MiCOM P125, P126 & P127

Directional/Non-Directional Relay

P12y/EN M/Gb5

Version	Software version: V16 Hardware version: 5

Technical Manual

MiCOM P125/P126 & P127
Directional/Non-directional Relay

CONTENT

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SAFETY SECTION

STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC EQUIPMENT

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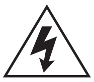
1. INTRODUCTION

This guide and the relevant equipment documentation provide full information on safe handling, commissioning and testing of this equipment. This Safety Guide also includes descriptions of equipment label markings.

Documentation for equipment ordered from Schneider Electric is despatched separately from manufactured goods and may not be received at the same time. Therefore this guide is provided to ensure that printed information which may be present on the equipment is fully understood by the recipient.

The technical data in this safety guide is typical only, see the technical data section of the relevant product publication(s) for data specific to a particular equipment.



Before carrying out any work on the equipment the user should be familiar with the contents of this Safety Guide and the ratings on the equipment's rating label.

Reference should be made to the external connection diagram before the equipment is installed, commissioned or serviced.

Language specific, self-adhesive User Interface labels are provided in a bag for some equipment.

2. HEALTH AND SAFETY

The information in the Safety Section of the equipment documentation is intended to ensure that equipment is properly installed and handled in order to maintain it in a safe condition.

It is assumed that everyone who will be associated with the equipment will be familiar with the contents of that Safety Section, or this Safety Guide.

When electrical equipment is in operation, dangerous voltages 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 also cause personal injury or physical damage.

Before working in the terminal strip area, the equipment must be isolated.

Proper and safe operation of the equipment 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 the equipment.

Qualified personnel are individuals who:

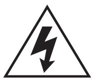
- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorised to energize and de-energize equipment and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

The equipment documentation gives instructions for its installation, commissioning, and operation. 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 Schneider Electric technical sales office and request the necessary information.

3. SYMBOLS AND EXTERNAL LABELS ON THE EQUIPMENT

For safety reasons the following symbols and external labels, which may be used on the equipment or referred to in the equipment documentation, should be understood before the equipment is installed or commissioned.

3.1 Symbols

 Caution: refer to equipment documentation	 Caution: risk of electric shock
 Protective Conductor (*Earth) terminal	 Functional/Protective Conductor (*Earth) terminal. Note: This symbol may also be used for a Protective Conductor (Earth) Terminal if that terminal is part of a terminal block or sub-assembly e.g. power supply.

*NOTE: THE TERM EARTH USED THROUGHOUT THIS GUIDE IS THE DIRECT EQUIVALENT OF THE NORTH AMERICAN TERM GROUND.

3.2 Labels

See Safety Guide (SFTY/4L M/G11) for equipment labelling information.

4. INSTALLING, COMMISSIONING AND SERVICING

Equipment connections

Personnel undertaking installation, commissioning or servicing work for this equipment should be aware of the correct working procedures to ensure safety.

The equipment documentation should be consulted before installing, commissioning, or servicing the equipment.

Terminals exposed during installation, commissioning and maintenance may present a hazardous voltage unless the equipment is electrically isolated.

The clamping screws of all terminal block connectors, for field wiring, using M4 screws shall be tightened to a nominal torque of 1.3 Nm.

Equipment intended for rack or panel mounting is for use on a flat surface of a Type 1 enclosure, as defined by Underwriters Laboratories (UL).

Any disassembly of the equipment may expose parts at hazardous voltage, also electronic parts may be damaged if suitable electrostatic voltage discharge (ESD) precautions are not taken.

If there is unlocked access to the rear of the equipment, care should be taken by all personnel to avoid electric shock or energy hazards.

Voltage and current connections shall be made using insulated crimp terminations to ensure that terminal block insulation requirements are maintained for safety.

Watchdog (self-monitoring) contacts are provided in numerical relays to indicate the health of the device. Schneider Electric strongly recommends that these contacts are hardwired into the substation's automation system, for alarm purposes.

To ensure that wires are correctly terminated the correct crimp terminal and tool for the wire size should be used.

The equipment must be connected in accordance with the appropriate connection diagram.

Protection Class I Equipment

- Before energizing the equipment it must be earthed using the protective conductor terminal, if provided, or the appropriate termination of the supply plug in the case of plug connected equipment.
- The protective conductor (earth) connection must not be removed since the protection against electric shock provided by the equipment would be lost.
- When the protective (earth) conductor terminal (PCT) is also used to terminate cable screens, etc., it is essential that the integrity of the protective (earth) conductor is checked after the addition or removal of such functional earth connections. For M4 stud PCTs the integrity of the protective (earth) connections should be ensured by use of a locknut or similar.

The recommended minimum protective conductor (earth) wire size is 2.5 mm² (3.3 mm² for North America) unless otherwise stated in the technical data section of the equipment documentation, or otherwise required by local or country wiring regulations.

The protective conductor (earth) connection must be low-inductance and as short as possible.

All connections to the equipment must 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.

Before energizing the equipment, the following should be checked:

- Voltage rating/polarity (rating label/equipment documentation),
- CT circuit rating (rating label) and integrity of connections,
- Protective fuse rating,
- Integrity of the protective conductor (earth) connection (where applicable),
- Voltage and current rating of external wiring, applicable to the application.

Accidental touching of exposed terminals

If working in an area of restricted space, such as a cubicle, where there is a risk of electric shock due to accidental touching of terminals which do not comply with IP20 rating, then a suitable protective barrier should be provided.

Equipment use

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

Removal of the equipment front panel/cover

Removal of the equipment front panel/cover may expose hazardous live parts, which must not be touched until the electrical power is removed.

UL and CSA/CUL Listed or Recognized equipment

To maintain UL and CSA/CUL Listing/Recognized status for North America the equipment should be installed using UL or CSA Listed or Recognized parts for the following items: connection cables, protective fuses/fuseholders or circuit breakers, insulation crimp terminals and replacement internal battery, as specified in the equipment documentation.

For external protective fuses a UL or CSA Listed fuse shall be used. The Listed type shall be a Class J time delay fuse, with a maximum current rating of 15 A and a minimum d.c. rating of 250 Vd.c., for example type AJT15.

Where UL or CSA Listing of the equipment is not required, a high rupture capacity (HRC) fuse type with a maximum current rating of 16 Amps and a minimum d.c. rating of 250 Vd.c. may be used, for example Red Spot type NIT or TIA.

Equipment operating conditions

The equipment should be operated within the specified electrical and environmental limits.

Current transformer circuits

Do not open the secondary circuit of a live CT since the high voltage produced may be lethal to personnel and could damage insulation. Generally, for safety, the secondary of the line CT must be shorted before opening any connections to it.

For most equipment with ring-terminal connections, the threaded terminal block for current transformer termination has automatic CT shorting on removal of the module. Therefore external shorting of the CTs may not be required, the equipment documentation should be checked to see if this applies.

For equipment with pin-terminal connections, the threaded terminal block for current transformer termination does NOT have automatic CT shorting on removal of the module.

External resistors, including voltage dependent resistors (VDRs)

Where external resistors, including voltage dependent resistors (VDRs), are fitted to the equipment, these may present a risk of electric shock or burns, if touched.

Battery replacement

Where internal batteries are fitted they should be replaced with the recommended type and be installed with the correct polarity to avoid possible damage to the equipment, buildings and persons.

Insulation and dielectric strength testing

Insulation testing may leave capacitors charged up to a hazardous voltage. At the end of each part of the test, the voltage should be gradually reduced to zero, to discharge capacitors, before the test leads are disconnected.

Insertion of modules and pcb cards

Modules and PCB cards must not be inserted into or withdrawn from the equipment whilst it is energized, since this may result in damage.

Insertion and withdrawal of extender cards

Extender cards are available for some equipment. If an extender card is used, this should not be inserted or withdrawn from the equipment whilst it is energized. This is to avoid possible shock or damage hazards. Hazardous live voltages may be accessible on the extender card.

External test blocks and test plugs

Great care should be taken when using external test blocks and test plugs such as the MMLG, MMLB and MiCOM P990 types, hazardous voltages may be accessible when using these. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

*Note: When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.

Fiber optic communication

Where fiber optic communication devices are fitted, these should not be viewed directly. Optical power meters should be used to determine the operation or signal level of the device.

Cleaning

The equipment may be cleaned using a lint free cloth dampened with clean water, when no connections are energized. Contact fingers of test plugs are normally protected by petroleum jelly, which should not be removed.

5. DECOMMISSIONING AND DISPOSAL

De-commissioning

The supply input (auxiliary) for the equipment may include capacitors across the supply or to earth. To avoid electric shock or energy hazards, after completely isolating the supplies to the equipment (both poles of any dc supply), the capacitors should be safely discharged via the external terminals prior to de-commissioning.

Disposal

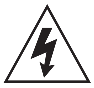
It is recommended that incineration and disposal to water courses is avoided. The equipment should be disposed of in a safe manner. Any equipment containing batteries should have them removed before disposal, taking precautions to avoid short circuits. Particular regulations within the country of operation, may apply to the disposal of the equipment.

6. TECHNICAL SPECIFICATIONS FOR SAFETY

Unless otherwise stated in the equipment technical manual, the following data is applicable.

6.1 Protective fuse rating

The recommended maximum rating of the external protective fuse for equipments is 16A, high rupture capacity (HRC) Red Spot type NIT, or TIA, or equivalent. Unless otherwise stated in equipment technical manual, the following data is applicable. The protective fuse should be located as close to the unit as possible.



CAUTION - CTs must NOT be fused since open circuiting them may produce lethal hazardous voltages.

6.2 Protective Class

IEC 60255-27: 2005 EN 60255-27: 2006	Class I (unless otherwise specified in the equipment documentation). This equipment requires a protective conductor (earth) connection to ensure user safety.

6.3 Installation Category

IEC 60255-27: 2005	Installation Category III (Overvoltage Category III):
EN 60255-27: 2006	Distribution level, fixed installation.
	Equipment in this category is qualification tested at 5 kV peak, 1.2/50 µs, 500 Ω, 0.5 J, between all supply circuits and earth and also between independent circuits.

6.4 Environment

The equipment is intended for indoor installation and use only. If it is required for use in an outdoor environment then it must be mounted in a specific cabinet or housing which will enable it to meet the requirements of IEC 60529 with the classification of degree of protection IP54 (dust and splashing water protected).

Pollution Degree - Pollution Degree 2 Altitude - Operation up to 2000m	Compliance is demonstrated by reference to safety standards.

IEC 60255-27:2005

EN 60255-27: 2006

INTRODUCTION

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1. INTRODUCTION

The MiCOM P125, P126 & P127 relays have been designed for controlling, protecting and monitoring industrial installations, public distribution networks and substations. They can also be used as part of a protection scheme for transformers and generator transformers. The P125, P126 & P127 relays can also provide back-up protection for HV and EHV transmission systems.

2. HOW TO USE THIS MANUAL

This manual provides a description of **MiCOM P125, P126** and **P127** functions and settings. The goal of this manual is to allow the user to become familiar with the application, installation, setting and commissioning of these relays.

This manual has the following format:

P12y/EN IT	*Introduction*
	The introduction presents the documentation structure and a brief presentation of the relay, including functions.
P12y/EN IN	*Handling, installation and case dimensions*
	This section provides logistics general instructions for handling, installing and stocking..
P12y/EN FT	*User Guide*
	This section provides relay settings with a brief explanation of each setting and detailed description. It also provides recording and measurements functions including the configuration of the event and disturbance recorder and measurement functions.
P12y/EN HI	*Menu content tables*
	This section shows the menu structure of the relays, with a complete list of all of the menu settings.
P12y/EN AP	*Application Notes*
	This section includes a description of common power system applications of the relay, calculation of suitable settings, some typical worked examples, and how to apply the settings to the relay.
P12y/EN TD	*Technical data and curve characteristics*
	This section provides technical data including setting ranges, accuracy limits, recommended operating conditions, ratings and performance data. Compliance with norms and international standards is quoted where appropriate.
P12y/EN CT	*Communication mapping data bases*
	This section provides an overview regarding the communication interfaces of the relay. Detailed protocol mappings, semantics, profiles and interoperability tables are not provided within this manual. Separate documents are available per protocol, available for download from our website.
P12y/EN CM	*Commissioning and Maintenance Guide*
	Instructions on how to commission the relay, comprising checks on the calibration and functionality of the relay.
P12y/EN CO	*Connection diagrams*
	This section provides the mechanical and electrical description. External wiring connections to the relay are indicated.
P12y/EN RS	*Commissioning test records*
	This section contains checks on the calibration and functionality of the relay.
P12y/EN VC	*Hardware/Software version history*
	History of all hardware and software releases for the product.

3. INTRODUCTION TO THE MiCOM RANGE

MiCOM is a comprehensive solution capable of meeting all electricity supply requirements. It comprises of a range of components, systems and services from Schneider Electric. Flexibility is central to the MiCOM concept.

MiCOM provides the ability to define an application solution and, through extensive communication capabilities, to integrate this solution with your power supply control system.

The components within MiCOM are:

- **P** range protection relays
- **C** range control products
- **M** range measurement products for accurate metering and monitoring
- **S** range versatile PC support and substation control packages

MiCOM products include extensive facilities for recording information on the state and behaviour of a power system, using disturbance and fault records.

They can also provide measurements of the power system at regular intervals to a control centre enabling remote monitoring and control to take place.

For up-to-date information on any MiCOM product, refer to the technical publications, which can be obtained from: Schneider Electric or your local sales office; alternatively visit our web site.

4. INTRODUCTION TO THE MiCOM P125, P126 & P127 RELAYS

The MiCOM P125, P126 & P127 relays are based on the successful K, MODN and MX3 range.

Each relay includes a large number of protection and control functions for most demanding applications.

On the front panel the relays are equipped with a liquid crystal display (LCD) with 2 x 16 backlit alphanumeric characters, a tactile 7-button keypad (to gain access to all parameters, alarms and measurements) and 8 LEDs to display the status of the MiCOM P125, P126 & P127.

A dedicated Schneider Electric setting software package is available that allows the user to read, initialise and change the relay parameter settings via the RS485 rear communications port(s) and/or the RS232 front port.

The MiCOM P125, P126 & P127 relays provide comprehensive directional overcurrent protection for utilities networks, industrial plants and networks in addition to other applications where directional or non-directional overcurrent protection is required.

The directional earth fault element is sensitive enough to be used in impedance-earthed systems (such as resistance or Peterson Coil) or insulated systems.

The models available are:

MiCOM P125: Directional earth fault relay with earth fault wattmetric element.

MiCOM P126: Three phase overcurrent and directional earth fault relay with earth fault wattmetric element and autoreclose function.

MiCOM P127: Directional overcurrent and directional earth fault relay with overpower element, overvoltage/undervoltage, under/overfrrequency protection and autoreclose function.

5. MAIN FUNCTIONS

5.1 Main functions

The following table shows the functions available with the models.

ANSI CODES	FEATURES	P125	P126	P127
50/51P/N	1 phase or earth overcurrent	●		
50/51	3 phase overcurrent		●	●
50/51N	Earth overcurrent		●	●
64N	Restricted Earth Fault	●	●	●
67P	3 phase directional overcurrent			●
67N	Earth fault directional overcurrent	●	●	●
67N	Derived earth fault			●
51V	Voltage controlled overcurrent			●
37	3 phase undercurrent	●	●	●
46	Negative phase sequence overcurrent		●	●
27/59	Phase under/over voltage (AND & OR mode)			●
59N	Residual over voltage	●	●	●
47	Negative overvoltage			●
32	Directional power (active / reactive, under / over power)			●
32N	Wattmetric Earth Fault	●	●	●
81U/O	Under/over frequency			●
81R	Rate of Frequency			●
49	Thermal overload		●	●
86	Output relay latching	●	●	●
79	Autoreclose		●	●
50BF	Circuit breaker failure detection		●	●
46BC	Broken conductor detection I2/I1		●	●
	Blocking Logic	●	●	●
	Test of output relays (Maintenance)	●	●	●
	CB control Local/remote	●	●	●
	Circuit Breaker Maintenance and Trip Circuit Supervision		●	●
	Cold load pick up		●	●
	Selective relay scheme logic		●	●
	Inrush blocking			●
	Switch on to fault (SOTF)		●	●
	Phase rotation			●
	VT supervision (VTS)			●
	CT Supervision (CTS)			●

5.2 General functions

The following table shows the general features available.

GENERAL FEATURES		P125	P126	P127
Number of digital inputs	Standard configuration	4	7	7
	Optional configuration			12
Total number of outputs relays		6	8	8
Events recording		250	250	250
Fault recording		25	25	25
Disturbance recording		5	5	5
Setting group		2	2	8
Auxiliary timers	Standard configuration	4	7	7
	Optional configuration			12
Communication	IEC60870-5-103, DNP 3.0 & Modbus RTU (port 1)	●	●	●
	IEC60870-5-103 or Modbus (port 2 – optional)			●
Time synchronisation	Via rear communication port (DCS)	●	●	●
	Via digital input (external clock)	●	●	●
	IRIG-B Synchronization (optional)			●
Settings software	MiCOM S1 using RS232 front port	●	●	●
	MiCOM S1 using optional RS485 rear port			●
Logic equation	AND, OR and NOT gates (8 equations)		●	●
Measurements	RMS currents values & frequency	●	●	●
	Peak and rolling currents values		●	●
	Max and average currents values		●	●
	Phase and/or neutral angle	●	●	●
	Max and average voltage values			●
	Power and Energy			●
	Apparent power and apparent energy			●
Metering (optional)	harmonics values, THD & TDD			●
	Class 0.5 measurements values (P, Q, S, E)			●

HANDLING, INSTALLATION AND CASE DIMENSIONS

CONTENT

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1. GENERAL CONSIDERATIONS

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTIONS OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

1.1 Receipt of relays

Protective relays, although generally of robust construction, require careful treatment prior to installation on site. Upon receipt, relays should be examined immediately to ensure no damage has been sustained in transit. If damage has been sustained during transit a claim should be made to the transport contractor and Schneider Electric should be promptly notified.

Relays that are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags.

1.2 Electrostatic discharge (ESD)

The relays use components that are sensitive to electrostatic discharges.

The electronic circuits are well protected by the metal case and the internal module should not be withdrawn unnecessarily. When handling the module outside its case, care should be taken to avoid contact with components and electrical connections. If removed from the case for storage, the module should be placed in an electrically conducting antistatic bag.

There are no setting adjustments within the module and it is advised that it is not unnecessarily disassembled. Although the printed circuit boards are plugged together, the connectors are a manufacturing aid and not intended for frequent dismantling; in fact considerable effort may be required to separate them. Touching the printed circuit board should be avoided, since complementary metal oxide semiconductors (CMOS) are used, which can be damaged by static electricity discharged from the body.

2. HANDLING OF ELECTRONIC EQUIPMENT

A person's normal movements can easily generate electrostatic potentials of several thousand volts. Discharge of these voltages into semiconductor devices when handling electronic circuits can cause serious damage, which often may not be immediately apparent but the reliability of the circuit will have been reduced.

The electronic circuits are completely safe from electrostatic discharge when housed in the case. Do not expose them to risk of damage by withdrawing modules unnecessarily.

Each module incorporates the highest practicable protection for its semiconductor devices. However, if it becomes necessary to withdraw a module, the following precautions should be taken to preserve the high reliability and long life for which the equipment has been designed and manufactured.

1. Before removing a module, ensure that you are at the same electrostatic potential as the equipment by touching the case.
2. Handle the module by its front-plate, frame or edges of the printed circuit board. Avoid touching the electronic components, printed circuit track or connectors.
3. Do not pass the module to another person without first ensuring you are both at the same electrostatic potential. Shaking hands achieves equipotential.
4. Place the module on an antistatic surface, or on a conducting surface which is at the same potential as yourself.
5. Store or transport the module in a conductive bag.

If you are making measurements on the internal electronic circuitry of an equipment in service, it is preferable that you are earthed to the case with a conductive wrist strap. Wrist straps should have a resistance to ground between 500kΩ – 10MΩ.

If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of static. Instrumentation which may be used for making measurements should be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS5783 and IEC 147-OF. It is strongly recommended that detailed investigations on electronic circuitry or modification work should be carried out in a special handling area such as described in the above-mentioned BS and IEC documents.

3. RELAY MOUNTING

Relays are dispatched either individually or as part of a panel/rack assembly.

If an MMLG test block is to be included it should be positioned at the right-hand side of the assembly (viewed from the front). Modules should remain protected by their metal case during assembly into a panel or rack.

If external test blocks are connected to the relay, great care should be taken when using the associated test plugs such as MMLB and MiCOM P992 since their use may make hazardous voltages accessible. *CT shorting links must be in place before the insertion or removal of MMLB test plugs, to avoid potentially lethal voltages.

NOTE: NOTE: When a MiCOM P992 Test Plug is inserted into the MiCOM P991 Test Block, the secondaries of the line CTs are automatically shorted, making them safe.

For individually mounted relays an outline diagram is supplied in section 6 of this chapter showing the panel cut-outs and hole centres.

4. UNPACKING

Care must be taken when unpacking and installing the relays so that none of the parts is damaged or the settings altered. Relays must only be handled by skilled persons. The installation should be clean, dry and reasonably free from dust and excessive vibration. The site should be well lit to facilitate inspection. Relays that have been removed from their cases should not be left in situations where they are exposed to dust or damp. This particularly applies to installations which are being carried out at the same time as construction work.

5. STORAGE

If relays are not to be installed immediately upon receipt they should be stored in a place free from dust and moisture in their original cartons. Where de-humidifier bags have been included in the packing they should be retained. The action of the de-humidifier crystals will be impaired if the bag has been exposed to ambient conditions and may be restored by gently heating the bag for about an hour, prior to replacing it in the carton.

Dust which collects on a carton may, on subsequent unpacking, find its way into the relay; in damp conditions the carton and packing may become impregnated with moisture and the de-humifier will lose its efficiency.

Storage temperature: –25°C to +70°C.

SUSTAINED EXPOSURE TO HIGH HUMIDITY DURING STORAGE MAY CAUSE DAMAGE TO ELECTRONICS AND REDUCE THE LIFETIME OF THE EQUIPMENT.

THEREFORE, ONCE THE MICOM PRODUCTS HAVE BEEN UNPACKED, WE RECOMMEND THAT THEY ARE ENERGIZED WITHIN THE THREE FOLLOWING MONTHS.

WHERE ELECTRICAL EQUIPMENT IS BEING INSTALLED, SUFFICIENT TIME SHOULD BE ALLOWED FOR ACCLIMATISATION TO THE AMBIENT TEMPERATURE OF THE ENVIRONMENT, BEFORE ENERGISATION.

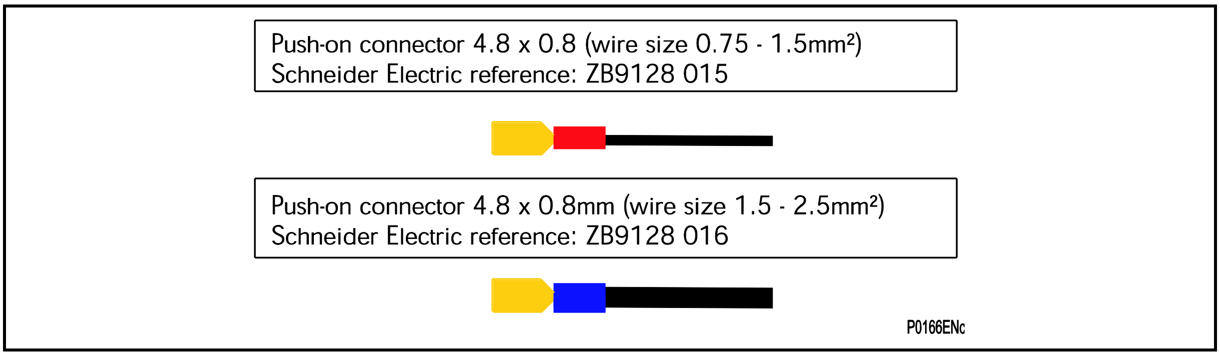
6. CONNECTIONS

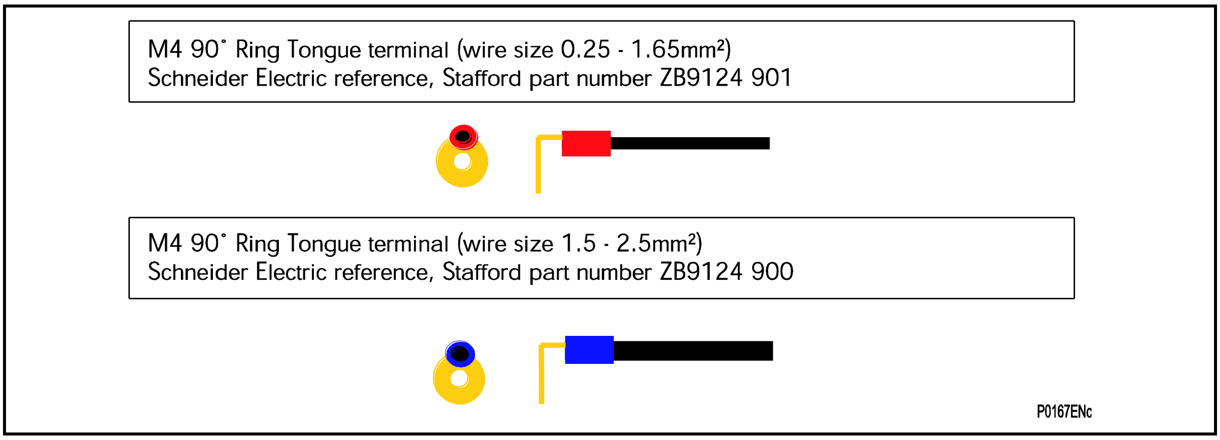
6.1 Connection of power terminals, and Signals terminals

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTIONS OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

The individual equipment is delivered with sufficient M4 screws and washers to connect the relay via insulated crimp ring terminals. The maximum number of crimped terminations, per terminal block terminal, is two.

If necessary, Schneider Electric can provide 4 types of insulated crimp terminals (see below) according to the cross sectional area of the wire and the type of terminal. Each reference corresponds to a sachet of 100 terminals.





To ensure the isolation of adjacent terminals, and to respect the security and safety instructions, an insulated sleeve must be used.

We recommend the following cable cross-sections:

– Auxiliary sources	Vaux: 1.5 mm²
– Communication Ports	see paragraphs 6.2 and 6.3
– Other circuits	1.0 mm²

Because of the limitations of the ring terminals, the maximum wire cross-section which can be used for the connector blocks (for current inputs and signals) is 6mm² by using non-insulated ring terminals. When only pre-insulated terminals can be used, the maximum wire cross-section is reduced to 2,63 mm² per ring terminal. If a more significant wire cross-section is necessary, two wires can be connected in parallel, each one terminated by a separate ring terminal.

Except for the RS485 port(s) all the terminal blocks used for connections, can withstand a maximum working voltage of 300V.

We recommend the auxiliary supply is protected by a NIT or TIA fuse type with a maximum breaking capacity of 16A. For safety reasons, never install fuses in current transformers circuits. Other circuits must be protected by fuses.

6.2 Communication port RS485

Connections to RS485 are made using ring terminals. It is recommended that a two core screened cable, is used with a maximum total length of 1000 m or a 200nF total cable capacitance.

Typical specification:

– Each core: 16/0.2 mm copper conductor, PVC insulated

– Nominal conductor area: 0.5 mm² per core

– Screen: Overall braid, PVC sheathed

– Linear capacitance between conductor and earth: 100pF/m

6.3 RS232 port

Short term connections to the RS232 port, located behind the bottom access cover, can be made using a screened multi-core communication cable up to 15m long, or a total capacitance of 2500pF. The cable should be terminated at the relay end with a 9-way, metal shelled, D-type male plug.

6.4 IRIG-B connections (P127 option)

The IRIG-B option integrates modulated and demodulated versions.

6.4.1 IRIG-B Modulated

IRIG-B modulated terminals: "+" = terminal 82, "–" = terminal 81.

NOTE: As IRIG-B signal is polarized, insure that BNC ground is connected on pin n°81.

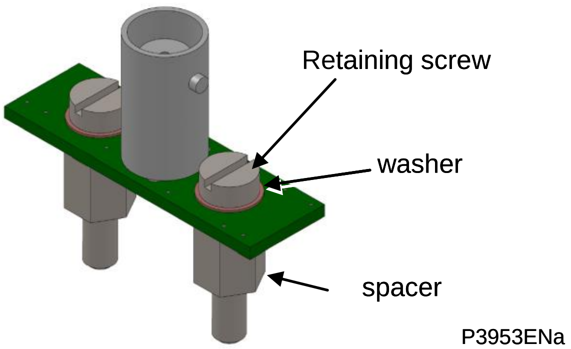
The IRIG-B input and BNC connector (including BNC adaptor) have a characteristic impedance of 50Ω. It is recommended that connections between the IRIG-B equipment and the relay are made using coaxial cable of type RG59LSF with a halogen free, fire retardant sheath.

To connect the BNC connector to the relay, use the BNC adaptor fixed on the rear connector:

– Remove the two retaining screws and the washers,

– Insert the two spacers in the 81 and 82 terminals,

– Position the BNC adaptor ("+" side on terminal 82) and screw the scre/washer assembly ("+" and "GND" sides are marked on the adaptor).



6.4.2 IRIG-B demodulated

IRIG-B demodulated terminals: "+" = terminal 84, "–" = terminal 83.

The connections to IRIG-B unmodulated terminals are classical connections.

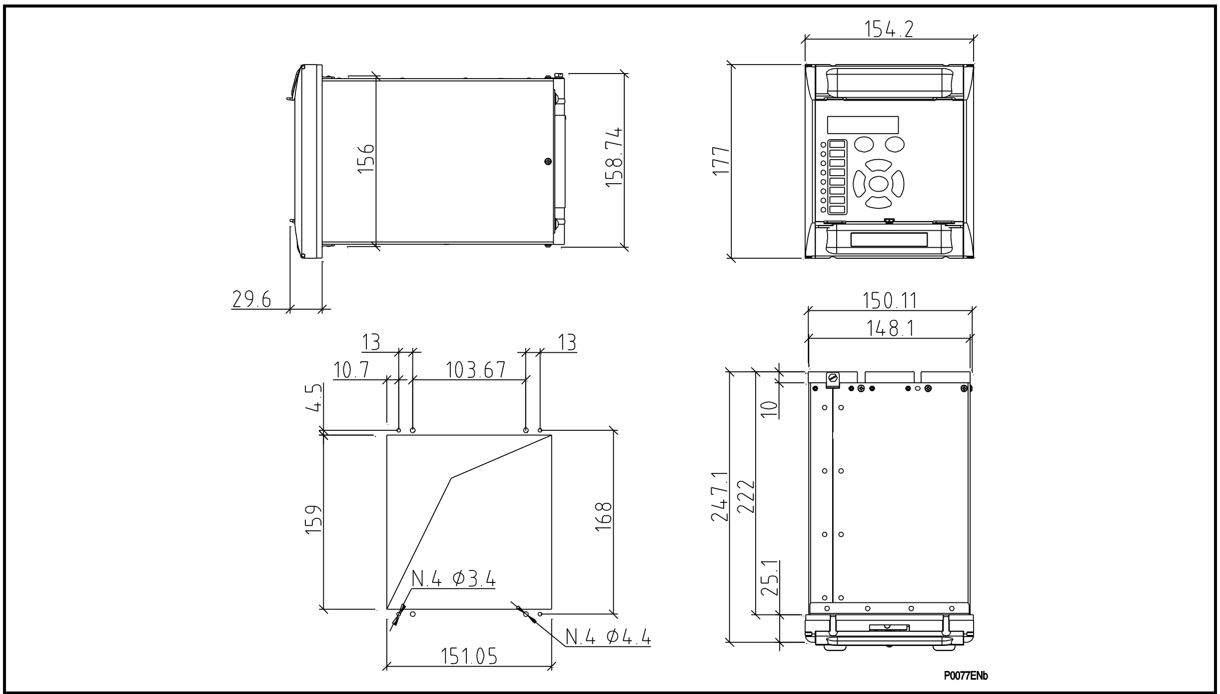
6.5 Protective Conductor (Earthing)

The equipment must be connected to the protective conductor via the M4 earth terminal of the terminal block numbered 1 to 28, marked with the earth symbol. We recommend a wire of minimal cross section of 2,5 mm². Because of the limitations of the ring terminals, the maximum possible wire cross section is 6mm². If a larger section is necessary, one can use cables connected in parallel, each one terminated with a ring terminal. Alternatively a suitably sized metal strip may be used.

NOTE: To prevent any electrolytic risk between copper conductor or brass conductors and the back plate of the equipment, it is necessary to take precautions to isolate them one from the other. This can be done in several ways, for example by inserting between the conductor and the case a plated nickel washer or by using tinned terminations.

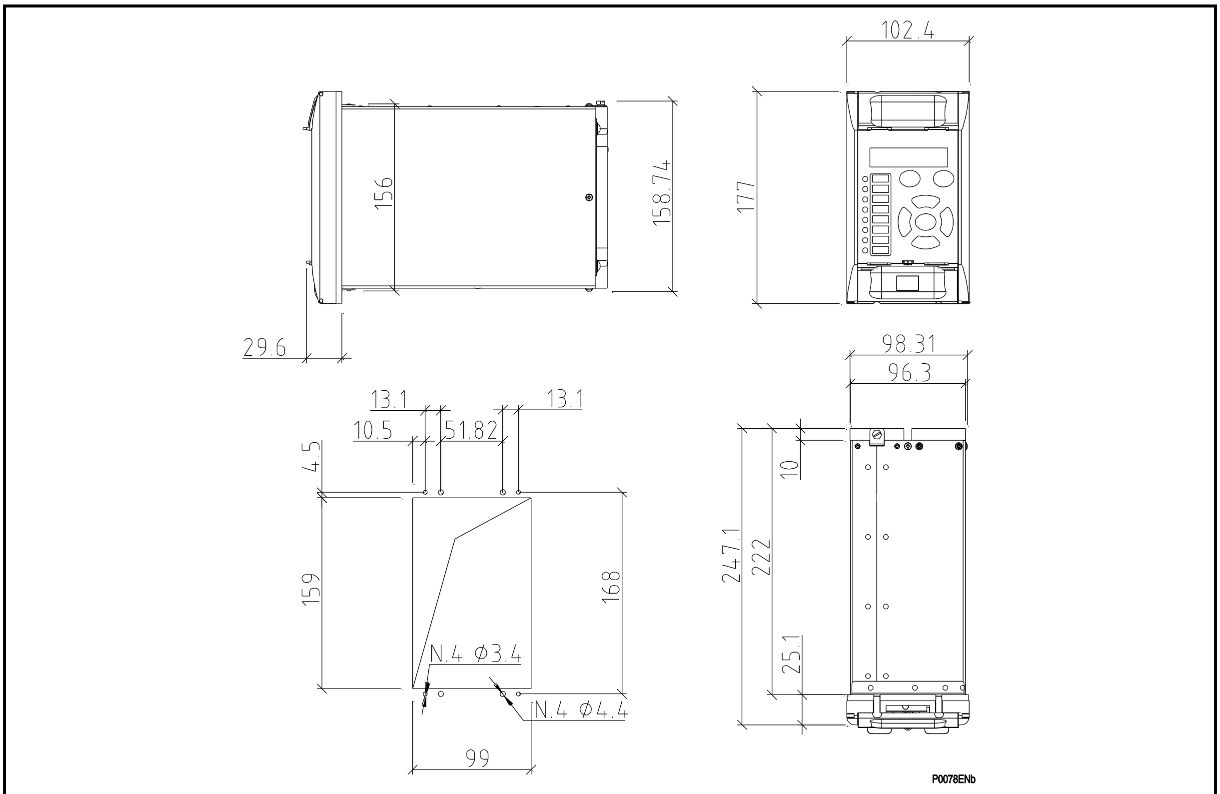
7. CASE DIMENSIONS

7.1 MiCOM P126 & P127



NOTE: For P127 with IRIG-B option with BNC adaptor, add 25 mm to the length.

7.2 MiCOM P125



NOTE: The chassis is normally secured in the case by four screws (Self tapping screws 6x1,4), to ensure good seating. The fixing screws should be fitted in normal service (do not add washers). Do not discard these screws.

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USER GUIDE

CONTENT

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1. PRESENTATION OF MiCOM P125, P126 AND P127 RELAYS

MiCOM P125, P126 & P127 are fully numerical relays designed to perform electrical protection and control functions.

The following sections describe content and structure of the menu.

The five keys situated in the middle of the MiCOM relay front panel are dedicated to set parameters.

With the keys it is possible to move in the direction indicated to the various levels of the menus. The key validates the settings modification.

The two keys and are dedicated to acknowledging/clearing and displaying/reading of data. For example if successive alarms are to be displayed, press on key .

The alarms are presented in reverse order of their detection (the most recent alarm first, the oldest last). The user can either acknowledge and clear each alarm from the LCD by using or go to the end of the ALARM menu and carry out a general acknowledgement.

1.1 User Interface

1.1.1 Relay Overview

The next figures show the P125 and P126/P127 relays.

P125 **P126/P127**

As can be seen in above figures the case width dimensions differ between the P125 and the P126/P127.

The table shows the case size for the relays.

Version	Height	Depth	Width
Type P125	4U (177mm)	226mm	20 TE
Type P126 & P127	4U (177mm)	226mm	30 TE

The hinged covers at the top and bottom of the relay are shown closed. Extra physical protection for the front panel can be provided by an optional transparent front cover; this allows read only access to the relays settings and data but does not affect the relays IP rating. When full access to the relay keypad is required to edit the settings, the transparent cover can be unclipped and removed when the top and bottom hinged covers are open. If the lower cover is secured with a wire seal, this will need to be removed. Using the side flanges of the transparent cover, pull the bottom edge away from the relay front panel until it is clear of the seal tab. The cover can then be moved vertically down to release the two fixing lugs from their recesses in the front panel.

1.1.2 Front Panel Description

MiCOM P125, P126 and **P127** relay front panel allows the user to easily enter relay settings, display measured values and alarms and to clearly display the status of the relay.

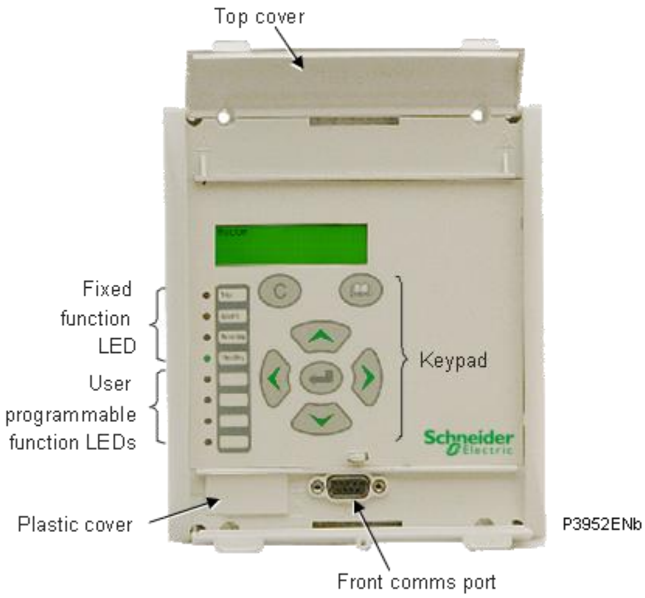


FIGURE 1: MiCOM P125, P126 AND P127 FRONT PANEL DESCRIPTION

The front panel of the relay has three separate sections:

1. The LCD display and the keypad,
2. The LEDs
3. The two zones under the upper and lower flaps.

NOTE: Starting from Hardware 5, there is no need of battery in the front of the relay. Indeed, disturbance, fault and event records are stored on a flash memory card that doesn’t need to be backed up by a battery. The compartment is fitted with a blanking cover.

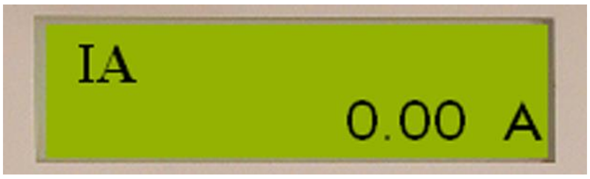
1.1.3 LCD display and keypad description

The front panel components are shown below. The front panel functionality is identical for the P125, P126 & P127 relays.

1.1.3.1 LCD display

In the front panel, a liquid crystal display (LCD) displays settings, measured values and alarms. Data is accessed through a menu structure.

The LCD has two lines, with sixteen characters each. A back-light is activated when a key is pressed and will remain lit for five minutes after the last key press. This allows the user to be able to read the display in most lighting conditions.



1.1.3.2 Keypad

The keypad has seven keys divided into two groups:

- Two keys located just under the screen (keys Ⓒ and 🕮).

Keys Ⓒ and 🕮 are used to read and acknowledge alarms. To display successive alarms, press key 🕮. Alarms are displayed in reverse order of their detection (the most recent alarm first, the oldest alarm last). To acknowledge the alarms, the user can either acknowledge each alarm using Ⓒ or go to the end of the ALARM menu and acknowledge all the alarms at the same time.

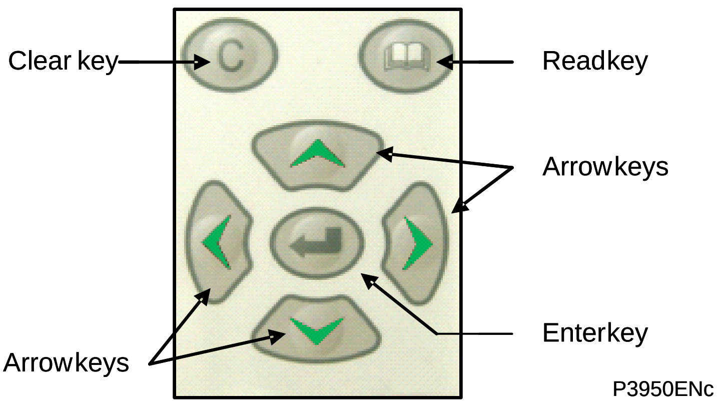
When navigating through submenus, key Ⓒ is also used to come back to the head line of the corresponding menu.

NOTE: To acknowledge a relay latched refer to the corresponding submenu section.

- Four main keys ⇩, ⇨, ⇦, ⇧ located in the middle of the front panel.

They are used to navigate through the different menus and submenus and to do the setting of the relay.

The key ↵ is used to validate a choice or a value (modification of settings).

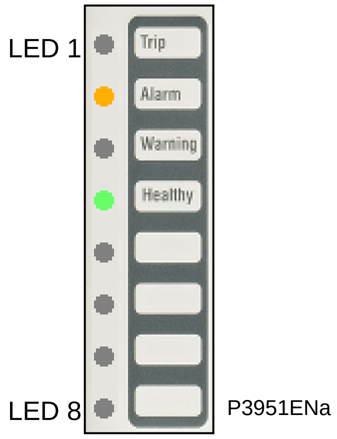


1.1.4 LEDs

The LED labels on the front panel are by default written in English, however the user has self-adhesive labels available with **MiCOM** relays on which it is possible to write using a ball point pen.

The top four LEDs indicate the status of the relay (Trip condition, alarm LED, equipment failure, auxiliary supply).

The four lower LEDs are freely programmable by the user and can be assigned to display a threshold crossing for example (available for all models) or to show the status of the logic inputs.The description of each one of these eight LEDs located in the left side of the front view is given hereafter (numbered from the top to bottom from 1 to 8):



LED 1 ***Colour: RED*** ***Label: Trip***

LED 1 indicates when a trip command has been issued by the relay to the cut-off element (circuit breaker, protection trip). This LED copies the trip command issued to the trip output relay contact (RL1). In its normal state the LED is not lit. It is illuminated as soon as a trip order is issued. It is reset when the associated alarm is acknowledged.

LED 2 ***Colour: ORANGE*** ***Label: Alarm***

LED 2 indicates that an alarm has been registered by MiCOM P125, P126 & P127 relays. The alarms are either threshold crossings (instantaneous) or tripping orders (time delayed). The LED will flash until the alarms have been accepted (read key), after which the LED will change to constant illumination. It will extinguish when the alarms have been cleared (clear key) and the trip cause is reset.

LED 3 ***Colour: ORANGE*** ***Label: Warning***

LED 3 is dedicated to the internal alarms of MiCOM P125, P126 & P127 relays.

When a "non critical" internal alarm (i.e. a communication fault) is detected, the LED flashes continuously. When the fault is classed as "critical", the LED is illuminated continuously. The LED only extinguishes after the cause that provoked this fault has been removed (i.e. repair of the module, disappearance of the fault).

LED 4 ***Colour: GREEN*** ***Label: Healthy***

LED 4 indicates that MiCOM P125, P126 and P127 relays are in correct working order and the auxiliary power supply is present.

LED 5 to 8 ***Colour: RED*** ***Label: Aux.1 to 4.***

These LEDs can be programmed by the user on the basis of information on available thresholds (instantaneous and time-delayed). The user selects the information he wishes to see associates with each LED from the menu element (Logic OR). Each LED illuminates when the associated information is valid. The extinguishing of each LED is linked to the acknowledgement of the associated alarms.

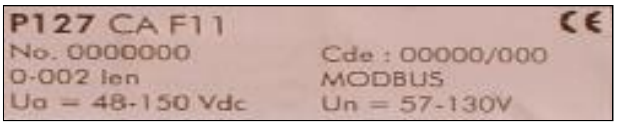
1.1.5 Description of the two areas under the top and bottom flaps

1.1.5.1 Relay Identification

Under the top hinged cover there is an adhesive paper label that contains the relay model number, serial number, sensitive earth current range, rating information and the Cortec code for ordering etc.

Each item on the label is described below:

P127CAF11: CORTEC code
This code allows the user to identify the characteristics of the relay.
No.: 0000000: Serial number
Cde: 00000/000: Reference to the purchasing order.
These numbers are needed when contacting Schneider Electric in case of problems.
Un = 57 – 130V: Voltage input range.
Modbus: Communication protocol of the RS485 communication port situated on the rear of the relay.
0.002 Ien: Sensitivity of the earth fault current (available are three sensitivity levels).
Ua = 48-150V DC: Auxiliary power supply range. In this example, the power supply must be a DC voltage.



1.1.5.2 Battery compartment (no longer used) and Communication Port

Under the bottom hinged cover of the relay there was a battery compartment to hold the ½AA size battery, which is no longer used. Starting from Hardware 5, disturbance, fault and event records are stored on a flash memory card that doesn't need to be backed up by a battery. Therefore battery in the front compartment of the relay are no longer needed. The battery compartment is fitted with a blanking cover.

Next to the (empty) battery compartment there is a 9-pin female D-type socket, which can be used to communicate with a local PC (up to 15m distance) via a RS232 serial data link cable (SK1 port).

1.1.5.3 The USB/RS232 cable (to power and set the relay)

The USB/RS232 cable is able to perform the following functions:

1. It is able to power the relay from its front port. This allows the user to view or modify data on the relay even when the auxiliary power supply of the relay has failed or when the relay is not connected to any power supply. The USB port of the PC supplies the power necessary to energize the relay. This lasts as long as the battery of the PC can last.

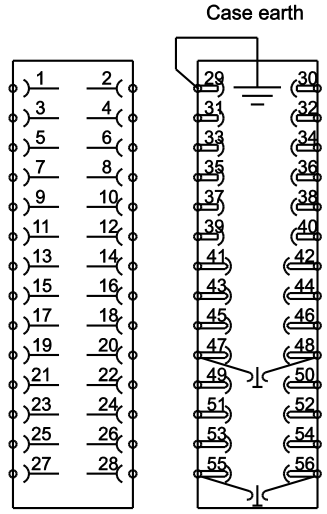
2. It provides an USB / RS 232 interface between the MiCOM relay and the PC. This allows the user to be able to change the setting of the relay using a PC with its USB port.

It eases the use of the relay allowing the retrieval of records and disturbance files for example when the auxiliary supply has failed or is not available.

The associated driver (supplied with the relay) needs to be installed in the PC. For more information , please refer to MiCOM E2 User Manual.

1.1.6 Description of rear Terminal Block for P125, P126 & P127

1.1.6.1 Description of rear Terminal Block for P125



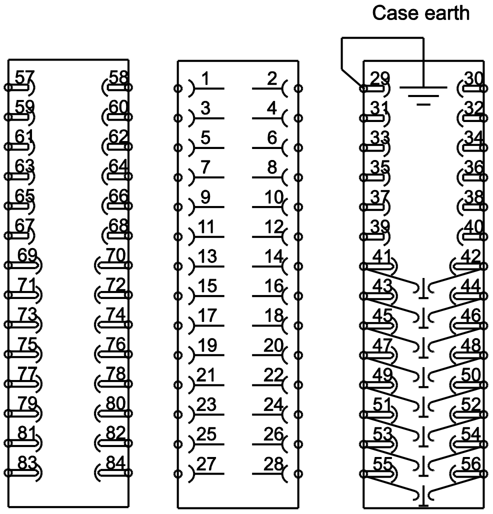
Module terminal blocks
viewed from rear
(with integral case earth link)

P0071ENb

Output 5	**1**	**2**	Common output 1
Common output 5	**3**	**4**	Output 1 (NC)
Output 6	**5**	**6**	Output1 (NO)
Common output 6	**7**	**8**	Common output 2
	9	**10**	Output 2 (NC)
	11	**12**	Output 2 (NO)
	13	**14**	Output 3
	15	**16**	Common output 3
Input 3 + terminal	**17**	**18**	Output 4
Input 3 – terminal	**19**	**20**	Common output 4
Input 4 + terminal	**21**	**22**	Input 1 + terminal
Input 4 – terminal	**23**	**24**	Input 1 – terminal
	25	**26**	Input 2 + terminal
	27	**28**	Input 2 – terminal

Case earth connection	**29**	**30**	Terminal RS485
RS485 - terminal	**31**	**32**	RS485 +
Vaux + terminal	**33**	**34**	Vaux – terminal
Relay failed (WD)	**35**	**36**	Common "Watchdog"
Relay healthy (WD)	**37**	**38**	
Residual volt. input	**39**	**40**	Residual volt. input
	41	**42**	
	43	**44**	
	45	**46**	
Current input (5A)	**47**	**48**	Current input (5A)
	49	**50**	
	51	**52**	
	53	**54**	
Current input (1A)	**55**	**56**	Current input (1A)

1.1.6.2 Description of rear Terminal Block for P126



Module terminal blocks
viewed from rear
(with integral case earth link)

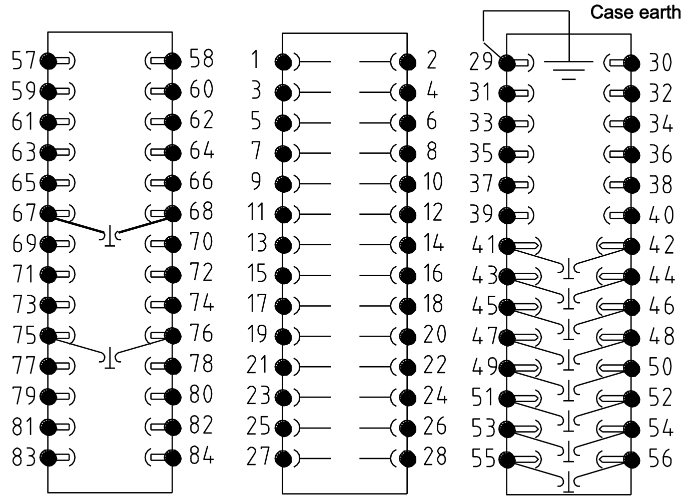
P0072ENb

Input 7 + terminal	**57**	**58**	Input 6 + terminal
Input 7 – terminal	**59**	**60**	Input 6 – terminal
	61	**62**	
	63	**64**	
	65	**66**	
	67	**68**	
	69	**70**	
	71	**72**	
Voltage input Vr	**73**	**74**	Voltage input Vr
	75	**76**	
	77	**78**	
	79	**80**	
	81	**82**	
	83	**84**	

Output 5	**1**	**2**	Common output 1
Common output 5	**3**	**4**	Output 1 (NC)
Output 6	**5**	**6**	Output1 (NO)
Common output 6	**7**	**8**	Common output 2
Common output 7	**9**	**10**	Output 2 (NC)
Output 7	**11**	**12**	Output 2 (NO)
Common output 8	**13**	**14**	Output 3
Output 8	**15**	**16**	Common output 3
Input 3 + terminal	**17**	**18**	Output 4
Input 3 – terminal	**19**	**20**	Common output 4
Input 4 + terminal	**21**	**22**	Input 1 + terminal
Input 4 – terminal	**23**	**24**	Input 1 – terminal
Input 5 + terminal	**25**	**26**	Input 2 + terminal
Input 5 – terminal	**27**	**28**	Input 2 – terminal

Case earth connection	**29**	**30**	Terminal RS485
RS485 - terminal	**31**	**32**	RS485 +
Vaux + terminal	**33**	**34**	Vaux – terminal
Relay failed (WD)	**35**	**36**	Common "Watchdog"
Relay healthy (WD)	**37**	**38**	
	39	**40**	
Current input IA (5A)	**41**	**42**	Current input IA (5A)
Current input IB (5A)	**43**	**44**	Current input IB (5A)
Current input IC(5A)	**45**	**46**	Current input IC(5A)
Current input Ie (5A)	**47**	**48**	Current input Ie(5A)
Current input IA (1A)	**49**	**50**	Current input IA (1A)
Current input IB (1A)	**51**	**52**	Current input IB (1A)
Current input IC (1A)	**53**	**54**	Current input IC (1A)
Current input Ie (1A)	**55**	**56**	Current input Ie (1A)

1.1.6.3 Description of rear Terminal Block for P127



Module terminal blocks
viewed from rear
(with integral case earth link)

P0072ENc

Input 7 + terminal	**57**	**58**	Input 6 + terminal
Input 7 – terminal	**59**	**60**	Input 6 – terminal
Input 8 + terminal (1)	**61**	**62**	Input COM – terminal (1)
Input A + terminal (1)	**63**	**64**	Input 9 + terminal (1)
Input C + terminal (1)	**65**	**66**	Input B + terminal (1)
Current I1 (3) meas. 1A/5A	**67**	**68**	Current I1 (3) meas. 1A/5A
Voltage input VA	**69**	**70**	Voltage input VA
Voltage input VB	**71**	**72**	Voltage input VB
Voltage input VC/Vr	**73**	**74**	Voltage input VC/Vr
Current I2 (3) meas. 1A/5A	**75**	**76**	Current I2 (3) meas. 1A/5A
Case earth connection(2)	**77**	**78**	RS485-2 term. Z (2)
RS485-2 – terminal (2)	**79**	**80**	RS485-2 + terminal (2)
IRIG-B mod – terminal (2)	**81**	**82**	IRIG-B mod + terminal (2)
IRIG-B dem – terminal (2)	**83**	**84**	IRIG-B dem + terminal (2)

Output 5	**1**	**2**	Common output 1
Common output 5	**3**	**4**	Output 1 (NC)
Output 6	**5**	**6**	Output1 (NO)
Common output 6	**7**	**8**	Common output 2
Common output 7	**9**	**10**	Output 2 (NC)
Output 7	**11**	**12**	Output 2 (NO)
Common output 8	**13**	**14**	Output 3
Output 8	**15**	**16**	Common output 3
Input 3 + terminal	**17**	**18**	Output 4
Input 3 – terminal	**19**	**20**	Common output 4
Input 4 + terminal	**21**	**22**	Input 1 + terminal
Input 4 – terminal	**23**	**24**	Input 1 – terminal
Input 5 + terminal	**25**	**26**	Input 2 + terminal
Input 5 – terminal	**27**	**28**	Input 2 – terminal

Case earth connection	**29**	**30**	Terminal RS485
RS485 - terminal	**31**	**32**	RS485 +
Vaux + terminal	**33**	**34**	Vaux – terminal
Relay failed (WD)	**35**	**36**	Common "Watchdog"
Relay healthy (WD)	**37**	**38**	
	39	**40**	
Current input IA (5A)	**41**	**42**	Current input IA (5A)
Current input IB (5A)	**43**	**44**	Current input IB (5A)
Current input IC(5A)	**45**	**46**	Current input IC(5A)
Current input Ie (5A)	**47**	**48**	Current input Ie(5A)
Current input IA (1A)	**49**	**50**	Current input IA (1A)
Current input IB (1A)	**51**	**52**	Current input IB (1A)
Current input IC (1A)	**53**	**54**	Current input IC (1A)
Current input Ie (1A)	**55**	**56**	Current input Ie (1A)

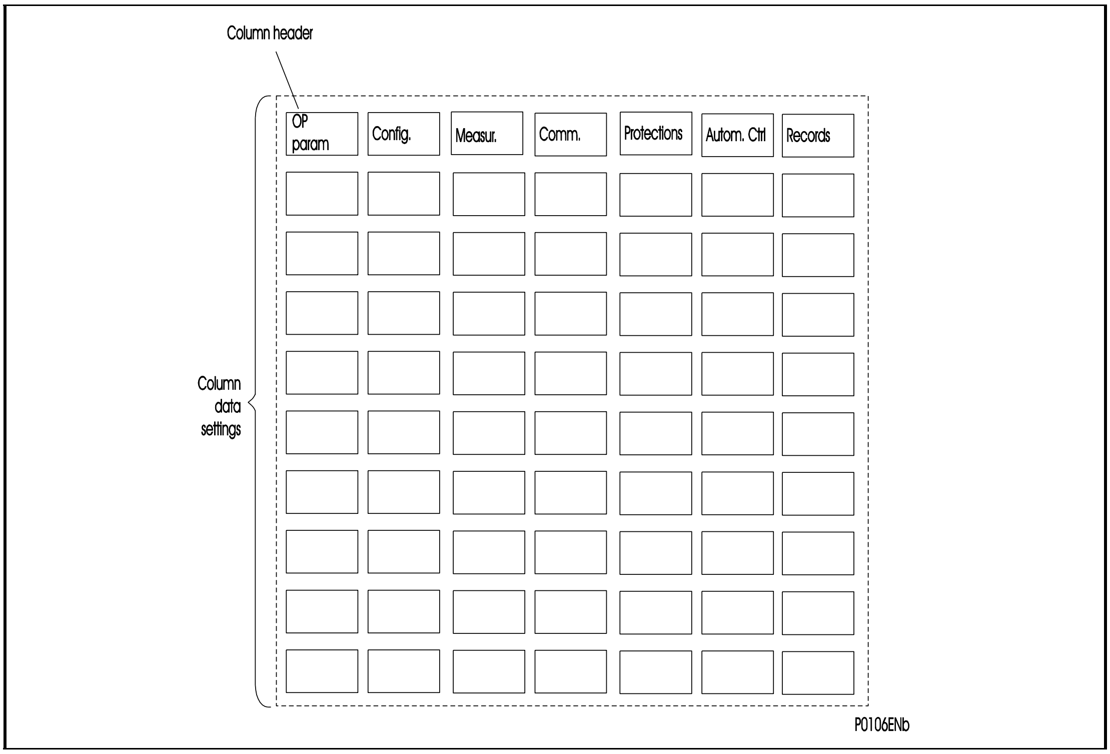
(1) Available only for P127 "5 opto-inputs" option (product codes P127xx1 or P127xx3). "Input COM – terminal" is the common terminal for inputs 8 to 12.

(2) Available only for P127 "IRIG-B and 2nd rear port option" option (product codes P127xx2 or P127xx3).
The "81" and "82" terminals are used to connect the optional BNC adaptor. This one must be plugged according to the "+" and "GND" positions marked on the adaptor.

(3) With I1 = IA or IB or IC and I2 = IA or IB or IC. Available only for P127 with additional measurement CT option (product codes P127xx4, P127xx5, P127xx6 or P127xx7).

1.2 Menu structure

The relay's menu is arranged in a tabular structure. Each setting in the menu is referred to as a cell, and each cell in the menu may be accessed by reference to a row and column address. The settings are arranged so that each column contains related settings, for example all of the disturbance recorder settings are contained within the same column. As shown in the figure, the top row of each column contains the heading that describes the settings contained within that column. Movement between the columns of the menu can only be made at the column heading level. A complete list of all of the menu settings is given in the Menu Content tables (P12y/EH HI section).



MENU STRUCTURE

1.3 Password

1.3.1 Password Protection

Password protection is applicable to most of the relay settings, especially to the selection of the various alarm thresholds, trip thresholds, communication parameters, allocation of logic inputs and outputs.

The password consists of four capital characters. When leaving the factory, the password is set to **AAAA**. The user can define any combination of four characters.

Should the password be lost or forgotten, modification of the stored parameters is blocked. It is then necessary to contact the manufacturer or his agent and a stand-by password specific to the relay concerned may be obtained.

The programming mode is indicated with the letter **"P"** on the right hand side of the display on each menu heading. The letter **"P"** remains present as long as the password is active (**5 minutes** if there is no action on the keypad).

1.3.2 Password Entry

The input of the password is requested as soon as a modification of a parameter is made for any one of the six/eight menus and the submenus. The user enters each of the 4 characters and then validates the entire password with ↵.

After 5 seconds, the display returns to the point of the preceding menu.

If no key is pressed inside of 5 minutes, the password is deactivated. A new password request is associated with any subsequent parameter modification.

1.3.3 Changing the Password

To change an active password, go to the OP. PARAMETERS menu and then to the Password submenu. Enter the current password and validate. Then press and enter the new password character by character and validate the new password using .

The message NEW PASSWORD OK is displayed to indicate that the new password has been accepted.

1.3.4 Change of Setting Invalidation

The procedure to modify a setting is shown in the next part of this document.

If during this action it occurs the need to get back to the old setting it is necessary push the key before validating the setting change. After this action the following message will appear on the LCD for some seconds and the old setting will be maintained.

UPGRADE **CANCEL**

1.4 Displays of Alarm & Warning Messages

Alarm messages are displayed directly on the front panel LCD. They have priority over the default current value. As soon as an alarm situation is detected by the relay (threshold crossing for example), the associated message is displayed on the MiCOM relay front panel LCD and the LED Alarm (LED 2) lights up.

The alarm and warning messages are classed as follows:

- Alarm messages generated by the electrical power network.
- Warning messages caused by hardware or software faults from the relay.

1.4.1 Electrical Network Alarms

Any crossing of a threshold (instantaneous or time delay) generates an "electrical network alarm". The involved threshold is indicated. Regarding the phase thresholds, the phase designation (A, B or C) is also displayed.

If several alarms are triggered, they are all stored in their order of appearance and presented on the LCD in reverse order of their detection (the most recent alarm first, the oldest alarm last). Each alarm message is numbered and the total stored is shown.

The user can read all the alarm messages by using .

The user acknowledges and clears the alarm messages from the LCD by using .

The user can acknowledge each alarm message one by one or all by going to the end of the list to acknowledge, and clear, all the alarm messages by using .

The control of the ALARM LED (LED 2) is directly assigned to the status of the alarm messages stored in the memory.

If one or several messages are NOT READ and NOT ACKNOWLEDGED, the ALARM LED (LED 2) flashes.

If all the messages have been READ but NOT ACKNOWLEDGED, the ALARM LED (LED 2) lights up continuously.

If all the messages have been ACKNOWLEDGED, and cleared, if the cause was reset, the ALARM LED (LED 2) is extinguished.

1.4.2 Relay Hardware or Software Warning Messages

Any software or hardware fault internal to MiCOM relay generates a "hardware/software alarm" that is stored in memory as a "Hardware Alarm". If several hardware alarms are detected they are all stored in their order of appearance. The warning messages are presented on the LCD in reverse order of their detection (the most recent first and the oldest last). Each warning message is numbered and the total stored is shown.

The user can read all warning messages by using , without entering the password.

The acknowledgement, and clearing, of a warning message caused by internal relay hardware or software faults is not possible. A warning message can only be made to disappear if the cause of the fault has been removed.

The control of the WARNING LED (LED 3) is directly assigned to the status of the warning messages stored in the memory:

The Watch Dog relay controls the correct operation of the protection and automation function. This relay fault “RL0 relay” is activated if the following functions or checks are faulty:

- microprocessor operation,
- power supply check,
- reconstituted internal power supply check,
- heating of a circuit board component monitoring,
- analog channel monitoring (acquisition sampling),
- programm execution monitoring,
- communication ports monitoring.

If the internal hardware or software fault is major (i.e. the relay cannot perform protection functions), the WARNING LED (LED 3) lights up continuously.

If the internal hardware or software fault is minor (i.e. a communication failure that has no influence on the protection and automation functions), the WARNING LED (LED 3) will flash.

Warning messages caused by internal hardware or software faults are:

< CALIBRATION ERROR >>

<< CLOCK ERROR >>

<< DEFAULT SETTINGS (*) >>

<< SETTING ERROR (**) >>

<< CT ERROR >>

<< COMMUNIC. ERROR >>

<< WATCH DOG >>

<< STAT RESET>>

(*) DEFAULT SETTINGS: Each time the relay is powered ON it will check its memory contents to determine whether the settings are set to the factory defaults. If the relay detects that the default settings are loaded an alarm is raised. The **ALARM LED (YELLOW)** will light up and the Watch Dog contact will be activated.

Only one parameter in the relay's menu needs to be changed to suppress these messages and to reset the watch dog. This alarm is only an indication to the user that the relay has its default settings applied.

(**) SETTING ERROR: Should the CPU fails to get correctly store data during a setting change, a "**HARDWARE**" **ALARM** will appear on the LCD display followed by "**SETTING ERROR**" message (when pushing on the button). In addition, the ALARM LED (YELLOW) will light up and the Watch Dog contact will be activated To reset this alarm it is necessary to power **ON** and **OFF** the relay. Following this, the last unsuccessful setting change will then need to be re-applied. If the alarm persists, i.e. the **"SETTING ERROR"** alarm is still displayed, please contact Schneider Electric Customer Care Center for advice and assistance.

Possible software alarm messages are:

I>	instantaneous 1^{st} threshold directional/non directional overcurrent
tI>	time delayed 1^{st} threshold directional/non directional overcurrent

For the I> and tI> a particular attention has to be taken.

The P126 & P127 are able to identify the phase where the fault occurs, and the relevant alarm messages are shown in the below listed table.

Menu ALARMS	
I> PHASE	tI> PHASE
A A	A A
B B	B B
C C	C C
A AB AB	A AB AB
A AB ABC	A AB ABC
ABC ABC ABC	ABC ABC ABC
ABC ABC	ABC ABC

The following messages are sorted in alphabetical order

The following table gives the list of alarms (sorted in alphabetical order) with description and type of acknowledgement. The five types of acknowledgement of alarm are:

– Man = alarm must be acknowledged manually (front panel or communication port),

– Self = self reset when time delayed alarm occurs (i.e. I> alarm is acknowledged when tI> occurs),

– Inhib = the alarm can be inhibited by setting (“CONFIGURATION/Alarms” menu),

– Auto = alarm is automatically acknowledged when the event disappears.

– manual reset using “ORDERS / Record Reset” menu.

Alarm	Description	Type
ΣAmps(n)	total Total measured current broken by CB is higher than the value set in AUTOMAT. CTRL/CB Supervision menu.	man
Recloser[79] Blockedint. locked [79] ext. locked	re-close (internal or external) blocking signal. Generated by: – external breaker failure signal (ex. SF6 low). – signal provided via logic input assigned to the CB Fail function in the AUTOMAT. CTRL/Inputs menu. – external blocking signal. External blocking can be set by the user in the PROTECTION G1 / [79] AUTORECLOSE/Ext Block menu. This blocking signal is provided via a logic input assigned to the Block_79 function in the AUTOMAT. CTRL/Inputs menu. – definitive trip. – breaker operating time (or tripping time) longer than the set time, but only if the function is enabled. – Trip of protection (See AP document for further information)	auto

Alarm	Description	Type
Brkn.Cond.	Broken conductor signal. I2/I1 element threshold exceeded for longer than tBC; tBC is settable in the AUTOMAT. CTRL/Broken Conductor menu.	man
CB Fail	Circuit breaker failure signal; the CB does not trip on Tbf (time-out). tBF is settable in the AUTOMAT. CTRL/CB Fail menu.	man
CB Open NB	number of circuit breaker operation higher that the value set in the AUTOMAT. CTRL/CB Supervision menu.	man
Conflict Recloser	configuration conflict of the re-close function. This signal is generated by: – None digital input assigned to the position of the CB 52a – no output relay assigned to the CB Close function (AUTOMAT. CTRL/Output Relays menu). – None protection is assigned to the trip command – no re-close cycle assigned to the protection functions (PROTECTION G1/ [79] Autoreclose menu).	auto
CTS	Current Transformer Supervision alarm	auto
dF/dt1 to dF/dt6	Rates of change of frequency (1 to 6).	man
EQU. A to EQU. H	Equation logic A, B, C, D, E, F, G or H set	inhib
F OUT	Frequency out of range	man
F1 to F6	Instantaneous 1st, 2nd, 3rd, 4th, 5th and 6th frequency threshold	man & self
I<	alarm threshold undercurrent fault	man & self
I>>	2nd alarm threshold directional/non directional overcurrent	man & self
I>>>	3rd alarm threshold directional/non directional overcurrent	man & self
I2>	1st alarm threshold negative sequence overcurrent	man & self
I2>>	2nd alarm threshold negative sequence overcurrent	man & self
I2>>>	3rd alarm threshold negative sequence current	man & self
Ie>	1st alarm threshold directional/non directional earth fault	man & self
Ie>>	2nd alarm threshold directional/non directional earth fault	man & self
Ie>>>	3rd alarm threshold directional/non directional earth fault	man & self
Ie_d>	First derived earth overcurrent threshold	man & self
Ie_d>>	Second derived earth overcurrent threshold	man & self
Latched Relays	at least one output relay is latched.	auto
Maintenance mode	The relay is in Maintenance mode	auto
P<	1st alarm threshold active underpower	man & self
P<<	2nd alarm threshold active underpower	man & self
P>	1st alarm threshold active overpower	man & self

Alarm	Description	Type
P>>	2nd alarm threshold active overpower	man & self
Pe/IeCos>	1st alarm threshold wattmetric/IeCos earth fault	man & self
Pe/IeCos>>	2nd alarm threshold wattmetric/IeCos earth fault	man & self
Q<	1st alarm threshold reactive underpower	man & self
Q<<	2nd alarm threshold reactive underpower	man & self
Q>	1st alarm threshold reactive overpower	man & self
Q>>	2nd alarm threshold reactive overpower	man & self
Recloser Successful	successful re-close signal. Indicates that the fault has been cleared upon circuit breaker re-closure, and has not re- appeared before expiry of the reclaim time.	auto
SF6 Low	faulty circuit breaker signal at assignable logic input (set in AUTOMAT. CTRL/Inputs menu).	auto
t U<	1st trip threshold undervoltage	inhib
t U<<	2nd trip threshold undervoltage	inhib
tAux1 to tAuxC	timer t Aux1 (to tAux C) associated with logic input Aux1 (tAux2, 3…C) Alarm occurs when the timer is expired and for any output relay assignement	inhib
tF1 to tF6	Time delayed 1st, 2nd, 3rd, 4th, 5th and 6th frequency threshold	man
Thermal Alarm	threshold thermal alarm	man
Thermal Overload	thermal overload trip	man
tI<	trip threshold undercurrent fault	man
tI>	1st trip threshold directional/non directional overcurrent	man
tI>>	2nd trip threshold directional/non directional overcurrent	man
tI>>>	3rd trip threshold directional/non directional overcurrent	man
tI2>	1st trip threshold negative sequence overcurrent	man
tI2>>	2nd trip threshold negative sequence current	man
tI2>>>	3rd trip threshold negative sequence current	man
tIe>	1st trip threshold directional/non directional earth fault	man
tIe>>	2nd trip threshold directional/non directional earth fault	man
tIe>>>	3rd trip threshold directional/non directional earth fault	man
tIe_d>	Time delayed first derived earth overcurrent threshold	man
tIe_d>>	Time delayed second derived earth overcurrent threshold	man
Toperating CB	operating Operating (or tripping) time of the circuit breaker longer than the value set in the AUTOMAT. CTRL/CB Supervision menu.	man

Alarm	Description	Type
tP<	1st trip threshold active underpower	man
tP<<	2nd trip threshold active underpower	man
tP>	1st trip threshold active overpower	man
tP>>	2nd trip threshold active overpower	man
tPe/IeCos>	1st trip threshold wattmetric/IeCos earth fault	man & self
tPe/IeCos>>	2nd trip threshold wattmetric/IeCos earth fault	man & self
tQ<	1st trip threshold reactive underpower	man
tQ<<	2nd trip threshold reactive underpower	man
tQ>	1st trip threshold reactive overpower	man
tQ>>	2nd trip threshold reactive overpower	man
Trip Circuit Super.	Circuit breaker trip circuit failure for longer than the supervision timer t SUP settable in the AUTOMAT.CTRL/CB Supervision menu or RL1 energised (trip circuit supervision not enabled).	man
tU>	1st trip threshold overvoltage	man
tU>>	2nd trip threshold overvoltage	man
tUe>>>>	trip threshold residual overvoltage	man
U<	1st alarm threshold undervoltage	inhib & self
U<<	2nd alarm threshold undervoltage	inhib & self
U>	1st alarm threshold overvoltage	man & self
U>>	2nd alarm threshold overvoltage	man & self
Ue>>>>	alarm threshold residual overvoltage	man & self
VTS	VTS alarm (internal VT fault, overloading, or faults on the interconnecting wiring) if enable (VT Supervision/VTS Alarm? = yes).	auto

1.5 General characteristics

1.5.1 Analogue Inputs

The analogue inputs for each relay are shown in the following table:

Type of Analogue Inputs	MiCOM P125	MiCOM P126	MiCOM P127
Phase current inputs (Protection CTs)		**3**	**3**
Optional phase current inputs (Measurements CTs)			**2**
Earth current inputs (high, medium, low sensitivity by Cortec code)	**1**	**1**	**1**
Residual voltage input	**1**	**1**	**1/0**
Phase to neutral or phase to phase voltage inputs			**2/3**
Total analogue inputs	**2**	**5**	**7**

Following is a description of the voltage inputs connection for the P127 relay.

Case A

2 phase to neutral voltage inputs

1 residual voltage input

VC is then calculated as VC= – (VA+ VB)

To obtain a correct reading of the input voltage the exact voltage transformer ratio for Ve has to be set.

Case B

2 phase to phase voltage inputs

VCA is then calculated as VCA= –(VAB + VBC)

Case C

3 phase to phase voltage inputs

No residual voltage input

Ve can be calculated as Ve = (VA+ VB+ VC)/3

- On the MiCOM P125 relays rear terminals there is one current input rated 1A and one current input rated 5A available and one voltage input. On the MiCOM P126 relay rear terminals there are four current inputs rated 1A and four current inputs rated 5A available and one voltage input. On the MiCOM P127 relay rear terminals there are four current inputs rated 1A and four current inputs rated 5A available and three voltages input.

- By using the Cortec code (see the appropriate section) the user can choose the voltage range for voltage inputs for the MiCOM P125 & P126 (one input) and P127 (three inputs).

All logic outputs can be programmed to respond to any of the available control or protection functions. Logic inputs can be assigned to various control functions.

All logic digital inputs can be programmed to respond to any of the available control or protection functions. Their supply level is the same as the power supply selected of the relay by Cortec. They can be supplied in A.C or D.C current by Cortec choice.

The MiCOM relays are powered either from a DC or an AC auxiliary power supply.

Any short time voltage interruption (<50ms) is filtered and regulated through the auxiliary power supply.

The front panel enables the user to navigate through the menu to access data, change settings, read measurements etc.

Eight LEDs on the front panel allow a clear and simple presentation of events. The various detected alarms are stored and can be displayed on the back-lit LCD.

No Password is required to read and acknowledge (clear) these alarm messages.

On their rear terminals the MiCOM P125, P126 & P127 relays have a standard RS485 port available. The user can choose, by ordering, the communication protocol ModBus RTU, IEC 60870-5-103 or DNP3 (when available).

Using the communication channel RS485, all stored information (measurements, alarms, and parameters) can be read and the settings can be modified if this functionality is allowed by the chosen protocol.

Evaluation and modification of this data can be carried out on site with a normal PC and the appropriate Schneider Electric software.

RS485 based communication allows MiCOM P125, P126 & P127 relays to be directly linked to a digital control system.

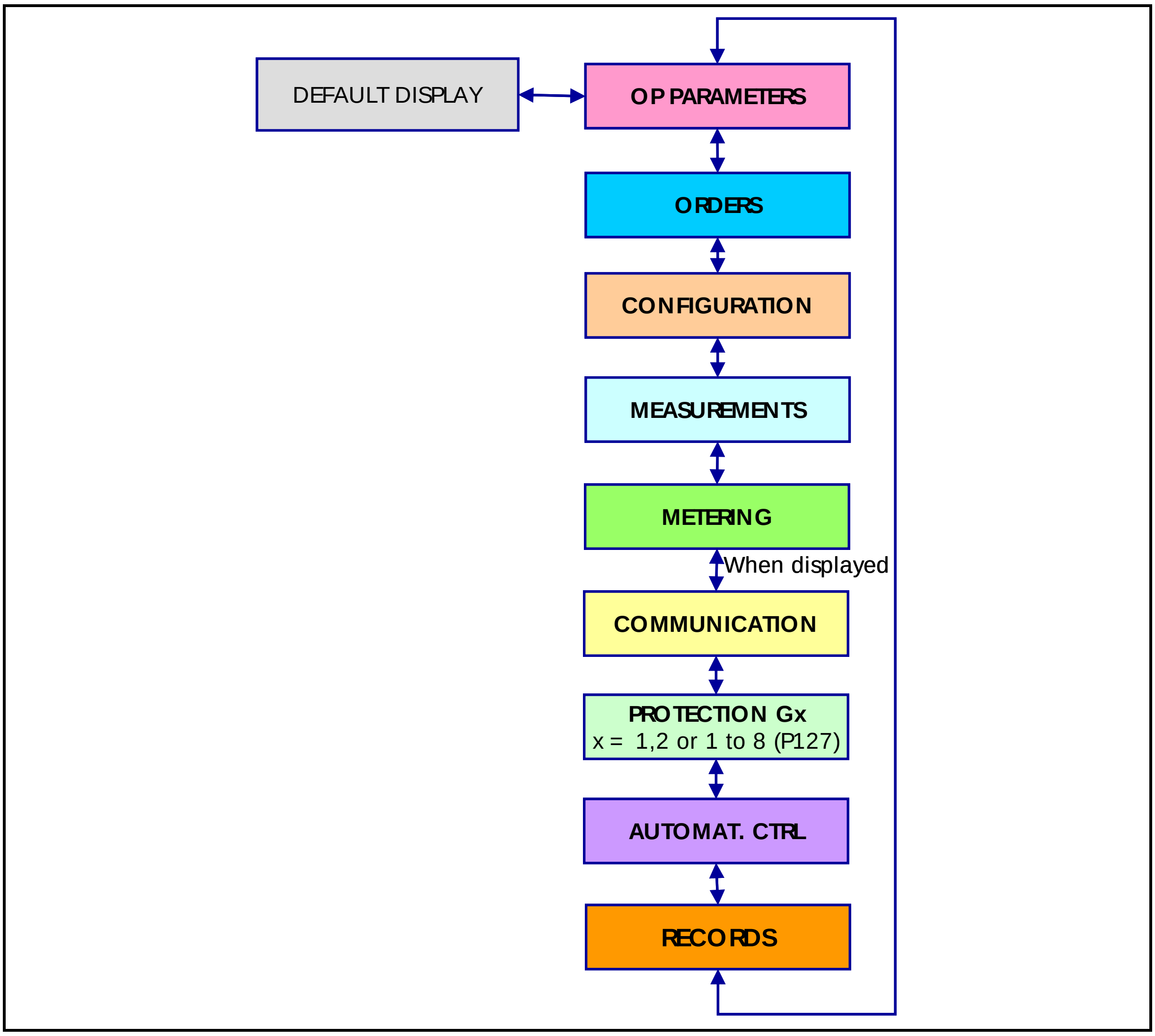
All the available data is then placed at the disposal of the supervisor and can be processed either local or remotely.

2. MENU

The menu for the MiCOM P125, P126 & P127 relays is divided into the following sections.

To access these menus from the default display press ⮉.

To return to the default display from these menus or submenus press ⮉.



2.1 OP PARAMETERS menu

To gain access to the OP PARAMETERS menu from the default display, press ⊗.

OP PARAMETERS	Heading of OP PARAMETERS menu. To gain access to the menu content, press ⊗.
Password ****	Entry of the password to be able to modify the MiCOM relay settings and parameters (see § 1.3).
Password AAAA	The password entry is made letter by letter, using ⊗ or ⊗ to go up or down in the alphabet. After each letter, press ⊗ to enter the following letter. At the end press ⊗ to validate the password. If the password is correct, the following message is displayed on the LCD: **PASSWORD OK**. The password is initially set in the factory to **AAAA**.

WARNING: NO SETTING CHANGES DONE EITHER LOCALLY (THROUGH RS232) OR REMOTELY (THROUGH RS485) WILL BE ALLOWED DURING THE 5 FIRST MINUTES FOLLOWING A CHANGE OF PASSWORD.

Language ENGLISH	Indicates the language used in the display.
Description P125-2	Indicates the type of relay, the near number is the sensitivity for the earth input circuit: from 0.1 to 40 Ien, from 0.01 to 8 Ien and from 0.002 to 1 Ien
Reference MiCOM	Displays the reference number that lists the equipment associated with the relay.
Software Version xx.x	Displays the software version downloaded
Frequency 50 Hz	Nominal value of the network frequency. Select either 50 or 60 Hz.
Active Group 1	This window displays the active protection and automatic features group.The display value can be 1 or 2 for P125/P126 and 1 to 8 for P127.
Input 7654321 Status 0110110	Displays the status of the logic Inputs. Logic inputs are numbered from 1 to 4 for P125 and 1 to 7 for P126 and P127. When the indicated status is - 0 the logic input is inactive; * 1 the logic input is active.
Input CBA98 Status 00000	Displays the status of the logic Inputs 8 to 12, only for P127 "5 opto-inputs" option (product codes P127xx1 or P127xx3)
Relay 87654321 Status 01011101	Displays the status of the logic outputs. Logic output relays are numbered from 1 to 6 for P125 and 1 to 8 for P126 and P127. When the indicated status is: - 1 the logic output relay is active; - 0 the logic output relay is inactive. To activate an unlatching operation, the password is requested. NOTE: The Watch-dog output (RL0) is not displayed in the output status menu.
Date 10/11/01	Displays the date (10/11/01 = November 10th 2001).
Time 13:57:44	Displays the time (13:57:44 = 1:57:44 pm).

2.2 ORDERS menu

This menu gives the possibility:

– to send open or close orders to the Circuit Breakers from the front panel. Open and close orders are written in the event file. This action generates a “Control Trip” alarm, which can be inhibited. If inhibited, the “trip” LED and the “Alarm” LED are not lit if the relay RL1 is ordered by a control trip information (affected to an input in the “configuration/inputs” submenu).

– to start a disturbance recording from the protection relay.

ORDERS	Heading of the ORDERS menu
Record reset **No**	“Record reset” clears LEDs, alarms, counters, disturbance records, fault records, disturbance records triggers, event records, measurements values (maximum phase currents), CB monitoring records (“CB opening time” and “CB closing time” values). The reset order does not reset the latched trip output relay RL1 or the latched output relays. To change the setting, enter the password (if necessary). In the “confirmation ?” cell, select Yes to apply the reset.
Open Order **No**	Sends manually an open order from the local control panel. This order is permanently assigned to the Trip output relay (selected with “automatic control/output relay” menu). Setting range: No, Yes. (the “confirmation ?” cell will be displayed after setting change)
Close Order **No**	Sends manually a close order from the local control panel: RL2 to RL8 (if configured) Setting range: No, Yes (the “confirmation ?” cell will be displayed after setting change)
Disturb rec start **No**	Trigs a disturbance recording from the relays HMI. Setting range: No, Yes (the “confirmation ?” cell will be displayed after setting change).

2.3 CONFIGURATION menu

The following parameters can be set in the CONFIGURATION menu:

- labels used to display currents and voltages,
- ratios for the earth and phase current transformers (CT)
- ratios for the phase measurements current transformers (CTm)
- ratios for the residual voltage and phase voltage transformers (VT),
- LEDs 5 to 8 assigned to several functions,
- The polarisation of the digital inputs by voltage present or lacking,
- The possibility to have the trip relay normally ON or OFF,
- The choice to enable alarms functionality as well as self reset on trip or instantaneous protection or other function,
- By the maintenance way to drive the output relays,
- To set the management date for the network in using.

The submenus are:

CONFIGUR-ATION			
General options (1)	**Transfo. ratio**	**Led 5**	**Led 6**
Led 7	**Led 8**	**Inputs configuration**	**Output relays**
Group Select	**Alarms**	**Date**	

(1) P126 and P127 only

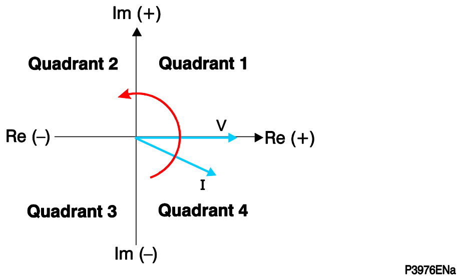
To gain access to the CONFIGURATION menu from the default display, press followed by until the desired submenu header is displayed.

2.3.1 Submenu General Options

The following submenu displays the connection mode only for the P127 and the default and phase rotation display only for the P126.The default display is fixed to **IN** and there is no VT connection setting choice.

CONFIGURATION	Heading of CONFIGURATION menu.
General Options	Heading of General Options submenu (1).
VT Connection **2Vpp+Vr**	P127 only Selection of the VT connection type (3Vpn, 2Vpp+Vr, 2Vpn+Vr). 3Vpn = 3 Phase-Neutral connection 2Vpp+Vr = two phase to phase plus an open delta connection 2Vpn+Vr = two phase to neutral plus an open delta connection See § 2.3.2 to select VTs configuration
VT Protection **Protect P–N**	P127 only, visible only if VT connection is “2Vpn+Vr” or “3Vpn”. Selection of the protection type: Phase – Phase or Phase - Neutral Setting choice “Protect P-N”, “Protect P-P”

Phase rotation **A-B-C**	P126 and P127 only Choose the phase rotation between either A-B-C or A-C-B.
CTm1 phase ? **none**	P127 only Configuration the first measurement CT phase: select the phase physically connected to CTm1. (Setting choices: none, IA, IB, IC)
CTm2 phase ? **none**	P127 only Configuration the second measurement CT phase: select the phase physically connected to CTm2. (Setting choices: none, IA, IB, IC)
Quadrant conv ? **Quadrant 1**	P127 only Configuration of the active and reactive power quadrant according to the following diagram. (Setting choices: 1 to 4)



Default Displays **RMS IA IB IC IN**	P126 and P127 only Configuration of the default current value displayed on the LCD panel, by selecting either Phase A (“RMS IA”), Phase B (“RMS IB”), Phase C (“RMS IC”), Earth N (“RMS IN”) or the four values simultaneously) (“RMS IA IB IC IN”) If the four values are simultaneously chosen, the values will be displayed as follows: IA RMS current IB RMS current IC RMS current IN RMS current Setting choice: “RMS IA”, “RMS IB”, “RMS IC”, “RMS IN” or “RMS IA IB IC IN.”
Earth Text **N**	P125 only Choose a label (displayed with the associated measurement value or in alarms messages) for earth Possible choices: N, o or E (modified after entering the password)
Phases/Earth Text **L1 L2 L3 N**	P126 and P127 only Choose a label (displayed with the associated measurement value, in alarms messages or in the default display) for the 3 phases and earth Possible choices: “L1 L2 L3 N”, “A B C o” or “R S T E” (modified after entering the password)
Iam Tdd denom **xx A** **Ibm Tdd denom** **xx A** **Icm Tdd denom** **xx A**	P127 only, with CT connected (measurement CT option). Set the value of IL (magnitude of the load of the system). IL is used to calculate the Total Demand Distorsion (TDD) (see metering menu, § 2.5.2 for detail). The default value is IAm, IBm or ICm value. If only one value is entered (for instance Iam Tdd denom = IAm), IAm will be the default value for “Ibm Tdd denom” and “Icm Tdd denom”. Setting Range: from 0.00% In to 200% In, step 1% In

Prot. Freq. Block **U< 5V**	Sets the voltage threshold below which frequency protection is blocked (1). Setting range: – from 5 to 130V, step 0.1 (voltage input range 57 to 130V, P127xA) – from 20 to 480V, step 0.1V (voltage input range 220 to 480V, P127xB)
dF/dt Cycles.nb. **5**	The dF/dt detection (rate of change of frequency) is defined as a calculation of an average frequency variation of the instantaneous values over a programmable number of cycles. This menu (1) adjusts the number of periods to calculate a dF/dt detection. (setting range from 1 to 200, step 1)
dF/dt Validat.nb= **4**	Sets the number of dF/dt detection to validate the dF/dt fault (1). (setting range from 1 to 12, step 1)
Inh.Block dF/dt **>20 Hz/s No**	If Yes is selected, the measurement of the frequency blocks the calculation when dF/dt exceeds ± 20Hz/s to avoid noise samples in the calculation (1), No: dF/dt measurement is always used for the calculation Setting choice: Yes or No)
Time Synchro. **IRIG-B**	Sets the time synchronization mode (2). Setting choices: – IRIG-B, Opto input, COMM1, COMM2: time is synchronized with the selected signal. – Automatic: the relay scans automatically IRIG-B, opto inputs, comm1 then comm2 to select the synchronization signal.
IRIG B **MODULATED**	Selects the modulated or unmodulated IRIG-B synchronization signal (2). Setting choice: Modulated/Demodulated

(1) P127 only
(2) P127 with optional functions only.

2.3.2 Voltage Connections

For the P127, it is important to select the VTs configuration in the 'Configuration / General Options / VT Connection" submenu, according to the relay wiring for a correct functionality of the voltage protections, or of the three phase and earth fault directional protections.

For the P127, there are three connection schemes for the VTs (see section P12y/EN CT).

2.3.2.1 Vpn (Three phase-neutral connection):

In this configuration, the relay directly measures Ua, Ub, and Uc and calculates internally the zero sequence voltage Ue = (1/3)[Ua+Ub+Uc]. This internal value Ue will be used to be compared to the threshold of Ue (the Earth Overvoltage Protection threshold and to evaluate the angle with the earth current for the earth fault directional protection). However, the Ue is displayed in the measurement Menu as well as the earth fault current and the relevant angle between them as IN, IN^UN.

2.3.2.2 2Vpn + Vr (Two phase-neutral plus an Open Delta connection):

In this configuration, the relay directly measures Ua and Ub. The input voltage of phase C of the relay (terminals 73-74) which is connected to the summation of the three voltage phases is used to be compared to the Ue (The earth Overvoltage Protection function threshold). This voltage at C input is considered as Ur and it is displayed in the measurement menu as UN.

Moreover for the phase Overvoltage and Undervoltage protection functions, the phase C voltage value Uc is internally reconstituted using the equation:

Uc = –(Ua+Ub). This value will be compared to the U/V or O/V threshold in case of a fault in phase C. Uc is not displayed in the measurement menu.

The reconstruction is valid if the Ur is measured from a transformer with 5 limbs; two used for the phase voltage Ua and Uc and the others used in Open delta configuration for the Ur.

BE CAREFUL: IF THE Ur IS MEASURED FROM A SEPARATE TRANSFORMER THE ABOVE RECONSTRUCTION IS NOT VALID AND CAN NOT BE USED.

2.3.2.3 Vpp + Vr (Two phase-phase plus an Open Delta connection)

The relay directly measures Uab and Ubc, the phase to phase (A-C) voltage value Uca is internally reconstituted using the equation Uca=–(Uab+Ubc).

The third input of voltage of the relay (terminals 73-74) can be connected to the output of a delta transformer or to a dedicated voltage transformer, the measured value can be used to compare to the earth overvoltage threshold.

This voltage is displayed in the measurement menu as UN and it is designed as the earth voltage.

The shown measurements are functions of system voltages taken at the relay inputs.

2.3.3 Submenu Transfo. Ratio

CONFIGURATION	
Transfo. Ratio	Heading of Transfo. Ratio submenu.
	Use ⇧ ⇩ ⇦ ⇨ to scroll and set available selections. Press ↵ to confirm choice. To gain access to the next window press ⇩. To gain access to the previous window press ⇧.
Line CT primary **5 A**	Displays the rated primary current of the line CT, from 1 to 9999 (1).
Line CT sec **5 A**	Displays the rated secondary current of the line CT (setting value: 1or 5) (1).
E/Gnd CT primary **5 A**	Displays the rated primary current of the earth CT from 1 to 9999.
E/Gnd CT sec **5 A**	Displays the rated secondary current of the earth CT (setting value: 1 or 5).
Line VT primary **0.10 kV**	Displays the rated primary voltage of the line VT (the rated voltage input range is given by relay Cortec code) from 0.1 to 1000kV (step 0.01kV). For the 10-480V model the setting range is from 10 to 480V, in steps of 1V (2).
Line VT sec **100.0 V**	Displays the rated secondary voltage of the line VT (Cortec code) from 2 to 130V (step 0.1V) This window is not available for the 10-480V model (2).

The two following lines are only displayed when the connection mode 2Vpp+Vr or 2Vpn+Vr is selected.

E/Gnd VT primary **0.10 kV**	Displays the rated primary voltage of the earth VT (Cortec code) from 0.1 to 1000kV (step 0.01kV). For the 10-480V model the setting range is from 10 to 480V, in steps of 1V (2).
E/Gnd VT sec **100.0 V**	Displays the rated secondary voltage of the earth VT (Cortec code): from 2 to 130V (step 0.1V). This window is not available for the 10-480V model (2).

The following lines are only displayed when the “measurement CT” option is present.

Line CTm primary **1°A**	Displays the rated primary current of the measurement CT, from 1 to 9999 (2). Setting range from 1 to 9999 A (step 1A)
Line CTm sec **1°A**	Displays the rated secondary current of the measurement CT (setting value: 1or 5) (2).

(1) P126 and P127 only
(2) P127 only

WARNING: **WITH THE P127 RELAY, NOT ALL MEASUREMENTS CAN BE READ IN THE DIRECT MODE. THESE MEASUREMENTS MUST BE READ IN THE INDIRECT MODE.**

These measurement values are called derived measurements. They depend on the selected electrical voltage connection mode.

2.3.4 Submenus to Configure LEDs 5 to 8

To gain access to the CONFIGURATION menu from the default display press . Then press until the submenu Led is reached.

To reach the LED configuration submenu press for Led 5. Press to reach Led 6, again to reach Led 7 and again to reach Led 8.

The following table lists the protection functions that can be assigned to the LEDs (5 to 8) for each MiCOM relay model.

Directional (P127) or three phase (P126) overcurrent protection.

TEXT	P125	P126	P127	Information
I>, I>, I>>>		X	X	Instantaneous 1^{st}, 2^{nd} and 3^{rd} phase overcurrent thresholds
tI>, tI>>, tI>>>		X	X	Time delayed 1^{st}, 2^{nd} and 3^{rd} phase overcurrent thresholds
tIA>, tIB>, tIC>		X	X	Time delayed first threshold trip on phases A, B, C

Directional earth fault protection

TEXT	P125	P126	P127	Information
Ie>, Ie>>, Ie>>>	X	X	X	Instantaneous 1^{st}, 2^{nd} and 3^{rd} earth thresholds
tIe>, tIe>>, tIe>>>	X	X	X	Time delayed 1^{st}, 2^{nd} and 3^{rd} earth thresholds
Ie_d>, Ie_d>>			X	Instantaneous 1^{st} and 2^{nd} derived earth overcurrent thresholds
tIe_d>, tIe_d>>			X	Time delayed 1^{st} and 2^{nd} derived earth overcurrent thresholds

Wattmetric Pe/IeCOS protection

TEXT	P125	P126	P127	Information

Pe/IeCos> Pe/IeCos>>	X	X	X	Instantaneous 1^{st} and 2^{nd} earth overpower/IeCos (wattmetric) thresholds
tPe/IeCos> tPe/IeCos>>	X	X	X	Time delayed 1^{st} and 2^{nd} earth overpower/IeCos (wattmetric) thresholds

Negative phase sequence overcurrent protection

TEXT	P125	P126	P127	Information
I2>, I2>>, I2>>>		X	X	Instantaneous 1^{st}, 2^{nd} and 3^{rd} negative phase sequence overcurrent thresholds
tI2>, tI2>>, tI2>>>		X	X	Time delayed 1^{st}, 2^{nd} and 3^{rd} negative phase sequence overcurrent thresholds

Thermal protection

TEXT	P125	P126	P127	Information
Therm Trip		X	X	Trip on Thermal overload

Three phase undercurrent protection

TEXT	P125	P126	P127	Information
I<		X	X	Instantaneous undercurrent threshold
tI<		X	X	Time delayed undercurrent threshold

Overvoltage protection

TEXT	P125	P126	P127	Information
U>, U>>			X	Instantaneous 1^{st} and 2^{nd} overvoltage thresholds
tU>, tU>>			X	Time delayed 1^{st} and 2^{nd} overvoltage thresholds

Undervoltage protection

TEXT	P125	P126	P127	Information
U<, U<<			X	Instantaneous 1^{st} and 2^{nd} undervoltage thresholds
tU<, tU<<			X	Time delayed 1^{st} and 2^{nd} undervoltage thresholds

Residual overvoltage protection

TEXT	P125	P126	P127	Information
Ue>>>>	X	X	X	Instantaneous derived earth overvoltage threshold
tUe>>>>	X	X	X	Time delayed derived earth overvoltage threshold

Negative overvoltage protection

TEXT	P125	P126	P127	Information
V2>, V2>>			X	Instantaneous 1^{st} and 2^{nd} negative overvoltage thresholds
tV2>, tV2>>			X	Time delayed 1^{st} and 2^{nd} negative overvoltage thresholds

Broken conductor protection

TEXT	P125	P126	P127	Information
Brkn. Cond		X	X	Broken conductor detection

CB Fail

TEXT	P125	P126	P127	Information

CB Fail		X	X	Detection of a Circuit Breaker failure (CB not open at the end of tBF timer)

Logic inputs

TEXT	P125	P126	P127	Information
Input1 to Input4	X	X	X	Copy of the status of logic inputs no 1, 2, 3 and 4 ("automat ctrl/inputs" menu)
Input5 to Input7		X	X	Copy of the status of logic inputs no 5, 6 and 7.
Input8 to InputC			X	Copy of the status of logic inputs no 8, 9, 10, 11 and 12 (option)

Autoreclose function

TEXT	P125	P126	P127	Information
79 Run		X	X	Signal that Autoreclose cycle is working
79i.Blocked		X	X	Autoreclose lock activated by the internal process of the autoreclose
79e.Blocked		X	X	Autoreclose lock activated by the input "block 79"

Auxiliary timers

TEXT	P125	P126	P127	Information
tAux1 to tAux4	X	X	X	Copy of Aux1 to Aux 4 logic input delayed by Aux1 to Aux4 time (Aux1…Aux4 logic input and aux1…aux4 time are set with "automat ctrl/inputs" menu)
tAux5 to tAux7		X	X	Copy of Aux5 to Aux7 logic inputs delayed by Aux 5 to Aux7 times
tAux8 to tAuxC			X	Copy of Aux8 to tAuxC logic inputs delayed by Aux 8 to tAuxC times (option)

t SOTF FUNCTION

TEXT	P125	P126	P127	Information
t SOTF		X	X	Switch on to fault timer expired

Active overpower protection

TEXT	P125	P126	P127	Information
P>, P>>			X	Instantaneous 1st and 2nd active overpower thresholds
tP>, tP>>			X	Time delayed 1st and 2nd active overpower thresholds

Active underpower protection

TEXT	P125	P126	P127	Information
P<, P<<			X	Instantaneous 1st and 2nd active underpower thresholds
tP<, tP<<			X	Time delayed 1st and 2nd active underpower thresholds

Reactive overpower protection

TEXT	P125	P126	P127	Information
Q>, Q>>			X	Instantaneous 1st and 2nd reactive overpower thresholds
tQ>, tQ>>			X	Time delayed 1st and 2nd reactive overpower thresholds

Reactive underpower protection

TEXT	P125	P126	P127	Information
Q<, Q<<			X	Instantaneous 1st and 2nd reactive underpower thresholds
tQ<, tQ<<			X	Time delayed 1st and 2nd reactive underpower thresholds

Voltage / Current Supervision function

TEXT	P125	P126	P127	Information
VTS			X	Voltage Transformer Supervision alarm, if enabled (VT Supervision/VTS Alarm? = yes)
CTS			X	Current Transformer Supervision alarm

Frequency protection

TEXT	P125	P126	P127	Information
F1 to F6			X	Instantaneous 1st to 6th frequency thresholds
tF1 to tF6			X	Time delayed 1st to 6th frequency thresholds
F Out			X	Frequency out of range signal

Rate of change of frequency

TEXT	P125	P126	P127	Information
dF/dt1 to dF/dt6			X	Instantaneous 1st to 6th rates of change of frequency.

Logic Equation

TEXT	P125	P126	P127	Information
tEQU.A to tEQU.H	X	X	X	Results of equations A to H.

MiCOM S1 Studio setting:

The LED 5 (6, 7 or 8) submenu contains up to 3 or 5 lines parameter settings. In the value column, each line represents a setting value. State "1" means that the corresponding parameter is associated to the LED.

The corresponding parameters are displayed in the setting panel: from 00 (last digit) up to 0D (first digit).

P12x Front panel setting:

Press to access the LED 5 CONFIGURATION submenu, then twice (press to access to others LEDs CONFIGURATION submenus).

Select "Yes" to assignate a LED to a function.

NOTES: Each parameter can be assigned to one or more LEDs.
One or more parameters (OR logic) can light each LED.

CONFIGURATION	
Led	Heading Led submenu.
	Activate (select choice "Yes" or inhibit ("No") LED 5 operation when:
Led 5 **protection function No**	Activate (select choice "Yes" or inhibit ("No") LED 5 operation when: - an alarm is exceeded, - a threshold time delay has elapsed. Refer to previous tables for protection functions list.

2.3.5 Submenu Logic Inputs Choice: Active High/Low

The inversion of the logic input in this menu inverts its allocated function status in the logic inputs allocation (AUTOMAT CTRL/INPUTS menu). For example: if EL 2 logic input is 1, then tAux1 = 0 when logic input is 1 and tAux1 = 1 when logic input is 0.

CONFIGURATION	
Inputs	Heading of configuration inputs submenu.
Inputs :7654321 **↑↓↓↓↑↑↑**	P125 (4 inputs), P126 and P127 (7 inputs) This menu is used to assign active high or low functionality to each logic input (1 to 7). ↑= active high, ↓= active low
Inputs :CBA98 **↑↓↓↓↑**	P127 (optional 12 inputs configuration): as above for input 8 to 12.
Voltage Input **DC**	Set choice AC or DC power supply for the digital input. The power supply for any input is the same one as much as the power supply for the relay.

2.3.6 Submenu Output Relays

CONFIGURATION	
Output Relays	Heading of the CONFIGURATION RELAYS MAINTENANCE submenu.
Fail Safe R. 87654321 **0000000**	P125 (6 relays), P126 and P127 (8 relays) This menu allows the user to invert each of the output relay contacts for the de-energised state. 1 = relay activated when driving signal is not active 0 = relay not activated when driving signal is not active
Maintenance Mode **Yes**	Choose if you want to activate the MAINTENANCE MODE of the relay. If the user selects Yes, output relays are disconnected from the protection and automation functions.
Relays CMD 8765W4321 **000000001**	P125 (6 relays + watchdog), P126 and P127 (8 relays + Watchdog) If the MAINTENANCE MODE is activated (set to Yes), this menu allows the user to activate each one of the output relay (from RL1 to RL8, W = Watchdog) 1 = relay activated 0 = relay not activated

2.3.7 Submenu Group Select

This submenu is used to select the active setting protection group, and to control the mode of changing of group.

The changing of the group is blocked when an alarm is active, except if this alarm is generated by a logic equation. If an order to change the group is generated when an alarm is active, the group will change when the alarm is cleared because the changing group order is recorded.

The setting group change is only executed when none protection function is running (except thermal overload function).

CONFIGURATION	
Group Select	Heading of the Group Select submenu.
Change Group **INPUT**	Selects the way to active the protection setting group. When "Input" is selected, "change set" should be assigned to a logical input in the 'AUTOMAT. CTRL / Inputs' menu. When "Menu" is selected, the setting group is activated: – locally by HMI, using "Setting Group" cell, – remotely, using communications port. Setting choice: Input or menu
Setting Group **1**	Displayed only when "Change group" = Menu. This cell is used either to activate locally a specific setting group or to define which value should be used when remote group switch command is received. A local setting change command can be perfomed by changing this value manually among [1 ; 2] for P125/P126 and among [1; 2 ; 3 ; 4 ; 5 ; 6 ; 7 ; 8] for P127. On P127, when remote group switch command is received, settings group will switch form 'setting Group' to 'Target group' and vice-versa. On P125/P126, 'Target group' doesn't exist as remote group switch command will switch from 1 to 2 or 2 to 1 by default Note: - Group will be actived only if no alarm is active - Active setting group is available in 'OP PARAMETERS / Active group' cell.
Target group **2**	Available on P127 only with setting choices from 0 to 8. 'Target group' defines the destination setting group. When remote group switch command is received, settings group will switch form 'setting Group' to 'Target group' and vice-versa. NOTE: If "0" is selected and remote group switch command is sned, the setting group will be switched from 'Active group' to 1. Next commands will switch settings group from 1 to 2 and vice-versa.

Group if low level G1	P127 only; displayed when “Change group” = Input. “Group if low level” defines which setting group should be activated when no voltage is received on the digital input (according ‘AUTOMAT. CTRL / Inputs’ menu)
Group if high level G2	“Group if high level” defines which setting group should be activated when polarization voltage is received on the digital input (according ‘AUTOMAT. CTRL / Inputs’ menu)
Group Copy ? No	P127 only. Yes: Copy the “copied from” selected group settings to “copied to” selected group.
copy from G1	P127 only. “Copy from” and “copy to” cells select the copy configuration.
copy to G1	Setting are unchanged when a setting group is copied to itself. A copy to an active group will overwrite the active setting. Setting choices: G1 to G8. The “Execution ?” cell will be displayed after “copy to” cell change: select Yes to apply the copy.

2.3.8 Submenu Alarms

CONFIGURATION	
Alarms	Heading of Alarms submenu.
Inst. Self-reset Yes	Enable/disable auto-acknowledgment mecanism of any instantaneous alarms/LEDs
Reset Led on Fault Yes	If selected, Reset Led on Fault will insure that only the latest active alarms/LEDs are present (other will be removed)
INH Alarm function ? No	Yes: the function will not raise an alarm. Alarm LED stays OFF no message will be displayed on the HMI. No: the function will raise an alarm. The default value is No (except “Inh Alarm Ctrl Trip”=Yes), In the inh Alarm sub-menus, when the event is noted as a time delayed threshold, the alarm is inhibited by the time delayed threshold and the corresponding instantaneous threshold (for instance, if “Inh Alarm tU<”= yes, U< and tU< will not raise an alarm. Note, If one of this function is set to Yes, the alarm will be inhibited if this one is NOT affected to RL1. Refer to the following table for trip list.

Event	Label description	P125	P126	P127
Ctrl_Trip ?	Control trip function assigned to the input. The default value value is Yes. The next table summarises the behaviour of control trip function when a control trip order is received by the relay.	X	X	X
tI< ?	Instantaneous and time delayed undercurrent threshold		X	X
tU< ?, tU<< ?	Instantaneous and time delayed 1st and 2nd undervoltage thresholds		X	X
tU> ?, tU>> ?	Instantaneous and time delayed 1st and 2nd overvoltage thresholds			X
tV2> ?, tV2>> ?	Instantaneous and time delayed 1st and 2nd negative overvoltage thresholds			X
tP< ? / tP<< ?	Instantaneous and time delayed first / second active underpower thresholds			X
tQ< ? / tQ<< ?	Instantaneous and time delayed first / second reactive underpower thresholds			X
F1 ? to F6 ?	Instantaneous 1st to 6th frequency threshold			X
F.out	Frequency out of range			X
[79] ext blk ?	Autoreclose locked by digital input		X	X
taux1? to tAux4?	Aux1 (to Aux 4) delayed by tAux1 (to tAux 4) time		X	X
taux5? to tAux7?	Aux5 (to Aux 7) delayed by tAux5 (to tAux 7) time		X	X
taux8? to tAuxC?	As above for tAux8 to tAuxC (optional configuration)			X
Eq A to Eq H	Logical output of boolean equation A to equation H	X	X	X

Case				
RL1 assigned to “Ctrl Trip”	No	No	Yes	Yes
“Ctrl trip” alarm inhibited	No	Yes	No	Yes
Result:				
LED trip	Off	Off	On	Off
LED Alarm	blinking	Off	blinking	Off
Alarm message on display	Yes	No	Yes	No
Event “EVT_TC_TRIP_X1” generated in the event file	Yes	Yes	Yes	Yes
Default recorded in the records/faul record menu	No	No	Yes	Yes
RL1 activated	No	No	Yes	Yes

2.3.9 Submenu Date

Menu	Description
CONFIGURATION	
Date	Heading type date submenu.
Date Format **PRIVATE**	Assigns free format date or IEC format date (This operation is seen from remote) Select choice: Private or IEC

2.4 MEASUREMENTS menu

By going to the MEASUREMENTS menu various system measurement values can be shown on the LCD.

The displayed voltage measures depend on which wiring scheme is choose.

The direct measure is the signal wires to the terminal.

The derived measure is the calculated.

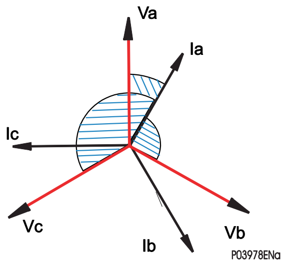
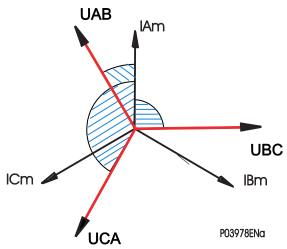
The RMS value is provided for the direct measures.

The fundamental value is provided for the derived (calculated) measures.

To gain access to the MEASUREMENTS menu from the default display, press then until the header of menu is reached.

The following table lists the items available in the measurements menu for the P125, P126 & P127 relays.

DISPLAY	UNIT	INFORMATION
MEASUREMENTS		Heading Measurements menu
Frequency 50.00 Hz	Hz	Displays the network frequency taken from analogue inputs having a reliable signal level. In case of non reliable analogue signal input level present the display shows XX.XX Hz.
I A (or I L1, or I R) I B (or I L2, or I S) I C (or I L3, or I T) IN (or I o, or I E)	A	Displays the A (or B, C or N) phase current (true RMS value) taking into account the phase CT ratio (CONFIGURATION/Transfo. Ratio submenu) [1]. The displayed label depends on the “Configuration / Phase/Earth Text” setting.
I1 I2	A	Displays the positive (I1) or negative (I2) sequence component [1].
RATIO I2/I1	%	Displays the ratio of I2/I1. This derived measurement is used by the Broken Conductor detection function. (Automat. Ctrl menu) [1].
UA UB UC	V	When a 3Vpn (three phases – neutral) or 2Vpn+Vr (two phase-neutral + open delta connection) connection mode is choosen, displays the RMS voltage value of phase A, or B or C [2],
UAB UBC UCA	V	When a 2Vpp+Vr (two phase-phase + open delta connection) connection mode is choosen, displays the calculated fondamental value of the line voltage UAB, or UBC, or UCA (vector calculus) [2].
UN	V	Displays the earth voltage taking in account the earth VT connection mode and ratio (General Options and Transfo. Ratio submenu).
Pe	W	Displays the neutral power based on neutral current value, neutral voltage and the relevant angle.
IeCos	A	Displays the active neutral current value.
IN ^ UN Angle	°	Displays the angle value between the Zero sequence voltage and earth fault current relevant.
IA ^ IB Angle IA ^ IC Angle	°	Displays the angle value between phase IA and IB, or between IA and IC [1].

DISPLAY	UNIT	INFORMATION
IA ^ VA Angle IA ^ VB Angle IA ^ VC Angle	°	When a 3Vpn (three phases – neutral) or 2Vpn+Vr (two phase-neutral + open delta connection) connection mode is choosen, displays the angle value between phase IA and voltage VA, or between phase IA and voltage VB, or between phase IA and voltage VC 
IA ^ VAB Angle IA ^ VBC Angle IN ^ UN Angle	°	When a 2Vpp+Vr (two phase-phase + open delta connection) connection mode is choosen, displays the angle value between phase IA and voltage VAB, or between phase IA and voltage VBC, or between the Zero sequence voltage and earth fault current.relevant. 
P	W	Displays the positive & negative active power. The maximum measured value displayed is 9999MW. If the measured value is above 9999MW this display remains on the LCD.
Q	VAR	As above for the positive & negative reactive power (see P12y/EN AP). Maximum measured value displayed is 9999MVAr. If the measured value is above, this display remains on the LCD.
S	VA	As above for the total apparent power (product of the per-element Volts and Amps). The maximum measured value displayed is 9999MVA. If the measured value is above, this display remains on the LCD.
Cos (Phi)	°	Displays the three phases power factor (cosine of the angle between the fundamental voltage vector and the fundamental current vector, see the following diagram).
Energy RST=[C]		Header for energy measurements. Allows the user to reset the measured energy value. To clear these values, press ©. Note: Password is requested to clear the display.
3Ph WHours Fwd	Wh	Displays the three phase active positive energy (forward). If the measured energy value is higher than 4200GWh then the display shows XXXX GWh
3Ph WHours Rev	Wh	Displays the three phase active negative energy (reverse). If the measured energy value is higher than 4200GWh then the display shows XXXX GWh
3Ph VArHours Fwd	Varh	Displays the three phase reactive energy forward. If the measured energy value is higher than 4200GVarh then the display shows XXXX GVarh

DISPLAY	UNIT	INFORMATION
3Ph VArHours Rev	Varh	Displays the three phase reactive energy reverse. If the measured energy value is higher than 4200GVarh then the display shows XXXX GVarh
3Ph VAHours	Vah	Displays the three phase apparent energy. If the measured energy value is higher than 4200 GVah then the display shows XXXX GVah
I N – fn RST=[C]	A	Displays the earth current I N (true RMS value) minus the earth current value at the fundamental frequency (value of the harmonic). To clear the value, press Ⓒ
THERMAL STATUS RST = [C]	%	Displays the % thermal state based on true RMS current phase values. To clear the % value, press Ⓒ (1).
MAX & AVERAGE RST = [C]		Allows the user to clear the maximum (peak) and average (rolling) memorised values of the current. To clear these values, press Ⓒ (1).
Max IA Rms Max IB Rms Max IC Rms	A	Displays the true RMS maximum current value for phase A, phase B or phase C (1).
Average IA Rms Average IB Rms Average IC Rms	A	Displays the true RMS average current value for phase A, phase B or phase C (1).
Max UAB Rms Max UBC Rms	V	Displays the true RMS maximum line voltage value for UAB or UBC (2).
Average UAB Rms Average UBC Rms	V	Displays the true RMS average line voltage value for UAB or UBC (2).
MAX SUBPERIOD RST = [C]		Allows the user to clear the maximum subperiod values of the 3 currents for each phase To clear the values, press Ⓒ (1).
MAX SUBPERIOD IA Rms IB Rms IC Rms	A	Display the IA, IB or IC peak value demand. The value is the true RMS maximum value on a subperiod (1).
ROLLING AVERAGE RST = [C]		Allows the user to clear the rolling average values of the 3 currents To clear the values, press Ⓒ (1).
ROLLING AVERAGE IA Rms IB Rms IC Rms	A	Display the IA, IB or IC average value demand. The value is the true RMS average value on a number of subperiod set in Record menu (1).
Reclose Stats RST = [C]		Allows the user to clear the statistics stored for the autoreclose function To clear the values, press Ⓒ (1).
Total recloses		Displays the total number of re-closings (1).
Cycle1 Recloses Cycle2 Recloses Cycle3 Recloses Cycle4 Recloses		Displays the total number of re-closings for cycle 1, cycle 2, cycle 3 or cycle 4 (1).
Total Trip & Lockout		Displays the total number of definitive trips issued by the autoreclose function (1).

(1) P126 and P127 only
(2) P127 only

2.5 METERING Menu (P127)

The “METERING” menu is only displayed when measurement current transformers are connected (optional configuration with product codes P127xx4, P127xx5, P127xx6 and P127xx7).

This menu is used to display:

– frequency,

– measured currents, total harmonics distortion (THD) and total demand distortion (TDD), K Factor, measured harmonics,

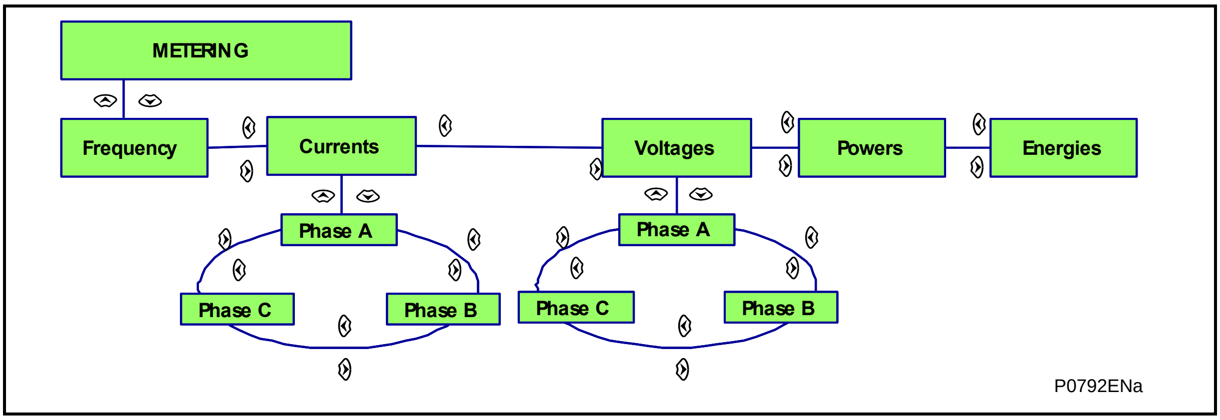
– voltages, total harmonics distortion (THD), harmonics,

– active / reactive / apparent powers,

– positive / negative energies (active / reactive),

To activate this menu, activate at least one “CTm1 phase ?” or CTm2 phase ?” in the ‘CONFIGURATION / General options’ menu (a measurement CT must be connected). The “metering” menu displays currents and voltages according to the table presented in the P12y/EN AP section.

To access METERING menu from the default display, press then until the header of menu is reached. The submenus of the Metering are:

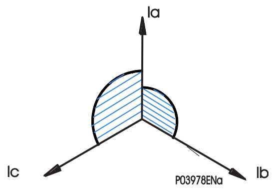


The following table lists the items available in the Metering menu for the P127 relay:

2.5.1 Submenu “Frequency”

DISPLAY	UNIT	INFORMATION
Submenu FREQUENCY		
Frequency	Hz	Displays the network frequency.

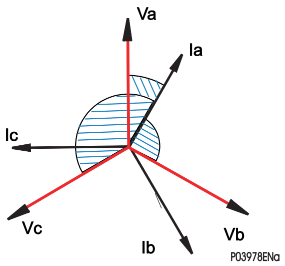
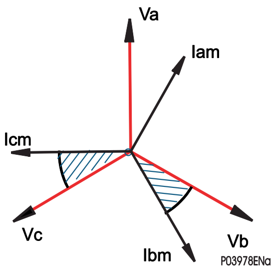
2.5.2 Submenu "Currents"

DISPLAY			UNIT	INFORMATION
Submenu CURRENTS				
Phase A	Phase B	Phase C		Use ◁ or ▷ keys to select phase B or phase C
IAm	IBm	ICm	A	Displays the magnitude of the measured current (true RMS value), taking in account the Quadrant convention and CTM ratio ('CONFIGURATION / General options' and 'Transfo ratio')
THDAm	THDBm	THDCm	%	Displays the percentage of the Total Harmonic Distortion (THD) measured for the current (irregular harmonics). For phase A: $THDAm = 100\% \times \frac{\sqrt{IAmh2?+IAmh3?+IAmh4?+\ldots}}{I1}$ with I1 = magnitude of fundamental current.
TDDAm	TDDBm	TDDCm	%	Displays the percentage of the Total Demand Distortion (TDD) measured for the current. For phase A: $TDDAm = 100\% \times \frac{\sqrt{IAmh2?+IAmh3?+IAmh4?+\ldots}}{IL}$ with IL = magnitude of the load of the system (set this value using 'CONFIGURATION / General options / IAm TDD denom.' menu.
	Iam^Ibm	Iam^Icm	°	Displays the angle value between phase IAm and IBm, or between phase IAm and ICm (Phase B only). 
KAm	KBm	KCm		Displays the K factor. K factor is a measure of the heating effects on transformers. For phase A: $KAM = 100 \times \frac{\sum_{i=1}^{10} IAmhi?\times i?}{\sum_{i=1}^{10} IAmhi?}$ with i = harmonic number.
IAmh2 to IAmh10	IBmh2 to IBmh10	ICmh2 to ICmh10	%	Displays the magnitude of the 2nd to 10th harmonics of the fundamental current

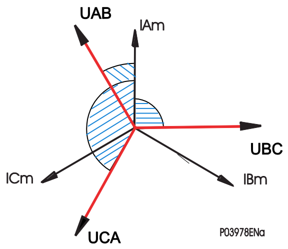
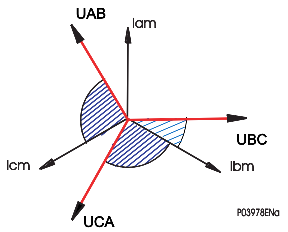
2.5.3 Submenu “Voltages”

The voltage metering depends on the VT connection and VT Protection settings (‘Configuration / General options’ menu). For more information about connection modes, refer to § 2.3.2. The voltage calculation mode, according to the connection, is given in the section P12y/EN AP.

2.5.3.1 Connection mode = 3Vpn AND “Protect P-N”, or 2Vpn+Vr AND “Protect P-N”

DISPLAY			UNIT	INFORMATION
Submenu VOLTAGES:				
Phase A	Phase B	Phase C		Use ⇦ or ⇨ keys to select phase B or phase C
VAm	VBm	VCm	V	Displays the magnitude of the VA, VB or VC voltage (true RMS value), taking in account the CTm ratio (‘CONFIGURATION / General options / Transfo ratio’)
THDAm	THDBm	THDCm	%	Displays the percentage of the Total Harmonic Distortion (THD) measured for the voltages (irregular harmonics). For phase A: $THDAm = 100\% \times \frac{\sqrt{VAm2? + VAm3? + VAm4? + \ldots}}{V1}$ with V1 = magnitude of fundamental Voltage.
Iam ^ Va	Iam ^ Vb	Iam ^ Vc	°	Displays the angle value between phase IA and voltage VA, VB or VC. 
	Ibm ^ Vb	Icm ^ Vc	°	Displays the angle value between phase IB and voltage VB, or between phase IC and voltage VC. 
VAmh2 to VAmh10			%	Displays the magnitude of the 2nd to 10th harmonics of the fundamental voltage

2.5.3.2 Connection mode = 3Vpp+Vr or "Protect P-P"

DISPLAY			UNIT	INFORMATION
Submenu VOLTAGES:				
Phase A	Phase B	Phase C		Use ⇦ or ⇨ keys to select phase B or phase C
UABm	UBCm	UCAm	V	Displays the calculated value of the line voltage UAB. (vector calculus), taking in account the CTm ratio ('CONFIGURATION / General options / Transfo ratio')
THDAm	THDBm	THDCm	%	Displays the percentage of the Total Harmonic Distortion (THD) measured for the voltages (irregular harmonics). See § 2.5.3.1
Iam^Uab	Iam^Ubc	Iam^Uca	°	Displays the angle value between phase IA and voltage UAB, UBC or UCA. 
Icm^Uab	Ibm^Ubc	Ibm^Uca	°	Displays the angle value between phase IC and voltage UAB, or between phase IB and voltage UBC or UCA, or between phase IC and voltage UCA. 
VABmh2 to VABmh10	VBCmh2 to VBCmh10	VCAmh2 to VCAmh10	%	Displays the magnitude of the 2nd to 10th harmonics of the fundamental voltage

2.5.4 Submenu Powers

DISPLAY	UNIT	INFORMATION
Submenu POWERS		
Pm	W	Displays the measured positive & negative active power.
Qm	VAR	Displays the measured positive & negative reactive power.
Sm	VA	Displays the measured total apparent power (product of the per-element Volts and Amps).
DPF	°	Displays the three Displacement Phase Power (DPF) factor (cosine of the angle between the fundamental voltage vector and the fundamental current vector).

See § 2.5.6 to see the convention for the positive (+) or negative (–) sign.

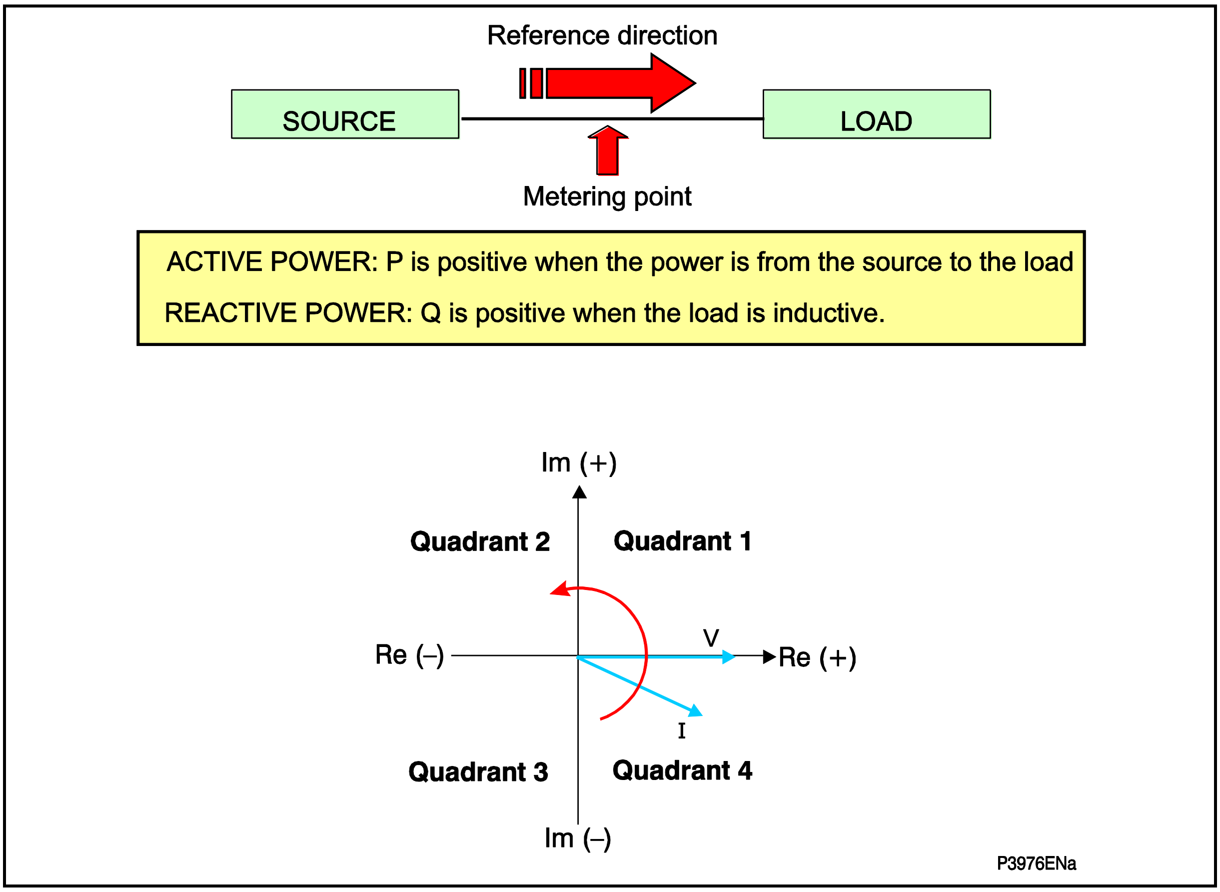
2.5.5 Submenu Energies

DISPLAY	UNIT	INFORMATION
Submenu ENERGIES		
RST = [C]		Allows the user to clear the measured energy values (export power, import power, lagging and Leading VARs). To clear these values, press ©. Note: Password is requested to clear the values.
Date		Displays the date of the beginning of the energies calculation (date of the last reset) (10/11/09 = November 10th 2009)
Time		Displays the hour of the beginning of the energies calculation (hour of the last reset) (13:57:44 = 1:57:44 pm).
Export Power	Wh	Displays the three phase active energy (forward) measured since the previously displayed date and time.
Import Power	Wh	Displays the three phase active energy (reverse) measured since the previously displayed date and time.
Lagging VARs	Varh	Displays the three phase reactive energy (forward) measured since the previously displayed date and time.
Leading VARs	Varh	Displays the three phase reactive energy (reverse) measured since the previously displayed date and time.

See § 2.5.6 to see the convention for the positive (+) or negative (–) sign.

2.5.6 Plus and minus signes for power and energy calculation.

Plus or minus signs are defined as follows:



with:

	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
Power				
Active (P)	+	–	–	+
Reactive (Q)	–	–	+	+
Energy				
Export Wh (Ea+)	+	–	–	+
Import Wh(Ea–)	–	+	+	–
Lagging VARh (Er+)	–	–	+	+
Leading VARh (Er–)	+	+	–	–

NOTE: Quadrant 1 is the default setting. See ‘CONFIGURATION / General options / Quadrant conv.’ menu to configure the active / reactive power quadrant.

2.6 COMMUNICATION menu

The COMMUNICATION menu depends:on the type of communications protocol: ModBus, IEC 60870-5-103 or DNP3.0 and on the connection type (P127 optional configuration)

To gain access to the COMMUNICATION menu from the default display, press then until the menu is reached.

COMMUNICATION	Heading of COMMUNICATION menu.
HMI ? **No**	Select Yes in order to use the front panel communication port. Setting choice: Yes or No
COMM1 ? **No**	Select Yes in order to use the first communication port. Setting choice: Yes or No
COMM2 ? **No**	P127 optional configuration only. Select Yes in order to use the second communication port. Setting choice: Yes or No

WARNING: A MODBUS NETWORK CAN ONLY COMPRISE **31 RELAY ADDRESSES + 1 RELAY MASTER** ON THE SAME MODBUS SUB-LAN.

2.6.1 HMI submenu

The following menu is displayed when "HMI" = Yes is selected.

HMI ? **Yes**	
Relay Address Modbus **1**	Indicates the front port communication address (MODBUS has native protocol)
Date format **Private**	Choose the format of the date, either PRIVATE or IEC protocol. Select from: Private or IEC.

2.6.2 COMM1 and COMM2 submenus

The following menu is displayed when "COMM1" or "COMM2" = Yes is selected. The first part of the following presentation is identical for the two communivation options.

COMM1 (or 2) ? **Yes**	
Baud Rate **19200 bd**	This cell controls the communication speed between relay and master station. It is important that both relay and master station are set at the same speed setting. Select from: 300, 600, 1200, 2400, 4800, 9600, 19200 or 38400 bd.
Parity **None**	Choose the parity in the ModBus data frame. Select parity: Even, Odd or None
Stop Bits **1**	Choose the number of stop bits in the DNP3.0 frame. Select 0 or 1 using . Press to validate your choice.
Relay Address **1**	This cell sets the unique address for the relay such that only one relay is accessed by master station software. Select from 1 to 255.

2.6.3 IEC60870-5-103 protocol additional cells

The following menu is specific to IEC60870-5-103 protocol.

Spont. event. &GI **A11 None**	Selection of spontaneous events and General Interrogation (events during a period) format. The events created by the relay have two formats (see P12y/EN CT chapter): - public range, using IEC protocol, - private range, using private number format. This command activates or deactivates private and public format transmission of the events to the master station. Select choice: None / Private only / IEC only / all
GI select. **Basic**	Selection of the General Interrogation data transmission: the list of basic (spontaneous messages) and advanced data sent to the master station during general interrogation is detailed in section P12y/EN CT, IEC 60870-5-103 part, § 1.3. Setting choice: Basic / Advanced
Measur. upload **ASDU 3.4 Yes**	Activates or deactivates the ASDU 3.4 measures transmission filtering mode. This option allows communication to the master station of earth current and earth voltage measures (IN and VN). Setting choice: Yes or No
Measur. upload **ASDU 9 Yes**	Activates or deactivates the ASDU 9 measures tansmission filtering mode. This option allows communication to the master station of: - phase current measures (IA, IB and IC), - phase voltage measures (VA, VB and VC) - frequency measures, - active and reactive power measures. Setting choice: Yes or No
Measur. upload **Other Yes**	Selects the measures transfert mode. This option allows communication of all measures. Setting choice: Yes or No
Events + Measur. **Blocking Yes**	Allows or blocks events and measurement communication Setting choice: Yes or No
Command **Blocking Yes**	Allows or blocks remote commands. Setting choice: Yes or No
Command duration **0.1s**	COMM1 only In order to avoid a transmission conflict between the two RS485 ports (optional configuration), transmission using the second port can be time-delayed. Transmission and reception with comm2 will start after the end of the “Command duration”. Setting range: from 0.1 to 30s, step 0.1s

2.7 PROTECTION menu

The protection menus are designated as PROTECTION G1 and PROTECTION G2 menu (available for the **MiCOM P125** and **P126**) and PROTECTION G1 to PROTECTION G8 menu available for the **MiCOM P127** relay. By opening the PROTECTION menu the user can program the parameters of various protection functions and settings (thresholds, time delay, logic) associated with each of the phase or earth protection functions.

The various submenus are:

PROTECTION G1 / G2 …G8

[67/50/51] Phase OC (1)	**[67N]E/ Gnd**	**[32] Phase power** (2)	**[32N] Earth Wattmetric** (1)
[46] Neg Seq OC (1)	**[49] Therm OL** (1)	**[37] Under current** (1)	**[59] Phase Over Voltage** (2)
[27] phase under voltage (2)	**[59N] residual** (1) **over voltage**	**[79] Autoreclose** (1)	**[81] Frequency** (2)
[81R] Freq. rate of change (2)			

(1) P126 and P127 only
(2) P127 only

2.7.1 Submenu [67/50/51] PHASE OC (P126 and P127 only)

The MiCOM P126 and P127 allow the following protections:

– P126: [50/51], three phase overcurrent,

– P127 [67/50/51], directional three phase overcurrent.

PROTECTION G1	
[67/50/51] Phase OC	Heading of [67/50/51] phase overcurrent submenu ("[50/51] PHASE OVERCURRENT").
I> ? **No**	Setting choice: No, Yes, DIR. - Yes, the first phase overcurrent threshold (I>) protection is enabled. The first phase overcurrent threshold protection submenu (see § 2.7.1.1) is displayed, - DIR: the relay operates like a three-phase directional overcurrent protection and the directional choice window (see § 2.7.1.1) is shown (P127 only), - No, the first phase overcurrent threshold (I>) protection is not enabled, and the next menu is the "I>> ?" menu.
I>> ? **Yes**	Selection of the second phase overcurrent threshold (I>>) protection. Setting choice: No, Yes, DIR, - Yes, the second phase overcurrent threshold (I>>) protection submenu is displayed (see § 2.7.1.2), - DIR, the relay operates like a three-phase directional overcurrent protection and the directional choice window is shown (P127 only), - No, the next window will show the "I>>> ?" menu.

I>>> ? **Yes**	Selection of the third phase overcurrent threshold (I>>>) protection. Setting choice: No, Yes, PEAK, DIR. - Yes: the third overcurrent threshold submenu is shown (see § 2.7.1.3) and I>>> threshold operates on Discrete Fourier transformation base, - DIR: the relay operates like a three-phase directional overcurrent protection, the directional windows are shown and I>>> threshold operates on Discrete Fourier transformation base (see § 2.7.1.3), - PEAK: The third threshold can be set to operate on the peak of the measured phase current. It compares the biggest peak value of the measured current against the setting (see § 2.7.1.3) , - No, next window will show the submenu [67] Phase OC.

2.7.1.1 Submenu First phase overcurrent threshold (I>) protection

I> ? **Yes**	"No", "Yes" or "DIR" option is selected. The first phase overcurrent threshold (I>) protection is enabled. If "DIR" is selected, "I> Torque" and "I> Trip zone" submenus are displayed.
I> **10.00 In**	Sets the value for the overcurrent threshold I>. The threshold setting range is from 0.1 to 25In (step 0.01In).
I> **Torque 90 °**	If "I> ?" = "DIR" only (P127 only). Displays setting value for the angle between voltage and current (see P12y/EN AP section) from 0° to 359° (step 1°).
I> **Trip Zone ±10 °**	If "I> ?" = "DIR" only (P127 only). Displays angle value for the Trip Zone. This defines the operating region to either side of the torque angle from ±10° to ±170°, in steps of 1°.
Delay Type **DMT**	Selects the time delay type associated with I>. Setting choices are: - "DMT" (definite minimum time): see a, - "RI" (electromechanical inverse time curve): section b, - IEC-xxx, CO2, CO8, IEEE-XX inverse time delay curve, see section c, - RECT curve, see section c.

a) Delay type = Definite Minimum Time

Delay Type **DMT**	"DMT" is selected
tI > **150.00 s**	Sets the time delay associated with I>. The setting range is from 0.040 to 150.0s (step 10ms).

b) Delay type = RI - electromechanical inverse time curve

Delay Type **RI**	Display of the I> inverse time delay (electromechanical RI curve).
K **2.500**	Selects the RI curve K value from 0.100 to 10 (step 0.005)
t Reset **60 ms**	Sets the reset time value from 0 to 100 s (step 10 ms)
I> >> >>> **Interlock Yes**	Interlock of first threshold by the second and third thresholds, but only if first threshold trip is set to IDMT. Setting choice: No, Yes

c) Delay type = IEC-xxx, RECT, COx or IEEE/ANSI

Delay Type **IEC-STI**	Display threshold delay type.
TMS **1.000**	Sets Time Multiplier Setting (TMS) value for the curve from 0.025 to 10.0 (step 0,001).
Reset Delay Type **DMT**	if “Delay type” = IEEE/ANSI or COx curve is selected only. Selects the reset delay time type. Select between DMT (Definitive Time) and IDMT (Inverse Time).
Rtms **0.025**	If “Reset Delay Type” = IDMT is selected. Sets the Reverse Time Multiplier Setting (RTMS) value associated with the IDMT reset time choice from 0.025 to 3.200 (step 0.001)
t Reset **0.10 s**	If “Reset Delay Type” is not “IDMT”. Sets the reset time value from 0 to 100 s (step 10 ms)
I> >> >>> **Interlock Yes**	Interlock of first threshold by the second and third thresholds, but only if first threshold trip is set to IDMT. Setting choice: No, Yes

2.7.1.2 Submenu second overcurrent threshold I>> protection

This section presents the main specific points for this submenu (I>> = Yes). Refer to § 2.7.1.1 for details (setting ranges, setting choices and availabilities).

I>> ? **Yes**	“Yes” or “DIR” option is selected. The second phase overcurrent threshold (I>) protection is enabled. If “DIR” is selected, “I> Torque” and “I> Trip zone” submenus are displayed.
I>> **10.00 In**	Sets the value for the overcurrent threshold. The threshold setting range is from 0.1 to 40 In (step 0.01) In.
I>> **Torque 90 °**	If “I>> ?” = “DIR” only. Displays setting value for the torque angle between voltage and current (see P12y/EN AP section) from 0° to 359° (step 1°).
I>> **Trip Zone ±10 °** **Trip** **Trip +/-**	If “I>> ?” = “DIR” only. Displays angle value for the Trip Zone. This defines the operating region to either side of the torque angle. Setting range is from ±10° to ±170°, in steps of 1°.

Delay Type **DMT**	Selects the time delay type associated with I>. Setting choices are: - "DMT" (definite minimum time): see a, - "RI" (electromechanical inverse time curve): section b,- - IEC-xxx, CO2, CO8, IEEE-XX inverse time delay curve, see c, - RECT curve, see section c..

a) Delay type = Definite Minimum Time

Identical to § 2.7.1.1, section a).

b) Delay type = RI - electromechanical inverse time curve

Identical to § 2.7.1.1, section b), excluding the "I> >> >>> Interlock" submenu.

c) Delay type = IEC-xxx, RECT, Cox or IEEE/ANSI

Identical to § 2.7.1.1, section b), excluding the "I> >> >>> Interlock" submenu.

2.7.1.3 Submenu Third phase overcurrent threshold (I>>>) protection

I>>> ? **Yes**	"Yes" or "No" or "DIR" or "PEAK" option is selected. The third phase overcurrent threshold (I>>>) protection is enabled. If "DIR" is selected, "I>>> Torque" and "I>>> Trip zone" submenus are displayed.
I>>> **10.00 In**	Displays setting value for the third overcurrent threshold I>>> from 0.1 to 40In (step 0.01In).
I>>> **Torque 90 °**	If ">>> ?" = "DIR" only. Displays setting value for the torque angle between current and voltage (see P12y/EN AP section), from 0° to 359° (step 1°).
I>>> **Trip Zone ±10 °**	If ">>> ?" = "DIR" only. Displays angle value for the Trip Zone. This defines the operating region to either side of the torque angle, from ±10° to 170° (step 1°).
tI>>> **150.00 s**	Sets the time delay associated with I>>>. The setting range is from 0 to 150 s (step 10ms).

2.7.2 Submenu [67N] E/GND

PROTECTION	Heading of Protection menu.
[67N] E/GND	Heading of the earth overcurrent protection submenu.
Ie> ? **No**	Setting choice: DIR, Yes or No - Yes: the first earth overcurrent threshold (Ie>) protection is enabled. The first earth overcurrent threshold submenu (see § 2.7.2.1) is displayed. - DIR: the relay operates like a three-phase directional overcurrent protection and the directional choice window (see § 2.7.2.1) is shown. - No: the first earth overcurrent threshold (Ie>) protection is not enabled, and the next menu is the "Ie>> ?" menu.

Ie>> ? **No**	Setting choice: DIR, Yes or No - Yes: the second earth overcurrent threshold (Ie>>) protection is enabled. The second earth overcurrent threshold submenu (see § 2.7.2.2) is displayed. - DIR: the relay operates like a three-phase directional overcurrent protection and the directional choice window (see § 2.7.2.2) is displayed. - No: the second earth overcurrent threshold (Ie>>) is not enabled, and the next menu is the “Ie>>> ?” menu.
Ie>>> ? **No**	Setting choice Yes, No, DIR and Peak - Yes: the third earth overcurrent threshold (Ie>>>) protection is enabled. The third earth overcurrent threshold submenu protection (see § 2.7.2.3) is displayed. - DIR: the relay operates like a three-phase directional overcurrent protection and the directional choice window (see § 2.7.2.3) is shown. - PEAK: The third threshold can be set to operate on the peak of the measured phase current. It compares the biggest peak value of the measured current against the setting (see § 2.7.2.3). - No: the third earth fault threshold (Ie>>>) is not enabled.
Ie_d> ? **No**	P127 only. Setting choice Yes, No or DIR Yes: the first derived earth overcurrent threshold (see § 2.7.2.4) is enabled. No: the first derived earth overcurrent threshold is disabled.
Ie_d>> ? **No**	P127 only. Setting choice Yes, No or DIR Yes: the second derived earth overcurrent threshold (see § 2.7.2.5) is enabled. No: the second derived earth overcurrent threshold is disabled.

2.7.2.1 Submenu First earth overcurrent threshold (Ie>) protection

Ie> ? **Yes**	“Yes” or “DIR” option is selected. The first earth overcurrent threshold (I>) protection is enabled. If “DIR” is selected, “Ue>”, “Ie> Torque” and “Ie> Trip zone” submenus are displayed.
Ie> **1.000 Ien**	Sets the value for the earth overcurrent threshold Ie>. The threshold setting range is from 0.002 to 1.000Ien (step 0.001Ien).
Ue> **5.0V**	If “Ie> ?” = “DIR” only. Displays setting value for the earth overvoltage threshold associated to Ie> (see P12y/EN AP section). Input voltage range 2–130V: The threshold setting range is from 1 to 260V, in steps of 0.1V. Input voltage range 10–480V: The threshold setting range is from 4 to 960V, in steps of 0.5V.
Ie> **Torque 0 °**	If “Ie> ?” = “DIR” only. Displays setting value for the torque angle between voltage and current (see P12y/EN AP section), from 0° to 359° (step 1°).
Ie> **Trip Zone ±10 °**	If “Ie> ?” = “DIR” only. Displays angle value for the Trip Zone. This defines the operating region to either side of the torque angle from ±10° to ±170°, in steps of 1°.

Delay Type **DMT**	Selects the time delay type associated with I>. Setting choices are: - "DMT" (definite minimum time): see section a, - "RI" (electromechanical inverse time curve): section b,- - IEC-xxx, CO2, CO8, IEEE-XX inverse time delay curve, see section c, - RECT curve, see section c..

a) Delay type = Definite Minimum Time

Delay Type **DMT**	"DMT" is selected
tIe > **150.00 s**	Sets the time delay associated with Ie>. The setting range is from 0.040 to 150.0s (step 10ms).
tReset **150.0 s**	Sets the reset time value from 0 to 100s (step 10ms).

b) Delay type = RI - electromechanical inverse time curve

Delay Type **RI**	Display of the I> inverse time delay (electromechanical RI curve).
K **1.000**	Selects the RI curve K value from 0.100 to 10 (step 0.005).
t Reset **0.10 s**	Sets the reset time value from 0 to 100s (step 10ms).
Ie> >> >>> **Interlock Yes**	Interlock of first threshold by the second and third thresholds, but only if first threshold trip is set to IDMT. Setting choice: No, Yes

c) Delay type = IEC-xxx, RECT, COx or IEEE/ANSI

Delay Type **IEC-STI**	Display threshold delay type.
TMS **1.000**	Sets time multiplier setting (TMS) value for the curve from 0.025 to 10.0 (step 0.001).
Reset Delay Type **DMT**	if "Delay type" = IEEE/ANSI or COx curve is selected only. Selects the reset delay time type. Select between DMT (Definitive Time) and IDMT (Inverse Time).
Rtms **0.025**	If "Reset Delay Type" = IDMT is selected. Sets the Reverse Time Multiplier Setting (RTMS) value associated with the IDMT reset time choice from 0.025 to 1.5 (step 0.001)
t Reset **0.10 s**	If "Reset Delay Type" is not "IDMT". Sets the reset time value from 0 to 100s (step 10ms)
Ie> >> >>> **Interlock Yes**	Interlock of first threshold by the second and third thresholds, but only if first threshold trip is set to IDMT. Setting choice: No, Yes

2.7.2.2 Submenu Second earth overcurrent threshold (Ie>>) protection

This section presents the main specific points for this submenu (Ie>> = Yes). Refer to § 2.7.2.1 for details (setting ranges, setting choices and availabilities).

Ie>> ? **Yes**	"Yes" or "DIR" option is selected. The second earth overcurrent threshold (Ie>>) protection is enabled. If "DIR" is selected, "Ue>>", "Ie>> Torque" and "Ie>> Trip zone" submenus are displayed.
Ie>> **1.000 Ien**	Sets the value for the second earth overcurrent threshold (Ie>>). Three earth overcurrent ranges are available: - from 0.002 to 1 Ien, in steps of 0.001 Ien. Cortec code C - from 0.01 to 8 Ien, in steps of 0.005 Ien. Cortec code B - from 0.1 to 40 Ien, in steps of 0.01 Ien. Cortec code A
Ue>> **5.0 V**	If "Ie>> ?" = "DIR" only. Sets the value for the earth overvoltage threshold associated to Ie>> (see P12y/EN AP section). Input voltage range 2–130V: The threshold setting range is from 1 to 260V, in steps of 0.1V. Input voltage range 10–480V: The threshold setting range is from 4 to 960V, in steps of 0.5V.
Ie>> **Torque 90 °**	If "Ie>> ?" = "DIR" only. Sets the value for the torque angle between voltage and current (see P12y/EN AP section), from 0° to 359 ° (step 1°).
Ie>> **Trip Zone ±10 °**	If "Ie>> ?" = "DIR" only. Sets angle value for the Trip Zone. This defines the operating region to either side of the torque angle. Setting range is from ±10° to ±170°, in steps of 1°.
Delay Type **DMT**	Selects the time delay type associated with I>>. Setting choices are: - "DMT" (definite minimum time): see section a, - "RI" (electromechanical inverse time curve): section b,- - IEC-xxx, CO2, CO8, IEEE-XX inverse time delay curve, see section c, - RECT curve, see section c..

a) Delay type = Definite Minimum Time

Identical to § 2.7.2.1, section a), with tIe> displaying setting value for the trip threshold (from 0 to 150s, step 10ms) and excluding the "Ie> >> >>> Interlock" submenu.

b) Delay type = RI - electromechanical inverse time curve

Identical to § 2.7.2.1, section b), excluding the "Ie> >> >>> Interlock" submenu.

c) Delay type = IEC-xxx, RECT, Cox or IEEE/ANSI

Identical to § 2.7.2.1, section b), excluding the "Ie> >> >>> Interlock" submenu.

2.7.2.3 Submenu Third earth overcurrent threshold (Ie>>>) protection

Ie>>> ? **Yes**	"Yes", "No", "DIR" or "PEAK" option is selected. The third earth overcurrent threshold (Ie>>>) protection is enabled. If "DIR" is selected, "Ue>>>", "Ie>>> Torque" and "Ie>>> Trip zone" submenus are displayed.
Ie>>> **1.000 Ien**	Sets the value for the third overcurrent threshold Ie>>>. Three earth overcurrent ranges are available: - from 0.002 to 1 Ien, in steps of 0.001 Ien. Cortec code C - from 0.01 to 8 Ien, in steps of 0.005 Ien. Cortec code B - from 0.1 to 40 Ien, in steps of 0.01 Ien. Cortec code A
Ue>>> **5.0 V**	If "Ie>>> ?" = DIR only Sets the values for the earth overvoltage threshold Ue>>> associated to Ie>>> (see P12y/EN AP section). Input voltage range 2–130V: The threshold setting range is from 1 to 260V, in steps of 0.1V. Input voltage range 10–480V: The threshold setting range is from 4 to 960V, in steps of 0.5V.
Ie>>> **Torque 90 °**	If "Ie>>> ?" = DIR only Sets the value for the torque angle between voltage and current (see P12y/EN AP section), from 0° to 359 °, (step 1°).
Ie>>> **Trip Zone ±10 °**	If "Ie>>> ?" = DIR only Sets angle value for the Trip Zone. This defines the operating region to either side of the torque angle. Setting range is from ±10° to ±170°, in steps of 1°.
tIe>>> **0.04 s**	Sets the time delay associated with Ie>>>, from 0 to 150 s, in steps of 10ms.
tReset **0.10 s**	Sets the value for the reset time, from 0 to 100 s, in steps of 10ms.

2.7.2.4 Submenu first derived earth overcurrent threshold (Ie_d>) protection

This section presents the main specific points for this submenu (tIe_d> = Yes or DIR). The first stage of derived earth protection, Ie_d>, represents the vectorial sum of the three phases. Refer to § 2.7.2.1 for details (setting ranges, setting choices and availabilities).

Ie_d> ? **Yes**	"Yes" or "DIR" option is selected. The first derived earth overcurrent threshold (Ie_d>) protection is enabled.
Ie_d> **1.000 Ien**	Sets the value for the derived earth overcurrent Ie_d> Setting range from 0.10 Ien to 40.00 Ien, in steps of 0.01 Ien, default value: 1.00 Ien
Ue(Ie_d>) **100.0 V**	If "Ie_d> ?" = DIR only Sets the values for the earth overvoltage threshold Ue>>>> associated to Ie_d>. Input voltage range 2–130V: The threshold setting range is from 1 to 260V, in steps of 0.1V. Input voltage range 10–480V: The threshold setting range is from 4 to 720V, in steps of 0.5V.
Ie_d> **Torque 90 °**	If "Ie_d> ?" = DIR only Sets the value for the torque angle between voltage and current. Setting range from 0° to 359 ° (step 1°).

Ie_d> **Trip Zone ±10 °**	If "Ie_d> ?" = DIR only Sets angle value for the Trip Zone. This defines the operating region to either side of the torque angle. Setting range is from ±10° to ±170°, in steps of 1°.
Delay Type **DMT**	Selects the time delay type associated with Ie_d>. Setting choices "DMT": see a, "IDMT": see b, "RI": see c.

a) Delay type = Definite Minimum Time

Delay Type **DMT**	"DMT" is selected
tIe_d> **0.000 s**	Set the value for the time delay associated with Ie_d> from 0.00s to 150.0s (step 0.01s)
t Reset **0 ms**	Reset time value. Setting range from 0.00s to 100.0s, step 0.01s.

b) Delay type = Inverse Definite Minimum Time

Identical to § 2.7.2.1, section b).

c) Delay type = RI - electromechanical inverse time curve

Identical to § 2.7.2.1, section c).

2.7.2.5 Submenu second derived earth overcurrent threshold (Ie_d>>) protection

This section presents the main specific points for this submenu (tIe_d>> = Yes or DIR). Ie_d>> is the second stage of derived earth protection. Refer to § 2.7.2.1 for details (setting ranges, setting choices and availabilities).

Ie_d>> ? **Yes**	"Yes" or "DIR" option is selected. The second derived earth overcurrent threshold (Ie_d>>) protection is enabled.
Ie_d>> **1.000 Ien**	Sets the value for the derived earth overcurrent Ie_d>> Setting range from 0.10 Ien to 40.00 Ien, in steps of 0.01 Ien, default value: 1.00 Ien
Ue(Ie_d>>) **100.0 V**	If "Ie_d>> ?" = DIR only Sets the values for the earth overvoltage threshold Ue>>>> associated to Ie_d>>. Input voltage range 2–130V: The threshold setting range is from 1 to 260V, in steps of 0.1V. Input voltage range 10–480V: The threshold setting range is from 4 to 720V, in steps of 0.5V.
Ie_d>> **Torque 90 °**	If "Ie_d>> ?" = DIR only Sets the value for the torque angle between voltage and current. Setting range from 0° to 359 ° (step 1°).
Ie_d>> **Trip Zone ±10 °**	If "Ie_d>> ?" = DIR only Sets angle value for the Trip Zone. This defines the operating region to either side of the torque angle. Setting range is from ±10° to ±170°, in steps of 1°.
Delay Type **DMT**	Selects the time delay type associated with Ie_d>>. Setting choices "DMT": see a, "IDMT": see b, "RI": see c.

a) Delay type = Definite Minimum Time

Delay Type **DMT**	"DMT" is selected
tIe_d>> **0.000 s**	Set the value for the time delay associated with Ie_d>> from 0.00s to 150.0s (step 0.01s)
t Reset **0 ms**	Reset time value. Setting range from 0.00s to 100.0s, step 0.01s.

b) Delay type = Inverse Definite Minimum Time

Identical to § 2.7.2.1, section b).

c) Delay type = RI - electromechanical inverse time curve

Identical to § 2.7.2.1, section c).

2.7.3 Submenu [32] DIRECTIONAL POWER (P127 only)

The following table is a summary table of the measured parameters in according to the configuration scheme:

	Configuration 3Vpn	Displayed on HMI	Configuration 2Vpn+Vr	Displayed on HMI	Configuration 2Vpp + Vr	Displayed on HMI
P (kW)	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
Q (KVAr)	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
S (KVA)	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
Cos(Phi) [°]	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
3Ph WHours Fwd	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
3Ph WHours Rev	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
3Ph VAr-Hours Fwd	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
3Ph VAr-Hours Rev	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
3Ph VA-Hours	Direct measurement	Yes	Derived measurement	Yes	Derived measurement	Yes

2.7.3.1 Threshold setting

In the following menu, default menu displayed for P>, P>>, P<, P<<, Q>, Q>>, Q< and Q<< is noted “10000× 1W”. The value displayed on MiCOM P127 HMI depends on the “input voltage range” and “line secondary CT” parameters. The following table gives the various cases of the setting ranges:

Input voltage range	Line secondary CT	Setting range				
		Min	Max	Step	Default value	
					Overpower	Underpower
2-130V	1A	1× 1W	10000× 1W	1× 1W	10000× 1W	1× 1W
	5A	1× 5W	10000× 5W	1× 5W	10000× 5W	1× 5W
10-480V	1A	5× 1W	40000× 1W	1× 1W	40000× 1W	5× 1W
	5A	5× 5W	40000× 5W	1× 5W	40000× 5W	5× 5W

To obtain the power value in W, multiply the selected number by 1W or 5W. Example, for 100:

– if the secondary of the CT = 1A, the HMI will display “100× 1W” and P> = 100W,

– if the secondary of the CT = 5A, the HMI will display “100× 5W” and P> = 500W.

PROTECTION

[32] Directional Power

Heading of three-phase active or reactive over power protection.
This protection monitors:

– the active overpower limits for the two thresholds P> and P>>,
– the active underpower limits for the two thresholds P< and P<<,
– the reactive overpower limits for the two thresholds Q> and Q>>,
– the reactive underpower limits for the two thresholds Q< and Q<<,

For all the threshods, a directional angle can be adjusted between triggering power

2.7.3.2 Active overpower protection

This directional power protection part follows “[32] directional power” menu. This part of the menu monitors the active overpower thresholds P> and P>>.

P> ?
No

Selection of the first active overpower threshold (P>) protection.
Setting choice: No, Yes
Yes: “P>”, “Directional Angle” and “tP>” menu are displayed and P> protection is active,
No, the next window will show the threshold menu “P>> ?”.

P>
10000x 1W

If “P> ?” = Yes only
Sets the value for the first active overpower threshold P>.
Default value: 10kW or 40kW or 50kW or 200kW (see § 2.7.3.1)

Directional Angle
0°

If “P>> ?” = Yes only
Selection of the directional angle between active power and triggering power.
Setting range from 0° to 359°, step 1°

tP> **0.00 s**	If “P> ?” = Yes only Sets the time delay associated with P>. The setting range is from 0 to 150s, in steps of 10ms.
P>> ? **No**	Selection of the second active overpower threshold (P>>) protection. Setting choice: No, Yes Yes: “P>>”, “Directional Angle” and “tP>>” menu are displayed and P>> protection is active, No: the next menu is “P< ?”
P>> **10000x 1W**	If “P>> ?” = Yes only Sets the value for the second active overpower threshold P>>. Default value: 10kW or 40kW or 50kW or 200kW (see § 2.7.3.1)
Directional Angle **0°**	If “P>> ?” = Yes only Selection of the directional angle between active power and triggering power. Setting range from 0° to 359°, step 1°
tP>> **0.00 s**	If “P>> ?” = Yes only Sets the time delay associated with P>>.. The setting range is from 0 to 150s, in steps of 10ms.

