MiCOM P120/P121/P122 & P123

Overcurrent Relays

Version 6

Technical Guide

P12x/EN T/E65

MiCOM P120/P121/P122 & P123 OVERCURRENT RELAYS TECHNICAL GUIDE

CONTENTS

Safety instructions	**Px2xxEN SSA11**
Introduction	**P12x/EN IT**
Handling, installation and case dimensions	**P12x/EN IN**
User guide	**P12x/EN FT**
Menu content tables	**P12x/EN HI**
Technical data and curve characteristics	**P12x/EN TD**
Application Guide	**P12x/EN AP**
Modbus Database	**P12x/EN CT**
Commissioning and maintenance guide	**P12x/EN CM**
Connection diagrams	**P12x/EN CO**
Commissioning test and setting records sheets	**P12x/EN RS**
Hardware/Software version history and compatibility	**P12x/EN VC**

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SAFETY SECTION

CONTENT

1. SAFETY INSTRUCTIONS 3

2. INSTALLATION, COMMISSIONING AND MAINTENANCE 4

3. OPERATING CONDITIONS OF THE MiCOM RELAY 4

3.1 Replacement of the batteries 4

3.2 Current transformer circuits 4

3.3 Dielectric withstand test 4

4. REMOVAL AND DESTRUCTION OF THE MiCOM RELAY 5

5. TECHNICAL SPECIFICATIONS 5

BLANK PAGE

1. SAFETY INSTRUCTIONS

For your safety, please read these instructions before doing any work on the MiCOM relay.

Health and safety

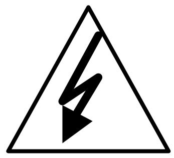
The safety instructions described in this document are intended to guarantee correct installation and use of the MiCOM relay and to avoid any damage. All persons directly or indirectly concerned with the use of these devices must be familiar with these safety instructions.

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:

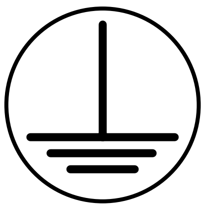
Important:

refer to the product documentation

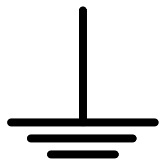


Important:

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.

2. INSTALLATION, COMMISSIONING AND MAINTENANCE

Connection of the MiCOM relay

The personnel in charge of the installation, commissioning and maintenance of a MiCOM 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 energisation, the MiCOM 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 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.

3. OPERATING CONDITIONS OF THE MiCOM RELAY

The operation of the MiCOM relay must comply with the electrical and environmental requirements described in this document.

3.1 Replacement of the batteries

The internal batteries, if used, must be replaced by batteries corresponding to the type recommended. They must be installed with the correct polarity, to avoid any risk of damage to the equipment.

3.2 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.

3.3 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.

4. REMOVAL AND DESTRUCTION OF THE MiCOM RELAY

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.

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.

5. 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.

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Introduction

CONTENTS

1. INTRODUCTION 3

2. HOW TO USE THIS MANUAL 3

3. INTRODUCTION TO THE MiCOM P120, P121, P122 & P123 RELAYS 4

4. MAIN FUNCTIONS 5

5. EQUIVALENCE TABLES 6

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1. INTRODUCTION

The overcurrent relays of the **MiCOM P120 range** are ALSTOM universal overcurrent relays. The **MiCOM P120, P121, P122** and **P123** relays have been designed to control, protect and monitor industrial installations, public distribution networks and substations, and to be used as back-up protection for EHV and HV transmission networks.

2. HOW TO USE THIS MANUAL

This manual provides a description of the **MiCOM P120, P121, P122** and **P123** functions and settings. It enables the user to become familiar with the application, installation, setting and commissioning of these relays.

This manual has the following format :

P12x/EN IT *Introduction*

Contents of the manual and general introduction to the **MiCOM P120 range** of relays covered by the Guide.

P12x/EN IN *Handling, installation and case dimensions*

Precautions to be taken when handling electronic equipment.

P12x/EN FT *User Guide of **MiCOM P120, P121, P122** and **P123** relays*

A detailed description of the features of the **MiCOM P120 range** of relays.

P12x/EN TD *Technical data and curve characteristics*

Comprehensive details on nominal values, setting ranges, specifications and curves characteristics

P12x/EN CM *Commissioning and Maintenance Guide*

Guide to commissioning, problem solving and maintenance of **MiCOM P120, P121, P122** and **P123**.

P12x/EN CO *Connection diagrams for **MiCOM P120/P121** and **P122/P123***

P12x/EN RS *Commissioning test records*

P12x/EN VC *Hardware/Software version history*

P12x/EN CT *Communication mapping data bases*

3. INTRODUCTION TO THE MiCOM P120, P121, P122 & P123 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 relays from the **MiCOM P120 range** are fully compatible and use the same modular box concept. The **MiCOM P120 range** of relays provides more protection for the most demanding applications.

Each relay has a large number of functions for controlling and collecting data. This can form part of a fully integrated system covering protection, control, instrumentation, data acquisition and the recording of faults, events and disturbances. The relays are equipped on the front panel with a liquid crystal display (LCD) with 2 x 16 back-lit alphanumerical characters, a tactile 7 button keypad (to gain access to all the parameters, alarms and measurements) and 8 LEDs simply displaying the state of the **MiCOM P120, P121, P122** and **P123** relays. In addition, the use of the RS485 communication port makes it possible to read, reinitialise and change the settings of the relays, if required, from a local or remote PC computer equipped with the software MiCOM S1.

Its flexibility of use, reduced maintenance requirements and ease of integration allow the MiCOM P120 range to provide an evolving solution for the problems of the protection of electric networks.

The **MiCOM P120, P121, P122** and **P123** relays provide comprehensive overcurrent phase and earth fault protection for utilities networks, industrial plants and networks in addition to other applications where overcurrent protection is required. The earth fault protection is sufficiently sensitive for electric networks in which the earth fault current is low.

4. MAIN FUNCTIONS

The following table shows the functions available in the various models of the **MiCOM P120 range** of relays.

Functions	ANSI Code	MiCOM P120	MiCOM P121	MiCOM P122	MiCOM P123
Single-phase overcurrent	50/51 or 50N/51N	X			
Three-phase overcurrent	50/51		X	X	X
Earth fault overcurrent	50N/51N	X	X	X	X
Restricted Earth fault	64N	X	X	X	X
Thermal overload (True RMS)	49			X	X
Undercurrent	37			X	X
Negative sequence overcurrent	46			X	X
Broken conductor detection				X	X
Cold load pickup				X	X
Instantaneous/start contact		X	X	X	X
Latching output contacts	86	X	X	X	X
Setting groups		1	1	2	2
Circuit breaker failure detection	50BF			X	X
Trip circuit supervision				X	X
Circuit Breaker monitoring and control				X	X
Blocking logic		X	X	X	X
Selective relay scheme logic				X	X
Multi-shot autoreclose	79				X
Clock phase and anti-clock phase rotation operation				X	X
Measurements (True RMS)		X	X	X	X
Peak and rolling values				X	X
Event records				X	X
Fault records				X	X
Instantaneous records				X	X
Disturbance records				X	X
RS 232 front communication				X	X
RS 485 rear communication		X	X	X	X

5. EQUIVALENCE TABLES

The following section describes the models of the **MiCOM P120 range** together with other existing relays in the ALSTOM and GEC-ALSTHOM catalogues :

K range	MIDOS range	TROPIC2 range	MiCOM range
KCGG 110, 122 KCGU 110	MCAG 11, 12 MCGG 22 MCSU MCTD 01 MCTI 14	TA 1xxx, 1220B TAH 111x TAS 1xxx	**P120**
KCGG 11x, 12x,13x, 14x KCGU 11x, 14x	MCAG 1x, 3x MCGG 22, 42, 5x MCGG 6x, 82 MCSU MCTD 01 MCTI 14, 34, 44	TA 1xxx, 2xxx, 3xxx TA 2220B TA 521x, 5320R TAS 1xxx, 2xxx, 3xxx TAS 5xxx, 6xxx	**P121**
KCGG 11x, 12x,13x, 14x KCGU 11x, 14x	MCAG 1x, 3x MCGG 22, 42, 5x MCGG 6x, 82 MCSU MCTD 01 MCHD 04 MCTI 14, 34, 44 MCTI 15, 35	TA 1xxx, 2xxx, 3xxx TA 2220B TA 521x, 5320R TAS 1xxx, 2xxx, 3xxx TAS 5xxx, 6xxx TAT xxx TR 1x, TR 2x	**P122**
KCGG 120, 130, 140 KCGG 141, 142 KCGU 140 KVTR	MCAG 1x, 3x MCGG 22, 42, 5x MCGG 6x, 82 MCSU MCTD 01 MCHD 04 MCND 04 MCTI 14, 34, 44 MCTI 15, 35 MVAX 12, 21, 31, 91 MVTR 51, 52	TA 1xxx, 2xxx, 3xxx TA 2220B TA 521x, 5320R TAS 1xxx, 2xxx, 3xxx TAS 5xxx, 6xxx TAT xxx TR 1x, TR 2x TOLD TE 3000	**P123**

FUNCTIONAL EQUIVALENCE TABLE BETWEEN ALSTOM **MiCOM P120** RANGE OF RELAYS *AND THE FORMER ALSTOM OR GEC-ALSTHOM RANGES*

Handling, Installation and Case Dimensions

CONTENTS

1.	**GENERAL CONSIDERATIONS**	**3**
1.1	**Receipt of relays**	**3**
1.2	**Electrostatic discharge (ESD)**	**3**
2.	**HANDLING OF ELECTRONIC EQUIPMENT**	**3**
3.	**RELAY MOUNTING**	**4**
4.	**UNPACKING**	**4**
5.	**STORAGE**	**4**
6.	**DIMENSIONS**	**5**
6.1	**Connection of power terminals, and Signals terminals**	**5**
6.2	**Communication port RS485**	**6**
6.3	**Earthing**	**6**
7.	**CASE DIMENSIONS**	**7**

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1. GENERAL CONSIDERATIONS

1.1 Receipt of relays

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

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

1.2 Electrostatic discharge (ESD)

The relays use components that are sensitive to electrostatic discharges.

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

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

2. HANDLING OF ELECTRONIC EQUIPMENT

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

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

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

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

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

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

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

3. RELAY MOUNTING

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

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

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

4. UNPACKING

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

5. STORAGE

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

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

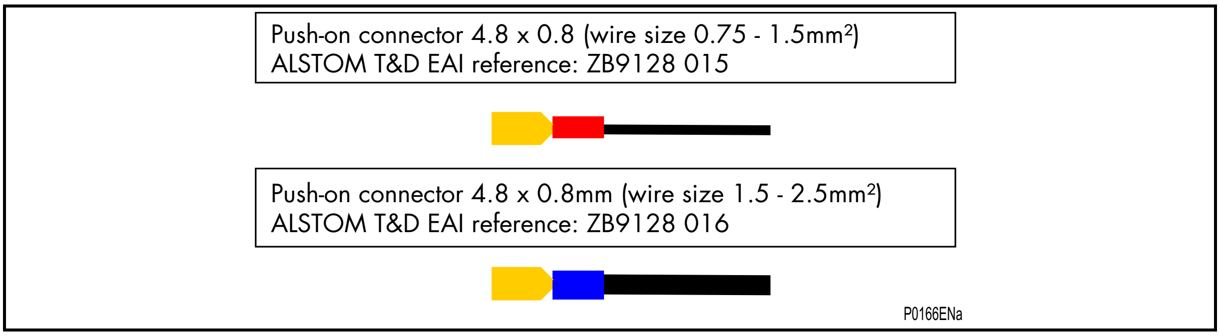
Storage temperature : –25°C to +70°C.

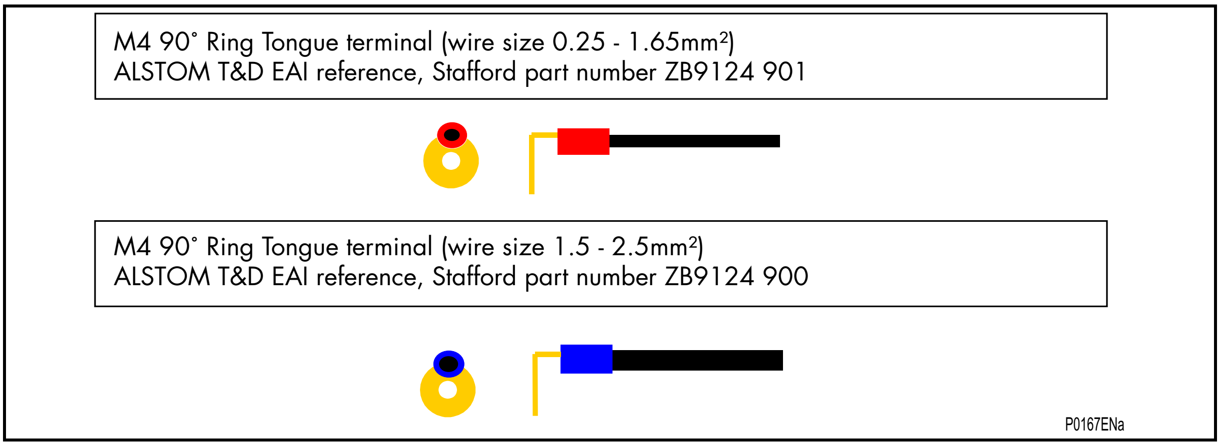
6. DIMENSIONS

6.1 Connection of power terminals, and Signals terminals

The individual equipment are delivered with sufficient M4 screws to connect the relay via annular terminals, with a maximum recommended of two annular terminals per contact.

If necessary, ALSTOM can provide annular terminals to crimp. 5 references exist according to the section of the wire (see below). Each reference corresponds to a sachet of 100 terminals.





To insure the insulation of the terminals and to respect the security and safety instructions, an isolated sleeve can be used.

We recommend the following cable cross-sections:

–	Auxiliary sources	Vaux : 1.5 mm^2
–	Communication Port	see paragraph 6.2
–	Other circuits	1.0 mm^2

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

All the terminal blocks used for connections, except of the port RS485, must be able to withstand a nominal voltage of minimum 300V peak value.

We recommend to protect the auxiliary source connection by using a fuse of type NIT or TIA with a breaking capacity of 16A. For security reasons, do never install fuses in current transformers circuits. The other circuits must be protected by fuses.

6.2 Communication port RS485

Connections to RS485 is made using annular terminals. It is recommended that a two core screened cable, is used with a maximum total length of 1000 m or a200nF total cable capacitance.

Typical specification:

–	Each core :	16/0.2 mm copper conductor, PVC insulated.
–	Nominal conductor area :	0.5 mm^2 per core
–	Screen :	Overall braid, PVC sheathed

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

6.3 Earthing

Each equipment must be connected to a local earth terminal by the intermediary of a M4 earth terminals. We recommend a wire of minimal section of 2,5 mm^2, with annular terminals on the side of the equipment. Because of the limitations of the annular terminals, the possible maximum section is of 6mm^2 by wire. If a larger section is necessary, one can use cables connected in parallel, each one ending with an annular terminal separated on the side of the equipment. One can also use a metal bar.

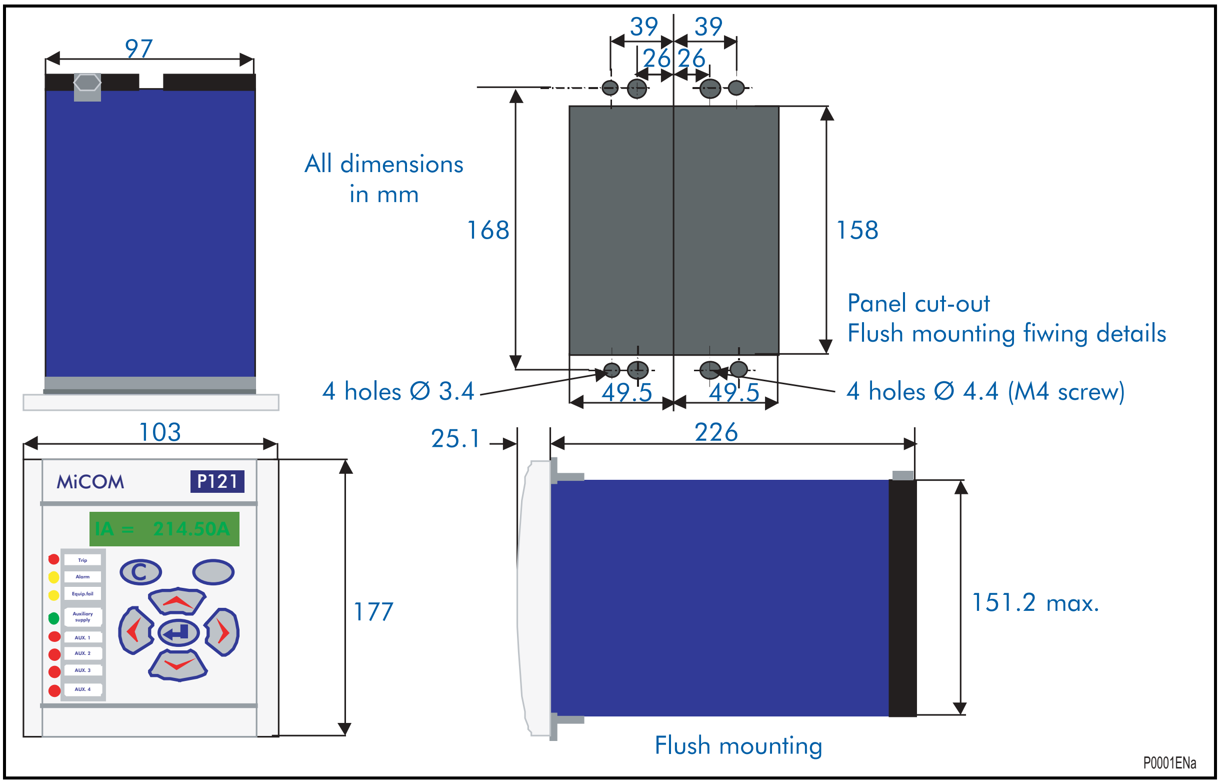
NOTE: To prevent any electrolytic risk between copper conductor or brass conductor and the back plate of the equipment, it is necessary to take precautions to isolate them one from the other. This can be done in several ways, for example by inserting between the conductor and the case a plated nickel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

7. CASE DIMENSIONS

MiCOM P120, P121, P122 and **P123** relays are available in a 4U metal case for panel or flush mounting.

Weight : 1.7 to 2.1 Kg

External size :			
	Height	case	152 mm
		front panel	177 mm
	Width	case	97 mm
		front panel	103 mm
	Depth	case	226 mm
		front panel + case	252 mm



MiCOM P120, P121, P122 AND P123 RELAYS CASE DIMENSIONS

NOTE : For flush mounting, use the screws supplied by Alstom with head diameter smaller than the hole of the front face, otherwise the active part will not be plugged properly (do not add washers).

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User Guide

CONTENTS

1. DESCRIPTION OF THE MiCOM P120, P121, P122 AND P123 RELAYS 5

2. USER INTERFACE 6

2.1 LCD display and keypad description 6

2.1.1 LCD display 6

2.1.2 Keypad 6

2.1.2.1 ALARM keys 6

2.1.2.2 Programming keypad 7

2.2 LEDs 7

2.3 The two areas under the top and bottom flaps 8

2.4 The battery box 9

3. MENUS 10

3.1 Default display 10

3.2 Access to the menu 10

3.3 Password 10

3.3.1 Password protection 10

3.3.2 Entering the password 10

3.3.3 Changing the password 11

3.4 ALARM display 11

3.4.1 Electrical system ALARMS 12

3.4.2 Relay Hardware or Software ALARMS 14

3.5 Menu contents description 15

3.5.1 OP PARAMETERS Menu 18

3.5.1.1 P121, P122 and P123 additional OP.PARAMETERS Menu 19

3.5.1.2 P122 and P123 additional OP.PARAMETERS Menu 19

3.5.2 CONFIGURATION Menu 20

3.5.2.1 DISPLAY sub-menu 20

3.5.2.2 CT RATIO sub-menu 21

3.5.2.3 LED 5 to 8 configuration sub-menus 21

3.5.2.4 Group. Select sub-menu (**P122 & P123** only) 26

3.5.2.5 Alarms sub-menu (**P122 & P123** only) 26

3.5.2.6 Configuration inputs sub-menu (**P122** & **P123** only) 27

3.5.2.7 Configuration Relays Maintenance sub-menu (**P122** & **P123** only) 28

3.5.2.8 Configuration Phase Rotation sub-menu (**P122** & **P123** only) 28

3.5.3 MEASUREMENTS Menu 29
3.5.3.1 **P122** & **P123** additional MEASUREMENTS Menu 29
3.5.3.2 **P123** additional MEASUREMENTS Menu 32
3.5.4 COMMUNICATION Menu 32
3.5.4.1 MODBUS COMMUNICATION Menu 33
3.5.4.2 Courier COMMUNICATION Menu 33
3.5.4.3 IEC 60870-5-103 COMMUNICATION Menu 34
3.5.4.4 DNP3 COMMUNICATION Menu 34
3.5.5 PROTECTION Menu 35
3.5.5.1 [50/51] Phase OC sub-menu 35
3.5.5.2 [50N/51N] EARTH OC sub-menu **(P121 - P122 - P123** only**)** 38
3.5.5.3 [46] NEGATIVE Phase SEQUENCE I2> sub-menu (**P122 & P123** only) 41
3.5.5.4 [37] UNDERCURRENT I< sub-menu (**P122 & P123** only) 45
3.5.5.5 [79] AUTORECLOSE sub-menu (**P123** only) 45
3.5.6 AUTOMAT. CTRL Menu 48
3.5.6.1 Trip Commands sub-menu 49
3.5.6.2 Latch of trip output relay by Function Sub-Menu (**P121, P122 & P123** relays) 51
3.5.6.3 Latch functions sub-menu (**P120** relay) 53
3.5.6.4 Blocking Logic sub-menu 54
3.5.6.5 Logic Select sub-menus (**P122 & P123** only) 56
3.5.6.6 Outputs Relays sub-menu 57
3.5.6.7 Latch of the auxiliary output relays (RL2 to RL8) 61
3.5.6.8 Inputs sub-menu 63
3.5.6.9 BROKEN CONDUCTOR sub-menu (**P122 & P123** only) 65
3.5.6.10 COLD LOAD PICK-UP sub-menu (**P122 & P123** only) 65
3.5.6.11 CIRCUIT BREAKER FAILURE sub-menu (**P122 & P123** only) 67
3.5.6.12 CIRCUIT BREAKER SUPERVISION sub-menu (**P122 & P123** only) 68
3.5.6.13 Comm. Order Sub-menu (**P122 & P123** only) 70
3.5.7 RECORDS Menu (**P122 & P123** only) 70
3.5.7.1 CB MONITORING sub-menu 71
3.5.7.2 Fault Record sub-menu 72
3.5.7.3 INSTANTANEOUS sub-menu 73
3.5.7.4 DISTURBANCE RECORD sub-menu 74
3.5.7.5 Time PEAK VALUE sub-menu 74
3.5.7.6 ROLLING DEMAND sub-menu 75

4. WIRING 76

4.1 Auxiliary supply 76

4.2 Current measurement inputs 76

4.3 Logic inputs 76

4.4 Output relays 76

4.5 Communication 77

4.5.1 RS485 rear communication port 77

4.5.2 RS232 front communication port (**P122 & P123** only) 77

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1. DESCRIPTION OF THE MiCOM P120, P121, P122 AND P123 RELAYS

MiCOM P120, P121 P122 and **P123** are fully numerical relays to perform electrical protection and control functions.

3 phase and 1 earth current inputs are available for 1 and 5 Amps (4 inputs for 1 A and 4 inputs for 5 A) on **MiCOM P121, P122** & **P123** rear connectors. On the same **MiCOM P121,P122** or **P123** relay, combination is possible between 1 and 5 Amp current inputs (i.e. a mix of 1A for earth fault and 5A for phase connections).

2 current inputs (One for 1 A and one for 5 A) are available on the **MiCOM P120** rear connectors.

All output relays can be programmed to respond to any of the available control or protection functions. Logic inputs can also be allocated to the various control functions.

The **MiCOM** relays are powered from either a DC or an AC auxiliary supply (3 ranges of auxiliary supply). Any short dips (< 50 ms) are filtered and regulated through the auxiliary supply.

The front panel enables the user to navigate through the menu to access data, to change the settings, to read the measurements, etc. Eight LEDs on the front panel allows a clear and simple presentation of events. The various alarms detected are displayed on the back-lit LCD display. No password is required to read these alarm messages. The modification and clearing can only be carried out with a password, however.

NOTE : From V3.B version it is not necessary to enter the password for clearing alarms.

MiCOM 120, P121, P122 and **P123** relays continuously measure the phase and earth currents (P120 makes a single measurement) and take into account the true RMS current value up to 10th harmonic (at 50 Hz).

MiCOM P120, P121, P122 and **P123** relays have their rear connectors, a standard RS485 port. Communication protocols can be chosen at the time of order, from MODBUS RTU, Courier, IEC 60870-5-103 or DNP3. Using the communication channel, all stored information (measurements, alarms, parameters) can be read, and settings can be modified.

Consultation and modification of this data can be carried out on site with a normal PC and the appropriate ALSTOM software MiCOM S1.

RS485 based communication allows **MiCOM P120, P121, P122** and **P123** relays to be directly linked to a digital control system (MiCOM S10 for example). All the available data is then placed at the disposal of the supervisor and can be processed either locally or remotely.

The **MiCOM P120** range of relays gives the user more flexibility to adapt the relays to the required applications. With regard to low installation costs, these relays offer an economic solution, providing integrated protection and control functions.

2. USER INTERFACE

The **MiCOM P120, P121, P122** and **P123** relay front panel serves as an interface between the user and the protection relay. It enables the user to enter relay settings, display the measured values, alarms and display clearly the various actions carried out by **MiCOM P120, P121, P122** and **P123** relay.

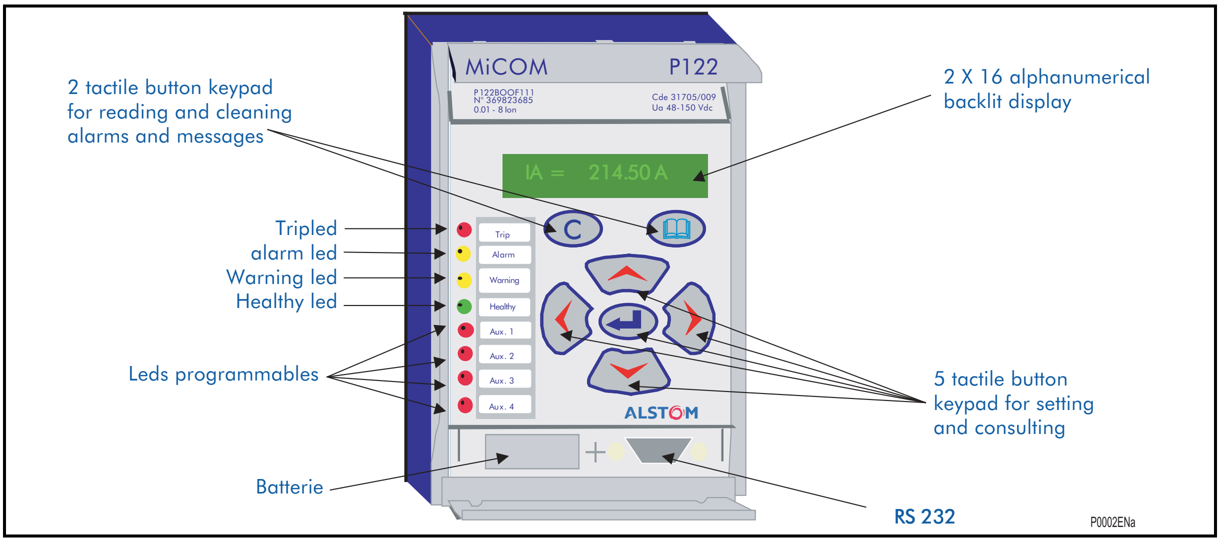

FIGURE 1 : MiCOM P120, P121, P122 AND P123 FRONT PANEL

The front panel of the relay consists of three separate sections:

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

2.1 LCD display and keypad description

2.1.1 LCD display

The front panel of the **MiCOM P120, P121, P122** and **P123** relays caries a liquid crystal display (LCD) on which data such as settings, measured values and alarms can be viewed. The data is accessed through a menu system.

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

2.1.2 Keypad

The keypad has seven keys divided into two groups :

Two keys situated immediately under the screen (keys Ⓒ and 🕮).

Five main keys situated at the middle of the front face are for programming.

2.1.2.1 ALARM keys

The two keys Ⓒ and 🕮 are dedicated for reading and acknowledging the alarms. So as to display successive alarms, press on key 🕮 The alarms are presented in reverse order for their detection (the most recent first, the oldest last). So as to acknowledge the alarms, the user can either acknowledge each alarm using Ⓒ or go to the end of the ALARM menu and carry out a general acknowledgement.

NOTE : the acknowledgement of the relay latched is described in the sub-menu contents description.

WARNING : TO ACKNOWLEDGE THE ALARMS, THE PASSWORD MUST BE ENABLE UP TO THE V3.A VERSION. FROM THE V3.B VERSION, THE ACKNOWLEDGE OF THE ALARMS IS WITHOUT PASSWORD.

2.1.2.2 Programming keypad

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

The keys ⇧ ⇩ ⇨ ⇦ make it possible to move in the direction indicated to the various levels of the menus.

The key ↵ validates a choice or value (modification of settings).

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 in French on which it is possible to write using a ball point pen.

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

The four lower LEDs can be freely programmed by the user to correspond to operation of the various thresholds (all models) and copy of the state of the logic inputs (P122 & P123 ONLY).

Eight LEDs are located in the left portion of the front face (numbered from 1 to 8 starting from the top):

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

LED 1 indicates when a trip order has been issued by the relay to the cut-off element (circuit breaker, contactor). This LED recopies the trip order issued to the Trip logic output. Its normal state is unlit. It is illuminated as soon as a triggering order is issued. It goes out when the associated alarm is acknowledged either by front panel, or by remote command, or by digital input, or by a new fault (CONFIGURATION/Alarms menu).

LED 2 ***Colour : ORANGE*** ***Label : ALARM***

LED 2 indicates that an alarm has been registered by MiCOM P120, P121, P122 and P123 relays. The alarms are either threshold crossings (instantaneous), or tripping orders (time delayed). As soon as an alarm is registered, the LED flashes. When all the stored alarms are read, the LED is illuminated continuously.

When all the alarms are acknowledged, the LED goes out.

NOTE : the alarms concerning the instantaneous can be selected self reset Yes or No in the CONFIGURATION/Alarms Menu

The alarm LED can be reset either by front panel, or by remote command, or by digital input, or by a new fault (CONFIGURATION/Alarms menu).

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

LED 3 is dedicated to the internal alarms of MiCOM P120, P121, P122 and P123 relays. When a « non critical » internal alarm (typically communication Fault) is detected, the LED flashes continuously. When the fault is classed as « critical », the LED is illuminated continuously. The extinction of this LED is only possible by the disappearance of the cause that provoked it (repair of the module, disappearance of the Fault).

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

LED 4 indicates that MiCOM P120, P121, P122 and P123 relays is auxiliary powered in the nominal range.

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

These LEDs can be programmed by the user on the basis of information on available thresholds (instantaneous and time-delayed) and state of the logic inputs (P122 & P123 only). The user selects the information he wishes to see associates with each LED from the menu element (Logic OR). Each LED illuminates when the associated information is valid. The extinction of each LED is linked to the acknowledgement of the associated alarms.

2.3 The two areas under the top and bottom flaps

Under the upper flap, a label identifies the relay according to its model (ordering code) and series number. This information defines the product uniquely and specifically.

In making all requests for information from ALSTOM T&D After Sales Department, please quote these two numbers.

Information indicated in the lower portion of this label covers the auxiliary supply voltage and the nominal earth current value.

Under the lower flap, a RS232 port is available in all **MiCOM** relays with different uses depending of the model :

1. For **MiCOM P120** and **P121**, this RS232 port can be used to download a new application software version into the relay flash memories.
2. For **MiCOM P122** and **P123**, this RS232 port can be used either to download a new application software version into the relay flash memories or to plug a laptop within the ALSTOM setting software MiCOM S1.

The withdrawability of the **MiCOM** active part (chassis) from the case is effected by opening the two flaps, then with a 3mm screwdriver, turn the extractor situated under the upper flap, and pull using the two slots situated behind these flaps.

2.4 The battery box

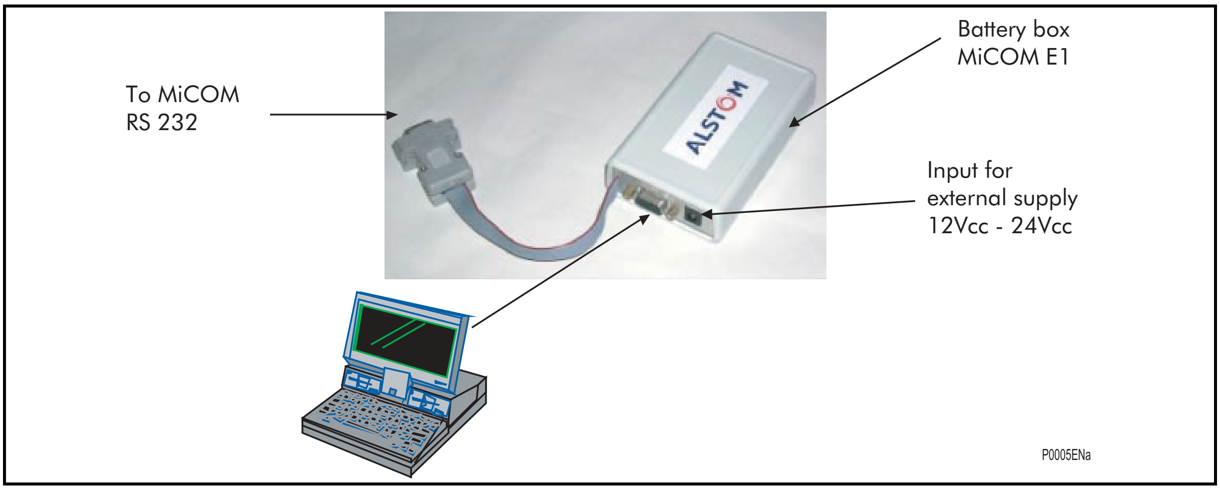

FIGURE 2 : BATTERY BOX MiCOM E1

The battery box performs the two following functions:

1. Temporary powering of the relay in order to allow the user to view or modify data when the auxiliary power supply has failed. The battery used is a 6LR61 type (9V) which can power the relay up to 3 hours.
   When the battery is flat it is possible to power the battery box with an external dc supply. The dc voltage value must be comprised between 12Vdc and 24Vdc.

2. RS232 interface between the MiCOM relay and the PC equipped with the setting software MiCOM S1.

3. MENUS

The menu of the **MiCOM P120, P121, P122** and **P123** relays is organised into main and sub menus. The content of these menus depends on the MiCOM model.

3.1 Default display

By default, the current value (selected phase or earth) is continuously displayed.

As soon as an alarm is generated by the **MiCOM** relay, that information is considered as priority and replaces the default value.

The default display choice is made in the CONFIGURATION/Display menu.

3.2 Access to the menu

Complete menu access is performed by manipulation of the keys ⇑ ⇓ ⇒ ⇐. The general arrangement of the menus is shown in figure 2 for **P120** and **P121** and figure 3 for **P122** and **P123**.

Reading of parameters and measurements is possible without entering the password.

Modification of the parameters requires entering the password.

Should an error be made in entering a parameter, press Ⓒ to cancel.

Except for reading and cancelling, the keys Ⓒ and Ⓘ are inactive.

NOTE : The letter P is displayed when the password is entered. If no key is pushed during 5 minutes, the password becomes inactive.

3.3 Password

3.3.1 Password protection

Password protection is applicable to the relay settings, especially to the selection of the various thresholds, time delays, communication parameters, allocation of inputs and outputs relays.

The password consists of four alphabetical capital characters. When leaving the factory, the password is AAAA. The user can define his own combination of characters.

Should the password be lost or forgotten, the modification of the stored parameters of the relay is prohibited. It is then necessary to contact the manufacturer or his agent by specifying the serial number of the relay so as to receive a stand-by password specific to the relay concerned.

NOTE :
- The programming mode is showed with the letter "P" on the Low right of the display on each head menu. The letter "P" is present as long as the password is active (5 minutes if no key is pushed).
- As soon as the password has been entered, no setting change using the communication (RS485 or RS232) can be accepted.

3.3.2 Entering the password

The input of the password is requested as soon as a modification of a parameter is made for any one of the menus or sub-menus. The user enters for each of the 4 characters/letters and validates **the entire** password with ↵.

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

If no action is taken on the keypad for 5 minutes, the password is deactivated. A new request shall be associated with any subsequent parameter modification.

3.3.3 Changing the password

To change the active password, go to the OP. PARAMETERS menu and then to the point of the Password sub menu. Enter the old password and validate. Then press ⊖ and enter the new password character per character and validate the new password using ⊖.

The message NEW PASSWORD OK is displayed to indicate that the password has changed.

3.4 ALARM display

Two alarm messages have been introduced in the relays since the firmware version V6.

DEFAULT SETTINGS: Each time the relay is powered ON it will check its memory contents to determine whether the settings are set to the factory defaults. If the relay detects that the default settings are loaded an alarm is raised.

A "HARDWARE " ALARM will appear on the LCD display. Pressing the ⊚ button will cause DEFAULT SETTINGS message to be displayed. In addition,

– the ALARM LED (YELLOW) will light up

– the Watch Dog contact will be activated

Only one parameter in the relay's menu needs to be changed to suppress these messages and to reset the watchdog.

This alarm is only an indication to the user that the relay has its default settings applied. When the firmware version V6 is downloaded into the relay, this will load the default settings and the relay will, therefore, display this alarm. Changing one of the setting values will allow this alarm to be cleared.

SETTING ERROR: Should the CPU fails to get correctly store data to the EEPROM during a setting change, a "HARDWARE" ALARM will appear on the LCD display followed by "SETTING ERROR" message (when pushing on the ⊚ button). In addition,

– the ALARM LED (YELLOW) will light up

– the Watch Dog contact will be activated

To reset this alarm it is necessary to power ON and OFF the relay. Following this, the last unsuccessful setting change will then need to be re-applied. If the alarm persists, i.e. the "SETTING ERROR" alarm is still displayed, please contact Alstom After Sales Services for advice and assistance.

The management of alarms is directly displayed on the LCD. The display of alarm messages has priority over the default current value. As soon as an alarm is detected by the relay (threshold crossing for example), the message is displayed on the MiCOM LCD display and the Alarm LED (2nd LED) lights up.

The alarm messages are classed as follows :

⇒ Electrical power network alarm message

⇒ Hardware or software fault message from the relay.

3.4.1 Electrical system ALARMS

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

If several alarms are triggered, they are all stored in their order of appearance the most recent alarm first, the oldest alarm last. Each message is numbered and the total of messages is shown.

The user read all the alarm messages using ◎ without entering the password.

The user acknowledges the alarms using ⓒ, but must enter the password (not necessary from the V3 Version). The user can acknowledge each message one by one or all by going to the end of the list and acknowledge all the messages using ⓒ.

The management of the ALARM LED is directly linked to the status of the stored alarms.

⇒ If one or several messages are NOT READ and NOT ACKNOWLEDGED, the alarm LED flashes.

⇒ If all the messages have been READ but NOT ACKNOWLEDGED, the alarm LED remains lights up continuously.

⇒ If all the messages have been READ and ACKNOWLEDGED, the alarm LED goes out.

NOTE :
- The alarms concerning the instantaneous can be selected self reset Yes or No in the CONFIGURATION/Alarms Menu
- The reset of the relay latched is described in the sub-menu content description.

The different electrical systems alarms are described below:

Ie>	1st stage earth fault pick-up
Ie>>	2nd stage earth fault pick-up
Ie>>>	3rd stage earth fault pick-up
I> PHASE	1st stage overcurrent pick-up
I>> PHASE	2nd stage overcurrent pick-up
I>>> PHASE	3rd stage overcurrent pick-up
tIe>	1st stage earth fault time-out
tIe>>	2nd stage earth fault time-out
tIe>>>	3rd stage earth fault time-out
tI> PHASE	1st stage overcurrent time-out
tI>> PHASE	2nd stage overcurrent time-out
tI>>> PHASE	3rd stage overcurrent time-out
THERMAL ALARM	thermal alarm threshold pick-up
THERMAL TRIP	thermal trip threshold pick-up
I<	undercurrent element pick-up
tI< PHASE	undercurrent fault time-out

BRKN COND.	broken conductor indication. I2/I1 element pick-up for longer than tBC. TBC is settable in the AUTOMAT. CTRL/Broken cond. menu.
t AUX 1	t AUX1 time-out
t AUX 2	t AUX2 time-out
CB FAILURE	circuit breaker failure indication (the CB does not trip on tBF time-out) tBF is settable in the AUTOMAT. CTRL/CB Fail menu.
I2>	negative sequence current threshold pick-up (1st stage)
tI2>	negative sequence current threshold time-out (1st stage)
I2>>	negative sequence current threshold pick-up (2nd stage)
tI2>>	negative sequence current threshold time-out (2nd stage)
SPRING CHARGE FAIL	Faulty circuit breaker indication by assignable logic input (settable in AUTOMAT. CTRL/Inputs menu).
T operating CB	Operating (or tripping) time of the circuit breaker longer than the value set in the AUTOMAT. CTRL/CB Supervision menu.
CB OPEN NB	Number of circuit breaker operation higher that the value set in the AUTOMAT. CTRL/CB Supervision menu.
Sum An	Broken current measured higher than the value set in the AUTOMAT. CTRL/CB Supervision menu.
TRIP CIRCUIT	Circuit breaker trip circuit failure for longer than the supervision timer t SUP settable in the AUTOMAT. CTRL/CB Supervision menu.
LATCH RELAY	A least one auxiliary relay is latched.
LATCH RELAY TRIP	The relay trip is latched.
CB CLOSE FAILURE	Circuit breaker closing time longer than the value set in the AUTOMAT. CTRL/CB Supervision menu.
RECLOSER SUCCESS	Successful reclose indication. Indicates that when the fault has been cleared upon circuit breaker reclosure, and has not re-appeared before expiry of the reclaim time.
RECLOSER LOCKED	Recloser blocking indication. Generated by: - auxiliary power supply failure during dead time (definitive trip). - external breaker failure indication (ex. SF6 low). Indication provided via a logic input assigned to the CB FAILURE function in the AUTOMAT. CTRL/Inputs menu.

	- external blocking indication, external blocking can be set by the user in the PROTECTION/ [79] AUTORECLOSE/EXT BLOCK menu. This blocking information is provided via a logic input assigned to the Block [79] function in the AUTOMAT. CTRL/Inputs menu.
	- definitive trip.
	- remote trip command during the reclaim time.
	- pick-up of I2> or thermal trip during dead time.
	- breaker failure (circuit breaker failure to trip on expiry of tBF).
	- breaker operating time (or tripping time) longer than the set time.
CONFLICT RECLOS.	Configuration conflict of the recloser function. This indication is generated by:
	- O/O Interlock not assigned to a logic input or assigned but not wired to the input.
	- no output relay assigned to the CB CLOSE function (AUTOMAT. CTRL/Output Relays menu).
	- trip contact latched.
	- no recloser cycle assigned to the protection functions (PROTECTION/ [79] Autoreclose menu).
MAINTENANCE MODE	The MiCOM relay is in maintenance mode.

3.4.2 Relay Hardware or Software ALARMS

Any software or hardware fault of the MiCOM relay generates a "hard/software alarm". If several alarms are acquired they are all stored in their order of appearance. Display of the alarms is in reverse order (the most recent first and the oldest last). Each message is numbered and the total of messages is indicated below.

The user can read all the alarm messages with the aid of , without entering the password.

The acknowledgement of the relay alarm messages is IMPOSSIBLE. Only the disappearance of the cause resets the alarm.

The management of the WARNING LED is directly linked to the status of the alarms stored in the memory.

⇒ If the fault is major (the relay cannot perform protection functions), the WARNING LED is lit fixed.

⇒ If the fault is minor (no influence on the protection and automation function e.g.communication failure), the WARNING LED is flashing.

Possible Hardware or Software alarm messages :

<u>Major fault</u>

The protection and automation functions are stopped.
The RL0 watchdog relay is de-energised (35-36 contact closed).

<<EEPROM ERROR CALIBR.>> : Calibration zone in fault

<<CT ERROR>> : Analog channel in fault

<u>Minor fault</u>

The MiCOM relay is fully operational.
The RL0 watchdog relay is energised (35-36 contact open, 36-37 contact closed).

<<RAM ERROR>> : RAM supplied by battery in fault.

<<Battery fail>> : battery in fault (flat or not correctly in place)

NOTE : The <<Battery backed RAM memory>> and <<Battery failure>> alarm messages can be configured displayed yes or no, in CONFIGURATION/Alarms menu.

<<COMM.ERROR>> : Communication in fault

<<CLOCK ERROR>> : Datation in fault

3.5 Menu contents description

The menu of the MiCOM P122 & P123 relays is divided into 8 sections(6 for P120 and P121):

⇒ OP PARAMETERS

⇒ CONFIGURATION

⇒ MEASUREMENTS

⇒ COMMUNICATION

⇒ PROTECTION G(1)

⇒ PROTECTION G2 (**P122 & P123** only)

⇒ AUTOMAT. CTRL

⇒ RECORDS (**P122 & P123** only)

To access these menus from the default display use .

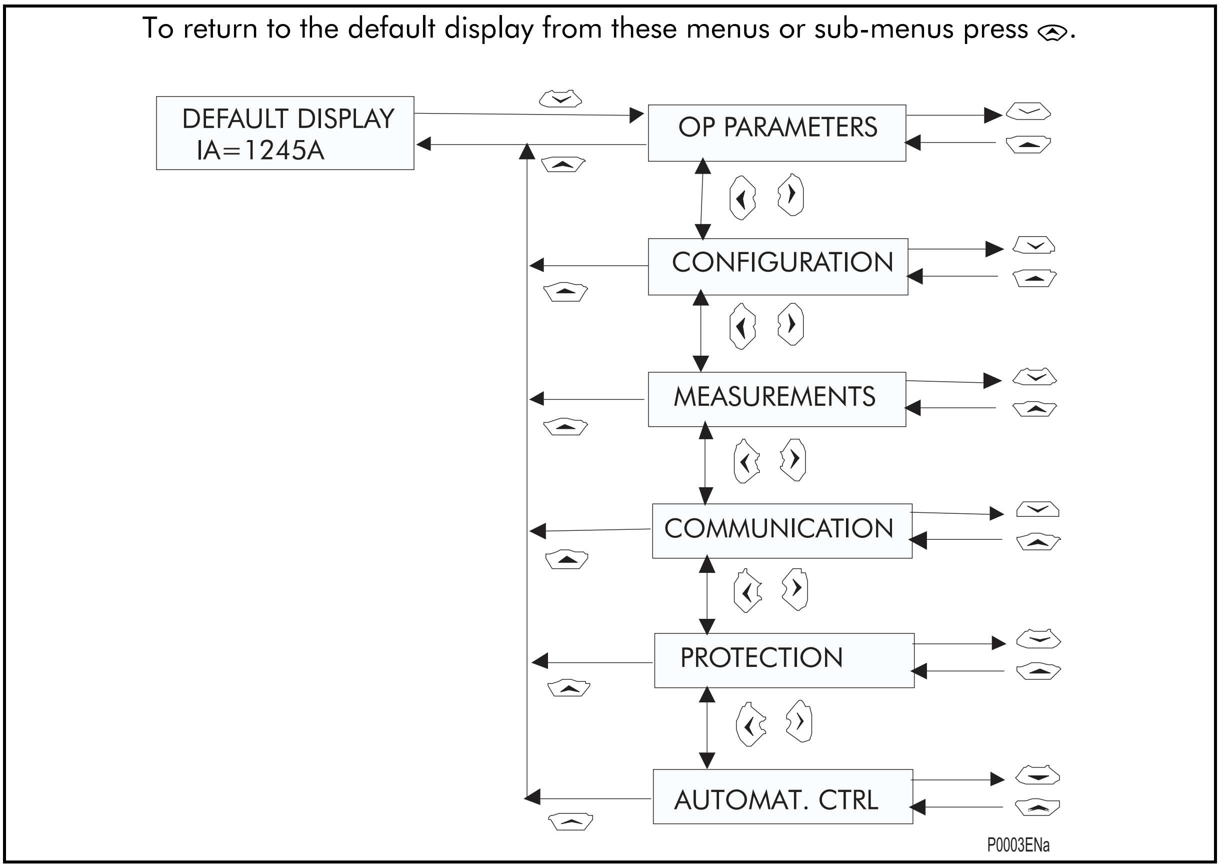

FIGURE 3 : ORGANISATION OF MiCOM P120 AND P121 MAIN MENU

NOTE : the menu content tables are supplied in P12x/EN HI document.

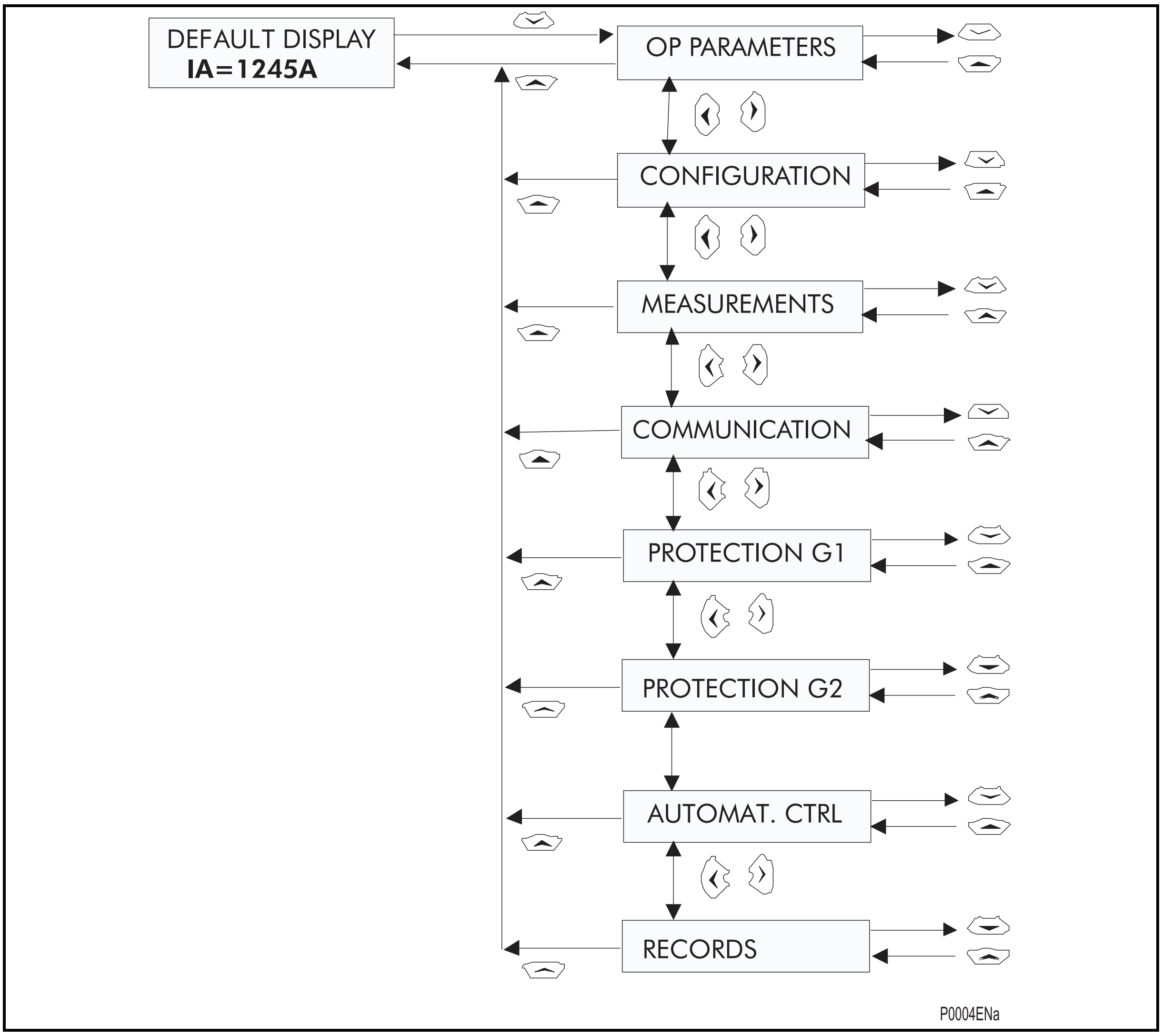

FIGURE 4 : ORGANISATION OF MiCOM P122 AND P123 MAIN MENU

NOTE : the menu content tables are supplied in P12x/EN HI document.

3.5.1 OP PARAMETERS Menu

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

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

WARNING : AS SOON AS THE PASSWORD HAS BEEN ENTERED, NO SETTING CHANGE USING THE COMMUNICATION (RS485 OR RS232) CAN BE ACCEPTED.

Description **P121**	Displays the MiCOM applicable relay model
Reference **ALST**	Displays the name of the equipment associated with the relay. The entry of the reference is made by character by character using After each character (letter, number or sign),press to enter the following character. At the end of entering, press to validate the reference. NOTE : The reference is initially set in the factory to **ALST**.
Frequency **50 Hz**	Nominal value of the network frequency. Select either 50 or 60 Hz. To modify this value, press and press to select the desired value. Validate your choice using .
Input 54321 **Status 10110**	Displays the state of the logic Inputs. The Logic Inputs are numbered from 1 to 5 for P123, 1 to 3 for P122 and 1 to 2 for P120 and P121 starting from the right. The state of each input is : - state 0 : input de-energised - state 1 : input energised
Relay 87654321 **Status 01011101**	Displays the state of the logic outputs. The Logic Outputs are numbered from 1 to 8 for P123, 1 to 6 for P122 and 1 to 4 for P120 and P121 starting from the right. The state of each output is : - state 0 : output relay active - state 1 : output relay inactive NOTE : The Watch-dog output (RL0) is not display in the output status menu.

3.5.1.1 P121, P122 and P123 additional OP.PARAMETERS Menu

Software version **6.A**	Displays the version of the software

3.5.1.2 P122 and P123 additional OP.PARAMETERS Menu

Active Group **1**	Display the active group (Protection G1 or Protection G2).
Date **12/08/02**	Displays the date. To modify this date press then using to enter the required value. Enable your choice using with this example the date is : 12 August 2002.
Time **13:57:44**	Displays the hour. To modify this hour press then using to enter the required value. Enable your choice using with this example the time is : 13 hours, 57 minutes, 44 seconds.

3.5.2 CONFIGURATION Menu

The various sub-menus are :

⇒ Display

⇒ CT Ratio

⇒ Led 5

⇒ Led 6

⇒ Led 7

⇒ Led 8

⇒ Group Select (**P122 & P123** only)

⇒ Alarms (**P122 & P123** only)

⇒ Configuration inputs (**P122 & P123** only)

⇒ Relays Maintenance (**P122 & P123** only)

⇒ Phase rotation (**P122 & P123** only)

To gain access to the CONFIGURATION menu from the default display, press then .

3.5.2.1 DISPLAY sub-menu

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the DISPLAY submenu, press .
Display	Heading of the DISPLAY sub-menu. To gain access to the sub-menu content, press .
Default Display **RMS I A**	Display of the default current value (by selecting either Phase A, Phase B , Phase C, Earth N, or the four values simultaneously). To modify this default value, press then using to enter the required value. Enable your choice using .
Phase A Text **A**	Edit phase A label by selecting A, L1, or R. This value can be modified after entering the password and is displayed with the corresponding measurement.
Phase B Text **B**	Edit phase B label by selecting B, L2, or S. This value can be modified after entering the password and is displayed with the corresponding measurement.
Phase C Text **C**	Edit phase C label by selecting C, L3, or T. This value can be modified after entering the password and is displayed with the corresponding measurement.

E/Gnd Text **E**	Edit earth label by selecting N, E, or G. This value can be modified after entering the password and is displayed with the corresponding measurement.

WARNING : This DISPLAY sub-menu does not exist for MiCOM P121. The default display is IA and A,B, C, N for the labels.

3.5.2.2 CT RATIO sub-menu

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the CT RATIO menu, press ⇓, ⇒.
CT Ratio	Heading of the CT RATIO sub-menu. To gain access to the sub-menu content, press ⇓, ⇒.
Line CT primary **1000**	Display of the primary ratio of the phase CT. The value consists of 4 digits: Minimum 1, Maximum 9999. Press ↵ to modify this value and use ⇑ ⇓ ⇒ ⇐ to display the new primary phase CT ratio. Enable your choice using ↵ at the end of selection
Line CT sec **5**	Display of the secondary ratio of the phase CT. This value toggles between 1 and 5.
E/Gnd CT primary **1000**	Display of the primary ratio of the earth CT. The consist of 4 digits : Minimum 1, Maximum 9999. Press ↵ to modify this value and use ⇑ ⇓ ⇒ ⇐ to display the new primary earth CT ratio. Enable your choice using ↵ at the end of selection.
E/Gnd CT sec **5**	Display of the secondary ratio of the earth CT. This value toggles between 1 and 5.

3.5.2.3 LED 5 to 8 configuration sub-menus

To gain access to the LED 5 CONFIGURATION sub-menu, press ⇓, ⇒ twice.

To access to the others LEDs CONFIGURATION sub-menus, press ⇒ 3 times for LED 6, 4 times for LED 7 and 5 times for LED 8.

26 different parameters can be assigned to each LED (20 for **MiCOM P122** and 12 for **MiCOM P120** and **P121**).

These parameters are :

TEXT	Information
I>	Instantaneous first phase threshold
I>>	Instantaneous second phase threshold
I>>>	Instantaneous third phase threshold
tI>	Time delayed first phase threshold
tI>>	Time delayed second phase threshold
tI>>>	Time delayed third phase threshold
Ie>	Instantaneous first earth threshold
Ie>>	Instantaneous second earth threshold
Ie>>>	Instantaneous third earth threshold
tIe>	Time delayed first earth threshold
tIe>>	Time delayed second earth threshold
tIe>>>	Time delayed third earth threshold
Therm Trip	Trip on Thermal overload
Brkn Cond.	Broken conductor detection
CB Fail	Detection of a Circuit Breaker failure (CB not open at the end of tBF timer)
tI2>	Time delayed negative phase sequence (1st threshold)
Input 1	Copy of the state of the Logic Input n°1
Input 2	Copy of the state of the Logic Input n°2
Input 3	Copy of the state of the Logic Input n°3
Input 4	Copy of the state of the Logic Input n°4
Input 5	Copy of the state of the Logic Input n°5
Recloser Run	Auto-recloser function in progress
Recloser Blocked	Auto-recloser function locked
t Aux 1	Copy of the state of the Logic Input delayed by t Aux 1
t Aux 2	Copy of the state of the Logic Input delayed by t Aux 2
tI2>>	Time delayed negative phase sequence (2nd threshold)

(light grey)	**Only available in model MiCOM P122 & P123**
(dark grey)	**Only available in model MiCOM P123**

NOTES : ⇒ Each parameter can be assigned to one or more LED's.
⇒ Each LED can be lit by one or more parameters (OR logic).

Example of LED 5 setting :

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the LED 5 submenu, press , 2 times.
Led 5	Heading LED 5 sub-menu. To gain access to the sub-menu content, press .
Led **I>** **Yes**	Displays the instantaneous threshold I> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **tI>** **No**	Displays the time delay threshold tI> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **I>>** **No**	Displays the instantaneous threshold I>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **tI>>** **No**	Displays the time delay threshold tI>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **I>>>** **No**	Displays the instantaneous threshold I>>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **tI>>>** **No**	Displays the time delay threshold tI>>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **Ie>** **No**	Displays the instantaneous threshold Ie> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **tIe>** **Yes**	Displays the time delay threshold tIe> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **Ie>>** **No**	Displays the instantaneous threshold Ie>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .

Led **tIe>> Yes**	Displays the time delay threshold tIe>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **Ie>>> No**	Displays the instantaneous threshold Ie>>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led **tIe>>> Yes**	Displays the time delay threshold tIe>>> associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .

<u>Example of LED 5 setting (information only for **P122 & P123**) :</u>

Led Therm. **Trip No**	Displays the thermal threshold $tI\theta$ trip order associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led Brkn. Cond **Yes**	Displays the broken conductor information associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led CB Fail **Yes**	Displays the circuit breaker failure information associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led Input 1 **No**	Displays the state of the logic input 1 associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led Input 2 **Yes**	Displays the state of the logic input 2 associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led Input 3 **No**	Displays the state of the logic input 3 associated with LED 5. To modify this choice, press and using scroll through the available selections. Enable your choice using .
Led t Aux 1 **Yes**	Displays the state of the logic input delayed by t Aux 1. To modify this choice, press and using scroll through the available selections.
Led t Aux 2 **No**	Displays the state of the logic input delayed by t Aux 2. To modify this choice, press and using scroll through the available selections.

Led tI2> **No**	Displays the negative phase sequence 1st threshold tI2> associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. Enable your choice using ↵.
Led tI2>> **No**	Displays the negative phase sequence 2nd threshold tI2>> associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. To this LED. Enable your choice using ↵.

Example of LED 5 setting (information only for **P123**):

Led Input 4 **No**	Displays the state of the logic input 4 associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. Enable your choice using ↵.
Led Input 5 **No**	Displays the state of the logic input 5 associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. Enable your choice using ↵.
Led Recloser Run **No**	Displays the state of the auto-recloser function (running or not) associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. To this LED. Enable your choice using ↵.
Led Recloser Blocked **No**	Displays the state of the auto-recloser function (locked or free) associated with LED 5. To modify this choice, press ↵ and using ⇕ scroll through the available selections. To this LED. Enable your choice using ↵.

3.5.2.4 Group. Select sub-menu (**P122 & P123** only)

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the menu, press , 6 times.
Group Select	Heading of the GROUP SELECT sub-menu. To gain access to the sub-menu content, press .
Change Group Input = EDGE	Displays the operation mode of the digital input associated to the change of group of protection : "EDGE" or "LEVEL". To change the operation mode, press then using scroll through the available selections. Enable your choice using .
Setting Group 1	Displays of the active setting group (1 or 2). To change the active setting group, press then using enter the required value (1 or 2). Enable your choice using . This window will disappear if the change group input choice is LEVEL.

3.5.2.5 Alarms sub-menu (**P122 & P123** only)

CONFIGURATION	Heading of the configuration menu. To gain access to Alarms menu, press , 7 times.
Alarms	Heading of the Alarms sub-menu. To gain access to the sub-menu content, press .
Inst. Self-reset ? No	Displays the reset mode of the alarms concerning the instantaneous : self-reset Yes or No. If the user chooses No, the reset will be done by push button. To change the reset mode press then using scroll through the available selections. Enable your choice using .
Reset led on fault ? No	Displays the reset mode of the alarms concerning the instantaneous :reset led on a new fault Yes or No. To change the reset mode press then using scroll through the available selections. Enable your choice using .
Alarm Battery No	Displays the possibility Yes or No to display the alarm "RAM ERROR" or "BATTERY FAIL" in case of ram error or battery failure. To change the required value (Yes or No) press then using scroll through the available selections. Enable your choice using .

3.5.2.6 Configuration inputs sub-menu (**P122** & **P123** only)

It is possible to configure the operation of the digital input, either on falling edge/low level, or on rising edge/high level.

Falling edge or low level (idem for rising edge or high level) depends of the application of the digital inputs.

Example : a digital input configured "blocking logic" will operate on level, on the other hand a digital input configured "Cold load pick up" will operate on edge.

ONLY a digital input configured "change of setting group" can operate either on edge or on level.

Function allocated to the Digital Input	**Operation of the Digital Input**
Unlatch of the output relays	On level
Position of the CB, 52a or 52b	On level
Blocking logic 1 & 2	On level
Logic Selectivity 1 & 2	On level
Aux 1, Aux 2, Aux 3 & Aux 4	On level
CB Fault	On level
Reset of the thermal state	On edge
Blocking of the Autorecloser	On level
Cold load Pick Up	On edge
Start of disturbance record	On edge
Trip circuit supervision	On level
Change of setting group	On edge, or on level
CB Fail start	On edge

The user has to set in the CONFIGURATION Menu the auxiliary voltage (AC or DC) for the operation of the digital inputs. This setting is necessary due to the time filtering different in DC and AC.

NOTE : If the V4 or V5 software is used with a V3 hardware the setting **must be DC**.

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to Configuration Inputs menu, press ⇩, ⇨ 8 times.
Configuration Inputs	Heading of the Configuration Inputs sub-menu. To gain access to the sub-menu content, press ⇩.
Inputs 5 4 3 2 1 **1 0 1 1 0**	Displays the operation of the digital Inputs either on falling edge/low level, or on rising edge/high level. 0 = falling edge/low level 1 = rising edge/high level To change the operation mode press ⏎ then using ⇩ scroll through the available selections. Enable your choice using ⏎.

Voltage input **DC**	Displays the voltage (AC or DC) on the digital Inputs. To change the voltage press then using scroll through the available selections. Enable your choice using .

3.5.2.7 Configuration Relays Maintenance sub-menu (**P122** & **P123** only)

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the Relays Maintenance menu, press , 9 times.
REL. Maintenance	Heading of the CONFIGURATION RELAYS MAINTENANCE sub-menu. To gain access to the sub- menu content, press .
Maintenance Mode **Yes**	Displays the MAINTENANCE MODE of the MiCOM relay. If the user chooses Yes, the protection and automation functions are disconnected of the output relays. When activating the maintenance mode, the Alarm LED will start flashing.
Relays 8765W4321 **000000001**	In MAINTENANCE MODE Yes, this menu ables the user to activate each output relay 1 = relay actived 0 = relay non actived

3.5.2.8 Configuration Phase Rotation sub-menu (**P122** & **P123** only)

CONFIGURATION	Heading of the CONFIGURATION menu. To gain access to the Phase Rotation menu, press , 10 times.
PHASE ROTATION	Heading of the PHASE ROTATION sub-menu. To gain access to the sub-menu content, press .
PHASE ROTATION **A-B-C**	Displays the phase rotation either A-B-C or A-C-B. To change the phase rotation press then using scroll through the available selections. Enable your choice using .

3.5.3 MEASUREMENTS Menu

The MEASUREMENTS menu makes it possible to read the various measurements.

To gain access to the MEASUREMENTS menu from the default display, press ⇩ then ⇨ 2 times.

MEASUREMENTS	Heading of the MEASUREMENTS menu. To gain access to the MEASUREMENTS menu, press ⇩, ⇨, 2 times. To gain access to the sub-menu content, press ⇩
Frequency **50.10 Hz**	Display the network frequency calculated from phase currents
I A **640.10 A**	Display the A phase current (True RMS value) taking into account the phase CT ratio (CONFIGURATION/CT RATIO sub-menu).
I B **629.00 A**	Display the B phase current (True RMS value) taking into account the phase CT ratio (CONFIGURATION/CT RATIO sub-menu).
I C **634.50 A**	Display the C phase current (True RMS value) taking into account the phase CT ratio (CONFIGURATION/CT RATIO sub-menu).
I N **3.15 A**	Display the earth current (True RMS value) taking into account the earth CT ratio (CONFIGURATION/CT RATIO sub-menu).

3.5.3.1 **P122** & **P123** additional MEASUREMENTS Menu

I1 **103A**	Display the positive sequence component
I2 **50A**	Display the negative sequence component
RATIO I2/I1 **50%**	Display the ratio I2/I1
In - fn **RST = [C] 0.0A**	Display the earth current (True RMS value) minus the current value at the fundamental frequency (value of the harmonics). To clear the value, press Ⓒ (password needed)

Thermal θ **RST = [C] 67%**	Display the % thermal state based on true RMS values. To clear the % values, press © (password needed).
Max & Average I **RST = [C]**	Allows the user to clear the maximum (peak) and average (rolling) memorised values of the current. To clear these values, press © (password needed).
Max IA Rms **127.36 A**	Display the peak value for phase A. The value is the true RMS maximum value.
Max IB Rms **156.28 A**	Display the peak value for phase B. The value is the true RMS maximum value.
Max IC Rms **139.01 A**	Display the peak value for phase C. The value is the true RMS maximum value.
Average IA Rms **98.25 A**	Display the rolling value for phase A. The value is the true RMS average value.
Average IB Rms **97.88 A**	Display the rolling value for phase B. The value is the true RMS average value.
Average IC Rms **99.02 A**	Display the rolling value for phase C. The value is the true RMS average value.
MAX. SUBPERIOD **RST = [C]**	Allows the user to clear the maximum subperiod values of the 3 currents.
MAX. SUBPERIOD **IA Rms = 245A**	Display the IA peak value demand. The value is the true RMS maximum value on a subperiod.
MAX. SUBPERIOD **IB Rms = 240A**	Display the IB peak value demand. The value is the true RMS maximum value on a subperiod.
MAX. SUBPERIOD **IC Rms = 250A**	Display the IC peak value demand. The value is the true RMS maximum value on a subperiod.

ROLLING AVERAGE **RST = [C]**	Allows the user to clear the rolling average values of the 3 currents.
ROLLING AVERAGE **IA Rms = 0A**	Display the IA average value demand. The value is the true RMS average value on a number of subperiod set in Record menu.
ROLLING AVERAGE **IB Rms = 0A**	Display the IB average value demand. The value is the true RMS average value on a number of subperiod set in Record menu.
ROLLING AVERAGE **IC Rms = 0A**	Display the IC average value demand. The value is the true RMS average value on a number of subperiod set in Record menu.

3.5.3.2 **P123** additional MEASUREMENTS Menu

Reclose Stats **RST = [C]**	Allows the user to clear the reclosing statistics. To clear these values, press ⓒ (password needed).
Total Recloses **16**	Display the total number of reclosers.
Cycle 1 Recloses **1**	Display the total number of cycle 1 reclosers.
Cycle 2 Recloses **7**	Display the total number of cycle 2 reclosers.
Cycle 3 Recloses **5**	Display the total number of cycle 3 reclosers.
Cycle 4 Recloses **3**	Display the total number of cycle 4 reclosers.
Total Trip & **Lockout 2**	Display the total number of definitive trips issued from the autorecloser.

3.5.4 COMMUNICATION Menu

The COMMUNICATION menu depends on the type of communication : MODBUS, Courier, IEC 60870-5-103, DNP3.
To gain access to the COMMUNICATION menu from the default display, press ⇩ then ⇨ 3 times.

3.5.4.1 MODBUS COMMUNICATION Menu

COMMUNICATION	Heading of the COMMUNICATION menu. To gain access to the menu, press , , 3 times. To gain access to the sub-menu points, press .
Communication ? **Yes**	Use MODBUS RTU communication via the RS485 on the rear of the relay. To activate communication, press the key and use to select Yes. Enable your choice using .
Baud Rate **9600 bd**	Display of the speed of MODBUS transmission. Select from : 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 bauds using and enable your choice using .
Parity **None**	Display the parity in the MODBUS frame. Select Even, Odd or None using and enable your choice using .
Stop Bits **1**	Display of the number of stop bits in the MODBUS frame. Select 0 or 1 using and enable your choice using .
Relay Address **29**	Display of the network address of the MiCOM relay in the MODBUS network. Select from 1 to 255 using and enable your choice using .
Date format **Private**	Display the format of the date, either PRIVATE or IEC protocol.

WARNING : A MODBUS NETWORK CAN ONLY COMPRISE 32 RELAY ADDRESSES ON THE SAME MODBUS SUB-LAN.

3.5.4.2 Courier COMMUNICATION Menu

COMMUNICATION	Heading of the COMMUNICATION menu. To gain access to the menu, press , , 3 times. To gain access to the sub-menu content, press .
Communication ? **Yes**	Use Courier communication via the RS485 on the rear of the relay. To activate communication, press the key and use to select Yes. Enable your choice using .
Relay Address **12**	Display the network address of the MiCOM relay in the Courier network. Select from 1 to 255 using and enable your choice using .

3.5.4.3 IEC 60870-5-103 COMMUNICATION Menu

COMMUNICATION	Heading of the COMMUNICATION menu. To gain access to the menu, press , , 3 times. To gain access to the sub-menu content, press .
Communication ? **Yes**	Use IEC 60870-5-103 communication via the RS485 on the rear of the relay. To activate communication, press the key and use to select Yes. Enable your choice using .
Data Bits **9600 bd**	Display of the speed of IEC 60870-5-103 transmission. Select from : 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 bauds using and enable your choice using .
Relay Address **29**	Display of the network address of the MiCOM relay in the IEC 60870-5-103 network. Select from 1 to 255 using and enable your choice using the key .

3.5.4.4 DNP3 COMMUNICATION Menu

COMMUNICATION	Heading of the COMMUNICATION menu. To gain access to the menu, press , , 3 times. To gain access to the sub-menu points, press .
Communication ? **Yes**	Use MODBUS RTU communication via the RS485 on the rear of the relay. To activate communication, press the key and use to select Yes. Enable your choice using .
Baud Rate **9600 bd**	Display of the speed of MODBUS transmission. Select from : 300, 600, 1200, 2400, 4800, 9600, 19200, 38400 bauds using and enable your choice using .
Parity **None**	Display the parity in the MODBUS frame. Select Even, Odd or None using and enable your choice using .
Stop Bits **1**	Display of the number of stop bits in the MODBUS frame. Select 0 or 1 using and enable your choice using .
Relay Address **29**	Display of the network address of the MiCOM relay in the MODBUS network. Select from 1 to 255 using and enable your choice using .

