all three trigger stages are activated.								
V<>: tV>> 3-pole PSx					011 092	011 094	011 095	011 096
1.00	0.00	100.00	s	Fig. 3-248, (p. 3-319)				
Setting for the operate delay of overvoltage stage V>> when all three trigger stages are activated.								
V<>: tV>>> 3-pole PSx					011 099	011 105	011 117	011 118
1.00	0.00	100.00	s	Fig. 3-249, (p. 3-320)				
Setting for the operate delay of overvoltage stage V>>> when all three trigger stages are activated.								
V<>: V< PSx					076 007	077 007	078 007	079 007
0.80	0.20	1.50	Vnom(/√3)	Fig. 3-250, (p. 3-321)				
Setting for operate value V<.								
V<>: V<< PSx					076 008	077 008	078 008	079 008
0.80	0.20	1.50	Vnom(/√3)	Fig. 3-250, (p. 3-321)				
Setting for operate value V<<.								
V<>: V<<< PSx					011 083	011 084	011 085	011 086
0.80	0.20	1.50	Vnom(/√3)	Fig. 3-251, (p. 3-322)				
Setting for operate value V<<<.								
V<>: tV< PSx					076 009	077 009	078 009	079 009
1.00	0.00	100.00	s	Fig. 3-250, (p. 3-321)				
Setting for the operate delay of undervoltage stage V<.								
V<>: tV<< PSx					076 010	077 010	078 010	079 010
1.00	0.00	100.00	s	Fig. 3-250, (p. 3-321)				
Setting for the operate delay of undervoltage stage V<<.								

Parameter					Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**				
V<>: tV<<< PSx					011 088	011 089	011 090	011 091
1.00	0.00	100.00	s	Fig. 3-251, (p. 3-322)				
Setting for the operate delay of undervoltage stage V<<<.								
V<>: tV< 3-pole PSx					076 028	077 028	078 028	079 028
1.00	0.00	100.00	s	Fig. 3-250, (p. 3-321)				
Setting for the operate delay of undervoltage stage V< when all three trigger stages are activated.								
V<>: tV<< 3-pole PSx					011 119	011 124	011 125	011 126
1.00	0.00	100.00	s	Fig. 3-250, (p. 3-321)				
Setting for the operate delay of undervoltage stage V<< when all three trigger stages are activated.								
V<>: tV<<< 3-pole PSx					011 127	011 128	011 129	011 130
1.00	0.00	100.00	s	Fig. 3-251, (p. 3-322)				
Setting for the operate delay of undervoltage stage V<<< when all three trigger stages are activated.								
V<>: Vpos> PSx					076 015	077 015	078 015	079 015
1.10	0.20	1.50	Vnom/√3	Fig. 3-253, (p. 3-325)				
Setting for operate value Vpos>.								
V<>: Vpos>> PSx					076 016	077 016	078 016	079 016
1.10	0.20	1.50	Vnom/√3	Fig. 3-253, (p. 3-325)				
Setting for operate value Vpos>>.								
V<>: tVpos> PSx					076 017	077 017	078 017	079 017
1.00	0.00	100.00	s	Fig. 3-253, (p. 3-325)				
Setting for the operate delay of overvoltage stage Vpos>.								
V<>: tVpos>> PSx					076 018	077 018	078 018	079 018
1.00	0.00	100.00	s	Fig. 3-253, (p. 3-325)				
Setting for the operate delay of overvoltage stage Vpos>>.								
V<>: Vpos< PSx					076 019	077 019	078 019	079 019
0.80	0.20	1.50	Vnom/√3	Fig. 3-253, (p. 3-325)				
Setting for operate value Vpos<.								
V<>: Vpos<< PSx					076 020	077 020	078 020	079 020
0.80	0.20	1.50	Vnom/√3	Fig. 3-253, (p. 3-325)				
Setting for operate value Vpos<<.								

Parameter					Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**				
V<>: tVpos< PSx					076 021	077 021	078 021	079 021
1.00	0.00	100.00	s	Fig. 3-253, (p. 3-325)				
Setting for the operate delay of undervoltage stage Vpos<.								
V<>: tVpos<< PSx					076 022	077 022	078 022	079 022
1.00	0.00	100.00	s	Fig. 3-253, (p. 3-325)				
Setting for the operate delay of undervoltage stage Vpos<<.								
V<>: Vneg> PSx					076 023	077 023	078 023	079 023
Blocked	0.02	1.50	Vnom/√3	Fig. 3-254, (p. 3-326)				
Setting for operate value Vneg>.								
V<>: Vneg>> PSx					076 024	077 024	078 024	079 024
Blocked	0.02	1.50	Vnom/√3	Fig. 3-254, (p. 3-326)				
Setting for operate value Vneg>>.								
V<>: tVneg> PSx					076 025	077 025	078 025	079 025
1.00	0.00	100.00	s	Fig. 3-254, (p. 3-326)				
Setting for the operate delay of overvoltage stage Vneg>.								
V<>: tVneg>> PSx					076 026	077 026	078 026	079 026
1.00	0.00	100.00	s	Fig. 3-254, (p. 3-326)				
Setting for the operate delay of overvoltage stage Vneg>>.								
V<>: Evaluation VNG PSx					076 002	077 002	078 002	079 002
1: Calculated				Fig. 3-255, (p. 3-327)				
This setting determines which neutral-point displacement voltage will be monitored: The displacement voltage calculated by the P139 or the displacement voltage measured at the T 90 voltage transformer.								
V<>: VNG> PSx					076 011	077 011	078 011	079 011
Blocked	0.02	1.00	Vnom(/√3)	Fig. 3-256, (p. 3-327)				
Setting for operate value VNG>.								
V<>: VNG>> PSx					076 012	077 012	078 012	079 012
Blocked	0.02	1.00	Vnom(/√3)	Fig. 3-256, (p. 3-327)				
Setting for operate value VNG>>.								
V<>: tVNG> PSx					076 013	077 013	078 013	079 013
1.00	0.00	100.00	s	Fig. 3-256, (p. 3-327)				
Setting for the operate delay of overvoltage stage VNG>.								
V<>: tVNG>> PSx					076 014	077 014	078 014	079 014
1.00	0.00	100.00	s	Fig. 3-256, (p. 3-327)				
Setting for the operate delay of overvoltage stage VNG>>.								

Parameter					Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**				
V<>: Vref> PSx					007 064	007 071	007 075	007 079
1.10	0.20	1.50	Vref,nom	Fig. 3-257, (p. 3-328)				
Setting for operate value Vref>.								
V<>: Vref>> PSx					007 065	007 068	007 072	007 076
1.10	0.20	1.50	Vref,nom	Fig. 3-257, (p. 3-328)				
Setting for operate value Vref>>.								
V<>: Vref>>> PSx					010 250	010 251	010 252	010 253
1.10	0.20	1.50	Vref,nom	Fig. 3-257, (p. 3-328)				
Setting for operate value Vref>>>.								
V<>: tVref> PSx					007 066	007 069	007 073	007 077
1.00	0.00	100.00	s	Fig. 3-257, (p. 3-328)				
Setting for the operate delay of overvoltage stage Vref>.								
V<>: tVref>> PSx					007 067	007 070	007 074	007 078
1.00	0.00	100.00	s	Fig. 3-257, (p. 3-328)				
Setting for the operate delay of overvoltage stage Vref>>.								
V<>: tVref>>> PSx					010 254	010 255	011 020	011 035
1.00	0.00	100.00	s	Fig. 3-257, (p. 3-328)				
Setting for the operate delay of overvoltage stage Vref>>>.								
V<>: Vref< PSx					007 086	007 097	007 101	007 105
0.80	0.20	1.50	Vref,nom	Fig. 3-258, (p. 3-329)				
Setting for operate value Vref<.								
V<>: Vref<< PSx					007 087	007 098	007 102	007 106
0.80	0.20	1.50	Vref,nom	Fig. 3-258, (p. 3-329)				
Setting for operate value Vref<<.								
V<>: Vref<<< PSx					011 059	011 062	011 069	011 070
0.80	0.20	1.50	Vref,nom	Fig. 3-258, (p. 3-329)				
Setting for operate value Vref<<<.								
V<>: tVref< PSx					007 088	007 099	007 103	007 107
1.00	0.00	100.00	s	Fig. 3-258, (p. 3-329)				
Setting for the operate delay of undervoltage stage Vref<.								
V<>: tVref<< PSx					007 096	007 100	007 104	007 108
1.00	0.00	100.00	s	Fig. 3-258, (p. 3-329)				
Setting for the operate delay of undervoltage stage Vref<<.								

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
V<>: tVref<<< PSx				011 071	011 072	011 073	011 074
1.00	0.00	100.00	s	Fig. 3-258, (p. 3-329)			
Setting for the operate delay of overvoltage stage Vref<<<.							
V<>: Op. mode V< mon. PSx				001 162	001 163	001 164	001 165
0: Without				Fig. 3-246, (p. 3-317)			
Activation of the minimum current monitoring mode for undervoltage stage V<.							
V<>: I enable V< PSx				001 155	001 159	001 160	001 161
0.10	0.04	1.00	Inom	Fig. 3-246, (p. 3-317)			
This setting defines the threshold value of the minimum current monitoring for undervoltage stage V<.							
V<>: tTransient pulse PSx				076 029	077 029	078 029	079 029
1.00	0.00	100.00	s	Fig. 3-251, (p. 3-322)			
Setting for the time limit of the signals generated by the undervoltage stages.							
V<>: Hyst. V<> meas. PSx				076 048	077 048	078 048	079 048
2	1	10	%	Fig. 3-248, (p. 3-319) Fig. 3-249, (p. 3-320)			
Setting for the hysteresis of the trigger stages for monitoring measured voltages.							
V<>: Hyst. V<> deduc. PSx				076 049	077 049	078 049	079 049
2	1	10	%	Fig. 3-253, (p. 3-325)			
Setting for the hysteresis of the trigger stages for monitoring deduced voltages such as Vneg and VNG.							

Over-/underfrequency protection

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
f<>: Enable PSx				018 196	018 197	018 198	018 199
0: No				Fig. 3-259, (p. 3-330)			
This setting defines the parameter subset in which over-/underfrequency protection is enabled.							
f<>: Oper. mode f1 PSx				018 120	018 121	018 122	018 123
1: f				Fig. 3-261, (p. 3-333)			
f<>: Oper. mode f2 PSx				018 144	018 145	018 146	018 147
1: f							
f<>: Oper. mode f3 PSx				018 168	018 169	018 170	018 171
1: f							
f<>: Oper. mode f4 PSx				018 192	018 193	018 194	018 195
1: f							
f<>: Oper. mode f5 PSx				019 171	019 172	019 173	019 174
1: f							
Setting for the operating mode of the timer stages of over-/underfrequency protection.							
f<>: f1 PSx				018 100	018 101	018 102	018 103
49.80	40.00	70.00	Hz	Fig. 3-261, (p. 3-333)			
f<>: f2 PSx				018 124	018 125	018 126	018 127
49.80	40.00	70.00	Hz				
f<>: f3 PSx				018 148	018 149	018 150	018 151
49.80	40.00	70.00	Hz				
f<>: f4 PSx				018 172	018 173	018 174	018 175
49.80	40.00	70.00	Hz				
f<>: f5 PSx				019 151	019 152	019 153	019 154
49.80	40.00	70.00	Hz				
Setting for the frequency threshold. The over-/underfrequency protection function will operate if one of the following two conditions applies: The threshold is higher than the set nominal frequency and the frequency exceeds this threshold. The threshold is lower than the set nominal frequency and the frequency falls below this threshold. Depending on the chosen operating mode, either a signal is issued without further monitoring, or further monitoring mechanisms are started.							
f<>: tf1 PSx				018 104	018 105	018 106	018 107
0.00	0.00	10.00	s	Fig. 3-261, (p. 3-333)			
f<>: tf2 PSx				018 128	018 129	018 130	018 131
0.00	0.00	10.00	s				

Parameter / Default	Min	Max	Unit	Address / Logic Diagram			
f<>: tf3 PSx				018 152	018 153	018 154	018 155
0.00	0.00	10.00	s				
f<>: tf4 PSx				018 176	018 177	018 178	018 179
0.00	0.00	10.00	s				
f<>: tf5 PSx				019 155	019 156	019 157	019 158
0.00	0.00	10.00	s				
Setting for the operate delay of over-/underfrequency protection.							
f<>: df1/dt PSx				018 108	018 109	018 110	018 111
2.0	0.1	10.0	Hz/s	Fig. 3-261, (p. 3-333)			
f<>: df2/dt PSx				018 132	018 133	018 134	018 135
2.0	0.1	10.0	Hz/s				
f<>: df3/dt PSx				018 156	018 157	018 158	018 159
2.0	0.1	10.0	Hz/s				
f<>: df4/dt PSx				018 180	018 181	018 182	018 183
2.0	0.1	10.0	Hz/s				
f<>: df5/dt PSx				019 159	013 092	013 093	013 094
2.0	0.1	10.0	Hz/s				
Setting for the frequency gradient to be monitored. **Note:** This setting is ineffective unless operating mode *f with df/dt* has been selected.							
f<>: Delta f1 PSx				018 112	018 113	018 114	018 115
0.30	0.01	5.00	Hz	Fig. 3-261, (p. 3-333)			
f<>: Delta f2 PSx				018 136	018 137	018 138	018 139
0.30	0.01	5.00	Hz				
f<>: Delta f3 PSx				018 160	018 161	018 162	018 163
0.30	0.01	5.00	Hz				
f<>: Delta f4 PSx				018 184	018 185	018 186	018 187
0.30	0.01	5.00	Hz				
f<>: Delta f5 PSx				019 163	019 164	019 165	019 166
0.30	0.01	5.00	Hz				
Setting for Delta f. **Note:** This setting is ineffective unless operating mode *f w. Delta f/Delta t* has been selected.							
f<>: Delta t1 PSx				018 116	018 117	018 118	018 119
0.30	0.04	3.00	s	Fig. 3-261, (p. 3-333)			
f<>: Delta t2 PSx				018 140	018 141	018 142	018 143
0.30	0.04	3.00	s				

Parameter / Default	Min	Max	Unit	Address			
Default	Min	Max	Unit	Logic Diagram			
f<>: Delta t3 PSx				018 164	018 165	018 166	018 167
0.30	0.04	3.00	s				
f<>: Delta t4 PSx				018 188	018 189	018 190	018 191
0.30	0.04	3.00	s				
f<>: Delta t5 PSx				019 167	019 168	019 169	019 170
0.30	0.04	3.00	s				

Setting for Delta t.

Note: This setting is ineffective unless operating mode *f w. Delta f/Delta t* has been selected.

Underfrequency load shedding

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
Pf<: Enable PSx				015 206	015 207	015 208	015 209
0: No				Fig. 3-262, (p. 3-335)			
This setting defines the parameter subset in which underfrequency load shedding protection is enabled.							
Pf<: f1 PSx				015 211	015 212	015 221	015 222
49.20	40.00	60.00	Hz				
Pf<: f2 PSx				015 223	015 224	015 225	015 226
49.00	40.00	60.00	Hz				
Pf<: f3 PSx				015 227	015 228	015 229	015 230
48.80	40.00	60.00	Hz				
Pf<: f4 PSx				015 231	015 232	015 233	015 234
48.60	40.00	60.00	Hz				
Pf<: f5 PSx				015 235	015 236	015 237	015 238
48.40	40.00	60.00	Hz				
Pf<: f6 PSx				015 239	015 240	015 241	015 242
48.20	40.00	60.00	Hz				
Pf<: f7 PSx				015 243	015 244	015 245	015 246
48.00	40.00	60.00	Hz				
Pf<: f8 PSx				015 247	015 248	015 249	015 250
48.00	40.00	60.00	Hz				
Pf<: f9 PSx				015 251	015 252	015 253	015 254
48.00	40.00	60.00	Hz				
Pf<: f10 PSx				015 255	016 001	016 002	016 003
48.00	40.00	60.00	Hz				
Setting for the frequency threshold.							
Pf<: tPF< PSx				016 004	016 005	016 006	016 007
0.00	0.00	10.00	s	Fig. 3-265, (p. 3-338)			
Setting for the operate delay of underfrequency load shedding protection.							
Pf<: Direction Pmin PSx				016 008	016 009	016 010	016 011
0: Forward directional							
This setting defines the active power direction.							
Pf<: Pmin PSx				016 012	016 016	016 020	016 021
0.050	0.000	0.100	Snom	Fig. 3-265, (p. 3-338)			
The setting defines the threshold of maximum active power for allowing tripping in case of underfrequency threshold is reached.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
Pf<: hysteresis Pmin PSx				016 217	016 218	016 219	016 220
0.010	0.001	0.010	Snom				
Setting for the hysteresis of the active power threshold.							
Pf<: Imin PSx				016 022	016 023	016 024	016 025
0.050	0.010	0.500	Inom	Fig. 3-265, (p. 3-338)			
The setting defines the minimum current to release active power measurement.							
Pf<: Sector angle PSx				016 026	016 027	016 028	016 029
5.0	0.0	10.0	°	Fig. 3-265, (p. 3-338)			
The setting defines the angle to provide stability under high active power condition.							

Power directional protection

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
P<>: Enabled PSx				014 252	014 253	014 254	014 255
0: No				Fig. 3-266, (p. 3-339)			
This setting defines the parameter subset in which power directional protection is enabled.							
P<>: Start w. Direct. PSx				021 074	021 075	021 076	021 077
0: No				Fig. 3-268, (p. 3-341) Fig. 3-270, (p. 3-343) Fig. 3-272, (p. 3-345) Fig. 3-275, (p. 3-348)			
Setting for start with or without direction.							
P<>: P> PSx				017 120	017 200	017 201	017 202
0.500	0.010	1.500	Snom	Fig. 3-268, (p. 3-341)			
Setting for the operate value P> for the active power.							
P<>: Operate delay P> PSx				017 128	017 129	017 130	017 131
0.10	0.00	100.00	s	Fig. 3-268, (p. 3-341)			
Setting for the operate delay of stage P>.							
P<>: Release delay P> PSx				017 132	017 133	017 134	017 135
0.00	0.00	100.00	s	Fig. 3-268, (p. 3-341)			
Setting for the release delay of stage P>.							
P<>: Direction P> PSx				017 136	017 137	017 138	017 139
1: Forward directional				Fig. 3-268, (p. 3-341) Fig. 3-269, (p. 3-342)			
This setting of the measuring direction determines whether a P>> trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.							
P<>: Diseng. ratio P> PSx				017 124	017 125	017 126	017 127
0.95	0.05	0.95		Fig. 3-268, (p. 3-341)			
Setting for the disengaging ratio of operate value P> of active power.							
P<>: P>> PSx				017 140	017 141	017 142	017 143
0.500	0.010	1.500	Snom	Fig. 3-268, (p. 3-341)			
Setting for the operate value P>> for the active power.							
P<>: Operate delay P>>PSx				017 148	017 149	017 150	017 151
Blocked	0.00	100.00	s	Fig. 3-268, (p. 3-341)			
Setting for the operate delay of stage P>>.							

Parameter					Address		
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
P<>: Release delay P>>PSx				017 152	017 153	017 154	017 155
0.00	0.00	100.00	s	Fig. 3-268, (p. 3-341)			
Setting for the release delay of stage P>>.							
P<>: Direction P>> PSx				017 156	017 157	017 158	017 159
1: Forward directional				Fig. 3-268, (p. 3-341) Fig. 3-269, (p. 3-342)			
This setting of the measuring direction determines whether a P>> trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.							
P<>: Diseng. ratio P>>PSx				017 144	017 145	017 146	017 147
0.95	0.05	0.95		Fig. 3-268, (p. 3-341)			
Setting for the disengaging ratio of operate value P>> of active power.							
P<>: Q> PSx				017 160	017 161	017 162	017 163
0.500	0.010	1.500	Snom	Fig. 3-270, (p. 3-343)			
Setting for the operate value Q> of the reactive power.							
P<>: Operate delay Q> PSx				017 168	017 169	017 170	017 171
Blocked	0.00	100.00	s	Fig. 3-270, (p. 3-343)			
Setting for the operate delay of stage Q>.							
P<>: Release delay Q> PSx				017 172	017 173	017 174	017 175
0.00	0.00	100.00	s	Fig. 3-270, (p. 3-343)			
Setting for the release delay of stage Q>.							
P<>: Direction Q> PSx				017 176	017 177	017 178	017 179
1: Forward directional				Fig. 3-270, (p. 3-343) Fig. 3-271, (p. 3-344)			
This setting of the measuring direction determines whether a Q> trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.							
P<>: Diseng. ratio Q> PSx				017 164	017 165	017 166	017 167
0.95	0.05	0.95		Fig. 3-270, (p. 3-343)			
Setting for the disengaging ratio of operate value Q> of reactive power.							
P<>: Q>> PSx				017 180	017 181	017 182	017 183
0.500	0.010	1.500	Snom	Fig. 3-270, (p. 3-343)			
Setting for the operate value Q>> of the reactive power.							
P<>: Operate delay Q>>PSx				017 188	017 189	017 190	017 191
Blocked	0.00	100.00	s	Fig. 3-270, (p. 3-343)			
Setting for the operate delay of stage Q>>.							

Parameter / Default	Min	Max	Unit	Address / Logic Diagram
P<>: Release delay Q>>PSx				017 192 · 017 193 · 017 194 · 017 195
0.00	0.00	100.00	s	Fig. 3-270, (p. 3-343)
Setting for the release delay of stage Q>>.				
P<>: Direction Q>> PSx				017 196 · 017 197 · 017 198 · 017 199
1: Forward directional				Fig. 3-270, (p. 3-343) Fig. 3-271, (p. 3-344)
This setting of the measuring direction determines whether a Q>> trip signal will be issued for forward, backward or non-directional fault decisions.				
P<>: Diseng. ratio Q>>PSx				017 184 · 017 185 · 017 186 · 017 187
0.95	0.05	0.95		Fig. 3-270, (p. 3-343)
Setting for the disengaging ratio of operate value Q>> of reactive power.				
P<>: P< PSx				017 030 · 017 031 · 017 032 · 017 033
0.500	0.010	0.500	Snom	Fig. 3-272, (p. 3-345)
Setting the operate value P< for the active power.				
P<>: Operate delay P< PSx				017 060 · 017 061 · 017 062 · 017 063
0.10	0.00	100.00	s	Fig. 3-272, (p. 3-345)
Setting for the operate delay of stage P<.				
P<>: Release delay P< PSx				017 226 · 017 227 · 017 228 · 017 229
0.00	0.00	100.00	s	Fig. 3-272, (p. 3-345)
Setting for the release delay (reset time) of stage P<.				
P<>: Direction P< PSx				017 230 · 017 231 · 017 232 · 017 233
1: Forward directional				Fig. 3-272, (p. 3-345) Fig. 3-273, (p. 3-346)
This setting of the measuring direction determines whether a P< trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.				
P<>: Diseng. ratio P< PSx				017 034 · 017 035 · 017 036 · 017 037
1.05	1.05	20.00		Fig. 3-272, (p. 3-345)
Setting for the disengaging ratio of operate value P< of active power.				
P<>: P<< PSx				017 234 · 017 235 · 017 236 · 017 237
0.500	0.010	0.500	Snom	Fig. 3-272, (p. 3-345)
Setting for operate value P<< of active power.				
P<>: Operate delay P<<PSx				017 242 · 017 243 · 017 244 · 017 245
Blocked	0.00	100.00	s	Fig. 3-272, (p. 3-345)
Setting for the operate delay of stage P<<.				

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
P<>: Release delay P<<PSx				017 246	017 247	017 248	017 249
0.00	0.00	100.00	s	Fig. 3-272, (p. 3-345)			
Setting for the release delay (reset time) of stage P<<.							
P<>: Direction P<< PSx				017 250	017 251	017 252	017 253
1: Forward directional				Fig. 3-272, (p. 3-345) Fig. 3-273, (p. 3-346)			
This setting of the measuring direction determines whether a P<< trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.							
P<>: Diseng.ratio P<< PSx				017 238	017 239	017 240	017 241
1.05	1.05	20.00		Fig. 3-272, (p. 3-345)			
Setting for the disengaging ratio of operate value P<< of active power.							
P<>: Q< PSx				018 035	018 036	018 037	018 038
0.500	0.010	0.500	Snom	Fig. 3-275, (p. 3-348)			
Setting for operate value Q< of reactive power.							
P<>: Operate delay Q< PSx				018 052	018 053	018 054	018 055
Blocked	0.00	100.00	s	Fig. 3-275, (p. 3-348)			
Setting for the operate delay of stage Q<.							
P<>: Release delay Q< PSx				018 056	018 057	018 058	018 059
0.00	0.00	100.00	s	Fig. 3-275, (p. 3-348)			
Setting for the release delay (reset time) of stage Q<.							
P<>: Direction Q< PSx				018 081	018 082	018 083	018 084
1: Forward directional				Fig. 3-275, (p. 3-348) Fig. 3-276, (p. 3-349)			
This setting of the measuring direction determines whether a Q< trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.							
P<>: Diseng. ratio Q< PSx				018 044	018 045	018 046	018 047
1.05	1.05	20.00		Fig. 3-275, (p. 3-348)			
Setting for the disengaging ratio of operate value Q< of reactive power.							
P<>: Q<< PSx				018 085	018 086	018 087	018 088
0.500	0.010	0.500	Snom	Fig. 3-275, (p. 3-348)			
Setting for operate value Q<< of reactive power.							
P<>: Operate delay Q<<PSx				018 213	018 214	018 215	018 216
Blocked	0.00	100.00	s	Fig. 3-275, (p. 3-348)			
Setting for the operate delay of stage Q<<.							

Parameter								Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**				
P<>: Release delay Q<<PSx					018 236	018 237	018 238	018 239
0.00	0.00	100.00	s	Fig. 3-275, (p. 3-348)				
Setting for the release delay (reset time) of stage Q<<.								
P<>: Direction Q<< PSx					018 242	018 243	018 244	018 245
1: Forward directional				Fig. 3-275, (p. 3-348) Fig. 3-276, (p. 3-349)				
This setting of the measuring direction determines whether a Q<< trip signal will be issued for forward, backward (reverse) or non-directional fault decisions.								
P<>: Diseng.ratio Q<< PSx					018 095	018 096	018 097	018 098
1.05	1.05	20.00		Fig. 3-275, (p. 3-348)				
Setting for the disengaging ratio of operate value Q<< of reactive power.								
P<>: tTransient pulse PSx					018 246	018 247	018 248	018 249
1.00	0.00	100.00	s	Fig. 3-272, (p. 3-345) Fig. 3-275, (p. 3-348)				
Setting for the time limit of the signals generated by stages P<, P<<, Q< and Q<< after the respective operate delays have elapsed.								

Voltage controlled directional reactive power protection

Parameter				Address			
Default	**Min**	**Max**	**Unit**	**Logic Diagram**			
QV: Enabled PSx				013 223	013 224	013 225	013 226
0: No				Fig. 3-280, (p. 3-352) Fig. 3-281, (p. 3-352)			
This setting defines the parameter subset in which QV protection is enabled.							
QV: V< PSx				013 231	013 232	013 233	013 234
0.85	0.20	1.50	Vnom				
The setting defines the phase-phase undervoltage threshold. The funcation operates when all three phase-phase voltages drop below the set threshold (AND combination).							
QV: hysteresis V< PSx				014 079	014 080	014 081	014 082
2	1	10	%				
Setting for the hysteresis of the undervoltage threshold of QV function.							
QV: Direction Q PSx				013 227	013 228	013 229	013 230
0: Forward directional							
This setting defines the reactive power direction.							
QV: Qmin PSx				014 084	014 085	014 086	014 087
0.050	0.000	0.100	Snom				
The setting defines the threshold of maximum reactive power for allowing tripping in case of undevoltage threshold is reached.							
QV: hysteresis Qmin PSx				016 213	016 214	016 215	016 216
0.010	0.001	0.010	Snom				
Setting for the hysteresis of the reactive power threshold.							
QV: Sector angle PSx				013 235	013 236	013 237	013 238
3.0	0.0	6.0	°				
The setting defines the angle to provide stability under high active power condition.							
QV: Imin PSx				013 243	013 244	013 245	013 246
0.100	0.020	0.200	Inom				
The setting defines the minimum current to release reactive power measurement.							
QV: t1 PSx				013 247	013 248	013 249	013 250
0.50	0.10	10.00	s	Fig. 3-283, (p. 3-354)			
QV: t2 PSx				013 251	013 252	013 253	013 254
1.50	0.10	10.00	s	Fig. 3-283, (p. 3-354)			
Setting for the first or second operate time, respectively.							

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
QV: Min.dur.tr.cmd.1 PSx				014 065	014 066	014 067	014 068
0.50	0.10	10.00	s	Fig. 3-283, (p. 3-354)			
Setting for the minimum pulse time of the first trip command.							
QV: Min.dur.tr.cmd.2 PSx				014 069	014 070	014 071	014 072
1.50	0.10	10.00	s	Fig. 3-283, (p. 3-354)			
Setting for the minimum pulse time of the second trip command.							

7.1.3.4 Control

Local control panel

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
LOC: SI request							221 118
0: No							
This setting defines whether or not the check of the interlock equations, that is carried out with the local control of switchgear units, also includes a check of station interlocking.							

Main function

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MAIN: BI active USER				221 003
1: Yes				Fig. 3-327, (p. 3-399)
Enabling the bay interlocking function from the local control panel.				
MAIN: SI active USER				221 002
0: No				Fig. 3-327, (p. 3-399)
Enabling the station interlocking function from the local control panel.				
MAIN: Inp.asg. fct.block.1				221 014
060 000: MAIN: Without function				Fig. 3-70, (p. 3-103)
MAIN: Inp.asg. fct.block.2				221 022
060 000: MAIN: Without function				Fig. 3-70, (p. 3-103)
Definition of the binary signals assigned to function block 1 and 2.				
MAIN: Op. delay fct. block				221 029
0	0	60	s	Fig. 3-70, (p. 3-103)
Setting for the operate delay of the function blocks.				
MAIN: Perm.No.mot.drive op				221 027
15	1	20		Fig. 3-340, (p. 3-416)
Setting for the permissible motor drive operations within the time interval defined at **MAIN: Mon.time mot.drives**.				
MAIN: Mon.time mot.drives				221 026
15	1	20	min	Fig. 3-340, (p. 3-416)
Setting for the monitoring time to monitor the number of motor drives.				
MAIN: Cool.time mot.drives				221 028
3	0	10	min	Fig. 3-340, (p. 3-416)
Setting for the cooling time for motors in motor-operated switchgear.				
MAIN: Mon.time Dir.Contr.				221 060
0.10	0.01	2.00	s	Fig. 3-343, (p. 3-420) Fig. 3-344, (p. 3-421)
Setting for the monitoring time for the motor relay.				
MAIN: CB1 max. oper. cap.				221 084
1	1	99		
MAIN: CB2 max. oper. cap.				221 088
1	1	99		
Setting for the maximum number of CB operations for an ARC cycle (or for a limited time period).				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: CB1 ready fct.assign					221 085
060 000: MAIN: Without function					
Selecting the event which, when present, will initialize the counter at **MAIN: CB1 act. oper. cap.** with the value at **MAIN: CB1 max. oper. cap.**.					
MAIN: CB2 ready fct.assign					221 089
060 000: MAIN: Without function					
Selecting the event which, when present, will initialize the counter at **MAIN: CB1 act. oper. cap.** (or **MAIN: CB2 act. oper. cap.**) with the value at **MAIN: CB1 max. oper. cap.** (or **MAIN: CB2 max. oper. cap.**, respectively).					
MAIN: DC op. delay t1					221 240
0.10	0.00	2.00	s	Fig. 3-345, (p. 3-423) Fig. 3-346, (p. 3-423) Fig. 3-347, (p. 3-424)	
Setting the delay of the commands CMD_DC1, CMD_DC2 and CMD_DC3.					
MAIN: DC1 impulse t2					221 241
1.50	0.00	20.00	s	Fig. 3-345, (p. 3-423)	
Setting the maximum duration of the command CMD_DC1.					
MAIN: DC2/3 release delay					221 242
0.10	0.01	2.00	s	Fig. 3-346, (p. 3-423) Fig. 3-347, (p. 3-424)	
Setting the delay of the termination of the commands CMD_DC2 and CMD_DC3.					
MAIN: W. ext. cmd. termin.					221 063
0: No					
This setting determines if bay types, defined for direct motor control, can be used together with external termination contacts to directly influence the control process of motor driven switchgear.					
MAIN: Cmd.end f. DC fail.					221 111
1: Yes				Fig. 3-342, (p. 3-419)	
In the case of direct motor control by motor relay K200, this parameter can be set to *Yes* or *No*. If the K200 contacts should not have opened until the end of the command to the motor when the set monitoring time-delay had expired (monitoring via binary signal input –U 706, signal **SIG_1: Signal S012 EXT** as the standard setting) then the direction control contacts are opened if this parameter is set to *Yes*. If this parameter is set to *No* then respective fault signals (**MAIN: DC fail. cmd. End**, **MAIN: DC fail. cmd.start**, **MAIN: DEV op.time exceeded**) are issued when the monitoring time-delay has expired and the direction control contacts will remain closed. (Note: This behavior still bears the danger of an undefined switch position!)					

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
MAIN: ext.cmd.term. w/o PI							221 115
1: Yes				Fig. 3-347, (p. 3-424)			

Select whether the command CMD_DC3 shall be terminated only by the signal SIG_DC3, or with positive indication of the final switchgear position as well.

(Note that in either case, the termination of CMD_DC3 is delayed by the setting **MAIN: DC2/3 release delay**.)

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV01: Designat. ext. dev.				210 000
0: Not assigned				
DEV02: Designat. ext. dev.				210 050
0: Not assigned				
DEV03: Designat. ext. dev.				210 100
0: Not assigned				
DEV04: Designat. ext. dev.				210 150
0: Not assigned				
DEV05: Designat. ext. dev.				210 200
0: Not assigned				
DEV06: Designat. ext. dev.				211 000
0: Not assigned				
DEV07: Designat. ext. dev.				211 050
0: Not assigned				
DEV08: Designat. ext. dev.				211 100
0: Not assigned				
DEV09: Designat. ext. dev.				211 150
0: Not assigned				
DEV10: Designat. ext. dev.				211 200
0: Not assigned				
Setting for the designation of the respective external device. Either one of the pre-defined designations or the term *Device Name User* may be selected. In the latter case any text (max 4 characters) may be entered at **DEV01: DEV-Name User** that will be used as the devices' designation. (The same holds for DEV02 etc.)				
DEV01: DEV-Name User				218 101
0:				
DEV02: DEV-Name User				218 102
0:				
DEV03: DEV-Name User				218 103
0:				
DEV04: DEV-Name User				218 104
0:				
DEV05: DEV-Name User				218 105
0:				
DEV06: DEV-Name User				218 106
0:				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DEV07: DEV-Name User				218 107
0:				
DEV08: DEV-Name User				218 108
0:				
DEV09: DEV-Name User				218 109
0:				
DEV10: DEV-Name User				218 110
0:				

Any text (max. 4 characters) may be entered as the devices' name which will then be used as the designation, if the associated parameter **DEV01: Designat. ext. dev.** has been set to *Device Name User*. When instead one of the pre-defined designations is selected at **DEV01: Designat. ext. dev.** it will be used and **DEV01: DEV-Name User** is ignored. A designation with more than 4 characters is internally truncated. (The same holds for DEV02 etc.)

Parameter				Address
DEV01: Oper. mode cmd.				210 024
3: Time control				Fig. 3-335, (p. 3-409)
DEV02: Oper. mode cmd.				210 074
3: Time control				
DEV03: Oper. mode cmd.				210 124
3: Time control				
DEV04: Oper. mode cmd.				210 174
3: Time control				
DEV05: Oper. mode cmd.				210 224
3: Time control				
DEV06: Oper. mode cmd.				211 024
3: Time control				
DEV07: Oper. mode cmd.				211 074
3: Time control				
DEV08: Oper. mode cmd.				211 124
3: Time control				
DEV09: Oper. mode cmd.				211 174
3: Time control				
DEV10: Oper. mode cmd.				211 224
3: Time control				

Selecting the operating mode of the command from long command, short command or time control.

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV01: Latching time					210 005
0.00	0.00	5.00	s	Fig. 3-331, (p. 3-405) Fig. 3-338, (p. 3-414) Fig. 3-339, (p. 3-414) Fig. 3-343, (p. 3-420) Fig. 3-344, (p. 3-421)	
DEV02: Latching time					210 055
0.00	0.00	5.00	s		
DEV03: Latching time					210 105
0.00	0.00	5.00	s		
DEV04: Latching time					210 155
0.00	0.00	5.00	s		
DEV05: Latching time					210 205
0.00	0.00	5.00	s		
DEV06: Latching time					211 005
0.00	0.00	5.00	s		
DEV07: Latching time					211 055
0.00	0.00	5.00	s		
DEV08: Latching time					211 105
0.00	0.00	5.00	s		
DEV09: Latching time					211 155
0.00	0.00	5.00	s		
DEV10: Latching time					211 205
0.00	0.00	5.00	s		
Setting for the time that a control command is sustained after a switchgear position signal – “Open” or “Closed” – has been received.					
DEV01: Op.time switch. dev.					210 004
20	0	254	s	Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412) Fig. 3-338, (p. 3-414) Fig. 3-343, (p. 3-420)	
DEV02: Op.time switch. dev.					210 054
20	0	254	s		
DEV03: Op.time switch. dev.					210 104
20	0	254	s		
DEV04: Op.time switch. dev.					210 154
20	0	254	s		
DEV05: Op.time switch. dev.					210 204
20	0	254	s		

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DEV06: Op.time switch. dev.				211 004
20	0	254	s	
DEV07: Op.time switch. dev.				211 054
20	0	254	s	
DEV08: Op.time switch. dev.				211 104
20	0	254	s	
DEV09: Op.time switch. dev.				211 154
20	0	254	s	
DEV10: Op.time switch. dev.				211 204
20	0	254	s	
Setting the operating time for switchgear (switching device).				
DEV01: Gr. assign. debounc.				210 011
1: Group 1				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)
DEV02: Gr. assign. debounc.				210 061
1: Group 1				
DEV03: Gr. assign. debounc.				210 111
1: Group 1				
DEV04: Gr. assign. debounc.				210 161
1: Group 1				
DEV05: Gr. assign. debounc.				210 211
1: Group 1				
DEV06: Gr. assign. debounc.				211 011
1: Group 1				
DEV07: Gr. assign. debounc.				211 061
1: Group 1				
DEV08: Gr. assign. debounc.				211 111
1: Group 1				
DEV09: Gr. assign. debounc.				211 161
1: Group 1				
DEV10: Gr. assign. debounc.				211 211
1: Group 1				
Assigning the external device to one of eight groups for debouncing and chatter suppression.				
DEV01: StartCmdTime superv.				210 007
Blocked	0.1	10.0	s	Fig. 3-337, (p. 3-412)
DEV02: StartCmdTime superv.				210 057
Blocked	0.1	10.0	s	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV03: StartCmdTime superv.				210 107
Blocked	0.1	10.0	s	
DEV04: StartCmdTime superv.				210 157
Blocked	0.1	10.0	s	
DEV05: StartCmdTime superv.				210 207
Blocked	0.1	10.0	s	
DEV06: StartCmdTime superv.				211 007
Blocked	0.1	10.0	s	
DEV07: StartCmdTime superv.				211 057
Blocked	0.1	10.0	s	
DEV08: StartCmdTime superv.				211 107
Blocked	0.1	10.0	s	
DEV09: StartCmdTime superv.				211 157
Blocked	0.1	10.0	s	
DEV10: StartCmdTime superv.				211 207
Blocked	0.1	10.0	s	

This parameter allows for defining a monitoring timer for the begin of a switch command.

After sending an Open / Close command, the corresponding timer starts. If the switchgear unit has not reached its intermediate position after this time has elapsed then the command is deactivated and **MAIN: Startcmdtime exceed.** is signaled.

In the default setting *blocked* this monitoring is switched off. This is recommended for switchgear units for which it is impossible to detect the intermediate position.

DEV01: Interm. pos. suppr.				210 012
0: No				
DEV02: Interm. pos. suppr.				210 062
0: No				
DEV03: Interm. pos. suppr.				210 112
0: No				
DEV04: Interm. pos. suppr.				210 162
0: No				
DEV05: Interm. pos. suppr.				210 212
0: No				
DEV06: Interm. pos. suppr.				211 012
0: No				
DEV07: Interm. pos. suppr.				211 062
0: No				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV08: Interm. pos. suppr.					211 112
0: No					
DEV09: Interm. pos. suppr.					211 162
0: No					
DEV10: Interm. pos. suppr.					211 212
0: No					
This setting determines whether the “intermediate position” signal will be suppressed or not, while the switchgear is operating.					
DEV01: Stat.ind.interm.pos.					210 027
0: No				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)	
DEV02: Stat.ind.interm.pos.					210 077
0: No					
DEV03: Stat.ind.interm.pos.					210 127
0: No					
DEV04: Stat.ind.interm.pos.					210 177
0: No					
DEV05: Stat.ind.interm.pos.					210 227
0: No					
DEV06: Stat.ind.interm.pos.					211 027
0: No					
DEV07: Stat.ind.interm.pos.					211 077
0: No					
DEV08: Stat.ind.interm.pos.					211 127
0: No					
DEV09: Stat.ind.interm.pos.					211 177
0: No					
DEV10: Stat.ind.interm.pos.					211 227
0: No					
This setting determines whether the actual status will be signaled with a 5 s delay after the “Faulty position” signal is issued.					
DEV01: Inp.asg. sw.tr. plug					210 014
060 000: MAIN: Without function				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)	
DEV02: Inp.asg. sw.tr. plug					210 064
060 000: MAIN: Without function					
DEV03: Inp.asg. sw.tr. plug					210 114
060 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV04: Inp.asg. sw.tr. plug				210 164
060 000: MAIN: Without function				
DEV05: Inp.asg. sw.tr. plug				210 214
060 000: MAIN: Without function				
DEV06: Inp.asg. sw.tr. plug				211 014
060 000: MAIN: Without function				
DEV07: Inp.asg. sw.tr. plug				211 064
060 000: MAIN: Without function				
DEV08: Inp.asg. sw.tr. plug				211 114
060 000: MAIN: Without function				
DEV09: Inp.asg. sw.tr. plug				211 164
060 000: MAIN: Without function				
DEV10: Inp.asg. sw.tr. plug				211 214
060 000: MAIN: Without function				
Definition of the binary signal that is used to signal the position (“plugged-in” / “unplugged”) of the switch truck plug.				
DEV01: With gen. trip cmd.1				210 021
0: No				Fig. 3-334, (p. 3-408)
DEV02: With gen. trip cmd.1				210 071
0: No				
DEV03: With gen. trip cmd.1				210 121
0: No				
DEV04: With gen. trip cmd.1				210 171
0: No				
DEV05: With gen. trip cmd.1				210 221
0: No				
DEV06: With gen. trip cmd.1				211 021
0: No				
DEV07: With gen. trip cmd.1				211 071
0: No				
DEV08: With gen. trip cmd.1				211 121
0: No				
DEV09: With gen. trip cmd.1				211 171
0: No				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV10: With gen. trip cmd.1					211 221
0: No					

This setting specifies whether the circuit breaker will be opened by “general trip command 1” of the protection function.

Note: This setting is only visible (active) for external devices that are defined as “circuit breakers”. This definition is included in the bay type definitions.

DEV01: With gen. trip cmd.2					210 022
0: No				Fig. 3-334, (p. 3-408)	
DEV02: With gen. trip cmd.2					210 072
0: No					
DEV03: With gen. trip cmd.2					210 122
0: No					
DEV04: With gen. trip cmd.2					210 172
0: No					
DEV05: With gen. trip cmd.2					210 222
0: No					
DEV06: With gen. trip cmd.2					211 022
0: No					
DEV07: With gen. trip cmd.2					211 072
0: No					
DEV08: With gen. trip cmd.2					211 122
0: No					
DEV09: With gen. trip cmd.2					211 172
0: No					
DEV10: With gen. trip cmd.2					211 222
0: No					

This setting specifies whether the circuit breaker will be opened by “general trip command 2” of the protection function.

Note: This setting is only visible (active) for external devices that are defined as “circuit breakers”. This definition is included in the bay type definitions.

DEV01: With close cmd./prot					210 023
0: No				Fig. 3-334, (p. 3-408)	
DEV02: With close cmd./prot					210 073
0: No					
DEV03: With close cmd./prot					210 123
0: No					
DEV04: With close cmd./prot					210 173
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV05: With close cmd./prot					210 223
0: No					
DEV06: With close cmd./prot					211 023
0: No					
DEV07: With close cmd./prot					211 073
0: No					
DEV08: With close cmd./prot					211 123
0: No					
DEV09: With close cmd./prot					211 173
0: No					
DEV10: With close cmd./prot					211 223
0: No					
This setting specifies whether the circuit breaker will be closed by the “close command” of the protection function. **Note:** This setting is only visible (active) for external devices that are defined as “circuit breakers”. This definition is included in the bay type definitions.					
DEV01: Inp.asg.el.ctrl.open					210 019
060 000: MAIN: Without function				Fig. 3-331, (p. 3-405)	
DEV02: Inp.asg.el.ctrl.open					210 069
060 000: MAIN: Without function					
DEV03: Inp.asg.el.ctrl.open					210 119
060 000: MAIN: Without function					
DEV04: Inp.asg.el.ctrl.open					210 169
060 000: MAIN: Without function					
DEV05: Inp.asg.el.ctrl.open					210 219
060 000: MAIN: Without function					
DEV06: Inp.asg.el.ctrl.open					211 019
060 000: MAIN: Without function					
DEV07: Inp.asg.el.ctrl.open					211 069
060 000: MAIN: Without function					
DEV08: Inp.asg.el.ctrl.open					211 119
060 000: MAIN: Without function					
DEV09: Inp.asg.el.ctrl.open					211 169
060 000: MAIN: Without function					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV10: Inp.asg.el.ctrl.open					211 219
060 000: MAIN: Without function					
This setting defines the binary signal that will be used as the control signal to move the switchgear unit to the open position. **Note:** Only signals that are defined in the DEVxx function groups can be selected.					
DEV01: Inp.asg.el.ctr.close					210 020
060 000: MAIN: Without function					Fig. 3-331, (p. 3-405)
DEV02: Inp.asg.el.ctr.close					210 070
060 000: MAIN: Without function					
DEV03: Inp.asg.el.ctr.close					210 120
060 000: MAIN: Without function					
DEV04: Inp.asg.el.ctr.close					210 170
060 000: MAIN: Without function					
DEV05: Inp.asg.el.ctr.close					210 220
060 000: MAIN: Without function					
DEV06: Inp.asg.el.ctr.close					211 020
060 000: MAIN: Without function					
DEV07: Inp.asg.el.ctr.close					211 070
060 000: MAIN: Without function					
DEV08: Inp.asg.el.ctr.close					211 120
060 000: MAIN: Without function					
DEV09: Inp.asg.el.ctr.close					211 170
060 000: MAIN: Without function					
DEV10: Inp.asg.el.ctr.close					211 220
060 000: MAIN: Without function					
This setting defines the binary signal that will be used as the control signal to move the switchgear unit to the “Closed” position. **Note:** Only signals that are defined in the DEVxx function groups can be selected.					
DEV01: Block cmd open					218 120
060 000: MAIN: Without function					Fig. 3-336, (p. 3-410)
DEV02: Block cmd open					218 121
060 000: MAIN: Without function					
DEV03: Block cmd open					218 122
060 000: MAIN: Without function					
DEV04: Block cmd open					218 123
060 000: MAIN: Without function					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV05: Block cmd open					218 124
060 000: MAIN: Without function					
DEV06: Block cmd open					218 125
060 000: MAIN: Without function					
DEV07: Block cmd open					218 126
060 000: MAIN: Without function					
DEV08: Block cmd open					218 127
060 000: MAIN: Without function					
DEV09: Block cmd open					218 128
060 000: MAIN: Without function					
DEV10: Block cmd open					218 129
060 000: MAIN: Without function					
Select whether open commands for the switchgear unit shall be blocked.					
DEV01: Block cmd close					218 160
060 000: MAIN: Without function				Fig. 3-336, (p. 3-410)	
DEV02: Block cmd close					218 161
060 000: MAIN: Without function					
DEV03: Block cmd close					218 162
060 000: MAIN: Without function					
DEV04: Block cmd close					218 163
060 000: MAIN: Without function					
DEV05: Block cmd close					218 164
060 000: MAIN: Without function					
DEV06: Block cmd close					218 165
060 000: MAIN: Without function					
DEV07: Block cmd close					218 166
060 000: MAIN: Without function					
DEV08: Block cmd close					218 167
060 000: MAIN: Without function					
DEV09: Block cmd close					218 168
060 000: MAIN: Without function					
DEV10: Block cmd close					218 169
060 000: MAIN: Without function					
Select whether close commands for the switchgear unit shall be blocked.					
DEV01: Oper.count.limit					218 211
Blocked	1	65000		Fig. 3-341, (p. 3-416)	

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV02: Oper.count.limit					218 212
Blocked	1	65000			
DEV03: Oper.count.limit					218 213
Blocked	1	65000			
DEV04: Oper.count.limit					218 214
Blocked	1	65000			
DEV05: Oper.count.limit					218 215
Blocked	1	65000			
DEV06: Oper.count.limit					218 216
Blocked	1	65000			
DEV07: Oper.count.limit					218 217
Blocked	1	65000			
DEV08: Oper.count.limit					218 218
Blocked	1	65000			
DEV09: Oper.count.limit					218 219
Blocked	1	65000			
DEV10: Oper.count.limit					218 220
Blocked	1	65000			
Setting a limit value for the number of switching commands for the respective switchgear unit.					
DEV01: Inp. asg. end Open					210 015
060 000: MAIN: Without function				Fig. 3-342, (p. 3-419)	
DEV02: Inp. asg. end Open					210 065
060 000: MAIN: Without function					
DEV03: Inp. asg. end Open					210 115
060 000: MAIN: Without function					
DEV04: Inp. asg. end Open					210 165
060 000: MAIN: Without function					
DEV05: Inp. asg. end Open					210 215
060 000: MAIN: Without function					
DEV06: Inp. asg. end Open					211 015
060 000: MAIN: Without function					
DEV07: Inp. asg. end Open					211 065
060 000: MAIN: Without function					
DEV08: Inp. asg. end Open					211 115
060 000: MAIN: Without function					
DEV09: Inp. asg. end Open					211 165
060 000: MAIN: Without function					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV10: Inp. asg. end Open					211 215
060 000: MAIN: Without function					
This setting defines the binary signal that will be used to terminate the “Open” command.					
DEV01: Inp. asg. end Close					210 016
060 000: MAIN: Without function				Fig. 3-342, (p. 3-419)	
DEV02: Inp. asg. end Close					210 066
060 000: MAIN: Without function					
DEV03: Inp. asg. end Close					210 116
060 000: MAIN: Without function					
DEV04: Inp. asg. end Close					210 166
060 000: MAIN: Without function					
DEV05: Inp. asg. end Close					210 216
060 000: MAIN: Without function					
DEV06: Inp. asg. end Close					211 016
060 000: MAIN: Without function					
DEV07: Inp. asg. end Close					211 066
060 000: MAIN: Without function					
DEV08: Inp. asg. end Close					211 116
060 000: MAIN: Without function					
DEV09: Inp. asg. end Close					211 166
060 000: MAIN: Without function					
DEV10: Inp. asg. end Close					211 216
060 000: MAIN: Without function					
This setting defines the binary signal that will be used to terminate the “Close” command.					
DEV01: Open w/o stat.interl					210 025
0: No				Fig. 3-333, (p. 3-407)	
DEV02: Open w/o stat.interl					210 075
0: No					
DEV03: Open w/o stat.interl					210 125
0: No					
DEV04: Open w/o stat.interl					210 175
0: No					
DEV05: Open w/o stat.interl					210 225
0: No					
DEV06: Open w/o stat.interl					211 025
0: No					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV07: Open w/o stat.interl					211 075
0: No					
DEV08: Open w/o stat.interl					211 125
0: No					
DEV09: Open w/o stat.interl					211 175
0: No					
DEV10: Open w/o stat.interl					211 225
0: No					
This setting specifies whether switching to “Open” position is permitted without a check by the station interlock function.					
DEV01: Close w/o stat. int.					210 026
0: No					Fig. 3-333, (p. 3-407)
DEV02: Close w/o stat. int.					210 076
0: No					
DEV03: Close w/o stat. int.					210 126
0: No					
DEV04: Close w/o stat. int.					210 176
0: No					
DEV05: Close w/o stat. int.					210 226
0: No					
DEV06: Close w/o stat. int.					211 026
0: No					
DEV07: Close w/o stat. int.					211 076
0: No					
DEV08: Close w/o stat. int.					211 126
0: No					
DEV09: Close w/o stat. int.					211 176
0: No					
DEV10: Close w/o stat. int.					211 226
0: No					
This setting specifies whether switching to “Closed” position is permitted without a check by the station interlock function.					
DEV01: Fct.assig.BIwSI open					210 039
060 000: MAIN: Without function					Fig. 3-332, (p. 3-406)
DEV02: Fct.assig.BIwSI open					210 089
060 000: MAIN: Without function					
DEV03: Fct.assig.BIwSI open					210 139
060 000: MAIN: Without function					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV04: Fct.assig.BlwSI open				210 189
060 000: MAIN: Without function				
DEV05: Fct.assig.BlwSI open				210 239
060 000: MAIN: Without function				
DEV06: Fct.assig.BlwSI open				211 039
060 000: MAIN: Without function				
DEV07: Fct.assig.BlwSI open				211 089
060 000: MAIN: Without function				
DEV08: Fct.assig.BlwSI open				211 139
060 000: MAIN: Without function				
DEV09: Fct.assig.BlwSI open				211 189
060 000: MAIN: Without function				
DEV10: Fct.assig.BlwSI open				211 239
060 000: MAIN: Without function				

This setting defines which output will issue the “Open” enable to the interlocking logic when there is “bay interlock with substation interlock”.

