MiCOM P921/P922&P923

Voltage and Frequency Relays

P92x/EN M/J62

Software Version: V12.D

Technical Manual

VOLTAGE AND FREQUENCY RELAYS
MiCOM P921/P922 & P923

CONTENT

BLANK PAGE

SAFETY SECTION

STANDARD SAFETY STATEMENTS AND EXTERNAL LABEL INFORMATION FOR SCHNEIDER ELECTRIC EQUIPMENT

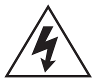
BLANK PAGE

1. INTRODUCTION

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

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

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



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

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

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

2. HEALTH AND SAFETY

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

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

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

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

Proper and safe operation of the equipment depends on appropriate shipping and handling, proper storage, installation and commissioning, and on careful operation, maintenance and servicing. For this reason only qualified personnel may work on or operate the equipment.

Qualified personnel are individuals who:

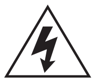
- Are familiar with the installation, commissioning, and operation of the equipment and of the system to which it is being connected;
- Are able to safely perform switching operations in accordance with accepted safety engineering practices and are authorised to energize and de-energize equipment and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

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

3. SYMBOLS AND EXTERNAL LABELS ON THE EQUIPMENT

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

3.1 Symbols

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

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

3.2 Labels

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

4. INSTALLING, COMMISSIONING AND SERVICING

Equipment connections

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

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

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

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

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

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

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

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

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

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

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

Protection Class I Equipment

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

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

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

All connections to the equipment must have a defined potential. Connections that are pre-wired, but not used, should preferably be grounded when binary inputs and output relays are isolated. When binary inputs and output relays are connected to common potential, the pre-wired but unused connections should be connected to the common potential of the grouped connections.

Before energizing the equipment, the following should be checked:

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

Accidental touching of exposed terminals

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

Equipment use

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

Removal of the equipment front panel/cover

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

UL and CSA/CUL Listed or Recognized equipment

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

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

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

Equipment operating conditions

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

Current transformer circuits

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

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

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

External resistors, including voltage dependent resistors (VDRs)

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

Battery replacement

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

Insulation and dielectric strength testing

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

Insertion of modules and pcb cards

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

Insertion and withdrawal of extender cards

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

External test blocks and test plugs

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

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

Fiber optic communication

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

Cleaning

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

5. DECOMMISSIONING AND DISPOSAL

De-commissioning

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

Disposal

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

6. TECHNICAL SPECIFICATIONS FOR SAFETY

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

6.1 Protective fuse rating

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

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

6.2 Protective Class

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

6.3 Installation Category

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

6.4 Environment

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

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

IEC 60255-27:2005

EN 60255-27: 2006

INTRODUCTION

CONTENTS

BLANK PAGE

1. INTRODUCTION

The relays of the **MiCOM P92x range** are Schneider Electric universal voltage/frequency relays. **MiCOM P921, P922** and **P923** relays have been designed to control, protect and monitor industrial installations, public distribution networks and substations and for EHV and HV transmission networks.

2. HOW TO USE THIS MANUAL

This manual provides a description of **MiCOM P921, P922** and **P923** functions and settings. The goal of this manua l is to allo w the user to becom e familiar with the application, installation, setting and commissioning of these relays.

This manual has the following format:

P92x/EN IT	*Introduction*
	The introduction presents the d ocumentation structure and a brief presentation of the relay, including functions.
P92x/EN GS	*Getting Started*
	This sections is a gui de to the different user interfaces of the protection relay describing how to start using it. This section provides detailed information regarding the communication interfaces of the relay, including a detailed description of how to access the settings database stored within the relay.
P92x/EN CO	*Connection diagrams for **MiCOM P920/P921** and **P922/P923***
	This section provides the mechanical and electrical description. External wiring connections to the relay are indicated.
P92x/EN TD	*Technical data and curve characteristics*
	This section provides technical data including setting ranges, accuracy limits, recommended operating conditions, ratings and performance data. Compliance with norms and i nternational standards is quoted where appropriate.
P92x/EN FT	*User Guide*
	This section provides relay settings with a brief explanation of each setting and detailed description. It also provides recording and measurements functions including the configuration of the event and disturbance recorder and measurement functions.
P92x/EN HI	*Menu content tables*
	This section shows the menu structure of the relays, with a complete list of all of the menu settings.
P92x/EN CT	*Communication mapping data bases*
	This section provides an overview regarding the communication interfaces of the relay. Detailed protocol mappings, semantics, profiles and interoperability tables are not provided within this manual. Separate documents are available per protocol, available for download from our website.
P92x/EN IN	*Handling, installation and case dimensions*
	This section provides logistics general instructions for handling, installing and stocking..
P92x/EN CM	*Commissioning and Maintenance Guide*
	Instructions on how to commission the relay, comprising checks on the calibration and functionality of the relay.
P92x/EN RS	*Commissioning test records*
	This section contains checks on the calibration and functionality of the relay.
P92x/EN VH	*Hardware/Software version history*

3. INTRODUCTION TO THE MiCOM P921, P922 & P923 RELAYS

The range of **MiCOM** protection relays is built on the success of the MIDOS, K and MODN ranges by incorporating the last changes in numerical technology. Relays from the MiCOM P92x range are fully compatible and use the same modular box concept.

MiCOM P921, P922 and **P923** relays provide comprehensive voltage and frequency protection.

In addition to its protective functions, each relay offers control and recording features. They can be fully integrated to a control system so protection, control, data acquisition and recording of faults, events and disturbances can be made available.

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 access all settings, clear alarms and read measurements) and 8 LEDs that indicate the status of **MiCOM P921, P922** and **P923** 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 loaded with MiCOM S1 software.

Its flexibility of use, reduced maintenance requirements and ease of integration allow the MiCOM P92x range to provide an adaptable solution for the problems of the protection of electric networks.

4. MAIN FUNCTIONS

The following table shows the functions available for the different models of the **MiCOM** P92x range of relays.

PROTECTION FUNCTIONS OVERVIEW		P921	P922	P923
	Configuration depending on the number and type of voltage transformers	●	●	●
	Phase-to-neutral or phase-to-phase voltage protection	●	●	●
27	Phase under voltage (AND/OR logic)	●	●	●
59	Phase over voltage (AND/OR logic)	●	●	●
	Settable hysteresis	●	●	●
59N	Zero-sequence over voltage	●	●	●
59N	Derived V0 sequence over voltage		●	●
47	Negative sequence over voltage	-	●	●
27D	Positive sequence under voltage	-	●	●
81U/81O	Under/over frequency	-	●	●
81R	Rate of change of Frequency	-	-	●
	Delta U / Delta T			●
	Blocking logic	●	●	●
	Under voltage Blocking (settable for P923)	-	●	●
	Balance voltage			●
GENERAL FUNCTIONS				
	Digital inputs	2	5	5
	Output relays	4	8	8
	Remote communication (RS485 port)	●	●	●
	Local communication (RS232 port)	●	●	●
	Event recording	-	250	250
	Fault recording	-	25	25
	Disturbance recording	-	5	5
	Setting group	1	2	2
	Time synchronisation (via digital input)			●
	Logic equation (AND / OR and NOT gates)	●	●	●
	Frequency change of rate of frequency (F + df/dt)			●
	VT Supervision		●	●
	CB Supervision	●	●	●
	General reset of records	-	●	●

GETTING STARTED

CONTENT

BLANK PAGE

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 Schneider Electric should be promptly notified.

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

1.2 Electrostatic discharge (ESD)

The relays use components that are sensitive to electrostatic discharges.

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

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

2. HANDLING OF ELECTRONIC EQUIPMENT

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

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

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

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

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

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

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

3. RELAY MOUNTING

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

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

For individually mounted relays an outline diagram is supplied in chapter 2 of this Technical Guide showing the panel cut-outs and hole centres.

4. UNPACKING

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

5. STORAGE

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

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

Storage temperature: –25°C to +70°C.

Sustained exposure to high humidity during storage may cause damage to electronics and reduce the lifetime of the equipment.

Therefore, once the MiCOM products have been unpacked, we recommend that they are energized within the three following months.

Where electrical equipment is being installed, sufficient time should be allowed for acclimatisation to the ambient temperature of the environment, before energisation.

6. INTRODUCTION TO THE MiCOM P921-P922-P923 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 **MiCOM P921-P922 and P923** are fully compatible and use the same modular box concept. The **MiCOM P921-P922 and P923** 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 P921-P922 and P923** 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 appropriate software.

Its flexibility of use, reduced maintenance requirements and ease of integration allow the MiCOM P921-P922 and P923 to provide an evolving solution for the problems of the protection of electric networks.

The **MiCOM P921-P922 and P923** relays provide comprehensive voltage and frequency protection for phase and ground faults together with measurements, control and recording facilities.

Functions	MiCOM P921	MiCOM P922	MiCOM P923
Protection functions			
Under voltage (27)	X	X	X
Over voltage (59)	X	X	X
Residual over voltage (59N)	X	X	X
Negative sequence overvoltage (47)		X	X
Positive sequence undervoltage (27D)		X	X
Under frequency (81U)		X	X
Over frequency (81O)		X	X
Rate of change of frequency (81R)			X
Undervoltage blocking (settable for P923)		X	X
Balance Voltage			X
Ancillary functions			
Settings groups	1	2	2
Measurements	X	X	X
Circuit Breaker Control	X	X	X
Circuit Breaker Supervision		X	X
Output relay latching	X	X	X
Blocking logic	X	X	X
Programmable logic equations	X	X	X
Peak demand		X	X
Rolling demand		X	X
Fault record		X	X
Events records		X	X
Disturbance recording		X	X
Rear communication port	X	X	X
Front communication port	X	X	X
Frequency disturbance recording			X

7. RELAY FRONT DESCRIPTION

7.1 Front view

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

Note that the MiCOM P921-P922 and P923 have the same size and the same front panel.

FIGURE 1: RELAY FRONT VIEW

The front panel of the relay includes the following, as indicated in Figure 1:

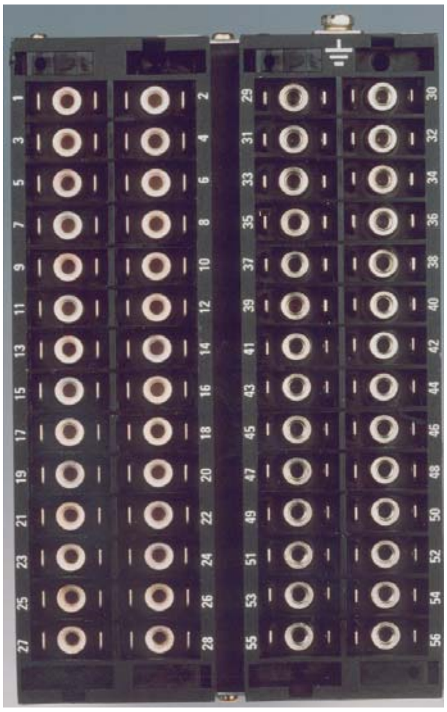
- a 16-character by 2-line alphanumeric liquid crystal display (LCD).
- a 7-key keypad comprising 4 arrow keys (⇩, ⇨, ⇦, ⇧, an enter key ↵, a clear key Ⓒ, and a read key 🕮).
- 8 LEDs; 4 fixed function LEDs and 4 programmable function LEDs on the left hand side of the front panel.
- Under the top hinged cover:
  - the relay serial number, and the relay's voltage rating information (see figure 3 in this chapter).

- Under the bottom hinged cover:
  - Former battery compartment (holds a ½AA size battery which was used for memory back-up for event, fault and disturbance records (P922 and P923 only)).
  - a 9-pin female D-type front port for communication with a PC locally to the relay (up to 15m distance) via a RS232 serial data connection (SK1 port).

The fixed function LEDs on the left hand side of the front panel are used to indicate the following conditions:

LEDS	Colour	Labels	Significance
LED1	Red	Trip.	LED 1 indicates when a trip order has been issued by the relay to the cut-off element (circuit breaker, contactor). This LED recopies the trip order issued to the trip output contact (RL1). Its normal state is unlit. It is illuminated as soon as a trip order is issued. It goes out when the associated alarm is acknowledged (by pushing the Ⓒ key).
LED2	Yellow	Alarm	LED 2 indicates that an alarm has been registered by MiCOM P921, P922 or P923 relays. The alarms are either threshold crossings (instantaneous), or tripping orders (time delayed). The LED will flash until the alarms have been accepted (read), after which the LED will change to constant illumination, and will extinguish when the alarms have been cleared.
LED3	Orange	Equip Failure	LED 3 is dedicated to the internal alarms of MiCOM P921, P922 and P923 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 caused its function (repair of the module, disappearance of the Fault).
LED4	Green	Aux Supply	LED 4 indicates that MiCOM P921, P922 and P923 relays are in correct working order.
LED5 to LED8	Red	Aux1 to Aux4	These LEDs can be programmed by the user on the basis of information on available thresholds (instantaneous and time-delayed). The user selects the information he wishes to see 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.

8. RELAY REAR DESCRIPTION



P0386XXa

FIGURE 2: RELAY MiCOM P921, P922 AND P923 REAR VIEW

P922 & P923 only			**P921, P922 and P923**
Common Output5	1	2	Common Output1
Output5	3	4	Ouput1 (NC)
Common Output6	5	6	Output1 (NO)
Output6	7	8	Common Output2
Common Output7	9	10	Output2 (NC)
Output7	11	12	Output2 (NO)
Common Output8	13	14	Common Output3
Output8	15	16	Output3
Input3+	17	18	Common Output4
Input3–	19	20	Output4
Input4+	21	22	Input1+
Input4–	23	24	Input1–
Input5+	25	26	Input2+
Input5–	27	28	Input2–

P921, P922 and P923			
Case earth	29	30	RS485 (resistance)
RS485+	31	32	RS485–
Vaux (+)	33	34	Vaux (–)
Relay faulty	35	36	Common "Watchdog"
Relay healthy	37	38	Not used
Not used	39	40	Not used
VA	41	42	Common VA
VB	43	44	Common VB
VC	45	46	Common VC
Not used	47	48	Not used
VR	49	50	Common VR
Not used	51	52	Not used
Not used	53	54	Not used
Not used	55	56	Not used

NOTA:
- By default, the output contact n°1 is associated to the trip command, which is defined in the menu « AUTOMAT. CTRL », sub-menu « TRIP OUTPUT RLY »
- MiCOM P921 hardware only provides 2 logic inputs and 4 output contacts.

9. PRODUCT IDENTIFICATION

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

P92101SM101	CE
No.4000168	Cde: 44705/002
Un = 57 – 130Vac	Modbus
Ua =	
48 – 250Vdc/100 – 250Vac 50/60Hz	

FIGURE 3: TECHNICAL INFORMATION

The significance of each information is described below:

– P92101SM**1**01: cortec code. In particular, this code allows the user to know what is the protocol used for remote communications (code **1** means MODBUS).

– N°4000168 and Cde: 44705/002: these numbers are the serial number and the reference of the order: they are necessary in case of problems.

– Un = 57 – 130V: voltage inputs range.

– Modbus: communication protocol available through the rear RS485 communication port.

– Ua = 48 – 250 Vdc (100-250Vac): power supply range. In this example, the power supply can be either ac or dc voltage.

10. ENERGISING THE RELAY

To energise correctly the relay, please follow carefully the following instructions.

Before carrying out any work on the equipment the user should be familiar with the contents of the Safety Section/Safety Guide SFTY/4LM/D11 or later issue and the ratings on the equipment's rating label.

10.1 System connections

1. Please check the wiring scheme of your installation,
2. Please check that the output relay N°1 is included in your trip circuit,

10.2 Power supply connections

Connect a DC or AC (according to nominal supply rating) voltage power supply.

CONNECTIONS ARE POSITIVE TO TERMINAL F33 AND NEGATIVE TO TERMINAL F34. DO NOT FORGET TO CONNECT THE EARTH REFERENCE (F29).

Turn on the DC or AC voltage and set to approximately rated voltage as shown on the front panel of the relay.

Display should show:

Va =
0.00 V

LEDs should be in the following configuration:

– Green LED « Vaux » lit
– All the other LEDs should be off

11. ACCESS TO THE MENU

Before using your MiCOM P921-P922 and P923, some settings have to be checked or modified.

Lift top cover and lower down bottom cover in order to remove the transparent front cover. When the keypad is exposed, it provides full access to the menu options of the relay, with the information displayed on the LCD.

11.1 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.

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

11.1.1 Password entry

When entry of a password is required the following prompt will appear:

PASSWORD =
AAAA

A flashing cursor will indicate which character field of the password may be changed. Press the and keys to vary each character between A and Z. To move between the character fields of the password, use and keys.

The password is confirmed by pressing the enter key . The display will indicated if an incorrect password is entered. If a correct password is entered the following message will appear:

Password OK

Alternatively, the password can be entered using the "Password" cell of the "OP. PARAMETERS" menu.

11.2 System Frequency

Press 6 times, the default system frequency appears on the LCD.

Change the setting by pressing either the key or the key. To validate the new value, press the enter key .

11.3 VT Ratios

The default ratios are equal to 1. If other ratios are required, please follow the instructions below. From the default display, press ⇩ once, ⇨ once, ⇩ once and press ⇨ once to access the « VT RATIO » menu.

Then, press ⇩ once and the following prompt will appear:

Main VT Primary **110.0 V**

Change the setting by pressing either the ⇩ key or the ⇧ key. To validate the new value, press the enter key ↵.

Press ⇩ once and the following prompt will appear (if the voltage input range is "57-130V"):

Main VT Sec'y **110.0 V**

If the voltage input range is 220-480V, there is no need to specify the VT secondary level.

Change the setting by pressing either the ⇩ key or the ⇧ key. To validate the new value, press the enter key ↵.

If the connection scheme includes a residual VT, the ratio of this VT must be set in this menu. The prompts will be:

E/Gnd VT Primary **110.0 V**

and

E/Gnd VT Sec'y **110.0 V**

11.4 Connection mode

From the heading of the menu, press ⇧ once to go back to the default display.

From the default display, press ⇩ once, ⇨ once and ⇩ once to access to the menu « CONFIGURATION », sub-menu « GENERAL ». Press ⇩ once.

The following connection schemes are supported:

$3V_{PN}$= 3 phase-neutral VTs
$3V_{PN}$ + V_R= 3 phase-neutral VTs + residual VT
$3V_{PP}$ + V_R= 3 phase-phase VTs + residual VT
$2V_{PP}$ + V_R= 2 phase-phase VTs + residual VT

The default configuration is:

Connection **$3V_{PN}$**

12. QUICK MEASUREMENT CHECK

Before carrying out any work on the equipment the user should be familiar with the contents of the Safety Section/Safety Guide SFTY/4LM/D11 or later issue and the ratings on the equipment's rating label.

12.1 Voltage

Switch off power supply.

Connect a single phase voltage to terminals 41 and 42 (VA voltage) and set to 0 V.

Switch on power supply and set as before. Switch on the AC voltage.

Press once, twice, once to read the magnitude of the voltage on phase A. Raise the voltage to rated volts. The LCD will show the voltage measurement in primary volts: divide by the set ratios to check accuracy.

13. PC CONNECTION – LOCAL COMMUNICATIONS

The MiCOM S1 access software is used to set the relay locally from a laptop.

13.1 Configuration of the connection

The configuration is shown below:

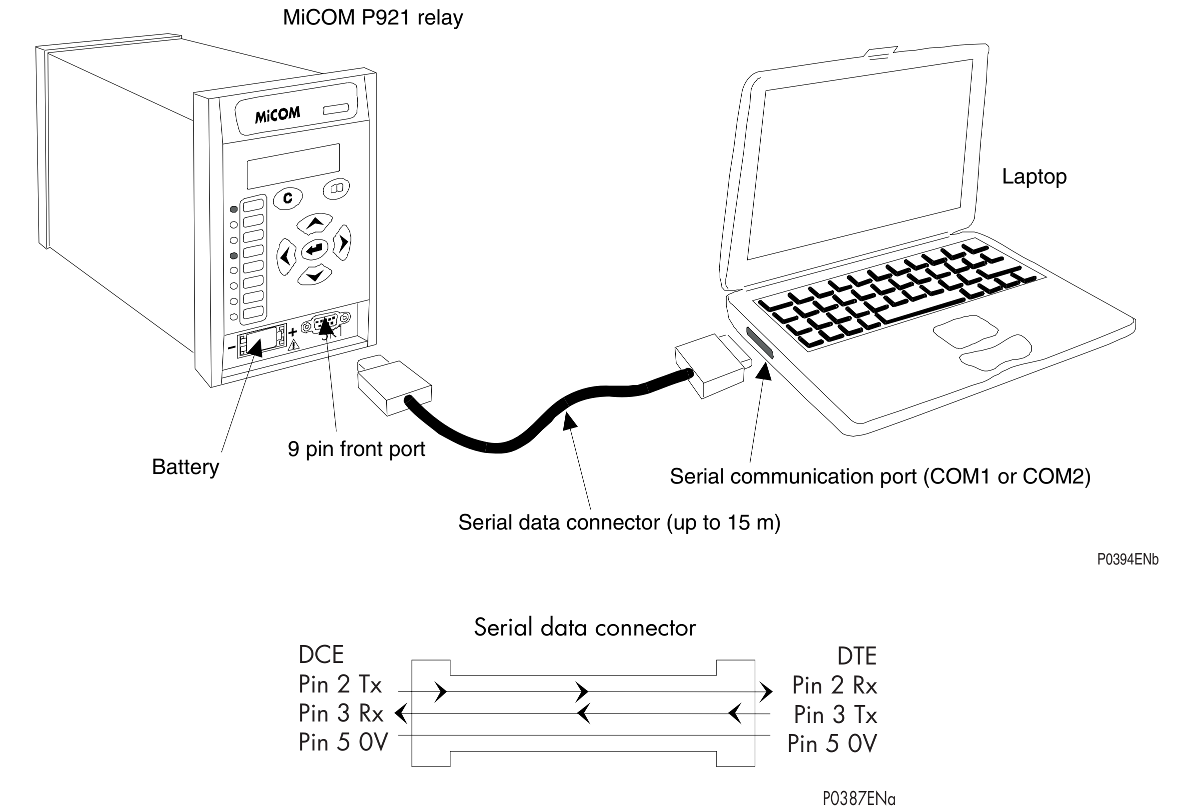


FIGURE 4: PC CONNECTION SHOWN ASSUMING 9 WAY SERIAL PORT

The front communication port is provided by a 9-pin female D-type connector located under the bottom hinged cover. It provides RS232 serial data communication (asynchronous RS232 connection according the IEC870 requirements) and is intended for use with a PC locally to the relay (up to 15m distance) as shown in Figure 4: this is for one to one connection and this is not suitable for permanent connection.

13.2 Configuration of the relay and of the laptop

Having made the physical connection from the relay to the PC, the PC's communication settings must be configured to match those of the relay. The relay's communication settings for the front port are fixed as shown in the table below:

Protocol	ModBus
Baud rate	19,200 bits/s
Message format	11 bit - 1 start bit, 8 data bits, 1 parity bit (even parity), 1 stop bit

The address of the relay must be set in the "COMMUNICATIONS" menu.

BLANK PAGE

CONNECTION DIAGRAMS

CONTENT

SCHEMES

BLANK PAGE

1. ANALOGUE INPUTS

The MiCOM P921-P922 and P923 relays have 4 voltage inputs: one voltage input for the residual voltage and 3 phase voltage inputs.

1.1 VT inputs

The following figures present different configurations of VTs.

1.1.1 3VTs (phase-neutral) configuration

Select the « $3V_{PN}$ » configuration in the « CONFIGURATION » menu and in the « GENERAL » sub-menu.

The 3 phase voltages VA, VB, VC are then measured by the MiCOM relay.

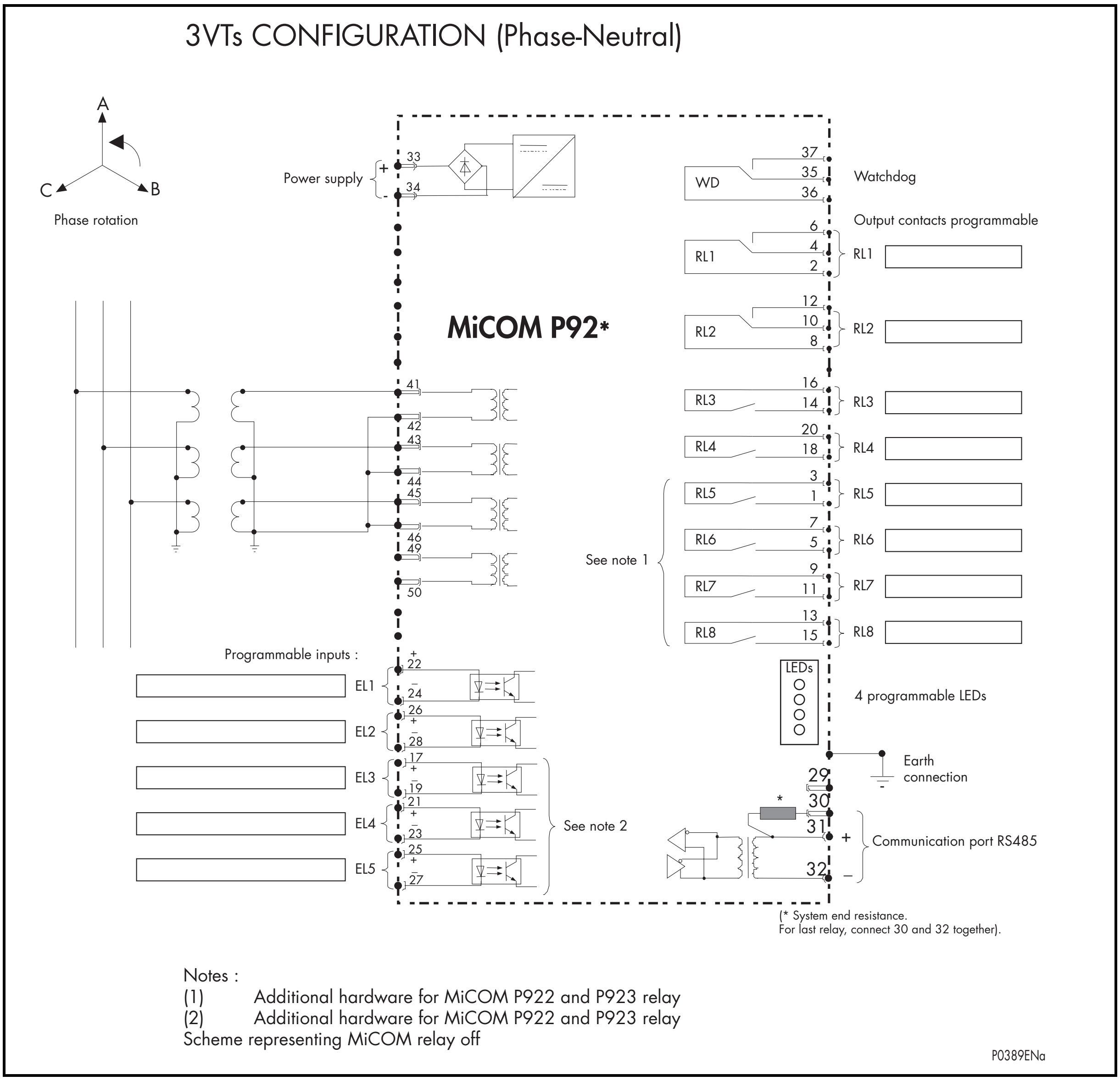


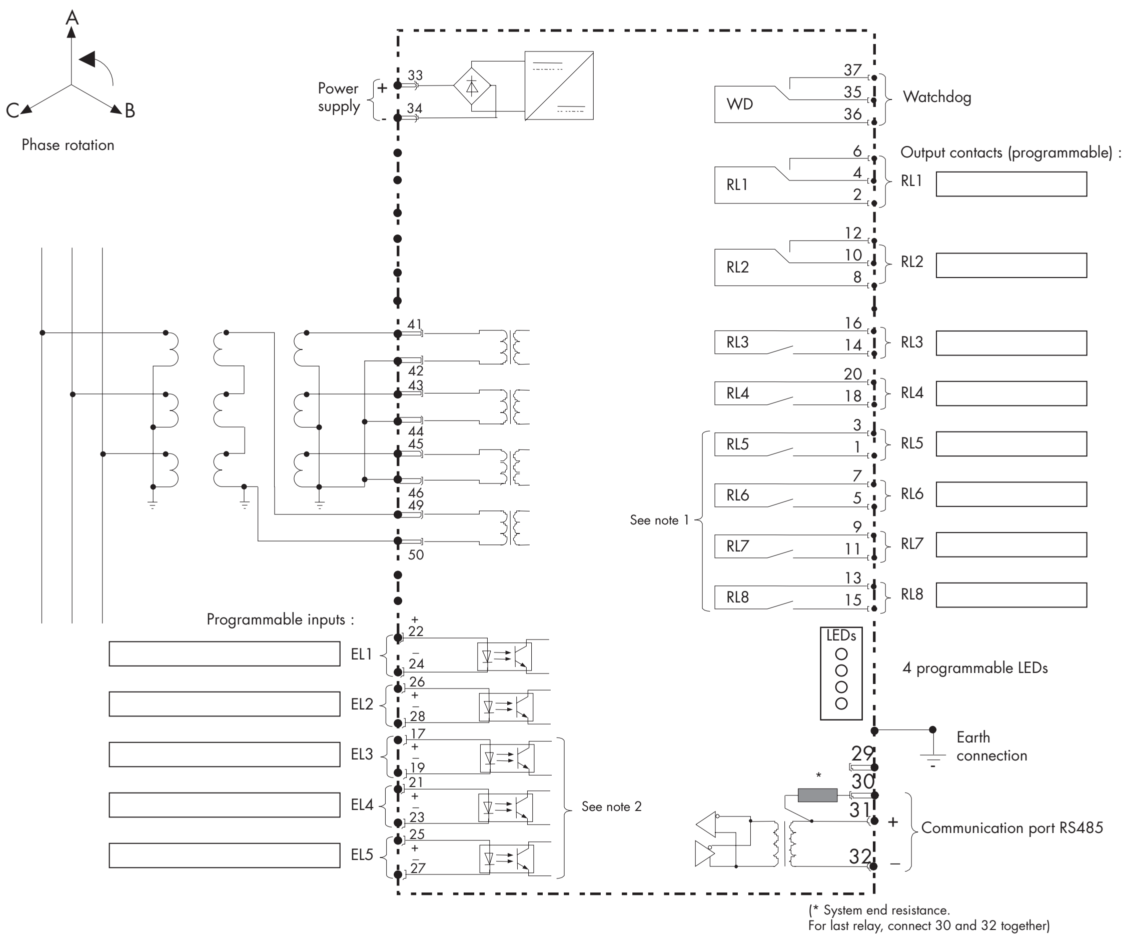
FIGURE 1: 3VTs CONNECTION

1.1.2 3VTs (phase-neutral) + residual VT configuration

Select the « $3V_{PN}$ + V_R » configuration in the « CONFIGURATION » menu and in the « GENERAL » sub-menu.

The 3 phase voltages VA, VB, VC and the residual voltage VR are then measured by the MiCOM relay.

