MiCOM P220/P225

Motor Protection Relays

P22x/EN M/G66

Software Version: V12

Technical Manual

MOTOR PROTECTION RELAYS
MiCOM P220/P225

CONTENTS

BLANK PAGE

SAFETY SECTION

STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC EQUIPMENT

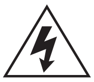
BLANK PAGE

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:

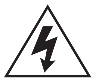
- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorised to energize and de-energize equipment and 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

CONTENTS

BLANK PAGE

1. INTRODUCTION

The MiCOM P220 & P225 relays have been designed for controlling, protecting and monitoring industrial installations, public distribution networks and substations. The MiCOM P22x protection relay range is designed for motor protection applications. A complete set of protection functions is performed on the measurement of current, voltage (P225 only) and temperature. In addition to these basic functions, the relay carries out a large number of other functions that enable it to protect and run the motor more effectively.

2. HOW TO USE THIS MANUAL

This manual provides a description of **MiCOM P220** and **P225** 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:

P22x/EN IT	*Introduction*
	The introduction presents the documentation structure and a brief presentation of the relay, including functions.
P22x/EN GS	*Getting Started*
	This sections provides a guide to the different user interfaces of the protection relay describing how to start using it.
P22x/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.
P22x/EN FT	*User Guide*
	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.
P22x/EN HI	*Menu of the HMI*
	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.
	This section shows also the menu structure of the relays, with a complete list of all of the menu settings.
P22x/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.
P22x/EN IN	*Handling, installation and case dimensions*
	This section provides logistics general instructions for handling, installing and stocking.
P22x/EN CO	*Connection diagrams*
	This section provides the mechanical and electrical description. External wiring connections to the relay are indicated.
P22x/EN CM	*Commissioning and Maintenance Guide*
	Instructions on how to commission the relay, comprising checks on the calibration and functionality of the relay.
P22x/EN RS	*Commissioning test records*
	This section contains checks on the calibration and functionality of the relay.

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 P220 & P225 RELAYS

The range of MiCOM protection relays follows on from the success of the MIDOS, K and MODN ranges by incorporating the last changes in digital technology. The MiCOM P22x is fully compatible and uses the same modular box concept. MiCOM P22x provides more protection elements for the most demanding applications.

This relay has a large number of control functions and collecting data. This can form part of a fully integrated system covering protection, control, measurements data acquisition and recording of faults, events, and disturbances. The relay is equipped on the front panel with a liquid crystal display (LCD) with 3x16 back-lit alphanumerical characters, a tactile 7 push keypad (to gain access to all the parameters, alarms and measurements) and 8 LEDs simply displaying the state of the relay.

In addition, the use of the RS485 communication port makes it possible to read, reinitialise and change the settings of the relay, if required, from a local or remote PC computer equipped with appropriate software.

Its flexibility of use, reduced maintenance requirements and ease of integration allow the MiCOM P22x to provide an evolving solution for the problems of the protection of motors.

The models available are **MiCOM P220** and **P225:** Numerical motor protection.

5. MAIN FUNCTIONS

5.1 Main functions

The following table shows the functions available with the models.

Protection functions	MiCOM P220	MiCOM P225
[49] Thermal overload	●	●
[50/51] Phase overcurrent	●	●
[50N/51N] Earth fault	●	●
[46] Unbalance	●	●
[27] Undervoltage	-	●
[59] Overvoltage	-	●
[48] Excess long start	●	●
[51LR-50S] Blocked rotor	●	●
[37] Loss of load	●	●
[49/38] Thermal overload (optional) or [49] Thermistance	●	●
Control and monitoring		
[27] Anti backspin (ABS)	-	●
Emergency start	●	●
Min time between 2 starts	●	●
General reset, start or stop motor local control (orders menu)	●	●
Alarm inhibition facilities	●	●
Boolean equations (AND, AND NOT, OR and OR NOT gates, 8 equations)	●	●
Circuit Breaker Supervision and Monitoring	●	●
Trip circuit supervision	●	●
Setting groups	2	2
Measurements and records		
Measurements (True RMS + direct/derived Current/Voltage (for P225) + MAX Value)	●	●
Faults records	25	25
Events records	250	250
Disturbance records	5	5
Communications		
RS232 front communication port	●	●
RS485 rear communication port	●	●
Optional second RS485 communication port	●	●
Communication protocols	**MiCOM P220**	**MiCOM P225**
Modbus RTU	●	●
IEC60870-5-103	●	●
KBus Courier	●	●

Time synchronization		
Via rear communication port (DCS)	●	●
Via digital input (external clock)	●	●
IRIG-B synchronization (optional)	●	●
Hardware		
Digital inputs	6 (11 with option)	6 (11 with option)
Output relays	6	6
Bus voltage control (optional voltage inputs)	-	1 or 3
Analog outputs (optional)	1 or 2	2
Optional additional digital inputs	5	5
RTD connections (optional)	6	10
Thermistance connections (optional)	2	3
1/5 dual rated AC current inputs (settable)	4	4
Re-acceleration. authorization	●	●
Auto re-start	-	●
Process menu	●	●
Trip statistics	●	●
Latching relays	●	●

5.2 Information required with order

MiCOM P220 order information

Information required with order

Versions | **Order - No.**

	1 – 3	4	5	6	7	8	9	10	11	12	13	14	15
MiCOM P220 – Numerical motor protection	**P22**	**0**	**C**	*	*	*	*	*	*	*	*	*	*

Earth current input			
	P220 – Numerical motor protection		0
Earth current input			
	0.002 to 1 Ion		C
Voltage Input			
	None		0
Mounting option			
	None (default)		0
	Pre-fixed HMI (no withdrawability)	(platforms 2&3)	1
	Sealed cover	(platforms 2&3)	2
	Pre-fixed HMI + sealed cover	(platforms 2&3)	3

Auxiliary voltage	**Digital input voltage**		
24-60 Vdc		(platform 1)	A
48-150Vdc		(platform 1)	F
130-250Vdc / 110250Vac		(platform 1)	M
48-250Vdc / 48-240 Vac	105-145 Vdc	(platforms 2&3)	H
48-250Vdc / 48-240 Vac	110Vdc –30% / +20%	(platforms 2&3)	V
48-250Vdc / 48-240 Vac	220 Vdc –30% / +20%	(platforms 2&3)	W
48-250Vdc / 48-240 Vac	24-250 Vdc / 24-240 Vac	(platforms 2&3)	Z

Communication interface			
	Modbus / Modbus (if 2nd RS485 port available)		1
	K-Bus / Courier / Modbus (if 2nd RS485 port available)		2
	IEC 60870-5-103 / Modbus (if 2nd RS485 port available)		3
	IEC 60870-5-103 / IEC 60870-5-103 (if 2nd RS485 port available)		5
Language			
	French		0
	English / American		1
	Spanish		2
	German		3
	Russian		5
	Polish		6
	Portuguese		7
	Czech		A
	Chinese (only available with platform 3)		D
Platform			
	Platform 1 = Phase 1 – shallow depth		1
	Platform 2 = Phase 2 – deep depth		2
	Platform 3 = Phase 2 with graphic interface		3
Option (temperature, IRIG-B / 2nd communication port / 5 DI, 3 Voltage)			
	No		0
	2 thermistors monitoring -	(platform 1)	2
	2 thermistors monitoring -	(platforms 2&3)	3
	6 RTD monitoring	(platform 1)	6
	6 RTD monitoring	(platforms 2&3)	A
	IRIG-B / Second communication port / 5 digital inputs (1)		1
Optional analog outputs			
	No		0
	1 analog output	(platform 1)	1
	2 analog outputs	(platforms 2&3)	2
Software version (2)			
	Major version		*
	Minor version		*

(1) Optional "analog output(s)" is not available with this option.
(2) Unless specified, the latest version will be delivered

(*) please contact us in order to know the availabilities

MiCOM P225 order information

Information required with order

Versions	Order - No.	1 – 3	4	5	6	7	8	9	10	11	12	13	14	15
MiCOM P225 – Numerical motor protection		**P22**	**5**	**C**	*	*	*	*	*	*	*	*	*	*

Earth current input			
P225 – Numerical motor protection			5
Earth current input			
0.002 to 1 Ion			C
Voltage Input			
57 – 130 V			A
220 – 480 V			B
Mounting option			
None (default)			0
Pre-fixed HMI (no withdrawability)		(platforms 2&3)	1
Sealed cover		(platforms 2&3)	2
Pre-fixed HMI + sealed cover		(platforms 2&3)	3
Auxiliary voltage	**Digital input voltage**		
24-60 Vdc		(platform 1)	A
48-150Vdc		(platform 1)	F
130-250Vdc / 110250Vac		(platform 1)	M
48-250Vdc / 48-240 Vac	105-145 Vdc	(platforms 2&3)	H
48-250Vdc / 48-240 Vac	110Vdc –30% / +20%	(platforms 2&3)	V
48-250Vdc / 48-240 Vac	220 Vdc –30% / +20%	(platforms 2&3)	W
48-250Vdc / 48-240 Vac	24-250 Vdc / 24-240 Vac	(platforms 2&3)	Z
Communication interface			
Modbus / Modbus (if 2nd RS485 port available)			1
K-Bus / Courier / Modbus (if 2nd RS485 port available)			2
IEC 60870-5-103 / Modbus (if 2nd RS485 port available)			3
IEC 60870-5-103 / IEC 60870-5-103 (if 2nd RS485 port available)			5
Language			
French			0
English / American			1
Spanish			2
German			3
Russian			5
Polish			6
Portuguese			7
Czech			A
Chinese (only available with platform 3)			D
Platform			
Platform 1 = Phase 1			1
Platform 2 = Phase 2			2
Platform 3 = Phase 2 with graphic interface			3
Option (temperature, IRIG-B / 2nd communication port / 5 DI, 3 Voltage)			
No			0
3 thermistors monitoring (1 voltage input)			3
10 RTD monitoring (1 voltage input)			A
IRIG-B / Second communication port / 5 digital inputs (1 voltage input) (1)			1
3 Voltage inputs (1)			7
3 Voltage inputs + IRIG-B / Second communication port / 5 digital inputs (1)			8
Optional 2 analog outputs			
No			0
Yes			
Software version (2)			
Major version			*
Minor version			*

(1) Optional “2 analog outputs” is not available with this option.
(2) Unless specified, the latest version will be delivered

(*) please contact us in order to know the availabilities

GETTING STARTED

CONTENTS

BLANK PAGE

1. INTRODUCTION TO MiCOM P22X

1.1 MiCOM P22x overview

MiCOM P220 & P225 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.

FIGURE 1 – MiCOM P22x RELAY

1.2 Front view

The front panel is described in figure 1. Extra physical protection for the front panel can be provided by an optional transparent front cover. This allows read access only to the relay settings and data but does not affect the relay IP rating. When full access to the relay keypad is required, for editing the settings, the transparent cover can be unclipped and removed when the top and bottom covers are open.

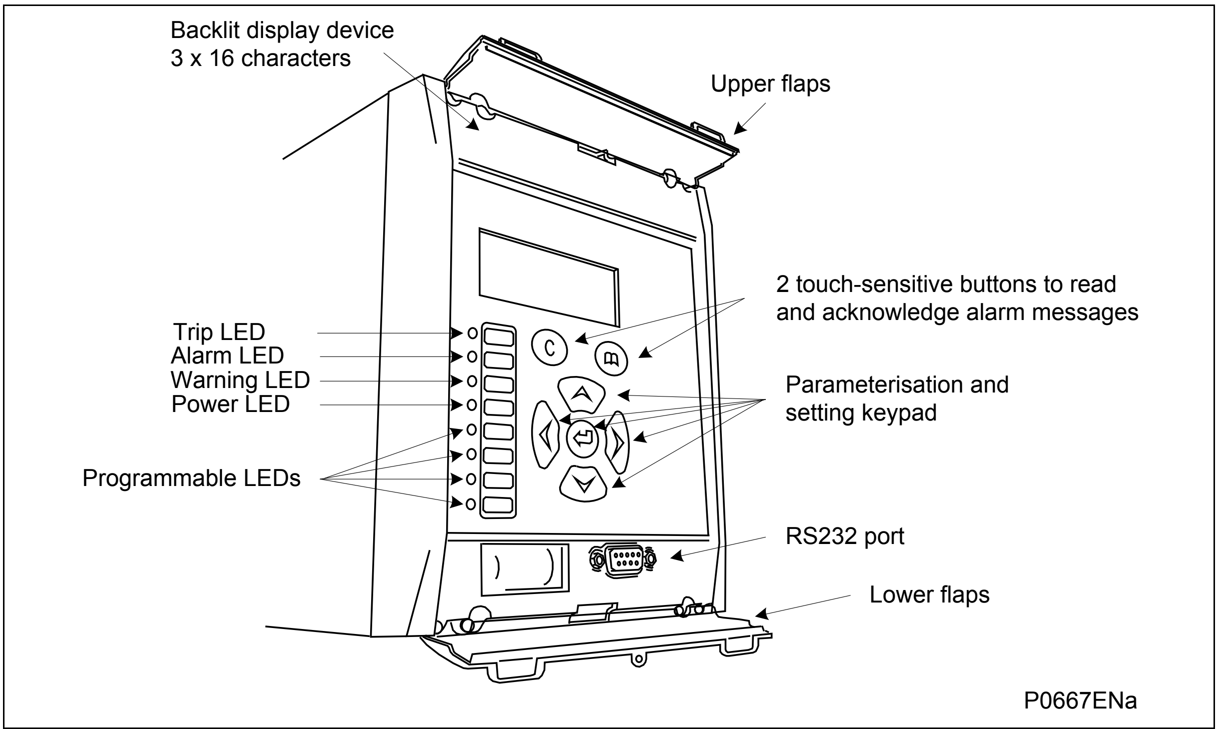


FIGURE 2 - FRONT PANEL OF THE MiCOM P22x RELAY

The front panel of the relay includes the following, as indicated in figure1:

- 16 character by 3-line alphanumeric liquid crystal display (LCD)
- 7-Keypad comprising 4 arrow keys (, , , an ENTER key , a CLEAR key , and a READ key)
- 8 LEDs: 4 fixed function LEDs and 4 programmable function LEDs on the left hand side of the front panel
- Under the top hinged cover:
    - The relay serial number and the relay voltage rating information (see figure 3 in this chapter)
- Under the bottom hinged cover:
    - A 9 pin female D-type front port for communication with a PC locally to the relay (up to 15m distance) via an RS232 serial data connection (SK1 port) or with the USB/RS232 MiCOM E2 cable.

1.2.1 LCD display and keypad description

The front panel components are shown below. The front panel functionality is identical for the MiCOM P220 & P225 relays.

1.2.1.1 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.

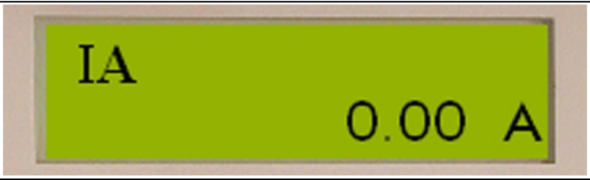


FIGURE 3 – LCD DISPLAY

1.2.1.2 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).

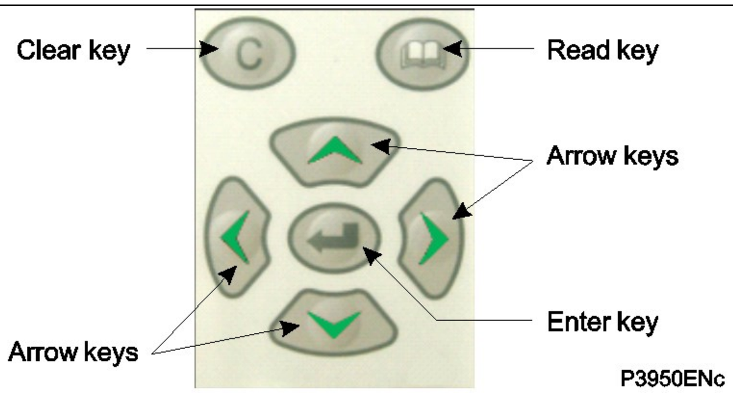


FIGURE 4 – MiCOM P22x KEYPAD

1.2.2 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):

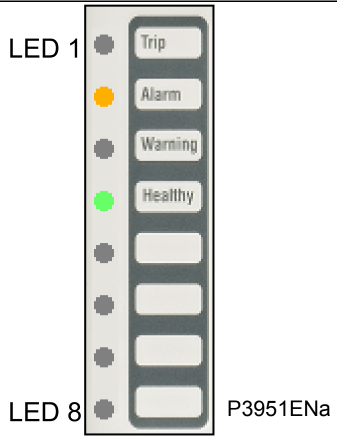


FIGURE 5 - LEDs

The fixed function LEDs are used to indicate the following conditions:

LEDs	Colour	Labels	Significance
LED 1	Red	Trip	LED 1 indicates when a trip order has been issued by the relay to the cut-off element (circuit breaker, contactor). This LED re-copies the trip order issued to the trip output contact (RL1). Its normal state is unlit. It will light as soon as a trip order is issued. It goes out when the associated alarm is acknowledged (by pushing the ⓒ key).
LED 2	Yellow	Alarm	Upon detection of a fault or an alarm (CB state) by MiCOM P22x relay, the LED will start flashing. After reading of the alarm(s) message(s) by pressing the 📖 key, the LED will change from flashing to constant illumination, and will extinguish when all the alarms are cleared (Key ⓒ). The alarms are either threshold crossings (instantaneous), or tripping orders (time delayed).
LED 3	Yellow	Warning	LED 3 is dedicated to the internal alarms of MiCOM P22x relays. When a "non critical" internal alarm (typically communication Fault) is detected, the LED flashes continuously. When the fault is classified as "critical", the LED is illuminated continuously. The extinction of this LED is only possible by the disappearance of the cause that caused its function (repair of the module, disappearance of the fault).
LED 4	Green	Healthy	LED 4 indicates that MiCOM P22x relays are working correctly.
LED 5 to LED 8	Red	Aux1 to Aux4	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 associated with an LED. Each LED illuminates when the associated information is valid. The extinction of each LED is linked to the acknowledgement of the associated alarms.

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

1.2.3.1 Relay Identification

Prior to applying power, unclip the top cover and check that the model number of the relay listed on the front panel (top left) corresponds to the model ordered.

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.

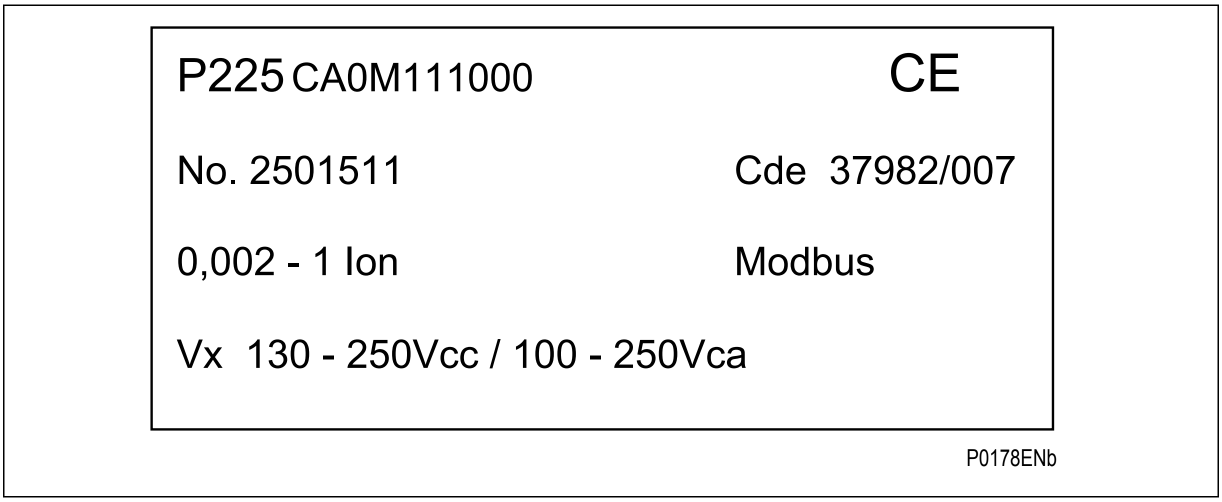


FIGURE 6 - TECHNICAL INFORMATION

The significance of each entry is described below:

– P225 CA0M11100: cortec code. In particular, this code allows the user to know what is the protocol used for remote communications (code 1 means MODBUS).

– No 2501511 and Cde 37982/007: these numbers are the serial number and the reference number of the order: they are necessary in case of problems.

– 0.002 - 1 Ion: This is referred to the sensibility of the E/F current input.

– MODBUS: Communication protocol available through the rear RS485 communication port.

– Vx 130 - 250Vdc / 100 - 250Vac: Power supply range. In this example, the power supply can be either ac or dc voltage.

1.2.3.2 Communication Port

Under the bottom hinged cover of the relay, a 9-pin female D-type socket, can be used to communicate with a local PC (up to 15m distance) via a RS232 serial data link cable (SK1 port).

This socket can be also used to connect the USB/RS232 cable MiCOM E2 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.

FIGURE 7 – USB/RS232 MiCOM E2 CABLE

1.3 Rear description

1.3.1 General features

The MiCOM P220 or P225 rear panels comprise 2 or 3 connectors. If only two connectors are present, a plate replaces the third connector.

The next figures represent the MiCOM P220 & P225 rear plates with different options.

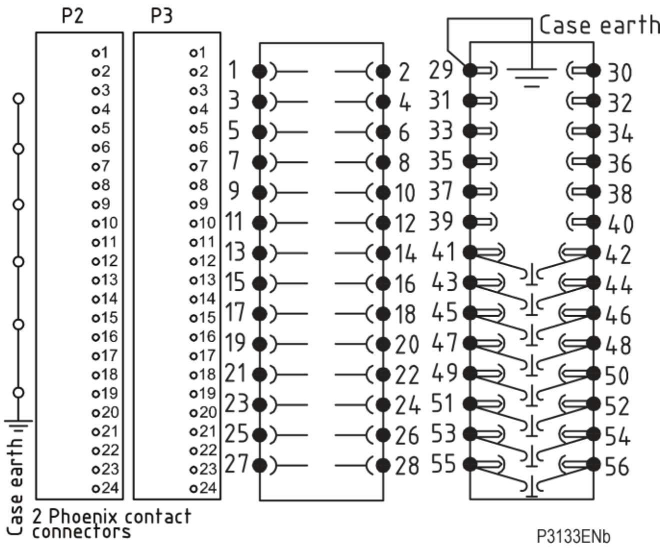


FIGURE 8 – REAR PANEL, WITH PHOENIX CONTACT CONNECTORS

Next figure represents MiCOM P220 & P225 with “IRIG-B, second communication port and 5 additional digital inputs” option:

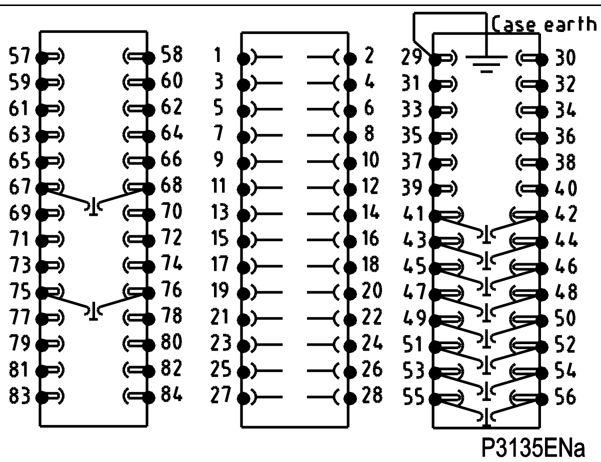


FIGURE 9 – REAR PANEL, WITH MIDOS CONNECTOR

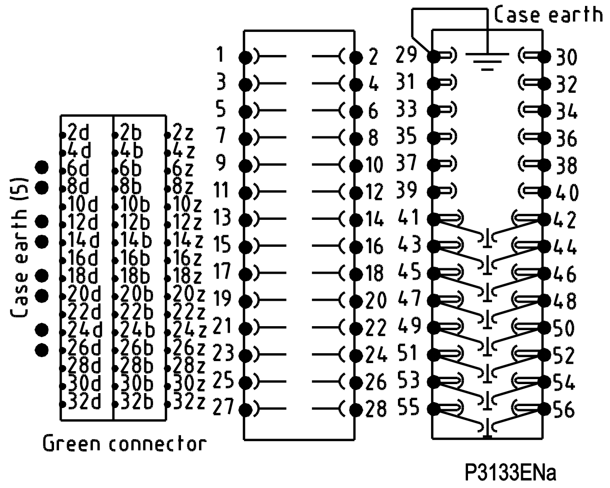


FIGURE 10 – REAR PANEL, WITH RTD AND ANALOGUE OUTPUT CONNECTOR (OLD VERSION)

The connection layout is detailed in section P22x/EN CO.

2. STARTING THE MiCOM P22x IN 5 MINUTES

The object of this chapter is to enable you to make the MiCOM P22x operational in 5 minutes before starting the motor.

2.1 Check the wiring of your installation

- First check that you have thoroughly taken note of Handling and Safety, Section SFTY/4LM/G11 or later issue.
- Check that the wiring of your installation is in compliance with the connection diagram shown in section P22x/EN CO.
- Check that the output relay No. 1 (terminals 2-4-6) is correctly inserted into the trip circuit of the breaking device.
- Verify that the logic input No. 1 (terminals 22-24) is correctly connected to an o/o interlock copying the position of the breaking device.

The USB/RS232 cable MiCOM E2 is able to power the relay and to interface the MiCOM P22x to a PC.

2.2 Connecting the MiCOM P22x relay to the auxiliary voltage

Before energising the MiCOM P22x relay, check that the electrical characteristics of the MiCOM P22x* protection correspond to those of the auxiliary voltage of the installation.

- Switch on the auxiliary source.
- Push the live part of the MiCOM P22x relay into its housing. Once the relay is plugged in and the auxiliary source is energised, the green LED marked "Healthy" (or "Uaux" in French) should light up. This is the 4th LED down from the top.

ATTENTION:	THE EXTRACTION OF THE ACTIVE PART OUT OF THE CASE COULD BE DONE BY OPENING THE TWO FLAPS (THE UPPER AND THE LOWER), THEN WITH A SCREWDRIVER OF 3MM, BY MAKING A SWIVEL OF THE EXTRACTOR LOCATED UNDER THE UPPER FLAP AND FINALLY BY EXERTING A TRACTION ON THE TWO NOTCHES SITUED BEHIND THESE SHUTTERS. **(IT IS NECESSARY - AFTER PIVOTING THE EXTRACTOR - TO WAIT 2 OR 3 SECONDS BEFORE MAKING COME OUT THE ACTIVE PART, TO LEAVE DISCHARGING THE CAPACITORS IN THE ACTIVE PART THUS AVOIDING POSSIBLE ELECTRIC ARCS IN THE EVENT OF DIRECT CONTACT OF THE CONNECTOR BLOCKS WITH METAL LIMP).**

2.3 Minimum configuration to start up the MiCOM P22x

2.3.1 OP PARAMETERS menu

2.3.1.1 Activation of the parameter mode

From the default display of the menu which appears when connecting the MiCOM P22x relay to the auxiliary voltage, double click on the button, the ‘PASSWORD’ cell appears.

OP PARAMETERS

PASSWORD = *** * * ***

Click on the button, and the flashing cursor appears. The following cell appears:

PASSWORD = **A A A A**

There are two possibilities:

- The relay leaves the factory with the default password AAAA. Press the button again. The following message appears for 2 seconds to indicate that the password has been entered correctly. The MiCOM relay thus goes into parameterisation mode.

PASSWORD OK

- If a password other than the AAAA has already been loaded since MiCOM P220 relay left the factory, enter this new password by using the buttons , , and . After the validation of the new password using the button, the cell below appears for 2 seconds. The MiCOM P220 relay goes thus into the parameterisation mode.

PASSWORD OK

NOTE: The parameterisation mode is deactivated if no button has been pressed for 5 minutes. If the relay was already in parameterisation mode when the password was entered; the cell…

PASSWORD = **A A A A**

…will be replaced by

NEW PASSWORD OK

2.3.1.2 Indication of the motor frequency

Once the password is confirmed, press the button 4 times. The following cell appears:

FREQUENCY = **50 Hz**

Then there are two possibilities:

- If the motor has a rated frequency of 50Hz, do nothing
- If the motor has a rated frequency of 60Hz, then press the button

A flashing cursor appears under the 0 of the term 50 Hz.

FREQUENCY = **50 Hz**

Press the button, and the cell below appears:

FREQUENCY = **60 Hz**

Confirm this by pressing the button.

2.3.2 CONFIGURATION menu

After having entered the motor frequency, press the button 6 times.

The following menu heading appears:

OP PARAMETERS

Press the button, and the heading of the ‘ORDERS’ menu appears:

ORDERS

This menu is not used for fast configuration. Press again the button, and the heading of the ‘CONFIGURATION’ menu appears:

CONFIGURATION

Press the button once. The heading of the ‘CONFIG. SELECT’ submenu appears:

CONFIG SELECT

<u>Settting group change</u>

Press the button once. The ‘SET GRP CHANGE INPUT’ submenu is displayed.

SET GRP CHANGE **INPUT= LEVEL**

Press button to modify the setting, or the button to select the next submenu.

If necessary, select:

– ‘LEVEL’: active setting group will depend on the level of a logical input, or press the button to set ‘EDGE’ menu,

– ‘EDGE’: local or remote control will activate a setting group.

Press to confirm.

If ‘EDGE’ is selected, the next submenu cell will appear when the button is pressed:

SETTING GROUP **1**

Press , then or to set group 1 or group 2 active. Press to confirm a choice.

Default display

Press the button once. The next cell will allow selection of the default displayed (selected value will be displayed).

Phase rotation

Press the button once. The ‘PHASE ROTATION’ submenu will appear. Select the mode (menu or digital input) to set phase rotation sequence.

PHASE ROTATION
Menu

When ‘Menu’ is set, press to set ‘PHASE SEQUENCE’ (Press , then or to select ‘A B C’ or ‘C B A’, then to validate).

Start detection

Press the button once. The ‘START DETECTION’ submenu will appear. Press , then or to select ‘52A’ or ‘52A + I’, then to validate).

Selection of the type of analog output

This can be set only if the MiCOM P22x relay is equipped with the "analog output" option.

Starting with the heading of the CONFIG. SELECT submenu, press the button until the following cell appears:

ANALOG. OUTPUT
0 - 20 mA

Two possibilities arise:

- If you need an analog output signal on a 0 - 20 mA current loop, do nothing
- If you need an analog output signal on a 4 - 20 mA current loop, press button and then the button

The following cell appears:

ANALOG. OUTPUT
4 - 20 mA

Confirm by pressing the button.

Selection of the information available on the analog output

This can be parameterised only if the MiCOM P22x relay is equipped with the "analog output" option.

Starting from the preceding cell, press the button, and the following cell appears:

DATA TYPE
ANALOG1 IA RMS

Using the and buttons, select the type of information you wish to bring onto the analog output, then confirm by pressing the key.

Selection of the type of RTD

This can be set only if the MiCOM P22x relay is equipped with the "monitoring of 10 RTDs" option or “monitoring of 3 thermistors” option.

Starting from the preceding cell, press the ⇩ button, otherwise starting from the heading of the CONFIG. SELECT submenu, press the ⇩ button 7 times.

The following cell appears:

RTD Type= **PT100**

Using the ↵ and ⇩ buttons, select the type of RTD with which the motor is equipped, then confirm by pressing the ↵ key.

Selection of the type of thermistors

This can be set only if the MiCOM P22x relay is equipped with the "monitoring of 3 thermistors" option.

Two possibilities arise:

- The MiCOM P22x relay is not equipped with the "analog output" option; starting from the CONFIG. SELECT submenu, press the ⇩ button 5 times. The following cell appears:

Thermist1Type = **PTC**

The MiCOM P22x relay is equipped with the "analog output" option; starting from the following cell:

DATA TYPE **ANALOG1 IA RMS**

(The type of information to be brought onto the analog output can be different from IA RMS). Press the ⇩ button once. The following cell appears:

Thermist1 Type= **PTC**

If the No. 1 group of thermistors equipping the motor is of the PTC (positive temperature coefficient) type, do nothing. On the other hand, if the motor is equipped with a group of thermistors of type NTC (negative temperature coefficient), press the ↵ button then the ⇩ button. The following cell appears:

Thermist 1Type = **NTC**

Confirm by pressing the ↵ button.

Press the ⇩ button, then the following cell appears:

Thermist 2 Type = **PTC**

Repeat the same operation if the No. 2 thermistor group of the motor is of type NTC.

Selection of the Time synchronization mode

Starting from the preceding cell, press the button, and the following cell appears:

Time Synchro
Automatic

Select time synchronization mode. When IRIG-B is set (optional), modulated or unmodulated IRIG-B synchronization signal can be set to synchronize the MiCOM P22x relay (next cell if is pressed).

2.3.2.1 CT RATIO Submenu: adjustment of the primary and secondary ratings of the current sensors

From inside the 'CONFIG. SELECT' submenu, press the button as many times as necessary to reach the heading of the 'CONFIG. SELECT' submenu. As indicated below:

Press the button once. The heading of the 'CT/VT RATIO' submenu appears:

CT/VT RATIO

Value of the primary rating of the phase CTs

Press once on the button. The following cell appears:

LINE CT PRIM =
****

In this cell, indicate the value of the primary rating of the phase CTs. For example, for a CT with a ratio of 200/5, set the value 200 as explained below.

Press the button. A flashing cursor appears under the last 0 of 200:

LINE CT PRIM =
200

Using the and buttons, increase and/or decrease the 1st digit. Then press the button.

The cursor moves under the 2nd digit. Using the and buttons, increase and/or decrease the 2nd digit. Then do the same for the 3rd digit. Confirm by pressing the button.

Value of the secondary rating of the phase CTs

Press the button once. The following cell appears:

LINE CT SEC =
****

If the current circuits coming from the secondaries of the phase CTs are connected to the phase current inputs with a rating of 1 A (terminals 49 - 50; 51 - 52; 53 - 54) of the MiCOM P22x, do nothing. This implies that the secondaries of the phase CTs have the rating of 1 A. On the other hand, if the current circuits are connected to the phase current inputs with a rating of 5 A (terminals 41 - 42; 43 - 44; 45 - 46) of the MiCOM P22x, this implies that the rating of the secondaries of the phase CTs is 5 A, press the button.

A cursor appears under the 1:

LINE CT SEC =
1

Press the button. Confirm by pressing the button. The following cell appears:

LINE CT SEC =
5

Value of the primary of the earth sensor

Press once on the button. The following cell appears:

E/GND CT PRIM =
****

Press the button. A cursor appears under the last 0 of 200:

PRIM E =
200

Two possibilities arise:

- The earth current input is connected to a core balanced CT. In this cell, set the value of the ratio of the core balanced CT using the buttons , and . Confirm by pressing .
- The earth current input is connected to the residual connection of the three secondary circuits coming from the phase CTs. In this cell, set the value of the primary rating of the phase CTs using the buttons , and . Confirm by pressing .

Value of the secondary of the earth sensor

Press the button once. The following cell appears:

E/GND CT SEC =
1

Two possibilities arise:

- The earth input is connected to a core balanced CT. Do nothing, leave this value at 1.
- The earth input is connected to the residual connection of the three secondary circuits coming from the phase CTs. In this cell, set the value of the secondary rating of the phase CTs (this implies that the residual connection circuit is cabled to the earth current input corresponding to the secondary rating of the phase CTs).

If the rating is 1A, do nothing. On the other hand, if the rating is 5 A, press the button, and a flashing cursor appears.

SEC E =
1

Press the button. Confirm by pressing the button.

The following cell appears:

SEC E =	
	5

2.3.3 COMMUNICATION menu

Starting from the preceding cell, press the ⊽ button once. The heading of the CT RATIO submenu appears. Press the ⊼ button once. The heading of the CONFIGURATION menu appears. Then press the ⊳ button until the heading of the COMMUNICATION menu appears.

COMMUNICATION

Press the ⊽ button once. The following cell appears:

COMM1 ?	
	No

You wish to use the MiCOM P22x relay for communication, so check that the word YES appears. If it does not appear, press ↵ once and then ⊼ once. YES appears, so confirm with ↵ .

If the relay MiCOM P22x is used for communication (via the RS485 port at the rear), set the various parameters of the COMMUNICATION menu using the buttons:

– ⊽ to move from one line to another and also to reduce the value of a parameter

– ⊳ to display 'COMM2 ?' setting (when available)

– ↵ to select a parameter to be modified and also to confirm the entry of a parameter

– ⊼ to increase the value of a parameter

Then press the ⊽ or ⊼ button as many times as necessary, to return to the heading of the COMMUNICATION menu.

2.3.4 PROTECTION G 1 menu

Press the ⊳ button once. The heading of the PROTECTION group 1 menu appears.

PROTECTION G1

2.3.4.1 Setting the thresholds related to Start criteria

Setting the thresholds related to the start characteristics of the motor being protected: Starting current detection minimum value in multiples of the full load rated current (Iutil) and the starting time (tIstart).

START CRITERIA

Iutil

tIstart

2.3.4.2 Setting the threshold of thermal current I teta >

[49] THERMAL OVERLOAD

Press the button once, the following cell appears.

THERMAL OVERLOAD
FUNCT ? YES

Check that the word YES actually appears. If not, press once on , then once on the word YES appears, confirm with .

Press the button twice. The following cell appears:

I flc > =
0.2 In

Press the button. A flashing cursor appears:

I flc > =
0.2 In

Using the , and buttons, set the value of the thermal current threshold Iθ> corresponding to the machine. Confirm by pressing the button.

From this point, a minimum configuration has been given for starting up the MiCOM P22x relay.

This minimum configuration makes it possible to start up the MiCOM P22x relay. It is not in any way sufficient to ensure that the motor is protected. For this, it is appropriate to configure the MiCOM P22x relay completely.

2.4 Complete Configuration of the MiCOM P22x

The MiCOM P22x relay can be completely configured:

- Either by using the interface on the front (buttons , , , and and the display unit);
- or by using the control and setting software **MiCOM S1 STUDIO**.
- You can set the protections and automatic controls of the MiCOM P22x you wish to use.

For further information, refer to section P22x/EN FT.

Do not forget to configure the trip output relay (Relay No. 1, terminals 2 – 4 - 6) in the TRIP OUTPUT RLY. Submenu.

3. COMPANY CONTACT INFORMATION

If you need information regarding the operation of the MiCOM product that you have, please contact your local Schneider Electric agent or the Customer Care Center of Schneider Electric and mention the reference of your MiCOM product.

The MiCOM product references are mentioned under the upper flap of the product front plate.

PLEASE MENTION THE FOLLOWING DATA WHEN YOU CALL US:

- CORTEC code of the MiCOM relay
- Serial number of the MiCOM relay
- Schneider Electric's order reference
- Schneider Electric's operator reference

Schneider Electric SAS
35 rue Joseph Monier
CS30323
92506 Rueil-Malmaison
FRANCE

www.schneider-electric.com

http://www.schneider-electric.com/CCC

TECHNICAL DATA AND CURVE CHARACTERISTICS

CONTENTS

1. PROTECTION FUNCTIONS

1.1 Too long start-up protection (Start-Up criteria)

Start-up detection criteria	(closing 52) or (closing 52 + current threshold) optional
Current threshold I_{UTIL}	0.5 to 5 In by steps of 0.01 In
Time-delay tI_{start}	1 to 200 s by steps of 1 s

1.2 Thermal replica [ANSI 49]

Thermal current threshold $I\theta>$	0,2 to 1,5 In by steps of 0,01 In
Negative sequence current recognition factor K_e	0 to 10 by step)s of 1
Overload time-constant T_{e1}	1 to 180 min by steps of 1min
Start-up time-constant T_{e2}	1 to 360 min by steps of 1min
Cooling time-constant T_r	1 to 999 min by steps of 1min
Trip thermal threshold	Set to 100%
Thermal alarm threshold	20 to 100% by steps of 1%
Thermal trip & alarm thresholds hysteresis	97%
Start-up inhibition	20 to 100% by steps of 1%

1.3 Short-circuit protection [ANSI 50/51]

Current threshold I>	0.1 to 25 In by steps of 0.05 In
Delay type:	DT, IDMT or RI
Time delay tI> (DMT)	0 to 150 s by steps of 0,01 s
Reset time t_{Reset}	0 to 600 s by steps of 0,01 s
Interlock with I>> & I>>> (IDMT)	Yes / no
Reverse Time Multiplier Setting (IDMT reset delay type)	0.025 to 1.5 by steps of 0.01
K multiplier (RI curve)	0.1 to 10 by steps of 0.001
Current threshold I>>	0.5 to 40 In by steps of 0,05 In
Delay type:	DT, IDMT or RI
Time delay tI>> (DMT)	0 to 150 s by steps of 0,01 s
Reverse Time Multiplier Setting (IDMT reset delay type)	0.025 to 1.5 by steps of 0.01
K multiplier (RI curve)	0.1 to 10 by steps of 0.001
Current Time delay tI>>>	0 to 150s by steps of 0,01 s
threshold I>>>	0.5 to 40 In by steps of 0.05 In
Time delay tI>>> (DMT)	0 to 150 s by steps of 0,01 s
Operating time	< 40 ms
Drop-off time	< 30 ms
Hysteresis	95 %

1.4 Earth fault protection [ANSI 50/51N]

Current threshold Io>, Io>>	0,002 to 1 Ion by steps of 0,001 Ion
Time-delays tIo>, tIo>>	0 to 100 s by steps of 0,01 s
Operating time	< 40 ms
Drop-off time	< 30 ms
Hysteresis	95%

1.5 Unbalance protection [ANSI 46]

Negative sequence current threshold I2>	0,04 to 0,8 In by steps of 0,01 In
Time-delay tI2>	0 to 200 s by steps of 0,01 s
Negative sequence current threshold I2>>	0,04 to 0,8 In by steps of 0,01 In
IDMT time-delay	$t = TMS \times 1{,}2/(I_2/In)$
Time Multiplier setting TMS I2>>	0,2 to 2 by steps of 0,001
Hysteresis	95%

1.6 Undervoltage protection (P225 only) [ANSI 27]

Voltage threshold V<	Range A	5 to 130 V by steps of 0,1 V
	Range B	20 to 480 V by steps of 0,5 V
Time-delay tV<		0 to 600 s by steps of 0,01 s
V< inhibition during start-up		Yes/No
Hysteresis		105 %

1.7 Overvoltage protection (P225 only) [ANSI 59]

Voltage threshold V>	Range A	5 to 260 V by steps of 0,1 V
	Range B	20 to 960 V by steps of 0,5 V
Time-delay tV>		0 to 600 s by steps of 0,01 s
Hysteresis		95 %

1.8 Locked rotor protection [ANSI 51LR/50S]

Current threshold I_{stall}	0.5 to 5 In by steps of 0.01 In
Hysteresis	95%
Time-delay tI_{stall}	0,1 to 60 s by steps of 0,1 s
Locked rotor at start-up detection	No/Input/Power Factor
Power factor	from 0.01 to 1 by steps of 0,01

1.9 Under current (Loss of load) protection [ANSI 37]

Current threshold I<	0,1 to 1 In by steps of 0,01 In
Time-delay tI<	0,2 to 100 s by steps of 0,1 s
Inhibition time at start-up T_{inhib}	0,05 to 300 s by steps of 0,1 s
Hysteresis	105%

1.10 Optional 6 (P220) or 10 (P225) RTD inputs

Thresholds	0 to 200 °C by steps of 1 °C
Time delays	0 to 100 s by steps of 0,1 s
Thermal image influence	Yes/No

1.11 Optional 2 (P220) or 3 (P225) thermistor inputs

Thresholds	100 to 30 000 Ω by step of 100 Ω
Time-delays	Set to 2 seconds

2. AUTOMATION FUNCTIONS

2.1 Limitation of the number of start-ups [ANSI 66]

Reference period $T_{reference}$		10 to 120 min by steps of 5 min
Number of cold starts		1 to 5 by steps of 1
Number of hot starts		0 to 5 by steps of 1
Restart inhibition time $T_{Interdiction}$		1 to 120 min by steps of 1 min

2.2 Time between 2 start-ups

Inhibition time $T_{betw\ 2\ start}$	1 to 120 min by steps of 1 min

2.3 Anti-backspin protection

Restart prevention time tABS	1 to 7200 s by steps of 1 s

2.4 Re-acceleration authorization (P225 only)

Voltage dip detection	Range A	37 to 98 V by steps of 0.2 V
	Range B	143 to 360 V by steps of 0.2 V
Voltage restoration detection	Range A	45 to 117 V by steps of 0.2 V
	Range B	176 to 32 V by steps of 0.2 V
Voltage collapse duration T_{reacc}		0.1 to 5 s by steps of 0,01 s
Auto Re-Start delay $t_{reacc\ long}$		OFF to 60 s by steps of 1 s
Auto Re-Start restoration delay $t_{reacc\ shed}$		OFF to 99 min by steps of 1 min

2.5 Presence of bus voltage prior to start-up (P225 only)

Voltage threshold	Range A	5 to 130 V by steps of 0,1 V
	Range B	20 to 480 V by steps of 0,5 V
Hysteresis		105 %

2.6 CB failure

Current threshold I< BF	10 to 100% In by steps of 10% In
Time-delay tBF	0,03 to 10 s by steps of 0,01 s

2.7 Trip circuit supervision

Time-delay tSUP	0,1 to 10 s by steps of 0,01 s

2.8 Auxiliary timers

Logic inputs with alarm message on occurrence	tAux1 to tAux10
Timers tAux1 to tAux10	0 to 200 s by steps of 0,01s

2.9 Logic equation

8 independants equations are available.

Each one can used a maximum of 16 operands among all start and trip signal

Each one can use NOT, OR, AND, OR NOT, AND NOT logical gates.

t operate	0 to 600s in steps of 0.01s
t Reset	0 to 600s in steps of 0.01s

2.10 Latching of output relays

Trip relay (RL1)	Configurable for each trip order
Auxiliary relays (RL2, RL3, RL4 and RL5)	Configurable for each auxiliary relay

2.11 CB control and monitoring

Close command hold	0,2 to 5 s by steps of 0,05 s
Open command hold	0,2 to 5 s by steps of 0,05 s
Number of operations alarm	0 to 50 000 operations by steps of 1
Summated contact breaking duty	10^6 to 4 000.10^6 by steps of 10^6
Adjustment of the exponent «n»	1 or 2
Opening time alarm	0,05 to 1 s by steps of 0,05 s

3. RECORDING FUNCTIONS

3.1 Event recorder

Capacity	250 events
Time-tag	to 1 millisecond
Triggers	Any protection alarm & threshold Any logic input change of state Self test events Any setting change

3.2 Fault recorder

Capacity	25 records
Time-tag	to 1 millisecond
Triggers	Any trip order (RL1 operation)
Data	Fault record number Fault date & hour Active setting group Faulty phase(s) Fault type, protection threshold Fault current/voltage magnitude Phase A, B, C and earth current magnitudes Phase A-Phase C voltage magnitude VAB, VBC, VCA ("3 voltage inputs" option)

3.3 Oscillography

Capacity	5 records
Duration of each record	2,5 s
Sampling rate	32 samples per frequency cycle
Pre-time setting	0,1 to 2,5 s by steps of 0,1 s
Post-time setting	0,1 to 2,5 s by steps of 0,1 s
Triggers	Any protection threshold overreach or any trip order (RL1 relay operation) logic input Remote command
Data	4 analogue current channels (3ϕ + N) Logic input and output states Frequency value 1 (or 3) analogue voltage channel ("3 voltage inputs" option)

3.4 Start-up current and voltage envelope record

Capacity		1 record
Maximum duration		200 s
Sampling rate		1 sample each 5 frequency cycles
Data	Current	True RMS value, maximum value of one of the 3 phase currents
	Voltage (P225 only)	True RMS value

4. 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, K-bus/Courier, IEC60870-5-103
RS485 isolated	Optional 2nd rear port	Screened twister pair	Screws or snap-on	300 to 38400 baud (programmable)	ModBus RTU, K-bus/Courier, IEC60870-5-103 (option)
RS232	Front port	Screened twister pair	Sub–D 9 pin female connector	300 to 38400 baud (programmable)	ModBus RTU

4.1 MODBUS™ communication

Mode	RTU (standard)
Transmission mode	Synchronous
Interface	RS 485, 2 wires + shielding
Data rate	300 to 38 400 bauds (programmable)
Relay address	1 to 255
Parity	Settable
Date format	IEC format or Private format
Connection	Multi-point (32 connections)
Cable	Half-duplex (screened twisted wire pair)
Maximum cable length	1000 meters
Connector	Connector screws or snap-on
Insulation	2 kV RMS

4.2 K-bus/Courier communication

Transmission mode	Synchronous
Interface	K-bus/RS485, 2 wires + shielding
Data rate	64000 bauds
Relay address	1 to 254
Connection	Multi-point (32 connections)
Cable	Half-duplex (screened twisted wire pair)
Maximum cable length	1000 meters
Connector	Connector screws or snap-on
Insulation	2 kV RMS

4.3 IEC 60870-5-103 communication

Transmission mode	Synchronous
Interface	RS 485, 2 wires + shielding
Data rate	9600 to 19200 bauds (programmable)
Relay address	1 to 254
Parity	Even
Connection	Multi-point (32 connections)
Cable	Half-duplex (screened twisted wire pair)
Maximum cable length	1000 meters
Connector	Connector screws or snap-on
Insulation	2 kV RMS

4.4 Front communication

Interface	RS232
Protocol	MODBUS™ RTU
Data rate	19200 bauds
Parity	Without
Stop bit	1
Data bits	8
Connector	Sub-D 9 pin female connector
Cable type	Screened twisted wire cable, no-crossed

5. IRIG-B INTERFACE

The IRIG-B is an 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

6. INPUTS AND OUTPUTS

6.1 Analogue current inputs

Phase currents In		1 and 5 Ampere
Earth current Ion		1 and 5 Ampere
Frequency	Range Nominal	45 to 65 Hz 50/60 Hz
Burdens	Phase current inputs	< 0.3 VA @ In (5A) < 0,025 VA @ In (1A)
	Earth current input	< 0.01 VA @ 0.1Ion (5A) < 0,004 VA @ 0,1 Ion (1A)
Thermal withstand of both phase and earth current inputs		100 In - 1 s 40 In - 2 s 4 In - continuous

6.2 Analogue voltage inputs (P225 only)

Phase A - Phase C voltage input : Vn or 3-phase voltage inputs (optional)		57-130 Volt (range A) 220-480 Volt (range B)
Frequency	Range Nominal	45 to 65 Hz 50/60 Hz
Burden		< 0,1 VA @ Vn
Thermal withstand	Range A	260 V - continuous 300 V - 10 s
	Range B	960 V - continuous 1300 V - 10 s

6.3 Logic inputs

Type	Independent optical isolated
Number:	
– Standard:	6 (5 programmable, 1 fixed)
– optional:	5 additional digital inputs
Burden	< 10 mA for each input
Recognition time	< 5 ms

6.4 Supply rating

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
H	48 - 250 Vdc 48 - 240 Vac	38.4 - 300 Vdc 38.4 - 264 Vac	105-145 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 48 - 240 Vac	19,2 - 300 Vdc 38.2 - 264 Vac	24 - 250 Vdc 24 - 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac

6.5 Output relay

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

6.6 Optional 2 analogue outputs

Rating	0-20 mA, 4-20 mA
Insulation	2 kV
Maximum load with active source mode	500 Ω for ratings 0-20 mA, 4-20 mA
Maximum voltage with passive source mode	24 Volt
Accuracy	± 1% at full scale

6.7 Optional 6 or 10 RTD inputs

RTD type	Pt100, Ni100, Ni120, Cu10
Connection type	3 wires + 1 shielding
Maximum load	25 Ω (Pt100, Ni100, Ni120) 2,5 Ω (Cu10)
Insulation	2 kV, active source mode

6.8 Optional 2 or 3 thermistor inputs

Thermistor type	PTC or NTC
Maximum load	100 Ω
Thresholds	100 to 30 000 Ω by step of 100 Ω
Time-delays	Set to 2 seconds

7. ACCURACY

Protection thresholds		± 2 % for all current protection and voltage protection with 57 – 130 V VT (± 5 % for voltage protection with 220 – 480 V VT)
Time delays		± 2 % with a minimum of 40ms
Measurements	Current	Typical ± 0,2 % @ In
	Voltage	Typical ± 0,2 % @ Vn
	Power	Typical ± 1 % @ Pn
	Temperature	± 2 °C

Pass band for measurements of true RMS values 500Hz

8. CT & VT DATA

Phase CTs primary		1 to 3000 by steps of 1
Earth CT primary		1 to 3000 by steps of 1
Phase CTs secondary		1 or 5
Earth CT secondary		1 or 5
Recommended phase CTs		5P10 - 5VA (typical)
Recommended earth CT		Residual connection or core balanced CT (preferred in isolated neutral systems)
VT primary (P225 only)		1 to 20 000 V by steps of 1 V
VT secondary (P225 only)	Range A	57 to 130 V by steps of 0,1 V
	Range B	220 to 480 V by steps of 1 V

9. 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

10. 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 4, 30A/m applied continuously, 300A/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

11. ENVIRONMENT

Temperature	IEC 60255-6: 1988 IEC 60068-2: 2007	Standard Storage -25°C to +70°C Operation -25°C to + 55°C Extended Storage -25°C to +85°C Operation -40°C to + 85°C Note: Operation at -40°C and +85°C only up to 96 hours. Storage at +85°C only up to 96 hours.
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 H_2S, NO_2, Cl_2 and SO_2.

12. EU DIRECTIVE

12.1 EMC compliance

CE 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

12.2 Product safety

CE 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

13. IDMT CHARACTERISTIC CURVES

13.1 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).

13.1.1 Inverse time curves:

The first and second stage thresholds for phase 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.

13.1.2 Reset timer

The first and second stage thresholds for phase overcurrent protection is 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.

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 P22x relay 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

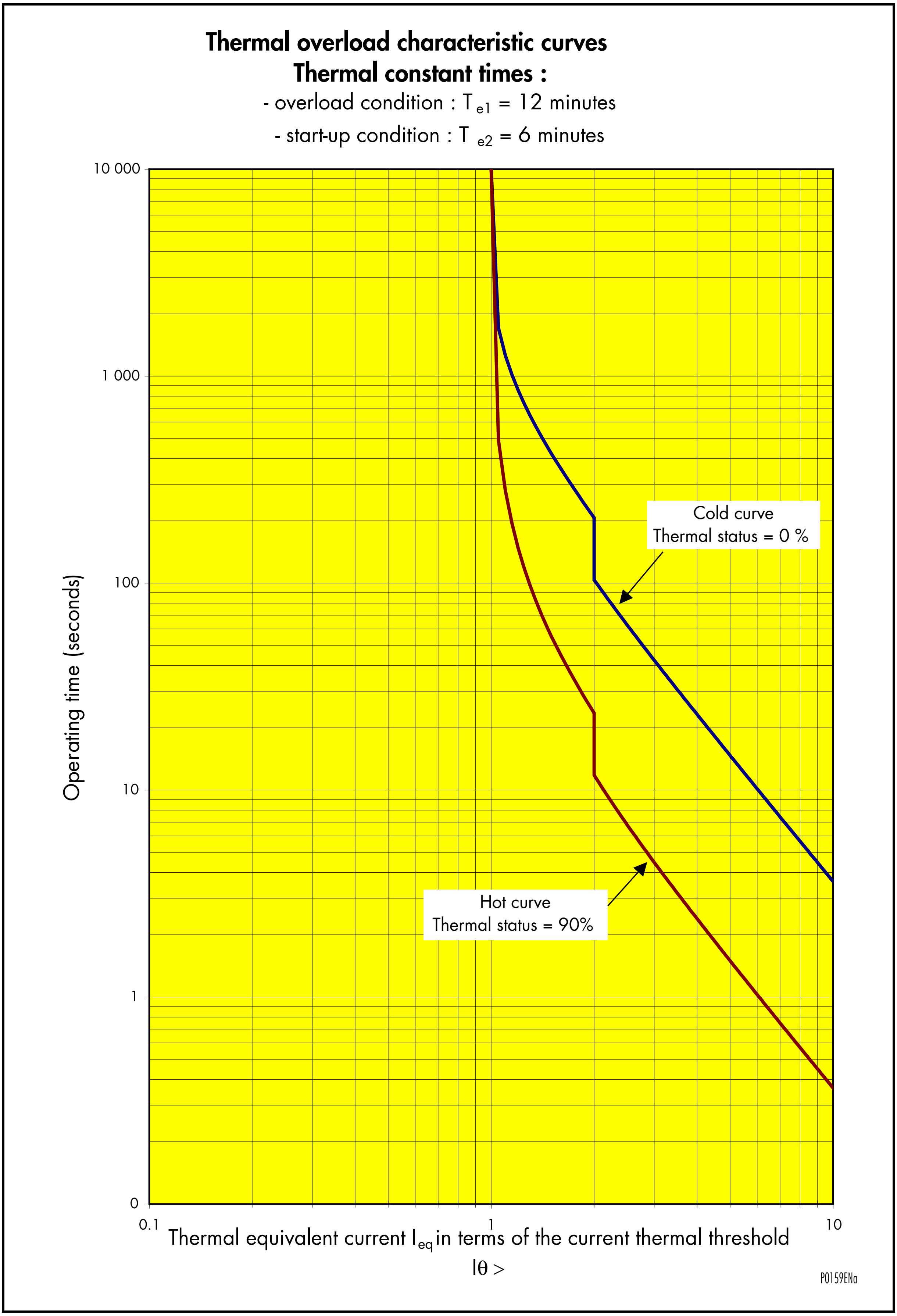
Is Value of the programmed threshold (pick-up value)

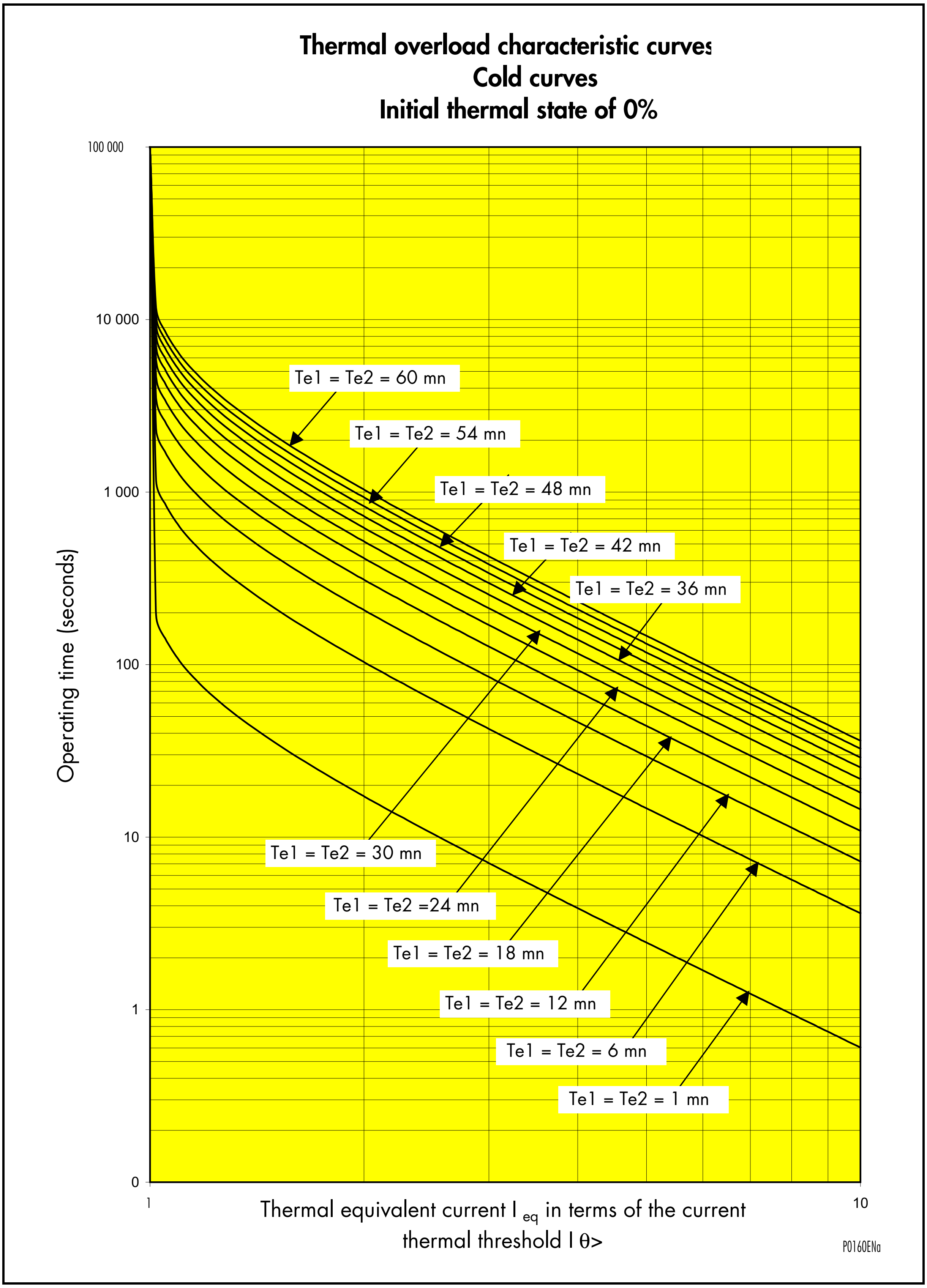
α Factor (see table)

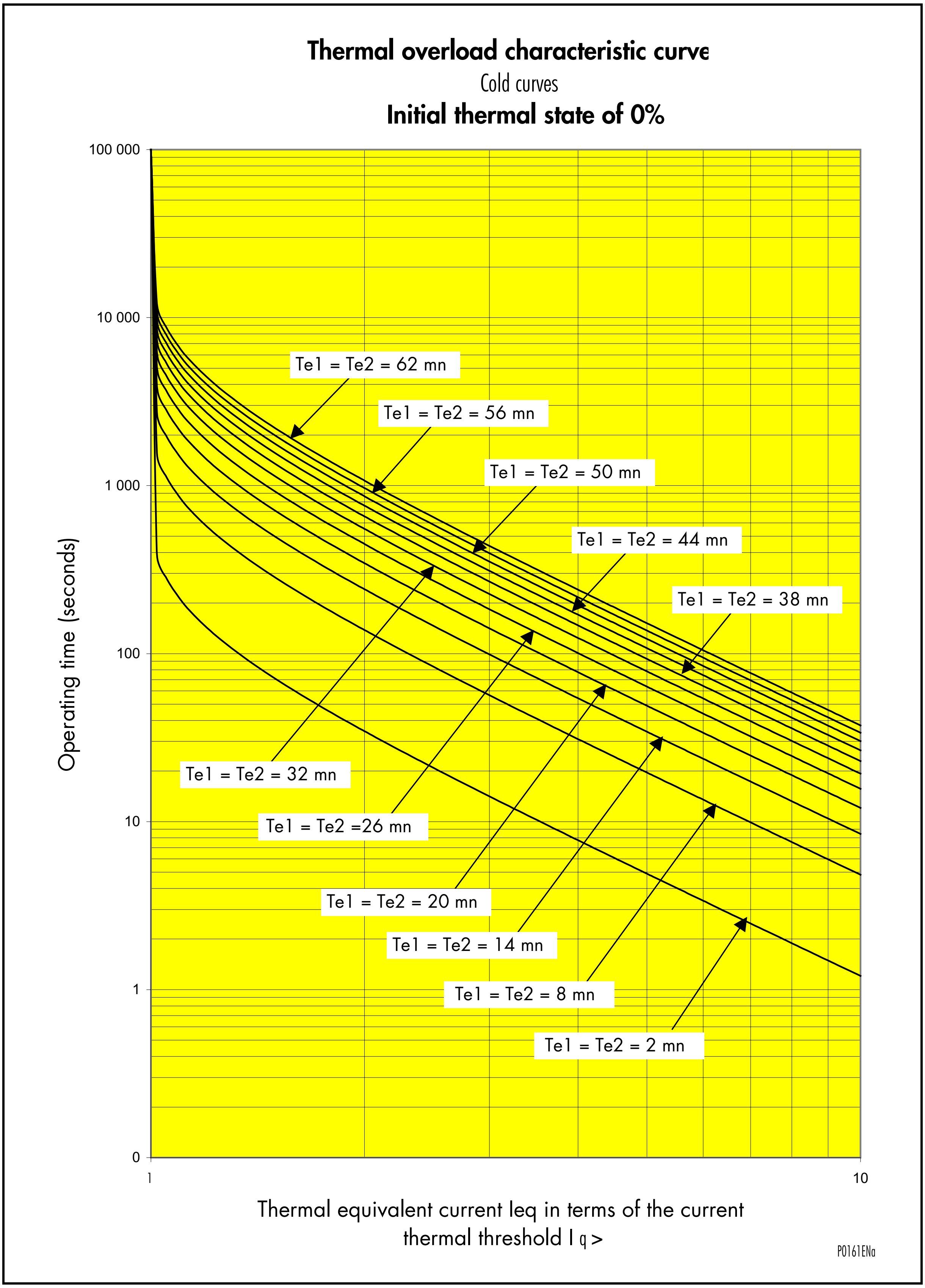
T Reset time multiplier (RTMS) setting between 0.025 and 1.5.

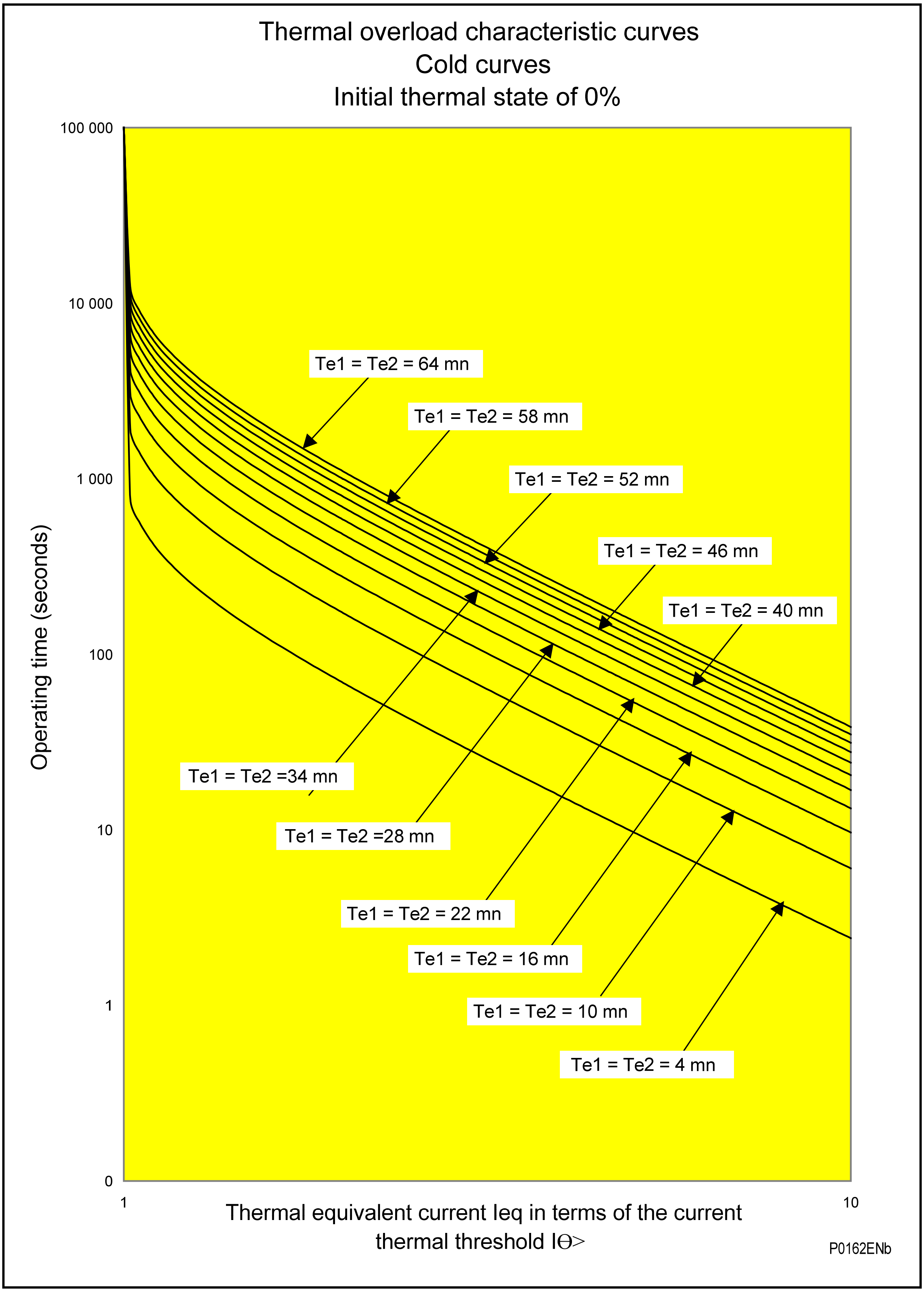
Type of Curve	**Standard**	**K Factor**	**α Factor**
Short time inverse	C02	2.261	2
Moderately inverse	ANSI/IEEE	4.850	2
Long time inverse	C08	5.950	2
Very inverse	ANSI/IEEE	21.600	2
Extremely Inverse	ANSI/IEEE	29.100	2

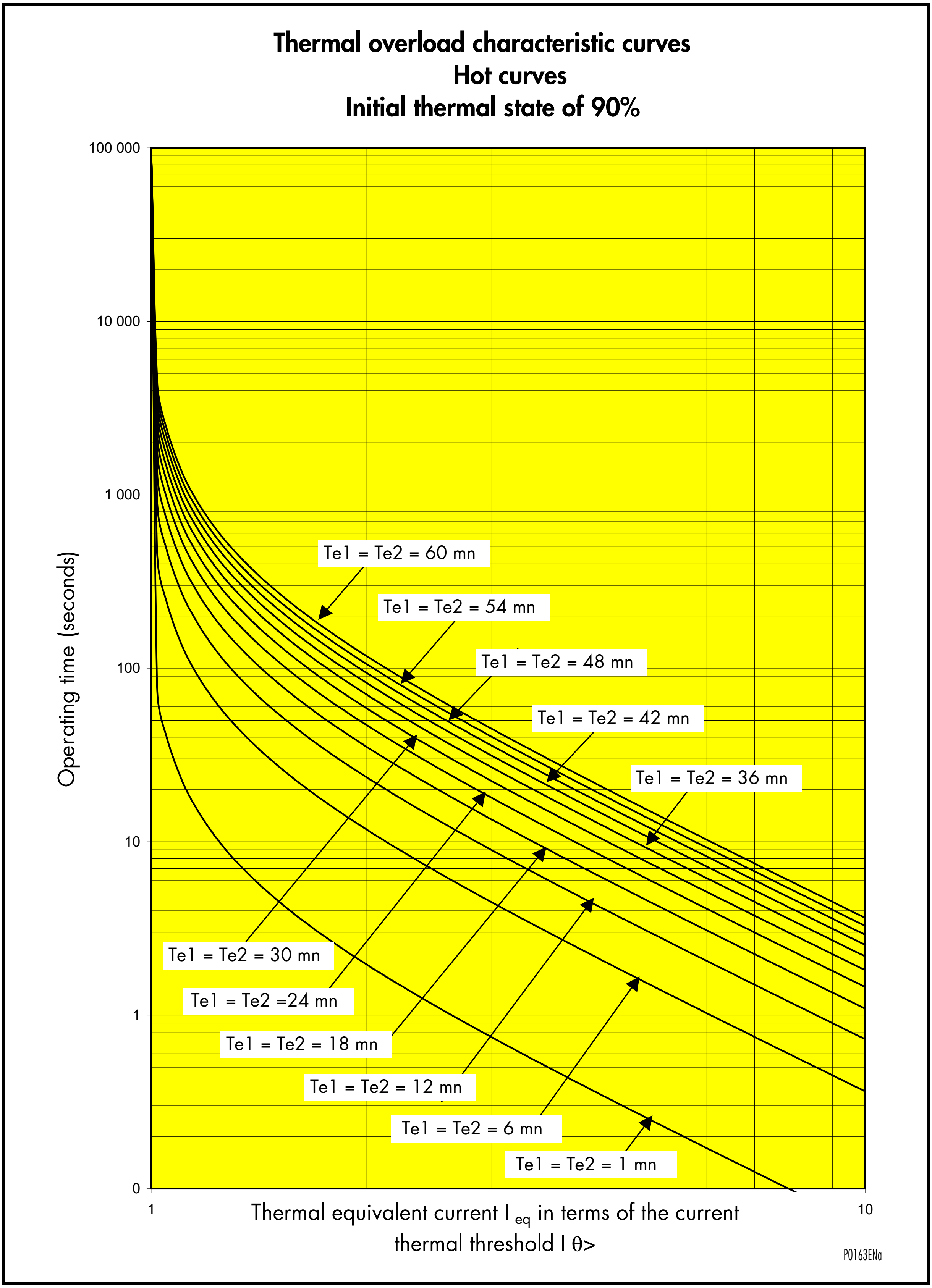
14. THERMAL OVERLOAD CHARACTERISTIC CURVES

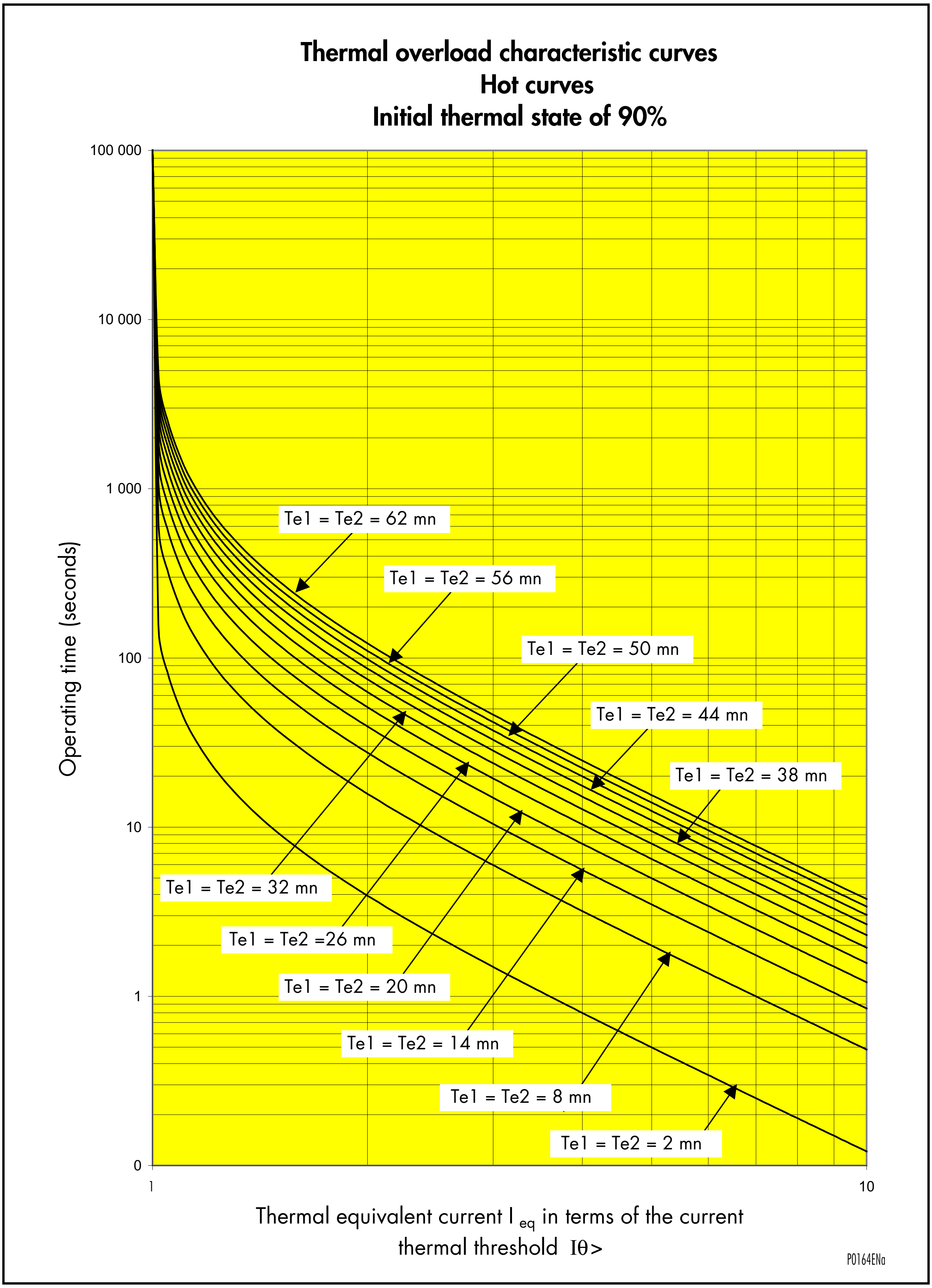


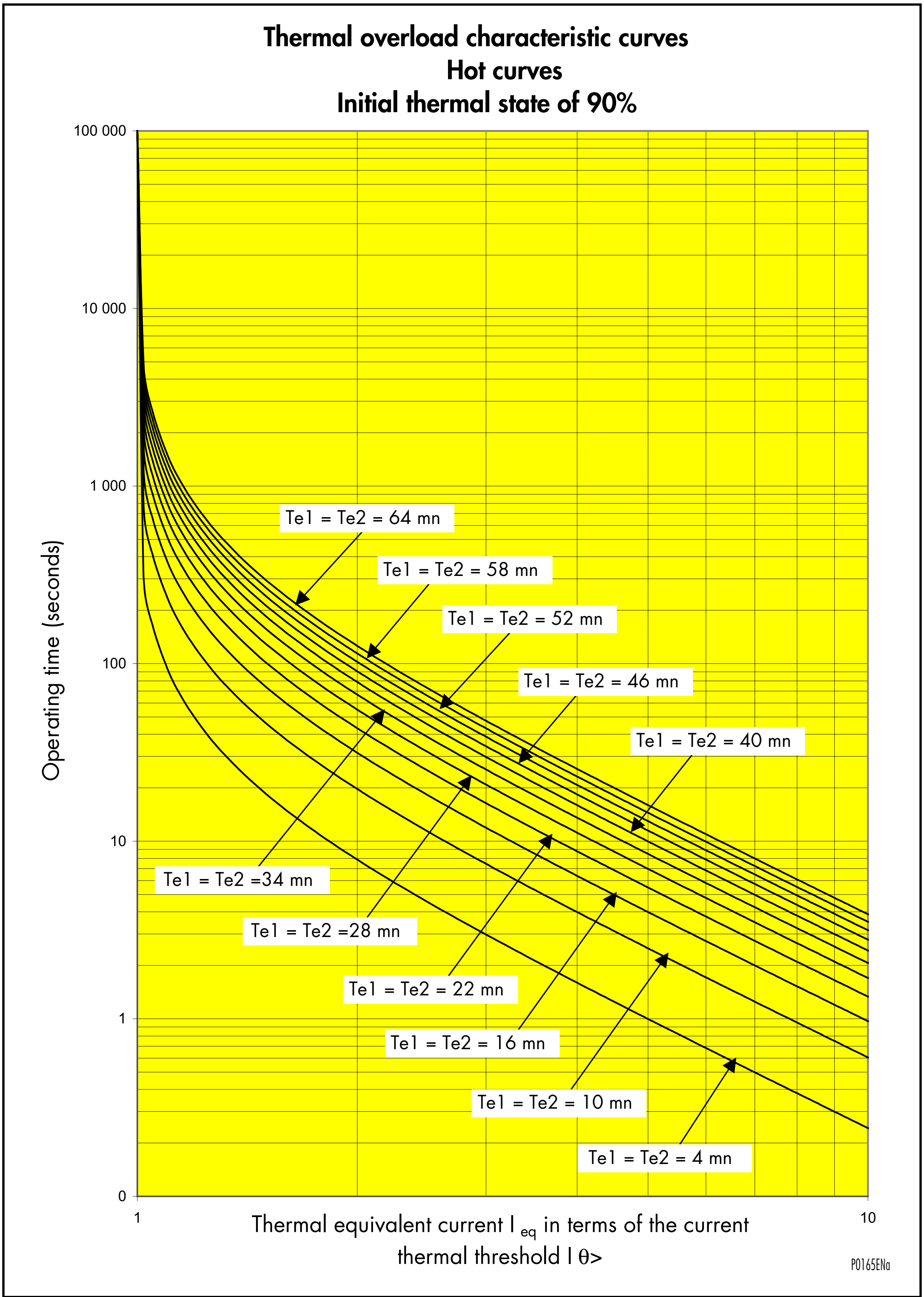

Thermal overload characteristic curves
Cold curves
Initial thermal state of 0%
100 000
10 000
1 000
100
10
1
0
Operating time (seconds)
Te1 = Te2 = 60 mn
Te1 = Te2 = 54 mn
Te1 = Te2 = 48 mn
Te1 = Te2 = 42 mn
Te1 = Te2 = 36 mn
Te1 = Te2 = 30 mn
Te1 = Te2 =24 mn
Te1 = Te2 = 18 mn
Te1 = Te2 = 12 mn
Te1 = Te2 = 6 mn
Te1 = Te2 = 1 mn
1
10
Thermal equivalent current I eq in terms of the current thermal threshold I θ>
P0160ENa

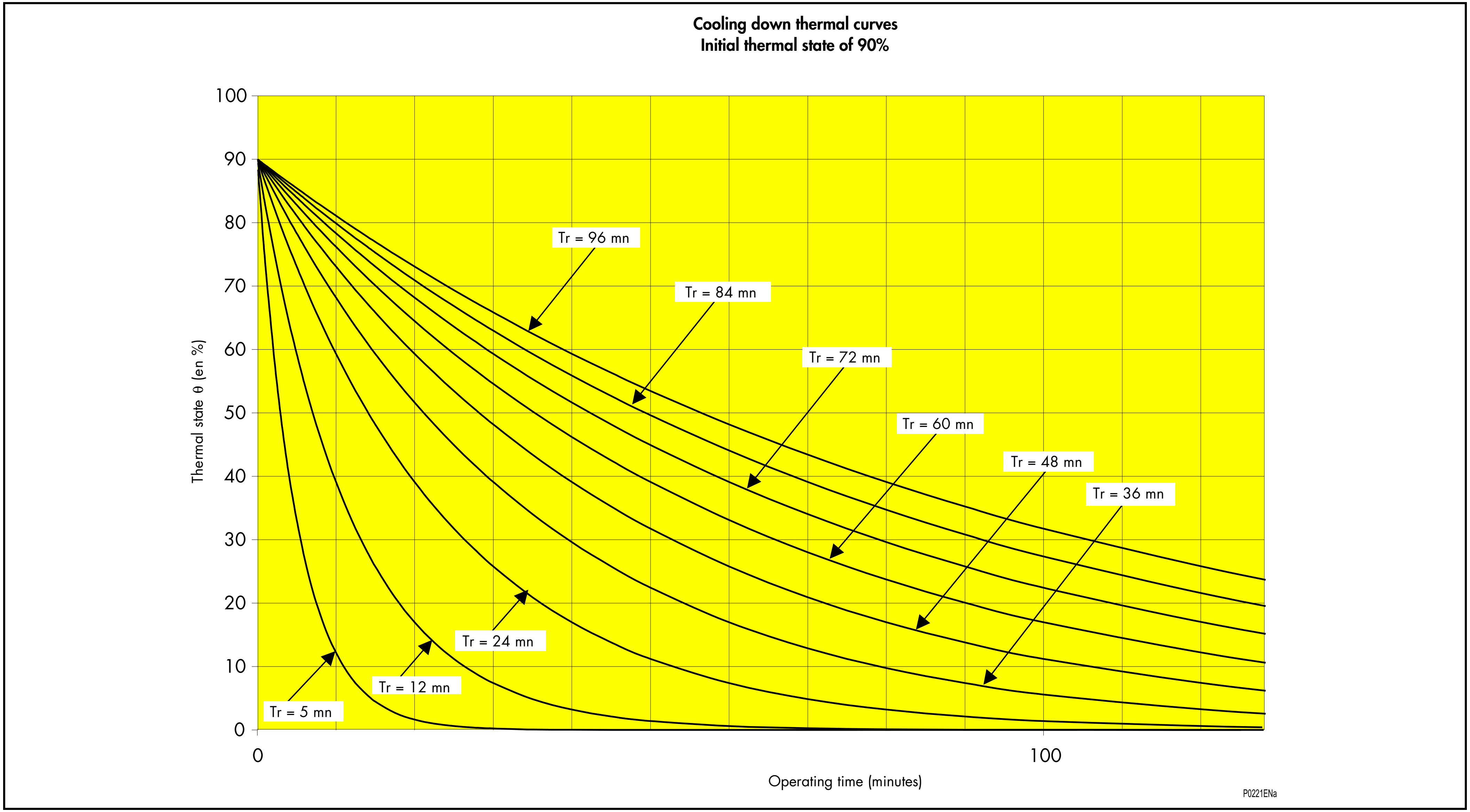

Thermal overload characteristic curve
Cold curves
Initial thermal state of 0%
100 000
10 000
1 000
100
10
1
0
1
10
Operating time (seconds)
Thermal equivalent current Ieq in terms of the current thermal threshold I q >
Te1 = Te2 = 62 mn
Te1 = Te2 = 56 mn
Te1 = Te2 = 50 mn
Te1 = Te2 = 44 mn
Te1 = Te2 = 38 mn
Te1 = Te2 = 32 mn
Te1 = Te2 =26 mn
Te1 = Te2 = 20 mn
Te1 = Te2 = 14 mn
Te1 = Te2 = 8 mn
Te1 = Te2 = 2 mn
P0161ENa

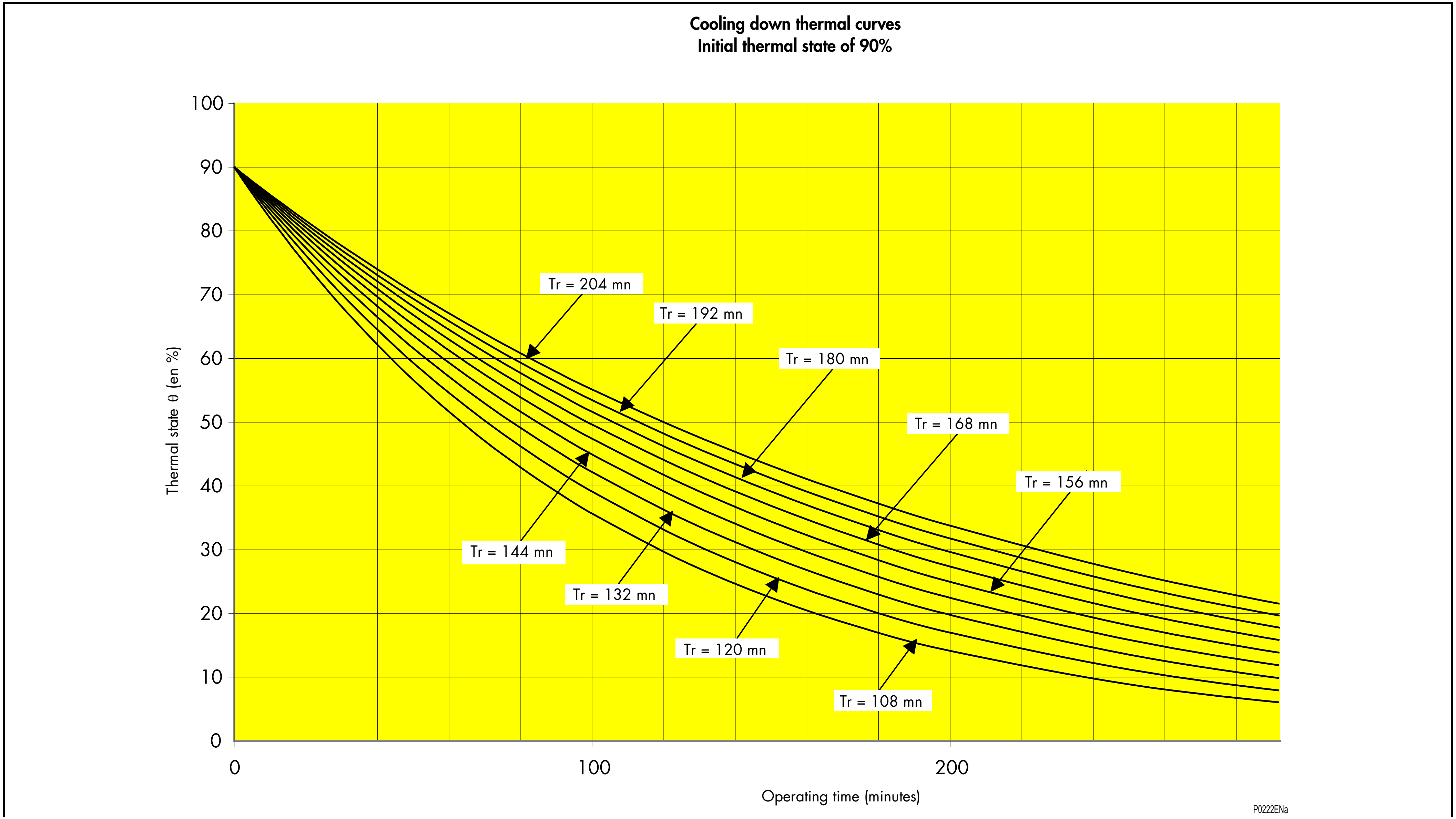

Thermal overload characteristic curves
Cold curves
Initial thermal state of 0%
100 000
10 000
1 000
100
10
1
0
Operating time (seconds)
1
10
Thermal equivalent current Ieq in terms of the current thermal threshold IΘ>
Te1 = Te2 = 64 mn
Te1 = Te2 = 58 mn
Te1 = Te2 = 52 mn
Te1 = Te2 = 46 mn
Te1 = Te2 = 40 mn
Te1 = Te2 =34 mn
Te1 = Te2 =28 mn
Te1 = Te2 = 22 mn
Te1 = Te2 = 16 mn
Te1 = Te2 = 10 mn
Te1 = Te2 = 4 mn
P0162ENb

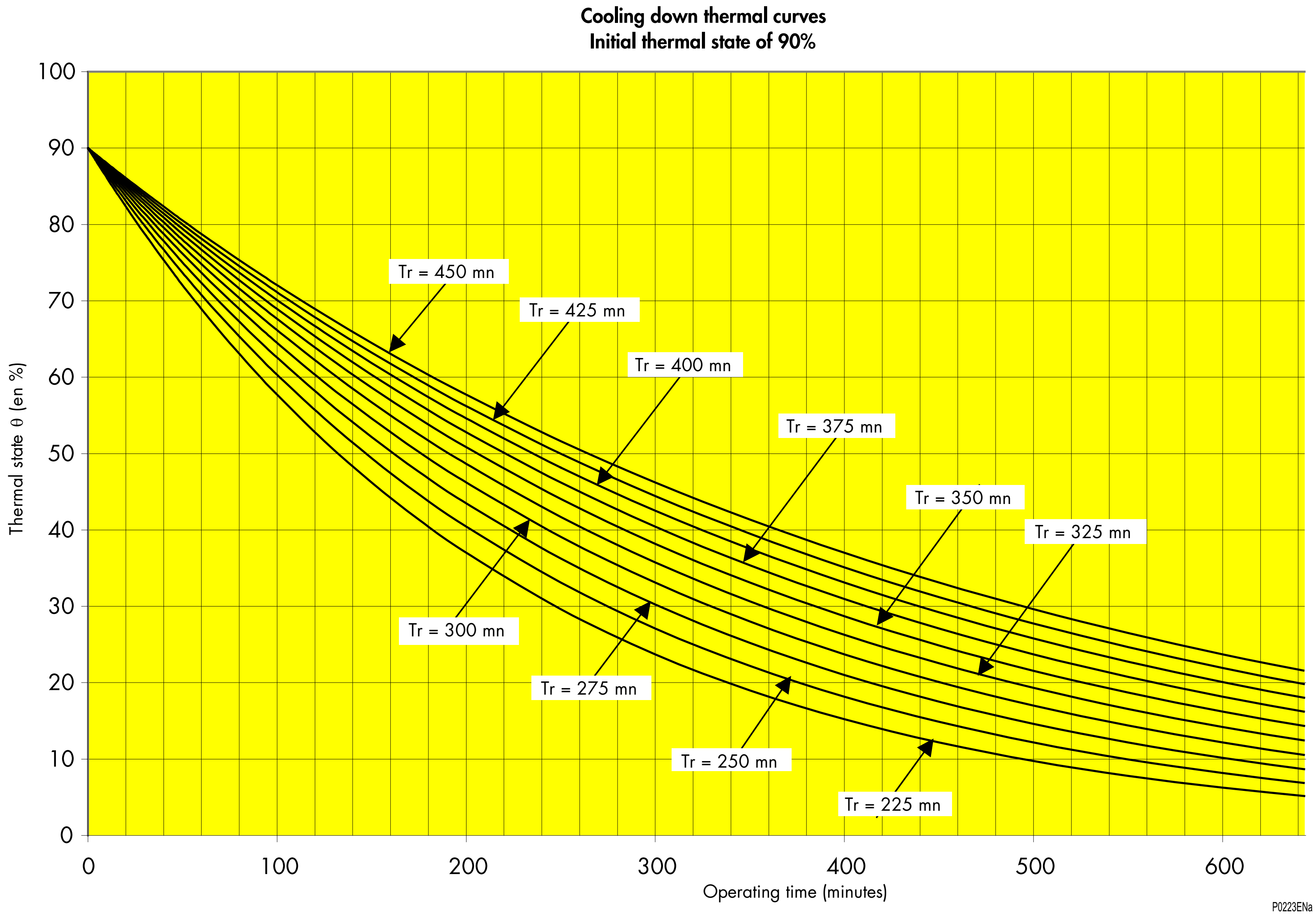

Thermal overload characteristic curves
Hot curves
Initial thermal state of 90%
100 000
10 000
1 000
100
10
1
0
Operating time (seconds)
Te1 = Te2 = 60 mn
Te1 = Te2 = 54 mn
Te1 = Te2 = 48 mn
Te1 = Te2 = 42 mn
Te1 = Te2 = 36 mn
Te1 = Te2 = 30 mn
Te1 = Te2 =24 mn
Te1 = Te2 = 18 mn
Te1 = Te2 = 12 mn
Te1 = Te2 = 6 mn
Te1 = Te2 = 1 mn
1
10
Thermal equivalent current I eq in terms of the current thermal threshold I θ>
P0163ENa