Note: The interlock conditions for bay interlock with station interlock are included in the bay type definitions (see “List of Bay Types” in the Appendix).
If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the latter case is it necessary to change the function assignment.

Parameter				Address
DEV01: Fct.assig.BlwSI clos				210 040
060 000: MAIN: Without function			Fig. 3-332, (p. 3-406)	
DEV02: Fct.assig.BlwSI clos				210 090
060 000: MAIN: Without function				
DEV03: Fct.assig.BlwSI clos				210 140
060 000: MAIN: Without function				
DEV04: Fct.assig.BlwSI clos				210 190
060 000: MAIN: Without function				
DEV05: Fct.assig.BlwSI clos				210 240
060 000: MAIN: Without function				
DEV06: Fct.assig.BlwSI clos				211 040
060 000: MAIN: Without function				
DEV07: Fct.assig.BlwSI clos				211 090
060 000: MAIN: Without function				
DEV08: Fct.assig.BlwSI clos				211 140
060 000: MAIN: Without function				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV09: Fct.assig.BIwSI clos					211 190
060 000: MAIN: Without function					
DEV10: Fct.assig.BIwSI clos					211 240
060 000: MAIN: Without function					

This setting defines which output will issue the “Close” enable to the interlocking logic when there is “bay interlock with substation interlock”.

Note: The interlock conditions for bay interlock with station interlock are included in the bay type definitions (see “List of Bay Types” in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the latter case is it necessary to change the function assignment.

DEV01: Fct.asg.BI w/o SI op					210 041
060 000: MAIN: Without function				Fig. 3-332, (p. 3-406)	
DEV02: Fct.asg.BI w/o SI op					210 091
060 000: MAIN: Without function					
DEV03: Fct.asg.BI w/o SI op					210 141
060 000: MAIN: Without function					
DEV04: Fct.asg.BI w/o SI op					210 191
060 000: MAIN: Without function					
DEV05: Fct.asg.BI w/o SI op					210 241
060 000: MAIN: Without function					
DEV06: Fct.asg.BI w/o SI op					211 041
060 000: MAIN: Without function					
DEV07: Fct.asg.BI w/o SI op					211 091
060 000: MAIN: Without function					
DEV08: Fct.asg.BI w/o SI op					211 141
060 000: MAIN: Without function					
DEV09: Fct.asg.BI w/o SI op					211 191
060 000: MAIN: Without function					
DEV10: Fct.asg.BI w/o SI op					211 241
060 000: MAIN: Without function					

This setting defines which output will issue the “Open” enable to the interlocking logic when there is “bay interlock without substation interlock”.

Note: The interlock conditions for bay interlock without station interlock are included in the bay type definitions (see “List of Bay Types” in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the latter case is it necessary to change the function assignment.

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV01: Fct.asg.BI w/o SI cl				210 042
060 000: MAIN: Without function				Fig. 3-332, (p. 3-406)
DEV02: Fct.asg.BI w/o SI cl				210 092
060 000: MAIN: Without function				
DEV03: Fct.asg.BI w/o SI cl				210 142
060 000: MAIN: Without function				
DEV04: Fct.asg.BI w/o SI cl				210 192
060 000: MAIN: Without function				
DEV05: Fct.asg.BI w/o SI cl				210 242
060 000: MAIN: Without function				
DEV06: Fct.asg.BI w/o SI cl				211 042
060 000: MAIN: Without function				
DEV07: Fct.asg.BI w/o SI cl				211 092
060 000: MAIN: Without function				
DEV08: Fct.asg.BI w/o SI cl				211 142
060 000: MAIN: Without function				
DEV09: Fct.asg.BI w/o SI cl				211 192
060 000: MAIN: Without function				
DEV10: Fct.asg.BI w/o SI cl				211 242
060 000: MAIN: Without function				

This setting defines which output will issue the “Close” enable to the interlocking logic when there is “bay interlock without substation interlock”.

Note: The interlock conditions for bay interlock without station interlock are included in the bay type definitions (see “List of Bay Types” in the Appendix). If the interlock condition is to be modified, this is possible by modifying the corresponding Boolean equation in the interlocking logic or by defining a new interlocking logic equation. Only in the latter case is it necessary to change the function assignment.

Three Position Drive

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
TPD1: Oper.count.limit					219 006
Blocked	1	65000		Fig. 3-348, (p. 3-426)	
TPD2: Oper.count.limit					219 026
Blocked	1	65000			
TPD3: Oper.count.limit					219 046
Blocked	1	65000			
TPD4: Oper.count.limit					219 066
Blocked	1	65000			

Setting a limit value for the number of switching commands to the Three Position Drive.

Interlocking logic

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
ILOCK: Cycle t interl.check							221 104
Blocked	0.1	10.0	s				
The interlock conditions are also transmitted together with reporting in the “phase 2” of the IEC 61850 communication protocol. Therefore it is a requirement that these interlock conditions are cyclically checked and not, as with software versions that still implement “phase 1”, only with the request for a switching operation. This parameter sets the cycle time, after which a check of the interlock conditions is carried out. As additional processor capacity must be provided for each of these checks it must be ensured that a favorable compromise is found for the cycle time setting value. On the one hand it is desirable to select a cycle time value which is as short as possible so that changes in the interlock conditions are updated without any notable delays, but on the other hand this cycle time value should not be so short that the P139 will be under too much strain. As the CPU load of the P139 is dependent on the total number of function groups having been configured it is not possible to suggest a generally acceptable cycle time value.							
ILOCK: Rset ILOCK violation							221 123
Blocked	1	10	s	Fig. 3-328, (p. 3-400)			
The interlock violation signal (221 018) **MAIN: Interlock equ. viol.** will be automatically reset after the time period set here. (The default value *Blocked* disables the automatic reset.)							
ILOCK: Fct.assignm. outp. 1							250 000
060 000: MAIN: Without function				Fig. 3-349, (p. 3-428)			
ILOCK: Fct.assignm. outp. 2							250 001
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 3							250 002
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 4							250 003
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 5							250 004
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 6							250 005
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 7							250 006
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 8							250 007
060 000: MAIN: Without function							
ILOCK: Fct.assignm. outp. 9							250 008
060 000: MAIN: Without function							

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
ILOCK: Fct.assignm. outp.10				250 009
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.11				250 010
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.12				250 011
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.13				250 012
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.14				250 013
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.15				250 014
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.16				250 015
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.17				250 016
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.18				250 017
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.19				250 018
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.20				250 019
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.21				250 020
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.22				250 021
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.23				250 022
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.24				250 023
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.25				250 024
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.26				250 025
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.27				250 026
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.28				250 027
060 000: MAIN: Without function				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
ILOCK: Fct.assignm. outp.29				250 028
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.30				250 029
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.31				250 030
060 000: MAIN: Without function				
ILOCK: Fct.assignm. outp.32				250 031
060 000: MAIN: Without function				
Definition of the interlock conditions.				

8 Information and Control Functions

8.1 Operation

The P139 generates a large number of signals, processes binary input signals, and acquires measured data during fault-free operation of the protected object as well as fault-related data. A number of counters are available for statistical purposes. This information can be read out from the integrated local control panel or via the operating program.

All this information can be found in the "Operation" and "Events" folders in the menu tree.

Note

Detailed information about all parameters, including complete selection tables and IEC 60870-5-103 protocol properties, are separately available as a set of interlinked PDF files for user-friendly navigation, packed in one ZIP archive named DataModelExplorer_P139_en_P01.zip.

A list of the Logical Nodes that have been implemented for the IEC 61850 protocol can be found in a separate document.

8.1.1 Cyclic Values

8.1.1.1 Measured Operating Data

InterMiCOM interface

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
COMM3: No. tel. errors p.u.				120 040
0.0	0.0	100.0	%	
Display of the updated measured operating value for the number of corrupted messages within the last 1000 received messages.				
COMM3: No.t.err.,max,stored				120 041
0.0	0.0	100.0	%	
Display of the updated measured operating value for the proportion of corrupted messages within the last 1000 received messages.				
COMM3: Loop back result				120 057
....: Not measured				
COMM3: Loop back receive				120 056
Not measured	0	255		
While the hold time is running, the loop back test results can be checked by reading out these values.				

Measured data input

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASI: Current IDC					004 134
Not measured	0.00	24.00	mA	Fig. 3-33, (p. 3-54)	
Display of the input current.					
MEASI: Current IDC p.u.					004 135
Not measured	0.00	1.20	IDC,nom	Fig. 3-33, (p. 3-54)	
Display of the input current referred to $I_{DC,nom}$.					
MEASI: Curr. IDC,lin. p.u.					004 136
Not measured	0.00	1.20	IDC,nom	Fig. 3-33, (p. 3-54)	
Display of the linearized input current referred to $I_{DC,nom}$.					
MEASI: Scaled value IDC,lin					004 180
Not measured	-32000	32000		Fig. 3-34, (p. 3-55)	
Display of the scaled linearized value.					
MEASI: Temperature T					004 133
Not measured	-40.0	215.0	°C	Fig. 3-35, (p. 3-56)	
Display of the temperature measured at the “PT 100” temperature input on the analog p/c board.					
MEASI: Temperature T1					004 224
Not measured	-40.0	215.0	°C	Fig. 3-36, (p. 3-57)	
MEASI: Temperature T2					004 225
Not measured	-40.0	215.0	°C		
MEASI: Temperature T3					004 226
Not measured	-40.0	215.0	°C		
MEASI: Temperature T4					004 227
Not measured	-40.0	215.0	°C		
MEASI: Temperature T5					004 228
Not measured	-40.0	215.0	°C		
MEASI: Temperature T6					004 229
Not measured	-40.0	215.0	°C		
MEASI: Temperature T7					004 230
Not measured	-40.0	215.0	°C		
MEASI: Temperature T8					004 231
Not measured	-40.0	215.0	°C		
MEASI: Temperature T9					004 232
Not measured	-40.0	215.0	°C		
Display of temperatures measured at inputs on the temperature p/c board.					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASI: Temperature Tmax					004 233
Not measured	-40.0	215.0	°C	Fig. 3-35, (p. 3-56)	
Display of the maximum temperature measured at the “PT 100” temperature input on the analog p/c board.					
MEASI: Temperature T1 max.					004 234
Not measured	-40.0	215.0	°C	Fig. 3-36, (p. 3-57)	
MEASI: Temperature T2 max.					004 235
Not measured	-40.0	215.0	°C		
MEASI: Temperature T3 max.					004 236
Not measured	-40.0	215.0	°C		
MEASI: Temperature T4 max.					004 237
Not measured	-40.0	215.0	°C		
MEASI: Temperature T5 max.					004 238
Not measured	-40.0	215.0	°C		
MEASI: Temperature T6 max.					004 239
Not measured	-40.0	215.0	°C		
MEASI: Temperature T7 max.					004 240
Not measured	-40.0	215.0	°C		
MEASI: Temperature T8 max.					004 241
Not measured	-40.0	215.0	°C		
MEASI: Temperature T9 max.					004 242
Not measured	-40.0	215.0	°C		
Display of maximum temperatures measured at inputs on the temperature p/c board.					
MEASI: Temperature p.u. T					004 221
Not measured	-0.40	2.15	100°C	Fig. 3-35, (p. 3-56)	
Display of the temperature measured at the “PT 100” temperature input on the analog p/c board referred to 100°C.					
MEASI: Temperature p.u. T1					004 081
Not measured	-0.40	2.15	100°C	Fig. 3-36, (p. 3-57)	
MEASI: Temperature p.u. T2					004 082
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T3					004 083
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T4					004 084
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T5					004 085
Not measured	-0.40	2.15	100°C		

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASI: Temperature p.u. T6					004 086
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T7					004 250
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T8					004 251
Not measured	-0.40	2.15	100°C		
MEASI: Temperature p.u. T9					004 252
Not measured	-0.40	2.15	100°C		

Display of temperatures measured at inputs on the temperature p/c board referred to 100°C.

Measured data output

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASO: Current A-1					005 100
0.00	0.00	20.00	mA	Fig. 3-46, (p. 3-73)	
MEASO: Current A-2					005 099
0.00	0.00	20.00	mA		

Display of the current on the analog measured data output (A1: channel 1; A2: channel 2).

Main function

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MAIN: Date				003 090
1997-01-01	1997-01-01	2098-11-08	dd.mm.yy	Fig. 3-88, (p. 3-119)
Date display. The date can also be set here. The centuries are not displayed. The supported dates range from January 1st, 1997, until November 7th, 2098.				
MAIN: Time of day				003 091
00:00:00	00:00:00	24:00:00	hh:mm:ss	Fig. 3-88, (p. 3-119)
Display of the time of day. The time can also be set here.				
MAIN: Time switching				003 095
0: Standard time				Fig. 3-88, (p. 3-119)
Setting for standard time or daylight saving time. This setting is necessary in order to avoid misinterpretation of the times assigned to signals and event data that can be read out through the PC or communication interfaces.				
MAIN: Frequency f				004 040
Not measured	40.00	70.00	Hz	Fig. 3-60, (p. 3-93)
Display of system frequency.				
MAIN: IA prim,demand				006 226
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
MAIN: IB prim,demand				006 227
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
MAIN: IC prim,demand				006 228
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
Display the three delayed phase currents (demand values) as primary quantities.				
MAIN: IA prim,demand stor.				006 223
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
MAIN: IB prim,demand stor.				006 224
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
MAIN: IC prim,demand stor.				006 225
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)
Display the three stored phase currents (demand values) as primary quantities.				
MAIN: Curr. IP,max prim.				005 050
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)
Display of the maximum phase current as a primary quantity.				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: IP,max prim.,demand					005 036
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)	
Display of the delayed maximum phase current as a primary quantity.					
MAIN: IP,maxprim,demand.st					005 034
Not measured	0	25000	A	Fig. 3-51, (p. 3-85)	
Display of the delayed stored maximum phase current as a primary quantity.					
MAIN: Curr. IP,min prim.					005 055
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)	
Display of the minimum phase current as a primary quantity.					
MAIN: Current A prim.					005 040
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)	
Display of phase current A as a primary quantity.					
MAIN: Current B prim.					006 040
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)	
Display of phase current B as a primary quantity.					
MAIN: Current C prim.					007 040
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)	
Display of phase current C as a primary quantity.					
MAIN: Current Σ(IP) prim.					005 010
Not measured	0	25000	A	Fig. 3-50, (p. 3-84)	
Display of the calculated resultant current as a primary quantity.					
MAIN: Current IN prim.					004 043
Not measured	0	25000	A	Fig. 3-52, (p. 3-86)	
Display of the updated value for the residual current as a primary quantity. The measured residual current is displayed.					
MAIN: Volt. VPG,max prim.					008 042
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the maximum phase-to-ground voltage as a primary quantity.					
MAIN: Volt. VPG,min prim.					009 042
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the minimum phase-to-ground voltage as a primary quantity.					
MAIN: Voltage A-G prim.					005 042
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage A-G as a primary quantity.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Voltage B-G prim.					006 042
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage B-G as a primary quantity.					
MAIN: Voltage C-G prim.					007 042
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage C-G as a primary quantity.					
MAIN: Volt. Σ(VPG)/3 prim.					005 012
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the calculated neutral-displacement voltage as a primary quantity.					
MAIN: Voltage VNG prim.					004 041
Not measured	0.0	2500.0	kV	Fig. 3-56, (p. 3-90)	
Display of the neutral-point displacement voltage measured at transformer T 90 as a primary quantity.					
MAIN: Voltage Vref prim.					005 046
Not measured	0.0	3000.0	kV	Fig. 3-57, (p. 3-90)	
Display of the reference voltage measured at transformer T 15 as a primary quantity.					
MAIN: Volt. VPP,max prim.					008 044
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the maximum phase-to-phase voltage as a primary quantity.					
MAIN: Voltage VPP,min prim					009 044
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the minimum phase-to-phase voltage as a primary quantity.					
MAIN: Voltage A-B prim.					005 044
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage A-B as a primary quantity.					
MAIN: Voltage B-C prim.					006 044
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage B-C as a primary quantity.					
MAIN: Voltage C-A prim.					007 044
Not measured	0.0	2500.0	kV	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage C-A as a primary quantity.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Appar. power S prim.					005 025
Not measured	-3199.9	3200.0	MVA	Fig. 3-58, (p. 3-91)	
Display of the updated apparent power value as a primary quantity.					
MAIN: Active power P prim.					004 050
Not measured	-3199.9	3200.0	MW	Fig. 3-58, (p. 3-91)	
Display of the updated active power value as a primary quantity.					
MAIN: Reac. power Q prim.					004 052
Not measured	-3199.9	3200.0	Mvar	Fig. 3-58, (p. 3-91)	
Display of the updated reactive power value as a primary quantity.					
MAIN: Active power factor					004 054
Not measured	-1.000	1.000		Fig. 3-58, (p. 3-91)	
Display of the updated active power factor.					
MAIN: Act.energy outp.prim					008 065
2:			MWh		
MAIN: Act.energy inp. prim					008 066
2:			MWh		
MAIN: React.en. outp. prim					008 067
2:			Mvarh		
MAIN: React. en. inp. prim					008 068
2:			Mvarh		

Display of the updated active energy output (or active energy input, reactive energy output, reactive energy input, respectively) as a primary quantity.

At run-time, the value is displayed with 32 bit precision. (But note that for technical reasons, this value is internally stored as a text value.)

Value ranges:

- **MAIN: Act.energy outp.prim** – *0 … 6,553,500.00 MWh*
- **MAIN: Act.energy inp. prim** – *0 … 6,553,500.00 MWh*
- **MAIN: React.en. outp. prim** – *0 … 6,553,500.00 Mvar h*
- **MAIN: React. en. inp. prim** – *0 … 6,553,500.00 Mvar h*

Note: As an alternative, the same values also exist as numbers with 16 bit precision:

- (005 061) **MAIN: Act.energy outp.prim**
- (005 062) **MAIN: Act.energy inp. prim**
- (005 063) **MAIN: React.en. outp. prim**
- (005 064) **MAIN: React. en. inp. prim**

MAIN: Act.energy outp.prim					005 061
0.00	0.00	655.35	MWh	Fig. 3-61, (p. 3-93)	

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Act.energy inp. prim					005 062
0.00	0.00	655.35	MWh	Fig. 3-61, (p. 3-93)	
MAIN: React.en. outp. prim					005 063
0.00	0.00	655.35	Mvar h	Fig. 3-61, (p. 3-93)	
MAIN: React. en. inp. prim					005 064
0.00	0.00	655.35	Mvar h	Fig. 3-61, (p. 3-93)	

Display of the updated active energy output (or active energy input, reactive energy output, reactive energy input, respectively) as a primary quantity.

The value is displayed as a number with 16 bit precision.

The setting at **MAIN: Op. mode energy cnt.** decides which procedure shall be used to determine the active and reactive energy:

- If procedure 1 is selected, active and reactive energy are determined every 2 s (approximately).
- If procedure 2 is selected, active and reactive energy are determined every 100 ms (approximately).

Procedure 2 obviously gives more precise results but puts more strain on the system.

Whenever the maximum value of *655.35 MWh* or *655.35 MVAr h* is exceeded, the determination of the energy output is restarted, and the value that exceeded the range is transferred to the new cycle. Moreover, a counter is incremented:

- (009 090) **MAIN: No.overfl.act.en.out**: Counter for value overflow of **MAIN: Act.energy outp.prim**
- (009 091) **MAIN: No.overfl.act.en.inp**: Counter for value overflow of **MAIN: Act.energy inp. prim**
- (009 092) **MAIN: No.ov/fl.reac.en.out**: Counter for value overflow of **MAIN: React.en. outp. prim**
- (009 093) **MAIN: No.ov/fl.reac.en.inp**: Counter for value overflow of **MAIN: React. en. inp. prim**

Note that the maximum value of these counters is 10000.

As an alternative to these 16 bit numbers, there are also 32 bit precision values available:

- (008 065) **MAIN: Act.energy outp.prim**
- (008 066) **MAIN: Act.energy inp. prim**
- (008 067) **MAIN: React.en. outp. prim**
- (008 068) **MAIN: React. en. inp. prim**

MAIN: Load angle phi A					004 055
Not measured	-180.0	180.0	°	Fig. 3-58, (p. 3-91)	

Display of the updated load angle value in phase A.

MAIN: Load angle phi B					004 056
Not measured	-180.0	180.0	°	Fig. 3-58, (p. 3-91)	

Display of the updated load angle value in phase B.

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Load angle phi C					004 057
Not measured	-180.0	180.0	°	Fig. 3-58, (p. 3-91)	
Display of the updated load angle value in phase C.					
MAIN: Angle phi N					004 072
Not measured	-180.0	180.0	°	Fig. 3-58, (p. 3-91)	
Display of the angle between the measured residual current system quantities I_N and V_{NG}.					
MAIN: Angle ΣVPG vs. IN					005 009
Not measured	-180.0	180.0	°	Fig. 3-58, (p. 3-91)	
Display of the angle between the calculated neutral-point displacement voltage and the measured residual current system quantities I_N.					
MAIN: Phase rel.,IN vs ΣIP					004 073
....: Not measured				Fig. 3-59, (p. 3-92)	
Display of the phase relation of measured and calculated residual current. (The phase relation is displayed as either "*Equal phase*" or "*Reverse phase*".)					
MAIN: Frequency f p.u.					004 070
Not measured	0.200	4.000	fnom	Fig. 3-60, (p. 3-93)	
Display of system frequency referred to fn.					
MAIN: IA p.u.,demand					006 235
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
MAIN: IB p.u.,demand					006 236
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
MAIN: IC p.u.,demand					006 237
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
Display of the delayed phase currents referred to I_{nom}.					
MAIN: IA p.u.,demand stor.					006 232
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
MAIN: IB p.u.,demand stor.					006 233
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
MAIN: IC p.u.,demand stor.					006 234
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
Display of the delayed stored phase currents referred to I_{nom}.					
MAIN: Current IP,max p.u.					005 051
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of the maximum phase current referred to I_{nom}.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: IP,max p.u.,demand					005 037
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
Display of the delayed maximum phase current referred to I_{nom}.					
MAIN: IP,maxp.u.,demand.st					005 035
Not measured	0.000	25.000	Inom	Fig. 3-51, (p. 3-85)	
Display of the delayed stored maximum phase current referred to I_{nom}.					
MAIN: Current IP,min p.u.					005 056
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of the minimum phase current referred to I_{nom}.					
MAIN: Current A p.u.					005 041
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of phase current A referred to I_{nom}.					
MAIN: Current B p.u.					006 041
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of phase current B referred to I_{nom}.					
MAIN: Current C p.u.					007 041
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of phase current C referred to I_{nom}.					
MAIN: Current Ipos p.u.					009 016
Not measured	0.000	25.000	Inom		
Display of the positive sequence current referred to I_{nom}.					
MAIN: Current Ineg p.u.					009 015
Not measured	0.000	25.000	Inom		
Display of the negative-sequence current referred to I_{nom}.					
MAIN: Current Σ(IP) p.u.					005 011
Not measured	0.000	25.000	Inom	Fig. 3-50, (p. 3-84)	
Display of the calculated residual current referred to I_{nom}.					
MAIN: Current IN p.u.					004 044
Not measured	0.000	16.000	IN,nom	Fig. 3-52, (p. 3-86)	
Display of the updated residual current value referred to I_{nom}. The measured residual current is displayed.					
MAIN: Voltage VPG,max p.u.					008 043
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the maximum phase-to-ground voltage referred to V_{nom}.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Voltage VPG,min p.u.					009 043
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the minimum phase-to-ground voltage referred to V_{nom}.					
MAIN: Voltage A-G p.u.					005 043
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage A-G referred to V_{nom}.					
MAIN: Voltage B-G p.u.					006 043
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage B-G referred to V_{nom}.					
MAIN: Voltage C-G p.u.					007 043
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-ground voltage C-G referred to V_{nom}.					
MAIN: Voltage Vpos p.u.					009 018
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the positive-sequence voltage referred to V_{nom}.					
MAIN: Voltage Vneg p.u.					009 017
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the negative-sequence voltage referred to V_{nom}.					
MAIN: Volt. Σ(VPG)/√3 p.u.					005 013
Not measured	0.000	12.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the calculated neutral-point displacement voltage referred to V_{nom}.					
MAIN: Voltage VNG p.u.					004 042
Not measured	0.000	25.000	VNG,nom	Fig. 3-56, (p. 3-90)	
Display of the neutral-point displacement voltage measured at transformer T 90 referred to V_{nom}.					
MAIN: Voltage Vref p.u.					005 047
Not measured	0.000	3.000	Vnom	Fig. 3-57, (p. 3-90)	
Display of the reference voltage measured at transformer T 15 referred to V_{nom}.					
MAIN: Voltage VPP,max p.u.					008 045
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the maximum phase-to-phase voltage referred to V_{nom}.					
MAIN: Voltage VPP,min p.u.					009 045
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the minimum phase-to-phase voltage referred to V_{nom}.					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Voltage A-B p.u.					005 045
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage A-B referred to V_{nom}.					
MAIN: Voltage B-C p.u.					006 045
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage B-C referred to V_{nom}.					
MAIN: Voltage C-A p.u.					007 045
Not measured	0.000	25.000	Vnom	Fig. 3-55, (p. 3-89)	
Display of the updated value for phase-to-phase voltage C-A referred to V_{nom}.					
MAIN: Appar. power S p.u.					005 026
Not measured	-10.700	10.700	Snom	Fig. 3-58, (p. 3-91)	
Display of the updated apparent power value referred to nominal apparent power S_{nom}.					
MAIN: Active power P p.u.					004 051
Not measured	-7.500	7.500	Snom	Fig. 3-58, (p. 3-91)	
Display of the updated active power value referred to nominal apparent power S_{nom}.					
MAIN: Reac. power Q p.u.					004 053
Not measured	-7.500	7.500	Snom	Fig. 3-58, (p. 3-91)	
Display of the updated value for reactive power referred to nominal apparent power S_{nom}.					
MAIN: Load angle phi A p.u					005 073
Not measured	-1.80	1.80	phi,ref	Fig. 3-58, (p. 3-91)	
Display of the updated load angle value in phase A referred to 100°C.					
MAIN: Load angle phi B p.u					005 074
Not measured	-1.80	1.80	phi,ref	Fig. 3-58, (p. 3-91)	
Display of the updated load angle value in phase B referred to 100°C.					
MAIN: Load angle phi C p.u					005 075
Not measured	-1.80	1.80	phi,ref	Fig. 3-58, (p. 3-91)	
Display of the updated load angle value in phase C referred to 100°C.					
MAIN: Angle phi N p.u.					005 076
Not measured	-1.80	1.80	phi,ref	Fig. 3-58, (p. 3-91)	
Display of the angle between the measured residual current system quantities I_N and V_{NG} referred to 100°.					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Angle ΣVPG/IN p.u.				005 072
Not measured	-1.80	1.80	phi,ref	Fig. 3-58, (p. 3-91)
Display of the angle between the calculated neutral-point displacement voltage and the measured residual current system quantities I_N referred to 100°.				
MAIN: Angle phi A-B,Local				003 153
Not measured	-180.0	180.0	°	
MAIN: Angle phi B-C,Local				003 154
Not measured	-180.0	180.0	°	
MAIN: Angle phi C-A,Local				003 159
Not measured	-180.0	180.0	°	
Display of the local phase-to-phase angles phi.				
MAIN: Current ΣI unfilt.				004 074
Not measured	0.000	25.000	Inom	
Display of calculated unfiltered resultant current.				

Ground fault direction determination using steady-state values

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GFDSS: Current IN,act p.u.				004 045
Not measured	0.000	30.000	IN,nom	Fig. 3-211, (p. 3-270)
Display of the updated value for the active component of residual current referred to $I_{N,nom}$.				
GFDSS: Curr. IN,reac p.u.				004 046
Not measured	0.000	30.000	IN,nom	Fig. 3-211, (p. 3-270)
Display of the updated value for the reactive component of residual current referred to $I_{N,nom}$.				
GFDSS: Curr. IN filt. p.u.				004 047
Not measured	0.000	30.000	IN,nom	Fig. 3-213, (p. 3-272)
Display of the updated value for the harmonic content of residual current referred to $I_{N,nom}$. This display is only active when the steady-state current evaluation mode of the ground fault direction determination function (GFDSS) is enabled.				
GFDSS: Admitt. Y(N) p.u.				004 191
Not measured	0.000	5.000	YN,nom	Fig. 3-218, (p. 3-276)
Display of the updated admittance value referred to $Y_{N,nom}$. **Note:** With setting: **GFDSS: Evaluation VNG PSx** set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ With setting: **GFDSS: Evaluation VNG PSx** = *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$				
GFDSS: Conduct. G(N) p.u.				004 192
Not measured	-5.000	5.000	YN,nom	Fig. 3-218, (p. 3-276)
Display of the updated conductance value referred to $Y_{N,nom}$. **Note:** With setting: **GFDSS: Evaluation VNG PSx** set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ With setting: **GFDSS: Evaluation VNG PSx** = *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$				
GFDSS: Suscept. B(N) p.u.				004 193
Not measured	-5.000	5.000	YN,nom	Fig. 3-218, (p. 3-276)
Display of the updated susceptance value referred to $Y_{N,nom}$. **Note:** With setting: **GFDSS: Evaluation VNG PSx** set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ With setting: **GFDSS: Evaluation VNG PSx** = *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$				

Motor protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MP: Therm.repl.buffer MP					004 018
Not measured	0	100	%	Fig. 3-234, (p. 3-297)	
Display of the buffer content of the motor protection function.					
MP: St-ups still permitt					004 012
Not measured	0	3		Fig. 3-234, (p. 3-297)	
Display of the current number of motor startups still permitted before RC blocking.					
MP: Therm. repl. MP p.u.					005 071
Not measured	0.00	1.00	100%	Fig. 3-234, (p. 3-297)	
Display of the buffer content of the motor protection (referred to 100%).					
MP: Pre-close time left					012 018
Not measured	0.0	1000.0	min		
Display of the remaining waiting time until the next start-up operation will be enabled.					
MP: St-ups st. perm.p.u.					005 086
Not measured	0.00	0.30	Factor 10	Fig. 3-234, (p. 3-297)	
Display of the current number of motor startups still permitted before RC blocking (referred to the factor 10).					

Thermal overload protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
THERM: Status THERM replica					004 016
Not measured	-25000	25000	%	Fig. 3-241, (p. 3-311)	
Display of the buffer content of the thermal overload protection function.					
THERM: Current I,therm prim					007 220
Not measured	0	25000	A	Fig. 3-241, (p. 3-311)	
THERM: Current I,therm p.u					007 221
Not measured	0.000	2.400	Iref	Fig. 3-241, (p. 3-311)	

Display of the “thermal current” (as a primary quantity, or as a per unit quantity, respectively).

These measured operating values are calculated as follows:

$$I_{\text{therm,prim}} = \sqrt{\frac{\text{Status}_{\text{therm. repl.}}}{100}}\, I_{\text{ref}} I_{\text{nom,CT,prim}}$$

$$I_{\text{therm,p.u.}} = \frac{I_{\text{therm,prim}}}{I_{\text{ref}} I_{\text{nom,CT,prim}}}$$

With:

- $I_{\text{therm,prim}}$ = **THERM: Current I,therm prim**
- $I_{\text{therm,p.u.}}$ = **THERM: Current I,therm p.u**
- $\text{Status}_{\text{therm. repl.}}$ = **THERM: Status THERM replica**
- I_{ref} = **THERM: Iref PSx**
- $I_{\text{nom,CT,prim}}$ = **MAIN: Inom C.T. prim.**

In a measured values message the thermal current is processed as a per-unit variable referred to I_{ref}.

Parameter					Address
THERM: Object temperature					004 137
Not measured	-40	300	°C	Fig. 3-241, (p. 3-311)	
Display of the temperature of the protected object.					
THERM: Coolant temperature					004 149
Not measured	-40	200	°C	Fig. 3-241, (p. 3-311)	
Display of coolant temperature, dependent on the setting for **THERM: Select meas.inputPSx**. When set to *None* the set temperature value will be displayed. When set to *PT100* the temperature measured by the resistance thermometer will be displayed. When set to *20mA input* the temperature measured via an external 20 mA transducer will be displayed.					
THERM: Pre-trip time left					004 139
Not measured	0.0	1000.0	min	Fig. 3-241, (p. 3-311)	
Display of the time remaining before the thermal overload protection function will reach the tripping threshold (“time-to-trip”).					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
THERM: Therm. replica p.u.					004 017
Not measured	-2.50	2.50	100%	Fig. 3-241, (p. 3-311)	
Display of the buffer content of the thermal overload protection function referred to a buffer content of 100%.					
THERM: Object temp. p.u.					004 179
Not measured	-0.40	3.00	100°C	Fig. 3-241, (p. 3-311)	
Display of the temperature of the protected object referred to 100°C.					
THERM: Coolant temp. p.u.					004 178
Not measured	-0.40	2.00	100°C	Fig. 3-241, (p. 3-311)	
Display of the coolant temperature referred to 100°C.					
THERM: Temp. offset replica					004 109
Not measured	-25000	25000	%	Fig. 3-241, (p. 3-311)	
Display of the additional reserve if coolant temperature is taken into account and if the measured coolant temperature is lower than the set maximum permissible coolant temperature. (In this case, the thermal model has been shifted downwards.) If there is no coolant temperature acquisition and if the coolant temperature and the maximum permissible coolant temperature have been set to the same value, then the coolant temperature is not taken into account and the characteristic is a function of the current only. The additional reserve amounts to 0 in this case.					

Binary counts

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
COUNT: Count 1					217 100
0	0	65535		Fig. 3-356, (p. 3-437)	
COUNT: Count 2					217 080
0	0	65535			
COUNT: Count 3					217 081
0	0	65535			
COUNT: Count 4					217 082
0	0	65535			
Display of the updated count. **Note:** The count value can be set here (Preload-Function).					

8.1.1.2 Physical State Signals

InterMiCOM interface

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM3: State receive 1				120 000
0: 0				
COMM3: State receive 2				120 003
0: 0				
COMM3: State receive 3				120 006
0: 0				
COMM3: State receive 4				120 009
0: 0				
COMM3: State receive 5				120 012
0: 0				
COMM3: State receive 6				120 015
0: 0				
COMM3: State receive 7				120 018
0: 0				
COMM3: State receive 8				120 021
0: 0				
Display of the relevant receive signal.				
COMM3: State send 1				121 000
0: 0				
COMM3: State send 2				121 002
0: 0				
COMM3: State send 3				121 004
0: 0				
COMM3: State send 4				121 006
0: 0				
COMM3: State send 5				121 008
0: 0				
COMM3: State send 6				121 010
0: 0				
COMM3: State send 7				121 012
0: 0				
COMM3: State send 8				121 014
0: 0				
Display of the updated value for the relevant send signal.				

Generic Object Orientated Substation Events

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Output 1 state				106 010
0: 0				
GOOSE: Output 2 state				106 012
0: 0				
GOOSE: Output 3 state				106 014
0: 0				
GOOSE: Output 4 state				106 016
0: 0				
GOOSE: Output 5 state				106 018
0: 0				
GOOSE: Output 6 state				106 020
0: 0				
GOOSE: Output 7 state				106 022
0: 0				
GOOSE: Output 8 state				106 024
0: 0				
GOOSE: Output 9 state				106 026
0: 0				
GOOSE: Output 10 state				106 028
0: 0				
GOOSE: Output 11 state				106 030
0: 0				
GOOSE: Output 12 state				106 032
0: 0				
GOOSE: Output 13 state				106 034
0: 0				
GOOSE: Output 14 state				106 036
0: 0				
GOOSE: Output 15 state				106 038
0: 0				
GOOSE: Output 16 state				106 040
0: 0				
GOOSE: Output 17 state				106 042
0: 0				
GOOSE: Output 18 state				106 044
0: 0				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Output 19 state					106 046
0: 0					
GOOSE: Output 20 state					106 048
0: 0					
GOOSE: Output 21 state					106 050
0: 0					
GOOSE: Output 22 state					106 052
0: 0					
GOOSE: Output 23 state					106 054
0: 0					
GOOSE: Output 24 state					106 056
0: 0					
GOOSE: Output 25 state					106 058
0: 0					
GOOSE: Output 26 state					106 060
0: 0					
GOOSE: Output 27 state					106 062
0: 0					
GOOSE: Output 28 state					106 064
0: 0					
GOOSE: Output 29 state					106 066
0: 0					
GOOSE: Output 30 state					106 068
0: 0					
GOOSE: Output 31 state					106 070
0: 0					
GOOSE: Output 32 state					106 072
0: 0					
Display of the virtual binary GOOSE output state.					
GOOSE: Input 1 state					106 200
0: 0					
GOOSE: Input 2 state					106 201
0: 0					
GOOSE: Input 3 state					106 202
0: 0					
GOOSE: Input 4 state					106 203
0: 0					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 5 state				106 204
0: 0				
GOOSE: Input 6 state				106 205
0: 0				
GOOSE: Input 7 state				106 206
0: 0				
GOOSE: Input 8 state				106 207
0: 0				
GOOSE: Input 9 state				106 208
0: 0				
GOOSE: Input 10 state				106 209
0: 0				
GOOSE: Input 11 state				106 210
0: 0				
GOOSE: Input 12 state				106 211
0: 0				
GOOSE: Input 13 state				106 212
0: 0				
GOOSE: Input 14 state				106 213
0: 0				
GOOSE: Input 15 state				106 214
0: 0				
GOOSE: Input 16 state				106 215
0: 0				
GOOSE: Input 17 state				106 216
0: 0				
GOOSE: Input 18 state				106 217
0: 0				
GOOSE: Input 19 state				106 218
0: 0				
GOOSE: Input 20 state				106 219
0: 0				
GOOSE: Input 21 state				106 220
0: 0				
GOOSE: Input 22 state				106 221
0: 0				
GOOSE: Input 23 state				106 222
0: 0				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
GOOSE: Input 24 state				106 223
0: 0				
GOOSE: Input 25 state				106 224
0: 0				
GOOSE: Input 26 state				106 225
0: 0				
GOOSE: Input 27 state				106 226
0: 0				
GOOSE: Input 28 state				106 227
0: 0				
GOOSE: Input 29 state				106 228
0: 0				
GOOSE: Input 30 state				106 229
0: 0				
GOOSE: Input 31 state				106 230
0: 0				
GOOSE: Input 32 state				106 231
0: 0				
GOOSE: Input 33 state				112 100
0: 0				
GOOSE: Input 34 state				112 101
0: 0				
GOOSE: Input 35 state				112 102
0: 0				
GOOSE: Input 36 state				112 103
0: 0				
GOOSE: Input 37 state				112 104
0: 0				
GOOSE: Input 38 state				112 105
0: 0				
GOOSE: Input 39 state				112 106
0: 0				
GOOSE: Input 40 state				112 107
0: 0				
GOOSE: Input 41 state				112 108
0: 0				
GOOSE: Input 42 state				112 109
0: 0				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 43 state					112 110
0: 0					
GOOSE: Input 44 state					112 111
0: 0					
GOOSE: Input 45 state					112 112
0: 0					
GOOSE: Input 46 state					112 113
0: 0					
GOOSE: Input 47 state					112 114
0: 0					
GOOSE: Input 48 state					112 115
0: 0					
GOOSE: Input 49 state					112 116
0: 0					
GOOSE: Input 50 state					112 117
0: 0					
GOOSE: Input 51 state					112 118
0: 0					
GOOSE: Input 52 state					112 119
0: 0					
GOOSE: Input 53 state					112 120
0: 0					
GOOSE: Input 54 state					112 121
0: 0					
GOOSE: Input 55 state					112 122
0: 0					
GOOSE: Input 56 state					112 123
0: 0					
GOOSE: Input 57 state					112 124
0: 0					
GOOSE: Input 58 state					112 125
0: 0					
GOOSE: Input 59 state					112 126
0: 0					
GOOSE: Input 60 state					112 127
0: 0					
GOOSE: Input 61 state					112 128
0: 0					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 62 state				112 129
0: 0				
GOOSE: Input 63 state				112 130
0: 0				
GOOSE: Input 64 state				112 131
0: 0				
GOOSE: Input 65 state				112 132
0: 0				
GOOSE: Input 66 state				112 133
0: 0				
GOOSE: Input 67 state				112 134
0: 0				
GOOSE: Input 68 state				112 135
0: 0				
GOOSE: Input 69 state				112 136
0: 0				
GOOSE: Input 70 state				112 137
0: 0				
GOOSE: Input 71 state				112 138
0: 0				
GOOSE: Input 72 state				112 139
0: 0				
GOOSE: Input 73 state				112 140
0: 0				
GOOSE: Input 74 state				112 141
0: 0				
GOOSE: Input 75 state				112 142
0: 0				
GOOSE: Input 76 state				112 143
0: 0				
GOOSE: Input 77 state				112 144
0: 0				
GOOSE: Input 78 state				112 145
0: 0				
GOOSE: Input 79 state				112 146
0: 0				
GOOSE: Input 80 state				112 147
0: 0				

Parameter								Address
Default	Min	Max	Unit					Logic Diagram
GOOSE: Input 81 state								112 148
0: 0								
GOOSE: Input 82 state								112 149
0: 0								
GOOSE: Input 83 state								112 150
0: 0								
GOOSE: Input 84 state								112 151
0: 0								
GOOSE: Input 85 state								112 152
0: 0								
GOOSE: Input 86 state								112 153
0: 0								
GOOSE: Input 87 state								112 154
0: 0								
GOOSE: Input 88 state								112 155
0: 0								
GOOSE: Input 89 state								112 156
0: 0								
GOOSE: Input 90 state								112 157
0: 0								
GOOSE: Input 91 state								112 158
0: 0								
GOOSE: Input 92 state								112 159
0: 0								
GOOSE: Input 93 state								112 160
0: 0								
GOOSE: Input 94 state								112 161
0: 0								
GOOSE: Input 95 state								112 162
0: 0								
GOOSE: Input 96 state								112 163
0: 0								
GOOSE: Input 97 state								112 164
0: 0								
GOOSE: Input 98 state								112 165
0: 0								
GOOSE: Input 99 state								112 166
0: 0								

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 100 state					112 167
0: 0					
GOOSE: Input 101 state					112 168
0: 0					
GOOSE: Input 102 state					112 169
0: 0					
GOOSE: Input 103 state					112 170
0: 0					
GOOSE: Input 104 state					112 171
0: 0					
GOOSE: Input 105 state					112 172
0: 0					
GOOSE: Input 106 state					112 173
0: 0					
GOOSE: Input 107 state					112 174
0: 0					
GOOSE: Input 108 state					112 175
0: 0					
GOOSE: Input 109 state					112 176
0: 0					
GOOSE: Input 110 state					112 177
0: 0					
GOOSE: Input 111 state					112 178
0: 0					
GOOSE: Input 112 state					112 179
0: 0					
GOOSE: Input 113 state					112 180
0: 0					
GOOSE: Input 114 state					112 181
0: 0					
GOOSE: Input 115 state					112 182
0: 0					
GOOSE: Input 116 state					112 183
0: 0					
GOOSE: Input 117 state					112 184
0: 0					
GOOSE: Input 118 state					112 185
0: 0					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 119 state					112 186
0: 0					
GOOSE: Input 120 state					112 187
0: 0					
GOOSE: Input 121 state					112 188
0: 0					
GOOSE: Input 122 state					112 189
0: 0					
GOOSE: Input 123 state					112 190
0: 0					
GOOSE: Input 124 state					112 191
0: 0					
GOOSE: Input 125 state					112 192
0: 0					
GOOSE: Input 126 state					112 193
0: 0					
GOOSE: Input 127 state					112 194
0: 0					
GOOSE: Input 128 state					112 195
0: 0					
Display of the virtual binary GOOSE input state.					

Binary input

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: State U 301				152 216
0: "Low"				
INP: State U 302				152 219
0: "Low"				
INP: State U 303				152 222
0: "Low"				
INP: State U 304				152 225
0: "Low"				
INP: State U 305				186 117
0: "Low"				
INP: State U 306				186 121
0: "Low"				
INP: State U 307				186 125
0: "Low"				
INP: State U 308				186 129
0: "Low"				
INP: State U 309				186 133
0: "Low"				
INP: State U 310				186 137
0: "Low"				
INP: State U 311				186 141
0: "Low"				
INP: State U 312				186 145
0: "Low"				
INP: State U 313				186 149
0: "Low"				
INP: State U 314				186 153
0: "Low"				
INP: State U 315				186 157
0: "Low"				
INP: State U 316				186 161
0: "Low"				
INP: State U 317				186 165
0: "Low"				
INP: State U 318				186 169
0: "Low"				
INP: State U 319				186 173
0: "Low"				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
INP: State U 320				186 177
0: "Low"				
INP: State U 321				186 181
0: "Low"				
INP: State U 322				186 185
0: "Low"				
INP: State U 323				186 189
0: "Low"				
INP: State U 324				186 193
0: "Low"				
INP: State U 601				152 090
0: "Low"				
INP: State U 602				152 093
0: "Low"				
INP: State U 603				152 096
0: "Low"				
INP: State U 604				152 099
0: "Low"				
INP: State U 605				152 102
0: "Low"				
INP: State U 606				152 105
0: "Low"				
INP: State U 701				152 108
0: "Low"				
INP: State U 702				152 111
0: "Low"				
INP: State U 703				152 114
0: "Low"				
INP: State U 704				152 117
0: "Low"				
INP: State U 705				152 120
0: "Low"				
INP: State U 706				152 123
0: "Low"				
INP: State U 801				184 001
0: "Low"				
INP: State U 802				184 005
0: "Low"				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
INP: State U 803					184 009
0: "Low"					
INP: State U 804					184 013
0: "Low"					
INP: State U 805					184 017
0: "Low"					
INP: State U 806					184 021
0: "Low"					
INP: State U 807					184 025
0: "Low"					
INP: State U 808					184 029
0: "Low"					
INP: State U 809					184 033
0: "Low"					
INP: State U 810					184 037
0: "Low"					
INP: State U 811					184 041
0: "Low"					
INP: State U 812					184 045
0: "Low"					
INP: State U 813					184 049
0: "Low"					
INP: State U 814					184 053
0: "Low"					
INP: State U 815					184 057
0: "Low"					
INP: State U 816					184 061
0: "Low"					
INP: State U 817					184 065
0: "Low"					
INP: State U 818					184 069
0: "Low"					
INP: State U 819					184 073
0: "Low"					
INP: State U 820					184 077
0: "Low"					
INP: State U 821					184 081
0: "Low"					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
INP: State U 822				184 085
0: "Low"				
INP: State U 823				184 089
0: "Low"				
INP: State U 824				184 093
0: "Low"				
INP: State U 901				152 144
0: "Low"				
INP: State U 902				152 147
0: "Low"				
INP: State U 903				152 150
0: "Low"				
INP: State U 904				152 153
0: "Low"				
INP: State U 1001				152 162
0: "Low"				
INP: State U 1002				152 165
0: "Low"				
INP: State U 1003				152 168
0: "Low"				
INP: State U 1004				152 171
0: "Low"				
INP: State U 1005				152 174
0: "Low"				
INP: State U 1006				152 177
0: "Low"				
INP: State U 1201				152 198
0: "Low"				
INP: State U 1202				152 201
0: "Low"				
INP: State U 1203				152 204
0: "Low"				
INP: State U 1204				152 207
0: "Low"				
INP: State U 1205				152 210
0: "Low"				
INP: State U 1206				152 213
0: "Low"				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
INP: State U 1401					190 001
0: "Low"					
INP: State U 1402					190 005
0: "Low"					
INP: State U 1403					190 009
0: "Low"					
INP: State U 1404					190 013
0: "Low"					
INP: State U 1405					190 017
0: "Low"					
INP: State U 1406					190 021
0: "Low"					
INP: State U 1601					192 001
0: "Low"					
INP: State U 1602					192 005
0: "Low"					
INP: State U 1603					192 009
0: "Low"					
INP: State U 1604					192 013
0: "Low"					
INP: State U 1605					192 017
0: "Low"					
INP: State U 1606					192 021
0: "Low"					
INP: State U 1607					192 025
0: "Low"					
INP: State U 1608					192 029
0: "Low"					
INP: State U 1609					192 033
0: "Low"					
INP: State U 1610					192 037
0: "Low"					
INP: State U 1611					192 041
0: "Low"					
INP: State U 1612					192 045
0: "Low"					
INP: State U 1613					192 049
0: "Low"					

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
INP: State U 1614							192 053
0: "Low"							
INP: State U 1615							192 057
0: "Low"							
INP: State U 1616							192 061
0: "Low"							
INP: State U 1617							192 065
0: "Low"							
INP: State U 1618							192 069
0: "Low"							
INP: State U 1619							192 073
0: "Low"							
INP: State U 1620							192 077
0: "Low"							
INP: State U 1621							192 081
0: "Low"							
INP: State U 1622							192 085
0: "Low"							
INP: State U 1623							192 089
0: "Low"							
INP: State U 1624							192 093
0: "Low"							
INP: State U 1801							194 001
0: "Low"							
INP: State U 1802							194 005
0: "Low"							
INP: State U 1803							194 009
0: "Low"							
INP: State U 1804							194 013
0: "Low"							
INP: State U 1805							194 017
0: "Low"							
INP: State U 1806							194 021
0: "Low"							
INP: State U 2001							153 086
0: "Low"							
INP: State U 2002							153 089
0: "Low"							

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
INP: State U 2003					153 092
0: "Low"					
INP: State U 2004					153 095
0: "Low"					

The state of the binary signal inputs is displayed as follows:

- *Without function*: No functions are assigned to the binary signal input.
- "*Low*": Not energized.
- "*High*": Energized.

This display appears regardless of the setting for the binary signal input mode.