3VTs CONFIGURATION (Phase-Neutral) + residual voltage



Notes :
(1) Additional hardware for MiCOM P922 and P923 relay
(2) Additional hardware for MiCOM P922 and P923 relay
Scheme representing MiCOM relay off

P0390ENa

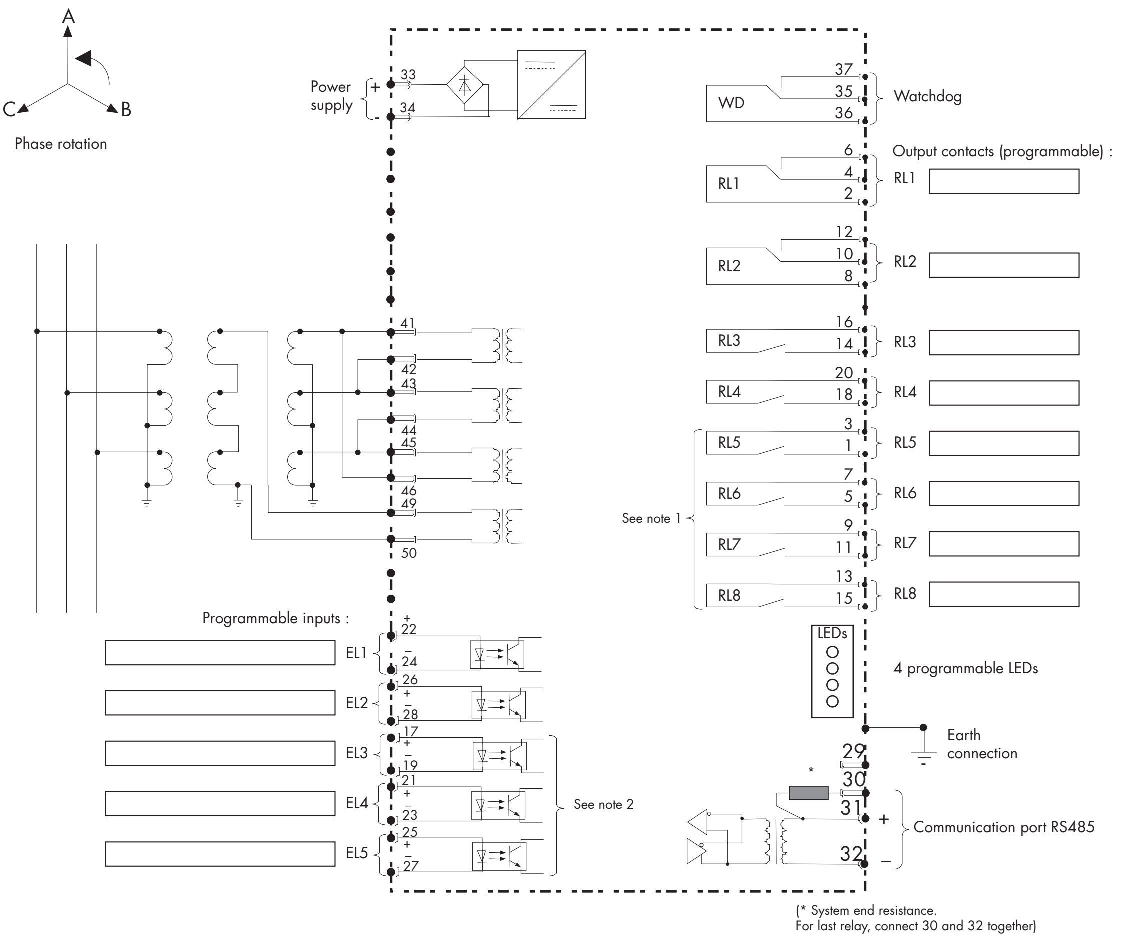
FIGURE 2: 3VTs + RESIDUAL VT CONNECTION

1.1.3 3VTs (phase-phase) + residual VT configuration

Select the « $3V_{PP}$ + V_R » configuration in the « CONFIGURATION » menu and in the « GENERAL » sub-menu.

The 3 line voltages VAB, VBC, VCA and the residual voltage VR are then measured by the MiCOM relay.

3VTs CONFIGURATION (Phase-Phase) + residual voltage



Notes :
(1) Additional hardware for MiCOM P922 and P923 relay
(2) Additional hardware for MiCOM P922 and P923 relay
Scheme representing MiCOM relay off

P0391ENa

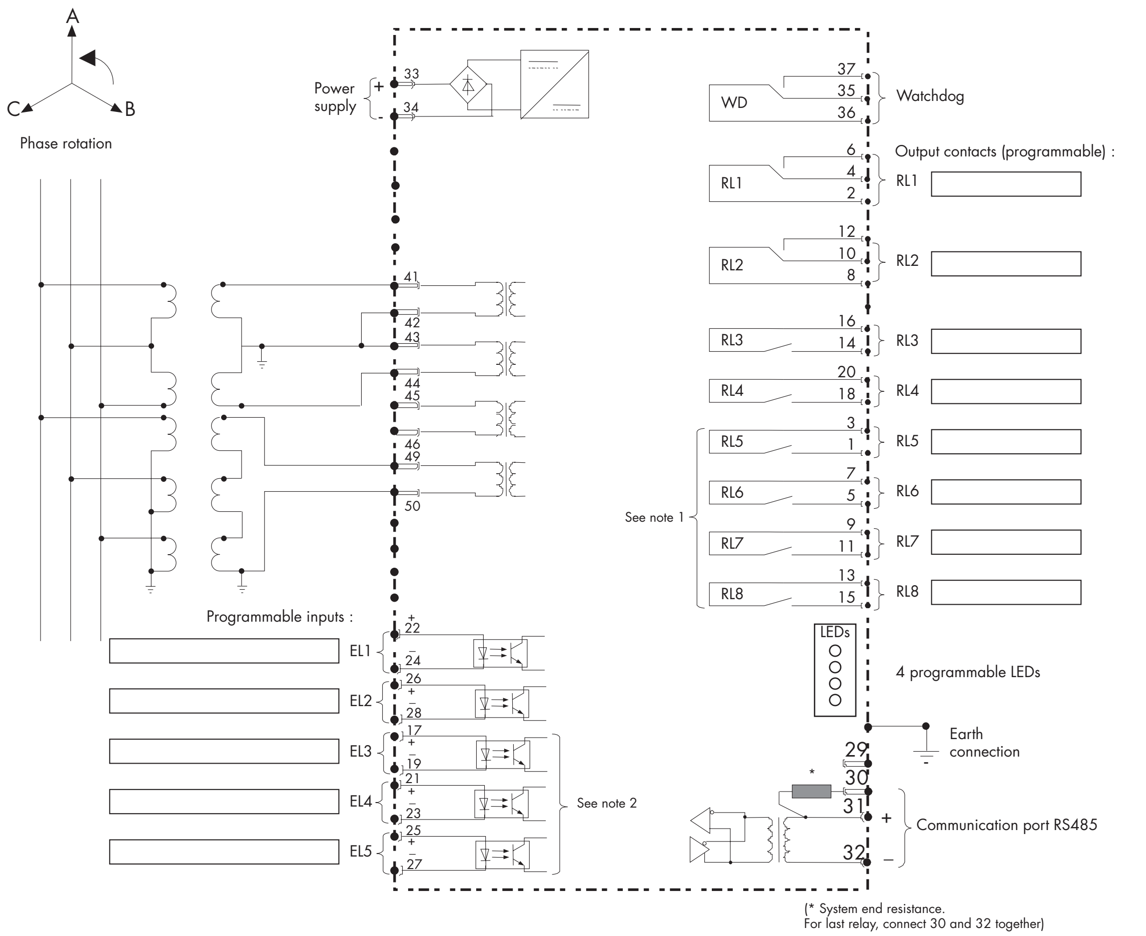
FIGURE 3: 3VTs (PHASE-PHASE) + RESIDUAL VT CONNECTION

1.1.4 2VTs + residual VT connection

Select the « $2V_{PP}$ $+V_R$ » configuration in the « CONFIGURATION » menu and in the « GENERAL » sub-menu.

The 3 line voltages VAB, VBC, VCA and the residual voltage VR are then measured by the MiCOM relay.

2VTs CONFIGURATION + residual voltage



Notes :
(1) Additional hardware for MiCOM P922 and P923 relay
(2) Additional hardware for MiCOM P922 and P923 relay
Scheme representing MiCOM relay off

P0392ENa

FIGURE 4: 2VTs + RESIDUAL VT CONNECTION

1.1.5 LV connection for P92x (220-480V range)

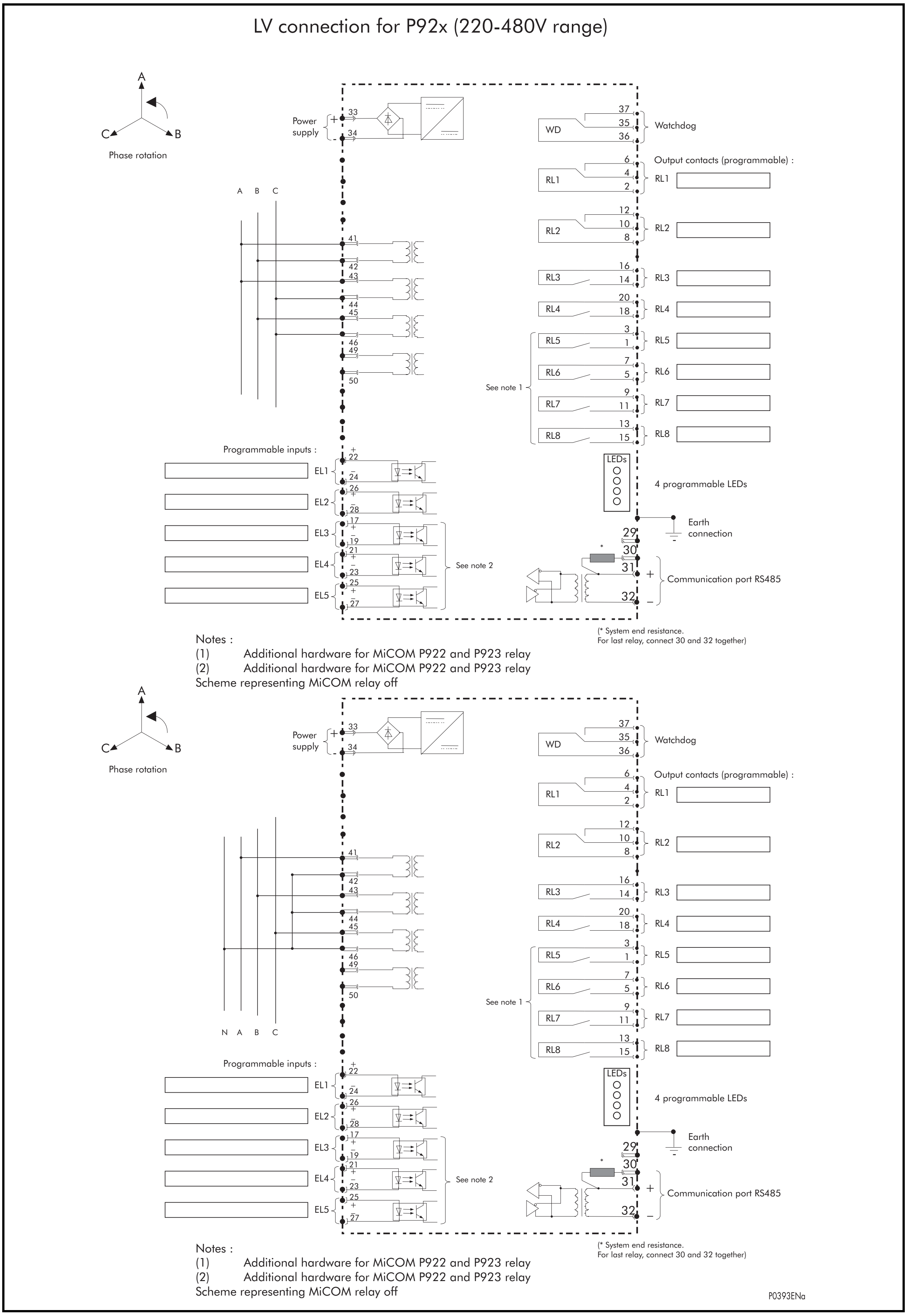


FIGURE 5: LV CONNECTION FOR P92x (220-480V RANGE)

2. PORTS CONNECTION

2.1 Front port connection (RS232)

The front communication port is provided by a 9-pin female D-type connector located under the bottom hinged cover. It provides RS232 serial data communication (asynchronous RS232 connection according the IEC870 requirements) and is intended for use with a PC locally to the relay (up to 15m distance).

The relay is a Data Communication Equipment (DCE) device. Thus the pin connections of the relay's 9-pin front port are as follows:

Pin no. 2	Tx	Transmit data
Pin no. 3	Rx	Receive data
Pin no. 5	0V	Zero volts common

None of the other pins are connected in the relay. The relay should be connected to the serial port of a PC, usually called COM1 or COM2. PCs are normally Data Terminal Equipment (DTE) devices which have a serial port pin connection as below (if in doubt check your PC manual):

Pin no. 2	Rx	Receive data
Pin no. 3	Tx	Transmit data
Pin no. 5	0V	Zero volts common

For successful data communication, the Tx pin on the relay must be connected to the Rx pin on the PC, and the Rx pin on the relay must be connected to the Tx pin on the PC, as shown in figure 5. Therefore, providing that the PC is a DTE with pin connections as given above, a 'straight through' serial connector is required, i.e. one that connects pin 2 to pin 2, pin 3 to pin 3, and pin 5 to pin 5. Note that a common cause of difficulty with serial data communication is connecting Tx to Tx and Rx to Rx. This could happen if a 'cross-over' serial connector is used, i.e. one that connects pin 2 to pin 3, and pin 3 to pin 2, or if the PC has the same pin configuration as the relay.

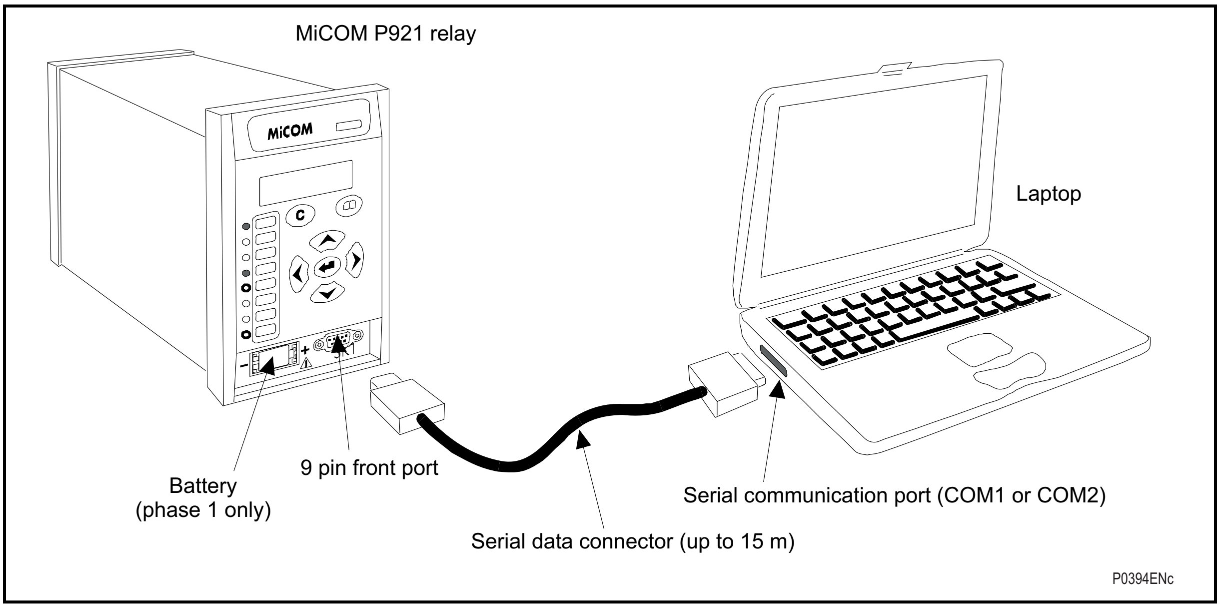


FIGURE 6: PC<->RELAY SIGNAL CONNECTION

2.2 RS485 rear port

2.2.1 Description

The rear RS485 interface is isolated and is suitable for permanent connection whichever protocol is selected. The advantage of this type of connection is that up to 31 relays can be 'daisy chained' together using a simple twisted pair electrical connection.

2.2.2 Connection

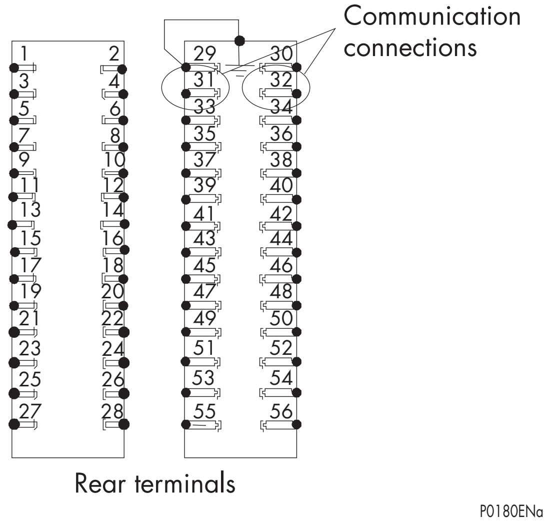


FIGURE 7: RS485 CONNECTION

The total communication cable from the master unit to the farthest slave device is a spur, and no branches may be made from this spur. The maximum cable length is 1000m and the maximum number of devices per spur is 32.

The transmission wires should be terminated using a 150 Ω resistor at both extreme ends of the cable. To do this, connect the terminals 30 and 32 together.

Polarity is not necessary for the 2 twisted wires.

WARNING: TERMINALS F33 AND F34 ARE USED FOR THE POWER SUPPLY. DO NOT CONNECT THE VOLTAGE POWER SUPPLY TO TERMINALS F31 AND F32.

2.2.3 Convertors

2.2.3.1 Protocol convertor: RS232 -> K-Bus

KITZ 101,102 and 201 can be used.

Configuration is: 19200 bauds, 11 bits, full duplex.

2.2.3.2 RS232 / RS485 converter

The following RS232/RS485 converters have been tested by AREVA P&C:

RS_CONV1	: convertor suitable for a short length and for up to 4 connected relays
RS_CONV32	: industrial convertor, suitable for up to 31 connected relays.

BLANK PAGE

TECHNICAL DATA

Information required with order

Information required with order

Versions		**Order - No.**
		1 – 3 4 5 6 7 8 9 10 11 12 13 14
MiCOM P92x - Voltage Protection Relays		**P92 * 0 * S * * * ***

Variant		
Voltage relay		1
Voltage / frequency relay (only choice for the "G" type of application)		2
Voltage/Frequency relay with (df / dt) relay		3
Voltage input		
57 - 130 V		A
220 - 480 V		B
Application		
Standard		S
Auxiliary voltage	**Digital input voltage**	
48 - 250 Vdc / 48 - 240 Vac	105 - 145 Vdc (special application)	H
Note: option H not available with graphical display: Chinese		
48 - 250 Vdc / 48 - 240 Vac	24 - 250 Vdc (Special option for ENA UK)	T
48 - 250 Vdc / 48 - 240 Vac	110 Vdc -30% / +20% (special application) (1)	V
48 - 250 Vdc / 48 - 240 Vac	220 Vdc -30% / +20% (special application) (1)	W
24 - 250 Vdc / 24 - 240 Vac	24-250Vdc / 24-240Vdc	Z
Communication interface		
Modbus (only choice for the "G" type of application)		1
K-BUS / Courier		2
IEC 60870-5-103		3
DNP3.0		4
Language		
French		0
English / American		1
Spanish		2
German		3
Italian		4
Russian		5
Polish		6
Portuguese		7
Dutch		8
Czech		A
Hungarian (not yet available)		B
Greek (not yet available)		C
Chinese (only available in phase II hardware)		D
Turkish (not yet available)		E
Hardware version		
All languages except Chinese (text display)		2
Chinese language only (graphical display)		3
Latest Major Software release		
V XX.X (2)		?
Latest Minor Software release		
V XX.X (2)		?
Mounting option		
None (default)		0
Pre-fixed HMI (no withdrawability)		1
Sealed cover		2
Pre-fixed with Auxiliary / digital input voltage option T		3

(1) Available only from PCV and PCW manufacturing
(2) Unless specified, the latest version will be delivered

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

TECHNICAL DATA

MICOM P921, P922 AND P923 VOLTAGE PROTECTION RELAYS:

* Voltage relay (P921)
* Voltage / frequency relay (P922),
* Voltage / Frequency Relay with df/dt (P923)

Input / Output (I/O)

* P921: 2I/4O
* P922: 5I/8O
* P923: 5I/8O

Voltage input (ordering option):

* 57 – 130V
* 220–480V

Protocol options:

* Modbus
* K-Bus
* IEC60870-5-103
* DNO3.0

Languages options:

* French, English, Spanish, German, Italian, Russian, Polish, Portuguese, Dutch, Czech, Chinese

Hardware options:

* text display (all languages)
* Graphical display (chinese language)

MECHANICAL SPECIFICATIONS

Design

Modular MiCOM Px2x platform relay:
P921, P922 & P923 – Case 20TE – 4U

Mounting

Rack or flush mounting.

Connections

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

Enclosure Protection

Front Panel: IEC 60529: 2001:

* IP 52 – Protection (front panel) against dust and dripping water
* IPx2 – Protected against vertically falling drops of water with the product in 4 fixed positions of 15° tilt with a flow rate of 3mm/minute for 2.5 minutes.
* IP50 – dust protection (whole case)
* IP 10 – Product safety protection for the rear due to live connections on the terminal block

DIMENSIONS

Case size of the different models:

HEIGHT	DEPTH	WIDTH
4U (177mm)	230mm	20 TE

Weight approx. **1.7 Kg**

PC interface

DIN 41652 CONNECTOR (X6),
TYPE D-SUB, 9-PIN.

ENVIRONMENTAL CONDITIONS

Ambient Temperature Range

Per IEC 60255-6: 1988

Operating temperature range:
Continuous Withstand:
–25 to +55°C (or –13°F to +131°F)
Limit (Note 1):
–25 to +70°C (or –28°F to +158°F).

Storage Temperature Range:
–25 to +70°C (or –28°F to +158°F)

Tested as per

IEC 60068-2-1:2007:
–25°C storage (96 hours)
–40°C operation (96 hours)

IEC 60068-2-2:2007:
+85°C storage (96 hours)
+85°C operation (96 hours)

Note 1: The upper limit is permissible for a single 6- hour duration within any 24 hour period.

Ambient Humidity Range

Humidity:

* Per IEC 60068-2-78: 2001:
  56 days at 93% relative humidity and +40 °C

Cyclic temperature with humidity:

* Per IEC 60068-2-30: 2005:
  Damp heat cyclic, six (12 + 12) hour cycles, 93% RH, +25 to +55 °C

Solar radiation

Avoid exposure of the front panel to direct solar radiation.

MECHANICAL ENVIRONMENT

Vibration Test

IEC 60255-21-1:1988
Vibration response Class 2 – 1g
Vibration endurance Class 2 – 2g

Shock and Bump Test

IEC 60255-21-2:1988
Shock response Class 2 – 10g
Shock withstand Class 1 – 15g
Bump Class 1 – 10g

Seismic Test

IEC 60255-21-3:1993: Class 2.

PRODUCT SAFETY

CE 73/23/EEC

Compliance with European Commission Low Voltage (safety and insulation) Directive.
Compliance is demonstrated by reference to generic safety standards:
IEC 60255-27:2005
EN 60255-5:2001

TYPE TESTS

Insulation

PER IEC 60255-5: 2000,
Insulation resistance > 100MΩ at 500Vdc
(Using only electronic/brushless insulation tester).

High Voltage (Dielectric) Withstand

(i) Per IEC 60255-5: 2000, 2 kV rms AC, 1 minute:

Between all case terminals connected together, and the case earth, and between all terminals of independent circuits (RS232 ports excepted).

* 2.0kVrms for one minute between all terminals and case earth
* 2.0kVrms for one minute between all terminals of independent circuits, including contact circuits
* 1.5kVrms for one minute across dedicated normally open contacts of output relays.
* 1.5kVrms AC for 1 minute, across open contacts and across open contacts of changeover output relays.

Impulse Voltage Withstand Test

Per IEC 60255-5: 2000
The product will withstand without damage impulses of 1.2 / 50 µs, peak value: 5 kV, 0.5J across:
* Each independent circuit and the case with the terminals of each independent circuit connected together.
* Independent circuits with the terminals of each independent circuit connected together.
* Terminals of the same circuit except normally open metallic contacts.

ELECTROMAGNETIC COMPATIBILITY (EMC)

DC Supply Interruption

Per IEC60255-11:1979: The product will withstand a 20ms interruption in the auxiliary voltage in its quiescent condition

AC Ripple on DC Supply

Per IEC60255-11:1979: The product will operate with 12% AC ripple on the DC auxiliary supply without any additional measurement errors

Disturbances on AC Supply

Per IEC61000-4-11:1994: The products satisfies the requirements of EN61000 - 4 - 11 for voltage dips and short interruptions.

1 MHz Burst High Frequency Disturbance Test

Per IEC 60255-22-1: 2008, Class III,
Common-mode test voltage: 2.5 kV,
Differential test voltage: 1.0 kV,
Test duration: 2 s, Source impedance: 200 Ω

Electrical Fast Transient or Burst Requirements

Per IEC 60255-22-4: 2002

The product complies with all classes up to and including Class A 4kV without any mal-operations or additional measurement errors.

Fast transient disturbances on terminal block, communications (common mode only)	2kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.
Fast transient disturbances on power supply, I/O signal, data and control lines (common mode only)	4kV, 5ns rise time, 50ns decay time, 2.5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.

Per IEC 61000-4-4: 2004.
The product complies with all classes up to and including Level 4 4kV without any mal-operations or additional measurement errors:

Fast transient disturbances on power supply (common mode only)	4kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.
Fast transient disturbances on I/O signal, data and control lines (common mode only)	2kV, 5ns rise time, 50ns decay time, 5kHz repetition time, 15ms burst, repeated every 300ms for 1min in each polarity, with a 50Ω source impedance.

Immunity to Electrostatic Discharge

Per IEC 60255-22-2: 1997 & IEC61000-4-2:2001, the product will withstand application of all discharge levels up to the following without mal-operation:
* 15kV discharge in air to user interface, display, and exposed metalwork.
* 8kV discharge in air to all communication ports.
* 8kV point contact discharge to any part of the front of the product.

Conducted Emissions

Per EN 55022: 1998:
* 0.15 – 0.5MHz, 79dBµV (quasi peak) 66dBµV (average)
* 0.5 – 30MHz, 73dBµV (quasi peak) 60dBµV (average).

Radiated Emissions

Per EN 55022: 1998:
* 30 - 230MHz, 40dBµV/m at 10m measurement distance
* 230 – 1GHz, 47dBµV/m at 10m measurement distance.

Immunity to Radiated Electromagnetic Energy

Per IEC 60255-22-3: 2000, Class III & IEC61000-4-3:2002
Test field strength, frequency band 80 to 1000 MHz:
* 10 V/m, test using AM: 1 kHz / 80%, at 80 to 1GHz,
* 30 V/m, test using AM: 1 kHz / 80%, at 80 to 900MHz and 1.4GHz to 2.0GHz

Conducted Immunity

Per IEC 60255-22-6: 2001
* 10 V/m, test using AM: 1 kHz / 80%, at 0.15 to 80MHz,

Surge Immunity

Per IEC 60255-22-5: 2002

* Class IV: 4kV common mode 12Ω source impedance, 2kV differential mode 2Ω source impedance – power supply
* Class IV: 4kV common mode 42Ω source impedance, 2kV differential mode 42Ω source impedance – Opto inputs, relays, CT, VT
* Class IV - 4kV common mode 2Ω source impedance applied to cable screen – terminal block communications

Power Frequency Magnetic Field Immunity

Per IEC 61000-4-8:2001, class IV: 30A/m quiescent condition, 300A/m short duration (1-3s)

Pulse Magnetic Field Immunity

Per IEC 61000-4-9:2001, class V: 1000A/m pulse (5 positive, 5 negative)

Damped Oscillatory Magnetic Field

Per IEC 61000-4-10:2001, class V: 100A/m @100kHz / 1MHz 2 second burst duration

Oscillatory Waves Immunity

Per IEC 61000-4-12:2001:

* 2.5kV peak between independent circuits and case earth
* 1.0kV peak across terminals of the same circuit

EMC compliance

89/336/EEC
93/31/EEC

Compliance with European Commission EMC Directive.

Generic standards were used to establish conformity:
EN50081-2: 1994
EN60952-2: 1995

Product Specific Standards were used to establish conformity: EN50263: 2000

Power Frequency Interference – Electricity Association (UK)

EA PAP Document, Environmental Test Requirements for Protection Relays and Systems Issue I, Draft 4.2.1 1995.

Class	Length of comms circuit	Unbalanced Comms Vrms	Balanced Comms (Unbalance 1%) Vrms	Balanced Comms (Unbalance 0.1%) Vrms
1	1 to 10 metres	0.5	0.005	0.0005
2	10 to 100 metres	5	0.05	0.005
3	100 to 1000 metres	50	0.5	0.05
4	1000 to 10,000m or >	500	5	0.5

ANSI TEST REQUIREMENTS

The products meet the ANSI / IEEE as follows:

ANSI / IEEE C37.90.1989: Standards for relays and relay systems associated with electric power apparatus

ANSI / IEEE C37.90.1:2002: Surge withstand capability (SWC) tests for protective relays and relay systems:
– Oscillatory test - 1MHz to 1.5MHz, 2.5kV to 3.0kV
– Fast transient test 4kV to 5kV

ANSI / IEEE C37.90.2:2004: Standard for withstand capability of relay systems to radiated electromagnetic interference from transceivers. 35V/m , 80 to 1000MHz, sweep 80% a.m. @ 1kHz, 35V/m , 80 to 1000MHz, keying sweep 100% duty cycle, 35V/m 900MHz pulse modulated 200Hz keying

RATINGS

Voltages

Nominal voltage	*Operating range*
57 – 130V_{ph-ph} eff	0 to 260V_{ph-ph} eff
220 – 480V_{ph-ph} eff	0 to 960V_{ph-ph} eff
Thermal withstand	*(Vn = 57V … 130V)*
Continuous	260V_{ph-ph} eff
10 seconds	300V_{ph-ph} eff
Thermal withstand	*(Vn = 220V … 480V)*
Continuous	960V_{ph-ph} eff
10 seconds	1300V_{ph-ph} eff

Auxiliary voltage

Ordering Code	Relay auxiliary power supply	
	Nominal voltage range Vx	Operating voltage range
A	24 - 60 Vdc	19.2 - 76 Vdc
F	48 - 250 Vdc 48 - 240 Vac	38.4 - 300 Vdc 38.4 - 264 Vac
T	48 - 250 Vdc 48 - 240 Vac Special ENA (**)	38.4 - 300 Vdc 38.4 - 264 Vac
H	48 - 250 Vdc 48 - 240 Vac	38.4 - 300 Vdc 38.4 - 264 Vac
V	48 - 250 Vdc 48 - 240 Vac	38.4 - 300 Vdc 38.4 - 264 Vac
W	48 - 250 Vdc 48 - 240 Vac	38.4 - 300 Vdc 38.4 - 264 Vac
Z	24 - 250 Vdc 24 - 240 Vac	19.2 - 300 Vdc 19.2 - 264 Vac

* The tolerance on the auxiliary voltage variations for the logic inputs is ±20% in DC voltage and -20%, +10% in AC voltage.