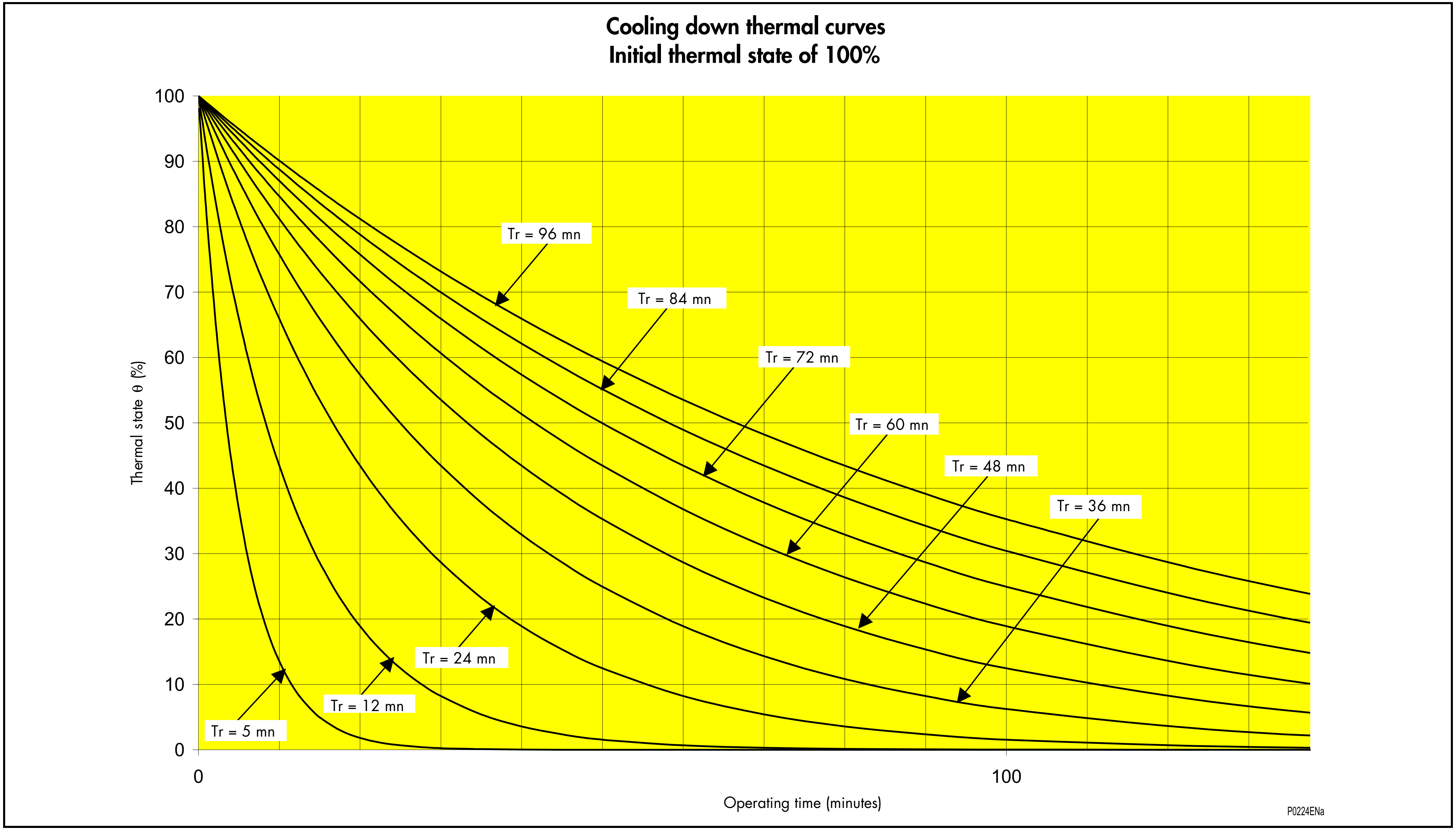

Thermal overload characteristic curves
Hot curves
Initial thermal state of 90%
100 000
10 000
1 000
100
10
1
0
Operating time (seconds)
1
10
Te1 = Te2 = 62 mn
Te1 = Te2 = 56 mn
Te1 = Te2 = 50 mn
Te1 = Te2 = 44 mn
Te1 = Te2 = 38 mn
Te1 = Te2 = 32 mn
Te1 = Te2 =26 mn
Te1 = Te2 = 20 mn
Te1 = Te2 = 14 mn
Te1 = Te2 = 8 mn
Te1 = Te2 = 2 mn
Thermal equivalent current I eq in terms of the current thermal threshold Iθ>
P0164ENa

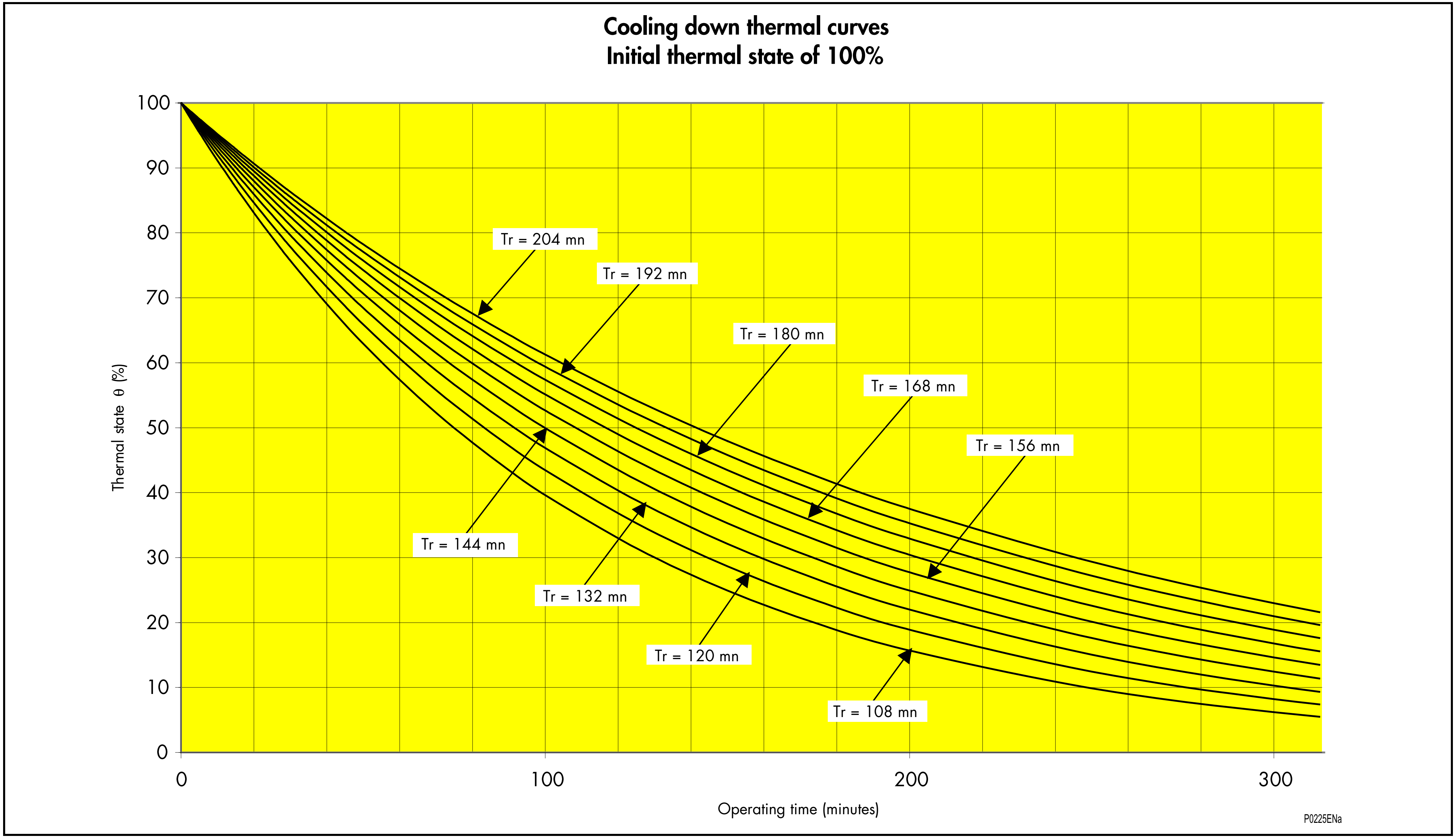

Thermal overload characteristic curves
Hot curves
Initial thermal state of 90%
100 000
10 000
1 000
100
10
1
0
Operating time (seconds)
Te1 = Te2 = 64 mn
Te1 = Te2 = 58 mn
Te1 = Te2 = 52 mn
Te1 = Te2 = 46 mn
Te1 = Te2 = 40 mn
Te1 = Te2 =34 mn
Te1 = Te2 =28 mn
Te1 = Te2 = 22 mn
Te1 = Te2 = 16 mn
Te1 = Te2 = 10 mn
Te1 = Te2 = 4 mn
1
10
Thermal equivalent current I eq in terms of the current thermal threshold I θ>
P0165ENa

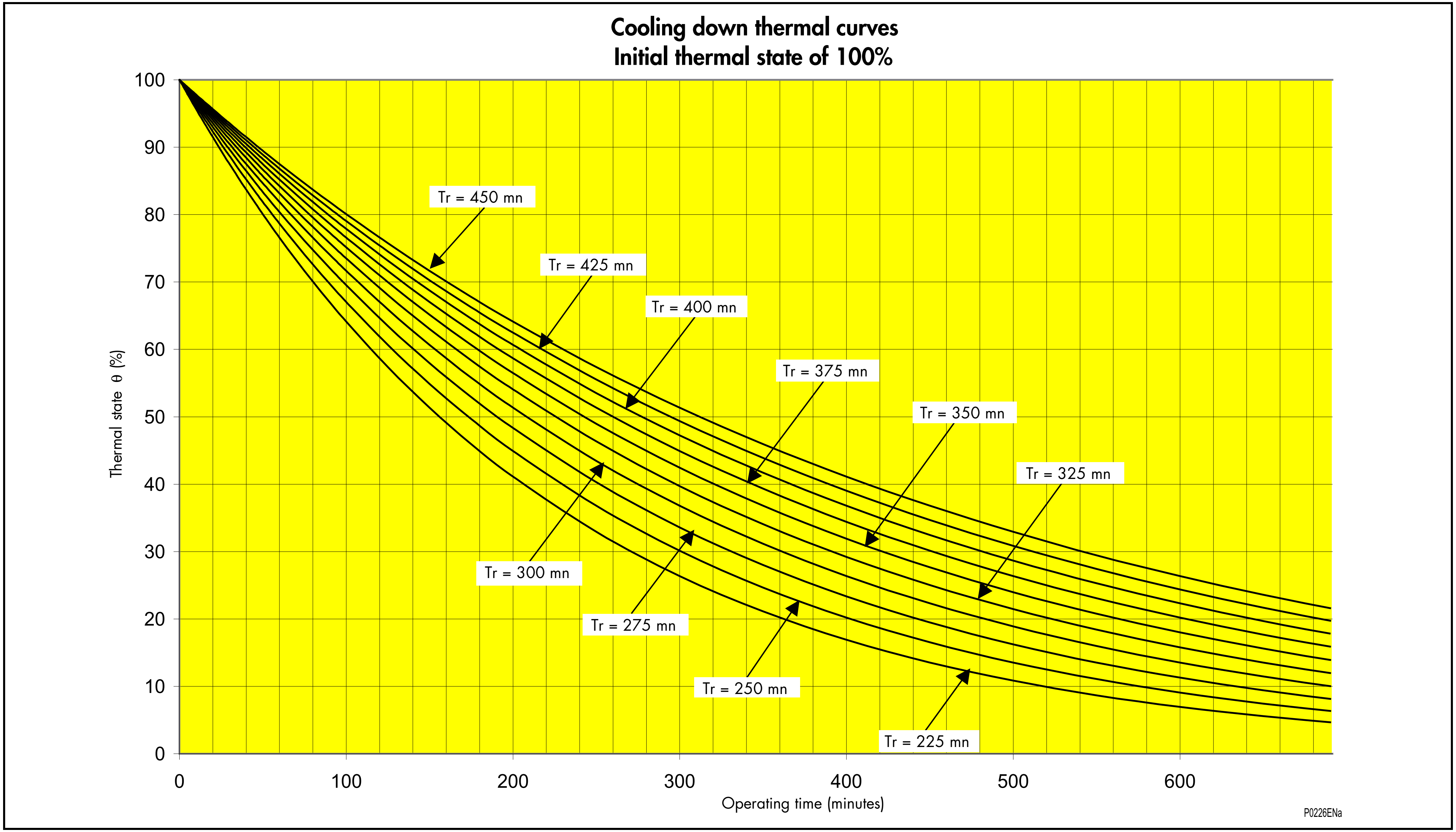

Cooling down thermal curves
Initial thermal state of 90%
Tr = 96 mn
Tr = 84 mn
Tr = 72 mn
Tr = 60 mn
Tr = 48 mn
Tr = 36 mn
Tr = 24 mn
Tr = 12 mn
Tr = 5 mn
Thermal state θ (en %)
100
90
80
70
60
50
40
30
20
10
0
0
100
Operating time (minutes)
P0221ENa

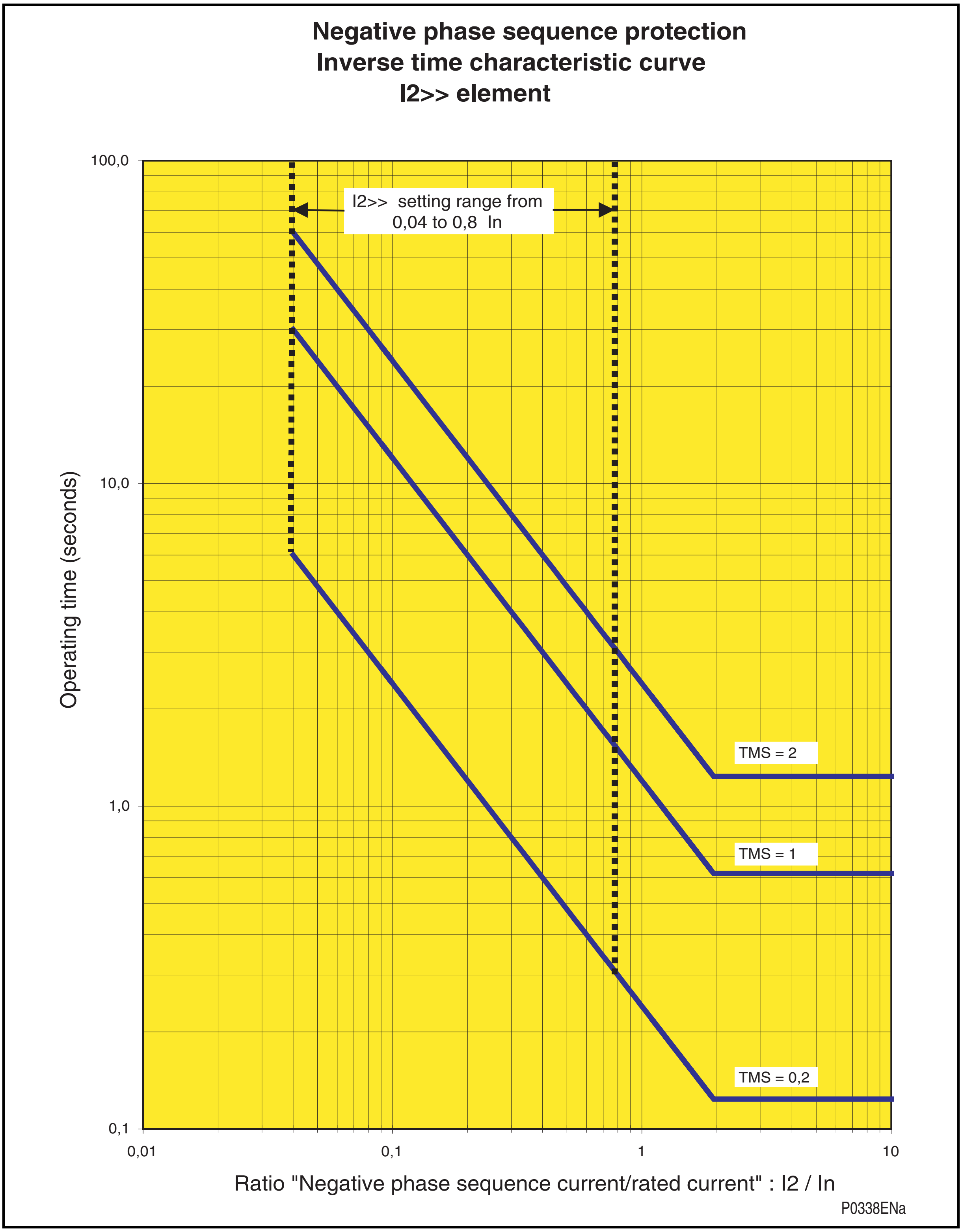

Cooling down thermal curves
Initial thermal state of 90%
100
90
80
70
60
50
40
30
20
10
0
Thermal state θ (en %)
0
100
200
Operating time (minutes)
Tr = 204 mn
Tr = 192 mn
Tr = 180 mn
Tr = 168 mn
Tr = 156 mn
Tr = 144 mn
Tr = 132 mn
Tr = 120 mn
Tr = 108 mn
P0222ENa


Cooling down thermal curves
Initial thermal state of 90%
100
90
80
70
60
50
40
30
20
10
0
Thermal state θ (en %)
Tr = 450 mn
Tr = 425 mn
Tr = 400 mn
Tr = 375 mn
Tr = 350 mn
Tr = 325 mn
Tr = 300 mn
Tr = 275 mn
Tr = 250 mn
Tr = 225 mn
0
100
200
300
400
500
600
Operating time (minutes)
P0223ENa


Cooling down thermal curves
Initial thermal state of 100%
Thermal state θ (%)
100
90
80
70
60
50
40
30
20
10
0
Tr = 96 mn
Tr = 84 mn
Tr = 72 mn
Tr = 60 mn
Tr = 48 mn
Tr = 36 mn
Tr = 24 mn
Tr = 12 mn
Tr = 5 mn
0
100
Operating time (minutes)
P0224ENa


Cooling down thermal curves
Initial thermal state of 100%
Thermal state θ (%)
100
90
80
70
60
50
40
30
20
10
0
0
100
200
300
Operating time (minutes)
Tr = 204 mn
Tr = 192 mn
Tr = 180 mn
Tr = 168 mn
Tr = 156 mn
Tr = 144 mn
Tr = 132 mn
Tr = 120 mn
Tr = 108 mn
P0225ENa


Cooling down thermal curves
Initial thermal state of 100%
Thermal state θ (%)
100
90
80
70
60
50
40
30
20
10
0
Tr = 450 mn
Tr = 425 mn
Tr = 400 mn
Tr = 375 mn
Tr = 350 mn
Tr = 325 mn
Tr = 300 mn
Tr = 275 mn
Tr = 250 mn
Tr = 225 mn
0
100
200
300
400
500
600
Operating time (minutes)
P0226ENa


Negative phase sequence protection
Inverse time characteristic curve
I2>> element
I2>> setting range from
0,04 to 0,8 In
100,0
10,0
1,0
0,1
TMS = 2
TMS = 1
TMS = 0,2
0,01
0,1
1
10
Operating time (seconds)
Ratio "Negative phase sequence current/rated current" : I2 / In
P0338ENa

15. EQUIVALENCE BETWEEN RTD MEASUREMENTS AND TEMPERATURE

The next table presents typical equivalence between measured value and temperature for each RTD type.

Temperature (°C)	100 OHM Platinum (Ω)	100 OHM Nickel (Ω)	120 OHM Nickel (Ω)	10 OHM Copper (Ω)
-40	84.27	79.13	92.76	7.490
-30	88.22	84.15	99.41	7.876
-20	92.16	89.23	106.41	8.263
-10	96.09	94.58	113.0	8.649
0	100.0	100.0	120.0	9.035
10	103.9	105.6	127.2	9.421
20	107.8	111.2	134.5	9.807
30	111.7	117.1	142.1	10.19
40	115.5	123.0	149.8	10.58
50	119.4	129.1	157.7	10.97
60	123.2	135.3	165.9	11.35
70	127.1	141.7	174.3	11.74
80	130.9	148.3	182.8	12.12
90	134.7	154.9	191.6	12.51
100	138.5	161.8	200.6	12.90
110	142.3	168.8	209.9	13.28
120	146.1	176.0	219.3	13.67
130	149.8	183.3	228.9	14.06
140	153.6	190.9	238.8	14.44
150	157.3	198.7	249.0	14.83
160	161.0	206.6	259.3	15.22
170	164.8	214.8	269.9	15.61
180	168.5	223.2	280.8	16.00
190	172.2	231.6	291.9	16.38
200	175.8	240.0	303.5	16.78

16. EQUIVALENCE BETWEEN ANALOGUE OUTPUT SIGNAL AND REMOTE MEASUREMENT

The following two tables provide equivalence data between the value of current signal in mA generated at the analogue outputs of the MiCOM P220/P225 and the corresponding measurement value:

Measurement Type	HMI Sign	Unit	Variation Range	Rating 0 - 20 mA
Phase A current	IA RMS	Ampere	0 to 2 In	Ias * 2 In/20 mA
Phase B current	IB RMS	Ampere	0 to 2 In	Ias * 2 In/20 mA
Phase C current	IC RMS	Ampere	0 to 2 In	Ias * 2 In/20 mA
Earth current	IN RMS	Ampere	0 to 2 In	Ias * 2 In/20 mA
Motor thermal state	THERM ST	%	0 to 150 %	Ias * 150/20 mA
Load in % of the full load current	% I LOAD	%	0 to 150 %	Ias * 150/20 mA
Time before a permitted start	TbefSTART	Minute	0 to 120 Minutes	Ias * 120/20 mA
Time before a thermal trip	TbefTRIP	Minute	0 to 120 Minutes	Ias * 120/20 mA
Phase A phase C voltage (range 57- 130 V)	VAC RMS	Volt	0 to 130 V	Ias * 130/20 mA
Phase A phase C voltage (range 220 - 480 V)	VAC RMS	Volt	0 to 480 V	Ias * 480/20 mA
Power factor	POWER FACT		-1 to 1	[Ias * 2/20 mA] - 1
Active power (WATT)	WATTs	W	- AO to AO	[Ias * 2 * MVA/20 mA] - AO
Réactive power (VAR)	VARs	VAR	- AO to AO	[Ias * 2 * MVA/20 mA] - AO
RTD's temperature	T°C RTD	°C	- 40 to 215 °C	[Ias * 255/20 mA] - 40°C
Hottest RTD number	No Hottest RTD		0 to 10	Ias * 10/20 mA

Measurement Type	HMI Sign	Unit	Variation Range	Rating 4 - 20 mA
Phase A current	IA RMS	Ampere	0 to 2 In	(Ias - 4 mA) * 2 In/16 mA
Phase B current	IB RMS	Ampere	0 to 2 In	(Ias - 4 mA) * 2 In/16 mA
Phase C current	IC RMS	Ampere	0 to 2 In	(Ias - 4 mA) * 2 In/16 mA
Earth current	IN RMS	Ampere	0 to 2 In	(Ias - 4 mA) * 2 In/16 mA
Motor thermal state	THERM ST	%	0 to 150 %	(Ias - 4 mA) * 150/16 mA
Load in % of the full load current	% I LOAD	%	0 to 150 %	(Ias - 4 mA) * 150/16 mA
Time before a permitted start	TbefSTART	Minute	0 to 120 Minutes	(Ias - 4 mA) * 120/16 mA
Time before a thermal trip	TbefTRIP	Minute	0 to 120 Minutes	(Ias - 4 mA) * 120/16 mA
Phase A phase C voltage (range 57- 130 V)	VAC RMS	Volt	0 to 130 V	(Ias - 4 mA) * 130/16 mA
Phase A phase C voltage (range 220 - 480 V)	VAC RMS	Volt	0 to 480 V	(Ias - 4 mA) * 480/16 mA
Power factor	POWER FACT		-1 to 1	(Ias - 12 mA) * 2/16 mA
Active power (WATT)	WATTs	W	- AO to AO	{[(Ias - 12 mA) * 2]/16 mA} * AO
Reactive power (VAR)	VARs	VAR	- AO to AO	{[(Ias - 12 mA) * 2]/16 mA} * AO
RTD's temperature	T°C RTD	°C	- 40 to 215 °C	[(Ias - 4 mA) * 255/16 mA] - 40°C
Hottest RTD number	No Hottest RTD		0 to 10	(Ias - 4 mA) * 10/16 mA

N.B.:

– Ias is the value of the current signal in mA generated by the analogue output.

– In the case where the measurement value to remote through the analogue output is outside the permissible variation range, the current signal is restricted to the limit value of the variation range.

– In the case where there is no thermal alarm "θ ALARM", the current signal value meaning the time before a thermal trip "Tbef TRIP" is equal to 20 mA.

– AO: Maximum rating of the power value (Active and/or reactive) transmitted by the analogue output ANALOG OUTPUT setting within the CONFIG. SELECT submenu).

USER GUIDE

CONTENT

1. INTRODUCTION

1.1 Object of this document

The purpose of this document is to present the characteristics of the P22x motor protection relay and to guide the operator through the setting procedures.

After an overview of the product, this manual explains the functions performed by this protection relay and how they must be used. The menu associated with each of these functions is presented and explained.

1.2 Definitions

Tripping

This operation consists of a command to open the breaking device (circuit breaker or fuse contactor) supplying power to the motor. A tripping command can be given:

⇒ either on detection of a fault by the MiCOM P22x relay,

⇒ or by the operator (in this case it is an external tripping command).

Alarm

The detection of a fault by the MiCOM P22x relay leads to the display of an alarm message.

Acknowledgement of an alarm

This operation consists of making an alarm message disappear.

Function in service/out of service

The MiCOM P22x relay offers a certain number of protection, monitoring and control functions. The end user can select from these functions by:

⇒ Enabling the functions that are required.

⇒ Disabling the functions that are not required after careful considerations since some functions are inter-linked.

Activated/deactivated function

Not all the protection functions of the P22x relay are activated at the same time. They are alternately activated/deactivated automatically by the P22x relay itself to ensure that the motor has protection specific to its various operating conditions: underload or overload conditions, starting phase, locked rotor condition, and motor shut down.

NOTE: A function cannot be activated or deactivated unless the operator has previously brought it into service.

2. DESCRIPTION OF THE MiCOM P220/P225 MOTOR PROTECTION RELAY

The **MiCOM P220/P225** relay uses digital techniques to fulfil the functions of protection, control and monitoring of motors.

The **MiCOM P220/P225** relay is equipped with up to eight current inputs (2 times 4 earth and phase current inputs). The current inputs have dual ratings of 1 or 5 amperes (it is possible to combine an earth current rating of 1 A and a phase current rating of 5 A). P225 has 1 phase to phase voltage inputs (or optional 3 voltages inputs). The voltage input's rating is either 57-130V or 220-480V (selected at time of order). These ranges make the relay suitable for connection to a VT secondary or direct connection to a system supply voltage of up to 440V.

It is possible to program the output relays to respond to any of the protection or control functions available. The different logic inputs can also be allocated to control functions.

The auxiliary power supply is provided by a direct current or alternating current auxiliary source via an internal converter. Satisfactory operation of the MiCOM P220/P225 relay is guaranteed during brief interruptions of the auxiliary power supply lasting less than 50 ms.

The front panel gives the operator access to the data of the **MiCOM P220/P225** relay either via LEDs or via the display unit and the keypad. The various alarms are stored in the memory and made available to the operator on the backlit display device. These alarms can be read and acknowledged directly without a password. All the parameters and measurements are accessible without a password. The setting values can only be modified after entering the password stored in the memory.

The **MiCOM P220/P225** relay records and measures a large number of data with high accuracy. It continuously measures the phase and earth currents and P225 continuously measures the phase-phase voltage taking into account the true RMS values up to the 10th harmonic for a 50 Hz motor and the 8th harmonic for a 60 Hz motor.

The **MiCOM P220/P225** relay has on the rear connector a RS485 type link (two RS485 communication links if the option is present) with a choice of MODBUS™, Courier or IEC 60870-5-103 communication protocols. This enables the operator to read the data stored by the relay (measurements, alarms, parameters), or modify the different settings and allocations of outputs of each relay, or transmit remote controls.

It is also possible to reassemble or modify these data via the RS232 communication located on the front panel by using the MiCOM S1 Studio support software.

The **MiCOM P220/P225** relay can be connected directly via this link to a digital monitoring and control system (for example: MiCOM S1, SCADA). All the data available are then at the disposal of the supervisor and can be utilised either locally or remotely.

The **MiCOM P220/P225** relay can be withdrawn while it is live. This means that its live parts can be withdrawn from the metal housing while the relay is supplied with power via the auxiliary source. When the relay is drawn out of its housing:

The current circuits from the phase and earth CTs are not interrupted thanks to the presence of internal short-circuiting devices located at the current inputs (metal housing part),

- no tripping order is generated,
- the watchdog relay drops out,

the RS485 link is not interrupted. However, communication is no longer possible for the relay which is drawn out.

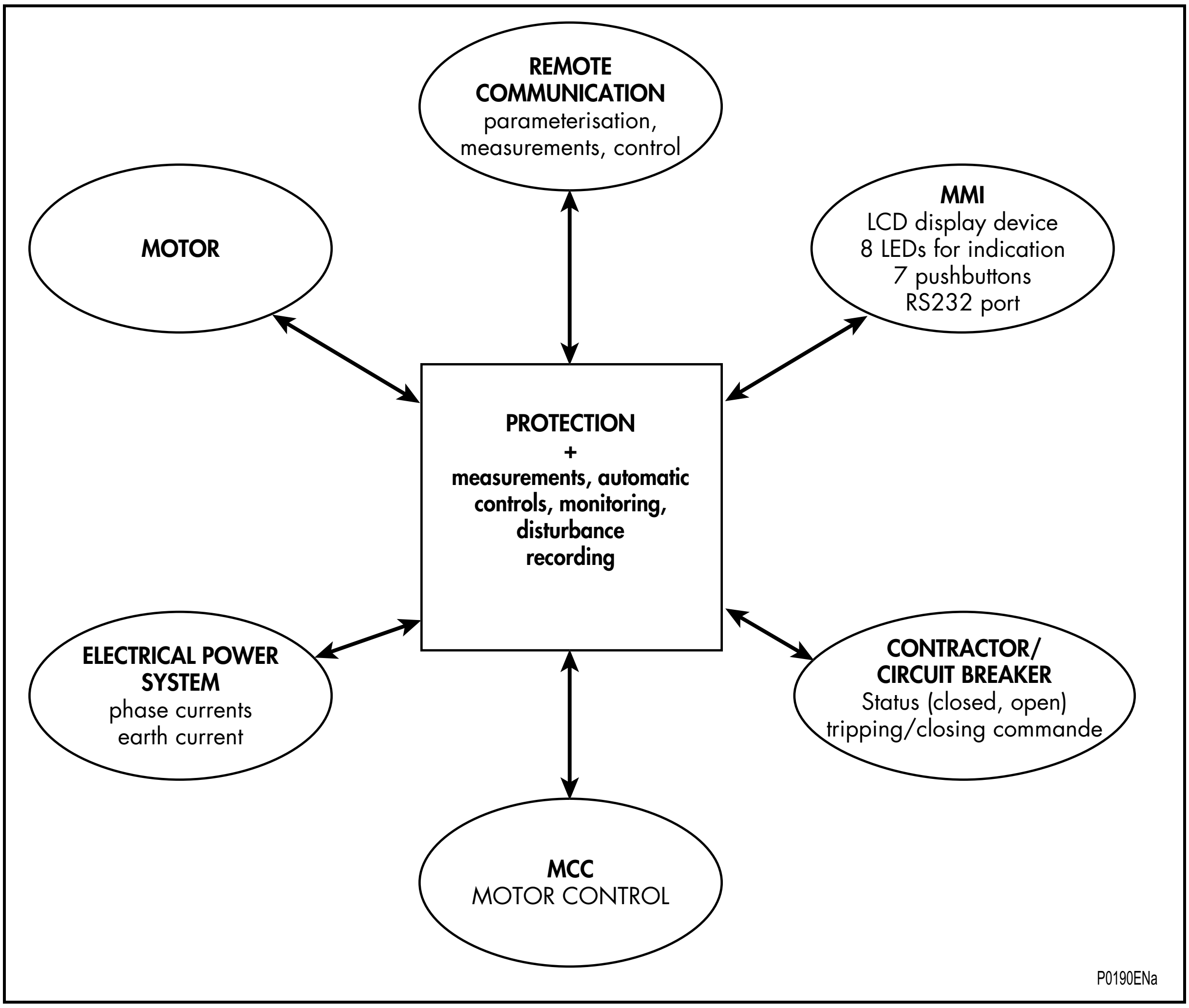


FIGURE 1 - ENVIRONMENT OF THE MiCOM P22x RELAY

3. THE OPERATOR INTERFACE

The front panel of the MiCOM P220/P225 relay serves as an interface between the human and the protection relay. It enables the operator to enter settings, to gain access to the display of measured values and alarms, and also to display in a simple manner the different actions performed by the MiCOM P220/P225 relay.

The front panel is fully described in the section P22x/EN GS – Getting started.

Under the lower flap, the RS232 link permits the connection of a portable PC to the **MiCOM P220/P225** relay. It can be used to connect the USB/RS232 cable MiCOM E2 connected to a PC, to power and set the relay.

4. THE MENU

The menu of the P220/P225 relay is organised into main menus, some of which are subdivided into submenus.

The operator dialogue of the MiCOM P220/P225 relay is divided into 11 main menus (menu column):

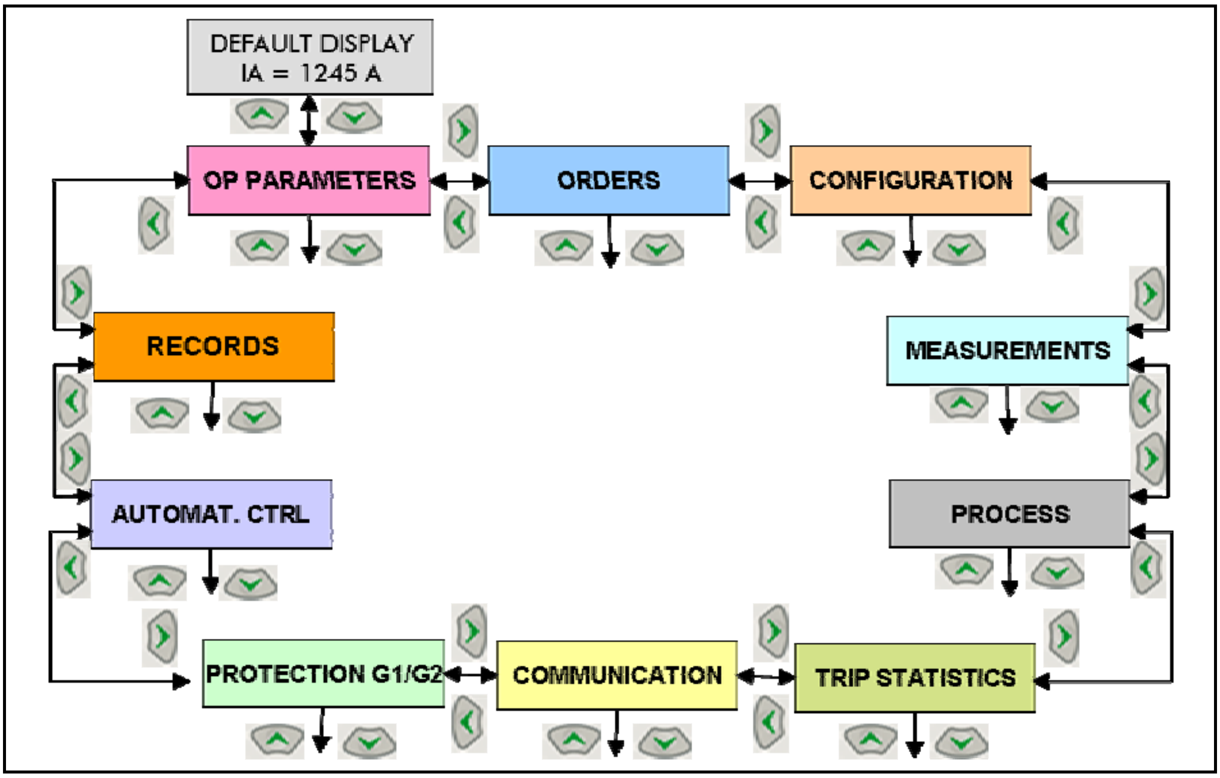


FIGURE 2 - ORGANIZATION OF THE MENUS OF THE MiCOM P220/P225 RELAY

Some of main menus are divided into submenus:

Menus	Sub-menus											
OP. PARAMETERS												
ORDERS												
CONFIGURATION	CONFIG. SELECT	CT/VT RATIO	LED5	LED6	LED7	LED8	ALARM CONFIG	INPUT CONFIG.				
MEASUREMENTS 1												
MEASUREMENTS 2												
PROCESS												
TRIP STATISTICS												
COMMUNICATION												
PROTECTION G1	START CRITERIA	[49] THERMAL OVERLOAD	[50/-51] PHASE OC	[50N/-51N] EARTH FAULT	[46] UNBALANCE	[27] UNDER-VOLTAGE (P225 only)	[59] OVER-VOLTAGE (P225 only)	[48] EXCES. LONG START	[51LR/50S] BLOCK ROTOR	[37] LOSS OF LOAD	[49/38] RTD	[49] THERMISTAN CE
PROTECTION G2	START CRITERIA	[49] THERMAL OVERLOAD	[50/-51] PHASE OC	[50N/-51N] EARTH FAULT	[46] UNBALANCE	[27] UNDER-VOLTAGE (P225 only)	[59] OVER-VOLTAGE (P225 only)	[48] EXCES. LONG START	[51LR/50S] BLOCK ROTOR	[37] LOSS OF LOAD	[49/38] RTD	[49] THERMISTAN CE
AUTOMAT. CTRL	[66] START NUMBER	MIN TIME BETW 2 START	REACCEL AUTHORIZ	INPUTS	LOGIC EQUATION	AUX OUTPUT RLY	LATCH AUX RLY	TRIP OUTPUT RLY	LATCH TRIP ORDER	CB FAIL	ABS	BUS VOLT-AGE CTRL (P225 only)
	CB SUPERVISION	LATCH AUX RLY										
RECORD	FAULT RECORD	DISTURB RECORD	CB MONITORING									

FIGURE 3 - ORGANIZATION OF THE MENUS AND SUBMENUS OF THE MiCOM P220/P225 RELAY

From the default display, access is gained to these different menus by using the key, then and keys.

To return to the default display from any one of the menus, press the key.

4.1 Default display

By default, a value is continuously displayed, and the operator can select this value from a list in the ‘CONFIGURATION/CONFIG. SELECT’ menu (“Default display” cell).

As soon as an alarm is generated by the MiCOM P220/P225 relay, the relay indicates it by an alarm message: this display takes priority and replaces the default value (see the MOTOR ALARMS and HARDW ALARMS menus).

4.2 Access to the submenus

From a main menu, access to a submenu is gained to the different submenus via the and keys.

It is possible to read all the parameters and measurements without the password.

The parameters can only be modified after entering the password.

4.3 Access to the setting parameters

Access to the setting parameters of the MiCOM P220/P225 relay is possible by:

– either locally: by using the keys or the RS232 port on the front panel,

– or remotely: via the RS485 port at the rear.

4.3.1 Protection by password

Modification of the relay parameters via the pushbuttons on the front panel is protected by password.

This protection applies to the relay configuration settings, particularly the selection of the different thresholds, time delays, communication parameters, allocation of the binary inputs, logic gates and output relays.

The password consists of four alphanumerical characters in capitals. On leaving the factory, the password is AAAA. The operator can define his own combination of characters. If the password is lost or forgotten, modification of the parameters stored in the memory of the relay is inhibited. All that is required then is to contact Schneider Electric or its agent, stating the serial number of the relay, to receive an emergency password specific to the relay concerned.

4.3.2 Entering the password/modification of the parameters

To modify a parameter, first press the key to go into updating mode (or parameterisation mode).

The operator is asked to enter the password as soon as a parameter is modified in any of the menus or sub-menus. So when the operator presses the key, to make an adjustment, and the password is not active, the following display appears on the screen:

ENTER PASSWORD **A A A A**

The password consists of the letters between A and Z. The password is entered letter by letter by using the and keys to move forwards and backwards in the alphabet.

After each letter, press the key to enter the next letter.

At the end of the input press the key to confirm the password. If the password is correct the message PASSWORD OK appears on the screen.

After 2 seconds, the display returns to the previous point in the menu. Press the key again. A cursor appears on the first field of the data to be updated:

Example modification of the current threshold I >> ([50/51] Phase OC submenu)

I>> THRESHOLD =
1.0 In

A flashing cursor indicates that the operator can change the value in the cell. To scroll through the possible values for a cell, use the and keys.

After each value, press the key to enter the next digit.

At the end of the input, press the key to confirm the modification.

While the relay is in setting mode, the letter P (Parameter) is displayed at the bottom right of the menus and submenus headers.

Example the letter P is displayed in the [50/51] Phase OC submenu header:

[50/51] Phase OC
P

If no action is taken on the keypad for 5 minutes, the password is deactivated and the letter P disappears. Any subsequent modification of parameters will give rise to a further request for the password.

NOTE:

- The parameterisation mode only allows modification of the relay configuration via the interface through which it was activated: if for example the password was entered by the keys on the front panel, only modifications carried out using these keys will be accepted.
- When the parameterisation mode is activated by entering the password via the front panel (pushbuttons), as long as this mode of parameterisation remains active, it is no longer possible to modify the relay parameters via the RS485 or RS232 communication ports. The parameters of the P220/P225 relay can only be modified by using the pushbuttons. Once the parameterisation mode is deactivated (no action on any pushbutton for 5 minutes), it is then possible to modify the parameters of the P220/P225 relay by using one of the communication ports.
- Pressing the key during modification makes it possible to return to the value before modification.
- To modify the active password, gain access to the 'OP. PARAMETERS' menu then to the PASSWORD point in the menu.

4.4 'OP. PARAMETERS' MENU

The 'OP. PARAMETERS' menu indicates the following information:

- the type of MiCOM relay, here it is the model P225 or P220, with the software version,,
- Frequency of the electrical power system, active phase sequence and active setting group,
- the state of all the logic inputs and of all programmable output relays.

In this menu, the operator can also:

- modify the password,
- give the relay/motor feeder a reference (4 characters, letters or figures),
- indicate the rated frequency of the motor (50 or 60 Hz),
- modify the date and time.

4.5 ‘ORDERS’ menu

‘ORDERS’ menu makes it possible to clear locally the relay, and to start or stop a motor.

This menu is divided into 3 orders: ‘GENERAL RESET’, ‘START MOTOR’ and ‘STOP MOTOR’.

Before sending an order, a ‘CONFIRMATION’ cell is displayed.

4.5.1 ‘GENERAL RESET’ order

‘GENERAL RESET’ order makes it possible to clear locally:

- LEDs,
- Alarms,
- Counters,
- Disturbance records,
- Fault records,
- Starting records,
- Event records,
- Measured values,
- CB monitoring records,
- Latched trip output (RL1) or latched output relays (under no fault condition).

4.5.2 ‘START MOTOR’ and ‘STOP MOTOR’ orders

‘START MOTOR’ and ‘STOP MOTOR’ orders make it possible to start and stop motors. A ‘CONFIRMATION’ cell is displayed before sending an order.

4.6 ‘CONFIGURATION’ menu

‘CONFIGURATION’ menu makes it possible to configure the MiCOM P220/P225 relay.

This menu is divided into 8 submenus:

- ‘CONFIG. SELECT’, to configure the relay and its accessories,
- ‘CT/VT RATIO’ setting,
- ‘LED 5’ to ’LED 8’ settings,
- ‘ALARM CONFIG’, allowing inhibition of an or several alarm,
- ‘INPUT CONFIG.’, for opto isolated inputs configuration.

4.6.1 ‘CONFIG. SELECT’ submenu

4.6.1.1 Setting group

The MiCOM P220/P225 relay has two setting groups corresponding to two protection groups (menus ‘PROTECTION G1’ and ‘PROTECTION G2’). The operator can thus carry out 2 settings for each parameter: one for setting group 1 and the other for setting group 2.

Management of the active setting group can be performed either on a transition or depending on a level. This selection is done by selecting in the ’SET GRP CHANGE INPUT‘ cell:

- either ‘EDGE’,
- or ‘LEVEL’.

1. If ‘EDGE’ is selected, the setting group switch can be controlled by:

- a local command:
  - via a logic input which must have been previously configured by the operator
  - via the keys on the front panel
  - via the RS232 port on the front panel
- a remote command via the RS485 port at the rear:

NOTE: – The default configuration group is PROTECTION G1.

– The list of access methods above is given in the order of priority: for example the configuration changeover order given by a logic input takes priority over the one given by the keys on the front panel.

2. If ‘LEVEL’ is selected, the active setting group depends on the state of the logic input configured as "SET GROUP":

- Logic input in low state: ‘PROTECTION G1’ group active
- Logic input in high state: ‘PROTECTION G2’ group active

NOTE: If no logic input is configured as ’SET GROUP‘, ‘PROTECTION G1’ is the default active group.

4.6.1.2 Selection of a default value to be display

The operator can select the measured value permanently displayed on the LCD screen as current, voltage or thermal overload… (see section P22x/EN HI: “configuration menu”).

4.6.1.3 ’Phase rotation’

‘Phase rotation’ is suitable for application such as mines conveyor where the use of bidirectional motors is part of the process. The direction of motor is changed by changing the phase sequence in the switchgear.

‘PHASE ROTATION’ cell makes it possible to change the phase sequence via INPUT or MENU. It is possible:

– to select ‘PHASE SEQUENCE” within A B C (default value) or A C B through MENU,

– to assign any digital input (except if some of them are dedicated to protection) to phase rotation. In this case, input energized means A C B, otherwise, it means default ABC.

Standard A B C: The calculations of positive (I1, V1) and negative (I2, V2) phase sequence voltage and current is as follows:

$$\overline{X}_1 = \frac{1}{3}\left(\overline{X}_a + \alpha\overline{X}_b + \alpha^2\overline{X}_c\right)$$

$$\overline{X}_2 = \frac{1}{3}\left(\overline{X}_a + \alpha^2\overline{X}_b + \alpha\overline{X}_c\right)$$

P3150ENa

Reverse A B C: The calculations of positive (I1, V1) and negative (I2, V2) phase sequence voltage and current is as follows:

$$\overline{X}_1 = \frac{1}{3}\left(\overline{X}_a + \alpha^2\overline{X}_b + \alpha\overline{X}_c\right)$$

$$\overline{X}_2 = \frac{1}{3}\left(\overline{X}_a + \alpha\overline{X}_b + \alpha^2\overline{X}_c\right)$$

Where $\alpha = 1 \angle 120°$

4.6.1.4 Motor start-up/motor halted detection criteria

- The MiCOM P220/P225 relay offers the choice of start detection criteria as follows:
  - closure of the contactor/circuit breaker: criterion listed as 52A,
  - closure of the contactor/circuit breaker and overshoot of the starting current threshold I_{UTIL} (START CRITERIA submenu). These two events must appear within an interval of time of approximately 90 ms for the detection of a start to be accepted. This criterion is known as 52A + I.

This facility makes it possible to adapt the configuration of the P220/P225 relay to the type of starting used: direct on_line or soft start.

- The relay will consider the motor stopped upon drop-off of logic input L1 (logic state 0).

NOTE: The P220/P225 relay detects the information "contactor/circuit breaker position" via logic input L1 (paragraph *.4.11.4.1. "Fixed" inputs*). **The connection of this logic input to the status of the breaking device is obligatory.**

4.6.1.5 Analogue outputs (optional)

The MiCOM P220/P225 relay offers 2 optional analogue outputs to make the data available to a logic controller, at 0-20 mA or 4-20 mA as desired. The current loop support can be used as an active source circuit or a passive source circuit. The values which can be transmitted by these analogue outputs are described in section P22x/EN HI: “configuration menu”)

When an analogue output is configured to indicate the active or reactive power, a cell is displayed. It is used to set the maximum rating of the analogue output.

Equivalence between analogue output signal and remote measurement is given in section P22x/EN TD.

4.6.1.6 Type of RTD temperature probes or thermistors (optional)

The P220/P225 relay offers optional monitoring of up to 10 RTD temperature probes or up to 3 thermistors to provide protection against temperature rises in the stator and mechanical bearings of the motor (PROTECTION menu).

The type of RTD (PT100, Ni100, Ni120, Cu10), or the type of thermistor (PTC/NTC) is selected in the CONFIG. SELECT submenu.

A typical equivalence table between the measured value and temperature for each RTD type is given in section P22x/EN TD.

4.6.1.7 IRIG-B time synchronization (optional)

The MiCOM P220/225 incorporates an internal clock with a resolution of 1ms. All events are time-tagged based on this clock, entered in the recording memory appropriate to their significance and signaled via the communication interface.

The clock is synchronized via different methods: communication, IRIG-B or Logic input. Only the clock synchronization via communication exists in the product, this option adds the synchronization via logic input and with IRIG-B.

Time synchronization can be set as follows:

- Automatic mode (in this case, MiCOM P220/P225 will synchronize IRIG-B. If IRIG-B synchronization is not correct: logical input will synchronize time. If logical input synchronization is not correct, rear communication port 1, then 2 will synchronize time)
- IRIG-B only,
- Logical Input only, if configured,
- Rear communication port 1 only,
- Rear communication port 2 only,

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 IRIG-B connection, or communication interface connected to the substation control system or via an opto-input.

Any of the available opto-inputs on the P22x 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.

4.6.2 'CT/VT RATIO' submenu

In the 'CT/VT RATIO' submenu, the operator sets the primary and secondary ratings of the Line and Earth CTs, and of the phase-phase VT.

NOTE: Where the earth current input is connected to a CT summation of the 3 phase current circuits (residual connection, no core balanced CT), the primary and secondary values of "Earth CT" must be set to the same values of those of the "Line CTs".

4.6.3 The 'LED 5', 'LED 6', 'LED 7' and 'LED 8' submenus

Four identical sub-menus – 'LED 5', 'LED 6', 'LED 7' and 'LED 8' are used to configure the 4 programmable LEDs of the MiCOM P220/P225 relay.

The user can assign one or several indications to each of these LEDs. These data can originate inside the relay (protection, automatic control, or internal logic state function) or outside the relay (logic input).

One LED is lit if at least one of the pieces of information associated with it is valid (logic OR). It is extinguished:

- either after acknowledgement of the of associated data item or items
- or on the disappearance of the data item or items which gave rise to it.

- The "EMERG. RESTART" information is activated:
  - either following reception of an emergency start command via the logic input programmed on "EMERG. RESTART". It stays lit up as long as the associated logic input is excited,
  - or following an emergency start remote order sent via the communication network. It will be extinguished when the "SUCCESSFUL START" information appears.
- The "FORBIDDEN START" information is active if at least one of the 4 pieces of data blocking signals is active:
  - either thermal blocking start "teta FORBID.START",
  - or blocking due to limitation of the number of starts "START NB LIMIT ",
  - or blocking due to a minimum time between 2 starts "T betw 2 start",
  - or blocking due to a minimum time between a stop and a start Anti backspin "ABS".
- The motor shut down information "MOTOR STOPPED" is activated when logic input L1 (terminals 22-24) is not excited. It remains active until logic input L1 is excited.

- The motor running information "MOTOR RUNNING" is activated when logic input L1 (terminals 22-24) is excited. It remains active until logic input L1 is de-energised.
- The successful start information "SUCCESSFUL START" is activated after a motor start phase if at the end of the time delay t Istart the following criteria are respected:
  - the locked rotor at start information "LOCKED ROTOR" is not present
  - the excessively long start information "EXCES LONG START" is not present.

This information stays active until the motor shuts down (de-energisation of logic input L1).

The protection functions that can be assigned to the LEDs (5 to 8) for the MiCOM P220 / P225 are detailed in section P22x/EN HI.

4.6.4 The ‘ALARM CONFIG’. Submenu

The ‘ALARM CONFIG.’ allows to avoid to generate alarms for instantaneous and temporized events (alarm inhibition). In this case, alarm LED does not light, and no message are displayed.

The MiCOM P220/P225 can inhibit tAux1 to tAux10 alarms, i< alarm and results of Boolean equations.

4.6.5 ‘INPUT CONFIG.’ sub-menu

- This allows the user to set the logical state of each logic input:
  - If 1 is selected: the logic input is active when energised, and inactive when de-energised.
  - if 0 is selected: the logic input is inactive when energised, and active when de-energised.

By default the logic inputs are active when they are energised and inactive when de-energised (logic inputs set to 1).

Explanations on the relay algorithms, connection diagrams and commissioning procedures in this manual are given for logic inputs set to 1. It is therefore recommended not to modify this setting of the logic inputs. Logic input L1 is reserved for motor start up detection and this information inturn is used by several protection functions. Therefore it is necessary to hardwire auxiliary contact of the motor switching device to logic input 1 of the relay.

4.7 ‘MEASUREMENTS1’ and ‘MEASUREMENT2’ menus

- The measurements of the phase currents and the earth current are expressed as true root-mean-square values. For a 50 Hz motor, the harmonics are taken into account up to the 10th order; for a 60 Hz motor the harmonics are taken into account up to the 8th order.
- The measurements of the phase-phase voltage VAC is expressed as true root-mean-square values (P225 only).
- The measurement of the symmetrical components is taken from the fundamental component of the current. The positive and negative sequence components of the current are calculated on the basis of the three phase currents, and the zero phase sequence component is calculated from the earth current input. The following formulae are used to calculate the symmetrical components:

$$\overrightarrow{I_{positive}} = 1/3 \cdot (\vec{I_A} + a \cdot \vec{I_B} + a^2 \cdot \vec{I_C})$$

$$\overrightarrow{I_{negative}} = 1/3 \cdot (\vec{I_A} + a^2 \cdot \vec{I_B} + a \cdot \vec{I_C})$$

$$\vec{I_0} = 1/3 \cdot \overrightarrow{I_{earth}}$$

- The frequency is measured if:
  - the amplitude of voltage VAC is above 5V (P225 only).
  - or if the amplitude of at least one of the three phase currents is greater than 10% of In (In is the rating of the phase current inputs, 1A or 5A defined in the CT RATIO submenu, on the line "LINE CT SEC =").

  Where the frequency cannot be calculated, the relays displays "****".
- The phase current maximeter retains the greatest current value of one of the three phases outside the motor starting phase. This variable is expressed as a true RMS value.
- The I2/I1 value is the ratio of the symmetrical components "negative-sequence current" over "positive-sequence current'.
- The active, reactive and apparent powers are derived assuming that the voltage system is balanced (P225 only).
- The active and reactive energy counters represent the energies absorbed by the motor. When these counters reach respectively 20GWh and 20GVARh, they are automatically reset (P225 only).

  These counters can be reset by pressing the ⓒ key (without password).

  The energy calculation is updated every second.
- The power factor is the ratio of the active power over the apparent power.

4.8 'PROCESS' menu

A set of measurements relating to operation displayed in the PROCESS menu makes it possible to monitor the utilisation and state of the motor.

- "%I FULL LOAD" is the percentage ratio of the equivalent thermal current Ieq absorbed by the motor over the thermal current threshold Iteta> (sub-menu 4.10.1 [49] THERMAL OVERLOAD).
- The value of the motor thermal state can be reset by the user:
  - either by pressing the ⓒ key after entering the password
  - or through a logic input set to "teta RESET"
  - or through a command received on the RS485 communications port
- The estimate of the time before a thermal trip "T before TH TRIP" is given under the following conditions:
  - the thermal alarm threshold teta ALARM is reached
  - the equivalent thermal current I_{eq} is greater than the thermal current threshold Iteta>
  - considering the constant motor overload rate I_{eq}/Iteta>

When the above conditions are not respected, the P220/P225 relay displays the value "****".

- The number of authorised starts of the motor "PERMIT START NB" takes into account all the criteria for limiting or blocking start, that is, the functions: "limitation of the number of starts", "minimum time between 2 starts", "minimum time between a stop and a start" and "thermal criterion for blocking a start". When there is no limit to the number of authorised starts, the relay displays the value "****".
- The temperature of each RTD is given in Celsius degrees.
- "No HOTTEST RTD" indicates the number of the hottest RTD.

- The indication of the time before a further start is authorised “T before START" is given when an inhibition on starting is in progress. This indication takes into account all the criteria for limiting or blocking start, that is, the functions: "limitation of the number of starts", "minimum time between 2 starts", "minimum time between a stop and a start" and "thermal criterion for blocking a start".
- The counter for the number of starts of the motor is incremented at each start. In contrast, authorisation for the motor to re-accelerate does not increment this counter.
- The counter for the number of motor operation hours is the accumulated sum of hours during which the motor is running.

4.9 ‘TRIP STATISTICS’ menu

In the ‘TRIP STATISTICS’ menu the following are displayed:

– the total number of tripping operations,

– the number of tripping operations per type of fault.

Tripping can have two possible causes:

– tripping on a fault: when the P220/P225 relay detects a fault (exceeding a threshold), it generates a tripping order.

– deliberate tripping. The operator can order tripping from three access points:

  – a logic input, (EXT1 and EXT2 functions),

  – the RS232 port on the front panel,

  – the communications network.

NOTE: – The tripping orders stored in the memory of the MiCOM P220/P225 protection relay for the statistics are only those transmitted to the tripping relay (logic output RL1). This relay is one of the logic outputs of the MiCOM P225. It is configured in the TRIP OUTPUT RLY submenu.

– Motor shutdowns for which the command was not relayed via the output relay RL1 of the MiCOM P220/P225 are not taken into account in the TRIP STATISTICS menu.

4.10 ‘COMMUNICATION’ menu

The MiCOM P220/P225 relay can communicate under the MODBUS™, K-bus / Courier or IEC 60870-5 protocols via RS485 port (general features) and second RS485 rear port (optional configuration). These protocols are based on the master-slave principle. The MiCOM P220/P225 relay can therefore be integrated, as a slave, in a digital monitoring and control system. In this system, the supervisor (master), for example a PC, can:

- read and modify the setting values,
- remote the measurements, alarm data, changes of state (changes of state of inputs/outputs, changes of setting group), values relating to fault recordings, disturbance recording and the form of the starting current and voltage,
- issue remote orders such as commands to open or close the circuit breaker/contactor (motor On/Off), to block start, to trig disturbance recording or to acknowledge the relay remotely.

4.11 'PROTECTION G1' and 'PROTECTION G2' menus

The menus 'PROTECTION G1' and 'PROTECTION G2' are identical and enable the operator to program 2 different configuration groups ('CONFIGURATION' menu).

Each of these 2 menus is divided into 11 submenus corresponding to the different protection functions:

- 'START CRITERIA', to define start-up threshold and time delay of the motor,
- '[49] THERMAL OVERLOAD', to protect the motor against thermal overload,
- '[50/51] PHASE OC', three phase overcurrent protection,
- '[50N/51N] EARTH FAULT'
- '[46] UNBALANCE', to protect the motor against unbalance condition, broken conductor and phase inversions,
- '[27] UNDERVOLTAGE' (P225 only),
- '[59] OVERVOLTAGE' (P225 only),
- '[48] EXCES. LONG START', to protect the motor against excessive start-up overcurrent,
- '[51LR/50S] BLOCK ROTOR', to detect stalling while the motor is running
- '[37] LOSS OF LOAD',
- '[49/38] RTD' or '[49] THERMISTOR' (optional) to monitor temperature sensors.

The operator can bring each of the 10 protections functions (except "START CRITERIA") into service or take them out of service in the submenus of the menu PROTECTION G1 or PROTECTION G2.

The setting parameters of the functions taken out of service do not appear on the LCD unit and are not accessible via the communication

If the threshold or thresholds of these functions are reached, a time delay with a duration preset by the operator is started. When this time delay expires, if the fault is still present, an instantaneously signal is generated and can be used to energize one of the output relays.

All the algorithms of the protection functions, except the thermal replica, are based on the fundamental component of the current.

The thermal replica is based on the model working with the true rms values of the line current and the negative-sequence component of the current.

STATE OF THE PROTECTION FUNCTIONS (ACTIVE/INACTIVE) ACCORDING TO THE OPERATION MODE OF THE MOTOR

The MiCOM P220/P225 protection functions are automatically* activated or deactivated by the relay itself according to the motor's operation mode (motor halted, start-up sequence, re-acceleration phase or normal running condition). The table below indicates under which conditions these protection functions are active or inactive.

Protective Functions	Motor Halted	Start-up Sequence	Motor Running	Re-acceleration Phase
Thermal overload	Activated (Tr)**	Activated (Te2)**	Activated (Te1)**	Activated (Te2)**
Phase OC	Activated	Activated	Activated	Activated
Earth fault	Activated	Activated	Activated	Activated
Unbalance	Activated	Activated	Activated	Activated
Excessive long start	Deactivated	Activated	Deactivated	Activated
Stalled rotor whilst running	Deactivated	Deactivated	Activated	Deactivated
Locked rotor at start	Deactivated	Activated	Deactivated	Deactivated
Undervoltage (P225 only)	Deactivated	Activated****	Activated	Activated
Overvoltage (P225 only)	Activated	Activated	Activated	Activated
Loss of load	Deactivated	Activated***	Activated***	Activated***
RTD and/or THERMISTOR	Activated	Activated	Activated	Activated

* These protection functions are activated by the relay only if they have previously been commissioned by the user.

** The time constant used in the thermal model depends on the value of the motor load current and on the motor's operating mode. The time constant indicated in brackets is the one used by the relay.

*** The "loss of load" function is activated upon expiry of the Tinhib timer. This timer is user settable, it is initiated by the relay when a motor start is detected.

**** The user can inhibit this function during the starting sequence.

4.11.1 'START CRITERIA' submenu

Although this submenu is not a protection entity, it contains two threshold settings that are used by other protection entities. This submenu contains two thresholds I_{util} and tI_{start}. I_{util} defines a start-up current threshold and tI_{start} defines start-up time delay threshold of the motor. Protection functions [49] THERMAL OVERLOAD and [48] EXCES. LONG START use both of these settings while [51LR-50S] BLOCK ROTOR uses tI_{start} setting for their operation. Detailed description of their use can be found in sections 4.11.2.1, 4.11.8 and 4.11.9.1 respectively.

4.11.2 '[49] THERMAL OVERLOAD' submenu: Protection against thermal overload conditions

The MiCOM P220/P225 relay produces a thermal image of the motor from the line current and the negative component of the current consumed by the motor, in such a way as to take into account the thermal effects created in the stator and in the rotor. The currents' harmonic components contribute to the motor's heating. For this reason, the thermal replica uses the line current I_{RMS} expressed in true rms value. The negative component currents consumed in the stator generate in the rotor large amplitude currents which create a substantial temperature rise in the rotor winding. The composition carried out by the MiCOM P220/P225 results in an equivalent thermal current I_{eq}, the image of the temperature rise caused by the current in the motor.

The current I_{eq} is calculated according to the following formula:

$$I_{eq} = (I_{RMS}{}^2 + Ke \cdot I_{negative}{}^2)^{0.5}$$

Starting from this equivalent thermal current, the thermal state of the motor θ is calculated every cycle (every 20 ms for a 50Hz system) by the MiCOM P220/P225 relay according to the following formula:

$$\theta_{i+1} = (I_{eq} / I\theta >)^2 \times [1 - \exp(-t / \mathrm{T})] + \theta_i \times \exp(-t / \mathrm{T})$$

In which:

- K_e is the negative sequence current recognition factor (settable).
- Iteta> is the thermal overload current threshold.
- θ_i is the value of the thermal state calculated above (1 cycle before, i.e. 20ms in a 50Hz system).
- t is the iteration cycle time (20 ms for a 50 Hz system, 16,67 ms for a 60 Hz system).
- T: is the time constant of the motor. As a function of the operating conditions of the motor, the relay uses one of the following 3 thermal time constants:
  - the heating time constant Te1, used when the equivalent thermal current I_{eq} is comprised between 0 and 2 Iteta>, i.e. when the motor is running at (under/full/over load condition);
  - the start-up time constant Te2, used when the equivalent thermal current I_{eq} is greater than 2 Iteta>, i.e. when the motor is in the start-up stage or in a locked rotor condition;
  - the cooling time constant Tr which is applied when the motor is shut down (logic input L1 in the zero logic state - terminals 22-24). In this case, the motor no longer consumes current and the value of the thermal state θ therefore decreases as time passes according to the formula:

    $$\theta_{i+1} = \theta_i \cdot \exp(-t / \mathrm{Tr})$$

The steady state thermal capacity used up in percent of the full thermal capacity is calculated according to the following formula:

% of thermal capacity used = $(I_{eq}/\text{Iteta>})^2 \times 100$

A thermal overload signal “THERM.OV” is generated when the value of the thermal state θ reaches 100 %.

NOTE:

- On interruption of the auxiliary power supply to the P220/P225 relay, the value of the thermal state θ is stored in the non-volatile memory. On re-energisation of the relay, the value of the thermal state θ is reset to its value before the interruption if it was lower than 90%. In the opposite case (greater than 90%), it is reset to 90%, to avoid premature tripping of the relay P220/P225 when the auxiliary voltage returns.
- The thermal state θ of the motor is displayed in the PROCESS menu.
- The thermal state value θ can be reset (see paragraph "4.8 The PROCESS menu" in this section).
- Examples of the thermal overload curve are shown in the chapter P22x/EN TD/B44.

4.11.2.1 Function inhibiting thermal tripping during a start: teta INHIBIT

This function permits inhibition of the thermal tripping information THERM. OV. during the starting phase. It may be necessary to use this function for some motors with temperature rise characteristics in a starting phase very different from those in a locked rotor condition.

If the user brings this function into service, this inhibition is activated as soon as the starting time delay tI_{start} begins (cf. submenu START CRITERIA). The timer tI_{start} begins after the issue of successful start. Successful start is issued as soon as 52a signal is set and the current exceeds I_{util} threshold. On expiry of tI_{start} (end of the time allowed for starting), this inhibition is deactivated.

When this function is activated, that is during the motor starting phase, the value of the thermal state θ calculated cannot exceed 90 %. This means that thermal tripping cannot take place under any circumstances as long as tI_{start} is timing. At the end of the time allowed for starting, the value of the thermal state is authorised to exceed 90 %.

NOTE:
- This function has no influence on the thermal alarm signal "teta ALARM" and thermal base blocking start function "teta FORBID. START".
- When this function is brought into service, the motor is still thermally protected by monitoring of the starting time.

4.11.2.2 Function of the thermal image influenced by ambient temperature (optional): RTD1 INFLUENCE

When the ambient temperature exceeds + 40°C, the admissible motor current diminishes in relation to its rated current. A setting of the protection parameters which is suitable under normal temperature conditions is no longer suitable when the ambient temperature rises above +40°C.

The MiCOM P220/P225 relay offers the possibility of taking into account this necessary derating of motors. The thermal image can be modified by the ambient temperature measurement.

When this function is brought into service by the user, if the ambient temperature rises above + 40°C, the value of the thermal threshold Iteta> is automatically modified to adapt the motor protection to the external temperature conditions. The rule for the ambient temperature measurement influencing the thermal image is:

- For an ambient temperature lower than or equal to + 40°C, the thermal image is not modified.
- For an ambient temperature between + 40°C and + 65°C, the thermal threshold Iteta> is modified by a multiplying coefficient in compliance with the following formula:
  - Multiplying coefficient = 1 - (ambient temperature in °C - 40)/100
- For a temperature greater than or equal to + 65°C, the thermal threshold Iteta> is modified by a multiplying coefficient of 0.75.

The table below gives the relationship between the ambient temperature measurement and the influence on the thermal image:

Ambient temperature (in ° Celsius)	+40 °C	+45 °C	+50 °C	+55 °C	+60 °C	+65 °C
Correction coefficient for the thermal threshold Iθ> (multiplying coefficient)	1,00	0,95	0,90	0,85	0,80	0,75

NOTE:

– This function can only be used if the relay has the option "10 RTD monitoring".

– The probe used for this function is RTD 1 (terminals 2d-2b-2z). To use this function, a RTD measuring the ambient temperature of the place where the motor is located must be connected to terminals 2d-2b-2z.

– The operator can program the temperature thresholds of RTD 1 ([49/38] RTD submenu) even if he has brought this RTD1 INFLUENCE function into service.

4.11.2.3 Thermal alarm function: teta ALARM

The purpose of this function is to produce an alarm signal indicating that the thermal state θ of the motor has exceeded an adjustable threshold: ALARM. Corrective action can thus be taken before thermal tripping occurs.

Once the threshold teta ALARM is exceeded, the MiCOM P220/P225 relay calculates and displays, in the PROCESS menu (cf. chapter 4.7 The PROCESS menu), an estimate of the time remaining before a thermal trip THERM. OV. Occurs. This estimate is given for a constant overload rate.

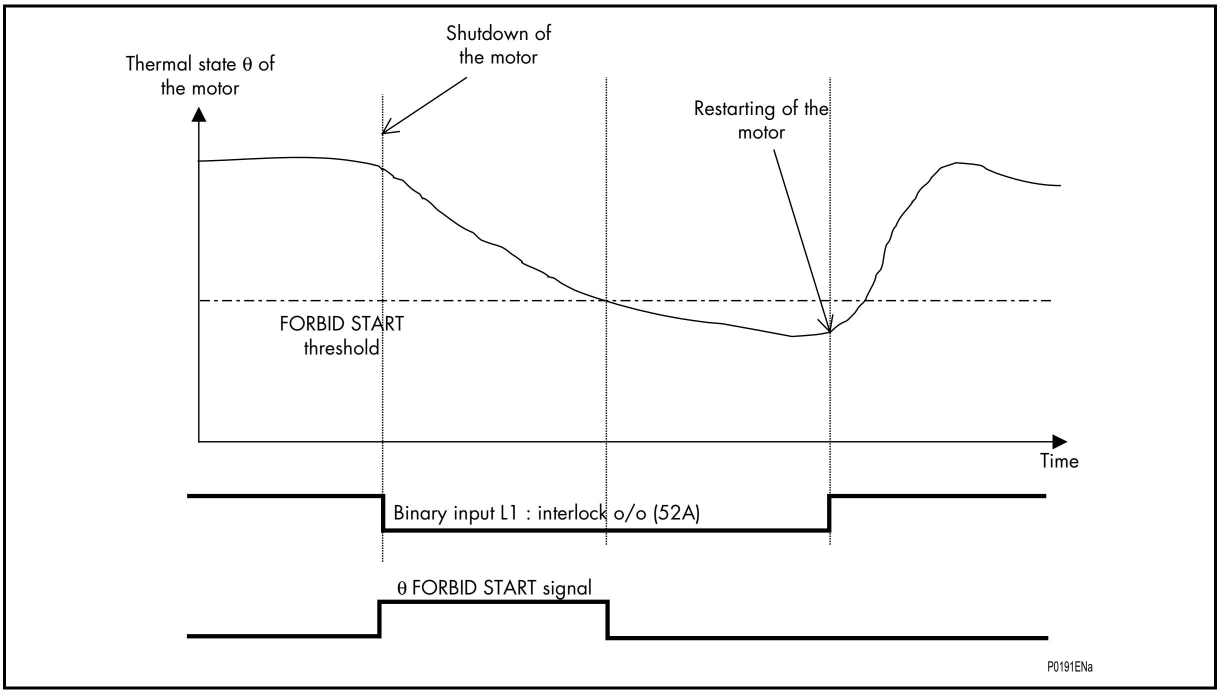
4.11.2.4 Thermal base blocking start function: teta FORBID. START

This function makes it possible to block a start on a hot motor, or not, as a function of its thermal state. When this function has been adjusted in service by the user, a further start is inhibited for the motor as long as its thermal state θ is higher than an adjustable threshold teta FORBID START. It is then necessary to wait until the motor cools down. When the value of the thermal state θ falls below the threshold teta FORBID START, the starting of the motor is authorised.

The blocking start teta FORBID START information is activated if both of the following conditions are met:

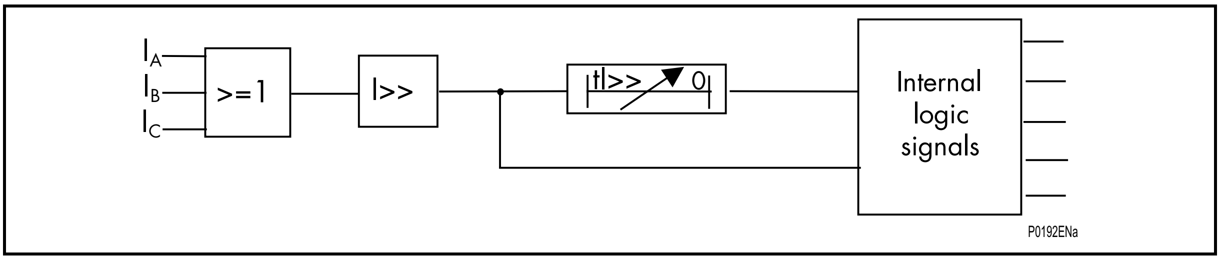
- Motor shut down: logic input L1 in the zero state (terminals 22-24).
- Thermal state value θ higher than the threshold teta FORBID START.

The following diagram illustrates the operation of the thermal base blocking start criterion:



4.11.3 The [50/51] non directional three phase overcurrent protection submenu

The non directional phase overcurrent protection has three thresholds: I>=, I>>= and I>>>=. The first and the second thresholds can be set as definite delay time or inverse delay time using the IEC, IEEE/ANSI and RI curves where their parameters are shown in the Technical Data section of this Technical Guide. The third threshold can be set as definite delay time only. The following diagram depicts the functionality for the second stage as an example. All other stages functionality are similar.



NOTE:

- The time delay can be set to instantaneous.
- When the operator has adjusted the [50/51] PHASE OC function in service, this function is always active whatever the mode of operation of the motor (motor running, shut down, starting phase, locked rotor condition).
- In the event of saturation of the phase CTs, the MiCOM P220/P225 will detect a short-circuit under the following conditions:
  - Fault current lower than 200 times the limit current value for saturation of the CTs.
- No remanent flux in the CTs at the time of establishing the fault.
- No direct current component at the time of establishing the fault.

4.11.4 '[50N/51N] EARTH FAULT' submenu

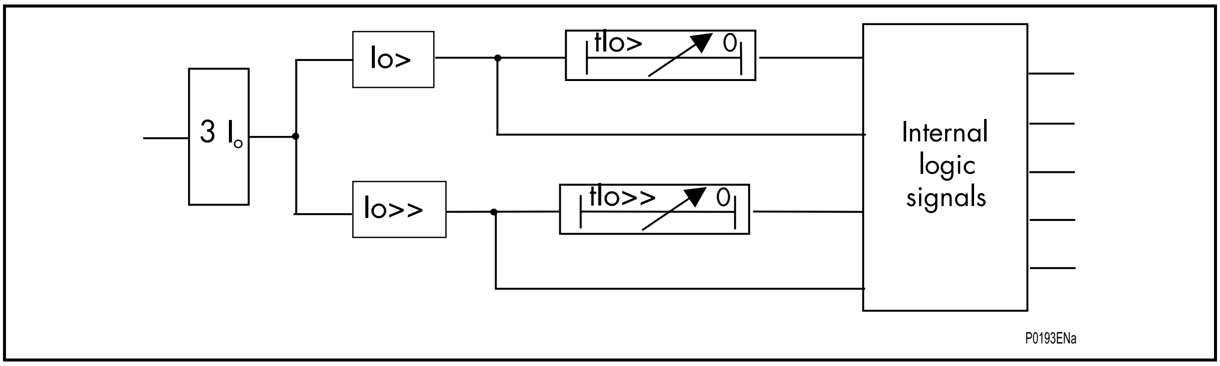
The [50N/51N] EARTH FAULT function which protects the motor against faults between one or more phases and earth uses a definite time zero phase sequence overcurrent protection.

Earth faults create a zero phase sequence current measured either by 3 phase CTs in a residual connection, or directly by a core balanced CT surrounding the 3 conductors.

Two independent earth current thresholds (Io > and Io >>) with their associated time delays (tIo > and tIo >>) enable the operator to configure for example an alarm threshold and a tripping threshold.

The settings of the thresholds are expressed as a function of the residual current (3 times the zero phase sequence component).

For each earth current threshold, time-delayed information and instantaneous information is available. The following diagram depicts the functionality of [50N/51N] EARTH FAULT protection function.



4.11.5 '[46] UNBALANCE' submenu

The '[46] UNBALANCE' function, which protects the motor against unbalance conditions, broken conductor and phase inversions, is based on the measurement of the negative sequence component of the current.

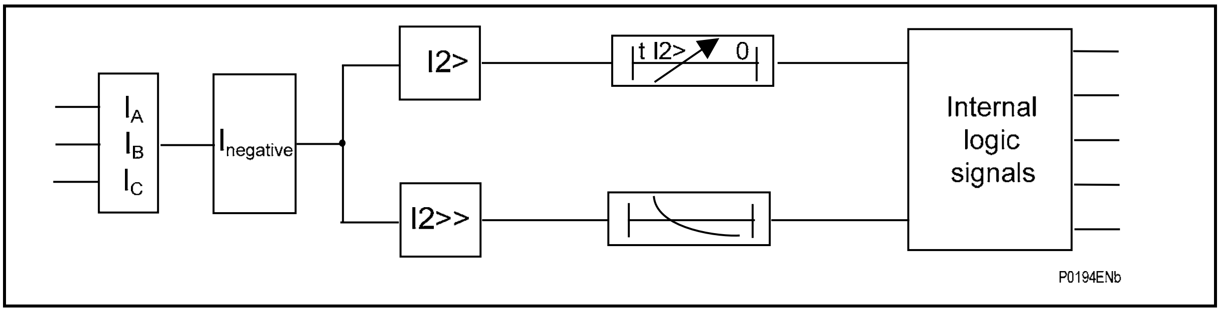
Two negative sequence overcurrent thresholds are available:

– I2>, is associated with a definite time delay,

– I2>>, is associated with a inverse time characteristic.

The user can use the threshold I2> to detect the inversion or loss of a phase, or to give an unbalance alarm.

The threshold I2>> has an inverse time characteristic which enables it to allow slight instantaneous unbalances to pass whilst more substantial unbalances will be detected more quickly. This inverse time characteristic permits selective clearance of external two-phase faults which appear on the system. This operating characteristic is in compliance with the withstand limits of the motors and is shown in the chapter P22x/EN TD/B44.

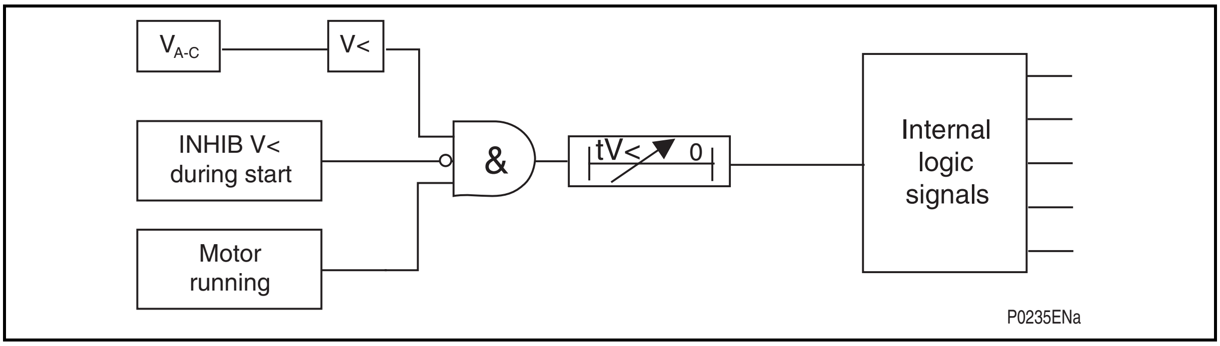


4.11.6 ‘[27] UNDERVOLTAGE’ submenu (P225 only): Undervoltage protection

This function, which makes it possible to detect a voltage drop, uses a phase-phase undervoltage protection with a definite time characteristic.

This function is deactivated when the motor is stopped (logic input L1 state = 0) and can also be deactivated during the motor start-up stage ("INHIB V<" set to "YES" by the user).

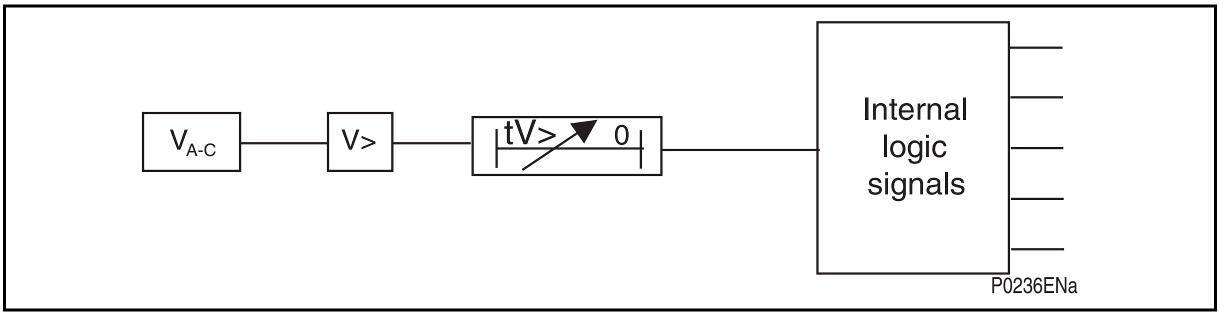
If the measured voltage (voltage between phases A and C) remains below the "V<" threshold for a time greater than or equal to "tV<", a voltage drop signal "tV<" is issued by the P225 relay.



4.11.7 The [59] OVERVOLTAGE sub-menu (P225 only): Overvoltage protection

This function, which makes it possible to detect a voltage increase, uses a phase-phase overvoltage protection with a definite time characteristic.

If the measured voltage (voltage between phases A and C) remains above the "V>" threshold for a time greater than or equal to "tV>", an overvoltage signal "tV>" is issued by the P225 relay.

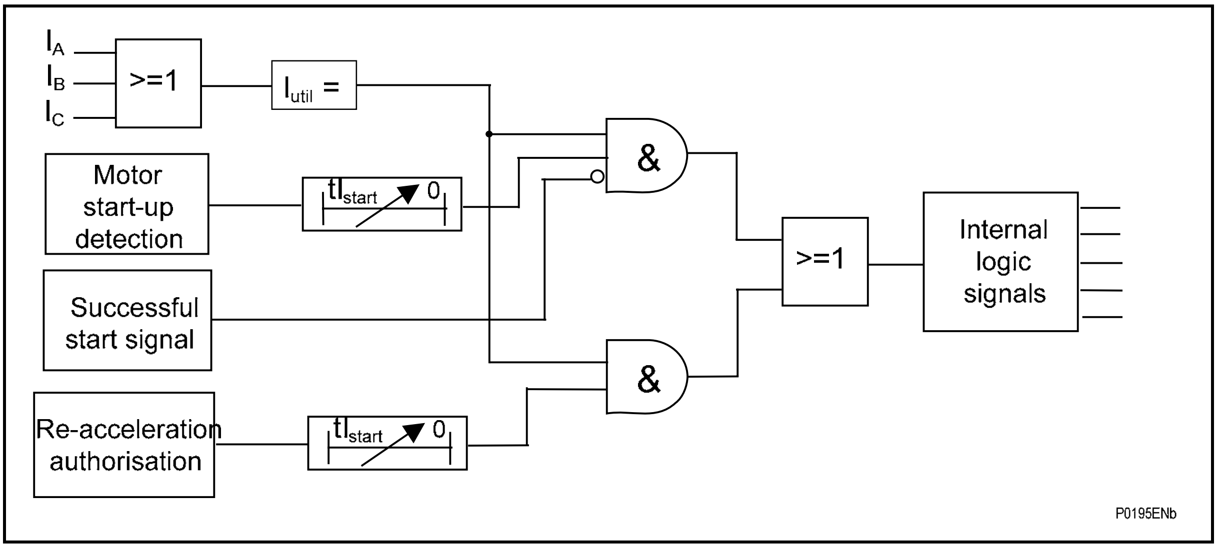


4.11.8 '[48] EXCES LONG START' submenu: Protection against excessively long starts

The '[48] EXCES. LONG START' function protects the motor against excessive start-up overcurrent. To this effect, it uses a start-up current threshold I_{util} and a start-up time-delay tI_{start}. These thresholds are set within the 'START CRITERIA' submenu. Both current threshold and the time delay can be adjusted to allow the starting current to pass. It is recommended to set I_{util} threshold to 2 times rated current of the motor and to set tI_{start} threshold to starting time of the motor which can be found in the motor data sheet provided by the manufacturer.

This function is activated (time delay tI_{start} initiated) as soon as the MiCOM P220/P225 relay detects a start (the criterion for detection of a start is selected in the CONFIGURATION menu). It is deactivated on expiry of the starting current time delay tI_{start}.

If, on expiry of the time delay tI_{start}, the current drawn by the motor has not fallen below the threshold I_{util}=, a prolonged start signal "EXCESS LONG START t I_{start}" will be generated.



Information indicating a "successful start" is generated on expiry of the time delay tI_{start} if no tripping order has been given.

NOTE: During normal operation of the motor, the excessively long start function "EXCES LONG START" can be reactivated during a flying restart of the motor (re-acceleration of the motor following a voltage dip), that is when re-acceleration is authorised (AUTOMAT. CTRL menu).

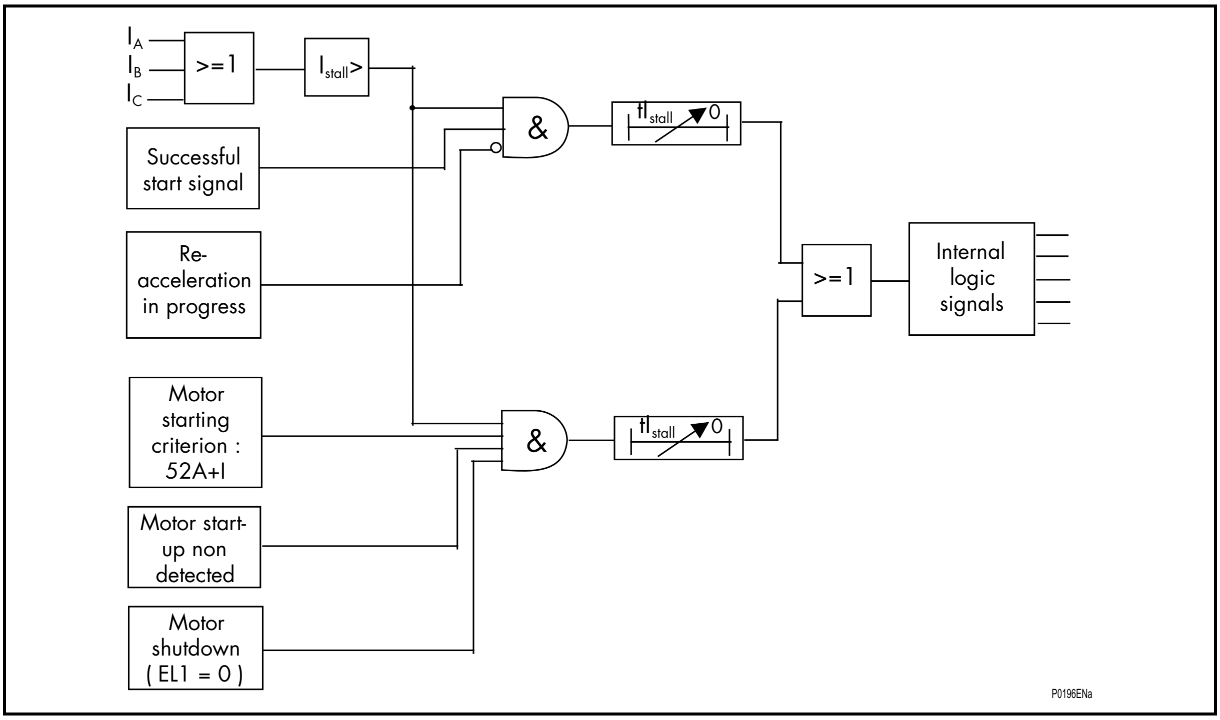
4.11.9 '[51LR/50S] BLOCK ROTOR' submenu

4.11.9.1 Rotor stalled whilst the motor running

This function, which makes it possible to detect stalling while the motor is running, is activated immediately after the starting period, that is on expiry of the starting time delay tI_{start} (submenu 4.11.1 'START CRITERIA').

Two parameters can be set: the stalled rotor current threshold I_{stall} with its associated time delay tI_{stall}, the stalled rotor time.

The MiCOM P220/P225 relay detects the overcurrent caused by stalling and generates information that the rotor has stalled while the motor is running if the phase current exceeds the threshold I_{stall} for a length of time greater than tI_{stall}.



NOTE:

– During authorisation of re-acceleration (AUTOMAT. CTRL menu), this function is deactivated during the time delay allowed for starting tI_{start} (4.11.1 START CRITERIA).

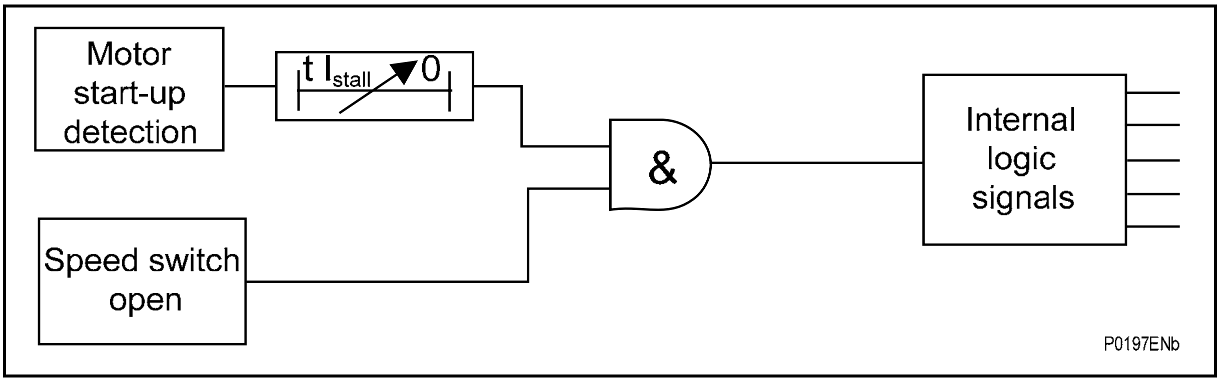
– On starting the motor, when the start detection criterion selected is "closure of the contactor/circuit breaker and exceeding of the starting current threshold I_{util} i.e. (52 a + I)", if the relay sees only one of these events, (closure of the breaking device or the appearance of a current greater than I_{util}), then the function of monitoring a stalled rotor whilst the motor is running is activated.

4.11.9.2 Locked rotor at start (with speed switch)

This function, which makes it possible to detect that the motor is locked at the start, is activated only during the starting phase, that is during the course of the starting time delay tI_{start}.

It uses a motor speed indication received via a logic input of the P220/P225 relay set on SPEED SW and the tI_{stall} time-delay: locked rotor time (a speed switch device must be connected to this logic input: paragraph 4.12.4.2.“ the INPUTS submenu: programmable inputs”).

On detection of a start, the "locked rotor at start" function is activated: the time delay tI_{stall} begins. At the end of this time delay, the logic input set on SPEED SW must be in logic state 1 to indicate that the motor speed is not zero. The opposite case (zero speed) means that the rotor is locked, so the P220/P225 relay generates a locked rotor at start order LOCKED ROTOR.



NOTE:

– The speed switch device sends information to the P220/P225 relay indicating, by the closing of a contact, that the rotor is rotating.

– The time delay tI_{stall} is common to the protection functions for "rotor stalled while motor is running" and "rotor locked at start".

– If the motor is not fitted with a speed switch device, this function cannot be used and must therefore be deactivated.

4.11.9.3 Locked rotor at start (Power factor setting)

The MiCOM P220/P225 relay in the following conditions:

– Motor where startup time is less than locked rotor withstand time,

– Reduced voltage start type motor,

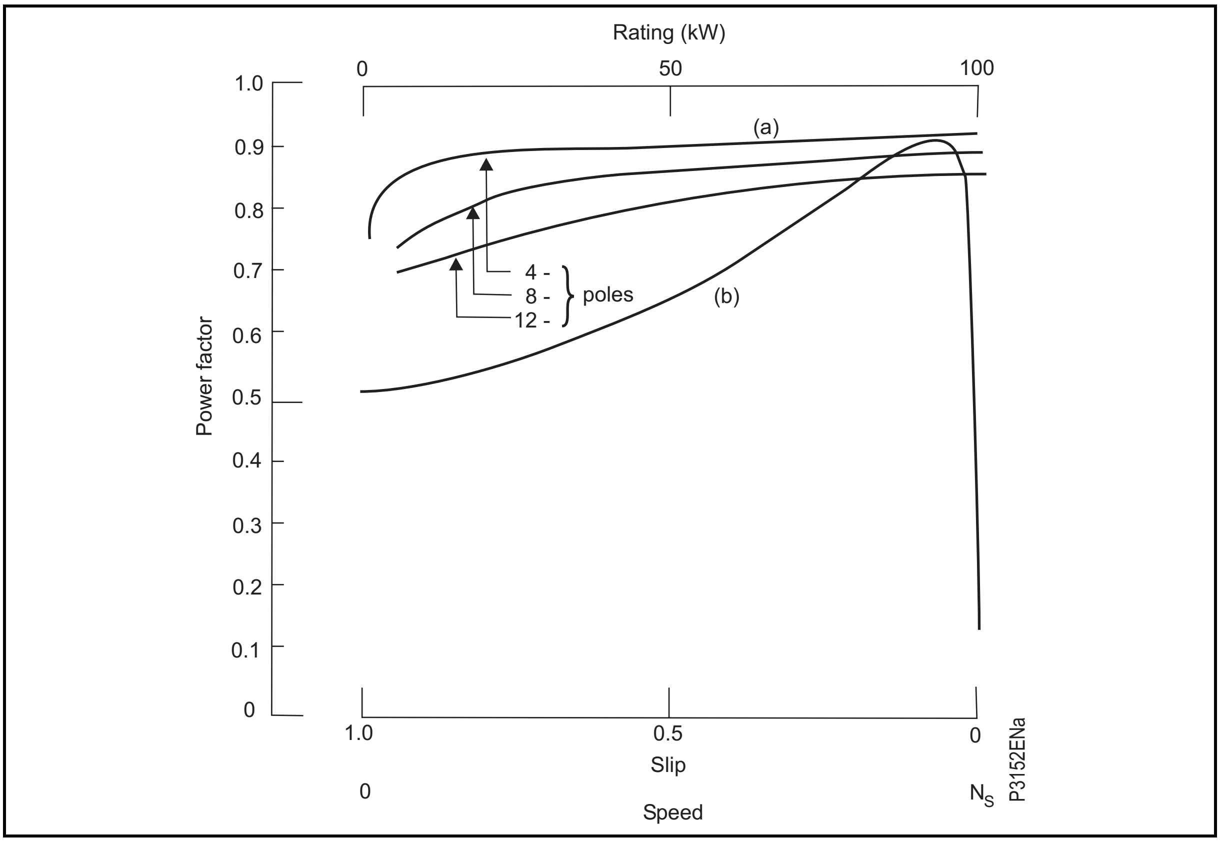
– Motors where startup time is greater than the locked rotor withstand time (i.e. for the high inertia type motors).,

Motors for which the real start-up time is shorter than their locked rotor withstand time can be protected against locked rotor condition at start-up without the help of a speed switch. For such cases, the use of [t_{Istart}] time setting shorter than the motor locked rotor withstand time allows to provide efficient protection against both too long start-up sequence and locked rotor at start-up conditions.