3.5.5 PROTECTION Menu

The PROTECTION menu (design as PROTECTION G1 and PROTECTION G2 menus in **MiCOM P122** and **P123**) enables a user to program various protection functions and settings (thresholds, time delay) associated with each of the phase or earth protection functions.

The various sub-menus are :

⇒ [50/51] Phase OC

⇒ [50N/51N] E/Gnd

⇒ [46] (**P122 & P123** only) Neg seq OC

⇒ [49] (**P122 & P123** only) Therm OL

⇒ [37] (**P122 & P123** only) Under Current

⇒ [79] (**P123** only) Autoreclose

To gain access to the PROTECTION menu (PROTECTION G1 menu for **MiCOM P122** and **P123**), press then 4 times.

For **MiCOM P122** and **P123**, to gain access to the PROTECTION G2 menu, press then five times.

3.5.5.1 [50/51] Phase OC sub-menu

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press , , 4 times.
[50/51] Phase OC	Heading of the [50/51] Phase OC sub-menu To gain access to the sub-menu points, press .
I> ? **Yes**	Selection of the first phase threshold (I>). Select Yes or No. If the user enters I>(Yes), the following menu is displayed. If the user enters I> (No), go to **I>> menu.**
I> **4 In**	Displays the threshold current value I>. To modify this value, press .The threshold I> is adjustable from 0.1 to 25 In. Press to enable your adjustment.
Delay Type **DMT**	Selection of the I> time delay type threshold. Select DMT for definite time, IDMT for inverse time curves, RI for the electromechanical inverse time curve.

3.5.5.1.1 I> DMT threshold menu

Delay Type **DMT**	Display of the I> DMT time delay.
tI > **100 ms**	Selection of the I> time delay. Select the time delay from 0 to 150 s using ⊗ and enable your choice using ⊖.
t Reset **0 ms**	Selection of the t Reset value from 0 to 600 s using ⊗ and enable your choice using ⊖ (only P122, P123).

3.5.5.1.2 I> IDMT threshold, IEC or IEEE/ANSI curve menu

Delay Type **IDMT**	Display the I> inverse time delay (IEC or IEEE/ANSI curves).
Idmt **IEC SI**	Selection of the I> curve. Select from IEC SI, IEC STI, IEC VI, IEC EI, IEC LTI, CO2, IEEE MI, CO8, IEEE VI, IEEE EI using ⊗ and enable your choice using the key ⊖.
Tms **0,025**	Select the curve TMS value. Select from 0.025 to 1.5 using ⊗ and enable your choice using ⊖.

3.5.5.1.2.1 P122 & P123 additional I> DMT reset time, IEC curves menu

t Reset **60 ms**	Selection of the t Reset value from 40 ms to 100 s using ⊗ and enable your choice using ⊖.

3.5.5.1.2.2 P122 & P123 additional I> DMT reset time, ANSI curves menu

Type Tempo Reset **DMT**	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using ⊗ and enable your choice using ⊖.
t Reset **40 ms**	Selection of the t Reset value associated with the DMT reset time choice. Select from 40 ms to 100 s using ⊗ and enable your choice using ⊖.

3.5.5.1.2.3 P122 & P123 additional I> IDMT reset time, ANSI curves menu

Type Tempo Reset **IDMT**	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using ⊜ and enable your choice using ⊖.
Rtms **0.025**	Selection of the Rtms value associated with the IDMT reset time choice. Select from 0.025 to 1.5 using ⊜ and enable your choice using ⊖.

3.5.5.1.3 I> IDMT threshold, Electromechanical RI curve menu

Delay Type **RI**	Display of the I> inverse time delay (electromechanical RI curve)
K **2.500**	Selection of the RI curve K value. Select from 0.100 to 10 using ⊜ and enable your choice using ⊖.

3.5.5.1.3.1 P122 & P123 additional I> DMT reset time, Electromechanical RI curves menu

t Reset **60 ms**	Selection of the t Reset value from 40 ms to 100 s using ⊜ and enable your choice using ⊖.

3.5.5.1.4 I>> threshold menu

I>> ? **Yes**	Selection of the I>> second phase threshold. Select Yes or No. If the user enters I>>(Yes), the following menu is displayed. If the user enters I>> (No) go to I>>> menu.
I>> **10 In**	Selection of the I>> second threshold current value. To modify this value, press ⊖.The threshold I>>> is adjustable from 0.5 to 40 In. Press ⊖ to enable your adjustment.
Delay Type **DMT**	Selection of the I>> time delay type threshold. Select DMT for definite time, IDMT for inverse time curves, RI for electromechanical inverse time curve.
tI >> **100 ms**	Selection of the second threshold I>> time delay. Select the time delay from 0 to 150 s using ⊜ and enable your choice using ⊖.
t Reset **0 ms**	Selection of the t Reset value from 0 to 600 s using ⊜ and enable your choice using ⊖ (only P122, P123).

3.5.5.1.5 I>>> threshold menu

I>>> ? **Yes**	Selection of the I>>> third phase threshold. Select Yes or No. If the user enters I>>>(Yes), the following menu is displayed. If the user enters I>>> (No), the LCD display returns to the heading of the menu [50/51] Phase OC.
I>>> Sample **No**	Selection of the mode of operation of the third threshold. I>>> operates on current sample base if you select (YES), or on Fast Fourier Transformation base if you select (NO) (Only P122, P123).
I>>> **10 In**	Selection of the I>>> third threshold current value. To modify this value, press .The threshold I>>> is adjustable from 0.5 to 40 In. Press to enable your adjustment
tI >>> **100 ms**	Selection of the third threshold I>>> time delay. Select the time delay from 0 to 150 s using and enable your choice using .

3.5.5.2 [50N/51N] EARTH OC sub-menu **(P121 - P122 - P123** only**)**

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press , , 4 times.
[50N/51N] E/Gnd	Heading of the [50N/51N] E/Gnd sub-menu. To gain access to the sub-menu content, press .
Ie> ? **Yes**	Selection of the first earth threshold (Ie>). Select Yes or No. If the user enters Ie>(Yes), the following menu is displayed. If the user enters Ie>(No), go to Ie>> menu
Ie > **0.05 Ien**	Displays the current threshold value Ie>. To modify this value, press . The threshold Ie> is adjustable from : 0.002 to 1 Ien (0.002 to 1 Ien Range), 0.01 to Ien (0.01 to 8 Ien Range) and 0.1 to 25 Ien (0.1 to 40 Ien Range). Press to enable your adjustment
Delay Type **DMT**	Selection of the Ie> threshold time delay type. Select (DMT for definite time, IDMT for inverse time curves, RI for the electromechanical inverse time curve, LABOR. for Laborelec inverse curves) using and enable your choice using .

3.5.5.2.1 Ie> DMT threshold menu

Delay Type **DMT**	Display of the Ie> DMT time delay.
tIe > **100 ms**	Selection of the Ie> time delay. Select the time delay from 0 to 150 s using and enable your choice using .
t Reset **0 ms**	Selection of the t Reset value from 0 to 600 s using and enable your choice using (Only P122, P123).

3.5.5.2.2 Ie> IDMT threshold, IEC or IEEE/ANSI curves menu

Delay Type **DMT**	Display of the Ie> inverse time delay (IEC or IEEE/ANSI curves).
Idmt **IEC SI**	Selection of the Ie> curve. Select from IEC SI, IEC STI, IEC VI, IEC EI, IEC LTI, CO2, IEEE MI, CO8, IEEE VI, IEEE EI using and enable your choice using the key .
Tms **0,025**	Selection of the selected curve Tms value. Select from 0.025 to 1.5 using and enable your choice using .

3.5.5.2.2.1 P122 & P123 additional Ie> DMT reset time, IEC curves menu

t Reset **60 ms**	Selection of the t Reset value from 40 ms to 100 s using and enable your choice using .

3.5.5.2.2.2 P122 & P123 additional Ie> DMT reset time, ANSI curves menu

Type Tempo Reset **DMT**	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using and enable your choice using .
t Reset **40 ms**	Selection of the t Reset value associated with the DMT reset time choice. Select from 40 ms to 100 s using and enable your choice using .

3.5.5.2.2.3 P122 & P123 additional Ie> IDMT reset time, ANSI curves menu

Type Tempo Reset IDMT	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using and enable your choice using .
Rtms 0.025	Selection of the Rtms value associated with the IDMT reset time choice. Select from 0.025 to 1.5 using and enable your choice using .

3.5.5.2.3 Ie> IDMT threshold, Electromechanical RI curve menu

Delay type RI	Display of the Ie> inverse time delay (electromechanical RI curve)
K 2.500	Selection of the RI curve K value. Select from 0.100 to 10 using and enable your choice using .

3.5.5.2.3.1 P122 & P123 additional Ie> DMT reset time, RI curves menu

t Reset 60 ms	Selection of the t Reset value from 40 ms to 100 s using and enable your choice using .

3.5.5.2.4 Ie>> threshold menu

Ie>> ? Yes	Selection of the Ie>> second earth threshold. Select Yes or No. If the user enters Ie>>(Yes), the following menu is displayed. If the user enters>> (No) go to **Ie>>>** menu
Ie>> 5 Ien	Selection of the Ie>> second threshold current value. To modify this value, press .The threshold Ie>> is adjustable from : 0.002 to 1Ien (0.002 to 1 Ien Range) 0.01 to 8 Ien (0.01 to 8 Ien Range), and 0.5 to 40 Ien(0.1 to 40 Ion Range). Press to validate your adjustment.
Delay Type DMT	Selection of the Ie>> time delay type threshold. Select DMT for definite time, IDMT for inverse time curves, RI for electromechanical inverse time curve.
tIe>> 100 ms	Selection of the second threshold Ie>> time delay. Select the time delay from 0 to 150 s using and validate your choice using .
t Reset 0 ms	Selection of the t Reset value from 0 to 600 s using and enable your choice using (Only P122, P123).

3.5.5.2.5 Ie>>> threshold menu

Ie>>> ? **Yes**	Selection of the Ie>>> third earth threshold. Select Yes or No. If the user validates Ie>>>(Yes), the following menu is displayed. If the user enters Ie>>> (No), the LCD display returns to the heading of the menu [50N/51N] E/Gnd.
Ie>>> Sample **No**	Selection of the mode of operation of the third threshold. Ie>>> operates on current sample base if you select (YES), or on Fast Fourier Transformation base if you select (NO) (Only P122, P123).
Ie>>> **10 Ien**	Selection of the Ie>>> third threshold current value. To modify this value, press ↵.The threshold Ie>>> is adjustable from 0.5 to 40 Ien. Press ↵ to validate your adjustment.
tIe>>> **100 ms**	Selection of the third threshold Ie>>> time delay. Select the time delay from 0 to 150 s using ⇕ and validate your choice using ↵.

3.5.5.3 [46] NEGATIVE Phase SEQUENCE I2> sub-menu (**P122 & P123** only)

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press⇔, ⇕, 4 times.
[46] Neg Seq OC	Heading of the [46] NEGATIVE Phase SEQUENCE I2>sub-menu.
I2 > ? **Yes**	Selection of the negative phase sequence overcurrent function. Select Yes or No. If the user validates (Yes), the following menu is displayed If the user does not validate (No), no menu is activated.
I2 > **0.1 In**	Displays the negative phase sequence threshold value I2>. To modify this value, press ↵. The threshold I2> is adjustable from 0.1 to 40 In, step of 0.01 In. Press ↵ to validate your adjustment.
Delay Type **DMT**	Selection of the I2> threshold time delay type. Select (DMT for independent time, IDMT for inverse time curves, RI for the electromechanical inverse time curve) using ⇕ and validate your choice using ↵.

3.5.5.3.1 I2> DMT threshold menu

Delay Type **DMT**	Display of the I2> DMT time delay.
t I2 > **100 ms**	Selection of the I2> time delay. Select the time delay from 0 to 150 s using and validate your choice using .

3.5.5.3.2 I2> IDMT threshold, IEC or IEEE/ANSI curves menu

Delay Type **IDMT**	Display of the I2> inverse time delay (IEC or IEEE/ANSI curves).
Curve **IEC SI**	Selection of the I2> curve. Select from IEC SI, IEC STI, IEC VI, IEC EI, IEC LTI, CO2, IEEE MI, CO8, IEEE VI, IEEE EI using and validate your choice using the key .
Tms **0,025**	Selection of the selected curve Tms value. Select from 0.025 to 1.5 using and validate your choice using .

3.5.5.3.2.1 I2> DMT reset time, IEC curves menu

t Reset **60 ms**	Selection of the t Reset value from 40 ms to 100 s using and validate your choice using .

3.5.5.3.2.2 I2> DMT reset time, ANSI curves menu

Type Tempo Reset **DMT**	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using and validate your choice using .
t Reset **40 ms**	Selection of the t Reset value associated with the DMT reset time choice. Select from 40 ms to 100 s using and validate your choice using .

3.5.5.3.2.3 I2> IDMT reset time, ANSI curves menu

Type Tempo Reset **IDMT**	Selection of the type of reset time delay. Select between DMT (Definitive Time) and IDMT (Inverse Time) using and validate your choice using .
Rtms **0.025**	Selection of the Rtms value associated with the IDMT reset time choice. Select from 0.025 to 1.5 using and validate your choice using .

3.5.5.3.3 I2> IDMT threshold, Electromechanical RI curve menu

Delay Type **RI**	Display of the I2> inverse time delay (electromechanical RI curve)
K **2.500**	Selection of the RI curve K value. Select from 0.100 to 10 using and validate your choice using .

3.5.5.3.3.1 I2> DMT reset time, RI curves

t Reset **60 ms**	Selection of the t Reset value from 40 ms to 100 s using and validate your choice using .

3.5.5.3.4 I2>> threshold menu

I2>> ? **Yes**	Selection of the 2nd threshold of the negative phase sequence overcurrent function. Select Yes or No. If the user validates (Yes), the following menu is displayed If the user does not validate (No), no menu is activated.
I2>> **1 In**	Displays the value of the 2nd threshold of the negative phase sequence overcurrent function. To modify this value, press . The threshold I2>> is adjustable from 0.1 In to 40 In, step of 0.01 In. Press to validate your adjustment.
tI2>> **150 ms**	Selection of the 2nd threshold I2>> time delay. Select the time delay from 0 to 150 s using and validate your choice using .

3.5.5.3.5 [49] Therm OL sub-menu (**P122 & P123** only)

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press ⊘, ⊘, 4 times.
[49] Therm OL	Heading of the [49] Therm OL (Thermal Overload) sub-menu To gain access to the sub-menu points, press ⊘.
Therm OL ? **Yes**	Selection of the thermal overload function. Select Yes or No. If the user enters Yes, the following menu is displayed. If the user enters No, no menu content is displayed.
Iθ > **0.5 In**	Displays the thermal current threshold value Iθ>. To modify this value, press ⊖. The threshold Iθ> is adjustable from 0.1 to 3.2 In step of 0.01. Press ⊖ to validate your choice.
Te **10 mn**	Displays the Te thermal time constant associated with the thermal overload formula. To modify this value, press ⊖. The time constant Te is adjustable from 1 min to 200 min, step of 1 min. Press ⊖ to validate your adjustment.
k **1.01**	Displays the k factor associated with the thermal overload function. To modify this value, press ⊖. k factor is adjustable from 1 to 1.5, step of 0.01. Press ⊖ to validate your adjustment.
θ **Trip** **110 %**	Displays the percentage applicable to the thermal overload trip threshold. To modify this value, press ⊖. θ Trip is adjustable from 50 % to 200 % step of 1%. Press ⊖ to validate your adjustment.
θ **Alarm ?** **Yes**	Selection of the thermal overload alarm function. Select Yes or No. If the user validates Yes, the following menu is displayed. If the user validate No, refer to the THERMAL OVERLOAD sub-menu.
θ **Alarm** **90 %**	Displays the percentage applicable to the thermal overload alarm threshold. To modify this value, press ⊖. θ Trip is adjustable from 50 % to 200 % step of 1%. Press ⊖ to validate your adjustment.

3.5.5.4 [37] UNDERCURRENT I< sub-menu (**P122 & P123** only)

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press , , 4 times.
[37] Under Current	Heading of the [37] Under-Current sub-menu To gain access to the sub-menu content, press .
I < ? **Yes**	Selection of the undercurrent function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), no menu points is activated.
I < **0.2 In**	Displays the undercurrent threshold value I<. To modify this value, press . The threshold I< is adjustable from 0.02 In to 1 In, step of 0.01 In. Press to validate your adjustment.
tI < **200 ms**	Selection of the time delay associated to the undercurrent threshold. Select the time delay from 0 s to 150 s using and validate your choice using .

3.5.5.5 [79] AUTORECLOSE sub-menu (**P123** only)

PROTECTION G1	Heading of the PROTECTION menu. To gain access to the menu, press , , 4 times.
[79] Autoreclose	Heading of the [79] AUTORECLOSER sub-menu To gain access to the sub-menu, press .
Autoreclose ? **Yes**	Selection of the autoreclose function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), no menu is activated.
Ext CB Fail ? **Yes**	Selection of the external circuit breaker failure function associated with the autorecloser function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), the Ext Block sub menu is activated.

3.5.5.5.1 [79] EXTERNAL CB FAILURE

Ext CB Fail **Yes**	Allows the use of a dedicated input (CB FLT) to inform the autorecloser function of the state (failure or operational) of the CB.
Ext CB Fail Time **10000 ms**	Selection of the external CB failure time delay tCFE. Select the time delay from 10 ms to 600 s using ⊗ and validate your choice using ⊖.

3.5.5.5.2 [79] EXTERNAL BLOCKING

Ext Block ? **Yes**	Allows the use of a dedicated input (Block_79) to block the autorecloser function.

3.5.5.5.3 [79] DEAD and RECLAIM TIMES

Dead Time **tD1 60 ms**	Selection of the First Cycle Dead Time (tD1) value associated with the autoreclose function. Select from 10 ms to 300 s step of 10 ms using ⊗ and validate your choice using ⊖.
Dead Time **tD2 100 ms**	Selection of the Second Cycle Dead Time (tD2) value associated with the autoreclose function. Select from 10 ms to 300 s step of 10 ms using ⊗ and validate your choice using ⊖.
Dead Time **tD3 200 ms**	Selection of the Third Cycle Dead Time (tD3) value associated with the autoreclose function. Select from 10 ms to 600 s step of 10 ms using ⊗ and validate your choice using ⊖.
Dead Time **tD4 60 ms**	Selection of the Fourth Cycle Dead Time (tD4) value associated with the autoreclose function. Select from 10 ms to 600 step of 10 ms using ⊗ and validate your choice using ⊖.
Reclaim Time **tR 120 ms**	Selection of the Reclaim Time (tR) value associated with the autoreclose function. Select from 20 ms to 600 s step of 10 ms using ⊗ and validate your choice using ⊖
Inhib Time **tI 120 ms**	Selection of the Inhibit Time (tI) value associated with the autoreclose function (following a manual CB closure). Select from 20 ms to 600 s step of 10 ms using ⊗ and validate your choice using ⊖ your choice

3.5.5.5.4 [79] Cycles number

Phase Cycles	
	4

Selection of the number of cycles associated with the phase autoreclose function. Select from 0 to 4 using and validate your choice using .

E/Gnd Cycles	
	4

Selection of the number of cycles associated with the earth autoreclose function. Select from 0 to 4 using and validate your choice using .

3.5.5.5.5 [79] Cycle allocation

CYCLES	**4321**
tI>	**1101**

0 = no action on autorecloser : definitive trip
1 = trip on tI> pick-up, followed by reclosing cycle
2 = no trip on tI> pick-up

CYCLES	**4321**
tI>>	**1211**

0 = no action on autorecloser : definitive trip
1 = trip on tI>> pick-up, followed by reclosing cycle
2 = no trip on tI>> pick-up

CYCLES	**4321**
tI>>>	**1110**

0 = no action on autorecloser : definitive trip
1 = trip on tI>>> pick-up, followed by reclosing cycle
2 = no trip on tI>>> pick-up

CYCLES	**4321**
tIe>	**0111**

0 = no action on autorecloser : definitive trip
1 = trip on tIe> pick-up, followed by reclosing cycle
2 = no trip on tIe> pick-up

CYCLES	**4321**
tIe>>	**1121**

0 = no action on autorecloser : definitive trip
1 = trip on tIe>> pick-up, followed by reclosing cycle
2 = no trip on tIe>> pick-up

CYCLES	**4321**
tIe>>>	**1111**

0 = no action on autorecloser : definitive trip
1 = trip on tIe>>> pick-up, followed by reclosing cycle
2 = no trip on tIe>>> pick-up

CYCLES	**4321**
tAux1>	**1112**

0 = no action on autorecloser : definitive trip
1 = trip on tAux1> pick-up, followed by reclosing cycle
2 = no trip on tAux1> pick-up

CYCLES	**4321**
tAux2>	**0111**

0 = no action on autorecloser : definitive trip
1 = trip on tAux2> pick-up, followed by reclosing cycle
2 = no trip on tAux2> pick-up

3.5.6 AUTOMAT. CTRL Menu

The AUTOMAT. CTRL Menu makes it possible to programme the various automation functions included in the **MiCOM P120, P121, P122** and **P123**.

The various sub-menus are :

⇒ Trip Commands

⇒ Latch of the trip output relay RL1 by function (**P121, P122, P123** only)

⇒ Latch of functions (**P120** only)

⇒ Blocking logic (1)

⇒ Blocking Logic 2 (**P122 & P123** only)

⇒ Logic Select. 1 (**P122 & P123** only)

⇒ Logic Select. 2 (**P122 & P123** only)

⇒ Outputs Relays

⇒ Latch of the auxiliary output relays (**P121, P122, P123** only)

⇒ Inputs

⇒ Broken Conductor (**P122 & P123** only)

⇒ Cold load PU(**P122 & P123** only)

⇒ CB Fail (**P122 & P123** only)

⇒ CB Supervision (**P122 & P123** only)

⇒ Comm. Ord. Latch times (**P122 & P123** only)

To access the AUTOMAT. CTRL Menu, press ⌃ then the key ⌄ six times.

3.5.6.1 Trip Commands sub-menu

This sub-menu makes it possible to assign to the trip output relay (RL1) part or all the selected thresholds.

AUTOMAT.CTRL	Heading of the AUTOMAT.CTRL Menu. To gain access to the menu, press , , 6 times.
Trip Commands	Heading of the Trip ORDER sub-menu. To gain access to the sub-menu points, press .
Trip tI> **Yes**	Allocation of the first phase time delay overcurrent threshold (tI>) to the trip output (select Yes or No). If the user validates Yes, the trip output relay (RL1) shall be activated at the end of the time delay tI>. If the user validates No, the trip output relay (RL1) shall never be activated, even at the end of the time delay tI>.
Trip tI>> **Yes**	Allocation of the second phase time delay overcurrent threshold (tI>>) to the trip output. Select Yes or No.
Trip tI>>> **No**	Allocation to the third phase time delay overcurrent threshold (tI>>>) to the trip output. Select Yes or No.
Trip tIe> **Yes**	Allocation of the first earth time delay overcurrent threshold (tIe>) to the trip output. Select Yes or No.
Trip tIe>> **No**	Allocation of the second earth time delay overcurrent threshold (tIe>>) to the trip output. Select Yes or No.
Trip tIe>>> **No**	Allocation of the third earth time delay overcurrent threshold (tIe>>>) to the trip output. Select Yes or No.

3.5.6.1.1 P122 & P123 additional Trip Commands menu

Trip tI < **No**	Allocation of the minimum current threshold (I<) to the trip output. This information is generated is less than a cycle of the network frequency (50 or 60 Hz). Select Yes or No. Select Yes or No.
Trip tI2 > **No**	Allocation of the delayed negative phase sequence overcurrent threshold (tI2>) to the trip output. Select Yes or No.
Trip tI2 >> **No**	Allocation of the delayed negative phase sequence overcurrent threshold (tI2>>) to the trip output. Select Yes or No.
Trip Thermal θ **No**	Allocation of the thermal overload Trip information (θTrip) to the trip output. Select Yes or No.
Trip Brkn.Cond **Yes**	Allocation of the broken conductor detection to the trip output. Select Yes or No.
Trip t Aux 1 **No**	Allocation of the delayed auxiliary input Aux 1 to the trip output. Select Yes or No.
Trip t Aux 2 **No**	Allocation of the delayed auxiliary input Aux 2 to the trip output. Select Yes or No.
Trip t Aux 3 **No**	Allocation of the delayed auxiliary input Aux 3 to the trip output. Select Yes or No.
Trip CB Fail **No**	Allocation of the Breaker failure information to the trip output. Select Yes or No.

3.5.6.1.2 P123 additional Trip COMMAND menu

Trip t Aux 4 **No**	Allocation of the delayed auxiliary input Aux 4 to the trip output. Select Yes or No.

3.5.6.2 Latch of trip output relay by Function Sub-Menu (**P121, P122 & P123** relays)

This sub-menu makes it possible to latch the **trip output relay RL1** associated with one or several thresholds/functions after the cause has disappeared.

AUTOMAT. CTRL	Heading of the AUTOMAT. CTRL menu. To gain access to the menu, press ⇩, ⇨, 6 times.
Latch Functions	Heading of the Latch functions sub-menu. To gain access to the sub-menu points, press ⇩.
Latch tI> **Yes**	Latch of the trip output relay RL1 associated with the first phase time delay overcurrent threshold (tI>) (select Yes or No). If the user validates Yes, RL1 shall be latched after tI> disappeared. If the user validates No, RL1 shall drop out after tI> disappeared.
Latch tI>> **Yes**	Latch of the trip output relay RL1 associated with the second phase time delay overcurrent threshold (tI>>) Select Yes or No.
Latch tI>>> **No**	Latch of the trip output relay RL1 associated with the third phase time delay overcurrent threshold (tI>>>) Select Yes or No.
Latch tIe> **No**	Latch of the trip output relay RL1 associated with the first earth time delay overcurrent threshold (tIe>) Select Yes or No.
Latch tIe>> **No**	Latch of the trip output relay RL1 associated with the second earth time delay overcurrent threshold (tIe>>) Select Yes or No.
Latch tIe>>> **No**	Latch of the trip output relay RL1 associated with the third earth time delay overcurrent threshold (tIe>>>) Select Yes or No.

3.5.6.2.1 P122 & P123 additional Latch functions sub-menu

Latch tI < **Yes**	Latch of the trip output relay RL1 associated with the time delay minimum current threshold (tI<). Select Yes or No.
Latch tI2 > **No**	Latch of the trip output relay RL1 associated with the time delay negative phase sequence overcurrent threshold (tI2>) to the trip output. Select Yes or No. Select Yes or No.
Latch tI2 >> **No**	Latch of the trip output relay RL1 associated with the time delay negative phase sequence overcurrent threshold (tI2>>) to the trip output. Select Yes or No. Select Yes or No.
Latch Thermal θ **No**	Latch of the trip output relay RL1 associated with the thermal overload Trip information (θ Trip). Select Yes or No.
Latch Brkn.Cond **No**	Latch of the trip output relay RL1 associated with the broken conductor function. Select Yes or No.
Latch t Aux 1 **No**	Latch of the trip output relay RL1 associated with the delayed auxiliary input Aux 1. Select Yes or No.
Latch t Aux 2 **No**	Latch of the trip output relay RL1 associated with the delayed auxiliary input Aux 2. Select Yes or No.
Latch t Aux 3 **No**	Latch of the trip output relay RL1 associated with the delayed auxiliary input Aux 3. Select Yes or No.

3.5.6.2.2 P123 additional latch functions sub-menu

Latch t Aux 4 **No**	Latch of the trip output relay RL1 associated with the delayed auxiliary input Aux 4. Select Yes or No.

NOTE : Reset of the latch of the trip output relay RL1 :

	P121	P122 &P123
Reset of RL1 latched by function	Either by reset of the alarm "tI> PHASE"* (© clear push button), or by opto, or by remote command. Note: No alarm dedicated to the latch of RL1	Either by reset of the alarm "LATCH RELAY TRIP" (© clear push button), or by opto, or by remote command. Note: The alarm "LATCH RELAY TRIP" is dedicated to the latch of RL1

* : tI> or other function presented in the "AUTOMAT. CTRL/Latch functions" menu

3.5.6.3 Latch functions sub-menu (**P120** relay)

This sub-menu makes it possible to latch the output relays (including the trip output relay) associated with one or several thresholds after the cause has disappeared.

AUTOMAT. CTRL	Heading of the AUTOMAT. CTRL menu. To gain access to the menu, press ⇔, ⇕, 6 times.
Latch function	Heading of the Latch function sub-menu. To gain access to the sub-menu point, press ⇔.
Latch tI> **Yes**	Latch of the output relay(s) associated with the first phase (or earth) time delay overcurrent threshold tI> (tIe>). If the user validates Yes, all output relay(s) associated with tI> (tIe>) threshold shall be latched after tI> (tIe>). If the user validates No, the output relay(s) associated with tI> (tIe>) shall drop out after tI> (tIe>) disappeared.
Latch tI>> **Yes**	Latch of the output relay(s) associated with the first phase (or earth) time delay overcurrent threshold tI>> (tIe>>). If the user validates Yes, all output relay(s) associated with tI>> (tIe>>) threshold shall be latched after tI>> (tIe>>). If the user validates No, the output relay(s) associated with tI>> (tIe>>) shall drop out after tI>> (tIe>>) disappeared.
Latch tI>>> **Yes**	Latch of the output relay(s) associated with the first phase (or earth) time delay overcurrent threshold tI>>> (tIe>>>). If the user validates Yes, all output relay(s) associated with tI>>> (tIe>>>) threshold shall be latched after tI>>> (tIe>>>). If the user validates No, the output relay(s) associated with tI>>> (tIe>>>) shall drop out after tI>>> (tIe>>>) disappeared.

NOTE : Reset of the latched relays with MiCOM P120 :
when a relay is latched associated to a time delay overcurrent threshold no alarm dedicated to the latch is displayed.
The reset of the latch is possible with an acknowledgement of the alarm message further any crossing of time delay overcurrent threshold associated to the relay latched, and this through to the keys and .
The latched relay can also be reset either by opto input or by remote command.

3.5.6.4 Blocking Logic sub-menu

The Blocking Logic sub-menu (design as Blocking Logic 1 and Blocking Logic 2 menus in MiCOM **P122 & P123**) enables a user to allocate each time delay threshold to the "Blk Log" input (refer to Inputs menu).

AUTOMAT. CTRL	Heading of the AUTOMAT. CTRL menu. To gain access to the menu, press , , 6 times.
Blocking Logic	Heading of the Blocking Logic sub-menu. To gain access to the sub-menu contents, press .
Block tI> **Yes**	Blocking logic of the first phase time delay overcurrent threshold (tI>) (select Yes or No). If the user validates Yes, the first threshold shall be locked on the transition (logic state 1) of the Logic "Blk log" logic input. If the user validates No, the transition of the "Blk log" logic input shall not alter the first phase threshold tI>.
Block tI>> **Yes**	Blocking logic of the second phase time delay overcurrent threshold (tI>>). Select Yes or No.
Block tI>>> **Yes**	Blocking logic of the third phase time delay overcurrent threshold (tI>>>) Select Yes or No.
Block tIe> **No**	Blocking logic of the first earth time delay overcurrent threshold (tIe>). Select Yes or No.
Block tIe>> **No**	Blocking logic of the second earth time delay overcurrent threshold (tIe>>). Select Yes or No.
Block tIe>>> **No**	Blocking logic of the third earth time delay overcurrent threshold (tIe>>>). Select Yes or No.

3.5.6.4.1 P122 & P123 additional Blocking Logic menu

Block 1 tI2 > **No**	Blocking logic of the time delay negative phase sequence overcurrent threshold (tI2>) to the trip output. Select Yes or No. Select Yes or No.
Block 1 tI2 >> **No**	Blocking logic of the time delay negative phase sequence overcurrent threshold (tI2>>) to the trip output. Select Yes or No. Select Yes or No.
Block 1 Thermal θ **Yes**	Blocking logic of the thermal state calculation. Select Yes or No.
Block 1 Brkn.Cond **No**	Blocking logic of the broken conductor function Select Yes or No.
Block 1 t Aux 1 **No**	Blocking logic of the time delay of the auxiliary input Aux 1. Select Yes or No.
Block 1 t Aux 2 **No**	Blocking logic of the time delay of the auxiliary input Aux 2. Select Yes or No.
Block 1 t Aux 3 **No**	Blocking logic of the time delay of the auxiliary input Aux 3. Select Yes or No.

3.5.6.4.2 P123 additional Blocking Logic menu

Block 1 t Aux 4 **No**	Blocking logic of the time delay of the auxiliary input Aux 4. Select Yes or No.

3.5.6.5 Logic Select sub-menus (**P122 & P123** only)

The Logic Selectivity sub-menus design as Logic Select. 1 and Logic Select. 2 sub-menus enable a user to allocate each time delay threshold to the "Log sel" input (refer to Inputs menu). To access to Logic Select. 1and Logic Select. 2, press ⊜, ⇳ 6 times, ⊜.

AUTOMAT. CTRL	Heading of the AUTOMAT. CTRL menu. To gain access to the menu, press ⊜, ⇳ 6 times.
Logic Select. 1	Heading of the Logic Select. 1 sub-menu. To gain access to the sub-menu contents, press ⊜.
Sel1 tI>> **Yes**	Logic selectivity of the second phase time delay overcurrent threshold (tI>>) (select Yes or No). If the user validates Yes, operation of the second threshold shall be delayed for tSel1 on the transition (logic state 1) of the "Log Sel 1" logic input. If the user validates No, the transition of the "Log Sel 1" logic input shall not alter the second phase threshold tI>>.
Sel1 tI>>> **Yes**	Logic selectivity of the third phase time delay overcurrent threshold (tI>>>) Select Yes or No.
Sel1 tIe>> **No**	Logic selectivity of the second earth time delay overcurrent threshold (tIe>>). Select Yes or No.
Sel1 tIe>>> **No**	Logic selectivity of the third earth time delay overcurrent threshold (tIe>>>). Select Yes or No.
t Sel1 **20 ms**	Displays the selective scheme logic time delay t Sel1. To modify this value, press ⊖. The t Sel1 is adjustable from 0 ms to 150 s by step of 10 ms. Press ⊖ to validate your adjustment.

3.5.6.6 Outputs Relays sub-menu

This sub-menu makes it possible to allocate to each logic output (excepted Watchdog RL0 and Tripping RL1 refer to Trip Commands submenu) the various thresholds (instantaneous and/or time delay).

MiCOM P123 allows configuration of 7 outputs (RL2 to RL 8) in this submenu, **P122** allows 5 outputs (RL2 to RL 6) and **P121** & **P120** 3 outputs (RL2 to RL4).

RL2 relay is a change over relay. The others RL3 to RL8 are normally open relays.

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press , 6 times.
Output Relays	Heading of the Output Relays sub-menu. To gain access to the sub-menu points, press .
Trip 8765432 **1100010**	Allocation of trip orders to the output relays (copies the trip contact onto one or several selected relays). To allocate this information to the output relay(s), press , then allocate to the desired output relay the value 1using . Repeat the operation on the other output relays if desired, then validate using .
I> 8765432 **1100010**	Allocation of the first phase instantaneous overcurrent threshold (I>) to the output relays . Select output relays.
tI> 8765432 **1100010**	Allocation of the first phase time delay overcurrent threshold (tI>) to the output relays. Select output relays.
I>> 8765432 **1100010**	Allocation of the second phase instantaneous overcurrent threshold (I>>) to the output relays Select output relays
tI>> 8765432 **1100010**	Allocation of the second phase time delay overcurrent threshold (tI>>) to the output relays Select output relays.
I>>> 8765432 **1100010**	Allocation of the third phase instantaneous overcurrent threshold (I>>>) to the output relays Select output relays.
tI>>> 8765432 **1100010**	Allocation of the third phase time delay overcurrent threshold (tI>>>) to the output relays Select output relays .

Ie>	**8765432** **1100010**	Allocation of the first earth instantaneous overcurrent threshold (Ie>) to the output relays Select output relays .
tIe>	**8765432** **1100010**	Allocation of the first earth time delay overcurrent threshold (tIe>) to the output relays Select output relays .
Ie>>	**8765432** **1100010**	Allocation of the second earth instantaneous overcurrent threshold (Ie>>) to the output relays Select output relays .
tIe>>	**8765432** **1100010**	Allocation of the second earth time delay overcurrent threshold (tIe>>) to the output relays Select output relays .
Ie>>>	**8765432** **1100010**	Allocation of the third earth instantaneous overcurrent threshold (Ie>>>) to the output relays Select output relays.
tIe>>>	**8765432** **1100010**	Allocation of the third earth time delay overcurrent threshold (tIe>>>) to the output relays Select output relays.
CB **Close**	**8765432** **1100010**	Allocation of the circuit breaker closing order to the output relays. Select output relays.

3.5.6.6.1 P122 & P123 additional Outputs menu

tI< 8765432 1100010	Allocation of the minimum current time delay threshold (tI<) to the output relays Select output relays.
tI2> 8765432 1100010	Allocation of the negative phase sequence overcurrent time delay threshold (tI2>) to the output relays. Select output relays.
tI2>> 8765432 1100010	Allocation of the negative phase sequence overcurrent time delay threshold (tI2>>) to the output relays. Select output relays.
Therm. 8765432 Alarm 1100010	Allocation of the thermal alarm threshold to the output relays Select output relays.
Therm. 8765432 Trip 1100010	Allocation of the thermal trip threshold to the output relays Select output relays.
CB Alarm 8765432 1100010	Allocation of the Circuit Breaker Alarm function to the output relays (CB OPEN Nb, SUM A^n, Tripping and closing Time). Select output relays.
52 Fail 8765432 1100010	Allocation of the Trip Circuit Supervision (TCS) Failure function to the output relays. Select output relays.
Brkn. 8765432 Cond 1100010	Allocation of the broken conductor function to the output relays. Select output relays .
CB Fail 8765432 1100010	Allocation of the circuit breaker failure function to the output relays. Select output relays. CB Fail = CB not open at the end of tBF timer.
t Aux 1 8765432 1100010	Allocation of the delayed auxiliary input Aux 1 to the output relays. Select output relays.
t Aux 2 8765432 1100010	Allocation of the delayed auxiliary input Aux 2 to the output relays. Select output relays.

t Aux 3 8765432 1010101	Allocation of the delayed auxiliary input Aux 3 to the output relays. Select output relays.
Order 1 Comm. 8765432 0000100	Allocation of the remote command 1 to the output relays. Select output relays.
Order 2 Comm. 8765432 0000010	Allocation of the remote command 2 to the output relays. Select output relays.
Order 3 Comm. 8765432 0000001	Allocation of the remote command 3 to the output relays. Select output relays.
Order 4 Comm. 8765432 1000000	Allocation of the remote command 4 to the output relays. Select output relays.
Active Group 8765432 0010000	Allocation of the Active Group indication to the output relays. Select output relays.

3.5.6.6.2 P123 additional Outputs menu

t Aux 4 8765432 0010000	Allocation of the delayed auxiliary input Aux 4 to the output relays. Select output relays.
79 Run 8765432 1100010	Allocation of the "autorecloser in progress" information to the output relays. Select output relays.
79 Trip 8765432 1100010	Allocation of the autorecloser final trip function to the output relays. Select output relays.

3.5.6.7 Latch of the auxiliary output relays (RL2 to RL8)

This sub-menu (not available in P120 menu) makes it possible to latch the auxiliary output relays, relay by relay.

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press , 6 times.
Latch Output Relays	Heading of the Latch Output Relays sub-menu. To gain access to the sub-menu points, press .
Output 2 **No**	Latch of the auxiliary output relay RL2. Select Yes or No.
Output 3 **Yes**	Latch of the auxiliary output relay RL3. Select Yes or No.
Output 4 **Yes**	Latch of the auxiliary output relay RL4. Select Yes or No.

3.5.6.7.1 P122 & P123 additional latch output relays menu

Output 5 **Yes**	Latch of the auxiliary output relay RL5. Select Yes or No.
Output 6 **No**	Latch of the auxiliary output relay RL6. Select Yes or No.

3.5.6.7.2 P123 additional latch output relays menu

Output 7 **Yes**	Latch of the auxiliary output relay RL7. Select Yes or No.
Output 8 **No**	Latch of the auxiliary output relay RL8. Select Yes or No.

NOTE : Reset of the latched auxiliary relays :

	P121	**P122 &P123**
Reset of the auxiliary output relay latched	Either by "OP PARAMETERS/Relay Status" menu and ⓒ clear push button, or by opto, or by remote command. Note: No alarm dedicated to the latch of the auxiliary output relay	Either by reset of the alarm "LATCH RELAY" (ⓒ clear push button), or by opto, or by remote command. Note: An alarm "LATCH RELAY" is dedicated to the latch of the auxiliary output relay

3.5.6.8 Inputs sub-menu

This sub-menu makes it possible to allocate to each logic input either a label or an automation function, following the table :

Label abstract	**Label signification**
None	No allocation
Unlatch	Reset the latching of the output relays
52 a	Position of the circuit breaker (open)
52 b	Position of the circuit breaker (close)
CB FLT	External failure information from the CB
Aux 1	Allocation to the input the external information Aux 1
Aux 2	Allocation to the input the external information Aux 2
Blk Log (1)	Blocking logic 1
Blk Log 2	Blocking logic 2
Strt Dist	Starting of the disturbance recording function
Cold L PU	Cold load pick up allocation
Log Sel 1	Logic selectivity 1
Log Sel 2	Logic selectivity 2
Change set	Change of setting group (default setting group 1)
θ **Reset**	Reset of the thermal state
Trip Circ	Trip circuit supervision input
Strt tBF	Starting of the Breaker Fail Timer
Rst led	Reset of the "Trip" & "Alarm" leds
Maint. M	Maintenance Mode ON/OFF change
Aux 3	Allocation to the input the external information Aux 3
Block [79]	Blocking of the autorecloser function [79]
Aux 4	Allocation to the input the external information Aux 4

NOTE: For P120 and P121 :
The external information Aux1 and Aux2 are only used for signalisation on the communication network.
T Aux1 and t Aux2 are fixed and equal to 0 ms.
Only one blocking logic function.

Only available in model MiCOM P122 and P123 (light grey)

Only available in model MiCOM P123 (dark grey)

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press ⊙, ⊙, 6 times.
Inputs	Heading of the Inputs sub-menu. To gain access to the sub-menu points, press ⊙.
Input 1 **52a**	Allocation of logic input 1. To allocate labels to logic input 1, press ⊙ then with ⊙ ⊙ select the desired label from the available list, then validate your choice using ⊙.
Input 2 **52b**	Allocation of logic input 2. To allocate labels to logic input 2, press ⊙ then with ⊙ ⊙ select the desired label from the available list, then validate your choice using ⊙.

3.5.6.8.1 **P122 & P123** additional Inputs menu

Input 3 **Aux1**	Allocation of logic input 3. To allocate labels to logic input 3, press ⊙ then with ⊙ ⊙ select the desired label from the available list, then validate your choice using ⊙.
Aux1 Time **t Aux1 300 ms**	Displays the time delay t Aux 1 associated with the logic input Aux1. To modify this value, press ⊙. The t Aux 1 is adjustable from 0 ms to 200 s by step of 10 ms, then validate your choice using ⊙.
Aux2 Time **t Aux2 1.2 ms**	Displays the time delay t Aux 2 associated with the logic input Aux 2. To modify this value, press ⊙. The t Aux 2 is adjustable from 0 ms to 200 s by step of 10 ms, then validate your choice using ⊙.
Aux3 Time **t Aux3 10s**	Displays the time delay t Aux 3 associated with the logic input Aux 3. To modify this value, press ⊙. The t Aux 3 is adjustable from 0 ms to 200 s by step of 10 ms, then validate your choice using ⊙.

3.5.6.8.2 P123 additional Inputs menu

Input 4 **Log Sel 1**	Allocation of logic input 4. To allocate labels to logic input 4, press ⊙ then with ⊙ ⊙ select the desired label from the available list, then validate your choice using ⊙.
Input 5 **Aux 2**	Allocation of logic input 5. To allocate labels to logic input 5, press ⊙ then with ⊙ ⊙ select the desired label from the available list, then validate your choice using ⊙.
Aux4 Time **t Aux4 100s**	Displays the time delay t Aux 4 associated with the logic input Aux 4. To modify this value, press ⊙. The t Aux 4 is adjustable from 0 ms to 200 s by step of 10 ms, then validate your choice using ⊙.

3.5.6.9 BROKEN CONDUCTOR sub-menu (**P122 & P123** only)

AUTOMAT. CTRL	Heading of the AUTOMAT. CTRL menu. To gain access to the menu, press ⇩, ⇨, 6 times.
Broken Cond.	Heading of the P123 BROKEN CONDUCTOR sub-menu. To access its content, press ⇩.
Brkn. Cond. ? **Yes**	Selection of the broken conductor function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user validates (No), the broken conductor function is inactive.
Brkn. Cond Time **tBC 20 ms**	Display the broken conductor time delay tBC. To modify this value, press ↵. The tBC is adjustable from 0 to 14400 s with step of 1 s. Press ↵ to validate your adjustment
Ratio I2/I1 **20 %**	Display the broken conductor threshold. This threshold is a ratio between the negative phase sequence and the positive phase sequence current. To modify this value, press ↵. The I2/I1 ratio is adjustable from 20 to 100 % by step of 1 %. Press ↵ to validate your adjustment

3.5.6.10 COLD LOAD PICK-UP sub-menu (**P122 & P123** only)

The Cold Load PU sub-menu allows to enable the cold load pick-up function and the associated settings.

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press ⇩, ⇨, 6 times.
Cold Load PU	Heading of the Cold Load PU sub-menu. To gain access to the sub-menu points, press ⇩.
Cold Load PU ? **Yes**	Selection of the cold load pick-up function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), the cold load pick-up function is inactive.
Cold Load PU **tI> ? No**	Associate the I> time delay threshold with the cold load pick up function. To modify this choice, press ↵ and using ⇩ allocate the desired threshold to the cold load pick-up function. Validate your choice using ↵.
Cold Load PU **tI>> ? Yes**	Associate the I>> time delay threshold with the cold load pick up function. To modify this choice, press ↵ and using ⇩ allocate the desired threshold to the cold load pick up function. Validate your choice using ↵.

Cold Load PU **tI>>> ? Yes**	Associated the I>>> time delay threshold to the cold load pick up function. To modify this choice, press and using allocate the desired threshold to the cold load pick up function. Validate your choice using .
Cold Load PU **tIe> ? Yes**	Associated the Ie> time delay threshold to the cold load pick up function. To modify this choice, press and using allocate the desired threshold to the cold load pick-up function. Validate your choice using .
Cold Load PU **tIe>> ? Yes**	Associated the Ie>> time delay threshold to the cold load pick up function. To modify this choice, press and using allocate the desired threshold to the cold load pick-up function. Validate your choice using .
Cold Load PU **tIe>>> ? Yes**	Associated the Ie>>> time delay threshold to the cold load pick up function. To modify this choice, press and using allocate the desired threshold to the cold load pick-up function. Validate your choice using .
COLD LOAD P/UP **tI2> Yes**	Associated the I2> time delay threshold the cold load pick up function. To modify this choice, press and using allocate desired threshold to the cold load start pick up function. Validate your choice using .
COLD LOAD P/UP **tI2>> No**	Associated the I2>> time delay threshold the cold load pick up function. To modify this choice, press and using allocate desired threshold to the cold load start pick up function. Validate your choice using .
Cold Load PU **t Therm. ? Yes**	Associated the Thermal overload time delay threshold to the cold load pick up function. To modify this choice, press and using allocate the desired threshold to the cold load pick-up function. Validate your choice using .
Cold Load PU **level 200 %**	Selection of the cold load pick up percentage scaling value associated with the selected thresholds. Select from 20% to 500% with steps of 1 % using and validate your choice using .
Cold Load PU **tCL = 400 ms**	Selection of the cold load pick up time delay. Select from 100 ms to 3600 s with steps of 10 ms using and validate your choice using .

3.5.6.11 CIRCUIT BREAKER FAILURE sub-menu (**P122 & P123** only)

The CB Fail sub-menu makes it possible to enable the circuit breaker failure detection function and associated settings.

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press , , 6 times.
CB Fail	Heading of the CB Fail sub-menu. To gain access to the sub-menu points, press .
CB Fail ? **Yes**	Selection of the circuit breaker failure function. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), the breaker failure function is inactive.
I<= **0.1 In**	Selection of the under current threshold associated to the CB failure detection function. Select from 0.02 In to 1 In by step of 0.01 In.
CB Fail Time **tBF 40 ms**	Selection of the circuit breaker failure time delay. Select from 10 ms to 10 s with steps of 10 ms using and validate your choice using .
Block I> ? **No**	Select the possibility to block the instantaneous signal I> in case of circuit breaker failure detection. Select Yes or No.
Block Ie> ? **Yes**	Select the possibility to block the instantaneous signal Ie> in case of circuit breaker failure detection. Select Yes or No.

3.5.6.12 CIRCUIT BREAKER SUPERVISION sub-menu (**P122 & P123** only)

The CB Supervision sub-menu makes it possible to validate the circuit breaker supervision and monitoring function and the various settings associated to this function.

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press , , 6 times.
CB Supervision	Heading of the CB Supervision sub-menu. To gain access to the sub-menu points, press .
TC Supervision **Yes**	Selection of the trip circuit supervision function. Select Yes or No. If the user validates (Yes), the function is active. If the user does not validate (No), go to CB Open Time menu. The trip circuit supervision function is inactive.
t Trip Circuit **t SUP 200 ms**	Selection of the Trip circuit supervision timer. Select from 0.1 s to 10s with steps of 10 ms using and validate your choice using .
CB Open S'vision **Yes**	Selection of the CB open operating time supervision function. Select Yes or No. If the user validates (Yes) the following menu is displayed. If the user does not validate (No), go to CB Close menu. The CB open operating time supervision function is inactive.
CB Open Time **100 ms**	Selection of the CB open operating time (tCBO). Select from 50 ms to 1.0 s with steps of 10 ms using and validate your choice using .
CB Close S'vision **Yes**	Selection of the CB close operating time supervision function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), go to CB. Open Alarm menu. The CB close operating time supervision function is inactive.
CB Close Time **100 ms**	Selection of the CB close operating time (tCBC). Select from 50 ms to 1.0 s with steps of 10 ms using and validate your choice using .
CB Open Alarm ? **Yes**	Selection of the maximum CB operations function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), refer to ΣAmps(n) menu. The CB open maximum number function is inactive.

CB Open NB = 0	Selection of the CB open numbers alarm threshold. Select from 0 to 50000 by step of 1 using ⇕ and validate your choice using ↵.
ΣAmps(n) ? Yes	Selection of the Summation Amps (or square Amps) interrupted by the CB function. Select Yes or No. If the user validates (Yes), the following menu is displayed. If the user does not validate (No), refer to t open pulse menu. The Summation Amps function is inactive.
ΣAmps(n) ? 1000 E6	Selection of the summation Amps (or square Amps) alarm threshold. Select from 0 to 4000 E6 A (or A2) with steps of 1 E6 using ⇕ and validate your choice using ↵.
n 1	Selection of the type of summation (Amps or square Amps). Select 1 or 2 using ⇕ and validate your choice using ↵.
t Open Pulse 100 ms	Selection of the tripping pulse time. Select from 100 ms to 5 s with steps of 100 ms using ⇕ and validate your choice using ↵.
t Close Pulse 100 ms	Selection of the closing time. Select from 100 ms to 5 s with steps of 100 ms using ⇕ and validate your choice using ↵.

3.5.6.13 Comm. Order Sub-menu (**P122 & P123** only)

AUTOMAT. CTRL	Heading of the AUTOMAT.CTRL menu. To gain access to the menu, press , , 6 times.
Comm. Ord. Latch Times	Heading of the Comm. Ord. Latch Times sub-menu. To gain access to the sub-menu points, press . NOTE : This sub-menu is visible if at least a communication order is assigned to an output relay.
t Comm 1 **100 ms**	Selection of the t Comm 1 pulse time. Select from 0.1 s to 5 s with steps of 0.05 s using and validate your choice using .
t Comm 2 **150 ms**	Selection of the t Comm 2 pulse time. Select from 0.1 s to 5 s with steps of 0.05 s using and validate your choice using .
t Comm 3 **5 s**	Selection of the t Comm 3 pulse time. Select from 0.1 s to 5 s with steps of 0.05 s using and validate your choice using .
t Comm 4 **1 s**	Selection of the t Comm 4 pulse time. Select from 0.1 s to 5 s with steps of 0.05 s using and validate your choice using .

3.5.7 RECORDS Menu (**P122 & P123** only)

The RECORDING menu makes it possible to read the records and the various sub-menus are :

⇒ CB Monitoring

⇒ fault record

⇒ Instantaneous

⇒ Disturb record

⇒ Time peak value

⇒ Rolling demand

To gain access to the RECORDING menu, press then 7 times.

3.5.7.1 CB MONITORING sub-menu

The CB Monitoring sub-menu makes possible to read and clear the parameters and measurements associated to this function.

RECORD	Heading the RECORD menu. To gain access to the menu, press ⇩, ⇨ 7 times.
CB Monitoring	Heading the CB Monitoring sub-menu. To gain access to the sub-menu points, press ⇩.
CB Opening Time **95 ms**	Display the circuit breaker opening time in ms
CB Closing Time **115 ms**	Display the circuit breaker closing time in ms
CB Operations **RST = [C] 5489**	Display the number of opening commands executed by the circuit breaker. To clear these values, press ©.
Σ **Amps (n)** **RST = [C]**	Allows the user to clear the memorised summations of interrupted currents. All 3 phases currents are clear together. To clear these values, press ©.
Σ **Amps (n) IA** **4 E4**	Display the summation of the Amps (or square Amps) interrupted by the circuit breaker phase A
Σ **Amps (n) IB** **2 E4**	Display the summation of the Amps (or square Amps) interrupted by the circuit breaker phase B
Σ **Amps (n) IC** **8 E3**	Display the summation of the Amps (or square Amps) interrupted by the circuit breaker phase C

3.5.7.2 Fault Record sub-menu

The fault RECORD sub-menu makes possible to read the various parameters and measurement for each of the five fault store in **MiCOM P122** and **P123** memory.

RECORD	Heading of the RECORD menu. To gain access to the menu, press , , 7 times.
fault Record	Heading of the fault Record sub-menu. To gain access to the sub-menu points, press .
Record Number **2**	Selection of the fault record number (by selecting either 1, 2, 3, 4 or 5) to be displayed. To modify this fault record number, press then using enter the required number. Validate your choice using the key .
fault Time **12:05:23:42**	Display the time of the fault record. The format of the time is HH:MM:ss:msms In this example the fault appeared at 12H am, 05 minutes, 23 seconds and 420 ms.
fault Date **12/11/99**	Display the Date of the fault record. The format of the Date is DD/MM/YY. In this example, the fault appeared on 12 November 1999.
Active Set Group **1**	Display the active setting group (1 or 2).
Faulted Phase **Phase A**	Display the faulty phase for the chosen fault record. (NONE, phase A, B, C, EARTH, AB, AC, BC, or ABC).
Threshold **I>>**	Display the origin of the fault that as generated the trip order.
Magnitude **1200 A**	Display the magnitude of the faulty current. This value is the 50/60 Hz amplitude.
IA Magnitude **1200 A**	Display the magnitude of the phase A current at the time of the Fault.
IB Magnitude **500 A**	Display the magnitude of the phase B current at the time of the Fault.

IC Magnitude **480 A**	Display the magnitude of the phase C current at the time of the Fault.
In Magnitude **103 A**	Display the magnitude of the earth current at the time of the Fault.

3.5.7.3 INSTANTANEOUS sub-menu

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

RECORDS	Heading of the RECORDS menu. To gain access to the menu, press , 7 times.
Instantaneous	Heading of the Instantaneous sub-menu. To gain access to the sub-menu points, press .
Number **5**	Selection of the Instantaneous record number (by selecting either 1, 2, 3, 4 or 5) to be displayed. To modify this Instantaneous record number, press then using enter the required number. Validate your choice using .
Hour **13:07:15:53**	Display the time of the instantaneous record. The format is HH:MM:SS:msms. In this example the start information appeared at 13H pm, 07 minutes, 15 seconds and 530 ms.
Date **09/01/01**	Display the date of the instantaneous record. The format is DD/MM/YY. In this example the start information appeared on 09 January 2001.
Origin **Ie>**	Display the origin of the start information.
Length **57 ms**	Display the length of the start information.
Trip **No**	Display if a trip has succeeded to the start information.

3.5.7.4 DISTURBANCE RECORD sub-menu

The DISTURBANCE sub-menu makes possible to set the various parameters and thresholds associated to this recording function.

RECORD	Heading of the RECORD menu. To gain access to the menu, press , 7 times.
Disturb Record	Heading of the Disturb Record sub-menu. To gain access to the sub-menu points, press .
Pre-Time **0.2 s**	Selection of the disturbance record pre-time. Select from 100 ms to 3s by step of 100 ms using and validate your choice using .
Post-Time **0.2 s**	Selection of the disturbance record post-time. Select from 100 ms to 3s by step of 100 ms using and validate your choice using .

WARNING : THE TOTAL DISTURBANCE RECORDING TIME IS 3 SECONDS (PRE TIME + POST TIME).

Disturb Rec Trig **ON INST.**	Selection of start criteria for the disturbance recording function. Select between ON INST. (start on instantaneous thresholds) or ON Trip (start on trip conditions) using and validate your choice using .

3.5.7.5 Time PEAK VALUE sub-menu

The Time PEAK VALUE sub-menu makes possible to set parameters associated to this function. (Peak and Average values displayed in the Measurements menu)

RECORD	Heading of the RECORD menu. To gain access to the menu, press , 7 times.
Time Peak Value	Heading of the Time Peak Value sub-menu. To gain access to the sub-menu points, press .
Time Window **5 mn**	Selection of the time of the window during the peak and average values are stored. Select either 5mn, 10mn, 15mn, 30mn, or 60mn using and validate your choice using .

3.5.7.6 ROLLING DEMAND sub-menu

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

RECORDS	Heading of the RECORDS menu. To gain access to the menu, press ⊙, ⊙ 7 times.
Rolling Demand	Heading of the Rolling Demand sub-menu. To gain access to the sub-menu points, press ⊙.
Sub period **1 mn**	Selection of the width of the sub-period during the rolling average values are calculated. Select from 1 mn to 60 mn with step of 1 mn using ⊙ and validate your choice using ⊙.
Num of Sub Per **1**	Selection of number of sub-period for the calculation of the average of these average values.

4. WIRING

The relays of the MiCOM P120 range have the same cable layout (for common elements). The cabling layouts of each model are provided in Appendix 1 to this Technical Guide.

4.1 Auxiliary supply

The electric auxiliary supply of the **MiCOM P120, P121, P122** and **P123** relays can be either continuous (range 24-60 Vdc, 48-150 Vdc, 130-250 Vdc) or alternative (100-250 Vac/ 50-60 Hz). The voltage range is specified on the relay data plate under the upper flap on the front face.

Supply must only be connected to terminals 33 and 34.

4.2 Current measurement inputs

The **MiCOM P120, P121, P122 and P123** relays may comprise up to eight current inputs
(2 times 4 earth and phase current inputs).

The nominal current value of these measuring inputs is either 1 Ampere or 5 Amperes (as per cabling layout). For the same relay, the user can mix the 1 and 5 Ampere inputs between phases and earth.

NOTE : all two or three phase inputs must have the same value (1 or 5 Amps)

4.3 Logic inputs

MiCOM P123 relays have 5 opto-isolated logic inputs (3 logic inputs for **P122**, 2 for **P120** and **P121**) Each input has its own independent polarity.

The voltage range of the inputs is identical to the **dc or ac** auxiliary supply range of the MiCOM relay (e.g. Uaux = 48-150 Vdc, logic input voltage range = 48-150 Vdc).

On the same MiCOM **P12x** relay, the user can mixed different voltage level for the logic inputs (e.g. Uaux = 48-150 Vdc, Input 1= 48 Vdc, Input 2-5= 110 Vdc)

The automation operations and signalling functions to which these logic inputs respond can be selected by means of the AUTOMAT. CTRL Menu.

NOTE : Do not forget to select in the CONFIGURATION/Configuration Inputs Menu if the voltage input is "AC" or "DC".

4.4 Output relays

Nine output relays are available on **MiCOM P123** (7 output relays for **P122** and 5 for **P121 and P120**).

8 relays are freely programmable (6 for P122, 4 for P121 & P120).

The first relay with change over contact (RL0) being allocated to signalling an equipment fault (WATCH DOG).

The second and third relays (RL1, RL2) are of change-over relays (1 common, 1 normally open contact, 1 normally closed contact).

The other relays (RL3, to RL 9) are normally open-type relays (1 common, 1 open contact).

The protection and control functions to which these relays respond can be selected by means of the AUTOMAT. CTRL. Menu.

4.5 Communication

4.5.1 RS485 rear communication port

All MiCOM relays have an RS485 rear communication port.

The connection of communication is allocated to terminals 29-30-31-32, following the schemes given in the Appendix 1 of the Technical Guide.

4.5.2 RS232 front communication port (**P122 & P123** only)

MiCOM P122 and **P123** relays provide the user an RS 232 communication port. This link is dedicated to the MiCOM Setting software MiCOM S1.

The cable between the **P122** or **P123** and the PC is a standard RS 232 shield-cable.

The connector on **P122** or **P123** side must be a male connector.

The wiring of this RS232 cable must follow the following scheme.

RS232 PC port	RS 232 Cable	MiCOM P122/P123 end 9 pin male connector
2	⟷	2
3	⟷	3
5	⟷	5
7	⟷	7

FIGURE 5 : RS232 FRONT PORT COMMUNICATION CABLE WIRING

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Menu Content Tables

CONTENT

1.	MiCOM P120 - V4 SOFTWARE	3
2.	MiCOM P121 – V5 SOFTWARE	5
3.	MiCOM P122 – V5 SOFTWARE	8
4.	MiCOM P123 – V5 SOFTWARE	14
5.	MiCOM P122 – V6 SOFTWARE	20
6.	MiCOM P123 – V6 SOFTWARE	26

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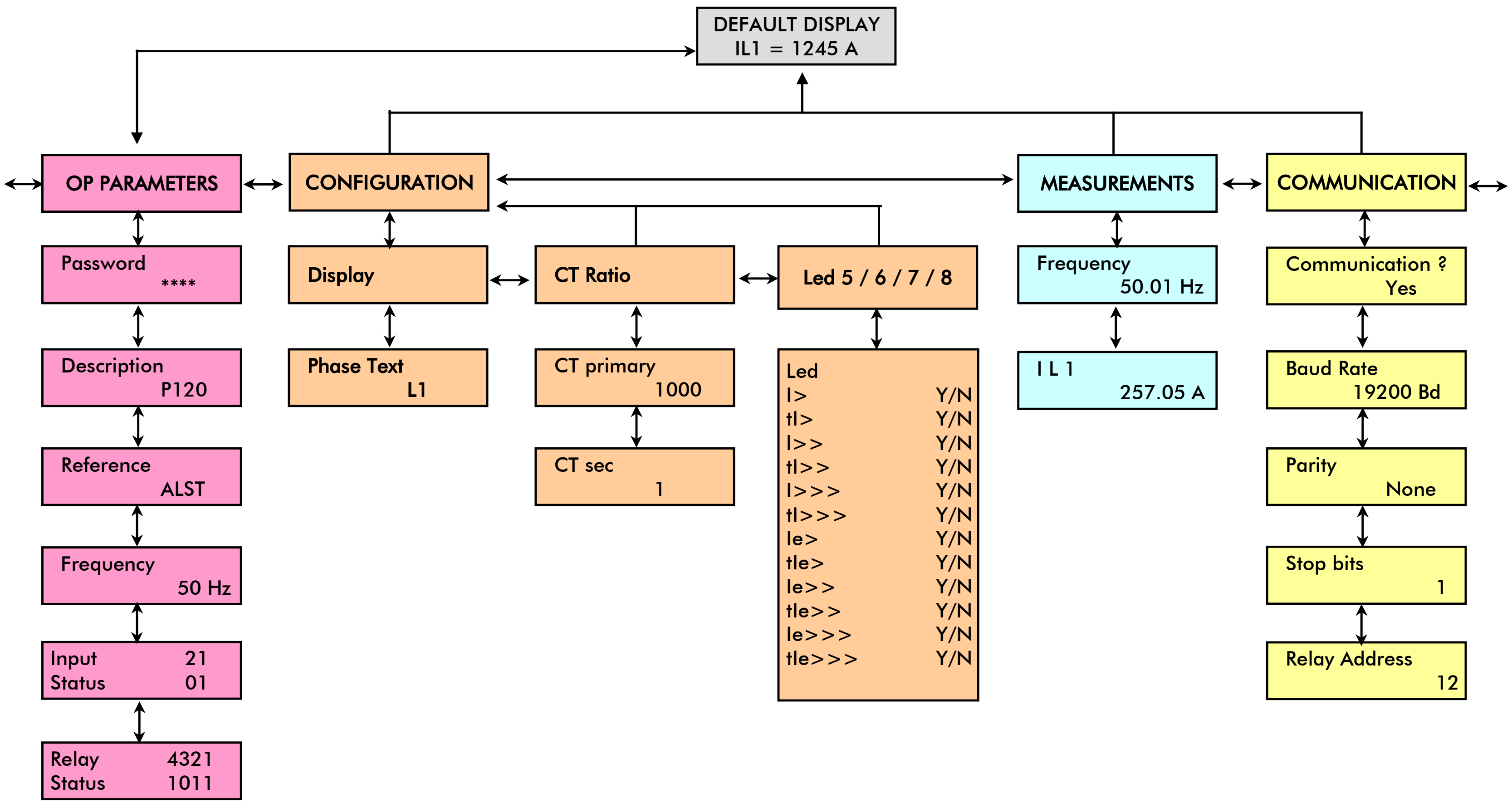
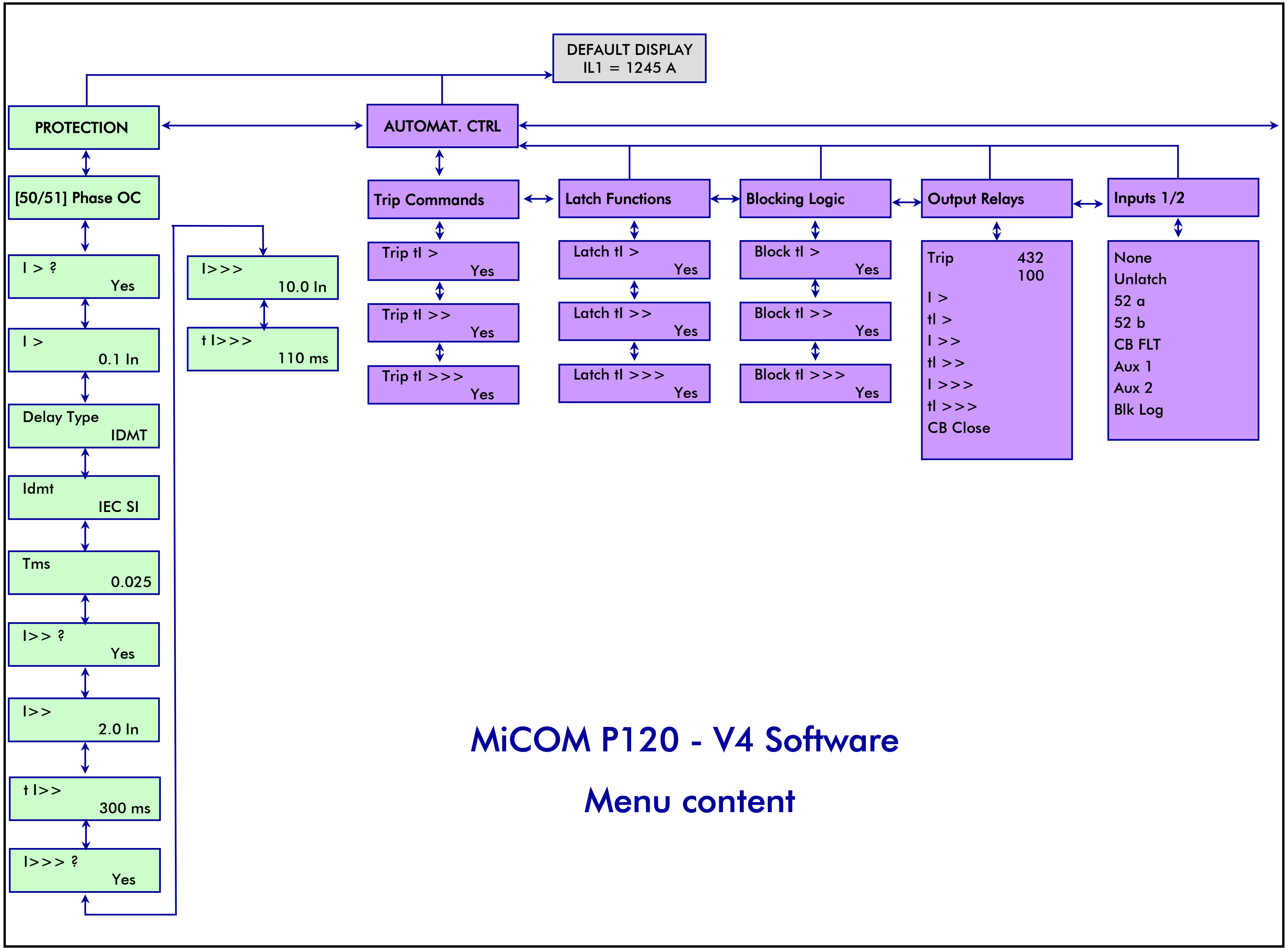
1. MiCOM P120 - V4 SOFTWARE