** Logic input recognition time = 5 ms for EA approval. Dedicated filtering on 24 samples (15 ms at 50 Hz)

Frequency

Nominal value 50Hz
Operating range 40 – 60 Hz
Nominal value 60Hz
Operating range 50 – 70 Hz

Output Relay Contacts

The output contacts of the MiCOM P921-P922-P923 relays are AgNi dry contacts.

Make and carry:	30A for 3s
Carry:	5A continuous
Rated voltage:	250Vac
Break :	DC : 50W resistive DC : 25W inductive (L/R = 40ms) AC : 1500VA resistive AC : 1500 VA inductive (cos φ = 0.5)
Maxima :	5A and 300V
Loaded contact :	10 000 operation minimum
Unloaded contact :	100 000 operation minimum
Operation time	< 7 ms

Logic inputs

All the logic inputs are optically-isolated and independent: MiCOM P921 relay has 2 logic inputs

MiCOM P922-P923 relays have 5 logic inputs.

Energization of the logic inputs is realised with a DC or AC auxiliary voltage.

Burdens

Voltage circuits

Reference voltage (Vn)

Vn = 57 – 130V <0,25 VA
Vn = 220 – 480V <0,36 VA

Auxiliary supply

Nominal*: 3W

* Nominal is with 50% of the optos energised and one relay per card energised

Optically-isolated inputs

Logic input burden: < 10mA per input,
Logic input recognition time: <5ms.

Ordering Code	Logic Inputs				
	Nominal Voltage range	**Minimum polarisation voltage**	**Maximum polarisation current**	**Holding current after 2 ms**	**Maximum continuous withstand**
A	24 - 250 Vdc	19,2 Vdc	35 mA	2.3 mA	300 Vdc
F	24 - 240 Vac	19,2 Vac			264 Vac
T	24 - 250 Vdc 24 - 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac
H	129 Vdc	105 Vdc	3.0 mA @ 129 Vdc		145 Vdc
V	110 Vdc	77 Vdc	7.3 mA @ 110 Vdc		132 Vdc
W	220 Vdc	154 Vdc	3.4 mA @ 220 Vdc		262 Vdc
Z	24 - 250 Vdc 24 - 240 Vac	19,2 Vdc 19,2 Vac	35 mA	2.3 mA	300 Vdc 264 Vac

TIMINGS AND ACCURACY

PERFORMANCE DATA

Undervoltage protection

V<, V<< and V<<<
Range 5-130V (range A):
Operate:
- DT: Vs ±2%
- IDMT : $V_{operate}$ = 0.95Vs ±2%

Reset: (1.02-1.05) $V_{operate}$ ±2%
Timer accuracy:
2% or 40ms Whichever is Greater (WIG)

Range 40-430V (range B):
Operate:
- DT: Vs ±2%
- IDMT : $V_{operate}$ = 0.95Vs ±2%

Reset: (1.02-1.05) $V_{operate}$ ±2%
Timer accuracy: 5% or 40ms WIG

Trip time (ranges A & B) ≤ 30ms
or ±10ms (timers ≤ 200ms)
or ±5% (timers ≥ 200ms)

Overvoltage protection

V>, V>> and V>>>
Range 5-260V (range A):
Operate:
- DT: Vs ±2%
- IDMT : $V_{operate}$ = 1.1Vs ±2%

Reset: (0.95-0.98) $V_{operate}$ ±2%
Timer accuracy:
2% or 40ms Whichever is Greater (WIG)

Range 20-960V (range B):
Operate:
- DT: Vs ±2%
- IDMT : $V_{operate}$ = 1.1Vs ±2%

Reset: (0.95-0.98) $V_{operate}$ ±2%
Timer accuracy: 5% or 40ms WIG

Trip time (ranges A & B) ≤ 30ms
or ±10ms (timers ≤ 200ms)
or ±5% (timers ≥ 200ms)

Residual voltage protection

V_0>, V_0>> and V_0>>>
Range 0.5-130V (range A):
Operate:
- DT: Vs ±2% (0.5-5V)
Vs ±7.5% (≥ 5V)
- IDMT : $V_{operate}$ = 1.1Vs ±2% (direct measurement)

Reset: 0.95$V_{operate}$ ±2%
Timer accuracy:
2% or 40ms Whichever is Greater (WIG)
Trip time: ≤30ms or ±10ms WIG
Hysteresis: $V_{operate}$ – 0.2V (0.5 to 4V)

V_0>, V_0>> and V_0>>>
Range 2-480V (range B):
Operate:
- DT: Vs ±2% (0.5-5V)
Vs ±7.5% (≥ 5V)
- IDMT : $V_{operate}$ = 1.1Vs ±2%(direct measurement)

Reset: 0.95$V_{operate}$ ±2%
Timer accuracy: 5% or 40ms WIG
Trip time: ≤30ms or ±10ms (WIG
Hysteresis: $V_{operate}$ – 0.8V (2 to 16V)

Frequency protection (under / over frequency)

F1 to F6
Range 50Hz: 40Hz to 60Hz
Range 60Hz: 50Hz to 70Hz
Operate (DT): fs ±10mHz
with [V>30% Un] or [(V<30% Un) AND (df/dt < 10 Hz/s)]
Reset: fs ±50mHz
Timer accuracy: 2% or 80ms WIG
Trip time: ≤75ms or ±25ms WIG

Rate of change of frequency

Df/dt
Range 50Hz: 40Hz to 60Hz
Range 60Hz: 50Hz to 70Hz
Operate: 0.5Hz / IT
with [V>30% Un] or [(V<30% Un) AND (df/dt < 10 Hz/s)]
(IT = number of frequency filtering periods)
Timer accuracy: 2% or 20ms WIG
Trip time: ≤75ms or ±25ms WIG

Delta U / Delta t

Δf/Δt

Operate:

- U:	1% U (if 5% Un < U < Umax) 5% U (if 1% U < U < 5% Un)
- ΔT:	0.5% or 3ms WIG

Timer accuracy:

- U:	5% (if 5% Un < U < Umax) 3% otherwise
- ΔT:	0.5% or 3ms WIG
Trip time:	(20ms + n × 20ms) ± 30ms n = DU/DT validation number

Voltage Balance

K1<, K2, K3< and Kpoly<

Accuracy:	±5%
Hysteresys:	±5%
Trip time:	≤50ms or ±25ms WIG

Measurements

Voltage:	Vn ±2%
Frequency:	40 – 70Hz ±10mHz

Performance conditions

General:

Ambient temperature:	20°C ±2°C
Atmospheric pressure :	86kPa to 106kPa
Relative humidity:	45 to 75%

Input energising quantity:

Voltage:	Vn ±5%
Frequency:	50 or 60Hz ±0.5%
Auxiliary supply:	
- DC:	48V or 110V ±5%
- AC:	63.5V or 110V ±5%

MEASUREMENT AND RECORDS

SETTINGS

The measured values are displayed on the LCD of the relay; they are true RMS values (up to the 10^{th} harmonic) and are primary values.

They can also be read through the communication ports (RS232 or RS485).

DISTURBANCE RECORD (P922 AND P923)

The MiCOM P922-P923 is able to store up to 5 records of 3s to 9s each: "5 × 3s" or "3 × 5s" or "2 × 7s" or "1 × 9s".

Pre-time	0 to 2.9s/4.9s/6.9s/8.9s in steps of 0.1s
Trigger for disturbance:	ON Inst. or ON Trip

FREQUENCY DISTURBANCE RECORD (P923 ONLY)

The MiCOM P923 is able to store one record of 20s.

Pre – time	5s (fixed)
Post – time	15s (fixed)
Sample rate	1 sample/cycle (fixed)
Digital signals	Logic inputs and output contacts status
Trigger logic	Instantaneous or time delayed tripping, Dedicated logic input, Logic equation, Remote command.

COMMUNICATIONS

FRONT PORT (RS232)

Communication Parameters (Fixed) :

Protocol:	Modbus RTU
Address:	to be specified in the "COMMUNICATIONS" menu of the relay
Messages format:	IEC60870FT1.2
Baud rate:	19200 bits/s
Parity:	Without
Stop bits:	1
Data bits:	8

REAR PORT (RS485)

Rear port settings	Setting options	Setting available for:
Remote address	0 - 255 (step = 1) & 1 – 59999 (step = 1)	IEC / Kbus-Courier / Modbus RTU & DNP3
Baud rate	9 600 or 19 200 bits/s	IEC
Baud rate	300 to 38 400 bits/s 1200 to 38 400 bits/s	Modbus DNP3
Baud rate	64000 bits/s	Kbus
Parity	"Even", "Odd" or "Without"	Modbus RTU or DNP3
Stop bits	0 or 1 or 2	Modbus RTU or DNP3

SETTINGS PROTECTION FUNCTIONS

Global Settings

Frequency:	50-60Hz
Active group:	1 or 2 (P922 & P923)
Date / Time	

ORDERS

Menu used to send an order to the CB from the front panel or to start a disturbance recording (P922&P923):

- CB Open Orders
- CB Close Order
- Disturbance Recorder start
- General reset

CONFIGURATION

General

Connection:	3Vpn, 3Vpp+Vr, 2Vpp+Vr, 3Vpn+Vr
Protection:	phase-phase / phase – neutral
Default display:	Va,Vb,Vc,Vr or Vab,Vbc,Vca,Vr or Vab,Vbc,Vr
Band-pass filter (P922&P923)	Yes/No

VT Ratio

Main VT primary:	0.1-100kV (by step 0.01kV) or 220-480V (by step 10V)
Main VT secondary:	57-130kV (by step 0.01kV)
E/Gnd VT primary:	0.1-100kV (by step 0.01kV) or 220-480V (by step 10V)
E/Gnd VT secondary:	57-130kV (by step 0.01kV)

LED configuration

LEDs 5 to 8

Setting group activation (P922&P923)

Mode of changing the setteing group:	Setting / Edge
Setting group:	1 or 2

Frequency protections configuration (P922&P923)

Number of cycles for validation of frequency threshold (P923):	1 to 12
Nr of cycles to calculate df/dt (P923):	1 to 200
Minimum voltage to unblock Frequency protection (P923):	5 to 130V (by step 0.1V) or 20 to 240V (by step 0.1V)
Inhibition of “blocking df/dt >20Hz/s” (P923)	Yes/No
Number of DU/DT for fault validation:	2 to 4

Alarms configuration (P922&P923)

Auto-acknowledgement	Yes/No
Alarm for (all models):	
“V>, tV>?”, “V>>,tV>>?” ”V>>>,tV>>>?”	Yes/No
“U<, tU<?”, “U<<,tU<<?” ”U<<<,tU<<<?”	Yes/No
“tAux1?”, “tAux2?”	Yes/No
Boolean equations A to H	Yes/No
P922&P923 additional alarms:	
“tAux3?”, “tAux4?” “tAux5” (P922&P923)	Yes/No
Frequency thresholds "F1 ?" to “F6?”	Yes/No
Frequency out of range	Yes/No
VT Supervision	Yes/No
Control trip?	Yes/No
P923 additional alarms:	
Voltage variation (“DU/Dt1?” to “DU/DT4?”)	Yes/No
Frequency variations “df/dt1?” to “df/dt6?”	Yes/No
Frequency trip AND variation (6 rates)	Yes/No
Voltage balance per phase	Yes/No
Multi-voltage palance (> 2 phases)	Yes/No

Opto inputs configuration

falling edge/low level or rising edge/high level
AC or DC Voltage input (P922&P923 only)

Output relays configuration

Active / Inactive mode configuration (per relay)
Maintenance mode (with activation control)

PROTECTIONS

Undervoltage (ANSI code 27)

Threshold settings (secondary values)

Nominal voltage range A: 57 – 130V	
V<= Voltage Set	0.5…130.0V (by step: 0.1V)
V<<= Voltage Set	0.5…130.0V (by step: 0.1V)
V<<<= Voltage Set	0.5…130.0V (by step: 0.1V)
Nominal voltage range B: 220 – 480V	
V<= Voltage Set	20.0…480.0V (by step: 0.5V)
V<<= Voltage Set	20.0…480.0V (by step: 0.5V)
V<<<= Voltage Set	20.0…480.0V (by step: 0.5V)

Time delay settings

Each voltage element is associated to an independent time delay.

Each measuring element time delay can be blocked by the operation of a user defined logic (optical isolated) input (see “Blocking logic1” or “Blocking logic2” functions).

Element	Time delay type
1st stage	Definite Time (DT) or IDMT
2nd stage	DT
3rd stage	DT

Inverse Time Delay Characteristic

The inverse characteristic is defined by the following formula:

$$t = \left(\frac{TMS}{\left| \frac{V}{Vs} - 1 \right|} \right)$$

Where:

t	= operating time in seconds
TMS	= time Multiplier Setting
V	= applied input voltage
Vs	= relay setting voltage

Note: this equation is only valid for $\frac{V}{Vs}$ ratio < than 0.95

TMS:	0.5…100.0 (by step: 0.5s)
tRESET (only DT)	0.00…100.00s (by step: 0.01s)

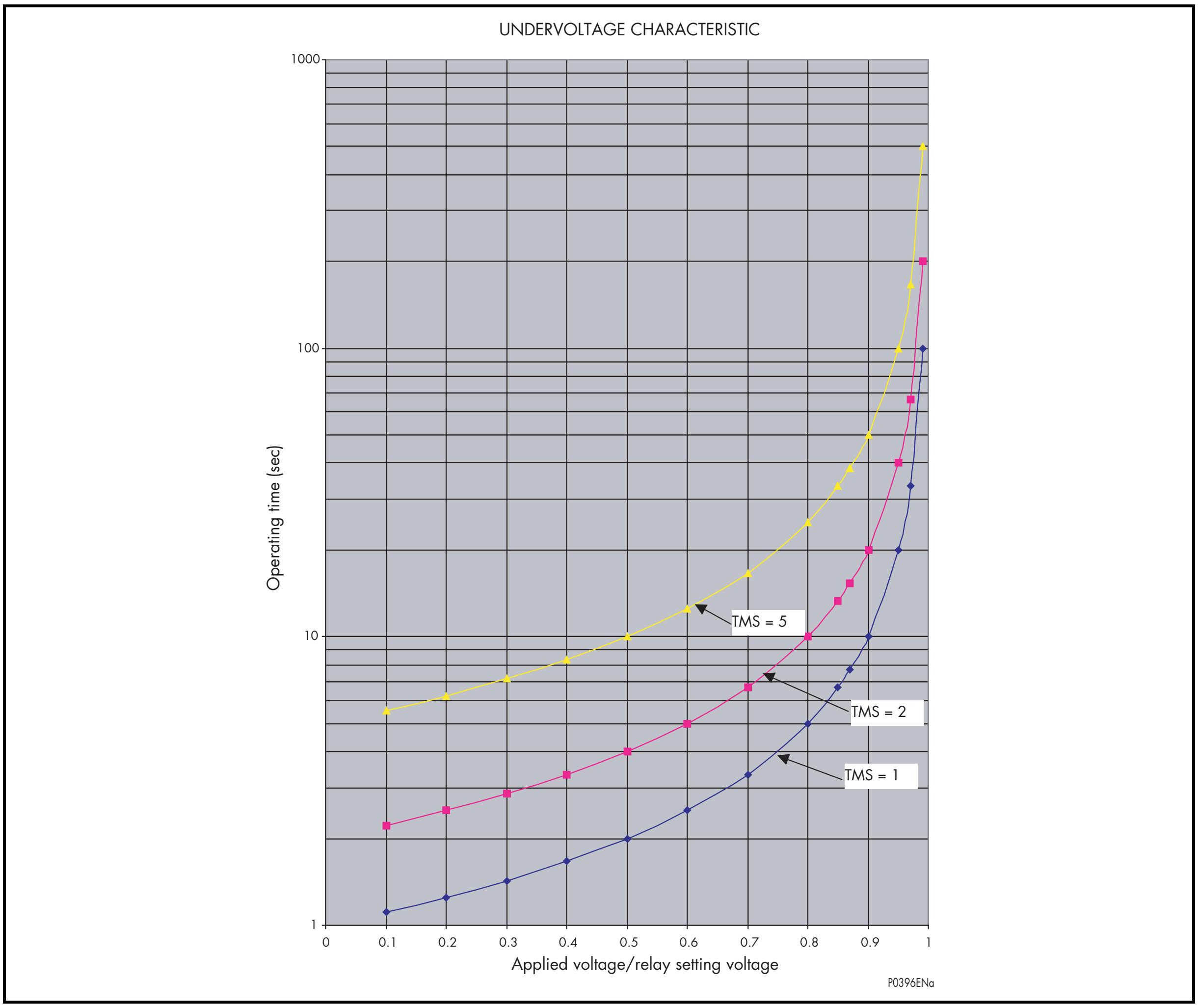
Definite time delay characteristics

tV<	0.00… 599.00s (by step: 0.1s)
tV<<	0.00… 599.00s (by step: 0.1s)
tV<<<	0.00… 599.00s (by step: 0.1s)

Hysteresis

Hysteresis	1.02… 1.05% (by step: 0.01%)

Note: this range is a percentage value of the pickup value of the undervoltage elements



IDMT curves for the undervoltage element “V<”

OVERVOLTAGE (ANSI code 59)

Threshold settings (secondary values)

Nominal voltage range A: 57 – 130V

V>= Voltage Set	0.5…200.0V (by step: 0.1V)
V>>= Voltage Set	0.5…260.0V (by step: 0.1V)
V>>>= Voltage Set	0.5…260.0V (by step: 0.1V)

Nominal voltage range B: 220 – 480V

V>= Voltage Set	20.0… 720.0V (by step: 0.5V)
V>>= Voltage Set	20.0… 960.0V (by step: 0.5V)
V>>>= Voltage Set	20.0… 960.0V (by step: 0.5V)

Time delay settings

Each voltage element is associated to an independent time delay.

Each measuring element time delay can be blocked by the operation of a user defined logic (optical isolated) input (see “Blocking logic1” or “Blocking logic2” functions).

Element	Time delay type
1st stage	Definite Time (DT) or IDMT
2nd stage	DT
3rd stage	DT

Inverse Time Delay Characteristic

The inverse characteristic is defined by the following formula:

$$t = \left(\frac{TMS}{\left| \frac{V}{Vs} - 1 \right|} \right)$$

Where:
t = operating time in seconds
TMS = time Multiplier Setting
V = applied input voltage
Vs = relay setting voltage

Note: this equation is only valid for $\frac{V}{Vs}$ ratio > than 1.1

TMS	0.5…100.0 (by step: 0.5)
tRESET (only DT)	0.00… 100.00s (by step: 0.01s)

When the V> is associated with IDMT curve, the recommended maximum setting value should be less or equal to max. setting range divided by 20.

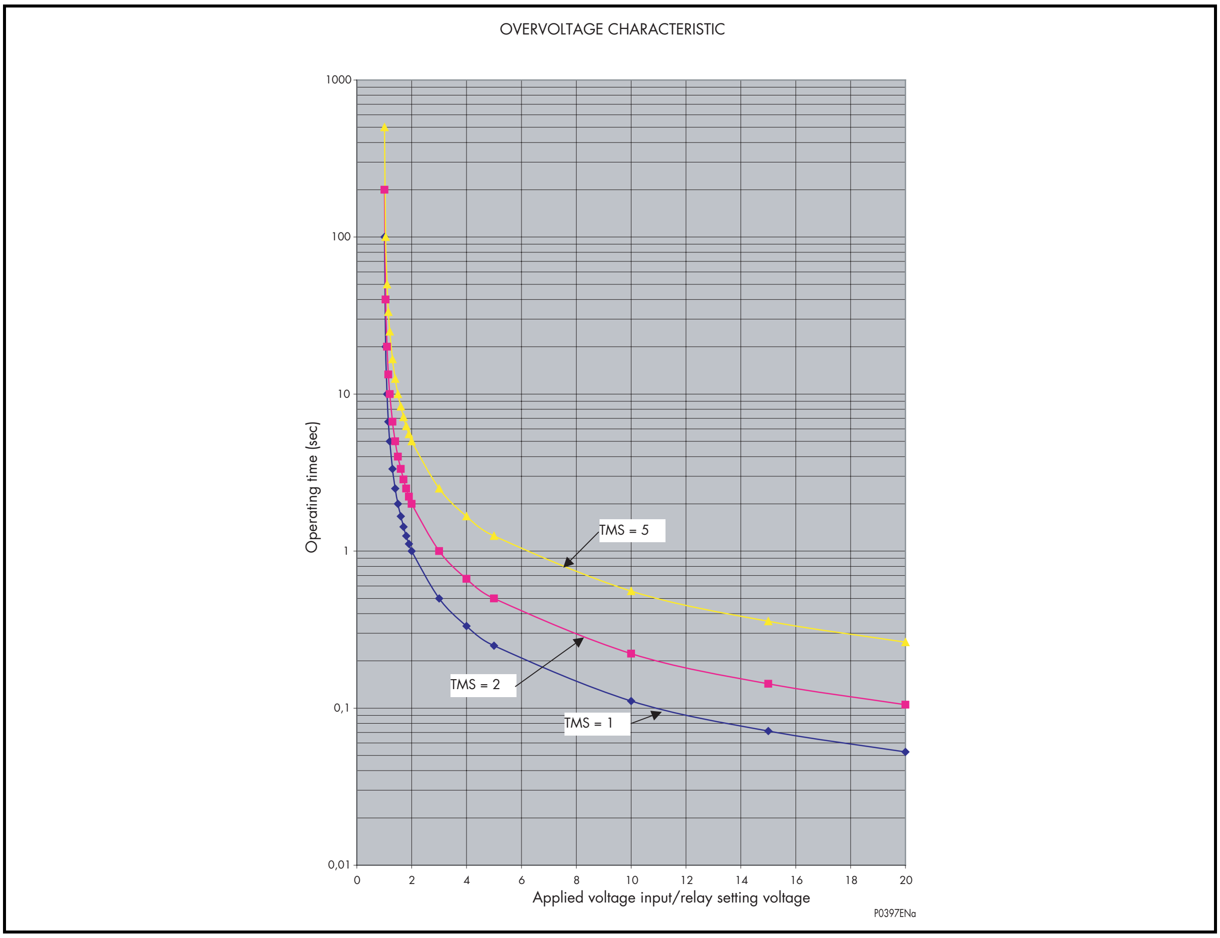
Definite time delay characteristics

tV>	0.00… 599.00s (by step: 0.1s)
tV>>	0.00… 599.00s (by step: 0.1s)
tV>>>	0.00… 599.00s (by step: 0.1s)

Hysteresis

Hysteresis 0.95… 0.98%

Note: this range is a percentage value of the pickup value of the overvoltage elements



IDMT CURVE FOR THE OVERVOLTAGE ELEMENT “V>”

RESIDUAL OVERVOLTAGE / NEUTRAL DISPLACEMENT (ANSI code 59N)

Threshold settings (secondary values)

Nominal voltage range A: 57 – 130V

V0>= Voltage Set	0.5…130.0V (by step: 0.1V)
V0>>= Voltage Set	0.5…130.0V (by step: 0.1V)
V0>>>= Voltage Set	0.5…130.0V (by step: 0.1V)

Derived voltage range A: 57 – 130V (P922&P923)

V0der>= Voltage Set	0.5…130.0V (by step: 0.1V)
V0der>>= Voltage Set	0.5…130.0V (by step: 0.1V)
V0der>>>= Voltage Set	0.5…130.0V (by step: 0.1V)

Nominal voltage range B: 220 – 480V

V0>= Voltage Set	2.0…480.0V (by step: 0.5V)
V0>>= Voltage Set	2.0…480.0V (by step: 0.5V)
V0>>>= Voltage Set	2.0…480.0V (by step: 0.5V)

Derived voltage range B: 220 – 480V (P922&P923)

V0der>= Voltage Set	2.0…480.0V (by step: 0.5V)
V0der>>= Voltage Set	2.0…480.0V (by step: 0.5V)
V0der>>>= Voltage Set	2.0…480.0V (by step: 0.5V)

Time delay settings

Each voltage element (V0 or V0der) is associated to an independent time delay.

Each measuring element time delay can be blocked by the operation of a user defined logic (optical isolated) input (see “Blocking logic1” or “Blocking logic2” functions).

Element	Time delay type
1st stage	Definite Time (DT) or IDMT
2nd stage	DT
3rd stage	DT

Inverse time delay characteristic

The inverse characteristic is defined by the following formula:

$$t = \left(\frac{TMS}{\left| \frac{V_0}{V_S} - 1 \right|} \right)$$

Where:
t = operating time in seconds
TMS = time Multiplier Setting
V0 = applied input voltage
Vs = relay setting voltage

TMS	0.5…100.0 (by step: 0.5)
tRESET (only DT)	0.00… 100.00s (by step: 0.01s)

Definite time delay characteristics

tV0>	0.00… 599.00s (by step: 0.1s)
tV0>>	0.00… 599.00s (by step: 0.1s)
tV0>>>	0.00… 599.00s (by step: 0.1s)
tV0der> ∗	0.00… 599.00s (by step: 0.1s)
tV0der>> ∗	0.00… 599.00s (by step: 0.1s)
tV0der>>> ∗	0.00… 599.00s (by step: 0.1s)

∗ P922&P923 ONLY

Hysteresis

Hysteresis (fixed) 0.95%

When the V0> is associated with IDMT curve, the recommended maximum setting value should be less or equal to max. withstand voltage of the VT inputs divided by 20.

NEGATIVE SEQUENCE OVERVOLTAGE (ANSI code 47 – P922 & P923)

Threshold settings (secondary values)

Nominal voltage range A: 57 – 130V

V2>= Voltage Set	5.0…200.0V (by step: 0.1V)
V2>>= Voltage Set	5.0…260.0V (by step: 0.1V)

Nominal voltage range B: 220 – 130V

V2>= Voltage Set	20.0…720.0V (by step: 0.5V)
V2>>= Voltage Set	20.0…720.0V (by step: 0.5V)

Time delay settings

Each voltage element is associated to an independent time delay.

Each measuring element time delay can be blocked by the operation of a user defined logic (optical isolated) input (see “Blocking logic1” or “Blocking logic2” functions).

Element	Time delay type
1st stage	Definite Time (DT) or IDMT
2nd stage	DT

Inverse Time Delay Characteristic

The inverse characteristic is defined by the following formula:

$$t = \left(\frac{TMS}{\left| \frac{V_2}{V_S} - 1 \right|} \right)$$

Where:
t = operating time in seconds
TMS = time Multiplier Setting
V2 = applied input voltage
Vs = relay setting voltage

TMS	0.5…100.0 (by step: 0.5)
tRESET (only DT)	0.00… 100.00s (by step: 0.01s)

Definite time delay characteristics

tV2>	0.00… 599.00s (by step: 0.1s)
tV2>>	0.00… 599.00s (by step: 0.1s)

Hysteresis

Hysteresis (fixed) 0.95%

When the V2> is associated with IDMT curve, the recommended maximum setting value should be less or equal to max. withstand voltage of the VT inputs divided by 20.

POSITIVE SEQUENCE UNDERVOLTAGE (ANSI code 27D – P922 & P923)

Threshold settings (secondary values)

Nominal voltage range A: 57 – 130V
V1<= Voltage Set 5.0…130.0V (by step: 0.1V)
V1<<= Voltage Set 5.0…130.0V (by step: 0.1V)
Nominal voltage range B: 220 – 130V
V1<= Voltage Set 20.0…480.0V (by step: 0.5V)
V1<<= Voltage Set 20.0…480.0V (by step: 0.5V)

Time delay settings

Each voltage element is associated to an independent time delay.
Each measuring element time delay can be blocked by the operation of a user defined logic (optical isolated) input (see "Blocking logic1" or "Blocking logic2" functions).

Inverse Time Delay Characteristic

The inverse characteristic is defined by the following formula:

$$t = \left(\frac{TMS}{\left| \frac{V_1}{V_S} - 1 \right|} \right)$$

Where:
t = operating time in seconds
TMS = time Multiplier Setting
V0 = applied input voltage
Vs = relay setting voltage

TMS 0.5…100.0 (by step: 0.5)

tRESET (only DT) 0.00… 100.00s (by step: 0.01s)

Definite time delay characteristics

tV1< 0.00… 599.00s (by step: 0.1s)
tV1<< 0.00… 599.00s (by step: 0.1s)

Hysteresis

Hysteresis (fixed) 105%

UNDER/OVERFREQUENCY (ANSI codes 81U/81O – P922 & P923)

Threshold settings

F1 to F6: Fn – 10Hz… Fn+ 10Hz (by step 0.01Hz)
Where: Fn = nominal frequency

Definite time delay characteristics

tF1 to tF6 0.00…599.00s (bys tep: 0.01s)

Minimum voltage to unblock Frequency protection

Protection blocking threshold (P923):
5 to 130V (by step 0.1V)
or 20 to 240V (by step 0.1V)

RATE OF CHANGE OF FREQUENCY (ANSI codes 81R – P923)

Threshold settings

Df/dt1 to df/dt6: – 10Hz/s… + 10Hz/s (by step 0.01Hz/s)

Integration time

Number of cycles to calculate df/dt: 1… 200 cycles (by step: 1 cycle)

Number of detections for df/dt validation

Number of df/dt for validation 2 or 4

ΔU/ΔT FUNCTION (P923)

Function and threshold settings for ΔU/ΔT:

DU/DT1: Yes/No
DU1: –720.0V… +720.0V (by step:0.5V)
DT1: 0.1… 10.0s (by step: 0.01s)
DU/DT2: Yes/No
DU2: –720.0V… +720.0V (by step:0.5V)
DT2: 0.1… 10.0s (by step: 0.01s)
DU/DT3: Yes/No
DU3: –720.0V… +720.0V (by step:0.5V)
DT3: 0.1… 10.0s (by step: 0.01s)
DU/DT4: Yes/No
DU4: –720.0V… +720.0V (by step:0.5V)
DT4: 0.1… 10.0s (by step: 0.01s)

VOLTAGE BALANCE (P923)

Function and threshold settings

Voltage balance per phase and multi-phase.