To address the second and third cases, the use of Power Factor involves usage of voltage inputs and the same can also avoid the usage of speed switch as we can always set the relay based on the relation between slip and Power Factor.

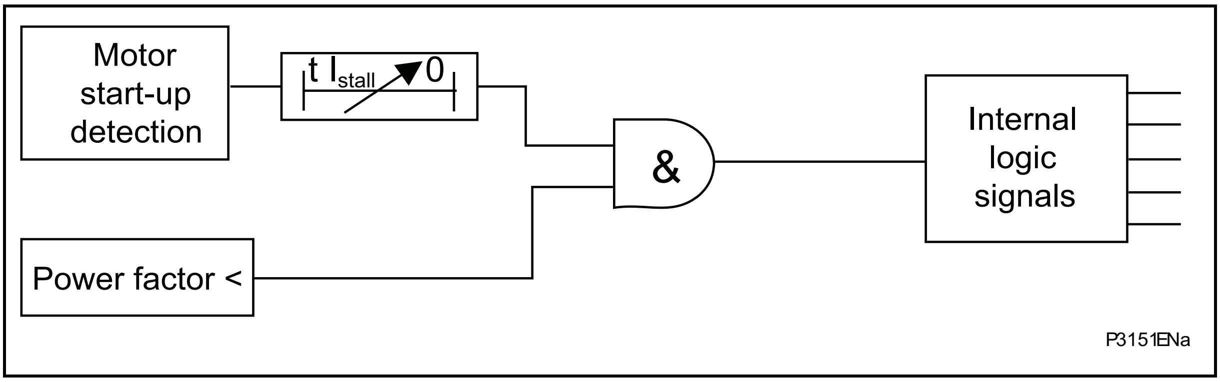
The Power Factor of the motors of a given rating decreases with increase in the number of poles. The slip of the motor similarly increases as we reach the locked rotor condition i.e. for a locked rotor situation slip is 1.

The below curve (b) shows the Power Factor for such a motor which is 0.5 at slip = 1. Hence depending on the motor’s slip VS Power Factor characteristics we can set the relay. We need only a Power Factor setting in the relay to differentiate normal operating condition and a locked rotor condition.



Three values are available for "LOCKED ROTOR AT START" setting: No, Input or Power Factor (Settable form 0 to 1 by steps of 0.1)

If the power factor is below the setting, it will operate as the speed switch open.



4.11.10 '[37] LOSS OF LOAD' submenu: Protection against undercurrent/loss of load conditions

The '[37] LOSS OF LOAD' function which makes it possible to detect a loss of load (for example the draining of a pump or breakage of a conveyor belt), uses definite time undercurrent protection. The user sets the following parameters:

– undercurrent threshold I <

– time delay tI < associated with the undercurrent threshold

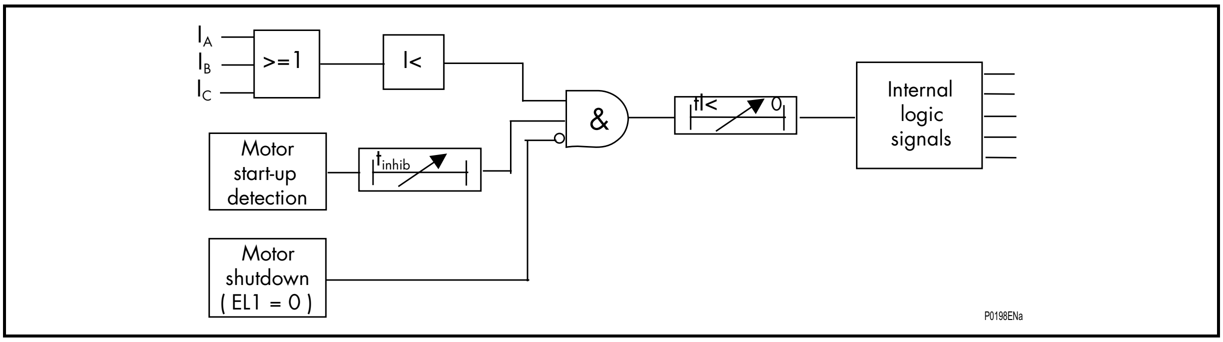
– the inhibit start time delay T_{inhib}

This function is deactivated when the motor is shut down (logic input L1 in the 0 state) and also during the inhibit time delay T_{inhib}.

When the P220/P225 relay detects that the motor is starting, this function is activated at the end of the inhibit time delay T_{inhib}.

The time delay T_{inhib} is useful for motors with no-load starting which take on load gradually at the end of starting.

When the motor is running (and after expiry of the inhibit time delay T_{inhib}), if the value of one of the phase currents consumed by the motor is lower than the threshold I< for a period greater than or equal to tI <, the P220/P225 relay will generate a loss of load signal “ t I< ”.



4.11.11 ‘[49/38] RTD’ submenu: Temperature protection by RTD (optional)

The ‘[49/38] RTD’ sensors function is intended to detect abnormal temperature rises of the motor by direct temperature monitoring. This is achieved by monitoring 10 RTDs (Remote Temperature Detectors). The RTDs can be selected from the following types: PT100, Ni120, Ni100 or Cu10 (types selected in the CONFIGURATION menu).

For each RTD, the user sets:

– an alarm threshold RTD # ALARM,

– a time delay associated with the alarm threshold t RTD# ALARM,

– a tripping threshold RTD # TRIP,

– a time delay associated with the tripping threshold t RTD TRIP #.

An alarm signal is generated if the temperature measured exceeds the programmed alarm threshold for a period of time equal to the time delay associated with this threshold.

A tripping signal is generated if the temperature measured exceeds the programmed tripping threshold for a period of time equal to the time delay associated with this threshold.

The P220/P225 continuously supervises the RTDs proper operation. A "RTD/Therm ERROR" alarm is issued if:

– a RTD wiring circuit is opening

– a RTD is short-circuited.

On detection of a RTD failure, a “RTD/Therm ERROR” alarm message is generated and the over temperature thresholds corresponding to this RTD will be deactivated.

The RTD can be located:

– at the stator windings (protection of the stator, indirect protection of the rotor, detection of failure of the cooling system),

– at the mechanical bearings (to detect failure of the lubrication),

– outside the motor (ambient temperature measurement), at the same level as that of the entry of cooling air.

NOTE:
- The symbol # corresponds to the number of the RTD.
- The RTDs monitored must obligatorily be all of the same type (all of type PT100, or Ni100, or Ni120, or Cu10).
- It is possible to connect only the RTDs that one wishes to monitor.
- RTD 1 can be used to measure the ambient temperature and thus influence the thermal image (see chapter 4.11.2.2.).

4.11.12 The [49] THERMISTOR submenu: Temperature protection by thermistor (optional)

The [49] THERMISTOR function, like the preceding one, detects abnormal temperature rises. It operates with thermistors of type PTC or NTC (selected in the CONFIGURATION menu).

The P220/P225 relay can monitor 3 thermistors (optional). Each thermistor input is linked to an independent threshold (Thermist#) with a fixed time delay of 2 seconds. For each thermistor, the user sets a threshold in ohms.

A "Thermist#" order is generated if the thermistor resistance measured exceeds this threshold for a length of time greater than or equal to 2 seconds.

NOTE:
- The symbol # corresponds to the number of the thermistor.
- The optional function for "3 thermistors monitoring" is incompatible with the function for "10 RTD monitoring" option.

4.12 The AUTOMAT. CTRL menu

The AUTOMAT. CTRL menu comprises the following 14 sub-menus:

- ‘[66] START NUMBER’ to limit number of starts,
- ‘MIN TIME BETW 2 START’ to set a minimum time before two start of a motor,
- ‘REACCEL AUTHORIZ’, to set re-acceleration/load shedding authorization
- ‘INPUTS’, to set opto-isolated inputs,
- ‘LOGIC EQUATION’, to customize the MiCOM P220/P225 relay,
- ’AUX OUTPUT RLY’, to assign data to an auxiliary output relay,
- ‘LATCH AUX RLY’,
- ‘TRIP OUTPUT RLY’, to configure the trip output relay,
- ‘LATCH TRIP ORDER’, to select functions maintaining output relays energized
- ‘CB FAIL’, to detect if a circuit-breaker has not opened
- ‘ABS’ (Anti-BackSpin), to set minimum time between stop and start,
- ‘BUS VOLTAGE CTRL’, to validate voltage presence before a start,
- ‘CB SUPERVISION’.

4.12.1 '[66] START NUMBER' submenu : Limitation of the number of starts per period

The [66] START NUMBER function allows the number of motor start-ups over a given period to be limited. In effect, starting the motor too frequently can be too constraining for the motor (over-heating), for its starting system (starting impedance, electrolytic bath,...) or can in some cases reveal an anomaly in the process operation,

The [66] START NUMBER function uses the following adjustable parameters.

– a monitoring period $T_{reference}$

– a number of hot starts limit HOT START NB

– a number of cold starts limit COLD START NB

– a start inhibit time delay $T_{interdiction}$.

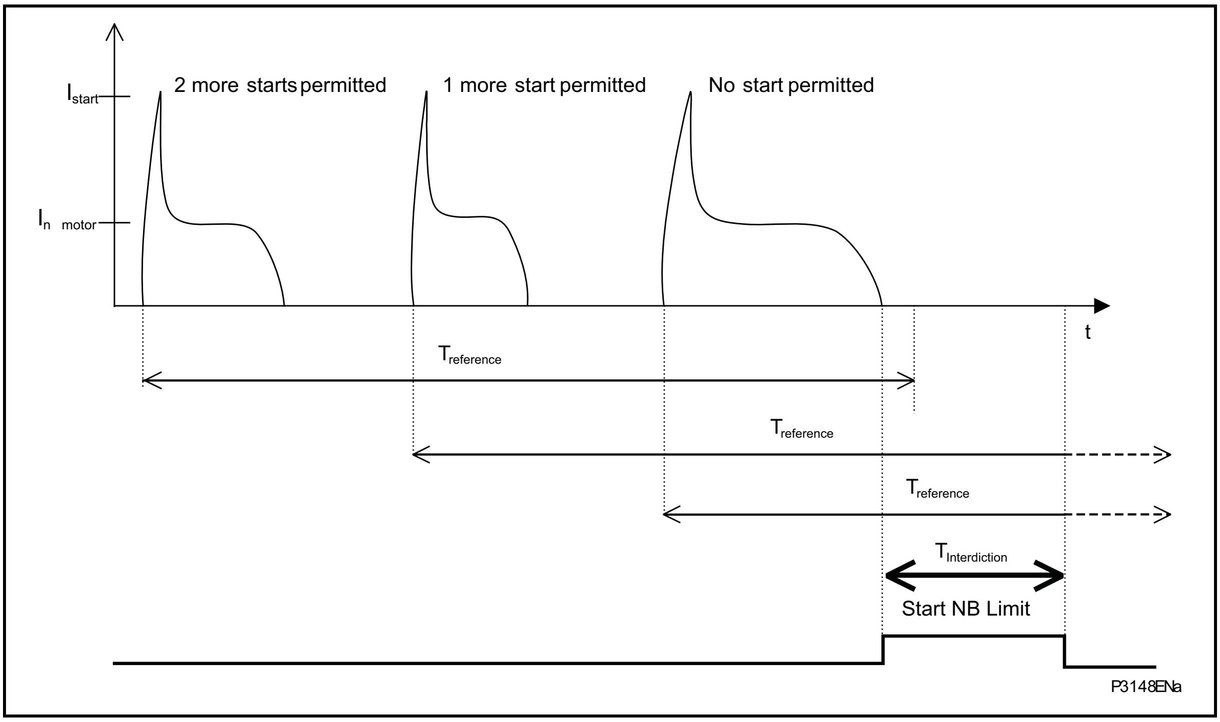
Each time a motor start is detected, the $T_{reference}$ time delay is initiated and the number of starts registered by the counter corresponding to the temperature of the motor (hot or cold) is incremented by one. At the end of this time delay, the counter in question will be decremented by one.

Each time the motor is stopped (change of state of logic input L1: from state 1 to state 0) relay P220/P225 establishes whether either of the two counters (cold and hot) has been reached. If so, start inhibit signal START NB LIMIT will be generated for a length of time equal to $T_{interdiction}$. At the end of $T_{interdiction}$, this signal drops out, and it is possible to start the motor again.

Examples: Taking as an example cold starts where the limit of the number of cold starts has been set at 3 for a period of $T_{reference}$.

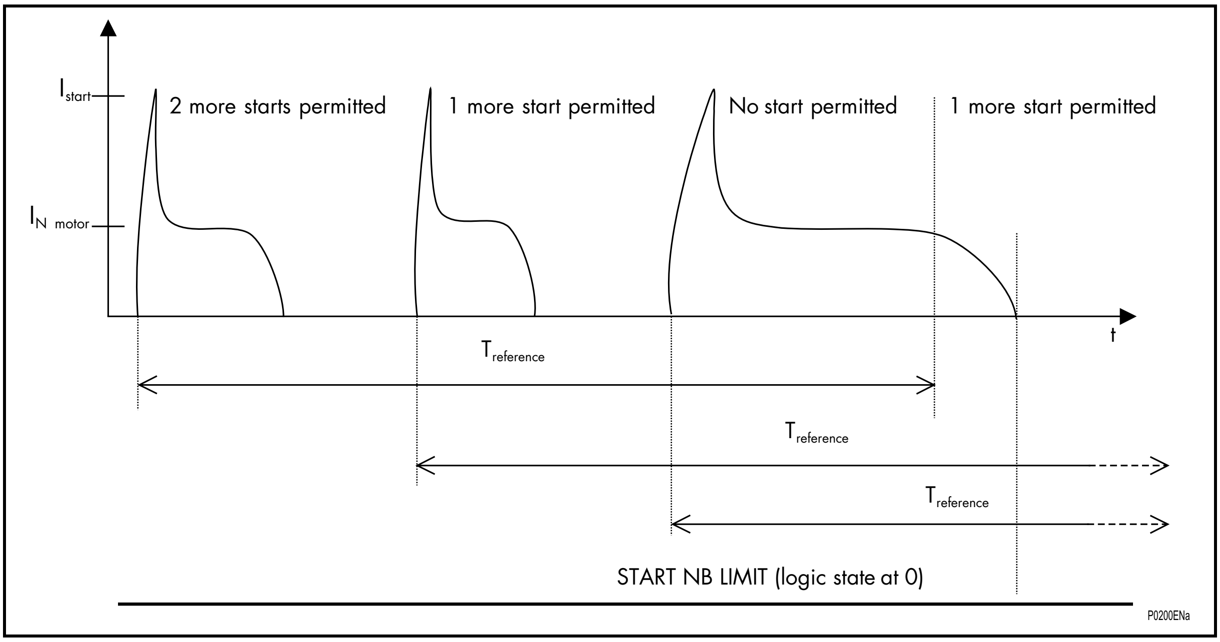
Case n°1:

The number of cold starts limit has been reached and the motor is stopped before the end of the $T_{reference}$ period: the $T_{interdiction}$ time delay is therefore initiated when the motor stops. A new start up is permitted at the end of the $T_{interdiction}$ time delay.



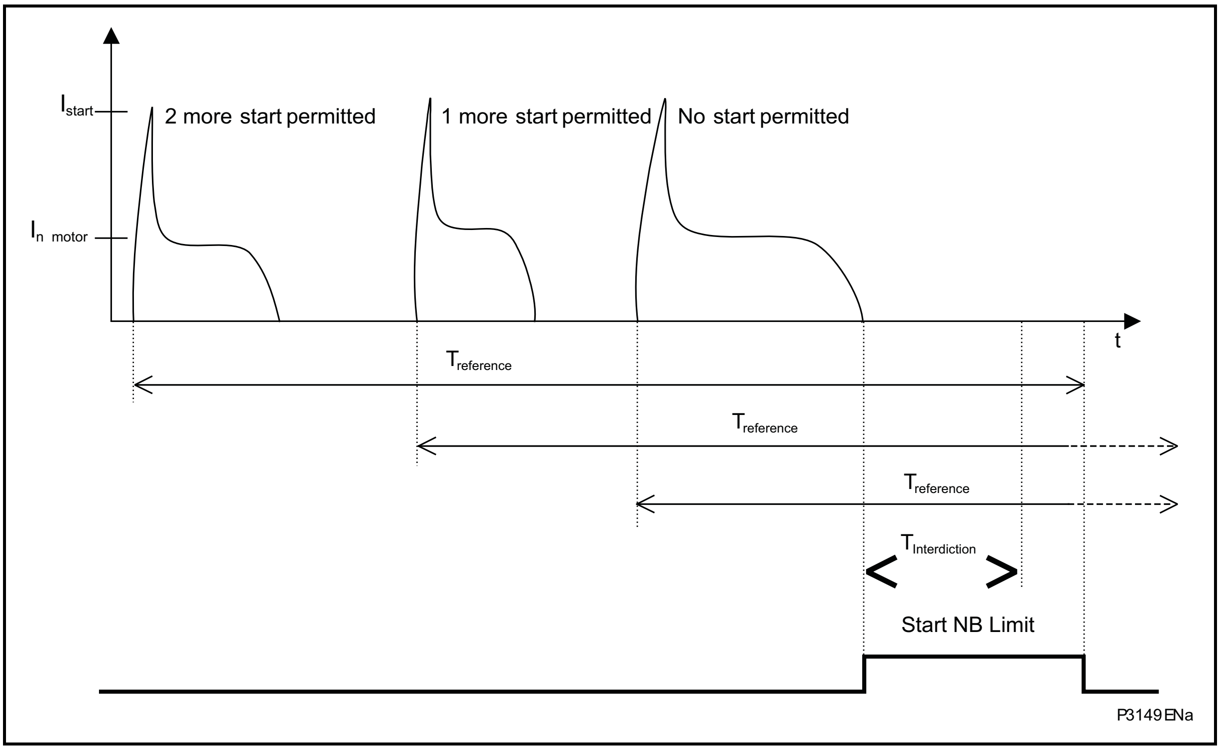
Case n°2:

The number of cold starts limit is reached but the motor is not stopped until after the end of the $T_{reference}$ period: therefore the $T_{interdiction}$ time delay is not initiated. There is no start inhibit.



<u>Case n°3:</u>

Particular cases where at the end of the $T_{interdiction}$ time delay, the number of starts counter is reached and the $T_{interdiction}$ time delay period is completed while $T_{reference}$ timer is still running: any new start up is inhibited until the end of the $T_{reference}$ period (the START NB LIMIT signal is extended).



NOTE:
- A start is considered cold if the value of the motor's thermal state is less than or equal to 50% when an motor start phase is detected.
- A start is considered warm if the value of the motor's thermal state is more than 50% when a motor start phase is detected.
- In cases where at the end of the $T_{interdiction}$ time delay period, one of the counters is has been reached, the START NB LIMIT start inhibit signal will not drop out until the counter in question is decremented (example case No.3).
- The number of authorised starts and the waiting time before a new start is authorised are available in the PROCESS menu (see section 4.7. The PROCESS menu).
- If the number of cold starts and the number of hot starts have not reached their settings while the time between two consequetive starts is greater than the fixed threshold, then the number of permitted start will be frozen to 1.

4.12.2 'MIN TIME BETW 2 START' submenu: Minimum time between two starts

Excessive motor heating caused by two consecutive starts can be avoided by means of the 'MIN TIME BETW 2 START' function.

It is based on the use of an adjustable time delay: minimum time between 2 starts "T betw 2 start".

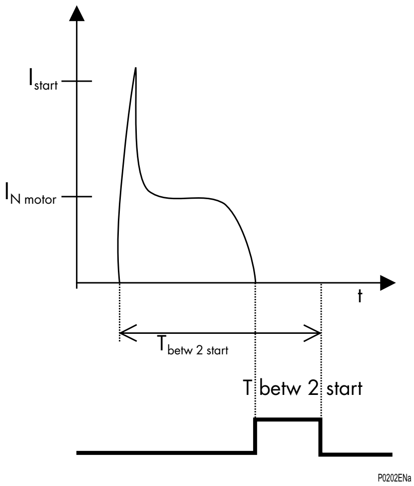
This time delay is initiated on detection of a motor start up by the P220/P225 relay. When the motor stops and if the "T betw 2 start" time delay has not reached, start inhibit signal "Tbetw 2 start" is generated until the end of the "Tbetw 2 start" time delay.

Examples:

Case n°1:

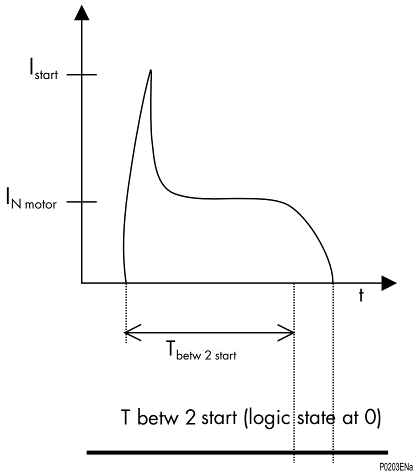
The stopping of the motor takes place before the end of the "Tbetw 2 start" time delay period.

A start inhibit signal "Tbetw 2 start" is generated during the "Tbetw 2 start" period.



Case n°2:

The stopping of the motor takes place after the end of the "Tbetw 2 start" time delay period, no start inhibit signal is generated.



4.12.3 'REACCEL AUTHORIZ' submenu: Re-acceleration/load shedding authorization

In cases when the supply voltage falls below a settable under voltage threshold, the duration of the fall in voltage can be classified as short, medium, or long (corresponding to "reacc", "reac-long" and "reac-shed" respectively of P220/P225 relay designations), based on settable time thresholds.

- Short falls are intended to cover situations when it is appropriate to authorize re-acceleration of the rotor and not to issue a trip order on voltage restoration detected via a settable over voltage threshold.
- Medium falls (interruptions actually) are for when it is appropriate to restart the motor with any staged startup sequence the starter type might provide.
- Long falls are intended to cover cases when restoration is from back-up power, and there must be substantial intervals between starting different motors to maintain stability, and/or only critical motors can be started.

A **short** fall in voltage from the electrical network causes a reduction in rotor speed. If the motor was running at the time a short fall occurred, a forced re-acceleration will occur as soon as the relay detects healthy supply voltage. A forced re-acceleration bypasses any pre-staged start-up sequence the starter type might otherwise provide.

When the voltage is restored, the rotor starts on a re-acceleration phase in order to regain its nominal speed. This re-acceleration manifests itself as an intake of current of approximately the same value as that of the locked rotor current, its duration being relative to the magnitude of the fall in voltage and the duration of the fall in voltage.

The MiCOM P220/P225 relay can detect and measure the duration of a voltage drop. By comparing how long this voltage reduction lasts with an adjustable short time delay T_{reacc}, the relay will authorise or prevent the motor's re-acceleration.

P220 relay can detect a fall in voltage via an external voltage based protection device the output signal of which is subsequently fed to any one of the 5 programmable inputs and assigned to "V Dip" for re-acceleration.

P225 relay can either detect a fall in voltage via an external voltage based protection device the output signal of which is subsequently fed to any one of the 5 programmable inputs assigned to “V Dip” for re-acceleration or P225 relay can be configured via “Detect Volt Dip” setting to monitor the voltage by the relay itself.

The user adjusts a time delay T_{reacc}. This time delay corresponds to the maximum duration of a voltage sag for which the motor re-acceleration is to be authorised.

If P225 relay is configured via “Detect Volt Dip” setting to monitor the voltage by the relay itself then the following applies:

A settable undervoltage threshold "Detection V DIP" (P225 only) makes it possible to detect a voltage drop.

A settable overvoltage threshold "Restoration V DIP" (P225 only) makes it possible to detect a restoration of the voltage.

Upon detection of a voltage drop, the P220/P225 relay initiates a time-delay, T_{reacc}.

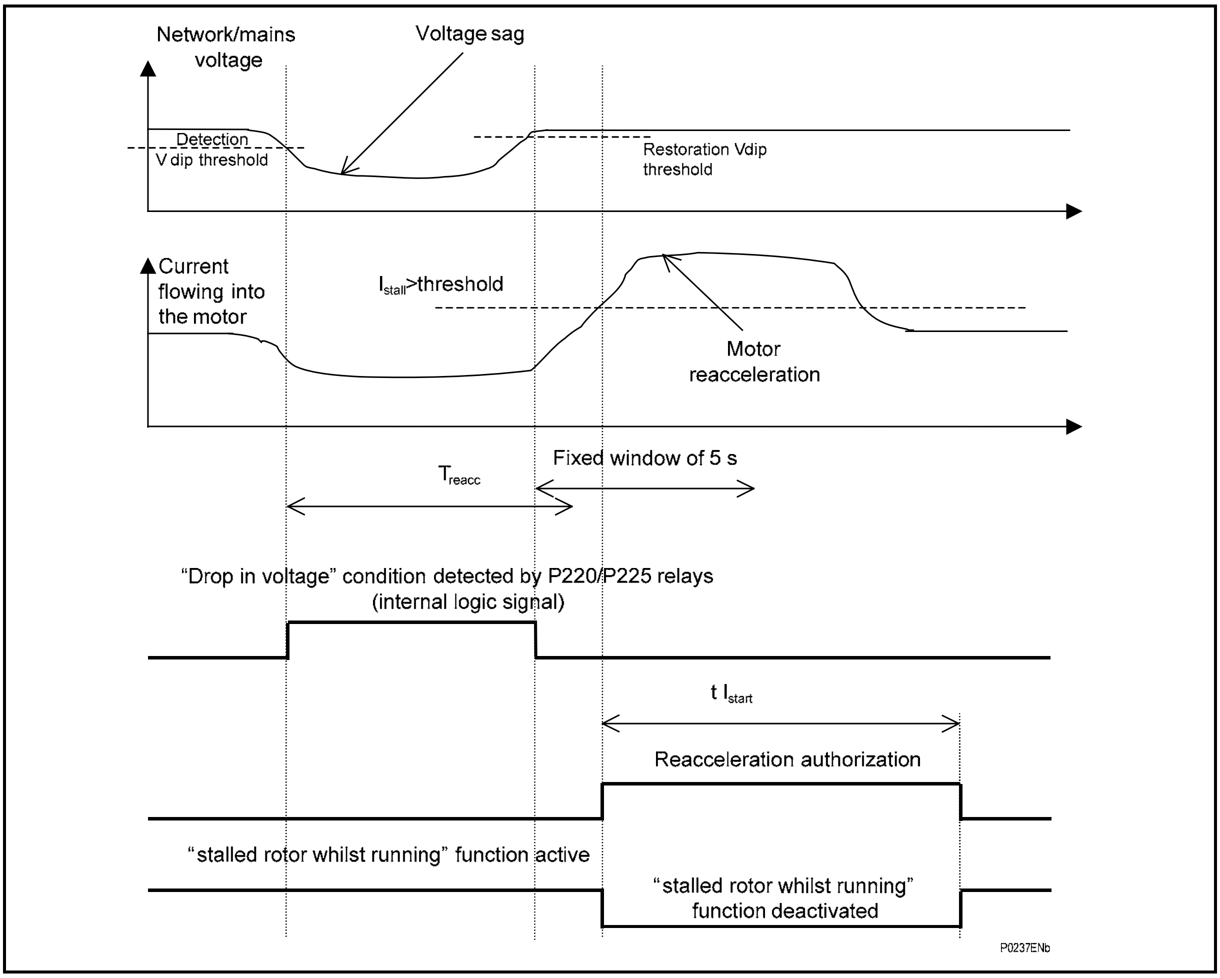
Three circumstances are possible:

- Before the end of the time-delay T_{reacc} (duration of the voltage sag shorter than T_{reacc}), the voltage is restored (voltage greater than "Restoration V Dip") and within 5 seconds after this restoration, the current absorbed by the motor exceeds the I_{stall} threshold (function [51LR/50S] BLOCK ROTOR), then:
  - the P220/P225 goes into monitoring of a start-up sequence (initiation of the tI_{start} time delay, START CRITERIA menu, and it deactivates the “stalled rotor whilst running” function.
  - at the end of the tI_{start} delay allowed for a start, the relay P220/P225 reactivates the “stalled rotor whilst running” function.
- Before the end of the T_{reacc} time-delay (duration of the voltage sag shorter than T_{reacc}), the voltage is restored (voltage greater than "Restoration V Dip"), but the current absorbed by the motor does not exceed the I_{stall} threshold within 5 seconds after this restoration, then:
  - the P220/P225 relay operation does not change.
- At the end of the T_{reacc} time-delay, the voltage drop is still present (duration of the voltage sag greater than T_{reacc}), then:
  - a VOLTAGE DIP signal is issued by the P220/P225 relay. Assigning this signal to the trip output relay (RL1) allows to stop the motor if required.

Examples

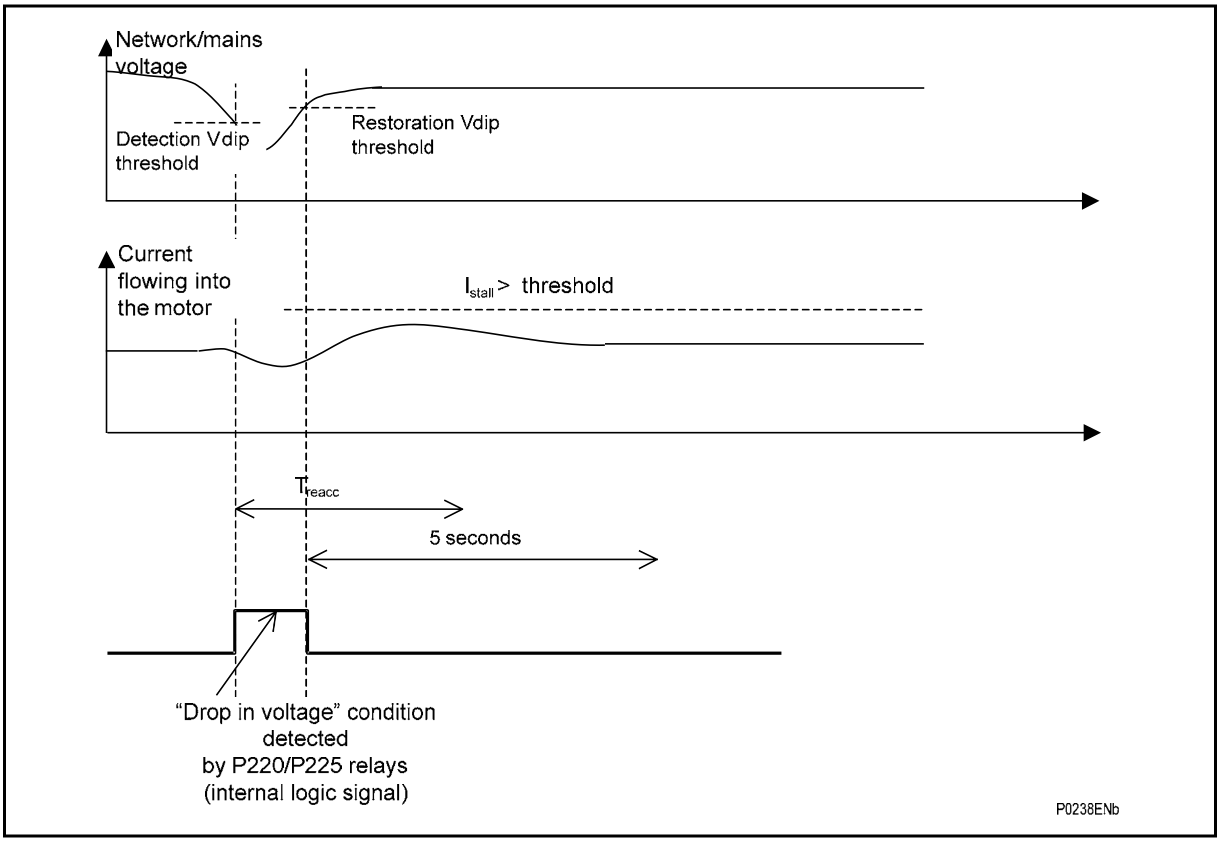
<u>Case n°1:</u>

The duration of the voltage drop is less than the T_{reacc} time delay, when the mains voltage is restored, re-acceleration of the motor is authorised.



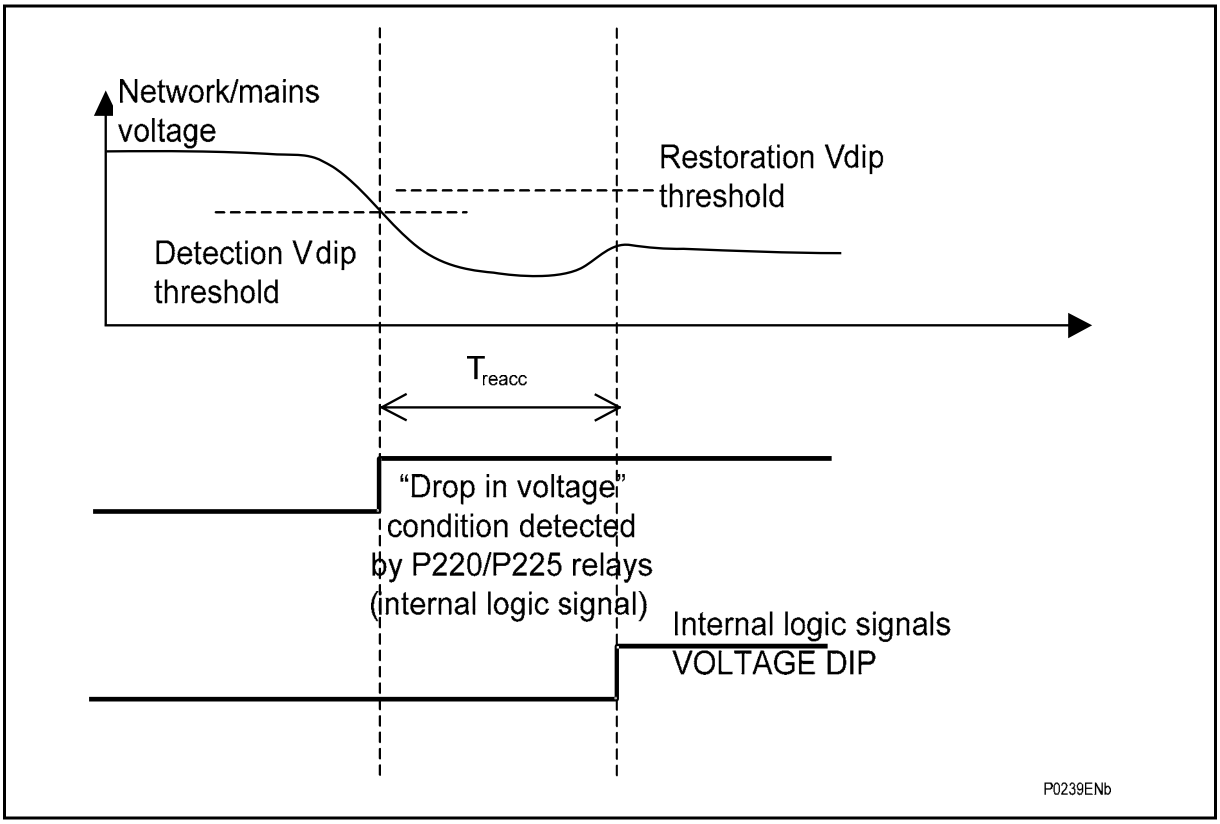
<u>Case n°2:</u>

The duration of the voltage sag is shorter than the T_{reacc} time-delay, but the motor does not reaccelerate within 5 seconds after the voltage has returned. The P220/P225 operation does not change.



Case n°3:

The duration of the voltage sag is greater than the T_{reacc} timer. A VOLTAGE DIP signal is issued by the P220/P225 relay at the end of T_{reacc}. It can be used to stop the motor.



4.12.3.1 The 'AUTO RE-START' submenu: Re-start/load restoration (P225 only)

When motor supply monitoring is included, as in P225, the Auto-Restart feature is available to carry out automatic re-starting of the motor upon restoration of supply for cases when duration of the voltage fall is medium or long .

The AUTO RE-START element provides for controlling the timing of controlled starts following interruptions.

The re-start is carried out after a **medium** set time delay $T_{reac\text{-}long}$ or after an extended **long** time delay $T_{reac\text{-}shed}$. $T_{reac\text{-}long}$ threshold setting can be used for when it is appropriate to restart the motor with any staged startup sequence the starter type might provide. $T_{reac\text{-}shed}$ threshold setting can be used for to cover cases when restoration is from backup power, and there must be substantial intervals between starting different motors to maintain stability, and/or only critical motors can be started. The Auto re-start feature, if enabled (AUTO RE-START FUNCT set to YES), becomes active after the relay has issued a trip signal due to a voltage sag condition with a duration longer than T_{reacc} threshold as described by example case no. 3 in section 4.12.3.

If $T_{reac\text{-}long}$ is set to a value other than Zero (off) and after a trip order has been issued (due to the supply voltage not being restored within the time interval of T_{reac}), the P225 relay initiates $T_{reac\text{-}long}$ time-delay.

If the supply is restored within $T_{reac\text{-}long}$ time-delay interval, a close order is issued by the relay and a normal start is allowed to initiate. A programmable LED and an output contact can be assigned to this close order while this event is recorded. If the supply is not restored within $T_{reac\text{-}long}$ time-delay interval, AUTO RE-START will be de-activated.

It is possible extend the delay to start different motors and to arrange a load restoration sequence in cases where the system is week or when restoration is from backup power In this case $T_{reac\text{-}shed}$ time-delay can be adjusted to perform a sequence start. If $T_{reac\text{-}shed}$ is set to a value other than Zero (off) while$T_{reac\text{-}long}$ time-delay has been set to Zero (off) re-start will be extended by $T_{reac\text{-}shed}$ time delay.

4.12.4 Binary inputs

The P220/P225 has 6 logic inputs (and 5 optional additional inputs), 5 (or 10) of which are programmable.

4.12.4.1 “Fixed” input

One of the logic inputs is predefined for a fixed usage, it is:

Logic input L1 (terminals 22 - 24) and is linked to the position of the fuse-contactor or circuit breaker (52a). This input should be linked to the 52a interlock of the cut off device (52a). This interlock is open when the cut off device is open and is closed when the cut off device is closed. **The connection of this logic input is compulsory.**

4.12.4.2 The INPUTS submenu: Programmable inputs

The user can program five of the logic inputs. These are logic inputs L2 (terminals 26-28), L3 (terminals 13-15), L4 (terminals 17-19), L5 (terminals 21-23) and L6 (terminals 25-27). The user with MiCOM P22x relays with optional “IRIG-B / Sec. comm port / 5 DI” relays can additionally program L7 to L11 digital inputs (terminals 61, 62, 63, 66 and 65, with common “–“ input on terminal 62) The user chooses the allocation of these logic inputs in the INPUTS menu, that is to say to what use the relay P220/P225 will put these external logic data:

4.12.4.2.1 Emergency Start

An emergency start may be necessary for safety reasons. When the logic input having been assigned to the “EMERG START” function is powered on (logic state at 1), the P220/P225 relay reacts as follows:

– The thermal state value θ is limited at 90% so that no thermal trip order “THERM. OV.” can occur during the motor start up phase (see section 4.11.2.1. Function inhibiting thermal tripping during a start: teta *INHIBIT*). At the end of the tI_{start} time delay allocated to the start up, the thermal condition value θ will be allowed to exceed 90%.

– The thermal base blocking start signal “teta FORBID. START” is suppressed.

– The blocking start “START NB LIMIT” signal from the “limitation of number of starts” function is suppressed.

– The “T betw 2 start” blocking start signal from the “minimum time between 2 starts” function is suppressed.

– The “ABS” blocking start signal from the “minimum time between a stop and a start” function is suppressed.

– The “AUTO RE-START” is suppressed while the scheme is still timing out.

The motor can therefore be restarted and no thermal tripping can take place during the start up phase.

NOTE:

– The logic input “EMERG ST” must be kept powered during the whole of the motor start up phase.

– The relay P220/P225 can also receive a remote emergency start command via the communication network.

– An emergency start up instruction “EMERG ST” does not order the closure of the cut off device (motor start up) but makes the motor start up possible.

4.12.4.2.2 Setting group switch/active setting group

- If “PICK UP” has been selected in the ‘INPUT CONFIG.’ sub-menu:

Upon receipt of a pick-up (minimum duration 15ms) of the logic input set to "SET GROUP", the MiCOM P220/P225 relay switches between setting groups.

The change from one configuration to another can also be achieved via the operator menu or the communication network (see section 4.5.1.1. Configuration Group).

- If “LEVEL” has been selected in ‘CONFIG. SELECT.’ Submenu:

Setting group G1 is active when the logic input set to "SET GROUP" is de-energised (low state).

Setting group G2 is active when the logic input set to "SET GROUP" is energised (high state).

A parameter setting group change is not possible if one of the following protection functions is in progress (that is if the threshold of these functions is exceeded):

– ‘[50/51] PHASE OVERCURRENT’ function,

– ‘[50N/51N] EARTH FAULT’ function,

– ‘[46] UNBALANCE’ function,

– ‘[27] UNDERVOLTAGE’ function (P225 only),

– ‘[59] OVERVOLTAGE’ function (P225 only),

– ‘[48] EXCES LONG START’ function,

– ‘[50S/51LR] BLOCK ROTOR’ function,

– ‘[37] LOSS OF LOAD’ function,

– ‘[49/38] RTD’ probe function,

– ‘[49] THERMAL OVERLOAD’ function.

4.12.4.2.3 Speed switch device

A logic input set on “SPEED SW” can be connected to a speed sensor usually known as a “speed switch”.

The speed switch should be open when the rotor is not turning and should close as soon as it detects rotor rotation. The connection of this logic input to a “speed switch device” is necessary in order to be able to use the “locked rotor at start” protection function.

NOTE: When no logic input is set to "SPEED SW", the "Locked rotor at start-up" function (refer to chapter 4.11.9.2) cannot be used, it must therefore be deactivated.

4.12.4.2.4 Trigging of the disturbance recording

By assigning the command “DIST TRIG” to a programmable logic input, the operator will be able to initiate the disturbance recordings (RECORD menu) from this input. The energising (rising edge) of this programmed logic input on “DIST TRIG” will trigger a disturbance recording.

4.12.4.2.5 External acknowledgement

By dedicating a logic input to the external acknowledgement command “EXT RESET”, the operator can acknowledge the alarms and unlatch the output relays if the latter were kept energised (see sections 4.12.12 and 4.12.7), by energising this logic input.

4.12.4.2.6 Auxiliary inputs and Auxiliary timers

The “tAux1” to “tAux10” assignments allow relay P220/P225 to acquire external binary data. A time delay (tAux1 to tAux10) is linked to each assignment.

Auxiliary timers tAux1 to tAux10 are available associated to Aux1 to Aux10. When these inputs are energized, the associated timers start and, after the set time, the output relays close. The time delays are independently settable.

The internal “Aux1” or “Aux2” signal to the relay is in logic state 1 if the associated logic input is energized for a time longer or equal to tAux1 or tAux2 time delay. When the logic input is no longer energised the logic state of the internal “Aux1” or “Aux2” signal drops back to 0.

When the tAux1 or tAux2 timers expire, the following happen:

- an alarm message is sent
- the Alarm LED is lit
- an event is recorded

The “Aux3” to “Aux10” assignments operate similarly to “Aux1” and “Aux2”, but when the associated timers expire:

- there is no alarm message,
- the "Alarm" led is not lit,
- an event is recorded.

NOTE: auxiliary timers are settable up to 200 s.

4.12.4.2.7 Thermal state reset

When a logic input is assigned to the "teta RESET" signal, the user can reset the thermal state value θ (refer to section 4.11.2), by energising this logic input.

4.12.4.2.8 Trip circuit supervision

One or two logic inputs can be set to "TRIP CIRC" so as to be used to supervise the trip circuit (refer to section 4.12.11.1).

4.12.4.2.9 Re-acceleration authorization

When INPUT is selected in Detection Volt Dip, any one of the programmable logic inputs can be set to “V Dip” so as to be used to initiate the timer used in re-acceleration authorization control function.

4.12.5 The Boolean ‘LOGIC EQUATION’ submenu

The MiCOM P220/P225 relays integrate complete logic equations to allow customization of the product based on customer application.

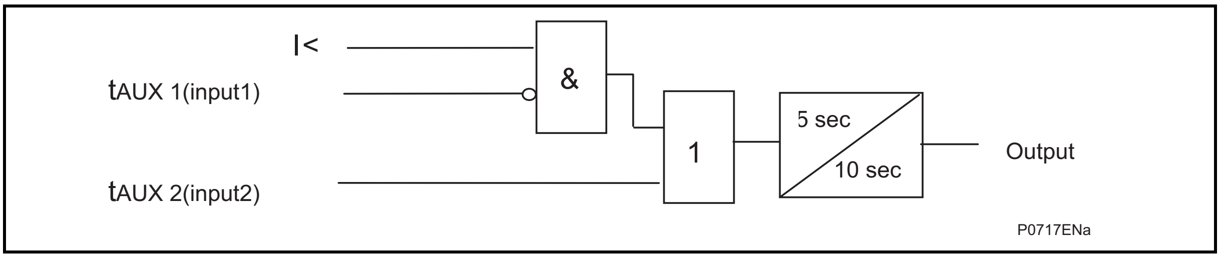
Up to 8 independent Boolean equations can be used. Each equation offers the possibility to use AND, OR, AND NOT, OR NOT & NOT logical gates. Up to 16 parameters can be used for each equation. Every result of equation can be time delayed and assigned to any output relays, trip, trip latching and/or HMI 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 of a logic implementation using Equation A is shown below:



4.12.6 ‘AUX OUTPUT RLY’ submenu: Auxiliary programmable output relays

In the ‘AUX OUTPUT RLY’ menu, the user assigns the MiCOM P220/P225 internal and external data to the auxiliary output relays (relays RL2, RL3, RL4 or RL5). These are changeover type relays (1 common, 1 normally open contact, 1 normally close contact). One relay is switched on when at least one of the data items linked to it is valid (OR logic). It drops back once all its associated data has disappeared.

Data assignable to the auxiliary output relays can be:

- of the internal type
  - logic state of a protection function (instantaneous, time delayed signals)
  - logic state of an automatism or state function (blocking start, successful start)
  - the result of an “AND” logic equation
- of the external type
  - signal received via logic inputs (“tAux1 to tAux10, Inputs 1 to 10”)
  - signal received via the communication network (remote control by the supervisor)

The protection functions that can be assigned to the output relays (2 to 5) for the P220/P225 is detailed in the section P22x/EN HI – Menu of the HMI.

4.12.6.1 ‘TRIP OUTPUT RLY’ submenu: Configuration of the trip output relay

Data which is going to control the relay RL1 (terminals 2-4-6) can be assigned using the ‘TRIP OUTPUT RLY’ sub-menu. This changeover type relay is used to give a tripping order to the cut-off device.

The relay RL1 (tripping relay) has the same electrical and mechanical characteristics as the other output relays.

<u>Reminder</u>: A certain number of the MiCOM P220/P225 functions are based on the operation of relay RL1, i.e.

- The Trip Cause Statistics (refer to section 4.9)
- The Latching of the Trip Output Relay (refer to section 4.12.12)
- The CB fail function (refer to section 4.12.8)
- The trip circuit supervision function (refer to section 4.12.11.1)
- The Surveillance of the cut-off device (refer to section 4.12.11)
- The record of fault values (refer to section 4.13.1)
- The triggering of disturbance record (refer to section 4.13.2)
- The display of data relating to the cut-off device (refer to section 4.13.3)

4.12.7 'LATCH TRIP ORDER' submenu: Latching of the trip output relay

In this menu, the user selects which functions are to maintain the output relays energized when an order is generated by these functions.

Therefore, when one of the functions set as latching issues a trip signal via output relay RL1, the relay remains energised after the end of the trip signal. It will be necessary to attend and acknowledge the MiCOM P220/P225 in order to switch off the output relay RL1.

NOTE:
- Latching of the output relays is optional for each of these functions. The user can choose whether to assign these functions to the "trip output relay latching facility"
- There are 3 possible ways to acknowledge the P220/P225, and thus switch off the output relay RL1 in the event of latching:
  - press the © pushbutton
  - send an acknowledge order to the configured logic input on "EXT RESET"
  - send an acknowledge remote order via the communication network (order given by a supervisor)
  - On loss of auxiliary power, the output relay drops back. On return of auxiliary power, the output relay is re-energised, independently of the fault status (whether the fault is still present or cleared)

4.12.8 'CB FAIL' sub-menu: Breaker failure protection

The breaker failure function is used to quickly detect if a circuit-breaker has not opened (phase fault currents still present) after a trip signal.

This function is based on a "I<BF" current threshold and on a "tBF" time-delay; these two settings can be configured by the user.

If this function is commissioned by the user, it is activated every time relay RL1 issues a trip command.

The "tBF" time-delay is initiated upon energization of output relay RL1. Then, for each phase, the MiCOM relay detects the first crossing of the current out of the zone created by "I<BF". Upon detecting this crossing, the MiCOM relay initiates another time-delay with a fixed value equivalent to 20 samples.

The relay sampling value is 32 samples/cycle. Therefore, the duration of the fixed time-delay is 12.5ms at 50Hz and 10.4ms at 60Hz As long as this 12.5ms timer is running, the relay checks whether the current leaves the current zone again. Where the current is not suppressed by the circuit breaker pole, it will come out of the zone after a half cycle, i.e. 16 samples (10ms at 50Hz).

The relay restarts the 20 sample timer each time it detects that the current comes out of the preset current zone "I<BF".

For each 20 sample window the relay checks that when the current leaves the zone it does so in the opposite direction to the previous crossing:

- If there is no opposed current crossing, then the relay decides that the circuit breaker pole is open.
- If there is a current crossing opposed to the previous crossing, then the relay decides that the circuit breaker pole is still close.

At the end of the tBF time-delay, the relay checks the state of each breaker pole (according to the principle described above). If one or several poles are not open, the MiCOM relay issues an alarm message: "CB FAIL".

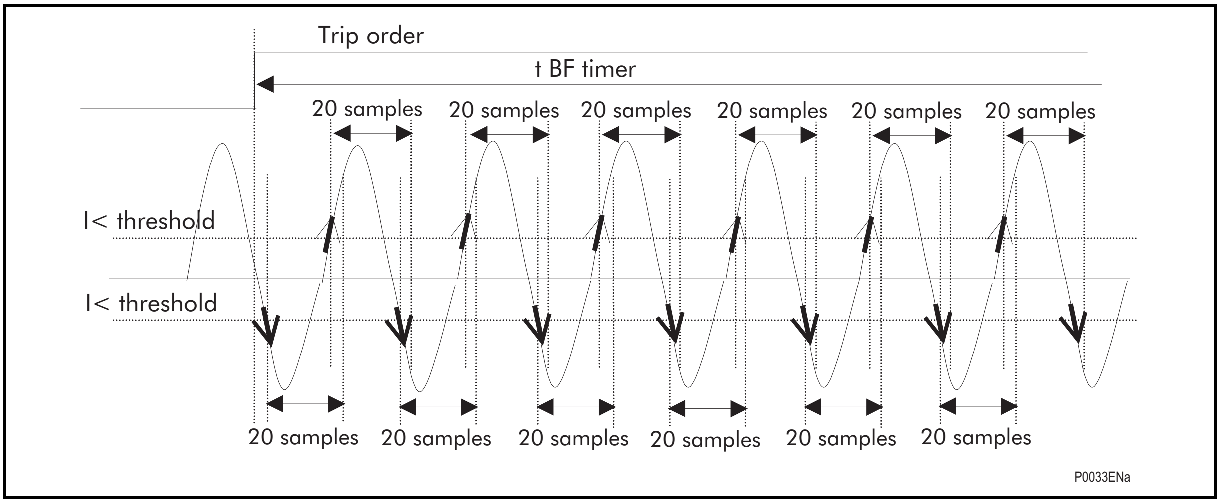


FIGURE 4 - CIRCUIT BREAKER FAILURE DETECTION PRINCIPLE

Case n°1:

The figure below shows a correct opening of the circuit-breaker before the tBF time-delay expires. In this case, no alarm is issued.

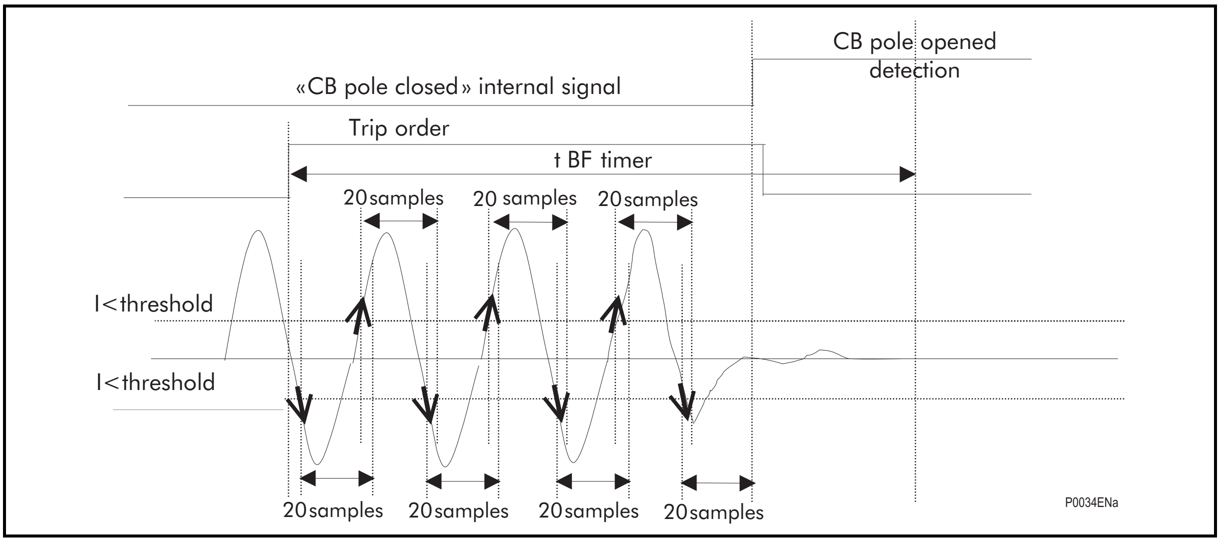


FIGURE 5 - OPENING OF THE BREAKER POLE BEFORE tBF DROPOFF

Case n°2:

In the figure below the circuit-breaker does not open before the end of the tBF time-delay. In this case the relay issues a CB FAIL indication.

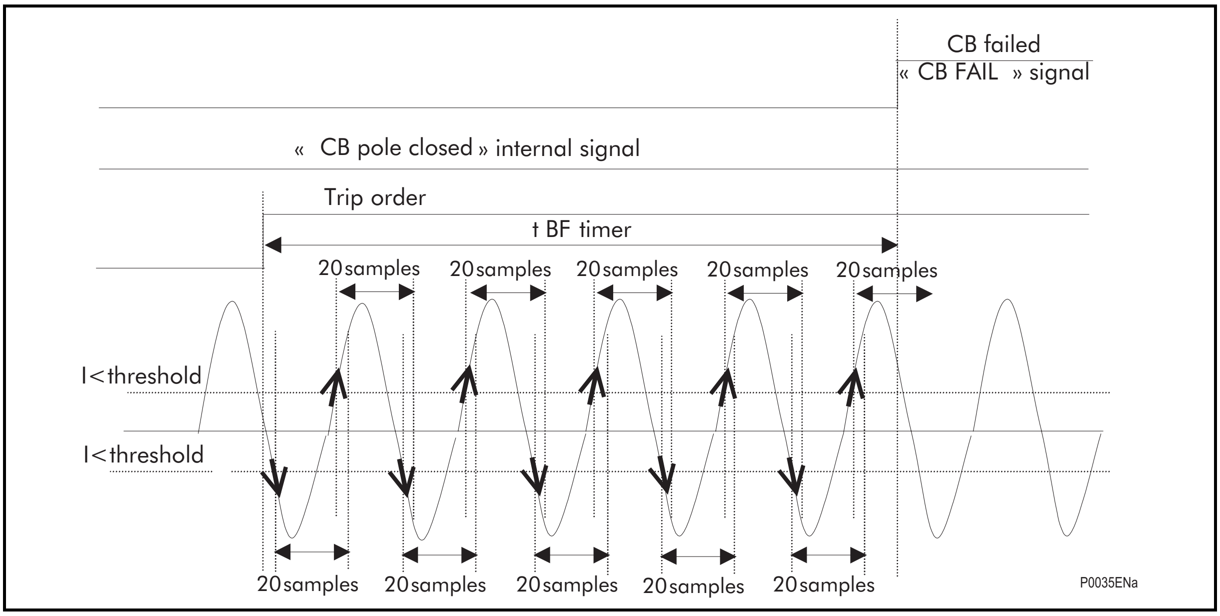


FIGURE 6 - THE BREAKER POLE DOES NOT OPEN BEFORE THE END OF TBF

Case n°3:

The figure below shows a correct circuit-breaker opening. After fault clearance, the phase current does not decrease immediately. This is often due to the phase CT de-magnetisation.

In this case, were the breaker failure detection based solely on an undercurrent threshold, there would be an erroneous breaker failure diagnostic.

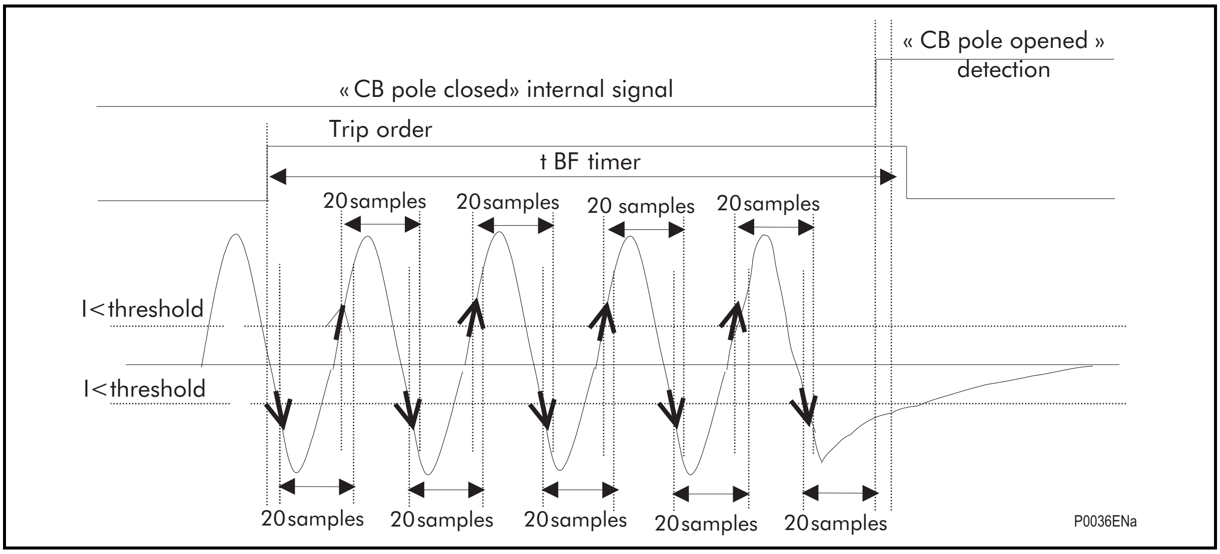


FIGURE 7 - DRAG DU TO THE PHASE CT DE-MAGNETISATION

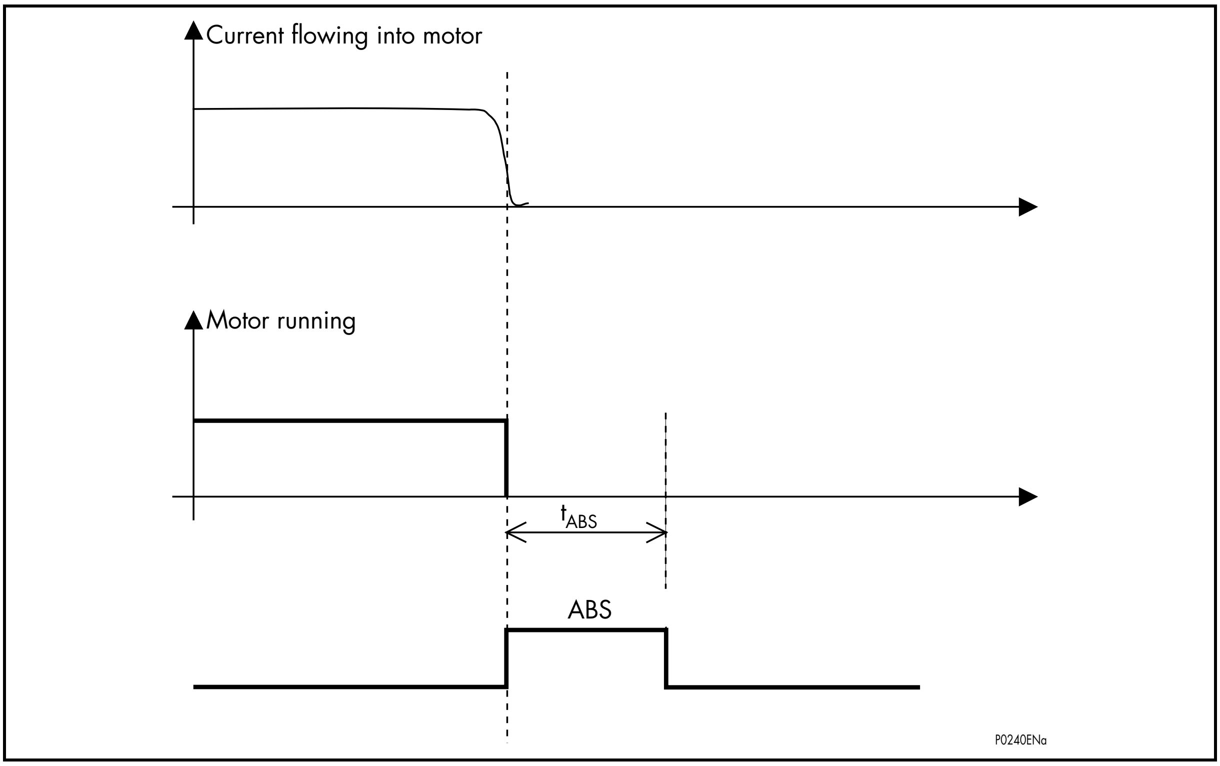
4.12.9 The ABS (Anti-BackSpin) sub-menu: Minimum time between a stop and a start

Anti-backspin protection is typically used on pump-motors which are installed down hole up to kilometres underground. Although stop valves are often used in this kind of application to prevent reversal of flow when the pump stops, however the reversal of flow may happen due to faulty or non existent stop valves, causing the pump impeller to rotate the motor in the reverse direction. Starting the motor while it is back-spinning may result in motor damage. Anti-backspin protection function ensures that the motor can only be started when the motor has fully stopped.

The ABS (anti-backspin) function imposes a waiting time between a stop and a re-start of the motor. This waiting time allows the rotor coming to a halt before the motor is re-started.

It is based on the use of an adjustable time delay: tABS.

This time-delay is initiated when a motor stop is detected. As long as this timer is running, an ABS indication remains issued. This ABS indication disappears at the end of the tABS time-delay.



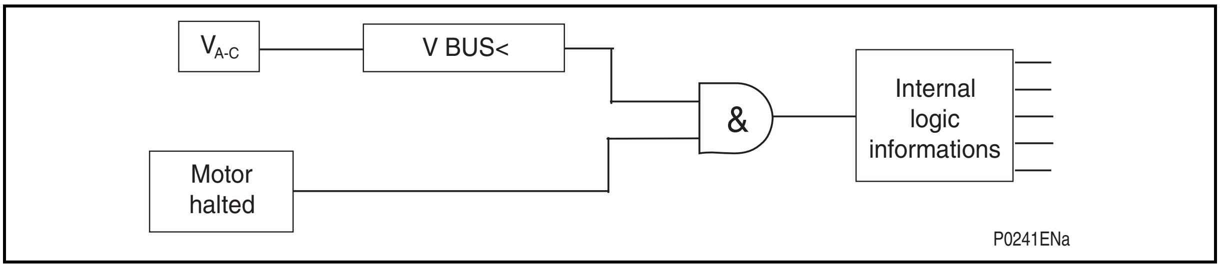
4.12.10 'BUS VOLTAGE CTRL' sub-menu (P225 only): Validation of voltage presence before a start

This function makes it possible to check that the system voltage level is sufficient to allow a satisfactory motor start sequence.

It is only valid when the relay "sees" the motor as stopped.

With the motor stopped, the P225 relay issues a "BUS VOLTAGE" indication if the measured voltage (between phases A and C) is below a settable threshold, "V BUS".

The pick-up and drop-off of the "BUS VOLTAGE" indication are instantaneous.



4.12.11 'CB SUPERVISION' submenu: Circuit-breaker supervision

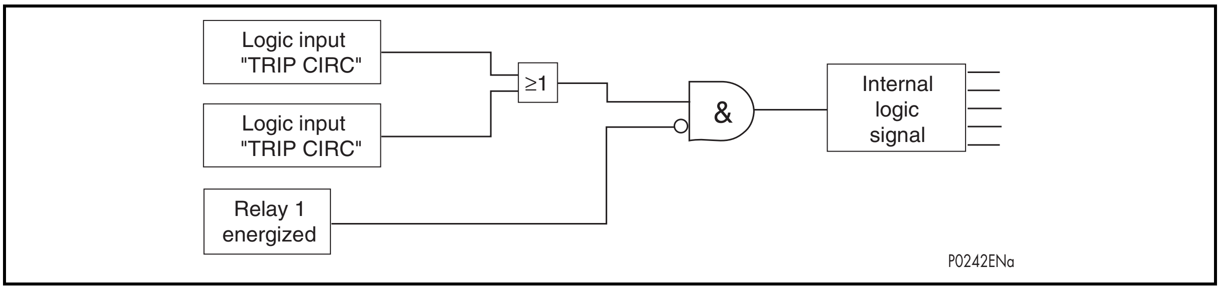
4.12.11.1 Trip circuit supervision

The 'TRIP CIRCUIT SUPERV' function supervises the trip circuit wiring continuity.

One or two logic inputs must have been assigned to "TRIP CIRC" (refer to section 4.12.4.2.8), then connected to the trip coil power circuit.

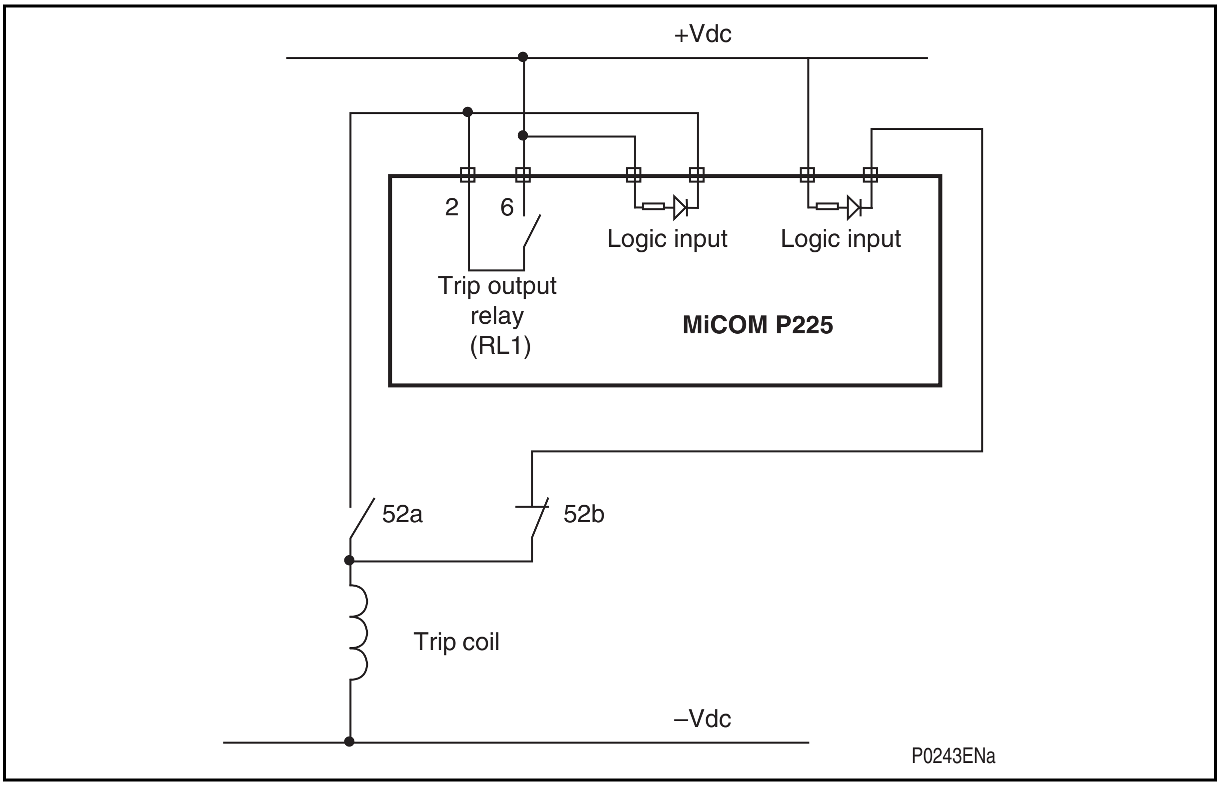
When the 'TRIP CIRCUIT SUPERV' function is set on YES, the MiCOM relay continuously checks the trip circuit whatever the position of the circuit breaker poles, open or closed. This function is inhibited when the protection relay sends a tripping order to the circuit-breaker, via its RL1 output relay.

If, during a time equal to tSUP, the state of the logic input(s) assigned to "TRIP CIRC" is 0, the MiCOM relay issues a 'TRIP CIRC. FAIL' alarm.



<u>Connection diagram example:</u>

This application diagram requires that 2 logic inputs are assigned to "TRIP CIRC", that the auxiliary contacts 52a (o/o) and 52b (c/o) are available. The MiCOM P220/P225 relay checks the trip circuit wiring continuity whatever the position of the circuit-breaker poles: open or closed.



4.12.11.2 Circuit-breaker supervision

The P220/P225 relay monitors the operation of the cut-off device (fuse-contactor or circuit breaker). Three criteria are monitored and for each of these an adjustable alarm threshold is available to the user. These thresholds are based on:

- Monitoring of the time of opening of the cut-off device. This is the time from the moment when the P220/P225 sends an order to the output relay RL1 to the moment when the P220/P225 relay receives the data on the logic input RL1 (terminals 22-24) indicating that the cut-off device is open.
- Monitoring of the number of opening orders. This is the number of tripping orders which have been issued to relay RL1.
- Monitoring of the sum of broken amp to the power of "n" broken by the switching device (exponent: n =1 or 2). The current value taken into account is that of the current when output relay RL1 receives the trip command.

When one of the thresholds described above is exceeded, an alarm message is available on the display and logic data can be assigned by the user on one or several of the auxiliary output relays (relays RL2, RL3, RL4 or RL5).

So as to adapt the MiCOM P220/P225 to any type of cut-off device, the user can also configure 2 time delays:

One maintenance of tripping order TRIP T time delay: For each tripping order sent on the relay RL1, the latter is kept switched on for a time TRIP T (if the “trip output relay latching” facility has not been set on).

One maintenance of tripping order CLOSE T time delay: a tripping order (closure of the cut-off device) given by the communication network (remote control CLOSE ORDER) is maintained on the auxiliary output relay for a time equal to CLOSE T. This is the output relay to which the CLOSE ORDER, order has been allocated (AUX OUTPUT RLY menu).

NOTE:
- For the summation of the amps to exponent “n” cut, the exponent “n” can be adjusted to the value 1 or the value 2.
- In all cases, the orders sent on the output relay RL1 (tripping order) are maintained for at least 100 ms.

4.12.12 ‘LATCH AUX OUTPUT RLY’ submenu: Latching of the output relays

In this menu the user programs each auxiliary output relays (relays RL2, RL3, RL4 or RL5) to have a latching operation or a self-reset operation.

When a relay set as latching receives an energisation signal, it remains energised even after the signal has been removed. It will then become necessary to acknowledge the P220/P225 in order to switch off this output relay.

NOTE:
- There are 3 possible ways to acknowledge the P220/P225, and thus switch off one output relay in the event of it being latched:
- press the ⓒ button
  - send an acknowledge order to the configured logic input on “EXT RESET”
  - send an acknowledge remote order via the communication network (order given by a supervisor)
  - On loss of auxiliary power, the output relay drops back. On return of auxiliary power, the output relay is re-energised, independently of the fault status (whether the fault is still present or cleared)

4.13 'RECORD' menu

The 'RECORD' menu comprises 3 sub menus:

- 'FAULT RECORD'
- 'DISTURB RECORD'
- 'CB MONITORING'

4.13.1 'FAULT RECORD' submenu

A collection of data on each of the 25 last faults registered is displayed in the 'FAULT RECORD' sub menu.

For each recording, the relays memorises

- the fault number,
- the time of the fault,
- the date of the fault,
- setting group (group G1 or G2) active at the time of the fault,
- the faulty phase,
- the function which detected the fault,
- magnitude of fault current or voltage (in fundamental value),
- the phase A, B and C currents (in true rms values),
- the earth current (in true rms value),
- the phase A - phase C voltage (in true rms value) (P225 only) or VAB (P225 with 3 voltages input option),
- VBC (P225 with 3 voltages input option),
- VCA (P225 with 3- voltages input option).

The recordings of the fault are accessible:

- either through the Human Machine Interface (display front face),
- either using the remote communication network (RS485 rear port(s)),
- or using the MiCOM S1 Studio support software (RS232 front port).

Fault number 25 is the last fault registered. **F**ault number 1 is the oldest.

NOTE:
- These data are not erasable. They are managed in a circular list (first in first out): when this is full, the oldest fault is erased.
- Faults are signalled by one or several alarm messages.

4.13.2 'DISTURBANCE RECORD' submenu

The MiCOM P220/P225 relay offers the possibility of saving 5 disturbance records. The data is acquired at a frequency of 32 samples per electrical cycle, i.e. 1600Hz in a 50Hz system or 1920 Hz in 60Hz system, and allows for a very true reconstruction of the analogue signals.

For each recording, the relays memorises:

– the 3 phase currents

– the earth current

– the phase-phase voltage VAC (P225 only), or phase voltage VA, VB, VC (P225 with ‘3 voltage’ inputs).

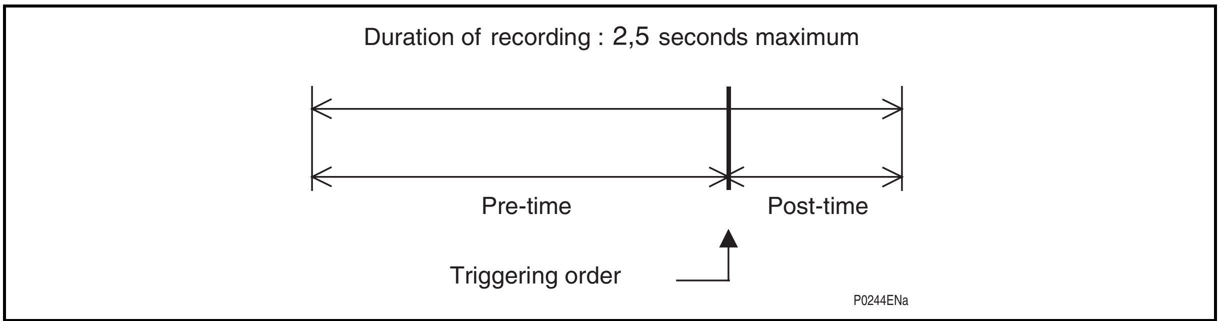
– the frequency

– the state of the 6 (or 11) logic inputs

– the state of all the output relays (including the watchdog relay)

– the date and the time

The total duration of a recording is defined by the configuration of the pre-time and post-time. The pre-time defines the duration of the recording before the disturbance recording triggering order. The post time defines the duration of the recording after the disturbance recording triggering order. In all cases, the total duration of a recording cannot exceed 2.5 seconds.



The triggering of a disturbance recording can be generated:

- when a logic entry programmed on “DIST TRIG” is excited (see section 4.12.4.2.4 Trigging of the disturbance recording)

- on receipt of a remote control from a supervisor on the communications network,

- on receipt of a remote control from MiCOM S1 Studio support software,

- when one of the following occurs (exclusive choice):

  – instantaneous over-stepping of one of the following current thresholds: I>>, Io>, Io>>, V< or V> (instantaneous short-circuit, instantaneous earth fault 1st and 2nd stages, instantaneous under- and overvoltage data respectively)

  – or when output relay RL1 is excited (relay dedicated to the tripping of the cut-off device). The excitement of this relay can be due to the detection of an electrical fault or to a voluntary opening order (opening remote control on the communication network, external order relayed by one of the logic inputs)

The disturbance recordings can be retrieved:

- either using the remote communication network (RS485 rear port(s))

- or using the MiCOM S1 Studio support software (RS232 front port)

NOTE: – If the configuration of the pre-time and post-time corresponds to total recording duration of more than 2.5 seconds then the post-time duration is automatically reduced so that the total recording duration is 2.5 seconds.

– Disturbance recordings are not erasable. They are managed in a circular list: when this is full, the oldest recording is erased.

– When the disturbance recordings are extracted from relay P220/P225 using the MiCOM S1 Studio support software, they are stored in the COMTRADE format.

4.13.3 'CB MONITORING' submenu display of the values related to the cut-off device

In this menu the operator with access to data relating to the cut-off device:

– Summation of the amps exponent "n" switched by the cut-off device for each phase

– Total number of operations of relay RL1

– Opening time of the cut-off device.

NOTE: – These data are those calculated by the relay P220/P225 whilst in the CB SUPERVISION menu the operator with access to the adjustment of the parameters to generate alarm data when a threshold is exceeded.

– The way in which relay P220/P225 calculates its data is explained in the section CB SUPERVISION .

4.14 ALARM messages

The management of the alarms is carried out directly on the front face screen. The display of alarm messages takes priority over that of the value by default (selected in CONFIG. SELECT submenu), so that as soon as an alarm is detected the message is displayed on the MiCOM P220/P225 relay LCD screen.

The alarm messages are classified into 2 categories:

- Motor alarm message
- Relay hardware or software fault, or RTD/thermistor failure message

The display of a HARDWARE ALARM message takes priority over the display of a MOTOR ALARM message.

NOTE: Upon loss of auxiliary power supply, the alarm messages disappear. They are restored upon return of the power supply. The MOTOR ALARM messages.

4.14.1 'ALARM' menu

Data considered as motor alarm are displayed in the MOTOR ALARMS menu.

If several alarms appear, they are written to memory in the order of their detection. They are displayed in reverse chronological order (the most recent alarm first, the oldest last). Each message is numbered and the total number of messages is indicated.

Example

This message indicates an earth fault (time delayed threshold tIo>>). This alarm is the 2nd out of total of 7.

t I0>>	**2/7**

The operator can read all of the alarm messages using the key, without any necessity to key in the password.

The operator can acknowledge the alarms using the Ⓒ key. Keying in the password is not necessary. The operator can acknowledge each message one at a time, or acknowledge all the messages by going to the end of the list and acknowledging all the messages by pressing the Ⓒ key.

NOTE: If an alarm has not been acknowledged, it will not be possible to view the default display programmed by the operator.

4.14.2 The HARDWARE ALARM messages

The safety and availability of the MiCOM P220/P225 relay can be improved by a cyclic auto-test procedure of both hardware and software. Each time the P220/P225 relay is switched on, auto-diagnostic tests are initiated: these tests deal with the output relays (engaging/triggering tests), the microprocessor, the memories (EEPROM checksum calculation, RAM tests) and the acquisition circuit of each analogue input.

The hardware faults are split into 2 groups:

- Minor faults: these are faults classified as non serious (communication fault, analogue output fault, RTD or thermistor failure and internal clock)
- Major faults: these are serious faults (RAM fault, EEPROM data fault, EEPROM calibration fault, analogue signal acquisition fault, watchdog fault)

Any major fault recorded is immediately the subject of an alarm and provokes the activation of the WATCHDOG relay (relay WD, terminals 35-36-37), as well as the switching off of the other output relays.

The acknowledged alarms are all written to memory in the order of their appearance. The display of the alarms is ensured in reverse chronological order (the most recent alarm first, the least recent last). Each message is numbered and the total number of messages is indicated in the top left hand corner of the display.

The operator can read all of the alarm messages using the 🕮 key, without any necessity to key in the password.

The acknowledgement of the relay hardware alarm messages is IMPOSSIBLE. Only the disappearance of the cause of the alarm will provoke their acknowledgement.

The display of a hardware fault (equipment fault) takes priority over the other alarms (non equipment fault).

NOTE: In the case of major hardware alarm and when the trip output relay RL1 has been configured latched, this relay drops out too.

5. AUXILIARY FUNCTIONS

5.1 Event records

The MiCOM P225 relay records 250 state changes in non-volatile memory and dates with a 1ms accuracy. For each state change (event) the relay gives the date, time and label.

This applies to any change of state of the logic inputs/outputs, the alteration of one or several setting parameters, alarm or triggering data. Please refer to Chapter P22x/EN CT/B44 for more information.

The recordings of the consignment of states can be downloaded:

- either using the remote communication network (RS485 rear port(s))
- or using the MiCOM S1 support software (RS232 front port)

NOTE: – These consignments are not erasable. They are managed in a circular list: when this is full, the change of state of the oldest is erased

5.2 Recording of the form of the starting current and voltage

The MiCOM P220/P225 relay records the current waveform and voltage waveform (P225 only) of the latest start. In order to do this, it records every 5 cycles (every 100 ms if the frequency is at 50 Hz) the maximum value of one of the three line currents, and the value of the line-line voltage V_{A-C} (P225 only). The values recorded are expressed in True RMS values.

The recording is initiated following detection by the relay of a motor start up, it stops at the end of the tI_{start} time delay allocated to the start up.

The file containing the recording of the form of the starting current/voltage can be repatriated on a PC:

- either using the remote communication network (RS485 rear port)
- or using the MiCOM S1 Studio support software (RS232 front port). The data will be stored in COMTRADE format.

NOTE: – The maximum duration of a recording is limited to 200 seconds

5.3 Standard remote control via the RS485 communications port

In the AUX OUTPUT RLY sub-menu, it is possible to assign the ORDER1 information to one or several output relays.

A communications command (via the RS485 port) issues the ORDER1 information, which is latched during a fixed 200ms period.

5.4 Block start via the RS485 communications port

In the AUX OUTPUT RLY sub-menu, it is possible to assign the ORDER2 information to one or several output relays.

A communication command (via the RS485 port) issues the ORDER2 information which is latched until another communication command (via the RS485 port) makes the first one drop off.

Inserting an output relay, to which the ORDER2 information has been assigned, into the start coil circuit allows a supervisor to remotely block/authorise a motor re-start.

BLANK PAGE

MENU OF THE HMI

CONTENTS

1. ‘OP. PARAMETERS’ MENU

OP. PARAMETERS	Press the and keys to move around in the OP PARAMETERS menu.
PASSWORD = ********	Modification of the password: key in the old password and confirm it. Then press the key, key in the new password and confirm the whole input with the key. The message NEW PASSWORD OK is displayed to indicate that the password has changed.
LANGUAGE = **ENGLISH**	Indicates the language used in the display. To switch to a different language, press , then choose the desired language using the or arrows.
DESCRIPTION = **P225**	Displays the model of MiCOM relay.
REFERENCE = **XXXX**	Displays your reference code. It contains letters between A and Z. To enter it, press the key for each letter and use the and to move forwards and backwards in the alphabet. After each letter, press the key to enter the next letter. At the end of the input, press the key to confirm your reference code.
SOFTWARE VERSION =	Displays the software version code.
FREQUENCY = **50 Hz**	Acquisition of the reference frequency of the electrical power system. There is a choice of: 50 Hz or 60 Hz.
ACTIVE PHASE **SEQUE = A B C**	Displays the active phase sequence
ACTIVE SETTING = **GROUP 1**	Displays the active setting group number: 1: PROTECTION Group 1 active 2: PROTECTION Group 2 active
INPUTS 6 5 4 3 2 1 **ST = 0 0 0 0 0 0**	Displays the state of the 6 binary inputs (or 11 binary inputs with option “5 digital inputs”). The binary inputs are numbered from 1 to 6 starting from the right. The state of each binary input is displayed immediately below: - state 0: input inactive - state 1: input active (state of 11 binary inputs is displayed with option
OUTPUTS 5 4 3 2 1 **ST = 0 0 0 0 0**	Displays the state of the output relays. The output relays are numbered from 1 to 5 starting from the right. The status of each output relay is displayed immediately below: - state 0: output inactive - state 1: output active
DATE **14/09/00**	Selection and display of the date.
TIME **16:35:30**	Selection and display of the time.

2. ‘ORDERS’ MENU

This menu gives the possibility:

– to send start and stop orders to the motors from the front panel,

– to clear LEDs, alarms and records.

ORDERS	Press the and keys to enter in the ORDERS menu.
General Reset **No**	“General reset” clears LEDs, alarms, counters, disturbance records, fault records, starting records, event records, measurements values (maximum and average phase currents, energies, thermal status…), CB monitoring records (“S A 2 n” and “CB OPERATION NB” 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.
Start Motor **No**	Sends manually a start command from the local control panel to the motor. Setting range: No, Yes. (the “confirmation ?” cell will be displayed after setting change).
Stop Motor **No**	Sends manually a stop command from the local control panel to the motor Setting range: No, Yes (the “confirmation ?” cell will be displayed after setting change)

3. 'CONFIGURATION' MENU

3.1 'CONFIG. SELECT' submenu

CONFIGURATION	Press the and keys to enter the CONFIGURATION menu then press the and keys to go into submenus.
CONFIG. SELECT	To move about in the CONFIG. SELECT submenu, use the and keys.
SET GRP CHANGE **INPUT = LEVEL**	Selection and display of the way to switch over from one setting group to another. The active setting group can be performed either on a transition (edge) or depending on a level. If "LEVEL" is set, the active group depends on the "SET GROUP" parameter (assigned to a logic input, see section 9.4): - "SET GROUP" low: "PROTECTION G1" is active, - "SET GROUP" high: "PROTECTION G2" is active, Otherwise ("EDGE" set), any local or remote control (RS 232, RS 485 ports, or logic input configured) sets the protection group. Choice of: EDGE or LEVEL
SETTING GROUP **1**	Selection and display of the configuration group. This cell appears only if the above EDGE mode has been selected. Choice of: group 1 or group 2 1: PROTECTION G1 2: PROTECTION G2
DEFAULT DISPLAY **IA RMS**	Selection and display of a default value. Choice of :IA RMS, IB RMS, IC RMS, IN RMS, THERM ST, % I LOAD, TbefSTART, TbefTRIP, VAC RMS, POWER FACT, WATTs or VARs.
PHASE ROTATION **Menu**	Selection of the phase rotation detection. When "menu" is set, the "PHASE SEQUENCE" cell is displayed and the user can select phase rotation sequence using this cell. When the detection of the change phase sequence is provided by a digital input wired to the relay, the "Input" selection makes possible to detect phase rotation sequence using a digital input (assigned to this function using "Automat. Ctrl, Phase rotat." Menu) Choice of: "Menu" or "Input"
PHASE SEQUENCE **A B C**	This cell is displayed when "PHASE ROTATION" setting is set to "Input". It allows phase rotation selection between either A-B-C or A-C-B
START DETECTION **52 A + I**	Selection and display of the start detection criterion. Choice of: 52A or 52A + I
ANALOG. OUTPUT **0 - 20 mA**	Selection and display of the analog output type: 0-20 mA or 4-20 mA (optional).

DATA TYPE ANALOG 1 IA RMS	Selection and display of the value transmitted by the analog output n°1(optional). Choice of: IA RMS, IB RMS, IC RMS, IN RMS, THERM ST, % I LOAD, TbefSTART, TbefTRIP, VAC RMS, POWER FACT, WATTs, VARs, T°C RTD1, T°C RTD2, T°C RTD3, T°C RTD4, T°C RTD5, T°C RTD6. P225 only: T°C RTD7, T°C RTD8, T°C RTD9, T°C RTD10. No Hottest RTD.
DATA TYPE ANALOG 2 WATTs	Selection and display of the value transmitted by the analog output n°2 (optional). Choice: idem as above.
MAX VALUE ANALOG 2 1 MW	Configuration of the maximum analog output rating if a power value is selected. Choice of: 10KW, 50KW, 100KW, 200KW, 500KW, 1MW, 10MW, 500 MW, 1GW, 4GW (if reactive power, VAR value).
RTD type = PT100	Selection and display of the type of RTD temperature probe (optional): PT100, Ni100, Ni120 or Cu10.
Thermist 1 type = PTC	Selection and display of the type of thermistor 1 (optional). Choice of: PTC or NTC.
Thermist 2 type = NTC	Selection and display of the type of thermistor 2 (optional). Choice of: PTC or NTC.
Thermist 3 type = PTC	P225 only: Selection and display of the type of thermistor 3 (optional). Choice of: PTC or NTC.
Time Synchro Automatic	Sets the time synchronization mode. 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 setting only with optional IRIG-B relays)
IRIG-B Modulated	Optional: Selects the modulated or unmodulated IRIG-B synchronization signal (see section P22x/EN IN) Setting choice: Modulated/Demodulated

3.2 'CT/VT RATIO' submenu

CONFIGURATION	Press the and keys to enter the CONFIGURATION menu then press the and keys To go into configuration submenus.
CT/VT RATIO	To move about in the CT/VT RATIO submenu, press the and keys.
LINE CT PRIM = ****	Selection and display of the primary rating of the phase CT. The value is entered on 4 figures: from 1 to 3000 in steps of 1.
LINE CT SEC = *	Selection and display of the secondary rating of the phase CT. The value is to be selected between either 1 or 5.
E/GND CT PRIM = ****	Selection and display of the primary rating of the earth CT. The value is entered on 4 figures: from 1 to 3000 in steps of 1.
E/GND CT SEC = *	Selection and display of the secondary rating of the earth CT. The value is to be selected between either 1 or 5.

LINE VT PRIM =
****

P225 only. Selection and display of the primary VT rating. The value is entered on 5 digits: from 1 to 20000 in steps of 1.

LINE VT SEC =
****

P225 only. Selection and display of the secondary VT rating. The value is entered on 3 digits.
Two ranges: 57 - 130 Volt or 220 - 480 Volt.

3.3 'LED' submenus

CONFIGURATION

Press the and keys to enter the CONFIGURATION menu then press the and keys to go into submenus.

LED 5

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.

THERM OVERLOAD?
YES

To link LED 5 with the «thermal overload» function so that it lights up if the thermal overload function operates, press , select YES by using the and keys, then press again to confirm.

Setting Choice: Yes or No. The default value is No (except "THERM OVERLOAD?"=Yes)

<u>MiCOM S1 Studio setting:</u>

A double click on LED 5 (6, 7 or 8) displays LEDs submenus. Each submenu contains several lines parameter settings. In the value column, the first value (function) is displayed. If several values (or functions) are selected, an arrow ("-->") is added to the first value selected.

<u>P22x Front panel setting:</u>

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.

The next table indicates the functions that can be assigned to the LEDs (5 to 8) for each MiCOM relay model:

Function	P220	P225	"YES" links the LED to…
THERM OVERLOAD?	●	●	The LED will indicate the thermal overload function operating
θALARM?	●	●	Thermal overload alarm threshold θ_{ALARM}.
tI>?	●	●	Time delayed 1st phase overcurrent threshold tI> (protection against Phase OC)
tI>>?	●	●	Time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)
tI>>>?	●	●	Time delayed 3rd phase overcurrent threshold tI>>> (protection against Phase OC)
tI0>?	●	●	Time delayed 1st earth overcurrent threshold tI0>
tI0>>?	●	●	Time delayed 2nd earth overcurrent threshold tI0>>

Function	P220	P225	"YES" links the LED to…
tI2>?	●	●	Time delayed 1st negative phase sequence overcurrent threshold tI2> (protection against unbalances)
tI2>>?	●	●	Time delayed 2nd negative phase sequence overcurrent threshold tI2>> (protection against unbalances)
tI<?	●	●	Time delayed undercurrent threshold tI< (protection against undercurrent/loss of load)
EXCES LONG START?	●	●	Time delayed threshold tI_{start} (protection against excessive long starts)
tIstall ?	●	●	Time delayed threshold tI_{stall} (protection against rotor stalling when the motor is running)
LOCKED ROTOR?	●	●	Function «rotor locked on starting»
EMERG RESTART?	●	●	«emergency restart» information
FORBIDDEN START?	●	●	«forbidden start» information
t RTD 1,2,3 ALARM?	●	●	Time delayed thresholds $t_{RTD1\ ALARM}$, $t_{RTD2\ ALARM}$ and $t_{RTD3\ ALARM}$ (temperature protection: optional).
t RTD 1,2,3 TRIP?	●	●	Time delayed thresholds $t_{RTD1\ TRIP}$, $t_{RTD2\ TRIP}$, and $t_{RTD3\ TRIP}$ (temperature protection: optional)
t RTD 4,5,6 ALARM?	●	●	Time delayed thresholds $t_{RTD4\ ALARM}$, $t_{RTD5\ ALARM}$ and $t_{RTD6\ ALARM}$ (temperature protection: optional)
t RTD 4,5,6 TRIP?	●	●	Time delayed thresholds $t_{RTD4\ TRIP}$, $t_{RTD5\ TRIP}$, and $t_{RTD6\ TRIP}$ (temperature protection: optional)
t RTD 7,8,9,10 ALARM?		●	Time delayed thresholds $t_{RTD7\ ALARM}$, $t_{RTD8\ ALARM}$, $t_{RTD9\ ALARM}$ and $t_{RTD10\ ALARM}$ (temperature protection: optional)
t RTD 7,8,9,10 TRIP?		●	Time delayed thresholds $t_{RTD7\ TRIP}$, $t_{RTD8\ TRIP}$, $t_{RTD9\ TRIP}$ and $t_{RTD10\ TRIP}$ (temperature protection: optional)
Thermist 1,2?	●		Time delayed temperature thresholds Thermist 1 and Thermist 2 3 (temperature protection: optional).
Thermist 1,2,3?		●	Time delayed temperature thresholds Thermist 1, Thermist 2 and Thermist 3 (temperature protection: optional).
tAux 1 ? … tAux 10 ?	●	●	Copy of Aux1 to Aux 10 logic inputs delayed by Aux1 to Aux6 timers (logic inputs and auxiliary timers are set with “automat ctrl/inputs” menu)
MOTOR STOPPED ?	●	●	Indication with the information «motor stopped».
MOTOR RUNNING ?	●	●	Indication with the information «motor running».
SUCCESSFUL START?	●	●	Information «successful start».
tV< ?		●	Time delayed undervoltage threshold tV< (undervoltage protection)
VOLTAGE DIP ?	●	●	Load shedding information further to a voltage dip (cf. re-acceleration authorization).
tV> ?		●	Time delayed overvoltage threshold tV< (overvoltage protection)
BUS VOLTAGE ?		●	BUS VOLTAGE information (Bus voltage too low to enable start).
AUTO RESTART?		●	Auto Restart

Function	P220	P225	"YES" links the LED to…
CB FAIL ?	●	●	Detection of a Circuit Breaker failure (CB not open at the end of tBF timer)
TRIP CIRCUIT FAIL ?	●	●	TRIP CIRCUIT FAIL information (open trip circuit).
INPUT 1 ? … INPUT 6 ?	●	●	Copy of the status of logic inputs ("automat ctrl/inputs" menu)
t Equ.A … t Equ.H	●	●	Results of equations A to H.