2.7.3.3 Reactive overpower protection

This directional power protection part follows “P<” (if No) or “tP<” menu. This part of the menu monitors the active overpower thresholds Q> and Q>>.

Q> ? **No**	Selection of the first reactive overpower threshold (Q>) protection. Setting choice: No, Yes Yes: “Q>”, “Directional Angle” and “tQ>” menu are displayed and Q> protection is active, No, the next window will show the threshold menu “Q>> ?”.
Q> **10000x 1W**	If “Q> ?” = Yes only Sets the value for the first reactive overpower threshold Q>. Default value: 10kW or 40kW or 50kW or 200kW (see § 2.7.3.1)
Directional Angle **0°**	If “Q>> ?” = Yes only Selection of the directional angle between reactive power and triggering power. Setting range from 0° to 359°, step 1°
tQ> **0.00 s**	If “Q> ?” = Yes only Sets the time delay associated with Q>. The setting range is from 0 to 150s, in steps of 10ms.
Q>> ? **No**	Selection of the second reactive overpower threshold (Q>>) protection. Setting choice: No, Yes Yes: “Q>>”, “Directional Angle” and “tQ>>” menu are displayed and Q>> protection is active, No: the next menu is “Q< ?”
Q>> **10000x 1W**	If “Q>> ?” = Yes only Sets the value for the second reactive overpower threshold Q>>. Default value: 10kW or 40kW or 50kW or 200kW (see § 2.7.3.1)

Directional Angle **0°**	If “Q>> ?” = Yes only Selection of the directional angle between reactive power and triggering power. Setting range from 0° to 359°, step 1°
tQ>> **0.00 s**	If “Q>> ?” = Yes only Sets the time delay associated with Q>>. The setting range is from 0 to 150s, in steps of 10ms.

2.7.3.4 Active underpower protection

This directional power protection part follows “P>>” (if No) or “tP>>” menu. This part of the menu monitors the active underpower thresholds P< and P<<.

P< ? **No**	Selection of the first active underpower threshold (P<) protection. Setting choice: No, Yes Yes: “P<”, “Directional Angle” and “tP<” menu are displayed and P< protection is active, No, the next window will show the threshold menu “P<< ?”.
P< **1x 1W**	If “P< ?” = Yes only Sets the value for the first active underpower threshold P<. Default value: 1W or 5W or 20W or 25W (see § 2.7.3.1)
Directional Angle **0°**	If “P< ?” = Yes only Selection of the directional angle between active power and triggering power. Setting range from 0° to 359°, step 1°
tP< **0.00 s**	If “P< ?” = Yes only Sets the time delay associated with P<. The setting range is from 0 to 150s, in steps of 10ms.
P<< ? **No**	Selection of the second active underpower threshold (P<<) protection. Setting choice: No, Yes Yes: “P<<”, “Directional Angle” and “tP<<” menu are displayed and P<< protection is active,
P<< **10000x 1W**	If “P<< ?” = Yes only Sets the value for the second active underpower threshold P<<. Default value: 1W or 5W or 20W or 25W (see § 2.7.3.1)
Directional Angle **0°**	If “P<< ?” = Yes only Selection of the directional angle between active power and triggering power. Setting range from 0° to 359°, step 1°
tP<< **0.00 s**	If “P<< ?” = Yes only Sets the time delay associated with P<<.. The setting range is from 0 to 150s, in steps of 10ms.

2.7.3.5 Underpower protection

This directional power protection part follows “Q>>” (if No) or “tQ>>” menu. This part of the menu monitors the active underpower thresholds Q< and Q<<.

Q< ? **No**	Selection of the first reactive underpower threshold (Q<) protection. Setting choice: No, Yes Yes: “Q<”, “Directional Angle” and “tQ<” menu are displayed and Q< protection is active, No, the next window will show the threshold menu “Q<< ?”.
Q< **1x 1W**	If “Q< ?” = Yes only Sets the value for the first reactive underpower threshold Q<. Default value: 1W or 5W or 20W or 25W (see § 2.7.3.1)
Directional Angle **0°**	If “Q< ?” = Yes only Selection of the directional angle between reactive power and triggering power. Setting range from 0° to 359°, step 1°
tQ< **0.00 s**	If “Q< ?” = Yes only Sets the time delay associated with Q<. The setting range is from 0 to 150s, in steps of 10ms.
Q<< ? **No**	Selection of the second reactive underpower threshold (Q<<) protection. Setting choice: No, Yes Yes: “Q<<”, “Directional Angle” and “tQ<<” menu are displayed and Q<< protection is active,
Q<< **10000x 1W**	If “Q<< ?” = Yes only Sets the value for the second reactive underpower threshold Q<<. Default value: 1W or 5W or 20W or 25W (see § 2.7.3.1)
Directional Angle **0°**	If “Q<< ?” = Yes only Selection of the directional angle between reactive power and triggering power. Setting range from 0° to 359°, step 1°
tQ<< **0.00 s**	If “Q<< ?” = Yes only Sets the time delay associated with Q<<. The setting range is from 0 to 150s, in steps of 10ms.

2.7.4 Submenu [32N] EARTH WATTMETRIC (P126 and P127 only)

PROTECTION	
[32N] Earth Wattmetric	Heading of [32N] earth wattmetric protection submenu.
[32N] Mode: **Pe**	Selection of the function mode: “Pe” (wattmetric) or “Ie Cos” (active component of the earth fault current). Each Pe and IeCos threshold has its own setting (time delay, threshold value etc), and the following instructionas are also valid for the two modes (Pe will change to IeCos>.
Pe> ? **No**	Selection of the first alarm threshold function for Pe>. These instructions are also valid for IeCos>. Setting choice: No, Yes Yes: the first earth wattmetric threshold (Pe> - Ie Cos) protection window is shown (see § 2.7.4.1) No: the next window will show the threshold menu “Pe>> ?” - “IeCos>> ?”).

Pe>> ? **No**	Selection of the second earth wattmetric threshold (Pe>>) protection. Setting choice: No, Yes Yes the second earth wattmetric threshold (Pe>> - IeCos>>) protection menu is shown (see § 0)
Pe> Pe>> **ANGLE 90°**	Only activated if at least one of the Pe/IeCos thresholds is enabled. Displays the setting angle for Pe/IeCos from 0° to 359° (step 1°). This angle is the RCA angle for the directional earth fault power.

2.7.4.1 First earth wattmetric threshold (Pe>) protection

Pe> **20 x 1 W**	Sets the value for the first earth wattmetric threshold Pe>. High sensitivity current: 0.001 to 1 In Input voltage range 2-130V: The setting range is from 0.2 to 20 x Ien W, in steps of 0.02 x Ien W. Input voltage range 10-480V: The setting range is from 1 to 80 x Ien W, in steps of 0.1 x Ien W. The setting range for IeCos> is from 0.002 to 1Ien, in steps of 0.001. Medium sensitivity current: 0.01 to 8 In Input voltage range 2-130V: The setting range is from 1 to 160 x Ien W, in steps of 0.1 x Ien W. Input voltage range 10-480V: The setting range is from 4 to 640 x Ien W, in steps of 0.5 x Ien W. The setting range for IeCos> is from 0.01 to 8 Ien, in steps of 0.005. Low sensitivity current: 0.1 to 40 In For range 2-130V from 10 to 800 x Ien W, in steps of 1 x Ien W. For range 10-480V from 40 to 3200 x Ien W, in steps of 5 x Ien W. The setting range for IeCos> is from 0.1 to 40 Ien, in steps of 0.01.
Delay Type **DMT**	Displays threshold delay time type. Setting choices are: DMT (definite time) RI for the electromechanical inverse time curve, IEC-XX, CO2, CO8, IEEE-XX inverse time delay curve and RECT curve.:
t Pe> **150.00 s**	If “Delay type” = DMT only Sets the value for the time delay associated with Pe> -or IeCos>), from 0 to 150s (step 10ms).
K **1.000**	If “Delay type” = RI only Selection of K value for the RI curve from 0.100 to 10 (step 0.005).
TMS **1.000**	If “Delay type” ≠ DMT and RI Sets the time multiplier setting (TMS) value for the curve from 0.025 to 10.0 (step 0,001).
Reset Delay Type **IDMT**	If “Delay type” = IEEE/ANSI only. Sets the reset delay time type. Select between DMT (Definitive Time) and IDMT (Inverse Time). If IDMT is selected, “RTMS” menu is displayed.
RTMS **1.000**	If “Reset Delay type” = IDMT only. Sets the Reverse Time Multiplier Setting (RTMS) value associated with the IDMT reset time choice, from 0.025 to 1.5 (step 0,001). tReset menu is not displayed.

tReset **0.10 s**	Sets the the reset time value. The setting range is from 0 to 100 s, in steps of 10ms.

2.7.4.2 Second earth wattmetric threshold (Pe>>) protection

Pe>> ? **Yes**	If the user selects Yes the following menu is shown.
Pe>> **20 x 1 W**	Sets the value for the earth second wattmetric threshold Pe>>. High sensitivity current: 0.001 to 1 In Input voltage range 2-130V: The setting range is from 0.2 to 20 x Ien W, in steps of 0.02 x Ien W. Input voltage range 10-480V: The setting range is from 1 to 80 x Ien W, in steps of 0.1 x Ien W. The setting range for IeCos>> is from 0.002 to 1In, in steps of 0.001. Medium sensitivity current: 0.01 to 8 In Input voltage range 2-130V: The setting range is from 1 to 160 x Ien W, in steps of 0.1 x Ien W. Input voltage range 10-480V: The setting range is from 4 to 640 x Ien W, in steps of 0.5 x Ien W. The setting range for IeCos>> is from 0.01 to 8 In, in steps of 0.005. Low sensitivity current: 0,1 to 40 In Input voltage range 2-130V: The setting range is from 10 to 800 x Ien W, in steps of1x Ien W. Input voltage range 10-480V: The setting range is from 40 to 3200 x Ien W, in steps of 5 x Ien W. The setting range for IeCos>> is from 0.5 to 40 In, in steps of 0.01.
tPe>> **1.00 s**	Sets the value for the second earth wattmetric threshold, from 0 to 150 s (step 10ms).
tReset **1.00 s**	Sets the value for the reset time from 0 to 100 s, in steps of 10ms.

2.7.5 Submenu [46] NEG SEQ OC (P126 & P127 only)

PROTECTION G1	
[46] Neg Seq OC	Heading of the negative phase sequence overcurrent threshold (I2>) protection submenu.
I2> ? **No**	Setting choice: Yes or No Yes: the first negative phase sequence overcurrent threshold (I2>) protection is enabled. The first negative phase sequence overcurrent threshold submenu (see § 2.7.5.1) is displayed. No: the first negative phase sequence overcurrent threshold (I2>) is not enabled, and the next menu is the "I2>> ?" menu.
I2>> ? **No**	Setting choice Yes or No Yes: the second negative phase sequence overcurrent threshold (I2>>) is enabled. The second negative phase sequence overcurrent threshold submenu (see § 2.7.5.2) is displayed. No: the second negative phase sequence overcurrent threshold (I2>>) is not enabled, and the next menu is the "I2>>> ?" menu.
I2>>> ? **No**	Setting choice Yes or No Yes: the third negative phase sequence overcurrent threshold (I2>>>) is enabled. The third negative phase sequence overcurrent threshold submenu (see § 2.7.5.3) is displayed. No: the third negative phase sequence overcurrent threshold (I2>>>) is not enabled.

2.7.5.1 Submenu First negative phase sequence overcurrent threshold (I2>) protection

I2> ? **Yes**	"Yes" option is selected. The first negative phase sequence overcurrent threshold (I2>) is enabled
I2> **1.00 In**	Sets the value for the first negative phase sequence overcurrent threshold I2>. The threshold setting range is from 0.1 to 25In (steps 0.01In).
Delay Type **DMT**	Displays threshold delay time type. Setting choices are: SMT, RI, RECT, IEEE EI, IEEE VI, C08, IEEE MI, C02, IEC LTI, IEC EI, IEC VI, IEC SI and IEC STI
tI2> **150.00 s**	If "Delay type" = DMT only Sets the time delay associated with the first negative phase sequence overcurrent threshold I2>, from 0 to 150 s (step 10ms).
K **1.000**	If "Delay type" = RI only Selection of K value for the RI curve from 0.100 to 10 (step 0.005).
TMS **1.000**	If "Delay type" ≠ DMT and RI Sets time multiplier setting (TMS) value associated to IEC family of curves from 0.025 to 10.0 (step 0,001).
Reset Delay Type **IDMT**	If "Delay type" = IEEE/ANSI only. Displays the reset delay time type. Select between DMT (Definitive Time) and IDMT (Inverse Time). If IDMT is selected, "RTMS" menu is displayed.

RTMS **1.000**	If "Reset Delay type" = IDMT only. Displays the Reverse Time Multiplier Setting (RTMS) value associated with the IDMT reset time choice, from 0.025 to 1.5 (step 0,001). tReset menu is not displayed.
tReset **0.10 s**	Displays setting value for the reset time. The setting range is from 0 to 100 s, in steps of 10ms.

2.7.5.2 Threshold Menu I2>>

I2>> ? **Yes**	"Yes" option is selected. second threshold of the negative phase sequence overcurrent I2>> is enabled
I2>> = **5.00 In**	Sets the second threshold of the negative phase sequence overcurrent I2>> The threshold setting range is from 0.5 to 40 In, in steps of 0.01 In.
t I2>> **150.00 s**	Sets the time delay associated with I2>> from 0 to 150s (steps 10ms).

2.7.5.3 Threshold Menu I2>>>

I2>>> ? **Yes**	"Yes" option is selected. Third threshold of the negative phase sequence overcurrent I2>> is enabled
I2>>> **10.00 In**	Sets the value for the third threshold of the negative phase sequence overcurrent I2>>, from 0.5 to 40In (step 0.01In).
t I2>>> **150.00 s**	Sets the time delay associated with I2>> from 0 to 150s (step 10ms)

2.7.6 Submenu [49] Therm OL (P126 & P127 only)

PROTECTION G1	
[49] Therm OL	Heading of [49] submenu.
Therm OL ? **Yes**	Setting choice Yes or No Yes: the thermal overload function is enabled. Then the following menu is displayed. No: the thermal overload function is not enabled, and no menu content is displayed.
Iθ > **0.50 In**	Sets the value for the thermal current threshold Iθ> from 0.1 to 3.2In (step 0.01In).
Te **10 mn**	Sets value for the Te thermal time constant associated with the thermal overload formula from 1 min to 200mn (step 1mn).
K **1.00**	Sets the value for the K factor associated with the thermal overload function, from 1 to 1.50 (step 0.01).
θ Trip **100%**	Displays the percentage applicable to the thermal overload trip threshold, from 50 to 200% (step 0.01).

θ Alarm ? **Yes**	Setting choice Yes or No. Yes: the thermal overload alarm function is enabled. Then the following menu is displayed. No: the thermal overload function is not enabled and the next menu is not activated.
θ Alarm **80%**	Sets the percentage applicable to the thermal overload alarm threshold, from 50 to 200% (step 0.01).

2.7.7 Submenu [37] UNDERCURRENT PROTECTION (P126 & P127)

Undercurrent function will:

- start as soon as the current of one phase is below I< threshold value (**OR** of the 3 phases current)
- trip if the current of one phase **-** at least - remains below this threshold during more than tI<.

I< starting could be inhibited when CB is open (52a)

```
Function I<          Yes
I<                   0.20 In
tI<                  0.00 s
Inhibition by 52A    Yes
```

PROTECTION G1	
[37] Under Current	Heading of [37] undercurrent submenu.
I< ? **Yes**	Setting choice Yes or No. Yes: the first undercurrent threshold (I<) protection is enabled. Then the following menu is displayed. No: the first undercurrent threshold (I<) protection is not enabled, and the next menu is not activated.
I< **0.10 In**	Sets the value for the undercurrent threshold I<, from 0.1 to 1In, in steps of 0.01In.
t I< **150.00 s**	Sets the time delay associated with I<, from 0 to 150 s (step 10ms).
I< inhibited on 52A **No**	When Yes is selected, this function inhibits undercurrent protection on circuit breaker (52A) trip.
I< inhibited on U< **No**	P127 only. When “Yes” is selected, this function inhibits undercurrent protection on threshold undervoltage and displays the following menu
I< inhibited on U< **10 V**	When “I< inhibited on U<” = Yes only. Displays setting value for the I< threshold, from 10 to 480V (step 0.1V)

2.7.8 Submenu [59] PHASE OVERVOLTAGE Protection (P127)

PROTECTION G1	
[59] Phase Over Voltage	Heading of [59] Phase over-Voltage submenu.
U> ? **AND**	Setting choice: No, AND or OR Selection of the first phase overvoltage threshold (U>) protection. If AND or OR is selected, the first phase overvoltage threshold (U>) protection is enabled. The first phase overvoltage threshold (U>) submenu is displayed, if OR is selected, the first overvoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. If No is selected, the first phase overvoltage threshold (U>) protection is not enabled and the next menu is the “U>> ?” menu.
U> **260.0 V**	If “U> ?” = AND or OR Sets the value for the alarm threshold: - Input voltage range 2–130V: from 1 to 260V (step 0.1V). - Input voltage range 10–480V: from 10 to 960V (step0.5V).
t U> **600.00 s**	If “U> ?” = AND or OR Sets the time delay associated with U>, from 0 to 600s (step 10ms).
U>> ? **OR**	Setting choice: No, AND or OR Selection of the second phase overvoltage threshold (U>>) protection. If AND or OR is selected, the second phase overvoltage threshold (U>>) protection is enabled. The second phase overvoltage threshold (U>>) submenu is displayed, if OR is selected, the second overvoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. If No is selected, the second phase overvoltage threshold (U>) protection is not enabled and no new window will be shown.
U>> **260.0 V**	If “U>> ?” = AND or OR Sets the value for the second phase overvoltage threshold (U>>). - Input voltage range 2–130V: from 2 to 260V (step of 0.1V). - Input voltage range 10–480V: from 10 to 960V (step 0.5V).
t U>> **600.00 s**	If “U>> ?” = AND or OR Sets the time delay associated with U>>, from 0 to 600s (step 10ms)

2.7.9 Submenu [27] PHASE UNDER-VOLTAGE Protection (P127)

PROTECTION G1	
[27] Phase Under Voltage	Heading of [27] phase under voltage submenu.
U< ? **Yes**	Setting choice: No, AND or OR Selection of the first phase undervoltage threshold (U<) protection. If AND or OR is selected, the first phase undervoltage threshold (U<) protection is enabled. The first phase undervoltage threshold (U<) submenu is displayed, if OR is selected, the first undervoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. If No is selected, the first phase undervoltage threshold (U<) protection is not enabled and the next menu is the "U<< ?" menu.
U< **5.0 V**	If "U< ?" = AND or OR Sets the value for the first phase undervoltage threshold (U<). - Input voltage range 2–130V: from 2 to130V (step 0.1V). - Input voltage range 10 –480V: from 10 to 480V (step 0.5V).
t U< **150.00 s**	If "U< ?" = AND or OR Sets the time delay associated with U< from 0 to 600s, (steps 10ms).
52a Inhib. U< ? **No**	If "U< ?" = AND or OR This function inhibits undervoltage protection on circuit breaker (52A) trip. Setting choice Yes or No.
U<< ? **Yes**	Setting choice: Yes or No Selection of the second phase undervoltage threshold (U<<) protection. Yes, the second phase undervoltage threshold (U<<) is enabled. The second phase undervoltage threshold (U<<) protection submenu is displayed. No: The second phase undervoltage threshold (U<<) protection is not enabled, and no new window will be shown.
U<< **2.0 V**	If "U<< ?" = AND or OR Sets the value for the second phase undervoltage threshold (U<<). - Input voltage range 2–130V: from 2 to 260V (step 0.1V), - Input voltage range 10–480V: from 10 to 960V (step 0.5V).
t U<< **600.00 s**	If "U<< ?" = AND or OR Sets the time delay associated with U<< from 0 to 600s (step 10ms).
52a Inhib. U<< ? **No**	If "U<< ?" = AND or OR This function inhibits undervoltage protection on circuit breaker (52A) trip. Setting choice Yes or No.

2.7.10 Submenu [59N] RESIDUAL OVERVOLTAGE Protection

PROTECTION G1	
[59N] Residual Over Voltage	Heading of [59N] residual (earth) overvoltage protection submenu.
Ue>>>> ? **Yes**	Setting choice: Yes or No Selection of the residual overvoltage threshold (Ue>>>>) protection. Yes, the residual overvoltage threshold (Ue>>>>) is enabled. The residual overvoltage threshold (Ue>>>>) protection submenu is displayed, No: The residual overvoltage threshold (Ue>>>>) is not enable and no new window will be shown.
Ue>>>> **5.0 V**	If “Ue>>>> ?” = Yes Sets the value for the residual overvoltage threshold (Ue>>>>). - Input voltage range 2–130V: from 1 to 260V (step0.1V). - Input voltage range 10–480V: from 10 to 960V (step 0.5V).
t Ue>>>> **600.00 s**	If “Ue>>>> ?” = Yes Sets the time associated with Ue>>>>.from 0 to 600 s (step 10ms).

2.7.11 Submenu [47] NEGATIVE OVERVOLTAGE Protection (P127)

PROTECTION G1	
[47] Negative Over Voltage	Heading of [47] Negative overvoltage submenu.
V2> ? **NO**	Setting choice: No or Yes Selection of the first negative overvoltage threshold (V2>) protection. If YES is selected, the first negative overvoltage threshold (V2>) protection is enabled. The first negative overvoltage threshold (V2>) submenu is displayed, If No is selected, the first negative overvoltage threshold (V2>) protection is disabled and the next menu is the “V2>> ?” menu.
V2> **15.0 V**	If “V2> ?” = YES Sets the voltage for the first V2> alarm threshold: - Input voltage range 57–130V: from 1 to 130V (step 0.1V). - Input voltage range 220–480V: from 4 to 480V (step 0.5V).
tV2> **5.00 s**	If “U> ?” = YES Sets the operating time delay associated with V2>, from 0 to 100s (step 10ms).
V2>> ? **YES**	Setting choice: No or Yes Selection of the first negative overvoltage threshold (V2>) protection. If YES is selected, the second negative overvoltage threshold (V2>>) protection is enabled and the submenu is displayed, If No is selected, the second negative overvoltage threshold (V2>) protection is disabled and no window will be shown

V2>> **260.0 V**	If “V2>> ?” = YES Sets the voltage for the second V2>> alarm threshold: - Input voltage range 57–130V: from 1 to 130V (step 1V). - Input voltage range 220–480V: from 4 to 480V (step 0.5V).
tV2>> **5.00 s**	If “U>> ?” = YES Sets the operating time delay associated with V2>>, from 0 to 100s (step 10ms).

2.7.12 Submenu [79] AUTORECLOSE (P126 & P127 only)

The autoreclose function provides the ability to automatically close the circuit breaker after a fault.

Up to 4 shot cycles can be configured . Each cycle implements a dead time and a reclaim time.

During the autorecloser cycle, if the relay receives an order to change setting group, this order is kept in memory, and will only be executed after the timer has elapsed.

Autoreclose function is available if:

- a logical input is assigned to 52a state,
- and trip output relay is not latched to the earth and/or phase protection.

In addition to these settings, the user can fully link the autoreclose function to the protection function using the menus “PROTECTION G1 / Phase OC” and “PROTECTION/ E/Gnd”.

PROTECTION G1	
[79] Autoreclose	Heading of [79] AUTORECLOSE submenu.
Autoreclose ? **Yes**	Selection of autoreclose function. Yes: the autoreclose function is enabled. Then the “Ext CB Fail ?” menu is shown, Immediately could appear the message:“Conflict Recloser”. Do not worry, you are hardly beginning to set your ARC and some settings must be worked out. No: no new window will be shown.

2.7.12.1 Selection Menu [79] EXTERNAL CB FAILURE

Ext CB Fail ? **Yes**	Allows the use of a dedicated input (CB FLT) to inform the autoreclose function of the state of the CB (failed or operational). This signal has to be assigned to a digital input by the Automatic Control inputs submenu Setting choice Yes or No. Yes: The CB will be declared fault and the autoreclose will move in the locked status when the Ext. CB Fail time will be elapsed and the Ext CB Fail will stand active. The Ext. CB Fail timer will start when the tD will be expired. If during this time the signal Ext CB Fail will disappear the ARC will continue with its programmed cycles No: next window will show the submenu “Ext Block ?”.
Ext CB Fail Time **1.00 s**	If “Ext CB Fail”=Yes option is selected only. Set the value for the external CB failure time delay tCFE. The Ext. CB Fail timer will start when the tD will be expired. If during this time the signal Ext CB Fail will disappear, the ARC will continue with its programmed cycles. Once this set time has elapsed, the information Ext CB Fail is validated. Setting range is from 10ms to 600s (step 10ms).

2.7.12.2 Selection Menu [79] EXTERNAL BLOCKING

Ext Block ? **Yes**	Setting choice: Yes or No Allows the use of a dedicated input (Block_79) to block the autoreclose function. If you set this item to Yes to make it active you have to assign to a digital input the function Block 79 by the inputs submenu in Automatic control function**.** With the Ext. Block actived (the relevant digital input supplied) the autoreclose will move to the locked status after a protection trip involved in the sequences matrix of the ARC.

2.7.12.3 Circuit breaker activity supervision

Rolling demand ? **Yes**	Setting choice: Yes or No Yes: activates the trip activity supervision. At the first trip order generated, the relay starts a temporization during which, if the current trip number reaches the programmed max trips number, the relay stops the pending autoreclose cycle (definitive trip).
Max cycles nb **10**	Setting range from 2 to 100 (step 1). Sets the programmed maximum trip number.
Time period **10 mn**	Setting range from 10mn to 1440mn (24h) (step 10mn). Sets the temporization for trip activity supervision.

2.7.12.4 [79] Dead and Reclaim Time

The dead time (tD1, tD2, tD3 and tD4) starts when the digital input connected to the 52a, auxiliary contact of the CB, is de-energised and the involved protection threshold reset. It means that CB has tripped. If on trip protection the CB opening signal (52a) is lacking, after a fixed time out of 2.00 s at 50 Hz or 1.67 s at 60 Hz, the ARC resets to the initial status. If on trip protection the 52a signal changes status but the protection threshold trip stands the tD timer will start when the protection trip threshold will disappear. In the above case .

The 52a signal has to be assigned to a digital input by the inputs submenu in Automatic control function. The 52a signal is in accordance with the CB status

Auxiliary Contact status		CB Status
52A	52B	-------------------
Valid	Invalid	Circuit Breaker open
Invalid	Valid	Circuit Breaker closed

Within the tD a further time window is active.This time window starts together to the **td**.It expires after 50ms.

If within this time window a threshold involved in the trip of the CB and in the ARC cycle is intermittent the ARC will be lock.

Dead Time **tD1 0.30 s**	Displays setting value of the first cycle dead time (tD1) for the autoreclose function from 0.01 to 300s (step 10ms).
Dead Time **tD2 180.00 s**	As above for the second cycle dead time (tD2).
Dead Time **tD3 180.00 s**	As above for the third cycle dead time (tD3).
Dead Time **tD4 180.00 s**	As above fir fourth cycle dead time (tD4).

Dead Time **tI> 0.05 s** **tI>> 0.05 s** **tI>>> 0.05 s**	Sets the value after a first, second and third trip This dead time is used with an IDMT electromagnetic relay, and starts when the CB opens. The induction disk returns to its initial position during this additional time Setting range is from 50ms to 600s (step 10ms).
DeadTime **tIe> 0.05 s** **tIe>> 0.05 s** **tIe>>> 0.05 s**	As above for IE>, IE>> and IE>>> Setting range is from 50ms to 600s (step 10ms).
Reclaim Time **tR 180.00 s**	Set the Reclaimer time value (tR). The reclaim time , starts when the CB has closed. Setting range is from 20ms to 600s (step 10ms). After the reclaim time, if the circuit breaker does not trip again, the autoreclose function resets; otherwise, the relay either advances to the next shot that is programmed in the autoreclose cycle, or, if all the programmed reclose attempts have been accomplished, it locks out. If the protection element operates during the reclaim time following the final reclose attempt, the relay will lockout and the autoreclose function is disabled until the lockout condition resets.
Inhib Time **tI 5.00 s**	The “Inhib Time tI” timer is used to block the autoreclose being initiated after the CB is manually closed onto a fault. The lockout condition can reset by a manual closing after the "Inhib Time tI". Setting range from 0.01s to 600s, in steps of 10ms.

2.7.12.5 [79] Phase and Earth Re-closing Cycles

Phase Cycles **4**	Displays setting of autoreclose cycles externally started by a phase protection trip signal or by tAux1. Setting choice is from 0 to 4 cycles.
E/Gnd Cycles **4**	Displays setting of autoreclose cycles externally started by an earth protection trip signal or by tAux2. Setting choice is from 0 to 4 cycles.

2.7.12.6 [79] Cycles allocation

CYCLES 4321 **tI> 1101**	4321 are the cycles associated to the trip on tI> pick up 1201 are the actions to be executed after the tI> time delay has elapsed: 0 = no action on autorecloser: definitive trip (autoreclose will move in the lock status), 1 = trip on tI> pick-up, followed by reclosing cycle 2 = no trip on tI> pick-up: and this whatever the setting is in the “AUTOMAT. CRTL/Trip commands/Trip tI>” menu.
CYCLES 4321 **tI>> 1101**	As above for tI>>.
CYCLES 4321 **tI>>> 1101**	As above for tI>>>.
CYCLES 4321 **tIe> 1101**	As above for tIe>.
CYCLES 4321 **tIe>> 1101**	As above for tIe>>.
CYCLES 4321 **tIe>>> 1101**	As above for tIe>>>.

CYCLES 4321 **tPe/Iecos> 1101**	As above for tPe/Iecos>.
CYCLES 4321 **tPe/Iecos>> 1101**	As above for tPe/Iecos>>.
CYCLES 4321 **tAux1 1101**	4321 are the cycles associated to the trip on tI> pick up 1201 are the actions to be executed after the tI> time delay has elapsed: 0 = no action on autorecloser: definitive trip (autoreclose will move in the lock status), 1 = trip on tI> pick-up, followed by reclosing cycle 2 = no trip on tI> pick-up: and this whatever the setting is in the “AUTOMAT. CRTL/Trip commands/Trip tI>” menu. 3 = autoreclose without trip (trip order is inhibited and no trip is performed from autoreclose function).
CYCLES 4321 **tAux2 1101**	As above for tAux2

2.7.13 Submenu [81] Frequency (P127 only)

The following HMI description is given for F1 frequency. These menus are identical for F2, F3, F4, F5 and F6 frequencies.

PROTECTION G1	
[81] Frequency	Heading of [81] Frequency protection submenu.
F1 ? **No**	Selection of the first alarm threshold function for over/underfrequency (F1). Setting choice: No, 81< or 81>. If the user selects 81< or 81>, the “F1 (Fn +/- 4.9Hz)” window is shown.
F1 (Fn +/- 4.9Hz) **50 Hz**	Displays setting value for the first alarm threshold, from 45.1 to 64.9Hz (step 0.01 Hz).
tF1 **0.00 s**	Displays setting value for the trip threshold from 0 to 600s (step 10ms).

2.7.14 Submenu [81R] Freq. rate of change (P127 only)

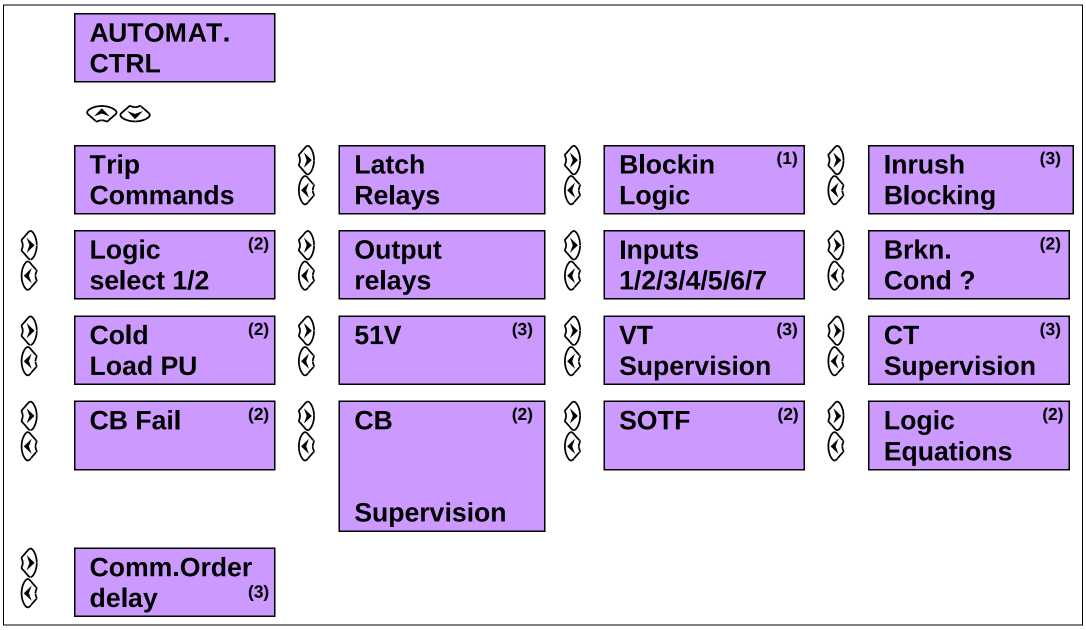
The following HMI description is given for dF/dt1 rate of frequency. The menu is identical for the 2^{nd} to the 6^{th} rates.

PROTECTION G1	
[81R] Freq. rate of change	Heading of [81R] rate of change of frequency protection function.
dF/dt1 ? **No**	Activation of the 1^{st} rate of frequency stage (delta f / delta t) Setting choice: Yes or No
dF/dt1= **1.0 Hz/s**	Setting of the 1^{st} frequency variation (ΔF) per second (Δt) in Hz/s with Δt = 1 period (20ms at 50Hz) Average value of dF/dt1 will be calculated using the number of cycles set in the ‘CONFIGURATION / dF/dt Cycles.nb.’ menu. The value is validated if it is repeted x times (x is set in the ‘CONFIGURATION / dF/dt Cycles.nb.’ menu) Setting range; from –10Hz/s to +10Hz/s, step = 0.1Hz/s

2.8 AUTOMAT. CTRL menu

The AUTOMAT. CTRL Menu makes it possible to programme the various automation functions included in the MiCOM P125, P126 & P127 relays.

The different submenus are:



(1) P126 and P127: Blocking Logic 1/2
(2) P126 and P127 only
(3) P127 only

2.8.1 Submenu Trip Commands

This submenu makes it possible to assign some or all the selected thresholds to the trip logic output (RL1).

TEXT	P125	P126	P127	INFORMATION
Trip tI>, tI>> or tI>>>		X	X	Time delayed 1st, 2nd or 3rd phase overcurrent threshold trip
Trip tIe>, tIe>> or tIe>>>	X	X	X	Time delayed 1st, 2nd or 3rd earth overcurrent threshold trip
Trip tIe_d> or tIe_d>>			X	Time delayed 1st or 2nd derived earth overcurrent threshold trip
Trip tP> or tP>>			X	Time delayed 1st or 2nd directional power threshold trip.
Trip tP< or tP<<			X	Time delayed 1st or 2nd active underpower threshold trip.
Trip tQ> or tQ>>			X	Time delayed 1st or 2nd reactive overpower threshold trip.
Trip tQ<< or tQ<<			X	Time delayed 1st or 2nd reactive underpower threshold trip.
Trip tPe/IeCos>, tPe/IeCos>>	X	X	X	Time delayed 1st or 2nd earth overpower/IeCos (wattmetric) threshold trip
Trip tI2>, tI2>> or tI2>>>		X	X	Time delayed 1st, 2nd or 3rd negative phase sequence overcurrent threshold (tI2>) trip.
Trip Thermal θ		X	X	Thermal overload threshold trip
Trip tU> or tU>>			X	Time delayed 1st or 2nd overvoltage threshold trip.

TEXT	P125	P126	P127	INFORMATION
Trip tU< or tU<<			X	Time delayed 1st or 2nd undervoltage threshold trip.
tUe>>>>	X	X	X	Time delayed derived earth overvoltage threshold
Trip tV2> or tV2>>			X	Time delayed 1st or 2nd negative overvoltage threshold trip.
Trip tF1 to tF6			X	Time delayed 1st to 6th frequency threshold trips.
Trip dF/dt1 to dF/dt6			X	1st to 6th rates of change of frequency protections
Trip Brkn. Cond		X	X	Broken conductor detection signal trip.
Trip tAux1 to tAux4	X	X	X	Time delayed auxiliary input Aux1 to Aux4 trips.
Trip tAux5 to tAux7		X	X	Time delayed auxiliary input Aux5 to Aux7 trips.
Trip tAux8 to tAuxC			X	Time delayed auxiliary input Aux8 to Aux C trips (option).
Trip SOTF		X	X	SOTF function to the trip output. When the tSOTF has elapsed, the trip command is ordered. .
Ctrl Trip	X	X	X	Control Trip function to the trip output relay RL1.
Trip tEQU A to tEQU H		X	X	Logical output of Boolean Equations A to H.

AUTOMAT. CTRL	
Trip Commands	Heading of Trip Commands submenu.
function **No**	Setting choice Yes: Assign the corresponding time delay or function to the trip output relay RL1. Then the trip output relay (RL1) will be activated at the end of the time delay tI>. Setting choice No: the trip output relay (RL1) will never be activated, even at the end of the corresponding time delay or function. Refer to previous tables for protection functions list.

2.8.2 Submenu Latch Relays

With this submenu the user can program trip functions so that the resulting output signal will remain latched after the cause for exceeding the threshold has disappeared.

2.8.2.1 Submenu Latch Relays

With the following menu the user can set each output relay as latched or not latched.

A “**0**” assigned to an output relay means that the relay is not latched. The output relay will be active when the relevant command will be active; the relay will not be active when the relevant command will reset.

A “**1**” setting assigned to an output relay means that the relay is latched. The output relay will be active when the relevant command will be active; the relay will remain active, if the relevant command will reset.

The active latched output relays can be reset by a logic input assigned to this function.

Further, the active latched output relays can be reset from the front panel by pushing ©. This action is available if the window status Output Relays in OP. PARAMETERS submenu is displayed.

The alarm string “Latched Relays” appears on LCD and the yellow LED is lighted.

AUTOMAT. CTRL	
Latch Relays	Heading of submenu.
Latch :87654321 **01001000**	P125: only relays 1 to 6 are displayed. In this example, the output relays set to Latch function are number 4 and 7 (RL4 & RL7).

2.8.3 Submenu Blocking Logic

The **MiCOM P125** relay has the submenu Blocking Logic available for setting. **MiCOM P126** & **P127** relays have the submenu Blocking Logic 1 and Blocking Logic 2 available for setting. By opening the Blocking Logic submenu the user can assign each delayed threshold to the "Blk Log" input (refer to Inputs menu).

It is possible to enable or disable the "blocking" of most protection functions even if a logic input has been assigned to that function.

TEXT	P125	P126	P127	INFORMATION
tI>, tI>> or tI>>>		X	X	Time delayed 1st, 2nd or 3rd phase overcurrent threshold
tIe>, tIe>> or tIe>>>	X	X	X	Time delayed 1st, 2nd or 3rd earth threshold
tIe_d> or tIe_d>>			X	Time delayed 1st or 2nd derived earth overcurrent threshold trip
tP> or P>>			X	Time delayed 1st or 2nd active overpower threshold
tP< or tP<<			X	Time delayed 1st or 2nd active underpower thresholds.
tQ> or tQ>>			X	Time delayed 1st or 2nd reactive overpower thresholds.
tQ< or tQ<<			X	Time delayed 1st or 2nd reactive underpower thresholds.
tPe/IeCos>, tPe/IeCos>>	X	X	X	Time delayed 1st or 2nd earth overpower/IeCos (wattmetric) threshold
tI2>, tI2>>or tI2>>>		X	X	Time delayed 1st, 2nd or 3rd negative phase sequence overcurrent threshold.
tThermal θ		X	X	Time delayed thermal overload threshold.
tI<		X	X	Time delayed undercurrent threshold
tU> or tU>			X	Time delayed 1st or 2nd overvoltage threshold
tU< or tU<<			X	Time delayed 1st or 2nd undervoltage threshold.
tUe>>>>	X	X	X	Time delayed derived earth overvoltage threshold
tV2> or tV2>>			X	Time delayed 1st or 2nd negative overvoltage threshold
tF1 to tF6			X	Time delayed 1^{st,} 2nd, to 6th frequency thresholds.
dF/dt1 to dF/dt6			X	Rates of change of frequency 1 to 6.
tBrk. Cond		X	X	Broken Conductor trip signal.
tAux1 to tAux4	X	X	X	Aux1 (to tAux4) delayed by tAux1 (to tAux4) time (Aux1, 2, 3 and 4 logic inputs and aux1, 2, 3 and 4 times are set with "automat ctrl/inputs" menu)
tAux5 to tAux7		X	X	Aux5, 6 and 7 delayed by tAux 5, tAux6 and tAux 7 times

TEXT	P125	P126	P127	INFORMATION
tAux8 to tAuxC			X	Aux8 to Aux C delayed by tAux 8 to tAux C times (option)

Blocking of a protection function can be prevented if “No” is selected in the relevant window. Blocking of a protection function can be enabled if “Yes” is selected in the relevant window.

AUTOMAT. CTRL	
Blocking Logic	Heading of Blocking Logic submenu.
Block function **No**	Enables or disables blocking logic of the function on the level (logic state =1) of logic input “Blk Log” Refer to previous tables for protection functions list.

2.8.4 Submenu Inrush Blocking Logic (P127 only)

Through the Inrush Blocking Logic submenu, the user can set a 2nd harmonic blocking threshold and block each delayed overcurrent threshold by setting.

It is possible to enable or disable the “blocking” of most protection functions even if a logic input has been assigned to that function. Blocking of a protection function can be prevented if “No” is selected in the relevant window (see below). Blocking of a protection function can be enabled if “Yes” is selected in the relevant window.

TEXT	INFORMATION
I>, I>> or I>>>	Instantaneous 1st, 2nd or 3rd phase overcurrent threshold
Ie>, Ie>> or Ie>>>	Instantaneous 1st, 2nd or 3rd earth overcurrent threshold
Ie_d> or Ie_d>>	Instantaneous 1st or 2nd derived earth overcurrent threshold
I2>, I2>> or I2>>>	Instantaneous 1st, 2nd or 3rd negative phase sequence overcurrent threshold

AUTOMAT. CTRL	
Blocking Inrush	Heading of the Inrush Blocking logic submenu.
Blocking Inrush **Yes**	Setting choice Yes: The crossing of the Harmonic H2 ratio threshold on any phase activates the Inrush Blocking Logic function instantaneously. Setting choice No: The crossing of the Harmonic H2 ratio threshold doesn’t activate the Inrush Blocking logic function.
Inr. Harmonic 2 Ratio = **20%**	Set the value for the 2nd harmonic threshold ratio calculated as a percentage of the fundamental component from 10 to 35% (step 0.1%). Press ↵ to validate your choice.
T Inrush reset = **0 ms**	Set the value for the Inrush tReset time. This provides a reset delay of the Inrush Blocking signal (logic state=1) once the 2nd harmonic level falls below the set threshold. The setting range is from 0.0s to 2 s (step 10ms).
Blocking Inrush Function **No**	Enables or disables Inrush blocking for the function. Refer to previous tables for protection functions list.

2.8.5 Submenu Logic Select

With the submenu Logic Select. 1 or Logic Select. 2 the user can assign each trip threshold to the "Log Sel" input (refer to Inputs menu).

The submenu Logic Select. 1 / Logic Select. 2 is only available in the software of the P126 & P127 relays. The thresholds I>>, I>>> are from the protection function [67/50/51] and Ie>>, Ie>>> from the protection function [67N/50N/51N].

Setting Yes or No enables or disables Logic Selectivity 1 of the following protection functions:

AUTOMAT. CTRL	
Logic Select. 1	Heading of Logic Select submenu.
Sel1 tI>>	Second trip threshold for phase overcurrent (tI>>).
Sel1 tI>>>	Third trip threshold for phase overcurrent threshold (tI>>>).
Sel1 tIe>>	Second trip threshold for earth fault overcurrent (tIe>>).
Sel1 tIe>>>	Third trip threshold for earth fault overcurrent (tIe>>>).
Sel1 tIe_d>	P127 only First time delayed derived earth overcurrent threshold trip
Sel1 tIe_d>>	P127 only Second time delayed derived earth overcurrent threshold trip
t Sel1 **150.00 s**	Displays time delay t Sel1 for Logic Select 1 . The setting range for t Sel1 is from 0 s to 150 s, in steps of 10 ms.

2.8.6 Submenu Outputs Relays

This submenu makes it possible to assign various alarm and trip thresholds (instantaneous and/or time delay) to a logic output. Excepted from this option are the Watchdog (RL0) and the Tripping (RL1) outputs (refer to Trip Commands submenu).

The total number of programmable logic outputs for the three relay models is listed in the table:

Model	P125	P126	P127
Output relays	6	8	8

The following functions can be assigned to output relays using this submenu.

Function	P125	P126	P127	INFORMATION
Trip		X	X	output signal Trip (RL1).
I>, I>> or I>>>		X	X	Instantaneous 1st, 2nd or 3rd phase overcurrent threshold
tI>, tI>> or tI>>>		X	X	Time delayed 1st, 2nd or 3rd phase overcurrent threshold
I_R>, I_R>> or I_R>>>		X	X	1st, 2nd or 3rd trip threshold for directional phase OC from the inverse trip zone (I_R>).
tIA>, tIB> or tIC>		X	X	Linking first delayed threshold for phase A (tIA>), phase B (tIB>) or phase C (tIC>)

Function	P125	P126	P127	INFORMATION
Ie>, Ie>> or Ie>>>	X	X	X	Instantaneous 1^{st}, 2^{nd} or 3^{rd} earth overcurrent threshold
tIe>, tIe>> or tIe>>>	X	X	X	Time delayed 1^{st}, 2^{nd} or 3^{rd} earth overcurrent threshold.
Ie_R>, Ie_R>> or Ie_R>>>			X	1^{st}, 2^{nd} or 3^{rd} trip threshold for directional earth fault overcurrent from the inverse trip zone (Ie_R>).
Ie_d> or Ie_d>>			X	1^{st} or 2^{nd} derived earth overcurrent threshold.
tIe_d> or tIe_d>>			X	Time delayed 1^{st} or 2^{nd} derived earth overcurrent threshold.
Ie_dR> or tIe_dR>>			X	1^{st} or 2^{nd} trip threshold for directional derived earth overcurrent fault from the inverse trip zone.
P> or P>>			X	Instantaneous 1^{st} or 2^{nd} active overpower threshold.
tP> or tP>>			X	Time delayed 1^{st} or 2^{nd} active overpower threshold.
P< or P<<			X	Instantaneous 1^{st} or 2^{nd} active underpower threshold.
tP< or tP<<			X	Time delayed 1^{st} or 2^{nd} active underpower threshold.
Q> or Q>>			X	Instantaneous 1^{st} or 2^{nd} reactive overpower threshold.
tQ> or tQ>>			X	Time delayed 1^{st} or 2^{nd} reactive overpower threshold.
Q< or Q<<			X	Instantaneous 1^{st} or 2^{nd} reactive underpower threshold.
tQ< or tQ<<			X	Time delayed 1^{st} or 2^{nd} reactive underpower threshold.
Pe/IeCos> or Pe/IeCos>>	X	X	X	Instantaneous 1^{st} or 2^{nd} earth overpower/IeCos (wattmetric) threshold
tPe/IeCos> or tPe/IeCos>>	X	X	X	Time delayed 1^{st} or 2^{nd} earth overpower/IeCos (wattmetric) threshold
I2>, I2>> or I2>>>		X	X	Instantaneous 1^{st}, 2^{nd} or 3^{rd} negative phase sequence overcurrent threshold
tI2>, tI2>> or tI2>>>		X	X	Time delayed 1^{st}, 2^{nd} or 3^{rd} negative phase sequence overcurrent threshold
ThermAlarm		X	X	thermal alarm.
ThermTrip		X	X	thermal trip threshold.
I<		X	X	Instantaneous undercurrent threshold
tI<		X	X	Time delayed undercurrent threshold
U> or U>>			X	Instantaneous 1^{st} or 2^{nd} overvoltage threshold
tU> or tU>>			X	Time delayed 1^{st} or 2^{nd} overvoltage threshold
U< or U<<			X	Instantaneous 1^{st} or 2^{nd} undervoltage threshold
tU< or tU<<			X	Time delayed 1^{st} or 2^{nd} undervoltage threshold
Ue>>>>	X	X	X	Instantaneous derived earth overvoltage threshold
tUe>>>>:	X	X	X	Time delayed derived earth overvoltage threshold
V2> or V2>>			X	Time delayed 1^{st} or 2^{nd} negative overvoltage threshold
tV2> or tV2>>			X	Time delayed 1^{st} or 2^{nd} negative overvoltage threshold

Function	P125	P126	P127	INFORMATION
F1 to F6			X	Instantaneous 1st to 6th frequency threshold
tF1 to tF6			X	Time delayed 1st to 6th frequency threshold
F.OUT			X	frequency out of range signal
dF/dt1 to dF/dt6			X	1st to 6th rates of change of frequency
BrknCond		X	X	Broken Conductor alarm signal.
CBAlarm		X	X	Circuit breaker alarm function signal (CB Open NB, Amps(n), CB Open Time and CB Close Time).
52 Fail		X	X	circuit breaker trip supervision failure function signal.
CBFail		X	X	circuit breaker failure function timer signal (tBF).
CB Close		X	X	circuit breaker closing order signal.
tAux1 to tAux6	X	X	X	Aux1 to Aux4 delayed by Aux1 to Aux4 times
tAux5 ti Aux7		X	X	Aux5 to Aux7 delayed by Aux 5 to Aux7 times.
tAux8 to tAuxC			X	Aux8 to AuxC delayed by Aux 8 to Aux C times (optional configuration).
79 Run		X	X	"autoreclose in progress" information.
79 Trip		X	X	autoreclose final trip signal.
79 int. Lock		X	X	Autoreclose lock activated by the internal process of the autoreclose
79 ext. Lock		X	X	Autoreclose lock activated by the input “block 79”
SOTF		X	X	SOTF functionality.
CONTROLTRIP	X	X	X	Control Trip command.
CONTROLCLOSE	X	X	X	Control Close command.
ActiveGroup	X	X	X	Close when Group 2 is active
Input1 to Input4	X	X	X	opto input 1 status to opto input 4 status.
Input5 to input7		X	X	opto input 5 status. to opto input 7 status
Input8 to inputC			X	opto input 8 status to opto input C status (optional configuration).
VTS			X	Voltage Transformer Supervision signal
CTS			X	Current Transformer Supervision signal (P127)
tEQU.A to tEQU.H		X	X	logic equation A to logic equation H results trip signals.
Order Comm1 to Order Comm4			X	Remote communication orders (pulse commands from remote devices through communication protocols).

AUTOMAT. CTRL	
Output Relays	Heading of Output Relays submenu.
Function :8765432 0000010	Assigning the corresponding porotection function to the output relays; i.e. to output 3 (RL3) Setting choice: 1 assigns the output relay; 0 no assignement
Function :65432 00010	Submenu for P125

2.8.7 Submenu Inputs

Each relay model has a fixed number of opto-isolated logic inputs.

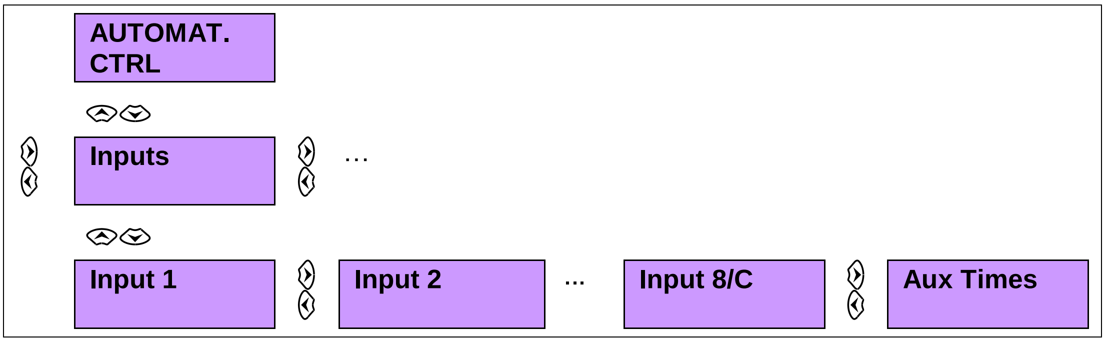
Logic inputs:

Model	P125	P126	P127	P127 with additional inputs (option)
Logic Input	4	7	7	12

With the submenu Inputs it is possible to assign a label or an automation function to each logic input (see the following table):

Label designation	Label description	P125	P126	P127
Unlatch	Unlocks latched output relays	X	X	X
Blk Log 1	Blocking logic 1	X	X	X
Blk Log 2	Blocking logic 2		X	X
52 a	Position of the circuit breaker (open)		X	X
52 b	Position of the circuit breaker (close)		X	X
CB FLT	External failure information from the CB		X	X
Aux 1 to Aux 4	Assigning external information to inputs Aux1 to Aux4	X	X	X
Aux 5 to Aux 7	Assigning external information to inputs Aux5 to Aux7		X	X
Aux 8 to Aux C	Assigning external information to inputs Aux8 to AuxC (optional configuration)			X
Strt Dist	Starting of the disturbance recording function		X	X
Cold L PU	Cold load pick up assignment		X	X
Log Sel 1	Logic selectivity 1		X	X
Log Sel 2	Logic selectivity 2		X	X
Change set	Change of setting group (default setting group 1) when the changing group parameter (‘CONFIGURATION / Group select / change group’) is set to input.		X	X
Block_79	Blocking of the autoreclose function [79]		X	X
θ Reset	Reset of the thermal state		X	X
Trip Circ	Trip circuit supervision input		X	X
Start t BF	Start CB fail timer from external input		X	X
Maint. M	Maintenance Mode ON/OFF change	X	X	X
SOTF	Start the Switch On To Fault automatism		X	X

Label designation	Label description	P125	P126	P127
Local	Local mode condition (if active, any remote operation involving the output relays is forbidden)	X	X	X
Synchro.	Assign a Time synchronisation input	X	X	X
LED Reset or Reset Led	Reset of the "Trip" & "Alarm" leds	X	X	X
Ctrl Trip	Assign a control trip function to the input. When activated, it is possible to order output relay(s) affected to the control trip function.	X	X	X
Ctr Close	Assign a control close function to the input. When activated, it is possible to order output relays affected to the CB Close (P126) or control close (P125 or P126) function. For P127, this input can be started by the SOTF feature.	X	X	X



2.8.7.1 Setting auxiliary timers at the end of submenu Inputs

AUTOMAT. CTRL	
Inputs	Heading of Inputs submenu.
Input 1 **52a**	Assigning label 52a to logic input 1. To modify see above windows.
Input 2 **52b**	Assigning label 52b to logic input 2. To modify see above windows.
Input 3 **Aux1**	Assigning label Aux1 to logic input 3. To modify see above windows.
Input 5 **Log Sel 1**	Assigning label Log Sel 1 to logic input 5 (P126 & P127 only). To modify see above windows.
Input 6 **Block_79**	Assigning label Block_79 to logic input 6 (P126 & P127 only). To modify see above windows.
Input 7 **Cold L PU**	Assigning label Cold L PU to logic input 7 (P126 & P127 only). To modify see above windows.
Input 8 … **Input C**	Assigning label to logic inputs 8 to 12 (C) (P127 with optional board only). To modify see above windows.

Aux1 Time **tAux1 200.00 s**	Displays setting value of timer assigned to logic input Aux1 from 0 ms to 200 s, in steps of 10 ms.
Aux2 Time **tAux2 200.00 s**	As Aux1 for input Aux2.
Aux 3 Time **tAux 3 200.00 s**	As Aux1 for input Aux3.
Aux4 Time **tAux4 200.00 s**	As Aux1 for input Aux4.
Aux5 Time **tAux5 200.00 s**	As Aux1 for input Aux 5. Setting value: from 0ms to 20000s (step 10ms)
Aux6 Time **tAux6 200.00 s**	As Aux1 for input Aux 6. Setting value: from 0ms to 20000s (step 10ms)
Aux7 Time **tAux7 200.00 s**	As Aux1 for input Aux 7. Setting value: from 0ms to 20000s (step 10ms)
Aux8 Time **tAux8 200.00 s** **…** **Aux C Time** **tAuxC 200.00 s**	As Aux1 for input Aux 8, Aux 9, Aux 10, Aux 11 and Aux 12 (optional configuration only).

2.8.8 Submenu Broken Conductor (P126 & P127 only)

AUTOMAT. CTRL	
Broken Conductor	Heading of Broken Conductor detector submenu.
Brkn. Cond ? **No**	Selection of the Broken Conductor function. If Yes is selected, the “Brkn.Cond Time” menu is displayed: If No is selected, the Broken Conductor function is inactive.
Brkn.Cond Time **tBC 14400 s**	Displays delay timer setting (tBC) for the Broken Conductor function. from 0 to 14400s (step 1s).
Ratio I2/I1 **20 %**	Displays value, in percent, for the Broken Conductor threshold. This threshold is the ratio between negative and positive phase sequence current. Setting range is from 20 to 100% by, in steps of 1%.

2.8.9 Submenu Cold Load PU (P126 & P127 only)

The Cold Load Pick-Up (CLP) submenu allows enabling of the cold load pick-up function and the associated settings.

TEXT	P126	P127	INFORMATION and COMMENTS
tI> ?	X	X	Time delayed I> threshold.
tI>> ?	X	X	Time delayed I>> threshold.
tI>>> ?	X	X	Time delayed tI>>> threshold.
tIe> ?	X	X	Time delayed tIe> threshold.
tIe>> ?	X	X	Time delayed tIe>> threshold.
tIe>>> ?	X	X	Time delayed tIe>>> threshold.
tIe_d> ?		X	Time delayed first derived earth overcurrent threshold.
tIe_d>> ?		X	Time delayed second derived earth overcurrent threshold.
tI2> ?	X	X	Time delayed tI2> threshold.
tI2>> ?	X	X	Time delayed tI2>> threshold.
ti2>>> ?	X	X	Time delayed tI2>>> threshold.
t Therm. ?	X	X	Time delayed Thermal overload threshold

AUTOMAT. CTRL	
Cold Load PU	Heading of Cold Load Pick-Up submenu.

In the following list, setting choice “Yes” assigns the corresponding function with the loading pick-up function:

Cold Load PU ? **No**	Cold load pick-up function. If Yes is selected, the following menu is displayed: If No is selected, the cold load pick-up function is inactive
Input? **Yes**	Setting choice “Yes” / “No” If selected, the CLP will be started by digital input 52A (selected using the “Cold Load PU xxx” menus),
Auto? **No**	Setting choice “Yes” / “No” If selected, the CLP will be started by the automatic detection of the CB closing when I grows from 5% IN to more than IN in less than 200ms. If “Input?” and “Auto?” are selected, CLP will be started by digital input 52A and automatic detection of CB closing..
Cold Load PU **Function ? No**	Setting choice “Yes” assigns the corresponding function (see the previous table) with the loading pick-up function.
Cold Load PU **Level 200 %**	Displays scaling value, in percent, for the cold load pick up assigned to the selected thresholds from 20% to 800% (step 1%).
Cold Load PU **tCL 3600.0 s**	Displays delay timer setting (tCL) for the Cold Load Pick-up function, from 0.1 to 3600s (step 100ms).

2.8.10 Submenu 51V (Overcurrent controlled by voltage transformer control (P127 only))

The 51V function can be inhibited when a VT fault occurs, using “Automatic Ctrl” / “VT Supervision” / “VTS Blocks 51V” menu

51V	Heading of 51V submenu.
(U< OR V2>) & I>>? **No**	Enable or disable the control of the start of the I>> by U< and V2 > stages value. Setting choice: Yes or No
V2>? **130V**	Assigning the V2> threshold value for the inverse voltage 47 for the I>> control. Select from 3V to 200V (step 0.1V).
(U<< OR V2>>) & I>>>? **No**	Enable or disable the control of the start of the I>>> by U<< and V2 >> stages value.Setting choice: Yes or No
V2>>? **130V**	Assigning the V2>> threshold value for the inverse voltage 47 for the I>>> control. Select from 3V to 200V by step of 0.1V.

2.8.11 Submenu VT Supervision (P127 only)

VT Supervision	Heading of the Voltage Transformer Supervision(VTS)
VTS? **No**	Enable or disable the VT supervision function. Setting choice: Yes or No If Yes is selected, the “VT Supervision” menu is activated and displayed: If No is selected, the VT Supervision function is inactive.
VTS Alarm? **No**	The VTS function can issue an alarm signal when the Voltage Transformer is lost. Setting choice: Yes or No If No is selected, the Alarm (message and LED) will not be displayed. An alarm can be caused by an internal VT fault, overloading, or faults on the interconnecting wiring.
VTS Blocks 51V? **No**	The VTS function can block the 51V function when a VTS alarm occurs (see § 2.8.10). Setting choice: Yes or No
VTS Blocks Protections? **No**	The VTS function can be used to block voltage dependent functions and to change directional overcurrent into non-directional functions. Setting choice: Yes or No. Note: all voltage and power protections are blocked if VT fault occurs.
VTS Non-dir **I>** **Yes** **I>>** **Yes** **I>>>** **Yes** **Ie>** **Yes** **Ie>>** **Yes** **Ie>>>** **Yes** **Ie_d>** **Yes** **Ie_d>>** **Yes**	Displayed when “VTS blocks protections?” = Yes, This menu is used to change directional overcurrent in non-directional function. If Yes is selected, the directional overcurrent will be changed into a non-directional overcurrent protection function for the corresponding threshold, If No is selected, even if VTS.
tVTS **0.0s**	Sets the VTS timer. The VTS alarm will occur if VT fault occurs during more than the VTS timer. Setting range is from 0 to 100s, in steps of 10ms.

2.8.12 Submenu CT Supervision (P127)

The Current Transformer Supervision (CTS) is used to detect failure of one or more of the ac phase current inputs to the relay. The CT supervision feature operates on detection of derived zero sequence current, in the absence of corresponding derived zero sequence voltage normally associated. The CTS alarm will occur when zero sequence current is above Ie> and zero sequence voltage is below Ue<, during more than tCTS time delay.

CT Supervision	Heading of the Current Transformer Supervision (CTS)
CT Supervision? **No**	Enable or disable the CT supervision function. Setting choice: Yes or No. If Yes is selected, the “CT Supervision” menu is activated and displayed: If No is selected, the CT Supervision function is inactive.
Ie> **0.08 In**	Selection of the zero sequence current threshold associated to the CT Supervision detection function, from 0.08 × In to 1.0 × In (step 0.01 × In)
Ue< **5V**	Selection of the zero sequence voltage threshold associated to the CT Supervision detection function, Setting ranges: – from 0.5V to 22V, in steps of 0.1V (voltage input range 57 to 130V, P127xA) – from 2V to 88V, in steps of 0.5V (for voltage input range 220 to 480V, P127xB)
tCTS **0.2s**	Displays time delay setting (tCTS) for the CTS function. Setting range from 0s to 100s, in steps of 10ms.

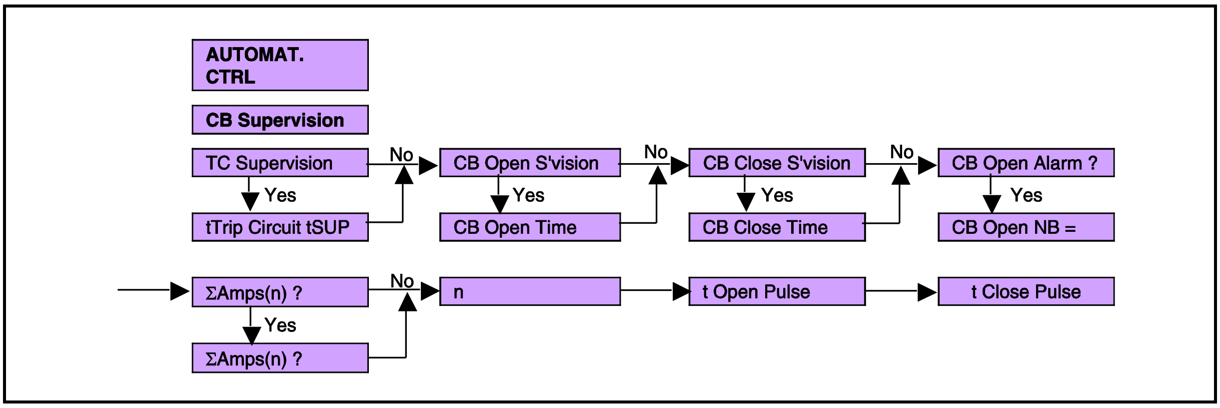
2.8.13 Submenu Circuit Breaker Fail (P126 & P127 only)

With the CB Fail submenu circuit breaker failure can be detected and associated parameters can be set. This protection feature is only available for P126 & P127 relays.

CB Fail	Heading of CB Fail sub menu.
CB Fail ? **No**	Selection of the circuit breaker failure function. Setting choice: Yes or No If Yes is selected, the following menu is displayed: If No is selected, the CB Fail function is inactive.
I< BF **0.02 In**	Selection of the under current threshold associated to the CB failure detection function, from 0.02In to 1In (step 0.01In).
CB Fail Time **tBF 0.00 s**	Displays time delay setting (tBF) for the CB Fail function. Setting range is from 0 to 10 s, in steps of 10 ms.
Block I>? **Yes**	Select the possibility to block the instantaneous signal I> in case of circuit breaker failure detection. Setting choice: Yes or No
Block Ie>? **Yes**	Select the possibility to block the instantaneous signal Ie> in case of circuit breaker failure detection.Setting choice: Yes or No

2.8.14 Submenu Circuit Breaker Supervision (P126 & P127 only)

With the CB Supervision submenu circuit breakers can be supervised and monitored, and associated parameters can be set.



AUTOMAT. CTRL	
CB Supervision	Heading of the CB Supervision submenu.
TC Supervision **Yes**	Selection of the trip circuit supervision function. If Yes is selected, the “t Trip Circuit t SUP” menu is displayed.
t Trip Circuit t SUP 200 ms	Displays the delay timer setting (tSUP) for TC supervision, from 0.1 to 10s (step 10ms).
CB Open S'vision **Yes**	Selection of the time monitoring function of CB open operations. If Yes is selected, the “CB Open Time” menu is displayed.
CB Open Time **100 ms**	Displays monitoring time for CB open operations. from 0.05 to 1.0s (step 10ms).
CB Close S'vision **Yes**	Selection of the time monitoring function of CB close operations. If Yes is selected, “CB Close” window is displayed. If No is selected the next window is CB Open Alarm.
CB Close Time **100 ms**	Displays monitoring time for CB close operations, from 0.050 to 1.0s (steps of 10 ms).
CB Open Alarm ? **Yes**	Selection of the monitor function for maximum count of CB operations. If Yes is selected, the “CB Open NB” window is displayed.
CB Open NB = **0**	Displays alarm threshold for CB open count from 0 to 50000 (step 1).
ΣAmps(n) ? **Yes**	Selection of the monitoring function that continuously sums the current (in Amps or square Amps) interrupted by the CB. Setting choice: Yes, No. If Yes is selected, “ΣAmps(n) ?” window is displayed.
ΣAmps(n) ? **1000 E6**	Displays alarm threshold for the summation of the current (in Amps or square Amps) interrupted by the CB, from 0 to 4000 E6 A (or A^2) (step 1 E6). (E6 = 106)
n **1**	Displays the exponent for the summation (I A or I^2 A^2). Setting choice for n: 1or 2
t Open Pulse **100 ms**	Displays and sets the tripping pulse time delay, from 0.1 to 5s, (step 10ms).
t Close Pulse **100 ms**	Displays and sets the closing pulse time delay, from 0.1 to 5s (step 10ms).

2.8.15 Submenu SOTF (Switch on to fault) (P126 & P127 only)

With the Switch On To Fault (SOTF) submenu, it is possible to shorten the time to trip when for example the relay has detected a fault that is still present on a feeder after energising.

Using this menu, when SOTF function is activated, it is possible to choose the origin of the circuit breaker closing command which will start the SOTF feature. One or several origins can be selected.

The SOTF function can be set using “Automatic Ctrl” menu, “Trip Command”, “Output relays” and “Inputs”submenus.

AUTOMAT. CTRL	
SOTF	Heading of Switch On To Fault (SOTF) sub menu.
Sotf? **No**	Selection of the Sotf function. Setting choice: Yes, No. If Yes is selected, the following menu is displayed, If No is selected, the Sotf sub menu is inactive.
t Sotf **0.10 s**	Displays the delay timer setting (tSotf) for SOTF function, from 0 to 500 ms (step 10 ms).
I>>? **No**	Enables/disables the possibility to start the SOTF by I>>. Setting choice: Yes, No
I>>>? **No**	Enables/disables the possibility to start the SOTF by I>>>. Setting choice: Yes, No
Ctrl close input **Yes/No**	Enables/disables the possibility to start the SOTF function by the dedicated logic input “Ctr Close”. This “Ctr Close” input should be assigned to input 1, 2, 3 or 4 using “Automat. ctrl/Inputs” menu.
SOTF Input **Yes/No**	Enables/disables the possibility to start the SOTF function by the dedicated logic input “SOTF”. This “SOTF” input should be assigned to input 1, 2, 3 or 4 using “Automat. ctrl/Inputs” menu.
HMI closing order: **Yes/No**	Enables/disables the possibility to start the SOTF function by a user’s manual closing order, using interface.
[79] closing **Yes/No**	Enables/disables the possibility to start the SOTF function by an internal autoreclose order.
Front comm. order **Yes/No**	Enables/disables the possibility to start the SOTF function by a front port communication order.
Rear comm. order **Yes/No**	Enables/disables the possibility to start the SOTF function with an order sent to the rear port communication.
Rear2 comm. order **Yes/No**	When existing, enables/disables the possibility to start the SOTF function with an order sent to the second rear port communication.

2.8.16 Submenu Logic Equations (P126 & P127 only)

With the Logic Equations submenu, it is possible to form up to 8 complex Boolean functions using NOT, AND and OR operators (in order of priority). Up to 16 operands can be used in any single equation. The following logic signals are available for mapping to an equation:

TEXT	Information
None	No link/assignment
I>, I>> or I>>>	Instantaneous 1^{st}, 2^{nd} or 3^{rd} phase overcurrent threshold
tI>, tI>> or tI>>>	Time delayed 1^{st}, 2^{nd} or 3^{rd} phase overcurrent threshold
Ie>, Ie>> or Ie>>>	Instantaneous 1^{st}, 2^{nd} or 3^{rd} earth overcurrent threshold
tIe>, tIe>> or tIe>>>	Time delayed 1^{st}, 2^{nd} or 3^{rd} earth overcurrent threshold
Pe> or Pe>>	1^{st} and 2^{nd} earth wattmetric alarm threshold
tPe> or tPe>>	Time delayed 1^{st} or 2^{nd} earth wattmetric trip threshold
I2>, I2>> or I2>>>	Instantaneous 1^{st}, 2^{nd} or 3^{rd} phase negative sequence threshold
tI2>, tI2>> or tI2>>>	Time delayed negative phase sequence (1^{st}; 2^{nd} or 3^{rd} threshold)
θ Alarm	Thermal alarm output signal
θ Trip	Trip on Thermal overload
I<	Instantaneous undercurrent threshold
tI<	Time delayed undercurrent
U> or U>>	Instantaneous 1^{st} or 2^{nd} overvoltage threshold (P127)
tU> or tU>>	Time delayed 1^{st} or 2^{nd} overvoltage threshold (P127)
U< or U<<	Instantaneous 1^{st} or 2^{nd} undervoltage threshold (P127)
tU< or tU<<	Time delayed 1^{st} or 2^{nd} undervoltage threshold (P127)
Ue>>>>	Instantaneous threshold for residual overvoltage
tUe>>>>	Time delayed trip threshold for residual overvoltage
tBC	Time delayed broken conductor
79 Trip	Autoreclose final trip
Input1 to Input 7:	opto input 1 to input 7 status.
Input8 to Input C	opto input 8 to input C status (optional configuration).
t Aux 1 to tAux 7	Copy of the status of the Logic Input delayed by tAux1 (… tAux7) time
t Aux 8 to tAux C	Copy of the status of the Logic Input delayed by tAux8 to tAux C time (optional configuration)
P> or P>>	Instaneous 1^{st} or 2^{nd} active overpower trip threshold (P127)
tP> or tP>>	Time delayed 1^{st} or 2^{nd} active overpower trip threshold (P127)
P< or P<<	Instaneous 1^{st} or 2^{nd} active underpower trip threshold (P127)
tP< or tP<<	Time delayed 1^{st} or 2^{nd} active underpower trip threshold (P127)
Q> or Q>>	Instaneous 1^{st} or 2^{nd} reactive overpower trip threshold (P127)
tQ> or tQ>>	Time delayed 1^{st} or 2^{nd} reactive overpower trip threshold (P127)
Q< or Q<<	Instaneous 1^{st} or 2^{nd} reactive underpower trip threshold (P127)

TEXT	Information
tQ< or tQ<<	Time delayed 1st or 2nd reactive underpower trip threshold (P127)
V2>, V2>>	Instaneous 1st or 2nd negative overpower trip threshold (P127)
tV2>, tV2>>	Time delayed 1st or 2nd negative overpower trip threshold (P127)
F1 to F6	Instantaneous first to sixth frequency trip threshold (P127)
tF1 to tF6	Time delayed first to sixth frequency trip threshold (P127)
dF/dt1 to dF/dt6	1st to 6th rates of change of frequency
VTS	Instantaneous Voltage Transformer Supervision output signal (P127)
CTS	Instantaneous Current Transformer Supervision signal (P127)
Ie_d>, Ie_d>>	Instantaneous 1st or 2nd derived earth overcurrent threshold
tIe_d>, tIe_d>>	Time delayed 1st or 2nd derived earth overcurrent threshold
79 i.Blo	Autoreclose lock activated by the internal process of the autoreclose (Internal Blocking)
79 e.Blo	Autoreclose lock activated by the input “block 79” (External Blocking)
tEQU. A to tEQU. H	Results of equations A to H.
CB FLT	Circuit Breaker failure
C.Order1 to C.Order4	P127 only Remote communication orders (pulse commands from remote devices through communication protocols)

Example settings for Equation A

AUTOMAT. CTRL	
Logic Equations	
Equation A	Heading of Equation A submenu.
Equ.A Toperat. **0.00s**	The time of operation setting is used to set the minimum time of truth of the selected conditions before validating the truth of the logic operation. Setting choice: from 0 to 600s, step 10ms
Equ.A Treset. **0.00s**	The reset time sets a minimum time before the logic operation is not true when at least one condition is not true. Setting choice: from 0 to 600s, step 10ms

The following submenu are identical from A.01 to A.15.

Equation A.00 1/2 **= Null**	Boolean function: Setting choice: “=”, “= Not”
Equation A.00 2/2 **= None**	Logic signal: Setting Choice: Null and logic signals (see table)

2.8.17 Submenu Comm. Order delay (P127 only)

It is possible to send to MiCOM P127 relays up to four remote communication orders. These signals can be assigned to output relays 2-8, and are available in the Boolean Logic equations.

This menu sets individually the pulse length of the "communication orders" pulses.

AUTOMAT. CTRL	
Comm. Order delay	Heading of remote communication order sub menu.
tOrder Comm 1 0.1s	Sets the pulse duration for the reception of the remote "communication order 1" signal. Setting range from 0s to 600s, in steps of 50ms.
tOrder Comm 2 0.1s **tOrder Comm 3 0.1s** **tOrder Comm 4 0.1s**	As above for communication orders 2, 3 and 4.

2.9 RECORDS menu

With the RECORDS menu stored data, events, disturbances and monitoring signals from various submenus can be displayed and read.

The different submenus are:

RECORDS			
CB Monitoring (1)	Fault Record	Instantaneous	Disturb Record
Time Peak Value (1)	Rolling Demand (1)		

(1) P126 and P127 only

2.9.1 Submenu CB Monitoring (P126 & P127 only)

With the CB Monitoring submenu it is possible to read and clear counter values associated with the circuit breaker.

RECORD	Heading the RECORD menu.
CB Monitoring	Heading the CB Monitoring submenu.
CB Opening Time **0.05 s**	Displays the circuit breaker opening time.
CB Closing Time **0.05 s**	Displays the circuit breaker closing time.
CB Operations **RST = [C] 0**	Displays the number of opening commands executed by the circuit breaker. To clear these values, press Ⓒ.
Σ Amps (n) **RST = [C]**	Displays the summation of the current (in Amps or square Amps) interrupted by the CB. Stored current values for all 3 phases are cleared together. To clear these values, press Ⓒ.
Σ Amps (n) IA **2 E04**	Displays the summation value of the current (in Amps or square Amps) for phase A interrupted by the circuit breaker.
Σ Amps (n) IB **2 E04**	As above for phase B.
Σ Amps (n) IC **2 E04**	As above for phase C.

2.9.1.1 Submenu Fault Record

The Fault Record submenu makes it possible to read up to 25 stored fault records, that occurred when programmed thresholds were exceeded.

The fault records are generated by the operation of trip relay RL1.

NOTE: All measurement magnitude values refer to the transformer primary side.

RECORD	
Fault Record	Heading of Fault Record submenu
Record Number **5**	Selection one of the 25 Fault Record to be displayed (selection = 5).
Fault Time **13:05:23**	Displays the time when the fault was recorded. The format of the time is hh:mm:ss. In this example the fault was recorded at 1:05:23 pm.
Fault Date **12/11/01**	Displays the date when the fault was recorded. The format of the Date is DD/MM/YY. In this example, the fault was recorded on November 12th 2001.
Active Set Group **1**	Displays the active setting group (1 or 2).
Faulted Phase **PHASE A**	Displays the phase, where a fault occurred, for the chosen fault record. (NONE, PHASE A, B, C, EARTH)
Threshold **-----**	Displays the origin of the fault that generated the trip order
Magnitude **1200 A**	Displays the magnitude value of the fault: Voltage, current, earth power. The value is based on the amplitude at 50 or 60 Hz.
IA Magnitude **1200 A**	Displays the magnitude value of the phase A current at the time of the fault.
IB Magnitude **1200 A**	As above for phase B.
IC Magnitude **1280 A**	As above for phase C.
IN Magnitude **103 A**	As above for earth current.
VAB Magnitude **10 KV**	Displays the magnitude value of the phase A to phase B voltage at the time of the fault (P127 only).
VBC Magnitude **10 KV**	Displays the magnitude value of the phase B to phase C voltage at the time of the fault (P127 only).
VCA Magnitude **10 KV**	Displays the magnitude value of the phase C to phase A voltage at the time of the fault (P127 only).
VN Magnitude **100 V**	Displays the magnitude value of the residual voltage at the time of the fault.
IA^VBC Angle **----°**	Displays the angle between phase A current and phase B to phase C voltage at the time of the fault (P127 only). The indication is ----° if the angle cannot be measured.

IB^VCA Angle **----°**	Displays the angle between phase B current and phase C to phase A voltage at the time of the fault (P127 only). The indication is ----° if the angle cannot be measured.
IC^VAB Angle **----°**	Displays the angle between phase C current and phase A to phase B voltage at the time of the fault. (P127 only) The indication is ----° if the angle cannot be measured.
IN^VN Angle **----°**	Displays the angle between earth current and voltage at the time of the fault. The indication is ----° if the angle cannot be measured.

2.9.1.2 Submenu Instantaneous

The instantaneous sub-menu makes possible to read the various parameters for each of the last five starting information.

NOTE: All measurement magnitude values refer to the transformer primary side.

RECORD	
Instantaneous	Heading of the Instantaneous sub-menu.
Number **5**	Selection of the Istantaneous Record number 5 to be displayed (selection: 1 to 5).
Hour **13:05:23**	Displays the time when the istantaneous record was recorded. The format of the time is hh:mm:ss. In this example the fault was recorded at 1:05:23 pm.
Date **12/11/01**	Displays the date when the instantaneous record was recorded. The format of the Date is DD/MM/YY. In this example, the fault was recorded on November 12th 2001.
Origin **-----**	Display the origin of the start information.
Lenght **70 ms**	Display the length of the start information.
Trip **No**	Display if a trip has succeeded to the start information..

2.9.2 Submenu Disturb Record

The Disturb Record submenu makes it possible to open and read disturbance records. Each disturbance record consists of analogue and digital data. Up to 9 seconds disturbance record(s) duration can be stored (5 x 3s, 4 x 3s, 3 x 5s, 2 x 7s or 1 x 9s). The beginning of the record can be adjusted with a selected pre-time.

RECORD	
Disturb Record	Heading of Disturb Record submenu.
Records number ? **5**	Setting choices: 1, 2, 3, 4 or 5. Sets the disturbance record length. This setting choice adjusts the number of records according to the record length. Setting choice allows 5 records of 3 seconds, 4 records of 3 seconds, 3 records of 5 seconds, 2 records of 7 seconds or 1 record of 9 seconds.
Pre-Time **0.1 s**	Selection of the disturbance record pre-time from 100 ms to 2.9s, 4.9s, 6.9s or 8.9s (record length minus 0.1s) in steps of 100 ms. The pre-time adjusts the beginning of the disturbance record: In this example, the record starts 100ms before the disturbance. Its length is fixed.
Disturb rec Trig **ON INST.**	Selection of start criteria for the disturbance recording function. Select between ON INST. (start on instantaneous thresholds) and ON TRIP (start on trip conditions) by pressing ⊗ or ⊗. Press ⊕ to confirm choice.

2.9.2.1 Submenu Time Peak Value (P126 & P127 only)

The Time Peak Value submenu makes it possible to set parameters associated to this function. (Peak and average values displayed in the Measurements menu).

RECORD	
Time Peak Value	Heading of Time Peak Value submenu.
Time Window **5 mn**	Selection of the time window during which peak and average values are stored. Selet choice: 5mn, 10mn, 15mn, 30mn, or 60mn.

2.9.2.2 Submenu Rolling Demand (P126 & P127)

The Rolling Demand sub-menu makes possible to set the rolling sub-period and the number of the sub-period for the calculation of the 3 phase Rolling Average and peak demand values, available in the Measurement menu.

RECORD	
Rolling Demand	Heading of the Rolling Demand sub-menu.
Sub Period **1 mn**	Set the window of time of the subperiod used to calculate rolling average values, from 1mn to 60mn (step 1mn)
Num of Sub Per **1**	Select the number of sub-period used for the calculation of the average of these average values.

3. WIRING

The **MiCOM P125, P126** & **P127** relays have the same terminal layout for common elements. The wiring diagram for each model is provided in Appendix 1 of the Technical Guide.

3.1 Auxiliary Power Supply

The auxiliary power supply for the **MiCOM P125, P126** & **P127** relays can be either direct current with a voltage range of 24-60 VDC, 48-250 VDC, 130-250 VDC, or alternative current with a voltage of 48-250 VAC/ 50-60 Hz. The voltage range (Ua) is specified on the adhesive paper label under the top hinged cover on the front of the relay.

The auxiliary power supply must only be connected to terminals 33 and 34.

3.2 Current Measurement Inputs

The **MiCOM P125, P126** & **P127** relays have up to eight current inputs (2 times 4 earth and phase current inputs).

The nominal current value of the measuring inputs is either 1 Amp or 5 Amp (refer to wiring diagram). For the same relay, the user can mix the 1 and 5 Amp inputs between phases and earth.

NOTE: All phase inputs must have the same rating (1 or 5 Amps).

3.3 Digital Inputs

The number of logic inputs depends on the relay model. The relays have programmable opto-isolated logic inputs, which may be assigned to any available label or function.

Digital inputs for each relay model:

Model	P125	P126	P127
Digital Inputs	4	7	7 / 12

The voltage range of the inputs is universal (from 24-240Vac/250 Vdc).

3.4 Output Relays

The number of logic outputs depends on the relay model. The relays have configurable logic outputs, which may be assigned to any available function.

The normally closed (NC) contact of the Watchdog (RL0) is not configurable. The other contacts are configurable to functions available in the relay. A basic output matrix is included in the relay. Some logic outputs have changeover contacts. RL1 and RL2 can be configured to be fail safe or not.

Logic outputs for each relay model:

Model	P125	P126	P127
Logic outputs	6	8	8

The first logic output (RL0) is dedicated to indicate a relay failure (Watchdog, WD) and is not part of this table.

3.5 Communication

3.5.1 RS485 Rear Communication Port

All MiCOM relays have one RS485 rear communication port by default. The terminals 29-30-31-32 are dedicated to the RS485 communication port. An optional RS485 port is available on P127.

See wiring diagrams in chapter P12y/EN CO of the Technical Guide.

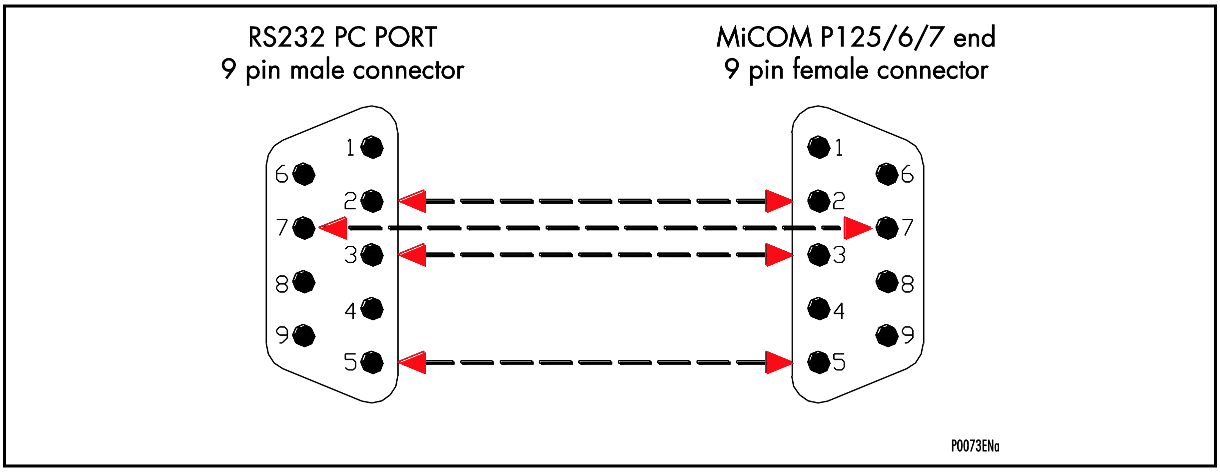
3.5.2 RS232 Front Communication Port

MiCOM P125, P126 & **P127** relays provide the user with a RS232 communication port on the front panel. This link is dedicated to MiCOM setting software.

The cable between the relays and the PC is a standard RS 232 shielded cable.

The relay requires a RS232 cable with a 9-pin male connector.

The wiring of the RS232 cable must be as follows:



FRONT PANEL PORT COMMUNICATION RS232 CABLE WIRING

A USB/RS232 cable can also be used to communicate to the relay.

MENU CONTENT TABLES

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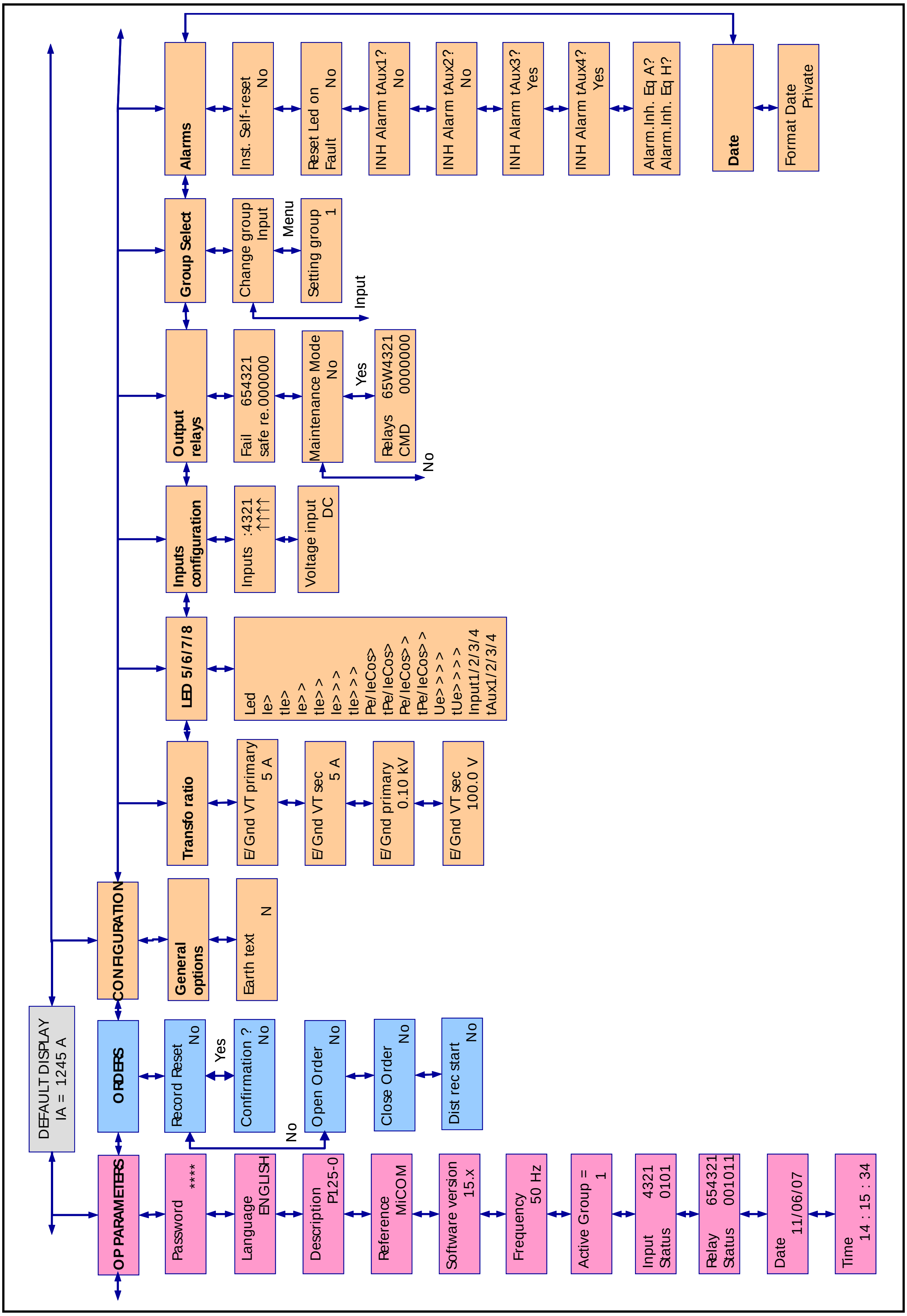
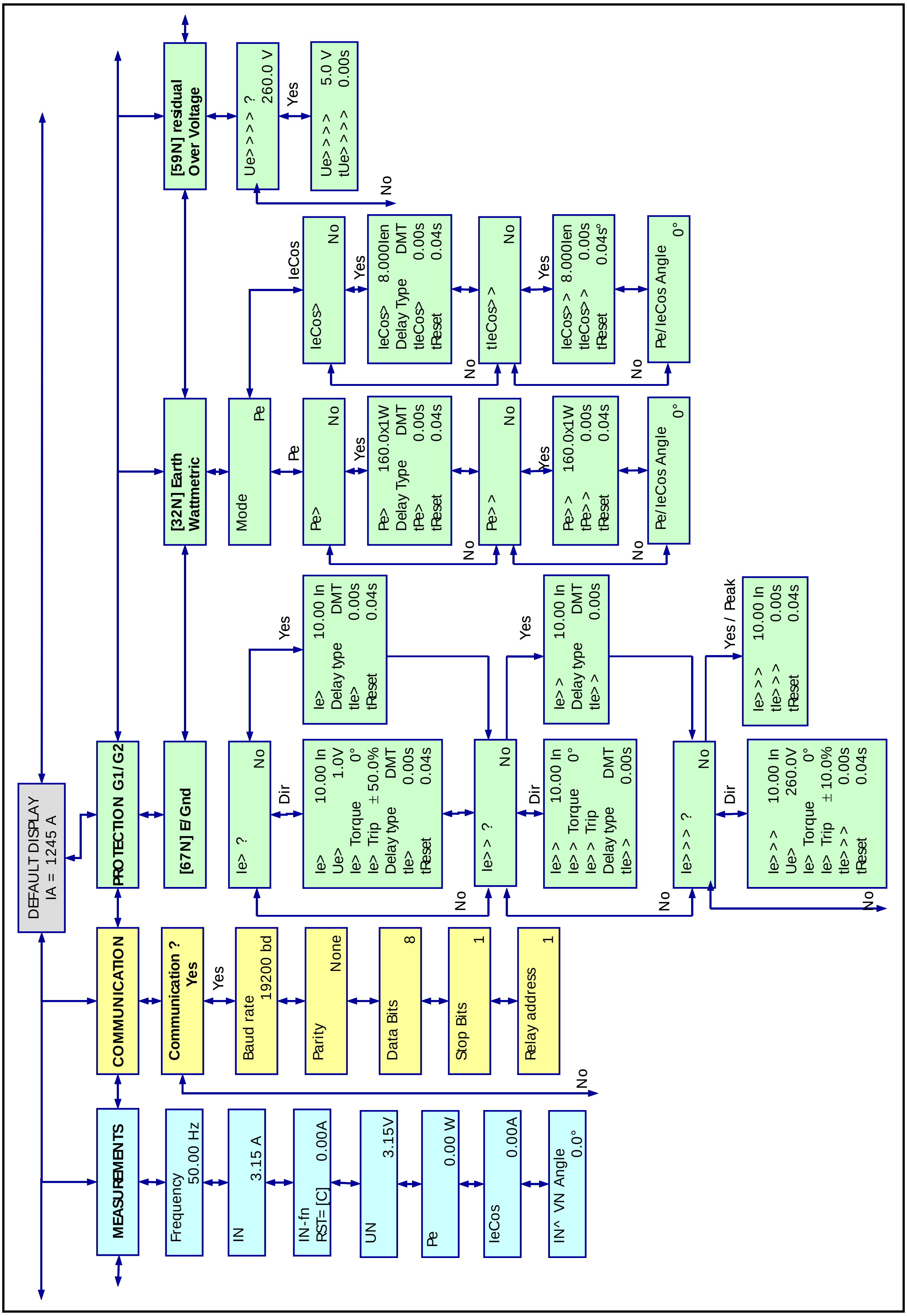
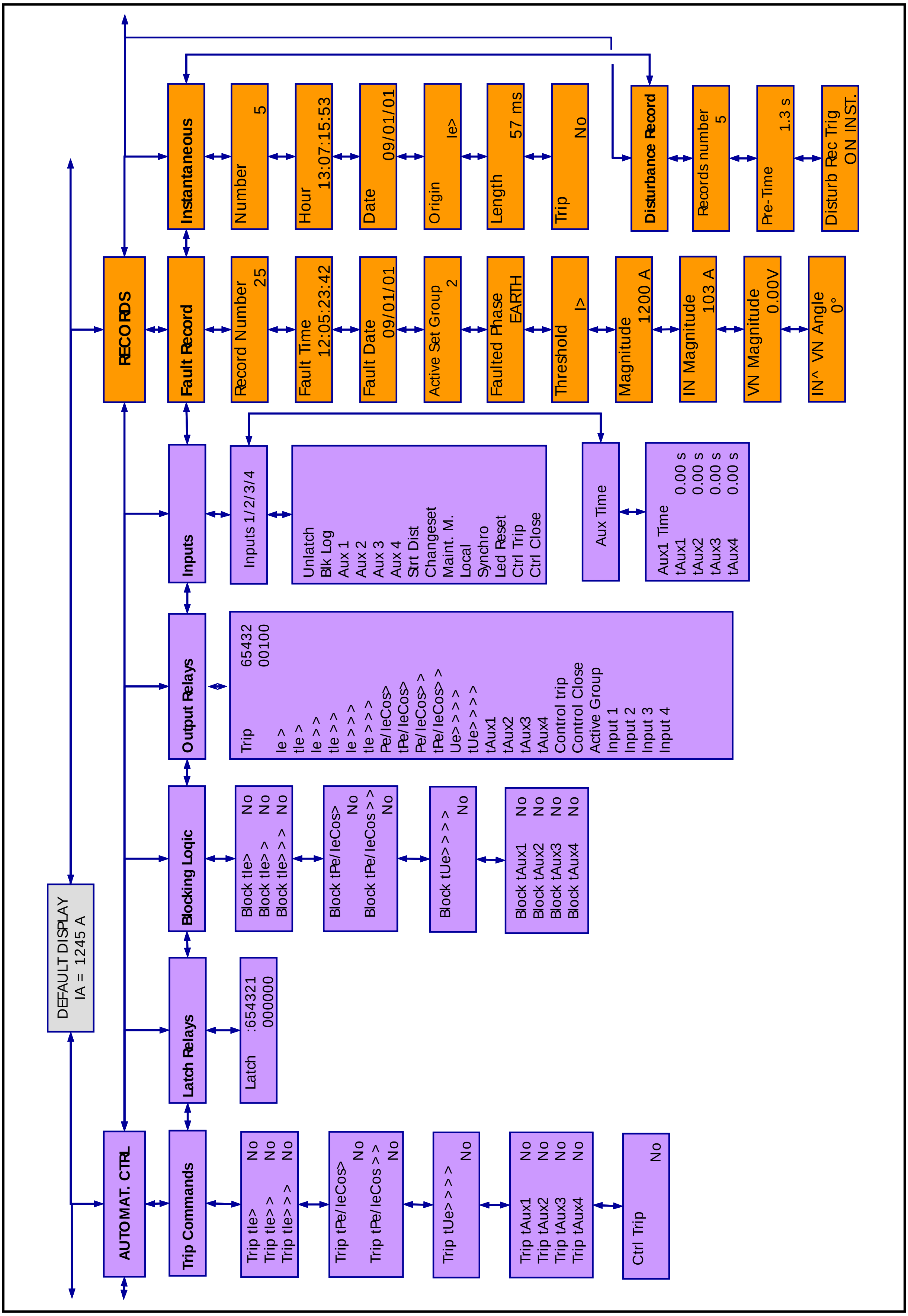
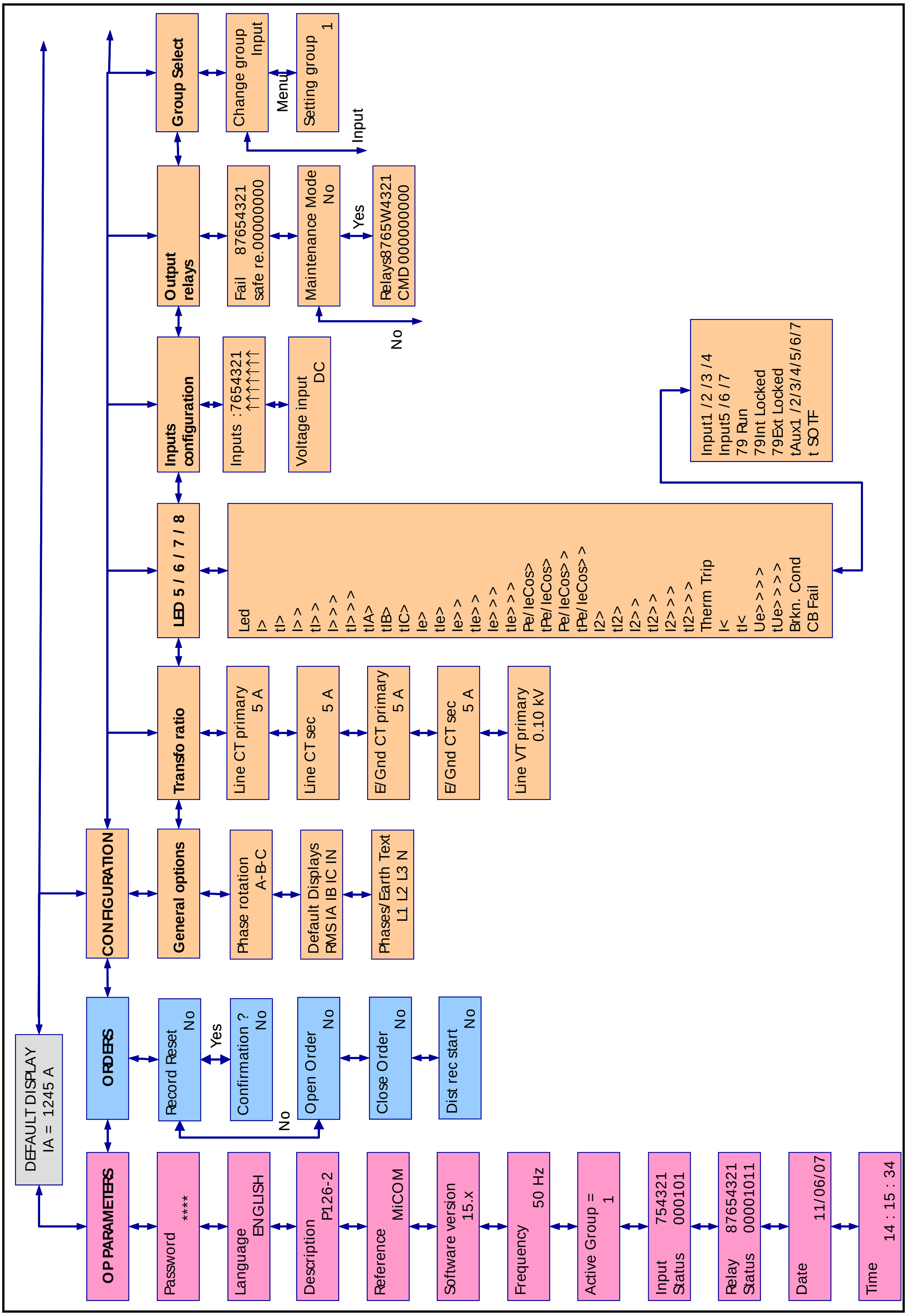
1. MiCOM P125 – V16 SOFTWARE

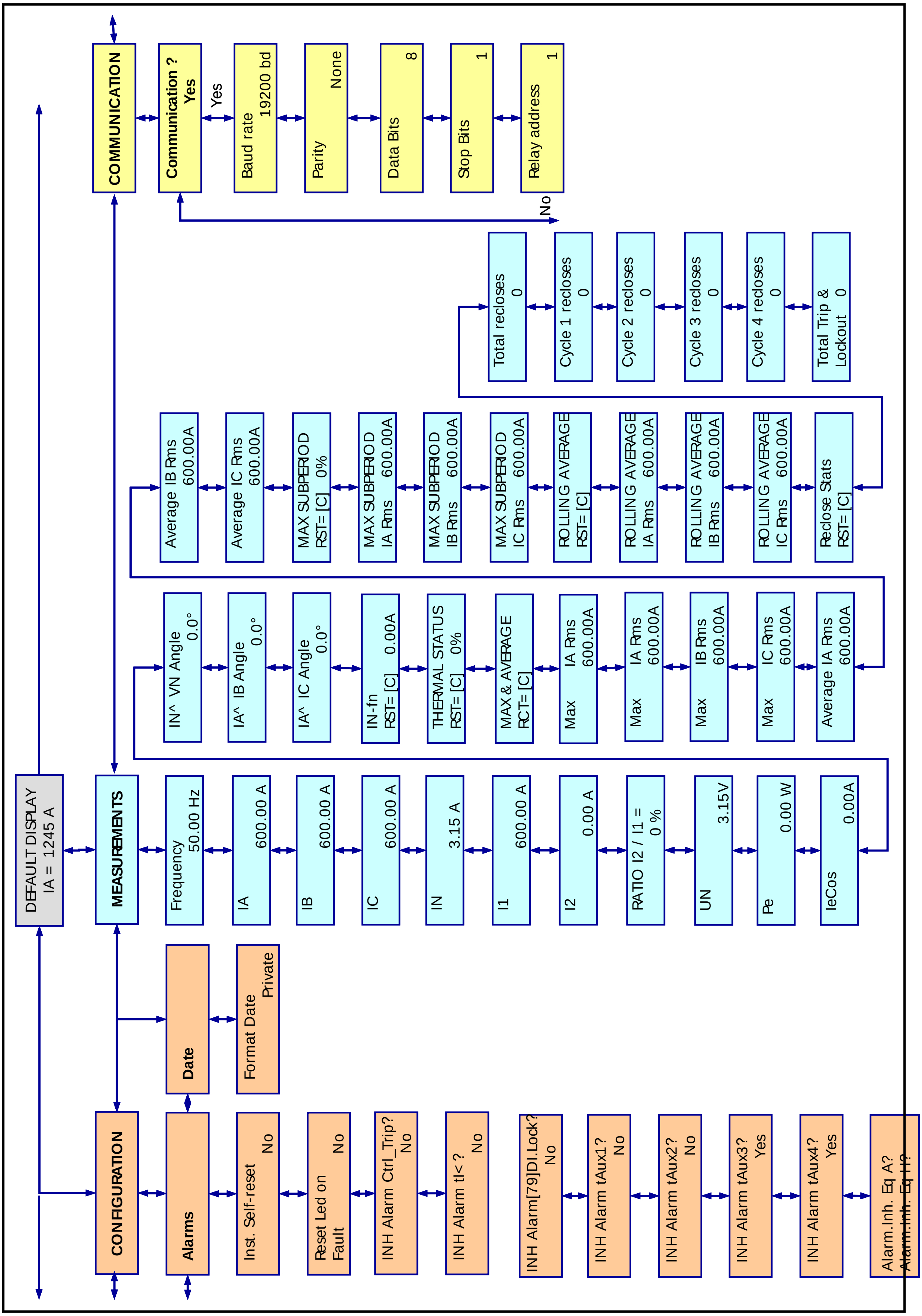


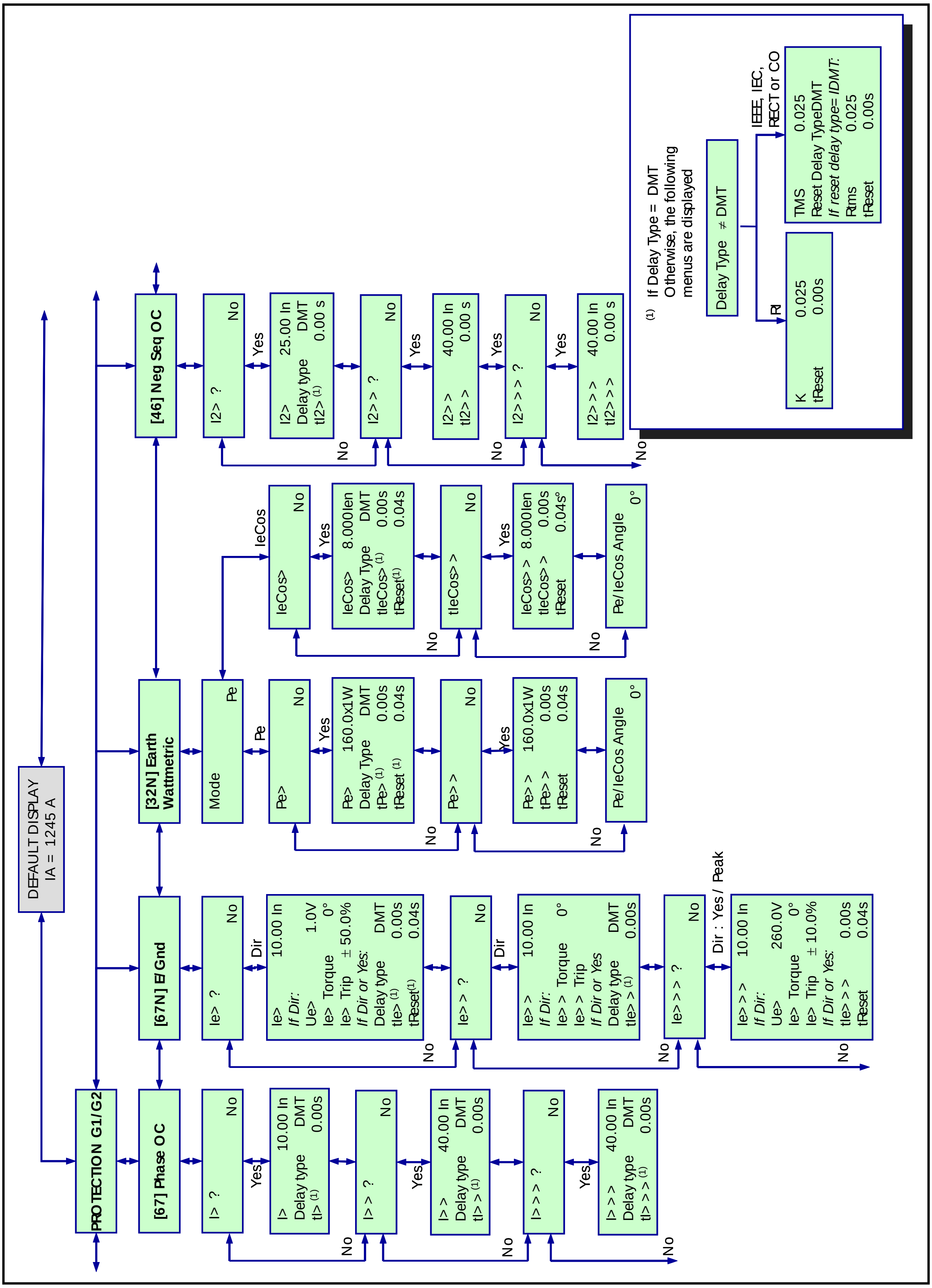

DEFAULT DISPLAY
IA = 1245 A
MEASUREMENTS
Frequency 50.00 Hz
IN 3.15 A
IN-fn RST= [C] 0.00A
UN 3.15V
Pe 0.00 W
IeCos 0.00A
IN^ VN Angle 0.0°
COMMUNICATION
Communication ? Yes
Yes
No
Baud rate 19200 bd
Parity None
Data Bits 8
Stop Bits 1
Relay address 1
PROTECTION G1/ G2
[67N] E/ Gnd
Ie> ? No
Dir
Yes
Ie> Ue> Ie> Torque Ie> Trip Delay type tIe> tReset 10.00 In 1.0V 0° ± 50.0% DMT 0.00s 0.04s
Ie> Delay type tIe> tReset 10.00 In DMT 0.00s 0.04s
Ie> > ? No
Ie> > Ie> > Torque Ie> > Trip Delay type tIe> > 10.00 In 0° DMT 0.00s
Ie> > Delay type tIe> > 10.00 In DMT 0.00s
Ie> > > ? No
Yes / Peak
Ie> > > Ue> Ie> Torque Ie> Trip tIe> > > tReset 10.00 In 260.0V 0° ± 10.0% 0.00s 0.04s
Ie> > > tIe> > > tReset 10.00 In 0.00s 0.04s
[32N] Earth Wattmetric
Mode Pe
Pe
Pe> No
Pe> Delay Type tPe> tReset 160.0x1W DMT 0.00s 0.04s
Pe> > No
Pe> > tPe> > tReset 160.0x1W 0.00s 0.04s
Pe/ IeCos Angle 0°
IeCos
IeCos> No
IeCos> Delay Type tIeCos> tReset 8.000Ien DMT 0.00s 0.04s
tIeCos> > No
IeCos> > tIeCos> > tReset 8.000Ien 0.00s 0.04s°
Pe/ IeCos Angle 0°
[59N] residual Over Voltage
Ue> > > > ? 260.0 V
Ue> > > > tUe> > > > 5.0 V 0.00s

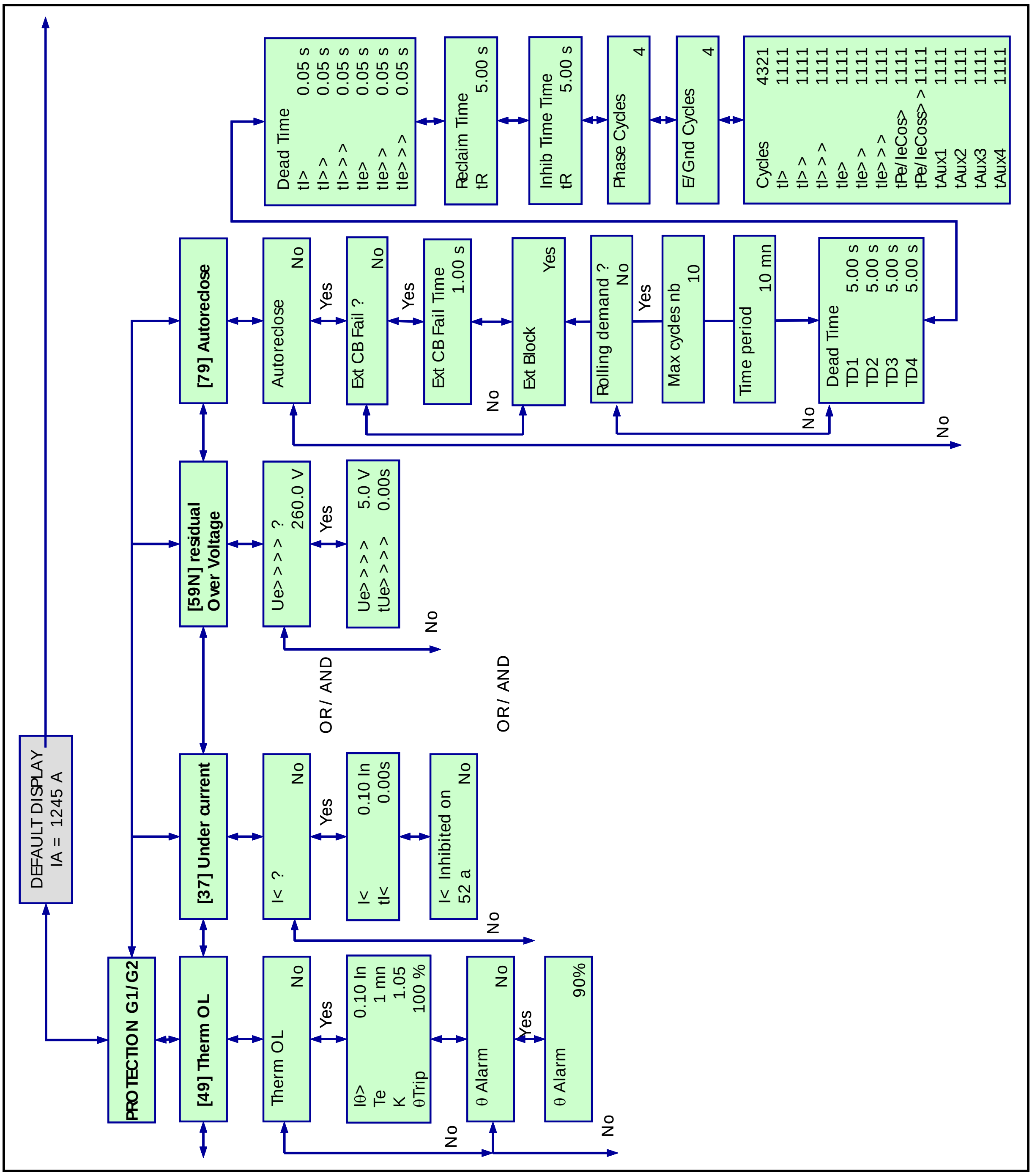

DEFAULT DISPLAY
IA = 1245 A
RECORDS
Instantaneous
Number 5
Hour 13:07:15:53
Date 09/01/01
Origin Ie>
Length 57 ms
Trip No
Disturbance Record
Records number 5
Pre-Time 1.3 s
Disturb Rec Trig ON INST.
Fault Record
Record Number 25
Fault Time 12:05:23:42
Fault Date 09/01/01
Active Set Group 2
Faulted Phase EARTH
Threshold I>
Magnitude 1200 A
IN Magnitude 103 A
VN Magnitude 0.00V
IN^ VN Angle 0°
Inputs
Inputs 1/2/3/4
Unlatch
Blk Log
Aux 1
Aux 2
Aux 3
Aux 4
Strt Dist
Changeset
Maint. M.
Local
Synchro
Led Reset
Ctrl Trip
Ctrl Close
Aux Time
Aux1 Time
tAux1 0.00 s
tAux2 0.00 s
tAux3 0.00 s
tAux4 0.00 s
Output Relays
Trip 65432 00100
Ie >
tIe >
Ie > >
tIe > >
Ie > > >
tIe > > >
Pe/IeCos>
tPe/IeCos>
Pe/IeCos> >
tPe/IeCos> >
Ue> > > >
tUe> > > >
tAux1
tAux2
tAux3
tAux4
Control trip
Control Close
Active Group
Input 1
Input 2
Input 3
Input 4
Blocking Logic
Block tIe> No
Block tIe> > No
Block tIe> > > No
Block tPe/IeCos> No
Block tPe/IeCos > > No
Block tUe> > > > No
Block tAux1 No
Block tAux2 No
Block tAux3 No
Block tAux4 No
Latch Relays
Latch :654321 000000
AUTOMAT. CTRL
Trip Commands
Trip tIe> No
Trip tIe> > No
Trip tIe> > > No
Trip tPe/IeCos> No
Trip tPe/IeCos > > No
Trip tUe> > > > No
Trip tAux1 No
Trip tAux2 No
Trip tAux3 No
Trip tAux4 No
Ctrl Trip No

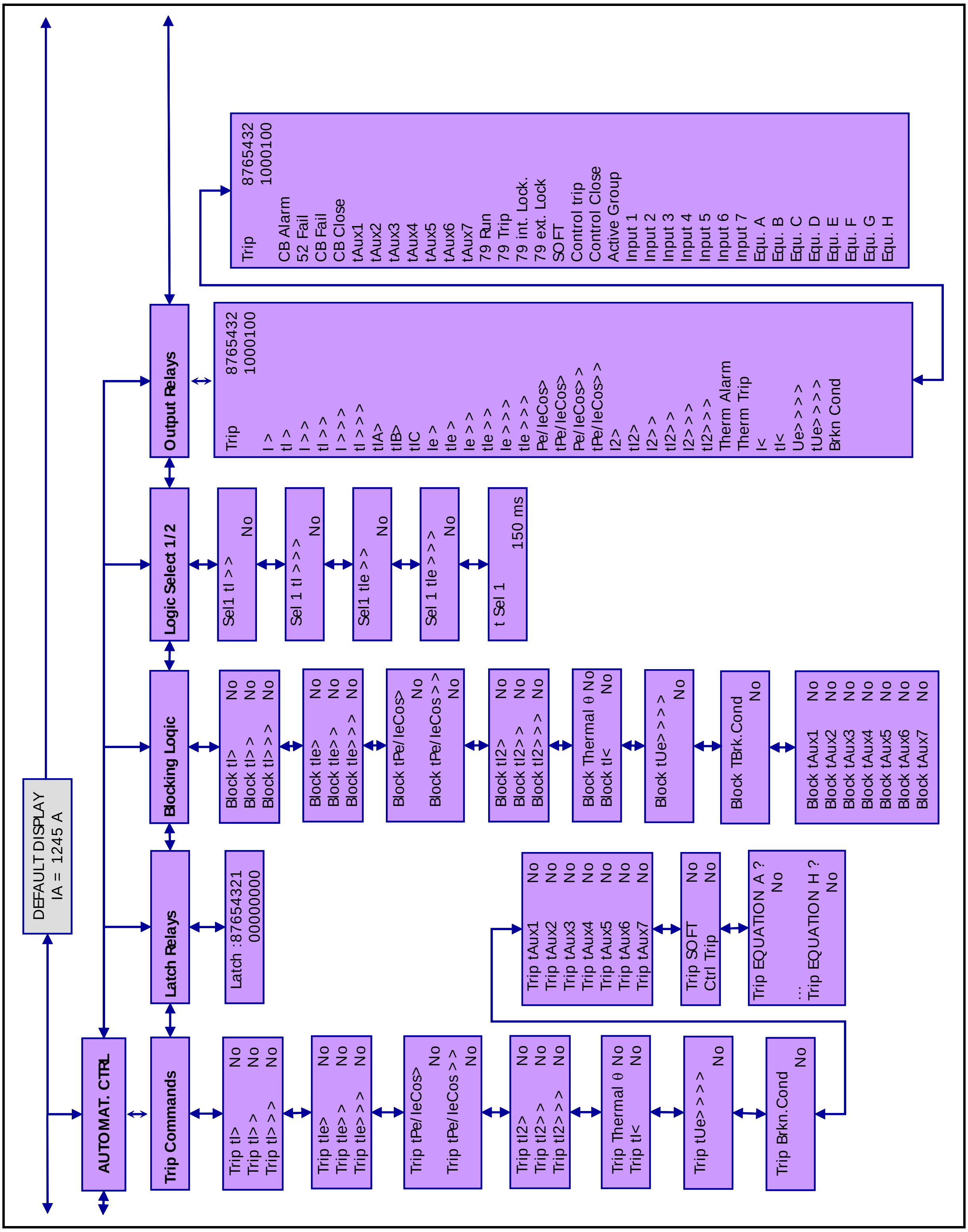
2. MiCOM P126 – V16 SOFTWARE

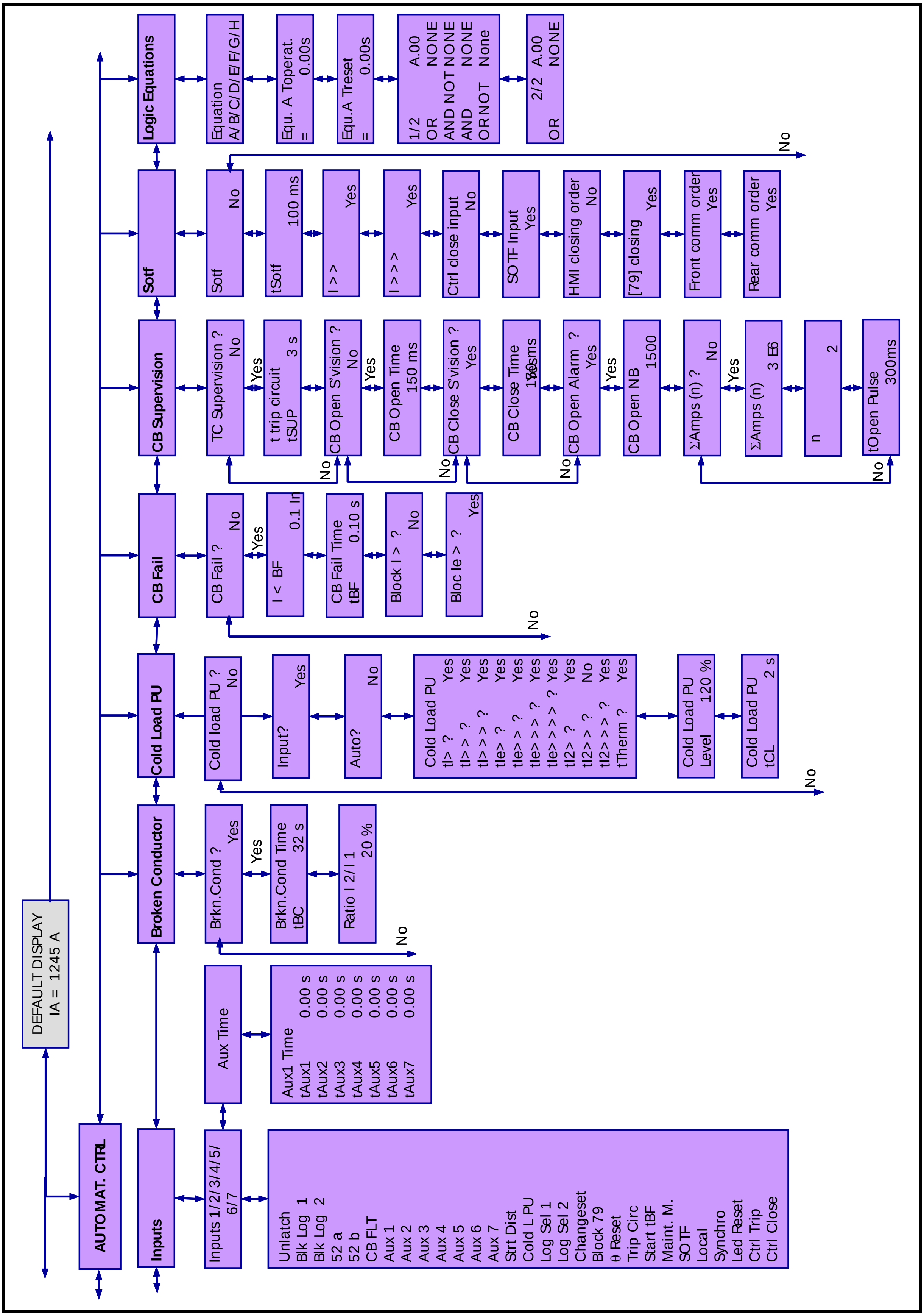


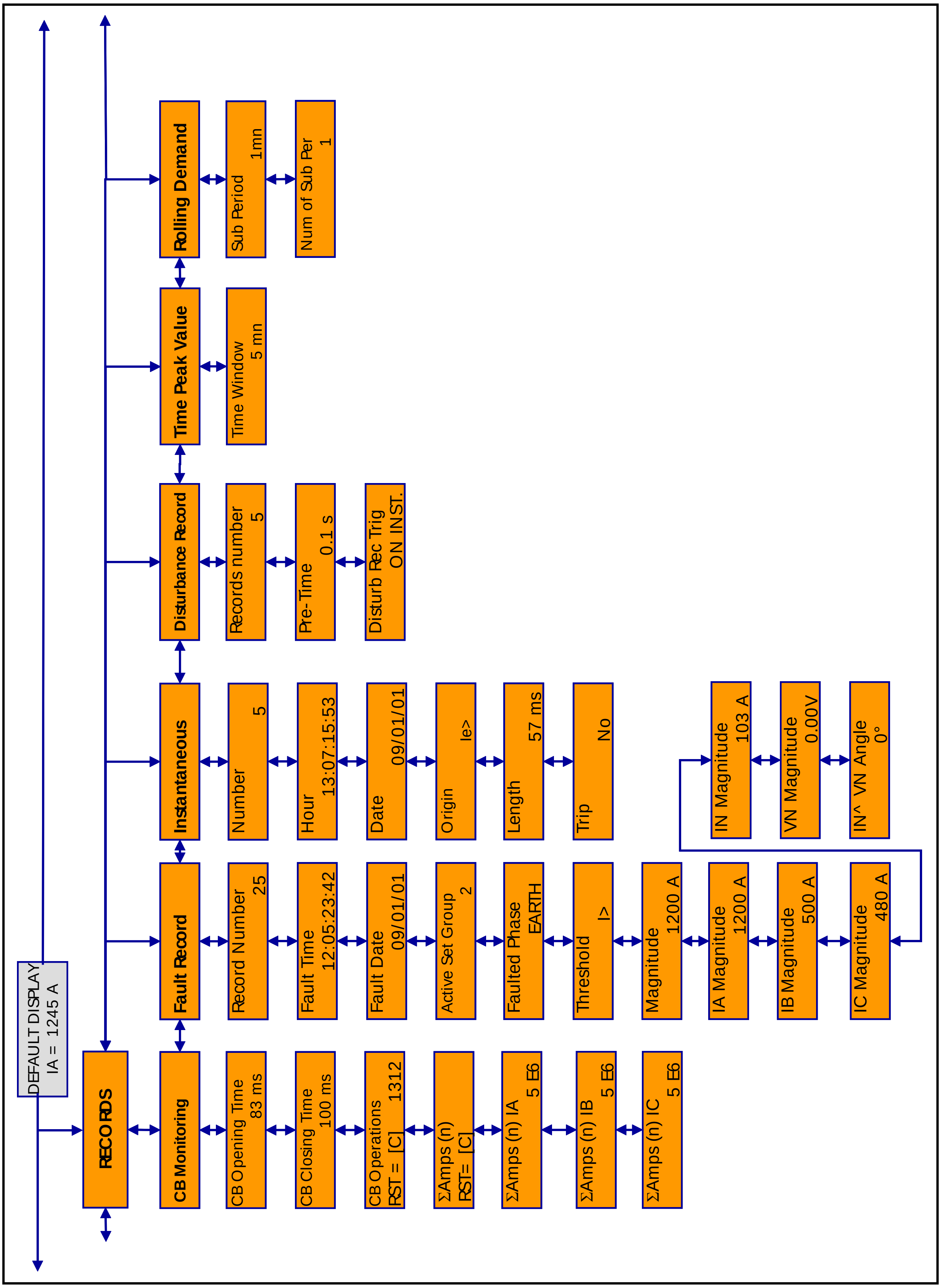

DEFAULT DISPLAY
IA = 1245 A
CONFIGURATION
Alarms
Inst. Self-reset
No
Reset Led on Fault
No
INH Alarm Ctrl_Trip?
No
INH Alarm tI< ?
No
INH Alarm[79]DI.Lock?
No
INH Alarm tAux1?
No
INH Alarm tAux2?
No
INH Alarm tAux3?
Yes
INH Alarm tAux4?
Yes
Alarm.Inh. Eq A?
Alarm.Inh. Eq H?
Date
Format Date
Private
MEASUREMENTS
Frequency
50.00 Hz
IA
600.00 A
IB
600.00 A
IC
600.00 A
IN
3.15 A
I1
600.00 A
I2
0.00 A
RATIO I2 / I1 =
0 %
UN
3.15V
Pe
0.00 W
IeCos
0.00A
IN^ VN Angle
0.0°
IA^ IB Angle
0.0°
IA^ IC Angle
0.0°
IN-fn
RST= [C] 0.00A
THERMAL STATUS
RST= [C] 0%
MAX & AVERAGE
RCT= [C]
Max IA Rms
600.00A
Max IA Rms
600.00A
Max IB Rms
600.00A
Max IC Rms
600.00A
Average IA Rms
600.00A
Average IB Rms
600.00A
Average IC Rms
600.00A
MAX SUBPERIOD
RST= [C] 0%
MAX SUBPERIOD
IA Rms 600.00A
MAX SUBPERIOD
IB Rms 600.00A
MAX SUBPERIOD
IC Rms 600.00A
ROLLING AVERAGE
RST= [C]
ROLLING AVERAGE
IA Rms 600.00A
ROLLING AVERAGE
IB Rms 600.00A
ROLLING AVERAGE
IC Rms 600.00A
Reclose Stats
RST= [C]
Total recloses
0
Cycle 1 recloses
0
Cycle 2 recloses
0
Cycle 3 recloses
0
Cycle 4 recloses
0
Total Trip &
Lockout 0
COMMUNICATION
Communication ?
Yes
Yes
Baud rate
19200 bd
Parity
None
Data Bits
8
Stop Bits
1
Relay address
1
No


DEFAULT DISPLAY
IA = 1245 A
PROTECTION G1/G2
[67] Phase OC
I> ?
No
Yes
I> 10.00 In
Delay type DMT
tI> (1) 0.00s
I> > ?
No
Yes
I> > 40.00 In
Delay type DMT
tI> > (1) 0.00s
I> > > ?
No
Yes
I> > > 40.00 In
Delay type DMT
tI> > > (1) 0.00s
No
[67N] E/Gnd
Ie> ?
No
Dir
Ie> 10.00 In
If Dir:
Ue> 1.0V
Ie> Torque 0°
Ie> Trip ± 50.0%
If Dir or Yes:
Delay type DMT
tIe> (1) 0.00s
tReset(1) 0.04s
Ie> > ?
No
Dir
Ie> > 10.00 In
If Dir:
Ie> > Torque 0°
Ie> > Trip
If Dir or Yes
Delay type DMT
tIe> > (1) 0.00s
Ie> > > ?
No
Dir : Yes / Peak
Ie> > > 10.00 In
If Dir:
Ue> 260.0V
Ie> Torque 0°
Ie> Trip ± 10.0%
If Dir or Yes:
tIe> > > 0.00s
tReset 0.04s
[32N] Earth Wattmetric
Mode
Pe
Pe>
No
Yes
Pe> 160.0x1W
Delay Type DMT
tPe> (1) 0.00s
tReset (1) 0.04s
Pe> >
No
Yes
Pe> > 160.0x1W
tPe> > 0.00s
tReset 0.04s
Pe/IeCos Angle 0°
IeCos
IeCos>
No
Yes
IeCos> 8.000Ien
Delay Type DMT
tIeCos> (1) 0.00s
tReset(1) 0.04s
tIeCos> >
No
Yes
IeCos> > 8.000Ien
tIeCos> > 0.00s
tReset 0.04s°
Pe/IeCos Angle 0°
[46] Neg Seq OC
I2> ?
No
Yes
I2> 25.00 In
Delay type DMT
tI2> (1) 0.00 s
I2> > ?
No
Yes
I2> > 40.00 In
tI2> > 0.00 s
I2> > > ?
No
Yes
I2> > > 40.00 In
tI2> > > 0.00 s
(1) If Delay Type = DMT
Otherwise, the following menus are displayed
Delay Type ≠ DMT
RI
K 0.025
tReset 0.00s
IEEE, IEC, RECT or CO
TMS 0.025
Reset Delay Type DMT
If reset delay type= IDMT:
Rtms 0.025
tReset 0.00s

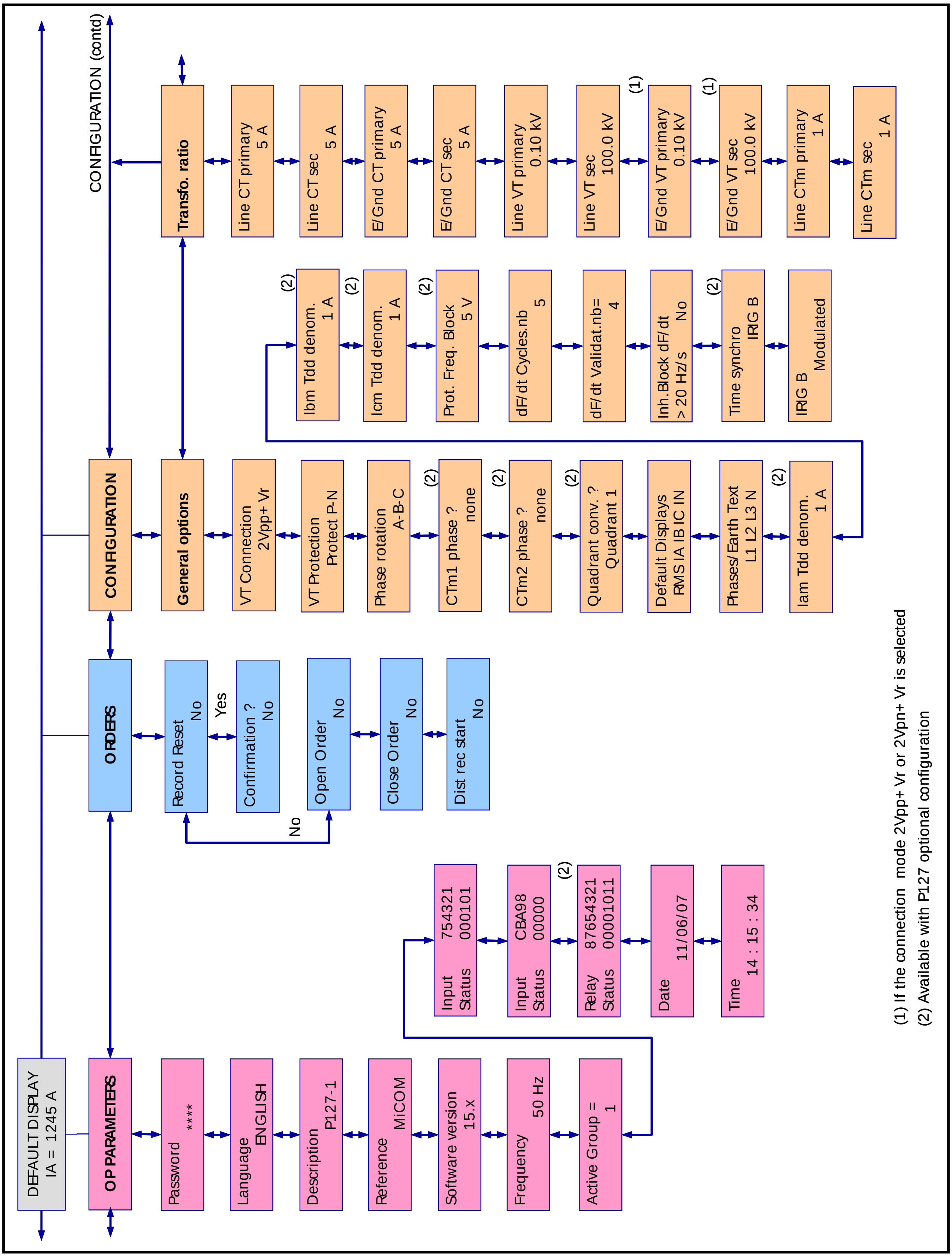

DEFAULT DISPLAY
IA = 1245 A
PROTECTION G1/G2
[49] Therm OL
Therm OL No
Iθ> 0.10 In
Te 1 mn
K 1.05
θTrip 100 %
θ Alarm No
θ Alarm 90%
[37] Under current
I< ? No
I< 0.10 In
tI< 0.00s
I< Inhibited on 52 a No
[59N] residual Over Voltage
Ue>>>> ? 260.0 V
Ue>>>> 5.0 V
tUe>>>> 0.00s
OR/ AND
OR/ AND
[79] Autoreclose
Autoreclose No
Ext CB Fail ? No
Ext CB Fail Time 1.00 s
Ext Block Yes
Rolling demand ? No
Max cycles nb 10
Time period 10 mn
Dead Time
TD1 5.00 s
TD2 5.00 s
TD3 5.00 s
TD4 5.00 s
Dead Time
tI> 0.05 s
tI>> 0.05 s
tI>>> 0.05 s
tIe> 0.05 s
tIe>> 0.05 s
tIe>>> 0.05 s
Reclaim Time
tR 5.00 s
Inhib Time Time
tR 5.00 s
Phase Cycles 4
E/Gnd Cycles 4
Cycles 4321
tI> 1111
tI>> 1111
tI>>> 1111
tIe> 1111
tIe>> 1111
tIe>>> 1111
tPe/IeCos> 1111
tPe/IeCos>> 1111
tAux1 1111
tAux2 1111
tAux3 1111
tAux4 1111
Yes
No

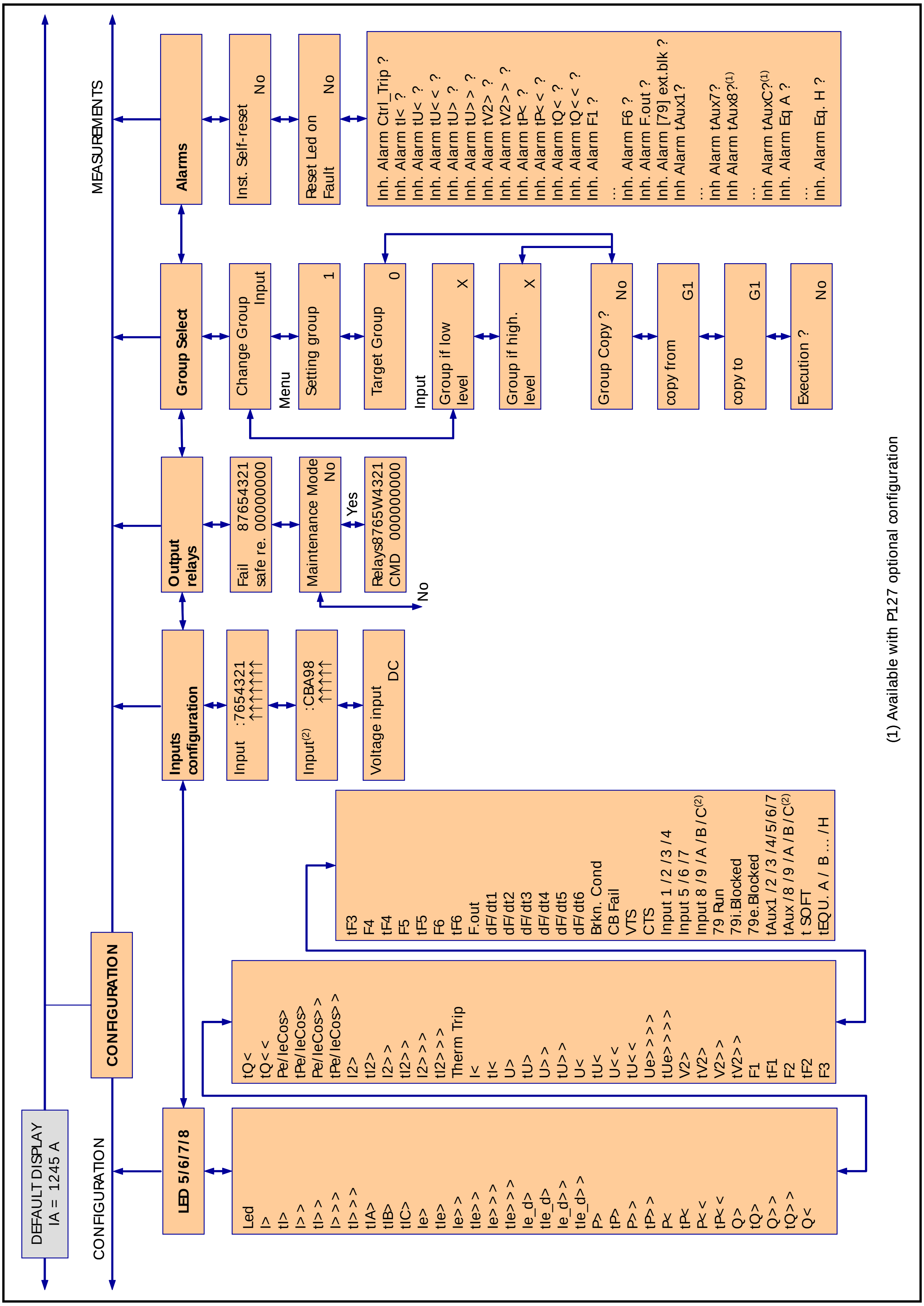

DEFAULT DISPLAY
IA = 1245 A
AUTOMAT. CTRL
Trip Commands
Trip tI> No
Trip tI> > No
Trip tI> > > No
Trip tIe> No
Trip tIe> > No
Trip tIe> > > No
Trip tPe/IeCos> No
Trip tPe/IeCos > > No
Trip tI2> No
Trip tI2> > No
Trip tI2> > > No
Trip Thermal θ No
Trip tI< No
Trip tUe> > > > No
Trip Brkn.Cond No
Latch Relays
Latch :87654321
00000000
Trip tAux1 No
Trip tAux2 No
Trip tAux3 No
Trip tAux4 No
Trip tAux5 No
Trip tAux6 No
Trip tAux7 No
Trip SOFT No
Ctrl Trip No
Trip EQUATION A ? No
...
Trip EQUATION H ? No
Blocking Logic
Block tI> No
Block tI> > No
Block tI> > > No
Block tIe> No
Block tIe> > No
Block tIe> > > No
Block tPe/IeCos> No
Block tPe/IeCos > > No
Block tI2> No
Block tI2> > No
Block tI2> > > No
Block Thermal θ No
Block tI< No
Block tUe> > > > No
Block TBrk.Cond No
Block tAux1 No
Block tAux2 No
Block tAux3 No
Block tAux4 No
Block tAux5 No
Block tAux6 No
Block tAux7 No
Logic Select 1/2
Sel1 tI > > No
Sel 1 tI > > > No
Sel1 tIe > > No
Sel 1 tIe > > > No
t Sel 1 150 ms
Output Relays
Trip 8765432
1000100
I >
tI >
I > >
tI > >
I > > >
tI > > >
tIA>
tIB>
tIC
Ie >
tIe >
Ie > >
tIe > >
Ie > > >
tIe > > >
Pe/IeCos>
tPe/IeCos>
Pe/IeCos> >
tPe/IeCos> >
I2>
tI2>
I2> >
tI2> >
I2> > >
tI2> > >
Therm Alarm
Therm Trip
I<
tI<
Ue> > > >
tUe> > > >
Brkn Cond
Trip 8765432
1000100
CB Alarm
52 Fail
CB Fail
CB Close
tAux1
tAux2
tAux3
tAux4
tAux5
tAux6
tAux7
79 Run
79 Trip
79 int. Lock
79 ext. Lock
SOFT
Control trip
Control Close
Active Group
Input 1
Input 2
Input 3
Input 4
Input 5
Input 6
Input 7
Equ. A
Equ. B
Equ. C
Equ. D
Equ. E
Equ. F
Equ. G
Equ. H

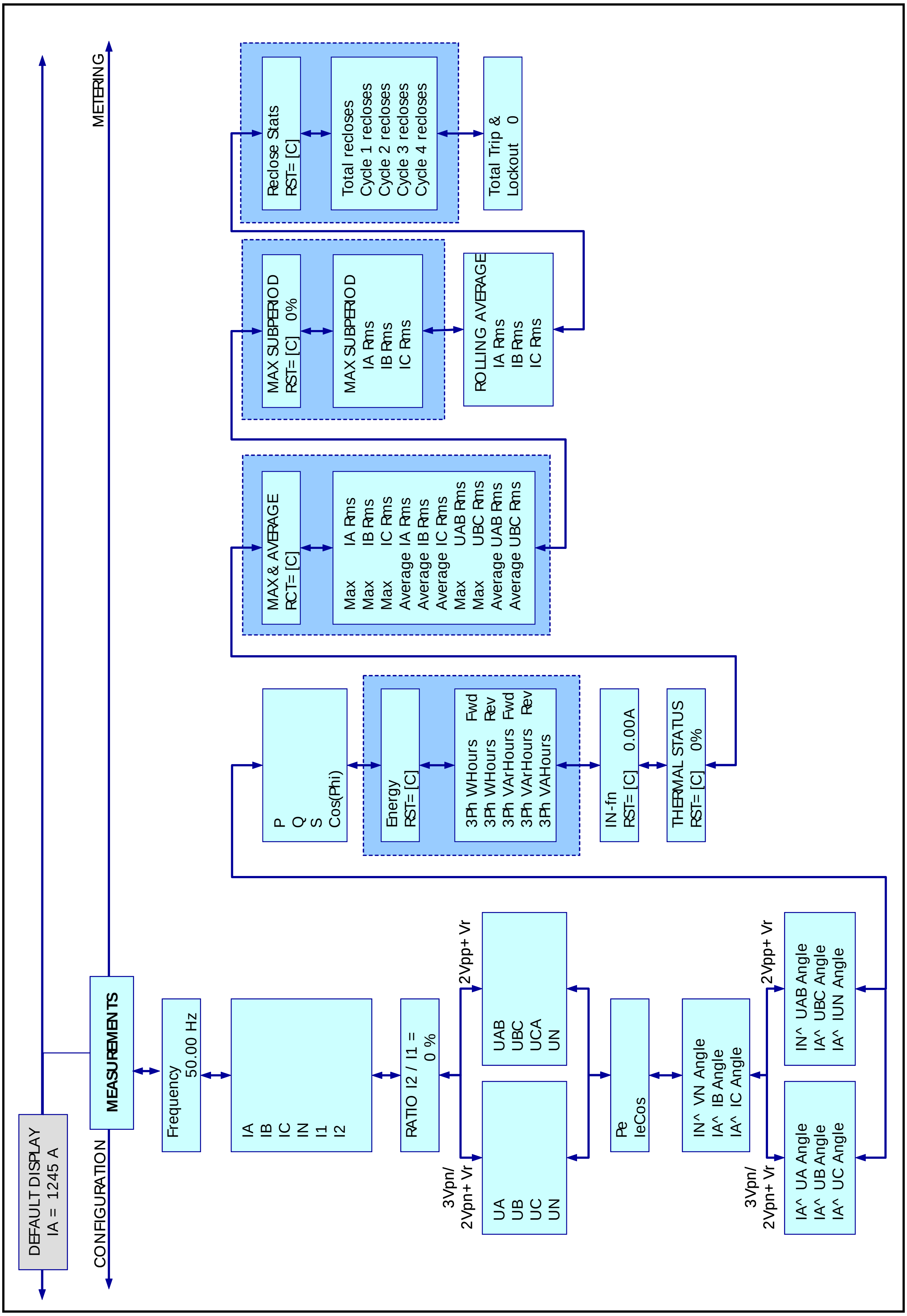

DEFAULT DISPLAY
IA = 1245 A
AUTOMAT. CTRL
Inputs
Inputs 1/2/3/4/5/6/7
Unlatch
Blk Log 1
Blk Log 2
52 a
52 b
CB FLT
Aux 1
Aux 2
Aux 3
Aux 4
Aux 5
Aux 6
Aux 7
Strt Dist
Cold L PU
Log Sel 1
Log Sel 2
Changeset
Block 79
θ Reset
Trip Circ
Start tBF
Maint. M.
SOTF
Local
Synchro
Led Reset
Ctrl Trip
Ctrl Close
Aux Time
Aux1 Time
tAux1 0.00 s
tAux2 0.00 s
tAux3 0.00 s
tAux4 0.00 s
tAux5 0.00 s
tAux6 0.00 s
tAux7 0.00 s
Broken Conductor
Brkn.Cond ? Yes
Brkn.Cond Time tBC 32 s
Ratio I 2/I 1 20 %
Cold Load PU
Cold load PU ? No
Input? Yes
Auto? No
Cold Load PU
tI> ? Yes
tI>> ? Yes
tI>>> ? Yes
tIe> ? Yes
tIe>> ? Yes
tIe>>> ? Yes
tIe>>>> ? Yes
tI2> ? No
tI2>> ? Yes
tI2>>> ? Yes
tTherm ? Yes
Cold Load PU Level 120 %
Cold Load PU tCL 2 s
CB Fail
CB Fail ? No
I < BF 0.1 In
CB Fail Time tBF 0.10 s
Block I > ? No
Bloc Ie > ? Yes
CB Supervision
TC Supervision ? No
t trip circuit tSUP 3 s
CB Open S'vision ? No
CB Open Time 150 ms
CB Close S'vision ? Yes
CB Close Time 150 ms
CB Open Alarm ? Yes
CB Open NB 1500
ΣAmps (n) ? No
ΣAmps (n) 3 E6
n 2
tOpen Pulse 300ms
Sotf
Sotf No
tSotf 100 ms
I > > Yes
I > > > Yes
Ctrl close input No
SOTF Input Yes
HMI closing order No
[79] closing Yes
Front comm order Yes
Rear comm order Yes
Logic Equations
Equation A/B/C/D/E/F/G/H
Equ. A Toperat. = 0.00s
Equ.A Treset = 0.00s
1/2 A.00
OR NONE
AND NOT NONE
AND NONE
OR NOT None
2/2 A.00
OR NONE
Yes
No

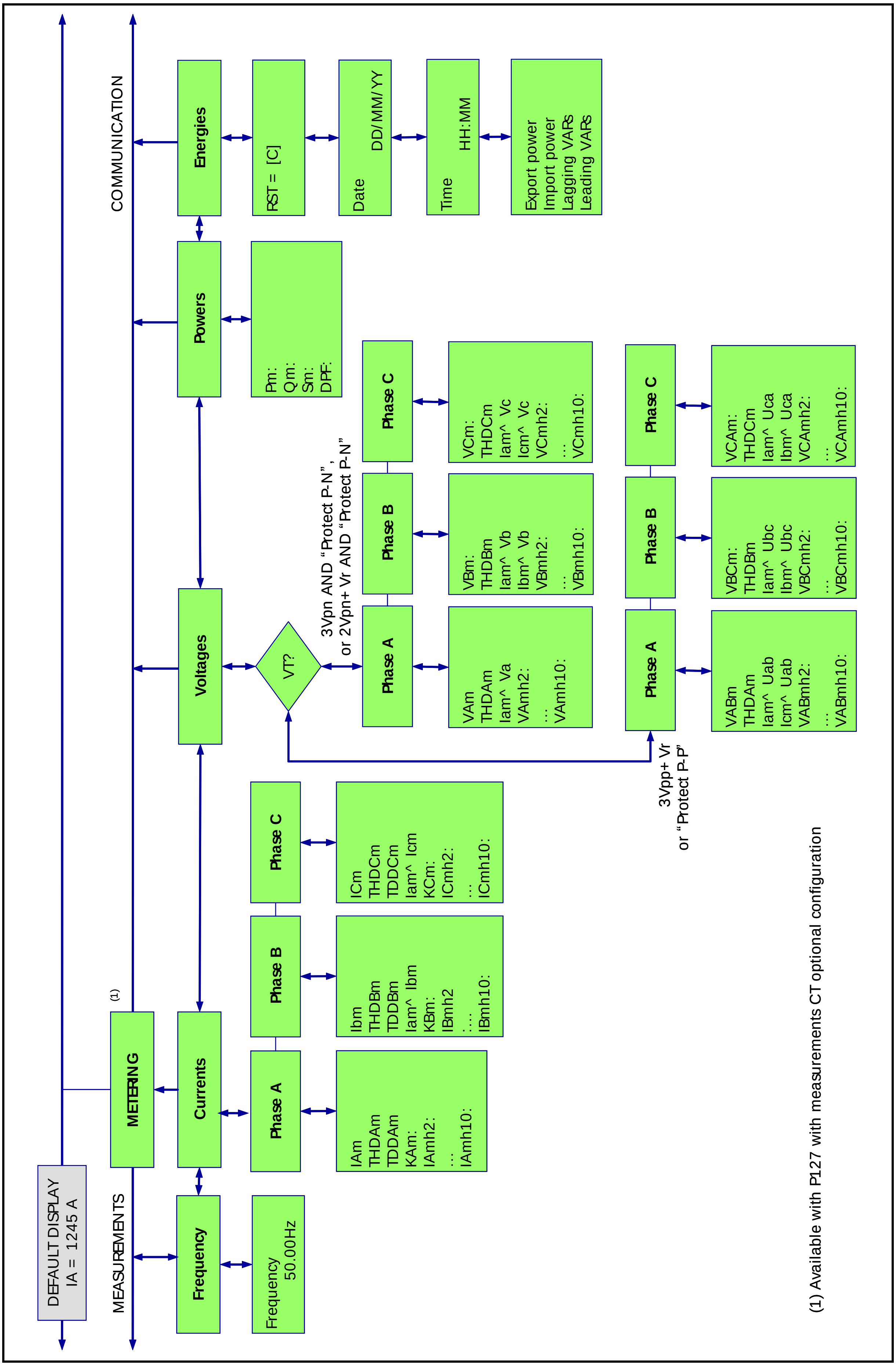

DEFAULT DISPLAY
IA = 1245 A
RECORDS
CB Monitoring
CB Opening Time 83 ms
CB Closing Time 100 ms
CB Operations RST = [C] 1312
ΣAmps (n) RST= [C]
ΣAmps (n) IA 5 E6
ΣAmps (n) IB 5 E6
ΣAmps (n) IC 5 E6
Fault Record
Record Number 25
Fault Time 12:05:23:42
Fault Date 09/01/01
Active Set Group 2
Faulted Phase EARTH
Threshold I>
Magnitude 1200 A
IA Magnitude 1200 A
IB Magnitude 500 A
IC Magnitude 480 A
IN Magnitude 103 A
VN Magnitude 0.00V
IN^ VN Angle 0°
Instantaneous
Number 5
Hour 13:07:15:53
Date 09/01/01
Origin Ie>
Length 57 ms
Trip No
Disturbance Record
Records number 5
Pre-Time 0.1 s
Disturb Rec Trig ON INST.
Time Peak Value
Time Window 5 mn
Rolling Demand
Sub Period 1 mn
Num of Sub Per 1