Binary and analog output

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
OUTP: State K 301					151 044
0: Inactive				Fig. 3-38, (p. 3-60)	
OUTP: State K 302					151 047
0: Inactive					
OUTP: State K 601					150 120
0: Inactive					
OUTP: State K 602					150 123
0: Inactive					
OUTP: State K 603					150 126
0: Inactive					
OUTP: State K 604					150 129
0: Inactive					
OUTP: State K 605					150 132
0: Inactive					
OUTP: State K 606					150 135
0: Inactive					
OUTP: State K 607					150 138
0: Inactive					
OUTP: State K 608					150 141
0: Inactive					
OUTP: State K 701					150 144
0: Inactive					
OUTP: State K 702					150 147
0: Inactive					
OUTP: State K 703					150 150
0: Inactive					
OUTP: State K 704					150 153
0: Inactive					
OUTP: State K 705					150 156
0: Inactive					
OUTP: State K 706					150 159
0: Inactive					
OUTP: State K 707					150 162
0: Inactive					
OUTP: State K 708					150 165
0: Inactive					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: State K 801				150 168
0: Inactive				
OUTP: State K 802				150 171
0: Inactive				
OUTP: State K 803				150 174
0: Inactive				
OUTP: State K 804				150 177
0: Inactive				
OUTP: State K 805				150 180
0: Inactive				
OUTP: State K 806				150 183
0: Inactive				
OUTP: State K 807				150 186
0: Inactive				
OUTP: State K 808				150 189
0: Inactive				
OUTP: State K 901				150 192
0: Inactive				
OUTP: State K 902				150 195
0: Inactive				
OUTP: State K 903				150 198
0: Inactive				
OUTP: State K 904				150 201
0: Inactive				
OUTP: State K 905				150 204
0: Inactive				
OUTP: State K 906				150 207
0: Inactive				
OUTP: State K 907				150 210
0: Inactive				
OUTP: State K 908				150 213
0: Inactive				
OUTP: State K 1001				150 216
0: Inactive				
OUTP: State K 1002				150 219
0: Inactive				
OUTP: State K 1003				150 222
0: Inactive				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
OUTP: State K 1004				150 225
0: Inactive				
OUTP: State K 1005				150 228
0: Inactive				
OUTP: State K 1006				150 231
0: Inactive				
OUTP: State K 1007				150 234
0: Inactive				
OUTP: State K 1008				150 237
0: Inactive				
OUTP: State K 1201				151 008
0: Inactive				
OUTP: State K 1202				151 011
0: Inactive				
OUTP: State K 1203				151 014
0: Inactive				
OUTP: State K 1204				151 017
0: Inactive				
OUTP: State K 1205				151 020
0: Inactive				
OUTP: State K 1206				151 023
0: Inactive				
OUTP: State K 1207				151 026
0: Inactive				
OUTP: State K 1208				151 029
0: Inactive				
OUTP: State K 1401				169 001
0: Inactive				
OUTP: State K 1402				169 005
0: Inactive				
OUTP: State K 1403				169 009
0: Inactive				
OUTP: State K 1404				169 013
0: Inactive				
OUTP: State K 1405				169 017
0: Inactive				
OUTP: State K 1406				169 021
0: Inactive				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: State K 1407				169 025
0: Inactive				
OUTP: State K 1408				169 029
0: Inactive				
OUTP: State K 1601				171 001
0: Inactive				
OUTP: State K 1602				171 005
0: Inactive				
OUTP: State K 1603				171 009
0: Inactive				
OUTP: State K 1604				171 013
0: Inactive				
OUTP: State K 1605				171 017
0: Inactive				
OUTP: State K 1606				171 021
0: Inactive				
OUTP: State K 1607				171 025
0: Inactive				
OUTP: State K 1608				171 029
0: Inactive				
OUTP: State K 1801				173 001
0: Inactive				
OUTP: State K 1802				173 005
0: Inactive				
OUTP: State K 1803				173 009
0: Inactive				
OUTP: State K 1804				173 013
0: Inactive				
OUTP: State K 1805				173 017
0: Inactive				
OUTP: State K 1806				173 021
0: Inactive				
OUTP: State K 2001				151 200
0: Inactive				
OUTP: State K 2002				151 203
0: Inactive				
OUTP: State K 2003				151 206
0: Inactive				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OUTP: State K 2004				151 209
0: Inactive				
OUTP: State K 2005				151 212
0: Inactive				
OUTP: State K 2006				151 215
0: Inactive				
OUTP: State K 2007				151 218
0: Inactive				
OUTP: State K 2008				151 221
0: Inactive				

The state of the output relays is displayed as follows:

- *Without function*: No functions are assigned to the output relay.
- *Inactive*: The output relay is not energized.
- *Active*: The output relay is energized.

This display appears regardless of the operating mode set for the output relay.

LED indicators

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LED: State H 1 green				085 180
1: Active				
LED: State H 2 yell.				085 000
0: Inactive				
LED: State H 3 yell.				085 003
0: Inactive				
LED: State H 4 red				085 006
0: Inactive				
LED: State H 5 red				085 009
0: Inactive				
LED: State H 6 red				085 012
0: Inactive				
LED: State H 7 red				085 015
0: Inactive				
LED: State H 8 red				085 018
0: Inactive				
LED: State H 9 red				085 021
0: Inactive				
LED: State H10 red				085 024
0: Inactive				
LED: State H11 red				085 027
0: Inactive				
LED: State H12 red				085 030
0: Inactive				
LED: State H13 red				085 033
0: Inactive				
LED: State H14 red				085 036
0: Inactive				
LED: State H15 red				085 039
0: Inactive				
LED: State H16 red				085 042
0: Inactive				
LED: State H17 red.				085 181
0: Inactive				
LED: State H 4 green				085 056
0: Inactive				
LED: State H 5 green				085 059
0: Inactive				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LED: State H 6 green					085 062
0: Inactive					
LED: State H 7 green					085 065
0: Inactive					
LED: State H 8 green					085 068
0: Inactive					
LED: State H 9 green					085 071
0: Inactive					
LED: State H10 green					085 074
0: Inactive					
LED: State H11 green					085 077
0: Inactive					
LED: State H12 green					085 080
0: Inactive					
LED: State H13 green					085 083
0: Inactive					
LED: State H14 green					085 086
0: Inactive					
LED: State H15 green					085 089
0: Inactive					
LED: State H16 green					085 092
0: Inactive					

The state of the LED indicators is displayed as follows:

- *Inactive*: The LED indicator is not energized.
- *Active*: The LED indicator is energized.

8.1.1.3 Logic State Signals

Local control panel

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
LOC: Edit mode					080 111
0: No					
Signal that the protection unit is in edit mode. As a standard this signal is linked to **LED: Fct.assig. H17 red**.					
LOC: Trig. menu jmp 1 EXT					030 230
0: No					
Signal that menu jump list 1 is being triggered. (See the corresponding setting at **LOC: Fct. menu jmp list 1**.)					
LOC: Trig. menu jmp 2 EXT					030 231
0: No					
Signal that menu jump list 2 is being triggered. (See the corresponding setting at **LOC: Fct. menu jmp list 2**.)					
LOC: Illumination on EXT					037 101
0: No					
This signal shows that the backlighting for the front panel LCD is switched on.					
LOC: Loc.acc.block.active					221 005
0: No					Fig. 3-9, (p. 3-13)
LOC: Rem.acc.block.active					221 004
0: No					Fig. 3-9, (p. 3-13)
LOC: Chg.Sig.Panel stat.					221 076
0: No					Fig. 3-4, (p. 3-8)
LOC: Chg.Sig.Panel flash.					221 077
0: No					Fig. 3-4, (p. 3-8)

"Logical" communication interface 1

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM1: Command block. EXT				003 173
0: No				
COMM1: Sig./meas. block EXT				037 074
0: No				
COMM1: Command blocking				003 174
0: No				Fig. 3-11, (p. 3-17)
COMM1: Sig./meas.val.block.				037 075
0: No				Fig. 3-12, (p. 3-18) Fig. 3-13, (p. 3-19) Fig. 3-14, (p. 3-20)
COMM1: IEC 870-5-103				003 219
0: No				
COMM1: IEC 870-5-101				003 218
0: No				
COMM1: IEC 870-5,ILS				003 221
0: No				
COMM1: MODBUS				003 223
0: No				
COMM1: DNP3				003 230
0: No				
COMM1: COURIER				103 041
0: No				

InterMiCOM interface

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM3: Reset No.tlg.err.EXT				006 054
0: No				
COMM3: Communications fault				120 043
0: No				
COMM3: Comm. link failure				120 044
0: No				
COMM3: Lim.exceed.,tel.err.				120 045
0: No				

IEC 61850 Communication

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IEC: Comm. link faulty				105 180
0: No				
Display when an Ethernet module is not operational, i.e. if the MAC address is missing or there is a non-plausible parameter setting.				
IEC: Control reservation				221 082
0: No				
Display when a client has made a reservation to control an external device (“select” for control by control mode “select before operate”).				

Generic Object Orientated Substation Events

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev01 position					109 000
0: Interm. pos.					
GOOSE: Ext.Dev02 position					109 005
0: Interm. pos.					
GOOSE: Ext.Dev03 position					109 010
0: Interm. pos.					
GOOSE: Ext.Dev04 position					109 015
0: Interm. pos.					
GOOSE: Ext.Dev05 position					109 020
0: Interm. pos.					
GOOSE: Ext.Dev06 position					109 025
0: Interm. pos.					
GOOSE: Ext.Dev07 position					109 030
0: Interm. pos.					
GOOSE: Ext.Dev08 position					109 035
0: Interm. pos.					
GOOSE: Ext.Dev09 position					109 040
0: Interm. pos.					
GOOSE: Ext.Dev10 position					109 045
0: Interm. pos.					
GOOSE: Ext.Dev11 position					109 050
0: Interm. pos.					
GOOSE: Ext.Dev12 position					109 055
0: Interm. pos.					
GOOSE: Ext.Dev13 position					109 060
0: Interm. pos.					
GOOSE: Ext.Dev14 position					109 065
0: Interm. pos.					
GOOSE: Ext.Dev15 position					109 070
0: Interm. pos.					
GOOSE: Ext.Dev16 position					109 075
0: Interm. pos.					
GOOSE: Ext.Dev17 position					109 100
0: Interm. pos.					
GOOSE: Ext.Dev18 position					109 105
0: Interm. pos.					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev19 position				109 110
0: Interm. pos.				
GOOSE: Ext.Dev20 position				109 115
0: Interm. pos.				
GOOSE: Ext.Dev21 position				109 120
0: Interm. pos.				
GOOSE: Ext.Dev22 position				109 125
0: Interm. pos.				
GOOSE: Ext.Dev23 position				109 130
0: Interm. pos.				
GOOSE: Ext.Dev24 position				109 135
0: Interm. pos.				
GOOSE: Ext.Dev25 position				109 140
0: Interm. pos.				
GOOSE: Ext.Dev26 position				109 145
0: Interm. pos.				
GOOSE: Ext.Dev27 position				109 150
0: Interm. pos.				
GOOSE: Ext.Dev28 position				109 155
0: Interm. pos.				
GOOSE: Ext.Dev29 position				109 160
0: Interm. pos.				
GOOSE: Ext.Dev30 position				109 165
0: Interm. pos.				
GOOSE: Ext.Dev31 position				109 170
0: Interm. pos.				
GOOSE: Ext.Dev32 position				109 175
0: Interm. pos.				
GOOSE: Ext.Dev33 position				113 000
0: Interm. pos.				
GOOSE: Ext.Dev34 position				113 004
0: Interm. pos.				
GOOSE: Ext.Dev35 position				113 008
0: Interm. pos.				
GOOSE: Ext.Dev36 position				113 012
0: Interm. pos.				
GOOSE: Ext.Dev37 position				113 016
0: Interm. pos.				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev38 position					113 020
0: Interm. pos.					
GOOSE: Ext.Dev39 position					113 024
0: Interm. pos.					
GOOSE: Ext.Dev40 position					113 028
0: Interm. pos.					
GOOSE: Ext.Dev41 position					113 032
0: Interm. pos.					
GOOSE: Ext.Dev42 position					113 036
0: Interm. pos.					
GOOSE: Ext.Dev43 position					113 040
0: Interm. pos.					
GOOSE: Ext.Dev44 position					113 044
0: Interm. pos.					
GOOSE: Ext.Dev45 position					113 048
0: Interm. pos.					
GOOSE: Ext.Dev46 position					113 052
0: Interm. pos.					
GOOSE: Ext.Dev47 position					113 056
0: Interm. pos.					
GOOSE: Ext.Dev48 position					113 060
0: Interm. pos.					
GOOSE: Ext.Dev49 position					113 064
0: Interm. pos.					
GOOSE: Ext.Dev50 position					113 068
0: Interm. pos.					
GOOSE: Ext.Dev51 position					113 072
0: Interm. pos.					
GOOSE: Ext.Dev52 position					113 076
0: Interm. pos.					
GOOSE: Ext.Dev53 position					113 080
0: Interm. pos.					
GOOSE: Ext.Dev54 position					113 084
0: Interm. pos.					
GOOSE: Ext.Dev55 position					113 088
0: Interm. pos.					
GOOSE: Ext.Dev56 position					113 092
0: Interm. pos.					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev57 position				113 096
0: Interm. pos.				
GOOSE: Ext.Dev58 position				113 100
0: Interm. pos.				
GOOSE: Ext.Dev59 position				113 104
0: Interm. pos.				
GOOSE: Ext.Dev60 position				113 108
0: Interm. pos.				
GOOSE: Ext.Dev61 position				113 112
0: Interm. pos.				
GOOSE: Ext.Dev62 position				113 116
0: Interm. pos.				
GOOSE: Ext.Dev63 position				113 120
0: Interm. pos.				
GOOSE: Ext.Dev64 position				113 124
0: Interm. pos.				
GOOSE: Ext.Dev65 position				113 128
0: Interm. pos.				
GOOSE: Ext.Dev66 position				113 132
0: Interm. pos.				
GOOSE: Ext.Dev67 position				113 136
0: Interm. pos.				
GOOSE: Ext.Dev68 position				113 140
0: Interm. pos.				
GOOSE: Ext.Dev69 position				113 144
0: Interm. pos.				
GOOSE: Ext.Dev70 position				113 148
0: Interm. pos.				
GOOSE: Ext.Dev71 position				113 152
0: Interm. pos.				
GOOSE: Ext.Dev72 position				113 156
0: Interm. pos.				
GOOSE: Ext.Dev73 position				113 160
0: Interm. pos.				
GOOSE: Ext.Dev74 position				113 164
0: Interm. pos.				
GOOSE: Ext.Dev75 position				113 168
0: Interm. pos.				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev76 position					113 172
0: Interm. pos.					
GOOSE: Ext.Dev77 position					113 176
0: Interm. pos.					
GOOSE: Ext.Dev78 position					113 180
0: Interm. pos.					
GOOSE: Ext.Dev79 position					113 184
0: Interm. pos.					
GOOSE: Ext.Dev80 position					113 188
0: Interm. pos.					
GOOSE: Ext.Dev81 position					113 192
0: Interm. pos.					
GOOSE: Ext.Dev82 position					113 196
0: Interm. pos.					
GOOSE: Ext.Dev83 position					113 200
0: Interm. pos.					
GOOSE: Ext.Dev84 position					113 204
0: Interm. pos.					
GOOSE: Ext.Dev85 position					113 208
0: Interm. pos.					
GOOSE: Ext.Dev86 position					113 212
0: Interm. pos.					
GOOSE: Ext.Dev87 position					113 216
0: Interm. pos.					
GOOSE: Ext.Dev88 position					113 220
0: Interm. pos.					
GOOSE: Ext.Dev89 position					113 224
0: Interm. pos.					
GOOSE: Ext.Dev90 position					113 228
0: Interm. pos.					
GOOSE: Ext.Dev91 position					113 232
0: Interm. pos.					
GOOSE: Ext.Dev92 position					113 236
0: Interm. pos.					
GOOSE: Ext.Dev93 position					113 240
0: Interm. pos.					
GOOSE: Ext.Dev94 position					113 244
0: Interm. pos.					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev95 position				113 248
0: Interm. pos.				
GOOSE: Ext.Dev96 position				113 252
0: Interm. pos.				
GOOSE: Ext.Dev97 position				114 000
0: Interm. pos.				
GOOSE: Ext.Dev98 position				114 004
0: Interm. pos.				
GOOSE: Ext.Dev99 position				114 008
0: Interm. pos.				
GOOSE: Ext.Dev100 position				114 012
0: Interm. pos.				
GOOSE: Ext.Dev101 position				114 016
0: Interm. pos.				
GOOSE: Ext.Dev102 position				114 020
0: Interm. pos.				
GOOSE: Ext.Dev103 position				114 024
0: Interm. pos.				
GOOSE: Ext.Dev104 position				114 028
0: Interm. pos.				
GOOSE: Ext.Dev105 position				114 032
0: Interm. pos.				
GOOSE: Ext.Dev106 position				114 036
0: Interm. pos.				
GOOSE: Ext.Dev107 position				114 040
0: Interm. pos.				
GOOSE: Ext.Dev108 position				114 044
0: Interm. pos.				
GOOSE: Ext.Dev109 position				114 048
0: Interm. pos.				
GOOSE: Ext.Dev110 position				114 052
0: Interm. pos.				
GOOSE: Ext.Dev111 position				114 056
0: Interm. pos.				
GOOSE: Ext.Dev112 position				114 060
0: Interm. pos.				
GOOSE: Ext.Dev113 position				114 064
0: Interm. pos.				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev114 position				114 068
0: Interm. pos.				
GOOSE: Ext.Dev115 position				114 072
0: Interm. pos.				
GOOSE: Ext.Dev116 position				114 076
0: Interm. pos.				
GOOSE: Ext.Dev117 position				114 080
0: Interm. pos.				
GOOSE: Ext.Dev118 position				114 084
0: Interm. pos.				
GOOSE: Ext.Dev119 position				114 088
0: Interm. pos.				
GOOSE: Ext.Dev120 position				114 092
0: Interm. pos.				
GOOSE: Ext.Dev121 position				114 096
0: Interm. pos.				
GOOSE: Ext.Dev122 position				114 100
0: Interm. pos.				
GOOSE: Ext.Dev123 position				114 104
0: Interm. pos.				
GOOSE: Ext.Dev124 position				114 108
0: Interm. pos.				
GOOSE: Ext.Dev125 position				114 112
0: Interm. pos.				
GOOSE: Ext.Dev126 position				114 116
0: Interm. pos.				
GOOSE: Ext.Dev127 position				114 120
0: Interm. pos.				
GOOSE: Ext.Dev128 position				114 124
0: Interm. pos.				
State of the virtual two-pole GOOSE input, representing the state of an external device.				
GOOSE: Ext.Dev01 open				109 001
0: No				
GOOSE: Ext.Dev02 open				109 006
0: No				
GOOSE: Ext.Dev03 open				109 011
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev04 open				109 016
0: No				
GOOSE: Ext.Dev05 open				109 021
0: No				
GOOSE: Ext.Dev06 open				109 026
0: No				
GOOSE: Ext.Dev07 open				109 031
0: No				
GOOSE: Ext.Dev08 open				109 036
0: No				
GOOSE: Ext.Dev09 open				109 041
0: No				
GOOSE: Ext.Dev10 open				109 046
0: No				
GOOSE: Ext.Dev11 open				109 051
0: No				
GOOSE: Ext.Dev12 open				109 056
0: No				
GOOSE: Ext.Dev13 open				109 061
0: No				
GOOSE: Ext.Dev14 open				109 066
0: No				
GOOSE: Ext.Dev15 open				109 071
0: No				
GOOSE: Ext.Dev16 open				109 076
0: No				
GOOSE: Ext.Dev17 open				109 101
0: No				
GOOSE: Ext.Dev18 open				109 106
0: No				
GOOSE: Ext.Dev19 open				109 111
0: No				
GOOSE: Ext.Dev20 open				109 116
0: No				
GOOSE: Ext.Dev21 open				109 121
0: No				
GOOSE: Ext.Dev22 open				109 126
0: No				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GOOSE: Ext.Dev23 open							109 131
0: No							
GOOSE: Ext.Dev24 open							109 136
0: No							
GOOSE: Ext.Dev25 open							109 141
0: No							
GOOSE: Ext.Dev26 open							109 146
0: No							
GOOSE: Ext.Dev27 open							109 151
0: No							
GOOSE: Ext.Dev28 open							109 156
0: No							
GOOSE: Ext.Dev29 open							109 161
0: No							
GOOSE: Ext.Dev30 open							109 166
0: No							
GOOSE: Ext.Dev31 open							109 171
0: No							
GOOSE: Ext.Dev32 open							109 176
0: No							
GOOSE: Ext.Dev33 open							113 001
0: No							
GOOSE: Ext.Dev34 open							113 005
0: No							
GOOSE: Ext.Dev35 open							113 009
0: No							
GOOSE: Ext.Dev36 open							113 013
0: No							
GOOSE: Ext.Dev37 open							113 017
0: No							
GOOSE: Ext.Dev38 open							113 021
0: No							
GOOSE: Ext.Dev39 open							113 025
0: No							
GOOSE: Ext.Dev40 open							113 029
0: No							
GOOSE: Ext.Dev41 open							113 033
0: No							

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
GOOSE: Ext.Dev42 open					113 037
0: No					
GOOSE: Ext.Dev43 open					113 041
0: No					
GOOSE: Ext.Dev44 open					113 045
0: No					
GOOSE: Ext.Dev45 open					113 049
0: No					
GOOSE: Ext.Dev46 open					113 053
0: No					
GOOSE: Ext.Dev47 open					113 057
0: No					
GOOSE: Ext.Dev48 open					113 061
0: No					
GOOSE: Ext.Dev49 open					113 065
0: No					
GOOSE: Ext.Dev50 open					113 069
0: No					
GOOSE: Ext.Dev51 open					113 073
0: No					
GOOSE: Ext.Dev52 open					113 077
0: No					
GOOSE: Ext.Dev53 open					113 081
0: No					
GOOSE: Ext.Dev54 open					113 085
0: No					
GOOSE: Ext.Dev55 open					113 089
0: No					
GOOSE: Ext.Dev56 open					113 093
0: No					
GOOSE: Ext.Dev57 open					113 097
0: No					
GOOSE: Ext.Dev58 open					113 101
0: No					
GOOSE: Ext.Dev59 open					113 105
0: No					
GOOSE: Ext.Dev60 open					113 109
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev61 open				113 113
0: No				
GOOSE: Ext.Dev62 open				113 117
0: No				
GOOSE: Ext.Dev63 open				113 121
0: No				
GOOSE: Ext.Dev64 open				113 125
0: No				
GOOSE: Ext.Dev65 open				113 129
0: No				
GOOSE: Ext.Dev66 open				113 133
0: No				
GOOSE: Ext.Dev67 open				113 137
0: No				
GOOSE: Ext.Dev68 open				113 141
0: No				
GOOSE: Ext.Dev69 open				113 145
0: No				
GOOSE: Ext.Dev70 open				113 149
0: No				
GOOSE: Ext.Dev71 open				113 153
0: No				
GOOSE: Ext.Dev72 open				113 157
0: No				
GOOSE: Ext.Dev73 open				113 161
0: No				
GOOSE: Ext.Dev74 open				113 165
0: No				
GOOSE: Ext.Dev75 open				113 169
0: No				
GOOSE: Ext.Dev76 open				113 173
0: No				
GOOSE: Ext.Dev77 open				113 177
0: No				
GOOSE: Ext.Dev78 open				113 181
0: No				
GOOSE: Ext.Dev79 open				113 185
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev80 open				113 189
0: No				
GOOSE: Ext.Dev81 open				113 193
0: No				
GOOSE: Ext.Dev82 open				113 197
0: No				
GOOSE: Ext.Dev83 open				113 201
0: No				
GOOSE: Ext.Dev84 open				113 205
0: No				
GOOSE: Ext.Dev85 open				113 209
0: No				
GOOSE: Ext.Dev86 open				113 213
0: No				
GOOSE: Ext.Dev87 open				113 217
0: No				
GOOSE: Ext.Dev88 open				113 221
0: No				
GOOSE: Ext.Dev89 open				113 225
0: No				
GOOSE: Ext.Dev90 open				113 229
0: No				
GOOSE: Ext.Dev91 open				113 233
0: No				
GOOSE: Ext.Dev92 open				113 237
0: No				
GOOSE: Ext.Dev93 open				113 241
0: No				
GOOSE: Ext.Dev94 open				113 245
0: No				
GOOSE: Ext.Dev95 open				113 249
0: No				
GOOSE: Ext.Dev96 open				113 253
0: No				
GOOSE: Ext.Dev97 open				114 001
0: No				
GOOSE: Ext.Dev98 open				114 005
0: No				

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
GOOSE: Ext.Dev99 open							114 009
0: No							
GOOSE: Ext.Dev100 open							114 013
0: No							
GOOSE: Ext.Dev101 open							114 017
0: No							
GOOSE: Ext.Dev102 open							114 021
0: No							
GOOSE: Ext.Dev103 open							114 025
0: No							
GOOSE: Ext.Dev104 open							114 029
0: No							
GOOSE: Ext.Dev105 open							114 033
0: No							
GOOSE: Ext.Dev106 open							114 037
0: No							
GOOSE: Ext.Dev107 open							114 041
0: No							
GOOSE: Ext.Dev108 open							114 045
0: No							
GOOSE: Ext.Dev109 open							114 049
0: No							
GOOSE: Ext.Dev110 open							114 053
0: No							
GOOSE: Ext.Dev111 open							114 057
0: No							
GOOSE: Ext.Dev112 open							114 061
0: No							
GOOSE: Ext.Dev113 open							114 065
0: No							
GOOSE: Ext.Dev114 open							114 069
0: No							
GOOSE: Ext.Dev115 open							114 073
0: No							
GOOSE: Ext.Dev116 open							114 077
0: No							
GOOSE: Ext.Dev117 open							114 081
0: No							

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev118 open				114 085
0: No				
GOOSE: Ext.Dev119 open				114 089
0: No				
GOOSE: Ext.Dev120 open				114 093
0: No				
GOOSE: Ext.Dev121 open				114 097
0: No				
GOOSE: Ext.Dev122 open				114 101
0: No				
GOOSE: Ext.Dev123 open				114 105
0: No				
GOOSE: Ext.Dev124 open				114 109
0: No				
GOOSE: Ext.Dev125 open				114 113
0: No				
GOOSE: Ext.Dev126 open				114 117
0: No				
GOOSE: Ext.Dev127 open				114 121
0: No				
GOOSE: Ext.Dev128 open				114 125
0: No				
Binary open state of the virtual two-pole GOOSE input, representing the state of an external device.				
GOOSE: Ext.Dev01 closed				109 002
0: No				
GOOSE: Ext.Dev02 closed				109 007
0: No				
GOOSE: Ext.Dev03 closed				109 012
0: No				
GOOSE: Ext.Dev04 closed				109 017
0: No				
GOOSE: Ext.Dev05 closed				109 022
0: No				
GOOSE: Ext.Dev06 closed				109 027
0: No				
GOOSE: Ext.Dev07 closed				109 032
0: No				

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
GOOSE: Ext.Dev08 closed					109 037
0: No					
GOOSE: Ext.Dev09 closed					109 042
0: No					
GOOSE: Ext.Dev10 closed					109 047
0: No					
GOOSE: Ext.Dev11 closed					109 052
0: No					
GOOSE: Ext.Dev12 closed					109 057
0: No					
GOOSE: Ext.Dev13 closed					109 062
0: No					
GOOSE: Ext.Dev14 closed					109 067
0: No					
GOOSE: Ext.Dev15 closed					109 072
0: No					
GOOSE: Ext.Dev16 closed					109 077
0: No					
GOOSE: Ext.Dev17 closed					109 102
0: No					
GOOSE: Ext.Dev18 closed					109 107
0: No					
GOOSE: Ext.Dev19 closed					109 112
0: No					
GOOSE: Ext.Dev20 closed					109 117
0: No					
GOOSE: Ext.Dev21 closed					109 122
0: No					
GOOSE: Ext.Dev22 closed					109 127
0: No					
GOOSE: Ext.Dev23 closed					109 132
0: No					
GOOSE: Ext.Dev24 closed					109 137
0: No					
GOOSE: Ext.Dev25 closed					109 142
0: No					
GOOSE: Ext.Dev26 closed					109 147
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev27 closed				109 152
0: No				
GOOSE: Ext.Dev28 closed				109 157
0: No				
GOOSE: Ext.Dev29 closed				109 162
0: No				
GOOSE: Ext.Dev30 closed				109 167
0: No				
GOOSE: Ext.Dev31 closed				109 172
0: No				
GOOSE: Ext.Dev32 closed				109 177
0: No				
GOOSE: Ext.Dev33 closed				113 002
0: No				
GOOSE: Ext.Dev34 closed				113 006
0: No				
GOOSE: Ext.Dev35 closed				113 010
0: No				
GOOSE: Ext.Dev36 closed				113 014
0: No				
GOOSE: Ext.Dev37 closed				113 018
0: No				
GOOSE: Ext.Dev38 closed				113 022
0: No				
GOOSE: Ext.Dev39 closed				113 026
0: No				
GOOSE: Ext.Dev40 closed				113 030
0: No				
GOOSE: Ext.Dev41 closed				113 034
0: No				
GOOSE: Ext.Dev42 closed				113 038
0: No				
GOOSE: Ext.Dev43 closed				113 042
0: No				
GOOSE: Ext.Dev44 closed				113 046
0: No				
GOOSE: Ext.Dev45 closed				113 050
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev46 closed				113 054
0: No				
GOOSE: Ext.Dev47 closed				113 058
0: No				
GOOSE: Ext.Dev48 closed				113 062
0: No				
GOOSE: Ext.Dev49 closed				113 066
0: No				
GOOSE: Ext.Dev50 closed				113 070
0: No				
GOOSE: Ext.Dev51 closed				113 074
0: No				
GOOSE: Ext.Dev52 closed				113 078
0: No				
GOOSE: Ext.Dev53 closed				113 082
0: No				
GOOSE: Ext.Dev54 closed				113 086
0: No				
GOOSE: Ext.Dev55 closed				113 090
0: No				
GOOSE: Ext.Dev56 closed				113 094
0: No				
GOOSE: Ext.Dev57 closed				113 098
0: No				
GOOSE: Ext.Dev58 closed				113 102
0: No				
GOOSE: Ext.Dev59 closed				113 106
0: No				
GOOSE: Ext.Dev60 closed				113 110
0: No				
GOOSE: Ext.Dev61 closed				113 114
0: No				
GOOSE: Ext.Dev62 closed				113 118
0: No				
GOOSE: Ext.Dev63 closed				113 122
0: No				
GOOSE: Ext.Dev64 closed				113 126
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev65 closed					113 130
0: No					
GOOSE: Ext.Dev66 closed					113 134
0: No					
GOOSE: Ext.Dev67 closed					113 138
0: No					
GOOSE: Ext.Dev68 closed					113 142
0: No					
GOOSE: Ext.Dev69 closed					113 146
0: No					
GOOSE: Ext.Dev70 closed					113 150
0: No					
GOOSE: Ext.Dev71 closed					113 154
0: No					
GOOSE: Ext.Dev72 closed					113 158
0: No					
GOOSE: Ext.Dev73 closed					113 162
0: No					
GOOSE: Ext.Dev74 closed					113 166
0: No					
GOOSE: Ext.Dev75 closed					113 170
0: No					
GOOSE: Ext.Dev76 closed					113 174
0: No					
GOOSE: Ext.Dev77 closed					113 178
0: No					
GOOSE: Ext.Dev78 closed					113 182
0: No					
GOOSE: Ext.Dev79 closed					113 186
0: No					
GOOSE: Ext.Dev80 closed					113 190
0: No					
GOOSE: Ext.Dev81 closed					113 194
0: No					
GOOSE: Ext.Dev82 closed					113 198
0: No					
GOOSE: Ext.Dev83 closed					113 202
0: No					

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GOOSE: Ext.Dev84 closed							113 206
0: No							
GOOSE: Ext.Dev85 closed							113 210
0: No							
GOOSE: Ext.Dev86 closed							113 214
0: No							
GOOSE: Ext.Dev87 closed							113 218
0: No							
GOOSE: Ext.Dev88 closed							113 222
0: No							
GOOSE: Ext.Dev89 closed							113 226
0: No							
GOOSE: Ext.Dev90 closed							113 230
0: No							
GOOSE: Ext.Dev91 closed							113 234
0: No							
GOOSE: Ext.Dev92 closed							113 238
0: No							
GOOSE: Ext.Dev93 closed							113 242
0: No							
GOOSE: Ext.Dev94 closed							113 246
0: No							
GOOSE: Ext.Dev95 closed							113 250
0: No							
GOOSE: Ext.Dev96 closed							113 254
0: No							
GOOSE: Ext.Dev97 closed							114 002
0: No							
GOOSE: Ext.Dev98 closed							114 006
0: No							
GOOSE: Ext.Dev99 closed							114 010
0: No							
GOOSE: Ext.Dev100 closed							114 014
0: No							
GOOSE: Ext.Dev101 closed							114 018
0: No							
GOOSE: Ext.Dev102 closed							114 022
0: No							

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev103 closed				114 026
0: No				
GOOSE: Ext.Dev104 closed				114 030
0: No				
GOOSE: Ext.Dev105 closed				114 034
0: No				
GOOSE: Ext.Dev106 closed				114 038
0: No				
GOOSE: Ext.Dev107 closed				114 042
0: No				
GOOSE: Ext.Dev108 closed				114 046
0: No				
GOOSE: Ext.Dev109 closed				114 050
0: No				
GOOSE: Ext.Dev110 closed				114 054
0: No				
GOOSE: Ext.Dev111 closed				114 058
0: No				
GOOSE: Ext.Dev112 closed				114 062
0: No				
GOOSE: Ext.Dev113 closed				114 066
0: No				
GOOSE: Ext.Dev114 closed				114 070
0: No				
GOOSE: Ext.Dev115 closed				114 074
0: No				
GOOSE: Ext.Dev116 closed				114 078
0: No				
GOOSE: Ext.Dev117 closed				114 082
0: No				
GOOSE: Ext.Dev118 closed				114 086
0: No				
GOOSE: Ext.Dev119 closed				114 090
0: No				
GOOSE: Ext.Dev120 closed				114 094
0: No				
GOOSE: Ext.Dev121 closed				114 098
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev122 closed					114 102
0: No					
GOOSE: Ext.Dev123 closed					114 106
0: No					
GOOSE: Ext.Dev124 closed					114 110
0: No					
GOOSE: Ext.Dev125 closed					114 114
0: No					
GOOSE: Ext.Dev126 closed					114 118
0: No					
GOOSE: Ext.Dev127 closed					114 122
0: No					
GOOSE: Ext.Dev128 closed					114 126
0: No					
Binary closed state of the virtual two-pole GOOSE input, representing the state of an external device.					
GOOSE: Ext.Dev01 interm.pos					109 003
0: No					
GOOSE: Ext.Dev02 interm.pos					109 008
0: No					
GOOSE: Ext.Dev03 interm.pos					109 013
0: No					
GOOSE: Ext.Dev04 interm.pos					109 018
0: No					
GOOSE: Ext.Dev05 interm.pos					109 023
0: No					
GOOSE: Ext.Dev06 interm.pos					109 028
0: No					
GOOSE: Ext.Dev07 interm.pos					109 033
0: No					
GOOSE: Ext.Dev08 interm.pos					109 038
0: No					
GOOSE: Ext.Dev09 interm.pos					109 043
0: No					
GOOSE: Ext.Dev10 interm.pos					109 048
0: No					
GOOSE: Ext.Dev11 interm.pos					109 053
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev12 interm.pos				109 058
0: No				
GOOSE: Ext.Dev13 interm.pos				109 063
0: No				
GOOSE: Ext.Dev14 interm.pos				109 068
0: No				
GOOSE: Ext.Dev15 interm.pos				109 073
0: No				
GOOSE: Ext.Dev16 interm.pos				109 078
0: No				
GOOSE: Ext.Dev17 interm.pos				109 103
0: No				
GOOSE: Ext.Dev18 interm.pos				109 108
0: No				
GOOSE: Ext.Dev19 interm.pos				109 113
0: No				
GOOSE: Ext.Dev20 interm.pos				109 118
0: No				
GOOSE: Ext.Dev21 interm.pos				109 123
0: No				
GOOSE: Ext.Dev22 interm.pos				109 128
0: No				
GOOSE: Ext.Dev23 interm.pos				109 133
0: No				
GOOSE: Ext.Dev24 interm.pos				109 138
0: No				
GOOSE: Ext.Dev25 interm.pos				109 143
0: No				
GOOSE: Ext.Dev26 interm.pos				109 148
0: No				
GOOSE: Ext.Dev27 interm.pos				109 153
0: No				
GOOSE: Ext.Dev28 interm.pos				109 158
0: No				
GOOSE: Ext.Dev29 interm.pos				109 163
0: No				
GOOSE: Ext.Dev30 interm.pos				109 168
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Ext.Dev31 interm.pos					109 173
0: No					
GOOSE: Ext.Dev32 interm.pos					109 178
0: No					
GOOSE: Ext.Dev33 interm.pos					113 003
0: No					
GOOSE: Ext.Dev34 interm.pos					113 007
0: No					
GOOSE: Ext.Dev35 interm.pos					113 011
0: No					
GOOSE: Ext.Dev36 interm.pos					113 015
0: No					
GOOSE: Ext.Dev37 interm.pos					113 019
0: No					
GOOSE: Ext.Dev38 interm.pos					113 023
0: No					
GOOSE: Ext.Dev39 interm.pos					113 027
0: No					
GOOSE: Ext.Dev40 interm.pos					113 031
0: No					
GOOSE: Ext.Dev41 interm.pos					113 035
0: No					
GOOSE: Ext.Dev42 interm.pos					113 039
0: No					
GOOSE: Ext.Dev43 interm.pos					113 043
0: No					
GOOSE: Ext.Dev44 interm.pos					113 047
0: No					
GOOSE: Ext.Dev45 interm.pos					113 051
0: No					
GOOSE: Ext.Dev46 interm.pos					113 055
0: No					
GOOSE: Ext.Dev47 interm.pos					113 059
0: No					
GOOSE: Ext.Dev48 interm.pos					113 063
0: No					
GOOSE: Ext.Dev49 interm.pos					113 067
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev50 interm.pos				113 071
0: No				
GOOSE: Ext.Dev51 interm.pos				113 075
0: No				
GOOSE: Ext.Dev52 interm.pos				113 079
0: No				
GOOSE: Ext.Dev53 interm.pos				113 083
0: No				
GOOSE: Ext.Dev54 interm.pos				113 087
0: No				
GOOSE: Ext.Dev55 interm.pos				113 091
0: No				
GOOSE: Ext.Dev56 interm.pos				113 095
0: No				
GOOSE: Ext.Dev57 interm.pos				113 099
0: No				
GOOSE: Ext.Dev58 interm.pos				113 103
0: No				
GOOSE: Ext.Dev59 interm.pos				113 107
0: No				
GOOSE: Ext.Dev60 interm.pos				113 111
0: No				
GOOSE: Ext.Dev61 interm.pos				113 115
0: No				
GOOSE: Ext.Dev62 interm.pos				113 119
0: No				
GOOSE: Ext.Dev63 interm.pos				113 123
0: No				
GOOSE: Ext.Dev64 interm.pos				113 127
0: No				
GOOSE: Ext.Dev65 interm.pos				113 131
0: No				
GOOSE: Ext.Dev66 interm.pos				113 135
0: No				
GOOSE: Ext.Dev67 interm.pos				113 139
0: No				
GOOSE: Ext.Dev68 interm.pos				113 143
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev69 interm.pos				113 147
0: No				
GOOSE: Ext.Dev70 interm.pos				113 151
0: No				
GOOSE: Ext.Dev71 interm.pos				113 155
0: No				
GOOSE: Ext.Dev72 interm.pos				113 159
0: No				
GOOSE: Ext.Dev73 interm.pos				113 163
0: No				
GOOSE: Ext.Dev74 interm.pos				113 167
0: No				
GOOSE: Ext.Dev75 interm.pos				113 171
0: No				
GOOSE: Ext.Dev76 interm.pos				113 175
0: No				
GOOSE: Ext.Dev77 interm.pos				113 179
0: No				
GOOSE: Ext.Dev78 interm.pos				113 183
0: No				
GOOSE: Ext.Dev79 interm.pos				113 187
0: No				
GOOSE: Ext.Dev80 interm.pos				113 191
0: No				
GOOSE: Ext.Dev81 interm.pos				113 195
0: No				
GOOSE: Ext.Dev82 interm.pos				113 199
0: No				
GOOSE: Ext.Dev83 interm.pos				113 203
0: No				
GOOSE: Ext.Dev84 interm.pos				113 207
0: No				
GOOSE: Ext.Dev85 interm.pos				113 211
0: No				
GOOSE: Ext.Dev86 interm.pos				113 215
0: No				
GOOSE: Ext.Dev87 interm.pos				113 219
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev88 interm.pos				113 223
0: No				
GOOSE: Ext.Dev89 interm.pos				113 227
0: No				
GOOSE: Ext.Dev90 interm.pos				113 231
0: No				
GOOSE: Ext.Dev91 interm.pos				113 235
0: No				
GOOSE: Ext.Dev92 interm.pos				113 239
0: No				
GOOSE: Ext.Dev93 interm.pos				113 243
0: No				
GOOSE: Ext.Dev94 interm.pos				113 247
0: No				
GOOSE: Ext.Dev95 interm.pos				113 251
0: No				
GOOSE: Ext.Dev96 interm.pos				113 255
0: No				
GOOSE: Ext.Dev97 interm.pos				114 003
0: No				
GOOSE: Ext.Dev98 interm.pos				114 007
0: No				
GOOSE: Ext.Dev99 interm.pos				114 011
0: No				
GOOSE: Ext.Dev100 interm.po				114 015
0: No				
GOOSE: Ext.Dev101 interm.po				114 019
0: No				
GOOSE: Ext.Dev102 interm.po				114 023
0: No				
GOOSE: Ext.Dev103 interm.po				114 027
0: No				
GOOSE: Ext.Dev104 interm.po				114 031
0: No				
GOOSE: Ext.Dev105 interm.po				114 035
0: No				
GOOSE: Ext.Dev106 interm.po				114 039
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Ext.Dev107 interm.po				114 043
0: No				
GOOSE: Ext.Dev108 interm.po				114 047
0: No				
GOOSE: Ext.Dev109 interm.po				114 051
0: No				
GOOSE: Ext.Dev110 interm.po				114 055
0: No				
GOOSE: Ext.Dev111 interm.po				114 059
0: No				
GOOSE: Ext.Dev112 interm.po				114 063
0: No				
GOOSE: Ext.Dev113 interm.po				114 067
0: No				
GOOSE: Ext.Dev114 interm.po				114 071
0: No				
GOOSE: Ext.Dev115 interm.po				114 075
0: No				
GOOSE: Ext.Dev116 interm.po				114 079
0: No				
GOOSE: Ext.Dev117 interm.po				114 083
0: No				
GOOSE: Ext.Dev118 interm.po				114 087
0: No				
GOOSE: Ext.Dev119 interm.po				114 091
0: No				
GOOSE: Ext.Dev120 interm.po				114 095
0: No				
GOOSE: Ext.Dev121 interm.po				114 099
0: No				
GOOSE: Ext.Dev122 interm.po				114 103
0: No				
GOOSE: Ext.Dev123 interm.po				114 107
0: No				
GOOSE: Ext.Dev124 interm.po				114 111
0: No				
GOOSE: Ext.Dev125 interm.po				114 115
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
GOOSE: Ext.Dev126 interm.po				114 119
0: No				
GOOSE: Ext.Dev127 interm.po				114 123
0: No				
GOOSE: Ext.Dev128 interm.po				114 127
0: No				
Binary intermediate position state of the virtual two-pole GOOSE input, representing the state of an external device.				
GOOSE: Input 01 faulty				111 100
0: No				
GOOSE: Input 02 faulty				111 101
0: No				
GOOSE: Input 03 faulty				111 102
0: No				
GOOSE: Input 04 faulty				111 103
0: No				
GOOSE: Input 05 faulty				111 104
0: No				
GOOSE: Input 06 faulty				111 105
0: No				
GOOSE: Input 07 faulty				111 106
0: No				
GOOSE: Input 08 faulty				111 107
0: No				
GOOSE: Input 09 faulty				111 108
0: No				
GOOSE: Input 10 faulty				111 109
0: No				
GOOSE: Input 11 faulty				111 110
0: No				
GOOSE: Input 12 faulty				111 111
0: No				
GOOSE: Input 13 faulty				111 112
0: No				
GOOSE: Input 14 faulty				111 113
0: No				
GOOSE: Input 15 faulty				111 114
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
GOOSE: Input 16 faulty					111 115
0: No					
GOOSE: Input 17 faulty					111 116
0: No					
GOOSE: Input 18 faulty					111 117
0: No					
GOOSE: Input 19 faulty					111 118
0: No					
GOOSE: Input 20 faulty					111 119
0: No					
GOOSE: Input 21 faulty					111 120
0: No					
GOOSE: Input 22 faulty					111 121
0: No					
GOOSE: Input 23 faulty					111 122
0: No					
GOOSE: Input 24 faulty					111 123
0: No					
GOOSE: Input 25 faulty					111 124
0: No					
GOOSE: Input 26 faulty					111 125
0: No					
GOOSE: Input 27 faulty					111 126
0: No					
GOOSE: Input 28 faulty					111 127
0: No					
GOOSE: Input 29 faulty					111 128
0: No					
GOOSE: Input 30 faulty					111 129
0: No					
GOOSE: Input 31 faulty					111 130
0: No					
GOOSE: Input 32 faulty					111 131
0: No					
GOOSE: Input 33 faulty					111 132
0: No					
GOOSE: Input 34 faulty					111 133
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 35 faulty				111 134
0: No				
GOOSE: Input 36 faulty				111 135
0: No				
GOOSE: Input 37 faulty				111 136
0: No				
GOOSE: Input 38 faulty				111 137
0: No				
GOOSE: Input 39 faulty				111 138
0: No				
GOOSE: Input 40 faulty				111 139
0: No				
GOOSE: Input 41 faulty				111 140
0: No				
GOOSE: Input 42 faulty				111 141
0: No				
GOOSE: Input 43 faulty				111 142
0: No				
GOOSE: Input 44 faulty				111 143
0: No				
GOOSE: Input 45 faulty				111 144
0: No				
GOOSE: Input 46 faulty				111 145
0: No				
GOOSE: Input 47 faulty				111 146
0: No				
GOOSE: Input 48 faulty				111 147
0: No				
GOOSE: Input 49 faulty				111 148
0: No				
GOOSE: Input 50 faulty				111 149
0: No				
GOOSE: Input 51 faulty				111 150
0: No				
GOOSE: Input 52 faulty				111 151
0: No				
GOOSE: Input 53 faulty				111 152
0: No				

Parameter								Address
Default	Min	Max	Unit					Logic Diagram
GOOSE: Input 54 faulty								111 153
0: No								
GOOSE: Input 55 faulty								111 154
0: No								
GOOSE: Input 56 faulty								111 155
0: No								
GOOSE: Input 57 faulty								111 156
0: No								
GOOSE: Input 58 faulty								111 157
0: No								
GOOSE: Input 59 faulty								111 158
0: No								
GOOSE: Input 60 faulty								111 159
0: No								
GOOSE: Input 61 faulty								111 160
0: No								
GOOSE: Input 62 faulty								111 161
0: No								
GOOSE: Input 63 faulty								111 162
0: No								
GOOSE: Input 64 faulty								111 163
0: No								
GOOSE: Input 65 faulty								111 164
0: No								
GOOSE: Input 66 faulty								111 165
0: No								
GOOSE: Input 67 faulty								111 166
0: No								
GOOSE: Input 68 faulty								111 167
0: No								
GOOSE: Input 69 faulty								111 168
0: No								
GOOSE: Input 70 faulty								111 169
0: No								
GOOSE: Input 71 faulty								111 170
0: No								
GOOSE: Input 72 faulty								111 171
0: No								

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 73 faulty				111 172
0: No				
GOOSE: Input 74 faulty				111 173
0: No				
GOOSE: Input 75 faulty				111 174
0: No				
GOOSE: Input 76 faulty				111 175
0: No				
GOOSE: Input 77 faulty				111 176
0: No				
GOOSE: Input 78 faulty				111 177
0: No				
GOOSE: Input 79 faulty				111 178
0: No				
GOOSE: Input 80 faulty				111 179
0: No				
GOOSE: Input 81 faulty				111 180
0: No				
GOOSE: Input 82 faulty				111 181
0: No				
GOOSE: Input 83 faulty				111 182
0: No				
GOOSE: Input 84 faulty				111 183
0: No				
GOOSE: Input 85 faulty				111 184
0: No				
GOOSE: Input 86 faulty				111 185
0: No				
GOOSE: Input 87 faulty				111 186
0: No				
GOOSE: Input 88 faulty				111 187
0: No				
GOOSE: Input 89 faulty				111 188
0: No				
GOOSE: Input 90 faulty				111 189
0: No				
GOOSE: Input 91 faulty				111 190
0: No				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GOOSE: Input 92 faulty							111 191
0: No							
GOOSE: Input 93 faulty							111 192
0: No							
GOOSE: Input 94 faulty							111 193
0: No							
GOOSE: Input 95 faulty							111 194
0: No							
GOOSE: Input 96 faulty							111 195
0: No							
GOOSE: Input 97 faulty							111 196
0: No							
GOOSE: Input 98 faulty							111 197
0: No							
GOOSE: Input 99 faulty							111 198
0: No							
GOOSE: Input 100 faulty							111 199
0: No							
GOOSE: Input 101 faulty							111 200
0: No							
GOOSE: Input 102 faulty							111 201
0: No							
GOOSE: Input 103 faulty							111 202
0: No							
GOOSE: Input 104 faulty							111 203
0: No							
GOOSE: Input 105 faulty							111 204
0: No							
GOOSE: Input 106 faulty							111 205
0: No							
GOOSE: Input 107 faulty							111 206
0: No							
GOOSE: Input 108 faulty							111 207
0: No							
GOOSE: Input 109 faulty							111 208
0: No							
GOOSE: Input 110 faulty							111 209
0: No							

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GOOSE: Input 111 faulty				111 210
0: No				
GOOSE: Input 112 faulty				111 211
0: No				
GOOSE: Input 113 faulty				111 212
0: No				
GOOSE: Input 114 faulty				111 213
0: No				
GOOSE: Input 115 faulty				111 214
0: No				
GOOSE: Input 116 faulty				111 215
0: No				
GOOSE: Input 117 faulty				111 216
0: No				
GOOSE: Input 118 faulty				111 217
0: No				
GOOSE: Input 119 faulty				111 218
0: No				
GOOSE: Input 120 faulty				111 219
0: No				
GOOSE: Input 121 faulty				111 220
0: No				
GOOSE: Input 122 faulty				111 221
0: No				
GOOSE: Input 123 faulty				111 222
0: No				
GOOSE: Input 124 faulty				111 223
0: No				
GOOSE: Input 125 faulty				111 224
0: No				
GOOSE: Input 126 faulty				111 225
0: No				
GOOSE: Input 127 faulty				111 226
0: No				
GOOSE: Input 128 faulty				111 227
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
GOOSE: IED link faulty				107 250
0: No				
Display which appears as soon as receipt of at least one of the configured GOOSEs is faulty or not available. To each GOOSE the GOOSE sending device will attach a validity stamp, up to which a repetition of GOOSE will be carried out independent of a change of state. Thus the unit monitors the time period at which the next state signal must be received.				
GOOSE: IED01-16 linked				107 251
2:				
GOOSE: IED17-32 linked				107 252
2:				
GOOSE: IED33-48 linked				112 200
2:				
GOOSE: IED49-64 linked				112 201
2:				
GOOSE: IED65-80 linked				112 202
2:				
GOOSE: IED81-96 linked				112 203
2:				
GOOSE: IED97-112 linked				112 204
2:				
GOOSE: IED113-128 linked				112 205
2:				
GOOSE: OrdRun01-16 linked				107 248
2:				
GOOSE: OrdRun17-32 linked				107 249
2:				
GOOSE: Uniqueness 1-16				007 217
Not measured	0	65535		
GOOSE: Uniqueness 17-32				007 218
Not measured	0	65535		

IRIG-B interface

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
IRIGB: Enabled				023 201
0: No				Fig. 3-28, (p. 3-48)
IRIGB: Synchron. ready				023 202
0: No				Fig. 3-28, (p. 3-48)

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**

Measured data input

Parameter				Address
MEASI: Reset Tmax EXT				006 076
0: No				
MEASI: Enabled				035 008
0: No	Fig. 3-30, (p. 3-51) Fig. 3-40, (p. 3-62)			
MEASI: RTD HW Failure				006 102
0: No				
MEASI: I/O HW Failure				006 103
0: No				
MEASI: Open circ. PT100				040 190
0: No	Fig. 3-35, (p. 3-56)			
MEASI: Open circ. T1				040 193
0: No	Fig. 3-36, (p. 3-57)			
MEASI: Open circ. T2				040 194
0: No				
MEASI: Open circ. T3				040 195
0: No				
MEASI: Open circ. T4				040 208
0: No				
MEASI: Open circ. T5				040 209
0: No				
MEASI: Open circ. T6				040 218
0: No				
MEASI: Open circ. T7				040 219
0: No				
MEASI: Open circ. T8				040 252
0: No				
MEASI: Open circ. T9				040 253
0: No				
MEASI: Overload 20mA input				040 191
0: No	Fig. 3-33, (p. 3-54)			
MEASI: Open circ. 20mA inp.				040 192
0: No	Fig. 3-33, (p. 3-54)			