3.4 'ALARM CONFIG.' submenu

CONFIGURATION	Press the and keys to enter the CONFIGURATION menu then press the and keys to go into submenus.
ALARM CONFIG.	To move about in the ALARM CONFIG. menu, press the and keys.
Inh. Alarm tAux1 **No**	Inhibit Alarm tAux1 Yes: the "tAux1" will not raise an alarm: Alarm LED stays OFF, no message will be displayed on the HMI. No: the "tAux1" will raise an alarm. Setting choice, Yes or No. 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 tAux1"= yes, "Aux1" 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.

Trip	Label description	P220	P225
Inh Alarm tAux1 … Inh Alarm tAux10	Inhibition of Aux1 (to Aux 10) delayed by tAux1 (to tAux 10) timer alarm	●	●
Inh Alarm I<	Inhibition of Instantaneous undercurrent threshold I< alarm (protection against undercurrent/loss of load)	●	●
Inh Alarm tEqu.A … Inh Alarm tEqu.H	Inhibition of logical output of boolean equation A to equation H alarms.	●	●

3.5 'INPUT CONFIG.' Submenu

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 the state of logic input number 2 is 1, then tAux1 = 0 when logic input is 1 and tAux1 = 1 when logic input is 0.

CONFIGURATION	Press the and keys to enter the CONFIGURATION menu then press the and keys to go into submenus.
INPUT CONFIG.	Heading of input configuration menu. To move about in the INPUT CONFIG. Menu, press the and keys
INPUT 6 5 4 3 2 1 **PICK-UP 1 1 1 1 1 1**	To configurate the active/inactive state of each binary input, press the key, use the and keys, then confirm your choice pressing the key. 0: inactive state when a control voltage is applied on. 1: active state when a control voltage is applied on. (the number of inputs depends on the relay option)
CONTROL VOLT = **DC**	Configuration of the control voltage type necessary to power on the binary inputs. Choice: DC: Direct current voltage Vdc AC: Alternative current voltage Vac

4. 'MEASUREMENTS 1' & 'MEASUREMENTS 2' SUBMENUS

MEASUREMENTS 1	Heading of the Measurements 1 menu. To gain access to the MEASUREMENTS 1 menu from the default display, press then until the menu is reached. Press the and keys to move about in the MEASUREMENTS 1 menu.
IA RMS = 0.00 A	Display of the current of phase A (true RMS value) taking into account the phase CT ratio (CT/VT RATIO submenu).
IB RMS = 0.00 A	Display of the current of phase B (true RMS value) taking into account the phase CT ratio (CT/VT RATIO submenu).
IC RMS = 0.00 A	Display of the current of phase C (true RMS value) taking into account the phase CT ratio (CT/VT RATIO submenu).
IN RMS = 0.00 A	Display of the earth current (true RMS value) taking into account the earth CT ratio (CT/VT RATIO submenu).
VA RMS = 0.00 V	P225 only (optional). Display of the voltage of phase A (true RMS value) taking into account the phase VT ratio (CT/VT RATIO submenu).
VB RMS = 0.00 V	P225 only (optional). Display of the voltage of phase B (true RMS value) taking into account the phase VT ratio (CT/VT RATIO submenu).
VC RMS = 0.00 V	P225 only (optional). Display of the voltage of phase C (true RMS value) taking into account the phase VT ratio (CT/VT RATIO submenu).
V1 POSITIVE= 0.00 A	P225 only. Display of the positive sequence voltage.
V2 NEGATIVE = 0.00 A	P225 only. Display of the negative sequence oltage.
V0 ZERO = 0.00 A	P225 only. Display of the zero sequence voltage.
VAB RMS = 0.00 V	P225 only (optional). Display of the phase A - phase B voltage (true RMS value) taking into account the VT phase ratio (CT/VT RATIO submenu).
VBC RMS = 0.00 V	P225 only (optional). Display of the phase B - phase C voltage (true RMS value) taking into account the VT phase ratio (CT/VT RATIO submenu).
VCA RMS = 0.00 V	P225 only. Display of the phase A - phase C voltage (true RMS value) taking into account the VT phase ratio (CT/VT RATIO submenu).
I1 POSITIVE= 0.00 A	Display of the positive sequence current.
I2 NEGATIVE = 0.00 A	Display of the negative sequence current.
I0 ZERO = 0.00 A	Display of the zero sequence current.
FREQUENCY = 0.0 Hz	Display of the frequency of the power system supplying the motor, calculated from the voltage or the phase current signals.

MAX PH CURRENT = **CLR? = CL 0.00 A**	Display of the maximum phase current value outside the starting period.
I2/I1 RATIO = ********	Display of the ratio negative sequence on positive sequence of the current.

NOTE: The 3 phase currents, the earth current and the line voltage are displayed as true RMS values: taking into account up to the 10^{th} harmonic at 50 Hz and up to the 8^{th} at 60 Hz.

MEASUREMENTS 2	Heading of the trip statistics menu. P225 only. To gain access to the MEASUREMENTS 2 menu from the default display, press then until the menu is reached. Press the and keys to move about in the MEASUREMENTS 2 menu.
WATTs ZERO= **kW 0.00**	P225 only. Display of the active power taking into account the CT and VT phase ratio (CT/VT RATIO submenu).
VARs = **kVAR 0.00**	P225 only. Display of the reactive power taking into account the CT and VT phase ratio (CT/VT RATIO submenu).
VAs = **kVA 0.00**	P225 only. Display of the «apparent» power taking into account the CT and VT phase ratio (CT/VT RATIO submenu).
WATT-Hours = **MWh 67.83**	P225 only. Display of the active energy taking into account the CT and VT phase ratio (CT/VT RATIO submenu).
VAR-Hours= **MVARh 25.24**	P225 only. Display of the reactive energy taking into account the CT and VT phase ratio (CT/VT RATIO submenu).
POWERHours RESET **CLR = [C]**	P225 only. Resetting of the active and reactive energy meters: press the key.
POWER FACTOR = **0.00**	P225 only. Display of the power factor.

5. 'PROCESS' MENU

PROCESS	Heading of the process menu. To gain access to the PROCESS menu from the default display, press ⇩ then ⇨ until the menu is reached. Press the ⇩ and ⇧ keys to move about in the PROCESS menu.
% I FLC **0 %**	Display of the current flowing into the motor as a percentage of the thermal current threshold Iθ>.
THERMAL STATE = **CLR? =[C] 0 %**	Display of the thermal state of the motor (tripping at 100 %). For the test phases of the P220/P225 relay, you can reset the thermal state to zero by pressing the key C.
T before TH TRIP *** * * ***	Display of the time before thermal tripping occurs, once the thermal alarm threshold θ_{ALARM} is exceeded.
Temperature **RTD 1= °C**	Display of the temperature of the RTD1 (optional) and similarly for RTD2, RTD3, RTD4, RTD5 and RTD6 (P220), RTD7, RTD8, RTD9 and RTD10 (P225).
No Hottest RTD **5**	Display of the hottest RTD number.
PERMIT START NB *** * * ***	Display of the number of starts permitted.
T before START **0 s**	Display of the time to wait before a new start is permitted.
Last Start I= **0.0 A**	Display of the current of the last start.
Last Start Time **0 s**	Display of the duration of the last start.
MOTOR START NB **CLR = [C] 0**	Display of the number of starts of the motor. To reset to zero, press C key.
EMERG RESTART NB **CLR = [C]**	Display of the number of emergency starts. To reset to zero, press C key.
MOT RUN. HOURS **CLR = [C] 0 h**	Display of the number of running hours of the motor. To reset to zero, press the C key.

6. 'TRIP STATISTICS' MENU

TRIP STATISTICS	Heading of the trip statistics menu. To gain access to the TRIP STATISTICS menu from the default display, press then until the menu is reached. Press the and keys to move about in the TRIP STATISTICS menu.
STATISTICS CLR = [C] NO	To reset all the tripping statistics to zero, press key .
TOTAL TRIP NB 0	Display of the total number of tripping operations (with and without fault).
OPERATOR TRIP NB 0	Display of the number of deliberate tripping operations (without fault).
THERM TRIP NB = 0	Display of the number of tripping operations caused by a thermal overload.
t I >> TRIP NB = 0	Display of the number of tripping operations caused by a short-circuit.
t IO>, t IO>> TRIP NB = 0	Display of the number of tripping operations caused by an Earth fault.
t I2 >, t I2 >> TRIP NB = 0	Display of the number of tripping operations caused by an unbalance.
tV< TRIP NB = 0	Display of the number of tripping operations caused by an undervoltage.
tV> TRIP NB = 0	Display of the number of tripping operations caused by an overvoltage.
VOLTAGE DIP TRIP NB = 0	Display of the number of tripping operations caused by a load shedding further to a voltage dip.
t Istart TRIP NB = 0	Display of the number of tripping operations caused by an excessively long start.
t Istall TRIP NB = 0	Display of the number of tripping operations caused by a stalled rotor while the motor is running.
LOCKED ROT TRIP NB = 0	Display of the number of tripping operations caused by a locked rotor when starting.
t I < TRIP NB = 0	Display of the number of tripping operations caused by the protection against undercurrents/loss of load.
RTD1 TRIP NB = 0	Display of the number of tripping operations caused by the temperature protection function by RTD1 (optional) and so on for RTD2, RTD3, RTD4, RTD5, RTD6, RTD7, RTD8, RTD9 and RTD10 (optional)
Thermist 1 TRIP NB = 0	Display of the number of tripping operations caused by the temperature protection function by thermistor 1 (optional) dito for thermistor 2 and thermistor 3 (optional).
EQUATION A TRIP NB = 0	Display of the number of tripping operations caused by the validation of equation A, dito for equations B to H.

7. 'COMMUNICATION' MENU

The COMMUNICATION menu depends on the type of communications protocoland on the connection type (optional second rear port configuration)

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

COMMUNICATION	Heading of COMMUNICATION menu.
COMM1 ? **No**	Select Yes in order to use the first communication port. Setting choice: Yes or No
COMM2 ? **No**	P22x 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.

7.1 '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 **Without**	Choose the parity in the ModBus data frame. Select parity: Even, Odd or Without
Stop Bits **1**	Choose the number of stop bits. Select 1 or 2 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.

8. 'PROTECTION G1' AND G2 MENUS

The protection menus are designated as PROTECTION G1 and PROTECTION G2 menus. 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.

8.1 'START CRITERIA' submenu

The start criteria menu contains setting relating starting characteristics of the motor (start detection and time for start-up)

PROTECTION G1	Heading of the PROTECTION G1menu. To gain access to the ROTECTION G1 menu from the default display, press then until the menu is reached. Press the and keys to enter the PROTECTION G1 menu.
START CRITERIA	This menu header contains two important setting thresholds that are used by several protection functions and should be set before the relay is commissioned. These thresholds relate to starting characteristic of the motor under control/protection.
Iutil = **1 In**	This threshold should be set to a typical value of twice the rated current of the motor. It is used by the relay to detect successful start of the motor. The range is from 0.5 In to 5.0 In in steps of 0.01 In.
t Istart = **1 s**	This threshold should be set according to the motor data sheet if available or a typical value pertaining to the motor being protected. This threshold defines the time it takes for the motor to start up. The range is from 1 s to 200 s in steps of 1 s.

8.2 '[49] THERMAL OVERLOAD' submenu

PROTECTION G1	Heading of the PROTECTION G1menu. To gain access to the ROTECTION G1 menu from the default display, press then until the menu is reached. Press the and keys to enter the PROTECTION G1 menu.
[49] THERMAL OVERLOAD	To move about in the [49] THERMAL OVERLOAD submenu, press the and keys. To enter the other submenus, press the and keys.
THERMAL OVERLOAD? FUNCT? YES	To switch on the «thermal overload» function: press the key, select YES using the and keys. To confirm the selection, press the key.
therm INHIBIT? **YES**	To switch on the «thermal inhibition on starting» function: press the key, select YES using the and keys. To confirm the selection, press the key.
I flc > = **0.2 In**	Setting of the thermal overload current threshold $I\theta$>: from 0,2 In to 1,5 In in steps of 0,01 In.
Ke = **3**	Setting of the value of the negative sequence contribution factor K_e in the thermal image: from 0 to 10 in steps of 1.
Te1 = **1 mn**	Setting of the value of the overload time constant T_{e1}: from 1 to 180 min in steps of 1 min.

Te2 = **1 mn**	Setting of the starting time constant value T_{e2}: from 1 to 360 min in steps of 1 min.
Tr = **1 mn**	Setting of the value of the cooling time constant T_r: from 1 to 999 min in steps of 1 min.
RTD1 INFLUENCE? **YES**	To switch on the «influence of a RTD temperature» function (optional): press the key, select YES by using the and keys. To confirm the selection, press the key.
therm ALARM? **YES**	To switch on the «thermal alarm» function: press the key, select YES by using the and keys. To confirm the choice, press the key. YES choice will display the "Therm alarm" setting.
therm ALARM = **20 %**	Setting of the thermal alarm threshold value θ_{ALARM}: from 20% to 100% in steps of 1%.
therm FORBID START? **YES**	To switch on the «thermal inhibition of start» function: press the key, select YES by using the and keys. To confirm the choice, press the key. YES choice will display the "Therm FORBID STA" setting.
therm FORBID START? **20 %**	Setting of the threshold value for thermal inhibition of start $\theta_{FORBID\ START}$: from 20% to 100% in steps of 1%.

8.3 '[50/51] PHASE OVERCURRENT' submenu

8.3.1 First stage overcurrent threshold (I>) protection

PROTECTION G1	Press the and keys to enter the PROTECTION G1 menu.
[50/51] PHASE OVERCURRENT	To move about in the [50/51] PHASE OVERCURRENT submenu, press the and keys. To enter the others submenus, press the an keys.
I> FUNCTION? **YES**	To switch on the first stage «phase overcurrent» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
I > **1.0 In**	Setting of the first stage of phase overcurrent current threshold value I>: from 0.10 to 25.00 In in steps of 0.05 In.
Delay Type IDMT	Setting of the first stage phase OC delay type. Selection of DMT (definite minimum time), IDMT (inverse time delay curve) or RI (electromechanical inverse time curve).

If Delay type = DMT

tI > **150.00 s**	Sets the time delay associated with I>. The setting range is from 0.040 to 150.0s (step 10ms).
t Reset 0 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s by steps of 0.01 s.

If Delay type = IDMT:

Idmt **SI (IEC)**	Setting of the first stage phase OC tripping characteristic: Reset Delay Type (when IDMT has been selected as delay type). Selection of IEC (STI, SI, VI, EI, LTI and RC), CO2 (SEI), ANSI (MI, VI, EI) and CO8 (LTI).
INTERLOCK I>> I>>> **NO**	Setting to interlink first stage with second and third stage characteristics.
TMS **0.025**	Time multiplier setting to adjust the operating time of the IEC IDMT characteristic. From 0.025 to 1.5 in steps of 0.001.
Reset Delay Type **DMT**	if “idmt” = 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 “idmt” = 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 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s in steps of 0.01.

If Delay type = RI:

K **0.1**	Time multiplier setting to adjust the operating time for the RI curve. From 0.100 to 10.00 in steps of 0.001.
t Reset 0 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s in steps of 0.01.

8.3.2 Second stage overcurrent threshold (I>>) protection

I>> FUNCTION? **YES**	To switch on the second stage «phase OC» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
I >> **1.0 In**	Setting of the second stage phase OC current threshold value I>>: from 0.5 to 40.0 In in steps of 0.05 In.
Delay Type IDMT	Setting of the second stage phase OC delay type. Selection of DMT (definite minimum time), IDMT (inverse time delay curve) or RI (electromechanical inverse time curve).

If Delay type = DMT

tI >> **150.00 s**	Sets the time delay associated with I>>. The setting range is from 0.040 to 150.0s (step 10ms).
t Reset 0 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s in steps of 0.01.

If Delay type = IDMT:

Idmt **SI (IEC)**	Setting of the first stage phase OC tripping characteristic: Reset Delay Type (when IDMT has been selected as delay type). Selection of IEC (STI, SI, VI, EI, LTI and RC), CO2 (SEI), ANSI (MI, VI, EI) and CO8 (LTI).

TMS **0.025**	Time multiplier setting to adjust the operating time of the IEC IDMT characteristic. From 0.025 to 1.5 in steps of 0.001.
Reset Delay Type **DMT**	if “idmt” = 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 “idmt” = 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 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s in steps of 0.01.

If Delay type = RI:

K **0.1**	Time multiplier setting to adjust the operating time for the RI curve. From 0.100 to 10.00 in steps of 0.001.
t Reset 0 s	Reset/release time setting for definite time reset characteristic. From 0.00 s to 600.0 s in steps of 0.01.

8.3.3 Third stage overcurrent threshold (I>>>) protection

I>>> FUNCTION? **YES**	To switch on the third stage «phase overcurrent» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
I >>> = **1.0 In**	Setting of the DMT third stage of phase overcurrent current threshold value I>>>: from 0.50 to 40.00 In in steps of 0.05 In.
t I >>> = **0.01 s**	Setting of the time delay tI>>> associated with the I>>> threshold: from 0.00 to 150.00 s in steps of 0,01 s.

8.4 ‘[50N/51N] EARTH FAULT’ submenu

8.4.1 First stage earth overcurrent threshold (I0>) protection

PROTECTION G1	Press the and keys to enter the PROTECTION G1 menu.
[50N/51N] EARTH FAULT	To move about in the [50N/51N] EARTH FAULT submenu, press the and keys. To enter the other submenus, press the and keys.
I0> FUNCTION? **YES**	To switch on the «Earth fault» function (Io> threshold): press the key, select YES by using the and keys. To confirm the selection, press the key.
I0> = **0.002 Ien**	Setting of the first earth fault current threshold value Io>: from 0,002 to 1 Ien in steps of 0,001 Ien.
t I0> = **0 s**	Setting of the tIo> time delay associated with the Io> threshold: from 0 to 100 s in steps of 0,01 s.

8.4.2 Second stage earth overcurrent threshold (I0>>) protection

I0>> FUNCTION? **YES**	To switch on the «Earth fault» function (Io>> threshold): press the key, select YES by using the and keys. To confirm the selection, press the key.
I0>> = **0.002 Ion**	Setting of the second earth fault current threshold value Io>>: from 0,002 to 1 Ien in steps of 0,001 Ien.
t I0>> = **0 s**	Setting of the tIo>> time delay associated with the Io >> threshold: from 0 ms to 100 s in steps of 0,01 s.

8.5 '[46] UNBALANCE' submenu

8.5.1 First stage unbalance threshold (I2>) protection

PROTECTION G1	Press the and keys to enter the PROTECTION G1 menu.
[46] UNBALANCE	To move about in the [46] UNBALANCE submenu, press the and keys. To enter the other submenus, press the and keys.
I2> FUNCTION? **YES**	To switch on the «unbalance» function (I2> threshold): press the key, select YES by using the and keys. To confirm the selection, press the key.
I2 > = **0.01 In**	Setting of the first unbalance current threshold value I2>: from 0,04 to 0,8 In in steps of 0,001 In.
t I2 > = **0 s**	Setting of the tI2> time delay associated with the I2> threshold: from 0 ms to 200 s in steps of 0,01 s.

8.5.2 Second stage unbalance threshold (I2>>) protection

I2>> FUNCTION? **YES**	To switch on the «unbalance» function (I2>> threshold): press the key, select YES by using the and keys. To confirm the selection, press the key.
TMS I2>> = **1**	Setting of the TMS time multiplier value of the curve associated with the I2>> threshold: from 0,2 to 2 in steps of 0,001.
I2 >> = **0.01 In**	Setting of the second unbalance current threshold value I2>>: from 0,04 to 0,8 In in steps of 0,001 In.

8.6 '[27] UNDERVOLTAGE' submenu (P225 only)

PROTECTION G1	Press the and keys to enter the PROTECTION G1 menu.
[27] UNDERVOLTAGE	To move about in the [27] UNDERVOLTAGE submenu, press the and keys. To enter the other submenus, press the and keys.
V< FUNCTION? **YES**	To switch on the «undervoltage» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
V< = **5 V**	Setting of the undervoltage threshold value V<: from 5 to 130 Volt or 20 to 480 Volt.
t V<= **0 s**	Setting of the tV< time delay associated with the V< threshold: from 0 to 600 s in steps of 0,01 s.
INHIB V<? **YES**	Inhibition of the [27] UNDERVOLTAGE function during the motor start sequence.

8.7 '[59] OVERVOLTAGE' submenu (P225 only)

PROTECTION G1	Press the and keys to enter the PROTECTION G1 menu.
[59] OVERVOLTAGE	To move about in the [59] OVERVOLTAGE submenu, press the and keys. To enter the other submenus, press the and keys.
V> FUNCTION? **YES**	To switch on the «overvoltage» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
V> = **5 V**	Setting of the overvoltage threshold value V>: from 5 to 260 Volt or from 20 to 960 Volt.
t V>= **0 s**	Setting of the tV> time delay associated with the V> threshold: from 0 to 600 s in steps of 0,01 s.

8.8 '[48] EXCES LONG START' submenu

PROTECTION G 1	Press the and keys to enter the PROTECTION G1 menu.
[48] EXCES LONG START	To move about in the [48] EXCES LONG START submenu, press the and keys. To enter the other submenus, press the and keys.
EXCES LONG START FUNCT? **YES**	To switch on the «excessively long start» function: press the key, select YES by using the and keys. To confirm the selection, press the key.

8.9 '[51LR/50S] BLOCK ROTOR' submenu

PROTECTION G 1	Press the and keys to enter the PROTECTION G1 menu (P225 only).
[51LR-50S] BLOCK ROTOR	To move about in the [51LR/50S] BLOCK ROTOR submenu, press the and keys. To enter the other submenus, press the and keys.
BLOCKED ROTOR FUNCTION? YES	To switch on the «blocked rotor» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
t Istall = 0,1 s	Setting of the blocked rotor tI_{stall} time delay associated with the I_{stall} current threshold: from 0,1 to 60 s in steps of 0,1 s.
STALLED ROTOR? YES	To switch on the «stalled rotor with motor running» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
Istall DETECTION = 1.0 In	Setting of the stalled rotor detection current threshold I_{stall}: from 0.50 to 5.00 In in steps of 0.01 In.
LOCKED ROTOR AT START? YES	To switch on the «locked rotor at start» function: press the key, select YES by using the and keys. To confirm the selection, press the key. Setting choice: NO, PF (Power Factor) or Input
Power Factor 0.5	P225 only. Sets the Power factor for "locked rotor at start". If the power factor is below theis setting, the motoot will operate as "speed switch" open. From 0.01 to 1 by steps of 0,01 s

8.10 '[37] LOSS OF LOAD' submenu

PROTECTION G 1	Press the and keys to enter the PROTECTION G1 menu.
[37] LOSS OF LOAD	To move about in the [37] LOSS OF LOAD submenu, press the and keys. To enter the other submenus, press the and keys.
I< FUNCTION? YES	To switch on the «undercurrent» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
I < = 0.1 In	Setting of the undercurrent threshold value I<: from 0,1 to 1 In in steps of 0,01 In.
t I < = 0.2 s	Setting of the tI< time delay associated with the I< threshold: from 0,2 to 100 s in steps of 0,1 s.
T inhib = 0.05 s	Setting of the inhibition time of the «undercurrent/loss of load» function on starting T_{inhib}: from 0.05 s to 300 s in steps of 0.01 s.

8.11 '[49/38] RTD' submenu (optional)

PROTECTION G 1	Press the ▼ and ▲ keys to enter the PROTECTION G1 menu.
[49/38] RTD	To move about in the [49/38] RTD submenu (P22x with RTD option only), press the ▼ and ▲ keys. To enter the other submenus, press the ◄ and ► keys.
RTD 1 FUNCTION? **YES**	To switch on the temperature protection function using RTD 1: press the ↵ key, select YES by using the ▼ and ▲ keys. To confirm the selection, press the ↵ key.
RTD 1 ALARM = **0°C**	Setting of the alarm temperature threshold value for RTD1 ALARM: from 0 to 200°C in steps of 1°C.
t RTD 1 ALARM = **0.0 s**	Setting of the $t_{RTD1\ ALARM}$ time delay associated with the RTD1 ALARM threshold: from 0 to 100 s in steps of 0,1 s.
RTD 1 TRIP = **0°C**	Setting of the tripping temperature threshold value for RTD1 TRIP: from 0 to 200°C in steps of 1°C.
t RTD 1 TRIP = **0.0 s**	Setting of the $t_{RTD1\ TRIP}$ time delay associated with the RTD1 TRIP threshold: from 0 to 100 s in steps of 0,1 s. …and so on for the RTD2, RTD3 (P220 & P225), RTD4, RTD5, RTD6, RTD7, RTD8, RTD9 and RTD10 (P225 only).

8.12 '[49] THERMISTOR' submenu (optional)

PROTECTION G 1	Press the ▼ and ▲ keys to enter the PROTECTION G1 menu .
[49] THERMISTANCE	To move about in the [49] THERMISTANCE submenu (P22x with thermistors monitoring option only), press the ▼ and ▲ keys. To enter the other submenus, press the ◄ and ► keys.
Thermistance 1 **YES**	To switch on the temperature protection function using thermistor 1: press the ↵ key, select YES by using the ▼ and ▲ keys. To confirm the selection, press the ↵ key.
Thermist 1 = **0.1 kΩ**	Setting of the resistance threshold value for Thermistor 1: from 0.10 to 30.00 KΩ in steps of 0.10 KΩ.
Thermistance 2 **YES**	To switch on the temperature protection function using thermistor 2: press the ↵ key, select YES by using the ▼ and ▲ keys. To confirm the selection, press the ↵ key.
Thermist 2 = **0.1 kΩ**	Setting of the resistance threshold value for Thermistor 2: from 0.10 to 30.00 KΩ in steps of 0.10 KΩ.
Thermistance 3 **YES**	P225 only: To switch on the temperature protection function using thermistor 3: press the ↵ key, select YES by using the ▼ and ▲ keys. To confirm the selection, press the ↵ key.
Thermist 3 = **0.1 kΩ**	P225 only: Setting of the resistance threshold value for Thermistor 3: from 0.10 to 30.00 KΩ in steps of 0.10 KΩ.

9. 'AUTOMAT. CTRL' MENU

9.1 '[66] START NUMBER' submenu

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
[66] START NUMBER	To move about in the [66] START NUMBER submenu, press the and keys. To enter the other submenus, press the and keys.
START NB LIMIT FUNCT? YES	To switch on the «number of starts limitation» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
Treference = 10 mn	Setting of the $T_{reference}$ reference time during which the starts are counted: from 10 to 120 min in steps of 5 min.
HOT START NB = 0	Setting of the threshold of the number of hot starts: from 0 to 5 in steps of 1.
COLD START NB = 1	Setting of the threshold of the number of cold starts: from 1 to 5 in steps of 1.
Tinterdiction = 1 mn	Setting of the time delay during which starting is forbidden $T_{forbiden}$: from 1 to 120 min in steps of 1 min.

9.2 'MIN TIME BETW 2 START' submenu

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
MIN TIME BETW 2 START	To move about in the MIN TIME BETW 2 START submenu, press the and keys. To enter the other submenus, press the and keys.
TIME BETW START FUNCT? YES	To switch on the «minimum time between two starts» function: press the key, select YES by using the and keys. To confirm the selection, press the key.
T betw 2 start = 1 mn	Setting of the minimum time between two starts $T_{betw\ 2\ start}$: from 1 to 120 min in steps of 1 min.

9.3 'REACCEL AUTHORIZ' submenu

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
REACCEL AUTHORIZ	To move about in the RE-ACCEL AUTHORIZ submenu, press the and keys. To enter the other submenus, press the and keys.
Detect Volt Dip VOLTAGE	P225 only. To select source of detection of voltage sag. Choice of INPUT or VOLTAGE available.
REACCEL AUTHORIZ FUNCT? YES	P225 only: To switch on the «re-acceleration authorisation» function, press the key, select YES by using the and keys. To confirm the selection, press the key.

Detection **V DIP = 72 V**	P225 only. Setting of the voltage dip detection threshold: from 37.0 to 98.0 Volt or from 143.0 to 360.0 Volt in steps of 0.1 Volt.
Restoration **V DIP = 99 V**	P225 only. Setting of the voltage restoration detection threshold: from 45.0 to 117.0 Volt or from 176.0 to 432.0 Volt in steps of 0.1 Volt.
VOLT. DIP DURAT **Treacc = 0.2 s**	Setting of the T_{reacc} time delay (maximum voltage dip duration to authorize a re-acceleration): from 0.1 s to 5 s in steps of 0.01 s.
AUTO RE-START FUNCT? **YES**	P225 only. To switch on the «Auto Re-start» function, press the ⏎ key, select YES by using the ⇩ and ⇧ keys. To confirm the selection, press the ⏎ key.
Treac-long = **2 s**	P225 only. To set a medium time interval during which if the voltage is restored a close order is issued: from 0.0 s to 60.0 s in steps of 0.1 s. If set to 0 s, meaning OFF, then «Auto Re-start» function will be de-activated.
Treac-shed = **OFF**	P225 only. To set a long time interval to be used for load restoration sequencing: from 0.0 s to 5940 s in steps of 0.1 s. If set to 0 s (meaning and displayed OFF), then «Auto Re-start» function will be de-activated.

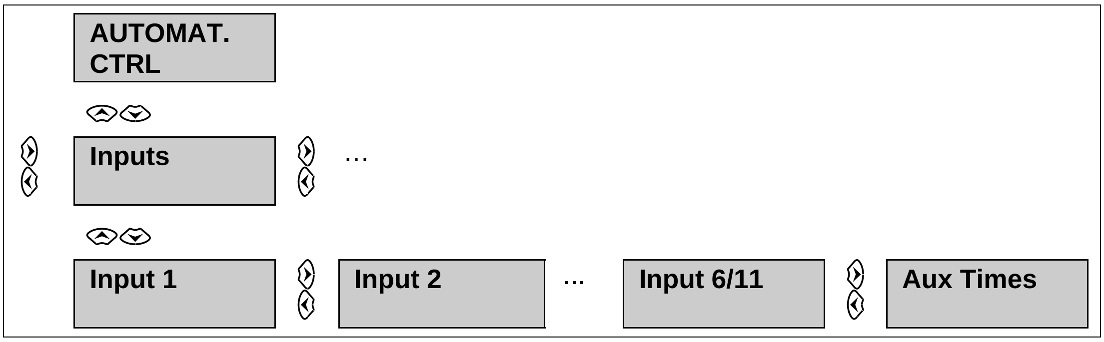
9.4 'INPUTS' submenu

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

Model	P220 P225	P220 and P225 with IRIG-B, 2nd communication port & 5 additional digital inputs option
Logic Input	6	11

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	P220	P225
Unlatch	Unlocks latched output relays	●	●
EMERG. START	«emergency restart» information	●	●
SET GROUP	Change of setting group (default setting group 1) when the changing group parameter ('CONFIGURATION / config select / Set grp change') is set to level.	●	●
SPEED SW	motor speed indication (speed switch)	●	●
DIST TRIG	Disturbance recorder trigger command	●	●
EXT. RESET	external acknowledgement command	●	●
tAux 1 to tAux 10	Assigning external information to inputs Aux1 to Aux10	●	●
Therm RESET	Reset of the thermal state	●	●
TRIP CIRC	Trip circuit supervision function	●	●
V DIP	undervoltage threshold Detection (voltage drop…)	●	●
Synchro.	Assign a Time synchronisation input	●	●
Phase Rotat.	Phase rotation signal input	●	●
52a	Position of the circuit breaker (open)	●	●



9.4.1 Setting of submenu Inputs

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
Inputs	Heading of inputs submenu To move about in the INPUTS submenu, press and keys.
Input 1 =	Heading of input 1 submenu. Press or key to select other input or auxiliary timers menu, and 2 or 8 to scroll through functions.
Input 1 LABEL **No**	Assigning a label or automation function (see previous table) to logic Input 1. Setting choice: Yes or No Press and keys to to scroll through the possible allocations, and to assign or de-assign a function to the input.

9.4.2 Setting auxiliary timers

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
Inputs	Heading of inputs submenu To move about in the INPUTS submenu, press the and keys.
Aux timers	Heading of auxiliary timers submenu. Press or key to select other input or auxiliary timers menu, and 2 or 8 to scroll through functions.
t Aux 1 **0 ms**	Displays setting value of timer assigned to logic input Aux1 from 0 ms to 200 s, in steps of 10 ms.
...	As above for auxiliary timers 2 to 6 (general case) or auxiliary timers 2 to 11 (“IRIG-B/2nd communication port / 5 additional digital inputs” option)

9.5 'LOGIC EQUATION' submenu

9.5.1.1 Parameters

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

Function	P220	P225	Information
Null	●	●	The condition is null (low level)
Not Null	●	●	The condition is not null (high level
TH.OVER	●	●	Thermal overload.
TH.ALARM	●	●	thermal alarm threshold θ_{ALARM}.
FOR.START	●	●	«forbidden start» information
I>	●	●	Instantaneous 1st phase overcurrent threshold I> (protection against Phase OC)
tI>	●	●	Time delayed 1st phase overcurrent threshold tI> (protection against Phase OC)
I>>	●	●	Instantaneous 2nd phase overcurrent threshold I>> (protection against Phase OC)
tI>>	●	●	time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)
I>>>	●	●	Instantaneous 2nd phase overcurrent threshold I>> (protection against Phase OC)
tI>>>	●	●	Time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)
I0>	●	●	Instantaneous 1st earth overcurrent threshold tI0>
tI0>	●	●	Time delayed 1st earth overcurrent threshold tI0>
I0>	●	●	Instantaneous 2nd earth overcurrent threshold I0>>
tI0>>	●	●	Time delayed 2nd earth overcurrent threshold tI0>>
tI2>	●	●	Time delayed 1st negative phase sequence overcurrent threshold tI2> (protection against unbalances)
tI2>>	●	●	Time delayed 2nd negative phase sequence overcurrent threshold tI2>> (protection against unbalances)
EX.START	●	●	Time delayed threshold tI_{start} (protection against excessive long starts)
t Istall	●	●	Time delayed threshold tI_{stall} (protection against rotor stalling when the motor is running)
LO.ROTOR	●	●	Function «rotor locked on starting»
tI<	●	●	Time delayed undercurrent threshold tI< (protection against undercurrent/loss of load)
CB FAIL	●	●	Detection of a Circuit Breaker failure (CB not open at the end of tBF timer)
T.C.FAIL	●	●	TRIP CIRCUIT FAIL information (open trip circuit).
tAux 1… tAux 10	●	●	Copy of Aux1 to Aux 10 logic inputs delayed by Auxiliary 1 (Aux1) to Aux6 timers
SUC.STAR	●	●	Information «successful start».

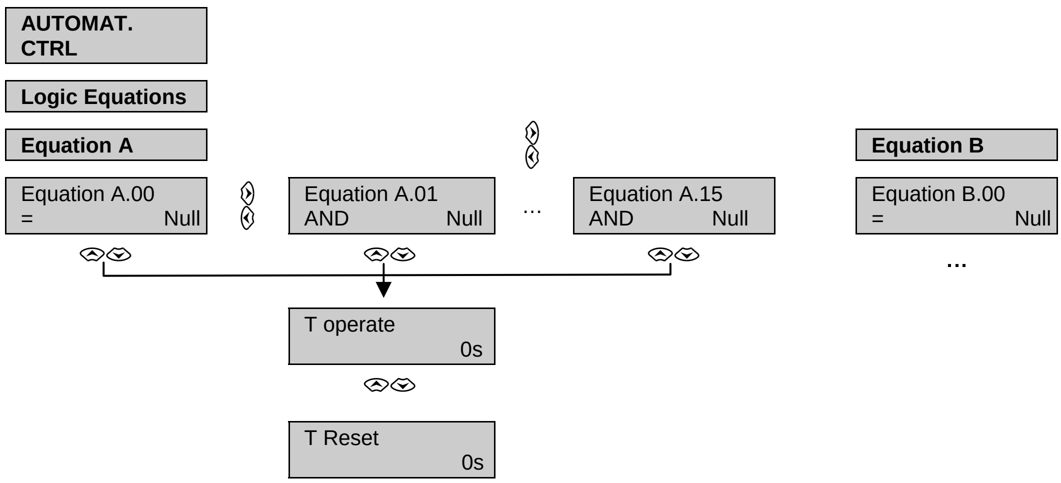
Function	P220	P225	Information
tV<		●	Time delayed undervoltage threshold tV< (undervoltage protection)
VOL DIP	●	●	Load shedding information further to a voltage dip (cf. re-acceleration authorization).
tV>		●	Time delayed overvoltage threshold tV< (overvoltage protection)
BUS VOLT		●	BUS VOLTAGE information (Bus voltage too low to enable start).
A.RESTAR		●	Auto Restart
EQU.A … EQU.H	●	●	Results of equations A to H.
INPUT 1 … INPUT 6	●	●	Copy of the status of logic inputs (“automat ctrl/inputs” menu)
t RDT 1 Alarm … t RDT 6 Alarm	●	●	Time delayed thresholds $t_{RTD1\ ALARM}$ to $t_{RTD6\ ALARM}$ (temperature protection: optional).
t RDT 1 TRIP … t RDT 6 TRIP	●	●	Time delayed thresholds $t_{RTD1\ TRIP}$ to $t_{RTD6\ TRIP}$ (temperature protection: optional)
t RDT 7 ALARM … t RDT 10 Alarm		●	Time delayed thresholds $t_{RTD7\ ALARM}$ to $t_{RTD10\ ALARM}$ (temperature protection: optional).
t RDT 7 TRIP … t RDT 10 Alarm		●	Time delayed thresholds $t_{RTD7\ TRIP}$ to $t_{RTD10\ TRIP}$ (temperature protection: optional)
Thermist 1	●	●	Time delayed temperature threshold Thermist1 (temperature protection: optional).
Thermist 2	●	●	Time delayed temperature threshold Thermist2 (temperature protection: optional).
Thermist 3		●	Time delayed temperature threshold Thermist3 (temperature protection: optional).

9.5.1.2 Interface

The Logic equation has the following structure:

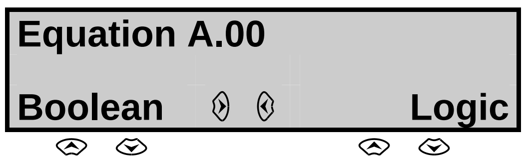
– "Equation A.00" to "Equation A.15" views are accessible using and keys,

– Pressing key will open "T Operate" menu.



In order to modify an "Equation A.xx" menu:

– Press key to access to the menu (if necessary, enter password).



press or key to access to Boolean operator or Logic signal

press or key to modify the corresponding value.

– Press to validate or to cancel the setting.

AUTOMAT. CTRL	
LOGIC EQUATIONS	
EQUATION A	Heading of Equation A submenu.

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

EQUATION A.00 **=** **Null**	Boolean function (left lower part of the LED panel): selects the Boolean function associated to the logic signal. Presence or not presence of the corresponding logic signal can selected and combined to the previous equation with an OR or AND condition. Setting choices: - for A.00: "=", "= Not" - for A.01 to A.15: "OR", "OR NOT", "AND" or "AND NOT", Note: AND operator has priority to OR operator (refer to the following note)

EQUATION A.00 **= Null**	Logic signal (right lower part): Is used to select the logic signal corresponding to the Boolean equation. Refer to the previous table to see the text corresponding to each signal. Setting Choice: Null and logic signals.
T OPERATE **0s**	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
T RESET **0s**	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

<u>Example of Equation A settings:</u>

Equation A.00 "= not" "tAux 1" + Equation A.01 "and not" "tAux 2" means not tAux 1 and not tAux 2.

<u>Note: AND operator has priority on OR operator:</u>

– "A or B and C" means "A or (B and C)".

– To obtain "A and (B or C)", select "A and B or A and C".

9.6 'AUX OUTPUT RLY' submenu

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).

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
AUX OUTPUT RLY	To move about in the AUX OUTPUT RLY, press the and keys. To enter the other submenus, press the and keys.
Function 5 4 3 2 **0 0 0 0**	To allocate the «function» (see next table) to one (or more) of the outputs n° 2 to 5: press the key, allocate the value 1 under the letter by pressing the and keys to increase or decrease, then confirm the selection using the key.

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

Function	P220	P225	Information
THERM OV	●	●	Thermal overload.
θ ALARM	●	●	Allocation of thermal alarm threshold $\theta_{ALARM.}$
θ FORBID START	●	●	Allocation of the thermal block start signal $\theta_{FORBID\ START}$.
I>	●	●	Allocation of instantaneous 1st phase overcurrent threshold I> (protection against Phase OC)
tI>	●	●	Allocation of time delayed 1st phase overcurrent threshold tI> (protection against Phase OC)
I>>	●	●	Allocation of instantaneous 2nd phase overcurrent threshold I>> (protection against Phase OC)
tI>>	●	●	Allocation of time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)

Function	P220	P225	Information
I>>>	●	●	Allocation of instantaneous 2^{nd} phase overcurrent threshold I>> (protection against Phase OC)
tI>>>	●	●	Allocation of time delayed 2^{nd} phase overcurrent threshold tI>> (protection against Phase OC)
I0>	●	●	Allocation of instantaneous 1^{st} earth overcurrent threshold tI0>
tI0>	●	●	Allocation of time delayed 1^{st} earth overcurrent threshold tI0>
I0>	●	●	Allocation of instantaneous 2^{nd} earth overcurrent threshold I0>>
tI0>>	●	●	Allocation of time delayed 2^{nd} earth overcurrent threshold tI0>>
tI2>	●	●	Allocation of time delayed 1^{st} negative phase sequence overcurrent threshold tI2> (protection against unbalances)
tI2>>	●	●	Allocation of time delayed 2^{nd} negative phase sequence overcurrent threshold tI2>> (protection against unbalances)
EXCES LG START	●	●	Time delayed threshold tI_{start} (protection against excessive long starts)
t Istall	●	●	Allocation of the tI_{stall} time-delayed threshold (stalling of the rotor when the motor is running).
LOCKED ROTOR	●	●	Allocation of function «rotor locked on starting»
tI<	●	●	Allocation of time delayed undercurrent threshold tI< (protection against undercurrent/loss of load)
START NB LIMIT	●	●	Allocation of the function «limitation of the number of starts».
T betw 2 start	●	●	Allocation of the $T_{betw\ 2\ start}$ time delay (minimum time between 2 starts function).
CB FAIL	●	●	Allocation of the «circuit breaker failure» function.
T.C.FAIL	●	●	Allocation of the «trip circuit wiring supervision» function.
tAux 1… tAux 10	●	●	Copy of Aux1 to Aux 10 logic inputs delayed by Auxiliary 1 (Aux1) to Aux6 timers
ABS	●	●	Anti Backspin protection signal
tV<		●	Time delayed undervoltage threshold tV< (undervoltage protection)
VOLTAGE DIP	●	●	Allocation of the load-shedding information VOLTAGE DIP (re-acceleration function).
tV>		●	Time delayed overvoltage threshold tV< (overvoltage protection)
BUS VOLTAGE		●	BUS VOLTAGE information (Bus voltage too low to enable start).
AUTO RE-START		●	Auto Restart
CLOSE ORDER	●	●	Allocation of the closing command (order given by a supervisor via the RS485).
TRIP ORDER	●	●	Allocation of the tripping command (order given by a supervisor via the RS485).

Function	P220	P225	Information
ORDER 1	●	●	Allocation of the ORDER 1 command (any order given by a supervisor via the RS485).
ORDER 2	●	●	Allocation of the ORDER 2 command (any order given by a supervisor via the RS485).
SUCCESS START	●	●	Allocation of «successful start» Information
tEQU.A … tEQU.H	●	●	Results of the logic equations A to H.
CB OPEN TIME	●	●	Allocation of the circuit breaker opening time threshold
CB OPER NB	●	●	Allocation of the threshold of the number of operations performed by the circuit breaker
S A n	●	●	Allocation of the threshold of the sum of amperes to the power of n interrupted by the circuit breaker.
CB Fail	●	●	Allocation of the «circuit breaker failure» function.
TRIP CIRC Fail			Allocation of the «trip circuit wiring supervision» function
GROUP 2 ACTIV			Allocation of the information «configuration group 2 active» (PROTECTION G2 active).
INPUT 1 … INPUT 6	●	●	Copy of the status of logic inputs (“automat ctrl/inputs” menu)
t RDT 1 Alarm … t RDT 6 Alarm	●	●	Time delayed thresholds $t_{RTD1\ ALARM}$ to $t_{RTD6\ ALARM}$ (temperature protection: optional).
t RDT 1 TRIP … t RDT 6 TRIP	●	●	Time delayed thresholds $t_{RTD1\ TRIP}$ to $t_{RTD6\ TRIP}$ (temperature protection: optional)
t RDT 7 ALARM … t RDT 10 Alarm		●	Time delayed thresholds $t_{RTD7\ ALARM}$ to $t_{RTD10\ ALARM}$ (temperature protection: optional).
Thermist 1	●	●	Time delayed temperature threshold Thermist1 (temperature protection: optional).
Thermist 2	●	●	Time delayed temperature threshold Thermist2 (temperature protection: optional).
Thermist 3		●	Time delayed temperature threshold Thermist3 (temperature protection: optional).

9.7 'LATCH AUX OUTPUT RLY' submenu

AUTOMAT. CTRL	Press the ⇩ and ⇧ keys to enter the AUTOMAT. CTRL menu.
LATCH AUX RLY	To move about in the LATCH AUX RLY submenu, press the ⇩ and ⇧ keys. To enter the other submenus, press the ⇦ and ⇨ keys.
LATCH RL2? YES	Latching of the RL2 auxiliary output relay: press the ↵ key, select «YES» by using the ⇩ and ⇧ keys, then confirm the selection using the ↵ key.
LATCH RL3? YES	Latching of the RL3 auxiliary output relay.
LATCH RL4? YES	Latching of the RL4 auxiliary output relay.
LATCH RL5? YES	Latching of the RL5 auxiliary output relay.

9.8 'TRIP OUTPUT RLY' submenu

AUTOMAT. CTRL	Press the ⇩ and ⇧ keys to enter the AUTOMAT. CTRL menu.
TRIP OUTPUT RLY	To move about in the TRIP OUTPUT RLY submenu, press the ⇩ and ⇧ keys. To enter the other submenus, press the ⇦ and ⇨ keys.
Function? YES	Allocation of a function (see next table). To allocate the "Function" to the tripping relay (RL1 relay): press the ↵ key, select YES by using the ⇩ and ⇧ keys, then confirm the selection by using the ↵ key.

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

Function	P220	P225	Information
tI>	●	●	Allocation of time delayed 1^{st} phase overcurrent threshold tI> (protection against Phase OC)
tI>>	●	●	Allocation of time delayed 2^{nd} phase overcurrent threshold tI>> (protection against Phase OC)
tI>>>	●	●	Allocation of time delayed 2^{nd} phase overcurrent threshold tI>> (protection against Phase OC)
tI0> ?	●	●	Allocation of time delayed 1^{st} earth overcurrent threshold tI0>
tI0>> ?	●	●	Allocation of time delayed 2^{nd} earth overcurrent threshold tI0>>
tI2> ?	●	●	Allocation of time delayed 1^{st} negative phase sequence overcurrent threshold tI2> (protection against unbalances)
tI2< ?	●	●	Allocation of time delayed 1^{st} undercurrent threshold tI< (protection against unbalances)
THERMAL OVERLOAD	●	●	Thermal overload information (protection against thermal overloads)
EXCES LG START	●	●	Time delayed threshold tI_{start} (protection against excessive long starts)

Function	P220	P225	Information
t Istall	●	●	Allocation of the tI_{stall} time-delayed threshold (stalling of the rotor when the motor is running).
LOCKED ROTOR	●	●	Allocation of function «rotor locked on starting»
t RDT 1 TRIP … t RDT 6 TRIP	●	●	Time delayed thresholds $t_{RTD1\ TRIP}$ to $t_{RTD6\ TRIP}$ (temperature protection: optional)
t RDT 7 TRIP … t RDT 10 TRIP		●	Time delayed thresholds $t_{RTD7\ TRIP}$ to $t_{RTD10\ TRIP}$ (temperature protection: optional)
Thermist 1	●	●	Time delayed temperature threshold Thermist1 (temperature protection: optional).
Thermist 2	●	●	Time delayed temperature threshold Thermist2 (temperature protection: optional).
Thermist 3		●	Time delayed temperature threshold Thermist3 (temperature protection: optional).
EQU.A … EQU.H	●	●	Results of the logic equations A to H.
tV<		●	Time delayed undervoltage threshold tV< (undervoltage protection)
VOLTAGE DIP	●	●	Allocation of the load-shedding information VOLTAGE DIP (re-acceleration function).
tV>		●	Time delayed overvoltage threshold tV< (overvoltage protection)

9.9 'LATCH TRIP ORDER' submenu

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.

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
LATCH TRIP ORDER	To move about in the LATCH TRIP ORDER submenu, press the and keys. To enter the other submenus, press the and keys.
LATCH tFunction ? **YES**	Latching on exceeding the function .

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

Function	P220	P225	Information
tI>	●	●	Latching on exceeding the time delayed 1st phase overcurrent threshold tI> (protection against Phase OC)
tI>>	●	●	Latching on exceeding the time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)
tI>>>	●	●	Latching on exceeding the time delayed 2nd phase overcurrent threshold tI>> (protection against Phase OC)
tI0> ?	●	●	Latching on exceeding the time delayed 1st earth overcurrent threshold tI0>

Function	P220	P225	Information
tI0>> ?	●	●	Latching on exceeding the time delayed 2nd earth overcurrent threshold tI0>>
tI2> ?	●	●	Latching on exceeding the time delayed 1st negative phase sequence overcurrent threshold tI2> (protection against unbalances)
tI2< ?	●	●	Latching on exceeding the time delayed 1st undercurrent threshold tI< (protection against unbalances)
THERMAL OVERLOAD	●	●	Latching on Thermal overload tripping (protection against thermal overloads)
EXCES LG START	●	●	Latching on exceeding the time delayed threshold tI_{start} (protection against excessive long starts)
t Istall	●	●	Latching on exceeding the tI_{stall} time-delayed threshold (stalling of the rotor when the motor is running).
LOCKED ROTOR	●	●	Latching on «rotor locked on starting» information (rotor stalled at start)
t RDT 1 TRIP … t RDT 6 TRIP	●	●	Latching on exceeding the $t_{RTD1\ TRIP}$ to $t_{RTD6\ TRIP}$ thresholds (temperature protection: optional)
t RDT 7 TRIP … t RDT 10 TRIP		●	Latching on exceeding the time delayed $t_{RTD7\ TRIP}$ to $t_{RTD10\ TRIP}$ thresholds (temperature protection: optional)
Thermist 1	●	●	Latching on exceeding the time delayed temperature threshold Thermist1 (temperature protection: optional).
Thermist 2	●	●	Latching on exceeding the time delayed temperature threshold Thermist2 (temperature protection: optional).
Thermist 3		●	Latching on exceeding the time delayed temperature threshold Thermist3 (temperature protection: optional).
EQU.A … EQU.H	●	●	Latching on validation of equations A to H.
tV<		●	Latching on exceeding the time delayed undervoltage threshold tV< (undervoltage protection)
VOLTAGE DIP	●	●	Latching on VOLTAGE DIP load-shedding information (re-acceleration function).
tV>		●	Latching on exceeding the t V> time-delayed threshold (overvoltage).

9.10 'CB FAIL' submenu

With the CB Fail submenu, circuit breaker failure can be detected and associated parameters can be set.

AUTOMAT. CTRL	Press the ↓ and ↑ keys to enter the AUTOMAT. CTRL menu.
CB FAIL	To move about in the CB FAIL submenu, press the ↓ and ↑ keys. To enter the other submenus, press the ← and → keys.
CB FAIL FUNCT? YES	To switch on the CB FAIL function: press the ↵ key, select YES by using the ↓ and ↑ keys. To confirm the selection, press the ↵ key again.
I< BF = 20%	Setting of the I< BF current threshold value: from 10% to 100% In in steps of 1% In.
t BF 0.1 s	Setting of the tBF time delay: from 0.03 s to 10.00 s in steps of 0.01 s.

9.11 'ABS', Anti Back Spin submenu

AUTOMAT. CTRL	Press the ↓ and ↑ keys to enter the AUTOMAT. CTRL menu.
ABS	To move about in the Anti Back Spin submenu, press the ↓ and ↑ keys. To enter the other submenus, press the ← and → keys.
ABS FUNCTION? YES	To switch on the ABS function: press the ↵ key, select YES by using the ↓ and ↑ keys. To confirm the selection, press the ↵ key again.
t ABS = 1s	Setting of the t ABS time delay (anti backspin/minimum time between a stop and a restart): from 1s to 7200s in steps of 1s.

9.12 'BUS VOLTAGE CTRL' submenu (P225 only)

AUTOMAT. CTRL	Press the ↓ and ↑ keys to enter the AUTOMAT. CTRL menu.
BUS VOLTAGE CTRL	To move about in the BUS VOLTAGE CTRL submenu, press the ↓ and ↑ keys. To enter the other submenus, press the ← and → keys.
BUS VOLTAGE CTRL FUNCT? YES	To switch on the BUS VOLTAGE CTRL function: press the ↵ key, select YES by using the ↓ and ↑ keys. To confirm the selection, press the ↵ key again.
V BUS = 5.0 V	Setting of the V BUS threshold value (presence of bus voltage before a start): from 5 to 130 Volt or from 20 to 480 Volt.

9.13 'CB SUPERVISION' submenu

AUTOMAT. CTRL	Press the and keys to enter the AUTOMAT. CTRL menu.
CB SUPERVISION	To move about in the CB SUPERVISION submenu, press the and keys. To enter the other submenus, press the and keys.
TRIP CIRCUIT SUPERV? YES	To switch on the TRIP CIRCUIT SUPERV function (trip circuit supervision): press the key, select YES by using the and keys. To confirm the selection, press the key again.
t SUP = 0.1 s	Setting of the tSUP time delay: from 100ms to 10s in steps of 10ms.
CB OPENING TIME? YES	Switching on the circuit breaker opening time function: select YES.
CB OPENING TIME = 0.05 s	Setting of the circuit breaker opening time threshold: from 50ms to 1s in steps of 10ms.
CB OPERATION NB? YES	Switching on the CB operation number function: select YES.
CB OPERATION NB = 0	Setting of the threshold of the CB operation number: from 0 to 50000 in steps of 1.
S A n? YES	Switching on the threshold of the sum of amperes to the power n interrupted by the circuit breaker: select YES.
S A n = 0 MA^n	Setting of the threshold of the sum of mega amperes to the power n interrupted: from 0 to 4 000 MA^n in steps of 1 MA^n.
n = 1	Setting of the exponent n: 1 or 2
TRIP T = 0.2 s	Setting of TRIP T: from 0.2 to 5s in steps of 0.01 s.
CLOSE T = 0.2 s	Setting of CLOSE T: from 0.2 to 5s in steps of 0.01 s.

10. 'RECORD' MENU

10.1 'FAULT RECORD' submenu

RECORD	Press the and keys to enter the RECORD menu.
FAULT RECORD	To move about in the FAULT RECORD submenu, press the and keys. To enter the DISTURB RECORD and CB MONITORING submenus, press the and keys.
RECORD NUMBER **5**	Displays the fault number. To display the information on one of the last 25 faults, press the key, select the number (1 to 25) by using the and keys, then press the key to confirm the selection.
FAULT TIME **16 : 39 : 23 : 82**	Displays the time of the fault occurence.
FAULT DATE **04/05/10**	Displays the date of the fault occurence.
ACTIVE SET GROUP. **1**	Displays the active configuration group (1 or 2) at the time of the fault.
PHASE IN FAULT **PHASE B**	Displays the faulty phase (or phases): phase A, phase B or phase C.
FAULT DETECTED BY I>>	Displays the origin of the fault: here it is exceeding the instantaneous threshold I>>.
MAGNITUDE **1.917 kA**	Displays the fault magnitude.
IA MAGNITUDE **1.917 kA**	Displays the value of the current of phase A (IA) at the time of the fault (true RMS value).
IB MAGNITUDE **1.997 kA**	Displays the value of the current of phase B (IB) at the time of the fault (true RMS value).
IC MAGNITUDE **1.931 kA**	Displays the value of the current of phase C (IC) at the time of the fault (true RMS value).
IN MAGNITUDE **0.03 A**	Displays the value of the earth current IN at the time of the fault (true RMS value).
V AC MAGNITUDE **5126 V**	P225 only. Displays the phase A - phase C voltage value at the time of the fault (true RMS value).

10.2 'DISTURB RECORD' submenu

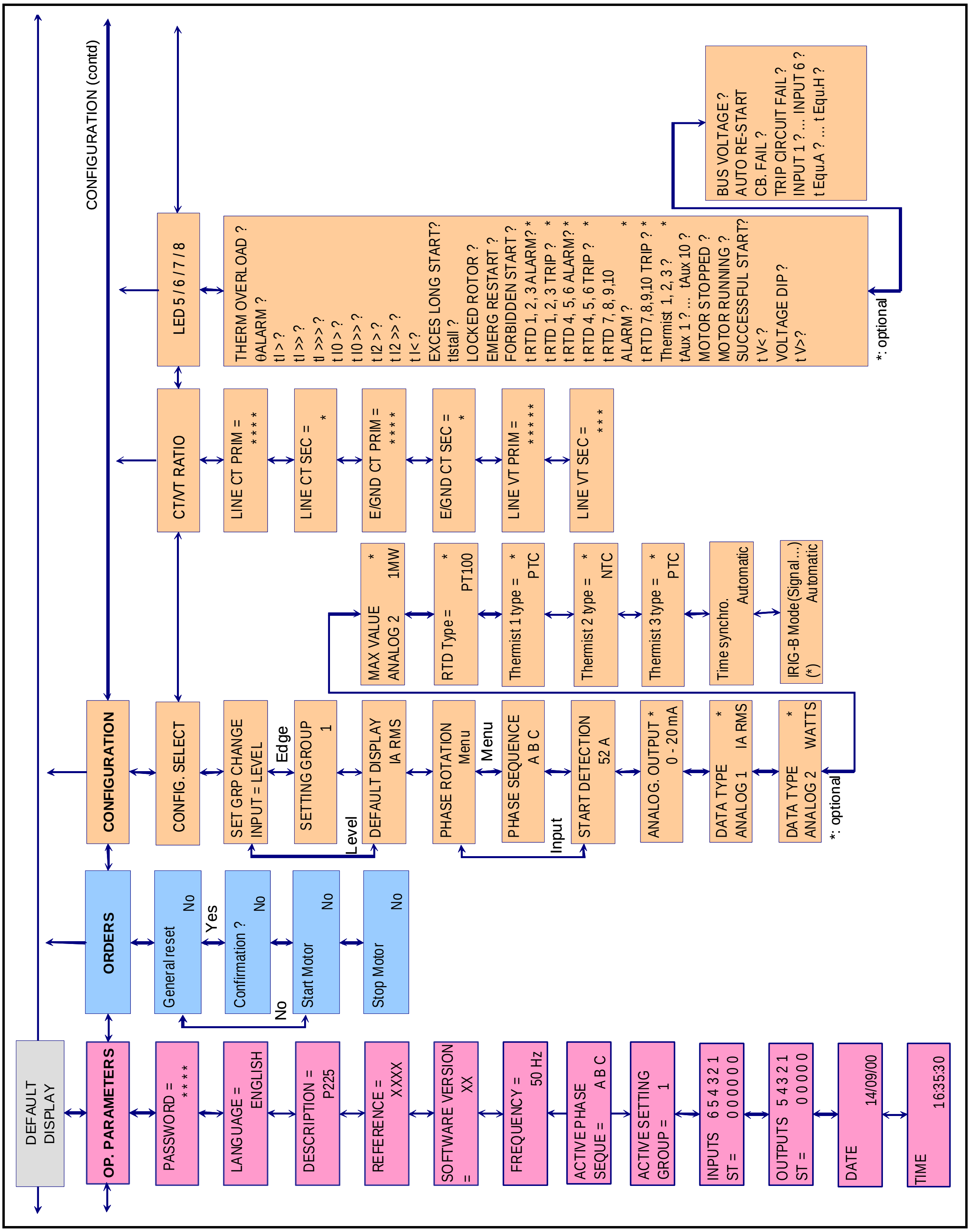
RECORD	Press the and keys to enter the RECORD menu.
DISTURB RECORD	To move about in the DISTURB RECORD submenu, press the and keys. To enter the FAULT RECORD and CB MONITORING submenus, press the and keys.
PRE-TIME = **0.1 s**	Setting of the «pre-time» time delay: from 0,1 to 2,5 s in steps of 0,1 s.
POST-TIME = **0.1 s**	Setting of the «post time» time delay: from 0,1 to 2,5 s in steps of 0,1 s.
DISTUR REC TRIG= **ON INST.**	Selection of the criterion for trigging the disturbance recording: - on exceeding certain instantaneous thresholds (I>>, Io>, Io>>, V< or V>): ON INST. - on tripping of the n°1 relay (trip output relay): ON TRIP.

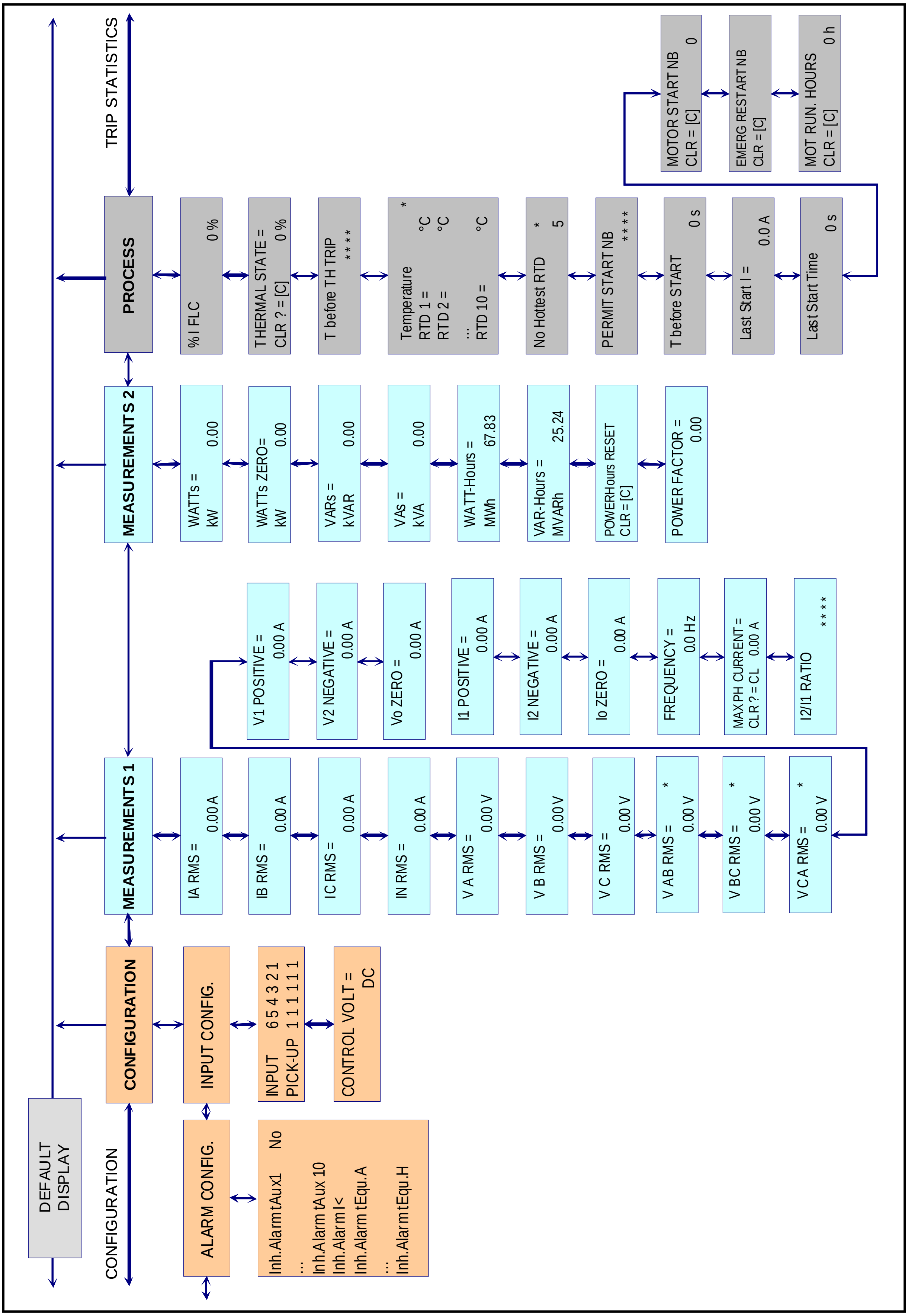
10.3 'CB MONITORING' submenu

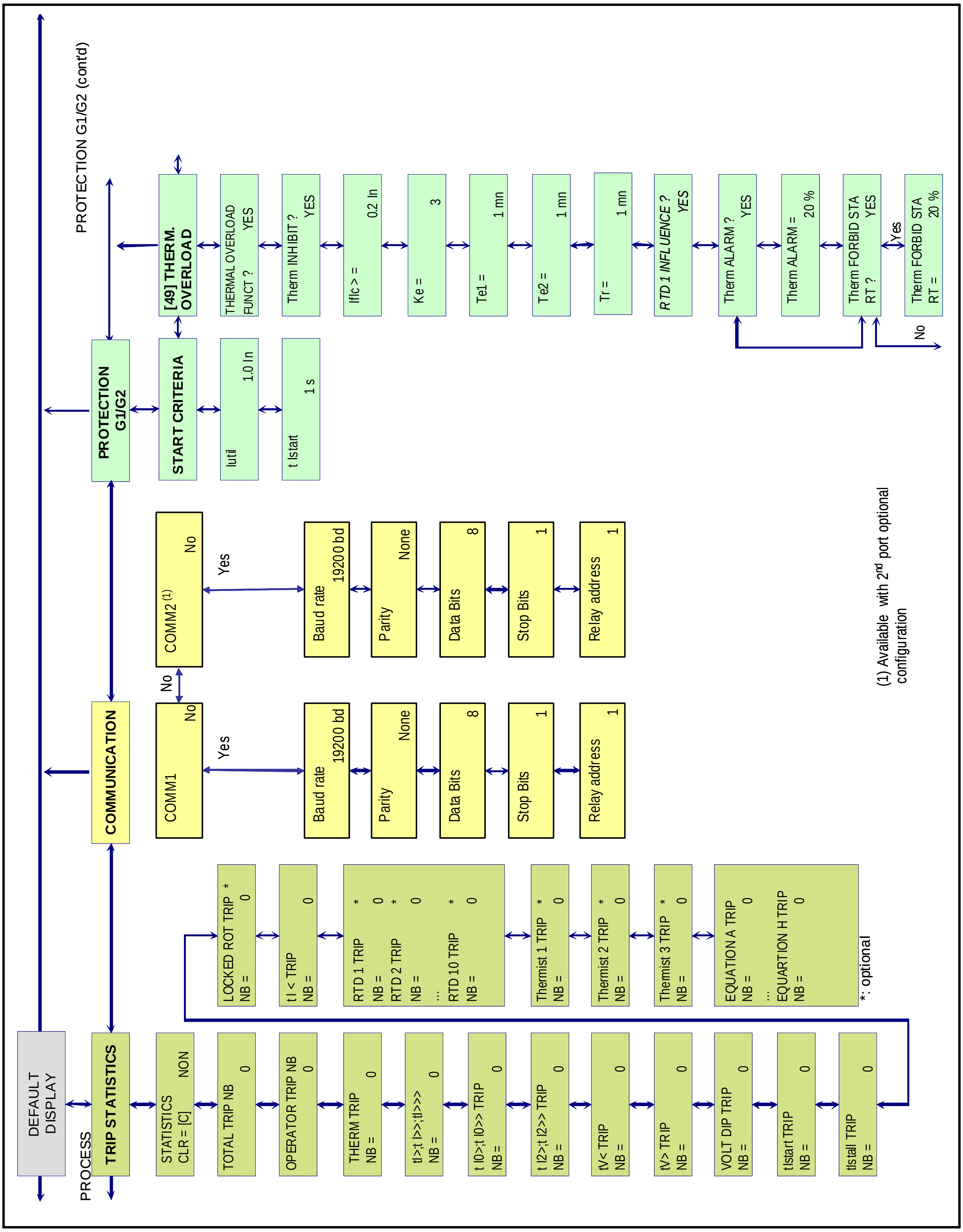
RECORD	Press the and keys to enter the RECORD menu.
CB MONITORING	To move about in the CB MONITORING submenu, press the and keys. To enter the other submenus, press the and keys.
S A n **CLR? = [C]**	To reset to zero the sum of the amperes to the power of n interrupted: press the key.
S A 2 IA = **E06**	Displays the sum of the square amperes interrupted by the circuit breaker for the current of phase IA. E06 means 10^6.
S A 2 IB = **E06**	Displays the sum of the square amperes interrupted by the circuit breaker for the current of phase IB. E06 means 10^6.
S A 2 IC = **E06**	Displays the sum of the square amperes interrupted by the circuit breaker for the current of phase IC. E06 means 10^6.
CB OPERATION NB = **CLR? =[C] 0**	Displays the number of operations performed by the circuit breaker. To reset to zero: press the key.
CB OPEN TIME = **100 ms**	Displays the opening time of the circuit breaker.

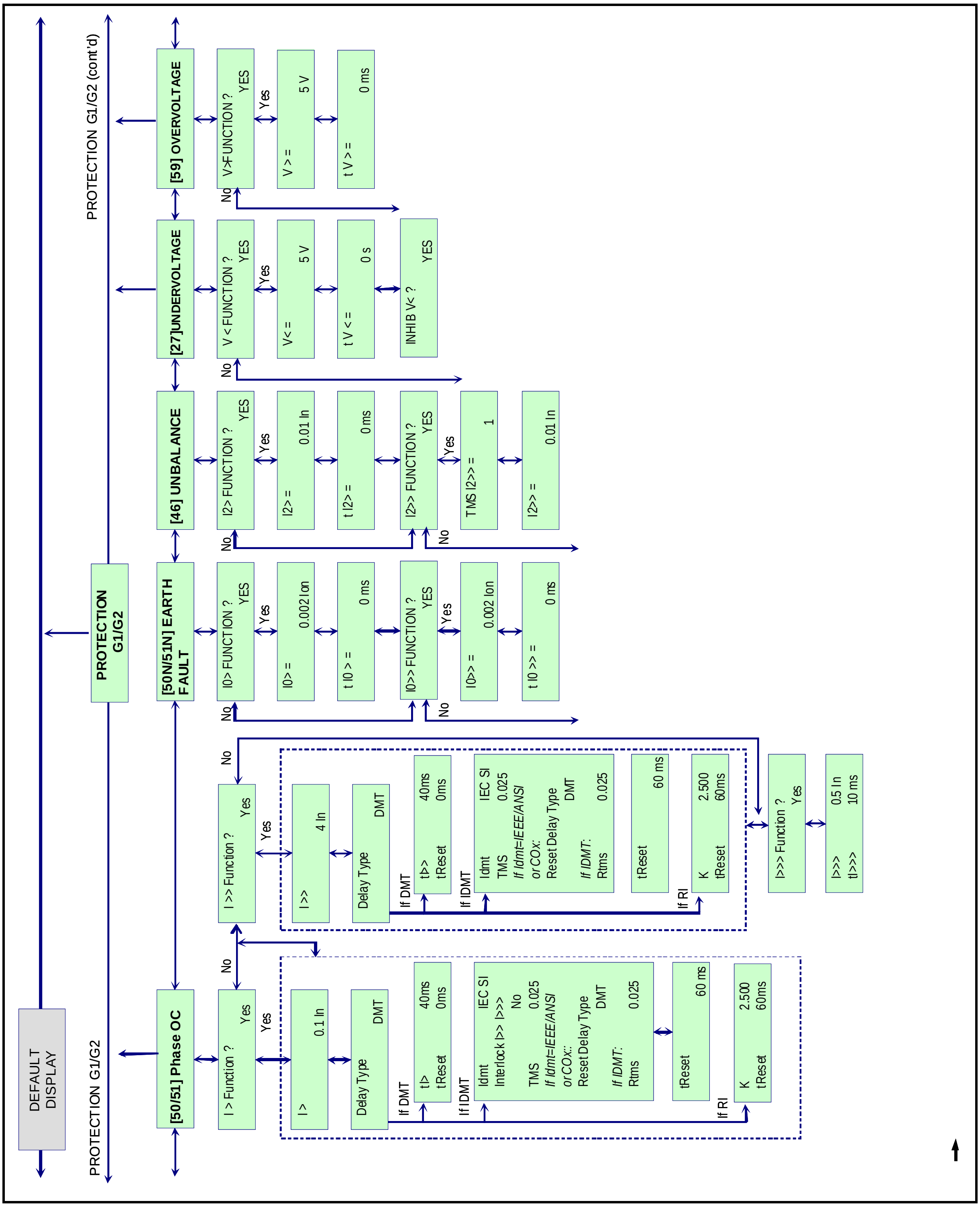
NOTE: If the user has set the exponent n to the value 1 in the CB SUPERVISION submenu, the term SA will replace the term SA2 to indicate the sum of the amperes interrupted in place of the sum of the square amperes interrupted.

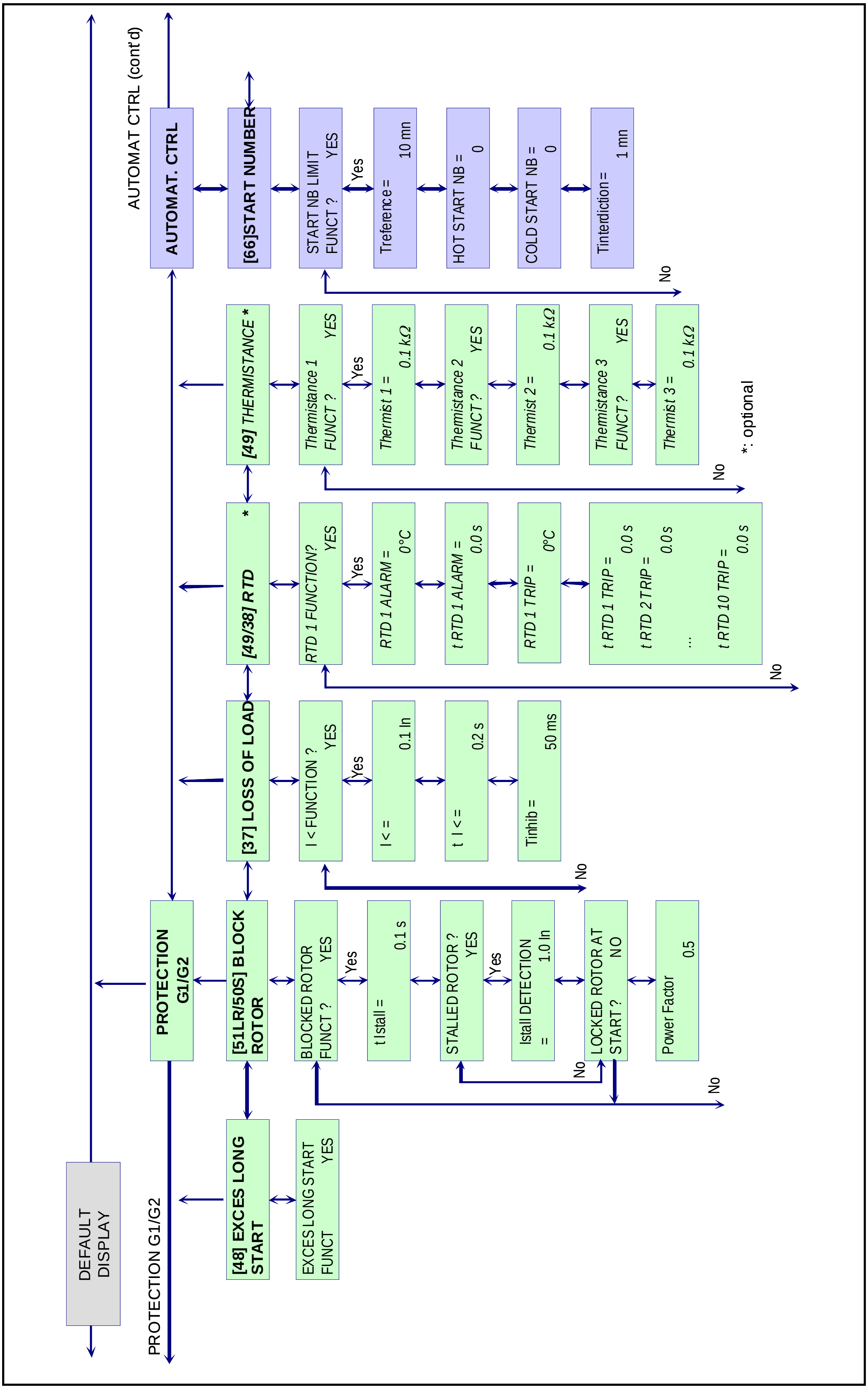
11. MiCOM P225 – V11 SOFTWARE – MENU CONTENT

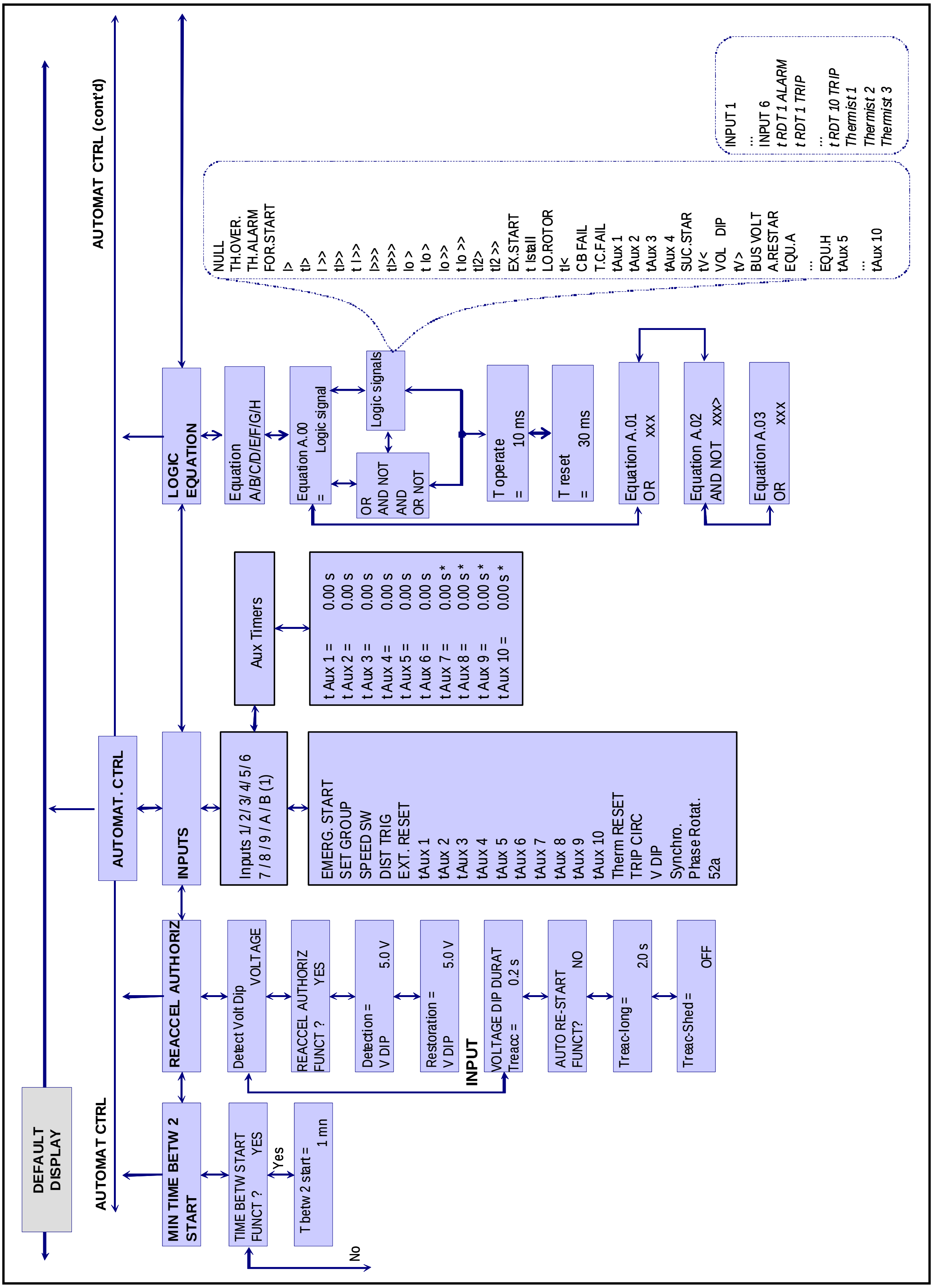


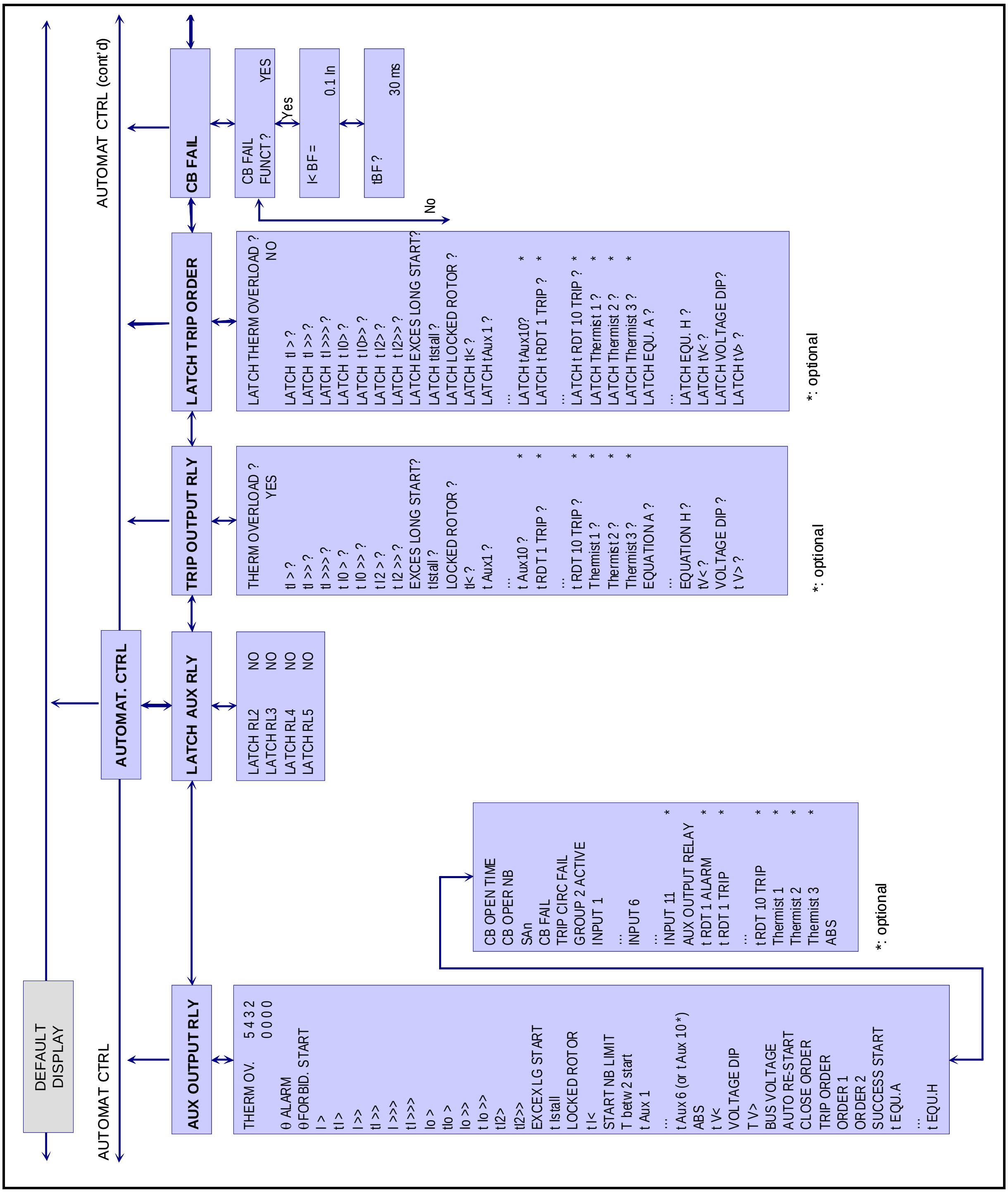

TRIP STATISTICS
PROCESS
% I FLC 0 %
THERMAL STATE = CLR ? = [C] 0 %
T before TH TRIP ****
Temperature * RTD 1 = °C RTD 2 = °C … RTD 10 = °C
No Hottest RTD * 5
PERMIT START NB ****
T before START 0 s
Last Start I = 0.0 A
Last Start Time 0 s
MOTOR START NB CLR = [C] 0
EMERG RESTART NB CLR = [C]
MOT RUN. HOURS CLR = [C] 0 h
MEASUREMENTS 2
WATTs = kW 0.00
WATTs ZERO= kW 0.00
VARs = kVAR 0.00
VAs = kVA 0.00
WATT-Hours = MWh 67.83
VAR-Hours = MVARh 25.24
POWERHours RESET CLR = [C]
POWER FACTOR = 0.00
V1 POSITIVE = 0.00 A
V2 NEGATIVE = 0.00 A
Vo ZERO = 0.00 A
I1 POSITIVE = 0.00 A
I2 NEGATIVE = 0.00 A
Io ZERO = 0.00 A
FREQUENCY = 0.0 Hz
MAX PH CURRENT = CLR ? = CL 0.00 A
I2/I1 RATIO ****
MEASUREMENTS 1
IA RMS = 0.00 A
IB RMS = 0.00 A
IC RMS = 0.00 A
IN RMS = 0.00 A
V A RMS = 0.00 V
V B RMS = 0.00 V
V C RMS = 0.00 V
V AB RMS = * 0.00 V
V BC RMS = * 0.00 V
V CA RMS = * 0.00 V
CONFIGURATION
INPUT CONFIG.
INPUT 6 5 4 3 2 1 PICK-UP 1 1 1 1 1 1
CONTROL VOLT = DC
ALARM CONFIG.
Inh.Alarm tAux1 No
…
Inh.Alarm tAux 10
Inh.Alarm I<
Inh.Alarm tEqu.A
…
Inh.Alarm tEqu.H
DEFAULT DISPLAY
CONFIGURATION

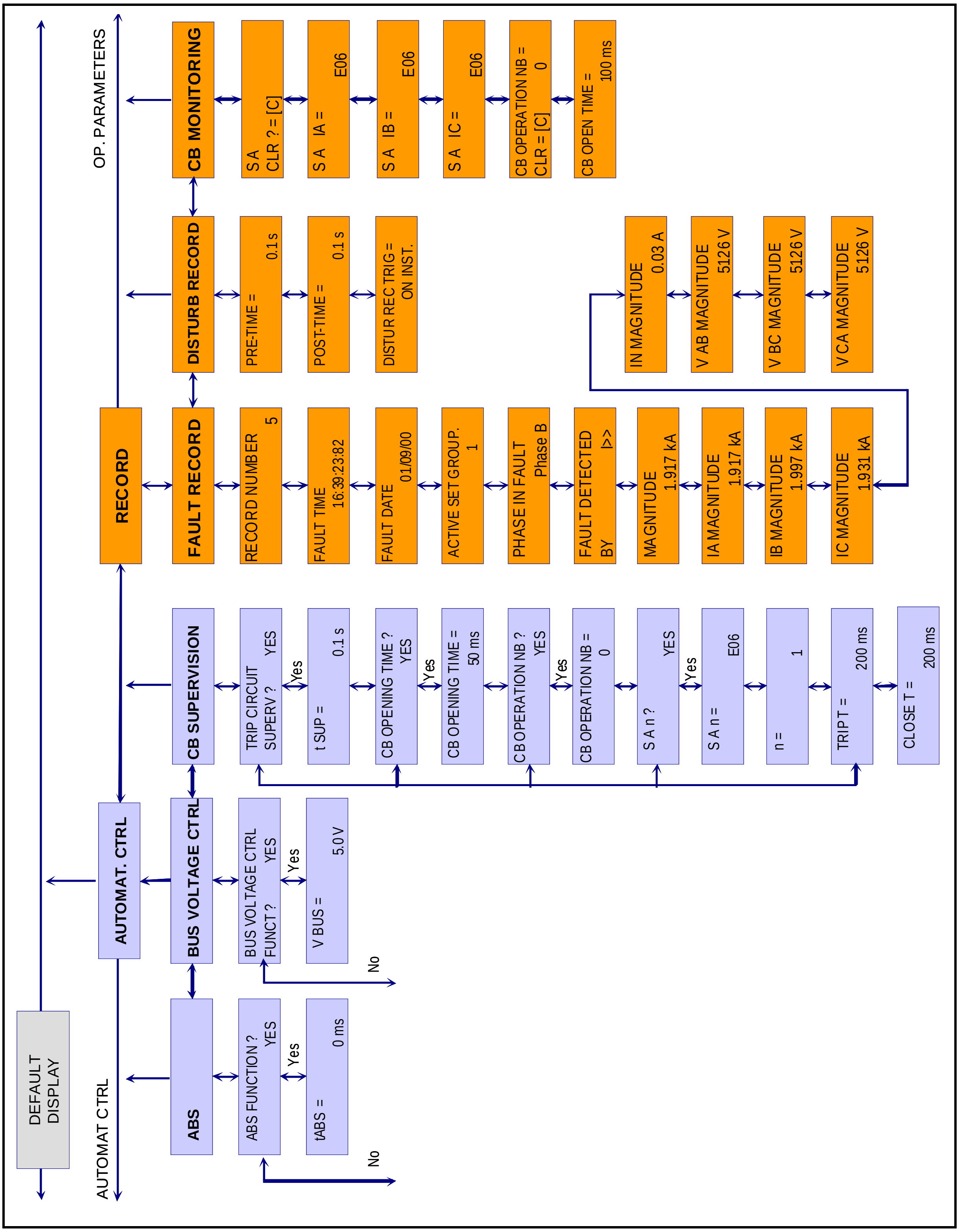

PROTECTION G1/G2 (cont'd)
DEFAULT DISPLAY
PROCESS
TRIP STATISTICS
COMMUNICATION
PROTECTION G1/G2
STATISTICS CLR = [C] NON
TOTAL TRIP NB 0
OPERATOR TRIP NB 0
THERM TRIP NB = 0
tI>;t I>>;tI>>> NB = 0
t I0>;t I0>> TRIP NB = 0
t I2>;t I2>> TRIP NB = 0
tV< TRIP NB = 0
tV> TRIP NB = 0
VOLT DIP TRIP NB = 0
tIstart TRIP NB = 0
tIstall TRIP NB = 0
LOCKED ROT TRIP * NB = 0
t I < TRIP NB = 0
RTD 1 TRIP * NB = 0
RTD 2 TRIP * NB = 0
...
RTD 10 TRIP * NB = 0
Thermist 1 TRIP * NB = 0
Thermist 2 TRIP * NB = 0
Thermist 3 TRIP * NB = 0
EQUATION A TRIP NB = 0
...
EQUARTION H TRIP NB = 0
*: optional
COMM1 No
Yes
No
COMM2 (1) No
Baud rate 19200 bd
Parity None
Data Bits 8
Stop Bits 1
Relay address 1
START CRITERIA
Iutil 1.0 In
t Istart 1 s
[49] THERM. OVERLOAD
THERMAL OVERLOAD FUNCT ? YES
Therm INHIBIT ? YES
Iflc > = 0.2 In
Ke = 3
Te1 = 1 mn
Te2 = 1 mn
Tr = 1 mn
RTD 1 INFLUENCE ? YES
Therm ALARM ? YES
Therm ALARM = 20 %
Therm FORBID STA RT ? YES
Therm FORBID STA RT = 20 %
(1) Available with 2nd port optional configuration


DEFAULT DISPLAY
PROTECTION G1/G2
PROTECTION G1/G2 (cont'd)
PROTECTION G1/G2
[50/51] Phase OC
I > Function ? Yes
I> 0.1 In
Delay Type DMT
If DMT
tI> 40ms
tReset 0ms
If IDMT
Idmt IEC SI
Interlock I>> I>>> No
TMS 0.025
If Idmt=IEEE/ANSI
or COx:
Reset Delay Type DMT
If IDMT:
Rtms 0.025
tReset 60 ms
If RI
K 2.500
tReset 60ms
I >> Function ? Yes
I>> 4 In
Delay Type DMT
tI>> 40ms
tReset 0ms
Idmt IEC SI
TMS 0.025
If Idmt=IEEE/ANSI
or COx:
Reset Delay Type DMT
If IDMT:
Rtms 0.025
tReset 60 ms
K 2.500
tReset 60ms
I>>> Function ? Yes
I>>> 0.5 In
tI>>> 10 ms
[50N/51N] EARTH FAULT
I0> FUNCTION ? YES
I0> = 0.002 Ion
t I0 > = 0 ms
I0>> FUNCTION ? YES
I0>> = 0.002 Ion
t I0 >> = 0 ms
[46] UNBALANCE
I2> FUNCTION ? YES
I2> = 0.01 In
t I2> = 0ms
I2>> FUNCTION ? YES
TMS I2>> = 1
I2>> = 0.01 In
[27]UNDERVOLTAGE
V < FUNCTION ? YES
V< = 5 V
t V < = 0 s
INHIB V< ? YES
[59] OVERVOLTAGE
V>FUNCTION ? YES
V > = 5 V
t V > = 0 ms
Yes
No