K< function= Yes/No
K< threshold= 0.50…1 (by step:0.01)
(common setting for the 3 phases)

CONTROL & MONITORING (Automatic control settings)

Trip and Latch commands

Assignation of the following thresholds to trip or latch output relays:

All Models:
Undervoltage : tU<, tU<< or tU<<<,
Overvoltage : tU>, tU>> or tU>>>,
Zero sequence: tV0>, tV0>> or tV0>>>,
Boolean equations: equations A to equation H,
time delayed logic inputs: tAux1 or tAux2

Additional for P922 and P923:
time delayed logic inputs: tAux3 to tAux5,
Frequency trip: tF1 to TF6,
Derived V0 sequence voltage:
tV0der>, tV0der>> or tV0der>>>,
Negative sequence undervoltage: tV1< or tV1<<,
Neagative sequence overvoltage: tV2>or tV2>>

Additional for P923:
Rate of frequency: df/dt1 to df/dt6,
Frequency AND rate of Freq. F1+df/dt1 to F6+df/dt6,
Voltage variation DU/DT1 to DU/DT4,
Voltage balance (per phase) K1<, K2<, K3<
Multi-volatge balance K< Poly

Blocking logic1 and blocking logic 2

Possibility to block the following delayed thresholds:

All Models:

Undervoltage :	tU<, tU<< or tU<<<,
Overvoltage :	tU>, tU>> or tU>>>,
Zero sequence:	tV0>, tV0>> or tV0>>>,
time delayed logic inputs:	tAux1 or tAux2

Additional for P922 and P923:

time delayed logic inputs:	tAux3 to tAux5,
Frequency trip:	tF1 to TF6,
Derived V0 sequence voltage:	tV0der>, tV0der>> or tV0der>>>,
Negative sequence undervoltage:	tV1< or tV1<<,
Negative sequence overvoltage:	tV2>or tV2>>

Additional for P923:

Rate of frequency:	df/dt1 to df/dt6,
Voltage variation	DU/DT1 to DU/DT4,
Voltage balance (per phase)	K1<, K2<, K3<
Multi-volatge balance	K< Poly

Auxiliary output relays

It is possible to allocate alarm and trip thresholds (instantaneous or time-delayed) available in the relay to one or more output relay (except RL1 and watchdog):

All Models:

Trip signal:	Trip.CB
CB Closed:	Clos.CB
Undervoltage :	V<, V<<, V<<<, tV<, tV<< or tV<<<,
Overvoltage :	V>, V>> V>>>, tV>, tV>> or tV>>>,
Zero sequence:	V0>, V0>> V0>>>, tV0>, tV0>> or tV0>>>,
time delayed logic inputs:	tAux1 or tAux2,
Circuit breaker failure:	CB Fail,
Output of boolean equations:	EQU A to EQU H,
Inputs:	IN1 to IN2.

Additional for P922 and P923:

Circuit breaker alarm signal:	CB ALAR,
time delayed logic inputs:	tAux3 to tAux5,
Frequency out of range:	F OUT,
Frequency trip:	F1 to F6, tF1 to TF6,
Derived V0 sequence voltage:	V0d>, tV0d>>, tV0d>>>, tV0d>, tV0d>> or tV0d>>>,
Negative sequence undervoltage:	V1<, V1<<, tV1< or tV1<<,
Negative sequence overvoltage:	V2>, tV2>>, tV2>or tV2>>,
Inputs:	IN3 to IN5,
VT supervision alarm:	tVTS,
Order from front panel:	Order 1 Comm, to Order 4 Comm.

Additional for P923:

Rate of frequency:	df/dt1 to df/dt6,
Frequency AND rate of Freq.	F1+df/dt1 to F6+df/dt6,
Active group:	ACTIVE GROUP
Voltage variation	DU/DT1 to DU/DT4,
Voltage balance (per phase)	K1<, K2<, K3<,
Multi-volatge balance	K< Poly,
Voltage balance (per phase)	K1<, K2<, K3<,
Multi-volatge balance	K< Poly.

Latch output relays

It is possible to latch the output contacts:
via a logic input,
via communication link.

Rfrequency Change of Rate of Frequency
(F + df/dt – P923)

Combination of Fi protection AND df/dti protection.

Inputs

With the Inputs submenu, it is possible to allocate a logic input to time-delayed function:

Time delay: 0…200s (by step: 0.01s)

Functions (all models):

No link / no assignment:	None
Output relay unlocking signal:	UNLOCK
Position of the circuit breaker (open/closed):	52a, 52b
Circuit breaker failure:	CB FAIL
Blocking logic 1 or 2:	BLK LOG1, BLK LOG 2,
Logic inputs:	Aux1 or Aux2
Control trip or control close function:	CTRL TRIP, CTRL CLOSE
Reset of the LEDs:	LED RESET,
Maintenance mode change:	Maint.

Additional for P922 and P923:

time delayed logic inputs:	tAux3 to tAux5,
Setting group change:	CHANG SET,
Disturbance recorder start:	STRT DIST,
Time synchronisation:	TIME SYNC,
VT supervision:	VTS,

VT Supervision (P922&P923)

VT Supervision (VTS) is used to detect an analog ac voltage inputs fault, which could be caused by voltage transformer fault.

VT Supervision:	Yes/No,
Detection mode:	VTS Input, delta Vr or both,
delta Vr setting:	
range A (57-130V):	2…130V (by step: 1V),
range b (220-480V):	20…480V (by step: 5V).

VTS blocking functions:

Undervoltage:	U<, U<< and U<<<
Overvoltage:	U>, U>> and U>>>,
Zero sequence:	V0>, V0>> and V0>>>,
Frequency:	F1 to F6,
Rate of frequency:	df/dt1 to df/dt6,
Voltage variation	DU/DT1 to DU/DT4.

CB Supervision (P922&P923)

CB Supervision (VTS) is used to control circuit breaker tripping and closing orders (P922 & P923) and to supervise closing and opening times.
It is possible to control the circuit breaker via the communication (RS232 or RS485 links).

CB OPEN Supervision (P922&P923):	Yes/No,
CB Opening time (P922&P923):	0.1…5s (by step: 0.05s),
CB CLOSE supervision (P922&P923):	Yes/No,
CB Closing time (P922&P923):	0.1s…5s (by step: 0.05s),
NB operation alarm:	Yes/No,
Nb operations= (P922&P923):	0…50000 (by step: 1),
Close pulse time:	0.1…5s (by step: 0.05s),
Trip pulse time:	0.1…5s (by step: 0.05s)

LOGIC EQUATIONS

With the Logic Equations submenu, 16 operands can be used in any single equation/

* 8 independants equations are available.
* Each one can used a maximum of 16 operands among all start and trip signal
* Each one can used NOT, OR, AND, OR NOT, AND NOT logical gates.
* T operate 0 to 600s in steps of 0.01s
* t Reset 0 to 600s in steps of 0.01s

The following logic signals are available for mapping to an equation:

All Models:

No link / no assignment:	Null
Undervoltage :	U<, U<<, U<<<, tU<, tU<< or tU<<<,
Overvoltage :	U>, U>> U>>>, tU>, tU>> or tU>>>,
Zero sequence:	V0>, V0>> V0>>>, tV0>, tV0>> or tV0>>>,
time delayed logic inputs:	tAux1 or tAux2

Additional for P922 and P923:

time delayed logic inputs:	tAux3 to tAux5,
Frequency trip:	F1 to F6, tF1 to TF6,
Derived V0 sequence voltage:	V0d>, tV0d>>, tV0d>>>, tV0d>, tV0d>> or tV0d>>>,
Negative sequence undervoltage:	V1<, V1<<, tV1< or tV1<<,
Neagative sequence overvoltage:	V2>, tV2>> tV2>or tV2>>

Additional for P923:

Rate of frequency:	df/dt1 to df/dt6,
Frequency AND rate of Freq.	F1+df/dt1 to F6+df/dt6,
Voltage variation	DU/DT1 to DU/DT4,
Voltage balance (per phase)	K1<, K2<, K3<
Multi-volatge balance	K< Poly

VT RATIOS

The primary and secondary rating can be independently set for each set of VT inputs, for example the residual VT ratio can be different to that used for the phase voltages.

VOLTAGE RANGES	PRIMARY	SECONDARY
A: 57 – 130V	0,1 – 100KV STEP = 0.01KV	57 – 130V STEP = 0.1V
B: 220 – 480V	220 – 480V STEP = 10V	220 – 480V STEP = 10V

ACCURACY

If no range is specified for the validity of the accuracy, then the specified accuracy shall be valid over the full setting range.

REFERENCE CONDITIONS

General:

Ambient temperature:	20°C ±2°C
Atmospheric pressure:	86kPa to 106kPa
Relative humidity	45 to 75%

Input energising quantity :

Voltage:	Vn ±5%
Frequency:	50 or 60Hz ±0.5%
Auxiliary supply:	
– DC:	48V or 110V ±5%,
– AC:	63.5V or 110V ±5%

MEASUREMENT ACCURACY

Voltage:	Vn ±2%
Frequency:	40 – 70Hz ±10mHz

MEASUREMENTS AND RECORDING FACILITIES

Settings

The measured values are displayed on the LCD of the relay; they are true RMS values (up to the 10th harmonic) and are primary values.
Values can also be read through the communication ports (RS232 or RS485).

Event Records

Capacity: 250 events,
Time tag: 1ms,
Triggers: Any selected protection alarm and threshold, Logic input change of state, Setting changes, Self test events.

Fault Records

Capacity: 25 faults
Time tag: 1ms
Data:
- Fault date
- Protection thresholds
- Setting Group
- AC inputs measurements (RMS)
- Fault measurements

Instantaneous Recorder

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

Disturbance recorder (P922&P923)

Strage: up to 5s
Triggers: Any selected protection alarm and threshold, logic input, remote command,
Data: AC input channels, Digital input and output status, Frequency values
Records number 1…5 (by step: 1)
Pre-time: 0.1 to 2.9 or 4.9 or 6.9 or 8.9s (by step: 0.1s) (depending of record number setting)
Disturbance rec trig: On trip or On inst.

Frequency recorder (P923)

Pre-time: 5s
Post-time: 15s
Sample rate: 1 sample / cycle
Digital signals Digital input and output status
Trigger logic:
- Instantaneous or time-delayed tripping
- Dedicated logic input,
- Logic equation
- Remote command

BLANK PAGE

USER GUIDE

CONTENT

PRELIMINARY DEFINITIONS

In this manual, all the following definitions and notations will be used:

Vr	Residual voltage = 3 × zero sequence voltage
V0	Zero sequence voltage
V0der	Derived V0 sequence voltage (calculated homopolar voltage)
V1, V2	Positive and negative sequence voltages
VA, VB, VC	Phase voltages
VAB, VBC, VCA	Line voltages
Vn	Rated voltage
VT	Voltage transformer
DMT	Definite minimum time
IDMT	Inverse definite minimum time

1. INTRODUCTION TO THE USER INTERFACES AND SETTINGS OPTIONS

MiCOM P921 P922 and **P923** are fully numerical relays designed to perform electrical protection and control functions.

The following section describes the MiCOM P92x range and the main differences between the different models.

MiCOM relays are powered either from a DC (2 voltage ranges) or an AC auxiliary power supply.

Using the front panel, the user can easily navigate through the menu and access data, change settings, read measurements, etc.

Eight LEDs situated in the front panel help the user to quickly know the status of the relay and the presence of alarms. Alarms that have been detected are stored and can be displayed on the back-lit LCD.

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

Output relays are freely configurable and can be activated by any of the control or protection functions available in the relay. Logic inputs can also be assigned to various control functions.

On their rear terminals **MiCOM P921 P922** and **P923** have a standard RS485 port available. When ordering, the user can choose between the following communication protocol: ModBus RTU, IEC 60870-5-103, Courier or DNP3.0.

The relay has three user interfaces:

– The front panel user interface via the LCD and keypad.

– The front port which supports ModBus communication.

– On their rear terminals **MiCOM P921 P922** and **P923** have a standard RS485 port available. When ordering, the user can choose between the following communication protocol: ModBus RTU, IEC 60870-5-103, Courier or DNP3.0.

Using RS485 communication channel, all stored information (measurements, alarms, and parameters) can be read and settings can be modified when the chosen protocol allows it.

Reading and modification of this data can be carried out on site with a standard PC loaded with MiCOM S1 setting software.

Thanks to its RS485 based communication, **MiCOM P921, P922** and **P923** relays can be connected directly to a digital control system. All the available data can then be gathered by a substation control system and be processed either locally or remotely.

Measures and relay settings availability are summarised in the following table:

	Keypad/LCD	Courier	ModBus	IEC60870
Display & modification of all settings	•	•	•	•
Digital I/O signal status	•	•	•	•
Display/extraction of measurements	•	•	•	•
Display/extraction of fault records	•	•	•	•
Display/extraction of event & alarm records	•	•	•	•
Extraction of disturbance records		•	•	•
Programmable logic equations	•	•	•	
Reset of fault & alarm records	•	•	•	•
Clear event & fault records	•	•	•	
Time synchronisation		•	•	•
Control commands		•	•	•

TABLE 1: SETTING AND MEASURES

1.1 USER INTERFACE

1.1.1 Relay Overview

The next figure shows the **MiCOM P921**, **P922** and **P923** relays.

The table shows the case size for the relays:

Height	Depth	Width
4U (177mm)	226mm	20 TE

The hinged covers at the top and bottom of the relay are shown closed. Extra physical protection for the front panel can be provided by an optional transparent front cover; this allows read only access to the relays settings and data but does not affect the relays IP rating. When full access to the relay keypad is required to edit the settings, the transparent cover can be unclipped and removed when the top and bottom hinged covers are open.

1.1.2 Front panel description

MiCOM P921, P922 and **P923** relay front panel allows the user to easily enter relay settings, display measured values and alarms and to clearly display the status of the relay.

FIGURE 1: MiCOM P921, P922 AND P923 FRONT PANEL DESCRIPTION

The front panel of the relay has three separate sections:

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

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

1.1.3 LCD display and keypad description

The front p anel components are shown below. The front panel functionality is identical for the P921, P922 & P923 relays.

1.1.3.1 LCD display

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

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

1.1.3.2 Keypad

The keypad has seven keys divided into two groups:

- Two keys located just under the screen (keys ⓒ and 📖).

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

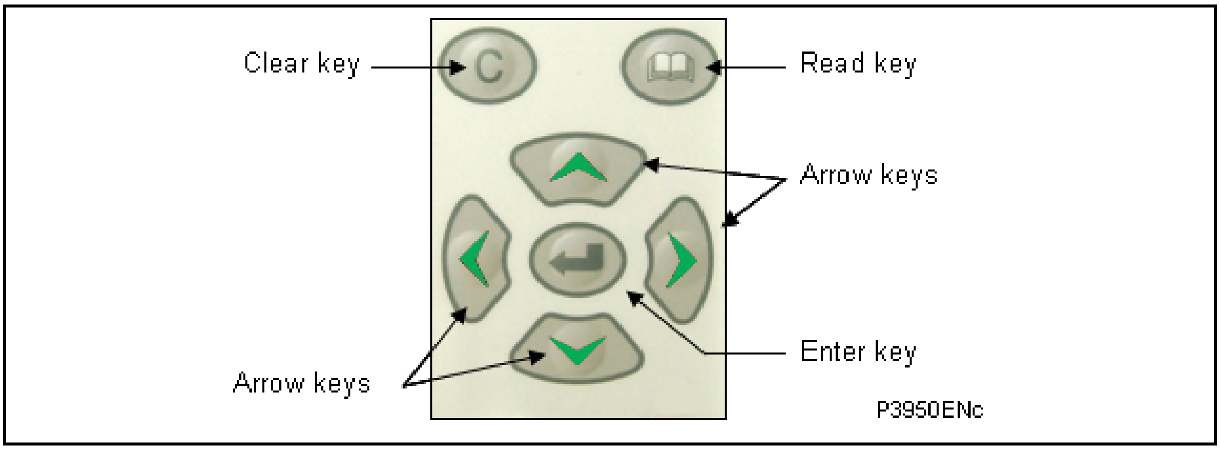
When navigating through submenus, key ⓒ is also used to come back to the head line of the corresponding menu.

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

- Four main keys ▽, ▷, ◁, △ located in the middle of the front panel.

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

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

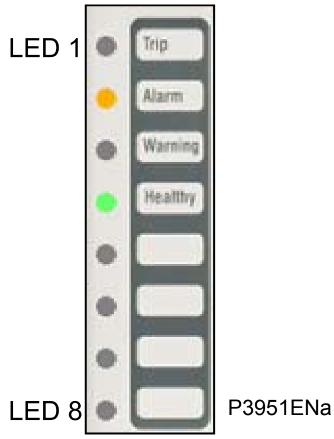


1.1.4 LEDs

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

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

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



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

LED 1 indicates that the relay has issued a trip order 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. As soon as a triggering order is issued, the LED lights up. It is cleared when the associated alarm is acknowledged either through the front panel, or by a remote command, a digital input, or by a new fault (CONFIGURATION/Alarms menu).

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

LED 2 indicates that the relay has detected an alarm. This alarm can either be a threshold crossing (instantaneous), or a trip order (time delayed). As soon as an alarm is detected, the LED starts blinking. After all the alarms have been read, the LED lights up continuously.

After acknowledgement of all the alarms, the LED is extinguished.

The alarm LED can be reset either through the front panel, or by remote command, by a digital input., etc.

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

LED 3 indicates internal alarms of the relay. When the relay detects a « non critical » internal alarm (typically a communication failure), the LED starts blinking continuously. When the relay detects a fault that is considered as « critical », the LED lights up continuously. Only the disappearance of the cause of the fault can clear this LED (repair of the module, clearance of the Fault).

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

LED 4 indicates that the relay is powered by an auxiliary source at the nominal range.

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

These LEDs are user programmable and can be set to display information about instantaneous and time-delayed thresholds as well as the status of the logic inputs. Under the CONFIGURATION/LED menu of the relay, the user can select the information he wishes to associate with each LED. He can affect more than one function to one LED. The LED will then light up when at least one of the associated information is valid (OR gate). The LED is cleared when all the associated alarms are acknowledged.

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

1.1.5.1 Relay Identification

Under the upper flap, a label identifies the relay according to its model number (order number) and its serial number. This information defines the product in a way that is unique. In all your requests, please make reference to these two numbers.

Under the model and serial number, you will find information about the level of voltage of the auxiliary supply and the nominal earth current value.

1.1.5.2 Lower flap

Under the lower flap, a RS232 port is available in all MiCOM relays. It can be used either to download a new version of the application software version into the relay flash memory or to download/retrieve settings plugging a laptop loaded with MiCOM S1 setting software.

To withdraw more easily the active part of the MiCOM relay (i-e the chassis) from its case, open the two flaps, then with a 3mm screwdriver, turn the extractor located under the upper flap, and pull it out of its case pulling the flaps towards you.

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

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

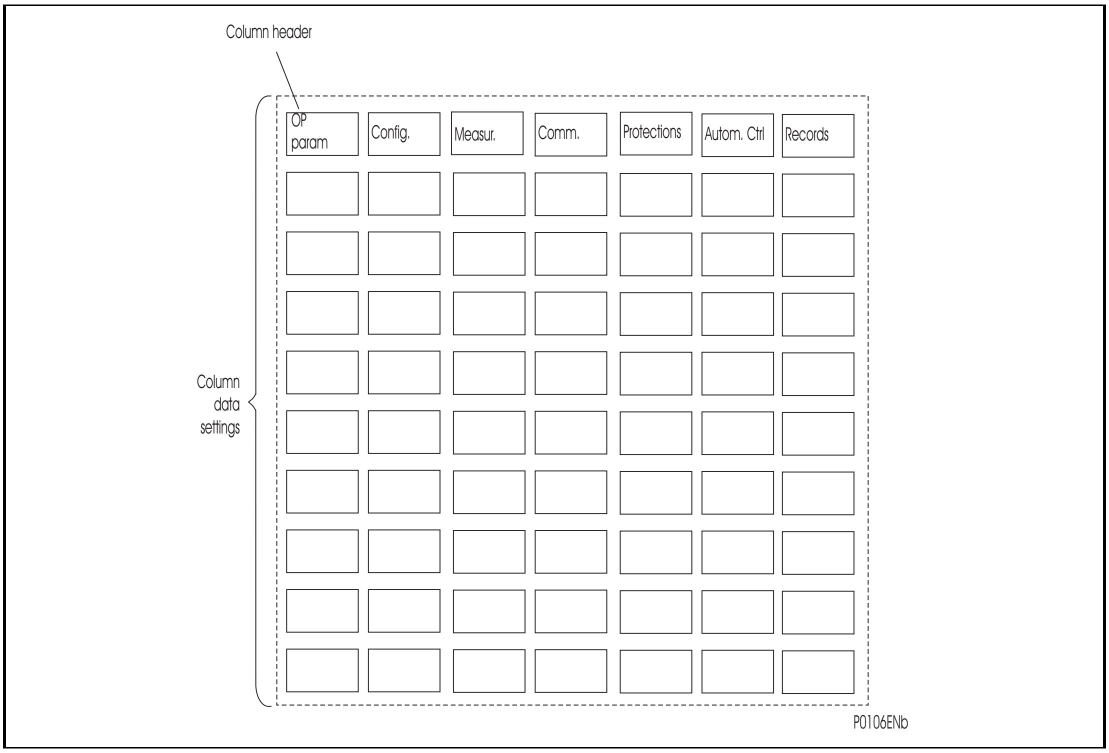
1. It is able to power the relay from its front port. This allows the user to view or modify data on the relay even when the auxiliary power supply of the relay has failed or when the relay is not connected to any power supply. The USB port of the PC supplies the power necessary to energize the relay. This lasts as long as the battery of the PC can last.
2. It provides an USB / RS 232 interface between the MiCOM relay and the PC. This allows the user to be able to change the setting of the relay using a PC with its USB port.

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

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

1.2 Menu structure

The relay's menu is arranged in a tabular structure. Each setting in the menu is referred to as a cell, and each cell in the menu may be accessed by reference to a row and column address. The settings are arranged so that each column contains related settings, for example all of the disturbance recorder settings are contained within the same column. As shown in the figure, the top row of each column contains the heading that describes the settings contained within that column. Movement between the columns of the menu can only be made at the column heading level. A complete list of all of the menu settings is given in the Menu Content tables (P92x/EN HI section).



MENU STRUCTURE

1.3 PASSWORD

1.3.1 Password protection

A password is required for relay settings, especially when changing the various thresholds, time delays, communication parameters, allocation of inputs and outputs relays.

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

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

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

1.3.2 Password entry

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

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

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

1.3.3 Changing the password

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

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

1.3.4 Change of setting invalidation

The procedure to modify a setting is described in the following sections of this manual.

If there is a need to get back to the old setting push key Ⓒ before validating the setting change. The following message will then appear on the LCD for a few seconds and the old setting will remain unchanged.

UPGRADE CANCEL

1.4 Displays of Alarm & Warning Messages

Alarm messages are displayed directly on the front panel LCD. They have priority over the default display presenting measured current values. As soon as the relay detects an alarm condition (crossing of a threshold for example), the associated message is displayed on the front panel LCD and the LED Alarm (LED 2) lights up.

Alarms

We distinguish two types of alarm and warning messages:

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

The alarm messages can either be self-resetting or latched, in which case they must be cleared manually. To view the alarm messages press the 📖 key . When all alarms have been viewed, but not cleared, the alarm LED will change from flashing to constant illumination. To scroll through these pages, press the 📖 key. The oldest alarm will be displayed on the last page, the most recent one on the first page: each message will be identified by a number. When all pages of the fault record have been viewed, the following prompt will appear:

Clear All Alarms

To clear all alarm messages press ⓒ ; to return to the display of the first alarm message and leave the alarms uncleared, press . There is no need to enter a password before the alarm messages can be cleared. When the alarms have been cleared the yellow alarm LED will extinguish, as will the red trip LED if it was illuminated following a trip.

The alarm messages are classified as indicated below:

- Electrical system alarms,
- Relay hardware or software alarms.

1.4.1 Electrical Network Alarms

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

For example:

```
V<               2/3
PHASE AB BC CA
```

NOTE: instantaneous information leads to a self-resetting alarm message. The alarm LED will then be switched off as soon as the instantaneous information has disappeared.

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

The user can read all the alarm messages pressing .

The user acknowledges and clears the alarm messages from the LCD pressing ⓒ.

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

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

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

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

If all the messages have been ACKNOWLEDGED, and cleared, if the cause that generated the alarm disappears, the ALARM LED (LED 2) is extinguished.

1.4.2 Relay Hardware or Software Warning Messages

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

If an hardware error appears, the following prompt will appear:

HARDWARE ALARMS

The user can read all warning messages pressing , without entering the password: for example,

STATS ERROR 1/1

It is not possible to acknowledge and clear warning messages caused by internal relay hardware or software failure. This message can only be cleared once the cause of the hardware or software failure has been removed.

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

Alarms can be classified as minor or major faults. If the internal hardware or software failure is major (i.e. the relay cannot perform protection functions), the WARNING LED (LED 3) lights up continuously.

– major fault: Protection and automation functions of the equipment are blocked. In this condition, the protection relay detects the corresponding fault and activates RL0 Watchdog relay (35-36 terminals contact is closed – " relay failed" position).

  For instance: the "DEF. ANA" fault (fault in the analog circuit channel) is considered as a major fault because the protection functions will not operate correctly.

– minor fault: Protection and automation functions of the relay operate. A minor fault will not activate RL0 Watch Dog relay (35-36 terminals contact is closed, 36-37 terminals is open). This fault causes a LED alarm and is displayed on the LCD panel.

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

– microprocessor operation,

– power supply check,

– reconstituted internal power supply check,

– heating of a circuit board component monitoring,

– analog channel monitoring (acquisition sampling),

– programm execution monitoring,

– communication ports monitoring.

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

Possible Hardware or Software alarm messages are:

Major fault:

- the protection functions of the relay are stopped. The watchdog contact is in the "relay failed" position

Alarm	Type	Significance	Solution
SETTING ERROR	Major	Fault in the Flash memory (data zone)	Send back the relay to the After Sales Services
VT ERROR	Major	Fault in the acquisition chain of analogue signals	Send back the relay to the After Sales Services
CALIBR. ERROR	Major	Fault in the Flash memory (calibration zone)	Send back the relay to the After Sales Services
WATCH DOG	Major	Fault in the internal circuits of the relay	Send back the relay to the After Sales Services

Minor fault:

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

The acknoledgment of those alarms can be done by pressing the ⓒ key

Alarm	Type	Significance	Solution
COMM. ERROR	Minor	Communication error	Check the RS485 connection at the rear of the relay
CLOCK ERROR	Minor	Fault of the internal clock (P922 and P923 only)	Change the date and time via the front panel or the communication links
STATS ERROR*	Minor	Fault in the flash memory	Stop and start again the relay (power off/on)

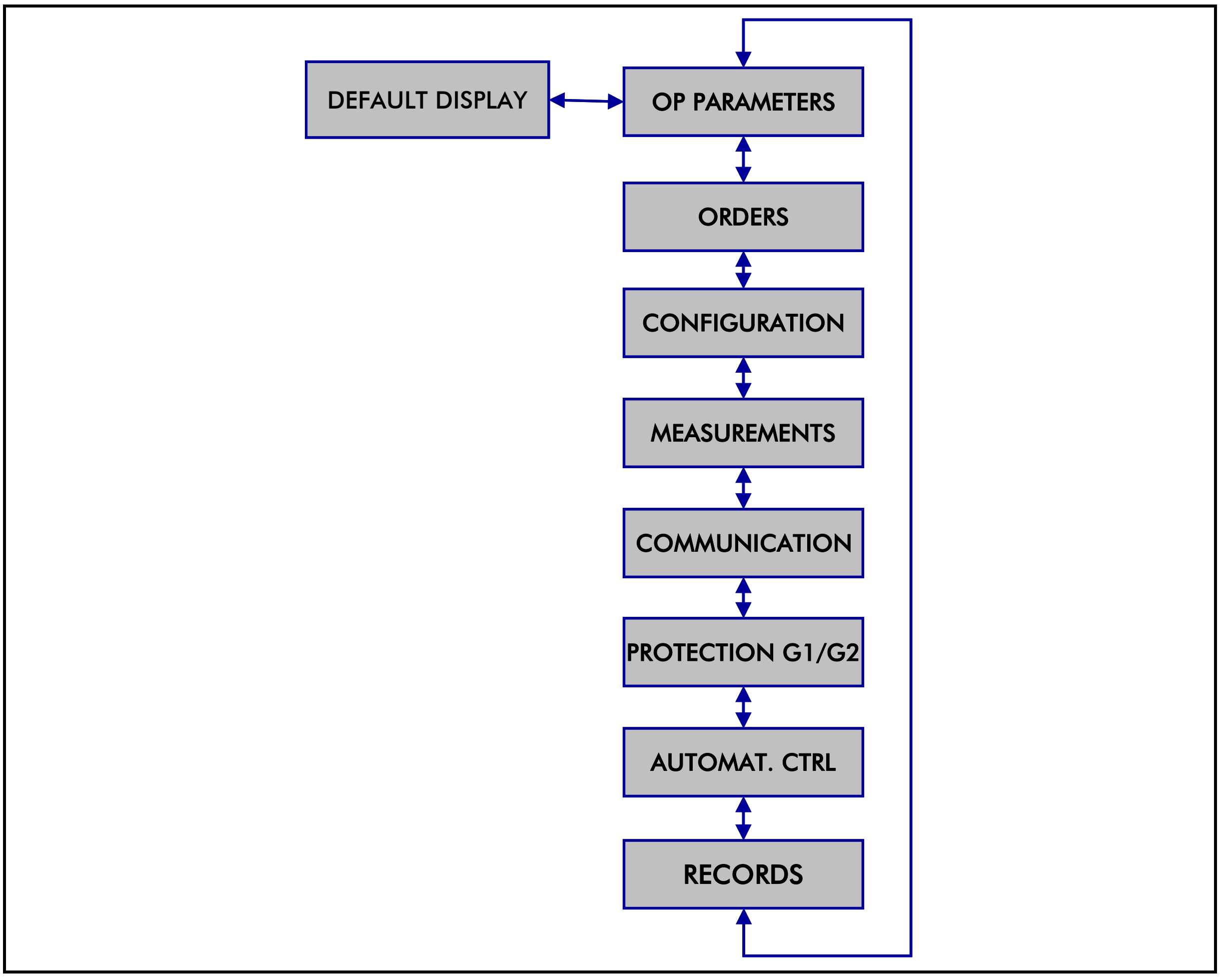
* The "STATS" alarm message can be configured yes or no in "CONFIGURATION /Alarms" menu.

2. MENU

The menu for the MiCOM P921, P922 & P923 relays is divided into the following sections.

To access these menus from the default display press ⊜.

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



2.1 "OP.PARAMETERS" Menu

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

OP PARAMETERS	Heading of the "OP.PARAMETERS" menu
PASSWORD= ****	**Description:** Enter the password to access the settings menus. **Range:** 4 characters. See paragraph **Erreur ! Source du renvoi introuvable.** for additional information.