MiCOM P120 - V4 Software

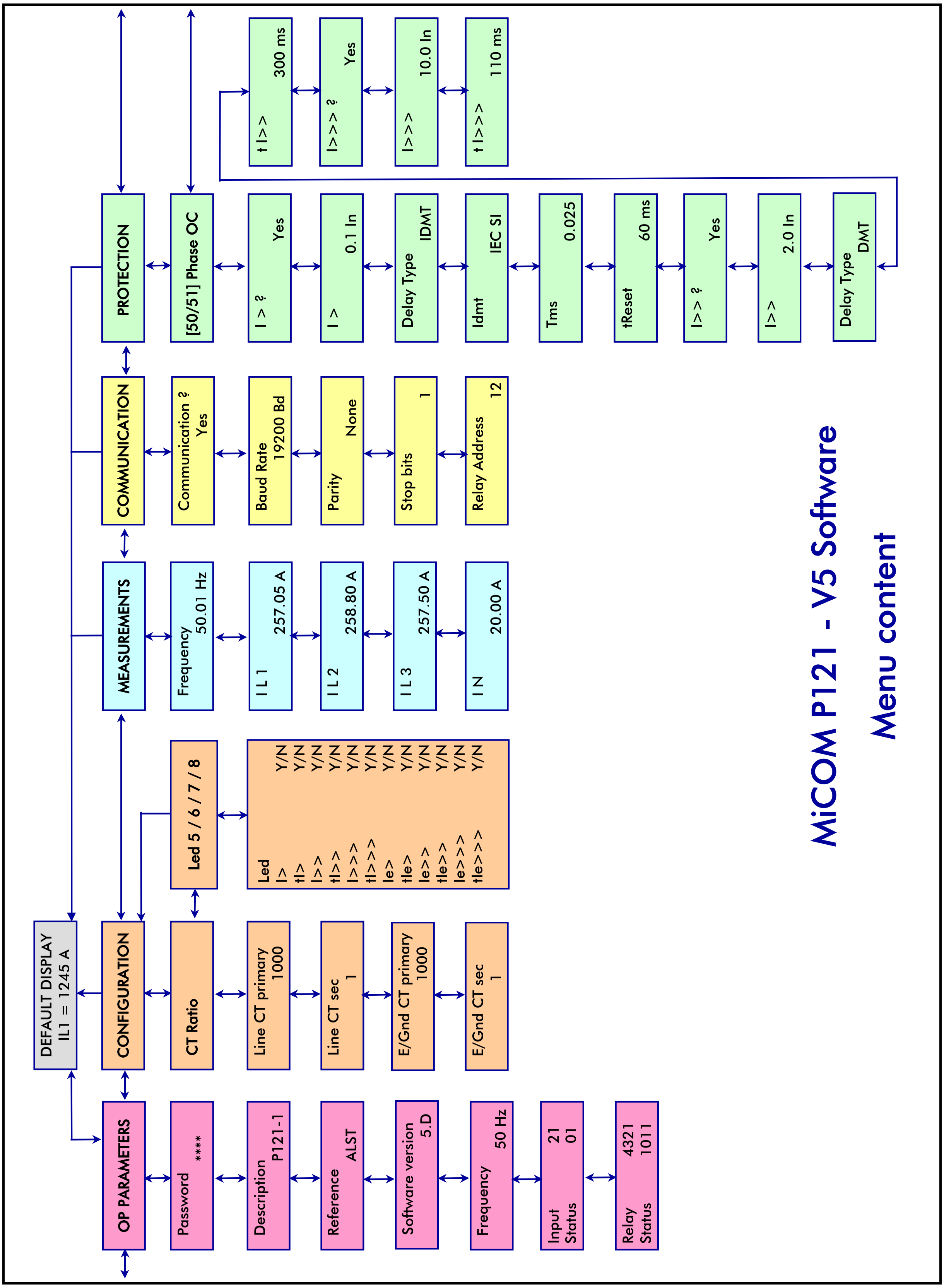
Menu content

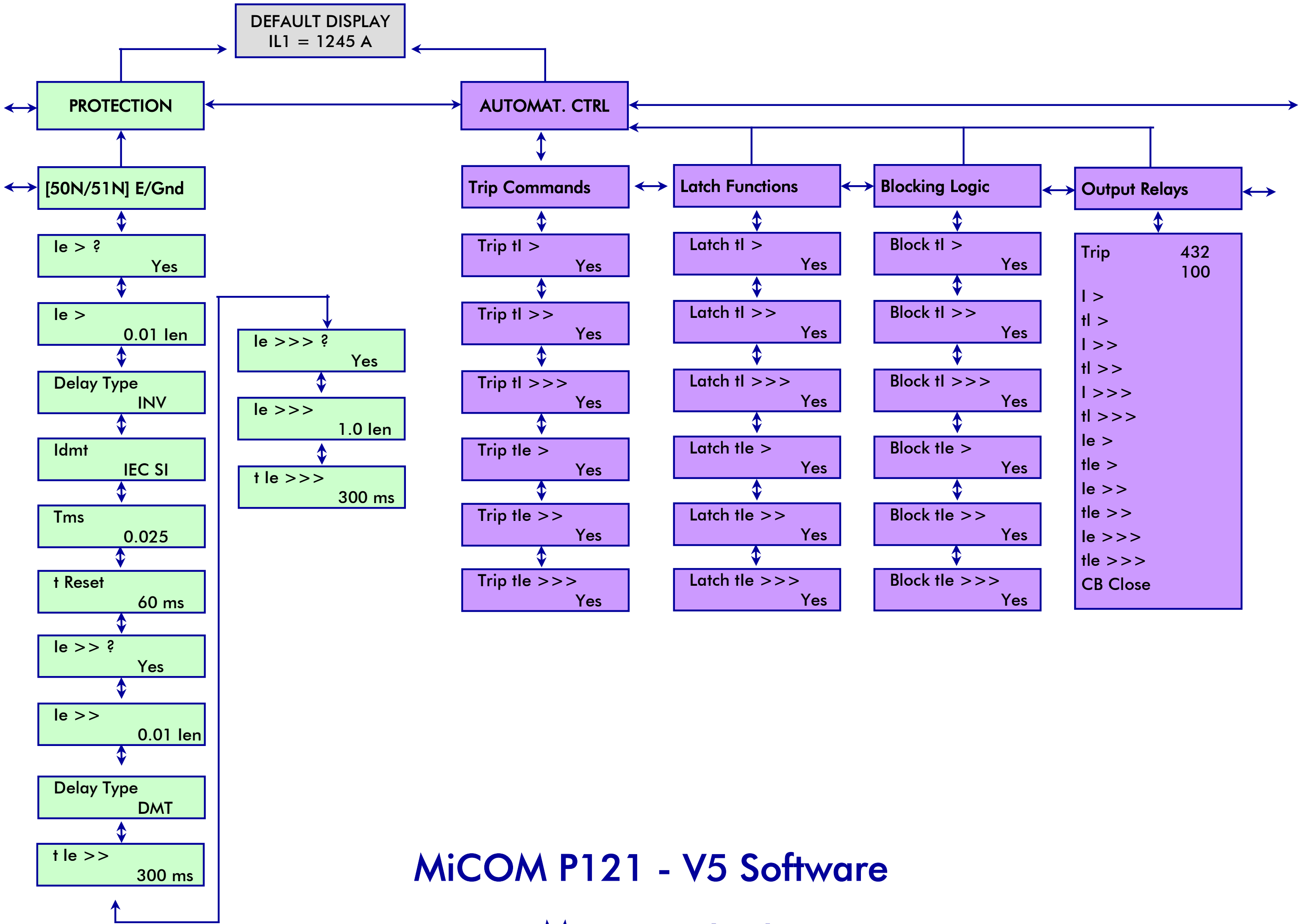


MiCOM P120 - V4 Software

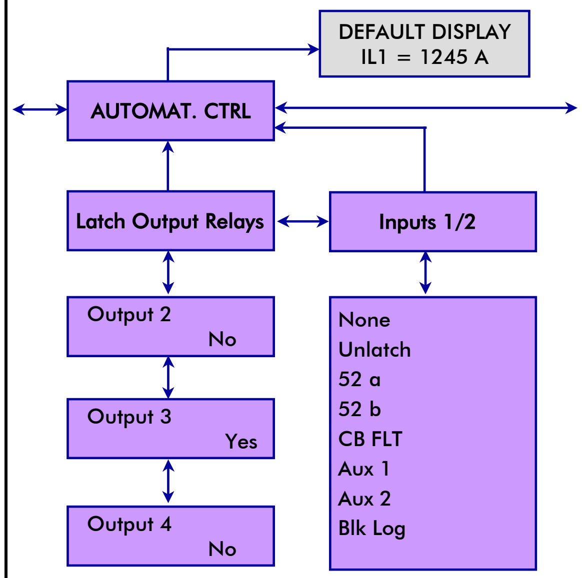
Menu content

2. MiCOM P121 – V5 SOFTWARE





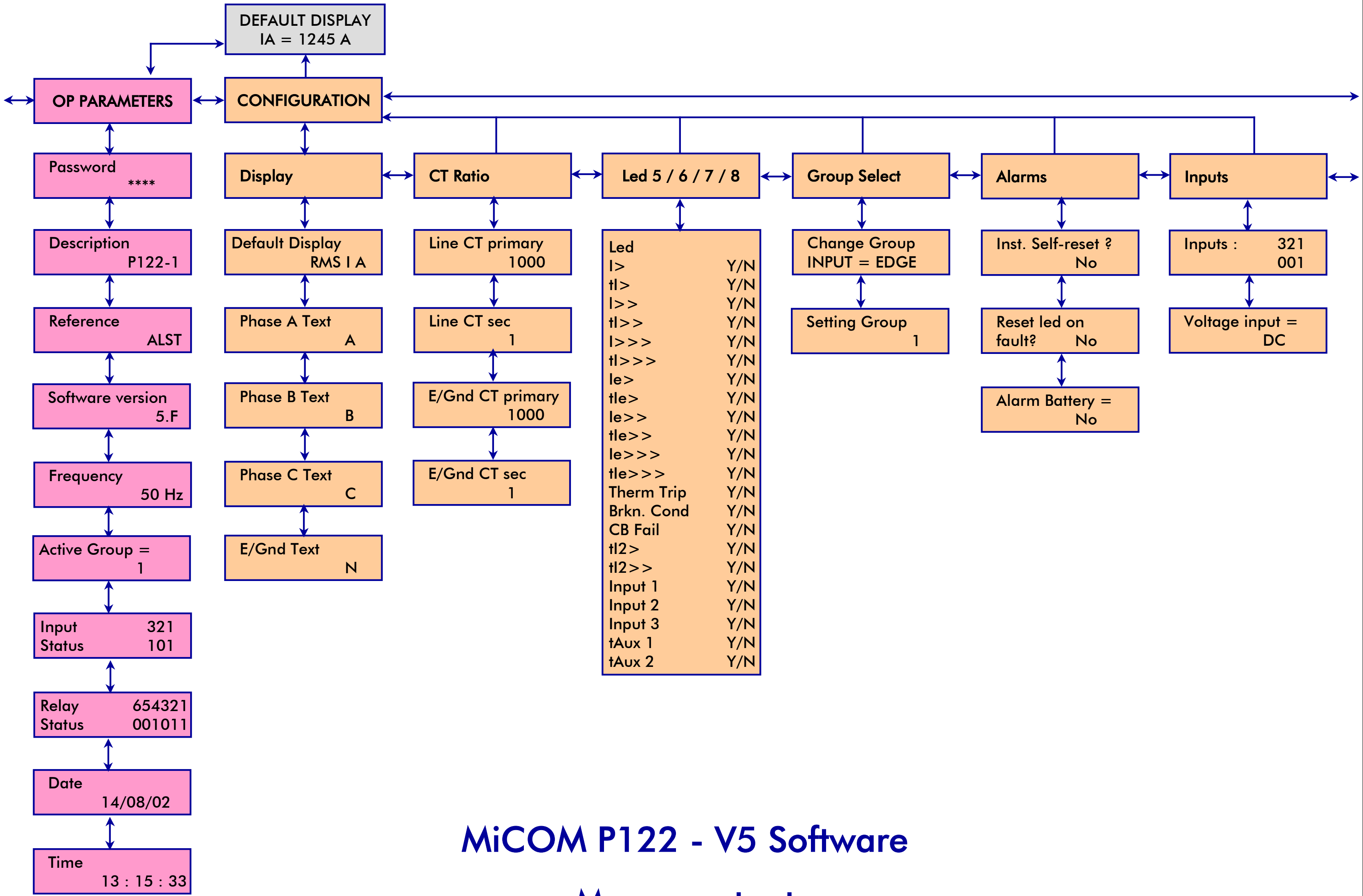
MiCOM P121 - V5 Software
Menu content



MiCOM P121 - V5 Software

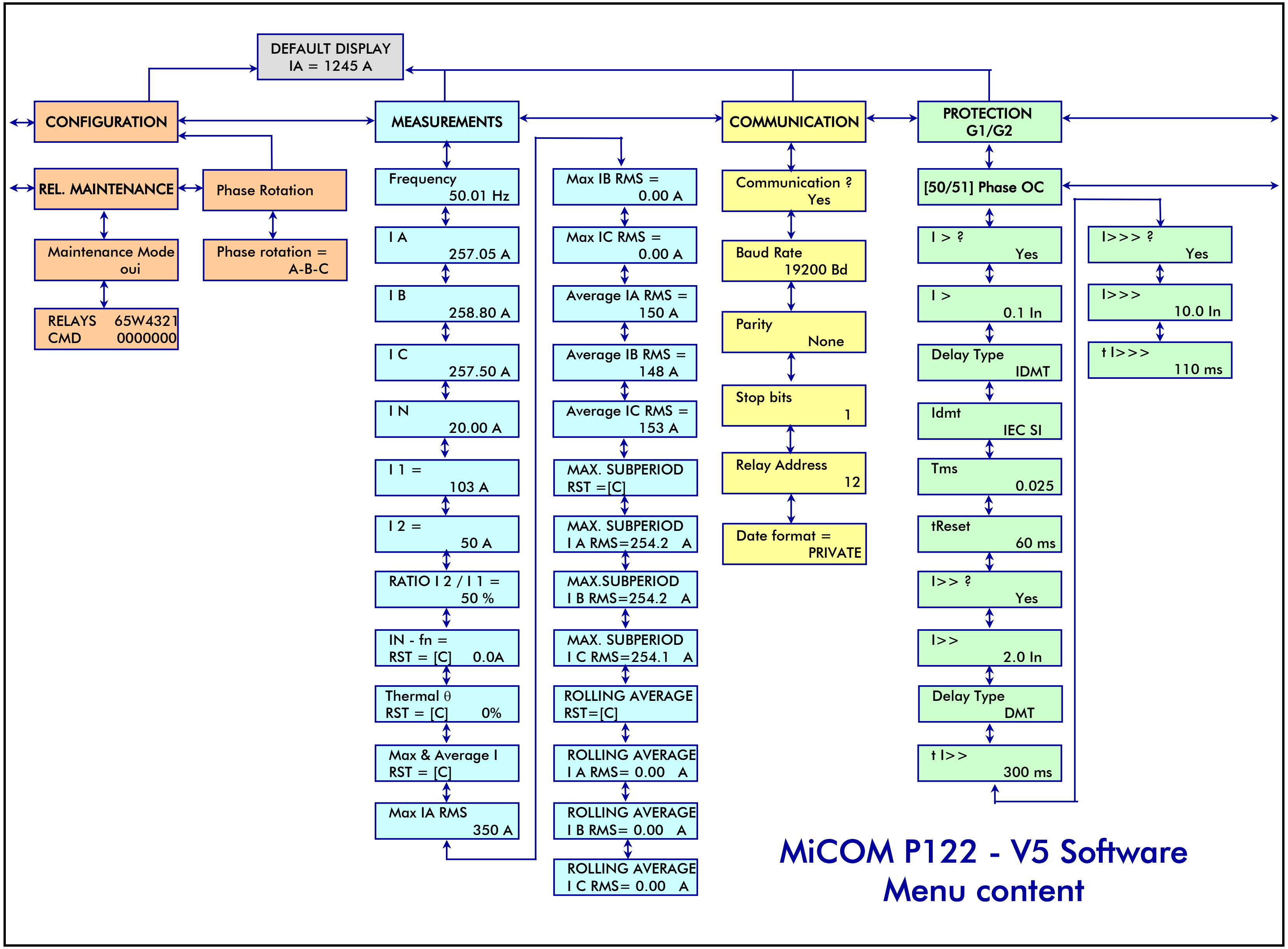
Menu content

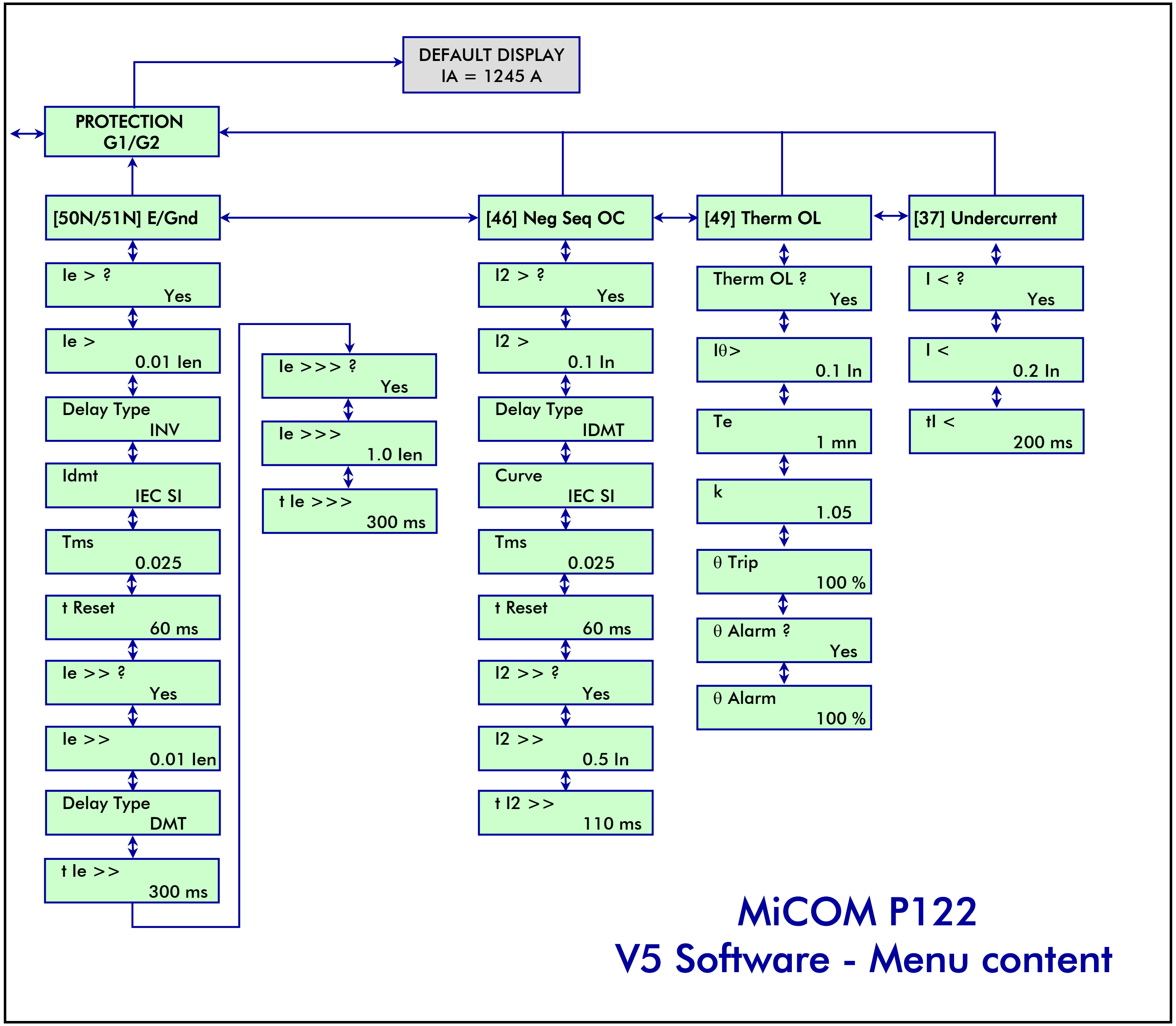
3. MiCOM P122 – V5 SOFTWARE

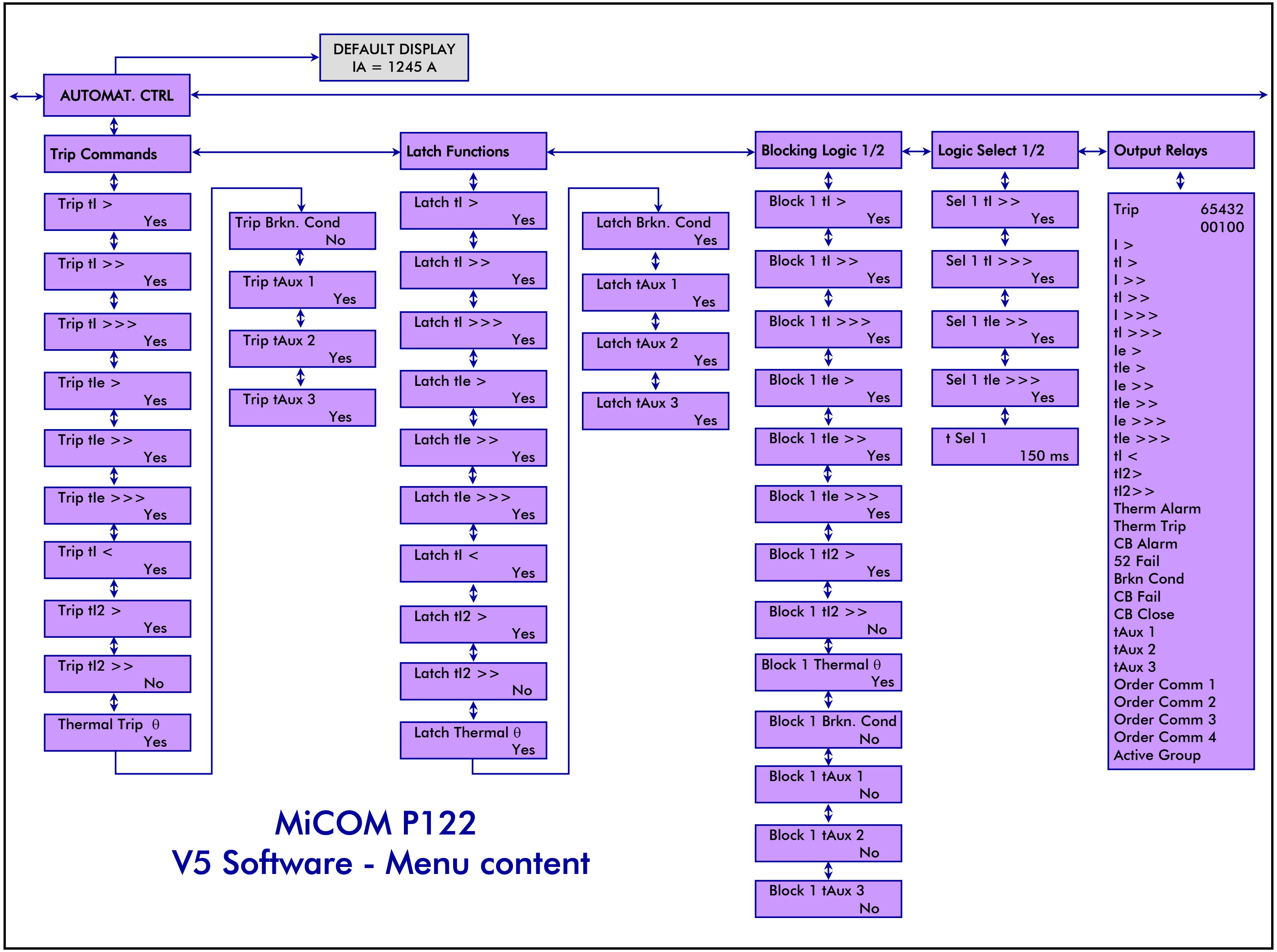


MiCOM P122 - V5 Software

Menu content


DEFAULT DISPLAY
IA = 1245 A
CONFIGURATION
MEASUREMENTS
COMMUNICATION
PROTECTION G1/G2
REL. MAINTENANCE
Phase Rotation
Maintenance Mode oui
Phase rotation = A-B-C
RELAYS 65W4321
CMD 0000000
Frequency 50.01 Hz
I A 257.05 A
I B 258.80 A
I C 257.50 A
I N 20.00 A
I 1 = 103 A
I 2 = 50 A
RATIO I 2 / I 1 = 50 %
IN - fn = RST = [C] 0.0A
Thermal θ RST = [C] 0%
Max & Average I RST = [C]
Max IA RMS 350 A
Max IB RMS = 0.00 A
Max IC RMS = 0.00 A
Average IA RMS = 150 A
Average IB RMS = 148 A
Average IC RMS = 153 A
MAX. SUBPERIOD RST =[C]
MAX. SUBPERIOD I A RMS=254.2 A
MAX.SUBPERIOD I B RMS=254.2 A
MAX. SUBPERIOD I C RMS=254.1 A
ROLLING AVERAGE RST=[C]
ROLLING AVERAGE I A RMS= 0.00 A
ROLLING AVERAGE I B RMS= 0.00 A
ROLLING AVERAGE I C RMS= 0.00 A
Communication ? Yes
Baud Rate 19200 Bd
Parity None
Stop bits 1
Relay Address 12
Date format = PRIVATE
[50/51] Phase OC
I > ? Yes
I > 0.1 In
Delay Type IDMT
Idmt IEC SI
Tms 0.025
tReset 60 ms
I>> ? Yes
I>> 2.0 In
Delay Type DMT
t I>> 300 ms
I>>> ? Yes
I>>> 10.0 In
t I>>> 110 ms
MiCOM P122 - V5 Software
Menu content


DEFAULT DISPLAY
IA = 1245 A
PROTECTION G1/G2
[50N/51N] E/Gnd
Ie > ? Yes
Ie > 0.01 Ien
Delay Type INV
Idmt IEC SI
Tms 0.025
t Reset 60 ms
Ie >> ? Yes
Ie >> 0.01 Ien
Delay Type DMT
t Ie >> 300 ms
Ie >>> ? Yes
Ie >>> 1.0 Ien
t Ie >>> 300 ms
[46] Neg Seq OC
I2 > ? Yes
I2 > 0.1 In
Delay Type IDMT
Curve IEC SI
Tms 0.025
t Reset 60 ms
I2 >> ? Yes
I2 >> 0.5 In
t I2 >> 110 ms
[49] Therm OL
Therm OL ? Yes
Iθ> 0.1 In
Te 1 mn
k 1.05
θ Trip 100 %
θ Alarm ? Yes
θ Alarm 100 %
[37] Undercurrent
I < ? Yes
I < 0.2 In
tI < 200 ms
MiCOM P122
V5 Software - Menu content



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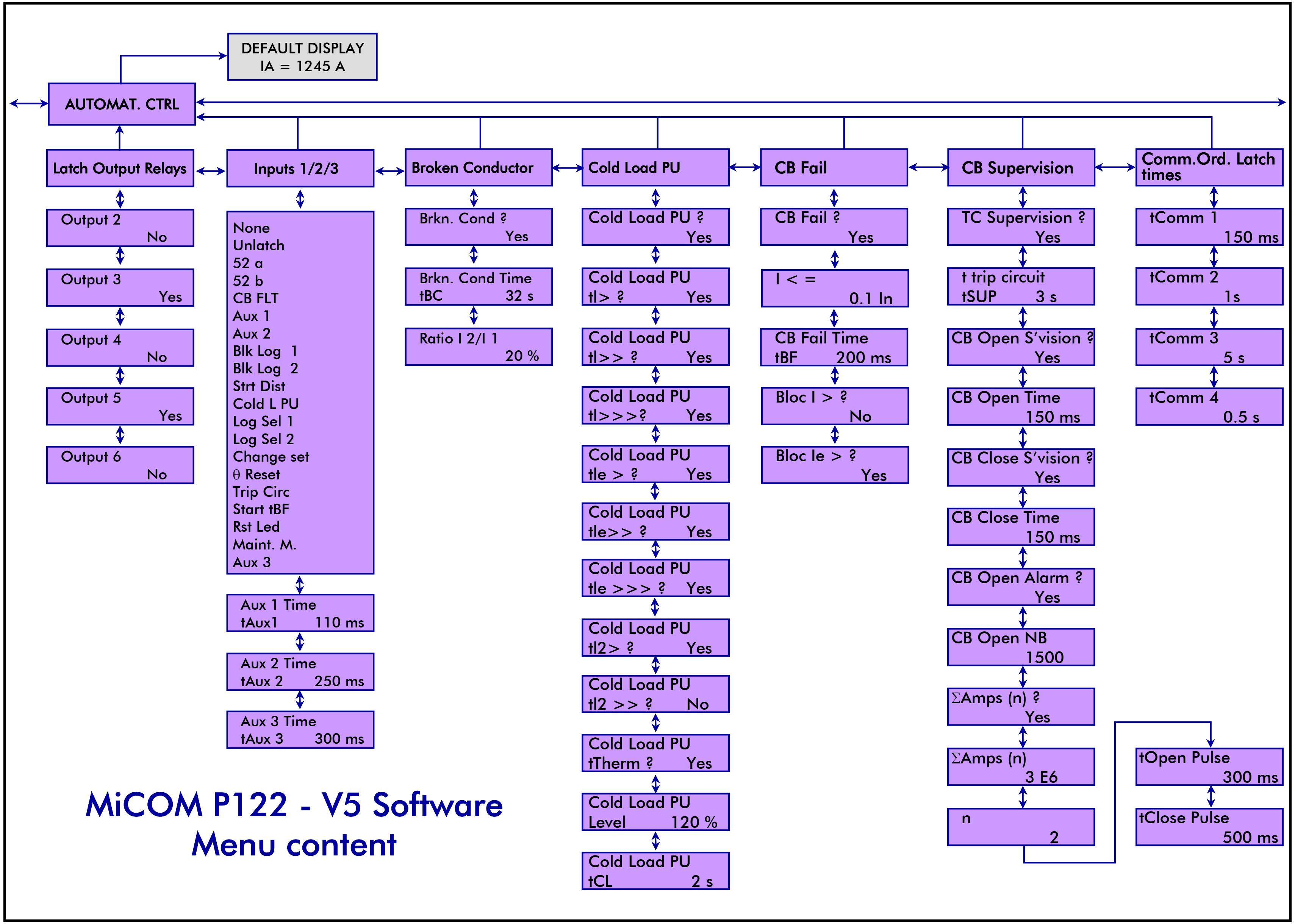
V5 Software - Menu content



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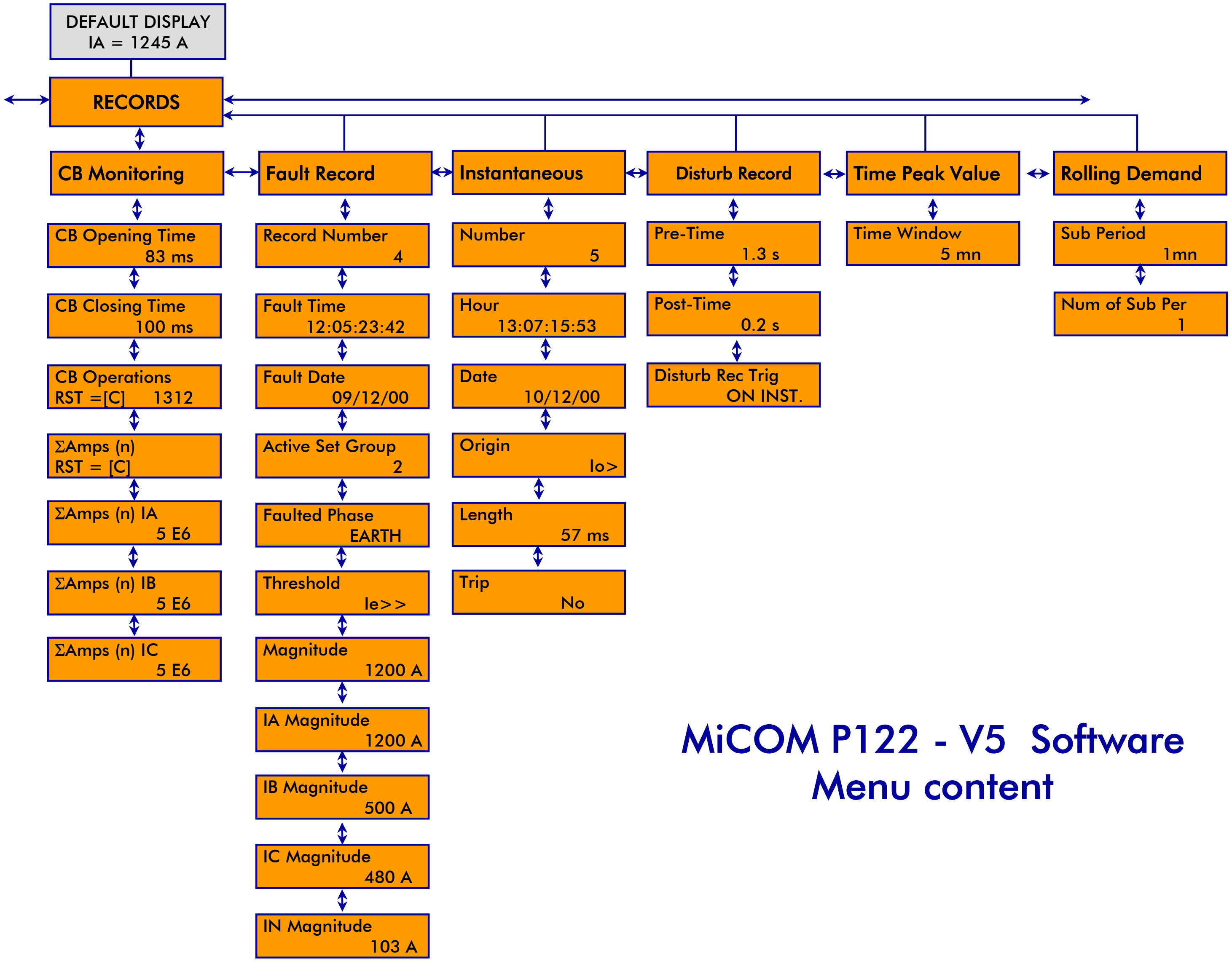
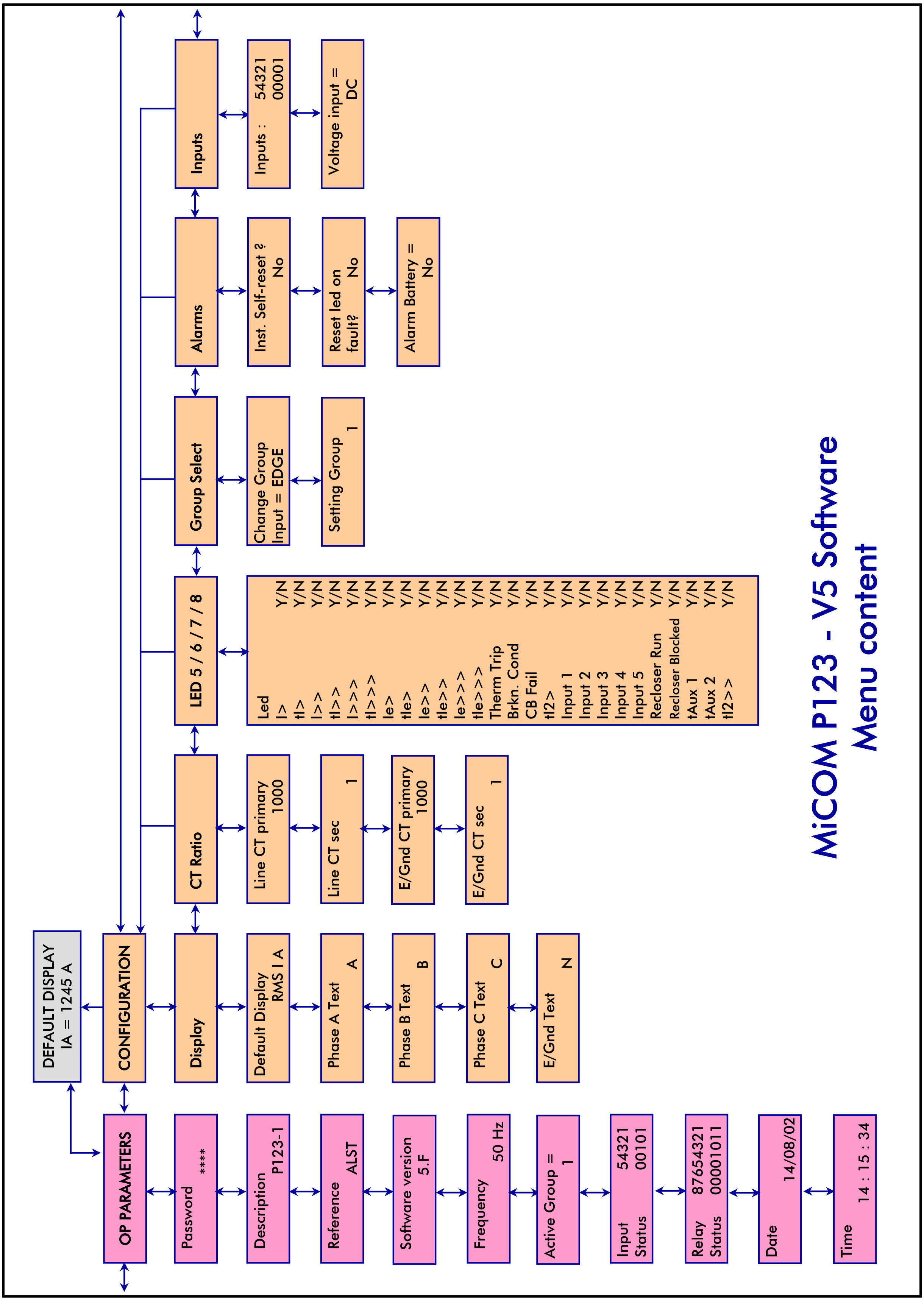
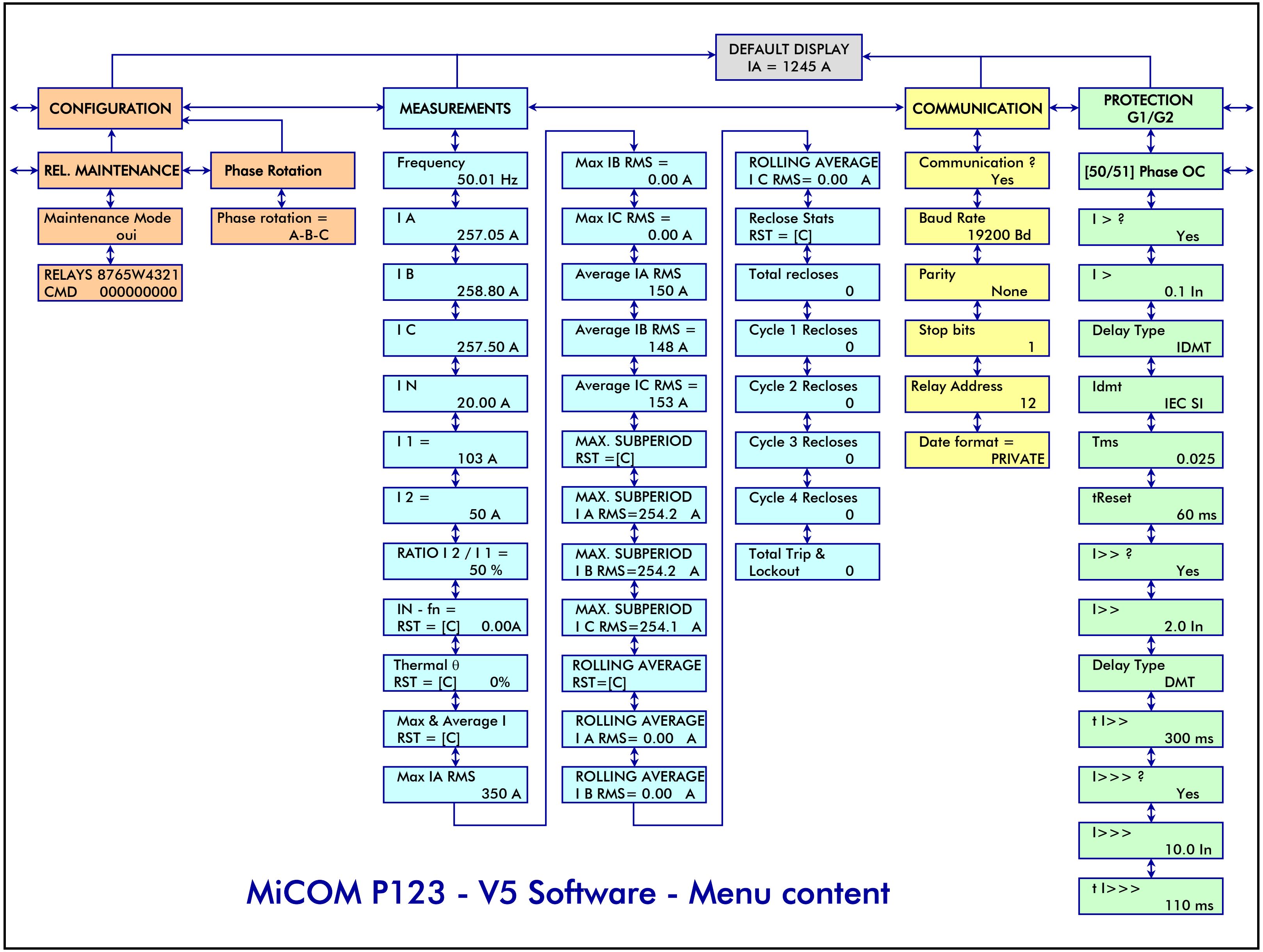


MiCOM P122 - V5 Software
Menu content

4. MiCOM P123 – V5 SOFTWARE





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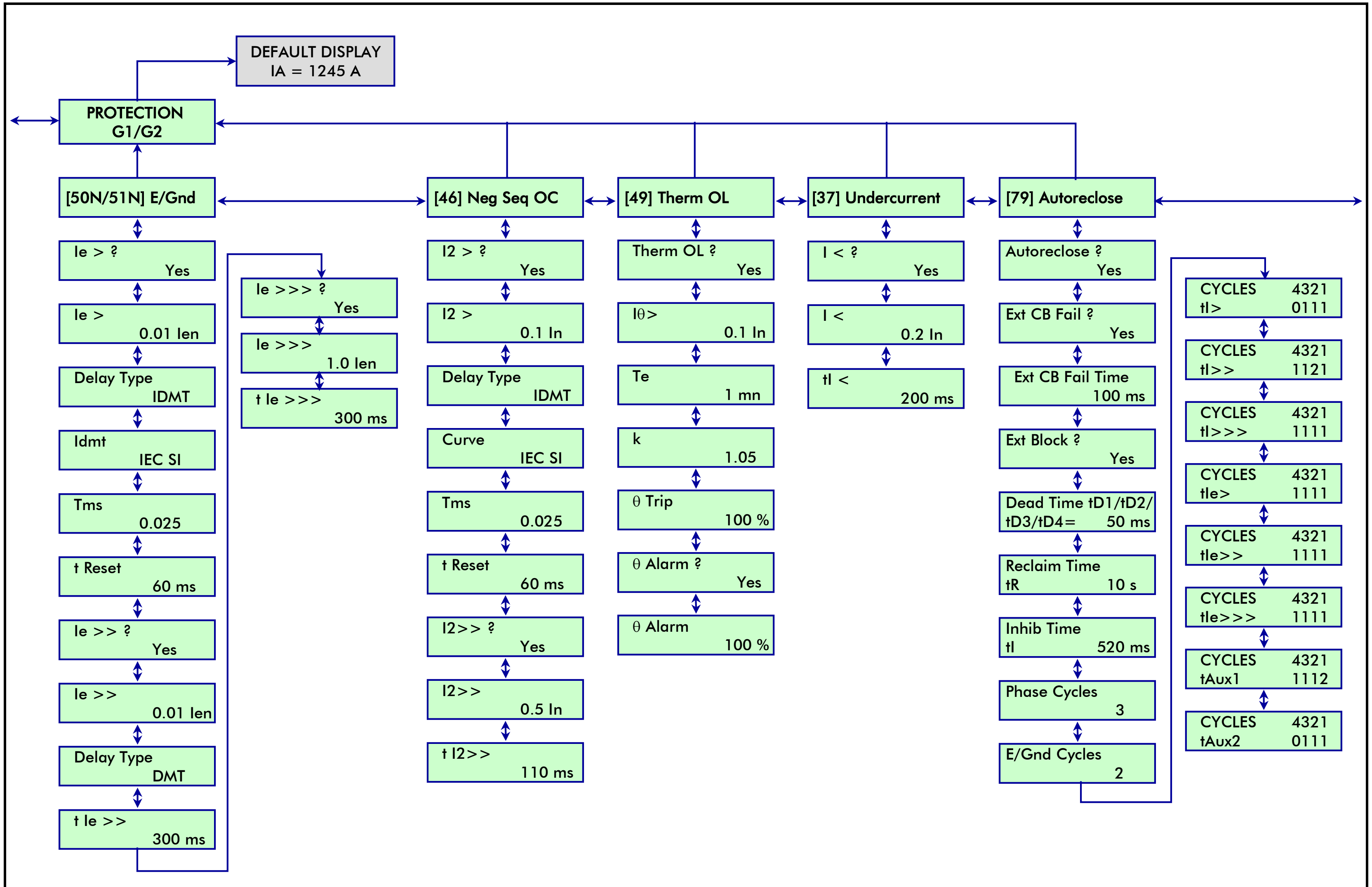

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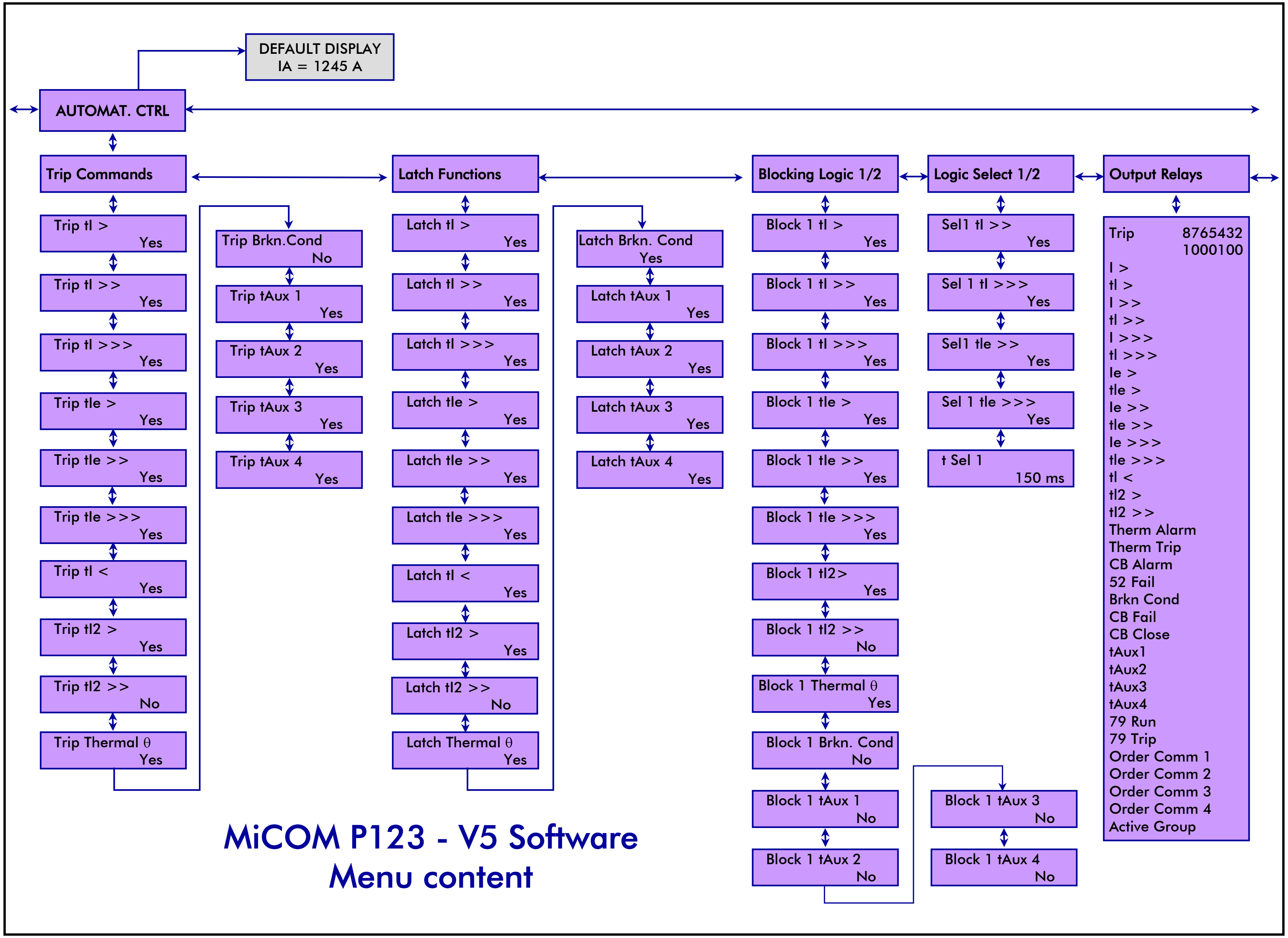

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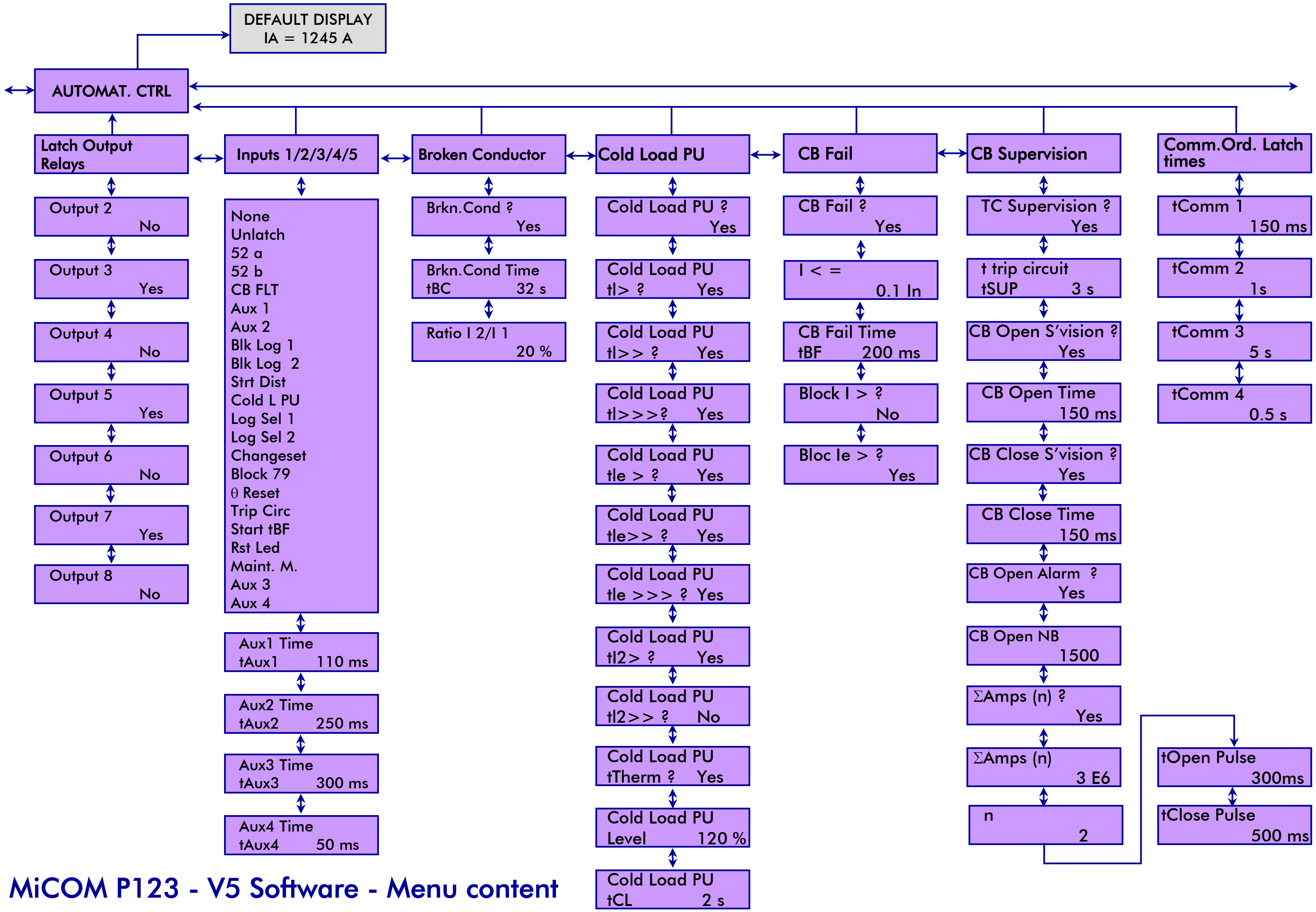

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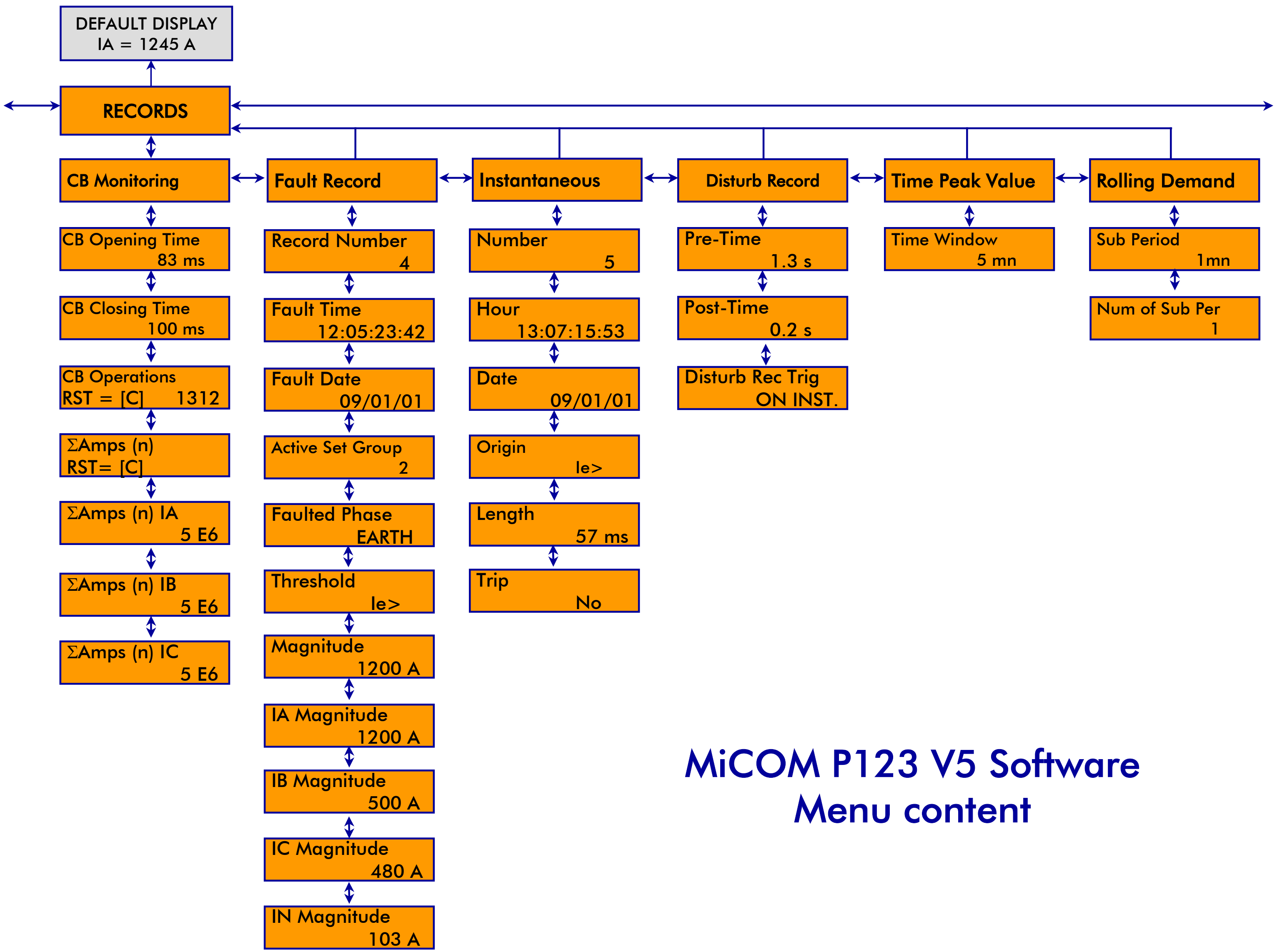

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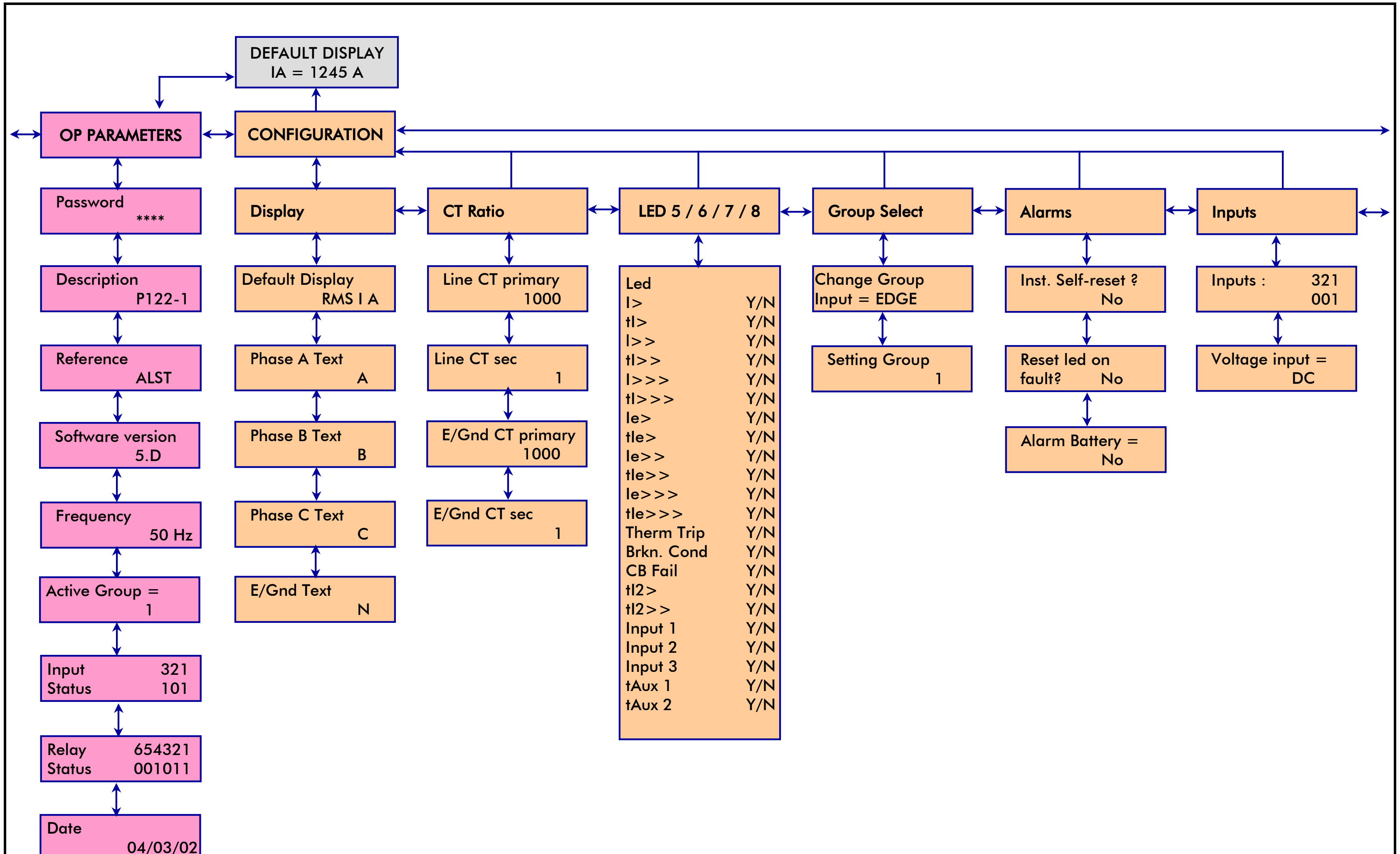
Menu content

5. MiCOM P122 – V6 SOFTWARE



MiCOM P122 - V6 Software

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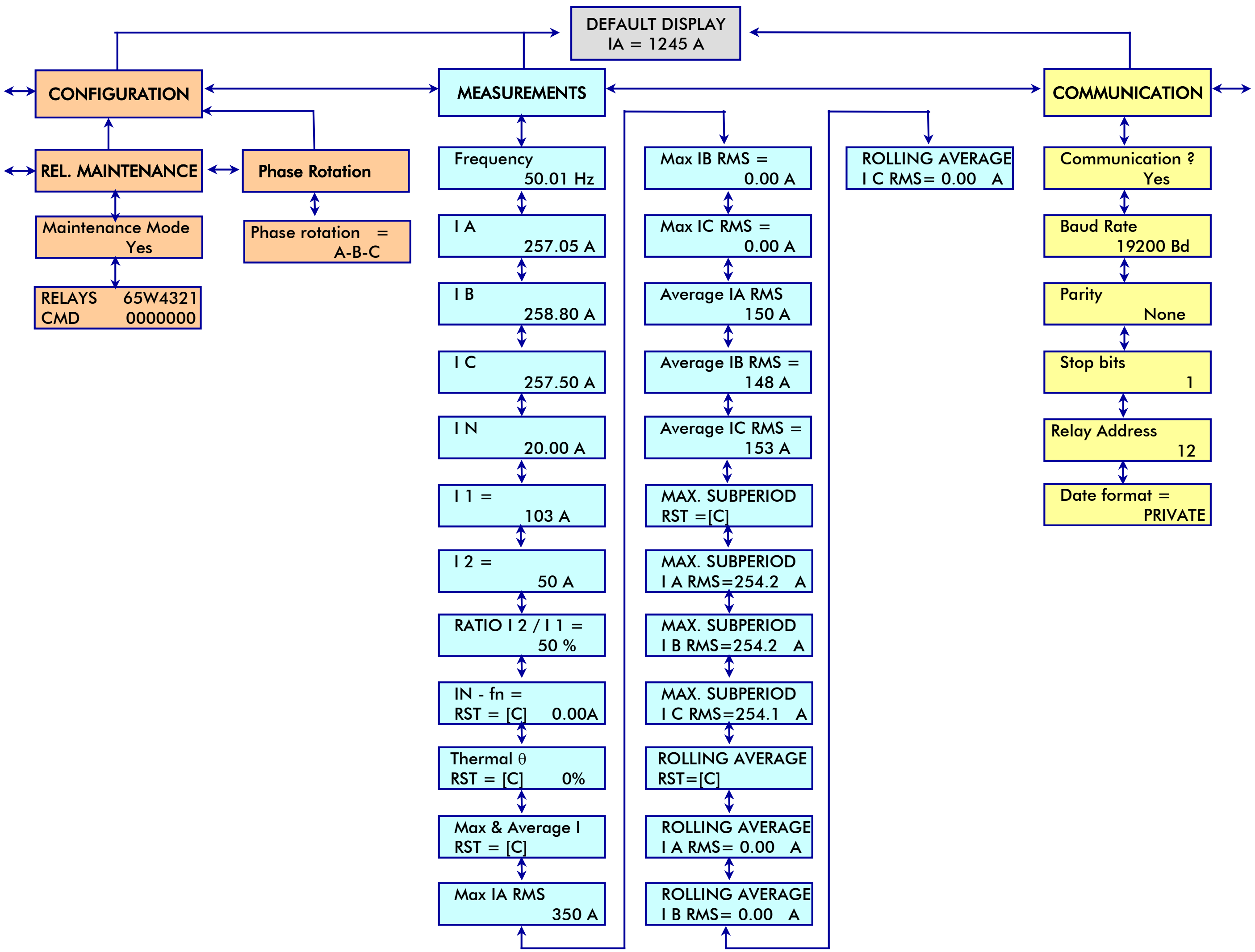

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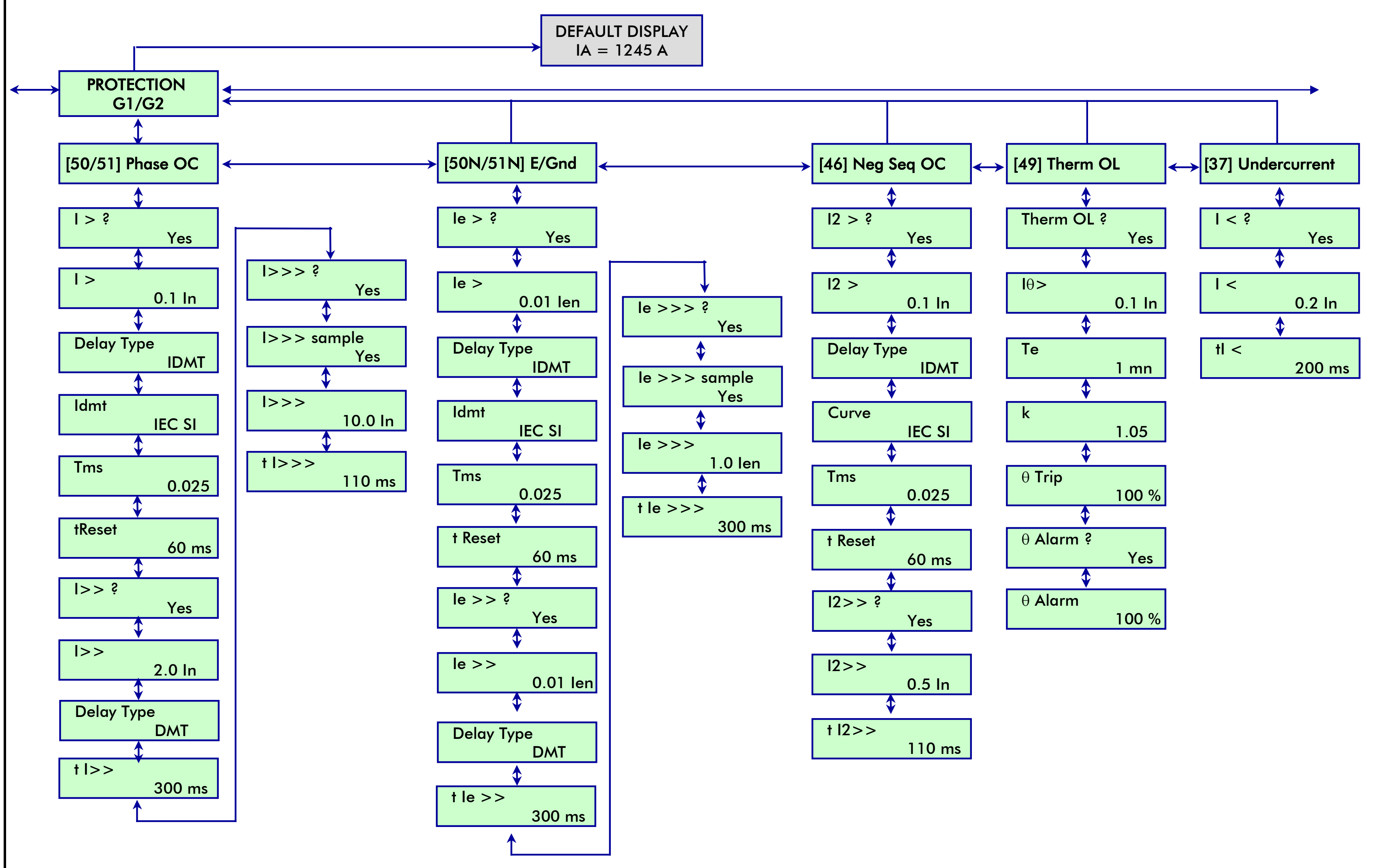

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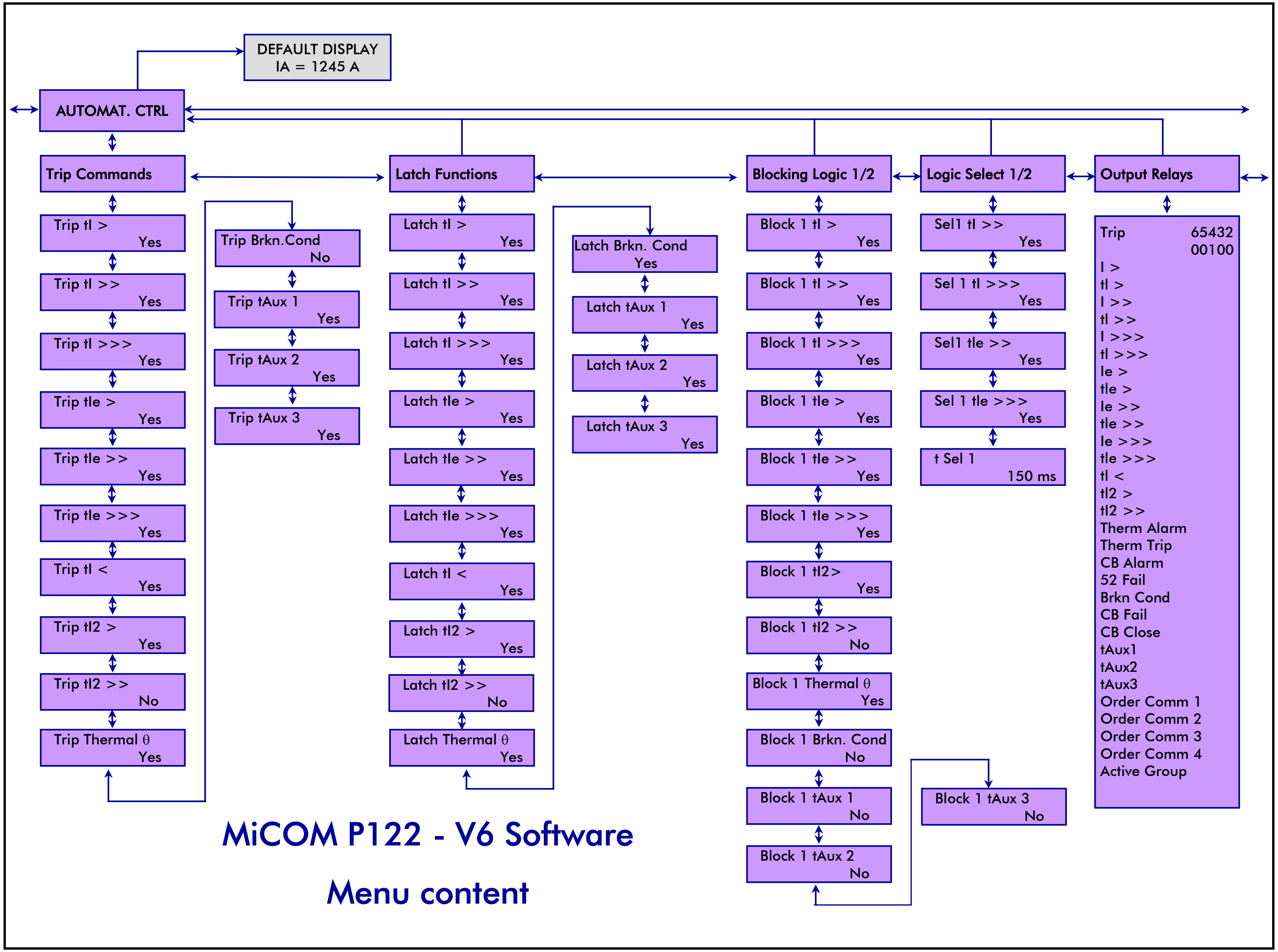

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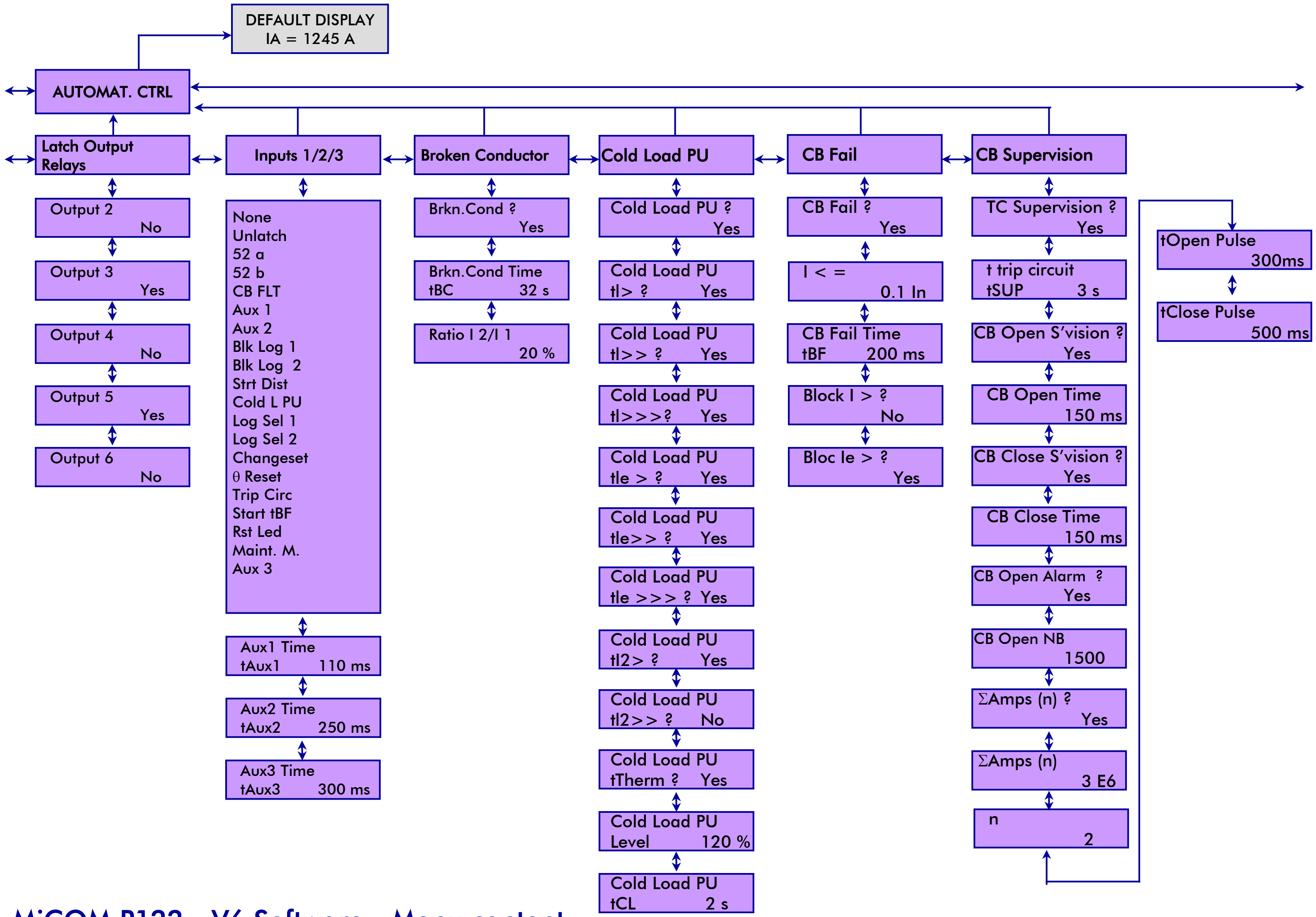