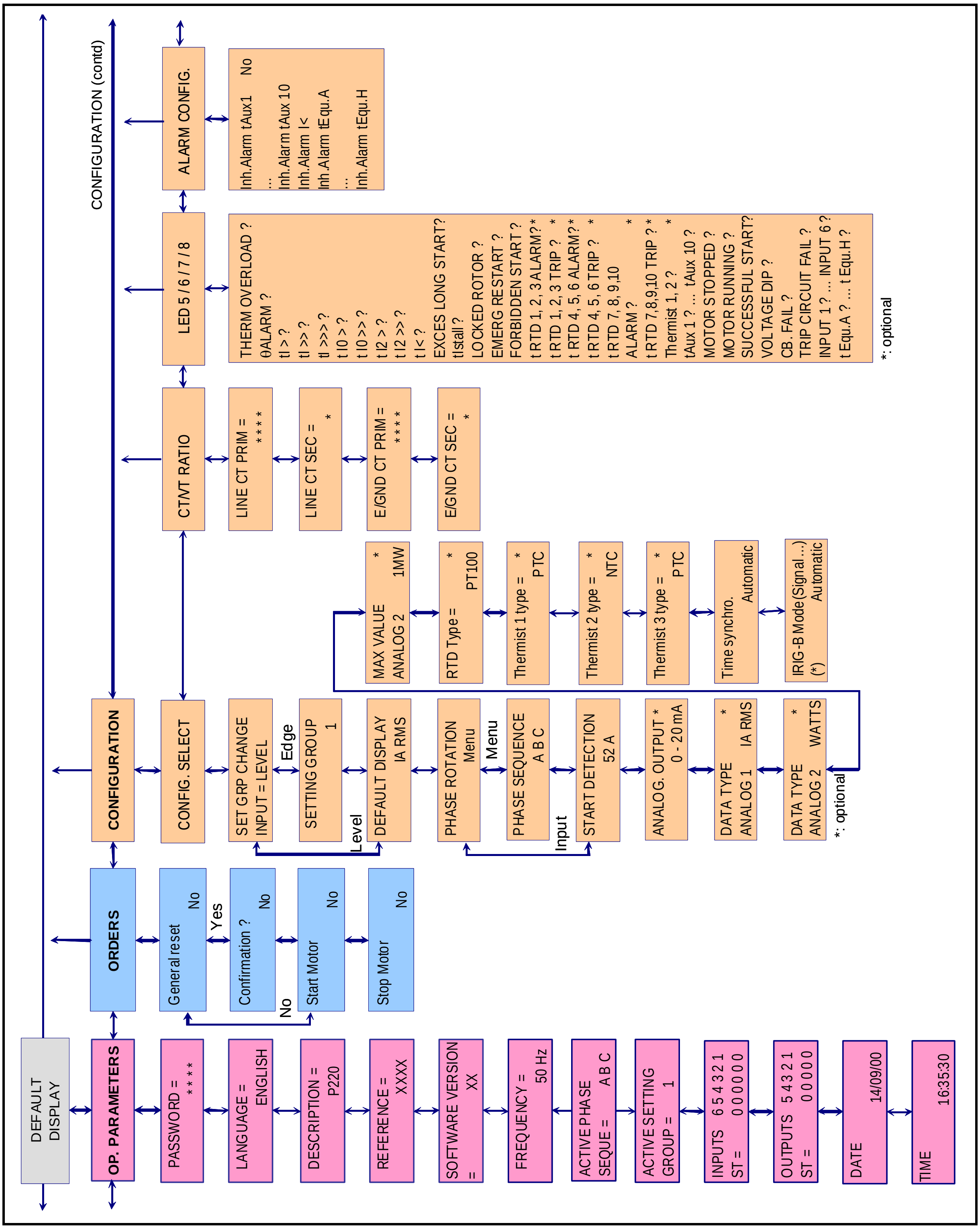

DEFAULT DISPLAY
PROTECTION G1/G2
AUTOMAT CTRL (cont'd)
AUTOMAT. CTRL
[66]START NUMBER
START NB LIMIT FUNCT ? YES
Yes
Treference = 10 mn
HOT START NB = 0
COLD START NB = 0
Tinterdiction = 1 mn
No
PROTECTION G1/G2
[48] EXCES LONG START
EXCES LONG START FUNCT YES
[51LR/50S] BLOCK ROTOR
BLOCKED ROTOR FUNCT ? YES
Yes
t Istall = 0.1 s
STALLED ROTOR ? YES
Yes
Istall DETECTION = 1.0 In
LOCKED ROTOR AT START ? NO
Power Factor 0.5
No
No
[37] LOSS OF LOAD
I < FUNCTION ? YES
Yes
I< = 0.1 In
t I< = 0.2 s
Tinhib = 50 ms
No
[49/38] RTD *
RTD 1 FUNCTION? YES
Yes
RTD 1 ALARM = 0°C
t RTD 1 ALARM = 0.0 s
RTD 1 TRIP = 0°C
t RTD 1 TRIP = 0.0 s
t RTD 2 TRIP = 0.0 s
...
t RTD 10 TRIP = 0.0 s
No
[49] THERMISTANCE *
Thermistance 1 FUNCT ? YES
Yes
Thermist 1 = 0.1 kΩ
Thermistance 2 FUNCT ? YES
Thermist 2 = 0.1 kΩ
Thermistance 3 FUNCT ? YES
Thermist 3 = 0.1 kΩ
No
*: optional

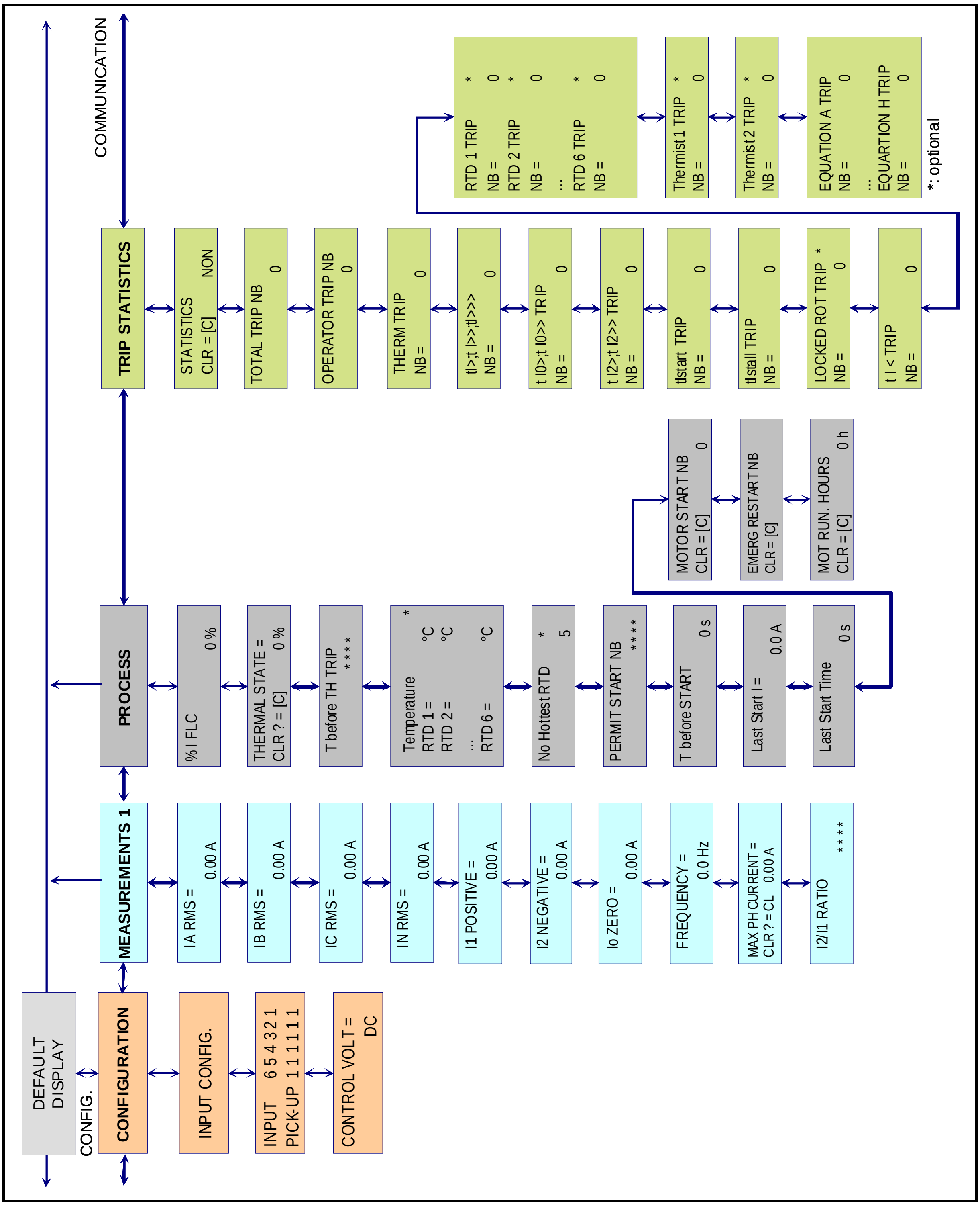

DEFAULT DISPLAY
AUTOMAT CTRL
AUTOMAT CTRL (cont'd)
AUTOMAT. CTRL
MIN TIME BETW 2 START
TIME BETW START FUNCT ? YES
Yes
No
T betw 2 start = 1 mn
REACCEL AUTHORIZ
Detect Volt Dip VOLTAGE
REACCEL AUTHORIZ FUNCT ? YES
Detection = V DIP 5.0 V
Restoration = V DIP 5.0 V
INPUT
VOLTAGE DIP DURAT Treacc = 0.2 s
AUTO RE-START FUNCT? NO
Treac-long = 2.0 s
Treac-Shed = OFF
INPUTS
Inputs 1/ 2/ 3/ 4/ 5/ 6 7 / 8 / 9 / A / B (1)
EMERG. START
SET GROUP
SPEED SW
DIST TRIG
EXT. RESET
tAux 1
tAux 2
tAux 3
tAux 4
tAux 5
tAux 6
tAux 7
tAux 8
tAux 9
tAux 10
Therm RESET
TRIP CIRC
V DIP
Synchro.
Phase Rotat.
52a
Aux Timers
t Aux 1 = 0.00 s
t Aux 2 = 0.00 s
t Aux 3 = 0.00 s
t Aux 4 = 0.00 s
t Aux 5 = 0.00 s
t Aux 6 = 0.00 s
t Aux 7 = 0.00 s *
t Aux 8 = 0.00 s *
t Aux 9 = 0.00 s *
t Aux 10 = 0.00 s *
LOGIC EQUATION
Equation A/B/C/D/E/F/G/H
Equation A.00 = Logic signal
OR
AND NOT
AND
OR NOT
Logic signals
T operate = 10 ms
T reset = 30 ms
Equation A.01 OR xxx
Equation A.02 AND NOT xxx>
Equation A.03 OR xxx
NULL
TH.OVER.
TH.ALARM
FOR.START
I>
tI>
I >>
tI>>
t I>>
I>>>
tI>>>
Io >
t Io >
Io>>
t Io >>
tI2>
tI2 >>
EX.START
t Istall
LO.ROTOR
tI<
CB FAIL
T.C.FAIL
tAux 1
tAux 2
tAux 3
tAux 4
SUC.STAR
tV<
VOL DIP
tV>
BUS VOLT
A.RESTAR
EQU.A
...
EQU.H
tAux 5
...
tAux 10
INPUT 1
...
INPUT 6
t RDT 1 ALARM
t RDT 1 TRIP
...
t RDT 10 TRIP
Thermist 1
Thermist 2
Thermist 3

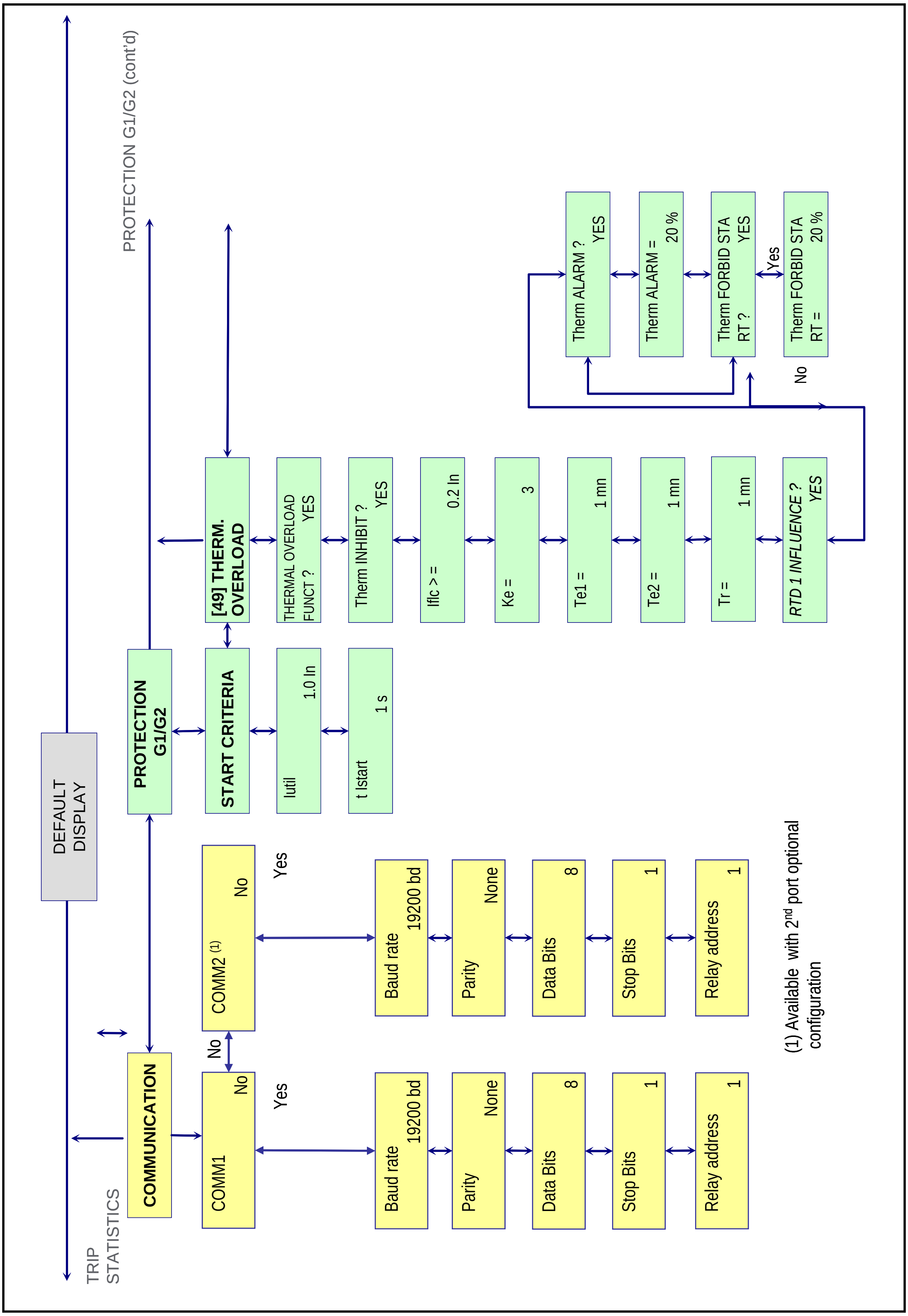

AUTOMAT CTRL (cont'd)
DEFAULT DISPLAY
AUTOMAT CTRL
AUTOMAT. CTRL
CB FAIL
CB FAIL FUNCT ? YES
Yes
I< BF = 0.1 In
tBF ? 30 ms
No
LATCH TRIP ORDER
LATCH THERM OVERLOAD ? NO
LATCH tI > ?
LATCH tI >> ?
LATCH tI >>> ?
LATCH t I0> ?
LATCH t I0>> ?
LATCH t I2> ?
LATCH t I2>> ?
LATCH EXCES LONG START?
LATCH tIstall ?
LATCH LOCKED ROTOR ?
LATCH tI< ?
LATCH tAux 1 ?
...
LATCH tAux10? *
LATCH t RDT 1 TRIP ? *
...
LATCH t RDT 10 TRIP ? *
LATCH Thermist 1 ? *
LATCH Thermist 2 ? *
LATCH Thermist 3 ? *
LATCH EQU. A ?
...
LATCH EQU. H ?
LATCH tV< ?
LATCH VOLTAGE DIP?
LATCH tV> ?
*: optional
TRIP OUTPUT RLY
THERM OVERLOAD ? YES
tI > ?
tI >> ?
tI >>> ?
t I0 > ?
t I0 >> ?
t I2 > ?
t I2 >> ?
EXCES LONG START?
tIstall ?
LOCKED ROTOR ?
tI< ?
t Aux1 ?
...
t Aux10 ? *
t RDT 1 TRIP ? *
...
t RDT 10 TRIP ? *
Thermist 1 ? *
Thermist 2 ? *
Thermist 3 ? *
EQUATION A ?
...
EQUATION H ?
tV< ?
VOLTAGE DIP ?
t V> ?
*: optional
LATCH AUX RLY
LATCH RL2 NO
LATCH RL3 NO
LATCH RL4 NO
LATCH RL5 NO
AUX OUTPUT RLY
THERM OV. 5 4 3 2
0 0 0 0
θ ALARM
θ FORBID. START
I >
tI >
I >>
tI >>
I >>>
tI >>>
Io >
tIo >
Io >>
t Io >>
tI2>
tI2>>
EXCEX LG START
t Istall
LOCKED ROTOR
tI<
START NB LIMIT
T betw 2 start
t Aux 1
...
t Aux 6 (or t Aux 10 *)
ABS
t V<
VOLTAGE DIP
T V>
BUS VOLTAGE
AUTO RE-START
CLOSE ORDER
TRIP ORDER
ORDER 1
ORDER 2
SUCCESS START
t EQU.A
...
t EQU.H
CB OPEN TIME
CB OPER NB
SAn
CB FAIL
TRIP CIRC FAIL
GROUP 2 ACTIVE
INPUT 1
...
INPUT 6
...
INPUT 11 *
AUX OUTPUT RELAY *
t RDT 1 ALARM *
t RDT 1 TRIP
...
t RDT 10 TRIP *
Thermist 1 *
Thermist 2 *
Thermist 3 *
ABS
*: optional

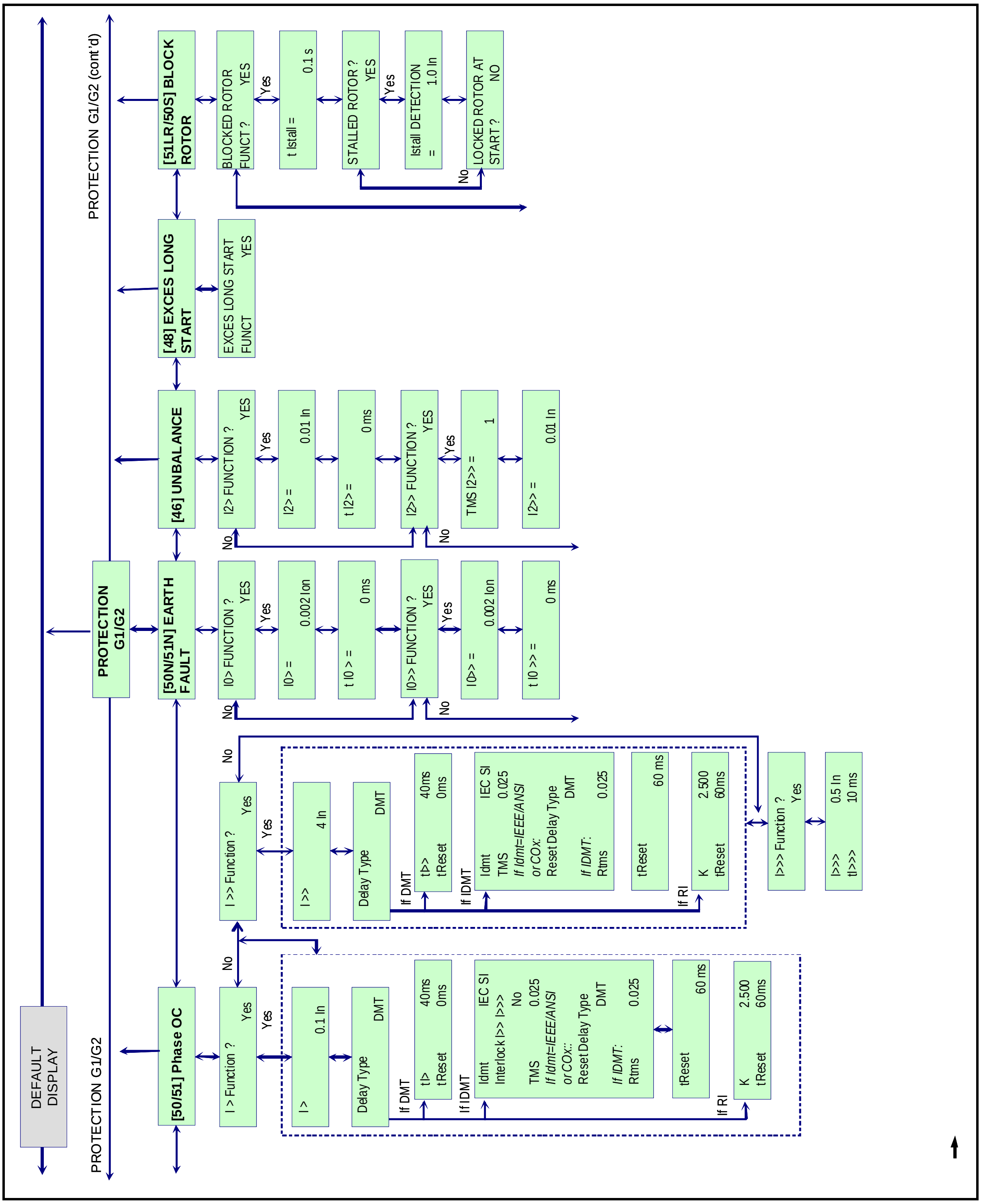

DEFAULT DISPLAY
OP. PARAMETERS
AUTOMAT CTRL
RECORD
CB MONITORING
S A CLR ? = [C]
S A IA = E06
S A IB = E06
S A IC = E06
CB OPERATION NB = CLR = [C] 0
CB OPEN TIME = 100 ms
DISTURB RECORD
PRE-TIME = 0.1 s
POST-TIME = 0.1 s
DISTUR REC TRIG = ON INST.
FAULT RECORD
RECORD NUMBER 5
FAULT TIME 16:39:23:82
FAULT DATE 01/09/00
ACTIVE SET GROUP. 1
PHASE IN FAULT Phase B
FAULT DETECTED BY I>>
MAGNITUDE 1.917 kA
IA MAGNITUDE 1.917 kA
IB MAGNITUDE 1.997 kA
IC MAGNITUDE 1.931 kA
IN MAGNITUDE 0.03 A
V AB MAGNITUDE 5126 V
V BC MAGNITUDE 5126 V
V CA MAGNITUDE 5126 V
AUTOMAT. CTRL
CB SUPERVISION
TRIP CIRCUIT SUPERV ? YES
Yes
t SUP = 0.1 s
CB OPENING TIME ? YES
Yes
CB OPENING TIME = 50 ms
CB OPERATION NB ? YES
Yes
CB OPERATION NB = 0
S A n ? YES
Yes
S A n = E06
n = 1
TRIP T = 200 ms
CLOSE T = 200 ms
BUS VOLTAGE CTRL
BUS VOLTAGE CTRL FUNCT ? YES
Yes
V BUS = 5.0 V
No
ABS
ABS FUNCTION ? YES
Yes
tABS = 0 ms
No

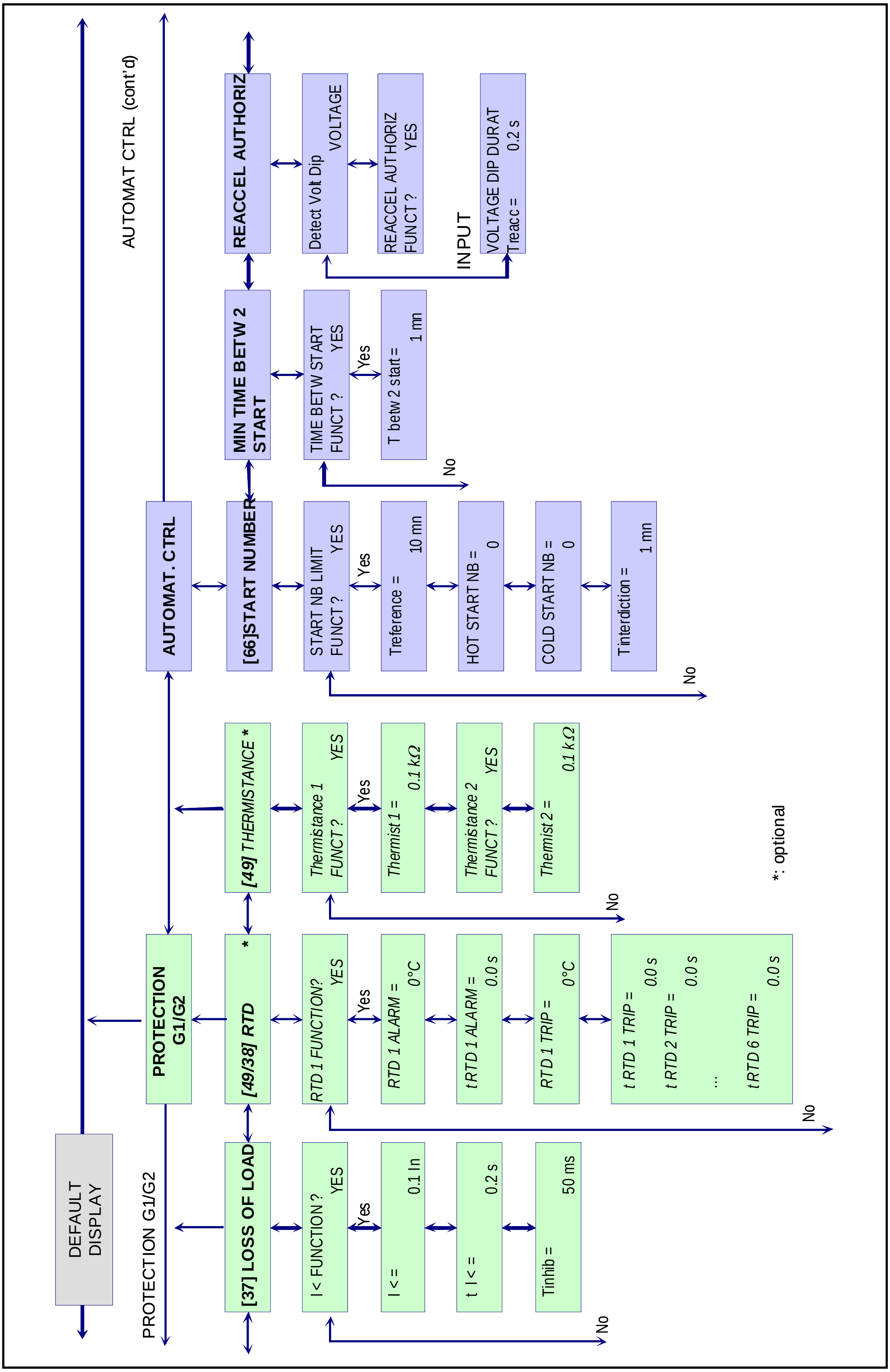
12. MiCOM P220 – V11 SOFTWARE – MENU CONTENT

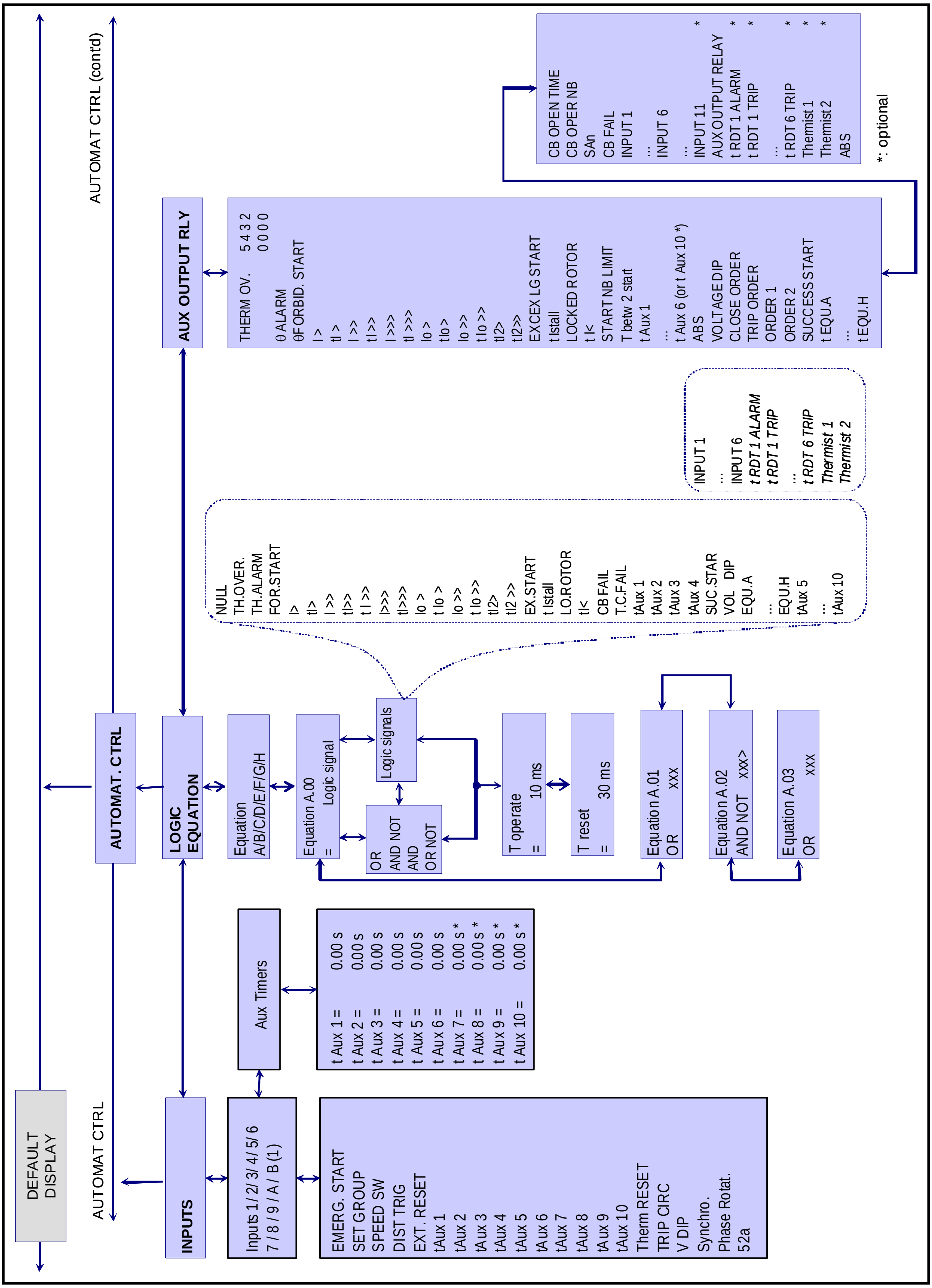


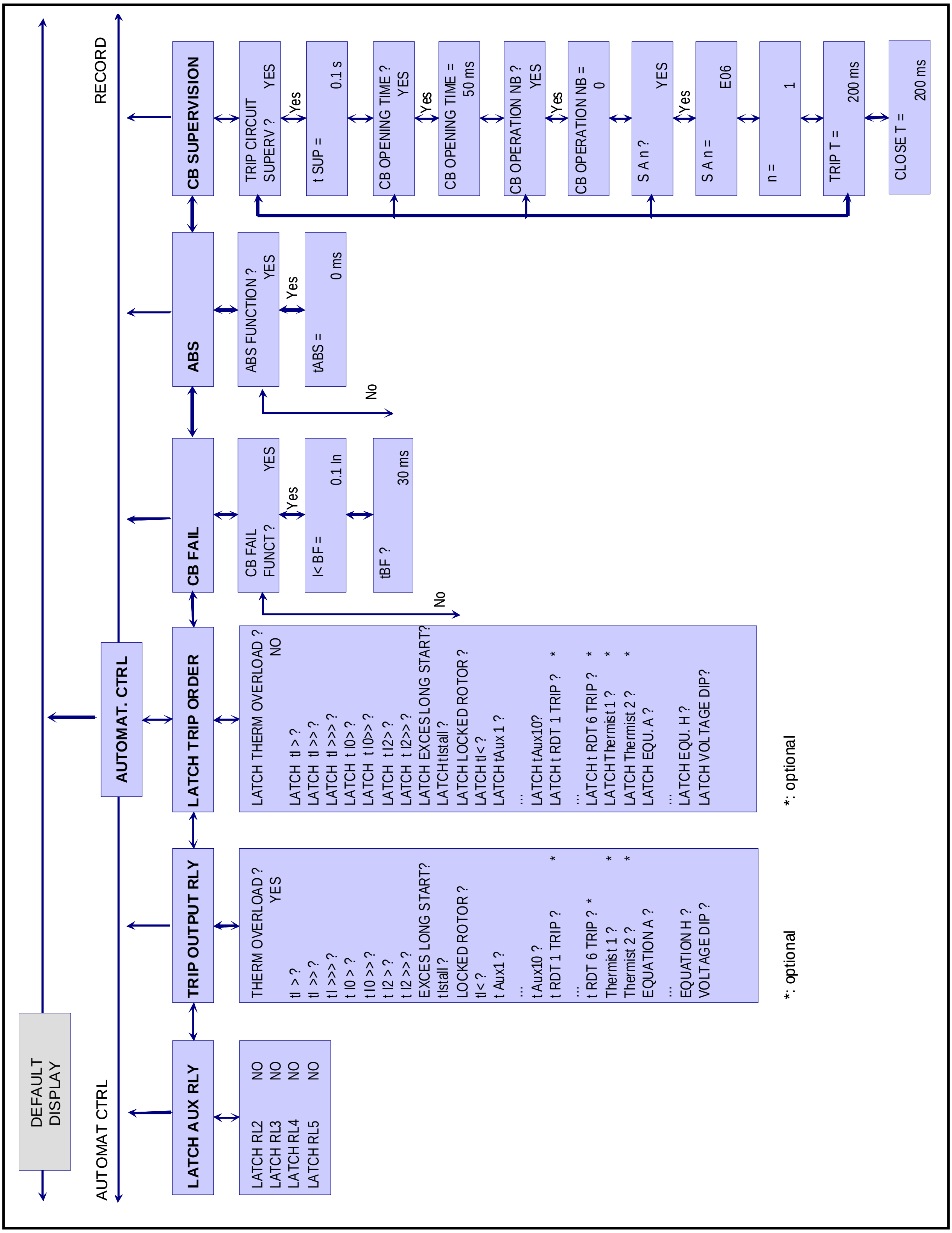

DEFAULT DISPLAY
CONFIG.
COMMUNICATION
CONFIGURATION
INPUT CONFIG.
INPUT 6 5 4 3 2 1
PICK-UP 1 1 1 1 1 1
CONTROL VOLT = DC
MEASUREMENTS 1
IA RMS = 0.00 A
IB RMS = 0.00 A
IC RMS = 0.00 A
IN RMS = 0.00 A
I1 POSITIVE = 0.00 A
I2 NEGATIVE = 0.00 A
Io ZERO = 0.00 A
FREQUENCY = 0.0 Hz
MAX PH CURRENT = CLR ? = CL 0.00 A
I2/I1 RATIO ****
PROCESS
% I FLC 0 %
THERMAL STATE = CLR ? = [C] 0 %
T before TH TRIP ****
Temperature *
RTD 1 = °C
RTD 2 = °C
...
RTD 6 = °C
No Hottest RTD * 5
PERMIT START NB ****
T before START 0 s
Last Start I = 0.0 A
Last Start Time 0 s
MOTOR START NB CLR = [C] 0
EMERG RESTART NB CLR = [C]
MOT RUN. HOURS CLR = [C] 0 h
TRIP STATISTICS
STATISTICS CLR = [C] NON
TOTAL TRIP NB 0
OPERATOR TRIP NB 0
THERM TRIP NB = 0
tI>;t I>>;tI>>> NB = 0
t I0>;t I0>> TRIP NB = 0
t I2>;t I2>> TRIP NB = 0
tIstart TRIP NB = 0
tIstall TRIP NB = 0
LOCKED ROT TRIP * NB = 0
t I < TRIP NB = 0
RTD 1 TRIP * NB = 0
RTD 2 TRIP * NB = 0
...
RTD 6 TRIP * NB = 0
Thermist 1 TRIP * NB = 0
Thermist 2 TRIP * NB = 0
EQUATION A TRIP NB = 0
...
EQUARTION H TRIP NB = 0
*: optional

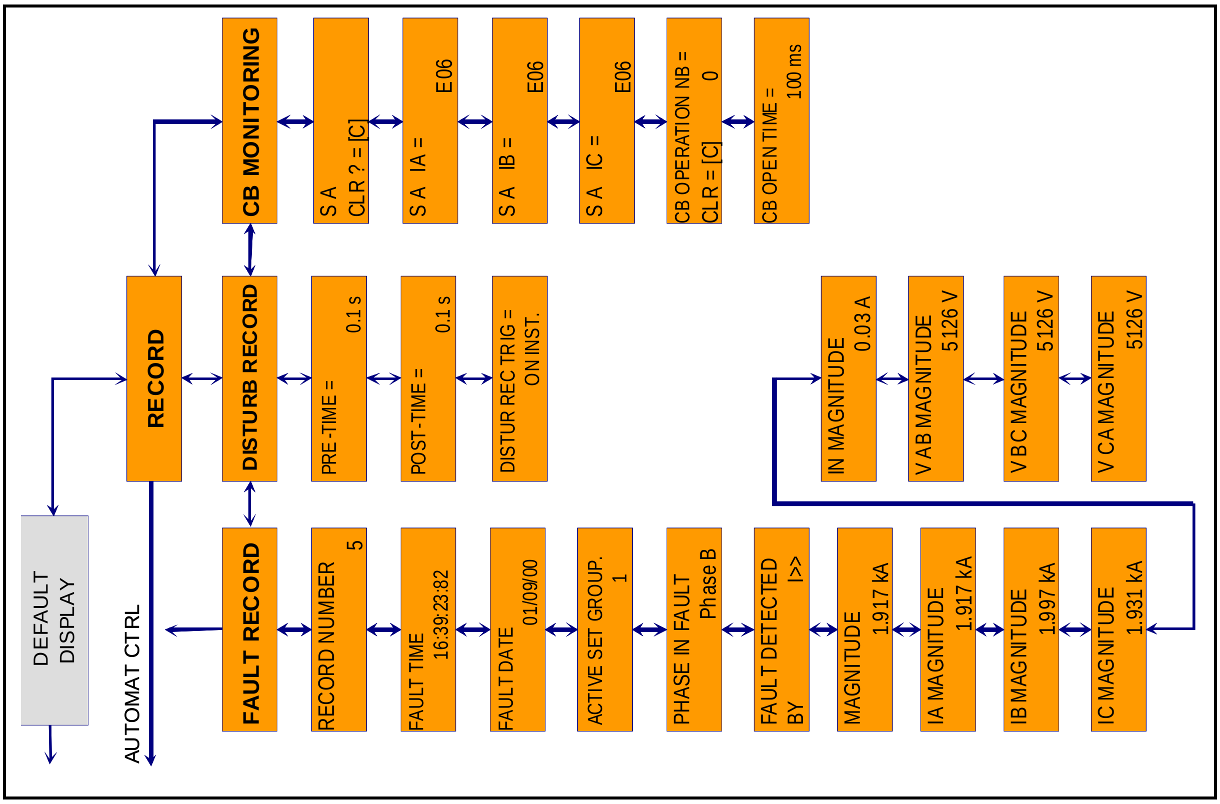

DEFAULT DISPLAY
PROTECTION G1/G2 (cont'd)
TRIP STATISTICS
COMMUNICATION
COMM1
No
Yes
Baud rate
19200 bd
Parity
None
Data Bits
8
Stop Bits
1
Relay address
1
No
COMM2 (1)
No
Yes
Baud rate
19200 bd
Parity
None
Data Bits
8
Stop Bits
1
Relay address
1
(1) Available with 2nd port optional configuration
PROTECTION G1/G2
START CRITERIA
Iutil
1.0 In
t Istart
1 s
[49] THERM. OVERLOAD
THERMAL OVERLOAD FUNCT ?
YES
Therm INHIBIT ?
YES
Iflc > =
0.2 In
Ke =
3
Te1 =
1 mn
Te2 =
1 mn
Tr =
1 mn
RTD 1 INFLUENCE ?
YES
Therm ALARM ?
YES
Therm ALARM =
20 %
Therm FORBID STA RT ?
YES
Yes
Therm FORBID STA RT =
20 %
No


DEFAULT DISPLAY
PROTECTION G1/G2
PROTECTION G1/G2
PROTECTION G1/G2 (cont'd)
[50/51] Phase OC
I > Function ? Yes
Yes
No
I> 0.1 In
Delay Type DMT
If DMT
tI> 40ms
tReset 0ms
If IDMT
Idmt IEC SI
Interlock I>> I>>> No
TMS 0.025
If Idmt=IEEE/ANSI or COx::
Reset Delay Type DMT
If IDMT:
Rtms 0.025
tReset 60 ms
If RI
K 2.500
tReset 40ms
I >> Function ? Yes
Yes
No
I>> 4 In
Delay Type DMT
If DMT
tI>> 40ms
tReset 0ms
If IDMT
Idmt IEC SI
TMS 0.025
If Idmt=IEEE/ANSI or COx:
Reset Delay Type DMT
If IDMT:
Rtms 0.025
tReset 60 ms
If RI
K 2.500
tReset 60ms
I>>> Function ? Yes
I>>> 0.5 In
tI>>> 10 ms
[50N/51N] EARTH FAULT
I0> FUNCTION ? YES
Yes
No
I0> = 0.002 Ion
t I0 > = 0 ms
I0>> FUNCTION ? YES
Yes
No
I0>> = 0.002 Ion
t I0 >> = 0 ms
[46] UNBALANCE
I2> FUNCTION ? YES
Yes
No
I2> = 0.01 In
t I2> = 0 ms
I2>> FUNCTION ? YES
Yes
No
TMS I2>> = 1
I2>> = 0.01 In
[48] EXCES LONG START
EXCES LONG START FUNCT YES
[51LR/50S] BLOCK ROTOR
BLOCKED ROTOR FUNCT ? YES
Yes
t Istall = 0.1 s
STALLED ROTOR ? YES
Yes
Istall DETECTION = 1.0 In
LOCKED ROTOR AT START ? NO
No


DEFAULT DISPLAY
PROTECTION G1/G2
AUTOMAT CTRL (cont'd)
PROTECTION G1/G2
AUTOMAT. CTRL
[37] LOSS OF LOAD
I< FUNCTION ? YES
Yes
I< = 0.1 In
t I< = 0.2 s
Tinhib = 50 ms
No
[49/38] RTD *
RTD 1 FUNCTION? YES
Yes
RTD 1 ALARM = 0°C
t RTD 1 ALARM = 0.0 s
RTD 1 TRIP = 0°C
t RTD 1 TRIP = 0.0 s
t RTD 2 TRIP = 0.0 s
...
t RTD 6 TRIP = 0.0 s
No
[49] THERMISTANCE *
Thermistance 1 FUNCT ? YES
Yes
Thermist 1 = 0.1 kΩ
Thermistance 2 FUNCT ? YES
Thermist 2 = 0.1 kΩ
No
[66]START NUMBER
START NB LIMIT FUNCT ? YES
Yes
Treference = 10 mn
HOT START NB = 0
COLD START NB = 0
Tinterdiction = 1 mn
No
MIN TIME BETW 2 START
TIME BETW START FUNCT ? YES
Yes
T betw 2 start = 1 mn
No
REACCEL AUTHORIZ
Detect Volt Dip VOLTAGE
REACCEL AUTHORIZ FUNCT ? YES
INPUT
VOLTAGE DIP DURAT Treacc = 0.2 s
*: optional


DEFAULT DISPLAY
AUTOMAT CTRL
AUTOMAT CTRL (contd)
INPUTS
Inputs 1/ 2/ 3/ 4/ 5/ 6 7 / 8 / 9 / A / B (1)
EMERG. START
SET GROUP
SPEED SW
DIST TRIG
EXT. RESET
tAux 1
tAux 2
tAux 3
tAux 4
tAux 5
tAux 6
tAux 7
tAux 8
tAux 9
tAux 10
Therm RESET
TRIP CIRC
V DIP
Synchro.
Phase Rotat.
52a
Aux Timers
t Aux 1 = 0.00 s
t Aux 2 = 0.00 s
t Aux 3 = 0.00 s
t Aux 4 = 0.00 s
t Aux 5 = 0.00 s
t Aux 6 = 0.00 s *
t Aux 7 = 0.00 s *
t Aux 8 = 0.00 s *
t Aux 9 = 0.00 s *
t Aux 10 = 0.00 s *
AUTOMAT. CTRL
LOGIC EQUATION
Equation A/B/C/D/E/F/G/H
Equation A.00 = Logic signal
Logic signals
OR
AND NOT
AND
OR NOT
T operate = 10 ms
T reset = 30 ms
Equation A.01 OR xxx
Equation A.02 AND NOT xxx>
Equation A.03 OR xxx
NULL
TH.OVER.
TH.ALARM
FOR.START
I>
tI>
I >>
tI>>
t I >>
I>>>
tI>>>
Io >
t Io >
Io >>
t Io >>
tI2>
tI2 >>
EX.START
t Istall
LO.ROTOR
tI<
CB FAIL
T.C.FAIL
tAux 1
tAux 2
tAux 3
tAux 4
SUC.STAR
VOL DIP
EQU.A
...
EQU.H
tAux 5
...
tAux 10
INPUT 1
...
INPUT 6
t RDT 1 ALARM
t RDT 1 TRIP
...
t RDT 6 TRIP
Thermist 1
Thermist 2
AUX OUTPUT RLY
THERM OV. 5 4 3 2
0 0 0 0
θ ALARM
θFORBID. START
I >
tI >
I >>
tI>>
I >>>
tI >>>
Io >
tIo >
Io >>
t Io >>
tI2>
tI2>>
EXCEX LG START
t Istall
LOCKED ROTOR
t I<
START NB LIMIT
T betw 2 start
t Aux 1
...
t Aux 6 (or t Aux 10 *)
ABS
VOLTAGE DIP
CLOSE ORDER
TRIP ORDER
ORDER 1
ORDER 2
SUCCESS START
t EQU.A
...
t EQU.H
CB OPEN TIME
CB OPER NB
SAn
CB FAIL
INPUT 1
...
INPUT 6
...
INPUT 11 *
AUX OUTPUT RELAY *
t RDT 1 ALARM *
t RDT 1 TRIP
...
t RDT 6 TRIP *
Thermist 1 *
Thermist 2 *
ABS
*: optional


DEFAULT DISPLAY
AUTOMAT CTRL
RECORD
AUTOMAT. CTRL
LATCH AUX RLY
LATCH RL2 NO
LATCH RL3 NO
LATCH RL4 NO
LATCH RL5 NO
TRIP OUTPUT RLY
THERM OVERLOAD ? YES
tI > ?
tI >> ?
tI >>> ?
t I0 > ?
t I0 >> ?
t I2 > ?
t I2 >> ?
EXCES LONG START?
tIstall ?
LOCKED ROTOR ?
tI< ?
t Aux1 ?
...
t Aux10 ?
t RDT 1 TRIP ? *
...
t RDT 6 TRIP ? *
Thermist 1 ? *
Thermist 2 ? *
EQUATION A ?
...
EQUATION H ?
VOLTAGE DIP ?
*: optional
LATCH TRIP ORDER
LATCH THERM OVERLOAD ? NO
LATCH tI > ?
LATCH tI >> ?
LATCH tI >>> ?
LATCH t I0> ?
LATCH t I0>> ?
LATCH t I2> ?
LATCH t I2>> ?
LATCH EXCES LONG START?
LATCH tIstall ?
LATCH LOCKED ROTOR ?
LATCH tI< ?
LATCH tAux 1 ?
...
LATCH tAux10?
LATCH t RDT 1 TRIP ? *
...
LATCH t RDT 6 TRIP ? *
LATCH Thermist 1 ? *
LATCH Thermist 2 ? *
LATCH EQU. A ?
...
LATCH EQU. H ?
LATCH VOLTAGE DIP?
*: optional
CB FAIL
CB FAIL FUNCT ? YES
Yes
I< BF = 0.1 In
tBF ? 30 ms
No
ABS
ABS FUNCTION ? YES
Yes
tABS = 0 ms
No
CB SUPERVISION
TRIP CIRCUIT SUPERV ? YES
Yes
t SUP = 0.1 s
CB OPENING TIME ? YES
Yes
CB OPENING TIME = 50 ms
CB OPERATION NB ? YES
Yes
CB OPERATION NB = 0
S A n ? YES
Yes
S A n = E06
n = 1
TRIP T = 200 ms
CLOSE T = 200 ms


CB MONITORING
S A
CLR ? = [C]
S A IA =
E06
S A IB =
E06
S A IC =
E06
CB OPERATION NB =
0
CLR = [C]
CB OPEN TIME =
100 ms
RECORD
DISTURB RECORD
PRE-TIME =
0.1 s
POST-TIME =
0.1 s
DISTUR REC TRIG =
ON INST.
IN MAGNITUDE
0.03 A
V AB MAGNITUDE
5126 V
V BC MAGNITUDE
5126 V
V CA MAGNITUDE
5126 V
DEFAULT
DISPLAY
AUTOMAT CTRL
FAULT RECORD
RECORD NUMBER
5
FAULT TIME
16:39:23:82
FAULT DATE
01/09/00
ACTIVE SET GROUP.
1
PHASE IN FAULT
Phase B
FAULT DETECTED
BY
I>>
MAGNITUDE
1.917 kA
IA MAGNITUDE
1.917 kA
IB MAGNITUDE
1.997 kA
IC MAGNITUDE
1.931 kA

BLANK PAGE

COMMUNICATION

CONTENT

BLANK PAGE

1. MODBUS PROTOCOL

The MiCOM P220/P225 relay offers MODBUS™ RTU mode communication via a rear RS485 port.

1.1 MODBUS communication characteristics

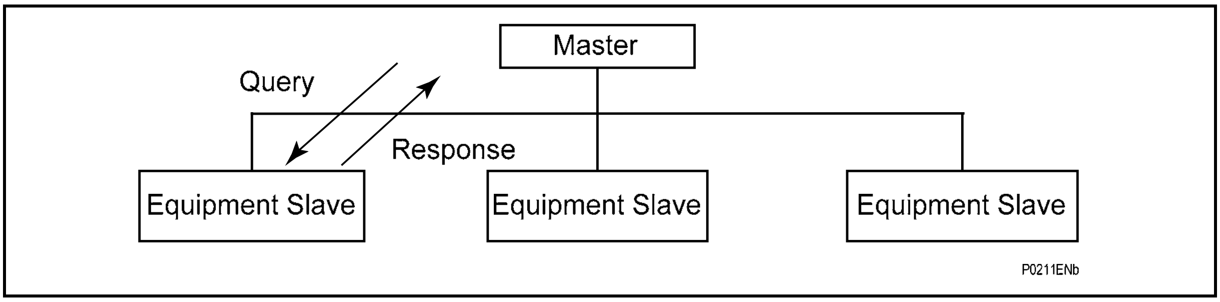
1.1.1 MODBUS network characteristics

The MODBUS protocol is based on the master-slave principle with the MiCOM P220/P225 relay as slave.

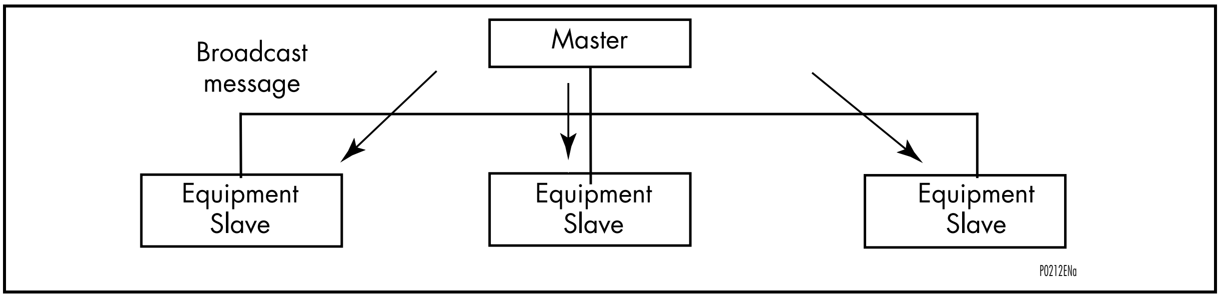
The MODBUS protocol allows the master to read and to write one or several bits, one or several words and to remote the event logging data.

The access to the network can be:

– either according to a query/response principle



– or according to a broadcast message sent from the master to all the slaves.



in that case:

– compulsory, the broadcast message is a writing order,

– the slaves return no response,

– the protocol is RTU mode. Each byte of the data frame is coded according to a hexadecimal base.

– At the end of each frame, two bytes of CRC16 validity checksum are applied on the whole of the frame content.

1.1.2 Parameters of the MODBUS connection

The different parameters of the MODBUS connection are as follows:

– Isolated two-point RS485 connection (2kV 50Hz).

– MODBUS line protocol in RTU mode.

– The baud rate can be configured by operator dialogue in the front panel of the relay:

Baud Rate
300
600
1200
2400
4800
9600
19200
38400

– Transmission mode of the configurable parameters by operator dialogue:

Transmission 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

1.1.3 Synchronisation of exchange messages

Any character received after a silence on the line with more or equal to a transmission time of 3 bytes is considered as a frame start.

1.1.4 Message validity check

The validation of a trame 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

1.1.5 Address of the MiCOM relays

The address of the MiCOM relay on a same MODBUS network is situated between 1 and 255. The address 0 is reserved for the broadcast messages.

1.2 MODBUS functions of the MiCOM relays

The MODBUS functions implemented on the MiCOM relays are:

Function 1 or 2: Reading of n bits

Function 3 or 4: Reading of n words

Function 5: Writing of 1 bit

Function 6: Writing of 1 word

Function 7: Fast reading of 8 bits

Function 8: Reading of the diagnosis counters

Function 11: Reading of the Event counter

Function 15: Writing of n bits

Function 16: Writing of n words

1.3 Presentation of the MODBUS protocol

MODBUS is a master-slave protocol whereby every exchange involves a master query and a slave response.

1.3.1 Frame size received by the MiCOM P220/P225 relay

Frame transmitted by the master (query):

Slave Number	Function Code	Information	CRC16
1 byte	1 byte	n bytes	2 bytes
0 to FFh	1 to 10h		

Slave number:

The slave number is situated between 1 and 255.

Function code:

Requested MODBUS function (1 to 16).

Information:

Contains the parameters of the selected function.

CRC16:

Value of the CRC16 calculated by the master.

NOTE: The MiCOM relay does not respond to globally broadcast frames sent out by the master.

1.3.2 Format of frames sent by the MiCOM P220/P225 relay

Frame sent by the MiCOM relay (response):

Slave Number	Function Code	Data	CRC16
1 byte	1 byte	n bytes	2 bytes
1 to FFh	1 to 10h		

Slave number:

The slave number is situated between 1 and 255.

Function code:

Processed MODBUS function (1 to 16).

Data:

Contains the response data to master query.

CRC16:

Value of the CRC16 calculated by the MiCOM relay.

1.3.3 Messages validity check

When the MiCOM relay receives a master query, it validates the frame:

- If the CRC is false, the frame is invalid. The MiCOM relay does not reply to the query. The master must retransmit its query. Excepting a broadcast message, this is the only case of non-reply by the MiCOM relay to a master query.
- If the CRC is correct but the MiCOM relay can not process the query, it sents to the master a exception response.

Exception frame sent by the MiCOM relay (response):

Slave Number	**Function Code**	**Error Code**	**CRC16**
1 byte	1 byte	1 byte	2 bytes
1 to FFh			LSB ... MSB

Slave number:

The slave number is situated between 1 and 255.

Function code:

The function code returned by the MiCOM relay in the exception frame is the code in which the most significant bit (bit7) is forced to 1.

Error code:

Among the 8 exception codes of the MODBUS protocol, the MiCOM relay manages two of them:

- code 01: Function code unauthorised or unknown.
- code 03: A value of the data field is unauthorised (incorrect code).
  - Control of pages being read.
  - Control of pages being written.
  - Control of address in pages.
  - Length of request messages.

CRC16:

The CRC16 value is calculated by the slave.

1.4 MODBUS request definition used to retrieve the disturbance records

To retrieve 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 in the saved RAM.
2. To retrieve the data of one channel:
   2a - (compulsory): send a service request specifying the record number and the channel number which have to be retrieved.
   2b - (compulsory): send requests to retrieve the data of a disturbance record channel as many time as needed.
   2c - (compulsory): send a request to retrieve the index frame.
3. Process the same operation (as described in the item 2) for each channel.

1.4.1 Request to know the number of available disturbance records in the Saved RAM.

Slave Number	**Function Code**	**Word Address**	**Word Number**	**CRC**
xx	03h	3Dh 00	00 24h	xx...........xx

This request may be answered an error message with the error code:

EVT_NOK (0F): No record available.

NOTE: If there are less than 5 records available, the answer will contain zero value in the non-used words.

1.4.2 Service request

This request shall be sent before to retrieve the sample data of a disturbance record channel. It allows to specify the record number and the channel number which have to be retrieved. It allows also to know 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 be answered an error message. Two error codes are possible:

CODE_DEF_RAM (02): Saved RAM failure.

CODE_EVT_NOK (03): No disturbance record available in the saved RAM.

1.4.3 Request to retrieve the data of a disturbance record channel

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	Refer to mapping	1 to 7Dh	xx...........xx

This request may be answered an error message. Two error codes are possible:

CODE_DEP_DATA (04): The requested sample number is superior than the number of samples in the specified channel.

CODE_SERV_NOK (05): The record number and the channel number have not been specified by a service request.

NOTE: This type of request can retrieve up to125 words. A sample is coded on 1 word (16 bits).

1.4.4 Request to retrieve an index frame

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	22h 00	00 07h	xx...........xx

This event request may be answered an error message with the error code:

CODE_SERV_NOK (05): The record number and the channel number have not been specified by a service request.

1.5 MODBUS request definition used to retrieve the event records

Two ways can be followed to retrieve an event record:

– Send a request to retrieve the oldest non-acknowledge event.

– Send a request to retrieve a dedicated event.

1.5.1 Request to retrieve the oldest non-acknowledge event

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	36h 00	00 09h	xx...........xx

This event request may be answered 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:

a) Automatic event record acknowledgement on event retrieval.

b) Non automatic event record acknowledgement on event retrieval.

a) Automatic event record acknowledgement on event retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 0. On event retrieval, this event record is acknowledged.

b) Non automatic event record acknowledgement on event retrieval:

The 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, an other remote order shall be sent to the relay. The bit 13 of this frame (format F9 - mapping address 0400h) shall be set to 1.

1.5.2 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 be answered 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.

1.6 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.

1.6.1 Request to retrieve the oldest non-acknowledge fault record

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	3Eh 00	00 10h	xx...........xx

NOTE: On fault retrieval, two possibilities exist regarding the fault record acknowledgement:

a) Automatic fault record acknowledgement on event retrieval.

b) Non automatic fault record acknowledgement on event retrieval.

a) Automatic event record acknowledgement on event retrieval:

The 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) Automatic fault record acknowledgement on fault retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 0. On fault retrieval, this fault record is acknowledged.

c) Non automatic fault record acknowledgement on fault retrieval:

The 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, an other remote order shall be sent to the relay. The bit 14 of this frame (format F9 - mapping address 0400h) shall be set to 1.

1.6.2 Request to retrieve a dedicated fault record

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	Refer to mapping	00 10h	xx...........xx

NOTE: This fault value retrieval does not acknowledge this fault record.

1.7 MODBUS request definition used to retrieve both start-up current & voltage form record

To retrieve both start-up current & voltage form record, process as described below:

1. Send a request to know the number of values stored into the saved RAM.
2. Send a request to retrieve the start-up record data relevant to current or voltage signal form.

1.7.1 Request to know the number of current values stored into the saved memory

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	34H 00	00 03h	xx...........xx

1.7.2 Request to retrieve the start-up current form record data

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	Refer to mapping	004 to 7Ch	xx...........xx

NOTE: The number of requested words shall be a 2 multiple number as the value of a start-up current form record sample is coded on 4 bytes. One page of the mapping can stored up to 248 words.

1.7.3 Request to know the number of voltage values stored into the saved memory

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	51h 00	00 03h	xx...........xx

1.7.4 Request to retrieve the start-up voltage form record data

Slave Number	Function Code	Word Address	Word Number	CRC
xx	03h	Refer to mapping	04 to 7Ch	xx...........xx

NOTE: The number of requested words shall be a 2 multiple number as the value of a start-up voltage form record sample is coded on 4 bytes. One page of the mapping can stored up to 248 words.

1.8 MiCOM P220/P225 database organisation

1.8.1 Description of the MODBUS application mapping

The MODBUS mapping contains 60 pages.

Pages 0 to 8: Contain the MiCOM P220/P225 parameters.

Pages 9 to 51h: Contain the data of the event records, data of the fault value records, data of the disturbance records and data of both start-up current & voltage form record.

These pages are explained in the following way:

Page No	Page Content	Access
Page 0h	Information of product, remote signaling, remote measurements	Reading
Page 1h	Remote settings for general parameters	Reading & writing
Page 2h	Remote settings for protection group number 1	Reading & writing
Page 3h	Remote settings for protection group number 2	Reading & writing
Page 4h	Remote controls	Writing
Pages 5h & 6h	Boolean equations parameters	Reading & writing

Page No	Page Content	Access
Page 6h	General remote parameters	Reading & writing
Page 7h	MiCOM P220/P225 relay status word	Quick reading
Page 8h	Synchronisation	Writing
Pages 9h to 21h	Disturbance record data	Reading
Page 22h	Index frame for the disturbance records	Reading
Pages 23h to 33h	Start-up current form record data	Reading
Page 34h	Index frame for the start-up current form record	Reading
Page 35h	Event record data	Reading
Page 36h	Data of the oldest event	Reading
Page 37h	Fault value record data	Reading
Pages 38h to 3Ch	Selection of the disturbance record and selection of its channel	Reading
Page 3Dh	Number of available disturbance records	Reading
Page 3Eh	Data of the oldest fault value record	Reading
Page 3Fh	Reserved page	Not accessible
Pages 40h to 50h	Start-up voltage form record data	Reading
Page 51h	Index frame for the start-up voltage form record	Reading

1.8.2 Page 0: Information of product, remote signaling, remote measurements

Access only for reading

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0000	**Product Informations**	Description of the relay characters 1 and 2	32 to 127	1	-	F10	
0001		Description of the relay characters 3 and 4	32 to 127	1	-	F10	P2
0002		Description of the relay characters 5 and 6	32 to 127	1	-	F10	25
0003		Factory reference characters 1 and 2	32 to 127	1	-	F10	AL
0004		Factory reference characters 3 and 4	32 to 127	1	-	F10	ST
0005		Software version	100 - xx	1	-	F21	
		Active setting group	1 to 2			F1	
0007 to 000E		*Reserved*					
000F		Status of the MiCOM relay selftest				F46	
0010	**Remote-Signalings**	Logic inputs	0 to 31	1	-	F12	
0011		Logic datas	0 to FFFF	1	-	F20	
0012		Internal logics	0 to FFFF	1	-	F22	
0013		Output relays	0 to 63	1	-	F13	
0014		Output information: threshold I>>	0 to FFFF	1	-	F17	
0015		Output information: threshold I0>	0 to FFFF	1	-	F16	
0016		Output information: threshold I0>>	0 to FFFF	1	-	F16	
0017		Output information: I2 >	0 to FFFF	1	-	F16	
0018		Output information: I2 >>	0 to FFFF	1	-	F16	
0019		Output information: I<	0 to FFFF	1	-	F17	

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
001A		Thermal image Information	0 to FFFF	1	-	F33	
001B		Informations: EXT1, EXT2, EXT3, EXT4 timers and «AND» logical gates	0 to FFFF	1	-	F36	
001C		Informations: Excessive long start/stalled rotor	0 to FFFF	1	-	F34	
001D		Informations: RTD1 to RTD6	0 to FFFF	1	-	F4	
001E		Number of available disturbance records	0 to 5	1		F55	
001F		Informations: RTD7 to RTD10	0 to FFFF	1	-	F4'	
0020		Trip output relay status (RL1)	0 to 1	1	-	F1	
0021		Circuit breaker monitoring flag				F43	
0022		Display alarm message: t I>> PHASE				F17	
0023		Display alarm message: t I< PHASE (Mini I)				F17	
0024		Display alarm messages				F41	
0025		Display alarm messages				F41'	
0026		Display alarm messages				F41 ''	
0027		Display alarm messages				F41 '''	
0028 to 0029		*Reserved*					
002A		Output information: threshold V<	0 to FFFF	1	-	F17	
002B		Output information: VOLTAGE DIP	0 to FFFF	1	-	F17	
002C		Output information: threshold V>	0 to FFFF	1	-	F17	
002D		Informations: CB FAIL, ABS and BUS VOLTAGE	0 to FFFF	1	-	F35	
002E		Display alarm message: tV<	0 to FFFF	1	-	F17	
002F		Display alarm message: tV>	0 to FFFF	1	-	F17	
0030	**Remote-Measurements**	Phase A current IA RMS	0 to $12*10^6$	1	A/100	F3	
0032		Phase B current IB RMS	0 to $12*10^6$	1	A/100	F3	
0034		Phase Current IC RMS	0 to $12*10^6$	1	A/100	F3	
0036		Neutral current IN RMS	0 to $3*10^5$	1	A/100	F3	
0038		Negative sequence I_2 current (fundamental)	0 to $12*10^6$	1	A/100	F3	
003A		Positive sequence I_1 current (fundamental)	0 to $12*10^6$	1	A/100	F3	
003C		Zero sequence current (fundamental) I0 (1/3 * IN)	0 to $1*10^5$	1	A/100	F3	
003E		Frequency	4500 to 6500	1	1/100 Hz	F1	
003F to 0040		Phase current maximeter	0 to $12*10^6$	1	A/100	F1	
0041		I2/I1 ratio			%		
0042		Line to line Voltage VAC RMS	0 to $4*10^6$	1	V/100	F3	
0044		Apparent power VAs	0 to $4,8*10^8$		KVA/100	F3	
0046		Active Power WATTS	+/- $4,8*10^8$		KW/100	F11	
0048		Reactive Power VARs	+/- $4,8*10^8$		KVAR/100	F11	
004A		Active power consumption WATT-Hours	+/- $2*10^9$		KWh/100	F11	
004C		Reactive power consumption VAR-Hours	+/- $2*10^9$		KVARh/100	F11	
004E		Power Factor	-100 to +100	1	1/100	F2	
004F		*Reserved*					

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0050	**Process**	Load current as % Iθ>			%	F1	
0051		Thermal status value			%	F1	
0052		*Reserved*					
0053		Time before thermal trip			Seconds	F1	
0054		RTD1 temperature value	-400 to 2000		1/10 °C	F2	
0055		RTD2 temperature value	-400 to 2000		1/10 °C	F2	
0056		RTD3 temperature value	-400 to 2000		1/10 °C	F2	
0057		RTD4 temperature value	-400 to 2000		1/10 °C	F2	
0058		RTD5 temperature value	-400 to 2000		1/10 °C	F2	
0059		RTD6 temperature value	-400 to 2000		1/10 °C	F2	
005A		Thermistor 1 value	0 to 30000	1	Ohm	F1	
005B		Thermistor 2 value	0 to 30000	1	Ohm	F1	
005C		Number of authorised start-ups			-	F1	
005D		Time before an authorised start-up			seconds	F1	
005E to 005F		Last start current value	0 to 120000	1	A	F1	
0060		Last start time value			seconds	F1	
0061		Total motor start number			-	F1	
0062		Total emergency start number			-	F1	
0063		Total motor running hours			hours	F1	
0064		RTDs status				F45	
0065		RTD7 temperature value	-400 to 2000		1/10 °C	F2	
0066		RTD8 temperature value	-400 to 2000		1/10 °C	F2	
0067		RTD9 temperature value	-400 to 2000		1/10 °C	F2	
0068		RTD10 temperature value	-400 to 2000		1/10 °C	F2	
0069		Thermistor 3 value	0 to 30000	1	Ohm	F1	
006A		No Hottest RTD	1 to 10	1	-	F1	
006B		Information: Auto Re-Start (P225 only)	0-FFFF	1	-	F34'	
006C		Display alarm message: tI>PHASE				F17	
006D		Display alarm message: tI>>>PHASE				F17	
006E		Output information: threshold I>	0-FFFF	1	-	F17	
006F		Output information: threshold I>>>	0-FFFF	1	-	F17	
0070	***Trip Cause Statistics***	*Reserved*					
0071		Total trip number (based on output relay No1: RL1)			-	F1	
0072		Operator trip number (logic inputs, pushbuttons or remote communication)			-	F1	
0073		Thermal trip number			-	F1	
0074		Earth fault trip number (tIo>, tIo>>)			-	F1	
0075		Phase OC trip number (tI>, tI>>, tI>>>)			-	F1	
0076		Excessive long start trip number (tIstart)			-	F1	
0077		Stalled rotor trip number (whilst running - tIstall))			-	F1	
0078		Locked rotor trip number (at start)			-	F1	
0079		Loss of load trip number (tI<)			-	F1	
007A		Unbalance trip number (tI2>, tI2>>)			-	F1	

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
007B		EQUATION A trip number				F1	
007C		EQUATION A trip number				F1	
007D		EQUATION A trip number				F1	
007E		EQUATION A trip number				F1	
007F		RTD1 trip number			-	F1	
0080		RTD2 trip number			-	F1	
0081		RTD3 trip number			-	F1	
0082		RTD4 trip number			-	F1	
0083		RTD5 trip number			-	F1	
0084		RTD6 trip number			-	F1	
0085		Thermistor 1 trip number			-	F1	
0086		Thermistor 2 trip number			-	F1	
0087		Thermistor 3 trip number			-	F1	
0088		Under voltage trip number (tV<)			-	F1	
0089		Over voltage trip number (tV>)			-	F1	
008A		RTD7 trip number			-	F1	
008B		RTD8 trip number			-	F1	
008C		RTD9 trip number			-	F1	
008D		RTD10 trip number			-	F1	
008E		VOLTAGE DIP trip number			-	F1	
008F		*Reserved*			-		
0090	**Fourier Magnitude**	I_A magnitude			-	F1	
0091		I_B magnitude			-	F1	
0092		I_C magnitude			-	F1	
0093		$3.I_0$ magnitude			-	F1	
0094	**Fourier Angle**	I_A angle			-	F1	
0095		I_B angle			-	F1	
0096		I_C angle			-	F1	
0097		$3.I_0$ angle			-	F1	
0098 to 0099	**Fourier Magnitude**	I_1 magnitude			-	F1	
009A to 009B		I_2 magnitude			-	F1	
009C		VAC voltage magnitude			-	F1	
009D	**Fourier Angle**	VAC voltage angle			-	F1	
009E		*Reserved*					
00A0		Active phase rotation	1-2		-	F1	1
00A1		*Reserved*					
00A3		Display alarm message				F41””	
00A4		Informations: tAux5-10 timers and logical gates	0-FFFF	1	-	F36’	
00A5 to 00AE		*reserved*					
00AF		Equation E trip number				F1	
00B0		Equation F trip number				F1	
00B1		Equation G trip number				F1	
00B2		Equation H trip number				F1	
00B3		VA voltage magnitude				F1	
00B4		VB voltage magnitude				F1	
00B5		VC voltage magnitude				F1	
00B6		3.V0 voltage magnitude				F1	
00B7-00B8		U1 magnitude				F1	
00B9-00BA		U2 magnitude				F1	
00BE		VB voltage angle				F1	
00CE		VC voltage angle				F1	
00BD		3.V0 voltage angle				F1	
00BE-00BF		Phase Voltage VA RMS	$0\text{-}4*10^6$	1	V/100	F3	
00C0-00C1		Phase Voltage VB RMS	$0\text{-}4*10^6$	1	V/100	F3	
00C2-00C3		Phase Voltage VC RMS	$0\text{-}4*10^6$	1	V/100	F3	
00C4-00C5		Zero sequence voltage	$0\text{-}1*10^5$	1	V/100	F3	

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
00C6-00C7		Zero power measurent	$–4.8*10^8$ - $4.8*10^8$	-	kW/100	F11	
00C8-00C9		Negative sequence volt (fundamental)	$0-4*10^6$	1	V/100	F3	
00CA-00CB		Positive sequence volt (fundamental)	$0-4*10^6$	1	V/100	F3	
00CC-00CD		Phase Voltage maximeter	$0-4*10^6$	1	V/100	F1	
00CE-00CF		*Reserved*					
00D3		Option board				F66	
00D4-00D5		Serial number					
00D6		Version hardware				F69	
00D7		Version analog				F70	
00D8		Logic datas	0-FFFF	1	-	F20’	
00D9		VA voltage angle				F1	
00DA		VAB voltage magnitude				F1	
00DB		VBC voltage magnitude				F1	
00DC		VCA voltage magnitude				F1	
00DD-00DE		Voltage VAB RMS	$0-4*10^6$	1	V/100	F3	
00DF-00E0		Voltage VBC RMS	$0-4*10^6$	1	V/100	F3	
00E1-00E2		Voltage VCA RMS	$0-4*10^6$	1	V/100	F3	
00E3		VAB voltage angle				F1	
00E4		VBC voltage angle				F1	
00E5		VCA voltage angle				F1	

1.8.3 Page 1: Remote settings for general parameters

Access for reading and writing

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0100	**Remote-Settings**	Address	1 to 255	1	-	F1	1
0101		Language	0 to 15	1		F1	
0102		Password: characters 1 and 2	0x41 to 0x5a	1	-	F10	AA
0103		Password: characters 3 and 4	0x41 to 0x5a	1	-	F10	AA
0104		Frequency	50 to 60	10	Hz	F1	50
0105		Default displayed value	1 to 23	1	-	F26	1
0106		Motor start-up detection criterion	0 to 1	1		F5	0
0107		Analogue output type	0 to 1	1	-	F18	0
0108		Data transmitted on the analogue output n°1	0 to 22	1		F7	0
0109		Active setting group	1 to 2	1		F1	1
010A-010B		User reference: characters	0x30 to 0x5a	1	-	F10	AA
10C		Displayed fault record number	1 to 25	1		F39	25
010D		Thermistor 1 type	0 to 1	1	-	F32	0
010E		Thermistor 2 type	0 to 1	1	-	F32	0
010F		RTDs type	0 to 3	1	-	F42	0
0110		Thermistor 3 type	0 to 1	1	-	F32	0
0111		Data transmitted on the analogue output n°2	0 to 22	1		F7	0
0112		Configuration of the maximum analogue output n°1 rating	0 to 10	1	-	F47	0=10 Kilo
0113		Configuration of the maximum analogue output n°2 rating	0 to 10	1	-	F47	0=10 Kilo
0114		Configuration of the logic input active state	0 to 1	1	-	F48	1
0115		Latching of the auxiliary output relays	0 to 15	1	-	F14	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0116		Configuration of the control voltage type for the logic inputs	0 to 1	1		F37	0
0117		Configuration of both RAM ERROR & BATTERY ERROR alarm message	0 to 1	1		F24	0
0118		Configuration of the way to switch of active setting group	0 to 1	1		F49	~~0~~ 1
0119		Detect Volt Dip	0 to 1	1		F60	0 (P225) or 1 (P220)
011A		Function: Auto Re-Start (P225 only)	0 to 1	1		F24	0
011B		Treac-long (P225 only)	0 to 600	1	Sec/10	F1	20
011C		Treac-shed (P225 only)	0 to 59400	1	Sec/10	F1	0
011D		Auto Re-Start (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
0120	**CT/VT Ratio**	Line CT primary	1 to 3000	1	-	F1	1
0121		Line CT secondary	1 to 5	4	-	F1	1
0122		Earth/Gnd CT primary	1 to 3000	1	-	F1	1
0123		Earth/Gnd CT secondary	1 to 5	4	-	F1	1
0124		Line VT primary	1 to 20000	1	-	F1	57 or 220
0125		Line VT secondary	57 to 130 or 220 to 480	1	-	F1	57 or 220
0126		INPUT1 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
0127		INPUT2 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
0128		INPUT3 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
0129		INPUT4 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
012A		INPUT5 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
012B		INPUT6 (AUX OUTPUT RLY)	0 to 15	1	-	F14	0
012C		Led5		2n			
012D		Led6		2n			
012E		Led7		2n			
012F		Led8		2n			
0130	**Rear RS485 Communication**	Data rate	0 to 7	1	-	F28	6 = 19200 bauds
0131		Parity	0 to 2	1	-	F29	0 = without
0132		*Reserved*					
0133		Stop bit	0 to 1	1	-	F31	0 =1 bit
0134		Communication available	0 to 1	1	-	F24	1 = Commu-nication available
0135 to 013C		*Reserved*					
013D	**CB Supervision**	CB operation number		1	-	F1	
013E		CB operating time		1	sec/100	F1	
013F		S A^n I_A (phase A)		1	A^n	F3	
0141		S A^n I_B (phase B)		1	A^n	F3	
0143		S A^n I_C (phase C)		1	A^n	F3	
0145		Configuration of the date format	0 to 1	1	-	F44	
0146		*Reserved*					
0147		I> (instantaneous)	0 to 15	1	-	F14	0
0148		tI> (time delayed)	0 to 15	1	-	F14	0
0149		I>>> (instantaneous)	0 to 15	1	-	F14	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
014A		tI>>> (time delayed)	0 to 15	1	-	F14	0
014B		I> (instantaneous)	0 to 15	1	-	F14	0
014C		tI> (time delayed)	0 to 15	1	-	F14	0
014D		I>>> (instantaneous)	0 to 15	1	-	F14	0
014E		tI>>> (time delayed)	0-15	1	-	F14	0
014F		Latching of the trip output relay (RL1) - (2/3)	0 to 8191	2^n	-	F8'	0
0150-0151	**LED Allocation**	Led 5		2^n	-	F19	0
0152-0153		Led 6		2^n	-	F19	0
0154-0155		Led 7		2^n	-	F19	0
0156-0157		Led 8		2^n		F19	0
0158	**Auxiliary Output Relays Allocation**	t RTD10 ALARM	0 to 15	1	-	F14	0
0159		t RTD10 TRIP	0 to 15	1	-	F14	0
015D	**Auxiliary Output Relays Allocation**	GROUP 2 ACTIVE	0 to 15	1	-	F14	0
015E	**Logic Inputs Allocation**	Logic input L6	0 to 2^n		-	F15	0
015F		Logic input L2	0 to 2^n		-	F15	0
0160		Logic input L3	0 to 2^n		-	F15	0
0161		Logic input L4	0 to 2^n		-	F15	0
0162		Logic input L5	0 to 2^n		-	F15	0
0163	**Auxiliary Output Relays Allocation**	ABS	0 to 15	1	-	F14	0
0164		CB FAIL	0 to 15	1	-	F14	0
0165		TRIP CIRC. FAIL	0 to 15	1	-	F14	0
0166		t RTD7 ALARM	0 to 15	1	-	F14	0
0167		t RTD7 TRIP	0 to 15	1	-	F14	0
0168		t RTD8 ALARM	0 to 15	1	-	F14	0
0169		t RTD8 TRIP	0 to 15	1	-	F14	0
016A		t RTD9 ALARM	0 to 15	1	-	F14	0
016B		t RTD9 TRIP	0 to 15	1	-	F14	0
016C		Thermist 3	0 to 15	1	-	F14	0
016D		tV< (time delayed)	0 to 15	1	-	F14	0
016E		VOLTAGE DIP	0 to 15	1	-	F14	0
016F		tV> (time delayed)	0 to 15	1	-	F14	0
0170		Thermal overload: THERM OV.	0 to 15	1		F14	0
0171		Thermal alarm: θ ALARM	0 to 15	1	-	F14	0
0172		Thermal start inhibition θ FORBID. START	0 to 15	1	-	F14	0
0173		I0> (instantaneous)	0 to 15	1	-	F14	0
0174		tI0> (time delayed)	0 to 15	1	-	F14	0
0175		I0>>(instantaneous)	0 to 15	1	-	F14	0
0176		tI0>>(time delayed)	0 to 15	1	-	F14	0
0177		I>> (instantaneous)	0 to 15	1	-	F14	0
0178		tI>> (time delayed)	0 to 15	1	-	F14	0
0179		tI2> (time delayed)	0 to 15	1	-	F14	0
017A		tI2>> (time delayed)	0 to 15	1	-	F14	0
017B		Excessive long start: EXCES LG START	0 to 15	1	-	F14	0
017C		Stalled rotor (whilst running): t Istall	0 to 15	1	-	F14	0
017D		Locked rotor (at start): LOCKED ROTOR	0 to 15	1	-	F14	0
017E		Loss of load: t I< (time delayed)	0 to 15	1	-	F14	0
017F		Start number limitation START NB LIMIT	0 to 15	1	-	F14	0
0180		Time between 2 start: T betw 2 start	0 to 15	1	-	F14	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0181		t RTD1 ALARM	0 to 15	1	-	F14	0
0182		t RTD1 TRIP	0 to 15	1	-	F14	0
0183		t RTD2 ALARM	0 to 15	1	-	F14	0
0184		t RTD2 TRIP	0 to 15	1	-	F14	0
0185		t RTD3 ALARM	0 to 15	1	-	F14	0
0186		t RTD3 TRIP	0 to 15	1	-	F14	0
0187		t RTD4 ALARM	0 to 15	1	-	F14	0
0188		t RTD4 TRIP	0 to 15	1	-	F14	0
0189		t RTD5 ALARM	0 to 15	1	-	F14	0
018A		t RTD5 TRIP	0 to 15	1	-	F14	0
018B		t RTD6 ALARM	0 to 15	1	-	F14	0
018C		t RTD6 TRIP	0 to 15	1	-	F14	0
018D		Thermist 1	0 to 15	1	-	F14	0
018E		Thermist 2	0 to 15	1	-	F14	0
018F		EXT 1	0 to 15	1	-	F14	0
0190		EXT 2	0 to 15	1	-	F14	0
0191		CLOSE ORDER	0 to 15	1	-	F14	0
0192		TRIP ORDER	0 to 15	1		F14	0
0193		ORDER 1	0 to 15	1		F14	0
0194		ORDER 2	0 to 15	1		F14	0
0195		SUCCESS START	0 to 15	1		F14	0
0196		«AND» logical gate A: t EQU. A	0 to 15	1	-	F14	0
0197		«AND» logical gate B: t EQU. B	0 to 15	1	-	F14	0
0198		«AND» logical gate C: t EQU. C	0 to 15	1	-	F14	0
0199		«AND» logical gate D: t EQU. D	0 to 15	1	-	F14	0
019A		CB opening time: CB OPEN TIME	0 to 15	1		F14	0
019B		CB operation number: CB OPER NB	0 to 15	1		F14	0
019C		Σ Amps^n cut by CB: S An	0 to 15	1		F14	0
019D		EXT 3	0 to 15	1	-	F14	0
019E		EXT 4	0 to 15	1	-	F14	0
019F		BUS VOLTAGE	0 to 15	1	-	F14	0
01A0-01CF		*Reserved*					
01D0	**Automation Control Functions**	Trip output relay assignment (RL1) – (1/3)	0 to 65535	2^n		F6	0
01D1		Trip output relay assignment (RL1) – (2/3)	0 to 8191	2^n		F6'	0
01D2		Latching of the trip output relay (RL1) – (1/3)	0 to 65535	2^n	-	F8	0
01D3		Function: Start number limitation	0 to 1	1	-	F24	0
01D4		Reference time: Treference	10 to 120	5	minute	F1	10
01D5		Hot start number	0 to 5	1	-	F1	0
01D6		Cold start number	1 to 5	1	-	F1	1
01D7		Start interdiction time: Tforbiden	1 to 120	1	minute	F1	1
01D8		Function: Time between 2 starts	0 to 1	1	-	F24	0
01D9		T betw 2 start	1 to 120	1	minute	F1	1
01DA		Function: Re-acceleration authorization	0 to 1	1	-	F24	0
01DB		Voltage dip duration: Treacc	10 to 500	1	1/100 sec	F1	20
01DC		Function: CB Opening time?	0 to 1	1	-	F24	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
01DD		CB OPENING TIME threshold	5 to 100	1	1/100 sec	F1	5
01DE		Function: CB Operation number?	0 to 1	1	-	F24	0
01DF		CB OPERATION NB threshold	0 to 50000	1	-	F1	0
01E0		Σ Amps^n cut by CB function?: S A^n	0 to 1	1	-	F24	0
01E1		SA^n threshold	0 to 4000		10^{e}6 A$^{\wedge n}$	F3	0
01E2		«n» exponent value	1 to 2	1	1	F1	1
01E3		TRIP T duration value (remote order)	20 to 500	5	1/100 sec	F1	20
01E4		CLOSE T duration value (remote order)	20 to 500	5	1/100 sec	F1	20
01E5	**Logic Inputs**	EXT1 time delay	0 to 20000	1	1/100 sec	F1	0
01E6		EXT2 time delay	0 to 20000	1	1/100 sec	F1	0
01E7	**Disturbance Record**	Pre-time	1 to 25	1	1/10 sec	F1	1
01E8		Post-time	1 to 25	1	1/10 sec	F1	1
01E9		Disturbance record trigging criterion: DISTUR REC TRIG	0 to 1	1		F40	0
01EA	**Logic Inputs**	EXT3 time delay	0 to 20000	1	1/100 sec	F1	0
01EB		EXT4 time delay	0 to 20000	1	1/100 sec	F1	0
01EC	**Automation Control Functions**	Voltage dip detection threshold: Detection V DIP	370 to 980 or 1430 to 3600	2	1/10 V	F1	720 or 2860
01ED		Voltage restoration detection threshold: Restoration V DIP	50 to 1300 or 200 to 4800	1	1/10 V	F1	50 or 200
01EE		Function: ABS?	0 to 1	1	-	F24	0
01EF		tABS timer	1 to 7200	1	sec	F1	1
01F0-01F8		*Reserved*					
01F9	**Automation Control Functions**	Function: TRIP CIRCUIT SUPERVISION?	0 to 1	1		F24	
01FA		tSUP timer	10 to 1000	1	1/100 sec	F1	10
01FB		Function: CB FAIL?	0 to 1	1		F24	
01FC		I< BF threshold	1 to 100	1	% In	F1	10
01FD		tBF timer	3 to 1000	1	1/100 sec	F1	3
01FE		Function: BUS VOLTAGE CONTROL? (P225 only)	0 to 1	1		F24	
01FF		V BUS threshold (P225 only)	50 to 1300 or 200 to 4800	1	1/10 V	F1	50 or 200

1.8.4 Page 2: Remote settings for protection functions group No1

Access for reading and writing

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0200	**Protection Group 1**	Thermal overload function	0 to 1	1	-	F24	0
0201		Thermal inhibition at start: θ INHIBIT	0 to 1	1	-	F24	0
0202		Thermal current threshold: Iθ>	20 to 150	1/100 In	-	F1	20
0203		Ke factor	0 to 10	1	-	F1	3
0204		Thermal constant time Te1	1 to 180	1	Minute	F1	1
0205		Thermal constant time Te2	1 to 360	1	Minute	F1	1
0206		Cooling constant time Tr	1 to 999	1	Minute	F1	1
0207		RTD1 influence: RTD1 INFLUENCE	0 to 1	1	-	F24	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0208		Thermal alarm function	0 to 1	1	-	F24	0
0209		θ ALARM threshold	20 to 100	1	%	F1	20
020A		Thermal start inhibition function	0 to 1	1	-	F24	0
020B		θ FORBID START	20 to 100	1	%	F1	20
020C		I>	0 to 1	1	-	F24	0
020D		I> threshold	10 to 2500	1	In/100	F1	10
020E		I> time delay type	0 to 2	1	-	F27	0
020F		I> IDMT Curve Type	0 to 10	1	-	F61	1
0216		I> TMS value	25 to 1500	1	1/1000	F1	25
0217		I> K value (RI curve)	100 to 10000	5	1/1000	F1	100
0218		tI> value	0 to15000	1	1/100 s	F1	4
0213		I> Reset type	0 to 1	1		F27	0
0214		I> RTMS value	25 to 3200	1	1/1000	F1	25
0215		I> tRESET value	0 to 60000	1	1/100 s	F1	0
0210		I>>	0 to 1	1	-	F24	0
0211		I>> Threshold	50 to 4000	5	In/100	F1	50
0212		tI>> value	0 to 15000	1	1/100 s	F1	1
0219		I>> time delay type	0 to 2	1	-	F27	0
021A		I>> IDMT curve type	0 to 10	1	-	F61	1
021B		I>> TMS value	25 to 1500	1	1/1000	F1	25
021C		K value (RI curve)	100 to 10000	5	1/1000	F1	100
021D		I>> Reset Type	0 to 1	1	-	F27	0
021E		I>> RTMS value	25 to 3200	1	1/1000	F1	25
021F		I>> tRESET value	0 to 60000	1	1/100 s	F1	0
0220		I0> function	0 to 1	1	-	F24	0
0221		I0> threshold	2 to 1000	1	1/1000 Ion	F1	2
0222		tI0> time delay	0 to 10000	1	1/100 s	F1	0
0223		I0>> function	0 to 1	1	-	F24	0
0224		I0>> threshold	2 to 1000	1	1/1000 Ion	F1	2
0225		tI0>> time delay	0 to 10000	1	1/100 s	F1	0
0226 to 022A		*Reserved*					-
022B		Interlock	0 to 1	1	-	F24	0
022C		I>>>	0 to 1	1	-	F24	0
022D		I>>> Threshold	50 to 4000	5	In/100	F1	50
022E		tI>>> value	0 to 15000	1	1/100 s	F1	1
022F		TMS I2>>	200 to 2000	25	1/1000	F1	1000
0230		I2> function	0 to 1	1	-	F24	0
0231		I2> threshold	40 to 800	10	1/1000 In	F1	40
0232		tI2> time delay	0 to 20000	1	1/100 s	F1	0
0233		I2>> function	0 to 1	1	-	F24	0
0234		I2>> threshold	40 to 800	10	1/1000 In	F1	40
0235		V< function (P225 only)	0 to 1	1	-	F24	0
0236		V< threshold (P225 only)	50 to 1300 or 200 to 4800	1	1/10V	F1	50 or 200
0237		tV< time delay (P225 only)	0 to 60000	1	1/100 sec	F1	0
0238		V< inhibition at start: INHIB V< (P225 only)	0 to 1	1	-	F24	0
0239 to 023C		*Reserved*				-	0
023D		V> function (P225 only)	0 to 1	1	-	F24	0
023E		V> threshold (P225 only)	50 to 2600 or 200 to 9600	1 ou 5	1/10V	F1	50 or 200
023F		tV> time delay (P225 only)	0 to 60000	1	1/100 sec	F1	0
0240		Excessive long start function	0 to 1	1	-	F24	0
0241		I util	50 to 500	1	1/100 In	F1	100
0242		t Istart time delay	1 to 200	1	Second	F1	1

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0243		*Reserved*				-	-
0244		Blocked rotor function	0 to 1	1	-	F24	0
0245		t Istall time delay	1 to 600	1	1/10 sec	F1	1
0246		Stalled rotor function	0 to 1	1	-	F24	0
0247		Istall detection threshold	50 to 500	1	1/100 In	F1	100
0248		Locked rotor at start function	0 to 2	1	-	F68	0
0249		PowerFactor setting	0 to 100	1	1/100	F1	50
0250 to 024F		*Reserved*					-
0250		I< function	0 to 1	1	-	F24	0
0251		I< threshold	10 to 100	1	1/100 In	F1	10
0252		t I< time delay	2 to 1000	1	1/10 sec	F24	2
0253		Tinhib inhibition time	5 to 30000	5	1/100 sec	F1	5
0254 to 0255		*Reserved*					-
0256		RTD10 function (P225 only)	0 to 1	1	-	F24	0
0257		RTD10 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
0258		t RTD10 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0259		RTD10 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
025A		t RTD10 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
025B		RTD9 function (P225 only)	0 to 1	1	-	F24	0
025C		RTD9 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
025D		t RTD9 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
025E		RTD9 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
025F		t RTD9 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0260		RTD1 function	0 to 1	1	-	F24	0
0261		RTD1 ALARM threshold	0 to 200	1	°C	F1	0
0262		t RTD1 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0263		RTD1 TRIP threshold	0 to 200	1	°C	F1	0
0264		t RTD1 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0265		RTD2 function	0 to 1	1	-	F24	0
0266		RTD2 ALARM threshold	0 to 200	1	°C	F1	0
0267		t RTD2 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0268		RTD2 TRIP threshold	0 to 200	1	°C	F1	0
0269		t RTD2 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
026A		RTD3 function	0 to 1	1	-	F24	0
026B		RTD3 ALARM threshold	0 to 200	1	°C	F1	0
026C		t RTD3 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
026D		RTD3 TRIP threshold	0 to 200	1	°C	F1	0
026E		t RTD3 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
026F		RTD4 function	0 to 1	1	-	F24	0
0270		RTD4 ALARM threshold	0 to 200	1	°C	F1	0
0271		t RTD4 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0272		RTD4 TRIP threshold	0 to 200	1	°C	F1	0
0273		t RTD4 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0274		RTD5 function	0 to 1	1	-	F24	0
0275		RTD5 ALARM threshold	0 to 200	1	°C	F1	0
0276		t RTD5 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0277		RTD5 TRIP threshold	0 to 200	1	°C	F1	0
0278		t RTD5 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0279		RTD6 function	0 to 1	1	-	F24	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
027A		RTD6 ALARM threshold	0 to 200	1	°C	F1	0
027B		t RTD6 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
027C		RTD6 TRIP threshold	0 to 200	1	°C	F1	0
027D		t RTD6 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
027E		Thermistor 1 function	0 to 1	1	-	F24	0
027F		Thermistor 1 threshold	1 to 300	1	1/10 kΩ	F1	1
0280		Thermistor 2 function	0 to 1	1	-	F24	0
0281		Thermistor 2 threshold	1 to 300	1	1/10 kΩ	F1	1
0282		Thermistor 3 function (P225 only)	0 to 1	1	-	F24	0
0283		Thermistor 3 threshold (P225 only)	1 to 300	1	1/10 kΩ	F1	1
0284		RTD7 function (P225 only)	0 to 1	1	-	F24	0
0285		RTD7 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
0286		t RTD7 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0287		RTD7 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
0288		t RTD7 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0289		RTD8 function (P225 only)	0 to 1	1	-	F24	0
028A		RTD8 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
028B		t RTD8 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
028C		RTD8 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
028D		t RTD8 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
028E to 028F		*Reserved*					-