Binary and analog output

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OUTP: Block outp.rel. EXT							040 014
0: No							
OUTP: Reset latch. EXT							040 015
0: No							
OUTP: Outp. relays blocked							021 015
1: Yes				Fig. 3-38, (p. 3-60)			
OUTP: Latching reset							040 088
0: No				Fig. 3-38, (p. 3-60)			

Measured data output

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MEASO: Outp. enabled EXT					036 085
1: Yes					
MEASO: Reset output EXT					036 087
0: No					
MEASO: Enabled					037 102
0: No					
MEASO: Output reset					037 117
0: No					Fig. 3-42, (p. 3-63)
MEASO: Valid BCD value					037 050
0: No					Fig. 3-44, (p. 3-67)
MEASO: 1-digit bit 0 (BCD)					037 051
0: No					Fig. 3-44, (p. 3-67)
MEASO: 1-digit bit 1 (BCD)					037 052
0: No					Fig. 3-44, (p. 3-67)
MEASO: 1-digit bit 2 (BCD)					037 053
0: No					Fig. 3-44, (p. 3-67)
MEASO: 1-digit bit 3 (BCD)					037 054
0: No					Fig. 3-44, (p. 3-67)
MEASO: 10-digit bit 0 (BCD)					037 055
0: No					Fig. 3-44, (p. 3-67)
MEASO: 10-digit bit 1 (BCD)					037 056
0: No					Fig. 3-44, (p. 3-67)
MEASO: 10-digit bit 2 (BCD)					037 057
0: No					Fig. 3-44, (p. 3-67)
MEASO: 10-digit bit 3 (BCD)					037 058
0: No					Fig. 3-44, (p. 3-67)
MEASO: 100-dig. bit 0 (BCD)					037 059
0: No					Fig. 3-44, (p. 3-67)
MEASO: 100-dig. bit 1 (BCD)					037 060
0: No					Fig. 3-44, (p. 3-67)
MEASO: Value A-1 valid					069 014
0: No					Fig. 3-46, (p. 3-73)
MEASO: Value A-1 output					037 118
0: No					Fig. 3-46, (p. 3-73)
MEASO: Value A-2 valid					069 015
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASO: Value A-2 output					037 119
0: No					

Main function

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Enable protect. EXT					003 027
2: Not configured					
MAIN: Disable protect. EXT					003 026
2: Not configured					
MAIN: System IN enable EXT					040 130
2: Not configured					
MAIN: Syst. IN disable EXT					040 131
2: Not configured					
MAIN: General reset EXT					005 255
0: No					
MAIN: Group reset 1 EXT					005 209
0: No					
MAIN: Group reset 2 EXT					005 252
0: No					
MAIN: Reset indicat. EXT					065 001
0: No					
MAIN: Reset latch.trip EXT					040 138
0: No					
MAIN: Rst.c.cl./tripc. EXT					005 210
0: No					
MAIN: Reset IP,max,st. EXT					005 211
0: No					
MAIN: Reset meas.v.en. EXT					005 212
0: No					
MAIN: CB open 3p EXT					031 028
0: No					
MAIN: CB closed 3p EXT					036 051
0: No					Fig. 3-73, (p. 3-105)
MAIN: CB closed A EXT					031 029
0: No					
MAIN: CB closed B EXT					031 030
0: No					
MAIN: CB closed C EXT					031 031
0: No					
MAIN: CB1 faulty EXT					221 086
0: No					
MAIN: CB2 faulty EXT					221 090
0: No					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: Blocking 1 EXT					040 060
0: No					
MAIN: Blocking 2 EXT					040 061
0: No					
MAIN: M.c.b. trip V EXT					004 061
0: No					
MAIN: M.c.b. trip VNG EXT					002 183
0: No					
MAIN: M.c.b. trip Vref EXT					036 086
0: No					
MAIN: Trip cmd. block. EXT					036 045
0: No					
MAIN: Man. trip cmd. EXT					037 018
0: No					
MAIN: Parallel trip EXT					037 019
0: No					
MAIN: Man.cl.cmd.enabl.EXT					041 023
1: Yes					
MAIN: Man. close cmd. EXT					041 022
0: No					Fig. 3-75, (p. 3-108)
MAIN: Manual close EXT					036 047
0: No					
MAIN: Switch dyn.param.EXT					036 033
0: No					
MAIN: Phase reversal I EXT					007 248
0: No					
MAIN: Test mode EXT					037 070
0: No					
MAIN: Time switching EXT					003 096
0: Standard time					
MAIN: Min-pulse clock EXT					060 060
0: No					
MAIN: Healthy					060 001
1: Yes					
Signal that the protection unit is operational. By default this signal is linked to **LED: Fct.assig. H 1 green**.					
MAIN: Time synchronized					009 109
0: No					

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Blocked/faulty				004 065
1: Yes				Fig. 3-72, (p. 3-104)
MAIN: Device not ready				004 060
1: Yes				Fig. 3-72, (p. 3-104)
MAIN: Test mode				037 071
0: No				Fig. 3-92, (p. 3-125)
MAIN: Prot. ext. enabled				003 028
0: No				Fig. 3-63, (p. 3-97)
MAIN: Prot. ext. disabled				038 046
1: Yes				Fig. 3-63, (p. 3-97)
MAIN: Syst.IN ext/user en.				040 132
1: Yes				Fig. 3-64, (p. 3-98)
MAIN: System IN enabled				040 133
0: No				Fig. 3-64, (p. 3-98)
MAIN: System IN disabled				040 134
1: Yes				Fig. 3-64, (p. 3-98)
MAIN: Dynam. param. active				040 090
0: No				Fig. 3-65, (p. 3-99)
MAIN: Current flow A				010 223
0: No				Fig. 3-66, (p. 3-99)
MAIN: Current flow B				010 224
0: No				Fig. 3-66, (p. 3-99)
MAIN: Current flow C				010 225
0: No				Fig. 3-66, (p. 3-99)
MAIN: CB open 3p				031 040
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB open >=1p				031 039
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB open A				031 032
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB open B				031 033
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB open C				031 034
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB closed 3p				031 042
0: No				Fig. 3-74, (p. 3-107)
MAIN: CB closed >= 1p				031 038
0: No				Fig. 3-74, (p. 3-107)

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
MAIN: CB closed A					031 035
0: No				Fig. 3-74, (p. 3-107)	
MAIN: CB closed B					031 036
0: No				Fig. 3-74, (p. 3-107)	
MAIN: CB closed C					031 037
0: No				Fig. 3-74, (p. 3-107)	
MAIN: CB pos.sig. implaus.					031 041
0: No				Fig. 3-74, (p. 3-107)	
MAIN: Trip cmd. blocked					021 013
1: Yes				Fig. 3-82, (p. 3-115) Fig. 3-83, (p. 3-116)	
MAIN: Latch. trip c. reset					040 139
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip command					035 071
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip command 1					036 071
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip command 2					036 022
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip signal					036 251
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip signal 1					036 005
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Gen. trip signal 2					036 023
0: No				Fig. 3-82, (p. 3-115)	
MAIN: Manual trip signal					034 017
0: No				Fig. 3-85, (p. 3-117)	
MAIN: Timer stage P elaps.					040 031
0: No				Fig. 3-81, (p. 3-114)	
MAIN: Timer st. Ineg elaps					040 050
0: No				Fig. 3-81, (p. 3-114)	
MAIN: Timer stage N elaps.					040 032
0: No				Fig. 3-81, (p. 3-114)	
MAIN: TripSig. tI>/tIrefP>					040 042
0: No				Fig. 3-81, (p. 3-114)	
MAIN: TrSg.tIneg>/Iref,neg					040 051
0: No				Fig. 3-81, (p. 3-114)	

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: TripSig tIN>/tIrefN>					040 043
0: No				Fig. 3-81, (p. 3-114)	
MAIN: Man. cl. cmd.enabl.					039 113
0: No				Fig. 3-75, (p. 3-108)	
MAIN: Man. close command					037 068
0: No				Fig. 3-75, (p. 3-108)	
MAIN: Close command					037 009
0: No				Fig. 3-75, (p. 3-108)	
MAIN: Close aft.man.cl.rqu					037 012
0: No					
MAIN: Inrush blk. trigg.					019 213
0: No					
MAIN: Rush restr. A trig.					041 027
0: No					
MAIN: Rush restr. B trig.					041 028
0: No					
MAIN: Rush restr. C trig.					041 029
0: No					
MAIN: General starting					040 000
0: No				Fig. 3-80, (p. 3-113)	
MAIN: tGS elapsed					040 009
0: No				Fig. 3-80, (p. 3-113)	
MAIN: Starting A					040 005
0: No				Fig. 3-79, (p. 3-112)	
MAIN: Starting B					040 006
0: No				Fig. 3-79, (p. 3-112)	
MAIN: Starting C					040 007
0: No				Fig. 3-79, (p. 3-112)	
MAIN: Starting GF					040 008
0: No				Fig. 3-79, (p. 3-112)	
MAIN: Starting Ineg					040 105
0: No				Fig. 3-79, (p. 3-112)	
MAIN: Ground fault					041 087
0: No				Fig. 3-78, (p. 3-111)	
MAIN: Ground fault A					041 054
0: No				Fig. 3-77, (p. 3-110)	
MAIN: Ground fault B					041 055
0: No				Fig. 3-77, (p. 3-110)	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: Ground fault C				041 056
0: No				Fig. 3-77, (p. 3-110)
MAIN: Gnd. fault forw./LS				041 088
0: No				Fig. 3-78, (p. 3-111)
MAIN: Gnd. fault backw./BS				041 089
0: No				Fig. 3-78, (p. 3-111)
MAIN: Enable control				221 058
1: Yes				Fig. 3-327, (p. 3-399)
MAIN: XSWI2 available				221 095
0: No				
MAIN: Bay interlock. act.				221 001
0: No				Fig. 3-327, (p. 3-399)
MAIN: Subst. interl. act.				221 000
0: No				Fig. 3-327, (p. 3-399)
MAIN: Fct. block. 1 active				221 015
0: No				Fig. 3-70, (p. 3-103)
MAIN: Fct. block. 2 active				221 023
0: No				Fig. 3-70, (p. 3-103)
MAIN: Mon. mot. drives tr.				221 056
0: No				Fig. 3-340, (p. 3-416)
MAIN: Interlock equ. viol.				221 018
0: No				Fig. 3-328, (p. 3-400)
MAIN: CB trip internal				221 006
0: No				Fig. 3-86, (p. 3-118)
MAIN: CB tripped				221 016
0: No				Fig. 3-86, (p. 3-118)
MAIN: DEV op.time exceeded				221 110
0: No				
In the case of direct motor control by motor relay K200 this fault signal is issued (as a group signal) when no positive position signal (status signal) has been received from the external device after it has been issued a close command and the set running time-delay has elapsed.				
MAIN: Chatt.suppr. started				221 121
0: No				
Signal that the chatter suppression has started.				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MAIN: DC fail. cmd. End				221 108
0: No				
In the case of direct motor control by motor relay K200 this signal is issued if the K200 contacts have not reopened after the set monitoring time-delay has elapsed.				
MAIN: DC fail. cmd.start				221 109
0: No				
In the case of direct motor control by motor relay K200 this signal is issued if the K200 contacts have not closed after the set monitoring time-delay has elapsed.				
MAIN: Startcmdtime exceed.				221 112
0: No				Fig. 3-337, (p. 3-412)
If the monitoring, set by **DEV01: StartCmdTime superv.** (or **DEV02: StartCmdTime superv.** etc.), is active then an exceeded timer is flagged by this logic state signal.				
MAIN: Shunt trip overrun				221 114
0: No				Fig. 3-348, (p. 3-426)
Signal that any of the operated switchgear units happens to end up in a faulty position after termination of the switching command.				
MAIN: Mult. sig. 1 active				221 017
0: No				Fig. 3-76, (p. 3-109)
MAIN: Mult. sig. 1 stored				221 054
0: No				Fig. 3-76, (p. 3-109)
MAIN: Mult. sig. 2 active				221 053
0: No				Fig. 3-76, (p. 3-109)
MAIN: Mult. sig. 2 stored				221 055
0: No				Fig. 3-76, (p. 3-109)
MAIN: Group signal 01				019 192
0: No				
MAIN: Group signal 02				019 193
0: No				
MAIN: Group signal 03				019 194
0: No				
MAIN: Group signal 04				019 195
0: No				
MAIN: Group signal 05				019 196
0: No				
MAIN: Group signal 06				019 197
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Group signal 07					019 198
0: No					
MAIN: Group signal 08					019 199
0: No					
MAIN: Communication error					221 019
1: Yes				Fig. 3-87, (p. 3-119)	
MAIN: Cmd. fr. comm.interf					221 101
0: No					
MAIN: Cmd. fr. electr.ctrl					221 103
0: No					
MAIN: Command from HMI					221 102
0: No					
MAIN: Auxiliary address					038 005
0: No					
MAIN: Dummy entry					004 129
0: No					
MAIN: Without function					060 000
0: No					
MAIN: Without function					061 000
0: No					

Parameter subset selection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
PSS: Control via user EXT				036 101
0: No				
PSS: Activate PS 1 EXT				065 002
2: Not configured				
PSS: Activate PS 2 EXT				065 003
2: Not configured				
PSS: Activate PS 3 EXT				065 004
2: Not configured				
PSS: Activate PS 4 EXT				065 005
2: Not configured				
PSS: Control via user				036 102
0: No				Fig. 3-93, (p. 3-127)
PSS: Ext.sel.param.subset				003 061
0: No param. subset sel				Fig. 3-93, (p. 3-127)
PSS: PS 1 activated ext.				036 094
0: No				Fig. 3-93, (p. 3-127)
PSS: PS 2 activated ext.				036 095
0: No				Fig. 3-93, (p. 3-127)
PSS: PS 3 activated ext.				036 096
0: No				Fig. 3-93, (p. 3-127)
PSS: PS 4 activated ext.				036 097
0: No				Fig. 3-93, (p. 3-127)
PSS: Actual param. subset				003 062
1: Parameter subset 1				Fig. 3-93, (p. 3-127)
PSS: PS 1 active				036 090
1: Yes				Fig. 3-93, (p. 3-127)
PSS: PS 2 active				036 091
0: No				Fig. 3-93, (p. 3-127)
PSS: PS 3 active				036 092
0: No				Fig. 3-93, (p. 3-127)
PSS: PS 4 active				036 093
0: No				Fig. 3-93, (p. 3-127)

Self-monitoring

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SFMON: CB faulty EXT				098 072
0: No				
SFMON: Warning (LED)				036 070
0: No				Fig. 3-94, (p. 3-128)
SFMON: Warning (relay)				036 100
0: No				Fig. 3-94, (p. 3-128)
SFMON: Warm restart exec.				041 202
0: No				
SFMON: Cold restart exec.				041 201
0: No				
SFMON: Cold restart				093 024
0: No				
SFMON: Cold rest./SW update				093 025
0: No				
SFMON: Blocking/ HW failure				090 019
0: No				
SFMON: Relay Kxx faulty				041 200
0: No				
SFMON: Hardware clock fail.				093 040
0: No				
SFMON: Battery failure				090 010
0: No				
SFMON: Invalid SW d.loaded				096 121
0: No				
SFMON: Invalid type of bay				096 122
0: No				
SFMON: +15V supply faulty				093 081
0: No				
SFMON: +24V supply faulty				093 082
0: No				
SFMON: -15V supply faulty				093 080
0: No				
SFMON: Wrong module slot 1				096 100
0: No				
SFMON: Wrong module slot 2				096 101
0: No				
SFMON: Wrong module slot 3				096 102
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Wrong module slot 4				096 103
0: No				
SFMON: Wrong module slot 5				096 104
0: No				
SFMON: Wrong module slot 6				096 105
0: No				
SFMON: Wrong module slot 7				096 106
0: No				
SFMON: Wrong module slot 8				096 107
0: No				
SFMON: Wrong module slot 9				096 108
0: No				
SFMON: Wrong module slot 10				096 109
0: No				
SFMON: Wrong module slot 11				096 110
0: No				
SFMON: Wrong module slot 12				096 111
0: No				
SFMON: Wrong module slot 13				096 112
0: No				
SFMON: Wrong module slot 14				096 113
0: No				
SFMON: Wrong module slot 15				096 114
0: No				
SFMON: Wrong module slot 16				096 115
0: No				
SFMON: Wrong module slot 17				096 116
0: No				
SFMON: Wrong module slot 18				096 117
0: No				
SFMON: Wrong module slot 19				096 118
0: No				
SFMON: Wrong module slot 20				096 119
0: No				
SFMON: Wrong module slot 21				096 120
0: No				
SFMON: Wrong module Dig.Bus				096 123
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SFMON: Wrong module HMI					096 124
0: No					
SFMON: Wrong module Comm					096 125
0: No					
SFMON: Wrong module Ana.Bus					096 126
0: No					
SFMON: Defect.module slot 1					097 000
0: No					
SFMON: Defect.module slot 2					097 001
0: No					
SFMON: Defect.module slot 3					097 002
0: No					
SFMON: Defect.module slot 4					097 003
0: No					
SFMON: Defect.module slot 5					097 004
0: No					
SFMON: Defect.module slot 6					097 005
0: No					
SFMON: Defect.module slot 7					097 006
0: No					
SFMON: Defect.module slot 8					097 007
0: No					
SFMON: Defect.module slot 9					097 008
0: No					
SFMON: Defect.module slot10					097 009
0: No					
SFMON: Defect.module slot11					097 010
0: No					
SFMON: Defect.module slot12					097 011
0: No					
SFMON: Defect.module slot13					097 012
0: No					
SFMON: Defect.module slot14					097 013
0: No					
SFMON: Defect.module slot15					097 014
0: No					
SFMON: Defect.module slot16					097 015
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SFMON: Defect.module slot17					097 016
0: No					
SFMON: Defect.module slot18					097 017
0: No					
SFMON: Defect.module slot19					097 018
0: No					
SFMON: Defect.module slot20					097 019
0: No					
SFMON: Defect.module slot21					097 020
0: No					
SFMON: +15V faulty mod. N					093 096
0: No					
SFMON: -15V faulty mod. N					093 097
0: No					
SFMON: DAC faulty module N					093 095
0: No					
SFMON: Module N DPR faulty					093 090
0: No					
SFMON: Module N RAM faulty					093 091
0: No					
SFMON: Module Y DPR faulty					093 110
0: No					
SFMON: Module Y RAM faulty					093 111
0: No					
SFMON: Mod.Y RTD DPR faulty					093 108
0: No					
SFMON: Mod.Y RTD RAM faulty					093 109
0: No					
SFMON: Error K 707					097 084
0: No					
SFMON: Error K 708					097 085
0: No					
SFMON: Error K 301					097 021
0: No					
SFMON: Error K 302					097 022
0: No					
SFMON: Error K 601					097 070
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Error K 602				097 071
0: No				
SFMON: Error K 603				097 072
0: No				
SFMON: Error K 604				097 073
0: No				
SFMON: Error K 605				097 074
0: No				
SFMON: Error K 606				097 075
0: No				
SFMON: Error K 607				097 076
0: No				
SFMON: Error K 608				097 077
0: No				
SFMON: Error K 701				097 078
0: No				
SFMON: Error K 702				097 079
0: No				
SFMON: Error K 703				097 080
0: No				
SFMON: Error K 704				097 081
0: No				
SFMON: Error K 705				097 082
0: No				
SFMON: Error K 706				097 083
0: No				
SFMON: Error K 801				097 086
0: No				
SFMON: Error K 802				097 087
0: No				
SFMON: Error K 803				097 088
0: No				
SFMON: Error K 804				097 089
0: No				
SFMON: Error K 805				097 090
0: No				
SFMON: Error K 806				097 091
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Error K 807				097 092
0: No				
SFMON: Error K 808				097 093
0: No				
SFMON: Error K 901				097 094
0: No				
SFMON: Error K 902				097 095
0: No				
SFMON: Error K 903				097 096
0: No				
SFMON: Error K 904				097 097
0: No				
SFMON: Error K 905				097 098
0: No				
SFMON: Error K 906				097 099
0: No				
SFMON: Error K 907				097 100
0: No				
SFMON: Error K 908				097 101
0: No				
SFMON: Error K 1001				097 102
0: No				
SFMON: Error K 1002				097 103
0: No				
SFMON: Error K 1003				097 104
0: No				
SFMON: Error K 1004				097 105
0: No				
SFMON: Error K 1005				097 106
0: No				
SFMON: Error K 1006				097 107
0: No				
SFMON: Error K 1007				097 108
0: No				
SFMON: Error K 1008				097 109
0: No				
SFMON: Error K 1201				097 118
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Error K 1202				097 119
0: No				
SFMON: Error K 1203				097 120
0: No				
SFMON: Error K 1204				097 121
0: No				
SFMON: Error K 1205				097 122
0: No				
SFMON: Error K 1206				097 123
0: No				
SFMON: Error K 1207				097 124
0: No				
SFMON: Error K 1208				097 125
0: No				
SFMON: Error K 1401				097 134
0: No				
SFMON: Error K 1402				097 135
0: No				
SFMON: Error K 1403				097 136
0: No				
SFMON: Error K 1404				097 137
0: No				
SFMON: Error K 1405				097 138
0: No				
SFMON: Error K 1406				097 139
0: No				
SFMON: Error K 1407				097 140
0: No				
SFMON: Error K 1408				097 141
0: No				
SFMON: Error K 1601				097 150
0: No				
SFMON: Error K 1602				097 151
0: No				
SFMON: Error K 1603				097 152
0: No				
SFMON: Error K 1604				097 153
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Error K 1605				097 154
0: No				
SFMON: Error K 1606				097 155
0: No				
SFMON: Error K 1607				097 156
0: No				
SFMON: Error K 1608				097 157
0: No				
SFMON: Error K 1801				097 166
0: No				
SFMON: Error K 1802				097 167
0: No				
SFMON: Error K 1803				097 168
0: No				
SFMON: Error K 1804				097 169
0: No				
SFMON: Error K 1805				097 170
0: No				
SFMON: Error K 1806				097 171
0: No				
SFMON: Error K 2001				097 182
0: No				
SFMON: Error K 2002				097 183
0: No				
SFMON: Error K 2003				097 184
0: No				
SFMON: Error K 2004				097 185
0: No				
SFMON: Error K 2005				097 186
0: No				
SFMON: Error K 2006				097 187
0: No				
SFMON: Error K 2007				097 188
0: No				
SFMON: Error K 2008				097 189
0: No				
SFMON: Undef. operat. code				093 010
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SFMON: Abnormal termination					093 030
0: No					
SFMON: Bad arg. system call					093 031
0: No					
SFMON: Mutex deadlock					093 032
0: No					
SFMON: Invalid memory ref.					093 033
0: No					
SFMON: Unexpected exception					093 034
0: No					
SFMON: Invalid arithm. op.					093 011
0: No					
SFMON: Undefined interrupt					093 012
0: No					
SFMON: Exception oper.syst.					093 013
0: No					
SFMON: Protection failure					090 021
0: No					
SFMON: Checksum error param					090 003
0: No					
SFMON: Clock sync. error					093 041
0: No					
SFMON: Interm.volt.fail.RAM					093 026
0: No					
SFMON: Overflow MT_RC					090 012
0: No					Fig. 3-96, (p. 3-132)
SFMON: Checksum DMOD					093 023
0: No					
SFMON: Semaph. MT_RC block.					093 015
0: No					
SFMON: Inval. SW COMM1/IEC					093 075
0: No					
SFMON: Inval. Config. IEC					093 079
0: No					
SFMON: Invalid SW vers. N					093 093
0: No					
SFMON: Time-out module N					093 092
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SFMON: Invalid SW vers. Y					093 113
0: No					
SFMON: Invalid SW vers YRTD					093 123
0: No					
SFMON: Time-out module Y					093 112
0: No					
SFMON: Time-out module YRTD					093 119
0: No					
SFMON: IRIGB faulty					093 117
0: No					
SFMON: M.c.b. trip V					098 000
0: No					Fig. 3-303, (p. 3-372)
SFMON: M.c.b. trip Vref					098 011
0: No					Fig. 3-303, (p. 3-372)
SFMON: Phase sequ. V faulty					098 001
0: No					Fig. 3-305, (p. 3-374)
SFMON: Undervoltage					098 009
0: No					Fig. 3-305, (p. 3-374)
SFMON: FF, Vref triggered					098 022
0: No					Fig. 3-306, (p. 3-375)
SFMON: M.circ. V,Vref flty.					098 023
0: No					Fig. 3-303, (p. 3-372)
SFMON: Meas. circ. V faulty					098 017
0: No					Fig. 3-303, (p. 3-372)
SFMON: Meas. circ. I faulty					098 005
0: No					Fig. 3-304, (p. 3-373)
SFMON: Meas.circ.V,I faulty					098 016
0: No					Fig. 3-303, (p. 3-372)
SFMON: Communic.fault COMM3					093 140
0: No					
SFMON: Hardware error COMM3					093 143
0: No					
SFMON: Invalid SW vers DHMI					093 145
0: No					
SFMON: Invalid config.TPDx					093 160
0: No					
SFMON: Comm.link fail.COMM3					093 142
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SFMON: Lim.exceed.,tel.err.				093 141
0: No				
SFMON: Telecom. faulty				098 006
0: No				Fig. 3-170, (p. 3-219)
SFMON: Setting error THERM				098 035
0: No				Fig. 3-241, (p. 3-311)
SFMON: Setting error CBM				098 020
0: No				
SFMON: CTA error				098 034
0: No				Fig. 3-239, (p. 3-306)
SFMON: TGFD mon. triggered				093 094
0: No				Fig. 3-226, (p. 3-284)
SFMON: CB No. CB op. >				098 066
0: No				
SFMON: Fcts.not perm.f.60Hz				093 098
0: No				Fig. 3-221, (p. 3-280)
SFMON: CB rem. No. CB op. <				098 067
0: No				
SFMON: CB ΣItrip >				098 068
0: No				
SFMON: CB ΣItrip2 >**				098 069
0: No				
SFMON: Invalid scaling BCD				093 124
0: No				
SFMON: CB tmax> A				098 070
0: No				
SFMON: CB tmax> B				098 071
0: No				
SFMON: CB tmax> C				098 077
0: No				
SFMON: Invalid scaling A-1				093 114
0: No				Fig. 3-46, (p. 3-73)
SFMON: Invalid scaling A-2				093 115
0: No				
SFMON: Invalid scaling IDC				093 116
0: No				Fig. 3-33, (p. 3-54)
SFMON: PT100 open circuit				098 024
0: No				Fig. 3-35, (p. 3-56)

Parameter	Default	Min	Max	Unit	Logic Diagram	Address
SFMON: T1 open circ.	0: No				Fig. 3-36, (p. 3-57)	098 029
SFMON: T2 open circ.	0: No					098 030
SFMON: T3 open circ.	0: No					098 040
SFMON: T4 open circ.	0: No					098 041
SFMON: T5 open circ.	0: No					098 042
SFMON: T6 open circ.	0: No					098 043
SFMON: T7 open circ.	0: No					098 044
SFMON: T8 open circ.	0: No					098 045
SFMON: T9 open circ.	0: No					098 052
SFMON: Overload 20 mA input	0: No				Fig. 3-33, (p. 3-54)	098 025
SFMON: Open circ. 20mA inp.	0: No				Fig. 3-33, (p. 3-54)	098 026
SFMON: Setting error f<>	0: No				Fig. 3-261, (p. 3-333)	098 028
SFMON: Setting error fn	0: No					098 133
SFMON: Inv.inp.f.clock sync	0: No					093 120
SFMON: Output 30	0: No					098 053
SFMON: Output 30 (t)	0: No					098 054
SFMON: Output 31	0: No					098 055
SFMON: Output 31 (t)	0: No					098 056
SFMON: Output 32	0: No					098 057

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
SFMON: Output 32 (t)							098 058
0: No							
SFMON: CB pos.sig. implaus.							098 124
0: No							

Operating data recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OP_RC: Reset record. EXT							005 213
0: No				Fig. 3-90, (p. 3-123)			

Monitoring signal recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MT_RC: Reset record. EXT							005 240
0: No							

Overload recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OL_RC: Reset record. EXT							005 241
0: No							
OL_RC: Record. in progress							035 003
0: No				Fig. 3-100, (p. 3-135)			
OL_RC: Overl. mem. overflow							035 007
0: No				Fig. 3-101, (p. 3-136)			

Ground fault recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
GF_RC: Reset record. EXT							005 242
0: No							
GF_RC: Record. in progress							035 005
0: No				Fig. 3-109, (p. 3-143)			
GF_RC: GF memory overflow							035 006
0: No				Fig. 3-110, (p. 3-144)			

Fault data acquisition

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
FT_DA: Trigger EXT					036 088
0: No					

Fault recording

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
FT_RC: Reset record. EXT					005 243
0: No					
FT_RC: Trigger EXT					036 089
0: No					
FT_RC: Trigger					037 076
0: No					Fig. 3-117, (p. 3-153)
FT_RC: I> triggered					040 063
0: No					Fig. 3-117, (p. 3-153)
FT_RC: Record.trig active					002 002
0: No					Fig. 3-117, (p. 3-153)
FT_RC: Record. in progress					035 000
0: No					Fig. 3-117, (p. 3-153)
FT_RC: System disturb. runn					035 004
0: No					Fig. 3-117, (p. 3-153)
FT_RC: Fault mem. overflow					035 001
0: No					Fig. 3-118, (p. 3-154)
FT_RC: Faulty time tag					035 002
0: No					

Definite-time over-current protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DTOC: Blocking tI> EXT				041 060
0: No				
DTOC: Blocking tI>> EXT				041 061
0: No				
DTOC: Blocking tI>>> EXT				041 062
0: No				
DTOC: Blocking tI>>>> EXT				016 173
0: No				
DTOC: Block. tIneg> EXT				036 141
0: No				
DTOC: Block. tIneg>> EXT				036 142
0: No				
DTOC: Block. tIneg>>> EXT				036 143
0: No				
DTOC: Block. tIneg>>>> EXT				016 194
0: No				
DTOC: Blocking tIN> EXT				041 063
0: No				
DTOC: Blocking tIN>> EXT				041 064
0: No				
DTOC: Blocking tIN>>> EXT				041 065
0: No				
DTOC: Blocking tIN>>>> EXT				041 101
0: No				
DTOC: Enabled				040 120
0: No				Fig. 3-120, (p. 3-157)
DTOC: Starting I>				040 036
0: No				Fig. 3-123, (p. 3-161)
DTOC: Starting I>>				040 029
0: No				Fig. 3-124, (p. 3-162)
DTOC: Starting I>>>				039 075
0: No				Fig. 3-125, (p. 3-163)
DTOC: Starting I>>>>				016 174
0: No				Fig. 3-126, (p. 3-164)
DTOC: Starting Ineg>				036 145
0: No				Fig. 3-129, (p. 3-168)

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DTOC: Starting Ineg>>					036 146
0: No				Fig. 3-129, (p. 3-168)	
DTOC: Starting Ineg>>>					036 147
0: No				Fig. 3-129, (p. 3-168)	
DTOC: Starting Ineg>>>>					016 195
0: No				Fig. 3-129, (p. 3-168)	
DTOC: Starting IN>					040 077
0: No					
DTOC: Starting IN>>					040 041
0: No				Fig. 3-132, (p. 3-172)	
DTOC: Starting IN>>>					039 078
0: No				Fig. 3-132, (p. 3-172)	
DTOC: Starting IN>>>>					035 031
0: No				Fig. 3-132, (p. 3-172)	
DTOC: tI> elapsed					040 010
0: No				Fig. 3-127, (p. 3-165)	
DTOC: tI>> elapsed					040 033
0: No				Fig. 3-127, (p. 3-165)	
DTOC: tI>>> elapsed					040 012
0: No				Fig. 3-127, (p. 3-165)	
DTOC: tI>>>> elapsed					016 175
0: No				Fig. 3-127, (p. 3-165)	
DTOC: Trip signal tI>					041 020
0: No				Fig. 3-128, (p. 3-166)	
DTOC: Trip signal tI>>					040 011
0: No				Fig. 3-128, (p. 3-166)	
DTOC: Trip signal tI>>>					040 076
0: No				Fig. 3-128, (p. 3-166)	
DTOC: Trip signal tI>>>>					016 176
0: No				Fig. 3-128, (p. 3-166)	
DTOC: tIneg> elapsed					036 148
0: No				Fig. 3-129, (p. 3-168)	
DTOC: tIneg>> elapsed					036 149
0: No				Fig. 3-129, (p. 3-168)	
DTOC: tIneg>>> elapsed					036 150
0: No				Fig. 3-129, (p. 3-168)	
DTOC: tIneg>>>> elapsed					016 196
0: No				Fig. 3-129, (p. 3-168)	

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DTOC: Trip signal tIneg>					036 151
0: No				Fig. 3-129, (p. 3-168) Fig. 3-130, (p. 3-169)	
DTOC: Trip signal tIneg>>					036 152
0: No				Fig. 3-129, (p. 3-168) Fig. 3-130, (p. 3-169)	
DTOC: Trip signal tIneg>>>					036 153
0: No				Fig. 3-129, (p. 3-168) Fig. 3-130, (p. 3-169)	
DTOC: Trip sign. tIneg>>>>					016 197
0: No				Fig. 3-129, (p. 3-168) Fig. 3-130, (p. 3-169)	
DTOC: tIN> elapsed					040 013
0: No				Fig. 3-132, (p. 3-172)	
DTOC: tIN>> elapsed					040 121
0: No				Fig. 3-132, (p. 3-172)	
DTOC: tIN>>> elapsed					039 079
0: No				Fig. 3-132, (p. 3-172)	
DTOC: tIN>>>> elapsed					035 040
0: No				Fig. 3-132, (p. 3-172)	
DTOC: Trip signal tIN>					041 021
0: No				Fig. 3-133, (p. 3-173)	
DTOC: Trip signal tIN>>					040 028
0: No				Fig. 3-133, (p. 3-173)	
DTOC: Trip signal tIN>>>					040 079
0: No				Fig. 3-133, (p. 3-173)	
DTOC: Trip sign. tIN>>>>					035 046
0: No				Fig. 3-133, (p. 3-173)	
DTOC: H.-time tIN>,i. runn					040 086
0: No				Fig. 3-134, (p. 3-175)	
DTOC: tIN>,interm. elapsed					040 099
0: No				Fig. 3-134, (p. 3-175)	
DTOC: Trip sig. tIN>,intm.					039 073
0: No				Fig. 3-134, (p. 3-175)	

Inverse-time overcurrent protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
IDMT1: Block. tIref,P> EXT				040 101
0: No				
IDMT1: Block. tIref,neg>EXT				040 102
0: No				
IDMT1: Block. tIref,N> EXT				040 103
0: No				
IDMT1: Enabled				040 100
0: No				Fig. 3-137, (p. 3-178)
IDMT1: Starting Iref,P>				040 080
0: No				Fig. 3-144, (p. 3-188)
IDMT1: tIref,P> elapsed				040 082
0: No				Fig. 3-144, (p. 3-188)
IDMT1: Trip signal tIref,P>				040 084
0: No				Fig. 3-146, (p. 3-190)
IDMT1: Hold time P running				040 053
0: No				Fig. 3-144, (p. 3-188)
IDMT1: Memory P clear				040 110
1: Yes				Fig. 3-144, (p. 3-188)
IDMT1: Starting Iref,neg>				040 107
0: No				Fig. 3-148, (p. 3-192)
IDMT1: tIref,neg> elapsed				040 109
0: No				Fig. 3-148, (p. 3-192)
IDMT1: Trip sig. tIref,neg>				040 108
0: No				Fig. 3-148, (p. 3-192)
IDMT1: Hold time neg runn.				040 113
0: No				Fig. 3-148, (p. 3-192)
IDMT1: Memory neg clear				040 111
1: Yes				Fig. 3-148, (p. 3-192)
IDMT1: Starting Iref,N>				040 081
0: No				Fig. 3-150, (p. 3-194)
IDMT1: tIref,N> elapsed				040 083
0: No				Fig. 3-150, (p. 3-194)
IDMT1: Trip signal tIref,N>				040 085
0: No				Fig. 3-152, (p. 3-196)
IDMT1: Hold time N running				040 054
0: No				Fig. 3-150, (p. 3-194)

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
IDMT1: Memory N clear							040 112
1: Yes				Fig. 3-150, (p. 3-194)			

Inverse-time overcurrent protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
IDMT2: Block. tIref,P> EXT				040 136
0: No				
IDMT2: Block. tIref,neg>EXT				040 149
0: No				
IDMT2: Block. tIref,N> EXT				040 150
0: No				
IDMT2: Enabled				040 135
0: No				
IDMT2: Starting Iref,P>				040 018
0: No				Fig. 3-145, (p. 3-189)
IDMT2: tIref,P> elapsed				040 021
0: No				Fig. 3-145, (p. 3-189)
IDMT2: Trip signal tIref,P>				040 023
0: No				Fig. 3-147, (p. 3-190)
IDMT2: Hold time P running				040 016
0: No				Fig. 3-145, (p. 3-189)
IDMT2: Memory P clear				040 178
1: Yes				Fig. 3-145, (p. 3-189)
IDMT2: Starting Iref,neg>				040 156
0: No				
IDMT2: tIref,neg> elapsed				040 159
0: No				
IDMT2: Trip sig. tIref,neg>				040 158
0: No				
IDMT2: Hold time neg runn.				040 189
0: No				
IDMT2: Memory neg clear				040 179
1: Yes				
IDMT2: Starting Iref,N>				040 019
0: No				Fig. 3-151, (p. 3-195)
IDMT2: tIref,N> elapsed				040 022
0: No				Fig. 3-151, (p. 3-195)
IDMT2: Trip signal tIref,N>				040 024
0: No				Fig. 3-153, (p. 3-196)
IDMT2: Hold time N running				040 017
0: No				Fig. 3-151, (p. 3-195)

Parameter								Address
Default	Min	Max	Unit					Logic Diagram
IDMT2: Memory N clear								040 188
1: Yes				Fig. 3-151, (p. 3-195)				

Short-circuit direction determination

Parameter								Address
Default	Min	Max	Unit					Logic Diagram
SCDD: Enabled								040 098
0: No				Fig. 3-155, (p. 3-199)				
SCDD: Blocked								040 062
0: No				Fig. 3-157, (p. 3-201)				
SCDD: Fault P forward								036 018
0: No				Fig. 3-158, (p. 3-202)				
SCDD: Fault P backward								036 019
0: No				Fig. 3-158, (p. 3-202)				
SCDD: Ground fault forward								040 037
0: No				Fig. 3-163, (p. 3-207)				
SCDD: Ground fault backw.								040 038
0: No				Fig. 3-163, (p. 3-207)				
SCDD: Fault P or G forwd.								040 039
0: No				Fig. 3-165, (p. 3-210)				
SCDD: Fault P or G backw.								040 040
0: No				Fig. 3-165, (p. 3-210)				
SCDD: Forw. w/o measurem.								038 044
0: No								
SCDD: Direct. using Vmeas								038 045
0: No								
SCDD: Direct. using memory								038 047
0: No								
SCDD: tVmemory running								040 034
0: No								

Switch on to fault protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SOTF: Par. ARC running EXT				039 063
0: No				
SOTF: Enabled				040 069
0: No				Fig. 3-166, (p. 3-213)
SOTF: tManual-close runn.				036 063
0: No				Fig. 3-166, (p. 3-213)
SOTF: Trip signal				036 064
0: No				Fig. 3-166, (p. 3-213)

Protective signaling

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
PSIG: Enable EXT					037 025
2: Not configured					
PSIG: Disable EXT					037 026
2: Not configured					
PSIG: Test telecom. EXT					036 038
0: No					
PSIG: Blocking EXT					036 049
0: No					
PSIG: Receive EXT					036 048
0: No					
PSIG: Ext./user enabled					037 023
1: Yes					Fig. 3-167, (p. 3-215)
PSIG: Enabled					015 008
0: No					Fig. 3-167, (p. 3-215)
PSIG: Ready					037 027
0: No					Fig. 3-167, (p. 3-215)
PSIG: Not ready					037 028
1: Yes					Fig. 3-167, (p. 3-215)
PSIG: Test telecom. chann.					034 016
0: No					Fig. 3-169, (p. 3-218)
PSIG: Telecom. faulty					036 060
0: No					Fig. 3-170, (p. 3-219)
PSIG: Send (signal)					036 035
0: No					Fig. 3-169, (p. 3-218)
PSIG: Send (transm.relay)					037 024
0: No					Fig. 3-169, (p. 3-218)
PSIG: Receive (signal)					037 029
0: No					Fig. 3-169, (p. 3-218)
PSIG: Trip signal					038 007
0: No					Fig. 3-169, (p. 3-218)

Auto-reclosing control

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
ARC: Reset counters EXT				005 244
0: No				
ARC: Enable EXT				037 010
2: Not configured				
ARC: Disable EXT				037 011
2: Not configured				
ARC: Test HSR A-B-C EXT				037 017
0: No				
ARC: Blocking EXT				036 050
0: No				
ARC: CB drive ready EXT				004 066
0: No				
ARC: Ext./user enabled				037 013
1: Yes				Fig. 3-173, (p. 3-223)
ARC: Enabled				015 064
0: No				Fig. 3-173, (p. 3-223)
ARC: Test HSR A-B-C				034 023
0: No				Fig. 3-187, (p. 3-240)
ARC: Blocked				004 069
0: No				Fig. 3-174, (p. 3-224)
ARC: Blocking trip				042 000
0: No				Fig. 3-184, (p. 3-235)
ARC: Ready				004 068
0: No				Fig. 3-175, (p. 3-225)
ARC: Not ready				037 008
1: Yes				Fig. 3-175, (p. 3-225)
ARC: Reject test HSR				036 055
0: No				Fig. 3-187, (p. 3-240)
ARC: Block. time running				037 004
0: No				Fig. 3-174, (p. 3-224)
ARC: Cycle running				037 000
0: No				Fig. 3-184, (p. 3-235)
ARC: Oper. time running				037 005
0: No				Fig. 3-184, (p. 3-235)
ARC: Start by LOGIC				037 078
0: No				Fig. 3-183, (p. 3-234)

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ARC: Dead time HSR runn.							037 002
0: No				Fig. 3-184, (p. 3-235)			
ARC: Dead time TDR runn.							037 003
0: No				Fig. 3-184, (p. 3-235)			
ARC: Reclaim time running							036 042
0: No				Fig. 3-184, (p. 3-235)			
ARC: Trip signal							039 099
0: No				Fig. 3-184, (p. 3-235)			
ARC: (Re)close request							037 077
0: No				Fig. 3-184, (p. 3-235)			
ARC: (Re)close signal HSR							037 007
0: No				Fig. 3-184, (p. 3-235)			
ARC: (Re)close signal TDR							037 006
0: No				Fig. 3-184, (p. 3-235)			
ARC: Reclosure successful							036 062
0: No							
ARC: Sig.interr. CB trip							036 040
0: No				Fig. 3-184, (p. 3-235)			

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**

Automatic synchronism check

ASC: Meas.V(T90) EXT					016 221
0: No					

This parameter allows to select the ASC input source via binary input, communication protocol signal or programmable logic. (See setting (016 222) **ASC: Meas.V(T90) USER PSx** for details.)

ASC: Meas.V(T90) active					016 240
0: No				Fig. 3-190, (p. 3-245)	

Signal that reports which voltage(s) the ASC function is currently using for the operating modes “voltage-checked close enable” and “voltage/synchronism-checked close enable”.

- The value *No* means that the three phase-to-ground voltages are checked.
- The value *Yes* means that the (single-phase) voltage measured at transformer T90 is checked.

(See also parameters (016 222) **ASC: Meas.V(T90) USER PSx**, (016 221) **ASC: Meas.V(T90) EXT**.)

ASC: Reset counters EXT					006 074
0: No					
ASC: Enable EXT					037 049
2: Not configured					
ASC: Disable EXT					037 061
2: Not configured					
ASC: Blocking EXT					037 048
0: No					
ASC: Test AR close r. EXT					000 106
0: No					

Close request via external signal for a test triggering of the ASC in operating mode automatic reclosure.

ASC: Test MC close r. EXT					037 064
0: No					

Close request via external signal for a test triggering of the ASC in operating mode manual reclosure.

ASC: Enabl.close requ.EXT					037 063
1: Yes					
ASC: MC Close request EXT					037 062
0: No					

Close request via external signal for a triggering of the ASC in operating mode manual reclosure.

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
ASC: AR close request EXT					008 236
0: No					
Close request via external signal for a triggering of the ASC in operating mode automatic reclosure.					
ASC: Ext./user enabled					037 092
1: Yes				Fig. 3-191, (p. 3-246)	
ASC: Enabled					018 024
0: No				Fig. 3-191, (p. 3-246)	
ASC: Blocked					038 018
0: No				Fig. 3-192, (p. 3-248)	
ASC: Ready					037 079
0: No				Fig. 3-192, (p. 3-248)	
ASC: Not ready					037 082
1: Yes				Fig. 3-192, (p. 3-248)	
ASC: Test AR close requ.					008 240
0: No				Fig. 3-193, (p. 3-249)	
Signaling of a close request for a test triggering of the ASC in operating mode automatic reclosure.					
ASC: Test MC close requ.					034 019
0: No				Fig. 3-194, (p. 3-250)	
Signaling of a close request for a test triggering of the ASC in operating mode manual reclosure.					
ASC: AR Close request					008 239
0: No				Fig. 3-193, (p. 3-249)	
Signaling of a close request for a triggering of the ASC in operating mode automatic reclosure.					
ASC: MC Close request					034 018
0: No				Fig. 3-194, (p. 3-250)	
Signaling of a close request for a triggering of the ASC in operating mode manual reclosure.					
ASC: Cycle running					038 019
0: No				Fig. 3-196, (p. 3-251) Fig. 3-204, (p. 3-262)	
ASC: Operat.time running					037 093
0: No				Fig. 3-196, (p. 3-251)	
ASC: Close enable					037 083
0: No				Fig. 3-198, (p. 3-254) Fig. 3-199, (p. 3-256)	

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
ASC: Close enable,volt.ch							037 085
0: No				Fig. 3-198, (p. 3-254) Fig. 3-199, (p. 3-256)			
ASC: Close enable,sync.ch							037 084
0: No				Fig. 3-200, (p. 3-257) Fig. 3-201, (p. 3-259)			
ASC: Close rejection							037 086
0: No				Fig. 3-196, (p. 3-251)			

Ground fault direction determination using steady-state values

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GFDSS: Reset counters EXT				005 245
0: No				
GFDSS: GF (curr.) eval. EXT				038 020
0: No				
GFDSS: GF (pow.) block. EXT				020 227
0: No				
GFDSS: Admittance block EXT				020 226
0: No				
GFDSS: Enabled				042 096
0: No				Fig. 3-206, (p. 3-265)
GFDSS: Grd. fault pow./adm.				009 037
0: No				
GFDSS: Direct. forward/LS				009 035
0: No				
GFDSS: Direct. backward/BS				009 036
0: No				
GFDSS: Starting forward/LS				009 040
0: No				
GFDSS: Starting backw. /BS				009 041
0: No				
GFDSS: Trip signal forw./LS				009 031
0: No				
GFDSS: GF (pow.) ready				038 026
0: No				Fig. 3-206, (p. 3-265)
GFDSS: GF (pow.) not ready				038 027
1: Yes				Fig. 3-206, (p. 3-265)
GFDSS: Grd. fault power				016 103
0: No				Fig. 3-208, (p. 3-267)
GFDSS: forward/LS power				016 109
0: No				Fig. 3-212, (p. 3-271)
GFDSS: backward/BS power				016 135
0: No				Fig. 3-212, (p. 3-271)
GFDSS: Start.forward/LS pow				016 136
0: No				Fig. 3-212, (p. 3-271)

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
GFDSS: Start. backw. /BSpow					016 137
0: No				Fig. 3-212, (p. 3-271)	
GFDSS: Trp sig forw./LS pow					020 228
0: No				Fig. 3-212, (p. 3-271)	
GFDSS: Admittance ready					038 167
0: No				Fig. 3-206, (p. 3-265)	
GFDSS: Admittance not ready					038 168
1: Yes				Fig. 3-206, (p. 3-265)	
GFDSS: Grd. fault adm.					016 138
0: No				Fig. 3-215, (p. 3-273)	
GFDSS: forward/LS adm					016 139
0: No				Fig. 3-218, (p. 3-276)	
GFDSS: backward/BS adm					016 140
0: No				Fig. 3-218, (p. 3-276)	
GFDSS: Start.forward/LS adm					016 141
0: No				Fig. 3-218, (p. 3-276)	
GFDSS: Start.backw. /BS adm					016 142
0: No				Fig. 3-218, (p. 3-276)	
GFDSS: Trp sig forw./LS adm					020 234
0: No				Fig. 3-218, (p. 3-276)	
GFDSS: Starting Y(N)>					009 074
0: No				Fig. 3-219, (p. 3-277)	
GFDSS: Non-dir. sig. Y(N)>					009 075
0: No				Fig. 3-219, (p. 3-277)	
GFDSS: Trip signal Y(N)>					009 072
0: No				Fig. 3-219, (p. 3-277)	
GFDSS: GF (curr.) ready					038 028
0: No				Fig. 3-206, (p. 3-265)	
GFDSS: GF (curr.) not ready					038 029
1: Yes				Fig. 3-206, (p. 3-265)	
GFDSS: GF (curr.) evaluat.					039 071
0: No				Fig. 3-206, (p. 3-265)	
GFDSS: Ground fault (curr.)					009 038
0: No				Fig. 3-213, (p. 3-272)	

Transient ground fault direction determination

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
TGFD: Blocking EXT							004 034
0: No							
TGFD: Reset counters EXT							005 246
0: No							
TGFD: Reset signal EXT							004 140
0: No							
TGFD: Enabled							037 100
0: No				Fig. 3-221, (p. 3-280)			
TGFD: Ready							037 080
0: No				Fig. 3-221, (p. 3-280)			
TGFD: Not ready							037 081
1: Yes				Fig. 3-221, (p. 3-280)			
TGFD: Ground fault							004 033
0: No				Fig. 3-223, (p. 3-282)			
TGFD: Direct. determined							004 030
0: No				Fig. 3-224, (p. 3-283)			
TGFD: Forward / LS							004 031
0: No				Fig. 3-224, (p. 3-283)			
TGFD: Backward / BS							004 032
0: No				Fig. 3-224, (p. 3-283)			
TGFD: Signals reset							004 141
0: No				Fig. 3-225, (p. 3-283)			

Motor protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MP: Therm.repl.block EXT					040 044
0: No					
MP: Reset replica EXT					041 082
0: No					
MP: Speed monitor n> EXT					040 045
0: No					
MP: Sig. Hours_Run >					025 155
0: No					
MP: Machine stopped					025 158
0: No					
MP: Machine running					025 159
0: No					
MP: Enabled					040 115
0: No				Fig. 3-228, (p. 3-285)	
MP: Reset therm. replica					041 083
0: No				Fig. 3-236, (p. 3-298)	
MP: Reclosure blocked					040 049
0: No				Fig. 3-234, (p. 3-297)	
MP: Starting k*Iref>					041 057
0: No				Fig. 3-229, (p. 3-286)	
MP: Startup					040 119
0: No				Fig. 3-234, (p. 3-297)	
MP: Trip by failed st-up					041 081
0: No				Fig. 3-234, (p. 3-297)	
MP: Trip signal					040 046
0: No				Fig. 3-234, (p. 3-297)	
MP: tI< elapsed					040 047
0: No				Fig. 3-237, (p. 3-299)	

Thermal overload protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
THERM: Block replica EXT					041 074
0: No					
THERM: Reset replica EXT					038 061
0: No					
THERM: CTA error EXT					038 062
0: No					
THERM: Enabled					040 068
0: No				Fig. 3-238, (p. 3-303)	
THERM: Not ready					040 035
1: Yes					
THERM: Reset replica					039 061
0: No				Fig. 3-242, (p. 3-313)	
THERM: Starting k*Iref>					041 108
0: No				Fig. 3-241, (p. 3-311)	
THERM: Warning					039 025
0: No				Fig. 3-241, (p. 3-311)	
THERM: Within pre-trip time					041 109
1: Yes				Fig. 3-241, (p. 3-311)	
THERM: Trip signal					039 020
0: No				Fig. 3-241, (p. 3-311)	
THERM: Reclosure blocked					039 024
0: No					
THERM: Buffer empty					039 112
1: Yes				Fig. 3-241, (p. 3-311)	
THERM: CTA error					039 111
0: No				Fig. 3-239, (p. 3-306)	
THERM: Setting error,block.					039 110
0: No				Fig. 3-241, (p. 3-311)	