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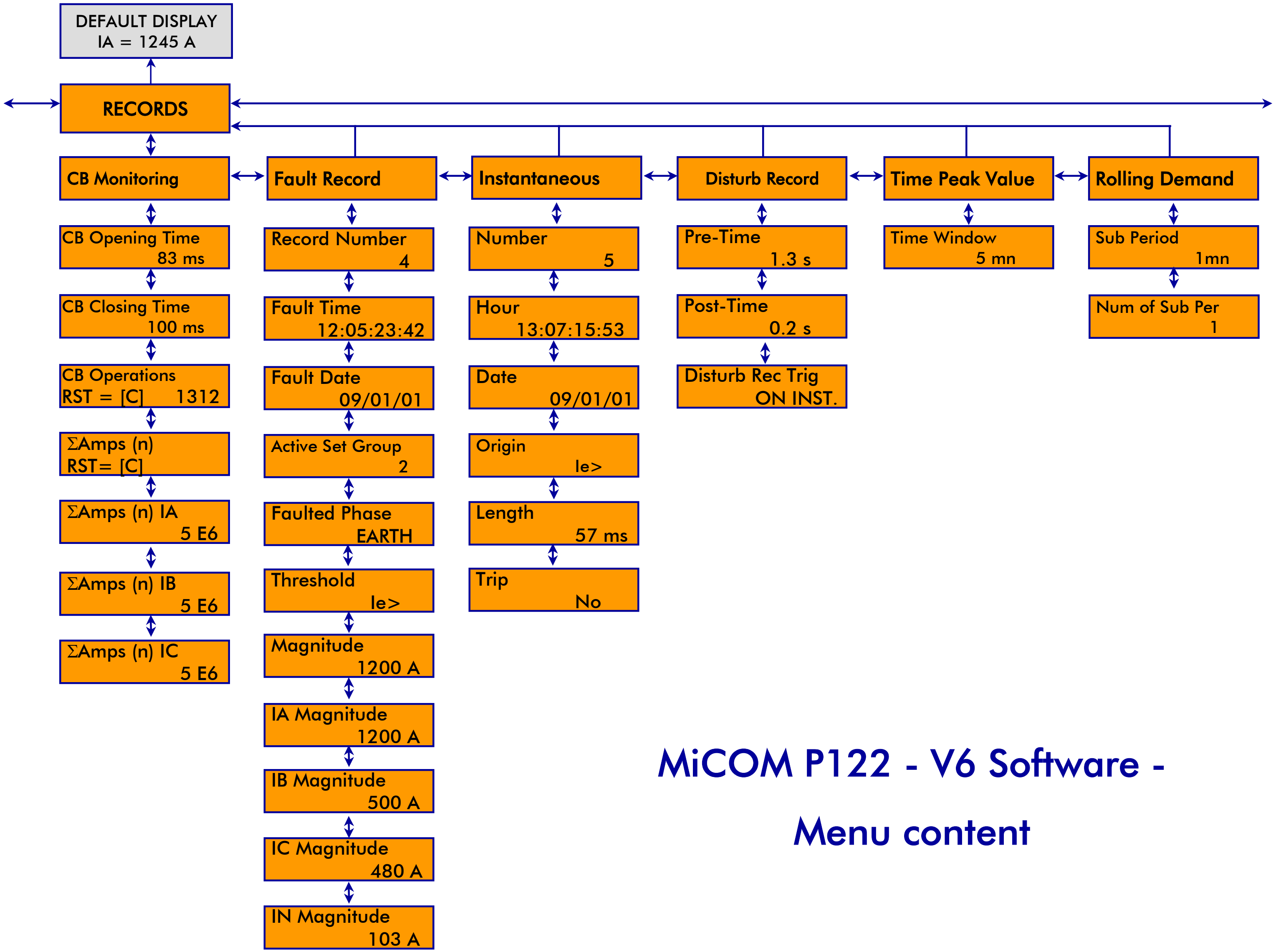
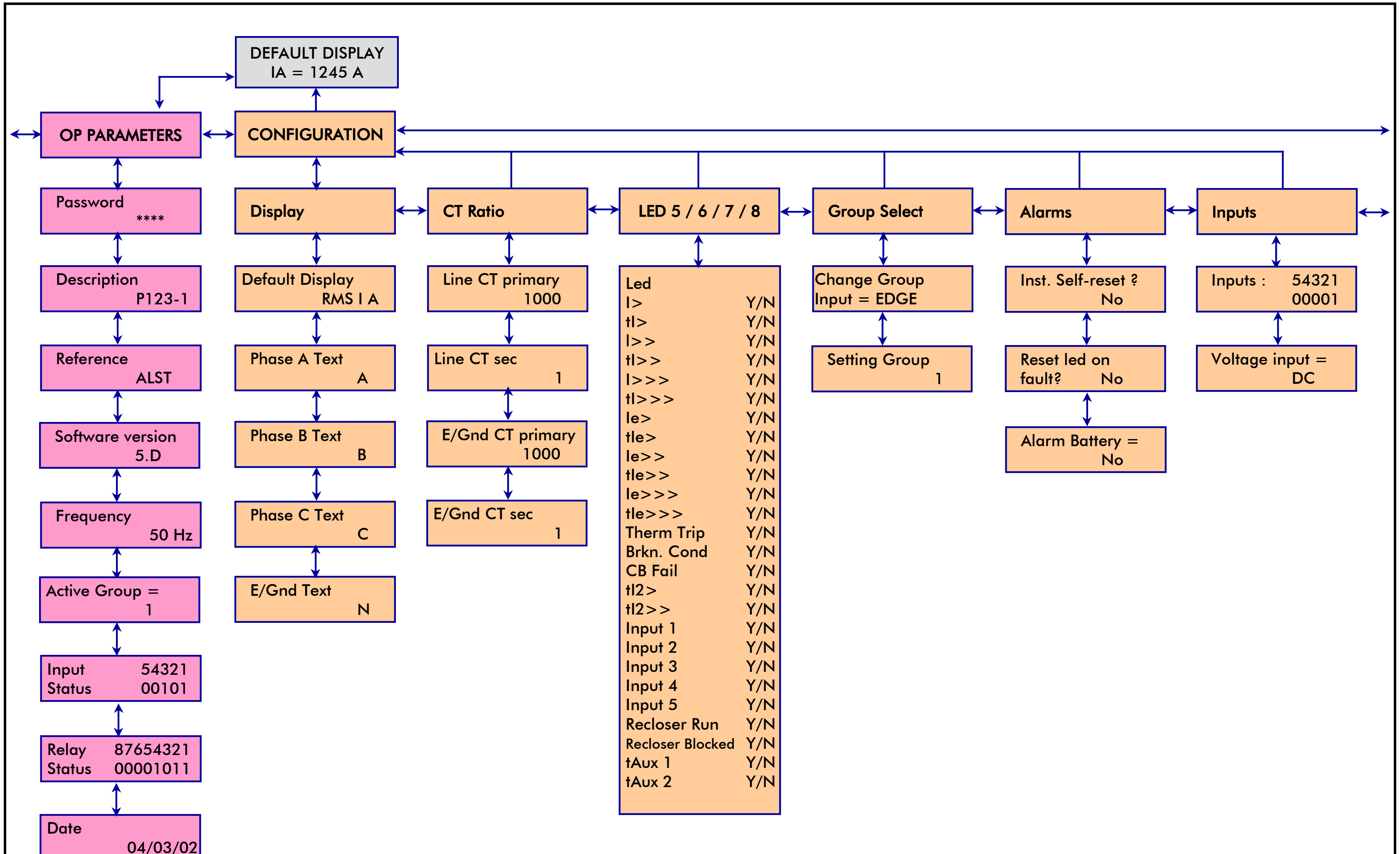


MiCOM P122 - V6 Software -

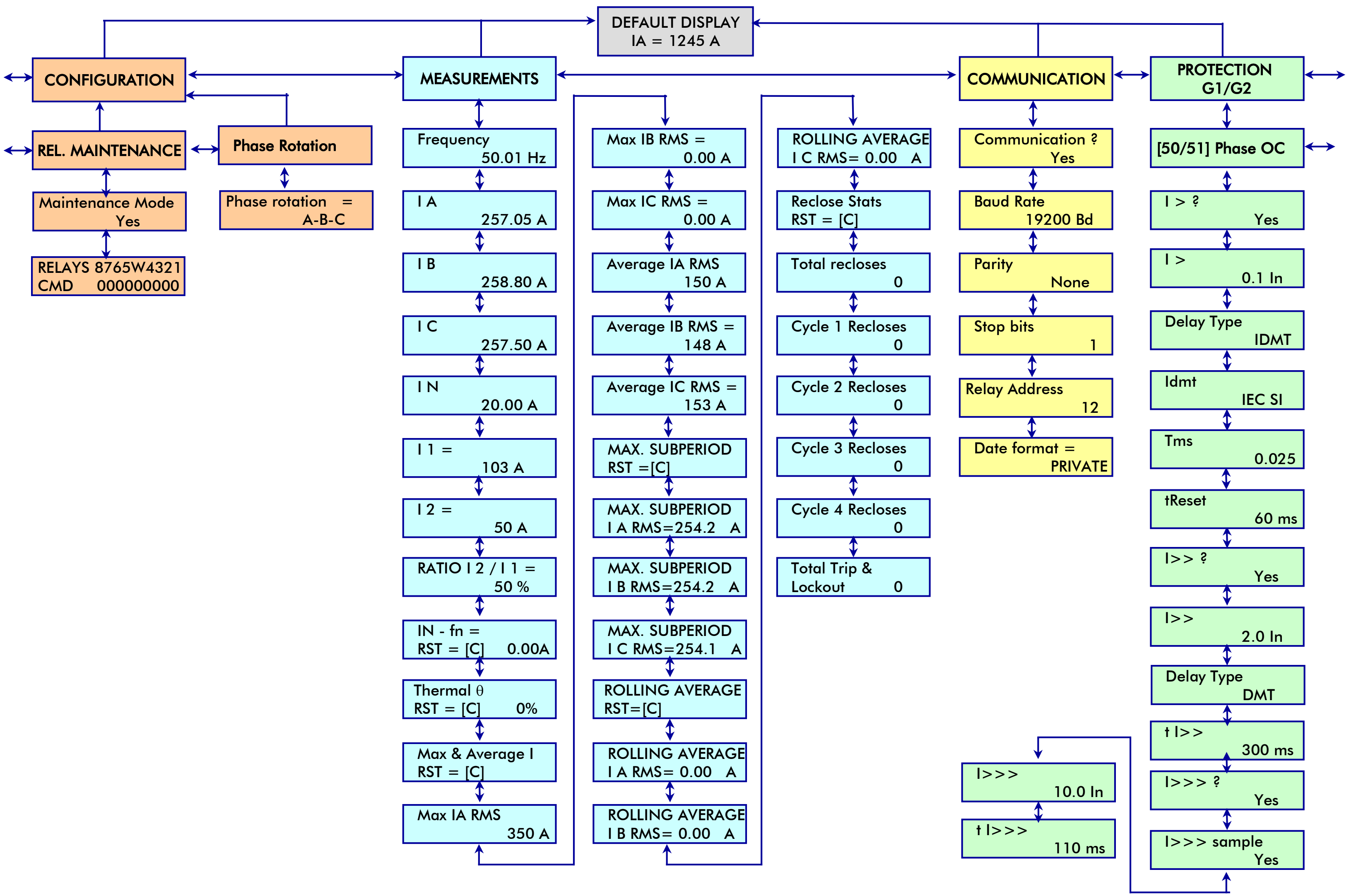
Menu content

6. MiCOM P123 – V6 SOFTWARE



MiCOM P123 - V6 Software

Menu content



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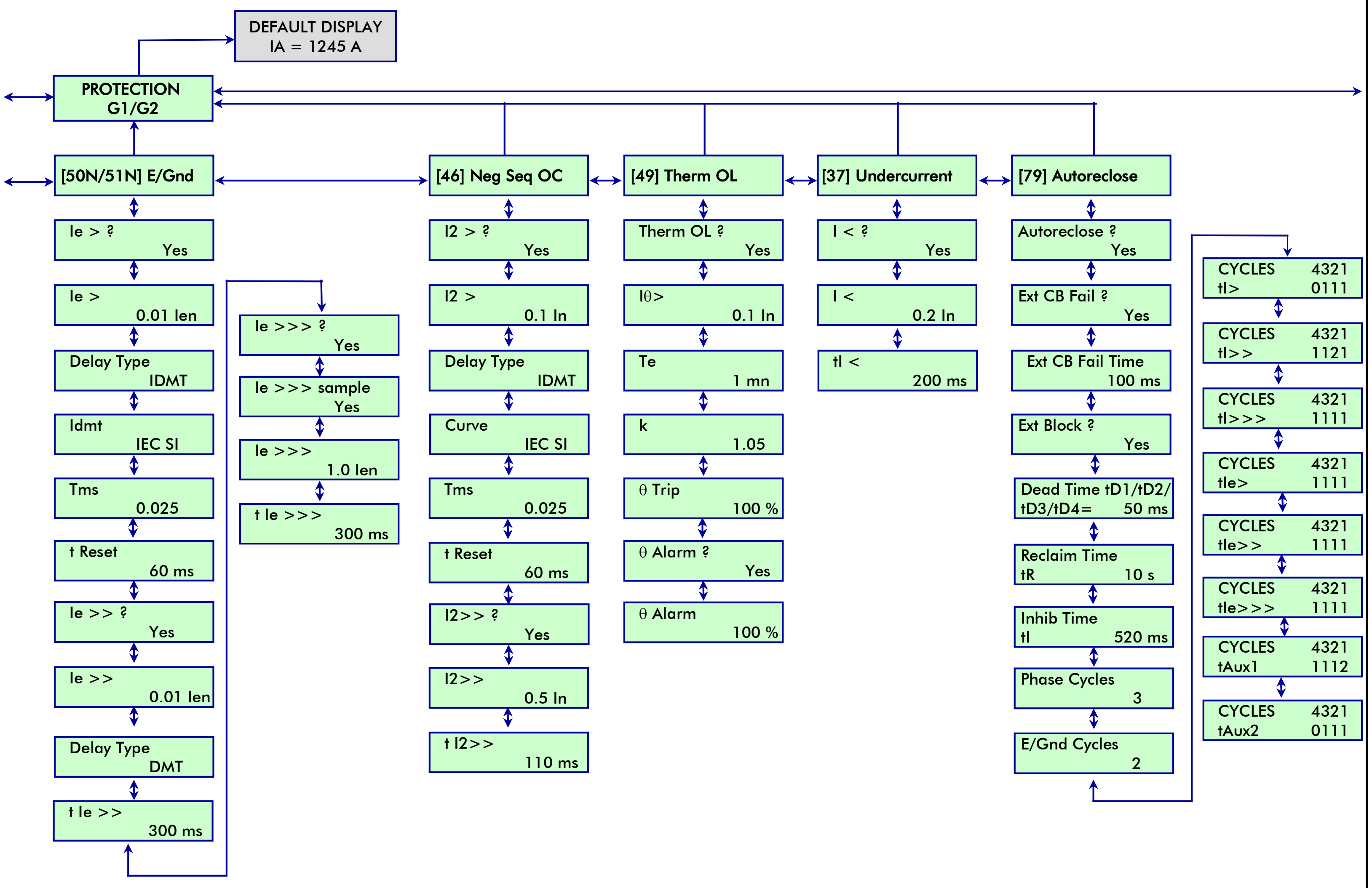

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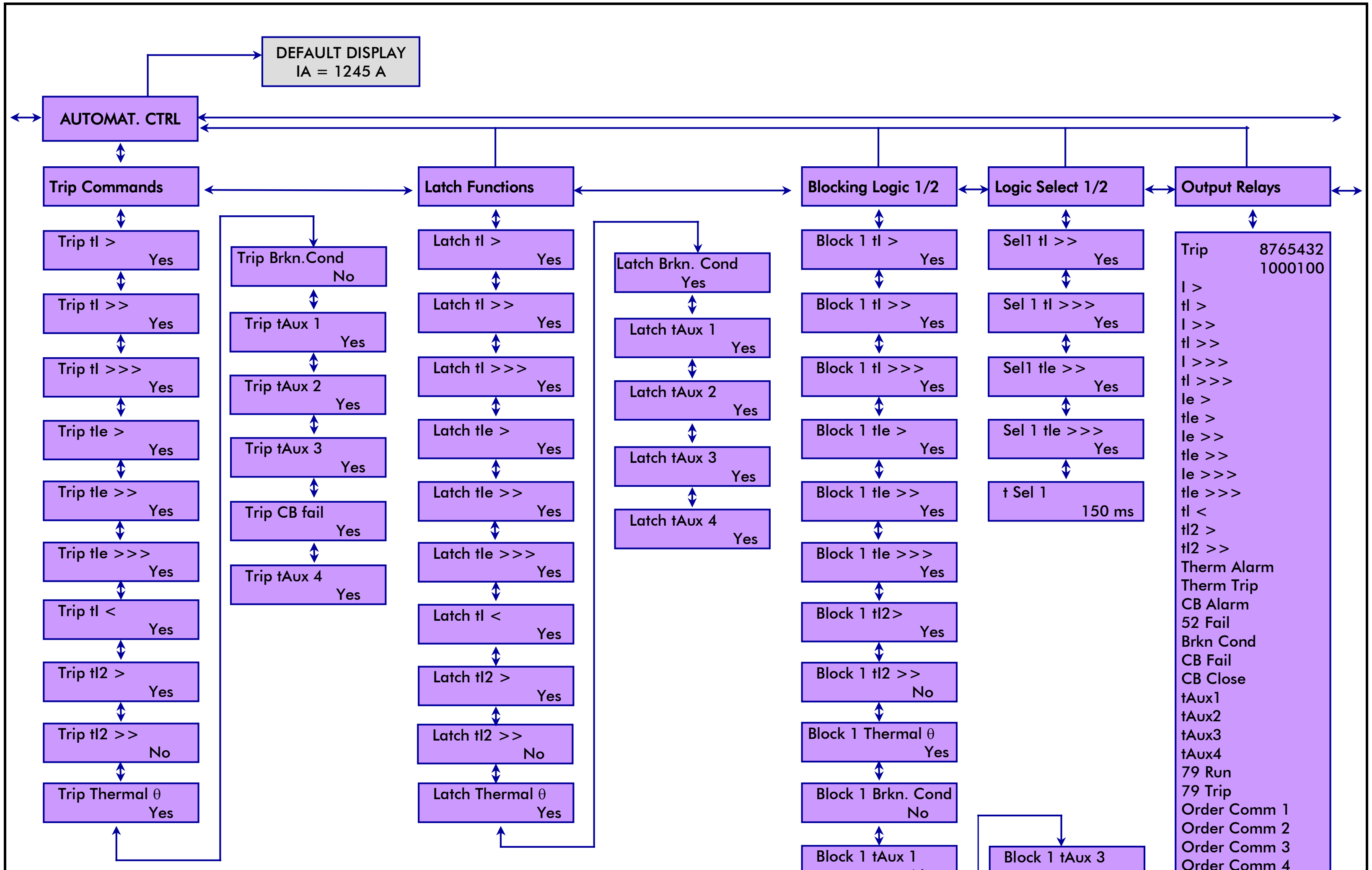
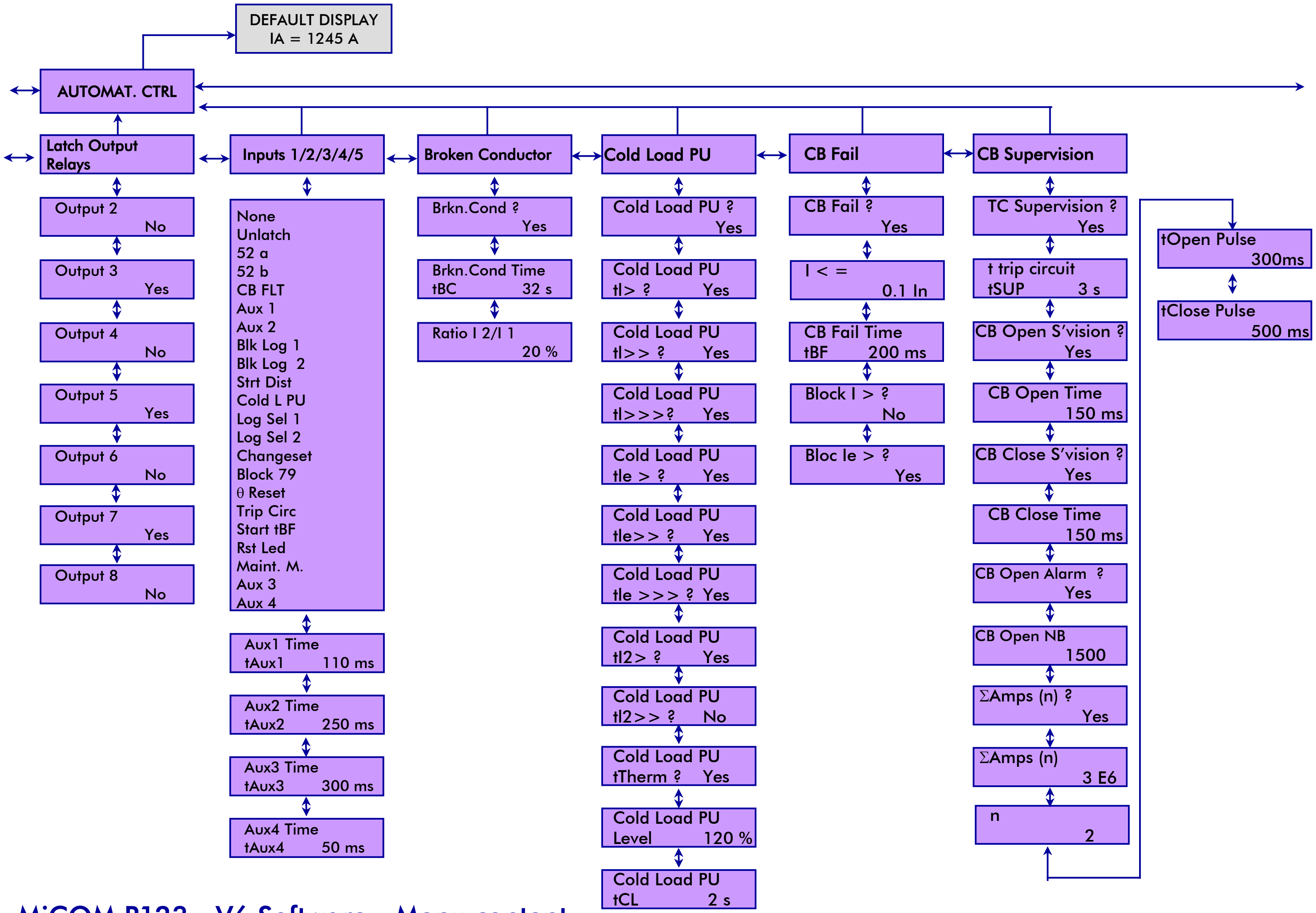
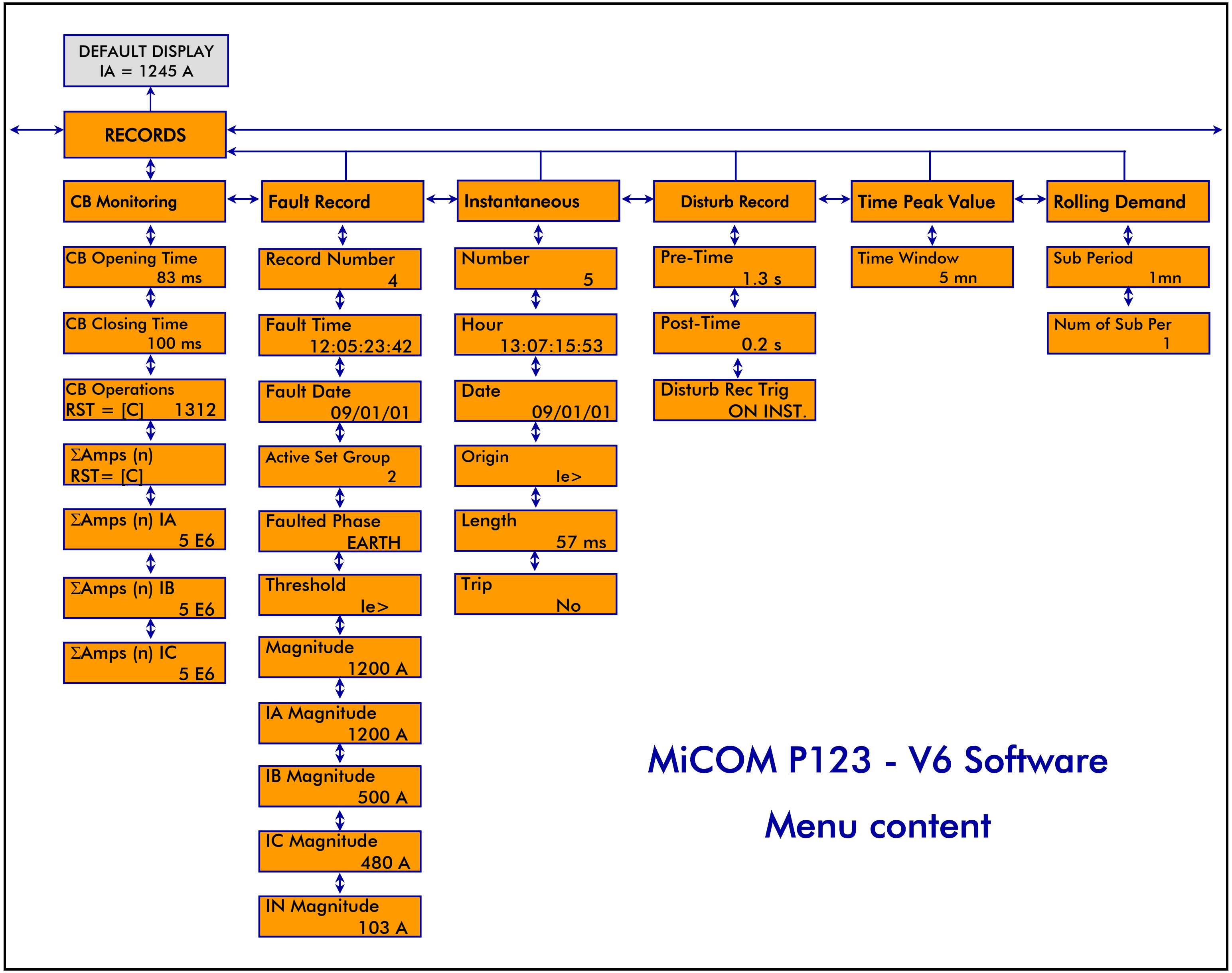


MiCOM P123 - V6 Software

Menu content



MiCOM P123 - V6 Software - Menu content


DEFAULT DISPLAY
IA = 1245 A
RECORDS
CB Monitoring
CB Opening Time 83 ms
CB Closing Time 100 ms
CB Operations RST = [C] 1312
ΣAmps (n) RST= [C]
ΣAmps (n) IA 5 E6
ΣAmps (n) IB 5 E6
ΣAmps (n) IC 5 E6
Fault Record
Record Number 4
Fault Time 12:05:23:42
Fault Date 09/01/01
Active Set Group 2
Faulted Phase EARTH
Threshold Ie>
Magnitude 1200 A
IA Magnitude 1200 A
IB Magnitude 500 A
IC Magnitude 480 A
IN Magnitude 103 A
Instantaneous
Number 5
Hour 13:07:15:53
Date 09/01/01
Origin Ie>
Length 57 ms
Trip No
Disturb Record
Pre-Time 1.3 s
Post-Time 0.2 s
Disturb Rec Trig ON INST.
Time Peak Value
Time Window 5 mn
Rolling Demand
Sub Period 1mn
Num of Sub Per 1
MiCOM P123 - V6 Software
Menu content

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Technical Data and Curve Characteristics

CONTENTS

1.	PROTECTION FUNCTIONS	3
1.1	Phase Overcurrent Protection (P121, P122 & P123 Only)	3
1.2	Neutral/Ground/Earth Overcurrent Protection	4
1.3	Sensitive ground/Earth overcurrent protection	5
1.4	Thermal overload protection (P122 & P123 only)	6
1.5	Undercurrent protection (P122 & P123 only)	6
1.6	Negative sequence overcurrent protection (P122 & P123 only)	6
2.	AUTOMATION FUNCTIONS	7
2.1	Cold load pickup (P122 & P123 only)	7
2.2	Auxiliary timers (P122 & P123 only)	7
2.3	Multishot autorecloser (P123 only)	7
2.4	Broken conductor detection (P122 & P123 only)	7
2.5	Circuit breaker failure (P122 & P123 only)	7
2.6	Trip circuit supervision (P122 & P123 only)	7
2.7	Circuit breaker control and monitoring (P122 & P123 only)	7
2.8	Logic selectivity (P122 & P123 only)	7
3.	RECORDING FUNCTIONS (P122 & P123 ONLY)	8
3.1	Event recorder	8
3.2	fault recorder	8
3.3	Instantaneous recorder	8
3.4	Disturbance recorder	8
4.	COMMUNICATION	9
5.	INPUTS AND OUTPUTS	10
5.1	AC Inputs	10
5.2	Logic inputs and outputs	10
5.3	Power supply	11
6.	ACCURACY	12
7.	CT DATA	12
8.	HIGH VOLTAGE WITHSTAND	12
9.	ELECTRICAL ENVIRONMENT	12

10. ENVIRONMENT 12

11. CURVES 13

11.1 IDMT Curves 13

11.1.1 Mathematical formula 13

11.1.1.1 IDMT threshold 13

11.1.1.2 Reset timer 14

11.1.2 IEC Curves 16

11.1.3 RI Curves 22

11.1.4 IEEE/ANSI & CO Curves 23

11.1.5 Rectifier protection curve 29

11.1.6 LABORELEC CURVE 30

11.2 Thermal overload curves 31

11.2.1 Mathematical formula 31

11.2.2 Tripping curve 32

1. PROTECTION FUNCTIONS

1.1 Phase Overcurrent Protection (P121, P122 & P123 Only)

– Current	Fundamental only
– Phase Current Range	0.1 to 40 x rated current, step of 0.01 In
– Thresholds	3 independent (I>, I>>, I>>>) I> 0.1 to 25 In (see note) I>> 0.5 to 40 In (see note) I>>> 0.5 to 40 In

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

– Hysteresis	95%
– Instantaneous time	< 30 ms
– Drop out time	30 ms
– Phase time delays	(tI>, tI>>, tI>>>)
DMT	0 ms to 150 s, step of 10 ms
Reset time (for DMT)	0 ms to 600 s, step of 10 ms
IDMT curves :	
IEC :	Short time inverse (ALSTOM), Standard Inverse (IEC), Very inverse (IEC), Extremely inverse (IEC), Long time inverse (ALSTOM).
RI :	(Electromechanical type).
IEEE/ANSI :	Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).
RECTIFIER :	Rectifier protection application (P122 & P123 only)
Time Multiplier Setting (TMS)	0.025 to 1.5, step of 0.025

– Reset time (**P121** only)

– If IDMT Phase time delay : fixed 50ms

– Reset time (**P122 & P123** only)

– If IEEE/ANSI phase time delay : Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).

– Reset Time Multiplier Setting (RTMS) 0.025 to 3.2, step of 0.025
or DMT : 0.04s to 100s; step of 0.01 s

– If IEC curves phase time delay : 0.04s to 100s; step of 0.01 s

1.2 Neutral/Ground/Earth Overcurrent Protection

– Current		Fundamental only
– Earth current Ranges		0.01 to 8 x rated current, step of 0.005 Ien 0.1 to 40 x rated current, step of 0.005 Ien
– Thresholds		3 independent (I_e>, I_e>>, I_e>>>)
	Range :	0.01 to 8 x Ien I_e> 0.01 to 1 Ien (see note) I_e>> 0.01 to 8 Ien (see note) I_e>>> 0.01 to 8 Ien
	Range :	0.1 to 40 x Ion I_e> 0.1 to 25 Ien (see note) I_e>> 0.5 to 40 Ien (see note) I_e>>> 0.5 to 40 Ien

NOTE : When I_e> or I_e>> is associated to an IDMT curve the maximum setting recommended should be the maximum of the range /20.

– Hysteresis		95%
– Instantaneous time		< 30 ms
– Drop out time		30 ms
– Earth time delays		(tI_e>, tI_e>>, tI_e>>>)
DMT Reset time (for DMT)		0 ms to 150 s, step of 10 ms 0 ms to 600 s, step of 10 ms
IDMT Curves	IEC :	Short time inverse (ALSTOM), Standard Inverse (IEC), Very inverse (IEC), Extremely inverse (IEC), Long time inverse (ALSTOM).
	RI :	(Electromechanical type).
	IEEE/ANSI :	Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).
	RECTIFIER :	Rectifier protection application (P122 & P123 only)
Time Multiplier Setting (TMS)		0.025 to 1.5, step of 0.025
	LABORELEC Curves	Laborelec curves 1, 2 and 3 (P122 & P123 only) used with 0.01 to 8 Ien range only
– Reset time (**P120 & P121** only)		
– if IDMT Earth time delay :		fixed 50 ms
– Reset time (**P122 & P123** only)		
– if IEEE/ANSI Earth time delay		Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).
	or DMT:	0.04s to 100s ; step of 0.01 s
– Reset Time Multiplier Setting (RTMS)		0.025 to 3.2, step of 0.025
– if IEC Curves Earth time delay		0.04s to 100s ; step of 0.01 s

1.3 Sensitive ground/Earth overcurrent protection

– Current	Fundamental only
– Sensitive Earth current Range	0.002 to 1 x rated current, step of 0.001 Ien
– Thresholds	3 independent (I_e>, I_e>>, I_e>>>)
Range :	0.002 to 1 x Ion
	I_e> 0.002 to 1 Ien (see note)
	I_e>> 0.002 to 1 Ien (see note)
	I_e>>> 0.002 to 1 Ien

NOTE : When I_e> or I_e>> is associated to an IDMT curve the maximum setting recommended should be 0.05 Ien.

– Hysteresis	95%
– Instantaneous time	< 30 ms
– Drop out time	30 ms
– Earth time delays	(tI_e>, tI_e>>, tI_e>>>)
DMT	0 ms to 150 s, step of 10 ms
Reset time (for DMT)	0 ms to 600 s, step of 10 ms
IDMT curves	
IEC :	Short time inverse (ALSTOM), Standard Inverse (IEC), Very inverse (IEC), Extremely inverse (IEC), Long time inverse (ALSTOM).
RI :	(Electromechanical type).
IEEE/ANSI:	Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).
RECTIFIER :	Rectifier protection application (P122 & P123 only)
Time Multiplier Setting (TMS)	0.025 to 1.5, step of 0.025
– Reset time (**P120 & P121** only)	
– if IDMT Earth time delay :	fixed 50 ms
– Reset time (**P122 & P123** only)	
– if IEEE/ANSI Earth time delay :	Short time inverse (CO2), Moderately inverse (ANSI), Inverse (CO8), Very inverse (ANSI), Extremely inverse (ANSI).
or DMT:	0.04s to 100s ; step of 0.01 s
– Reset Time Multiplier Setting (RTMS)	0.025 to 3.2, step of 0.025
– if IEC curves Earth time delay :	0.04s to 100s ; step of 0.01 s

1.4 Thermal overload protection (P122 & P123 only)

– Current		RMS
– Current threshold	I θ>	0.1 to 3.2 x rated current, step of 0.01
– Thermal state (alarm and trip)		50 to 200 % x θ, step of 1 %
– Constant Time Te		1 to 200 mn, step of 1 mn
– k factor		1 to 1.5, step of 0.01

1.5 Undercurrent protection (P122 & P123 only)

– Current		Fundamental only
– Phase Current Range	I<	2 to 100 % x rated current, step of 1%
– Time delay	tI<	0 to 150 s, step of 10 ms
– Hysteresis		105%

1.6 Negative sequence overcurrent protection (P122 & P123 only)

– Current: Fundamental only

– Phase Current Range I2> & I2>>: 0.1 to 40 x rated current

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

– Hysteresis: 95%

– I2> Time delay

DMT: 0 ms to 150 s, step of 10 ms

IDMT curves

IEC : Short time inverse (ALSTOM),
Standard Inverse (IEC),
Very inverse (IEC),
Extremely inverse (IEC),
Long time inverse (ALSTOM).

RI : (Electromechanical type).

IEEE/ANSI: Short time inverse (CO2),
Moderately inverse (ANSI),
Inverse (CO8),
Very inverse (ANSI),
Extremely inverse (ANSI).

Time Multiplier Setting (TMS): 0.025 to 1.5, step of 0.025

– Reset time

– If IEEE/ANSI I2> Time delay : Short time inverse (CO2),
Moderately inverse (ANSI),
Inverse (CO8),
Very inverse (ANSI),
Extremely inverse (ANSI).

or DMT: 0.04s to 100s ; step of 0.01 s

– Reset Time Multiplier Setting (RTMS): 0.025 to 3.2, step of 0.025

– If IEC I2> Time delay : 0.04s to 100s ; step of 0.01 s

– I2>> Time delay

DMT: 0 ms to 150 s, step of 10 ms

2. AUTOMATION FUNCTIONS

2.1 Cold load pickup (P122 & P123 only)

Range		20 to 500 % x nominal settings, step of 1%
Time delay	tCL	0.1 s to 3600 s, step of 100 ms

2.2 Auxiliary timers (P122 & P123 only)

Auxiliary timer numbers	P123:	4 independent associated to the logic Inputs Aux 1, Aux 2, Aux 3 and Aux 4
	P122:	3 independent associated to the logic Inputs Aux 1, Aux 2 and Aux 3
tAux1, tAux2, tAux3 & tAux4 Range		0 ms to 200 s ; step of 10 ms

2.3 Multishot autorecloser (P123 only)

Main shots	4 independent shots phase and/or earth
Dead times	Cycles 1 & 2 0.01 to 300 s; step of 10 ms Cycles 3 & 4 0.01 to 600 s; step of 10 ms
Reclaim time	20 ms to 600 s; step of 10 ms
Inhibition time	20 ms to 600 s; step of 10 ms
External logic inputs	4 inputs (External CB fail, phase start, earth start, blocking order)

2.4 Broken conductor detection (P122 & P123 only)

Principle used		I2/I1
Broken conductor threshold		20 to 100 %; step of 1 %
Broken conductor time delay	tBC	1 to 14400 s; step of 1 s

2.5 Circuit breaker failure (P122 & P123 only)

Under current threshold	I<	2% to 100% x rated current, step of 1%
Threshold accuracy		from 0.02 In to 0.1 In : 0.006 In from 0.1 In to 1 In : 2% Is
Threshold hysteresis		max. 0.008 In or 0.95 Is
CB failure time	tBF	30 ms to 10 s; step of 10 ms

2.6 Trip circuit supervision (P122 & P123 only)

Trip circuit supervision time	t SUP	0.1s to 10 s step 50 ms

2.7 Circuit breaker control and monitoring (P122 & P123 only)

– Circuit breaker opening time	(t Open Pulse)	50 ms to 1 s; step of 10 ms
– Circuit breaker closing time	(t Close Pulse)	50 ms to 1 s; step of 10 ms
– Circuit breaker opening alarm threshold		0 to 50000 operations
– Amps or square amps alarm threshold		0 to 4 10^9; step of 10^6
– Circuit breaker tripping time alarm threshold		100 ms to 5 s; step of 100 ms
– Circuit breaker closing time alarm threshold		100 ms to 5 s; step of 100 ms

2.8 Logic selectivity (P122 & P123 only)

Timer Number	2 Independent : t Sel 1 & t Sel 2
Range	0ms to 150s ; step of 10ms

3. RECORDING FUNCTIONS (P122 & P123 ONLY)

3.1 Event recorder

Capacity		75 events
Time-tag		to 1 millisecond
Triggers		Any selected protection alarm and threshold Logic input change of state Self test events Setting changes

3.2 fault recorder

Capacity		5 faults
Time-tag		to 1 millisecond
Triggers		Any selected protection alarm and threshold
Data		Fault date Protection thresholds Setting Group AC inputs measurements(RMS) Fault magnitudes

3.3 Instantaneous recorder

Capacity		5 starting informations (instantaneous threshold pick-up)
Time-tag		to 1 ms
Trigger		Any selected phase or earth threshold
Data		date, hour origin (I>, I>>, I>>>, I_e>, I_e>>, I_e>>>) length (duration of the instantaneous) trip yes or no

3.4 Disturbance recorder

Capacity		5 records of 3 s each
Sampling rate		32 samples per frequency cycle
Settings	Pre-time Post-time	100 ms to 3 s, step of 100 ms 100 ms to 3 s, step of 100 ms
Triggers		Any selected protection alarm and threshold Logic input Remote command
Data		AC input channels Digital input and output states Frequency value

4. COMMUNICATION

RS 485 port		rear port, screened twisted wire pair
	Connectors	screws or snap-on
	Protocols	MODBUS^{TM} RTU Courier IEC 60870-5-103 DNP3
Data rate		300 to 38 400 baud (programmable)
RS 232 port (**P122 & P123** only)		front port, screened twisted wire cable
	Protocol	MODBUS^{TM} RTU
	Connector	Sub-D 9 pin female connector

5. INPUTS AND OUTPUTS

5.1 AC Inputs

Phase current inputs		1 and 5 Amps by connection
Earth current inputs		1 and 5 Amps by connection
Frequency	Range Nominal	45 to 65 Hz 50/60 Hz
Current inputs burden	Phase	< 0.025 VA (1 A) < 0.3 VA (5 A)
	Earth	< 0.008 VA at $0{,}1I_E$ (1 A) < 0.01 VA for $0{,}1I_E$ (5 A)
Thermal withstand		1s @ 100 x rated current 2s @ 40 x rated current continuous @ 4 x rated current

5.2 Logic inputs and outputs

Logic Input

Logic input type	independent optical isolated
Logic input burden	<10 mAmps per input
Logic input recognition time	< 5 ms

Supply

The logic inputs shall be powered with a DC voltage, excepted the M auxiliary voltage range which accepts both DC and AC voltage as logic input control voltage.

		Logic input operation		
Cortec Code	Relay auxiliary voltage range	Auxiliary voltage range for the logic inputs*	Minimum voltage level (Volt)	Minimum current level (milli-Amp)
A	24 - 60 Vdc	19 - 60 Vdc	15 Vdc	3.35 mA
F	48 - 150 Vdc	32 - 150 Vdc	25 Vdc	3.35 mA
M	130 - 250 Vdc 100 - 250 Vac	48 - 250 Vdc 48 - 250 Vac	38 Vdc 38 Vac	2.20 mA 1.90 mA rms
T	48 - 150 Vdc special EA	32 - 150 Vdc	25 Vdc	3.35 mA
U	130 - 250 Vdc special EA	48 - 250 Vdc	38 Vdc	2.20 Ma
H	125 - 250 Vdc 100 - 250 Vac	105 - 145 Vdc	96 Vdc	1.8 mA

* The tolerance on the auxiliary voltage variations for the logic inputs is ±20% in dc voltage and –20%, +10% in ac voltage.

Logic Output

Logic output type		dry contact Ag Cdo
Logic output rating	Make Carry Break	30 Amps and carry for 3 s 5 Amps continuous 135 Vdc, 0.3 Amps (L/R = 30 ms) 250 Vdc, 50 W resistive or 25W inductive (L/R=40ms) 220 Vac, 5 Amps (cos φ = 0.6)
Logic output operation time		< 7 ms
Logic output mechanical durability		> 100 000 operations

5.3 Power supply

Auxiliary voltage Vaux, 4 ranges :	24–60 Vdc 48–150 Vdc 130–250 Vdc / 100-250 Vac, 50/60 Hz 125–250 Vdc / 100-250 Vac, 50/60 Hz (special application)
Power supply variations	dc ± 20 % ac –20%, +10%
Ripple	12 %.
Power off withstand	50 ms
Burden	3 W standby + 0.25 W per energised relay 6 VA standby + 0.4 VA per energised relay.

6. ACCURACY

O/C Protection thresholds	± 2 %
Thermal replica thresholds	± 5 %
Time delay (DT)	± 2 % with a minimum of 10 ms
Time delay (inverse curves)	conform to BS142 class 5 see time delay accuracy table in chapter P12x:EN CM
Measurements	$\leq$ ± 1 % @ In
Measurements pass band	500 Hz

7. CT DATA

Phase CT primary	1 to 9999, step of 1
Earth CT primary	1 to 9999, step of 1
Phase CT secondary	1 or 5
Earth CT secondary	1 or 5
Phase inputs	5P10, 5 VA (typical)
Earth current	Residual connection or Core balanced CT(preferred in isolated and compensated neutral systems)

8. HIGH VOLTAGE WITHSTAND

Dielectric withstand	IEC 60-255-5	2 kV common mode 1 kV differential mode
Impulse voltage	IEC 60-255-5	5 kV common mode 1 kV differential mode
Insulation resistance	IEC 60-255-5	> 1000 MΩ

9. ELECTRICAL ENVIRONMENT

High frequency disturbance	IEC 61000-4-12	2.5 kV common mode, class 3 1 kV differential mode, class 3
Fast transient	IEC 61000-4-4 ANSI C37.90.1	4 kV auxiliary voltage, class 4 2 kV others, class4
Electrostatic discharge	IEC 61000-4-2	8 kV, class 4
Radio frequency impulse	ANSI C37.90.2 IEC 61000-4-3	35 V/m 10 V/m

10. ENVIRONMENT

Temperature	IEC 60-255-6	Storage -25°C to +70°C Operation -25°C to + 55 °C
Humidity	IEC 600-68-2-3	56 days at 93% RH and 40°C
Enclosure protection	IEC 60-529	IP 52, IK 07
Vibrations	IEC 60-255-21-1	Response and endurance, class 2
Shocks and bumps	IEC 60-255-21-11	Response and withstand, class 1
Seismic	IEC 60-255-21-3	Class 1

11. CURVES

11.1 IDMT Curves

11.1.1 Mathematical formula

11.1.1.1 IDMT threshold

Inverse Time Curves :

The first and second phases (earth) overcurrent threshold can be selected with a dependent time characteristic. The time delay is calculated with a mathematical formula.

In all, there are eleven inverse time characteristics available.

The mathematical formula applicable to the first ten curves is :

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

Where:

t = Tripping time

K = Coefficient (see table)

I = Value of measured current

I_S = Value of the programmed threshold (Pick-up value)

α = Coefficient (see table)

L = ANSI/IEEE coefficient (zero for IEC curves)

T = Time multiplier between 0.025 and 1.5

Type of curve	Standard	K factor	α factor	L factor
Short Time Inverse	ALSTOM	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	ALSTOM	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	0.1215
Rectifier Protection		45900	5.6	0

The RI curve (electromechanical) is given by the following formula:

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

With K adjustable from 0.10 to 10 in steps of 0.05

This equation is valid for 1.1<= (I/Is) <= 20

Although the curves tend towards infinite when the current approaches Is, 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), except rectifier Protection curve for which the minimum value is 1.6 Is ±0.05 Is.

LABORELEC CURVES :

The first and second earth threshold can be selected with dedicated Laborelec curves.

There are 3 curves available with the following formula :

$$t = aI + b$$

where : t = tripping time
a and b = coefficient (see table)
I = Primary residual current (between 1 and 40A)

Type of curve	a	b
LABORELEC 1	– 0.0897	4.0897
LABORELEC 2	– 0.0897	4.5897
LABORELEC 3	– 0.0897	5.0897

In order to be compliant with the Laborelec specifications the relay must be used with :

- An earth current range 0.01 Ion to 8 Ion
- A rated current wiring 1A
- A core balanced CT with a ratio 20/1.

For a complete operating of the curve, the relay must be set to 0.05Ion (secondary residual current).

11.1.1.2 Reset timer

The first phase overcurrent threshold [I>/tI>] ([Ie>/tIe>] for the earth) has a reset time. The fixed period for this determines the minimum time during the current need to remain lower than 95% of the phase (earth) threshold before the time delay associated with the phase (earth) overcurrent threshold resets.

NOTE : There is an exception to this rule when the protection triggers. In fact, in this situation, the time delays tI>/tIe> are immediately reinitialised.

The value of the Reset Timer depends on the type of the timer associated to the pick-up first phase (Earth) threshold.

Type of timer associated to the first & second phase (earth) threshold	**Reset Timer**	
	P120, P121	**P122, P123**
DMT	0 ms	0 ms
LABORELEC *, Rectifier, IDMT IEC or RI	50 ms	Settable from 40 ms to 100s
IDMT IEEE or CO	50 ms	Settable from 40 ms to 100s or Inverse Time (Choice of 5 IEEE curves)

* first & second earth threshold only

Reset timer of the P122 & P123 relays :

The first phase and earth overcurrent stages in the P122 and P123 relays are provided with a timer hold facility "t Reset", which may be set to a definite time value or to an inverse time characteristic (IEEE/ANSI curves only). This may be useful in certain applications, for example when grading with upstream electromechanical overcurrent relays which have inherent reset time delays.

Another possible situation where the timer hold facility may be used to reduce fault clearance times is where intermittent faults occur. An example of this may occur in a plastic insulated cable . In this application it is possible that the fault energy melts and reseals the cable insulation, thereby extinguishing the fault. This process repeats 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 minimum the relay will be repeatedly reset and not be able to trip until the fault becomes permanent. By using the Timer Hold facility the relay will integrate the fault current pulses, thereby reducing fault clearance time.

The reset timer "t Reset" facility for the MiCOM P122 & P123 can be found in the following menu :

– If the first phase (earth) threshold is selected with an IDMT IEC or RI curve, the reset timer "t Reset" with DMT characteristic is settable in the menu :
  – Protection /[50/51] Phase OC/t Reset for the phase
  – Protection /[50N/51N] E/Gnd/t Reset for the earth.
– If the first phase (earth) threshold is selected with an IDMT IEEE or CO curve, the reset timer "t Reset" with a DMTor IDMT characteristic is settable in the menu :
  – Protection /[50/51] Phase OC/Type Tempo Reset for the phase
  – Protection /[50N/51N] E/Gnd/Type Tempo Reset for the earth.

Reset Time "t Reset" with an IDMT characteristic :

The mathematical formula applicable to the five curves is :

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

Where :

t = Reset time

K = Coefficient (see table)

I = Value of the measured current

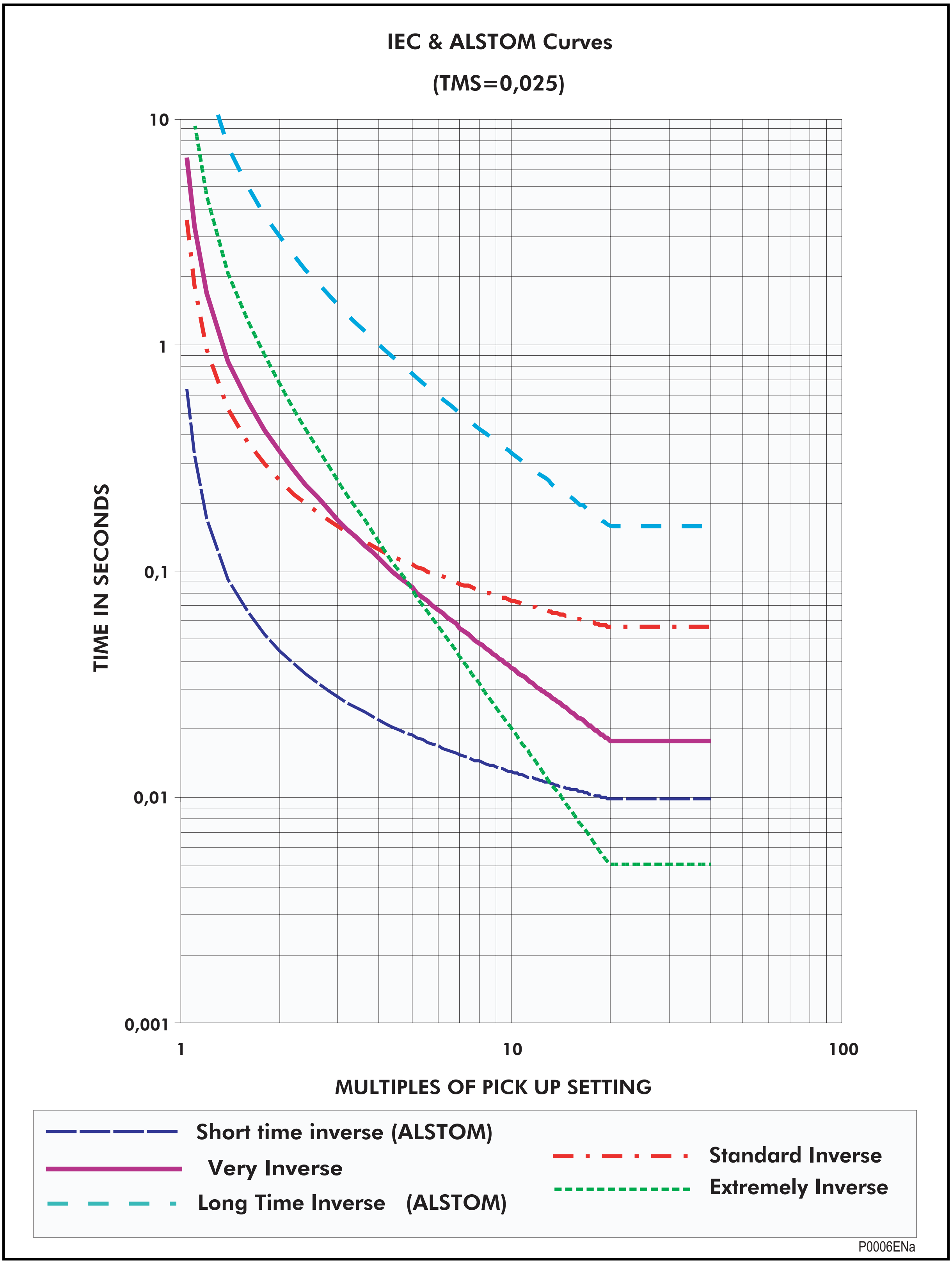
I_S = Value of the programmed threshold (pick-up value)

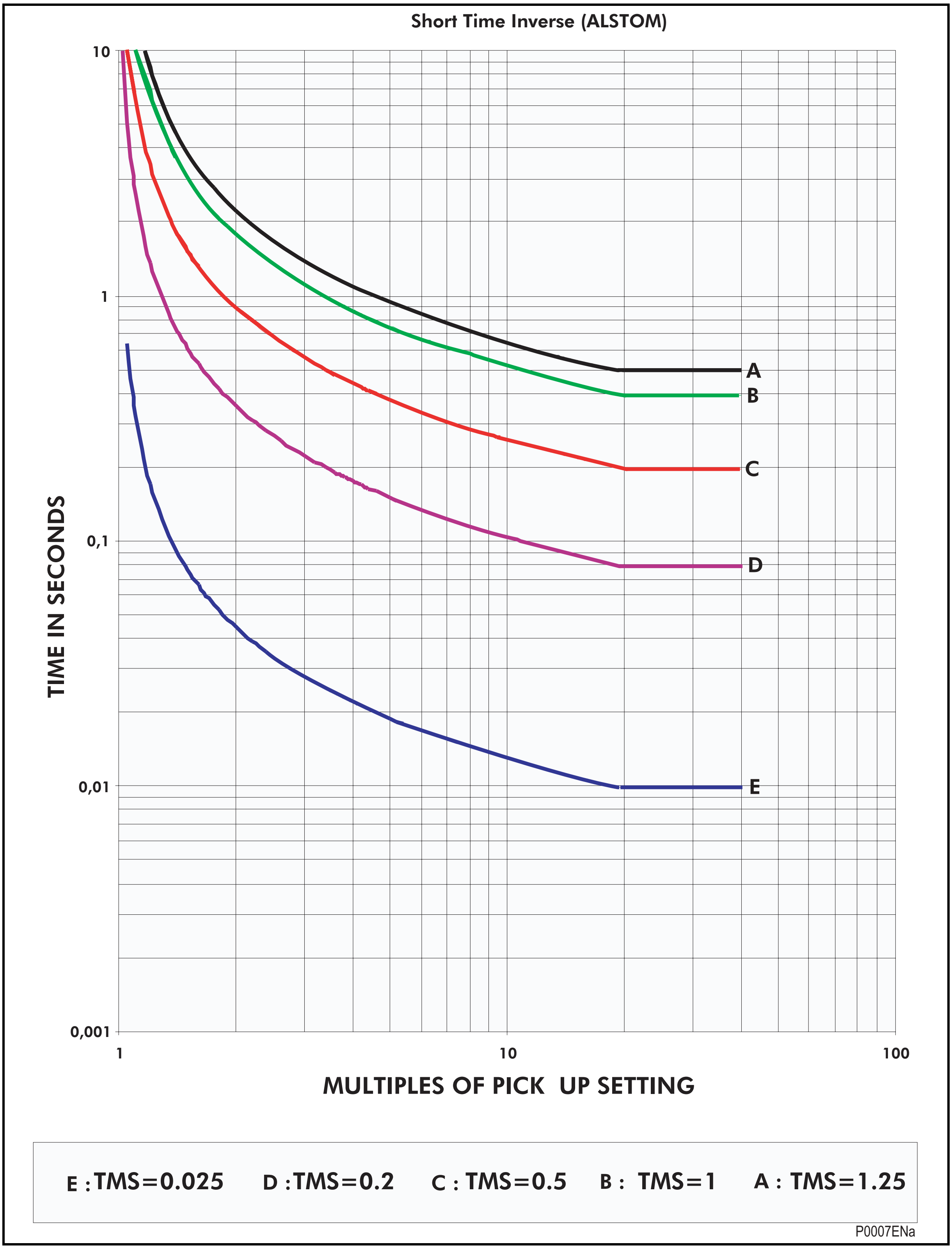
α = Coefficient (see table)

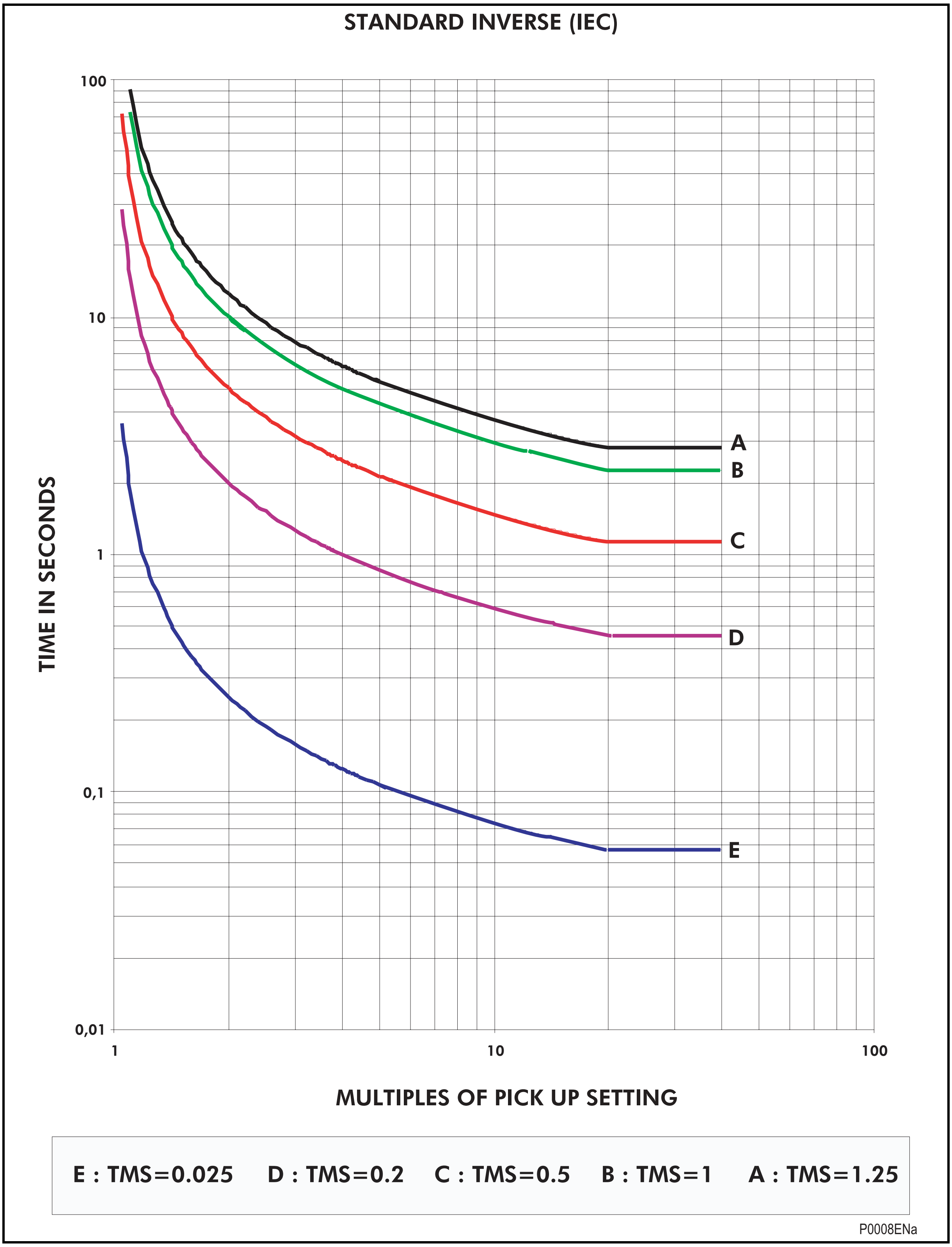
T = Reset Time Multiplier (Rtms) between 0.025 and 3.2

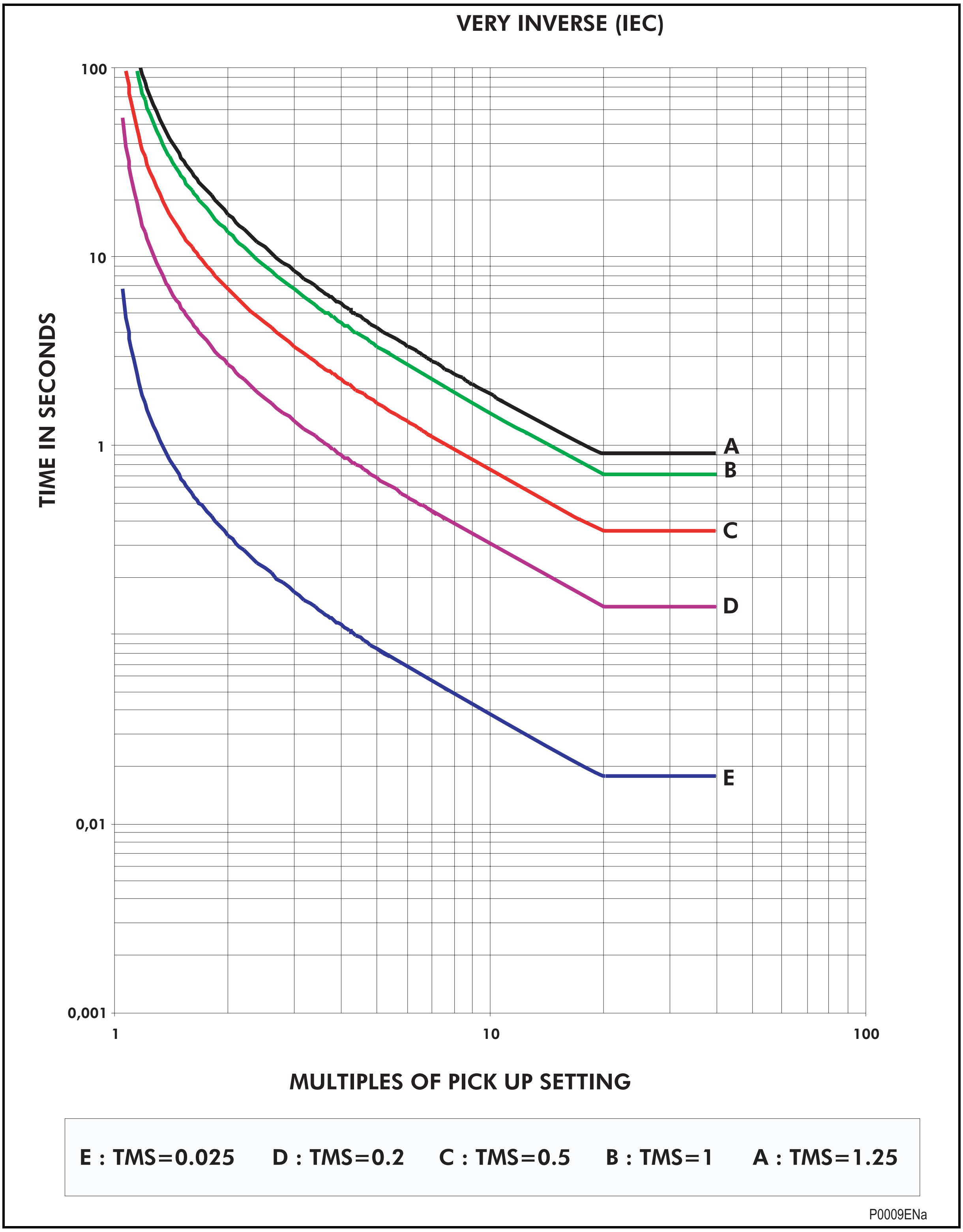
Type of curves	**Standard**	**K factor**	**α factor**
Short time inverse	C02	2.261	2
Moderately Inverse	ANSI/IEEE	4.85	2
Long time Inverse	C08	5.95	2
Very inverse	ANSI/IEEE	21.6	2
Extremely inverse	ANSI/IEEE	29.1	2

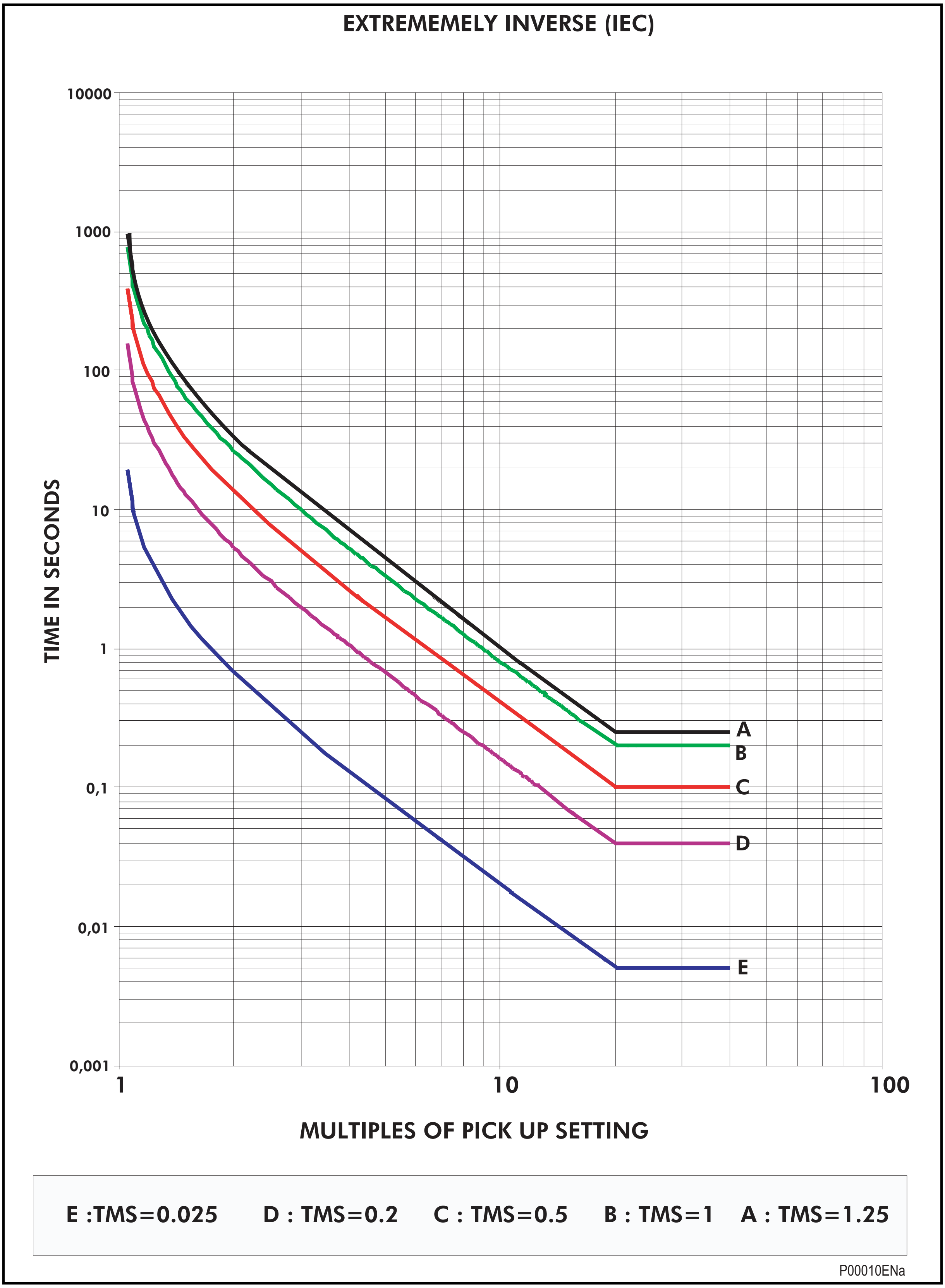
11.1.2 IEC Curves

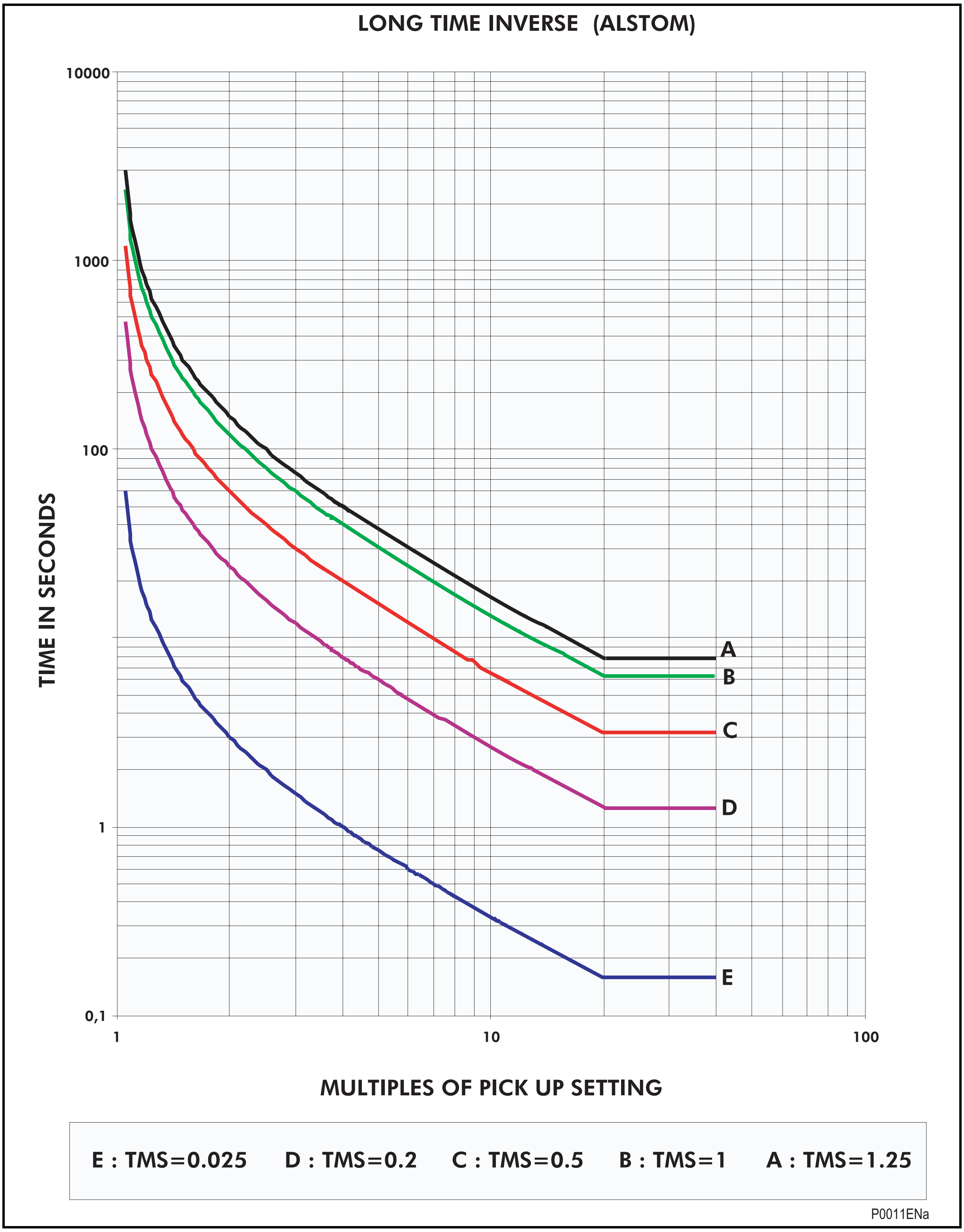



Short Time Inverse (ALSTOM)
TIME IN SECONDS
10
1
0,1
0,01
0,001
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS=0.025
D : TMS=0.2
C : TMS=0.5
B : TMS=1
A : TMS=1.25
P0007ENa