1.8.5 Page 3: Remote settings for protection functions group No2

Access for reading and writing

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0300	**Protection Group 2**	Thermal overload function	0 to 1	1	-	F24	0
0301		Thermal inhibition at start: θ INHIBIT	0 to 1	1	-	F24	0
0302		Thermal current threshold: Iθ>	20 to 150	1/100 In	-	F1	20
0303		Ke factor	0 to 10	1	-	F1	3
0304		Thermal constant time Te1	1 to 180	1	Minute	F1	1
0305		Thermal constant time Te2	1 to 360	1	Minute	F1	1
0306		Cooling constant time Tr	1 to 999	1	Minute	F1	1
0307		RTD1 influence: RTD1 INFLUENCE	0 to 1	1	-	F24	0
0308		Thermal alarm function	0 to 1	1	-	F24	0
0309		θ ALARM threshold	20 to 100	1	%	F1	20
030A		Thermal start inhibition function	0 to 1	1	-	F24	0
030B		θ FORBID START	20 to 100	1	%	F1	20
030C		I>	0 to 1	1	-	F24	0
030D		I> threshold	10 to 2500	1	In/100	F1	10
030E		I> time delay type	0 to 2	1	-	F27	0
030F		I> IDMT Curve Type	0 to 10	1	-	F61	1
0316		I> TMS value	25 to 1500	1	1/1000	F1	25

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0317		I> K value (RI curve)	100 to 10000	5	1/1000	F1	100
0318		tI> value	0 to15000	1	1/100 s	F1	4
0313		I> Reset type	0 to 1	1		F27	0
0314		I> RTMS value	25 to 3200	1	1/1000	F1	25
0315		I> tRESET value	0 to 60000	1	1/100 s	F1	0
0310		I>>	0 to 1	1	-	F24	0
0311		I>> Threshold	50 to 4000	5	In/100	F1	50
0312		tI>> value	0 to 15000	1	1/100 s	F1	1
0319		I>> time delay type	0 to 2	1	-	F27	0
031A		I>> IDMT curve type	0 to 10	1	-	F61	1
031B		I>> TMS value	25 to 1500	1	1/1000	F1	25
031C		K value (RI curve)	100 to 10000	5	1/1000	F1	100
031D		I>> Reset Type	0 to 1	1	-	F27	0
031E		I>> RTMS value	25 to 3200	1	1/1000	F1	25
031F		I>> tRESET value	0 to 60000	1	1/100 s	F1	0
0320		I0> function	0 to 1	1	-	F24	0
0321		I0> threshold	2 to 1000	1	1/1000 Ion	F1	2
0322		tI0> time delay	0 to 10000	1	1/100 s	F1	0
0323		I0>> function	0 to 1	1	-	F24	0
0324		I0>> threshold	2 to 1000	1	1/1000 Ion	F1	2
0325		tI0>> time delay	0 to 10000	1	1/100 s	F1	0
0326 to 032A		*Reserved*					-
032B		Interlock	0 to 1	1	-	F24	0
032C		I>>>	0 to 1	1	-	F24	0
032D		I>>> Threshold	50 to 4000	5	In/100	F1	50
032E		tI>>> value	0 to 15000	1	1/100 s	F1	1
032F		TMS I2>>	200 to 2000	25	1/1000	F1	1000
0330		I2> function	0 to 1	1	-	F24	0
0331		I2> threshold	40 to 800	10	1/1000 In	F1	40
0332		tI2> time delay	0 to 20000	1	1/100 s	F1	0
0333		I2>> function	0 to 1	1	-	F24	0
0334		I2>> threshold	40 to 800	10	1/1000 In	F1	40
0335		V< function (P225 only)	0 to 1	1	-	F24	0
0336		V< threshold (P225 only)	50 to 1300 or 200 to 4800	1	1/10V	F1	50 or 200
0337		tV< time delay (P225 only)	0 to 60000	1	1/100 sec	F1	0
0338		V< inhibition at start: INHIB V< (P225 only)	0 to 1	1	-	F24	0
0339 to 033C		*Reserved*				-	0
033D		V> function (P225 only)	0 to 1	1	-	F24	0
033E		V> threshold (P225 only)	50 to 2600 or 200 to 9600	1 ou 5	1/10V	F1	50 or 200
033F		tV> time delay (P225 only)	0 to 60000	1	1/100 sec	F1	0
0340		Excessive long start function	0 to 1	1	-	F24	0
0341		I util	50 to 500	1	1/100 In	F1	100
0342		t Istart time delay	1 to 200	1	Second	F1	1
0343		*Reserved*				-	-
0344		Blocked rotor function	0 to 1	1	-	F24	0
0345		t Istall time delay	1 to 600	1	1/10 sec	F1	1
0346		Stalled rotor function	0 to 1	1	-	F24	0
0347		Istall detection threshold	50 to 500	1	1/100 In	F1	100
0348		Locked rotor at start function	0 to 1	1	-	F24	0
0349 to 034F		*Reserved*					-
0350		I< function	0 to 1	1	-	F24	0
0351		I< threshold	10 to 100	1	1/100 In	F1	10

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0352		t I< time delay	2 to 1000	1	1/10 sec	F24	2
0353		Tinhib inhibition time	5 to 30000	5	1/100 sec	F1	5
0354 to 0355		*Reserved*					-
0356		RTD10 function (P225 only)	0 to 1	1	-	F24	0
0357		RTD10 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
0358		t RTD10 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0359		RTD10 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
035A		t RTD10 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
035B		RTD9 function (P225 only)	0 to 1	1	-	F24	0
035C		RTD9 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
035D		t RTD9 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
035E		RTD9 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
035F		t RTD9 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0360		RTD1 function	0 to 1	1	-	F24	0
0361		RTD1 ALARM threshold	0 to 200	1	°C	F1	0
0362		t RTD1 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0363		RTD1 TRIP threshold	0 to 200	1	°C	F1	0
0364		t RTD1 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0365		RTD2 function	0 to 1	1	-	F24	0
0366		RTD2 ALARM threshold	0 to 200	1	°C	F1	0
0367		t RTD2 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0368		RTD2 TRIP threshold	0 to 200	1	°C	F1	0
0369		t RTD2 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
036A		RTD3 function	0 to 1	1	-	F24	0
036B		RTD3 ALARM threshold	0 to 200	1	°C	F1	0
036C		t RTD3 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
036D		RTD3 TRIP threshold	0 to 200	1	°C	F1	0
036E		t RTD3 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
036F		RTD4 function	0 to 1	1	-	F24	0
0370		RTD4 ALARM threshold	0 to 200	1	°C	F1	0
0371		t RTD4 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0372		RTD4 TRIP threshold	0 to 200	1	°C	F1	0
0373		t RTD4 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0374		RTD5 function	0 to 1	1	-	F24	0
0375		RTD5 ALARM threshold	0 to 200	1	°C	F1	0
0376		t RTD5 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
0377		RTD5 TRIP threshold	0 to 200	1	°C	F1	0
0378		t RTD5 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
0379		RTD6 function	0 to 1	1	-	F24	0
037A		RTD6 ALARM threshold	0 to 200	1	°C	F1	0
037B		t RTD6 ALARM time delay	0 to 1000	1	1/10 sec	F1	0
037C		RTD6 TRIP threshold	0 to 200	1	°C	F1	0
037D		t RTD6 TRIP time delay	0 to 1000	1	1/10 sec	F1	0
037E		Thermistor 1 function	0 to 1	1	-	F24	0
037F		Thermistor 1 threshold	1 to 300	1	1/10 kΩ	F1	1
0380		Thermistor 2 function	0 to 1	1	-	F24	0
0381		Thermistor 2 threshold	1 to 300	1	1/10 kΩ	F1	1
0382		Thermistor 3 function (P225 only)	0 to 1	1	-	F24	0

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0383		Thermistor 3 threshold (P225 only)	1 to 300	1	1/10 kΩ	F1	1
0384		RTD7 function (P225 only)	0 to 1	1	-	F24	0
0385		RTD7 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
0386		t RTD7 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0387		RTD7 TRIP threshold (P225 only)	0 to 200	1	°C	F1	0
0388		t RTD7 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
0389		RTD8 function (P225 only)	0 to 1	1	-	F24	0
038A		RTD8 ALARM threshold (P225 only)	0 to 200	1	°C	F1	0
038B		t RTD8 ALARM time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
038C		RTD8 TRIP threshold(P225 only)	0 to 200	1	°C	F1	0
038D		t RTD8 TRIP time delay (P225 only)	0 to 1000	1	1/10 sec	F1	0
038E to 038F		*Reserved*					-

1.8.6 Page 4: Remote controls

Access in writing

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0400	Remote control	Remote control word 1	0 to 31	1	-	F9	0
0401 to 0402		*Reserved*					
0403		Remote control word 3	0 to 1	1	-	F9'	0
0404		Remote control word 2 Remote control of the output relays - under Maintenance mode only	0 to 63	1	-	F38	0

1.8.7 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		F59	0
0501		Equation A.00 operand	0 - 111	1		F58	0
0502		Equation A.01 operator	0 - 3	1		F58	0
0503		Equation A.01 operand	0 - 111	1		F58	0
0504		Equation A.02 operator	0 - 3	1		F58	0
0505		Equation A.02 operand	0 - 111	1		F58	0
0506		Equation A.03 operator	0 - 3	1		F58	0
0507		Equation A.03 operand	0 - 111	1		F58	0
0508		Equation A.04 operator	0 - 3	1		F58	0
0509		Equation A.04 operand	0 - 111	1		F58	0
050A		Equation A.05 operator	0 - 3	1		F58	0
050B		Equation A.05 operand	0 - 111	1		F58	0
050C		Equation A.06 operator	0 - 3	1		F58	0
050D		Equation A.06 operand	0 - 111	1		F58	0
050E		Equation A.07 operator	0 - 3	1		F58	0
050F		Equation A.07 operand	0 - 111	1		F58	0
0510		Equation A.08 operator	0 - 3	1		F58	0
0511		Equation A.08 operand	0 - 111	1		F58	0
0512		Equation A.09 operator	0 - 3	1		F58	0
0513		Equation A.09 operand	0 - 111	1		F58	0
0514		Equation A.10 operator	0 - 3	1		F58	0
0515		Equation A.10 operand	0 - 111	1		F58	0
0516		Equation A.11 operator	0 - 3	1		F58	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0517		Equation A.11 operand	0 - 111	1		F58	0
0518		Equation A.12 operator	0 - 3	1		F58	0
0519		Equation A.12 operand	0 - 111	1		F58	0
051A		Equation A.13 operator	0 - 3	1		F58	0
051B		Equation A.13 operand	0 - 111	1		F58	0
051C		Equation A.14 operator	0 - 3	1		F58	0
051D		Equation A.14 operand	0 - 111	1		F58	0
051E		Equation A.15 operator	0 - 3	1		F58	0
051F		Equation A.15 operand	0 - 111	1		F58	0
0520		Equation B.00 operator	0 - 1	1		F59	0
0521		Equation B.00 operand	0 - 111	1		F58	0
0522		Equation B.01 operator	0 - 3	1		F58	0
0523		Equation B.01 operand	0 - 111	1		F58	0
0524		Equation B.02 operator	0 - 3	1		F58	0
0525		Equation B.02 operand	0 - 111	1		F58	0
0526		Equation B.03 operator	0 - 3	1		F58	0
0527		Equation B.03 operand	0 - 111	1		F58	0
0528		Equation B.04 operator	0 - 3	1		F58	0
0529		Equation B.04 operand	0 - 111	1		F58	0
052A		Equation B.05 operator	0 - 3	1		F58	0
052B		Equation B.05 operand	0 - 111	1		F58	0
052C		Equation B.06 operator	0 - 3	1		F58	0
052D		Equation B.06 operand	0 - 111	1		F58	0
052E		Equation B.07 operator	0 - 3	1		F58	0
052F		Equation B.07 operand	0 - 111	1		F58	0
0530		Equation B.08 operator	0 - 3	1		F58	0
0531		Equation B.08 operand	0 - 111	1		F58	0
0532		Equation B.09 operator	0 - 3	1		F58	0
0533		Equation B.09 operand	0 - 111	1		F58	0
0534		Equation B.10 operator	0 - 3	1		F58	0
0535		Equation B.10 operand	0 - 111	1		F58	0
0536		Equation B.11 operator	0 - 3	1		F58	0
0537		Equation B.11 operand	0 - 111	1		F58	0
0538		Equation B.12 operator	0 - 3	1		F58	0
0539		Equation B.12 operand	0 - 111	1		F58	0
053A		Equation B.13 operator	0 - 3	1		F58	0
053B		Equation B.13 operand	0 - 111	1		F58	0
053C		Equation B.14 operator	0 - 3	1		F58	0
053D		Equation B.14 operand	0 - 111	1		F58	0
053E		Equation B.15 operator	0 - 3	1		F58	0
053F		Equation B.15 operand	0 - 111	1		F58	0
0540		Equation C.00 operator	0 - 1	1		F59	0
0541		Equation C.00 operand	0 - 111	1		F58	0
0542		Equation C.01 operator	0 - 3	1		F58	0
0543		Equation C.01 operand	0 - 111	1		F58	0
0544		Equation C.02 operator	0 - 3	1		F58	0
0545		Equation C.02 operand	0 - 111	1		F58	0
0546		Equation C.03 operator	0 - 3	1		F58	0
0547		Equation C.03 operand	0 - 111	1		F58	0
0548		Equation C.04 operator	0 - 3	1		F58	0
0549		Equation C.04 operand	0 - 111	1		F58	0
054A		Equation C.05 operator	0 - 3	1		F58	0
054B		Equation C.05 operand	0 - 111	1		F58	0
054C		Equation C.06 operator	0 - 3	1		F58	0
054D		Equation C.06 operand	0 - 111	1		F58	0
054E		Equation C.07 operator	0 - 3	1		F58	0
054F		Equation C.07 operand	0 - 111	1		F58	0
0550		Equation C.08 operator	0 - 3	1		F58	0
0551		Equation C.08 operand	0 - 111	1		F58	0
0552		Equation C.09 operator	0 - 3	1		F58	0
0553		Equation C.09 operand	0 - 111	1		F58	0
0554		Equation C.10 operator	0 - 3	1		F58	0
0555		Equation C.10 operand	0 - 111	1		F58	0
0556		Equation C.11 operator	0 - 3	1		F58	0
0557		Equation C.11 operand	0 - 111	1		F58	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0558		Equation C.12 operator	0 - 3	1		F58	0
0559		Equation C.12 operand	0 - 111	1		F58	0
055A		Equation C.13 operator	0 - 3	1		F58	0
055B		Equation C.13 operand	0 - 111	1		F58	0
055C		Equation C.14 operator	0 - 3	1		F58	0
055D		Equation C.14 operand	0 - 111	1		F58	0
055E		Equation C.15 operator	0 - 3	1		F58	0
055F		Equation C.15 operand	0 - 111	1		F58	0
0560		Equation D.00 operator	0 - 1	1		F59	0
0561		Equation D.00 operand	0 - 111	1		F58	0
0562		Equation D.01 operator	0 - 3	1		F58	0
0563		Equation D.01 operand	0 - 111	1		F58	0
0564		Equation D.02 operator	0 - 3	1		F58	0
0565		Equation D.02 operand	0 - 111	1		F58	0
0566		Equation D.03 operator	0 - 3	1		F58	0
0567		Equation D.03 operand	0 - 111	1		F58	0
0568		Equation D.04 operator	0 - 3	1		F58	0
0569		Equation D.04 operand	0 - 111	1		F58	0
056A		Equation D.05 operator	0 - 3	1		F58	0
056B		Equation D.05 operand	0 - 111	1		F58	0
056C		Equation D.06 operator	0 - 3	1		F58	0
056D		Equation D.06 operand	0 - 111	1		F58	0
056E		Equation D.07 operator	0 - 3	1		F58	0
056F		Equation D.07 operand	0 - 111	1		F58	0
0570		Equation D.08 operator	0 - 3	1		F58	0
0571		Equation D.08 operand	0 - 111	1		F58	0
0572		Equation D.09 operator	0 - 3	1		F58	0
0573		Equation D.09 operand	0 - 111	1		F58	0
0574		Equation D.10 operator	0 - 3	1		F58	0
0575		Equation D.10 operand	0 - 111	1		F58	0
0576		Equation D.11 operator	0 - 3	1		F58	0
0577		Equation D.11 operand	0 - 111	1		F58	0
0578		Equation D.12 operator	0 - 3	1		F58	0
0579		Equation D.12 operand	0 - 111	1		F58	0
057A		Equation D.13 operator	0 - 3	1		F58	0
057B		Equation D.13 operand	0 - 111	1		F58	0
057C		Equation D.14 operator	0 - 3	1		F58	0
057D		Equation D.14 operand	0 - 111	1		F58	0
057E		Equation D.15 operator	0 - 3	1		F58	0
057F		Equation D.15 operand	0 - 111	1		F58	0
0580		Equation E.00 operator	0 - 1	1		F59	0
0581		Equation E.00 operand	0 - 111	1		F58	0
0582		Equation E.01 operator	0 - 3	1		F58	0
0583		Equation E.01 operand	0 - 111	1		F58	0
0584		Equation E.02 operator	0 - 3	1		F58	0
0585		Equation E.02 operand	0 - 111	1		F58	0
0586		Equation E.03 operator	0 - 3	1		F58	0
0587		Equation E.03 operand	0 - 111	1		F58	0
0588		Equation E.04 operator	0 - 3	1		F58	0
0589		Equation E.04 operand	0 - 111	1		F58	0
058A		Equation E.05 operator	0 - 3	1		F58	0
058B		Equation E.05 operand	0 - 111	1		F58	0
058C		Equation E.06 operator	0 - 3	1		F58	0
058D		Equation E.06 operand	0 - 111	1		F58	0
058E		Equation E.07 operator	0 - 3	1		F58	0
058F		Equation E.07 operand	0 - 111	1		F58	0
0590		Equation E.08 operator	0 - 3	1		F58	0
0591		Equation E.08 operand	0 - 111	1		F58	0
0592		Equation E.09 operator	0 - 3	1		F58	0
0593		Equation E.09 operand	0 - 111	1		F58	0
0594		Equation E.10 operator	0 - 3	1		F58	0
0595		Equation E.10 operand	0 - 111	1		F58	0
0596		Equation E.11 operator	0 - 3	1		F58	0
0597		Equation E.11 operand	0 - 111	1		F58	0
0598		Equation E.12 operator	0 - 3	1		F58	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
0599		Equation E.12 operand	0 - 111	1		F58	0
059A		Equation E.13 operator	0 - 3	1		F58	0
059B		Equation E.13 operand	0 - 111	1		F58	0
059C		Equation E.14 operator	0 - 3	1		F58	0
059D		Equation E.14 operand	0 - 111	1		F58	0
059E		Equation E.15 operator	0 - 3	1		F58	0
059F		Equation E.15 operand	0 - 111	1		F58	0
05A0		Equation F.00 operator	0 - 1	1		F59	0
05A1		Equation F.00 operand	0 - 111	1		F58	0
05A2		Equation F.01 operator	0 - 3	1		F58	0
05A3		Equation F.01 operand	0 - 111	1		F58	0
05A4		Equation F.02 operator	0 - 3	1		F58	0
05A5		Equation F.02 operand	0 - 111	1		F58	0
05A6		Equation F.03 operator	0 - 3	1		F58	0
05A7		Equation F.03 operand	0 - 111	1		F58	0
05A8		Equation F.04 operator	0 - 3	1		F58	0
05A9		Equation F.04 operand	0 - 111	1		F58	0
05AA		Equation F.05 operator	0 - 3	1		F58	0
05AB		Equation F.05 operand	0 - 111	1		F58	0
05AC		Equation F.06 operator	0 - 3	1		F58	0
05AD		Equation F.06 operand	0 - 111	1		F58	0
05AE		Equation F.07 operator	0 - 3	1		F58	0
05AF		Equation F.07 operand	0 - 111	1		F58	0
05B0		Equation F.08 operator	0 - 3	1		F58	0
05B1		Equation F.08 operand	0 - 111	1		F58	0
05B2		Equation F.09 operator	0 - 3	1		F58	0
05B3		Equation F.09 operand	0 - 111	1		F58	0
05B4		Equation F.10 operator	0 - 3	1		F58	0
05B5		Equation F.10 operand	0 - 111	1		F58	0
05B6		Equation F.11 operator	0 - 3	1		F58	0
05B7		Equation F.11 operand	0 - 111	1		F58	0
05B8		Equation F.12 operator	0 - 3	1		F58	0
05B9		Equation F.12 operand	0 - 111	1		F58	0
05BA		Equation F.13 operator	0 - 3	1		F58	0
05BB		Equation F.13 operand	0 - 111	1		F58	0
05BC		Equation F.14 operator	0 - 3	1		F58	0
05BD		Equation F.14 operand	0 - 111	1		F58	0
05BE		Equation F.15 operator	0 - 3	1		F58	0
05BF		Equation F.15 operand	0 - 111	1		F58	0
05C0		Equation G.00 operator	0 - 1	1		F59	0
05C1		Equation G.00 operand	0 - 111	1		F58	0
05C2		Equation G.01 operator	0 - 3	1		F58	0
05C3		Equation G.01 operand	0 - 111	1		F58	0
05C4		Equation G.02 operator	0 - 3	1		F58	0
05C5		Equation G.02 operand	0 - 111	1		F58	0
05C6		Equation G.03 operator	0 - 3	1		F58	0
05C7		Equation G.03 operand	0 - 111	1		F58	0
05C8		Equation G.04 operator	0 - 3	1		F58	0
050C9		Equation G.04 operand	0 - 111	1		F58	0
05CA		Equation G.05 operator	0 - 3	1		F58	0
05CB		Equation G.05 operand	0 - 111	1		F58	0
05CC		Equation G.06 operator	0 - 3	1		F58	0
05CD		Equation G.06 operand	0 - 111	1		F58	0
05CE		Equation G.07 operator	0 - 3	1		F58	0
05CF		Equation G.07 operand	0 - 111	1		F58	0
05D0		Equation G.08 operator	0 - 3	1		F58	0
05D1		Equation G.08 operand	0 - 111	1		F58	0
05D2		Equation G.09 operator	0 - 3	1		F58	0
05D3		Equation G.09 operand	0 - 111	1		F58	0
05D4		Equation G.10 operator	0 - 3	1		F58	0
05D5		Equation G.10 operand	0 - 111	1		F58	0
05D6		Equation G.11 operator	0 - 3	1		F58	0
05D7		Equation G.11 operand	0 - 111	1		F58	0
05D8		Equation G.12 operator	0 - 3	1		F58	0
05D9		Equation G.12 operand	0 - 111	1		F58	0

Address (hex)	Group	Description	Values range	Step	Unit	For-mat	Def. Value
05DA		Equation G.13 operator	0 - 3	1		F58	0
05DB		Equation G.13 operand	0 - 111	1		F58	0
05DC		Equation G.14 operator	0 - 3	1		F58	0
05DD		Equation G.14 operand	0 - 111	1		F58	0
05DE		Equation G.15 operator	0 - 3	1		F58	0
05DF		Equation G.15 operand	0 - 111	1		F58	0
05E0		Equation H.00 operator	0 - 1	1		F59	0
05E1		Equation H.00 operand	0 - 111	1		F58	0
05E2		Equation H.01 operator	0 - 3	1		F58	0
05E3		Equation H.01 operand	0 - 111	1		F58	0
05E4		Equation H.02 operator	0 - 3	1		F58	0
05E5		Equation H.02 operand	0 - 111	1		F58	0
05E6		Equation H.03 operator	0 - 3	1		F58	0
05E7		Equation H.03 operand	0 - 111	1		F58	0
05E8		Equation H.04 operator	0 - 3	1		F58	0
05E9		Equation H.04 operand	0 - 111	1		F58	0
05EA		Equation H.05 operator	0 - 3	1		F58	0
05EB		Equation H.05 operand	0 - 111	1		F58	0
05EC		Equation H.06 operator	0 - 3	1		F58	0
05ED		Equation H.06 operand	0 - 111	1		F58	0
05EE		Equation H.07 operator	0 - 3	1		F58	0
05EF		Equation H.07 operand	0 - 111	1		F58	0
05F0		Equation H.08 operator	0 - 3	1		F58	0
05F1		Equation H.08 operand	0 - 111	1		F58	0
05F2		Equation H.09 operator	0 - 3	1		F58	0
05F3		Equation H.09 operand	0 - 111	1		F58	0
05F4		Equation H.10 operator	0 - 3	1		F58	0
05F5		Equation H.10 operand	0 - 111	1		F58	0
05F6		Equation H.11 operator	0 - 3	1		F58	0
05F7		Equation H.11 operand	0 - 111	1		F58	0
05F8		Equation H.12 operator	0 - 3	1		F58	0
05F9		Equation H.12 operand	0 - 111	1		F58	0
05FA		Equation H.13 operator	0 - 3	1		F58	0
05FB		Equation H.13 operand	0 - 111	1		F58	0
05FC		Equation H.14 operator	0 - 3	1		F58	0
05FD		Equation H.14 operand	0 - 111	1		F58	0
05FE		Equation H.15 operator	0 - 3	1		F58	0
05FF		Equation H.15 operand	0 - 111	1		F58	0

1.8.8 Page 6H: General remote parameters

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0600	**Configuration**	Alarms inhibition part 1				F67	
0602		Alarms inhibition part 2				F67’	
0610	**Boolean Equations**	Equation A rising time	0 - 60000	1	10ms	F1	0
0611		Equation A falling time	0 - 60000	1	10ms	F1	0
0612		Equation B rising time	0 - 60000	1	10ms	F1	0
0613		Equation B falling time	0 - 60000	1	10ms	F1	0
0614		Equation C rising time	0 - 60000	1	10ms	F1	0
0615		Equation C falling time	0 - 60000	1	10ms	F1	0
0616		Equation D rising time	0 - 60000	1	10ms	F1	0
0617		Equation D falling time	0 - 60000	1	10ms	F1	0
0618		Equation E rising time	0 - 60000	1	10ms	F1	0
0619		Equation E falling time	0 - 60000	1	10ms	F1	0
061A		Equation F rising time	0 - 60000	1	10ms	F1	0
061B		Equation F falling time	0 - 60000	1	10ms	F1	0
061C		Equation G rising time	0 - 60000	1	10ms	F1	0
061D		Equation G falling time	0 - 60000	1	10ms	F1	0
061E		Equation H rising time	0 - 60000	1	10ms	F1	0
061F		Equation H falling time	0 - 60000	1	10ms	F1	0
0620-062F		*Reserved*					
0630		Communication port2 available	0-1	1	-	F24	

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0631		Data rate	0-7	1	-	F28	
0632		Parity	0-2	1	-	F29	
0633		Address com2	1-255	1	-	F1	
0634		Stop bit	0-1	1	-	F31	
0635		Reserved			-		
0637		Private messages com2	0-1	1	-	F44	
0638		Reserved					
0640		t EQU. E	0-15	1	-	F14	
0641		t EQU. F	0-15	1	-	F14	
0642		t EQU. G	0-15		-	F14	
0643		t EQU. H	0-15	1	-	F14	
0644		tAux 5	0-15	1	-	F14	
0645		tAux 6	0-15	1	-	F14	
0646		tAux 7	0-15	1	-	F14	
0647		tAux 8	0-15	1	-	F14	
0648		tAux 9	0-15	1	-	F14	
0649		tAux 10	0-15	1	-	F14	
064A-064F		Reserved					
0650		Logic input L7	$0-2^n$		-	F15	0
0651		Logic input L8	$0-2^n$		-	F15	0
0652		Logic input L9	$0-2^n$		-	F15	0
0653		Logic input LA	$0-2^n$		-	F15	0
0654		Logic input LB	$0-2^n$		-	F15	0
0655		Logic input L6 (word 2)	$0-2^n$		-	F15'	0
0656		Logic input L2 (word 2)	$0-2^n$		-	F15'	0
0657		Logic input L3 (word 2)	$0-2^n$		-	F15'	0
0658		Logic input L4 (word 2)	$0-2^n$	-	-	F15'	0
0659		Logic input L5(word 2)	$0-2^n$	-	-	F15'	0
065A		Logic input L7(word 2)	$0-2^n$	-	-	F15'	0
065B		Logic input L8(word 2)	$0-2^n$	-	-	F15'	0
065C		Logic input L9 (word 2)	$0-2^n$	-	-	F15'	0
065D		Logic input LA(word 2)	$0-2^n$	-	-	F15'	0
065E		Logic input LB(word 2)	$0-2^n$	-	-	F15'	0
065F		Logic input L1	$0-2^n$	-	-	F15	0
0660		Logic input L1(word2)	$0-2^n$	-	-	F15'	0
0661		Phase Rotation change by	0-1	1	-	F62	0
0662		phase sequence	0-1		-	F63	1
0663		Reserved					
0664		INPUT7 (AUX OUTPUT RLY)	0-15	1	-	F14	0
0665		INPUT8 (AUX OUTPUT RLY)	0-15	1	-	F14	0
0666		INPUT9 (AUX OUTPUT RLY)	0-15	1	-	F14	0
0667		INPUT10 (AUX OUTPUT RLY)	0-15	1	-	F14	0
0668		INPUT11 (AUX OUTPUT RLY)	0-15	1	-	F14	0
0669		Led5 (word 3)	-	2n	-	F19"	0
066A		Led6 (word 3)	-	2n	-	F19"	0
066B		Led7 (word 3)	-	2n	-	F19"	0
066C		Led8 (word 3)	-	2n	-	F19"	0
066D		Trip output relay assignment (RL1) — (3/3)	0-8191	2n	-	F6"	
066E		Latching of the trip output relay (RL1)— (3/3)	0-65635	2n	-	F8"	
066F		Reserved					
0670		tAux 5 time delay	0-20000	1	1/100 sec	F1	0
0671		tAux 6 time delay	0-20000	1	1/100 sec	F1	0
0672		tAux 7 time delay	0-20000	1	1/100 sec	F1	0
0673		tAux 8 time delay	0-20000	1	1/100 sec	F1	0
0674		tAux 9 time delay	0-20000	1	1/100 sec	F1	0
0675		tAux 10 time delay	0-20000	1	1/100 sec	F1	0
067F		Reserved					

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0681		Reserved					
0682		Date and Time synchronisation mode	0	4	1	F64	0
0683		IRIG B mode	1	2	1	F65	0
068F		Reserved					

1.8.9 Page 7: MiCOM P220/P225 relay status word

Access for quick reading

Address	Group	Description	Values Range	Step	Unit	Format	Default Value
0700	Quick reading byte	Quick reading byte		1	-	F23	0

1.8.10 Page 8: Synchronisation

Access in writing. It exists 2 possible date format configurations:

- IEC format: Inverted IEC 870-5-4 CP56Time2a
- Private format

1.8.10.1 Mapping for IEC format

The format of the clock synchronisation is coded on 8 bytes (4 words).

Words	7	6	5	4	3	2	1	0	7	6	5	4	3	2	1	0	Value range
1	0	0	0	0	0	0	0	0	Year								00..99
2	0	0	0	0	Month				Day of week			Day of Month					1..12 1..7 1..31
3	Su	0	0	Hours					iv	0	Minutes						0..23 0..59
4	Millisecond MSB								Millisecond LSB								0..59999
	2^{15}							2^8	2^7							2^0	(s) + (ms)

su = 0: Standard su = 1: Summer Time
iv = 0: valid iv = 1: non valid or non synchronised in system case

1.8.10.2 Mapping for PRIVATE format:

The format of the clock synchronisation is coded on 8 bytes (4 words).

Clock	@ Page	Byte Number	Value Range	Unit
Year LSB + MSB	8	2		Year
Months	8	1	1 - 12	Month
Days	8	1	1 - 31	Day
Hours	8	1	0 - 23	Hour
Minutes	8	1	0 - 59	Minute
ms LSB + MSB	8	2	0 - 59999	ms

1.8.11 Page 9h to 21h: Disturbance record data (25 pages)

Access in reading. Each page of the mapping contains 250 words.

Address	Contents	Format
0900 to 09FAh	250 words of disturbance record data	F58
0A00 to 0AFAh	250 words of disturbance record data	F58
0B00 to 0BFAh	250 words of disturbance record data	F58
0C00 to 0CFAh	250 words of disturbance record data	F58
0D00 to 0DFAh	250 words of disturbance record data	F58
0E00 to 0EFAh	250 words of disturbance record data	F58
0F00 to 0FFAh	250 words of disturbance record data	F58
1000 to 10FAh	250 words of disturbance record data	F58
1100 to 11FAh	250 words of disturbance record data	F58
1200 to 12FAh	250 words of disturbance record data	F58
1300 to 13FAh	250 words of disturbance record data	F58
1400 to 14FAh	250 words of disturbance record data	F58
1500 to 15FAh	250 words of disturbance record data	F58
1600 to 16FAh	250 words of disturbance record data	F58
1700 to 17FAh	250 words of disturbance record data	F58
1800 to 18FAh	250 words of disturbance record data	F58
1900 to 19FAh	250 words of disturbance record data	F58
1A00 to 1AFAh	250 words of disturbance record data	F58
1B00 to 1BFAh	250 words of disturbance record data	F58
1C00 to 1CFAh	250 words of disturbance record data	F58
1D00 to 1DFAh	250 words of disturbance record data	F58
1E00 to 1EFAh	250 words of disturbance record data	F58
1F00 to 1FFAh	250 words of disturbance record data	F58
2000 to 20FAh	250 words of disturbance record data	F58
2100 to 21FAh	250 words of disturbance record data	F58

N.B.: The above disturbance record data pages of the mapping contain the data for only one record channel.

1.8.12 Page 22h: Index frame for the disturbance records

Access in reading

Address	Contents	Format
2200h	Index frame for the disturbance records	F50

1.8.13 Page 23h to 33h: Start-up current form record data

Access in reading

Address	Contents	Format
2300 to 23F8h	124 values	
2400 to 24F8h	124 values	
2500 to 25F8h	124 values	
2600 to 26F8h	124 values	
2700 to 27F8h	124 values	
2800 to 28F8h	124 values	
2900 to 29F8h	124 values	
2A00 to 2AF8h	124 values	
2B00 to 2BF8h	124 values	
2C00 to 2CF8h	124 values	
2D00 to 2DF8h	124 values	
2E00 to 2EF8h	124 values	
2F00 to 2FF8h	124 values	
3000 to 30F8h	124 values	
3100 to 31F8h	124 values	
3200 to 32F8h	124 values	
3300 to 330Fh	16 values	

1.8.14 Page 34h: Index frame for the start-up current form record

Access in reading

Address	Contents	Format
3400h	Number of available values of the start-up current form record	F51
3401h	Number of the last page	F51
3402h	Number of available values stored in the last page	F51

1.8.15 Page 35h: Event record data

Access in reading

Address	Contents	Format	Address	Contents	Format	Address	Contents	Format
3500h	EVENT n°1	F52	3519h	EVENT n°26	F52	3532h	EVENT n°51	F52
3501h	EVENT n°2	F52	351Ah	EVENT n°27	F52	3533h	EVENT n°52	F52
3502h	EVENT n°3	F52	351Bh	EVENT n°28	F52	3534h	EVENT n°53	F52
3503h	EVENT n°4	F52	351Ch	EVENT n°29	F52	3535h	EVENT n°54	F52
3504h	EVENT n°5	F52	351Dh	EVENT n°30	F52	3536h	EVENT n°55	F52
3505h	EVENT n°6	F52	351Eh	EVENT n°31	F52	3537h	EVENT n°56	F52
3506h	EVENT n°7	F52	351Fh	EVENT n°32	F52	3538h	EVENT n°57	F52
3507h	EVENT n°8	F52	3520h	EVENT n°33	F52	3539h	EVENT n°58	F52
3508h	EVENT n°9	F52	3521h	EVENT n°34	F52	353Ah	EVENT n°59	F52
3509h	EVENT n°10	F52	3522h	EVENT n°35	F52	353Bh	EVENT n°60	F52
350Ah	EVENT n°11	F52	3523h	EVENT n°36	F52	353Ch	EVENT n°61	F52
350Bh	EVENT n°12	F52	3524h	EVENT n°37	F52	353Dh	EVENT n°62	F52
350Ch	EVENT n°13	F52	3525h	EVENT n°38	F52	353Eh	EVENT n°63	F52
350Dh	EVENT n°14	F52	3526h	EVENT n°39	F52	353Fh	EVENT n°64	F52
350Eh	EVENT n°15	F52	3527h	EVENT n°40	F52	3540h	EVENT n°65	F52
350Fh	EVENT n°16	F52	3528h	EVENT n°41	F52	3541h	EVENT n°66	F52
3510h	EVENT n°17	F52	3529h	EVENT n°42	F52	3542h	EVENT n°67	F52
3511h	EVENT n°18	F52	352Ah	EVENT n°43	F52	3543h	EVENT n°68	F52
3512h	EVENT n°19	F52	352Bh	EVENT n°44	F52	3544h	EVENT n°69	F52
3513h	EVENT n°20	F52	352Ch	EVENT n°45	F52	3545h	EVENT n°70	F52
3514h	EVENT n°21	F52	352Dh	EVENT n°46	F52	3546h	EVENT n°71	F52
3515h	EVENT n°22	F52	352Eh	EVENT n°47	F52	3547h	EVENT n°72	F52
3516h	EVENT n°23	F52	352Fh	EVENT n°48	F52	3548h	EVENT n°73	F52
3517h	EVENT n°24	F52	3530h	EVENT n°49	F52	3549h	EVENT n°74	F52
3518h	EVENT n°25	F52	3531h	EVENT n°50	F52	354Ah	EVENT n°75	F52

1.8.16 Page 36h: Data of the oldest event

Access in reading

Address	Contents	Format
3600h	Data of the oldest event	F52

1.8.17 Page 37h: Fault value record data

Access in reading

Address	Contents	Format
3700h	Data of the fault value record n°1	F53
3701h	Data of the fault value record n°2	F53
3702h	Data of the fault value record n°3	F53
3703h	Data of the fault value record n°4	F53
3704h	Data of the fault value record n°5	F53
3705h	Data of the fault value record n°6	F53
3706h	Data of the fault value record n°7	F53
3707h	Data of the fault value record n°8	F53
3708h	Data of the fault value record n°9	F53
3709h	Data of the fault value record n°10	F53
370Ah	Data of the fault value record n°11	F53
370Bh	Data of the fault value record n°12	F53
370Ch	Data of the fault value record n°13	F53
370Dh	Data of the fault value record n°14	F53
370Eh	Data of the fault value record n°15	F53
370Fh	Data of the fault value record n°16	F53
3710h	Data of the fault value record n°17	F53
3711h	Data of the fault value record n°18	F53
3712h	Data of the fault value record n°19	F53
3713h	Data of the fault value record n°20	F53
3714h	Data of the fault value record n°21	F53
3715h	Data of the fault value record n°22	F53
3716h	Data of the fault value record n°23	F53
3717h	Data of the fault value record n°24	F53
3718h	Data of the fault value record n°25	F53

1.8.18 Pages 38h à 3Ch: Selection of the disturbance record and selection of its channel

Access in reading

Address	Disturbance Record Number	Channel	Format
3800h	1	I A (phase A current)	F54
3801h	1	I B (phase B current)	F54
3802h	1	I C (phase C current)	F54
3803h	1	I N (neutral current)	F54
3804h	1	Frequency	F54
3805h	1	Logic inputs and logic outputs	F54

Address	Disturbance Record Number	Channel	Format
3806h	1	V AC (phase A–phase C voltage) (P225 only)	F54
3900h	2	I A (phase A current)	F54
3901h	2	I B (phase B current)	F54
3902h	2	I C (phase C current)	F54
3903h	2	I N (neutral current)	F54
3904h	2	Frequency	F54
3905h	2	Logic inputs and logic outputs	F54
3906h	2	V AC (phase A–phase C voltage) (P225 only)	F54
3A00h	3	I A (phase A current)	F54
3A01h	3	I B (phase B current)	F54
3A02h	3	I C (phase C current)	F54
3A03h	3	I N (neutral current)	F54
3A04h	3	Frequency	F54
3A05h	3	Logic inputs and logic outputs	F54
3A06h	3	VA (3 voltage inputs) VB VC	F54
3B00h	4	I A (phase A current)	F54
3B01h	4	I B (phase B current)	F54
3B02h	4	I C (phase C current)	F54
3B03h	4	I N (neutral current)	F54
3B04h	4	Frequency	F54
3B05h	4	Logic inputs and logic outputs	F54
3B06h	4	V AC (phase A–phase C voltage) (P225 only)	F54
3C00h	5	I A (phase A current)	F54
3C01h	5	I B (phase B current)	F54
3C02h	5	I C (phase C current)	F54
3C03h	5	I N (neutral current)	F54
3C04h	5	Frequency	F54
3C05h	5	Logic inputs and logic outputs	F54
3C06h	5	VA (3 voltage inputs) VB VC	F54

1.8.19 Page 3Dh: Number of available disturbance records

Access in reading

Address	Contents	Format
3D00h	Number of available disturbance records	F55

1.8.20 Page 3Eh: Data of the oldest non-acknowledged fault record

Access in reading

Address	Contents	Format
3E00h	Data of the oldest fault value record	F53

1.8.21 Page 3Fh: Reserved

1.8.22 Page 40h to 50h: Start-up voltage form record data

Access in reading

Address	Contents	Format
4000 to 40F8h	124 values	
4100 to 41F8h	124 values	
4200 to 42F8h	124 values	
4300 to 43F8h	124 values	
4400 to 44F8h	124 values	
4500 to 45F8h	124 values	
4600 to 46F8h	124 values	
4700 to 47F8h	124 values	
4800 to 48F8h	124 values	
4900 to 49F8h	124 values	
4A00 to 4AF8h	124 values	
4B00 to 4BF8h	124 values	
4C00 to 4CF8h	124 values	
4D00 to 4DF8h	124 values	
4E00 to 4EF8h	124 values	
4F00 to 4FF8h	124 values	
5000 to 500Fh	16 values	

1.8.23 Page 51h: Index frame for the start-up voltage form record

Access in reading

Address	Contents	Format
5100h	Number of available values of the start-up voltage form record	F51
5101h	Number of the last page	F51
5102h	Number of available values stored in the last page	F51

1.9 Description of the mapping format

CODE	DESCRIPTION
F1	Unsigned integer - numerical data 1-65535
F2	Signed integer - numerical data -32768 to +32767
F3	Unsigned long integer - numerical data 0 to 4294967925
F4	Unsigned integer - RTD/thermistor monitoring function status - RTD1 to RTD6 (P225 only) Bit 0: t RTD1 ALARM signal or Thermist1 signal Bit 1: t RTD1 TRIP signal or Thermist2 signal Bit 2: t RTD2 ALARM signal or Thermist3 signal Bit 3: t RTD2 TRIP signal Bit 4: t RTD3 ALARM signal Bit 5: t RTD3 TRIP signal Bit 6: t RTD4 ALARM signal Bit 7: t RTD4 TRIP signal Bit 8: t RTD5 ALARM signal Bit 9: t RTD5 TRIP signal Bit 10: t RTD6 ALARM signal Bit 11: t RTD6 TRIP signal *Bits 13 to 15: reserved*
F4’	Unsigned integer - RTD/thermistor monitoring function status - RTD7 to RTD10 Bit 0: t RTD7 ALARM signal Bit 1: t RTD7 TRIP signal Bit 2: t RTD8 ALARM signal Bit 3: t RTD8 TRIP signal Bit 4: t RTD9 ALARM signal Bit 5: t RTD9 TRIP signal Bit 6: t RTD10 ALARM signal Bit 7: t RTD10 TRIP signal *Bits 8 to 15: reserved*
F5	Unsigned integer: Motor start-up detection criterion Bit 0: Closing of the CB (52A) Bit 1: Closing of the CB **and** overshoot of the I_{util} current threshold (52A + I_{util})
F6	Unsigned long: Trip output relay assignment (RL1) Bit 0: tI>> Bit 1: tI0> Bit 2: tI0>> Bit 3: tI2> Bit 4: tI< (loss of load) Bit 5: THERM OVERLOAD (Thermal overload) Bit 6: EXCES LONG START (Excessive long start) Bit 7: t Istall (Stalled rotor whilst running) Bit 8: LOCKED ROTOR (locked rotor at start) Bit 9: t RTD1 TRIP or Thermist1 Bit 10: t RTD2 TRIP or Thermist2 Bit 11: t RTD3 TRIP or Thermist3 Bit 12: t RTD4 TRIP Bit 13: t RTD5 TRIP Bit 14: t RTD6 TRIP Bit 15: t RTD 10 TRIP (P225 only)

CODE	DESCRIPTION
F6’	Bit 0: t I2>> Bit 1: EXT 1 Bit 2: EXT 2 Bit 3: Equation A (« AND » logical gate A) Bit 4: Equation B (« AND » logical gate B) Bit 5: Equation C (« AND » logical gate C) Bit 6: Equation D (« AND » logical gate D) Bit 7: t RTD7 TRIP (P225 only) Bit 8: t RTD8 TRIP (P225 only) Bit 9: t RTD9 TRIP (P225 only) Bit 10: t V< (P225 only) Bit 11: VOLTAGE DIP Bit 12: t V> (P225 only) Bit 13: tI> Bit 14: tI>>> Bit 15: EQUATION E
F6”	Bit 0: EQUATION F Bit 1: EQUATION G Bit 2: EQUATION H Bit 3: tAux 3 Bit 4: tAux 4 Bit 5: tAux 5 Bit 6: tAux 6 Bit 7: tAux 7 Bit 8: tAux 8 Bit 9: tAux 9 Bit 10: tAux 10
F7	Unsigned integer: Data transmitted on the analogue outputs 0: IA RMS 1: IB RMS 2: IC RMS 3: IN RMS 4: THERM ST (thermal state) 5: % I LOAD (load in % of full load current) 6: Tbef START (time before a permitted start) 7: Tbef TRIP (time before a thermal trip) 8: V AC RMS (phase A-phase C voltage) (P225 only) 9: POWER FACT 10: WATTs 11: VARs 12: T°C RTD1 13: T°C RTD2 14: T°C RTD3 15: T°C RTD4 16: T°C RTD5 17: T°C RTD6 18: T°C RTD7 (P225 only) 19: T°C RTD8 (P225 only) 20: T°C RTD9 (P225 only) 21: T°C RTD10 (P225 only) 22: No Hottest RTD
F8	Unsigned integer: Latching of the trip output relay (RL1) Bit 0: tI>> Bit 1: tI0> Bit 2: tI0>> Bit 3: tI2> Bit 4: tI< Bit 5: THERM OVERLOAD (Thermal overload) Bit 6: EXCES LONG START (Excessive long start) Bit 7: t Istall (Stalled rotor whilst running) Bit 8: LOCKED ROTOR (locked rotor at start) Bit 9: t RTD1 TRIP or Thermist1 Bit 10: t RTD2 TRIP or Thermist2 Bit 11: t RTD3 TRIP or Thermist3 (P225 only) Bit 12: t RTD4 TRIP Bit 13: t RTD5 TRIP Bit 14: t RTD6 TRIP Bit 15: t RTD 10 TRIP (P225 only)

CODE	DESCRIPTION
F8’	Bit 0: t I2>> Bit 1: EXT 1 Bit 2: EXT 2 Bit 3: Equation A (« AND » logical gate A) Bit 4: Equation B (« AND » logical gate B) Bit 5: Equation C (« AND » logical gate C) Bit 6: Equation D (« AND » logical gate D) Bit 7: t RTD7 TRIP (P225 only) Bit 8: t RTD8 TRIP (P225 only) Bit 9: t RTD9 TRIP (P225 only) Bit 10: t V< (P225 only) Bit 11: VOLTAGE DIP Bit 12: t V> (P225 only) Bit 13: tI> Bit 14: tI>>> Bit 15: EQUATION E
F8”	Bit 0: EQUATION F Bit 1: EQUATION G Bit 2: EQUATION H Bit 3: tAux 3 Bit 4: tAux 4 Bit 5: tAux 5 Bit 6: tAux 6 Bit 7: tAux 7 Bit 8: tAux 8 Bit 9: tAux 9 Bit 10: tAux 10
F9	Unsigned integer: Remote control word 1 Bit 0: Remote delocking of the trip output relay (RL1) Bit 1: Remote alarm acknowledgement Bit 2: Remote TRIP ORDER Bit 3: Remote CLOSE ORDER Bit 4: Remote EMERGENCY START Bit 5: Remote order to change of active setting group Bit 6: Remote ORDER 1 Bit 7: Remote ORDER 2 Bit 8: Remote trigging of disturbance record Bit 9: Remote maintenance mode enabling order Bit 10: Remote maintenance mode disabling order Bit 11: Remote thermal state value reset Bit 12: Non automatic event/fault record acknowledgement on record retrieval Bit 13: Remote acknowledgement of the oldest non-acknowledged event record Bit 14: Remote acknowledgement of the oldest non-acknowledged fault record Bit 15: Remote acknowledgement of the « RAM memory error » alarm
F9’	Unsigned integer: Remote control word 3 Bit 0 to 1: Reserved Bit 2: Remote acknowledgement of the oldest non-acknowledged disturbance record
F10	ASCII characters 32 - 127 = ASCII character 1 32 - 127 = ASCII character 2
F11	Longer integer: numerical data - 2 147 483 648 to + 2 147 483 647
F12	Unsigned integer: Logic inputs status Bit 0: Logic input 1 (CB/contactor status: 52a) Bit 1: Logic input 2 Bit 2: Logic input 3 Bit 3: Logic input 4 Bit 4: Logic input 5 Bit 5: Logic input 6 Bit 6: Logic input 7 Bit 7: Logic input 8 Bit 8: Logic input 9 Bit 9: Logic input 10 Bit 10: Logic input 11

CODE	DESCRIPTION
F13	Unsigned integer: Output relays status Bit 0: Output relay 1 (trip output relay) Bit 1: Output relay 2 Bit 2: Output relay 3 Bit 3: Output relay 4 Bit 4: Output relay 5 Bit 5: Watchdog relay
F14	Unsigned integer: Auxiliary output relays allocation Bit 0: Allocation to relay 2 Bit 1: Allocation to relay 3 Bit 2: Allocation to relay 4 Bit 3: Allocation to relay 5 *Bits 4 to 15: reserved*
F15	Unsigned integer: Logic inputs allocation. Bit 0: EMERG ST (emergency start) Bit 1: SET GROUP (change from one protection setting group to another) Bit 2: SPEED SW (speed switch - locked rotor detection at start-up) Bit 3: DIST TRIG (trigging of a disturbance recording) Bit 4: EXT RESET (external reset) Bit 5: EXT 1 (auxiliary 1 timer) Bit 6: EXT 2 (auxiliary 2 timer) Bit 7: EXT 3 (auxiliary 3 timer) Bit 8: EXT 4 (auxiliary 4 timer) Bit 9: θ RESET (thermal state value reset) Bit 10: TRIP CIRC (trip circuit wiring supervision) Bit 11: VOLTAGE DIP Bit 12: tAux 5 Bit 13: tAux 6 Bit 14: tAux 7 Bit 15: tAux 8
F16	Unsigned integer: Earth fault and unbalance protection information *Bits 0 to 4: reserved* Bit 5: Instantaneous signal (I0> or I0>>) bit 6: Time delayed signal (tI0> or tI0>> or tI2> or tI2>>) *Bits 7 to 15: reserved*
F17	Unsigned integer: Phase OC and loss of load protection information Bit 0: Any phase, overshoot of the I>, I>>, I>>> threshold signal or VOLTAGE DIP signal Bit 1: Phase A signal , overshoot of the I>, I>>, I>>> threshold Bit 2: Phase B signal, overshoot of the I>, I>>, I>>> threshold Bit 3: Phase C signal, overshoot of the I>, I>>, I>>> threshold *Bit 4: reserved* Bit 5: Instantaneous signal I>, I>>, I>>> or V< or V> Bit 6: Time delayed signal tI>, tI>>, tI>>> or tI< or tV< or tV> *Bits 7 to 15: reserved*
F18	Unsigned integer: Analogue output type 0: 4-20 mA 1: 0-20 mA
F19	Unsigned long: LED allocation Bit 0: θ ALARM (thermal alarm) Bit 1: THERM OVERLOAD (thermal overload) Bit 2: tI0> Bit 3: tI0>> Bit 4: t I >> Bit 5: tI2> Bit 6: tI2>> Bit 7: tI< Bit 8: EXCES LONG START Bit 9: t Istall (stalled rotor whilst running) Bit 10: LOCKED ROTOR (at start) Bit 11: EMERG RESTART (emergency restart) Bit 12: FORBIDDEN START Bit 13: t RTD 1, 2, 3 ALARM Bit 14: t RTD 1, 2, 3 TRIP or Thermist 1, 2, 3

CODE	DESCRIPTION
F19	Bit 15: t RTD 4, 5, 6 ALARM Bit 16: t RTD 4, 5, 6 TRIP Bit 17: TRIP CIRCUIT FAIL (trip circuit wiring in failure) Bit 18: EXT 1 Bit 19: EXT 2 Bit 20: MOTOR STOPPED Bit 21: MOTOR RUNNING Bit 22: SUCCESSFUL START Bit 23: tI> Bit: 24: tI>>> Bit 25: t RTD 7, 8, 9, 10 ALARM (P225 only) Bit 26: t RTD 7, 8, 9, 10 TRIP (P225 only) Bit 27: tV< (P225 only) Bit 28: VOLTAGE DIP (load shedding further a voltage dip) Bit 29: tV> (P225 only) Bit 30: BUS VOLTAGE (bus voltage too low to enable a start) (P225 only) Bit 31: CB FAIL (CB failure)
F19`	Unsigned integer: LED allocation 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: AUTO RE-START (P225 only) Bit 7: INPUT 7 Bit 8: INPUT 8 Bit 9: INPUT 9 Bit 10: INPUT 10 Bit 11: INPUT 11 Bit 12: Logic Equation A Bit 13: Logic Equation B Bit 14: Logic Equation C Bit 15: Logic Equation D
F19”	Unsigned integer: LED allocation Bit 0: Logic Equation E Bit 1: Logic Equation F Bit 2: Logic Equation G Bit 3: Logic Equation H Bit 4: tAux 3 Bit 5: tAux 4 Bit 6: tAux 5 Bit 7: tAux 6 Bit 8: tAux 7 Bit 9: tAux 8 Bit 10: tAux 9 Bit 11: tAux 10
F20	Unsigned integer: Status of the information assigned to the logic inputs Bit 0: tAux 5 Bit 1: tAux 6 Bit 2: tAux 7 Bit 3: tAux 8 Bit 4: tAux 9 Bit 5: tAux 10 Bit 6: Synchronization Bit 7: Phase Rotation

CODE	DESCRIPTION
F20’	Unsigned integer: Status of the information assigned to the logic inputs Bit 0: Emergency start Bit 1: Change from one protection setting group to another Bit 2: Voltage Dip Bit 3: CB/Contactor status (52a interlock): open = 0, close = 1 Bit 4: Trigging of a disturbance recording Bit 5: Speed switch signal Bit 6: External reset Bit 7: Auxiliary timer EXT 1 Bit 8: Auxiliary timer EXT 2 Bit 9: Auxiliary timer EXT 3 Bit 10: Auxiliary timer EXT 4 *Bit 11: reserved* Bit 12: Thermal state value reset *Bits 13 to 14: reserved* Bit 15: Trip circuit supervision
F21	Unsigned integer: Software version Most significant digit: software version number Lost significant digit: software version letter 100: 10.A version 101: 10.B version 110: 11.A version 122: 12.C version
F22	Unsigned integer: Internal logic status Bit 0: Trip output relay latched (RL1) *Bit 1: reserved*
F23	Unsigned integer: Quick reading byte Bit 0: General MiCOM relay status Bit 1: Minor relay failure Bit 2: Presence of a non-acknowledged event record Bit 3: Clock synchronisation status Bit 4: Presence of a non-acknowledged disturbance record Bit 5: Presence of a non-acknowledged fault record *Bits 6 to 15: reserved*
F24	0: Function out of service 1: Function in service
F25	2: ASCII characters

CODE	DESCRIPTION
F26	Default displayed value 1: IA RMS 2: IB RMS 3: IC RMS 4: IN RMS 5: THERM ST (Thermal state) 6: % I LOAD (load in % of full load current) 7: Tbef START (time before a permitted start) 8: Tbef TRIP (time before a thermal trip) 9: V AC RMS (phase A–phase C voltage) 10: POWER FACT 11: WATTs 12: VARs 13: T°C RTD1 14: T°C RTD2 15: T°C RTD3 16: T°C RTD4 17: T°C RTD5 18: T°C RTD6 19: T°C RTD7 (P225 only) 20: T°C RTD8 (P225 only) 21: T°C RTD9 (P225 only) 22: T°C RTD10 (P225 only) 23: No Hottest RTD 24: UA_RMS, 25: UB_RMS, 26: UC_RMS, 27: UN_RMS, 28: UAB_RMS, 29: UBC_RMS, 30: UCA_RMS, 31: WATTS_ZERO
F27	Time delay type: 0: DMT time delay 1: IDMT time delay 2: RI time delay
F28	Unsigned integer: Baudrate 0: 300 1: 600 2: 1200 3: 2400 4: 4800 5: 9600 6: 19200 7: 38400
F29	Unsigned integer: parity 0: Without 1: Even 2: Odd
F30	*Reserved*
F31	Unsigned integer: Stop bit 0: 1 stop bit 1: 2 stop bits
F32	Unsigned integer: Thermistor type 0: PTC 1: NTC
F33	Unsigned integer: Thermal image information Bit 0: θ ALARM signal (thermal alarm) Bit 1: THERM OV. signal (thermal overload) Bit 2: θ FORBID START signal (prohibited start due to thermal criteria) *Bits 3 to 15: reserved*

CODE	DESCRIPTION
F34	Unsigned integer: Start sequence and stalled/locked rotor information Bit 0: Start sequence in progress signal Bit 1: Successful start signal Bit 2: Excessive long start signal Bit 3: Stalled rotor whilst running signal Bit 4: Locked rotor at start signal Bit 5: Overshoot of the permitted hot starts number signal Bit 6: Overshoot of the permitted cold starts number signal Bit 7: Limitation of the starts number signal Bit 8: Minimum time between two starts signal Bit 9: Prohibiting start signal *Bit 10: reserved* Bit 11: Re-acceleration phase in progress signal *Bit 12: reserved* Bit 13: Overshoot of the Istall threshold signal Bit 14: Motor running signal *Bit 15: Detection V DIP threshold signal*
F34`	Unsigned integer: information of Auto Re-Start (P225 only) Bit 0: Start in progress(Treac-shed not time out) (P225 only) Bit 1: Start failed(Treac-shed timed out and no re-start) (P225 only) Bit 2: Auto Re-Start (P225 only) Bit 3: Treac-long not timed out (P225 only) *Bit 4: Flag of "AUTO RE-START" on LCD ALARM* (P225 only)
F35	Unsigned integer: CB Fail, Busbars Voltage Control, ABS functions information Bit 0: ABS signal Bit 1: CB FAIL signal Bit 2: Phase A open Pole signal Bit 3: Phase B open Pole signal Bit 4: Phase C open Pole signal Bit 5: BUS VOLTAGE signal (P225 only) *Bits 6 to 15: reserved*
F36	Unsigned integer: EXT1…EXT4 timers and « AND » logical gates information Bit 0: EXT1 timer signal Bit 1: EXT2 timer signal Bit 2: Equation A signal Bit 3: Equation B signal Bit 4: Equation C signal Bit 5: Equation D signal Bit 6: reserved Bit 7: EXT3 timer signal Bit 8: EXT4 timer signal Bit9: Equation E signal Bit 10: Equation F signal Bit 11: Equation G signal Bit 12: Equation H signal Bit 13: tAux 5 timer signal Bit 14: tAux 6 timer signal Bit 15: tAux 7 timer signal
F36'	Unsigned integer: EXT1…EXT4 timers and « AND » logical gates information Bit 0: tAux 8 timer signal Bit 1: tAux 9 timer signal Bit 2: tAux 10 timer signal Bit 3: Config Alarm 52A Bit 4:Config Alarm Group Bit 5: Config Alarm Phase Rotation
F37	Control voltage type necessary to power on the logic inputs 0: Direct voltage (DC) 1: Alternating voltage (AC)
F38	Unsigned integer: Remote control word 2 - Remote control of the output relays - under Maintenance mode only Bit 0: Output relay 1 (trip output relay) Bit 1: Output relay 2 Bit 2: Output relay 3 Bit 3: Output relay 4 Bit 4: Output relay 5 Bit 5: Watchdog relay

CODE	DESCRIPTION
F39	Unsigned integer: Displayed fault record number *0: reserved* 1: Fault record n°1 2: Fault record n°2 3: Fault record n°3 4: Fault record n°4 5: Fault record n°5 6: Fault record n°6 7: Fault record n°7 8: Fault record n°8 9: Fault record n°9 10: Fault record n°10 11: Fault record n°11 12: Fault record n°12 13: Fault record n°13 14: Fault record n°14 15: Fault record n°15 16: Fault record n°16 17: Fault record n°17 18: Fault record n°18 19: Fault record n°19 20: Fault record n°20 21: Fault record n°21 22: Fault record n°22 23: Fault record n°23 24: Fault record n°24 25: Fault record n°25
F40	Disturbance record trigging criterion 0: ON INST: Overshoot of a current or voltage threshold (I>, I>>, I>>, I0>, I0>>, V< or V>) 1: ON TRIP: Relay n°1 operation (trip output relay operation: RL1)
F41	Display alarm messages Bit 0 a: TH OVERLOAD (thermal overload) Bit 1 a: t Io> Bit 2 a: t Io>> Bit 3 a: t I2> Bit 4 a: t I2>> Bit 5 a: LONG START tIstart Bit 6 a: MECHAN JAM tIstall (whilst running) Bit 7 a: LOCKED ROTOR (at start) Bit 8 a: t RTD 1 TRIP Bit 9 a: t RTD 2 TRIP Bit 10 a: t RTD 3 TRIP Bit 11 a: t RTD 4 TRIP Bit 12 a: t RTD 5 TRIP Bit 13 a: t RTD 6 TRIP Bit 14 a: Thermist 1 Bit 15 a: Thermist 2
F41’	Display alarm messages Bit 0 b: EXT 1 Bit 1 b: EXT 2 Bit 2 b: EQUATION A Bit 3 b: EQUATION B Bit 4 b: EQUATION C Bit 5 b: EQUATION D Bit 6 b: θ ALARM (thermal alarm) Bit 7 b: t RTD 1 ALAR Bit 8 b: t RTD 2 ALAR Bit 9 b: t RTD 3 ALAR Bit 10 b: t RTD 4 ALAR Bit 11 b: t RTD 5 ALAR Bit 12 b: t RTD 6 ALAR Bit 13 b: θ FORBIDDEN START Bit 14 b: START NB LIMIT Bit 15 b: T between 2 start

CODE	DESCRIPTION
F41’’	Display alarm messages Bit 0 c: RE-ACCELER AUTHOR (re-acceleration in progress) Bit 1 c: CB OPENING TIME (CB opening time) Bit 2 c: CB OPERTION NB (CB operation number) Bit 3 c: SA2n (Σ $Amps^n$ cut by CB) Bit 4 c: Thermist 3 (P225 only) Bit 5 c: t RTD 7 TRIP (P225 only) Bit 6 c: t RTD 8 TRIP (P225 only) Bit 7 c: t RTD 9 TRIP (P225 only) Bit 8 c: t RTD 7 ALAR (P225 only) Bit 9 c: t RTD 8 ALAR (P225 only) Bit 10 c: t RTD 9 ALAR (P225 only) Bit 11 c: CB FAIL Bit 12 c: TRIP CIRC. FAIL Bit 13 c: VOLTAGE DIP Bit 14 c: BUS VOLTAGE (P225 only) Bit 15 c: ANTI BACK SPIN
F41’’’	Display alarm messages Bit 0 d: t RTD 10 ALAR (P225 only) Bit 1 d: t RTD 10 TRIP (P225 only) Bit 2 d: start in progress(Treac-shed no time out) Bit 3 d: start failed(Treac-shed time out and no re-start) Bit 4 d: Auto Re-Start Bit 5 d: EQUATION E Bit 6 d: EQUATION F Bit 7 d: EQUATION G Bit 8 d: EQUATION H Bit 9 d: tAux 3 Bit 10 d: tAux 4 Bit 11 d: tAux 5 Bit 12 d: tAux 6 Bit 13 d: tAux 7 Bit 14 d: tAux 8 Bit 15 d: tAux 9
F41’’’’	Display alarm messages Bit 0 d: tAux 10
F42	RTD type 0: Pt100 type 1: Ni 120 type 2: Ni 100 type 3: Cu 10 type
F43	Circuit breaker monitoring flag Bit 0: CB opening time signal Bit 1: CB operation number signal Bit 2: Σ $Amps^n$ cut by CB signal
F44	Datation format 0: Private format 1: IEC format
F45	RTD status Bit 0: RTD 1 failure or thermistance 1 failure Bit 1: RTD 2 failure or thermistance 2 failure Bit 2: RTD 3 failure or thermistance 3 failure Bit 3: RTD 4 failure Bit 4: RTD 5 failure Bit 5: RTD 6 failure Bit 6: RTD board error Bit 7: RTD 7 failure (P225 only) Bit 8: RTD 8 failure (P225 only) Bit 9: RTD 9 failure (P225 only) Bit 10: RTD 10 failure (P225 only)

CODE	DESCRIPTION
F46	Unsigned integer: Status of the MiCOM relay self-test Bit 0: ANALOG OUTPUT ERROR (Analogue output error) Bit 1: COMM. ERROR (Communication error) Bit 2: EEPROM ERROR DATA (EEPROM memory error) Bit 3: CT/VT ERROR (Analogue signals acquisition error) Bit 4: CLOCK ERROR (Internal clock error) Bit 5: EEPROM ERROR CALIBR. (EEPROM calibration error) Bit 6: RAM ERROR (RAM memory error) Bit 7: RTD/Therm ERROR (short-wiring or open circuit) *Bits 8: reserved* *Bit 9: Maintenance mode* *Bit10: default Setting*
F47	Unsigned integer: Maximum analogue output rating for power data: 0: 10K 1: 50K 2: 100K 3: 200K 4: 500K 5: 1M 6: 10M 7: 100M 8: 500M 9: 1G 10:4G
F48	Unsigned integer: Configuration of the logic input active state 0: inactive state when control voltage is applied on. 1: active state when control voltage is applied on. Bit 0: Logic input 1 Bit 1: Logic input 2 Bit 2: Logic input 3 Bit 3: Logic input 4 Bit 4: Logic input 5 Bit 5: Logic input 6
F49	Configuration of the way to switch of active setting group 0: PICK-UP 1: LEVEL
F58	0: None 1: Thermal overload: THERM OV. 2: Thermal alarm : θ ALARM 3: FORBIDDEN START 4: I > 5: tI > 6: I >> 7: tI >> 8: I >>> 9: tI >>> 10: I0 > 11: tI0 > 12: I0 >> 13: tI0 >> 14: tI2> 15: tI2>> 16: EXCES LG START 17: t Istall 18: LOCKED ROTOR 19: tI< 20: CB FAIL 21: TRIP CIRC FAIL 22: t RTD1 ALARM 23: t RTD1 TRIP 24: t RTD2 ALARM

CODE	DESCRIPTION
F58 (cont'd)	25: t RTD2 TRIP 26: t RTD3 ALARM 27: t RTD3 TRIP 28: t RTD4 ALARM 29: t RTD4 TRIP 30: t RTD5 ALARM 31: t RTD5 TRIP 32: t RTD6 ALARM 33: t RTD6 TRIP 34: t RTD7 ALARM(P225 only) 35: t RTD7 TRIP(P225 only) 36: t RTD8 ALARM(P225 only) 37: t RTD8 TRIP(P225 only) 38: t RTD9 ALARM(P225 only) 39: t RTD9 TRIP(P225 only) 40: t RTD10 ALARM(P225 only) 41: t RTD10 TRIP(P225 only) 42: Therm. 1 43: Therm. 2 44: Therm. 3(P225 only) 45: tAux 1 46: tAux 2 47: tAux 3 48: tAux 4 49: SUCCESS START 50: t V<(P225 only) 51: VOLTAGE DIP 52: t V>(P225 only) 53: BUS VOLT- AGE(P225 only) 54: AUTO RE-START (P225 only) 55: Equation A 56: Equation B 57: Equation C 58: Equation D 59: Equation E 60: Equation F 61: Equation G 62: Equation H 63: tAux 5 64: tAux 6 65: tAux 7 66: tAux 8 67: tAux 9 68: tAux 10 69: Input 1 70: Input 2 71: Input 3 72: Input 4 73: Input 5 74: Input 6 75: Input 7 76: Input 8 77: Input 9 78: Input 10 79: Input 11
F59	0: OR 1: OR NOT 2: AND 3: AND NOT
F60	Detect Volt Dip 0: Voltage 1: Logic Input

CODE	DESCRIPTION
F61	Unsigned integer: Curve type Bit 0: STI (IEC) Bit 1: SI (IEC) Bit 2: VI (IEC) Bit 3: EI (IEC) Bit 4: LTI (IEC) Bit 5: STI (CO2) Bit 6: MI (ANSI) Bit 7: LTI (CO8) Bit 8: VI (ANSI) Bit 9: EI (ANSI) Bit 10: RC (IEC) Rectifier curve
F62	Phase Rotation change by: 0: Menu 1: Input
F63	Phase Sequence: 0: A B C 1: A C B
F64	Data and time synchronization mode: Bit 0: Automatic Bit 1: IRIG-B only Bit 2: Logic input Bit 3: communication port1 Bit 4: communication port2
F65	IRIG-B signal type: Bit 0: Logical Bit 1: modulated
F66	Option board: 0: none 1: with optional board
F67	Inh, Alarm part 1: 1: With optional board bit 0: tAux 1 alarm inhibited bit 1: tAux 2 alarm inhibited bit 2: tAux 3 alarm inhibited bit 3: tAux 4 alarm inhibited bit 4: tAux 5 alarm inhibited bit 5: tAux 6 alarm inhibited bit 6: tAux 7 alarm inhibited bit 7: tAux 8 alarm inhibited bit 8: tAux 9 alarm inhibited bit 9: tAux 10 alarm inhibited bit 10: I< alarm inhibited
F67’	Alarms inhibition part 2: bit 0: tEquation A alarm inhibited bit 1: tEquation B alarm inhibited bit 2: tEquation C alarm inhibited bit 3: tEquation D alarm inhibited bit 4: tEquation E alarm inhibited bit 5: tEquation F alarm inhibited bit 6: tEquation G alarm inhibited bit 7: tEquation H alarm inhibited
F68	0: Function out of service 1: Input (speed switch) 2: POWER FACT
F69	Version mat: 1: If bit 11 of Cortect = 'A' 2: If bit 11 of Cortect = '3' 3: If bit 11 of Cortect = '7' OR '8' 0: else
F70	Analog channel: 1: If bit 12 of Cortect = '2' 0: else

1.10 Modbus Events and alarms

Related address	Code	Event Type	Associated Value Type (1)	Alarm text	Reset type (2)
-	00	"No EVENT"	-	-	-
-	01	"REMOTE CLOSING"	F9	-	-
-	02	"REMOTE TRIPPING"	F9	-	-
-	03	«DISTURBANCE RECORD TRIGGING»	F60	-	-
-	04	«SETTING CHANGE»	address of the modified value	-	-
014H	05	"I >>" (instantaneous signal)	F17 ↑↓	-	-
015H	06	"I0 >" (instantaneous signal)	F16 ↑↓	-	-
016H	07	"I0 >>" (instantaneous signal)	F16 ↑↓	-	-
017H	08	"I2 >" (instantaneous signal)	F16 ↑↓	-	-
018H	09	"I2 >>" (instantaneous signal)	F16 ↑↓	-	-
019H	10	"I <" (instantaneous signal)	F17 ↑↓	-	-
01AH	11	"THERMAL ALARM"	F33 ↑↓	θ ALARM	S/R
01DH	12	"t RTD1 ALARM"	F4 ↑↓	t RTD1 ALAR	S/R
01DH	13	"t RTD2 ALARM"	F4 ↑↓	t RTD2 ALAR	S/R
01DH	14	"t RTD3 ALARM"	F4 ↑↓	t RTD3 ALAR	S/R
01DH	15	"t RTD4 ALARM"	F4 ↑↓	t RTD4 ALAR	S/R
01DH	16	"t RTD5 ALARM"	F4 ↑↓	t RTD5 ALAR	S/R
01DH	17	"t RTD6 ALARM"	F4 ↑↓	t RTD6 ALAR	S/R
01AH	18	"THERMAL OVERLOAD"	F33 ↑↓	TH.OVERLOAD	M
01AH	19	"THERMAL FORBIDDEN START"	F33 ↑↓	θ FORBIDDEN START	S/R
014H	20	"t I >>" (time delayed signal)	F17 ↑↓	t I >> PHASE	M
015H	21	"t I0 >" (time delayed signal)	F17 ↑↓	t I0 >	M
016H	22	"t I0 >>" (time delayed signal)	F16 ↑↓	t I0 >>	M
017H	23	"t I2 >" (time delayed signal)	F16 ↑↓	t I2 >	M
018H	24	"t I2 >>" (time delayed signal)	F16 ↑↓	t I2 >>	M
019H	25	"t I <" (time delayed signal)	F16 ↑↓	t I < PHASE	M
01CH	26	"REACCELERATION IN PROGRESS"	F17 ↑↓	RE-ACCELER AUTHOR	-
011H	27	"EMERGENCY START"	F34 ↑↓	EMERG ST.	S/R
01CH	28	"START-UP DETECTION"	F34	-	-
011H	29	"MOTOR HALTED"	F34	-	-
01CH	30	"EXCESSIVE START TIME"	F34	LONG START tIstart	M
01CH	31	"STALLED ROTOR WHILST RUNNING"	F34 ↑↓	MECHAN JAM tIstall	M
01CH	32	"LOCKED ROTOR AT START"	F34 ↑↓	LOCKED ROTOR	M
01CH	33	"START NUMBER LIMITATION"	F34 ↑↓	START NB LIMIT	S/R
01CH	34	"MINIMUM TIME BETWEEN 2 STARTS"	F34 ↑↓	T between 2 start	S/R
01BH	35	"EXT 1"	F34 ↑↓	EXT 1	M
01BH	36	"EXT 2"	F36 ↑↓	EXT 2	M
01BH	37	"EQUATION A"	F36 ↑↓	EQUATION A	M
01BH	38	"EQUATION B"	F36 ↑↓	EQUATION B	M
01BH	39	"EQUATION C"	F36 ↑↓	EQUATION C	M
01BH	40	"EQUATION D"	F36 ↑↓	EQUATION D	M
01DH	41	"t RTD1 TRIP"	F4 ↑↓	t RTD1 TRIP	M
01DH	42	"t RTD2 TRIP"	F4 ↑↓	t RTD2 TRIP	M
01DH	43	"t RTD3 TRIP"	F4 ↑↓	t RTD3 TRIP	M
01DH	44	"t RTD4 TRIP"	F4 ↑↓	t RTD4 TRIP	M
01DH	45	"t RTD5 TRIP"	F4 ↑↓	t RTD5 TRIP	M
01DH	46	"t RTD6 TRIP"	F4 ↑↓	t RTD6 TRIP	M
01DH	47	"THERMISTOR 1"	F4 ↑↓	Thermist 1	M
01DH	48	"THERMISTOR 2"	F4 ↑↓	Thermist 2	M
021H	49	"CB OPENING TIME ALARM"	F43 ↑↓	CB OPENING TIME	M
021H	50	"CB OPERATION NUMBER ALARM"	F43 ↑↓	CB OPENING NB	M
021H	51	"CB SAn ALARM"	F43 ↑↓	SA2N	M

Related address	Code	Event Type	Associated Value Type (1)	Alarm text	Reset type (2)
01AH	52	"TRIPPING: THERMAL OVERLOAD"	F33	-	-
014H	53	"TRIPPING: t I >>" (time delayed signal)	F17	-	-
015H	54	"TRIPPING: t I0 >" (time delayed signal)	F16	-	-
016H	55	"TRIPPING: t I0 >>" (time delayed signal)	F16	-	-
017H	56	"TRIPPING: t I2 >" (time delayed signal)	F16	-	-
018H	57	"TRIPPING: t I2 >>" (time delayed signal)	F16	-	-
019H	58	"TRIPPING: t I <" (time delayed signal)	F17	-	-
01CH	59	"TRIPPING: EXCESSIVE START TIME"	F34	-	-
01CH	60	" TRIPPING: STALLED ROTOR WHILST RUNNING"	F34	-	-
01CH	61	"TRIPPING: LOCKED ROTOR AT START"	F34	-	-
01BH	62	"TRIPPING: EXT 1"	F36	-	-
01BH	63	"TRIPPING: EXT 2"	F36	-	-
01BH	64	"TRIPPING: EQUATION A"	F36	-	-
01BH	65	"TRIPPING: EQUATION B"	F36	-	-
01BH	66	"TRIPPING: EQUATION C"	F36	-	-
01BH	67	"TRIPPING: EQUATION D"	F36	-	-
01DH	68	"TRIPPING: t RTD1 TRIP"	F4	-	-
01DH	69	"TRIPPING: t RTD2 TRIP"	F4	-	-
01DH	70	"TRIPPING: t RTD3 TRIP"	F4	-	-
01DH	71	"TRIPPING: t RTD4 TRIP"	F4	-	-
01DH	72	"TRIPPING: t RTD5 TRIP"	F4	-	-
01DH	73	"TRIPPING: t RTD6 TRIP"	F4	-	-
01DH	74	"TRIPPING: THERMISTOR 1"	F4	-	-
01DH	75	"TRIPPING: THERMISTOR 2"	F4	-	-
-	76	"ACKNOWLEDGEMENT OF ONE ALARM USING KEYPAD"	-	-	-
-	77	"ACKNOWLEDGEMENT OF ALL ALARMS USING KEYPAD"	-	-	-
N/A	78	"REMOTE ACKNOWLEDGEMENT OF ONE ALARM"	-	N/A	N/A
-	79	"REMOTE ACKNOWLEDGEMENT OF ALL ALARMS"	-	-	-
010H	80	"CHANGE OF THE LOGIC INPUTS STATUS"	F12 ↑↓	-	-
00FH	81	"MAJOR RELAY FAILURE»	F46 ↑↓	HARDW ALARMS	S/R
00FH	82	"MINOR RELAY FAILURE"	F46 ↑↓	HARDW ALARMS	S/R
013H	83	"CHANGE OF THE LOGIC OUTPUTS STATUS"	F13 ↑↓	-	-
01BH	84	"EXT 3"	F36 ↑↓	-	-
01BH	85	"EXT 4"	F36 ↑↓	-	-
N/A	86	*Reserved*	-	-	-
02AH	87	"V <" (instantaneous signal) (P225 only)	F17 ↑↓	-	-
N/A	88	*Reserved*	-	-	-
02CH	89	"V >" (instantaneous signal)	F17 ↑↓	-	-
01FH	90	"t RTD7 ALARM" (P225 only)	F4' ↑↓	t RTD7 ALAR	S/R
01FH	91	"t RTD8 ALARM" (P225 only)	F4' ↑↓	t RTD8 ALAR	S/R
01FH	92	"t RTD9 ALARM" (P225 only)	F4' ↑↓	t RTD9 ALAR	S/R
01FH	93	"t RTD10 ALARM" (P225 only)	F4' ↑↓	t RTD10 ALAR	S/R
01FH	94	"t RTD7 TRIP" (P225 only)	F4' ↑↓	t RTD7 TRIP	M
01FH	95	"t RTD8 TRIP" (P225 only)	F4' ↑↓	t RTD8 TRIP	M
01FH	96	"t RTD9 TRIP" (P225 only)	F4' ↑↓	t RTD9 TRIP	M
01FH	97	"t RTD10 TRIP" (P225 only)	F4' ↑↓	t RTD10 TRIP	M
01DH	98	"THERMISTOR 3" (P225 only)	F4 ↑↓	Thermist 3	M
02AH	99	"t V <" (time delayed signal) (P225 only)	F17 ↑↓	t V<	M
N/A	100	*Reserved*	-	-	-

Related address	Code	Event Type	Associated Value Type (1)	Alarm text	Reset type (2)
02CH	101	"t V >" (time delayed signal) (P225 only)	F17 ↑↓	t V>	M
N/A	102	«ACTIVE SETTING GROUP CHANGE»	-	-	-
02DH	103	"BUS VOLTAGE" (P225 only)	F17 ↑↓	BUS VOLTAGE	S/R
02DH	104	"ANTI BACK SPIN"	F35 ↑↓	ANTI BACK SPIN	S/R
02DH	105	"CB. FAIL"	F35 ↑↓	CB. FAIL	M
01CH	106	"VOLTAGE DIP"	F35 ↑↓	VOLTAGE DIP	M
021H	107	"TRIP CIRC. FAIL"	F43	TRIP CIRC. FAIL	M
01FH	108	"TRIPPING: t RTD7 TRIP" (P225 only)	F4'	-	-
01FH	109	"TRIPPING: t RTD8 TRIP" (P225 only)	F4'	-	-
01FH	110	"TRIPPING: t RTD9 TRIP" (P225 only)	F4'	-	-
01FH	111	"TRIPPING: t RTD10 TRIP" (P225 only)	F4'	-	-
01DH	112	"TRIPPING: THERMISTOR 3" (P225 only)	F4	-	-
02AH	113	"TRIPPING: t V<" (time delayed signal) (P225 only)	F17	-	-
02CH	114	"TRIPPING: t V>" (time delayed signal) (P225 only)	F17	-	-
-	115	"LATCHING OF THE OUTPUT RELAYS"	-	LATCH AUX OUTPUT RELAY	M
-	116	"MAINTENANCE MODE ACTIVE"	F9	-	-
013H	117	"OUTPUT RELAY REMOTE CONTROL - UNDER MAINTENANCE MODE"	F38	-	-
01CH	118	TRIPPING: VOLTAGE DIP	F35	-	-
-	119	LOCAL MODE (IEC870-5-103)	-	-	-
-	120	CB POSITION CLOSED (IEC870-5-103)	-	-	-
030H	121	I > (instantaneous signal)	F17 ↑↓	-	-
031H	122	I >>> (instantaneous signal)	F17 ↑↓	-	-
030H	123	TRIPPING : t I > (time delayed signal)	F17	-	-
031H	124	TRIPPING : t I >>> (time delayed signal)	F17	-	-
030H	125	t I >(time delayed signal)	F17 ↑↓	t I > PHASE	M
031H	126	t I >>>(time delayed signal)	F17 ↑↓	t I >>> PHASE	M
014H	127	t Reset I>	F17 ↑↓	-	-
030H	128	t Reset I>>	F17 ↑↓	-	-
06BH	129	Start in progress(Treac-shed no time out)	F34'	START IN PROGRESS	S/R
06BH	130	Start failed(Treac-shed time out and no re-start)	F34'	START FAILED	S/R
06BH	131	Auto Re-Start	F34'	AUTO RE-START	S/R
01BH	132	EQUATION E	F36 ↑↓	EQUATION E	M/I
01BH	133	EQUATION F	F36 ↑↓	EQUATION F	M/I
01BH	134	EQUATION G	F36 ↑↓	EQUATION G	M/I
01BH	135	EQUATION H	F36 ↑↓	EQUATION H	M/I
01BH	136	tAux 5	F36 ↑↓	-	-
01BH	137	tAux 6	F36 ↑↓	-	-
01BH	138	tAux 7	F36 ↑↓	-	-
0A4H	139	tAux 8	F36' ↑↓	-	-
0A4H	140	tAux 9	F36' ↑↓	-	-
0A4H	141	tAux 10	F36' ↑↓	-	-
01BH	142	EQUATION E	F36 ↑↓	-	-
01BH	143	EQUATION F	F36 ↑↓	-	-
01BH	144	EQUATION G	F36 ↑↓	-	-
01BH	145	EQUATION H	F36 ↑↓	-	-
01BH	146	tAux 3	F36 ↑↓	-	-
01BH	147	tAux 4	F36 ↑↓	-	-
01BH	148	tAux 5	F36 ↑↓	-	-
01BH	149	tAux 6	F36 ↑↓	-	-
01BH	150	tAux 7	F36 ↑↓	-	-

Related address	Code	Event Type	Associated Value Type (1)	Alarm text	Reset type (2)
0A4H	151	tAux 8	F36' ↑ ↓	-	-
0A4H	152	tAux 9	F36' ↑ ↓	-	-
0A4H	153	tAux 10	F36' ↑ ↓	-	-
0700	154	Quick Read Status Byte Format	F23	-	-
	155	Reserved		-	-
0A4H	156	Config Alarm 52a	F36'↑ ↓↓	-	-
0A4H	157	Config Alarm setting group	F36' ↑ ↓	-	-
0A4H	158	Config Alarm Phase Rotation	F36' ↑ ↓	-	-
00FH	159	Hardware alarm with main power supply	F46	-	-
0E7H	160	Hardware alarm with -3.3v power supply	F98	-	-
0E7H	161	Hardware alarm with 5.0v power supply	F98	-	-
0E7H	162	Hardware alarm with 3.3v power supply	F98	-	-
0E7H	163	Hardware alarm with 12v power supply	F98	-	-
0E7H	164	Hardware alarm with 1.3v power supply	F98	-	-
0E7H	165	Hardware alarm with 0 v power supply	F98	-	-
0E8H	166	Hardware alarm with transformer 1	F99	-	-
0E8H	167	Hardware alarm with transformer 2	F99	-	-
0E8H	168	Hardware alarm with transformer 3	F99	-	-
0E8H	169	Hardware alarm with transformer 4	F99	-	-
0E8H	170	Hardware alarm with transformer 5	F99	-	-
0E8H	171	Hardware alarm with transformer 6	F99	-	-
0E8H	172	Hardware alarm with transformer 7	F99	-	-
0E8H	173	Hardware alarm with transformer 8	F99	-	-
0E8H	174	Hardware alarm with transformer 9	F99	-	-

(1)
- The double arrow ↑↓ means the event is generated on event occurrence and another is generated 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 ».

(2)
S/R = Self / reset
M = Manual
M/I = Manual / Inhibition

1.11 Fault records

1.11.1 Fault record memory mapping

Address	Contents
3700h	Fault Record 1 Data
3701h	Fault Record 2 Data
3702h	Fault Record 3 Data
3703h	Fault Record 4 Data
3704h	Fault Record 5 Data
3705h	Fault Record 6 Data
3706h	Fault Record 7 Data
3707h	Fault Record 8 Data
3708h	Fault Record 9 Data
3709h	Fault Record 10 Data
370Ah	Fault Record 11 Data
370Bh	Fault Record 12 Data
370Ch	Fault Record 13 Data
370Dh	Fault Record 14 Data
370Eh	Fault Record 15 Data
370Fh	Fault Record 16 Data
3710h	Fault Record 17 Data
3711h	Fault Record 18 Data
3712h	Fault Record 19 Data
3713h	Fault Record 20 Data
3714h	Fault Record 21 Data
3715h	Fault Record 22 Data
3716h	Fault Record 23 Data
3717h	Fault Record 24 Data
3718h	Fault Record 25 Data
3E00h	Data of the oldest fault value record

NOTE: Fault Record Size is 18 Words

1.11.2 Fault record format

Word Number	Contents
1	Fault record number
2	Fault date (sec) : second number since 01/01/1994.lsb (low significant bit)
3	Fault date (sec) : second number since 01/01/1994.lsb (most significant bit)
4	Fault date (ms) … lsb (low significant bit)
5	Fault date (ms) … lsb (most significant bit)
6	Fault date (season): (0 = winter,1 = summer, 2 = non defined)
7	Active setting group while the fault occurrence : (1 or 2)
8	Faulty phase: See Table 1
9	Cause of the Fault record : See Table 2
10	Fault value magnitude (fundamental value): See section P22x/EN FT
11	Phase A current magnitude (True RMS value): See section P22x/EN FT
12	Phase B current magnitude (True RMS value): See section P22x/EN FT
13	Phase C current magnitude (True RMS value): See section P22x/EN FT
14	Earth current magnitude (True RMS value): See section P22x/EN FT
15	Phase A-Phase C voltage magnitude (True RMS value): See section P22x/EN FT / VAB (3 phase voltage selected)
16	VBC (3 phase voltage selected)
17	VCA (3 phase voltage selected)
18	Acknowledgement : - non acknowledged Fault record = 0 - acknowledged = 1

1.11.3 Fault phases

Number	Description
0	None
1	Phase A
2	Phase B
3	Phase C
4	Phases A - B
5	Phases A - C
6	Phases B - C
7	Phases A - B - C
8	Earth
9	V A-C voltage / Phase A-B (3 phase voltage selected)
10	Phase B C voltage (3 phase voltage selected)
11	Phase C A voltage (3 phase voltage selected)
12	Phase AB-CA voltage (3 phase voltage selected)
13	Phase AB-BC voltage (3 phase voltage selected)
14	Phase BC-CA voltage (3 phase voltage selected)
15	Phase A B C voltage (3 phase voltage selected)

1.11.4 Fault origin

Number	Description
0	NO FAULT
1	REMOTE TRIPPING
2	TRIPPING: t I >> (time delayed signal)
3	TRIPPING: t I0> (time delayed signal)
4	TRIPPING: t I0 » (time delayed signal)
5	TRIPPING: t I2> (time delayed signal)
6	TRIPPING: t I2 » (time delayed signal)
7	TRIPPING: t I < (time delayed signal)
8	TRIPPING: EXCESSIVE LONG START
9	TRIPPING: STALLED ROTOR WHILST RUNNING
10	TRIPPING: LOCKED ROTOR AT START
11	TRIPPING: THERMAL OVERLOAD
12	TRIPPING: EXT 1
13	TRIPPING: EXT2
14	TRIPPING: EQUATION A
15	TRIPPING: EQUATION B
16	TRIPPING: EQUATION C
17	TRIPPING: EQUATION D
18	TRIPPING: t RTD1 TRIP
19	TRIPPING: t RTD2 TRIP
20	TRIPPING: t RTD3 TRIP
21	TRIPPING: t RTD4 TRIP
22	TRIPPING: t RTD5 TRIP
23	TRIPPING: t RTD6 TRIP
24	TRIPPING: THERMISTOR 1
25	TRIPPING: THERMISTOR 2
26	TRIPPING: THERMISTOR 3
27	TRIPPING: t RTD7 TRIP
28	TRIPPING: t RTD8 TRIP
29	TRIPPING: t RTD9 TRIP
30	TRIPPING: t RTD10 TRIP
31	TRIPPING: tU < (time delayed signal)
32	TRIPPING: VOLTAGE DIP
33	TRIPPING: tU > (time delayed signal)
34	TRIPPING: t I > (time delayed signal)
35	TRIPPING: t I >>> (time delayed signal)
36	TRIPPING: EQUATION E
37	TRIPPING: EQUATION F
38	TRIPPING: EQUATION G
39	TRIPPING: EQUATION H
40	TRIPPING: tAux 3
41	TRIPPING: tAux 4

Number	Description
42	TRIPPING: tAux 5
43	TRIPPING: tAux 6
44	TRIPPING: tAux 7
45	TRIPPING: tAux 8
46	TRIPPING: tAux 9
47	TRIPPING: tAux 10

1.12 Disturbance records

1.12.1 Disturbance record memory mapping

Address	Contents
3D00h	Number of available disturbance records (section 1.12.2)
3800h	Disturbance Record 1 (section 1.12.3)
3900h	Disturbance Record 2 (section 1.12.3)
3A00h	Disturbance Record 3 (section 1.12.3)
3B00h	Disturbance Record 4 (section 1.12.3)
3C00h	Disturbance Record 5 (section 1.12.3)
2200h	Disturbance Record Index Frame (section 1.12.6)

1.12.2 Disturbance record summary format

Word format	Contents
1	Number of disturbance record available
2	Oldest disturbance record number
3	Oldest disturbance record date (sec) : number of seconds since the 01/01/1994 lsb (low significant bit)
4	Oldest disturbance record date (sec) : number of seconds since the 01/01/1994 msb (most significant bit)
5	Oldest disturbance record date (ms) lsb (low significant bit)
6	Oldest disturbance record date (ms) msb (most significant bit)
7	Cause of the oldest disturbance record (See Note1)
8	Acknowledgement
9	Previous disturbance record number
10	Previous disturbance record date (sec) : number of seconds since the 01/01/1 994 lsb (low significant bit)
11	Previous disturbance record date (sec) : num ber of seconds since the 01/01/1 994 msb (most significant bit)
12	Previous disturbance record date (ms) lsb (low significant bit)
13	Previous disturbance record date (ms) msb (most significant bit)
14	Cause of the previous disturbance record *
15	Acknowledqement and so on regarding the other disturbance records.