Unbalance protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
I2>: Blocking EXT					035 100
0: No					
I2>: Blocking tIneg> EXT					041 076
0: No					
I2>: Blocking tIneg>> EXT					041 077
0: No					
I2>: Enabled					040 073
0: No					Fig. 3-243, (p. 3-314)
I2>: Starting Ineg>					035 024
0: No					Fig. 3-244, (p. 3-315)
I2>: Starting Ineg>>					035 025
0: No					Fig. 3-244, (p. 3-315)
I2>: tIneg> elapsed					035 033
0: No					Fig. 3-244, (p. 3-315)
I2>: tIneg>> elapsed					035 034
0: No					Fig. 3-244, (p. 3-315)

Time-voltage protection

Parameter	Default	Min	Max	Unit	Address	Logic Diagram
V<>: Blocking tV> EXT	0: No				041 068	
V<>: Blocking tV>> EXT	0: No				041 069	
V<>: Blocking tV>>> EXT	0: No				010 246	
V<>: Blocking tV< EXT	0: No				041 070	
V<>: Blocking tV<< EXT	0: No				041 071	
V<>: Blocking tV<<< EXT	0: No				010 247	
V<>: Blocking tVpos> EXT	0: No				041 090	
V<>: Blocking tVpos>> EXT	0: No				041 091	
V<>: Blocking tVpos< EXT	0: No				041 092	
V<>: Blocking tVpos<< EXT	0: No				041 093	
V<>: Blocking tVneg> EXT	0: No				041 094	
V<>: Blocking tVneg>> EXT	0: No				041 095	
V<>: Blocking tVNG> EXT	0: No				041 072	
V<>: Blocking tVNG>> EXT	0: No				041 073	
V<>: Blocking tVref> EXT	0: No				007 036	
V<>: Blocking tVref>> EXT	0: No				007 037	
V<>: Blocking tVref>>>EXT	0: No				010 248	
V<>: Blocking tVref< EXT	0: No				007 039	

Parameter	Default	Min	Max	Unit	Logic Diagram	Address
V<>: Blocking tVref<< EXT	0: No					007 046
V<>: Blocking tVref<<<EXT	0: No					010 249
V<>: Enabled	0: No				Fig. 3-245, (p. 3-316)	040 066
V<>: Ready	0: No				Fig. 3-245, (p. 3-316)	042 003
V<>: Not ready	1: Yes				Fig. 3-245, (p. 3-316)	042 004
V<>: Starting V>/>> A(-B)	0: No				Fig. 3-248, (p. 3-319)	041 031
V<>: Starting V>/>> B(-C)	0: No				Fig. 3-248, (p. 3-319)	041 032
V<>: Starting V>/>> C(-A)	0: No				Fig. 3-248, (p. 3-319)	041 033
V<>: Starting V>	0: No				Fig. 3-248, (p. 3-319)	041 030
V<>: Starting V>>	0: No				Fig. 3-248, (p. 3-319)	041 096
V<>: Starting V>>>	0: No				Fig. 3-248, (p. 3-319) Fig. 3-249, (p. 3-320)	010 231
V<>: Starting V> 3-pole	0: No				Fig. 3-248, (p. 3-319)	041 097
V<>: Starting V>> 3-pole	0: No					010 226
V<>: Starting V>>> 3-pole	0: No				Fig. 3-249, (p. 3-320)	010 232
V<>: tV> elapsed	0: No				Fig. 3-248, (p. 3-319)	041 034
V<>: tV>> elapsed	0: No				Fig. 3-248, (p. 3-319)	041 035
V<>: tV>>> elapsed	0: No				Fig. 3-249, (p. 3-320)	010 233
V<>: tV> 3-pole elapsed	0: No				Fig. 3-248, (p. 3-319)	041 098

Parameter / Default	Min	Max	Unit	Logic Diagram	Address
V<>: tV>> 3-pole elapsed					010 227
0: No				Fig. 3-248, (p. 3-319) Fig. 3-250, (p. 3-321)	
V<>: tV>>> 3-pole elapsed					010 234
0: No				Fig. 3-249, (p. 3-320)	
V<>: Starting V</<< A(-B)					041 038
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V</<< B(-C)					041 039
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V</<< C(-A)					041 040
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V<					041 037
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V<<					041 099
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V<<<					010 235
0: No				Fig. 3-251, (p. 3-322)	
V<>: Starting V< 3-pole					042 005
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V<< 3-pole					010 228
0: No				Fig. 3-250, (p. 3-321)	
V<>: Starting V<<< 3-pole					010 236
0: No				Fig. 3-251, (p. 3-322)	
V<>: tV< elapsed					041 041
0: No				Fig. 3-250, (p. 3-321)	
V<>: tV<< elapsed					041 042
0: No				Fig. 3-250, (p. 3-321)	
V<>: tV<<< elapsed					010 237
0: No				Fig. 3-251, (p. 3-322)	
V<>: tV< elaps. transient					042 023
0: No				Fig. 3-250, (p. 3-321) Fig. 3-251, (p. 3-322)	
V<>: tV<< elapsed trans.					042 025
0: No				Fig. 3-250, (p. 3-321) Fig. 3-251, (p. 3-322)	
V<>: tV<<< elaps. trans.					010 238
0: No				Fig. 3-251, (p. 3-322)	
V<>: tV</<</<<< el.trans					042 007
0: No				Fig. 3-251, (p. 3-322)	

Parameter	Default	Min	Max	Unit	Logic Diagram	Address
V<>: tV< 3-pole elapsed	0: No				Fig. 3-250, (p. 3-321)	042 006
V<>: tV<< 3-pole elapsed	0: No					010 229
V<>: tV<<< 3-pole elapsed	0: No				Fig. 3-251, (p. 3-322)	010 239
V<>: tV< 3p elaps. trans.	0: No				Fig. 3-250, (p. 3-321) Fig. 3-251, (p. 3-322)	042 024
V<>: tV<< 3p elaps. trans	0: No				Fig. 3-250, (p. 3-321) Fig. 3-251, (p. 3-322)	010 230
V<>: tV<<< 3p elaps.trans	0: No				Fig. 3-251, (p. 3-322)	010 240
V<>: Fault V<	0: No				Fig. 3-250, (p. 3-321)	041 110
V<>: Fault V<<	0: No				Fig. 3-250, (p. 3-321)	041 112
V<>: Fault V<<<	0: No				Fig. 3-251, (p. 3-322)	011 134
V<>: Fault V< 3-pole	0: No				Fig. 3-250, (p. 3-321)	041 111
V<>: Fault V<< 3-pole	0: No				Fig. 3-250, (p. 3-321)	011 132
V<>: Fault V<<< 3-pole	0: No				Fig. 3-251, (p. 3-322)	011 133
V<>: Starting Vpos>	0: No				Fig. 3-253, (p. 3-325)	042 010
V<>: Starting Vpos>>	0: No				Fig. 3-253, (p. 3-325)	042 011
V<>: tVpos> elapsed	0: No				Fig. 3-253, (p. 3-325)	042 012
V<>: tVpos>> elapsed	0: No				Fig. 3-253, (p. 3-325)	042 013
V<>: Starting Vpos<	0: No				Fig. 3-253, (p. 3-325)	042 014
V<>: Starting Vpos<<	0: No				Fig. 3-253, (p. 3-325)	042 015

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
V<>: tVpos< elapsed				042 016
0: No				Fig. 3-253, (p. 3-325)
V<>: tVpos<< elapsed				042 017
0: No				Fig. 3-253, (p. 3-325)
V<>: tVpos< elaps. trans.				042 026
0: No				Fig. 3-253, (p. 3-325)
V<>: tVpos<< elaps.trans.				042 027
0: No				Fig. 3-253, (p. 3-325)
V<>: tVpos</<< elap.trans				042 018
0: No				Fig. 3-253, (p. 3-325)
V<>: Fault Vpos<				041 113
0: No				Fig. 3-253, (p. 3-325)
V<>: Fault Vpos<<				041 114
0: No				Fig. 3-253, (p. 3-325)
V<>: Starting Vneg>				042 019
0: No				Fig. 3-254, (p. 3-326)
V<>: Starting Vneg>>				042 020
0: No				Fig. 3-254, (p. 3-326)
V<>: tVneg> elapsed				042 021
0: No				Fig. 3-254, (p. 3-326)
V<>: tVneg>> elapsed				042 022
0: No				Fig. 3-254, (p. 3-326)
V<>: Starting VNG>				041 044
0: No				Fig. 3-256, (p. 3-327)
V<>: Starting VNG>>				042 008
0: No				Fig. 3-256, (p. 3-327)
V<>: tVNG> elapsed				041 045
0: No				Fig. 3-256, (p. 3-327)
V<>: tVNG>> elapsed				041 046
0: No				Fig. 3-256, (p. 3-327)
V<>: Starting Vref>				007 051
0: No				Fig. 3-257, (p. 3-328)
V<>: Starting Vref>>				007 052
0: No				Fig. 3-257, (p. 3-328)
V<>: Starting Vref>>>				010 241
0: No				Fig. 3-257, (p. 3-328)
V<>: tVref> elapsed				007 047
0: No				Fig. 3-257, (p. 3-328)

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
V<>: tVref>> elaps.							007 048
0: No				Fig. 3-257, (p. 3-328)			
V<>: tVref>>> elapsed							010 242
0: No				Fig. 3-257, (p. 3-328)			
V<>: Starting Vref<							007 055
0: No				Fig. 3-258, (p. 3-329)			
V<>: Starting Vref<<							007 056
0: No				Fig. 3-258, (p. 3-329)			
V<>: Starting Vref<<<							010 243
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref< elapsed							007 053
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref<< elapsed							007 054
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref<<< elapsed							010 244
0: No							
V<>: tVref< elaps. trans.							007 057
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref<< elaps.trans.							007 060
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref<<< elaps.trans							010 245
0: No				Fig. 3-258, (p. 3-329)			
V<>: tVref</<</<<< el.tr.							007 063
0: No				Fig. 3-258, (p. 3-329)			
V<>: Fault Vref<							007 061
0: No				Fig. 3-258, (p. 3-329)			
V<>: Fault Vref<<							007 062
0: No				Fig. 3-258, (p. 3-329)			
V<>: Fault Vref<<<							011 135
0: No				Fig. 3-258, (p. 3-329)			

Over-/ underfrequency protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
f<>: Reset meas.val. EXT				006 075
0: No				
f<>: Blocking f1 EXT				042 103
0: No				
f<>: Blocking f2 EXT				042 104
0: No				
f<>: Blocking f3 EXT				042 105
0: No				
f<>: Blocking f4 EXT				042 106
0: No				
f<>: Blocking f5 EXT				013 095
0: No				
f<>: Enabled				042 100
0: No				Fig. 3-259, (p. 3-330)
f<>: Ready				042 101
0: No				Fig. 3-259, (p. 3-330)
f<>: Not ready				042 140
0: No				Fig. 3-259, (p. 3-330)
f<>: Blocked by V<				042 102
0: No				Fig. 3-69, (p. 3-102) Fig. 3-259, (p. 3-330)
f<>: Starting f1				042 107
0: No				Fig. 3-261, (p. 3-333)
f<>: Starting f1/df1				042 108
0: No				Fig. 3-261, (p. 3-333)
f<>: Delta f1 triggered				042 109
0: No				Fig. 3-261, (p. 3-333)
f<>: Delta t1 elapsed				042 110
0: No				Fig. 3-261, (p. 3-333)
f<>: Trip signal f1				042 111
0: No				Fig. 3-261, (p. 3-333)
f<>: Starting f2				042 115
0: No				
f<>: Starting f2/df2				042 116
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
f<>: Delta f2 triggered					042 117
0: No					
f<>: Delta t2 elapsed					042 118
0: No					
f<>: Trip signal f2					042 119
0: No					
f<>: Starting f3					042 123
0: No					
f<>: Starting f3/df3					042 124
0: No					
f<>: Delta f3 triggered					042 125
0: No					
f<>: Delta t3 elapsed					042 126
0: No					
f<>: Trip signal f3					042 127
0: No					
f<>: Starting f4					042 131
0: No					
f<>: Starting f4/df4					042 132
0: No					
f<>: Delta f4 triggered					042 133
0: No					
f<>: Delta t4 elapsed					042 134
0: No					
f<>: Trip signal f4					042 135
0: No					
f<>: Starting f5					013 100
0: No					
f<>: Starting f5/df5					013 101
0: No					
f<>: Delta f5 triggered					013 103
0: No					
f<>: Delta t5 elapsed					013 104
0: No					
f<>: Trip signal f5					013 105
0: No					

Underfrequency load shedding

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
Pf<: Enabled				016 052
0: No				Fig. 3-262, (p. 3-335)
Pf<: Ready				016 053
0: No				Fig. 3-263, (p. 3-336)
Pf<: Blocked				016 055
0: No				Fig. 3-263, (p. 3-336)
Pf<: Blocked by V<				016 056
0: No				Fig. 3-69, (p. 3-102)
Pf<: Blocked by Pmin				016 057
0: No				Fig. 3-265, (p. 3-338)
Pf<: Starting Pf<				016 058
0: No				Fig. 3-265, (p. 3-338)
Pf<: Trip signal Pf<				016 059
0: No				Fig. 3-265, (p. 3-338)
Pf<: f1 active				016 071
0: No				
Pf<: f2 active				016 075
0: No				
Pf<: f3 active				016 080
0: No				
Pf<: f4 active				016 081
0: No				
Pf<: f5 active				016 084
0: No				
Pf<: f6 active				016 085
0: No				
Pf<: f7 active				016 086
0: No				
Pf<: f8 active				016 087
0: No				
Pf<: f9 active				016 088
0: No				
Pf<: f10 active				016 089
0: No				
Pf<: Blocking tPF< EXT				016 030
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
Pf<: Activate f1 EXT				016 031
0: No				
Pf<: Activate f2 EXT				016 032
0: No				
Pf<: Activate f3 EXT				016 033
0: No				
Pf<: Activate f4 EXT				016 034
0: No				
Pf<: Activate f5 EXT				016 035
0: No				
Pf<: Activate f6 EXT				016 036
0: No				
Pf<: Activate f7 EXT				016 037
0: No				
Pf<: Activate f8 EXT				016 038
0: No				
Pf<: Activate f9 EXT				016 039
0: No				
Pf<: Activate f10 EXT				016 046
0: No				
Pf<: Deactivate fn EXT				016 051
0: No				

Power directional protection

Parameter	Default	Min	Max	Unit	Logic Diagram	Address
P<>: Blocking tP> EXT	0: No					035 082
P<>: Blocking tP>> EXT	0: No					035 083
P<>: Blocking tQ> EXT	0: No					035 084
P<>: Blocking tQ>> EXT	0: No					035 085
P<>: Blocking tP< EXT	0: No					035 050
P<>: Blocking tP<< EXT	0: No					035 051
P<>: Blocking tQ< EXT	0: No					035 052
P<>: Blocking tQ<< EXT	0: No					035 053
P<>: Enabled	0: No				Fig. 3-266, (p. 3-339)	036 250
P<>: Starting P>	0: No				Fig. 3-268, (p. 3-341)	035 086
P<>: Starting P>>	0: No				Fig. 3-268, (p. 3-341)	035 089
P<>: Signal P> delayed	0: No				Fig. 3-268, (p. 3-341)	035 087
P<>: Signal P>> delayed	0: No				Fig. 3-268, (p. 3-341)	035 090
P<>: Trip signal P>	0: No				Fig. 3-269, (p. 3-342)	035 088
P<>: Trip signal P>>	0: No				Fig. 3-269, (p. 3-342)	035 091
P<>: Starting Q>	0: No				Fig. 3-270, (p. 3-343)	035 092
P<>: Starting Q>>	0: No				Fig. 3-270, (p. 3-343)	035 095
P<>: Signal Q> delayed	0: No				Fig. 3-270, (p. 3-343)	035 093

Parameter					Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**	
P<>: Signal Q>> delayed					035 096
0: No				Fig. 3-270, (p. 3-343)	
P<>: Trip signal Q>					035 094
0: No				Fig. 3-271, (p. 3-344)	
P<>: Trip signal Q>>					035 097
0: No				Fig. 3-271, (p. 3-344)	
P<>: Starting P<					035 054
0: No				Fig. 3-272, (p. 3-345)	
P<>: Starting P<<					035 060
0: No				Fig. 3-272, (p. 3-345)	
P<>: Signal P< delayed					035 055
0: No				Fig. 3-272, (p. 3-345)	
P<>: Signal P<< delayed					035 061
0: No				Fig. 3-272, (p. 3-345)	
P<>: tP< elapsed trans.					035 056
0: No				Fig. 3-272, (p. 3-345)	
P<>: tP<< elapsed trans.					035 062
0: No				Fig. 3-272, (p. 3-345)	
P<>: tP</tP<< elaps.trans					035 178
0: No				Fig. 3-272, (p. 3-345)	
P<>: Fault P<					035 057
0: No				Fig. 3-272, (p. 3-345)	
P<>: Fault P<<					035 063
0: No				Fig. 3-272, (p. 3-345)	
P<>: Trip signal P<					035 058
0: No				Fig. 3-273, (p. 3-346)	
P<>: Trip signal P<<					035 064
0: No				Fig. 3-273, (p. 3-346)	
P<>: Trip signal P< trans					035 059
0: No				Fig. 3-273, (p. 3-346)	
P<>: Trip sig. P<< trans.					035 065
0: No				Fig. 3-273, (p. 3-346)	
P<>: Starting Q<					035 066
0: No				Fig. 3-275, (p. 3-348)	
P<>: Starting Q<<					035 010
0: No				Fig. 3-275, (p. 3-348)	
P<>: Signal Q< delayed					035 067
0: No				Fig. 3-275, (p. 3-348)	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
P<>: Signal Q<< delayed				035 011
0: No				Fig. 3-275, (p. 3-348)
P<>: tQ< elapsed trans.				035 068
0: No				Fig. 3-275, (p. 3-348)
P<>: tQ<< elapsed trans.				035 016
0: No				Fig. 3-275, (p. 3-348)
P<>: tQ</tQ<< elaps.trans				035 179
0: No				Fig. 3-275, (p. 3-348)
P<>: Fault Q<				035 069
0: No				Fig. 3-275, (p. 3-348)
P<>: Fault Q<<				035 049
0: No				Fig. 3-275, (p. 3-348)
P<>: Trip signal Q<				035 155
0: No				Fig. 3-276, (p. 3-349)
P<>: Trip signal Q<<				035 176
0: No				Fig. 3-276, (p. 3-349)
P<>: Trip sig. Q< trans.				035 156
0: No				Fig. 3-276, (p. 3-349)
P<>: Trip sig. Q<< trans.				035 177
0: No				Fig. 3-276, (p. 3-349)
P<>: Direction P forw.				035 181
0: No				Fig. 3-278, (p. 3-350)
P<>: Direction P backw.				035 191
0: No				Fig. 3-278, (p. 3-350)
P<>: Direction Q forw.				035 193
0: No				Fig. 3-279, (p. 3-351)
P<>: Direction Q backw.				035 194
0: No				Fig. 3-279, (p. 3-351)

Voltage controlled directional reactive power protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
QV: Blocking EXT				013 149
0: No				
QV: Enabled				013 181
0: No				Fig. 3-280, (p. 3-352)
QV: Blocked				013 182
0: No				Fig. 3-281, (p. 3-352)
QV: Ready				013 183
0: No				Fig. 3-281, (p. 3-352)
QV: Not ready				013 255
0: No				
QV: Starting V< 3p				014 073
0: No				
QV: Starting Imin				014 083
0: No				
QV: Starting Q direction				014 074
0: No				
QV: Starting QV				014 088
0: No				
QV: Trip signal t1				014 075
0: No				Fig. 3-283, (p. 3-354)
QV: Trip signal t2				014 076
0: No				Fig. 3-283, (p. 3-354)
QV: Trip command t1				014 077
0: No				Fig. 3-283, (p. 3-354)
QV: Trip command t2				014 078
0: No				Fig. 3-283, (p. 3-354)

Circuit breaker failure protection

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CBF: Enable EXT					038 041
2: Not configured					
CBF: Disable EXT					038 042
2: Not configured					
CBF: Blocking EXT					038 058
0: No					
CBF: Start enable EXT					038 209
1: Yes					
CBF: Start 3p EXT					038 205
0: No					
CBF: Starting trig. EXT					038 016
0: No					
CBF: CB faulty EXT					038 234
0: No					
CBF: Ext./user enabled					038 040
1: Yes				Fig. 3-284, (p. 3-355)	
CBF: Enabled					040 055
0: No				Fig. 3-284, (p. 3-355)	
CBF: Ready					038 009
0: No					
CBF: Not ready					040 025
1: Yes				Fig. 3-285, (p. 3-356)	
CBF: CB pos. implausible					038 210
0: No				Fig. 3-287, (p. 3-358)	
CBF: Current flow A					038 230
0: No				Fig. 3-286, (p. 3-357)	
CBF: Current flow B					038 231
0: No				Fig. 3-286, (p. 3-357)	
CBF: Current flow C					038 232
0: No				Fig. 3-286, (p. 3-357)	
CBF: Current flow Phx					038 233
0: No				Fig. 3-286, (p. 3-357)	
CBF: Current flow N					038 235
0: No				Fig. 3-286, (p. 3-357)	
Signal that the residual current is greater than the set value **CBF: IN<**.					
CBF: Startup 3p					038 211
0: No				Fig. 3-288, (p. 3-359)	

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CBF: Trip signal t1				038 215
0: No				Fig. 3-289, (p. 3-360)
CBF: Trip signal t2				038 219
0: No				Fig. 3-289, (p. 3-360)
CBF: Trip command t1				038 220
0: No				Fig. 3-290, (p. 3-361)
CBF: Trip command t2				038 224
0: No				Fig. 3-290, (p. 3-361)
CBF: CB failure				036 017
0: No				Fig. 3-289, (p. 3-360)
CBF: Starting				038 021
0: No				Fig. 3-291, (p. 3-361)
CBF: Trip signal				040 026
0: No				Fig. 3-291, (p. 3-361)
CBF: Fault behind CB				038 225
0: No				Fig. 3-292, (p. 3-362)
CBF: TripSig CBsync.super				038 226
0: No				Fig. 3-293, (p. 3-362)
CBF: CBsync.superv A open				038 227
0: No				Fig. 3-293, (p. 3-362)
CBF: CBsync.superv B open				038 228
0: No				Fig. 3-293, (p. 3-362)
CBF: CBsync.superv C open				038 229
0: No				Fig. 3-293, (p. 3-362)

Circuit breaker condition monitoring

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CBM: Reset meas.val. EXT					005 247
0: No					
CBM: Blocking EXT					044 128
0: No					
CBM: Enabled					044 130
0: No				Fig. 3-294, (p. 3-363)	
CBM: Blocked					044 199
0: No				Fig. 3-302, (p. 3-371)	
CBM: Sig. No. CB op. >					044 135
0: No				Fig. 3-301, (p. 3-370)	
CBM: Sig. Rem. No.CB op.<					044 136
0: No				Fig. 3-300, (p. 3-370)	
CBM: Signal ΣItrip>					044 137
0: No					
CBM: Signal ΣItrip2>**					044 138
0: No					
CBM: Signal ΣI*t>					044 139
0: No					
CBM: Cycle running A					044 205
0: No					
CBM: Cycle running B					044 206
0: No					
CBM: Cycle running C					044 207
0: No					
CBM: tmax> A					044 177
0: No					
CBM: tmax> B					044 178
0: No					
CBM: tmax> C					044 179
0: No					
CBM: Curr. flow ended A					044 201
0: No					
CBM: Curr. flow ended B					044 202
0: No					
CBM: Curr. flow ended C					044 203
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CBM: Setting error CBM					044 204
0: No					

Measuring-circuit monitoring

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MCMON: Enabled					040 094
0: No				Fig. 3-304, (p. 3-373)	
MCMON: Meas. circ. I faulty					040 087
0: No				Fig. 3-304, (p. 3-373)	
MCMON: Undervoltage					038 038
0: No				Fig. 3-305, (p. 3-374)	
MCMON: Phase sequ. V faulty					038 049
0: No				Fig. 3-305, (p. 3-374)	
MCMON: Meas. circ. V faulty					038 023
0: No				Fig. 3-303, (p. 3-372)	
MCMON: Meas.circ.V,I faulty					037 020
0: No				Fig. 3-303, (p. 3-372)	
MCMON: FF, Vref triggered					038 100
0: No				Fig. 3-306, (p. 3-375)	
MCMON: Meas. voltage o.k.					038 048
0: No				Fig. 3-305, (p. 3-374)	
MCMON: M.circ. Vref flty.					007 213
0: No				Fig. 3-303, (p. 3-372)	
MCMON: M.circ. VNG flty.					007 214
0: No				Fig. 3-303, (p. 3-372)	
MCMON: M.circ. V,Vref flty.					040 078
0: No				Fig. 3-303, (p. 3-372)	
MCMON: Blocking FF,Vref EXT					018 099
0: No				Fig. 3-306, (p. 3-375)	
This parameter allows to block the “Fuse Failure” monitoring of the reference voltage via binary input (e. g. from circuit breaker auxiliary contacts) or programmable logic.					

Limit value monitoring

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LIMIT: Enabled				040 074
0: No				Fig. 3-307, (p. 3-378) Fig. 3-311, (p. 3-382)
LIMIT: tI> elapsed				040 220
0: No				Fig. 3-307, (p. 3-378)
LIMIT: tI>> elapsed				040 221
0: No				Fig. 3-307, (p. 3-378)
LIMIT: tI< elapsed				040 222
0: No				Fig. 3-307, (p. 3-378)
LIMIT: tI<< elapsed				040 223
0: No				Fig. 3-307, (p. 3-378)
LIMIT: tVPG> elapsed				040 224
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPG>> elapsed				040 225
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPG< elapsed				040 226
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPG<< elapsed				040 227
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPP> elapsed				040 228
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPP>> elapsed				040 229
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPP< elapsed				040 230
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVPP<< elapsed				040 231
0: No				Fig. 3-308, (p. 3-379)
LIMIT: tVNG> elapsed				040 168
0: No				Fig. 3-309, (p. 3-380)
LIMIT: tVNG>> elapsed				040 169
0: No				Fig. 3-309, (p. 3-380)
LIMIT: tVref> elapsed				042 152
0: No				Fig. 3-311, (p. 3-382)
LIMIT: tVref>> elapsed				042 153
0: No				Fig. 3-311, (p. 3-382)
LIMIT: tVref< elapsed				042 154
0: No				Fig. 3-311, (p. 3-382)

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LIMIT: tVref<< elapsed					042 155
0: No				Fig. 3-311, (p. 3-382)	
LIMIT: Starting IDC,lin>					040 180
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: Starting IDC,lin>>					040 181
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: tIDC,lin> elapsed					040 182
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: tIDC,lin>> elapsed					040 183
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: Starting IDC,lin<					040 184
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: Starting IDC,lin<<					040 185
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: tIDC,lin< elapsed					040 186
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: tIDC,lin<< elapsed					040 187
0: No				Fig. 3-310, (p. 3-381)	
LIMIT: Starting T>					040 170
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: Starting T>>					040 171
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: tT> elapsed					040 172
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: tT>> elapsed					040 173
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: Starting T<					040 174
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: Starting T<<					040 175
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: tT< elapsed					040 176
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: tT<< elapsed					040 177
0: No				Fig. 3-312, (p. 3-383)	
LIMIT: Starting T1>					040 200
0: No				Fig. 3-313, (p. 3-384)	
LIMIT: Starting T1>>					040 201
0: No				Fig. 3-313, (p. 3-384)	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LIMIT: tT1> elapsed				040 202
0: No				Fig. 3-313, (p. 3-384)
LIMIT: tT1>> elapsed				040 203
0: No				Fig. 3-313, (p. 3-384)
LIMIT: Starting T1<				040 204
0: No				Fig. 3-313, (p. 3-384)
LIMIT: Starting T1<<				040 205
0: No				Fig. 3-313, (p. 3-384)
LIMIT: tT1< elapsed				040 206
0: No				Fig. 3-313, (p. 3-384)
LIMIT: tT1<< elapsed				040 207
0: No				Fig. 3-313, (p. 3-384)
LIMIT: Starting T2>				040 210
0: No				
LIMIT: Starting T2>>				040 211
0: No				
LIMIT: tT2> elapsed				040 212
0: No				
LIMIT: tT2>> elapsed				040 213
0: No				
LIMIT: Starting T2<				040 214
0: No				
LIMIT: Starting T2<<				040 215
0: No				
LIMIT: tT2< elapsed				040 216
0: No				
LIMIT: tT2<< elapsed				040 217
0: No				
LIMIT: Starting T3>				040 160
0: No				
LIMIT: Starting T3>>				040 161
0: No				
LIMIT: tT3> elapsed				040 162
0: No				
LIMIT: tT3>> elapsed				040 163
0: No				
LIMIT: Starting T3<				040 164
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LIMIT: Starting T3<<				040 165
0: No				
LIMIT: tT3< elapsed				040 166
0: No				
LIMIT: tT3<< elapsed				040 167
0: No				
LIMIT: Starting T4>				041 150
0: No				
LIMIT: Starting T4>>				041 151
0: No				
LIMIT: tT4> elapsed				041 152
0: No				
LIMIT: tT4>> elapsed				041 153
0: No				
LIMIT: Starting T4<				041 154
0: No				
LIMIT: Starting T4<<				041 155
0: No				
LIMIT: tT4< elapsed				041 156
0: No				
LIMIT: tT4<< elapsed				041 157
0: No				
LIMIT: Starting T5>				041 160
0: No				
LIMIT: Starting T5>>				041 161
0: No				
LIMIT: tT5> elapsed				041 162
0: No				
LIMIT: tT5>> elapsed				041 163
0: No				
LIMIT: Starting T5<				041 164
0: No				
LIMIT: Starting T5<<				041 165
0: No				
LIMIT: tT5< elapsed				041 166
0: No				
LIMIT: tT5<< elapsed				041 167
0: No				

Parameter / Default	Min	Max	Unit	Address / Logic Diagram
LIMIT: Starting T6>				041 170
0: No				
LIMIT: Starting T6>>				041 171
0: No				
LIMIT: tT6> elapsed				041 172
0: No				
LIMIT: tT6>> elapsed				041 173
0: No				
LIMIT: Starting T6<				041 174
0: No				
LIMIT: Starting T6<<				041 175
0: No				
LIMIT: tT6< elapsed				041 176
0: No				
LIMIT: tT6<< elapsed				041 177
0: No				
LIMIT: Starting T7>				041 180
0: No				
LIMIT: Starting T7>>				041 181
0: No				
LIMIT: tT7> elapsed				041 182
0: No				
LIMIT: tT7>> elapsed				041 183
0: No				
LIMIT: Starting T7<				041 184
0: No				
LIMIT: Starting T7<<				041 185
0: No				
LIMIT: tT7< elapsed				041 186
0: No				
LIMIT: tT7<< elapsed				041 187
0: No				
LIMIT: Starting T8>				041 190
0: No				
LIMIT: Starting T8>>				041 191
0: No				
LIMIT: tT8> elapsed				041 192
0: No				

Parameter / Default	Min	Max	Unit	Address / Logic Diagram
LIMIT: tT8>> elapsed				041 193
0: No				
LIMIT: Starting T8<				041 194
0: No				
LIMIT: Starting T8<<				041 195
0: No				
LIMIT: tT8< elapsed				041 196
0: No				
LIMIT: tT8<< elapsed				041 197
0: No				
LIMIT: Starting T9>				041 240
0: No				
LIMIT: Starting T9>>				041 241
0: No				
LIMIT: tT9> elapsed				041 242
0: No				
LIMIT: tT9>> elapsed				041 243
0: No				
LIMIT: Starting T9<				041 244
0: No				
LIMIT: Starting T9<<				041 245
0: No				
LIMIT: tT9< elapsed				041 246
0: No				
LIMIT: tT9<< elapsed				041 247
0: No				
LIMIT: 2out of3 with T1,2,3				041 248
0: No				Fig. 3-314, (p. 3-386)
LIMIT: 2out of3 with T4,5,6				041 249
0: No				Fig. 3-315, (p. 3-387)
LIMIT: 2out of3 with T7,8,9				041 250
0: No				Fig. 3-315, (p. 3-387)
LIMIT: tIPxx triggered				221 232
0: Not triggered				
LIMIT: tVPGxx triggered				221 233
0: Not triggered				
LIMIT: tVPPxx triggered				221 234
0: Not triggered				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LIMIT: tVNGxx triggered					221 235
0: Not triggered					
LIMIT: tVrefxx triggered					221 237
0: Not triggered					

Programmable Logic

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Input 01 EXT				034 000
0: No				
LOGIC: Input 02 EXT				034 001
0: No				
LOGIC: Input 03 EXT				034 002
0: No				
LOGIC: Input 04 EXT				034 003
0: No				
LOGIC: Input 05 EXT				034 004
0: No				
LOGIC: Input 06 EXT				034 005
0: No				
LOGIC: Input 07 EXT				034 006
0: No				
LOGIC: Input 08 EXT				034 007
0: No				
LOGIC: Input 09 EXT				034 008
0: No				
LOGIC: Input 10 EXT				034 009
0: No				
LOGIC: Input 11 EXT				034 010
0: No				
LOGIC: Input 12 EXT				034 011
0: No				
LOGIC: Input 13 EXT				034 012
0: No				
LOGIC: Input 14 EXT				034 013
0: No				
LOGIC: Input 15 EXT				034 014
0: No				
LOGIC: Input 16 EXT				034 015
0: No				
LOGIC: Input 17 EXT				034 086
0: No				
LOGIC: Input 18 EXT				034 087
0: No				
LOGIC: Input 19 EXT				034 088
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOGIC: Input 20 EXT				034 089
0: No				
LOGIC: Input 21 EXT				034 090
0: No				
LOGIC: Input 22 EXT				034 091
0: No				
LOGIC: Input 23 EXT				034 092
0: No				
LOGIC: Input 24 EXT				034 093
0: No				
LOGIC: Input 25 EXT				034 094
0: No				
LOGIC: Input 26 EXT				034 095
0: No				
LOGIC: Input 27 EXT				034 096
0: No				
LOGIC: Input 28 EXT				034 097
0: No				
LOGIC: Input 29 EXT				034 098
0: No				
LOGIC: Input 30 EXT				034 099
0: No				
LOGIC: Input 31 EXT				034 100
0: No				
LOGIC: Input 32 EXT				034 101
0: No				
LOGIC: Input 33 EXT				034 102
0: No				
LOGIC: Input 34 EXT				034 103
0: No				
LOGIC: Input 35 EXT				034 104
0: No				
LOGIC: Input 36 EXT				034 105
0: No				
LOGIC: Input 37 EXT				034 106
0: No				
LOGIC: Input 38 EXT				034 107
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Input 39 EXT					034 108
0: No					
LOGIC: Input 40 EXT					034 109
0: No					
LOGIC: Set 1 EXT					034 051
2: Not configured					
LOGIC: Set 2 EXT					034 052
2: Not configured					
LOGIC: Set 3 EXT					034 053
2: Not configured					
LOGIC: Set 4 EXT					034 054
2: Not configured					
LOGIC: Set 5 EXT					034 055
2: Not configured					
LOGIC: Set 6 EXT					034 056
2: Not configured					
LOGIC: Set 7 EXT					034 057
2: Not configured					
LOGIC: Set 8 EXT					034 058
2: Not configured					
LOGIC: Reset 1 EXT					034 059
2: Not configured					
LOGIC: Reset 2 EXT					034 060
2: Not configured					
LOGIC: Reset 3 EXT					034 061
2: Not configured					
LOGIC: Reset 4 EXT					034 062
2: Not configured					
LOGIC: Reset 5 EXT					034 063
2: Not configured					
LOGIC: Reset 6 EXT					034 064
2: Not configured					
LOGIC: Reset 7 EXT					034 065
2: Not configured					
LOGIC: Reset 8 EXT					034 066
2: Not configured					
LOGIC: 1 has been set					034 067
0: No				Fig. 3-317, (p. 3-390)	

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: 2 has been set					034 068
0: No					
LOGIC: 3 has been set					034 069
0: No					
LOGIC: 4 has been set					034 070
0: No					
LOGIC: 5 has been set					034 071
0: No					
LOGIC: 6 has been set					034 072
0: No					
LOGIC: 7 has been set					034 073
0: No					
LOGIC: 8 has been set					034 074
0: No					
LOGIC: 1 set externally					034 075
0: No				Fig. 3-317, (p. 3-390)	
LOGIC: 2 set externally					034 076
0: No					
LOGIC: 3 set externally					034 077
0: No					
LOGIC: 4 set externally					034 078
0: No					
LOGIC: 5 set externally					034 079
0: No					
LOGIC: 6 set externally					034 080
0: No					
LOGIC: 7 set externally					034 081
0: No					
LOGIC: 8 set externally					034 082
0: No					
LOGIC: Enabled					034 046
0: No				Fig. 3-318, (p. 3-391)	
LOGIC: Output 01					042 032
0: No				Fig. 3-318, (p. 3-391)	
LOGIC: Output 01 (t)					042 033
0: No				Fig. 3-318, (p. 3-391)	
LOGIC: Output 02					042 034
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Output 02 (t)					042 035
0: No				Fig. 3-183, (p. 3-234)	
LOGIC: Output 03					042 036
0: No					
LOGIC: Output 03 (t)					042 037
0: No					
LOGIC: Output 04					042 038
0: No					
LOGIC: Output 04 (t)					042 039
0: No					
LOGIC: Output 05					042 040
0: No					
LOGIC: Output 05 (t)					042 041
0: No					
LOGIC: Output 06					042 042
0: No					
LOGIC: Output 06 (t)					042 043
0: No					
LOGIC: Output 07					042 044
0: No					
LOGIC: Output 07 (t)					042 045
0: No					
LOGIC: Output 08					042 046
0: No					
LOGIC: Output 08 (t)					042 047
0: No					
LOGIC: Output 09					042 048
0: No					
LOGIC: Output 09 (t)					042 049
0: No					
LOGIC: Output 10					042 050
0: No					
LOGIC: Output 10 (t)					042 051
0: No					
LOGIC: Output 11					042 052
0: No					
LOGIC: Output 11 (t)					042 053
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
LOGIC: Output 12					042 054
0: No					
LOGIC: Output 12 (t)					042 055
0: No					
LOGIC: Output 13					042 056
0: No					
LOGIC: Output 13 (t)					042 057
0: No					
LOGIC: Output 14					042 058
0: No					
LOGIC: Output 14 (t)					042 059
0: No					
LOGIC: Output 15					042 060
0: No					
LOGIC: Output 15 (t)					042 061
0: No					
LOGIC: Output 16					042 062
0: No					
LOGIC: Output 16 (t)					042 063
0: No					
LOGIC: Output 17					042 064
0: No					
LOGIC: Output 17 (t)					042 065
0: No					
LOGIC: Output 18					042 066
0: No					
LOGIC: Output 18 (t)					042 067
0: No					
LOGIC: Output 19					042 068
0: No					
LOGIC: Output 19 (t)					042 069
0: No					
LOGIC: Output 20					042 070
0: No					
LOGIC: Output 20 (t)					042 071
0: No					
LOGIC: Output 21					042 072
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 21 (t)				042 073
0: No				
LOGIC: Output 22				042 074
0: No				
LOGIC: Output 22 (t)				042 075
0: No				
LOGIC: Output 23				042 076
0: No				
LOGIC: Output 23 (t)				042 077
0: No				
LOGIC: Output 24				042 078
0: No				
LOGIC: Output 24 (t)				042 079
0: No				
LOGIC: Output 25				042 080
0: No				
LOGIC: Output 25 (t)				042 081
0: No				
LOGIC: Output 26				042 082
0: No				
LOGIC: Output 26 (t)				042 083
0: No				
LOGIC: Output 27				042 084
0: No				
LOGIC: Output 27 (t)				042 085
0: No				
LOGIC: Output 28				042 086
0: No				
LOGIC: Output 28 (t)				042 087
0: No				
LOGIC: Output 29				042 088
0: No				
LOGIC: Output 29 (t)				042 089
0: No				
LOGIC: Output 30				042 090
0: No				
LOGIC: Output 30 (t)				042 091
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 31				042 092
0: No				
LOGIC: Output 31 (t)				042 093
0: No				
LOGIC: Output 32				042 094
0: No				
LOGIC: Output 32 (t)				042 095
0: No				
LOGIC: Output 33				042 180
0: No				
LOGIC: Output 33 (t)				042 181
0: No				
LOGIC: Output 34				042 182
0: No				
LOGIC: Output 34 (t)				042 183
0: No				
LOGIC: Output 35				042 184
0: No				
LOGIC: Output 35 (t)				042 185
0: No				
LOGIC: Output 36				042 186
0: No				
LOGIC: Output 36 (t)				042 187
0: No				
LOGIC: Output 37				042 188
0: No				
LOGIC: Output 37 (t)				042 189
0: No				
LOGIC: Output 38				042 190
0: No				
LOGIC: Output 38 (t)				042 191
0: No				
LOGIC: Output 39				042 192
0: No				
LOGIC: Output 39 (t)				042 193
0: No				
LOGIC: Output 40				042 194
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 40 (t)				042 195
0: No				
LOGIC: Output 41				042 196
0: No				
LOGIC: Output 41 (t)				042 197
0: No				
LOGIC: Output 42				042 198
0: No				
LOGIC: Output 42 (t)				042 199
0: No				
LOGIC: Output 43				042 200
0: No				
LOGIC: Output 43 (t)				042 201
0: No				
LOGIC: Output 44				042 202
0: No				
LOGIC: Output 44 (t)				042 203
0: No				
LOGIC: Output 45				042 204
0: No				
LOGIC: Output 45 (t)				042 205
0: No				
LOGIC: Output 46				042 206
0: No				
LOGIC: Output 46 (t)				042 207
0: No				
LOGIC: Output 47				042 208
0: No				
LOGIC: Output 47 (t)				042 209
0: No				
LOGIC: Output 48				042 210
0: No				
LOGIC: Output 48 (t)				042 211
0: No				
LOGIC: Output 49				042 212
0: No				
LOGIC: Output 49 (t)				042 213
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 50				042 214
0: No				
LOGIC: Output 50 (t)				042 215
0: No				
LOGIC: Output 51				042 216
0: No				
LOGIC: Output 51 (t)				042 217
0: No				
LOGIC: Output 52				042 218
0: No				
LOGIC: Output 52 (t)				042 219
0: No				
LOGIC: Output 53				042 220
0: No				
LOGIC: Output 53 (t)				042 221
0: No				
LOGIC: Output 54				042 222
0: No				
LOGIC: Output 54 (t)				042 223
0: No				
LOGIC: Output 55				042 224
0: No				
LOGIC: Output 55 (t)				042 225
0: No				
LOGIC: Output 56				042 226
0: No				
LOGIC: Output 56 (t)				042 227
0: No				
LOGIC: Output 57				042 228
0: No				
LOGIC: Output 57 (t)				042 229
0: No				
LOGIC: Output 58				042 230
0: No				
LOGIC: Output 58 (t)				042 231
0: No				
LOGIC: Output 59				042 232
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 59 (t)				042 233
0: No				
LOGIC: Output 60				042 234
0: No				
LOGIC: Output 60 (t)				042 235
0: No				
LOGIC: Output 61				042 236
0: No				
LOGIC: Output 61 (t)				042 237
0: No				
LOGIC: Output 62				042 238
0: No				
LOGIC: Output 62 (t)				042 239
0: No				
LOGIC: Output 63				042 240
0: No				
LOGIC: Output 63 (t)				042 241
0: No				
LOGIC: Output 64				042 242
0: No				
LOGIC: Output 64 (t)				042 243
0: No				
LOGIC: Output 65				047 128
0: No				
LOGIC: Output 65 (t)				047 129
0: No				
LOGIC: Output 66				047 002
0: No				
LOGIC: Output 66 (t)				047 003
0: No				
LOGIC: Output 67				047 004
0: No				
LOGIC: Output 67 (t)				047 005
0: No				
LOGIC: Output 68				047 006
0: No				
LOGIC: Output 68 (t)				047 007
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 69				047 008
0: No				
LOGIC: Output 69 (t)				047 009
0: No				
LOGIC: Output 70				047 010
0: No				
LOGIC: Output 70 (t)				047 011
0: No				
LOGIC: Output 71				047 012
0: No				
LOGIC: Output 71 (t)				047 013
0: No				
LOGIC: Output 72				047 014
0: No				
LOGIC: Output 72 (t)				047 015
0: No				
LOGIC: Output 73				047 016
0: No				
LOGIC: Output 73 (t)				047 017
0: No				
LOGIC: Output 74				047 018
0: No				
LOGIC: Output 74 (t)				047 019
0: No				
LOGIC: Output 75				047 020
0: No				
LOGIC: Output 75 (t)				047 021
0: No				
LOGIC: Output 76				047 022
0: No				
LOGIC: Output 76 (t)				047 023
0: No				
LOGIC: Output 77				047 024
0: No				
LOGIC: Output 77 (t)				047 025
0: No				
LOGIC: Output 78				047 026
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 78 (t)				047 027
0: No				
LOGIC: Output 79				047 028
0: No				
LOGIC: Output 79 (t)				047 029
0: No				
LOGIC: Output 80				047 030
0: No				
LOGIC: Output 80 (t)				047 031
0: No				
LOGIC: Output 81				047 032
0: No				
LOGIC: Output 81 (t)				047 033
0: No				
LOGIC: Output 82				047 034
0: No				
LOGIC: Output 82 (t)				047 035
0: No				
LOGIC: Output 83				047 036
0: No				
LOGIC: Output 83 (t)				047 037
0: No				
LOGIC: Output 84				047 038
0: No				
LOGIC: Output 84 (t)				047 039
0: No				
LOGIC: Output 85				047 040
0: No				
LOGIC: Output 85 (t)				047 041
0: No				
LOGIC: Output 86				047 042
0: No				
LOGIC: Output 86 (t)				047 043
0: No				
LOGIC: Output 87				047 044
0: No				
LOGIC: Output 87 (t)				047 045
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 88				047 046
0: No				
LOGIC: Output 88 (t)				047 047
0: No				
LOGIC: Output 89				047 048
0: No				
LOGIC: Output 89 (t)				047 049
0: No				
LOGIC: Output 90				047 050
0: No				
LOGIC: Output 90 (t)				047 051
0: No				
LOGIC: Output 91				047 052
0: No				
LOGIC: Output 91 (t)				047 053
0: No				
LOGIC: Output 92				047 054
0: No				
LOGIC: Output 92 (t)				047 055
0: No				
LOGIC: Output 93				047 056
0: No				
LOGIC: Output 93 (t)				047 057
0: No				
LOGIC: Output 94				047 058
0: No				
LOGIC: Output 94 (t)				047 059
0: No				
LOGIC: Output 95				047 060
0: No				
LOGIC: Output 95 (t)				047 061
0: No				
LOGIC: Output 96				047 062
0: No				
LOGIC: Output 96 (t)				047 063
0: No				
LOGIC: Output 97				047 064
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output 97 (t)				047 065
0: No				
LOGIC: Output 98				047 066
0: No				
LOGIC: Output 98 (t)				047 067
0: No				
LOGIC: Output 99				047 068
0: No				
LOGIC: Output 99 (t)				047 069
0: No				
LOGIC: Output100				047 070
0: No				
LOGIC: Output100 (t)				047 071
0: No				
LOGIC: Output101				047 072
0: No				
LOGIC: Output101 (t)				047 073
0: No				
LOGIC: Output102				047 074
0: No				
LOGIC: Output102 (t)				047 075
0: No				
LOGIC: Output103				047 076
0: No				
LOGIC: Output103 (t)				047 077
0: No				
LOGIC: Output104				047 078
0: No				
LOGIC: Output104 (t)				047 079
0: No				
LOGIC: Output105				047 080
0: No				
LOGIC: Output105 (t)				047 081
0: No				
LOGIC: Output106				047 082
0: No				
LOGIC: Output106 (t)				047 083
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output107				047 084
0: No				
LOGIC: Output107 (t)				047 085
0: No				
LOGIC: Output108				047 086
0: No				
LOGIC: Output108 (t)				047 087
0: No				
LOGIC: Output109				047 088
0: No				
LOGIC: Output109 (t)				047 089
0: No				
LOGIC: Output110				047 090
0: No				
LOGIC: Output110 (t)				047 091
0: No				
LOGIC: Output111				047 092
0: No				
LOGIC: Output111 (t)				047 093
0: No				
LOGIC: Output112				047 094
0: No				
LOGIC: Output112 (t)				047 095
0: No				
LOGIC: Output113				047 096
0: No				
LOGIC: Output113 (t)				047 097
0: No				
LOGIC: Output114				047 098
0: No				
LOGIC: Output114 (t)				047 099
0: No				
LOGIC: Output115				047 100
0: No				
LOGIC: Output115 (t)				047 101
0: No				
LOGIC: Output116				047 102
0: No				

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Output116 (t)				047 103
0: No				
LOGIC: Output117				047 104
0: No				
LOGIC: Output117 (t)				047 105
0: No				
LOGIC: Output118				047 106
0: No				
LOGIC: Output118 (t)				047 107
0: No				
LOGIC: Output119				047 108
0: No				
LOGIC: Output119 (t)				047 109
0: No				
LOGIC: Output120				047 110
0: No				
LOGIC: Output120 (t)				047 111
0: No				
LOGIC: Output121				047 112
0: No				
LOGIC: Output121 (t)				047 113
0: No				
LOGIC: Output122				047 114
0: No				
LOGIC: Output122 (t)				047 115
0: No				
LOGIC: Output123				047 116
0: No				
LOGIC: Output123 (t)				047 117
0: No				
LOGIC: Output124				047 118
0: No				
LOGIC: Output124 (t)				047 119
0: No				
LOGIC: Output125				047 120
0: No				
LOGIC: Output125 (t)				047 121
0: No				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
LOGIC: Output126							047 122
0: No							
LOGIC: Output126 (t)							047 123
0: No							
LOGIC: Output127							047 124
0: No							
LOGIC: Output127 (t)							047 125
0: No							
LOGIC: Output128							047 126
0: No							
LOGIC: Output128 (t)							047 127
0: No							

Programmable Logic

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
LOG_2: Enabled							011 138
0: No				Fig. 3-319, (p. 3-392)			
LOG_2: Output 1							052 032
0: No				Fig. 3-319, (p. 3-392)			
LOG_2: Output 1 (t)							052 033
0: No				Fig. 3-319, (p. 3-392)			
LOG_2: Output 2							052 034
0: No							
LOG_2: Output 2 (t)							052 035
0: No							
LOG_2: Output 3							052 036
0: No							
LOG_2: Output 3 (t)							052 037
0: No							
LOG_2: Output 4							052 038
0: No							
LOG_2: Output 4 (t)							052 039
0: No							

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV01: Open signal EXT				210 030
0: No				
DEV01: Closed signal EXT				210 031
0: No				
DEV01: Control state				210 018
0: Intermediate pos.				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)
DEV01: Switch. device open				210 036
0: No				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)
DEV01: Switch.device closed				210 037
0: No				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)
DEV01: Dev. interm./flt.pos				210 038
0: No				Fig. 3-330, (p. 3-403) Fig. 3-337, (p. 3-412)
DEV01: Open command				210 028
0: No				Fig. 3-335, (p. 3-409)
DEV01: Close command				210 029
0: No				Fig. 3-335, (p. 3-409)
DEV01: Open cmd. received				218 000
0: No				
DEV01: Close cmd. received				218 001
0: No				
DEV01: Warning op.count.				219 081
0: No				Fig. 3-341, (p. 3-416)
DEV02: Warning op.count.				219 082
0: No				
DEV03: Warning op.count.				219 083
0: No				
DEV04: Warning op.count.				219 084
0: No				
DEV05: Warning op.count.				219 085
0: No				
DEV06: Warning op.count.				219 086
0: No				
DEV07: Warning op.count.				219 087
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV08: Warning op.count.					219 088
0: No					
DEV09: Warning op.count.					219 089
0: No					
DEV10: Warning op.count.					219 090
0: No					
Warning that the number of switching commands has exceeded the set limit value.					