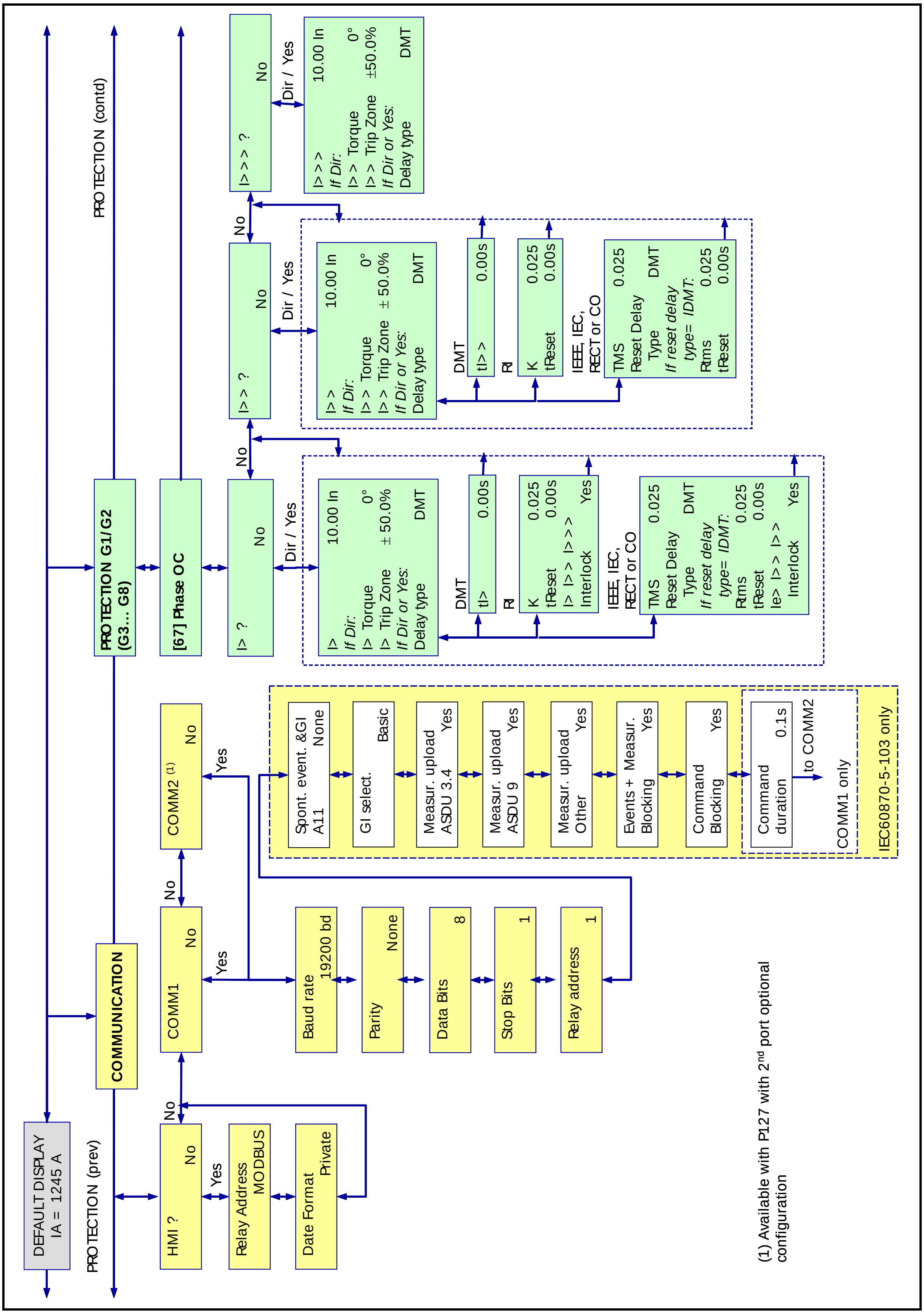
3. MiCOM P127 – V16 SOFTWARE

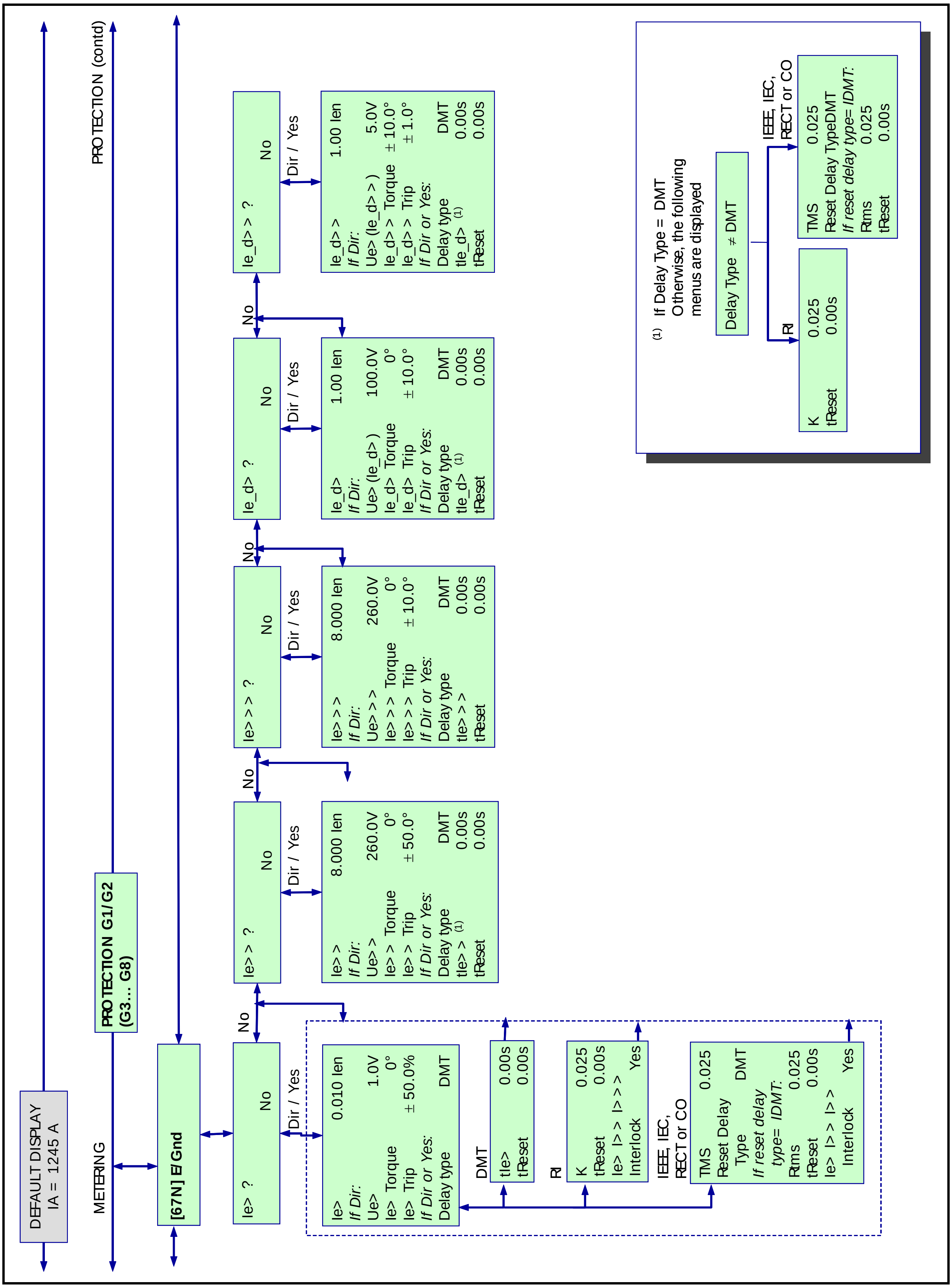


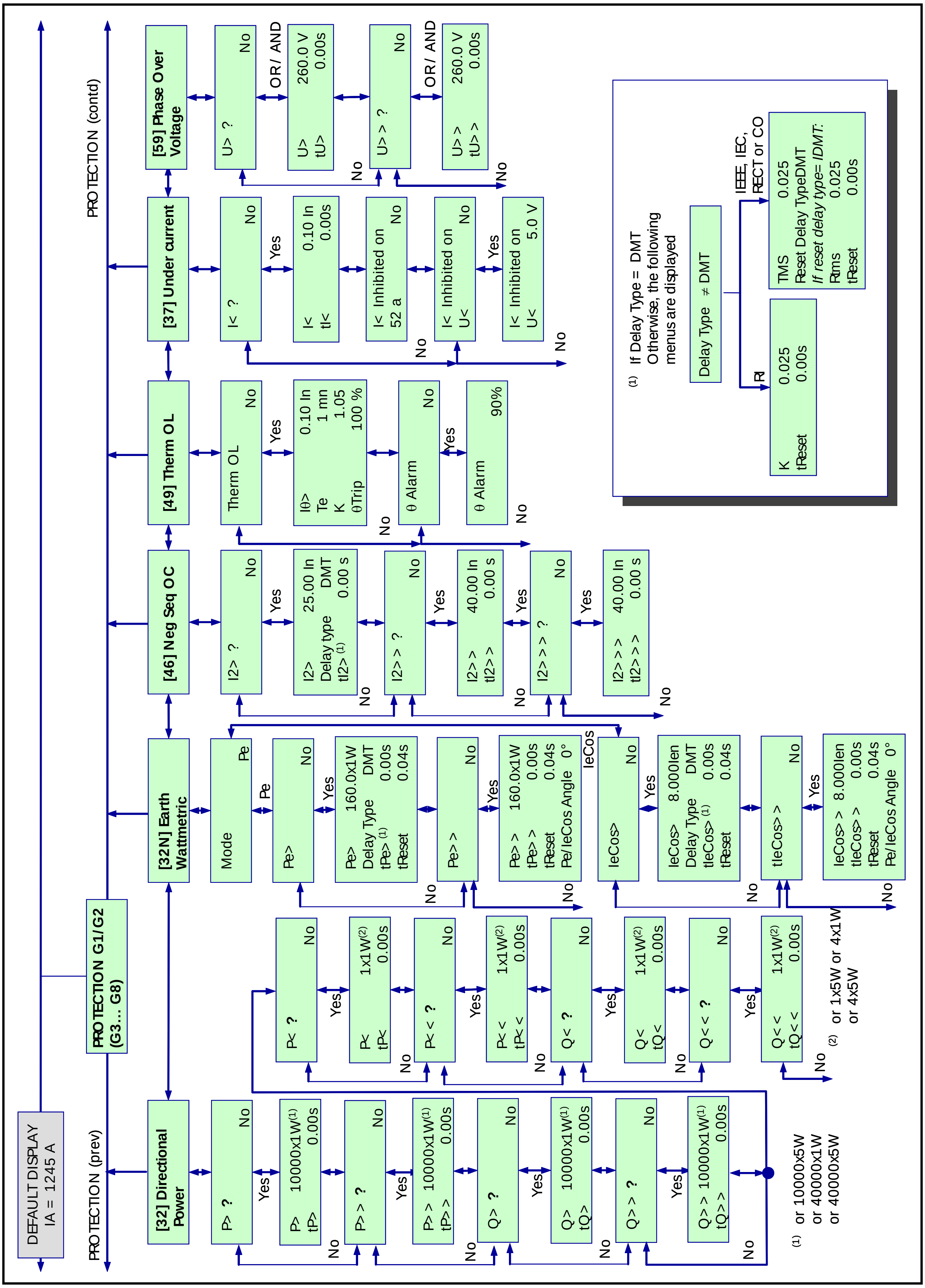

DEFAULT DISPLAY
IA = 1245 A
CONFIGURATION
MEASUREMENTS
CONFIGURATION
Alarms
Inst. Self-reset No
Reset Led on Fault No
Inh. Alarm Ctrl_Trip ?
Inh. Alarm tI< ?
Inh. Alarm tU< ?
Inh. Alarm tU<< ?
Inh. Alarm tU> ?
Inh. Alarm tU>> ?
Inh. Alarm tV2> ?
Inh. Alarm tV2>> ?
Inh. Alarm tP< ?
Inh. Alarm tP<< ?
Inh. Alarm tQ< ?
Inh. Alarm tQ<< ?
Inh. Alarm F1 ?
...
Inh. Alarm F6 ?
Inh. Alarm F.out ?
Inh. Alarm [79] ext.blk ?
Inh Alarm tAux1?
...
Inh Alarm tAux7?
Inh Alarm tAux8?(1)
...
Inh Alarm tAuxC?(1)
Inh. Alarm Eq A ?
...
Inh. Alarm Eq. H ?
Group Select
Change Group Input
Menu
Setting group 1
Target Group 0
Input
Group if low level X
Group if high. level X
Group Copy ? No
copy from G1
copy to G1
Execution ? No
Output relays
Fail safe re. 87654321 00000000
Maintenance Mode No
Yes
Relays8765W4321 CMD 000000000
No
Inputs configuration
Input :7654321
Input(2) :CBA98
Voltage input DC
LED 5/6/7/8
Led I> tI> I>> tI>> I>>> tI>>> tIA> tIB> tIC> Ie> tIe> Ie>> tIe>> Ie>>> tIe>>> Ie_d> tIe_d> Ie_d>> tIe_d>> P> tP> P>> tP>> P< tP< P<< tP<< Q> tQ> Q>> tQ>> Q<
tQ< tQ<< Pe/IeCos> tPe/IeCos> Pe/IeCos>> tPe/IeCos>> I2> tI2> I2>> tI2>> I2>>> tI2>>> Therm Trip I< tI< U> tU> U>> tU>> U< tU< U<< tU<< Ue>>>> tUe>>>> V2> tV2> V2>> tV2>> F1 tF1 F2 tF2 F3
tF3 F4 tF4 F5 tF5 F6 tF6 F.out dF/dt1 dF/dt2 dF/dt3 dF/dt4 dF/dt5 dF/dt6 Brkn. Cond CB Fail VTS CTS Input 1 /2 /3 /4 Input 5 /6 /7 Input 8 /9 /A /B /C(2) 79 Run 79i.Blocked 79e.Blocked tAux1 /2 /3 /4/5/6/7 tAux /8 /9 /A /B /C(2) t SOFT tEQU. A / B ... / H
(1) Available with P127 optional configuration

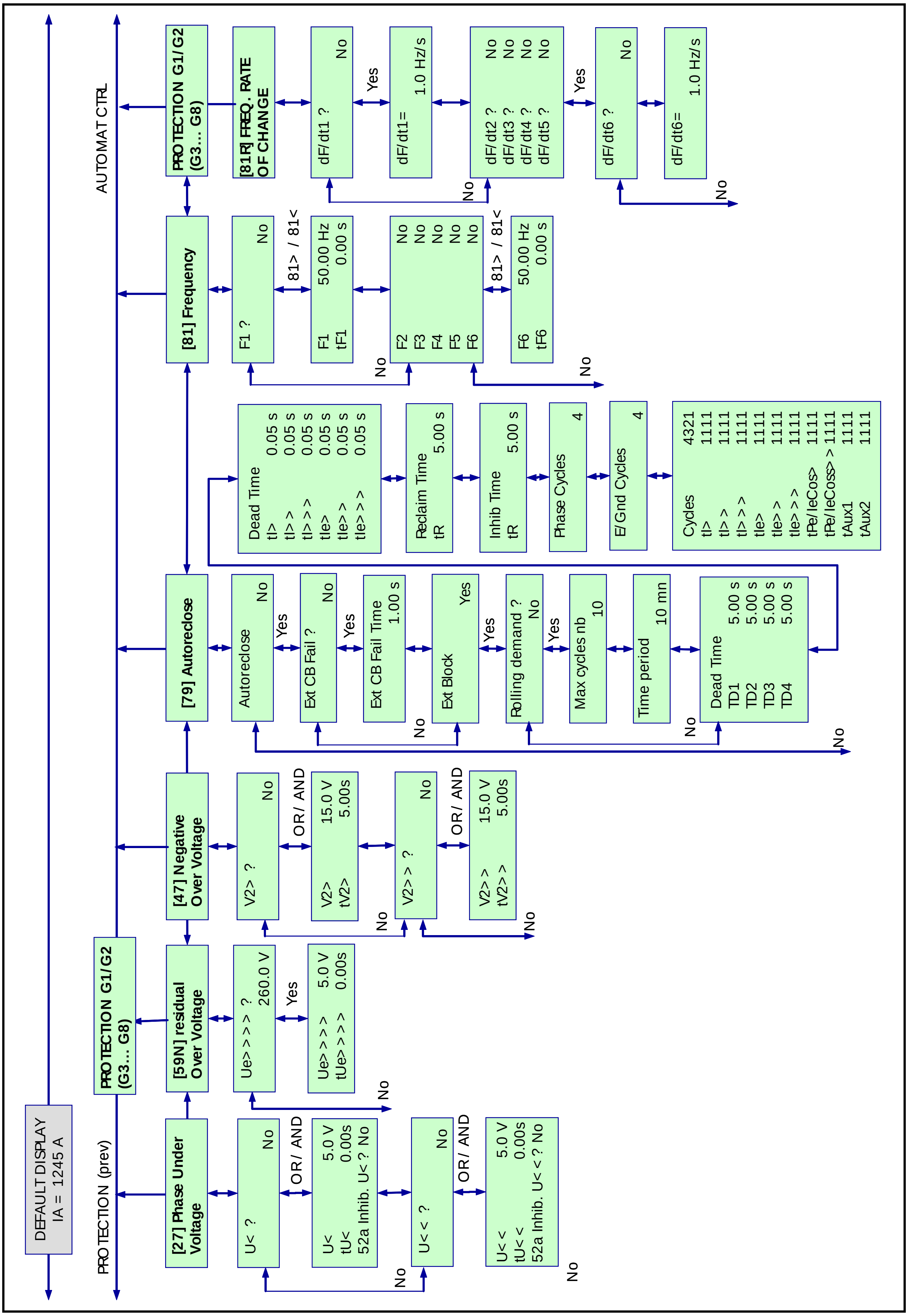

DEFAULT DISPLAY
IA = 1245 A
CONFIGURATION
MEASUREMENTS
METERING
Frequency
50.00 Hz
IA
IB
IC
IN
I1
I2
RATIO I2 / I1 =
0 %
3Vpn/
2Vpn+ Vr
UA
UB
UC
UN
2Vpp+ Vr
UAB
UBC
UCA
UN
Pe
IeCos
IN^ VN Angle
IA^ IB Angle
IA^ IC Angle
3Vpn/
2Vpn+ Vr
IA^ UA Angle
IA^ UB Angle
IA^ UC Angle
2Vpp+ Vr
IN^ UAB Angle
IA^ UBC Angle
IA^ IUN Angle
P
Q
S
Cos(Phi)
Energy
RST= [C]
3Ph WHours Fwd
3Ph WHours Rev
3Ph VArHours Fwd
3Ph VArHours Rev
3Ph VAHours
IN-fn
RST= [C] 0.00A
THERMAL STATUS
RST= [C] 0%
MAX & AVERAGE
RCT= [C]
Max IA Rms
Max IB Rms
Max IC Rms
Average IA Rms
Average IB Rms
Average IC Rms
Max UAB Rms
Max UBC Rms
Average UAB Rms
Average UBC Rms
MAX SUBPERIOD
RST= [C] 0%
MAX SUBPERIOD
IA Rms
IB Rms
IC Rms
ROLLING AVERAGE
IA Rms
IB Rms
IC Rms
Reclose Stats
RST= [C]
Total recloses
Cycle 1 recloses
Cycle 2 recloses
Cycle 3 recloses
Cycle 4 recloses
Total Trip &
Lockout 0

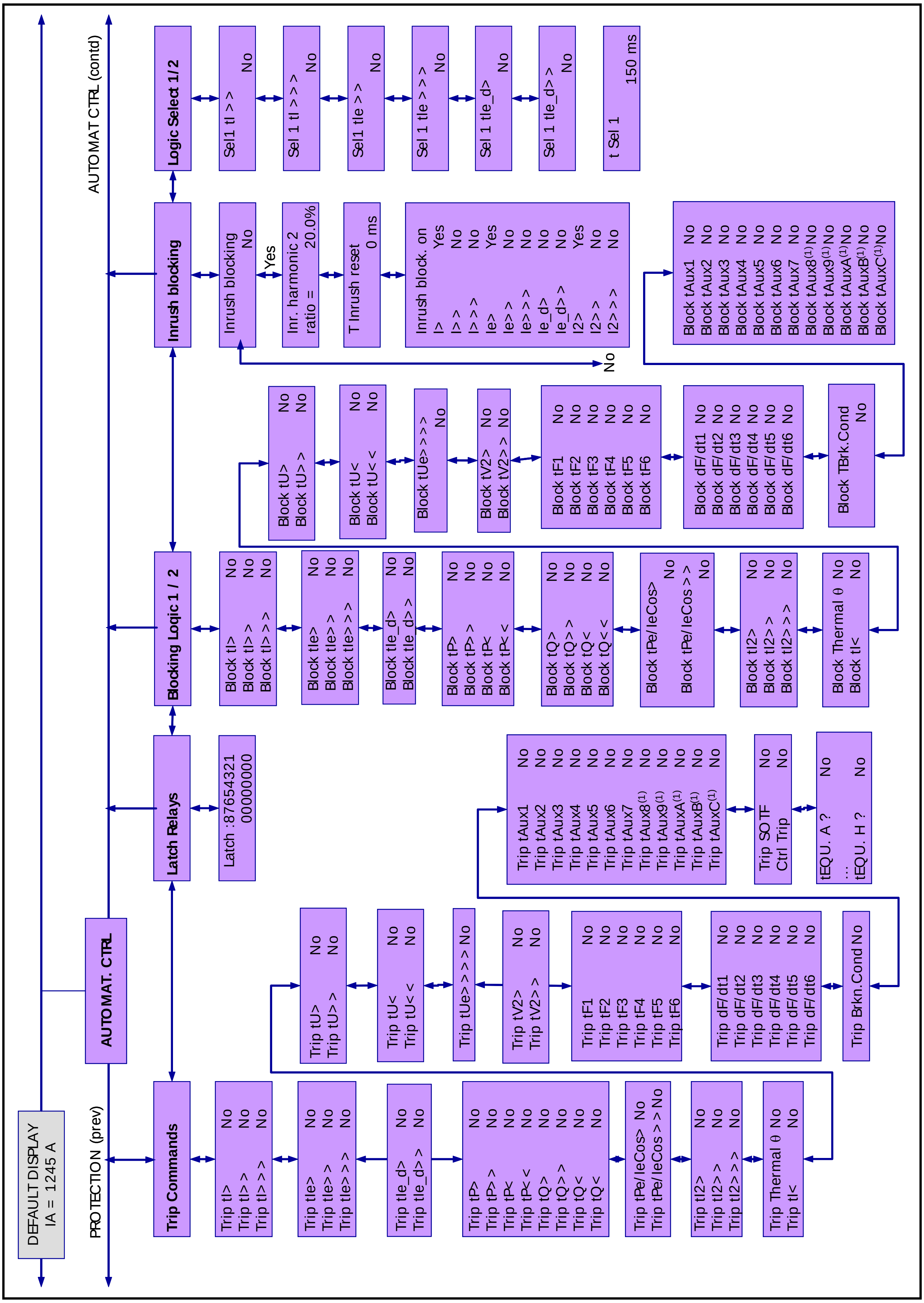

DEFAULT DISPLAY
IA = 1245 A
MEASUREMENTS
COMMUNICATION
METERING (1)
Frequency
Frequency 50.00Hz
Currents
Phase A
IAm THDAm TDDAm KAm: IAmh2: ... IAmh10:
Phase B
Ibm THDBm TDDBm Iam^ Ibm KBm: IBmh2 ... IBmh10:
Phase C
ICm THDCm TDDCm Iam^ Icm KCm: ICmh2: ... ICmh10:
Voltages
VT?
3Vpn AND "Protect P-N", or 2Vpn+ Vr AND "Protect P-N"
Phase A
VAm THDAm Iam^ Va VAmh2: ... VAmh10:
Phase B
VBm: THDBm Iam^ Vb Ibm^ Vb VBmh2: ... VBmh10:
Phase C
VCm: THDCm Iam^ Vc Icm^ Vc VCmh2: ... VCmh10:
3Vpp+ Vr or "Protect P-P"
Phase A
VABm THDAm Iam^ Uab Icm^ Uab VABmh2: ... VABmh10:
Phase B
VBCm: THDBm Iam^ Ubc Ibm^ Ubc VBCmh2: ... VBCmh10:
Phase C
VCAm: THDCm Iam^ Uca Ibm^ Uca VCAmh2: ... VCAmh10:
Powers
Pm: Qm: Sm: DPF:
Energies
RST = [C]
Date DD/MM/YY
Time HH:MM
Export power Import power Lagging VARs Leading VARs
(1) Available with P127 with measurements CT optional configuration

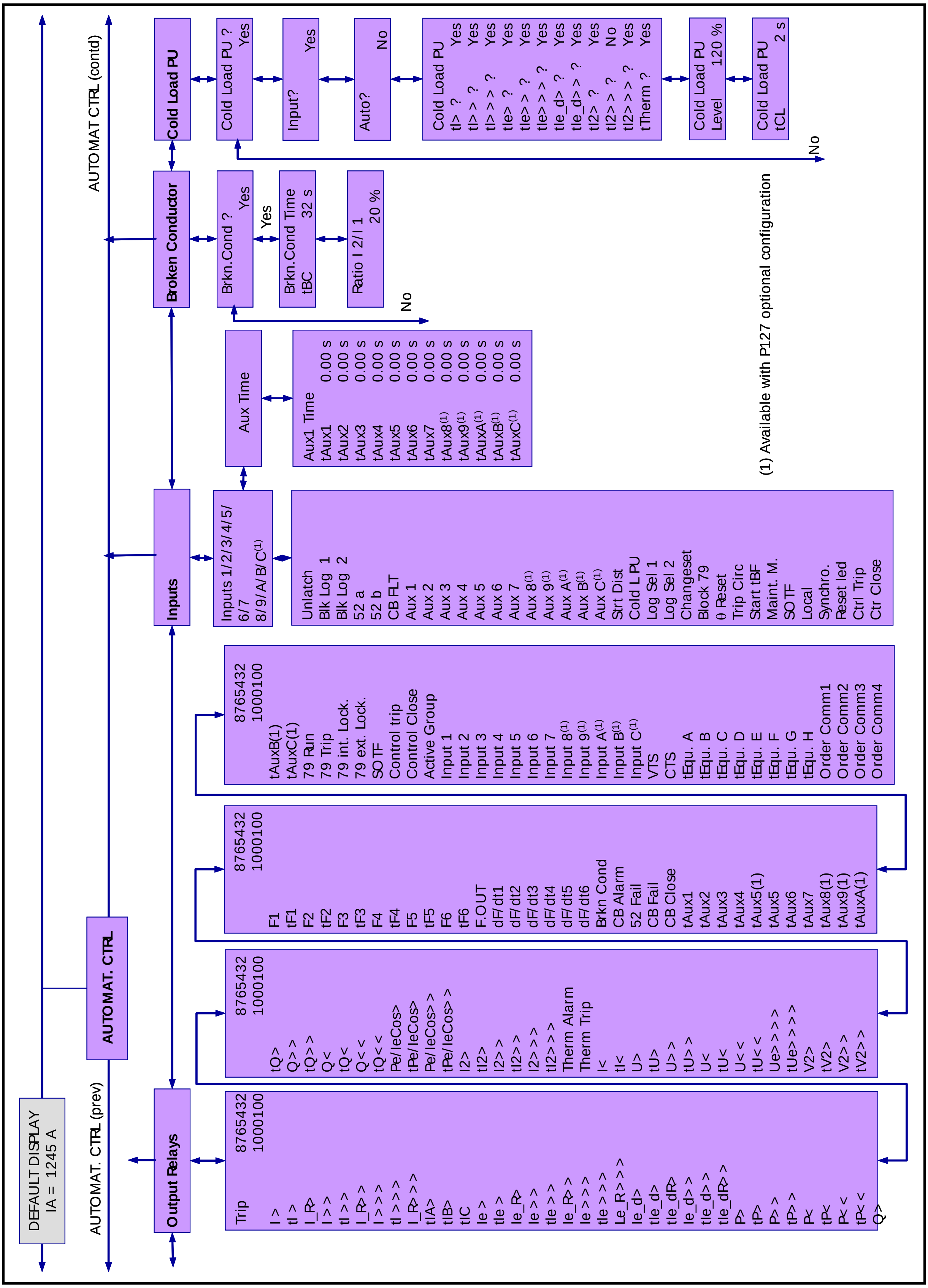

DEFAULT DISPLAY
IA = 1245 A
PROTECTION (prev)
PROTECTION (contd)
COMMUNICATION
HMI ? No
Relay Address MODBUS
Date Format Private
COMM1 No
Baud rate 19200 bd
Parity None
Data Bits 8
Stop Bits 1
Relay address 1
COMM2 (1) No
Spont. event. &GI A11 None
GI select. Basic
Measur. upload ASDU 3.4 Yes
Measur. upload ASDU 9 Yes
Measur. upload Other Yes
Events + Measur. Blocking Yes
Command Blocking Yes
Command duration 0.1s
to COMM2
COMM1 only
IEC60870-5-103 only
PROTECTION G1/G2 (G3... G8)
[67] Phase OC
I> ? No
Dir / Yes
I> 10.00 In
If Dir:
I> Torque 0°
I> Trip Zone ± 50.0%
If Dir or Yes:
Delay type DMT
DMT
tI> 0.00s
RI
K 0.025
tReset 0.00s
I> I>> I>>> Yes
Interlock
IEEE, IEC, RECT or CO
TMS 0.025
Reset Delay Type DMT
If reset delay type= IDMT:
Rtms 0.025
tReset 0.00s
Ie> I>> I>> Yes
Interlock
I>> ? No
Dir / Yes
I>> 10.00 In
If Dir:
I>> Torque 0°
I>> Trip Zone ± 50.0%
If Dir or Yes:
Delay type DMT
DMT
tI>> 0.00s
RI
K 0.025
tReset 0.00s
IEEE, IEC, RECT or CO
TMS 0.025
Reset Delay Type DMT
If reset delay type= IDMT:
Rtms 0.025
tReset 0.00s
I>>> ? No
Dir / Yes
I>>> 10.00 In
If Dir:
I>> Torque 0°
I>> Trip Zone ±50.0%
If Dir or Yes:
Delay type DMT
No
Yes
(1) Available with P127 with 2nd port optional configuration

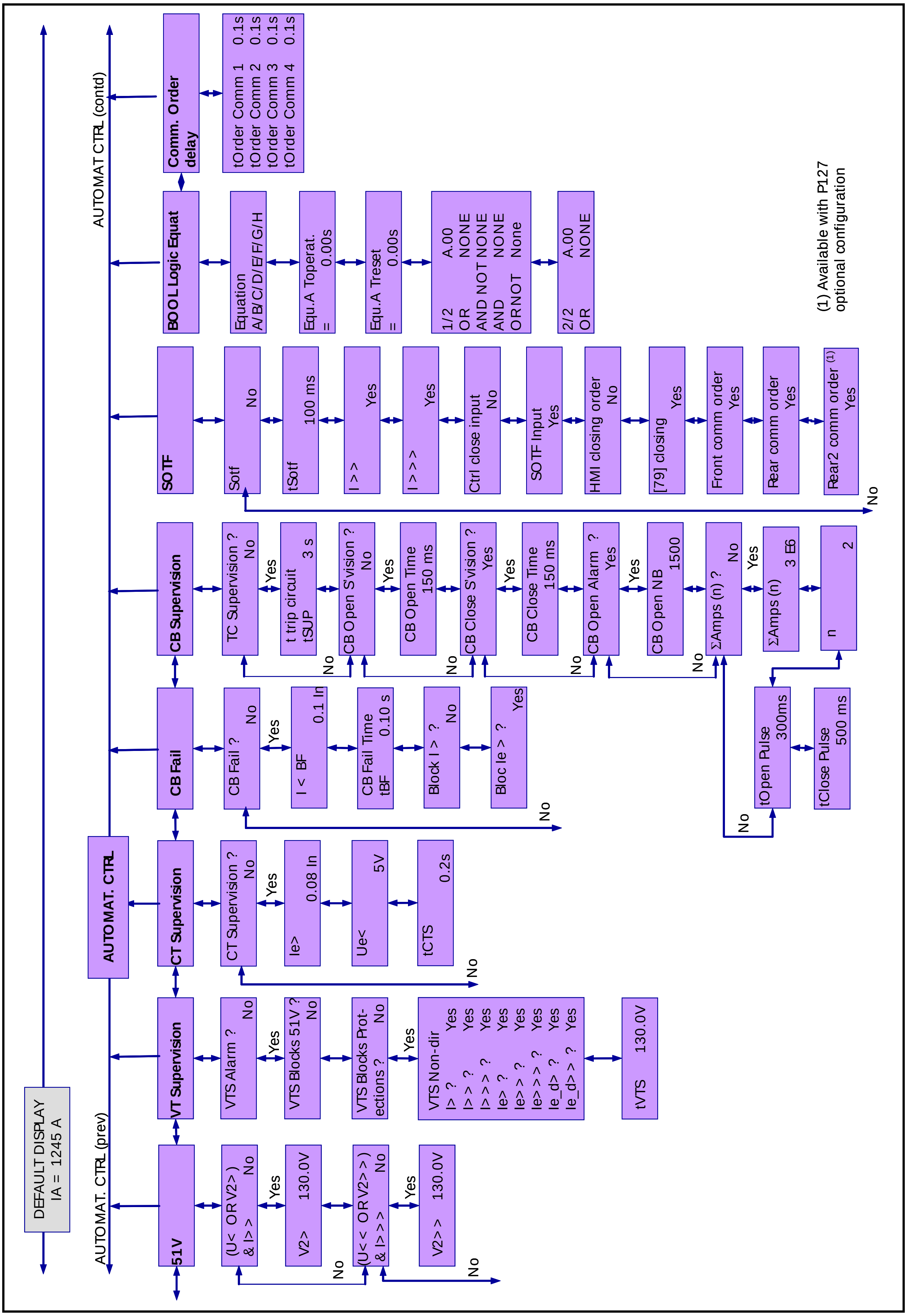

DEFAULT DISPLAY
IA = 1245 A
METERING
PROTECTION G1/G2 (G3... G8)
PROTECTION (contd)
[67N] E/Gnd
Ie> ? No
Dir / Yes
Ie> 0.010 Ien
If Dir:
Ue> 1.0V
Ie> Torque 0°
Ie> Trip ± 50.0%
If Dir or Yes:
Delay type DMT
DMT
tIe> 0.00s
tReset 0.00s
RI
K 0.025
tReset 0.00s
Ie> I>> I>>>
Interlock Yes
IEEE, IEC, RECT or CO
TMS 0.025
Reset Delay Type DMT
If reset delay type= IDMT:
Rtms 0.025
tReset 0.00s
Ie> I>> I>>>
Interlock Yes
No
Ie>> ? No
Dir / Yes
Ie>> 8.000 Ien
If Dir:
Ue>> 260.0V
Ie>> Torque 0°
Ie>> Trip ± 50.0°
If Dir or Yes:
Delay type (1) DMT
tIe>> 0.00s
tReset 0.00s
No
Ie>>> ? No
Dir / Yes
Ie>>> 8.000 Ien
If Dir:
Ue>>> 260.0V
Ie>>> Torque 0°
Ie>>> Trip ± 10.0°
If Dir or Yes:
Delay type DMT
tIe>>> 0.00s
tReset 0.00s
No
Ie_d> ? No
Dir / Yes
Ie_d> 1.00 Ien
If Dir:
Ue> (Ie_d>) 100.0V
Ie_d> Torque 0°
Ie_d> Trip ± 10.0°
If Dir or Yes:
Delay type DMT
tIe_d> (1) 0.00s
tReset 0.00s
No
Ie_d>> ? No
Dir / Yes
Ie_d>> 1.00 Ien
If Dir:
Ue> (Ie_d>>) 5.0V
Ie_d>> Torque ± 10.0°
Ie_d>> Trip ± 1.0°
If Dir or Yes:
Delay type DMT
tIe_d> (1) 0.00s
tReset 0.00s
(1) If Delay Type = DMT
Otherwise, the following menus are displayed
Delay Type ≠ DMT
RI
K 0.025
tReset 0.00s
IEEE, IEC, RECT or CO
TMS 0.025
Reset Delay TypeDMT
If reset delay type= IDMT:
Rtms 0.025
tReset 0.00s

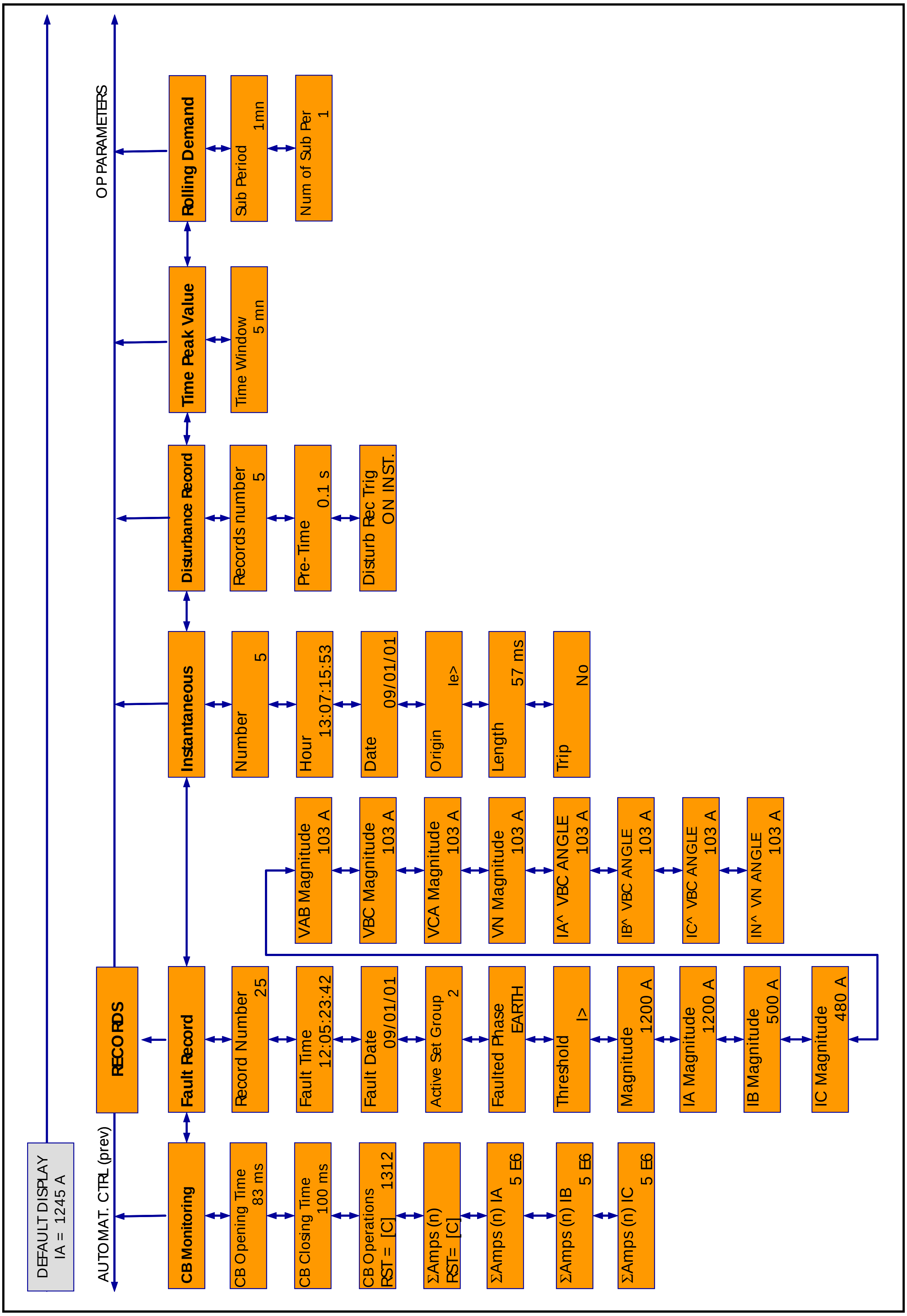

DEFAULT DISPLAY
IA = 1245 A
PROTECTION (prev)
PROTECTION G1/G2 (G3… G8)
PROTECTION (contd)
[32] Directional Power
[32N] Earth Wattmetric
[46] Neg Seq OC
[49] Therm OL
[37] Under current
[59] Phase Over Voltage
If Delay Type = DMT
Otherwise, the following menus are displayed
Delay Type ≠ DMT
IEEE, IEC, RECT or CO
RI
or 10000x5W
or 40000x1W
or 40000x5W
or 1x5W or 4x1W
or 4x5W


DEFAULT DISPLAY
IA = 1245 A
PROTECTION (prev)
AUTOMAT CTRL
PROTECTION G1/G2 (G3… G8)
[27] Phase Under Voltage
U< ? No
OR/ AND
U< 5.0 V
tU< 0.00s
52a Inhib. U< ? No
U< < ? No
OR/ AND
U< < 5.0 V
tU< < 0.00s
52a Inhib. U< < ? No
[59N] residual Over Voltage
Ue> > > > ? 260.0 V
Yes
Ue> > > > 5.0 V
tUe> > > > 0.00s
[47] Negative Over Voltage
V2> ? No
OR/ AND
V2> 15.0 V
tV2> 5.00s
V2> > ? No
OR/ AND
V2> > 15.0 V
tV2> > 5.00s
[79] Autoreclose
Autoreclose No
Yes
Ext CB Fail ? No
Yes
Ext CB Fail Time 1.00 s
Ext Block Yes
Yes
Rolling demand ? No
Yes
Max cycles nb 10
Time period 10 mn
Dead Time
TD1 5.00 s
TD2 5.00 s
TD3 5.00 s
TD4 5.00 s
Dead Time
tI> 0.05 s
tI> > 0.05 s
tI> > > 0.05 s
tIe> 0.05 s
tIe> > 0.05 s
tIe> > > 0.05 s
Reclaim Time
tR 5.00 s
Inhib Time
tR 5.00 s
Phase Cycles 4
E/Gnd Cycles 4
Cycles 4321
tI> 1111
tI> > 1111
tI> > > 1111
tIe> 1111
tIe> > 1111
tIe> > > 1111
tPe/IeCos> 1111
tPe/IeCos> > 1111
tAux1 1111
tAux2 1111
[81] Frequency
F1 ? No
81> / 81<
F1 50.00 Hz
tF1 0.00 s
F2 No
F3 No
F4 No
F5 No
F6 No
81> / 81<
F6 50.00 Hz
tF6 0.00 s
[81R] FREQ. RATE OF CHANGE
dF/dt1 ? No
Yes
dF/dt1= 1.0 Hz/s
dF/dt2 ? No
dF/dt3 ? No
dF/dt4 ? No
dF/dt5 ? No
Yes
dF/dt6 ? No
dF/dt6= 1.0 Hz/s
No


DEFAULT DISPLAY
IA = 1245 A
PROTECTION (prev)
AUTOMAT CTRL (contd)
AUTOMAT. CTRL
Trip Commands
Trip tI> No
Trip tI> > No
Trip tI> > > No
Trip tIe> No
Trip tIe> > No
Trip tIe> > > No
Trip tIe_d> No
Trip tIe_d> > No
Trip tP> No
Trip tP> > No
Trip tP< No
Trip tP< < No
Trip tQ> No
Trip tQ> > No
Trip tQ< No
Trip tQ< < No
Trip tPe/IeCos> No
Trip tPe/IeCos > > No
Trip tI2> No
Trip tI2> > No
Trip tI2> > > No
Trip Thermal θ No
Trip tI< No
Trip tU> No
Trip tU> > No
Trip tU< No
Trip tU< < No
Trip tUe> > > > No
Trip tV2> No
Trip tV2> > No
Trip tF1 No
Trip tF2 No
Trip tF3 No
Trip tF4 No
Trip tF5 No
Trip tF6 No
Trip dF/dt1 No
Trip dF/dt2 No
Trip dF/dt3 No
Trip dF/dt4 No
Trip dF/dt5 No
Trip dF/dt6 No
Trip Brkn.Cond No
Trip tAux1 No
Trip tAux2 No
Trip tAux3 No
Trip tAux4 No
Trip tAux5 No
Trip tAux6 No
Trip tAux7 No
Trip tAux8(1) No
Trip tAux9(1) No
Trip tAuxA(1) No
Trip tAuxB(1) No
Trip tAuxC(1) No
Trip SOTF No
Ctrl Trip No
tEQU. A ? No
...
tEQU. H ? No
Latch Relays
Latch :87654321
00000000
Blocking Logic 1 / 2
Block tI> No
Block tI> > No
Block tI> > > No
Block tIe> No
Block tIe> > No
Block tIe> > > No
Block tIe_d> No
Block tIe_d> > No
Block tP> No
Block tP> > No
Block tP< No
Block tP< < No
Block tQ> No
Block tQ> > No
Block tQ< No
Block tQ< < No
Block tPe/IeCos> No
Block tPe/IeCos > > No
Block tI2> No
Block tI2> > No
Block tI2> > > No
Block Thermal θ No
Block tI< No
Block tU> No
Block tU> > No
Block tU< No
Block tU< < No
Block tUe> > > > No
Block tV2> No
Block tV2> > No
Block tF1 No
Block tF2 No
Block tF3 No
Block tF4 No
Block tF5 No
Block tF6 No
Block dF/dt1 No
Block dF/dt2 No
Block dF/dt3 No
Block dF/dt4 No
Block dF/dt5 No
Block dF/dt6 No
Block TBrk.Cond No
Block tAux1 No
Block tAux2 No
Block tAux3 No
Block tAux4 No
Block tAux5 No
Block tAux6 No
Block tAux7 No
Block tAux8(1) No
Block tAux9(1) No
Block tAuxA(1) No
Block tAuxB(1) No
Block tAuxC(1) No
Inrush blocking
Inrush blocking No
Yes
No
Inr. harmonic 2 ratio = 20.0%
T Inrush reset 0 ms
Inrush block. on
I> Yes
I> > No
I> > > No
Ie> Yes
Ie> > No
Ie> > > No
Ie_d> No
Ie_d> > No
I2> Yes
I2> > No
I2> > > No
Logic Select 1/2
Sel1 tI > > No
Sel 1 tI > > > No
Sel1 tIe > > No
Sel 1 tIe > > > No
Sel 1 tIe_d> No
Sel 1 tIe_d> > No
t Sel 1 150 ms


DEFAULT DISPLAY
IA = 1245 A
AUTOMAT. CTRL (prev)
AUTOMAT. CTRL
AUTOMAT CTRL (contd)
Output Relays
Trip 8765432 1000100
I > tI > I_R> I > > tI > > I_R> > I > > > tI > > > I_R> > > tIA> tIB> tIC Ie > tIe > Ie_R> Ie > > tIe > > Ie_R> > Ie > > > tIe > > > Ie_R> > > Ie_d> tIe_d> tIe_dR> Ie_d> > tIe_d> > tIe_dR> > P> tP> P> > tP> > P< tP< P< < tP< < Q>
tQ> Q> > tQ> > Q< tQ< Q< < tQ< < Pe/IeCos> tPe/IeCos> Pe/IeCos> > tPe/IeCos> > I2> tI2> I2> > tI2> > I2> > > tI2> > > Therm Alarm Therm Trip I< tI< U> tU> U> > tU> > U< tU< U< < tU< < Ue> > > > tUe> > > > V2> tV2> V2> > tV2> >
F1 tF1 F2 tF2 F3 tF3 F4 tF4 F5 tF5 F6 tF6 F.OUT dF/dt1 dF/dt2 dF/dt3 dF/dt4 dF/dt5 dF/dt6 Brkn Cond CB Alarm 52 Fail CB Fail CB Close tAux1 tAux2 tAux3 tAux4 tAux5(1) tAux5 tAux6 tAux7 tAux8(1) tAux9(1) tAuxA(1)
tAuxB(1) tAuxC(1) 79 Run 79 Trip 79 int. Lock. 79 ext. Lock. SOTF Control trip Control Close Active Group Input 1 Input 2 Input 3 Input 4 Input 5 Input 6 Input 7 Input 8(1) Input 9(1) Input A(1) Input B(1) Input C(1) VTS CTS tEqu. A tEqu. B tEqu. C tEqu. D tEqu. E tEqu. F tEqu. G tEqu. H Order Comm1 Order Comm2 Order Comm3 Order Comm4
Inputs
Inputs 1/2/3/4/5/6/7 8/9/A/B/C(1)
Unlatch Blk Log 1 Blk Log 2 52 a 52 b CB FLT Aux 1 Aux 2 Aux 3 Aux 4 Aux 5 Aux 6 Aux 7 Aux 8(1) Aux 9(1) Aux A(1) Aux B(1) Aux C(1) Strt Dist Cold L PU Log Sel 1 Log Sel 2 Changeset Block 79 θ Reset Trip Circ Start tBF Maint. M. SOTF Local Synchro. Reset led Ctrl Trip Ctr Close
Aux Time
Aux1 Time
tAux1 0.00 s
tAux2 0.00 s
tAux3 0.00 s
tAux4 0.00 s
tAux5 0.00 s
tAux6 0.00 s
tAux7 0.00 s
tAux8(1) 0.00 s
tAux9(1) 0.00 s
tAuxA(1) 0.00 s
tAuxB(1) 0.00 s
tAuxC(1) 0.00 s
Broken Conductor
Brkn.Cond ? Yes
No
Yes
Brkn.Cond Time tBC 32 s
Ratio I 2/I 1 20 %
Cold Load PU
Cold Load PU ? Yes
No
Input? Yes
Auto? No
Cold Load PU
tI> ? Yes
tI> > ? Yes
tI> > > ? Yes
tIe> ? Yes
tIe> > ? Yes
tIe> > > ? Yes
tIe_d> ? Yes
tIe_d> > ? Yes
tI2> ? Yes
tI2> > ? No
tI2> > > ? Yes
tTherm ? Yes
Cold Load PU Level 120 %
Cold Load PU tCL 2 s
(1) Available with P127 optional configuration


DEFAULT DISPLAY
IA = 1245 A
AUTOMAT. CTRL (prev)
AUTOMAT. CTRL (contd)
AUTOMAT. CTRL
51V
(U< OR V2>) & I>> No
V2> 130.0V
(U<< OR V2>>) & I>>> No
V2>> 130.0V
VT Supervision
VTS Alarm ? No
VTS Blocks 51V ? No
VTS Blocks Protections ? No
VTS Non-dir
I> ? Yes
I>> ? Yes
I>>> ? Yes
Ie> ? Yes
Ie>> ? Yes
Ie>>> ? Yes
Ie_d> ? Yes
Ie_d>> ? Yes
tVTS 130.0V
CT Supervision
CT Supervision ? No
Ie> 0.08 In
Ue< 5V
tCTS 0.2s
CB Fail
CB Fail ? No
I< BF 0.1 In
CB Fail Time tBF 0.10 s
Block I> ? No
Bloc Ie> ? Yes
CB Supervision
TC Supervision ? No
t trip circuit tSUP 3 s
CB Open S'vision ? No
CB Open Time 150 ms
CB Close S'vision ? Yes
CB Close Time 150 ms
CB Open Alarm ? Yes
CB Open NB 1500
ΣAmps (n) ? No
ΣAmps (n) 3 E6
n 2
tOpen Pulse 300ms
tClose Pulse 500 ms
SOTF
Sotf No
tSotf 100 ms
I>> Yes
I>>> Yes
Ctrl close input No
SOTF Input Yes
HMI closing order No
[79] closing Yes
Front comm order Yes
Rear comm order Yes
Rear2 comm order (1) Yes
BOOL Logic Equat
Equation A/B/C/D/E/F/G/H
Equ.A Toperat. = 0.00s
Equ.A Treset = 0.00s
1/2 A.00
OR NONE
AND NOT NONE
AND NONE
OR NOT None
2/2 A.00
OR NONE
Comm. Order delay
tOrder Comm 1 0.1s
tOrder Comm 2 0.1s
tOrder Comm 3 0.1s
tOrder Comm 4 0.1s
(1) Available with P127 optional configuration


DEFAULT DISPLAY
IA = 1245 A
AUTOMAT. CTRL (prev)
OP PARAMETERS
RECORDS
CB Monitoring
CB Opening Time 83 ms
CB Closing Time 100 ms
CB Operations RST = [C] 1312
ΣAmps (n) RST= [C]
ΣAmps (n) IA 5 E6
ΣAmps (n) IB 5 E6
ΣAmps (n) IC 5 E6
Fault Record
Record Number 25
Fault Time 12:05:23:42
Fault Date 09/01/01
Active Set Group 2
Faulted Phase EARTH
Threshold I>
Magnitude 1200 A
IA Magnitude 1200 A
IB Magnitude 500 A
IC Magnitude 480 A
VAB Magnitude 103 A
VBC Magnitude 103 A
VCA Magnitude 103 A
VN Magnitude 103 A
IA^ VBC ANGLE 103 A
IB^ VBC ANGLE 103 A
IC^ VBC ANGLE 103 A
IN^ VN ANGLE 103 A
Instantaneous
Number 5
Hour 13:07:15:53
Date 09/01/01
Origin Ie>
Length 57 ms
Trip No
Disturbance Record
Records number 5
Pre-Time 0.1 s
Disturb Rec Trig ON INST.
Time Peak Value
Time Window 5 mn
Rolling Demand
Sub Period 1mn
Num of Sub Per 1

TECHNICAL DATA AND CHARACTERISTIC CURVES

CONTENT

1. RATINGS

1.1 Power Supply

Nominal auxiliary voltage Vx	24 – 60Vdc / 48 – 250Vdc/ 24 – 250Vdc 24 – 240 Vac / 48-240 Vac
Operating range	DC ± 20% of Vx AC – 20%, +10% of Vx
Residual ripple	Up to 12%
Stored energy time	≥50 ms for interruption of Vx
Burden P125	Stand by: <3W DC or <8VA AC Max: <5W DC or <12VA AC
Burden P126	Stand by: <3W DC or <8VA AC Max: <6W DC or <14VA AC
Burden P127	Stand by: <3W DC or <8VA AC Max: <6W DC or <14VA AC

1.2 Frequency

Frequency protection functions	From 45 to 65Hz
Nominal frequency	50/60Hz

1.3 Current Inputs

Phase current inputs	1 and 5A by connection
Earth current inputs	1 and 5A by connection
Operating range	Selection by ordering code (Cortec)
Burden Phase Current	< 0.025VA (1A) < 0.3VA (5A)
Burden Earth Current	< 0.08VA (1A) < 0.42VA (5A)
Rrp (Impedance of relay phase current input at 30In)	25 mΩ (1A input) 8 mΩ (5A input)
Rrn (Impedance of relay neutral current input at 30In)	87 mΩ (1A input) 15 mΩ (5A input)
Thermal withstand	1s @ 100 x rated current 2s @ 40 x rated current continuous @ 4 x rated current

1.4 Measurement Current Inputs (P127 with measurement CT)

Phase current inputs	1 and 5A by connection
Operating range	Selection by ordering code (Cortec)
Burden Phase Current	< 0.5VA
Bandwidth	500Hz
Thermal withstand	1s @ 20 x rated current 4s @ 10 x rated current continuous @ 2 x rated current

1.5 Voltage Inputs

Voltage input range Un	57 to 130V	220 to 480V
Operating range (measuring range)	0 to 260V	0 to 960V
Burden	Resistive 44 kΩ: 0.074W/57V 0.38W/130V 1.54W/260V	438 kΩ: 0.1102W/220V 0.525W/480V 2.1W/960V
Thermal Withstand:		
Continuous	260V ph-ph	960V ph-ph
10 seconds	300V ph-ph	1300V ph-ph

1.6 Logic Inputs

Logic input type	**Independent optically insulated**
Logic input burden	< 10 mAmps per input
Logic input recognition time	< 5ms

1.6.1 Supply

Ordering Code	Relay auxiliary power supply		Logic Inputs				
	Nominal voltage range Vx	Operating voltage range	Nominal Voltage range	Minimal polarisation voltage	Maximum polarisation current	Holding current after 2 ms	Maximum continuous withstand
A	24 - 60 Vdc	19,2 – 76 Vdc	24 – 250 Vdc 24 – 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac
F	48 – 250 Vdc 48 – 240 Vac	38.4 – 300 Vdc 38.4 – 264 Vac					
T	48 – 250 Vdc 48 – 240 Vac Special EA (**)	38.4 – 300 Vdc 38.4 – 264 Vac	24 – 250 Vdc 24 – 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac
H	48 – 250 Vdc 48 – 240 Vac	38.4 – 300 Vdc 38.4 – 264 Vac	129 Vdc	105 Vdc	3.0 mA @ 129 Vdc		145 Vdc
V	48 – 250 Vdc 48 – 240 Vac	38.4 – 300 Vdc 38.4 – 264 Vac	110 Vdc	77 Vdc	7.3 mA @ 110 Vdc		132 Vdc
W	48 – 250 Vdc 48 – 240 Vac	38.4 – 300 Vdc 38.4 – 264 Vac	220 Vdc	154 Vdc	3.4 mA @ 220 Vdc		262 Vdc
Z	24 – 250 Vdc 24 – 250 Vac	19.2 – 300 Vdc 38.4 – 264 Vac	24 – 250 Vdc 24 – 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac

(**) Logic input recognition time for EA approval. Dedicated filtering on 24 samples (15 ms at 50 Hz)

1.7 Output Relay Characteristic

Contact rating	
Contact relay	Dry contact Ag Ni
Make current	Max. 30A and carrry for 3s
Carry capacity	5A continuous
Rated Voltage	250Vac
Breaking characteristic	
Breaking capacity AC	1500 VA resistive 1500 VA inductive (P.F. = 0.5) 220 Vac, 5A (cos φ = 0.6)
Breaking capacity DC	135 Vdc, 0.3A (L/R = 30 ms) 250 Vdc, 50W resistive or 25W inductive (L/R=40ms)
Operation time	<7ms
Durability	
Loaded contact	10000 operation minimum
Unloaded contact	100000 operation minimum

2. MECHANICAL DATA

Design

MiCOM P125, P126 and P127 relays are available in a 4U metal case for panel or flush mounting.

The table shows the case size of the different models:

Version	Height	Depth	Width
Type P125	4U (177mm)	230mm	20 TE
Type P126 & P127	4U (177mm)	230mm	30 TE

Weight

P125 approx.: 3.0 Kg

P126/7 approx.: 4.0 Kg

Mounting

Rack or flush mounting

Connections

Rear (double fast on + M4 screw per connection)
Full draw-out with automatic CT shorting in the case of the relay

Enclosure protection

Per IEC 60529: 2001:

- IP 52 Protection (front panel) against dust and dripping water,
- IP 50 Protection for the rear and sides of the case against dust,
- IP 10 Product safety protection for the rear due to live connections on the terminal block

Dimensions

See dimensions diagram (P12y/EN IN chapter).

PC Interface

DIN 41652 connector (X6),

type D-Sub, 9-pin.

3. INSULATION WITHSTAND

Dielectric withstand	IEC 60255-5: 2000	2 kVrms 1 minute to earth and between independent circuits.
	IEEE C39.90:1989	1.5kV rms AC for 1 minute, (reaffirmed 1994) across normally open contacts
Impulse voltage	IEC 60255-5: 2000	5 kVp Between all terminals & all terminals and case earth
Insulation resistance	IEC 60255-5: 2000	> 1000 MΩ at 500 Vdc

4. ELECTRICAL ENVIRONMENT

High frequency disturbance	IEC 60255-22-1:1998	2.5 kV common mode, class 3 1 kV differential mode, class 3
Fast transient	IEC 60255-22-4:2002	Class A 2 kV 5kHz terminal block comms 4 kV 2.5kHz all circuits excluding comms.
	EN 61000-4-4:1995 Level 4	2 kV 5kHz all circuits excluding power supply 4 kV 5kHz power supply
Electrostatic discharge	EN 61000-4-2:1995 & IEC60255-22-2:1996	8 kV contact discharge, class 4 15kV air discharge, class 4
Surge Immunity	EN 61000-4-5:1995 & IEC 60255-22-5:2002	4kV common mode, level 4 2kV differential mode, level 4
Conducted emissions	EN55022:1998 & IEC 60255-25:2000	0.15-0.5MHz, 79dBµV (quasi peak) 66 dBµV (average) 0.5-30MHz, 73dBµV (quasi peak) 60 dBµV (average)
Radiated emissions	EN55022:1998 & IEC 60255-25:2000	30-230MHz, 40dBµV/m at 10m measurement distance 230-1GHz, 47dBµV/m at 10m measurement distance
Conducted immunity	EN 61000-4-6:1996 & IEC 60255-22-6:2001	Level 3, 10V rms @ 1kHz 80% am, 150kHz to 80MHz
Radiated Immunity	EN 61000-4-3:2002 & IEC 60255-22-3:2000	Level 3, 10V/m 80MHz to 1GHz @ 1kHz 80% am
Radiated Immunity from digital telephones	EN 61000-4-3:2002	Level 4, 30V/m 800MHz to 960MHz and 1.4GHz to 2GHz @ 1kHz 80% am
	ANSI/ IEEE C37.90.2:2004	35V/m 80MHz to 1GHz @ 1kHz 80% am 35V/m 80MHz to 1GHz @ 100% pulse modulated front face only
Magnetic field immunity	EN 61000-4-8:1994	Level 5, 100A/m applied continuously, 1000A/m for 3s
	EN 61000-4-9:1993	Level 5, 1000A/m
	EN 61000-4-10:1993	Level 5, 100A/m at 100kHz and 1MHz
ANSI Surge withstand capability	IEEE/ ANSI C37.90.1:2002	4kV fast transient and 2.5kV damped oscillatory applied common and transverse mode

5. ENVIRONMENT

Temperature	IEC 60255-6	Ambient temperature range Operating temperature range –25°C to +55°C (or –13°F to +131°F) Storage and transit –25°C to +70°C (or –13°F to +158°F)* Tested as per IEC 60068-2-1: 2007 –25°C (–13°F) storage (96 hours) –40°C (–40°F) operation (96 hours) IEC 60068-2-2: 2007 +85°C (+185°F) (storage (96 hours) +85°C (+185°F) operation (96 hours)
		(*) The upper limit is permissible for a single 6 hour duration within any 24 hour period.
Humidity	IEC 60068-2-78:2001	56 days at 93% RH and 40 °C
Enclosure protection	IEC 60-529: 2001	IP 52 Protection (front panel) against dust and dripping water, IP 50 Protection for the rear and sides of the case against dust,, IP 10 Product safety protection for the rear due to live connections on the terminal block
Sinusoidal Vibrations	IEC 60255-21-1:1998	Response and endurance, class 2
Shocks	IEC 60255-21-2:1998	Response and withstand, class 1 & 2
Bump	IEC 60255-21-2:1998	Response and withstand, class 1
Seismic	IEC 60255-21-3:1998	Class 2
Creepage Distances and Clearances	IEC 60255-27: 2005	Pollution degree 2, Overvoltage category III, Impulse test voltage 5 kV
Corrosive Environments	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 Exposure to elevated concentrations of H2S, NO2, Cl2 and SO2.

6. EU DIRECTIVE

6.1 EMC compliance

89/336/EEC

93/31/EEC

Compliance with European Commission EMC Directive.

Generic standards were used to establish conformity:

EN50081-2: 1994

EN60952-2: 1995

6.2 Product safety

2006/95/EC
(replacing 73/23/EEC from 01/2007)

Compliance with European Commission Low Voltage Directive. Compliance is demonstrated by reference to generic safety standards:

– EN61010-1: 1993/A2: 1995

– EN60950: 1992/A11: 1997

7. GENERAL INFORMATION AND DEVIATION OF THE PROTECTION ELEMENTS

Glossary

I	:	Phase current
Is	:	I>, I>>, I>>> & I<
I2s	:	I2>, I2>> & I2>>>
Ies	:	Ie>, Ie>>, Ie>>>, Ie_d> & Ie_d>>
IesCos	:	IeCos> & IeCos>>
P	:	Active over / under power, P>, P>> and P<, P<<
Q	:	Reactive over / under power, Q>, Q>> and Q<, Q<<
Pe	:	Earth fault (wattmetric)
Pes	:	Pe> & Pe>>
Us	:	U>, U>>, U< & U<<
Urs	:	Ue>, Ue>>, Ue>>> & Ue>>>>
V2	:	V2> & V2>>
DT	:	Definite time
IDMT	:	Inverse definite minimum time

Element	Range	Deviation	Trigger	Reset	Time deviation
Phase overcurrent elements I> & I>> & I>>>	0.1 to 40 In	± 2%	DT: Is ± 2% IDMT: 1.1Is ±2%	0.95 Is ±2% 1.05 Is ±2%	±2% +30…50ms ±5% +30…50ms
Relay characteristic angle RCA (RCA-Torque angle)	0° to 359°	≤ 3°			
Trip zone	±10° to ±170°	≤ 3°			
Earth fault overcurrent elements Ie> & Ie>> & Ie>>> & Ie_d> & Ie_d>>	0.002 to 1Ien 0.01 to 8 Ien 0.1 to 40 Ien	± 2%	DT: Ies ± 2% IDMT: 1.1Ies ±2%	0.95 Ies ±2% 1.05 Ies ±2%	±2% +30…50ms ±5% +30…50ms
Active overpower P>&P>>	1 to 10000*1W 4 to 40000*1W 1 to 10000*5W 4 to 40000*5W	± 5%	DT: P> & P>> ± 2%	0.95 P> ±2%	±2% +20…40ms
Active underpower P<&P<<	1 to 10000*1W 4 to 40000*1W 1 to 10000*5W 4 to 40000*5W	± 5%	DT: P< & P<< ± 2%	0.95 P< ±2%	±2% +20…40ms
Reactive overpower Q>&Q>>	1 to 10000*1W 4 to 40000*1W 1 to 10000*5W 4 to 40000*5W	± 5%	DT: Q> & Q>> ± 2%	0.95 Q> ±2%	±2% +20…40ms
Reactive underpower Q<&Q<<	1 to 10000*1W 4 to 40000*1W 1 to 10000*5W 4 to 40000*5W	± 5%	DT: Q< & Q<< ± 2%	0.95 Q< ±2%	±2% +20…40ms
Wattmetric earth fault elements	57 to 130V 0.2 to 20W 1 to 160W 10 to 800W	±4% ± error on cos φ	DT: Pes ± accuracy IDMT: 1.1Pes ± accuracy	0.95 Pes ± accuracy 1.05 Pes ± accuracy	±2% +30…50ms ±5% +30…50ms

Element	Range	Deviation	Trigger	Reset	Time deviation
Wattmetric earth fault elements Pe> & Pe>>	220 to 480V 1 to 80W 4 to 640W 40 to 3200W	±4% ± error on cos φ	DT: Pes ± accuracy IDMT: 1.1Pes ± accuracy	0.95 Pes ± accuracy 1.05 Pes ± accuracy	±2% +30…50ms ±5% +30…50ms
Active earth fault overcurrent elements IeCosφ> & IeCosφ>>	0.002 to 1Ien 0.01 to 8 Ien 0.1 to 40 Ien	±2% ± error on cos φ	DT: IesCos ± accuracy IDMT: 1.1 IesCos ± accuracy	0.95 IesCos ± accuracy 1.05 IesCos ± accuracy	±2% +30…50ms ±5% +30…50ms
Negative sequence phase overcurrent elements I2>, I2>> & I2>>>	0.1 to 40 In	± 2%	DT: I2s ± 2% IDMT: 1.1I2s ±2%	0.95 I2s ±2% 1.05 I2s ±2%	±2% +30…50ms ±5% +30…50ms
Thermal overload Iθ>, θ Alarm, θ Trip	0.10 to 3.2 In	± 3%	IDMT: Iθ> ± 3%	0.97 Iθ>±3%	–5% +30…50ms (ref. IEC 60255-8)
Phase undercurrent element I<	0.1 to 1 In	± 2%	DT: I< ± 2%	1.05 I< ±2%	±2% +30…50ms
Broken conductor [I2/I1].	20 to 100%	± 3%	DT: I2/I1 ± 3%	0.95 I2/I1 ±3%	±2% +30…50ms
Overvoltage U> & U>>	57 to 130V 2 to 260V	± 2%	DT: Us ± 2%	0.95 Us ±2%	±2% +20…40ms
	220 to 480V 10 to 960V	± 2%	DT: Us ± 2%	0.95 Us ±2%	±2% +20…40ms
Undervoltage U< & U<<	57 to 130V 2 to 130V	± 2%	DT: Us ± 2%	1.05 Us ±2%	±2% +20…40ms
	220 to 480V 10 to 480V	± 2%	DT: Us ± 2%	1.05 Us ±2%	±2% +20…40ms
Residual overvoltage (Direct input) Ue>, Ue>>, Ue>>>, Ue>>>>	57 to 130V 1 to 260V 1 to 260V	± 2%	DT: Urs ± 2%	0.95 Urs ±2%	±2% +20…40ms
	220 to 480V 4 to 960V 5 to 960V	± 2%	DT: Urs ± 2%	0.95 Urs ±2%	±2% +20…40ms
Derived residual overvoltage Ue>, Ue>>, Ue>>>, Ue>>>>	57 to 130V 1 to 260V 1 to 260V	± 2% or 0.2V	DT: Urs ± 2%	0.95 Urs ±2%	±2% +20…40ms
	220 to 480V 4 to 960V 5 to 960V	± 2% or 1V	DT: Urs ± 2%	0.95 Urs ±2%	±2% +20…40ms
Negative overvoltage V2>, V2>>	57 to 130V 1 to 130V	± 2%	DT: V2 ± 2% IDMT: 1.1 V2 ±2%	0.95 V2 ±2% 1.05 V2±2%	±2% +30…50ms ±5% +30…50ms
	220 to 480V 4 to 480V	± 2%	DT: V2 ± 2% IDMT: 1.1 V2 ±2%	0.95 V2 ±2% 1.05 V2 ±2%	±2% +30…50ms ±5% +30…50ms
Overfrequency Fx>	45,1 to 54,9Hz 55,1 to 64,9Hz	± 2%	DT: Fx ± 2%	0.95 Fx ±2%	±2% +80…100ms
	45,1 to 54,9Hz 55,1 to 64,9Hz	± 2%	DT: Fx ± 2%	1.05 Fx ±2%	±2% +80…100ms

8. DEVIATION OF AUTOMATION FUNCTIONS TIMERS

Autoreclose timers tDs, tR, tI	±2% +10…30ms
CB fail & CB monitoring timers	±2% +10…30ms
Auxiliary timers tAUX1, tAUX2, tAUX3, tAUX4, tAUX5, tAUX6, tAUX7, tAUX8, tAUX9, tAUX10, tAUX11 and tAUX12 (when available)	±2% +10…30ms
Cold load pickup	±2% +20…40ms
Inrush blocking	±2% +20…40ms
SOTF/TOR	±2% +20…40ms
Programmable AND, OR & NOT logic	±2% +10…30ms

9. DEVIATION OF MEASUREMENTS

9.1 Measurements

Measurement	Range	Deviation
Phase current	0.1 to 40 In	Typical ±0.5% at In
Earth current	0.002 to 1Ien	Typical ±0.5% at Ien
	0.01 to 8 Ien	Typical ±0.5% at Ien
	0.1 to 40 Ien	Typical ±0.5% at Ien
Voltage	57 to 260V	Typical ±0.5% at Un
	220 to 960V	Typical ±0.5% at Un
Power	Alpha	Typical ±1° at Pn
	P (active power)	Typical ±5% at Pn
	Q (reactive power)	Typical ±5% at Pn

Active Power and Active Energy		Reactive Power and Reactive Energy	
Cos φ	Deviation	Sin φ	Deviation
0.866	< 1.5%	0.866	< 3%
0.5	< 3%	0.5	< 1.5%

9.2 Metering (P127 with measurement CT)

Measurement	Accuracy
Phase current	<0.2% at IN
Voltage	<0.2% at VN
Power	<0.5% for Pm, Qm and Sm
Sampling rate	1600Hz

10. PROTECTION SETTING RANGES

Relay	Number of protection group
P125	2
P126	2
P127	8

10.1 [67/50/51] Directional/Non-Directional Phase Overcurrent (P127)

- Phase current — Fundamental only
- Phase or phase to phase voltage — Fundamental only
- Minimum voltage operation — 0.6V (Un: 57 to 130V)
- Minimum voltage operation — 3.0V (Un: 220 to 480V)

10.1.1 Synchronous Polarisation

- Minimum phase voltage fixed threshold enabling synchronous polarising: 0.6V
- Synchronous polarising permanence time phase voltage thresholds: 5 s

NOTE: When I> is associated to an IDMT curve, the maximum setting recommended should be 2In.

10.1.2 Protection Setting Ranges (P127)

[67] Phase OC	Setting Range		
	Min	Max	Step
I> ?	No or Yes or DIR		
I>	0.1 In	25 In	0.01 In
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tI>	0 s	150 s	0.01 s
I> TMS	0.025	10.0	0.001
I> Reset Delay Type	DT or IDMT		
I> RTMS	0.025	3.2	0.025
I> tReset	0.00 s	100 s	0.01 s
I> I>> I>>> Interlock	No or Yes		
I> Torque angle	0°	359°	1°
I> Trip zone	±10°	±170°	1°
I>> ?	No or Yes or DIR		
I>>	0.1 In	40 In	0.01 In
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tI>>	0 s	150 s	0.01 s

[67] Phase OC	Setting Range		
	Min	Max	Step
I>> TMS	0.025	10.0	0.001
I>> Reset Delay Type	DT or IDMT		
I>> RTMS	0.025	3,2	0.025
I>> tReset	0.00 s	100 s	0.01 s
I>> Torque angle	0°	359°	1°
I>> Trip zone	±10°	±170°	1°
I>>> ?	No or Yes or DIR or Peak		
I>>>	0.1 In	40 In	0.01 In
tI>>>	0 s	150 s	0.01 s
I>>> Torque angle	0°	359°	1°
I>>> Trip zone	±10°	±170°	1°

10.2 [50/51] Phase Overcurrent Protection (P126)

– Phase current Fundamental only

NOTE: When I> and I>> is associated to an IDMT curve, the maximum setting recommended should be 2In.

10.2.1.1 Protection Setting Ranges (P126)

[51] Phase OC	Setting Range		
	Min	Max	Step
I> ?	No or Yes		
I>	0.1 In	25 In	0.01 In
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tI>	0 s	150 s	0.01 s
I> TMS	0.025	10.0	0.001
I> Reset Delay Type	DT or IDMT		
I> RTMS	0.025	3.2	0.025
I> tReset	0.00 s	100 s	0.01 s
I> I>> I>>> Interlock	No or Yes		
I>> ?	No or Yes		
I>>	0.5 In	40 In	0.01 In
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tI>>	0 s	150 s	0.01 s
I>> TMS	0.025	10.0	0.001
I>> Reset Delay Type	DT or IDMT		

I>> RTMS	0.025	3.2	0.025
I>> tReset	0.00 s	100 s	0.01 s
I>>> ?	No or Yes or Peak		
I>>>	0.5 In	40 In	0.01 In
tI>>>	0 s	150 s	0.01 s

10.3 [67N/50N/51N] Dir./Non-Dir. Earth fault protection (P125, P126 & P127)

- Earth fault current Fundamental only
- Earth fault current ranges See following table
- Residual voltage Fundamental only
- Residual voltage range See following table
- Minimum residual voltage operation 0.7V (Uen: 57 to 130V)
- Minimum residual voltage operation 3.0V (Uen: 220 to 480V)

NOTE: When Ie> or Ie>> are associated to an IDMT curve, the maximum setting recommended should be the maximum of the range divided by 20.

10.3.1 Protection Setting Ranges

[67N] Earth OC	Setting Range		
	Min	Max	Step
High sensitivity current set	Cortec code **P12-C-X---X**		
Ie>	0.002 Ien	1 Ien	0.001 Ien
Ie>>	0.002 Ien	1 Ien	0.001 Ien
Ie>>>	0.002 Ien	1 Ien	0.001 Ien
Ie_d>	0.1 Ien	40 Ien	00.01 Ien
Ie_d>>	0.1 Ien	40 Ien	00.01 Ien
Med. sensitivity current set	Cortec code **P12-B-X---X**		
Ie>	0.01 Ien	1 Ien	0.005 Ien
Ie>>	0.01 Ien	8 Ien	0.005 Ien
Ie>>>	0.01 Ien	8 Ien	0.005 Ien
Ie_d>	0.1 Ien	40 Ien	00.01 Ien
Ie_d>>	0.1 Ien	40 Ien	00.01 Ien
Low sensitivity current set	Cortec code **P12-A-X---X**		
Ie>	0.1 Ien	25 Ien	0.1 Ien
Ie>>	0.5 Ien	40 Ien	0.1 Ien
Ie>>>	0.5 Ien	40 Ien	0.1 Ien
Ie_d>	0.1 Ien	40 Ien	00.01 Ien
Ie_d>>	0.1 Ien	40 Ien	00.01 Ien
Ie> ?	No or Yes or DIR		

[67N] Earth OC	Setting Range		
	Min	Max	Step
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tIe>	0 s	150 s	0.01 s
Ie> TMS	0.025	10.0	0.025
Ie> Reset Delay Type	DT or IDMT		
Ie> RTMS	0.025	3.2	0.025
Ie> tReset	0.00 s	100 s	0.01 s
Ie> Ie>> Ie>>> Interlock	No or Yes		
Ie> Torque angle	0°	359°	1°
Ie> Trip zone	±10°	±170°	1°
Input residual voltage with range from 57 to 130V			
Ue>	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue>	4 V	960 V	0.5 V
Ie>> ?	No or Yes or DIR		
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tIe>>	0 s	150 s	0.01 s
Ie>> TMS	0.025	10.0	0.025
Ie>> Reset Delay Type	DT or IDMT		
Ie>> RTMS	0.025	3.2	0.025
Ie>> tReset	0.00 s	100 s	0.01 s
tIe>>	0 s	150	0.01 s
Ie>> Torque angle	0°	359°	1°
Ie>> Trip zone	±10°	±170°	1°
Ie>> tReset	0.00 s	100 s	0.01 s
Input residual voltage with range from 57 to 130V			
Ue>>	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue>>	4 V	960 V	0.5 V
Ie>>> ?	No or Yes or DIR or Peak		
tIe>>>	0 s	150 s	0.01 s
Ie>>> Torque angle	0°	359°	1°
Ie>>> Trip zone	±10°	±170°	1°
Ie>>> tReset	0.00 s	100 s	0.01 s
Input residual voltage with range from 57 to 130V			

[67N] Earth OC	Setting Range		
	Min	Max	Step
Ue>>>	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue>>>	4 V	960 V	0.5 V
Input residual voltage with range from 57 to 130V			
Ue>>	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue>>	4 V	960 V	0.5 V
Ie>>> ?	No or Yes or DIR		
tIe>>>	0 s	150 s	0.01 s
Ie>>> Torque angle	0°	359°	1°
Ie>>> Trip zone	±10°	±170°	1°
Ie>>> tReset	0.00 s	100 s	0.01 s
Input residual voltage with range from 57 to 130V			
Ue>>>	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue>>>	4 V	960 V	0.5 V
Ie_d> ?	No or Yes or DIR		
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tIe_d>	0 s	150 s	0.01 s
Ie_d> TMS	0.025	10.0	0.025
Ie> Reset Delay Type	DT or IDMT		
Ie> RTMS	0.025	3.2	0.025
Ie_d> tReset	0.00 s	100 s	0.01 s
Ie_d> Torque	0°	359°	1°
Ie> Trip zone	±10°	±170°	1°
Input residual voltage with range from 57 to 130V			
Ue(Ie_d>)	1 V	260 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue(Ie_d>)	4 V	720 V	0.5 V
Ie_d>> ?	No or Yes or DIR		
Delay type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tIe_d>>	0 s	150 s	0.01 s
Ie_d>> TMS	0.025	10.0	0.025
Ie>> Reset Delay Type	DT or IDMT		
Ie>> RTMS	0.025	3.2	0.025

[67N] Earth OC	Setting Range		
	Min	Max	Step
Ie_d>> tReset	0.00 s	100 s	0.01 s
Ie_d>> Torque	0°	359°	1°
Ie>> Trip zone	±10°	±170°	1°
Input residual voltage with range from 57 to 130V			
Ue(Ie_d>>)	1 V	130 V	0.1 V
Input residual voltage with range from 220 to 480V			
Ue(Ie_d>>)	4 V	480 V	0.5 V

ATTENTION: THE Ue THRESHOLD SETTINGS DEPEND ON THE ADOPTED CONNECTION OPTION. IN CONFIGURATION/GENERAL OPTIONS MENU OF THE P127 RELAY THE Ve INPUT CAN BE SET DIRECTLY FROM A VT (I.E. FROM A DELTA VT) OR CAN BE DERIVED FROM THE MEASUREMENT OF THE THREE PHASE TO NEUTRAL VOLTAGES (3VPN). IN THIS CASE THE Ue IS CALCULATED AS:

$$Ue = \frac{1}{3} x(\overrightarrow{UA} + \overrightarrow{UB} + \overrightarrow{UC})$$

THE SETTING OF THE Ue THRESHOLDS MUST TAKE THE ABOVE FORMULA IN ACCOUNT.

10.4 Earth Wattmetric Protection

– Earth fault current Fundamental only

– Residual voltage Fundamental only

– Minimum Operating Voltage

- ange from 57 to 130V 0.7 V
- Range from 220 to 480V 3.0 V

– Minimum Operating Current with Ien=1A and Ien=5A

- Range from 0.002 to 1 Ien 1 mA
- Range from 0.01 to 8 Ien 5 mA
- Range from 0.1 to 40 Ien 50 mA

NOTE: When Pe> or Iecos> is associated to an IDMT curve, the maximum setting recommended should be the maximum of the range divided by 20.

10.4.1 Functionality Mode

This protection element can operate in Pe or IeCos mode.

10.4.2 Protection Setting Ranges

ATTENTION: The PE thresholds are displayed in the format:

x K W

with ## = threshold value, and K = Ien.

The threshold value is in watt [W] secondary.

The PE> threshold setting value is 20 W and is to be set from the front panel keypad:

– if Ien = 1A, the internal relay setting value will be equal to 20 x 1 = 20W.

– if Ien = 5a, the internal relay setting value will be equal to 20 x 5 = 100w.

[32N] Earth Wattmetric	Setting range		
	Min	Max	Step
Mode	Pe or IeCos		
High sensitivity:	Current input from 0.002 to 1 Ien		
57–130V Input voltage	Cortec code: **P12-CAX---X**		
Pe> (*)	0.2xK W	20xK W	0.02xK W
Pe>> (*)	0.2xK W	20xK W	0.02xK W
220–480V Input voltage	Cortec code: **P12-CBX---X**		
Pe> (*)	1xK W	80xK W	0.1xK W
Pe>> (*)	1xK W	80xK W	0.1xK W
Med. Sensitivity:	Current input from 0.01 to 8 Ien		
57–130V Input voltage	Cortec code: **P12-BAX---X**		
Pe> (*)	1xK W	160xK W	0.1xK W
Pe>> (*)	1xK W	160xK W	0.1xK W
220–480V Input voltage	Cortec code: **P12-BBX---X**		
Pe> (*)	4xK W	640xK W	0.5xK W
Pe>> (*)	4xK W	640xK W	0.5xK W
Low sensitivity:	Current input from 0.1 to 40 Ien		
57–130V Input voltage	Cortec code: **P12-AAX---X**		
Pe> (*)	10xK W	800xK W	1xK W
Pe>> (*)	10xK W	800xK W	1xK W
220–480V Input voltage	Cortec code: **P12-ABX---X**		
Pe> (*)	40xK W	3200xK W	5xK W
Pe>> (*)	40xK W	3200xK W	5xK W
Pe> ?	No or Yes		
Delay Type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI,RI, RECT curve)		
tPe>	0 s	150 s	0.01 s
Pe> TMS	0.025	10.0	0.025
Pe> Reset Delay Type	DT or IDMT		
Pe> RTMS	0.025	1.5	0.025
Pe> tReset	0.00 s	100 s	0.01 s
Pe>> ?	No or Yes		
tPe>>	0 s	150 s	0.01 s
Pe>> tReset	0.00 s	100 s	0.01 s
High sensitivity IeCos	Cortec code **P12-C-X---X**		

[32N] Earth Wattmetric	Setting range		
	Min	Max	Step
IeCos>	0.002 Ien	1 Ien	0.001 Ien
IeCos>>	0.002 Ien	1 Ien	0.001 Ien
Med. sensitivity IeCos	Cortec code **P12-B-X---X**		
IeCos>	0.01 Ien	8 Ien	0.005 Ien
IeCos>>	0.01 Ien	8 Ien	0.005 Ien
Low sensitivity IeCos	Cortec code **P12-A-X---X**		
IeCos>	0.1 Ien	25 Ien	0.01 Ien
IeCos>>	0.5 Ien	40 Ien	0.01 Ien
IeCos> ?	Yes or No		
Delay Type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tIeCos>	0 s	150 s	0.01 s
IeCos> TMS	0.025	10.0	0.025
IeCos> Reset Delay Type	DT or IDMT		
IeCos> RTMS	0.025	1.5	0.025
IeCos> tReset	0.00 s	100 s	0.01 s
IeCos>> ?	Yes or No		
tIeCos>>	0 s	150 s	0.01 s
IeCos> tReset	0.00 s	100 s	0.01 s
Pe/IeCos Torque angle	0°	359°	1°

10.5 Undercurrent Protection (P126 & P127)

– Undercurrent

– Phase current: Fundamental only

10.5.1 Protection Setting Ranges

[37] Undercurrent	Setting ranges		
	Min	Max	Step
I< ?	Yes or No		
I<	0.1 In	1 In	0.01 In
tI<	0 s	150 s	0.01 s
I< Inhibited on 52A	Yes or No		
I< inhibited on U<	Yes or No		
I< inhibited on U<	Yes or No		

10.6 Negative Sequence Overcurrent Protection (P126 & P127)

– Phase current: Fundamental only

NOTE: When I2> is associated to an IDMT curve, the maximum setting recommended should be 2In.

10.6.1 Protection Setting Ranges

[46] Neg.Seq. OC	Setting ranges		
	Min	Max	Step
I2> ?	No or Yes		
I2>	0.1 In	25 In	0.01 In
Delay Type	DT or IDMT (IEC_STI, IEC_SI, IEC_VI, IEC_EI, IEC_LTI, C02, C08, IEEE_MI, IIEEE_VI, IEEE_EI, RI, RECT curve)		
tI2>	0 s	150s	0.01s
I2> TMS	0.025	10.0	0.025
I2> Reset Delay Type	DT or IDMT		
I2> RTMS	0.025	1.5	0.025
I2> tReset	0.04 s	100 s	0.01 s
I2>> ?	No or Yes		
I2>>	0.5 In	40 In	0.01 In
tI2>>	0 s	150s	0.01s
I2>>> ?	No or Yes		
I2>>>	0.5 In	40 In	0.01 In
tI2>>>	0 s	150s	0.01s

10.7 Thermal Overload Protection (P126 & P127)

– Phase Current: RMS

10.7.1 Protection Setting Ranges

[49] Therm. OL	Setting range		
	Min	Max	Step
Therm. OL ?	No or Yes		
Iθ	0.1 In	3.2 In	0.01
Te	1 mn	200 mn	1mn
k	1	1,5	0.01
θ Trip	50%	200%	1%
θ Alarm ?	No or Yes		
θ Alarm	50%	200%	1%

10.8 Undervoltage Protection (P127)

- Phase or phase to phase voltage Fundamental only
- Thresholds selection mode **AND** or **OR (*)**

10.8.1 Protection Setting Ranges (P127)

[27] Phase Undervoltage	Setting ranges		
	Min	Max	Step
57–130V Input voltage	Cortec code: **P127-AX---X**		
U< ?	No or AND or OR		
U<	2 V	130 V	0.1 V
tU<	0 s	600 s	0.01 s
52a Inhib. U< ?	Yes or No		
U<< ?	No or AND or OR		
U<<	2 V	130 V	0.1 V
tU<<	0 s	600 s	0.01 s
52a Inhib. U<< ?	Yes or No		
220–480V Input voltage.	Cortec code: **P127-BX---X**		
U< ?	No or AND or OR		
U<	10 V	480 V	0.5 V
tU<	0 s	600 s	0.01 s
52a Inhib. U< ?	Yes or No		
U<< ?	No or AND or OR		
U<<	10 V	480 V	0.5 V
tU<<	0 s	600 s	0.01 s
52a Inhib. U<< ?	Yes or No		

10.9 Overvoltage Protection (P127)

– Phase or phase to phase voltage Fundamental only

– Thresholds selection mode **AND** or **OR (*)**

10.9.1 Protection Setting Ranges (P127)

[59] Phase Overvoltage	Setting ranges		
	Min	Max	Step
57–130V Input voltage	Cortec code: **P127-AX---X**		
U> ?	No or AND or OR		
U> tU>	2 V 0 s	260 V 260 s	0.1 V 0.01 s
U>> ?	No or AND or OR		
U>> tU>>	2 V 0 s	260 V 600 s	0.1 V 0.01 s
220–480V Input voltage.	Cortec code: **P127-BX---X**		
U> ?	No or AND or OR		
U> tU>	10 V 0 s	960 V 600 s	0.5 V 0.01 s
U>> ?	No or AND or OR		
U>> tU>>	10 V 0 s	960 V 600 s	0.5 V 0.01 s

(*) **OR** trip caused by one or two or three phase values exceeding the threshold.

AND trip caused by three phase values exceeding the threshold.

10.10 Under/over frequency Function (P127)

– Phase or phase to phase voltage Fundamental only

10.10.1 Protection Setting Ranges (P127)

OP PARAMETERS	Setting ranges		
	Min	Max	Step
Frequency	50 Hz	60 Hz	N.A
[81] Frequency	Min	Max	Step
F1?	81> or 81< or No		
F1 tF1	45,1 Hz 0 s	64,9 Hz 600 s	0.01 Hz 0.01 s
F2?	81> or 81< or No		
F2 tF2	45,1 Hz 0 s	64,9 Hz 600 s	0.01 Hz 0.01 s
F3?	81> or 81< or No		
F3 tF3	45,1 Hz 0 s	64,9 Hz 600 s	0.01 Hz 0.01 s
F4?	81> or 81< or No		
F4	45,1 Hz	64,9 Hz	0.01 Hz

OP PARAMETERS	Setting ranges		
	Min	Max	Step
tF4	0 s	600 s	0.01 s
F5?	81> or 81< or No		
F5 tF5	45,1 Hz 0 s	64,9 Hz 600 s	0.01 Hz 0.01 s
F6?	81> or 81< or No		
F6 tF6	45,1 Hz 0 s	64,9 Hz 600 s	0.01 Hz 0.01 s

10.11 Rate of change of frequency (P127)

OP PARAMETERS	Setting ranges		
	Min	Max	Step
dF/dt1 ?	Yes or No		
dF/dt1	–10Hz/s	+10Hz/s	0.1Hz/s
dF/dt2 ?	Yes or No		
dF/dt2	–10Hz/s	+10Hz/s	0.1Hz/s
dF/dt3 ?	Yes or No		
dF/dt3	–10Hz/s	+10Hz/s	0.1Hz/s
dF/dt4 ?	Yes or No		
dF/dt4	–10Hz/s	+10Hz/s	0.1Hz/s
dF/dt5 ?	Yes or No		
dF/dt5	–10Hz/s	+10Hz/s	0.1Hz/s
dF/dt6 ?	Yes or No		
dF/dt6	–10Hz/s	+10Hz/s	0.1Hz/s

10.12 Directional power Function (P127)

– Phase or phase to phase voltage Fundamental only

Power protection:

– Active overpower (two thresholds P> and P>>),

– Reactive Overpower (two thresholds Q> and Q>>),

– Active Underpower (two thresholds P< and P<<),

– Reactive Underpower (two thresholds Q< and Q<<).

10.12.1 Protection Setting Ranges

[32] Directional Power	Setting ranges		
	Min	Max	Step
57–130V Input voltage	Cortec code: P127AA or P127BA or P127CA		
“P>?” or “Q>?” or “P<?” or “Q<?”	Yes or No		
P> or Q> or P< or Q<	1 W*k (*)	10000 W*k (*)	1 W*k (*)
Directional angle	0°	359°	1°
tP> or tQ> or tP< or tQ<	0 s	150 s	0.01 s
“P>>?” or “Q>>?” or “P<<?” or “Q<<?”	Yes or No		
P>> or Q>> or P<< or Q<<	1 W*k (*)	10000 W*k (*)	1 W*k (*)
Directional angle	0°	359°	1°
tP>> or tQ>> or tP<< or tQ<<	0 s	150 s	0.01 s
220–480V Input voltage	Cortec code: P127AB or P127BA or P127CA		
“P>?” or “Q>?” or “P<?” or “Q<?”	Yes or No		
P> or Q> or P< or Q<	4 W*k (*)	40000 W*k (*)	1 W*k (*)
Directional angle	0°	359°	1°
tP> or tQ> or tP< or tQ<	0 s	150 s	0.01 s
“P>>?” or “Q>>?” or “P<<?” or “Q<<?”	Yes or No		
P>> or Q>> or P<< or Q<<	4 W*k (*)	40000 W*k (*)	1 W*k (*)
Directional angle	0°	359°	1°
tP>> or tQ>> or tP<< or tQ<<	0 s	150 s	0.01 s

(*) **k = 1 if** TC secondary ration = 1A
k = 5 if TC secondary ration = 5A

10.13 Residual Overvoltage Protection

– Residual voltage: Fundamental only

10.13.1 Protection Setting Ranges

[59] Residual Overvoltage	Setting range		
	Min	Max	Step
57–130V Input voltage.	Cortec code: **P127-AX---X**		
Ue>>>> ?	No or Yes		
Ue>>>>	1 V	260 V	0.1 V
tUe>>>>	0 s	600 s	0.01 s
220–480V Input voltage.	Cortec code: **P127-BX---X**		
Ue>>>> ?	No or Yes		
Ue>>>>	5 V	960 V	0.5 V
tUe>>>>	0 s	600 s	0.01 s

ATTENTION: THE Ue THRESHOLD SETTINGS DEPEND ON THE ADOPTED CONNECTION OPTION. IN **CONFIGURATION/GENERAL OPTIONS** MENU OF THE P127 RELAY THE Ve INPUT CAN BE SET DIRECTLY FROM A VT (I.E. FROM A DELTA VT) OR CAN BE DERIVED FROM THE MEASUREMENT OF THE THREE PHASE TO NEUTRAL VOLTAGES (3VPN). IN THIS CASE THE Ue IS CALCULATED AS:

$$Ue = \frac{1}{3} x(\overrightarrow{UA} + \overrightarrow{UB} + \overrightarrow{UC})$$

THE SETTING OF THE Ue THRESHOLDS MUST TAKE THE ABOVE FORMULA IN ACCOUNT.

10.14 Negative overvoltage (P127)

[47] Negative Overvoltage	Setting range		
	Min	Max	Step
57–130V Input voltage.	Cortec code: **P127-AX---X**		
V2> ?	No or Yes		
V2>	1 V	130 V	0.1 V
tV2>	0 s	100 s	0.01 s
V2>> ?	No or Yes		
V2>>	1 V	130 V	0.1 V
tV2>>	0 s	100 s	0.01 s
220–480V Input voltage.	Cortec code: **P127-BX---X**		
V2> ?	No or Yes		
V2>	4 V	480 V	0.5 V
tV2>	0 s	100 s	0.01 s
V2>> ?	No or Yes		
V2>>	4 V	480 V	0.5 V
tV2>>	0 s	100 s	0.01 s

10.15 Multishot Autoreclose Function (P126 & P127)

Main shots: 4 independent shots.

External logic inputs: 6 inputs (CB opened signal, CB closed signal, manual opening command, manual closing command, blocking order, cycle activation).

Internal programmable trigger from phase and earth fault on all re-closing cycles.

External trigger from logic input.

Inhibit time on manual closing.

Programmable dead times and reclaim time setting.

Maximum CB closing control equal to 5s (+t_Pulse setting).

10.15.1 Multishot Autoreclose Settings

[79] Autoreclose	Setting range		
	Min	Max	Step
Autoreclose ?	Yes or No		
Ext. CB Fail ?	Yes or No		
Ext. CB Fail time	0.01 s	600 s	0.01 s
Aux1 ((I>) ?	Yes or No		
Aux2 (Ie>) ?	Yes or No		
Ext Block ?	Yes or No		
Rolling Demand	Yes or No		
Max cycles nb	2	100	1
Time period	10mn	24h	10mn
Dead time			
tD1	0.01 s	300 s	0.01 s
tD2	0.01 s	300 s	0.01 s
tD3	0.01 s	600 s	0.01 s
tD4	0.01 s	600 s	0.01 s
tI>	0.05 s	600 s	0.01 s
tI>>	0.05 s	600 s	0.01 s
tI>>>	0.05 s	600 s	0.01 s
tIe>	0.05 s	600 s	0.01 s
tIe>>	0.05 s	600 s	0.01 s
tIe>>>	0.05 s	600 s	0.01 s
Reclaim time			
tR	0.02 s	600 s	0.01 s
Inhib time			
tI	0.02 s	600 s	0.01 s
Phase Cycles	0	4	1
E/Gnd Cycles	0	4	1
Cycles	4 3 2 1	Settings	
tI>	1 1 1 1	0 or 1 or 2	
tI>>	1 1 1 1	0 or 1 or 2	
tI>>>	1 1 1 1	0 or 1 or 2	
tIe>	1 1 1 1	0 or 1 or 2	
tIe>>	1 1 1 1	0 or 1 or 2	

[79] Autoreclose	Setting range		
	Min	Max	Step
tIe>>>	1 1 1 1	0 or 1 or 2	
tPe/Iecos>	1 1 1 1	0 or 1 or 2	
tPe/Iecos>>	1 1 1 1	0 or 1 or 2	
tAux1	1 1 1 1	0 or 1 or 2	
tAux2	1 1 1 1	0 or 1 or 2	

With:

0 = no action on autorecloser: definitive trip

1 = trip on pick up of the protection element, followed by reclosing cycle

2 = no trip on pick up of the protection element also if this has been set in the *CRTL/Trip commands/Trip* menu

10.15.2 Further timing

Fixed time out for lacking of CB opening signal on trip protection: 2.00 s at 50 Hz
1.67 s at 60 Hz

Time out for lacking of CB closing signal on close control after dead time:

tClose Pulse(*): from 0.1 to 5.00 s in steps of 0.01 s

(*) Setting available in CB monitoring menu.

11. AUTOMATION CONTROL FUNCTIONS

11.1 Trip commands

Assignation of the following thresholds to trip output relays:

– all models: tIe>, tIe>>, tIe>>>, tPe/IeCos>, tPe/IeCos>> , tUe>>>>, tAux 1, tAux 2, tAux 3, tAux 4, Ctrl Trip,

– P126 and P127 only, tI> , tI>> , tI>>> , tI2>, tI2>>, tI2>>>, Thermal θ, Brkn. Cond , SOTF, tEQUATION A, tEQUATION B, tEQUATION C ,t EQUATION D , tEQUATION E , tEQUATION F, tEQUATION G, tEQUATION H

– P127 only: tIe_d>, tIe_d>>, tP>, tP>>, tU>, tU>>, tU<, tU<<, tV2>, tV2>>, tF1, tF2 , tF3 , tF4 , tF5 , tF6 , dF/dt1, dF/dt2, dF/dt3, dF/dt4, dF/dt5, dF/dt6, tAux 5, tAux 6, tAux 7, tAux 8, tAux 9, tAux A, tAux B, tAux C

11.2 Latch relays

Number of relay settable:

P125	P126	P127
6	8	8

11.3 Blocking logic

Possibility to block the following delayed thresholds:

– all models: tIe>, tIe>>, tIe>>>, tPe/IeCos>, tPe/IeCos>>, tUe>>>>, tAux1, tAux2, tAux3, tAux4,

– P126 and P127: tI>, tI>>, tI>>>, tI2>, tI2>>, tI2>>>, tThermal θ, tI<, tBrk. Cond

– P127: tIe_d>, tIe_d>>, tP>, tP>>, tP<, tP<<, tQ>, tQ>>, tQ<, tQ<<, tU>, tU>>, tU<, tU<<, tV2>, tV2>>, tF1 , tF2 , tF3 , tF4 , tF5 , tF6 , dF/dt1, dF/dt2, dF/dt3, dF/dt4, dF/dt5, dF/dt6, tAux5, tAux6, tAux7, tAux8, tAux9, tAuxA, tAuxB, tAuxC,

11.4 Inrush blocking Logic (P127)

Inrush Block	Setting range		
	Min	Max	Step
Inrush Block	Yes or No		
Inrush H2 ration	10 %	35 %	0,1 %
Inrush tReset	0 ms	2 s	0,1 s
Block I>	No	Yes	Yes or No
Block I>>	No	Yes	Yes or No
Block I>>>	No	Yes	Yes or No
Block Ie>	No	Yes	Yes or No
Block Ie>>	No	Yes	Yes or No
Block Ie>>>	No	Yes	Yes or No
Block I2>	No	Yes	Yes or No
Block I2>>	No	Yes	Yes or No
Block I2>>>	No	Yes	Yes or No
Block Ie_d>, Ie_d>>	No	Yes	Yes or No

11.5 Logic select

Logic selectivity 1 and logic selectivity 2: this function is used to assign each time delay to threshold to the “Log Sel” input.

Blocking Inrush	Setting range		
	Min	Max	Step
Sel1 tI>>	Yes or No		
Sel1 tI>>>	Yes or No		
Sel1 tIe>>	Yes or No		
Sel1 tIe>>>	Yes or No		
Sel1 tIe_d>	Yes or No		
Sel1 tIe_d>>	Yes or No		
T Sel1	0s	150s	10ms

11.6 Output relays

Alarm and trip threshold assignation to a logic output: 6 relays (P125), 8 relays (P126 and P127).

Assignable functions:

- all models: Ie>, tIe>, Ie_R>, Ie>>, tIe>>, Ie_R>>, Ie>>>, tIe>>>, Ie_R>>>, Pe/IeCos>, tPe/IeCos>, Pe/IeCos>>, tPe/IeCos>>, Ue>>>>, tUe>>>>, tAux1, tAux2, tAux3, tAux4, CONTROLTRIP, CONTROLCLOSE, ActiveGroup, Input1, Input2, Input3:, Input4,
- P126 and P127: Trip, I>, tI>, I_R>, I>>, tI>>, I_R>>, I>>>, tI>>>, I_R>>>, tIA>, tIB>, tIC>, I2>, tI2>, I2>>, tI2>>, I2>>>, tI2>>>, ThermAlarm, ThermTrip, I<, tI<, BrknCond, CBAlarm, 52 Fail, CBFail , CB Close , 79 Run, 79 Trip, SOTF, Input5, Input6, Input7, t EQU.A, t EQU.B, t EQU.C, t EQU.D, t EQU.E, t EQU.F, t EQU.G, t EQU.H, 79 int. Lock, 79 Ext Lock,
- P127: Ie_d>, tIe_d>, Ie_dR>, tIe_dR>, Ie_d>>, tIe_d>>, Ie_dR>>, tIe_dR>>, P>, tP>, P>>, tP>>, U>, tU>, U>>, tU>>, U<, tU<, U<<, tU<<, V2>, tV2>, V2>>, tV2>>, F1, tF1, F2, tF2, F3, tF3, F4, tF4, F5, tF5, F6, tF6, dF/dt1, dF/dt2, dF/dt3, dF/dt4, dF/dt5, dF/dt6, F.OUT, tAux5, tAux6, tAux7, tAux8, tAux9, tAuxA, tAuxB, tAuxC, VTS, CTS, Command1, Command2, Command3, Command4

11.7 Inputs

11.7.1 Inputs assignation

Single function or multiple automation functions assignable to 4 (P125) or 7 (P126 and P127) logic inputs:

- all models: None, Unlatch, Blk Log 1, Aux 1, Aux 2, Aux 3, Aux 4, Maint. M, Man. Close, Local, Synchronisation, LED Reset (or reset LED),
- P126 and P127: Blk Log 2, 52 a, 52 b, CB FLT, θ Reset, Change set, Log Sel 2, Cold L PU, Strt Dist, Block_79, Trip Circ, Start t BF, Ctrl Trip, Ctrl Close
- P127: Aux 5, Aux 6, Aux 7, Aux 8, Aux 9, Aux A, Aux B, Aux C, Log Sel 1

11.7.2 Auxiliary Timers (P126 & P127)

Auxiliary timers: up to 12 assigned to the logic inputs Aux1, Aux2, Aux3, Aux4 + optional auxiliary timers Aux5, Aux6, Aux7, Aux8 Aux9, AuxA, AubB and AuxC

Auxiliary timers	Setting range		
	Min	Max	Step
tAux1	0	200 s	0.01 s
tAux2	0	200 s	0.01 s
tAux3	0	200 s	0.01 s
tAux4	0	200 s	0.01 s
tAux5	0	200 s	0.01 s
tAux6	0	200 s	0.01 s
tAux7	0	20000 s	0.01 s
tAux8	0	20000 s	0.01 s
tAux9	0	20000 s	0.01 s
tAuxA (tAux10)	0	200 s	0.01 s
tAuxB (tAux11)	0	200 s	0.01 s
tAuxC (tAux12)	0	200 s	0.01 s

11.8 Broken Conductor Detection (P126 & P127)

Principle used: I2/I1

Functionality available for: (IA or IB or IC) > 10% In

11.8.1 Broken conductor detection setting range

Broken Conductor	Setting range		
	Min	Max	Step
Brkn.Cond ?	Yes or No		
Ratio I2/I1	20%	100%	1%
Brkn.Cond Time tBC	1s	14400s	1s

11.9 Cold Load Pickup (P126 & P127)

Cold Load PU	Setting range		
	Min	Max	Step
Cold Load PU ?	Yes or No		
Input?	Yes or No		
Auto?	Yes or No		
Cold Load pickup activable with: tI>, tI>>, tI>>>, tIe>, tIe>>, tIe>>>, tIe_d, tIe_d>>, tI2>, tI2>>, tI2>>> and/or tTherm			
Cold Load PU level	20%	800%	1%
tCL	0.1s	3600s	0.1s

11.10 51V function (P127)

The 51V function means the control of the overcurrent elements by the monitoring of the phase voltage; !The settings involved are listed below. The VTS function can also block the 51V.

51V	Setting range		
	Min	Max	Step
Voltage range 57-130V			
(U<OR V2>) & I>>	Yes or No		
V2>	3V	200V	0.1V
(U<<OR V2>>) & I>>>	Yes or No		
V2>	3V	200V	0.1V
Voltage range 220-480V			
(U<OR V2>) & I>>	Yes or No		
V2>	20V	720V	0.5V
(U<<OR V2>>) & I>>>	Yes or No		
V2>	20V	720V	0.5V
VTS Blocks 51V	Yes or No		
VTS Alarm	Yes or No		

11.11 VT Supervision (P127 only)

11.11.1 VT Supervision Setting range

VT Supervision	Setting range		
	Min	Max	Step
VTS?	Yes or No		
VTS Alarm	Yes or No		
VTS Blocks 51V	Yes or No		
VTS Blocks protection ?	Yes or No		
VTS Non Dir I>, I>>, I>>>, Ie>, Ie>>, Ie>>>, Ie_d> and/or Ie_d>>	Yes or No		
tVTS	0s	100s	10ms

11.12 CT Supervision (P127)

11.12.1 CT Supervision Setting range

CT Supervision	Setting range		
	Min	Max	Step
CT Supervision	Yes or No		
Ie>	0.08 × In	1.0 × In	0.01 × In
Ue< (P127xA)	0.5V	22V	0.1V
Ue< (P127xB)	2V	88V	0.5V
tCTS	0s	100s	0.01s

11.13 Circuit Breaker Failure (P126 & P127)

11.13.1 Circuit Breaker Failure Setting range

CB Fail	Setting range		
	Min	Max	Step
CB Fail ?	Yes or No		
I< BF	0.02 In	1In	0.01 In
CB Fail Time tBF	0 s	10 s	0.01 s
Block I>	Yes or No		
Block Ie>	Yes or No		

11.14 Trip Circuit Supervision (P126 & P127)

11.14.1 Trip Circuit Supervision Setting range

TC Supervision	Setting range		
	Min	Max	Step
TC Supervision ?	Yes or No		
t trip circuit tSUP	0.1 s	10 s	0.01 s

11.15 Circuit Breaker Control and Monitoring (P126 & P127)

11.15.1 Setting Ranges

CB Supervision	Setting range		
	Min	Max	Step
CB Open S'vision?	Yes or No		
CB Open time	0.05 s	1 s	0.01 s
CB Close S'vision?	Yes or No		
CB Close time	0.05 s	1 s	0.01 s
CB Open Alarm ?	Yes or No		
CB Open NB	0	50000	1
ΣAmps(n) ?	Yes or No		
ΣAmps(n)	0 E6 A	4000 E6 A	1E6 A
n	1	2	1
tOpen Pulse(*)	0.10 s	5 s	0.01 s
tClose Pulse(*)	0.10 s	5 s	0.01 s

(*) Note: The tOpen/Close Pulse is available in the P125 for the Local /Remote functionality

11.16 SOTF/TOR Switch on to fault / Trip on reclose (P126 & P127)

11.16.1 Setting Ranges

SOTF	Setting range		
	Min	Max	Step
SOTF?	Yes or No		
t SOTF	0 ms	500 ms	10ms
I>>	Yes or No		
I>>>	Yes or No		
Ctrl close input	Yes or No		
SOTF input	Yes or No		
HMI closing order	Yes or No		
[79] closing	Yes or No		
Front comm. order	Yes or No		
Rear comm. order	Yes or No		
Rear2 comm. order	Yes or No		

11.17 Logic Equation (P126 & P127)

The MiCOM P126 and P127 relays integrate complete logic equations to allow customization of the product based on customer application.

Up to 8 independent Boolean equations can be used (from A to H). Every result of equation can be time delayed and assigned to any output relays, trip, trip latching and/or HMI LEDs.

Up to 16 operands can be used (from 00 to 15). Within operands, there are two parts:

- (1/2): **logical gates** (NOT, OR, AND, NOT AND, NOT OR)
- (2/2): **signals** (I>, tI>>, Input1 …etc)

11.17.1 Timer Setting Ranges

logic equat T delay	Setting range		
	Min	Max	Step
EQU. A Toperat	0 s	600 s	0.01 s
EQU. A Treset	0 s	600 s	0.01 s
EQU. B Toperat	0 s	600 s	0.01 s
EQU. B Treset	0 s	600 s	0.01 s
EQU. C Toperat	0 s	600 s	0.01 s
EQU. C Treset	0 s	600 s	0.01 s
EQU. D Toperat	0 s	600 s	0.01 s
EQU. D Treset	0 s	600 s	0.01 s
EQU. E Toperat	0 s	600 s	0.01 s
EQU. E Treset	0 s	600 s	0.01 s
EQU. F Toperat	0 s	600 s	0.01 s
EQU. F Treset	0 s	600 s	0.01 s
EQU. G Toperat	0 s	600 s	0.01 s
EQU. G Treset	0 s	600 s	0.01 s

logic equat T delay	Setting range		
	Min	Max	Step
EQU. H Toperat	0 s	600 s	0.01 s
EQU. H Treset	0 s	600 s	0.01 s

11.17.2 Available logical gates

Logical gates	Availability (1/2)
NOT	A00 B00 C00 D00 E00 F00 G00 H00
OR (by default) AND AND NOT OR NOT	A01 to A15 B01 to B15 C01 to C15 D01 to D15 E01 to E15 F01 to F15 G01 to G15 H01 to H15

11.17.3 Available signals

With the Logic Equations submenu, 16 operands can be used in any single equation. The following logic signals are available for mapping to an equation:

TEXT	Signals (2/2)
I>, I> and I>>	Instantaneous first, second and third phase overcurrent thresholds
tI>, tI>> and tI>>>	Time delayed first, second and third phase overcurrent thresholds
Ie>, Ie>> and Ie>>>	Instantaneous first, second and third earth overcurrent thresholds
tIe>, tIe>> and tIe>>>	Time delayed first, second and third earth overcurrent thresholds
Pe>, Pe>>	First and second earth wattmetric alarm thresholds
tPe>, tPe>>	Time delayed first and second earth wattmetric trip thresholds
t Aux 1 to t Aux 4	Copy of the status of the Logic Input delayed by tAux1, tAux2, tAux3 and tAux4 times
t Aux 5 to t Aux C (when available)	Copy of the status of the Logic Input delayed by tAux5, tAux6, tAux7, tAux8, tAux9, tAuxA, tAuxB and tAuxC times
I2>, I2>> and I2>>>	Instantaneous first, second and third phase negative sequence thresholds
tI2>, tI2>> and tI2>>>	Time delayed negative phase sequence (1^{st}, 2^{nd} and 3^{rd} threshold)
θ Alarm	Thermal alarm output signal
θ Trip	Trip on Thermal overload
I<	Instantaneous undercurrent threshold

TEXT	Signals (2/2)
tI<	Time delayed undercurrent
tBC	Time delayed broken conductor
U>, U>>	Instantaneous first and second overvoltage threshold (P127)
tU>, tU>>	Time delayed first and second overvoltage threshold (P127)
U<, U<<	Instantaneous first and second undervoltage threshold (P127)
tU<, tU<<	Time delayed first and second undervoltage threshold (P127)
Ue>>>>	Instantaneous threshold for residual overvoltage
tUe>>>>	Time delayed trip threshold for residual overvoltage
tBC	Time delayed broken conductor
79 Trip	Autoreclose final trip
Input 1 to Input C (when available)	Opto input 1 to opto input C.
P>, P>>	Instaneous first and second active overpower trip threshold (P127)
tP>, tP>>	Time delayed first and second active overpower trip threshold (P127)
P<, P<<	Instaneous first and second active underpower trip threshold (P127)
tP<, tP<<	Time delayed first and second active underpower trip threshold (P127)
Q>, Q>>	Instaneous first and second reactive overpower trip threshold (P127)
tQ>, tQ>>	Time delayed first and second reactive overpower trip threshold (P127)
Q<, Q<<	Instaneous first and second reactive underpower trip threshold (P127)
tQ<, tQ<<	Time delayed first and second reactive underpower trip threshold (P127)
V2>, V2>>	Instaneous 1st or 2nd negative overpower trip threshold (P127)
tV2>, tV2>>	Time delayed 1st or 2nd negative overpower trip threshold (P127)
F1 to F6	Instantaneous first, second, third, fourth, fifth and sixth frequency trip threshold (P127)
tF1 to tF6	Time delayed first, second, third, fourth, fifth and sixth frequency trip threshold (P127)
dF/dt1 to dF/dt6	1^{st} to 6^{th} rates of change of frequency
VTS	Instantaneous VTS output signal (P127)
CTS	Instantaneous Current Transformer Supervision signal (P127)
Ie_d>, Ie_d>>	Instantaneous 1^{st} or 2^{nd} derived earth overcurrent threshold
tIe_d>, tIe_d>>	Time delayed 1^{st} or 2^{nd} derived earth overcurrent threshold
79 i.Blo	Autoreclose lock activated by the internal process of the autoreclose (Internal Blocking)
79 e.Blo	Autoreclose lock activated by the input “block 79” (External Blocking)

TEXT	Signals (2/2)
tEQU. A to tEQU. H	Results of equations A to H.
CB FLT	Circuit Breaker failure
C.Order1 to C.Order4	Remote communication orders (P127)

11.18 Communication order delay

The following delay times set the duration for the reception of the remote "communication order" signals.

logic equat T delay	Setting range		
	Min	Max	Step
tCommand 1	0s	600s	50ms
tCommand 2	0s	600s	50ms
tCommand 3	0s	600s	50ms
tCommand 4	0s	600s	50ms

12. RECORDING FUNCTIONS

12.1 Event Records

Capacity	250 events
Time-tag	1 millisecond
Triggers	Any selected protection alarm and threshold Logic input change of state Setting changes Self test events

12.2 Fault Records

Capacity	25 faults
Time-tag	1 millisecond
Triggers	Any selected protection alarm and threshold
Data	Fault date Protection thresholds Setting Group AC inputs measurements (RMS) Fault measurements

12.3 Instantaneous recorder

Capacity	5 starting informations (instantaneous)
Time-tag	1 millisecond
Triggers	Any selected protection alarm and threshold
Data	date, hour origin (any protection alarm) length (duration of the instantaneous trip yes or no

12.4 Disturbance Records

12.4.1 Triggers; Data; Setting Ranges

Disturbance Records				
Triggers	Any selected protection alarm and threshold, logic input, remote command			
Data	AC input channels digital input and output states frequency value			
	Default value	**Setting range**		
		Min	**Max**	**Step**
Records number	5	1	5	1
Pre-Time	0.1s	0.1	2.9 / 4.9 / 6.9 or 8.9	0.1
Disturb rec Trig	ON TRIP	ON TRIP or ON INST.		
Trigger	Any selected protection alarm and threshold Logic input Remote command			

13. COMMUNICATION

Type Port	Relay position	Physical Link	Connectors	Data Rate	Protocol
RS485	Rear port	Screened twister pair	Screws or snap-on	300 to 38400 baud (programmable)	ModBus RTU, , IEC60870-5-103, DNP3
RS485 isolated	Optional 2nd rear port	Screened twister pair	Screws or snap-on	300 to 38400 baud (programmable)	ModBus RTU, IEC60870-5-103 (option)
RS232	Front port	Screened twister pair	Sub–D 9 pin female connector	300 to 38400 baud (programmable)	ModBus RTU

14. IRIG-B INTERFACE

The IRIG-B is a P127 optional interface used to receive synchronization signal from a GPS clock.

Type: Modulated (1kHz) or demodulated

Interface:

- Modulated IRIG-B interface:
  - BNC socket and BNC adaptor,
  - total impedance: 50Ω
- No modulated IRIG-B interface: screw,

SELV rated circuit

Date code: BCD

15. CURVES

15.1 General

Although the curves tend towards infinite when the current approaches Is (general threshold), the minimum guaranteed value of the operating current for all the curves with the inverse time characteristic is 1.1Is (with a tolerance of ± 0.05Is).

15.1.1 Inverse Time Curves:

The first stage thresholds for phase (earth) overcurrent can be selected with an inverse definite minimum time (IDMT) characteristic. The time delay is calculated with a mathematical formula.

In all, there are eleven IDMT characteristics available.

The mathematical formula applicable to the first ten curves is:

$$t = T \times \left(\frac{K}{\left(I / I_S\right)^{\alpha} - 1} + L \right)$$

Where:

t Operation time

K Factor (see table)

I Value of measured current

Is Value of the programmed threshold (pick-up value)

α Factor (see table)

L ANSI/IEEE constant (zero for IEC and RECT curves)

T Time multiplier setting from 0.025 to 1.5

Type of curve	Standard	K factor	α factor	L factor
Short time inverse	Schneider Electric	0.05	0.04	0
Standard inverse	IEC	0.14	0.02	0
Very inverse	IEC	13.5	1	0
Extremely inverse	IEC	80	2	0
Long time inverse	Schneider Electric	120	1	0
Short time inverse	C02	0.02394	0.02	0.01694
Moderately Inverse	ANSI/IEEE	0.0515	0.02	0.114
Long time inverse	C08	5.95	2	0.18
Very inverse	ANSI/IEEE	19.61	2	0.491
Extremely inverse	ANSI/IEEE	28.2	2	0.1217
Rectifier protection	RECT	45900	5.6	0

The RI curve has the following definition:

$$t = K \cdot \frac{1}{0.339 - \frac{0.236}{\left(I / Is \right)}}$$

K setting is from 0.10 to 10 in steps of 0.05.
The equation is valid for 1.1 ≤ I/Is ≤ 20.

15.1.2 Reset Timer

The first stage thresholds for phase and earth overcurrent protection, negative sequence overcurrent and wattmetric/IeCos are provided with a timer hold facility "t Reset".

It may be set to a definite time value or to an inverse definite minimum time characteristic (IEEE/ANSI curves only). This may be useful in certain applications, for example when grading with upstream electromechanical overcurrent relays that have inherent reset time delays.

The second and third stage thresholds for the wattmetric/IeCos protection and earth fault overcurrent protection only have a definite time reset.

A possible situation where the reset timer may be used is to reduce fault clearance times where intermittent faults occur.

An example may occur in a cable with plastic insulation. In this application it is possible that the fault energy melts the cable insulation, which then reseals after clearance, thereby eliminating the cause for the fault. This process repeats itself to give a succession of fault current pulses, each of increasing duration with reducing intervals between the pulses, until the fault becomes permanent.

When the reset time of the overcurrent relay is set to minimum the P125, P126 and P127 relays will be repeatedly reset and will not be able to trip until the fault becomes permanent. By using the reset timer hold function the relay will integrate the fault current pulses, thereby reducing fault clearance time.

The mathematical formula applicable to the five curves is:

$$t = T \times \left(\frac{K}{1 - \left(I \;/ I_S \right)^{\alpha}} \right)$$

Where:

t Reset time

K Factor (see table)

I Value of the measured current

Is Value of the programmed threshold (pick-up value)

α Factor (see table)

T Reset time multiplier (RTMS) setting between 0.025 and 1.5.

Type of curve	Standard	K factor	α factor
Short time inverse	C02	2.261	2
Moderately inverse	ANSI/IEEE	4.850	2
Long time inverse	C08	5.950	2
Very inverse	ANSI/IEEE	21.600	2
Extremely Inverse	ANSI/IEEE	29.100	2

15.2 Thermal Overload Curves

The thermal time characteristic is given by:

$$e^{\left(\frac{-t}{\tau}\right)} = \frac{\left(I^2 - (kxI_{FLC})^2\right)}{\left(I^2 - I_P{}^2\right)}$$

Where:

t = Time to trip, following application of the overload current, I

τ = Heating and cooling time constant of the protected plant equipment

I = Largest phase current

I_{FLC} = Full load current rating (relay setting 'Thermal Trip')

k = 1.05 constant, allows continuous operation up to < 1.05 I_{FLC}

I_P = Steady state pre-loading current before application of the overload

The time to trip varies depending on the load current carried before application of the overload, i.e. whether the overload was applied from "hot" or "cold".

Curves of the thermal overload time characteristic are given in Technical Data.

The mathematical formula applicable to MiCOM Relays is the following

$$\mathrm{t\ Trip} = \mathrm{Te\ In}\left(\frac{|\mathrm{K?}\text{-}\ \theta|}{|K^2 - \theta trip|}\right)$$

Where:

t Trip = Time to trip (in seconds)

Te = Thermal time constant of the equipment to be protected (in seconds)

K = Thermal overload equal to Ieq/k Iθ> with:

Ieq = Equivalent current corresponding to the RMS value of the largest phase current

Iθ> = Full load current rating given by the national standard or by the supplier

k = Factor associated to the thermal state formula

θ alarm = Initial thermal state. If the initial thermal state = 30% then θ =0.3

θ trip = Trip thermal state. If the trip thermal state is set at 100%, then θ trip = 1

The settings of these parameters are available in the various menus. The calculation of the thermal state is given by the following formula:

$$\Theta_{\tau+1} = \left(\frac{\mathrm{I_{eq}}}{\mathrm{kxI\Theta >}}\right)^2 \left[1 - e^{\left(\frac{-t}{Te}\right)}\right] + \Theta_\tau e^{\left(\frac{-t}{Te}\right)}$$

θ being calculated every 100ms.

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GETTING STARTED

CONTENT

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1. ENERGISING THE RELAY

To energise the relay correctly, follow the following instructions carefully.

1.1 System Connections

1. Check the wiring scheme of your installation.
2. Check that the contacts of output relay **RL1** are included in your trip circuit.

1.2 Auxiliary Power Supply Connections

Connect a DC or AC (according to nominal supply rating Ua) voltage power supply.

POSITIVE Vaux TO TERMINAL 33
NEGATIVE Vaux TO TERMINAL 34
DO NOT FORGET TO CONNECT THE EARTH REFERENCE TO TERMINAL 29!

Turn on the auxiliary power supply and set to approximately rated voltage as shown on the front panel of the relay.

The display should show:

IA **1.00 A**	Displays the A phase current (true RMS value) taking into account the phase CT ratio (CONFIGURATION/CT RATIO submenu).

LEDs should be in the following configuration:

– Green LED L3 "Healthy" (Vaux) is iluminated

– All the other LEDs should be off.

2. USER INTERFACE AND MENU STRUCTURE

Before carrying out any work on the equipment, the user should be familiar with the contents of the safety section/safety guide SFTY/4LM/D11 or later issue, the technical data section and the ratings on the equipment rating label.

Refer to "GETTING STARTED" (GS) section for the description of the following procedures (interfaces and menu).

Before the initial operation of the relay, some of the parameter settings must be checked or modified (otherwise, "Setting alarm" is displayed).

Lift the upper and lower hinged covers and remove the transparent cover over the front panel. When the keypad is exposed, it provides full access to the menu options of the relay. The relevant information is displayed on the LCD.

2.1 User interfaces and menu structure

The settings and functions of the MiCOM relay can be accessed both from the front panel keypad and LCD, and via the front and rear communication ports. Information on each of these methods is given in this section to describe how to start using the relay.

The front panel of the relay includes a keypad, a 16-character alphanumeric liquid crystal display (LCD) and 8 LEDs.

2.1.1 "Default settings" alarm

When the relay is powered ON, it checks its memory contents. If the default settings are loaded, an alarm is raised and The ALARM yellow LED lights up.

To suppress this message and to reset the watch dog, change one parameter in the relay's menu:

- Press the button,
- Modify, for instance, the password or the language ("OP parameters" menu.

2.1.2 Password protection

Password protection is applicable to most of the relay parameter settings, especially to the selection of the various thresholds, time delays, communication parameters, allocation of logic inputs and logic outputs.

The password consists of four capital characters. When leaving the factory, the password is set to **AAAA**. The user can define any combination of four characters.

Should the password be lost or forgotten, the modification of stored parameters is blocked. It is then necessary to contact the manufacturer or his agent and by specifying the serial number of the relay, a stand-by password specific to the relay concerned may be obtained.

NOTE: The programming mode is indicated with the letter **"P"** on the right hand side of the display on each menu heading. The letter **"P"** remains present as long as the password is active (**5 minutes** if there is no action on the keypad).

- Go to the "OP. Parameters" menu by pressing and then to the "password" menu by pressing ,
- Enter the current password (default password = "AAAA") and validate with (this operation is not necessary if the password has been entered some minutes ago),
- Enter the new password character by character, using and arrows to change a letter (maintain the key pressed to scroll through the letter in the alphabet). Use and arrows to select another character: a flashing cursor will indicate which character field of the password may be entered.,
- Validate using or cancel using . If the password is correct, the following message is displayed on the LCD: PASSWORD OK

As soon as the password has been entered, no setting change will be accepted via the remote or local communication port (RS485 or RS232).

Alternatively, the password can be entered by using the **Password** window in the **OP.PARAMETERS** menu. This password entry procedure is the same as above.

NOTE: In case of loss of password a back up password can be provided contacting Schneider Electric Customer Care Center.

2.1.3 Setting the language

– Go to the “OP. Parameters” menu by pressing and then to the “Language” menu by pressing , ,

– If necessary, enter the current password and validate with ,

– Select the language using or arrows, and validate with ,

– Validate using or cancel using .

2.1.4 Setting Date and time

NOTE: If the optional IRIG-B board is installed (P127 option), date and time synchronization could be automatic.

– Go to the “OP. Parameters” menu by pressing and then to the “Date” menu by pressing (x9),

– If necessary, enter the current password and validate with ,

– Set the date using or arrow, and validate with (10/11/08 means November 10th 2008),

NOTE: When you modify the date, the first digit for the day or the month can be selected according to the second digit. For instance, if 13/09/08 is displayed, you cannot select 33 for the day, or 29 for the month.

– Validate using or cancel using .

– Select the “Time ” menu by pressing 2 key,

– Set the date using or arrow, and validate with (14:21:42 means 2:21:42 pm)

2.1.5 Menu navigation

A simple menu structure (refer to P12y/EN GS section) allows setting and reading of parameters and functionality.

The keypad provides full access to the menu options, with informations displayed on the LCD.

– Press , , and keys for menu navigation:

- Press or keys to navigate from a menu heading to another menu heading (refer to the figure below),
- Press key to access to a sub menu, then navigate using or keys.

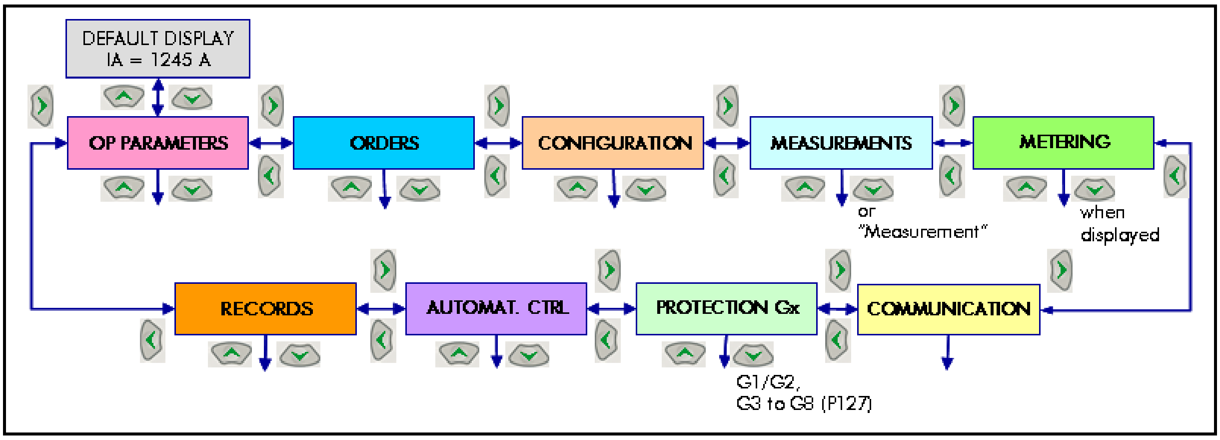
– Maintain these keys pressed to scroll through the menu,

– If necessary, modify a parameter by pressing key.

- Modify the corresponding parameter using arrows,
- Validate using , or cancel using .

2.2 Menu structure

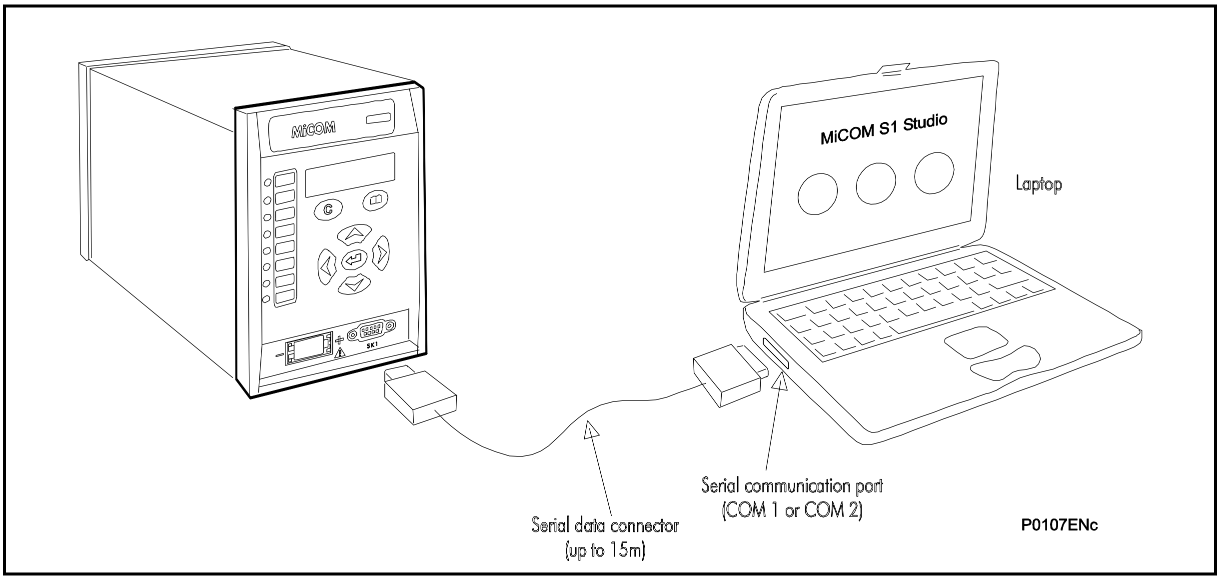
The menu structure is shown below.



Refer to P12y/EN HI section for the detail of the menu.

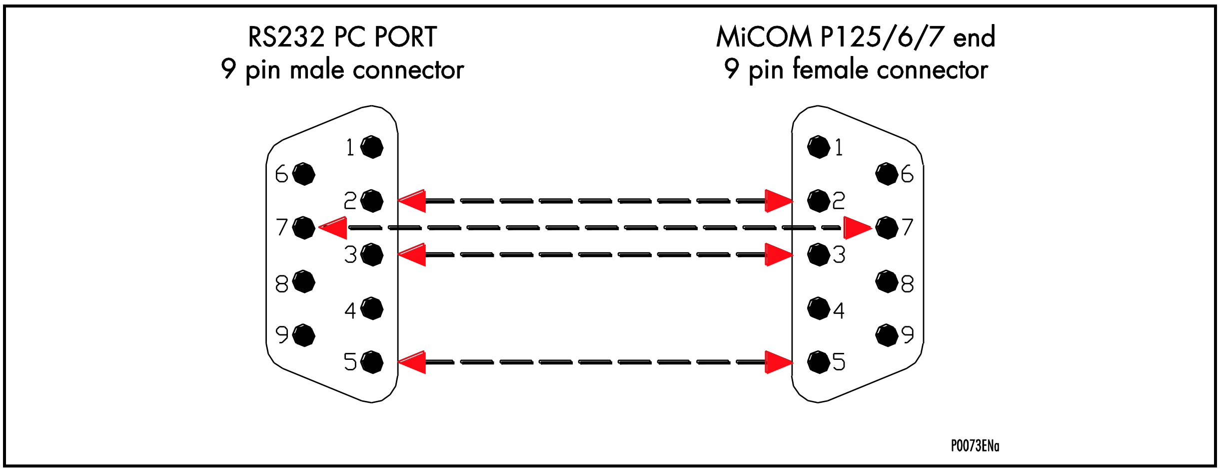
3. LOCAL CONNECTION TO A PC

3.1 Configuration



For a local connection between a PC and the relay, a serial cable with metallic shield should be used.

The wiring of the RS232 cable must be as shown in the following drawing.

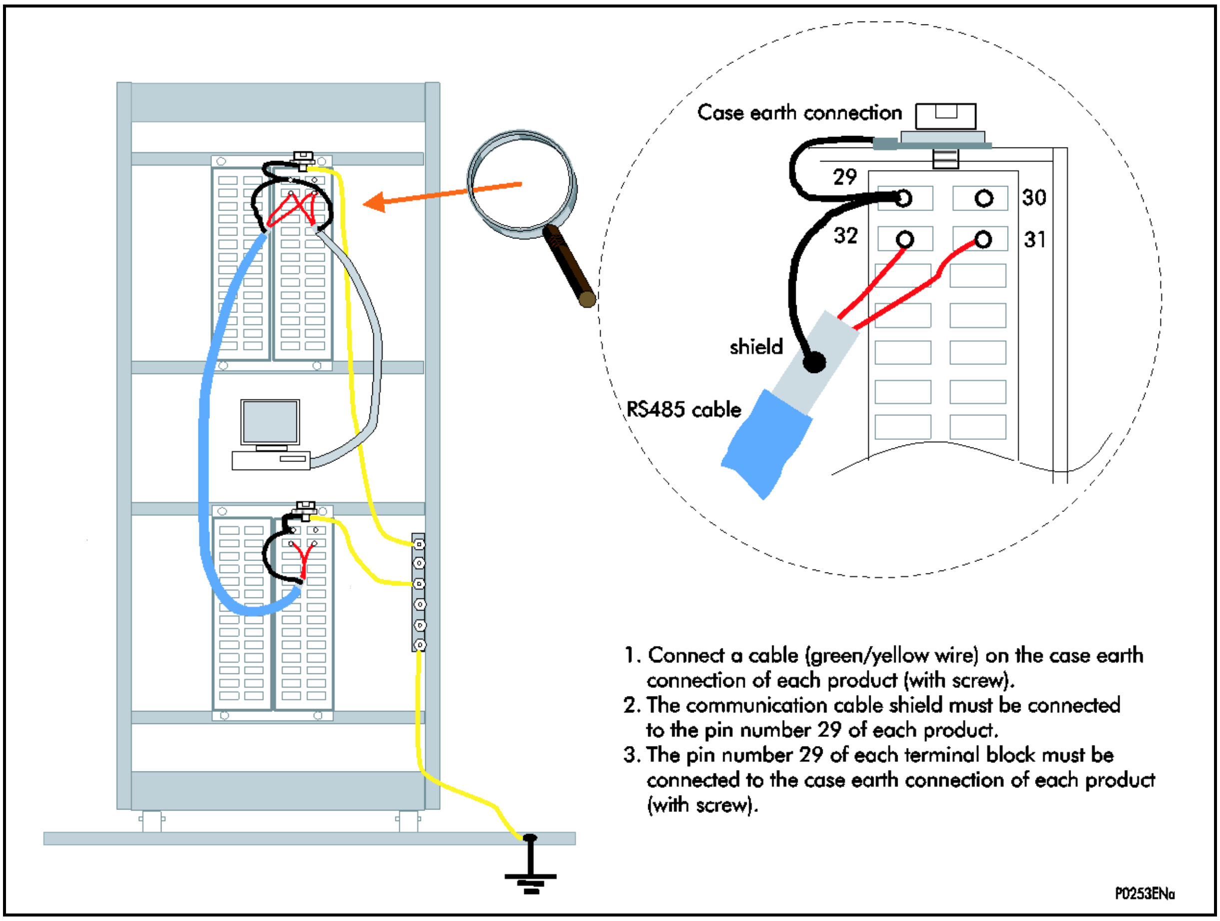


A USB/RS232 cable can also be used to communicate to the relay

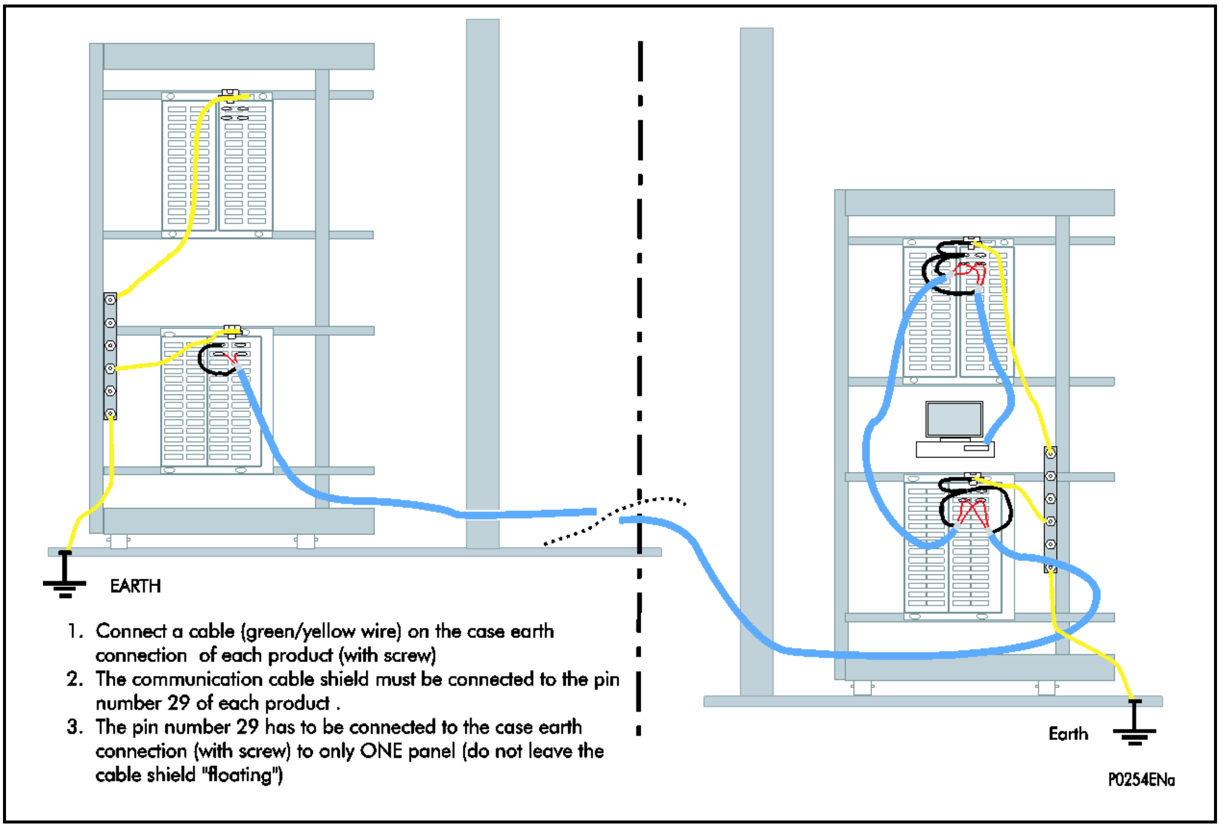
3.1.1 REMOTE connection

The figure shows the recommended way to connect a RS485 cable to the relay to build a local network.

3.2 Products plugged in the same panel



3.3 Communication between distant products



3.4 MiCOM S1 and MiCOM S1 Studio relay communications basics

MiCOM S1 and MiCOM S1 Studio are the universal MiCOM IED Support Softwares and provide users a direct and convenient access to all stored data in any MiCOM IED using the EIA(RS)232 front communication port.

MiCOM S1 Studio provide full access to MiCOM Px20, Px30, Px40 relays and others IED,

The following sections give the main procedures to connect and to use MiCOM S1 and MiCOM S1 Studio.

Before starting, verify that the EIA(RS)232 serial cable is properly connected to the EIA(RS)232 port on the front panel of the relay. Please follow the instructions in section 3.1 to ensure a proper connection is made between the PC and the relay before attempting to communicate with the relay.

This section is intended as a quick start guide to using MiCOM S1 and MiCOM S1 Studio, and assumes you have a copy of MiCOM S1 or MiCOM S1 Studio installed on your PC. Please refer to the MiCOM S1 or MiCOM S1 Studio User Manual for more detailed information.

3.5 MiCOM S1 Studio

3.5.1 Data Model Management

The settings and parameters of the protection relay can be extracted from the relay or loaded using Data Model manager. The Data Model Manager can load any model from Local file, CD ROM or Internet server (if connected).

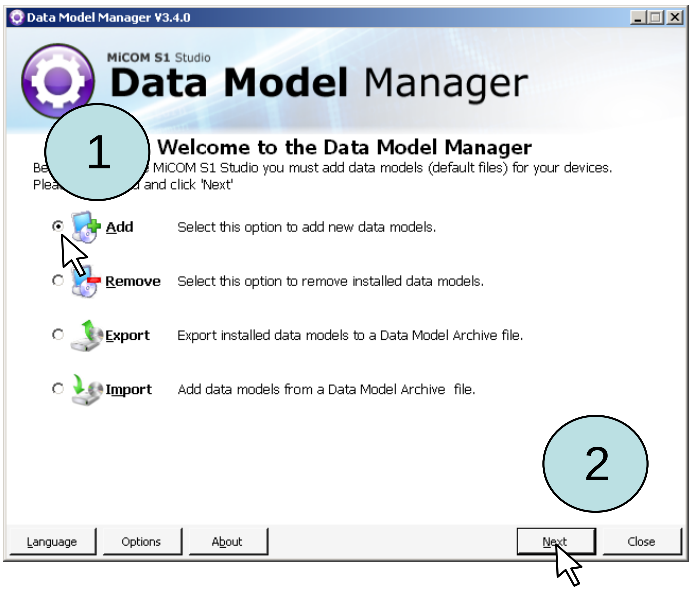
The Data Model Manager is used to add or to remove data models, to export and to import data model files.

It is necessary to close MiCOM S1 Studio when the Data Model Manager is opened.

To Open Data Model manager, click on the icon: 

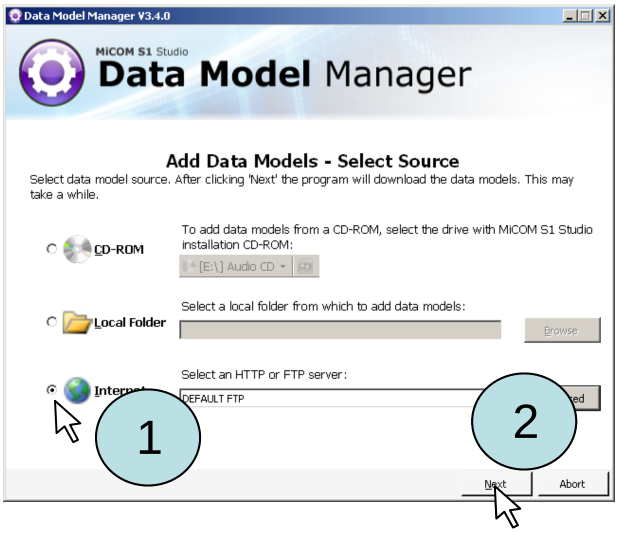
, select "MiCOM S1 Studio" then "Data Model Manager" in the "Programs" menu.

The following panel is displayed:



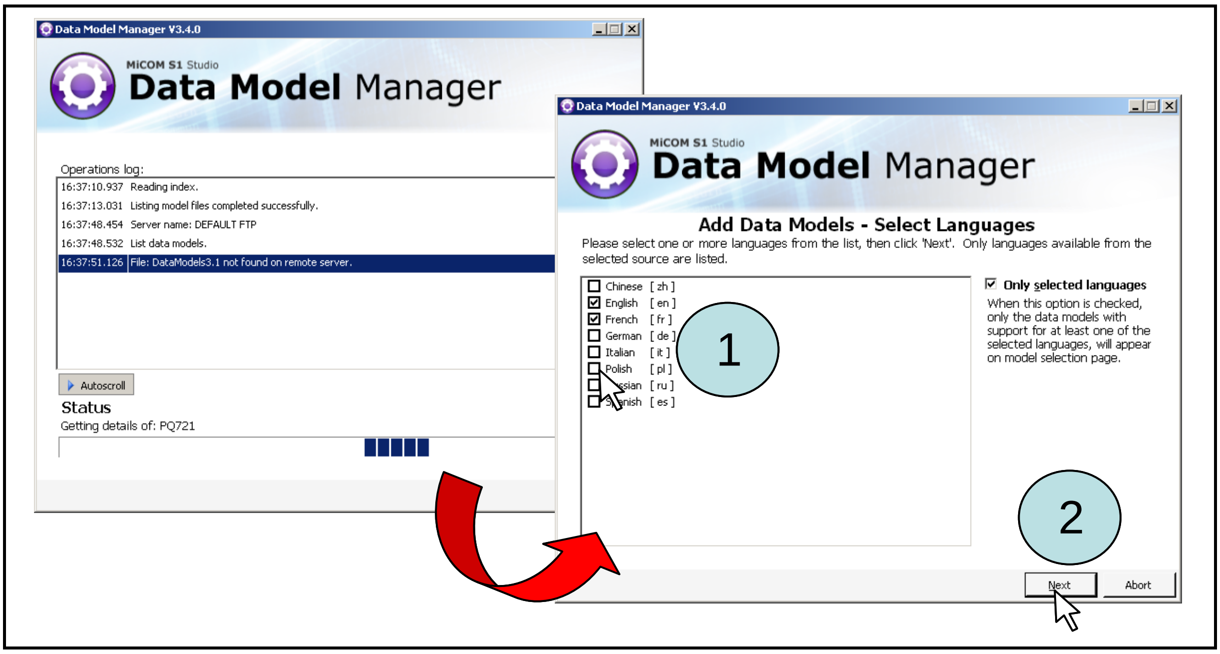
Select the “Add” option to add the new data model then click on the “Next” button.

The next panel is used to select the model source (CD ROM, local folder or Schneider Electric FTP server [DEFAULT FTP]). Select the model source and click on the “next” button.

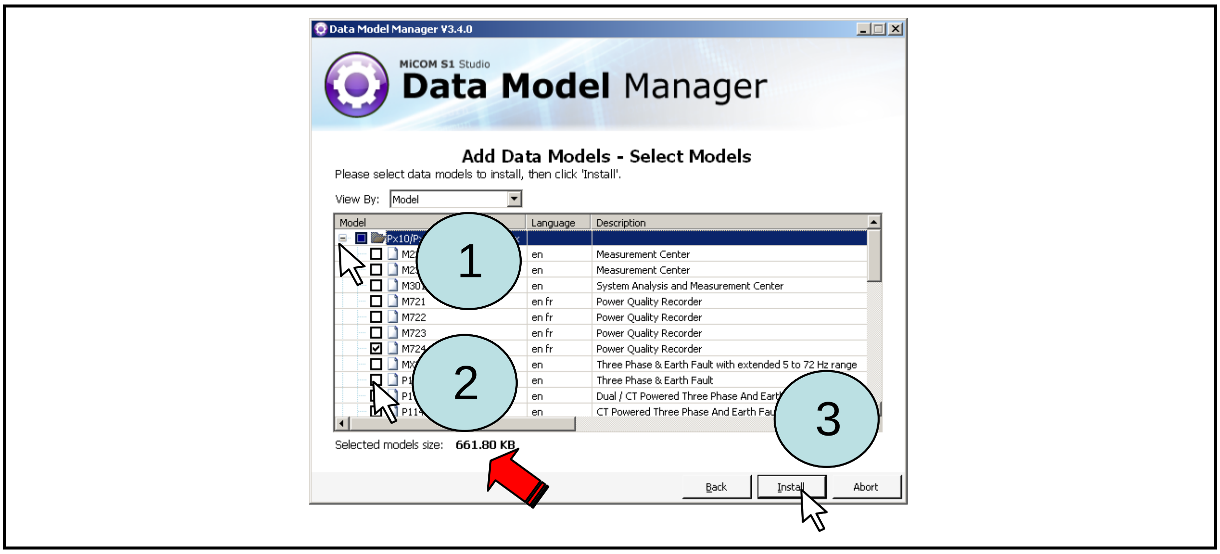


NOTE: the following procedure is given with FTP server selected.

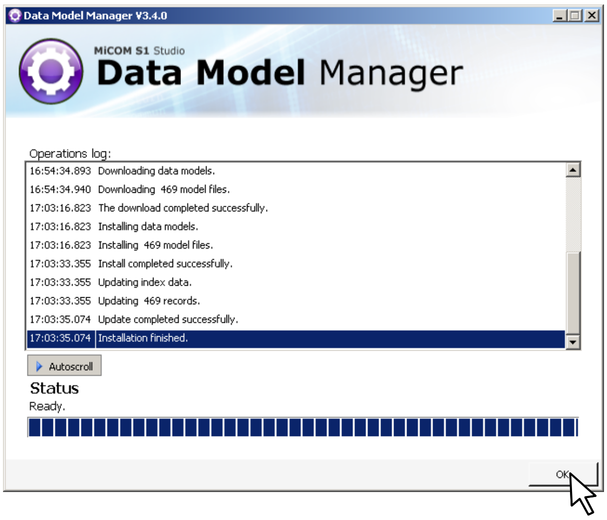
The Data Model Manager loads data models details, and then displays automatically the language selection option panel. Select the menu language(s) and click on the "Next" button.



The data models panel is displayed. Select the data model for your product (for instance, to download P12x data models, open the "Px10/Px20/Px20C/M/Modulex" sub-menu (click on "+" then select data model according to your product). When data models are selected, the Data Model Manager panel displays the selected models size to download.



Click on "Install button". The model files are downloaded and updated in the system.



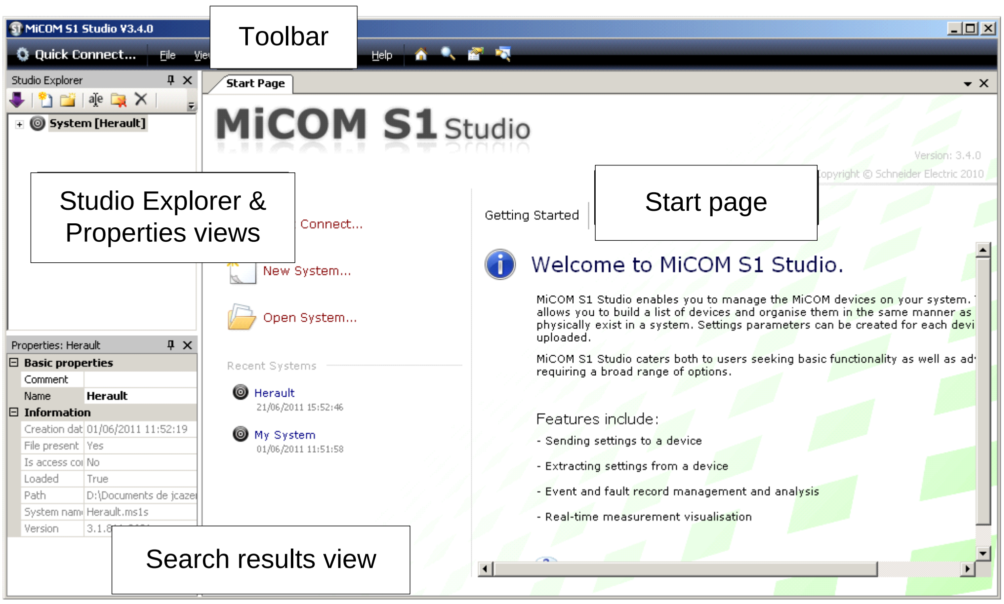
When installation has been completed, close the Data Model Manager. This Data Model is used with MiCOM S1 Studio when a system is opened or created. To open this default setting file, refer to § 3.5.8.

3.5.2 "Quick Connection" to the relay using MiCOM S1 Studio

To start MiCOM S1 Studio, click on the icon: 

In the "Programs" menu, select "MiCOM S1 Studio".

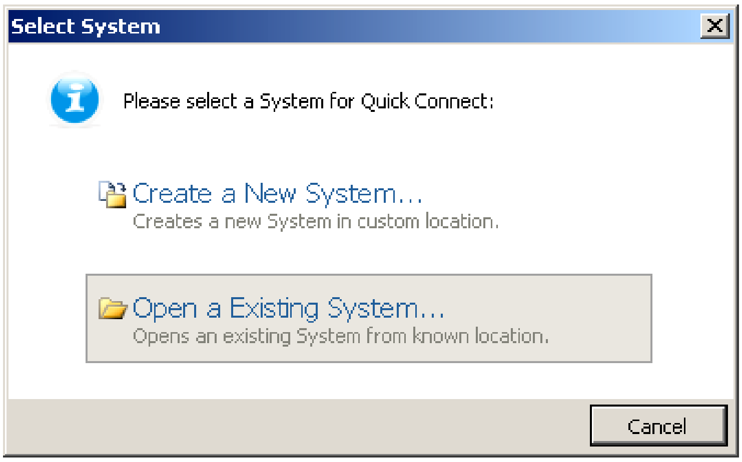
The MiCOM S1 Studio launcher screen is displayed:



P0841FRb

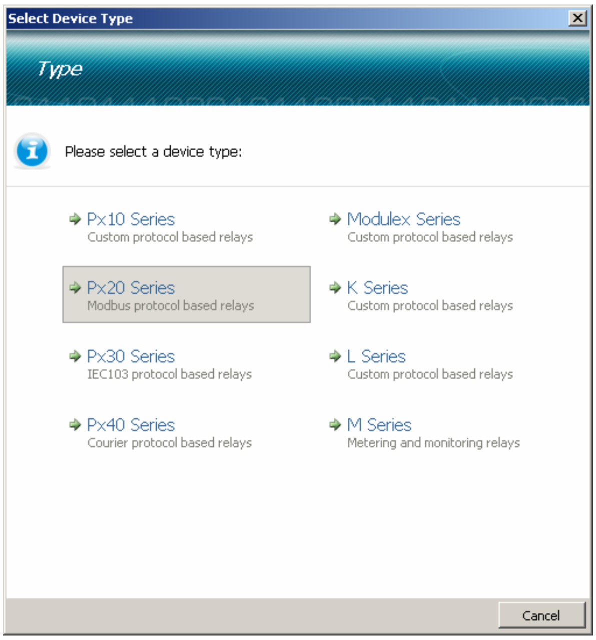
Click on the "Quick Connect" button at the top left of the application:

Create a new system (see § 3.5.3) or open an existing one:

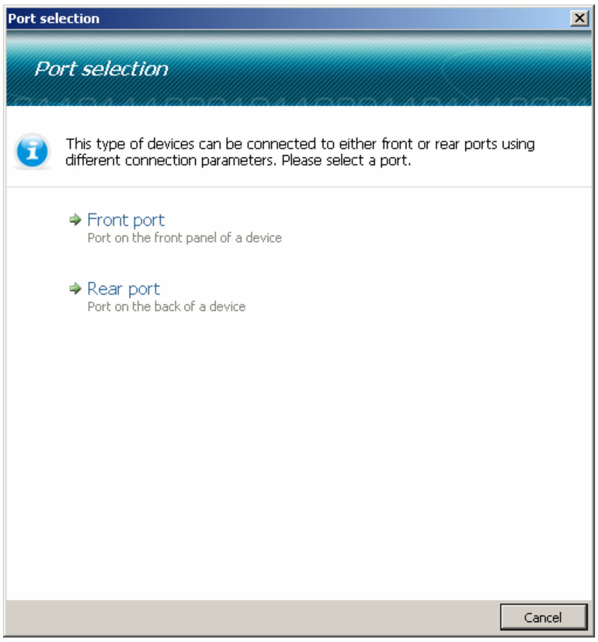


When a system is opened (or created), the following “device type” window is displayed.

Select “Px20 Series” from the presented options:



Select a port from the presented options:



Upon a successful connection, a dialog will be displayed showing device type, model number and plant reference. Options for language, device name and comment are also available.

The device is displayed in the Studio Explorer panel.

3.5.3 Create a system

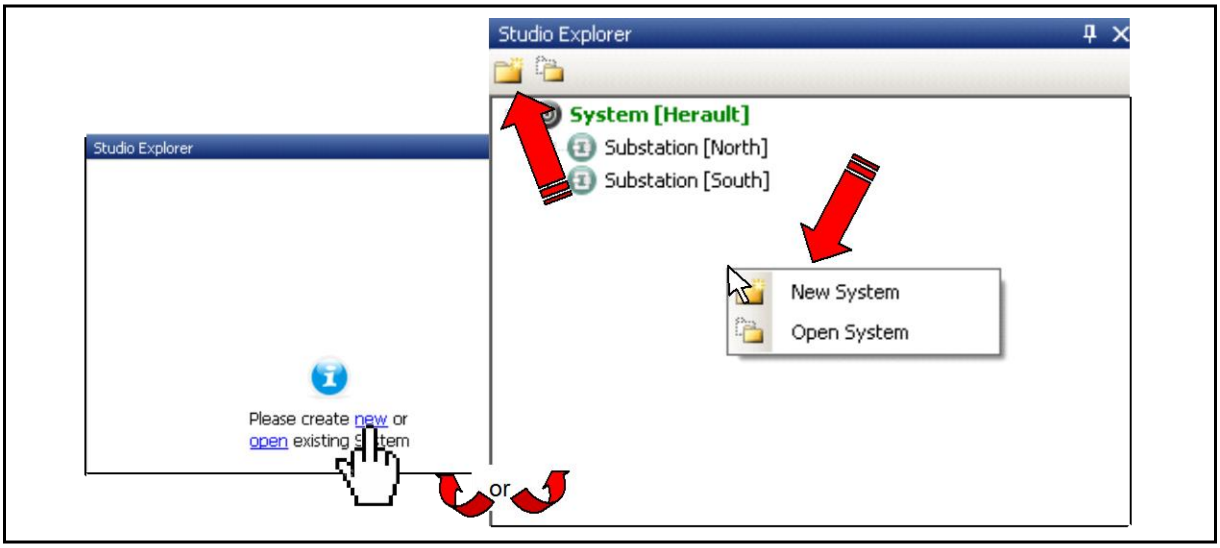
In MiCOM S1 Studio, a System provides a root node in the Studio Explorer from which all subsequent nodes are created.

Substations, bays, voltage levels and devices are added to the system. If a system is no longer needed, It can be deleted using the delete command.

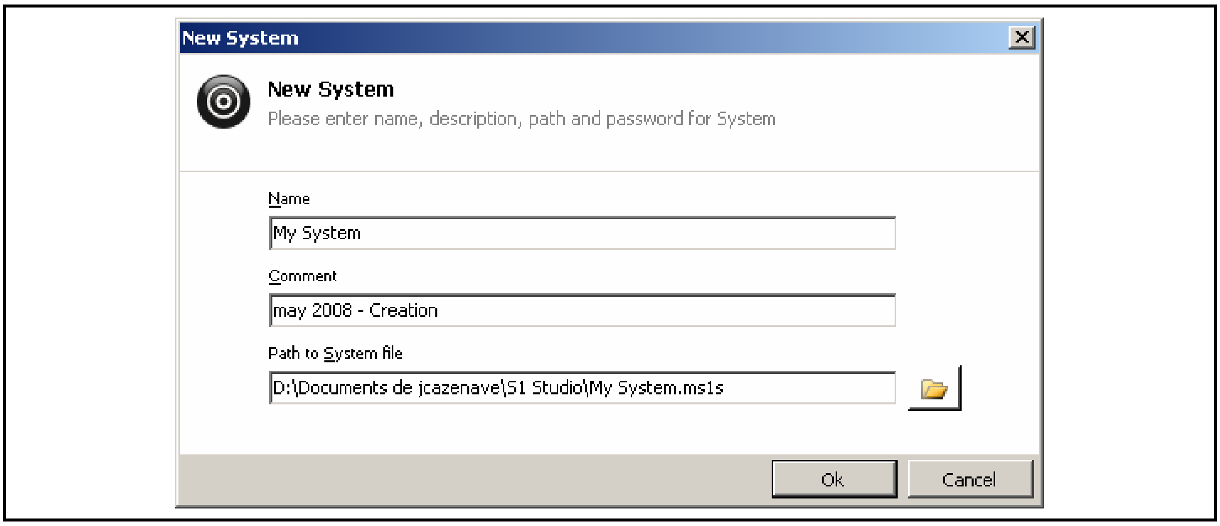
The use of Quick Connect will automatically create a default system, if one does not already exist. Systems are not opened automatically, unless “Reopen last System at start-up” is selected in “Options / Preferences…” menu.