* 1: Relay n°1 operation
2: Overshoot of a current or voltage threshold (I>, I>>,I>>>, I0>, I0», V< or V>)
3: Remote trig
4: Trig order received through a logic input

1.12.3 Disturbance record data mapping

Word format	Contents
0	IA (phase A current)
1	IB (phase B current)
2	IC (phase C current)
3	IN (neutral current)
4	Frequency
5	Logic inputs (5 added DI) and logic outputs
6	V AC (phase A-phase C voltage) / VA (3 phase voltage selected)
7	VB (3 phase voltage selected)
8	VC (3 phase voltage selected)

1.12.4 Disturbance record configuration data

Word format	Contents
1	Samples number containing in the mapping
2	Pre-time sample number
3	Post-time sample number
4	Primary line CT value
5	Secondary line CT value
6	Primary earth CT value
7	Secondary earth CT value
8	Ratio of the internal phase CT
9	Ratio of the internal earth CT
10	Primary line VT value lsb (low significant bit)
11	Primary line VT value msb (most significant bit)
12	Secondary line CT value
13	reserved
14	reserved
15	reserved
16	Ratio of the internal voltage numerator (100)
17	Ratio of the internal voltage denominator (12600 or 3400) – 16 bits ADC
18	Address of the last page containing samples
19	Word number contained in the last page (containing samples)

1.12.5 Disturbance record configuration data

Address	Contents
0900H	250 Disturbance Data Words (Block 1)
0A00H	250 Disturbance Data Words (Block 2)
0B00H	250 Disturbance Data Words (Block 3)
0C00H	250 Disturbance Data Words (Block 4)
0D00H	250 Disturbance Data Words (Block 5)
0E00H	250 Disturbance Data Words (Block 6)
0F00H	250 Disturbance Data Words (Block 7)
1000H	250 Disturbance Data Words (Block 8)
1100H	250 Disturbance Data Words (Block 9)
1200H	250 Disturbance Data Words (Block 10)
1300H	250 Disturbance Data Words (Block 11)
1400H	250 Disturbance Data Words (Block 12)
1500H	250 Disturbance Data Words (Block 13)
1600H	250 Disturbance Data Words (Block 14)
1700H	250 Disturbance Data Words (Block 15)
1800H	250 Disturbance Data Words (Block 16)
1900H	250 Disturbance Data Words (Block 17)
1A00H	250 Disturbance Data Words (Block 18)
1B00H	250 Disturbance Data Words (Block 19)
1C00H	250 Disturbance Data Words (Block 20)
1D00H	250 Disturbance Data Words (Block 21)
1E00H	250 Disturbance Data Words (Block 22)
1F00H	250 Disturbance Data Words (Block 23)
2000H	250 Disturbance Data Words (Block 24)
2100H	250 Disturbance Data Words (Block 25)

1.12.6 Disturbance record index frame

Word format	Contents
1	Disturbance record number
2	Disturbance recording end time (sec) : number of seconds since the 01/01/1 994 lsb (low significant bit)
3	Disturbance recording end time (sec): number of seconds since the 01/01/1 994 msb (most significant bit)
4	Disturbance recording end time (ms) lsb (low significant bit)
5	Disturbance recording end time (ms) msb (most significant bit)
6	Cause of the disturbance record trigging *
7	Frequency

* 1: Relay n°1 operation
2: Overshoot of a current or voltage threshold (I>, I>>,I>>>, I0>, I0», V< or V>)
3: Remote trig
4: Trig order received through a logic input

1.13 Motor starts records

1.13.1 Start-up current form record data

Address	Contents
2300H	124 values
2400H	124 values
2500H	124 values
2600H	124 values
2700H	124 values
2800H	124 values
2900H	124 values
2A00H	124 values
2B00H	124 values
2C00H	124 values
2D00H	124 values
2E00H	124 values
2F00H	124 values
3000H	124 values
3100H	124 values
3200H	124 values
3300H	16 values

1.13.2 Index frame for the start-up current form record

Address	Contents
3400H	Number of available values of the start-up current form record
3401H	Number of the last page
3402H	Number of available values stored in the last page

1.13.3 Start-up voltage form record data

Address	Contents
4000H	124 values
4100H	124 values
4200H	124 values
4300H	124 values
4400H	124 values
4500H	124 values
4600H	124 values
4700H	124 values
4800H	124 values
4900H	124 values
4A00H	124 values
4B00H	124 values
4C00H	124 values

Address	Contents
4D00H	124 values
4E00H	124 values
4F00H	124 values
5000H	16 values

1.13.4 Index frame for the start-up voltage form record

Address	Contents
5100H	Number of available values of the start-up voltage form record
5101H	Number of the last page
5102H	Number of available values stored in the last page

1.13.5 Motor Start Record Summary Format

Address	Contents
0	Number of available values in the start-up current & voltage form record
1	Address of the last page containing significant record data
2	Word number contained in the last page (containing significant record data)

2. IEC 60870-5-103 PROTOCOL

2.1 General information

2.1.1 Time tagged messages

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.

2.1.2 System commands

Synchronisation Command: **ASDU 6** 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** 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.

2.1.3 General commands

Control direction: **ASDU 20**. 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.

2.1.4 Private commands – Setting management

2.1.4.1 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.

2.1.4.2 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.

2.1.5 Relay reinitialisation

In case of relay re initialization, the relay send to the master station:

– A message indicating relay start/restart

– or a message indicating Reset CU

– or a message indicating Reset FCB

Each identification message of the relay (ASDU 5) contains the manufacturer name in 8 ASCII characters (“Schneider Electric”) and 2 free bytes containing: « 220 » or « 225 »,in decimal format, then 2 free bytes containing the software version number in decimal (for ex.: 112 corresponds to “11.C”).

2.1.6 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** (value stored),

– In **ASDU 3, (ASDU3.4)** (value stored),

– In first **ASDU 77,** which is a private ASDU (value stored in IEEE 32 bits floating-point format),

– In second **ASDU 77,** which is a private option active (value stored in IEEE 32 bits floating-point format),

2.2 Messages representation

Messages representation is expressed with the associated:

– INFORMATION NUMBER: **INF**

– ASDU TYPE: **TYP**

– CAUSE OF TRANSMISSION: **COT**

– FUNCTION NUMBER: **FUN** .

2.3 System state

System State 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 following indications are sent to the master station if the option “Basic” or “Advanced GI” is chosen in the ‘COMMUNICATION / GI Select’ menu.

2.4 Compatible Range Information Numbers in Monitor Direction

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
System Functions						
8	10	255	0	End of General Interrogation		
6	8	255	0	Time Synchronization		
5	3	160	2	Reset FCB		
5	4	160	3	Reset CU		
5	5	160	5	Start		
Status Indications						
1	1,9	160	19	LED Reset		Reset Indications
1	1,9	160	22	Local Parameter Setting	*	Password Entered Locally
1	1,9	160	23	Characteristic 1	*	PG1 Changed
1	1,9	160	24	Characteristic 2	*	PG2 Changed
1	1,9	160	27	Auxillary Input 1	*	Auxillary 1 Timer Expiry
1	1,9	160	28	Auxillary Input 2	*	Auxillary 2 Timer Expiry
1	1,9	160	29	Auxillary Input 3	*	Auxillary 3 Timer Expiry
1	1,9	160	30	Auxillary Input 4	*	Auxillary 4 Timer Expiry
1	1,9	160	140	CB in O/O (« closed ») position	*	CB Change of State - Closed State
1	1,9	160	141	CB in F/O (« open ») position	*	CB Change of State - Open State
1	1,9	160	161	Logic Input 1	*	Change of Logic Input 1 State
1	1,9	160	162	Logic Input 2	*	Change of Logic Input 2 State
1	1,9	160	163	Logic Input 3	*	Change of Logic Input 3 State
1	1,9	160	164	Logic Input 4	*	Change of Logic Input 4 State
1	1,9	160	165	Logic Input 5	*	Change of Logic Input 5 State
1	1,9	160	166	Logic Input 6	*	Change of Logic Input 7 State
1	1,9	160	167	Logic Input 7	*	Change of Logic Input 7 State
1	1,9	160	168	Logic Input 8	*	Change of Logic Input 8 State
1	1,9	160	169	Logic Input 9	*	Change of Logic Input 9 State
1	1,9	160	170	Logic Input 10	*	Change of Logic Input 10 State
1	1,9	160	171	Logic Input 11	*	Change of Logic Input 11 State
1	1,9	160	176	Relay Contact 1	*	Change of Relay Output 1 State
1	1,9	160	177	Relay Contact 2	*	Change of Relay Output 2 State
1	1,9	160	178	Relay Contact 3	*	Change of Relay Output 3 State
1	1,9	160	179	Relay Contact 4	*	Change of Relay Output 4 State
1	1,9	160	180	Relay Contact 5	*	Change of Relay Output 5 State
1	1,9	160	181	Relay Contact 6	*	Change of Relay Output 6 State
1	1,9	160	182	Auxillary Input 5	*	Auxillary 5 Timer Expiry
1	1,9	160	183	Auxillary Input 6	*	Auxillary 6 Timer Expiry
1	1,9	160	184	Auxillary Input 7	*	Auxillary 7 Timer Expiry
1	1,9	160	185	Auxillary Input 8	*	Auxillary 8 Timer Expiry
1	1,9	160	186	Auxillary Input 9	*	Auxillary 9 Timer Expiry
1	1,9	160	187	Auxillary Input 10	*	Auxillary 10 Timer Expiry
Fault Indications						
2	1	160	36	Trip Circuit		Trip Circuit Fail
2	1	160	64	Start / pick-up I>		I> Overcurrent Start
2	1	160	65	Start / pick-up I>>		I>> Overcurrent Start
2	1	160	66	Start / pick-up I>>>		I>>> Overcurrent Start
2	1,9	160	67	Start /Pickup N	*	Any IN Start
2	1	160	68	General Trip		Any Trip
2	1	160	69	Trip L1		Trip L1

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
2	1	160	70	Trip L2		Trip L2
2	1	160	71	Trip L3		Trip L3
2	1,9	160	84	General Start	*	Any Start
2	1	160	86	Trip logical equation 1		
2	1	160	87	Trip logical equation 2		
2	1	160	88	Trip logical equation 3		
2	1	160	89	Trip logical equation 4		
2	1	160	90	Trip I>		I> Overcurrent Trip
2	1	160	91	Trip I>>		I>> Overcurrent Trip
2	1	160	94	Trip I>>>		I>>> Overcurrent Trip
2	1	160	92	Trip IN>		IN> Overcurrent Trip
2	1	160	93	Trip IN>>		IN>> Overcurrent Trip
2	1	160	96	Start / pick-up IN>		IN> Overcurrent Start
2	1	160	97	Start / pick-up IN>>		IN>> Overcurrent Start
2	1	160	100	Start / pick-up I<		I< Overcurrent Start
2	1	160	101	Trip I<		I< Undercurrent Trip
2	1	160	104	Start / pick-up I2>		I2> Overcurrent Start
2	1	160	106	Start / pick-up I2>>		I2>> Overcurrent Start
2	1	160	105	Trip I2>		I2> Overcurrent Trip
2	1	160	107	Trip I2>>		I2>> Overcurrent Trip
2	1	160	109	Stalled Rotor		
2	1	160	110	Thermal Alarm		Thermal Overload Alarm
2	1	160	111	Thermal Overload		Thermal Overload Trip
2	1	160	113	Locked rotor (at start)		
2	1	160	120	Excess long start		
2	1	160	122	RTD Start		RTD Start
2	1	160	123	RTD Trip		RTD Trip
2	1	160	125	Thermistors Trip		Thermistors Trip
2	1	160	128	Trip U>		U> Overvoltage Trip
2	1	160	131	Trip U<		U< Undervoltage Trip
2	1	160	135	Trip Voltage Dip		Voltage Dip Trip
2	1	160	136	Trip logical equation 5		
2	1	160	137	Trip logical equation 6		
2	1	160	138	Trip logical equation 7		
2	1	160	139	Trip logical equation 8		
Measurands						
9,3	2	160	147	Measurands I0, V0		Measurement = 2.4 x Rated Value
9	2	160	148	Measurands Ia Ib Ic Uac Va Vb Vc P Q f		Measurement = 2.4 x Rated Value
77	2	160	149	I1, I2, Thermal state (in %), I% load		IEEE 32 bits floating-point format
77	2	160	150	RTD temperature measurands		If the RTD hardware option is set, 10 RTD temperature measurands are included. If the Thermistors hardware option is set, 3 RTD temperature measurands are included. the 7 other values are declared « Invalid ».(in degrees)
System Functions						
7	9	255	0	Init. General Interrogation		
6	8	255	0	Time Synchronization		
General Commands						
20	20	160	19	LED Reset		Reset Indications
20	20	160	23	Activate Characteristic 1		Activate Setting Group 1
20	20	160	24	Activate Characteristic 2		Activate Setting Group 2

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
20	20	160	142	Perform a CB Trip		Perform a CB Trip
20	20	160	143	Perform a CB Close		Perform a CB Close

2.5 Private Range Information Numbers in Monitor Direction

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
Status Indications						
1	1	168	1	Trip TC		CB Trip Command Acknowledged
1	1	168	2	Close TC		CB Close Command Acknowledged
1	1,9	168	33	CB in O/O (« closed ») position	*	CB Change of State - Closed State
1	1,9	168	34	CB in F/O (« open ») position	*	CB Change of State - Open State
1	1,9	168	160	Logic Input 1	*	Change of Logic Input 1 State
1	1,9	168	161	Logic Input 2	*	Change of Logic Input 2 State
1	1,9	168	162	Logic Input 3	*	Change of Logic Input 3 State
1	1,9	168	163	Logic Input 4	*	Change of Logic Input 4 State
1	1,9	168	164	Logic Input 5	*	Change of Logic Input 5 State
1	1,9	168	165	Logic Input 6	*	Change of Logic Input 6 State
1	1,9	168	166	Logic Input 7	*	Change of Logic Input 7 State
1	1,9	168	167	Logic Input 8	*	Change of Logic Input 8 State
1	1,9	168	168	Logic Input 9	*	Change of Logic Input 9 State
1	1,9	168	169	Logic Input 10	*	Change of Logic Input 10 State
1	1,9	168	170	Logic Input 11	*	Change of Logic Input 11 State
1	1,9	168	176	Relay Contact 1	*	Change of Relay Output 1 State
1	1,9	168	177	Relay Contact 2	*	Change of Relay Output 2 State
1	1,9	168	178	Relay Contact 3	*	Change of Relay Output 3 State
1	1,9	168	179	Relay Contact 4	*	Change of Relay Output 4 State
1	1,9	168	180	Relay Contact 5	*	Change of Relay Output 5 State
1	1,9	168	181	Relay Contact 6	*	Change of Relay Output 6 State
Fault Indications						
2	1	168	9	Start / pick-up I>		I> Overcurrent Start
2	1	168	10	Start / pick-up I>>		I>> Overcurrent Start
2	1	168	11	Start / pick-up I>>>		I>>> Overcurrent Start
2	1	168	12	Start / pick-up IN>		IN> Overcurrent Start
2	1	168	13	Start / pick-up IN>>		IN>> Overcurrent Start
2	1	168	15	Thermal Alarm		Thermal Overload Alarm
2	1	168	16	Thermal Overload		Thermal Overload Trip
2	1	168	17	I> Reset		I> Overcurrent Reset Occurrence/Disappearance
2	1	168	18	I>> Reset		I>> Overcurrent Reset Occurrence/Disappearance
2	1	168	182	Start in Progress		Start in Progress
2	1	168	183	start Failed		start Failed
2	1	168	184	Auto Restart		Auto Restart
2	1	168	23	Trip I<		I< Undercurrent Trip
2	1	168	57	Start / pick-up I2>		I2> Overcurrent Start
2	1	168	58	Trip I2>		I2> Overcurrent Trip
2	1	168	59	CB Opening Time Alarm		CB Opening Time Alarm
2	1	168	60	CB Operation Number Alarm		CB Operation Number Alarm
2	1	168	61	CB SAn Alarm		Sum of square Amp. overrun
2	1	168	73	Start / pick-up I<		I< Overcurrent Start

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
2	1	168	74	Start / pick-up I2>>		I2>> Overcurrent Start
2	1	168	75	Trip I2>>		I2>> Overcurrent Trip
2	1	168	102	Trip U>		U> Overvoltage Trip
2	1	168	105	Trip U<		U< Undervoltage Trip
2	1	168	109	Trip Voltage Dip		Voltage Dip Trip
2	1	168	122	RTD Start		RTD Start
2	1	168	123	RTD Trip		RTD Trip
2	1	168	125	Thermistors Trip		Thermistors Trip
2	1	168	128	Excess long start		
2	1	168	129	Stalled Rotor		
2	1	168	130	Locked rotor (at start)		
2	1	168	144	Trip logical equation 1		
2	1	168	145	Trip logical equation 2		
2	1	168	146	Trip logical equation 3		
2	1	168	147	Trip logical equation 4		
2	1	168	148	Trip logical equation 5		
2	1	168	149	Trip logical equation 6		
2	1	168	150	Trip logical equation 7		
2	1	168	151	Trip logical equation 8		
1	1	168	152	52a configure error		
1	1	168	153	setting group configure error		
1	1	168	154	Phase rotation configure error		
1	1	168	155	Time Syncronization		Time Syncronization Event generated by communication, logic input, IRIG-B
Measurands						
77	2	168	209	I1, I2, Thermal state (in %), I% load		IEEE 32 bits floating-point format
77	2	168	210	RTD temperature measurands		If the RTD hardware option is set, 10 RTD temperature measurands are included. If the Thermistors hardware option is set, 3 RTD temperature measurands are included. the 7 other values are declared « Invalid ».(in degrees)

2.6 Private Range Information Numbers in Control Direction

ASDU TYPE	COT	FUN	INF	Description	GI	Interpretation
General Commands						
20	20	168	1	Trip TC		Perform a CB Trip
20	20	168	2	Close TC		Perform a CB Close

INSTALLATION GUIDE

CONTENT

BLANK PAGE

1. GENERAL

1.1 Receipt of the relays

Protection relays are generally robust. However it is appropriate to treat them with care before installing them on site. As soon as they arrive, the relays should be examined immediately, looking for any deterioration which could have occurred during transport. If there is any deterioration, make a claim against the forwarding company and inform Schneider Electric as soon as possible.

Relays not intended for immediate installation must be stored in their protective polyethylene packaging.

1.2 Electrostatic discharge (ESD)

Relays use components sensitive to electrostatic discharges. The electronic circuits are well protected by the metal housing. Consequently, the internal module must not be taken out pointlessly. When handling the module outside its housing, be very careful to avoid any contact with electrical connections and components. If it is removed from its housing for storage, the module must be placed in electrically conductive antistatic packaging.

No configuration setting is possible in the module. We therefore advise you not to dismantle it pointlessly. The printed circuit boards are interconnected. They are not designed for disconnection by the user. Avoid touching the printed circuit boards. They are made with complementary metal-oxide semiconductors (CMOS) and the static electricity discharged by the human body has an adverse effect on them.

2. HANDLING ELECTRONIC EQUIPMENT

The usual movements of a person easily generate electrostatic energy which may reach several thousand volts. The discharging of this voltage into devices comprising semiconductors, when handling electronic circuits, can cause severe deterioration. Such damage is not necessarily visible immediately. Nevertheless, it reduces the reliability of the circuit.

Electronic circuits are completely protected against any electrostatic discharge when inside their housing. Do not expose them to any risk by needlessly taking the modules out of their housings.

Each module has the best possible protection for its devices consisting of semiconductors. However, should it be necessary to withdraw the module from its housing, please take the following precautions to preserve the great reliability and long service life for which the equipment was designed and manufactured.

1. Before taking the module out of its housing, touch the housing to balance your electrostatic potential.
2. When handling the module, hold it by its front plate, or by its frame or by the edges of the printed circuit board. Do not touch the electronic components, the printed circuit conductors and the connectors.
3. Before passing the module to another person, shake hands with him or her for example to balance your electrostatic potential.
4. Place the module on an antistatic surface or an electrically conductive surface with the same potential as yourself.
5. To store or transport the module, place it in conductive packaging.

If you carry out any measurements on the internal electronic circuits of a device in service, earth yourself to exposed conductive parts by linking yourself to the housing by a conductive strap attached to your wrist. The resistance to earth of the conductive strap which you attach to your wrist and to the housing must be between 500 kΩ and 10 MΩ. If you do not have a device of this type, you must remain permanently in contact with the housing to prevent any static energy accumulating. The instruments used to take the measurements must be earthed to the housing insofar as this is possible.

For further information on the procedures for safe working with all the electronic equipment, please consult standards BS5783 and IEC 147-OF. In a special handling area we strongly advise you to undertake a detailed analysis of the electronic circuits and working conditions according to the BS and IEC standards mentioned above.

3. INSTALLING THE RELAYS

The relays are supplied either individually or mounted in a cubicle. If separate relays have to be installed according to a particular drawing, please follow the mounting details indicated in publication R7012. If a MMLG test unit has to be incorporated, position it to the right of the set of relays (looking at them from the front). The modules must still be protected in their metal housings during installation on a cubicle. The design of the relays makes it possible to reach the mounting holes easily without taking off the cover. For individually mounted relays, a positioning diagram is normally supplied to indicate the centre of the holes and the layout of the cubicle.

4. UNPACKING

When unpacking and installing relays, take great care to avoid damaging the parts and changing the settings. Relays must be handled only by people who are experts in this field. As far as possible, the installation must remain clean, dry, free from dust and free from excessive vibration. The site must be well lit to facilitate inspection. Relays removed from their housings must not be exposed to dust or humidity. To this end, it is necessary to take great care when installing relays whilst construction work is taking place on the same site.

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 packaging. If dehumidifying crystals are placed in the relay packaging, it is advisable not to remove them. The effect of the dehumidifying crystals is reduced if the packaging is exposed to ambient conditions. To restore their original effectiveness, you need only to heat the crystals slightly for around an hour, before replacing them in their delivery carton.

As soon as the packaging is opened, the dust which has accumulated on the carton risks settling on the relays. In the presence of moisture, the carton and the packaging can become humidified to the point where the effectiveness of the dehumidifying crystals is reduced.

The temperature for storage should remain between - 25 °C and + 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. SAFETY INSTRUCTIONS

FOR YOUR SAFETY, PLEASE READ THESE INSTRUCTIONS BEFORE CARRYING OUT ANY WORK ON THE MiCOM P220/P225 RELAY.

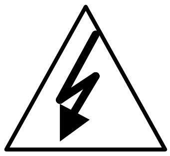
Health and safety

The safety instructions described in this document are intended to guarantee correct installation and use of the MiCOM P220/P225 relay and to avoid any damage. All persons directly or indirectly concerned with the use of these devices must be familiar with these safety instructions.

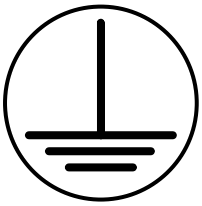
The meaning of the symbols

The meaning of the symbols which may be used on the equipment or in the product documentation is as indicated below:

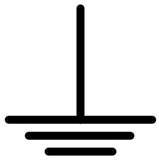
Important: refer to the product documentation



Important: risk of electrocution



Protective/safety earth *



Functional earth *

Note: This symbol can also be used for a protective/safety earth on a terminal strip or in a subassembly, for example for the electrical power supply.

*NOTE: The term "earth" used in the product documentation is the direct equivalent of the term "exposed conductive parts" which is also used.

7. INSTALLATION, COMMISSIONING AND MAINTENANCE

7.1 Connection of the MiCOM P220/P225 relay

The personnel in charge of the installation, commissioning and maintenance of a MiCOM P220/P225 relay must apply adequate procedures to guarantee safety when using the equipment. Before installation, commissioning or maintenance on the equipment, consult the relevant chapters in the technical documentation of the relay.

The terminal blocks of the relays may have a dangerously high voltage during installation, commissioning or maintenance, if electrical isolation is not carried out.

Access to the connectors at the rear of the relays can present risks of electrocution and thermal shock.

Before you consider energization, the MiCOM P220/P225 relay must be connected to earth via the terminal provided for this purpose.

Unless otherwise indicated in the technical data chapter of the product documentation, the minimum size recommended for the earth wire is 2.5 mm^2.

Before energising your MiCOM P220/P225 relay, please check the following points:

- Rated voltage and polarity of the auxiliary power supply
- Current value of the current transformer circuit and integrity of the connections
- Integrity of the earth connection.

7.2 Operating conditions of the MiCOM P220/P225 relay

The operation of the MiCOM P220/P225 relay must comply with the electrical and environmental requirements described in this document.

7.3 Current transformer circuits

Never open the auxiliary circuit of a live current transformer. The high voltage produced may cause serious physical injury and damage the insulation of the equipment.

7.4 Dielectric withstand test

Following an insulation test, the capacitors may still be charged with a potentially dangerous voltage. At the end of each part of the test, the voltage must be progressively brought down to zero to discharge the capacitors before disconnecting the test wiring.

7.5 Removal and destruction of the MiCOM P220/P225 relay

7.5.1 Removal

The auxiliary power supply circuit of the relay can include capacitors for the power supply or for earthing. To avoid any risk of electrocution or thermal shock, it is appropriate to isolate the relay completely (the two direct current poles) from any power supply, then to discharge the capacitors in complete safety via the external terminals, before taking the device out of service.

7.5.2 Destruction

It is recommended that the relay should not be incinerated nor thrown into a river. MiCOM relays and their components should be disposed of and recycled strictly in compliance with regulations on safety and the environment. Before destruction, remove the batteries, taking the necessary precautions to avoid any risk of electrocution.

7.6 Technical specifications

Insulation level:	IEC 1010-1: 1990/A2: 1995 class I EN 61010-1: 1993/A2: 1995 class I	This device must be connected to earth to guarantee the safety of the user.
Environment:	IEC 1010-1: 1990/A2: 1995 pollution level 2 EN 61010-1: 1993/A2: 1995 pollution level 2	Conformity is established by reference to the generic safety standards.
Product safety:	73/23/EEC	Conformity with the European Commission directive relating to low voltages.
CE	EN 61010-1: 1993/A2: 1995 EN 60905: 1992/A3: 1995	Conformity is established by reference to the generic safety standards.

8. CONNECTIONS

8.1 Connection of power and signal circuits

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.

To ensure the safe isolation of adjacent terminals and to maintain UL/CSA Listing, equipment wire terminations shall be made using UL/CSA Listed wire and suitable insulated pressure/crimp terminals or terminal kits only.

All wires shall have a minimum temperature rating 75°C and for power circuits be terminated in insulated pressure/crimp terminals. The exception is for low voltage signal circuits, the wire for these connections may be directly inserted into the screw clamp connector, or be terminated in a suitable crimp/pressure pin terminal, before insertion. Wires shall have the following minimum cross-sections:

- Current Transformers (CTs) 2.5 mm² or 12 AWG
- Auxiliary (supply input), Vx: 1.5 mm² or 16 AWG
- Communication Port See section 8.3
- Low voltage signal circuits See section 8.4
- Protective Earth/Ground See section 8.8
- Other Input/Output Circuits 1.0 mm² or 18 AWG

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

If necessary, Schneider Electric can provide 3 types of suitable insulated crimp/pressure 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.

*Push-on terminal 4.8 x 0.8 (wire size 0.25 - 1.65mm²/ 22AWG - 16AWG)
Schneider Electric Automation Products reference: ZB9128 015

*See Note below

M4 90° Ring Tongue terminal (wire size 0.25 - 1.65mm²/22AWG - 16AWG)
Schneider Electric Automation Products reference: ZB9124 901

M4 90° Ring Tongue terminal (wire size 1.04 - 2.63mm²/16AWG - 14AWG)
Schneider Electric Automation Products reference: ZB9124 900

*NOTE: Pressure/crimp push-on or ring terminals may be used for communication circuit connections. Only pressure/crimp ring terminals shall be used for connections to other circuits.

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 mm²/14AWG 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 all the terminal blocks used for connections, can withstand a maximum working voltage of 300V.

8.2 External branch circuit protection

For external protective fuses a UL or CSA Listed or Recognized fuse and fuseholder shall be used. The fuse type shall be a Class J time delay fuse, with a maximum current rating of 15 A and a minimum rating of 250 Vd.c. and 250 Va.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. and 250 Va.c. may be used, for example Red Spot type NIT or TIA.

8.3 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 UL/CSA Listed Cable Specification:

-	Each core:	16/0.2 mm Copper conductor, PVC insulated
-	Minimum conductor cross sectional area per core:	0.25 mm² per core/22AWG
-	Screen:	Overall braid, PVC sheathed
-	Linear capacitance between conductor and Earth/Ground:	100pF/m

8.4 Low voltage signal circuits

Connections to low voltage signal circuits, for optional analogue outputs (for example P22x), are made using screw clamp connectors on the rear of the relay. These connectors can accept wire sizes between 0.1mm^2 and 1.5 mm^2, for minimum wire size see the table below.

It is recommended that a two core screened cable, is used with a maximum total length of 1000m or a 200nF total cable capacitance. For optional RTD/Thermistor (for example P22x) input wires see the specific criteria below.

Typical UL/CSA Listed Cable Specification:

-	Each core:	Copper wire, PVC sheathed (heat resistant for RTD/Thermistor applications)
-	Minimum conductor cross sectional area per core:	0.25 mm²/22AWG
-	Screen:	Nickel-plated copper wire braid, PVC sheathed (heat resistant for RTD/Thermistor applications)
-	Linear capacitance between conductor and Earth/Ground:	100pF/m

8.5 RTD/Thermistor connections (option)

Where resistance temperature device (RTD) or Thermistor inputs are used, for example on a MiCOM P22x relay, the connections between the relay and the temperature device shall be made using a screened 3-core cable with a total resistance less than 10 Ω. The cable should have a minimum voltage rating of 300 Vrms.

A 3-core cable shall be used even for 2-wire applications, as it allows for the cable's resistance to be removed from the overall resistance measurement. In such cases the 3rd wire is connected to the 2nd wire at the point the cable is joined to the temperature device.

The screen of each cable must only be earthed/grounded at one end, preferably at the relay end and must be continuous. Multiple earthing/grounding of the screen can cause circulating current to flow along the screen, which induces noise and is unsafe.

It is recommended to minimize noise pick-up in the cables by keeping them close to earthed/grounded metal casings and avoiding areas of high electromagnetic and radio interference.

The cables should not be run adjacent to or in the same conduit as high voltage or current cables, to avoid pick-up and electromagnetic interference.

Typical specification for 2-core or 3-core connections:

- Total resistance: less than 10 Ω
- Minimum voltage rating: 300 Vrm
- Each core: 7/0.2 mm copper conductors heat resistant PVC
- Nominal conductor area: 0.22 mm² per core
- Screen: Nickel-plated copper wire braid heat resistant PVC sheathed
- Conductor impedance: Strictly identical for 2 of the 3 cores
- Accuracy: Difference less than 1%

8.6 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.

8.7 IRIG-B connections (option)

The IRIG-B option integrates modulated and demodulated versions.

8.7.1 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.

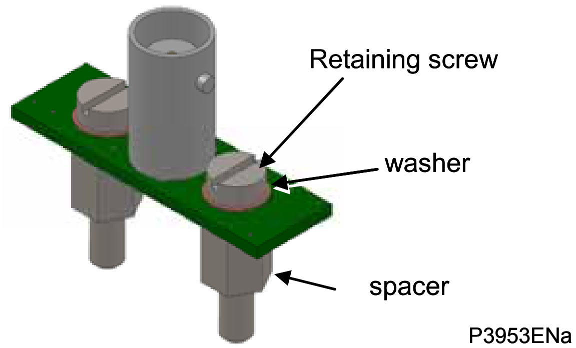
The IRIG-B input and BNC connector (including BNC adaptor) have a characteristic impedance of 50Ω. It is recommended that connections between the IRIG-B equipment and the relay are made using coaxial cable of type RG59LSF with a halogen free, fire retardant sheath.

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).



8.7.2 IRIG-B demodulated

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

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

8.8 Protective conductor (earth/ground)

The equipment must be connected to the protective conductor via the M4 protective conductor (earth/ground) terminal (PCT) of the terminal block numbered 1 to 28, marked with the earth/ground symbol. We recommend a wire of minimal cross section 2,5 mm²/12AWG. 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.

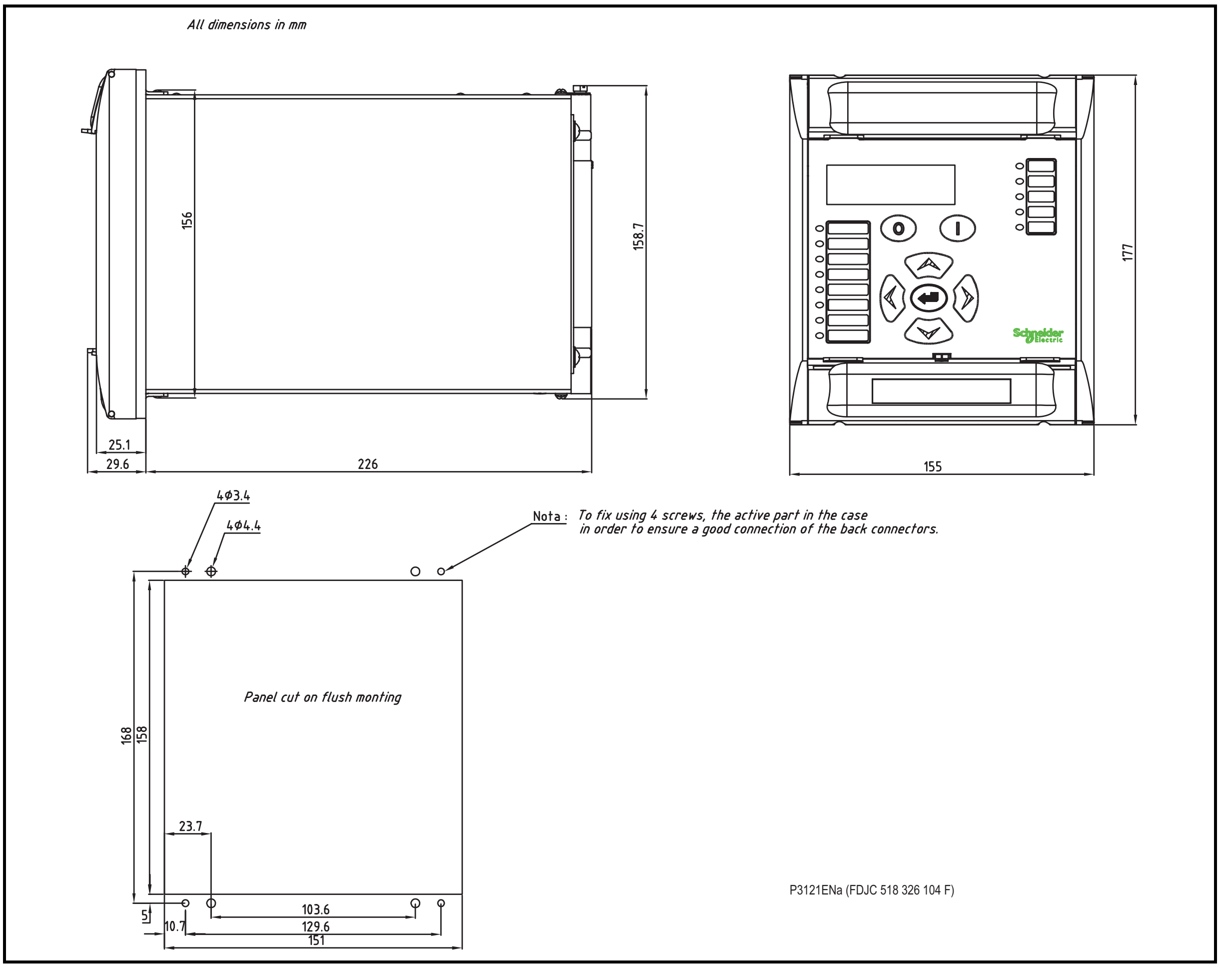
9. CASE DIMENSIONS

MiCOM P220/P225 relays are available in a 4U metal case for panel or flush mounting.

Weight: about 3.7 Kg

External size:	Height	Case	156 mm
		Front panel	177 mm
	Width	Case	148,1 mm
		Front panel	155 mm
	Depth	Case (flush part)	226 mm
		Case + Front panel	256 mm

NOTE: For P22x with IRIG-B option and BNC adaptor, add 25 mm to the length.



BLANK PAGE

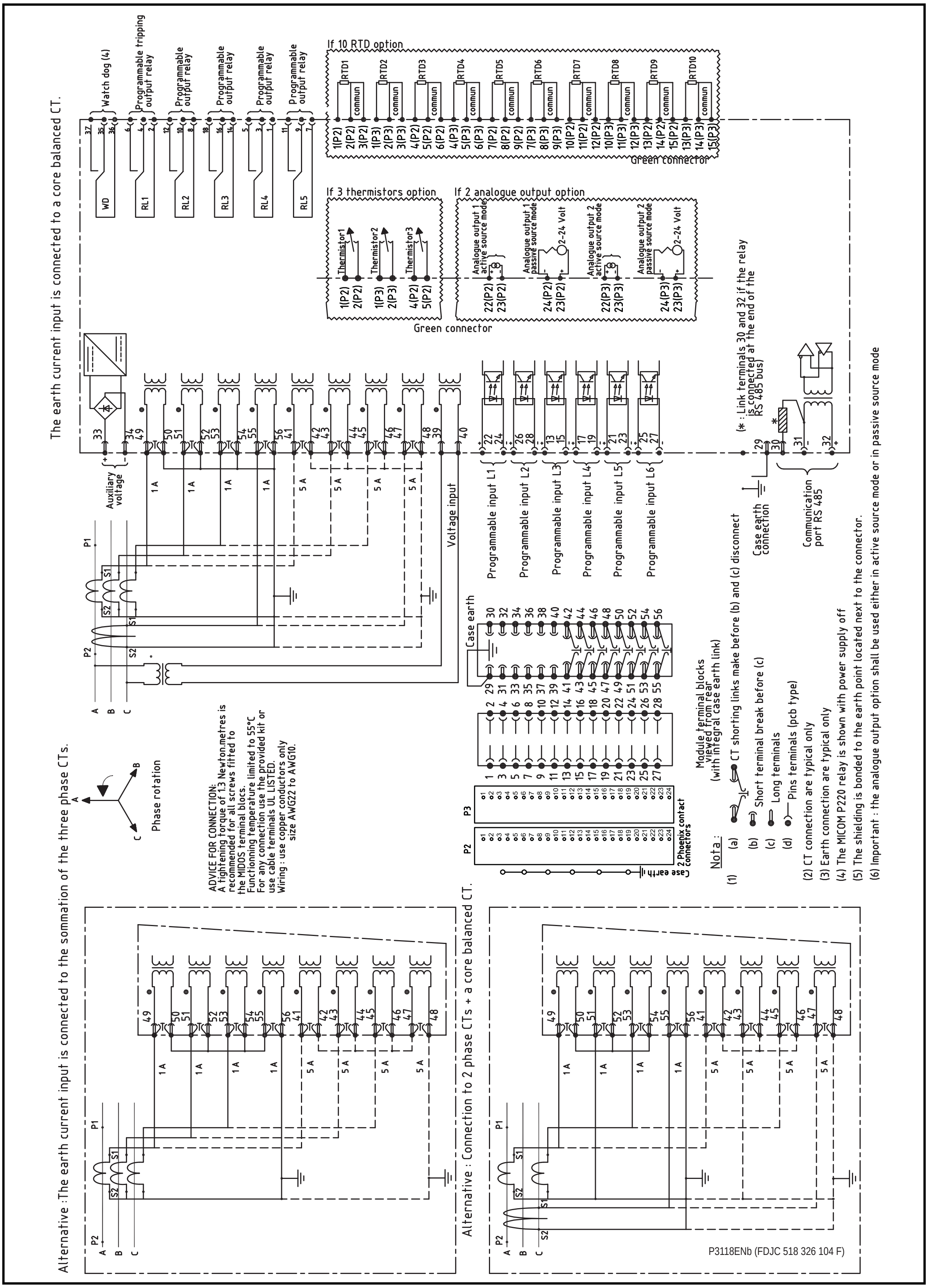
CONNECTION DIAGRAMS

CONTENTS

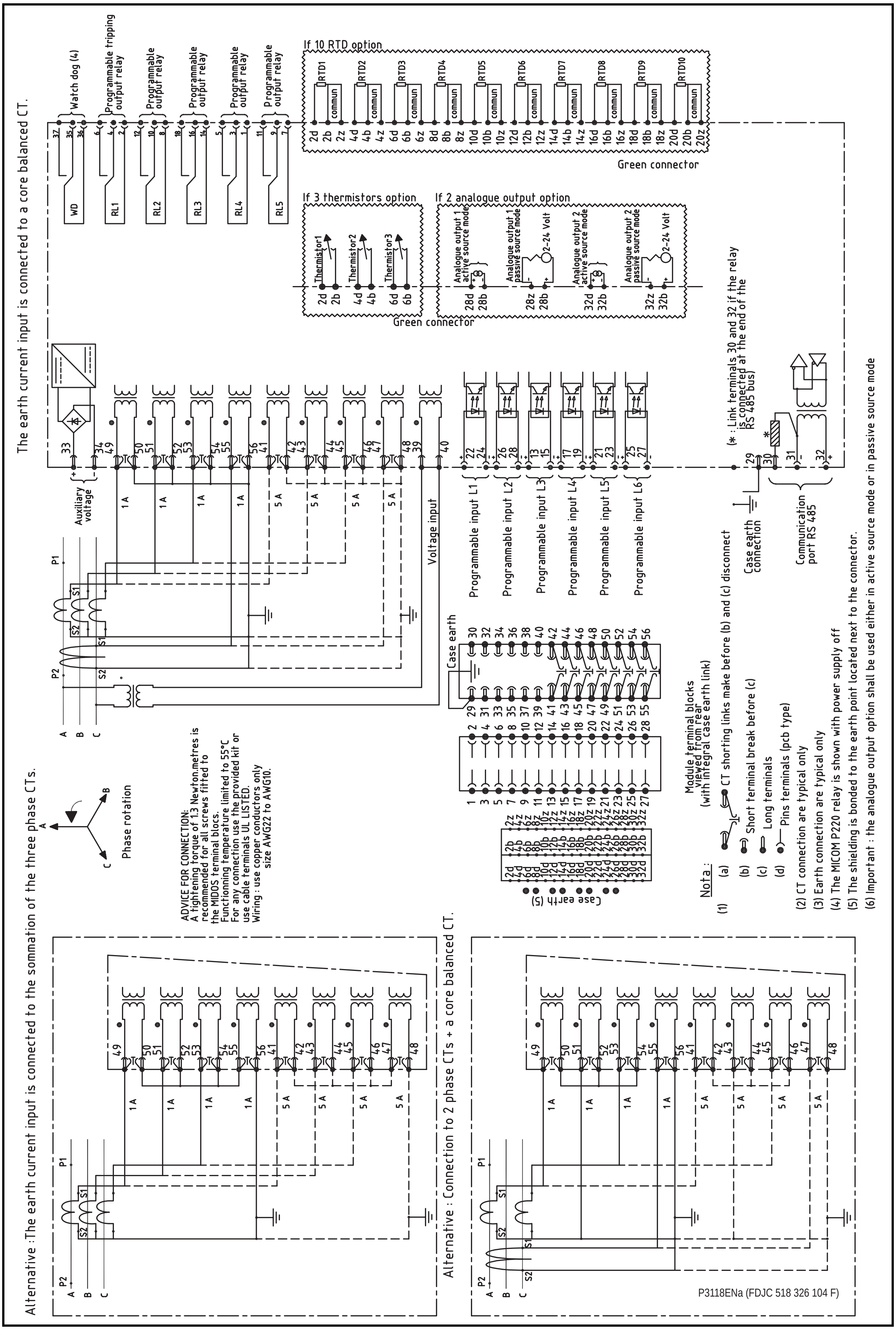
1. CONNECTION DIAGRAMS

1.1 MiCOM P225 typical connection

MiCOM P225 with no option, optional 10 RTDs or 3-thermistor monitoring:

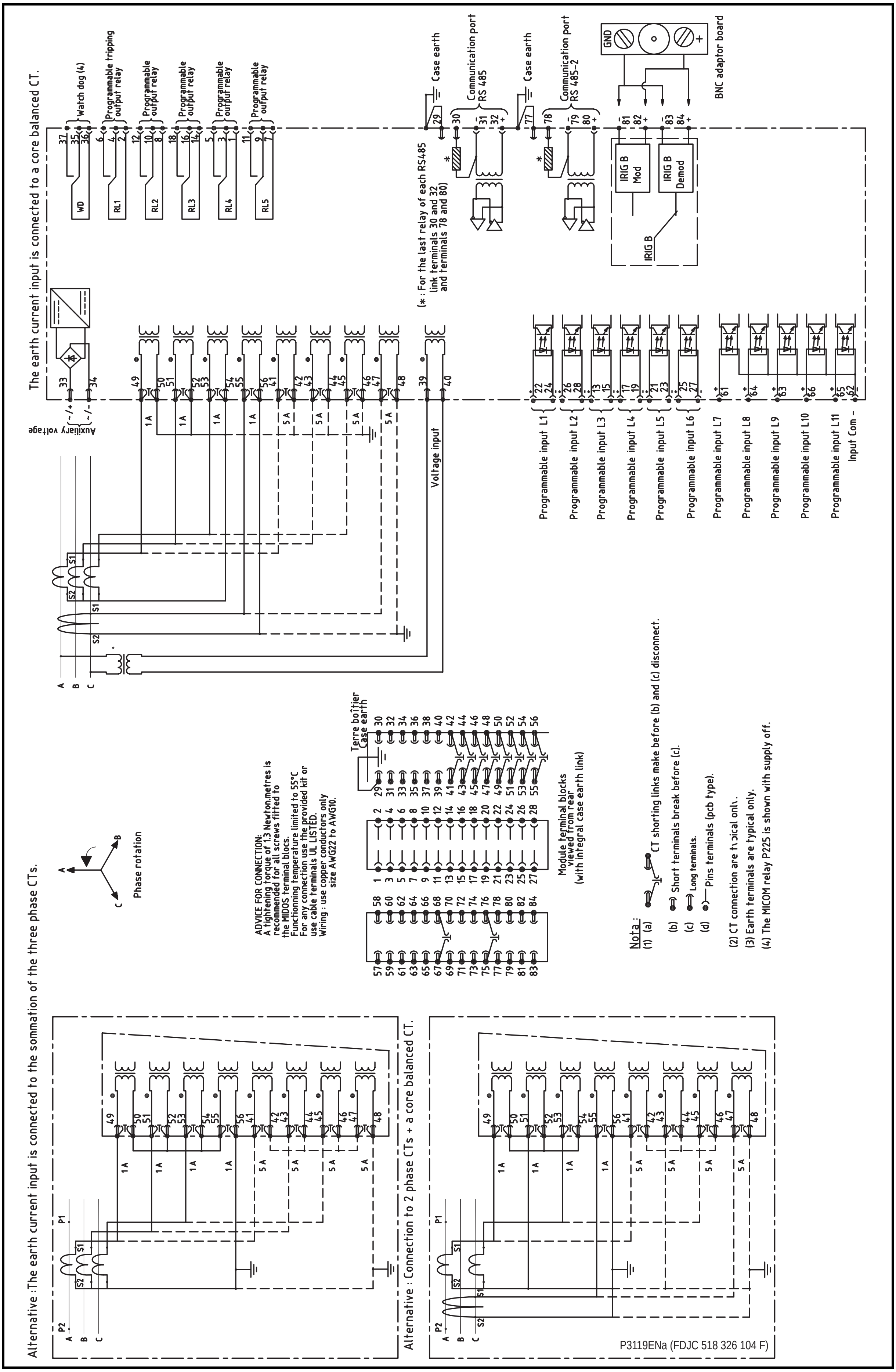


Model with Phoenix contact connectors

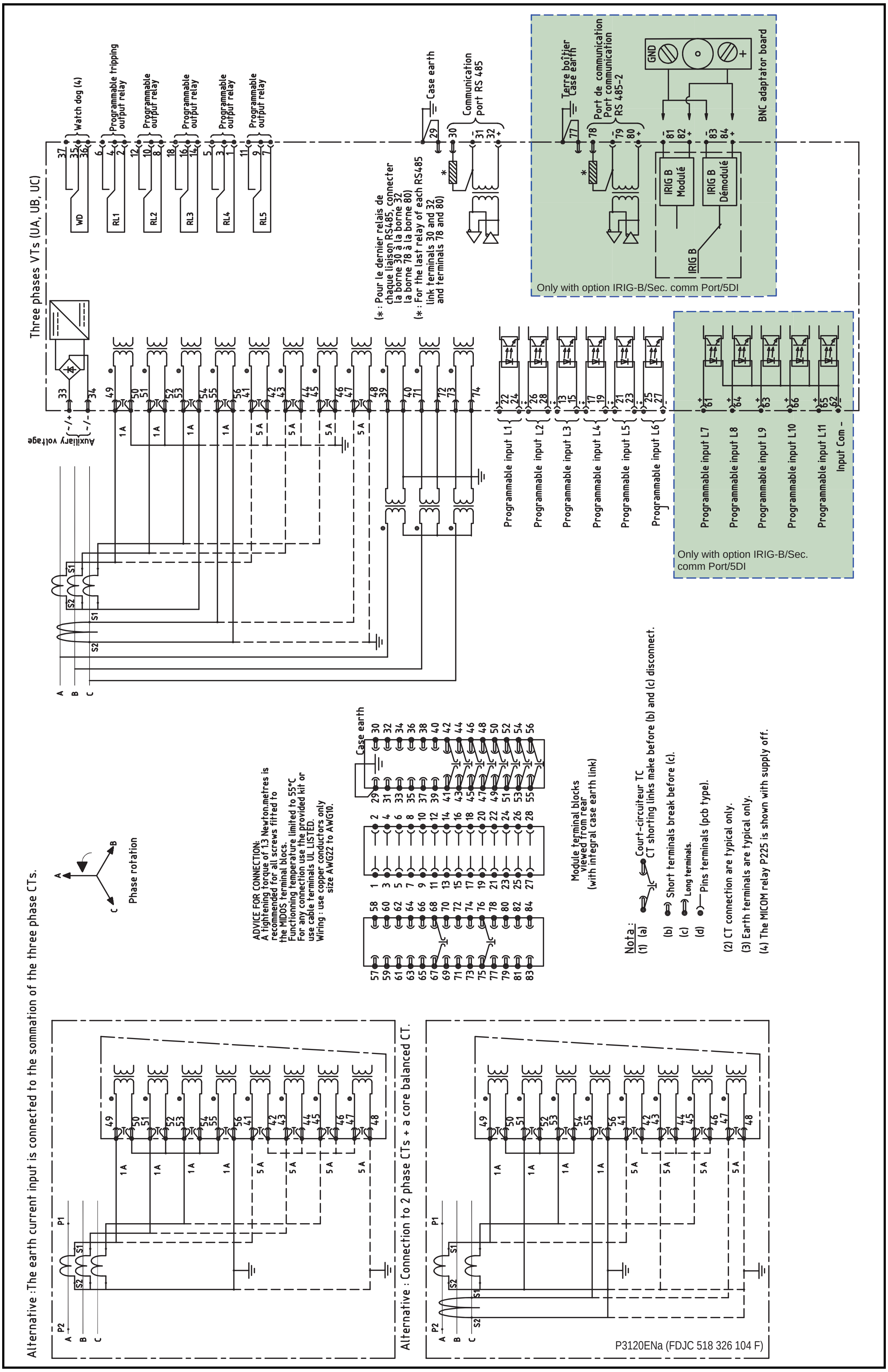


Model without Phoenix contact connectors

MiCOM P225 with IRIG-B / 2nd communication port / 5 digital inputs (1 voltage input) option:

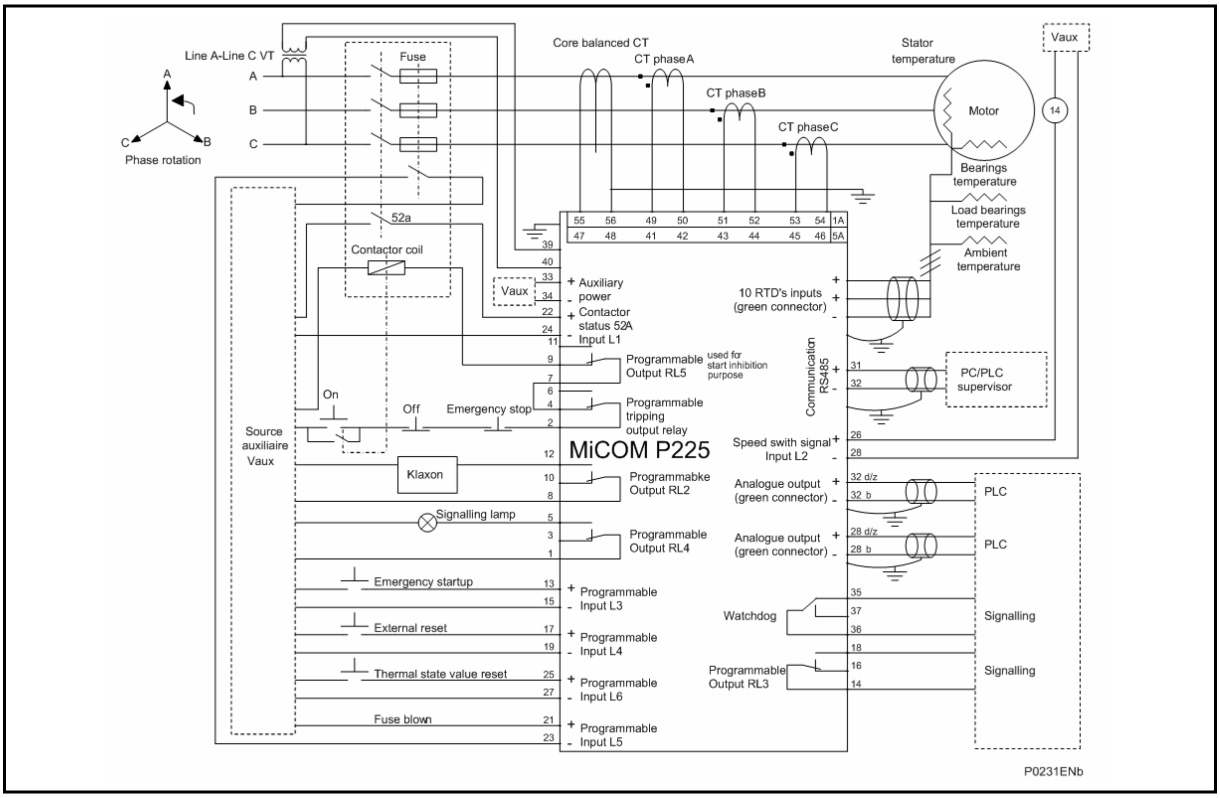


P225 with 3 voltage inputs options:



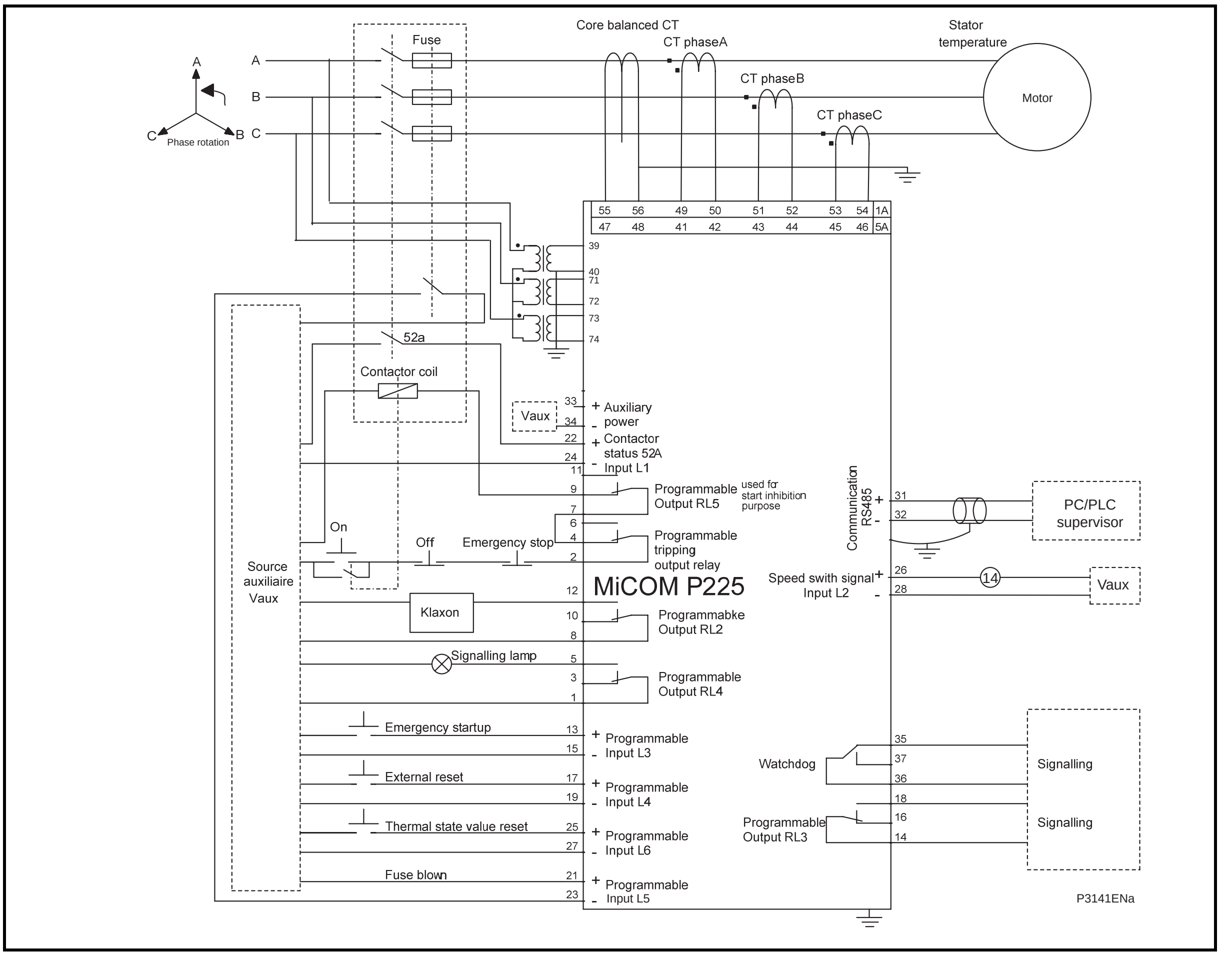
1.2 Typical MiCOM P225 application diagrams

MiCOM P225 with RTD monitoring and analog outputs options:



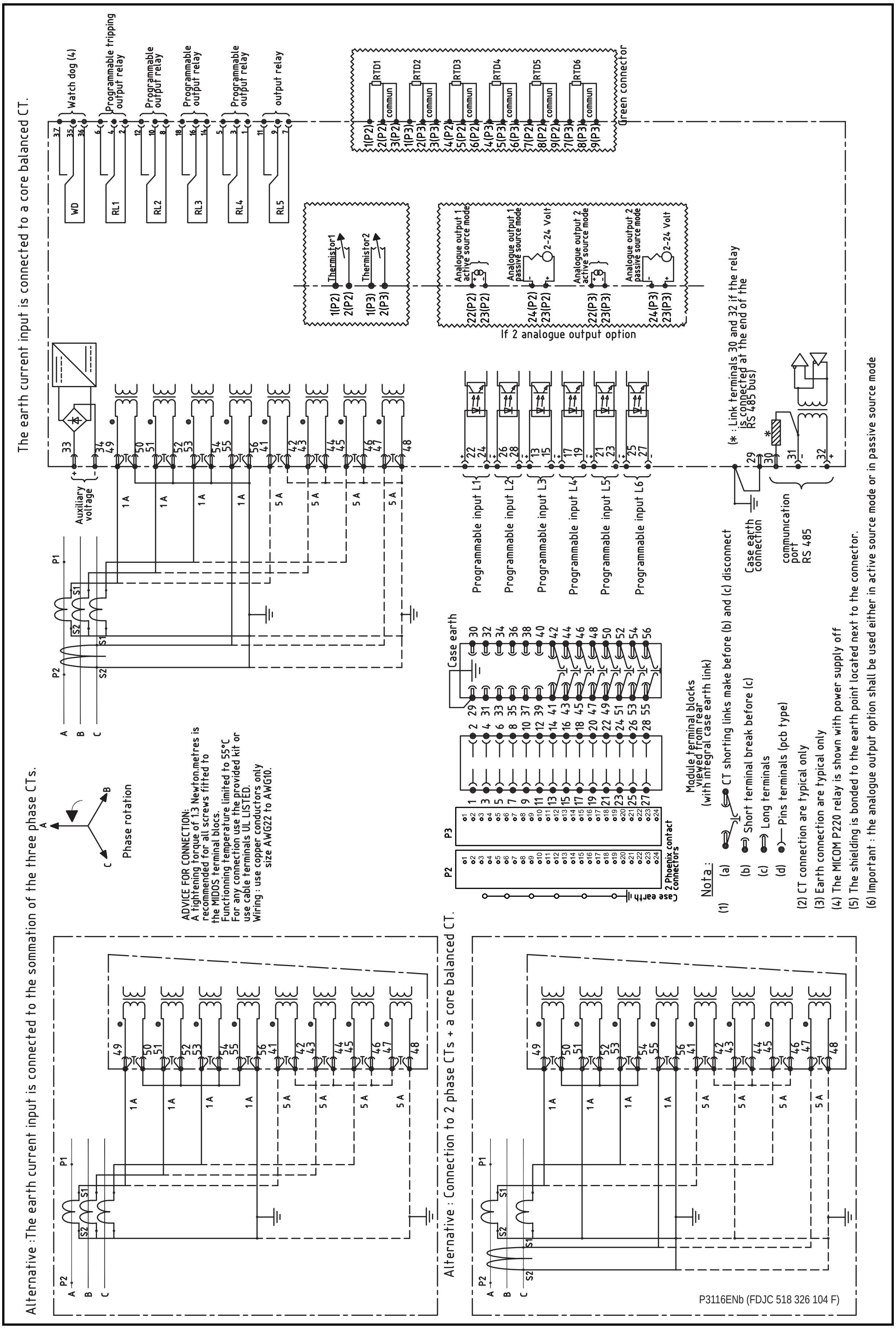
The MiCOM P225 is shown with power supply off.

MiCOM P225 with 3-voltage inputs option:

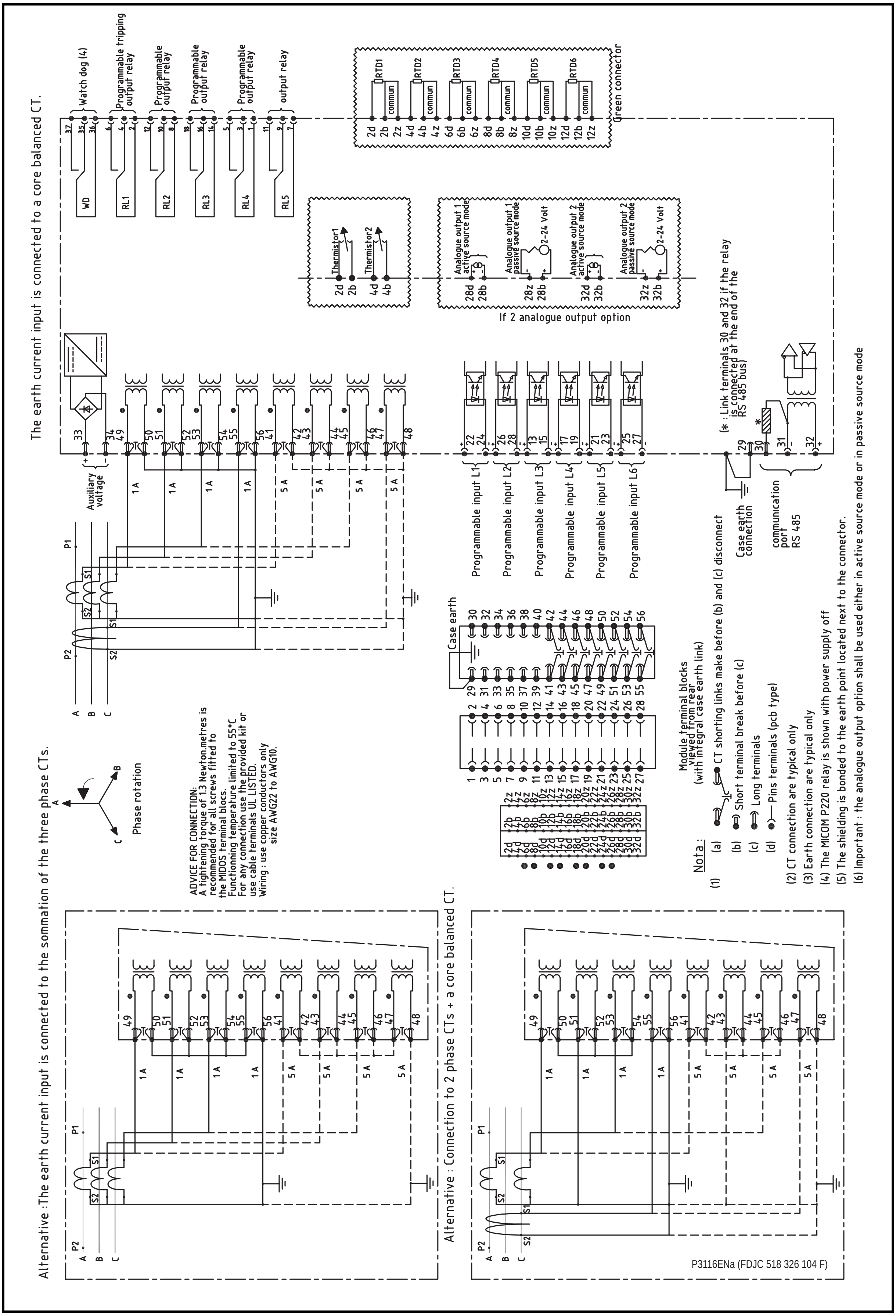


The MiCOM P225 is shown with power supply off.

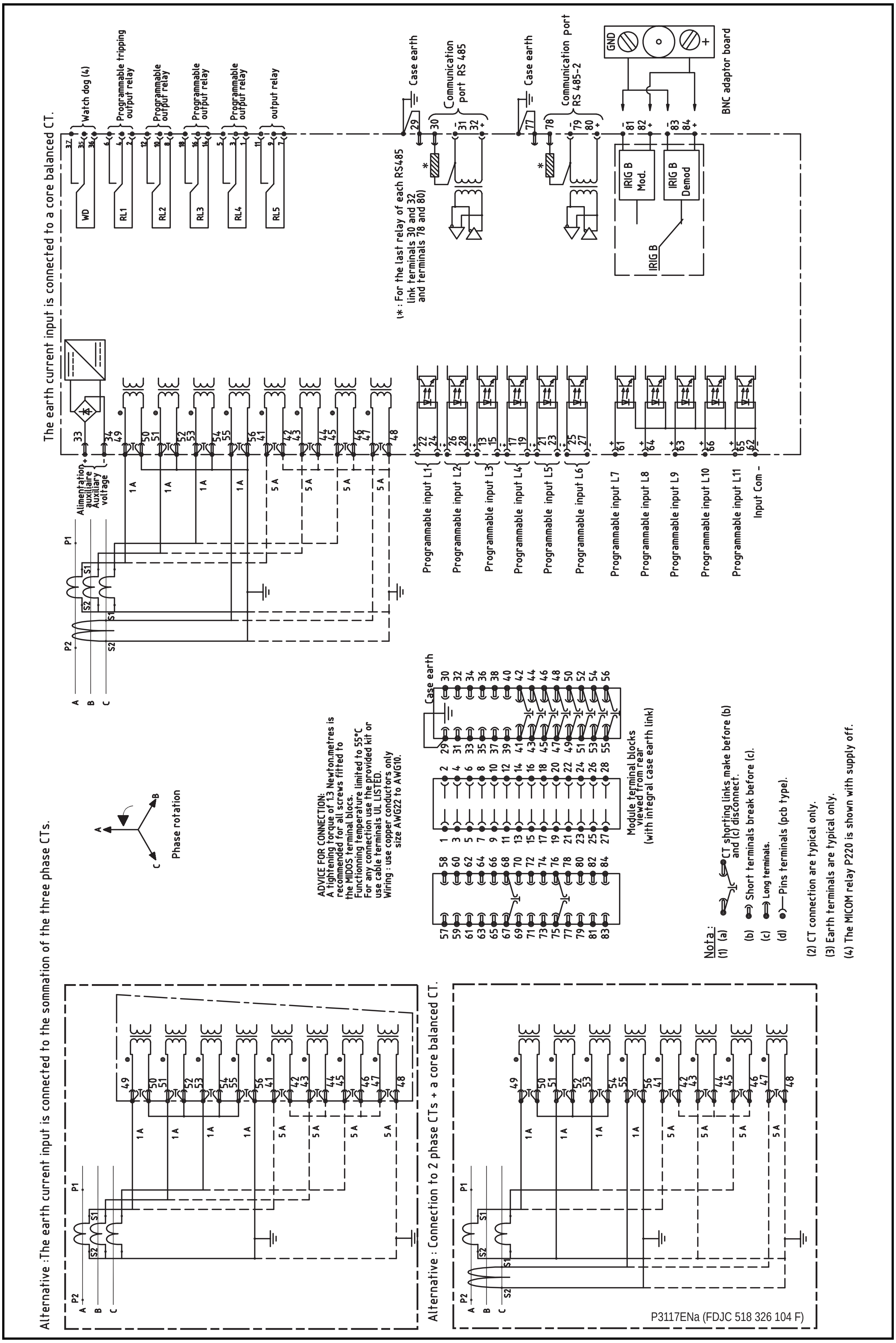
1.3 MiCOM P220 typical connection



Model with Phoenix contact connectors

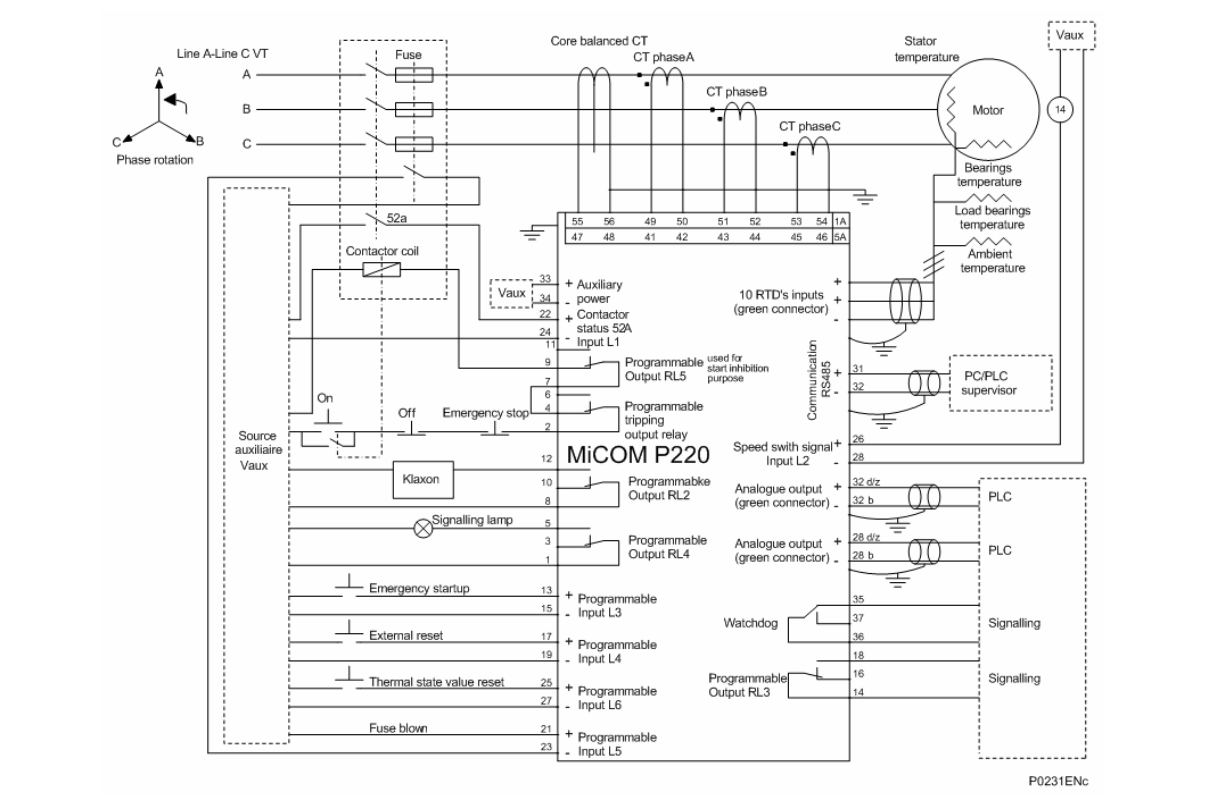


Model without Phoenix contact connectors



Model with IRIG-B, Second communication port and 5 digital inputs

1.4 Typical P220 application diagram



THE MiCOM P220 IS SHOWN WITH POWER SUPPLY OFF.

2. CONNECTION

The rear face of the MiCOM P22x relay comprises at least 2 connectors. The relay may have:

– an optional green third connector dedicated to the connection of:

  - 6 temperature RTD sensors or 2 thermistors for P220 and 10 temperature RTD or 3 thermistors for P225,
  - 2 analogue outputs,

– or an optional MiDOS connector dedicated to the connection of:

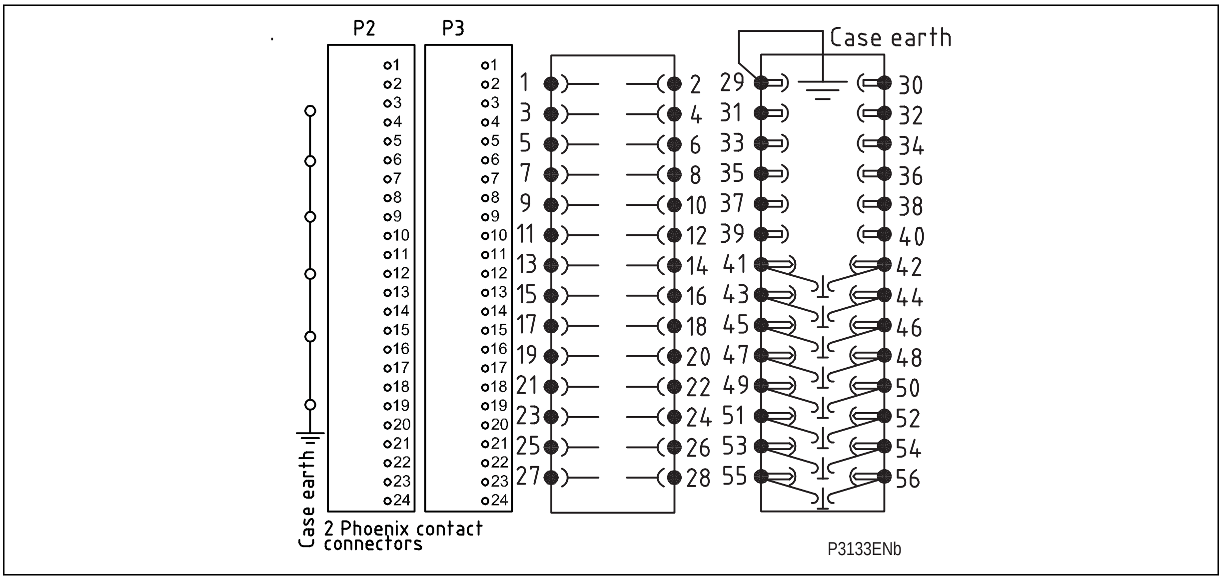
  - IRIG-B connection, second RS485 communication port and 5 additional digital inputs,
  - 2 voltage inputs (MiCOM P225 with “3 voltage inputs” option)

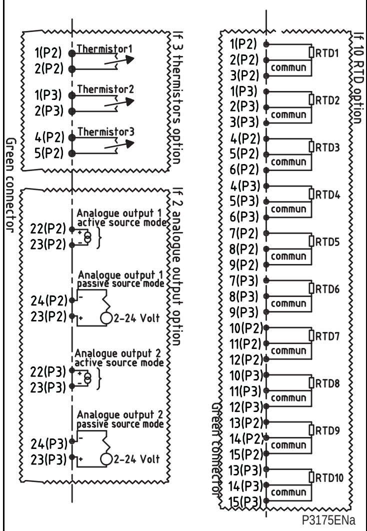
The terminals of MiCOM P22x are represented with power supply off.

NO = Normally Open,
NC = Normally Closed
WD = Watchdog)

NOTE: See section P22x/EN IN – Installation Guide for cable characteristics.

MiCOM P225 relay rear view with Phoenix contact connectors





RL4 (common)	**1**	**2**	RL1 (common)	Case earth	**29**	**30**	RS485 (resistance)
RL4 (NC)	**3**	**4**	RL1 (NC)	RS485(–)	**31**	**32**	RS485(+)
RL4 (NO)	**5**	**6**	RL1 (NO)	Auxiliary Supply (+)	**33**	**34**	Auxiliary Supply (–)
RL5 (common)	**7**	**8**	RL2 (common)	WD (NO)	**35**	**36**	Common WD
RL5 (NC)	**9**	**10**	RL2 (NC)	WD (NC)	**37**	**38**	
RL5 (NO)	**11**	**12**	RL2 (NO)	Voltage input VA	**39**	**40**	Voltage input VC
Input L3(+)	**13**	**14**	RL3 (common)	IA (input ph.A/5A)	**41**	**42**	Common IA (ph.A/5A)
Input L3(–)	**15**	**16**	RL3 (NC)	IB (input ph.B/5A)	**43**	**44**	Common IA (ph.B/5A)
Input L4(+)	**17**	**18**	RL3 (NO)	IC (input ph.C/5A)	**45**	**46**	Common IA (ph.C/5A)
Input L4(–)	**19**	**20**	--	E/F input (5A)	**47**	**48**	Common E/F (5A)
Input L5(+)	**21**	**22**	Input L1(+)	IA (input ph.A/1A)	**49**	**50**	Common IA (ph.A/1A)
Input L5(–)	**23**	**24**	Input L1(–)	IB (input ph.B/1A)	**51**	**52**	Common IA (ph.B/1A)
Input L6(+)	**25**	**26**	Input L2(+)	IC (input ph.C/1A)	**53**	**54**	Common IA (ph.C/1A)
Input L6(–)	**27**	**28**	Input L2(–)	E/F input (1A)	**55**	**56**	Common E/F (1A)

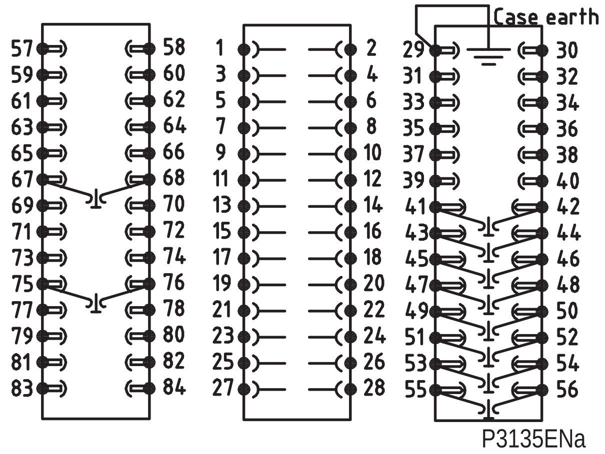
(1) with “IRIG-B / Sec. Comm. Port / 5 Digital Inputs” options
(2) with “3-voltage inputs” options

MiCOM P220 relay rear view with Phoenix contact connectors.

MiCOM P225 with:

– “IRIG-B, second communication port and 5 additional digital inputs option,

– 3 voltage inputs option.



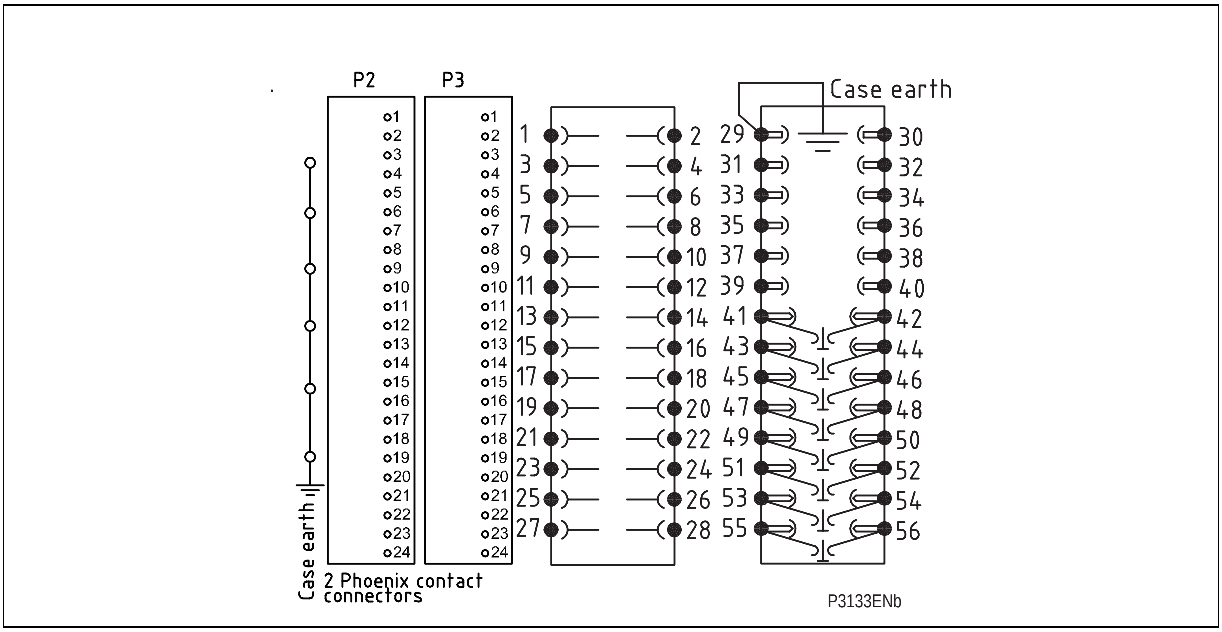
	57	**58**	
	59	**60**	
Input L7(1) (+)	**61**	**62**	Input COMM L7-L11(1) (–)
Input L9(1) (+)	**63**	**64**	Input L8(1) (+)
Input L11(1) (+)	**65**	**66**	Input L10(1) (+)
--	**67**	**68**	--
--	**69**	**70**	--
Voltage input VB(2)	**71**	**72**	Voltage input VB(2)
Voltage input VC(2)	**73**	**74**	Voltage input VC(2)
--	**75**	**76**	--
Case earth(1)	**77**	**78**	RS485-2(1) (resistance)
RS485-2(1) (–)	**79**	**80**	RS485-2(1) (+)
IRIG-B mod – terminal	**81**	**82**	IRIG-B mod + terminal
IRIG-B dem – terminal	**83**	**84**	IRIG-B dem + terminal

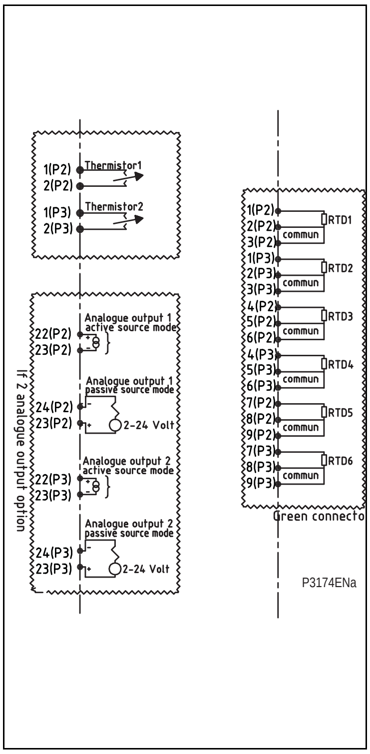
RL4 (common)	**1**	**2**	RL1 (common)
RL4 (NC)	**3**	**4**	RL1 (NC)
RL4 (NO)	**5**	**6**	RL1 (NO)
RL5 (common)	**7**	**8**	RL2 (common)
RL5 (NC)	**9**	**10**	RL2 (NC)
RL5 (NO)	**11**	**12**	RL2 (NO)
Input L3(+)	**13**	**14**	RL3 (common)
Input L3(–)	**15**	**16**	RL3 (NC)
Input L4(+)	**17**	**18**	RL3 (NO)
Input L4(–)	**19**	**20**	--
Input L5(+)	**21**	**22**	Input L1(+)
Input L5(–)	**23**	**24**	Input L1(–)
Input L6(+)	**25**	**26**	Input L2(+)
Input L6(–)	**27**	**28**	Input L2(–)

Case earth	**29**	**30**	RS485 (resistance)
RS485(–)	**31**	**32**	RS485(+)
Auxiliary Supply (+)	**33**	**34**	Auxiliary Supply (–)
WD (NO)	**35**	**36**	Common WD
WD (NC)	**37**	**38**	--
Voltage input VA	**39**	**40**	Voltage input VA
IA (input ph.A/5A)	**41**	**42**	Common IA (ph.A/5A)
IB (input ph.B/5A)	**43**	**44**	Common IA (ph.B/5A)
IC (input ph.C/5A)	**45**	**46**	Common IA (ph.C/5A)
E/F input (5A)	**47**	**48**	Common E/F (5A)
IA (input ph.A/1A)	**49**	**50**	Common IA (ph.A/1A)
IB (input ph.B/1A)	**51**	**52**	Common IA (ph.B/1A)
IC (input ph.C/1A)	**53**	**54**	Common IA (ph.C/1A)
E/F input (1A)	**55**	**56**	Common E/F (1A)

MiCOM P225 with:“IRIG-B, 2nd communication port, 5 additional digital inputs” option, or 3 voltage inputs option.

MiCOM P220 relay rear view with Phoenix contact connectors



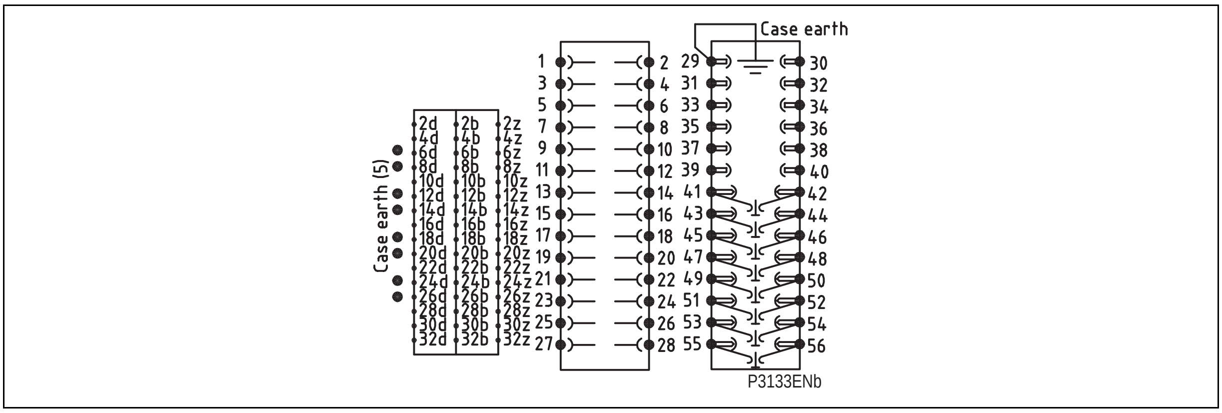


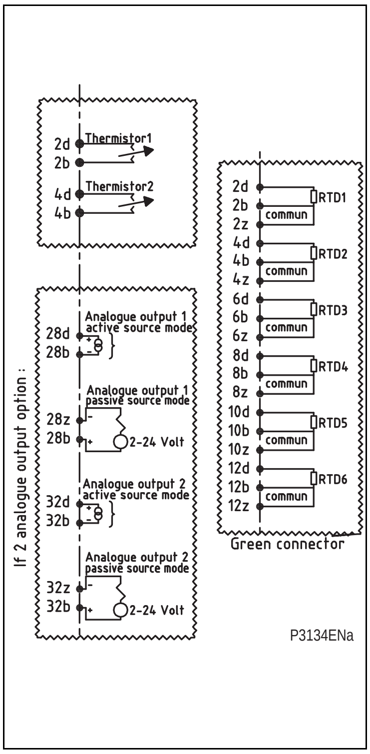
RL4 (common)	**1**	**2**	RL1 (common)
RL4 (NC)	**3**	**4**	RL1 (NC)
RL4 (NO)	**5**	**6**	RL1 (NO)
RL5 (common)	**7**	**8**	RL2 (common)
RL5 (NC)	**9**	**10**	RL2 (NC)
RL5 (NO)	**11**	**12**	RL2 (NO)
Input L3(+)	**13**	**14**	RL3 (common)
Input L3(–)	**15**	**16**	RL3 (NC)
Input L4(+)	**17**	**18**	RL3 (NO)
Input L4(–)	**19**	**20**	--
Input L5(+)	**21**	**22**	Input L1(+)
Input L5(–)	**23**	**24**	Input L1(–)
Input L6(+)	**25**	**26**	Input L2(+)
Input L6(–)	**27**	**28**	Input L2(–)

Case earth	**29**	**30**	RS485 (resistance)
RS485(–)	**31**	**32**	RS485(+)
Auxiliary Supply (+)	**33**	**34**	Auxiliary Supply (–)
WD (NO)	**35**	**36**	Common WD
WD (NC)	**37**	**38**	
--	**39**	**40**	--
IA (input ph.A/5A)	**41**	**42**	Common IA (ph.A/5A)
IB (input ph.B/5A)	**43**	**44**	Common IA (ph.B/5A)
IC (input ph.C/5A)	**45**	**46**	Common IA (ph.C/5A)
E/F input (5A)	**47**	**48**	Common E/F (5A)
IA (input ph.A/1A)	**49**	**50**	Common IA (ph.A/1A)
IB (input ph.B/1A)	**51**	**52**	Common IA (ph.B/1A)
IC (input ph.C/1A)	**53**	**54**	Common IA (ph.C/1A)
E/F input (1A)	**55**	**56**	Common E/F (1A)

MiCOM P220 relay rear view with Phoenix contact connectors.

MiCOM P220 relay rear view without Phoenix contact connectors



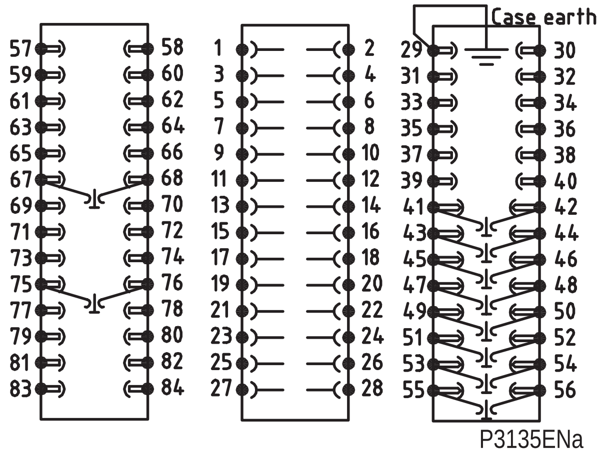


RL4 (common)	**1**	**2**	RL1 (common)
RL4 (NC)	**3**	**4**	RL1 (NC)
RL4 (NO)	**5**	**6**	RL1 (NO)
RL5 (common)	**7**	**8**	RL2 (common)
RL5 (NC)	**9**	**10**	RL2 (NC)
RL5 (NO)	**11**	**12**	RL2 (NO)
Input L3(+)	**13**	**14**	RL3 (common)
Input L3(–)	**15**	**16**	RL3 (NC)
Input L4(+)	**17**	**18**	RL3 (NO)
Input L4(–)	**19**	**20**	--
Input L5(+)	**21**	**22**	Input L1(+)
Input L5(–)	**23**	**24**	Input L1(–)
Input L6(+)	**25**	**26**	Input L2(+)
Input L6(–)	**27**	**28**	Input L2(–)

Case earth	**29**	**30**	RS485 (resistance)
RS485(–)	**31**	**32**	RS485(+)
Auxiliary Supply (+)	**33**	**34**	Auxiliary Supply (–)
WD (NO)	**35**	**36**	Common WD
WD (NC)	**37**	**38**	
--	**39**	**40**	--
IA (input ph.A/5A)	**41**	**42**	Common IA (ph.A/5A)
IB (input ph.B/5A)	**43**	**44**	Common IA (ph.B/5A)
IC (input ph.C/5A)	**45**	**46**	Common IA (ph.C/5A)
E/F input (5A)	**47**	**48**	Common E/F (5A)
IA (input ph.A/1A)	**49**	**50**	Common IA (ph.A/1A)
IB (input ph.B/1A)	**51**	**52**	Common IA (ph.B/1A)
IC (input ph.C/1A)	**53**	**54**	Common IA (ph.C/1A)
E/F input (1A)	**55**	**56**	Common E/F (1A)

MiCOM P220 relay rear view without Phoenix contact connectors.

MiCOM P220 with “IRIG-B, second communication port and 5 additional digital inputs option:



	57	**58**	
	59	**60**	
Input L7(+)	**61**	**62**	Input COMM L7-L11 (–)
Input L9(+)	**63**	**64**	Input L8(+)
Input L11(+)	**65**	**66**	Input L10(+)
--	**67**	**68**	--
--	**69**	**70**	--
--	**71**	**72**	--
--	**73**	**74**	--
--	**75**	**76**	--
Case earth	**77**	**78**	RS485-2 (resistance)
RS485-2 (–)	**79**	**80**	RS485-2 (+)
IRIG-B mod – terminal	**81**	**82**	IRIG-B mod + terminal
IRIG-B dem – terminal	**83**	**84**	IRIG-B dem + terminal

RL4 (common)	**1**	**2**	RL1 (common)
RL4 (NC)	**3**	**4**	RL1 (NC)
RL4 (NO)	**5**	**6**	RL1 (NO)
RL5 (common)	**7**	**8**	RL2 (common)
RL5 (NC)	**9**	**10**	RL2 (NC)
RL5 (NO)	**11**	**12**	RL2 (NO)
Input L3(+)	**13**	**14**	RL3 (common)
Input L3(–)	**15**	**16**	RL3 (NC)
Input L4(+)	**17**	**18**	RL3 (NO)
Input L4(–)	**19**	**20**	--
Input L5(+)	**21**	**22**	Input L1(+)
Input L5(–)	**23**	**24**	Input L1(–)
Input L6(+)	**25**	**26**	Input L2(+)
Input L6(–)	**27**	**28**	Input L2(–)

Case earth	**29**	**30**	RS485 (resistance)
RS485(–)	**31**	**32**	RS485(+)
Auxiliary Supply (+)	**33**	**34**	Auxiliary Supply (–)
WD (NO)	**35**	**36**	Common WD
WD (NC)	**37**	**38**	--
--	**39**	**40**	--
IA (input ph.A/5A)	**41**	**42**	Common IA (ph.A/5A)
IB (input ph.B/5A)	**43**	**44**	Common IA (ph.B/5A)
IC (input ph.C/5A)	**45**	**46**	Common IA (ph.C/5A)
E/F input (5A)	**47**	**48**	Common E/F (5A)
IA (input ph.A/1A)	**49**	**50**	Common IA (ph.A/1A)
IB (input ph.B/1A)	**51**	**52**	Common IA (ph.B/1A)
IC (input ph.C/1A)	**53**	**54**	Common IA (ph.C/1A)
E/F input (1A)	**55**	**56**	Common E/F (1A)

MiCOM P220 with “IRIG-B, second communication port and 5 additional digital inputs option:

2.1 Earth connection

The case shall be earthed according to the local standards.

2.2 Auxiliary power

The universal auxiliary power for the MiCOM P22x relays can be either Direct (range 24 - 250 Vdc) or Alternating (24 - 240 Vac - 50/60Hz). The range of voltage is specified on the relay indicator plate under the top flap of the front face. The power should be connected to terminals 33 and 34 only.

A minimum 1.5mm² wire size is recommended.

2.3 Current inputs

The MiCOM P22x relays have 2x4 analogue inputs for phase and earth currents. The nominal value of current of these measuring inputs is either 1 Amp or 5 Amp (according to the wiring diagram). The operator can, for the same relay, mix the 1 and 5 Amp inputs (phase and earth).

A minimum 2.5mm² wire size is recommended.

2.4 Voltage measurement input (P225 only)

The MiCOM P225 relay has:

– one voltage input for phases A and C,

– or three voltage inputs for U_{AB}, U_{BC} and U_{CA}.