External device

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV02: Open signal EXT					210 080
0: No					
DEV02: Closed signal EXT					210 081
0: No					
DEV02: Control state					210 068
0: Intermediate pos.					
DEV02: Switch. device open					210 086
0: No					
DEV02: Switch.device closed					210 087
0: No					
DEV02: Dev. interm./flt.pos					210 088
0: No					
DEV02: Open command					210 078
0: No					
DEV02: Close command					210 079
0: No					
DEV02: Open cmd. received					218 002
0: No					
DEV02: Close cmd. received					218 003
0: No					

External device

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
DEV03: Open signal EXT					210 130
0: No					
DEV03: Closed signal EXT					210 131
0: No					
DEV03: Control state					210 118
0: Intermediate pos.					
DEV03: Switch. device open					210 136
0: No					
DEV03: Switch.device closed					210 137
0: No					
DEV03: Dev. interm./flt.pos					210 138
0: No					
DEV03: Open command					210 128
0: No					
DEV03: Close command					210 129
0: No					
DEV03: Open cmd. received					218 004
0: No					
DEV03: Close cmd. received					218 005
0: No					

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV04: Open signal EXT				210 180
0: No				
DEV04: Closed signal EXT				210 181
0: No				
DEV04: Control state				210 168
0: Intermediate pos.				
DEV04: Switch. device open				210 186
0: No				
DEV04: Switch.device closed				210 187
0: No				
DEV04: Dev. interm./flt.pos				210 188
0: No				
DEV04: Open command				210 178
0: No				
DEV04: Close command				210 179
0: No				
DEV04: Open cmd. received				218 006
0: No				
DEV04: Close cmd. received				218 007
0: No				

External device

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DEV05: Open signal EXT				210 230
0: No				
DEV05: Closed signal EXT				210 231
0: No				
DEV05: Control state				210 218
0: Intermediate pos.				
DEV05: Switch. device open				210 236
0: No				
DEV05: Switch.device closed				210 237
0: No				
DEV05: Dev. interm./flt.pos				210 238
0: No				
DEV05: Open command				210 228
0: No				
DEV05: Close command				210 229
0: No				
DEV05: Open cmd. received				218 008
0: No				
DEV05: Close cmd. received				218 009
0: No				

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV06: Open signal EXT				211 030
0: No				
DEV06: Closed signal EXT				211 031
0: No				
DEV06: Control state				211 018
0: Intermediate pos.				
DEV06: Switch. device open				211 036
0: No				
DEV06: Switch.device closed				211 037
0: No				
DEV06: Dev. interm./flt.pos				211 038
0: No				
DEV06: Open command				211 028
0: No				
DEV06: Close command				211 029
0: No				
DEV06: Open cmd. received				218 010
0: No				
DEV06: Close cmd. received				218 011
0: No				

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV07: Open signal EXT				211 080
0: No				
DEV07: Closed signal EXT				211 081
0: No				
DEV07: Control state				211 068
0: Intermediate pos.				
DEV07: Switch. device open				211 086
0: No				
DEV07: Switch.device closed				211 087
0: No				
DEV07: Dev. interm./flt.pos				211 088
0: No				
DEV07: Open command				211 078
0: No				
DEV07: Close command				211 079
0: No				
DEV07: Open cmd. received				218 012
0: No				
DEV07: Close cmd. received				218 013
0: No				

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV08: Open signal EXT				211 130
0: No				
DEV08: Closed signal EXT				211 131
0: No				
DEV08: Control state				211 118
0: Intermediate pos.				
DEV08: Switch. device open				211 136
0: No				
DEV08: Switch.device closed				211 137
0: No				
DEV08: Dev. interm./flt.pos				211 138
0: No				
DEV08: Open command				211 128
0: No				
DEV08: Close command				211 129
0: No				
DEV08: Open cmd. received				218 014
0: No				
DEV08: Close cmd. received				218 015
0: No				

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV09: Open signal EXT				211 180
0: No				
DEV09: Closed signal EXT				211 181
0: No				
DEV09: Control state				211 168
0: Intermediate pos.				
DEV09: Switch. device open				211 186
0: No				
DEV09: Switch.device closed				211 187
0: No				
DEV09: Dev. interm./flt.pos				211 188
0: No				
DEV09: Open command				211 178
0: No				
DEV09: Close command				211 179
0: No				
DEV09: Open cmd. received				218 016
0: No				
DEV09: Close cmd. received				218 017
0: No				

External device

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
DEV10: Open signal EXT				211 230
0: No				
DEV10: Closed signal EXT				211 231
0: No				
DEV10: Control state				211 218
0: Intermediate pos.				
DEV10: Switch. device open				211 236
0: No				
DEV10: Switch.device closed				211 237
0: No				
DEV10: Dev. interm./flt.pos				211 238
0: No				
DEV10: Open command				211 228
0: No				
DEV10: Close command				211 229
0: No				
DEV10: Open cmd. received				218 018
0: No				
DEV10: Close cmd. received				218 019
0: No				

Three Position Drive

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TPD1: Cmd. clockwise				219 001
0: No				Fig. 3-348, (p. 3-426)
TPD1: Cmd. counter-clockw.				219 002
0: No				Fig. 3-348, (p. 3-426)
Signaling of the rotating direction of the motor.				
TPD1: Warning op.count.				219 007
0: No				Fig. 3-348, (p. 3-426)
Warning that the number of switching commands has exceeded the set limit value.				

Three Position Drive

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TPD2: Cmd. clockwise				219 021
0: No				
TPD2: Cmd. counter-clockw.				219 022
0: No				
TPD2: Warning op.count.				219 027
0: No				

Three Position Drive

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TPD3: Cmd. clockwise				219 041
0: No				
TPD3: Cmd. counter-clockw.				219 042
0: No				
TPD3: Warning op.count.				219 047
0: No				

Three Position Drive

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TPD4: Cmd. clockwise				219 061
0: No				
TPD4: Cmd. counter-clockw.				219 062
0: No				
TPD4: Warning op.count.				219 067
0: No				

Single-pole signals

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Signal S001 EXT					226 004
0: No					
SIG_1: Logic signal S001					226 005
0: No				Fig. 3-351, (p. 3-431)	
SIG_1: Signal S002 EXT					226 012
0: No					
SIG_1: Logic signal S002					226 013
0: No					
SIG_1: Signal S003 EXT					226 020
0: No					
SIG_1: Logic signal S003					226 021
0: No					
SIG_1: Signal S004 EXT					226 028
0: No					
SIG_1: Logic signal S004					226 029
0: No					
SIG_1: Signal S005 EXT					226 036
0: No					
SIG_1: Logic signal S005					226 037
0: No					
SIG_1: Signal S006 EXT					226 044
0: No					
SIG_1: Logic signal S006					226 045
0: No					
SIG_1: Signal S007 EXT					226 052
0: No					
SIG_1: Logic signal S007					226 053
0: No					
SIG_1: Signal S008 EXT					226 060
0: No					
SIG_1: Logic signal S008					226 061
0: No					
SIG_1: Signal S009 EXT					226 068
0: No					
SIG_1: Logic signal S009					226 069
0: No					
SIG_1: Signal S010 EXT					226 076
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Logic signal S010					226 077
0: No					
SIG_1: Signal S011 EXT					226 084
0: No					
SIG_1: Logic signal S011					226 085
0: No					
SIG_1: Signal S012 EXT					226 092
0: No					
SIG_1: Logic signal S012					226 093
0: No				Fig. 3-342, (p. 3-419)	
SIG_1: Signal S013 EXT					226 100
0: No					
SIG_1: Logic signal S013					226 101
0: No					
SIG_1: Signal S014 EXT					226 108
0: No					
SIG_1: Logic signal S014					226 109
0: No					
SIG_1: Signal S015 EXT					226 116
0: No					
SIG_1: Logic signal S015					226 117
0: No					
SIG_1: Signal S016 EXT					226 124
0: No					
SIG_1: Logic signal S016					226 125
0: No					
SIG_1: Signal S017 EXT					226 132
0: No					
SIG_1: Logic signal S017					226 133
0: No					
SIG_1: Signal S018 EXT					226 140
0: No					
SIG_1: Logic signal S018					226 141
0: No					
SIG_1: Signal S019 EXT					226 148
0: No					
SIG_1: Logic signal S019					226 149
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Signal S020 EXT					226 156
0: No					
SIG_1: Logic signal S020					226 157
0: No					
SIG_1: Signal S021 EXT					226 164
0: No					
SIG_1: Logic signal S021					226 165
0: No					
SIG_1: Signal S022 EXT					226 172
0: No					
SIG_1: Logic signal S022					226 173
0: No					
SIG_1: Signal S023 EXT					226 180
0: No					
SIG_1: Logic signal S023					226 181
0: No					
SIG_1: Signal S024 EXT					226 188
0: No					
SIG_1: Logic signal S024					226 189
0: No					
SIG_1: Signal S025 EXT					226 196
0: No					
SIG_1: Logic signal S025					226 197
0: No					
SIG_1: Signal S026 EXT					226 204
0: No					
SIG_1: Logic signal S026					226 205
0: No					
SIG_1: Signal S027 EXT					226 212
0: No					
SIG_1: Logic signal S027					226 213
0: No					
SIG_1: Signal S028 EXT					226 220
0: No					
SIG_1: Logic signal S028					226 221
0: No					
SIG_1: Signal S029 EXT					226 228
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Logic signal S029					226 229
0: No					
SIG_1: Signal S030 EXT					226 236
0: No					
SIG_1: Logic signal S030					226 237
0: No					
SIG_1: Signal S031 EXT					226 244
0: No					
SIG_1: Logic signal S031					226 245
0: No					
SIG_1: Signal S032 EXT					226 252
0: No					
SIG_1: Logic signal S032					226 253
0: No					
SIG_1: Signal S033 EXT					227 004
0: No					
SIG_1: Logic signal S033					227 005
0: No					
SIG_1: Signal S034 EXT					227 012
0: No					
SIG_1: Logic signal S034					227 013
0: No					
SIG_1: Signal S035 EXT					227 020
0: No					
SIG_1: Logic signal S035					227 021
0: No					
SIG_1: Signal S036 EXT					227 028
0: No					
SIG_1: Logic signal S036					227 029
0: No					
SIG_1: Signal S037 EXT					227 036
0: No					
SIG_1: Logic signal S037					227 037
0: No					
SIG_1: Signal S038 EXT					227 044
0: No					
SIG_1: Logic signal S038					227 045
0: No					

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
SIG_1: Signal S039 EXT					227 052
0: No					
SIG_1: Logic signal S039					227 053
0: No					
SIG_1: Signal S040 EXT					227 060
0: No					
SIG_1: Logic signal S040					227 061
0: No					
SIG_1: Signal S041 EXT					227 068
0: No					
SIG_1: Logic signal S041					227 069
0: No					
SIG_1: Signal S042 EXT					227 076
0: No					
SIG_1: Logic signal S042					227 077
0: No					
SIG_1: Signal S043 EXT					227 084
0: No					
SIG_1: Logic signal S043					227 085
0: No					
SIG_1: Signal S044 EXT					227 092
0: No					
SIG_1: Logic signal S044					227 093
0: No					
SIG_1: Signal S045 EXT					227 100
0: No					
SIG_1: Logic signal S045					227 101
0: No					
SIG_1: Signal S046 EXT					227 108
0: No					
SIG_1: Logic signal S046					227 109
0: No					
SIG_1: Signal S047 EXT					227 116
0: No					
SIG_1: Logic signal S047					227 117
0: No					
SIG_1: Signal S048 EXT					227 124
0: No					

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
SIG_1: Logic signal S048				227 125
0: No				
SIG_1: Signal S049 EXT				227 132
0: No				
SIG_1: Logic signal S049				227 133
0: No				
SIG_1: Signal S050 EXT				227 140
0: No				
SIG_1: Logic signal S050				227 141
0: No				
SIG_1: Signal S051 EXT				227 148
0: No				
SIG_1: Logic signal S051				227 149
0: No				
SIG_1: Signal S052 EXT				227 156
0: No				
SIG_1: Logic signal S052				227 157
0: No				
SIG_1: Signal S053 EXT				227 164
0: No				
SIG_1: Logic signal S053				227 165
0: No				
SIG_1: Signal S054 EXT				227 172
0: No				
SIG_1: Logic signal S054				227 173
0: No				
SIG_1: Signal S055 EXT				227 180
0: No				
SIG_1: Logic signal S055				227 181
0: No				
SIG_1: Signal S056 EXT				227 188
0: No				
SIG_1: Logic signal S056				227 189
0: No				
SIG_1: Signal S057 EXT				227 196
0: No				
SIG_1: Logic signal S057				227 197
0: No				

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
SIG_1: Signal S058 EXT				227 204
0: No				
SIG_1: Logic signal S058				227 205
0: No				
SIG_1: Signal S059 EXT				227 212
0: No				
SIG_1: Logic signal S059				227 213
0: No				
SIG_1: Signal S060 EXT				227 220
0: No				
SIG_1: Logic signal S060				227 221
0: No				
SIG_1: Signal S061 EXT				227 228
0: No				
SIG_1: Logic signal S061				227 229
0: No				
SIG_1: Signal S062 EXT				227 236
0: No				
SIG_1: Logic signal S062				227 237
0: No				
SIG_1: Signal S063 EXT				227 244
0: No				
SIG_1: Logic signal S063				227 245
0: No				
SIG_1: Signal S064 EXT				227 252
0: No				
SIG_1: Logic signal S064				227 253
0: No				
SIG_1: SIG_DC3 EXT				233 004
0: No				
SIG_1: Logic SIG_DC3				233 005
0: No				Fig. 3-347, (p. 3-424)

Single-pole commands

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
CMD_1: Command C001				200 001
0: No				Fig. 3-350, (p. 3-429)
CMD_1: Command C002				200 006
0: No				
CMD_1: Command C003				200 011
0: No				
CMD_1: Command C004				200 016
0: No				
CMD_1: Command C005				200 021
0: No				
CMD_1: Command C006				200 026
0: No				
CMD_1: Command C007				200 031
0: No				
CMD_1: Command C008				200 036
0: No				
CMD_1: Command C009				200 041
0: No				
CMD_1: Command C010				200 046
0: No				
CMD_1: Command C011				200 051
0: No				Fig. 3-342, (p. 3-419)
CMD_1: Command C012				200 056
0: No				Fig. 3-342, (p. 3-419)
CMD_1: Command C013				200 061
0: No				
CMD_1: Command C014				200 066
0: No				
CMD_1: Command C015				200 071
0: No				
CMD_1: Command C016				200 076
0: No				
CMD_1: Command C017				200 081
0: No				
CMD_1: Command C018				200 086
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CMD_1: Command C019					200 091
0: No					
CMD_1: Command C020					200 096
0: No					
CMD_1: Command C021					200 101
0: No					
CMD_1: Command C022					200 106
0: No					
CMD_1: Command C023					200 111
0: No					
CMD_1: Command C024					200 116
0: No					
CMD_1: Command C025					200 121
0: No					
CMD_1: Command C026					200 126
0: No					
CMD_1: CMD_DC1					202 001
0: No				Fig. 3-345, (p. 3-423)	
CMD_1: CMD_DC2					202 006
0: No				Fig. 3-346, (p. 3-423)	
CMD_1: CMD_DC3					202 011
0: No				Fig. 3-347, (p. 3-424)	

Interlocking logic

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
ILOCK: Output 01				250 032
0: No				Fig. 3-349, (p. 3-428)
ILOCK: Output 02				250 033
0: No				
ILOCK: Output 03				250 034
0: No				
ILOCK: Output 04				250 035
0: No				
ILOCK: Output 05				250 036
0: No				
ILOCK: Output 06				250 037
0: No				
ILOCK: Output 07				250 038
0: No				
ILOCK: Output 08				250 039
0: No				
ILOCK: Output 09				250 040
0: No				
ILOCK: Output 10				250 041
0: No				
ILOCK: Output 11				250 042
0: No				
ILOCK: Output 12				250 043
0: No				
ILOCK: Output 13				250 044
0: No				
ILOCK: Output 14				250 045
0: No				
ILOCK: Output 15				250 046
0: No				
ILOCK: Output 16				250 047
0: No				
ILOCK: Output 17				250 048
0: No				
ILOCK: Output 18				250 049
0: No				
ILOCK: Output 19				250 050
0: No				

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
ILOCK: Output 20					250 051
0: No					
ILOCK: Output 21					250 052
0: No					
ILOCK: Output 22					250 053
0: No					
ILOCK: Output 23					250 054
0: No					
ILOCK: Output 24					250 055
0: No					
ILOCK: Output 25					250 056
0: No					
ILOCK: Output 26					250 057
0: No					
ILOCK: Output 27					250 058
0: No					
ILOCK: Output 28					250 059
0: No					
ILOCK: Output 29					250 060
0: No					
ILOCK: Output 30					250 061
0: No					
ILOCK: Output 31					250 062
0: No					
ILOCK: Output 32					250 063
0: No					

Output of the respective equation of the interlocking logic.

These logic state signals are transmitted with the request for a switching operation, and cyclically (according to the setting **ILOCK: Cycle t interl.check**).

Binary counts

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COUNT: Set counter 1 EXT				217 130
0: No				
COUNT: Set counter 2 EXT				217 085
0: No				
COUNT: Set counter 3 EXT				217 086
0: No				
COUNT: Set counter 4 EXT				217 087
0: No				
COUNT: Transmit counts EXT				217 009
0: No				
COUNT: Reset EXT				217 004
0: No				
COUNT: Enabled				217 001
0: No				Fig. 3-356, (p. 3-437)
COUNT: Transmit counts				217 010
0: No				Fig. 3-356, (p. 3-437)
COUNT: Reset				217 005
0: No				Fig. 3-356, (p. 3-437)
COUNT: Warning count 1				217 191
0: No				
COUNT: Warning count 2				217 192
0: No				
COUNT: Warning count 3				217 193
0: No				
COUNT: Warning count 4				217 194
0: No				
Warning that the counter value has exceeded the set limit value.				

Real Timer

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
TIMER: Monday				014 139
0: No				Fig. 3-357, (p. 3-438)
TIMER: Tuesday				014 148
0: No				
TIMER: Wednesday				014 149
0: No				
TIMER: Thursday				014 158
0: No				
TIMER: Friday				014 159
0: No				
TIMER: Saturday				014 168
0: No				
TIMER: Sunday				014 169
0: No				Fig. 3-357, (p. 3-438)
TIMER: Timer stage 1				015 006
0: No				Fig. 3-357, (p. 3-438)
TIMER: Timer stage 2				015 007
0: No				
TIMER: Timer stage 4				015 013
0: No				
TIMER: Timer stage 3				015 010
0: No				

8.1.2 Control and Testing

Device

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
DVICE: Service info 031 080				031 080
0: No				

Local control panel

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
LOC: Param. change enabl.				003 010
0: No				
Setting the enable for changing values from the local control panel.				

"Logical" communication interface 1

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM1: Sel.spontan.sig.test				003 180
060 000: MAIN: Without function				Fig. 3-18, (p. 3-24)
Signal selection for testing purposes.				
COMM1: Test spont.sig.start				003 184
0: don't execute				Fig. 3-18, (p. 3-24)
Triggering of transmission of a selected signal as "starting".				
COMM1: Test spont.sig. end				003 186
0: don't execute				Fig. 3-18, (p. 3-24)
Triggering of transmission of a selected signal as "ending".				
COMM1: Sel. pos. dev.test				221 105
0: Not assigned				
Select a device DEVxx for testing the transmission of switchgear device position in monitoring direction.				
COMM1: Test position dev.				221 106
0: don't execute				
Carry out a test to check the transmission of switchgear device position in monitoring direction for the device selected at **COMM1: Sel. pos. dev.test**.				

"Logical" communication interface 2

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM2: Sel.spontan.sig.test				103 180
060 000: MAIN: Without function				Fig. 3-20, (p. 3-26)
Signal selection for testing purposes.				
COMM2: Test spont.sig.start				103 184
0: don't execute				Fig. 3-20, (p. 3-26)
Triggering of transmission of a selected signal as "starting".				
COMM2: Test spont.sig. end				103 186
0: don't execute				Fig. 3-20, (p. 3-26)
Triggering of transmission of a selected signal as "ending".				

InterMiCOM interface

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
COMM3: Rset.No.tlg.err.USER							120 037
0: don't execute							
Resetting counter for number of telegram errors.							
COMM3: Send signal for test							120 050
0: None							
COMM3: Log. state for test							120 051
1: 1							
COMM3: Send signal, test							120 053
0: don't execute							
COMM3: Loop back send							120 055
170	0	255					
Setting a bit pattern consisting of 3 bits.							
COMM3: Loop back test							120 054
0: don't execute							
Carrying out a loop back test with the PCOMM interface.							
COMM3: Hold time for test							120 052
10	1	600	s				
Selecting the hold time (in seconds) for the functional testing.							

IEC 61850 Communication

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
IEC: Sel.spontan.sig.test							104 245
060 000: MAIN: Without function							
IEC: Test spont.sig.start							104 246
0: don't execute							
IEC: Test spont.sig. end							104 247
0: don't execute							
IEC: Sel. pos. DEV test							104 248
0: Not assigned							
IEC: Test position DEV							104 249
0: don't execute							

Measured data input

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASI: Reset Tmax USER					003 045
0: don't execute					
Resetting measured maximum temperatures Tmax and Tmax Tx (x=1...9) to updated measured values.					

Binary and analog output

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
OUTP: Reset latch. USER					021 009
0: don't execute				Fig. 3-38, (p. 3-60)	
Reset of latched output relays from the user interface.					
OUTP: Relay assign. f.test					003 042
060 000: MAIN: Without function				Fig. 3-39, (p. 3-61)	
Selection of the relay to be tested.					
OUTP: Relay test					003 043
0: don't execute				Fig. 3-39, (p. 3-61)	
The relay selected for testing is triggered for the duration set at **OUTP: Hold-time for test**.					
OUTP: Hold-time for test					003 044
1	1	10	s	Fig. 3-39, (p. 3-61)	
Setting for the time period for which the selected output relay is triggered for functional testing.					

Measured data output

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MEASO: Reset output USER					037 116
0: don't execute				Fig. 3-42, (p. 3-63)	
Resetting the measured data output function.					

Main function

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: General reset USER				003 002
0: don't execute				Fig. 3-89, (p. 3-123)

Reset of the following memories:

- All counters
- LED indicators
- Operating data memory
- All event memories
- Event counters
- Fault data
- Measured overload data
- Recorded fault values

MAIN: Enable syst. IN USER				003 142
0: don't execute				Fig. 3-64, (p. 3-98)

Enabling the residual current stages of the DTOC/IDMT protection.

MAIN: Disable syst.IN USER				003 141
0: don't execute				Fig. 3-64, (p. 3-98)

Disabling the residual current stages of the DTOC/IDMT protection.

MAIN: Reset indicat. USER				021 010
0: don't execute				Fig. 3-89, (p. 3-123)

Reset of the following displays:

- LED indicators
- Fault data

MAIN: Rset.latch.trip USER				021 005
0: don't execute				Fig. 3-82, (p. 3-115)

Reset of latched trip commands from the local control panel.

MAIN: Reset c. cl/tr.cUSER				003 007
0: don't execute				Fig. 3-75, (p. 3-108) Fig. 3-84, (p. 3-116)

The counters for counting the close and trip commands are reset.

MAIN: Reset IP,max,st.USER				003 033
0: don't execute				Fig. 3-51, (p. 3-85)

The display of the stored maximum phase current is reset.

MAIN: Reset meas.v.en.USER				003 032
0: don't execute				Fig. 3-61, (p. 3-93)

The display of active and reactive energy output and input is reset.

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
MAIN: Group reset 1 USER					005 253
0: don't execute				Fig. 3-90, (p. 3-123)	
MAIN: Group reset 2 USER					005 254
0: don't execute				Fig. 3-90, (p. 3-123)	
Group of resetting commands.					
MAIN: Man. trip cmd. USER					003 040
0: don't execute				Fig. 3-85, (p. 3-117)	
A 100 ms trip command is issued from the local control panel. **Note:** The command is only executed if the manual trip command has been configured as trip command 1 or 2.					
MAIN: Man.cl.cmd.enablUSER					003 105
0: No				Fig. 3-75, (p. 3-108)	
Setting the enable for the issue of a close command from the local control panel (enables manual breaker close operations).					
MAIN: Man. close cmd. USER					018 033
0: don't execute				Fig. 3-75, (p. 3-108)	
A close command is issued from the local control panel for the set reclose command time.					
MAIN: Soft Warm restart					003 039
0: don't execute					
A warm restart of the software is carried out. The device functions as it does when the power supply is turned on, except that no hardware tests are carried out.					
MAIN: Warm restart					010 166
0: don't execute					
A warm restart is carried out. The device functions as it does when the power supply is turned on.					
MAIN: Soft Cold restart					000 085
0: don't execute					
A cold restart of the software is carried out. This means that all settings and recordings are cleared, but no tests of the hardware are carried out during the restart. Parameter values used by the P139 after a cold restart have been selected in such a manner that the P139 is blocked after a cold restart.					
MAIN: Cold restart					009 254
0: don't execute					
A cold restart is carried out. A cold restart means that all settings and recordings are cleared. Parameter values used by the P139 after a cold restart have been selected in such a manner that the P139 is blocked after a cold restart.					

Operating data recording

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
OP_RC: Reset record. USER							100 001
0: don't execute				Fig. 3-95, (p. 3-131)			

The operating data memory and the counter for operation signals are reset.

Monitoring signal recording

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
MT_RC: Reset record. USER							003 008
0: don't execute				Fig. 3-96, (p. 3-132)			

Reset of the monitoring signal memory.

Overload recording

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
OL_RC: Reset record. USER							100 003
0: don't execute				Fig. 3-101, (p. 3-136)			

Reset of the overload memory.

Ground fault recording

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
GF_RC: Reset record. USER							100 000
0: don't execute				Fig. 3-110, (p. 3-144)			

Reset of the ground fault memory.

Fault recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
FT_RC: Trigger USER				003 041
0: don't execute				Fig. 3-117, (p. 3-153)

Fault recording is enabled from the local control panel for 500 ms.

Parameter				Address
FT_RC: Reset record. USER				003 006
0: don't execute				Fig. 3-118, (p. 3-154)

Reset of the following memories:

- LED indicators
- Fault memory
- Fault counter
- Fault data
- Recorded fault values

Protective signaling

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
PSIG: Enable USER				003 132
0: don't execute				Fig. 3-167, (p. 3-215)

Protective signaling is enabled from the local control panel.

Parameter				Address
PSIG: Disable USER				003 131
0: don't execute				Fig. 3-167, (p. 3-215)

Protective signaling is disabled from the local control panel.

Parameter				Address
PSIG: Test telecom. USER				015 009
0: don't execute				Fig. 3-169, (p. 3-218)

A send signal is issued for 500 ms.

Auto-reclosing control

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
ARC: Enable USER					003 134
0: don't execute				Fig. 3-173, (p. 3-223)	
The auto-reclosing control function is enabled from the local control panel.					
ARC: Disable USER					003 133
0: don't execute				Fig. 3-173, (p. 3-223)	
The auto-reclosing control function is disabled from the local control panel.					
ARC: Test HSR A-B-C USER					011 066
0: don't execute				Fig. 3-187, (p. 3-240)	
A three-pole test HSR is triggered.					
ARC: Reset counters USER					003 005
0: don't execute				Fig. 3-189, (p. 3-243)	
The ARC counters are reset.					

Automatic synchronism check

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
ASC: Enable USER				003 136
0: don't execute				Fig. 3-191, (p. 3-246)
Automatic synchronism check is enabled from the local control panel.				
ASC: Disable USER				003 135
0: don't execute				Fig. 3-191, (p. 3-246)
Automatic synchronism check is disabled from the local control panel.				
ASC: AR close requ. USER				008 238
0: don't execute				Fig. 3-193, (p. 3-249)
A close request is issued with Automatic Reclose parameters. This will trigger the ASC functional operation. A close command is transmitted to the CB if the check of the ASC is positive.				
ASC: MC close requ. USER				018 004
0: don't execute				Fig. 3-194, (p. 3-250)
A close request is issued from the integrated local control panel. This will trigger the ASC functional operation. A close command is transmitted to the CB if the check of the ASC is positive.				
ASC: Test AR close r.USER				008 237
0: don't execute				Fig. 3-193, (p. 3-249)
A close request is issued with Automatic Reclose parameters. This will trigger the ASC functional operation. No close command is transmitted to the CB if the check of the ASC is positive. Only a signal is issued.				
ASC: Test MC close r.USER				018 005
0: don't execute				Fig. 3-194, (p. 3-250)
A close request is issued from the integrated local control panel. This will trigger the ASC functional operation. No close command is transmitted to the CB if the check of the ASC is positive. Only a signal is issued.				
ASC: Reset counters USER				003 089
0: don't execute				Fig. 3-205, (p. 3-262)
The ASC counters are reset.				

Ground fault direction determination using steady-state values

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GFDSS: Reset counters USER				003 004
0: don't execute				Fig. 3-214, (p. 3-272) Fig. 3-220, (p. 3-278)

The counters for the ground fault direction determination function using steady-state values are reset.

Transient ground fault direction determination

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TGFD: Reset signal USER				003 009
0: don't execute				Fig. 3-225, (p. 3-283)

The direction decisions can be reset while the buffer time is elapsing.

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
TGFD: Reset counters USER				003 022
0: don't execute				Fig. 3-227, (p. 3-284)

The counters for the transient ground fault direction determination function are reset.

Motor protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MP: Reset replica USER				022 073
0: don't execute				Fig. 3-236, (p. 3-298)

Resetting the thermal replica of the motor protection function.

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MP: Initialize Hours_Run				025 151
0: don't execute				

In order to set the default value for the operating hours, this parameter should be set to “execute”.

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MP: Init. val. Hours_Run				025 154
Blocked	0	65000	h	

Setting for the default value of the operating hours counter.

Thermal overload protection

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
THERM: Reset replica USER							022 061
0: don't execute				Fig. 3-242, (p. 3-313)			
Resetting the thermal replica of the thermal overload protection function.							

Over-/underfrequency protection

Parameter							Address
Default	**Min**	**Max**	**Unit**				**Logic Diagram**
f<>: Reset meas.val. USER							003 080
0: don't execute							
Resetting the measured event values **f<>: Max. frequ. for f>** and **f<>: Min. frequ. for f<**.							

Underfrequency load shedding

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
Pf<: Trigger Deactivate				016 200
0: don't execute				
Pf<: Trigger f1				016 201
0: don't execute				
Pf<: Trigger f2				016 202
0: don't execute				
Pf<: Trigger f3				016 203
0: don't execute				
Pf<: Trigger f4				016 204
0: don't execute				
Pf<: Trigger f5				016 205
0: don't execute				
Pf<: Trigger f6				016 206
0: don't execute				
Pf<: Trigger f7				016 207
0: don't execute				
Pf<: Trigger f8				016 208
0: don't execute				
Pf<: Trigger f9				016 209
0: don't execute				
Pf<: Trigger f10				016 210
0: don't execute				

Circuit breaker failure protection

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
CBF: Enable USER				003 016
0: don't execute				Fig. 3-284, (p. 3-355)
Circuit breaker failure protection is enabled from the local control panel.				
CBF: Disable USER				003 015
0: don't execute				Fig. 3-284, (p. 3-355)
Circuit breaker failure protection is disabled from the local control panel.				

Circuit breaker condition monitoring

Parameter					Address
Default	Min	Max	Unit	Logic Diagram	
CBM: Initialize values					003 011
0: don't execute					
Values are initialized to trigger circuit breaker condition monitoring.					
CBM: Reset meas.val. USER					003 013
0: don't execute					
Resetting circuit breaker condition monitoring					
CBM: Set No. CB oper. A					022 131
Blocked	0	65000		Fig. 3-299, (p. 3-368)	
CBM: Set No. CB oper. B					022 132
Blocked	0	65000			
CBM: Set No. CB oper. C					022 133
Blocked	0	65000			
Set the number of CB operations.					
CBM: Set remain. CB op. A					022 134
Blocked	0	65000		Fig. 3-299, (p. 3-368)	
CBM: Set remain. CB op. B					022 135
Blocked	0	65000			
CBM: Set remain. CB op. C					022 136
Blocked	0	65000			
Set the remaining CB operations.					
CBM: Set ΣItrip A					022 137
Blocked	0	65000	Inom,CB	Fig. 3-299, (p. 3-368)	
CBM: Set ΣItrip B					022 138
Blocked	0	65000	Inom,CB		
CBM: Set ΣItrip C					022 139
Blocked	0	65000	Inom,CB		
CBM: Set ΣItrip2 A**					022 140
Blocked	0	65000	Inom,CB**2	Fig. 3-299, (p. 3-368)	
CBM: Set ΣItrip2 B**					022 141
Blocked	0	65000	Inom,CB**2		
CBM: Set ΣItrip2 C**					022 142
Blocked	0	65000	Inom,CB**2		
CBM: Set ΣI*t A					022 143
Blocked	0.0	4000.0	kAs	Fig. 3-299, (p. 3-368)	

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
CBM: Set ΣI*t B				022 144
Blocked	0.0	4000.0	kAs	
CBM: Set ΣI*t C				022 145
Blocked	0.0	4000.0	kAs	

Set the limit values for the ruptured currents and their squares. (An alarm is displayed if these limit values are exceeded.)

Programmable Logic

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
LOGIC: Trigger 1				034 038
0: don't execute				Fig. 3-318, (p. 3-391)
LOGIC: Trigger 2				034 039
0: don't execute				
LOGIC: Trigger 3				034 040
0: don't execute				
LOGIC: Trigger 4				034 041
0: don't execute				
LOGIC: Trigger 5				034 042
0: don't execute				
LOGIC: Trigger 6				034 043
0: don't execute				
LOGIC: Trigger 7				034 044
0: don't execute				
LOGIC: Trigger 8				034 045
0: don't execute				Fig. 3-318, (p. 3-391)

Intervention in the logic at the appropriate point by a 100 ms pulse.

Binary counts

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COUNT: Transmit counts USER				217 008
0: don't execute				Fig. 3-356, (p. 3-437)

Count transmission.

Parameter				Address
COUNT: Reset USER				217 003
0: don't execute				Fig. 3-356, (p. 3-437)

Count reset.

8.1.3 Operating Data Recording

Operating data recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OP_RC: Operat. data record.				003 024
0	0	1000		Fig. 3-95, (p. 3-131)

Point of entry into the operating data log.

Monitoring signal recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
MT_RC: Mon. signal record.				003 001
0	0	30		Fig. 3-96, (p. 3-132)

Point of entry into the monitoring signal log.

8.2 Events

8.2.1 Event Counters

InterMiCOM interface

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
COMM3: No. telegram errors				120 042
0	0	65535		
Number of corrupted telegrams.				

Main function

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MAIN: No. general start.				004 000
0: don't execute				Fig. 3-80, (p. 3-113)
Number of general starting signals.				
MAIN: CB1 act. oper. cap.				221 087
1	1	99		
MAIN: CB2 act. oper. cap.				221 091
1	1	99		
Setting for the maximum number of CB operations for an ARC cycle (or for a limited time period).				
MAIN: No. gen.trip cmds. 1				004 006
0: don't execute				Fig. 3-84, (p. 3-116)
Number of general trip commands 1.				
MAIN: No. gen.trip cmds. 2				009 050
0: don't execute				Fig. 3-84, (p. 3-116)
Number of general trip commands 2.				
MAIN: No. close commands				009 055
0: don't execute				Fig. 3-75, (p. 3-108)
Number of close commands.				
MAIN: No. motor drive op.				221 025
0: don't execute				Fig. 3-340, (p. 3-416)
Number of times external devices with direct motor control are activated during the monitoring time.				
MAIN: No.overfl.act.en.out				009 090
0: don't execute				Fig. 3-61, (p. 3-93)
Counter for the number of times the measuring range of the active energy output was exceeded. **Note:** The maximum value of this counter is 10000.				
MAIN: No.overfl.act.en.inp				009 091
0: don't execute				Fig. 3-61, (p. 3-93)
Counter for the number of times the measuring range of the active energy input was exceeded. **Note:** The maximum value of this counter is 10000.				

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MAIN: No.ov/fl.reac.en.out							009 092
0: don't execute				Fig. 3-61, (p. 3-93)			

Counter for the number of times the measuring range of the reactive energy output was exceeded.

Note: The maximum value of this counter is 10000.

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MAIN: No.ov/fl.reac.en.inp							009 093
0: don't execute				Fig. 3-61, (p. 3-93)			

Counter for the number of times the measuring range of the reactive energy input was exceeded.

Note: The maximum value of this counter is 10000.

Operating data recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OP_RC: No. oper. data sig.							100 002
0	0	1000		Fig. 3-95, (p. 3-131)			

Number of signals stored in the operating data memory.

Monitoring signal recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
MT_RC: No. monit. signals							004 019
0	0	30		Fig. 3-96, (p. 3-132)			

Number of signals stored in the monitoring signal memory.

Overload recording

Parameter							Address
Default	Min	Max	Unit				Logic Diagram
OL_RC: No. overload							004 101
0	0	9999		Fig. 3-100, (p. 3-135)			

Number of overload events.

Ground fault recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
GF_RC: No. ground faults				004 100
0	0	9999		Fig. 3-109, (p. 3-143)
Number of ground faults.				

Fault recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
FT_RC: No. of faults				004 020
0	0	9999		Fig. 3-117, (p. 3-153)
Number of faults.				
FT_RC: No. system disturb.				004 010
0	0	9999		Fig. 3-117, (p. 3-153)
Number of system disturbances.				

Auto-reclosing control

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
ARC: Number HSR A-B-C					004 007
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of high-speed reclosures.					
ARC: Number TDR					004 008
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of time-delay reclosures.					
ARC: No. HSR successful					016 198
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of OC reclosures.					
ARC: No. HSR unsuccessful					016 199
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of OCO reclosures.					
ARC: No. TDR successful					016 211
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of OCOC reclosures.					
ARC: No. TDR unsuccessful					016 212
0: don't execute				Fig. 3-189, (p. 3-243)	
Number of OCOCO reclosures.					

Automatic synchronism check

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
ASC: No. RC aft. man.clos					004 009
0: don't execute				Fig. 3-205, (p. 3-262)	
Number of reclosures after a manual close request.					
ASC: No. close requests					009 033
0: don't execute				Fig. 3-205, (p. 3-262)	
Number of close requests.					
ASC: No. close rejections					009 034
0: don't execute				Fig. 3-205, (p. 3-262)	
Number of close rejections.					

Ground fault direction determination using steady-state values

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
GFDSS: No. GF power/admitt.				009 002
0: don't execute				Fig. 3-220, (p. 3-278)
Number of ground faults detected by steady-state power evaluation.				
GFDSS: No. GF (curr. meas)				009 003
0: don't execute				Fig. 3-214, (p. 3-272)
Number of ground faults detected by steady-state current evaluation.				
GFDSS: No. GF admitt. Y(N)				009 060
0: don't execute				Fig. 3-220, (p. 3-278)
Number of ground faults (non-directional) detected by the admittance evaluation method.				
GFDSS: No. GF forward/LS				009 000
0: don't execute				Fig. 3-220, (p. 3-278)
Number of ground faults in the forward direction.				
GFDSS: No. GF backward/BS				009 001
0: don't execute				Fig. 3-220, (p. 3-278)
Number of ground faults in the backward direction.				

Transient ground fault direction determination

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
TGFD: No. GF				004 015
0: don't execute				Fig. 3-227, (p. 3-284)
Number of transient ground faults.				
TGFD: No. GF forward/LS				004 013
0: don't execute				Fig. 3-227, (p. 3-284)
Number of transient ground faults in the forward direction.				
TGFD: No. GF backward/BS				004 014
0: don't execute				Fig. 3-227, (p. 3-284)
Number of ground faults in the backward direction.				

Motor protection

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
MP: No. of start-ups				004 011
0: don't execute				Fig. 3-235, (p. 3-298)
Number of motor startups since the last reset.				
MP: No. of hours run				025 150
0	0	65000	h	
Number of operating hours since the last reset.				

Circuit breaker condition monitoring

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
CBM: No. of CB oper. A				008 011
0	0	65000		Fig. 3-299, (p. 3-368)
CBM: No. of CB oper. B				008 012
0	0	65000		
CBM: No. of CB oper. C				008 013
0	0	65000		
Number of mechanical switching operations made.				
CBM: Remain. No. CB op. A				008 014
30000	0	65000		Fig. 3-299, (p. 3-368)
CBM: Remain. No. CB op. B				008 015
30000	0	65000		
CBM: Remain. No. CB op. C				008 016
30000	0	65000		
Number of remaining switching operations (as shown by evaluating wear with reference to the CB wear characteristic).				

External device

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV01: Operation counter					210 043
0	0	65535		Fig. 3-341, (p. 3-416)	
DEV02: Operation counter					210 093
0	0	65535			
DEV03: Operation counter					210 143
0	0	65535			
DEV04: Operation counter					210 193
0	0	65535			
DEV05: Operation counter					210 243
0	0	65535			
DEV06: Operation counter					211 043
0	0	65535			
DEV07: Operation counter					211 093
0	0	65535			
DEV08: Operation counter					211 143
0	0	65535			
DEV09: Operation counter					211 193
0	0	65535			
DEV10: Operation counter					211 243
0	0	65535			
Number of switching operations made. It is also possible to manually set this counter to any value from 0 to 65535.					
DEV01: Dev. op. capability					210 003
1	1	99			
DEV02: Dev. op. capability					210 053
1	1	99			
DEV03: Dev. op. capability					210 103
1	1	99			
DEV04: Dev. op. capability					210 153
1	1	99			
DEV05: Dev. op. capability					210 203
1	1	99			
DEV06: Dev. op. capability					211 003
1	1	99			
DEV07: Dev. op. capability					211 053
1	1	99			
DEV08: Dev. op. capability					211 103
1	1	99			

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
DEV09: Dev. op. capability					211 153
1	1	99			
DEV10: Dev. op. capability					211 203
1	1	99			

Number of remaining switching operations. It is also possible to manually set this counter to any value from 1 to 99.

Three Position Drive

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
TPD1: Operation counter					219 005
0	0	65535		Fig. 3-348, (p. 3-426)	
TPD2: Operation counter					219 025
0	0	65535			
TPD3: Operation counter					219 045
0	0	65535			
TPD4: Operation counter					219 065
0	0	65535			

Number of switching operations made. It is also possible to manually set this counter to any value from 0 to 65535.

8.2.2 Measured Event Data

Overload data acquisition

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
OL_DA: Overload duration					004 102
Not measured	0.0	6500.0	s	Fig. 3-97, (p. 3-133)	
Duration of the overload event.					
OL_DA: T.taken f.startup,MP					005 096
Not measured	0.0	1000.0	s	Fig. 3-98, (p. 3-133)	
Display of the motor startup time.					
OL_DA: Start-up current, MP					005 098
Not measured	0.0	10.0	Iref	Fig. 3-98, (p. 3-133)	
Display of the motor startup current.					
OL_DA: Heat.dur.start-up,MP					005 097
Not measured	0	100	%	Fig. 3-98, (p. 3-133)	
Display of startup heating in motor protection.					
OL_DA: Status THERM replica					004 147
Not measured	0	250	%	Fig. 3-99, (p. 3-134)	
Display of the buffer content of the thermal overload protection function.					
OL_DA: Load current THERM					004 058
Not measured	0.00	3.00	Inom	Fig. 3-99, (p. 3-134)	
Display of the load current used by the thermal overload protection function to calculate the tripping time.					
OL_DA: Object temp. THERM					004 035
Not measured	-40	300	°C	Fig. 3-99, (p. 3-134)	
Display of the temperature of the protected object.					
OL_DA: Coolant temp. THERM					004 036
Not measured	-40	215	°C	Fig. 3-99, (p. 3-134)	
Display of coolant temperature, dependent on the setting for **THERM: Select meas.inputPSx**. When set to *None* the set temperature value will be displayed. When set to *PT100* the temperature measured by the resistance thermometer will be displayed. When set to *20mA input* the temperature measured via an external 20 mA transducer will be displayed.					
OL_DA: Pre-trip t.leftTHERM					004 148
Not measured	0.0	1000.0	min	Fig. 3-99, (p. 3-134)	
Display of the time remaining before the thermal overload protection function will reach the tripping threshold (“time-to-trip”).					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
OL_DA: Offset THERM replica					004 154
Not measured	-25000	25000	%	Fig. 3-99, (p. 3-134)	

Display of the additional reserve if coolant temperature is taken into account and if the measured coolant temperature is lower than the set maximum permissible coolant temperature. (In this case, the thermal model has been shifted downwards.)

If there is no coolant temperature acquisition and if the coolant temperature and the maximum permissible coolant temperature have been set to the same value, then the coolant temperature is not taken into account and the characteristic is a function of the current only. The additional reserve amounts to 0 in this case.

Ground fault data acquisition

Parameter					Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**	
GF_DA: Ground flt. duration					009 100
Not measured	0.0	6500.0	min	Fig. 3-102, (p. 3-137)	
Display of the ground fault duration of the most recent ground fault.					
GF_DA: GF duration pow.meas					009 024
Not measured	0.0	6500.0	min	Fig. 3-103, (p. 3-138)	
Display of the ground fault duration of the most recent ground fault as determined by the steady-state power evaluation feature of the ground fault direction determination function.					
GF_DA: Voltage VNG p.u.					009 020
Not measured	0.000	1.500	VNG,nom	Fig. 3-104, (p. 3-139) Fig. 3-108, (p. 3-142)	
Display of the neutral-displacement voltage of the most recent ground fault referred to V_{nom}. **Note:** This display is only active if the steady-state power evaluation mode of the ground fault direction determination function is enabled.					
GF_DA: Current IN p.u.					009 021
Not measured	0.000	10.000	IN,nom	Fig. 3-104, (p. 3-139) Fig. 3-106, (p. 3-140) Fig. 3-108, (p. 3-142)	
Display of the residual current of the most recent ground fault referred to I_{nom}. **Note:** This display is only active when the ground fault direction determination function using steady state values (GFDSS) is enabled.					
GF_DA: Curr. IN,act p.u.					009 022
Not measured	0.000	10.000	IN,nom	Fig. 3-104, (p. 3-139)	
Display of the active component of the residual current of the most recent ground fault referred to I_{nom}. **Note:** This display is only active if the steady-state power evaluation mode of the ground fault direction determination function is enabled.					
GF_DA: Curr. IN,reac p.u.					009 023
Not measured	0.000	10.000	IN,nom	Fig. 3-104, (p. 3-139)	
Display of the reactive component of the residual current of the most recent ground fault referred to I_{nom}. **Note:** This display is only active if the steady-state power evaluation mode of the ground fault direction determination function is enabled.					
GF_DA: GF durat. curr.meas.					009 026
Not measured	0.0	6500.0	min	Fig. 3-105, (p. 3-140)	
Display of the ground fault duration of the most recent ground fault as determined by the steady-state current evaluation feature of the ground fault direction determination function.					

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
GF_DA: Curr. IN filt. p.u.					009 025
Not measured	0.000	10.000	IN,nom	Fig. 3-106, (p. 3-140)	
Display of the residual current component having the set filter frequency for the most recent ground fault (referred to I_{nom}).					
GF_DA: GF duration admitt.					009 068
Not measured	0.0	6500.0	min	Fig. 3-107, (p. 3-141)	
Display of the ground fault duration of the most recent ground fault as determined by the admittance evaluation mode of the ground fault direction determination function.					
GF_DA: Admittance Y(N) p.u.					009 065
Not measured	0.000	5.000	YN,nom	Fig. 3-108, (p. 3-142)	
Display of the admittance value referred to $Y_{N,nom}$. **Note:** If **GFDSS: Evaluation VNG PSx** is set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ If **GFDSS: Evaluation VNG PSx** is set to *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$					
GF_DA: Conduct. G(N) p.u.					009 066
Not measured	-5.000	5.000	YN,nom	Fig. 3-108, (p. 3-142)	
Display of the conductance value referred to $Y_{N,nom}$. **Note:** If **GFDSS: Evaluation VNG PSx** is set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ If **GFDSS: Evaluation VNG PSx** is set to *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$					
GF_DA: Suscept. B(N) p.u.					009 067
Not measured	-5.000	5.000	YN,nom	Fig. 3-108, (p. 3-142)	
Display of the susceptance value referred to $Y_{N,nom}$. **Note:** If **GFDSS: Evaluation VNG PSx** is set to *Measured*: $Y_{N,nom} = I_{N,nom} / V_{NG,nom}$ If **GFDSS: Evaluation VNG PSx** is set to *Calculated*: $Y_{N,nom} = I_{N,nom} / V_{nom}$					

Fault data acquisition

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
FT_DA: Fault duration					008 010
Not measured	0.0	60.0	s	Fig. 3-111, (p. 3-145)	
Display of the fault duration.					
FT_DA: Running time					004 021
Not measured	0.00	65.00	s	Fig. 3-111, (p. 3-145)	
Display of the running time.					
FT_DA: Fault type					010 198
....: Not measured				Fig. 3-114, (p. 3-148)	
Display of the fault type. This value is determined from the starting signals of the function group MAIN.					
FT_DA: Meas. loop selected					004 079
....: Not measured				Fig. 3-115, (p. 3-150)	
Display of the measuring loop selected for determination of fault data.					
FT_DA: Fault current P p.u.					004 025
Not measured	0.00	100.00	Inom	Fig. 3-115, (p. 3-150)	
Display of the fault current referred to I_{nom}.					
FT_DA: Flt.volt. PG/PP prim					010 217
Not measured	0.0	2500.0	kV	Fig. 3-115, (p. 3-150)	
Display of the fault voltage as a primary quantity.					
FT_DA: Flt.volt. PG/PP p.u.					004 026
Not measured	0.000	3.000	Vnom	Fig. 3-115, (p. 3-150)	
Display of the fault voltage referred to V_{nom}.					
FT_DA: Fault loop angle P					004 024
Not measured	-180	180	°	Fig. 3-115, (p. 3-150)	
Display of the fault angle.					
FT_DA: Fault curr. N prim.					010 216
Not measured	0	25000	A	Fig. 3-115, (p. 3-150)	
Display of the ground fault current as a primary quantity.					
FT_DA: Fault curr. N p.u.					004 049
Not measured	0.00	100.00	Inom	Fig. 3-115, (p. 3-150)	
Display of the ground fault current referred to $I_{N,nom}$.					
FT_DA: Fault loop angle N					004 048
Not measured	-180	180	°	Fig. 3-115, (p. 3-150)	
Display of the ground fault angle.					

Parameter					Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**	
FT_DA: Fault react., prim.					004 029
Not measured	-320.00	320.00	Ω	Fig. 3-115, (p. 3-150)	
Display of the fault reactance as a primary quantity.					
FT_DA: Fault reactance,sec.					004 028
Not measured	-320.00	320.00	Ω	Fig. 3-115, (p. 3-150)	
Display of the fault reactance as a secondary quantity.					
FT_DA: Fault impedance, sec					004 023
Not measured	0.00	320.00	Ω	Fig. 3-115, (p. 3-150)	
Display of the fault impedance as a secondary quantity.					
FT_DA: Fault locat. percent					004 027
Not measured	-320.00	320.00	%	Fig. 3-116, (p. 3-151)	
Display of the fault location of the last fault (in %) referred to the setting at **FT_DA: Line reactance PSx**.					
FT_DA: Fault current P prim					010 199
Not measured	0	25000	A	Fig. 3-115, (p. 3-150)	
Display of the fault current as a primary quantity.					
FT_DA: Fault location					004 022
Not measured	-500.0	500.0	km	Fig. 3-116, (p. 3-151)	
Display of the fault location of the last fault in km.					

Automatic synchronism check

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
ASC: Voltage Vref					004 087
Not measured	0.000	3.000	Vnom	Fig. 3-204, (p. 3-262)	
ASC: Volt. sel. meas.loop					004 088
Not measured	0.000	3.000	Vnom	Fig. 3-204, (p. 3-262)	
ASC: Volt. magnit. diff.					004 091
Not measured	-3.000	3.000	Vnom	Fig. 3-200, (p. 3-257) Fig. 3-201, (p. 3-259) Fig. 3-204, (p. 3-262)	
Display of the difference between amplitudes of the measurement loop voltage and the reference voltage during a close request, referred to V_{nom}. The display only appears if ASC is operating.					
ASC: Angle difference					004 089
Not measured	-180.0	180.0	°	Fig. 3-200, (p. 3-257) Fig. 3-201, (p. 3-259) Fig. 3-204, (p. 3-262)	
Display of the angle difference between measured voltage and reference voltage at the time of the close request (in degrees). This display only appears when the automatic synchronism check function is active.					
ASC: Frequ. difference					004 090
Not measured	-5.00	5.00	Hz	Fig. 3-200, (p. 3-257) Fig. 3-201, (p. 3-259) Fig. 3-204, (p. 3-262)	
Display of the frequency difference between measured voltage and reference voltage at the time of the close request (in Hz). This display only appears when the automatic synchronism check function is active.					