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

LANGUAGE = **ENGLISH**	**Description:** Indicates the language used in the display. **Range:** To switch to a different language, press , then choose the desired language using the or arrows.
DESCRIPTION= **P92x**	**Description:** Product description **Range:** no modifications allowed, display only.
REFERENCE= **xxxx**	**Description:** Plant reference – User programmable text **Range:** 4 characters
SOFTWARE VERSION **XX**	**Description:** Software reference for the product **Range:** no modifications allowed, display only.
FREQUENCY= **50 Hz**	**Description:** Default sampling frequency – must be set to power system frequency. **Range:** 50 Hz or 60 Hz
ACTIVE GROUP = **1**	**Description:** display of the actual active group (P922 and P923 only) **Range:** no modification allowed, display only.
INPUTS: 54321 **00000**	**Description:** Indicates the current status of all the logic inputs : from 1 to 2 (MiCOM P921), from 1 to 5 (MiCOM P922 and P923). **Range:** no modifications allowed, display only. **Note:** state=0 => input deenergised, state=1 => input energised
OUTPUTS: 87654321 **00000000**	**Description:** Indicates the current status of all the output relay drives: from1 to 4 (MiCOM P921), from 1 to 8 (MiCOM P922 and P923) **Range:** no modifications allowed, display only. **Note:** state=0 => output inactive, state=1 => output active

The "Date" and "Time" cells allow the settings of the date and time of the MiCOM P922-P923, so that all the records (events, faults and disturbance) can be correctly time/date stamped. The internal time clock accuracy is 1ms.

If the relay is integrated into a control-command system, the RS485 serial link can be used to realise the time synchronisation.

Note that this information must be checked and corrected periodically either manually or via the remote communication link.

DATE **28/03/00**	Description: setting of the current date (P922 and P923 only) Range: 1-31 for days, 1-12 for months, 0-99 for years Note: default date = 01/01/94

TIME **23:03:10**	Description: setting of the current time Range: 0-23 for hours, 0-59 for minutes and seconds.

NOTE: during the settings, if one of the data exceeds the minimum or maximum value, then the following message will appear:

INCORRECT
DATA

and the modifications are not taken into account.

2.2 "ORDERS" Menu (P922 and P923 only)

This menu gives the possibility:

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

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

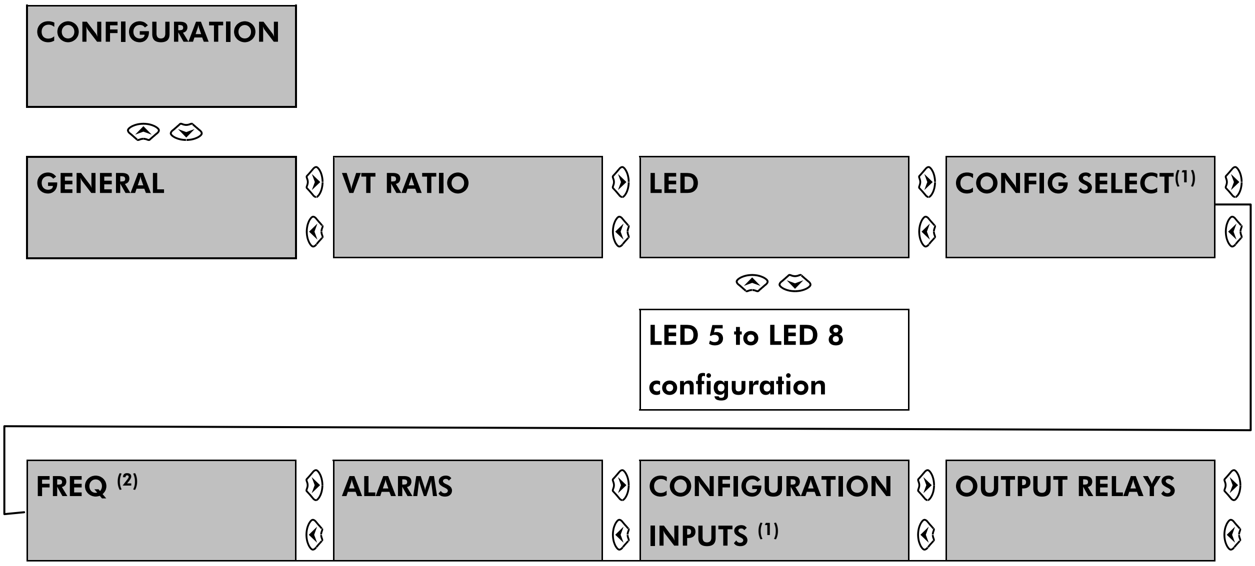
ORDERS	Heading of the ORDERS menu
Open Order **No**	**Description:** Sends manually an open order from the local control panel. This order is permanently assigned to the Trip output relay (selected with "automatic control/Aux output rly" menu). **Range:** No, Yes. (the "confirmation ?" cell will be displayed after setting change)
Close Order **No**	**Description:** Sends manually a close order from the local control panel: RL2 to RL8 (if configured) **Range:** No, Yes (the "confirmation ?" cell will be displayed after setting change)
Disturb rec start **No**	**Description:** Trigs a disturbance recording from the relays HMI. Setting range: No, Yes (the "confirmation ?" cell will be displayed after setting change). **Range:** Yes/No
General Reset **No**	**Description:** Clears LEDs, alarms, counters, disturbance records, fault records, starting records, event records, measured values and CB supervision values **Setting range:** No, Yes (the "confirmation ?" cell will be displayed after setting change). **Range:** Yes/No

2.3 RELAY CONFIGURATION Menu

The "CONFIGURATION" menu makes it possible to configure the protection and the connection which is used, and the VTs ratio. The allocation of the information to the 4 programmable LEDS, the alarm configuration and the input configuration are also done via this menu.

To gain access to the "CONFI GURATION" menu from the default display, press once and until the desired submenu header is displayed.

The accessible submenus are indicated below:



(1) P922-P923 only
(2) P923 only

2.3.1 "GENERAL" Submenu

In the "General" submenu, the user may select the connection used, the type of voltage protection and the default display.

– "Phase – Neutral" protection: the analogue input data, which will be compared to the stages, are then the phase voltages VA, VB and VC. Select "PROT P-N" in the menu.

– "Phase – Phase" protection: the analogue input data, which will be compared to the stages, are then the line voltages Vab, Vbc and Vca (calculated or measured data according to the connection scheme). Select "PROT P-P" in the menu.

This submenu is common to the MiCOM P921, P922 and P923 relays:

To gain access to the General configuration submenu from the “Configuration” menu, press ⯆.

CONFIGURATION	Heading of the “CONFIGURATION” submenu. To gain access to the CONFIGURATION menu from the default display press ⯆ followed by ◁ or ▷ until the menu is displayed.
GENERAL	Heading of the “GENERAL” submenu.
CONNECTION **3 Vpn**	**Description:** Selection of the VT connection type: **Range:** 3Vpn = 3 Phase-Neutral VTs connection 3Vpp+Vr = 3 Phase-Phase VTs + Residual VT connection 2Vpp+Vr = 2 Phase-Phase VTs + Residual VT connection 3Vpn+Vr = 3 Phase-Neutral VTs + Residual VT connection
PROTECTION **PROT P-N**	**Description:** selection of the voltage protection type: Phase – Phase or Phase – Neutral **Range:** PROT P-P / PROT P-N **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection selected
DEFAULT DISPLAY **VA+VB+VC**	**Description:** Configuration of the default current value displayed on the LCD panel.

The three phases voltages and the residual voltage (Vr) can be displayed simultaneously. If the four values are simultaneously chosen, the values will be displayed as follows:

3Vpn / 3Vpn + Vr:

Va	Vb
Vc	Vr (3Vpn+Vr only)

2 / 3 Vpp+Vr:

Vab	Vbc
Vca (3Vpp+Vr)	Vr

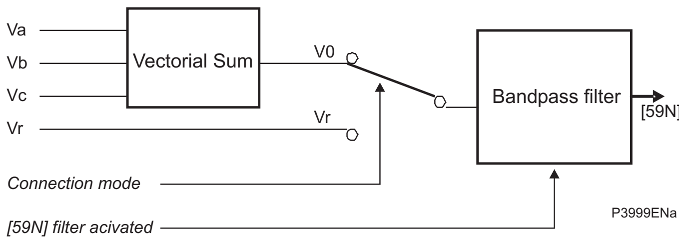
Range:	VA/VB/VC/Vr	if "3Vpn" or "3Vpn+Vr"connection
	Vab/Vbc/Vca/Vr	if "3Vpp+Vr" connection
	Vab/Vbc/Vr	if "2Vpp+Vr" connection

Note:
– in the MiCOM P922 and P923, frequency, V1 and V2 can also be selected
– Vr is the real RMS Vr measured voltage.

[59N] filter
No

P922 an P923 only

Description: Activates a software Band-pass filter (60 dB / decade attenuation) centered on the fundamental value (50 or 60 Hz), in order to insure that residual over voltage function (59N) is immune to 10Hz & 200Hz frequency. In 3Vpp+Vr, 3Vpn+Vr or 2Vpp+Vr connection mode configuration, Vr channel is filtered. In 3Vpn connection mode, Va, Vb and Vc are filtered.



Range: Yes/No

Please refer to "Connection diagrams" section of this Technical Guide for the complete description of the connection schemes.

2.3.2 "VT RATIO" Submenu

This menu is common to the MiCOM P921, P922 and P923 relays. It makes it possible to configure the VT ratios.

To gain access to the "VT RATIO" submenu from the "CONFIGURATION" menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION

Heading of the "CONFIGURATION" submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.

VT RATIO

Heading of the "VT RATIO" submenu

MAIN VT PRIMARY
20.00 kV

Description: Primary of the voltage transformer(s) feeding the relay
Range: 0.1-100kV, step =0.01kV (for the "57-130V" model)
220-480V, step=10V (for the "220-480V" model)

MAIN VT SEC'Y
100 V

Description: Secondary of the voltage transformer(s) feeding the relay
Range: 57-130V, step=0,1V (for the "57-130V" model)
Note: no VT secondary voltage for the "220-480V" model

E/Gnd VT PRIMARY
20.00 kV

Description: Primary of the residual voltage transformer (if configured)
Range: 0.1-100kV, step =0.01kV (for the "57-130V" model)
220-480V, step=10V (for the "220-480V" model)
Note: this message only seen if "3Vpn+Vr", "3Vpp+Vr" or "2Vpp+Vr" connection selected

E/Gnd VT SEC'Y
100 V

Description: Secondary of the residual voltage transformer (if configured)
Range: 57-130V, step=0.1V (for the "57-130V" model)
Note: this message only seen if "3Vpn+Vr", "3Vpp+Vr" or "2Vpp+Vr" connection selected
No VT secondary voltage for the "220-480V" model

2.3.3 LEDS 5 to 8 configuration

The LED 5 to LED 8 configuration submenu is used to assignate to a LED a protection function (the LED lights up when the protection function is active).

To gain access to the “LED 5” submenu from the “CONFIGURATION” menu, press followed by or until the desired submenu header is displayed.

To reach th e LED configuration su bmenu press for Le d 5. Press to reach Led 6, again to reach Led 7 and again to reach Led 8.

Display	Description
CONFIGURATION	Heading of the “CONFIGURATION” submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
LED	Heading of the “LED” submenu. The configuration menu contains “LED 5”, “LED 6”, “LED 7” and “LED 8” submenus. These menus are identical.
LED 5 CONF. **Function = NO**	**Description:** Activate (select choice “Yes” or inhibit (“No”) LED 5 operation when: - a threshold is reached, - a threshold time delay has elapsed. Refer to the following table for functions list. **Range:** YES/NO Refer to the following table to list the protection functions according to each relay.

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

Function	P921	P922	P923	Function
V<, V<<, V<<<	X	X	X	Instantaneous 1^{st}, 2^{nd} and 3^{rd} undervoltage thresholds
tV<, tV<<, tV<<<	X	X	X	Time delayed 1^{s}, 2^{nd} and 3^{rd} undervoltage thresholds
V>, V>>, V>>>	X	X	X	Instantaneous 1^{st} , 2^{nd} and 3^{rd} overvoltage thresholds
tV>, tV>>, tV>>>	X	X	X	Time delayed 1^{st} , 2^{nd} and 3^{rd} overvoltage thresholds
V0>, V0>>, V0>>>	X	X	X	Instantaneous 1^{st} , 2^{nd} and 3^{rd} zero sequence voltage thresholds
tV0>, tV0>>, tV0>>>	X	X	X	Time delayed 1^{st} , 2^{nd} and 3^{rd} zero sequence voltage thresholds
V0d>, V0d>>		X	X	Instantaneous 1^{st} and 2^{nd} derived V0 sequence voltage thresholds
tV0d>, tV0d>>		X	X	Time delayed 1^{st} and 2^{nd} derived V0 sequence voltage thresholds
V2>, V2>>		X	X	Instantaneous 1^{st} and 2^{nd} negative sequence overvoltage thresholds
tV2>, tV2>>		X	X	Time delayed 1^{st} and 2^{nd} negative sequence overvoltage thresholds
V1<, V1<<		X	X	Instantaneous 1^{st} and 2^{nd} positive sequence undervoltage thresholds
tV1<, tV1<<		X	X	Time delayed 1^{st} and 2^{nd} positive sequence undervoltage thresholds

Function	P921	P922	P923	Function
F1 to F6		X	X	Instantaneous 1^{st} to 6^{th} frequency trip thresholds
tF1 to tF6		X	X	Time delayed 1^{st} to 6^{th} frequency trip thresholds
df/dt1 to df/dt6			X	Instantaneous 1^{st} to 6^{th} rates of frequency variation protection (“delta f / delta t”).
F1+df/dt1 to F6+df/dt6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
F OUT OF R		X	X	Frequency out of range
tAux1 or tAux2	X	X X		Copy of the status of the logic input delayed by t Aux1 or tAux2
tAux3 to tAux5		X	X	Copy of the status of the logic input delayed by tAux3, tAux4 or tAux5
EQU A to EQU H	X	X X		Output of Boolean Equation A to Equation H
Input 1	X	X	X	Copy of the status of logic input No 1
Input 2	X	X	X	Copy of the status of logic input No 2
Input 3/4/5			X	Copy of the status of logic input No 3, 4 or 5
DU/DT 1 to DU/DT 4			X	1^{st} , 2^{nd}, 3^{rd} or 4^{th} rate of voltage variation protection (“delta U / delta t”)
t VTS		X	X	Voltage Transformer Supervision alarm, if enabled (VT Supervision/VT S Supervision submenu)
K1= to K3=			X	Status of the voltage balance for phase A (K1), phase B (K2) or phase C (K3). K1 or K2 or K3 is faulty when its value is below K< setting.
KPOLY=			X	Status of the multi-voltage balance (active when, at least, two phases are unbalanced, below K< setting).

2.3.3.1 Example of configuration

<u>The aim is:</u>

The LED5 shall be on if the auxiliary input AUX1 is energised.

<u>Settings:</u>

– Go into the “AUTOMAT.CTRL” menu, “INPUTS” submenu and assign the “AUX1” information to one of the inputs.

– In the “LED5” menu, which is describes above, select “YES” in front of the “tAUX1” information.

2.3.4 "CONFIG SELECT" Submenu (MiCOM P922 and P923 only)

This menu allows the user to select the active setting group (1or 2). By default, the active setting group is "GROUP 1".

A digital input configured "CHANG SET" can operate either on edge or on level.

When the user chooses the "LEVEL", then the change of setting group is only authorized by a logic input.

Starting from firmware Version 4, the Active Group will be displayed (read mode only) in the "OP PARAMETER" menu.

The change of the active setting group can also be done via a remote command through the communication link (refer to section P92x/EN CM of this Technical Guide).

To gain access to the "CONFIG SELECT" submenu from the "CONFIGURATION" menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION	Heading of the "CONFIGURATION" submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
CONFIG SELECT	Heading of the "GROUP SELECT" submenu
CHANGE GROUP INPUT EDGE	**Description:** selection of mode of changing the active group **Range:** EDGE/SETTING
SETTING GROUP 1	**Description:** selection of active parameters group **Range:** 1 or 2 **Remark:** this submenu is active only if "Change group input" setting is EDGE

2.3.5 "FREQ" Submenu (MiCOM P922 and P923 only)

This menu allows the user to select the number of cycle to be involved in the calculation of the rate of change of frequency elements, and the number of confirmation of calculation for positionning the protection.

In fact, the instantaneous element is positionned after exceeding the threshold for a programmable number of df/dt function calculation.

This number of confirmation is 2 or 4.

In addition, it allows the configuration of the undervoltage blocking element.

When the input voltage value is unsufficient this will lead to irregular behavior and it is imaginable that the frequency elements could mal operate.

This is important during line energization, de-energization or a generator acceleration where significant distortion can be experienced. To prevent the mal operation, all the frequency elements and related thresholds are blocked by mean of an adjustable U/V blocking function.

To gain access to the "FREQ" submenu from the "CONFIGURATION" menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION	Heading of the “CONFIGURATION” submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
FREQ	Heading of frequency and df/dt configuration submenu.
F : VALIDAT. NB= 1	MiCOM P923 only **Description:** “frequency validation number”, defines the number of periods to validate a frequency threshold For instance, at 50 Hz, if ‘F. VALIDAT. NB =’ 3, the frequency fault will be validated if the fault conditions are met more than 3 × 20ms. **Range:** 1 – 12 step of 1
df/dt: CYCLE NB = 1	MiCOM P923 only **Description:** define the total number of integration time involved for calculation of the rate of change of frequency The dF/dt detection (rate of change of frequency) is defined as a calculation of an average frequency variation of the instantaneous values over a programmable number of cycles. This menu adjusts the number of periods to calculate a dF/dt detection. **Range:** 1 – 200 step of 1
df/dt: VALIDAT. NB = 4	MiCOM P923 only **Description:** Sets the number of dF/dt detection to validate the dF/dt fault **Range:** 2 – 12 step 1
PROTECTION BLOCK = 20.0 V	MiCOM P923 only **Description:** U/V threshold for blocking frequency elements **Range:** 5V to 130V, step of 0.1V (for the "57-130V" model) 20V to 240V, step of 0.1V (for the "220-480V" model)
INH.BLOCK df/dt >20Hz/s Yes/No	**Description:** Yes: the measurement of the frequency blocks the calculation when df/dt exceeds ± 20Hz/s to avoid noise samples in the calculation. No: df/dt measurement is always used for the calculation **Range:** Yes/no
DU/DT: VALIDATION NB = 2	MiCOM P923 only **Description:** Sets the number of ΔU / Δt detection to validate the DU/Dt fault. **Range:** 2 – 4 step 1

NOTE: This threshold is independent of the undervoltage threshold in the "PROTECTION MENUS". It uses the analogic input voltages delivered for the calculation and measurement of the frequency. It never uses the line to line voltage.

2.3.6 “ALARMS” Submenu

This menu allows the user to select the acknowledgement mode of the instantaneous informations.

To gain access to the “ALARMS” submenu from the “CONFIGURATION” menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION	Heading of the “CONFIGURATION” submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
ALARMS	Heading of "ALARMS" submenu

INST. SELF RESET NO

Description: Enable/disable auto-acknowledgment mecanism of any instantaneous alarms/LEDs
Range: YES/NO

ALARMS V>, tV> ? YES

Description: If YES is selected, the function will raise an alarm. Alarm LED stays ON and a message will be displayed on the HMI.

If No is selected: the function will not raise an alarm (Alarm LED stays OFF and no message will be displayed). In this case, the Alarm inhibition will be restricted to the yellow alarm LED (user defined LEDs are not affected), and will not affect transmission by communication transmission.

Range: YES/NO

The following table lists the alarm display options:

Event	Label description	P921	P922	P923
V>, tV>? or V>>, tV>>? or V>>>, tV>>>?	Instantaneous and time delayed 1^{st}, 2^{nd} or 3^{rd} overcurrent threshold	X	X	X
DU/DT1? or DU/DT2? or DU/DT3? or DU/DT4?	1st, 2^{nd}, 3rd or 4th rate of voltage variation protection (“delta U / delta t”)			X
U< & tU<? or U<< & tU<<? or U<<< & tU<<<?	Instantaneous and time delayed 1^{st}, 2^{nd} or 3^{rd} undervoltage threshold	X	X	X
tAux1? or tAux2? or tAux3? to tAux5?	Aux1 (to Aux 5) delayed by tAux1 (to tAux 5) time	X	X X	X X
F1? to F6?	Instantaneous 1^{st} to 6^{th} frequency threshold		X	X
dF/dt1? to dF/dt6?	1^{st} to 6^{th} rates of frequency variation protection (“delta f / delta t”).			X
F1+dF/dt1? to F6+dF/dt6?	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt			X
FR. OUT OF RANGE?	Frequency out of range		X	X
VTS?	Voltage Transformer Supervision alarm (internal VT fault, overloading, or faults on the interconnecting wiring), if enabled (VT Supervision/VT S Supervision submenu).		X	X
Control trip?	Control trip function assigned to the input. The next table summarises the behaviour of control trip function when a control trip order is received by the relay		X	X
EQU. A? to EQU. H?	Output of Boolean Equation A, B, C, D, E, F, G or H	X	X	X
VOLT BAL K1< ?, VOLT BAL K2< ? VOLT BAL K3< ?	Phase A (K1), B (K2) or C(K3) voltage balance threshold alarm. K1 or K2 or K3 is faulty when its value is below K< setting.			X
VOLT BAL Kpoly< ?	Multi-voltage balance threshold alarm (at least, two phases are unbalanced, below K< setting).			X

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

2.3.7 "CONFIGURATION INPUTS" Submenu

This menu allows the user to configure the operation of the logic inputs; either on falling edge/low level or on rising edge/high level. When selecting 1, the logic input becomes active when it is excited or energized, and inactive when it is de-energized. This menu allows also the selection of the type of the auxiliary voltage signal to be applied to the logic inputs.

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

A logic input inversion in this menu will inverts its allocated function status in the logic inputs allocation ("AUTOMAT. CTRL/INPUTS" menu). For example, if INPUTS: (21) = 10, and if tAux1 is selected in the "AUTOMAT. CTRL/INPUTS" menu, then tAux1 will be low when the logic input is high, and tAux1 will be high when the logic input is low.

To gain access to the "CONFIGURATION INPUT" submenu from the "CONFIGURATION" menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION	Heading of the "CONFIGURATION" submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
CONFIGURATION INPUTS	Heading of "CONFIGURATION INPUT"

- MiCOM P921

INPUTS: 21 11	**Description:** This menu is used to assign active high or low functionality to each logic input **Range:** 0 or 1

- MiCOM P922 & P923

INPUTS: 54321 11111	**Description:** This menu is used to assign active high or low functionality to each logic input **Range:** 0 or 1

VOLTAGE INPUT = DC	**Description:** Set choice AC or DC power supply for the digital input. The power supply for any input is the same one as much as the power supply for the relay. **Range:** DC or AC

NOTE: with version V4 software and V3 hardware, the setting of the VOLTAGE INPUT should be DC.

2.3.8 "OUTPUT RELAY" Submenu

To gain access to the "FAIL SAFE RELAYS" submenu from the "CONFIGURATION" menu, press followed by or until the desired submenu header is displayed.

CONFIGURATION	Heading of the "CONFIGURATION" submenu. To gain access to the CONFIGURATION menu from the default display press followed by or until the menu is displayed.
OUTPUT RELAYS	Heading of "FAIL SAFE RELAYS" (relay 1 and relay 2 ouputs.)
Fail 87654321 Safe R. 00000000	P921 (5 relays), P922 and P923 (8 relays). **Description:** This menu allows the user to invert each of the output relay contacts for the de-energised state. 1 = relay activated when driving signal is not active 0 = relay not activated when driving signal is not active **Range:** 0 or 1
Maintenance Mode ? Yes	**Description:** Choose if you want to activate the MAINTENANCE MODE of the relay. If the user selects Yes, output relays are disconnected from the protection and automation functions. **Range:** Yes/No
Relays 8765W4321 CMD 000000001	P921 (5 relays + watchdog), P922 and P923 (8 relays + Watchdog) **Description:** If the MAINTENANCE MODE is activated (set to Yes), this menu allows the user to activate each one of the output relay (from RL1 to RL8, W = Watchdog) 1 = relay activated 0 = relay not activated **Range:** Yes/No

2.4 Measurements

All measured quantities are displayed in primary values (true RMS values, up to the 10^{th} harmonic). They are refreshed once per second.

2.4.1 Configuration

According to the connection scheme, which is selected, the phase or line voltages will be measured and then displayed.

2.4.1.1 "3Vpn" configuration (3VTs "Phase-Neutral")

The 3 phase voltages VA, VB and VC will be measured by the MiCOM relay.

The derived quantities are the symetrical components of the voltage: zero-sequence voltage (V0), positive and negative sequences voltages (V1 and V2 for MiCOM P922 and P923).

$$\overrightarrow{V1} = 1/3(\overrightarrow{VA} + a\overrightarrow{VB} + a^2\overrightarrow{VC}) \qquad \text{with } a = e^{i2\pi/3}$$

$$\overrightarrow{V2} = 1/3(\overrightarrow{VA} + a^2\overrightarrow{VB} + a\overrightarrow{VC})$$

$$\overrightarrow{V0} = 1/3(\overrightarrow{VA} + \overrightarrow{VB} + \overrightarrow{VC})$$

If the protection mode is "Phase-Phase", the line voltages Vab, Vbc and Vca will be used in the protection algorithms. These line voltages are derived from the formulas below:

$$\overrightarrow{VAB} = (\overrightarrow{VB} - \overrightarrow{VA})$$

$$\overrightarrow{VBC} = (\overrightarrow{VC} - \overrightarrow{VB})$$

$$\overrightarrow{VCA} = (\overrightarrow{VA} - \overrightarrow{VC})$$

2.4.1.2 "3Vpp+Vr" configuration (3 "Phase-Phase" VTs + 1 residual VT)

The 3 line voltages Vab, Vbc, Vca and the residual voltage Vr are then measured by the MiCOM relay.

The derived quantities are: positive and negative sequences voltages (V1 and V2, only for MiCOM P922 and P923):

$$\overrightarrow{V1} = -1/3(\overrightarrow{UAB} + \frac{(a-1)}{(1+2a)}\overrightarrow{VBC}) \qquad \text{with } a = e^{i2\pi/3}$$

$$\overrightarrow{V2} = -1/3(\overrightarrow{UAB} + \frac{(2+a)}{(1+2a)}\overrightarrow{VBC})$$

The only protection mode, which is available in this configuration, is the "Phase-Phase" mode.

2.4.1.3 "2Vpp+Vr" configuration (2 “Phase-Phase” VTs + 1 residual VT)

The 2 line voltages Vab, Vbc and the residual voltage Vr are then measured by the MiCOM relay.

The derived quantities are: positive and negative sequences voltages (V1 and V2, only for MiCOM P922 and p923), and the Vca line voltage.

$$\overrightarrow{V1} = -1/3(\overrightarrow{VAB} + \frac{(a-1)}{(1+2a)}\overrightarrow{VBC}) \qquad \text{with } a = e^{\,j2\pi/3}$$

$$\overrightarrow{V2} = -1/3(\overrightarrow{VAB} + \frac{(2+a)}{(1+2a)}\overrightarrow{VBC})$$

$$\overrightarrow{VCA} = -(\overrightarrow{VAB} + \overrightarrow{VBC})$$

The only protection mode, which is available in this configuration, is the "Phase-Phase" mode.

2.4.1.4 "3Vpn+Vr" configuration (3 "Phase-Neutral" VTs + 1 residual VT)

The 3 phase voltages VA, VB, VC and the residual voltage Vr will be measured by the MiCOM relay.

The derived quantities are: positive and negative sequences voltages (V1 and V2, only for MiCOM P922 and P923).

$$\overrightarrow{V1} = 1/3(\overrightarrow{VA} + a\overrightarrow{VB} + a^2\overrightarrow{VC}) \qquad \text{with } a = e^{\,j2\pi/3}$$

$$\overrightarrow{V2} = 1/3(\overrightarrow{VA} + a^2\overrightarrow{VB} + a\overrightarrow{VC})$$

If the protection mode is “Phase-Phase”, the line voltages Vab, Vbc and Vca will be used in the protection algorithms. These line voltages are derived from the formulas below:

$$\overrightarrow{VAB} = (\overrightarrow{VB} - \overrightarrow{VA})$$

$$\overrightarrow{VBC} = (\overrightarrow{VC} - \overrightarrow{VB})$$

$$\overrightarrow{VCA} = (\overrightarrow{VA} - \overrightarrow{VC})$$

Please refer to the chapter P92x/EN CO of this Technical Guide, in which all the connection schemes are indicated.

2.4.2 MiCOM P921, MiCOM P922 and MiCOM P923: common measurements

To gain access to the “MEASUREMENT S” menu from the default display, press ⊘ followed by ⊘ until the desired submenu header is displayed..

The measured quantities only will be displayed in this menu.

Display	Description
MEASUREMENTS	Heading of the “MEASUREMENTS” menu
VA = **0.00 V**	**Description:** True RMS measured phase A voltage **Note:** this message only seen if "3Vpn+Vr" or "3Vpn" connection selected
VB = **0.00 V**	**Description:** True RMS measured phase B voltage **Note:** this message only seen if "3Vpn+Vr" or "3Vpn" connection selected
VC = **0.00 V**	**Description:** True RMS measured phase C voltage **Note:** this message only seen if "3Vpn+Vr" or "3Vpn" connection selected
VAB = **0.00 V**	**Description:** True RMS measured line Vab voltage **Note:** this message only seen if "3Vpp+Vr" or"2Vpp+Vr" connection
VBC = **0.00 V**	**Description:** True RMS measured line Vbc voltage. **Note:** this message only seen if "3Vpp+Vr" or"2Vpp+Vr" connection
VCA = **0.00 V**	**Description:** True RMS measured line Vca voltage. **Note:** this message only seen if "3Vpp+Vr" connection
V0 = **0.00 V**	**Description:** True RMS measured zero-sequence voltage V0. **Note:** this message only seen if "3Vpp+Vr", "3Vpn+Vr", "2Vpp+Vr" connection
FREQUENCY = **XX.XX Hz**	**Description:** value of the network frequency **Note:** if the measurement of the frequency is not possible, the display will be XX.XX – The measurement is not possible if the input voltage is less than 10% of the rated voltage

2.4.3 Specific measurements for the MiCOM P922-MiCOM P923

In this menu, all the derived quantities are displayed: positive and negative sequence voltages, peak and rolling demands.

2.4.3.1 Maximum and average values

The maximum and average values are calculated over a defined period of time: this time period for the calculation of the average values is defined in the "RECORDS" menu, "TIME PEAK VALUE" (see § 2.8.4).

These values are updated each 1s: a new calculation will be done as soon as the user has reseted those values through the HMI (see the menu below), or through the local or remote communication.

V1 = **0.00 V**	**Description:** Magnitude of the calculated positive sequence voltage V1
V2 = **0.00 V**	**Description:** Magnitude of the calculated negative sequence voltage V2
MAX & AVERAGE V **RST = [C]**	**Description:** reset of the voltages average and maximum values (measured and derived quantities).
MAX. VA Rms = **0.00 V**	**Description:** maximum value of the phase A voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.
MAX. VB Rms = **0.00 V**	**Description:** maximum value of the phase B voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.
MAX. VC Rms = **0.00 V**	**Description:** maximum value of the phase C voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.
AVERAGE VA Rms = **0.00 V**	**Description:** average value of the phase A voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.
AVERAGE VB Rms = **0.00 V**	**Description:** average value of the phase B voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.
AVERAGE VC Rms = **0.00 V**	**Description:** average value of the phase C voltage. **Note:** this message only seen if "3Vpn" or "3Vpn+Vr" connection.