To create a new system:

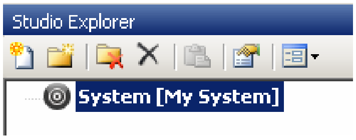
- By default, the window displays the message “create new or open existing system”: click on “new” to create a new system.
- If a system is loaded in the “Studio Explorer” window, right-click on the panel background and select New System or select the corresponding icon on Studio Explorer's toolbar.



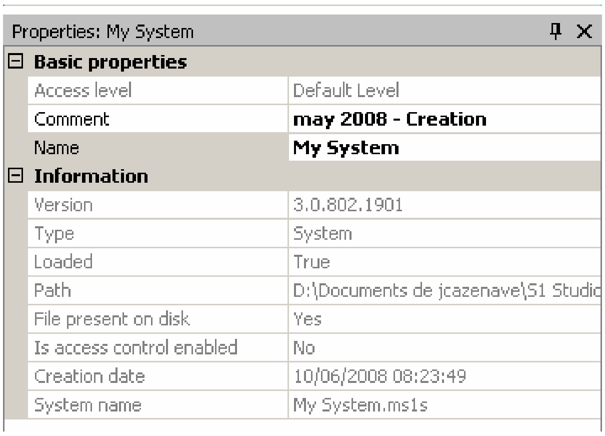
The following window is displayed: Enter the name of the system, and the path to save the system file.



The new System is displayed in the Studio Explorer panel:



NOTE: In the Studio Explorer panel, if an item is selected, its properties are displayed in the “Properties” panel

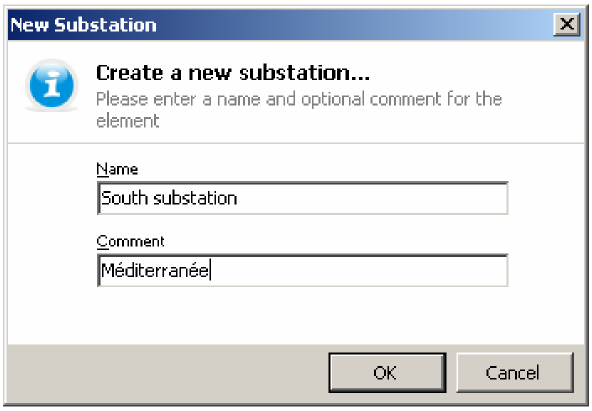


3.5.4 Create a new substation

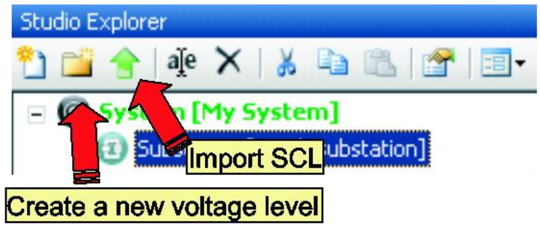
Select the system: the menu bar is updated with “new device”, “new substation”, “close”, “delete”, “paste”, “properties” and “options” icons.

P0901ENa

Click on “new substation” icon (or select the menu using right-click). The following window is displayed:



The new substation is displayed and the menu bar is updated when a substation is selected:



P0902ENa

Click on "Import SCL" button to import a Substation Configuration File.

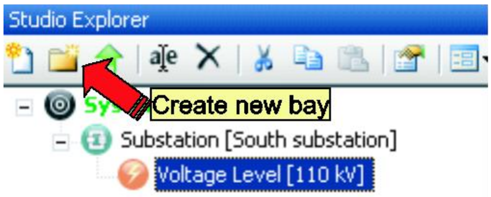
To create a substation configuration, click on "new voltage level" button.

3.5.5 Create a new voltage level

Select the substation and click on "new station level" button (or select the menu using right-click).

In the "Create a new voltage level", enter the voltage level of the station.

The "new voltage level" is displayed and the "new bay" icon is displayed.



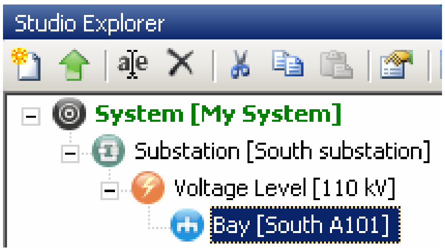
P0903ENa

3.5.6 Create a new bay

Select the substation and click on "new bay" button (or select the menu using right-click).

In the "Create new bay…" window, enter the bay indication,

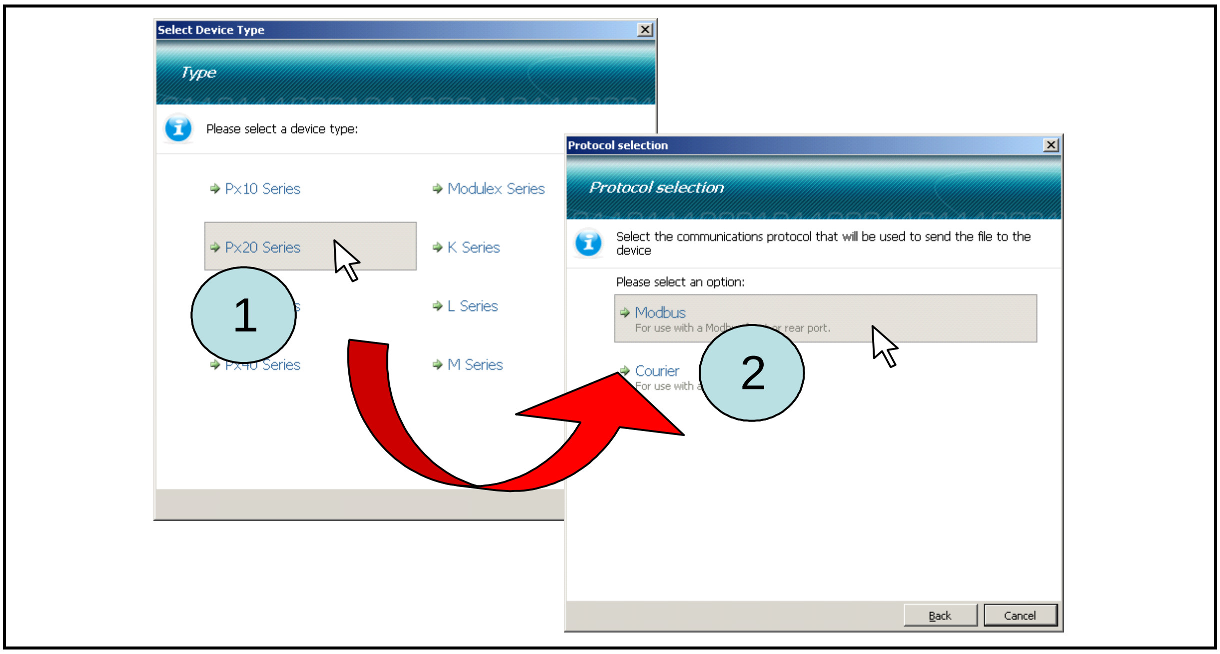
Th new bay is displayed.



3.5.7 Create a new device

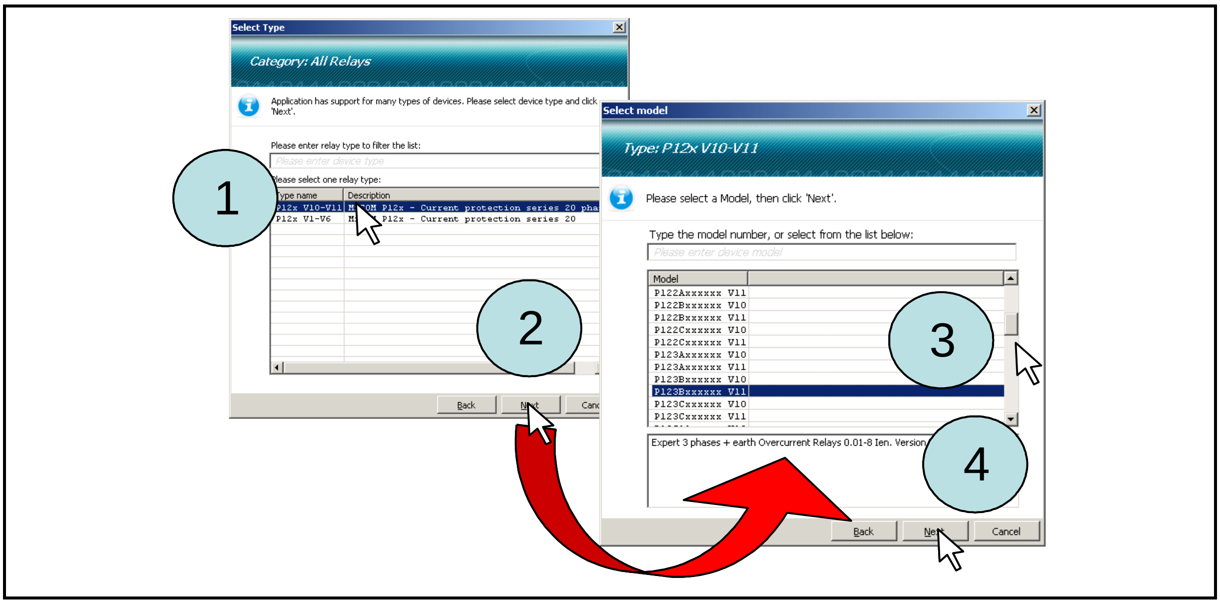
Click on “new device” button (or select the menu using right-click).

Select the device type and, if necessary, the communications protocol mode that will be used to send the file to the device.

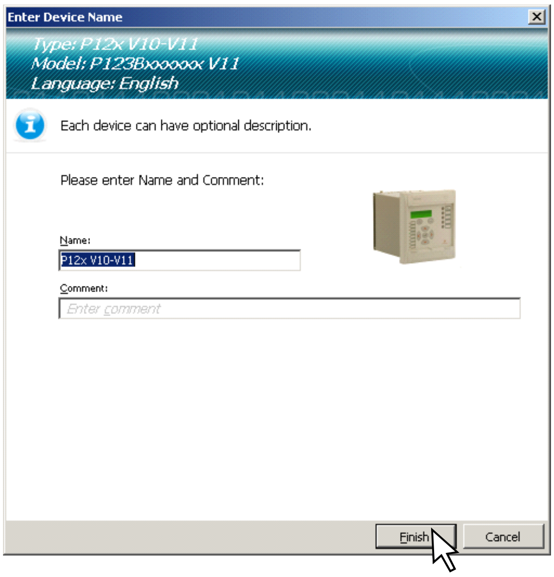


Select the device type, click “Next” button.

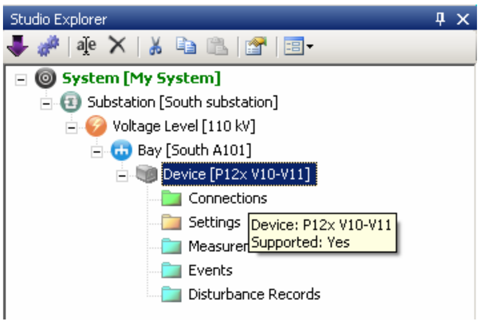
Select the model and click “Next” button.



Enter the name and add a description of the device:



The new device is created and displayed.

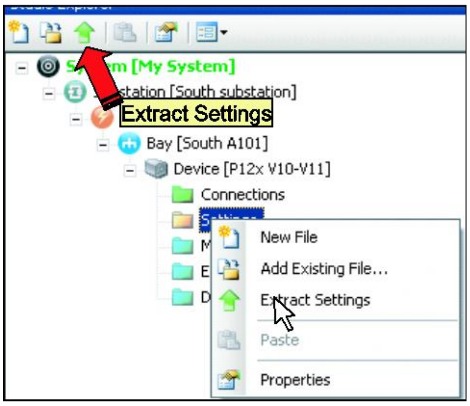


3.5.8 Open Settings File

To open an existing file:

– If the file is saved or if the relay is not connected: open the Settings folder and open the Settings file,

– If the relay is connected, extract the settings from the relay: click on the "Extract Settings" command or right click on the Settings folder.

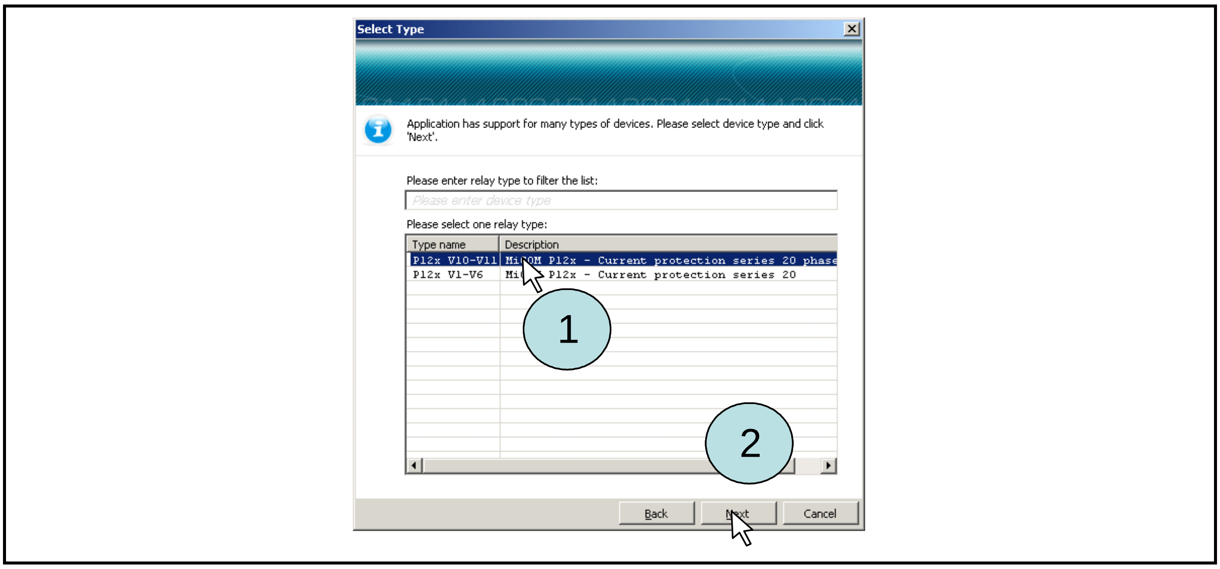


To open default settings:

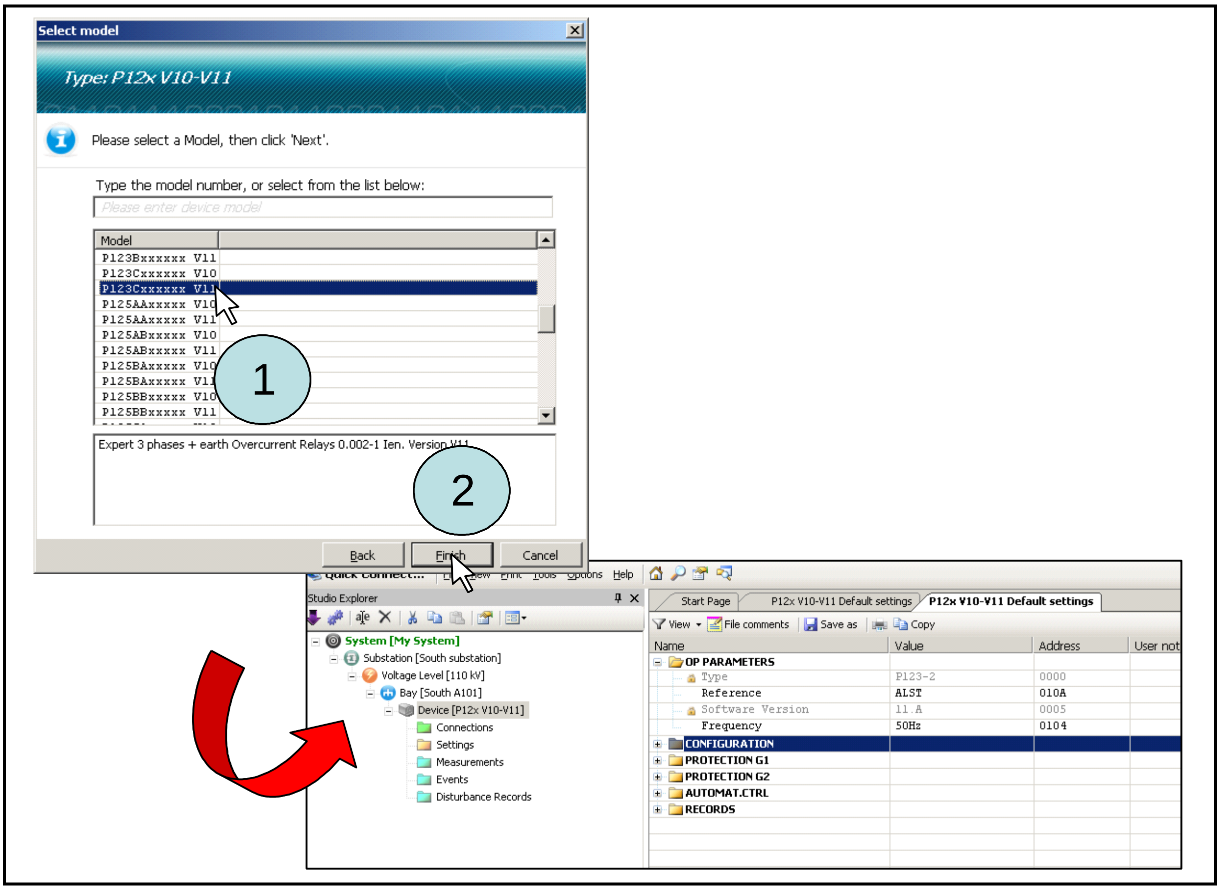
– Click on “Open Default Settings File” Option in the File menu.

– Select the device type then the communication protocol.

– Select the device type and click on the “Next” button:



– Select the Model and click on the “Finish” button. The default settings are displayed.

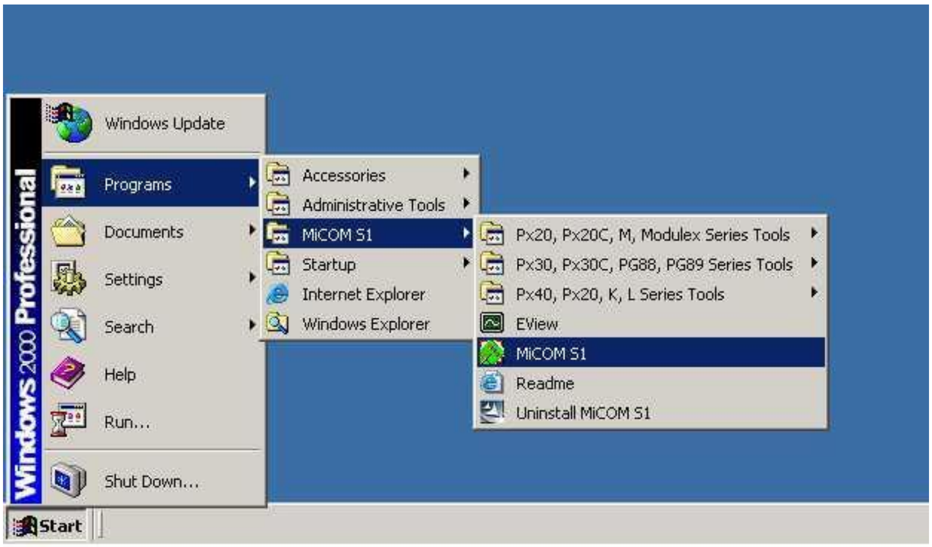


3.6 MiCOM S1

3.6.1 Starting MiCOM S1

To start MiCOM S1 Studio, click on the icon: 

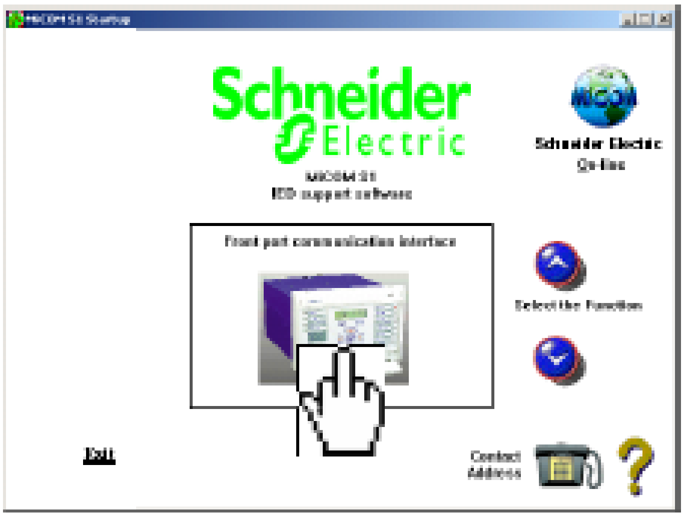
In the "Programs" menu, select "MiCOM S1" then "MiCOM S1".



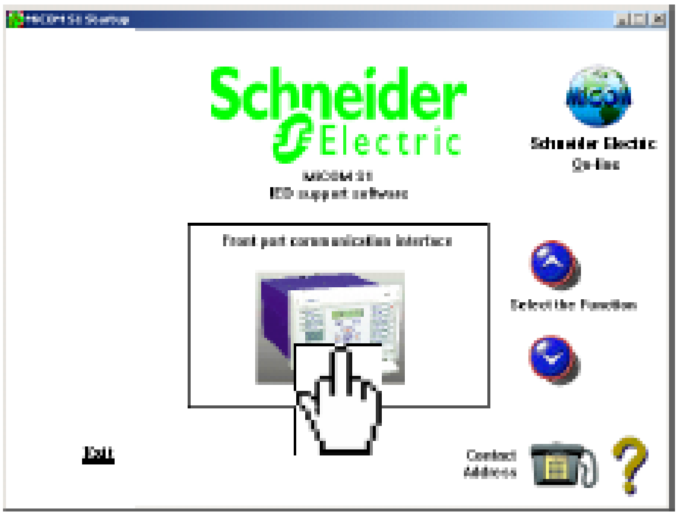
S0013ENb

WARNING: CLICKING ON "UNINSTALL MiCOM S1", WILL UNINSTALL MiCOM S1, AND ALL DATA AND RECORDS USED IN MiCOM S1.

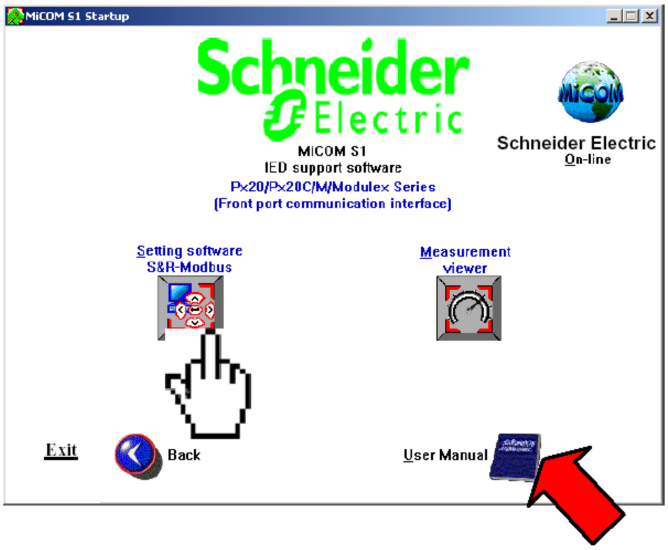
You access the MiCOM S1 launcher screen.



- Select the Px20 product: If necessary, click on the blue arrows ().



Select the Setup button: 

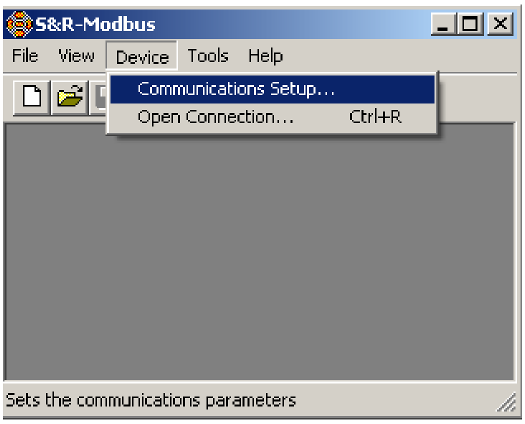


NOTE: Select the “User Manual” button to read “setting & records” and “Measurement Viewer” description and operating procedures.

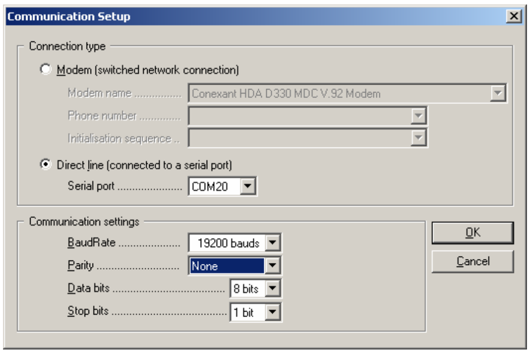
3.6.2 Open communication link with relay

To open the communications link from S1 to the relay, follow the following procedure.

First, if necessary, the communication setup must be adjusted. In the "Device" menu, select "Communications Setup…"

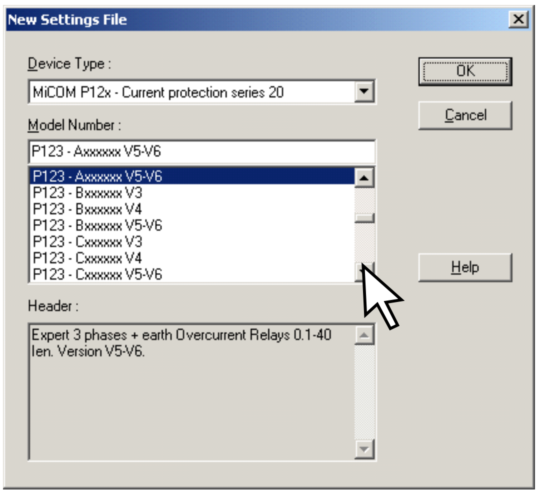


This brings up the following screen:

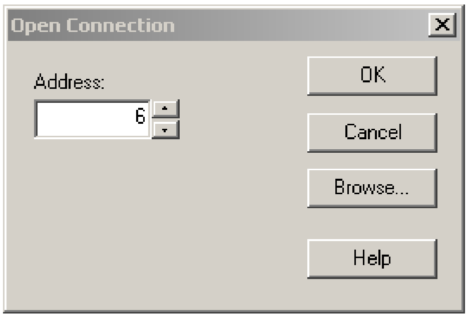


COMMUNICATION SET-UP SCREEN

When the communications setup is correct, the link with the relay can be initialized. In the "Device" menu, select "Open Connection…"

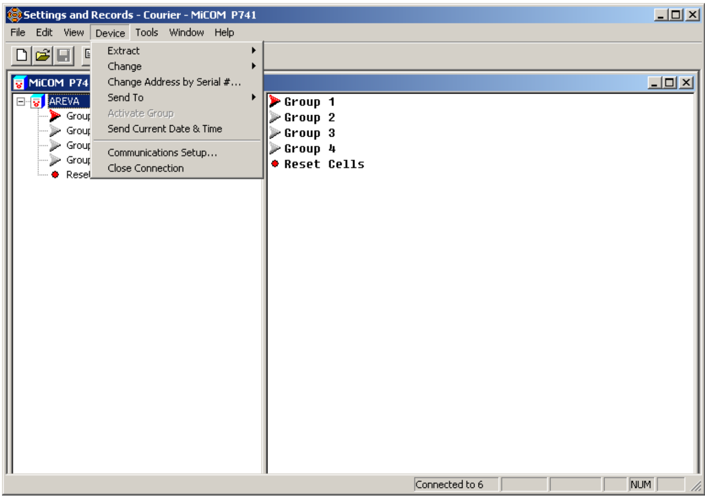


This brings up a prompt for the address of the relay to be interrogated.



When this has been entered, a prompt for the password appears.

When these have been entered satisfactorily the relay is then able to communicate with MiCOM S1. When a communication link has been established between the PC and a MiCOM IED, both are said to be online. Data and information can be directly transferred from and to the IED using the menu available under the “DEVICE” menu.

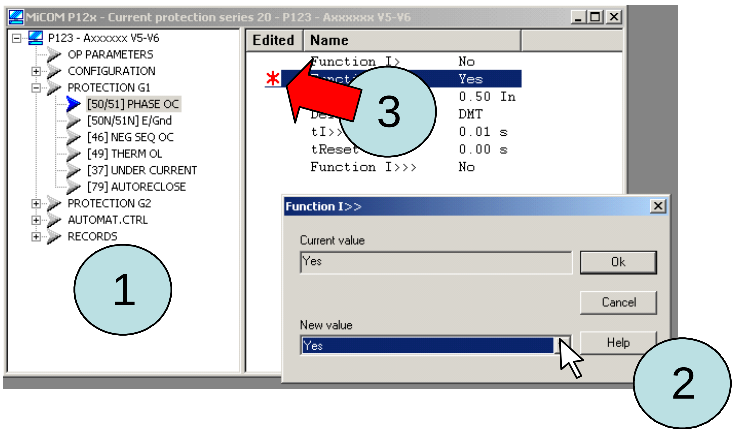


For further instruction on how to extract, download and modify settings files, please refer to the MiCOM S1 User Manual.

Select the main function in the right hand window.

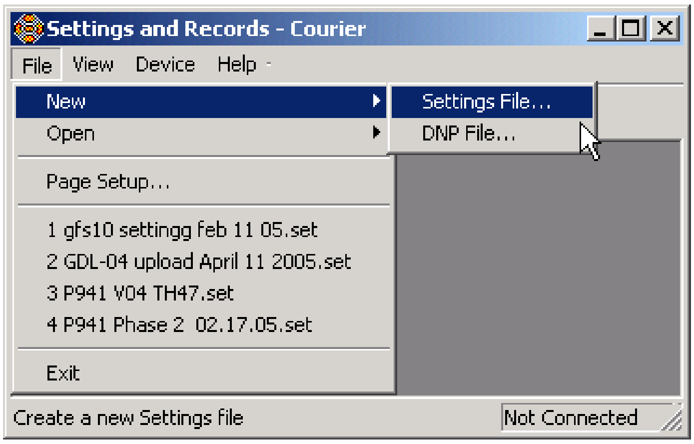
To modify a setting value, double click the corresponding line in the left hand window. It opens a setting window.

A red star (∗) indicates that a setting value is modified.

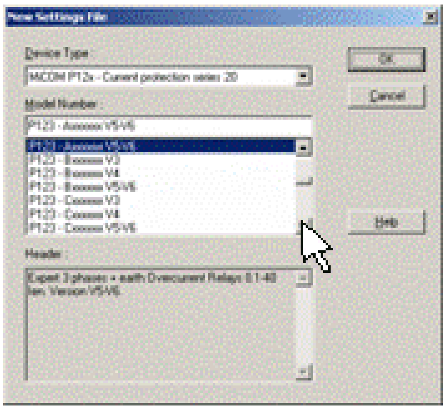


3.6.3 Off-line use of MiCOM S1

As well as being used for the on-line editing of settings, MiCOM S1 can also be used as an off-line tool to prepare settings without access to the relay. In order to open a default setting file for modification, in the “File” menu, select “New” and then “Settings File…”



This brings up a prompt for the relay model type where you can select the correct relay for your application:

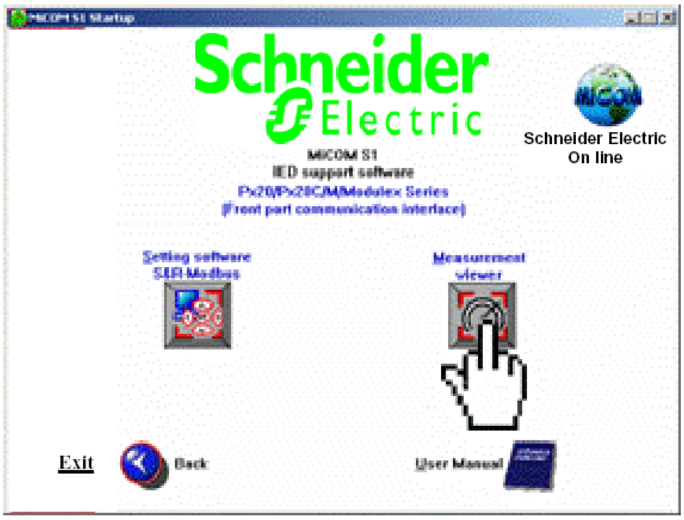


Clicking on “OK” will open the default file and you can start to edit settings. For further instruction on how to extract, download and modify settings files, please refer to the MiCOM S1 User Manual.

3.6.4 MiCOM monitoring

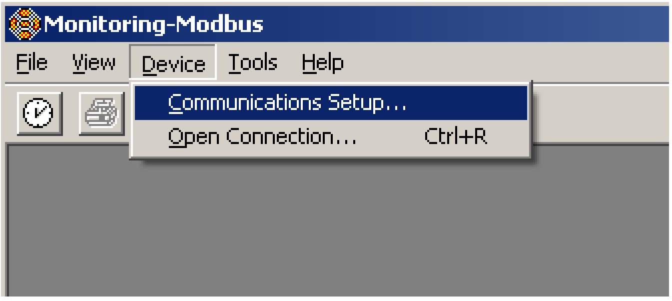
The monitoring module enables to connect to the front port, retrieve and monitor its measurements.

Click on the monitoring button: .



The monitoring module is displayed.

Use the "Device" menu to configure the communication:



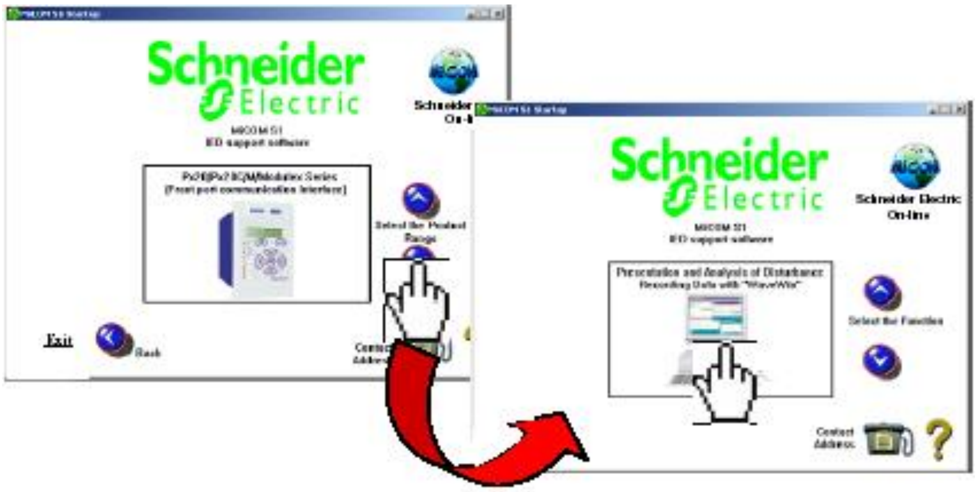
The "Communications setup…" menu enables to select or to setup the communication settings. The "Open Connection…" menu enables the PC to retrieve data from the online device.

3.7 Presentation and analysis of disturbance

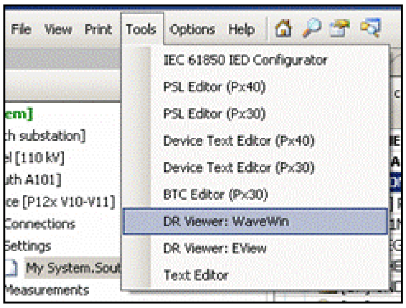
The reading and analisys of disturbance is performed using Wavewin.

To open Wavewin with MiCOM S1:

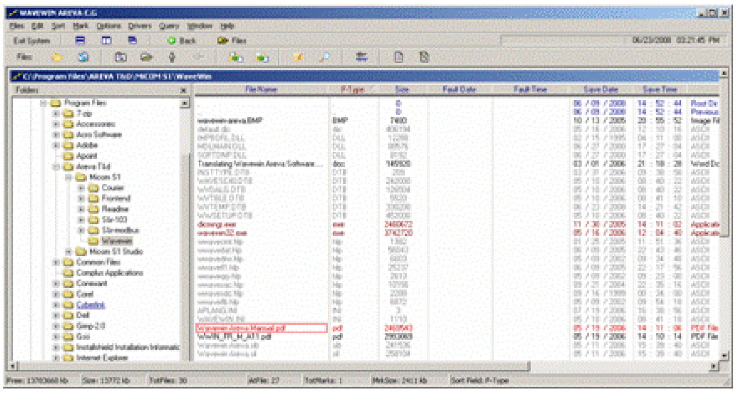
- In the main page, select the function using the blue arrows ( ),
- Click on the “presentation and Analysis of Disturbance Recording Data with “Wavewin” window.



Using MiCOM S1 Studio, open Wavewin using “Tools” menu.

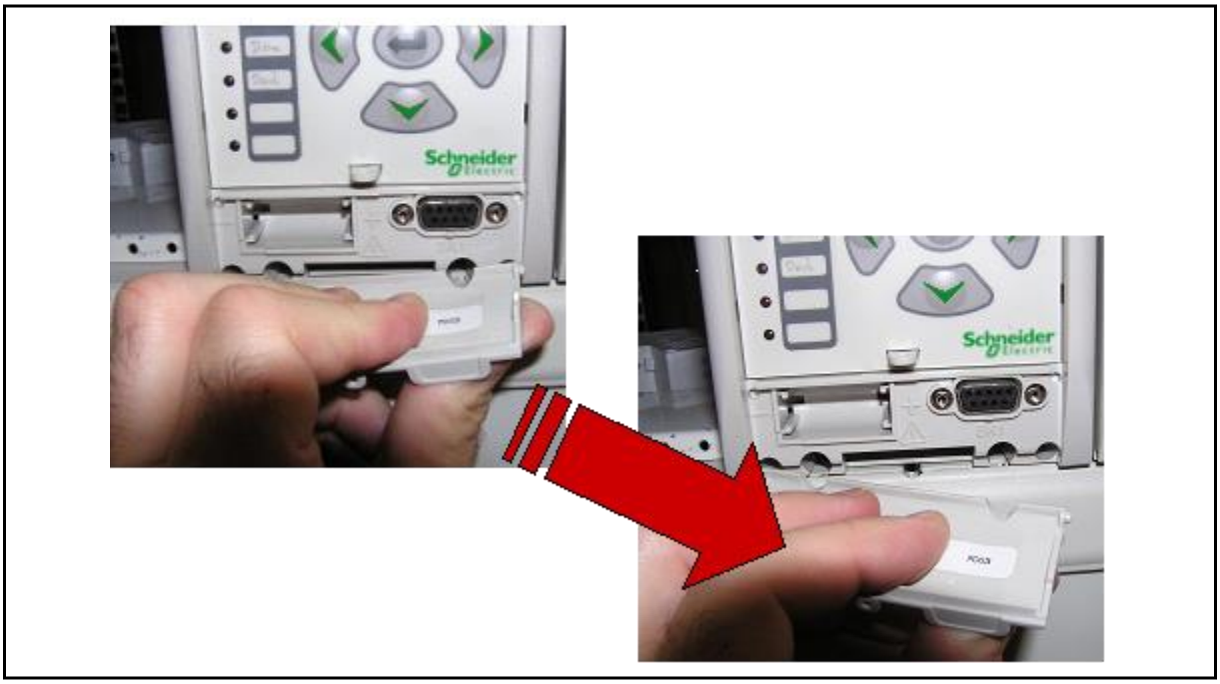


The Wavewin File Manager is displayed (refer to the Wavewin User’s guide to operate Wavewin).

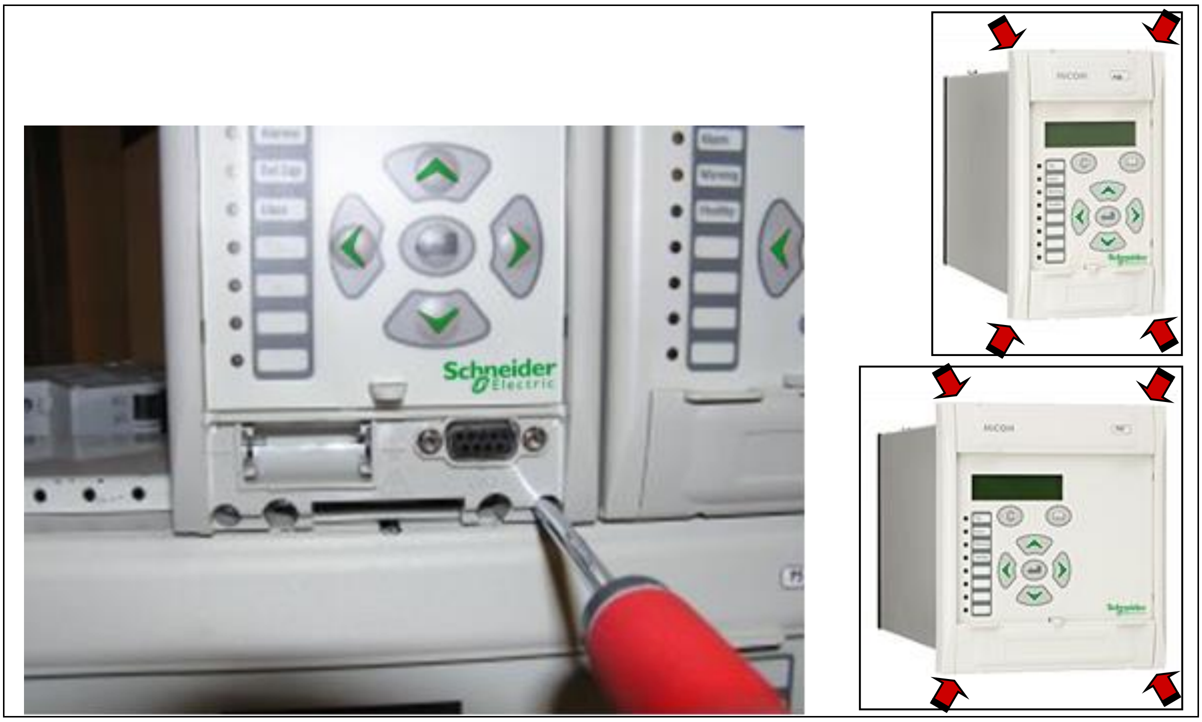


4. WITHDRAWING MODULE FROM CASE

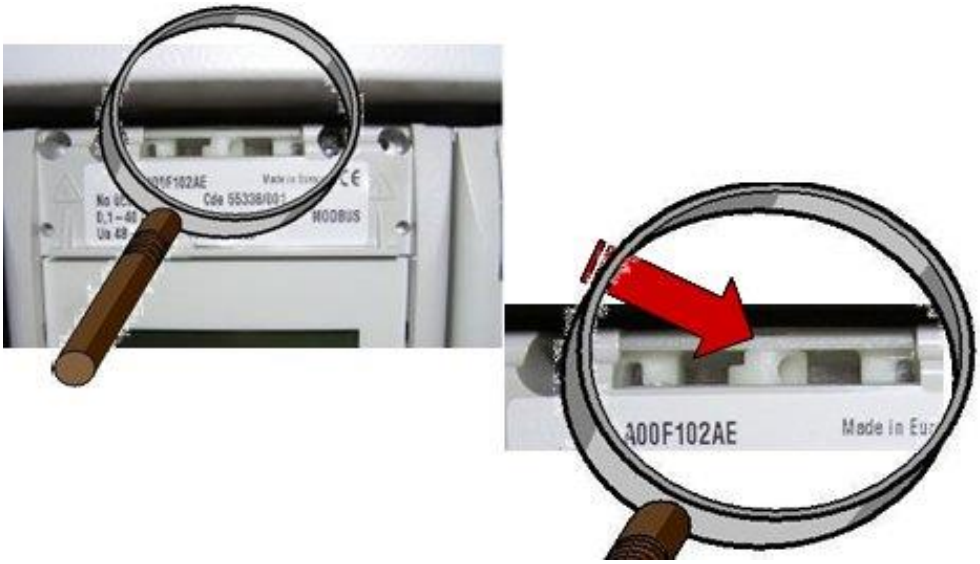
Remove the top and bottom hinged covers:



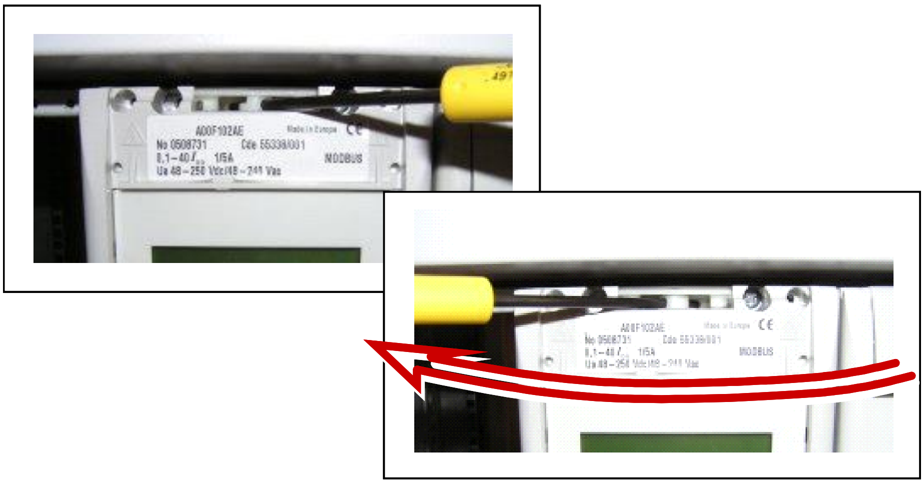
Depose the four retaining screws in the top and the bottom side of the relay. These screws retain the relay to the case.



Insert a 3mm screwdriver into the hole situated under the upper hinged cover above the LCD:



Turn the lock pin 90° to the left:



Insert the screwdriver into the second hole under the lower hinged cover, and the lower lock pin is turned 90° to the right.

By this turning action, push slightly forward the module and extract it by pulling on both sides of the front panel.

5. COMPANY CONTACT INFORMATION

If you need information pertaining to the operation of this MiCOM product that you have purchased, please contact your local Schneider Electric agent or the Customer Care Center (www.schneider-electric.com/ccc). Do not forget to give the serial number and reference of the MiCOM product.

The MiCOM product reference and serial numbers are documented under the upper hinged cover on the front of the relay. For more precise information, refer to the section "Relay Identification" in this chapter.

PLEASE GIVE THE FOLLOWING DATA WHEN MAKING A CALL TO Schneider Electric:

– CORTEC code of the MiCOM relay

– Serial number of the MiCOM relay

– Order reference

– Operator reference

APPLICATION GUIDE

CONTENT

1. INTRODUCTION

1.1 Protection of Underground and Overhead Lines

The secure and reliable transmission and distribution of power within a network is heavily dependent upon the integrity of underground cables and overhead lines, which link the various sections of the network together. Therefore the associated protection system must also provide both secure and reliable operation.

The most common fault conditions, on underground cables and overhead lines, are short circuit faults. These faults may occur between the phase conductors but will most often involve one or more phase conductor becoming short-circuited to earth.

Faults caused by short circuits require the fastest faulted conductor clearance times but at the same time allowing for suitable co-ordination with other downstream protection devices.

Fault sensitivity is an issue common to all voltage levels. For transmission systems, tower-footing resistance can be high. Also, high resistance faults might be prevalent where lines pass over sandy or rocky terrain. Fast, discriminative faulted conductor clearance is required for these fault conditions.

The effect of fault resistance is more pronounced on lower voltage systems, resulting in potentially lower fault currents, which in turn increases the difficulty in the detection of high resistance faults. In addition, many distribution systems use earthing arrangements designed to limit the passage of earth fault current.

Earthed methods as such as using resistance, Petersen coil or insulated systems make the detection of earth faults arduous. Special protection equipment is often used to overcome these problems.

Nowadays, the supply continuity in the energy distribution is of paramount importance.

On overhead lines most of faults are transient or semi-permanent in nature.

In order to increase system availability multi-shot autoreclose cycles are commonly used in conjunction with instantaneous tripping elements. For permanent faults it is essential that only the faulted section of the network is isolated. High-speed, discriminative fault clearance is therefore a fundamental requirement of any protection scheme on a distribution network.

Power transformers are installed at all system voltage levels and have their own specific requirements with regard to protection. In order to limit the damage incurred by a transformer under fault conditions, fast clearance of the windings with phase to phase and phase to earth faults is a primary requirement.

Damage to electrical plant equipment such as transformers, cables and lines may also be incurred by excessive loading conditions, which leads directly to overheating of the equipment and subsequent degradation of their insulation. To protect against such fault conditions, protective devices require thermal characteristics too.

Uncleared faults, arising either from the failure of the associated protection system or of the switchgear itself, must also be considered. The protection devices concerned should be fitted with logic to deal with breaker failure and relays located upstream must be able to provide adequate back-up protection for such fault conditions.

Other situations may arise on overhead lines, such as broken phase conductors. Traditionally, a series fault has been difficult to detect.

With today's digital technology, it is now possible to design elements, which are responsive to such unbalanced system, conditions and to subsequently issue alarm and trip signals.

On large networks, time co-ordination of the overcurrent and earth fault protection relays can often lead to problematic grading situations or, as is often the case, excessive fault clearance times. Such problems can be overcome by relays operating in blocked overcurrent schemes.

2. CURRENT PROTECTIONS & AUTOMATION FUNCTIONS

2.1 [67/50/51] Directional/non Directional Three Phase Overcurrent Protection (P127)

The directional/non directional overcurrent protection has three thresholds.

Each threshold can operate in directional or non-directional mode; if the setting is [Yes] it operates like a typical three-phase overcurrent protection.

With the setting [DIR] the relay operates like a three-phase directional overcurrent protection (only for the P127 relay), when the setting is [NO] it can not operate.

The third threshold can be set to operate on the peak of the measured phase current.

It compares the biggest peak value of the measured current against the setting.

The peak detection is applied where a CT saturation condition occurs and the measure is not more trustworthy.

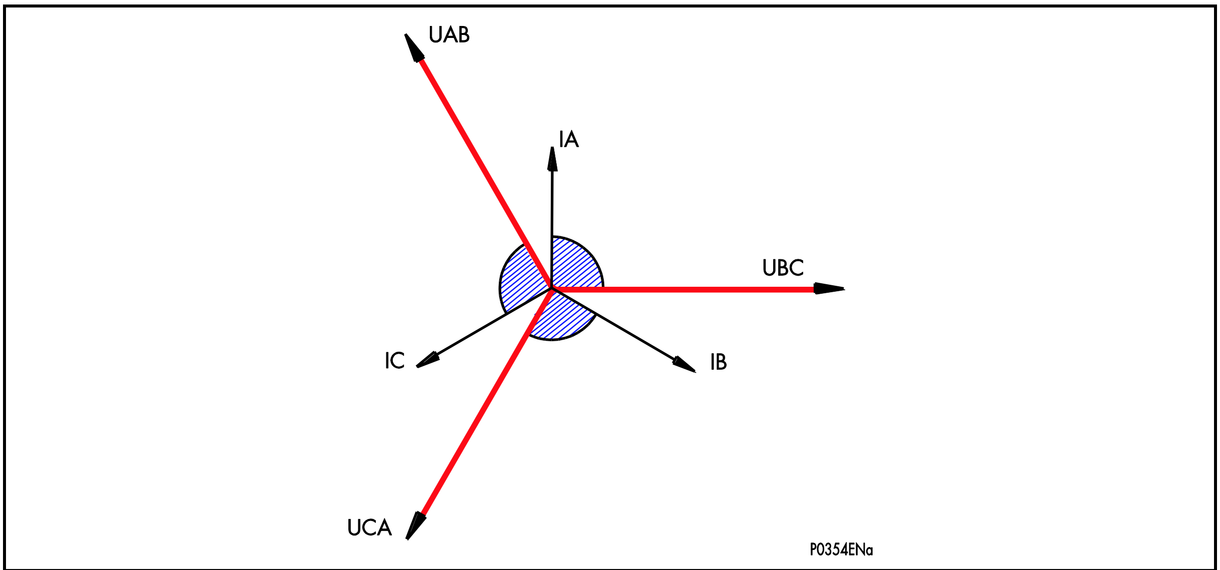
2.2 [67] Directional Overcurrent protection

2.2.1 Description

If a fault current can flow in both directions through a relay location, it is necessary to add directionality to the overcurrent relays in order to obtain correct co-ordination. Typical systems that require such protection are parallel feeders (both plain and transformer) and ring main systems, each of which are relatively common in distribution networks.

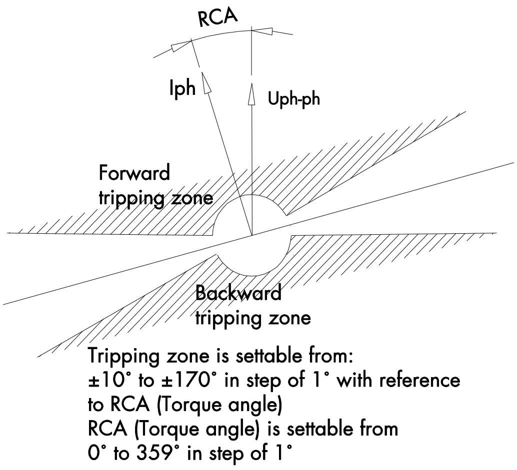
In order to give directionality to an overcurrent relay, it is necessary to provide it with a suitable reference, or polarising signal. The reference generally used is the system voltage, as its angle remains relatively constant under fault conditions. The phase fault elements of the directional relay are internally polarised by the quadrature phase-phase voltages, as listed in the table below:

Protected Phase	Operating Current	Polarising Voltage
A Phase	IA	VBC
B Phase	IB	VCA
C Phase	IC	VAB



Under system fault conditions, the fault current vector will generally lag its nominal phase voltage by an angle dependent on the system X/R ratio.

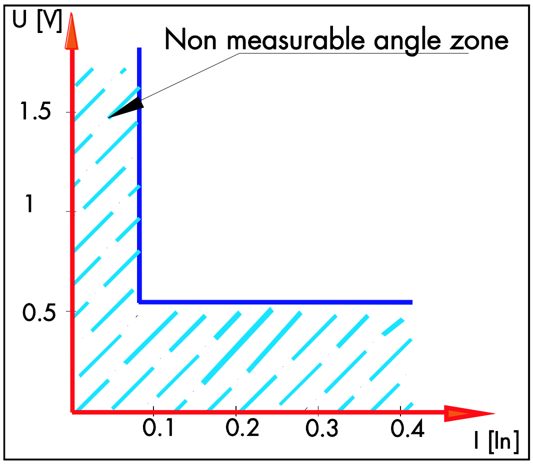
It is important that the relay operates with maximum sensitivity for currents lying in this region.



P0079ENa

This is achieved by means of the relay characteristic angle (RCA) setting (also referred to as torque angle). RCA defines the angle by which the current applied to the relay must be displaced from the voltage applied to the relay to obtain maximum relay sensitivity.

A programmable tripping zone with reference to relay characteristic angle (RCA) or torque angle is available.



P0080ENa

The calculation of the angle between phase voltage and phase current depends on the values for voltage and current.

The close figure shows the calculation zone.

Each directional threshold consists of:

– Current threshold

– RCA angle /Torque angle and Trip boundary zone

The system voltage provides the polarisation signal, the minimum voltage operating value is 0.6V secondary for the voltage input range 57-130V and 3V for the voltage input range 220-480V.

The first and second thresholds can be set as definite delay time or inverse delay time using the IEC, IEEE/ANSI, CO, RI and RECT curves where their parameters are shown in the Technical Data of this Technical Guide.

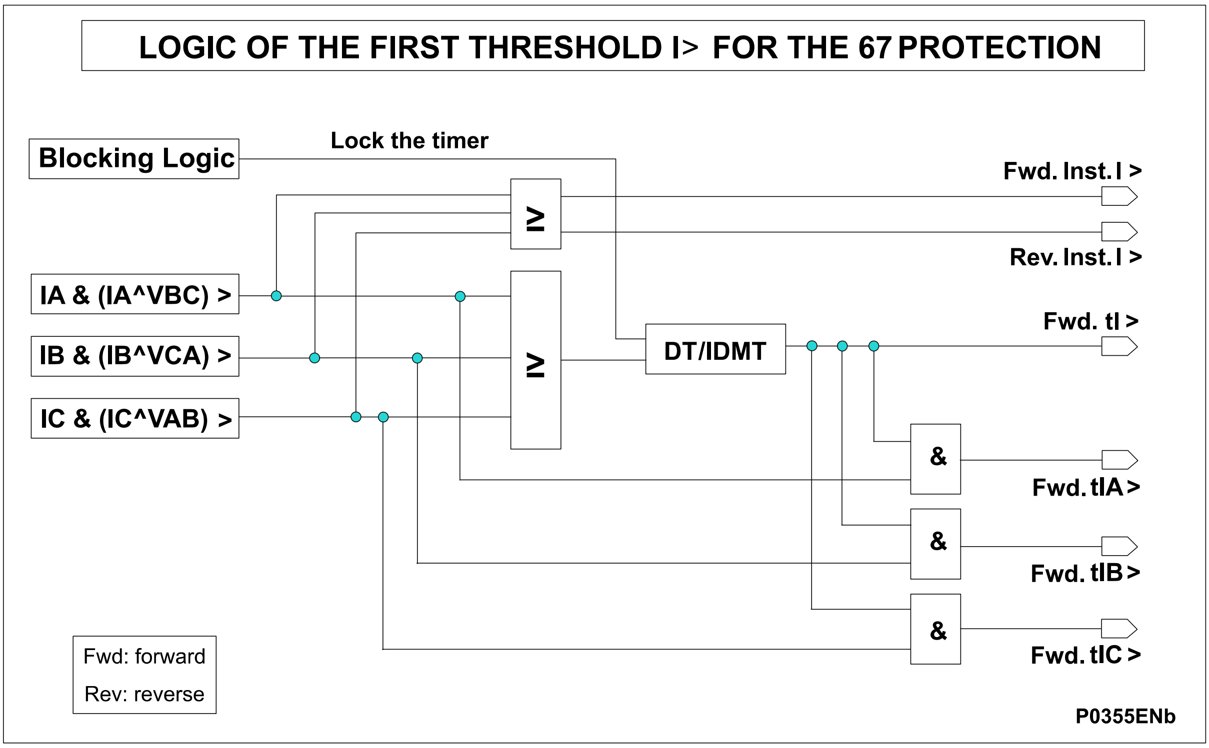
The third threshold can be set as definite delay time only, but can be set to work on the peak of the current measured in non-directional way.

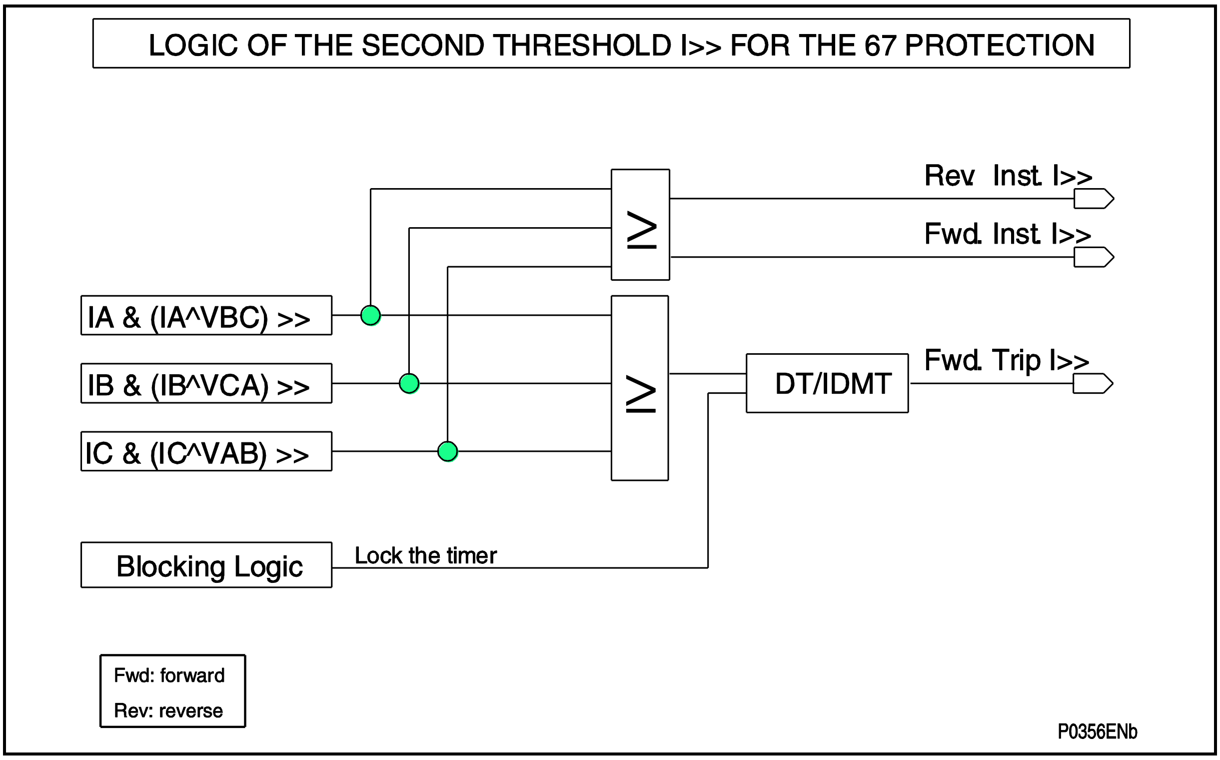
The protection elements trip when the following conditions occur:

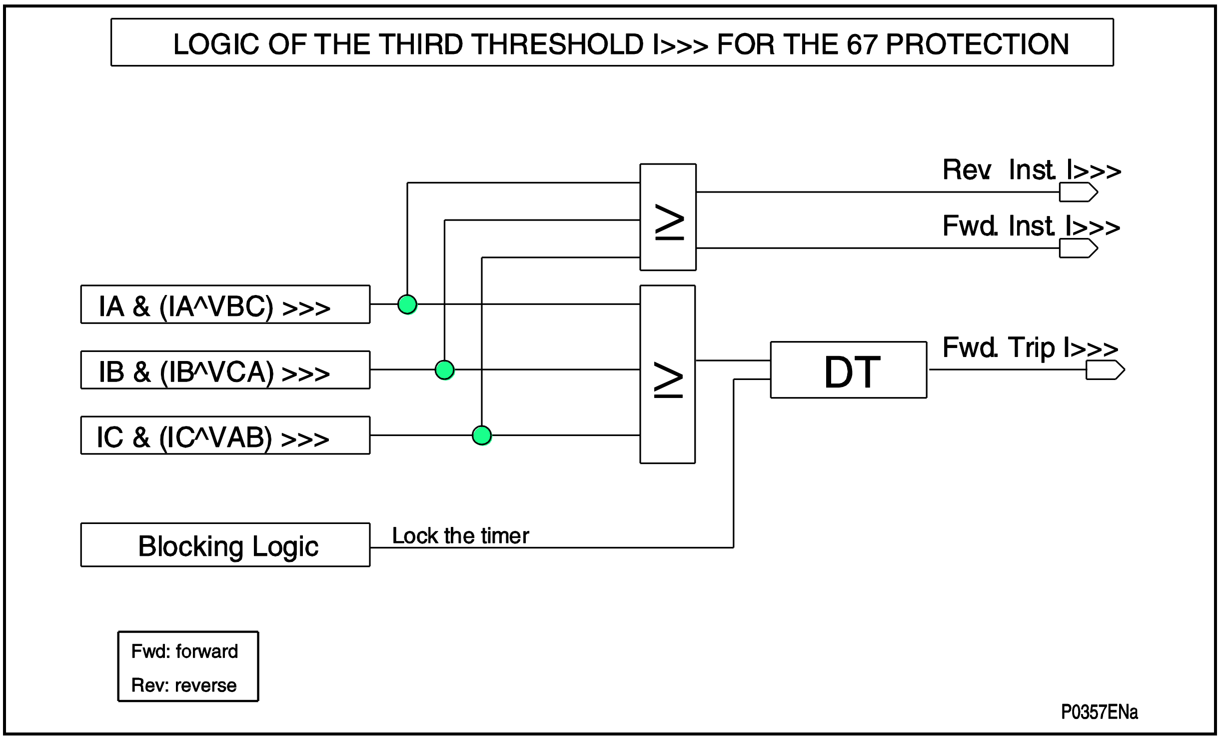
– The phase current exceeds the set overcurrent threshold.

– The current vector lies within the trip boundary zone.

The following diagrams show the functionality for each threshold







The following figures show the windows where the first phase trip forward and instantaneous reverse trip can be assigned to an output relay. The same one is for the 2nd and 3rd stages.

tI>	**8765432** **0000100**	Assigning the first phase delayed forward directional overcurrent threshold (tI>) to output 4 (RL4). Setting choice: 1 is assigning an output relay; 0 no assignment.
I_R>	**8765432** **0100010**	Assigning the first phase instantaneous reverse directional overcurrent (I_R>) to output 3 & 7 (RL3 & RL7). Setting choice: 1 is assigning an output relay; 0 no assignment.

2.2.2 Synchronous Polarisation

The directional overcurrent elements are polarised by the line voltage (phase to phase) in quadrature to the considered phase current.

The absolute phase angle of line voltages is measured every cycle and the last value is stored in the relay memory.

When with close-up three phase faults the polarisation voltage is collapsed, the synchronous polarisation is switched on.

The polarisation discrimination voltage value is 0.6V (fixed value) for relays with a system voltage of 57 to 130V and 3V (fixed value) for relays with a system voltage of 220 to 480V.

Over this value the directional relay uses standard polarisation (the measured voltage), under this value the synchronous polarisation (stored vector) is used. The synchronous polarisation is maintained up to the restoration of an input voltage value.

If the input voltage loss continues longer than 5s the directional overcurrent protection is blocked.

2.2.3 I>…I>>…I>>> Interlock

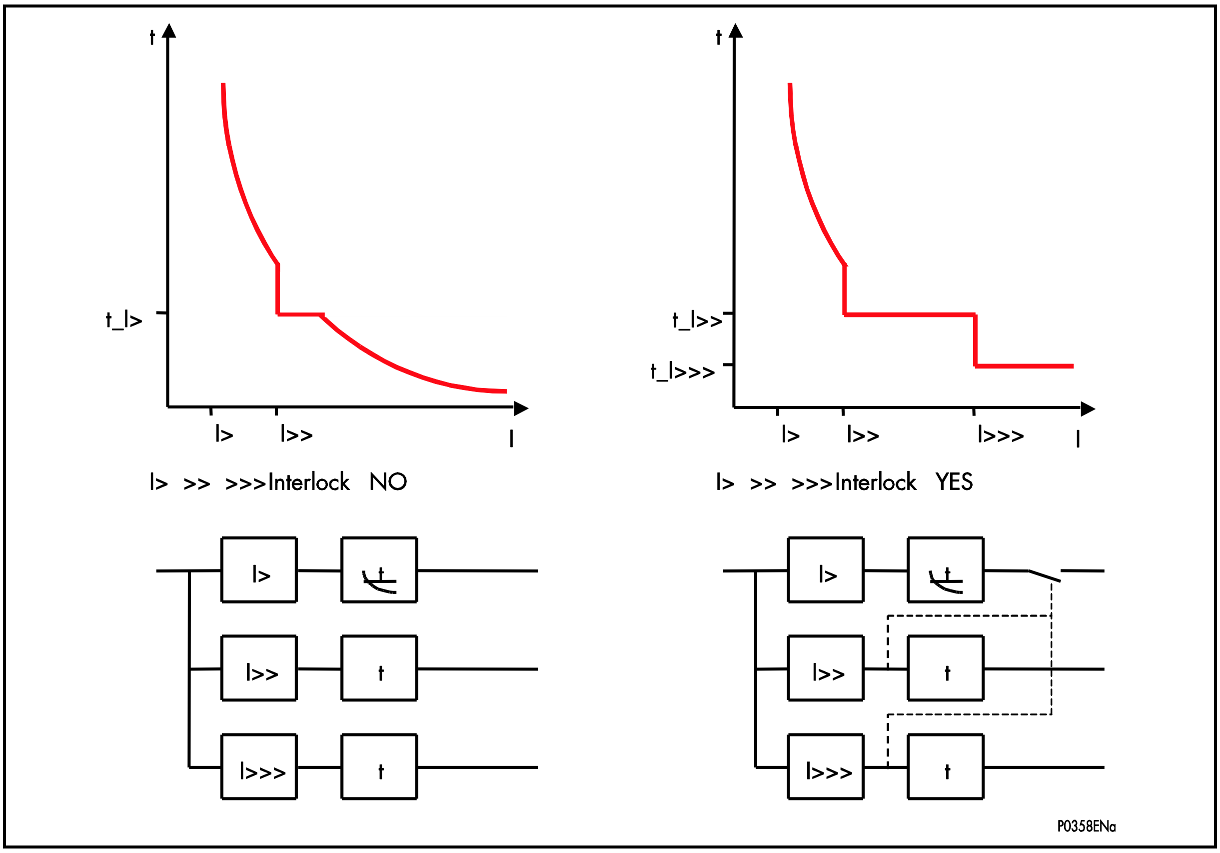
The choice of this functionality is available when the IDMT delay trip time is chosen on the first threshold.

The following figures show the window where the functionality can be or not to be assigned

I> >> >>> Interlock Yes	Interlock of first threshold by the second and third thresholds, but only if first threshold trip is set to IDMT. Setting choice: No, Yes

The 2nd and 3rd threshold pickup can suspend 1st threshold output control to save selectivity

Below it is shown the trend of the delay trip time of the first threshold in the both cases Yes or No.



2.2.4 Setting Guidelines

The applied current settings for directional overcurrent relays depend on the specific application. In a parallel feeder arrangement, load current is always flowing in the non-operating direction. Consequently the relay current setting may be less than the full load rating of the circuit, typically 50% of In.

Note that the minimum setting that may be applied has to take into account the thermal rating of the relay. Some electro-mechanical directional overcurrent relays have continuous withstand ratings of only twice the applied current setting. Therefore 50% of rating was the minimum setting that had to be applied.

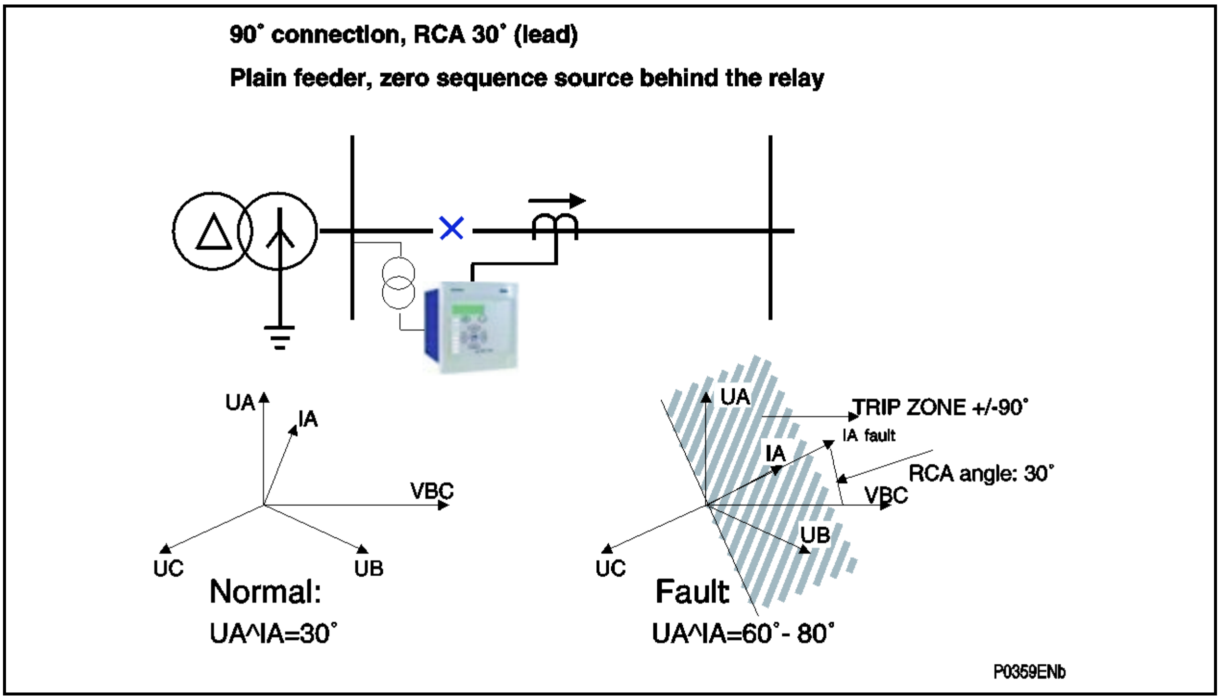
With the latest generation relays the continuous current rating is 4 x rated current. If required it is now possible to apply much more sensitive settings.

In a ring main arrangement, it is possible for load current to flow in either direction through the point where the relay is located. Consequently the current setting must be above the maximum load current, as in a standard non-directional application.

The required relay characteristic angle (RCA) settings for directional relays will depend on the exact application in which they are used.

For instance for plain feeders where the zero sequence source is behind the relay, a RCA of 30° should be set.

The following picture shows the above examples.

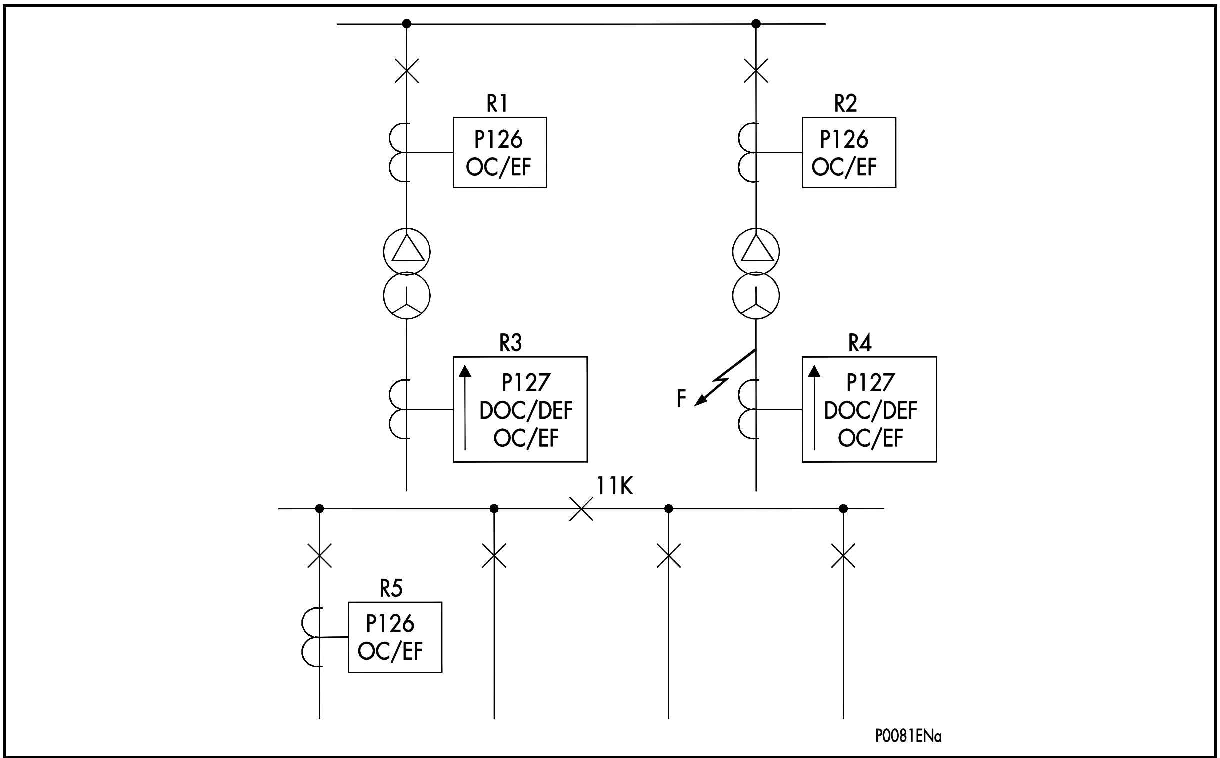


On the P127 relay, it is possible to set the relay characteristic angle (RCA) or torque angle, as it is also called, in the range of 0° to +359° in steps of 1°. The trip boundary zone associated to the RCA is settable in the range from ±10° to ±170° in steps of 1°.

Further information about the setting range for the directional overcurrent protection are available in the Technical Data document.

2.2.5 Directional three phase overcurrent applications

2.2.5.1 Parallel Feeders



TYPICAL DISTRIBUTION SYSTEM USING PARALLEL TRANSFORMERS

The above figure shows a typical distribution system using parallel power transformers.

In such an application, a fault at ‘F’ could result in the tripping of both relays R3 and R4, and the subsequent loss of supply to the 11kV busbar.

Consequently with this system configuration, it is necessary to apply directional relays at these locations set to 'look into' their respective upstream transformers.

These relays should co-ordinate with the relays R1 and R2, so that discriminative relay operation during such fault conditions is ensured.

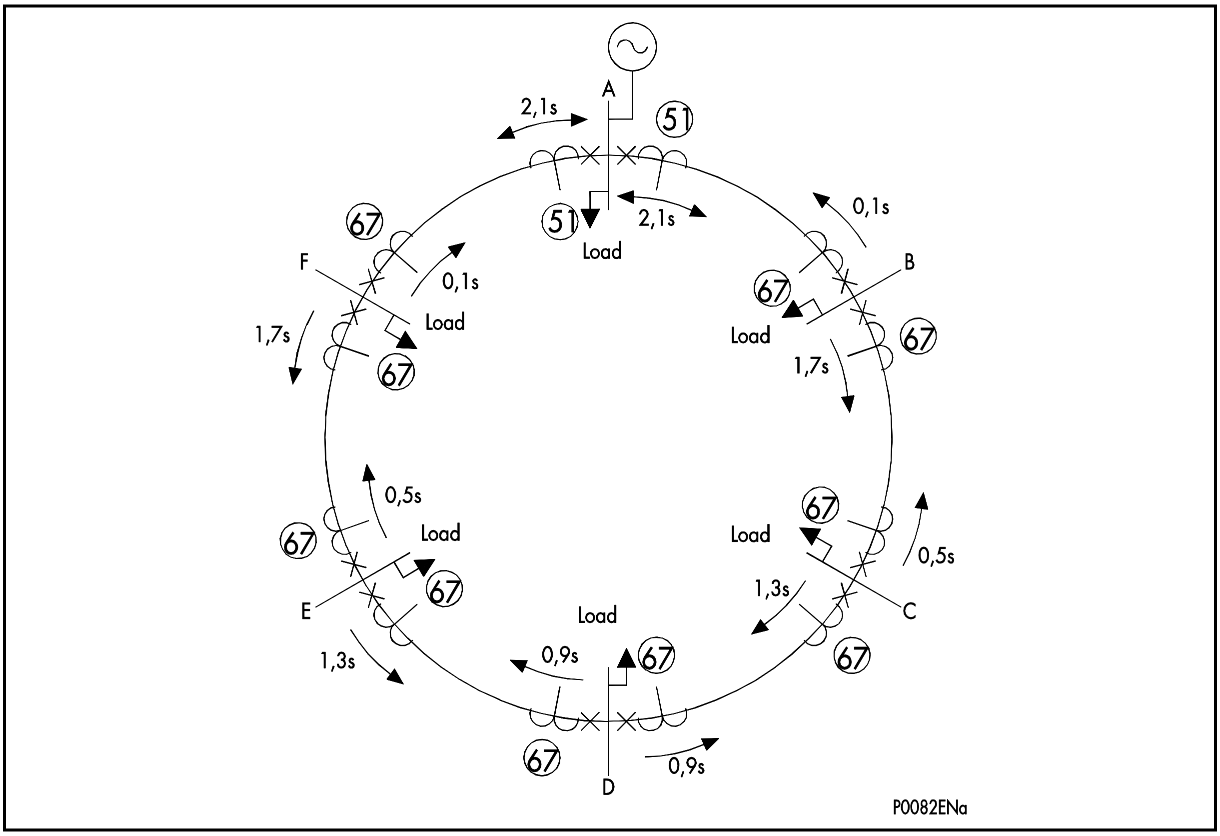
In such an application, relays R3 and R4 may commonly require non-directional overcurrent protection elements to provide protection to the 11kV busbar, in addition to providing a back-up function to the overcurrent relays on the outgoing feeders (R5).

Note that the above requirements outlined for parallel transformer arrangements are equally applicable for plain feeders, which are operating in parallel.

2.2.5.2 Ring Main Arrangement

A particularly common arrangement within distribution networks is the ring main circuit. The primary reason for its use is to maintain supplies to consumers in the event of fault conditions occurring on the interconnecting feeders.

A typical ring main with associated overcurrent protection is shown in the following figure.



TYPICAL RING MAIN WITH ASSOCIATED OVERCURRENT PROTECTION

As with the previously described parallel feeder arrangement, it can be seen here that current may flow in either direction through the various relay locations.

Therefore, directional overcurrent relays are again required in order to provide a discriminative protection system.

The normal grading procedure for overcurrent relays protecting a ring main circuit is to open the ring at the supply point and to grade the relays first clockwise and then counter-clockwise. The arrows shown at the various relay locations in above figure depict the direction for forward operation of the respective relays, i.e. in the same way as for parallel feeders, the directional relays are set to 'look into' the feeder that they are protecting. The above figure shows typical relay time settings (if definite delay time co-ordination was set), from which it can be seen that faults on the interconnections between stations are cleared without any discrimination by the relays at each end of the feeder.

Again, any of the three overcurrent stages may be configured to be directional and co-ordinated as per the previously outlined grading procedure, noting that IDMT characteristics are selectable on the first and second stage.

Note that the above requirements outlined for the parallel transformer arrangements are equally applicable for plain feeders, which are operating in parallel.

2.3 [50/51] Three phase Overcurrent protection (P126 – P127)

The three phase overcurrent protection has three independent thresholds.

The first and second threshold can be set as definite delay time or inverse delay time using the IEC, IEEE/ANSI, CO, RI and RECT curves where their parameters are shown in the Technical Data of this Application Guide.

The third threshold can be set to operate on the peak of the measured phase current.
It compares the biggest peak value of the measured current against the setting.

The peak detection is applied where a CT saturation condition occurs and the measure is not more trustworthy.

The logical current over-threshold functionality is defined below.

2.3.1 Instantaneous Function [50/51]

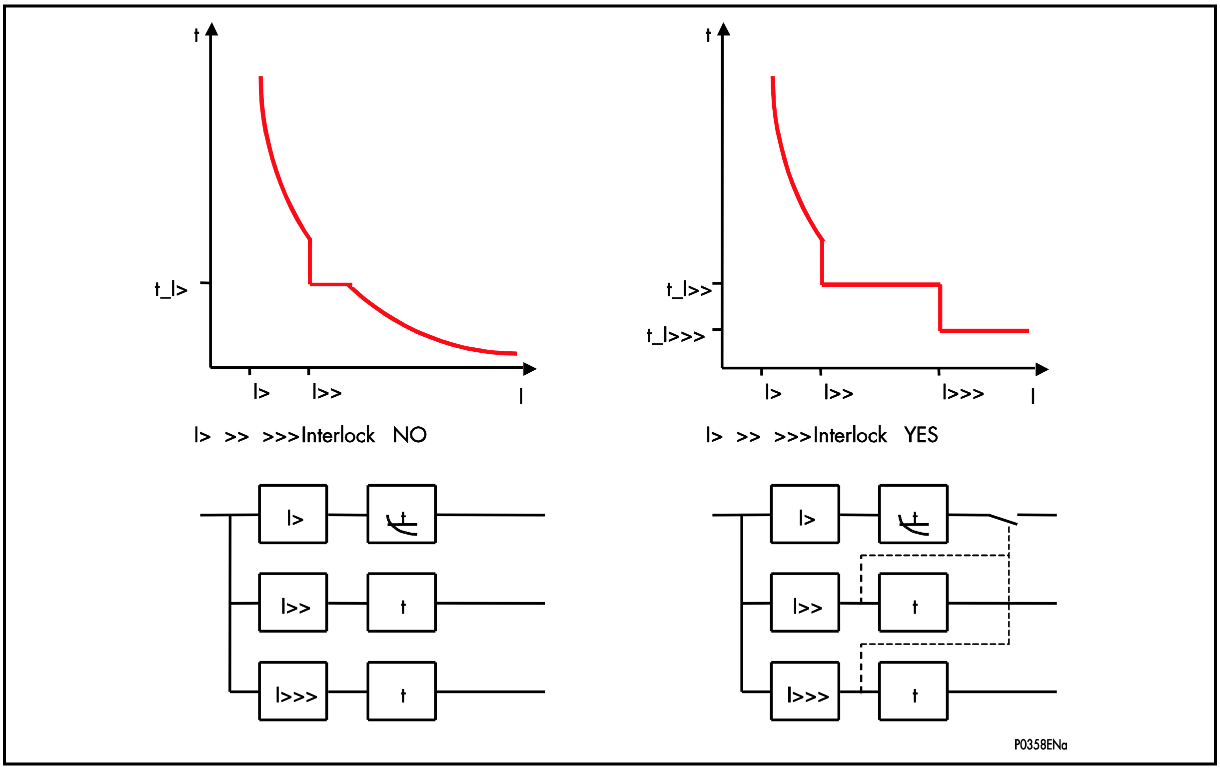
As soon as a phase threshold is running, the instantaneous output associated with this threshold is activated. This output indicates that the protection element has detected a phase fault and that the time delay associated with the threshold has started.

2.3.2 I>…I>>…I>>> Interlock

The choice of this functionality is available when the IDMT delay trip time is selected.

The 2nd and 3rd threshold pickup can suspend 1st threshold output control to save selectivity

Below it is shown the trend of the delay trip time of the first threshold in the both cases Yes or No.

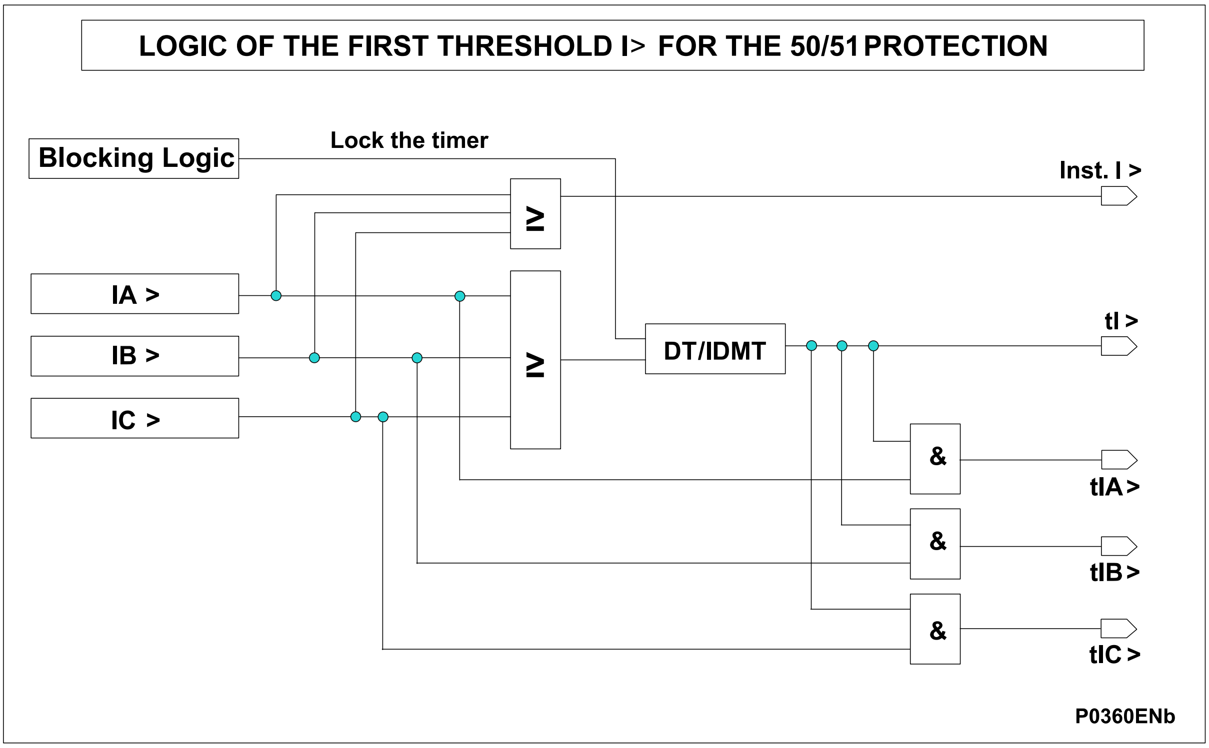


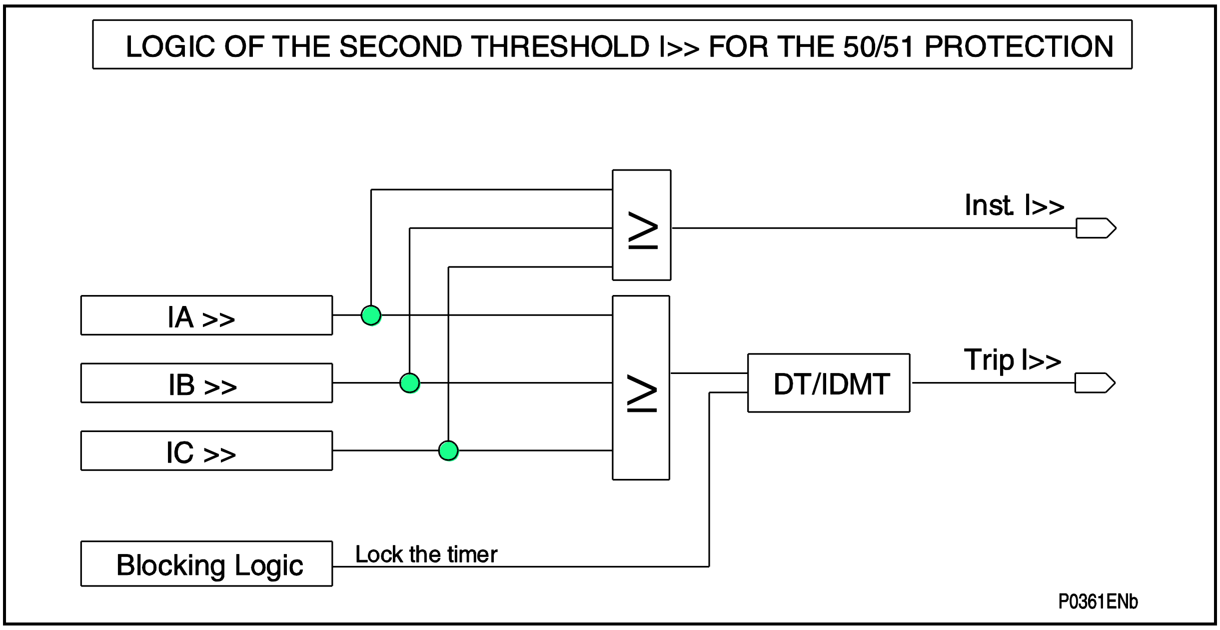
2.3.3 Three phase overcurrent protection applications

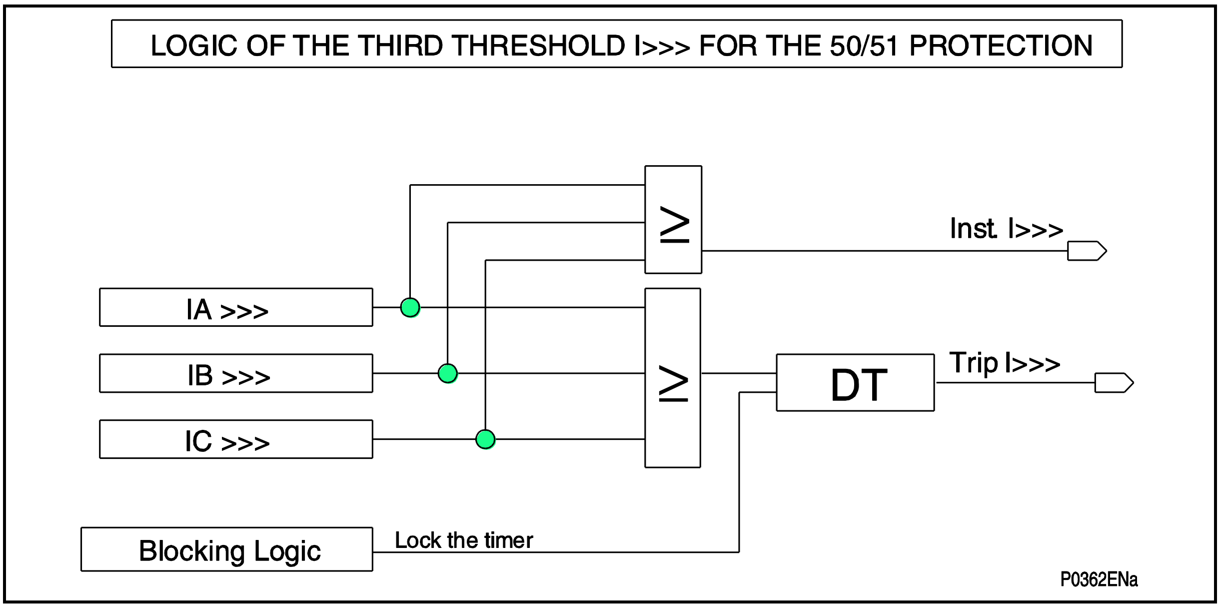
Being P127 a three phase directional/non directional relay an overcurrent protection involves the P127 used as non directional relay and the P126.

Some applications can be considered, but for indicative applications it is better to involve the blocking logic and selective functions, so an overcurrent application will be shown in the part of this TG regarding the blocking logic and selective function.

The following diagrams show the functionality for each thresholds







2.4 Directional Earth Fault Protection (P125, P126 & P127)

The MiCOM P125, P126, P127 relays have a directional/non directional earth fault protection.

It provides three directional/non directional earth overcurrent thresholds and two wattmetric and active earth fault current thresholds.

The first and second threshold can be set as definite or inverse delay time using the IEC, IEEE/ANSI, CO2-8, RI and RECT curves as shown in the Technical Data of the relays; for the wattmetric protection (Pe / IeCos) only the first threshold can be set as definite or inverse delay time, always using IEC, IEEE/ANSI, CO, RI and RECT curves.

The directional earth fault overcurrent protection element compares the earth fault current, residual voltage with the set thresholds Ie>, Ue>, Ie>>, Ue>>, Ie>>>, Ue>>>, the derived earth currents Ie_d> and Ie_d>> and the relevant angle between the Ie and Ue for each threshold. Once all the following listed requirements are met the tripping command is set:

– thresholds for Ie and Ue are exceeded (earth fault OC protection element)

– Ie current vector is in the tripping area (Ie^Ue)

– Ie [mA] + Ue [V] > 18 (Ien=1A) or Ie [mA] + 5 x Ue [V] > 90 (Ien=5A)

– the tripping timer expires

The protection's tripping area is defined by a tripping zone settable form ± 10° to ± 170° in steps of 1° for each tripping threshold and a settable angle from 0° to 359° in steps of 1° named torque/RCA angle (Ie^Ue), which can be separately set for each tripping threshold and

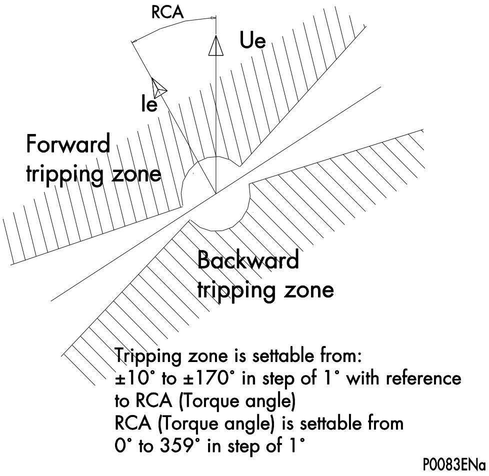
The same threshold can be set as non-directional with definite or inverse delay time.

The third current threshold can be set as directional or non-directional but with only definite delay time setting. The same applies to the Pe or IeCos second threshold.

The third threshold can work on the measured peak by an opportune choice in the dedicated submenu. (See the FT part of the TG)

The peak detection is applied where a CT saturation condition occurs and the measure is not more trustworthy.

The reset delay time for each threshold provides protection against intermittent faults.

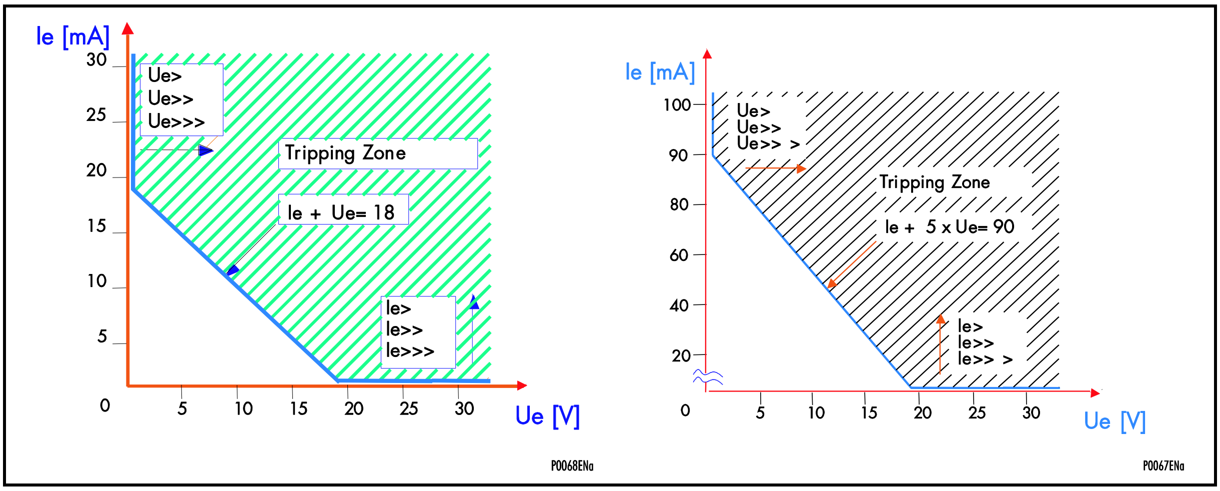


The close figure shows the forward and reverse tripping zone for the directional earth fault protection.

The protection element also provides a non-sensitive area to avoid instability due to small asymmetries and unbalances that can generally be present in the network system. This condition is represented by the characteristic reproduced below, where the hatched area is the tripping zone.

The tripping zone is limited by the equation Ie +(k x Ue) < (k x 18). (18 is a value derived experimentally where stability is guaranteed).

The K factor is 1, if Ien=1A, 5 if Ien=5A.



Ien=1A　　　　Ien=5A

The directional earth fault element needs a suitable voltage supply to provide the necessary polarisation. (See the Technical data for further information)

The polarising signal must be representative of the earth fault condition. As residual voltage is generated during earth fault conditions, and this quantity is used to polarise directional earth fault elements. The P127 relay can derive this voltage internally from the 3 phase voltage inputs when the VT connection option 3Vpn is set. It can also be measured directly by a VT transformer when the VT connection option 2Vpp+Vr (two phase to phase) or 2Vpn+Vr (two phase to neutral) is set.

The P125 and P126 measures this voltage directly from a broken delta or single VT.

2.4.1 General Setting Guidelines

When setting the relay characteristic/torque angle for the three phase directional overcurrent element, a positive angle setting was specified. This was due to the fact that we consider as polarising voltage, the phase voltage value in quadrature of the current under fault conditions. With directional earth fault protection, the residual current under fault conditions lies at an angle lagging the polarising residual earth fault voltage.

The following listed angle settings are recommended to fix the right direction of the earth fault for the various earthed systems.

Resistance earthed systems	180°
Insulated systems	270°
Petersen Coil system	200°
Transmission Systems (solidly earthed)	90°-120°

The setting ranges for directional/non-directional earth fault and wattmetric protection (Pe/IeCos) can be found in the FT and TD chapters of the technical guide.

2.4.2 An application of 67N in an Insulated Systems

The advantage with an insulated power system is that during a single phase to earth fault condition, no high earth fault current will flow. Consequently, it is possible to maintain power flow on the system even with an earth fault condition present. However, this advantage is offset by the fact that the resultant steady state and transient over-voltages on the healthy phases can be very high. In general insulated systems will only be used in low or medium voltage networks where it does not prove too costly to provide the necessary insulation against such over-voltages.

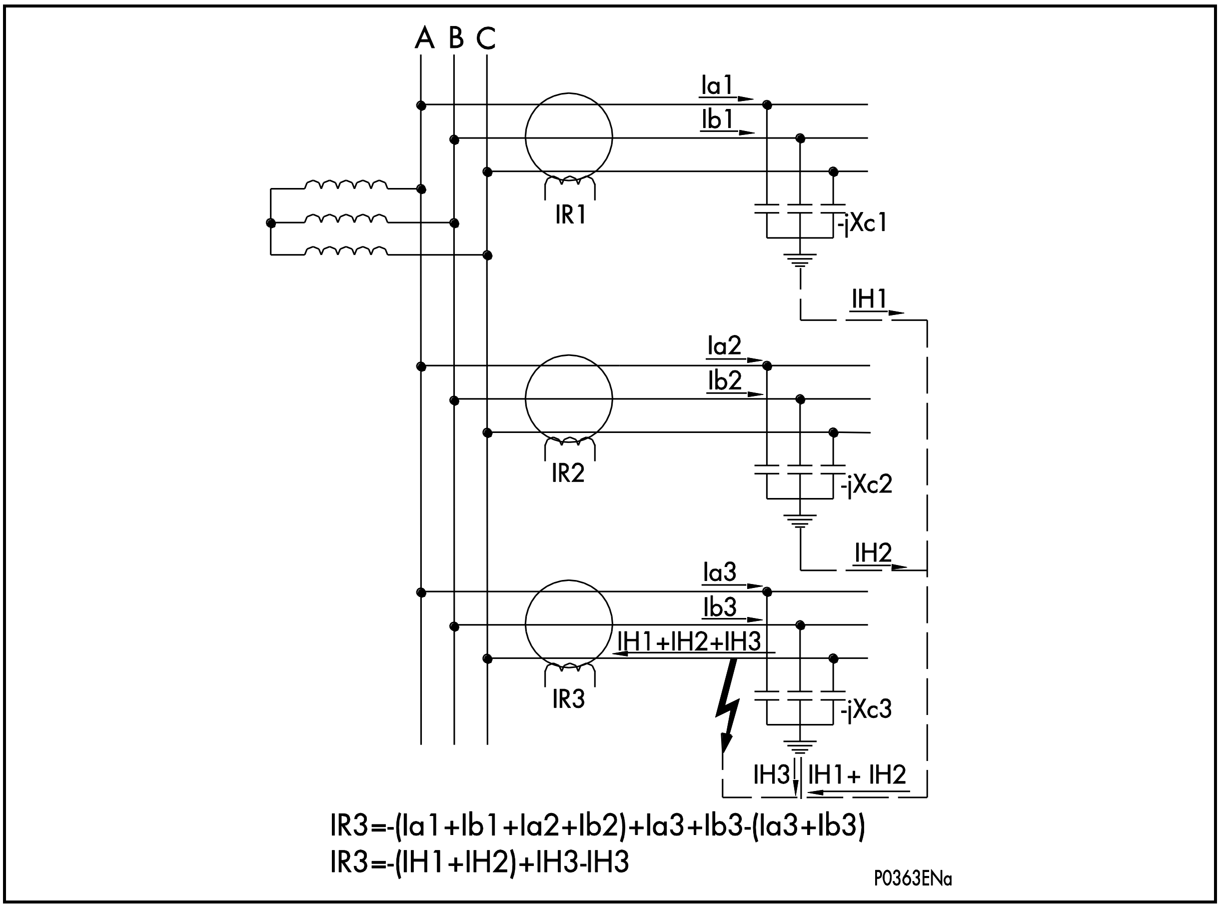
Higher system voltages would normally be solidly earthed or earthed via a low impedance.

Operational advantages may be obtained by the use of insulated systems.

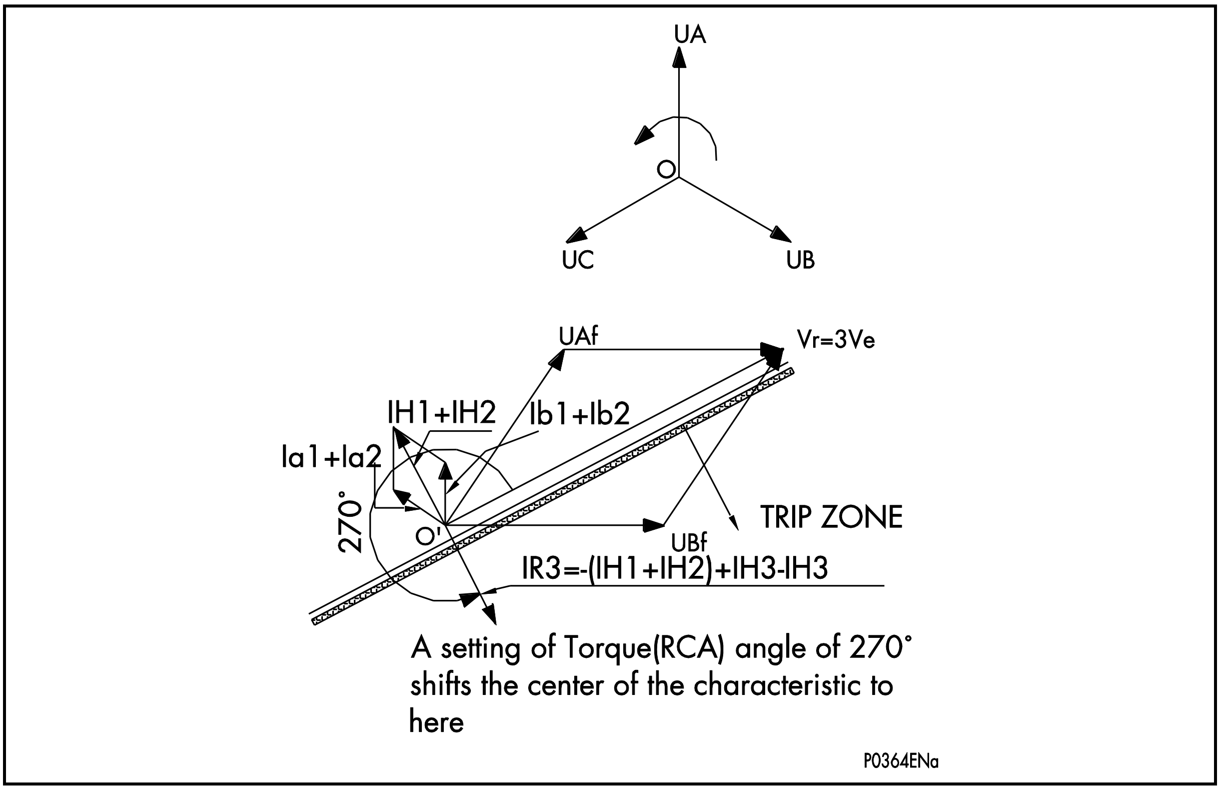
However, it is still essential that detection of the earth fault condition is achieved. This is not possible if standard current operated earth fault protection equipment is used. One possibility for earth fault detection is by applying a residual over-voltage protection device. This functionality is provided by the MiCOM P125, P126 and P127 relays.

However, fully discriminative earth fault protection on this type of system can only be achieved by earth fault protection element. This protection element is included in directional relays MiCOM P125, P126 & P127.

It is essential that a core balance CT is used for high sensitive earth fault detection. This eliminates the possibility of spill current that may arise from slight mismatches between residually connected line CTs. It also enables a much lower CT ratio to be applied, thereby allowing the required protection sensitivity to be more easily achieved.



From above figure and the vector diagram below it can be seen that the relays on the healthy feeders see the unbalance in the charging currents on their own feeder. The relay on the faulted feeder, however, sees the charging current from the rest of the system [IH1 and IH2 in this case], with it’s own feeders charging current [IH3] being cancelled out



Referring to the vector diagram, it can be seen that the C phase to earth fault causes the phase voltages on the healthy phases to rise by a factor of $\sqrt{3}$.

The A phase charging current (Ia), is then shown to be leading the resultant A phase voltage by 90°. Likewise, the IB phase charging current leads the resultant voltage Vb by 90°.

The unbalance current detected by a core balance current transformer on the healthy feeders can be seen as the vector addition of Ia1 and Ib1 (Ia2 and Ib2), giving a residual current which lies at exactly 90° anticipating the polarising voltage (Vr=3Ve).

The vector diagram indicates that the residual currents on the healthy and faulted feeders, IH1& IH2 and IR3 respectively, are in opposite direction to each other (180°). A directional element could therefore be used to provide discriminative earth fault protection.

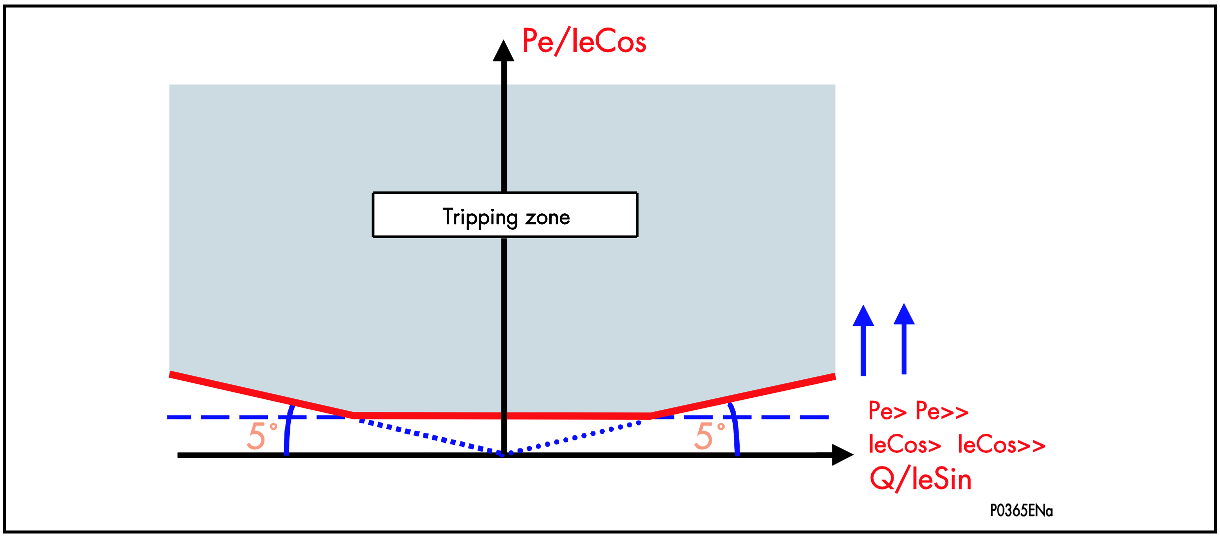
If the polarising voltage of this element, equal to 3Ve, is shifted through +270°, the residual current seen by the relay on the faulted feeder will lie within the operate region (Trip Zone) of the directional characteristic. As previously stated, the required RCA setting for the sensitive earth fault protection when applied to insulated systems, is 270°.

2.4.3 Wattmetric (Pe) Characteristic

The P125, P126 and P127 relays include the zero sequence power measurement function.

They also offer the possibility to choose between a Wattmetric (Pe) protection and IeCos (active component of the earth fault current) protection functionality mode.

The following figure shows the characteristic tripping zone for the wattmetric protection.



In the following formula the power thresholds in the relay menu are called Pe> & Pe>>.

The Pe> and Pe>> settings are calculated as:

Vres x Ires x Cos (f – fc) = 9 x Ve x Ie x Cos (f – fc)

Where:

f	= angle between the polarising voltage (Vres) and the residual current
fc	= relay characteristic angle (RCA/torque angle)
Vres	= residual voltage
Ires	= residual current
Ve	= zero sequence voltage
Ie	= zero sequence current

2.4.3.1 Setting Guidelines for Pe Thresholds

The Pe thresholds are displayed in the format: ##.## x Ien W

In this formula the ##.## setting value is multiplied by the setting value of the Ien.

The threshold value is expressed in Watt secondary.

Example: The Pe> threshold is to be set from the relay front panel and the setting value is 20W.

Ien = 1A, the internal relay setting value will be equal to 20 x 1 = 20W.

To set the thresholds for the Pe (Wattmetric/IeCos) protection the relay will display the menu “Wattmetric Protection \ Pe>” (refer to P12y/EN FT section).

The same procedure is to be applied for setting the second Pe>> threshold.

For the settings of the trip delay time see the FT chapter of the TG)

2.4.4 Application Considerations

The protection Pe> and Pe>> require relay current and voltage connections to be actived.
The measurement of the Pe depends on the voltage wiring of the relay.
In case of 3Vpn wiring the Ve will be equal to Ve= 1/3(Va+VB+VC) in the other insertions way the applied voltage to the relay is directly used to calculate the Pe.

Referring to the relevant application diagram for the P125, P126 and P127 relays, it should be installed such that its direction for forward operation is 'looking into' the protected feeder i.e. away from the busbar, with the appropriate RCA .

Resistance earthed systems	180°
Insulated systems	270°
Petersen Coil system	200°
Transmission Systems (solidly earthed)	90°-120°

As illustrated in the relay application diagram, it is usual for the earth fault element to be driven from a core balance current transformer. This eliminates the possibility of spill current that may arise from slight mismatches between residually connected line CTs. It also enables a much lower CT ratio to be applied, thereby allowing the required protection sensitivity to be more easily achieved.

2.4.5 Iecos protection

The Iecos protection follows the same concepts of the Pe protection.

The difference is that the thresholds take in account the active component of the earth fault current.

The setting of the RCA follows the above listed table.

2.4.6 Where use Iecos and where use Pe.

The wattmetric protection Pe/Iecos is almost used in the Petersen Coil systems.

In a Petersen Coil scheme during a fault we have a resistive current and an inductive current.

The resistive current is constant because the residual voltage is always present; the inductive current is the summation of the capacitive contribution of the healthy line and the reactive contribution of the fault line.

In this situation is difficult to discriminate the line and detect the fault current value because the capacitive and reactive are of opposite sign.

Since the residual voltage is present to the parallel between the coil and resistance a wattmetric protection is used to be sure to open the fault line.

The unique resistive present component depends on the fault line.

The discriminative for the using of Pe or Iecos protection is the fault current value and the relative fault operating boundary.

In some applications, the residual current on the healthy feeder can lie just inside the operating boundary following a fault condition. The residual current for the faulted feeder lies close to the operating boundary.

In this case, a correct discrimination is achieved by means of an Iecos characteristic, as the faulted feeder will have a large active component of residual current, whilst the healthy feeder will have a small value.

For insulated earth applications, it is common to use the Iesin characteristic that can be obtained by the setting of the characteristic angle to 90° or 270°.

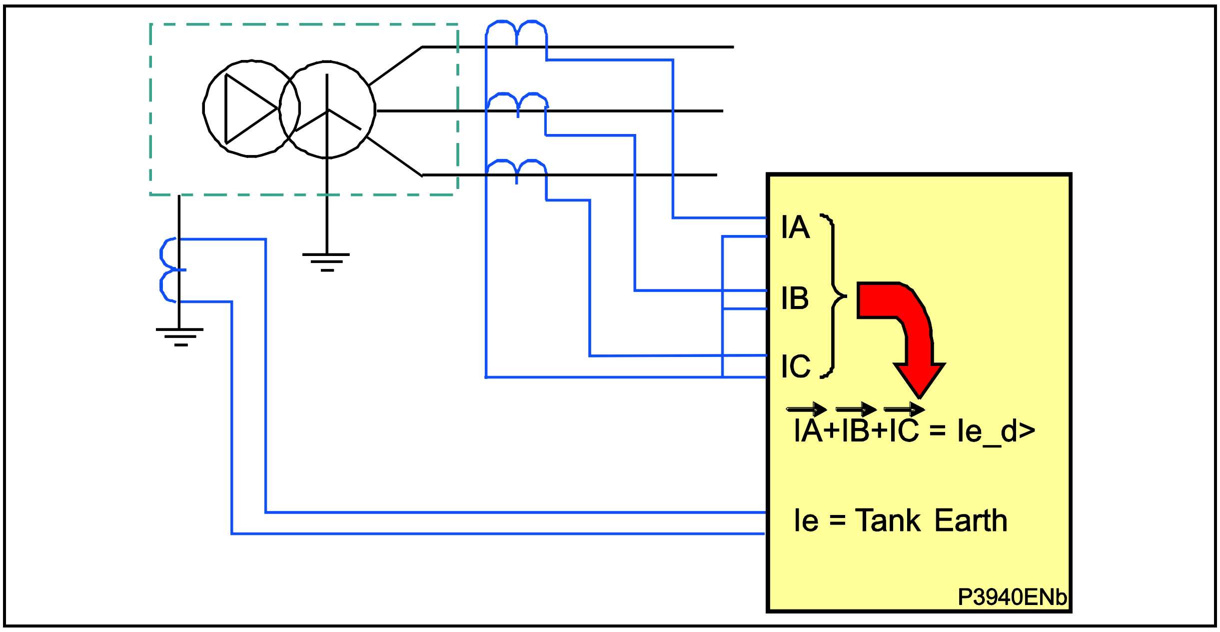
2.5 Derived earth overcurrent (Ie_d>, P127 only)

The derived earth overcurrent element protection is used to cover applications such as HTB/HTA transformers. The derived earth current (Ie_d>) is the vectorial summation: $\overrightarrow{IA} + \overrightarrow{IB} + \overrightarrow{IC}$:

$\overrightarrow{IA} + \overrightarrow{IB} + \overrightarrow{IC}$ = Ie_d>.

The derived earth overcurrent has two independent thresholds: Ie_d> and Ie_d>>.

The two thresholds can be set as definite delay time or inverse delay time using the IEC, IEEE/ANSI, CO, RI and RECT curves. Their parameters are shown in the Technical Data chapter of this Technical Guide.

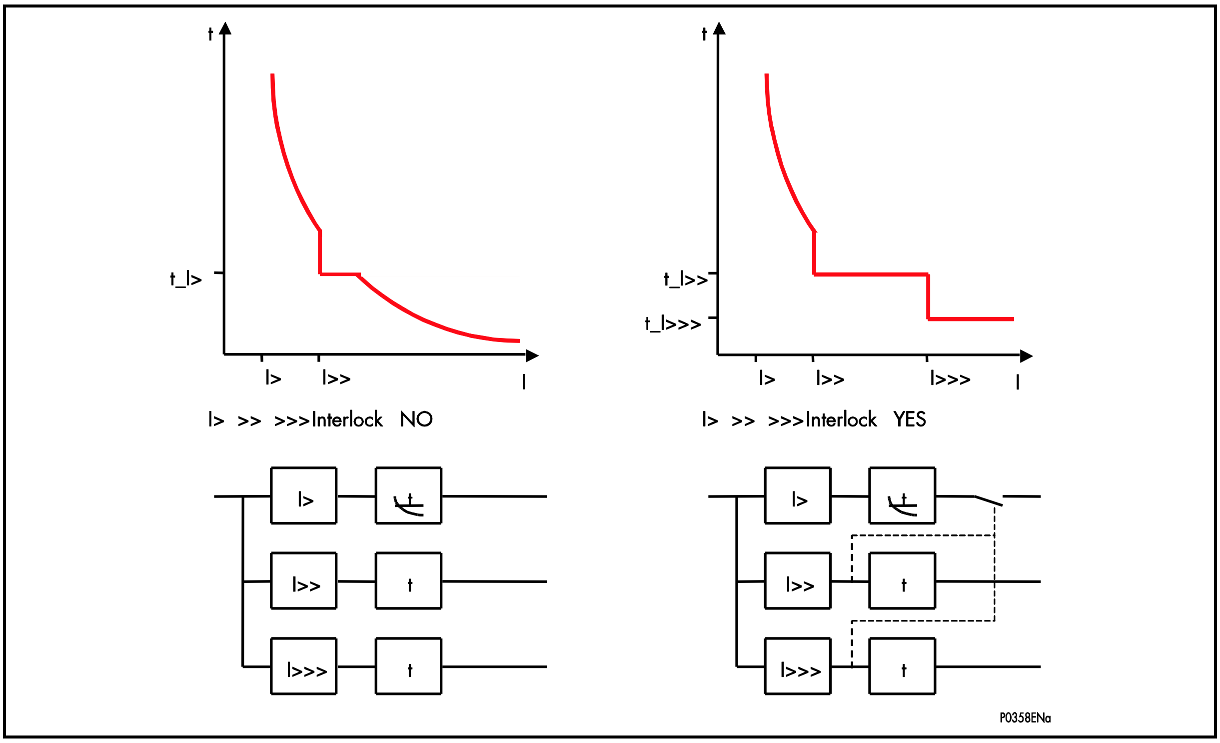


As soon as Ie_d> threshold is running, the instantaneous output associated with this threshold is activated. This output indicates that the protection element has detected an earth fault and that the time delay associated with the threshold has started. This time delay can be blocked via the logic input "Block Logic" associated with this threshold. If this blocking input is activated by an output contact of a downstream relay, the logic that will lead to the trip command is then blocked only if the relay that is the closest to the fault can see and therefore eliminate the fault. This principle is known as «Blocking logic» or «Blocking». It is described in more detail in this document.

2.5.1 Ie>…Ie>>…Ie>>> Interlock

The choice of this functionality is available when the IDMT delay trip time is selected for the first earth threshold.

The following figures show the window where this functionality can be or not to be actived. The 2nd and 3rd threshold pickup can suspend 1st threshold output control to save selectivity.Below the trend of the delay trip time of the first threshold is shown for both cases Yes or No.



2.6 Application of a MiCOM P125 relay as a Single Element Power Relay

2.6.1 Overview

The MiCOM P125 relay is a single phase relay designed for stand alone directional earth fault protection. This relay incorporates both an IeCosø and a Zero Sequence Power element. These elements can be configured to provide a single phase power measurement or alternatively a sensitive directional overcurrent characteristic similar to that of the MWTU11/TWL1111 Reverse Power relay.

Using a MiCOM P125 relay as a stand alone power relay provides a wide setting range, the setting range available is dependent on the CT range ordered. The table below outlines the settings available for each of the voltage and CT input ranges.

	Analogue Input		Setting Range (p.u.)	
	CT Range	VT Range	Pe	Ie Cosø
P125AA	0.1 – 40	57 – 130	10 – 800W	0.1 – 40
P125AB		220 - 480	40 – 3200W	
P125BA	0.01 – 8	57 – 130	1 – 60W	0.01 – 8
P125BB		220 - 480	4 – 640W	
P125CA	0.002 – 1	57 – 130	0.2 – 20W	0.002 – 1
P125CB		220 - 480	1 – 80W	

Flexible connection arrangements allow for phase to phase or phase to ground connection of the polarising voltage, a wide range of angle settings allows the relay to operate for Watts or Vars, Import or export.

The VT inputs for the MiCOM P125 relay are rated 57 to 130 Vac or 220 – 480 Vac (Selected at time of order) these ranges make the relay suitable for connection to a VT secondary or direct connection to a 415V systems.

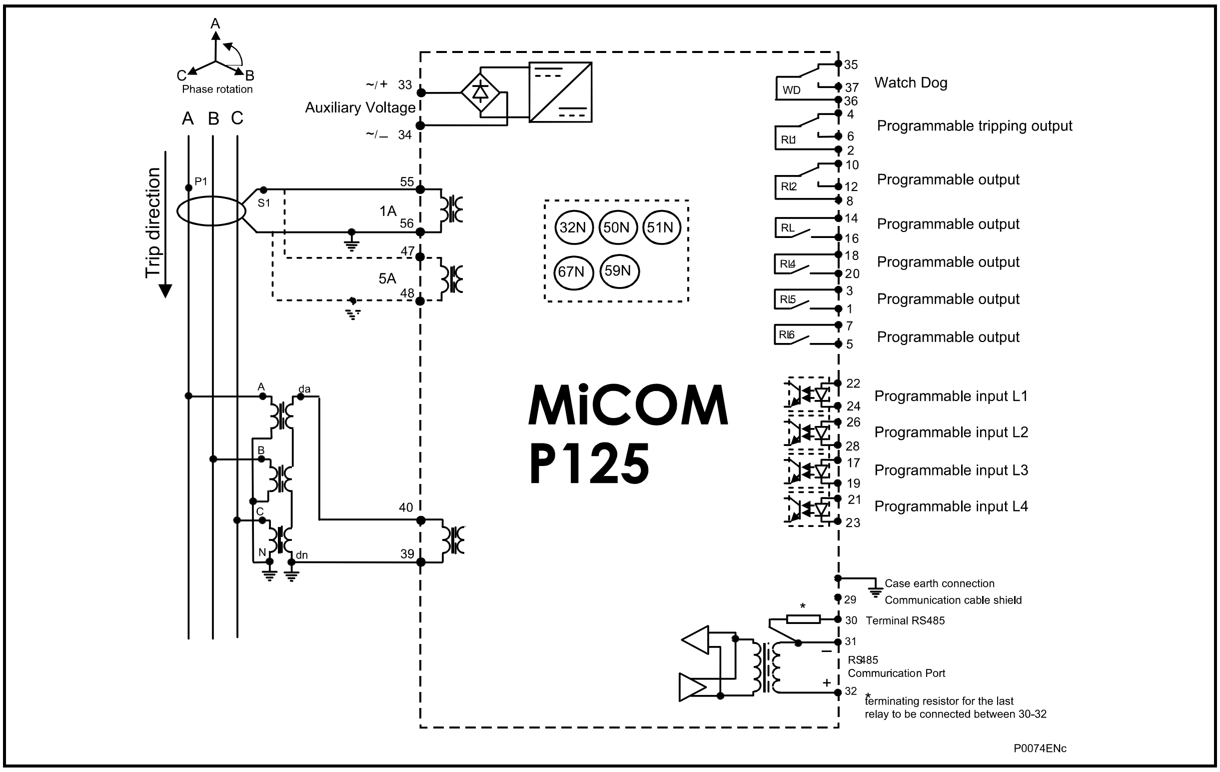
2.6.2 Relay Connection

The relay setting angle which is discussed in further detail below allows the user to customise the VT connection to suit the primary plant, available VT secondaries and the protection philosophy of the customer.

The VT connection can be made phase to phase or phase to ground using the connection table below

For simplicity the connection has been made so as a reverse power setting will require an angle of 180 degrees.

Polarising Voltage	**Terminals**	
	Leading Subscript (Eg Va-n)	**Laging Subscript (Eg Va-n)**
Va-n	40	39
Vb-n		
Vc-n		
Va-b		
Vb-c		
Vc-a		



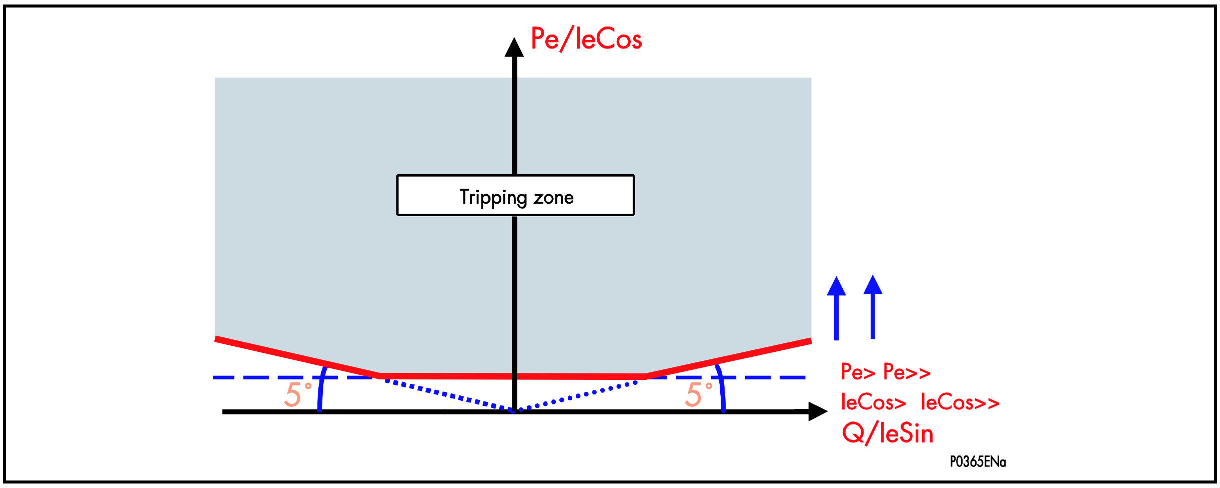
One of the possible line CT connection is shown below, The CT input can be connected to any available phase CT, (A, B or C).

2.6.3 Relay Characteristic Angle Setting

Below is a table of some of the possible settings to achieve various protection functions for different CT and VT connections, the settings below are with reference to the connections outlined above.

Function	Voltage	Current	Angle Setting
Active Power Import	Va-n	Ia	180
	Vb-n	Ib	
	Vc-n	Ic	
	Va-b	Ic	270
	Vb-c	Ia	
	Vc-a	Ib	
Reactive Power Import*	Va-n	Ia	90
	Vb-n	Ib	
	Vc-n	Ic	
	Va-b	Ic	180
	Vb-c	Ia	
	Vc-a	Ib	
Active Power Export	Va-n	Ia	0
	Vb-n	Ib	
	Vc-n	Ic	
	Va-b	Ic	90
	Vb-c	Ia	
	Vc-a	Ib	
Reactive Power Export*	Va-n	Ia	270
	Vb-n	Ib	
	Vc-n	Ic	
	Va-b	Ic	0
	Vb-c	Ia	
	Vc-a	Ib	

*Refers to lagging Vars import and export



2.6.4 Replacing an MWTU11/TWL1111 Reverse Power / Forward Power Relay.

The MWTU11/TWL1111 was not strictly a power measuring relay. The relay operated using an Icosø characteristic. Provided enough voltage was present to polarise the measuring element, a 1% setting on a 1A relay would pickup at 10mA independent of the voltage magnitude applied.

By selecting the 0.01 to 8Ien, model number MiCOM P125B, A setting range of 1 to 100% of the nominal current in 0.1% steps is available.

2.6.5 Application of the Power Function

The standard configuration of the MiCOM P125 when set to use the wattmetric earth fault protection can measure the zero sequence power, the connection for this can be found in the sales publication and service manual. By adopting the connection above the relay can measure the phase current and phase to phase, or phase to ground voltage, the operate quantity when using these connections is a single phase power. As power protection is generally required to operate for balanced three phase conditions basing the protection on a single phase measured quantity is of no consequence.

When using the Power Function of the relay (Pe) care must be taken when selecting the relay range. If the MiCOM P125CA relay is considered and is connected phase to ground with 1A CT secondaries. A 0.2W setting would be equivalent to 0.2/63.5 Watts, 0.3% of the nominal load.

2.7 Thermal Overload Protection (P126 & P127)

Thermal overload protection can be applied to prevent damages to the electrical plant equipment when operating at temperatures in excess of the designed maximum withstand. A prolonged overloading causes excessive heating, which may result in premature deterioration of the insulation, or in extreme cases, insulation failure.

MiCOM P126 & P127 relays incorporate a current based thermal replica, using load current to reproduce the heating and cooling of the equipment to be protected. The element thermal overload protection can be set with both alarm and trip stages.

The heating within any plant equipment, such as cables or transformers, is of resistive type (I^2R x t). Thus, the quantity of heat generated is directly proportional to current squared (I^2). The thermal time characteristic used in the relay is based on current squared, integrated over time.

The MiCOM P126 & P127 relays automatically use the highest phase current as input information for the thermal model.

Protection equipment is designed to operate continuously at a temperature corresponding to its full load rating, where heat generated is balanced with heat dissipated by radiation etc. Over-temperature conditions therefore occur when currents in excess of rating are allowed to flow for a certain period of time. It can be shown that temperatures during heating follow exponential time constants and a similar exponential decrease of temperature occurs during cooling.

In order to apply this protection element, the thermal time constant (Te) of the plant equipment to be protected is therefore required.

The following sections will show that different plant equipment possesses different thermal characteristics, due to the nature of their construction.

2.7.1 Time Constant Characteristic

This characteristic is used to protect cables, dry type transformers (e.g. type AN), and capacitor banks.

The thermal time characteristic is given by:

$$\boxed{e^{\left(\frac{-t}{\tau}\right)} = \frac{\left(I^2 - (k \times I_{FLC})^2\right)}{\left(I^2 - I_p^2\right)}}$$

Where:

t	=	Time to trip, following application of the overload current, I
τ	=	Heating and cooling time constant of the protected plant equipment
I	=	Largest phase current
I_{FLC}	=	Full load current rating (relay setting 'Thermal Trip')
k	=	1.05 constant, allows continuous operation up to < 1.05 I_{FLC}
I_P	=	Steady state pre-loading current before application of the overload

The time to trip varies depending on the load current carried before application of the overload, i.e. whether the overload was applied from "hot" or "cold".

Curves of the thermal overload time characteristic are given in Technical Data.

2.7.2 Mathematical Formula Applicable to MiCOM Relays:

The calculation of the Time to Trip is given by:

$$t\ Trip = Te\ In\left(\frac{\left|Ix^2 - \theta\right|}{\left|Ix^2 - \theta trip\right|}\right)$$

With:

t Trip	=	Time to trip (in seconds)
Te	=	Thermal time constant of the equipment to be protected (in seconds)
Ix	=	Thermal overload equal to Ieq/k Iθ >
Ieq	=	Equivalent current corresponding to the RMS value of the largest phase current
Iθ >	=	Full load current rating given by the national standard or by the supplier
k	=	Factor associated to the thermal state formula
θ	=	Initial thermal state. If the initial thermal state = 30% then $\theta = 0.3$
θtrip	=	Trip thermal state. If the trip thermal state is set at 100%, then θ trip = 1

The settings of these parameters are available in the various menus.

The calculation of the thermal state is given by the following formula:

$$\Theta_{\tau+1} = \left(\frac{I_{eq}}{k \times I\Theta >}\right)^2 \left[1 - e^{\left(\frac{-t}{T_e}\right)}\right] + \Theta_\tau e^{\left(\frac{-t}{T_e}\right)}$$

θ being calculated every 100ms.

2.7.3 Setting Guidelines

The current setting is calculated as:

Thermal Trip (θtrip) = Permissible continuous loading of the plant equipment / CT ratio. Typical time constant values are given in the following tables.

The relay setting, 'Time Constant', is in minutes.

Paper insulated lead sheathed cables or polyethylene insulated cables, placed above ground or in conduits. The table shows τ in minutes, for different cable rated voltages and conductor cross-sectional areas:

CSA mm^2	6 -11 kV	22 kV	33 kV	66 kV
25 - 50	10	15	40	-
70 - 120	15	25	40	60
150	25	40	40	60
185	25	40	60	60
240	40	40	60	60
300	40	60	60	90
	Time constant τ (minutes)			

Other plant equipment:

	Time constant τ (minutes)	Limits
Dry-type transformers	40 60 - 90	Rating < 400 kVA Rating 400 - 800 kVA
Air-core reactors	40	
Capacitor banks	10	
Overhead lines	10	Cross section $\geq$ 100 mm^2 Cu or 150mm^2 Al
Busbars	60	

An alarm can be raised on reaching a thermal state corresponding to a percentage of the trip threshold. A typical setting might be 'Thermal Trip' = 70% of thermal capacity.

2.8 Undercurrent Protection (P126 & P127)

The undercurrent function [37] makes it possible to detect a loss of load (for example the draining of a pump or breakage of a conveyor belt). It uses definite delay time undercurrent protection.

The user can set the following parameters:

– undercurrent threshold I<

– time delayed undercurrent threshold tI<

2.9 Negative Sequence Overcurrent Protection (P126 & P127)

When applying traditional phase overcurrent protection, the overcurrent elements must be set higher than maximum load current, thereby limiting the sensitivity of the element. Most protection techniques also use an earth fault element operating from residual current, which improves sensitivity for earth faults. However, certain faults may arise which can remain undetected by such techniques.

Any unbalanced fault condition will produce negative sequence current of some magnitude. Thus, a negative phase sequence overcurrent element can operate for both phase-to-phase and phase to earth faults.

This section describes how negative phase sequence overcurrent protection may be applied in conjunction with standard overcurrent and earth fault protection in order to alleviate some less common application difficulties.

– Negative phase sequence overcurrent elements give greater sensitivity to resistive phase-to-phase faults, where phase overcurrent elements may not operate.

– In certain applications, residual current may not be detected by an earth fault relay due to the system configuration. For example, an earth fault relay applied on the delta side of a delta-star transformer is unable to detect earth faults on the star side. However, negative sequence current will be present on both sides of the transformer for any fault condition, irrespective of the transformer configuration. Therefore, a negative phase sequence overcurrent element may be employed to provide time-delayed back-up protection for any un-cleared asymmetrical fault.

– Where fuses protect motors on rotating machines, a blown fuse produces a large amount of negative sequence current. This is a dangerous condition for the motor due to the heating effects of negative phase sequence current at double frequency. A negative phase sequence overcurrent element may be applied to provide efficient back-up protection for dedicated motor protection relays.

– It may also be required to simply set an alarm at the presence of negative phase sequence currents on the system. Operators are then prompted to investigate the cause of the unbalance.

The negative phase sequence overcurrent elements have a current pick up settings I2>, I2>>, I2>>>, and are time delayed in operation by the adjustable timers tI2>, tI2>>, tI2>>>.

2.9.1 I2 Thresholds Setting Guidelines

This protection element includes three thresholds.

The first threshold can be set as DT or IDMT trip delay time.

The curves are the same as for the [50/51], [50N/51N] protection.

The current pick-up threshold (settable in the menu **PROTECTION G1/[46] Neg. Seg. OC**) must be set higher than the normal negative phase sequence current due to the normal load unbalance that is always present on the system. This can be set at the commissioning stage, making use of the relay measurement function to display the standing negative phase sequence current, and apply a setting at least 20% above.

Where the negative phase sequence element is required to operate for specific un-cleared asymmetric faults, a precise threshold setting has to be based on an individual fault analysis for that particular system due to the complexities involved. However, to ensure operation of the protection element, the current pick-up setting must be set approximately 20% below the lowest calculated negative phase sequence fault current for a specific remote fault condition.

The correct setting of the time delay is vital for this protection element. It should be also seen that this element is applied primarily to provide back-up protection to other protective devices or to provide an alarm. Therefore, it would be associated with a long delay time.

It must be ensured that the time delay is set longer than the operating time of any other protective device (at minimum fault level) on the system, which may respond to unbalanced faults, such as:

– Phase overcurrent protection elements

– Earth fault protection elements

– Broken conductor protection elements

– Negative phase sequence influenced thermal protection elements

2.10 Restricted earth fault

2.10.1 Introduction

The restricted earth fault relay is a high impedance differential scheme which balances zero sequence current flowing in the transformer neutral against zero sequence current flowing in the transformer phase windings. Any unbalance for in-zone fault will result in an increasing voltage on the CT secondary and thus will activate the REF protection.

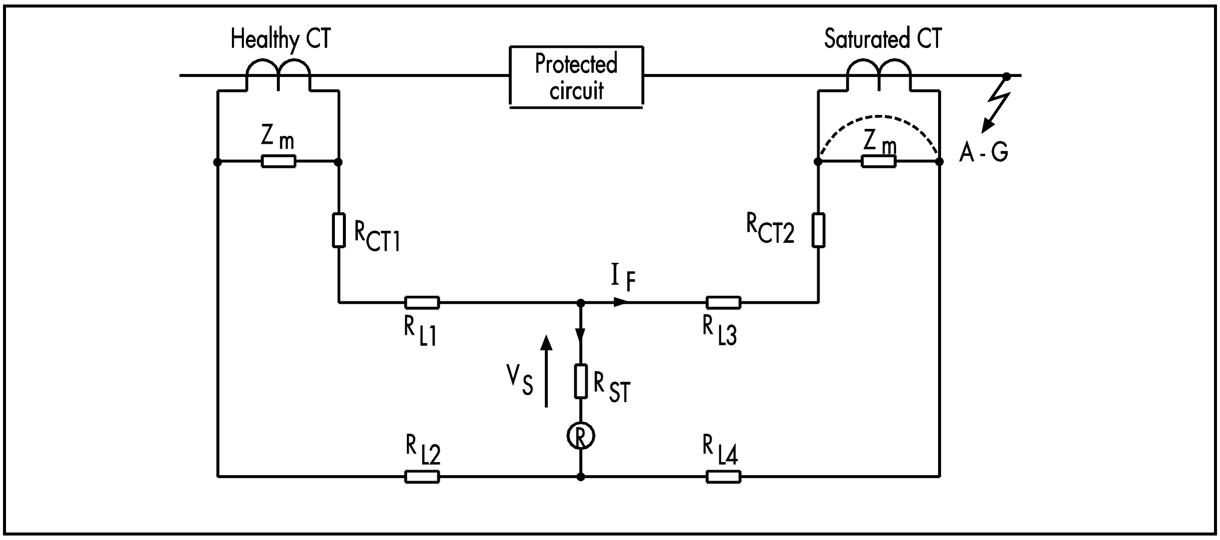
This scheme is very sensitive and can then protect against low levels of fault current in resistance grounded systems where the earthing impedance and the fault voltage limit the fault current.

In addition, this scheme can be used in a solidly grounded system. It provides a more sensitive protection, even though the overall differential scheme provides a protection for faults over most of the windings.

The high impedance differential technique ensures that the impedance of the circuit is of sufficiently high impedance such that the differential voltage that may occur under external fault conditions is lower than the voltage required to drive setting current through the relay. This ensures stability against external fault conditions and then the relay will operate only for faults occurring inside the protected zone.

2.10.2 High impedance principle

High impedance schemes are used in a differential configuration where one current transformer is completely saturated and the other CTs are healthy.



HIGH IMPEDANCE SCHEME PRINCIPLE

The voltage applied across the relay is:

$V_r = I_f (R_{CT} + 2R_L)$

I_f : Maximum secondary external fault current.
R_{CT} : Resistance of the Current transformer secondary winding.
R_L : Resistance of a single wire from the relay to the CT.

A stabilizing resistor R_{ST} can be used in series with the relay circuit in order to improve the stability of the relay under external fault conditions. This resistor will limit the spill current under I_s.

$V_s = I_s (R_{ST})$

I_s: Current relay setting

V_s: Stability Voltage setting

Note that the relay consumption has been taken into account.

The general stability conditions can be obtained when:

$V_s > K.I_f (R_{CT} + 2R_L)$

Where K is the stability factor.

This stability factor is influenced by the ratio V_k/V_s which in turns governs the stability of the REF protection element for through faults .

V_k = The Knee point voltage of the CT.

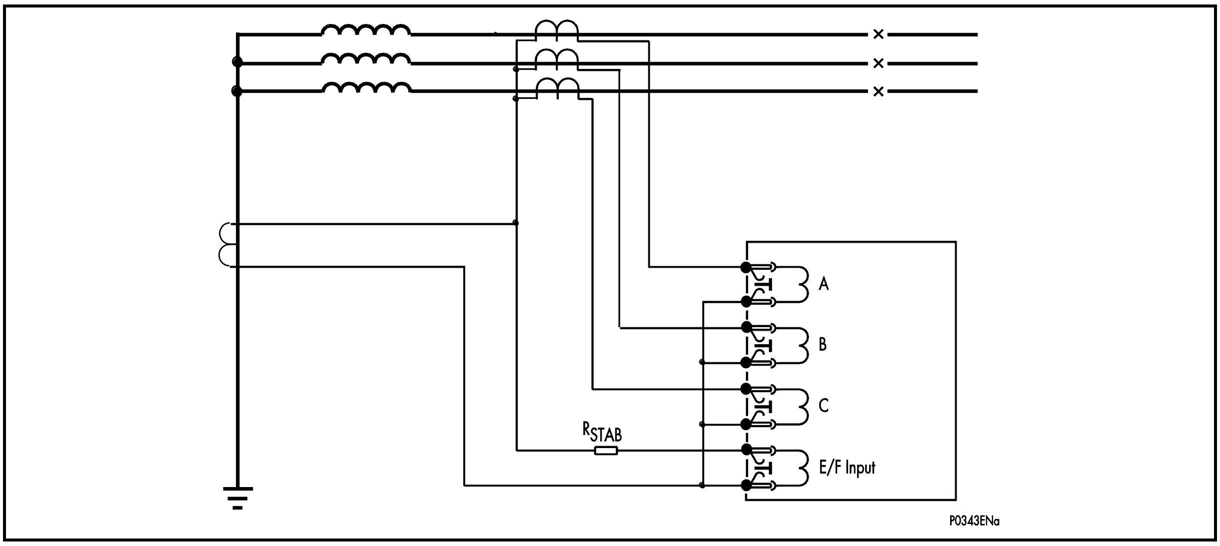
To obtain a high speed operation for internal faults, the Knee point voltage V_k of the CT must be significantly higher than the stability voltage V_s . A ratio of 4 or 5 would be appropriate.

For MiCOM P121, P122 and P123, we found the following results:

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

NOTE: The maximum internal fault level for stage 3 of 0.002 to 1In board must not exceed 20In.



CT CONNECTION DIAGRAM FOR HIGH IMPEDANCE REF APPLICATION

2.10.3 Setting guide

The characteristics of the relay and the value of K influence the stability of the scheme as explained here above.

The typical setting values shall be chosen to provide a primary operating current less than 30 % of the minimum earth fault level for a resistance earthed system. For a solidly earthed system, the typical setting shall provide an operating current between 10 and 60 % of the rated current.

The primary operating current, at the secondary, depends on the following factors:

– Current Transformer ratio
– Relay operating current I_S
– Number of CT in parallel with the relay element (n)
– The inrush current of each CT (I_e) at the stability voltage

$$I_{op} = CT_{Ratio} .(I_s + n.I_e)$$

Current setting should be selected for a high impedance element so that the primary current reaches its nominal current with a given CT, according to the following equation:

$I_s < \{(I_{op} / CT_{Ratio}) - n.I_e\}$

It is also possible to determine the maximum inrush current of the CT to reach a specific primary operating current with a given relay setting.

The setting of the stabilising resistor must be calculated according to the above formula, where the setting depends on the required stability voltage setting V_s and the relay setting I_s

Error!

For MiCOM P12x, I_s is equivalent to I_e>, so the above equation becomes:

Error!

with

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

So

Error!

with Vk ≥ 4.Is.R_{ST} (A typical value to ensure the high speed operation for an internal fault).

<u>CT requirements for High Impedance Restricted Earth Fault Protection</u>

The High Impedance Restricted Earth Fault element shall remain stable for through faults and operate in less than 40ms for internal faults provided that the following equations are met in determining CT requirements and the value of the associated stabilising resistor:

$$Rs = [k^* (If) * (R_{CT} + 2R_L)] / I_S$$

$$V_K \geq 4 * Is * Rs$$

with

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

2.10.4 Use of METROSIL non linear resistors

Metrosils are used to limit the peak voltage developed by the current transformers under internal fault conditions, to a value below the insulation level of the current transformers, relay and interconnecting leads, which are normally able to withstand 3KV peak.

The following formula should be used to estimate the peak transient voltage that could be induced by an internal fault. This peak voltage depends on:

– CT Knee point (V_K)

– Voltage that would be induced by an internal fault if CT doesn’t saturate (V_f)

This prospective voltage itself depends on:

– Maximum internal fault secondary current

– CT ratio

– CT secondary winding resistance

– CT lead resistance to the common point

– Relay lead resistance

– Stability resistor value

$Vp = 2\sqrt{\{2.V_K (V_f - V_k)\}}$

$V_f = I'_f.(R_{ct} + 2R_L + R_{ST})$

Where

- Vp: peak voltage developed by the CT under internal fault conditions
- V_f: maximum voltage that would be produced if CT saturation did not occur
- V_k: current transformer Knee point voltage
- I'_f: is the maximum internal secondary fault current
- R_{ct}: current transformer secondary winding transformer
- R_L: maximum lead burden from CT to relay
- R_{ST}: Relay stabilising resistor.

When the value given by the formula is greater than 3KV peak, it is necessary to use Metrosils. They are connected across the relay circuit and they allow to shunt the secondary current output of the current transformer from the relay in order to prevent very high secondary voltages.

Metrosils are externally mounted and have annular discs shape.

Their operating characteristics is according to the formula:

$$V = C.I^{0.25}$$

Where

- V: Instantaneous voltage applied to the non-linear resistor (Metrosil)
- C: Constant of the non-linear resistor (Metrosil)
- I: Instantaneous current through the non-linear resistor (Metrosil)

With the sinusoidal voltage applied across the Metrosil, the RMS current would be approximately 0.25 times the peak current. This current value can be calculated as follows:

$$Irms = 0.52\left\{\frac{Vs(rms).\sqrt{2}}{C}\right\}^4$$

Where

- Vs(rms): RMS value of the sinusoidal voltage applied across the Metrosil.

This is due to the fact that the current waveform through the Metrosil is not sinusoidal but appreciably distorted.

For satisfactory application of the non-linear resistor (Metrosil), its characteristics should comply with the following requirements:

- At the relay voltage setting, the non-linear resistor (Metrosil) current should be as low as possible, but no greater than approximately 30mA rms for 1A current transformers and approximately 100mA rms for 5A current transformer.
- At the maximum secondary current, the non-linear resistor (Metrosil) should limit the voltage to 1500V rms or 2120V peak for 0.25 second. At higher relay voltage settings, it is not always possible to limit the fault voltage to 1500V rms, so higher fault voltage may have to be tolerated.

The following tables show the typical types of Metrosil that will be required, depending on relay current rating, REF voltage setting etc.

Metrosil units for relays with 1A CT

The Metrosil units with 1A CTs have been designed to comply with the following restrictions:

– At the relay voltage setting, the Metrosil current should be less than 30mA rms.

– At the maximum secondary internal fault current, the Metrosil unit should limit the voltage to 1500V rms if possible.

The Metrosil units normally recommended to be used with 1Amp CTs are shown in the following table:

Relay Voltage setting	Nominal Characteristics		Recommended Metrosil Type	
	C	β	Single pole Relay	Triple pole relay
Up to 125V rms	450	0.25	600A/S1/S256	600A/S3/1/S802
125 to 300V rms	900	0.25	600A/S1/S1088	600A/S3/1/S1195

NOTE: Single pole Relay Metrosil Units are normally supplied without mounting brackets unless otherwise specified by the customer.

Metrosil units for relays with 5A CT

These Metrosil units have been designed to comply with the following requirements:

– At the relay voltage setting, the Metrosil current should be less than 100mA rms (the actual maximum currents passed by the units shown below their type description)

– At the maximum secondary internal fault current the Metrosil unit should limit the voltage to 1500V rms for 0.25 second. At the higher relay settings, it is not possible to limit the fault voltage to 1500V rms, hence higher voltage have to be tolerated (indicated by * ,** , ***).

The Metrosil units normally recommended for the used with 5 Amps CTs and single pole relays are shown in the following table:

Secondary Internal fault current	Recommended Metrosil Type			
	Relay Voltage Setting			
Amps rms	Up to 200V rms	250V rms	275V rms	300V rms
50A	600A/S1/S1213 C= 540/640 35mA rms	600A/S1/S1214 C= 670/800 40mA rms	600A/S1/S1214 C= 670/800 50mA rms	600A/S1/S1223 C= 740/870* 50mA rms
100A	600A/S2/P/S1217 C= 470/540 35mA rms	600A/S2/P/S1215 C= 570/670 75mA rms	600A/S2/P/S1215 C= 570/670 100mA rms	600A/S2/P/S1196 C= 620/740* 100mA rms
150A	600A/S3/P/S1219 C= 430/500 100mA rms	600A/S3/P/S1220 C= 520/620 100mA rms	600A/S3/P/S1221 C= 570/670** 100mA rms	600A/S3/P/S1222 C= 620/740*** 100mA rms

NOTE: * 2400V peak
** 2200V peak
*** 2600V peak
In some cases, single disc assemblies may be acceptable, contact Schneider Electric for detailed information.
The Metrosil units used with 5 Amps CTs can also be used with triple pole relays and consist of three single pole units mounted on the same central stud but electrically insulated from each other. To order these units please specify “Triple pole Metrosil type”, followed by the single pole type reference.

3. VOLTAGE PROTECTIONS

3.1 Setting for the Voltage Connections

For the P127, it is important to select the VTs configuration and VT protection in the Configuration/ General Options/ VT Connection and VT protection submenu in according to the relay wiring for a corrected functionality of the voltage protections.

Protection thresholds are not automatically converted when the protection mode is modified; they are directly expressed into the set protection mode. So, if the protection mode is modified, the thresholds have to be recalculated. For example, to keep the same protection level when the mode is converted from P-P to P-N, it is necessary to divide thresholds by √3.

In the above mentioned is menu you will find that for the P127 relay there are three configurations of VTs.

1. **3Vpn (Three phase-neutral connection):**

In this configuration, the relay directly measures Ua, Ub, and Uc and calculates internally the zero sequence voltage Ue = (1/3)[Ua+Ub+Uc]. This internal value Ue will be used to be compared to the threshold of Ue (the Earth Overvoltage Protection threshold and to evaluate the angle with the earth current for the earth fault directional protection). However, none UN is displayed in the measurement Menu.

2. **2Vpn + Vr (Two phase-neutral plus an Open Delta connection):**

In this configuration, the relay directly measures Ua and Ub. The input voltage of phase C of the relay (terminals 73-74) which is connected to the summation of the three voltage phases is used to be compared to the Ue (The earth Overvoltage Protection function threshold). This voltage at C input is considered as Ur and it is displayed in the measurement menu as UN.

Moreover for the phase Overvoltage and Undervoltage protection functions, the phase C voltage value Uc is internally reconstituted using the equation:

– Uc = Ua+Ub+Ur. This value will be compared to the U/V or O/V threshold in case of a fault in phase C. Uc is not displayed in the measurement menu.

– The reconstruction is valid if the Ur is measured from a transformer with 5 limb;

– two used for the phase voltage Ua and Uc and the others used in Open delta configuration for the Ur.

BE CAREFUL: IF THE Ur IS MEASURED FROM A SEPARATE TRANSFORMER THE ABOVE RECONSTRUCTION IS NOT VALID AND CAN NOT BE USED.

3. **2Vpp + Vr (Two phase-phase plus an Open Delta connection):**

The relay directly measures Uab and Ubc, the phase to phase (A-C) voltage value Uca is internally reconstituted using the equation Uca=Uab+Ubc.

The third input of voltage of the relay (terminals 73-74) can be connected to the output of a delta transformer or to a dedicated voltage transformer, the measured value can be used to compare to the earth overvoltage threshold.

This voltage is displayed in the measurement menu as UN and it is designed as the earth voltage.

4. **VT Protection:**

This setting is only available for 3VPN or 2VPN+Vr connection.

– If “VT Protection” = “Protect P-P”, threshold (P-P voltage) is the P-N threshold multiplied by √3 to match to wished physical thresholds. Example: U> flag will be activated for measured P-N voltage higher than 57V, if threshold = 100V.

– if "VT Protection" = "Protect P-N", set thresholds are P-N voltages, and effective thresholds used for protections algorithm are set thresholds multiplied by √3. Example: U> flag will be activated for measured P-N voltage higher than 57V, if threshold = 57V.

3.2 Consideration on the measurement menu

Why UN for the earth voltage measurement?

The neutral, earth or residual or zero sequence voltage are considered a single voltage and because it is not possible to modify the label in the display we have used the following terminology:

– Ue for the thresholds.

– UN for the measurement menu.

– UN in the fault recorder.

UN for the measurement and fault record menu is to intend residual, zero sequence voltage earth voltage etc.

3.3 (59N) Zero Sequence Overvoltage Protection (P125, P126 & P127)

On a healthy three phase power system, the addition of each of the three phase to earth voltages is nominally zero, as this results from the vector addition of three balanced vectors set at 120° to one another. However, when an earth fault occurs on the primary system this balance is upset and a 'residual' voltage is produced. This can be measured, for example, at the secondary terminals of a voltage transformer having a "broken delta" secondary connection. Hence, a residual voltage-measuring relay can be used to offer earth fault protection on such a system. Note that this condition causes a rise in the neutral voltage with respect to earth, which is commonly referred to as "neutral voltage displacement".

3.3.1 Setting Guidelines

The voltage setting applied to the protection elements is dependent upon the magnitude of residual voltage that is expected to occur during an earth fault condition.

This in turn is dependent upon the method of system earthing employed. It must also be ensured that the relay is set above any standing level of residual voltage that is present on the system.

The protection element has one programmable element with delay time tUe>>>>.

The setting range and the functionality limits for the residual over-voltage are described in the TD chapter, the setting menu is described in the User Guide chapter.

3.4 (27) Undervoltage Protection (P127)

Under-voltage conditions may occur on a power system for a variety of reasons, some of which are outlined below:

Increased system loading

Generally, some corrective action would be taken by voltage regulating equipment such as AVRs or On Load Tap Changers, in order to bring the system voltage back to its nominal value. If this voltage regulating equipment is unsuccessful in restoring healthy system voltage, then tripping by means of an under-voltage relay will be required following a suitable time delay.

Faults occurring on the power system result in a reduction in voltage of the phases involved in a fault. The proportion by which the voltage decreases is directly dependent upon the type of fault, method of system earthing and it's location with respect to the relay installation point. Consequently, co-ordination with other voltage and current-based protection devices is essential in order to achieve sufficient discrimination.

Complete loss of bus-bar voltage

This may occur due to fault conditions present on the incomer or busbar itself, resulting in total isolation of the incoming power supply. For this condition, it may be a requirement for each of the feeders to be isolated, so that when supply voltage is restored, the load is not connected. Hence, the automatic tripping of a CB on a feeder upon detection of complete loss of voltage on the busbar may be required. This may be achieved by a three-phase undervoltage protection element.

3.4.1 Setting Guidelines

In the majority of applications, undervoltage protection is not required to operate during system earth fault conditions. If this is the case, the protection element should be selected in the menu to operate from a phase-to-phase voltage measurement, as this quantity is less affected by the decrease of a single-phase voltage due to an earth fault.

The voltage threshold setting for the undervoltage protection element should be set at some value below the voltage decreases which may be expected under normal system operating conditions. This threshold is dependent upon the system in question but typical healthy system voltage decreases may be in the order of -10% of nominal value.

The undervoltage protection element has two programmable thresholds with delay timers: tU<, tU<<

After a trip command the thresholds will be reset when all phase voltages have risen above 105% of setting values.

The undervoltage protection element, which can be set as OR or AND logic, operates by comparing each UAB, UBC and UCA voltage input with the U<, U<< thresholds.

The relay continuously monitors the phase-to-phase voltages.