Over-/underfrequency protection

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
f<>: Max. frequ. for f>					005 002
Not measured	12.00	70.00	Hz		
Maximum frequency during an overfrequency condition.					
f<>: Min. frequ. for f<					005 001
Not measured	12.00	70.00	Hz		
Minimum frequency during an underfrequency condition.					

Circuit breaker condition monitoring

Parameter					Address
Default	Min	Max	Unit		Logic Diagram
CBM: Itrip,prim A					009 212
Not measured	0	65000	A	Fig. 3-299, (p. 3-368)	
CBM: Itrip,prim B					009 213
Not measured	0	65000	A		
CBM: Itrip,prim C					009 214
Not measured	0	65000	A		
CBM: Itrip A					009 047
Not measured	0.00	100.00	Inom,CB	Fig. 3-299, (p. 3-368)	
CBM: Itrip B					009 048
Not measured	0.00	100.00	Inom,CB		
CBM: Itrip C					009 049
Not measured	0.00	100.00	Inom,CB		
CBM: Itrip2 A**					009 051
Not measured	0.0	6000.0	Inom,CB**2	Fig. 3-299, (p. 3-368)	
CBM: Itrip2 B**					009 052
Not measured	0.0	6000.0	Inom,CB**2		
CBM: Itrip2 C**					009 053
Not measured	0.0	6000.0	Inom,CB**2		
Ruptured currents and their squared values.					
CBM: ΣItrip A					009 071
0	0	65000	Inom,CB	Fig. 3-299, (p. 3-368)	
CBM: ΣItrip B					009 073
0	0	65000	Inom,CB		
CBM: ΣItrip C					009 076
0	0	65000	Inom,CB		
Sum of the per-unit ruptured currents for each circuit breaker contact.					
CBM: ΣItrip2 A**					009 077
0	0	65000	Inom,CB**2	Fig. 3-299, (p. 3-368)	
CBM: ΣItrip2 B**					009 078
0	0	65000	Inom,CB**2		

Parameter					Address
Default	**Min**	**Max**	**Unit**		**Logic Diagram**
CBM: ΣItrip2 C**					009 079
0	0	65000	Inom,CB**2		
Sum of the squared per-unit ruptured currents for each circuit breaker contact.					
CBM: I*t A					009 061
Not measured	0	60000	As	Fig. 3-299, (p. 3-368)	
CBM: I*t B					009 062
Not measured	0	60000	As		
CBM: I*t C					009 063
Not measured	0	60000	As		
Current-time integral of the per-unit ruptured current for each circuit breaker contact.					
CBM: ΣI*t A					009 087
0.0	0.0	4000.0	kAs	Fig. 3-299, (p. 3-368)	
CBM: ΣI*t B					009 088
0.0	0.0	4000.0	kAs		
CBM: ΣI*t C					009 089
0.0	0.0	4000.0	kAs		
Sum of the current-time integrals of the per-unit ruptured currents for each circuit breaker contact.					

8.2.3 Event Recording

Overload recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
OL_RC: Overload recording 1				033 020
0	0	9999		Fig. 3-101, (p. 3-136)
OL_RC: Overload recording 2				033 021
0	0	9999		
OL_RC: Overload recording 3				033 022
0	0	9999		
OL_RC: Overload recording 4				033 023
0	0	9999		
OL_RC: Overload recording 5				033 024
0	0	9999		
OL_RC: Overload recording 6				033 025
0	0	9999		
OL_RC: Overload recording 7				033 026
0	0	9999		
OL_RC: Overload recording 8				033 027
0	0	9999		
Point of entry into the overload log.				

Ground fault recording

Parameter				Address
Default	**Min**	**Max**	**Unit**	**Logic Diagram**
GF_RC: Ground flt.record. 1				033 010
0	0	9999		
GF_RC: Ground flt.record. 2				033 011
0	0	9999		
GF_RC: Ground flt.record. 3				033 012
0	0	9999		
GF_RC: Ground flt.record. 4				033 013
0	0	9999		
GF_RC: Ground flt.record. 5				033 014
0	0	9999		
GF_RC: Ground flt.record. 6				033 015
0	0	9999		
GF_RC: Ground flt.record. 7				033 016
0	0	9999		
GF_RC: Ground flt.record. 8				033 017
0	0	9999		
Point of entry into the ground fault log.				

Fault recording

Parameter				Address
Default	Min	Max	Unit	Logic Diagram
FT_RC: Fault recording 1				003 000
0	0	9999		
FT_RC: Fault recording 2				033 001
0	0	9999		
FT_RC: Fault recording 3				033 002
0	0	9999		
FT_RC: Fault recording 4				033 003
0	0	9999		
FT_RC: Fault recording 5				033 004
0	0	9999		
FT_RC: Fault recording 6				033 005
0	0	9999		
FT_RC: Fault recording 7				033 006
0	0	9999		
FT_RC: Fault recording 8				033 007
0	0	9999		
Point of entry into the fault log.				

9 IEC 61850 Settings via IED Configurator

This chapter lists all IEC 61850-specific settings, that are carried out with the configuration tool “IED Configurator”.

The sequence in which the settings are listed and described in this chapter corresponds to their sequence in the menu tree of the “IED Configurator”.

However, only those setting parameters are described that are mandatory for establishing the IEC 61850 communication.

Further setting parameters are listed in the “Settings” chapter under the function groups IEC and GOOSE. A list of all available *Logical Nodes* can be found in a separate document.

9.1 Manage IED

The menu item “Manage IED” allows for establishing a connection between the “IED Configurator” and the device.

The P139 features two memory “banks” one of which includes the active setting parameters. The other memory bank is used with the configuration procedure for parameters via “IED Configurator” or operating program.

Toggling between active and inactive memory bank is carried out either by executing the parameter **IEC: Switch Config. Bank** or via “IED Configurator” (after the connection has been established) by pressing the “Switch Banks” button.

Active Bank

Parameter
SCL File ID
Name of the configuration bank currently valid. Setting is carried out with the *IED Configurator*, after a connection with the device has been established (via menu item “Manage IED”).
SCL File Version
Version number of the configuration bank currently valid. Setting is carried out with the *IED Configurator*, after a connection with the device has been established (via menu item “Manage IED”).

Inactive Bank

Parameter
SCL File ID
Name of the inactive configuration bank. Setting is carried out with the *IED Configurator*, after a connection with the device has been established (via menu item “Manage IED”).
SCL File Version
Version number of the inactive configuration bank. Setting is carried out with the *IED Configurator*, after a connection with the device has been established (via menu item “Manage IED”).

9.2 IED Details

The category “IED Details” contains several settings that characterize the device as well as the SCL file, which identifies the IEC 61850 configuration.

SCL Details

Parameter	Default Value
SCL File ID	PX 139
Identification of the .MCL configuration file. If required, this preset value may be modified by, for example, entering a bay name.	
SCL File Version	237.2.01
Specific value to identify the IEC 61850 data model and configuration. If required, this preset value may be modified by, for example, identifying the revision states during engineering.	

IED Details

Parameter	Address
Name	104 057
Explicitly assigned device name for the function in the system (IED); is part of the Logical Device Name. **Important note:** According to the IEC standard the name must consist of only letters (A..Z, a..z), digits (0..9) and underscore characters (_), and the name must start with a letter. Note that a non-standard name causes problems with the IEC 61850 communication.	

Template Details

Parameter
ICD Template
SCL Schema Version
Description
Type
Configuration Revision
Supported Models
The values listed in the column “Template Details” only provide information. They are preset and cannot be modified.

9.3 Communications

The category “Communications” contains the general network-related settings.

Connected Sub-Network

Parameter	Default Value	
Connected Sub-Network	NONE	
Optional name available to identify the Ethernet network.		
Access Point	AP1	
Part of the communications control; preset, cannot be modified.		

Address Configuration

Parameter	Default Value	Address
IP Address	0.0.0.0	104 001
Assigned IP address of the P139 for the server function in the system.		
SubNet Mask	0.0.0.0	104 005
The subnet mask defines which part of the IP address is addressed by the sub-network and which part by the device that is logged-on to the network.		
Gateway Address	0.0.0.0	104 011
This parameter shows the IPv4 address of the network gateway for communication links to clients outside of the local network.		

General Configuration

Parameter	Default Value	
Media	Fibre	
Network hardware provided as fiber optics (“Fibre”) or twisted pair copper wires (“Copper”).		
TCP Keepalive	5 seconds	
Communication monitoring at TCP level.		
Database Lock Timeout	2 minutes	
Return time period for setting procedures that have commenced. (The default value above is in seconds. The *IED Configurator*, however, displays converts this to minutes.)		

9.4 SNTP

The category “SNTP” contains the clock synchronization settings.

9.4.1 General Config

Client Operation

Parameter	Default Value	
Poll Rate (seconds)	64	
Polling interval for clock synchronization.		
Accepted Stratum Level	All levels (0 - 15)	
Quality criterion to accept an SNTP server for clock synchronization; preset, cannot be modified.		

9.4.2 External Server 1

Settings for the primary clock synchronization server.

Note that all values except **IP Address** and the “Use Anycast” button are usually disabled and may be accepted only when imported from an XML configuration file.

External Server Parameters

Parameter	Default Value	Address
IP Address	0.0.0.0	104 202
IP address of the preferred server used for clock synchronization. Clicking the “Use Anycast” button in the *IED Configurator* changes the value such that any server in the local network is appointed to provide clock synchronization.		

9.4.3 External Server 2

Settings for the primary clock synchronization server.

Note that all values except **IP Address** and the “Use Anycast” button are usually disabled and may be accepted only when imported from an XML configuration file.

External Server Parameters

Parameter	Default Value	Address
IP Address	0.0.0.0	104 210
IP address of the backup server used for clock synchronization. Clicking the “Use Anycast” button in the *IED Configurator* changes the value such that any server in the local network is appointed to provide clock synchronization.		

9.5 Dataset Definitions

Dataset Definitions

Parameter
Name
Explicitly (and uniquely) assigned name for the dataset.
Location
Saving datasets at System/LLN0 is compulsory.
Contents
Content (data objects, data attributes) of a dataset. The “GOOSE Capacity” display allows for checking the length of a dataset for less than 1500 bytes to permit transmission in GOOSE messages. **Note:** It is not possible to read the IEC configuration back from the P139 if the “Dataset” sizes exceed the GOOSE size limit significantly. Therefore it is recommended to limit the “Dataset” size(s) to 100% of the GOOSE capacity. Too large a dataset can spoil IEC61850 communication. Hence, the dataset size limit of 100% of the GOOSE capacity should not be exceeded, neither for GOOSE nor for reports.

9.6 GOOSE Publishing

9.6.1 System/LLN0

Network Parameters

Parameter	Default Value
Multicast MAC Address	01-0C-CD-01-00-00
Virtual MAC address that the sending device provides as the destination; preset.	
Application ID (hex)	0000
Explicitly (and uniquely) assigned ID-number of the GOOSE.	
VLAN Identifier (hex)	0
ID-number of the virtual LAN with which the GOOSE is sent; preset.	
VLAN Priority	4
Priority with which the GOOSE is sent in the virtual LAN; preset.	

Repeat Message Transmission Parameters

Parameter	Default Value
Minimum Cycle Time	10 ms
First send repetition of the GOOSE occurring after the set time period; preset.	
Maximum Cycle Time	1 s
Continuous send repetition of the GOOSE occurring after the set time period; preset.	
Increment	900
Specification factor for the transition of time intervals for GOOSE send repetitions from the first to the continuous repetition.	

Message Data Parameters

Parameter	Default Value
GOOSE Identifier	TEMPLATESystem/LLN0GOgcb01
GOOSE ID consisting of the Device Name and the GOOSE Control Block.	
Dataset Reference	
Name of the dataset assigned to the GOOSE.	
Configuration Revision	1
Revision status of the configuration.	

9.7 GOOSE Subscribing

9.7.1 Mapped Inputs

Source Network Parameters

Parameter	Default Value
Multicast MAC Address	01-0C-CD-01-00-00
Virtual MAC address used as a receive filter; preset.	
Application ID (hex)	0
ID-number of the GOOSE.	

GOOSE Source Parameters

Parameter	Default Value
Source Path	
Information data attribute in the transmitting device.	
GOOSE Identifier	
ID of the GOOSE in the transmitting device.	
Dataset Reference	
Name of the dataset assigned to the GOOSE in the transmitting device.	
Configuration Revision	0
Configuration revision status of the transmitting device.	
Data Obj Index	1
Position index of the data object within the GOOSE.	
Data Obj Type	Unknown
Structure of the data object; possible settings: ● *Unknown* ● *Boolean* (logical value) ● *Int8* (Integer, with 8 digits) ● *Int16* (Integer, with 16 digits) ● *Int32* (Integer, with 32 digits) ● *UInt8* (Positive integer, with 8 digits) ● *UInt16* (Positive integer, with 16 digits) ● *UInt32* (Positive integer, with 32 digits) ● *Float* (Floating-point number) ● *BStr2* (Binary state, with 2 digits) ● *SPS* (Single-pole signal) ● *DPS* (Two-pole signal)	
Quality Obj Index	1
Distance of the quality descriptor to the data object if not preset. The quality of the received information is to be tested if such has been configured.	

Destination Parameters

Parameter	Default Value
Evaluation Expression	Equal to
Criteria to check the received information content by comparing it with a set integer value; the parameter is not supported in the device. ● *Equal to* (Compared to: equal) ● *Not equal to* (Compared to: unequal) ● *Greater than* (Compared to: greater) ● *Less than* (Compared to: less) ● *Pass through* (Do not compare)	
Default Input Value	False
Default value for the information in case GOOSE receipt has failed. ● *False* – not set ● *True* – set ● *Last Known Value* – retain last value received ● *Double Point: intermediate (00)* – switching device in intermediate position ● *Double Point: Off (01)* – switching device open ● *Double Point: On (10)* – switching device closed ● *Double Point: Bad state (11)* – switching device in intermediate position	
Invalidity Quality bits	
Quality criterion, which is to be tested. ● *Invalid / Questionable*: Invalid / questionable ● *Source*: Information source is faulty ● *Relay test*: Sending device is set to test mode ● *OperatorBlocked*: Blocked by operator and ● *Overflow*: Measured value has exceeded its capacity ● *OutofRange*: Measured value has exceeded its range ● *BadReference*: Referenced value is faulty ● *Oscillatory*: Value is volatile ● *Failure*: Faulty ● *OldData*: Information is out-of-date ● *Inconsistent*: Information is unreliable ● *Inaccurate*: Information is inaccurate	

9.8 Report Control Blocks

9.8.1 System/LLN0

Report Parameters

Parameter	Default Value
Report Type	
Report type: ● *Unbuffered* (updating) ● *Buffered* (saving)	
Report ID	TEMPLATESystem/ LLN0$RP $urcbA, ..., TEMPLATESystem/ LLN0$RP $urcbP, ..., TEMPLATESystem/ LLN0$BR $brcbA, ..., TEMPLATESystem/ LLN0BRbrcbH
Report ID consisting of the Device Name and the Report Control Block.	
Dataset Reference	
Name of the dataset assigned to the report.	
Configuration Revision	1
Revision status of the configuration.	

9.9 Controls

9.9.1 Control Objects

Control Object Parameters

Parameter	Default Value
ctlModel	sbo-with-enhanced-security
To control external devices the following operating modes can be set: ● *Status only* (manually operated switching device) ● *Direct control with enhanced security* (direct command issue with extended monitoring of command effecting) ● *SBO (Select before operate) with enhanced security* (switching device selection procedure with extended monitoring of command effecting)	
sboTimeout	120000
Return time period after selection without issuing a command.	

9.9.2 Uniqueness of Control

Source Network Parameters

Parameter	Default Value
Multicast MAC Address	01-0C-CD-01-00-00
Virtual MAC address used as a receive filter; preset.	
Application ID (hex)	0
ID-number of the GOOSE.	

GOOSE Source Parameters

Parameter	Default Value
Source Path	
Information data attribute in the transmitting device.	
GOOSE Identifier	
ID of the GOOSE in the transmitting device.	
Dataset Reference	
Name of the dataset assigned to the GOOSE in the transmitting device.	
Configuration Revision	0
Configuration revision status of the transmitting device.	
Data Obj Index	1
Position index of the data object within the GOOSE.	
Default Input Value	True
Default value for the information in case GOOSE receipt has failed: ● *False* – not set ● *True* – set ● *Last Known Value* – retain last value received ● *Double Point: intermediate (00)* – switching device in intermediate position ● *Double Point: Off (01)* – switching device open ● *Double Point: On (10)* – switching device closed ● *Double Point: Bad state (11)* – switching device in intermediate position	

9.10 Measurements

Scaling

Parameter
Unit Multiplier
Multiplication factor; not supported.

Range configuration

Parameter
Scaled Measurement Range: Min
Scaled Measurement Range: Max
Lower / Upper measuring range limit value; not supported.

Deadband Configuration

Parameter	Default Value
Deadband	100
Multiplier for the smallest display value of the measured value. In order to have the current measured value sent when it has changed from the value last sent the result of the set dead band value multiplied by the smallest display value must exceed the smallest display value.	

9.11 Configurable Data Attributes

9.11.1 System/LLN0

Mod.measCyc

Parameter	Default Value
Value	5
Transmission of measured values: Time interval in seconds between two dead band evaluations.	

Mod.enCyc

Parameter	Default Value
Value	65535
Cyclic transmission of measured values without dead band check: Time interval in seconds between transmissions of two energy count values.	

Mod.comtrade

Parameter	Default Value
Value	BINARY
Transmission of COMTRADE fault files formatted either as ASCII or binary files.	

Mod.distExtr

Parameter	Default Value
Value	true
Cancelling fault transmission or including it in the configuration.	

10 Commissioning

10.1 Safety Instructions

DANGER

Only qualified personnel, familiar with the “Warning” page at the beginning of this manual, may work on or operate this device.

DANGER

When installing and connecting the device the warning notices at the beginning of Chapter “Installation and Connection” (Chapter 5, (p. 5-1)) must be observed.

DANGER

The device must be reliably grounded before auxiliary voltage is turned on.

The surface-mounted case is grounded using the bolt and nut, appropriately marked, as the ground connection. The flush-mounted case must be grounded in the area of the rear sidepieces at the location provided. The cross-section of the ground conductor must conform to applicable national standards. A minimum cross section of 2.5 mm² (US: AWG12 or thicker) is required.

In addition, a protective ground connection at the terminal contact on the power supply module (identified by the letters “PE” on the terminal connection diagram) is also required for proper operation of the device. The cross-section of this ground conductor must also conform to applicable national standards. A minimum cross section of 1.5 mm² (US: AWG14 or thicker) is required.

DANGER

Before working on the device itself or in the space where the device is connected, always disconnect the device from the supply.

DANGER

The secondary circuit of live system current transformers must not be opened! If the secondary circuit of a live CT is opened, there is the danger that the resulting voltages will endanger personnel and damage the insulation.

For pin-terminal connection devices, the terminal block for connection to the current transformers is not a shorting block. Therefore always short-circuit current transformers before loosening the threaded terminals.

DANGER

The power supply must be turned off for at least 5 s before power supply module V is removed. Otherwise there is the danger of an electric shock.

DANGER

When increased-safety machinery is located in a hazardous area the P139 must always be installed outside of this hazardous area.

WARNING

The fiber-optic interface may only be connected or disconnected when the supply voltage for the device is shut off.

WARNING

The PC interface is not designed for permanent connection. Consequently, the female connector does not have the extra insulation from circuits connected to the system that is required per VDE 0106 Part 101. Therefore, when connecting the prescribed connecting cable be careful not to touch the socket contacts.

WARNING

Application of analog signals to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see “Technical Data”, Chapter 2, (p. 2-1)).

⚠ WARNING

When using the programmable logic (function group LOGIC), the user must carry out a functional type test to conform to the requirements of the relevant protection/control application. In particular, it is necessary to verify that the requirements for the implementation of logic linking (by setting) as well as the time performance during device startup, during operation and when there is a fault (device blocking) are fulfilled.

10.2 Commissioning Tests

10.2.1 Preparation

After the P139 has been installed and connected as described in Chapter 5, (p. 5-1), the commissioning procedure can begin.

Before turning on the power supply voltage, the following items must be checked again:

- Is the device connected to the protective ground at the specified location?
- Does the nominal voltage of the battery agree with the nominal auxiliary voltage of the device?
- Are the current and voltage transformer connections, grounding, and phase sequences correct?

After the wiring work is completed, check the system to make sure it is properly isolated. The conditions given in VDE 0100 must be satisfied.

Once all checks have been made, the power supply voltage may be turned on. After voltage has been applied, the device starts up. During startup, various startup tests are carried out (see Section 3.13, (p. 3-128)). The LED indicators for HEALTHY (H1) and OUT OF SERVICE (H2) will light up. After approximately 15 s, the P139 is ready for operation. By default (factory setting) or after a cold restart, the device type “P139” and the time are displayed on the first line of the LCD after the device has started up. If a bay type has already been selected this bay will then be shown as a single-pole display.

Once the change enabling command has been issued (see Section 6.11.3, (p. 6-30)), all settings can be entered. The procedure for entering settings from the integrated local control panel is described in Section 6.11.4, (p. 6-33).

First the type of bay wanted is to be set at MAIN: Type of bay, Par/Conf menu branch. When the automatic assignment has been enabled at MAIN: Auto-assignment I/O then selecting the type of bay will automatically configure binary signal inputs and output relays according to the definitions corresponding to the bay type (see Vol. 2, Chapter A5, (p. A5-1)).

After pressing the ENTER key to confirm the setting parameter MAIN: Type of bay the signal Bay initialization is displayed on the LCD for a time duration of 20 s. The LED indicator labeled EDIT MODE will light up. A control action is not possible during this time period.

If either the PC interface or the communication interface will be used for setting the P139 and reading out event records, then the following settings must first be made from the integrated local control panel.

***Par/DvID* menu branch:**

- DVICE: Device password 1
- DVICE: Device password 2

Par/Conf **menu branch:**

- PC: Bay address
- PC: Device address
- PC: Baud rate
- PC: Parity bit
- COMM1: Function group COMM1
- COMM1: General enable USER
- COMM1: Name of manufacturer
- COMM1: Line idle state
- COMM1: Baud rate
- COMM1: Parity bit
- COMM1: Communicat. protocol
- COMM1: Octet comm. address
- COMM1: Octet address ASDU
- COMM2: Function group COMM2
- COMM2: General enable USER
- COMM2: Name of manufacturer
- COMM2: Line idle state
- COMM2: Baud rate
- COMM2: Parity bit
- COMM2: Octet comm. address
- COMM2: Octet address ASDU
- COMM3: Function group COMM3
- COMM3: General enable USER
- COMM3: Baud rate

Par/Func/Glob **menu branch:**

- PC: Command blocking
- PC: Sig./meas.val.block.
- COMM1: Command block. USER
- COMM1: Sig./meas.block.USER
- COMM2: Command block. USER
- COMM2: Sig./meas.block.USER

Instructions on these settings are given in Chapters “Settings” and “Information and Control Functions”.

The settings given above apply to the IEC 60870-5-103 communication protocol. If another protocol is being used for the communication interface, additional settings may be necessary. See Chapter “Settings” for further details.

After the settings have been made, the following checks should be carried out again before the blocking is cancelled:

- Is the correct bay type configured?
- Does the function assignment of the binary signal inputs agree with the terminal connection diagram?
- Has the correct operating mode been selected for the binary signal inputs?
- Does the function assignment of the output relays agree with the terminal connection diagram?
- Has the correct operating mode been selected for the output relays?
- Are the interlocking conditions and the external interlock inputs correctly configured?
- Have all settings been made correctly?

Now blocking can be cleared as follows (*Par/Func/Glob* menu branch):

- MAIN: Device on-line = *Yes (= on)*

10.2.2 Testing

When testing trip or close commands configured to standard outputs, the CB must not be mechanically locked, so that its auxiliary 52a/b contact could operate and break the DC current. If the CB has to stay locked, tripping or closing circuit has to be opened by terminal disconnection or test switch. Otherwise there is a high risk of damaging the P139 output contact.

By using the signals and displays generated by the P139, it is possible to determine whether the P139 is correctly set and properly interconnected with the station. Signals are signaled by output relays and LED indicators and entered into the event memory. In addition, the signals can be checked by selecting the appropriate signal in the menu tree.

If the user does not wish the circuit breaker to operate during protection testing, the trip commands can be blocked through MAIN: Trip cmd.block. USER (*Par/Func/Glob* menu branch) or an appropriately configured binary signal input. If circuit breaker testing is desired, it is possible to issue a trip command for 100 ms through MAIN: Man. trip cmd. USER (*Oper/CtrlTest* menu branch) or an appropriately configured binary signal input. Selection of the trip command from the integrated local control panel is password-protected (see Section 6.11.8, (p. 6-41)).

The manual trip command is not executed unless the manual trip is included in the selection of possible functions to effect a trip (in the configuration of trip commands).

If the P139 is connected at substation control level, the user is advised to activate the test mode via MAIN: Test mode USER (*Par/Func/Glob* menu branch) or an appropriately configured binary signal input. The telegrams are then identified accordingly (reason for transmission: test mode).

10.2.3 Checking the Binary Signal Inputs

By selecting the corresponding state signal (*Oper/Cycl/Phys* menu branch), it is possible to determine whether the input signal that is present is recognized correctly by the device. The values displayed have the following meanings:

- "*Low*": Not energized.
- "*High*": Energized.
- *Without function*: No functions are assigned to the binary signal input.

This display appears regardless of the binary signal input mode selected.

10.2.4 Checking the Output Relays

It is possible to trigger the output relays for a settable time period for test purposes (time setting at OUTP: Hold-time for test in *Oper/CtrlTest* menu branch). First select the output relay to be tested (OUTP: Relay assign. f.test, *Oper/CtrlTest* menu branch).

Test triggering then occurs via OUTP: Relay test (*Oper/CtrlTest* menu branch).

It is password-protected (see Section 6.11.8, (p. 6-41)).

⚠ WARNING

Before starting the test, open any triggering circuits for external devices so that no inadvertent switching operations will take place.

10.2.5 Checking the Current-Measuring Inputs

By injecting appropriate analog test values at the measuring inputs it is possible to check, by taking a readout from the operating data display (see Chapter 8, (p. 8-1)), whether the Time-Overcurrent Protection and Control Unit will detect such analog signals within the required class accuracy (*Oper/Cycl/Data* menu branch).

- MAIN: Current A p.u.: Display of the updated phase A current in reference to the nominal device current I_{nom}.
- MAIN: Current B p.u.: Display of the updated phase B current in reference to the nominal device current I_{nom}.
- MAIN: Current C p.u.: Display of the updated phase C current in reference to the nominal device current I_{nom}.
- MAIN: Current IN p.u.: Display of the updated residual current I_N in reference to the nominal device current I_{nom}.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see Chapter “Technical Data”).

10.2.6 Checking the Correct Phase Connection of Current and Voltage Transformers with Load Current

The user can check correct connection to the system’s current and voltage transformers by consulting the operating data displays for load angle (MAIN: Load angle phi A, MAIN: Load angle phi C in the *Oper/Cycl/Data* menu branch).

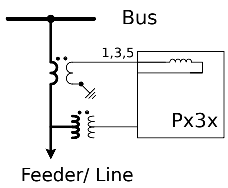
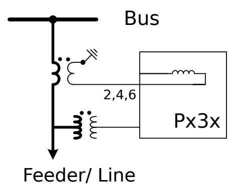
Based on the actual connection scheme of the current transformers (“standard” schematic connection diagram shown in Chapter “Installation and Connection”) and the device setting at MAIN: Conn. meas. circ. IP = *Standard* or *Opposite* (*Par/Func/Glob* menu branch) the “forward” direction of the protection functions is determined. Therefore the connection and the settings must be known for the direction control. This is of fundamental importance for all directional metering and protection functions of the device, and therefore should be done as one of the first steps in commissioning.

The table of possible combinations below lists the 4 possible combinations of CT connections and direction settings.

It is recommended to carry out the direction control with either primary injected currents and voltages, or under load flow conditions, to make sure that the actual CT and VT connections are implied.

The check itself shall be done by reading the measured load angles. Power measurement operating data can lead to misinterpretation, since the devices additionally provide inverted display of power metering values (setting MAIN: Meas. direction P,Q). The load angles are independent from such post-processing and indicate the actual phase angle between phase current (as reference) and phase-ground voltage. They are displayed for phase currents greater than 5% Inom.

For directional control it is sufficient to check the load angles at active power flow (which is predominantly present in power systems). If active power flow direction is correct, inherently also reactive power flow direction is correct, which is advantageous because only relatively small reactive power flows are in practice available. The expected load angles for active power flow usually is around ±0° (typically −10° ... 0° and 0° ... +10°) or ±180° (typically −170° ... −180° and +170° ... +180°). Even for balanced loads small differences between the three load angles may be present (typ. ±2°). Root cause of bigger differences of load angles should be clarified.

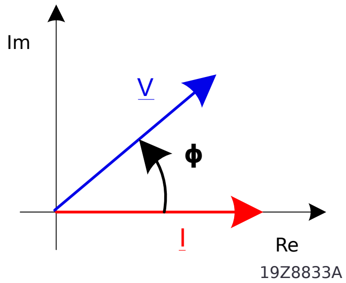
CT connection scheme:	**Standard** 		**Opposite** 	
Direction Definition: Forward = by user	**Feeder/Line**	**Bus**	**Feeder/Line**	**Bus**
required **Relay setting**: MAIN: Conn. meas. circ. IP =	Standard	Opposite	Opposite	Standard
Direction check: with active power flow from Feeder to Bus: Load angle phi[1]) =	±180°	±0°	±180°	±0°
from Bus to Feeder: Load angle phi[1]) =	±0°	±180°	±0°	±180°

1) Check all three load angles:

MAIN: Load angle phi A

MAIN: Load angle phi B

MAIN: Load angle phi C



Devices from the “Easergy MiCOM 30” family use the current phasor as reference for angle measurement. With positive reactive power the load angle is positive, too.

10.2.7 Checking the Correct Phase Connection of the Residual Current Transformer with Load Current

The user can check that the P139 connection to the system's residual current transformer involves the correct phase by consulting the operating data display at MAIN: Angle phi N (*Oper/Cycl/Data* menu branch). For this the required measured variables $V_{N\text{-}G}$ and I_N must be generated. When the connection *Standard* has been made according to the standard schematic connection diagram shown in Chapter "Installation and Connection" and the parameter at MAIN: Conn. meas. circ. IN (*Par/Func/Glob* menu branch) is set to *Standard*, then one phase-to-ground voltage must be opened and the phase currents of the other two phases must be shorted at the same time (see Fig. 10-1, (p. 10-11)).

The selected phase sequence (alternative terminology: Rotary field) must match the actual phase sequence. If there is only an ohmic (resistive) load then angle ϕ_N must take on the following values (depending whether the energy flow is towards the line or towards the busbar):

Display	Energy flow towards the line	Energy flow towards the busbar
MAIN: Angle phi N (*Oper/Cycl/Data* menu branch)	Approx. 0°	Approx. 180°

10.2.8 Simple Check of the Correct Phase Connection of the Residual Current Transformer with Load Current

In case no system current transformer (e.g. a core balance CT) is available to supply a residual current value then a simple check may be carried out. After a positive check of the correct phase connection of current and voltage transformers and after one of the phase currents has been short-circuited, a phase comparison of the measured residual current value with the total value of all phase currents is carried out. In the event of phase congruence or a positive directional check, the operating panel MAIN: Phase rel.,IN vs ΣIP (*Oper/Cycl/Data* menu branch) will display the value "1". A check of the phase relation will only be carried out if the calculated residual current exceeds the value $0.1 \cdot I_{nom}$.

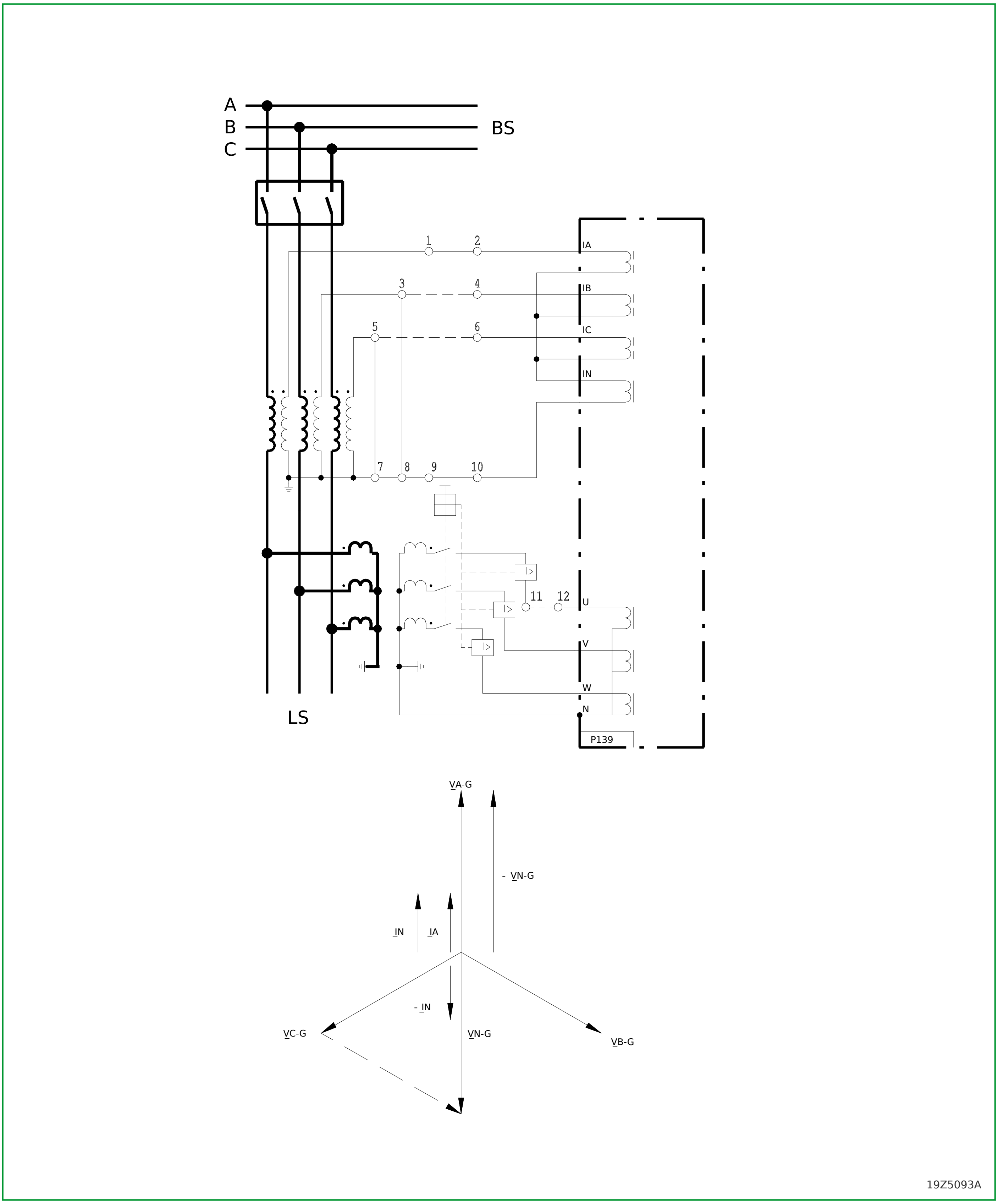


Fig. 10-1: Connection example to generate measured variables.

10.2.9 Checking the Protection Function

Four parameter subsets are stored in the P139, one of which is activated. Before checking the protective function, the user should determine which parameter subset is activated. The active parameter subset is displayed at PSS: Actual param. subset (*Oper/Cycl/Log* menu branch).

When checking the time-overcurrent protection function with a testing device the measuring-circuit monitoring function must be disabled at (MCMON: General enable USER, *Par/Func/Gen* menu branch), as this protection will always be triggered – depending on the setting – and error messages will be issued.

10.2.9.1 Checking the Definite-Time Overcurrent Protection Function

A test of the definite-time overcurrent protection can only be carried out when the following conditions are met:

- The DTOC function is activated. This can be determined by checking logic state signal DTOC: Enabled (*Oper/Cycl/Log* menu branch).
- The function at MAIN: Bl.tim.st.IN,neg PSx must be set to *Without* (*Par/Func/PSx* menu branch).
- The function at MAIN: Gen. start. mode PSx is to be set to *With start. IN, Ineg* (*Par/Func/PSx* menu branch).
- SCDD: General enable USER is to be set to *No* (*Par/Func/Gen* menu branch).

By injecting appropriate analog test values at the current measuring inputs it is possible to check the overcurrent stages and their associated timer stages.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see Chapter “Technical Data”).

10.2.9.2 Checking the Inverse-Time Overcurrent Protection Function

A test of the inverse-time overcurrent protection can only be carried out when the following conditions are met:

- The IDMT function is activated. This can be determined by checking logic state signal IDMT1: Enabled or IDMT2: Enabled (*Oper/Cycl/Log* menu branch).
- The function at MAIN: Bl.tim.st.IN,neg PSx must be set to *Without* (*Par/Func/PSx* menu branch).
- The function at MAIN: Gen. start. mode PSx is to be set to *With start. IN, Ineg* (*Par/Func/PSx* menu branch).
- The short-circuit direction determination function must be disabled. SCDD: General enable USER is to be set to *No* (*Par/Func/Gen* menu branch).

By injecting appropriate analog test values at the current measuring inputs it is possible to check the overcurrent stages and their associated timer stages.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see “Technical Data”, Chapter 2, (p. 2-1)).

Tripping times issued by the inverse-time maximum current protection, and dependent on the tripping characteristic selected, are given in the table in section “Inverse-time Overcurrent Protection” (Section 3.23.2, (p. 3-179)).

10.2.9.3 Checking the Short-Circuit Direction Determination: Direction of the Phase Current Stages

A system's current and voltage transformers must be simulated by an appropriate testing device. A test of the phase current stages, used with short-circuit direction determination, can only be carried out when the following conditions are met:

- The short-circuit direction determination function must be activated (see Chapter "Operation").
- All phase currents exceed $0.1 \cdot I_{nom}$.
- At least two phase-to-phase voltages exceed 200 mV.
- The directions for short-circuit direction determination are set to *Forward directional*.

When the connection *Standard* has been made according to the standard schematic connection diagram shown in Chapter "Installation and Connection" and the parameter at MAIN: Conn. meas. circ. IP is also set to *Standard*, then measurement of the short-circuit direction determination is towards the line. The selected phase sequence (alternative terminology: Rotary field) must match the actual phase sequence. Now the various fault types may simulated with the appropriate starting by the DTOC and IDMT protection by connecting different short-circuit wiring (e.g. Phase A to N). Trip signals issued by the phase current stages are now directional.

10.2.9.4 Short-Circuit Direction Determination: Checking the Direction of the Residual Current Stages

A test of the residual current stages, used with short-circuit direction determination, can only be carried out when the following conditions are met:

- The short-circuit direction determination function must be activated (see Chapter "Operation").
- The residual current calculated must exceed $0.01 \cdot I_{nom}$.
- The neutral-point displacement voltage must exceed the trigger value set at SCDD: VNG> PSx.

When the connection *Standard* has been made according to the standard schematic connection diagram shown in Chapter "Installation and Connection" and the parameter at MAIN: Conn. meas. circ. IP is also set to *Standard*, then measurement of the short-circuit direction determination is towards the line. The selected phase sequence (alternative terminology: Rotary field) must match the actual phase sequence. Now the various fault types may simulated as described above in the paragraph "Checking direction of the phase current stages" (Section 10.2.9.3, (p. 10-14)). Trip signals issued by the residual current stages are now directional.

10.2.9.5 Checking Protective Signaling

The protective signaling function can only be tested if protective signaling is ready. This can be determined by checking logic state signal PSIG: Ready (*Oper/Cycl/Log* menu branch).

If protective signaling is not ready, this may be due to the following reasons:

- Protective signaling is not enabled.

  PSIG: General enable USER is set to *No*.
- Protective signaling is being blocked by triggering a correspondingly configured binary signal input (PSIG: Blocking EXT).
- A fault in the data transmission channel was detected (PSIG: Telecom. faulty).

If conditions for a test are met it is possible to generate, for testing purposes, a “test send” signal from the integrated local control panel (PSIG: Test telecom. USER) This pulse will be present for 1 s and is extended for the set reset time. The generated “test send” signal may be checked at the logic state signal PSIG: Send (transm.relay).

10.2.9.6 Checking the Auto-Reclosing Function

The auto-reclosing function (ARC) can only be checked if it is ready. This may be determined by checking logic state signal ARC: Ready (*Oper/Cycl/Log*).

If the ARC function is not ready, this may be due to the following reasons:

- The ARC function is not enabled

  (check at ARC: Enabled (*Oper/Cycl/Log* menu branch). This may be due to the following reasons:
  - ARC: General enable USER (*Par/Func/Gen* menu branch) has been set to *No*.
  - ARC was disabled from an appropriately configured binary signal input (check at the logic state signal ARC: Ext./user enabled (*Oper/Cycl/Log* menu branch).
- ARC is blocked (check at the logic state signal ARC: Blocked, *Oper/Cycl/Log* menu branch).
- There is no signal with a logic value of “1” at the binary signal input configured for ARC: CB drive ready EXT.
- There is no signal with a logic value of “1” at the binary signal input configured for MAIN: CB closed 3p EXT. The circuit breaker position signal is only necessary if the setting at ARC: CB clos.pos.sig. PSx is *With*.
- An ARC cycle is in progress. (This can be determined by checking logic state signal ARC: Cycle running in the *Oper/Cycl/Log* menu branch.)

A test HSR can be executed for testing purposes from the integrated local control panel or by triggering a binary signal input. The test HSR function first issues a trip command and then issues a reclose command after the set dead time has elapsed.

10.2.9.7 Checking the Motor Protection Function

By injecting appropriate analog test values it is possible to check the overcurrent stage and the associated time delay.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see chapter “Technical Data”).

Before the motor protection can be tested the thermal replica must always be cleared. Clearing the thermal replica is done by short term disabling of the protection by setting MAIN: Device on-line to *No (= off)* (*Par/Func/Glob* menu branch). The actual status of the thermal replica may be read out from the operating data display at MP: Therm.repl.buffer MP (*Oper/Cycl/Data* menu branch). Because the characteristic curve is settable, there can be different tripping times:

With the thermal replica cleared an applied test current is abruptly changed from 0 (= machine stopped) to a value ≥ to the setting of MP: tIStUp> PSx, in the *Par/Func/PSx* menu branch (= machine starting up):

$$t = t_{6I_{\mathrm{ref}}} \cdot \frac{36}{(I / I_{\mathrm{ref}})^2}$$

(reciprocally squared characteristic curve)

$$t = t_{6I_{\mathrm{ref}}} \cdot 36 \cdot \ln \frac{(I / I_{\mathrm{ref}})^2}{(I / I_{\mathrm{ref}})^2 - 1}$$

(logarithmic characteristic curve)

10.2.9.8 Checking the Thermal Overload Protection Function

By injecting appropriate analog test values it is possible to check the reference current setting and the associated time delay.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see Chapter “Technical Data”).

Before the thermal overload protection can be tested the thermal replica must always be cleared. Clearing the thermal replica is done by short term disabling of the protection by setting MAIN: Device on-line to *No (= off)* (*Par/Func/Glob* menu branch). The actual status of the thermal replica may be read out from the operating data display at THERM: Status THERM replica (*Oper/Cycl/Data* menu branch). The tripping time may be checked:

With the thermal replica cleared an applied test current is abruptly changed from 0 to the value ≥ $0.1 \cdot I_{\mathrm{ref}}$

$$t = \tau \cdot \ln \frac{(\frac{I}{I_{ref}})^2 - \Delta\vartheta_0}{(\frac{I}{I_{ref}})^2 - \Delta\vartheta_{trip} \cdot (1 - \frac{\Theta_a - \Theta_{a,max}}{\Theta_{max} - \Theta_{a,max}})}$$

10.2.9.9 Checking the Time-Voltage Protection Function

By injecting appropriate analog test values at the measuring inputs it is possible to check, by taking a readout from the operating data display (see “Information and Control Functions”), whether the device will detect such analog signals within the required class accuracy (*Oper/Cycl/Data* menu branch).

- MAIN: Voltage A-G p.u.: Display of the updated value for phase A to ground voltage referred to V_{nom}.
- MAIN: Voltage B-G p.u.: Display of the updated value for phase B to ground voltage referred to V_{nom}.
- MAIN: Voltage C-G p.u.: Display of the updated value for phase C to ground voltage referred to V_{nom}.
- MAIN: Voltage VPG,max p.u.: Display of the updated value for max phase to ground voltage referred to V_{nom}.
- MAIN: Voltage VPG,min p.u.: Display of the updated value for min phase to ground voltage referred to V_{nom}.
- MAIN: Voltage A-B p.u.: Display of the updated value for phase A to phase B voltage referred to V_{nom}.
- MAIN: Voltage B-C p.u.: Display of the updated value for phase B to phase C voltage referred to V_{nom}.
- MAIN: Voltage C-A p.u.: Display of the updated value for phase C to phase A voltage referred to V_{nom}.
- MAIN: Voltage VPP,max p.u.: Display of the updated value for max phase to phase voltage referred to V_{nom}.
- MAIN: Voltage VPP,min p.u.: Display of the updated value for min phase to phase voltage referred to V_{nom}.
- MAIN: Voltage VNG p.u.: Display of the updated value for min phase to phase voltage referred to V_{nom}.
- MAIN: Volt. Σ(VPG)/√3 p.u.: Display of the calculated neutral-point displacement voltage referred to V_{nom}.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see Chapter “Technical Data”).

By injecting appropriate analog test values at the voltage measuring inputs it is possible to check the overvoltage and undervoltage stages as well as their associated timer stages.

The P139 calculates the neutral-point displacement voltage from the analog test values at the voltage measuring inputs according to below formula:

$$|\underline{V}_{N-G}| = \frac{1}{3} \cdot |\underline{V}_{A-G} + \underline{V}_{B-G} + \underline{V}_{C-G}|$$

In the case of a single-phase test setup using $|\underline{V}_{B\text{–}G}| = |\underline{V}_{C\text{–}G}| = 0$, the result of the calculation formula for $\underline{V}_{N\text{–}G}$ given above is that the triggers $V_{NG>}$ and $V_{NG>>}$ operate when the test voltage exceeds the following value:

$$|\underline{V}_{test}| = 3 \cdot V_{NG} \cdot \frac{V_{nom}}{\sqrt{3}}$$

In this formula V_{NG} is the setting V<>: VNG> PSx or V<>: VNG>> PSx.

⚠ WARNING

Application of analog test values to the measuring inputs must be in compliance with the maximum permissible rating of the measuring inputs (see chapter "Technical Data").

10.2.9.10 Checking the Steady-State-Power Ground Fault Direction Detection

If values for both residual current and neutral-point displacement voltage are available as measuring quantities the P139, when set to operating mode *Steady-state power* or *Steady-state admitt.*, will determine the direction of a ground fault by steady-state power evaluation of the measuring values. Depending on the setting either the value calculated by the P139 or the value measured at the transformer T 90 will be evaluated as the neutral-point displacement voltage. If current values only can be measured the P139 will decide on "ground fault" (*Steady-state current* evaluation) because of the residual current value level. Switching to *Steady-state current* evaluation is made via the integrated local control panel or by triggering an appropriately configured binary signal input.

Should the system permit such operation a ground fault on the busbar side (BS) or on the line side (LS) may be simulated by wiring a short circuit. Then the P139 must issue the respective signal. With the operating mode for ground faults set to *Steady-state power* it is assumed that threshold values for residual current (set at GFDSS: IN,act>/reac> BS PSx and GFDSS: IN,act>/reac> LS PSx) and the neutral-point displacement voltage with *Steady-state current* evaluation (set at GFDSS: VNG> PSx) or GFDSS: IN> PSx are exceeded. With the operating mode set to *Steady-state current* the set threshold values for conductance / susceptance (set at GFDSS: G(N)> / B(N)> LS PSx and GFDSS: G(N)> / B(N)> BS PSx) and the neutral-point displacement voltage (GFDSS: VNG> PSx) or the admittance (GFDSS: Y(N)> PSx must be exceeded.

A ground fault functional test by wiring a short circuit is, in most cases, not possible as there is the danger of a double ground fault occurring. As an alternative it is possible to wire the system's CTs and VTs such that a functional test is possible without causing a ground fault.

The residual current and the neutral-point displacement voltage measured by the P139 are displayed as measured operating values in primary quantities referred to the nominal quantities of the Protection & Control device (see "Measured Operating Data" in Section 3.11, (p. 3-79)).

10.2.9.11 Ancillary Circuit for Systems with Ground Fault Compensation

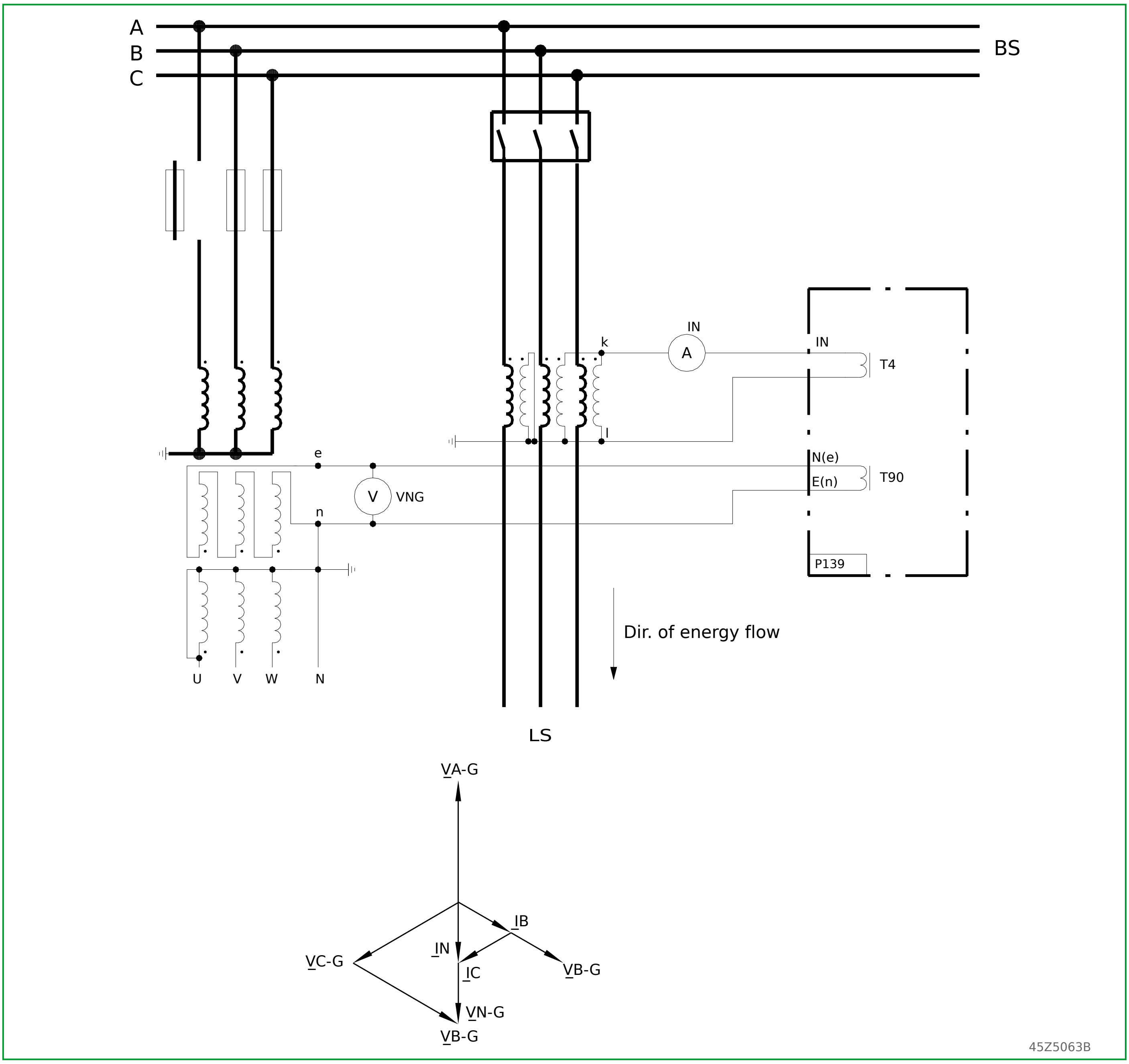


Fig. 10-2: Ancillary circuit for systems with ground fault compensation and Holmgreen group, ground fault towards BS.