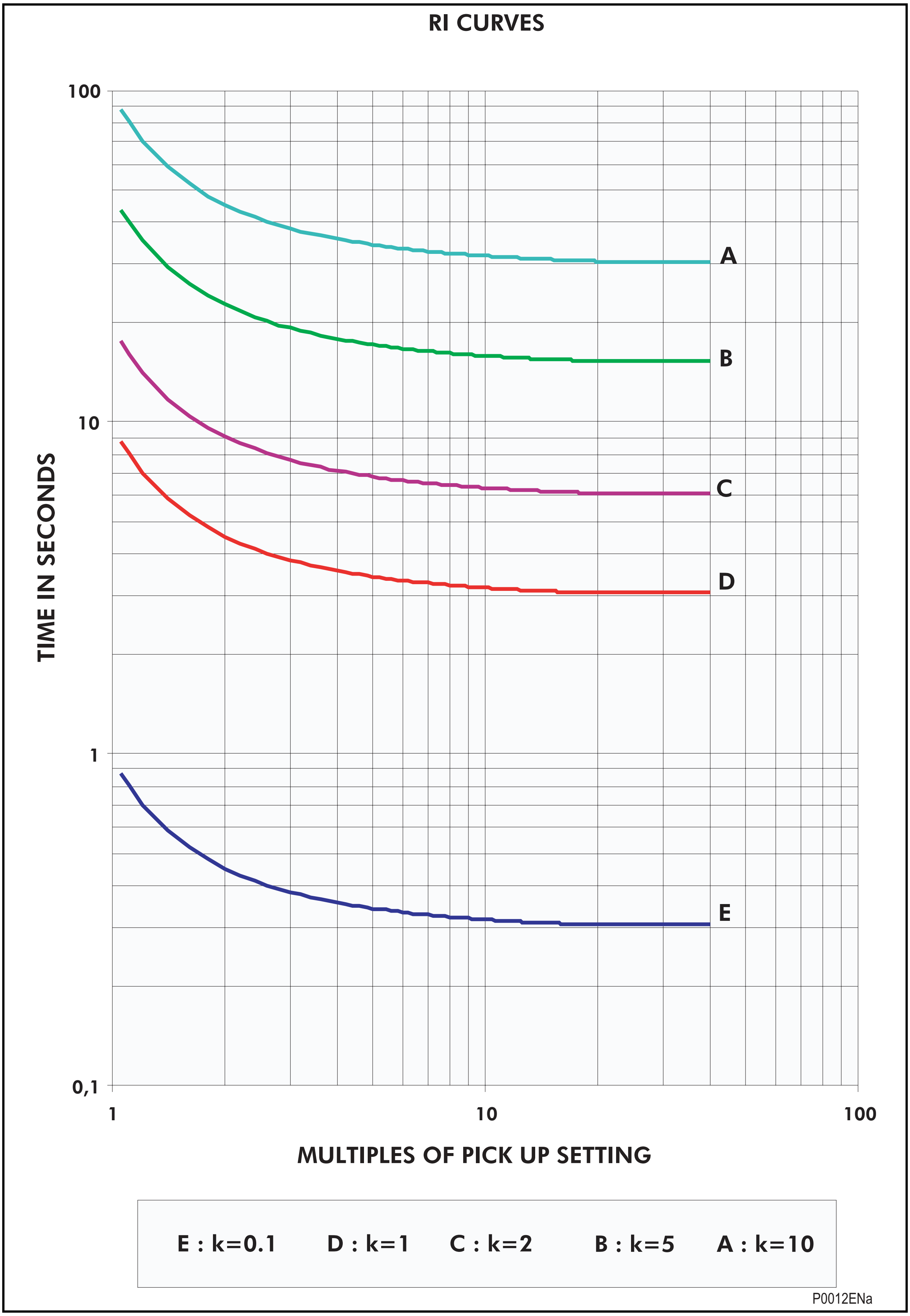

STANDARD INVERSE (IEC)
100
10
1
0,1
0,01
TIME IN SECONDS
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS=0.025
D : TMS=0.2
C : TMS=0.5
B : TMS=1
A : TMS=1.25
P0008ENa


VERY INVERSE (IEC)
TIME IN SECONDS
100
10
1
0,01
0,001
1
10
100
A
B
C
D
E
MULTIPLES OF PICK UP SETTING
E : TMS=0.025
D : TMS=0.2
C : TMS=0.5
B : TMS=1
A : TMS=1.25
P0009ENa

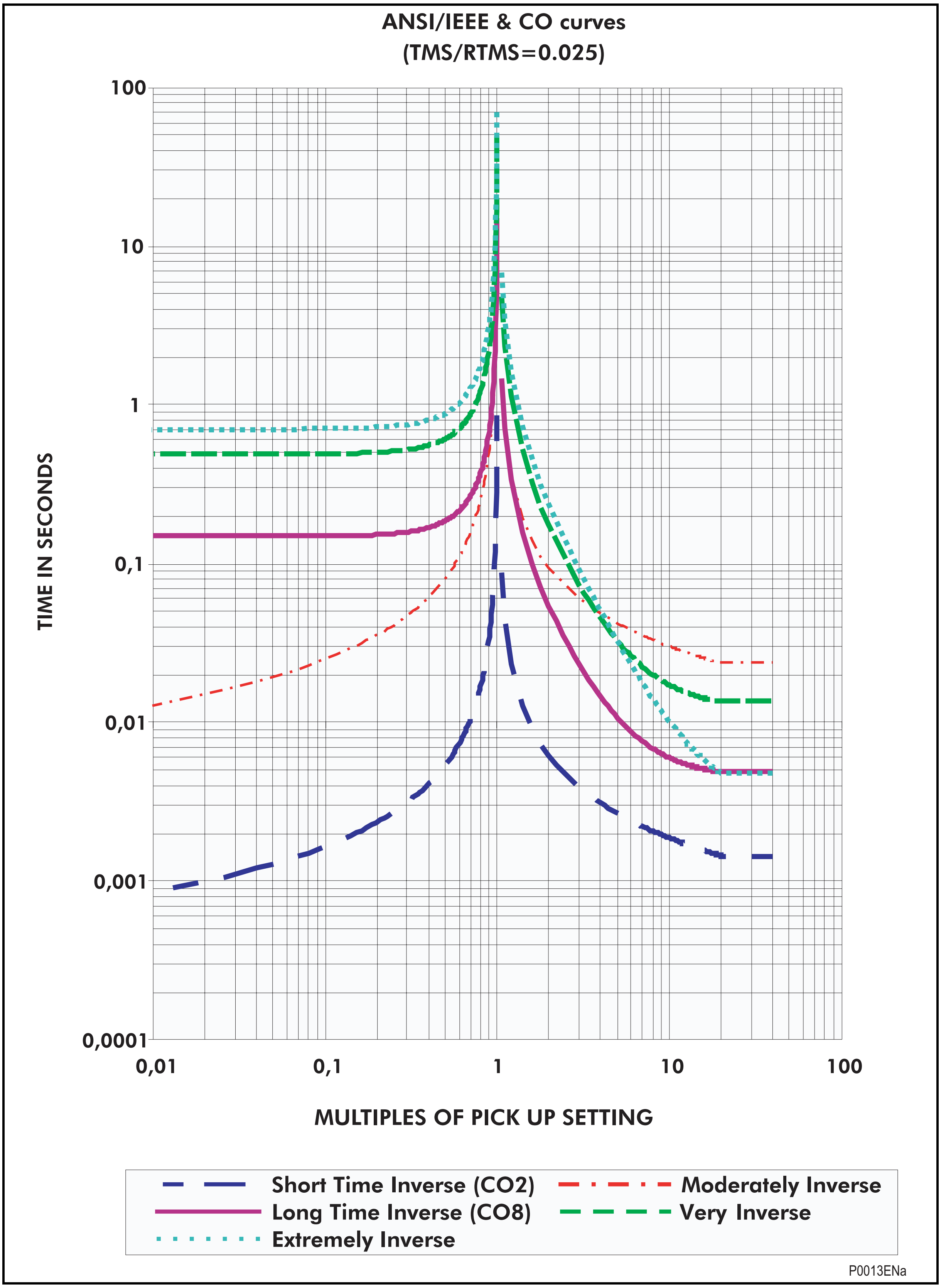

EXTREMEMELY INVERSE (IEC)
10000
1000
100
10
1
0,1
0,01
0,001
TIME IN SECONDS
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E :TMS=0.025
D : TMS=0.2
C : TMS=0.5
B : TMS=1
A : TMS=1.25
P00010ENa

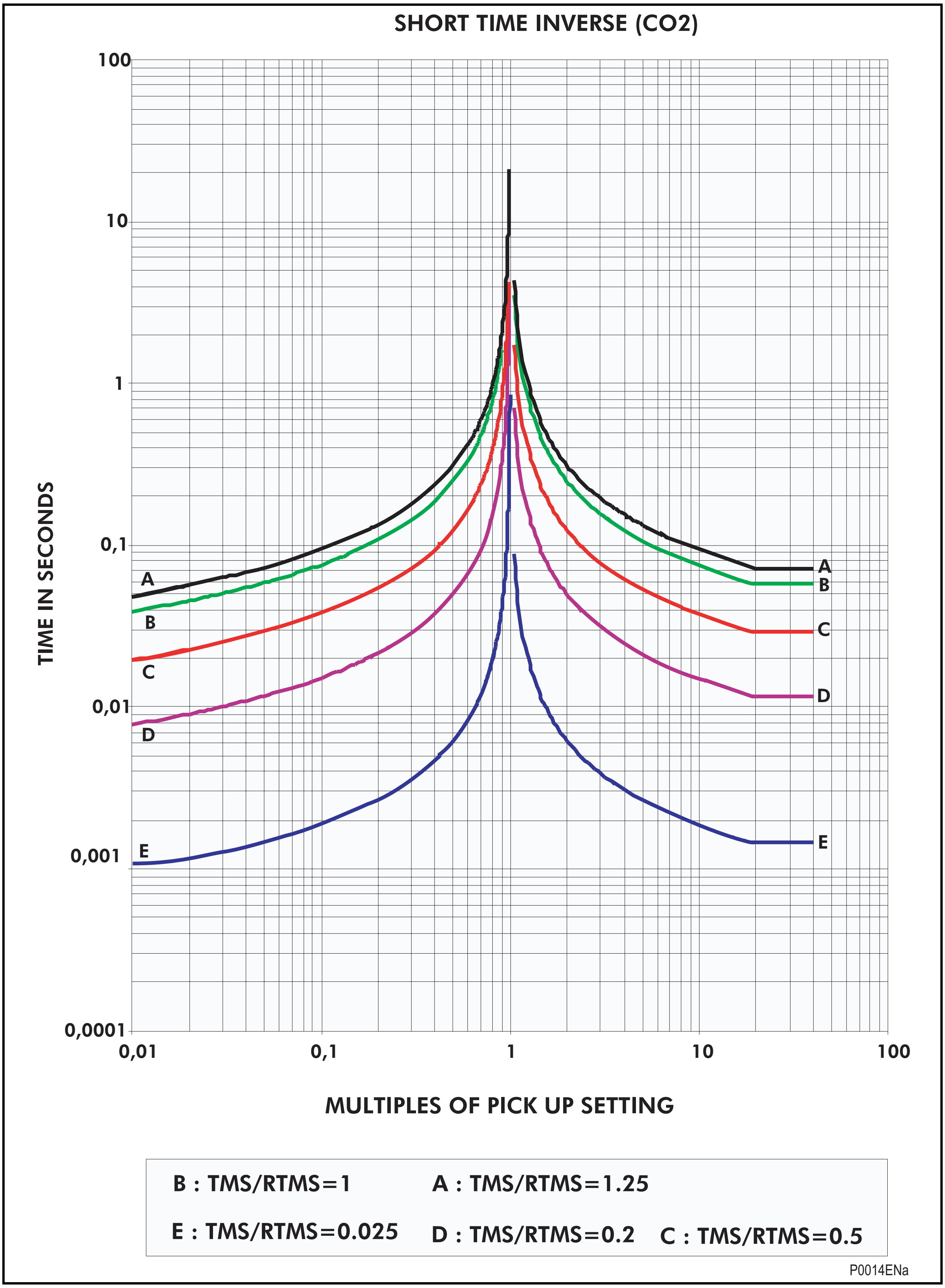

LONG TIME INVERSE (ALSTOM)
10000
1000
100
1
0,1
TIME IN SECONDS
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS=0.025
D : TMS=0.2
C : TMS=0.5
B : TMS=1
A : TMS=1.25
P0011ENa

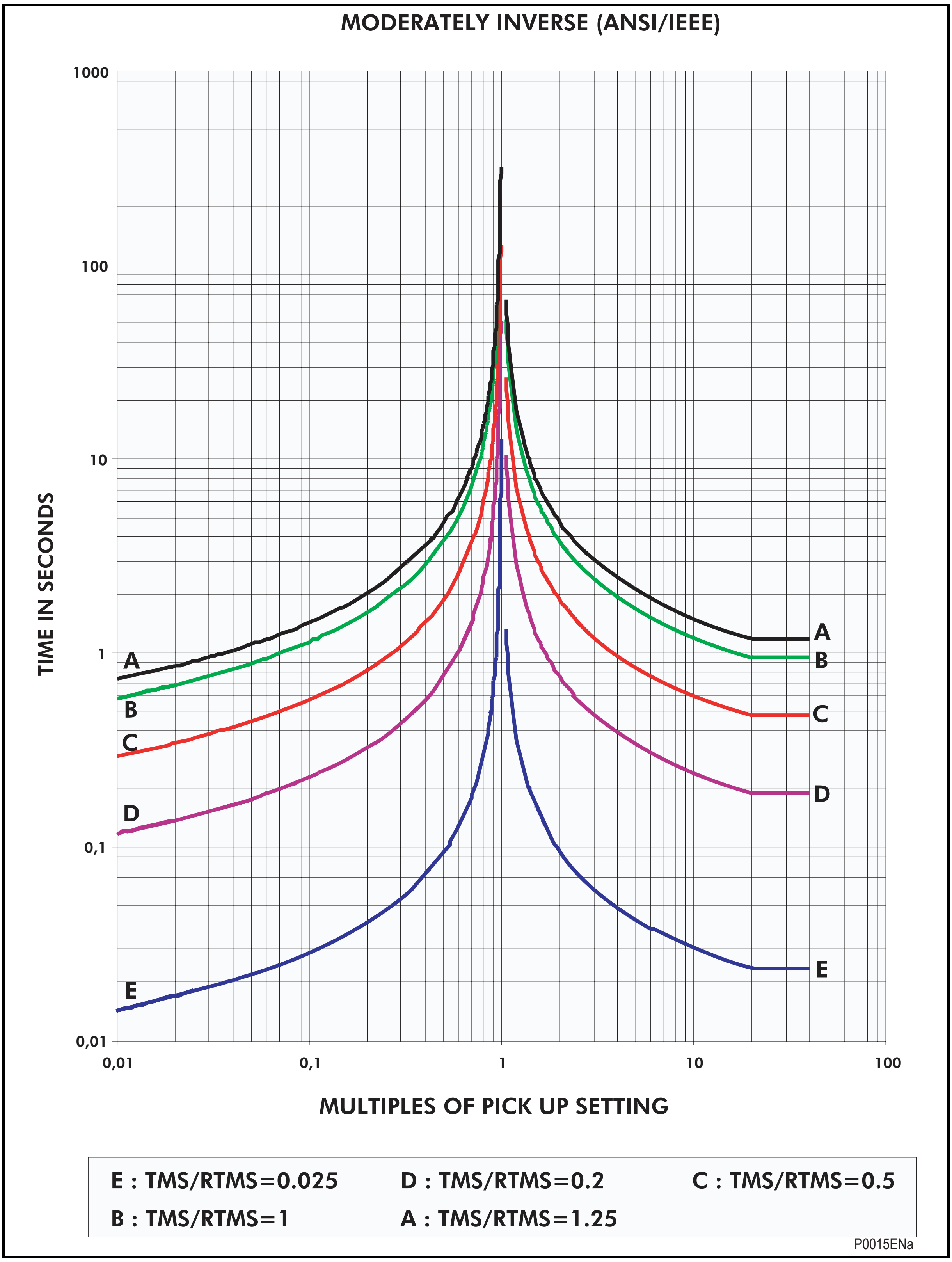
11.1.3 RI Curves

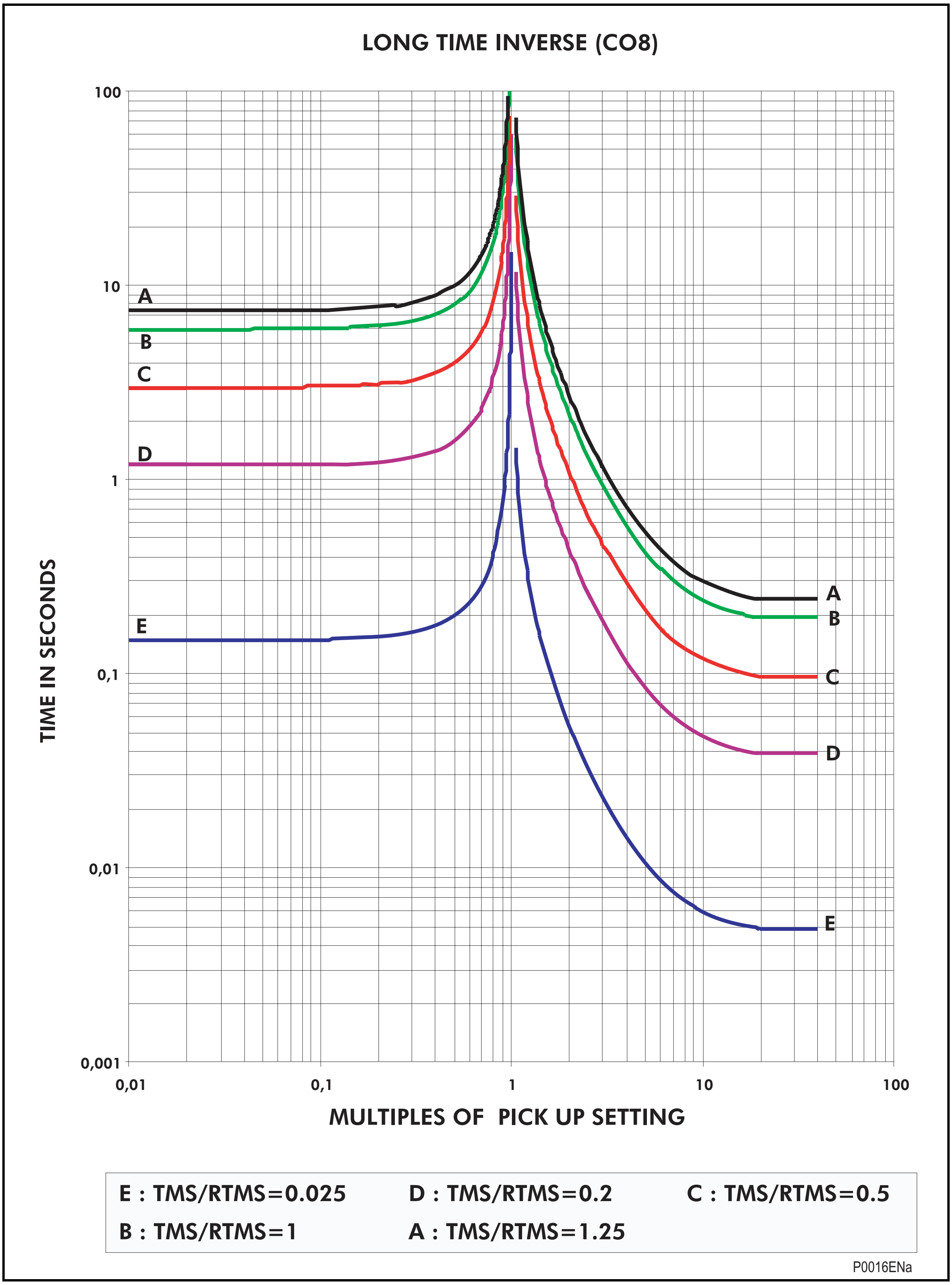


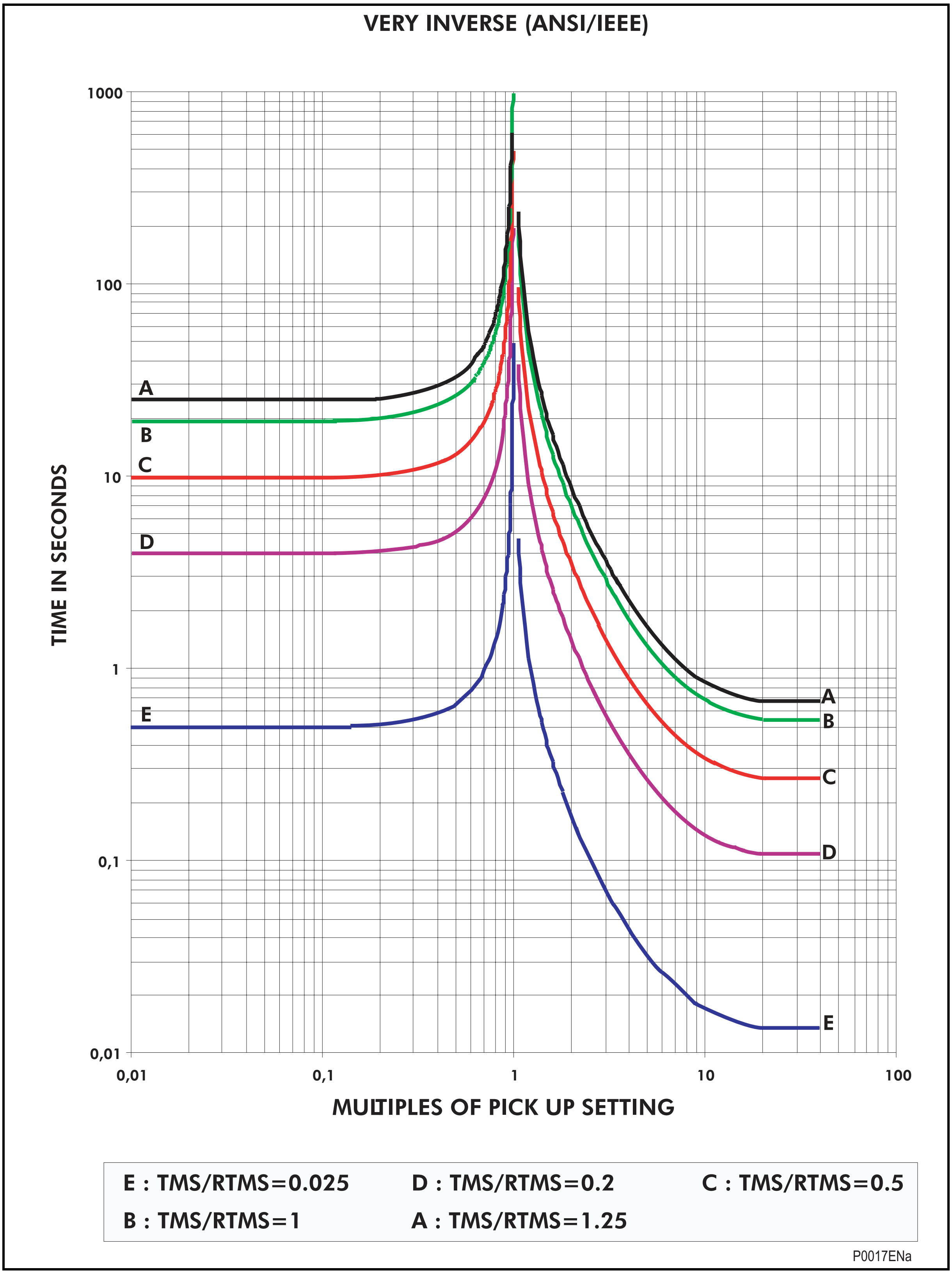
11.1.4 IEEE/ANSI & CO Curves

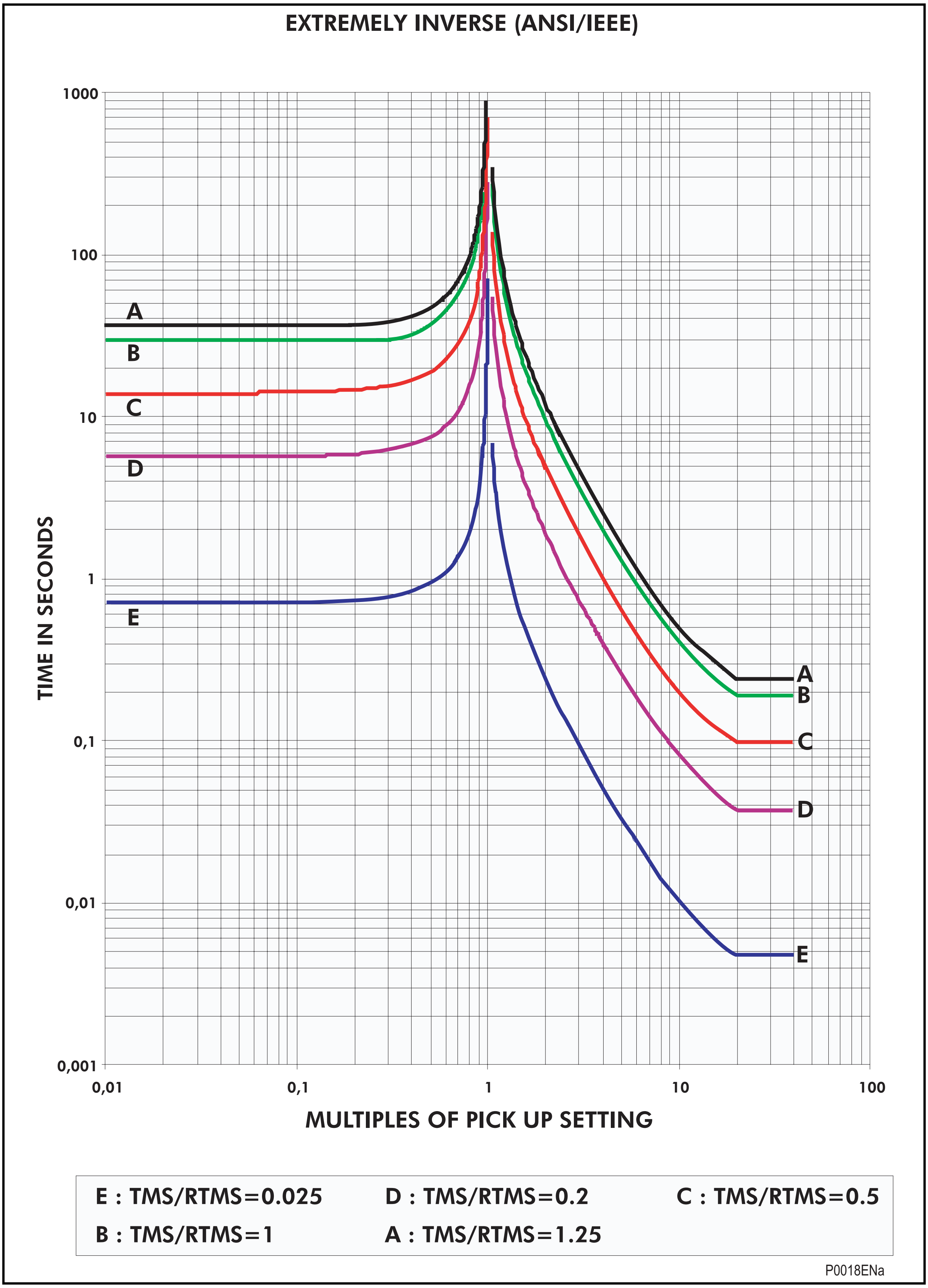



SHORT TIME INVERSE (CO2)
TIME IN SECONDS
100
10
1
0,1
0,01
0,001
0,0001
0,01
0,1
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
B : TMS/RTMS=1
A : TMS/RTMS=1.25
E : TMS/RTMS=0.025
D : TMS/RTMS=0.2
C : TMS/RTMS=0.5
P0014ENa

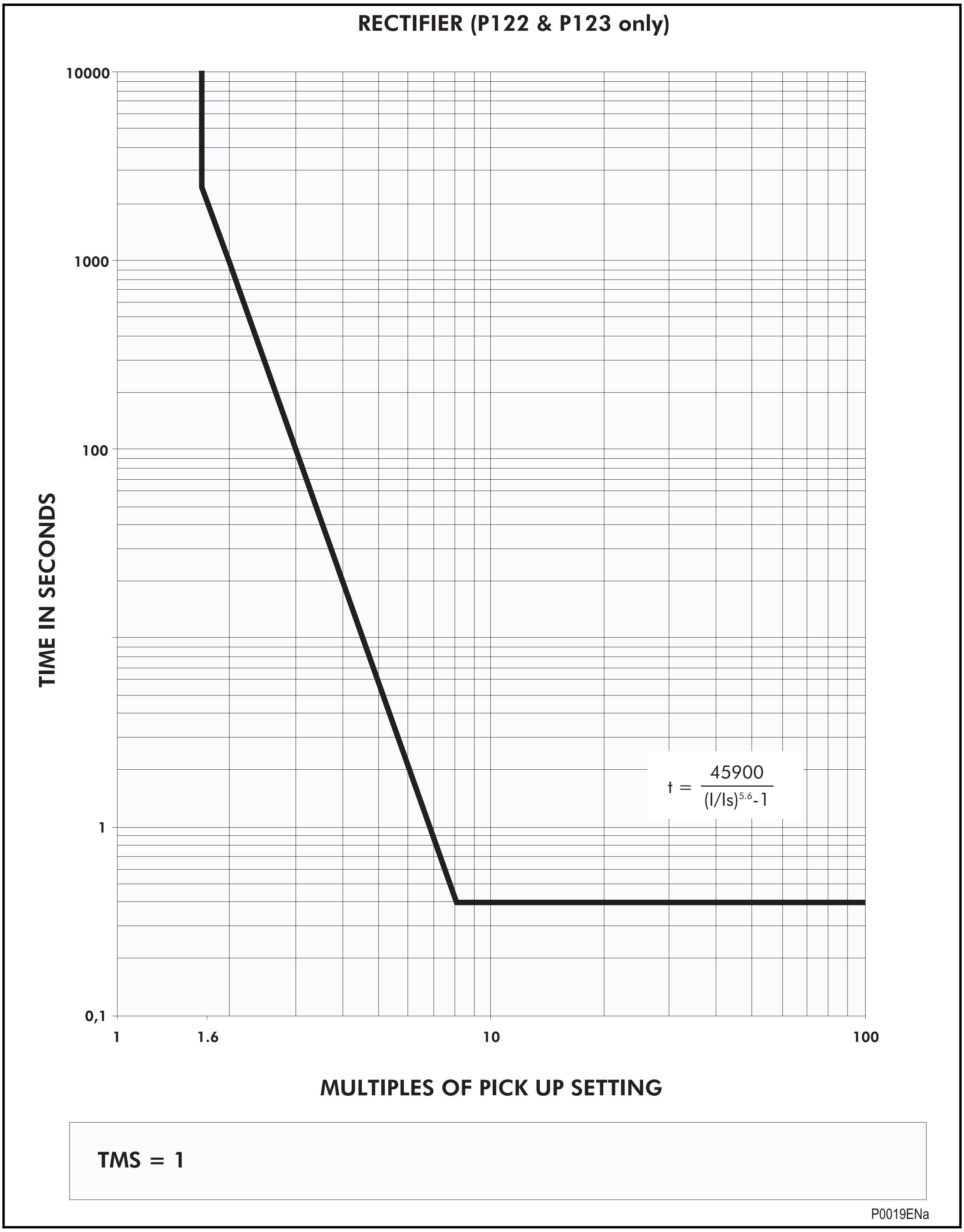

MODERATELY INVERSE (ANSI/IEEE)
TIME IN SECONDS
1000
100
10
1
0,1
0,01
0,01
0,1
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS/RTMS=0.025
D : TMS/RTMS=0.2
C : TMS/RTMS=0.5
B : TMS/RTMS=1
A : TMS/RTMS=1.25
P0015ENa


LONG TIME INVERSE (CO8)
100
10
1
0,1
0,01
0,001
TIME IN SECONDS
0,01
0,1
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
A
B
C
D
E
E : TMS/RTMS=0.025
D : TMS/RTMS=0.2
C : TMS/RTMS=0.5
B : TMS/RTMS=1
A : TMS/RTMS=1.25
P0016ENa

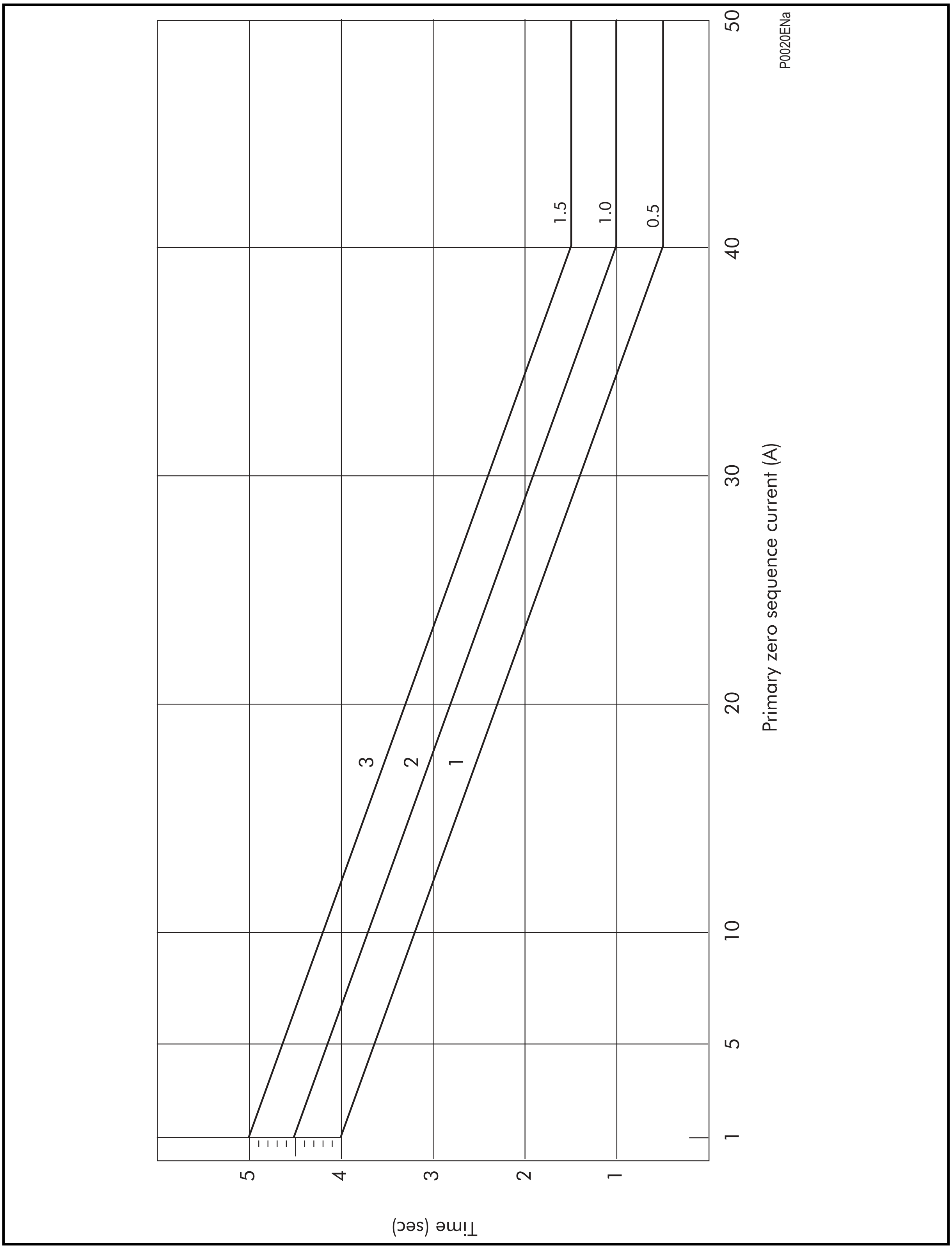

VERY INVERSE (ANSI/IEEE)
TIME IN SECONDS
1000
100
10
1
0,1
0,01
0,01
0,1
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS/RTMS=0.025
D : TMS/RTMS=0.2
C : TMS/RTMS=0.5
B : TMS/RTMS=1
A : TMS/RTMS=1.25
P0017ENa


EXTREMELY INVERSE (ANSI/IEEE)
1000
100
10
1
0,1
0,01
0,001
TIME IN SECONDS
0,01
0,1
1
10
100
MULTIPLES OF PICK UP SETTING
A
B
C
D
E
E : TMS/RTMS=0.025
D : TMS/RTMS=0.2
C : TMS/RTMS=0.5
B : TMS/RTMS=1
A : TMS/RTMS=1.25
P0018ENa

11.1.5 Rectifier protection curve



11.1.6 LABORELEC CURVE



11.2 Thermal overload curves

11.2.1 Mathematical formula

The thermal time characteristic is given by:

$\exp(-t/\tau) \quad = \quad (I^2 - (k.I_{FLC})^2) / (I^2 - I_P^2)$

Where:

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

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

I = Largest phase current; (RMS value)

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

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

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

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

Mathematical formula applicable to the MiCOM Relays :

The calculation of the Time to Trip is given by :

$$Ttrip = Te \ln\left(\frac{|K^2 - \theta^2|}{|K^2 - \theta trip^2|}\right)$$

With :

Ttrip = Time to trip (in seconds)

Te = Thermal time constant of the protected element (in seconds)

K = Thermal overload equal to Ieq/k Iθ>

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

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

k = Factor associated to the thermal state formula.

θ^2 = Initial thermal state. If the initial thermal state = 30% then $\theta^2 = 0.3$

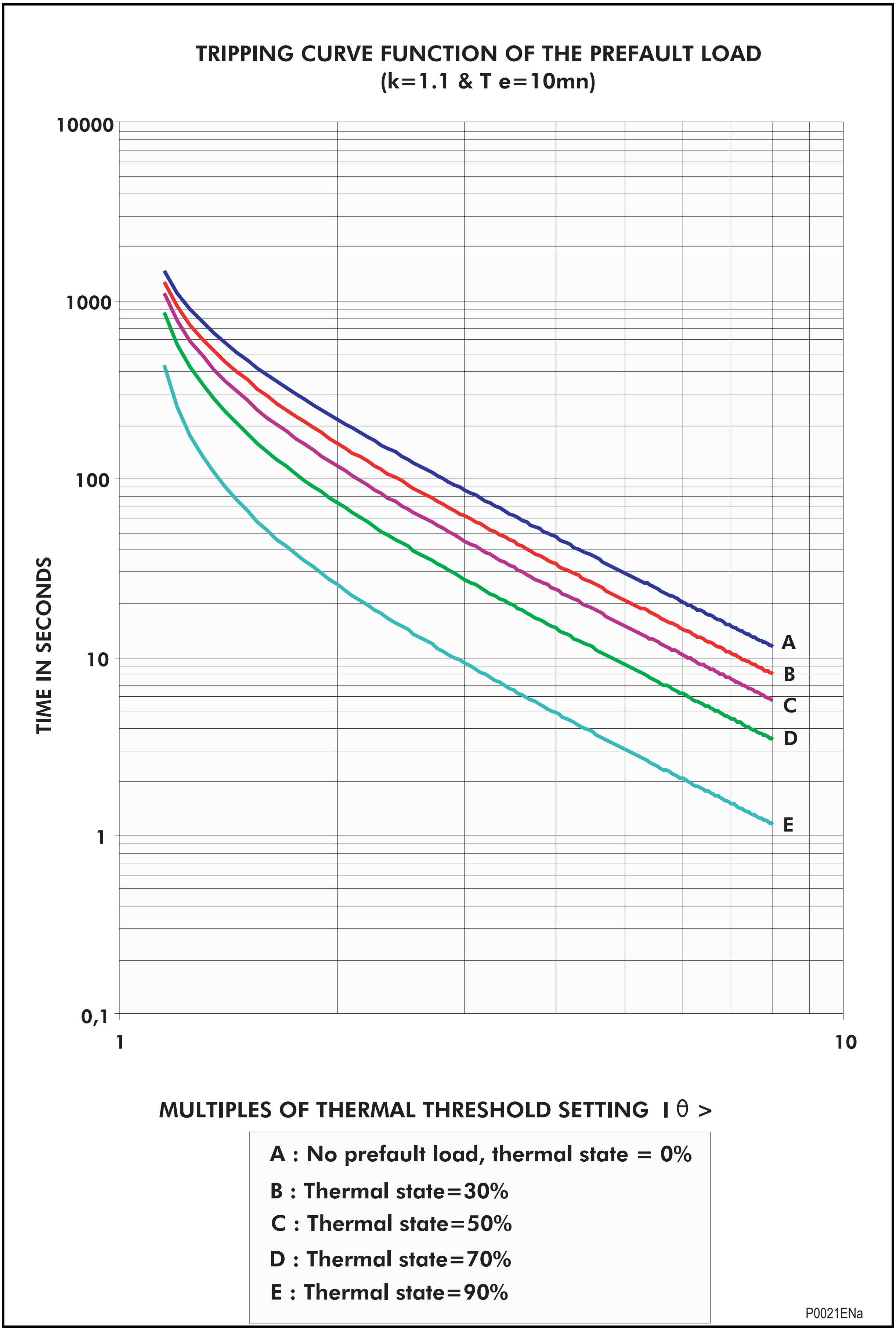
$\theta trip^2$ = Trip thermal state. If the trip thermal state is set at 100%, then $\theta\ trip^2 = 1$

The calculation of the thermal state is given by the following formula :

$\theta_{\iota+1} = (Ieq/\ k\ I\theta>)^2\ [1 - \exp(-t/Te)] + \theta_\iota \exp(-t/Te)$

θ being calculated every 100ms.

11.2.2 Tripping curve



Application Guide

CONTENTS

1.	**INTRODUCTION**	**5**
2.	**EARTH AND PHASE CURRENT OVERCURRENT FUNCTIONS**	**7**
2.1	**Instantaneous function (50/50N)**	**8**
2.2	**DMT thresholds**	**8**
2.3	**IDMT thresholds**	**8**
2.3.1	Inverse time curves	8
2.3.2	Laborelec curves	9
2.4	**Reset timer**	**10**
2.4.1	Reset timer (**P122 & P123** only)	10
2.5	**Time graded protection**	**11**
3.	**TRANSFORMER INRUSH CURRENTS**	**12**
4.	**BUSBAR PROTECTION ON RADIAL SYSTEMS**	**13**
5.	**BLOCKED OVERCURRENT PROTECTION**	**14**
6.	**RESTRICTED EARTH FAULT**	**15**
6.1	**Introduction**	**15**
6.2	**High impedance principle**	**16**
6.3	**Setting guide**	**17**
6.3.1	CT requirements for High Impedance Restricted Earth Fault Protection	18
6.4	**Use of METROSIL non linear resistors**	**18**
6.4.1	Metrosil units for relays with 1A CT	20
6.4.2	Metrosil units for relays with 5A CT	20
7.	**RECTIFIER PROTECTION**	**22**
8.	**BACK-UP DIAGRAM USING « TRANSFERRED SELECTIVE TRIPPING »**	**24**
9.	**REMOTE PROTECTION STAND-BY DIAGRAM**	**26**
10.	**1 ½ BREAKER SCHEME**	**27**
11.	**THERMAL OVERLOAD PROTECTION (P122 & P123 ONLY)**	**28**
11.1	**Time Constant Characteristic**	**28**
11.2	**Setting Guidelines**	**30**

12. COLD LOAD PICK-UP (P122 & P123 ONLY) 31

12.1 Air Conditioning/Resistive Heating Loads 32

12.2 Motor Feeders 32

12.3 Earth Fault Protection applied to Transformers 33

12.4 Switch onto Fault Protection (SOTF) 33

13. AUXILIARY TIMERS (P122 & P123 ONLY) 33

14. SETTING GROUP SELECTION (P122 & P123 ONLY) 34

15. MAINTENANCE MODE 36

16. SELECTIVE SCHEME LOGIC (P122 & P123 ONLY) 37

17. NEGATIVE SEQUENCE OVERCURRENT PROTECTION (P122 & P123 ONLY) 38

17.1 I2> and I2>> Setting Guidelines 38

18. BROKEN CONDUCTOR DETECTION (P122 & P123 ONLY) 40

18.1 Example Setting 42

19. DESCRIPTION AND SETTING GUIDE OF THE AUTORECLOSE FUNCTION (P123 ONLY) 43

19.1 Introduction 43

19.2 Description of the function 45

19.2.1 Autorecloser activation 45

19.2.2 Autoreclose menu 45

19.2.3 Logic Functions 46

19.2.4 Autoreclose logic operating sequence 47

19.2.5 Autoreclose Inhibit Following Manual Close 48

19.2.6 Recloser lockout 48

19.2.7 Setting group change lockout 48

19.3 Setting Guidelines 48

19.3.1 Number Of Shots 48

19.3.2 Dead Timer Setting 49

19.3.3 Reclaim Timer Setting 50

20. CIRCUIT BREAKER STATE MONITORING 51

21. CIRCUIT BREAKER CONDITION MONITORING (P122 & P123 ONLY) 52

21.1 Circuit Breaker Condition Monitoring Features 52

21.2 Setting guidelines 53

21.2.1 Setting the Σ I^n Thresholds 53

21.2.2 Setting the Number of Operations Thresholds 54

21.2.3 Setting the Operating Time Thresholds 54

22. UNDERCURRENT PROTECTION FUNCTION (P122 & P123 ONLY) 55

23. CIRCUIT BREAKER FAILURE PROTECTION : CBF (P122 & P123 ONLY) 56

23.1 Circuit Breaker Failure Protection mechanism 56

23.2 Typical settings 59

23.2.1 Breaker Fail Timer Settings 59

23.2.2 Breaker Fail Undercurrent Settings 59

24. TRIP CIRCUIT SUPERVISION (P122 & P123 ONLY) 60

24.1 Trip Circuit Supervision mechanism 60

25. EVENT RECORDS (P122 & P123 ONLY) 63

26. FAULT RECORDS. (P122 & P123 ONLY) 64

27. INSTANTANEOUS RECORDER (P122 & P123 ONLY) 64

28. DISTURBANCE RECORDER (P122 & P123 ONLY) 64

29. ROLLING AND PEAK VALUE DEMANDS (P122 & P123 ONLY) 65

29.1 Rolling demand 65

29.2 Peak value demand 66

30. CT REQUIREMENTS 67

30.1 Definite time / IDMT overcurrent & earth fault protection 67

30.2 Instantaneous overcurrent & earth fault protection 67

30.3 Definite time / IDMT sensitive earth fault (SEF) protection 67

30.4 Low impedance restricted earth fault (REF) protection 68

30.5 High Impedance Restricted Earth Fault Protection 68

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1. INTRODUCTION

MiCOM P120, P121, P122 and **P123** relays have been designed to provide more functionality in terms of protection, measuring, automatic operation and order control in any medium voltage electric network.

These relays can be used in industrial and distribution network applications, as well as in high voltage and extremely high voltage protection applications. The specific nature of these relays makes it possible to respond to the various cases of application: energy intake, medium voltage subscriber, cable outlet, overhead line. The earth and phase protection functions comprise instantaneous information and time delay information. The first can be used in logic blocking diagrams so as to optimise the performance of the protection schemes, thus reducing triggering times. The second can be either of the constant type or of the dependent type (IEC, ALSTOM, ANSI/IEEE, C0 and Rectifier). This wide choice of characteristics of triggering times makes it possible to easily adapt these relays to an existing protection scheme, irrespective of the other relays already installed on the network.

The main functions integrated in the various models are listed below:

Functions	**ANSI Code**	**MiCOM P120**	**MiCOM P121**	**MiCOM P122**	**MiCOM P123**
Single-phase overcurrent	**50/51 or 50N/51N**	**X**			
Three-phase overcurrent	**50/51**		**X**	**X**	**X**
Earth fault overcurrent	**50N/51N**	**X**	**X**	**X**	**X**
Restrictive Earth fault	**64N**	**X**	**X**	**X**	**X**
Thermal overload (True RMS)	**49**			**X**	**X**
Undercurrent	**37**			**X**	**X**
Negative sequence overcurrent	**46**			**X**	**X**
Broken conductor detection				**X**	**X**
Cold load pickup				**X**	**X**
Instantaneous/start contact		**X**	**X**	**X**	**X**
Latching output contacts	**86**	**X**	**X**	**X**	**X**
Setting groups		**1**	**1**	**2**	**2**
Circuit breaker failure detection	**50BF**			**X**	**X**
Trip circuit supervision				**X**	**X**
Circuit Breaker monitoring and control				**X**	**X**
Blocking logic		**X**	**X**	**X**	**X**
Selective relay scheme logic				**X**	**X**
Multi-shot autoreclose	**79**				**X**
Clock phase and anti-clock Phase rotation operation				**X**	**X**
Measurements (True RMS)		**X**	**X**	**X**	**X**
Peak and rolling values				**X**	**X**

Functions	**ANSI Code**	**MiCOM P120**	**MiCOM P121**	**MiCOM P122**	**MiCOM P123**
Event records				**X**	**X**
Instantaneous records				**X**	**X**
Fault records				**X**	**X**
Disturbance records				**X**	**X**
RS 232 front communication for MiCOM S1 Software				**X**	**X**
RS 485 rear communication		**X**	**X**	**X**	**X**

2. EARTH AND PHASE CURRENT OVERCURRENT FUNCTIONS

Each phase current and earth current input has three independent time delay overcurrent thresholds available.

The phase adjustments are marked: I>/tI>; I>>/tI>> and I>>>/tI>>>. These adjustments affect the three phases in the same way.

The earth fault elements have similar adjustments, but independent of the phase adjustments. These adjustments are marked: Ie>/tIe>; Ie>>/tIe>> and Ie>>>/tIe>>>.

Figure 1 below illustrates the logic associated with all the phase current maximum thresholds.

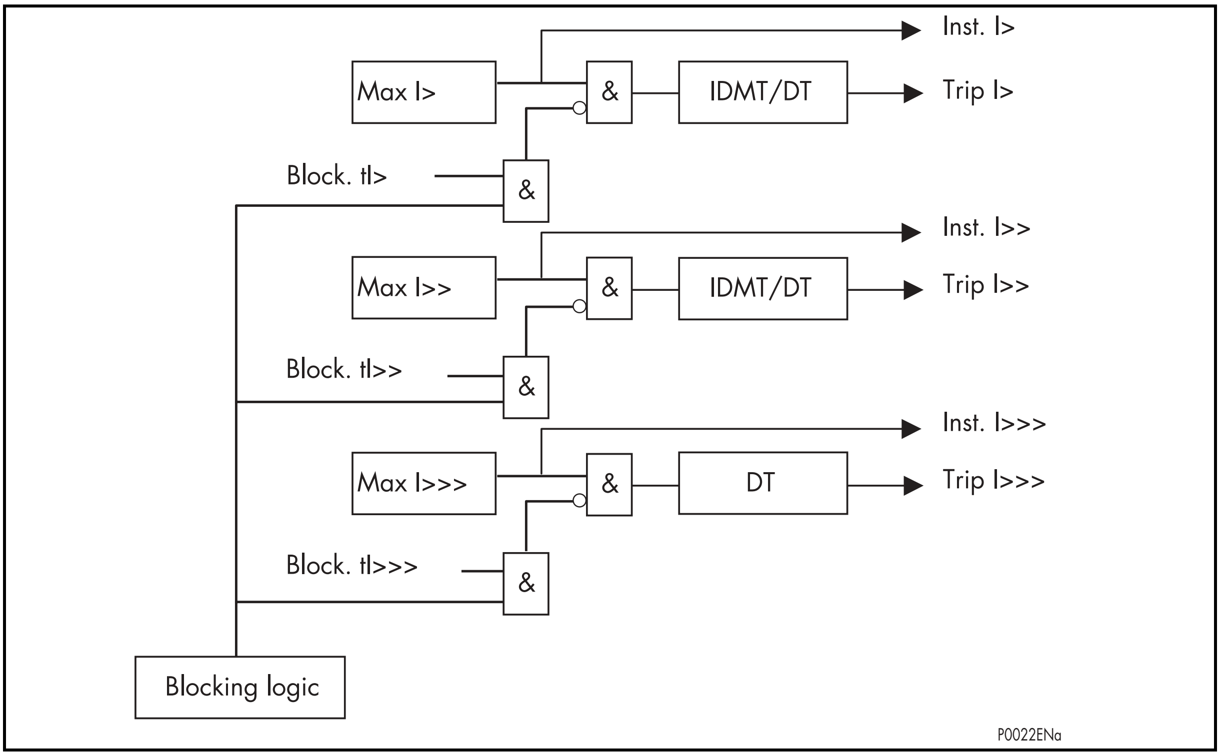

FIGURE 1 : LOGIC OF PHASE THRESHOLDS I>, I>> AND I>>>

With: Max I> = [IA>] OR [IB>] OR [IC>]

Max I>> = [IA>> OR [IB>>] OR [IC>>]

Max I>>> = [IA>>>] OR [IB>>>] OR [IC>>>]

The diagram illustrating the logic associated with all the earth default thresholds is identical to the one described above. The thresholds I>/tI>, I>>/tI>> and I>>>/tI>>> are replaced respectively by Ie>/tIe>, Ie>>/tIe>> and Ie>>>/te>>>.

The «Blocking Logic» function makes it possible to freeze the time delay as long as the signal "Blk Log" is present.

On disappearance of the blocking signal "Blk Log", if the overcurrent threshold is still exceeded, the time delay restarts taking the value prior to the block as the new initial value.

2.1 Instantaneous function (50/50N)

For P122 and P123 relays :

In order to ensure fast tripping on highly saturated current signal, it has been decided that I>>> and Ie>>> should operate on a current sample base in addition to the Fast Fourier transformation bases, (see User Guide chapter, relevant windows). Both algorithms can operate on a highly saturated current signal. However with a high X/R ratio, it is recommended to use the sample base method.

As soon as a phase (earth) threshold is exceeded, the instantaneous output associated with this threshold is active. This output indicates that the protection has detected a phase (earth) fault and that the time delay associated with the threshold started. This time delay can be blocked via the logic input "Blk Log" associated with this threshold. If this blocking input is activated by an output contact of a downstream relay, operations are then only blocked if the relay closest to the fault can see and therefore eliminate the fault. This principle is known as «Blocking logic» or merely «Blocking». It is described in more detail further in this document.

2.2 DMT thresholds

The three phase (earth) overcurrent thresholds can be selected with a constant time delay. The period of operation is equal to the set time delay, plus the operation time of the output contact (typically about 20 to 30 ms ; 20ms for a current exceeding or equal to 2 times the threshold) and the time required to detect the overcurrent state (maximum 20ms at 50Hz). For DMT curves, a “t Reset” reset time delay is associated with the first and second thresholds (phase and earth elements).

2.3 IDMT thresholds

2.3.1 Inverse time curves

The first and second phases (earth) overcurrent threshold can be selected with a dependent time characteristic. The time delay is calculated with a mathematical formula.

In all, there are eleven inverse time characteristics available.

The mathematical formula applicable to the first ten curves is :

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

Where:

t = Tripping time

K = Coefficient (see table)

I = Value of measured current

I_S = Value of the programmed threshold (Pick-up value)

α = Coefficient (see table)

L = ANSI/IEEE coefficient (zero for IEC curves)

T = Time multiplier between 0.025 and 1.5

Type of curve	Standard	K factor	α factor	L factor
Short Time Inverse	ALSTOM	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	ALSTOM	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	0.1215
Rectifier Protection		45900	5.6	0

The RI curve (electromechanical) is given by the following formula:

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

With K adjustable from 0.10 to 10 in steps of 0.05

This equation is valid for 1.1<= (I/Is) <= 20

Although the curves tend towards infinite when the current approaches Is, 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), except rectifier Protection curve for which the minimum value is 1.6 Is ±0.05 Is.

2.3.2 Laborelec curves

The first and second earth threshold can be selected with dedicated Laborelec curves.

There are 3 curves available with the following formula :

t = aI + b

where : t = tripping time
a and b = coefficient (see table)
I = Primary residual current (between 1 and 40A)

Type of curve	a	b
LABORELEC 1	– 0.0897	4.0897
LABORELEC 2	– 0.0897	4.5897
LABORELEC 3	– 0.0897	5.0897

In order to be compliant with the Laborelec specifications the relay must be used with :

- An earth current range 0.01 Ion to 8 Ion
- A rated current wiring 1A
- A core balanced CT with a ratio 20/1.

For a complete operating of the curve, the relay must be set to 0.05Ion (secondary residual current).

2.4 Reset timer

The first phase overcurrent threshold [I>/tI>] ([Ie>/tIe>] for the earth) has a reset time. The fixed period for this determines the minimum time during the current need to remain lower than 95% of the phase (earth) threshold before the time delay associated with the phase (earth) overcurrent threshold resets.

NOTE : There is an exception to this rule when the protection triggers. In fact, in this situation, the time delays tI>/tIe> are immediately reinitialised.

The value of the Reset Timer depends on the type of the timer associated to the pick-up first phase (Earth) threshold.

Type of timer associated to the first & second phase (earth) threshold	**Reset Timer**	
	P120, P121	**P122, P123**
DMT (see note below)	0 ms	0 ms to 600 s
LABORELEC *, Rectifier, IDMT IEC or RI	50 ms	Settable from 40 ms to 100 s
IDMT IEEE or CO	50 ms	Settable from 40 ms to 100 s or Inverse Time (Choice of 5 IEEE curves)

- first & second earth threshold only

NOTE : The DMT reset time is for fist and second phase/earth thresholds.

2.4.1 Reset timer (**P122 & P123** only)

The first phase and earth overcurrent stages in the P122 and P123 relays are provided with a timer hold facility "t Reset", which may be set to a definite time value or to an inverse time characteristic (IEEE/ANSI curves only). This may be useful in certain applications, for example when grading with upstream electromechanical overcurrent relays which have inherent reset time delays.

Another possible situation where the timer hold facility may be used to reduce fault clearance times is where intermittent faults occur. An example of this may occur in a plastic insulated cable . In this application it is possible that the fault energy melts and reseals the cable insulation, thereby extinguishing the fault. This process repeats 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 minimum the relay will be repeatedly reset and not be able to trip until the fault becomes permanent. By using the Timer Hold facility the relay will integrate the fault current pulses, thereby reducing fault clearance time.

The reset timer "t Reset" facility for the MiCOM P122 & P123 can be found in the following menu :

– If the first phase (earth) threshold is selected with an IDMT IEC or RI curve, the reset timer "t Reset" with DMT characteristic is settable in the menu :

  – Protection /[50/51] Phase OC/t Reset for the phase
  – Protection /[50N/51N] E/Gnd/t Reset for the earth.

– If the first phase (earth) threshold is selected with an IDMT IEEE or CO curve, the reset timer "t Reset" with a DMTor IDMT characteristic is settable in the menu :

  – Protection /[50/51] Phase OC/Type Tempo Reset for the phase
  – Protection /[50N/51N] E/Gnd/Type Tempo Reset for the earth.

Reset Time "t Reset" with an IDMT characteristic :

The mathematical formula applicable to the five curves is :

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

Where :

t = Reset time

K = Coefficient (see table)

I = Value of the measured current

I_S = Value of the programmed threshold (pick-up value)

α = Coefficient (see table)

T = Reset Time Multiplier (Rtms) between 0.025 and 3.2

Type of curves	**Standard**	**K factor**	**α factor**
Short time inverse	C02	2.261	2
Moderately Inverse	ANSI/IEEE	4.85	2
Long time Inverse	C08	5.95	2
Very inverse	ANSI/IEEE	21.6	2
Extremely inverse	ANSI/IEEE	29.1	2

2.5 Time graded protection

Inverse definite minimum time relays are time graded such that the relay nearer to the fault operates faster than the upstream relays. This is referred to as relay co-ordination because if the relay nearest to the fault does not operate, the next will trip in a slightly longer time. The time grading steps are typically 400 ms, the operation times becoming progressively longer with each stage.

Where difficulty is experienced in arranging the required time grading steps the use of a blocked overcurrent scheme should be considered (described in a later section).

NOTE : The dynamic range of measurement is typically 1000 times minimum setting.

3. TRANSFORMER INRUSH CURRENTS

Either I>>/Ie>> or I>>>/Ie>>> elements can be used as high-set instantaneous elements. The design is such that they do not respond to the DC transient component of the fault current. The principle of operation allows the current settings to be set down to 35% of the prospective peak inrush current that will be taken by a transformer when it is energised. To a first approximation the peak inrush is given by the reciprocal of the per unit series reactance of the transformer.

4. BUSBAR PROTECTION ON RADIAL SYSTEMS

The principle for using non-directional overcurrent relays for the busbar protection is based on the following hypotheses:

The network is a radial system,

The incoming and outgoing feeders are clearly defined, the incomers always being considered as suppliers and feeders as loads.

In this case, the busbar is effectively protected using the interlocking principle (Figure 2).

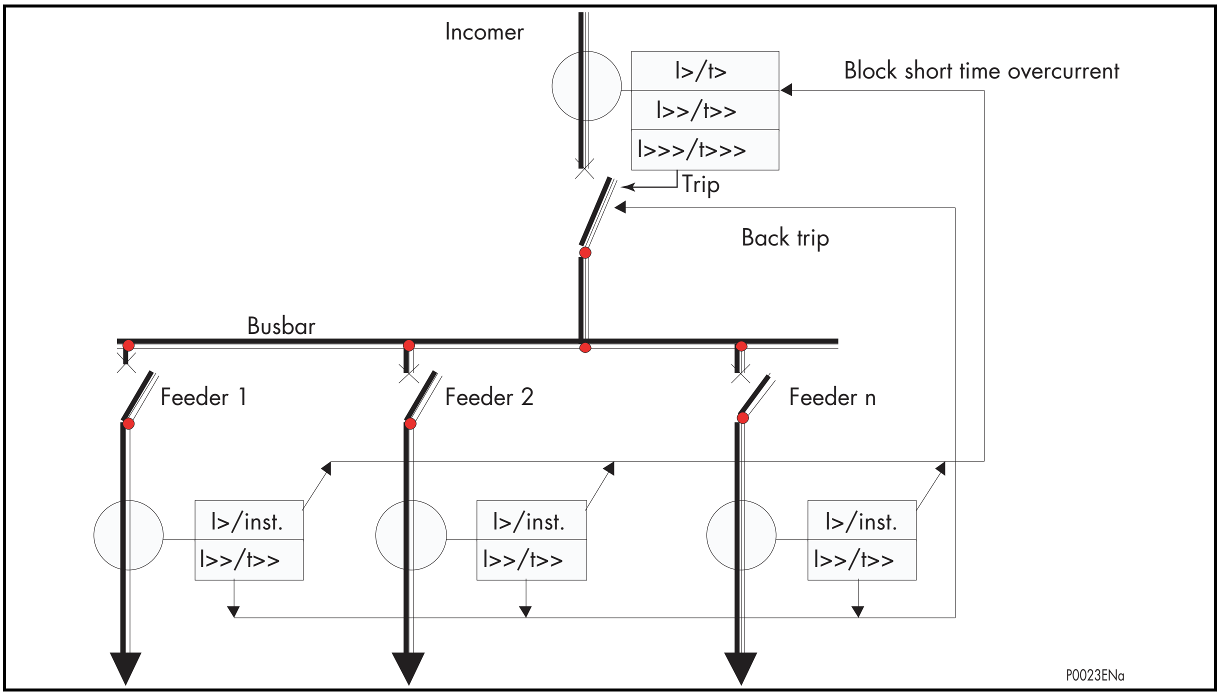

FIGURE 2 : BLOCKED OVERCURRENT FOR BUSBAR PROTECTION

The instantaneous overcurrent signals of the feeders protection are grouped and wired to the « Blocking logic » logic input of the incoming protection. The blocking function is programmed to inhibit either the first or first two thresholds. The third I>>> threshold is pick-up at a high value (>10 In) with a short operating time (<60 ms).

If a fault on a feeder, the protection of the start concerned shall immediately (<30 ms) send a blocking order to the incoming protection. After elimination of the fault (opening of the start circuit breaker concerned), the order is withdrawn and the incoming protection is unblocked. As the fault current is no longer present, the hold time is reinitialised.

If the fault appears on the bar set, the fault current widely exceeds the value of the third threshold (I>>>). As this third threshold is not affected by the logic blocking of the incoming protections, the order of triggering is sent in less than 60 ms and the bar set is de-energised.

5. BLOCKED OVERCURRENT PROTECTION

This type of protection is applicable for radial feeder circuits where there is a little or no back feed. For parallel feeders, ring circuits or where there can be a back feed from generators, directional relays should be considered.

This application relies on the up-stream IDMT relay being blocked by the start output from a down-stream relay that detect the presence of fault current above its setting. Thus both the up-stream and down-stream relays can then have the same current and time settings and grading will be automatically provided by the blocking feature. If the breaker fail protection is active, the block on the up-stream relay will be released if the down-stream circuit breaker fails to trip.

Thus for a fault below relay C, the start output from relay C will block operation of relay B and the start output of relay B will block operation of relay A. Hence all 3 relays could have the same time and current settings and the grading would be obtained by the blocking signal received from a relay closer to the fault. This gives a constant, close time grading, but there will be no back-up protection in the event of the pilots being short circuited.

NOTE : There is a small window where operation may not occur with this arrangement. This occurs because the start relay picks-up at the current setting (I>), but the IDMT curve requires the current to be 1.05 I> before it operates. Hence the up-stream relay should have a slightly lower current setting than the downstream relay to prevent this situation arising. Alternatively, the up-stream relay may have an increased current flowing through it due to the load current for other feeders and this would be a solution.

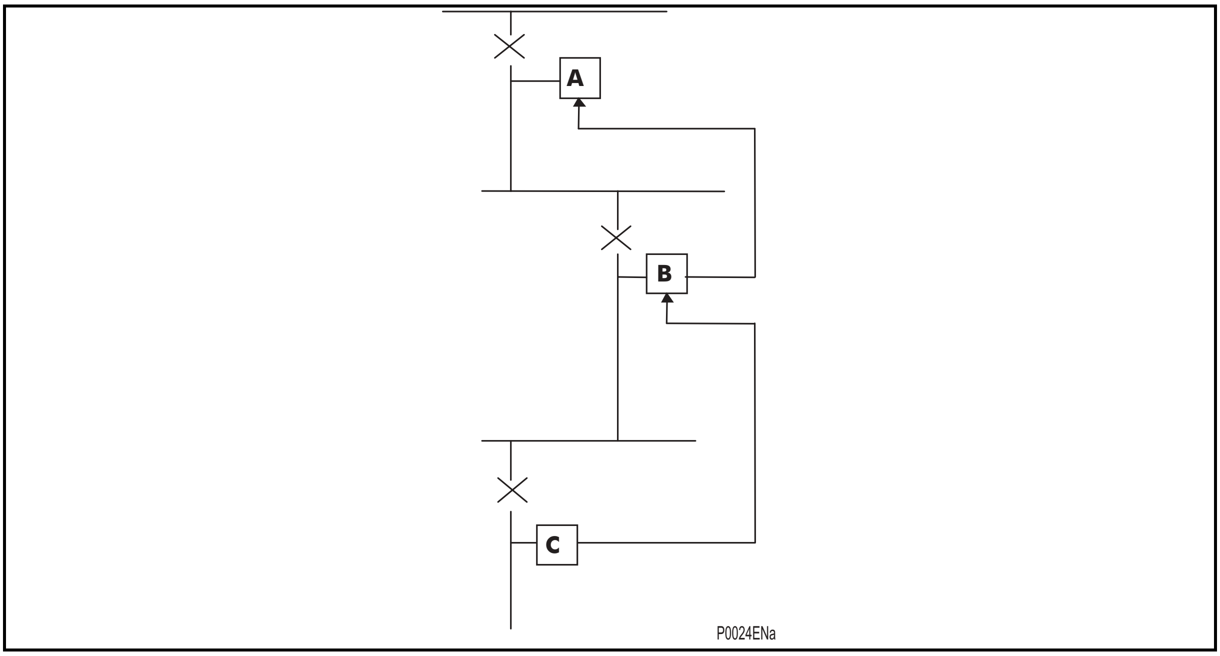

FIGURE 3 : BLOCKING LOGIC

The allocations of the "Blocking Logic" functions are available in the AUTOMAT CTRL/Blocking Logic menu.

The MiCOM P120 & P121 Relays have only one blocking logic function.

The MiCOM P122 & P123 Relays have two blocking functions, which can be used for the blocking of the Earth and Phase thresholds.

6. RESTRICTED EARTH FAULT

The Restricted Earth Fault function is offered by the following MiCOM relays: P120, P121, P122 and P123, and It is important to notify the following:

The algorithms implemented in P120 and P121 for the first and second stages (I> , I0> and I>>, I0>>) are similar to those implemented in the P122 and P123 for the same stages. However the third stage (I>>> and I0>>>) of P120 and P121 is not identical to that of P122 and P123.

In fact, the third stage algorithm of P122 and P123 is operating on current sample base in addition to the Fast Fourier Transformation base, this implementation provides fast tripping on highly saturated current signals. The third stage of P120 and P121- as the first and second stages of P120, P121, P122 and P123 products - operates basing on the Fourier transformation;

This difference in algorithm explains the outstanding results of the third stage of P122 and P123 with respect to the other stages concerning the High impedance restricted earth fault application. So for :

- P122 and P123 : You can use all the stages for REF application and the result of the third stage is outstanding due to the fact of using the instantaneous value (sample base).
- P120 and P121 : You can use all the stages for REF application. The third stage results are identical to the first and second stage results (since all the stages are based on Fast Fourier Transformation).

NOTE: For P122 and P123, the maximum internal fault level for the third stage (of the 0.002 to 1In range) must not exceed 20In.

6.1 Introduction

The restricted earth fault relay is a high impedance differential scheme which balances zero sequence current flowing in the transformer neutral against zero sequence current flowing in the transformer phase windings. Any unbalance for in-zone fault will result in an increasing voltage on the CT secondary and thus operating the REF relay.

This scheme in very sensitive and can protect against the low levels of fault current inherent in the resistance grounded system, where this fault current value is limited by the earthing impedance and the fault point voltage governed by the fault location.

In addition, it can be used in a solidly grounded system, providing more sensitive protection, even though the overall differential scheme provides a protection for faults over most of the windings.

The High impedance differential Technique ensures that the relay circuit is of sufficiently high impedance such that the differential voltage that may occur under external fault conditions is less than that required to drive setting current through the relay. This ensures the required stability under through fault conditions and relay operation only for faults occurring inside the protected zone.

6.2 High impedance principle

The extreme case for stability will be if one current transformer is completely saturated in case of through fault condition, the other CTs are unaffected.

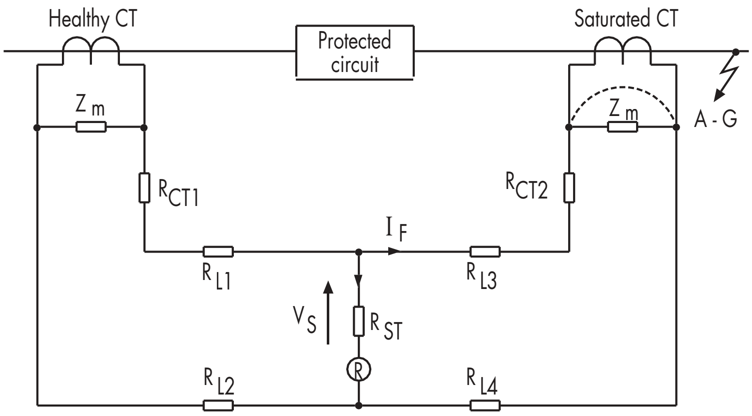

FIGURE 4 : HIGH IMPEDANCE SCHEME PRINCIPLE

The applied voltage across the relay is

$V_r = I_f\,(R_{CT} + 2R_L)$

I_f : Maximum secondary through fault current

R_{CT} : Current transformer secondary winding resistance

R_L : Resistance of a single lead from the relay to the CT

A stabilising resistor R_{ST} can be used in series with the relay circuit to improve the stability of the relay under through fault conditions. This resistor will limit the spill current to less than I_s

$V_s = I_s\,(R_{ST})$

I_s : Relay setting

V_s : Stability Voltage setting

NOTE: (The relay burden has been neglected)

The general stability requirement can be achieved when having

$V_s > K.I_f\,(R_{CT} + 2R_L)$

Where K is the stability factor.

This stability factor is influenced by the ratio V_k/V_s which in turns governs the stability of the REF protection element for through faults .

V_k = The Knee point voltage of the CT.

To obtain a high speed operation for internal faults, the Knee point voltage V_k of the CT must be significantly higher than the stability voltage V_s . A ratio of 4 or 5 would be appropriate.

For MiCOM P121, P122 and P123, the following results have been found:

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

NOTE: The maximum internal fault level for stage 3 of 0.002 to 1In board must not exceed 20In.