NOTE: If the relay is connected in the mode 3 Vpn to control the phase to neutral voltages, the thresholds must be multiplied by $\sqrt{3}$.

Exemple with a 400V analog VT input and a setting at 85% of this voltage:

- if this voltage is a phase to phase (Vpp) setting, U< = 85% x Un, the setting will be 340V
- if this voltage is a phase to neutral (Vpn = 230V) setting, U< = (85% x Un) x $\sqrt{3}$, the setting will be 340V

When OR operating logic is set and one or more voltage values fall below the threshold value, the tripping command is sent after the tripping timer has reached the set overtime condition.

When AND operating logic is set and all of the voltage values have fallen below the threshold value, the tripping command is sent after the tripping timer has reached the set overtime condition.

The protection element under-voltage has two programmable thresholds with definite delay time tU< and tU<<.

The two thresholds can be individually inhibited when circuit breaker is opened (52A).

Information as to the thresholds setting range can be found in the FT and TD parts of the technical guide.

3.5 (59) Overvoltage Protection (P127)

As previously discussed, under-voltage conditions are relatively common, as they are related to fault conditions etc. However, over-voltage conditions are also a possibility and are generally related to loss of load conditions as described below.

Under load shedding conditions, the supply voltage will increase in magnitude. This situation would normally be rectified by voltage regulating equipment such as AVRs or on-load tap changers. However, failure of this equipment to bring the system voltage back within prescribed limits, leaving the system with an over-voltage condition which must be cleared in order to preserve the life of the system insulation. Hence, over-voltage protection, which is suitably time delayed to allow for normal regulator action, may be applied. During earth fault conditions on a power system there may be an increase in the healthy phase voltages.

Ideally, the system should be designed to withstand such over-voltages for a defined period of time.

Normally, there will be a relay with a primary protection element employed to detect the earth fault condition and to issue a trip command if the fault is non-cleared after a nominal time. However, in this instance it would be possible to use a relay with an over-voltage protection element as back-up protection. Sufficient would be a single stage of protection, having a definite delay time.

3.5.1 Setting Guidelines

The relay with this type of protection element must be co-ordinated with any other over-voltage relay at other locations on the system. This should be carried out in a similar manner to that used for grading current operated protection devices.

The protection element over-voltage has two programmable thresholds and two delay timers, tU>, tU>>.

After a trip command the thresholds will be reset when all phase voltages have fallen below 95% of setting values.

The overvoltage protection element, which can be set as OR or AND logic, operates by comparing each UAB, UBC and UCA voltage input with the U>, U>> thresholds.

NOTE: If the relay is connected in the mode 3Vpn to control the phase to neutral voltages, the thresholds must be multiplied by $\sqrt{3}$.

When OR operating logic is set and one or more voltage has risen above the threshold value, the tripping command is sent after the tripping timer has reached the set overtime condition.

When AND operating logic is set and all of the voltage values have risen above the threshold value, the tripping command is sent after the tripping timer has reached the set overtime condition.

Information as to the thresholds setting range can be found in the FT and TD parts of the technical guide.

3.6 Negative sequence overvoltage protection

Where an incoming feeder is supplying a switchboard which is feeding rotating plant (e.g. induction motors), correct phasing and balance of the ac supply is essential. Incorrect phase rotation will result in any connected motors rotating in the wrong direction. For directionally sensitive applications, such as elevators and conveyor belts, it may be unacceptable to allow this to happen

Any unbalanced condition occurring on the incoming supply will result in the presence of negative phase sequence (nps) components of voltage. In the event of incorrect phase rotation, the supply voltage would effectively consist of 100% negative phase sequence voltage only

3.6.1 Setting guideline

The negative sequence overvoltage protection has two independent thresholds: V2> and tV2>.

Any unbalanced condition occurring on the incoming supply will result in the presence of negative phase sequence (nps) components of voltage. In the event of incorrect phase rotation, the supply voltage would effectively consist of 100% negative phase sequence typical.

The operation time of the element will be highly dependent on the application. A typical setting would be in the region of 5s.

The relay will trip according to an inverse characteristic or a definite time characteristic for the first stage and according to a definite time characteristic for the second stage.

The inverse characteristic is given by the following formula:

$$t = K / (M - 1)$$

Where: K = Time Multiplier Setting
t = operating time in seconds
M = Applied input voltage / Relay setting voltage (Vs).

4. OTHER PROTECTION FUNCTION INTEGRATED IN P127

4.1 Under/Over frequency (81 U/O)

4.1.1 Description

Time delayed under and over frequency protection available on P127 provides the fundamental form of frequency protection.

Six thresholds are available: Each one can be configured to detect an under or over frequency within the range [fn – 4,9Hz, fn + 4,9Hz], where fn is the nominal frequency selected (50Hz or 60Hz). A definite timer is assigned to each threshold.

When the frequency measured is crossing one of the 6 pre-defined thresholds, the relays generates a start signal and after a user settable time delay, a trip signal.

NOTE: Under / Over frequency protection is available when voltage inputs are connected.

4.2 Rate of frequency change protection (dF/dt) (81R)

4.2.1 Description

The calculation of the rate of change of frequency is an average measurement of the instantaneous values over a programmable number of cycles (1 to 200); refer to the ‘CONFIGURATION / General options" menu. The instantaneous values of rate of change of frequency are measured every cycle (20ms at 50Hz). The rate of frequency change elements are very important to detect any power loss under severe disturbances and eventually perform load shedding of secondary load.

These elements offer the possibility to detect the tendency of the variation of frequency, and thus re establish the correct load/generation without waiting for big frequency reduction. These elements could be combined to the frequency elements using the AND logic equations to provide a very useful mechanism allowing a more secure trip decision to be achieved during transient system disturbances.

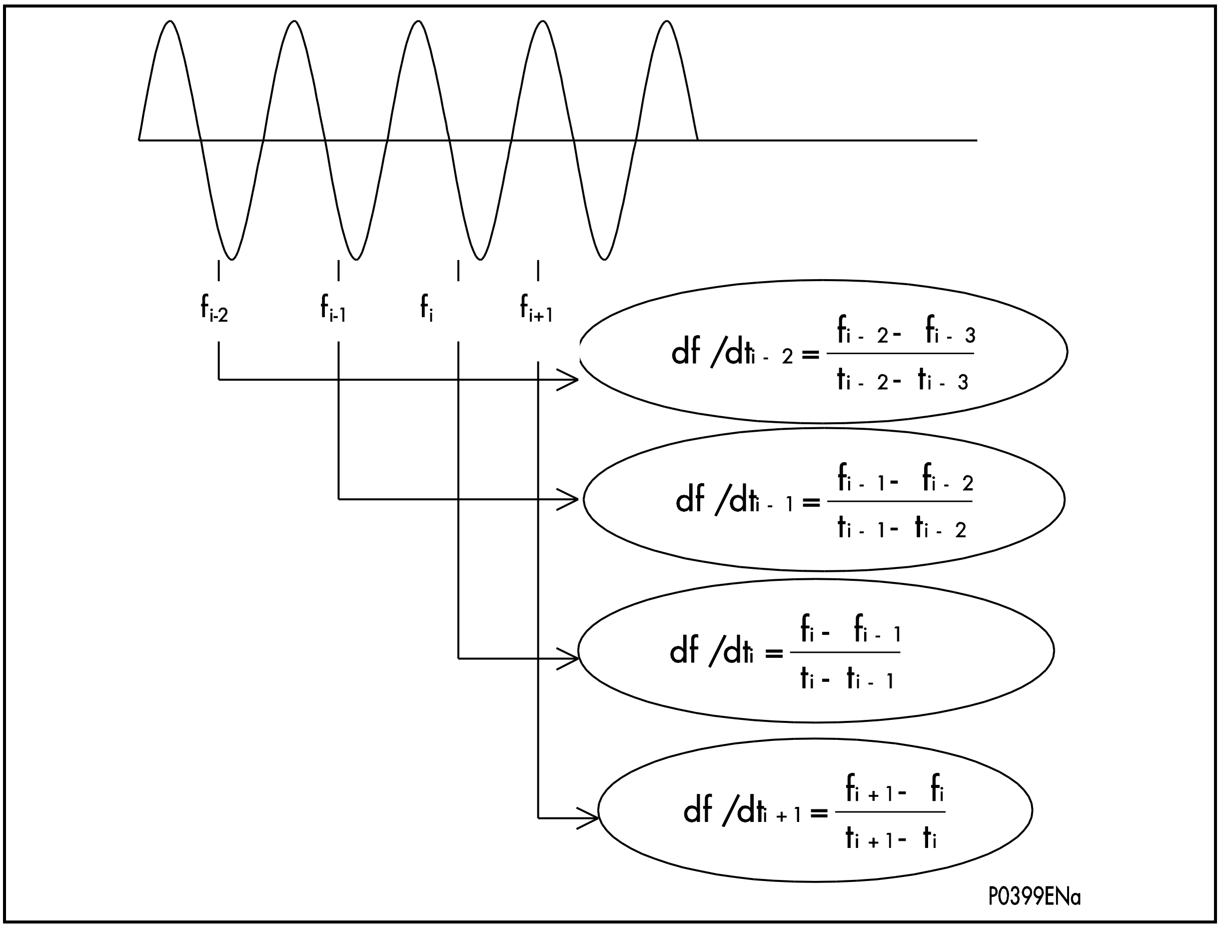
According ‘CONFIGURATION / General options’ setting, this function will be inhibited in the following case:

– if the voltage level for each phase is below the settable undervoltage blocking value (see “Prot. Freq. Block U<” cell),

– if the frequency is out of range: $f_{measured}$ > (fn+20Hz) or $f_{measured}$ < (fn–20Hz)

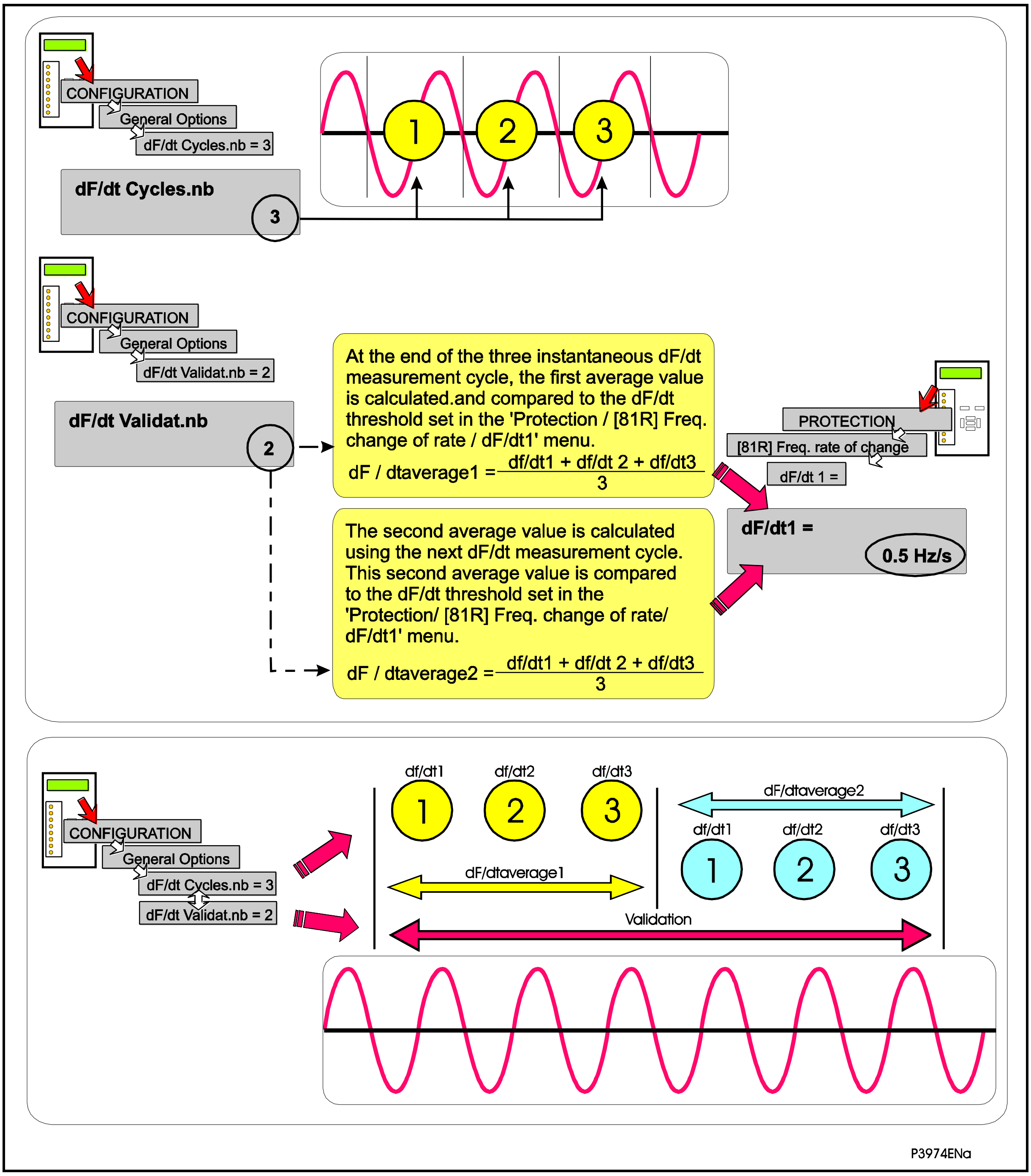
– if dF/dt > ±20hz/s and “Inhib. dF/dt>20Hz/s” is set to “No”.

4.2.2 dF/dt functionning



The rates of change of frequency are calculated every cycle based upon zero crossing.

NOTE: To be insensitive to the phase shift and vector jumps, we can reject all measurements of dF/dt greater than 20Hz/s .



With "dF/dt Validation nb = 2", the rate of change of frequency:

– will be validated when dF/dtaverage1 and dfF/dtaverage2 exceed df/dt1 setting value (protection menu).

– will not be validated when only one of the average value exceeds df/dt1 setting value.

NOTE: the rate of change of frequency is available when voltage inputs are connected.

4.3 3 phases directional Over / Under power (32)

4.3.1 Description

MiCOM P127 provides the three-phase power protection which monitors the active and reactive power limits and detects (when selected):

– active overpower value on thresholds P> and P>>,

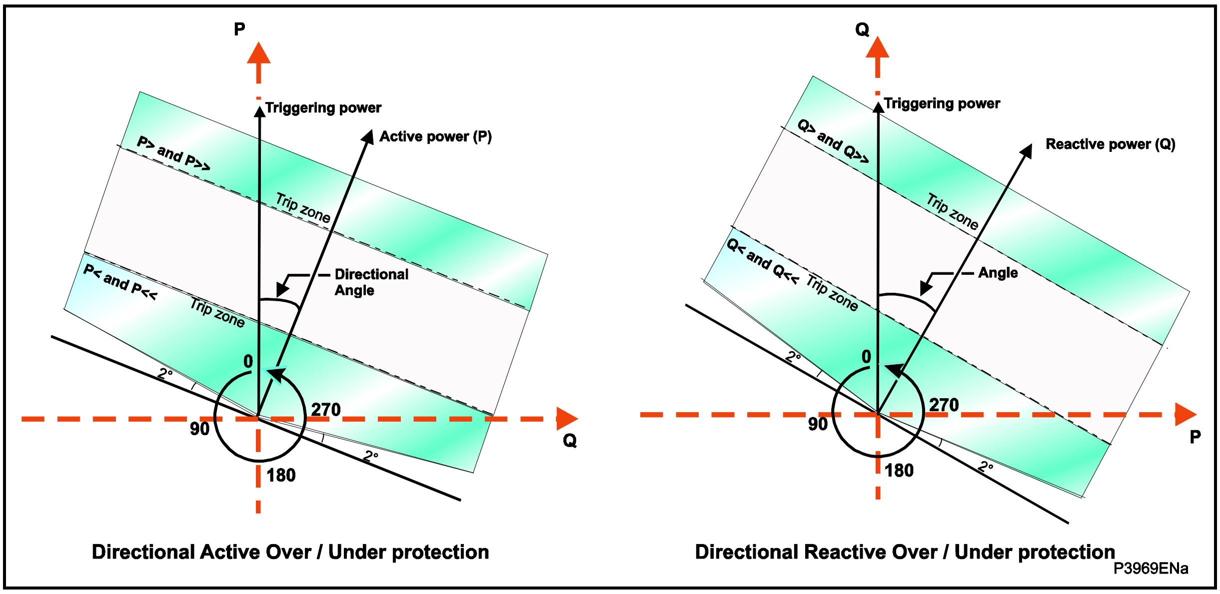
– reactive overpower value on thresholds Q> and Q>>,

– active underpower value on thresholds P< and P<<,

– reactive underpower value on thresholds Q< and Q<<.

A definite timer is assigned to each threshold. When the active and reactive power measurements are inside the trip zone, the relays generates a start signal and after a user settable time delay, a trip signal.

The directional angle between active (or reactive) over / under power and triggering power can be adjusted between 0° and 359°.



4.3.2 Power Measurement displayed

For the P127, it is important to select the VTs configuration in the Configuration/ General Options/ VT Connection submenu in according to the relay wiring for a corrected functionality of the power protections (See 3.1)

3Vpn (Three phase-neutral connection)

2Vpn + Vr (Two phase-neutral plus an Open Delta connection)

2Vpp + Vr (Two phase-phase plus an Open Delta connection)

NOTE: P> “100x 1W” if the secondary of the CT = 1A, and the setting of P> = 100W
“P> “100x 5W” if the secondary of the CT = 5A, and the setting of P> = 500W

<u>Example1:</u>

VT connection = 3Vpn

CT Ratio = 100A / 1A

VT Ratio = 2kV / 100V

I = 10A primary = 100mA secondary injected on the 3 phases,

V = 1155V primary = 57.7V secondary injected on the 3 phases

Phase Difference = 0 degrees

P= 57.7 x 0.1 cos (0) + 57.7x 0.1 cos (0) + 57.7 x 0.1 cos (0) = 17.3 W sec
or 17.3 x CT Ratio x VT Ratio x K (K= CT 1A or 5A) = 17.5 x 100 X 20 x 1 = 35000 W Primary

4.3.2.1 Active power (P)

The calculation of the active power is:

For a 3 Vpn or a 2Vpn+Vr connection:

$$P = Ua*Ia*\cos(Ua \wedge Ia) + Ub*Ib*\cos(Ub \wedge Ib) + Uc*Ic*\cos(Uc \wedge Ic)$$
$$Sn = 3.In \cdot Un$$

For a 2Upp+Vr connection:

$$P = Uab*Ia*\cos(Uab \wedge Ia) - Ubc*Ic*\cos(Ubc \wedge Ic)$$
$$Sn = \sqrt{3}.In \cdot Un$$

$$P'' = \frac{P}{\sqrt{3}.KI \cdot KU \cdot Un}$$
$$P' = InTA \cdot UnTV \cdot P'' = \frac{InTA \cdot UnTV}{\sqrt{3}.KI \cdot KU \cdot Un} P$$

where:

– P the active power expressed in ADC (Analog to Digital Conversion) points

where In and Un are respectively the nominal current and voltage to the secondary side

– P” the active power to the secondary side expressed in Pn

– P’ the active power to the primary side expressed in Watt

Since these are measurements used only for protection purposes, they aren’t displayed on HMI.

4.3.2.2 Reactive power (Q)

The calculation of the reactive power is:

For a 3 Vpn or a 2Vpn+Vr connection:

$$Q = Ua*Ia*\sin(Ua \wedge Ia) + Ub*Ib*\sin(Ub \wedge Ib) + Uc*Ic*\sin(Uc \wedge Ic)$$

For a 2Upp+Vr connection:

$$Q = Uab*Ia*\sin(Uab \wedge Ia) - Ubc*Ic*\sin(Ubc \wedge Ic)$$

$$Q'' = \frac{Q}{\sqrt{3}.KI \cdot KU \cdot Un}$$
$$Q' = InTA \cdot UnTV \cdot Q'' = \frac{InTA \cdot UnTV}{\sqrt{3}.KI \cdot KU \cdot Uan} Q$$

where:

– Q is the reactive power expressed in ADC (Analog to Digital Conversion) points

where In and Un are respectively the nominal earth current and voltage to the secondary side

– Q” is the reactive earth power to the secondary side expressed in VAR

– Q’ is the reactive earth power to the primary side expressed in VAR

Since these are measurements used only for protection purposes, they aren’t displayed on HMI.

4.3.2.3 Phase shifts of the power

The calculation of the phase shift of the power *phi* is:

$$phi = \arctan\left(\frac{Q}{P}\right)$$

4.3.3 Overview

Using a MiCOM P127 relay as a stand alone power relay provides a wide setting range, the setting range available is dependent on the VT range ordered. The table below outlines the settings available for each of the VT input ranges.

	Analogue Input		
	CT Range (A)	VT Range (V)	P
P127AA	0.1 – 40	57 – 130	1 – 10000xk W with k = 1 or 5 A
P127AB		220 - 480	4 – 40000xk W with k = 1 or 5 A
P127BA	0.01 – 8	57 – 130	1 – 10000xk W with k = 1 or 5 A
P127BB		220 - 480	4 – 40000xk W with k = 1 or 5 A
P127CA	0.002 – 1	57 – 130	1 – 10000xk W with k = 1 or 5 A
P127CB		220 - 480	4 – 40000xk W with k = 1 or 5 A

5. DESCRIPTION AND SETTING GUIDE OF THE AUTORECLOSE FUNCTION (P126 & P127)

5.1 Introduction

An analysis of faults on any overhead line network has shown that:

– 80 - 90% are transient in nature,

– the remaining 10-20% of faults are either non-permanent (arcing fault) or permanent.

A transient fault is a self-clearing ‘non-damage’ fault. This type of fault can be isolated and cleared by the immediate tripping of one or more circuit breakers, and does not recur when the line is re-energised. The most common cause of transient faults are lightning, insulator flashover clashing conductors and wind blown debris.

The immediate trip will not clear a non-permanent or permanent fault, and the use of the recloser may be necessary to clear it. A small tree branch falling on the line could cause a non-permanent fault. Permanent faults could be broken conductors, transformer faults, cable faults or machine faults that must be located and repaired before the supply can be restored.

Most of the time, if the faulty line is immediately tripped, and the fault arc has sufficient time to de-ionise, reclose of the circuit breakers will result in the line being successfully re-energised. Autoreclose schemes are used to automatically reclose a switching device once a time delay has elapsed and starting after the CB has opened.

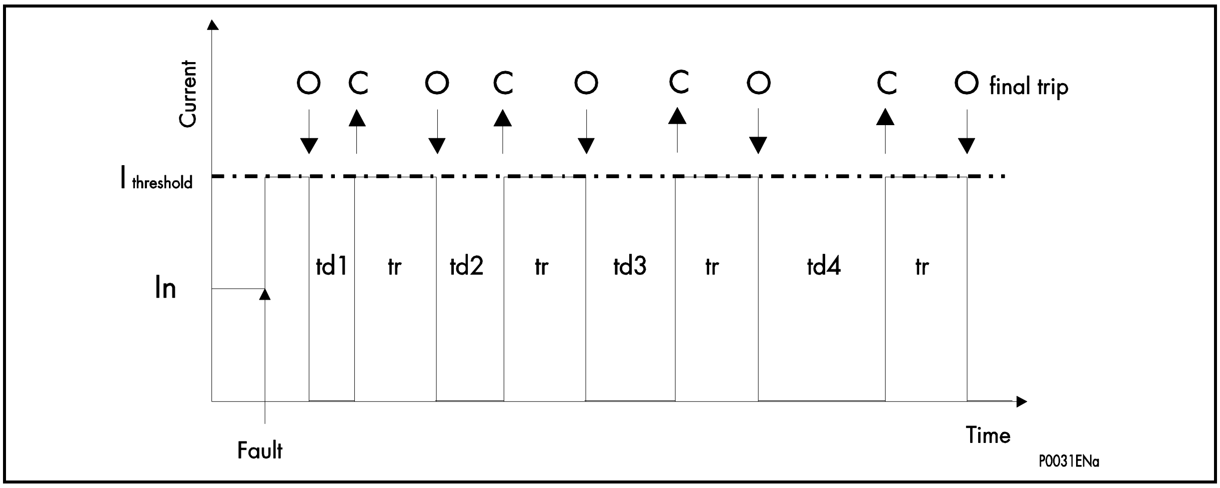
On HV and MV distribution networks, the autoreclose function is applied mainly to radial feeders where system stability problems do not generally arise. Using the autoreclose minimises time of interruption and reduces operating costs.

Automatic autorecloser allows a substation to operate unattended:the number of visits to manually reclose a circuit breaker is substantially reduced. This feature constitutes therefore an important advantage for substations supervised remotely.

On circuits using time graded protection, the automatic autorecloser allows the use of instantaneous protection to give a high speed first trip. With fast tripping, the duration of the power arc resulting from an overhead line fault is reduced to a minimum, thus lessening the chance of damage and to develop the transient fault into a permanent fault.

Using short time delay protection prevents blowing of fuses and reduces circuit breaker maintenance by eliminating pre-arc heating when clearing transient faults.

The next figure shows an example of 4 autoreclose cycles (maximum numbers of allowed cycles) to the final trip (in the following diagram, td1, td2, td3, td4 = dead time 1, 2, 3 and 4 timers, tr = Reclaim time, O = CB open and C = CB closed).



TYPICAL AUTORECLOSE CYCLES

When short time delay protection is used with autoreclose, the scheme is normally arranged to block the instantaneous protection after the first trip. Therefore, if the fault persists after re-closing, time-graded protection will give discriminative tripping with fuses or other protection devices, resulting in the isolation of the faulted section. However, for certain applications, where the majority of the faults are likely to be transient, it is not uncommon to allow more than one instantaneous trip before the instantaneous protection is blocked.

Some schemes allow a number of re-closings and time graded trips after the first instantaneous trip, which may result in the burning out and clearance of non-permanent faults. Such an approach may also be used to allow fuses to operate in teed feeders where the fault current is low.

Any decision to apply the autoreclose function would be influenced by all data known on the frequency of transient faults (for instance feeders which consist partly of overhead lines and partly of underground cables). When a significant proportion of the faults are permanent, the advantages of autoreclose are small, particularly since re-closing on to a faulty cable is likely to aggravate the damage.

5.2 Description of the function

5.2.1 Autorecloser activation

The autoreclose function is activated using “AUTOMAT. CTRL/ PROTECTION G1” menu. The same settings apply for the Menu PROTECTION G2.

The autoreclose function of the relay is available only if the following conditions are verified:

– The auxiliary contact of the CB status 52a must be connected to the relay.
Refer to the “AUTOMAT. CTRL/Inputs” menu

– The trip output relay RL1 must not be latched to the earth and/or phase protection function.
Refer to the “AUTOMAT. CTRL/Latch functions” menu

NOTE: If the auxiliary supply is lost during an autoreclose cycle, the autoreclose function is totally disabled.

In addition to Autoreclose settings, the user will be able to fully link the autoreclose function to the protection function using the menus “PROTECTION G1/Phase OC” and “PROTECTION/E/Gnd”.

5.2.2 Logic Inputs

The autoreclose function has four inputs that can be assigned to the autoreclose logic. These inputs can be opto-isolated inputs configured for that under the “AUTOMAT. CTRL” menu. External contacts can then be wired to be used as an input and influence the autorecloser scheme. These 4 inputs are:

– one external CB fail,

– two external starting orders,

– one external blocking order.

The following table gives the “AUTOMAT.CTRL/Inputs” menu assigned to the autoreclose logic input. The second column presents the menu disabling the function if not assigned in the “PROTECTION G1/Autoreclose” menu (Setting = No).

	“Inputs” menu	Enabled with:
External CB Fail	CB FLT	EXT CB FAIL
External starting orders	Aux 1 Aux 2	CYCLES tAux1 * CYCLES tAux2 *
External blocking order	Block-79	Ext Block ?

* These two external orders can be independently disabled.

5.2.2.1 External CB fail

Most of circuit breakers provide one trip-close-trip cycle. A delay time is necessary to return to the nominal state of the CB (for example, the spring that allows the circuit breaker to close should be fully charged). The state of the CB can be checked using an input assigned to the “CB FLT” function. If on completion of the “Ext CB Fail time” (tCFE), the “CB FLT” indicates a failed state of the CB, a lockout occur and the CB remains open.

5.2.2.2 External starting orders

Two independent and programmable inputs (Aux 1 and Aux 2) can be used to initiate the autorecloser function from an external device (such as an existing overcurrent relay). These logic inputs may be used independently and also in parallel with the MiCOM P123 Overcurrent settings.

5.2.2.3 Internal and external blocking order

The autoreclose can be blocked by an internal or an external control. It can be used when a protection is needed without requiring the use of the autorecloser function.

The external block is the “Block 79” input.

The internal block can be a final trip, a number of A/R rolling demand valid or an A/R conflict.

A typical example is on a transformer feeder, where the autoreclose may be initiated from the feeder protection but need to be blocked from the transformer protection side.

5.2.3 Autoreclose Logic Outputs

The following output signals can be assigned to a LED (see “CONFIGURATION / Led” menu) or to the output relays (see “AUTOMAT.CTRL/Output Relays” menu) to provide information about the status of the autoreclose cycle.

– Autoreclose in progress

– Final Trip (internal or external activation).

The following table gives the “CONFIGURATION/Led” and the “AUTOMAT.CTRL/Output Relays” menus used to assign the autoreclose output signal.

	LED menu	Output relays menu
Autoreclose in progress	79 Run	79 Run
Final Trip:		
Autoreclose lock activated by the internal process of the autoreclose	79Int. Locked	79 int. Lock.
Autoreclose lock activated by the input “block 79”	79Ext. Locked	79 ext. Lock.

5.2.3.1 Autoreclose in progress

The “Autoreclose in progress” signal is present during the complete reclose cycles from protection initiation to the end of the reclaim time or lockout.

5.2.3.2 Final trip

The "Final trip" signal indicates that a complete autoreclose cycle has been completed and that the fault has been cleared.

The "Final trip" signal can be reset after a manual closing of the CB after the settable “inhibit time (tI)”.

5.2.4 Autoreclose logic description

The autoreclose function provides the ability to automatically control the autorecloser (two, three or four shot cycle, settable using “Phase Cycles” and “E/Gnd Cycles” menu). Dead times for all the shots (reclose attempts) can be independently adjusted.

The number of shots is directly related to the type of faults likely to occur on the system and the voltage level of the system (for instance medium voltage networks).

The Dead Time (tD1, tD2, tD3 and tD4) starts when the CB has tripped (when the 52a input has disappeared). Dead Time is adjusted to start autoreclose when circuit breaker is closed.

> NOTE: If an electromagnetic relay is used (working on the principle of disc in the electromagnetic field due to eddy current generated in the disc), an additional dead time, depending of the tripping cause, is settable,

At the end of the relevant dead time, “CB FLT” input is sent (see § 5.2.2.1).

The reclaim time (tR) starts when the CB has closed. If the circuit breaker does not trip again, the autoreclose function resets at the end of the reclaim time.

If the protection operates during the reclaim time, the relay either advances to the next shot that is programmed in the autoreclose cycle, or it locks out (see § 5.2.6).

The total number of reclosures is displayed under the “MEASUREMENTS/Reclose Stats” menu.

5.2.5 Autoreclose Inhibit Following Manual Close

The “Inhib Time tI” timer can be used to block the autoreclose being initiated after the CB is manually closed onto a fault. The Autoreclose is blocked during the “Inhib Time tI“ following manual CB Closure.

5.2.6 Recloser lockout

If the protection element operates during the reclaim time, following the final reclose attempt, the relay will lockout and the autoreclose function is disabled until the lockout condition resets.

The lockout condition can reset by a manual closing after the "Inhib Time tI".

The Autoreclose can also be locked out using a “CB FLT” input. This information can be issued from the "not charged" or "Low gas pressure" indications of CB springs.

Note that Autoreclose can also be locked by:

– The fact that the CB doesn’t open after tBf delay (CB Fail)

– An operating time that is above programmed thresholds.

5.2.7 Setting group change lockout

The change of setting groups is only possible if there are no protection or automation functions running (except the thermal overload function). During the autorecloser cycle, if the relay receives an order to change setting groups, this order is kept in memory, and will only be executed after the timer has elapsed.

5.2.8 Rolling demand

This specific counter avoids a frequent operation of a CB in case of frequent intermittent fault. The numbers of shoot can be adjusted from 1 to 100 in the cell “Max cycles nb”, settable in a time period from 10min to 24 hours.

The rolling demand is used when a definite number of successfully recloses are made on a definite time.

5.3 Setting Guidelines

5.3.1 Number Of Shots

There is no perfect rule to define the number of shots for a particular application.

For medium voltage systems it is common to use two or three autoreclose shots, and, for specific applications, four shots. Using four shots, final dead time can be set for a time long enough to allow thunderstorms to stop before definitive final reclose. This scheme prevents unnecessary lockout caused by consecutive transient faults.

Typically, the first trip, and sometimes the second, are caused by the instantaneous protection. Since 80% of faults are transient, the following trips will be time delayed, and all will have increasing dead times to clear non-permanent faults.

In order to determine the number of shots required; the first factor is the ability for the circuit breaker to perform several trip-close operations in a short time and, the effect of these operations on the maintenance period.

If a moderate percentage of non-permanent faults is present in a system, two or more shots are justified. If fused 'tees' are used and the fault level is low, the timer of the fuses may not discriminate with the main IDMT relay: several shots are usefull. This would not warm up the fuse to a such extent that it would eventually blow before the main protection operated.

5.3.2 Dead Timer Setting

Load, circuit breaker, fault de-ionising time and protection reset are taken into consideration when setting the dead timer.

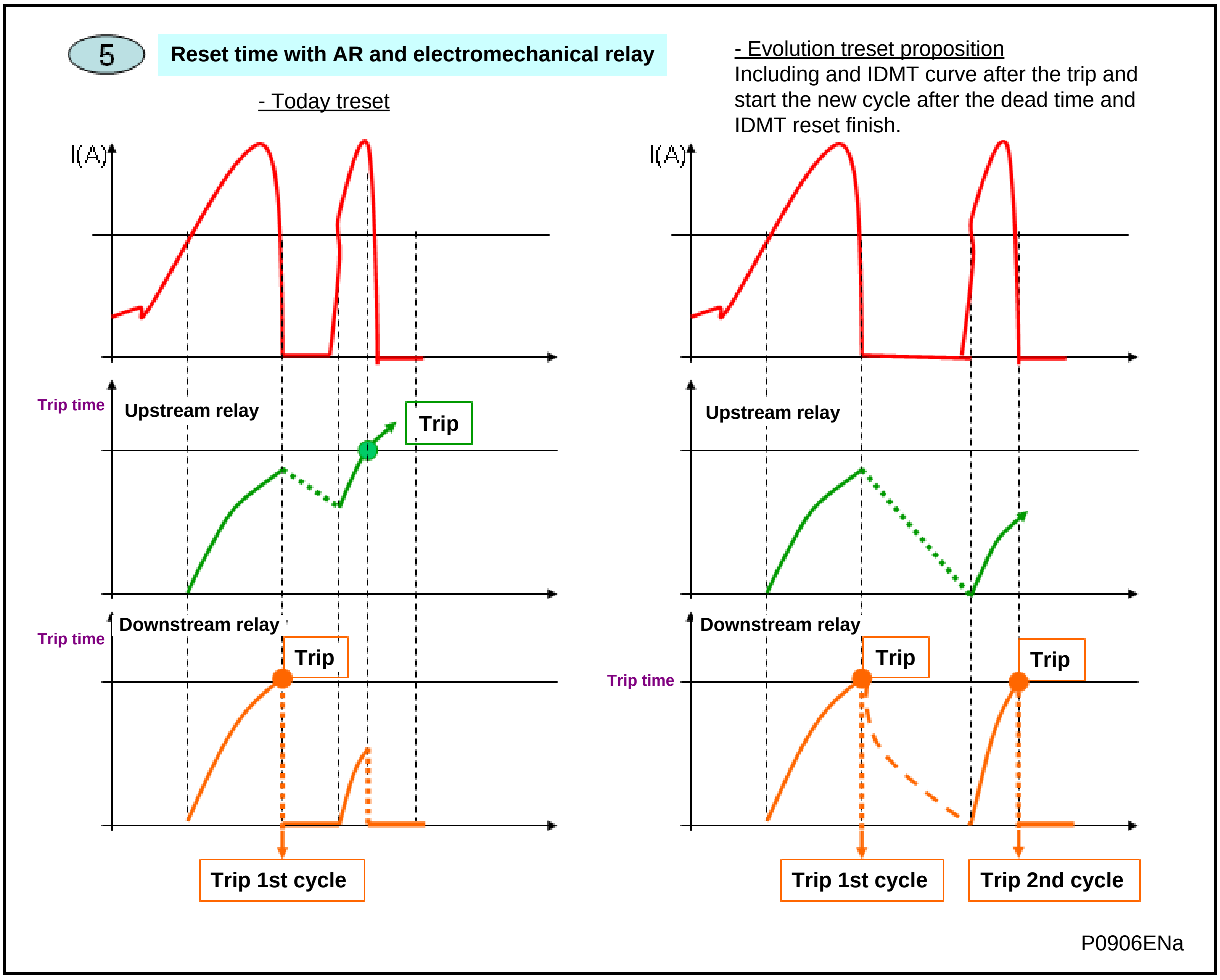
5.3.3 Minimum drop-off time setting

If an electromagnetic relay is used (working on the principle of disc in the electromagnetic field due to eddy current generated in the disc), an additional dead time (tI>, tI>>, tI>>>, tIe>, tIe>> or tIe>>>) depending of the tripping cause is settable,

This function includes the choice to select an IDMT curve on the relay reset time, setting the dropp-off time on phase and neutral autoreclose cycles.

This drop-off time blocks the next cycle if this one not elapsed.

A next cycle can be start if the dead time is elapsed and treset elapsed to.



NOTE: this function is currently used with IDMT curve.
If dead time > Drop-off time, the relay will close the CB at the end of dead time.
If dead time < Drop-off time, the relay will close the CB at the end of dropp-off time.

5.3.3.1 Load

It is very difficult to optimize the dead time due to the great diversity of load on a system. However, it is possible to study each type of load separately and thereby be able to define a typical dead time.

The most common types of loads are synchronous or induction motors and lighting circuits.

Synchronous motors tolerate only extremely short interruptions of supply without loss of synchronism. In practice, the dead time should be sufficient to allow the motor no-volt device to operate. Typically, a minimum dead time of 0.2-0.3 seconds is recommended.

Induction motors, on the other hand, can withstand supply interruptions, up to a maximum of 0.5 seconds and re-accelerate successfully. In general dead times of 3-10 seconds are normally satisfactory, but there may be special cases for which additional time is required to allow the reset of manual controls and safety devices.

Loss of supply of lighting circuits, such as street lighting, can lead to important safety problems (car circulation). Regarding domestic customers, the main consideration is linked to the inconvenience caused.

The number of minutes lost per year to customers will be reduced on feeders using the autorecloser and will also be affected by the dead time settings used.

5.3.3.2 Circuit Breaker

For high speed autoreclose, the minimum dead time of the power system depends on the minimum time delay imposed by the circuit breaker during a trip and reclose operation.

Since a circuit breaker is a mechanical device, it has an inherent contact separation time. This operating time for a modern circuit breaker is usually within the 50-100ms range, but could be longer with older designs.

NOTE: The closing pulse time delay (adjusted using 'AUTOMAT. CTRL / CB Supervision / tClose Pulse' setting) should be higher than the time delay necessary to close the CB (mechanical closing and CB Closing loop). In the same way, the opening pulse time delay ('AUTOMAT. CTRL / CB Supervision / tOpen Pulse' setting) should be higher than the time delay necessary to open the CB. Otherwise, the autorecloser can be locked.

Once the circuit breaker has reset, the breaker can start to close. The period of time between the energisation of the closing mechanism and the making of the contacts is called closing time. Because of the time constant of a solenoid closing mechanism and the inertia of the plunger, a solenoid closing mechanism may take 0.3s. A spring operated breaker, on the other hand, can close in less than 0.2 seconds.

Where high speed reclosing is required, for the majority of medium voltage applications, the circuit breaker mechanism dictates itself the minimum dead time. However, the fault de-ionising time may also have to be considered.

High speed autoreclose may be required to maintain stability on a network that has two or more power sources. For high speed autoreclose, the system disturbance time should be minimised using fast protection, <50 ms, such as distance or feeder differential protection and fast circuit breakers < 100 ms. Fast fault clearance can reduce the time for the fault arc to de-ionise.

To ensure stability between two sources, a dead time of <300 ms is typically required. Considering only the CB, this minimum time corresponds to the reset time of the mechanism plus the CB closing time. Thus, a solenoid mechanism is not adapted for high speed autoreclose due to the fact that the closing time is generally too long.

5.3.3.3 Fault De-ionising Time

For high speed autoreclose, the time to de-ionise faults may be the factor the most important when considering the dead time. This is the time required for the ionised air to disperse around the fault position so that the insulation level of the air is restored. This time may be around the following value:

De-ionising time = (10.5 + ((system voltage in kV)/34.5)) / frequency

For 66 kV = 0.25 s (50Hz)

For 132 kV = 0.29 s (50 Hz)

5.3.3.4 Protection Reset

It is essential that the protection fully resets during the dead time, so that correct time discrimination is maintained after reclose on to a fault. For high speed autoreclose, instantaneous reset of protection is required.

Typical 11/33kV dead time settings in the UK are as follow:

1st dead time = 5 - 10 seconds

2nd dead time = 30 seconds

3rd dead time = 60 - 100 seconds

4th dead time (uncommon in the UK, however used in South Africa) = 60 - 100 seconds

5.3.4 Reclaim Timer Setting

The following factors influence the choice of the reclaim timer:

– Supply continuity - Large reclaim times can result in unnecessary lockout for transient faults.

– Fault incidence/Past experience - Small reclaim times may be required where there is a high incidence of lightning strikes to prevent unnecessary lockout for transient faults.

– Charging time of the spring or resetting of electromagnetical induction disk relay - For high speed autoreclose, the reclaim time may be set longer than the spring charging time to ensure that there is sufficient energy in the circuit breaker to perform a trip-close-trip cycle. For delayed autoreclose, this setting is of no need as the dead time can be extended by an extra CB healthy check window time if there is insufficient energy in the CB. If there is insufficient energy after the check window time the relay will lockout.

– Switchgear Maintenance - Excessive operation resulting from short reclaim times can mean shorter maintenance periods. A minimum reclaim time of 5s may be needed to give sufficient time to the CB to recover after a trip and close before it can perform another trip-close-trip cycle.

The reclaim time must be long enough to allow any time delayed protection leading to autoreclose to operate. Failure to do so can cause the autoreclose scheme to reset too soon and the reactivation of the instantaneous protection.

If that were the case, a permanent fault would look like some transient faults, caused by continuous autorecloses. Applying a protection against excessive fault frequency lockout is an additional precaution that can solve this problem.

It is possible to obtain short reclaim times to obtain less lockouts of the CB by blocking the reclaim time from the protection start signals. If short reclaim times are to be used, then the switchgear rating may dictate the minimum reclaim time.

Sensitive earth fault protection is used to detect high resistance earth faults. The time delay of such protections is usually a long time delay, typically about 10-15s. If autoreclose is generated by the SEF protection, this timer must be taken into account when deciding the value of the reclaim time, if the reclaim time is not blocked by an SEF protection start signal. Sensitive earth faults, caused by a broken overhead conductor in contact with dry ground or a wood fence are rarely transient faults and may be dangerous to people.

It is therefore common practice to block the autoreclose using the sensitive earth fault protection and lockout the circuit breaker.

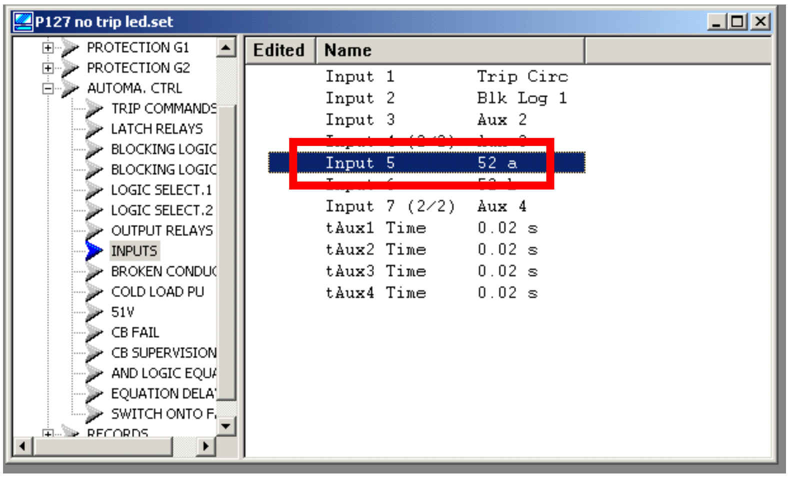
Where motor-wound spring closed circuit breakers are used, the reclaim time must be at least as long as the spring winding time for high speed autoreclose to ensure that the breaker can perform a trip-close-trip cycle.

A typical 11/33kV reclaim time is 3-10 seconds, this prevents unnecessary lockout during thunderstorms. However, times up to 60-180 seconds maybe used.

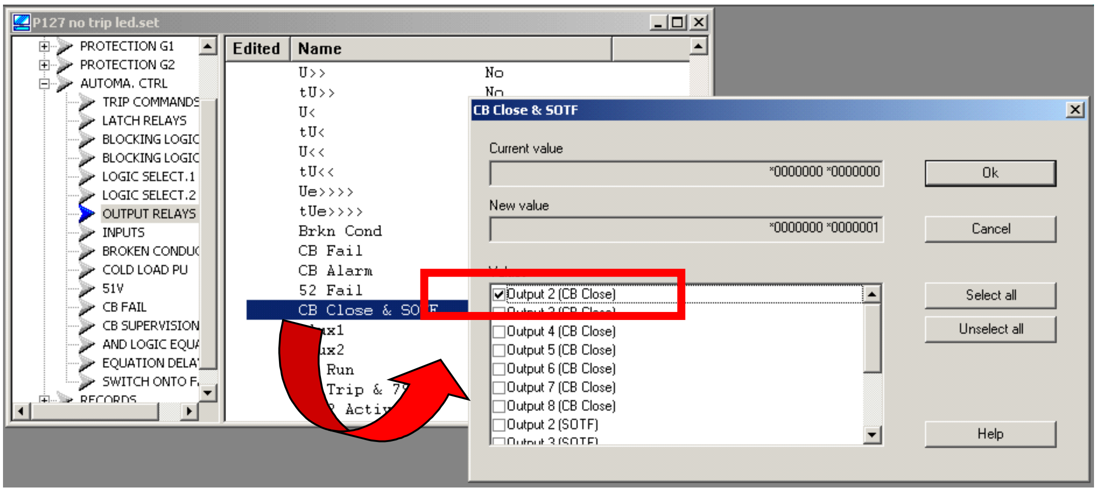
5.3.5 Autoreclose setting guideline

5.3.5.1 General setting

SETTING CONDITION FOR THE ARC FUNCTIONALITY		
“PROTECTION Gx / [79] AUTORECLOSE”		
“Autoreclose”	Yes	
“Phase Cycles” or/and “E/GND Cycles”	At least 1	If the cycle = 0 none autoreclose available
“Cycles xxxx”	1234 0111	Max number cycle: max. 4 cycles
“AUTOMA. CTRL / INPUTS”		
One of the digital inputs. The relevant input must be configured as Active High	52a	This input must be in accordance with the CB position: HIGH with CB close, LOW with CB opened.



“AUTOMA. CTRL / OUTPUTS RELAYS”		
“CB Close & SOTF” One of the relays from 2 to 8	CB Close	This relay must be only assigned to this function.

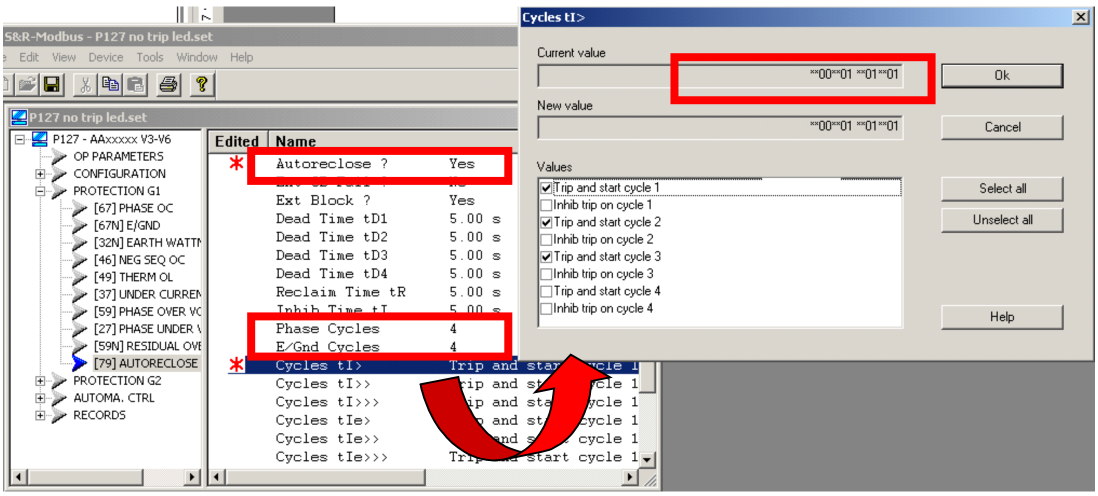


5.3.5.2 Trip and reclose (normal operation)

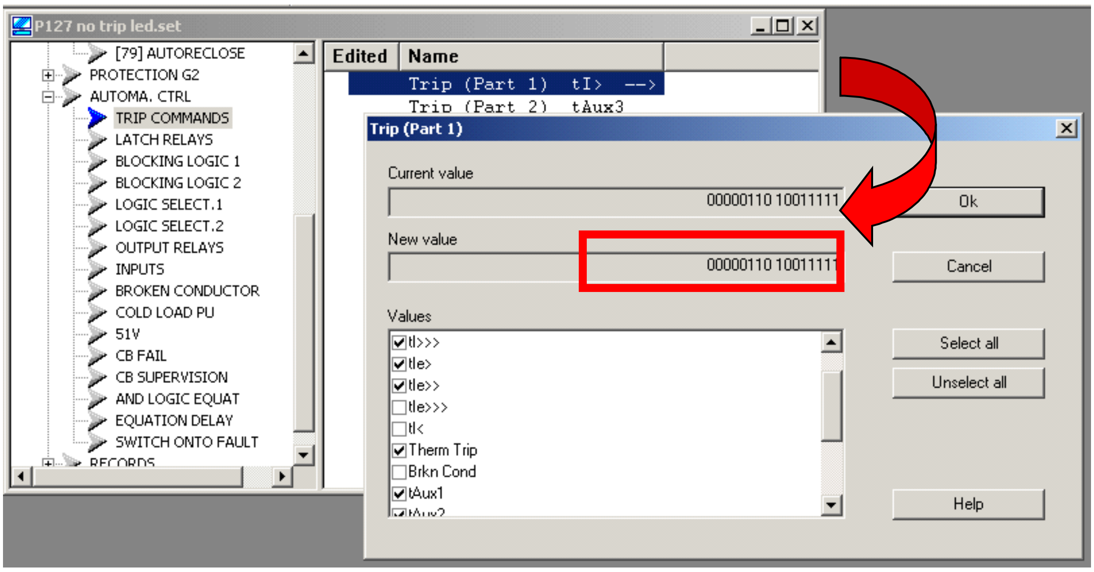
Autoreclose starts only if tripping order (RL1) has been performed (Trip & Start).

Red LED of trip will always come whenever autoreclose starts.

“PROTECTION Gx / [79] AUTORECLOSE”		
“Autoreclose”	Yes	
“Phase Cycles” or/and “E/GND Cycles”	At least 1	If the cycle = 0 none autoreclose available
Cycles tI>, tI>>, tI>>>, tIe>, tIe>>, tIe>>>, tPe/IeCos>, tPe/IeCos>>	1234 0111	Max number cycle: max. 4 cycles



“AUTOMA. CTRL / TRIP COMMANDS”		
Trip Commands	At least a trip command.	Overcurrent and/or earth fault overcurrent trip thresholds (One of them is enough)



5.3.5.3 Autoreclose only (external trip)

Since v11.B version, it is now possible to inhibit trip order (tick Trip & Inhib trip) in the settings file to work like a standalone autorecloser (see the next figure).

In the following configuration:

– tAux is removed from Trip commands,

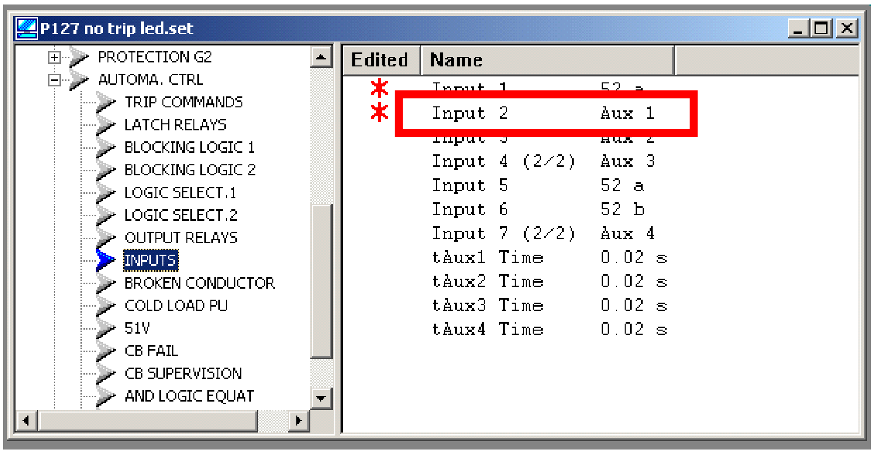
– No trip is performed from autoreclose function,

– Trip LED will remain OFF.

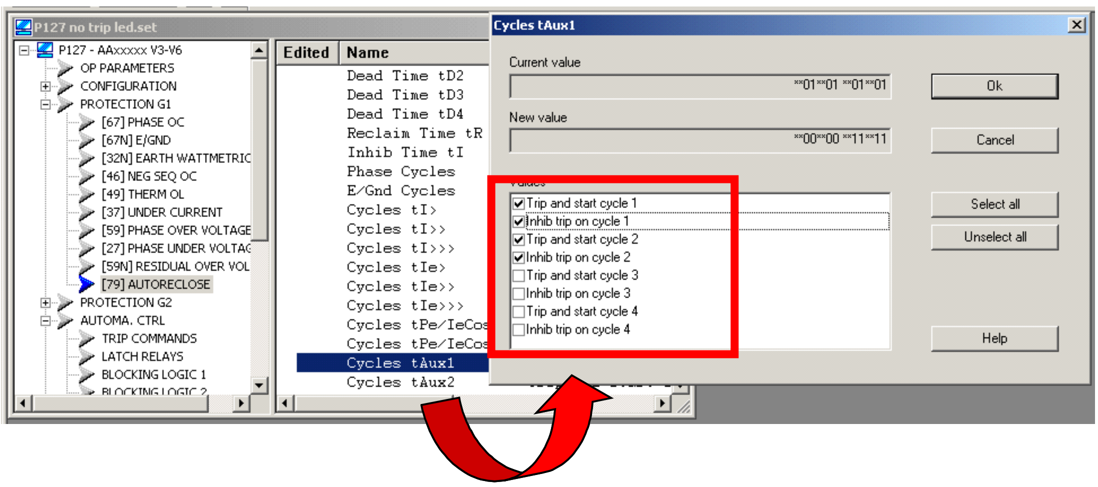
“PROTECTION Gx / [79] AUTORECLOSE”		
“Autoreclose”	Yes	
“Phase Cycles” or/and “E/GND Cycles”	At least 1	If the cycle = 0 none autoreclose available
“Cycles tAux1” “Cycles tAux2”		For each cycle used, enable “trip and start cycle” **AND** “Inhib trip on cycle”

To achieve “autoreclose only” setting, external start should be wired on a digital input. This digital input should be assigned to tAux1 and/or tAux2.

“AUTOMA. CTRL / INPUTS”		
Automat control inputs	Aux	Select on Automat control input Aux

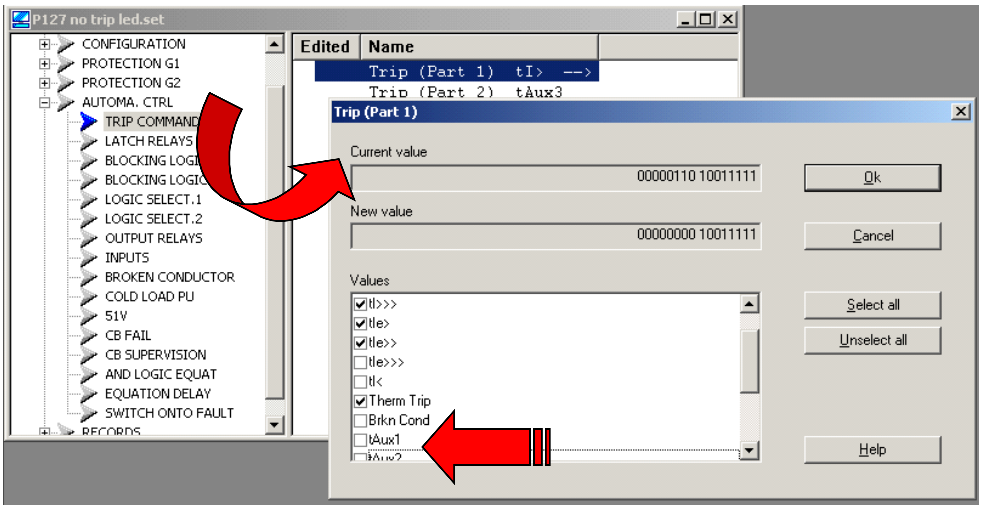


Within Autorecloser menu, both “strip and start” and “inhib trip” should be selected for tAux1 and/or tAux2



To avoid any trip when tAux is ON, ensure that tAux is not selected in trip command menu.

“AUTOMA. CTRL / TRIP COMMANDS”		
Trip Commands	Trip command without tAux	Untick the corresponding tAux



5.3.6 Number Of Shots

There are no clear-cut rules for defining the number of shots for a particular application. Generally medium voltage systems utilize only two or three shot autoreclose schemes. However, in certain countries, for specific applications, four shot approaches are not uncommon. Four shots have the advantage that the final dead time can be set sufficiently long to allow any thunderstorms to pass before re-closing for the final time. This approach will prevent unnecessary lockout for consecutive transient faults.

Typically, the first trip, and sometimes the second, will result from short time protection. Since 80% of faults are transient, the subsequent trips will be time delayed, all with increasing dead times to clear non-permanent faults.

In order to determine the required number of shots the following factors must be taken into account:

An important consideration is the ability of the circuit breaker to perform several trip-close operations in quick succession and the effect of these operations on the maintenance period.

If statistical information on a particular system shows a moderate percentage of non-permanent faults, which could be burned out, two or more shots are justified. In addition to this, if fused ‘tees’ are used and the fault level is low, the fusing time may not discriminate with the main IDMT relay and it would then be useful to have several shots. This would warm up the fuse to such an extent that it would eventually blow before the main protection operated.

5.3.7 Dead Timer Setting

The following factors can influence the choice of dead timer setting. Due to the great diversity of load, which may exist on a system it may prove very difficult to arrive at an optimum dead time. However, it is possible to address each type of load individually and thereby arrive at a typical dead time. The most common types of load are addressed below.

Synchronous motors are only capable of tolerating extremely short interruptions of supply without loss of synchronism. In practice it is desirable to disconnect the motor from the supply in the event of a fault. The dead time should be sufficient to allow the motor no-volt device to operate. Typically, a minimum dead time of 0.2 - 0.3 seconds has been suggested to allow this device to operate. Induction motors, on the other hand, can withstand supply interruptions, up to a maximum of 0.5 seconds and then re-accelerate successfully. In general dead times of 3 - 10 seconds are normally satisfactory, but there may be special cases for which additional time is required to permit the resetting of manual controls and safety devices.

Loss of supply to lighting circuits, such as street lighting may be important for safety reasons as intervals of 10 seconds or more may be dangerous for traffic. The main considerations of supply interruptions for domestic customers are those of inconvenience.

An important measurement criterion for many power utilities is the number of minutes lost per year to customers, which will be reduced on feeders using autoreclose and will also be affected by the dead time settings used.

For high-speed autoreclose the minimum dead time of the power system will depend on the minimum time delays imposed by the circuit breaker during a tripping and re-closing operation.

Since a circuit breaker is a mechanical device, it will have an inherent contact separation time. The operating time for a modern circuit breaker is usually within the range of 50 - 100 ms, but could be longer with older designs.

After tripping, time must be allowed for the mechanism to reset before applying a closing pulse. This resetting time will vary depending on the circuit breaker, but is typically 0.1 seconds.

Once the circuit breaker has reset, it can begin to close. The time interval between the energizing of the closing mechanism and the making of the contacts is termed the closing time. Owing to the time constant of a solenoid closing mechanism and the inertia of the plunger, a solenoid closing mechanism may take 0.3 s. A spring-operated breaker, on the other hand, can close in less than 0.2 seconds.

Where high-speed re-closing is required, which is true for the majority of medium voltage applications, the circuit breaker mechanism itself dictates the minimum dead time. However, the fault de-ionizing time may also have to be considered. High-speed autoreclose may be required to maintain stability on a network with two or more power sources. For high-speed autoreclose the system disturbance time should be minimized by using fast protection, <50 ms, such as distance or feeder differential protection and fast circuit breakers <100 ms. Fast fault clearances can reduce the required fault arc de-ionizing time.

For stability between two sources a dead time of <300 ms may typically be required. When only considering the CB the minimum system dead time is given by the mechanism reset time plus the CB closing time. Thus, a solenoid mechanism will not be suitable for high-speed autoreclose as the closing time is generally too long.

For high-speed autoreclose the fault de-ionizing time may be the most important factor when considering the dead time. This is the time required for ionized air to disperse around the fault position so that the insulation level of the air is restored. This can be approximated from the following formula:

$$\text{De-ionizing time} = \left(10.5 + \frac{\text{Vsys}}{34.5}\right) \times \frac{1}{\text{frequency}} \ \text{[s]} \quad \text{(Vsys = System voltage in kV)}$$

For 66 kV = 0.25 s (50Hz)

For 132 kV = 0.29 s (50 Hz)

It is essential that the protection fully resets during the dead time, so that correct time discrimination will be maintained after re-closing on to a fault. For high-speed autoreclose instantaneous reset of protection is required.

Typical 11/33kV dead time settings in the UK are as follows:

1st dead time = 5 - 10 seconds
2nd dead time = 30 seconds
3rd dead time = 60 - 100 seconds
4th dead time (uncommon in the UK, however used in South Africa) = 60 - 100 seconds

5.3.7.1 Reclaim Timer Setting

A number of factors influence the choice of the reclaim timer, such as:

– Supply continuity - long reclaim times can result in unnecessary lockout for transient faults.

– Fault incidence and past experience - short reclaim times may be required where there is a high incidence of lightning strikes to prevent unnecessary lockout for transient faults.

– Spring charging time - for high-speed autoreclose the reclaim time may be set longer than the spring charging time to ensure there is sufficient energy in the circuit breaker to perform a trip-close-trip cycle. For delayed autoreclose there is no need to set the reclaim time longer than the spring charging time as the dead time can be extended by an extra CB healthy check window time if there is insufficient energy in the CB. If there is insufficient energy after the check window time has elapsed the relay will lockout.

– Switchgear maintenance - excessive operation resulting from short reclaim times can mean shorter maintenance periods. A minimum reclaim time of >5 s may be needed to allow the CB time to recover after a trip and close operation before it can perform another trip-close-trip cycle. This time will depend on the duty (rating) of the CB.

– The reclaim time must be long enough to allow any time-delayed protection initiating autoreclose to operate. Failure to do so would result in premature resetting of the autoreclose scheme and re-enabling of instantaneous protection.

– If this condition arose, a permanent fault would effectively look like a number of transient faults, resulting in continuous autoreclose operations unless additional measures were taken to overcome this, such as excessive fault frequency lockout protection.

– A sensitive earth fault protection is usually applied to detect high resistance earth faults. Usually, a long trip delay time is set, typically 10 - 15 s. This longer time may be taken into consideration, if autoreclose is started by an earth fault protection, and when deciding on a reclaim time, if the reclaim time is not blocked by a SEF protection start signal. Sensitive earth faults, for example, a broken overhead conductor in contact with dry ground or a wood fence, is rarely transient and presents great danger to persons and animals. It is therefore common practice to block autoreclose by operation of sensitive earth fault protection and lockout the circuit breaker.

– Where motor-wound spring closed circuit breakers are used, the reclaim time must be at least as long as the spring winding time for high-speed autoreclose to ensure that the breaker can perform a trip-close-trip cycle.

– A typical 11/33kV reclaim time is 3 - 10 seconds; this prevents unnecessary lockout during thunderstorms. However, reclaim times up to 60 - 180 seconds maybe used.

5.3.8 Fuse application

An application of the ARC is the coordination with a fuse. This application is typical in rural areas where derived lines are protected by a fuse.

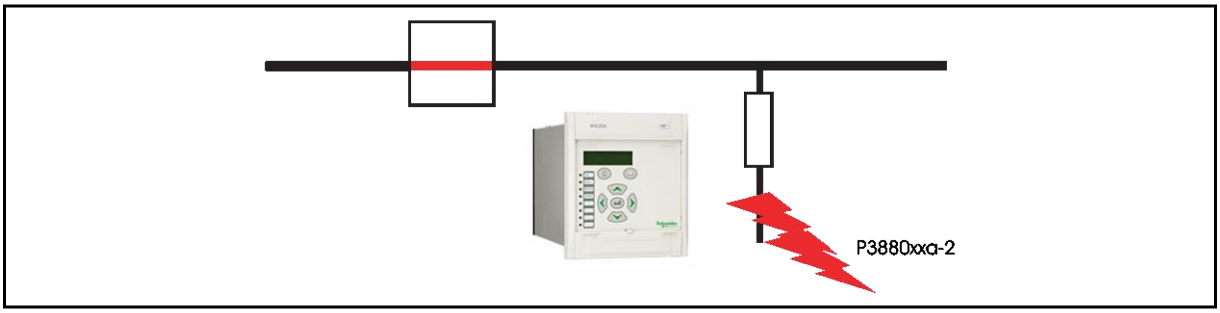
We suppose to have the following settings for the protection and the ARC narrow to the configuration matrix. All the others have to be compliance with the rules above.

67 protection	
I> ON	I>> ON
I> 8 In	I>> 10 In
tI> 5 sec.	tI>> 0 sec

AUTORECLOSE (only the matrix)	
ARC cycles AR init tI>	4 3 2 1 0 1 1 0
ARC cycles AR init tI>>	4 3 2 1 0 0 2 1
ARC cycles AR init tI>>>	4 3 2 1 0 0 0 0
ARC cycles AR init tAux1	4 3 2 1 0 0 0 0
Number of phase cycles	1

The sequence is the following.

1. Fault on the line protected by the fuse.



2. Istantaneous trip of the I>> and opening of the CB.

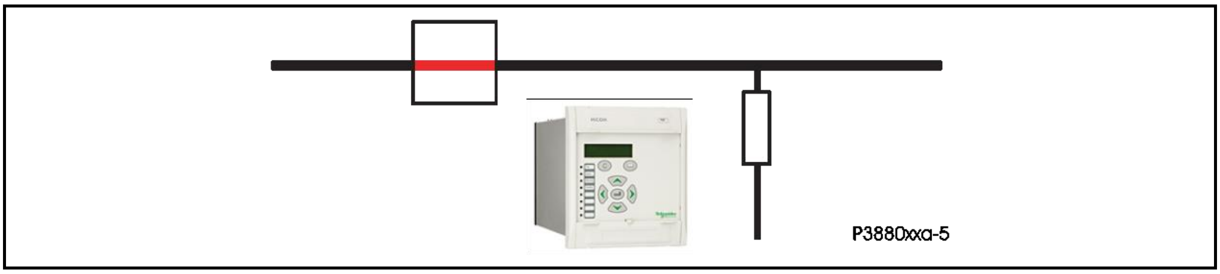
3. tD1 in progress.

4. tD1 is expired.

5. Closing of the CB and start of the tR.
Due to the setting of the ARC the I>> will start but won't generate a trip. During the delay trip time of the I> the fault will be cleared for the breaking of the fuse or for the auto-extintion of the fault.

Breaker of the fuse

Auto-extinction of the fault



The above one is an example to show a basic using of the “2” setting in the ARC function.

6. AUTOMATIC CONTROL FUNCTIONS

6.1 Trip Commands

This menu is used to assign the trip of the protection and the automatic control function to the relay 1. See the P12y/EN FT (User Guide).

The relay 1 is usually used for the trip of the CB and the logic output is used to start all the functionality relevant to the CB control.

6.2 Latch relays

Sometimes it occurs to memorise trips or alarms.

By this menu it is possible the latching of the relay from 1 to 8 the relevant relays to the 79 function must not be assigned latched.

6.3 Broken Conductor Detection (P126 & P127)

The majority of faults on a power system occur between one phase and ground or two phases and ground. These are known as shunt faults and arise from lightning discharges and other overvoltages, which initiate flashover. Alternatively, they may arise from other causes such as birds on overhead lines or mechanical damage to cables etc.

Such faults induce an appreciable current increase and are easily detectable in most applications.

Another type of unbalanced system condition is the series or open circuit fault. This fault can arise from broken conductors, mal-operation of single-phase switchgear, or the operation of fuses.

Series faults will not induce an increase in phase current on the system and hence are not easily detectable by standard overcurrent protection elements available with common relays. However, they will produce an unbalance and an important level of negative phase sequence current, which can be detected.

It is possible to apply a negative phase sequence overcurrent relay to detect a series fault condition as described. However, on a lightly loaded line, the negative sequence current resulting from a series fault condition may be very close to, or less than, the full load steady state unbalance arising from CT errors, load unbalance etc. A negative sequence protection element therefore would not operate at low load levels.

The MiCOM P126 and P127 relays incorporate a protection element, which measures the ratio of negative to positive phase sequence current (I2/I1). This protection element will be affected to a lesser extent than the measurement of negative sequence current alone, since the ratio is approximately constant with variations in load current. Hence, a more sensitive setting may be achieved.

6.3.1 Setting Guidelines

In the case of a single point earthed power system, there will be little zero sequence current flow and the ratio of I2/I1 that flows in the protected circuit will approach 100%. In the case of a multiple earthed power system (assuming equal impedance in each sequence network), the ratio I2/I1 will be 50%.

The setting for the broken conductor protection element is described in Technical Data and the menu is described in User Guide.

6.3.2 Example Setting

The following information was recorded by the relay during commissioning:

full load = 500A

I2 = 50A

therefore the quiescent ratio for I2/I1 is given by:

I2/I1 = 50/500 = 0.1

To allow for tolerances and load variations a setting of 200% of this value may be typical: Therefore set **RATIO I2/I1** = 20%

Set **tBC** = 60 s to allow adequate time for short circuit fault clearance by time delayed protections.

6.4 Inrush Blocking (P127 only)

The inrush blocking function assumes stability protection during transformer energising based on harmonic 2 presence.

In applications where the sensitivity of overcurrent thresholds need to be set below the prospective peak inrush current, the inrush block function can be used to block the overcurrent, earth fault and negative sequence overcurrent stages. During transformer inrush conditions, the second harmonic component of the inrush current may be as high as 70%. In practice, the second harmonic level may not be the same for all phases during inrush and therefore the relay will provide an Inrush Blocking signal for any phase above the set threshold. In general, a setting of 15% to 20% for the Inrush harmonic 2 ratio can be applied in most cases taking care that setting it too high, inrush blocking may not operate for low levels of second harmonic current which may result in the O/C element tripping during transformer energization. Similarly applying a too low a setting, inrush blocking may prevent tripping during some internal transformer faults with significant second harmonic current.

6.4.1 Overview

Inrush Blocking function operates by measuring ratio of second to fundamental harmonic current. It could be used as “blocking logic” of **I** >, I >>, I >>>, I0 >, I0 >>, I0 >>>, Ie_d>, Ie_d>>, I2 >, I2 >> or I2 >>> in case the harmonic 2 ratio is higher than the settable threshold. Indeed, inrush blocking functions will reset selected protection function starting.

The minimum duration of overcurrent threshold inhibition (tReset) can be also set. This value depends on the transformer power transient inrush duration: between 0.1 second (for a 100kVA transformer) to 1.0 second (for a large unit). It is used to avoid any maloperation during a fixed duration in case of too sensitive setting.

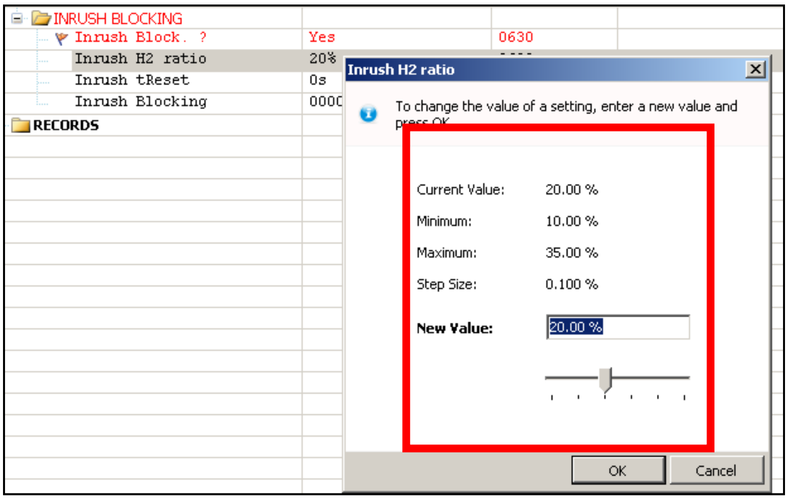
6.4.2 Operation

For each of the three phases currents (IA, IB, IC), the harmonic restraint function compares the ratio of harmonic 2 to fundamental with the setting ratio (adjustable from Harmonic 2 / Fundamental = 10 % up to 35 % step 1%).

Minimum fundamental current value required for operation of Inrush Blocking function. There is 0.2In, and there is no upper limit to disable this feature. However, in transformer protection, the high set overcurrent stage shall not be controlled by this Inrush Blocking feature; this enables detection of all high current faults without inrush blocking.

Inrush Blocking feature will block selected protection stages, any time inrush conditions occurs on the line (Ratio of 2nd Harmonics measured > Inrush H2 settings ratio), and will be at least active during tReset.

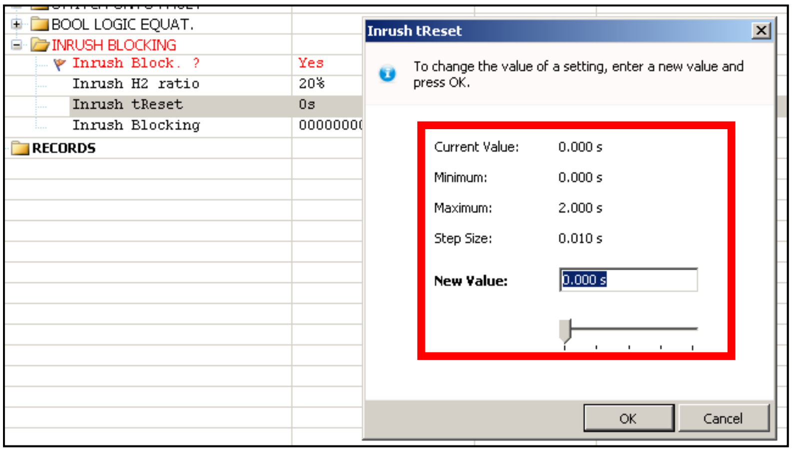
Operating Inrush current is settable from 10% to 35% of fundamental current.



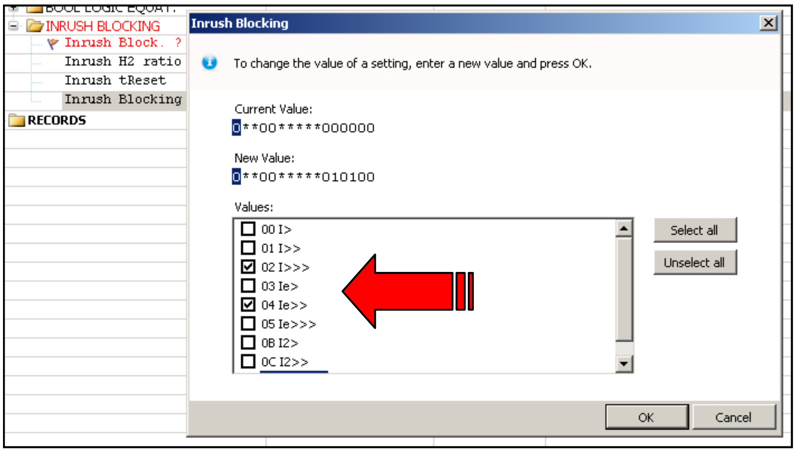
tReset timer defines the minimum duration of overcurrent threshold inhibition (0-2s, settable). This timer starts as soon as operating inrush current threshold picks up:

– If inrush condition duration is smaller than tReset setting value, selected overcurrent function will remain inhibited during tReset.

– If inrush condition duration is longer than tReset setting value, selected overcurrent function will be inhibited as long as inrush condition remains valid.

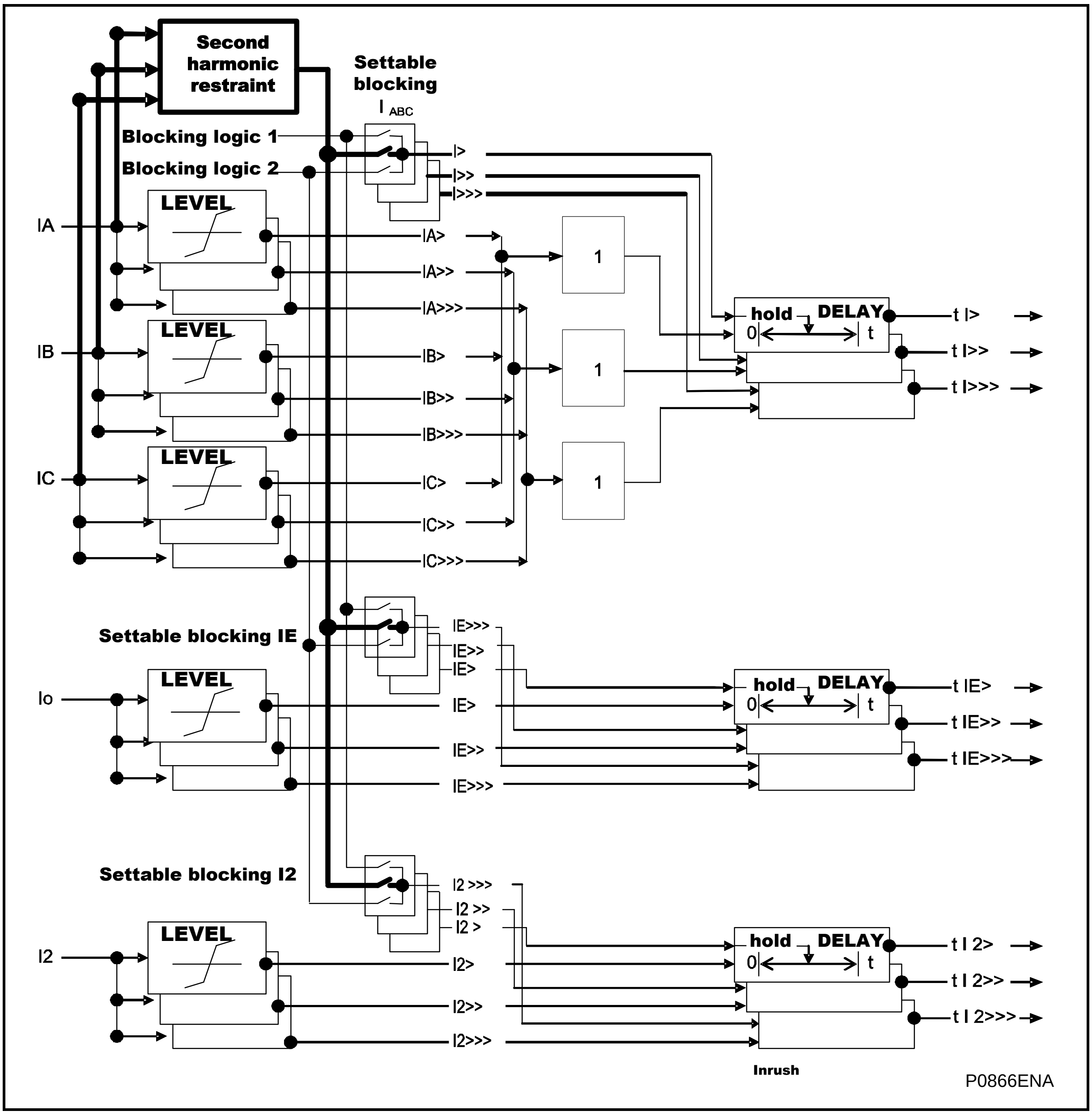


Under inrush condition, the following selectable protection stages will be blocked:



NOTE: Inrush Blocking in P127 relay is not phase selective. On occurrence of inrush condition, in any phase, selected protection stages in all 3 phases will be blocked.

6.4.3 Principle



6.5 Cold Load Pick-up (P126 & P127)

The Cold Load Pick-up feature enables the selected settings of the **MiCOM P126** and **P127** relays to be changed to react to temporary overload conditions that may occur during cold starts. This condition may occur by switching on large heating loads after a sufficient cooling period, or loads that draw high initial starting currents.

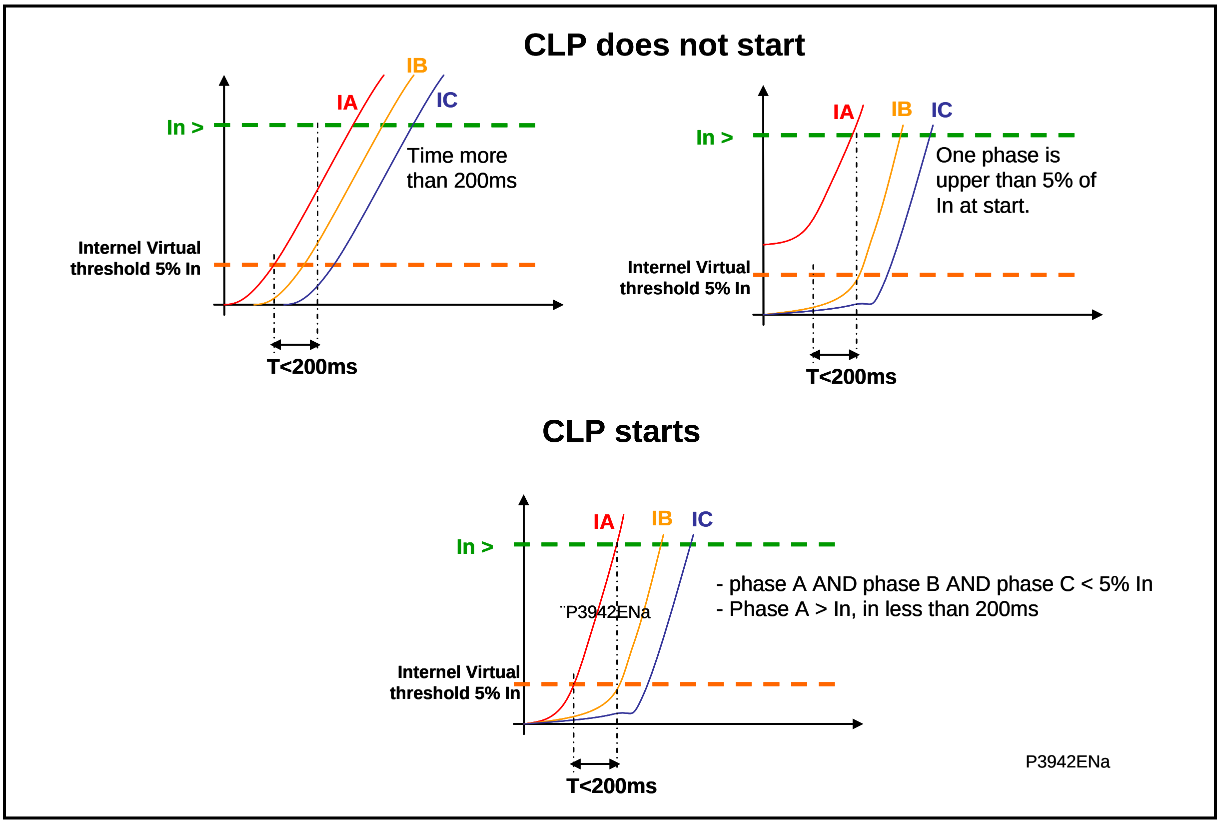
When a feeder is energised, the current levels that flow for a period of time following energising may differ greatly from the normal load levels. Consequently, overcurrent settings that have been applied to give short circuit protection may not be suitable during this period.

The Cold Load Pick-up (CLP) logic raises the settings of selected stages for a set duration **tCL**. This allows the protection settings to be set closer to the load profile. Cold load pick-up cannot restart until the end of **tCL** duration. The CLP logic provides stability, without compromising protection performance during starting.

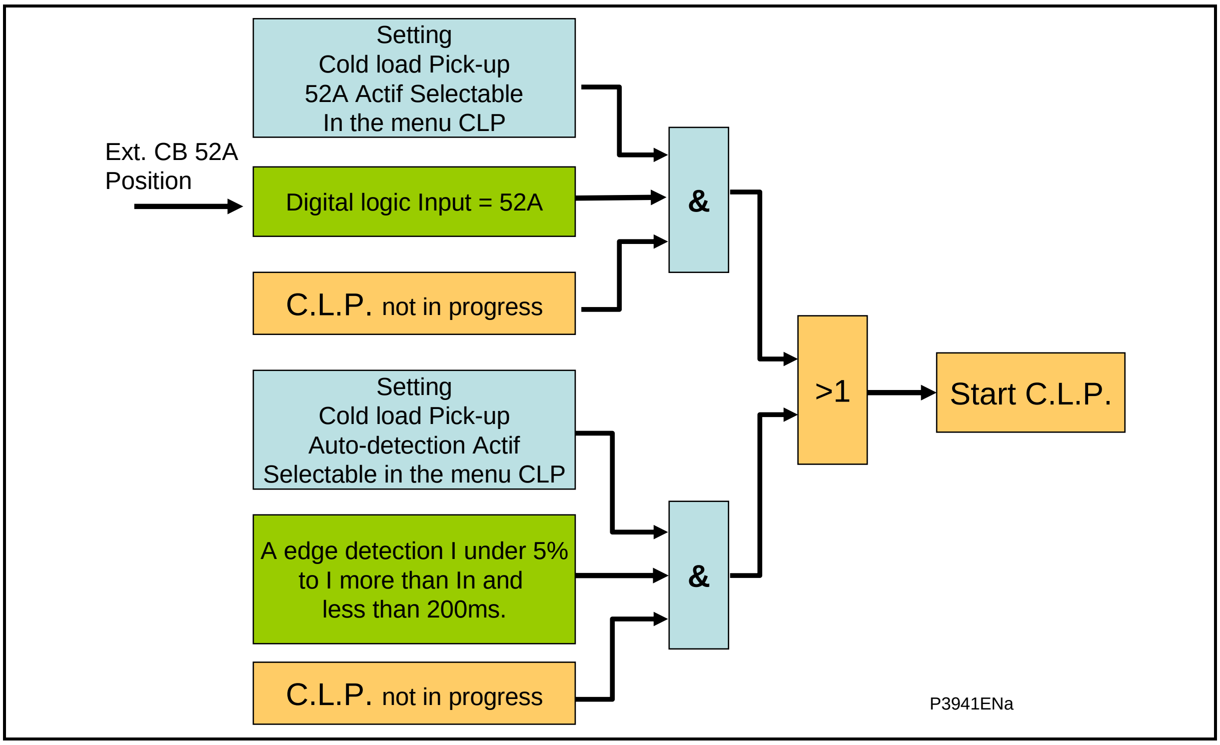
The CLP can be started by digital logic Input 52a and/or internal threshold detection by (Not I< & I>) and/or internal threshold detection by (Not I0< & I0>).

If the CB positions are not available, to detect the Cold Load Pick-up start, a new internal threshold is created named autostart.

To detect the Cold Load Pick-up, the three phases current should be under 5% of In. When the current grows up to In or more, with a time of less than 200 ms, an internal edge detection is created.



The following diagram shows the logic start of CLP



6.6 VTS

The voltage transformer supervision (VTS) feature is used to detect failure of the analog ac voltage inputs to the relay. This may be caused by internal voltage transformer faults, overloading, or faults on the interconnecting wiring to relays. This usually results in one or more VT fuses blowing.

MiCOM P127 is able to detect a VT loss by using VTS automatism. As soon as VT loss is detected, all voltage dependent functions will be blocked, an alarm can be raised and directional overcurrent functions might be replaced by non-directional overcurrent functions.

6.6.1 VTS occurrence

VTS automation uses a fixed logic. A VT fault occurs if at least one of the two following conditions is verified:

– negative sequence voltage is greather than 0,17*Vn (0,3*Vn for 3Vpn connexion) and negative sequence current is smaller than 0,5*In

OR

– voltage is smaller than 0,1*Vn and current greather than 0,1*In.

The VT fault disappears as soon as one criteria is not valid anymore.

6.6.2 VTS alarm

A VTS alarm occurs when a VT fault occurs during more than tVTS.

VTS Alarm won't occur if VTS conditions remain valid less than the timer tVTS (settable from 0 to 100s). If VTS condition remains longer than tVTS, this alarm will be latched until HMI/communication reset.

The "VTS alarm" menu activates or deactivates the alarm message and LED (see diagram § 6.7).

6.6.3 VTS Blocks 51V

This function blocks the overcurrent controlled by voltage transformer (51V) protection (see diagram § 6.7, "Automat Ctrl" / "VTS blocks 51V").

6.6.4 Directional protection modification

If a VT is faulty, the VTS alarm occurs and the directional overcurrent (67/67N) protections do not operate. Only the non-directional overcurrent (50/51/50N/51N) protections are available for I>, I>>, I>>>; Ie>, Ie>>, Ie>>>, Ie_d> and Ie_d>> thresholds.

The VTS menu gives the possibility to select the protection in case of non directional overcurrent threshold. The “VTS Blocks Protection” function can be used to:

– block voltage dependent functions

– to change directional overcurrents (I>, I>>, I>>>; Ie>, Ie>>, Ie>>>, Ie_d> and Ie_d>>) into non-directional functions. For instance, when “VTS Non dir I>” is selected, the non directional overcurrent protection is available for I> threshold.

“VTS Blocks Protection” = No	The VTS does not block non directional current	
“VTS Blocks Protection” = Yes	“VTS Non dir I>” = No	Non directional overcurrent protection is blocked for I> threshold.
	“VTS Non dir I>” = Yes	Non directional overcurrent protection is available for I> threshold.

– “VTS Blocks Protections?” submenu will unblock all the non directional overcurrent protection, or give the possibility to select individually the non directional overcurrent protection(s),

– When “VTS Blocks protections?” = yes, the non directional overcurrent protections (I>, I>>, I>>>; Ie>, Ie>>, Ie>>>, Ied> and Ie_d>> thresholds) can be blocked: for instance, if “VTS Non dir I>>” = Yes, when a VT fault occurs, the non directional overcurrent protection is available for I>> threshold.

6.6.5 Voltage/Power protection

If VTS occurs, all voltage and power protection will be blocked:

– Undervoltage phase (27) protection.

– Overvoltage earth (59N) protection if connection 3Vpn.

– Overpower earth (32N) protection if connection 3Vpn.

– Overpower (32) protection if connection 3Vpn.

6.7 Current Transformer Supervision (CTS)

The current transformer supervision feature is used to detect failure of one or more of the ac phase current inputs to the relay. Failure of a phase CT or an open circuit of the interconnecting wiring can result in incorrect operation of any current operated element. Additionally, interruption in the ac current circuits risks dangerous CT secondary voltages being generated.

6.7.1 The CT Supervision Feature

The CT supervision feature operates on detection of derived zero sequence current, in the absence of corresponding derived zero sequence voltage that would normally accompany it.

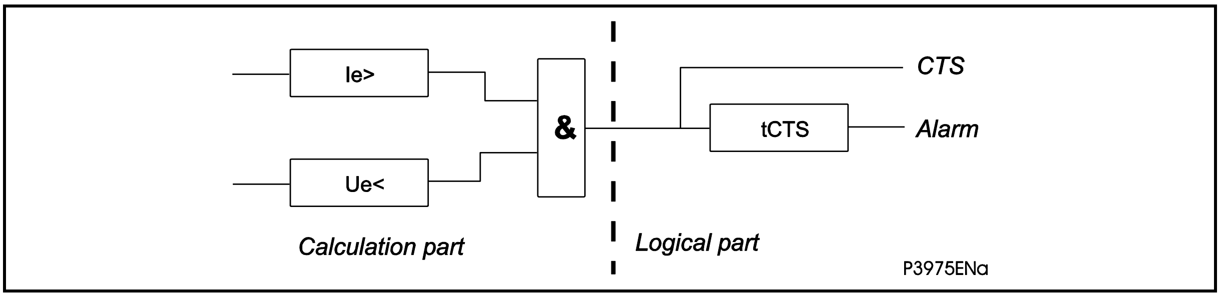
The voltage transformer connection used must be able to refer zero sequence voltages from the primary to the secondary side. Thus, this element should only be enabled where the VT is of five limb construction, or comprises three single phase units, and has the primary star point earthed.

Operation of the element will produce a time-delayed alarm visible on the LCD and event record, with an instantaneous block for inhibition of protection elements. Protection elements operating from derived quantities are always blocked on operation of the CT Supervision element.

The following table shows the relay menu for the CT Supervision element, including the available setting ranges and factory defaults:

Menu text	Default setting	Setting range		step size
		Min	max	
Automat. Ctrl				
CT Supervision				
CT Supervision ?	No	Yes / No		
Ie>	0.08 × In	0.08 × In	1 × In	0.01 × In
Ue<	5 / 20 V	0.5 / 2V	22 / 88V	0.1 / 0.5V
tCTS	200ms	0s	100s	10ms

6.7.1.1 Setting the CT Supervision Element



The residual voltage setting, **Ue<** and the residual current setting, **Ie>**, should be set to avoid unwanted operation during healthy system conditions. For example **Ue<** should be set to 120% of the maximum steady state residual voltage. The **Ie>** will typically be set below minimum load current. The time-delayed alarm, t**CTS**, is generally set to 5 seconds.

6.8 51V (voltage controlled overcurrent) features (P127 only)

Voltage restrained overcurrent protection is used to clear faults which current is lower than the rated through current.

Indeed, fault currents lower than the rated value cannot be cleared by phase overcurrent protection (ANSI codes: 50/51), which, by definition, clears faults which currents are much higher than the rated current value.

The voltage restrained overcurrent function implemented in the MiCOM P127 is used to inhibit tripping by the phase overcurrent protection function when the relevant conditions are met.

To this effect, the 51V function uses negative-sequence overvoltage settable values (V2> and V2>>), as well as the set threshold values for phase overcurrent (ANSI codes: 50/51) – I>> and I>>> – and phase undervoltage (ANSI code: 27) – U< and U<< –.

When enabling the 51V function, the user selects whether it should inhibit the 2nd stage and/or the 3rd stage of the phase overcurrent protection function:

– I>> is inhibited when:

- the voltage measured at the voltage inputs is higher than U<,
- AND the negative sequence voltage is lower than V2>.

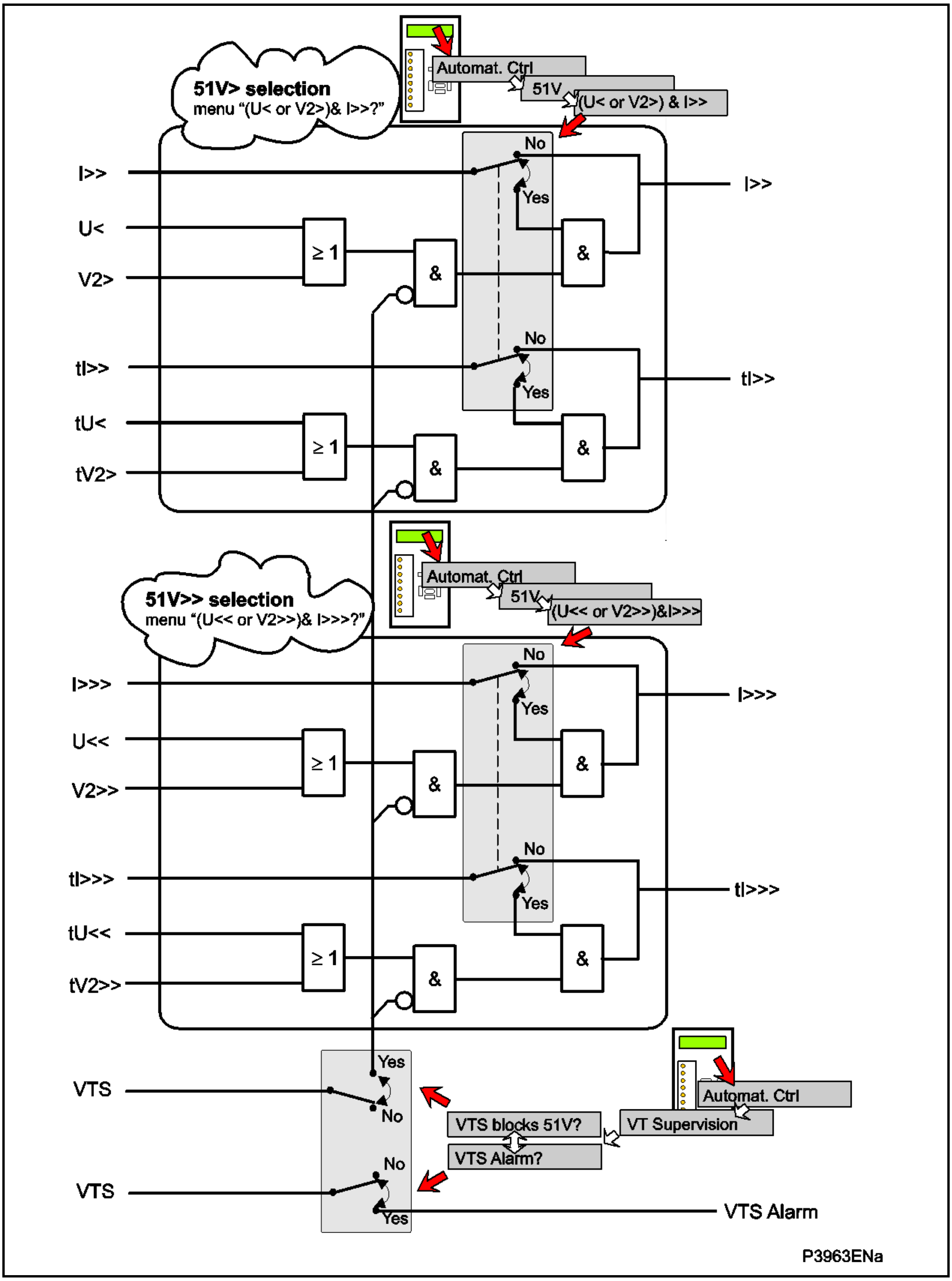
– I>>> is inhibited when:

- the voltage measured at the voltage inputs is higher than U<<,
- AND the negative sequence voltage is lower than V2>>.

The result of the 51V function is given by the following equations:

Function	Output relay	Equation
	this signal is transmitted to the output relay when 51V function is not selected	this signal is transmitted to the output relay when 51V function is selected
51V>	I>> output	(U< or V2>) and I>>
t51V> (1)	tI>> output	(tU< or tV2>) and tI>>
51V>>	I>>>	(U<< or V2>>) and I>>>
t51V>> (1)	tI>>>	(tU<< or tV2>>) and tI>>>

(1) Since software version 11. These functions are selected with “(U< or V2>) & I>>” and “(U<< or V2>>) & I>>>” menus.


Automat. Ctrl
51V
(U< or V2>) & I>>
51V> selection
menu "(U< or V2>)& I>>?"
No
Yes
I>>
U<
V2>
≥ 1
&
tI>>
tU<
tV2>
Automat. Ctrl
51V
(U<< or V2>>)&I>>>
51V>> selection
menu "(U<< or V2>>)& I>>>?"
I>>>
U<<
V2>>
tI>>>
tU<<
tV2>>
VTS
VTS blocks 51V?
VTS Alarm?
Automat. Ctrl
VT Supervision
VTS Alarm
P3963ENa

6.9 Auxiliary Timers (P125, P126 & P127)

Twelve auxiliary timers tAux1 to to tAuxC (tAux8 to tAuxC are P127 optional auxiliary timers) are available associated to Aux1to tAuxC logic inputs (refer to **AUTOMAT. CRTL/INPUTS** menu). When these inputs are energised, the associated timers start and, after the set time, the output relays close (refer to **AUTOMAT. CRTL/OUTPUTS** menu). The time delays are independently settable.

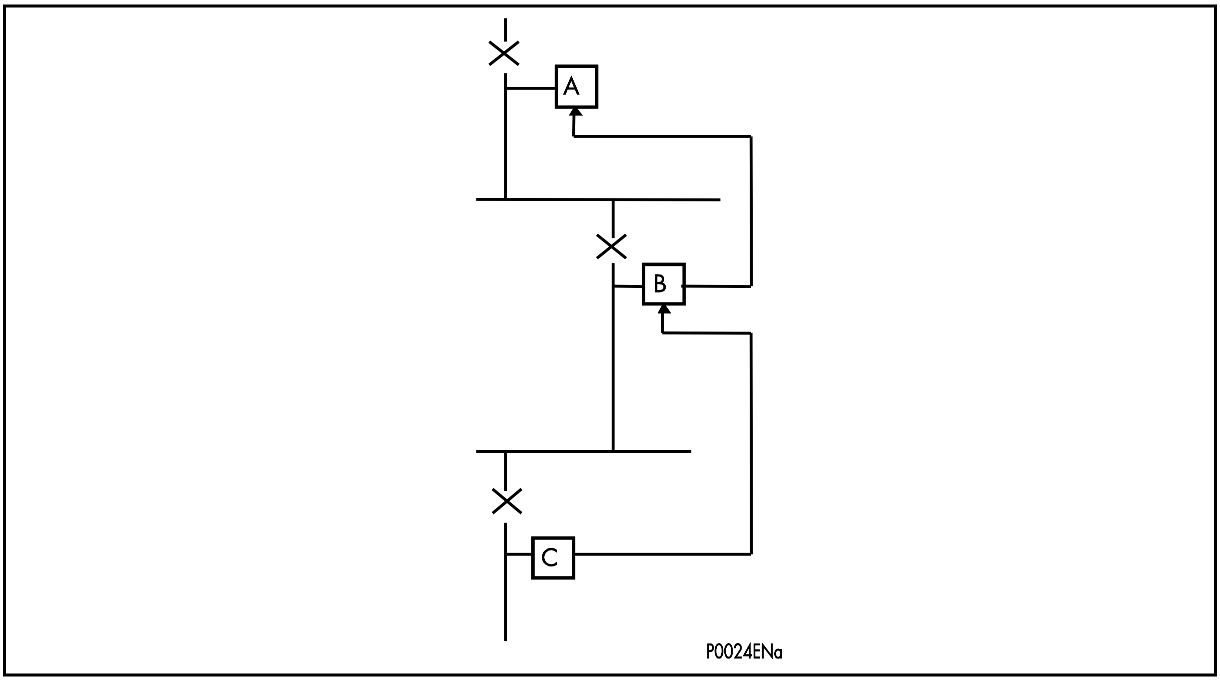
The tAux1 and tAux2 timers always provide an alarm when their set time is expired; the tAux3 and tAuxC provide an alarm only when they are assigned to the trip relay in the Automatic Ctrl Trip Command menu.

NOTE: auxiliary timers are settable up to 200ms, except tAux 5, tAux6 and tAux7, settable up to 20000s.

6.10 Selective Scheme Logic (P126 & P127)

The following figure describes the use of non-cascade protection schemes using the start contacts from downstream relays to block operation of upstream relays.

In the case of Selective Overcurrent Logic (SOL), the start contacts are used to increase the time delays of upstream relays, instead of blocking them. This provides an alternative approach to achieving a non-cascade type of overcurrent scheme. It may be more familiar to some utilities than the blocked overcurrent arrangement.



TYPICAL SELECTIVE SCHEME LOGIC

The SOL function temporarily increases the time delay settings of the second and third stages of phase overcurrent. This logic is initiated by energising the appropriate logic input (**Log Sel1** or **Log Sel2**) as selected in **AUTOMAT. CRTL/INPUTS** menu.

To allow time for a start contact to initiate a change of setting, the time settings of the second and third stages should include a nominal delay. Guidelines for minimum

time settings are identical to those given for blocked overcurrent schemes.

The **tSel1** and **tSel2** timers are independently settable.

See the TD (Technical Data) for the setting values and FT (User Guide) for the selective scheme logic menu.

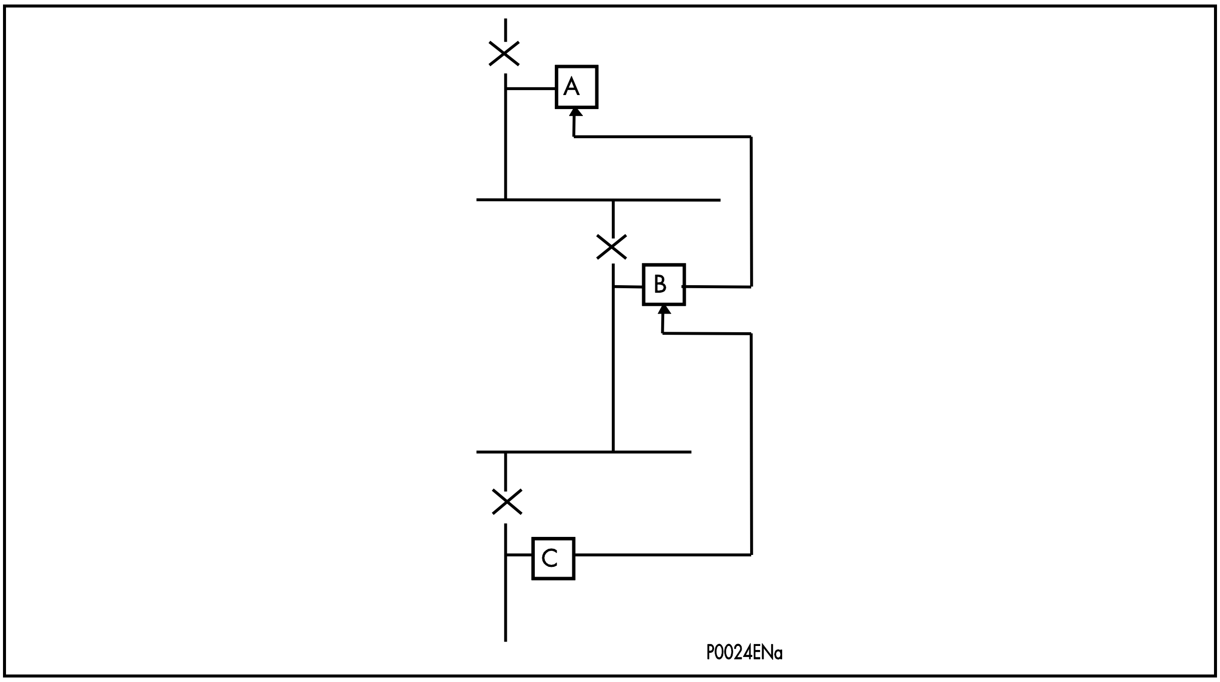
6.11 Blocking logic function (Blocked directional/non directional overcurrent protection)

The directional non directional overcurrent and overcurrent protection are applicable for radial feeder circuits where there is small or no back feed.

This application shows that the upstream IDMT relay being blocked by the start output from a downstream relay that has detected the presence of a fault current, which is above its threshold settings. Thus both the upstream and downstream relays can then have the same current and the blocking feature will automatically provide time settings and grading. If the CB failure protection function is active, the blocking order on the upstream relay will be removed if the downstream circuit breaker fails to trip.

Thus for a fault downstream from relay C, the start output from relay C will block operation of relay B, the start output of relay B will block operation of relay A. All the 3 relays could have the same time and current threshold settings and the grading would be obtained by the blocking signal received from a relay closer to the fault. This gives a constant, close time grading, but there will be no back-up protection in the event of the pilots being short circuited.

However, in practice it is recommended that the upstream relay should be set greater (plus 10%) than the downstream relay setting. This ensures that the downstream relay successfully blocks the upstream relay when required to do so.



BLOCKING LOGIC

The allocations of the "Blocking Logic1 and 2” functions are available in the menu **AUTOMAT. CTRL/Blocking Logic1 / Blocking Logic2**; this logic is initiated by energizing the appropriate logic input (Blk **Log1** or Blk L**og2**) selecting in the **AUTOMAT. CRTL/INPUTS** menu.

This functionality involves all the current and voltage protections available in the relays.

6.12 Circuit Breaker State Monitoring

An operator at a remote location requires a reliable indication of the state of the switchgear. Without an indication that each circuit breaker is either open or closed, the operator has insufficient information to decide on switching operations. The MiCOM P126 and P127 relays incorporate a circuit breaker state monitoring function, giving an indication of the position of the circuit breaker contacts.

This indication is available either on the relay front panel or via the communications network.

The circuit breaker state monitoring function is selectable in the **AUTOMAT. CTRL/Inputs** and **CONFIGURATION/Led** menu.

Further, the MiCOM P126 and P127 relays are able to inform the operator that the CB has not opened following a remote trip command.

6.13 Circuit Breaker Condition Monitoring (P126 & P127)

Periodic maintenance of circuit breakers is necessary to ensure that the trip circuit and mechanism operate correctly, and also that the breaking capability has not been compromised due to previous fault interruptions. Generally, such maintenance is based on a fixed time interval, or a fixed number of fault current interruptions. These methods of monitoring circuit breaker condition give a rough guide only and can lead to excessive maintenance.

The relays record various statistics related to each circuit breaker trip operation, allowing a more accurate assessment of the circuit breaker condition to be determined. These CB condition monitoring features are discussed in the following section.

6.14 Circuit Breaker Condition Monitoring Features (P126 & P127)

For each circuit breaker trip operation the relay records statistics as shown in the following table taken from the relay menu. The **RECORDS/CB Monitoring** menu cells shown are counter values only.

These cells can only be read:

MENU TEXT	
CB Monitoring	
CB Opening Time	Displays the CB opening time
CB Closing Time	Displays the CB closing time
CB Operations	Displays the number of opening commands executed by the CB
Σ Amps(n) I1	Displays the summation of the Amps (or square Amps) interrupted by the CB phase A
Σ Amps(n) I2	Displays the summation of the Amps (or square Amps) interrupted by the CB phase B
Σ Amps(n) I3	Displays the summation of the Amps (or square Amps) interrupted by the CB phase C

The above counters in the CB condition monitoring function may be reset to zero, for example, following a maintenance inspection and overhaul.

The circuit breaker condition monitoring counters will be updated every time the CB opens, from all the different way. In cases where the breaker is tripped by an external protection device it is also possible to update the CB condition monitoring. This is achieved by allocating one of the logic inputs or via the communications to accept a trigger from an external device.

The options available for the CB condition monitoring function include the set-up of the broken conductor protection element and those features, which can be set to raise an alarm, or to lockout the CB.

All the settings are available in the **AUTOMAT. CTRL/CB Supervision** menu.

6.14.1 Setting Guidelines

6.14.1.1 Setting the Σ I^n Thresholds

Where overhead lines are prone to frequent faults and are protected by oil circuit breakers (OCB), oil changes account for a large proportion of the life cycle cost for the switchgear. Generally, oil changes are performed at a fixed interval of circuit breaker fault operations. However, this may result in premature maintenance where fault currents tend to be low, and hence oil degradation is slower than expected.

The Σ I^n counter monitors the cumulative severity of the duty placed on the interrupter allowing a more accurate assessment of the circuit breaker condition to be made.

For OCBs, the dielectric withstand of the oil generally decreases as a function of Σ I^2t. This is where 'I' is the fault current broken, and 't' is the arcing time within the interrupter tank (not the breaking time). As the arcing time cannot be determined accurately, the relay would normally be set to monitor the sum of the broken current squared, by setting **n** = 2.

For other types of circuit breaker, especially those operating on higher voltage systems, practical evidence suggests that the value of **n** = 2 may be inappropriate. In such applications **n** may be set to 1.

An alarm in this instance for example may be indicative of the need for gas/vacuum interrupter HV pressure testing.

It is imperative that any maintenance programme must be fully compliant with the switchgear manufacturer's instructions.

6.14.1.2 Setting the Number of Operations Thresholds

Every operation of a circuit breaker results in some degree of wear for its components. Thus, routine maintenance, such as oiling of mechanisms, may be based upon the number of operations. Suitable setting of the maintenance threshold will allow an alarm to be raised, indicating when preventative maintenance is due.

Should maintenance not be carried out, the relay can be set to lockout the autoreclose function on reaching an operations threshold. This prevents further re-closing when the circuit breaker has not been maintained to the standard demanded by the maintenance instructions supplied by the switchgear manufacturer.

Certain circuit breakers, such as oil circuit breakers (OCB) can only perform a specific number of fault interruptions before requiring maintenance attention. This is because each fault interruption causes carbonising of the oil, degrading its dielectric properties.

6.14.1.3 Setting the Operating Time Thresholds

Slow CB operation is also indicative of the need for mechanism maintenance. Therefore, an alarm is provided and is settable in the range of 100 ms to 5 s. This time is set in relation to the specified breaking time of the circuit breaker.

6.15 Circuit Breaker Failure (P126 & P127)

Following the inception of a fault one or more main protection devices will operate and issue a trip output to the circuit breaker(s) associated with the faulted circuit. Operation of the circuit breaker is essential to isolate the fault, and prevent damage or further damage to the power system.

For transmission and sub-transmission systems, slow fault clearance can also threaten system stability. It is therefore common practice to install circuit breaker failure protection [50BF], which monitors that the circuit breaker has opened within a reasonable time. If the fault current has not been interrupted following a set time delay from circuit breaker trip initiation, breaker failure protection (CBF) will operate.

CBF operation can be used to back-trip upstream circuit breakers to ensure that the fault is isolated correctly. CBF can also operate to reset all start output contacts, by external logic, ensuring that any blocks asserted on upstream protection are removed.

6.15.1 Circuit Breaker Failure Protection Mechanism

The CB failure protection included in both MiCOM P126 & P127 relays is performed as follows.

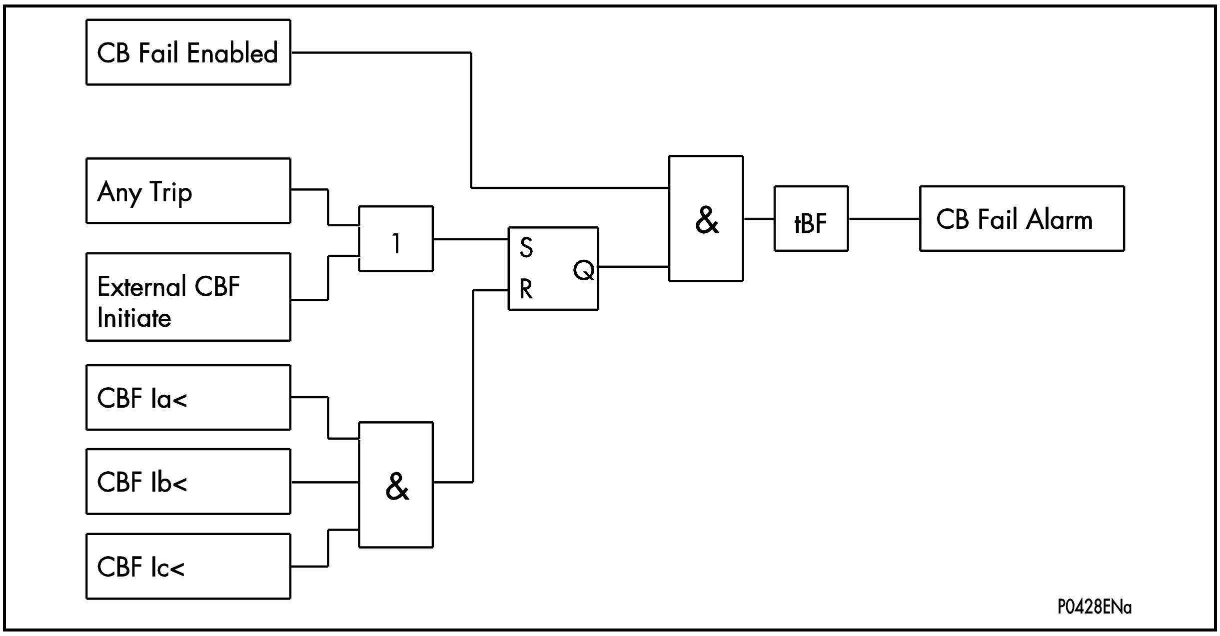
The **tBF** timer is initiated when a trip order is issued through the logic output **RL1** or by an assigned digital input (**start tBF**l).

The trip order can be emitted from a protection element or auxiliary function associated to the logic output RL1, the logic digital input can be energised from an external device.

In case of command from external device the start of the tBF is active by the change of status of the relevant digital input (edge), when the tBF is expired a CBF signal is issued. The tBF is reset when the relevant I< BF is verified for each phase. ((Ia< && Ib< && Ic<)==TRUE).

In case of a trip by a RL1 the MiCOM P126 & P127 relays monitor the current signal of each phase and they compare each phase current signal with the undercurrent I< BF threshold settable its menu. If the undercurrent I<BF is FALSE ((Ia< && Ib< && Ic<)==FALSE) when the tBF timer is expired a CBF signal is issued, if it is TRUE (((Ia< && Ib< && Ic<)==TRUE) the tBF timer is reset. A TRUE condition of the I<BF resets the tBF always.

In the CB fail menu it is also possible to choose if to lock the instantaneous I> and Ie> thresholds when a CBF signal is emitted. This one allows more flexibility in the fault localisation and isolation.



6.15.2 Breaker Fail Settings

A typical timer setting used with a 2 ½ cycle circuit breaker is around 150 ms.

The phase undercurrent settings (I<) must be set less than load current, to ensure that I< operation indicates that the circuit breaker pole is open. A typical setting for overhead line or cable circuits is 20% In, with 5% In common for generator circuit breaker CBF.

6.16 Trip Circuit Supervision (P126 & P127)

The trip circuit extends beyond the relay enclosure and passes through more components, such as fuses, links, relay contacts, auxiliary switch contacts and so on.

This complexity, coupled with the importance of the trip circuit, has directed attention to its supervision.

The simplest arrangement for trip circuit supervision contains a healthy trip lamp in series with a resistance placed in parallel with a trip output relay contacts of the protection device.

However, this solution has limitations as no alarm can be generated. Following paragraphs describe typical application examples.

6.16.1 MiCOM P126 & P127 Trip Circuit Supervision Mechanism

The Trip Circuit Supervision function included in the **MiCOM P126** and **P127** relays is described below:

WARNING 1: SINCE HARDWARE 5 (NAMED ALSO PHASE II), THE VALUES USED IN THE CALCULATION OF THE EXTERNAL RESISTOR NEEDED FOR THE TRIP CIRCUIT SUPERVISION HAVE CHANGED.

WARNING 2: THE POLARISATION CURRENT OF THE LOGIC INPUT MUST BE 3.5mA / 19.2VDC DURING 2ms (MINIMUM). THE HOLDING CURRENT AFTER THESE 2ms SHOULD BE 2.3mA (SEE P12y/EN TD CHAPTER FOR SPECIFIC POLARISATION RANGES ACCORDING TO NOMINAL RANGE).

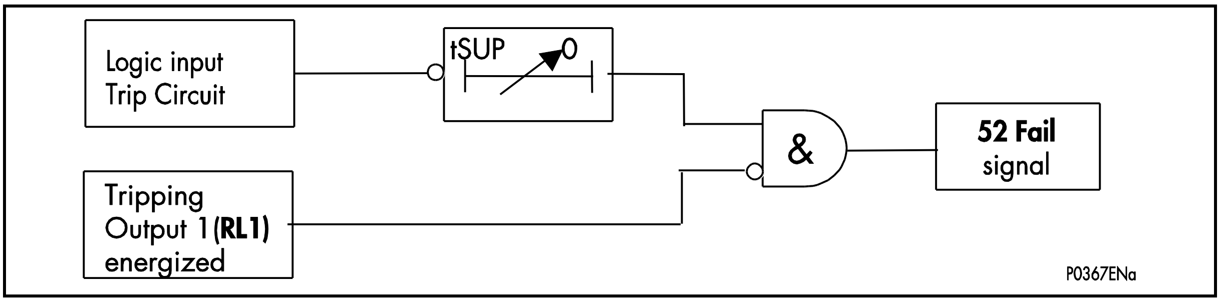
A logic input is programmed to the **AUTOMAT. CTRL/CB Supervision/TC Supervision** function. The logic input is associated to the label **Trip Circ** within the **AUTOMAT. CTRL/Inputs** menu. Then, this logic input is wired in the trip circuit according to one of the typical application diagrams shown in the following example. The method of connecting the logic input to provide TC supervision, is shown later.

When the function TC Supervision is set "Yes" within **CB Supervision** sub-menu, the relay checks continuously on trip circuit continuity whatever the CB status – CB opened or CB closed. The function **TC Supervision** is enabled when the trip logic output (**RL1**) is not energised. The function **TC Supervision** is not enabled when the trip logic output (**RL1**) is energised.

NOTE: If RL1 is energised, the “Trip Circuit Super” alarm message is displayed in order to inform that the TC Supervision is not enabled.

A **52 Fail** (trip circuit failure) signal is generated if the logic input detects no voltage signal during a time longer than the settable timer **tSUP**. See Chapter P12y/EN FT (User Guide) and Chapter P12y/EN TD (Technical Data) for the settings.

As this function is disabled when the trip logic output (**RL1**) is energised, this function is suitable for use with the enabled relay latching logic.



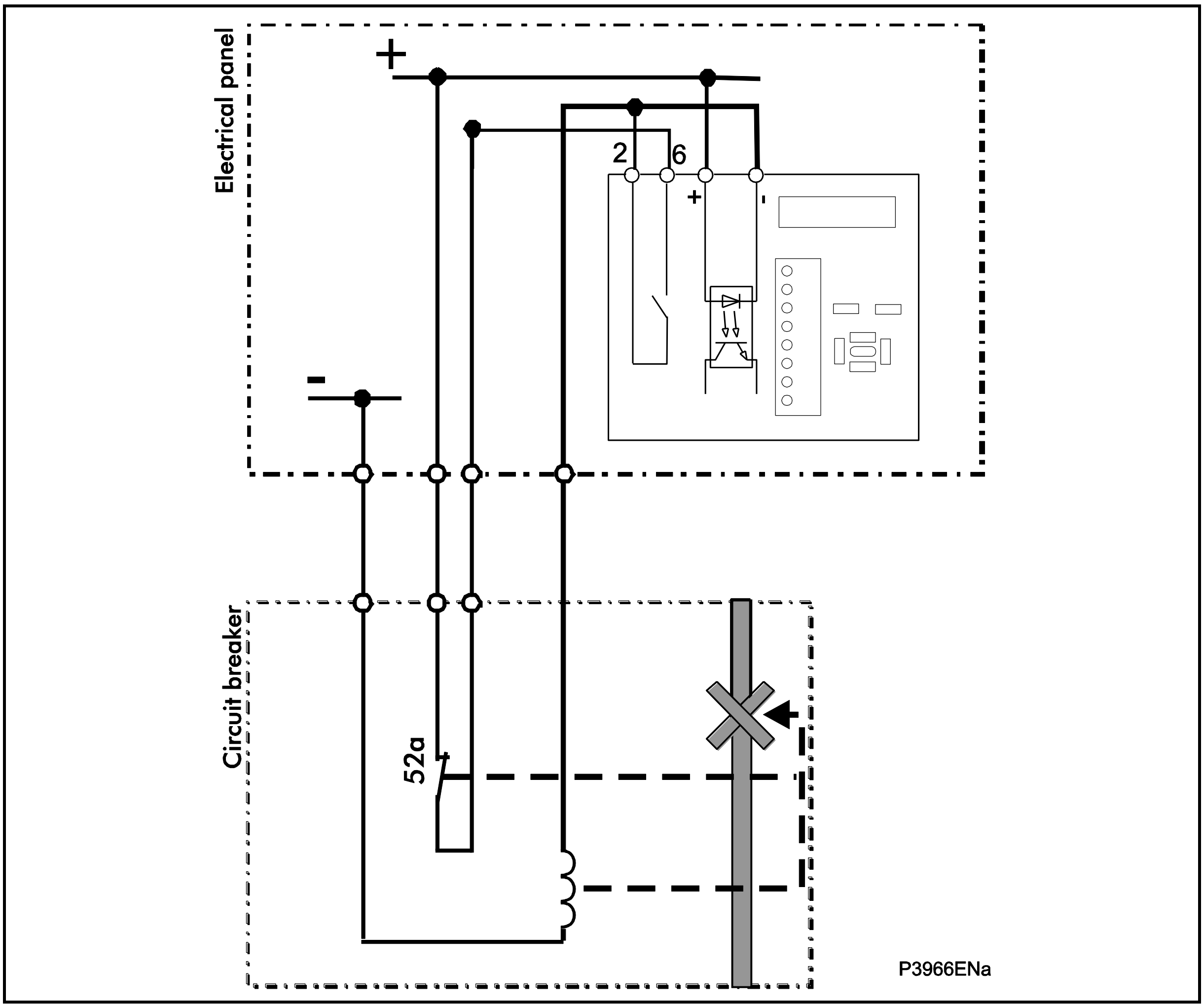
TRIP CIRCUIT SUPERVISION PRINCIPLE DIAGRAM

Three examples of application are given below.

Example 1

In this example only the 52a auxiliary contact is available, the MiCOM P126 & P127 relays monitor the trip coil whatever the CB status (CB open or CB closed).

However, this configuration is not recommended because the 52a contact and associated circuit is not monitored.



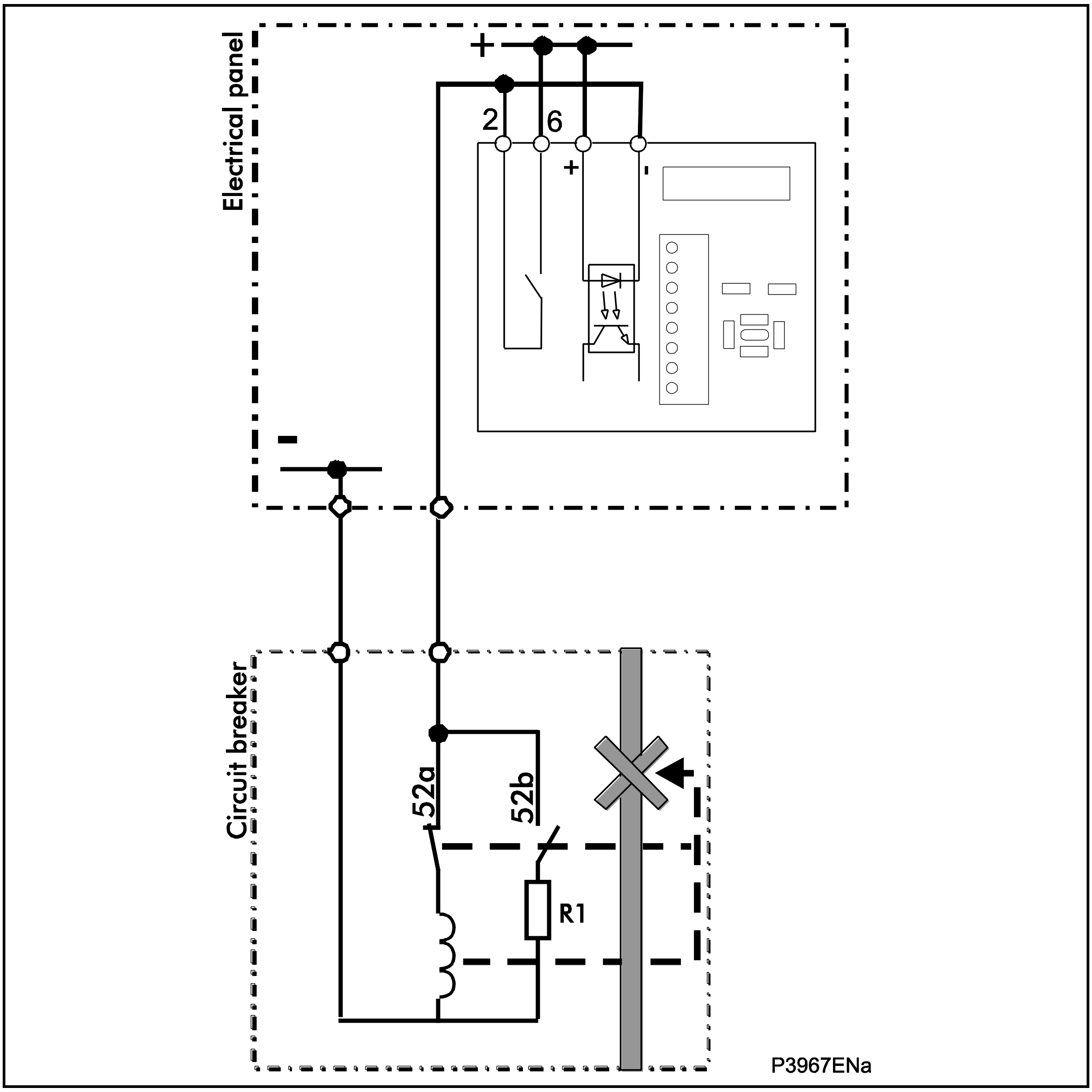
TRIP COIL MONITORING

Example 2

In this example both 52a and 52b auxiliary contacts are available; the MiCOM P126 and P127 relays monitor the complete trip circuit when the CB is closed and a part of the trip circuit when the CB is open.

In this case it is necessary to insert a resistor R1 in series with 52b, if either the output (**RL1**) trip is latched or it stays involuntarily closed, or a long time trip pulse is programmed (See § 6.16.2 for R1 calculation). Otherwise, a short circuit of DC trip supply would occur during tripping sequence.

In this example, the protection is limited: the coil is only monitored when CB is closed.

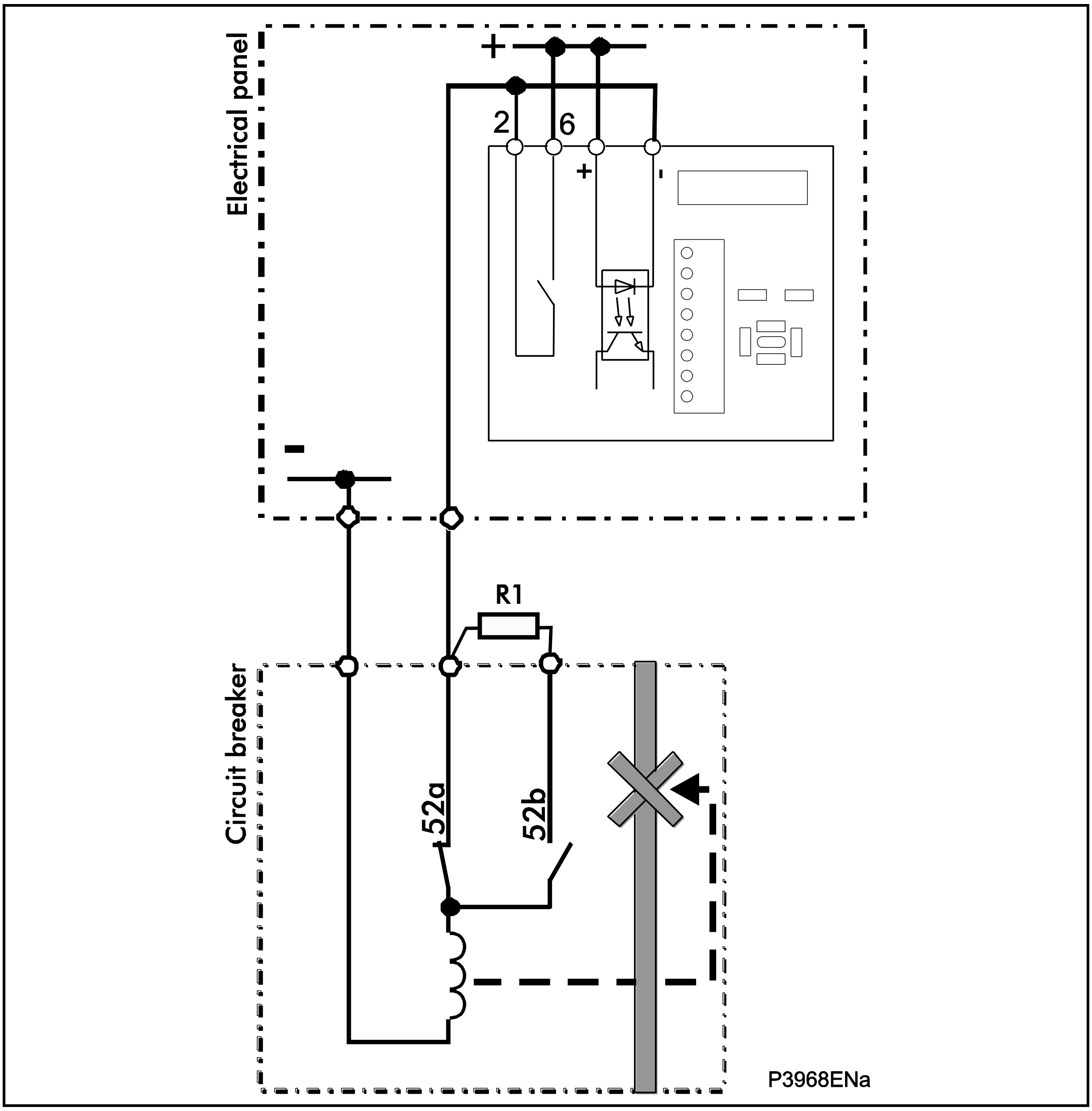


TRIP COIL AND AUXILIARY CONTACTS MONITORING

Example 3

In this example both 52a and 52b auxiliary contacts are available, the MiCOM P126 & P127 relays monitor the complete trip circuit whatever the CB status (CB open or CB closed).

In this case it is necessary to insert a R1, if either the output (**RL1**) trip is latched, or it stays involuntarily closed, or a long time trip pulse is programmed (See § 6.16.2 for R1 calculation). Otherwise, a short circuit of DC trip supply would occur during tripping sequence.



TRIP COIL AND AUXILIARY CONTACTS MONITORING
WHATEVER THE POSITION OF THE CB

6.16.2 External Resistor R1 Calculation

The calculation of the R1 resistor value will take into account that a minimum current is flowing through the logic input. This minimum current value is a function of the relay auxiliary voltage range (Ua).

Remarks:
- The presence of auxiliary relays, such an anti-pumping system for instance, in the trip circuit must be taken into account for the R1 resistance values specification.
- It is assumed the maximum variations of the auxiliary voltage value are ±20%.

1 - Case of example no 2:

The R1 resistor maximum value (in Ohm) is defined by the following formula:

$$R1 < \frac{0{,}8 \times U_a - U_{min}}{I_{min}} [Ohm]$$

Where:

Ua = Auxiliary voltage value (in this case a DC voltage; range is given on label under the top hinged cover. See table below).
Umin = Internal minimum voltage value needed for the opto logic input to operate.
Imin = Minimum current value needed for the opto logic input to operate.

Relay auxiliary voltage range (Ua)	
24-60 VDC (ordering code P12xx00**A**xxxxx)	48-250 VDC/AC (ordering code P12xx00**F**xxxxx)
R1 < (0,8 x Ua – 19,2)/0.035	R1 < (0,8 x Ua – 19,2)/0.035

The R1 resistor withstand value (in Watt) is defined below:

Error! Objects cannot be created from editing field codes.

2 - Case of example no 3:

The R1 resistor maximum value (in Ohm) is defined by the following formula:

$$R1 < \frac{0{,}8 \times U_a - U_{min}}{I_{min}} - R_{Coil} [Ohm]$$

Where:

Ua = Auxiliary voltage value (in this case a DC voltage; range is given on label under the top hinged cover. See table below).
Umin = Internal minimum voltage value needed for the opto logic input to operate.
Imin = Minimum current value needed for the opto logic input to operate.
R_{coil} = Trip coil resistance value.

Relay auxiliary voltage range (Ua)	
24-60 VDC (ordering code P12xx00**A**xxxxx)	48-250 VDC/AC (ordering code P12xx00**F**xxxxx)
R1 < (0,8 x Ua – 19,2)/0.035 - Rcoil	R1 < (0,8 x Ua – 19,2)/0.035 - Rcoil

The R1 resistor withstand value (in Watt) is defined below:

$$P_{R1} > 2 \times \frac{(1{,}2 \times U_a)^2}{(R1 + R_{Coil})} [W]$$

If the trip contact is latched or temporarily by-passed, the continuous current through the tripping coil is:

$$I_{CONTINUOUS} = \frac{(R1 + R_{COIL})}{1.2 \times va}$$

If the value is above admissible continuous current through the tripping coil, trip contact latching must not be made and by-passing trip contact should never be made.

6.17 Switch onto Fault Protection & Trip on Reclose (SOTF/TOR) (P126 & P127)

6.17.1 General

Under particular conditions, it can happen that when the feeder is supplied by the closing of the CB a fast trip command may be required if a fault is present (Closing on to fault).

Some faults may be caused by conditions not removed from the feeder after a reclosing cycle or a manual trip, or due to earthed clamps left on after maintenance works. In these cases, it may be desirable to clear the fault condition in fast time, rather than waiting for the trip time delay DMT or IDMT associated with the involved protection.

In case of manually closing of the CB it can happen to switch on to an existing fault. This is a particularly critical situation, because the overcurrent protection would not clear the fault until the set operate delay had elapsed. This is another typical case of closing on to fault. Hence it is desirable to clear the fault as fast as possible.

The P126 and P127 relays provide the SOTF/TOR functionality.

The SOTF acronym means switch on to fault.

The TOR acronym means trip on recloser.

The available setting to enable/disable/set the SOTF/TOR (Switch On To Fault/ Trip On Reclose) function is written in a submenu of the AUTOMATIC CTRL menu.

The setting regarding the I>> and I>>> is provided to initiate the SOTF function.

6.17.2 SOTF/TOR description

When the SOTF/TOR function is enable, it can be initiated by a local manual CB control close command detected by the digital input labelled Man.Close, or by a TC (closing command by remote via network: Modbus, IEC 60870) or by an automatic reclosing cycle.

When CB has been closed on some faults caused by lightning or something else, the fault detection needs a time period. This is the reason why a 500ms fixed time window after initiatialization of the SOTF/TOR function is included.

When this fixed timer is elapsed and the I>> or I>>> is detected, the settable timer t Sotf starts.

The existence of this settable timer is justified because in some applications selectivity for fault occurring in stage two or three is requested.

Another justification of the SOTF/TOR tripping time delay is for cases where serious transient happen and the three poles of the CB do not close at the same time and for those cases where the CB may not be closed instantaneously.

Furthermore, the t SOFT can also be considered a trip delay time that substitutes the trip timer of the started threshold such to accelerate the tripping.

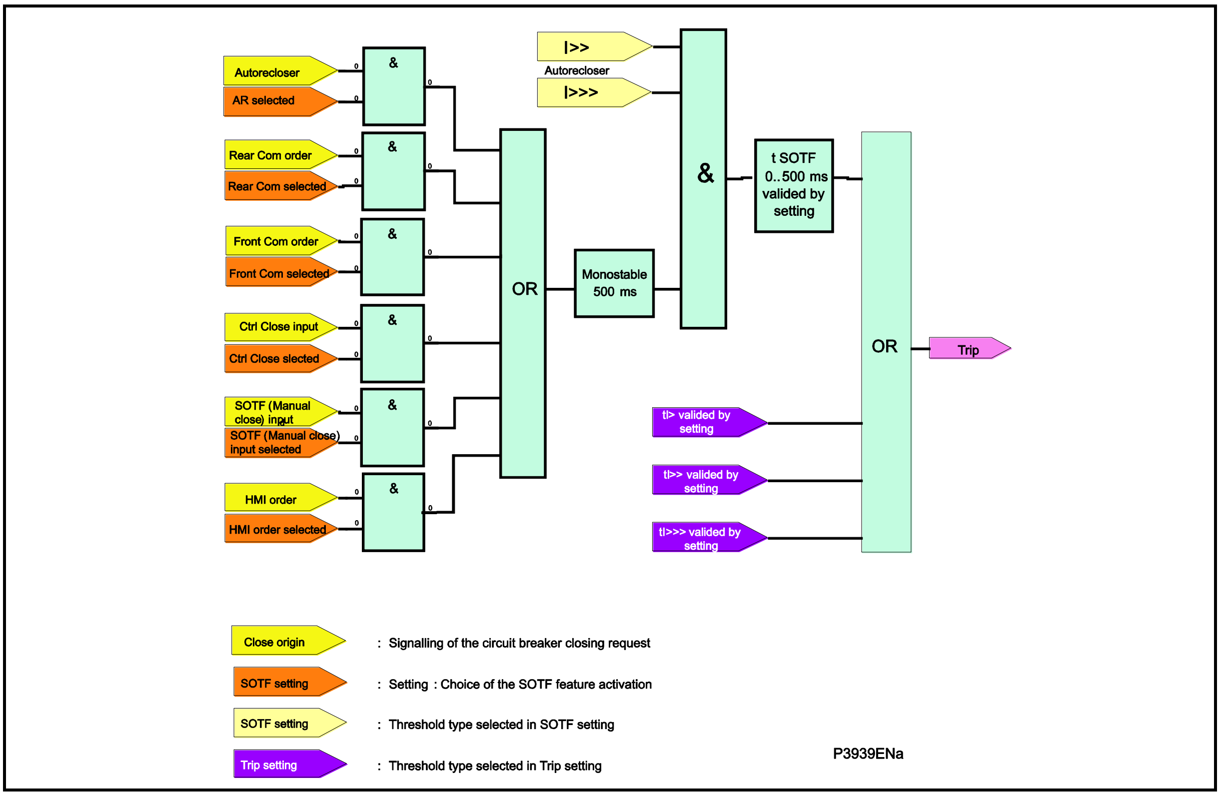
If a trip due to switch on to fault occurs during the reclaim time of the ARC, the trip will be definitive and the ARC will move in the blocked status.

If the I>> and I>>> reset during the settable timer t Sotf the SOTF/TOR function resets.

The following signals can activate the SOTF/TOR function:

- “Ctrl close” logical input,
- manual closing ordered by HMI,
- command generated by a digital input labelled “SOTF”,
- front communication order,
- rear communication order,
- when existing, second rear communication order,
- close ordered by autorecloser,

The SOTF/TOR functionality diagram is shown below.



The trip by SOTF is settable in the AUTOMATIC CTRL/TRIP COMMAND submenu and in the AUTOMATIC CTRL/Output relays submenu.

6.18 Local/Remote conditioning (P125, P126 & P127)

6.18.1 General

The goal of this feature is to be able to block commands sent remotely through communication networks (like setting parameters, control command, etc.), to prevent any accidents or maloperation during maintenance work performed on site.

A digital input labelled “LOCAL MODE” is assigned to this feature. In Local mode, only the synchronising time signal is allowed.

Commands sent remotely (CTRL TRIP and CTRL CLOSE) as well as commands sent by the autoreclose function (CB Close) can be set to activate their own dedicated output relay (and not necessarily the same output relay as the protection trip output RL1).

6.18.2 Settings

In the “AUTOMATIC CTRL/Trip Commands ” menu, TC item uses the “CTRL TRIP” function to open the CB.

In the “AUTOMATIC CTRL/Output relays” menu, the “CTRL TRIP” and “CTRL CLOSE” functions are assigned to remotely open and close the CB.

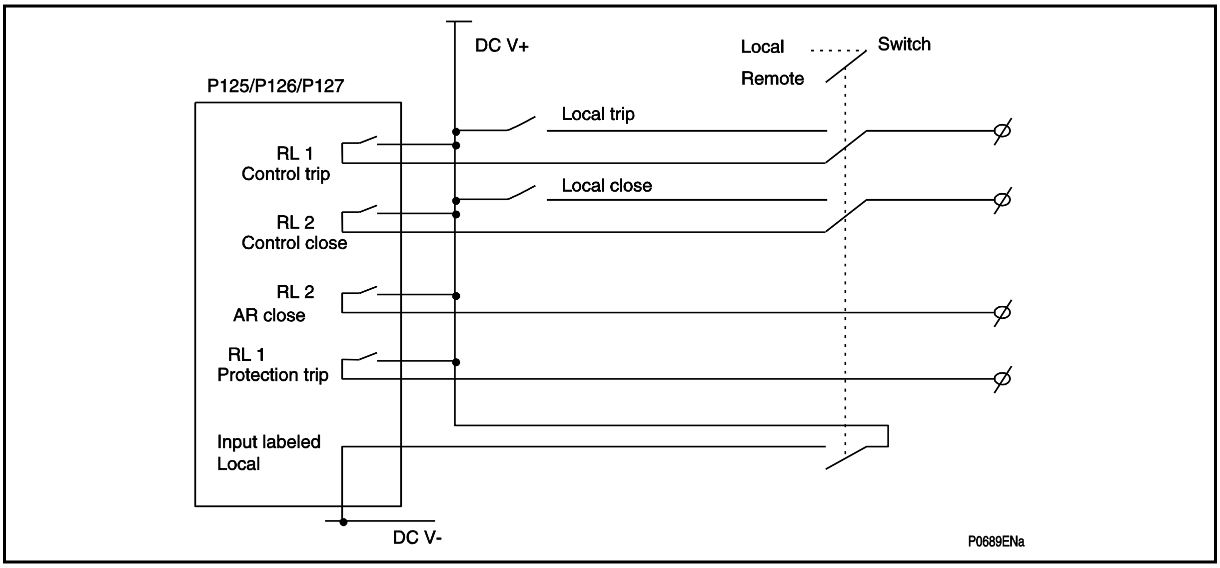
The CB CLOSE relay can be used for the close command.

In order to keep the normal functionality, the customer will have to assign both information TRIP by protection and Ctrl Trip on (RL1), and to assign both information CLOSE CTRL and CB CLOSE on the same auxiliary relay.

An application of the subject mentioned above is presented below.

In the following schematic, the customer will have to assign the TRIP and CTRL TRIP to the TRIP RELAY, the CB CLOSE and the CTRL CLOSE to the auxiliary relay number two, in accordance with setting above.

If the Local input is energised any remote command will be ignored if the Local input is de-energised all the remote control will be considered.



6.19 Logic equations (P126 & P127)

The MiCOM P126 and P127 relays integrate complete logic equations to allow customization of the product based on customer application.

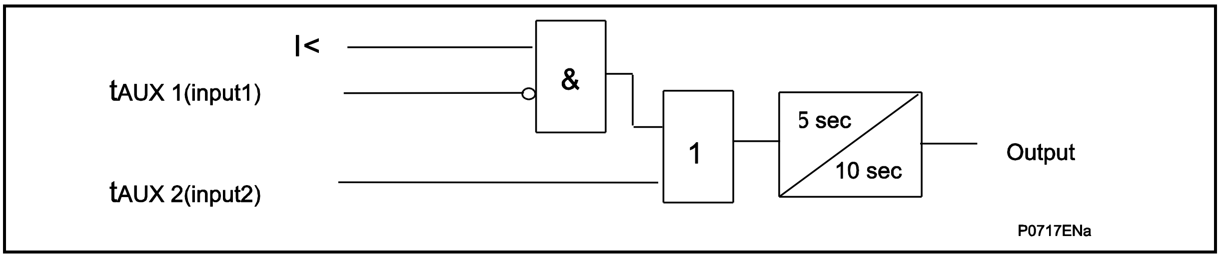
Up to 8 independent Boolean equations can be used. Each equation offers the possibility to use AND, OR, AND NOT, OR NOT & NOT logical gates. Up to 16 parameters can be used for each equation. Every result of equation can be time delayed and assigned to any output relays, trip, trip latching and/or HMI LEDs.

Every equation has a rising temporisation from 0 s to 600 s with a step of 0.01 s.

Every equation has a falling temporisation from 0 s to 600 s with a step of 0.01 s.

Every equation temporised result is assignable to trip, trip latching, outputs and LEDs.

An example logic implementation using Equation A is shown below:



7. RECORDS (P125, P126 & P127)

7.1 Event Records

The relay records and time tags up to 250 events and stores them in a non-volatile memory. This enables the system operator to analyse the sequence of events that occurred within the relay following a particular power system condition, switching sequence etc. When the available memory space is exhausted, the new fault automatically overwrites the oldest fault.

The real time clock within the relay provides the time tag to each event, to a resolution of 1ms.

The event records are available for viewing either on the front panel, or via the front panel EIA RS232 port or remotely, via the rear EIA RS485 port.

7.2 Fault Records

Each time any of the programmed thresholds are crossed a fault record is created and stored in a memory. The fault record tags up to 25 faults and stores them in a non-volatile memory. This enables the system operator to identify and analyse network failures. When the available memory space is exhausted, the new fault automatically overwrites the oldest fault.

Note that viewing of the actual fault record is carried out in the **RECORD/Fault Record** menu, which is selectable from up to 25 stored records. These records consist of fault flags, fault measurements etc. Also note that the time stamp given in the fault record itself will be more accurate than the corresponding stamp given in the event record as the event is logged some time after the actual fault record is generated.

The fault records are available for viewing either on the display, or via the front panel EIA RS232 port or remotely, via the rear EIA RS485 port.

7.3 Instantaneous Recorder

Each time any of programmed threshold is crossed an instantaneous record is created and displayed in the RECORDS/Instantaneous menu. The last five starting information with the duration of the information are available. The number of the fault, hour, date, origin (voltage, current and wattmetric protection thresholds), length (duration of the instantaneous), trip (a trip is appeared, yes or no) are displayed in the RECORDS/Fault Record menu.

7.4 Disturbance Records

The integral disturbance recorder has an area of memory specifically set aside for disturbance record storage. The disturbance records that may be stored are 3, 5, 7 or 9 seconds length each. Disturbance records continue to be recorded until the available memory space is exhausted, at which time the oldest disturbance record(s) is (are) overwritten to make space for the newest disturbance record(s).

The recorder stores actual samples, which are taken at a rate of 16 samples per cycle.
Each disturbance record consists of analogue data channels and digital data channels. Note that the relevant VTs and CTs ratios for the analogue channels are also extracted to enable scaling to primary quantities.

The total disturbance recording time is 5 records of 3 seconds, or 4 × 3s, or 3 × 5s, or 2 × 7s or 1 × 9s. The disturbance record starts with the disturbance. If the pre-time time is set to 100ms, the record starts 100 ms before the disturbance.

For the settings of the parameters see FT (User Guide) and TD (Technical Data) chapters of this TG.

8. ROLLING AND PEAK VALUE DEMANDS (P126 & P127)

The MiCOM P126 and P127 relays are able to store the 3 phases rolling average and maximum subperiod values. The description and principle of calculation are given bellow.

8.1 Rolling demand

The principle of the calculation of the rolling demand value for IA, IB and IC currents is following:

– Calculation of the average of the RMS values on a "Rolling Sub Period" period.

The setting of the width of the period "Rolling Sub Period" is in the "RECORDS/Rolling Demand/Sub Period" menu.

Setting range: from 1 to 60 minutes.

– Storage of these values in a sliding window

– Calculation of the average of these average values (sliding window values) on the number of "Num. of Sub Periods" periods

The setting of the number of Sub Period "Num of Sub Periods" in the "RECORDS/Rolling Demand/Num of Sub Per" menu.

Setting range: from 1 to 24.

Display of the first result in the MEASUREMENTS menu only after the storage of "Num of Sub Periods" periods.
The 3 phases Rolling average value are displayed:

– Rolling Average IA RMS

– Rolling Average IB RMS

– Rolling Average IC RMS

The calculation is reset by either "hand Reset" (by key _) without use of password, or a remote command.

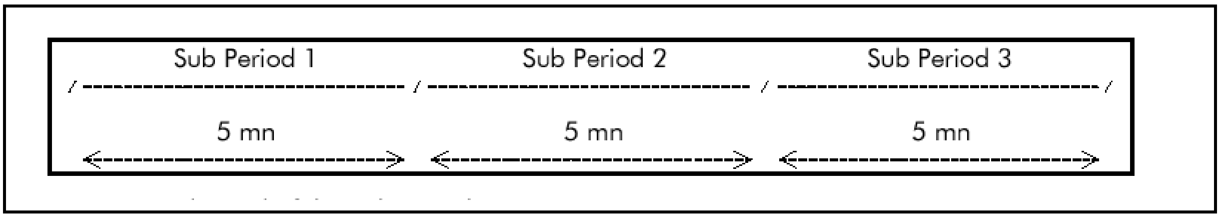
NOTE: In case of loss of power supply the rolling demand are not stored.

A modification of the settings (either "Rolling Sub Period" or "Num of Sub Periods" parameter) reset the calculation.

Example:

Sub Period = 5 mn

Num of Sub Period = 2



At the end of the Sub Period 2:

Rolling average value = (average value 1 + average value 2)/2

At the end of the Sub Period 3:

New Rolling average value = (average value 2 + average value 3)/2

8.2 Peak value demand

The principle of the calculation of the Peak value demand for IA, IB and IC currents is following:

Every "Rolling Sub Period", a new average value is compared with the previous value calculated at the previous "Rolling Sub Period". If this new value is greater than the

previous value already stored, then this new value is stored instead of the previous one.

In the opposite if this new value is lower than the previous value already stored, then the previous value is kept stored.

In this way, a average peak vale will be refreshed each Sub Period; There is no dedicated setting for this calculation. The setting of the Sub Period in the RECORDS menu is used.

The 3 phase Peak value demand are displayed in the MEASUREMENTS menu:

- MAX SUBPERIOD IA RMS
- MAX SUBPERIOD IB RMS
- MAX SUBPERIOD IC RMS

The calculation is reset by either "hand Reset" (by key _) without use of password, or a remote command.

NOTE: In case of loss of power supply the Peak average values are stored.

A modification of the setting "Rolling Sub Period" parameter reset the calculation.

9. SETTING GROUP SELECTION (P125, P126 & P127)

The MiCOM P125, P126 relays have two protection related setting groups named **PROTECTION G1** and **PROTECTION G2**. Only one of two setting groups is active. The MiCOM P127 relay have eight protection groups (**PROTECTION G1** to **PROTECTION G8**).

Changes between the groups are executed via the front interface **(CONFIGURATION / GROUP SELECT / SETTING GROUP)**, a dedicated logic input **(AUTOMAT CTRL / INPUT X / CHANGESET)** where X is the chosen logic input, or through the communication port (refer to Mapping Data Base for more detailed information).

To avoid any undesirable tripping, the setting group change is only executed when none protection function is running excepted than for thermal overload function.

If a setting group change is received during any protection or automation function, it is stored and executed after the last timer has elapsed.

The active group is displayed in the **OP PARAMETER** menu.

The active group can also be assigned to an output relay: with a normally open contact.

– a contact open will indicate Group 1

– a contact closed will indicate Group 2

9.1.1 Setting group change by digital input

It is possible to configure the change of the setting group by a digital input, either on low level or on high level. The choice can be done in the **CONFIGURATION/Inputs** menu.

Low level (idem for high level) depending of the application is selectable in the **CONFIGURATION/Group Select/Change Group/Input** menu.

If the digital input assigned to the change of setting group operates on level (low or high), it is not possible to change of setting group via either remote communication or front panel.

Switching between the groups can be done via:

- the relay front panel interface (CONFIGURATION / GROUP SELECT / SETTING GROUP),
- a dedicated logic input (AUTOMAT. CTRL/INPUT X / CHANGE SET) where X is the chosen logic input,
- through the communications port.

9.1.2 Priority

The front panel is priority level maximum due the fact when the user takes the hand on front panel and enters a password , it is not possible to change of setting group via remote communication as long as the password is active (5mn).

Below are listed the priorities in the different ways to switch between setting groups.

ORIGIN OF THE ORDER	PRIORITY LEVEL
FRONT PANEL	MAXIMUM
LOGIC INPUT	MEDIUM
REMOTE COMMUNICATIONS	MINIMUM

10. MEASUREMENTS

The measurement functions on MiCOM P125, P126 and P127 relays are described in chapter User Guide of this Technical Guide.

Particular attention is to be given to the power and energy measurement.

10.1 Power and Energy Measurements (P127)

The MiCOM P127 relay provides the measurements function for active and reactive power and for active and reactive energy.

The fundamental value is provided for the derived (calculated) measures.

The following table lists the shown voltage measurements, according to the VT connection (‘CONFIGURATION / General options / VT Connection)

	Configuration 3Vpn	Displayed on HMI	Configuration 2Vpn+Vr	Displayed on HMI	Configuration 2Vpp + Vr	Displayed on HMI
Ua	Direct measurement	Yes	Direct measurement	Yes	N.A	-------------
Ub	Direct measurement	Yes	Direct measurement	Yes	N.A	-------------
Uc	Direct measurement	Yes	Derived measurement	Yes	N.A	-------------
Uab	Derived measurement	Yes	Derived measurement	Yes	Direct measurement	Yes
Ubc	Derived measurement	Yes	Derived measurement	Yes	Direct measurement	Yes
Uac	Derived measurement	Yes	Derived measurement	Yes	Derived measurement	Yes
UN	Derived measurement	Yes	Direct measurement	Yes	Direct measurement	Yes

The value for power is calculated in accordance with the following listed table.

VTs connection	Active Reactive power calculation method	
3Vpn	Sum of each power phase	P= PA+PB+PC Q= QA+QB+QC
2Vpn+Vr	Sum of each power phase	P= PA+PB+PC Q= QA+QB+QC
2Vpp+Vr	Aron insertion	

The value for energy is calculated by multiplying the calculated power value by time.

The calculated energy value is stored in a non-volatile memory (E^2PROM) every second, so that in case of temporary power supply fault, the previous values calculated can be recalled.