2.5 Communication

2.5.1 Rear communication port description

The rear communication port is provided by a 3-terminal screw connector located on the back of the relay.

The rear port provides RS485 serial data communication and is intended for use with a permanently-wired connection to a remote control centre. Of the three connections, two are for the signal connection which can be connected either way round, and the other is for the earth shield of the cable.

The rear RS485 interface is isolated and is suitable for permanent connection whichever protocol is selected. The advantage of this type of connection is that up to 32 relays can be 'daisy chained' together using a simple twisted pair electrical connection.

All the connections are described in details into the Chapter 2 of this Technical Guide.

2.5.2 Rear and front communication management

2.5.2.1 Modification through the front panel

If there is any modification of the settings done through the front panel, a downloading of a new settings file via the MiCOM S1 software (locally), or via a remote master station will be forbidden.

The change of settings will be possible as soon as the setting mode will elapse (at the end of the 5mn timer or after power off/power on of the relay).

2.5.2.2 Modification through the MiCOM S1 software (front port, RS232)

If there is any modification of the settings through the MiCOM S1 software, a modification through the front panel will be forbidden and the following message will appear:

Write lockout

2.5.2.3 Modification through the rear port (RS485)

If the user is trying to access simultaneously to the settings of the relay through the RS232 and RS485 communication ports, there will be no messages on the display of the MiCOM relay: the last modifications will be taken into account without any warning.

2.5.3 HMI description

The « COMMUNICATION » menu depends on the rear communication protocol which is implemented into the MiCOM relay. This protocol must be selected at the order among the following protocols: Kbus/Courier, Modbus, IEC60870-5-103. Please refer to the cortec page (Chapter 3 of this Technical Guide).

2.5.3.1 Courier Interface

Courier is the communication language developed to allow remote interrogation of its range of protection relays. Courier works on a master/slave basis where the slave units contain information in the form of a database, and respond with information from the database when it is requested by a master unit.

The relay is a slave unit which is designed to be used with a Courier master unit such as MiCOM S1, MiCOM S10, PAS&T, ACCESS or a SCADA system. MiCOM S1 is a Windows 98 and NT compatible software package which is specifically designed for setting changes with the relay.

To gain access to the "COMMUNICATION" menu from the default display, press once and 3 times. The HMI is described below:

COMMUNICATION	**Heading of the "COMMUNICATIONS" menu**
COMMUNICATION ? **YES**	**Description:** enable/disable the "COMMUNICATION" function **Range:** YES/NO
RELAY ADDRESS **1**	**Description:** selection of the Kbus address of the relay **Range:** 1 to 255. **Note:** message only seen if the communication has been enabled

2.5.3.2 Modbus interface

Modbus is a master/slave communication protocol which can be used for network control. In a similar fashion to Courier, the system works by the master device initiating all actions and the slave devices (the relays) responding to the master by supplying the requested data or by taking the requested action. Modbus communication is achieved via a twisted pair connection to the rear port and can be used over a distance of 1000m and up to 32 slave devices.

To gain access to the "COMMUNICATION" menu from the default display, press once and 3 times. The HMI is described below:

COMMUNICATION	Heading of the "COMMUNICATIONS" menu
COMMUNICATION ? **YES**	**Description:** selection of the function "COMMUNICATION" **Range:** YES/NO
BAUD RATE **19200 Bd**	**Description:** selection of the baud rate **Range:** 300/600/1200/2400/4800/9600/19200/38400 Bauds **Note:** message only seen if the communication has been enabled
PARITY **NONE**	**Description:** selection of the parity **Range:** NONE / EVEN / ODD **Note:** message only seen if the communication has been enabled
STOP BITS **1**	**Description:** selection of the stop bits number **Range:** 1 or 2 **Note:** message only seen if the communication has been enabled
RELAY ADDRESS **1**	**Description:** selection of the Modbus address of the relay **Range:** 1 to 255. **Note:** message only seen if the communication has been enabled

2.5.3.3 IEC60870-5-103 interface

The IEC60870-5-103 interface is also a master/slave interface with the relay as the slave device. This protocol is based on the VDEW communication protocol. The relay conforms to compatibility level 2, compatibility level 3 is not supported.

To gain access to the "COMMUNICATION" menu from the default display, press once and 3 times. The HMI is described below:

COMMUNICATION	Heading of the "COMMUNICATIONS" menu
COMMUNICATION ? **YES**	**Description:** enable/disable the "COMMUNICATION" function **Range:** YES/NO
BAUD RATE **19200 Bd**	**Description:** selection of the baud rate **Range:** 9600 or19200 Bauds **Note:** message only seen if the communication has been enabled
RELAY ADDRESS **1**	**Description:** selection of the IEC address of the relay **Range:** 1 to 255. **Note:** message only seen if the communication has been enabled

2.6 Protections

To gain access to the "PROT ECTION" menu from the def ault display, press followed by until the desired submenu header (Protect ion group 1 or protection group 2) is displayed..

The accessible submenus are then indicated below:

PROTECTION G1

[27]UNDERVOLTAGE

[59]OVERVOLTAGE

[59N]RESIDUAL O/V

[47] NEG SEQ O/V (1)

[27D] POS SEQ U/V (1)

[81] FREQUENCY (1)

[81R]FREQ CHANGE OF RATE (2)

DELTA U / DELTA T (2)

VOLTAGE BALANCE (2)

(1) P922 and P923
(2) P923 only

2.6.1 Undervoltage protection

This function can be configured according to the connection scheme of the VTs: phase-phase protection (delta connection) or phase-neutral protection (star connection).

The configuration of this function can also be done in order to detect an absence of voltage for all phases:

- Undervoltage condition for one of the 3 phases (select OR for the considered stage),
- Undervoltage condition for all 3 phases (select AND for the considered stage).

The settings of the voltage thresholds are done in secondary values.

The relay will trip according to an inverse characteristic or a definite time characteristic for the first stage and according to a definite time characteristic for the second and third stages.

The inverse characteristic is given by the following formula:

$$t = K / (1-M)$$

Where, K = Time Multiplier Setting

t = operating time in seconds

M = Applied input voltage / Relay setting voltage (Vs).

To gain access to the " [27] UNDERVOLTAGE" submenu from the "PROTECTI ON group" menu, press .

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.

[27] UNDERVOLTAGE	Heading of the undervoltage submenu.
[27] V<= **NO**	**Description:** activation of the first undervoltage stage If OR is selected, the first undervoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Range:** NO / OR / AND **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V<< » message.
[27] V<= **50 V**	**Description:** setting of the first undervoltage stage **Range:** range 57-130V: 5-130V step = 0.1V range 220-480V: 20-480V step = 0.5V
[27] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic associated with V< **Range:** definite time (DMT) / inverse definite time (IDMT)
[27] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 **Note:** this message only seen if “IDMT” time delay selected
[27] tRESET V<= **10 ms**	**Description:** reset time for the first undervoltage stage **Range:** 0 – 100s, step = 0.01s **Note:** this message only seen if “IDMT” time delay selected
[27] tV<= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** this message only seen if “DMT” time delay selected
[27] Inhib V</52a **No**	**Description:** inhibition of the first undervoltage stage alarm on 52a. **Range:** YES / NO
[27] V<<= **NO**	**Description:** activation of the 2nd undervoltage stage If OR is selected, the second undervoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Range:** NO / AND / OR **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V<<< » message.
[27] V<<= **5.0 V**	**Description:** setting of the 2nd undervoltage stage **Range:** range 57-130V: 5-130V step = 0.1V range 220-480V: 20-480V step = 0.5V
[27] tV<<= **10 ms**	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage
[27] Inhib V<</52a **No**	**Description:** inhibition of the second undervoltage stage alarm on 52a. **Range:** YES / NO
[27] V<<<= **NO**	**Description:** activation of the 3rd undervoltage stage If OR is selected, the third undervoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Range:** NO / AND / OR **Note:** if disabled (« NO » selected), all the following messages are invisible, until the heading of the menu
[27] V<<<= **20 V**	**Description:** setting of the 2nd undervoltage stage **Range:** range 57-130V: 5-130V step = 0.1V range 220-480V: 20-480V step = 0.5V
[27] tV<<<= **10 ms**	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage

[27] Inhib V<<</52a **No**	**Description:** inhibition of the third undervoltage stage alarm on 52a. **Range:** YES / NO
[27] HYSTERESIS = **1.02**	**Description:** setting of the HYSTERESIS element **Range:** 1.02 – 1.05 step of 0.01

2.6.2 Overvoltage protection

This function can be configured according to the connection scheme of the VTs: phase-phase (delta connection) or phase-neutral protection (star connection).

For this overvoltage protection, the configuration can also be done in order to have:

- the highest voltage of each phase will be decisive: select OR for the considered stage,
- each voltage for each phase must be higher than the settable stage: select AND for the considered stage.

The settings of the voltage thresholds are done in secondary values.

The relay will trip according to an inverse characteristic or a definite time characteristic for the first stage and according to a definite time characteristic for the second and third stage.

The inverse characteristic is given by the following formula:

$$t = K / (M - 1)$$

Where, K = Time Multiplier Setting
t = operating time in seconds
M = Applied input voltage / Relay setting voltage (Vs).

To gain access to the “[59] OVERVOLTAGE” submenu from the “PROTECTION group” menu, press followed by or until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.
[59] OVERVOLTAGE	Heading of the “OVERVOLTAGE” submenu
[59] V>= **NO**	**Description:** activation of the first overvoltage stage **Range:** NO / AND / OR If OR is selected, the first overvoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V>> » message.
[59] V>= **130.0 V**	**Description:** setting of the first overvoltage stage **Range:** range 57-130V: 5-200V, step =0.1V range 220-480V: 20-720V, step = 0.5V
[59] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic **Range:** definite time (DMT) / inverse definite time (IDMT)
[59] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 **Note:** this message only seen if “IDMT” time delay selected

[59] tRESET V>= 10 ms	**Description:** reset time for the first overvoltage stage **Range:** 0 – 100s, step = 0,01s **Note:** this message only seen if "IDMT" time delay selected
[59] tV>= 40 ms	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** this message only seen if "DMT" time delay selected
[59] V>>= NO	**Description:** activation of the 2nd overvoltage stage **Range:** NO / AND / OR If OR is selected, the second overvoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V>>> » message.
[59] V>>= 130.0 V	**Description:** setting of the 2nd overvoltage stage **Range:** range 57-130V: 5-260V, step =0.1V range 220-480V: 20-960V, step = 0.5V
[59] tV>>= 40 ms	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage
[59] V>>>= NO	**Description:** activation of the 3rd overvoltage stage **Range:** NO / AND / OR If OR is selected, the third overvoltage stage alarm is emitted if one phase (at least) is faulty. If AND is selected, this alarm appears when the stage appears on the three phases. **Note:** if disabled (« NO » selected), all the following messages are invisible, until the heading of the submenu.
[59] V>>>= 130.0 V	**Description:** setting of the 3rd overvoltage stage **Range:** range 57-130V: 5-260V, step =0.1V range 220-480V: 20-960V, step = 0.5V
[59] tV>>>= 10 ms	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage
[59] HYSTERESIS = 0.98	**Description:** setting of the HYSTERESIS element **Range:** 0.98 – 0.95 step of 0.01

2.6.3 Zero sequence overvoltage (neutral displacement) protection

The zero sequence overvoltage element functions according to the VT configuration.

– VT configuration = $3V_{pn} + V_r$, $3V_{pp} + V_r$ or $2V_{pp} + V_r$, then the [59N] will operate based on the residual voltage (due to the summation of the 3 phase voltages), measured on relay terminals (49-50).

– VT configuration = $3V_{pn}$, then [59N] will operate based on the zero sequence voltage $V_0 = \frac{(Ua + Ub + Uc)}{3}$ calculated internally.

The inverse characteristic (only for the 1st stage) is given by the following formula:

$t = K / (1 – M)$

Where, K = Time Multiplier Setting
t = operating time in seconds
M = Applied input voltage / Relay setting voltage (Vs)

When residual voltage cannot be measured, the derived V0 sequence protection (V0der>, P922 and P923 only) depends only on the connection mode an d calculation based on the phase voltage ($\frac{(Ua + Ub + Uc)}{3}$ calculation).

– If VT configuration = 3 V_{pn}+V_r", 3V_{pp} + V_r or 2V_{pp} + V_r, the derived V0 sequence voltage is calculated,

– If VT configuration is 3 V_{pn}, then, the derived V0 sequence voltage threesholds are equal to the residual voltage threesholds.

To gain access to the "[59N] RESIDUAL OVERVOLTAGE" subme nu from the "PROTECTION group" menu, press followed by or until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.
[59N] RESIDUAL O/V	Heading of the RESIDUAL OVERVOLTAGE submenu
[59N] V0>= **NO**	**Description:** activation of the 1st residual overvoltage stage **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V0>> » message.
[59N] V0>= **5.0 V**	**Description:** setting of the 1st residual overvoltage stage **Range:** range 57-130V: 0.5-130V, step = 0.1V range 220-480V: 2-480V, step = 0.5V
[59N] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic **Range:** definite time (DMT) / inverse definite time (IDMT)
[59N] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 **Note:** this message only seen if "IDMT" time delay selected
[59N] tRESET V0>= **10 ms**	**Description:** reset time for the first residual overvoltage stage **Range:** 0 – 100s, step = 0,01s **Note:** this message only seen if "IDMT" time delay selected
[59N] tV0>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** this message only seen if "DMT" time delay selected
[59N] V0>>= **NO**	**Description:** activation of the 2nd residual overvoltage stage **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V0>>> » message.
[59N] V0>>= **5.0 V**	**Description:** setting of the 2nd residual overvoltage stage **Range:** range 57-130V: 0.5 – 130V, step =0,1V range 220-480V: 2 – 480V, step = 0,5V
[59N] tV0>>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage
[59N] V0>>>= **NO**	**Description:** activation of the 3rd residual overvoltage stage **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until the heading of the submenu.
[59N] V0>>>= **5.0 V**	**Description:** setting of the 2nd residual overvoltage stage **Range:** range 57-130V: 0.5 – 130V, step =0.1V range 220-480V: 2 – 480V, step = 0.5V
[59N] tV0>>>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage

[59N] V0der>= **NO**	P922 and P923 only **Description:** activation of the 1st derived V0 sequence overvoltage stage **Range:** YES/NO Note: if disabled (« NO » selected), all the following messages are invisible, until « V0der>> » message.
[59N] V0der>= **5.0 V**	**Description:** setting of the 1st derived V0 sequence overvoltage stage **Range:** range 57-130V: 0.5-130V, step = 0.1V range 220-480V: 2-480V, step = 0.5V
[59N] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic **Range:** definite time (DMT) / inverse definite time (IDMT)
[59N] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 Note: this message only seen if “IDMT” time delay selected
[59N] tRESET V0der>= **10 ms**	**Description:** reset time for the first derived V0 sequence overvoltage stage **Range:** 0 – 100s, step = 0,01s Note: this message only seen if “IDMT” time delay selected
[59N] tV0der>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599.99s, step = 0.01s Note: this message only seen if “DMT” time delay selected
[59N] V0der>>= **NO**	P922 and P923 only **Description:** activation of the 2nd derived V0 sequence overvoltage stage **Range:** YES/NO Note: if disabled (« NO » selected), all the following messages are invisible, until « V0der>>> » message.
[59N] V0der>>= **5.0 V**	**Description:** setting of the 2nd derived V0 sequence overvoltage stage **Range:** range 57-130V: 0.5 – 130V, step =0,1V range 220-480V: 2 – 480V, step = 0,5V
[59N] tV0der>>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599.99s, step = 0.01s Note: definite time delay only for this stage
[59N] V0der>>>= **NO**	**Description:** activation of the 3rd derived V0 sequence overvoltage stage **Range:** NO / AND / OR Note: if disabled (« NO » selected), all the following messages are invisible, until the heading of the submenu.
[59N] V0der>>>= **5.0 V**	**Description:** setting of the 2nd derived V0 sequence overvoltage stage **Range:** range 57-130V: 0.5 – 130V, step =0.1V range 220-480V: 2 – 480V, step = 0.5V
[59N] tV0der>>>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s Note: definite time delay only for this stage

2.6.4 Negative sequence overvoltage protection (MiCOM P922 and P923)

The relay will trip according to an inverse characteristic or a definite time characteristic for the first stage and according to a definite time characteristic for the second stage.

The inverse characteristic is given by the following formula:

$$t = K / (M - 1)$$

Where, K = Time Multiplier Setting
t = operating time in seconds
M = Applied input voltage / Relay setting voltage (Vs).

To gain access to the "[47] NEGATIVE SEQUENCE OVERVOLTAGE" submenu from the "PROTECTION group" menu, press followed by or until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.
[47] NEG SEQ O/V	Heading of the "NEG.SEQ O/V" submenu
[47] V2>= **NO**	**Description:** activation of the 1st negative overvoltage stage (V2>) **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V2>> » message.
[47] V2>= **5.0 V**	**Description:** setting of the 1st V2> stage **Range:** range 57-130V: 5 – 200V, step = 0.1V range 220-480V: 20 – 720V, step = 0.5V
[47] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic **Range:** definite time (DMT) / inverse definite time (IDMT)
[47] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 **Note:** this message only seen if "IDMT" time delay selected
[47] tRESET V2>= **10 ms**	**Description:** reset time for the first negative overvoltage stage **Range:** 0 – 100s, step = 0.01s **Note:** this message only seen if "IDMT" time delay selected
[47] tV2>= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** this message only seen if "DMT" time delay selected
[47] V2>>= **NO**	**Description:** activation of the 2nd negative overvoltage stage (V2>>) **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until the heading of the submenu.
[47] V2>>= **130 V**	**Description:** setting of the 2nd stage **Range:** range 57-130V: 5 – 200V, step =0.1V range 220-480V: 20 – 720V, step = 0.5V
[47] tV2>>= **40 ms**	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage

2.6.5 Positive sequence undervoltage protection (MiCOM P922 and P923)

The relay will trip according to an inverse characteristic or a definite time characteristic for the first stage and according to a definite time characteristic for the second stage.

The inverse characteristic is given by the following formula:

$$t = K / (1 - M)$$

Where, K = Time Multiplier Setting
t = operating time in seconds
M = Applied input voltage / Relay setting voltage (Vs).

To gain access to the "[27D] POSITIVE SEQUENCE UNDERVOLTAGE" submenu from the "PROTECTION group" menu, press followed by or until the desired submenu header is displayed.

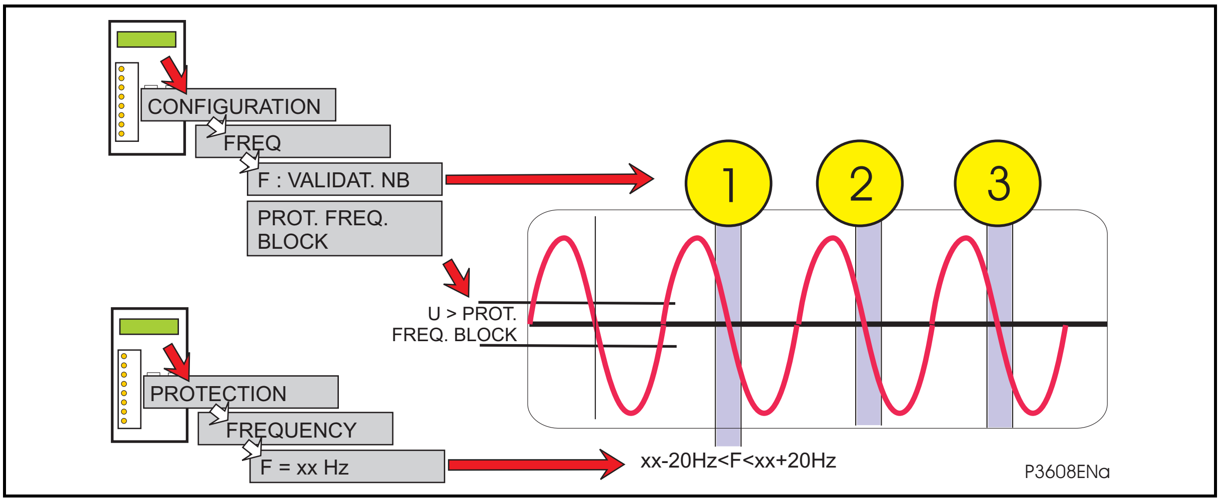
PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.
[27D] POS SEQ U/V	Heading of the "POS.SEQ U/V" submenu
[27D] V1<= **NO**	**Description:** activation of the 1st stage of undervoltage protection (V1<) **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until « V1< » message.
[27D] V1<= **5.0 V**	**Description:** setting of the 1st stage **Range:** range 57-130V: 5 – 130V, step = 0.1V range 220-480V: 20 – 480V, step = 0.5V
[27D] DELAY TYPE = **DMT**	**Description:** selection of the time delay characteristic **Range:** definite time (DMT) / inverse definite time (IDMT)
[27D] TMS= **1.0**	**Description:** time multiplier setting. **Range:** 0.5 – 100, step = 0.5 **Note:** this message only seen if "IDMT" time delay selected
[27D] tRESET V1<= **10 ms**	**Description:** reset time for the first positive undervoltage stage **Range:** 0 – 100s, step = 0.01s **Note:** this message only seen if "IDMT" time delay selected
[27D] tV1<= **40 ms**	**Description:** time delay setting for a definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** this message only seen if "DMT" time delay selected
[27D] V1<<= **NO**	**Description:** activation of the 2nd stage of undervoltage protection (V1<<) **Range:** YES/NO **Note:** if disabled (« NO » selected), all the following messages are invisible, until the heading of the submenu.
[27D] V1<<= **5.0 V**	**Description:** setting of the 2nd stage **Range:** range 57-130V: 5 – 130V, step =0.1V range 220-480V: 20 – 480V, step = 0.5V
[27D] tV1<<= **40 ms**	**Description:** time delay setting for the definite time curve. **Range:** 0 – 599s, step = 0.01s **Note:** definite time delay only for this stage

2.6.6 Frequency protection (MiCOM P922 and P923)

The principle of measurement of frequency is based in general on the measurement of time every cycle, thus a new measurement is started at each voltage zero crossing. Numerical filters are used to minimize the harmonics influence. Frequency threshold is validated after a number of periods set in the Configuration menu ('F : Validat. Nb =' setting, MiCOM P923).

Precautions have been made to make this mode of calculation insensitive to the vector shifts and phases jumps.

This function will be in hibited if th e voltage level for each phase i s below the blocking minimum voltage. This voltage is settable (P923) in the CONFIGURATION menu (5 to 130V for range 1 and 20 to 480V for range 2).



The information “Freq. Out Of Range” will be generated when the following conditions are met:

- For the MiCOM P923 relay, fault duration exceeds ‘F: Validat. Nb’ setting (i.e. if ‘F: Validat. Nb’ is set to 3, fault is validated if frequency is faulty during 3 × 20ms = 60ms at 50Hz)
- average voltage is greater than ‘Prot. Freq. block’ voltage setting,
- if the frequency is out of the Range: $f_{measured}$ > fn+20Hz or $f_{measured}$ < fn–20Hz with fn=50Hz or 60Hz according to the settings of the relay.

The following HMI description is given for F1 Frequency. These menus are identical for F2, F3, F4, f5 and F6 frequencies.

To gain access to the “[81] FREQUENCY” submenu from the “PROTECTION group” menu, press ⊕ followed by ◁ or ▷ until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press ⊕ followed by ◁ or ▷ until the menu is displayed.
[81] FREQUENCY	Heading of the “FREQUENCY” submenu
[81] F1 = **NO**	**Description:** configuration of the 1st frequency stage: No activation, under (81<) or over (81>) the corresponding setting. “81>” or “81<” selection activate the frequency setting and time delay setting submenus. **Range:** NO / 81> / 81<
[81] F1 = **50.0 Hz**	**Description:** setting of the 1er frequency stage. **Range:** from "40Hz" to "70Hz" step 0.01 Hz
[81] tF1 = **0 ms**	**Description:** time delay setting. **Range:** from 0 to 599.9s, step = 0.01s

2.6.7 Rate of change of frequency (MiCOM P923 only)

The calculation of the rate of change of frequency is an average measurement of the instantaneous values over a programmable number of cycles (1 to 200); refer to the "CONFIGURATION" menu. The instantaneous values of rate of change of frequency are measured every cycle. The rate of change of frequency elements are very important to detect any active power loss under severe disturbances: they can be used for load shedding schemes. These elements offer the possibility to detect the tendency of the variation of frequency, and thus re establish the correct load/generation without waiting for big frequency reduction. These elements could be combined to the frequency elements using the AND logic equations, or using the "F+df/dt in the AUT OMAT. CTRL menu (MiCOM P923), to provide a very usefull mechanism allowing a more secure trip decision to be achieved during transient system disturbances.

This function will be inhibited if the voltage level for each phase is below the settable undervoltage blocking value (see menu "CONFIGURATION", submenu "FREQ and df/dt CONFIG").

The information "freq out of range" will be generated:

– in the above mentioned application

– if the frequency is out of Range: $f_{measured}$ > (fn+20Hz) or $f_{measured}$ < (fn–20Hz)

The following HMI description is given for df/dt1 "change of requency". These menus are identical for df/dt2, df/dt3, df/dt4, df/dt5 and df/dt6 rates.

To gain access to the "[81R] FREQUENCY CHANGE OF RATE" submenu from the "PROTECTION group" menu, press followed by or until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.
[81R] FREQ CHANGE OF RATE	Heading of the "Rate of change of Frequency" submenu
[81R] df/dt1 = NO	**Description:** activation of the 1st change of frequency stage (delta f / delta t) **Range:** YES/NO
[81R] df/dt1 = 1.0 Hzs	**Description:** setting of the 1er frequency variation (ΔF) per second (Δt) in Hz/s(with Δt = 1 period (20ms at 50Hz). The value is validated if it is repeted x times (x is set in the 'CONFIGURATION / dF/dt Cycles.nb.' menu) **Range:** [– 10Hz/s to + 10Hz/s], step = 0.1

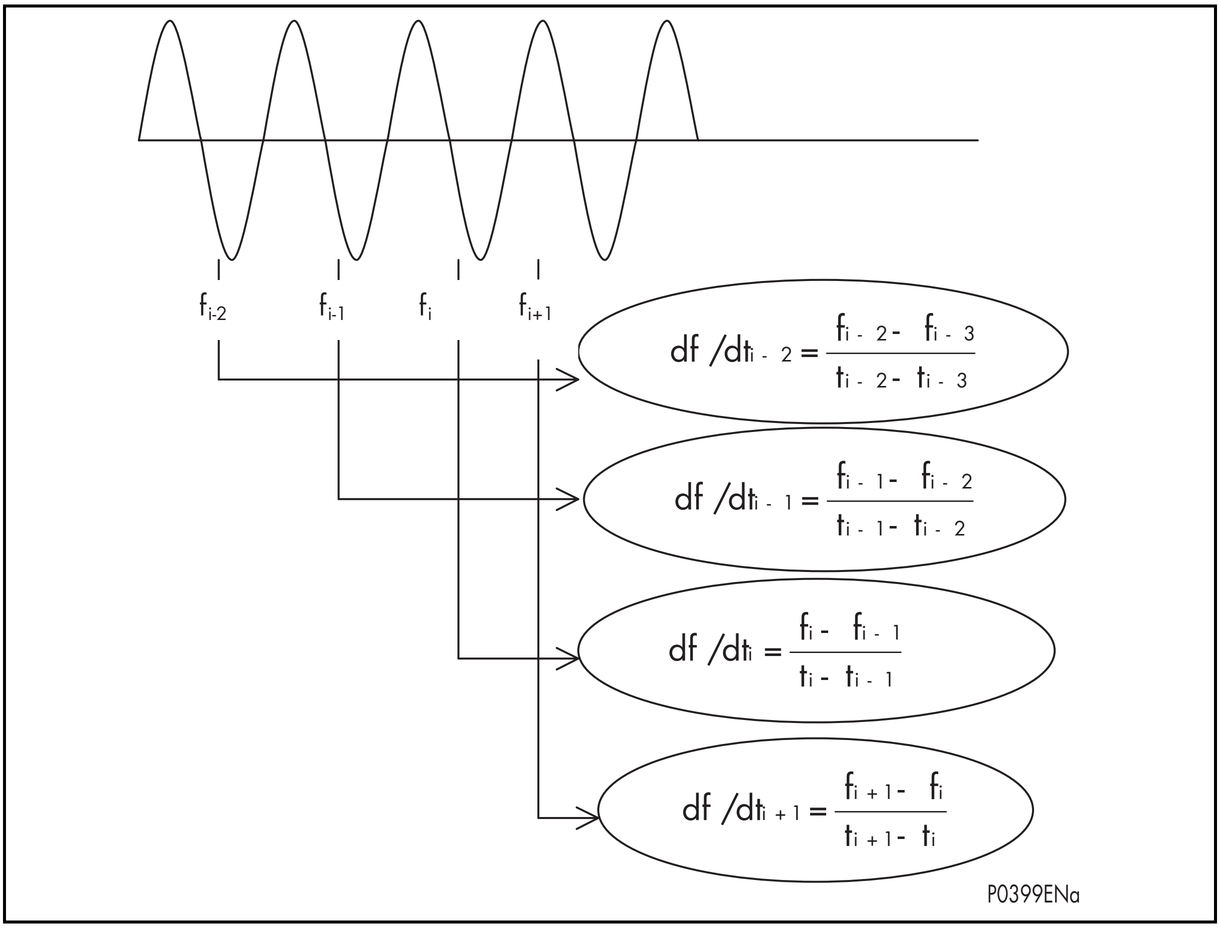
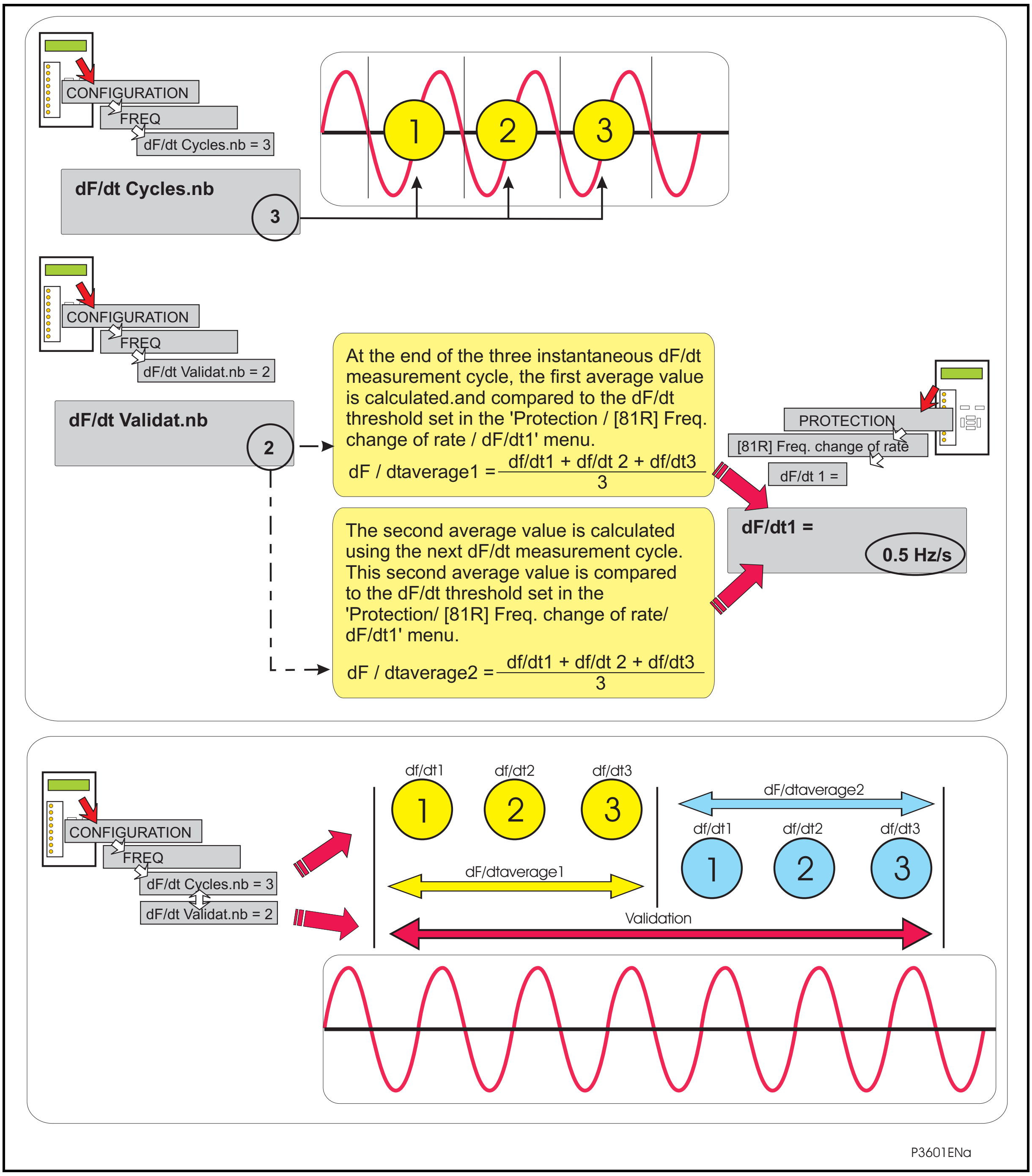


FIGURE 2

The rates of change of frequency are calcu lated every cycle ba sed upon zero crossing.