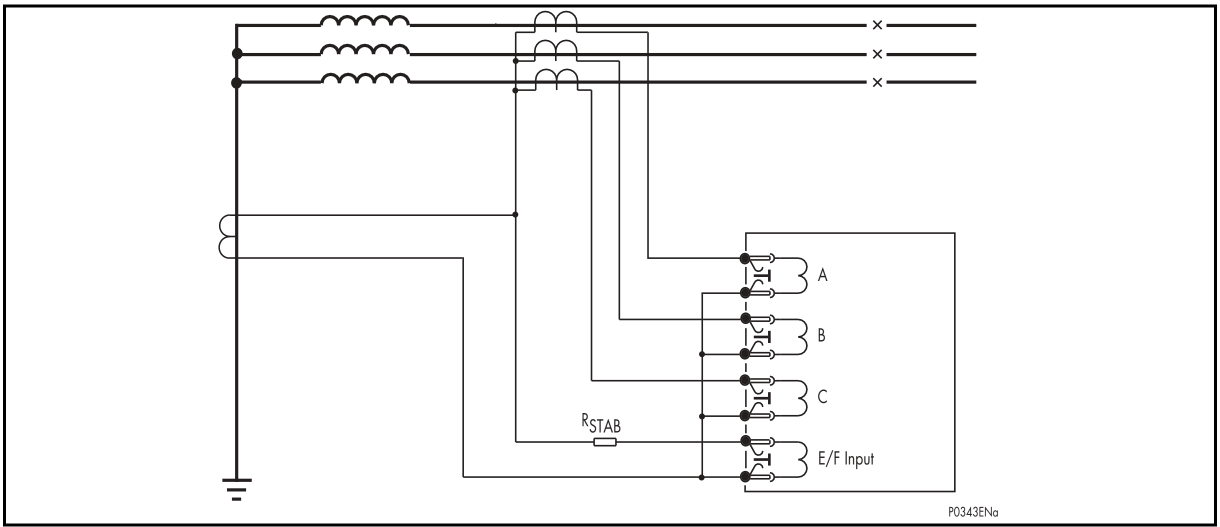

FIGURE 5 : CT CONNECTION DIAGRAM FOR HIGH IMPEDANCE REF APPLICATION

6.3 Setting guide

The stability of the scheme is affected by the characteristics of the relay and the value of K, in the above expressions, takes account of this.

The typical setting values shall be chosen to provide a primary operating current less that 30 % of the minimum earth fault level for a resistance earthed system. For a solidly earthed system, the typical setting shall provide an operating current between 10 and 60% of rated current.

The primary operating current, in secondary terms, is a function of:

- Current Transformer ratio
- Relay operating current I_S
- Number of CT in parallel with the relay element (n)
- The magnetising current of each CT (I_e) at the stability voltage

$$I_{op} = CT_{Ratio} .(I_s + n.I_e)$$

In order to achieve the required primary operation current with a given CT, the relay setting current must be selected for a high impedance element.

$I_s < \{(I_{op} / CT_{Ratio}) - n.I_e\}$

It is also possible to determine the maximum CT magnetising current to achieve a specific primary operating current with a given relay setting.

The setting of the stabilising resistor must be calculated in the following manner, where the setting is a function of the required stability voltage setting V_s and the relay setting I_s

$$\frac{V_s}{I_s} = \frac{k\ I_f\,(R_{CT}+2R_L)}{I_S}$$

For MiCOM P12x, the I_s is equivalent to $I_e>$, so the above equation becomes

$$\frac{V_s}{I_e>} = \frac{k\ I_f\,(R_{CT}+2R_L)}{I_e>}$$

with

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

So

$$R_{ST} = \frac{k\ I_f\,(R_{CT}+2R_L)}{I_e>}$$

with

$Vk \geq 4.Is.R_{ST}$ (A typical value to insure the high speed operation for an internal fault).

6.3.1 CT requirements for High Impedance Restricted Earth Fault Protection

The High Impedance Restricted Earth Fault element shall maintain stability for through faults and operate in less than 40ms for internal faults provided the following equations are met in determining CT requirements and the value of the associated stabilising resistor:

$$Rs = [k^* (If) * (R_{CT} + 2R_L)] / I_S$$

$$V_K \geq 4 * Is * Rs$$

with

K= 1 for Vk/Vs less or equal to 16 and

K= 1.2 for Vk/Vs > 16.

6.4 Use of METROSIL non linear resistors

Metrosils are used to limit the peak voltage developed by the current transformers under internal fault conditions, to a value below the insulation level of the current transformers, relay and interconnecting leads, which are normally able to withstand 3KV peak.

The following formulae should be used to estimate the peak transient voltage that could be produced for an internal fault. This peak voltage will be a function of

– CT Knee point (V_K)

– Prospective voltage that would be produced for an internal fault if CT saturation did not occur (V_f)

This prospective voltage, in turns, is a function of

– Maximum internal fault secondary current

– CT ratio

– CT secondary winding resistance

– CT lead resistance to the common point

– Relay lead resistance

– Stability resistor value

$$Vp = 2\sqrt{\{2.V_K\,(V_f - V_k)\}}$$

$$V_f = I'_f.(R_{ct} + 2R_L + R_{ST})$$

Where

- Vp : peak voltage developed by the CT under internal fault conditions
- V_f : maximum voltage that would be produced if CT saturation did not occur
- V_k : current transformer Knee point voltage
- I'_f : is the maximum internal secondary fault current
- R_{ct} : current transformer secondary winding transformer
- R_L : maximum lead burden from CT to relay
- R_{ST} : Relay stabilising resistor.

When the value given by the formulae is greater than 3KV peak, Metrosils should be applied. They are connected across the relay circuit and serve the purpose of shunting the secondary current output of the current transformer from the relay in order to prevent very high secondary voltages.

Metrosils are externally mounted and take the form of annular discs.

Their operating characteristics follow the expression:

$$V = C.I^{0.25}$$

Where

- V : Instantaneous voltage applied to the non-linear resistor (Metrosil)
- C : Constant of the non-linear resistor (Metrosil)
- I : Instantaneous current through the non-linear resistor (Metrosil)

With the sinusoidal voltage applied across the Metrosil, the RMS current would be approximately 0.25 times the peak current. This current value can be calculated as follows:

$$Irms = 0.52\left\{\frac{Vs(rms).\sqrt{2}}{C}\right\}^4$$

Where

- Vs(rms) : RMS value of the sinusoidal voltage applied across the Metrosil.

This is due to the fact that the current waveform through the Metrosil is not sinusoidal but appreciably distorted.

For satisfactory application of the non-linear resistor (Metrosil), its characteristics should be such that it complies with the following requirements:

- At the relay voltage setting, the non-linear resistor (Metrosil) current should be as low as possible, but no greater than approximately 30mA rms for 1A current transformers and approximately 100mA rms for 5A current transformer.
- At the maximum secondary current, the non-linear resistor (Metrosil) should limit the voltage to 1500V rms or 2120V peak for 0.25 second. At higher relay voltage settings, it is not always possible to limit the fault voltage to 1500V rms, so higher fault voltage may have to be tolerated.

The following tables show the typical Metrosil types that will be required, depending on relay current rating, REF voltage setting etc.

6.4.1 Metrosil units for relays with 1A CT

The Metrosil units with 1A CTs have been designed to comply with the following restrictions:

1. At the relay voltage setting, the Metrosil current should be less than 30mA rms.

2. At the maximum secondary internal fault current, the Metrosil unit should limit the voltage to 1500V rms if possible.

The Metrosil units normally recommended for use with 1Amp CTs are shown in the following table:

Relay Voltage setting	Nominal Characteristics		Recommended Metrosil Type	
	C	β	Single pole Relay	Triple pole relay
Up to 125V rms	450	0.25	600A/S1/S256	600A/S3/1/S802
125 to 300V rms	900	0.25	600A/S1/S1088	600A/S3/1/S1195

NOTE: Single pole Relay Metrosil Units are normally supplied without mounting brackets unless otherwise specified by the customer.

6.4.2 Metrosil units for relays with 5A CT

These Metrosil units have been designed to comply with the following requirements:

1. At the relay voltage setting, the Metrosil current should be less than 100mA rms (the actual maximum currents passed by the units shown below their type description)

2. At the maximum secondary internal fault current the Metrosil unit should limit the voltage to 1500V rms for 0.25 second. At the higher relay settings, it is not possible to limit the fault voltage to 1500V rms, hence higher voltage have to be tolerated (indicated by * ,** , ***).

The Metrosil units normally recommended for use with 5 Amps CTs and singlee pole relays are as shown in the following table:

Secondary Internal fault current	Recommended Metrosil Type			
	Relay Voltage Setting			
Amps rms	Up to 200V rms	250V rms	275V rms	300V rms
50A	600A/S1/S1213 C= 540/640 35mA rms	600A/S1/S1214 C= 670/800 40mA rms	600A/S1/S1214 C= 670/800 50mA rms	600A/S1/S1223 C= 740/870* 50mA rms
100A	600A/S2/P/S1217 C= 470/540 35mA rms	600A/S2/P/S1215 C= 570/670 75mA rms	600A/S2/P/S1215 C= 570/670 100mA rms	600A/S2/P/S1196 C= 620/740* 100mA rms
150A	600A/S3/P/S1219 C= 430/500 100mA rms	600A/S3/P/S1220 C= 520/620 100mA rms	600A/S3/P/S1221 C= 570/670** 100mA rms	600A/S3/P/S1222 C= 620/740*** 100mA rms

NOTE: * 2400V peak
** 2200V peak
*** 2600V peak
In some situations single disc assemblies may be acceptable, contact ALSTOM T&D EAI for detailed applications.
The Metrosil units recommended for use with 5Amps CTs can also be applied for use with triple pole relays and consist of three single pole units mounted on the same central stud but electrically insulated for each other. To order these units please specify "Triple pole Metrosil type" , followed by the single pole type reference.

7. RECTIFIER PROTECTION

The rectifiers require a specific inverse time protection curve.

The protection of a rectifier differs from that of conventional current maximum applications. In fact, a large number of rectifiers can withstand relatively long periods of overcharge without incurring damage, generally 150 % for 2 hours and 300 % for 1 minute.

A typical application of this characteristic is shown on the diagram below.

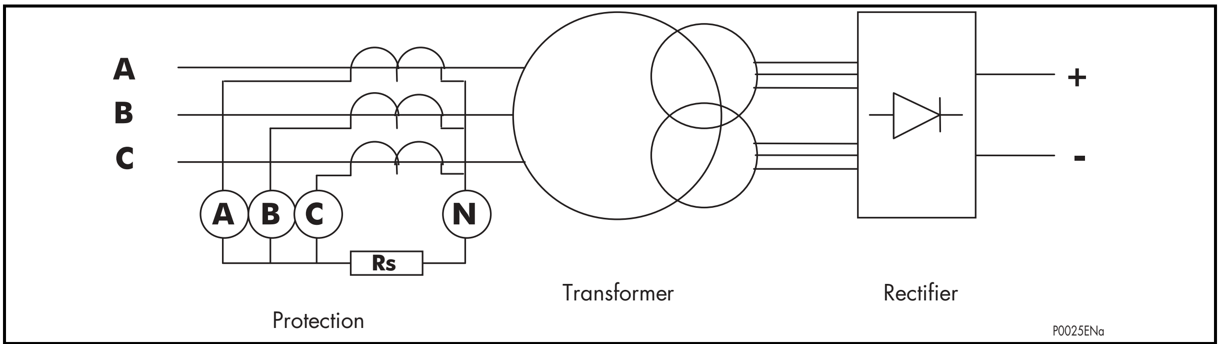

FIGURE 6 : PROTECTION FOR SILICON RECTIFIERS

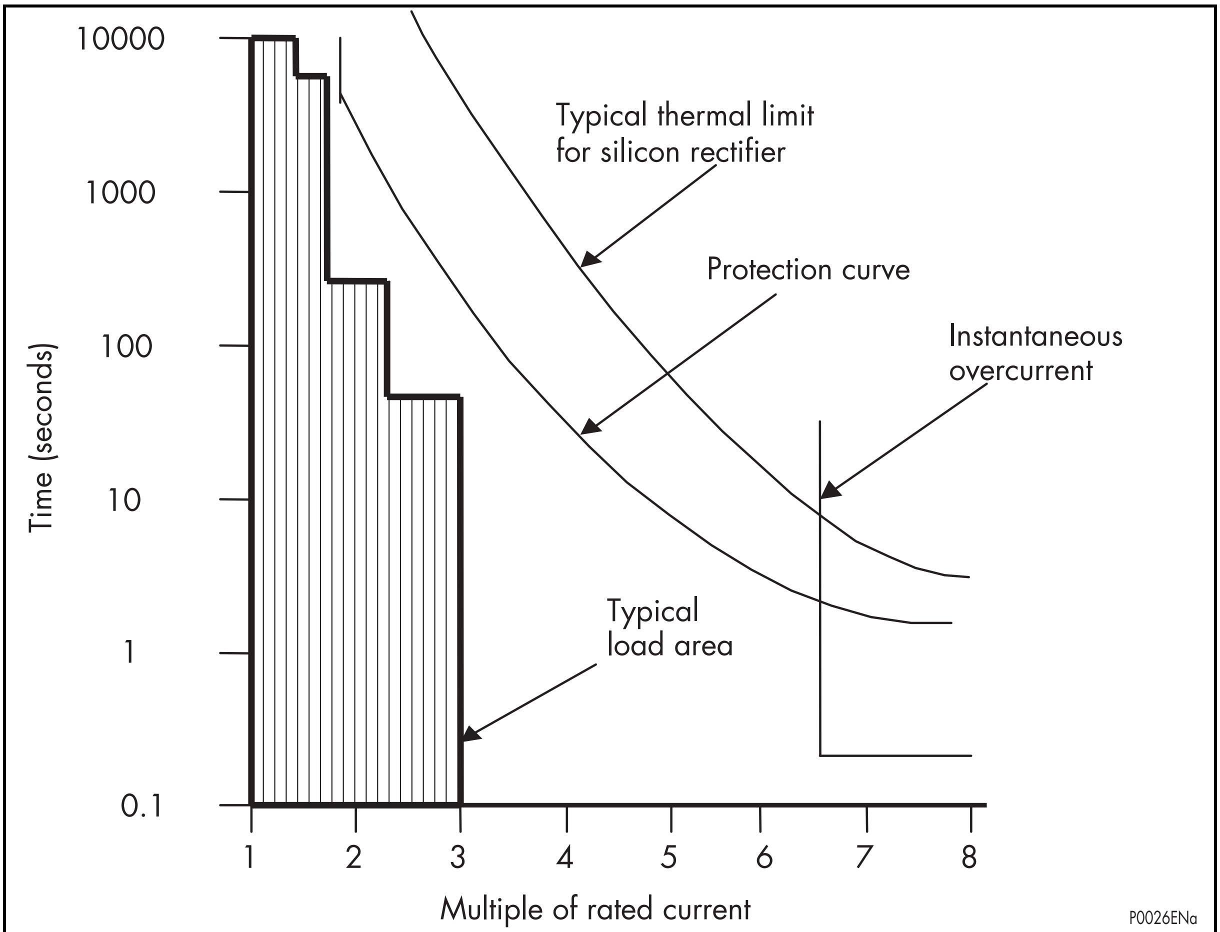

FIGURE 7 : MATCHING CURVE TO LOAD AND THERMAL LIMIT OF RECTIFIER

The relay I> setting of the relay should be set to the rated rms value of the current that flows into the transformer when the rectifier is delivering its rated load. The relay will give a start indication when the current exceeds this setting but this is of no consequence because this function is not used in this application. Rectifier curve should be selected for the inverse time curve and this cuts-off for currents below 1.6 times allowing the rectifier to carry 150% overload for long periods. If this is not acceptable the I> setting can be adjusted to move the cut-off point relative to the current scale. The operation time can be modified by adjustment of the time multiplier setting (TMS) so that it lies between limiting characteristic of the rectifier and the allowable load area.

Typical settings for the TMS area :

Light industrial service	TMS = 0.025
Medium duty service	TMS = 0.1
Heavy duty traction	TMS = 0.8

The high set is typically set at 8 times rated current as this ensures HV AC protection will discriminate with faults covered by the LV protection. However, it has been known for the high set to be set to 4 or 5 times where there is more confidence in the AC protection.

Use of the thermal element to provide protection between 70% and 160% of rated current could enhance the protection. It is also common practice to provide restricted earth fault protection for the transformer feeding the rectifier. See the appropriate section dealing with restricted earth fault protection.

8. BACK-UP DIAGRAM USING « TRANSFERRED SELECTIVE TRIPPING »

In this application, the incoming relay can via the watchdog contact of the faulty feeder relay, trip the circuit breaker of the faulty feeder.

This principle is shown Figure 8 :

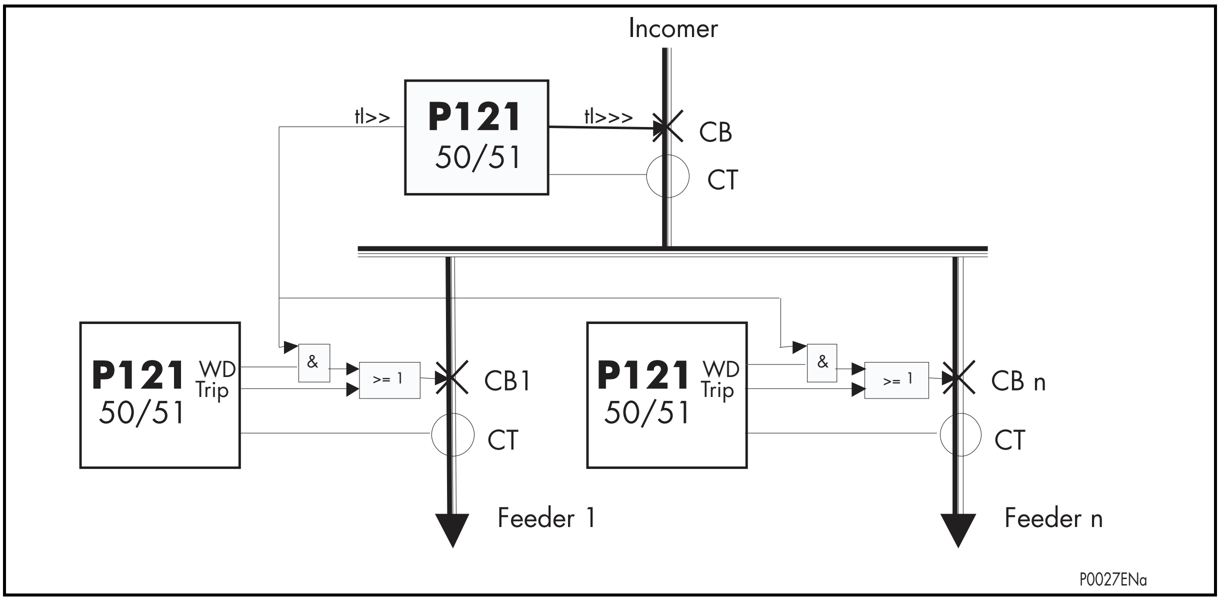

FIGURE 8 : EXAMPLE OF A BACK-UP DIAGRAM USING " TRANSFERRED SELECTIVE TRIP"

Thus, a fault occurring on a feeder can be eliminated by tripping the feeder circuit breaker, even if the feeder relay is out of use. Of course, without this principle, the fault would normally be eliminated via the opening of the incoming circuit breaker, which would mean a total loss of operation on the bar set concerned.

The relay situated on the input makes available, among others, two time delay output contacts :

– 3rd threshold: tI>>> time delay at 60ms (active threshold for the high phase faults)

– 2nd threshold: tI>> time delay selectively greater than for the third threshold, i.e. 360ms.

The output contact associated with the 2nd threshold is cabled in series with the watch-dog contact of the downstream relays, so as to act on the triggering coil of the circuit breakers of the outputs. As for the output contact associated with the 2nd and 3rd threshold, this is directly cabled onto the triggering coil of the incoming circuit breaker.

Case n°1 → all the relays function normally :

In this case, the watch-dog contacts of all the relays are open.

Thus, for a phase fault on the bar set, the fault is eliminated by the threshold tI>> or tI>>> of the P121 relay situated on the incomer.

For a phase fault on one of the feeder, as the thresholds tI>> and tI>>> of the relay situated on the incomer were selectively adjusted to be greater than the settings for the phase thresholds of the downstream relays, the fault shall be eliminated selectively by the relay of the default output (selectivity between the relay of the incomer and those of the feeder being ensured by means of selecting adequate intervals, or even by means of a suitable locking diagram).

Case n°2 → the relay of one of the outputs is faulty :

In this case, the watch-dog contact of this relay is closed.

Thus, for a phase fault on the bar set, the thresholds tI>> and tI>>> act on their associated output contact. However, the fault is eliminated by the threshold tI>> which is selectively adjusted to be lower than the threshold tI>>>.

For a phase fault on one of the 'healthy' feeders, as the thresholds tI>> and tI>>> of the relay situated on the incomer have been selectively adjusted to be greater than the settings of the phase thresholds of the downstream relays, the fault shall be eliminated selectively by the relay of the default output (selectivity between the relay of the input and those of the outputs being ensured by means of selecting adequate intervals, or even by means of a suitable locking diagram).

For a phase fault on the output of the fault relay, the threshold tI>> of the relay situated on the input acts via the watch-dog contact of the faulty relay on the triggering coil of the circuit breaker of the default output. As this threshold is adjusted to be selectively less than the threshold tI>>> (which acts directly on the coil of the circuit breaker of the input), the fault is therefore selectively eliminated.

9. REMOTE PROTECTION STAND-BY DIAGRAM

MiCOM P121, P122 and **P123** protection can be used as a stand-by of a high voltage remote protection (Figure 9). The function 51/51N of the **P121, P122** and **P123** needs to be programmed, either in constant time or in dependent time according to the type of selectivity required. The value of the hold time of I>/Ie> is adjusted to a value compatible with the thresholds Z2 or Z3 (2nd and 3rd remote protection zone).

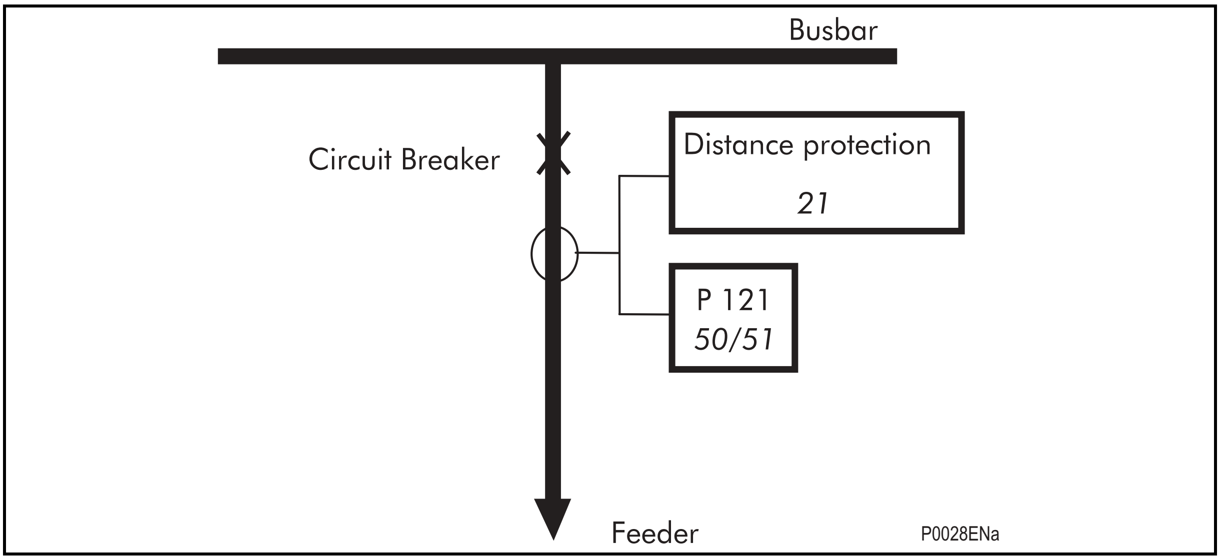

FIGURE 9 : ASSISTANCE OF REMOTE PROTECTION BY A MiCOM P121 PROTECTION

The «Equipment fault » contact of the remote distance protection (case of a numerical protection) can be cabled onto **MiCOM P121, P122** and **P123** relays to ensure optimisation of the triggering times.

10. 1 ½ BREAKER SCHEME

For high voltage/extremely high voltage stations with a 1 ½ circuit breaker scheme (Figure 10), the zone between the two circuit breakers and the section switch needs to be protected by a standard ANSI 50 protection.

The triggering time is an essential element in choosing this protection. **MiCOM P121, P122** or **P123** relays are ideal for this application through the adjusting of the triggering hold time of the first threshold (tI>) to a low value (typically 100 ms greater than the time of the circuit breaker failure) thus locking the protection via the closing contact of the line section switch.

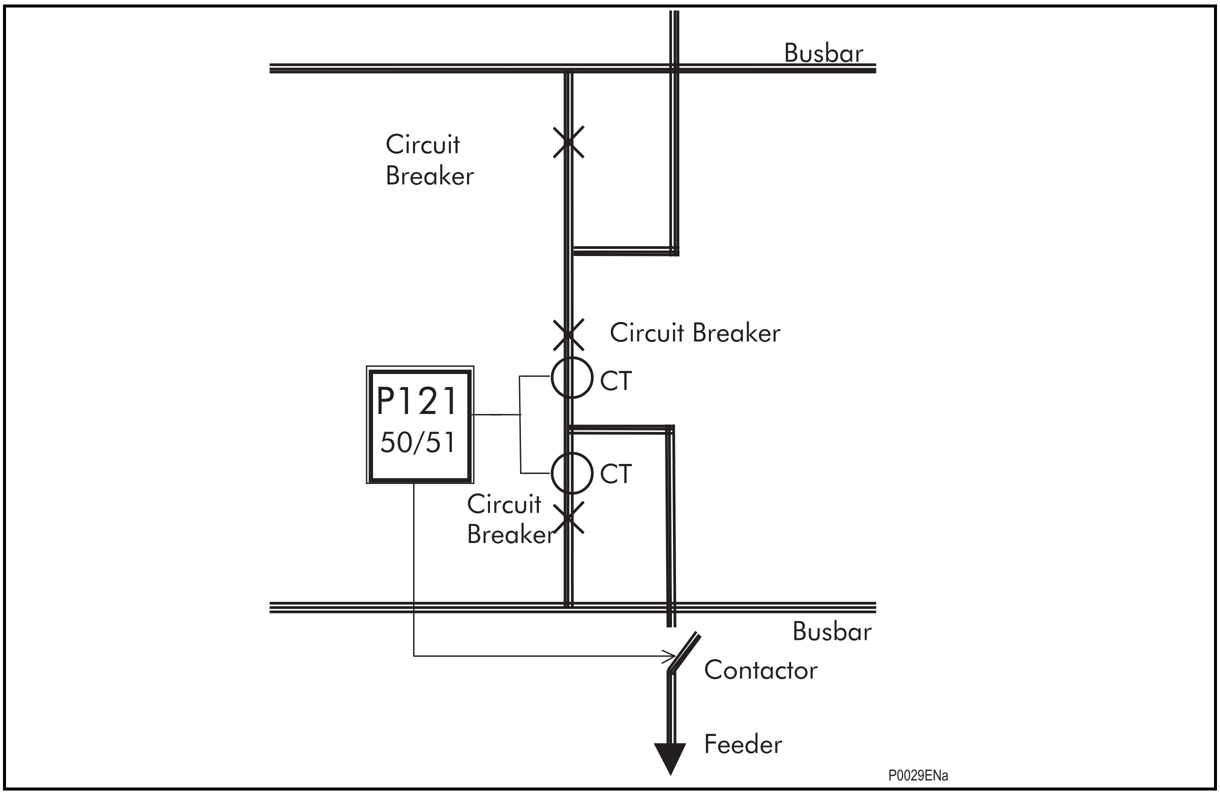

FIGURE 10 : 1 ½ BREAKER SCHEME

11. THERMAL OVERLOAD PROTECTION (P122 & P123 ONLY)

Thermal overload protection can be used to prevent electrical plant from operating at temperatures in excess of the designed maximum withstand. Prolonged overloading causes excessive heating, which may result in premature deterioration of the insulation, or in extreme cases, insulation failure.

MiCOM P122 & P123 incorporate a current based thermal replica, using load current to model heating and cooling of the protected plant. The element can be set with both alarm and trip stages.

The heat generated within an item of plant, such as a cable or a transformer, is the resistive loss (I^2R x t). Thus, heating is directly proportional to current squared. The thermal time characteristic used in the relay is therefore based on current squared, integrated over time.

MiCOM relay automatically uses the largest phase current for input to the thermal model.

Equipment is designed to operate continuously at a temperature corresponding to its full load rating, where heat generated is balanced with heat dissipated by radiation etc. . Over-temperature conditions therefore occur when currents in excess of rating are allowed to flow for a period of time. It can be shown that temperatures during heating follow exponential time constants and a similar exponential decrease of temperature occurs during cooling.

In order to apply this protection element, the thermal time constant for the protected item of plant is therefore required.

The following sections will show that different items of plant possess different thermal characteristics, due to the nature of their construction.

11.1 Time Constant Characteristic

This characteristic is used to protect cables, dry type transformers (e.g. type AN), and capacitor banks.

The thermal time characteristic is given by:

$$\exp(-t/\tau) = (I^2 - (k.I_{FLC})^2) / (I^2 - I_P^2)$$

Where:

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

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

I = Largest phase current;

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

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

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

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

Curves of the thermal overload time characteristic are given in the chapter P12x/EN TD/C55 of the Technical Guide.

Mathematical formula applicable to the MiCOM Relays :

The calculation of the Time to Trip is given by :

$$\text{Ttrip} = \text{Te} \ln \left(\frac{|K^2 - \theta^2|}{|K^2 - \theta\text{trip}^2|} \right)$$

With :

Ttrip = Time to trip (in seconds)

Te = Thermal time constant of the protected element (in seconds)

K = Thermal overload equal to Ieq/k Iθ >

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

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

k = Factor associated to the thermal state formula.

θ^2 = Initial thermal state. If the initial thermal state = 30% then $\theta^2 = 0.3$

θtrip^2 = Trip thermal state. If the trip thermal state is set at 100%, then $\theta\ \text{trip}^2 = 1$

The settings of these parameters are available in the menus :

PROTECTION G1/ [49] Therm OL

PROTECTION G2/ [49] Therm OL

The calculation of the thermal state is given by the following formula :

$\theta_{t+1} = (\text{Ieq}/\ k\ \text{I}\theta >)^2\ [1 - \exp(-t/\text{Te})] + \theta_t \exp(-t/\text{Te})$

θ being calculated every 100ms

11.2 Setting Guidelines

The current setting is calculated as:

Thermal Trip =Permissible continuous loading of the plant item / CT ratio.

Typical time constant values are given in the following tables.

The relay setting, 'Time Constant', is in minutes.

Paper insulated lead sheathed cables or polyethylene insulated cables, placed above ground or in conduits. The table shows τ in minutes, for different cable rated voltages and conductor cross-sectional areas:

CSA mm^2	6 -11 kV	22 kV	33 kV	66 kV
25 - 50	10	15	40	-
70 - 120	15	25	40	60
150	25	40	40	60
185	25	40	60	60
240	40	40	60	60
300	40	60	60	90
		Time constant τ (minutes)		

Other plant items:

	Time constant τ (minutes)	**Limits**
Dry-type transformers	40 60 - 90	Rating < 400 kVA Rating 400 - 800 kVA
Air-core reactors	40	
Capacitor banks	10	
Overhead lines	10	Cross section ≥ 100 mm^2 Cu or 150mm^2 Al
Busbars	60	

An alarm can be raised on reaching a thermal state corresponding to a percentage of the trip threshold. A typical setting might be 'Thermal Trip' = 70% of thermal capacity.

12. COLD LOAD PICK-UP (P122 & P123 ONLY)

The cold load pickup feature enables the selected settings of the **MiCOM P122** and **P123** relays to be changed to cater for temporary overload conditions that may occur during ,cold starts, such as switching on large heating loads after a sufficient cooling period, or loads that draw high initial starting currents.

When a feeder is energised, the current levels for a period of time following energisation may differ greatly from the normal load levels. Consequently, overcurrent settings that have been applied to give short circuit protection may not be suitable during this period.

The Cold Load Pick-Up (CLP) logic included in the MiCOM P122 & P123 relays serves to raise the settings of selected stages for a set duration. This allows the protection settings to be set closer to the load profile by automatically increasing them after energisation. The CLP logic provides stability, without compromising protection performance during starting. Note that any of the disabled overcurrent stages in the main relay menu will not appear in the Cold Load PU Menu.

The following table shows the relay menu for the '*Cold Load Pick-up* ' logic, including the available setting ranges and factory defaults.

MENU TEXT	SETTING RANGE		STEP SIZE
AUTOMAT. CTRL	MIN	MAX	
Cold Load PU	NO	YES	
tI>	NO	YES	
tI>>	NO	YES	
tI>>>	NO	YES	
tI_e>	NO	YES	
tI_e>>	NO	YES	
tI_e>>>	NO	YES	
t Therm	NO	YES	
tI2>	NO	YES	
tI2>>	NO	YES	
level	20 %	500 %	1 %
tCL	100 ms	3 600 s	100 ms

tCL controls the time for which the relevant overcurrent and earth fault settings (%) are altered following an external input (e.g. circuit breaker closure). When the set *tCL* time has elapsed, all of the relevant settings revert back to their original values or become unblocked.

tCL are initiated via a dedicated logic input (refer to AUTOMAT. CTRL/INPUTS menu) signal generated by connecting an auxiliary contact from the circuit breaker or starting device to the relay's opto-inputs.

The following sections describe applications where the CLP logic may be useful and the settings that need to be applied.

12.1 Air Conditioning/Resistive Heating Loads

Where a feeder is used to supply air conditioning or resistive heating loads there may be a conflict between the 'steady state' overcurrent settings and those required following energisation. This is due to the temporary increase in load current that may arise during starting. The CLP logic is used to alter the applied settings during this time.

With the Cold Load PU enabled, the affected thresholds are selected to be adjusted for the required time to allow the start condition to subside. A percentage value is selected as the amount by which the selected threshold is increased/decreased.

The time for which the adjusted thresholds are valid is defined by the tCL setting. After this time, the settings return to normal.

It may not be necessary to alter the protection settings following a short supply interruption. In this case the CLP function is not activated.

12.2 Motor Feeders

In general, feeders supplying motor loads would be protected by a dedicated motor protection device, such as the MiCOM P220, P225 or P241 relay. However, if no specific protection has been applied (possibly due to economic reasons) then the CLP function in the MiCOM P122 or P123 relay may be used to modify the overcurrent settings accordingly during starting.

Depending upon the magnitude and duration of the motor starting current, it may be sufficient to simply block operation of instantaneous elements or, if the start duration is long, the time delayed protection settings may also need to be raised. Hence, a combination of both blocking and raising of settings of the relevant overcurrent stages may be adopted. The CLP overcurrent settings in this case must be chosen with regard to the motor starting characteristic.

As previously described, the CLP logic includes the option of raising the settings of the first stage of the earth fault protection. This may be useful where instantaneous earth fault protection is required to be applied to the motor. During conditions of motor starting, it is likely that incorrect operation of the earth fault element would occur due to asymmetric CT saturation. This is a result of the high level of starting current causing saturation of one or more of the line CT's feeding the overcurrent / earth fault protection. The resultant transient imbalance in the secondary line current quantities is thus detected by the residually connected earth fault element. For this reason, it is normal to either apply a nominal time delay to the element, or to utilise a series stabilising resistor.

The CLP logic may be used to allow reduced operating times or current settings to be applied to the earth fault element under normal running conditions. These settings could then be raised prior to motor starting, via the logic.

12.3 Earth Fault Protection applied to Transformers

Where an earth fault relay is residually connected on the primary side of a delta-star transformer, no time delay is required for co-ordination purposes, due to the presence of the delta winding. However, a nominal time delay or stabilising resistor is recommended, to ensure transient stability during transformer energisation.

The CLP logic may be used in a similar manner to that previously described for the motor application.

It should be noted that this method will not provide stability in the event of asymmetric CT saturation which occurs as a result of an unbalanced fault condition. If problems of this nature are encountered, the best solution would still be the use of a stabilising resistor.

12.4 Switch onto Fault Protection (SOTF)

In some feeder applications, fast tripping may be required if a fault is present on the feeder when it is energised.

Such faults may be due to a fault condition not having been removed from the feeder, or due to earthing clamps having been left on following maintenance. In either case, it may be desirable to clear the fault condition in an accelerated time, rather than waiting for the time delay associated with IDMT overcurrent protection.

The above situation may be catered for by the CLP logic. Selected overcurrent / earth fault stages could be set to shorter operation (typically 30% of the nominal threshold) for a defined period following circuit breaker closure (typically 200ms). Hence, fault clearance would be achieved for a switch onto fault (SOTF) condition.

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13. AUXILIARY TIMERS (P122 & P123 ONLY)

Four auxiliary timers tAux1, tAux2, tAux3 and tAux4 (P123 only) are available associated to Aux1, Aux2, Aux3 and Aux4 logic inputs (refer to ***AUTOMAT. CRTL/INPUTS*** menu). When these inputs are energised, the associated timers start and, after the set time, the output relays associated to the timer close (refer to ***AUTOMAT. CRTL/OUTPUTS*** menu). The time delays are independently settable from 0 ms to 200 s.

NOTE : It is possible to allocate the logic inputs of the MiCOM P120 & P121 to the external information Aux1 and Aux2. Therefore, these inputs cannot be directed to output relays. In more the tAux1 and tAux2 timers are fixed and equal to 0. Thus the Aux1 and Aux2 inputs can be used only for signalisation on the communication network.

14. SETTING GROUP SELECTION (P122 & P123 ONLY)

The MiCOM P122 and P123 relays have two setting groups related to the protection functions named PROTECTION G1 and PROTECTION G2. Only one group is active, the other one is inactive. Changes between the two groups are done via the front interface (***CONFIGURATION/GROUP SELECT/SETTING GROUP 1*** or ***2***) , via a dedicated logic input (***AUTOMAT CTRL/INPUT X/CHANGE SET***) where X is the chosen logic input, or through the communication port (refer to Mapping Data Base for more detailed information).

To avoid nuisance tripping, the setting group change is only executed when no protection function (except for thermal overload function) or automation function is running.

If a setting group change is received during any protection or automation function, it is stored and executed after the last timer has elapsed.

The active group is displayed in the OP PARAMETERS menu.

The active group can also be assigned to an output relay : with a normally open contact,

– a contact open will indicate Group 1

– a contact closed will indicate Group 2

Change of setting group done by a logic input

It is possible to configure the operation of the digital input, either on falling edge/ low level or on rising edge/ high level. The choice is done in the CONFIGURATION/Inputs menu.

Falling edge or low level (idem for rising edge or high level) depending of the application is selectable in the CONFIGURATION/Group Select/Change Group/Input menu.

Warning: if the digital input assigned to the change of setting group operates on level (low or high), it is not possible to change of setting group via either remote communication or front panel.

ACTIVE GROUP CHANGEOVER WITH "LEVEL" OPTION :

When switching ON the auxiliary supply, the selected group corresponds to the logic input state. This means:

<u>A - LEVEL option and Logic input configuration = 0</u>

Groupe 1 = logic Input is not active
Groupe 2 = logic Input is active

If the programmed logic input is supplied with +V, then the active group will be G1.
If the programmed logic input is not supplied with +V , then the active group will be G2.

B - LEVEL option and Logic input configuration = 1

Groupe 1 = logic Input is not active
Groupe 2 = logic Input is active

If the programmed logic input is supplied with +V, then the active group will be G2. If the programmed logic input is not supplied with +V, then the active group will be G1.

If the user wishes to change the groups by the communication or by the front panel, he has to select the option " EDGE".

ACTIVE GROUP CHANGEOVER WITH "EDGE" OPTION :

A- FRONT option with Logic input configuration = 1

The active group changes every time the voltage applied to the logic input changes state from 0V to +V.
Switch OFF the relay, then if we

1. Switch ON the power supply of the relay with the voltage applied to the logic input =0V:
   The group will not change. It will remain as before the switching off of the relay.

2. Switch ON the power supply of the relay with the voltage applied to the logic input =+V:
   The group will change and **it will change after every switching off.**

B- FRONT option with Logic input configuration = 0

The active group changes every time the voltage applied to the logic input changes state from +V to 0V.
Switch OFF the relay, then if we

1. Switch ON the power supply of the relay with the voltage applied to the logic input =0V:
   The group will change state and **it will change after every switching off.**

2. Switch ON the power supply of the relay with the voltage applied to the logic input =+V:
   The group will not change. It will remain as before the switching off of the relay.

NOTE : It is important to set properly the change active group with FRONT option via a logic input. In general the customer should be conform to the cases A-1 and B-2, so no group changes will take place upon energizing the relay.

Priority

The front panel is priority level maximum due the fact when the user takes the hand on front panel and enters a password , it is not possible to change of setting group via remote communication as long as the password is active (5mn).

15. MAINTENANCE MODE

This menu allows the user to verify the operation of the protection functions without sending any external order (Tripping or signaling).

Maintenance Mode	
	YES

When activating this menu (YES), the Alarm led will start flashing and an alarm message will appear "MAINTENANCE MODE". In this case, all output contacts are blocked, no operation will take place on these contacts even if a protection threshold associated to one of these output contacts is exceeded.
(If protection threshold is exceeded, all the associated leds will become ON, even the TRIP LED, if the threshold is associated to the RL1).

RELAYS	8765W4321
CMD	000000000

This window allows the user to verify the external wiring to the relay output contacts, to do this, it is sufficient to assign a 1 to any of the output contacts, this will close the contact and the wiring continuity could be verified.

16. SELECTIVE SCHEME LOGIC (P122 & P123 ONLY)

Figure 11 describes the use of non-cascade protection schemes which use the start contacts from downstream relays to block operation of upstream relays.

In the case of Selective Overcurrent Logic (SOL), the start contacts are used to increase the time delays of upstream relays, instead of blocking. This provides an alternative approach to achieving a non-cascade type of overcurrent scheme. It may be more familiar to some utilities than the blocked overcurrent arrangement.

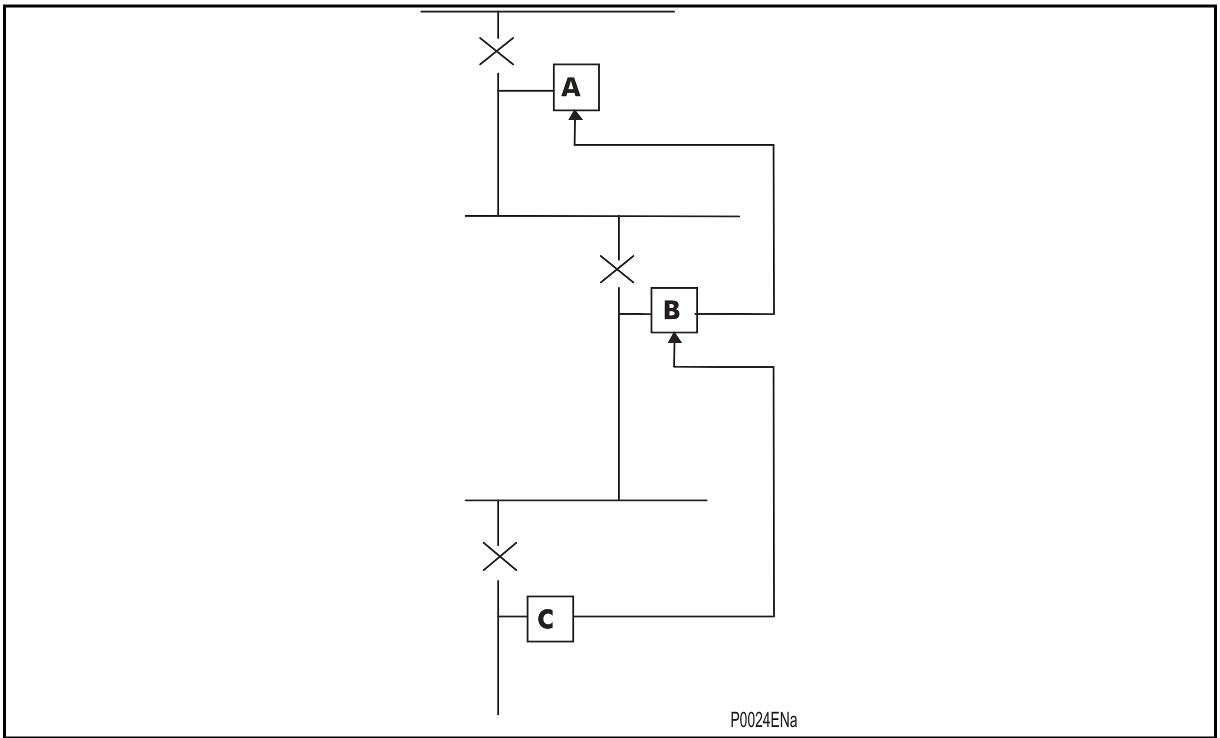

FIGURE 11 : TYPICAL SCHEME LOGIC

The SOL function temporarily increase the time delay settings of the second and third stages of phase overcurrent, derived and measured earth fault and sensitive earth fault protection elements. This logic is initiated by energising the appropriate logic input (Log Sel1 or Log Sel2) selected in AUTOMAT.CRTL/INPUTS menu.

To allow time for a start contact to initiate a change of setting, the time settings of the second and third stages should include a nominal delay. Guidelines for minimum time settings are identical to those given for blocked overcurrent schemes.

The tSel1 and tSel2 timers are independently settable from 0 to 150 s.

17. NEGATIVE SEQUENCE OVERCURRENT PROTECTION (P122 & P123 ONLY)

When applying traditional phase overcurrent protection, the overcurrent elements must be set higher than maximum load current, thereby limiting the element's sensitivity. Most protection schemes also use an earth fault element operating from residual current, which improves sensitivity for earth faults. However, certain faults may arise which can remain undetected by such schemes.

Any unbalanced fault condition will produce negative sequence current of some magnitude. Thus, a negative phase sequence overcurrent element can operate for both phase-to-phase and phase to earth faults.

This section describes how negative phase sequence overcurrent protection may be applied in conjunction with standard overcurrent and earth fault protection in order to alleviate some less common application difficulties.

- Negative phase sequence overcurrent elements give greater sensitivity to resistive phase-to-phase faults, where phase overcurrent elements may not operate.

- In certain applications, residual current may not be detected by an earth fault relay due to the system configuration. For example, an earth fault relay applied on the delta side of a delta-star transformer is unable to detect earth faults on the star side. However, negative sequence current will be present on both sides of the transformer for any fault condition, irrespective of the transformer configuration. Therefore, an negative phase sequence overcurrent element may be employed to provide time-delayed back-up protection for any uncleared asymmetrical faults.

- Where rotating machines are protected by fuses, a blown fuse produces a large amount of negative sequence current. This is a dangerous condition for the machine due to the heating effects of negative phase sequence current at double frequency. A negative phase sequence overcurrent element may be applied to provide efficient back-up protection for dedicated motor protection relays.

- It may also be required to simply alarm for the presence of negative phase sequence currents on the system. Operators are then prompted to investigate the cause of the unbalance.

The negative phase sequence overcurrent element has a current pick up setting 'I2> Current Set', and is time delayed in operation by the adjustable timer 'I2> Time Delay.'

17.1 I2> and I2>> Setting Guidelines

The current pick-up threshold (settable in the PROTECTION G1 (2)/[46] Neg Seg 0C menu) must be set higher than the normal negative phase sequence current due to the normal load unbalance on the system. This can be set at the commissioning stage, making use of the relay measurement function to display the standing negative phase sequence current, and apply a setting at least 20% above this figure.

Where the negative phase sequence element is required to operate for specific uncleared asymmetric faults, a precise threshold setting have to be based on an individual fault analysis for that particular system due to the complexities involved. However, to ensure operation of the protection, the current pick-up setting must be set approximately 20% below the lowest calculated negative phase sequence fault current for a specific remote fault condition.

The correct setting of the time delay for this function is vital. It should also be noted that this element is applied primarily to provide back-up protection to other protective devices or to provide an alarm. Therefore, it would be associated with a long time delay.

It must be ensured that the time delay is set greater than the operating time of any other protective device (at minimum fault level) on the system which may respond to unbalanced faults, such as:

- Phase overcurrent elements
- Earth fault elements
- Broken conductor elements
- Negative phase sequence influenced thermal elements

The tI2> and tI2>> timers associated to the I2 threshold is settable in the PROTECTION G1(2)/[46] Neg Seg OC menu.

18. BROKEN CONDUCTOR DETECTION (P122 & P123 ONLY)

The majority of faults on a power system occur between one phase and ground or two phases and ground. These are known as shunt faults and arise from lightning discharges and other overvoltages which initiate flashovers. Alternatively, they may arise from other causes such as birds on overhead lines or mechanical damage to cables etc.

Such faults result in an appreciable increase in current and in the majority of applications are easily detectable.

Another type of unbalanced fault which can occur on the system is the series or open circuit fault. These can arise from broken conductors, maloperation of single phase switchgear, or the operation of fuses.

Series faults will not cause an increase in phase current on the system and hence are not readily detectable by standard overcurrent relays. However, they will produce an unbalance and a resultant level of negative phase sequence current, which can be detected.

It is possible to apply a negative phase sequence overcurrent relay to detect the above condition. However, on a lightly loaded line, the negative sequence current resulting from a series fault condition may be very close to, or less than, the full load steady state unbalance arising from CT errors, load unbalance etc. A negative sequence element therefore would not operate at low load levels.

The **MiCOM P122 and P123** relays incorporate an element which measures the ratio of negative to positive phase sequence current (I_2/I_1). This will be affected to a lesser extent than the measurement of negative sequence current alone, since the ratio is approximately constant with variations in load current. Hence, a more sensitive setting may be achieved.

NOTE: the Broken conductor function is inhibited if the three phases are less than 10% of the nominal current.

Setting Guidelines

In the case of a single point earthed power system, there will be little zero sequence current flow and the ratio of I2/I1 that flows in the protected circuit will approach 100%. In the case of a multiple earthed power system (assuming equal impedances in each sequence network), the ratio I2/I1 will be 50%.

It is possible to calculate the ratio of I2/I1 that will occur for varying system impedances, by referring to the following equations:-

$$I_{1F} = \frac{E_g(Z_2+Z_0)}{Z_1Z_2+Z_1Z_0+Z_2Z_0}$$

$$I_{2F} = \frac{-E_gZ_0}{Z_1Z_2+Z_1Z_0+Z_2Z_0}$$

Where :

E_g = System Voltage

Z_0 = Zero sequence impedance

Z_1 = Positive sequence impedance

Z_2 = Negative sequence impedance

Therefore :

$$\frac{I_{2F}}{I_{1F}} = \frac{Z_0}{Z_0+Z_2}$$

It follows that, for an open circuit in a particular part of the system, I2/I1 can be determined from the ratio of zero sequence to negative sequence impedance. It must be noted however, that this ratio may vary depending upon the fault location. It is desirable therefore to apply as sensitive a setting as possible. In practice, this minimum setting is governed by the levels of standing negative phase sequence current present on the system. This can be determined from a system study, or by making use of the relay measurement facilities at the commissioning stage. If the latter method is adopted, it is important to take the measurements during maximum system load conditions, to ensure that all single phase loads are accounted for.

Since sensitive settings are employed, it can be expected that the element will operate for any unbalance condition occurring on the system (for example, during a single pole autoreclose cycle). Therefore, a long time delay is necessary to ensure co-ordination with other protective devices. A 60 second time delay setting may be typical.

The following table shows the relay menu for the Broken Conductor protection, including the available setting ranges and factory defaults :

MENU TEXT	DEFAULT SETTING	SETTING RANGE		STEP SIZE
		MIN	MAX	
AUTOMAT. CTRL				
Brkn Cond.?	NO	NO	YES	
tBC	1	1 s	14 400 s	1 s
RATIO I2/I1	20 %	20 %	100 %	1 %

18.1 Example Setting

The following information was recorded by the relay during commissioning;

$I_{full\ load} = 500A$

$I_2 = 50A$

therefore the quiescent I2/I1 ratio is given by;

$I_2/I_1 = 50/500 = 0.1$

To allow for tolerances and load variations a setting of 200% of this value may be typical: Therefore set ***RATIO I2/I1*** = 20%

Set ***tBC*** = 60 s to allow adequate time for short circuit fault clearance by time delayed protections.

19. DESCRIPTION AND SETTING GUIDE OF THE AUTORECLOSE FUNCTION (P123 ONLY)

19.1 Introduction

An analysis of faults on any overhead line network has shown that 80-90% are transient in nature.

A transient fault, such as an insulator flash-over, is a self clearing 'non-damage' fault. This type of fault can be cleared by the immediate tripping of one or more circuit breakers to isolate the fault, and does not recur when the line is re-energised. Lightning is the most common cause of transient faults, other possible causes being clashing conductors and wind blown debris. The remaining 10 - 20% of faults are either non-permanent (arcing fault) or permanent.

A non-permanent fault could be caused by a small tree branch falling on the line. Here the cause of the fault would not be removed by the immediate tripping of the circuit, but could be burnt away during a time delayed trip.

Permanent faults could be broken conductors, transformer faults, cable faults or machine faults which must be located and repaired before the supply can be restored.

In the majority of fault incidents, if the faulty line is immediately tripped out, and time is allowed for the fault arc to de-ionise, reclosure of the circuit breakers will result in the line being successfully re-energised. Autoreclose schemes are employed to automatically reclose a switching device a set time after it has been opened due to operation of protection where transient and non-permanent faults are prevalent.

On HV/MV distribution networks, auto-reclosing is applied mainly to radial feeders where system stability problems do not generally arise. The main advantages to be derived from using autoreclose can be summarised as follows:

- Minimises interruptions in supply to the consumer.
- Reduces operating costs - less man hours in repairing fault damage and the possibility of running substations unattended. With autoreclose instantaneous protection can be used which means shorter fault duration's which gives rise to less fault damage and fewer permanent faults.

As 80% of overhead line faults are transient, elimination of loss of supply from such faults, by the introduction of autoreclosing gives obvious benefits. Furthermore, autoreclosing may allow a particular substation to operate unattended. In the case of unattended substations, the number of visits by personnel to reclose a circuit breaker manually after a fault can be substantially reduced, an important consideration for substations in remote areas.

Autoreclosing gives an important benefit on circuits using time graded protection, in that it allows the use of instantaneous protection to give a high speed first trip. With fast tripping, the duration of the power arc resulting from an overhead line fault is reduced to a minimum, thus lessening the chance of damage to the line, which might otherwise cause a transient fault to develop into a permanent fault.

Using short time delay protection also prevents blowing of fuses and reduces circuit breaker maintenance by eliminating pre-arc heating when clearing transient faults.

Figure 12 shows an example of 4 autoreclose cycles to the final trip :

td1, td2, td3, td4 = dead time 1, 2, 3 and 4 timers

tr = Reclaim type

O = CB open

C = CB closed.

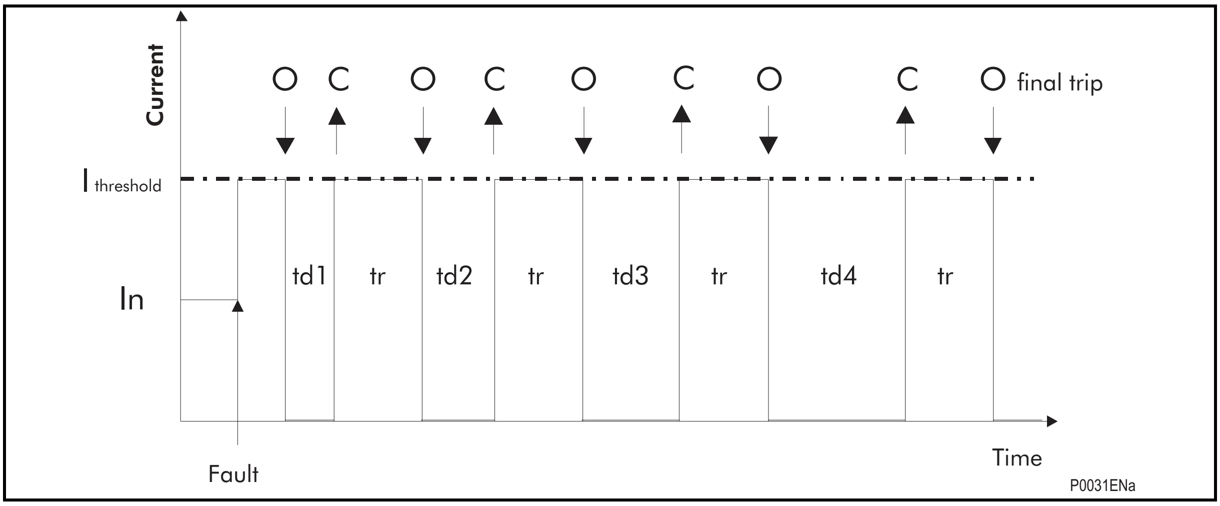

FIGURE 12 : TYPICAL AUTORECLOSE CYCLES

It should be noted that when short time delay protection is used with autoreclosing, the scheme is normally arranged to block the instantaneous protection after the first trip. Therefore, if the fault persists after reclosure, the time graded protection will give discriminative tripping with fuses or other protection devices, resulting in the isolation of the faulted section. However, for certain applications, where the majority of the faults are likely to be transient, it is not uncommon to allow more than one instantaneous trip before the instantaneous protection is blocked.

Some schemes allow a number of reclosures and time graded trips after the first instantaneous trip, which may result in the burning out and clearance of non-permanent faults. Such a scheme may also be used to allow fuses to operate in teed feeders where the fault current is low.

When considering feeders which are partly overhead line and partly underground cable, any decision to install autoreclosing would be influenced by any data known on the frequency of transient faults. When a significant proportion of the faults are permanent, the advantages of autoreclosing are small, particularly since reclosing on to a faulty cable is likely to aggravate the damage.

19.2 Description of the function

19.2.1 Autorecloser activation

The autoreclose function of the MiCOM P123 is available only if the following conditions are verified :

- The auxiliary contact of the CB status 52a must be connected to the relay
  See AUTOMAT. CTRL/Inputs menu
- The trip output relay RL1 must not be latched to the earth and/or phase protection function
  See AUTOMAT. CTRL/Latch functions menu

NOTE : If the auxiliary supply is lost during an autoreclose cycle, the autoreclose function is totally disabled.

19.2.2 Autoreclose menu

The following table shows the relay settings for the autoreclose function, including the available setting ranges. The same settings are available in the PROTECTION 2 Menu.

MENU TEXT	SETTING RANGE		STEP SIZE
PROTECTION G1	**MIN**	**MAX**	
Autoreclose ?	NO	YES	
Ext CB Fail ?	NO	YES	
Ext CB Fail Time	10 ms	600 s	10 ms
Ext Block ?	NO	YES	
tD1	10 ms	300 000 ms	10 ms
tD2	10 ms	300 000 ms	10 ms
tD3	10 ms	600 000 ms	10 ms
tD4	10 ms	600 000 ms	10 ms
Reclaim Time tR	20 ms	600 000 ms	10 ms
Inhib Time tI	20 ms	600 000 ms	10 ms
Phase Cycles	0	4	1
E/Gnd Cycles	0	4	1
CYCLES tI>	4321 1201		
CYCLES tI>>	4321 1211		
CYCLES tI>>>	4321 1110		
CYCLES tIe>	4321 0111		
CYCLES tIe>>	4321 1121		
CYCLES tIe>>>	4321 1111		
CYCLES tAux1	4321 1112		
CYCLES tAux2	4321 0101		

Example of setting :

CYCLES tI>	4321 1201

4321 are the cycles 1 to 4 associated to the trip on tI> pick up
1201 are the actions following the tI> time out :

0 = no action on autorecloser : definitive trip
1 = trip on tI> pick up, followed by reclosing cycle
2 = no trip on tI> pick up : and this whatever the setting in ***AUTOMAT. CRTL/Trip commands/Trip tI>*** menu.

In addition to these settings, function links in the ***PROTECTION G1/Phase OC*** or ***PROTECTION/E/Gnd*** menus are also required to fully integrate the autoreclose logic in the MiCOM P123 relay. Refer to Chapter 3 of the Technical Guide.

19.2.3 Logic Functions

19.2.3.1 Logic Inputs

The autoreclose function has four inputs affecting the logic, which are configured to any of the opto-isolated inputs on the relay via the ***AUTOMAT. CTRL*** menu. External inputs may be used to influence the autorecloser scheme. The function of these inputs are described below.

19.2.3.2 External CB fail

The majority of circuit breakers are only capable of providing one trip-close-trip cycle. Following this, it is necessary to establish if there is sufficient energy to reclose the CB. The ***CB FLT*** input is used to ensure that there is sufficient energy available to close and trip the CB before initiating a CB close command. If on completion of the dead time, sufficient energy is not available by checking the ***CB FLT*** input for a time given by the ***tCFE***, a lockout occur and the CB remains open.

This function is disabled by not allocating the function in the ***PROTECTION G1/Autoreclose*** menu (function ***CB FLT*** to NO).

19.2.3.3 External starting orders

Two separate and programmable inputs (AUTOMAT.CTRL/INPUTS menu) may be used to initiate the autorecloser function from an external device (such as an existing overcurrent relay). These logic inputs may be used independently and also in parallel with the MiCOM P123 Overcurrent settings.

These external orders can be disabled independently by not allocating the functions in the ***PROTECTION G1/Autoreclose/CYCLES tAux1*** menu and ***PROTECTION G1/Autoreclose/CYCLES tAux2*** menu.

19.2.3.4 External blocking order

The ***Block –79*** input (programmable in the ***AUTOMAT.CTRL/INPUTS***) menu may block the autoreclose function and cause a lock-out if the autorecloser function is in progress. This input can be used when protection operation without autorecloser function is required.

A typical example is on a transformer feeder, where autoreclosing may be initiated from the feeder protection but need to be blocked from the transformer protection side.

These external order can be disabled by not allocating the function in the ***PROTECTION/Autoreclose/Ext Block*** menu.

19.2.3.5 Autoreclose Logic Outputs

The following output signals can be assigned to relay contact or to LEDs to provide information about the status of the auto Reclose cycle. These are described below, identified by their namings.

19.2.3.6 Autoreclose in progress

The "***Autoreclose in progress***" signal is present during the complete reclose cycles from protection initiation to the end of the reclaim time or lockout.

The "***Autoreclose in progress***" information is allocated to a LED in the ***CONFIGURATION/Led/Recloser Run*** menu.

The "***Autoreclose in progress***" information is allocated to the output relays in the ***AUTOMAT.CTRL/Output Relays/79 Run*** menu.

19.2.3.7 Final trip

The "***Final trip***" signal indicates that an autoreclose cycle has been completed. A autoreclose signal is given after the CB has tripped from the protection and reclosed whereupon the fault has not been cleared. The "***Final trip***" signal is reset at the next CB manual closing order after the inhibit time (tI).

The inhibit time (tI) is settable in the ***PROTECTION G1/Autoreclose/Inhib Time*** menu.

The "***Final trip***" signal is allocated to the output relays in ***the AUTOMAT.Ctrl/Output Relays/79 Trip*** menu.

The "***Final trip***" signal is allocated to a LED in the ***CONFIGURATION/Led/Recloser Blocked*** menu.

19.2.4 Autoreclose logic operating sequence

The autoreclose function provides multi-shot three phase autoreclose control. It can be adjusted to perform a single shot, two shot, three shot or four shot cycle, selectable via ***Phase Cycles*** numbers and ***E/Gnd Cycles*** *numbers*. Dead times for all shots (reclose attempts) are independently adjustable.

The number of shots is directly related to the type of faults likely to occur on the system and the voltage level of the system. Generally, on medium voltage networks where the percentage of transient and non-permanent faults is likely to be high, a multi-shot autoreclose device will increase the possibility of the distribution line being successfully re-energised following reclosure of the circuit breaker.

An autoreclose cycle can be internally initiated by operation of a protection element (phase or earth), provided the circuit breaker is closed until the instant of protection operation. The dead time (***Dead Time tD1***, ***Dead Time tD2***, ***Dead Time tD3***, ***Dead Time tD4***) starts when the CB has tripped (when the 52a input disappears).

At the end of the relevant dead time, a CB close signal is given, provided system conditions are suitable. The system conditions to be met for closing are that the circuit breaker closing spring, or other energy source, is fully charged indicated from the ***CB FLT*** input. The CB close signal is cut-off when the circuit breaker closes.

When the CB has closed the reclaim time (***Reclaim Time***) starts.

If the circuit breaker does not trip again, the autoreclose function resets at the end of the reclaim time.

If the protection operates during the reclaim time the relay either advances to the next shot in the programmed autoreclose cycle, or, if all programmed reclose attempts have been made, goes to lockout.

The total number of reclosures and for each cycle is shown in the ***MEASUREMENT*** menu. This value can be reset to zero with command "C" (Clear) in the ***MEASUREMENTS/Reclose Stats*** menu.

19.2.5 Autoreclose Inhibit Following Manual Close

The ***Inhib Time tI*** setting can be used to prevent autoreclose being initiated when the CB is manually closed onto a fault. Autoreclose is disabled for the ***Inhib Time tI*** following manual CB Closure.

19.2.6 Recloser lockout

If protection operates during the reclaim time, following the final reclose attempt, the relay will lockout and the autoreclose function is disabled until the lockout condition resets.

The lockout condition is reset by a manual closing after the **"*Inhib Time tI*".**

Autoreclose lockout can also be caused by a ***CB FLT*** input. This CB FLT information can be issued from the CB springs are not charged/Low gas pressure.

Note, lockout can also be caused by :

- CB no open after tBf delay (CB Fail)
- Operating Time over the threshold set.

19.2.7 Setting group change lockout

Change of setting groups is only assumed by the MiCOM P122 and P123 relays if no protection functions (except thermal overload function) or automation functions is running. During the whole autorecloser cycles, if any setting group change order is received, this order is stored in memory, and will be executed after the last timer of the autorecloser cycle.

19.3 Setting Guidelines

19.3.1 Number Of Shots

There are no clear-cut rules for defining the number of shots for a particular application. Generally medium voltage systems utilise only two or three shot autoreclose schemes. However, in certain countries, for specific applications, four shots is not uncommon. Four shots have the advantage that the final dead time can be set sufficiently long to allow any thunderstorms to pass before reclosing for the final time, this arrangement will prevent unnecessary lockout for consecutive transient faults.

Typically, the first trip, and sometimes the second, will result from short time protection since 80% of faults are transient, the subsequent trips will be time delayed, all with increasing dead times to clear non-permanent faults.

In order to determine the required number of shots the following factors must be taken into account.

An important consideration is the ability of the circuit breaker to perform several trip-close operations in quick succession and the effect of these operations on the maintenance period.

If statistical information on a particular system shows a moderate percentage of non-permanent faults which could be burned out, two or more shots are justified. In addition to this, if fused 'tees' are used and the fault level is low, the fusing time may not discriminate with the main IDMT relay and it would then be useful to have several shots. This would warm up the fuse to such an extent that it would eventually blow before the main protection operated.

19.3.2 Dead Timer Setting

The factors which influence the choice of dead timer setting are as follows.

19.3.2.1 Load

Due to the great diversity of load which may exist on a system it may prove very difficult to arrive at an optimum dead time. However, it is possible to address each type of load individually and thereby arrive at a typical dead time. The most common types of load are addressed below.

Synchronous motors are only capable of tolerating extremely short interruptions of supply without loss of synchronism. In practice it is desirable to disconnect the motor from the supply in the event of a fault; the dead time should be sufficient to allow the motor no-volt device to operate. Typically, a minimum dead time of 0.2-0.3 seconds has been suggested to allow this device to operate. Induction motors, on the other hand, can withstand supply interruptions, up to a maximum of 0.5 seconds and re-accelerate successfully. In general dead times of 3-10 seconds are normally satisfactory, but there may be special cases for which additional time is required to permit the resetting of manual controls and safety devices.

Loss of supply to lighting circuits, such as street lighting may be important for safety reasons as intervals of 10 seconds or more may be dangerous for traffic. The main considerations for domestic customers are those of inconvenience.

An important measurement criteria for many power utilities is the number of minutes lost per year to customers which will be reduced on feeders using autoreclose and will also be affected by the dead time settings used.

19.3.2.2 Circuit Breaker

For high speed autoreclose the minimum dead time of the power system will depend on the minimum time delays imposed by the circuit breaker during a tripping and reclosing operation.

Since a circuit breaker is a mechanical device, it will have an inherent contact separation time. This operating time for a modern circuit breaker is usually within the range of 50-100ms, but could be longer with older designs.

After tripping, time must be allowed for the mechanism to reset before applying a closing pulse. This resetting time will vary depending on the circuit breaker, but is typically 0.1 seconds.

Once the circuit breaker has reset, the breaker can begin to close. The time interval between the energisation of the closing mechanism and the making of the contacts is termed the closing time. Owing to the time constant of a solenoid closing mechanism and the inertia of the plunger, a solenoid closing mechanism may take 0.3s. A spring operated breaker, on the other hand, can close in less than 0.2 seconds.

Where high speed reclosing is required, for the majority of medium voltage applications, the circuit breaker mechanism itself dictates the minimum dead time. However, the fault de-ionising time may also have to be considered.

High speed autoreclose may be required to maintain stability on a network with two or more power sources. For high speed autoreclose the system disturbance time should be minimised by using fast protection, <50 ms, such as distance or feeder differential protection and fast circuit breakers < 100 ms. Fast fault clearance can reduce the required fault arc de-ionising time.

For stability between two sources a dead time of <300 ms may typically be required. The minimum system dead time only considering the CB is the mechanism reset time plus the CB closing time. Thus, a solenoid mechanism will not be suitable for high speed autoreclose as the closing time is generally too long.

19.3.2.3 Fault De-ionising Time

For high speed autoreclose the fault de-ionising time may be the most important factor when considering the dead time. This is the time required for ionised air to disperse around the fault position so that the insulation level of the air is restored. This can be approximated from:

De-ionising time = (10.5 + ((system voltage in kV)/34.5)) / frequency

For 66 kV = 0.25 s (50Hz)

For 132 kV = 0.29 s (50 Hz)

19.3.2.4 Protection Reset

It is essential that the protection fully resets during the dead time, so that correct time discrimination will be maintained after reclosure on to a fault. For high speed autoreclose instantaneous reset of protection is required.

Typical 11/33kV dead time settings in the UK are as follows;

1st dead time = 5 - 10 seconds

2nd dead time = 30 seconds

3rd dead time = 60 - 100 seconds

4th dead time (uncommon in the UK, however used in South Africa) = 60 - 100 seconds

19.3.3 Reclaim Timer Setting

A number of factors influence the choice of the reclaim timer, such as;

- Supply continuity - Large reclaim times can result in unnecessary lockout for transient faults.
- Fault incidence/Past experience - Small reclaim times may be required where there is a high incidence of lightning strikes to prevent unnecessary lockout for transient faults.
- Spring charging time - For high speed autoreclose the reclaim time may be set longer than the spring charging time to ensure there is sufficient energy in the circuit breaker to perform a trip-close-trip cycle. For delayed autoreclose there is no need as the dead time can be extended by an extra CB healthy check window time if there is insufficient energy in the CB. If there is insufficient energy after the check window time the relay will lockout.

- Switchgear Maintenance - Excessive operation resulting from short reclaim times can mean shorter maintenance periods. A minimum reclaim time of >5s may be needed to allow the CB time to recover after a trip and close before it can perform another trip-close-trip cycle. This time will depend on the duty (rating) of the CB.

The reclaim time must be long enough to allow any time delayed protection initiating autoreclose to operate. Failure to do so would result in premature resetting of the autoreclose scheme and re-enabling of instantaneous protection.

If this condition arose, a permanent fault would effectively look like a number of transient faults, resulting in continuous autoreclosing unless additional measures were taken to overcome this such as excessive fault frequency lockout protection.

It is possible to have short reclaim times by blocking the reclaim time from the protection start signals. If short reclaim times are to be used then the switchgear rating may dictate the minimum reclaim time. The advantage of a short reclaim time is that there are less lockouts of the CB, however, there will be more CB operations and so maintenance periods would be reduced.

Sensitive earth fault protection is applied to detect high resistance earth faults and usualy has a long time delay, typically 10-15s. This longer time may have to be taken into consideration, if autoreclosing from SEF protection, when deciding on a reclaim time, if the reclaim time is not blocked by an SEF protection start signal. Sensitive earth faults, for example, a broken overhead conductor in contact with dry ground or a wood fence, is rarely transient and may be a danger to the public.

It is therefore common practice to block autoreclose by operation of sensitive earth fault protection and lockout the circuit breaker.

Where motor-wound spring closed circuit breakers are used, the reclaim time must be at least as long as the spring winding time for high speed autoreclose to ensure that the breaker can perform a trip-close-trip cycle.

A typical 11/33kV reclaim time is 3-10 seconds, this prevents unnecessary lockout during thunderstorms. However, times up to 60-180 seconds maybe used.

20. CIRCUIT BREAKER STATE MONITORING

An operator at a remote location requires a reliable indication of the state of the switchgear. Without an indication that each circuit breaker is either open or closed, the operator has insufficient information to decide on switching operations. The MiCOM P120/P121/P122/P123 relays incorporate a circuit breaker state monitoring, giving an indication of the position of the circuit breaker.

This indication is available either in front of the relay (P122 - P123 only) or via the communication network.

The positions of the CB are selectable in the ***AUTOMAT.CTRL/Inputs*** and ***CONFIGURATION/Led*** menu.

In more, the MiCOM P122 and P123 are capable to inform the operator that the CB is not open following a remote trip command (refer section “CB FAIL protection”).

21. CIRCUIT BREAKER CONDITION MONITORING (P122 & P123 ONLY)

Periodic maintenance of circuit breakers is necessary to ensure that the trip circuit and mechanism operate correctly, and also that the interrupting capability has not been compromised due to previous fault interruptions. Generally, such maintenance is based on a fixed time interval, or a fixed number of fault current interruptions. These methods of monitoring circuit breaker condition give a rough guide only and can lead to excessive maintenance.

The relays record various statistics related to each circuit breaker trip operation, allowing a more accurate assessment of the circuit breaker condition to be determined. These monitoring features are discussed in the following section.