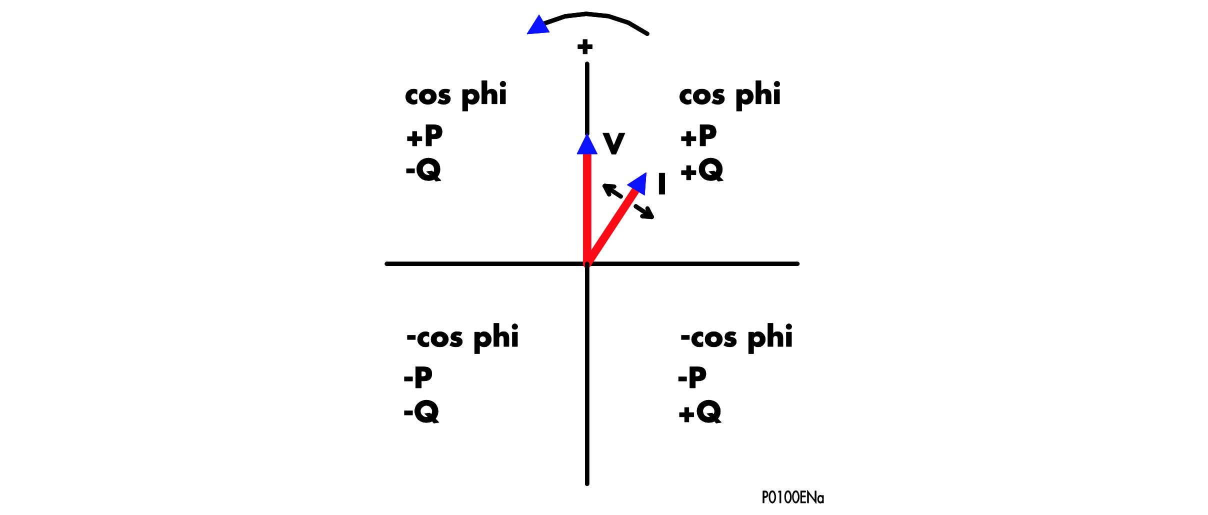
The MiCOM P127 relay provides, on the display, the measurements of the power and of the energy. Both refer to primary values and rely on the CT and VT ratio.

The maximum active and reactive power value displayed is 9999MW and 9999MVAr.

The maximum active and reactive energy value displayed is 4200GWh and 4200GVArh.

The sign of the active and reactive power/energy values is taken according to the diagram below.

They are in accordance with the wiring diagrams in the chapter P12y/EN CO in this Technical Guide.



10.2 Additional measurement CT (P127 optional configuration only)

In addition to existing protection CT (Ia, Ib, Ic, I0) and (Va, Vb, Vc), two measurements CT are added (optional configuration).

The "Metering" menu is a dedicated menu. Phases currents and voltages are displayed according to CTM1 and CTM2 phases configuration:

'CONFIGURATION / General options'		
"CTM1 phase ?"	"CTM2 phase ?"	"METERING" menu
= none	= none	The menu is not displayed.
= IA (or IB, or IC)	= none	This option indicates that CTm1 is physically connected to phase A, and CTM2 not connected. The menu displays the phase A currents.
= IA (or IB, or IC)	= IB (or IC, or IA)	This option indicates that CTm1 is physically connected to phase A, and CTm2 is connected to phase B. The menu displays the phase A and phase B measured values. The third phase is computed using the vectorial equation: "$\overrightarrow{IA} + \overrightarrow{IB} + \overrightarrow{IC} = 0$.

When CTm1 and CTm2 phases are connected, "Metering" menu displays frequency, 3-phases currents, 3-phases voltage, power and energy measured values.

NOTE: the following explanations are given for phase A. The same equations are applicable to phase B or phase C using (IBm or ICm) and (VBm or VCm).

10.2.1 Frequency

This menu displays network frequency.

10.2.2 Currents

The “Currents” menu displays the magnitude of the measured currents (true RMS value). It takes into account the CTm connection (see the previous table) and CTm ratio (‘CONFIGURATION / Transfo ratio’).

MiCOM P127 displays the magnitude of fundamental current, and the magnitude of the currents up to the 10^{th} harmonics.

10.2.2.1 Total Harmonic Distortion (THD) and Total Demand Distorsion (TDD)

Current Harmonic Distortion is measured by phase in several different ways. The first method is Total Harmonic Distortion (THD). The MiCOM P127 THD (THD IAm) equation is given in the following equation (for phase A):

$$\text{THD IAm} = 100\% \times \frac{\sqrt{\sum_{h=2}^{10} \text{IAm}\,h?}}{\text{I1}}$$

NOTE: The denominator I1 is the magnitude of the fundamental current.

Alternatively, Current Harmonic Distortion can be measured as Total Demand Distortion (TDD). Demand Distortion differs from traditional harmonic distortion in that the denominator of the distortion equation is a fixed value “I_L”. This fixed denominator value is defined as the average peak demand, and is set using ‘CONFIGURATION / General options / IAm TDD denom.’ cell:

$$\text{TDD IAm} = 100\% \times \frac{\sqrt{\sum_{h=2}^{10} \text{IAm}\,h?}}{\text{IL}}$$

By creating a measurement that is based on a fixed value, TDD is a "better" measure of distortion problems. Traditional THD is determined on the ratio of harmonics to the fundamental. While this is acceptable for voltage measurements, where the fundamental only varies slightly, it is ineffective for current measurements since the fundamental varies over a wide range. Using traditional THD, 30% THD may mean a 1 Amp load with 30% Distortion, or a 100 Amp load with 30% Distortion. By using TDD, these same two loads would exhibit 0.3%

10.2.2.2 K Factor

K-Factor is a measure of the heating effects on transformers. The following equation is used, for MiCOM P127, to determine phase A K-Factor, where "h" is the harmonic number and "IAmh" is the magnitude of the h^{th} harmonic.

$$\text{K IAm} = 100 \times \frac{\sum_{h=1}^{10} \text{IAm}\,h? \times h?}{\sum_{h=1}^{10} \text{IAm}\,h?}$$

K-Factor is measured on each of the three phases of amps, however there is no "Total" K-Factor. K-Factor, like THD, does not indicate the actual load on a device, since all three of these measurements are ratios. Given the same harmonic ratio, the calculated K-Factor for a lightly loaded transformer will be the same as the calculated K-Factor for a heavily loaded transformer, although the actual heating on the transformer will be significantly different.

10.2.3 Voltages

The following table lists the displayed voltage measurements, according to the VT connection ('CONFIGURATION / General options / VT Connection) and / or to the VT protection ('CONFIGURATION / General options / VT Protection).

	Configuration "3Vpn" AND "Protect P-N"	Displayed on HMI	Configuration "2Vpn+Vr" AND "Protect P-N"	Displayed on HMI	Configuration "2Vpp + Vr" OR "Protect PP"	Displayed on HMI
Va	Direct measurement	Yes	Direct measurement	Yes	N.A	-------------
Vb	Direct measurement	Yes	Direct measurement	Yes	N.A	-------------
Vc	Direct measurement	Yes	Derived (calculated) measurement	Yes	N.A	-------------
Uab	N.A	-------------	N.A	-------------	Direct measurement	Yes
Ubc	N.A	-------------	N.A	-------------	Direct measurement	Yes
Uca	N.A	-------------	N.A	-------------	Derived measurement	Yes

The "Voltages" menu displays the magnitude of the measured voltages (true RMS value). It takes in account the CTm connection (see the previous table) and CTm ratio ('CONFIGURATION / Transfo ratio').

MiCOM P127 displays the magnitude of fundamental voltage, and the magnitude of the voltages up to the 10^{th} harmonics.

10.2.3.1 Total Harmonic Distortion (THD)

Voltage Harmonic Distortion is measured by phase in several different ways. The MiCOM P127 equation for phase A Total Harmonic Distortion (THD) is given in the following equation:

$$\text{THD VAm} = 100\% \times \frac{\sqrt{\sum_{h=2}^{10} \text{VAm h?}}}{\text{V1}}$$

Note the denominator V1 is the fundamental magnitude. For Individual Harmonic Distortion there is no summation, only one component is used in the numerator.

10.2.4 Powers

The MiCOM P127 displays:

– the measured positive & negative active power; see § 4.3,

– the measured positive & negative reactive power; see § 4.3.

– the measured total apparent power (product of the per-element Volts and Amps):

– the three phase displacement power factor (cosine of the angle between the fundamental voltage vector and the fundamental current vector): The Total Displacement Power Factor measurement is calculated using the "Power Triangle," or the three-phase Fundamental WATTS divided by the three-phase Fundamental VAs. The per-phase Fundamental VA measurement is calculated from the product of the per-phase Fundamental Amp and Fundamental Volts values. The three-phase Fundamental VA measurement is the sum of the per-phase Fundamental VA values (Arithmetic VAs).

See § 10.2.6 to see the convention for the positive (+) or negative (–) sign.

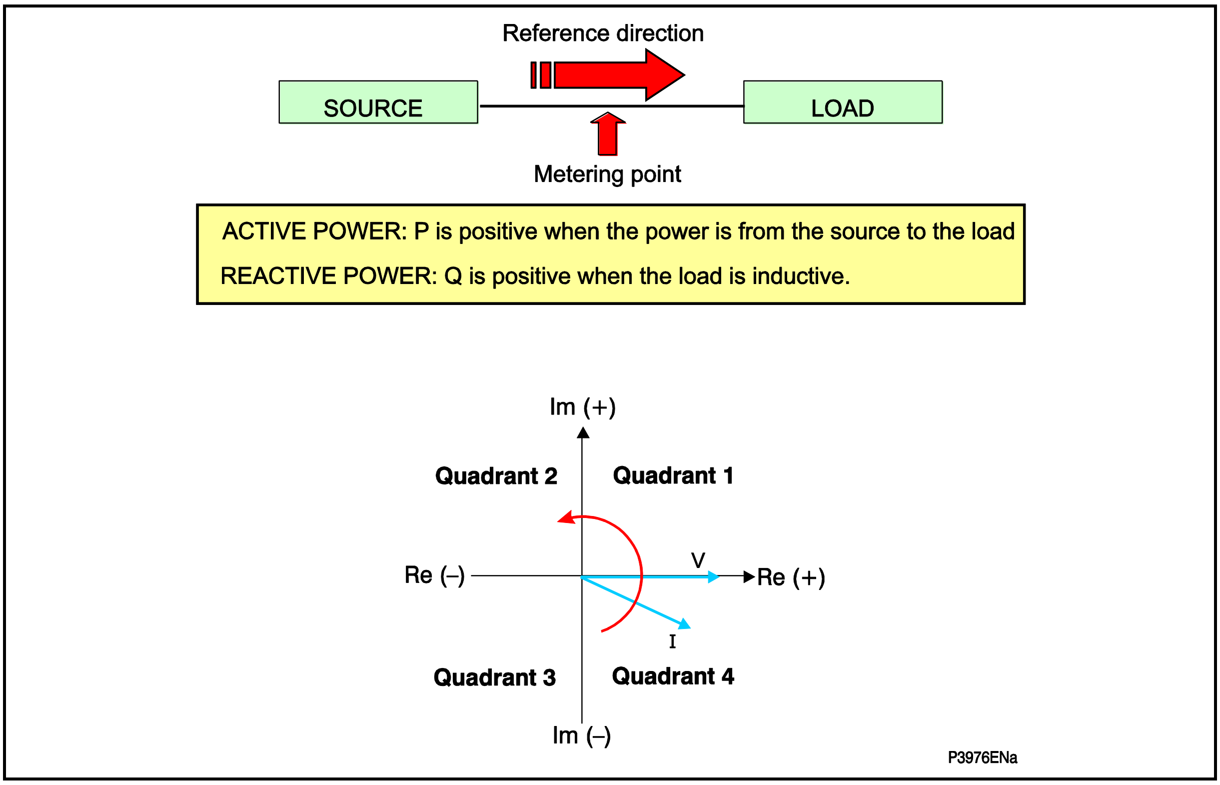
10.2.5 Energies

Separate values are maintained for both positive and negative Watt-hours (export and import powers) and positive and negative VAR-hours (Lagging and leading VARs. These energy quantities are calculated every minute from the Total Watts and Total VARs.

See § 10.2.6 to see the convention for the positive (+) or negative (–) sign.

10.2.6 Plus and minus signes for power and energy calculation.

Plus or minus signs are defined as follows:



with:

	Quadrant 1	Quadrant 2	Quadrant 3	Quadrant 4
Power				
Active (P)	+	–	–	+
Reactive (Q)	–	–	+	+
Energy				
Export Wh (Ea+)	+	–	–	+
Import Wh(Ea–)	–	+	+	–
Lagging VARh (Er+)	–	–	+	+
Leading VARh (Er–)	+	+	–	–

11. LOGIC INPUTS AND LOGIC OUTPUTS

11.1 Logic Inputs

In the logic input submenu can be set the digital inputs as active high or active low, can be chosen the supply type DC or AC and it is possible to set the start/stop of the relevant auxiliary timers assigned to the inputs by front or edge.

By the ordering code it is possible to select the relay with the digital inputs with EA approval regulation.

See the technical data for further information.

The setting menu for this functionality is in the **CONFIGURATION** menu. For more details see FT (User Guide).

In modern protective schemes it is often desirable to synchronize the relay's real time clock so that events from different relays can be placed in chronological order.

This can be done using the communication interface connected to the substation control system or via an opto-input.

Any of the available opto-inputs on the P12x relay can be selected for synchronization. Pulsing this input will result in the real time clock snapping to the nearest minute. The recommended pulse duration is 20ms to be repeated no more than once per minute. An example of the time synchronization function is shown.

Time of "Sync. Pulse"	Corrected Time
19:47:00.000 to 19:47:29.999	19:47:00.000
19:47:30.000 to 19:47:59.999	19:48:00.000

NOTE: The above assumes a time format of hh:mm:ss

A single digital input can be used for several internal functions or assigned directly to any output contact

11.2 Logic Outputs

A dedicated output relay is assigned to each logic output. It is possible to set the relays as self reset or latching.

The two first output contacts (RL1 & RL2) can be used as failsafe relays to provide a "fail safe alarm" in case of power supply loss or major hardware failure. Other available relays can be inverted to reverse NO relays operating condition (output relays closing when logical state of the signal changes from 1 to 0).

FAIL	87654321
SAFE RE.	00100010

This settings means:

– RL1: Normally Open (NO)

– RL2: Fail Safe relay

– RL3, 4, 5, 7 & 8: NO

– RL6: Inverted (NO but output relays closed when logical state of the signal is going down)

The setting menu for the functionality of the logic outputs is available in the **AUTOMAT. CTRL** menu.

It is possible to assign a specific function to each output relay except **RL1**.

For more details see the chapter User Guide.

12. MAINTENANCE MODE

This menu allows the user to verify the operation of the protection functions without sending any external order (Tripping or signalling).

The selection of the maintenance mode is possible by logic input, control command (rear or front port), or by front display. The end of maintenance mode is done by logic input, by control command or on the front display time out (5minutes) and by turning off the power supply.

Maintenance Mode	
	YES

When activating this menu (YES), the Alarm led will start flashing and an alarm message will appear “MAINTENANCE MODE”. In this case, all output contacts are blocked, no operation will take place on these contacts even if a protection threshold associated to one of these output contacts is exceeded.

(If protection threshold is exceeded, all the associated leds will become ON, even the TRIP LED, if the threshold is associated to the RL1).

RELAYS	8765W4321
CMD	000000000

This window allows the user to verify the external wiring to the relay output contacts, to do this, it is sufficient to assign a 1 to any of the output contacts, this will close the contact and the wiring continuity could be verified.

13. CT REQUIREMENTS

The CT requirements for the MiCOM P12y relays are given below.

The current transformer requirements are based on a maximum prospective fault current of 50 times the relay rated current (In) and the relay having an instantaneous setting of 25 times rated current (In). The current transformer requirements are designed to provide operation of all protection elements.

Where the criteria for a specific application are in excess of those detailed above, or the actual lead resistance exceeds the limiting value quoted, the CT requirements may need to be increased according to the formulae in the following sections.

Nominal Rating	Nominal Output	Accuracy Class	Accuracy Limit Factor	Limiting lead resistance
1A	2.5VA	10P	20	1.3 ohms
5A	7.5VA	10P	20	0.11 ohms

13.1 Definite time / IDMT overcurrent & earth fault protection

Time-delayed Phase overcurrent elements:

$$V_K \geq I_{cp}/2 * (R_{CT} + R_L + R_{rp})$$

Time-delayed Earth Fault overcurrent elements:

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

13.2 Instantaneous overcurrent & earth fault protection

CT requirements for instantaneous phase overcurrent elements:

$$V_K \geq I_{sp} * (R_{CT} + R_L + R_{rp})$$

CT requirements for instantaneous earth fault overcurrent elements:

$$V_K \geq I_{sn} * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

13.3 Definite time / IDMT sensitive earth fault (SEF) protection

Time delay SEF protection:

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

SEF Protection - as fed from a core-balance CT:

Core balance current transformers of metering class accuracy are required and should have a limiting secondary voltage satisfying the formulae given below:

Time Delayed element:

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

Instantaneous element:

$$V_K \geq I_{fn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

Note that, in addition, it should be ensured that the phase error of the applied core balance current transformer is less than 90 minutes at 10% of rated current and less than 150 minutes at 1% of rated current.

Abbreviations used in the previous formulae are explained below:

Where:

VK	=	Required CT knee-point voltage (volts),
Ifn	=	Maximum prospective secondary earth fault current (amps),
Ifp	=	Maximum prospective secondary phase fault current (amps),
Icn	=	Maximum prospective secondary earth fault current or 31 times I> setting (whichever is lower) (amps),
Icp	=	Maximum prospective secondary phase fault current or 31 times I> setting (whichever is lower) (amps),
Isn	=	Stage 2 & 3 Earth Fault setting (amps),
Isp	=	Stage 2 and 3 setting (amps),
RCT	=	Resistance of current transformer secondary winding (ohms)
RL	=	Resistance of a single lead from relay to current transformer (ohms),
Rrp	=	Impedance of relay phase current input at 30In (ohms),
Rrn	=	Impedance of the relay neutral current input at 30In (ohms).

MODBUS &
IEC 60870-5-103 &
DNP 3.0
DATABASE

MiCOM P125-P126–P127 – V16

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MODBUS DATABASE
MiCOM P125-P127 – V16

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CONTENT

1. INTRODUCTION

1.1 Purpose of this document

This document describes the characteristics of the different communication protocols of **MiCOM P127, P126 and P125** relays (named P12y in this document).

The available communication protocols on the relay are listed below:

- MODBUS
- IEC 60870-5-103
- K-BUS/COURIER (not available)
- DNP3

1.2 Glossary

Ie	: earth fault current measured
Ue	: residual voltage measured directly by the input terminals on rear panel
Pe	: earth fault power (Calculated)
IeCosPhi	: active component of the earth fault current
MWh+	: positive active energy
MWh-	: negative active energy
MVARh+	: positive re-active energy
MVARh-	: negative re-active energy
MVAh	: apparent energy
pf	: soft weight of a 16 bits word
PF	: heavy weight of a 16 bits word
Dec	: decimal representation value
Hex	: hexadecimal representation value

COURIER are not available yet (in grey colour)

2. MODBUS PROTOCOL

MiCOM P12y relay can communicate by a RS 485 link. The terminals are placed on the rear panel (terminals 31 and 32). See the GS document for further information on the wiring. The applied ModBus protocol is compliance with the MODBUS RTU.

2.1 MODBUS connection technical characteristics

2.1.1 MODBUS connection parameters

The different parameters of the MODBUS connection are as follows:

– Isolated two-point RS485 connection (2kV 50Hz),

– MODBUS line protocol in RTU mode

Communication speed can be configured by an operator dialog in the front panel of the relay:

Baud rate (dec)
300
600
1200
2400
4800
9600
19200
38400

Transmission mode of the configured characters by operator dialog

Mode
1 start / 8 bits / 1 stop: total 10 bits
1 start / 8 bits / even parity / 1 stop: total 11 bits
1 start / 8 bits / odd parity / 1 stop: total 11 bits
1 start / 8 bits / 2 stop: total 11 bits

2.1.2 Exchanges messages synchronisation

Any character received after a silence on the line of more than or equal to a transmission time of 3 bytes is considered as a frame start.

2.1.3 Message validity check

The validation of a frame is performed with a 16-bit cyclical redundancy check (CRC).
The generator polynomial is:

$1 + x^2 + x^{15} + x^{16}$ = 1010 0000 0000 0001 binary = A001h

2.1.4 Address

In order to integrate a protection device into a control and monitoring system, the address must be set from the local control panel. The address may be selected from the range of 1 to 255. The address 0 is reserved for broadcast messages.

2.2 MODBUS functions available in the protection device

Protection device data may be read or modified by using function codes. Following are the available function codes. Function codes to read from or write into parameter cells in the protection device are described in the listed following table.

Function Nr.	Data Read	Data Write	Data Format & Type
1	X		N bits
2	X		N bits
3	X		N words
4	X		N words
5		X	1 bit
6		X	1 word
7	Fast		8 bits
8	X		Diagnostics counter
11	X		Event counter
15		X	N bits
16		X	N words

2.3 Description of the ModBus protocol

MODBUS is a master-slave protocol where every exchange involves a master device request for data and a slave devices response with data.

2.3.1 Frame size received from the protection device (slave)

Frame transmitted from the master (query):

Slave number	Function code	Information	CRC16
1 byte	1 byte	n bytes	2 bytes
0 to FFh	1 to 10h		

Slave address:

The slave address is in the range from 1 to 255. A transmitted frame with a slave address equal to 0 is a globally addressed to all installed equipment (broadcast frame)

Function code:

The function code returned from the slave in the exception response frame is the code in which the most significant bit (bit 7) is forced to 1.

Error code:

Among the 8 exception codes of the MODBUS protocol, the protection device manages two:

– Code 01: Function code unauthorised or unknown.

– Code 03: A value from the data field is unauthorised (incorrect code).

  – Control of data being read.
  – Control of data being written.
  – Control of data address.
  – Length of request for data message.

CRC16:

The slave calculates the CRC16 value.

NOTE: The slave device does not respond to globally broadcast frames sent out from the master.

2.3.2 Format of frames sent from the relay

Frame sent (response)

Slave number	Function code	Data	CRC16
1 byte	1 byte	n bytes	2 bytes
1 to FFh	1 to 10h		

Slave address:

The slave address is in the range from 1 to 255.

Function code:

Processed MODBUS function (1 to 16).

Data:

Contains reply data to master query.

CRC 16:

CRC16 value calculated by the slave.

2.3.3 Messages validity check

When **MiCOM P12y** relay (slave) receives a master query, it validates the frame:

– If the CRC is incorrect, the frame is discarded as invalid. The slave does not reply to the request for data. The master must retransmit its request for data. With the exception of a broadcast message, this is the only case where the slave does not reply to a request for data from the master.

– If the CRC is correct but the slave can not process the request for data, it sends an exception response to the master.

Warning frame sent (response)

Slave number	Function code	Error code	CRC16
1 byte	1 byte	1 byte	2 bytes
1 to FFh	81h or 83h or 8Ah or 8Bh		pf ... PF

Slave number:

The address range of the slave device is between 1 and 255.

Function code:

The function code returned by the relay in the warning frame is the code in which the most significant bit (bit 7) is forced to 1.

Warning code:

On the 8 warning codes of the MODBUS protocol, the relay manages two of them:

– code 01: function code unauthorised or unknown.

– code 03: a value in the data field is unauthorised (incorrect data).

  - Control of pages being read
  - Control of pages being written
  - Control of addresses in pages
  - Length of request messages

CRC16:

Value of the CRC16 calculated by the slave.

3. DATABASE ORGANISATION

Application mapping are organised in pages. The characteristics are the following:

Page	Data type	Read permission	Write permission	Function Nr
0h	Product information, remote signalling, measurements (part 1)	X		3, 4 and 5
1h	General remote parameters (part 1)	X	X	1, 2, 3, 4, 5, 6, 15 and 16
2h (24h)	Setting group 1 remote parameters	X	X	3, 4, 6 and 16
3h (26h)	Setting group 2 remote parameters	X	X	3, 4, 6 and 16
4h	Remote controls	X	X	1, 2, 3, 4, 5, 6, 15 and 16
5h	Boolean equations parameters	X	X	3, 4, 6 and 16
6h	General remote parameters (part 2)	X	X	1, 2, 3, 4, 5, 6, 15 and 16
7h	Device status	Fast		3, 4 and 5
8h	Time synchronisation	X	X	3, 4 and 16
9h – 22h	Disturbance records	X		3 and 4
23h	Measurements (part 2)	X		3, 4 and 5
28h	Setting group 3 remote parameters	X	X	3, 4, 6 and 16
2Ah	Setting group 4 remote parameters	X	X	3, 4, 6 and 16
2Ch	Setting group 5 remote parameters	X	X	3, 4, 6 and 16
2Eh	Setting group 6 remote parameters	X	X	3, 4, 6 and 16
30h	Setting group 7 remote parameters	X	X	3, 4, 6 and 16
32h	Setting group 8 remote parameters	X	X	3, 4, 6 and 16
35h – 36h	Event records	X		3 and 4
37h	Fault records	X		3 and 4
38h – 3Dh	Disturbance selection	X		3 and 4
3Eh	Fault records	X		3 and 4
5Ah	Error counters	X		3 and 4

They are completely listed below.

3.1 Product information, remote signalling, measurements

3.1.1 **Page 0H** - Product information, remote signalling, measurements (part 1)

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0000	**Product Information**	Relay description characters 1 and 2	32 - 127	1		F10		•	•	•
0001		Relay description characters 3 and 4	32 -127	1		F10	P1	•	•	•
0002		Relay description characters 5 and 6	32 -127	1		F10	20	•	•	•
0003		Unit reference characters 1 and 2	32 - 127	1		F10	AL	•	•	•
0004		Unit reference characters 3 and 4	32 - 127	1		F10	ST	•	•	•
0005		Software version	100 – xxx	1		F21	121	•	•	
0006		Front & rear port available communication protocols	0 - 3			F41		•	•	•
0007		Internal ratio phase current				F1			•	•
0008		Internal ratio earth current				F1		•	•	•
0009		Internal ratio rated voltage				F1		•	•	•
000A		Internal ratio voltage				F1		•	•	•
000B		Info General Start /General Trip (only if IEC 60870-5-103 protocol)				F95		•	•	•
000C		LED status	0 - 256	1		F62		•	•	•
000D		Digital inputs state, part 2				F20A		•	•	•
000E		Password status	0 -1			F24	0	•	•	•
000F		HW alarm status				F45		•	•	•
0010	**Remote signals**	Digital inputs status				F12		•	•	•
0011		Digital inputs state, part 1				F20		•	•	•
0012		Trip relay: output status	0 - 1			F22		•	•	•
0013		Output relays operation command				F13		•	•	•
0014	**Protection 67**	Information of the threshold status I>				F17			•	•
0015		Information of the threshold status I>>				F17			•	•
0016		Information of the threshold status I>>>				F17			•	•
0017	**Protection 67n**	Information of the threshold status Ie>				F16		•	•	•
0018		Information of the threshold status Ie>>				F16		•	•	•
0019		Information of the threshold status Ie>>>				F16		•	•	•
001A-001F		Do not use (compatibility)								
0020	**Protection 49**	Information of the thermal protection status				F37			•	•
0021	**Protection 37**	Information of the undercurrent threshold status I<				F17			•	•
0022	**Accessory functions**	Information of the status of the accessory functions 2/3				F38A			•	•
0023		Information of the status of the accessory functions 1/3				F38			•	•
0024		Do not used (compatibility)								
0025	**Alarms 1**	Non acknowledged alarms , part 1				F36		•	•	•
0026	**Disturbance**	Numbers of available disturbance records	0 - 5			F31		•	•	•
0027	**Trip relay status**	Information on the starting origin of the trip relay				F61		•	•	•
0028	**Circuit Breaker**	CB Supervision status				F43			•	•
0029	**Alarms 2**	Non acknowledged alarms, part 2,				F36A		•	•	•
002A	**Alarms 3**	Non acknowledged alarms, part 3,				F36B		•	•	•
002B	**Alarms 4**	Non acknowledged alarms, part 4,				F36C		•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
002C	**Alarms 5**	Non acknowledged alarms, part 5,				F36D			•	•
002D	**Alarms 6**	Non acknowledged alarms, part 6,				F36E				
002E	**Relays**	Output relays, latch configuration and status				F27		•	•	•
002F	**Accessory functions**	Information of the status of the accessory functions 3/3				F38B			•	•
0030–0031	**Remote measurements**	Phase A RMS current		1	10mA	F18			•	•
0032–0033		Phase B RMS current		1	10mA	F18			•	•
0034–0035		Phase C RMS current		1	10mA	F18			•	•
0036–0037		Earth RMS current		1	10mA	F18		•	•	•
0038–0039		Inverse current I2 (fundamental)		1	10mA	F18			•	•
003A–003B		Direct current I1 (fundamental)		1	10mA	F18			•	•
003C		Ratio I2 / I1	0 - 999	1	%	F1			•	•
003D		Thermal status (protected)	0 - 999	1	%	F1			•	•
003E		Frequency	4500–6500	1	10mHz	F1		•	•	•
003F–0040		Phase A RMS max current		1	10mA	F18			•	•
0041–0042		Phase B RMS max current		1	10mA	F18			•	•
0043–0044		Phase C RMS max current		1	10mA	F18			•	•
0045–0046		Phase A RMS average current		1	10mA	F18			•	•
0047–0048		Phase B RMS average current		1	10mA	F18			•	•
0049–004A		Phase C RMS average current		1	10mA	F18			•	•
004B–004C		Ie harmonic		1	10mA	F18		•	•	•
004D	**Alarms 7**	Non acknowledged alarms, part 7,				F36F		•	•	•
004E		Module V1				F1				•
004F		Module V2				F1				•
0050		Module IA				F1			•	•
0051		Module IB				F1			•	•
0052		Module IC				F1			•	•
0053		Module Ie				F1		•	•	•
0054		Angle between IA^IA (reference)	0		Deg	F1			•	•
0055		Angle between IA^IB	0-359		Deg	F1			•	•
0056		Angle between IA^IC	0-359		Deg	F1			•	•
0057		Angle between IA^Ie	0-359		Deg	F1			•	•
		Angle between Ie^Ie (reference)	0		Deg	F1		•		
0058		Inverse current module I2				F1			•	•
0059		Direct current module I1				F1			•	•
005A	**Recloser 79**	Nr. of total cycles	0-999	1		F1			•	•
005B		Nr. of cycles 1	0-999	1		F1			•	•
005C		Nr. of cycles 2	0-999	1		F1			•	•
005D		Nr. of cycles 3	0-999	1		F1			•	•
005E		Nr. of cycles 4	0-999	1		F1			•	•
005F		Nr. of definitive trips	0-999	1		F1			•	•
0060		Nr. of tripping orders	0-999	1		F1			•	•
0061–0062	**Energy measures**	Positive active energy	from 1 to 4.200 x 10^9	1	kWh	F18A				•
0063–0064		Negative active energy	from 1 to 4.200 x 10^9	1	kWh	F18A				•
0065–0066		Positive reactive energy	from 1 to 4.200 x 10^9	1	kVARh	F18A				•
0067–0068		Negative reactive energy	from 1 to 4.200 x 10^9	1	kVARh	F18A				•
0069–006A		Rolling demand max RMS IA value		1	10mA	F18			•	•
006B–006C		Rolling demand max RMS IB value		1	10mA	F18			•	•
006D–006E		Rolling demand max RMS IC value		1	10mA	F18			•	•
006F	**Alarms 8**	Non acknowledged alarms, part 8,				F36G		•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0070	**Protection 27**	Information of the threshold status U<				F17				•
0071		Information of the threshold status U<<				F17				•
0072	**Protection 32n**	Information of the threshold status Pe/ IeCos>				F16		•	•	•
0073		Information of the threshold status Pe/ IeCos>>				F16		•	•	•
0074		Angle between Ie^Ue	0-359		Deg	F1				
0075		Angle between Ie^Ue	0-359		Deg	F1		•	•	•
0076	**Protection 59**	Information of the threshold status U>				F17				•
0077		Information of the threshold status U>>				F17				•
0078–0079		Reserved								
007A	**Protection 59n**	Information of the threshold status Ue>>>>				F16		•	•	•
007B	**Protection 67n**	Information of the threshold status Ie_d>				F16				•
007C	**Protection 46**	Information of the threshold status I2>				F17			•	•
007D		Information of the threshold status I2>>				F17			•	•
007E		Information of the threshold status I2>>>				F17			•	•
007F	**Boolean equations**	Boolean equation status				F48			•	•
0080–0081	**Voltage measurement**	Phase A RMS voltage		1	10mV	F18A				•
0082–0083		Phase B RMS voltage		1	10mV	F18A				•
0084–0085		Phase C RMS voltage		1	10mV	F18A				•
0086–0087		Earth RMS voltage		1	10mV	F18A		•	•	•
0088		Module UAB				F1				•
0089		Module UBC				F1				•
008A		Module UCA				F1				•
008B		Module Ue				F1		•	•	•
008C		Angle between IA^UAB	0-359		Deg	F1				•
008D		Angle between IA^UBC	0-359		Deg	F1				•
008E		Angle between IA^UCA	0-359		Deg	F1				•
008F		Angle between IA^Ue	0-359		Deg	F1			•	•
0090–0092		Max phase A RMS voltage		1	10mV	F18				•
0092–0093		Max phase B RMS voltage		1	10mV	F18				•
0094–0095		Max phase C RMS voltage		1	10mV	F18				•
0096–0097		Average phase A RMS voltage		1	10mV	F18				•
0098–0099		Average phase B RMS voltage		1	10mV	F18				•
009A–009B		Average phase C RMS voltage		1	10mV	F18				•
009C–009D	**Power measures**	Module Pe			CAN	F18A		•	•	•
009E–009F		3-Phase Active Power (P)	-999.9 10^6 to 999.9 10^6	1	10Watt	F18				•
00A0–00A1		3-Phase Re-active Power (Q)	-999.9 10^6 to 999.9 10^6	1	10VAR	F18				•
00A2		3-Phase CosPHI	-100 to 100	1	0.01	F2				•
00A3–00A4		Rolling demand average RMS IA value		1	10mA	F18A			•	•
00A5–00A6		Rolling demand average RMS IB value		1	10mA	F18A			•	•
00A7–00A8		Rolling demand average RMS IC value		1	10mA	F18A			•	•
00A9–00AA	**Power measures**	Module IeCos				F18A		•	•	•
00AB-00AC		3-Phase Apparent power (S)	-999.9 10^6 to 999.9 10^6	1	10VA	F18				•
00AD-00AE	**Energy measures**	Apparent energy 3Ph V A Hours	from 1 to 4.200 x 10^9	1	kVAh	F18A				•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
00AF	**Measurement**	Module VA				F1				•
00B0		Module VB				F1				•
00B1		Module VC				F1				•
00B2		Angle IA^VA	0-359		Deg	F1				•
00B3		Angle IA^VB	0-359		Deg	F1				•
00B4		Angle IA^VC	0-359		Deg	F1				•
00B5		Inf. of the threshold status f1	0 to 7	1		F67				•
00B6		Inf. of the threshold status f2	0 to 7	1		F67				•
00B7		Inf. of the threshold status f3	0 to 7	1		F67				•
00B8		Inf. of the threshold status f4	0 to 7	1		F67				•
00B9		Inf. of the threshold status f5	0 to 7	1		F67				•
00BA		Inf. of the threshold status f6	0 to 7	1		F67				•
00BB		F out	0 to 3			F69				•
00BC	**IRIG-B Synch-ronisation (Option)**	Date-and-time synchronisation origin	0 to 4	1		F79		•	•	•
00BD	**Optional board**	Functions available (read only)	0 to 3	1		F80	0	•	•	•
00BE	**Inputs**	Digital inputs state, part 3				F20B		•	•	•
00BF	**Status**	df/dt protection status	0 to 63	1		F94				•
00C0	**Measurements**	df/dt	-20 000 to 20 000	1	mHz/s	F2				•
00C1		Voltage of the reference channel				F1				•
00C2–00C3		Not used								
00C4	**Protection 67n**	Information of the threshold status Ie_d>>				F16				•
00C5	**Measurements**	Module Ie der				F1				•
00C6		Angle IA^Ie der			Deg	F1				•
00C7	**CT Mease.**	CT Measurement presence	0 to 1	1		F24	0			•
00C8	**Protection 47**	V2> status protection		1		F16	0		•	•
00C9		V2>> status protection		1		F16	0		•	•
00CA–00DF		Reserved								
00E0–00EF	**HMI screen**	Copy of HMI screen	ASCII code			16 x F10				
00F0–00FF		Reserved								

3.1.2 **Page 23H** – Measurements / P127 with CT of measurement (part 2)

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
2300-2301	**IA measurement**	Fondamental	Float 32bits		A	F88				•
2302		THD	10000	1	0.01%	F1				•
2303		Harmonic 2	10000	1	0.01%	F1				•
2304		Harmonic 3	10000	1	0.01%	F1				•
2305		Harmonic 4	10000	1	0.01%	F1				•
2306		Harmonic 5	10000	1	0.01%	F1				•
2307		Harmonic 6	10000	1	0.01%	F1				•
2308		Harmonic 7	10000	1	0.01%	F1				•
2309		Harmonic 8	10000	1	0.01%	F1				•
230A		Harmonic 9	10000	1	0.01%	F1				•
230B		Harmonic 10	10000	1	0.01%	F1				•
230C–2319		Reserve								•
231A		TDD	0-65534	1	0.01%	F1				•
231B		Angle Iam^Iam (always 0)	0-65534	1	360° /65536	F1	0			•
231C–231D		RMS	Float 32bits		A	F88				•
231E		Reserved								•
231F		K factor	0-65534	1	0.01%	F1				•
2320-2321	**IB measurement**	Fondamental	Float 32bits		A	F88				•
2322		THD	10000	1	0.01%	F1				•
2323		Harmonic 2	10000	1	0.01%	F1				•
2324		Harmonic 3	10000	1	0.01%	F1				•
2325		Harmonic 4	10000	1	0.01%	F1				•
2326		Harmonic 5	10000	1	0.01%	F1				•
2327		Harmonic 6	10000	1	0.01%	F1				•
2328		Harmonic 7	10000	1	0.01%	F1				•
2329		Harmonic 8	10000	1	0.01%	F1				•
232A		Harmonic 9	10000	1	0.01%	F1				•
232B		Harmonic 10	10000	1	0.01%	F1				•
232C–2339		Reserve								•
233A		TDD	0-65534	1	0.01%	F1				•
233B		Angle Ibm^Iam	0-65534	1	360° /65536	F1				•
233C–233D		RMS	Float 32bits		A	F88				•
233E		Reserved								•
233F		K factor	0-65534	1	0.01%	F1				•
2340-2341	**IC measurement**	Fondamental	Float 32bits			F88				•
2342		THD	10000	1	0.01%	F1				•
2343		Harmonic 2	10000	1	0.01%	F1				•
2344		Harmonic 3	10000	1	0.01%	F1				•
2345		Harmonic 4	10000	1	0.01%	F1				•
2346		Harmonic 5	10000	1	0.01%	F1				•
2347		Harmonic 6	10000	1	0.01%	F1				•
2348		Harmonic 7	10000	1	0.01%	F1				•
2349		Harmonic 8	10000	1	0.01%	F1				•
234A		Harmonic 9	10000	1	0.01%	F1				•
234B		Harmonic 10	10000	1	0.01%	F1				•
234C–2359		Reserve								•
235A		TDD	0-65534	1	0.01%	F1				•
235B		Angle Icm^Iam	0-65534	1	360° /65536	F1				•
235C–235D		RMS	Float 32bits		A	F88				•
235E		Reserved								•
235F		K factor	0-65534	1	0.01%	F1				•
2360-2361	**VA or UAB**	Fondamental	Float 32bits		V	F88				•
2362		THD	10000	1	0.01%	F1				•
2363		Harmonic 2	10000	1	0.01%	F1				•
2364		Harmonic 3	10000	1	0.01%	F1				•
2365		Harmonic 4	10000	1	0.01%	F1				•
2366		Harmonic 5	10000	1	0.01%	F1				•
2367		Harmonic 6	10000	1	0.01%	F1				•
2368		Harmonic 7	10000	1	0.01%	F1				•
2369		Harmonic 8	10000	1	0.01%	F1				•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
236A		Harmonic 9	10000	1	0.01%	F1				•
236B		Harmonic 10	10000	1	0.01%	F1				•
236C–2379		Reserve								•
237A		Angle Va^Ia or Uab^Ic	0-65534	1	360° /65536	F1				•
237B		Angle Va^Iam or Uab^Iam	0-65534	1	360° /65536	F1				•
237C–237D		RMS	Float 32bits		V	F88				•
237E		Reserved								•
237F		K factor	0-65534	1	0.01%	F1				•
2380-2381	**VB or UBC**	Fondamental	Float 32bits		V	F88				•
2382		THD	10000	1	0.01%	F1				•
2383		Harmonic 2	10000	1	0.01%	F1				•
2384		Harmonic 3	10000	1	0.01%	F1				•
2385		Harmonic 4	10000	1	0.01%	F1				•
2386		Harmonic 5	10000	1	0.01%	F1				•
2387		Harmonic 6	10000	1	0.01%	F1				•
2388		Harmonic 7	10000	1	0.01%	F1				•
2389		Harmonic 8	10000	1	0.01%	F1				•
238A		Harmonic 9	10000	1	0.01%	F1				•
238B		Harmonic 10	10000	1	0.01%	F1				•
238C–2399		Reserve								•
239A		Angle Vb^Ib or Ubc^Ia	0-65534	1	360° /65536	F1				•
239B		Angle Vb^Iam or Ubc^Iam	0-65534	1	360° /65536	F1				•
239C–239D		RMS	Float 32bits		V	F88				•
239E		Reserved								•
239F		K factor	0-65534	1	0.01%	F1				•
23A0-23A1	**VC or UCA**	Fondamental	Float 32bits		V	F88				•
23A2		Harmonic distortion percentage	10000	1	0.01%	F1				•
23A3		Harmonic 2	10000	1	0.01%	F1				•
23A4		Harmonic 3	10000	1	0.01%	F1				•
23A5		Harmonic 4	10000	1	0.01%	F1				•
23A6		Harmonic 5	10000	1	0.01%	F1				•
23A7		Harmonic 6	10000	1	0.01%	F1				•
23A8		Harmonic 7	10000	1	0.01%	F1				•
23A9		Harmonic 8	10000	1	0.01%	F1				•
23AA		Harmonic 9	10000	1	0.01%	F1				•
23AB		Harmonic 10	10000	1	0.01%	F1				•
23AC–23B9		Reserve								•
23BA		Angle Vc^Ic or Uca^Ib	0-65534	1	360° /65536	F1				•
23BB		Angle Vc^Iam or Uca^Iam	0-65534	1	360° /65536	F1				•
23BC–23BD		RMS	Float 32bits		V	F88				•
23BE		Reserved								•
23BF		K factor	0-65534	1	0.01%	F1				•
23C0-23C1	**Power & Energie**	Active Power	Float 32bits		W	F88				•
23C2-23C3		Reactive Power	Float 32bits		VAR	F88				•
23C4-23C5		Apparent power	Float 32bits		VA	F88				•
23C6		Displacement power factor	–100 to 100	1	0.01	F2				•
23C7		Reserve	10000	1	0.01%	F1				•
23C8-23C9		Positive active energy	Float 32 bits		W h	F88				•
23CA-23CB		Negative active energy	Float 32 bits		W h	F88				•
23CC-23CD		Positive reactive energy	Float 32 bits		VAR h	F88				•
23CE-23CF		Negative reactive energy	Float 32 bits		VAR h	F88				•
23D0-23D3		Energy time origin	Private format date			F97				•
23D4-23FF		Reserved								

3.2 General remote parameters

3.2.1 **Page 1H** - General remote parameters (part 1)

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0100	**Remote setting**	Address of front port: MODBUS	1 - 255	1		F1	1	•	•	•
0101		Language	0 – 14			F63		•	•	•
0102		Password, ASCII digits 1 and 2	32 – 127	1		F10	AA	•	•	•
0103		Password, ASCII digits 3 and 4	32 – 127	1		F10	AA	•	•	•
0104	**OP Parameters**	Rated frequency	50 – 60	10	Hz	F1	50	•	•	•
0105	**General Options**	Phase and Earth labels	0 - 1 – 2	1		F85	0	•	•	•
0106–0108		Free (not used)								
0109		Default display	0 – 4	1		F26	4		•	•
010A		User reference, ASCII digits 1 and 2	32 - 127	1		F10	AL	•	•	•
010B		User reference, ASCII digits 3 and 4	32 - 127	1		F10	ST	•	•	•
010C		Number of the default records to be displayed	1- 25	1		F31A	25	•	•	•
010D		Inputs mode configuration (edge or level), part 2,		1		F54A		•	•	•
010E		Maintenance Mode	0 - 1	1		F24	0	•	•	•
010F		Digital inputs signal type: AC–DC	0 - 1	1		F51	1	•	•	•
0110	**CB monitoring measurements**	CB operations number		1		F1			•	•
0111		CB operating time		1	10ms	F1			•	•
0112–0113		Switched square Amps phase A summation			A^n	F18			•	•
0114–0115		Switched square Amps phase B summation			A^n	F18			•	•
0116–0117		Switched square Amps phase C summation			A^n	F18			•	•
0118		*Circuit breaker closing time*		1	10ms	F1			•	•
0119	**Digital input**	Digital input 1, part 2		1		F15A		•	•	•
011A		Digital input 2, part 2		1		F15A		•	•	•
011B		Digital input 3, part 2		1		F15A		•	•	•
011C		Digital input 4, part 2		1		F15A		•	•	•
011D		Digital input 5, part 2		1		F15A			•	•
011E		Digital input 6, part 2		1		F15A			•	•
011F		Digital input 7, part 2		1		F15A			•	•
0120	**Ratios CT**	Primary phase CT	1 - 9999	1	A	F1	1		•	•
0121		Secondary phase CT	1 or 5		A	F1	1		•	•
0122		Primary earth CT	1 - 9999	1	A	F1	1	•	•	•
0123		Secondary earth CT	1 or 5		A	F1	1	•	•	•
	Ratios VT									
0124–0125	Primary phase VT	57 - 130V operating range	10 –100000	1	10V	F18A	100V			•
		220 - 480V operating range	220 – 480	1	V	F18A	220V			•
0126	Secondary phase VT	57 - 130V operating range	570 -1300	1	100mV	F1	100V			•
		220 - 480V operating range	2200	1	100mV	F1	220V			•
0127	**Scheme VTs connection**	VTs connection mode: 3Vpn, 2Vpp+Vr, 2Vpn+Vr	0, 2, 4			F7	0			•
0128 –0129	Primary earth VT	57 - 130V operating range	10 -100000	1	10V	F18A	100V	•	•	•
		220 - 480V operating range	220 – 480	1	V	F18A	220V	•	•	•
012A	Secondary earth VT	57 - 130V operating range	570 -1300	1	100mV	F1	100V	•	•	•
		220 - 480V operating range	2200	1	100mV	F1	220V	•	•	•
012B		Maintenance mode relays command				F13		•	•	•
012C		Obsolete								
012D		Number Instantaneous record to be displayed	1- 5	1		F31B	5	•	•	•
012E	**Communi-cation**	Communication speed (Baud): IEC 60870-5-103 DNP3	 0 - 1 0 - 5	1		F53	 1 4	•	•	•
012F		Date format	0 - 1	1		F52	0	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0130		Communication speed (Baud)	0 - 7	1		F4	6	•	•	•
0131		Parity	0 - 2	1		F5	0	•	•	•
0132		Address of rear port: DNP3 / IEC 60870-5-103	1- 59999 / 1-255	1		F1	1	•	•	•
0133		Stop bits	0 - 1	1		F29	0	•	•	•
0134		COM available info	0 - 15	1		F30	1	•	•	•
0135	**Configuration group**	Active group	1 - 8	1		F55	1			•
			1 - 2					•	•	
0136	**LED**	Led 5, part 1		1		F19	0	•	•	•
0137		Led 6, part 1		1		F19	0	•	•	•
0138		Led 7, part 1		1		F19	0	•	•	•
0139		Led 8, part 1		1		F19	0	•	•	•
013A		Led 5, part 2		1		F19A	0	•	•	•
013B		Led 6, part 2		1		F19A	0	•	•	•
013C		Led 7, part 2		1		F19A	0	•	•	•
013D		Led 8, part 2		1		F19A	0	•	•	•
013E		Led 5, part 3		1		F19B	0	•	•	•
013F		Led 6, part 3		1		F19B	0	•	•	•
0140		Led 7, part 3		1		F19B	0	•	•	•
0141		Led 8, part 3		1		F19B	0	•	•	•
0142	**Digital inputs configuration**	Inputs mode configuration (edge or level)				F54		•	•	•
0143		Inputs sense configuration (High or Low)		1		F47	0	•	•	•
0144	**Digital input**	Digital input 6, part 1		1		F15	0		•	•
0145		Digital input 7, part 1		1		F15	0		•	•
0146		Digital input 1, part 1		1		F15	0	•	•	•
0147		Digital input 2, part 1		1		F15	0	•	•	•
0148		Digital input 3, part 1		1		F15	0	•	•	•
0149		Digital input 4, part 1		1		F15	0	•	•	•
014A		Digital input 5, part 1		1		F15	0		•	•
014B	**Output relays**	Output relays: Broken conductor		1		F14	0		•	•
014C		Output relays: Breaker failure		1		F14	0		•	•
014D	**Protection 37**	Output relays: tI<		1		F14	0		•	•
014E	**Alarm**	Self reset start protection alarms enable / disable	0 - 1	1		F24	0	•	•	•
014F	**Protection 49**	Output relays: Thermal overload alarm(θ alarm)		1		F14	0		•	•
0150		Output relays: Thermal overload tripping (θ trip)		1		F14	0		•	•
0151	**Circuit breaker**	Output relays: Switch on to fault, circuit breaker tripping & SOTF/TOR		1		F14A	0		•	•
0152		Output relays: tAUX 1		1		F14	0	•	•	•
0153		Output relays: tAUX 2		1		F14	0	•	•	•
0154		Output relays: circuit breakers alarms		1		F14	0		•	•
0155		Output relays: Trip circuit supervision		1		F14	0		•	•
0156	**Output Relays**	Fail safe and inversion relays		1		F56	0	•	•	•
0157		Conf. Block relay on I> start	0 - 1	1		F24	0		•	•
0158		Conf. Block relay on Ie> start	0 - 1	1		F24	0		•	•
0159		Output relays: tIA>		1		F14	0		•	•
015A		Output relays: tIB>		1		F14	0		•	•
015B		Output relays: tIC>		1		F14	0		•	•
015C		RL1-RL8: configuration and latch		1		F27	0	•	•	•
015D		Output relays: Trip output relay RL1 on RLx		1		F14	0	•	•	•
015E	**Protection 67**	Output relays: tI>		1		F14	0		•	•
015F		Output relays: tI>>		1		F14	0		•	•
0160		Output relays: tI>>>		1		F14	0		•	•
0161	**Protection 67n**	Output relays: tIe>		1		F14	0	•	•	•
0162		Output relays: tIe>>		1		F14	0	•	•	•
0163		Output relays: tIe>>>		1		F14	0	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0164	**Protection 67**	Output relays: I>		1		F14	0		•	•
0165		Output relays: I>>		1		F14	0		•	•
0166		Output relays: I>>>		1		F14	0		•	•
0167	**Protection 67n**	Output relays: Ie>		1		F14	0	•	•	•
0168		Output relays: Ie>>		1		F14	0	•	•	•
0169		Output relays: Ie>>>		1		F14	0	•	•	•
016A	**Recloser 79**	Output relays: recloser running		1		F14	0		•	•
016B		Output relays: definitive tripping & Recloser int. locked (conf.)		1		F14D	0		•	•
016C	**Tripping**	Conf. tripping on relay RL1, part 1		1		F6	1	•	•	•
016D	**Breaker Failure**	Current Threshold	2 -100	1	1/100 In	F1	2		•	•
016E	**Blocking Logic**	Blocking logic 1, part 1		1		F8	0	•	•	•
016F		Blocking logic 2, part 1		1		F8	0		•	•
0170	**Broken Conductor**	Brkn. Cond. operating mode	0 - 1	1		F24	0		•	•
0171		Brkn. Cond. trip delay time	0 - 14400	1	s	F1	1		•	•
0172		Brkn. Cond. limit	20 - 100	1		F1	100		•	•
0173	**Cold Load PU**	Operating mode	0 - 1	1		F24	0		•	•
0174		Cold load start thresholds		1		F33	0		•	•
0175		Percentage of desensitization	20 - 800	1	%	F1	100		•	•
0176		Desensitising timer	1 - 36000	1	100ms	F1	1		•	•
0177	**Breaker failure**	Breaker Failure operating mode	0 - 1	1		F24	0		•	•
0178		Breaker failure delay time	0 - 1000	1	10ms	F1	0		•	•
0179	**Selectivity**	Digital selectivity 1		1		F40	0		•	•
017A		Digital selectivity 2		1		F40	0		•	•
017B		tSel1	0 - 15000	1	10ms	F1	0		•	•
017C		tSel2	0 - 15000	1	10ms	F1	0		•	•
017D	**Disturbance**	Pre-trigger time	5 rec: 1 to 29 4 rec: 1 to 29 3 rec: 1 to 49 2 rec: 1 to 69 1 rec: 1 to 89	1	100ms	F1	1	•	•	•
017E		Do not use: not available for compatibility reasons								
017F		Config. Disturbance start	0 - 1	1		F32	0		•	•
0180	**CB monitoring**	CB open operating mode	0 - 1	1		F24	0		•	•
0181		CB open time thereshold	5 - 100	5	10ms	F1	5		•	•
0182		Operations number	0 - 1	1		F24	0		•	•
0183		CB opening operations number threshold.	0 - 50000	1		F1	0		•	•
0184		CB switched Amps sum	0 - 1	1		F24	0		•	•
0185		CB switched Amps sum threshold			$10^{E}6$ A^n	F1			•	•
0186		Amps or square Amps	1 - 2	1		F1	1		•	•
0187		Closing time threshold	5 - 100	5	10ms	F1	5		•	•
0188		Auxiliary timer 1	0 - 20000	1	10ms	F1	0	•	•	•
0189		Auxiliary timer 2	0 - 20000	1	10ms	F1	0	•	•	•
018A		Max & average (current + voltage) time window selection	5 – 10 – 15 – 30 - 60	VTA	mn	F42	5		•	•
018B		CB open pulse duration	10 - 500	1	10ms	F1	10	•	•	•
018C		CB close pulse duration	10 - 500	1	10ms	F1	10	•	•	•
018D		CB close operating mode	0 - 1	1		F24	0		•	•
018E		CB supervision operating mode	0 - 1	1		F24	0		•	•
018F		Trip circuit time	10 - 1000	1	10ms	F1			•	•
0190	**Blocking logic**	Blocking logic 1, part 2		1		F8A	0		•	•
0191		Blocking logic 2, part 2		1		F8A	0		•	•
0192	**Tripping**	Conf. tripping on relay RL1, part 2		1		F6A	0		•	•
0193		Auxiliary timer 3	0 - 20000	1	10ms	F1	0		•	•
0194		Auxiliary timer 4	0 - 20000	1	10ms	F1	0	•	•	•
0195-019C		Do not use (Courier description)								
019D	**Protection 67n**	Output relays: Ie> reverse		1		F14	0	•	•	•
019E		Output relays: Ie>> reverse		1		F14	0	•	•	•
019F		Output relays: Ie>>> reverse		1		F14	0	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
01A0	**Protection 32n**	Output relays: Pe/Iecos>		1		F14	0	•	•	•
01A1		Output relays: tPe/Iecos>		1		F14	0	•	•	•
01A2		Output relays: Pe/Iecos>>		1		F14	0	•	•	•
01A3		Output relays: tPe/Iecos>>		1		F14	0	•	•	•
01A4	**Protection 59**	Output relays: U>		1		F14	0			•
01A5		Output relays: tU>		1		F14	0			•
01A6		Output relays: U>>		1		F14	0			•
01A7		Output relays: tU>>		1		F14	0			•
01A8	**Protection 59N**	Output relays: Ue>>>>		1		F14	0	•	•	•
01A9		Output relays: tUe>>>>		1		F14	0	•	•	•
01AA	**Protection 67**	Output relays: I> reverse		1		F14	0		•	•
01AB		Output relays: I>> reverse		1		F14	0		•	•
01AC		Output relays: I>>> reverse		1		F14	0		•	•
01AD	**Protection 27**	Output relays: U<		1		F14	0			•
01AE		Output relays: tU<		1		F14	0			•
01AF		Output relays: U<<		1		F14	0			•
01B0		Output relays: tU<<		1		F14	0			•
01B1	**Protection 46**	Output relays: I2>		1		F14	0		•	•
01B2		Output relays: tI2>		1		F14	0		•	•
01B3		Output relays: I2>>		1		F14	0		•	•
01B4		Output relays: tI2>>		1		F14	0		•	•
01B5		Output relays: I2>>>		1		F14	0		•	•
01B6		Output relays: tI2>>>		1		F14	0	•	•	•
01B7-01DE		Obsolete (Ex AND Logic Equa)								
01DF	**Boolean Equations**	Tripping equation A time	0 - 60000	1	10ms	F1	0		•	•
01E0		Reset equation A time	0 - 60000	1	10ms	F1	0		•	•
01E1		Output relays: tEqu. A				F14	0		•	•
01E2		Tripping equation B time	0 - 60000	1	10ms	F1	0		•	•
01E3		Time reset equation B time	0 - 60000	1	10ms	F1	0		•	•
01E4		Output relays: tEqu. B				F14	0		•	•
01E5		Tripping equation C time	0 - 60000	1	10ms	F1	0		•	•
01E6		Reset equation C time	0 - 60000	1	10ms	F1	0		•	•
01E7		Output relays: tEqu. C				F14	0		•	•
01E8		Tripping equation D time	0 - 60000	1	10ms	F1	0		•	•
01E9		Reset equation D time	0 - 60000	1	10ms	F1	0		•	•
01EA		Output relays: tEqu. D				F14	0		•	•
01EB		Output relays: tAUX 3 & tAUX 4		1		F14B	0	•	•	•
01EC		Output relays: Control Trip & Control Close		1		F14C	0	•	•	•
01ED		Output relays: I<				F14	0		•	•
01EE		Output relays: Group 2 active				F14		•	•	•
01EF	**LED**	Led 5, part 4		1		F19C	0	•	•	•
01F0		Led 6, part 4		1		F19C	0	•	•	•
01F1		Led 7, part 4		1		F19C	0	•	•	•
01F2		Led 8, part 4		1		F19C	0	•	•	•
01F3		Obsolete								
01F4		Obsolete								
01F5		Self-reset LEDs on fault	0 - 1	1		F24	1	•	•	•
01F6		Temporal opening for Rolling Subperiod	1 - 60	1	mn	F1	1		•	•
01F7		Number of Subperiods considered	1 – 24	1		F1	1		•	•
01F8		Switch onto Fault (SOTF)	0 – 32771	1		F58	1		•	•
01F9		SOTF time	0 – 500	1	ms	F1	100		•	•
01FA	**51V function**	51V configuration	0 – 3	1		F59	0			•
01FB	**V2> value**	57 – 130V operating range	30 -2000	1	100mV	F1	1300			•
		220 – 480V operating range	200 -7200	5	100mV	F1	4800			•
01FC	**V2>> value**	57 – 130V operating range	30 -2000	1	100mV	F1	1300			•
		220 – 480V operating range	200 -7200	5	100mV	F1	4800			•
01FD	**VTS function**	VTS configuration	0 – 7	1		F60	0			•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
01FE		VTS conv. directional to non-dir.	0-FFFFh	1		F65	FFF h			•
01FF	**U< blocking frequency protection**	57 – 130V operating range	50 -1300	1	100mV	F1	50			•
		220 – 480V operating range	200 - 4800	5	100mV	F1	200			•

3.2.2 **Page 6H** - General remote parameters (part 2)

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0600	**Configuration**	Alarms inhibition part1				F64	1FF C	•	•	•
0601		Phase rotation	0-1	1		F66	0		•	•
0602		Alarms inhibition part 2				F64A	FF	•	•	•
0603		Alarms inhibition part 3				F64B	0	•	•	•
0604	**Disturbance**	Disturbances record number	1 – 5	1		F1	5	•	•	•
0605	**Cold Load PU**	Cold load start mode	0 – 3	1		F87	1		•	•
0606-060B		Reserved								
060C	**LED**	Led 5, part 5		1		F19D	0			•
060D		Led 6, part 5		1		F19D	0			•
060E		Led 7, part 5		1		F19D	0			•
060F		Led 8, part 5		1		F19D	0			•
0610	**Output relays**	Output relays: P>		1		F14	0			•
0611		Output relays: tP>		1		F14	0			•
0612		Output relays: P>>		1		F14	0			•
0613		Output relays: tP>>		1		F14	0			•
0614		Output relays: f1		1		F14	0			•
0615		Output relays: tf1		1		F14	0			•
0616		Output relays: f2		1		F14	0			•
0617		Output relays: tf2		1		F14	0			•
0618		Output relays: f3		1		F14	0			•
0619		Output relays: tf3		1		F14	0			•
061A		Output relays: f4		1		F14	0			•
061B		Output relays: tf4		1		F14	0			•
061C		Output relays: f5		1		F14	0			•
061D		Output relays: tf5		1		F14	0			•
061E		Output relays: f6		1		F14	0			•
061F		Output relays: tf6		1		F14	0			•
0620		Output relays: F out		1		F14	0			•
0621		Output relays: Input 1		1		F14	0			•
0622		Output relays: Input 2		1		F14	0			•
0623		Output relays: Input 3		1		F14	0			•
0624		Output relays: Input 4		1		F14	0			•
0625		Output relays: Input 5		1		F14	0			•
0626		Output relays: Input 6		1		F14	0			•
0627		Output relays: Input 7		1		F14	0			•
0628		Output relays: VTS		1		F14	0			•
0629		Output relays: Input 8		1		F14	0			•
062A		Output relays: Input 9		1		F14	0			•
062B		Output relays: Input A		1		F14	0			•
062C		Output relays: Input B		1		F14	0			•
062D		Output relays: Input C		1		F14	0			•
062E	**Tripping**	Conf. tripping on relay RL1, part 4		1		F6C	0		•	•
062F		Conf. tripping on relay RL1, part 4		1		F6D	0		•	•
0630	**Automation**	Inrush validation	0 - 1	1		F24	0			•
0631		Inrush blocking selection				F83	0			•
0632		Inrush harmonic 2 ratio	100-350	1	0.1%	F1	200			•
0633		tInrush_reset	0 - 200	10	10ms	F1	0			•
0634		Blocking logic 1, part 3		1		F8B	0			•
0635		Blocking logic 2, part 3		1		F8B	0			•
0636	**Tripping**	Conf. tripping on relay RL1, part 3		1		F6B	0		•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0637		VTS delay time	0 10000	1	10ms	F1	20			•
0638-063F		Reserved								
0640	**Boolean Equations**	Tripping equation E time	0 - 60000	1	10ms	F1	0		•	•
0641		Reset equation E time	0 - 60000	1	10ms	F1	0		•	•
0642		Output relays: tEqu. E				F14	0		•	•
0643		Tripping equation F time	0 - 60000	1	10ms	F1	0		•	•
0644		Time reset equation F time	0 - 60000	1	10ms	F1	0		•	•
0645		Output relays: tEqu. F				F14	0		•	•
0646		Tripping equation G time	0 - 60000	1	10ms	F1	0		•	•
0647		Reset equation G time	0 - 60000	1	10ms	F1	0		•	•
0648		Output relays: tEqu. G				F14	0		•	•
0649		Tripping equation H time	0 - 60000	1	10ms	F1	0		•	•
064A		Reset equation H time	0 - 60000	1	10ms	F1	0		•	•
064B		Output relays: tEqu. H				F14	0		•	•
064C-064D		Auxiliary timer 5	0 – 2 000 000	1	10ms	F18A	0		•	•
064E-064F		Auxiliary timer 6	0 – 2 000 000	1	10ms	F18A	0		•	•
0650-0641		Auxiliary timer 7	0 – 2 000 000	1	10ms	F18A	0		•	•
0652		Reserved						•	•	•
0653		Auxiliary timer 8 (Option)	0 - 20000	1	10ms	F1	0			•
0654		Auxiliary timer 9 (Option)	0 - 20000	1	10ms	F1	0			•
0655		Auxiliary timer A (Option)	0 - 20000	1	10ms	F1	0			•
0656		Auxiliary timer B (Option)	0 - 20000	1	10ms	F1	0			•
0657		Auxiliary timer C (Option)	0 - 20000	1	10ms	F1	0			•
0658	**LED**	Led 5, part 6		1		F19E	0		•	•
0659		Led 6, part 6		1		F19E	0		•	•
065A		Led 7, part 6		1		F19E	0		•	•
065B		Led 8, part 6		1		F19E	0		•	•
065C		Led 5, part 7		1		F19F	0		•	•
065D		Led 6, part 7		1		F19F	0		•	•
065E		Led 7, part 7		1		F19F	0		•	•
065F		Led 8, part 7		1		F19F	0		•	•
0660	**Communication port 2 (Option)**	Communication speed (Baud)	0 - 7	1		F4	6	•	•	•
0661		Parity	0 - 2	1		F5	0	•	•	•
0662		Stop bits	0 - 1	1		F29	0	•	•	•
0663		Address of rear port 2: MODBUS IEC 60870-5-103 DNP3	 1 - 255 1 – 254 1 - 59999	1		F1	1	•	•	•
0664		IEC870-5-103 only: source setting group for copy	1 - 8	1		F55	1			•
0665		IEC870-5-103 only: destination setting group for copy	1 - 8	1		F55	2			•
0666	**IEC870-5-103 port 1**	IEC870-5-103 only: Spontaneous event enabling	0 - 3	1		F74	3	•	•	•
0667		IEC870-5-103: Measurements enabling	0 - 7	1		F75	3	•	•	•
0668		IEC870-5-103 Measurements/ Commands Blocking	0 - 3	1		F78	0	•	•	•
0669		IEC870-5-103 GI selection port 1	0 - 1	1		F93	0			•
066A	**IEC870-5-103**	IEC870-5-103 command & setting write timeout	1 - 300	1	100 ms	F1	2			•
066B	**IEC870-5-103 port 2**	IEC870-5-103 only, port 2: Spontaneous event enabling	0 - 3	1		F74	3			•
066C		IEC870-5-103, port 2: Measurements enabling	0 - 7	1		F75	3			•
066D		IEC870-5-103, port 2: Measurements/ Commands Blocking	0 - 3	1		F78	0			•
066E		IEC870-5-103, port 2: GI selection	0 - 1	1		F93	0			•
066F		Reserved								
0670	**Digital input (Option)**	Digital input 8, part 1		1		F15	0	•	•	•
0671		Digital input 9, part 1		1		F15	0	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0672		Digital input A, part 1		1		F15	0	•	•	•
0673		Digital input B, part 1		1		F15	0	•	•	•
0674		Digital input C, part 1		1		F15	0		•	•
0675-0678		Reserved								
0679		Digital input 8, part 2		1		F15A	0	•	•	•
067A		Digital input 9, part 2		1		F15A	0	•	•	•
067B		Digital input A, part 2		1		F15A	0	•	•	•
067C		Digital input B, part 2		1		F15A	0	•	•	•
067D		Digital input C, part 2		1		F15A	0		•	•
067E-0681		Reserved								
0682	**IRIG-B Synch-ronisation (Option)**	Date-and-time synchronisation mode		1		F76	0	•	•	•
0683		IRIG-B mode (Signal type)		1		F77	0			•
0684		Reserve								
0685	**Output relays**	Output relays: tAux 5		1		F14	0		•	•
0686		Output relays: tAux 6		1		F14	0		•	•
0687		Output relays: tAux 7		1		F14	0		•	•
0688	**Output relays (Optional board)**	Output relays: tAux 8		1		F14	0			•
0689		Output relays: tAux 9		1		F14	0			•
068A		Output relays: tAux A		1		F14	0			•
068B		Output relays: tAux B		1		F14	0			•
068C		Output relays: tAux C		1		F14	0			•
068D	**Output relays**	Output relays: Ie_d>		1		F14	0		•	•
068E		Output relays: tIe_d>		1		F14	0		•	•
068F		reverse		1		F14	0		•	•
0690		Output relays: [79] Ext.Lock.		1		F14	0		•	•
0691		Output relays: 51V		1		F14	0			•
0692	**Digital inputs**	Digital input 1, part 3		0		F15B	0	•	•	•
0693		Digital input 2, part 3		0		F15B	0	•	•	•
0694		Digital input 3, part 3		0		F15B	0	•	•	•
0695		Digital input 4, part 3		0		F15B	0	•	•	•
0696		Digital input 5, part 3		0		F15B	0	•	•	•
0697		Digital input 6, part 3		0		F15B	0	•	•	•
0698		Digital input 7, part 3		0		F15B	0	•	•	•
0699		Digital input 8, part 3		0		F15B	0	•	•	•
069A		Digital input 9, part 3		0		F15B	0	•	•	•
069B		Digital input A, part 3		0		F15B	0	•	•	•
069C		Digital input B, part 3		0		F15B	0	•	•	•
069D		Digital input C, part 3		0		F15B	0	•	•	•
069E	**Automation/SOTF**	SOTF source activation	0 – 127	1		F82	1B		•	•
069F	**Connexion**	Vt protection	0-1	1		F84	0			•
06A0	**LED**	Led 5, part 8				F19G	0		•	•
06A1		Led 6, part 8				F19G	0		•	•
06A2		Led 7, part 8				F19G	0		•	•
06A3		Led 8, part 8				F19G	0		•	•
06A4	**CTS supervision**	CTS operating mode	0 - 1	1		F24	0			•
06A5		I2 / I1 threshold (futur use)	20 - 100	1	%	F1	20			•
06A6		Idiff threshold (futur use)	10 - 90	1	%	F1	50			•
06A7		Ie threshold	8 - 100	1	1/100 In	F1	8			•
06A8		Ve threshold range A range B	 5 - 220 20 - 880	 1 5	 0.1V 0.1V	 F1 F1	 50 200			•
06A9		t CTS timer	0 – 10000	1	0.01 s	F1	20			•
06AA	**Output relays**	Output relays: CTS		1		F14	0			•
06AB	**General Config**	df/dt cycles number	1 – 200	1		F1	5			•
06AC		df/dt validations number	1 – 12	1		F1	4			•
06AD		>20 Hz/s df/dt block inhibition	0 - 1	1		F24	0			•
06AE	**Blocking Logic**	Blocking logic 1, part 4		1		F8C	0			•
06AF		Blocking logic 2, part 4		1		F8C	0			•
06B0	**Output relays**	Output relays: df/dt1		1		F14	0			•
06B1		Output relays: df/dt2		1		F14	0			•
06B2		Output relays: df/dt3		1		F14	0			•
06B3		Output relays: df/dt4		1		F14	0			•
06B4		Output relays: df/dt5		1		F14	0			•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
06B5		Output relays: df/dt6		1		F14	0			•
06B6	**Ratios CTm**	Primary CTm	1 - 9999	1	A	F1	1			2
06B7		Secondary CTm	1 or 5		A	F1	1			2
06B8	**CTm connection**	CTm1 connection	0 - 3	1		F90	0			2
06B9		CTm2 connection	0 - 3	1		F90	0			2
06BA	**Power**	Quadrant power	1 – 4	1		F91	4			2
06BB		Not used								
06BC		Inputs mode configuration (edge or level), part 3,		1		F54B	0	•	•	•
06BD	**Group changing**	Group number for digital input inactive	1-8	1		F55	1			•
06BE		Group number for digital input active	1-8	1		F55	2			•
06BF		Target group	0-8	1		F55	0			•
06C0	**Output relays**	Output relays: P<		1		F14	0			•
06C1		Output relays: tP<		1		F14	0			•
06C2		Output relays: P<<		1		F14	0			•
06C3		Output relays: tP<<		1		F14	0			•
06C4		Output relays: Q>		1		F14	0			•
06C5		Output relays: tQ>		1		F14	0			•
06C6		Output relays: Q>>		1		F14	0			•
06C7		Output relays: tQ>>		1		F14	0			•
06C8		Output relays: Q<		1		F14	0			•
06C9		Output relays: tQ<		1		F14	0			•
06CA		Output relays: Q<<		1		F14	0			•
06CB		Output relays: tQ<<		1		F14	0			•
06CC		Output relays: Comm. order 1		1		F14	0			•
06CD		Output relays: Comm. order 2		1		F14	0			•
06CE		Output relays: Comm. order 3		1		F14	0			•
06CF		Output relays: Comm. order 4		1		F14	0			•
06D0	**Com order tempo**	T comm. Order 1	10 – 60000	5	10ms	F1	10			•
06D1		T comm. Order 2	10 – 60000	5	10ms	F1	10			•
06D2		T comm. Order 3	10 – 60000	5	10ms	F1	10			•
06D3		T comm. Order 4	10 – 60000	5	10ms	F1	10			•
06D4	**Td demand**	Iam Td demand	0 – 20000	1	1/100% IN	F1	100 00			•
06D5		Ibm Td demand	0 – 20000	1	1/100% IN	F96	0			•
06D6		Icm Td demand	0 – 20000	1	1/100% IN	F96	0			•
06D7	**Output relays**	Output relays: Ie_d>>		1		F14	0		•	•
06D8		Output relays: tIe_d>>		1		F14	0		•	•
06D9		Output relays: V2>		1		F14	0		•	•
06DA		Output relays:tV2>		1		F14	0		•	•
06DB		Output relays: V2>>		1		F14	0		•	•
06DC		Output relays:tV2>>		1		F14	0		•	•
06DD		Output relays: tIe_R_d>>		1		F14	0		•	•
06DE-06FF		Not used								

3.3 Protection groups parameters

3.3.1 **Page 2H** - Setting group 1 remote parameters

Also mapped at page 24H.

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
0200	**Protection 50/51/67**	I> operating mode	0 - 1 - 2	1		F24A	0		•	•
0201		I> value	10 - 2500	1	1/100 In	F1	100		•	•
0202		Trip time type I>				F3	0		•	•
0203		DMT Trip time I>	0 - 15000	1	10ms	F1	0		•	•
0204		TMS: I> trip time multiplier	25 – 10000	1	0.001	F1	25		•	•
0205		K: I>trip time multiplier for RI type curve	100 -10000	5	0.001	F1	100		•	•
0206		Reset time type: DMT / IDMT	0 - 1	1		F34	0		•	•
0207		DMT reset time I>	0 - 10000	1	10ms	F1	100		•	•
0208		RTMS: I> reset time multiplier	25 - 3200	1	0.001	F1	25		•	•
0209		Torque (RCA) angle I^U>	0 - 359	1	Degree	F1	0			•
020A		Trip angle I^U>	10 -170	1	Deg	F1	50			•
020B		Interlock I>	0 - 1			F24	0		•	•
020C		I>> operating mode	0 – 1 - 2	1		F24A	0		•	•
020D		I>> value	50 - 4000 10 - 4000	1	1/100 In	F1	400 0		• •	• •
020E		Trip time I>>	0 - 15000	1	10ms	F1	0		•	•
020F		Torque (RCA) angle I^U>>	0 - 359	1	Degree	F1	0			•
0210		Trip angle I^U>>	10 - 170	1	Degree	F1	50			•
0211		I>>> operating mode	0 - 1 - 2 - 3	1		F24A	0		•	•
0212		I>>> value	50 - 4000 10 - 4000	1	1/100 In	F1	400 0		• •	• •
0213		Trip time I>>>	0 - 15000	1	10ms	F1	0		•	•
0214		Torque (RCA) angle I^U>>>	0 - 359	1	Degree	F1	0			•
0215		Trip angle I^U>>>	10 - 170	1	Degree	F1	50			•
0216	**Protection 50n/51n/67n**	Ie> operating mode	0 - 1 - 2	1		F24A	0	•	•	•
0217	Ie> value	0.002 - 1 Ien operating range	2 - 1000	1	1/1000 Ien	F1	100 0	•	•	•
		0.01 - 1 Ien operating range	10 -1000	5	1/1000 Ien	F1	10	•	•	•
		0.1 - 25 Ien operating range	10- 2500	1	1/100 Ien	F1	250 0	•	•	•
0218		Trip time type Ie>				F3	0	•	•	•
0219		DMT Trip time Ie>	0 - 15000	1	10ms	F1	0	•	•	•
021A		TMS: Ie> trip time multiplier	25 - 10000	1	0.001	F1	25	•	•	•
021B		K: Ie> trip time multiplier for RI type curve	100 -10000	5	0.001	F1	100	•	•	•
021C		Ie> reset time type DMT or IDMT	0 - 1	1		F34		•	•	•
021D		DMT Reset time Ie>	0 - 10000	1	10ms	F1	100	•	•	•
021E		RTMS: Ie> reset time multiplier	25 - 3200	1	0.001	F1	25	•	•	•
021F	Ue> value	57 - 130V operating range	10 - 2600	1	1/10 V	F1	10	•	•	•
		220 - 480V operating range	40 - 7200	5	1/10 V	F1	720 0	•	•	•
0220		Torque (RCA) angle Ie^Ue>	0 - 359	1	Degree	F1	0	•	•	•
0221		Trip angle Ie^Ue>	10 - 170	1	Degree	F1	50	•	•	•
0222		Interlock Ie>	0 - 1	1		F24	0	•	•	•
0223		Ie>> operating mode	0 - 1 - 2	1		F24A	0	•	•	•
0224	Ie>> value	0.002-1 Ien operating range	2 - 1000	1	1/1000 Ien	F1	100 0	•	•	•
		0.01 - 8 Ien operating range	10 - 8000	5	1/1000 Ien	F1	800 0	•	•	•
		0.1 - 40 Ien operating range	50 - 4000	1	1/100 Ien	F1	100	•	•	•
0225		Trip time Ie>>	0 - 15000	1	10ms	F1	0	•	•	•
0226	Ue>> value	57 - 130V operating range	10 - 2600	1	100mV	F1	260 0	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
		220 - 480V operating range	40 - 9600	5	100mV	F1	9600	•	•	•
0227		Torque (RCA) angle Ie^Ue>>	0 - 359	1	Degree	F1	0	•	•	•
0228		Trip angle Ie^Ue>>	10 -170	1	Degree	F1	10	•	•	•
0229		Ie>>> operating mode	0 - 1 - 2 - 3	1		F24A	0	•	•	•
022A	Ie>>> value	0.002-1 Ien operating range	2 - 1000	1	1/1000 Ien	F1	1000	•	•	•
		0.01 - 8 Ien operating range	10 - 8000	5	1/1000 Ien	F1	8000	•	•	•
		0.1 - 40 Ien operating range	50 - 4000	1	1/100 Ien	F1	100	•	•	•
022B		Trip time Ie>>>	0 -15000	1	10ms	F1	0	•	•	•
022C	Ue>>> value	57 - 130V operating range	10 - 2600	1	100mV	F1	2600	•	•	•
		220 - 480V operating range	40 - 9600	5	100mV	F1	9600	•	•	•
022D		Torque (RCA) angle (Ie^Ue)>>>	0 - 359	1	Degree	F1	0	•	•	•
022E		Trip angle (Ie^Ue)>>>	10 - 170	1	Degree	F1	10	•	•	•
022F	**Protection 49**	θ alarm operating mode	0 - 1	1		F24	0		•	•
0230		θ alarm value	50 - 200	1	%	F1	90		•	•
0231		Iθ> (nominal current thermal)	10 - 320	1	1/100	F1	10		•	•
0232		K	100 - 150	1	1/100 In	F1	105		•	•
0233		Thermal overload time constant	1 - 200	1	Mn	F1	1		•	•
0234		θ trip operating mode	0 - 1	1		F24	0		•	•
0235		θ trip value	50 - 200	1	%	F1	100		•	•
0236	**Protection 37**	I< operating mode	0 - 1	1		F24	0		•	•
0237		I< value	10 - 100	1	1/100 In	F1	10		•	•
0238		Trip time I<	0 - 15000	1	10ms	F1	0		•	•
0239	**Protection 46**	I2> operating mode	0 - 1	1		F24	0		•	•
023A		I2> value	10 -2500	1	1/100 In	F1	2500		•	•
023B		Trip time type I2>				F3	0		•	•
023C		DMT trip time I2>	0 -15000	1	10ms	F1	0		•	•
023D		TMS: I2> trip time multiplier	25 - 10000	1	0.001	F1	25		•	•
023E		K: I2> trip time multiplier for RI type curve	100-10000	5	1/1000	F1	100		•	•
023F		I2 reset time type: DMT or IDMT	0 - 1	1		F34	0		•	•
0240		DMT reset time I2>	4 - 10000	1	10ms	F1	4		•	•
0241		RTMS: I2> reset time multiplier	25 -3200	1	0.001	F1	25		•	•
0242		I2>> operating mode	0 - 1	1		F24	0		•	•
0243		I2>> value	50 -4000	1	1/100 In	F1	4000		•	•
0244		Trip time I2>>	0 - 15000	1	10ms	F1	0		•	•
0245		I2>>> operating mode	0 - 1	1		F24	0		•	•
0246		I2>>> value	50 - 4000	1	1/100 In	F1	4000		•	•
0247		Trip time I2>>>	0 - 15000	1	10ms	F1	0		•	•
0248	**Protection 27**	U< operating mode	0 - 1 - 2	1		F24B	0			•
0249	U< value	57 - 130V operating range	20 -1300	1	100mV	F1	50			•
		220 - 480V operating range	100 - 4800	5	100mV	F1	200			•
024A		Trip time U<	0 - 60000	1	10ms	F1	0			•
024B		U<< operating mode	0 - 1 - 2	1		F24B	0			•
024C	U<< value	57 - 130V operating range	20 -1300	1	100mV	F1	50			•
		220 -. 480V	100 - 4800	5	100mV	F1	200			•
024D		Trip time U<< operating range	0 - 60000	1	10ms	F1	0			•
024E	**Protection 32n**	Pe> trip angle	0 - 359	1		F1	0	•	•	•
024F		32n operating mode: Pe or IeCos	0 - 1	1		F24C	0	•	•	•
0250		Pe> operating mode	0 - 1	1		F24	0	•	•	•
0251	Pe> value	0.002-1 Ien / 57-130V operating range	20 - 2000	2	10mW. Ien	F1	2000	•	•	•
		0.002-1 Ien / 220 - 480V operating range	100 - 8000	10	10mW. Ien	F1	8000	•	•	•
		0.01 - 8 Ien / 57 - 130V operating range	100 - 16000	10	10mW. Ien	F1	16000	•	•	•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
		0.01 - 8 Ien / 220-480V operating range	400 - 64000	50	10mW.Ien	F1	64000	•	•	•
		0.1 - 40 Ien / 57 - 130V operating range	10 - 800	1	W.Ien	F1	800	•	•	•
		0.1 - 40 Ien / 220-480V operating range	40 - 3200	5	W.Ien	F1	3200	•	•	•
0252		Trip time type Pe>				F3	0	•	•	•
0253		Trip time Pe>	0 - 15000	1	10ms	F1	0	•	•	•
0254		TMS: Pe> trip time multiplier	25 - 10000	1	0.001	F1	25	•	•	•
0255		K: Pe> trip time multiplier for RI type curve	100 -10000	5	0.001	F1	100	•	•	•
0256		Reset time type Pe>: DMT or IDMT	0 - 1	1		F34	0	•	•	•
0257		DMT reset time Pe>	0 - 10000	1	10ms	F1	4	•	•	•
0258		RTMS reset time Pe>	25 - 3200	1	1/1000	F1	25	•	•	•
0259		Pe>> operating mode	0 -1	1		F24	0	•	•	•
025A	Pe>> value	0.002-1 Ien / 57-130V operating range	20 - 2000	2	10mW.Ien	F1	2000	•	•	•
		0.002-1 Ien / 220 - 480V operating range	100 - 8000	10	10mW.Ien	F1	8000	•	•	•
		0.01 - 8 Ien / 57 - 130V operating range	100 - 16000	10	10mW.Ien	F1	16000	•	•	•
		0.01 - 8 Ien / 220-480V operating range	400 - 64000	50	10mW.Ien	F1	64000	•	•	•
		0.1 - 40 Ien / 57 - 130V operating range	10 - 800	1	W.Ien	F1	800	•	•	•
		0.1 - 40 Ien / 220-480V operating range	40 - 3200	5	W.Ien	F1	3200	•	•	•
025B		Trip time Pe>>	0 - 15000	1	10ms	F1	0	•	•	•
025C		IeCos> operating mode	0 – 1	1		F24	0	•	•	•
025D	IeCos> value	0.002 - 1 Ien operating range	2 - 1000	1	1/1000 Ien	F1	1000	•	•	•
		0.01 - 1 Ien operating range	10- 8000	5	1/1000 Ien	F1	8000	•	•	•
		0.1 - 25 Ien operating range	10 - 2500	1	1/100 Ien	F1	2500	•	•	•
025E		Trip time type IeCos>				F3	0	•	•	•
025F		DMT Trip time IeCos>	0 -15000	1	10ms	F1	0	•	•	•
0260		TMS: IeCos> trip time multiplier	25 - 10000	1	0.001	F1	25	•	•	•
0261		K: IeCos> trip time multiplier for RI type curve	100 -10000	5	0.001	F1	100	•	•	•
0262		Reset time type IeCos>: DMT or IDMT	0 - 1	1		F34	0	•	•	•
0263		DMT Reset time IeCos>	0 - 10000	1	10ms	F1	4	•	•	•
0264		RTMS reset time IeCos>	25 - 3200	1	0.001	F1	25	•	•	•
0265		IeCos>> mode	0 – 1	1		F24	0	•	•	•
0266	IeCos>> value	0.002 - 1 Ien operating range	2 - 1000	1	1/1000 Ien	F1	1000	•	•	•
		0.01 - 1 Ien operating range	10 - 8000	5	1/1000 Ien	F1	8000	•	•	•
		0.1 - 25 Ien operating range	50 - 4000	1	1/100 Ien	F1	4000	•	•	•
0267		Trip time IeCos>>	0 - 15000	1	10ms	F1	1	•	•	•
0268	**Protection 59**	U> operating mode	0 - 1 - 2	1	-	F24B	0			•
0269	U> value	57 – 130V operating range	20 -2600	1	100mV	F1	2600			•
		220 – 480V operating range	100 -9600	5	100mV	F1	7200			•
026A		Trip time U>	0 - 60000	1	10ms	F1	0			•
026B		U>> operating mode	0 – 1 - 2	1		F24B	0			•
026C	U>> value	57 – 130V operating range	20 - 2600	1	100mV	F1	2600			•
		220 – 480V operating range	100 - 9600	1	100mV	F1	9600			•
026D		Trip time U>>	0 - 60000	1	10ms	F1	0			•
026E	**Protection 59n**	Ue>>>> operating mode	0 - 1	1		F24	0			•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
026F	Ue>>>> value	57 – 130V operating range	10 - 2600	1	100mV	F1	2600			•
		220 – 480V operating range	50 - 9600	5	100mV	F1	9600			•
0270		Trip time Ue>>>>	0 - 60000	1	10ms	F1	0			•
0271	**Recloser 79**	Recloser info	0 - 1	1		F24	0		•	•
0272		CB position active	0 - 1	1		F24	0		•	•
0273–0274		Supervision window	1 -.60000	1	10ms	F18A	1		•	•
0275		External blocking input	0 - 1	1		F24	1		•	•
0276		tAux1 cycle configuration	0 - 2222	1		F57	1111		•	•
0277		tAux2 cycle configuration	0 - 2222	1		F57	1111		•	•
0278		Dead time 1	1 - 30000	1	10ms	F1	500		•	•
0279		Dead time 2	1 - 30000	1	10ms	F1	500		•	•
027A–027B		Dead time 3	1 - 60000	1	10ms	F18A	500		•	•
027C–027D		Dead time 4	1 - 60000	1	10ms	F18A	500		•	•
027E–027F		Reclaim time	2 - 60000	1	10ms	F18A	500		•	•
0280–0281		Inhibit time	2 - 60000	1	10ms	F18A	500		•	•
0282		Recloser cycles for phase faults	0 - 4	1		F1	4		•	•
0283		Recloser cycles for earth faults	0 - 4	1		F1	4		•	•
0284	**Reset time 67N**	DMT Reset time Ie>>	0 - 10000	1	10ms	F1	4	•	•	•
0285		DMT Reset time Ie>>>	0 - 10000	1	10ms	F1	4	•	•	•
0286	**Reset time 32N**	DMT Reset time IeCos>>	0 - 10000	1	10ms	F1	4	•	•	•
0287		DMT Reset time Pe>>	0 - 10000	1	10ms	F1	4	•	•	•
0288	**Protection 50/51/67**	Trip time type I>>				F3	0		•	•
0289		TMS: I>> trip time multiplier	25 - 10000	1	0.001	F1	25		•	•
028A		K: I>> trip time multiplier for RI type curve	100 -10000	5	0.001	F1	100		•	•
028B		Reset time type: DMT / IDMT	0 - 1	1		F34	0		•	•
028C		DMT reset time I>>	0 - 10000	1	10ms	F1	4		•	•
028D		RTMS: I>> reset time multiplier	25 - 3200	1	0.001	F1	25		•	•
028E	**Protection 50n/51n/67n**	Trip time type Ie>>				F3	0	•	•	•
028F		TMS: Ie>> trip time multiplier	25 - 10000	1	0.001	F1	25	•	•	•
0290		K: Ie>> trip time multiplier for type curve	100 - 10000	5	0.001	F1	100	•	•	•
0291		Reset time type: DMT / IDMT	0 - 1	1		F34	0	•	•	•
0292		RTMS: Ie>> reset time multiplier	25 - 3200	1	0.001	F1	25	•	•	•
0293	**Recloser 79**	I> cycle configuration	0 - 2222	1		F57	1111		•	•
0294		I>> cycle configuration	0 - 2222	1		F57	1111		•	•
0295		I>>> cycle configuration	0 - 2222	1		F57	1111		•	•
0296		Ie> cycle configuration	0 - 2222	1		F57	1111		•	•
0297		Ie>> cycle configuration	0 - 2222	1		F57	1111		•	•
0298		Ie>>> cycle configuration	0 - 2222	1		F57	1111		•	•
0299		Pe/IeCos> cycle configuration	0 - 2222	1		F57	1111		•	•
029A		Pe/IeCos>> cycle configurat.	0 - 2222	1		F57	1111		•	•
029B-029F		Reserved								
02A0	**Active Power**	P> operating mode	0-1	1		F24	0			•
02A1	P> value	57-130V operating range	1-10000	1	W.In	F1	10000			•
		220V-480V operating range	4-40000	1	W.In	F1	40000			•
02A2		Trip time tP>	0-15000	1	10ms	F1	0			•
02A3		P> directional angle	0-359	1	Degree	F1	0			•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
02A4		P< operating mode	0-1	1		F24	0			•
02A5	P< triggering level	57-130V operating range	1-10000	1	W x In	F1	1			•
		220V-480V operating range	4-40000	1	W x In	F1	5			•
02A6		Trip time tP<	0-15000	1	10ms	F1	0			•
02A7		P< directional angle	0-359	1	Degree	F1	0			
02A8		P>> operating mode	0-1	1		F24	0			•
02A9	P>> value	57-130V operating range	1-10000	1	W.In	F1	100 00			•
		220V-480V operating range	4-40000	1	W.In	F1	400 00			•
02AA		Trip time tP>>	0-15000	1	10mS	F1	0			•
02AB		P>> directional angle	0-359	1	Degree	F1	0			
02AC		P<< operating mode	0-1	1		F24	0			•
02AD	P<< triggering level	57-130V operating range	1-10000	1	W x In	F1	1			•
		220V-480V operating range	4-40000	1	W x In	F1	5			•
02AE		Trip time tP<<	0-15000	1	10ms	F1	0			•
02AF		P<< directional angle	0-359	1	Degree	F1	0			
02B0	**Frequency**	f1 operating mode	0-2	1		F68	0			•
02B1	f1 value	50 Hz nominal frequency	4510-5490	1	10mHz	F1	500 0			•
		60 Hz nominal frequency	5510-6490	1	10mHz	F1	600 0			•
02B2		Trip time tf1	0-60000	1	10ms	F1	0			•
02B3		f2 operating mode	0-2	1		F68	0			•
02B4	f2 value	50 Hz nominal frequency	4510-5490	1	10mHz	F1	500 0			•
		60 Hz nominal frequency	5510-6490	1	10mHz	F1	600 0			•
02B5		Trip time tf2	0-60000	1	10ms	F1	0			•
02B6		f3 operating mode	0-2	1		F68	0			•
02B7	f3 value	50 Hz nominal frequency	4510-5490	1	10mHz	F1	500 0			•
		60 Hz nominal frequency	5510-6490	1	10mHz	F1	600 0			•
02B8		Trip time tf3	0-60000	1	10ms	F1	0			•
02B9		f4 operating mode	0-2	1		F68	0			•
02BA	f4 value	50 Hz nominal frequency	4510-5490 5510-6490	1	10mHz	F1	500 0 ou 600 0			•
02BB		Trip time tf4	0-60000	1	10ms	F1	0			•
02BC		f5 operating mode	0-2	1		F68	0			•
02BD	f5 value	50 Hz nominal frequency	4510-5490	1	10mHz	F1	500 0			•
		60 Hz nominal frequency	5510-6490	1	10mHz	F1	600 0			•
02BE		Trip time tf5	0-60000	1	10ms	F1	0			•
02BF		f6 operating mode	0-2	1		F68	0			•
02C0	f6 value	50 Hz nominal frequency	4510-5490	1	10mHz	F1	500 0			•
		60 Hz nominal frequency	5510-6490	1	10mHz	F1	600 0			•
02C1		Trip time tf6	0-60000	1	10ms	F1	0			•
02C2	**Protection 37**	Inhibition of I< on 52A	0-1	1		F24	0		•	•
02C3		Inhibition of I< on U<	0-1	1		F24	0			•
02C4	U< value of inhibition I<	57 - 130V operating range	20-1300	1	100mV	F1	50			•
		220 - 480V operating range	100-4800	5	100mV	F1	200			•
02C5	**Reactive Power**	Q> operating mode	0-1	1		F24	0			•
02C6	Q> triggering level	57-130V operating range	1-10000	1	W x In	F1	100 00			•
		220V-480V operating range	4-40000	1	W x In	F1	400 00			•
02C7		Trip time tQ>	0-15000	1	10ms	F1	0			•
02C8		Q> directional angle	0-359	1	Degree	F1	0			
02C9		Q< operating mode	0-1	1		F24	0			•

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
02CA	Q< triggering level	57-130V operating range	1-10000	1	W x In	F1	1			•
		220V-480V operating range	4-40000	1	W x In	F1	5			•
02CB		Trip time tQ<	0-15000	1	10ms	F1	0			
02CC		Q< directional angle	0-359	1	Degree	F1	0			
02CD		Q>> operating mode	0-1	1		F24	0			
02CE	Q>> triggering level	57-130V operating range	1-10000	1	W x In	F1	10000			•
		220V-480V operating range	4-40000	1	W x In	F1	40000			•
02CF		Trip time tQ>>	0-15000	1	10mS	F1	0			
02D0		Q>> directional angle	0-359	1	Degree	F1	0			
02D1		Q<< operating mode	0-1	1		F24	0			
02D2	Q<< triggering level	57-130V operating range	1-10000	1	W x In	F1	1			•
		220V-480V operating range	4-40000	1	W x In	F1	5			•
02D3		Trip time tQ<<	0-15000	1	10ms	F1	0			
02D4		Q<< directional angle	0-359	1	Degree	F1	0			
02D5	**Recloser 79**	Trips nb / time block ?	0 - 1	1		F24	0		•	•
02D6		Openings number	2-100	1		F1	10		•	•
02D7		Time period	10 - 1440	1	minutes	F1	60		•	•
02D8-02D9		Dead Time tI>	5 - 60000	1	10 ms	F18A	5		•	•
02DA-02DB		Dead Time tI>>	5 - 60000	1	10 ms	F18A	5		•	•
02DC-02DD		Dead Time tI>>>	5 - 60000	1	10 ms	F18A	5		•	•
02DE-02DF		Dead Time tIE>	5 - 60000	1	10 ms	F18A	5		•	•
02E0-02E1		Dead Time tIE>>	5 - 60000	1	10 ms	F18A	5		•	•
02E2-02E3		Dead Time tIE>>>	5 - 60000	1	10 ms	F18A	5		•	•
02E4	[50N/51N] Ie_d>	Ie_d> operating mode	0-1-2	1		F24A	0			•
02E5		Ie_d> Threshold	10 to 4000	1	1/100 IEn	F1	100			•
02E6		Ie_d> Trip time type				F3	0			•
02E7		DMT Trip time tIe_d>	0 to 15000	1	1/100 s	F1	0			•
02E8		TMS: Ie_d> trip time multiplier	25 to 10000	1	1/1000	F1	25			•
02E9		K: Ie_d> trip time multiplier for RI curve	100 to 10000	5	1/1000	F1	100			•
02EA		Ie_d> reset time type DMT or IDMT	0 – 1	1		F34	0			•
02EB		DMT Reset time Ie_d>	0 to 10000	1	1/100 s	F1	0			•
02EC		RTMS: Ie_d> reset time multiplier	25 - 3200	1	0.001	F1	25			•
02ED	Ue>>>> value for Ie_d>	57 - 130V operating range	10 - 2600	1	1/10 V	F1	1000			•
		220 - 480V operating range	40 - 7200	5	1/10 V	F1	4000			•
02EE		Torque (RCA) angle Ie_d>^Ue	0 - 359	1	Degree	F1	0			•
02EF		Trip angle Ie_d>^Ue	10 - 170	1	Degree	F1	10			•
02F0		Not used								
02F1	Protection 27	U< and U<< Inhibition by 52a	0 – 3	1		F86	0			•
02F2	**[81R] FREQ. CHANGE OF RATE**	df/dt1 activation	0 - 1	1		F24	0			•
02F3		df/dt1 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02F4		df/dt2 activation	0 - 1	1		F24	0			•
02F5		df/dt2 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02F6		df/dt3 activation	0 - 1	1		F24	0			•
02F7		df/dt3 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02F8		df/dt4 activation	0 - 1	1		F24	0			•
02F9		df/dt4 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02FA		df/dt5 activation	0 - 1	1		F24	0			•
02FB		df/dt5 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02FC		df/dt6 activation	0 - 1	1		F24	0			•
02FD		df/dt6 threshold	-100 - +100	1	0.1Hz/s	F2	+10			•
02FE – 02FF		Unused								

3.3.2 **Page 25H** - Setting group 1 remote parameters

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. value	P125	P126	P127
2500	**[50N/51N] Ie_d>>**	Ie_d>> operating mode	0-1-2	1		F24A	0			•
2501		Ie_d>> Threshold	10 to 4000	1	1/100 IEn	F1	100			•
2502		Ie_d>> Trip time type				F3	0			•
2503		DMT Trip time tIe_d>>	0 to 15000	1	1/100 s	F1	0			•
2504		TMS: Ie_d>> trip time multiplier	25 to 10000	1	1/1000	F1	25			•
2505		K: Ie_d>> trip time multiplier for RI curve	100 to 10000	5	1/1000	F1	100			•
2506		Ie_d>> reset time type DMT or IDMT	0 – 1	1		F34	0			•
2507		DMT Reset time Ie_d>>	0 to 10000	1	1/100 s	F1	0			•
2508		RTMS: Ie_d>> reset time multiplier	25 - 3200	1	0.001	F1	25			•
2509	Ue value for Ie_d>>	57 - 130V operating range	10 - 2600	1	1/10 V	F1	100 0			•
		220 - 480V operating range	40 - 7200	5	1/10 V	F1	400 0			•
250A		Torque (RCA) angle Ie_d>>^Ue	0 - 359	1	Degree	F1	0			•
250B		Trip angle Ie_d>>^Ue	10 - 170	1	Degree	F1	10			•
250C		Not used								
250D	[47] V2>	V2> operating mode	0-1	1		F24	0			•
250E		V2> Threshold (57-130V) V2> Threshold (220-480V)	1-130V 4-480V	10 40	1/10V 1/10V	F1 F1	150 600			•
250F		DMT Trip time V2>	0 to 10000	1	1/100s	F1	500			•
2510	[47] V2>>	V2>> operating mode	0-1	1		F24	0			•
2511		V2>> Threshold (57-130V) V2>> Threshold (220-480V)	1-130V 4-480V	10 40	1/10V 1/10V	F1 F1	150 600			•
2512		DMT Trip time V2>>	0 to 10000	1	1/100s	F1	500			•
2513-257E		Not used								
257F		Last available substained setting								

3.3.3 **Page 3H** - Setting group 2 remote parameters

The addresses 03XX (page 03) are equivalent to addresses 26XX (page 26).

Same structure as group1 (page 2H): replace addresses 02XX by 03XX.

3.3.4 **Page 24H**: Setting group 1 remote parameters

Page 24XX: Same structure with addresses beginning by 24XX (page 24) instead of 02XX.

Page 25H: Continuation of "Setting group 1 remote parameters" (refer to the previous table).

3.3.5 **Page 26H** - Setting group 2 remote parameters

Page 26XX: Same structure as group 1 (page 02H), with addresses beginning by 26XX instead of 02XX.

Page 27H: Continuation of "Setting group 2 remote parameters"

Page 27XX: Same structure as group 1 (page 25H). Replace addresses 25XX by 27XX.

3.3.6 **Page 28H** - Setting group 3 remote parameters

Page 28H: Same structure as group 1 (page 02H). Replace addresses 02XX by 28XX.

Page 29H: continuation of "Setting group 3 remote parameters"

Page 29XX: Same structure as group 1 (page 25H). Replace addresses 25XX by 29XX.

3.3.7 **Page 2AH** - Setting group 4 remote parameters

Page 2AH: Same structure as group 1 (page 02H). Replace addresses 02XX by 2AXX.

Page 2BH: continuation of "Setting group 4 remote parameters"

Page 2BXX: Same structure as group 1 (page 25H). Replace addresses 25XX by 2BXX.

3.3.8 **Page 2CH** - Setting group 5 remote parameters

Page 2CH: Same structure as group 1 (page 02H). Replace addresses 02XX by 2CXX.

Page 2DH: continuation of "Setting group 5 remote parameters"

Page 2DXX: Same structure as group 1 (page 25H). Replace addresses 25XX by 2DXX.

3.3.9 **Page 2EH** - Setting group 6 remote parameters

Page 2EXX: Same structure as group 1 (page 02H). Replace addresses 02XX by 2EXX.

Page 2FH: Setting group 6 remote parameters continued

Page 2FXX: Same structure as group 1 (page 25H). Replace addresses 25XX by 2FXX.

3.3.10 **Page 30H** - Setting group 7 remote parameters

Page 30H: Same structure as group 1 (page 02H). Replace addresses 02XX by 30XX.

Page 31H: Setting group 7 remote parameters continued

Page 31XX: Same structure as group 1 (page 25H). Replace addresses 25XX by 31XX.

3.3.11 **Page 32H** - Setting group 8 remote parameters

Page 32H: Same structure as group 1(page 02H). Replace addresses 02XX by 32XX.

Page 33H: Setting group 8 remote parameters continued

Page 33XX: Same structure as group 1 (page 25H). Replace addresses 25XX by 33XX.

3.4 Boolean equations

3.4.1 **Page 5H** - Boolean equations parameters

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0500	**Bool Equations**	Equation A.00 operator	0 - 1	1		F70	0
0501		Equation A.00 operand	0 - 111	1		F72	0
0502		Equation A.01 operator	0 - 3	1		F71	0
0503		Equation A.01 operand	0 - 111	1		F72	0
0504		Equation A.02 operator	0 - 3	1		F71	0
0505		Equation A.02 operand	0 - 111	1		F72	0
0506		Equation A.03 operator	0 - 3	1		F71	0
0507		Equation A.03 operand	0 - 111	1		F72	0
0508		Equation A.04 operator	0 - 3	1		F71	0
0509		Equation A.04 operand	0 - 111	1		F72	0
050A		Equation A.05 operator	0 - 3	1		F71	0
050B		Equation A.05 operand	0 - 111	1		F72	0
050C		Equation A.06 operator	0 - 3	1		F71	0
050D		Equation A.06 operand	0 - 111	1		F72	0
050E		Equation A.07 operator	0 - 3	1		F71	0
050F		Equation A.07 operand	0 - 111	1		F72	0
0510		Equation A.08 operator	0 - 3	1		F71	0
0511		Equation A.08 operand	0 - 111	1		F72	0
0512		Equation A.09 operator	0 - 3	1		F71	0
0513		Equation A.09 operand	0 - 111	1		F72	0
0514		Equation A.10 operator	0 - 3	1		F71	0
0515		Equation A.10 operand	0 - 111	1		F72	0
0516		Equation A.11 operator	0 - 3	1		F71	0
0517		Equation A.11 operand	0 - 111	1		F72	0
0518		Equation A.12 operator	0 - 3	1		F71	0
0519		Equation A.12 operand	0 - 111	1		F72	0
051A		Equation A.13 operator	0 - 3	1		F71	0
051B		Equation A.13 operand	0 - 111	1		F72	0
051C		Equation A.14 operator	0 - 3	1		F71	0
051D		Equation A.14 operand	0 - 111	1		F72	0
051E		Equation A.15 operator	0 - 3	1		F71	0
051F		Equation A.15 operand	0 - 111	1		F72	0
0520		Equation B.00 operator	0 - 1	1		F70	0
0521		Equation B.00 operand	0 - 111	1		F72	0
0522		Equation B.01 operator	0 - 3	1		F71	0
0523		Equation B.01 operand	0 - 111	1		F72	0
0524		Equation B.02 operator	0 - 3	1		F71	0
0525		Equation B.02 operand	0 - 111	1		F72	0
0526		Equation B.03 operator	0 - 3	1		F71	0
0527		Equation B.03 operand	0 - 111	1		F72	0
0528		Equation B.04 operator	0 - 3	1		F71	0
0529		Equation B.04 operand	0 - 111	1		F72	0
052A		Equation B.05 operator	0 - 3	1		F71	0
052B		Equation B.05 operand	0 - 111	1		F72	0
052C		Equation B.06 operator	0 - 3	1		F71	0
052D		Equation B.06 operand	0 - 111	1		F72	0
052E		Equation B.07 operator	0 - 3	1		F71	0
052F		Equation B.07 operand	0 - 111	1		F72	0
0530		Equation B.08 operator	0 - 3	1		F71	0
0531		Equation B.08 operand	0 - 111	1		F72	0
0532		Equation B.09 operator	0 - 3	1		F71	0
0533		Equation B.09 operand	0 - 111	1		F72	0
0534		Equation B.10 operator	0 - 3	1		F71	0
0535		Equation B.10 operand	0 - 111	1		F72	0
0536		Equation B.11 operator	0 - 3	1		F71	0
0537		Equation B.11 operand	0 - 111	1		F72	0
0538		Equation B.12 operator	0 - 3	1		F71	0
0539		Equation B.12 operand	0 - 111	1		F72	0
053A		Equation B.13 operator	0 - 3	1		F71	0
053B		Equation B.13 operand	0 - 111	1		F72	0
053C		Equation B.14 operator	0 - 3	1		F71	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
053D		Equation B.14 operand	0 - 111	1		F72	0
053E		Equation B.15 operator	0 - 3	1		F71	0
053F		Equation B.15 operand	0 - 111	1		F72	0
0540		Equation C.00 operator	0 - 1	1		F70	0
0541		Equation C.00 operand	0 - 111	1		F72	0
0542		Equation C.01 operator	0 - 3	1		F71	0
0543		Equation C.01 operand	0 - 111	1		F72	0
0544		Equation C.02 operator	0 - 3	1		F71	0
0545		Equation C.02 operand	0 - 111	1		F72	0
0546		Equation C.03 operator	0 - 3	1		F71	0
0547		Equation C.03 operand	0 - 111	1		F72	0
0548		Equation C.04 operator	0 - 3	1		F71	0
0549		Equation C.04 operand	0 - 111	1		F72	0
054A		Equation C.05 operator	0 - 3	1		F71	0
054B		Equation C.05 operand	0 - 111	1		F72	0
054C		Equation C.06 operator	0 - 3	1		F71	0
054D		Equation C.06 operand	0 - 111	1		F72	0
054E		Equation C.07 operator	0 - 3	1		F71	0
054F		Equation C.07 operand	0 - 111	1		F72	0
0550		Equation C.08 operator	0 - 3	1		F71	0
0551		Equation C.08 operand	0 - 111	1		F72	0
0552		Equation C.09 operator	0 - 3	1		F71	0
0553		Equation C.09 operand	0 - 111	1		F72	0
0554		Equation C.10 operator	0 - 3	1		F71	0
0555		Equation C.10 operand	0 - 111	1		F72	0
0556		Equation C.11 operator	0 - 3	1		F71	0
0557		Equation C.11 operand	0 - 111	1		F72	0
0558		Equation C.12 operator	0 - 3	1		F71	0
0559		Equation C.12 operand	0 - 111	1		F72	0
055A		Equation C.13 operator	0 - 3	1		F71	0
055B		Equation C.13 operand	0 - 111	1		F72	0
055C		Equation C.14 operator	0 - 3	1		F71	0
055D		Equation C.14 operand	0 - 111	1		F72	0
055E		Equation C.15 operator	0 - 3	1		F71	0
055F		Equation C.15 operand	0 - 111	1		F72	0
0560		Equation D.00 operator	0 - 1	1		F70	0
0561		Equation D.00 operand	0 - 111	1		F72	0
0562		Equation D.01 operator	0 - 3	1		F71	0
0563		Equation D.01 operand	0 - 111	1		F72	0
0564		Equation D.02 operator	0 - 3	1		F71	0
0565		Equation D.02 operand	0 - 111	1		F72	0
0566		Equation D.03 operator	0 - 3	1		F71	0
0567		Equation D.03 operand	0 - 111	1		F72	0
0568		Equation D.04 operator	0 - 3	1		F71	0
0569		Equation D.04 operand	0 - 111	1		F72	0
056A		Equation D.05 operator	0 - 3	1		F71	0
056B		Equation D.05 operand	0 - 111	1		F72	0
056C		Equation D.06 operator	0 - 3	1		F71	0
056D		Equation D.06 operand	0 - 111	1		F72	0
056E		Equation D.07 operator	0 - 3	1		F71	0
056F		Equation D.07 operand	0 - 111	1		F72	0
0570		Equation D.08 operator	0 - 3	1		F71	0
0571		Equation D.08 operand	0 - 111	1		F72	0
0572		Equation D.09 operator	0 - 3	1		F71	0
0573		Equation D.09 operand	0 - 111	1		F72	0
0574		Equation D.10 operator	0 - 3	1		F71	0
0575		Equation D.10 operand	0 - 111	1		F72	0
0576		Equation D.11 operator	0 - 3	1		F71	0
0577		Equation D.11 operand	0 - 111	1		F72	0
0578		Equation D.12 operator	0 - 3	1		F71	0
0579		Equation D.12 operand	0 - 111	1		F72	0
057A		Equation D.13 operator	0 - 3	1		F71	0
057B		Equation D.13 operand	0 - 111	1		F72	0
057C		Equation D.14 operator	0 - 3	1		F71	0
057D		Equation D.14 operand	0 - 111	1		F72	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
057E		Equation D.15 operator	0 - 3	1		F71	0
057F		Equation D.15 operand	0 - 111	1		F72	0
0580		Equation E.00 operator	0 - 1	1		F70	0
0581		Equation E.00 operand	0 - 111	1		F72	0
0582		Equation E.01 operator	0 - 3	1		F71	0
0583		Equation E.01 operand	0 - 111	1		F72	0
0584		Equation E.02 operator	0 - 3	1		F71	0
0585		Equation E.02 operand	0 - 111	1		F72	0
0586		Equation E.03 operator	0 - 3	1		F71	0
0587		Equation E.03 operand	0 - 111	1		F72	0
0588		Equation E.04 operator	0 - 3	1		F71	0
0589		Equation E.04 operand	0 - 111	1		F72	0
058A		Equation E.05 operator	0 - 3	1		F71	0
058B		Equation E.05 operand	0 - 111	1		F72	0
058C		Equation E.06 operator	0 - 3	1		F71	0
058D		Equation E.06 operand	0 - 111	1		F72	0
058E		Equation E.07 operator	0 - 3	1		F71	0
058F		Equation E.07 operand	0 - 111	1		F72	0
0590		Equation E.08 operator	0 - 3	1		F71	0
0591		Equation E.08 operand	0 - 111	1		F72	0
0592		Equation E.09 operator	0 - 3	1		F71	0
0593		Equation E.09 operand	0 - 111	1		F72	0
0594		Equation E.10 operator	0 - 3	1		F71	0
0595		Equation E.10 operand	0 - 111	1		F72	0
0596		Equation E.11 operator	0 - 3	1		F71	0
0597		Equation E.11 operand	0 - 111	1		F72	0
0598		Equation E.12 operator	0 - 3	1		F71	0
0599		Equation E.12 operand	0 - 111	1		F72	0
059A		Equation E.13 operator	0 - 3	1		F71	0
059B		Equation E.13 operand	0 - 111	1		F72	0
059C		Equation E.14 operator	0 - 3	1		F71	0
059D		Equation E.14 operand	0 - 111	1		F72	0
059E		Equation E.15 operator	0 - 3	1		F71	0
059F		Equation E.15 operand	0 - 111	1		F72	0
05A0		Equation F.00 operator	0 - 1	1		F70	0
05A1		Equation F.00 operand	0 - 111	1		F72	0
05A2		Equation F.01 operator	0 - 3	1		F71	0
05A3		Equation F.01 operand	0 - 111	1		F72	0
05A4		Equation F.02 operator	0 - 3	1		F71	0
05A5		Equation F.02 operand	0 - 111	1		F72	0
05A6		Equation F.03 operator	0 - 3	1		F71	0
05A7		Equation F.03 operand	0 - 111	1		F72	0
05A8		Equation F.04 operator	0 - 3	1		F71	0
05A9		Equation F.04 operand	0 - 111	1		F72	0
05AA		Equation F.05 operator	0 - 3	1		F71	0
05AB		Equation F.05 operand	0 - 111	1		F72	0
05AC		Equation F.06 operator	0 - 3	1		F71	0
05AD		Equation F.06 operand	0 - 111	1		F72	0
05AE		Equation F.07 operator	0 - 3	1		F71	0
05AF		Equation F.07 operand	0 - 111	1		F72	0
05B0		Equation F.08 operator	0 - 3	1		F71	0
05B1		Equation F.08 operand	0 - 111	1		F72	0
05B2		Equation F.09 operator	0 - 3	1		F71	0
05B3		Equation F.09 operand	0 - 111	1		F72	0
05B4		Equation F.10 operator	0 - 3	1		F71	0
05B5		Equation F.10 operand	0 - 111	1		F72	0
05B6		Equation F.11 operator	0 - 3	1		F71	0
05B7		Equation F.11 operand	0 - 111	1		F72	0
05B8		Equation F.12 operator	0 - 3	1		F71	0
05B9		Equation F.12 operand	0 - 111	1		F72	0
05BA		Equation F.13 operator	0 - 3	1		F71	0
05BB		Equation F.13 operand	0 - 111	1		F72	0
05BC		Equation F.14 operator	0 - 3	1		F71	0
05BD		Equation F.14 operand	0 - 111	1		F72	0
05BE		Equation F.15 operator	0 - 3	1		F71	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
05BF		Equation F.15 operand	0 - 111	1		F72	0
05C0		Equation G.00 operator	0 - 1	1		F70	0
05C1		Equation G.00 operand	0 - 111	1		F72	0
05C2		Equation G.01 operator	0 - 3	1		F71	0
05C3		Equation G.01 operand	0 - 111	1		F72	0
05C4		Equation G.02 operator	0 - 3	1		F71	0
05C5		Equation G.02 operand	0 - 111	1		F72	0
05C6		Equation G.03 operator	0 - 3	1		F71	0
05C7		Equation G.03 operand	0 - 111	1		F72	0
05C8		Equation G.04 operator	0 - 3	1		F71	0
050C9		Equation G.04 operand	0 - 111	1		F72	0
05CA		Equation G.05 operator	0 - 3	1		F71	0
05CB		Equation G.05 operand	0 - 111	1		F72	0
05CC		Equation G.06 operator	0 - 3	1		F71	0
05CD		Equation G.06 operand	0 - 111	1		F72	0
05CE		Equation G.07 operator	0 - 3	1		F71	0
05CF		Equation G.07 operand	0 - 111	1		F72	0
05D0		Equation G.08 operator	0 - 3	1		F71	0
05D1		Equation G.08 operand	0 - 111	1		F72	0
05D2		Equation G.09 operator	0 - 3	1		F71	0
05D3		Equation G.09 operand	0 - 111	1		F72	0
05D4		Equation G.10 operator	0 - 3	1		F71	0
05D5		Equation G.10 operand	0 - 111	1		F72	0
05D6		Equation G.11 operator	0 - 3	1		F71	0
05D7		Equation G.11 operand	0 - 111	1		F72	0
05D8		Equation G.12 operator	0 - 3	1		F71	0
05D9		Equation G.12 operand	0 - 111	1		F72	0
05DA		Equation G.13 operator	0 - 3	1		F71	0
05DB		Equation G.13 operand	0 - 111	1		F72	0
05DC		Equation G.14 operator	0 - 3	1		F71	0
05DD		Equation G.14 operand	0 - 111	1		F72	0
05DE		Equation G.15 operator	0 - 3	1		F71	0
05DF		Equation G.15 operand	0 - 111	1		F72	0
05E0		Equation H.00 operator	0 - 1	1		F70	0
05E1		Equation H.00 operand	0 - 111	1		F72	0
05E2		Equation H.01 operator	0 - 3	1		F71	0
05E3		Equation H.01 operand	0 - 111	1		F72	0
05E4		Equation H.02 operator	0 - 3	1		F71	0
05E5		Equation H.02 operand	0 - 111	1		F72	0
05E6		Equation H.03 operator	0 - 3	1		F71	0
05E7		Equation H.03 operand	0 - 111	1		F72	0
05E8		Equation H.04 operator	0 - 3	1		F71	0
05E9		Equation H.04 operand	0 - 111	1		F72	0
05EA		Equation H.05 operator	0 - 3	1		F71	0
05EB		Equation H.05 operand	0 - 111	1		F72	0
05EC		Equation H.06 operator	0 - 3	1		F71	0
05ED		Equation H.06 operand	0 - 111	1		F72	0
05EE		Equation H.07 operator	0 - 3	1		F71	0
05EF		Equation H.07 operand	0 - 111	1		F72	0
05F0		Equation H.08 operator	0 - 3	1		F71	0
05F1		Equation H.08 operand	0 - 111	1		F72	0
05F2		Equation H.09 operator	0 - 3	1		F71	0
05F3		Equation H.09 operand	0 - 111	1		F72	0
05F4		Equation H.10 operator	0 - 3	1		F71	0
05F5		Equation H.10 operand	0 - 111	1		F72	0
05F6		Equation H.11 operator	0 - 3	1		F71	0
05F7		Equation H.11 operand	0 - 111	1		F72	0
05F8		Equation H.12 operator	0 - 3	1		F71	0
05F9		Equation H.12 operand	0 - 111	1		F72	0
05FA		Equation H.13 operator	0 - 3	1		F71	0
05FB		Equation H.13 operand	0 - 111	1		F72	0
05FC		Equation H.14 operator	0 - 3	1		F71	0
05FD		Equation H.14 operand	0 - 111	1		F72	0
05FE		Equation H.15 operator	0 - 3	1		F71	0
05FF		Equation H.15 operand	0 - 111	1		F72	0

3.5 Remote controls, device status & time synchronisation

3.5.1 **Page 4H** - Remote controls

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0400	Remote control	Remote control word 1	0 -.65535	1		F9	0
0401		Calibration mode					0
0402		Remote control word 2 (single output command)	0 --511	1		F39	0
0403		Remote control word 3	0 – 65535	1		F9A	0
0404		Remote control word 4	0 – 65535	1		F9B	0
0405		Keyboard remote control	Binary	1		F81	0

3.5.2 Page 7H - Device status

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0700		Relays status		1	-	F23	0

3.5.3 **Page 8H** - Time synchronisation

Time synchronisation: access only in writing or reading 4 words (function 16 or 3). The time synchronisation format is based on 8 bytes (4 words). Format (F52) is depending on address 012Fh.

Timer	Address (hex)	Nb bytes	Mask (hex)	Values range	Unit
With private date format:					
Year	0800	2	FFFF	1994-2093	Years
Month	0801	1 (Hi)	FF	1 -12	Months
Day		1 (Lo)	FF	1 - 31	Days
Hour	0802	1 (Hi)	FF	0 - 23	Hours
Minute		1 (Lo)	FF	0 - 59	Minutes
Milliseconds	0803	2	FFFF	0 - 59999	ms
With IEC 60870-5-103 format:					
	0800	1 (Hi)			
Year		1 (Lo)	7F	94-99 (1994-1999) 0-93 (2000-2093)	Years
Month	0801	1 (Hi)	0F	1 - 12	Months
Day of the week		1 (Lo)	E0	1 – 7 (Monday – Sunday)	Days
Day of the month		1 (Lo)	1F	1 - 31	Days
Season	0802	1 (Hi)	80	0 - 1 (summer – winter)	
Hour		1 (Hi)	1F	0 - 23	Hours
Date validity		1 (Lo)	80	0 - 1 (valid – invalid)	
Minute		1 (Lo)	3F	0 - 59	Minutes
Milliseconds	0803	2	FFFF	0 - 59999	ms

3.6 Disturbance records

Pages 38h to 3Ch: mapping pages used to send a service request to select the record number to be uploaded before uploading any disturbance record.

The answer following this request contain the following information:

1. Numbers of samples (pre and post time)
2. Phase CT ratio
3. Earth CT ratio
4. Internal phase and earth current ratios
5. Phase VT ratio
6. Earth VT ratio
7. Internal phase and earth voltage ratios
8. Number of the last disturbance mapping page
9. Number of samples in this last disturbance mapping page

Pages 9h to 21h: contain the disturbance data (25 pages)

A disturbance mapping page contains 250 words:

0900 to 09FAh: 250 disturbance data words
0A00 to 0AFAh: 250 disturbance data words
0B00 to 0BFAh: 250 disturbance data words
…
2100 to 21FAh: 250 disturbance data words

The disturbance data pages contain the sample of a single channel from a record.

Page 22h: contains the index of the disturbance

Page 38h to 3Ch: selection of the disturbance record and channel

Page 3Dh: a dedicated request allows to know the number of disturbance records stored.

3.6.1 **Pages 9H to 21H** - Disturbance record data

Disturbance record data (25 pages).

Writing access in words (**function 03**)
Each disturbance mapping page contains 250 words.

Addresses (hex)	Contents
0900h to 09FAh	250 disturbance data words
0A00h to 0AFAh	250 disturbance data words
0B00h to 0BFAh	250 disturbance data words
0C00h to 0CFAh	250 disturbance data words
0D00h to 0DFAh	250 disturbance data words
0E00h to 0DFAh	250 disturbance data words
0F00h to 0FFAh	250 disturbance data words
1000h to 10FAh	250 disturbance data words
1100h to 11FAh	250 disturbance data words
1200h to 12FAh	250 disturbance data words

Addresses (hex)	Contents
1300h to 13FAh	250 disturbance data words
1400h to 14FAh	250 disturbance data words
1500h to 15FAh	250 disturbance data words
1600h to 16FAh	250 disturbance data words
1700h to 17FAh	250 disturbance data words
1800h to 18FAh	250 disturbance data words
1900h to 19FAh	250 disturbance data words
1A00h to 1AFAh	250 disturbance data words
1B00h to 1BFAh	250 disturbance data words
1C00h to 1CFAh	250 disturbance data words
1D00h to 1DFAh	250 disturbance data words
1E00h to 1EFAh	250 disturbance data words
1F00h to 1FFAh	250 disturbance data words
2000h to 20FAh	250 disturbance data words
2100h to 21FAh	250 disturbance data words

NOTE: The disturbance data pages contain the values of one channel from one given disturbance record.

3.6.1.1 Meaning of each channel value

See pages 38H to 3CH

– **IA, IB, IC, Ie** channels.

The values are signed 16 bits words equivalent to the ADC value.

Phase current values calculation formula

Line phase current value (primary value) = value x phase primary CT ratio x √2 / 800

Earth current values calculation formula

The formula depends of nominal earth current:

0.1 to 40 Ien range
Line earth current value (primary value) = value x earth primary CT ratio x √2 / 800

0.01 to 8 Ien range
Line earth current value (primary value) = value x earth primary CT ratio x √2 / 3277

0.002 to 1 Ien range
Line earth current value (primary value) = value x earth primary CT ratio x √2 / 32700

– **UA, UB, UC/Ue** channels.

The values are signed 16 bits words equivalent to the ADC value.

Phase voltage values calculation formula

The formula depends of nominal phase voltage:

57 to 130 V range
Line phase voltage value (primary value) = value x (phase primary VT ratio / phase secondary VT ratio) x √2 / 126

220 to 480 V range
Line phase voltage value (primary value) = value x √2 / 34

Earth voltage values calculation formula

The formula depends of nominal earth voltage:

57 to 130 V range
Line earth voltage value (primary value) = value x (earth primary VT ratio / earth secondary VT ratio) x √2 / 126

220 to 480 V range
Line earth voltage value (primary value) = value x √2 / 34

– **Frequency** channel:

Time between two samples in microseconds

– **Logical** channels:

Logical channel 1 (if MODBUS or DNP3 on rear ports)

Logic channel	Contents
Bit 0	Trip relay (RL1)
Bit 1	Output relay 2 (RL2)
Bit 2	Output relay 3 (RL3)
Bit 3	Output relay 4 (RL4)
Bit 4	Watch-Dog relay (RL0)
Bit 5	Output relay 5 (RL5)
Bit 6	Output relay 6 (RL6)
Bit 7	Output relay 7 (RL7)
Bit 8	Output relay 8 (RL8)
Bit 9	Logical input 1 (EL1)
Bit 10	Logical input 2 (EL2)
Bit 11	Logical input 3 (EL3)
Bit 12	Logical input 4 (EL4)
Bit 13	Logical input 5 (EL5)
Bit 14	Logical input 6 (EL6)
Bit 15	Logical input 7 (EL7)

Logical channel 2 (if MODBUS or DNP3 on rear ports)

Logic channel	Contents
Bit 0	Logical input 8 (EL8)
Bit 1	Logical input 9 (EL9)
Bit 2	Logical input 10 (EL10)
Bit 3	Logical input 11 (EL11)
Bit 4	Logical input 12 (EL12)
Bit 5	Reserved (EL13)
Bit 6	Reserved (EL14)
Bit 7	Reserved (EL15)
Bit 8	Reserved (EL16)
Bit 9	Reserved
Bit 10	Reserved
Bit 11	Reserved
Bit 12	Reserved
Bit 13	Reserved
Bit 14	Reserved
Bit 15	Reserved

Logical channel 1 (if IEC870-5-103 on rear ports)

Logic channel	Contents
Bit 0	General Start
Bit 1	CB Failure
Bit 2	General Trip
Bit 3	trip tI>
Bit 4	trip tI>> or trip tI>>>
Bit 5	trip tIe>
Bit 6	trip tIe>> or trip tIe>>> or trip tIe_d> or trip tIe_d>>
Bit 7	trip tPw>
Bit 8	trip tPw>>
Bit 9	Logical input 1 (EL1)
Bit 10	Logical input 2 (EL2)
Bit 11	Logical input 3 (EL3)
Bit 12	Logical input 4 (EL4)
Bit 13	Logical input 5 (EL5)
Bit 14	Logical input 6 (EL6)
Bit 15	Logical input 7 (EL7)

Logical channel 2 (if IEC870-5-103 on rear ports)

Logic channel	Contents
Bit 0	Logical input 8 (EL8)
Bit 1	Logical input 9 (EL9)
Bit 2	Logical input 10 (EL10)
Bit 3	Logical input 11 (EL11)
Bit 4	Logical input 12 (EL12)
Bit 5	Reserved (EL13)
Bit 6	Reserved (EL14)
Bit 7	Trip relay (RL1)
Bit 8	Output relay 2 (RL2)
Bit 9	Output relay 3 (RL3)
Bit 10	Output relay 4 (RL4)
Bit 11	Watch-Dog relay (RL0)
Bit 12	Output relay 5 (RL5)
Bit 13	Output relay 6 (RL6)
Bit 14	Output relay 7 (RL7)
Bit 15	Output relay 8 (RL8)

3.6.2 **Page 22H** - Disturbance record index frame

Disturbance record index frame

Reading access in word (**function 03**)

Addresses (hex)	Contents
2200h	Disturbance data index frame

Disturbance record index frame

Word Nr.	Contents
1	Disturbance record number
2	Disturbance record finish date (second)
3	Disturbance record finish date (second)
4	Disturbance record finish date (millisecond)
5	Disturbance record finish date (millisecond)
6	Disturbance record starting condition: 1 → tripping command (RL1) 2 → instantaneous 3 → remote command 4 → logical input
7	Frequency at the post-time beginning

3.6.3 **Pages 38H to 3CH** - Disturbance record & channel selection

Selection of the disturbance record and channel (19 words are uploaded for each address reading)

Access in word reading (**function 03**)

Address (hex)	Disturbance record number	Channel
3800h	1	IA
3801h	1	IB
3802h	1	IC
3803h	1	Ie
3804h	1	UA
3805h	1	UB
3806h	1	UC / Ue
3807h	1	Frequency
3808h	1	Logical infos 1
3809h	1	Logical infos 2
3900h	2	IA
3901h	2	IB
3902h	2	IC
3903h	2	Ie
3904h	2	UA
3905h	2	UB
3906h	2	UC / Ue
3907h	2	Frequency
3908h	2	Logical infos 1
3909h	2	Logical infos 2
3A00h	3	IA
3A01h	3	IB
3A02h	3	IC
3A03h	3	Ie
3A04h	3	UA
3A05h	3	UB
3A06h	3	UC / Ue
3A07h	3	Frequency
3A08h	3	Logical infos 1
3A09h	3	Logical infos 2
3B00h	4	IA
3B01h	4	IB
3B02h	4	IC
3B03h	4	Ie
3B04h	4	UA
3B05h	4	UB
3B06h	4	UC / Ue
3B07h	4	Frequency
3B08h	4	Logical infos 1
3B09h	4	Logical infos 2
3C00h	5	IA
3C01h	5	IB
3C02h	5	IC
3C03h	5	Ie
3C04h	5	UA
3C05h	5	UB
3C06h	5	UC / Ue
3C07h	5	Frequency
3C08h	5	Logical infos 1
3C09h	5	Logical infos 2

Word Nr.	Contents
n° 1	Number of samples included in the mapping
n° 2	Sample number in pre-time
n° 3	Sample number in post-time
n° 4	Phase primary CT
n° 5	Phase secondary CT
n° 6	Earth primary CT
n° 7	Earth secondary CT
n° 8	Phase Internal CT ratio
n° 9	Earth Internal CT ratio
n° 10	Phase primary VT – byte low
n° 11	Phase primary VT – byte high
n° 12	Phase secondary VT
n° 13	Earth primary VT – byte low
n° 14	Earth primary VT – byte high
n° 15	Earth secondary VT
n° 16	Internal VT ratio – numerator: 100
n° 17	Internal VT ratio – denominator: 12600 or 3400
n° 18	Last mapping page
n° 19	Last mapping page words number

Calculation formula for phase current values

Line phase current value (primary value) = phase sampled value (e.g. adress 3800h, 3801h or 3802h) * phase primary CT * (1 / internal phase ratio) * √2

Calculation formula for earth current values

Line earth current value (primary value) = earth sampled value (e.g. adress 3803h) * earth primary CT ratio * (1 / internal earth ratio) * √2

Phase voltage values calculation formula

Line phase voltage value (primary value) = 100 * phase sampled value (e.g. address 3804h or 3805h or 3806h if Uc) * (phase primary VT / phase secondary VT) * (100 / internal VT denominator) * √2

phase primary VT is expressed in 10 V: phase primary VT = 4 means 40 V.

phase secondary VT is expressed in 0.1 V: phase secondary VT = 4 means 0.4 V.

phase internal VT denominator = 12 600 in A range, and 3 400 in B range.

Earth voltage values calculation formula

Line earth voltage value (primary value) = earth sampled value (e.g. address 3806h if Ue) * earth primary VT ratio / earth internal VT ratio * √2

Earth voltage value (primary value) = 100 * earth sampled value (e.g. address 3806h) * (earth primary VT / earth secondary VT) * (100 / internal VT denominator) * √2

earth primary VT is expressed in 10 V: earth primary VT = 4 means 40 V.

earth secondary VT is expressed in 0.1 V: earth secondary VT = 4 means 0.4 V.

earth internal VT denominator = 12 600 in A range, and 3 400 in B range.

3.6.4 **Page 3DH** - Number of disturbance records available

Number of disturbance records available

Access in word reading (**function 03**)

Address (hex)	Contains
3D00h	Number of disturbance records available

Words description:

Word Nr.	Contents
1	Number of disturbance records available
2	Oldest disturbance record number (n)
3 to 6	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
7	Disturbance record starting origin 1= trip relay (RL1) 2= instantaneous threshold 3= remote command 4= logical input
8	Acknowledge
9	Disturbance record previous number (n+1)
10 to 13	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
14	Disturbance record starting origin 1= trip relay (RL1) 2= instantaneous threshold 3= remote command 4= logical input
15	Acknowledge
16	Disturbance record previous number (n+2)
17 to 20	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
IEC FORMAT: 17 to 20	Previous disturbance record date (see format of time synchronisation, address 0800h)
21	Disturbance record starting origin 1= trip relay (RL1) 2= instantaneous threshold 3= remote command 4= logical input
22	Acknowledge
23	Disturbance record previous number (n+3)
24 to 27	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
28	Disturbance record starting origin 1= trip relay (RL1) 2= instantaneous threshold 3= remote command 4= logical input
29	Acknowledge
30	Disturbance record previous number (n+4)
31 to 36	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
35	Disturbance record starting origin 1= trip relay (RL1) 2= instantaneous threshold 3= remote command 4= logical input
36	Acknowledge

3.7 Events records

To upload the events records two requests are allowed:

Page 35h: request to upload an event record without acknowledges of this event.

Used addresses:

3500h: EVENT 1
…
54Ah: EVENT 75

Page 36h: request to upload the non-acknowledged oldest stored event record.

Two modes are available for the acknowledgement: automatic acknowledgement or manual acknowledgement

The mode depends of the state of bit 12 of remote control word (address 400 h).

If this bit is set, then the acknowledgement is manual else the acknowledgement is automatic.

In automatic mode, the reading of the event acknowledges the event.

In manual mode, it is necessary to write a specific command to acknowledge the oldest event

(set the bit 13 of control word addressed to 400 h)

3.7.1 **Page 35H** - Event record data

Event record data (9 words).

Reading access in word (**function 03**)

Addresses 3500h to 35F9h.

Word Nr.	Contents
1	Event meaning (see table below)
2	MODBUS address
3	MODBUS associated value
4	Reserved
5 to 8	Date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
9	Acknowledgement: 0 = event non acknowledged 1 = event acknowledged

Word n. 1 event meaning and relative codes

Code (Dec)	Event meaning	Format	MODBUS address (Hex)	Alarm
01	Control close (Remote, input, HMI)	F9	013	
02	Control trip (Remote, input, HMI)	F9	013	
03	Disturbance recording start	F73		
04	Trip output unlatch	F9	013	
05	Settings change	Address		
06	Remote thermal reset	F9		
07	Maintenance Mode	F9↑↓	0402	Auto
08	Control relay in maintenance mode	F39↑↓	013	
09	U<	F17↑↓	70	Inhib & Self
10	U<<	F17↑↓	71	Inhib & Self
11	Pe/Iecos>	F16↑↓	72	Yes & Self
12	Pe/Iecos>>	F16↑↓	73	Yes & Self
13	I<	F17↑↓	21	Yes & Self
14	I2>	F17↑↓	7C	Yes & Self
15	I2>>	F17↑↓	7D	Yes & Self
16	I2>>>	F17↑↓	7E	Yes & Self
17	θ alarm (Thermal overload)	F37↑↓	020	Yes
18	U>	F17↑↓	76	Yes & Self
19	U>>	F17↑↓	77	Yes & Self
20	Ue>>>>	F16↑↓	7A	Yes & Self
21	I>	F17↑↓	14	Yes & Self
22	I>>	F17↑↓	15	Yes & Self
23	I>>>	F17↑↓	16	Yes & Self
24	Ie>	F16↑↓	17	Yes & Self
25	Ie>>	F16↑↓	18	Yes & Self
26	Ie>>>	F16↑↓	19	Yes & Self
27	U< trip	F17↑↓	70	Inhib
28	U<< trip	F17↑↓	71	Inhib
29	Pe/Iecos> trip	F16↑↓	72	Yes
30	Pe/Iecos>> trip	F16↑↓	73	Yes
31	I< trip	F17↑↓	21	Yes
32	I2> trip	F17↑↓	7C	Yes
33	I2>> trip	F17↑↓	7D	Yes
34	I2>>> trip	F17↑↓	7E	Yes
35	θ trip (Thermal overload)	F37↑↓	20	Yes
36	U> trip	F17↑↓	76	Yes
37	U>> trip	F17↑↓	77	Yes
38	Ue>>>> trip	F16↑↓	7A	Yes
39	*Reserved*			
40	*Reserved*			
41	*Reserved*			
42	I> trip	F17↑↓	14	Yes
43	I>> trip	F17↑↓	15	Yes
44	I>>> trip	F17↑↓	16	Yes
45	Ie> trip	F16↑↓	17	Yes
46	Ie>> trip	F16↑↓	18	Yes
47	Ie>>> trip	F16↑↓	19	Yes
48	Trip SOTF	F38↑↓	23	Yes
49	X1 trip: t AUX3	F13	13	
50	X1 trip: t AUX4	F13	13	
51	Equ. Log. A trip	F48↑↓	7F	Inhib
52	Equ. Log. B trip	F48↑↓	7F	Inhib
53	Equ. Log. C trip	F48↑↓	7F	Inhib
54	Equ. Log. D trip	F48↑↓	7F	Inhib
55	Broken conductor	F38↑↓	23	Yes
56	t AUX1 trip	F38↑↓	23	Inhib
57	t AUX2 trip	F38↑↓	23	Inhib
58	CB Flt or SF6 low (by logical input)	F20↑↓	11	Auto
59	Working time	F43↑↓	28	Yes

Code (Dec)	Event meaning	Format	MODBUS address (Hex)	Alarm
60	Operation numbers	F43↑↓	28	Yes
61	Sum of switched square amps	F43↑↓	28	Yes
62	Trip circuit supervision	F43↑↓	28	Yes
63	Closing time	F43↑↓	28	Yes
64	Reclose successful	F43↑↓	28	Auto
65	Recloser final trip	F43↑↓	28	
66	Recloser settings error	F43↑↓	28	Auto
67	Circuit Breaker Failure	F38↑↓	23	Yes
68	Selective scheme logic 1 (by logical input)	F20↑↓	11	
69	Selective scheme logic 2 (by logical input)	F20↑↓	11	
70	Blocking logic 1 (by logical input)	F20↑↓	11	
71	Blocking logic 2 (by logical input)	F20↑↓	11	
72	Setting group change	F55	11	
73	O/O (by logical input)	F20↑↓	11	
74	F/O (by logical input)	F20↑↓	11	
75	All alarms acknowledgement (by logical input)	F20↑↓	11	
76	Cold load pick up	F20↑↓	11	
77	Input logic state change	F12↑↓	10	
78	X1 trip: θ trip	F13	13	
79	X1 trip: t I>	F13	13	
80	X1 trip: t I>>	F13	13	
81	X1 trip: t I>>>	F13	13	
82	X1 trip: t Ie>	F13	13	
83	X1 trip: t Ie>>	F13	13	
84	X1 trip: t Ie>>>	F13	13	
85	X1 trip: t Pe/Iecos>	F13	13	
86	X1 trip: t Pe/Iecos>>	F13	13	
87	X1 trip: t U<	F13	13	
88	X1 trip: t U<<	F13	13	
89	X1 trip: t I<	F13	13	
90	X1 trip: t U>	F13	13	
91	X1 trip: t U>>	F13	13	
92	X1 trip: t I2>	F13	13	
93	X1 trip: t I2>>	F13	13	
94	X1 trip: t I2>>>	F13	13	
95	X1 trip: t Ue>>>>	F13	13	
96	X1 trip: Broken Conductor	F13	13	
97	X1 trip: Equ. Log. A	F13	13	
98	X1 trip: Equ. Log. B	F13	13	
99	X1 trip: Equ. Log. C	F13	13	
100	X1 trip: Equ. Log. D	F13	13	
101	X1 trip: t AUX1	F13	13	
102	X1 trip: t AUX2	F13	13	
103	Output relays command	F39↑↓	402	
104	Front panel single alarm acknowledge			
105	All alarms front panel acknowledgement			
106	Single alarm remote acknowledgement			
107	All alarms remote acknowledgement			
108	Major material alarm	F45↑↓	0F	Yes
109	Minor material alarm	F45↑↓	0F	Yes
110	Operating Latched Relays status	F27↑↓	2E	Auto
111	General “Start” protection (IEC 60870-5-103 protocol)	F95↑↓	0B	
112	Recloser in “Service” (IEC 60870-5-103 only)	F43↑↓	28	
113	52a by recloser (IEC 60870-5-103 protocol)	Cycle		
114	Local parameter setting (password active) - (IEC 60870-5-103 protocol)	↑↓		
115	Start timer Breaker failure (by logical input)	F20A↑↓	0D	
116	t AUX3 trip	F38↑↓	23	Inhib
117	t AUX4 trip	F38↑↓	23	Inhib
118	Manual Close (by logical input)	F20A↑↓	0D	

Code (Dec)	Event meaning	Format	MODBUS address (Hex)	Alarm
119	X1 trip: SOTF	F38↑↓	23	
120	Local Mode (by logical input)	F20A↑↓	0D	
121	I>> Blocked	F38A↑↓	22	
122	I>>> Blocked	F38A↑↓	22	
123	VTS	F38A↑↓	22	Auto
124	V2>	F38A↑↓	22	
125	V2>>	F38A↑↓	22	
126	Recloser int locked	F43↑↓	28	Auto
127	Recloser in progress	F43↑↓	28	
128	Synchronization	F23		
129	Inrush blocking	F38A↑↓	22	
130	P>	F38A↑↓	22	Yes & Self
131	P>>	F38A↑↓	22	Yes & Self
132	P> trip	F38A↑↓	22	Yes
133	P>> trip	F38A↑↓	22	Yes
134	X1 trip: t P>	F13	13	
135	X1 trip: t P>>	F13	13	
136	f1	F67↑↓	B5	Yes & Self
137	f2	F67↑↓	B6	Yes & Self
138	f3	F67↑↓	B7	Yes & Self
139	f4	F67↑↓	B8	Yes & Self
140	f5	F67↑↓	B9	Yes & Self
141	f6	F67↑↓	BA	Yes & Self
142	tf1	F67↑↓	B5	Yes
143	tf2	F67↑↓	B6	Yes
144	tf3	F67↑↓	B7	Yes
145	tf4	F67↑↓	B8	Yes
146	tf5	F67↑↓	B9	Yes
147	tf6	F67↑↓	BA	Yes
148	F out	F69↑↓	BB	Auto
149	X1 trip: tf1 Trip	F13	13	
150	X1 trip: tf2 Trip	F13	13	
151	X1 trip: tf3 Trip	F13	13	
152	X1 trip: tf4 Trip	F13	13	
153	X1 trip: tf5 Trip	F13	13	
154	X1 trip: tf6 Trip	F13	13	
155	Equ. Log. E trip	F48↑↓	7F	Inhib
156	Equ. Log. F trip	F48↑↓	7F	Inhib
157	Equ. Log. G trip	F48↑↓	7F	Inhib
158	Equ. Log. H trip	F48↑↓	7F	Inhib
159	X1 trip: Equ. Log. E	F13	13	
160	X1 trip: Equ. Log. F	F13	13	
161	X1 trip: Equ. Log. G	F13	13	
162	X1 trip: Equ. Log. H	F13	13	
163	Comm. IEC-103: Signals&Measurements blocking	F78	0668	
164	Comm. IEC-103: Commands blocking	F78	0668	
165	t AUX5 trip	F38B↑↓	2F	Inhib
166	t AUX6 trip	F38B↑↓	2F	Inhib
167	t AUX7 trip	F38B↑↓	2F	Inhib
168	t AUX8 trip	F38B↑↓	2F	Inhib
169	t AUX9 trip	F38B↑↓	2F	Inhib
170	t AUX A trip	F38B↑↓	2F	Inhib
171	t AUX B trip	F38B↑↓	2F	Inhib
172	t AUX C trip	F38B↑↓	2F	Inhib
173	X1 trip: t AUX5	F13	13	
174	X1 trip: t AUX6	F13	13	
175	X1 trip: t AUX7	F13	13	
176	X1 trip: t AUX8	F13	13	
177	X1 trip: t AUX9	F13	13	
178	X1 trip: t AUXA	F13	13	

Code (Dec)	Event meaning	Format	MODBUS address (Hex)	Alarm
179	X1 trip: t AUXB	F13	13	
180	X1 trip: t AUXC	F13	13	
181	Start Earth (for IEC-103)			
182	Ie_d>	F16↑↓	1A	Yes & Self
183	Ie_d> trip	F16↑↓	1A	Yes
184	X1 trip: t Ie_d	F13	13	
185	Reset LEDs (by logical input)	F20B↑↓	BE	
186	CTS	F38A↑↓	24	Auto
187	df/dt1	F94↑↓	BF	Yes
188	df/dt2	F94↑↓	BF	Yes
189	df/dt3	F94↑↓	BF	Yes
190	df/dt4	F94↑↓	BF	Yes
191	df/dt5	F94↑↓	BF	Yes
192	df/dt6	F94↑↓	BF	Yes
193	X1 trip: df/dt1 Trip	F13	13	
194	X1 trip: df/dt2 Trip	F13	13	
195	X1 trip: df/dt3 Trip	F13	13	
196	X1 trip: df/dt4 Trip	F13	13	
197	X1 trip: df/dt5 Trip	F13	13	
198	X1 trip: df/dt6 Trip	F13	13	
199	Recloser ext locked	F43↑↓	28	Auto
200	P<	F38A↑↓	22	Yes & Self
201	P<<	F38A↑↓	22	Yes & Self
202	P< trip	F38A↑↓	22	Yes
203	P<< trip	F38A↑↓	22	Yes
204	X1 trip: t P<	F13	13	
205	X1 trip: t P<<	F13	13	
206	Q>	F38B↑↓	2F	Yes & Self
207	Q>>	F38B↑↓	2F	Yes & Self
208	Q> trip	F38B↑↓	2F	Yes
209	Q>> trip	F38B↑↓	2F	Yes
210	X1 trip: t Q>	F13	13	
211	X1 trip: t Q>>	F13	13	
212	Q<	F38B↑↓	2F	Yes & Self
213	Q<<	F38B↑↓	2F	Yes & Self
214	Q< trip	F38B↑↓	2F	Yes
215	Q<< trip	F38B↑↓	2F	Yes
216	X1 trip: t Q<	F13	13	
217	X1 trip: t Q<<	F13	13	
218	Comm order 1	F9A	0403	
219	Comm order 2	F9A	0403	
220	Comm order 3	F9A	0403	
221	Comm order 4	F9A	0403	
222	"General Trip" (IEC 60870-5-103 protocol)	F95↑↓	0B	
223	Trip Phase A (IEC 60870-5-103 protocol)	F17↑↓	14/15/16 or 76/77 or 70/71	
224	Trip Phase B (IEC 60870-5-103 protocol)	F17↑↓	14/15/16 or 76/77 or 70/71	
225	Trip Phase C (IEC 60870-5-103 protocol)	F17↑↓	14/15/16 or 76/77 or 70/71	
226	General reset command	F9A	0403	
227	Hardware alarm with main power supply	F2 unit millivolt	0x000F	No
228	Hardware alarm with -3.3v power supply	F2 unit millivolt	0x00C2	No
229	Hardware alarm with 5.0v power supply	F2 unit millivolt	0x00C2	No
230	Hardware alarm with 3.3v power supply	F2 unit millivolt	0x00C2	No
231	Hardware alarm with 12v power supply	F2 unit millivolt	0x00C2	No

Code (Dec)	Event meaning	Format	MODBUS address (Hex)	Alarm
232	Hardware alarm with 1.3v power supply	F2 unit millivolt	0x00C2	No
233	Hardware alarm with 0 v power supply	F2 unit millivolt	0x00C2	No
234	Hardware alarm with transformer 1 (offset excess)	F2 unit CAN	0x00C3	No
235	Hardware alarm with transformer 2 (offset excess)	F2 unit CAN	0x00C3	No
236	Hardware alarm with transformer 3 (offset excess)	F2 unit CAN	0x00C3	No
237	Hardware alarm with transformer 4 (offset excess)	F2 unit CAN	0x00C3	No
238	Hardware alarm with transformer 5 (offset excess)	F2 unit CAN	0x00C3	No
239	Hardware alarm with transformer 6 (offset excess)	F2 unit CAN	0x00C3	No
240	Hardware alarm with transformer 7 (offset excess)	F2 unit CAN	0x00C3	No
241	Hardware alarm with transformer 8 (offset excess)	F2 unit CAN	0x00C3	No
242	Hardware alarm with transformer 9 (offset excess)	F2 unit CAN	0x00C3	No
243	Ie_d>>	F16↑↓	C4	Yes & Self
244	Ie_d>> trip	F16↑↓	C4	Yes
245	X1 trip: t Ie_d>>	F13	13	
246	V2>	F16↑↓	C8	Yes & Self
247	V2> trip	F16↑↓	C8	Yes
248	X1 V2>	F13	13	
249	V2>>	F16↑↓	C9	Yes & Self
250	V2>> trip	F16↑↓	C9	Yes
251	X1 V2>>	F13	13	

NOTE: The double arrow ↑↓ means the event is generated on event occurrence (↑) and on event disappearance (↓).
On event occurrence, the corresponding bit of the associated format is set to « 1 ».
On event disappearance, the corresponding bit of the associated format is set to « 0 ».

ALARM: a front alarm associated with the event appears. Details
Yes = alarm must be acknowledged manually (front panel or communication)
Self = Self reset start protection alarms if trip occurs (setting address 014Eh)
Inhib = the alarm can be inhibited by setting (address 0600h and 0602h)
Auto = alarm is automatically acknowledged when the event disappears

3.7.2 **Page 36H** - Oldest event data

Oldest event data.

Reading access in word (**function 03**)

Address (hex)	Contents
3600h	Oldest event data

3.8 Fault records

Page 37h: Page dedicated to upload fault record

Used addresses:

3700h: FAULT 1

3701h: FAULT 2
…
3718h: FAULT 25

Page 3Eh: Request to upload the non-acknowledged oldest stored fault record.

Two modes are available for the acknowledgement: automatic acknowledgement or manual acknowledgement

The mode depends of the state of **bit 12** of remote control word (**address 400 h**).

If this bit is set, then the acknowledgement is manual else the acknowledgement is automatic.

In automatic mode, the reading of the fault acknowledges automatically the event.

In manual mode, it is necessary to write a specific command to acknowledge the oldest fault.

(**set the bit 14 of control word addressed to 400 h**)

3.8.1 **Page 37H** - Fault record

Fault record value data

Reading access in word (**function 03**)

Address (hex)	Contents
3700h	Fault value record n°1
3701h	Fault value record n°2
3702h	Fault value record n°3
-	
3718h	Fault value record n°25

Each record is made up of 24 words:

Word Nr.	Contents
1	Fault number
2 to 5	Event date is depending on address 012Fh format F52: – With private date format: see format F97 – With IEC 60870-5-103 format: see format of time synchronisation address 0800h
6	Fault date (season) 0= winter 1= summer 2= undefined
7	Active setting group during the fault (F55)
8	Phase origin (F90)
9	Fault recording starting origin (see format F61)
10 & 11	Fault value (10: LS word; 11: MS word) (1)
12	Phase A current value (nominal value)
13	Phase B current value (nominal value)
14	Phase C current value (nominal value)
15	Earth current value (nominal value)
16	Phase A voltage value (nominal value)
17	Phase B voltage value (nominal value)
18	Phase C voltage value (nominal value)
19	Earth voltage value (nominal value)
20	Angle between phase A current and phase B-C voltage values
21	Angle between phase B current and phase C-A voltage values
22	Angle between phase C current and phase A-B voltage values
23	Angle between earth current and earth voltage values

Word Nr.	Contents
24	Acknowledgement: 0 = fault not acknowledged 1 = fault acknowledged

(1) Fault value is a CAN value; it has to be processed according to the below formulas to find corresponding primary value.

Phase current values calculation formula

Line phase current value (primary value) = value x phase primary CT ratio / 800

Earth current values calculation formula

The formula depends of nominal earth current:

0.1 to 40 Ien range
Line earth current value (primary value) = value x earth primary CT ratio / 800

0.01 to 8 Ien range
Line earth current value (primary value) = value x earth primary CT ratio / 3277

0.002 to 1 Ien range
Line earth current value (primary value) = value x earth primary CT ratio / 32700

Phase voltage values calculation formula

The formula depends of nominal phase voltage:

57 to 130 V range
Line phase voltage value (primary value) = value x (phase primary VT ratio / phase secondary VT ratio) / 63

220 to 480 V range
Line phase voltage value (primary value) = value / 17

Earth voltage values calculation formula

The formula depends of nominal earth voltage:

57 to 130 V range
Line earth voltage value (primary value) = value x (earth primary VT ratio / earth secondary VT ratio) / 63

220 to 480 V range
Line earth voltage value (primary value) = value / 17

Phase power values calculation formula

The formula depends of nominal phase voltage:

57 to 130 V range
Line phase power value (primary value) = value x (phase primary CT ratio x (phase primary VT ratio / phase secondary VT ratio)) / (800 x 63)

220 to 480 V range
Line phase power value (primary value) = value x phase primary CT ratio / (800 x 17)

Earth power values calculation formula

The formula depends of nominal earth current and voltage:

0.1 to 40 Ien range and 57 to 130 V range
Line earth power value (primary value) = value x (earth primary CT ratio x (phase primary VT ratio / phase secondary VT ratio)) / (800 x 63)

0.1 to 40 Ien rangee and 220 to 480 V range
Line earth power value (primary value) = value x earth primary CT ratio / (800 x 17)

0.01 to 8 Ien range and 57 to 130 V range
Line earth power value (primary value) = value x (earth primary CT ratio x (phase primary VT ratio / phase secondary VT ratio)) / (3277 x 63)

0.01 to 8 Ien rangee and 220 to 480 V range
Line earth power value (primary value) = value x earth primary CT ratio / (3277 x 17)

0.002 to 1 Ien range and 57 to 130 V range
Line earth power value (primary value) = value x (earth primary CT ratio x (phase primary VT ratio / phase secondary VT ratio)) / (32700 x 63)

0.002 to 1 Ien rangee and 220 to 480 V range
Line earth power value (primary value) = value x earth primary CT ratio / (32700 x 17)

Frequency values calculation formula

Frequency value = 1000000 / value

df/dt values calculation formula

df/dt value = value / 1000

3.8.2 **Page 3EH** - Oldest fault record

Oldest fault record value data.

Access in word reading (**function 03**).

Address (hex)	Contents
3E00h	Oldest fault record

3.9 Error counters

3.9.1 **Page 5AH** - Error counters

Error counters.

Access in word reading (**function 03**).

Address (hex)	Contents
5A00h	Error counters

Words description:

Word Nr.	Contents
1	Number of errors in page 1
2	Last error address of page 1
3	Number of errors in page 2
4	Last error address of page 2
5	Number of errors in page 3
6	Last error address of page 3
7	Number of errors in calibration page
8	Last error address of calibration page
9	Number of data checksum errors
10	Number of calibration checksum errors

4. MAPPING FORMAT DESCRIPTION

Values are decimal except when differently specified.