NOTE: To be insensitive to the phase shift and vector jumps, we can reject all measuements of df/dt greater than 20Hz/s .



With “dF/dt Validation nb = 2”, the rate of change of frequency:

– will be validated when dF/dtaverage1 and dfF/dtaverage2 exceed df/dt1 setting value (protection menu).

– will not be validated when only one of the average value exceeds df/dt1 setting value.

NOTE: the rate of change of frequency is available when voltage inputs are connected.

2.6.8 "DELTA U / DELTA T" submenu (MiCOM P923 only)

"Delta U / Delta t" protects the circuit against voltage variations.

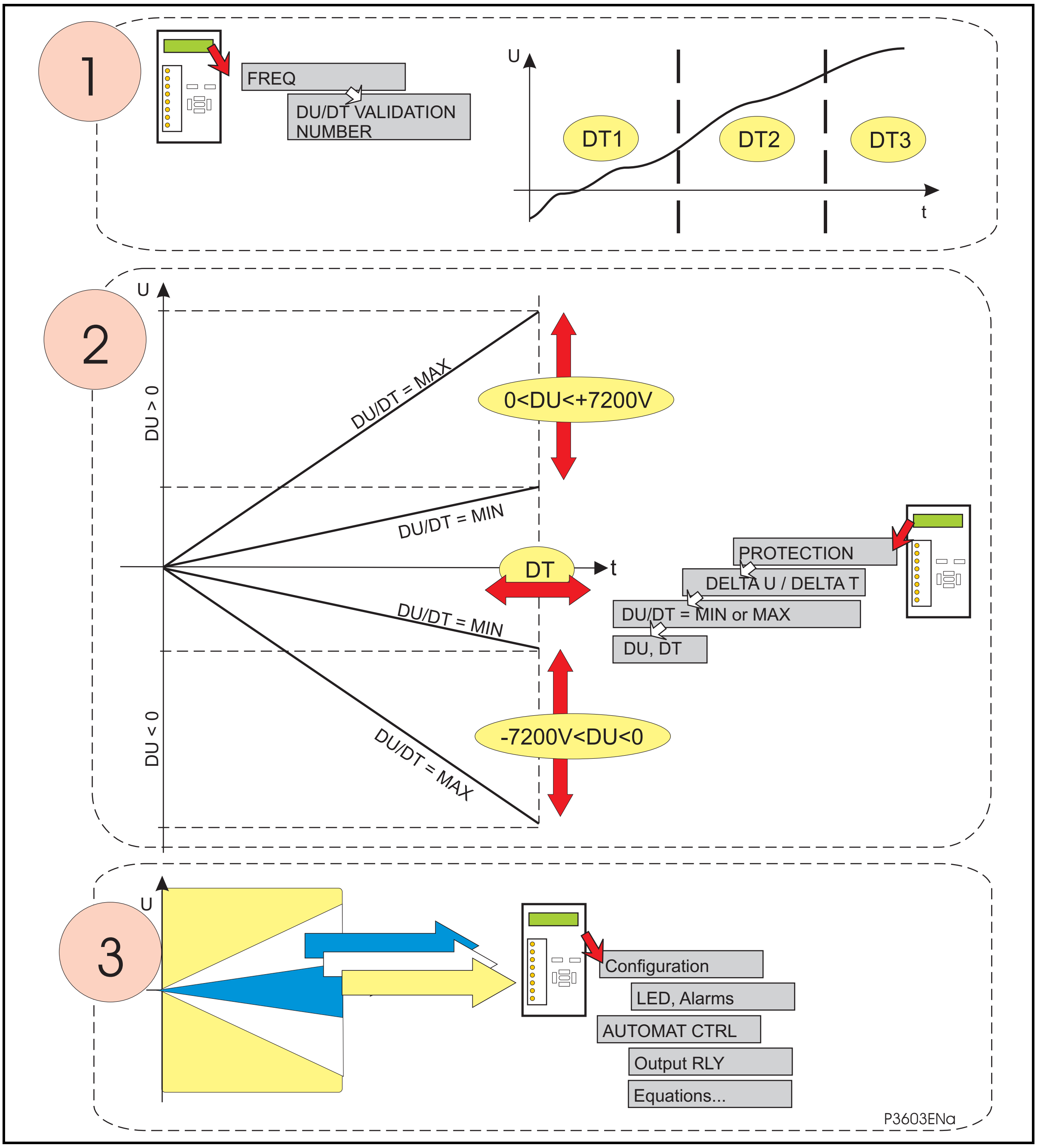
This menu is useful to detect a voltage variation (load variation):

– A fast voltage drop or increase, exceeding user's threholds can be used as an alarmor to trip the protection,

– A slow voltage variation can be associated to another threshold (as U>, U>…) in a boolean equation.

"Delta U / Delta P" allows 4 independant settings, giving you a a largest flexibility for your application: For instance, you can monitor a minimum and a maximum voltage variation, for positive and negative voltages. The four thresholds can be independently used.

DU / DT validation is set in the "FREQ" submenu.



To gain access to the "DELTA U / Delt a T" submenu from the "PROTECTIO N group" menu, press followed by or until the desired submenu header is displayed.

PROTECTION G1 (G2)

Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press followed by or until the menu is displayed.

DELTA U / DELTA T
P

Heading of the "delta U / delta T" submenu

DU/DT 1
No

Description: activates delta U / delta T function for 1st zone.

Setting choices: "No" (no check), "MIN/OR", "MIN/AND", "MAX/OR"* or "MAX/AND"*.

"MIN " indicates a slow variation of DU/DT. Function is validated if DU/DT does not exceed the DU1/DT1 setting.

"MAX" indicates a high variation of DU/DT. Function is validated if DU/DT exceeds the DU1/DT1 setting.

"OR" indicates that the function is validated if at least one phase validates the function,

"AND" indicates that the function is validated if the three phases validate the function,

"DU1" and "DT1" submenus accessible if ≠"No".

In order to validate the DU/DT function, set the validation number in the "FREQ" menu.

DU1
10.0V

Description: Voltage value for the voltage variation per second (DU1/DT 1 ratio).

Range: from – 720.0 V to + 720.0V, step 0.5 V

DT1
1.0s

Description: Time value for DU1/DT 1 ratio.

Range: from 0.1s to 10.0s, step 0.01s

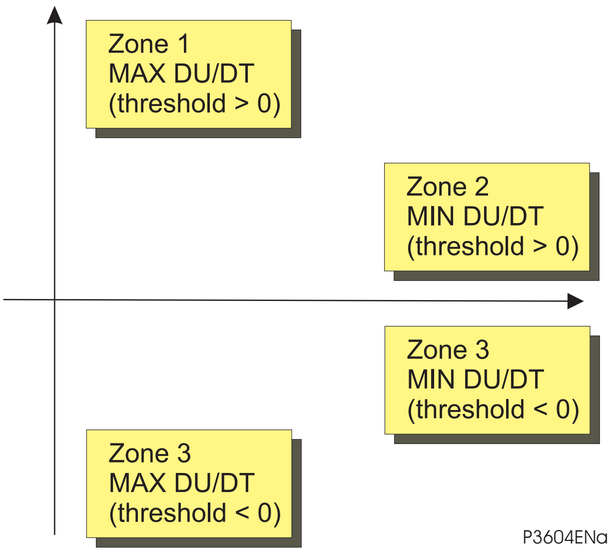
DU/DT 2
No

DU/DT 3
No

DU/DT 4
No

Description: activates delta U / delta T function the $2^{nd,}$ 3^{rd} and 4^{th} zone.

New diagram gives an exemple of zone setting:



2.6.9 Voltage balance submenu (MiCOM P923 only)

The Voltage balance protection is only available with 3 Phase-Neutral VTs connections (‘3Vpn or ‘3Vpn+Vr’ VT connection mode, “Relay configuration / General” menu).

This protection protects a 3-phases system against unbalanced voltages. It compares the phase voltages (VA, VB and VC) to the line voltages (UAB, UBC or UCA):

– If UBC > 20% × $\sqrt{3}$ × nominal voltage:
  K1 = $\sqrt{3}$ VA / UBC,

– If UCA > 20% × $\sqrt{3}$ × nominal voltage:
  K2 = $\sqrt{3}$ VB / UCA,

– If UAB > 20% × $\sqrt{3}$ × nominal voltage:
  K3 = $\sqrt{3}$ VC / UAB,

One-phase unbalanced voltage alarm (K1<, K2< or K3<) condition is detected when K1, K2 or K3 decreases under ‘K<=’ setting.

If two, or more, voltages are unbalanced, the “KPOLY” alarm condition is detected.

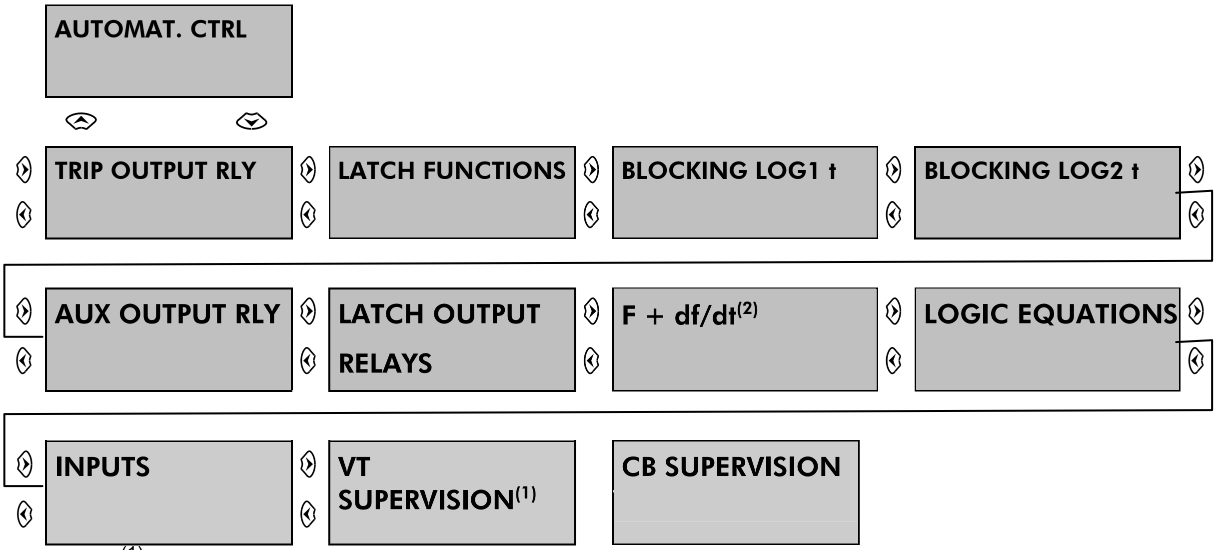
To gain access to the “VOLTAGE BALANCE” submenu from the “PROTECTION group” menu, press ⌄ followed by ‹ or › until the desired submenu header is displayed.

PROTECTION G1 (G2)	Heading of the protection menu (group 1 or group 2). To gain access to the menu from the default display press ⌄ followed by ‹ or › until the menu is displayed.
VOLTAGE BALANCE **P**	Heading of the “Voltage Balance” submenu
K<= **No**	**Description:** activates the delta balance submenu **Setting choices:** “Yes” or “No” When “Yes” is set, the voltage balance value can be set.
K<= **0.85**	**Description:** Sets the threshold value for K1, K2 and K3. When K1, K2 or K3 value drops under K<, K1, K2 or K3 is faulty **Range:** from 0.50 to 1, in steps of 0.01

2.7 Automatic Control functions

The AUTOMAT. CT RL Menu makes it po ssible to programme the various automation functions included in the MiCOM P921, P922 & P923 relays.

The different submenus are:



(1) P922-P923 only
(2) P923 only

2.7.1 "TRIP OUTPUT RLY" Submenu

This submenu makes it possible to assign to the trip output contact (RL1) part or all the selected time-delayed information.

In order to assign an information to the trip output contact, please go to the cell corresponding to the selected information and press the key. Select the configuration (YES or NO) with the and keys. Validate with the key.

To gain access to the "Trip outpu t relay" submenu from the "Automatic contro l" menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
TRIP OUTPUT RLY	Heading of the "TRIP OUTPUT RELAY" submenu
TRIP tFunction = NO	**Description:** selection of the time-delayed information tFunction, which will be sent to the RL1 output contact Setting choice Yes: Assign the corresponding time delay to the trip output relay RL1. Then the trip output relay (RL1) will be activated at the end of the corresponding time delay. Setting choice No: the trip output relay (RL1) will never be activated, even at the end of the corresponding time delay. **Range:** YES/NO Refer to the following table for protection functions list and comments.

tFunction	P921	P922	P923	Function
tU<, tU<< or tU<<<	X	X	X	Time delayed 1^{st}, 2^{nd} or 3rd undervoltage threshold
tU>, tU>> or tU>>>	X	X	X	Time delayed 1^{st}, 2^{nd} or 3^{rd} overvoltage threshold
tV0>, tV0>> or tV0>>>	X	X	X	Time delayed 1^{st}, 2^{nd} or 3^{rd} zero sequence voltage threshold
tV0der>, tV0der>> or tV0der>>>		X	X	Time delayed 1^{st}, 2^{nd} or 3^{rd} derived V0 sequence voltage threshold
tV2>or tV2>>		X	X	Time delayed 1^{st} or 2^{nd} negative sequence overvoltage threshold
tV1< or tV1<<		X	X	Time delayed 1^{st}, 2^{nd} positive sequence undervoltage threshold
tF1 to TF6		X	X	Time delayed 1^{st} to 6^{th} frequency trip thresholds
df/dt1 to df/dt6			X	1^{st} to 6^{th} rates of frequency variation protection.
F1+df/dt1 to F6+df/dt6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
tAux1 or tAux2	X	X	X	Copy of the status of the logic inputs delayed by tAux1 or tAux2
tAux3 to tAux5		X	X	Copy of the status of the logic inputs delayed by tAux3 to tAux5
Equation A to Equation H	X	X	X	Outputs of Boolean Equations A to H
DU/DT1 to DU/DT4			X	1^{st} to 4^{th} rates of voltage variation protections ("delta U / delta t")
V BAL K1 V BAL K2 V BAL K3			X	Status of the voltage balance for phase A (K1), phase B (K2) or phase C(K3). K1 or K2 or K3 is faulty when its value is below K< setting.
V B KPoly			X	Status of the multi-voltage balance (active when, at least, two phases are unbalanced, below K< setting).

2.7.2 "LATCH FUNCTIONS" Submenu

This submenu makes it possible to latch the information of any stage associated to the trip output contact (RL1). The latched trip output contact will then be maintained even if the fault has disappeared, and as long as a reset will not be performed. The reset can be done:

- via a logic input (select "UNLATCH" in the list of available data, see "INPUTS" menu § 2.7.8),
- via the local or remote communication link.

In order to latch one information, please go to the relevant cell corresponding to the selected information, press then the key. Select the configuration (YES or NO) with the and keys. Validate with the key.

To gain access to the " Latch outputs" submenu from the "Automatic co ntrol" menu, press followed by or until the desired submenu header is displayed.

Display	Description
AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
LATCH FUNCTIONS	Heading of the "LATCH FUNCTIONS" menu
LATCH tFunction= NO	**Description:** selection of the time-delayed information "ttFunction", which will be latched. Setting choice Yes: Latch the trip output relay associated with the corresponding time-delayed function. The relay will be remain latched after the fault has disappeared. Setting choice No: The trip output relay will be active when the relevant command is active. The relay will not be active if the relevant command is reset. Refer to Following table for time-delayed functions list and comments. **Range:** YES/NO

tFunction	P921	P922	P923	Function
tU<, tU<< or tU<<<	X	X X		Time delayed 1st, 2nd or 3rd undervoltage threshold
tU>, tU>> or tU>>>	X	X X		Time delayed 1st, 2nd or 3rd overvoltage threshold
tV0>, tV0>> or tV0>>>	X	X X		Time delayed 1st , 2nd or 3rd zero sequence voltage threshold
tV0der>, tV0der>> or tV0der>>>		X	X	Time delayed 1st , 2nd or 3rd derived V0 sequence voltage sequence voltage threshold
tV2> or tV2>>		X	X	Time delayed 1st or 2nd negative sequence overvoltage threshold
tV1< or tV1<<		X	X	Time delayed 1st or 2nd positive sequence undervoltage threshold
tF1 to tF6		X	X	Time delayed 1st to 6th frequency trip thresholds ("delta f / delta t")
df1/dt1 to df/dt6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
F1+df/dt1 to F6+df/dt6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
tAux1 or tAux2	X	X X		Copy of the status of the logic inputs delayed by tAux1 or tAux2
tAux3 to tAux5		X	X	Copy of the status of the logic inputs delayed by tAux3 to tAux5
Equation A to Equation H	X	X X		Outputs of Boolean Equations A to H
DU/DT1 to DU/DT4			X	1st to 4th rates of voltage variation protections ("delta U / delta t")

tFunction	P921	P922	P923	Function
V BAL K1= V BAL K2= V BAL K3=			X	Voltage balance status for phase A (K1), phase B (K2) or phase C(K3). K1 or K2 or K3 is faulty when its value is below K< setting.
V B Poly=			X	Multi-voltage balance status (active when, at least, two phases are unbalanced, below K< setting).

2.7.2.1 Example of configuration

The aim is:

Latching of the output contact RL1, which is linked to the “tV>” information.

Settings are:

- select “YES” for the information which must be latched in the above menu: “tV>”,

2.7.3 "BLOCKING LOG1 t" Submenu

The principle of the blocked overcurrent protection involves the use of start contacts from downstream relays (P121 or P122 for example) wired onto blocking inputs of upstream relays (P921, P922 or P923 for example).

In the MiCOM P921 or P922-P923, the “BLOCKING LOGIC1 t” and “BLOCKING LOGIC2 t” submenus allow the user to select time-delayed information, which will be blocked by a dedicated logic input (see “INPUTS” submenu, “BLOCK LOG1” or “BLOCK LOG2” input).

To gain access to the “blockin logic” submenu from the “Automatic control” menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
BLOCKING LOG1 t	Heading of the “BLOCKING LOGIC 1” submenu
BLOCK1 tFunction= **NO**	**Description:** selection of the time-delayed information “tFunction”, which will be blocked by energisation of the “BLK LOG1” logic input. **Range:** YES/NO Refer to the following table for protection functions list.

tFunction	P921	P922	P923	Function
tU<, tU<< or tU<<<	X	X	X	Time delayed 1st, 2nd or 3rd undervoltage threshold
tU>, tU>> or tU>>>	X	X	X	Time delayed 1st, 2nd or 3rd overvoltage threshold
tV0>, tV0>> or tV0>>>	X	X	X	Time delayed 1st , 2nd or 3rd zero sequence voltage threshold
tV0der>, tV0der>> or tV0der>>>		X	X	Time delayed 1st , 2nd or 3rd derived V0 sequence voltage threshold
tV2>or tV2>>		X	X	Time delayed 1st or 2nd negative sequence overvoltage threshold

tFunction	P921	P922	P923	Function
tV1< or tV1<<		X	X	Time delayed 1st , 2nd positive sequence undervoltage threshold
tF1 to TF6		X	X	Time delayed 1st to 6th frequency trip thresholds
df/dt1 to df/dt6			X	1st to 6th rates of frequency variation protection.
tAux1 or tAux2	X	X X		Copy of the status of the logic inputs delayed by tAux1 or tAux2
tAUX3 to tAUX5		X	X	Copy of the status of the logic inputs delayed by tAux3 to tAux5
DU/DT 1 to DU/DT 4			X	1st , 2nd, 3rd or 4th rate of voltage variation protection ("delta U / delta t")

2.7.3.1 Example of configuration

The aim is:

The user wants to block the first undervoltage stage if the logic input n°2 is energised.

Settings are:

- select "YES" for the information «tV<« in the "BLOCKING LOG1 t" menu. See above,
- select the logic input n°2 in the "INPUTS" submenu and allocate to this input the information "BLK LOG1", as indicated below:

INPUT 2 =
BLK LOG1

2.7.4 "BLOCKING LOG2 t" Submenu

The aim of this submenu is identical to the one of the "BLOCKING LOG1 t" submenu. In consequence, its description is not done in this Technical Guide.

To gain access to the "BLOCKING LOG2 t" submenu from the default display, press once, 5 times(P921) or 6 times(P922 and P923), once and 3 times.

2.7.5 "AUX OUTPUT RLY" Submenu

This submenu makes it possible to allocate to each individual output contact (excepted the watchdog and the trip output RL1) the information available in the MiCOM relay. Instantaneous and time-delayed information can be then affected to one or many output contacts.

The available output contacts are:

- MiCOM **P921**: 3 output contacts, RL2 to RL4 (indicated by "432" in the following cells),
- MiCOM **P922 and P923:** 7 output contacts, RL2 to RL8 (indicated by "8765432" in the following cells),

To gain access to the “Auxiliary output relay” submenu from the “Automatic control” menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
AUX OUTPUT RLY	Heading of the AUXILIARY OUTPUT RELAY menu
Function: 8765432 **0000000**	**Description:** selection of the output contacts, which are used to duplicate the trip output This menu assigns the corresponding protection function to the output relays; i.e. to output 3 (RL3) Setting choice: 1 assigns the output relay; 0 no assignemen **Range:** 0 or 1 for each output contact
Function: 432 **000**	Submenu for P921. Refer to the following table for protection functions list.

In order to assign one information to one output contact, please go to the relevant cell corresponding to the selected information, press then the key. Select the configuration (0 or 1) with the and keys. Validate with the key.

NOTE: if the information assigned to the trip output contact (RL1) has been latched, all output contacts (RL2 to RL8) which are used to duplicate the trip output will be latched.

Function	P921	P922	P923	Function
TRIP.CB	X	X	X	circuit breaker trip signal
CLOS.CB	X	X	X	Circuit breaker closed information (this command comes from the remote communication)
V<, V<<, V<<<	X	X	X	Instantaneous 1st, 2nd and 3rd undervoltage thresholds
tV<, tV<<, tV<<<	X	X	X	Time delayed 1s, 2nd and 3rd undervoltage thresholds
V>, V>>, V>>>	X	X	X	Instantaneous 1st , 2nd and 3rd overvoltage thresholds
tV>, tV>>, tV>>>	X	X	X	Time delayed 1st , 2nd and 3rd overvoltage thresholds
V0>, V0>>, V0>>>	X	X	X	Instantaneous 1st , 2nd and 3rd zero sequence voltage thresholds
tV0>, tV0>>, tV0>>>	X	X	X	Time delayed 1st , 2nd and 3rd zero sequence voltage thresholds
V0d>, V0d>>		X	X	Instantaneous 1st and 2nd derived V0 sequence voltage thresholds
tV0d>, tV0d>>		X	X	Time delayed 1st and 2nd derived V0 sequence voltage thresholds
V2>, V2>>		X	X	Instantaneous 1st and 2nd negative sequence overvoltage thresholds
tV2>, tV2>>		X	X	Time delayed 1st and 2nd negative sequence overvoltage thresholds

Function	P921	P922	P923	Function
V1<, V1<<		X	X	Instantaneous 1st and 2nd positive sequence undervoltage thresholds
tV1<, tV1<<		X	X	Time delayed 1st and 2nd positive sequence undervoltage thresholds
F1 to F6		X	X	Instantaneous 1st to 6th frequency trip thresholds
tF1 to tF6		X	X	Time delayed 1st to 6th frequency trip thresholds
df/dt1 to df/dt6			X	Instantaneous 1st to 6th rates of frequency variation protection (“delta f / delta t”).
F1+df/dt1 to F6+df/dt6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
tAux1, tAux2	X	X	X	Copy of the status of the logic input delayed by t Aux 1 or 2
tAux3 to tAux5		X	X	Copy of the status of the logic input delayed by t Aux 3, 4 or 5
CB ALAR.		X	X	Circuit breaker alarm signal
F OUT		X	X	Frequency out of range
CB FAIL	X	X X		Circuit breaker failure signal
EQU A to EQU H	X	X X		Output of Boolean Equation A to Equation H
IN 1, IN2 IN 3 to IN 5	X	X X	X X	Input 1 to Input 5
ACTIVE GROUP			X	Active group
DU/DT 1 to DU/DT 4			X	1st , 2nd, 3rd or 4th rate of voltage variation protection (“delta U / delta t”)
tVTS		X	X	Voltage Transformer Supervision alarm, if enabled (VT Supervision/VT S Supervision submenu)
Order 1 Comm to Order 4 Comm		X	X	Order from the local control panel
V Bal K1 V Bal K2 V Bal K3			X	Status of the voltage balance for phase A (K1), phase B (K2) or phase C(K3). K1 or K2 or K3 is faulty when its value is below K< setting.
V Bal KPoly			X	Status of the multi-voltage balance (active when, at least, two phases are unbalanced, below K< setting).

2.7.6 "LATCH OUTPUT RELAYS" Submenu

This menu makes it possible to latch the output contacts (RL2 to RL4 for MiCOM P921- and RL2 to RL8 for MiCOM P922 and P923) which are associated with one or several stages, the latch is done by relay and not by functions.

The latched output contacts will then be maintained even if the fault has disappeared, and as long as a reset will not be performed.

The reset an be done:

– via a logic input (select "UNLATCH" in the list of available data, see "AUTOMAT CONTROL / INPUTS" menu)

– via a local or remote communication link

In order to latch one output relay, please go to the relevant cell corresponding to the selected information, press then key. Select the configuration (YES or NO) with and keys. Validate with the key.

To gain access to the " latch output relay" submenu from the "Automatic control" menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
LATCH OUTPUT RELAYS	Heading of the LATCH OUPTUT RELAYS menu
OUTPUT 2 **NO**	**Description:** selection of the output contact "RL2" to be latched. **Range:** YES/NO
OUTPUT 3 **NO**	**Description:** selection of the output contact "RL3" to be latched. **Range:** YES/NO
OUTPUT 4 **NO**	**Description:** selection of the output contact "RL4" to be latched. **Range:** YES/NO
OUTPUT 5 **NO**	P922 & P923 only **Description:** selection of the output contacts "RL5" to "RL8" to be latched. **Range:** YES/NO
…	
OUTPUT 8 **NO**	

2.7.7 "F + df/dt" (Frequency change of rate of frequency) submenu (MiCOM P923 only)

This menu makes it possible to combinate (AND operator in a Boolean equation) the Fi protection with the dF/dti (i from 1 to 6) protections: "Fi + df/dt" means "Fi protection" AND "change of frequency dF/dti protection".

The "Fi+df/dti" protection is enabled when the df/dti value is out of range while the frequency is above (or below) the frequency threshold.

The alarm in the HMI will occur when F and dF/dt are valid. If "Fi+dF/dti" is activated, Fi and dF/dti alarms are automatically inhibited

NOTE : The Fi + df/dti protection function is enabled when both tFi and df/dti are enabled.