21.1 Circuit Breaker Condition Monitoring Features

For each circuit breaker trip operation the relay records statistics as shown in the following table taken from the relay menu. The ***RECORDS/CB Monitoring*** menu cells shown are counter values only.

These cells can only be read:

MENU TEXT	
CB Monitoring	
CB Opening Time	Display the CB opening time (Note 1)
CB Closing Time	Display the CB closing time (Note 2)
CB Operations	Display the number of opening commands executed by the CB
ΣAmps(n) IA	Display the summation of the Amps (or square Amps) interrupted by the CB phase A
Σ Amps(n) IB	Display the summation of the Amps (or square Amps) interrupted by the CB phase B
Σ Amps(n) IC	Display the summation of the Amps (or square Amps) interrupted by the CB phase C

NOTE 1: the CB opening time is measured between the trip command (Trip output relay) and the change of position of O/O (52a).

NOTE 2: the CB closing time is measured between the closing command (output auxiliary relay) and the change of position of O/O (52a).

The above counters may be reset to zero, for example, following a maintenance inspection and overhaul.

The following table, detailing the options available for the CB condition monitoring, is taken from the relay menu. It includes the setup of the current broken facility and those features which can be set to raise an alarm or CB lockout.

All the settings are available in the ***AUTOMAT.CTRL/CB supervision*** menu.

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
CB Supervision			
CB Open S'vision	No	Yes	
CB Open Time	50 ms	1 000 ms	50 ms
CB Close S'vision	No	Yes	
CB Close Time	50 ms	1 000 ms	50 ms
CB Open Alarm ?	No	Yes	
CB Open NB	0	50 000	1
ΣAmps (n) ?	No	Yes	
ΣAmps (n)	0	4 000 E6	1 E6
n	1	2	1
t Open Pulse	100 ms	5 000 ms	100 ms
t Close Pulse	100 ms	5 000 ms	100 ms

The circuit breaker condition monitoring counters will be updated every time the relay issues a trip command. In cases where the breaker is tripped by an external protection device it is also possible to update the CB condition monitoring. This is achieved by allocating one of the logic inputs or via the communication to accept a trigger from an external device.

21.2 Setting guidelines

21.2.1 Setting the ΣI^n Thresholds

Where overhead lines are prone to frequent faults and are protected by oil circuit breakers (OCB's), oil changes account for a large proportion of the life cycle cost of the switchgear. Generally, oil changes are performed at a fixed interval of circuit breaker fault operations. However, this may result in premature maintenance where fault currents tend to be low, and hence oil degradation is slower than expected.

The ΣI^n counter monitors the cumulative severity of the duty placed on the interrupter allowing a more accurate assessment of the circuit breaker condition to be made.

For OCB's, the dielectric withstand of the oil generally decreases as a function of ΣI^2t. This is where 'I' is the fault current broken, and 't' is the arcing time within the interrupter tank (not the interrupting time). As the arcing time cannot be determined accurately, the relay would normally be set to monitor the sum of the broken current squared, by setting ***n*** = 2.

For other types of circuit breaker, especially those operating on higher voltage systems, practical evidence suggests that the value of ***n*** = 2 may be inappropriate. In such applications ***n'*** may be set to 1.

An alarm in this instance may be indicative of the need for gas/vacuum interrupter HV pressure testing, for example.

It is imperative that any maintenance programme must be fully compliant with the switchgear manufacturer's instructions.

21.2.2 Setting the Number of Operations Thresholds

Every operation of a circuit breaker results in some degree of wear for its components. Thus, routine maintenance, such as oiling of mechanisms, may be based upon the number of operations. Suitable setting of the maintenance threshold will allow an alarm to be raised, indicating when preventative maintenance is due.

Should maintenance not be carried out, the relay can be set to lockout the autoreclose function on reaching a operations threshold. This prevents further reclosure when the circuit breaker has not been maintained to the standard demanded by the switchgear manufacturer's maintenance instructions.

Certain circuit breakers, such as oil circuit breakers (OCB's) can only perform a certain number of fault interruptions before requiring maintenance attention. This is because each fault interruption causes carbonising of the oil, degrading its dielectric properties.

21.2.3 Setting the Operating Time Thresholds

Slow CB operation is also indicative of the need for mechanism maintenance. Therefore, alarm is provided and is settable in the range of 100 ms to 5 s. This time is set in relation to the specified interrupting time of the circuit breaker.

22. UNDERCURRENT PROTECTION FUNCTION (P122 & P123 ONLY)

The MiCOM P122 & P123 relays include 2 undercurrent elements. One is dedicated for the CB fail detection (see CB failure protection section).

An another one can be used to provide some additional functions to the protection function to prevent damage/further damage to the power system. This function allows typical applications such as loss of load.

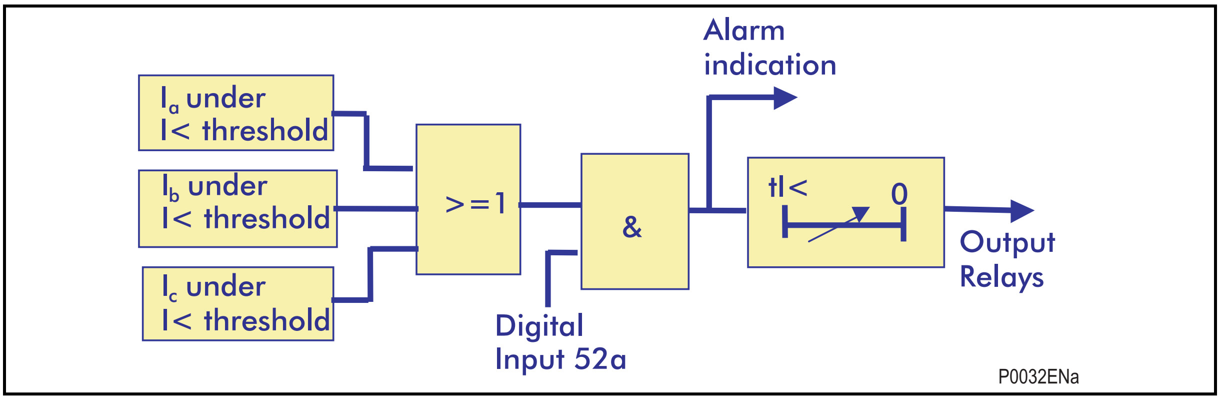

FIGURE 13 : UNDERCURRENT PROTECTION LOGIC

The undercurrent protection function is available only if the auxiliary contact of the CB status is connected to the relay. A logic input should be energised via the 52a contact of the CB.

In this way a logic input (1 to 5 for P123, 1 to 3 for P122) is allocated to the 52a function. See the ***AUTOMAT. CTRL/ Inputs x*** menu.

An alarm is given when :

– at least one of the 3 phase current is detected under the threshold I<

– and the CB is closed.

When the alarm condition has been present for longer than the set time tI<, one or more output relay can be energised.

See the ***AUTOMAT. CTRL/trip commands/Trip tI<*** menu for the allocation of tI< to the trip output relay RL1.

See the ***AUTOMAT. CTRL/Output Relays/ tI<*** menu for the allocation of tI< to the auxiliary output relay RL2 to RL8 (to RL6 for P122).

I< threshold is settable in the ***PROTECTION G1(2)/Undercurrent/ I<*** menu from 2% to 100% of the rated current In.

tI< time is settable in the ***PROTECTION G1(2)/Undercurrent/ tI<*** menu from 0 to 150s.

23. CIRCUIT BREAKER FAILURE PROTECTION : CBF (P122 & P123 ONLY)

Following inception of a fault one or more main protection devices will operate and issue a trip output to the circuit breaker(s) associated with the faulted circuit. Operation of the circuit breaker is essential to isolate the fault, and prevent damage / further damage to the power system.

For transmission/sub-transmission systems, slow fault clearance can also threaten system stability. It is therefore common practice to install circuit breaker failure protection, which monitors that the circuit breaker has opened within a reasonable time. If the fault current has not been interrupted following a set time delay from circuit breaker trip initiation, breaker failure protection (CBF) will operate.

CBF operation can be used to backtrip upstream circuit breakers to ensure that the fault is isolated correctly. CBF operation can also reset all start output contacts, ensuring that any blocks asserted on upstream protection are removed.

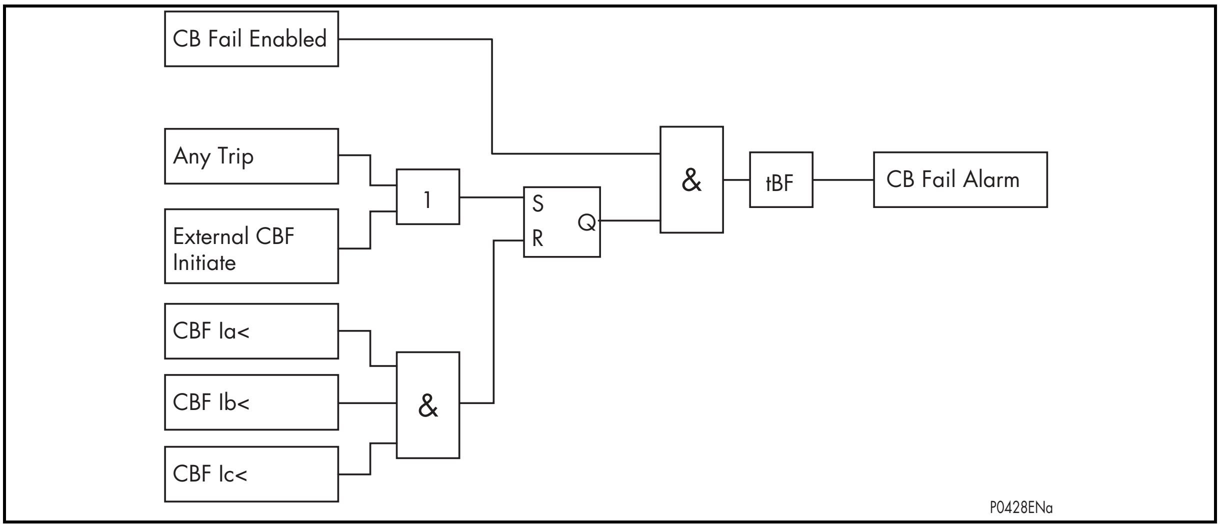

FIGURE 14 : CB FAIL PRINCIPLE

23.1 Circuit Breaker Failure Protection mechanism

The CB failure protection included in both MiCOM P122 & P123 product is performed as follows.

When a trip order is given through the output relay **RL1**, the t BF timer is initiated. Note, the trip order can be issued either from a protection element, or a logic input. Then the MiCOM relay monitors the current signal of each phase and it compares each phase current signal with the bandzone made by the undercurrent I< threshold. This threshold value is settable within the AUTOMAT. CTRL/CB FAIL menu.

Following the start of the t BF timer, the relay detects the first time when the current goes out the I< bandzone. At detection of this transition, the relay initiates an other timer which has a non-settable duration of 20 samples.

The relay sampling rate being 32 samples by cycle , this timer duration is 12,5 ms for a 50 Hz system and it is 10,4 ms for a 60 Hz system. During this time duration, the relay is checking if the current goes out the I< bandzone again. In the case where the current is not switched off, the current signal should again go out the I< bandzone at a time equal to 16 samples after the former detection (10ms at 50Hz).

And each time the relay detects the current goes out the I< bandzone, the relay initiates again a timer which has a duration of 20 samples and it checks again if the current would go out the I< bandzone.

In the window of 20 samples, the relay checks that the current signal going out the I< bandzone is in opposite way than the first one.

- If there is no current signal going out in opposite way than the first one, the relay states there is an opened CB pole condition. The « CB pole open » internal signal is initiated.
- If there is a current signal going out in opposite way than the first one, the relay states the pole of the CB is not yet open. The « CB pole closed » internal signal is maintained.

At the drop off the t BF time delay, the relay checks what is the internal status of each pole of the breaker device. If one or several internal signals mention one or several are not opened, the P122/P123 relay initiates the CB FAIL signal. The "CB failure" message is displayed.

Note the possibility to start the CB fail detection function by a digital input without trip order given by the MiCOM relay. In this case the tBF timer starts on the digital input. If the CB is not open (by an another protection relay) at the end of tBF, the MiCOM relay initiates the CB FAIL signal.

The configuration of the digital input to the "CB Fail detection" function is done in the AUTOMAT. CTRL/Inputs menu.

The Figure 15 below shows a CB Fail detection start further to the trip order :

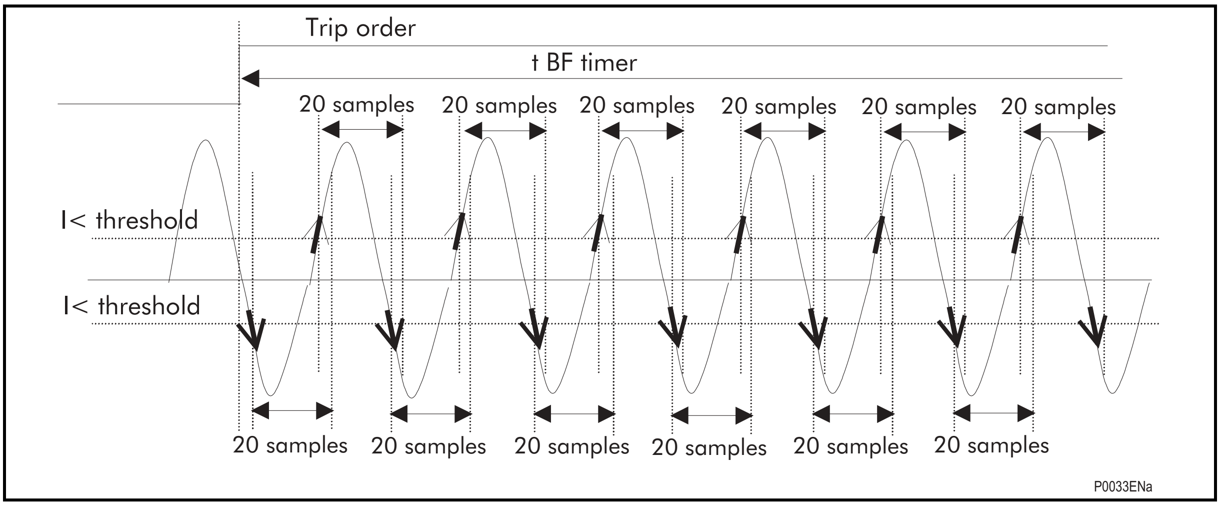

FIGURE 15 : CB FAIL DETECTION PRINCIPLE

The Figure 16 below shows a normal CB operation before tBF expired. No CB fail signal is given.

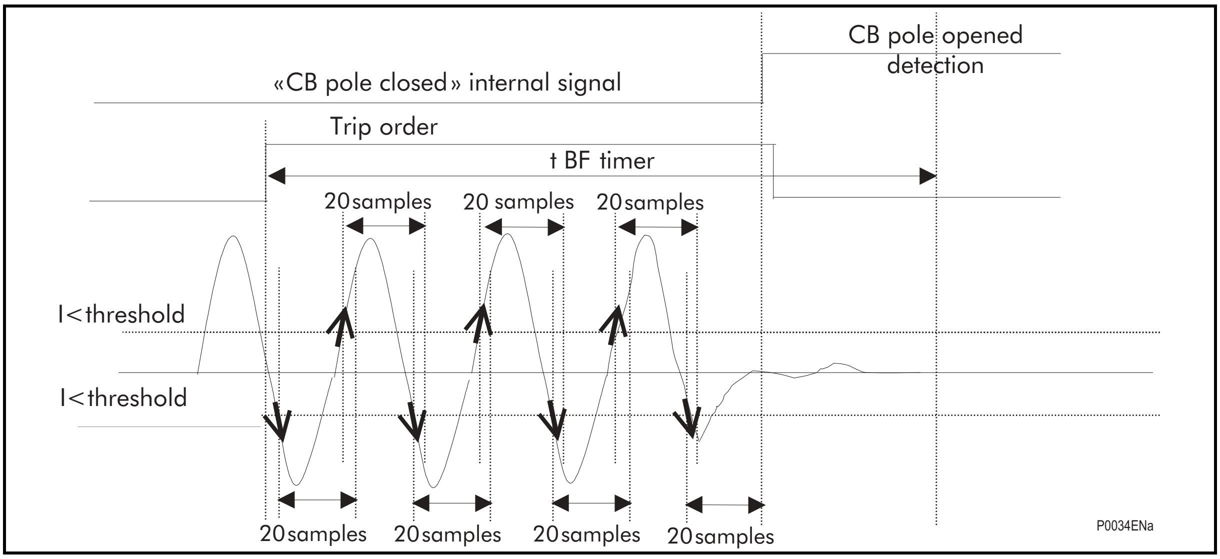

FIGURE 16 : CB OPEN BEFORE tBF EXPIRED

The Figure 17 below shows a CB failure condition. At the drop off of the t BF timer, the relay has not detected an opening of the CB pole. So a CB FAIL signal is initiated.

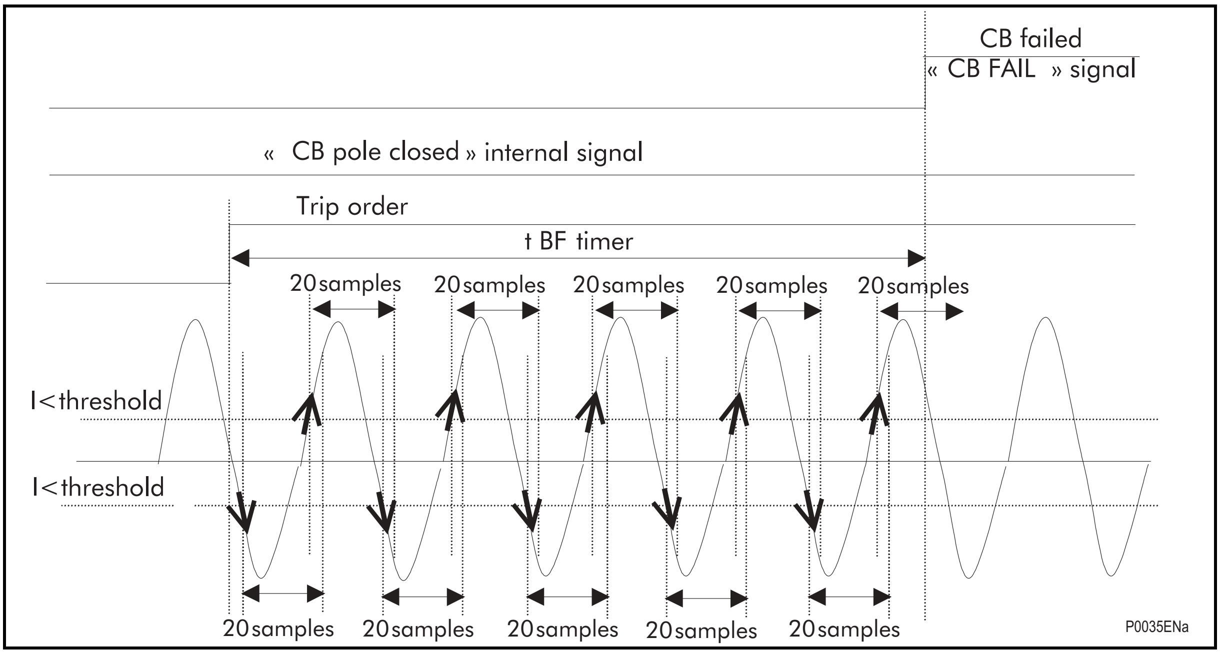

FIGURE 17 : CB NOT YET OPEN BEFORE tBF EXPIRED

The Figure 18 below shows an other case of normal CB operation. On fault clearance, the decreasing of the phase current signal takes time, often due to the de-energization of the phase CT. It is a typical case for TPY class CTs which are built with airgap in their magnetic core. Before the drop off of the t BF timer, the relay has detected an opening of the CB pole, thus no CB failure signal is given as it is required. A basic Breaker Failure element based on an simple undercurrent element would detect a false CB failure condition as the current signal value is outside the I< bandzone at the t BF timer drop off.

NOTE : Both « CB pole closed » and « CB pole opened » internal signals mentioned in the above diagrams are derived from the Circuit Breaker Failure function algorithm. They are not affected by the status of the relay opto-inputs wired to the 52a and 52b CB auxiliary contacts.

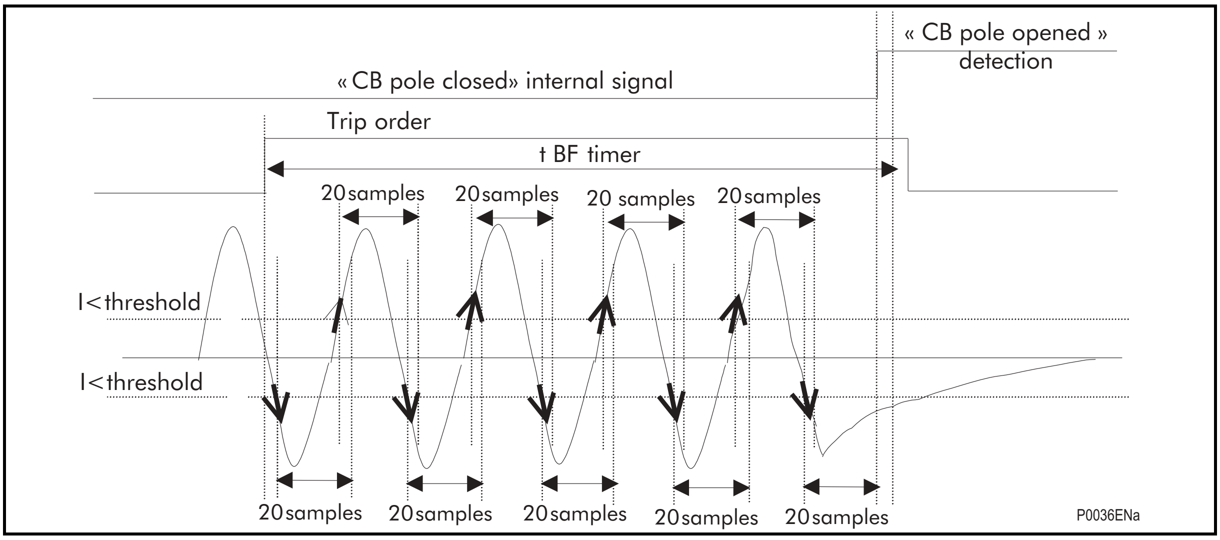

FIGURE 18 : DE-ENERGIZATION OF THE CT PHASE

The selection in the relay menu is grouped as follows:

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
CB Fail ?	No	Yes	
tBF	0.03 s	10 s	10 ms
I<	0.02 In	In	0.01 In

23.2 Typical settings

23.2.1 Breaker Fail Timer Settings

A typical timer setting used with a 2 ½ cycle circuit breaker is around 150 ms.

23.2.2 Breaker Fail Undercurrent Settings

The phase undercurrent settings (I<) must be set less than load current, to ensure that I< operation indicates that the circuit breaker pole is open. A typical setting for overhead line or cable circuits is 20% In, with 5% In common for generator circuit breaker CBF.

NOTE: The reset time of P122 and P123 is around 15 ms.

24. TRIP CIRCUIT SUPERVISION (P122 & P123 ONLY)

The trip circuit extends beyond the relay enclosure and passes through more components, such as fuse, links, relay contacts, auxiliary switch contact and so on.

These complications, coupled with the importance of the circuit, have directed attention to its supervision.

The simplest arrangement contains a healthy trip lamp with in serie a resistance placed in parallel with trip output relay of the protection relay.

24.1 Trip Circuit Supervision mechanism

The Trip Circuit Supervision function included in the **MiCOM P122 & P123** relays is performed as follow :

An binary input shall be programmed to the AUTOMAT.CTRL/ CB Supervision/ TC Supervision function. For that the binary input is associated to the label « Trip Circ » within the AUTOMAT.CTRL/Inputs menu. Then, this binary input shall be inserted in the trip circuit according to one of the hereafter typical application diagrams.

When the function TC Supervision is set « Yes » within CB SUPERVISION sub-menu, the relay checks continuously the trip circuit continuity whatever the CB status – opened CB or closed CB. This function is enabled when the trip output contact (relay **RL1**) is not energised and it is disabled as long as the trip output contact is operating.

A « TRIP CIRCUIT » (trip circuit failure) alarm is displayed and a “52 FAIL” signal is generated if the opto-input detects no voltage signal during a time longer than the settable timer tSUP.

As this function is disabled when the trip output contact is operating, this function is suitable for use with the product latching logic on.

The tSUP timer can be set following the below table :

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
TC Supervision ?	Yes	No	
tSUP	100ms	10s	50ms

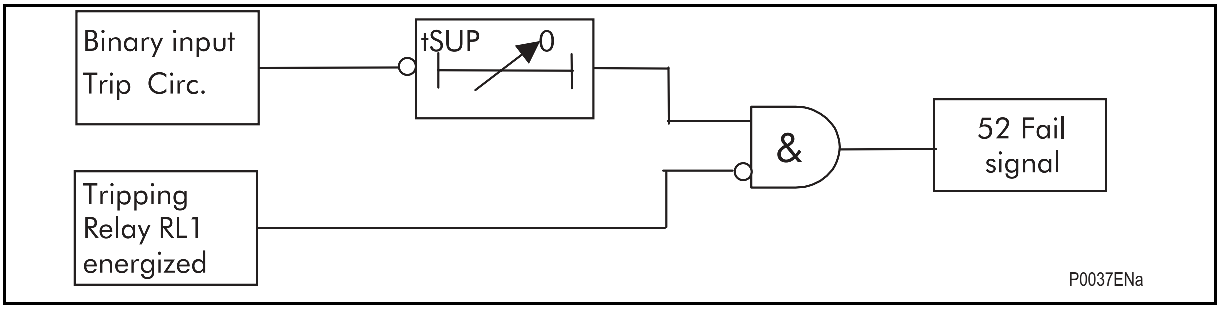

FIGURE 19 : TRIP CIRCUIT SUPERVISION PRINCIPLE DIAGRAM

Three examples of application are given below.

NOTE : it is considered that the CB is fitted out with its own safety device.

Example 1

In this example only the 52a auxiliary contact is available, the MiCOM relay monitors the trip coil whatever the CB status (CB open or CB closed).

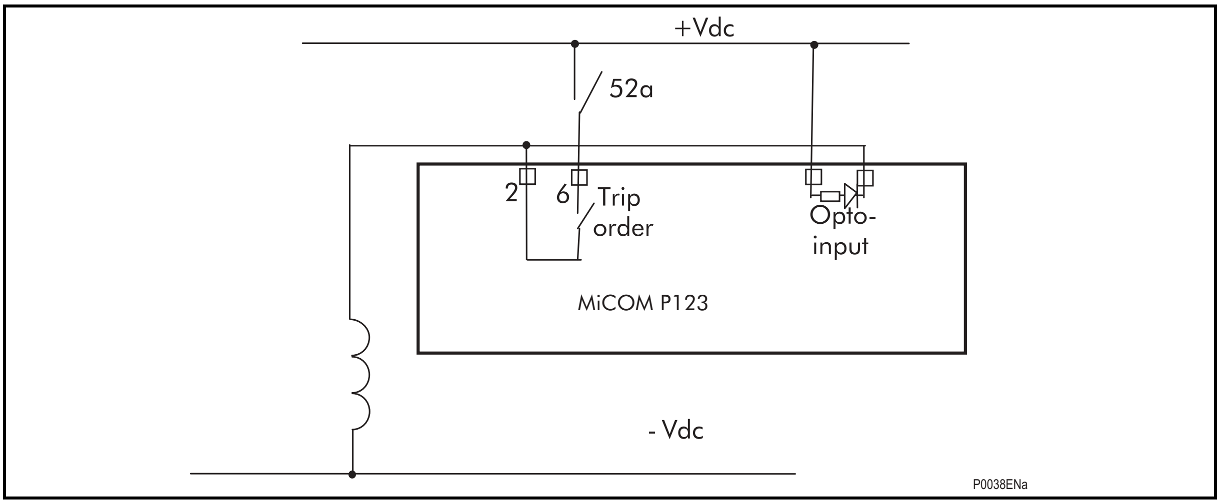

FIGURE 20 : TRIP COIL MONITORING

Example 2

In this example both 52a and 52b auxiliary contacts are available, the MiCOM relay monitors the whole of the trip circuit when the CB is closed and a part of the trip circuit when the CB is open.

In this case a resistor R1 is necessary in series with 52b to avoid short circuit between +Vdc and –Vdc , if either the contact trip order is latched or it stays involuntary closed, or a long time trip pulse is programmed.

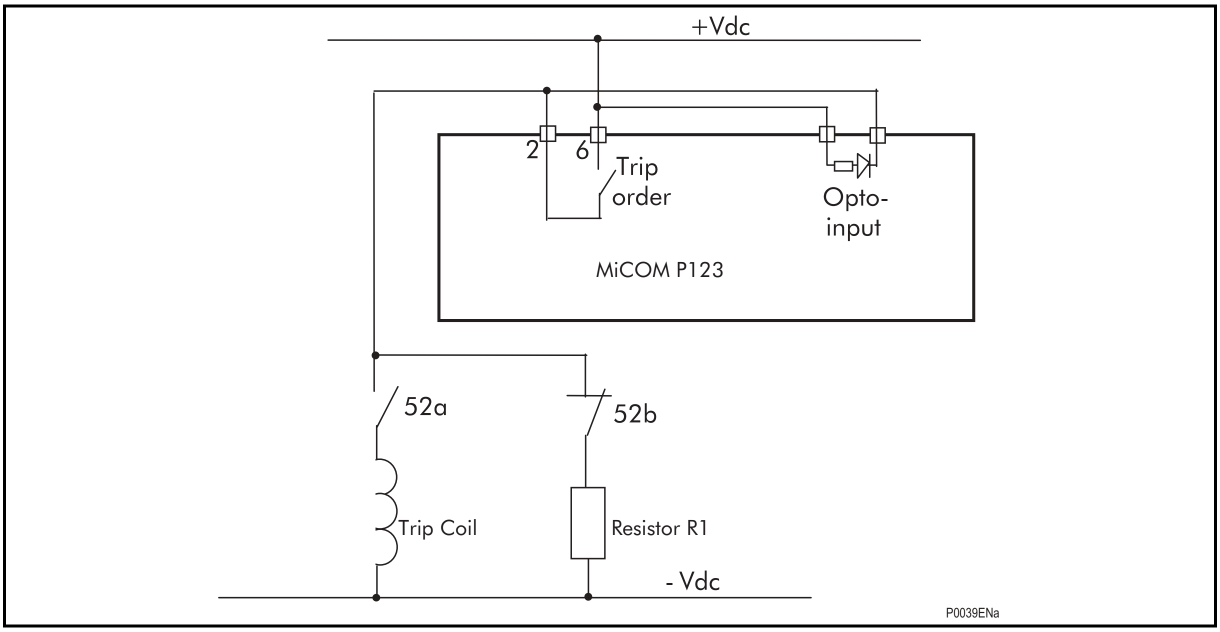

FIGURE 21 : TRIP COIL AND AUXILIARY CONTACTS MONITORING

Example 3

In this example both 52a and 52b auxiliary contacts are available, the MiCOM relay monitors the whole of the trip circuit whatever the CB status (CB open or CB closed).

In this case a resistor R1 is necessary to avoid a full current in the trip coil with CB already open (52a open), if either the contact trip order is latched, or it stays involuntary closed, or a long time trip pulse is programmed.

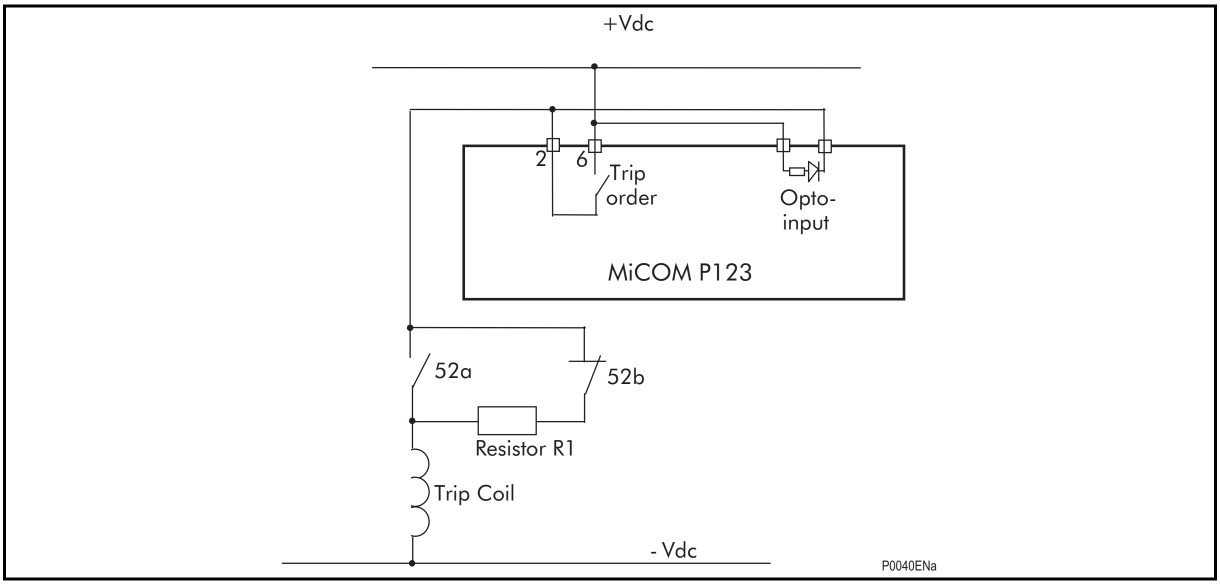

FIGURE 22 : TRIP COIL AND AUXILIARY CONTACTS MONITORING WHATEVER THE POSITION OF THE CB

EXTERNAL RESISTOR R1 CALCULATION

The calculation of the R1 resistor value will take in account a minimum current value flowing through the opto-input. This minimum current value is function of the relay auxiliary voltage range.

1 - Case of example No 2 :

The R1 resistor maximum value (in Ohm) is defined by the following formula :

$R1 < (0,8 * Vdc – V_{mini}) / I_{mini}$

Where :

Vdc = auxiliary voltage value (dc voltage)

V_{mini} = internal minimum voltage value needful for the opto-input operation

I_{mini} = minimum current value needful for the opto-input operation

Relay auxiliary voltage range		
24 – 60 Vdc	48 – 150 Vdc	130 – 250 Vdc/110-250 Vac
R1<(0,8 * Vdc - 15)/0,0035	R1<(0,8 * Vdc - 25)/0,0035	R1<(0,8 * Vdc - 38)/0,0022

In addition, the R1 resistor withstand value (in Watt) is defined as below :

$P_{R1} > 2 * (1,2 * Vdc)^2 / R1$

2 - Case of example No 3 :

The R1 resistor maximum value (in Ohm) is defined by the following formula :

$R1 < (0{,}8 * Vdc - V_{mini}) / I_{mini} - R_{coil}$

Where :

Vdc = auxiliary voltage value (dc voltage).

V_{mini} = internal minimum voltage value needful for the opto-input operation

I_{mini} = minimum current value needful for the opto-input operation

R_{coil} = Trip coil resistance value

Relay auxiliary voltage range		
24 – 60 Vdc	48 – 150 Vdc	130 – 250 Vdc/110-250 Vac
$R1 < \frac{(0.8 \cdot Vdc - 15)}{0.0035} - R_{coil}$	$R1 < \frac{(0.8 \cdot Vdc - 25)}{0.0035} - R_{coil}$	$R1 < \frac{(0.8 \cdot Vdc - 38)}{0.0022} - R_{coil}$

In addition, the R1 resistor withstand value (in Watt) is defined as below :

$P_{R1} > 2 * (1{,}2 * Vdc)^2 / (R1 + R_{coil})$

REMARKS : The presence of auxiliary relays such an anti-pumping system for instance, in the trip circuit shall be taken into account for the R1 resistance values specification.

It is assumed the maximum variations of the auxiliary voltage value are -/+ 20%.

25. EVENT RECORDS (P122 & P123 ONLY)

The relay records and time tags up to 75 events and stores them in non-volatile (battery backed up) memory. This enables the system operator to establish the sequence of events that occurred within the relay following a particular power system condition, switching sequence etc. When the available space is exhausted, the oldest event is automatically overwritten by the new one.

The real time clock within the relay provides the time tag to each event, to a resolution of 1ms.

The event records are available for viewing either via the front panel RS232 port or remotely, via the rear RS485 port.

For extraction from a remote source via communications, refer to the Mapping Database of the Technical Guide, where the procedure is fully explained.

26. FAULT RECORDS. (P122 & P123 ONLY)

Each time any of the programmed threshold is crossed a fault record is created and stored in memory. The fault record tags up to 5 faults and stores them in non-volatile (battery backed up) memory. This enables the system operator to understand and analyse the network failures. When the available space is exhausted, the oldest fault is automatically overwritten by the new one.

Note that viewing of the actual fault record is carried out in the ***RECORD/Fault Record*** menu, which is selectable from up to 5 records. These records consist of fault flags, fault measurements etc. Also note that the time stamp given in the fault record itself will be more accurate than the corresponding stamp given in the event record as the event is logged some time after the actual fault record is generated.

The fault records are available for viewing either on the display, or via the front panel RS232 port or remotely, via the rear RS485 port.

For extraction from a remote source via communications, refer to the Mapping Database of the Technical Guide, where the procedure is fully explained.

27. INSTANTANEOUS RECORDER (P122 & P123 ONLY)

Each time any of programmed threshold is crossed an instantaneous record is created and displayed in the RECORDS/Instantaneous menu. The last five starting information with the duration of the information are available. The number of the fault, hour, date, origin (I>, I>>, I>>> or Ie>, Ie>>, Ie>>>), length (duration of the instantaneous), trip (a trip is appeared, yes or no) are displayed in the RECORDS/Fault Record menu.

28. DISTURBANCE RECORDER (P122 & P123 ONLY)

The integral disturbance recorder has an area of memory specifically set aside for record storage. The number of records that may be stored is 5 disturbance records of 3 seconds each. Disturbance records continue to be recorded until the available memory is exhausted, at which time the oldest record(s) are overwritten to make space for the newest one.

The recorder stores actual samples which are taken at a rate of 32 samples per cycle.

Each disturbance record consists of analogue data channels and digital data channels. (Note that the relevant CT ratios for the analogue channels are also extracted to enable scaling to primary quantities).

The ***RECORD/DISTURB RECORD*** menu is shown below :

MENU TEXT	SETTING RANGE		STEP SIZE
	MIN	MAX	
Disturb Record			
Pre-Time	100 ms	3000 ms	100 ms
Post-Time	100 ms	3000 ms	100 ms
Disturb Rec Trig	On Instantaneous	On Trip	

The total recording time is set by a combination of the pre and post fault recording times. For example, the default settings show that the pre-time time is set to 100 ms and if the post -time is set to 2.5 s, than the total disturbance recording time will be 2.6 s.

29. ROLLING AND PEAK VALUE DEMANDS (P122 & P123 ONLY)

The MiCOM P122 and P123 relays are able to store the 3 phases rolling average and maximum subperiod values. The description and principle of calculation are given bellow.

29.1 Rolling demand

The principle of the calculation of the rolling demand value for IA, Ib and IC currents is following :

– Calculation of the average of the RMS values on a "Rolling Sub Period" period.

The setting of the width of the period "Rolling Sub Period" is in the "RECORDS/Rolling Demand/Sub Period" menu.

Setting range : from 1 to 60 minutes.

– Storage of these values in a sliding window.

– Calculation of the average of these average values (sliding window values) on the number of "Num of Sub Periods" periods.

The setting of the number of Sub Period "Num of Sub Periods" in the "RECORDS/Rolling Demand/Num of Sub Per" menu.

Setting range : from 1 to 24.

– Display of the first result in the MEASUREMENTS menu only after the storage of "Num of Sub Periods" periods. The 3 phases Rolling average value are displayed :

Rolling Average IA RMS
Rolling Average IB RMS
Rolling Average IC RMS

– The calculation is reset by either "hand Reset" (by key ⓒ) without use of password, or a remote command.

NOTE : In case of loss of power supply the rolling demand are not stored.
A modification of the settings (either "Rolling Sub Period" or "Num of Sub Periods" parameter) reset the calculation.

Example :

Sub Period = 5 mn
Num of Sub Period = 2

```
        Sub Period 1                    Sub Period 2                    Sub Period 3
/ -------------------------------- / -------------------------------- / -------------------------------- /

            5 mn                            5 mn                            5 mn
 <----------------------------->   <----------------------------->   <----------------------------->
```

At the end of the Sub Period 2 :
Rolling average value = (average value 1 + average value 2)/2

At the end of the Sub Period 3 :
New Rolling average value = (average value 2 + average value 3)/2

29.2 Peak value demand

The principle of the calculation of the Peak value demand for IA, IB and IC currents is following :

Every "Rolling Sub Period", a new average value is compared with the previous value calculated at the previous "Rolling Sub Period". If this new value is greater than the previous value already stored, then this new value is stored instead of the previous one.
In the opposite if this new value is lower than the previous value already stored, then the previous value is kept stored.
In this way, a average peak vale will be refreshed each Sub Period;

There is no dedicated setting for this calculation. The setting of the Sub Period in the RECORDS menu is used.

The 3 phase Peak value demand are displayed in the MEASUREMENTS menu :

MAX SUBPERIOD IA RMS
MAX SUBPERIOD IB RMS
MAX SUBPERIOD IC RMS

– The calculation is reset by either "hand Reset" (by key ©) without use of password, or a remote command.

NOTE : In case of loss of power supply the Peak average values are stored.
A modification of the setting "Rolling Sub Period" parameter reset the calculation.

30. CT REQUIREMENTS

The CT requirements for the MiCOM P12x Overcurrent relays are given below.

The current transformer requirements are based on a maximum prospective fault current of 50 times the relay rated current (In) and the relay having an instantaneous setting of 25 times rated current (In). The current transformer requirements are designed to provide operation of all protection elements.

Where the criteria for a specific application are in excess of those detailed above, or the actual lead resistance exceeds the limiting value quoted, the CT requirements may need to be increased according to the formulae in the following sections.

Nominal Rating	Nominal Output	Accuracy Class	Accuracy Limit Factor	Limiting lead resistance
1A	2.5VA	10P	20	1.3 ohms
5A	7.5VA	10P	20	0.11 ohms

30.1 Definite time / IDMT overcurrent & earth fault protection

Time-delayed Phase overcurrent elements :

$$V_K \geq I_{cp}/2 * (R_{CT} + R_L + R_{rp})$$

Time-delayed Earth Fault overcurrent elements :

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

30.2 Instantaneous overcurrent & earth fault protection

CT requirements for instantaneous phase overcurrent elements :

$$V_K \geq I_{sp}/2 * (R_{CT} + R_L + R_{rp})$$

CT requirements for instantaneous earth fault overcurrent elements :

$$V_K \geq I_{sn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

30.3 Definite time / IDMT sensitive earth fault (SEF) protection

Time delay SEF protection :

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

SEF Protection - as fed from a core-balance CT :

Core balance current transformers of metering class accuracy are required and should have a limiting secondary voltage satisfying the formulae given below:

Time Delayed element:

$$V_K \geq I_{cn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

Instantaneous element:

$$V_K \geq I_{fn}/2 * (R_{CT} + 2R_L + R_{rp} + R_{rn})$$

Note that, in addition, it should be ensured that the phase error of the applied core balance current transformer is less than 90 minutes at 10% of rated current and less than 150 minutes at 1% of rated current.

Abbreviations used in the previous formulae are explained below:

Where :

VK = Required CT knee-point voltage (volts),
Ifn = Maximum prospective secondary earth fault current (amps),
Ifp = Maximum prospective secondary phase fault current (amps),
Icn = Maximum prospective secondary earth fault current or 31 times I> setting (whichever is lower) (amps),
Icp = Maximum prospective secondary phase fault current or 31 times I> setting (whichever is lower) (amps),
Isn = Stage 2 & 3 Earth Fault setting (amps),
Isp = Stage 2 and 3 setting (amps),
RCT = Resistance of current transformer secondary winding (ohms)
RL = Resistance of a single lead from relay to current transformer (ohms),
Rrp = Impedance of relay phase current input at 30In (ohms),
Rrn = Impedance of the relay neutral current input at 30In (ohms).

30.4 Low impedance restricted earth fault (REF) protection

$V_K \geq 24 * In * (R_{CT} + 2R_L)$ for $X/R < 40$ and if $< 15In$

$V_K \geq 48 * In * (R_{CT} + 2R_L)$ for $X/R < 40$, $15In < If < 40In$
and $40 < X/R < 120$, $If < 15In$

Where :

V_K = Required CT knee point voltage (volts),
I_n = Rated secondary current (amps),
R_{CT} = Resistance of current transformer secondary winding (ohms)
R_L = Resistance of a single lead from relay to current transformer (ohms),
If = Maximum through fault current level (amps).

30.5 High Impedance Restricted Earth Fault Protection

The High Impedance Restricted Earth Fault element shall maintain stability for through faults and operate in less than 40ms for internal faults provided the following equations are met in determining CT requirements and the value of the associated stabilising resistor:

$Rs = [K * (If) * (R_{CT} + 2R_L)] / I_S$

$V_K \geq 4 * Is * Rs$

K = 1 for Vk/Vs less or equal to 16
K = 1.2 for Vk/Vs greater than 16

Where :

V_K = Required CT knee-point voltage (volts),
Rs = Value of Stabilising resistor (ohms),
If = Maximum through fault current level (amps).
V_K = CT knee point voltage (volts),
I_S = Current setting of REF element (amps),
R_{CT} = Resistance of current transformer secondary winding (ohms),
R_L = Resistance of a single lead from relay to current transformer (ohms).

Commissioning and Maintenance Guide

CONTENTS

1.	**REQUIREMENTS PRIOR TO COMMISSIONING**	**3**
2.	**COMMISSIONING TEST ENVIRONMENT**	**4**
2.1	**Important notes**	**4**
2.1.1	Injection test sets	4
2.1.2	Additional commissioning test equipment	4
2.1.3	Communication	4
2.2	**Commissioning test sheets**	**4**
3.	**PRODUCT VERIFICATION TESTS**	**5**
3.1	**Allocation of terminals**	**5**
3.2	**Electrostatic discharge (ESD)**	**5**
3.3	**Visual inspection**	**5**
3.4	**Earthing**	**5**
3.5	**Current transformers (CT's)**	**5**
3.5.1	Use of a Core CT for earth faults.	5
3.6	**Auxiliary supply**	**7**
3.7	**Logic inputs**	**7**
3.8	**Logic outputs**	**8**
3.9	**RS 485 rear communication**	**9**
4.	**SETTING CHECK**	**10**
4.1	**Settings**	**10**
4.2	**Measurements**	**10**
4.2.1	MiCOM P120	10
4.2.2	MiCOM P121, P122 and P123	10
4.3	**Phase overcurrent (I> and I>>)**	**11**
4.3.1	Test wiring diagram	11
4.3.2	MiCOM settings	11
4.4	**Final checks**	**15**

5. MAINTENANCE 16

5.1 Equipment failure 16

5.1.1 Minor fault 16

5.1.2 Major fault 16

5.2 Method of repair 17

5.2.1 Replacing the active part 17

5.2.2 Replacing the complete relay 17

5.2.3 Changing the battery (**MiCOM P122** & **P123** only) 18

5.3 Problem solving 18

5.3.1 Password lost or not accepted 18

5.3.2 Communication 19

1. REQUIREMENTS PRIOR TO COMMISSIONING

The MiCOM P12x relays are fully numerical in their design, implementing all protection and non-protection functions in software. The MiCOM relays employ a high degree of self-checking and, in the unlikely event of a failure, will give an alarm. As a result of this, the commissioning test do not need to be as extensive as with non-numerical relays (static or electromechanical).

To commission MiCOM relays, it is only necessary to verify that the hardware is functioning correctly and the application-specific software setting have been applied to the MiCOM relay. It is considered unnecessary to test every function of the relay if the settings have been verified by one of the following method :

- Extracting the settings applied to the relay using the appropriate setting software MiCOM S1 (preferred method)
- Via the front panel user interface.

Reminder : It is not possible to download a new setting software as long as the programming mode is active.

To confirm that the product is operating correctly once the application-specific settings have been applied, a test should be performed on a single protection element.

Unless previously agreed to the contrary, the customer will be responsible for determining the application-specific settings to be applied to the MiCOM relays and for testing of any scheme logic applied by external wiring.

Blank commissioning test and setting records are provided at the APPENDIX 2 of the Technical Guide for completion as required.

WARNING : BEFORE COMMISSIONING THE RELAY, THE SAFETY SECTION OF THE MANUAL MUST BE READ.

2. COMMISSIONING TEST ENVIRONMENT

2.1 Important notes

All the commissioning tests of the **MiCOM P120, P121, P122** and **P123** relays are carried out by injecting currents to the secondary of the earth and/or phases CTs using appropriate injection test sets provided for this purpose.

2.1.1 Injection test sets

For reasons of convenience (weight, spatial requirement, transportation), a single-phased injection test set is more suitable for commissioning and is able to perform all commissioning tests regarding **MiCOM P120, P121, P122** and **P123** relays.

Thus, the following descriptions indicate how to conduct the commissioning tests with a single-phase injection test set.

However, for certain commissioning tests, the three-phase wiring diagrams are easier to understand and in this case the description is also given in three-phase format.

<u>Single-phase injection test set</u>

1 current (0 to 50 A), timer (precision 1 ms).

<u>Three-phase injection test set</u>

3 currents (0 to 50 A), timer (precision 1 ms).

2.1.2 Additional commissioning test equipment

- 1 multimeter (precision 1%),
- 1 connecting terminal to measure the currents exceeding 10 A (precision 2%),
- Test plugs and wires to carry out injections to the CT's secondary (dimension according to the currents injected).

2.1.3 Communication

For all commissioning tests, the records can be made by using the RS 485 communication on the rear connector of the **MiCOM P120, P121, P122** and **P123** relays or for **MiCOM P122** and **P123** using the RS232 front port.

According to each RS 485 communication protocol (MODBUS, Courier, IEC 60870-5-103, DNP3).

2.2 Commissioning test sheets

Commissioning test sheets are available in the APPENDIX 2 of the Technical Guide.

The presentation of the Commissioning test sheets follows the description of the tests of this chapter.

The contents of these Commissioning test sheets enable you to log :

The name of the relay, station and circuit

The characteristics of the **MiCOM P120, P121, P122** and **P123** relays

The various settings

The results of the protection and automation checks

The result of the test records after commissioning.

3. PRODUCT VERIFICATION TESTS

3.1 Allocation of terminals

It is necessary to consult the appropriate wiring diagram provided in the APPENDIX 1 of the Technical Guide whilst observing the various polarities and ground/earth connection.

3.2 Electrostatic discharge (ESD)

Before any handling of the module (active part of the relay), please refer to the recommendations in User guide of this Technical Guide.

3.3 Visual inspection

Carefully examine the relay to see if there has been any possible deterioration following installation.

Check if the external wiring corresponds to the appropriate relay diagram or the assembly diagram. The reference number of the relay diagram is indicated on a label situated under the upper flap of the front panel.

When the relay is withdraw from its case, use a continuity tester to check if the current short-circuits (phases and earth CT's) between the terminals indicated on the wiring diagram are closed.

3.4 Earthing

Check if the earth connection of the case situated above the rear terminal block is used to connect the relay to a local earth bar. With several relays present, make sure that the copper earth bar is properly installed for solidly connecting the earthing terminals of each case.

3.5 Current transformers (CT's)

DANGER :
NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

3.5.1 Use of a Core CT for earth faults.

If a core CT is used to detect earth faults, prior to any test, the user must check the following points:

MV or HV cable screens and core CT,

No current flow through the MV or HV cables,

Orientation of the core CT (P1-S1, P2-S2)

3.5.1.1 Cable shields and core CT

When mounting a core CT around electric cables, check the connection to the earth of the cable shields. It is vital that the earth cable of the shield moves in the opposite direction through the core CT. This cancel the currents carried by the cable shields through the core CT.

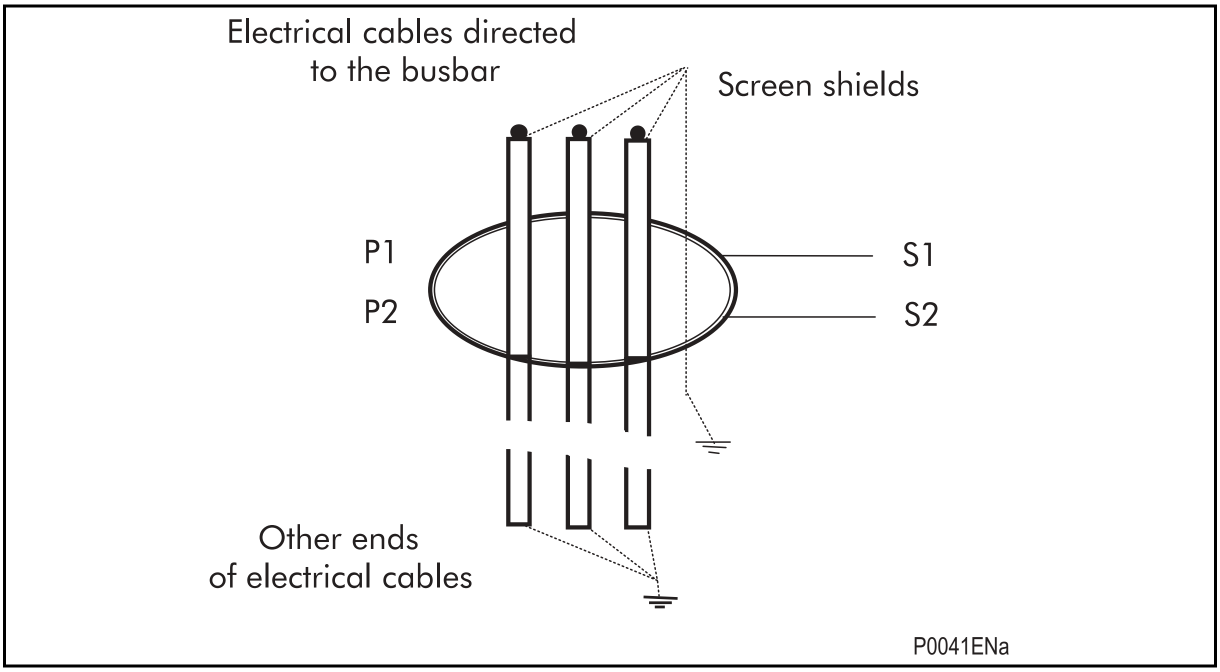

FIGURE 1 : SCREEN SHIELDS AND CT CORE

3.5.1.2 Induced current flow through electric cables

When an electric line is earthed at its two ends for logging purposes, induced current may circulate if a second line is in parallel. This current can be read on the **MiCOM P120, P121, P122** and **P123** and produce false readings.

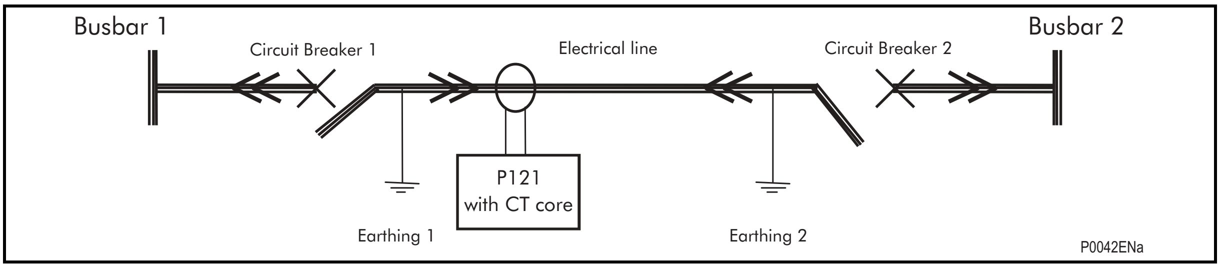

FIGURE 2 : LOGGING OF AN ELECTRICAL LINE

3.5.1.3 Core CT polarity

It is necessary to check the polarity of the core CT by following the figure below :

Momentarily connect the battery + to P1 and – to P2. The centre zero ammeter connected with + to S1 and – to S2 will deflect in the positive direction if the wiring is correct.

CT phase may be tested using the same method.

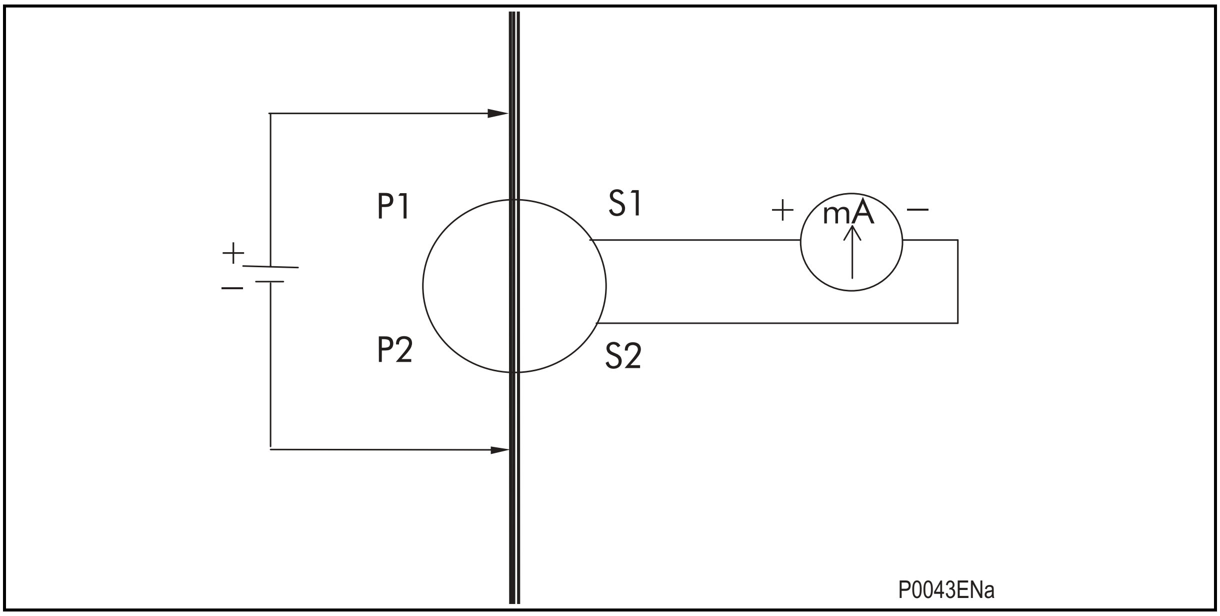

FIGURE 3 : CORE CT ORIENTATION TEST

NOTE : De-magnetise the CT after polarity test. Inject an ac current starting from zero and increase to slowly exceed the CT nominal value and then decrease slowly to zero.

3.6 Auxiliary supply

Check the value of the auxiliary supply voltage (terminals 33 and 34). The value measured shall be between 0.8 and 1.2 time the dc nominal auxiliary supply voltage, or 0.8 and 1.1 time the ac nominal auxiliary supply voltage indicated on the **MiCOM P120, P121, P122** and **P123**.

Uaux range (Volts)	Uaux nominal zone (Volts)	Maximum peak value (Volts)
24 - 60 Vdc	19 - 72 Vdc	80
48 - 150 Vdc	38 -180 Vdc	201
130 - 250 Vdc/100 - 250 Vac	100 - 300 Vdc/80 - 275 Vac	336

3.7 Logic inputs

This test checks that all the opto-isolated inputs are functioning correctly. The P123 have 5 opto-isolated inputs while P122 relays have 3 opto-isolated inputs and P120/P121 have 2 logic opto-isolated inputs.

The opto inputs should be energised on at a time. The status of the input can be viewed using menu OP. PARAMETERS/Input Status, an 1 indicating an energised input and a 0 indicating a de-energised input. When each logic input is energised one of the characters on the bottom line of the menu display will change to the value show in the following table to indicate the new state of the inputs.

Input	MiCOM P12x models	OP. PARAMETERS/Inputs Status cell value
Opto input 1 22-24 Terminals	P120,P121, P122, P123	00001
Opto input 2 26-28 Terminals	P120,P121, P122, P123	00010
Opto input 3 17-19 Terminals	P122, P123	00100
Opto input 4 21-23 Terminals	P123	01000
Opto input 5 25-27 Terminals	P123	10000

3.8 Logic outputs

This test checks that all outputs are functioning correctly. The P123 have 9 outputs while P122 relays have 7 outputs and P120/P121 have 5 outputs.

For all MiCOM relays, the WATCHDOG output is a normally close relays and is designed as WD (35-36), (normally open pin terminals 35-37).

For all MiCOM relays, the RL1 and RL2 are change-over relays (2-4-6, 8-10-12).

For all MiCOM relays, the RL3 and RL4 are normally open relays (14-16, 18-20).

For MiCOM P122 and P123 relays, the RL5 and RL6 are normally open relays (1-3, 5-7).

For MiCOM P123 relay, the RL7 and RL8 are normally open relays (9-11, 13-15).

Each output contact may have its own and independent power supply (refer to wiring schemes).

The status of the outputs can be viewed using menu OP. PARAMETERS/ Relay Status, an indicating an close output relay and a 0 indicating a open output relay. When each output relay is closed one of the characters on the bottom line of the menu display will change to the value show in the following table to indicate the new state of the inputs.

OUTPUT	MiCOM P12x models	OP. PARAMETERS/Relay Status cell value
RL 1	P120,P121, P122, P123	00000001
RL 2	P120,P121, P122, P123	00000010
RL 3	P120,P121, P122, P123	00000100
RL 4	P120,P121, P122, P123	00001000
RL 5	P122, P123	00010000
RL 6	P122, P123	00100000
RL 7	P123	01000000
RL 8	P123	10000000

3.9 RS 485 rear communication

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communication protocol being adopted (refer to label under the upper flap).

It is not the intention of the test to verify the operation of the complete system from the relay to the remote location, just the relay's rear communication port and any protocol converter necessary.

Connect a laptop PC to the RS485 rear port (via a KITZ for Courier communication) and check the communication with the appropriate command.

4. SETTING CHECK

The setting checks ensure that all of the application-specific relay setting for the particular installation have been correctly applied to the relay.

Transfer the setting file to the relay using a laptop PC running the appropriate software via the RS232 front port (MiCOM P122 and P123) or the RS485 rear port (all MiCOM models). This method is preferred transfer function settings because it is much faster and there is less margin for error.

If the setting software is not used then enter manually via the relay front panel interface.

The commissioning is following the points below:

1. Consignation of the settings
2. Validation of the measurements
3. Validation of the thresholds and associated timers.

4.1 Settings

Carry forward the settings on the commissioning test sheets.

4.2 Measurements

The **MiCOM P120, P121, P122** and **P123** relays measure phase and earth currents (P120 only one phase or earth) as a True RMS value up to the 10th harmonics. The value(s) indicated take account of the phase and/or earth CT ratio.

WARNING : MiCOM P120, P121, P122 AND P123 RELAYS HAVE 1 AND 5 AMP CURRENT INPUTS.
CHECK THAT THE INJECTED CURRENT IS COMPATIBLE WITH THE SELECTED RANGE.

4.2.1 MiCOM P120

- Note the select CT ratio.
- Energise the **MiCOM P120** relay.
- Apply current to input terminals 55-56 or 47-48 and verify the value on the LCD display.
- Carry forward the results to the Commissioning test sheets (Applied value and relay value displayed)

4.2.2 MiCOM P121, P122 and P123

- Note the select phase and earth CTs ratio.
- Energise the **MiCOM P121, P122** or **P123** relay.
- Apply current to input (as per wiring diagram) and verify the values on the LCD display.
- Carry forward the results to the Commissioning test sheets (Applied values and relay values displayed).

4.3 Phase overcurrent (I> and I>>)

Set the various thresholds on the trip output (refer to User Guide). For **MiCOM P120**, the same test can be performed for the phase/or earth threshold.

4.3.1 Test wiring diagram

This test wiring diagram makes it possible to conduct tests relating to the I> and I>> thresholds.

The diagram describes current injection onto the 5 Amp phase current inputs (terminals 41-42, 43-44, 45-46). To carry out injection for the 1 Amp phase inputs, perform the same test on the 1 Amp inputs (terminals 49-50, 51-52, 53-54).

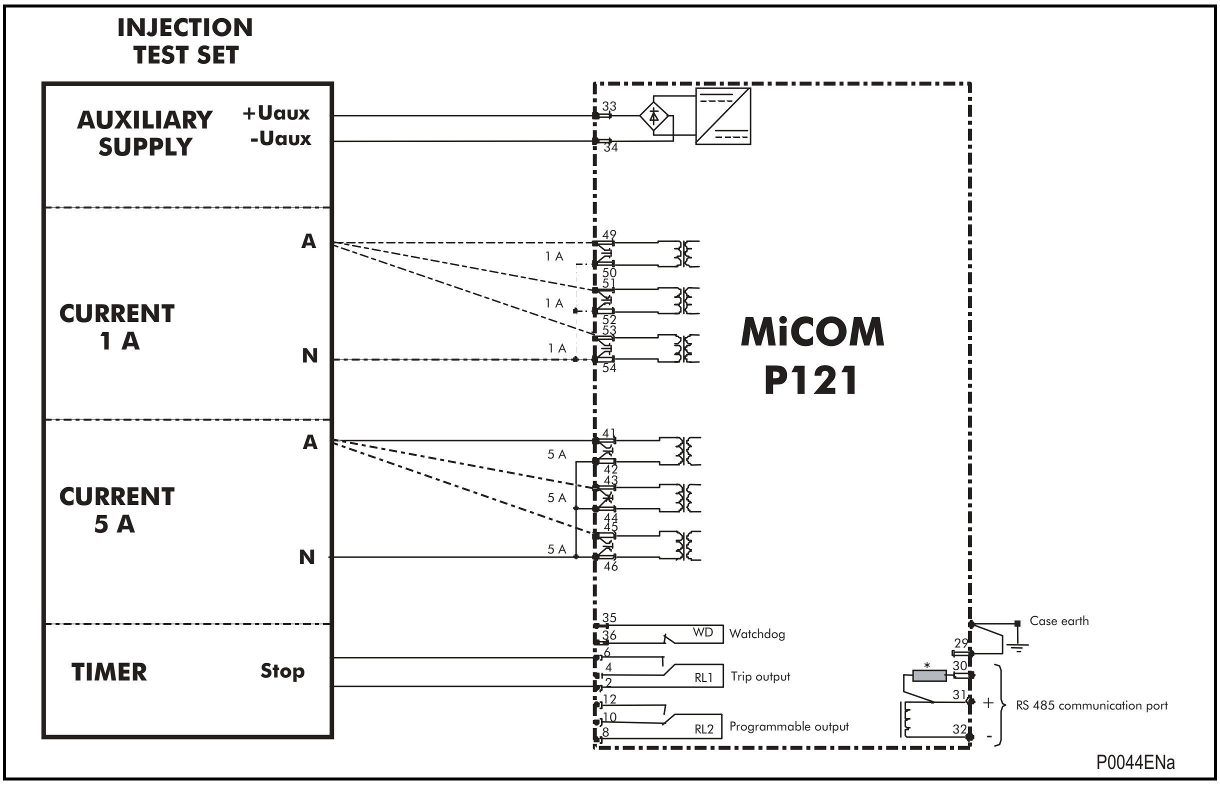

FIGURE 4 : I> AND I>> TESTS WIRING

4.3.2 MiCOM settings

4.3.2.1 MiCOM P120 Settings

Protection Menu

I_e>	YES
I_e>	1 In
tI_e>	DMT or IDMT or RI
tI_e> (if DMT)	20 s
Type of curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)	1
K value (if RI)	1
I_e>>	YES
I_e>>	12 In
tI_e>>	10 s

AUTOMAT. CTRL/Trip commands Menu

TRIP tI_e>	YES
TRIP tI_e>>	YES

4.3.2.1.1 MiCOM P121, P122 and P123 settings

Protection Menu

I>	YES
I>	1 In
tI>	DMT or IDMT or RI
tI> (if DMT)	20 s
Type of curve (if IDMT)	IEC VI or IEEE VI
TMS value (if IDMT)	1
K value (if RI)	1
I>>	YES
I>>	12 In

AUTOMAT. CTRL/Trip commands Menu

TRIP tI>	YES
TRIP tI>>	YES

4.3.2.2 I> threshold with DMT tI>

Values to be recorded :

I> threshold for each phase

Time delay tI> for each phase.

I> threshold check:

If the time delay tI> is short, gradually increase the injection current up to the value of the I> threshold.

If the time delay tI> is long, inject 0.95 x I threshold and check that there is no tripping. Then inject 1,1 x I threshold and check the trip.

Gradually decreases the injected current and record the value of the drop out I> threshold.

Checks :

Alarm message on the LCD display.

Alarm LED flashes.

Trip LED on

I> threshold LED on (if programmed).

Trip output closes.

I> threshold output closes (if programmed).

tI> time delay check :

Apply a current onto one of the phases and measure the time delay tI> by pre-setting the current above the I> threshold (I injected > 2 x I threshold).

Apply a current onto one of the phases and measure the time delay tI> by pre-setting the current above the I> threshold (I injected > 10 x I threshold).

4.3.2.3 I> threshold with IDMT tI>

Values to be recorded :

I> threshold for each phase

tI>time delay for each phase.

I> threshold check:

Inject a current equal to 2 x I threshold onto one of the phase current inputs. Repeat the operation for various current values (n x I threshold with n ranging from 4 to 10, for example). Check that the values measured correspond to those indicated in the table below (for TMS = 1).

IEC curves

Type of curve	Tripping time (in seconds) for TMS =1					
IEC	2 x I threshold			10 x I threshold		
	Nominal	Min	Max	Nominal	Min	Max
Accuracy	+/- 12.5 % for nominal tripping time greater than 40ms. +/- 50 ms for nominal tripping time less than 40ms.			+/- 5 % for nominal tripping time greater than 40ms. +/- 20 ms for nominal tripping time less than 40ms.		
STI (Alstom)	1.78	1.56	2.00	0.518	0.492	0.544
SI	10.03	8.78	11.28	2.971	2.822	3.119
VI	13.5	11.81	15.19	1.5	1.425	1.575
EI	26.67	23.33	30.00	0.808	0.7676	0.8484
LTI (Alstom)	120	105.0	135.0	13.33	12.667	14.00

IEEE/ANSI curves

Type of curve	Tripping time (in seconds) for TMS =1					
IEEE/ANSI	2 x I threshold			10 x I threshold		
	Nominal	Min	Max	Nominal	Min	Max
Accuracy	+/- 12.5 % for nominal tripping time greater than 40ms. +/- 50 ms for nominal tripping time less than 40ms.			+/- 5 % for nominal tripping time greater than 40ms. +/- 20 ms for nominal tripping time less than 40ms.		
STI (CO2)	1.7319	1.515	1.948	0.5249	0.4987	0.5512
MI	3.8032	3.328	4.279	1.2068	1.1464	1.2671
LTI (CO8)	2.1633	1.893	2.434	0.2401	0.2201	0.2601
VI	7.0277	6.149	7.906	0.6891	0.6546	0.7235
EI	9.5215	8.33	10.71	0.4063	0.3860	0.4267

RI electromechanical curve

Type of curve	Tripping time (in seconds) for K =1			
Electromechanical	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
RI	4.5	4 - 5	3.2	2.8 - 3.6

Rectifier curve

Type of curve	Tripping time (in seconds) for TMS =1			
Rectifier	2 x I threshold		10 x I threshold	
	Nominal	Min - Max	Nominal	Min - Max
RC	966	917 - 1014	0.402	0.382 - 0.422

Laborelec curve

Type of curve	Tripping time (in seconds)			
	Primary zero sequence 1A		Primary zero sequence 40A	
	Nominal	Min - Max	Nominal	Min - Max
Laborelec 1	4	3.80 - 4.20	0.5	0.48 - 0.52
Laborelec 2	4.5	4.22 - 4.73	1	0.96 - 1.04
Laborelec 3	5	4.75 - 5.25	1.5	1.44 - 1.56

For other injected current values, compare the values found with the theoretical values calculated according to the formulae of the curves.

NOTE : Equations of IEC, IEEE/ANSI, RI, RC and Laborelec curves are given in Chapter "Application Guide" of the present Technical Guide.

Checks :

Display of an alarm message on the front panel LCD.

Alarm LED flashes.

Trip LED on

I> threshold LED on (if programmed).

Trip output closes.

I> threshold output closes (if programmed).

4.3.2.4 I>> threshold

Values to be recorded

I>> threshold for each phase

tI>> time delay for each phase

I>> threshold check :

If tI>> time delay is short, gradually raise the injection current up to the value of I>> threshold.

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.

Gradually lower the injected current and note the value of the drop out I>> threshold.

Checks :

Display of an alarm message on the front panel LCD.

Alarm LED flashes

Trip LED on

I>> threshold LED on (if programmed).

Trip output closes.

I>> threshold output closes (if programmed).

tI>> time delay check :

Apply a current onto one of the phases and measure the time delay tI>> by pre-setting the current above the I>> threshold (I injected > 2 x I threshold).

Apply a current onto one of the phases and measure the time delay tI>> by pre-setting the current above the I>> threshold (I injected > 10 x I threshold).