CODE	DESCRIPTION
F1	Unsigned integer: numerical data 0 to 65535
F2	Signed integer: numerical data -32768 to 32767
F3	Unsigned integer: trip / reset curves type (**hex** values) 000 : DMT 010 : IEC STI 011 : IEC SI 012 : IEC VI 013 : IEC EI 014 : IEC LTI 115: C02 116: IEEE MI 117: CO8 118: IEEE VI 119: IEEE EI 01A: RECT 020 : RI
F4	Unsigned integer: UART Baud rate 0: 300 1: 600 2: 1200 3: 2400 4: 4800 5: 9600 6: 19200 7: 38400
F5	Unsigned integer: Modbus and DNP3 parity bit 0: none 1: even 2: odd
F6	Unsigned integer: conf. tripping on relay RL1, part 1 Bit 0: tI> Bit 1: tI>> Bit 2: tI>>> Bit 3: tIe> Bit 4: tIe>> Bit 5: tIe>>> Bit 6: tI< Bit 7: θ trip Bit 8: broken conductor trip Bit 9: AUX 1 trip Bit 10: AUX 2 trip Bit 11: tI2> Bit 12: tPe/Iecos> Bit 13: tPe/Iecos>> Bit 14: tUe>>>> Bit 15: Control trip
F6A	Unsigned integer: conf. tripping on relay RL1, part 2 Bit 0: tU> Bit 1: tU>> Bit 2: tU< Bit 3: tU<< Bit 4: t Boolean equation A Bit 5: t Boolean equation B Bit 6: t Boolean equation C Bit 7: t Boolean equation D Bit 8: tI2>> Bit 9: tI2>>> Bit 10: tP> Bit 11: tP>> Bit 12: Reserved Bit 13: AUX 3 trip Bit 14: AUX 4 trip Bit 15: SOTF/TOR

CODE	DESCRIPTION
F6B	Unsigned integer: conf. tripping on relay RL1, part 3 Bit 0: t Boolean equation E Bit 1: t Boolean equation F Bit 2: t Boolean equation G Bit 3: t Boolean equation H Bit 4: tF1 Bit 5: tF2 Bit 6: tF3 Bit 7: tF4 Bit 8: tF5 Bit 9: tF6 Bit 10: t Aux 5 (P126-7) Bit 11: t Aux 6 (P126-7) Bit 12: t Aux 7 (P126-7) Bit 13: tIe_d> Bit 14: tP< Bit 15: tP<<
F6C	Unsigned integer: conf. tripping on relay RL1, part 4 (P127 with logical inputs 8-12) Bit 0: t Aux 8 Bit 1: t Aux 9 Bit 2: t Aux A Bit 3: t Aux B Bit 4: t Aux C Bit 5: df/dt1 Bit 6: df/dt2 Bit 7: df/dt3 Bit 8: df/dt4 Bit 9: df/dt5 Bit 10: df/dt6 Bit 11: tQ> Bit 12: tQ>> Bit 13: tQ< Bit 14: tQ<< Bit 15: Not used
F6D	Unsigned integer: conf. tripping on relay RL1, part 5 Bit 0: tV2> Bit 1: tV2>> Bit 2: not significant Bit 3: not significant Bit 4: not significant Bit 5: not significant Bit 6: not significant Bit 7: not significant Bit 8: not significant Bit 9: not significant Bit 10: not significant Bit 11: not significant Bit 12: not significant Bit 13: not significant Bit 14: not significant Bit 15: not significant
F7	Unsigned integer: U connection mode 0: 3Vpn 2: 2Vpp + Vr 4: 2Vpn + Vr

CODE	DESCRIPTION
F8	Unsigned integer: blocking logic configuration, part 1 Bit 0: tI>+ tI>REV Bit 1: tI>> + tI>>REV Bit 2: tI>>> + tI>>>REV Bit 3: tIe> + tIe>REV Bit 4: tIe>> + tIe>>REV Bit 5: tIe>>> + tIe>>>REV Bit 6: tI< Bit 7: θ trip Bit 8: broken conductor trip Bit 9: aux1 trip Bit 10: aux2 trip Bit 11: tI2> Bit 12: tPe/Iecos> Bit 13: tPe/Iecos>> Bit 14: tUe>>>> Bit 15: tIe_d> + tIe_d>REV
F8A	Unsigned integer: blocking logic configuration, part 2 Bit 0: tU> Bit 1: tU>> Bit 2: tU< Bit 3: tU<< Bit 4: aux3 trip Bit 5: aux4 trip Bit 6: t P< Bit 7: t P<< Bit 8: tI2>> Bit 9: tI2>>> Bit 10: tP > Bit 11: tP >> Bit 12: t Q> Bit 13: t Q>> Bit 14: t Q< Bit 15: t Q<<
F8B	Unsigned integer: blocking logic configuration, part 3 Bit 0: tF1 Bit 1: tF2 Bit 2: tF3 Bit 3: tF4 Bit 4: tF5 Bit 5: tF6 Bit 6: Reserve Bit 7: tIe_d> + tIe_d>REV Bit 8: tAux 5 Bit 9: tAux 6 Bit 10: tAux 7 Bit 11: tAux 8 Bit 12: tAux 9 Bit 13: tAux A Bit 14: tAux B Bit 15: tAux C
F8C	Unsigned integer: blocking logic configuration, part 4 Bit 0: df/dt1 Bit 1: df/dt2 Bit 2: df/dt3 Bit 3: df/dt4 Bit 4: df/dt5 Bit 5: df/dt6 Bit 6: tV2> Bit 7: tV2>> Bit 8: reserve Bit 9: reserve Bit 10: reserve Bit 11: reserve Bit 12: reserve Bit 13: reserve Bit 14: reserve Bit 15: reserve

CODE	DESCRIPTION
F9	Unsigned integer: remote control 1 Bit 0: relays de-latching Bit 1: 1st alarm acknowledge Bit 2: all alarms acknowledge Bit 3: remote and HMI tripping (CONTROL trip) Bit 4: remote and HMI closing (CONTROL close) Bit 5: settings group change Bit 6: thermal state reset Bit 7: max & average values reset Bit 8: disturbance record remote and HMI start Bit 9: maintenance mode Bit 10: recloser counter reset Bit 11: recloser reset Bit 12: manual acknowledge mode Bit 13: oldest event acknowledge Bit 14: oldest fault acknowledge Bit 15: Reset of stats reset alarm.
F9A	Previously F50 format Unsigned integer: remote control word number 3 Bit 0: flag sync. harmonic earth current Bit 1: LEDs reset Bit 2: energy reset Bit 3: oldest disturbance acknowledge Bit 4: rolling average values reset Bit 5: rolling max sub-period values reset Bit 6: Communication Order 1 Bit 7: Communication Order 2 Bit 8: Communication Order 3 Bit 9: Communication Order 4 Bit 10: Not used Bit 11: Not used Bit 12: SA^2n counter reset Bit 13: Trips counter reset Bit 14: General reset command Bit 15: Not used
F9B	Bit 0: Settings group 1 selection Bit 1: Settings group 2 selection Bit 2: Settings group 3 selection Bit 3: Settings group 4 selection Bit 4: Settings group 5 selection Bit 5: Settings group 6 selection Bit 6: Settings group 7 selection Bit 7: Settings group 8 selection
F10	Unsigned integer: 2 ASCII characters 32 -127 = ASCII character1 32 - 127 = ASCII character 2
F11	Obsolete
F12	Unsigned integer: logical input status Bit 0: logical input number 1 Bit 1: logical input number 2 Bit 2: logical input number 3 Bit 3 logical input number 4 Bit 4 logical input number 5 Bit 5 logical input number 6 Bit 6 logical input number 7 Bit 7: logical input number 8 (optional board) Bit 8: logical input number 9 (optional board) Bit 9: logical input number 10 (optional board) Bit 10: logical input number 11 (optional board) Bit 11: logical input number 12 (optional board) Bits 12 to 15: Reserved

CODE	DESCRIPTION
F13	Unsigned integer: logical outputs status Bit 0: logical output number RL1 (X1 tripping) Bit 1: logical output number RL2 Bit 2: logical output number RL3 Bit 3: logical output number RL4 Bit 4: logical output number RL0 (Watch-Dog) Bit 5: logical output number RL5 Bit 6: logical output number RL6 Bit 7: logical output number RL7 Bit 8: logical output number RL8 Bits 9 to 15: Reserved
F14	Unsigned integer: Rl2 - RL8 output configuration Bit 0: logical output number RL2 selection Bit 1: logical output number RL3 selection Bit 2: logical output number RL4 selection Bit 3: logical output number RL5 selection Bit 4: logical output number RL6 selection Bit 5: logical output number RL7 selection Bit 6: logical output number RL8 selection Bits 7 to 15: Reserved
F14A	Unsigned integer: Rl2 - RL8 output configuration for CB & SOTF Bit 0: logical output number RL2 selection (Recloser) Bit 1: logical output number RL3 selection (Recloser) Bit 2: logical output number RL4 selection (Recloser) Bit 3: logical output number RL5 selection (Recloser) Bit 4: logical output number RL6 selection (Recloser) Bit 5: logical output number RL7 selection (Recloser) Bit 6: logical output number RL8 selection (Recloser) Bit 7: Reserved Bit 8: logical output number RL2 selection (SOTF) Bit 9: logical output number RL3 selection (SOTF) Bit 10: logical output number RL4 selection (SOTF) Bit 11: logical output number RL5 selection (SOTF) Bit 12: logical output number RL6 selection (SOTF) Bit 13: logical output number RL7 selection (SOTF) Bit 14: logical output number RL8 selection (SOTF) Bit 15: Reserved
F14B	Unsigned integer: Rl2 - RL8 output configuration for tAux3 & tAux4 Bit 0: logical output number RL2 selection (tAux3) Bit 1: logical output number RL3 selection (tAux3) Bit 2: logical output number RL4 selection (tAux3) Bit 3: logical output number RL5 selection (tAux3) Bit 4: logical output number RL6 selection (tAux3) Bit 5: logical output number RL7 selection (tAux3) Bit 6: logical output number RL8 selection (tAux3) Bit 7: Reserved Bit 8: logical output number RL2 selection (tAux4) Bit 9: logical output number RL3 selection (tAux4) Bit 10: logical output number RL4 selection (tAux4) Bit 11: logical output number RL5 selection (tAux4) Bit 12: logical output number RL6 selection (tAux4) Bit 13: logical output number RL7 selection (tAux4) Bit 14: logical output number RL8 selection (tAux4) Bit 15: Reserved

CODE	DESCRIPTION
F14C	Unsigned integer: Rl2 - RL8 output configuration for Control Trip & Close Bit 0: logical output number RL2 selection (Control Trip) Bit 1: logical output number RL3 selection (Control Trip) Bit 2: logical output number RL4 selection (Control Trip) Bit 3: logical output number RL5 selection (Control Trip) Bit 4: logical output number RL6 selection (Control Trip) Bit 5: logical output number RL7 selection (Control Trip) Bit 6: logical output number RL8 selection (Control Trip) Bit 7: Reserved Bit 8: logical output number RL2 selection (Control Close) Bit 9: logical output number RL3 selection (Control Close) Bit 10: logical output number RL4 selection (Control Close) Bit 11: logical output number RL5 selection (Control Close) Bit 12: logical output number RL6 selection (Control Close) Bit 13: logical output number RL7 selection (Control Close) Bit 14: logical output number RL8 selection (Control Close) Bit 15: Reserved
F14D	Unsigned integer: RL2 - RL8 output configuration for recloser trip final & locked Bit 0: logical output number RL2 selection (recloser trip final) Bit 1: logical output number RL3 selection (recloser trip final) Bit 2: logical output number RL4 selection (recloser trip final) Bit 3: logical output number RL5 selection (recloser trip final) Bit 4: logical output number RL6 selection (recloser trip final) Bit 5: logical output number RL7 selection (recloser trip final) Bit 6: logical output number RL8 selection (recloser trip final) Bit 7: Reserved Bit 8: logical output number RL2 selection (recloser internaly locked) Bit 9: logical output number RL3 selection (recloser internaly locked) Bit 10: logical output number RL4 selection (recloser internaly locked) Bit 11: logical output number RL5 selection (recloser internaly locked) Bit 12: logical output number RL6 selection (recloser internaly locked) Bit 13: logical output number RL7 selection (recloser internaly locked) Bit 14: logical output number RL8 selection (recloser internaly locked) Bit 15: Reserved
F15	Unsigned integer: digital inputs configuration, part 1 Bit 0: auxuliary relays de-latching command Bit 1: O/O (52A) Bit 2: F/O (52B) Bit 3: CB Flt Bit 4: aux 1 Bit 5: aux 2 Bit 6: blocking logic 1 Bit 7: blocking logic 2 Bit 8: disturbance start Bit 9: cold load start Bit 10: digital selection 1 Bit 11: digital selection 2 Bit 12: settings group change (configuration must be equal to INPUT) Bit 13: recloser latched Bit 14: reset thermal status Bit 15: control tripping circuit
F15A	Unsigned integer: digital inputs configuration, part 2 Bit 0: start Breaker Failure timer Bit 1: maintenance mode Bit 2: aux 3 Bit 3: aux 4 Bit 4: Reserved Bit 5: SOTF (ex Manual close) Bit 6: Local mode Bit 7: Synchronization. Bit 8: aux 5 Bit 9: aux 6 Bit A: aux 7 Bit B: aux 8 Bit C: aux 9 Bit D: aux A Bit E: aux B Bit F: aux C

CODE	DESCRIPTION
F15B	Unsigned integer: digital inputs configuration, part 3 Bit 0: Ctrl Trip Bit 1: Ctrl Close Bit 2: Led reset Bit 3: Reserve 33 Bit 4: Reserve 34 Bit 5: Reserve 35 Bit 6: Reserve 36 Bit 7: Reserve 37 Bit 8: Reserve 38 Bit 9: Reserve 39 Bit A: Reserve 3A Bit B: Reserve 3B Bit C: Reserve 3C Bit D: Reserve 3D Bit E: Reserve 3E Bit F: Reserve 3F
F16	Unsigned integer: earth threshold (current, voltage & power) information status Bit 0: info limit exceeding Bits 1 to 3: Reserved Bit 4: Ie> Interlock activated Bit 5: info start Bit 6: info tripping Bit 7: info tripping reverse mode Bits 8 to 15: Reserved
F17	Unsigned integer: phase threshold (current, voltage & power) information status Bit 0: info limit exceeding Bit 1: phase A (or AB) trip Bit 2: phase B (or BC) trip Bit 3: phase C (or CA) trip Bit 4: I> Interlock activated Bit 5: info start Bit 6: info tripping Bit 7: info tripping reverse mode Bits 8 to 15: Reserved
F18	Signed long integer: numeric data: -2E31 to (2E31 – 1)
F18A	Unsigned long integer: numeric data: 0 to (2E32 -1)
F19	Unsigned integer: leds configuration mask, part 1 Bit 0: I> Bit 1: tI> Bit 2: I>> Bit 3: tI>> Bit 4: I>>> Bit 5: tI>>> Bit 6: Ie> Bit 7: tIe> Bit 8: Ie>> Bit 9: tIe>> Bit 10: Ie>>> Bit 11: tIe>>> Bit 12: θ trip Bit 13: tI2> Bit 14: broken conductor trip Bit 15: breaker failure trip

CODE	DESCRIPTION
F19A	Unsigned integer: leds configuration mask, part 2 Bit 0: digital input 1 Bit 1: digital input 2 Bit 2: digital input 3 Bit 3: digital input 4 Bit 4: digital input 5 Bit 5: recloser running Bit 6: [79] Internally locked Bit 7: tAux1 Bit 8: tAux2 Bit 9: Pe/Iecos> Bit 10: tPe/Iecos> Bit 11: Pe/Iecos>> Bit 12: tPe/Iecos>> Bit 13: Ue>>>> Bit 14: tUe>>>> Bit 15: SOTF
F19B	Unsigned integer: leds configuration mask, part 3 Bit 0: U> Bit 1: tU> Bit 2: U>> Bit 3: tU>> Bit 4: U< Bit 5: tU< Bit 6: U<< Bit 7: tU<< Bit 8: tI2>> Bit 9: tI< Bit 10: tI> phase A Bit 11: tI> phase B Bit 12: tI> phase C Bit 13: digital input 6 Bit 14: digital input 7 Bit 15: tI2>>>
F19C	Unsigned integer: leds configuration mask, part 4 Bit 0: I2> Bit 1: I2>> Bit 2: I2>>> Bit 3: I< Bit 4: tAux3 Bit 5: tAux4 Bit 6: P > Bit 7: tP > Bit 8: P >> Bit 9: tP >> Bit 10: VTS Bit 11: 51V Bit 12: P< Bit 13: tP< Bit 14: P<< Bit 15: tP<<
F19D	Unsigned integer: leds configuration mask, part 5 Bit 0: f1 Bit 1: tf1 Bit 2: f2 Bit 3: tf2 Bit 4: f3 Bit 5: tf3 Bit 6: f4 Bit 7: tf4 Bit 8: f5 Bit 9: tf5 Bit 10: f6 Bit 11: tf6 Bit 12: out of frequency Bit 13: Q > Bit 14: tQ > Bit 15: Q >>

CODE	DESCRIPTION
F19E	Unsigned integer: leds configuration mask, part 6 Bit 0: Equ. A Bit 1: Equ. B Bit 2: Equ. C Bit 3: Equ. D Bit 4: Equ. E Bit 5: Equ. F Bit 6: Equ. G Bit 7: Equ. H Bit 8: tAux 5 (P126-P127). Bit 9: tAux 6 (P126-P127). Bit 10: tAux 7 (P126-P127). Bit 11: tQ>> Bit 12: Q< Bit 13: tQ< Bit 14: Q<< Bit 15: tQ<<
F19F	Unsigned integer: leds configuration mask, part 7 (only with p127 optional board) Bit 0: t Aux 8 Bit 1: t Aux 9 Bit 2: t Aux A Bit 3: t Aux B Bit 4: t Aux C Bit 5: reserve Bit 6: reserve Bit 7: reserve Bit 8: digital input 8 Bit 9: digital input 9 Bit 10: digital input A Bit 11: digital input B Bit 12: digital input C Bit 13: reserve Bit 14: reserve Bit 15: reserve
F19G	Unsigned integer: leds configuration mask, part 8 Bit 0: df/dt1 Bit 1: df/dt2 Bit 2: df/dt3 Bit 3: df/dt4 Bit 4: df/dt5 Bit 5: df/dt6 Bit 6: Ie_d> Bit 7: tIe_d> Bit 8: CTS Bit 9: [79] Ext locked Bit 10: Ie_d>> Bit 11: tIe_d>> Bit 12: V2> Bit 13: tV2> Bit 14: V2>> Bit 15: tV2>>
F20	Unsigned integer: logical inputs state, part 1 Bit 0: logic selection 1 Bit 1: logic selection 2 Bit 2: relays de-latching Bit 3: CB position (52a) Bit 4: CB position (52b) Bit 5: external CB failure Bit 6: aux 1 Bit 7: aux 2 Bit 8: blocking logic 1 Bit 9: blocking logic 2 Bit 10: disturbance recording start Bit 11: cold load start Bit 12: settings group change Bit 13: recloser locked Bit 14: thermal status reset Bit 15: trip circuit supervision

CODE	DESCRIPTION
F20A	Unsigned integer: logical inputs state, part 2 Bit 0: start Breaker Failure timer Bit 1: maintenance mode Bit 2: aux 3 Bit 3: aux 4 Bit 4: Reserved Bit 5: Manual close Bit 6: Local mode Bits 7:Synchro Bit 8: aux 5 Bit 9: aux 6 Bit 10: aux 7 Bit 11: aux 8 Bit 12: aux 9 Bit 13: aux A Bit 14: aux B Bit 15: aux C
F20B	Unsigned integer: logical inputs status, part 3 Bit 0: Ctrl Trip Bit 1: Ctrl Close Bit 2: LEDs Reset Bit 3 to bit 15: Not used
F21	Unsigned integer: software version (Dec value) : 100 – 999 (XY) X digit = Version number 10 – 99 Y digit = Revision number 0 (A) – 9 (J)
F22	Unsigned integer: internal logic data Bit 0: RL1 trip relay status Bits 1 to 15: Reserved
F23	Unsigned integer: machine status Bit 0: major material alarm Bit 1: minor material alarm Bit 2: presence of a non-acknowledged event Bit 3: synchronisation state bit 4: presence of a non-acknowledged disturbance recording Bit 5: presence of a non-acknowledged fault record Bits 6 to 15: Reserved
F24	Unsigned integer: generic info operating mode 0: out of service / not active 1: in service / active
F24A	Unsigned integer: 50/51/67 and 50N/51N/67N operating mode 0: NO 1: YES 2: DIR 3: PEAK
F24B	Unsigned integer: threshold operating mode 0: NO 1: AND 2: OR
F24C	Unsigned integer: 32N protection operating mode 0: Pe type mode seuil 1: IeCos type mode seuil
F25	Unsigned integer: 2 ASCII characters
F26	Unsigned integer: default display configuration 0: IA measurement display (True RMS) 1: IB measurement display (True RMS) 2: IC measurement display (True RMS) 3: IN measurement display (True RMS) 4: IA, IB, IC, and IN measurement display (True RMS)
F27	Unsigned integer: RL1 - RL8 output relays latch configuration and status Bit 0: relay number 1 (RL1) Bit 1: relay number 2 (RL2) Bit 2: relay number 3 (RL3) Bit 3: relay number 4 (RL4) Bit 4: relay number 5 (RL5) Bit 5: relay number 6 (RL6) Bit 6: relay number 7 (RL7) Bit 7: relay number 8 (RL8) Bits 8 to15: Reserved

CODE	DESCRIPTION
F28	Reserved
F29	Unsigned integer: Modbus and DNP3 stop bits number 0: one stop bit 1: two stop bits
F30	Unsigned integer: communication status (IEC 60870-5-103 protocol) Bit 0: communication RS485 port 1 available if = 1 Bit 1: obsolete (previously IEC 60870-5-103 protocol private option) Bit 2: communication RS232 available if = 1 Bit 3: communication RS485 port 2 available if = 1
F31	Unsigned integer: numbers of available disturbance records 0: no records available 1: one events record available 2: two events records available 3: three events records available 4: four events records available 5: five events records available
F31A	Unsigned integer: numbers of default records to display 1: First record (the oldest) … 25: Twenty fifth record (more recently)
F31B	Unsigned integer: numbers of intantaneous records to display 1: First record (the oldest) … 5: Fifth record (more recently)
F32	Unsigned integer: disturbance recording configuration 0: disturbance recording start condition on protection START 1: disturbance recording start condition on protection TRIPPING
F33	Unsigned integer: Cold load start thresholds Bit 0: tI> Bit 1: tI>> Bit 2: tI>>> Bit 3: tIe> Bit 4: tIe>> Bit 5: tIe>>> Bit 6: θ trip Bit 7: tI2> Bit 8: tI2>> Bit 9: tI2>>> Bit 10: tIe_d> Bit 11: tIe_d>> Bit 12: Not used Bit 13: Not used Bit 14: Not used Bit 15: Not used
F34	Unsigned integer: threshold reset timer type 0: DMT 1: IDMT
F35	Unsigned integer: disturbance recording status 0: no disturbance recording uploaded 1: disturbance recording upload running
F36	Unsigned integer: non acknowledged memorised alarms flags, part 1 Bit 0: Ie> Bit 1: tIe> Bit 2: Ie>> Bit 3: tIe>> Bit 4: Ie>>> Bit 5: tIe>>> Bit 6: tIe>REV Bit 7: tIe>> REV Bit 8: tIe>>>REV Bit 9: thermal alarm (θ alarm) Bit 10: thermal trip (θ trip) Bit 11: broken conductor trip Bit 12: breaker failure trip Bit 13: Ie_d> Bit 14: AUX1 trip Bit 15: AUX2 trip

CODE	DESCRIPTION
F36A	Unsigned integer: non acknowledged memorised alarms flags, part 2 Bit 0: CB operating time overreach Bit 1: CB operation number overreach Bit 2: square Amps sum overreach Bit 3: trip circuit supervision Bit 4: CB closing time overreach Bit 5: t Boolean Equation A Bit 6: t Boolean Equation B Bit 7: t Boolean Equation C Bit 8: t Boolean Equation D Bit 9: Pe/Iecos> Bit 10: tPe/Iecos> Bit 11: Pe/Iecos>> Bit 12: tPe/Iecos>> Bit 13: I2> Bit 14: tI2> Bit 15: SOTF
F36B	Unsigned integer: non acknowledged memorised alarms flags part 3 Bit 0: U< Bit 1: tU< Bit 2: U<< Bit 3: tU<< Bit 4: U> Bit 5: tU> Bit 6: U>> Bit 7: tU>> Bit 8: Ue>>>> Bit 9: tUe>>>> Bit 10: recloser internally locked Bit 11: recloser successful Bit 12: I2>> Bit 13: tI2>> Bit 14: I2>>> Bit 15: tI2>>>
F36C	Unsigned integer: non acknowledged memorised alarms flags, part 4 Bit 0: AUX3 trip Bit 1: AUX4 trip Bit 2: I> (old format before release V6: address 001Ah bit 5) Bit 3: tI> (old format before release V6: address 001Dh bit 6) Bit 4: I>> (old format before release V6: address 001Bh bit 5) Bit 5: tI>> (old format before release V6: address 001Eh bit 6) Bit 6: I>>> (old format before release V6: address 001Ch bit 5) Bit 7: tI>>> (old format before release V6: address 001Fh bit 6) Bit 8: I< (old format before release V6: address 0024h bit 5) Bit 9: tI< (old format before release V6: address 0024h bit 6) Bit 10: VTS Bit 11: P> Bit 12: tP> Bit 13: P>> Bit 14: tP>> Bit 15: tIe_d>
F36D	Unsigned integer: non acknowledged memorised alarms flags, part 5 Bit 0: f1 Bit 1: tf1 Bit 2: f2 Bit 3: tf2 Bit 4: f3 Bit 5: tf3 Bit 6: f4 Bit 7: tf4 Bit 8: f5 Bit 9: tf5 Bit 10: f6 Bit 11: tf6 Bit 12: t Boolean Equation E Bit 13: t Boolean Equation F Bit 14: t Boolean Equation G Bit 15: t Boolean Equation H

CODE	DESCRIPTION
F36E	Unsigned integer: non acknowledged memorised alarms flags, part 6 Bit 0: AUX5 trip Bit 1: AUX6 trip Bit 2: AUX7 trip Bit 3: AUX8 trip Bit 4: AUX9 trip Bit 5: AUXA trip Bit 6: AUXB trip Bit 7: AUXC trip Bit 8: P< Bit 9: tP< Bit 10: P<< Bit 11: tP<< Bit 12: Q> Bit 13: tQ> Bit 14: Q>> Bit 15: tQ>>
F36F	Unsigned integer: non acknowledged memorised alarms flags, part 7 Bit 0: Q< Bit 1: tQ< Bit 2: Q<< Bit 3: tQ<< Bit 4: dfdt1 Bit 5: dfdt2 Bit 6: dfdt3 Bit 7: dfdt4 Bit 8: dfdt5 Bit 9: dfdt6 Bit 10: Recloser externally locked Bit 11: Ctrl Trip Bit 12: CTS Bit 13: Ie_d>> Bit 14: tIe_d>> Bit 15: Not used
F36G	Unsigned integer: non acknowledged memorised alarms flags, part 8 Bit 0: V2> Bit 1: t V2> Bit 2: V2>> Bit 3: t V2>> Bit 4: not used Bit 5: not used Bit 6: not used Bit 7: not used Bit 8: not used Bit 9: not used Bit 10: not used Bit 11: not used Bit 12: not used Bit 13: not used Bit 14: not used Bit 15: not used
F37	Unsigned integer: thermal overload information Bit 0: thermal overload alarm Bit 1: thermal overload trip Bits 2 to 15: Reserved

CODE	DESCRIPTION
F38	Unsigned integer: accessory functions, part 1
	Bit 0: SOTF running
	Bit 1: CB failure
	Bit 2: pole A opening
	Bit 3: pole B opening
	Bit 4: pole C opening
	Bit 5: broken conductor
	Bit 6: Aux 1 trip
	Bit 7: Aux 2 trip
	Bit 8: broken conductor time delay
	Bit 9: CB failure time delay
	Bit 10: cold load pick up temporization started
	Bit 11: CB alarms or bits 0, 1, 4 of F43
	Bit 12: Aux 3 trip
	Bit 13: Aux 4 trip
	Bit 14: Start SOTF
	Bit 15: Trip SOTF
F38A	Unsigned integer: accessory functions, part 2
	Bit 0: I>> Blocked
	Bit 1: I>>> Blocked
	Bit 2: VTS
	Bit 3: V2>
	Bit 4: V2>>
	Bit 5: P>
	Bit 6: tP>
	Bit 7: P>>
	Bit 8: tP>>
	Bit 9: Inrush blocking
	Bit 10: CTS
	Bit 11: P<
	Bit 12: tP<
	Bit 13: P<<
	Bit 14: tP<<
	Bit 15: CTS time delay
F38B	Unsigned integer: accessory functions, part 3
	Bit 0: Aux 5 trip
	Bit 1: Aux 6 trip
	Bit 2: Aux 7 trip
	Bit 3: Aux 8 trip
	Bit 4: Aux 9 trip
	Bit 5: Aux A trip
	Bit 6: Aux B trip
	Bit 7: Aux C trip
	Bit 8: Q>
	Bit 9: tQ>
	Bit 10: Q>>
	Bit 11 tQ>>
	Bit 12: Q<
	Bit 13: tQ<
	Bit 14: Q<<
	Bit 15: tQ<<
F39	Unsigned integer: output relay remote word in maintenance mode
	Bit 0: RL1 (trip)
	Bit 1: RL2
	Bit 2: RL3
	Bit 3: RL4
	Bit 4: WD i.e. RL0 (watch-dog)
	Bit 5: RL5
	Bit 6: RL6
	Bit 7: RL7
	Bit 8: RL8
	Bits 9 to15: Reserved

CODE	DESCRIPTION
F40	Unsigned integer: selective scheme logic configuration Bit 0: tI>> Bit 1: tI>>> Bit 2: tIe>> Bit 3: tIe>>> Bit 4: tIe_d> Bit 5: tIe_d>> Bit 6: not used Bit 7: not used Bit 8: not used Bit 9: not used Bit 10: not used Bit 11: not used Bit 12: not used Bit 13: not used Bit 14: not used Bit 15: not used
F41	Unsigned integer: remote communication configuration 0: front and rear MODBUS 1: front MODBUS rear IEC 60870-5-103 2: front MODBUS rear COURIER 3: front MODBUS rear DNP3
F42	Unsigned integer: max & average current + voltage time window selection (dec values) 5: 5 min 10: 10 min 15: 15 min 30: 30 min 60: 60 min
F43	Unsigned integer Bit 0: CB operating time overreach Bit 1: CB operation number overreach Bit 2: square Amps sum overreach Bit 3: trip circuit supervision Bit 4: CB closing time overreach Bit 5: recloser internaly locked Bit 6: recloser successful Bit 7: recloser in progress Bit 8: closing command issued from recloser cycle Bit 9: recloser configuration error Bit 10: recloser in service (IEC 60870-5-103 protocol) Bits 11: recloser final trip Bit 12: "CB operations number / time" overreach Bit 13: Recloser external locked Bit 14: Recloser reinitialized Bit 15: Not used
F44	Reserved
F45	Unsigned integer: HW alarm relay status Bit 0: Watch-Dog operating Bit 1: communication failure Bit 2: data failure Bit 3: analogue failure Bit 4: datation failure Bit 5: calibration failure Bit 6: record data failure Bit 7: Reserved Bit 8: Reserved Bit 9: factory alarm (default factory configuration reloaded) Bit 10: main power supply Bit 11: auxilliary power supplies Bit 12: transformers offset failure Bits 13 to 15: Reserved
F46	Unsigned integer: Ie harmonic content extraction Bit 0: calculation active Bits 1 to 15: Reserved

CODE	DESCRIPTION
F47	Unsigned integer: digital inputs operating mode Bit x = 0 → active when de-energized 1 → active when energized; Bit 0: input 1 Bit 1: input 2 Bit 2: input 3 Bit 3: input 4 Bit 4: input 5 Bit 5: input 6 Bit 6: input 7 Bit 7: input 8 (optional board) Bit 8: input 9 (optional board) Bit 9: input A (optional board) Bit 10: input B (optional board) Bit 11: input C (optional board) Bits 12 to 15: Reserved
F48	Unsigned integer: Boolean Equation Status Bit 0: Reserved Bit 1: t Boolean Equation A Bit 2: t Boolean Equation B Bit 3: t Boolean Equation C Bit 4: t Boolean Equation D Bit 5: Temporisation A, B,- or H active Bit 6: t Boolean Equation E Bit 7: t Boolean Equation F Bit 8: t Boolean Equation G Bit 9: t Boolean Equation H Bit 10: One or more instantaneous equation activated Bits 11 to 15: Reserved
F49	Unsigned integer: calibration status flag 0: calibration KO 1: calibration OK
F50	Has been replaced by F9A (F50 is kept for compatibility reasons
F51	Unsigned integer: digital inputs signal type 0: DC 1: AC
F52	Unsigned integer: date and time format 0: internal format (see « page 8H» description) 1: IEC
F53	Unsigned integer: IEC 60870-5-103 and DNP3 communication speed (Baud) INTERNAL USE ONLY IEC 60870-5-103: 0: 9600 1: 19200 DNP3.0: 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 38400

CODE	DESCRIPTION
F54	Unsigned integer: Digital inputs configuration mode, part 1: Bit x = 0 → level / 1→ edge Bit 0: logic selection 1; operating only on level; not configurable (0) Bit 1: logic selection 2; operating only on level; not configurable (0) Bit 2: relays de-latching; operating only on level; not configurable (0) Bit 3: CB position (52a) ; operating only on level; not configurable (0) Bit 4: CB position (52b) ; operating only on level; not configurable (0) Bit 5: external CB failure; operating only on level; not configurable (0) Bit 6: tAux 1; operating only on level; not configurable (0) Bit 7: tAux 2; operating only on level; not configurable (0) Bit 8: blocking logic 1; operating only on level; not configurable (0) Bit 9: blocking logic 2; operating only on level; not configurable (0) Bit 10: disturbance recording start; operating only on edge; not configurable (1) Bit 11: cold load start; operating only on level; not configurable (0) Bit 12: settings group change ; Attention: 0 → Input / 1→ Menu Bit 13: recloser locked; operating only on level; not configurable (0) Bit 14: thermal status reset; operating only on edge; not configurable (1) Bit 15: trip circuit supervision; operating only on level; not configurable (0)
F54A	Unsigned integer: Digital inputs configuration mode, part2: Bit x = 0 → level / 1→ edge Bit 0: start Breaker Failure timer; operating only on level; not configurable (0) Bit 1: maintenance mode; operating only on level; not configurable (0) Bit 2: tAux 3; operating only on level; not configurable (0) Bit 3: tAux 4; operating only on level; not configurable (0) Bit 4: Reserved Bit 5: Manual close; operating only on level; not configurable (0) Bit 6: Local mode; operating only on level; not configurable (0) Bit 7: Synchronisation; operating only on level; not configurable (0) Bit 8: tAux 5 Bit 9: tAux 6 Bit 10: tAux 7 Bit 11: tAux 8 Bit 12: tAux 9 Bit 13: tAux A Bit 14: tAux B Bit 15: tAux C
F54B	Unsigned integer: Digital inputs configuration mode, part3: Bit x = 0 → level / 1→ edge Bit 0: Control trip(1) Bit 1: Control close(1) Bit 2: Leds reset(0) Bits 3 to 15: Not used
F55	Unsigned integer: active group Group change format (unsigned integer) 0: toggle from group 1 to group 2 1 group 1 2 group 2 3 group 3 4 group 4 5 group 5 6 group 6 7 group 7 8 group 8
F56	Unsigned integer: Fail safe and inversion relays bit x = 0: relay normally de-energized. bit x = 1: relay normally energized. bit 0: Fail safe logical output number RL1 (tripping) bit 1: Fail safe logical output number RL2 bit 2: Inversion logical output number RL3 bit 3: Inversion logical output number RL4 bit 4: Inversion logical output number RL5 bit 5: Inversion logical output number RL6 bit 6: Inversion logical output number RL7 bit 7: Inversion logical output number RL8 bits 8 à 15: Reserved

CODE	DESCRIPTION
F57	Unsigned integer: recloser cycles configuration Bit 0: Cycle 1 configuration (trip and initialize the reclosure) Bit 1: Cycle 1 configuration (block the tripping on cycle) Bit 2, Bit 3: Reserved Bit 4: Cycle 2 configuration (trip and initialize the reclosure) Bit 5: Cycle 2 configuration (block the tripping on cycle) Bit 6, Bit 7: Reserved Bit 8: Cycle 3 configuration (trip and initialize the reclosure) Bit 9: Cycle 3 configuration (block the tripping on cycle) Bit 10, Bit 11: Reserved Bit 12: Cycle 4 configuration (trip and initialize the reclosure) Bit 13: Cycle 4 configuration (block the tripping on cycle) Bit 14, Bit 15: Reserved
F58	Unsigned integer: Switch onto fault configuration Bit 0: Start I>> Bit 1: Start I>>> Bits 2 to 14: Reserved Bit 15: SOTF on/off
F59	Unsigned integer: 51V configuration Bit 0: (U< OR V2>) & I>> ? yes/no Bit 1: (U<< OR V2>>) & I>>> ? yes/no Bits 3 to 15: Reserved
F60	Unsigned integer: VTS configuration Bit 0: VTS Alarm ? yes/no Bit 1: VTS Blocks 51V ? yes/no Bit 2: VTS Blocks protections which use VT ? yes/no Bits 3 to 15: Reserved

CODE	DESCRIPTION
F61	Unsigned integer: Information on the starting origin of the RL1 trip relay 01 - Remote X1 trip 02 - θ trip (Thermal overload) 03 - I> trip 04 - I>> trip 05 - I>>> trip 06 - Ie> trip 07 - Ie>> trip 08 - Ie>>> trip 09 - I< trip 10 - Broken conductor trip 11 - U< trip 12 - U<< trip 13 - Pe/Iecos> trip 14 - Pe/Iecos>> trip 15 - I2> trip 16 - I2>> trip 17 - I2>>> trip 18 - U> trip 19 - U>> trip 20 - Ue>>>> trip 21 - Aux 1 trip 22 - Aux 2 trip 23 - AND Logic equate A trip 24 - AND Logic equate B trip 25 - AND Logic equate C trip 26 - AND Logic equate D trip 27 - Aux 3 trip 28 - Aux 4 trip 29 - SOTF 30 - P > 31 - P >> 32 - f1 33 - f2 34 – f3 35 – f4 36 – f5 37 – f6 38 - AND Logic equate E trip 39 - AND Logic equate F trip 40 - AND Logic equate G trip 41 - AND Logic equate H trip 42 - t Aux 5 (P126-7) 43 - t Aux 6 (P126-7) 44 - t Aux 7 (P126-7) 45 - t Aux 8 (P127 with logical inputs 8-12) 46 - t Aux 9 (P127 with logical inputs 8-12) 47 - t Aux A (P127 with logical inputs 8-12) 48 - t Aux B (P127 with logical inputs 8-12) 49 - t Aux C (P127 with logical inputs 8-12) 50 - Ie_d> trip 51 - P < 52 - P << 53 - Q > 54 - Q >> 55 - Q < 56 - Q << 57 – df/dt1 58 – df/dt2 59 – df/dt3 60 – df/dt4 61 – df/dt5 62 – df/dt6 63 – Ie_d>> trip 64 – V2> trip 65 – V2>> trip

CODE	DESCRIPTION
F62	Unsigned integer: LED status (bit = 0 if LED inactive) Bit 0 – Trip LED Bit 1 – Alarm LED Bit 2 – Warning LED Bit 3 – Healthy LED (always active) Bit 4 – LED 5 Bit 5 – LED 6 Bit 6 – LED 7 Bit 7 – LED 8
F63	Unsigned integer: Language 00 – French 01 – English 02 - Spanish 03 - German 04 – Italian 05 - Russian 06 - Polish 07 - Portuguese 08 - Dutch 09 - American 10 - Czech 11 - Hungarian 12 - Greek 13 - Chinese 14 - Turkish Other – Language by default (product code)
F64	Unsigned integer: Alarms inhibition part 1 Bit 0: Alarm tAux 1 inhibited Bit 1: Alarm tAux 2 inhibited Bit 2: Alarm tAux 3 inhibited Bit 3: Alarm tAux 4 inhibited Bit 4: Alarm tAux 5 inhibited Bit 5: Alarm tAux 6 inhibited Bit 6: Alarm tAux 7 inhibited Bit 7: Alarm tAux 8 inhibited Bit 8: Alarm tAux 9 inhibited Bit 9: Alarm tAux A inhibited Bit 10: Alarm tAux B inhibited Bit 11: Alarm tAux C inhibited Bit 12: Alarm Control Trip inhibited Bit 13: Alarm [79] ext. lock. inhibited Bit 14: Alarm I< inhibited Bit 15: Not used
F64A	Unsigned integer: Alarms inhibition part 2 Bit 0: Alarm Boolean equation A inhibited Bit 1: Alarm Boolean equation B inhibited Bit 2: Alarm Boolean equation C inhibited Bit 3: Alarm Boolean equation D inhibited Bit 4: Alarm Boolean equation E inhibited Bit 5: Alarm Boolean equation F inhibited Bit 6: Alarm Boolean equation G inhibited Bit 7: Alarm Boolean equation H inhibited Bit 8: Alarm U< inhibited Bit 9: Alarm U<< inhibited Bit 10: Alarm U<<< inhibited (not used) Bit 11: Alarm P< inhibited Bit 12: Alarm P<< inhibited Bit 13: Alarm Q< inhibited Bit 14: Alarm Q<< inhibited Bit 15: Not used

CODE	DESCRIPTION
F64B	Unsigned integer: Alarms inhibition part 3 Bit 0: F1 alarm inhibited Bit 1: F2 alarm inhibited Bit 2: F3 alarm inhibited Bit 3: F4 alarm inhibited Bit 4: F5 alarm inhibited Bit 5: F6 alarm inhibited Bit 6: F out inhibited Bit 7: tU> inhibited Bit 8: tU>> inhibited Bit 9: tV2> inhibited Bit 10: tV2>> inhibited Bits 11 to 15: Not used
F65	Unsigned integer: VTS conv. directional to non-dir Bit 0: VTS I> non-Dir ? yes/no Bit 1: VTS I>> non-Dir ? yes/no Bit 2: VTS I>>> non-Dir ? yes/no Bit 3: VTS Ie> non-Dir ? yes/no Bit 4: VTS Ie>> non-Dir ? yes/no Bit 5: VTS Ie>>> non-Dir ? yes/no Bit 6: VTS Ie_d> non-Dir ? yes/no Bit 7: VTS Ie_d>> non-Dir ? yes/no Bits 8 to 15: Reserved
F66	Unsigned integer: phase rotation Value 0: Normal , A_B_C Value 1: Reverse , A_C_B
F67	Unsigned integer: frequency protection Bit 0: information first crossing threshold Bit 1: information of starting (second crossing) Bit 2: information of tripping Bit 3 to 15: Reserved
F68	Unsigned integer: frequency operating mode 0: No 1: Protection under frequency 81< 2: Protection over frequency 81>
F69	Unsigned integer: frequency measurement status Bit 0: F out Bit 1: F out because of U min
F70	Unsigned integer: 1st Operator for Boolean equations 0: Nothing 1: NOT
F71	Unsigned integer: Other than 1st Operator for Boolean equations 0: OR 1: OR NOT 2: AND 3: AND NOT

CODE	DESCRIPTION
F72	Unsigned integer: Operand for Boolean equations 0: NULL 1: I> 2: tI> 3: I>> 4: tI>> 5: I>>> 6: tI>>> 7: Ie> 8: tIe> 9: Ie>> 10: tIe>> 11: Ie>>> 12: tIe>>> 13: Pe/IeCos> 14: tPe/IeCos > 15: Pe/IeCos >> 16: tPe/IeCos >> 17: I2> 18: tI2> 19: I2>> 20: tI2>> 21: I2>>> 22: tI2>>> 23: Thermal alarm (Ith>) 24: Thermal tripping (Ith>>) 25: I< 26: tI< … See next page

CODE	DESCRIPTION
F72 (following)	Unsigned integer: Operand for Boolean equations 27: U> 28: tU> 29: U>> 30: tU>> 31: U< 32: tU< 33: U<< 34: tU<< 35: Ue>>>> 36: tUe>>>> 37: Broken conductor 38: Tripping 79 39: tAux1 40: tAux2 41: tAux3 42: tAux4 43: P> 44: tP> 45: P>> 46: tP>> 47: F1 48: tF1 49: F2 50: tF2 51: F3 52: tF3 53: F4 54: tF4 55: F5 56: tF5 57: F6 58: tF6 59: VTS 60: tAux 5 (P126-P127) 61: tAux 6 (P126-P127) 62: tAux 7 (P126-P127) 63: tAux 8 (P127 with logical inputs 8-12) 64: tAux 9 (P127 with logical inputs 8-12) 65: tAux A (P127 with logical inputs 8-12) 66: tAux B (P127 with logical inputs 8-12) 67: tAux C (P127 with logical inputs 8-12) 68: Input 1 69: Input 2 70: Input 3 71: Input 4 72: Input 5(P126-P127) 73: Input 6(P126-P127) 74: Input 7(P126-P127) 75: Input 8 (P127 with Inputs 8-12) 76: Input 9 (P127 with Inputs 8-12) 77: Input A (P127 with Inputs 8-12) 78: Input B (P127 with Inputs 8-12) 79: Input C (P127 with Inputs 8-12) 80: Ie_d> 81: tIe_d> 82: [79] int. lock 83: [79] ext. lock 84: tEquation A 85: tEquation B 86: tEquation C 87: tEquation D 88: tEquation E 89: tEquation F 90: tEquation G 91: tEquation H 92: CB Fail

CODE	DESCRIPTION
F72 (following)	Unsigned integer: Operand for Boolean equations 93: CTS 94: df/dt1 95: df/dt2 96: df/dt3 97: df/dt4 98: df/dt5 99: df/dt6 100: P< 101: tP< 102: P<< 103: tP<< 104: Q> 105: tQ> 106: Q>> 107: tQ>> 108: Q< 109: tQ< 110: Q<< 111: tQ<< 112: Ie_d>> 113: t Ie_d>> 114: V2> 115: t V2> 116: V2>> 117: t V2>> 118: Communication order 1 119: Communication order 2 120: Communication order 3 121: Communication order 4
F73	Unsigned integer: Source of the disturbance recording start 0: None 1: On trip protection 2: On instantaneous protection 3: On communication order 4: On logical input order 5: No disturbance 6: On HMI order
F74	Unsigned integer: Spontaneous event enabling for IEC870-5-103 communication Bit 0: IEC only Bit 1: Private
F75	Unsigned integer: Measurements transmission enabling for IEC870-5-103 communication (0 = transmission disabled , 1 = transmission enabled) Bit 0: ASDU3.4 only Bit 1: ASDU 9 only Bit 2: Others
F76	Unsigned integer: Date-and-time synchronisation mode. 0: Automatic: with following priority, in decreasing order: 1/ IRIG-B if configured (Option) 2/ Logical input 3/ Communication rear port 1 4/ Communication rear port 2 (if option configured) 1: IRIG-B only (manual mode), if configured 2: Logical input only (manual mode), 3: Communication rear port 1 only (manual mode). 4: Communication rear port 2 only (manual mode), if option configured.
F77	Unsigned integer: IRIG-B mode (Signal type) 0: Logical. 1: Modulated.
F78	Unsigned integer: IEC870-5-103 communication blocking (0 = enabled ; 1 = blocked) Bit 0: Signals and measurements Bit 1: Commands
F79	Unsigned integer: Date-and-time synchronisation origin: 0: None 1: IRIG-B, if configured 2: Logical input, if configured 3: Communication rear port 1 4: Communication rear port 2, if option configured.

CODE	DESCRIPTION
F80	Unsigned integer: Optional board bit 0: logical input 8 to 12 present bit 1: IRIG-B + RS485_2 (second rs485 rear port) presents
F81	Unsigned integer: Keyboard remote control word. Only one bit simultaneously. The bit active simulate a pressure on the key. bit 0: CLEAR key bit 1: ALARM key bit 2: UP key bit 3: RIGHT key bit 4: ENTER key bit 5: DOWN key bit 6: LEFT key bit 7: bit 8: bit 9: bit 10: bit 11: bit 12: bit 13: bit 14: bit 15: Dialog re-init (factory test reserved)
F82	SOTF parameters: Closing orders types for SOTF starting Bit 0: Front port communication order Bit 1: Rear port communication order Bit 2: "Ctrl Close" logical input Bit 3: "SOTF" logical input Bit 4: Reclosing ordered by Autorecloser Bit 5: Reclosing ordered by HMI BIT 6: Rear port 2 (optional) communication order (P127 only)
F83	Unsigned integer: Inrush blocking configuration bit 0: I> bit 1: I>> bit 2: I>>> bit 3: Ie> bit 4: Ie>> bit 5: Ie>>> bit 6: reserved bit 7: reserved bit 8: reserved bit 9: reserved bit 10: reserved bit 11: I2> bit 12: I2>> bit 13: I2>>> bit 14: Ie_d> bit 15: Ie_d>>
F84	VT protection 0: V P-P 1: V P-N
F85	Phases and Earth labels 0: L1, L2, L3, N 1: A, B, C, o 2: R, S, T, E
F86	U< and U<< inhibition by 52a Bit 0: U< inhibited Bit 1: U<< inhibited
F87	Unsigned integer: Cold load start starting mode Bit 0: Detection with CLPU input Bit 1: Automatic detection
F88	IEEE 32 bits floating-point format Default availlable range from + 3.2 E+38 to - 3.2 E+38
F89	IEEE 64 bits floating-point format

CODE	DESCRIPTION
F90	Phase designation 0 = none 1 = phase A 2 = phase B 3 = phase C 4 = phases A-B 5 = phases B-C 6 = phases C-A 7 = phases A-B-C 8 = earth
F91	Measurement mode 1 Quadrant 1 P: direct Q: inverted 2 Quadrant 2 P: inverted Q: direct 3 Quadrant 3 P: inverted Q: inverted 4 Quadrant 4 P: direct Q: direct
F92	CTS Activation and CTS Mode (Futur use) 0: CTS inhibited 1: I2/I1 2: Null current 3: I Diff 4: I Earth
F93	**IEC870-5-103 communication:** GI selection 0: Basic GI 1: Advanced GI
F94	Unsigned integer: df/dt protection flags Bit 0: df/dt1 Bit 1: df/dt2 Bit 2: df/dt3 Bit 3: df/dt4 Bit 4: df/dt5 Bit 5: df/dt6
F95	IEC870-5-103 communication: Info General Start / General Trip Bit 0: General Start Bit 1: General Trip
F96	F1 value except if less than 100 (1.00%) In that case Td demand is equal to Iam Td demand (modbus address 06D4)
F97	Private format date (4 words): Words 1 & 2 = seconds since 01/01/1994 Words 3 & 4 = milliseconds
F98	Auxiliary power self-test status Bit 0: -3V3 out of range Bit 1: 5V0 out of range Bit 2: 3V3 out of range Bit 3: 12V out of range Bit 4: 1V3 out of range Bit 5: 0V out of range
F99	Transformer self-test status bit 0: transformer 1 fault bit 1: transformer 2 fault bit 2: transformer 3 fault bit 3: transformer 4 fault bit 4: transformer 5 fault bit 5: transformer 6 fault bit 6: transformer 7 fault bit 7: transformer 8 fault bit 8: transformer 9 fault

4.1 Disturbance record additional information

4.1.1 MODBUS request definition used for disturbance record

To upload a disturbance record, the following requests must be done in the exact given order:

1. (optional): Send a request to know the number of disturbance records available.
2. (compulsory): Send a request with the record number and the channel number.
3. (compulsory): Send one or several requests to upload the disturbance record data. It depends of the number of samples.
4. (compulsory): Send a request to upload the index frame.

4.1.2 Request to know the number of disturbance records

Slave number	Function code	Word address	Word number	CRC
Xx	03h	3Dh 00	00 24h	xx xx

This request may generate an error message with the error code:

EVT_NOK(OF): No record available

NOTE: If there are less than 5 records available, the answer will contain zero in non-used words.

4.1.3 Service requests

This request must be sent before uploading the disturbance record channel samples. It allows knowing the record number and the channel number to upload.

It allows also knowing the number of samples in the channel.

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 13h	xx xx

This request may generate an error message with two different error codes:

CODE_DEF_RAM(02): failure

CODE_EVT_NOK(03): no disturbance record available

4.1.4 Disturbance record upload request

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	01 to 7Dh	xx xx

This request may geberate an error message with two different error codes:

CODE_DEP_DATA(04): the required disturbance data number is greater than the memorised number.

CODE_SERV_NOK(05): the service request for disturbance record and channel number has not been sent.

4.1.5 Index frame upload request

Slave number	Function code	Word address	Word number	CRC
xx	03h	22h 00	00 07h	xx xx

This request may generate an error message with an error code:

CODE_SERV_NOK(05): the service request for disturbance record and channel number has not been sent.

4.1.6 Request to retrieve the oldest non-acknowledge event

Two ways can be followed to retrieve an event record:

– Send a request to retrieve the oldest non-acknowledged event.

– Send a request to retrieve a dedicated event.

Slave number	Function code	Word address	Word number	CRC
xx	03h	36h 00	00 09h	xx...........xx

This event request may generate an error message with the error code:

EVT_EN_COURS_ECRIT (5): An event is being written into the saved RAM.

NOTE: On event retrieval, two possibilities exist regarding the event record acknowledgement:

– Automatic event record acknowledgement on event retrieval:

  – Bit12 of the remote order frame (format F9 – mapping address 0400h) shall be set to 0. On event retrieval, this event record is acknowledged.

– Non automatic event record acknowledgement on event retrieval:

  – Bit12 of the remote order frame (format F9 – mapping address 0400h) shall be set to 1. On event retrieval, this event record is not acknowledged.

  – To acknowledge this event, another remote order shall be sent to the relay. Bit 13 of this frame (format F9 – mapping address 0400h) shall be set to 1.

4.1.7 Request to retrieve a dedicated event

Slave number	Function code	Word address	Word number	CRC
Xx	03h	Refer to mapping	00 09h	xx...........xx

This event request may generate an error message with the error code:

EVT_EN_COURS_ECRIT (5): An event is being written into the saved RAM.

NOTE: This event retrieval does not acknowledge this event.

4.1.8 Modbus request definition used to retrieve the fault records

Two ways can be followed to retrieve a fault record:

– Send a request to retrieve the oldest non-acknowledge fault record.

– Send a request to retrieve a dedicated fault record.

4.1.8.1 Request to retrieve the oldest non-acknowledge fault record

Slave number	Function code	Word address	Word number	CRC
Xx	03h	3Eh 00	00 18h	xx...........xx

NOTE: On fault retrieval, two possibilities exist regarding the fault record acknowledgement:

a) Automatic fault record acknowledgement on event retrieval.
Bit12 of the remote order frame (format F9 – mapping address 0400h) shall be set to 0. On fault retrieval, this fault record is acknowledged.

b) Non automatic fault record acknowledgement on fault retrieval:
Bit12 of the remote order frame (format F9 – mapping address 0400h) shall be set to 1. On fault retrieval, this fault record is not acknowledged.
To acknowledge this fault, another remote order shall be sent to the relay. Bit 14 of this frame (format F9 – mapping address 0400h) shall be set to 1.

4.1.8.2 Request to retrieve a dedicated fault record

Slave number	Function code	Word address	Word number	CRC
Xx	03h	Refer to mapping	00 18h	xx...........xx

NOTE: This fault value retrieval does not acknowledge this fault record.

IEC 60870-5-103 DATABASE

MiCOM P125-P126-P127 – V16

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1. IEC 60870-5-103 PROTOCOL

1.1 General information

Messages representation is expressed with the associated:

- INFORMATION NUMBER: **INF**
- ASDU TYPE: **TYP**
- CAUSE OF TRANSMISSION: **COT**
- FUNCTION NUMBER: **FUN** .

1.2 Spontaneous messages

These messages include a sub-assembly of the events, which are generated on the relay.

The messages considered are concerning highest priority events.

An event is always generated on the rising edge of the information; some can be generated also on falling edge.

In the list below, events generated only on rising edge will be tagged with a '*'.

1.2.1 Time Tagged Message

Two types of ASDU can be generated for events:

- **ASDU 1**: time-tagged message
- **ASDU 2**: time-tagged message with relative time

In the following list of processed events, FUNCTION NUMBERS (**FUN**) **160** and **161** are used for Public range, respectively for current and voltage protections data, and FUNCTION NUMBERS (**FUN**) **168** and **169** are used for Private range, respectively for current and voltage protections data.

Status indications (monitor direction):

P127 + P126 + P125

- LEDS reset: FUN<160>;INF <19>; TYP <1>; COT<1>,*
- First alarm acknowledge: FUN<168>;INF <53>; TYP <1>; COT<1>,*
- All alarms acknowledge: FUN<168>;INF <52>; TYP <1>; COT<1>,*
- Signals&measurements blocking active: FUN<160>;INF <20>; TYP <1>; COT<1> ↑↓
- Commands blocking active: FUN<168>;INF <151>; TYP <1>; COT<1> ↑↓
- Local parameter Setting active: FUN<160>;INF <22>; TYP <1>; COT<1> ↑↓
- Maintenance mode active: FUN<168>;INF <7>; TYP <1>; COT<1> ↑↓
- Setting group number 1 active: FUN<160>;INF <23>; TYP <1>; COT<1> ↑↓
- Setting group number 2 active: FUN<160>;INF <24>; TYP <1>; COT<1> ↑↓
- Auxiliary input 1: FUN<160>;INF <27>; TYP <1>; COT<1> ↑↓
- Auxiliary input 2: FUN<160>;INF <28>; TYP <1>; COT<1> ↑↓
- Auxiliary input 3: FUN<160>;INF <29>; TYP <1>; COT<1> ↑↓
- Auxiliary input 4: FUN<160>;INF <30>; TYP <1>; COT<1> ↑↓
- Logical input 1: FUN<168>;INF <160>; TYP <1>; COT<1> ↑↓
- Logical input 2: FUN<168>;INF <161>; TYP <1>; COT<1> ↑↓

- Logical input 3: FUN<168>;INF <162>; TYP <1>; COT<1> ↑↓
- Logical input 4: FUN<168>;INF <163>; TYP <1>; COT<1> ↑↓
- Logical output 1: FUN<168>;INF <176>; TYP <1>; COT<1> ↑↓
- Logical output 2: FUN<168>;INF <177>; TYP <1>; COT<1> ↑↓
- Logical output 3: FUN<168>;INF <178>; TYP <1>; COT<1> ↑↓
- Logical output 4: FUN<168>;INF <179>; TYP <1>; COT<1> ↑↓
- Watch Dog: FUN<168>;INF <180>; TYP <1>; COT<1> ↑↓
- Logical output 5: FUN<168>;INF <181>; TYP <1>; COT<1> ↑↓
- Logical output 6: FUN<168>;INF <182>; TYP <1>; COT<1> ↑↓
- Time synchronisation: FUN<168>;INF <226>; TYP <1>; COT<1> *
- Logical selectivity 1: FUN<168>;INF <28>; TYP <1>; COT<1> ↑↓
- Logical selectivity 2: FUN<168>;INF <29>; TYP <1>; COT<1> ↑↓
- Logical blocking 1: FUN<168>;INF <30>; TYP <1>; COT<1> ↑↓
- Logical blocking 2: FUN<168>;INF <31>; TYP <1>; COT<1> ↑↓
- Latch relays: FUN<168>;INF <230>; TYP <1>; COT<1> *
- Unlock relays: FUN<168>;INF<231>; TYP<1>; COT<1> *
- General Reset: FUN<168>;INF<232>; TYP<1>; COT<1> *

P127 + P126

- Autorecloser active: FUN<160>;INF <16>; TYP <1>; COT<1> ↑↓
- Auxiliary input 5: FUN<168>;INF <96>; TYP <1>; COT<1> ↑↓
- Auxiliary input 6: FUN<168>;INF <97>; TYP <1>; COT<1> ↑↓
- Auxiliary input 7: FUN<168>;INF <98>; TYP <1>; COT<1> ↑↓
- Logical input 5: FUN<168>;INF <164>; TYP <1>; COT<1> ↑↓
- Logical input 6: FUN<168>;INF <165>; TYP <1>; COT<1> ↑↓
- Logical input 7: FUN<168>;INF <166>; TYP <1>; COT<1> ↑↓
- Logical output 7: FUN<168>;INF <183>; TYP <1>; COT<1> ↑↓
- Logical output 8: FUN<168>;INF <184>; TYP <1>; COT<1> ↑↓
- Reset thermal state: FUN<168>;INF<6>; TYP<1>; COT<1> *

P127 only (optional board)

- Auxiliary input 8: FUN<168>;INF <99>; TYP <1>; COT<1> ↑↓
- Auxiliary input 9: FUN<168>;INF <100>; TYP <1>; COT<1> ↑↓
- Auxiliary input 10: FUN<168>;INF <101>; TYP <1>; COT<1> ↑↓
- Auxiliary input 11: FUN<168>;INF <102>; TYP <1>; COT<1> ↑↓
- Auxiliary input 12: FUN<168>;INF <103>; TYP <1>; COT<1> ↑↓
- Logical input 8: FUN<168>;INF <167>; TYP <1>; COT<1> ↑↓
- Logical input 9: FUN<168>;INF <168>; TYP <1>; COT<1> ↑↓
- Logical input A: FUN<168>;INF <169>; TYP <1>; COT<1> ↑↓

– Logical input B:	FUN<168>;INF <170>; TYP <1>; COT<1> ↑↓
– Logical input C:	FUN<168>;INF <171>; TYP <1>; COT<1> ↑↓

P127 only

– Setting group number 3 active:	FUN<160>;INF <25>; TYP <1>; COT<1> ↑↓
– Setting group number 4 active:	FUN<160>;INF <26>; TYP <1>; COT<1> ↑↓
– Setting group number 5 active:	FUN<168>;INF<41>; TYP <1>; COT<1> ↑↓
– Setting group number 6 active:	FUN<168>;INF<42>; TYP <1>; COT<1> ↑↓
– Setting group number 7 active:	FUN<168>;INF<43>; TYP <1>; COT<1> ↑↓
– Setting group number 8 active:	FUN<168>;INF<44>; TYP <1>; COT<1> ↑↓
– Setting group copy successful:	FUN<168>;INF<240>; TYP <1>; COT<1>,*

Supervision Indications (monitor direction):

P127 + P126

– Trip Circuit Supervision:	FUN<160>;INF <36>; TYP <1>; COT<1> ↑↓
– Group warning (Minor hardware alarm):	FUN<160>;INF <46>; TYP <1>; COT<1> ↑↓
– Group alarm (Major hardware alarm):	FUN<160>;INF <47>; TYP <1>; COT<1> ↑↓

Start Indications (monitor direction):

P127 + P126 + P125

– Start IN>:	FUN<168>;INF <12>; TYP <2>; COT<1> ↑↓
– Start IN>>:	FUN<168>;INF <13>; TYP <2>; COT<1> ↑↓
– Start IN>>>:	FUN<168>;INF <14>; TYP <2>; COT<1> ↑↓
– Start / pick-up N:	FUN<160>;INF <67>; TYP <2>; COT<1> ↑↓
– Start UN>>>>:	FUN<169>;INF <14>; TYP <2>; COT<1> ↑↓
– Start PN>:	FUN<169>;INF <84>; TYP <2>; COT<1> ↑↓
– Start PN>>:	FUN<169>;INF <85>; TYP <2>; COT<1> ↑↓

P127 + P126

– Start I>:	FUN<168>;INF <9>; TYP <2>; COT<1> ↑↓
– Start I>>:	FUN<168>;INF <10>; TYP <2>; COT<1> ↑↓
– Start I>>>:	FUN<168>;INF <11>; TYP <2>; COT<1> ↑↓
– Start I<:	FUN<168>;INF <73>; TYP <2>; COT<1> ↑↓
– Start I2>:	FUN<168>;INF <57>; TYP <2>; COT<1> ↑↓
– Start I2>>:	FUN<168>;INF <74>; TYP <2>; COT<1> ↑↓
– Start I2>>>:	FUN<168>;INF <76>; TYP <2>; COT<1> ↑↓
– General Start / pick-up:	FUN<160>;INF <84>; TYP <2>; COT<1> ↑↓
– Start Therm:	FUN<168>;INF <15>; TYP <2>; COT<1> ↑↓
– Start Broken conductor:	FUN<168>;INF <38>; TYP <2>; COT<1> ↑↓
– CB Operating time:	FUN<168>;INF <59>; TYP <2>; COT<1> ↑↓
– CB Operation number:	FUN<168>;INF <60>; TYP <2>; COT<1> ↑↓

- SA2n: FUN<168>;INF <61>; TYP <2>; COT<1> ↑↓
- CB Closing time: FUN<168>;INF <63>; TYP <2>; COT<1> ↑↓
- CB Fail extern.("SF6 low"): FUN<168>;INF <224>; TYP <2>; COT<1> ↑↓
- Cold load Start: FUN<168>;INF <37>; TYP <2>; COT<1> ↑↓
- Start tBF: FUN<168>;INF <70>; TYP <2>; COT<1> ↑↓

P127 only

- Start IN>>>>: FUN<168>;INF <24>; TYP <2>; COT<1> ↑↓
- Start U<: FUN<169>;INF <73>; TYP <2>; COT<1> ↑↓
- Start U<<: FUN<169>;INF <100>; TYP <2>; COT<1> ↑↓
- Start U>: FUN<169>;INF <9>; TYP <2>; COT<1> ↑↓
- Start U>>: FUN<169>;INF <10>; TYP <2>; COT<1> ↑↓
- 51V: I>> blocked: FUN<169>;INF <134>; TYP <2>; COT<1> ↑↓
- 51V: I>>> blocked: FUN<169>;INF <135>; TYP <2>; COT<1> ↑↓
- Start VTS: FUN<169>;INF <136>; TYP <2>; COT<1> ↑↓
- Start V2>: FUN<169>;INF <137>; TYP <2>; COT<1> ↑↓
- Start V2>>: FUN<169>;INF <138>; TYP <2>; COT<1> ↑↓
- Start CTS: FUN<160>;INF <32>; TYP <2>; COT<1> ↑↓
- Start P>: FUN<169>;INF <150>; TYP <2>; COT<1> ↑↓
- Start P>>: FUN<169>;INF <151>; TYP <2>; COT<1> ↑↓
- Start P<: FUN<169>;INF <154>; TYP <2>; COT<1> ↑↓
- Start P<<: FUN<169>;INF <155>; TYP <2>; COT<1> ↑↓
- Start Q>: FUN<169>;INF <158>; TYP <2>; COT<1> ↑↓
- Start Q>>: FUN<169>;INF <159>; TYP <2>; COT<1> ↑↓
- Start Q<: FUN<169>;INF <162>; TYP <2>; COT<1> ↑↓
- Start Q<<: FUN<169>;INF <163>; TYP <2>; COT<1> ↑↓
- Blocking Inrush: FUN<168>;INF <225>; TYP <2>; COT<1>,↑↓
- Start F1: FUN<169>;INF <112>; TYP <2>; COT<1> ↑↓
- Start F2: FUN<169>;INF <114>; TYP <2>; COT<1> ↑↓
- Start F3: FUN<169>;INF <116>; TYP <2>; COT<1> ↑↓
- Start F4: FUN<169>;INF <118>; TYP <2>; COT<1> ↑↓
- Start F5: FUN<169>;INF <120>; TYP <2>; COT<1> ↑↓
- Start F6: FUN<169>;INF <122>; TYP <2>; COT<1> ↑↓
- Non measured Freq.: FUN<169>;INF <124>; TYP <2>; COT<1> ↑↓

Fault Indications (monitor direction):

P127 + P126 + P125

- Start / pick-up N: FUN<160>;INF <67>; TYP <2>; COT<1> ↑↓
- General Trip: FUN<160>;INF <68>; TYP <2>; COT<1> ↑↓
- Trip IN>: FUN<160>;INF <92>; TYP <2>; COT<1> ↑↓
- Trip IN>>: FUN<160>;INF <93>; TYP <2>; COT<1> ↑↓
- Trip IN>>>: FUN<168>;INF <22>; TYP <2>; COT<1> ↑↓
- Trip UN>>>>: FUN<169>;INF <22>; TYP <2>; COT<1> ↑↓
- Trip PN>: FUN<169>;INF <86>; TYP <2>; COT<1> ↑↓
- Trip PN>>: FUN<169>;INF <87>; TYP <2>; COT<1> ↑↓
- Local Mode (input): FUN<168>;INF <40>; TYP <2>; COT<1> ↑↓

P127 + P126

- Trip L1: FUN<160>;INF <69>; TYP <2>; COT<1> ↑↓
- Trip L2: FUN<160>;INF <70>; TYP <2>; COT<1> ↑↓
- Trip L3: FUN<160>;INF <71>; TYP <2>; COT<1> ↑↓
- Trip I>: FUN<160>;INF <90>; TYP <2>; COT<1> ↑↓
- Trip I>>: FUN<160>;INF <92>; TYP <2>; COT<1> ↑↓
- Trip I>>>: FUN<168>;INF <19>; TYP <2>; COT<1> ↑↓
- Trip I<: FUN<168>;INF <23>; TYP <2>; COT<1> ↑↓
- Trip I2>: FUN<168>;INF <58>; TYP <2>;COT<1> ↑↓
- Trip I2>>: FUN<168>;INF <75>; TYP <2>; COT<1> ↑↓
- Trip I2>>>: FUN<168>;INF <77>; TYP <2>; COT<1> ↑↓
- Trip Therm: FUN<168>;INF <16>; TYP <2>; COT<1> ↑↓
- Breaker failure trip: FUN<160>;INF <85>; TYP <2>; COT<1> ↑↓
- Broken conductor trip: FUN<168>;INF <39>; TYP <2>; COT<1> ↑↓
- Manual Close (SOTF, input): FUN<168>;INF <238>; TYP <2>; COT<1> ↑↓
- SOTF trip: FUN<168>;INF <239>; TYP <2>; COT<1> ↑↓
- Logic Equation A trip: FUN<168>;INF <144>; TYP <2>; COT<1> ↑↓
- Logic Equation B trip: FUN<168>;INF <145>; TYP <2>; COT<1> ↑↓
- Logic Equation C trip: FUN<168>;INF <146>; TYP <2>; COT<1> ↑↓
- Logic Equation D trip: FUN<168>;INF <147>; TYP <2>; COT<1> ↑↓
- Logic Equation E trip: FUN<168>;INF <196>; TYP <2>; COT<1> ↑↓
- Logic Equation F trip: FUN<168>;INF <197>; TYP <2>; COT<1> ↑↓
- Logic Equation G trip: FUN<168>;INF <198>; TYP <2>; COT<1> ↑↓
- Logic Equation H trip: FUN<168>;INF <199>; TYP <2>; COT<1> ↑↓

P127 only

- Trip IN>>>>: FUN<168>;INF <25>; TYP <2>; COT<1> ↑↓
- Trip U<: FUN<169>;INF <23>; TYP <2>; COT<1> ↑↓
- Trip U<<: FUN<169>;INF <101>; TYP <2>; COT<1> ↑↓
- Trip U>: FUN<169>;INF <90>; TYP <2>; COT<1> ↑↓
- Trip U>>: FUN<169>;INF <91>; TYP <2>; COT<1> ↑↓
- Trip P>: FUN<169>;INF <152>; TYP <2>; COT<1> ↑↓
- Trip P>>: FUN<169>;INF <153>; TYP <2>; COT<1> ↑↓
- Trip P<: FUN<169>;INF <156>; TYP <2>; COT<1> ↑↓
- Trip P<<: FUN<169>;INF <157>; TYP <2>; COT<1> ↑↓
- Trip Q>: FUN<169>;INF <160>; TYP <2>; COT<1> ↑↓
- Trip Q>>: FUN<169>;INF <161>; TYP <2>; COT<1> ↑↓
- Trip Q<: FUN<169>;INF <164>; TYP <2>; COT<1> ↑↓
- Trip Q<<: FUN<169>;INF <165>; TYP <2>; COT<1> ↑↓
- Trip F1: FUN<169>;INF <113>; TYP <2>; COT<1> ↑↓
- Trip F2: FUN<169>;INF <115>; TYP <2>; COT<1> ↑↓
- Trip F3: FUN<169>;INF <117>; TYP <2>; COT<1> ↑↓
- Trip F4: FUN<169>;INF <119>; TYP <2>; COT<1> ↑↓
- Trip F5: FUN<169>;INF <121>; TYP <2>; COT<1> ↑↓
- Trip F6: FUN<169>;INF <123>; TYP <2>; COT<1> ↑↓
- Trip dFdT1: FUN<169>;INF <128>; TYP <2>; COT<1> ↑↓
- Trip dFdT2: FUN<169>;INF <129>; TYP <2>; COT<1> ↑↓
- Trip dFdT3: FUN<169>;INF <130>; TYP <2>; COT<1> ↑↓
- Trip dFdT4: FUN<169>;INF <131>; TYP <2>; COT<1> ↑↓
- Trip dFdT5: FUN<169>;INF <132>; TYP <2>; COT<1> ↑↓
- Trip dFdT6: FUN<169>;INF <133>; TYP <2>; COT<1> ↑↓

Auto-recloser Indications (monitor direction):

P127 + P126

- Circuit Breaker 'ON' by short-time autorecloser:
  FUN<160>;INF <128>; TYP <1>; COT<1> ↑↓
- Circuit Breaker 'ON' by long-time autorecloser:
  FUN<160>;INF <129>; TYP <1>; COT<1> ↑↓
- Autorecloser internally locked: FUN<160>;INF <130>; TYP <1>; COT<1> ↑↓
- Autorecloser externally locked: FUN<168>;INF <68>; TYP <1>; COT<1> ↑↓
- Autorecloser successful: FUN<168>;INF <64>; TYP <1>; COT<1> ↑↓
- CB in O/O (« closed ») position: FUN<168>;INF <33>; TYP <1>; COT<1> ↑↓
- CB in F/O (« open ») position: FUN<168>;INF <34>; TYP <1>; COT<1> ↑↓

- Trip TC: FUN<168>;INF <1>; TYP <1>; COT<1> ↑↓
- Close TC: FUN<168>;INF <2>; TYP <1>; COT<1> ↑↓

1.3 System state

It is given in the answer to the General Interrogation (GI).

Relay state information is Class 1 data, they are systematically sent to the master station, during a General Interrogation.

The list of processed data, following a General Interrogation, is given below; it is a sub-assembly of the spontaneous messages list, so like spontaneous messages, these data are generated on rising and falling edge.

The following indications are sent to the master station if the option “Basic” or “Advanced GI” is chosen in the ‘COMMUNICATION / GI Select’ menu.

Status indications (monitor direction):

P127 + P126 + P125

- Local parameter Setting active: FUN<160>;INF <22>; TYP <1>; COT<9>
- Signals&measurements blocking active: FUN<160>;INF <20>; TYP <1>; COT<9>
- Commands blocking active: FUN<168>;INF <151>; TYP <1>; COT<9>
- Maintenance mode active: FUN<168>;INF <7>; TYP <1>; COT<9>
- Setting group number 1 active: FUN<160>;INF <23>; TYP <1>; COT<9>
- Setting group number 2 active: FUN<160>;INF <24>; TYP <1>; COT<9>
- Auxiliary input 1: FUN<160>;INF <27>; TYP <1>; COT<9>
- Auxiliary input 2: FUN<160>;INF <28>; TYP <1>; COT<9>
- Auxiliary input 3: FUN<160>;INF <29>; TYP <1>; COT<9>
- Auxiliary input 4: FUN<160>;INF <30>; TYP <1>; COT<9>
- Auxiliary input 5: FUN<168>;INF <96>; TYP <1>; COT<9>
- Auxiliary input 6: FUN<168>;INF <97>; TYP <1>; COT<9>
- Auxiliary input 7: FUN<168>;INF <98>; TYP <1>; COT<9>
- Logical input 1: FUN<168>;INF <160>; TYP <1>; COT<9>
- Logical input 2: FUN<168>;INF <161>; TYP <1>; COT<9>
- Logical input 3: FUN<168>;INF <162>; TYP <1>; COT<9>
- Logical input 4: FUN<168>;INF <163>; TYP <1>; COT<9>
- Logical input 5: FUN<168>;INF <164>; TYP <1>; COT<9>
- Logical output 1: FUN<168>;INF <176>; TYP <1>; COT<9>
- Logical output 2: FUN<168>;INF <177>; TYP <1>; COT<9>
- Logical output 3: FUN<168>;INF <178>; TYP <1>; COT<9>
- Logical output 4: FUN<168>;INF <179>; TYP <1>; COT<9>
- Watch Dog output: FUN<168>;INF <180>; TYP <1>; COT<9>
- Logical output 5: FUN<168>;INF <181>; TYP <1>; COT<9>
- Logical output 6: FUN<168>;INF <182>; TYP <1>; COT<9>

P127 + P126

- Autorecloser active: FUN<160>;INF <16>; TYP <1>; COT<9>
- Auxiliary input 5: FUN<168>;INF <96>; TYP <1>; COT<9>
- Auxiliary input 6: FUN<168>;INF <97>; TYP <1>; COT<9>
- Auxiliary input 7: FUN<168>;INF <98>; TYP <1>; COT<9>
- Logical input 6: FUN<168>;INF <165>; TYP <1>; COT<9>
- Logical input 7: FUN<168>;INF <166>; TYP <1>; COT<9>
- Logical output 7: FUN<168>;INF <183>; TYP <1>; COT<9>
- Logical output 8: FUN<168>;INF <184>; TYP <1>; COT<9>

P127 only (optional board)

- Auxiliary input 8: FUN<168>;INF <99>; TYP <1>; COT<9>
- Auxiliary input 9: FUN<168>;INF <100>; TYP <1>; COT<9>
- Auxiliary input 10: FUN<168>;INF <101>; TYP <1>; COT<9>
- Auxiliary input 11: FUN<168>;INF <102>; TYP <1>; COT<9>
- Auxiliary input 12: FUN<168>;INF <103>; TYP <1>; COT<9>
- Logical input 8: FUN<168>;INF <167>; TYP <1>; COT<9>
- Logical input 9: FUN<168>;INF <168>; TYP <1>; COT<9>
- Logical input A: FUN<168>;INF <169>; TYP <1>; COT<9>
- Logical input B: FUN<168>;INF <170>; TYP <1>; COT<9>
- Logical input C: FUN<168>;INF <171>; TYP <1>; COT<9>

P127 only

- Setting group number 3 active: FUN<160>;INF <25>; TYP <1>; COT<9> ↑↓
- Setting group number 4 active: FUN<160>;INF <26>; TYP <1>; COT<9> ↑↓
- Setting group number 5 active: FUN<168>;INF<41>; TYP <1>; COT<9> ↑↓
- Setting group number 6 active: FUN<168>;INF<42>; TYP <1>; COT<9> ↑↓
- Setting group number 7 active: FUN<168>;INF<43>; TYP <1>; COT<9> ↑↓
- Setting group number 8 active: FUN<168>;INF<44>; TYP <1>; COT<9> ↑↓

Supervision Indications (monitor direction):

P127 + P126

- Trip Circuit Supervision: FUN<160>;INF <36>; TYP <1>; COT<9>
- Group warning (Minor hardware alarm): FUN<160>;INF <46>; TYP <1>; COT<9>
- Group alarm (Major hardware alarm): FUN<160>;INF <47>; TYP <1>; COT<9>

Start Indications (monitor direction):

P127 + P126 + P125

- Start / pick-up N: FUN<160>;INF <67>; TYP <2>; COT<9>
- General Start / pick-up: FUN<160>;INF <84>; TYP <2>; COT<9>
- Start IN>: FUN<168>;INF <12>; TYP <2>; COT<9>

– Start IN>>:	FUN<168>;INF <13>; TYP <2>; COT<9>
– Start IN>>>:	FUN<168>;INF <14>; TYP <2>; COT<9>
– Start UN>>>>:	FUN<169>;INF <14>; TYP <2>; COT<9>
– Start PN>:	FUN<169>;INF <84>; TYP <2>; COT<9>
– Start PN>>:	FUN<169>;INF <85>; TYP <2>; COT<9>

P127 + P126

– Start I>:	FUN<168>;INF <9>; TYP <2>; COT<9>
– Start I>>:	FUN<168>;INF <10>; TYP <2>; COT<9>
– Start I>>>:	FUN<168>;INF <11>; TYP <2>; COT<9>
– Start I<:	FUN<168>;INF <73>; TYP <2>; COT<9>
– Start I2>:	FUN<168>;INF <57>; TYP <2>; COT<9>
– Start I2>>:	FUN<168>;INF <74>; TYP <2>; COT<9>
– Start I2>>>:	FUN<168>;INF <76>; TYP <2>; COT<9>
– Start Therm:	FUN<168>;INF <15>; TYP <2>; COT<9>

P127 only

– Start IN>>>>:	FUN<168>;INF <24>; TYP <2>; COT<9>
– Start U>:	FUN<169>;INF <9>; TYP <2>; COT<9>
– Start U>>:	FUN<169>;INF <10>; TYP <2>; COT<9>
– Start U<:	FUN<169>;INF <73>; TYP <2>; COT<9>
– Start U<<:	FUN<169>;INF <100>; TYP <2>; COT<9>
– Start CTS:	FUN<160>;INF <32>; TYP <2>; COT<9>
– 51V: I>> blocked:	FUN<169>;INF <134>; TYP <2>; COT<9>
– 51V: I>>> blocked:	FUN<169>;INF <135>; TYP <2>; COT<9>
– Start VTS:	FUN<169>;INF <136>; TYP <2>; COT<9>
– Start V2>:	FUN<169>;INF <137>; TYP <2>; COT<9>
– Start V2>>:	FUN<169>;INF <138>; TYP <2>; COT<9>
– Blocking Inrush:	FUN<168>;INF <225>; TYP <2>; COT<9>
– Start F1:	FUN<169>;INF <112>; TYP <2>; COT<9>
– Start F2:	FUN<169>;INF <114>; TYP <2>; COT<9>
– Start F3:	FUN<169>;INF <116>; TYP <2>; COT<9>
– Start F4:	FUN<169>;INF <118>; TYP <2>; COT<9>
– Start F5:	FUN<169>;INF <120>; TYP <2>; COT<9>
– Start F6:	FUN<169>;INF <122>; TYP <2>; COT<9>
– Non measured Freq.:	FUN<169>;INF <124>; TYP <2>; COT<9>
– Start P>:	FUN<169>;INF <150>; TYP <2>; COT<9>
– Start P>>:	FUN<169>;INF <151>; TYP <2>; COT<9>
– Start P<:	FUN<169>;INF <154>; TYP <2>; COT<9>

- Start P<<: FUN<169>;INF <155>; TYP <2>; COT<9>
- Start Q>: FUN<169>;INF <158>; TYP <2>; COT<9>
- Start Q>>: FUN<169>;INF <159>; TYP <2>; COT<9>
- Start Q<: FUN<169>;INF <162>; TYP <2>; COT<9>
- Start Q<<: FUN<169>;INF <163>; TYP <2>; COT<9>

Auto-recloser Indications (monitor direction):

P127 + P126

- Autorecloser internally locked: FUN<160>;INF <130>; TYP <1>; COT<9>
- Autorecloser externally locked: FUN<168>;INF <68>; TYP <1>; COT<9>
- CB in O/O (« closed ») position: FUN<168>;INF <33>; TYP <1>; COT<9>
- CB in F/O (« open ») position: FUN<168>;INF <34>; TYP <1>; COT<9>

Fault Indications (monitor direction):

The following indications are sent to the master station only if the option “Advanced GI” is chosen in the ‘COMMUNICATION / GI Select’ menu.

- General Trip: FUN<160>;INF <68>; TYP <2>; COT<9>
- Trip IN>: FUN<160>;INF <92>; TYP <2>; COT<9>
- Trip IN>>: FUN<160>;INF <93>; TYP <2>; COT<9>
- Trip IN>>>: FUN<168>;INF <22>; TYP <2>; COT<9>
- Trip UN>>>>: FUN<169>;INF <22>; TYP <2>; COT<9>
- Trip PN>: FUN<169>;INF <86>; TYP <2>; COT<9>
- Trip PN>>: FUN<169>;INF <87>; TYP <2>; COT<9>
- Trip L1: FUN<160>;INF <69>; TYP <2>; COT<9>
- Trip L2: FUN<160>;INF <70>; TYP <2>; COT<9>
- Trip L3: FUN<160>;INF <71>; TYP <2>; COT<9>
- Trip I>: FUN<160>;INF <90>; TYP <2>; COT<9>
- Trip I>>: FUN<160>;INF <91>; TYP <2>; COT<9>
- Trip I>>>: FUN<168>;INF <19>; TYP <2>; COT<9>
- Trip I<: FUN<168>;INF <23>; TYP <2>; COT<9>
- Trip I2>: FUN<168>;INF <58>; TYP <2>;COT<9>
- Trip I2>>: FUN<168>;INF <75>; TYP <2>; COT<9>
- Trip I2>>>: FUN<168>;INF <77>; TYP <2>; COT<9>
- Trip Therm: FUN<168>;INF <16>; TYP <2>; COT<9>
- Breaker failure trip: FUN<160>;INF <85>; TYP <2>; COT<9>
- Broken conductor: FUN<168>;INF <39>; TYP <2>; COT<9>
- Local Mode (input): FUN<168>;INF <40>; TYP <2>; COT<9>
- Manual Close (SOTF, input): FUN<168>;INF <238>; TYP <2>; COT<9>
- SOTF trip: FUN<168>;INF <239>; TYP <2>; COT<9>

– Cold load Start:	FUN<168>;INF <37>; TYP <2>; COT<9>
– Logic Equation A trip:	FUN<168>;INF <144>; TYP <2>; COT<9>
– Logic Equation B trip:	FUN<168>;INF <145>; TYP <2>; COT<9>
– Logic Equation C trip:	FUN<168>;INF <146>; TYP <2>; COT<9>
– Logic Equation D trip:	FUN<168>;INF <147>; TYP <2>; COT<9>
– Logic Equation E trip:	FUN<168>;INF <196>; TYP <2>; COT<9>
– Logic Equation F trip:	FUN<168>;INF <197>; TYP <2>; COT<9>
– Logic Equation G trip:	FUN<168>;INF <198>; TYP <2>; COT<9>
– Logic Equation H trip:	FUN<168>;INF <199>; TYP <2>; COT<9>
– Trip IN>>>>:	FUN<168>;INF <25>; TYP <2>; COT<9>
– Trip U<:	FUN<169>;INF <23>; TYP <2>; COT<9>
– Trip U<<:	FUN<169>;INF <101>; TYP <2>; COT<9>
– Trip U>:	FUN<169>;INF <90>; TYP <2>; COT<9>
– Trip U>>:	FUN<169>;INF <91>; TYP <2>; COT<9>
– Trip P>:	FUN<169>;INF <152>; TYP <2>; COT<9>
– Trip P>>:	FUN<169>;INF <153>; TYP <2>; COT<9>
– Trip P<:	FUN<169>;INF <156>; TYP <2>; COT<9>
– Trip P<<:	FUN<169>;INF <157>; TYP <2>; COT<9>
– Trip Q>:	FUN<169>;INF <160>; TYP <2>; COT<9>
– Trip Q>>:	FUN<169>;INF <161>; TYP <2>; COT<9>
– Trip Q<:	FUN<169>;INF <164>; TYP <2>; COT<9>
– Trip Q<<:	FUN<169>;INF <165>; TYP <2>; COT<9>
– Trip F1:	FUN<169>;INF <113>; TYP <2>; COT<9>
– Trip F2:	FUN<169>;INF <115>; TYP <2>; COT<9>
– Trip F3:	FUN<169>;INF <117>; TYP <2>; COT<9>
– Trip F4:	FUN<169>;INF <119>; TYP <2>; COT<9>
– Trip F5:	FUN<169>;INF <121>; TYP <2>; COT<9>
– Trip F6:	FUN<169>;INF <123>; TYP <2>; COT<9>
– Trip dFdT1:	FUN<169>;INF <128>; TYP <2>; COT<9>
– Trip dFdT2:	FUN<169>;INF <129>; TYP <2>; COT<9>
– Trip dFdT3:	FUN<169>;INF <130>; TYP <2>; COT<9>
– Trip dFdT4:	FUN<169>;INF <131>; TYP <2>; COT<9>
– Trip dFdT5:	FUN<169>;INF <132>; TYP <2>; COT<9>
– Trip dFdT6:	FUN<169>;INF <133>; TYP <2>; COT<9>

1.4 Processed commands

1.4.1 System commands

– Synchronisation Command: **ASDU 6**

FUN<255>;INF <0>; TYP <6>; COT<8>

This command can be sent to a specific relay, or global.

The time sent by master is the time of the first bit of the frame. The relay synchronises with this time, corrected by the frame transmission delay. After updating its time, the relay sends back acknowledgement info to the master, by giving its new current time. This acknowledgement message will be an event of ASDU 6 type.

– General Interrogation Initialisation command: **ASDU 7**

FUN<255>;INF <0>; TYP <7>; COT<9>

This command starts the relay interrogation.

The relay then sends a list of data containing the relay state (see the list described above). The GI command contains a scan number which will be included in the answers of the GI cycle generated by the GI command.

If a data has just changed before extracted by the GI, the new state is sent to the master station.

When an event is generated during the GI cycle, the event is sent in priority, and the GI cycle is temporarily interrupted. The end of a GI consists in sending an ASDU 8 to the master station.

If, during a General Interrogation cycle, another GI Initialisation command is received, the previous answer is stopped, and the new GI cycle is started.

1.4.2 General commands

Control direction: **ASDU 20**

P127 + P126 + P125

– LEDS Reset: this command acknowledges all alarms on Front Panel:

FUN<160>;INF<19>; TYP<20>; COT<20>

– Setting group number 1: FUN<160>;INF<23>; TYP<20>; COT<20>
– Setting group number 2: FUN<160>;INF<24>; TYP<20>; COT<20>
– Trip TC: FUN<168>;INF<1>; TYP<20>; COT<20>
– Close TC: FUN<168>;INF<2>; TYP<20>; COT<20>
– Unlock relays: FUN<168>;INF<231>; TYP<20>; COT<20>
– General Reset: FUN<168>;INF<232>; TYP<20>; COT<20>
– First alarm acknowledge: FUN<168>;INF <53>; TYP <20>; COT<20>
– All alarms acknowledge: FUN<168>;INF <52>; TYP <20>; COT<20>

P127 + P126

– Auto-recloser On / Off: FUN<160>;INF<16>; TYP<20>; COT<20>
– tCOMM1 order: FUN<168>;INF<234>; TYP<20>; COT<20>
– tCOMM2 order: FUN<168>;INF<235>; TYP<20>; COT<20>
– tCOMM3 order: FUN<168>;INF<227>; TYP<20>; COT<20>
– tCOMM4 order: FUN<168>;INF<228>; TYP<20>; COT<20>
– Setting group number 3: FUN<160>;INF<25>; TYP<20>; COT<20>

– Setting group number 4: FUN<160>;INF<26>; TYP<20>; COT<20>

– Setting group number 5: FUN<168>;INF<41>; TYP<20>; COT<20>

– Setting group number 6: FUN<168>;INF<42>; TYP<20>; COT<20>

– Setting group number 7: FUN<168>;INF<43>; TYP<20>; COT<20>

– Setting group number 8: FUN<168>;INF<44>; TYP<20>; COT<20>

– Setting group copy: FUN<168>;INF<240>; TYP<20>; COT<20>

This command must be used in association with data mapped at address 664h (source setting group) and 665h (destination setting group).

After executing one of these commands, the relay sends an acknowledgement message, which contains the result of command execution.

If a state change is the consequence of the command, it must be sent in a ASDU 1 with COT 12 (remote operation).

If the relay receives another command message from the master station before sending the acknowledgement message, it will be discarded.

Commands which are not processed by the relay are rejected with a negative acknowledgement message.

1.4.3 Private commands – Setting management

1.4.3.1 ASDUs for setting read

ASDU 140 (8Ch) 16 or 32 bits value read:

FUN field contains the offset of the measure or of the parameter defined from the beginning of the page, and INF field contains the page number.

ASDUs of answer to setting read:

– ASDU 17 (11h): 16 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte, then a 4 byte time tag is transmitted.

This ASDU is used for all parameter pages: 1, 2, 3, 5, 6, 36 (group 1), 38 (group 2), 40 (group 3), 42 (group 4), 44 (group 5), 46 (group 6), 48 (group 7) and 50 (group 8).

– ASDU 49 (31h): 16 bits analog protection signal:

FUN and INF: same definition than ASDU 140, parameter is transmitted in MW field, first low-byte, then high byte, then a 4 byte time tag is transmitted.

This ASDU is used for signals and measurements pages: 0 and 35.

– ASDU 169 (A9h): 32 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word, then a QDS quality descriptor, then a 4 byte time tag is transmitted.

This ASDU is used for all parameter pages: 1, 2, 3, 6, 36 (group 1), 38 (group 2), 40 (group 3), 42 (group 4), 44 (group 5), 46 (group 6), 48 (group 7) and 50 (group 8).

– ASDU 4: 32 bits floating-point analog protection parameter:

FUN and INF: same definition than ASDU 140, floating-point parameter is transmitted first low-word (low-byte, then high byte), then high word, then relative date field forced to 0, then FAN field forced to 0, then a 4 byte time tag is transmitted.

This ASDU is used for signals and measurements pages: 0 and 35.

1.4.3.2 ASDUs for setting write:

ASDU 144 (90h) 16 bits analog protection value write:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte.

ASDU of answer to ASDU 144 setting write:

– ASDU 17 (11h): 16 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte, then a 4 byte time tag is transmitted.

ASDU 201 (C9h) 32 bits analog protection value write:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word.

ASDU of answer to ASDU 201 setting write:

– ASDU 169 (A9h): 32 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word, then a QDS quality descriptor, then a 4 byte time tag is transmitted.

1.4.3.3 Error messages

All errors detected in settings management are returned to the master in a special message called “Rejection telegram”, which is a special ASDU 49 with FUN = 7Fh and INF = FFh, and the error code (rejection cause”) contained in the MW value.

List of rejection causes used for P127:

CAUSE OF REJECTION	**MEANING**
80H 01H	Message received with command or indication lock active
80H 06H	Unknown command; Structure type (DT field) invalid
80H 07H	Unknown parameter address
80H 0AH	Wrong value in receive message
80H 0BH	Hardware or software option does not exist
80H 15H	Date, time invalid (>30 days, >24 hours etc.)
80H 30H	Wrong Data TYPE in message
80H 33H	Wrong INF field in Message
80H 64H	Invalid command: function group is not configured
80H 72H	Control function cannot be assigned

1.5 Relay reinitialisation

In case of relay re initialization, the relay send to the master station:

		Availability
A message indicating relay start/restart	(FUN<160>;INF <5>; TYP <5> COT <5>)	
or a message indicating Reset CU	(FUN<160>;INF <5>; TYP <3> COT <4>)	
or a message indicating Reset FCB	(FUN<160>;INF <5>; TYP <2> COT <3>)	

Each identification message of the relay (ASDU 5) contains the manufacturer name in 8 ASCII characters (“AREVA”) and 2 free bytes containing: « 127 » or « 126 », or « 125 » in decimal format, then 2 free bytes containing the software version number in decimal (for ex.: 112 corresponds to “11.C”).

1.6 Cyclic Messages

Only measurands can be stored in these messages.

Measurands values are stored in lower levels of communication, before polling by master station.

In **ASDU 9** FUN<160>;INF <148>; TYP <9>; COT<2>

The following values are stored (with a rate such as: 2,4 * nominal value = 4096):

P127 + P126

– RMS Ia,

– RMS Ib,

– RMS Ic,

P127 only

– RMS Ua,

– RMS Ub,

– RMS Uc,

– P,

– Q,

– Frequency (If frequency is out of bounds, the value is set to « unvalid ».

– In **ASDU 3, (ASDU3.4)** FUN<160>;INF <147>; TYP <3>; COT<2>

the following values are stored (with a rate such as: 2,4 * nominal value = 4096):

– RMS IN,

– RMS Un.

In first **ASDU 77,** which is a private ASDU, FUN<168>;INF <209>; TYP <77>; COT<2>

The following values are stored (in IEEE 32 bits floating-point format):

– First value: invalid

P127 + P126

- I1 (module, unit: V)
- I2 (module, unit: V)
- Thermal state (in %).

P127 + P126 + P125

- Harmonic power Pe (unit: W).
- Harmonic power IeCos (unit: A).
- Angle Ie ^ Ue (unit: degree).

P127 + P126

- Angle Ia ^ Ib (unit: degree).
- Angle Ia ^ Ic (unit: degree).
- Angle Ia ^ Ue (unit: degree).

P127 only

- Angle Ia ^ Va (unit: degree), or Ia ^Uab if cabling mode is 2Vpp + Vr .
- Angle Ia ^ Vb (unit: degree), or Ia ^Ubc if cabling mode is 2Vpp + Vr .
- Angle Ia ^ Vc (unit: degree), or Ia ^Uca if cabling mode is 2Vpp + Vr .
- Apparent power (unit: KVA).
- Apparent energy (unit: KVAh).

These values are not rated.

In second **ASDU 77 (private option active)** FUN<248>;INF <25>; TYP <77>; COT<2>

The following 4 energy values are stored (in IEEE 32 bits floating-point format):

P127 only

- Positive active energy (unit: KWh).
- Negative active energy (unit: KWh).
- Positive reactive energy (unit: KVARh).
- Negative reactive energy (unit: KVARh).

1.7 Disturbance record extraction

– The disturbance extraction procedure with IEC870-5-103 in MICOM Px2x relays is in conformance with IEC870-5-103 standard definition.
The maximum disturbance record number stored in a P12y is 5.

– The disturbance record mapping is the following:

P127 only

– Number of analog channels transmitted: 8, which are:

0 Channel 1: Ia current (Phase L1).
1 Channel 2: Ib current (Phase L2).
2 Channel 3: Ic current (Phase L3).
3 Channel 4: IN current (Earth).
4 Channel 5: Ua voltage.
5 Channel 6: Ub voltage.
6 Channel 7: Uc/U0 voltage.
7 Channel 8: Frequency.

Identifiers of tags (30) transmitted in ASDU 29 (logical information) for P127:

0	Tag number 1: General start:	FUN <160> INF <84>
1	Tag number 2: General Trip:	FUN <160> INF <68>
2	Tag number 3: CB Failure:	FUN <160> INF <85>
3	Tag number 4: tI>:	FUN <160> INF <90>
4	Tag number 5: tI>>:	FUN <160> INF <92>
5	Tag number 6: tIN> (Earth):	FUN <160> INF <92>
6	Tag number 7: tIN>> (Earth):	FUN <160> INF <93>
7	Tag number 8: PN>:	FUN <168> INF <86>
8	Tag number 9: PN>>:	FUN <168> INF <87>
9	Tag number 10: Log input 1:	FUN <168> INF <160>
10	Tag number 11: Log input 2:	FUN <168> INF <161>
11	Tag number 12: Log input 3:	FUN <168> INF <162>
12	Tag number 13: Log input 4:	FUN <168> INF <163>
13	Tag number 14: Log input 5:	FUN <168> INF <164>
14	Tag number 15: Log input 6:	FUN <168> INF <165>
15	Tag number 16: Log input 7:	FUN <168> INF <166>
16	Tag number 17: Log input 8:	FUN <168> INF <167>
17	Tag number 18: Log input 9:	FUN <168> INF <168>
18	Tag number 19: Log input 10:	FUN <168> INF <169>
19	Tag number 20: Log input 11:	FUN <168> INF <170>
20	Tag number 21: Log input 12:	FUN <168> INF <171>
21	Tag number 22: Log output 1:	FUN <168> INF <176>
22	Tag number 23: Log output 2:	FUN <168> INF <177>
23	Tag number 24: Log output 3:	FUN <168> INF <178>
24	Tag number 25: Log output 4:	FUN <168> INF <179>
25	Tag number 26: Log output 5 (Watch-dog):	FUN <168> INF <180>
26	Tag number 27: Log output 6:	FUN <168> INF <181>
27	Tag number 28: Log output 7:	FUN <168> INF <182>
28	Tag number 29: Log output 8:	FUN <168> INF <183>
29	Tag number 30: Log output 9:	FUN <168> INF <184>

P126 only

Number of analog channels transmitted: 6, which are:

0 Channel 1: Ia current (Phase L1).
1 Channel 2: Ib current (Phase L2).
2 Channel 3: Ic current (Phase L3).
3 Channel 4: IN current (Earth).
4 Channel 5: Uc/U0 voltage.
5 Channel 6: Frequency.

Identifiers of tags (25) transmitted in ASDU 29 (logical informations) for P126:

0	Tag number 1: General start:	FUN <160> INF <84>
1	Tag number 2: General Trip:	FUN <160> INF <68>
2	Tag number 3: CB Failure:	FUN <160> INF <85>
3	Tag number 4: tI>:	FUN <160> INF <90>
4	Tag number 5: tI>>:	FUN <160> INF <92>
5	Tag number 6: tIN> (Earth):	FUN <160> INF <92>
6	Tag number 7: tIN>> (Earth):	FUN <160> INF <93>
7	Tag number 8: PN>:	FUN <168> INF <86>
8	Tag number 9: PN>>:	FUN <168> INF <87>
9	Tag number 10: Log input 1:	FUN <168> INF <160>
10	Tag number 11: Log input 2:	FUN <168> INF <161>
11	Tag number 12: Log input 3:	FUN <168> INF <162>
12	Tag number 13: Log input 4:	FUN <168> INF <163>
13	Tag number 14: Log input 5:	FUN <168> INF <164>
14	Tag number 15: Log input 6:	FUN <168> INF <165>
15	Tag number 16: Log input 7:	FUN <168> INF <166>
16	Tag number 17: Log output 1:	FUN <168> INF <176>
17	Tag number 18: Log output 2:	FUN <168> INF <177>
18	Tag number 19: Log output 3:	FUN <168> INF <178>
19	Tag number 20: Log output 4:	FUN <168> INF <179>
20	Tag number 21: Log output 5 (Watch-dog):	FUN <168> INF <180>
21	Tag number 22: Log output 6:	FUN <168> INF <181>
22	Tag number 23: Log output 7:	FUN <168> INF <182>
23	Tag number 24: Log output 8:	FUN <168> INF <183>
24	Tag number 25: Log output 9:	FUN <168> INF <184>

P125 only

Number of analog channels transmitted: 3, which are:

0 Channel 1: IN current (Earth).
1 Channel 2: U0 voltage.
2 Channel 3: Frequency.

Identifiers of tags (17) transmitted in ASDU 29 (logical informations) for P125:

0	Tag number 1: General start:	FUN <160> INF <84>
1	Tag number 2: General Trip:	FUN <160> INF <68>
2	Tag number 3: tIN> (Earth):	FUN <160> INF <92>
3	Tag number 4: tIN>> (Earth):	FUN <160> INF <93>
4	Tag number 5: PN>:	FUN <168> INF <86>
5	Tag number 6: PN>>:	FUN <168> INF <87>

6	Tag number 7: Log input 1:	FUN <168> INF <160>
7	Tag number 8: Log input 2:	FUN <168> INF <161>
8	Tag number 9: Log input 3:	FUN <168> INF <162>
9	Tag number 10: Log input 4:	FUN <168> INF <163>
10	Tag number 11: Log output 1:	FUN <168> INF <176>
11	Tag number 12: Log output 2:	FUN <168> INF <177>
12	Tag number 13: Log output 3:	FUN <168> INF <178>
13	Tag number 14: Log output 4:	FUN <168> INF <179>
14	Tag number 15: Log output 5 (Watch-dog):	FUN <168> INF <180>
15	Tag number 16: Log output 6:	FUN <168> INF <181>
16	Tag number 17: Log output 7:	FUN <168> INF <182>

1.8 Fault data record extraction

The fault data are extracted with IEC870-5-103 in MICOM Px2x relays in conformance with AREVA IEC870-5-103 private definitions described in document: *MiCOMACAPart4_IEC60870-5-103_G*. These data are uploaded through ASDU 4 messages, containing the following values in IEEE 32 bits floating-point format, at the end of disturbance record upload, before the acknowledgement of the record:

- fault number:	FUN <243> INF <1>
- active group (**F55**, 1 to 8):	FUN <243> INF <2>
- phase origin (**F90**):	FUN <243> INF <3>
- fault code (**F61**):	FUN <243> INF <4>
- measure unit (Format below):	FUN <243> INF <5>
- fault magnitude:	FUN <243> INF <6>
- fault Ia magnitude (unit= A):	FUN <243> INF <7>
- fault Ib magnitude (unit= A):	FUN <243> INF <8>
- fault Ic magnitude (unit= A):	FUN <243> INF <9>
- fault Ie magnitude (unit= A):	FUN <243> INF <10>
- fault Va magnitude (unit= V):	FUN <243> INF <11>
- fault Vb magnitude (unit= V):	FUN <243> INF <12>
- fault Vc magnitude (unit= V):	FUN <243> INF <13>
- fault Ue magnitude (unit= V):	FUN <243> INF <14>
- fault Ia ^ Ubc angle (unit= degree, 0 to 360):	FUN <243> INF <15>
- fault Ib ^ Uca angle (unit= degree, 0 to 360):	FUN <243> INF <16>
- fault Ic ^ Uab angle (unit= degree, 0 to 360):	FUN <243> INF <17>
- fault Ie ^ Ue angle (unit= degree, 0 to 360):	FUN <243> INF <18>

Measure unit format:

0 = No

1 = V

2 = A

3 = W (Active or reactive power).

4 = W for Pe power.

DNP 3.0 DATABASE

MICOM P125-P126-P127 – V16

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CONTENTS

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1. DNP-3 PROTOCOL

1.1 Purpose of this document

The purpose of this document is to describe the specific implementation of the **D**istributed **N**etwork **P**rotocol (DNP) 3.0 within P12y MiCOM relays.

P12y uses the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library Version 2.18.

This document, in conjunction with the DNP 3.0 Basic 4 Document Set, and the DNP Subset Definitions Document, provides complete information on how to communicate with P12y via the DNP 3.0 protocol.

This implementation of DNP 3.0 is fully compliant with DNP 3.0 Subset Definition Level 2, contains many Subset Level 3 features, and contains some functionality even beyond Subset Level 3.

1.2 DNP V3.00 Device Profile

The following table provides a "Device Profile Document" in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a "Document," it is only a component of a total interoperability guide. This table, in combination with the following should provide a complete interoperability/configuration guide for P12y:

the Implementation Table provided in paragraph 4.3 (beginning on page 118),

and the Point List Tables provided in Section 4.4 (beginning on page 120).

<table>
<tr><td colspan="2">DNP V3.00
DEVICE PROFILE DOCUMENT
(Also see the Implementation Table in Section 1.3, beginning on page 117).</td></tr>
<tr><td colspan="2">Vendor Name: Schneider Electric</td></tr>
<tr><td colspan="2">Device Name: SERIAL 20 Platform using the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library, Version 2.18.</td></tr>
<tr><td>Highest DNP Level Supported:
For Requests: Level 2
For Responses: Level 2</td><td>Device Function:
☒ Master
☐ Slave</td></tr>
<tr><td colspan="2">Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table):
For static (non-change-event) object requests, request qualifier codes 00 and 01 (start-stop), 07 and 08 (limited quantity), and 17 and 28 (index) are supported in addition to request qualifier code 06 (no range – or all points).
Static object requests received with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Static object requests received with qualifiers 17 or 28 will be responded with qualifiers 17 or 28.
For change-event object requests, qualifiers 17 or 28 are always responded.
16-bit and 32-bit Analog Change Events with Time may be requested.
The read function code for Object 50 (Time and Date), variation 1, is supported.</td></tr>
<tr><td>Maximum Data Link Frame Size (octets):
Transmitted: 292
Received 292</td><td>Maximum Application Fragment Size (octets):
Transmitted: 2048
Received: 2048</td></tr>
<tr><td>Maximum Data Link Re-tries:
☒ None
☐ Fixed at 2
☒ Configurable</td><td>Maximum Application Layer Re-tries:

☐ None
☒ Configurable</td></tr>
</table>

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(Also see the Implementation Table in Section 1.3, beginning on page 117).

Requires Data Link Layer Confirmation:

- ☐ **Never**
- ☐ Always
- ☐ Sometimes
- ☐ Configurable

Requires Application Layer Confirmation:

- ☐ Never
- ☐ Always
- ☐ **When reporting Event Data**
- ☐ **When sending multi-fragment responses**
- ☐ Sometimes
- ☐ Configurable

Timeouts while waiting for:

Data Link Confirm:	☐ None	☐ **Fixed at 100 m**	☐ Variable	☐ Configurable.
Complete Appl. Fragment:	☐ **None**	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm:	☐ None	☐ **Fixed at 1s**	☐ Variable	☐ Configurable
Complete Appl. Response:	☐ **None**	☐ Fixed at ____	☐ Variable	☐ Configurable

Others:

Binary input change scanning period: 5ms

Analog input change scanning period: 1s

Sends/Executes Control Operations:

WRITE Binary Outputs	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☐ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☐ Never	☐ **Always**	☐ Sometimes	☐ Configurable
DIRECT OPERATE – NO ACK	☐ Never	☐ **Always**	☐ Sometimes	☐ Configurable
Count > 1	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Pulse On	☐ Never	☐ **Always**	☐ Sometimes	☐ Configurable
Pulse Off	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Latch Off	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Queue	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☐ **Never**	☐ Always	☐ Sometimes	☐ Configurable

Reports Binary Input Change Events when no specific variation requested:

- ☐ Never
- ☐ **Only time-tagged for P126 and P127**
- ☐ **Only non-time-tagged for P125**
- ☐ Configurable

Reports time-tagged Binary Input Change Events when no specific variation requested:

- ☐ **Never for P121**
- ☐ **Binary Input Change With Time for P126 and P127**
- ☐ Binary Input Change With Relative Time
- ☐ Configurable (attach explanation)

Sends Unsolicited Responses:

- ☐ **Never**
- ☐ Configurable
- ☐ Only certain objects
- ☐ Sometimes (attach explanation)
- ☐ ENABLE/DISABLE UNSOLICITED
- ☐ Function codes supported

Sends Static Data in Unsolicited Responses:

- ☐ **Never**
- ☐ When Device Restarts
- ☐ When Status Flags Change

No other options are permitted.

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(Also see the Implementation Table in Section 1.3, beginning on page 117).

Default Counter Object/Variation:	Counters Roll Over at:
☐ No Counters Reported ☐ Configurable ☐ **Default Object: 20** ☐ **Default Variation: 5** ☐ Point-by-point list attached	☐ No Counters Reported ☐ Configurable (attach explanation) ☐ **16 Bits** ☐ **32 Bits** ☐ Other Value: _____ ☐ **Point-by-point list attached**

Sends Multi-Fragment Responses:

☐ **Yes**
☐ No

1.3 Implementation Table

The following table identifies the variations, function codes, and qualifiers supported by the P12y in both request messages and in response messages.

For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Static object requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

In the table below the text shaded as Subset Level 3 indicates Subset Level 3 functionality

(beyond Subset Level 2), and text shaded as beyond Subset Level 3 indicates functionality

beyond Subset Level 3.

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
1	0	Binary Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
1	1 (default – see note 1)	Binary Input	1 (read) 22	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
1	2	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1(default – see note 1 for P120 - P121)	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
2	2 (default – see note 1)	Binary Input Change with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
10	0	Binary Output Status (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
10	2 (default – see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
12	1	Control Relay Output Block	3 (select) 4 (operate) 5 (direct op) 6 (dir. op, noack)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)	129 (response)	echo of request
20	0	Binary Counter (Variation 0 is used to request default variation)	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
20	1	32-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	2	16-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	5	32-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20	6	16-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	0	Frozen Counter (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
21	1	32-Bit Frozen Counter	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	**Variation Number**	**Description**	**Function Codes (dec)**	**Qualifier Codes (hex)**	**Function Codes (dec)**	**Qualifier Codes (hex)**
21	2	16-Bit Frozen Counter	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	9	32-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21	10	16-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	0	Analog Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
30	1 (default – see note 1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	2	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	3	32-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	4	16-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
32	0	Analog Change Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1 (default – see note 1)	32-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
32	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
32	3	32-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
32	4	16-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129 (response)	17, 28 (index)
50	0	Time and Date	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
50	1 (default – see note 1)	Time and Date	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07 (limited qty=1) 08 (limited qty) 17, 28 (index)	129 (response)	00, 01 (start-stop) 17, 28 (index – see note 2)
52	2	Time Delay Fine			129 (response)	07 (limited qty) (qty = 1)
60	0	Class 0, 1, 2, and 3 Data	1 (read)	06 (no range, or all)		
60	1	Class 0 Data	1 (read)	06 (no range, or all)	129	17,28
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
80	1	Internal Indications	2 (write)	00 (start-stop) (index must =7)		
		No Object (function code only) –See Note 3	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			

Note 1: A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

Note 3: For P12y, a cold restart is implemented as a warm restart – the executable is not restarted, but the DNP process is restarted.

1.4 Point Listt

The tables in the following sections identify all the individual data points provided by this implementation of DNP 3.0. uses the database protection.

1.4.1 Binary Input Points

Every Binary Input Status points are included in class 0 polls, because they are included in one of classes 1, 2 or 3.

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **1 for P125 and 2 (Binary Input Change with Time) for P126 and P127**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
0	0	0	Output relay 1 (trip)	0	1
1	1	1	Output relay 2	0	2
2	2	2	Output relay 3	0	2
3	3	3	Output relay 4	0	2
4	4	4	Output relay 0 (watch dog)	0	2
5	5	5	Output relay 5	0	2
6	6	6	Output relay 6	0	2
	7	7	Output relay 7	0	2
	8	8	Output relay 8	0	2
7	9	9	Opto isolator 1	0	2
8	10	10	Opto isolator 2	0	2
9	11	11	Opto isolator 3	0	2
10	12	12	Opto isolator 4	0	2
	13	13	Opto isolator 5	0	2
	14	14	Opto isolator 6	0	2
	15	15	Opto isolator 7	0	2
	16	16	Phase overcurrent stage 1 start	0	1
	17	17	Phase overcurrent stage 1 trip	0	1
	18	18	Phase overcurrent stage 2 start	0	1
	19	19	Phase overcurrent stage 2 trip	0	1
	20	20	Phase overcurrent stage 3 start	0	1
	21	21	Phase overcurrent stage 3 trip	0	1
11	22	22	Earth overcurrent stage 1 start	0	1
12	23	23	Earth overcurrent stage 1 trip	0	1
13	24	24	Earth overcurrent stage 2 start	0	1
14	25	25	Earth overcurrent stage 2 trip	0	1
15	26	26	Earth overcurrent stage 3 start	0	1
16	27	27	Earth overcurrent stage 3 trip	0	1
	28	28	I min Start	0	1
	29	29	tImin trip	0	1
	30	30	I2> start	0	1
	31	31	tI2> trip	0	1
	32	32	I2>> start	0	1
	33	33	tI2>> trip	0	1
	34	34	I2>>> start	0	1
	35	35	tI2>>> trip	0	1
		36	U< start	0	1
		37	tU< trip	0	1
		38	U<< start	0	1
		39	tU<< trip	0	1

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **1 for P125 and 2 (Binary Input Change with Time) for P126 and P127**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
		40	U> start	0	1
		41	tU> trip	0	1
		42	U>> start	0	1
		43	tU>> trip	0	1
17	36	44	UN>>>> start	0	1
18	37	45	tUN>>>> trip	0	1
19	38	46	PN> start	0	1
20	39	47	PN> trip	0	1
21	40	48	PN>> start	0	1
22	41	49	PN>> trip	0	1
	42	50	Thermal start	0	1
	43	51	Thermal trip	0	1
23	44	52	Taux1	0	1
24	45	53	Taux2	0	1
25	46	54	Taux3	0	1
26	47	55	Taux4	0	1
	48	56	Logical Equation A trip	0	1
	49	57	Logical Equation B trip	0	1
	50	58	Logical Equation C trip	0	1
	51	59	Logical Equation D trip	0	1
	52	60	Broken conductor	0	1
	53	61	cb failure	0	1
	54	62	Number of cb operation	0	1
	55	63	Cb operation time alarm	0	1
	56	64	sa2n	0	1
	57	65	trip circuit alarm	0	1
	58	66	cb close time alarm	0	1
	59	67	Internally locked autoreclosure	0	1
	60	68	Successful autoreclosure	0	1
	61	69	In Progress autoreclosure	0	1
	62	70	Final trip (autorecloser)	0	1
	63	71	Fault Configuration of autoreclosure	0	3
	64	72	logic Selectivity 1	0	1
	65	73	logic Selectivity 2	0	1
27	66	74	Blocking logic 1	0	1
	67	75	Blocking logic 2	0	1
	68	76	52a	0	1
	69	77	52b	0	1
	70	78	Lack of SF6	0	1
	71	79	Cold load Pick up	0	1
	72	80	Start tBF	0	1
	73	81	Trip SOTF	0	1
	74	82	Manual Close	0	1
	75	83	Local Mode	0	1
		84	I>> blocked (VCTRLI)	0	1
		85	I>>> blocked (VCTRLI)	0	1
		86	VTS	0	1
		87	Start V2>	0	1

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **1 for P125 and 2 (Binary Input Change with Time) for P126 and P127**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
		88	Start V2>>	0	1
28	76	89	De latching by a logical input	0	1
29	77	90	De latching of the Tripping output relay by remote order	0	1
30	78	92	Closing order by remote order	0	1
31	79	92	Tripping order by remote order	0	1
	80	93	Thermal Resetting by communication	0	1
32	81	94	Shifting to maintenance mode (remote order)	0	1
33	82	95	Major material Alarms	0	1
34	83	96	Minor material Alarms	0	1
	84	97	Phase overcurrent stage 1 trip alarm (latched)	0	3
	85	98	Phase overcurrent stage 2 trip alarm (latched)	0	3
	86	99	Phase overcurrent stage 3 trip alarm (latched)	0	3
35	87	100	Earth overcurrent stage 1 trip alarm (latched)	0	3
36	88	101	Earth overcurrent stage 2 trip alarm (latched)	0	3
37	89	102	Earth overcurrent stage 3 trip alarm (latched)	0	3
	90	103	tI< alarm (latched)	0	3
	92	104	tI2> alarm (latched)	0	3
	92	105	tI2>> alarm (latched)	0	3
	93	106	tI2>>> alarm (latched)	0	3
		107	tU< alarm (latched)	0	3
		108	tU<< alarm (latched)	0	3
		109	tU> alarm (latched)	0	3
		110	tU>> alarm (latched)	0	3
38	94	111	tUN>>>> alarm (latched)	0	3
39	95	112	PN> alarm (latched)	0	3
40	96	113	PN>> alarm (latched)	0	3
	97	114	Thermal start alarm (latched)	0	3
	98	115	Thermal trip alarm (latched)	0	3
41	99	116	Taux1 alarm (latched)	0	3
42	100	117	Taux2 alarm (latched)	0	3
43	101	118	Taux3 alarm (if latched by Trip)	0	3
44	102	119	Taux4 alarm (if latched by Trip)	0	3
	103	120	Logical Equation A alarm (latched)	0	3
	104	121	Logical Equation B alarm (latched)	0	3
	105	122	Logical Equation C alarm (latched)	0	3
	106	123	Logical Equation D alarm (latched)	0	3
	107	124	Broken conductor alarm (latched)	0	3
	108	125	cb failure alarm (latched)	0	3
	109	126	trip circuit alarm(latched)	0	3
45	110	127	Latching of Relay	0	2
	111	128	Logical Equation E trip	0	1
	112	129	Logical Equation F trip	0	1
	113	130	Logical Equation G trip	0	1
	114	131	Logical Equation H trip	0	1
		132	Start P>	0	1
		133	Start P>>	0	1

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **1 for P125 and 2 (Binary Input Change with Time) for P126 and P127**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
		134	Trip P>	0	1
		135	Trip P>>	0	1
		136	Blocking Inrush	0	1
		137	Start F1	0	1
		138	Start F2	0	1
		139	Start F3	0	1
		140	Start F4	0	1
		141	Start F5	0	1
		142	Start F6	0	1
		143	Trip F1	0	1
		144	Trip F2	0	1
		145	Trip F3	0	1
		146	Trip F4	0	1
		147	Trip F5	0	1
		148	Trip F6	0	1
		149	Non measured Frequency	0	1
	115	150	Logical Equation E alarm (latched)	0	3
	116	151	Logical Equation F alarm (latched)	0	3
	117	152	Logical Equation G alarm (latched)	0	3
	118	153	Logical Equation H alarm (latched)	0	3
		154	Trip P> alarm (latched)	0	3
		155	Trip P>> alarm (latched)	0	3
		156	Trip F1 alarm (latched)	0	3
		157	Trip F2 alarm (latched)	0	3
		158	Trip F3 alarm (latched)	0	3
		159	Trip F4 alarm (latched)	0	3
		160	Trip F5 alarm (latched)	0	3
		161	Trip F6 alarm (latched)	0	3
		162	Opto isolator 8 (optional board)	0	2
		163	Opto isolator 9 (optional board)	0	2
		164	Opto isolator 10 (optional board)	0	2
		165	Opto isolator 11 (optional board)	0	2
		166	Opto isolator 12 (optional board)	0	2
	119	167	Taux5	0	1
	120	168	Taux6	0	1
	121	169	Taux7	0	1
		170	Taux8	0	1
		171	Taux9	0	1
		172	Taux10	0	1
		173	Taux11	0	1
		174	Taux12	0	1
	122	175	Taux5 alarm (if latched by Trip)	0	3
	123	176	Taux6 alarm (if latched by Trip)	0	3
	124	177	Taux7 alarm (if latched by Trip)	0	3
		178	Taux8 alarm (if latched by Trip) (optional board)	0	3
		179	Taux9 alarm (if latched by Trip) (optional board)	0	3
		180	Taux10 alarm (if latched by Trip) (optional board)	0	3

Binary Input Points
Static (Steady-State) Object Number: **1**
Change Event Object Number: **2**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (Binary Input without status)**
Change Event Variation reported when variation 0 requested: **1 for P125 and 2 (Binary Input Change with Time) for P126 and P127**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
		181	Taux11 alarm (if latched by Trip) (optional board)	0	3
		182	Taux12 alarm (if latched by Trip) (optional board)	0	3
		183	Earth overcurrent stage 4 start (IN>>>>)I	0	1
		184	Earth overcurrent stage 4 trip (tIN>>>>)	0	1
		185	Earth overcurrent stage 4 trip alarm (latched)	0	3
	125	186	Externally locked autoreclosure	0	1
		187	Start P<	0	1
		188	Start P<<	0	1
		189	Start Q>	0	1
		190	Start Q>>	0	1
		191	Start Q<	0	1
		192	Start Q<<	0	1
		193	Trip P<	0	1
		194	Trip P<<	0	1
		195	Trip Q>	0	1
		196	Trip Q>>	0	1
		197	Trip Q<	0	1
		198	Trip Q<<	0	1
		199	Trip P< alarm (latched)	0	3
		200	Trip P<< alarm (latched)	0	3
		201	Trip Q> alarm (latched)	0	3
		202	Trip Q>> alarm (latched)	0	3
		203	Trip Q< alarm (latched)	0	3
		204	Trip Q<< alarm (latched)	0	3
		205	Trip dFdT1	0	1
		206	Trip dFdT2	0	1
		207	Trip dFdT3	0	1
		208	Trip dFdT4	0	1
		209	Trip dFdT5	0	1
		210	Trip dFdT6	0	1
		211	Trip dFdT1 alarm (latched)	0	3
		212	Trip dFdT2 alarm (latched)	0	3
		213	Trip dFdT3 alarm (latched)	0	3
		214	Trip dFdT4 alarm (latched)	0	3
		215	Trip dFdT5 alarm (latched)	0	3
		216	Trip dFdT6 alarm (latched)	0	3
		217	CTS	0	1

1.4.2 Binary Output Status Points and Control Relay Output Blocks

The following table lists both the Binary Output Status Points (Object 10) and the Control Relay Output Blocks (Object 12). Binary Output Status points are not included in class 0 polls.

Binary Output Status Points
Object Number: **10**
Request Function Codes supported: **1 (read)**
Default Variation reported when variation 0 requested: **2 (Binary Output Status)**
Control Relay Output Blocks
Object Number: **12**
Request Function Codes supported: **3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	Initial Status Value	Supported Control Relay Output Block Fields
0	0	0	De Latch of relays	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
1	1	1	Acknowledgement of the 1st alarm	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
2	2	2	Acknowledgement of all the alarms	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
3	3	3	Remote control Tripping	0	Unpaired Pulse On, Paired Trip/Pulse On,
4	4	4	Remote control Closing	0	Unpaired Pulse On, Paired Close/Pulse On
5	5	5	Change of Active Group	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	6	6	Thermal State Resetting	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	7	7	Average and Max rms values resetting	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	8	8	Counters initialization of the autoreclosure	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	9	9	Initialization of rolling demand (average)	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	10	10	Initialization of Maximum	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
6	11	11	Reinitialization of I0 harmonic calculation	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		12	Reinitialization of Energy counters	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	12	13	Re initialization of autoreclosure	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	13	14	CB operation number reset	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	14	15	SA2n reset	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	15	16	Com1 order	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	16	17	Com2 order	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	17	18	Com3 order	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
	18	19	Com4 order	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On

Binary Output Status Points
Object Number: **10**
Request Function Codes supported: **1 (read)**
Default Variation reported when variation 0 requested: **2 (Binary Output Status)**
Control Relay Output Blocks
Object Number: **12**
Request Function Codes supported: **3 (select), 4 (operate),**
5 (direct operate), 6 (direct operate, noack)

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	Initial Status Value	Supported Control Relay Output Block Fields
	19	20	General reset	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		21	Group 1 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		22	Group 2 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		23	Group 3 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		24	Group 4 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		25	Group 5 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		26	Group 6 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		27	Group 7 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On
		28	Group 8 select	0	Unpaired Pulse On, Paired Trip/Pulse On, Paired Close/Pulse On

1.4.3 Counters

The following table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point.

Binary Counters and Frozen Counters are not included in class 0 polls.

P125 do not support binary Counters and Frozen Counters.

Binary Counters
Static (Steady-State) Object Number: **20**
Change Event Object Number: not supported
Request Function Codes supported: **1 (read), 7 (freeze), 8 (freeze noack)**
9 (freeze and clear), 10 (freeze and clear, noack)
Static Variation reported when variation 0 requested: **5 (32-Bit Binary Counter without Flag**
Change Event Variation reported when variation 0 requested: none-not supported
Frozen Counters
Static (Steady-State) Object Number: **21**
Change Event Object Number: not supported
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **9 (32-Bit Frozen Binary without Flag)**
Change Event Variation reported when variation 0 requested: none-not supported

P126 Point Index	P127 Point Index	Name/Description	Data type
0	0	Max RMS current phase A (A/100)	D1
1	1	Max RMS current phase B (A/100)	D1
2	2	Max RMS current phase C (A/100)	D1
3	3	Average RMS current phase A (A/100)	D1
4	4	Average RMS current phase B (A/100)	D1
5	5	Average RMS current phase C (A/100)	D1
6	6	CB operation number	D2
7	7	sa2n ia	D3
8	8	sa2n ib	D3
9	9	sa2n ic	D3
10	10	Total number of autoreclosure cycle	D2
11	11	Number of cycles 1	D2
12	12	Number of cycles 2	D2
13	13	Number of cycles 3	D2
14	14	Number of cycles 4	D2
15	15	Definitive Tripping number	D2
16	16	Number of closing order	D2
17	17	Rolling demand(average) RMS phase A (A/100)	D1
18	18	Rolling demand(average) RMS phase B (A/100)	D1
19	19	Rolling demand(average) RMS phase C (A/100)	D1
20	20	Maximum RMS phase A (after a new initialization) (A/100)	D1
21	21	Maximum RMS phase B (after a new initialization) (A/100)	D1
22	22	Maximum RMS phase C (after a new initialization) (A/100)	D1
	23	Positive active energy (kWh/100)	D1
	24	Negative active energy (kWh/100)	D1
	25	Positive reactive energy (kVARh/100)	D1
	26	Negative reactive energy (kVARh/100)	D1
	27	Max RMS voltage phase A (V/100)	D1
	28	Max RMS voltage phase B (V/100)	D1
	29	Max RMS voltage phase C (V/100)	D1
	30	Average RMS voltage phase A (V/100)	D1
	31	Average RMS voltage phase B (V/100)	D1
	32	Average RMS voltage phase C (V/100)	D1
	33	Apparent energy (kVAh/100)	D1

1.4.4 Analog Inputs

The following table lists Analog Inputs (Object 30). It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog Output Statuses are transmitted through DNP as signed numbers. Even for analog input points that are not valid as negative values, the maximum positive representation is 32767. For each point, the “Scaling and Units” column indicates the value of a transmitted 32767. This also implies the value of a transmitted –32767. The entry in the column *does not* imply a valid value for the point.

Always indicating the representation of 32767 in the tables below is a consistent method for representing scale, applicable to all scaling possibilities.

The “Default Deadband,” and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before an analog change event will be generated, and once generated in which class poll (1, 2, 3) will the change event be reported. Only the default values for these columns are documented here because the values may change in operation due to either local (user-interface) or remote (through DNP) control.

Every Analog Inputs points are included in class 0 polls, because they are included in one of classes 1, 2 or 3.

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
Change Event Scan Rate: **The scan rate for analog input change events is fixed at 1s**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	Initial Value	Scaling and Units (representation of 32767 – see above)	Valid Range	Change Event Dead-band	Initial Change Event Class (1, 2, 3 or none)
0	0	0	Active Group	1	32767	1 à 2	1	1
	1	1	Magnitude IA	0	40 In	0 to 40 In	0.02 In	3
	2	2	Magnitude IB	0	40 In	0 to 40 In	0.02 In	3
	3	3	Magnitude IC	0	40 In	0 to 40 In	0.02 In	3
1	4	4	Magnitude IN	0	40 IEn if Low sensi-tivity 8 IEn if medium sen-sitivity 1 IEn if high sensi-tivity	0 to 40 IEn	0.02 IEn if Low sensitivity 0.004 IEn if Medium sensitivity 0.0008 IEn if high sensitivity	3
	5	5	rms IA	0A	327.67A	0 to 40000000 A/100	2%	3
	6	6	rms IB	0A	327.67A	0 to 40000000 A/100	2%	3
	7	7	rms IC	0A	327.67A	0 to 40000000 A/100	2%	3
2	8	8	rms IN	0A	327.67A	0 to 40000000 A/100	2%	3
		9	rms VA	0V	327.67V	0 to 500000000 V/100	2%	3
		10	rms VB	0V	327.67V	0 to 500000000 V/100	2%	3
		11	rms VC	0V	327.67V	0 to 500000000 V/100	2%	3
3	9	12	rms VN	0V	327.67V	0 to 500000000 V/100	2%	3

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
Change Event Scan Rate: **The scan rate for analog input change events is fixed at 1s**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	Initial Value	Scaling and Units (representation of 32767 – see above)	Valid Range	Change Event Dead-band	Initial Change Event Class (1, 2, 3 or none)
		13	Magnitude VA	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
		14	Magnitude VB	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
		15	Magnitude VC	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
4	10	16	Magnitude VN	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
	11	17	Thermal State	0%	32767%	0 to 65535	10	3
5	12	18	Frequency	0	327,67 Hz	45Hz to 65 Hz and 99.99Hz == ERROR	1Hz	3
	13	19	Magnitude I2	0	40 In	0 to 40 In	0.1 In	3
	14	20	Magnitude I1	0	40 In	0 to 40 In	0.1 In	3
		21	Magnitude V2	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
		22	Magnitude V1	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
		23	RMS active 3-phase power	0	327.67kW	-9.999 E8 to 9.999 E8 kW/100	2%	3
		24	RMS reactive 3-phase power	0	327.67kVAr	-9.999 E8 to 9.999 E8 kVAr/100	2%	3
6	15	25	Harmonic power Pe	0	327.67 W	-9.999 E8 to 9.999 E8 W/100	2%	3
7	16	26	Harmonic power IeCos	0	327.67 A	-9.999 E8 to 9.999 E8 A/100	2%	3
8	17	27	Angle Ie ^ Ue	0	32767	0 to 360 °	1 °	3
		28	3-phase CosPhi	0		-100 to 100 (1/100)	2	3
	18	29	Tripping Time	0	327.67s	0 to 10.00s	10 ms	3
	19	30	Closing Time	0	327.67s	0 to 10.00s	10 ms	3
	20	31	Fault number	0	32767	0 to 65535	1	2
	21	32	group	0	32767	1 to 2	each new fault	2
	22	33	Fault phase	0	32767	0 to 8 (F1)	each new fault	2
	23	34	Fault origin	0	32767	0 to 29 (F2)	each new fault	2
	24	35	Fault magnitude	0	40 In	0 to 40 In	each new fault	2
	25	36	Fault magnitude IA	0	40 In	0 to 40 In	each new fault	2
	26	37	Fault magnitude IB	0	40 In	0 to 40 In	each new fault	2
	27	38	Fault magnitude IC	0	40 In	0 to 40 In	each new fault	2
	28	39	Fault magnitude IN	0	40 IEn	0 to 40 IEn	each new fault	2
		40	Fault magnitude VA	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
		41	Fault magnitude VB	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
		42	Fault magnitude VC	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2

Analog Inputs
Static (Steady-State) Object Number: **30**
Change Event Object Number: **32**
Request Function Codes supported: **1 (read)**
Static Variation reported when variation 0 requested: **1 (32-Bit Analog Input)**
Change Event Variation reported when variation 0 requested: **1 (32-Bit Analog Change Event w/o Time)**
Change Event Scan Rate: **The scan rate for analog input change events is fixed at 1s**

P125 Point Index	P126 Point Index	P127 Point Index	Name/Description	Initial Value	Scaling and Units (representation of 32767 – see above)	Valid Range	Change Event Dead-band	Initial Change Event Class (1, 2, 3 or none)
	29	43	Fault magnitude Ue	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
		44	Fault angle IA ^ UBC	0	32767	0 to 360 °	each new fault	2
		45	Fault angle IB ^ UCA	0	32767	0 to 360 °	each new fault	2
		46	Fault angle IC ^ UAB	0	32767	0 to 360 °	each new fault	2
	30	47	Fault angle Ie ^ Ue	0	32767	0 to 360 °	each new fault	2
		48	RMS apparent power	0	327.67kVA	-9.999 E8 to 9.999 E8 kVA/100	2%	3
	31	49	Angle Ia ^ Ib	0	32767	0 to 360 °	1 °	3
	32	50	Angle Ia ^ Ic	0	32767	0 to 360 °	1 °	3
		51	Angle Ia ^ Va Or Angle Ia ^ Uab	0	32767	0 to 360 °	1 °	3
		52	Angle Ia ^ Vb Or Angle Ia ^ Ubc	0	32767	0 to 360 °	1 °	3
		53	Angle Ia ^ Vc Or Angle Ia ^ Uca	0	32767	0 to 360 °	1 °	3
	33	54	Angle Ia ^ Ue	0	32767	0 to 360 °	1 °	3

Format:

F1:
0: None, 1: Phase A, 2: Phase B, 4: Phase C, 3: Phase AB, 5: Phase AC, 6: Phase BC, 7: Phase A B C, 8: Earth.

F2:
0: Null, 1: Remote trip, 2: thermal overload, 3: tI>, 4: tI>>, 5: tI>>>, 6: tIN>, 7: tIN>>, 8: tIN>>>, 9: tI<, 10: broken conductor, 11: tU<, 12: tU<<, 13: Pe/Iecos>, 14: Pe/Iecos>>, 15: tI2>, 16: tI2>>, 17: tI2>>>, 18: tU>, 19: tU>>, 20: tUN>>>>, 21: tAux1, 22: tAux2, 23: tEqu.A, 24: tEqu.B, 25: tEqu.C, 26: tEqu.D, 27:tAux3, 28: tAux4, 29: SOTF, 30: tP>, 31: tP>>, 32: tF1, 33: tF2, 34: tF3, 35: tF4, 36: tF5, 37: tF6, 38: tEqu.E, 39: tEqu.F, 40: tEqu.G, 41: tEqu.H.

G1*: Voltage range 57 - 130 V.

G2*: Voltage range 220 – 480 V.

COMMISSIONING AND MAINTENANCE GUIDE

CONTENT

1. REQUIREMENTS PRIOR TO COMMISSIONING

The MiCOM P125 P126 and P127 relays are fully numerical in their design, implementing all protection and non-protection functions in software. The MiCOM relays employ a high degree of self-checking and, in the unlikely event of a failure, will provide an alarm. As a result of this, the commissioning test does not need to be as extensive as with non-numerical relays (static or electromechanical).

To commission MiCOM relays, it is only necessary to verify that the hardware is functioning correctly and the application-specific software setting have been applied to the MiCOM relay. It is considered unnecessary to tests every function of the relay if the settings have been verified by one of the following method:

- Extracting the settings applied to the relay using the appropriate setting software (preferred method)
- Via the front panel user interface.

REMINDER: It is not possible to download a new setting software as long as the programming mode is active.

To confirm that the product is operating correctly once the application-specific settings have been applied, a test should be performed on a single protection element.

Unless previously agreed to the contrary, the customer will be responsible for determining the application-specific settings to be applied to the MiCOM relays and for testing of any scheme logic applied by external wiring.

Blank commissioning test and setting records are provided at the chapter P12y/EN RS of this Technical Guide for completion as required.

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTIONS OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

2. COMMISSIONING TEST ENVIRONMENT

2.1 Important notes

All the commissioning tests of the **MiCOM P125, P126,** and **P127** relays are carried out by injecting currents and voltages to the secondary of the earth and/or phases CTs and VTs using appropriate injection test sets provided for this purpose.

2.1.1 Injection test sets

The test of directional protection within P125, P126 and P127 requires at least a phase current, phase to phase and residual voltage injection.

The test equipment must provide tools to change the phase between voltage and current.

For reasons of convenience (weight, spatial requirement, transportation), a single-phased current injection and single voltage test set is more suitable for commissioning and is able to perform all commissioning tests regarding overcurrent directional/non directional protection of **MiCOM P125, P126 & P127 relays.**

Thus, the following descriptions indicate how to conduct the commissioning tests with a single-phase injection test set.

However, for certain commissioning tests, the three-phase wiring diagrams are easier to understand and in this case the description is also given in three-phase format.

Single-phase injection test set:

- 1 current (0 to 50 A), timer (precision 1 ms).
- 1 voltage (30 to 130V), timer (precision 1 ms)

Three-phase injection test set:

- 3 currents (0 to 50 A), timer (precision 1 ms).
- 3 voltage (30 to 130V), timer (precision 1 ms)

Possibility to lag the current respect to voltage injection.

2.1.2 Additional commissioning test equipment:

- 1 multimeter (precision 1%),
- 1 connecting terminal to measure the currents exceeding 10 A (precision 2%),

Test plugs and wires to carry out injections to the CT's secondary (dimension according to the currents injected).

2.1.3 Communication

Using the RS 485 communication on the rear connector of the MiCOM P125, P126 & P127 relays or using the RS232 front port can make all commissioning test records.

All above in according to each RS 485 communication protocol (MODBUS, IEC 60870-5-103,).

2.2 Commissioning test sheets

Commissioning test sheets are available in the chapter P12y/EN RS of this Technical Guide.

The presentation of the Commissioning test sheets follows the description of the tests of this chapter.

The contents of these Commissioning test sheets enable you to log:

- The name of the relay, station and circuit
- The characteristics of the MiCOM P125, P126 and P127 relays
- The various settings
- The results of the protection and automation checks
- The result of the test records after commissioning.

3. PRODUCT VERIFICATION TESTS

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTIONS OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

3.1 Allocation of terminals

It is necessary to consult the appropriate wiring diagram provided in the chapter P12y/EN CO of this Technical Guide whilst observing the various polarities and ground/earth connection.

3.2 Electrostatic discharge (ESD)

Before any handling of the module (active part of the relay), please refer to the recommendations in Safety Section of this Technical Guide.

3.3 Visual inspection

Carefully examine the relay to see if there has been any possible deterioration following installation.

Check if the external wiring corresponds to the appropriate relay diagram or the assembly diagram. The reference number of the relay diagram is indicated on a label situated under the upper flap of the front panel.

When the relay is outside from its case, use a continuity tester to test that the current short-circuits (phases and earth CT's) between the terminals indicated on the wiring diagram are closed.

3.4 Earthing

Check if the earth connection of the case situated above the rear terminal block is used to connect the relay to a local earth bar. With several relays present, make sure that the copper earth bar is properly installed for solidly connecting the earthing terminals of each case.

3.5 Current transformers (CT's)

DANGER: NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

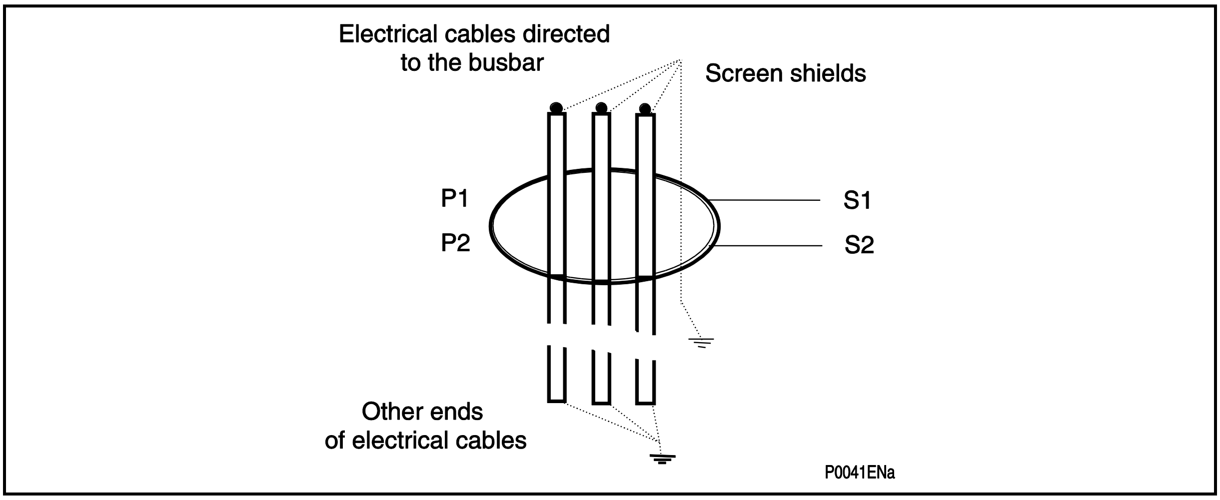
3.6 Use of a Core Balance CT for earth faults

If a core balance CT is used to detect earth faults, prior to any test, the user must check the following points:

- MV or HV cable screens and core CT,
- No current flow through the MV or HV cables,
- Orientation of the core CT (P1-S1, P2-S2)

3.6.1 Cable shields and core CT

When mounting a core balance CT around electric cables, check the connection to the earth of the cable shields. It is vital that the earth cable of the shield moves in the opposite direction through the core CT. This cancels the currents carried by the cable shields through the core CT.



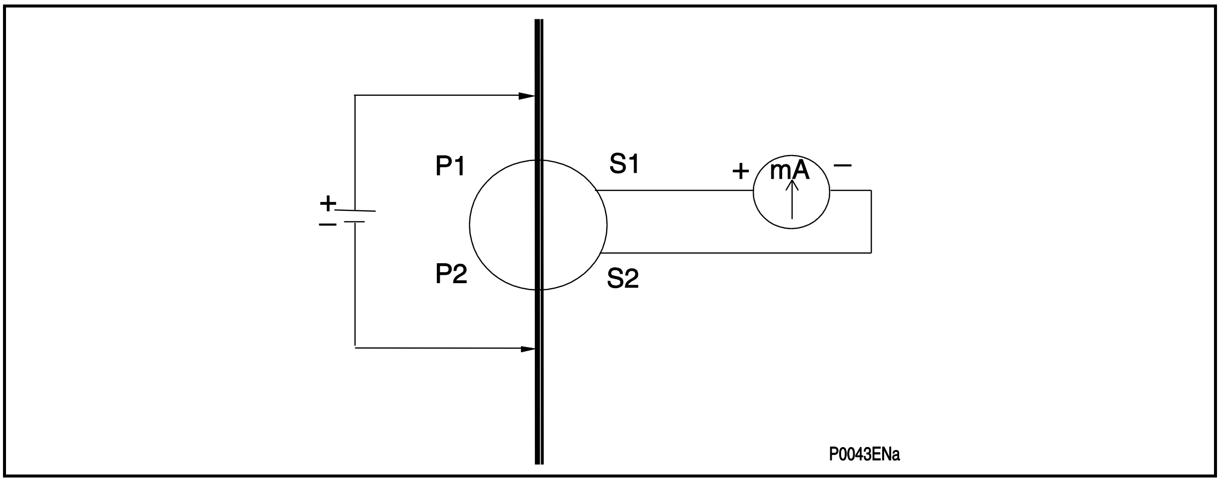
SCREEN SHIELDS AND CT CORE

3.6.2 Core CT polarity

It is necessary to check the polarity of the core CT by following the figure below:

Momentarily connect the battery + to P1 and – to P2. The centre zero ammeter connected with + to S1 and – to S2 will deflect in the positive direction if the wiring is correct.

The phase CT may be tested using the same method.



CORE CT ORIENTATION TEST

NOTE: De-magnetise the CT after polarity test. Inject an ac current starting from zero and increase to slowly exceed the CT nominal value and then decrease slowly to zero.

3.7 Auxiliary supply

Check the value of the auxiliary supply voltage (terminals 33 and 34). The value measured shall be between 0.8 and 1.2 times the nominal auxiliary supply voltage indicated on the **MiCOM P125, P126** and **P127**.

You can read the Uaux range of the relay under the flap on the top of front relay.

Uaux range (Volts)	Uaux nominal zone (Volts)	Maximum peak value (Volts)
24 - 60 Vdc	19 - 72 Vdc	80
48 - 250 Vdc/48 - 250 Vac	38 - 300 Vdc/38 - 275 Vac	336

3.8 Logic inputs

This test checks that all the opto-isolated inputs are functioning correctly. The P125 has 4 (+5 optional) opto-isolated inputs while P126 and P127 have 7 logic opto-isolated inputs.

The opto inputs should be energised a time. The status of the input can be viewed using menu OP. PARAMETERS/Input Status, a 1 indicating an energised input and a 0 indicating a de-energised input. When each logic input is energised one of the characters on the bottom line of the menu display will change to the value show in the following table to indicate the new state of the inputs.

Input	MiCOM P12x models	OP. PARAMETERS/Inputs Satuts. cell value
Opto input 1 22-24 Terminals	P125, P126, P127	7654321 0000001
Opto input 2 26-28 Terminals	P125, P126, P127	7654321 0000010
Opto input 3 17-19 Terminals	P125, P126, P127	7654321 0000100
Opto input 4 21-23 Terminals	P125, P126, P127	7654321 0001000
Opto input 5 25-27 Terminals	P126, P127	7654321 0010000
Opto input 6 58-60 Terminals	P126, P127	7654321 0100000
Opto input 7 57-59 Terminals	P126, P127	7654321 1000000
Opto input 8 61-62 terminals	P127 (1)	CBA98 00001
Opto input 9 64-62 terminals	P127 (1)	CBA98 00010
Opto input 10 63-62 terminals	P127 (1)	CBA98 00100
Opto input 11 66-62 terminals	P127 (1)	CBA98 01000
Opto input 12 65-62 terminals	P127 (1)	CBA98 10000

(1) Available only for P127 “5 opto-inputs” option (product codes P127xx1 or P127xx3). “Input COM – terminal” 62 is the common terminal for inputs 8 to 12.

3.9 Logic outputs

This test checks that all output relays are functioning correctly. The P126 and P127 relays have 8 outputs, P125 relay has 6 outputs.

The watch dog relay is always on. In case of relay failure the watch dog relay moves to the off and the terminals 35-36 are opened.

The status of the outputs can be viewed using menu OP. PARAMETERS/ Relay Status, an indicating 1 means relay supplied and a 0 indicating means relay non-supplied. When each output relay is closed one of the characters on the bottom line of the menu display will change to the value show in the following table to indicate the new state of the output relays.

Each output contact may have its own and independent power supply (refer to wiring schemes).

OUTPUT RELAYS	MiCOM P125 range	OP. PARAMETERS/Relay Status. cell value
WD Relay Terminals 35-37	P125, P126 and P127	Normal close
RL 1 Change over type. Terminals: 2 Common -4 NC-6 NO	P125, P126 and P127	00000001
RL 2 Change over type. Terminals: 8 Common -10 NC-12 NO	P125, P126 and P127	00000010
RL 3 Terminals 14-16	P125, P126 and P127	00000100
RL 4 Terminals 18-20	P125, P126 and P127	00001000
RL 5 Terminals 1-3	P125, P126 and P127	00010000
RL 6 Terminals 7-8	P125, P126 and P127	00100000
RL 7 Terminals 9-11	P126 and P127	01000000
RL 8 Terminals 13-15	P126 and P127	10000000

3.10 RS 485 rear communication

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communication protocol being adopted (refer to label under the upper flap).

It is not the intention of the test to verify the operation of the complete system from the relay to the remote location, just the relay's rear communication port and any protocol converter necessary.

Connect a laptop PC to the RS485 rear port (first or second port when present) and check the communication with the appropriate command.

4. SETTING CHECK

The setting checks must ensure that all relay settings have been correctly applied to the relay for the specific application.

Transfer the setting file to the relay using a laptop PC running the appropriate software via the RS232 front port or the RS485 rear port.

This is the preferred setting transfer method, because it is faster and there are fewer margins for errors.

If the setting software is not used, the relay settings must be checked manually via the relay front panel interface.

The commissioning checks are as follows:

1. Settings verify and delivery to customer
2. Validation of the measurements
3. Validation of the thresholds and associated timers.

4.1 Settings

Log the settings on the commissioning test sheets.

4.2 Measurements

The MiCOM P125 P126 P127 relays measure phase and earth currents, phase (phase to phase) voltage, zero sequence voltage as a True RMS value up to the 10^{th} harmonics. The value(s) indicated take account of the phase and/or earth CT ratio and VT ratio.

WARNING: MiCOM P125 P126 P127 RELAYS HAVE 1 AND 5 A CURRENT INPUTS, AND 57 –130V OR 220 – 480V VOLTAGE INPUT.
CHECK THAT THE INJECTED CURRENT AND VOLTAGE ARE COMPATIBLE WITH THE SELECTED RANGE.

4.2.1 MiCOM P125

- Note the CT and neutral VT ratio.
- Energise the MiCOM P125 relay.
- Apply current to input terminals 55-56 (Ien=1A) or 47-48 (Ien=5A) and verify the IN value shown on the LCD taking in account the relevant nominal current.
- Apply earth voltage to 39-40 terminals and verify in measurements menu the UN value shown on LCD.
- Log the results to the Commissioning test sheets (Applied value and relay value displayed).

4.2.2 MiCOM P126

- Note the select phase and earth CTs ratio and neutral VT ratio.
- Energise the MiCOM P126 relay.
- Apply current to input terminals 49-50 (In=1A) or 41-42 (In=5A) and verify the IA value shown on the LCD.
- Apply current to input terminals 51-52 (In=1A) or 43-44 (In=5A) and verify the IB value shown on the LCD.
- Apply current to input terminals 53-54 (In=1A) or 45-46 (In=5A) and verify the IC value shown on the LCD.
- Apply current to input terminals 55-56 (Ien=1A) or 47-48 (Ien=5A) and verify the IN values on the LCD in relay measurement menu.
- Apply earth voltage to 73-74 terminals and verify the UN values on the LCD in relay measurement menu.
- Log the results to the Commissioning test sheets (Applied values and relay values displayed).

4.2.3 MiCOM P127

- Configure the relay in CONFIGURATION-General Options item menu as: 2Vph-ph+Vr VT connection mode. (See User Guide, chapter P12y/EN FT, of this Technical Guide)
- Note the select phase and earth CTs ratio, phase voltage VTs ratio and neutral voltage VTs ratio.
- Energise the MiCOM P127 relay.
- Apply current to input terminals 49-50 (In=1A) or 41-42 (In=5A) and verify the IA value shown on the LCD.
- Apply current to input terminals 51-52 (In=1A) or 43-44 (In=5A) and verify the IB value shown on the LCD.
- Apply current to input terminals 53-54 (In=1A) or 45-46 (In=5A) and verify the IC value shown on the LCD.
- Apply current to input terminals 55-56 (Ien=1A) or 47-48 (Ien=5A) and verify the IN values on the LCD in relay measurement menu.
- Apply voltage to inputs terminals 69-70 and 71-72 and verify the UAB and UBC values in relay measurement menu on the LCD.
- Apply current to input terminals 55-56 (Ien=1A) or 47-48 (Ien=5A) and verify the IN value in relay measurement menu on the LCD.
- Apply voltage to inputs terminals 73-74 and verify the UN value in relay measurement menu on the LCD.

Log the results to the Commissioning test sheets (Applied values and relay values displayed).

4.3 Thresholds validation

This test type demonstrates that the relay is operating correctly at the application specific settings.

4.3.1 MiCOM settings

Set the following thresholds for the relay~~.~~

Applying the voltage and current to terminals as in wiring diagrams in chapter P12y/EN CO of this Technical Guide.

The applied current and voltage must be great than setting value.

4.3.1.1 MiCOM P125 Settings

Configuration Menu	
Transfo. Ratio	
E/Gnd CT primary	1 A
E/Gnd CT Sec	1 A
E/Gnd VT primary	0.100 kV
E/Gnd VT Sec	100.0 V
Protection Menu	
Ie>	Yes
Ie>	1 Ien
tIe>	DT or IDMT or RI
tIe> (if DT)	10 s
Curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)	1
K value (if RI)	1
Ue>>>>	10 V
tUe>>>>	10 s
Automation Menu	
TRIP tIe>	YES
TRIP tUe>>>>	YES

4.3.1.2 MiCOM P126 Settings

Configuration menu	
Transfo. Ratio	
Line CT primary	1 A
Line CT Sec	1 A
E/Gnd CT primary	1 A
E/Gnd CT Sec	1 A
E/Gnd VT primary	0.100 kV
E/Gnd VT Sec	100.0 V
Protection Menu G1	
I>	Yes
I>	1 In
tI>	DT or IDMT or RI
tI>	(if DT) 10 s
Curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)	1
K value (if RI)	1
Ie>	Yes
Ie>	1 In
tIe>	DT or IDMT or RI
tIe> (if DT)	20 s
Curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)1	K value (if RI)1
Ue>>>>	10V
tUe>>>>	10 s
Automation Menu	
TRIP tI>	YES
TRIP tIe>	YES
TRIP tUe>>>>	YES

4.3.1.3 MiCOM P127 settings

CONFIGURATION	
General Options	
2Vpp+Vr	
Transfo. Ratio	
Line CT primary	1 A
Line CT Sec	1 A
E/Gnd CT primary	1 A
E/Gnd CT Sec	1 A
Line VT primary	0.100 kV
Line VT Sec	100.0 V
E/Gnd VT primary	0.100 kV
E/Gnd VT Sec	100.0 V
Protection Menu G1	
I>	Yes
I>	1 In
tI>	DT or IDMT or RI
tI> (if DT)	10 s
Curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)	1
K value (if RI)	1
U>	Yes
U>	20V
tU>	10 s
Ie>	Yes
Ie>	1 In
tIe>	DT or IDMT or RI
tIe> (if DT)	20 s
Curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)1	K value (if RI)=1
Ue>>>>	10 V
tUe>>>>	10 s
Automation Menu	
TRIP tI>	YES
TRIP tU>	YES
TRIP tIe>	YES
TRIP Ue>>>>	YES

4.3.2 Earth current and neutral voltage test

This test can be executed on the P125, P126 and P127 relay and the operating sequence is the same for all three relays.

After the setting is completed connect the relay using the wiring diagram in chapter P12y/EN CO.

4.3.2.1 Earth fault overcurrent and residual over voltage test.

Delay type: Definite time

Used thresholds for this test:

- Ie>, tIe>, Ue >>>>, tUe>>>>.
- Supply the relay, inject current and voltage with magnitude greater then Ie> and Ue>>>> setting value.
- If the time delay tIe> is short, gradually increases injection current up to the value of the Ie> threshold.
- If the time delay tIe> is long, inject 0.95 x I threshold and check that there is no tripping. Then inject 1,1 x Ie threshold and check the trip.
- Gradually decreases the injected current and record the value of the drop out Ie> threshold.
- The same procedure above for Ue>>>>.
- Checks:
- Alarm message on the LCD display.
- Alarm LED flashes.
- Trip LED on
- Ie>, Ue>>>> threshold LED on (if programmed).
- Trip output closes.
- Ie>, Ue>>>> threshold output closes (if programmed).

Delay type: Inverse time (IDMT)

Used thresholds for this test:

- Ie>, tIe>
- Supply the relay inject a current equal to 2 x Ie> threshold into one of the earth current inputs. Repeat the operation for various current values (n x Ie threshold with n ranging from 4 to 10, for example). Check that the values measured correspond to those indicated in the table below (for TMS=1).

IEC curves

Type of curve	Tripping time (in seconds) for TMS =1			
IEC	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
STI	1.78	1.62 - 1.98	0.5	0.45 - 0.55
SI	10.1	9.1 - 11.1	3	2.7 - 3.3
VI	13.5	12.2 - 14.9	1.5	1.35 - 1.65
EI	26.7	24 - 29.5	0.8	0.72 - 0.88
LTI	120	108 - 132	13.3	12 - 14.6

IEEE/ANSI curves

Type of curve	Tripping time (in seconds) for TMS =1			
IEEE/ANSI	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
STI	0.25	0.22 - 0.28	0.08	0.07- 0.09
MI	3.8	3.4 - 4.2	1.2	1.08 - 1.32
I	2.2	1.9 - 2.4	0.3	0.27 - 0.33
VI	7.2	6.5 - 8	0.7	0.63 - 0.77
EI	9.5	8.5 - 10.5	0.4	0.36 - 0.44

Checks:

- Ie> Alarm message on the LCD display.
- Alarm LED flashes.
- Trip LED on
- Ie> threshold LED on (if programmed).
- Trip output closes.
- Ie> threshold output closes (if programmed).

4.3.2.2 Phase overcurrent I> threshold test (P126 & P127)

Phase overcurrent threshold check:

- If the time delay tI> is short, gradually increase the injection current up to the value of the I> threshold.
- If the time delay tI> is long, inject 0.95 x I threshold and check that there is no tripping. Then inject 1,1 x I threshold and check the trip.
- Gradually decrease the injected current and record the value of the drop out off (I> threshold).

Checks:

- Alarm message on the LCD display.
- Alarm LED flashes.
- Trip LED on
- I> threshold LED on (if programmed).
- Trip output closes.
- I> threshold output closes (if programmed).

Delay type: Definite time tI>

- Apply a current into one of the phases and measure the time delay tI> by pre-setting the current above the I> threshold (I injected > 2 x I threshold).
- Apply a current onto one of the phases and measure the time delay tI> by pre-setting the current above the I> threshold (I injected > 10 x I threshold).

Checks:

- Alarm message on the LCD display for I> after that the setting trip delay time is expired.
- Alarm LED flashes > after that the setting trip delay time is expired.
- Trip LED on after that the setting trip delay time is expired.
- I> threshold LED on (if programmed) > after that the setting trip delay time is expired.
- Trip output closes > after that the setting trip delay time is expired..
- I> threshold output closes (if programmed) > after that the setting trip delay time is expired.

Delay type: Inverse time (IDMT)

Used threshold for this test:

- I>, tI>
- Supply the relay, inject a current equal to 2 x I> threshold into one of the earth current inputs. Repeat the operation for various current values (n x Ie threshold with n ranging from 4 to 10, for example). Check that the values measured correspond to those indicated in the table below (for TMS=1).

IEC curves

Type of curve	Tripping time (in seconds) for TMS =1			
IEC	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
STI	1.78	1.62 - 1.98	0.5	0.45 - 0.55
SI	10.1	9.1 - 11.1	3	2.7 - 3.3
VI	13.5	12.2 - 14.9	1.5	1.35 - 1.65
EI	26.7	24 - 29.5	0.8	0.72 - 0.88
LTI	120	108 - 132	13.3	12 - 14.6

IEEE/ANSI curves

Type of curve	Tripping time (in seconds) for TMS =1			
IEEE/ANSI	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
STI	0.25	0.22 - 0.28	0.08	0.07- 0.09
MI	3.8	3.4 - 4.2	1.2	1.08 - 1.32
I	2.2	1.9 - 2.4	0.3	0.27 - 0.33
VI	7.2	6.5 - 8	0.7	0.63 - 0.77
EI	9.5	8.5 - 10.5	0.4	0.36 - 0.44

RI electromechanical curve

Type of curve	Tripping time (in seconds) for K =1			
Electromechanical	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
RI	4.5	4 - 5	3.2	2.8 - 3.6

For other injected current values, compare the values found with the theoretical values calculated according to the formula of the curves.

NOTE: Equations of IEC, IEEE/ANSI and RI curves are given in chapter P12y/EN TD of this Technical Guide.

Checks:

- I> Alarm message on the LCD display.
- Alarm LED flashes.
- Trip LED on
- I> threshold LED on (if programmed).
- Trip output closes.
- I> threshold output closes (if programmed).

4.3.2.3 Phase to phase (phase to neutral) over-voltage U> threshold (P127)

Phase overcurrent threshold check:

- If tU> time delay is short, gradually raise the injection voltage up to the value of U> threshold.
- If U> time delay is long, inject 0.95 x U> threshold setting and check there is no trip. Then inject 1.1 x U> threshold setting and check the trip output is close.
- Gradually lower the injected current and note the value of the drop out U> threshold.