The nominal value of these inputs is either comprised between 57 and 250 Volts, or between 220 and 480 Volts. P220 has no voltage input.

A minimum 1mm² wire size is recommended.

2.5 Binary inputs

The MiCOM P22x relays have:

– six opto-insulated logic inputs of which five are programmable,

– or eleven opto-insulated logic inputs of which ten are programmable,.

Each input has its own polarity and it shall be powered with either a dc voltage or an ac voltage between the range of 24 to 250 volts (please, refer to section P22x/EN TD - Technical Data - of this guide for more informations).

The control and signalling functions to which the programmable logic inputs are assigned can be selected by means of the AUTOMAT. CTRL menu.

A minimum 1mm² wire size is recommended.

NOTE: A 52a contact (CB auxiliary contact: open when CB is opened) shall be wired to the binary input n°1 (terminals 22-24).

2.6 Output relays

Six output relays are available on the MiCOM P22x relays. Five relays are programmable, the last relay being assigned to the signalling of an equipment fault (WATCH DOG). All these relays are of the changeover type (1 common, 1 normally opened, 1 normally closed).

The protection and control functions to which these relays are assigned can be selected via the AUTOMAT. CTRL menu.

2.7 Front port connection (RS232)

The front communication port is provided by a 9-pin female D-type connector located under the bottom hinged cover. It provides:

– Connection to a PC using the USB/RS232 MiCOM E2 cable to power and set the relay,

– RS232 serial data communication (asynchronous RS232 connection according the IEC60870 requirements) and is intended for use with a PC locally to the relay (up to 15m distance).

The relay is a Data Communication Equipment (DCE) device. Thus the pin connections of the relay's 9-pin front port are as follows:

Pin no. 2	Tx	Transmit data
Pin no. 3	Rx	Receive data
Pin no. 5	0V	Zero volts common

The relay should be connected to the serial port of a PC, usually called COM1 or COM2. PCs are normally Data Terminal Equipment (DTE) devices which have a serial port pin connection as below (if in doubt check your PC manual):

Pin no. 2	Rx	Receive data
Pin no. 3	Tx	Transmit data
Pin no. 5	0V	Zero volts common

For successful data communication, the Tx pin on the relay must be connected to the Rx pin on the PC, and the Rx pin on the relay must be connected to the Tx pin on the PC. Therefore, providing that the PC is a DTE with pin connections as given above, a 'straight through' serial connector is required, i.e. one that connects pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5.

The cable between the MiCOM relay and the PC is a standard RS232 shielded cable (male connector on the MiCOM relay side, usually female connector on PC side).

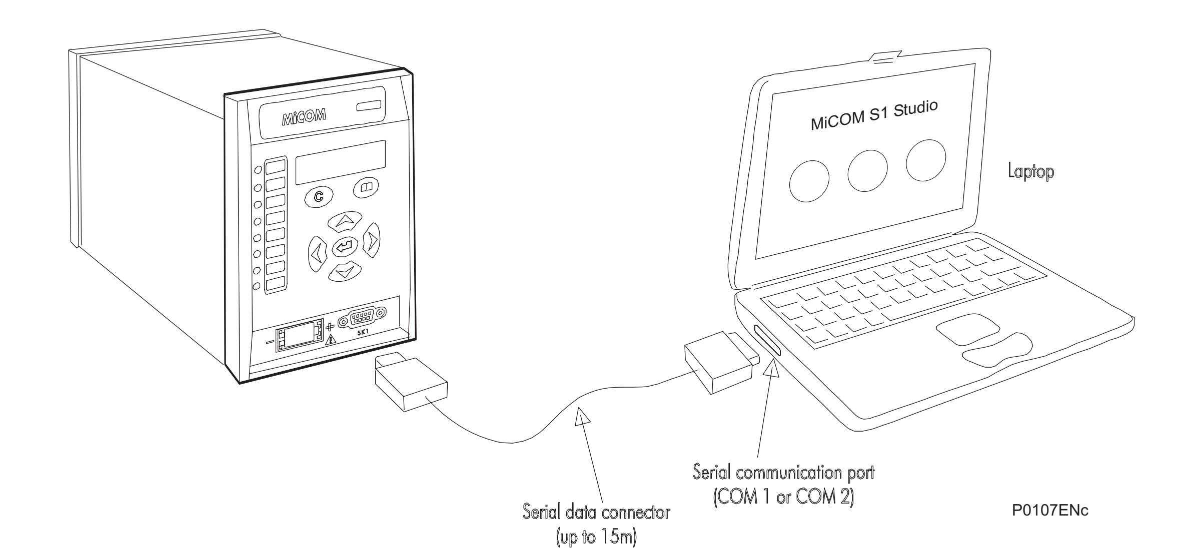
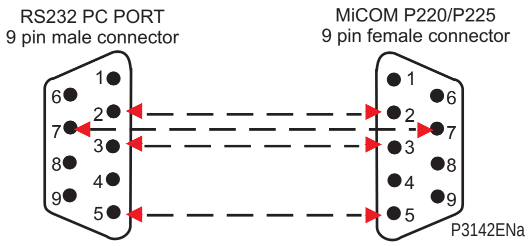


FIGURE 2 - PC<->FRONT PORT CONNECTION

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

Once the physical connection is established, the relay and PC settings must be checked in order to start the communication.

The default communication settings of the RS232 port are as follows:

Protocol	MODBUS
Rate	19 200 bits/s
Address	Must be set in the "Communication" menu, "Address" line
Message format	11 bit - 1 bit start, 8 bits data, 1 bit even, 1 bit stop

2.8 RS485 rear ports

2.8.1 Description

The standard configuration of MiCOM P22x relays is fitted with one RS485 rear port. The second one is optional. The rear RS485 interfaces are isolated and are suitable for permanent connection whichever protocol is selected. The advantage of this type of connection is that up to 31 relays can be 'daisy chained' together using a simple twisted pair electrical connection.

2.8.2 Connection

The first communication connection (port RS485) is assigned on terminals 31 - 32 according to the MiCOM P22x relay wiring diagram. The optional second RS485 communication port is assigned on terminals 79 – 80.

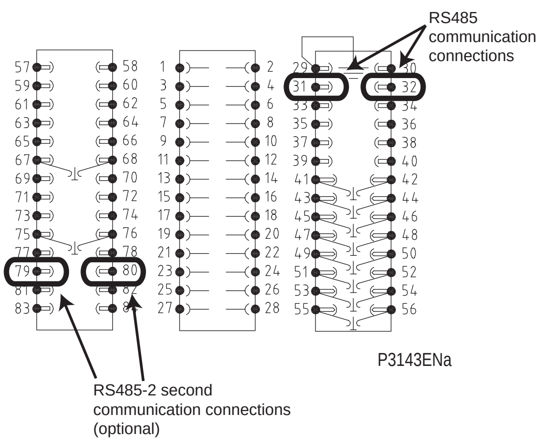


FIGURE 3 - RS485 CONNECTION

The total communication cable from the master unit to the farthest slave device is a spur, and no branches may be made from this spur. The maximum cable length is 1000m and the maximum number of devices per spur is 31. Polarity is necessary for the 2 twisted wires.

The transmission wires should be terminated using a 150 Ω resistor at both extreme ends of the cable. To this effect, link terminals 30 and 32, if the relay is connected at the end of the

RS485 bus, as indicated in figure 3. If a second RS485 communication port is used, a 150 Ω resistor is connected on terminals 78 and 79.

Terminals 29 and 77 of each MiCOM relay shall be connected to the RS485 cable shielding, as mentioned figure 3.

For only one MiCOM relay connected to the RS485 bus, link terminal 29 to the case earth as indicated in figures 2 and 3.

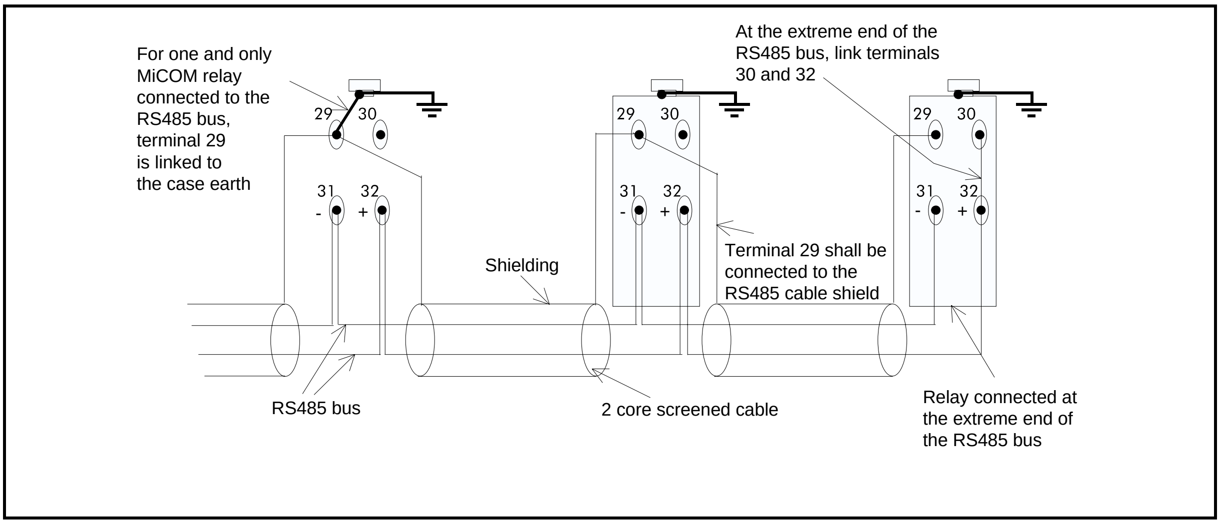


FIGURE 4 - RS485 FIRST CONNECTION

2.8.3 RS485 cable

It is recommended that a 2 core screened cable is used with a maximum total length of 1000 m or 200 nF total cable capacitance (see technical specifications: section “Low voltage signal circuits, P22x/EN IN – Installation)

2.8.4 RS232/RS485 converter

The following RS232/RS485 converters have been tested by Schneider Electric:

- RS_CONV1 converter suitable for a short length and for up to 4 connected relays
- RS_CONV32 industrial converter, suitable for up to 31 connected relays

2.9 Analogue outputs

The MiCOM P22x relay can include two optional analogue outputs assigned on the 28d-28b-28z and 32d-32b-32z terminals (green connector) which allow certain data and measuring values to be reassembled on a current loop towards an automatic controller. The selections of the type of analogue outputs (options: 0-20 mA or 4-20 mA) and of the type of data to be reassembled are effected in the ‘CONFIGURATION/CONFIG. SELECT’ submenu (‘data type analog’ 1 and 2 cells).

It is recommended that a 2-core screened cable is used (see technical specifications: section “Low voltage signal circuits, P22x/EN IN – Installation). The cable shielding shall be bonded to the MiCOM relay case earth connector.

NOTE: The analogue outputs shall be used either in active source mode (terminals 28d-28b et 32d-32b), or in passive source mode (terminals 28z-28b et 32z-32b). This is an exclusive OR logic.

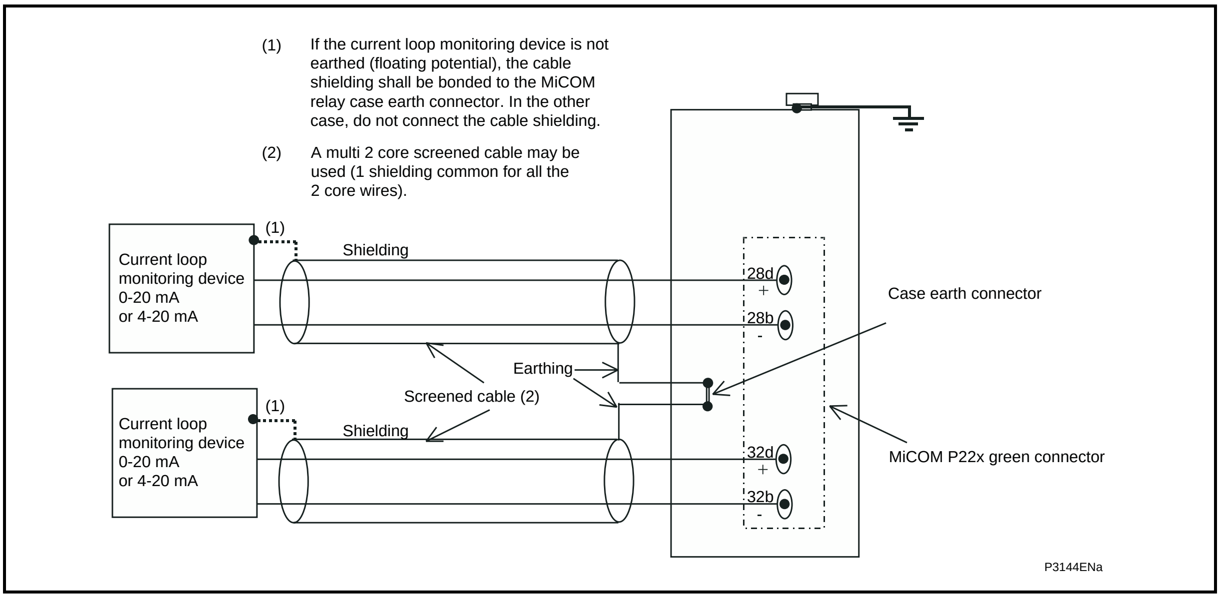


FIGURE 5 - CONNECTION FOR ANALOGUE OUTPUT IN ACTIVE SOURCE MODE

2.10 RTDs

The P22x relay can, as an option, be connected to up to 10 RTD's, which enables it to monitor temperature (PROTECTION G1 or PROTECTION G2 menu). The choice of these types of RTD sensors is affected in the CONFIG. SELECT submenu.

It is recommended that connections between the relay and the RTD's are made using a 3-core screened cable (see section P22x/EN IN – Installation) with a total resistance less than 10 Ω in case of PT100, Ni100 or Ni120 RTD. For Cu10 RTD, the cable total resistance shall be less than 2.5 Ω. The wire also should have a minimum voltage rating of 300 Vrms. Impedance of cores connected to both terminals 2d and 2b (see figure 5) shall be of identical value. The cable shielding shall be bonded to the MiCOM relay case earth connector.

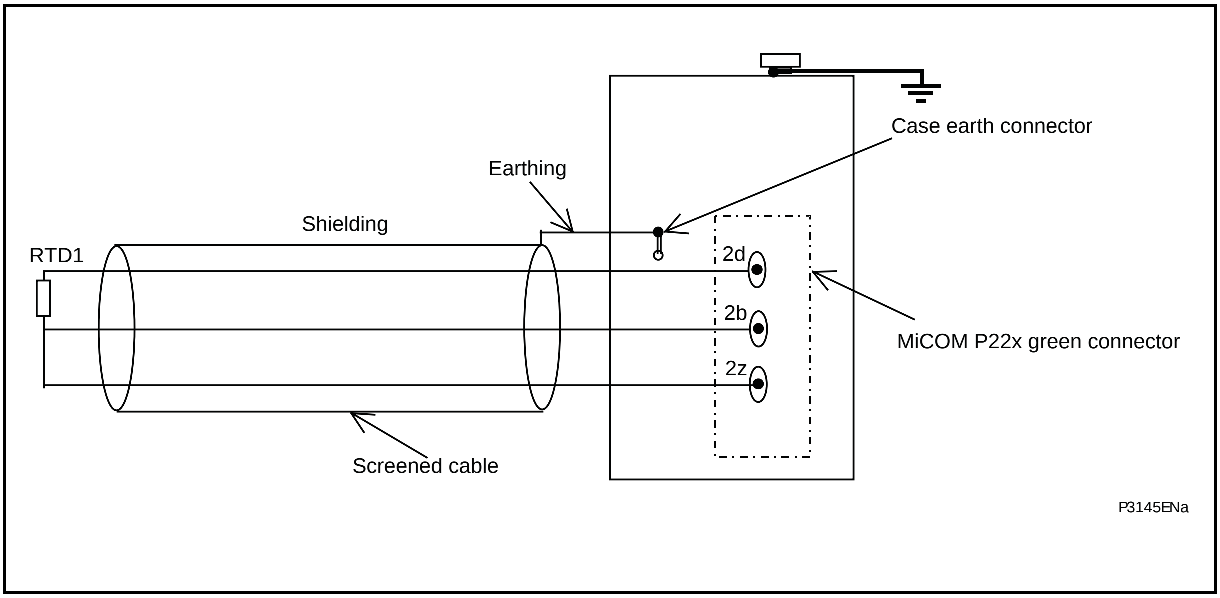


FIGURE 6 - RTD CONNECTION

2.11 Thermistors

The P22x relay can, as an option, be connected up to 3 thermistors which allows it to protect against over-temperature conditions (PROTECTION G1 or PROTECTION G2 menu). The choice between these types of thermistor is affected in the CONFIG. SELCT submenu.

It is recommended that connections between the relay and the thermistors are made using a screened 2-core cable (see section P22x/EN IN – Installation) with a total resistance less than 10 Ω. The wire also should have a minimum voltage rating of 300 Vrms. Impedance of the 2 cores shall have similar values. The cable shielding shall be bonded to the MiCOM relay case earth connector.

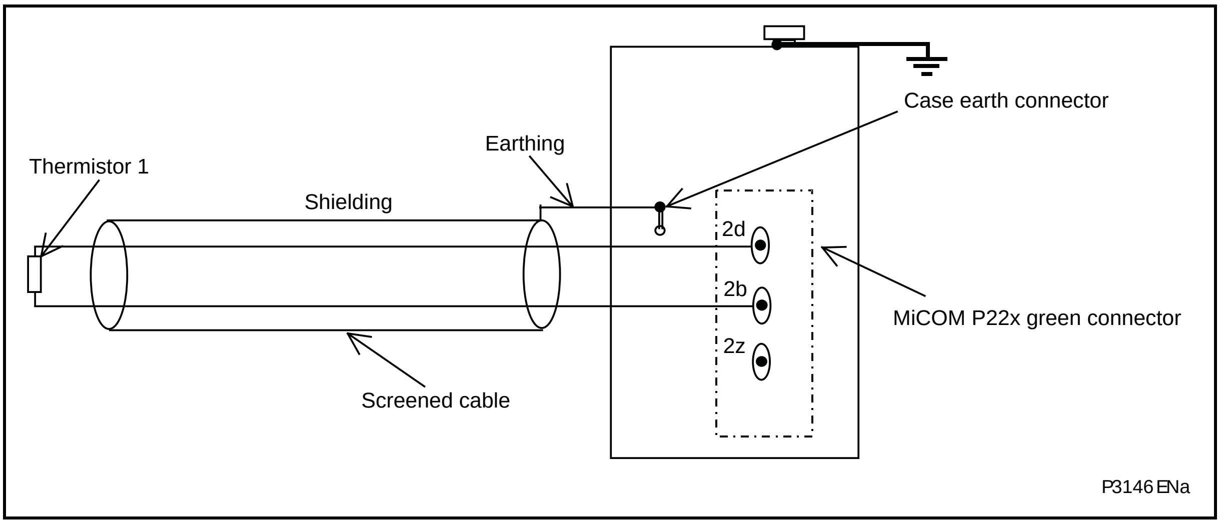


FIGURE 7 - THERMISTOR CONNECTION

2.11.1 PTC type thermistors

For PTC type thermistor, it is usually possible to connect to the same input several thermistors in series as indicated in figure 7.

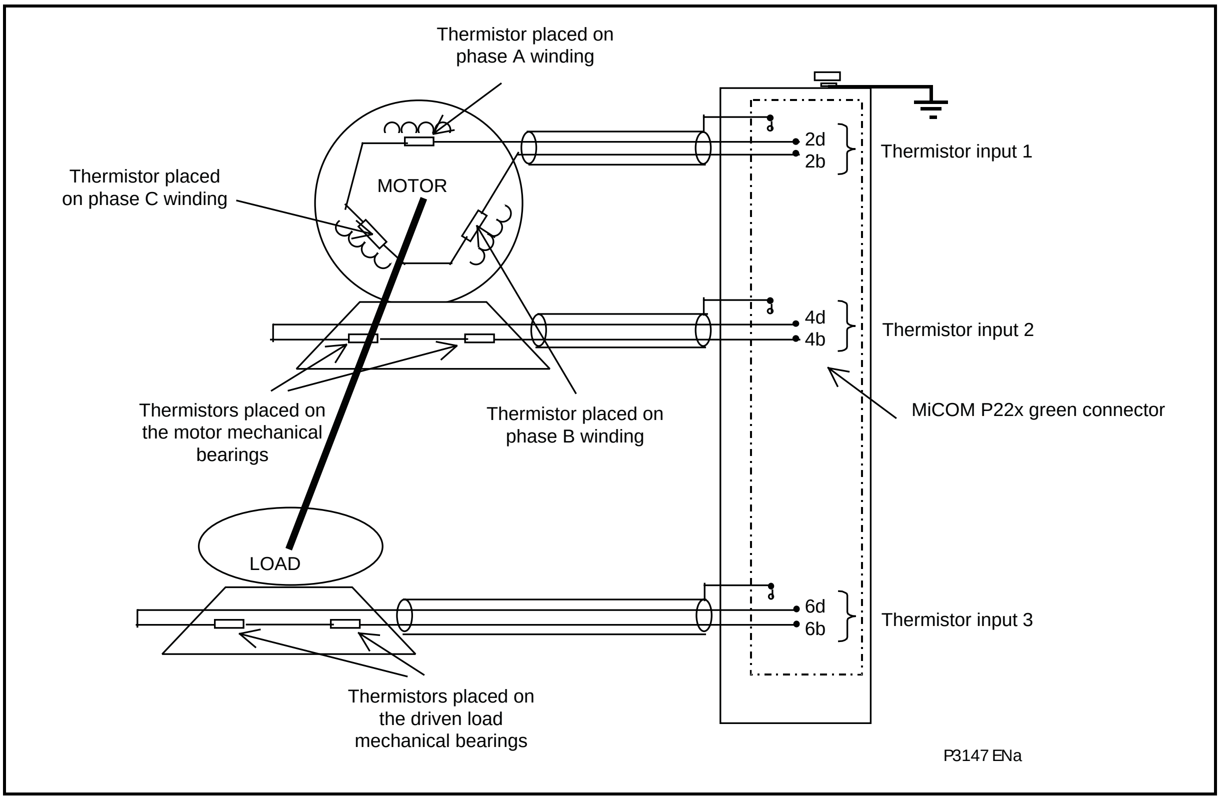


FIGURE 8 - PTC THERMISTORS CONNECTED IN SERIES

2.11.2 NTC type thermistors

For NTC type thermistors, it is recommended that only one thermistor is connected to each MiCOM relay input.

Exceptionally, certain NTC type thermistors can be connected in parallel to the same input. However, we do not recommend such a connection.

2.12 IRIG-B Connection (option)

The P22x relay time and date can be synchronized to the IRIG-B network (optionaml configuration). The synchronization is set in the menu 'CONFIGURATION / CONFIG. SELECT' menu, "Time synchro." Cell.

The connection to IRIG-B network is performed using a BNC connector connected to 81 – 82 terminals via a BNC adaptor (see section P22x/EN IN – Installation).

BLANK PAGE

COMMISSIONING AND MAINTENANCE

CONTENT

1. INTRODUCTION

The MiCOM P220/P225 relays are fully numerical in design and employ a high degree of self-checking. Any fault affecting a hardware or software component is instantly detected and signalled as a device fault.

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE "HANDLING AND SAFETY" SECTION.

2. REQUIREMENTS PRIOR TO COMMISSIONING

BEFORE COMMISSIONING THE RELAY, THE SAFETY SECTION OF THE MANUAL MUST BE READ.

When commissioning the MiCOM relay for the first time, 1/4 hour should be allowed to become familiar with the menu (“MENU OF THE HMI” section).

With a laptop computer and Schneider Electric setting software MiCOM S1 Studio, the user can configure the MiCOM P220/P225 relay and save this setting. The saved file can subsequently be downloaded via the RS232 front port or via the RS485 link on the rear of the MiCOM relays.

2.1 Injection test boxes

For reasons of convenience (weight, spatial requirement, transportation), a single-phase injection test set is more suitable for the tests and is able to perform all the tests relating to the MiCOM P220/P225 relay.

Thus, the following descriptions indicate how to conduct the tests with a single-phase injection test set.

However, for certain 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).

Three-phase injection test set

3 currents (0 to 50 A), timer (precision 1 ms).

2.1.1 Additional test equipments

2 multimeters (precision 1%),

1 clip-on ammeter to measure the currents exceeding 10 A (precision 2%),

Test plugs and wires to carry out injections to the CTs secondary (dimensions according to the currents injected).

2.1.2 Communication

For all tests, the records can be made by using either the RS485 rear port or the RS232 front port of the relay.

2.1.3 Commissioning test records

Commissioning test records are available in Chapter P22x/EN RS/B44.

The presentation of the Commissioning test records follows the sequence of the tests of this chapter.

The contents of these Commissioning test records enable you to log:

- The name of the relay, station and circuit/plant
- The characteristics of the MiCOM P220/P225 relay
- The various settings
- The results of the tests

3. PRODUCT VERIFICATION TESTS

3.1 Allocation of terminals

It is necessary to consult the appropriate wiring diagram of the MiCOM P220/P225 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 chapter P22x/EN SS/B44.

Visual inspection

Carefully examine the relay to see if there has been any possible deterioration following installation.

Check the serial number under the upper flap of the front panel. Also inspect the stated nominal values and the model number.

Check if the external wiring corresponds to the appropriate relay diagram or the assembly diagram.

When the relay is withdrawn from its case, use a continuity tester to check if the current short-circuits (phases and earth CTs) between the terminals indicated on the wiring diagram are closed.

3.3 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.

3.4 Current transformers (CTs)

DANGER: NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

3.4.1 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:

1. MV cable screens and core balance CT,
2. No current flow through the MV cables.

3.4.2 Cable shields and core balance 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 balance CT. This cancels the currents carried by the cable shields through the core balance CT.

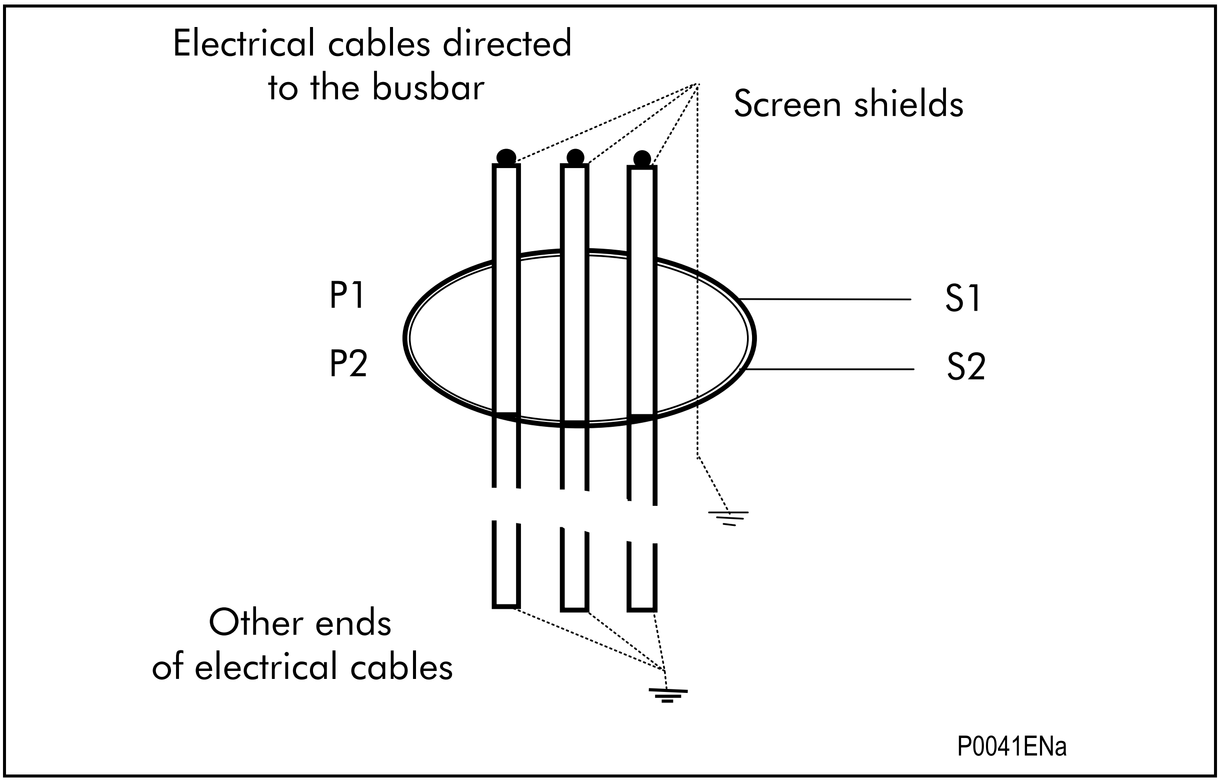


FIGURE 1 - SCREEN SHIELDS AND CORE BALANCE CT

3.4.3 Phase CTs orientation

It is necessary to check the orientation of the phase CTs by using the following quickest method (flick test):

Have available a centre point analogue ammeter. Temporarily short-circuit the battery by checking the diagram polarities (+ on P1 and – on P2). A positive current pulse traverses the milliammeter and the needle shall turn in a positive direction .

Proceed this test for each phase CT.

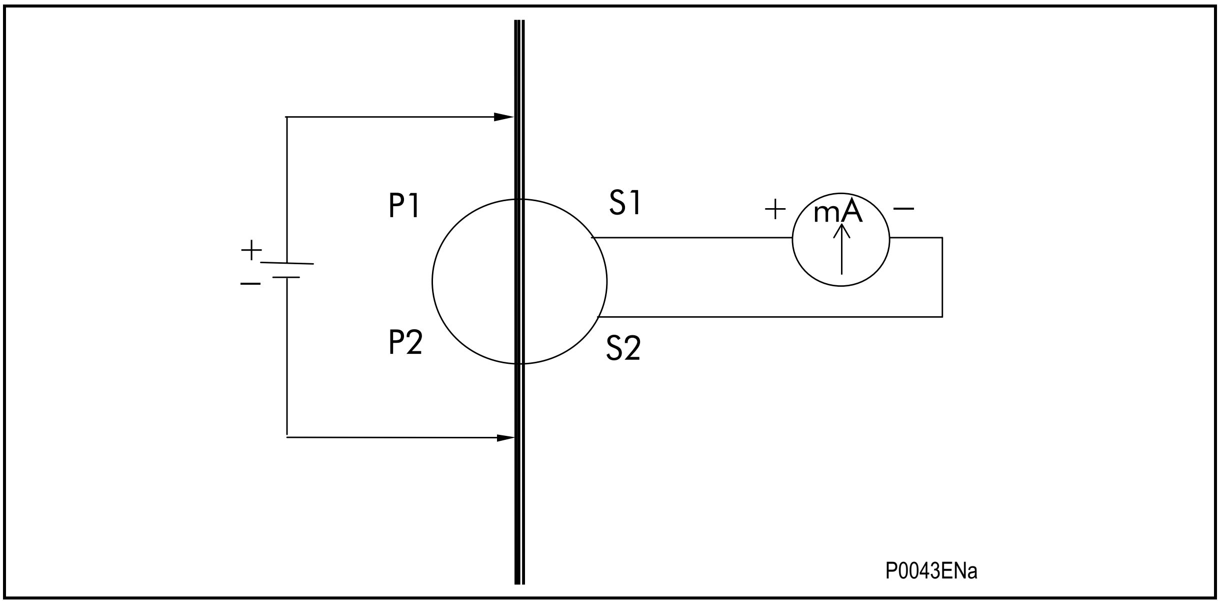


FIGURE 2 - PHASE CT ORIENTATION TEST

NOTE: De-magnetise the CT after the test. Inject a current starting from zero and slowly cross the CT nominal value and then decrease slowly to zero.

4. COMMISSIONING

The various operations described in this section are not exhaustive, but combine functions of MiCOM P220/P225 relay which are able to confirm that the relay is operational. The use of appropriate Schneider Electric setting software connected to either the RS485 rear port or the RS232 front is not obligatory. The various indications associated with each commissioning module are described for the MiCOM P220/P225 front panel display (LCD and LEDs).

Commissioning covers the following points:

1. Input of settings

3. Validation of measurements

4. Validation of the thermal replica: I_{teta}>=, teta ALARM, teta FORBID START, Te1, Te2, Tr (49)

5. Validation of phase overcurrent protection thresholds and time delays: I>>, tI>> (50/51)

6. Validation of earth fault protection thresholds and time delays: Io>, tIo>, Io>>, t Io>> (50N/51N)

7. Validation of the negative sequence thresholds I_2> and I_2>> (46)

8. Validation of the automation function: latching of the relay outputs

4.1 Settings

Input into the Commissioning Test Report file all of the settings of the MiCOM P220/P225 relay.

4.2 Measurements

The MiCOM P220/P225 relay measures phase and earth currents as a True RMS value up to the 10th harmonic. The value(s) indicated take account of the phase and/or earth CT ratio.

WARNING: MiCOM P220/P225 RELAY HAS 1 AND 5 AMP CURRENT INPUTS. CHECK THAT THE INJECTED CURRENT IS COMPATIBLE WITH THE SELECTED RANGE

- Bring forward to the Setting report the values of phase and earth CTs
- Energise the MiCOM P220/P225 relay
- Apply to each current input (as per wiring diagram) a current and check the values on the LCD display
- Carry forward the results to the Commissioning test report (applied values and relay values displayed)

4.2.1 Thermal overload protection

P220/P225 relays model the time-current thermal characteristic of a motor by internally generating a thermal replica of the machine. The aim of this test is to check:

- The presence of a thermal alarm as soon as the thermal state reaches the set threshold
- The time to a thermal trip in case of a thermal overload
- The measurements of the thermal load and thermal state

The settings of this function are listed in the **THERMAL OVERLOAD, GROUP 1** menu column. Check these settings before the test.

To avoid spurious operation of any other protection elements all protection elements except the thermal protection should be disabled for the duration of the thermal element tests. Make a note of which elements need to be re-enabled after testing.

4.2.1.1 Perform the test

Ensure that the timer on the test set is reset.

Ensure that the thermal state is reset. Check the position of the interrupting device by viewing the status of the two opto-inputs (52a and 52b status inputs) used to indicate the device position. The 52a input must be energised to simulate the closed position of the interrupting device to enable the thermal protection heating time constants. The cooling time constant is used when the interrupting device is open.

Apply a current of twice the setting to the relay and note the time displayed when the timer stops. Since most portable secondary injection test sets have limited current output capability, it is suggested to change the **Iteta>** setting to 1 In (after the as found value is recorded) and use the 1 A phase current input terminals. In order to save time during testing, it is advisable to set all the thermal time constants to 5 minutes.

Ensure that the thermal state is reset to zero. On completion of the tests any protection elements that were disabled for testing purposes must have their original settings restored in the CONFIGURATION column.

Assign the thermal overload protective function to the trip output contact (relay RL1) and assign the tetaALARM protective function to an auxiliary output contact, RL2 for example.

4.2.1.2 Verify the operating time

This test is done by a single-phase injection on the A phase current input, it results in that the relay sees equal current magnitudes for both positive and negative phase sequence quantities. Upon injection of a single phase current value equal to Iinject, the relay will see current magnitudes of Iinject/3 for both positive and negative phase sequences quantities and Iinject for Irms. The equivalent thermal current value Ieq calculated by the relay will be given by the following:

$I_{eq} = \sqrt{(I_{rms}^2 + K_e I_2^2)}$

Where:

I_{rms}: root mean square current

I_2: negative sequence current

K_e is a constant proportional to the thermal capacity of the motor
(**K_e Coefficient** default setting = 3)

The equivalent motor heating current assuming K_e = 3 becomes:

$I_{eq} = \sqrt{[4/3 * (I_{inject}) 2]}$

$= (\mathbf{2\ I_{injected}/\sqrt{3}})$

The equation used to calculate the trip time at 100% of thermal state is:

$\mathbf{t = \tau\ ln((k^2 - A)/(k^2-1))}$

Where the value of τ (thermal time constant) depends on the current value absorbed by the motor:

$\tau = T_{e\,1}$ (**Thermal Const T1**) if $I_{teta} < I_{eq} <= 2*I_{teta}$: overload time constant

$\tau = T_{e\,2}$ (**Thermal Const T2**) if $I_{eq} > 2*I_{teta}$: start-up time constant

τ = Tr (**Cooling Const Tr**) if interrupting device is opened : cooling time constant

I_{teta} = thermal setting

$k = I_{eq}/I_{teta}$ = measured thermal load (or thermal capacity)

A = initial state of the machine, in percentage of the thermal state = 0 for this test.

The time to a thermal trip becomes:

$$t = \tau \ln(k^2/(k^2 - 1))$$

The equation used to calculate the time to the thermal alarm is:

talarm = τ ln(k^2/(k^2–teta Alarm/100))

Teta ALARM = (**Thermal Alarm**) thermal alarm setting in percentage of the thermal state Since a current of twice the setting Iteta> is applied, consequently one of the following thermal constants will be used:

- T_e 1 (overload time constant) if the interrupting device is closed.
- Tr (cooling time constant) if the interrupting device is opened.

Apply a current of twice the setting to the relay and note the time displayed when the timer stops. Check that the operating time recorded by the timer is within the range (calculated trip time ±5% or 40 ms whichever is the greater). Allowance must be made for the accuracy of the test equipment being used.

Example:

For **Iteta> Current Set** = 0.5 A and **A** phase I_{inject} = 2 A, T_e 1 = 5 mins.

$k = I_{eq}/I_{th} = (2 \times 2/\sqrt{3})/0.5 = 8/\sqrt{3}$ A

top = 5 x 60 ln ((8/√3) 2/((8/√3) 2 – 1)) = 14.4 s

For a thermal alarm setting = 90% t_{alarm} = 12.96 s

If the injection is done equally on the 3 phases current transformers, the equation used to evaluate I_{eq} will be:

$$I_{eq} = \sqrt{(I_{rms}^2 + K\, I_2^2)}$$

And provided the phase currents are balanced, then I2 will be zero.

On completion of the tests any protection elements that were disabled for testing purposes must have their original settings restored in the CONFIGURATION column.

4.3 Phase overcurrent

<u>Example</u>: I>>, Delay Type DMT

Set the threshold on the trip output.

4.3.1 I>> threshold

Values to be recorded

1. I>> threshold.
2. tI>> time delay.

I>> threshold check:

1. If tI>> time delay is short, gradually increase the injected current up to the value of I>> threshold.
2. If tI>> time delay is long, inject 0.95 x I threshold and check there is no trip. Then inject 1.1 x I threshold and check the trip output is close.
3. Gradually decrease the injected current and note the value of the drop out of the I>> threshold.

Checks:

1. Display of an alarm message on the front panel LCD.
2. Alarm LED flashes.
3. Trip LED flashes.
4. I>> threshold LED flashes (if programmed).
5. Trip output closes.
6. I>> threshold output closes (if programmed).

tI>> time delay check:

1. Apply a current on 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).
2. Apply a current on 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).

4.4 Earth overcurrent: Io>, Io>>

Two earth overcurrent thresholds are available in the MiCOM P220/P225 relays. Each threshold is adjusted independently. Set the various thresholds on the trip output.

4.4.1 Io> threshold

Values to be recorded:

1. Io> threshold.
2. Time delay tIo>.

Io> threshold check:

1. If the time delay tIo> is short, gradually increase the injection current up to the value of the Io> threshold.
2. If the time delay tIo> 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.
3. Gradually decrease the injected current and record the value of the drop out Io> threshold.

Checks:

1. Alarm message on the LCD display.
2. Alarm LED flashes.
3. Trip LED flashes.
4. Io> threshold LED flashes (if programmed).
5. Trip output closes.
6. Io> threshold output closes (if programmed).

tIo> time delay check:

1. Apply a current on the earth input and measure the time delay tIo> by pre-setting the current above the Io> threshold (I injected > 2 x I threshold).
2. Apply a current on the earth input and measure the time delay tIo> by pre-setting the current above the Io> threshold (I injected > 10 x I threshold).

4.4.2 Io>> threshold

Values to be recorded:

1. Io>> threshold.
2. tIo>> time delay.

Io>> threshold check:

1. If tIo>> time delay is short, gradually increase the injected current up to the value of Io>> threshold.
2. If tIo>> time delay is long, inject 0.95 x I threshold and check there is no trip. Then inject 1.1 x I threshold and check the trip output is closed.
3. Gradually decrease the injected current and note the value of the drop out Io>> threshold.

Checks:

1. Display of an alarm message on the front panel LCD.
2. Alarm LED flashes.
3. Trip LED flashes.
4. Io>> threshold LED flashes (if programmed).
5. Trip output closes.
6. Io>> threshold output closes (if programmed).

tIo>> time delay check:

1. Apply a current on to the earth and measure the time delay tIo>> by pre-setting the current above the Io>> threshold (I injected > 2 x I threshold).
2. Apply a current on to the earth and measure the time delay tIo>> by pre-setting the current above the Io>> threshold (I injected > 10 x I threshold).

4.5 Negative phase sequence threshold(46)

Two overcurrent thresholds based on the negative phase sequence component are available in the MiCOM P220/P225 relays. Each threshold is adjusted independently. The threshold I_2> has a definite time characteristic while the second threshold I_2>> is associated with an inverse time characteristic. Set the various thresholds on the trip output.

Reminder: the MiCOM P220/P225 relay calculates the negative phase sequence component using the formula:

$I_2 = 1/3\ (I_a + a^2\ I_b + a\ I_c)$

With a = cos (2/3) + j sin (2/3)

With a single phase injection into phase A as an example results;

$I_2 = 1/3\ I_a$

In this case, the negative sequence current measured by the MiCOM P220/P225 is equal to one third of the injected current.

4.5.1 I_2> threshold

Values to be recorded:

1. I2> threshold.
2. Time delay tI_2>.

I_2> threshold check:

1. If the time delay tI_2> is short, gradually increase the injected current up to the value of the I_2> threshold.
2. If the time delay tIo> 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.
3. Gradually decrease the injected current and record the value of the drop out I_2> threshold.

Checks:

1. Alarm message on the LCD display.
2. Alarm LED flashes.
3. Trip LED flashes.
4. I_2> threshold LED flashes (if programmed).
5. Trip output closes.
6. I_2> threshold output closes (if programmed).

tI_2> time delay check:

7. Apply a current on to the earth input and measure the time delay tI_2> by pre-setting the current above the I_2> threshold (I injected > 2 x I threshold).
8. Apply a current on to the earth input and measure the time delay tI_2> by pre-setting the current above the I_2> threshold (I injected > 10 x I threshold).

4.5.2 I_2>> threshold

Values to be recorded:

1. I_2>> threshold.
2. TMS I_2>>.

NOTE: Time to trip can be calculated by using the following relationship;

t = (TMS I2>>) x [1.2/(I2/In)]

Example;

For **TMS I2>>** = 1 and **I2>> = 0.2 In then t = 6 sec**

Repeat steps referred to in section 4.5.1 above.

4.6 Commissioning parameters data base

The various parameters shown below make possible to test functions of **MiCOM P220/P225** relays according to the commissioning tests (see section 4). Settings in accordance with the commissioning tests only are given.

4.6.1 PROTECTION menu

THERMAL OVERLOAD FUNCTION ?	NO/YES*
Therm INHIBIT?	NO
Iflc>	1 In
Ke	3
Te1	5 mn
Te2	5 mn
Tr	5 mn
RTD1 INFLUENCE?	NO
Therm ALARM?	YES
Therm ALARM	90%
Therm FORBID START?	NO
I> FUNCTION?	NO/YES*
I>	1 In
tI>	20 s
I>> FUNCTION?	NO/YES*
I>>	1 In
tI>>	20 s
Io> FUNCTION?	NO/YES*
Io>	0.1 Ion
tIo>	20 s
Io>> FUNCTION?	NO/YES*
Io>>	1 Ion
tIo>>	10 s
I_2> FUNCTION?	NO/YES*
I_2>	0.2 In
tI_2>	20 s
I_2>> FUNCTION?	NO/YES*
TMS I_2>>	1
I_2>>	0.2 In

* During the commissioning tests, all the protective functions shall be preferably set to off (NO) excepted the one which is being tested.

5. MAINTENANCE PERIOD

It is recommended that products supplied by Schneider Electric receive regular monitoring after installation. As with all products some deterioration with time is inevitable. In view of the critical nature of protective relays and their infrequent operation, it is desirable to confirm that they are operating correctly at regular intervals.

MiCOM P220/P225 relays are self-supervising and so require less maintenance than earlier designs. Most problems will result in an alarm so that remedial action can be taken. However, some periodic tests should be performed to ensure that the relay is functioning correctly and that the external wiring is intact.

If a Preventive Maintenance Policy exists within the customer's organisation, the recommended product checks should be included in the regular programme.

Maintenance periods will depend on many factors, such as:

- The operating environment
- The accessibility of the site
- The amount of available manpower
- The importance of the installation in the power system
- The consequences of failure

6. MAINTENANCE CHECKS

Although some functionality checks can be performed from a remote location by utilising the communications ability of the relays, it is recommended that maintenance checks are performed locally.

6.1 Alarms

The alarm status LED should first be checked to identify if any alarm conditions exist. If so, press the read key repeatedly to step through the alarms. Clear the alarms to extinguish the LED(s) provided the original cause no longer exists.

6.2 Logic inputs

The logic inputs (opto-isolators) can be checked to ensure that the relay responds on energisation.

This test checks that all 6 opto-isolated outputs of the MiCOM P220/P225 are functioning correctly.

Energise the logic inputs one at a time with voltage V, with the terminal numbers in accordance with the table below.

The status of each opto-isolated input can be viewed in the "OP.PARAMETERS" menu. "1" indicates an energised input, "0" indicates a de-energised input.

LOGIC INPUTS	Supply to Terminals + V	Supply to Terminals – V	OP. PARAMETERS/INPUT Value
Input L1	22	24	0 0 0 0 0 1
Input L2	26	28	0 0 0 0 1 0
Input L3	13	15	0 0 0 1 0 0
Input L4	17	19	0 0 1 0 0 0
Input L5	21	23	0 1 0 0 0 0
Input L6	25	27	1 0 0 0 0 0
If option present:			
Input L7	61	62	0 0 0 0 1 0 0 0 0 0 0
Input L8	64	62	0 0 0 1 0 0 0 0 0 0 0
Input L9	63	62	0 0 1 0 0 0 0 0 0 0 0
Input L10	66	62	0 1 0 0 0 0 0 0 0 0 0
Input L11	65	62	1 0 0 0 0 0 0 0 0 0 0

NOTE: The voltage V to be applied to the logic inputs is defined in Chapter TD Technical Specifications, paragraph 6.4 "Logic inputs" in this Technical Guide.

6.3 Output relays

6.3.1 Maintenance mode

The output relays can be individually controlled by setting the MiCOM relay to Maintenance mode.

The MiCOM relay can be switched to Maintenance mode either:

– By using the MiCOM S1 Studio software, or

– By remote control via the RS485 communication port (refer to Chapter CT Communication in this Technical Guide)

While the MiCOM relay is in Maintenance mode:

– All protective functions are disabled

– All automation functions are disabled

– All output relays are off (including the watchdog relay)

– The ALARM LED flashes

– The MAINTENANCE MODE alarm appears

– Communication via RS232 and/or RS485 ports is once more available

When the MiCOM relay is in Maintenance mode:

– A remote control signal is used to energise the required output relays

– Another remote control signal must be sent to de-energise the output relays

Once the output relay tests are completed, reset the MiCOM relays to normal operation mode

– By using the MiCOM S1 software, or

– Via the RS485 communication port

6.3.2 Testing the output relays

Connect a continuity tester across the terminals of each output contact to check the correct contact position (open/closed circuit) as in the table below:

The state of each output relay (1: energised/0: standby) is given in the "OP. PARAMETERS" menu.

OUTPUT RELAY	Output Relay on Standby		Output Relay Energised	
	Normally Closed	Normally Open	Circuit Open	Circuit Closed
WD (watchdog)	36 - 35	36 - 37	36 - 37	36 - 35
RL1	2 - 4	2 - 6	2 - 4	2 - 6
RL2	8 - 10	8 - 12	8 - 10	8 - 12
RL3	14 - 16	14 - 18	14 - 16	14 - 18
RL4	1 - 3	1 - 5	1 - 3	1 - 5
RL5	7 - 9	7 - 11	7 - 9	7 - 11

7. EXCHANGING THE RELAY

The case and the rear terminal blocks have been designed to facilitate removal of the relay without having to disconnect the scheme wiring.

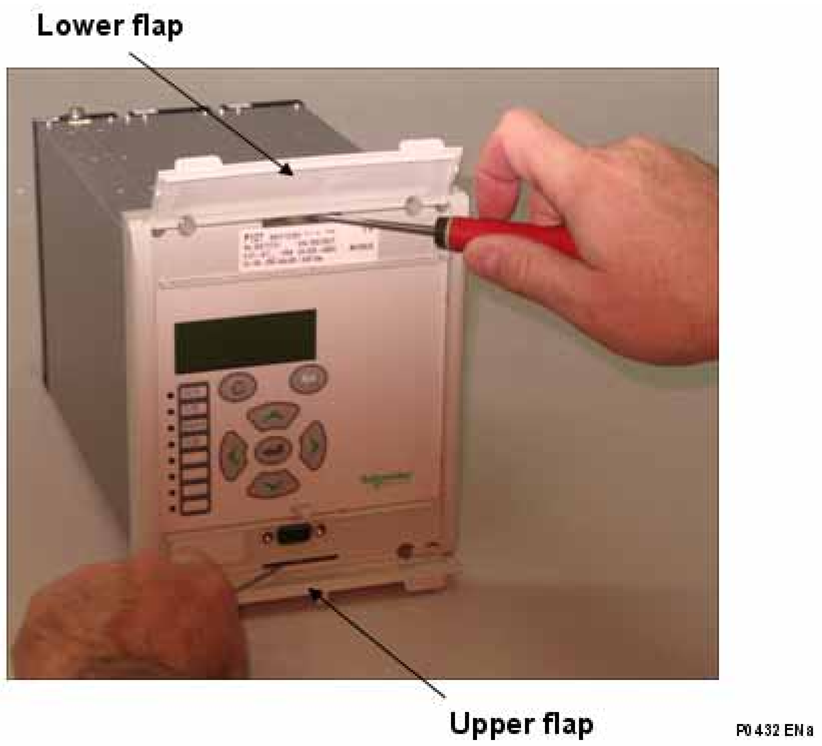
BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT, THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE "HANDLING AND SAFETY" SECTION.

The method is to replace the withdrawable part, but it may be necessary to replace the complete relay (with the case):

7.1 Remove the withdrawable part

To remove the withdrawable part, lift the upper flap on the front panel to reveal a slot in the centre towards the top. Using a screwdriver (approx. 3 mm cross-section) insert it in the hole in the middle of the slot then move the screwdriver from right to left. This moves a cam which has the effect of moving the withdrawable part of the MiCOM relay a few centimetres.

Lift the lower flap on the front panel. Proceed as above. The withdrawable part can now be easily removed from the case.



Before replacing the withdrawable part in the case, reset the 2 opposing cams.

NOTE:
- MiCOM P220/P225 relays have integral current transformer shorting switches which will close when the withdrawable part is removed.
- In case of fuse-contactor controlled by a voltage loss coil, do not remove the withdrawable part if the contactor is closed. In fact, removing the withdrawable part will break the power circuit for the voltage loss coil, causing the opening of the contactor.

7.2 Exchanging the relay and the case

BEFORE WORKING AT THE REAR OF THE RELAY, ISOLATE ALL VOLTAGE AND CURRENT SUPPLIES TO THE RELAY.

DISCONNECT THE RELAY EARTH CONNECTION FROM THE REAR OF THE CASE.

NOTE: The use of a magnetic-bladed screwdriver is recommended to minimise the risk of the screws being left in the terminal block or lost.

WITHDRAW THE RELAY FROM THE PANEL, RACK, ETC. CAREFULLY AS IT WILL BE HEAVY OWING 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 THE CASE EARTH IS REPLACED.

8. EQUIPMENT FAILURE

8.1 Types of equipment failure

HARDWARE ALARMS

As soon as an internal fault (i.e. an equipment failure) is detected in the MiCOM relay:

An alarm is displayed as a priority on the front panel display.

The "Warning" fault LED is illuminated:

– Constant (major failure)

– Flashing (minor failure)

8.2 The equipment failure relay (WD) is closed (only for major faults)

Equipment failures can be divided into 2 types, minor and major.

An equipment failure (minor or major) cannot be acknowledged on the front panel using the keypad. Only the disappearance of the cause will acknowledge the fault and the associated alarm.

8.3 Minor faults

The following hardware alarms are considered minor faults:

– COMM. ERROR

– CLOCK ERROR

– RAM ERROR

– ANALOG OUTPUT ERROR

– RTD/Therm ERROR

The protective relay continues to function in the event of a minor equipment failure.

8.3.1 Major faults

The following hardware alarms are considered major faults:

– EEPROM ERROR DATA

– EEPROM ERROR CALIBR.

– CT/VT ERROR

The protective relay ceases to function in the event of a major equipment failure, the protective and automation components are disabled and all output relays are de-energised: the equipment failure relay (WD) is off, as are all other output relays if already energised - even if programmed "latched".

8.4 Equipment failures and solutions

8.4.1 COMM. ERROR

Communication module failure via RS485 port. This can be a hardware or software failure.

Action:

– If communication is not being used, declare communication OFF in the COMMUNICATION menu

– If communication is being used, remove the withdrawable part and return it to the factory for repair

8.4.2 CLOCK ERROR

This alarm appears if there are problems accessing the clock or there is an inconsistency in the date being read.

Action:

If the alarm persists, remove the withdrawable part and return it to the factory for repair.

8.4.3 RAM ERROR

This alarm appears if the result of the checksum calculation in safeguarded RAM is incorrect. The data in RAM will be considered inconsistent and will be lost.

This alarm may appear after downloading a new firmware version, after loss of the auxiliary power supply while the relay was writing to safeguarded RAM or if there is a RAM hardware fault.

Action:

Press button C on the relay front panel to clear the alarm.

If the alarm persists, de-energise then re-energise the relay.

If the alarm still persists, remove the withdrawable part and return it to the factory for repair.

8.4.4 RTD/Therm ERROR

This alarm appears if:

– The impedance measured at the relay detector input terminals is outside a certain range. This may be due to short-wiring or an open circuit or a disconnected RTD

– The RTD monitoring board is faulty or wrongly fitted

Action:

Check that the RTD's declared in the RTD sub-menu [49/38] or THERMISTOR sub-menu [49] are correctly wired to the MiCOM relay.

Check the connection wiring for each RTD (short-wiring, open circuit).

After removing the withdrawable part, check that the RTD board is correctly connected to the rest of the relay.

If the alarm persists, remove the withdrawable part and return it to the factory for repair.

8.4.5 EEPROM ERROR DATA

Hardware failure

Action:

Remove the withdrawable part and return it to the factory for repair.

8.4.6 EEPROM ERROR CALIBR

Hardware failure

Action:

Remove the withdrawable part and return it to the factory for repair.

8.4.7 CT/VT ERROR

Hardware failure

Action:

Remove the withdrawable part and return it to the factory for repair.

9. PROBLEM SOLVING

9.1 Password lost or not accepted

Problem:

Password lost or not accepted

Cause:

MiCOM P220/P225 relays are supplied with the password set to: ***AAAA***

This password can be changed by the user (refer to the OP. PARAMETERS menu).

Action:

There is an additional unique recovery password associated with the relay which can be supplied by the factory or service agent if provided with details of the model and serial number (under the upper flap on the front panel). Contact your Schneider Electric local dealer or the Schneider Electric contact centre with the serial number.

9.1.1 Communication

9.1.1.1 Values measured locally and remotely

Problem:

Values measured locally and remotely (via RS485 communication) differ.

Cause:

The values accessible on the front panel via the MEASUREMENT menus are refreshed every second. Those fed back via communication and accessible via the Schneider Electric setting software generally have settable refresh frequencies. If the refresh frequency of the supervision software differs from that of the MiCOM relay (1s), there may be a difference between the indicated values.

Action:

Adjust the refresh frequency for the measurements of the supervision software or the support software to 1 second.

9.1.1.2 MiCOM relay no longer responds

Problem:

No response from the MiCOM relay following a request by the supervision software: no communication fault message.

Cause:

Normally this type of problem is linked to a configuration error in the MiCOM relay communication parameters.

Action:

Check that the MiCOM relay communication parameters (data rate, parity, etc.) are in accordance with the supervision software.

Check the MiCOM relay 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 respond to supervision requests.

9.1.1.3 A remote control signal is not taken into account

Problem:

Communication between the relay and the PC is OK but the MiCOM relay will not accept remote control signals nor setting file downloads.

Cause:

Normally this type of problem is because the MiCOM relay is in programming mode, i.e. the user has entered the password.

Action:

Wait for deactivation of the password. Deactivation occurs 5 minutes after the keypad is last used.

10. LIST OF THE RELAY ALARM MESSAGES

HARDW ALARMS	Heading of the HARDW ALARMS messages, default display in case of either relay error alarm or RTDs/thermistor failure. To display the alarms messages, press the key.

The Next alarms can be displayed

Alarm	Description
COMM. ERROR	Communication error (communication suing the rear RS485 port). *(Minor failure*)
EEPROM ERROR DATA	EEPROM memory error. *(Major failure)*
EEPROM ERROR CALIBR.	EEPROM calibration error. *(Major failure)*
CT/VT ERROR	Analogue signal acquisition error. *(Major failure)*
CLOCK ERROR	Internal clock error. *(Minor failure*)
RAM ERROR	RAM memory error. *(Minor failure)*
ANALOG OUTPUT ERROR	Analogue output error. *(Minor failure)*
RTD/Therm ERROR	RTD or thermistor in failure (short-wiring or open circuit). *(Minor failure)*

11. LIST OF THE MOTOR ALARM MESSAGES

MOTOR ALARMS	Heading of the MOTOR ALARMS messages, default display in case of motor alarm. To display the alarms messages, press the key.

The next alarms can be displayed (alphabetical order)

Alarm	Description
ANTI BACK SPIN	Block start due to Anti backspin function: minimum time between a motor stoppage and a re-start (self resettable alarm).
AUTO RE-START	Auto Re-start sequence in progress (self-resettable) (P225 only)
BUS VOLTAGE	Busbar voltage too low to enable a start. (P225 only) (self resettable alarm).
CB FAIL.	Circuit breaker failure.
CB OPENING TIME	Circuit breaker opening time has reached (or it has exceeded) the “CB OPENING TIME” threshold.
CB OPERATION NB	Circuit breaker operation number has reached (or it has exceeded) the “CB OPERATION NB” threshold.
CLEAR ALL ALARMS.	To clear all the alarms, press the key.
EQUATION A	And logic equation A active …and so on for the AND logic equations B, C and D
LATCH AUX OUTPUT RLY	One or several output relays are latched energised.
LOCKED ROTOR	Operation of the “locked rotor at start” function.
LONG START t Istart	Operation of the “excessive start time” function: time delayed element tI_{start}
MECHAN JAM tIstall (whilst running)	Operation of the “stalled rotor while running” function: time delayed element tIstall
RE-ACCELER AUTHOR (re-acceleration in progress)	Authorised motor reacceleration sequence in progress (self-resettable)
SA2n (Ampsr cut by CB)	The sum of amperesn has reached (or it has exceeded) the “SAn” threshold.
start failed(Treac-shed time out and no re-start)	Auto Re-start sequence progress failed (self-resettable) (P225 only)
start in progress(Treac-shed no time out)	Auto Re-start load restoration sequence in progress (self-resettable) (P225 only)
START NB LIMIT	Block start based on the “limitation of starts number” function active (self resettable)
T between 2 start	Block start based on the “minimum time between 2 starts” function active. (self-resettable).
t I >> PHASE …	Operation of the “phase OC” function: time delayed element tI>>. Display of the faulty phase.
t I >> PHASE	Operation of the “phase OC” function: time delayed element tI>>. Display of the faulty phase.

Alarm	Description
t I >>> PHASE …	Operation of the "phase OC" function: time delayed element tI>>>. Display of the faulty phase.
t I >PHASE	Operation of the "phase OC" function: time delayed element tI>. Display of the faulty phase.
t I< PHASE	Operation of the "loss of load" function: time delayed element t I<. Display the faulty phase.
t I0>	Operation of the "earth fault" function: time delayed element t Io>
t I0>>	Operation of the "earth fault" function: time delayed element t Io>>
t I2>	Operation of the "unbalance" function: time delayed element tI2>
t I2>>	Operation of the "unbalance" function: time delayed element tI2>>
t RTD 1 ALAR	Operation of the RTD1 temperature alarm element: time delayed element tRTD1 ALARM (self-resettable)
t RTD 1 TRIP	Operation of the RTD1 temperature trip element: time delayed element tRTD1 TRIP, and so on for RTD2, RTD3, RTD4, RTD5, RTD6, RTD7, RTD8, RTD9 and RTD10.
t V<	Undervoltage default: tV< time delayed threshold. (P225 only)
t V>	Overvoltage default: tV> time delayed threshold. (P225 only)
tAux1… tAux10	Operation of the auxiliary timer tAux 1.to tAux 10
TH OVERLOAD (thermal overload)	Operation of the «thermal overload» function
Thermist 1	Operation of the Thermist1 temperature element …and so on for Thermist 2 and Thermist 3.
TRIP CIRC. FAIL	Open trip circuit wiring.
VOLTAGE DIP	Load shedding further to a voltage dip. (P225 only)
θ ALARM (thermal alarm)	«Thermal alarm» element active: □ALARM (self-resettable).
θ FORBIDDEN START	«Block start based on thermal criterion» active (self resettable).

BLANK PAGE

COMMISSIONING TEST AND RECORD SHEET

CONTENT

BLANK PAGE

1. RELAY IDENTIFICATION

Commissioning date:

Engineer:

Motor reference:

Circuit-breaker/Fuse-contactor reference:

MiCOM relay type	
Serial number	
Earth current setting range	
Voltage input range	
Auxiliary voltage supply	
Communication protocol	
Language	
Firmware version	

2. INSPECTION

Put a cross after each inspection stage.

Serial number check? ☐

All current transformer shorting switches closed? ☐

Wiring checked against diagram (if available)? ☐

Case earthing link? ☐

Current circuit wirings? ☐

Voltage circuit wiring? ☐

Trip circuit wiring (RL1 relay)? ☐

52a auxiliary contact wired to logic input No1 (EL1)? ☐

RTD’s circuit wirings (if option fitted)? ☐

Analogue output wirings (if option fitted)? ☐

Other circuit wirings ☐

Test block connections checked (if available)? ☐

Auxiliary voltage checked? ☐

Auxiliary voltage magnitude? ☐

Control voltage polarity for logic input checked? ☐

MiCOM relay fully plugged-in to its case? ☐

Meters reset (MEASUREMENTS 2, PROCESS, TRIP STATISTICS and CB MONITORING submenus)? ☐

At the end of the tests, MiCOM relay with the right Setting File? ☐

3. MEASUREMENT VALUE VERIFICATION

	Applied value		Relay value	
Phase A current input	_____	A	_____	A
Phase B current input	_____	A	_____	A
Phase C current input	_____	A	_____	A
Earth current input	_____	A	_____	A
Phase A - phase C voltage input	_____	V	______	V

4. PARAMETERS

4.1 OP. PARAMETERS menu

Password	
Reference	
Frequency	Hz
Date	
Time	

4.2 CONFIGURATION menu

4.2.1 CONFIG. SELECT submenu

Way to switch over active setting group	
Active setting group	
Default display	
Phase rotation	
Start detection criterion	
Analogue output type (optional)	
Value transmitted by the analogue output 1 (optional)	
Maximum analogue output 1 rating (optional)	
Value transmitted by the analogue output 2 (optional)	
Maximum analogue output 2 rating (optional)	
RTD type (optional)	
Thermistor 1 type (optional)	
Thermistor 2 type (optional)	
Thermistor 3 type (optional)	
Time synchronization	
IRIG-B (optional	

4.2.2 CT/VT RATIO submenu

Line CT primary	
Line CT secondary	
Earth/Ground CT primary	
Earth/Ground CT secondary	
Line VT primary (P225 only)	
Line VT secondary (P225 only)	

LED 5, LED 6, LED 7 and LED 8 submenus	LED 5	LED 6	LED 7	LED 8
Allocation: Thermal alarm: θ ALARM				
Allocation: Thermal overload: THERM OVERLOAD				
Allocation: tI>				
Allocation: tI>>				
Allocation: tI>>>				
Allocation: tIo>				
Allocation: tIo>>				
Allocation: tI2>				
Allocation: tI2>>				
Allocation: tI<				
Allocation: Excessive long start: EXCES LONG START				
Allocation: Stalled rotor while running: tIstall				
Allocation: Locked rotor at start: LOCKED ROTOR				
Allocation: Emergency restart: EMERG START				
Allocation: Block start: FORBIDDEN START				
Allocation: $t_{RTD1\ ALARM}$, $t_{RTD2\ ALARM}$, $t_{RTD3\ ALARM}$ (optional)				
Allocation: $t_{RTD1\ TRIP}$, $t_{RTD2\ TRIP}$, $t_{RTD3\ TRIP}$ (optional)				
Allocation: $t_{RTD4\ ALARM}$, $t_{RTD5\ ALARM}$, $t_{RTD6\ ALARM}$ (optional)				
Allocation: $t_{RTD4\ TRIP}$, $t_{RTD5\ TRIP}$, $t_{RTD6\ TRIP}$ (optional)				
Allocation: $t_{RTD7\ ALARM}$, $t_{RTD8\ ALARM}$, $t_{RTD9\ ALARM}$, $t_{RTD10\ ALARM}$ (optional) (P225 only)				
Allocation: $t_{RTD7\ TRIP}$, $t_{RTD8\ TRIP}$, $t_{RTD9\ TRIP}$, $t_{RTD10\ TRIP}$ (optional) (P225 only)				
Allocation: Thermist 1, Thermist 2 , Thermist 3 (optional) (P225 only)				
Allocation: tAux1				
Allocation: tAux2				
Allocation: tAux3				
Allocation: tAux4				
Allocation: tAux5				
Allocation: tAux6				
Allocation: tAux7				
Allocation: tAux8				
Allocation: tAux9				
Allocation: tAux10				
Allocation: Motor halted: MOTOR STOPPED				
Allocation: Motor running: MOTOR RUNNING				

LED 5, LED 6, LED 7 and LED 8 submenus	LED 5	LED 6	LED 7	LED 8
Allocation: Successful start: SUCCESSFUL START				
Allocation: tV< (P225 only)				
Allocation: Load shedding further to a voltage dip: VOLTAGE DIP				
Allocation: tV> (P225 only)				
Allocation: Bus voltage too low to enable a start: BUS VOLTAGE (P225 only)				
Allocation: Auto re-start: AUTO RE-START (P225 only)				
Allocation: CB failure: CB FAIL.				
Allocation: Open trip circuit: TRIP CIRCUIT FAIL				
Allocation: INPUT 1				
Allocation: INPUT 2				
Allocation: INPUT 3				
Allocation: INPUT 4				
Allocation: INPUT 5				
Allocation: INPUT 6				
Allocation: tEqu.A				
Allocation: tEqu.B				
Allocation: tEqu.C				
Allocation: tEqu.D				
Allocation: tEqu.E				
Allocation: tEqu.F				
Allocation: tEqu.G				
Allocation: tEqu.H				

Alarm CONFIG. submenu	EL 6	EL 5	EL 4	EL 3	EL 2	EL 1
Inh; Alarm tAux1	(☐Yes / ☐No)					
Inh; Alarm tAux2	(☐Yes / ☐No)					
Inh; Alarm tAux3	(☐Yes / ☐No)					
Inh; Alarm tAux4	(☐Yes / ☐No)					
Inh; Alarm tAux5	(☐Yes / ☐No)					
Inh; Alarm tAux6	(☐Yes / ☐No)					
Inh; Alarm tAux7	(☐Yes / ☐No)					
Inh; Alarm tAux8	(☐Yes / ☐No)					
Inh; Alarm tAux9	(☐Yes / ☐No)					
Inh; Alarm tAux10	(☐Yes / ☐No)					
Inh; Alarm I<	(☐Yes / ☐No)					
Inh; Alarm tEqu.A	(☐Yes / ☐No)					

Alarm CONFIG. submenu	EL 6	EL 5	EL 4	EL 3	EL 2	EL 1
Inh; Alarm tEqu.B	(☐Yes / ☐No)					
Inh; Alarm tEqu.C	(☐Yes / ☐No)					
Inh; Alarm tEqu.D	(☐Yes / ☐No)					
Inh; Alarm tEqu.E	(☐Yes / ☐No)					
Inh; Alarm tEqu.F	(☐Yes / ☐No)					
Inh; Alarm tEqu.G	(☐Yes / ☐No)					
Inh; Alarm tEqu.H	(☐Yes / ☐No)					

INPUT CONFIG. submenu	EL 6	EL 5	EL 4	EL 3	EL 2	EL 1
Configuration of the logic input active state: INPUT PICK-UP (1: active state when a control voltage is applied on)						
Control voltage type for the logic inputs: CONTROL VOLT						

4.3 COMMUNICATION MODBUS^{TM} menu

Communication enabled?	(☐Yes / ☐No)
Data rate	Bauds
Parity	
Number of stop bits	
Relay address	
Date format configuration	

4.4 COMMUNICATION courier menu

Communication enabled?	(☐Yes / ☐No)
Relay address	

4.5 COMMUNICATION IEC 60870-5-103 menu

Communication enabled?	(☐Yes / ☐No)
Data rate	Bauds
Relay address	

4.6 START criteria

Iutil	In
tIstart	s

4.7 PROTECTION G1 and G2 menus

START CRITERIA submenu	PROTECTION G 1	PROTECTION G 2
I Util	In	In
t Istart	s	s

[49] THERMAL OVERLOAD submenu	PROTECTION G 1	PROTECTION G 2
Thermal overload function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
“Thermal inhibition on starting” function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold Iflc>	In	In
K_e		
T_{e1}	mn	mn
T_{e2}	mn	mn
T_r	mn	mn
RTD1 influence (optional)	(☐Yes / ☐No)	(☐Yes / ☐No)
Thermal alarm enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Thermal alarm θ_{ALARM} threshold	%	%
Block start on thermal base function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
θ FORBID START threshold	%	%

[50/51] PHASE OVERCURRENT submenu	PROTECTION G 1	PROTECTION G 2
First stage phase overcurrent function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I>	In	In
Delay type		
Interlock I>> and I>>>	(☐Yes / ☐No)	(☐Yes / ☐No)
Second stage phase overcurrent function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I>>	In	In
Delay type		
Third stage phase overcurrent function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I>>>	In	In
tI>>>	s	s

[50/51] EARTH FAULT submenu	PROTECTION G 1	PROTECTION G 2
Io> element of the earth fault function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold Io>	Ion	Ion
tIo>		
Io>> element of the earth fault function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold Io>>	Ion	Ion
tIo>>		

[46] UNBALANCE submenu	PROTECTION G 1	PROTECTION G 2
I2> element of the unbalance function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I2>	In	In
tI2>		
I2>> element of the unbalance function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Time multiplier setting TMS I2>>		
Threshold I2>>	In	In

[27] UNDERVOLTAGE submenu (P225 only)	PROTECTION G 1	PROTECTION G 2
Undervoltage function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold V<	V	V
tV<		
Inhibition V< at start	(☐Yes / ☐No)	(☐Yes / ☐No)

[59] OVERVOLTAGE submenu (P225 only)	PROTECTION G 1	PROTECTION G 2
Overvoltage function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold V>	V	V
tV>		

[48] EXCES LONG START submenu	PROTECTION G 1	PROTECTION G 2
Excessive long start function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)

[51LR/50S] BLOCK ROTOR submenu	PROTECTION G 1	PROTECTION G 2
Block rotor function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
tI_{stall}		
Stalled rotor function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I_{stall}	$I\theta$	$I\theta$
Locked rotor at start function enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
Power factor		

[37] LOSS OF LOAD submenu	PROTECTION G 1	PROTECTION G 2
Loss of load function enabled ?	(☐Yes / ☐No)	(☐Yes / ☐No)
Threshold I<	In	In
tI<		
T_{inhib}		

[49] THERMISTOR submenu (optional)	PROTECTION G 1	PROTECTION G 2
Thermistor 1 enabled	(☐Yes / ☐No)	(☐Yes / ☐No)
Thermist 1	kΩ	kΩ
Thermistor 2 enabled	(☐Yes / ☐No)	(☐Yes / ☐No)
Thermist 2	kΩ	kΩ
Thermistor 3 enabled (P225 only)	(☐Yes / ☐No)	(☐Yes / ☐No)
Thermist 3	kΩ	kΩ

[49/38] RTD submenu (optional)	PROTECTION G 1	PROTECTION G 2
RTD1 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD1 ALARM	°C	°C
$t_{RTD1\ ALARM}$		
RTD1 TRIP	°C	°C
$t_{RTD1\ TRIP}$		
RTD2 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD2 ALARM	°C	°C
$t_{RTD2\ ALARM}$		
RTD2 TRIP	°C	°C
$t_{RTD2\ TRIP}$		
RTD3 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD3 ALARM	°C	°C
$t_{RTD3\ ALARM}$		
RTD3 TRIP	°C	°C
$t_{RTD3\ TRIP}$		
RTD4 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD4 ALARM	°C	°C
$t_{RTD4\ ALARM}$		
RTD4 TRIP	°C	°C
$t_{RTD4\ TRIP}$		
RTD5 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD5 ALARM	°C	°C
$t_{RTD5\ ALARM}$		
RTD5 TRIP	°C	°C
$t_{RTD5\ TRIP}$		

[49/38] RTD submenu (optional)	PROTECTION G 1	PROTECTION G 2
RTD6 enabled?	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD6 ALARM	°C	°C
$t_{RTD6\ ALARM}$		
RTD6 TRIP	°C	°C
$t_{RTD6\ TRIP}$		
RTD7 enabled? (P225 only)	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD7 ALARM	°C	°C
$t_{RTD7\ ALARM}$		
RTD7 TRIP	°C	°C
$t_{RTD7\ TRIP}$		
RTD8 enabled? (P225 only)	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD8 ALARM	°C	°C
$t_{RTD8\ ALARM}$		
RTD8 TRIP	°C	°C
$t_{RTD8\ TRIP}$		
RTD9 enabled? (P225 only)	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD9 ALARM	°C	°C
$t_{RTD9\ ALARM}$		
RTD9 TRIP	°C	°C
$t_{RTD9\ TRIP}$		
RTD10 enabled? (P225 only)	(☐Yes / ☐No)	(☐Yes / ☐No)
RTD10 ALARM	°C	°C
$t_{RTD10\ ALARM}$		
RTD10 TRIP	°C	°C
$t_{RTD10\ TRIP}$		

4.8 AUTOMAT. CTRL menu

4.8.1 [66] START NUMBER submenu

Start Number Limitation function enabled?	(☐Yes / ☐No)
T reference	mn
Hot start number	
Cold start number	
T Interdiction	mn

4.8.2 MIN TIME BETW 2 START submenu

Time Between Start function enabled?	(☐Yes / ☐No)
T betw 2 start	mn

4.8.3 REACCEL AUTHORIZ submenu

Re-acceleration authorisation function enabled?	(☐Yes / ☐No)
Detection Volt Dip VOLTAGE	
Voltage dip detection threshold: Detection V DIP (P225 only)	V
Voltage restoration threshold: Restoration V DIP (P225 only)	V
VOLTAGE DIP DURAT Treacc	s
AUTO RE-START function enabled? (P225 only)	(☐Yes / ☐No)
Treac-long	s
Treac-shed	s

4.8.4 INPUTS submenu

Allocation: input n°2	
Allocation: input n°3	
Allocation: input n°4	
Allocation: input n°5	
Allocation: input n°6	
Auxiliary timer tAux1 =	s
Auxiliary timer tAux2 =	s
Auxiliary timer tAux3 =	s
Auxiliary timer tAux4 =	s
Auxiliary timer tAux5 =	s
Auxiliary timer tAux6 =	s
Auxiliary timer tAux7 =	s
Auxiliary timer tAux8 =	s
Auxiliary timer tAux9 =	s
Auxiliary timer tAux10 =	s

4.8.5 LOGIC EQUATION submenu

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	

4.8.6 AUX OUTPUT RLY submenu

Aux output rly	D	C	B	A
Allocation: Thermal overload: THERM OVERLOAD				
Allocation: Thermal alarm: θ ALARM				
Allocation: Block start: FORBIDDEN START				
Allocation: I>				
Allocation: tI>				
Allocation: I>>				
Allocation: tI>>				
Allocation: I>>>				
Allocation: tI>>>				
Allocation: Io>				
Allocation: tIo>				
Allocation: Io>>				
Allocation: tIo>>				
Allocation: tI2>				
Allocation: tI2>>				
Allocation: Excessive long start: EXCES LONG START				
Allocation: Stalled rotor while running: tIstall				
Allocation: Locked rotor at start: LOCKED ROTOR				
Allocation: tI<				
Allocation: START NB LIMIT				
Allocation: T betw 2 start				
Allocation: tAux1				
Allocation: tAux2				
Allocation: tAux3				
Allocation: tAux4				
Allocation: tAux5				
Allocation: tAux6				
Allocation: tAux7 (optional)				
Allocation: tAux8 (optional)				
Allocation: tAux9 (optional)				
Allocation: tAux10 (optional)				
Allocation: Anti backspin (ABS)				
Allocation: tV< (P225 only)				
Allocation: Load shedding further to a voltage dip: VOLTAGE DIP				
Allocation: tV>				

Aux output rly	D	C	B	A
Allocation: Bus voltage too low to enable a start: BUS VOLTAGE (P225 only)				
Auto Re-start (P225 only)				
Allocation CLOSE ORDER				
Allocation TRIP ORDER				
Allocation ORDER 1				
Allocation ORDER 2				
Allocation SUCCESS START				
Allocation: tEqu.A				
Allocation: tEqu.B				
Allocation: tEqu.C				
Allocation: tEqu.D				
Allocation: tEqu.E				
Allocation: tEqu.F				
Allocation: tEqu.G				
Allocation: tEqu.H				
Allocation: CB OPEN TIME				
Allocation: CB OPER NB				
Allocation: S A n				
Allocation: CB failure: CB FAIL.				
Allocation: Open trip circuit: TRIP CIRCUIT FAIL				
Allocation: GROUP 2 ACTIVE				
Allocation: Input 1				
Allocation: Input 2				
Allocation: Input 3				
Allocation: Input 4				
Allocation: Input 5				
Allocation: Input 6				
Allocation: Input 7 (optional)				
Allocation: Input 8 (optional)				
Allocation: Input 9 (optional)				
Allocation: Input 10 (optional)				
Allocation: Input 11 (optional)				
Allocation: $t_{RTD1\ ALARM}$ (optional)				
Allocation: $t_{RTD1\ TRIP}$ (optional)				
Allocation: $t_{RTD2\ ALARM}$ (optional)				
Allocation: $t_{RTD2\ TRIP}$ (optional)				
Allocation: $t_{RTD3\ ALARM}$ (optional)				
Allocation: $t_{RTD3\ TRIP}$ (optional)				

Aux output rly	D	C	B	A
Allocation: t $_{RTD4\ ALARM}$ (optional)				
Allocation: t $_{RTD4\ TRIP}$ (optional)				
Allocation: t $_{RTD5\ ALARM}$ (optional)				
Allocation: t $_{RTD5\ TRIP}$ (optional)				
Allocation: t $_{RTD6\ ALARM}$ (optional)				
Allocation: t $_{RTD6\ TRIP}$ (optional)				
Allocation: t $_{RTD7\ ALARM}$ (optional) (P225 only)				
Allocation: t $_{RTD7\ TRIP}$ (optional) (P225 only)				
Allocation: t $_{RTD8\ ALARM}$ (optional) (P225 only)				
Allocation: t $_{RTD8\ TRIP}$ (optional) (P225 only)				
Allocation: t $_{RTD9\ ALARM}$ (optional) (P225 only)				
Allocation: t $_{RTD9\ TRIP}$ (optional) (P225 only)				
Allocation: t $_{RTD10\ ALARM}$ (optional) (P225 only)				
Allocation: t $_{RTD10\ TRIP}$ (optional) (P225 only)				
Allocation: Thermist 1 (option)				
Allocation: Thermist 2 (option)				
Allocation: Thermist 3 (option) (P225 only)				

4.8.7 LATCH AUX OUTPUT RLY submenu

Latching of RL2 relay: LATCH RL2	(☐Yes / ☐No)
Latching of RL3 relay: LATCH RL3	(☐Yes / ☐No)
Latching of RL4 relay: LATCH RL4	(☐Yes / ☐No)
Latching of RL5 relay: LATCH RL5	(☐Yes / ☐No)

4.8.8 TRIP OUTPUT RLY submenu

Allocation: Thermal overload: THERM OVERLOAD	(☐Yes / ☐No)
Allocation: Thermal alarm: θ ALARM	(☐Yes / ☐No)
Allocation: tI>	(☐Yes / ☐No)
Allocation: tI>>	(☐Yes / ☐No)
Allocation: tI>>>	(☐Yes / ☐No)
Allocation: tIo>	(☐Yes / ☐No)
Allocation: tIo>>	(☐Yes / ☐No)
Allocation: tI2>	(☐Yes / ☐No)
Allocation: tI2>>	(☐Yes / ☐No)
Allocation: Excessive long start: EXCES LONG START	(☐Yes / ☐No)
Allocation: Stalled rotor while running: tIstall	(☐Yes / ☐No)
Allocation: Locked rotor at start: LOCKED ROTOR	(☐Yes / ☐No)
Allocation: tI<	(☐Yes / ☐No)

Allocation: t Aux1	(☐Yes / ☐No)
Allocation: t Aux2	(☐Yes / ☐No)
Allocation: t Aux3	(☐Yes / ☐No)
Allocation: t Aux4	(☐Yes / ☐No)
Allocation: t Aux5	(☐Yes / ☐No)
Allocation: t Aux6	(☐Yes / ☐No)
Allocation: t Aux7	(☐Yes / ☐No)
Allocation: t Aux8	(☐Yes / ☐No)
Allocation: t Aux9	(☐Yes / ☐No)
Allocation: t Aux10	(☐Yes / ☐No)
Allocation: $t_{RTD1\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD1\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD2\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD2\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD3\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD3\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD4\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD4\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD5\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD5\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD6\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD6\ TRIP}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD7\ ALARM}$ (optional)	(☐Yes / ☐No)
Allocation: $t_{RTD7\ TRIP}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD8\ ALARM}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD8\ TRIP}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD9\ ALARM}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD9\ TRIP}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD10\ ALARM}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: $t_{RTD10\ TRIP}$ (optional) (P225 only)	(☐Yes / ☐No)
Allocation: Thermist 1 (optional)	(☐Yes / ☐No)
Allocation: Thermist 2 (optional)	(☐Yes / ☐No)
Allocation: Thermist 3 (optional) (P225 only)	(☐Yes / ☐No)
Allocation EQUATION A	(☐Yes / ☐No)
Allocation EQUATION B	(☐Yes / ☐No)
Allocation EQUATION C	(☐Yes / ☐No)
Allocation EQUATION D	(☐Yes / ☐No)
Allocation EQUATION E	(☐Yes / ☐No)
Allocation EQUATION F	(☐Yes / ☐No)
Allocation EQUATION G	(☐Yes / ☐No)

Allocation EQUATION H	(☐Yes / ☐No)
Allocation: tV< (P225)	(☐Yes / ☐No)
Allocation: Load shedding further to a voltage dip: VOLTAGE DIP	(☐Yes / ☐No)
Allocation: tV> (P225)	(☐Yes / ☐No)

4.8.9 LATCH TRIP ORDER submenu (RL1 relay latching on)

LATCH Thermal overload: THERM OVERLOAD ?	(☐Yes / ☐No)
LATCH Thermal alarm: θ ALARM ?	(☐Yes / ☐No)
LATCH tI> ?	(☐Yes / ☐No)
LATCH tI>> ?	(☐Yes / ☐No)
LATCH tI>>> ?	(☐Yes / ☐No)
LATCH tIo> ?	(☐Yes / ☐No)
LATCH tIo>> ?	(☐Yes / ☐No)
LATCH tI2> ?	(☐Yes / ☐No)
LATCH tI2>> ?	(☐Yes / ☐No)
LATCH Excessive long start: EXCES LONG START ?	(☐Yes / ☐No)
LATCH Stalled rotor while running: tIstall ?	(☐Yes / ☐No)
LATCH Locked rotor at start: LOCKED ROTOR ?	(☐Yes / ☐No)
LATCH tI< ?	(☐Yes / ☐No)
LATCH t Aux1 ?	(☐Yes / ☐No)
LATCH t Aux2 ?	(☐Yes / ☐No)
LATCH t Aux3 ?	(☐Yes / ☐No)
LATCH t Aux4 ?	(☐Yes / ☐No)
LATCH t Aux5 ?	(☐Yes / ☐No)
LATCH t Aux6 ?	(☐Yes / ☐No)
LATCH t Aux7 ?	(☐Yes / ☐No)
LATCH t Aux8 ?	(☐Yes / ☐No)
LATCH t Aux9 ?	(☐Yes / ☐No)
LATCH t Aux10 ?	(☐Yes / ☐No)
LATCH $t_{RTD1\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD1\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD2\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD2\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD3\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD3\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD4\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD4\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD5\ ALARM}$ (optional) ?	(☐Yes / ☐No)

LATCH $t_{RTD5\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD6\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD6\ TRIP}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD7\ ALARM}$ (optional) ?	(☐Yes / ☐No)
LATCH $t_{RTD7\ TRIP}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD8\ ALARM}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD8\ TRIP}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD9\ ALARM}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD9\ TRIP}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD10\ ALARM}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH $t_{RTD10\ TRIP}$ (optional) (P225 only) ?	(☐Yes / ☐No)
LATCH Thermist 1 (optional) ?	(☐Yes / ☐No)
LATCH Thermist 2 (optional) ?	(☐Yes / ☐No)
LATCH Thermist 3 (optional) (P225 only) ?	(☐Yes / ☐No)
Allocation EQUATION A ?	(☐Yes / ☐No)
Allocation EQUATION B ?	(☐Yes / ☐No)
Allocation EQUATION C ?	(☐Yes / ☐No)
Allocation EQUATION D ?	(☐Yes / ☐No)
Allocation EQUATION E ?	(☐Yes / ☐No)
Allocation EQUATION F ?	(☐Yes / ☐No)
Allocation EQUATION G ?	(☐Yes / ☐No)
Allocation EQUATION H ?	(☐Yes / ☐No)
LATCH tV< (P225) ?	(☐Yes / ☐No)
LATCH Load shedding further to a voltage dip: VOLTAGE DIP ?	(☐Yes / ☐No)
LATCH tV> (P225) ?	(☐Yes / ☐No)

4.8.10 CB FAIL menu

CB FAIL submenu

CB FAIL function enabled?	(☐Yes / ☐No)
Threshold I< BF	In
t BF	

4.8.11 ANTI BACKSPIN menu

ABS submenu (anti backspin)

ABS function enabled?	(☐Yes / ☐No)
t ABS	mn

4.8.12 BUS VOLTAGE CONTROL menu

BUS VOLTAGE CTRL submenu (P225 only)

Bus voltage control function enabled?	(☐Yes / ☐No)
Threshold V BUS	V

4.8.13 CB SUPERVISION submenu

Trip circuit supervision function enabled?	(☐Yes / ☐No)
t SUP	
CB opening time function enabled?	(☐Yes / ☐No)
CB opening time	
CB operation number function enabled?	(☐Yes / ☐No)
CB operation number	
S A n function enabled?	(☐Yes / ☐No)
S A n	
Exponent n value	
Trip T	
Close T	

4.9 RECORD menu

4.9.1 DISTURB RECORD submenu

Pre-Time	
Post-Time	
Disturbance Record Trig	

BLANK PAGE

HARDWARE/SOFTWARE VERSION P220 P225 HISTORY AND COMPATIBILITY

CONTENTS

BLANK PAGE

1. P22X PHASE I HARDWARE/SOFTWARE HISTORY

Software Version	Date of Issue	Full Description of Changes	P220	P225
V6.C	09/2004	**Fixed Defects**		
		- Correction of probe acquisition bug and non-pertinent occurrence of the alarm "RTD/Th fugitive".	X	X
		- Modification to fix upload program for FPGA of new CPU board (index E or higher). (This problem affects all Px2x products equipped with this CPU board).	X	X
		- Correction of a small-time difference between analogue and digital channels.	X	X
		- Some polish texts are corrected.	X	X
		- Trouble of initialisation of CB FAIL function at boot.	X	X
V6.D	07/2007	**Software changes implemented in this version**		
		- Avoids non-significant power measurement when Current or Voltage are near zero.		X
		Fixed defects		
		- Analogue outputs set on Uac don't have a good scale.		X
		- K-BUS/Courier rear port, extraction of disturbance: The amplitude is decreased by a factor square root (RMS unit).	X	X
		- IEC 61870-5-103 communication, the processing of Start In event is not correct.	X	X
		- The processing of Start In event is not correct.	X	X
		- The assignment of the disturbance start information to the logic input number 6 does not work.	X	X
		- The upload of disturbance Uac channel is missing in IEC 61870-5-103 communication.		X
		- The scale factor RFA of IEC 61870-5-103 disturbance upload is false.	X	X
V6.E	11/2007	**Fixed Defects**		
		- Risk of inconsistency between the content of a backup SRAM zone and the corresponding checksum after an update operation.		X
V6.F	06/2008	**Fixed Defects**		
		- Inconsistent HMI for Inputs assignation to relays.	X	X
V6.G	12/2008	**Fixed Defects**		
		- P220 and P225 loose its number of starts count when setting group is changed.	X	X

Software Version	Date of Issue	Full Description of Changes	P220	P225
V6.H	09/2009	**Fixed Defects**		
		- with COURIER, the setting of nominal frequency to 60 Hz by MODBUS in front panel is incorrect.	X	X
		- Protocol COURIER/KBUS: the mode calibration TC doesn't work. It affects only the test bench of the industrialization.	X	X
		- COURIER protocol, the date-and-time synchronisation message sent to the relay address is not processed correctly.	X	X
		- Input 6 can’t be affected to disturbance Trigger.	X	X
		- Starting current is sometime not readable.	X	X
V6.I	05/2010	**Fixed Defects**		
		- AUTOMAT.CTRL ->INPUT the VOLT.DIP cannot be downloaded by Modbus.		X
		- tV<, tV> mapping to the Latch trip order doesn't work correctly.		X
		- The Threshold of RTD10 Alarm is not initialized when modified by Modbus.		X
		- The actual operation time of RTD10 Alarm is inconsistent with the setting value.		X
		- The motor run hours are not correct when motor stops and starts again.	X	X
V6.J	12/2010	**Software changes implemented in this version**		
		- Schneider Electric rebranding of the HMI and Communication protocols.	X	X
V7.A	05/2011	**Fixed Defects**		
		- Powers as P and Q as well as voltage are not reported over IEC 61870-5-103 protocol P225 Phase I.		X

2. P22X PHASE II HARDWARE/SOFTWARE HISTORY

Software Version	Date of Issue	Full Description of Changes	P220	P225
V10.B	07/2010	**Software changes implemented in this version**		
		- First software version of the hardware phase II of P22x products.	X	X
V10.C	11/2010	**Software changes implemented in this version**		
		- Rebranded with Schneider Electric	X	X
		Fixed DTS		
		- Active power and reactive power cannot be extracted by IEC 60870-5-103 protocol.	X	X
		- On P22x phase II with COURIER protocol, when more than one fault record, the data associated to a fault extracted by automatic manner is not correct.	X	X
		- In Modbus protocol, it takes a long time to read a specific event whose number does not exist because P22x do not return error code.	X	X
		- When bit of flag of event is beyond 12, bit of flag of extracted event cannot be displayed correctly on P22x with courier protocol.	X	X
V11.A	05/2012	**Hardware Changes implemented in this version**		
		- optional boards for additional 5DI + 2nd RS485 + IRIG-B	X	X
		- optional board for 3 Voltage Inputs		X
		Software changes implemented in this version		
		- support language Portuguese	X	X
		- support Boolean Logic Equation (logic gate AND, OR, NOT)	X	X
		- improvement on "Lock rotor" for the application when motor start without speed sensor	X	X
		Fixed DTS		
		- Send a maintenance mode enabling order to the relay via Modbus command 5 to enter maintenance mode, the relay should raise a software alarm "MAINTENANCE MODE", but a hardware alarm "DEFAULT SETTINGS" is raised.	X	X
		- Send a "Reset LEDs" order via IEC 60870-5-103 Command to the relay, LEDs still light.	X	X
		- In IEC 60870-5-103 protocol communication the status of "Logic Input 6" is not included in "Status Indications" when the relay responds the ASDU 1 message.	X	X
		- When extracting disturbance record via IEC 60870-5-103 protocol, the information of t I> and t I>>> are not included in communication logic values.	X	X
		- In Russian language, at menu INPUT ST 654321, the input status in second row does not match the input number in the first row of the relay on LCD.	X	X
		- After download software, trip output is set contingently.	X	X
		- Fault phase indication isn't correct when IDMT curve is applied for a fault with 3-phase unbalanced current but all above setting threshold.	X	X

Software Version	Date of Issue	Full Description of Changes	P220	P225
V11.B	08/2013	**Changes implemented in this version** - Optional Ethernet board with 2 RJ45 port, support Modbus TCP/IP, or IEC103 (for China market) **Fixed DTS** - Bad spelling of "arret moteur" in French language. - Operating time of 2nd stage (inverse time characteristic) of Unbalance protection (I2>>) is not in line with the given characteristic in user manual for small I2	 X X	X X X
V11.C	05/2014	**Fixed DTS** - Thermal state value which is used by protection calculation cannot be reset when THERMAL OVERLOAD (49) function is disabled. CCHS number is RJUS-0006	X	X
V12.A	10/2014	**Fixed DTS** - No alarm will indicate internal failure of the RTD board, CCHS number is DCHA-0007 - The S1 studio cannot display correct Major Hardware Alarm Event Info Bit. Such as: Loss of setting; Main power supply; Auxiliary Power Supply; Transformer Offset.	X X	X X
V12.B	04/2016	**Software changes implemented in this version** - Improved monitoring function on the RTD board	X	X

Customer Care Centre

http://www.schneider-electric.com/CCC

Schneider Electric

35 rue Joseph Monier
92506 Rueil-Malmaison
FRANCE

Phone: +33 (0) 1 41 29 70 00
Fax: +33 (0) 1 41 29 71 00

www.schneider-electric.com

Publication: P22x/EN M/G66

Publishing: Schneider Electric
01/2018