4.4 Final checks

The tests are now complete. Remove all test or temporary shorting leads, etc… If it is necessary to disconnect any of the external wiring from the relay in order to perform the wiring verification tests, it should be ensured that all connections are replace in accordance with the relevant external connection or scheme diagram.

If a MMLG test block is installed, remove the MMLB01 test plug and replace the MMLG cover so that the protection is put into service.

For **MiCOM P122** and **P123** models, ensure that all event, fault and disturbance records, alarm and LEDs have been reset before leaving the relay.

For **MiCOM P123**, if the relay is in a new installation or the circuit breaker has been just maintained, the circuit breaker maintenance and current counters should be zero. These counters can be reset using command in RECORD/CB Monitoring menu (refer to User Guide).

5. MAINTENANCE

5.1 Equipment failure

MiCOM P120, P121, P122 and **P123** relays are full digital and self-diagnosing. As soon as an internal fault is detected, depending on its type (minor or major), an alarm message is displayed as a priority on the front panel LCD before the fault LED is illuminated (fixed or flashing) and the watchdog relay is closed (if the fault is a major one).

An equipment failure (major or minor) cannot be acknowledged on the front panel (using the dedicated tactile button keypad). Only the disappearance of the cause will acknowledge the fault and hence reset the fault LED.

All tests are performed during relay boot and permanently in the background software task excepted EEPROM tests performed only when relay boots and on any setting change.

All tests are performed during relay boot and permanently in the background software task excepted EEPROM tests performed only when relay boots and on any setting change.

5.1.1 Minor fault

Regarded by the **MiCOM P120, P121, P122** and **P123** relays as a minor fault is a communication failure. If the communication is in fault, **MiCOM P120, P121, P122** and **P123** protection and automation modules are not affected. The MiCOM relay is fully operational. The watchdog relay is energised (35-36 contact open and 36-37 contact closed).

Message :

"COMM.ERROR" : Communication fault

Cause :

Hardware or software failure of the communication module

Action :

Withdraw the active part and return it to the factory for repair.

Alternative : If communication is not used, disable communication in the COMMUNICATION menu (Communication ? = No).

Message :

"RAM ERROR" : Ram supplied by battery in fault.

"Battery Fail" : Battery in fault.

Cause :

See Section 5.2.3 of this Commissioning and Maintenance Guide.
If the message still remain after restart, return the module to the factory for repair.

5.1.2 Major fault

Major fault for **MiCOM P120, P121, P122** and **P123** relays are all software and hardware failures except the communication faults. As soon as this type of failure is detected, the watchdog (WD) is de-energised (35-36 contact closed and 36-37 contact open) and all operations are stopped (protection, automation, communication).

5.1.2.1 Hardware and software faults

Messages :

"DEFAULT SETTING" : Indication that the relay has its default setting

"SETTING ERROR" : Failure to get access to EEPROM during setting change

"EEPROM ERROR CALIBR." : Calibration zone in fault

"CT ERROR" : Analogue channel in fault

Cause :

Hardware or software failure

Action :

Restart the protection software (refer § 5.3).
If the software fault still remain after restart, withdraw the active part and return the module to the factory for repair.

5.2 Method of repair

5.2.1 Replacing the active part

The case and the rear terminals blocks have been designed to facilitate removal of the MiCOM P12x relay should replacement or repair become necessary without disconnect the scheme wiring.

NOTE : The MiCOM range of relays have integral current transformer shorting switches which will close when the active part is removed from the case.

Remove the upper and lower flap without exerting excessive force. Remove the external screws. Under the upper flap, turn the extractor with a 3 mm screwdriver and extract the active part of the relay by pulling from the upper and lower notches on the front panel of the MiCOM relay.

The reinstall the repaired or replacement relay follow the above instruction in reverse, ensuring that no modification has been done on the scheme wiring.

5.2.2 Replacing the complete relay

To remove the complete relay (active part and case) the entire wiring must be removed from the rear connector.

Before working at the rear of the relay, isolate all current supplies to the MiCOM relay and ensure that the relay is no more powered.

DANGER :
NEVER OPEN CIRCUIT THE SECONDARY CIRCUIT OF A CURRENT TRANSFORMER SINCE THE HIGH VOLTAGE PRODUCED MAY BE LETHAL AND COULD DAMAGE INSULATION.

Remove all wiring (communication, logic inputs, outputs, auxiliary voltage, current inputs). Disconnect the relay earth connection from the rear of the relay.

Remove the screws used to fasten the relay to the panel, rack, etc… .These are the screws with the larger diameter heads that are accessible when the upper and lower flaps are installed.

Withdraw the relay from the panel, rack, etc… carefully because it will be heavy due to the internal transformers.

To reinstall the repaired or replacement relay follow the above instructions reverse, ensuring that each terminal block is relocated in the correct position and case earth, communication are replaced.

Once reinstallation is complete the relay should be recommissioned using the instruction in sections 1 to 4 inclusive of this chapter.

5.2.3 Changing the battery (**MiCOM P122** & **P123** only)

Each **MiCOM P122** and **P123** relay has a battery to maintain recording data and the correct time when the auxiliary voltage fails. The data maintained include event, fault and disturbance records and the thermal state at the time failure.

The battery is designed for a life of 10 years in standard atmospheric conditions.

"RAM ERROR" message could be the result of a battery failure.

"Battery Fail" message is the result of a battery failure.

To replace the battery follow the following instructions :

- Open the lower flap on the front of the relay
- Gently extract the battery from its socket. If necessary, use a small screwdriver.
- Ensure that metal terminals in the battery socket are free from corrosion, grease and dust.
- The replacement battery should be removed from its packaging and placed into the battery holder, ensure that the polarity markings on the battery agree with those adjacent to the socket.

NOTE :
ONLY USE A TYPE 1/2AA LITHIUM BATTERY WITH A NOMINAL VOLTAGE OF 3.6 V.

- Ensure that the battery is securely held in its socket and that the battery terminals are making good contact with the metal terminals of the socket.
- Close the lower flap on the front of the relay.
- The battery that has been removed should be disposed of in accordance with the disposal procedure for Lithium batteries in the country in which the relay is installed.

5.3 Problem solving

5.3.1 Password lost or not accepted

Problem :

Password lost or not accepted

Cause :

MiCOM P120, P121, P122 and **P123** relays are supplied with the password set to ***AAAA.***
This password can be changed by the user (refer OP PARAMETERS menu).

Action :

There is an additional unique recovery password associated to the relay which can be supplied by the factory or service agent, if given details of its serial number (under the upper flap of the front panel). With this serial number, contact your ALSTOM local dealer or ALSTOM After Sales Dept.

5.3.2 Communication

5.3.2.1 Values measured locally and remotely

Problem :

The measurements noted remotely and locally (via RS485 communication) differ.

Cause :

The values accessible on the front face via the Measurement menu are refreshed every second. Those fed back via the communication and accessible by the ALSTOM T&D Setting software generally have skeletal refreshing frequencies. If the refreshing frequency of the supervision software differs from that of **MiCOM P120, P121, P122** and **P123** relays (1s), there may be a difference between indicated values.

Action:

Adjust the frequency for refreshing the measurements of the supervision software or of the setting software to 1 second.

5.3.2.2 MiCOM relay no longer responds

Problem :

No response from **MiCOM P120, P121, P122** and **P123** relays when asked by the supervision software without any communication fault message.

Cause :

Mainly, this type of problem is linked to an error in the **MiCOM P120, P121, P122** and **P123** communication parameters.

Action :

Check **MiCOM P120, P121, P122** and **P123** communication parameters (data rate, parity, etc.) are in accordance with the supervision settings.

Check **MiCOM P120, P121, P122** and **P123** network address.

Check that this address is not used by another device connected on the same LAN.

Check that the other devices on the same LAN answer to supervision requests.

5.3.2.3 A remote command is not taken in account

Problem :

The communication between the relay and the PC is correct, but the relay does not accept any remote command or file downloading.

Cause :

Generally this is due to the fact that the relay is in programming situation. This means that the password is active.

Action :

Check that the password is not active in the relay since the last 5 minutes.

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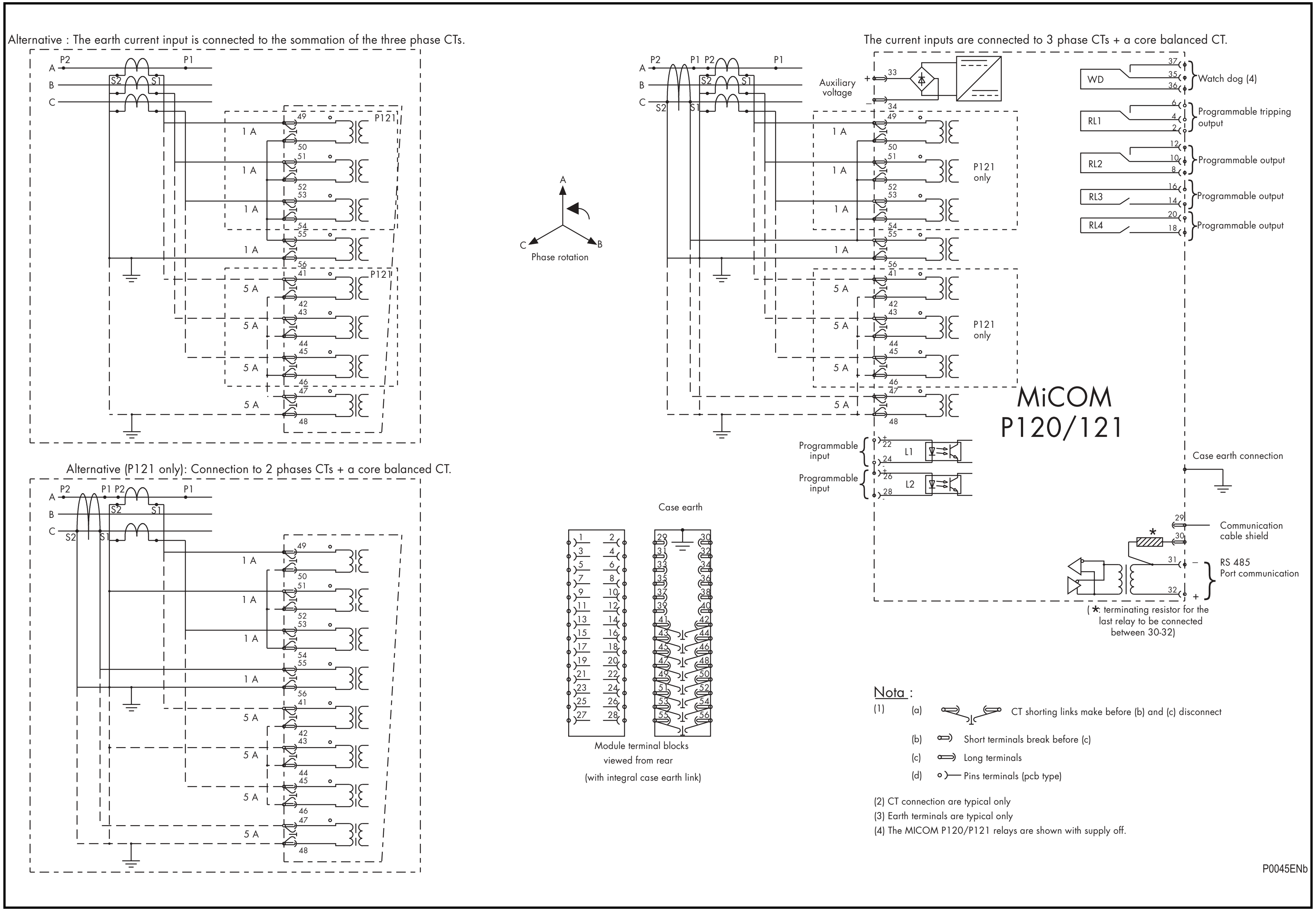
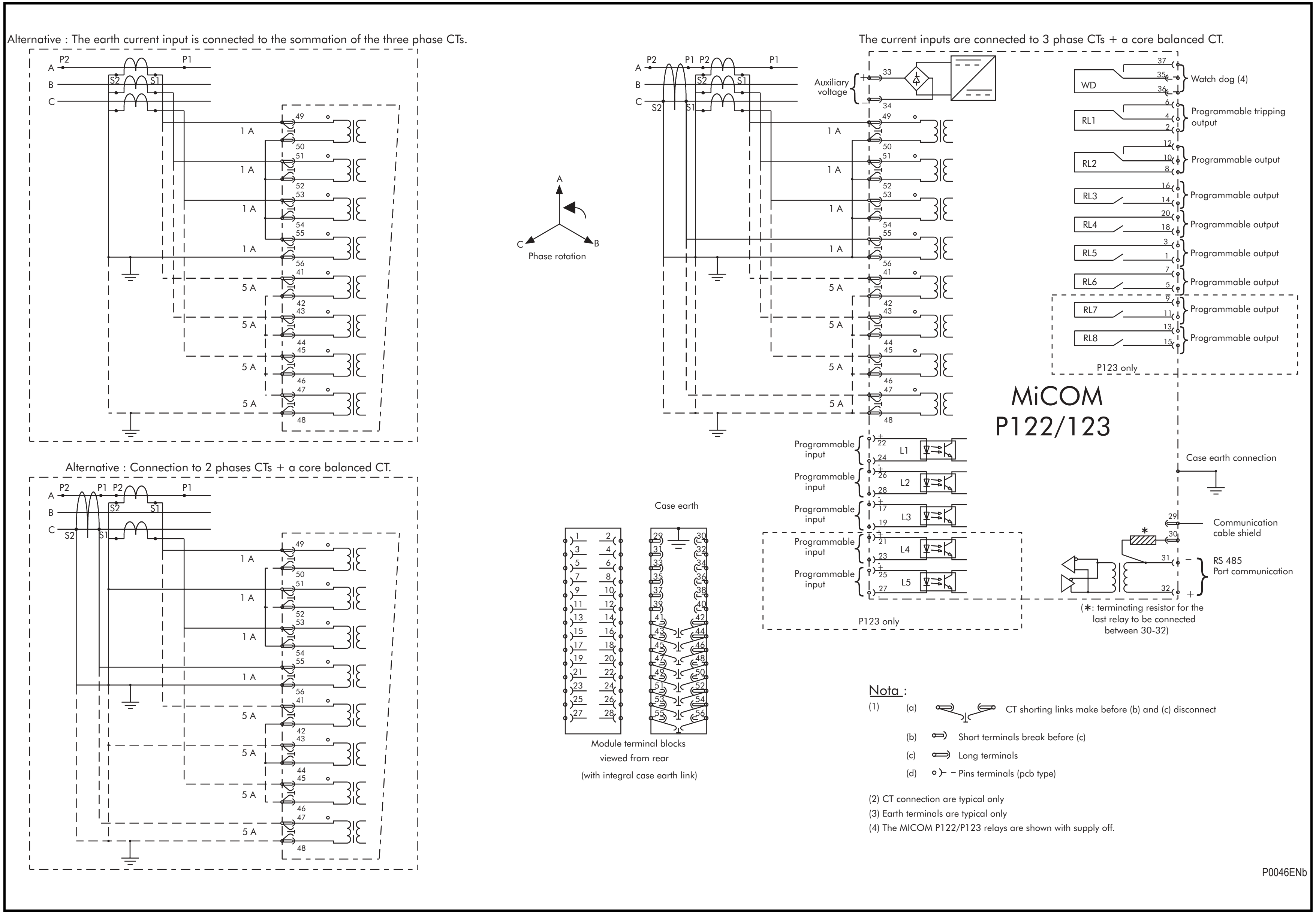
Connection Diagrams

SCHEME REPRESENTING MiCOM RELAY OFF

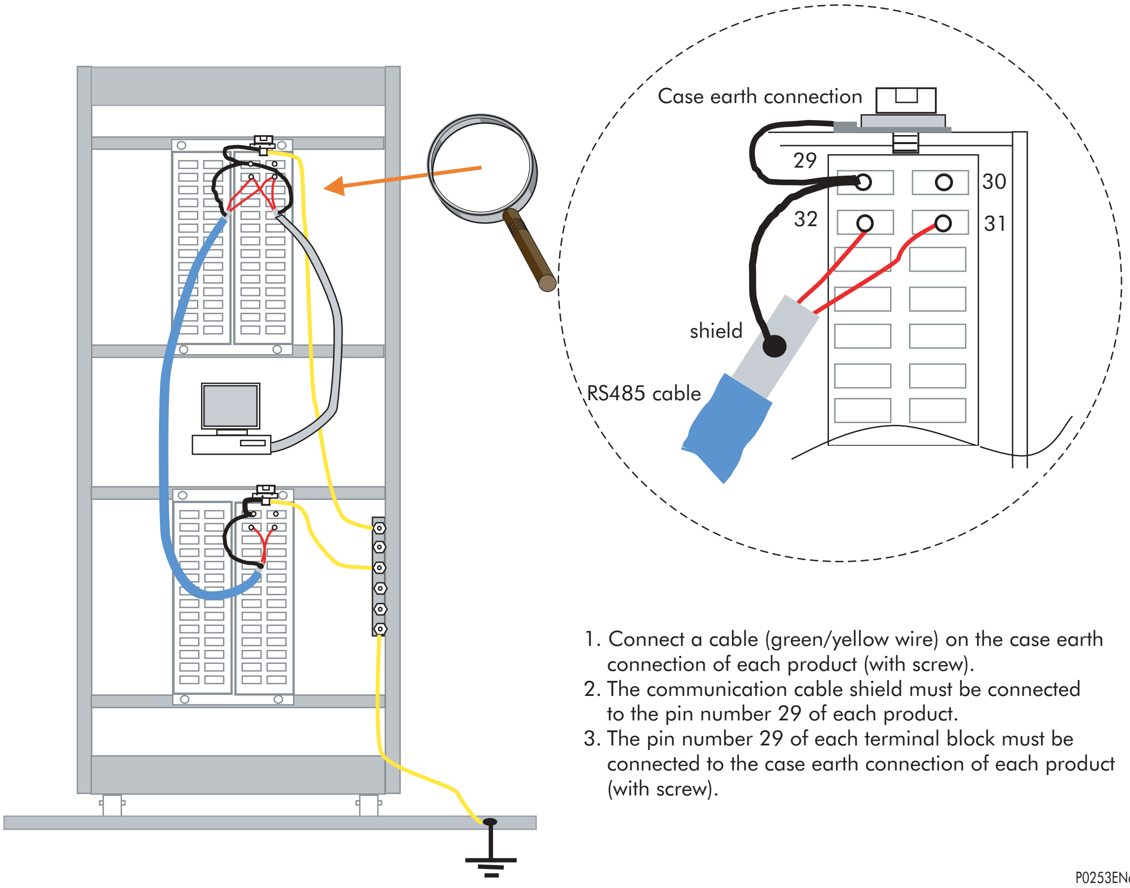


SCHEME REPRESENTING MiCOM RELAY OFF



1. COMMUNICATION CABLE CONNECTION

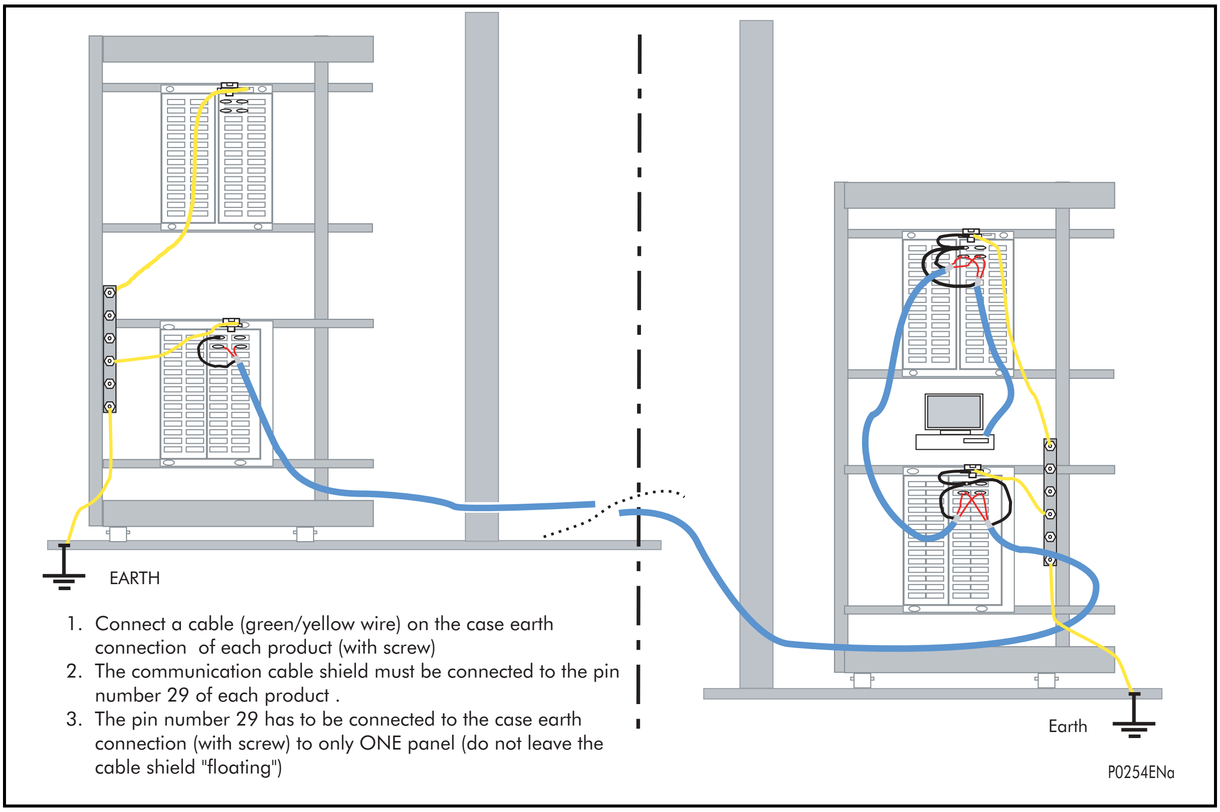
1.1 Products plugged in the same panel



1. Connect a cable (green/yellow wire) on the case earth connection of each product (with screw).
2. The communication cable shield must be connected to the pin number 29 of each product.
3. The pin number 29 of each terminal block must be connected to the case earth connection of each product (with screw).

P0253ENa

1.2 Communication between distant products



1. Connect a cable (green/yellow wire) on the case earth connection of each product (with screw)
2. The communication cable shield must be connected to the pin number 29 of each product .
3. The pin number 29 has to be connected to the case earth connection (with screw) to only ONE panel (do not leave the cable shield "floating")

COMMISSIONING TEST & RECORD SHEETS

CONTENTS

1.	**COMMISSIONING TEST SHEETS**	**3**
1.1	**Relay identification**	**3**
1.2	**Commissioning test record**	**3**
2.	**COMMISSIONING SETTING RECORD SHEETS**	**5**
2.1	**MiCOM P120 COMMISSIONING SETTING RECORD SHEETS**	**5**
2.1.1	OP PARAMETERS Menu	5
2.1.2	CONFIGURATION Menu	5
2.1.3	COMMUNICATION Menu	6
2.1.4	PROTECTION Menu	7
2.1.5	AUTOMAT.CTRL Menu	8
2.2	**MiCOM P121 COMMISSIONING SETTING RECORD SHEETS**	**9**
2.2.1	OP PARAMETERS Menu	9
2.2.2	CONFIGURATION Menu	9
2.2.3	COMMUNICATION Menu	10
2.2.4	PROTECTION Menu	11
2.2.5	AUTOMAT.CTRL Menu	13
2.3	**MiCOM P122 COMMISSIONING SETTING RECORD SHEETS**	**15**
2.3.1	OP PARAMETERS Menu	15
2.3.2	CONFIGURATION Menu	15
2.3.3	COMMUNICATION Menu	18
2.3.4	PROTECTION G1 Menu	19
2.3.5	PROTECTION G2 Menu	24
2.3.6	AUTOMAT. CTRL Menu	29
2.3.7	RECORDS Menu	36
2.4	**MiCOM P123 COMMISSIONING SETTING RECORD SHEETS**	**37**
2.4.1	OP PARAMETERS Menu	37
2.4.2	CONFIGURATION Menu	37
2.4.3	COMMUNICATION Menu	40
2.4.4	PROTECTION G1 Menu	41
2.4.5	PROTECTION G2 Menu	47
2.4.6	AUTOMAT.CTRL Menu	53
2.4.7	RECORDING Menu	62

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1. COMMISSIONING TEST SHEETS

1.1 Relay identification

Commissioning date : ______________________

Engineer : ______________________

Substation : ______________________

Circuit : ______________________

Network nominal frequency: ______________________

MiCOM Overcurrent relay model : ☐ **P120** ☐ **P121** ☐ **P122** ☐ **P123**

Serial number : ______________________

Rated current In : ______________________

Auxiliary voltage Uaux : ______________________

Communication protocol : ______________________

Language : ______________________

1.2 Commissioning test record

(put a cross after each checked stage)

Serial number check ?	☐
All current transformer shorting switches closed ?	☐
Wiring checked against diagram (if available)?	☐
Case earth installed ?	☐
Test block connections checked (if installed) ?	☐
Insulation tested ?	☐

Auxiliary supply control

Auxiliary voltage to relay		☐
Auxiliary voltage value		____________Vdc/Vac
Watchdog contacts		
With auxiliary supply off	Terminals 35 and 36	☐
With auxiliary supply on	Terminals 35 and 36	☐

Measurements

	Applied value	Relay value
Phase CT input		
Phase A current	____________A	____________A
Phase B current	____________A	____________A
Phase C current	____________A	____________A
Earth CT input		
Earth current	____________A	____________A

Phase protection test

	Theoretical value	Relay value
I> threshold	____________A	
I> threshold		____________A
I> drop threshold		____________A
Time delay		
Time delay at 2 x I>	____________ms	____________A
Time delay at 10 x I>	____________ms	____________A
I>> threshold	____________A	
I>> threshold		____________A
I>> drop threshold		____________A
Time delay		
Time delay at 2 x I>>	____________A	____________A
Time delay at 10 x I>>	____________A	____________A

Earth protection test

	Theoretical value	Relay value
I_e> threshold	____________A	
I_e> threshold		____________A
I_e> drop threshold		____________A
Time delay		
Time delay at 2 x I_e>	____________ms	____________ms
Time delay at 10 x I_e>	____________ms	____________ms
I_e>> threshold	____________A	
I_e>> threshold		____________A
I_e>> drop threshold		____________A
Time delay		
Time delay at 2 x I_e>>	____________ms	____________ms
Time delay at 10 x I_e>>	____________ms	____________ms

Commissioning Engineer ______________________________

Date ____________

2. COMMISSIONING SETTING RECORD SHEETS

2.1 MiCOM P120 COMMISSIONING SETTING RECORD SHEETS

2.1.1 OP PARAMETERS Menu

Password : ______________________

Reference : ______________________

Frequency : ❑ 50 Hz ❑ 60 Hz

2.1.2 CONFIGURATION Menu

2.1.2.1 Display

E/Gnd text	❑ N	❑ E	❑ G

2.1.2.2 CT Ratio

E/Gnd CT Primary	Primary CT ratio		
E/Gnd CT Secondary	Secondary CT ratio	❑ 1A	❑ 5A

2.1.2.3 LEDs 5 to 8 configuration

Functions	**LED 5**		**LED 6**		**LED 7**		**LED 8**	
I_e>/I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>/tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>/I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>/tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>/I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>/tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.1.3 COMMUNICATION Menu

2.1.3.1 COMMUNICATION Menu (MODBUS)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.1.3.2 COMMUNICATION Menu (Courier)

Communication ?	❑ YES	❑ NO
Relay Address		

2.1.3.3 COMMUNICATION Menu (IEC 60870-5-103)

Communication ?	❑ YES	❑ NO
Baud Rate	❑ 300 bds	❑ 600 bds
	❑ 1 200 bds	❑ 2 400 bds
	❑ 4 800 bds	❑ 9 600 bds
	❑ 19 200 bds	❑ 38 400 bds
Relay Address		

2.1.3.4 COMMUNICATION Menu (DNP3)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.1.4 PROTECTION Menu

2.1.4.1 [50N/51N] E/Gnd

I_e> ?	❑ YES		❑ NO	
I_e>	Ien			
Delay Type	❑ IDMT		❑ DMT	❑ RI

2.1.4.1.1 [51N] I_e > DMT

tI_e>	ms

2.1.4.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.1.4.1.3 [51N] I_e> RI

K	

2.1.4.2 [51N] I_e>>

I_e>>	❑ YES	❑ NO
I_e>>	Ien	
tI_e>>	ms	

2.1.4.3 [51N] I_e >>>

I_e>>> ?	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.1.5 AUTOMAT.CTRL Menu

2.1.5.1 Trip Command allocation

Trip $tI_e>$	❑ YES	❑ NO
Trip $tI_e>>$	❑ YES	❑ NO
Trip $tI_e>>>$	❑ YES	❑ NO

2.1.5.2 Latch Function allocation

Latch $tI_e>$	❑ YES	❑ NO
Latch $tI_e>>$	❑ YES	❑ NO
Latch $tI_e>>>$	❑ YES	❑ NO

2.1.5.3 Blocking logic allocation

Block $tI_e>$ =	❑ YES	❑ NO
Block $tI_e>>$ =	❑ YES	❑ NO
Block $tI_e>>>$ =	❑ YES	❑ NO

2.1.5.4 Output Relays allocation (RL2 to RL4)

Functions	**RL 2**		**RL 3**		**RL 4**	
trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$I_e>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$tI_e>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$I_e>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$tI_e>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$I_e>>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$tI_e>>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.1.5.5 Inputs allocation

Input 1	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux2**	❑ **Blk log**	
Input 2	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux2**	❑ **Blk log**	

2.2 MiCOM P121 COMMISSIONING SETTING RECORD SHEETS

2.2.1 OP PARAMETERS Menu

Password : ____________________

Reference : ____________________

Software version : ____________________

Frequency : ❑ 50 Hz ❑ 60 Hz

2.2.2 CONFIGURATION Menu

2.2.2.1 Display

Phase A Text	❑ A	❑ L1	❑ R
Phase B Text	❑ B	❑ L2	❑ S
Phase C Text	❑ C	❑ L3	❑ T
E/Gnd Text	❑ N	❑ E	❑ G

2.2.2.2 CT Ratio

Line CT Primary	Primary phase CT ratio		
Line CT Secondary	Secondary phase CT ratio	❑ 1A	❑ 5A
E/Gnd CT Primary	Primary earth CT ratio		
E/Gnd CT Secondary	Secondary earth CT ratio	❑ 1A	❑ 5A

2.2.2.3 LEDs 5 to 8 configuration

Functions	**LED 5**		**LED 6**		**LED 7**		**LED 8**	
I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_E>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.2.3 COMMUNICATION Menu

2.2.3.1 COMMUNICATION Menu (MODBUS)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.2.3.2 COMMUNICATION Menu (Courier)

Communication ?	❑ YES	❑ NO
Relay Address		

2.2.3.3 COMMUNICATION Menu (IEC 60870-5-103)

Communication ?	❑ YES	❑ NO
Baud Rate	❑ 300 bds	❑ 600 bds
	❑ 1 200 bds	❑ 2 400 bds
	❑ 4 800 bds	❑ 9 600 bds
	❑ 19 200 bds	❑ 38 400 bds
Relay Address		

2.2.3.4 COMMUNICATION Menu (DNP3)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.2.4 PROTECTION Menu

2.2.4.1 Phase Overcurrent [50/51]

2.2.4.1.1 [50/51] I>

I>?	❑ YES	❑ NO
I>	In	
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.2.4.1.1.1 [51] I> DMT

tI>	ms

2.2.4.1.1.2 [51] I> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.2.4.1.1.3 [51] I> RI

K	

2.2.4.1.2 [51] I>>

I>>?	❑ YES	❑ NO
I>>	In	
tI>>	ms	

2.2.4.1.3 [51] I>>>

I>>>?	❑ YES	❑ NO
I>>>	In	
tI>>>	ms	

2.2.4.2 Earth Overcurrent [50N/51N]

2.2.4.2.1 [50N/51N] E/Gnd

I_e>?	❑ YES	❑ NO	
I_e>	Ien		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.2.4.2.1.1 [51N] I_e > DMT

tI_e>	ms

2.2.4.2.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.2.4.2.1.3 [51N] I_e> RI

K	

2.2.4.2.2 [51N] I_e>>

I_e>>?	❑ YES	❑ NO
I_e>>	Ien	
tI_e>>	ms	

2.2.4.2.3 [51N] I_e >>>

I_e>>> ?	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.2.5 AUTOMAT.CTRL Menu

2.2.5.1 Trip Command allocation

Trip tI>	❑ YES	❑ NO
Trip tI>>	❑ YES	❑ NO
Trip tI>>>	❑ YES	❑ NO
Trip tI$_e$>	❑ YES	❑ NO
Trip tI$_e$>>	❑ YES	❑ NO
Trip tI$_e$>>>	❑ YES	❑ NO

2.2.5.2 Latch function allocation

Latch tI>	❑ YES	❑ NO
Latch tI>>	❑ YES	❑ NO
Latch tI>>>	❑ YES	❑ NO
Latch tI$_e$>	❑ YES	❑ NO
Latch tI$_e$>>	❑ YES	❑ NO
Latch tI$_e$>>>	❑ YES	❑ NO

2.2.5.3 Blocking Logic function allocation

Block tI>	❑ YES	❑ NO
Block tI>>	❑ YES	❑ NO
Block tI>>>	❑ YES	❑ NO
Block tI$_e$>	❑ YES	❑ NO
Block tI$_e$>>	❑ YES	❑ NO
Block tI$_e$>>>	❑ YES	❑ NO

2.2.5.4 OUTPUT RELAYS allocation (RL2 to RL4)

Functions	**RL 2**		**RL 3**		**RL 4**	
Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I$_e$>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

Functions	RL 2		RL 3		RL 4	
$tI_e>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$I_e>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$tI_e>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$I_e>>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
$tI_e>>>$	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.2.5.5 Inputs allocation

Input 1	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux2**	❑ **Blk log**	
Input 2	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux2**	❑ **Blk log**	

2.3 MiCOM P122 COMMISSIONING SETTING RECORD SHEETS

2.3.1 OP PARAMETERS Menu

Password : ______________________

Reference : ______________________

Software version : ______________________

Frequency : ❑ 50 Hz ❑ 60 Hz

2.3.2 CONFIGURATION Menu

2.3.2.1 Display

Phase A Text	❑ A	❑ L1	❑ R
Phase B Text	❑ B	❑ L2	❑ S
Phase C Text	❑ C	❑ L3	❑ T
E/Gnd Text	❑ N	❑ E	❑ G

2.3.2.2 CT Ratio

Line CT Primary	Primary phase CT ratio		
Line CT Secondary	Secondary phase CT ratio	❑ 1A	❑ 5A
E/Gnd CT Primary	Primary earth CT ratio		
E/Gnd CT Secondary	Secondary earth CT ratio	❑ 1A	❑ 5A

2.3.2.3 LEDs 5 to 8 configuration

Functions	LED 5		LED 6		LED 7		LED 8	
I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Thermal Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Brkn. Cond	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
CB Fail	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 3	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
t Aux1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
t Aux2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.3.2.4 Group select configuration

Change group input	❑ Edge	❑ Level
Setting group	❑ 1	❑ 2

2.3.2.5 Alarms configuration

Inst. Self Reset	❑ YES	❑ NO
Reset Led on fault	❑ YES	❑ NO
Alarm battery	❑ YES	❑ NO

2.3.2.6 Inputs configuration

Inputs	3 ❑	2 ❑	1 ❑
Voltage input DC	❑ DC	❑ AC	

2.3.2.7 Relays maintenance

Maintenance Mode	❑ YES			❑ NO			
Relays CMD	6	5	W	4	3	2	1

2.3.2.8 Phase rotation configuration

Phase rotation	❑ A-B-C	❑ A-C-B

2.3.3 COMMUNICATION Menu

2.3.3.1 COMMUNICATION Menu (MODBUS)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.3.3.2 COMMUNICATION Menu (Courier)

Communication ?	❑ YES	❑ NO
Relay Address		

2.3.3.3 COMMUNICATION Menu (IEC 60870-5-103)

Communication ?	❑ YES	❑ NO
Baud Rate	❑ 300 bds	❑ 600 bds
	❑ 1 200 bds	❑ 2 400 bds
	❑ 4 800 bds	❑ 9 600 bds
	❑ 19 200 bds	❑ 38 400 bds
Relay Address		

2.3.3.4 COMMUNICATION Menu (DNP3)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.3.4 PROTECTION G1 Menu

2.3.4.1 Phase Overcurrent [50/51]

2.3.4.1.1 [50/51] I>

I> ?	❑ YES		❑ NO
I>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.4.1.1.1 [51] I> DMT

tI>	ms
t Reset	ms

2.3.4.1.1.2 [51] I> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.4.1.1.3 [51] I> DMT reset time

t Reset	ms

2.3.4.1.1.4 [51] I> IDMT reset time

Rtms	

2.3.4.1.1.5 [51] I> RI

K	
t Reset	ms

2.3.4.1.2 [51] I>>

I>> ?	❑ YES		❑ NO
I>>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.4.1.2.1 [51] I>> DMT

tI>>	ms
t Reset	ms

2.3.4.1.2.2 [51] I>> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.4.1.2.3 [51] I>> DMT reset time

t Reset	ms

2.3.4.1.2.4 [51] I>> IDMT reset time

Rtms	

2.3.4.1.2.5 [51] I>> RI

K	
t Reset	ms

2.3.4.1.3 [51] I>>>

I>>>?	❑ YES	❑ NO
I>>> Sample	❑ YES	❑ NO
I>>>	In	
tI>>>	ms	

2.3.4.2 Earth Overcurrent [50N/51N]

2.3.4.2.1 [50N/51N] E/Gnd

I_e>?	❑ YES		❑ NO	
I_e>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.3.4.2.1.1 [51N] I_e > DMT

tI_e>	ms
t Reset	ms

2.3.4.2.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.4.2.1.3 [51N] I_e> DMT reset time

t Reset	ms

2.3.4.2.1.4 [51N] Ie> IDMT reset time

Rtms	

2.3.4.2.1.5 [51N] I_e> RI

K	
t Reset	ms

2.3.4.2.1.6 [51N] I_e> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.3.4.2.2 [51N] I_e>>

I_e>>?	❑ YES		❑ NO	
I_e>>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.3.4.2.2.1 [51N] I_e >> DMT

tI_e>>	ms
t Reset	ms

2.3.4.2.2.2 [51N] I_e >> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.4.2.2.3 [51N] I_e>> DMT reset time

t Reset	ms

2.3.4.2.2.4 [51N] Ie>> IDMT reset time

Rtms	

2.3.4.2.2.5 [51N] I_e>> RI

K	
t Reset	ms

2.3.4.2.2.6 [51N] I_e>> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.3.4.2.3 [51N] I_e>>>

I_e>>> ?	❑ YES	❑ NO
I_e>>> Sample	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.3.4.3 [49] THERMAL OVERLOAD

Therm OL ?	❑ YES	❑ NO
Iθ>	In	
Te	mn	
k		
θ **Trip**	%	
θ **Alarm ?**	❑ YES	❑ NO
θ **Alarm**	%	

2.3.4.4 [37] UNDERCURRENT I<

I< ?	❑ YES	❑ NO
I<	%	
tI<	ms	

2.3.4.5 [46] Negative phase sequence overcurrent I2>

I2> ?	❑ YES	❑ NO	
I2>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.4.5.1 [46] I2> DMT

tI>	ms

2.3.4.5.2 [46] I2> DMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.3.4.5.3 [46] I2> DMT reset time

t Reset	ms

2.3.4.5.4 [46] I2> IDMT reset time

Rtms	

2.3.4.5.5 [46] I2> RI

K	
t Reset	ms

2.3.4.6 [46] Negative phase sequence overcurrent I2>>

I2>> ?	❑ YES	❑ NO
I2>>	In	
tI2>>	ms	

2.3.5 PROTECTION G2 Menu

2.3.5.1 Phase Overcurrent [50/51]

2.3.5.1.1 [50/51] I>

I> ?	❑ YES	❑ NO	
I>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.5.1.1.1 [51] I> DMT

tI>	ms
t Reset	ms

2.3.5.1.1.2 [51] I> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.5.1.1.3 [51] I> DMT reset time

t Reset	ms

2.3.5.1.1.4 [51] I> IDMT reset time

Rtms	

2.3.5.1.1.5 [51] I> RI

K	
t Reset	ms

2.3.5.1.2 [51] I>>

I>> ?	❑ YES	❑ NO	
I>>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.5.1.2.1 [51] I>> DMT

tI>>	ms
t Reset	ms

2.3.5.1.2.2 [51] I>> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.5.1.2.3 [51] I>> DMT reset time

t Reset	ms

2.3.5.1.2.4 [51] I>> IDMT reset time

Rtms	

2.3.5.1.2.5 [51] I>> RI

K	
t Reset	ms

2.3.5.1.3 [51] I>>>

I>>>?	❑ YES	❑ NO
I>>> Sample	❑ YES	❑ NO
I>>>	In	
tI>>>	ms	

2.3.5.2 Earth Overcurrent [50N/51N]

2.3.5.2.1 [50N/51N] E/Gnd

I_e>?	❑ YES		❑ NO	
I_e>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.3.5.2.1.1 [51N] I_e > DMT

tI_e>	ms
t Reset	ms

2.3.5.2.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.5.2.1.3 [51N] I_e> DMT reset time

t Reset	ms

2.3.5.2.1.4 [51N] I_e> IDMT reset time

Rtms	

2.3.5.2.1.5 [51N] I_e> RI

K	
t Reset	ms

2.3.5.2.1.6 [51N] I_e> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.3.5.2.2 [51N] I_e>>

I_e>>?	❑ YES		❑ NO	
I_e>>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.3.5.2.2.1 [51N] I_e >> DMT

tI_e>>	ms
t Reset	ms

2.3.5.2.2.2 [51N] I_e >> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.3.5.2.2.3 [51N] I_e>> DMT reset time

t Reset	ms

2.3.5.2.2.4 [51N] I_e>> IDMT reset time

Rtms	

2.3.5.2.2.5 [51N] I_e>> RI

K	
t Reset	ms

2.3.5.2.2.6 [51N] I_e>> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.3.5.2.3 [51N] I_e>>>

I_e>>> ?	❑ YES	❑ NO
I_e>>> Sample	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.3.5.3 [49] THERMAL OVERLOAD

Therm OL ?	❑ YES	❑ NO
Iθ>	In	
Te	mn	
k		
θ **Trip**	%	
θ **Alarm ?**	❑ YES	❑ NO
θ **Alarm**	%	

2.3.5.4 [37] UNDERCURRENT I<

I< ?	❑ YES	❑ NO
I<	%	
tI<	ms	

2.3.5.5 [46] Negative phase sequence overcurrent I2>

I2> ?	❑ YES	❑ NO	
I2>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.3.5.5.1 [46] I2> DMT

tI>	ms

2.3.5.5.2 [46] I2> DMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.3.5.5.3 [46] I2> DMT reset time

t Reset	ms

2.3.5.5.4 [46] I2> IDMT reset time

Rtms	

2.3.5.5.5 [46] I2> RI

K	
t Reset	ms

2.3.5.6 [46] Negative phase sequence overcurrent I2>>

I2>> ?	❑ YES	❑ NO
I2>>	In	
tI2>>	ms	

2.3.6 AUTOMAT. CTRL Menu

2.3.6.1 TRIP Command allocation

Trip tI>	❑ YES	❑ NO
Trip tI>>	❑ YES	❑ NO
Trip tI>>>	❑ YES	❑ NO
Trip tI$_e$>	❑ YES	❑ NO
Trip tI$_e$>>	❑ YES	❑ NO
Trip tI$_e$>>>	❑ YES	❑ NO
Trip tI<	❑ YES	❑ NO
Trip tI2>	❑ YES	❑ NO
Trip tI2>>	❑ YES	❑ NO
Trip Thermal θ	❑ YES	❑ NO
Trip Brkn. Cond	❑ YES	❑ NO
Trip tAux1	❑ YES	❑ NO
Trip tAux2	❑ YES	❑ NO
Trip tAux3	❑ YES	❑ NO

2.3.6.2 Latch function allocation

Latch tI>	❑ YES	❑ NO
Latch tI>>	❑ YES	❑ NO
Latch tI>>>	❑ YES	❑ NO
Latch tI$_e$>	❑ YES	❑ NO
Latch tI$_e$>>	❑ YES	❑ NO
Latch tI$_e$>>>	❑ YES	❑ NO
Latch tI<	❑ YES	❑ NO
Latch tI2>	❑ YES	❑ NO
Latch tI2>>	❑ YES	❑ NO
Latch Thermal θ	❑ YES	❑ NO
Latch Brkn .Cond	❑ YES	❑ NO
Latch tAux1	❑ YES	❑ NO
Latch tAux2	❑ YES	❑ NO
Latch tAux3	❑ YES	❑ NO

2.3.6.3 Blocking Logic 1 function allocation

Block 1 tI>	☐ YES	☐ NO
Block 1 tI>>	☐ YES	☐ NO
Block 1 tI>>>	☐ YES	☐ NO
Block 1 tI$_e$>	☐ YES	☐ NO
Block 1 tI$_e$>>	☐ YES	☐ NO
Block 1 tI$_e$>>>	☐ YES	☐ NO
Block 1 tI<	☐ YES	☐ NO
Block 1 tI2>	☐ YES	☐ NO
Block 1 tI2>>	☐ YES	☐ NO
Block 1 Thermal θ	☐ YES	☐ NO
Block 1 Brkn .Cond	☐ YES	☐ NO
Block 1 tAux1	☐ YES	☐ NO
Block 1 tAux2	☐ YES	☐ NO
Block 1 tAux3	☐ YES	☐ NO

2.3.6.4 Blocking Logic 2 function allocation

Block 2 tI>	☐ YES	☐ NO
Block 2 tI>>	☐ YES	☐ NO
Block 2 tI>>>	☐ YES	☐ NO
Block 2 tI$_e$>	☐ YES	☐ NO
Block 2 tI$_e$>>	☐ YES	☐ NO
Block 2 tI$_e$>>>	☐ YES	☐ NO
Block 2 tI<	☐ YES	☐ NO
Block 2 tI2>	☐ YES	☐ NO
Block 2 tI2>>	☐ YES	☐ NO
Block 2 Thermal θ	☐ YES	☐ NO
Block 2 Brkn .Cond	☐ YES	☐ NO
Block 2 tAux1	☐ YES	☐ NO
Block 2 tAux2	☐ YES	☐ NO
Block 2 tAux3	☐ YES	☐ NO

2.3.6.5 SELECTIVE SCHEME LOGIC1 function allocation

Logic Select 1	❑ YES	❑ NO
Sel1 tI>>	❑ YES	❑ NO
Sel1 tI>>>	❑ YES	❑ NO
Sel1 tI$_e$>>	❑ YES	❑ NO
Sel1 tI$_e$>>>	❑ YES	❑ NO
t SeL1	ms	

2.3.6.6 SELECTIVE SCHEME LOGIC2 function allocation

Logic Select 2	❑ YES	❑ NO
Sel2 tI>>	❑ YES	❑ NO
Sel2 tI>>>	❑ YES	❑ NO
Sel2 tI$_e$>>	❑ YES	❑ NO
Sel2 tI$_e$>>>	❑ YES	❑ NO
t Sel2	ms	

2.3.6.7 OUTPUT RELAYS allocation

2.3.6.7.1 OUTPUT RELAYS allocation (RL2 to RL4)

Functions	RL 2		RL 3		RL 4	
Trip	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I_e>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI_e>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I_e>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI_e>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I_e>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI_e>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI<	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI2>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI2>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Therm Alarm	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Therm Trip	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Alarm	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
52 Fail	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Brkn cond	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Fail	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Close	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux1	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux2	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux3	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Order COM 1	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Order COM 2	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Order COM 3	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Order COM 4	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Active Group	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO

2.3.6.7.2 OUTPUT RELAYS allocation (RL5 to RL8)

Functions	RL 5		RL 6	
Trip	❑ YES	❑ NO	❑ YES	❑ NO
I>	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO
I_e>	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>	❑ YES	❑ NO	❑ YES	❑ NO
tI<	❑ YES	❑ NO	❑ YES	❑ NO
tI2>	❑ YES	❑ NO	❑ YES	❑ NO
tI2>>	❑ YES	❑ NO	❑ YES	❑ NO
Therm Alarm	❑ YES	❑ NO	❑ YES	❑ NO
Therm Trip	❑ YES	❑ NO	❑ YES	❑ NO
CB Alarm	❑ YES	❑ NO	❑ YES	❑ NO
52 Fail	❑ YES	❑ NO	❑ YES	❑ NO
Brkn cond	❑ YES	❑ NO	❑ YES	❑ NO
CB Fail	❑ YES	❑ NO	❑ YES	❑ NO
CB Close	❑ YES	❑ NO	❑ YES	❑ NO
tAux1	❑ YES	❑ NO	❑ YES	❑ NO
tAux2	❑ YES	❑ NO	❑ YES	❑ NO
tAux3	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 1	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 2	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 3	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 4	❑ YES	❑ NO	❑ YES	❑ NO
Active Group	❑ YES	❑ NO	❑ YES	❑ NO

2.3.6.8 LOGIC INPUT allocation

2.3.6.8.1 Inputs

Input 1	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux1**
	❑ **Aux2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Trip Circ.**	❑ **Rst Led**	❑ **Maint. M.**
	❑ **Aux3**	❑ **Strt tBF**	❑
Input 2	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux1**
	❑ **Aux2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Trip Circ.**	❑ **Rst Led**	❑ **Maint. M.**
	❑ **Aux3**	❑ **Strt tBF**	❑
Input 3	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux1**
	❑ **Aux2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Trip Circ.**	❑ **Rst Led**	❑ **Maint. M.**
	❑ **Aux3**	❑ **Strt tBF**	❑

2.3.6.8.2 t Aux

Aux 1 time : t Aux 1	ms
Aux 2 time : t Aux 2	ms
Aux 3 time : t Aux 3	ms

2.3.6.9 BROKEN CONDUCTOR

Brkn. Cond ?	❑ YES	❑ NO
tBC	ms	
Ratio I2/I1	%	

2.3.6.10 Cold Load Pick-up

Cold Load PU ?	❑ YES	❑ NO
tI> ?	❑ YES	❑ NO
tI>> ?	❑ YES	❑ NO
tI>>> ?	❑ YES	❑ NO
tI_e> ?	❑ YES	❑ NO
tI_e>> ?	❑ YES	❑ NO
tI_e>>> ?	❑ YES	❑ NO
tI2> ?	❑ YES	❑ NO
tI2>> ?	❑ YES	❑ NO
t Therm ?	❑ YES	❑ NO
Level	%	
tCL	ms	

2.3.6.11 CIRCUIT BREAKER FAILURE

CB Fail ?	❑ YES	❑ NO
I<	In	
tBF	ms	
Block I> ?	❑ YES	❑ NO
Block I_e> ?	❑ YES	❑ NO

2.3.6.12 CIRCUIT BREAKER SUPERVISION

TC Supervision ?	❑ YES	❑ NO
t SUP	s	
CB Open S'vision	❑ YES	❑ NO
CB Open Time	ms	
CB Close S'vision	❑ YES	❑ NO
CB Close Time	ms	
CB Open Alarm ?	❑ YES	❑ NO
CB Open NB		
Σ **Amps (n) ?**	❑ YES	❑ NO
Σ **Amps (n)**		
n		
t Open Pulse	ms	
t Close Pulse	ms	

2.3.7 RECORDS Menu

2.3.7.1 DISTURBANCE RECORD

Pre-Time	ms	
Post-Time	ms	
Disturb Rec Trig	❑ ON INST.	❑ ON TRIP

2.3.7.2 TIME PEAK VALUE

Time Window	mn

2.3.7.3 ROLLING DEMAND

Sub Period	mn
Num of Sub Per.	

2.4 MiCOM P123 COMMISSIONING SETTING RECORD SHEETS

2.4.1 OP PARAMETERS Menu

Password : ______________________

Reference : ______________________

Software version : ______________________

Frequency : ❑ 50 Hz ❑ 60 Hz

2.4.2 CONFIGURATION Menu

2.4.2.1 Display

Phase A Text	❑ A	❑ L1	❑ R
Phase B Text	❑ B	❑ L2	❑ S
Phase C Text	❑ C	❑ L3	❑ T
E/Gnd Text	❑ N	❑ E	❑ G

2.4.2.2 CT Ratio

Line CT Primary	Primary phase CT ratio		
Line CT Secondary	Secondary phase CT ratio	❑ 1A	❑ 5A
E/Gnd CT Primary	Primary earth CT ratio		
E/Gnd CT Secondary	Secondary earth CT ratio	❑ 1A	❑ 5A

2.4.2.3 LEDs 5 to 8 configuration

Functions	LED 5		LED 6		LED 7		LED 8	
I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Therm Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Brkn. Cond	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
CB Fail	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 3	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 4	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Input 5	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Recloser Run	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Recloser Blocked	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
T Aux 1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
T Aux 2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.4.2.4 Group select configuration

Change group input	❑ Edge	❑ Level
Setting group	❑ 1	❑ 2

2.4.2.5 Alarms configuration

Inst. Self Reset	❑ YES	❑ NO
Reset Led on fault	❑ YES	❑ NO
Alarm battery	❑ YES	❑ NO

2.4.2.6 Inputs configuration

Inputs	3 ❑	2 ❑	1 ❑
Voltage input DC	❑ DC	❑ AC	

2.4.2.7 Relays maintenance

Maintenance Mode	❑ YES				❑ NO				
Relays CMD	8	7	6	5	W	4	3	2	1

2.4.2.8 Phase rotation configuration

Phase rotation	❑ A-B-C	❑ A-C-B

2.4.3 COMMUNICATION Menu

2.4.3.1 COMMUNICATION Menu (MODBUS)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.4.3.2 COMMUNICATION Menu (Courier)

Communication ?	❑ YES	❑ NO
Relay Address		

2.4.3.3 COMMUNICATION Menu (IEC 60870-5-103)

Communication ?	❑ YES	❑ NO
Baud Rate	❑ 300 bds	❑ 600 bds
	❑ 1 200 bds	❑ 2 400 bds
	❑ 4 800 bds	❑ 9 600 bds
	❑ 19 200 bds	❑ 38 400 bds
Relay Address		

2.4.3.4 COMMUNICATION Menu (DNP3)

Communication ?	❑ YES		❑ NO
Baud Rate	❑ 300 bds		❑ 600 bds
	❑ 1 200 bds		❑ 2 400 bds
	❑ 4 800 bds		❑ 9 600 bds
	❑ 19 200 bds		❑ 38 400 bds
Parity	❑ Odd	❑ Even	❑ None
Data bits	❑ 7		❑ 8
Stop bits	❑ 1		❑ 2
Relay Address			

2.4.4 PROTECTION G1 Menu

2.4.4.1 Phase Overcurrent [50/51]

2.4.4.1.1 [50/51] I>

I> ?	❑ YES		❑ NO
I>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.4.4.1.1.1 [51] I> DMT

tI>	ms
t Reset	ms

2.4.4.1.1.2 [51] I> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.4.1.1.3 [51] I> DMT reset time

t Reset	ms

2.4.4.1.1.4 [51] I> IDMT reset time

Rtms	

2.4.4.1.1.5 [51] I> RI

K	
t Reset	ms

2.4.4.1.2 [51] I>>

I>> ?	❑ YES		❑ NO
I>>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.4.4.1.2.1 [51] I>> DMT

tI>>	ms
t Reset	ms

2.4.4.1.2.2 [51] I>> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.4.1.2.3 [51] I>> DMT reset time

t Reset	ms

2.4.4.1.2.4 [51] I>> IDMT reset time

Rtms	

2.4.4.1.2.5 [51] I>> RI

K	
t Reset	ms

2.4.4.1.3 [51] I>>>

I>>>?	❑ YES	❑ NO
I>>> Sample	❑ YES	❑ NO
I>>>	In	
tI>>>	ms	

2.4.4.2 Earth Overcurrent [50N/51N]

2.4.4.2.1 [50N/51N] E/Gnd

I_e> ?	❑ YES		❑ NO	
I_e>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.4.4.2.1.1 [51N] I_e > DMT

tI_e>	ms
t Reset	ms

2.4.4.2.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.4.4.2.1.3 [51N] I_e> DMT reset time

t Reset	ms

2.4.4.2.1.4 [51N] I_e> IDMT reset time

Rtms	

2.4.4.2.1.5 [51N] I_e> RI

K	
t Reset	ms

2.4.4.2.1.6 [51N] I_e> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.4.4.2.2 [51N] I_e>>

I_e>> ?	❑ YES		❑ NO	
I_e>>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.4.4.2.2.1 [51N] I_e >> DMT

tI_e>>	ms
t Reset	ms

2.4.4.2.2.2 [51N] I_e >> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.4.4.2.2.3 [51N] I_e>> DMT reset time

t Reset	ms

2.4.4.2.2.4 [51N] I_e>> IDMT reset time

Rtms	

2.4.4.2.2.5 [51N] I_e>> RI

K	
t Reset	ms

2.4.4.2.2.6 [51N] I_e>> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.4.4.2.3 [51N] I_e >>>

I_e>>> ?	❑ YES	❑ NO
I_e>>> Sample	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.4.4.3 [49] THERMAL OVERLOAD

[49] Therm OL ?	❑ YES	❑ NO
Iθ>	In	
Te	mn	
k		
θ **Trip**	%	
[49] θ **Alarm ?**	❑ YES	❑ NO
θ **Alarm**	%	

2.4.4.4 [37] UNDERCURRENT I<

I< ?	❑ YES	❑ NO
I<	%	
tI<	ms	

2.4.4.5 [46] Negative phase sequence overcurrent I2>

I2>?	❑ YES	❑ NO	
I2>	In		
Delay Trip	❑ IDMT	❑ DMT	❑ RI

2.4.4.5.1 [46] I2> DMT

tI2>	ms

2.4.4.5.2 [46] I2> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.4.4.5.3 [46] I2> DMT reset time

t Reset	ms

2.4.4.5.4 [46] I2> IDMT reset time

Rtms	

2.4.4.5.5 [46] I2> RI

K	
t Reset	ms

2.4.4.6 [46] Negative phase sequence overcurrent I2>>

I2>>?	❑ YES	❑ NO
I2>>	In	
tI2>>	ms	

2.4.4.7 [79] AUTORECLOSER

[79] Autoreclose ?	❑ YES		❑ NO	
Ext CB Fail ?	❑ YES		❑ NO	
Ext CB Fail Time	ms			
Ext Block ?	❑ YES		❑ NO	
Aux 1 (I>)	❑ YES		❑ NO	
Aux 2 (I_e>)	❑ YES		❑ NO	
Dead Time tD1	ms			
Dead Time tD2	ms			
Dead Time tD3	ms			
Dead Time tD4	ms			
Reclaim Time tR	ms			
Inhib Time tI	ms			
Phase Cycles				
E/Gnd Cycles				
CYCLES tI>	4 ❑	3 ❑	2 ❑	1 ❑

CYCLES tI>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI>>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI$_e$>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI$_e$>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI$_e$>>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tAux 1	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tAux 2	4 ❑	3 ❑	2 ❑	1 ❑

2.4.5 PROTECTION G2 Menu

2.4.5.1 Phase Overcurrent [50/51]

2.4.5.1.1 [50/51] I>

I> ?	❑ YES		❑ NO
I>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.4.5.1.1.1 [51] I> DMT

tI>	ms
t Reset	ms

2.4.5.1.1.2 [51] I> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.5.1.1.3 [51] I> DMT reset time

t Reset	ms

2.4.5.1.1.4 [51] I> IDMT reset time

Rtms	

2.4.5.1.1.5 [51] I> RI

K	
t Reset	ms

2.4.5.1.2 [51] I>>

I>> ?	❑ YES		❑ NO
I>>	In		
Delay Type	❑ IDMT	❑ DMT	❑ RI

2.4.5.1.2.1 [51] I>> DMT

tI>>	ms
t Reset	ms

2.4.5.1.2.2 [51] I>> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.5.1.2.3 [51] I>> DMT reset time

t Reset	ms

2.4.5.1.2.4 [51] I>> IDMT reset time

Rtms	

2.4.5.1.2.5 [51] I>> RI

K	
t Reset	ms

2.4.5.1.3 [51] I>>>

I>>>?	❑ YES	❑ NO
I>>> Sample	❑ YES	❑ NO
I>>>	In	
tI>>>	ms	

2.4.5.2 Earth Overcurrent [50N/51N]

2.4.5.2.1 [50N/51N] E/Gnd

I_e> ?	❑ YES		❑ NO	
I_e>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.4.5.2.1.1 [51N] I_e > DMT

tI_e>	ms
t Reset	ms

2.4.5.2.1.2 [51N] I_e > IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.5.2.1.3 [51N] I_e> DMT reset time

t Reset	ms

2.4.5.2.1.4 [51N] I_e> IDMT reset time

Rtms	

2.4.5.2.1.5 [51N] I_e> RI

K	
t Reset	ms

2.4.5.2.1.6 [51N] I_e> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.4.5.2.2 [51N] I_e>>

I_e>> ?	❑ YES		❑ NO	
I_e>>	Ien			
Delay Type	❑ IDMT	❑ DMT	❑ RI	❑ LABOR.

2.4.5.2.2.1 [51N] I_e >> DMT

tI_e>>	ms
t Reset	ms

2.4.5.2.2.2 [51N] I_e >> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
	❑ IEEE RC	
Tms		

2.4.5.2.2.3 [51N] I_e>> DMT reset time

t Reset	ms

2.4.5.2.2.4 [51N] I_e>> IDMT reset time

Rtms	

2.4.5.2.2.5 [51N] I_e>> RI

K	
t Reset	ms

2.4.5.2.2.6 [51N] I_e>> LABORELEC

Idmt	❑ 1	❑ 2	❑ 3

2.4.5.2.3 [51N] I_e >>>

I_e>>> ?	❑ YES	❑ NO
I_e>>> Sample	❑ YES	❑ NO
I_e>>>	Ien	
tI_e>>>	ms	

2.4.5.3 [49] THERMAL OVERLOAD

[49] Therm OL ?	❑ YES	❑ NO
Iθ>	In	
Te	mn	
k		
θ **Trip**	%	
[49] θ **Alarm ?**	❑ YES	❑ NO
θ **Alarm**	%	

2.4.5.4 [37] UNDERCURRENT I<

I< ?	❑ YES	❑ NO
I<	%	
tI<	ms	

2.4.5.5 [46] Negative phase sequence overcurrent I2>

I2>?	❑ YES	❑ NO	
I2>	In		
Delay Trip	❑ IDMT	❑ DMT	❑ RI

2.4.5.5.1 [46] I2> DMT

tI2>	ms

2.4.5.5.2 [46] I2> IDMT

Idmt	❑ IEC SI	❑ IEC STI
	❑ IEC VI	❑ IEC EI
	❑ IEC LTI	❑ CO2
	❑ IEEE MI	❑ CO8
	❑ IEEE VI	❑ IEEE EI
Tms		

2.4.5.5.3 [46] I2> DMT reset time

t Reset	ms

2.4.5.5.4 [46] I2> IDMT reset time

Rtms	

2.4.5.5.5 [46] I2> RI

K	
t Reset	ms

2.4.5.6 [46] Negative phase sequence overcurrent I2>>

I2>>?	❑ YES	❑ NO
I2>>	In	
tI2>>	ms	

2.4.5.7 [79] AUTORECLOSER

[79] Autoreclose ?	❑ YES		❑ NO	
Ext CB Fail ?	❑ YES		❑ NO	
Ext CB Fail Time	ms			
Ext Block ?	❑ YES		❑ NO	
Aux 1 (I>)	❑ YES		❑ NO	
Aux 2 (I_e>)	❑ YES		❑ NO	
Dead Time tD1	ms			
Dead Time tD2	ms			
Dead Time tD3	ms			
Dead Time tD4	ms			
Reclaim Time tR	ms			
Inhib Time tI	ms			
Phase Cycles				
E/Gnd Cycles				
CYCLES tI>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI>>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI_e>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI_e>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tI_e>>>	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tAux 1	4 ❑	3 ❑	2 ❑	1 ❑
CYCLES tAux 2	4 ❑	3 ❑	2 ❑	1 ❑

2.4.6 AUTOMAT.CTRL Menu

2.4.6.1 TRIP Command allocation

Trip tI>	❑ YES	❑ NO
Trip tI>>	❑ YES	❑ NO
Trip tI>>>	❑ YES	❑ NO
Trip tI$_e$>	❑ YES	❑ NO
Trip tI$_e$>>	❑ YES	❑ NO
Trip tI$_e$>>>	❑ YES	❑ NO
Trip tI<	❑ YES	❑ NO
Trip tI2>	❑ YES	❑ NO
Trip tI2>>	❑ YES	❑ NO
Trip Thermal θ	❑ YES	❑ NO
Trip Brkn Cond	❑ YES	❑ NO
Trip tAux1	❑ YES	❑ NO
Trip tAux2	❑ YES	❑ NO
Trip tAux3	❑ YES	❑ NO
Trip tAux4	❑ YES	❑ NO

2.4.6.2 Latch function allocation

Latch tI>	❑ YES	❑ NO
Latch tI>>	❑ YES	❑ NO
Latch tI>>>	❑ YES	❑ NO
Latch tI$_e$>	❑ YES	❑ NO
Latch tI$_e$>>	❑ YES	❑ NO
Latch tI$_e$>>>	❑ YES	❑ NO
Latch tI<	❑ YES	❑ NO
Latch tI2>	❑ YES	❑ NO
Latch tI2>>	❑ YES	❑ NO
Latch Thermal θ	❑ YES	❑ NO
Latch Brkn . Cond	❑ YES	❑ NO
Latch tAux1	❑ YES	❑ NO
Latch tAux2	❑ YES	❑ NO
Latch tAux3	❑ YES	❑ NO
Latch tAux4	❑ YES	❑ NO

2.4.6.3 Blocking Logic 1 function allocation

Block 1 tI>	❑ YES	❑ NO
Block 1 tI>>	❑ YES	❑ NO
Block 1 tI>>>	❑ YES	❑ NO
Block 1 tI$_e$>	❑ YES	❑ NO
Block 1 tI$_e$>>	❑ YES	❑ NO
Block 1 tI$_e$>>>	❑ YES	❑ NO
Block 1 tI<	❑ YES	❑ NO
Block 1 tI2>	❑ YES	❑ NO
Block 1 tI2>>	❑ YES	❑ NO
Block 1 Thermal θ	❑ YES	❑ NO
Block 1 Brkn. Cond	❑ YES	❑ NO
Block 1 tAux1	❑ YES	❑ NO
Block 1 tAux2	❑ YES	❑ NO
Block 1 tAux3	❑ YES	❑ NO
Block 1 tAux4	❑ YES	❑ NO

2.4.6.4 Blocking Logic 2 function allocation

Block 2 tI>	❑ YES	❑ NO
Block 2 tI>>	❑ YES	❑ NO
Block 2 tI>>>	❑ YES	❑ NO
Block 2 tI$_e$>	❑ YES	❑ NO
Block 2 tI$_e$>>	❑ YES	❑ NO
Block 2 tI$_e$>>>	❑ YES	❑ NO
Block 2 tI<	❑ YES	❑ NO
Block 2 tI2>	❑ YES	❑ NO
Block 2 tI2>>	❑ YES	❑ NO
Block 2 Thermal θ	❑ YES	❑ NO
Block 2 Brkn. Cond	❑ YES	❑ NO
Block 2 tAux1	❑ YES	❑ NO
Block 2 tAux2	❑ YES	❑ NO
Block 2 tAux3	❑ YES	❑ NO
Block 2 tAux4	❑ YES	❑ NO

2.4.6.5 Selective Scheme Logic1 function allocation

Logic Select 1	☐ YES	☐ NO
Sel1 tI>>	☐ YES	☐ NO
Sel1 tI>>>	☐ YES	☐ NO
Sel1 tI$_e$>>	☐ YES	☐ NO
Sel1 tI$_e$>>>	☐ YES	☐ NO
t Sel1	ms	

2.4.6.6 Selective Scheme Logic2 function allocation

Logic Select 2	☐ YES	☐ NO
Sel2 tI>>	☐ YES	☐ NO
Sel2 tI>>>	☐ YES	☐ NO
Sel2 tI$_e$>>	☐ YES	☐ NO
Sel2 tI$_e$>>>	☐ YES	☐ NO
tSel2 =	ms	

2.4.6.7 OUTPUT RELAYS allocation

2.4.6.7.1 OUTPUT RELAYS allocation (RL2 to RL4)

Functions	RL 2		RL 3		RL 4	
Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
I_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI_e>>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI<	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tI2>>	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Therm Alarm	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Therm Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Brkn Cond	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
CB Fail	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
CB Close	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tAux1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tAux2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tAux3	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
tAux4	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
CB Alarm	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
52 Fail	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
79 Run	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

Functions	RL 2		RL 3		RL 4	
79 Trip	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 3	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 4	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Active Group	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.4.6.7.2 OUTPUT RELAYS allocation (RL5 to RL8)

Functions	RL 5		RL 6		RL 7		RL8	
Trip	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
I>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI>>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$I_e>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$tI_e>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$I_e>>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$tI_e>>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$I_e>>>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
$tI_e>>>$	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI<	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI2>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tI2>>	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Therm Alarm	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Therm Trip	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
Brkn Cond	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Fail	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Close	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux1	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux2	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux3	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
tAux4	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
CB Alarm	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
52 Fail	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
79 Run	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO
79 Trip	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO	☐ YES	☐ NO

Functions	RL 5		RL 6		RL 7		RL8	
Order COM 1	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 2	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 3	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Order COM 4	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO
Active Group	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO	❑ YES	❑ NO

2.4.6.8 LOGIC INPUT allocation

2.4.6.8.1 Inputs

Input 1	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux 2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Block - 79**	❑ **Trip Circ**	❑ **Rst Led**
	❑ **Maint. M.**	❑ **Aux 3**	❑ **Aux 4**
	❑ **Strt tBF**		
Input 2	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux 2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Block - 79**	❑ **Trip Circ**	❑ **Rst Led**
	❑ **Maint. M.**	❑ **Aux 3**	❑ **Aux 4**
	❑ **Strt tBF**		
Input 3	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux 2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Block - 79**	❑ **Trip Circ**	❑ **Rst Led**
	❑ **Maint. M.**	❑ **Aux 3**	❑ **Aux 4**
	❑ **Strt tBF**		
Input 4	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux 2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Block - 79**	❑ **Trip Circ**	❑ **Rst Led**
	❑ **Maint. M.**	❑ **Aux 3**	❑ **Aux 4**
	❑ **Strt tBF**		

Input 5	❑ **None**	❑ **Unlatch**	❑ **52a**
	❑ **52b**	❑ **CB FLT**	❑ **Aux 1**
	❑ **Aux 2**	❑ **Blk Log 1**	❑ **Blk Log 2**
	❑ **Strt Dist**	❑ **Cold L PU**	❑ **Log Sel 1**
	❑ **Log Sel 2**	❑ **Change Set**	❑ **θ Reset**
	❑ **Block - 79**	❑ **Trip Circ**	❑ **Rst Led**
	❑ **Maint. M.**	❑ **Aux 3**	❑ **Aux 4**
	❑ **Strt tBF**		

2.4.6.8.2 tAux

Aux 1 : Time tAux 1	ms
Aux 2 : Time tAux 2	ms
Aux 3 : Time tAux 3	ms
Aux 4 : Time tAux 4	ms

2.4.6.9 BROKEN CONDUCTOR

Brkn Cond	❑ YES	❑ NO
tBC	ms	
Ratio I2/I1	%	

2.4.6.10 Cold Load Pick up

Cold Load PU ?	❑ YES	❑ NO
tI> ?	❑ YES	❑ NO
tI>> ?	❑ YES	❑ NO
tI>>> ?	❑ YES	❑ NO
tI_e> ?	❑ YES	❑ NO
tI_e>> ?	❑ YES	❑ NO
tI_e>>> ?	❑ YES	❑ NO
t2> ?	❑ YES	❑ NO
t2>> ?	❑ YES	❑ NO
T Therm ?	❑ YES	❑ NO
Level	%	
tCL	ms	

2.4.6.11 CIRCUIT BREAKER FAILURE

CB Fail ?	❑ YES	❑ NO
tBF	ms	
I<	In	
Block I> ?	❑ YES	❑ NO
Block I_e> ?	❑ YES	❑ NO

2.4.6.12 CIRCUIT BREAKER SUPERVISION

TC Supervision?	❑ YES	❑ NO
t SUP	s	
CB Open S'vision	❑ YES	❑ NO
CB Open Time	ms	
CB Close S'vision	❑ YES	❑ NO
CB Close Time	ms	
CB Open Alarm?	❑ YES	❑ NO
CB Open NB		
Σ **Amps(n)?**	❑ YES	❑ NO
Σ **Amps(n)**		
n		
t Open Pulse	ms	
t Close Pulse	ms	

2.4.7 RECORDING Menu

2.4.7.1 DISTURBANCE RECORD

Pre-time	ms	
Post-time	ms	
Disturb Rec Trig	❑ ON INST.	❑ ON TRIP

2.4.7.2 TIME PEAK VALUE

Time Window	mn

2.4.7.3 ROLLING DEMAND

Sub Period	mn
Num of Sub Per.	

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