Checks:

- Alarm message on the LCD display for U> after that the setting trip delay time is expired.
- Alarm LED flashes after that the setting trip delay time is expired.
- Trip LED on, after that the setting trip delay time is expired.
- U> threshold LED on (if programmed) > after that the setting trip delay time is expired.
- Trip output closes U> after that the setting trip delay time is expired..
- U> threshold output closes (if programmed) after that the setting trip delay time is expired.

4.4 Final checks

1. Remove all test or temporary shorting leads, etc… If it is necessary to disconnect any of the external wiring from the relay in order to perform the wiring verification tests, it should be ensured that all connections are replace in accordance with the relevant external connection or scheme diagram.
2. If a MMLG test block is installed, remove the MMLB01 test plug and replace the MMLG cover so that the protection is put into service.
3. For MiCOM P126 and P127 models, ensure that all event, fault and disturbance records, alarm and LEDs have been reset before leaving the relay.
4. If the relays are in a new installation or the circuit breaker has been just maintained, the circuit breaker maintenance and current counters should be zero. These counters (only P126 & P127) have to be reset using relevant command in RECORD/CB Monitoring menu (refer to User Guide).

5. MAINTENANCE

5.1 Equipment failure

MiCOM P125, P126 and **P127** relays are full digital and permanent self-diagnosing. Any failure of software or hardware elements is instantly detected. As soon as an internal fault is detected, depending on its type (minor or major), an alarm message is displayed as a priority on the front panel LCD before the fault LED is illuminated (fixed or flashing) and the watchdog relay is closed (if the fault is a major one).

The watchdog facility provides two output relay contacts, one normally open and one normally closed that are driven by the processor board. These are provided to give an indication that the relay is in a healthy state.

An equipment failure (major or minor) cannot be acknowledged on the front panel (using the dedicated tactile button keypad). Only the disappearance of the cause will acknowledge the fault and hence reset the fault LED.

5.1.1 Minor fault

Regarded by the **MiCOM P125, P126** and **P127** relays as a minor fault is a communication failure. If the communication is in fault, **MiCOM P125, P126** and **P127** protection and automation modules are not affected.

Message:

"COMM.ERROR": Communication fault

Cause:

Hardware or software failure of the communication module

Action:

Withdraw the active part and return it to the factory for repair.

Alternative:

If communication is not used, disable communication in the COMMUNICATION menu (Communication ? = No).

5.1.2 Major fault

Major fault for **MiCOM P125, P126** and **P127** relays are all software and hardware failures except the communication faults. As soon as this type of failure is detected, the watchdog (WD) is closed and all operations are stopped (protection, automation, communication).

5.1.3 Hardware and software faults

Messages:

"DEFAULT SETTING": Indication that the relay is running with default setting

"SETTING ERROR": Failure in the setting

" CALIBRATION ERROR.": Calibration zone failure

"CT ERROR": Analogue channel failure

Cause:

Hardware or software failure

Action:

Restart the protection software.
If the software fault still remain after restart, withdraw the active part and return the module to the factory for repair.

5.2 Method of repair

5.2.1 Replacing the active part

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/E11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTIONS OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

The case and the rear terminals blocks have been designed to facilitate removal of the MiCOM P12x relay should replacement or repair become necessary without disconnect the scheme wiring.

NOTE: The MiCOM relays have integral current transformer shorting switches which will close when the active part is removed from the case.

Remove the upper and lower flap without exerting excessive force. Remove the external screws. Under the upper flap, turn the extractor with a 3 mm screwdriver and extract the active part of the relay by pulling from the upper and lower notches on the front panel of the MiCOM relay.

The reinstall the repaired or replacement relay follow the above instruction in reverse, ensuring that no modification has been done on the scheme wiring.

5.2.2 Replacing the complete relay

To remove the complete relay (active part and case) the entire wiring must be removed from the rear connector.

Before working at the rear of the relay, isolate all current supplies to the MiCOM relay and ensure that the relay is no more powered.

DANGER: NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

Remove all wiring (communication, logic inputs, outputs, auxiliary voltage, current inputs). Disconnect the relay earth connection from the rear of the relay.

Remove the screws used to fasten the relay to the panel, rack, etc… .These are the screws with the larger diameter heads that are accessible when the upper and lower flaps are open.

Withdraw the relay from the panel, rack, etc… carefully because it will be heavy due to the internal transformers.

To reinstall the repaired or replacement relay follow the above instructions in reverse, ensuring that each terminal block is relocated in the correct position and case earth, communication are replaced.

Once reinstallation is complete the relay should be recommissioned using the instruction in sections 1 to 4 inclusive of this chapter.

5.3 Problem solving

5.3.1 Password lost or not accepted

Problem:

Password lost or not accepted

Cause:

MiCOM P125, P126 and **P127** relays are supplied with the password set to **AAAA.** This password can be changed by the user (refer OP PARAMETERS menu).

Action:

There is an additional unique recovery password associated to the relay which can be supplied by the factory or service agent, if given details of its serial number (under the upper flap of the front panel). With this serial number, contact your Schneider Electric local dealer or Schneider Electric Customer Care Center.

5.3.2 Communication

5.3.2.1 Values measured locally and remotely

Problem:

The measurements noted remotely and locally (via RS485 communication) differ.

Cause:

The values accessible on the front face via the Measurement menu are refreshed every second. Those fed back via the communication and accessible by the Schneider Electric Setting software generally have skeletal refreshing frequencies. If the refreshing frequency of the supervision software differs from that **of MiCOM P125, P126** and **P127** relays (1s), there may be a difference between indicated values.

Action:

Adjust the frequency for refreshing the measurements of the supervision software or of the setting software to 1 second.

5.3.2.2 MiCOM relay no longer responds

Problem:

No response from **MiCOM P125, P126** and **P127** relays when asked by the supervision software without any communication fault message.

Cause:

Mainly, this type of problem is linked to an error in the **MiCOM P125, P126** and **P127** communication parameters.

Action:

Check **MiCOM P125, P126** and **P127** communication parameters (data rate, parity, etc.) are in accordance with the supervision settings.

Check **MiCOM P125, P126** and **P127** network address.

Check that this address is not used by another device connected on the same LAN.

Check that the other devices on the same LAN answer to supervision requests.

5.3.2.3 A remote command is not taken in account

Problem:

The communication between the relay and the PC is correct, but the relay does not accept any remote command or file downloading.

Cause:

Generally this is due to the fact that the relay is in programming situation. This means that the password is active.

Action:

Check that the password is not active in the relay since the last 5 minutes.

CONNECTIONS AND WIRING DIAGRAMS

CONTENT

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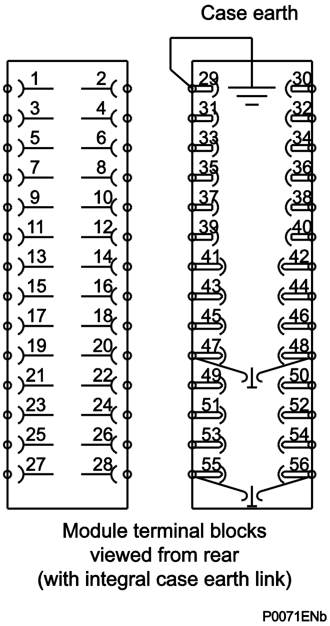
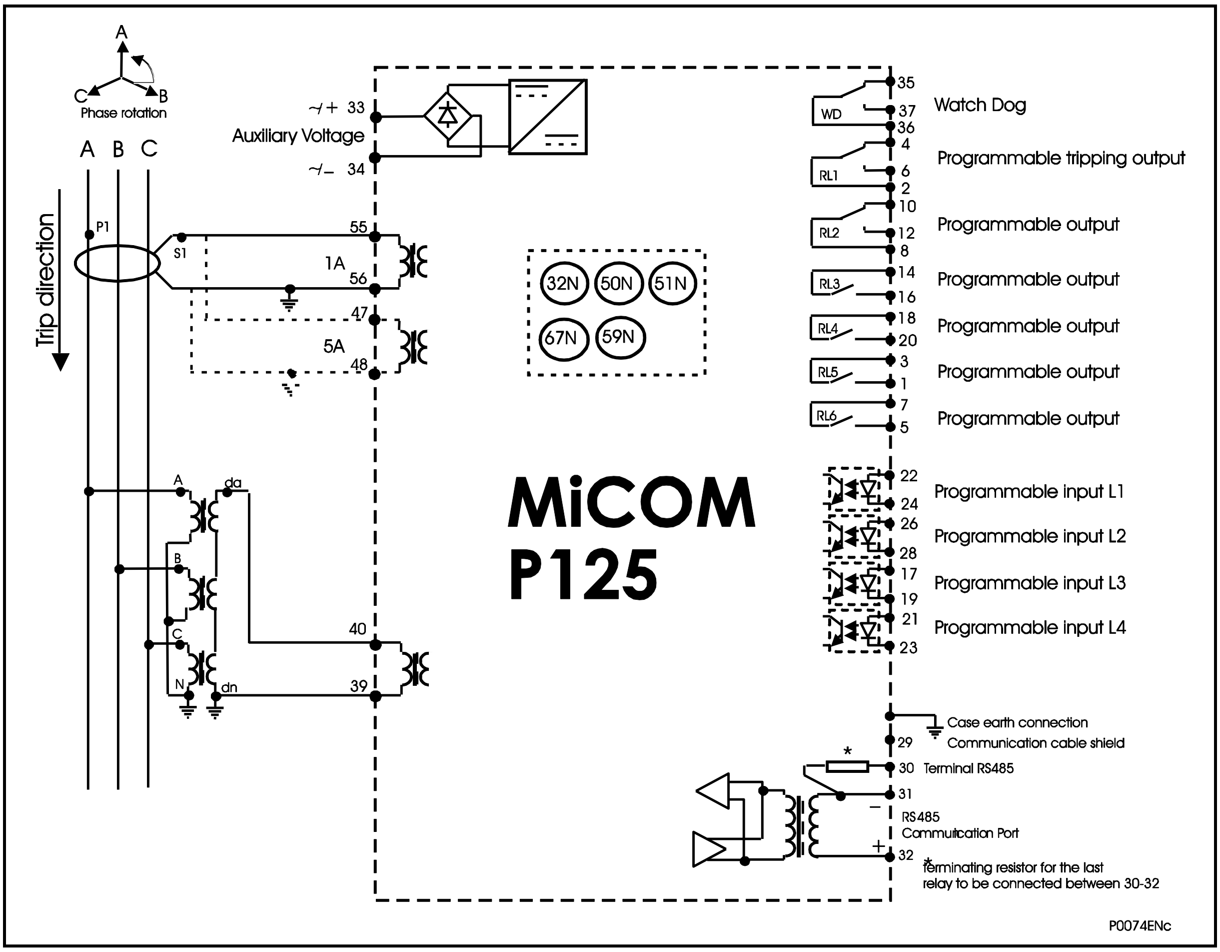
1. P125 REAR DESCRIPTION



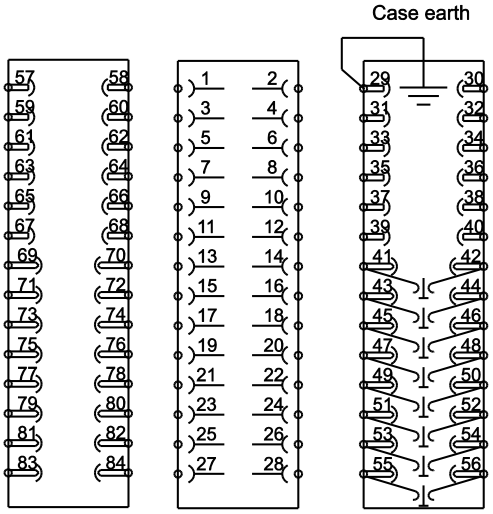
Output 5	**1**	**2**	Common output 1	Case earth connection	**29**	**30**	Terminal RS485
Common output 5	**3**	**4**	Output 1 (NC)	RS485 -	**31**	**32**	RS485 +
Output 6	**5**	**6**	Output1 (NO)	Vaux +	**33**	**34**	Vaux –
Common output 6	**7**	**8**	Common output 2	Relay faulty	**35**	**36**	Common "Watchdog"
	9	**10**	Output 2 (NC)	Relay healthy	**37**	**38**	
	11	**12**	Output 2 (NO)	Residual volt. Input -	**39**	**40**	Residual volt. Input +
	13	**14**	Output 3		**41**	**42**	
	15	**16**	Common output 3		**43**	**44**	
Input3 +	**17**	**18**	Output 4		**45**	**46**	
Input3 –	**19**	**20**	Common output 4	Current input (5A)	**47**	**48**	Current input (5A)
Input4 +	**21**	**22**	Input1 +		**49**	**50**	
Input4 –	**23**	**24**	Input1 –		**51**	**52**	
	25	**26**	Input2 +		**53**	**54**	
	27	**28**	Input2 –	Current input (1A)	**55**	**56**	Current input (1A)

1.1 P125 wiring diagram

Scheme shows output relays off



2. P126 REAR DESCRIPTION



Module terminal blocks
viewed from rear
(with integral case earth link)

P0072ENb

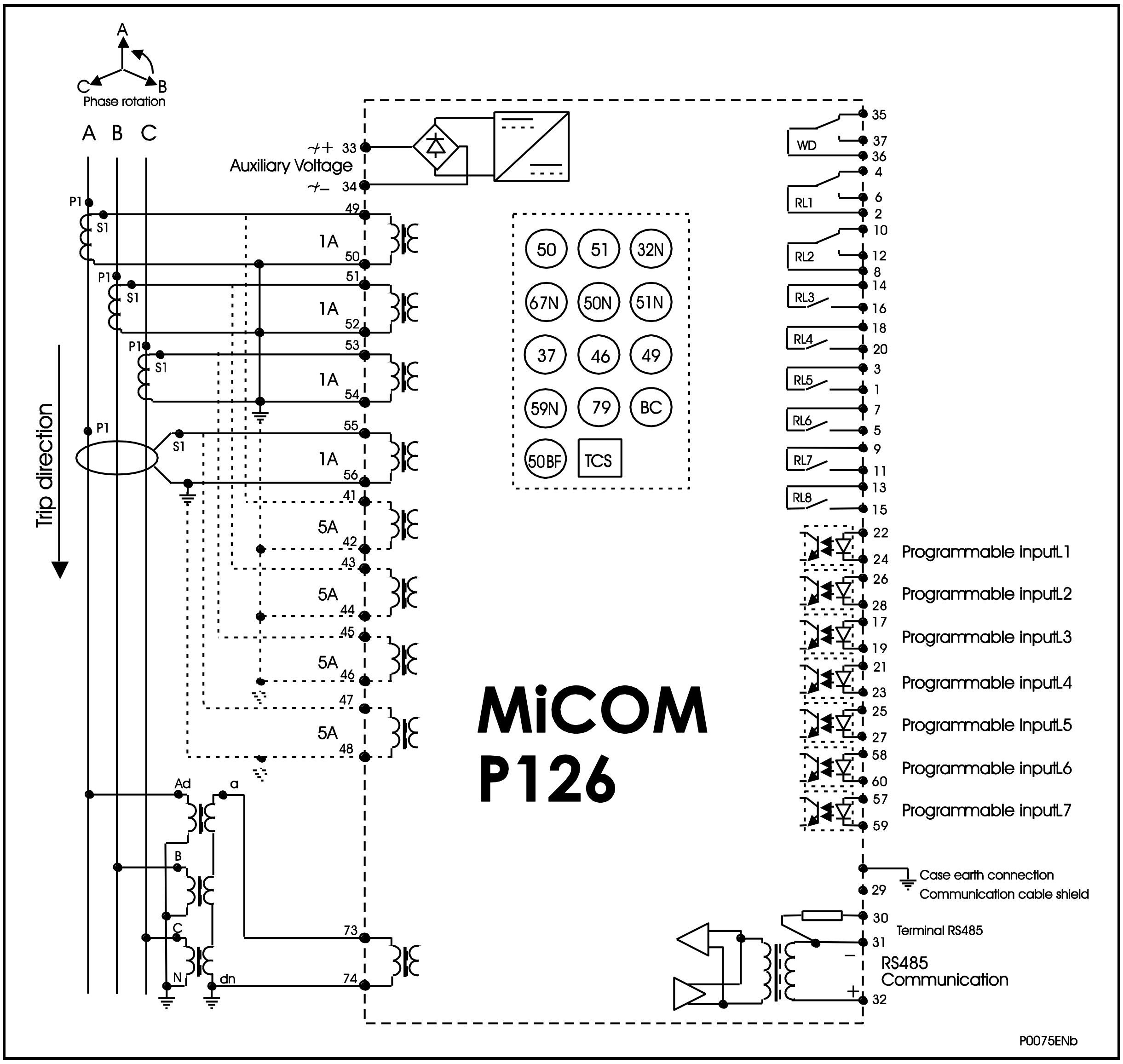
Input 7 +	**57**	**58**	Input 6 +
Input 7 –	**59**	**60**	Input 6 –
	61	**62**	
	63	**64**	
	65	**66**	
	67	**68**	
Voltage input VA	**69**	**70**	Voltage input VA
Voltage input VB	**71**	**72**	Voltage input VB
Voltage input VC/Vr	**73**	**74**	Voltage input VC/Vr
	75	**76**	
	77	**78**	
	79	**80**	
	81	**82**	
	83	**84**	

Output 5	**1**	**2**	Common output 1
Common output 5	**3**	**4**	Output 1 (NC)
Output 6	**5**	**6**	Output1 (NO)
Common output 6	**7**	**8**	Common output 2
Common output 7	**9**	**10**	Output 2 (NC)
Output 7	**11**	**12**	Output 2 (NO)
Common output 8	**13**	**14**	Output 3
Output 8	**15**	**16**	Common output 3
Input 3 +	**17**	**18**	Output 4
Input 3 –	**19**	**20**	Common output 4
Input 4 +	**21**	**22**	Input 1 +
Input 4 –	**23**	**24**	Input 1 –
Input 5 +	**25**	**26**	Input 2 +
Input 5 –	**27**	**28**	Input 2 –

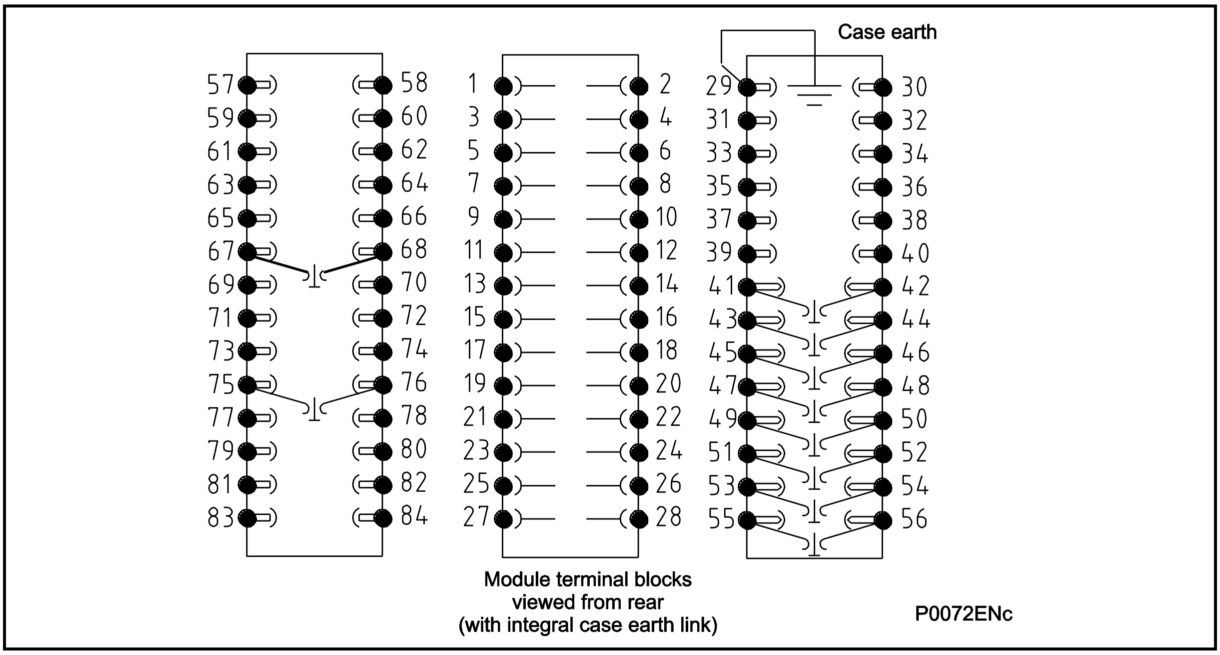
Case earth connection	**29**	**30**	Terminal RS485
RS485 -	**31**	**32**	RS485+
Vaux +	**33**	**34**	Vaux –
Relay failed	**35**	**36**	Common "Watchdog"
Relay healthy	**37**	**38**	
	39	**40**	
Current input IA (5A)	**41**	**42**	Current input IA (5A)
Current input IB (5A)	**43**	**44**	Current input IB (5A)
Current input IC(5A)	**45**	**46**	Current input IC(5A)
Current input Ie (5A)	**47**	**48**	Current input Ie(5A)
Current input IA (1A)	**49**	**50**	Current input IA (1A)
Current input IB (1A)	**51**	**52**	Current input IB (1A)
Current input IC(1A)	**53**	**54**	Current input IC(1A)
Current input Ie (1A)	**55**	**56**	Current input Ie(1A)

2.1 P126 wiring diagram

Scheme represents relays off



3. P127 REAR DESCRIPTION



Input 7 +	**57**	**58**	Input 6 +
Input 7 –	**59**	**60**	Input 6 –
Input 8 + terminal [(1)]	**61**	**62**	Input COM – terminal [(1)]
Input A + terminal [(1)]	**63**	**64**	Input 9 + terminal [(1)]
Input C + terminal [(1)]	**65**	**66**	Input B + terminal [(1)]
Current I1 [(3)] meas. 1A/5A	**67**	**68**	Current I1 [(3)] meas. 1A/5A
Voltage input VA	**69**	**70**	Voltage input VA
Voltage input VB	**71**	**72**	Voltage input VB
Voltage input VC/Vr	**73**	**74**	Voltage input VC/Vr
Current I2 [(3)] meas. 1A/5A	**75**	**76**	Current I2 [(3)] meas. 1A/5A
Case earth connection(2	**77**	**78**	RS485-2 term. Z [(2)]
RS485-2 – terminal [(2)]	**79**	**80**	RS485-2 + terminal [(2)]
IRIG-B mod – terminal [(2)]	**81**	**82**	IRIG-B mod + terminal [(2)]
IRIG-B dem – terminal [(2)]	**83**	**84**	IRIG-B dem – terminal [(2)]

Output 5	**1**	**2**	Common output 1
Common output 5	**3**	**4**	Output 1 (NC)
Output 6	**5**	**6**	Output1 (NO)
Common output 6	**7**	**8**	Common output 2
Common output 7	**9**	**10**	Output 2 (NC)
Output 7	**11**	**12**	Output 2 (NO)
Common output 8	**13**	**14**	Output 3
Output 8	**15**	**16**	Common output 3
Input 3 +	**17**	**18**	Output 4
Input 3 –	**19**	**20**	Common output 4
Input 4 +	**21**	**22**	Input 1 +
Input 4 –	**23**	**24**	Input 1 –
Input 5 +	**25**	**26**	Input 2 +
Input 5 –	**27**	**28**	Input 2 –

Case earth connection	**29**	**30**	Terminal RS485
RS485 -	**31**	**32**	RS485+
Vaux +	**33**	**34**	Vaux –
Relay failed	**35**	**36**	Common "Watchdog"
Relay healthy	**37**	**38**	
	39	**40**	
Current input IA (5A)	**41**	**42**	Current input IA (5A)
Current input IB (5A)	**43**	**44**	Current input IB (5A)
Current input IC(5A)	**45**	**46**	Current input IC(5A)
Current input Ie (5A)	**47**	**48**	Current input Ie(5A)
Current input IA (1A)	**49**	**50**	Current input IA (1A)
Current input IB (1A)	**51**	**52**	Current input IB (1A)
Current input IC(1A)	**53**	**54**	Current input IC(1A)
Current input Ie (1A)	**55**	**56**	Current input Ie(1A)

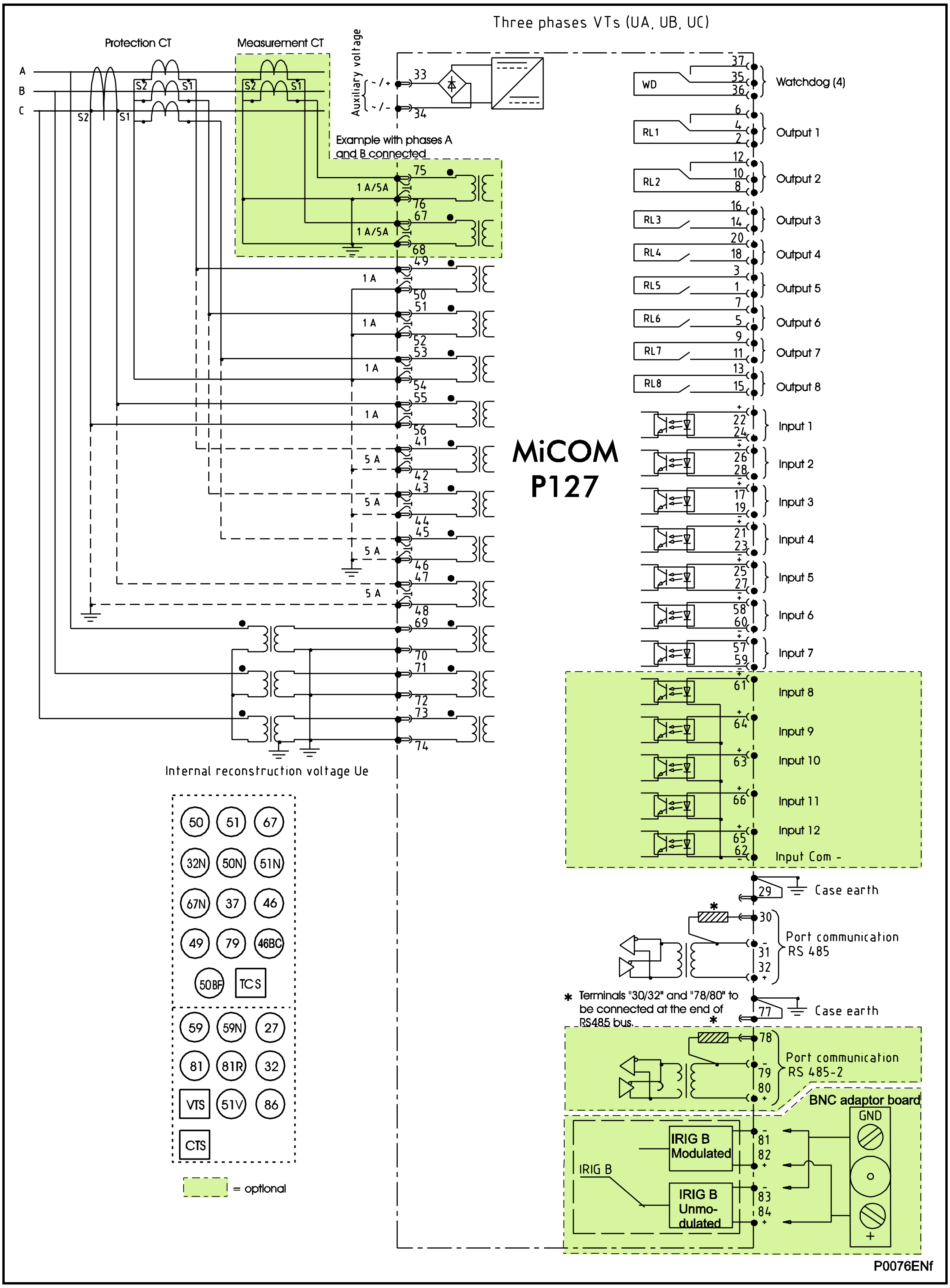
[(1)] Available only for P127 “5 opto-inputs” option (product codes P127xx1 or P127xx3). “Input COM – terminal” is the common terminal for inputs 8 to 12.

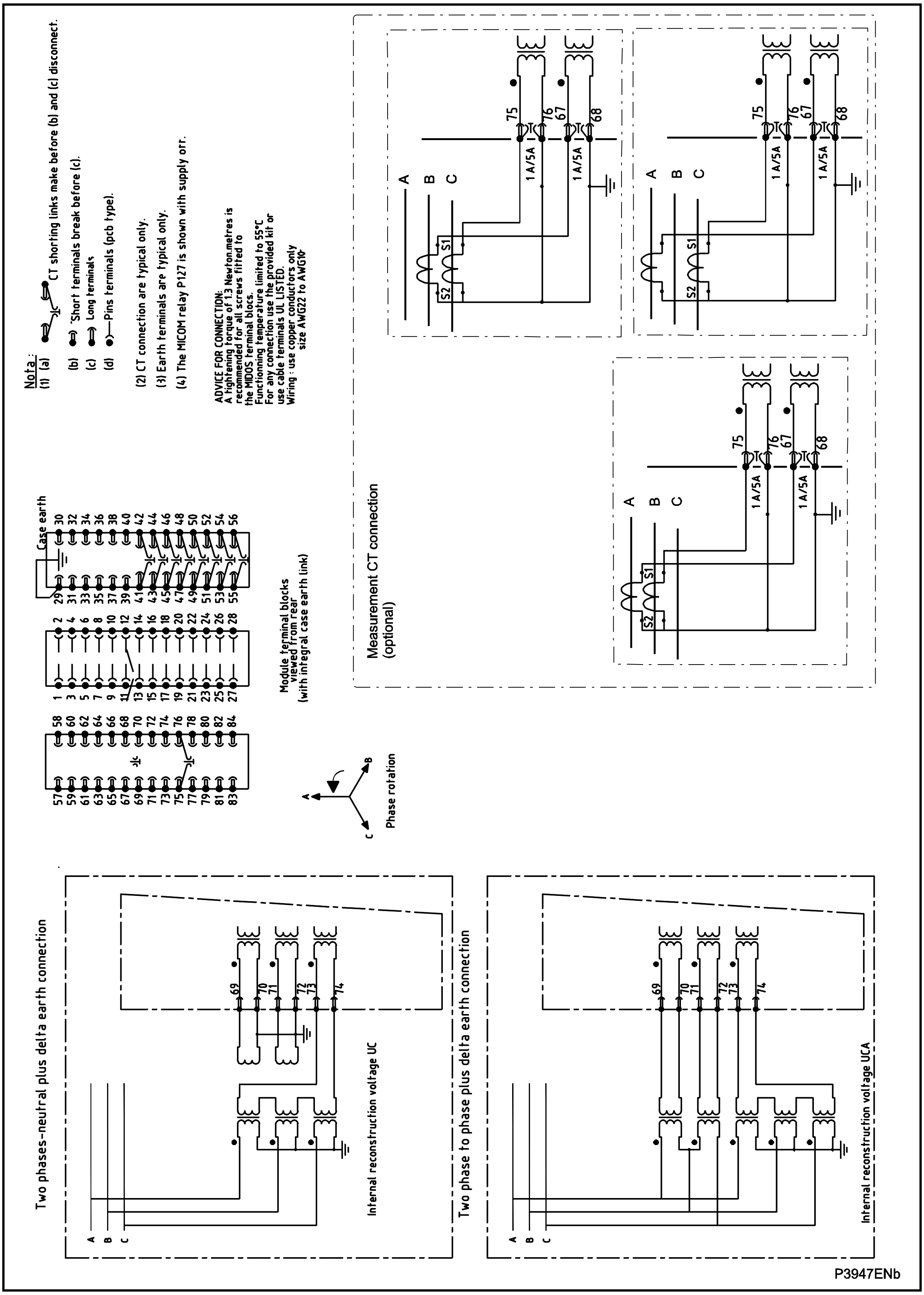
[(2)] Available only for P127 “IRIG-B and 2nd rear port option” option (product codes P127xx2 or P127xx3).
The “81” and “82” terminals are used to connect the optional BNC adaptor. This one must be plugged according to the “+” and “GND” positions marked on the adaptor.

[(3)] With I1 = IA or IB or IC and I2 = IA or IB or IC. Available only for P127 with additional measurement CT option (product codes P127xx4, P127xx5, P127xx6 or P127xx7).

3.1 P127 wiring diagram

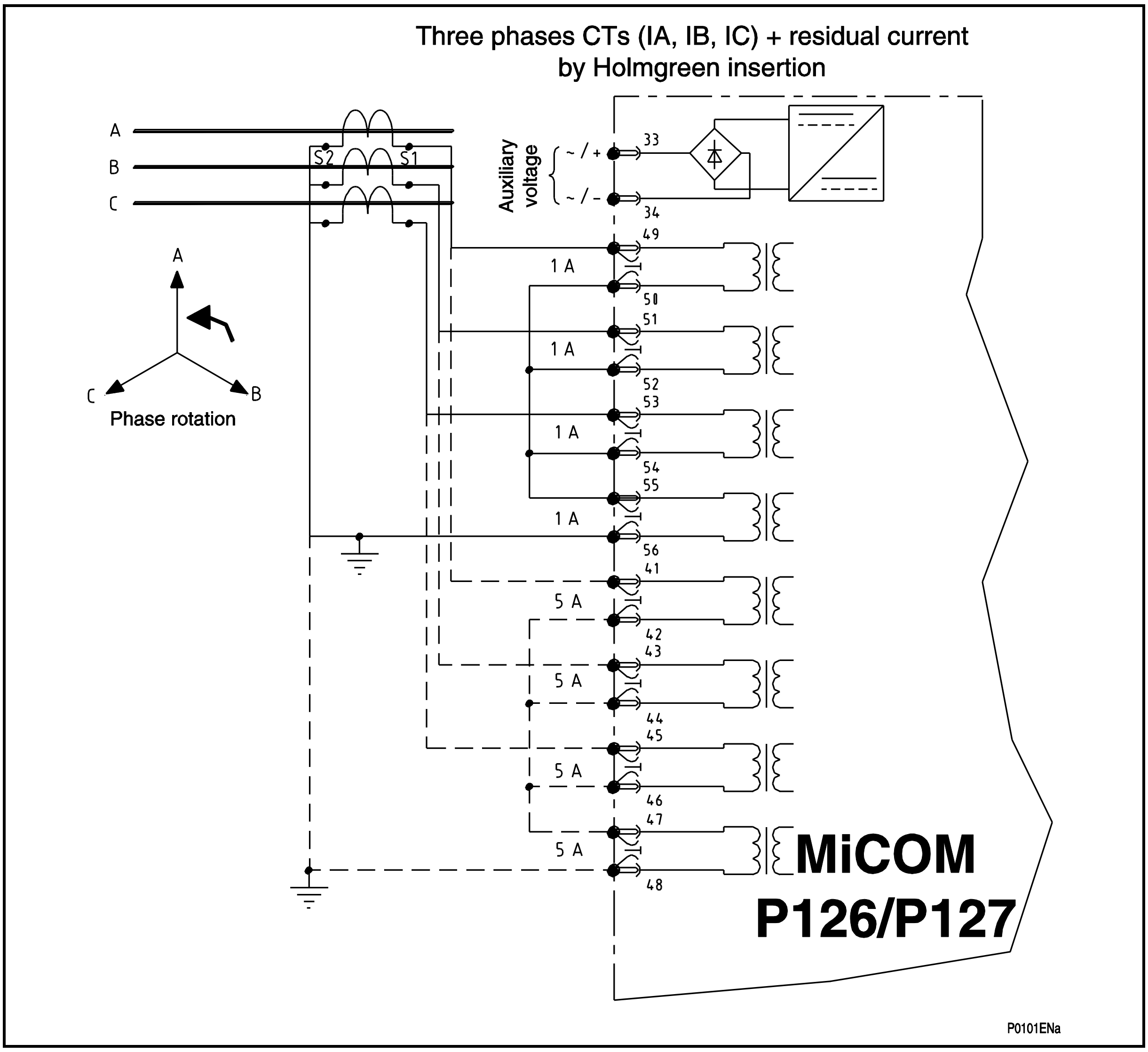
Scheme represents relays off



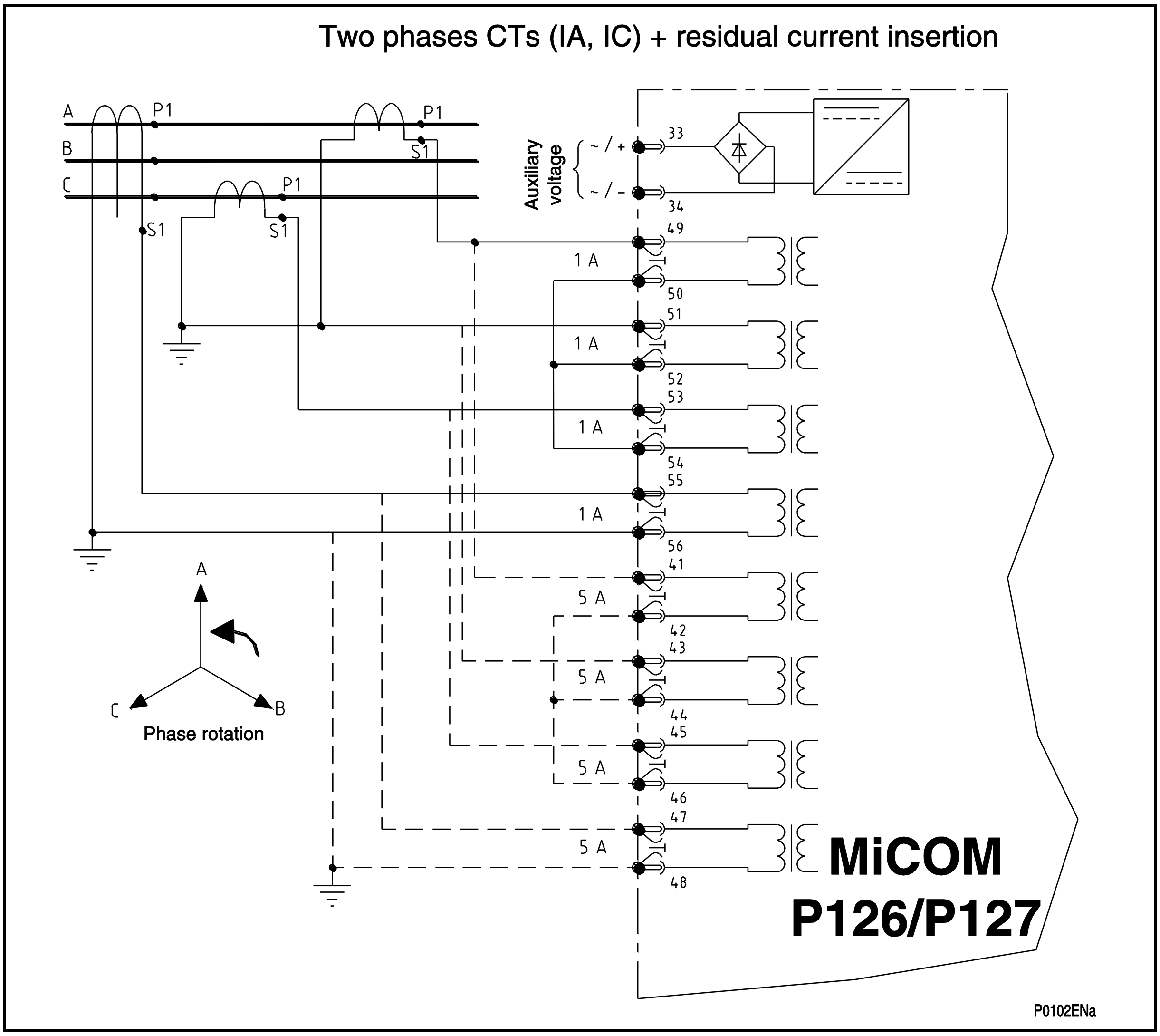

Nota :
(1) (a) CT shorting links make before (b) and (c) disconnect.
(b) Short terminals break before (c).
(c) Long terminals
(d) Pins terminals (pcb type).
(2) CT connection are typical only.
(3) Earth terminals are typical only.
(4) The MiCOM relay P127 is shown with supply off.
ADVICE FOR CONNECTION:
A tightening torque of 1.3 Newton.metres is recommended for all screws fitted to the MiDOS terminal blocks.
Functioning temperature limited to 55°C
For any connection use the provided kit or use cable terminals UL LISTED.
Wiring : use copper conductors only size AWG22 to AWG16
Case earth
Module terminal blocks viewed from rear (with integral case earth link)
Phase rotation
Measurement CT connection (optional)
1 A/5A
Two phases-neutral plus delta earth connection
Internal reconstruction voltage UC
Two phase to phase plus delta earth connection
Internal reconstruction voltage UCA
P3947ENb

4. P126 & P127 CURRENT INSERTION SCHEMES

4.1 P126 & P127 Holmgreen CT's insertion



4.2 P126 & P127 Two phases CT's insertion



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COMMISSIONING TEST AND RECORD SHEET

CONTENT

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1. COMMISSIONING TEST

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY GUIDE SFTY/4LM/D11 OR LATER ISSUE, OR THE SAFETY AND TECHNICAL DATA SECTION OF THE TECHNICAL MANUAL AND ALSO THE RATINGS ON THE EQUIPMENT RATING LABEL.

1.1 Relay identification

Commissioning date : ______________________

Engineer : ______________________

Substation : ______________________

Circuit : ______________________

Network nominal frequency: ______________________

MiCOM relay model: ❑ P125 ❑ P126 ❑ P127

Serial number: ______________________

Rated current In : ______________________

Rated current Ien : ______________________

Rated Voltage primary : ______________________

Rated Voltage secondary: ______________________

Auxiliary voltage Uaux : ______________________

Communication protocol : ______________________

Language : ______________________

1.2 Commissioning test record

(Put a cross after each checked stage)

Serial number check ? ☐

All current transformer shorting switches closed ? ☐

Wiring checked against diagram (if available)? ☐

Case earth installed ? ☐

Test block connections checked (if installed) ? ☐

Insulation tested ? ☐

1.3 Auxiliary supply control

Auxiliary voltage to relay ☐

Auxiliary voltage value _________Vdc/Vac

Watchdog contacts

With auxiliary supply off	Terminals 35 and 36	☐
With auxiliary supply on	Terminals 36 and 37	☐

1.4 Measurements and analogue inputs control

- Set the voltage wiring mode in CONFIGURATION/General options menu as 2Vpn+Vr
- Set in the configuration menu in the submenu Transfo Ratio as shown below.

Line CT primary	Line CT secondary	E/Gnd CT primary	E/Gnd CT Secondary	Line VT Primary	Line VT secondary	E/Gnd VT Primary	E/Gnd VT Secondary
1	1	1	1	0.10 kV	100V	0.10 kV	100V

Phase Applied Current	Measured value
Phase A: A	IA: A
Phase B: A	IB: A
Phase C: A	IC: A

Earth Current Applied	Measured value
Earth current: A	IN: A

Phase Voltage Applied	Measured value
Phase A: A	UA: A
Phase B: A	UB: A

Residual Voltage Applied	Measured value
Residual Voltage: V	UN: V

NOTE: The measured values are displayed in the Measurement submenu of the involved relay.

1.5 Phase overcurrent protection test

Type and setting threshold in In	Value applied in In	Delay Time Setting	Trip value in In	Drop value in In
I>: A	0.2 x I>	1s		

Type and setting threshold in In	Value applied in In	Delay Time Setting	Measured Trip Delay time	Drop value in In
I>: A	2 x I>	1s		

Type and setting threshold in In	Value applied in In	Delay Time Setting	Trip value in In	Drop value in In
I>>: A	0.5x I>>	1s		

Type and setting threshold in In	Value applied in In	Delay Time Setting	Measured Trip Delay time	Drop value in In
I>>: A	2.5x I>>	1s		

Type and setting threshold in In	Value applied in In	Delay Time Setting	Trip value in In	Drop value in In
I>>>: A	0.5xI>>>	1s	s	

Type and setting threshold in In	Value applied in In	Delay Time Setting	Measured Trip Delay time	Drop value in In
I>>>: A	2.5xI>>>	1s	s	

1.6 Phase under current protection test

Type and setting threshold in In	Value applied in In	Delay Time Setting	Trip value in In	Drop value in In
I<: A	0.2 x I<	1s	s	s

Type and setting threshold in In	Value applied in In	Delay Time Setting	Measured Trip Delay time	Drop value in In
I<: A	0.2 x I<	1s	s	s

1.7 Earth over current protection test

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Trip value in In	Drop value in In
Ie>:	0.2 x Ie>	1s		

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Measured Trip Delay time	Drop value in In
Ie>:	2 x Ie>	1s		

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Trip value in In	Drop value in In
Ie>>:	0.2x Ie>>	1s		

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Measured Trip Delay time	Drop value in In
Ie>>:	2 x Ie>>	1s		

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Trip value in In	Drop value in In
Ie>>>:	0.5 x Ie>>>	1s		

Type and setting threshold in Ien	Value applied in Ien	Delay Time Setting	Measured Trip Delay time	Drop value in Ien, Ue, R
Ie>>>:	2 x Ie>>>	1s		

1.8 Directional earth fault overcurrent

The setting range depends on the sensitivity of the relay type.

However the setting value is expressed in Ien and this one bypasses the problem.

The test is proposed for the first stage, but using the same values can be executed for the others stages two stages.

Below it is listed the guide table.

Type and setting current stage in Ien, Ue> in Volt, in degrees for the torque angle and the trip zone	Value applied in In, in Volt and the angles in degrees	Delay Time Setting	Measured Trip Delay time	Drop value for Ien, Ue, Torque angle, and trip zone
Ie>:	0.5 x Ie>	1s		
Ue>:10V	2 x 10V			
Torque angle : 0°	0°			
Trip Zone : +/- 90°	+/-85°			
Type and setting current stage in Ien, the Ue> in Volt and in degrees the torque angle and the trip zone	Value applied in In, in Volt and the angles in degrees	Delay Time Setting	Measured Trip Delay time	Drop value for Ien, Ue, Torque angle, and trip zone
Ie>:	2 x Ie>	1s		
Ue>:10V	80V			
Torque angle : 0°	0°			
Trip Zone : +/- 90°	+/-85°			

1.9 Earth Fault Wattmetric protection test

The earth fault wattmetric protection can be tested but as above needs of the residual voltage injection the wattmetric power is calculated as Ie x Ue x cos (Ie^Ue+φc)

The calculation is referred to the secondary values.

The same test can be repeated for the second stage.

Type and setting Pe stage are in watt referred to the secondary. The setting value depends on the set nominal Ien current (1A).	Value applied in In, in Volt and the angles in degrees	Delay Time Setting	Measured Trip Delay time	Drop value for Ien, Ue, Torque angle, and trip zone
Pe>: 20W	0.5 x Ien=0.5A	tPe>=1s		
	Ue=45V			
	Ue^Ie =0°			
φ_C = 0°				
Note: Change the angle between Ue^Ie and verify the trip and drop off of the Pe stage and the value of the Pe in the measurement menu.				

1.10 Over/Under Phase voltage protection test

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Trip value in Volt	Drop value in Volt
U>:	2 x U >	1s		

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Measured Trip Delay time	Drop value in Volt
U>:	2 x U >	1s		

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Trip value in Volt	Drop value in Volt
U<:	0.2 x U <	1s		

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Measured Trip Delay time	Drop value in Volt
U<<:	0.2 x U <<	1s		

1.11 Residual voltage protection test

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Trip value in Volt	Drop value in Volt
Ue>>>>:	2 x Ue>>>>	1s		

Type and setting threshold in Volt	Value applied in Volt	Delay Time Setting	Measured Trip Delay time	Drop value in Volt
Ue>>>>:	2 x Ue>>>>	1s		

1.12 Autoreclose basic test

From the 6A firmware version the ARC function follows the other ones of the Px20 range.

The testing of this functionality requires a bit attention and some more setting.

Below the setting table and the test procedure is listed.

MENU TEXT	SET FOR THE TEST
PROTECTION G1	
[67] Phase OC	
I>	Yes
I>	1 In
Delay type	DMT
tI>	1 sec
I>>	Yes
I>>	2 In
Delay	DMT
tI>>	1 sec
I>>>	No
[67N] E/GND	
Ie>	Yes
Ie>	1 In
Delay type	DMT
tIe>	1 sec
tReset	0,04s
Ie>> and Ie>>>	No
AUTORECLOSE	
Autoreclose?	YES
Ext CB Fail?	NO
Ext Block?	NO
tD1	5 sec
tD2	5 sec
tD3	5 sec
tD4	5 sec

MENU TEXT	SET FOR THE TEST
Reclaim Time tR	10 sec
Inhibit Time tI	0.2 sec
Phase Cycles	4
E/Gnd Cycles	4
Cycles tI>	4321 1111
Cycles tI>>	4321 0000
Cycles tI>>>	4321 0000
Cycles tIe>	4321 2222
Cycles tIe>>	4321 0000
Cycles tIe>>>	4321 0000
Cycles tPe/Iecos>,	4321 0000
Cycles tPe/Iecos>>	4321 0000
Cycles tAux1	4321 0000
Cycles tAux2	4321 0000

In the below table are listed the setting to have a corrected functionality of the 79 function.

The output relay, the digital input and the led assigne are free.

The indicating setting are those used for internal test.

In the output relay none other functionality can be assigned to the relay CB Close.

AUTOMATIC CTRL MENU	SET FOR THE TEST
Output relay	
CB Close	relay 2
TRIP 79	relay 8
79 Run	relay 7
Inputs menu	
52a	input 1
Trip Command	
tI>	Yes
tIe>	Yes
All the other ones	No
Configuration menu	
LED	
Led 5	I> Ie>

AUTOMATIC CTRL MENU	SET FOR THE TEST
Led 6	tI> tIe>
Led 7	Recl. Blocked
Led 8	Recl Run

NOTE : To execute the ARC test you have to connect an external relay for the monitoring the CB status (52a OFF when the CB is open, ON when CB is closed). Further the flowing of the current to the relay must be interrupted when the 52a is OFF; CB is open.

1.12.1 ARC test procedure with tI>

– Close the CB and inject current the led 7 lights for 0.2 s.

– After 1 sec the CB open tD1 start the led 8 lights

– After 5 seconf the CB closes and start tR

– After 1 sec. The CB open and td 2 start

– …………………………………….

– When we are to the td 4 when the CB close and after 1 sec the tI> trip the 79 trip and Recl Blocked will be actived. 4 shots was done.

1.12.2 ARC test procedure with tIe>

– Close the CB and inject the Ie current, the led 7 lights for 0.2 s.

– After 1 sec the CB does not open and tDx does not start none led will be light

This result is corrected because to the Ie was imposed the setting “2”.

Commissioning Engineer :	
Date :	

Remarks

2. COMMISSIONING RECORD SHEET

2.1 OP PARAMETERS Menu

Password : ______________________

Reference : ______________________

Software version : ______________________

Frequency : ❑ 50 Hz ❑ 60 Hz

2.2 CONFIGURATION menu

2.2.1 General options

VT connection	❑ 3Vpn	❑ 2Vpp + Vr		❑ 2Vpn + Vr
VT connection	❑ Not available	❑ Modulated		❑ Unmodulated
VT Protection	❑ Protect P-N		❑ Protect P-P	
Phase rotation	❑ A-B-C		❑ A-C-B	
CTm1 phase ? (P127)	❑ None	❑ IA	❑ IB	❑ IC
CTm2 phase ? (P127)	❑ None	❑ IA	❑ IB	❑ IC
CTm3 phase ? (P127)	❑ None	❑ IA	❑ IB	❑ IC
Default Displays (P126/P127)	❑ RMS IA	❑ RMS IB		❑ RMS IC
	❑ RMS IN		❑ RMS IA IB IC IN	
Earth Text (P125)	❑ N	❑ o		❑ E
Phases/Eath Text (P126 / P127)	❑ L1 L2 L3 N	❑ A B C o		❑ R S T E
Iam Tdd denom (P127)	A			
Ibm Tdd denom (P127)	A			
Icm Tdd denom (P127)	A			
Prot. Freq. Block	V			
dF/dt Cycles.nb. (P127)				
dF/dt Validat.nb= (P127)				
Inh.Block dF/dt >20 Hz/s (P127)	❑ Yes		❑ No	
Time Synchro.	❑ Not available (Cortec code P127--2 or P127--3---- only) ❑ IRIG-B ❑ COMM2 ❑ COMM1 ❑ Automatic			
IRIG-B	❑ Modulated	❑ Demodulated		❑ Not applicable

2.2.2 Transfo. Ratio

• = available with this model.
O = Optional

	P125	P126	P127			
Line CT Primary		•	•	A		
Line CT Secondary		•	•	❑ 1 A	❑ 5ª	
E/Gnd CT Primary	•	•	•	A		
E/Gnd CT Secondary	•	•	•	❑ 1 A	❑ 5A	
Line VT primary			•	V		
Line VT sec			•	V		
E/Gnd VT primary	•	•	•	V		❑ Not visible
E/Gnd VT secondary	•	•	•	V		❑ Not visible
Line CTm primary			•	A		❑ Not visible
Line CTm sec			•	A		❑ Not visible

2.2.3 LEDs 5 to 8 configuration

• = available with this model.
O = Optional

Functions	**P125**	**P126**	**P127**	**LED 5**	**LED 6**	**LED 7**	**LED 8**
				Yes	**Yes**	**Yes**	**Yes**
I>		•	•	❑	❑	❑	❑
tI>		•	•	❑	❑	❑	❑
I>>		•	•	❑	❑	❑	❑
tI>>		•	•	❑	❑	❑	❑
I>>>		•	•	❑	❑	❑	❑
tI>>>		•	•	❑	❑	❑	❑
tIA>		•	•	❑	❑	❑	❑
tIB>		•	•	❑	❑	❑	❑
tIC>		•	•	❑	❑	❑	❑
Ie>	•	•	•	❑	❑	❑	❑
tIe>	•	•	•	❑	❑	❑	❑
Ie>>	•	•	•	❑	❑	❑	❑
tIe>>	•	•	•	❑	❑	❑	❑
Ie>>>	•	•	•	❑	❑	❑	❑
tIe>>>	•	•	•	❑	❑	❑	❑
Ie_d>			•	❑	❑	❑	❑
tIe_d>			•	❑	❑	❑	❑
Ie_d>>			•	❑	❑	❑	❑
tIe_d>>			•	❑	❑	❑	❑

Functions	P125	P126	P127	LED 5	LED 6	LED 7	LED 8
				Yes	Yes	Yes	Yes
P>			•	❑	❑	❑	❑
tP>			•	❑	❑	❑	❑
P>>			•	❑	❑	❑	❑
tP>>			•	❑	❑	❑	❑
P<			•	❑	❑	❑	❑
tP<			•	❑	❑	❑	❑
P<<			•	❑	❑	❑	❑
tP<			•	❑	❑	❑	❑
Q>			•	❑	❑	❑	❑
tQ>			•	❑	❑	❑	❑
Q>>			•	❑	❑	❑	❑
tQ>>			•	❑	❑	❑	❑
Q<			•	❑	❑	❑	❑
tQ<			•	❑	❑	❑	❑
Q<<			•	❑	❑	❑	❑
tQ<			•	❑	❑	❑	❑
Pe/IeCos>	•	•	•	❑	❑	❑	❑
tPe/IeCos>	•	•	•	❑	❑	❑	❑
Pe/IeCos>>	•	•	•	❑	❑	❑	❑
tPe/IeCos>>	•	•	•	❑	❑	❑	❑
I2>		•	•	❑	❑	❑	❑
tI2>		•	•	❑	❑	❑	❑
I2>>		•	•	❑	❑	❑	❑
tI2>>		•	•	❑	❑	❑	❑
I2>>>		•	•	❑	❑	❑	❑
tI2>>>		•	•	❑	❑	❑	❑
Therm. Trip		•	•	❑	❑	❑	❑
I<		•	•	❑	❑	❑	❑
tI<		•	•	❑	❑	❑	❑
U>			•	❑	❑	❑	❑
tU>			•	❑	❑	❑	❑
U>>			•	❑	❑	❑	❑
tU>>			•	❑	❑	❑	❑
U<			•	❑	❑	❑	❑
tU<			•	❑	❑	❑	❑
U<<			•	❑	❑	❑	❑

Functions	P125	P126	P127	LED 5	LED 6	LED 7	LED 8
				Yes	Yes	Yes	Yes
tU<<			•	❑	❑	❑	❑
Ue>>>>	•	•	•	❑	❑	❑	❑
tUe>>>>	•	•	•	❑	❑	❑	❑
V2>			•	❑	❑	❑	❑
V2>			•	❑	❑	❑	❑
V2>>			•	❑	❑	❑	❑
V2>>			•	❑	❑	❑	❑
F1			•	❑	❑	❑	❑
tF1			•	❑	❑	❑	❑
F2			•	❑	❑	❑	❑
tF2			•	❑	❑	❑	❑
F3			•	❑	❑	❑	❑
tF3			•	❑	❑	❑	❑
F4			•	❑	❑	❑	❑
tF4			•	❑	❑	❑	❑
F5			•	❑	❑	❑	❑
tF5			•	❑	❑	❑	❑
F6			•	❑	❑	❑	❑
tF6			•	❑	❑	❑	❑
F Out			•	❑	❑	❑	❑
dF/dt1			•	❑	❑	❑	❑
dF/dt2			•	❑	❑	❑	❑
dF/dt3			•	❑	❑	❑	❑
dF/dt4			•	❑	❑	❑	❑
dF/dt5			•	❑	❑	❑	❑
dF/dt6			•	❑	❑	❑	❑
F. out			•	❑	❑	❑	❑
Brkn. Cond		•	•	❑	❑	❑	❑
CB Fail		•	•	❑	❑	❑	❑
VTS			•	❑	❑	❑	❑
CTS			•	❑	❑	❑	❑
Input 1	•	•	•	❑	❑	❑	❑
Input 2	•	•	•	❑	❑	❑	❑
Input 3	•	•	•	❑	❑	❑	❑
Input 4	•	•	•	❑	❑	❑	❑
Input 5		•	•	❑	❑	❑	❑

Functions	P125	P126	P127	LED 5 Yes	LED 6 Yes	LED 7 Yes	LED 8 Yes
Input 6		•	•	❑	❑	❑	❑
Input 7			•	❑	❑	❑	❑
Input 8			O	❑	❑	❑	❑
Input 9			O	❑	❑	❑	❑
Input A			O	❑	❑	❑	❑
Input B			O	❑	❑	❑	❑
Input C			O	❑	❑	❑	❑
79 Run		•	•	❑	❑	❑	❑
79i Blocked		•	•	❑	❑	❑	❑
79e. Blocked		•	•	❑	❑	❑	❑
tAux1	•	•	•	❑	❑	❑	❑
tAux2	•	•	•	❑	❑	❑	❑
tAux3		•	•	❑	❑	❑	❑
tAux4		•	•	❑	❑	❑	❑
tAux5			•	❑	❑	❑	❑
tAux6			•	❑	❑	❑	❑
tAux7			•	❑	❑	❑	❑
tAux8			O	❑	❑	❑	❑
tAux9			O	❑	❑	❑	❑
tAuxA			O	❑	❑	❑	❑
tAuxB			O	❑	❑	❑	❑
tAuxC			O	❑	❑	❑	❑
tSOTF		•	•	❑	❑	❑	❑
tEQU. A	•	•	•	❑	❑	❑	❑
tEQU. B	•	•	•	❑	❑	❑	❑
tEQU. C	•	•	•	❑	❑	❑	❑
tEQU. D	•	•	•	❑	❑	❑	❑
tEQU. E	•	•	•	❑	❑	❑	❑
tEQU. F	•	•	•	❑	❑	❑	❑
tEQU. G	•	•	•	❑	❑	❑	❑
tEQU. H	•	•	•	❑	❑	❑	❑

2.2.4 Inputs configuration

❑ = ↓, ☑ = ↑

Inputs (P125 only)		3 ❑		2 ❑		1 ❑	
Inputs (P126 and P127)	7 ❑	6 ❑	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑
Inputs (P127 with 12 inputs configuration)		C ❑	B ❑	A ❑	9 ❑	8 ❑	
Voltage input DC	❑ DC				❑ AC		

2.2.5 Output relays configuration

				← ❑ P125 →					
		← ❑ P126 & P127 →							
Fail Safe Relay		8	7	6	5	4	3	2	1
Maintenance Mode	❑ YES				❑ NO				
			← ❑ P125 →						
	← ❑ P126 & P127 →								
Relays CMD P122 and P123 only	8	7	6	5	W	4	3	2	1

2.2.6 Group select configuration

Change group	❑ Input	❑ Menu
Setting group (P125/P126)	❑ 1	❑ 2
Setting Group (P127)		
Target group (P127)		
Group if low level (P127)		
Group if high level (P127)		

2.2.7 Alarms configuration

Inst. Self Reset	❑ YES	❑ NO
Reset Led on fault	❑ YES	❑ NO

Inhibited alarms	P125	P126	P127
	YES	YES	YES
Ctrl_Trip ?	❑	❑	❑
tI< ?		❑	❑
tU< ?		❑	❑
tU<< ?		❑	❑
tU> ?			❑
tU>> ?			❑
tV2> ?			❑
tV2>> ?			❑
tP< ?			❑
tP<< ?			❑
tQ< ?			❑
tQ<< ?			❑
F1			❑
F2			❑
F3			❑
F4			❑
F5			❑
F6			❑
F.out			❑
[79] ext. blk ?		❑	❑
tAux 1	❑	❑	❑
tAux 2	❑	❑	❑
tAux 3	❑	❑	❑
tAux 4	❑	❑	❑
tAux 5		❑	❑
tAux 6		❑	❑
tAux 7		❑	❑
tAux 8 (option)			❑
tAux 9 (option)			❑
tAux A (option)			❑
tAux B (option)			❑
tAux C (option)			❑
Equ A	❑	❑	❑
Equ B	❑	❑	❑
Equ C	❑	❑	❑
Equ D	❑	❑	❑

Inhibited alarms	P125	P126	P127
	YES	YES	YES
Equ E	❑	❑	❑
Equ F	❑	❑	❑
Equ G	❑	❑	❑
Equ H	❑	❑	❑

2.3 COMMUNICATION menu

2.3.1 HMI communication

HMI ?	❑ YES	❑ NO
Relay address		
HMI ?	❑ Private	❑ IEC

2.3.2 COMM1 communication

COMM1 ?	❑ YES	❑ NO	
Baud rate			
Parity	❑ Even	❑ Odd	❑ None
Stop bits	❑ 0	❑ 1	
Relay address			
Spont. event & GI A11	❑ None ❑ IEC only	❑ Private only ❑ All	
GI select.	❑ Basic	❑ Advanced	
Measur. upload ASDU 3.4	❑ YES	❑ NO	
Measur. upload ASDU 9	❑ YES	❑ NO	
Measur. upload Other	❑ YES	❑ NO	
Events + Measur. Blocking	❑ YES	❑ NO	
Command Blocking	❑ YES	❑ NO	
Command timeout	s		

2.3.3 COMM2 communication

COMM1 ?	❑ YES	❑ NO	
Baud rate			
Parity	❑ Even	❑ Odd	❑ None
Stop bits	❑ 0	❑ 1	
Relay address			
Spont. event & GI A11	❑ None ❑ IEC only	❑ Private only ❑ All	
GI select.	❑ Basic	❑ Advanced	
Measur. upload ASDU 3.4	❑ YES	❑ NO	
Measur. upload ASDU 9	❑ YES	❑ NO	
Measur. upload Other	❑ YES	❑ NO	
Events + Measur. Blocking	❑ YES	❑ NO	
Command Blocking	❑ YES	❑ NO	

2.4 PROTECTION Menu

For several groups with different settings, copy this section.

G1	G2	G3	G4	G5	G6	G7	G8
❑	❑	❑	❑	❑	❑	❑	❑

Group copied from	
Group copied to	

2.4.1 Phase overcurrent [(67/)50/51]

2.4.1.1 [(67/)50/51] I>

I> ?	❑ Yes	❑ DIR (P127)	❑ No: Next menu: I>> ?
I>	In		
I> Torque	°	❑ Not displayed	
I> Trip Zone	°	❑ Not displayed	
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		

2.4.1.1.1 [(67/)50/51] I> = DMT

tI>	s

2.4.1.1.2 [(67/)50/51] I> = RI

K		
t Reset	s	
I> >> >>> Interlock	❑ Yes	❑ No

2.4.1.1.3 [(67/)50/51] I> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed
I> >> >>> Interlock	❑ Yes	❑ No	

2.4.1.2 [(67/)50/51] I>>

I>> ?	❑ Yes	❑ DIR (P127)	❑ No: Next menu: I>>> ?
I>>	In		
I>> Torque	°		❑ Not displayed
I>> Trip Zone	°		❑ Not displayed
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		

2.4.1.2.1 [(67/)50/51] I>> = DMT

tI>	s

2.4.1.2.2 [(67/)50/51] I>> = RI

K	
t Reset	s

2.4.1.2.3 [(67/)50/51] I>> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed

2.4.1.3 [(67/)50/51] I>>>

I>>>?	❑ YES	❑ DIR (P127)	
	❑ PEAK	❑ NO (last menu)	
I>>> Torque	°		❑ Not displayed
I>>> Trip Zone	°		❑ Not displayed
I>>>	In		
tI>>>	s		

2.4.2 [67N] E/GND

2.4.2.1 [67N] I_e>

I_e> ?	❑ Yes	❑ DIR	❑ NO: Next menu: I_e>> ?
I_e>	Ien		
U_e>	V		❑ Not displayed
I_e> Torque	°		❑ Not displayed
I_e> Trip Zone	°		❑ Not displayed

Delay Type	❑ DMT	❑ RI
	❑ IEC-STI	❑ IEC SI
	❑ IEC VI	❑ IEC-EI
	❑ IEC-LTI	❑ CO2
	❑ IEEE-MI	❑ CO8
	❑ IEEE-VI	❑ IEEE-EI
	❑ RECT	

2.4.2.1.1 [67N] I_e> = DMT

tI_e>	s
tReset	s

2.4.2.1.2 [67N] I_e> = RI

K		
t Reset	s	
I_e> >> >>> Interlock	❑ Yes	❑ No

2.4.2.1.3 [67N] I_e> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed
I_e> >> >>> Interlock	❑ Yes	❑ No	

2.4.2.2 [67N] I_e>>

I_e>> ?	❑ Yes	❑ DIR	❑ No: Next menu: Ie>>>?
I_e>>	Ien		
U_e >>	V	❑ Not displayed	
I_e>> Torque	°	❑ Not displayed	
I_e>> Trip Zone	°	❑ Not displayed	
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		

2.4.2.2.1 [67N] I_e>> = DMT

tI_e>	s
tReset	s

2.4.2.2.2 [67N] I_e>> = RI

K	
t Reset	s

2.4.2.2.3 [67N] I_e>> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed

2.4.2.3 [67N] I_e>>>

I_e>>>?	❑ YES ❑ PEAK	❑ DIR ❑ NO (last menu)
I_e>>>	In	
U_e>>>	V	❑ Not displayed
I_e>>> Torque	°	❑ Not displayed
I_e>>> Trip Zone	°	❑ Not displayed
tI_e>>>	s	
tReset	s	

2.4.2.4 [67N] I_e_d>

I_e_d>?	❑ Yes	❑ DIR	❑ No: Next menu: e_d>>
I_e_d>	Ien		
U_e (I_e_d>)	V		❑ Not displayed
I_e_d> Torque	°		❑ Not displayed
I_e_d> Trip Zone	°		❑ Not displayed
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		

2.4.2.4.1 [67N] I_e_d> = DMT

tI_e>	s
tReset	s

2.4.2.4.2 [67N] I_e_d>= RI

K	
t Reset	s

2.4.2.4.3 [67N] I_e_d> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed

2.4.2.5 [67N] I_e_d>>

I_e_d>>?	❑ Yes	❑ DIR	❑ No: (last menu)
I_e_d>>	Ien		
U_e (I_e_d>>)	V		❑ Not displayed
I_e_d>> Torque	°		❑ Not displayed
I_e_d>> Trip Zone	°		❑ Not displayed
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		

2.4.2.5.1 [67N] I_e_d>> = DMT

tI_e>>	s
tReset	s

2.4.2.5.2 [67N] I_e_d>>= RI

K	
t Reset	s

2.4.2.5.3 [67N] I_e_d>> = IEC, RECT, CO or IEEE

TMS			
Reset Delay Type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed

2.4.3 [32] Directional power

Relay:	❑	P125 (not available)
Relay:	❑	P126 (not available)

P>?	❑ YES	❑ NO: next menu P>> ?
P>	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tP>	s	❑ Not displayed
P>?	❑ YES	❑ NO: last menu
P>	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tP>	s	❑ Not displayed

Q>?	❑ YES	❑ NO: next menu P>> ?
Q>	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tQ>	s	❑ Not displayed
Q>?	❑ YES	❑ NO: last menu
Q>	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tQ>	s	❑ Not displayed

P<?	❑ YES	❑ NO: next menu P<< ?
P<	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tP<	s	❑ Not displayed
P<?	❑ YES	❑ NO: last menu
P<	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tP<	s	❑ Not displayed

Q<?	❑ YES	❑ NO: next menu P<< ?
Q<	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tQ<	s	❑ Not displayed
Q<?	❑ YES	❑ NO: last menu
Q<	x W	❑ Not displayed
Directional Angle	°	❑ Not displayed
tQ<	s	❑ Not displayed

2.4.4 [32N] Earth wattmetric

Relay:	❑	P125 (not available)

[32N] mode	❑ Pe	❑ Ie Cos	
Pe>? or IeCos> ?	❑ YES	❑ NO: Next menu P>>??/IeCos>>??	
Pe> or IeCos>		❑ Not displayed	
Delay Type	❑ DMT	❑ RI	
	❑ IEC-STI	❑ IEC SI	
	❑ IEC VI	❑ IEC-EI	
	❑ IEC-LTI	❑ CO2	
	❑ IEEE-MI	❑ CO8	
	❑ IEEE-VI	❑ IEEE-EI	
	❑ RECT		
tPe> or tIeCos>	s	❑ Not displayed	
K		❑ Not displayed	
TMS		❑ Not displayed	
Reset delay type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms		❑ Not displayed	
tReset	s	❑ Not displayed	

Pe>>? or IeCos>> ?	❑ YES	❑ NO: Last menu
tPe>> or tIeCos>>	s	❑ Not displayed
tReset	s	❑ Not displayed

2.4.5 [46] Neg Seq OC

Relay:	❑ P125 (not available)

[32N] mode	❑ Pe		❑ Ie Cos
I2> ?	❑ YES		❑ NO: Next menu I2>>?
I2>	In		❑ Not displayed
Delay Type	❑ DMT		❑ RI
	❑ IEC-STI		❑ IEC SI
	❑ IEC VI		❑ IEC-EI
	❑ IEC-LTI		❑ CO2
	❑ IEEE-MI		❑ CO8
	❑ IEEE-VI		❑ IEEE-EI
	❑ RECT		
tI2>	s		❑ Not displayed
K			❑ Not displayed
TMS			❑ Not displayed
Reset delay type	❑ DMT	❑ IDMT	❑ Not displayed
Rtms			❑ Not displayed
tReset	s		❑ Not displayed

I2>> ?	❑ YES	❑ NO: Next menu I2>>>?
I2>>	In	❑ Not displayed
tI2>>	S	❑ Not displayed

I2>>> ?	❑ YES	❑ NO: Last menu
I2>>>	In	❑ Not displayed
tI2>>>	s	❑ Not displayed

2.4.6 [49] Thermal OL

Relay:	❑	P125 (not available)

Therm OL ?	❑ YES	❑ NO: Last menu
Iθ >	In	
Te	mn	
K		
θ Trip		
θ Alarm ?	❑ YES	❑ NO: Last menu
θ Alarm	%	

2.4.7 [37] UNDERCURRENT I<

Relay:	❑	P125 (not available)

I< ?	❑ YES	❑ NO
I<	In	
tI<	s	
Inhibition I< on 52A	❑ YES	❑ NO
Inhibition I< on U< (P127)	❑ YES	❑ NO
Inhibition I< on U< (P127)	V	

2.4.8 [59] Phase Over Voltage

Relay:	❑	P125 (not available)
Relay:	❑	P126 (not available)

U> ?	❑ AND	❑ OR	❑ No: Next menu: U>>?
U>	V		❑ Not displayed
tU>	s		❑ Not displayed

U>> ?	❑ AND	❑ OR	❑ No: Last menu
U>>	V		❑ Not displayed
tU>>	s		❑ Not displayed

2.4.9 [27] Phase Under Voltage

Relay:	❑	P125 (not available)
Relay:	❑	P126 (not available)

U< ?	❑ AND	❑ OR	❑ No: Next menu: U>>?
U<	V		❑ Not displayed
tU<	s		❑ Not displayed
52a Inhib. U< ?	❑ AND	❑ OR	❑ Not displayed

U<< ?	❑ AND	❑ OR	❑ No: Last menu
U<<	V		❑ Not displayed
tU<<	s		❑ Not displayed
52a Inhib. U<< ?	❑ AND	❑ OR	❑ Not displayed

2.4.10 [59N] Residual overvoltage

Ue>>>> ?	❑ YES	❑ NO: Last menu
Ue>>>>	V	❑ Not displayed
t Ue>>>>	s	❑ Not displayed

2.4.11 [47] Negative overvoltage (P127)

V2> ?	❑ YES	❑ NO: Last menu
V2>	V	❑ Not displayed
tV2>	s	❑ Not displayed
V2>> ?	❑ YES	❑ NO: Last menu
V2>>	V	❑ Not displayed
tV2>>	s	❑ Not displayed

2.4.12 [79] Autoreclose

Relay:	❑	P125 (not available)

[79] Autoreclose ?	❑ YES	❑ NO Last menu
Ext CB Fail ?	❑ YES	❑ NO Next menu: Ext Block?
Ext CB Fail Time	ms	
Ext Block ?	❑ YES	❑ NO
Rolling demand ?	❑ YES	❑ NO
Max cycle nb		
Time period	mn	
Dead Time tD1	s	
Dead Time tD2	s	
Dead Time tD3	s	
Dead Time tD4	s	
Dead Time tI>	s	
Dead Time tI>>	s	
Dead Time tI>>>	s	
Dead Time tIe>	s	
Dead Time tIe>>	s	
Dead Time tIe>>>	s	
Reclaim time tR	s	
Inhib Time tI	s	
Phase Cycles	❑ 1 ❑ 2 ❑ 3 ❑ 4	
E/Gnd Cycles	❑ 1 ❑ 2 ❑ 3 ❑ 4	

	Cycles			
	4	3	2	1
tI>				
tI>>				
tI>>>				
tIe>				
tIe>>				
tIe>>>				
tPe/IeCos>				
tPe/IeCos>>				
tAux 1				
tAux 2				

2.4.13 Frequency [81] menu

Relay:	❑	P125 (not available)
Relay:	❑	P126 (not available)

	Fx			Fx =	tFx
	No	81>	81<	Hz *	ms *
[81] F1	❑	❑	❑	_______	_______
[81] F2	❑	❑	❑	_______	_______
[81] F3	❑	❑	❑	_______	_______
[81] F4	❑	❑	❑	_______	_______
[81] F5	❑	❑	❑	_______	_______
[81] F6	❑	❑	❑	_______	_______

2.4.14 Freq. rate of change [81R] menu

Relay:	❑	P125 (not available)
Relay:	❑	P126 (not available)

	dF/dtx ?	dF/dtx =
	Yes	Hz/s*
[81R] dF/dt1	❑	_______
[81R] dF/dt2	❑	_______
[81R] dF/dt3	❑	_______
[81R] dF/dt4	❑	_______
[81R] dF/dt5	❑	_______
[81R] dF/dt6	❑	_______

2.5 AUTOMAT. CTRL menu

2.5.1 Trip Commands

Function	P125	P126	P127
	Yes	Yes	Yes
Trip tI>		❐	❐
Trip tI>>		❐	❐
Trip tI>>>		❐	❐
Trip tIe>	❐	❐	❐
Trip tIe>>	❐	❐	❐
Trip tIe>>>	❐	❐	❐
Trip tIe_d>			❐
Trip tIe_d>>			❐
Trip tP>			❐
Trip tP>>			❐
Trip tP<			❐
Trip tP<<			❐
Trip tQ>			❐
Trip tQ>>			❐
Trip tQ<			❐
Trip tQ<<			❐
Trip tPe/IeCos>	❐	❐	❐
Trip tPe/IeCos>>	❐	❐	❐
Trip tI2>		❐	❐
Trip tI2>>		❐	❐
Trip tI2>>>		❐	❐
Trip Thermal θ		❐	❐
Trip tU>			❐
Trip tU>>			❐
Trip tU<			❐
Trip tU<<			❐
Trip tUe>>>>	❐	❐	❐
Trip tV2>			❐
Trip tV2>>			❐
Trip tF1			❐
Trip tF2			❐
Trip tF3			❐

Function	P125	P126	P127
	Yes	Yes	Yes
Trip tF4			❒
Trip tF5			❒
Trip tF6			❒
Trip dF/dt1			❒
Trip dF/dt2			❒
Trip dF/dt3			❒
Trip dF/dt4			❒
Trip dF/dt5			❒
Trip dF/dt6			❒
Trip Brkn. Cond		❒	❒
Trip tAux 1	❒	❒	❒
Trip tAux 2	❒	❒	❒
Trip tAux 3	❒	❒	❒
Trip tAux 4	❒	❒	❒
Trip tAux 5		❒	❒
Trip tAux 6		❒	❒
Trip tAux 7		❒	❒
Trip tAux 8 (option)			❒
Trip tAux 9 (option)			❒
Trip tAux A (option)			❒
Trip tAux B (option)			❒
Trip tAux C (option)			❒
Trip SOTF		❒	❒
Ctrl Trip	❒	❒	❒
Trip tEQU A	❒	❒	❒
Trip tEQU B	❒	❒	❒
Trip tEQU C	❒	❒	❒
Trip tEQU D	❒	❒	❒
Trip tEQU E	❒	❒	❒
Trip tEQU F	❒	❒	❒
Trip tEQU G	❒	❒	❒
Trip tEQU H	❒	❒	❒

2.5.2 Latch relays

		← ☐ P125 →						
	← ☐ P126 & P127 →							
Latch relays	8	7	6	5	4	3	2	1

2.5.3 Blocking logic 1 function allocation

Function	P125	P126	P127
	Yes	Yes	Yes
tI>		☐	☐
tI>>		☐	☐
tI>>>		☐	☐
tIe>	☐	☐	☐
tIe>>	☐	☐	☐
tIe>>>	☐	☐	☐
tIe_d>			☐
tIe_d>>			☐
tP>			☐
tP>>			☐
tP<			☐
tP<<			☐
tQ>			☐
tQ>>			☐
tQ<			☐
tQ<<			☐
tPe/IeCos>	☐	☐	☐
tPe/IeCos>>	☐	☐	☐
tI2>		☐	☐
tI2>>		☐	☐
tI2>>>		☐	☐
tThermal θ		☐	☐
tI<		☐	☐
tU>			☐
tU>>			☐
tU<			☐
tU<<			☐
tUe>>>>	☐	☐	☐
tV2>			☐

Function	P125	P126	P127
	Yes	Yes	Yes
tV2>>			❐
tF1			❐
tF2			❐
tF3			❐
tF4			❐
tF5			❐
tF6			❐
tBrk. Cond		❐	❐
tAux1	❐	❐	❐
tAux2	❐	❐	❐
tAux3	❐	❐	❐
tAux4	❐	❐	❐
tAux5		❐	❐
tAux6		❐	❐
tAux7		❐	❐
tAux8 (option)			❐
tAux9 (option)			❐
tAuxA (option)			❐
tAuxB (option)			❐
tAuxC (option)			❐

2.5.4 Blocking logic 2 function allocation

Function	P125	P126	P127
	Yes	Yes	Yes
tI>		❐	❐
tI>>		❐	❐
tI>>>		❐	❐
tIe>	❐	❐	❐
tIe>>	❐	❐	❐
tIe>>>	❐	❐	❐
tIe_d>			❐
tIe_d>>			❐
tP>			❐
tP>>			❐
tP<			❐
tP<<			❐

Function	P125 Yes	P126 Yes	P127 Yes
tQ>			❒
tQ>>			❒
tQ<			❒
tQ<<			❒
tPe/IeCos>	❒	❒	❒
tPe/IeCos>>	❒	❒	❒
tI2>		❒	❒
tI2>>		❒	❒
tI2>>>		❒	❒
tThermal θ		❒	❒
tI<		❒	❒
tU>			❒
tU>>			❒
tU<			❒
tU<<			❒
tUe>>>>	❒	❒	❒
tV2>			❒
tV2>>			❒
tF1			❒
tF2			❒
tF3			❒
tF4			❒
tF5			❒
tF6			❒
dF/dt1			❒
dF/dt2			❒
dF/dt3			❒
dF/dt4			❒
dF/dt5			❒
dF/dt6			❒
tBrk. Cond		❒	❒
tAux1	❒	❒	❒
tAux2	❒	❒	❒
tAux3	❒	❒	❒
tAux4	❒	❒	❒

Function	P125	P126	P127
	Yes	Yes	Yes
tAux5		❐	❐
tAux6		❐	❐
tAux7		❐	❐
tAux8 (option)			❐
tAux9 (option)			❐
tAuxA (option)			❐
tAuxB (option)			❐
tAuxC (option)			❐

2.5.5 Inrush Blocking Logic function allocation

Relay:	❑	P125 (not available)
	❑	P126 (not available)

Blocking Inrush	❑ YES	❑ NO
Inr. harmonic 2 ratio =	%	
T Inrush reset	ms	

Function	P127
	Yes
I>	❑
I>>	❑
I>>>	❑
Ie>	❑
Ie>>	❑
Ie>>>	❑
Ie_d>	❑
Ie_d>>	❑
I2>	❑
I2>>	❑
I2>>>	❑

2.5.6 Logic Select 1 function allocation

Relay:	❑	P125 (not available)

Sel1 tI>>	❑ YES	❑ NO

Sel1 tI>>>	❑ YES	❑ NO
Sel1 tIe>>	❑ YES	❑ NO
Sel1 tIe>>>	❑ YES	❑ NO
Sel1 tIe_d> (P127)	❑ YES	❑ NO
Sel1 tIe_d>> (P127)	❑ YES	❑ NO
t Sel1	ms	

2.5.7 Logic Select 2 function allocation

Relay:	❑	P125 (not available)

Sel1 tI>>	❑ YES	❑ NO
Sel1 tI>>>	❑ YES	❑ NO
Sel1 tIe>>	❑ YES	❑ NO
Sel1 tIe>>>	❑ YES	❑ NO
Sel1 tIe_d>	❑ YES	❑ NO
Sel1 tIe_d>> (P127)	❑ YES	❑ NO
t Sel2	ms	

2.5.8 OUTPUT RELAYS allocation

• = available
O = Option (P127)

				← P125 →						
				← P126 / P127 →						
Function	**P125**	**P126**	**P127**	**RL2 Yes**	**RL3 Yes**	**RL4 Yes**	**RL5 Yes**	**RL6 Yes**	**RL7 Yes**	**RL8 Yes**
Trip		•	•	❑	❑	❑	❑	❑	❑	❑
I>		•	•	❑	❑	❑	❑	❑	❑	❑
tI>		•	•	❑	❑	❑	❑	❑	❑	❑
I_R>		•	•	❑	❑	❑	❑	❑	❑	❑
I>>		•	•	❑	❑	❑	❑	❑	❑	❑
tI>>		•	•	❑	❑	❑	❑	❑	❑	❑
I_R>>		•	•	❑	❑	❑	❑	❑	❑	❑
I>>>		•	•	❑	❑	❑	❑	❑	❑	❑
tI>>>		•	•	❑	❑	❑	❑	❑	❑	❑
I_R>>>		•	•	❑	❑	❑	❑	❑	❑	❑
tIA>		•	•	❑	❑	❑	❑	❑	❑	❑
tIB>		•	•	❑	❑	❑	❑	❑	❑	❑
tIC>		•	•	❑	❑	❑	❑	❑	❑	❑
Ie>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tIe>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie_R>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tIe>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie_R>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tIe>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie_d>			•	❑	❑	❑	❑	❑	❑	❑
tIe_d>			•	❑	❑	❑	❑	❑	❑	❑
Ie_dR>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Ie_d>>			•	❑	❑	❑	❑	❑	❑	❑
tIe_d>>			•	❑	❑	❑	❑	❑	❑	❑
Ie_dR>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
P>			•	❑	❑	❑	❑	❑	❑	❑
tP>			•	❑	❑	❑	❑	❑	❑	❑
P>>			•	❑	❑	❑	❑	❑	❑	❑
tP>>			•	❑	❑	❑	❑	❑	❑	❑

• = available
O = Option (P127)

				← P125 →						
				← P126 / P127 →						
Function	**P125**	**P126**	**P127**	**RL2**	**RL3**	**RL4**	**RL5**	**RL6**	**RL7**	**RL8**
				Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
P<			•	❑	❑	❑	❑	❑	❑	❑
tP<			•	❑	❑	❑	❑	❑	❑	❑
P<<			•	❑	❑	❑	❑	❑	❑	❑
tP<<			•	❑	❑	❑	❑	❑	❑	❑
Q>			•	❑	❑	❑	❑	❑	❑	❑
tQ>			•	❑	❑	❑	❑	❑	❑	❑
Q>>			•	❑	❑	❑	❑	❑	❑	❑
tQ>>			•	❑	❑	❑	❑	❑	❑	❑
Q<			•	❑	❑	❑	❑	❑	❑	❑
tQ<			•	❑	❑	❑	❑	❑	❑	❑
Q<<			•	❑	❑	❑	❑	❑	❑	❑
tQ<<			•	❑	❑	❑	❑	❑	❑	❑
Pe/IeCos>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tPe/IeCos>	•	•	•	❑	❑	❑	❑	❑	❑	❑
Pe/IeCos>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tPe/IeCos>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
I2>		•	•	❑	❑	❑	❑	❑	❑	❑
tI2>		•	•	❑	❑	❑	❑	❑	❑	❑
I2>>		•	•	❑	❑	❑	❑	❑	❑	❑
tI2>>		•	•	❑	❑	❑	❑	❑	❑	❑
I2>>>		•	•	❑	❑	❑	❑	❑	❑	❑
tI2>>>		•	•	❑	❑	❑	❑	❑	❑	❑
ThermAlarm		•	•	❑	❑	❑	❑	❑	❑	❑
ThermTrip		•	•	❑	❑	❑	❑	❑	❑	❑
I<		•	•	❑	❑	❑	❑	❑	❑	❑
tI<		•	•	❑	❑	❑	❑	❑	❑	❑
U>			•	❑	❑	❑	❑	❑	❑	❑
tU>			•	❑	❑	❑	❑	❑	❑	❑
U>>			•	❑	❑	❑	❑	❑	❑	❑
tU>>			•	❑	❑	❑	❑	❑	❑	❑
U<			•	❑	❑	❑	❑	❑	❑	❑
tU<			•	❑	❑	❑	❑	❑	❑	❑

• = available
O = Option (P127)

Function	P125	P126	P127	RL2	RL3	RL4	RL5	RL6	RL7	RL8
				← P125 →						
				← P126 / P127 →						
				Yes	Yes	Yes	Yes	Yes	Yes	Yes
U<<			•	❑	❑	❑	❑	❑	❑	❑
tU<<			•	❑	❑	❑	❑	❑	❑	❑
Ue>>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tUe>>>>:	•	•	•	❑	❑	❑	❑	❑	❑	❑
V2>			•	❑	❑	❑	❑	❑	❑	❑
tV2>			•	❑	❑	❑	❑	❑	❑	❑
V2>>			•	❑	❑	❑	❑	❑	❑	❑
tV2>>			•	❑	❑	❑	❑	❑	❑	❑
F1			•	❑	❑	❑	❑	❑	❑	❑
tF1			•	❑	❑	❑	❑	❑	❑	❑
F2			•	❑	❑	❑	❑	❑	❑	❑
tF2			•	❑	❑	❑	❑	❑	❑	❑
F3			•	❑	❑	❑	❑	❑	❑	❑
tF3			•	❑	❑	❑	❑	❑	❑	❑
F4			•	❑	❑	❑	❑	❑	❑	❑
tF4			•	❑	❑	❑	❑	❑	❑	❑
F5			•	❑	❑	❑	❑	❑	❑	❑
tF5			•	❑	❑	❑	❑	❑	❑	❑
F6			•	❑	❑	❑	❑	❑	❑	❑
tF6			•	❑	❑	❑	❑	❑	❑	❑
F.OUT			•	❑	❑	❑	❑	❑	❑	❑
dF/dt1			•	❑	❑	❑	❑	❑	❑	❑
dF/dt2			•	❑	❑	❑	❑	❑	❑	❑
dF/dt3			•	❑	❑	❑	❑	❑	❑	❑
dF/dt4			•	❑	❑	❑	❑	❑	❑	❑
dF/dt5			•	❑	❑	❑	❑	❑	❑	❑
dF/dt6			•	❑	❑	❑	❑	❑	❑	❑
BrknCond		•	•	❑	❑	❑	❑	❑	❑	❑
CBAlarm		•	•	❑	❑	❑	❑	❑	❑	❑
52 Fail		•	•	❑	❑	❑	❑	❑	❑	❑
CBFail		•	•	❑	❑	❑	❑	❑	❑	❑
CB Close		•	•	❑	❑	❑	❑	❑	❑	❑

• = available
O = Option (P127)

				← P125 →						
				← P126 / P127 →						
Function	**P125**	**P126**	**P127**	**RL2**	**RL3**	**RL4**	**RL5**	**RL6**	**RL7**	**RL8**
				Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
tAux1	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux2	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux3	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux4	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux5			•	❑	❑	❑	❑	❑	❑	❑
tAux6			•	❑	❑	❑	❑	❑	❑	❑
tAux7			•	❑	❑	❑	❑	❑	❑	❑
tAux8			O	❑	❑	❑	❑	❑	❑	❑
tAux9			O	❑	❑	❑	❑	❑	❑	❑
tAuxA			O	❑	❑	❑	❑	❑	❑	❑
tAuxB			O	❑	❑	❑	❑	❑	❑	❑
tAuxC			O	❑	❑	❑	❑	❑	❑	❑
79 Run		•	•	❑	❑	❑	❑	❑	❑	❑
79 Trip		•	•	❑	❑	❑	❑	❑	❑	❑
79 int. Lock		•	•	❑	❑	❑	❑	❑	❑	❑
79 ext. Lock		•	•	❑	❑	❑	❑	❑	❑	❑
SOTF		•	•	❑	❑	❑	❑	❑	❑	❑
CONTROLTRIP	•	•	•	❑	❑	❑	❑	❑	❑	❑
CONTROLCLOSE	•	•	•	❑	❑	❑	❑	❑	❑	❑
ActiveGroup	•	•	•	❑	❑	❑	❑	❑	❑	❑
Input1 :	•	•	•	❑	❑	❑	❑	❑	❑	❑
Input2	•	•	•	❑	❑	❑	❑	❑	❑	❑
Input3 :	•	•	•	❑	❑	❑	❑	❑	❑	❑
Input4	•	•	•	❑	❑	❑	❑	❑	❑	❑
Input5		•	•	❑	❑	❑	❑	❑	❑	❑
Input6		•	•	❑	❑	❑	❑	❑	❑	❑
Input7		•	•	❑	❑	❑	❑	❑	❑	❑
Input8			O	❑	❑	❑	❑	❑	❑	❑
Input8			O	❑	❑	❑	❑	❑	❑	❑
InputA			O	❑	❑	❑	❑	❑	❑	❑
InputB			O	❑	❑	❑	❑	❑	❑	❑
InputC			O	❑	❑	❑	❑	❑	❑	❑

• = available
O = Option (P127)

				← P125 →						
				← P126 / P127 →						
Function	**P125**	**P126**	**P127**	**RL2**	**RL3**	**RL4**	**RL5**	**RL6**	**RL7**	**RL8**
				Yes	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
VTS			•	❑	❑	❑	❑	❑	❑	❑
CTS			•	❑	❑	❑	❑	❑	❑	❑
t EQU.A		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.B		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.C		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.D		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.E		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.F		•	•	❑	❑	❑	❑	❑	❑	❑
t EQU.G		•	•	❑	❑	❑	❑	❑	❑	❑
T EQU.H		•	•	❑	❑	❑	❑	❑	❑	❑
Order Comm1			•	❑	❑	❑	❑	❑	❑	❑
Order Comm2			•	❑	❑	❑	❑	❑	❑	❑
Order Comm3			•	❑	❑	❑	❑	❑	❑	❑
Order Comm4			•	❑	❑	❑	❑	❑	❑	❑

2.5.9 LOGIC INPUT allocation

2.5.9.1 Inputs

• = available O = Option.				← P125 →											
				← P126 / P127 →							← option P127 →				
Function	**P125**	**P126**	**P127**	**Inputs**											
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**
None	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Unlatch	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Blk Log 1	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Blk Log 2		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
52 a		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
52 b		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
CB FLT		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 1	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 2	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 3	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 4	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 5			•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 6			•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 7			•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 8			O	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux 9			O	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux A			O	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux B			O	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Aux C			O	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Strt Dist		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Cold L PU		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Log Sel 1		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Log Sel 2		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Change Set		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Block_79		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
θ Reset		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Trip Circ		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Start t BF		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Maint. M	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
SOTF		•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Local	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Synchro.	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

• = available O = Option.				← P125 →											
				← P126 / P127 →							← option P127 →				
Function	**P125**	**P126**	**P127**	**Inputs**											
				1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**A**	**B**	**C**
Led Reset or Reset Led	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Ctrl Trip	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑
Ctr Close	•	•	•	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑	❑

2.5.9.2 tAux

Aux 1 : Time tAux 1	s
Aux 2 : Time tAux 2	s
Aux 3 : Time tAux 3	s
Aux 4 : Time tAux 4	s
Aux 5 : Time tAux 5 (P126 & P127)	s
Aux 6 : Time tAux 5 (P126 & P127)	s
Aux 7 : Time tAux 5 (P126 & P127)	s
Aux 8 : Time tAux 5 (P127 option)	s
Aux 9 : Time tAux 5 (P127 option)	s
Aux A : Time tAux 5 (P127 option)	s
Aux B : Time tAux 5 (P127 option)	s
Aux C : Time tAux 5 (P127 option)	s

2.5.10 BROKEN CONDUCTOR allocation

Relay:	❑	P125 (not available)

Brkn Cond ?	❑ YES	❑ NO
Broken Conductor time tBC	s	
Ratio I2/I1	%	

2.5.11 COLD LOAD PU allocation

Relay:	❑	P125 (not available)

Cold Load PU ?	❑ YES	❑ NO
Input ?	❑ YES	❑ NO
Auto ?	❑ YES	❑ NO
tI> ?	❑ YES	❑ NO
tI>> ?	❑ YES	❑ NO
tI>>> ?	❑ YES	❑ NO
tI$_e$> ?	❑ YES	❑ NO
tI$_e$>> ?	❑ YES	❑ NO
tI$_e$>>> ?	❑ YES	❑ NO
tI$_e$_d> ?	❑ YES	❑ NO
tI$_e$_d>> ?	❑ YES	❑ NO
t2> ?	❑ YES	❑ NO
t2>> ?	❑ YES	❑ NO
T Therm ?	❑ YES	❑ NO
Cold load PU Level	%	
Cold load PU tCL	s	

2.5.12 51V allocation

Relay:	❑	P125 (not available)
	❑	P126 (not available)

(U< OR V2>) & I>>?	❑ YES	❑ NO: next menu: (U<< OR V2>>) & I>>>?
V2>?	V	❑ not displayed
(U< OR V2>) & I>>?	❑ YES	❑ NO (last menu)
V2>?	V	❑ not displayed

2.5.13 VTS allocation

Relay:	❑	P125 (not available)
	❑	P126 (not available)

VTS?	❑ YES	❑ NO (last menu)
VTS Alarm?	❑ YES	❑ NO
VTS Blocks 51V ?	❑ YES	❑ NO
VTS Blocks Protections?	❑ YES	❑ NO
VTS Non dir I>	❑ YES	❑ NO
VTS Non dir I>>	❑ YES	❑ NO
VTS Non dir I>>>	❑ YES	❑ NO
VTS Non dir Ie>>	❑ YES	❑ NO
VTS Non dir Ie>>>	❑ YES	❑ NO
VTS Non dir Ie_d>	❑ YES	❑ NO
VTS Non dir Ie_d>>	❑ YES	❑ NO
tVTS	s	

2.5.14 CTS allocation

Relay:	❑	P125 (not available)
	❑	P126 (not available)
	❑	P127 (option not available)

CT Supervision?	❑ YES	❑ NO (last menu)
Ie>	In	
Ue<	V	
tCTS	s	

2.5.15 CB FAIL allocation

Relay:	❑	P125 (not available)

CB Fail ?	❑ YES			❑ NO (last menu)	
I< BF	In			❑ not displayed	
CB Fail Time tBF	In			❑ not displayed	
Block I> ?	❑ Yes	❑ No		❑ not displayed	
Block Ie> ?	❑ Yes	❑ No		❑ not displayed	

2.5.16 CIRCUIT BREAKER SUPERVISION allocation

Relay:	❑	P125 (not available)

TC Supervision?	❑ YES	❑ NO
T trip circuit t SUP	s	
CB Open S'vision	❑ YES	❑ NO
CB Open Time	ms	
CB Close S'vision	❑ YES	❑ NO
CB Close Time	ms	
CB Open Alarm?	❑ YES	❑ NO
CB Open NB		
Σ Amps(n)?	❑ YES	❑ NO
Σ Amps(n)		
n		
t Open Pulse	ms	
t Close Pulse	ms	

2.5.17 SOTF

Relay:	❑ P125 (not available)

SOTF?	❑ YES	❑ NO
t SOTF	ms	
I>> ?	❑ YES	❑ NO
I>>> ?	❑ YES	❑ NO
Ctrl close input	❑ YES	❑ NO
SOTF input	❑ YES	❑ NO
HMI closing order	❑ YES	❑ NO
[79] closing	❑ YES	❑ NO
Front comm. order	❑ YES	❑ NO
Rear comm. order	❑ YES	❑ NO
Rear2 comm. order	❑ YES	❑ NO

2.5.18 LOGIC EQUATIONS

Equ. A	**Boolean**	**Logic**
A.00	❑ = / ❑ = NOT	
A.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ B	Boolean	Logic
B.00	❑ = / ❑ = NOT	
B.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. C	Boolean	Logic
C.00	❑ = / ❑ = NOT	
C.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. D	Boolean	Logic
D.00	❑ = / ❑ = NOT	
D.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. E	Boolean	Logic
E.00	❑ = / ❑ = NOT	
E.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. F	Boolean	Logic
F.00	❑ = / ❑ = NOT	
F.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. G	Boolean	Logic
G.00	❑ = / ❑ = NOT	
G.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. H	Boolean	Logic
H.00	❑ = / ❑ = NOT	
H.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

2.5.19 Comm. Order delay

Relay:	❑	P125 (not available)
	❑	P126 (not available)

tCommand1	s
tCommand1	s
tCommand1	s
tCommand4	s

2.6 RECORDING MENU

2.6.1 CB MONITORING Record

P126 & P127 only.

CB Monitoring Time	s
CB Closing Time	s
Σ Amps (n) IA	
Σ Amps (n) IB	
Σ Amps (n) IC	

2.6.2 FAULT RECORD Record

Record Number	
Fault Time	: :
Fault date	/ /
Active Set Group	❑ 1 ❑ 2
Faulted phase	❑ None ❑ Phase A ❑ Phase B ❑ Phase C ❑ Earth
Threshold	
Magnitude	A
IA Magnitude	A
IB Magnitude	A
IC Magnitude	A
IN Magnitude	A
VAB Magnitude (P127)	V
VBC Magnitude (P127)	V
VCA Magnitude (P127)	V
VN Magnitude	V
IA^VBC Angle	°
IB^VCA Angle	°
IC^VAB Angle	°
IN^VN Angle	°

2.6.3 INSTANTANEOUS Record

Number	❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5
Hour	: :
Date	/ /
Origin	
Length	s
Trip	❑ YES ❑ NO

2.6.4 DISTURB RECORD record

Pre-Time	s
Post-Time	s
Disturb rec Trig	❑ On trip ❑ On inst.

2.6.5 TIME PEAK VALUE

P126 and P127 only

Time Window	mn

2.6.6 ROLLING DEMAND

P126 and P127 only

Sub Period	mn
Num of Sub Per.	

RECORDS						
Fault Record						
Record Number	N.A.			1	5	1
Disturb Record						
Pre-Time	N.A.			0.1	3	0.1
Post-Time	N.A.			0.1	3	0.1
Disturb rec Trig	N.A.			☐ON TRIP or ☐ON INST.		
Time Peak Value						
Time Window	N.A.			☐5 mn, ☐10 mn, ☐15mn, ☐30mn, ☐60mn		
Rolling Demand	N.A.			☐5 mn, ☐10 mn, ☐15mn, ☐30mn, ☐60mn		
Time Window	N.A.			☐1 mn	☐60 mn	☐1 mn

3. P126 & P127 FURTHER TESTS

3.1 Introduction

The following procedures are written for demonstrating the main protection functions of the MiCOM P126 (where possible) & P127 relays using an Omicron test or similar. The tests do not test the limits / boundaries of all available function characteristics. They do tests that the function is operating at one or two chosen points an a characteristic. This document is not a complete commissioning procedure but could be referred to when performing commissioning tests in association with the commissioning section of the service manual.

The procedures will state if a deviation from the standard connections or default settings is required for testing a particular function. For specific on site applications only enabled functions would be tested using application specific settings.

3.2 Test equipment

The test procedure has been written on the assumption that an Omicron, or equivalent, test set will be used. Auxiliary supplies of adequate rating will also be required.

3.3 Type used relay

The following tests have been done using a P127 with the following characteristic.

- Earth Current : 0.01 to 8Ien
- Voltage input : 57-130V
- Auxiliary supply voltage : 130-250Vdc/110-250Vac
- Communication protocol : Mod Bus
- HMI Language : English
- Relay software : Current Version

3.4 Test configuration

Input the factory default settings. These settings shall then be downloaded and recorded in the test results. Any changes to the settings required by this test procedure shall be recorded in the test results. Any deviation from the default settings will be indicated for each test.

3.5 Connections to test equipment

The test equipment will be wired as described in the table below unless otherwise stated.

3.6 Test Overcurrent Protection

The following general settings for the relay are suggested

- VT Connection : 3Vpn
- Line CT primary : 1A
- Line CT secondary : 1A
- E/Gnd CT primary : 1A
- E/Gnd CT secondary : 1A
- Line VT primary : 0.10 kV
- Line VT secondary : 100 V

3.7 Non-directional overcurrent protection

3.7.1 Overcurrent sensitivity tests

Object:

The following tests verify that the relay overcurrent elements operate at the set thresholds.

Test with the following relay settings (all thresholds set as non-directional):

- ON
- 1 In
- Characteristic IDMT
- Curve IEC_SI (Standard Inverse)
- TMS 0.025
- Reset time delay 0.04 s

Inject current of 0.95 In into the A phase input. Increase the current in 0.01In steps, pausing for 2.5s between each step, until the relay operates. The current must then be reduced in the same manner until the protection resets.

Repeat the above tests for all phases.

Repeat the above test for other overcurrent stages taking in account that the delay time for nthe second and third threshold is DMT (t=0s). Make the test before on I>> after on I>>>.

3.7.1.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

Delay trip IDMT (inverse time only for I>):

- Pick-up should occur at 1.1Is ±2%.
- Reset should occur at 1.04Is ±2%.

Delay Trip DT (definite time for I>, I>>, I>>>)

- Pick-up should occur at : Is ±2%.
- Reset should occur at 0.95 Is ±2%.

3.7.2 Overcurrent characteristic tests

Object:

The following tests verify that the relay overcurrent elements trip in the correct time.

Test with the following relay settings:

- Is 1 In
- Characteristic DT / IDMT
- Curve IEC_SI (Standard Inverse)
- TMS 1.0
- Time Delay 1s
- Directionality Non-directional
- Reset time delay 0s

Enable stage 1 overcurrent and prepare the tests set so that A phase current can be instantaneously applied at 2In and 10In respectively. Measure the operating times of the relay start and trip contacts. Repeat the test with the element set to IDMT. Repeat the test with the element disabled and verify that no start or trip elements operate.

Repeat the above testing for all phases and stages (with the exception of IDMT which is only for the first stage).

3.7.2.1 Pass Criteria

For the relay to pass it shall operate as detailed below

- DT operating time 1.0s ±2%
- IDMT operating time: 10.070s ±2% at 2 In.
- 2.991s ±2% at 10 In.

3.7.3 Non-directional earth fault overcurrent protection

3.7.3.1 Neutral sensitivity test

Object:

The following tests verify that the relay earth fault elements operate at the set thresholds.

Test with the following relay settings:

- 0.1Ien
- Characteristic IDMT
- Curve IEC_SI (Standard Inverse)
- TMS 0.025
- Delay time 0s
- Directionality Non-directional
- Reset time delay 0.04s

Enable stage 1of Earth Fault protection and inject current of 0.095Ies into the Ie current input. Increase the current in 0.001In steps, pausing for 2.5s between each step, until the relay operates.

The current must then be reduced in the same manner until the protection resets.

Repeat the above test for all stages of Earth fault protection (delay type is DT).

3.7.3.2 Pass Criteria

For the relay to pass it shall operate as detailed below.

- Pick-up should occur at 1.1 Ies ±2%.
- Reset should occur at 1.05 Ies ±2%.

3.7.4 Neutral characteristic tests

Object:

The following tests verify that the relay earth fault elements trip in the correct time.

Test with the following relay settings:

- Characteristic DT / IDMT
- Curve Standard Inverse
- TMS 1.0
- Time Delay 1s
- Directionality Non-directional
- Reset time delay 0s
- Is 1 Ien

Enable stage 1 of Earth Fault protection and prepare the tests set so that Ie current can be instantaneously applied at 2 Ies and 10 Ies respectively. Measure the operating times of the relay start and trip contacts. Repeat the test with the element set to IDMT. Repeat the test with the element disabled and verify that no start or trip elements operate.

Repeat the above testing for all stages (IDMT is only for the first stage).

3.7.4.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

- DT operating time
- 1.0s ±2%
- IDMT operating time :
- 10.07s ±2% at 2 Ies
- 2.999s ±2% at 10 Ies

3.7.5 Directional earth fault overcurrent protection

3.7.5.1 Neutral sensitivity test

Object:

The following tests verify that the relay directional earth fault elements operate at the set thresholds and boundary trip zone

Wirng scheme: 3Vpn for the voltage, Holmgreen insertion for the currents. The Ie current is the output common of the phase current inputs.

Test with the following relay settings:

- E/GND Primary 5A
- E/GND Secondary 5A
- Ie> 0.2 Ien
- Characteristic IDMT
- Curve IEC_SI (Standard Inverse)
- TMS 1
- Ue 1V
- Trip Zone -45°/+45°
- Torque Angle 180°
- Directionality Directional
- Reset time delay 0.04s

Set the phase voltage adn phase current as following

- Ua=50V, Ub=57.70V, Uc=57.70V.

Set the Ia current to have the ratio Ia/Ie> as:

- Ia/Ie> =2 Trip time in 10.08s
- Inject the current and verify the delay trip time.
- Repeat the test for the following ratio
- Ia/Ie> =3 Trip time in 6.36s
- Ia/Ie> =4 Trip in 5.022s

3.7.5.2 Pass Criteria

For the relay to pass it shall operate as detailed below.

Pick-up should occur at 1.1 Ies ±2%.

- Time accuracy +/-2% or 20….40ms

3.7.6 Reset time test

Repeat the test at the paragraph 6.8.1 using definite time setting the tIe> to 10s and Treset to 10s.

Make the sequence:

On Input current 2A, after 5s inject 0 A after 5 seconds again 2A

3.7.6.1 Pass Criteria

For the relay to pass; it shall operate as detailed below.

The trip occurs after 5s.

Time accuracy: +/-2% or 20….40ms

3.7.7 Directional earth fault operating boundary

Object:

The following tests verify the operating boundary of the characteristic and to verify its pick-up and drop-off.

Test with the following relay settings:

- VT connection 3Vpn.
- Characteristic DT
- t 10s (Operation to be determined by start contacts)
- Is 0.2 Ien
- Torque Angle(RCA) 180°
- Boundary trip zone +/-45°

Enable stage and configure the test set applying Ua=50V, Ub=57.70V, Uc=57.70V.

Apply A phase current of twice setting at 50° leading the A phase voltage.

Increase/decrease the angle between the phase A voltage and current in step of 1° every 2.5s and determine the angle at which the start contacts non-operate and operate, once the element has started decrease/increase the angle and determine the drop-off.

Repeat the same test for IDMT delay trip time using the previous settings.

3.7.7.1 Pass Criteria

For the relay to pass the following must be satisfied:

The directional decision shall be from the following equations:

Directional forward -45° < RCA (Torque angle) < 45°

The operating boundary shall be within ±3° of the relay characteristic angle ±45°.

The element shall drop off within 3° of pick-up.

3.7.8 Neutral characteristic tests

Object:

The following tests verify that the relay earth fault elements trip in the correct time.

Test with the following relay settings:

• Characteristic	DT / IDMT
• Curve	Standard Inverse
• TMS	1.0
• Time Delay	1s
• Directionality	Non-directional
• Reset time delay	0s
• Is	1 Ien

Enable stage 1 of Earth Fault protection and prepare the tests set so that Ie current can be instantaneously applied at 2 Ies and 10 Ies respectively. Measure the operating times of the relay start and trip contacts. Repeat the test with the element set to IDMT. Repeat the test with the element disabled and verify that no start or trip elements operate.

Repeat the above testing for all stages (IDMT is only for the first stage).

3.7.8.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

DT operating time

- 1.0s ±2%,

IDMT operating time :

- 10.07s ±2% at 2 Ies
- 2.999s ±2% at 10 Ies

3.7.9 Directionaloperating boundary – PHASE overcurrent (only P127)

Object:

The following tests verify the operating boundary of the characteristic and to verify its pick-up and drop-off.

Test with the following relay settings:

• VT connection	3Vpn.
• Characteristic	DT
• t	10s (Operation to be determined by start contacts)
• Is	1 In
• Characteristic Angle (RCA)	0°
• Boundary trip zone	+/-80°

Enable stage 1of Overcurrent and configure the test set to apply balanced three phase nominal voltages (57.7V) to the voltage inputs.

Apply A phase current of twice setting at 30° leading the A phase voltage.

Increase/decrease the angle between the A phase voltage and current in step of 1° evry 2.5s and determine the angle at which the start contacts non-operate and operate, once the element has started decrease/increase the angle and determine the drop-off.

3.7.9.1 Pass Criteria

For the relay to pass the following must be satisfied:

The directional decision shall be from the following equations:

Directional forward -80° < RCA (Torque angle) < 80°

The operating boundary shall be within ±3° of the relay characteristic angle ±80°.

The element shall drop off within 3° of pick-up.

3.7.10 Earth directional wattmetric test

Wiring scheme is:

- 3Vpn for the voltage
- Holmgreen insertion for the phase and earth current
- CT phase and E/GND ratio primary and secondary to 5A
- VTs primary and secondary set to 0.1kV and 100V

Relay settings:

- Pe> 5 x K W -> 25W
- Delay type IDMT: IEC SI CURVE
- Reset time 0.04s
- Torque angle 180°
- Inject: Ua=57.7V, Ub= 57.7V, Uc=57.7V with these values the Ue is equal to 0.

Inject the Ia phase current with displacement 0° with Ua to have the following ratios Pe/Pe> : 2, 3, 4

- Inject Ua=27.7V, Ub= 57.7V, Uc=57.7V
- Ue=1/3(Ua+Ub+Uc) (vectorial summation)

The relay calculates the Pe as:

Pe= Ue x Ie x Cos(Ie^Ue + Torque angle)

Pe= (27.7-57.7)/3 x Ia x cos(180°) with Ia = 5A you have 50W the ratio is equal 2 follow the other ones.

Inject 5A for a ratio equal to 2; theoretical delay time 10.03s, measured delay time 10,273s

Inject 7.5A for a ratio equal to 3 theoretical delay time 6.3s, measured delay time 6.43s

Inject 10A for a ratio equal to 4 theoretical delay time 10.03s, measured delay time 5.077s

3.7.10.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

IDMT operating time :

- Accuracy: ±2% or 30…..40ms

3.7.11 Negative sequence overcurrent

Object:

To verify that the negative sequence overcurrent operation is recorded as a fault record.

Test with the following relay settings:

- DT time Delay 10s
- I2> 0.1In

Apply three phase currents to the relay at a magnitude of In. Step change the A phase current to a magnitude of 0.5In. Verify that the fault record indicates that the negative sequence overcurrent has started.

Repeat the above testing with the time delay set to 0s. The fault record should now indicate trips.

3.7.11.1 Pass Criteria

For the relay to pass it shall operate as detailed above.

3.7.12 Thermal overload

Object:

The following tests verify that thermal overload starts and trips applied to the relay operate correctly.

Test with the following relay settings:

- Thermal trip current $I\theta>$ 0.5 In
- Thermal alarm $\theta>$ No
- Time Constant Te 1 min
- K 1
- θ Trip 100%

Configure the test set to apply 3 phase balanced current to the relay

Reset the thermal time state of the relay. Inject three phase 0.55 In to the relay and measure the operating time of the contact. Verify that the fault record indicates that the thermal overload alarm has operated followed by a thermal overload trip after 107 s ±2%.

3.7.12.1 Pass Criteria

For the relay to pass it shall operate as detailed above.

3.8 Voltage Protection (only P127)

The voltage protection 27 and 59 compare the line voltage to the setting elements of each protection.

3.8.1 Under voltage

Object:

The following tests verify that under voltage starts and trips applied to the relay operate correctly.

Test with the following relay settings:

- Mode OR
- Characteristic DT
- DT 30s

3.8.2 Phase to neutral under voltage element

Test with the following relay settings:

- U< 50V

Enable stage 1 over voltage and apply rated three phase voltages (57.7V per phase) to the relay. After 2s reduce the phase A voltage and phase B voltage to 20V. Measure the operating times of the relay start and trip contacts. Repeat the test with the element disabled and verify that no start or trip elements operate.

Repeat the above tests for stage 2 under voltage.

3.8.3 Over voltage

Object:

To verify that over voltage starts and trips applied to the relay operate correctly.

Test with the following relay settings:

- Mode OR
- Characteristic DT
- DT 10s

3.8.4 Phase to neutral over voltage element

Test with the following relay settings:

- U>100V

Enable stage 1 and apply three phase voltages (50V per phase) to the relay. After 1s increase the phase A voltage and phase B voltage to 60V. Measure the operating times of the relay start and trip contacts. Repeat the test with the element disabled and verify that no start or trip elements operate.

Repeat the above testing for stage 2 overvoltage.

3.8.5 Residual over voltage

Object:

The following tests verify that residual over voltage starts and trips applied to the relay are recorded as fault records.

Test with the following relay settings:

- Ue Derived (VT Connection setting 3Vpn)
- Ue>>>> 10V
- Trip Delay 10s

Enable stage of the residual overvoltage protection and apply balanced three phase voltages to the relay (57.7V per phase) after 2s reduce UA phase voltage to 25V . Measure the operating times of the relay start and trip contacts. Repeat the test with the element disabled and verify that no start or trip elements operate.

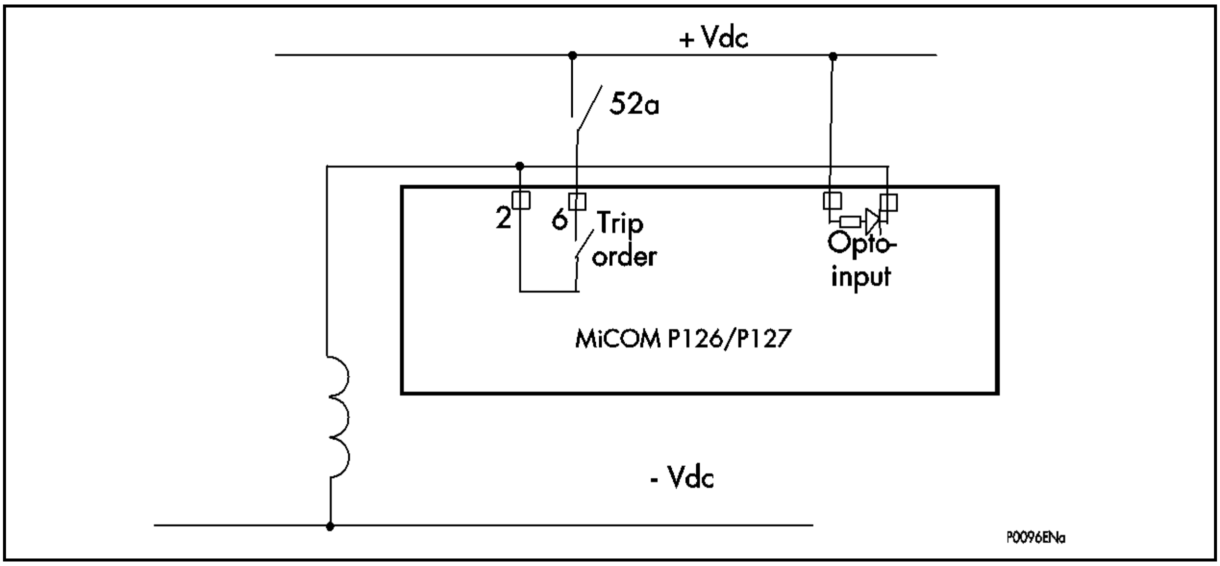
3.8.5.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

3.9 Automatic control functions

3.9.1 Trip circuit supervision

Connect the coil of the external auxiliary relay as the example in the Technical Guide P12y/EN AP page 55.



Set the following parameters.

Set in the CB Monitoring TCS ON and

Input menu:

Assign Trip. Circ. to input 1

Assign an output relay to the 52 Fail

Procedure

Supply the input and verify that the led and the relay are OFF

Remove the supply from the input and verify that the output relay are ON after the set of the TCS timer.

3.9.2 Circuit breaker failure

Object:

The following test verifies the Breaker Failure operation.

Test with the following relay settings:

Overcurrent:

- Characteristic DT
- Time Delay 0s
- Directionality Non-directional
- Reset time delay 0s
- Is (I>) 1 In

CBF:

- Time Delay 0s
- I<BF 0.5 In
- tBF 5s

The relay shall be configured with trip commands relay assigned to t_I>, with relay 2 assigned to CB fail function and with relay 2 assigned as latched.

Enable stage 1 overcurrent and apply three phase currents to the relay at 0.8 In for 1s; instantaneously increase the currents applied to the ABC phase inputs to 2 In for 7s. Verify after the increase that tat the relays number 2 change in the status display windows to level 1 after 5s.

3.9.2.1 Pass Criteria

For the relay to pass it shall operate as detailed above.

3.9.3 Cold load pick-up

Test with the following relay settings:

Cold load pick-up:

- t_I> Yes
- Level 200%
- tCL 5.0 s

Overcurrent:

- Characteristic DT
- Time Delay 2s
- Directionality Non-directional
- Reset time delay 0s
- Is (I>) 1In

Inputs:

- Input 1 Cold L PU

Apply three phase currents to the relay at a magnitude of 1.5 In and supply the input 1. Verify after 8 sec the trip of the overcurrent is recrided as a fault record

3.9.3.1 Pass Criteria

For the relay to pass it shall operate as detailed above.

3.9.4 Broken Conductor

Object:

The following tests verify that a broken conductor condition causes the relay to operate correctly.

Test with the following relay settings:

- I2/I1 setting 20%
- Characteristic DT
- Time Delay 10s

Apply rated three phase currents (1In). After 10 seconds have elapsed, reduce the current in A phase to zero and measure the time taken for the relay to indicate a broken conductor trip.

Repeat the test with the element disabled and verify that no start or trip elements operate.

3.9.4.1 Pass Criteria

For the relay to pass it shall operate as detailed below.

- DT operating time 10.0s ±2%

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HARDWARE/SOFTWARE VERSION HISTORY AND COMPATIBILITY P125 P126-P127 V16

CONTENTS

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1. INTRODUCTION

HARDWARE INSTALLED
HARD 4: First version of hardware (Px2x Phase 1)
HARD 5: Latest version of hardware (Px2x Phase 2**)**

SERIAL NUMBER HELP
The serial number (e.g. 0804253) informs about the date of manufacture and the version of hardware. It printed on the front relay label. This number is read from left to right: - 2 first number define the week (e.g. 08 is the calendar week 8). - 2 number following define the year (e.g. 04 is the year 2004). - 3 final is a consecutive number up to 999 to uniquely identify the relay. E.g.: W W Y Y N N N - W = Week 01 To 52 - Y = Year (19)94 To (20)93 - N = Product Arrang. 001 To 999

2. MiCOM P125

P125 – Serial number – Hardware Correlation	
Serial Number	Hardware installed
Phase 1	HARDWARE VERSION 4
Phase 2	HARDWARE VERSION 5

Relay Type P125				
Software Version	Date of Issue	Full Description of Changes	S1 Compatibility	Backward Compatibility with previous hardware
V3	2001	Software changes implemented in this version - Addition of Polish, Czech and Spanish - Software corrections.	V2.03	HARD 4
V4	2001	Software changes implemented in this version - Addition of: . cyrillic characters, Italian, German and Dutch, . factory and battery alarms, . energy reset by remote TC (Modbus), . "parameter changed" event . LED & output relays conf. on single pole current tripping, . digital inputs supply & operating modes, . 2nd settings group active on output relay conf. . start protections alarms, . IDMT curve on 1st threshold (32n, 46, 67 and 67n), . rescue password, . VDEW protocol, - date & time IEC format implemented, - Password request for energy reset, - Software corrections.	V2.03	HARD 4
V5	2003	Software changes implemented in this version - EEPROM self test and management modified, - Real time clock evolution, - Modification during transmissions, - Modification of hardware text alarms, - Addition of Russian and Portuguese languages.	V2.10	HARD 4
V6.A	09/2003	Software changes implemented in this version - Enhancement of EEPROM software, - Protection 67 and 67N, addition of IDMT time on 2nd threshold, - For every protection with IDMT thresholds moved max RTMS to 3.2 from 1.5, - For Automatism addition of: . maintenance mode,	V2.10	Hard 2 or Hard 4

Relay Type P125				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		. tAUX3 and tAUX4, . LED autotest on new fault, - Threshold setting of 32N protection: K constant substitued by E/Gnd CT sec value, - Modbus - addition of 32N: Po, IoCos, Io^Uo angle. - 67N: trip zone correction (secondary ground TC = 5A), - Modification to fix FPGA upload, - Correction of communication bug.		
V6.C	09/2005	Software changes implemented in this version - Protocol IEC60870-5-103: . management of private/public address added, . class 1 information corrected, . no ASDU23 sent after disturbance creation if already connected corrected, . reset LED not updated information corrected, . time synchro. correction, - Cyrillic character display corrected,	V2.11	Hard 4
V6.F	09/2005	Software changes implemented in this version - In the Configuration / Group Select sub-menu: . “Change Group By Input” becomes “Change Group By”, . “LEVEL / EDGE” becomes “INPUT / MENU”, . the setting “Start/Stop tAux_ by input” is removed, - Creation of Hungarian language.	V2.12	Hard 4
V6.F1	01/2007	Software changes implemented in this version - IEC60870-5-103 communication, correction of: . relay blocking after reception of a time synchronisation frame (IEC60870-5-103), . processing of Start In> event, . period of sampling in disturbance extracted, . scale factor for Ia, . disturbance record upload of channels for U0 and frequency, . ASDU 9 unused fields.	V2.12	Hard 4
V6.G	02/2007	Software changes implemented in this version - Software corrections: . Angle Ie/Ue, . [67n]U>> and [67N]U>>> initialization (comm. Modbus), . data copy address during initialization, . elimination of offset of analog input in the displayed measurement of IE & UE, . Initialization of minimum threshold of I0 & U0, . trip and auxiliary relays latches, . implementation of commands of group 1 and group 2 (IEC60870-5-103), . IN event start (IEC60870-5-103), . Correction alarm string display, . minimum of amplitude to calculate frequency, . IeCos calculation with verification of Ue voltage, . “Control trip” and “Control close” french label,	V2.12	Hard 4

Relay Type P125

Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		. Initialisation of the process after CT and VT ratio setting with modbus comm., . DMT temporization parameter “TiE>>” visibility, . Io_cos & Po_cos when IR injected is near saturation, . “Ue>>>” fault records french label, . Ia, Ib and Ic channels scale factor in disturbance record extraction.		
V6.H	01/2008	Software changes implemented in this version - Correction of Phase I DTS, - “RTMS Ie>>” and “tReset Ie>>>” reinitialisation if sent by communication modbus, - Correction of the reinitialization of settings (“RTMS Ie>>” and “tReset Ie>>>”) sent by communication modbus.	V2.13	Hard 4
V10.D	08/2006	V10.D software is equivalent to V6.H software based on the phase II hardware redesign (Hard 4) Software changes implemented in this version - None.	V2.13	Hard 5
V11.A	06/2007	Software changes implemented in this version - Phase rotation: right computation with ACB phase rotation, - Phase angle display: the order of phases (I & U) can be displayed in the measurement menu, - Improvement of offset: offset calibration values can be memorized for each range and each gain, - Auxiliary logic inputs: temporized and assignable to LED, trip order, output relays and equations, and recordable in event file. - Fail safe relay: possibility to deactivate a relay if associated information is activated, - The clock can be synchronized by logic input, - TMS and RTMS step reduced to 0.001, - Multi assignable logic inputs: . assignable to several internal signal, . full ascendant compatibilty with former system, - phase of each signal can be calibrated, - Addition of disturbance, event, instantaneous and default information saving, saved statistics records functionality, - logic inputs can be assignated to the outputs, - 25 faults and 250 events recordable, - 51V protection: I>>(>) minimum threshold value can be adjusted to 0.1 In, - DNP3.0 protocol added, - Correction of software defects: . values error after disturbance avalanche. presence of non-acknoledged records bit in Modbus communication improved, . communication Modbus addresses improved for reading	V2.14	Hard 5

Relay Type P125				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V11.B	12/2007	Software changes implemented in this version - Addition of Turkish language, - Event of latched relays: correction of the modbus address, - “Disturbance trigger” event added in event records, - Communication Modbus: . modification of the manual acknowledgement of oldest event and fault record, . modification of the disturbance record acknowledgement status, . modification of the remote control for disturbances acknowledgement, . disturbance record: correction of number of pages and number of samples in the service frame.	V2.14	Hard 5
V11.C	06/2009	Software changes implemented in this version - logic equations: opto-inputs state added, - new inhibited alarms (auxiliary timers and logic equations), - German labels updated, - Correction of: . settings after password setting (front keyboard) . communication port failure alarm, . tAux alarm generation . HMI trouble after local paswword entering during data edition with offset, . disturbance recording duration, . events display during CPU load phases.	V3.1	Hard 5
V12.A	09/2009	Software changes implemented in this version - Possibility to operate the CB and to start a disturbance recording from the relay HMI, - Total trips number calculated with all the CB operations, - Disturbance recorder time modified, - IA, IB, IC & I0 displayed on the same time on relay, - The result of a Boolean equation can be used in an other equation, - Correction of: . the decimal value of DMT temporisation when ≥ 20s, . absolute time on disturbance record, . Chinese text on “Output Relay” menu, . 32bits value in E2PROM with MODBUS Protocol, . problem of extraction of events with MiCOM S1 using MODBUS protocol.	V3.1	Hard 5
V12.B	01/2010	Software changes implemented in this version - Correction of: . default language selection, . IEC60870-5-103 comm.: event transmission with ModBus, . HMI translations, . disturbance records: storage of start of disturbance,	V3.1	Hard 5
V12.C		General: New Schneider Electric brand	V3.1	Hard 5

Relay Type P125

Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V14.A	03/2011	Software changes implemented in this version - Power supply and transformer offset self-test improvement, - Correction of: . the synchronous polarisation sometimes doesn't work . Date/time failure: no hardware alarm occurs . the language parameter can be set to "Chinese" even the LCD not supported . Disturbance record doesn't trig if the tEqu=0.0s . IEC 103 comm.: writing address 0110h, 0111h, 0118h are not forbidden . Timestamp of the appearance of I> not correct . IEC 103 comm.: the frequency in fault record is expressed in 100*Hz, instead of Hz . Protection may not operate when "changing group by logical input" is selected	V3.1	Hard 5
V15.A	10/2011	Software changes implemented in this version - "General reset" control added to "Orders" menu. - Correction of: . trip command to RL1 (IEC 61870-5-103 protocol) . Chinese language: HMI errors.	V3.1	Hard 5
V15.B	02/2012	Software changes implemented in this version - Correction of: * On local HMI, the measurement value is not correct		
V15.C		Software changes implemented in this version - Add LCD contrast control - Model number and series number can read from relay menu - Correction of: * Disturbance records trigger by digital input does not work properly * Incorrect menu cell for E/GND protection in Group 2	V3.1	Hard 5
V15D	08/2013	Software changes implemented in this version - Correction of: * Pe threshold in the firmware is 1/3*Vres*Ires*Cos(f-fc), not agree with the manual which is Vres*Ires*Cos(f-fc). *No "Setting group changed" event generated when change setting group by binary input	V3.1	Hard 5
V15E	05/2014	Software changes implemented in this version - Correction of *correction of "reset all alarms" behavior	V3.1	Hard 5
V16A	03/2017	Software changes implemented in this version - Extension the TMS setting range for IDMT curves - Fixed a voltage memory issue during synchronous polarization when pre-fault current is too low	V3.1	Hard 5

3. MiCOM P126

P126 - Serial number – Hardware Correlation	
Serial Number	Hardware installed
Phase 1	HARDWARE VERSION 4
Phase 2	HARDWARE VERSION 5

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V3.A to V3.J	2001	<u>Software changes implemented in this version</u> - Addition of Polish Czech and Spanish, - Software corrections,	V2.03	HARD 4
V4.A to V4.J	2001 - 2003	<u>Software changes implemented in this version</u> - Addition of: . cyrillic characters, Italian, German and Dutch, . factory and battery alarms, . energy reset by remote TC (Modbus), . “ parameter changed” event, . LED & output relays conf. on single pole current tripping, . digital inputs supply & operating modes, . 2nd settings group active on output relay conf. . start protections alarms, . IDMT curve on 1st threshold (32n, 46, 67 and 67n), . rescue password, . VDEW protocol, - date & time IEC format implemented, - Password request for energy reset, - Software corrections.	V2.03	HARD 4
V5.A V5.B V5.C	2003	<u>Software changes implemented in this version</u> - EEPROM self test and management modified, - Real time clock evolution, - Modification during transmissions, - Modification of hardware text alarms, - Addition of Russian and Portuguese languages.	V2.10	HARD 4
V6.A	09/2003	<u>Software changes implemented in this version</u> - Enhancement of EEPROM software, - Addition of matrix management for recloser, - Protection 67 and 67N, addition of: . IDMT time on 2nd threshold, . peak detection on 3rd threshold - For every protection with IDMT thresholds moved max RTMS to 3.2 from 1.5, - For Automatism addition of: . SOTF/TOR function, . maintenance mode, . tAUX3 and tAUX4, . LED autotest on new fault,	V2.10	Hard 2 or Hard 4

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		. rolling demand on new fault, . local/remote function, - Addition of instantaneous records, - tIA, tIB and tIC modification, - Threshold setting of 32N protection: K constant substitued by E/Gnd CT sec value, - Modbus: addition of 32N: Po, IoCos, Io^Uo angle. - Correction of alarms saving in backup RAM, - Start tBF correction (breaker failure), - Correction of delay between analog and logic channel (disturbance record), - Correction of P & Q calculation (3Vpn & 2Vpn+Vr wiring), - 67N: trip zone correction (secondary ground TC = 5A), - Modification to fix FPGA upload, - Correction of communication bug.		
V6.B	10/2004	Software changes implemented in this version - Correction of the IEC60870-5-103 disturbance extracted from the front Modbus port, correcting the logical information "GENERAL START", "CB FAIL" and "tle>>/tle>>>", - Addition of event record of alarm acknowledgement by push-button, - Enhancement when phase A, B or C is near the hysteresis threshold, - Communication IEC60870-5-103: addition of management of private/public address.	V2.11	Hard 4
V6.C	12/2004	Software changes implemented in this version - Event record of alarm acknowledgement by push-button added, - Protocol IEC60870-5-103: . management of private/public address added, . Class 1 information corrected, . no ASDU23 sent after disturbance creation if already connected corrected, . Reset LED not updated information corrected, . time synchro. correction, - Broken conductor: logic equation A, B, C and D corrected, - Cyrillic character display corrected, - Frequency tracking correction.	V2.11	Hard 4
V6.D	09/2005	Software changes implemented in this version - Correction of relay blocking after some tripping, - Backup SRAM alarm correction.	V2.12	Hard 4
V6.F	09/2005	Software changes implemented in this version - In the Configuration / Group Select sub-menu: . “Change Group By Input” becomes “Change Group By”,	V2.12	

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		. "LEVEL / EDGE" becomes "INPUT / MENU", . the setting "Start/Stop tAux_ by input" is removed, - Creation of Hungarian language,		
V6.F1	01/2007	Software changes implemented in this version - IEC60870-5-103 communication, correction of: . relay blocking after reception of a time synchronisation frame (IEC60870-5-103), . processing of Start In> event, . period of sampling in disturbance extracted, . scale factor for Ia, . disturbance record upload of channels for U0 and frequency, . ASDU 9 unused fields,	V2.12	
V6.G		Software changes implemented in this version - Software defects corrections: . Angle Ie/Ue, . "SF6" alarm text, . [67n]U>> and [67N]U>>> initialisation (comm. Modbus), . time synchronization frame reception (IEC60870-5-103), . data copy address during initialization, . verification of local mode to inhibit command (IEC60870-5-103), . trip and auxiliary relays latches, . IN event start (IEC60870-5-103), . Correction alarm string display, . minimum of amplitude to calculate frequency, . IeCos calculation with verification of Ue voltage, . "Control trip" and "Control close" french label, . Initialisation of the process after CT and VT ratio setting with modbus comm., . frequency of disturbance records is nominal network frequency according to comtrade format, . Equation logic for I2>>> and tI2>>>, . DMT temporization parameter "TiE>>" visibility, . blocking Logic of thermal state, . protection thermal "Ith>" and "Te" initialization after setting, . amplitude of IeCos fault, . Io_cos & Po_cos when IR injected is near saturation, . "Ue>>>" fault records french label, . Period of samples of disturbance extracted (IEC60870-5-103), . ASDU 9 unused fields, . "recloser blocked" or "VTS" alarm after switching ON/OFF, . Ia, Ib and Ic channels scale factor in disturbance record extraction, . disturbance record upload of channels for U0 and frequeency, . RAM content verification at starting.	V2.12	
V6.H		Software changes implemented in this version	V2.13	Hard 4

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		- Possibility to start autoreclose from an external device using tAux1 and tAux2 without tripping the CB, - Correction of Phase I DTS, - recloser: information of definitive trip occurs if the matrix of cycle does not set “nb cycle”+1, - Correction of SF6 front face alarm text (same as logical input text corresponding to “CB Ftt”, - “RTMS Ie>>” and “tReset Ie>>>” reinitialisation if sent by communication modbus, - Communication IEC-60870-5-103: inhibition of command if the local mode has been selected by logic input, - the fault record number to display can be modified using Modbus communication w/o affecting the displayed fault, - Modification of the primary ratio for voltages channels with voltage option 220-480V in disturbance records uploaded with IEC-60870-5-103, - Correction of the reinitialization of settings (“RTMS Ie>>” and “tReset Ie>>>”) sent by communication modbus.		
V10.D	08/2006	v10.D software is equivalent to v6.H software based on the phase II hardware redesign (Hard 4) Software changes implemented in this version - None.	V2.13	Hard 5
V11.A	06/2007	Software changes implemented in this version	V2.14	Hard 5

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		- Phase rotation: right computation with ACB phase rotation, - Phase angle display: the order of phases (I & U) can be displayed in the measurement menu, - Improvement of offset: offset calibration values can be memorized for each range and each gain, - Auxiliary logic inputs: temporized and assignable to LED, trip order, output relays and equations, and recordable in event file, - Fail safe relay: possibility to deactivate a relay if associated information is activated, - The clock can be synchronized by logic input, - TMS and RTMS step reduced to 0.001, - Multi assignable logic inputs: . assignable to several internal signal, . full ascendant compatibilty with former system, - I< configurable on opened circuit breaker (o/o), - Addition of boolean equations with operators NOT, AND and OR, - phase of each signal can be calibrated, - logic inputs can be assignated to the outputs, - 25 faults and 250 events recordable, - 51V protection: I>>(>) minimum threshold value can be adjusted to 0.1In - DNP3.0 protocol added, - correction of software defects: . values error after disturbance avalanche, . date of event logic input improvement, . presence of non-acknoledged records bit in Modbus communication improved, . the fault record number to display can be modified using Modbus communication, . communication Modbus addresses improved for reading, . correction of auto-acknowledgement of disturbance.		

Relay Type P126

Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V11.B	12/2007	Software changes implemented in this version - Addition of equation logic logic assigned to LED, - Modification of all equation logic labels (from Equ.x" to "tEqu.x"), - Addition of Turkish language, - Event of latched relays: correction of the modbus address, - "Disturbance trigger" event added in event records, - Communication Modbus: . modification of the manual acknowledgement of oldest event and fault record, . modification of the disturbance record acknowledgement status, . modification of the remote control for disturbances acknowledgement, . disturbance record: correction of number of pages and number of samples in the service frame,	V2.14	Hard 5
V11.C	06/2009	Software changes implemented in this version - Addition of auxiliary timers in coherence with the number of opto inputs. tAux5, tAux6 and tAux7 timers duration can be set up to 20000s (> 5.5 hours), - logic equations: opto-inputs state added, - new inhibited alarms (auxiliary timers and logic equations), - German labels updated, - Correction of: . settings after password setting (front keyboard) . ΣAmps(n) counter, . communication port failure alarm, . tAux alarm generation . blocking by "CB fail" of "I> rev" and "Ie> rev", . display of protection (minimum amplitude) after boot or remote setting. . HMI trouble after local paswword entering during data edition with offset, . AR Cycle tAux settable to start and inhib, . disturbance recording duration, . events display during CPU load phases.	V3.1	Hard 5
V12.A	09/2009	Software changes implemented in this version - New inhibited alarms added (possibility to inhibit alarm on tAux, I<, U<, P<, Q<, F< and Boolean logic) - Possibility to operate the CB and to start a disturbance recording from the relay HMI, - Possibility to start: . SOTF using any control close information, . Cold Load Pickup by 52A or "not I< & I>" or "I0< & I0>", - Total trips number calculated with all the CB operations, - Possibility to program autoreclose blocking after a number of reclose or a defined time,	V3.1	Hard 5

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		- Possibility to assign any signal to any LED, - Disturbance recorder time modified, - IA, IB, IC & I0 displayed on the same time on relay, - Front face Led resettable via a logic input selection, - "79 internal locked" and "79 external locked" assigned to output signals, - Selectivity between two relays with tReset + autorecloser. - The result of a Boolean equation can be used in an other equation, - CB Fail added in Boolean equation, - Correction of: . the decimal value of DMT temporisation when ≥ 20s, . absolute time on disturbance record, . Chinese text on "Output Relay" menu, . 32bits value in E2PROM with MODBUS Protocol, . problem of extraction of events with MiCOM S1 using MODBUS protocol.		
V12.B	01/2010	Software changes implemented in this version - Correction of: . DNP V3.0 comm.: "multi-fragment responses" processing, . default language selection, . IEC60870-5-103 comm.: event transmission with ModBus, . HMI translations, . disturbance records: storage of start of disturbance,	V3.1	Hard 5
V12.C		General: New Schneider Electric brand	V3.1	Hard 5
V14.A	03/2011	Software changes implemented in this version Power supply and transformer offset self-test improvement, - Correction of: . the synchronous polarisation sometimes doesn't work . Date/time failure: no hardware alarm occurs . the language parameter can be set to "Chinese" even the LCD not supported . Disturbance record doesn't trig if the tEqu=0.0s . IEC 103 comm.: writing address 0110h, 0111h, 0118h are not forbidden . Timestamp of the appearance of I> not correct . IEC 103 comm.: the frequency in fault record is expressed in 100*Hz, instead of Hz . Protection may not operate when "changing group by logical input" is selected	V3.1	Hard 5
V15.A	10/2011	Software changes implemented in this version - "General reset" control added to "Orders" menu. - Correction of: . trip command to RL1 (IEC 61870-5-103 protocol) . overcurrent protection: tIA>, tIB>, tIC> reset with directional protection, . Chinese language: HMI errors.	V3.1	Hard 5

Relay Type P126				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V15.B	02/2012	<u>Software changes implemented in this version</u> - Correction of: * On I> alarm and fault, phase origin indication is not correct * On local HMI, the measurement value is not correct		
V15.C		<u>Software changes implemented in this version</u> - Add LCD contrast control - Model number and series number can read from relay menu - Correction of: * Disturbance records trigger by digital input does not work properly * Incorrect menu cell for E/GND protection in Group 2	V3.1	Hard 5
V15D	08/2013	<u>Software changes implemented in this version</u> - Correction of: * Pe threshold in the firmware is 1/3*Vres*Ires*Cos(f-fc), not agree with the manual which is Vres*Ires*Cos(f-fc). *No "Setting group changed" event generated when change setting group by binary input	V3.1	Hard 5
V15E	05/2014	<u>Software changes implemented in this version</u> - Correction of *correction of “reset all alarms” behavior	V3.1	Hard 5
V16A	03/2017	<u>Software changes implemented in this version</u> - Extension the TMS setting range for IDMT curves - Fixed a voltage memory issue during synchronous polarization when pre-fault current is too low	V3.1	Hard 5

4. MiCOM P127

P127 - Serial number – Hardware Correlation	
Serial Number	Hardware installed
Phase 1	HARDWARE VERSION 4
Phase 2	HARDWARE VERSION 5

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V3.A to V3.J	2001	Software changes implemented in this version - Addition of Polish Czech and Spanish, - Software corrections.	V2.03	HARD 4
V4.A to V4.J	2001 - 2003	Software changes implemented in this version - Addition of: . cyrillic characters, Italian, German and Dutch, . factory and battery alarms, . energy reset by remote TC (Modbus), . " parameter changed" event, . LED & output relays conf. on single pole current tripping, . digital inputs supply & operating modes, . 2nd settings group active on output relay conf., . start protections alarms, . IDMT curve on 1st threshold (32n, 46, 67 and 67n), . rescue password, . VDEW protocol, - date & time IEC format implemented, - Password request for energy reset, - Software corrections.	V2.03	HARD 4
V5.A V5.B V5.C	2003	Software changes implemented in this version - EEPROM self test and management modified, - Real time clock evolution, - Modification during transmissions, - Modification of hardware text alarms, - Addition of Russian and Portuguese languages.	V2.10	HARD 4
V6.A	09/2003	Software changes implemented in this version - enhancement of EEPROM software, - addition of matrix management for recloser, - protection 67 and 67N, addition of IDMT time on 2nd threshold, - For every protection with IDMT thresholds moved max RTMS to 3.2 from 1.5, - For Automatism addition of: . SOTF/TOR function, . maintenance mode, . tAUX3 and tAUX4, . LED autotest on new fault,	V2.10	Hard 2 or Hard 4

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		. rolling demand on new fault, . local/remote function, - Addition of instantaneous records, - tIA, tIB and tIC modification, - threshold setting of 32N protection: K constant substitued by E/Gnd CT sec value, - Modbus: addition of 32N: Po, IoCos, Io^Uo angle, - correction of alarms saving in backup RAM, - modification of cos(φ) calculation, - start tBF correction (breaker failure), - correction of delay between analog and logic channel (disturbance record), - 67N: trip zone correction (secondary ground TC = 5A), - Modification to fix FPGA upload, - Correction of communication bug.		
V6.A	09/2003	Software changes implemented in this version - addition of periodic self test of EEPROM data, - Optimization of the readings in E2PROM (writing of the value of the checksums in internal RAM), - Replacement of the data storage circuit breaker in E2PROM by a storage in safeguarded RAM, - IEC870-5-103 communication: addition of ASDU 3.4 for measurement IN, - in the management of the validity of the date and season in the messages, modifications in acknowledgement of the orders and time synchronization.	V2.10	Hard 2 or Hard 4
V6.B	10/2004	Software changes implemented in this version ·Addition of the automatism 51V (Voltage controlled over-current protection) for I>> and I>>> thresholds. The 51V blocks the I>> if there isn't the U< or V2> detected. It blocks the I>>> if there isn't the U<< or V2>> detected.. · Addition of the automatism VTS (Voltage Transformer Supervision). Addition of alarm and event associated. The VTS is	V2.11	Hard 4

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		active if (V2 > 0.3Vn & I2 < 0.5In) or (V1 < 0.1Vn & I1 > 0.1In). Possibility to blocks the 51V if VTS is active.. · Addition of the calculation of V1 and V2 (module of Fourier) for use with 51V and VTS. · Addition of the two settings of thresholds V2> and V2>> for use with 51V, - correction of I> and I>> start when I> or I>> are in "yes" or "dir" mode, and I>>> in "peak" mode, - Correction of the IEC60870-5-103 disturbance extracted from the front Modbus port, correcting the logical information "GENERAL START", "CB FAIL" and "tIe>>/tIe>>>"		
V6.C	12/2004	Software changes implemented in this version - event record of alarm acknowledgement by push-button added, - Protocol IEC60870-5-103: . management of private/public address added, . Class 1 information corrected, . no ASDU23 sent after disturbance creation if already connected corrected, . Reset LED not updated information corrected, . time synchro. correction, - broken conductor: logic equation A, B, C and D corrected, - Cyrillic character display corrected, - frequency tracking correction.	V2.11	Hard 4
V6.D	09/2005	Software changes implemented in this version - correction of relay blocking after some tripping, - backup SRAM alarm correction	V2.12	Hard 4
V6.E	09/2005	Software changes implemented in this version - Recloser 79: . modification of "auto-recloser in progress" management and associated event generation: . mofification of "final trip" information management, . locked auto-recloser assignable to the output, . manual close modified . "Ctrl Trip", "tAux3", "tAux4" and "Trip SOTF" added, - Communication IEC870-5-103: correction of scale factor RFA calculated for Current and Voltage values	V2.12	Hard 4
V6.F	09/2005	Software changes implemented in this version - In the Configuration / Group Select sub-menu: . "Change Group By Input" becomes "Change Group By". . "LEVEL / EDGE" becomes "INPUT / MENU". . the setting "Start/Stop tAux_ by input" is removed. - Creation of Hungarian language.	V2.12	
V6.F1	01/2007	Software changes implemented in this version - IEC60870-5-103 communication, correction of: . relay blocking after reception of a time synchronisation frame	V2.12	

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		(IEC60870-5-103), . processing of Start In> event . period of sampling in disturbance extracted, . scale factor for Ia, . disturbance record upload of channels for U0 and frequency, . ASDU 9 unused fields		
V6.G	02/2007	Software changes implemented in this version - Software defects corrections: . Uc RMS and Uca RMS values (2Vpn+Vr and 2Vpp+Vr connections . Angle Ie/Ue, . “SF6” alarm text, . [67n]U>> and [67N]U>>> initialisation (comm. Modbus) . time synchronization frame reception (IEC60870-5-103) . data copy address during initialization . verification of local mode to inhibit command (IEC60870-5-103) . trip and auxiliary relays latches, . IN event start (IEC60870-5-103), . Correction alarm string display, . minimum of amplitude to calculate frequency, . IeCos calculation with verification of Ue voltage, . measurement of hig power and energy display value, . “Control trip” and “Control close” french label, . Initialisation of the process after CT and VT ratio setting with modbus comm., . frequency of disturbance records is nominal network frequency according to comtrade format, . Equation logic for I2>>> and tI2>>> . blocking Logic of thermal state, . “VT connection” parameter on “2Vpn+Vr” value, . protection thermal “Ith>” and “Te” initialization after setting, . amplitude of IeCos fault, . Io_cos & Po_cos when IR injected is near saturation, . “Ue>>>” fault records french label, . Period of samples of disturbance extracted (IEC60870-5-103), . “recloser blocked” or “VTS” alarm after switching ON/OFF . Ia, Ib and Ic channels scale factor in disturbance record extraction, . alarm VTS with the closing or opening of the CB, . VTS occuring after 3 phase default (3Vpn connection), . RAM content verification at starting.	V2.12	Hard 4
V6.H	01/2008	Software changes implemented in this version	V2.13	Hard 4

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
		- if U< and U<< protection is used with 51V, ther is no alarm and no blocking of change group from this protection, - Possibility to start autoreclose from an external device using tAux1 and tAux2 without tripping the CB, - Correction of Phase I DTS, - recloser: information of definitive trip occurs if the matrix of cycle does not set “nb cycle”+1, - Correction of SF6 front face alarm text (same as logical input text corresponding to “CB Ftt”, - “RTMS Ie>>” and “tReset Ie>>>” reinitialisation if sent by communication modbus, - Communication IEC-60870-5-103: inhibition of command if the local mode has been selected by logic input, - the fault record number to display can be modified using Modbus communication w/o affecting the displayed fault, - Modification of the primary ratio for voltages channels with voltage option 220-480V in disturbance records uploaded with IEC-60870-5-103, - correction of change settings group, - Correction of the reinitialization of settings (“RTMS Ie>>” and “tReset Ie>>>”) sent by communication modbus.		
V10.D	08/2006	v10.D software is equivalent to v6.H software based on the phase II hardware redesign (Hard 4) Software changes implemented in this version - None.	V2.13	Hard 5
V11.A	06/2007	Software changes implemented in this version - 2nd harmonic blocking: For each three currents phases the harmonic restraint compare the ratio of harmonic 2 to fundamental	V2.14	Hard 5

		with the ratio setting. Inrush detection could block I>, I>>, I>>>, Ie>, Ie>>, Ie>>>, I2>, I2>> and I2>>> - Improve measurements with VA & VAH: The apparent power and apparent energy are available (as measurement) in the LCD panel, - Phase rotation: right computation with ACB phase rotation, - Phase angle display: the order of phases (I & U) can be displayed in the measurement menu, - Improvement of offset: offset calibration values can be memorized for each range and each gain, - Auxiliary logic inputs: temporized and assignable to LED, trip order, output relays and equations, and recordable in event file. - Fail safe relay: possibility to deactivate a relay if associated information is activated, - The clock can be synchronized by logic input, - TMS and RTMS step reduced to 0.001, - VTS: . assignable to output relay. . Overcurrent directional protection can be transformed to the non-directional protection when VTS is cactive. . Some protection blocking are extended when VTS is active - Multi assignable logic inputs: . assignable to several internal signal, . full ascendant compatibilty with former system - I< configurable on opened circuit breaker (o/o) and/or U< - Addition of boolean equations with operators NOT, AND and OR. - phase of each signal can be calibrated, - addition of 6 instantaneous and temporized frequency min/max protections (81< and 81>) - overpower relay (alternator protection agains power inversion) functionality added - logic inputs can be assignated to the output s - 25 faults and 250 events recordable - 51V protection: . I>>(>) minimum threshold value can be adjusted to 0.1 in . if U< and U<< protection is used with 51V, ther is no alarm and no blocking of change group from this protection, - DNP3.0 protocol added, - correction of software defects: . values error after disturbance avalanche . calculation of average measurement of UC . date of event logic input improvement, . presence of non-acknoledged records bit in Modbus communication improved, . the fault record number to display can be modified using Modbus communication w/o affecting the displayed fault, . communication Modbus addresses improved for reading . Event tI> signalled after each instantaneous fault origin, . correction of auto-acknowledgement of disturbance.		
V11.B	12/2007	<u>Software changes implemented in this version</u>	V2.14	Hard 5

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compatibility	Backward Compatibility with previous hardware
		- Addition of equation logic logic assigned to LED, - Modification of all equation logic labels (from Equ.x" to "tEqu.x", - Addition of Turkish language, - Event of latched relays: correction of the modbus address - Setting group can be changed when reverse current is present, - "Disturbance trigger" event added in event records, - Communication Modbus: . modification of the manual acknowledgement of oldest event and fault record, . modification of the disturbance record acknowledgement status, . modification of the remote control for disturbances acknowledgement, . disturbance record: correction of number of pages and number of samples in the service frame,		
V11.C	06/2009	Software changes implemented in this version - Addition of auxiliary timers in coherence with the number of opto inputs. tAux5, tAux6 and tAux7 timers duration can be set up to 20000s (> 5.5 hours), - logic equations: opto-inputs state added, - new inhibited alarms (auxiliary timers and logic equations), - German labels updated, - Correction of: . settings after password setting (front keyboard) . ΣAmps(n) counter, . communication port failure alarm, . tAux alarm generation . blocking by "CB fail" of "I> rev" and "Ie> rev", . Inrush blocking submenu, . LED affectation menu on VTS added, . display of protection (minimum amplitude) after boot or remote setting. . HMI trouble after local paswword entering during data edition with offset, . AR Cycle tAux settable to start and inhib, . VTS output display, . disturbance recording duration, . events display during CPU load phases. Hardware changes implemented in this version - New options added: . 5 opto-inputs . IRIG-B + + 2nd rear port, . IRIG-B + 2nd rear port + 5 opto-inputs	V3.1	Hard 5

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V12.A	09/2009	<u>Software changes implemented in this version</u> - New inhibited alarms added (possibility to inhibit alarm on tAux, I<, U<, P<, Q<, F< and Boolean logic) - Possibility to operate the CB and to start a disturbance recording from the relay HMI, - Possibility to start: . SOTF using any control close information, . Cold Load Pickup by 52A or “not I< & I>” or “I0< & I0>”, - Total trips number calculated with all the CB operations, - Addition of a new derived earth overcurrent threshold, - Possibility to program autoreclose blocking after a number of reclose or a defined time, - Possibility to assign any signal to any LED, - Disturbance recorder time modified, - Implementation of the adjustable directionality on the two threshold independently P> and P>>, Creation of adjustable directional threshold P< and P<< and four adjustable directional Under / over reactive power threshold Q<, Q<<, Q>, Q>>. - IA, IB, IC & I0 displayed on the same time on relay, - Front face Led resettable via a logic input selection, - “79 internal locked” and “79 external locked” assigned to output signals, - Selectivity between two relays with tReset + autorecloser. - voltage protection thresholds settable with Ph / Ph or Ph / N mode, - Possibility to Inhibit U< or U<< when CB is open, - The result of a Boolean equation can be used in an other equation, - CB Fail added in Boolean equation, - Correction of: . the decimal value of DMT temporisation when ≥ 20s, . absolute time on disturbance record, . Chinese text on “Output Relay” menu, . 32bits value in E2PROM with MODBUS Protocol, . problem of extraction of events with MiCOM S1 using MODBUS protocol.	V3.1	Hard 5

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V13.A	01/2010	Hardware changes implemented in this version - New option added: measurement CT option, Software changes implemented in this version - Current transformer supervision added, - Rate of change of frequency (df/dt) protection added, - Currents, voltages, powers and energies metering display added (with measurement CT), - New record reset order, - Eight protection setting groups, - Possibility to copy settings from a group to a 2nd group, - Communication settings adapted for 2 RS485 port using IEC60870-5-103, - "Communication orders" setting added. - Correction of: . DNP V3.0 comm.: cold restart and warm restart answer, . DNP V3.0 comm.: "multi-fragment responses" processing, . default language selection, . IEC60870-5-103 comm.: event transmission with ModBus, . HMI translations, . disturbance records: storage of start of disturbance, . frequency value storage after a frequency fault. . Σ Amps (n) counter reset remote order, . statistics data storage.	V3.1	Hard 6
V13.B	11/2011	General: New Schneider Electric brand Software changes implemented in this version - Correction of: IEC 103 comm.: the general command "Automrecloser On/Off" doesn't work for setting group 3 to 8. IEC 103 comm.: most of GI information in the "Advanced GI" list are not correctly transmitted IEC 103 comm.: ACD bit is not set to 1 in the short message of acknowledgementr after reception of a setting read or write(ASDU 140), or a general command (ASDU 20) , or time synchro command (ASDU 6)		
V14.A	03/2011	Software changes implemented in this version - Power supply and transformer offset self-test improvement, - Correction of: * the synchronous polarisation sometimes doesn't work * Date/time failure: no hardware alarm occurs * the language parameter can be set to "Chinese" even the LCD not supported * Disturbance record doesn't trig if the tEqu=0.0s * IEC 103 comm.: writing address 0110h, 0111h, 0118h are not forbidden * Timestamp of the appearance of I> and Ie>>>> not correct * IEC 103 comm.: the frequency in fault record is expressed in 100*Hz, instead of Hz * Protection may not operate when "changing group by logical input" is selected	V3.1	Hard 5

Relay Type P127				
Software Version	Date of Issue	Full Description of Changes	S1 Compati-bility	Backward Compatibility with previous hardware
V15.A	10/2011	Software changes implemented in this version - 2nd threshold added to derived earth fault protection ("Ie>>>>" becomes "Ie_d>") - Addition of [47] Negative overvoltage protection (2 thresholds), - Alarm can be inhibited by tU>, tU>>, tV2> & tV2>>, - Assignation of "communication orders" to the Logic equations. - Correction of: . trip command to RL1 (IEC 61870-5-103 protocol) . Ie_d directionality calculation without Ie, . overcurrent protection: tIA>, tIB>, tIC> reset with directional protection, . Summation of current (ΣAmps) after some events, . Chinese language: HMI errors.	V3.1	Hard 5
V15.B	02/2012	Software changes implemented in this version - Correction of: * On I> alarm and fault, phase origin indication is not correct * On local HMI, the measurement value is not correct	V3.1	Hard 5
V15.C		Software changes implemented in this version - Add LCD contrast control - Model number and series number can read from relay menu - Correction of: * Disturbance records trigger by digital input does not work properly * Incorrect menu cell for E/GND protection in Group 2	V3.1	Hard 5
V15D	08/2013	Hardware changes implemented in this version - New option added: Ethernet board with 2* RJ45 interface, offers Modbus TCP/IP protocol Software changes implemented in this version - Correction of: * Pe threshold in the firmware is 1/3*Vres*Ires*Cos(f-fc), not agree with the manual which is Vres*Ires*Cos(f-fc). *No "Setting group changed" event generated when change setting group by binary input * incorrect menu cell for E/GND protection in Group 2 * Tracking system frequency by default voltage input, switch to current when no healthy voltage detected.	V3.1	Hard 5
V15E	05/2014	Software changes implemented in this version - Correction of *correction of “reset all alarms” behavior * wrong phase indications for U<< Start and Trip alarm on HMI	V3.1	Hard 5
V16A	03/2017	Software changes implemented in this version - Extension the TMS setting range for IDMT curves - Fixed a voltage memory issue during synchronous polarization when pre-fault current is too low	V3.1	Hard 5

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