First the fuse in the phase A line to the voltage transformer is removed and the associated secondary VT line is short circuited (see Fig. 10-2, (p. 10-19) and Fig. 10-3, (p. 10-20)). This will produce a neutral-point displacement voltage $\underline{V}_{N\text{-}G}$ with an amplitude which is smaller by the factor $\sqrt{3}$ than with a saturated ground fault.

If current is measured at a Holmgreen group the secondary side of the phase A line current transformer must be disconnected and shorted (see Fig. 10-2, (p. 10-19)).

A test-wire is inserted through the core balance current transformer to obtain a current flow from the phase B line (see Fig. 10-3, (p. 10-20)). The ancillary circuit figures include vector diagrams displaying the position of current and voltage vectors.

A simulated ground fault on the busbar is displayed in the example. The current connections or the voltage connections must be exchanged to test a ground fault on the line side.

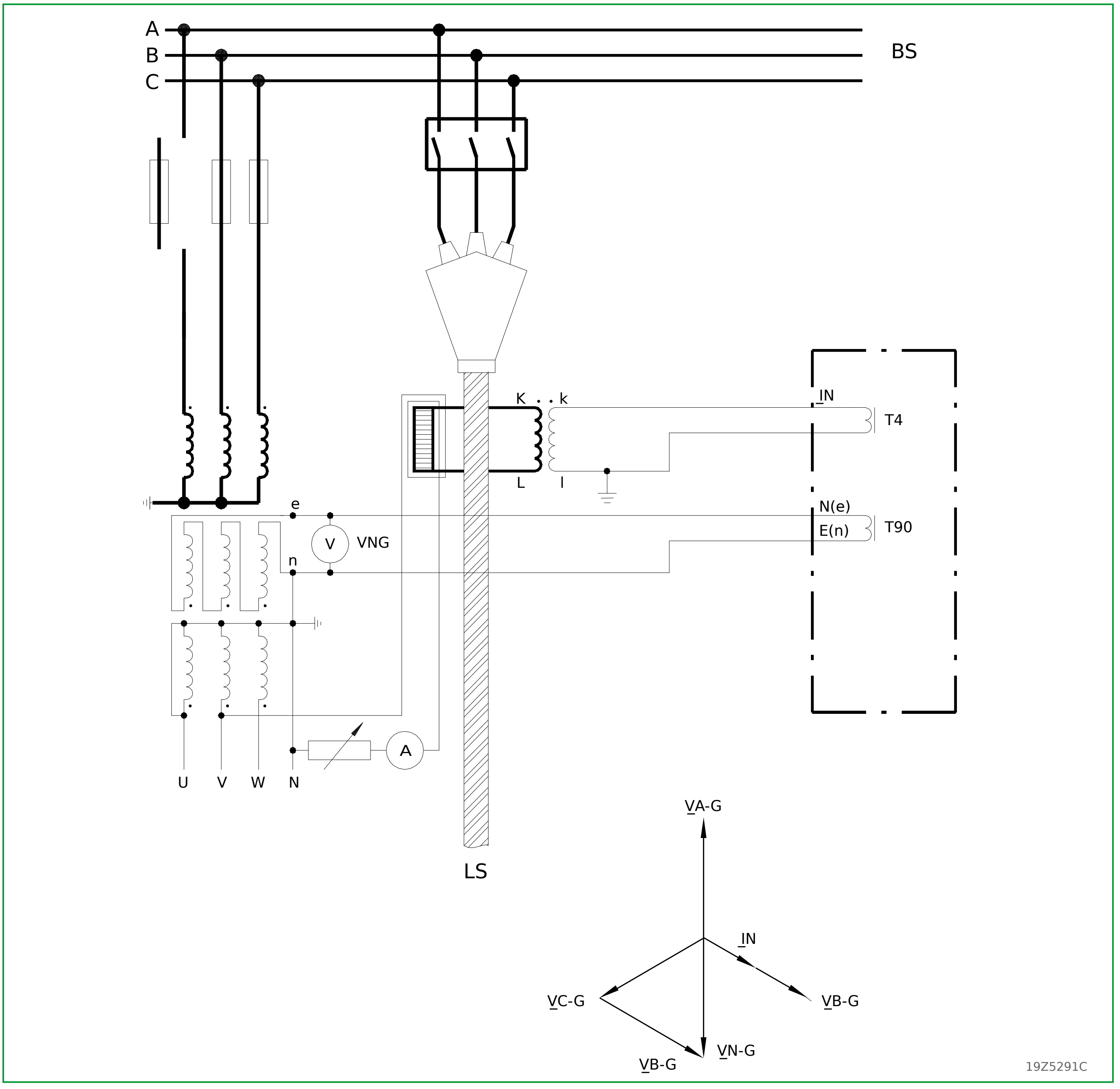


Fig. 10-3: Ancillary circuit for systems with ground fault compensation and core balance current transformer, ground fault towards BS.

10.2.9.12 Ancillary Circuit for Isolated Neutral-Point Systems

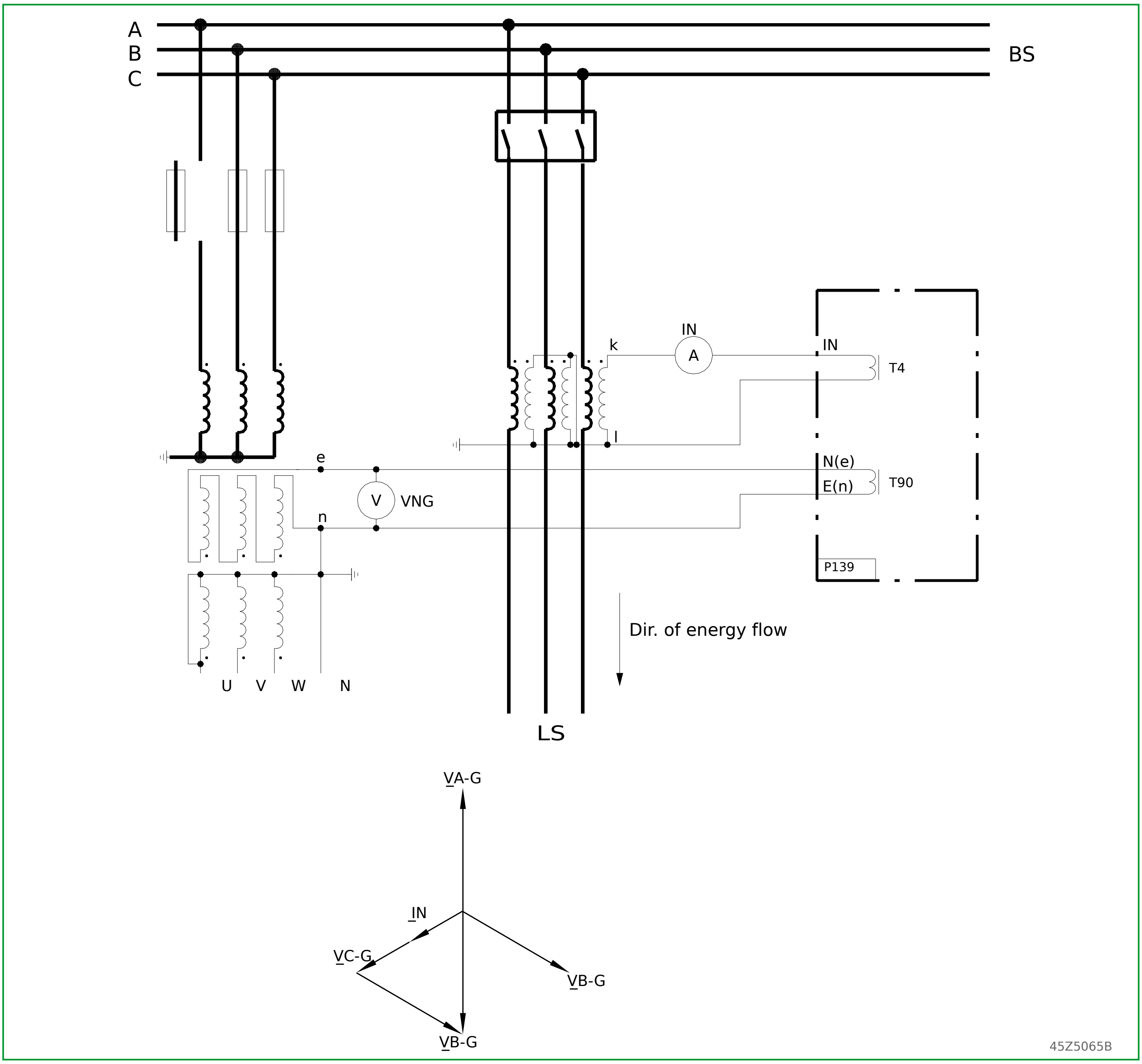


Fig. 10-4: Ancillary circuit for isolated neutral-point systems and Holmgreen group, ground fault towards LS.

First the fuse in the phase A line to the voltage transformer's primary side is removed and the associated secondary VT line is short circuited (see Fig. 10-4, (p. 10-21) and Fig. 10-5, (p. 10-22)). This will produce a neutral-point displacement voltage $\underline{V}_{N\text{-}G}$ with an amplitude which is smaller by the factor $\sqrt{3}$ than with a saturated ground fault.

If current is measured at a Holmgreen group the secondary side of the phase A and B line current transformers must be disconnected and shorted (see Fig. 10-4, (p. 10-21)).

A test-wire is inserted through the core balance current transformer to obtain current flow from the phase B and C lines (see Fig. 10-5, (p. 10-22)). The ancillary circuit figures include vector diagrams displaying the position of current and voltage vectors.

A simulated ground fault on the line side is displayed in the example. The current connections or the voltage connections must be exchanged to test a ground fault on the busbar side.

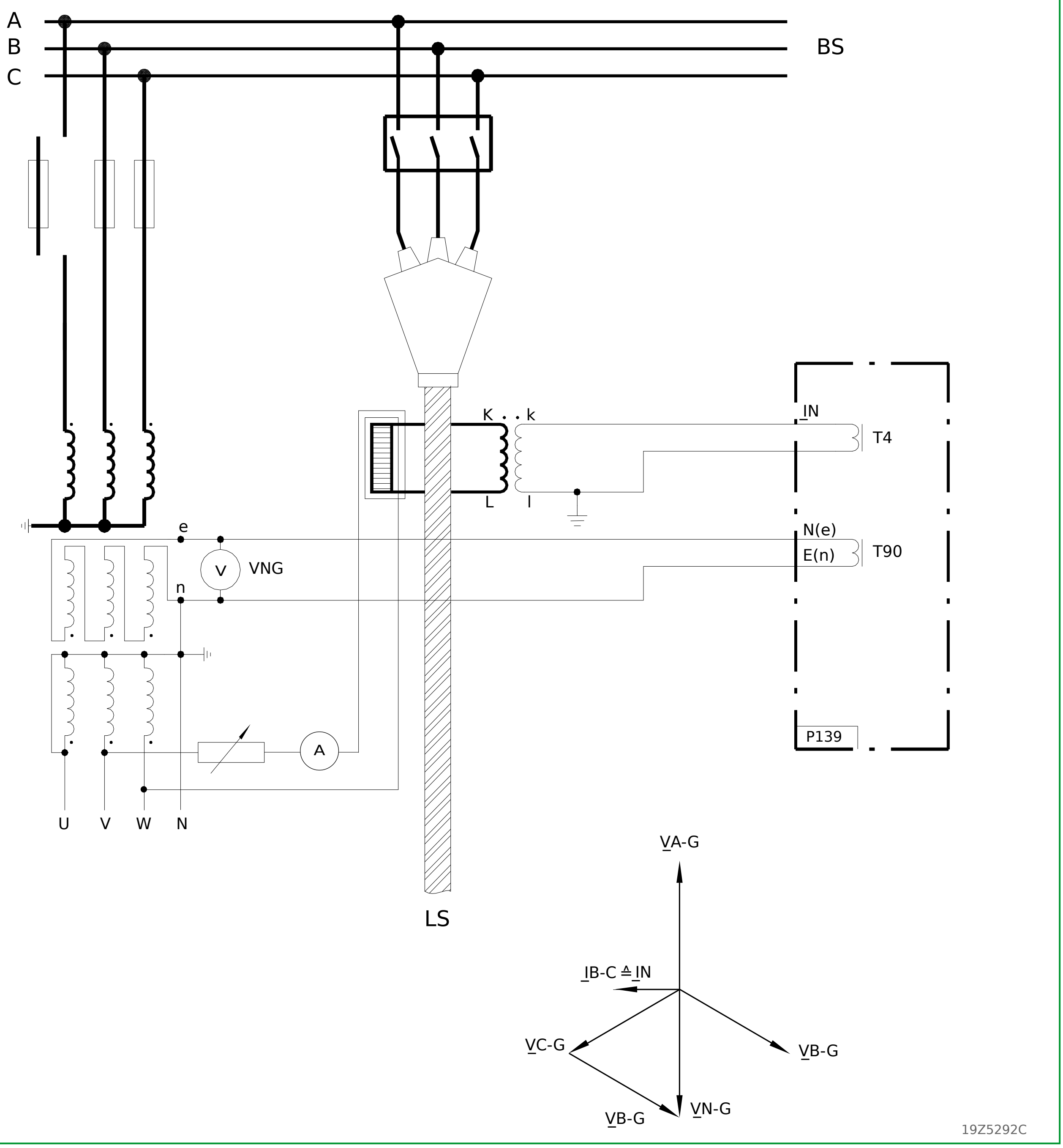


Fig. 10-5: Ancillary circuit for isolated neutral-point systems and core balance current transformers, ground fault towards LS.

10.2.9.13 Checking the Transient Ground Fault Direction Determination

A secondary check of the transient ground fault direction determination is only possible by applying a testing device which is capable of simulating the transient pulse with sufficient accuracy. Otherwise it is possible that the transient ground fault direction determination will not operate as the logic has been designed specifically to detect such transient pulses.

10.2.10 Checking Control Functions

The selected bay type is displayed on the Bay Panel. The selection of the Bay Panel is described in the Chapter 6. The current switching state of the switchgear units is displayed on the Bay Panel if state signals from such switching devices are connected properly to binary signal inputs on the P139. Should the switching state not be displayed correctly then it can be determined by checking the physical state of binary signal inputs whether the state signals are presented correctly to the P139 (check at parameter INP: State U xxx, **Oper/Cycl/Phys** menu branch).

10.2.10.1 Local/Remote Selection

Controlling switchgear units may be carried out from keys on the local control panel, remotely via the communication interface or through appropriately configured binary signal inputs. The control site – *Local* or *Remote* – is selected by the L/R key on the local control panel or by an appropriately configured binary signal input. The L/R key has no effect when a binary signal input has been configured. Using the L/R key on the local control panel to switch from “*Remote*” to “*Local*” is only possible after the “Password L/R” was entered (see Chapter “Local Control Panel” for further information). The Bay Panel display will show which control site has been selected.

10.2.10.2 Local Control

The switchgear unit to be controlled is selected by pressing the selection key on the local control panel, and pressing the “Open” or “Close” key will generate a switching request. When control is carried out with binary signal inputs the respective binary signal input is to be triggered.

10.2.10.3 Remote Control

Remote control of switchgear units may be carried out via the communication interface or with appropriately configured binary signal inputs.

10.2.10.4 Switchgear Unit Cannot Be Controlled

Should a switchgear unit refuse to be controlled, then this may be due to the following reasons:

- General enable for switch commands has not been set.

  (Configuration at MAIN: Inp.asg. ctrl.enabl., *Par/Func/Glob* menu branch)
- Interlocking has operated.

  (Check at MAIN: Interlock equ. viol., *Oper/Cycl/Log* menu branch).
- Only with bays for direct motor control:

  The motor protection has operated.

  (Check at parameter MAIN: Mon. mot. drives tr., *Oper/Cycl/Log* menu branch)

Which interlock(s) is(are) activated may be checked at:

- Bay interlock (BI): MAIN: Bay interlock. act., *Oper/Cycl/Log* menu branch
- Substation interlock (SI): MAIN: Subst. interl. act., *Oper/Cycl/Log* menu branch
- With control set to *“Local”*:

  It is possible to deactivate the interlock through an appropriately configured binary signal input.

  (Configuration at MAIN: Inp.asg.interl.deact, *Par/Func/Glob* menu branch)

A substation interlock is only effective when a communication link exists from the communication interface to the substation control level. If the communication link is disrupted then the device switches automatically to bay interlock (BI) without substation interlock (SI). Whether or not a communication error is present can be checked at MAIN: Communication error (Oper/Cycl/Log menu branch).

The substation interlock (SI) can be deactivated selectively for any switchgear unit and in any control direction – “Open” or “Close”. (Check – e.g. for DEV01 – at DEV01: Open w/o stat.interl or DEV01: Close w/o stat. int. (Par/Func/Cont menu branch).

10.2.11 Completing Commissioning

Before the P139 is released for operation, the user should make sure that the following steps have been taken:

- (Reset at MAIN: General reset USER (password-protected) and MT_RC: Reset record. USER, both in *Oper/CtrlTest* menu branch.)
- Blocking of output relays has been cancelled.

  (OUTP: Outp.rel.block USER, *Par/Func/Glob* menu branch, setting *No*.)
- Blocking of the trip command has been cancelled.

  (MAIN: Trip cmd.block. USER, *Par/Func/Glob* menu branch, setting *No*.)
- The device is on-line.

  (MAIN: Device on-line, *Par/Func/Glob* menu branch, setting *Yes (= on)*.)
- The residual current stages are enabled (on).

  MAIN: Syst.IN enabled USER, *Par/Func/Gen* menu branch, setting *Yes*)
- Measuring-circuit monitoring is enabled – if it was previously cancelled for testing purposes.

  (MCMON: General enable USER, *Par/Func/Gen* menu branch, setting *Yes*)
- The correct control point – *Local* or *Remote* – has been activated.
- The required interlock equations have been activated.

After completion of commissioning, only the green LED indicator signaling “HEALTHY” (H1) should be on.

11 Troubleshooting

This chapter describes problems that might be encountered, their causes, and possible methods for eliminating them. It is intended as a general orientation only, and in cases of doubt it is better to return the P139 to the manufacturer. Please follow the packaging instructions in Section 5.1, (p. 5-4) when returning equipment to the manufacturer.

> **⚠ WARNING**
>
> Only qualified personnel, familiar with the “Warning” page at the beginning of this manual, may work on or operate this device.

> **⚠ WARNING**
>
> Before checking further, disconnect the P139 from the power supply.

The following instructions apply to surface-mounted cases:

> **⚠ WARNING**
>
> The local control panel is connected to processor module P by a plug-in connecting cable. Remember the connector position! Do not bend the connecting cable.

Problem

- Lines of text are not displayed on the local control panel.
  - Check to see whether there is supply voltage at the device connection points.
  - Check to see whether the magnitude of the auxiliary voltage is correct. The P139 is protected against damage resulting from polarity reversal.
- The P139 issues an “Alarm” signal on LED H 3.
  - Identify the specific problem by reading out the monitoring signal memory (see Section 6.11.6.2, (p. 6-38)). The table below lists possible monitoring or warning indication (provided that a configuration setting has been entered at SFMON: Fct. assign. warning), the faulty area, the P139's response, and the mode of the output relay configured for “Warning” and “Blocked/faulty”.

Key

- **–**: No reaction and/or no output relay triggered.
- **Yes**: The corresponding output relay is triggered.
- **Updating**: The output relay configured for 'Warning' starts only if the monitoring signal is still present.

Self-monitoring

Parameter				Address
SFMON: Fct. assign. warning				021 030
SFMON: Mon.sig. retention				021 018

Self-monitoring

Parameter				Address
SFMON: CB faulty EXT				098 072
The external input **CBF: CB faulty EXT** has become active. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Warning (LED)				036 070
Warning configured for LED H3.				
SFMON: Warning (relay)				036 100
Warning configured for an output relay.				
SFMON: Warm restart exec.				041 202
A warm restart has been carried out.				
SFMON: Cold restart exec.				041 201
A cold restart has been carried out.				
SFMON: Cold restart				093 024
A cold restart has been carried out on account of a checksum error in the memory (NOVRAM). 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Cold rest./SW update				093 025
A cold restart has been carried out following a software update. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Blocking/ HW failure				090 019
Supplementary warning that this device is blocked. “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: Relay Kxx faulty				041 200
Multiple signal: output relay defective. Device reaction: – 'Warning' output relay: Updating 'Blocked/faulty' output relay: Yes				

Parameter				Address
SFMON: Hardware clock fail.				093 040
The hardware clock has failed. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Battery failure				090 010
Battery voltage too low. Replace battery. Device reaction: – “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: Invalid SW d.loaded				096 121
Wrong or invalid software has been downloaded. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Invalid type of bay				096 122
If the user has selected a bay type that requires a P139 hardware configuration that is not actually fitted, then this signal is generated. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: +15V supply faulty				093 081
The +15 V internal supply voltage has dropped below a minimum value. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: +24V supply faulty				093 082
The +24 V internal supply voltage has dropped below a minimum value. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				

Parameter				Address
SFMON: -15V supply faulty				093 080
The −15 V internal supply voltage has dropped below a minimum value. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Wrong module slot 1				096 100
SFMON: Wrong module slot 2				096 101
SFMON: Wrong module slot 3				096 102
SFMON: Wrong module slot 4				096 103
SFMON: Wrong module slot 5				096 104
SFMON: Wrong module slot 6				096 105
SFMON: Wrong module slot 7				096 106
SFMON: Wrong module slot 8				096 107
SFMON: Wrong module slot 9				096 108
SFMON: Wrong module slot 10				096 109
SFMON: Wrong module slot 11				096 110
SFMON: Wrong module slot 12				096 111
SFMON: Wrong module slot 13				096 112
SFMON: Wrong module slot 14				096 113
SFMON: Wrong module slot 15				096 114
SFMON: Wrong module slot 16				096 115
SFMON: Wrong module slot 17				096 116
SFMON: Wrong module slot 18				096 117
SFMON: Wrong module slot 19				096 118
SFMON: Wrong module slot 20				096 119
SFMON: Wrong module slot 21				096 120
Module in wrong slot. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				

Parameter				Address
SFMON: Wrong module Dig.Bus				096 123
The device has been fitted with a wrong digital bus. Since this is checked using the module variant number this signal can also occur after a firmware upgrade to a version that is not compatible with the hardware. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Wrong module HMI				096 124
The device has been fitted with a wrong HMI. Since this is checked using the module variant number this signal can also occur after a firmware upgrade to a version that is not compatible with the hardware. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Wrong module Comm				096 125
The device has been fitted with a wrong communication module. Since this is checked using the module variant number this signal can also occur after a firmware upgrade to a version that is not compatible with the hardware. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Wrong module Ana.Bus				096 126
The device has been fitted with a wrong analog bus. Since this is checked using the module variant number this signal can also occur after a firmware upgrade to a version that is not compatible with the hardware. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Defect.module slot 1				097 000
SFMON: Defect.module slot 2				097 001
SFMON: Defect.module slot 3				097 002
SFMON: Defect.module slot 4				097 003
SFMON: Defect.module slot 5				097 004
SFMON: Defect.module slot 6				097 005
SFMON: Defect.module slot 7				097 006
SFMON: Defect.module slot 8				097 007
SFMON: Defect.module slot 9				097 008

Parameter				Address
SFMON: Defect.module slot10				097 009
SFMON: Defect.module slot11				097 010
SFMON: Defect.module slot12				097 011
SFMON: Defect.module slot13				097 012
SFMON: Defect.module slot14				097 013
SFMON: Defect.module slot15				097 014
SFMON: Defect.module slot16				097 015
SFMON: Defect.module slot17				097 016
SFMON: Defect.module slot18				097 017
SFMON: Defect.module slot19				097 018
SFMON: Defect.module slot20				097 019
SFMON: Defect.module slot21				097 020
Defective module in slot x. Device reaction: – “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: +15V faulty mod. N				093 096
The +15 V internal supply voltage of the transient ground fault evaluation module has dropped below a minimum value. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: -15V faulty mod. N				093 097
The −15 V internal supply voltage of the transient ground fault evaluation module has dropped below a minimum value. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: DAC faulty module N				093 095
The digital-to-analog converter of the transient ground fault evaluation module is defective. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: Module N DPR faulty				093 090
The checksum feature of the transient ground fault evaluation module has detected a fault in the data transmission of the Dual-Port-RAM. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Module N RAM faulty				093 091
Fault in the program or data memory of the transient ground fault evaluation module. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Module Y DPR faulty				093 110
The checksum feature of analog I/O module Y has detected a fault in the data transmission of the Dual-Port-RAM. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Module Y RAM faulty				093 111
Fault in the program or data memory of the analog I/O module. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Mod.Y RTD DPR faulty				093 108
The checksum feature of analog module (RTD) has detected a fault in the data transmission of the Dual-Port-RAM. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Mod.Y RTD RAM faulty				093 109
Fault in the program or data memory of the analog module (RTD). Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Error K 707				097 084
SFMON: Error K 708				097 085
SFMON: Error K 301				097 021
SFMON: Error K 302				097 022
SFMON: Error K 601				097 070

Parameter				Address
SFMON: Error K 602				097 071
SFMON: Error K 603				097 072
SFMON: Error K 604				097 073
SFMON: Error K 605				097 074
SFMON: Error K 606				097 075
SFMON: Error K 607				097 076
SFMON: Error K 608				097 077
SFMON: Error K 701				097 078
SFMON: Error K 702				097 079
SFMON: Error K 703				097 080
SFMON: Error K 704				097 081
SFMON: Error K 705				097 082
SFMON: Error K 706				097 083
SFMON: Error K 801				097 086
SFMON: Error K 802				097 087
SFMON: Error K 803				097 088
SFMON: Error K 804				097 089
SFMON: Error K 805				097 090
SFMON: Error K 806				097 091
SFMON: Error K 807				097 092
SFMON: Error K 808				097 093
SFMON: Error K 901				097 094
SFMON: Error K 902				097 095
SFMON: Error K 903				097 096
SFMON: Error K 904				097 097
SFMON: Error K 905				097 098
SFMON: Error K 906				097 099
SFMON: Error K 907				097 100
SFMON: Error K 908				097 101
SFMON: Error K 1001				097 102
SFMON: Error K 1002				097 103
SFMON: Error K 1003				097 104
SFMON: Error K 1004				097 105
SFMON: Error K 1005				097 106
SFMON: Error K 1006				097 107
SFMON: Error K 1007				097 108

Parameter				Address
SFMON: Error K 1008				097 109
SFMON: Error K 1201				097 118
SFMON: Error K 1202				097 119
SFMON: Error K 1203				097 120
SFMON: Error K 1204				097 121
SFMON: Error K 1205				097 122
SFMON: Error K 1206				097 123
SFMON: Error K 1207				097 124
SFMON: Error K 1208				097 125
SFMON: Error K 1401				097 134
SFMON: Error K 1402				097 135
SFMON: Error K 1403				097 136
SFMON: Error K 1404				097 137
SFMON: Error K 1405				097 138
SFMON: Error K 1406				097 139
SFMON: Error K 1407				097 140
SFMON: Error K 1408				097 141
SFMON: Error K 1601				097 150
SFMON: Error K 1602				097 151
SFMON: Error K 1603				097 152
SFMON: Error K 1604				097 153
SFMON: Error K 1605				097 154
SFMON: Error K 1606				097 155
SFMON: Error K 1607				097 156
SFMON: Error K 1608				097 157
SFMON: Error K 1801				097 166
SFMON: Error K 1802				097 167
SFMON: Error K 1803				097 168
SFMON: Error K 1804				097 169
SFMON: Error K 1805				097 170
SFMON: Error K 1806				097 171
SFMON: Error K 2001				097 182
SFMON: Error K 2002				097 183
SFMON: Error K 2003				097 184
SFMON: Error K 2004				097 185
SFMON: Error K 2005				097 186

Parameter				Address
SFMON: Error K 2006				097 187
SFMON: Error K 2007				097 188
SFMON: Error K 2008				097 189
Output relay K xxx defective. Device reaction: – “Warning” output relay: Updating “Blocked/faulty” output relay: Yes				
SFMON: Undef. operat. code				093 010
Undefined operation code. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Abnormal termination				093 030
The application has been terminated in an unexpected way. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Bad arg. system call				093 031
Invalid parameter when calling a function of the operating system. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Mutex deadlock				093 032
Software threads are locked from each other by mutex. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				

Parameter				Address
SFMON: Invalid memory ref.				093 033
Attempt to access an invalid memory segment. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Unexpected exception				093 034
Miscellaneous error message from the processor or operating system. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Invalid arithm. op.				093 011
Invalid arithmetic operation. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Undefined interrupt				093 012
Undefined interrupt. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Exception oper.syst.				093 013
Interrupt of the operating system. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Protection failure				090 021
Watchdog is monitoring the periodic start of protection routines. It has detected an error. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				

Parameter				Address
SFMON: Checksum error param				090 003
A checksum error involving the parameters in the memory (NOVRAM) has been detected. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Clock sync. error				093 041
In 10 consecutive clock synchronization telegrams, the difference between the time of day given in the telegram and that of the hardware clock is greater than 10 ms. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Interm.volt.fail.RAM				093 026
Faulty test pattern in the RAM. This can occur, for example, if the processor module or the power supply module is removed from the bus module (digital). This fault is only detected during device startup. After the fault is detected, the software initializes the RAM. This means that all records are deleted. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Overflow MT_RC				090 012
Last entry in the monitoring signal memory in the event of overflow. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Checksum DMOD				093 023
A checksum that was calculated from the data model in the memory of the device yielded a wrong result. If this error occurs during a (re-)start of the device then this message is displayed and the device is blocked. 1st device reaction: Warm restart 2nd device reaction: Device blocking “Warning” output relay: Yes “Blocked/faulty” output relay: Yes				
SFMON: Semaph. MT_RC block.				093 015
Software overloaded. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: Inval. SW COMM1/IEC				093 075
Incorrect or invalid communication software has been downloaded. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Inval. Config. IEC				093 079
Invalid parameters in the IEC configuration. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Invalid SW vers. N				093 093
Incorrect or invalid software for transient ground fault evaluation module has been downloaded. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Time-out module N				093 092
Watchdog is monitoring the periodic status signal of the transient ground fault evaluation module. It has detected an error. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Invalid SW vers. Y				093 113
Incorrect or invalid software for analog I/O module Y has been downloaded. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Invalid SW vers YRTD				093 123
Incorrect or invalid software for analog module (RTD) has been downloaded. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Time-out module Y				093 112
Watchdog is monitoring the periodic status signal of the analog I/O module Y. It has detected an error. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: Time-out module YRTD				093 119
Watchdog is monitoring the periodic status signal of the analog module (RTD). It has detected an error. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: IRIGB faulty				093 117
The IRIGB interface is enabled but there is no plausible input signal. Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: M.c.b. trip V				098 000
The line-side voltage transformer m.c.b. has tripped. Device reaction: Blocking of the short-circuit direction determination. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: M.c.b. trip Vref				098 011
The m.c.b. monitoring the reference voltage transformer has tripped. Device reaction: Blocking of automatic synchronism check (ASC). “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Phase sequ. V faulty				098 001
Measuring-circuit monitoring has detected a fault in the phase sequence of the phase-to-ground voltages. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Undervoltage				098 009
The measuring-circuit monitoring function has detected an undervoltage. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: FF, Vref triggered				098 022
The fuse failure monitoring function has detected a fault in the reference voltage-measuring circuit. “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: M.circ. V,Vref flty.				098 023
Multiple signal: Voltage-measuring circuits for phase-to-ground voltages or the reference voltage faulty. Device reaction: Depends on type of fault. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Meas. circ. V faulty				098 017
Multiple signal: Voltage-measuring circuits faulty. Device reaction: Depends on type of fault. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Meas. circ. I faulty				098 005
The measuring-circuit monitoring function has detected a fault in the current-measuring circuits. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Meas.circ.V,I faulty				098 016
Multiple signal: Multiple signaling: Current- or voltage-measuring circuits faulty. Device reaction: Depends on type of fault. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Communic.fault COMM3				093 140
The set time **COMM3: Time-out comm.fault** has elapsed since the most recent 100% valid telegram was received. The receive signals are set to their user-defined default values. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Hardware error COMM3				093 143
The device has detected a hardware error in the effective connection InterMiCOM (communication interface 3). “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Invalid SW vers DHMI				093 145
Incorrect or invalid software was loaded to operate the detachable display (DHMI). Device reaction: – “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: Invalid config.TPDx				093 160
An invalid assignment of switchgear units has been made for **TPD1: TPD1 Disconnector** and **TPD1: TPD1 ground. switch**. Device reaction: Blocking of the Three Position Drive. “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: Comm.link fail.COMM3				093 142
Timer stage **COMM3: Time-out link fail.** has elapsed indicating a persistent failure of the transmission channel. The receive signals are set to their user-defined default values. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Lim.exceed.,tel.err.				093 141
The threshold set for timer stage **COMM3: Limit telegr. errors** was exceeded and the receive signals are set to their user-defined default values. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Telecom. faulty				098 006
The transmission channel of protective signaling is faulty. Device reaction: Blocking of protective signaling. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Setting error THERM				098 035
Invalid parameters in the setting for the thermal replica. Device reaction: Blocking of thermal overload protection. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Setting error CBM				098 020
An invalid characteristic has been set for circuit breaker monitoring. Device reaction: Depends on type of fault. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: CTA error				098 034
Measurement of the coolant temperature via the analog module is faulty. “Warning” output relay: Yes “Blocked/faulty” output relay: –				

Parameter				Address
SFMON: TGFD mon. triggered				093 094

The monitoring function for transient ground fault direction determination has operated.

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: CB No. CB op. >				098 066

The maximum number of CB operations performed has been exceeded.

Device reaction: Depends on type of fault.

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: Fcts.not perm.f.60Hz				093 098

A protective function has been activated that is not permitted for operation at a system frequency of 60 Hz.

Device reaction: –

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: CB rem. No. CB op. <				098 067

The minimum number of CB operations performed at nominal current has fallen below the threshold.

Device reaction: Depends on type of fault.

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: CB ΣItrip >				098 068

The maximum sum of disconnection current values has been exceeded.

Device reaction: Depends on type of fault.

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: CB ΣItrip2 >**				098 069

The maximum sum of the disconnection current values to the second power has been exceeded.

Device reaction: Depends on type of fault.

“Warning” output relay: Yes

“Blocked/faulty” output relay: –

SFMON: Invalid scaling BCD				093 124

An invalid characteristic has been set for the BCD output channel of analog I/O module Y.

Device reaction: Depends on type of fault detected.

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

SFMON: CB tmax> A				098 070

Parameter				Address
SFMON: CB tmax> B				098 071
SFMON: CB tmax> C				098 077
The maximum duration for the opening of a CB pole has been exceeded. Disconnection is not determined for this CB pole. Device reaction: Depends on type of fault. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: Invalid scaling A-1				093 114
SFMON: Invalid scaling A-2				093 115
An invalid characteristic has been set for one of the analog output channels of analog I/O module Y. Device reaction: Depends on type of fault detected. “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: Invalid scaling IDC				093 116
An invalid characteristic has been set for the analog input channel of analog I/O module Y. Device reaction: Depends on type of fault detected. “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: PT100 open circuit				098 024
The P139 has detected an open circuit in the connection of the resistance thermometer “PT100” to the analog I/O module Y. Device reaction: Depends on type of fault detected. “Warning” output relay: Updating “Blocked/faulty” output relay: –				
SFMON: T1 open circ.				098 029
SFMON: T2 open circ.				098 030
SFMON: T3 open circ.				098 040
SFMON: T4 open circ.				098 041
SFMON: T5 open circ.				098 042
SFMON: T6 open circ.				098 043
SFMON: T7 open circ.				098 044
SFMON: T8 open circ.				098 045

Parameter	Address
SFMON: T9 open circ.	098 052

The P139 has detected an open circuit in the connection of a resistance thermometer Tx (x = 1 ... 9) to the analog module (RTD).

Device reaction: Depends on type of fault detected.

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter	Address
SFMON: Overload 20 mA input	098 025

The 20 mA input of analog I/O module Y is overloaded.

Device reaction: Depends on type of fault detected.

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter	Address
SFMON: Open circ. 20mA inp.	098 026

The P139 has detected an open circuit in the connection of the 20 mA input.

Device reaction: Depends on type of fault detected.

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter	Address
SFMON: Setting error f<>	098 028

The over-/underfrequency protection function has been set for “overfrequency” monitoring (based on the settings for operate value and nominal frequency). This setting is not valid in the *f w. Delta f/Delta t* operating mode.

Device reaction: Blocking of the over-/under frequency protection function

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter	Address
SFMON: Setting error fn	098 133

The underfrequency load shedding protection function Pf< has been set for “overfrequency” monitoring (based on Pf< underfrequency threshold settings and nominal frequency).

If fnom = 50 Hz and **any** Pf< threshold setting is greater or equal to 50 Hz, the alarm is raised and the Pf< function is blocked. Ditto fnom = 60 Hz and **any** Pf< threshold setting is equal to 60 Hz.

Whether the threshold with false setting is activated or not does not matter.

Device reaction: Blocking of the underfrequency load shedding protection function Pf<

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter	Address
SFMON: Inv.inp.f.clock sync	093 120

The function was configured to a binary signal input on the analog I/O module Y. Such a configuration is not permitted for this function.

Device reaction: –

“Warning” output relay: Updating

“Blocked/faulty” output relay: –

Parameter				Address
SFMON: Output 30				098 053
SFMON: Output 30 (t)				098 054
SFMON: Output 31				098 055
SFMON: Output 31 (t)				098 056
SFMON: Output 32				098 057
SFMON: Output 32 (t)				098 058
These LOGIC outputs can be included in the list of warning signals by selection at **SFMON: Fct. assign. warning**. The warning signals are also recorded in the monitoring signal memory. “Warning” output relay: Yes “Blocked/faulty” output relay: –				
SFMON: CB pos.sig. implaus.				098 124
The plausibility logic was triggered during the acquisition of the circuit breaker's (CB) status signals. “Warning” output relay: Yes “Blocked/faulty” output relay: –				

12 Maintenance

⚠ WARNING

Only qualified personnel, familiar with the “Warning” page at the beginning of this manual, may work on or operate this device.

The P139 is a low-maintenance device. The components used in the units are selected to meet exacting requirements. Recalibration is not necessary.

12.1 Maintenance Procedures in the Power Supply Area

Replacement of the power supply module must be carried out by trained personnel, and the power supply voltage must be turned off while the work is being performed.

DANGER

Always turn off the power supply voltage before removing a hardware module.

The power supply must be turned off for at least 5 s before power supply module V is removed.

Otherwise there is the danger of an electric shock.

WARNING

The following instructions apply to surface-mounted cases:

The local control panel is connected to processor module P by a plug-in connecting cable. Remember the connector position! Do not bend the connecting cable.

NOTICE

The replaced power supply module must be disposed of in compliance with applicable national regulations.

In general, the electronic components used for the device family *Easergy MiCOM 30* are designed for a long service life.

For the power supply, however, dimensioning requirements dictate the use of electrolytic capacitors that are subject to increased wear and tear. The useful life of these capacitors depends on their temperature and thus on the components fitted in the device, the load conditions, device location and environmental conditions.

The internal voltage levels are cyclically checked by the P30 self-monitoring functions. In case the voltage levels deviate from their specified values a warning message will be issued or, for persistent problems, the device will be set to a safe condition (blocking). Hence, there is no imperative need to replace the power supply module after a pre-defined period of time. However, should you need to guarantee a high availability of the device then we recommend preventive replacement of the power supply module after a period of 8 to 10 years.

Moreover, the power supply module of the P139 is equipped with a lithium battery for non-volatile storage of fault data and for keeping the internal clock running in the event of failure of the auxiliary power supply. The useful life of the lithium battery depends on the auxiliary power supply of the device.

- If the P139 is continuously connected to the auxiliary power supply, then there is no discharging of the battery, and the battery will thus not be depleted during its service life.
- Should the P139 be disconnected from the auxiliary power supply for several years, then the battery capacity would decrease.

During normal operation, the battery voltage is monitored. If the voltage falls below a pre-defined threshold, a warning message will be issued and the battery has to be replaced.

After the maintenance procedures described above have been completed, new commissioning tests as described in Section 10.2, (p. 10-4) must be carried out.

12.2 Routine Functional Testing

The P139 is used as a safety device and must therefore be routinely injection tested for proper operation. The first functional tests should be carried out approximately 6 to 12 months after commissioning. Functional tests should be performed at intervals of 2 to 3 years – 4 years at the maximum.

The P139 incorporates in its system a very extensive self-monitoring function for hardware and software. The internal structure guarantees, for example, that communication within the processor system will be checked on a continuing basis.

Nonetheless, there are a number of subfunctions that cannot be checked by the self-monitoring feature without injection testing from the device terminals. The respective device-specific properties and settings must be observed in such cases.

In particular, none of the control and signaling circuits that are run to the device from the outside are checked by the self-monitoring function.

12.3 Analog Input Circuits

The analog inputs are fed through an analog preprocessing feature (anti-aliasing filtering) to a common analog-to-digital converter. In conjunction with the self-monitoring function, the CT/VT supervision function that is available for the device’s general functions can detect deviations in many cases. However, it is still necessary to test from the device terminals in order to make sure that the analog measuring circuits are functioning correctly.

The best way to carry out a static test of the analog input circuits is to check the primary measured operating data using the operating data measurement function or to use a suitable testing instrument. A “small” measured value (such as the nominal current in the current path) and a “large” measured value (such as the nominal voltage in the voltage path) should be used to check the measuring range of the A/D converter. This makes it possible to check the entire dynamic range.

The accuracy of operating data measurement is <1%. An important factor in evaluating device performance is long-term performance based on comparison with previous measurements.

In addition, a dynamic test can be used to check transmission performance and the phase relation of the current transformers and the anti-aliasing filter. This can best be done by measuring the trigger point of the first zone when there is a two-phase ungrounded fault. For this test, the value of the short-circuit current should be such that a loop voltage of approximately 2 V is obtained at the device's terminals with the set impedance. Furthermore, a suitable testing instrument that correctly replicates the two-phase ungrounded fault should be used for this purpose.

This dynamic test is not absolutely necessary, since it only checks the stability of a few passive components. Based on reliability analysis, the statistical expectation is that only one component in 10 years in 1000 devices will be outside the tolerance range.

Additional analog testing of such factors as the impedance characteristic or the starting characteristic is not necessary, in our opinion, since information processing is completely digital and is based on the measured analog current and voltage values. Proper operation was checked in conjunction with type testing.

12.4 Binary Opto Inputs

The binary inputs are not checked by the self-monitoring function. However, a testing function is integrated into the software so that the trigger state of each input can be read out (*Oper/Cycl/Phys* menu branch). This check should be performed for each input being used and can be done, if necessary, without disconnecting any device wiring.

12.5 Binary Outputs

With respect to binary outputs, the integrated self-monitoring function includes even two-phase triggering of the relay coils of all the relays. There is no monitoring function for the external contact circuit. In this case, the all-or-nothing relays must be triggered by way of device functions or integrated test functions. For these testing purposes, triggering of the output circuits is integrated into the software through a special control function (*Oper/CtrlTest* menu branch).

WARNING

Before starting the test, open any triggering circuits for external devices so that no inadvertent switching operations will take place.

12.6 Serial Interfaces

The integrated self-monitoring function for the PC or communication interface also includes the communication module. The complete communication system, including connecting link and fiber-optic module (if applicable), is always totally monitored as long as a link is established through the control program or the communication protocol.

13 Storage

Devices must be stored in a dry and clean environment. A temperature range of -25°C to +70°C (-13°F to +158°F) must be maintained during storage (see chapter entitled “Technical Data”). The relative humidity must be controlled so that neither condensation nor ice formation will result.

If the units are stored without being connected to auxiliary voltage, then the electrolytic capacitors in the power supply area need to be recharged every 4 years. Recharge the capacitors by connecting auxiliary voltage to the P139 for approximately 10 minutes.

If the units are stored during a longer time, the battery of the power supply module is used for the continuous buffering of the event data in the working memory of the processor module. Therefore the battery is permanently required and discharges over time. In order to avoid this continuous discharge, it is recommended to remove the power supply module from the mounting rack during long storage periods. The contents of the event memory should be previously read out and stored separately!

14 Accessories and Spare Parts

The P139 is supplied with standard labeling for the LED indicators. LED indicators that are not already configured and labeled can be labeled using the label strips supplied. Affix the label strips to the front of the unit at the appropriate location.

The label strips can be filled in using a “Stabilo” brand pen containing water-resistant ink (Type OH Pen 196 PS).

Description	**Order No.**
Cable bushings	88512-4-0337414-301
Resistor 200 Ω	255.002.696
84 TE frame	88512-4-9650723-301
Operating program for Windows	On request (MiCOM S1 Studio)

15 Order Information

Basic Configuration Variants

MiCOM P139

18 character cortec	1 2 3 4	5	6	7		8	9	10	11	12, 13					14	15	16	17	18
Feeder Management and Bay Control	P 1 3 9 -			9	0					315	4xx	5xx	657	7xx	47x	46x	9x x	9x x	8xx
Basic device:																			
Basic device 40TE, pin-terminal connection,		3									-423								
Basic device 40TE, CT/VT ring-, I/O pin-terminal connection,		5									-424								
Basic device 84TE, ring-terminal connection, [20) 26)]		8									-425								
basic complement with 4 binary inputs, 8 output relays																			
and 6 binary inputs and 6 output relays (2-pole) for the																			
control of 3 switchgear units																			
Mounting option and display:																			
Surface-mounted, local control panel with serial graphic display			5																
Flush-mounted, local control panel with serial graphic display			6																
Surface-mounted, with detachable HMI			7																
Flush-mounted, with detachable HMI			9																
Current transformer:																			
Inom = 1 A/ 5 A (T1...T4) [2)]				9															
Voltage transformer:																			
Without						0													
Vnom = 50 ... 130 V (4-pole)						4													
Vnom = 50 ... 130 V (5-pole) for automatic synchronism control						5													
Additional binary I/O options:																			
Without							0												
With 1 binary module (add. 6 binary inputs and 6 output relays (2-pole)) for the control of up to 3 additional switchgear units							5												
Power supply and additional binary I/O options:																			
VA , nom = 24 … 60 VDC								E											
VA,nom = 60 ... 250 VDC / 100 ... 230 VAC								F											
VA,nom = 24 ... 60 VDC and 6 output relays								G											
VA,nom = 60 ... 250 VDC / 100 ... 230 VAC and 6 output relays								H											
VA , nom = 24 … 60 VDC and 6 binary inputs and 3 output relays								J											
VA,nom = 60 ... 250 VDC / 100 ... 230 VAC and 6 binary inputs and 3 output relays								K											
VA , nom = 24 … 60 VDC and 4 high break contacts								L											
VA,nom = 60 ... 250 VDC / 100 ... 230 VAC and 4 high break contacts								M											

Further Options

MiCOM P139														
18 character cortec	**1 2 3 4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12, 13**	**14**	**15**	**16**	**17**	**18**
Feeder Management and Bay Control	**P 1 3 9 -**			**9 0**					**315 4xx 5xx 657 7xx**	**47x**	**46x**	**9x x**	**9x x**	**8xx**
Further add. Options:														
Without								0						
With TGF (transient ground fault direction determination) module [3) 10)]								1						
With analog module								2						
With TGF and analog module [3) 10)]								3						
With binary module (add. 24 binary inputs)								4						
With TGF and binary module (add. 24 binary inputs) [3) 10)]								5						
With RTD module [3)]								7						
With RTD and analog module [3)]								8						
With RTD module and binary module (add. 24 binary inputs) [3)]								9						
With analog module and binary module (add. 24 binary inputs) [21)]								A						
With two binary modules (add. 48 binary inputs) [3)]								B						
With binary module (add. 6 binary inputs and 8 outputs)								C						
With binary modules (add. 6 binary inputs and 8 outputs) and 24 binary inputs [3)]								D						
With binary modules (add. 6 binary inputs and 8 outputs) and analog module [3)]								E						
With binary modules (add. 6 binary inputs and 8 outputs) and RTD module module [3)]								F						
With binary modules (add. 6 binary inputs and 8 outputs) and TGF module [3)]								G						
Binary modules with single pole high break contacts for control : [19)]														
Without high break contact characteristic									Without order extension No.					
With 1 module with high break contacts (1-pole)										471				
With 2 modules with high break contacts (1-pole)										472				
Switching threshold on binary inputs:														
Standard variant with switching threshold at 65% of 24 VDC (VA,min) [8)]									Without order extension No.					
Special variant with switching threshold at 65% of 127 VDC (VA,nom) [8)]											461			
Special variant with switching threshold at 65% of 250 VDC (VA,nom) [8)]											462			
Special variant with switching threshold at 65% of 110 VDC (VA,nom) [8)]											463			
Special variant with switching threshold at 65% of 220 VDC (VA,nom) [8)]											464			

Communication Options

MiCOM P139														
18 character cortec	**1 2 3 4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12, 13**	**14**	**15**	**16**	**17**	**18**
Feeder Management and Bay Control	**P 1 3 9 -**			**9 0**					**315 4xx 5xx 657 7xx**	**47x**	**46x**	**9x x**	**9x x**	**8xx**
With communication / information interface:														
Without									Without order extension No.					
Protocol can be switched between:												92		
IEC 60870-5-101/-103, Modbus, DNP3, Courier														
and IRIG-B input for clock synchronization														
and 2nd interface (RS485, IEC 60870-5-103)														
For connection to wire, RS485, isolated												1		
For connection to plastic fiber, FSMA connector												2		
For connection to glass fiber, ST connector												4		
Protocol IEC 61850, single connection												94		
For connection to 100 Mbit/s Ethernet, glass fiber SC and wire RJ45												6		
and 2nd interface (RS485, IEC 60870-5-103)														
For connection to 100 Mbit/s Ethernet, glass fiber ST and wire RJ45												7		
and 2nd interface (RS485, IEC 60870-5-103)														
Protocol IEC 61850, redundant connection												98		
For connection to 100 Mbit/s Ethernet, glass fiber ST, SHP												1		
and IRIG-B input for clock synchronization														
and 2nd interface (RS485, IEC 60870-5-103)														
For connection to 100 Mbit/s Ethernet, glass fiber ST, RSTP												2		
and IRIG-B input for clock synchronization														
and 2nd interface (RS485, IEC 60870-5-103)														
For connection to 100 Mbit/s Ethernet, glass fiber ST, dual homing												3		
and IRIG-B input for clock synchronization														
and 2nd interface (RS485, IEC 60870-5-103)														
For connection to 100 Mbit/s Ethernet, glass fiber ST, PRP												4		
and IRIG-B input for clock synchronization														
and 2nd interface (RS485, IEC 60870-5-103)														
With guidance / protection interface:														
Without									Without order extension No.					
Protocol InterMiCOM													95	
For connection to wire, RS485, isolated													1	
For connection to glass fiber, ST connector													4	
For connection to wire, RS232, isolated													5	
Language: 4) 20)														
English (German)									Without order extension No.					
German (English)														801
Polish (English)														804
Other languages on request														80x

Key

2) Switching via parameter, default setting is underlined!
3) This option is excluded if the InterMiCOM interface (-95x) is ordered.
4) Second included language in brackets.
8) Standard variant recommended if higher pickup threshold not explicitly required by the application.
*10) Transient ground fault option for variants with current **and** voltage transformers only.*
19) Depending on the selected numbers of binary modules (6 binary inputs and 6 output relays). Use of High-break contacts: 1-pole only.
20) The Chinese HMI is available only for 40 TE variants and only up to firmware -633.
21) The analog module is fitted in slot 3, the binary I/O board in slot 8 or 16.
26) 84 TE ring-terminal variant; the 2nd additional X(24I) binary module in slot 3 is available only with pin-terminals.

Information about Ordering Options

Binary Inputs' Switching Threshold

The standard version of binary signal inputs (opto-couplers) is recommended in most applications, as these inputs operate with any voltage from 18 V. Special versions with higher pick-up/drop-off thresholds (see also “Technical Data”, Chapter 2, (p. 2-1)) are provided for applications where a higher switching threshold is expressly required.

Customer Care Centre

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