To gain access to the “F + df/dt” submenu from the “Automatic control” menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
F + df/dt	P923 only Heading of the F+dF/dt (combination of time delayed frequency trip threshold and frequency variation (df/dt): tF AND dF/dt) menu
F1 + df/dt1 **NO** … **F6 + df/dt6** **NO**	P923 only **Description:** Activation of F1+dF/dt1 to dF6+dF/dt6 protection. The Fi+dF/dti (I = 1 to 6) is enabled when Fi protection is enabled and dF/dti protection is enabled. **Range:** YES/NO

2.7.8 "LOGIC EQUATIONS" Submenu

2.7.8.1 Parameter

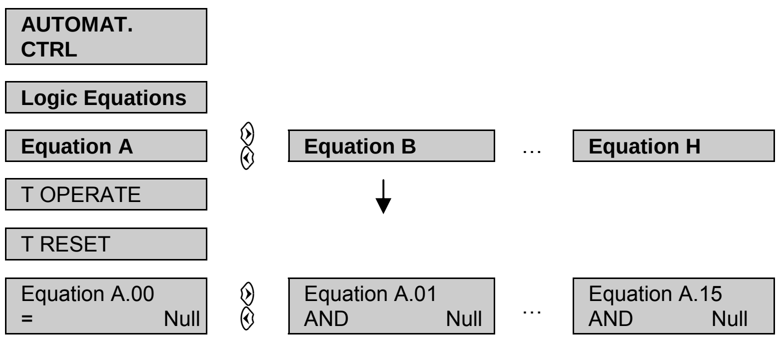
With the Logic Equations submenu, it is possible to form complex Boolean functions using NOT, AND and OR operators (indicated from highest to lowest priority). Up to 16 operands can be used in any single equation. The following logic signals are available for mapping to an equation:

TEXT	P921	P922	P923	Function
Null	X	X X		No link/assignment
U<, U<< or U<<<	X	X X		Instantaneous 1st , 2nd or 3rd undervoltage threshold
tU<, tU< or tU<<<	X	X X		Time delayed 1st , 2nd or 3rd undervoltage threshold
U>, U>> or U>>>	X	X X		Instantaneous 1st , 2nd or 3rd overvoltage threshold
tU>, tU>> or tU>>>	X	X X		Time delayed 1st , 2nd or 3rd overvoltage threshold
V0>, V0>> or V0>>>	X	X X		Instantaneous 1st , 2nd or 3rd zero sequence voltage threshold
tV0>, tV0>> or tV0>>>	X	X X		Time delayed 1st , 2nd or 3rd zero sequence voltage threshold
V0d>, V0d>> or V0d>>>		X	X	Instantaneous 1st , 2nd or 3rd derived V0 sequence voltage threshold
tV0d>, tV0d>> or tV0d>>>		X	X	Time delayed 1st , 2nd or 3rd derived V0 sequence voltage threshold
V2> or V2>>		X	X	Instantaneous 1st or 2nd negative sequence overvoltage threshold
tV2> or tV2>>		X	X	Time delayed 1st or 2nd negative sequence overvoltage threshold
V1< or V1<<		X	X	Instantaneous 1st or 2nd positive sequence undervoltage threshold

TEXT	P921	P922	P923	Function
tV1< or tV1<<		X	X	Time delayed 1st or 2nd positive sequence undervoltage threshold
F1 to F6		X	X	Instantaneous 1st to 6th frequency trip thresholds
tF1 to tF6		X	X	Time delayed 1st to 6th frequency trip thresholds
df/dt1 to df/dt6			X	1st to 6th rates of frequency variation protection.
F1+df1 to F6+df6			X	Combination of time delayed frequency trip threshold (tF) and frequency variation (df/dt): tF AND dF/dt
F out		X	X	Frequency out of range
du/dt1 to du/dt4			X	1st , 2nd, 3rd or 4th rate of voltage variation protection ("delta U / delta t")
tVTS		X	X	Voltage Transformer Supervision alarm, if enabled (VT Supervision/VT S Supervision submenu)
Input 1	X	X	X	Copy of the status of logic input No 1
Input 2	X	X	X	Copy of the status of logic input No 2
Input 3/4/5		X	X	Copy of the status of logic input No 3, 4 or 5
tAux1 or tAux2	X	X	X	Copy of the status of the logic input delayed by t Aux1 or Aux2
tAux3 to tAux5		X	X	Copy of the status of the logic input delayed by t Aux3 or Aux5
tEqu A to tEqu H	X	X	X	Result of equations A to H.
CB Fail		X	X	Circuit breaker failure signal
CB Alrm		X	X	Circuit breaker alarm signal
K1< K2< K3<			X	Phase A (K1), B (K2) or C(K3) voltage balance threshold alarm. K1 or K2 or K3 is faulty when its value is below K< setting.
KPOLY<			X	Multi-voltage balance threshold alarm (at least, two phases are unbalanced, below K< setting).

2.7.8.2 Description

The Logic equation menu has th e following structure, with "Equation A.00" to "Equation A.15" views accessible using ◁ and ▷ keys:



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

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

Equation A.00	
Boolean	Logic

press or key to access to Boolean operator or Logic signal

press or key to modify the corresponding value.

– Press to validate or to cancel the setting.

To gain access to the "logic equations" submenu from the "Automatic control" menu, press followed by or until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
Logic Equations	
Equation A	Heading of Equation A submenu.

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

T Operate 0s	**Description:** The time of operation setting is used to set the minimum time of truth of the selected conditions before validating the truth of the logic operation. **Range:** from 0 to 3600s, step 0.1s
T Reset 0s	The reset time sets a minimum time before the logic operation is not true when at least one condition is not true. **Range:** from 0 to 3600s, step 0.1s
Equation A.00 __=__ Null	**Description:** Boolean function (left lower part of the LED panel): selects the Boolean function associated to the logic signal. Presence or not presence of the corresponding logic signal can selected and combined to the previous equation with an OR or AND condition. **Range:** - for A.00: "=", "= Not" - for A.01 to A.15: "OR", "OR NOT", "AND" or "AND NOT", **Note:** AND operator has priority to OR operator (refer to the following note)
Equation A.00 = __Null__	**Description:** Logic signal (right lower part): Is used to select the logic signal corresponding to the Boolean equation. Refer to the previous table to see the text corresponding to each signal. **Range:** Setting Choice: Null and logic signals.

Example of Equation A settings:

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

Note: AND operator has priority on OR operator:

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

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

2.7.9 "INPUTS" Submenu

This submenu makes it possible to allocate each logic input to one specified function.

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 on the application of the digital inputs.

ONLY a digital input configured "CHANG SET" can operate either on edge or on level.

The following functions are available for mapping to a logic input:

Label	P921	P922	P923	Function
NONE	X	X	X	No link/assignment
UNLATCH	X	X	X	Unlocks latched output relays
52a	X	X	X	Position of the circuit breaker (open)
52b	X	X	X	Position of the circuit breaker (close)
CB FAIL	X	X	X	External failure information from the CB
BLK LOG 1	X	X	X	Blocking logic 1
BLK LOG 2	X	X	X	Blocking logic 2
AUX 1 or AUX 2	X	X	X	Allocation of the input to an external auxiliary information AUX1 or AUX2
AUX 3 to AUX 5		X	X	Allocation of the input to an external auxiliary information AUX3, AUX4 or AUX5
CHANG SET		X	X	Allocation of the input in order to change the active setting group: each transition of the input will be taken into account (default setting group = 1).
STRT DIST		X	X	External start of the disturbance recorder.
CTRL TRIP	X	X	X	Assign a control trip function to the input. When activated, it is possible to order output relay(s) affected to the control trip function (without specific setting: RL1).
CTRL CLOS	X	X	X	Assign a control close function to the input. When activated, it is possible to order output relays affected to the CB Close function.
TIME SYNC		X	X	Assign a Time synchronisation input
LED RESET	X	X	X	Reset of the "Trip" & "Alarm" leds
VTS		X	X	Voltage Transformer Supervision
Maint.	X	X	X	Maintenance Mode ON/OFF change

In order to allocate one function to one logic input, please go to the relevant cell corresponding to the selected input, press then the key. Press then the and to activate/deactivate the information. Validate with the key.

To gain access to the "Inputs" sub menu from the "Automatic control" menu, press ⊖ followed by ◁ or ▷ until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press ⊖ followed by ◁ or ▷ until the menu is displayed.
INPUT 1 = NONE	**Description:** allocation of the logic input n°1, 2, 3, 4 or 5 to one of the above listed input choice. Inputs 3, 4 and 5: P922 and P923 only.
…	
INPUT 2 = NONE	**Range:** see the above list for input choices
t AUX 1 = 0.0 s	**Description:** setting of the auxiliary timer associated to the AUX1 logic input. **Range:** 0 – 200s, step = 0,01s
t AUX 2 = 0.0 s	**Description:** setting of the auxiliary timer associated to the AUX 2 logie input. **Range:** 0 – 200s, pas = 0,01s

2.7.10 "VT SUPERVISION" Submenu (MiCOM P922 and P923 only)

The voltage transformer supervision (VTS) feature is used to detect failure of the analog ac voltage inputs to the relay. This may be caused by internal voltage transformer faults, overloading, or faults on the interconnecting wiring to relays. This usually results in one or more VT fuses blowing.

MiCOM P922 and P923 are able to detect a VT loss by using VTS automatism. As soon as VT loss is detected, all voltage dependent functions will be blocked (according to the setting), an alarm can be raised.

To gain access to the VT Supervision submenu from the "Automatic control" menu, press ⊖ followed by ◁ or ▷ until the desired submenu header is displayed.

AUTOMATIC CTRL	Heading of the Automatic control menu. To gain access to the menu from the default display press ⊖ followed by ◁ or ▷ until the menu is displayed.
VT SUPERVISION	Heading of the Voltage Transformer Supervision(VTS)
VTS supervision ? No	**Description:** Enable or disable the VT supervision function. Setting choice: Yes or No If Yes is selected, the "VT Supervision" menu is activated and displayed: If No is selected, the VT Supervision function is inactive. **Range:** Yes/No
Detection mode VTS Input	**Description:** **Range:** VTS Input in 3Vpn+Vr mode only: VTS Input, dVr+Input or delta Vr
Delta Vr 15V or 50V	**Description:** Residual voltage (3 × zero sequence voltage) setting **Range:** range 57-130V: 2-130V step = 1V range 220-480V: 20-480V step = 5V
tVTS 5s	**Description:** Sets the VTS timer. The VTS alarm will occur if VT fault occurs during more than the VTS timer. **Range:** from 0 to 100s, in steps of 10ms.

Inhib. VTS / 52a?
No

Description: Inhibition of VT supervision by the 52a signal. In this case, the VTS detection will be inhibited when the circuit breaker is open.

Range: Yes/No

Block Function	
U<	**Yes**
U>	**Yes**
V1<	**Yes**
V0>	**Yes**
Frequ.	**Yes**
df/dt	**Yes**
du/dt	**Yes**

Description: When Yes is selected, the VT fault will block the corresponding protection (“U> = Yes” will block U>, U>> and U>>> protections, “V0> = yes” will block V0>, V0>>, V0>>>, V0der>, V0der>> and V0der>>>)

Range: Yes/No

2.7.11 "CB SUPERVISION" Submenu

This submenu makes it possible to validate the circuit breaker supervision and monitoring functions, and the various settings associated to these functions.

In the MiCOM P921 – P922 and P923 relays, the control of the circuit breaker can be done:

- Tripping order: the tripping order is realized by using the dedicated trip output contact (RL1). This command is maintained during the specified “TRIP PULSE TIME”. The command can be generated by a protective function of the relay: it can also be done via a logic input (select the “AUX1” logic input and assign the "tAUX1" to the trip output relay), or via the local/remote communication (see chapter 6 of this Technical Guide),
- Closing order: 2 different ways can be used.
  - This order is realized by using the output contact, which has been configured for this closing order (see "AUX OUTPUT RLY" menu, "CLOS. CB" cell). This command is maintained during the specified "CLOSE PULSE TIME". The command can only be generated via the local/remote communication (see section 2.5).
  - This order can also be realized by using one logic input (select the "AUX2 logic input) which can be assigned to any of the output contacts. This command will be maintained as long as the logic input is energized.

Moreover, the MiCOM P922-P923 relays offer the supervision of the closing/opening time of the circuit breaker. They also include the supervision of the number of CB operations, with a settable threshold of the maximum allowed operations.

To gain a ccess to the Open cir cuit breaker supervision submenu from the “Automatic control” menu, press followed by or until the de sired submenu header is displayed.

AUTOMATIC CTRL

Heading of the Automatic control menu. To gain access to the menu from the default display press followed by or until the menu is displayed.

CB OPEN S’vision
NO

Description: enable/disable the “CB OPEN SUPERVISION” function. If enabled, the function will generate an alarm if the maximum open time has been reached.
Range: YES/NO
Note: only for MiCOM P922 – MiCOM P923

CB OPENING TIME **0.0 s**	**Description:** setting of the maximum allowed opening time **Range:** 0.1 – 5s, step = 0.05s **Note: only for MiCOM P922 – MiCOM P923**
CB CLOSE S'vision **NO**	**Description:** enable/disable the "CB CLOSE SUPERVISION" function. If enabled, the function will generate an alarm if the maximum close time has been reached. **Range:** YES/NO **Note: only for MiCOM P922 – MiCOM P923**
CB CLOSING TIME **0.0 s**	**Description:** setting of the maximum allowed closing time **Range:** 0.1 – 5s, step = 0.05s **Note: only for MiCOM P922 – MiCOM P923**
NB OPER. ALARM ? **NO**	**Description:** enable/disable the "NB OPER ALARM" function. If enabled, an alarm will be generated if the maximum nb of operations has been reached **Range:** YES/NO **Note: only for MiCOM P922 – MiCOM P923**
NB OPERATIONS= **0**	**Description:** Maximum duration to close. **Range:** 0 – 50000, step = 1 **Note: only for MiCOM P922 – MiCOM P923**
CLOSE PULSE TIME **150 ms**	**Description:** Duration of the close pulse **Range:** 0.1 – 5s, step = 0.05s **Note: common to MiCOM P921 – MiCOM P922 and MiCOM P923**
TRIP PULSE TIME **150 ms**	**Description:** Duration of the trip pulse **Range:** 0.1 – 5s, step = 0.05s **Note: common to MiCOM P921 – MiCOM P922 and MiCOM P923**

2.8 RECORDS functions (MICOM P922 and P923 ONLY)

The accessible submenus are indicated below:

RECORDS

CB MONITORING	**FAULT RECORD**	**DISTURB RECORDER**	**TIME PEAK VALUE**	**FREQ. DISTURB REC**

2.8.1 "CB MONITORING" Submenu

This submenu makes it possible to read and clear the measurements relative to the circuit breaker monitoring function: closing and opening times, number of operations…

To gain access to the Circuit Breaker monitoring submenu from the "Records" menu, press followed by or until the desired submenu header is displayed.

RECORDS	Heading of the Records menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
CB MONITORING	Heading of the "CB MONITORING" submenu
CB OPENING TIME= **0.0 ms**	**Description:** measurement of the opening time of the CB **Note:** read only, no modifications allowed

CB CLOSING TIME = 0.0 ms	**Description:** measurement of the closing time of the CB **Note:** read only, no modifications allowed
CB OPERATIONS = RST=[C] 0	**Description:** display of the total number of CB operations. The reset of this number is possible by pressing the Ⓒ key.

2.8.2 "FAULT RECORD" Submenu

Fault records are stored in the non-volatile memory with the time of the fault to the accuracy of 1 ms. A total of 5 such latest events are stored.

When the available record space is exhausted, the relay will automatically overwrite the oldest record, to accomodate the new record.

The fault records are available for viewing either via the frontplate LCD or remotely, via the communications ports.

Local viewing on the LCD is achieved in the menu column entitled « FAULT RECORD ». This column is described below.

To gain access to the Fault record submenu from the "Re cords" menu, press followed by or until the desired submenu header is displayed.

RECORDS	Heading of the Records menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
FAULT RECORD	Heading of the "FAULT RECORD" submenu
RECORD NUMBER 5	**Description:** This selects the required fault record from the possible 5 that may be stored. **Range:** 1 – 5, step = 1. **Note:** a value of 5 corresponds to the latest fault and so on.
FAULT TIME 10: 45: 22: 12	**Description:** time of the fault with an accuracy within 1ms. The time of the fault recorded will be the time at which the protection algorithm gives a trip/alarm order. **Note:** read only, no modifications allowed.
FAULT DATE 02/05/00	**Description:** date of the fault recorded will be the date at which the protection algorithm gives a trip/alarm order. **Note:** read only, no modifications allowed.
ACTIVE SET GROUP 1	**Description:** active setting group at the time of the fault **Note:** read only, no modifications allowed.
FAULTED PHASE PHASE A B C	**Description:** phase(s) of fault **Note:** read only, no modifications allowed.
TRIP ELEMENT V<	**Description:** elements that tripped for the fault **Note:** read only, no modifications allowed.
MAGNITUDE xxxxxx	**Description:** magnitude of the voltage that has generated a fault, at the instant of the fault **Note:** read only, no modifications allowed.
VA MAGNITUDE xxxxxx	**Description:** magnitude of the phase A voltage at the instant of the fault (or Vab according to the connection scheme) **Note:** read only, no modifications allowed.
VB MAGNITUDE xxxxxx	**Description:** magnitude of the phase B voltage at the instant of the fault (or Vbc according to the connection scheme) **Note:** read only, no modifications allowed.

VC MAGNITUDE **xxxxxx**	**Description:** magnitude of the phase C voltage at the instant of the fault (or Vca according to the connection scheme) **Note:** read only, no modifications allowed.
V0 MAGNITUDE **xxxxxx**	**Description:** magnitude of the residual voltage at the instant of the fault (if residual VT connected) **Note:** read only, no modifications allowed.

2.8.3 "DISTURB RECORDER" Submenu

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

When the available record space is exhausted, the relay will automatically overwrite the oldest record, to accomodate the new record.

The acquisition frequency for the disturbance recorder is 32 samples per cycle of the power system frequency .

Disturbance records can be extracted either automatically (rear port only) or manually (front or rear port).

The recording of the disturbance data can be triggered by any instantaneous information, any time-delayed information, activation of a logic input or a logic equation.

To gain access to the Disturbance recorder submenu fro m the "Records" menu, press followed by or until the desired submenu header is displayed.

RECORDS	Heading of the Records menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
DISTURB RECORDER	Heading of the "DISTURB RECORDER" submenu
Records number **5**	**Description:** Sets the disturbance record length. This setting choice adjusts the number of records according to the record length. Setting choice allows 5 records of 3 seconds, 4 records of 3 seconds, 3 records of 5 seconds, 2 records of 7 seconds or 1 record of 9 seconds. **Range:** 1, 2, 3, 4 or 5
PRE-TIME **0.1 s**	**Description:** Selection of the disturbance record pre-time from 100 ms to 2.9s, 4.9s, 6.9s or 8.9s (record length minus 0.1s) in steps of 100 ms. The pre-time adjusts the beginning of the disturbance record: In this example, the record starts 100ms before the disturbance. Its length is fixed.
DISTURB REC TRIG **ON INST**	**Description:** Selection of start criteria for the disturbance recording function. Select between ON INST. (start on instantaneous thresholds) and ON TRIP (start on trip conditions) by pressing or . Press to confirm choice. **Range:** ON INST / ON TRIP

2.8.4 "TIME PEAK VALUE" Submenu

This submenu makes it possible to set the period of time which will be used to calculate average and maximum values.

To gain access to the Time peak value submenu from the "Records" menu, press followed by or until the desired submenu header is displayed.

RECORDS	Heading of the Records menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
TIME PEAK VALUE	Heading of the "TIME PEAK VALUE" submenu
TIME WINDOW **5 min**	**Description:** setting of the period of time used to calculate the average and maximum values of voltages. **Range:** 5 / 10 / 15 / 30 / 60 min

2.8.5 "FREQ DISTURB REC" Submenu (only MiCOM P923)

Frequency disturbance records are stored in the non-volatile memory. One record could be stored, its duration is of 20 seconds; the pre-trigger and the post-trigger times are fixed at 5 and 15 seconds repectively.

The acquisition frequency of the frequency disturbance record is 1 sample per cycle of the power system frequency.

Frequency disturbance records can be extracted either automatically (rear port only) or manually (front or rear port).

The recording of data can be triggered by frequency element, any instantaneous or time delayed information, activation of a logic input or a logic equation.

To gain access to the Circuit Breaker monitoring submenu from the "Records" menu, press followed by or until the desired submenu header is displayed.

RECORDS	Heading of the Records menu. To gain access to the menu from the default display press followed by or until the menu is displayed.
FREQ DISTURB REC	Heading of the "**Frequency Disturbance Records**" menu
FREQ DISTURB REC **TRIG = ON TRIP**	**Description:** configuration of the frrequency disturbance records trigger. **Range:** TRIP/FREQ/EQU.

3. WIRING

MiCOM P92x range of relays have the same terminal layout for commo n elements. The wiring diagram for each model is provid ed in Appe ndix 1 of the Technical Guide.

3.1 Auxiliary supply

The auxiliary power supply for the **MiCOM P921, P922** & **P923** relays can be either direct current with a voltage range of 24-60 VDC, 48-250 VDC,or alternative current with a voltage range of 48-250 VAC/ 50-60 Hz. The voltage range (Ua) is spe cified on the adhesive paper label under the top hinged cover on the front of the relay.

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

3.2 Voltage measurement inputs

MiCOM P921, P922 and P923 have 3 phase and 1 earth voltage inputs available.

3.3 Logic inputs

The number of logic inputs depends on th e relay model. The r elays have programmable opto-isolated logic inputs, which can be a ssigned to any available label or function**.**

Logic inputs for each relay model:

Model	P921	P922	P923
Logic outputs	2	5	5

The voltage range of the inputs is identical to the **DC (or AC)** auxiliary supply range of the MiCOM relay (e .g. Uaux = 24-250 Vdc, logic input voltage range = 24-25 0 Vdc).

On the s ame MiCOM **P92x** relay, the user can mix differe nt voltage levels for the logic inputs (e.g. Uaux = 24-250 Vdc, Input 1= 48 Vdc, Input 2-5= 110 Vdc).

If the user sets the supply of the logic input as AC the y are active from 24 to 240Vac.

The automation functions that can be assigned to these logic inputs can be selected from the AUTOMAT. CTRL Menu.

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

3.4 Output relays

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

The number of logic o utputs available for each relay model is presented in th e following table:

Model	P921	P922	P923
Logic outputs	5	8	8

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

The normally closed (NC) contact of the Watchdog (RL0) can not be configured. The other contacts can be configured to be activated on a ctivation of the differ ent functions available in the relay. A basic output matrix is included in the relay.

Some logic outputs have changeover contacts (RL1 and RL2). The other relays (RL3, to RL 8) are normally open contacts.

The protection and control functions that can be assigned to these output relays can be selected from the AUTOMAT. CTRL Menu.

3.5 Communication

3.5.1 RS485 rear communication port

All MiCOM relays have an RS485 rear communication port.

The terminals 29-30-31-32 are dedicated to the RS485 communication port. See wiring diagrams in chapter P92x/EN CO of the Technical Guide.

3.5.2 RS232 front communication port (**P921, P922, P923**)

MiCOM P921, P922 and P923 relays provide a RS 232 communication port. This port is dedicated to Setting software MiCOM S1.

The cable between the **relay** and the PC is a standard RS 232 shielded-cable.

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

The RS232 cable has to be wired as indicated below:

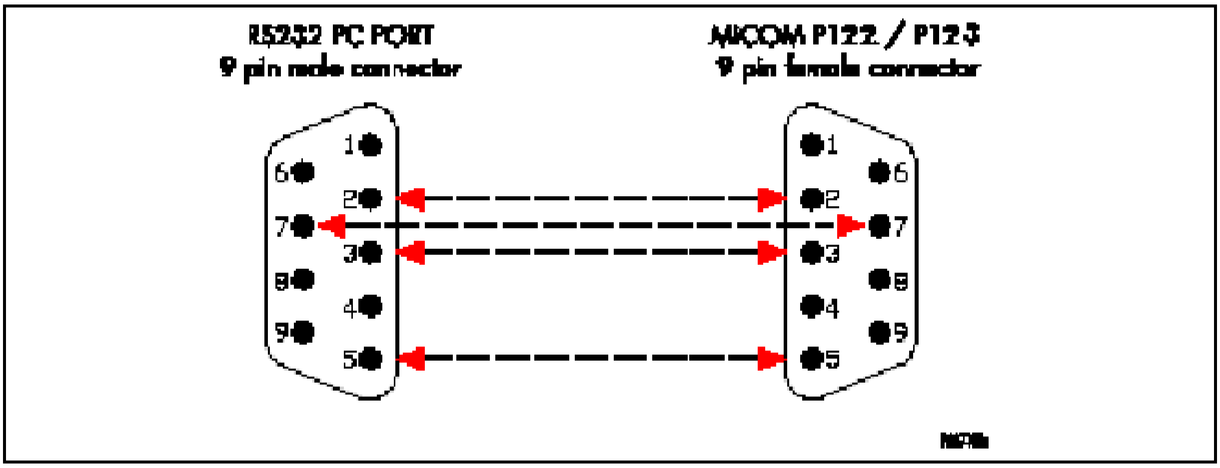


FIGURE 3: FRONT PANEL PORT COMMUNICATION RS232 CABLE WIRING

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

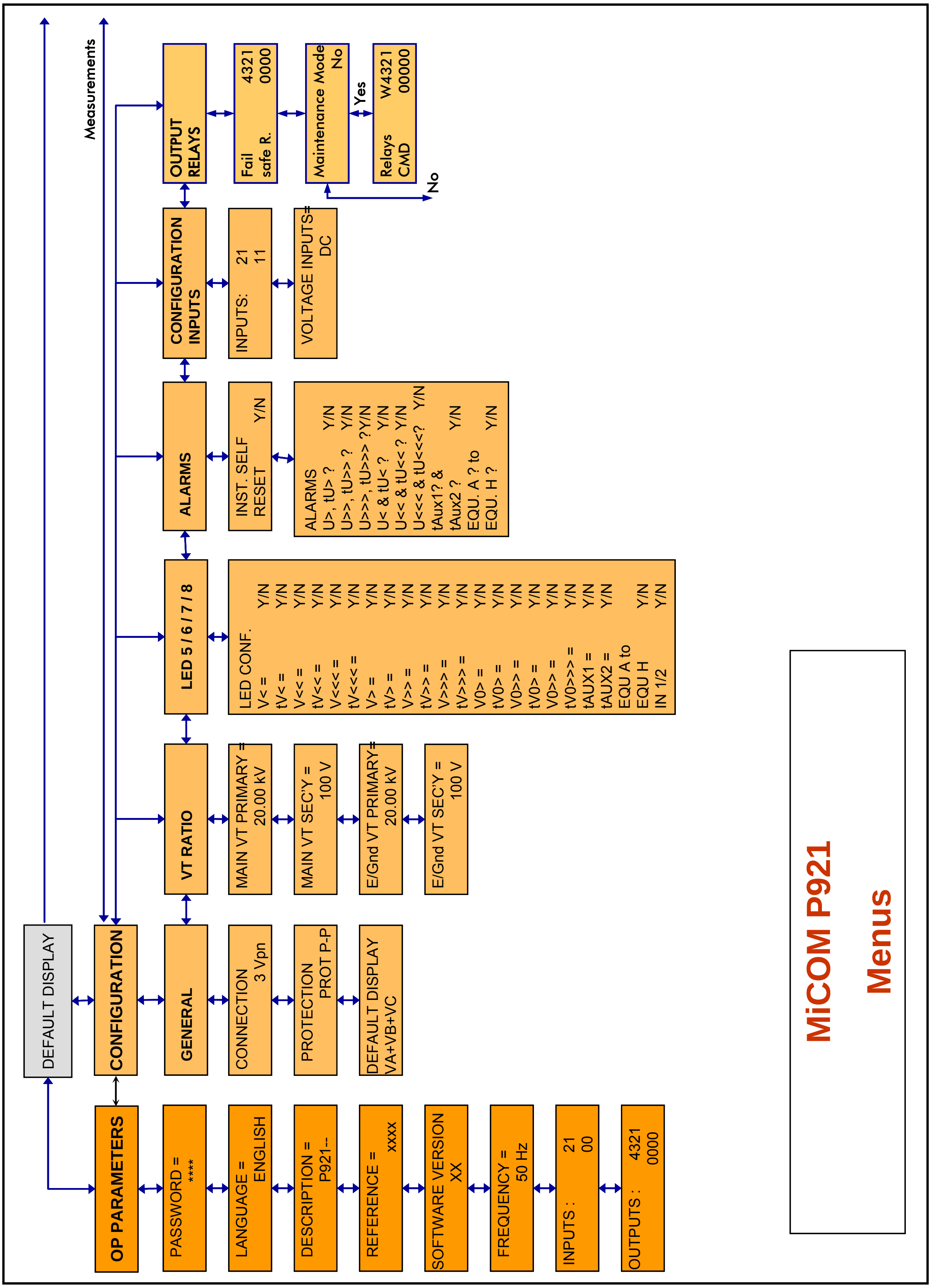
BLANK PAGE

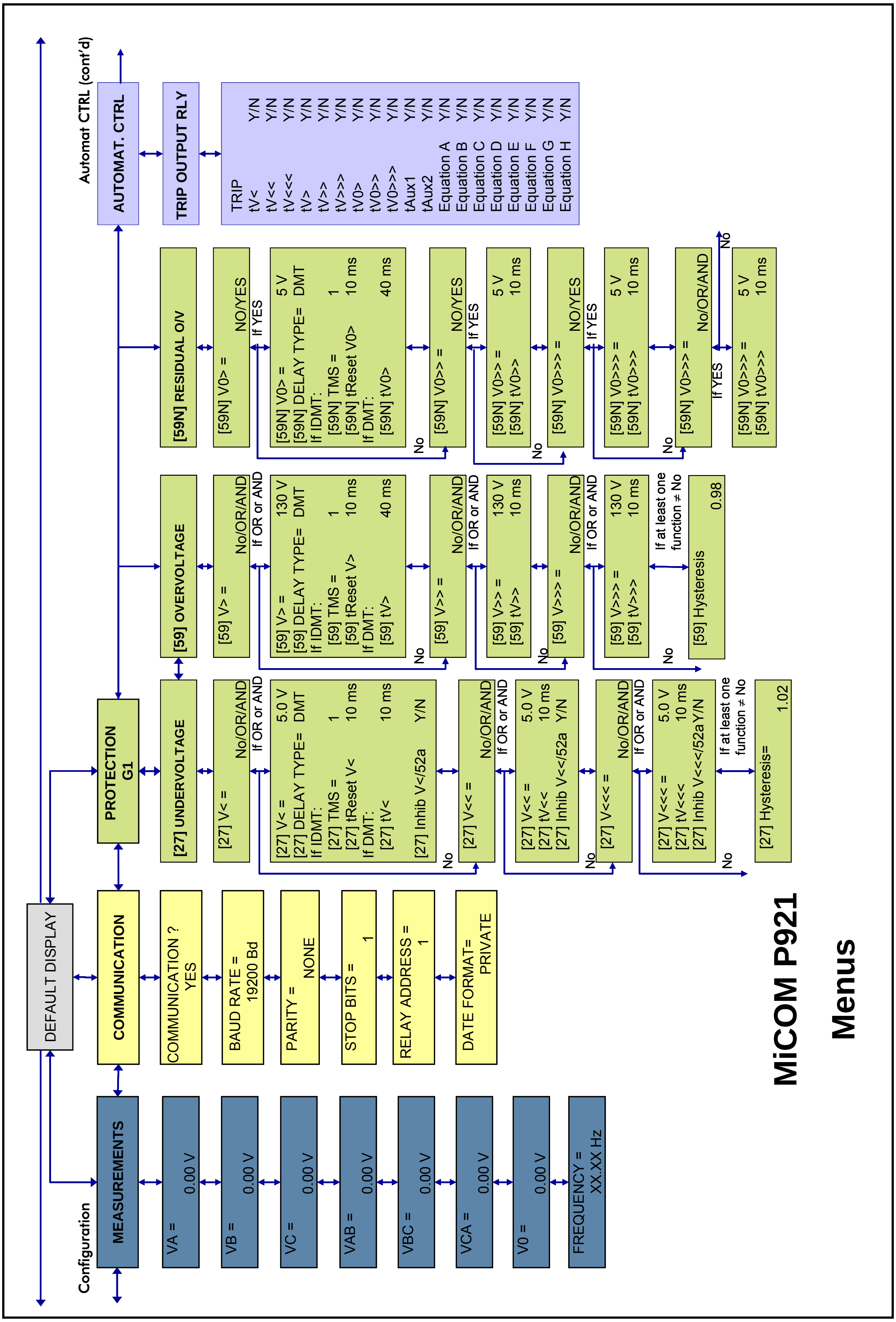
MENU CONTENT TABLES

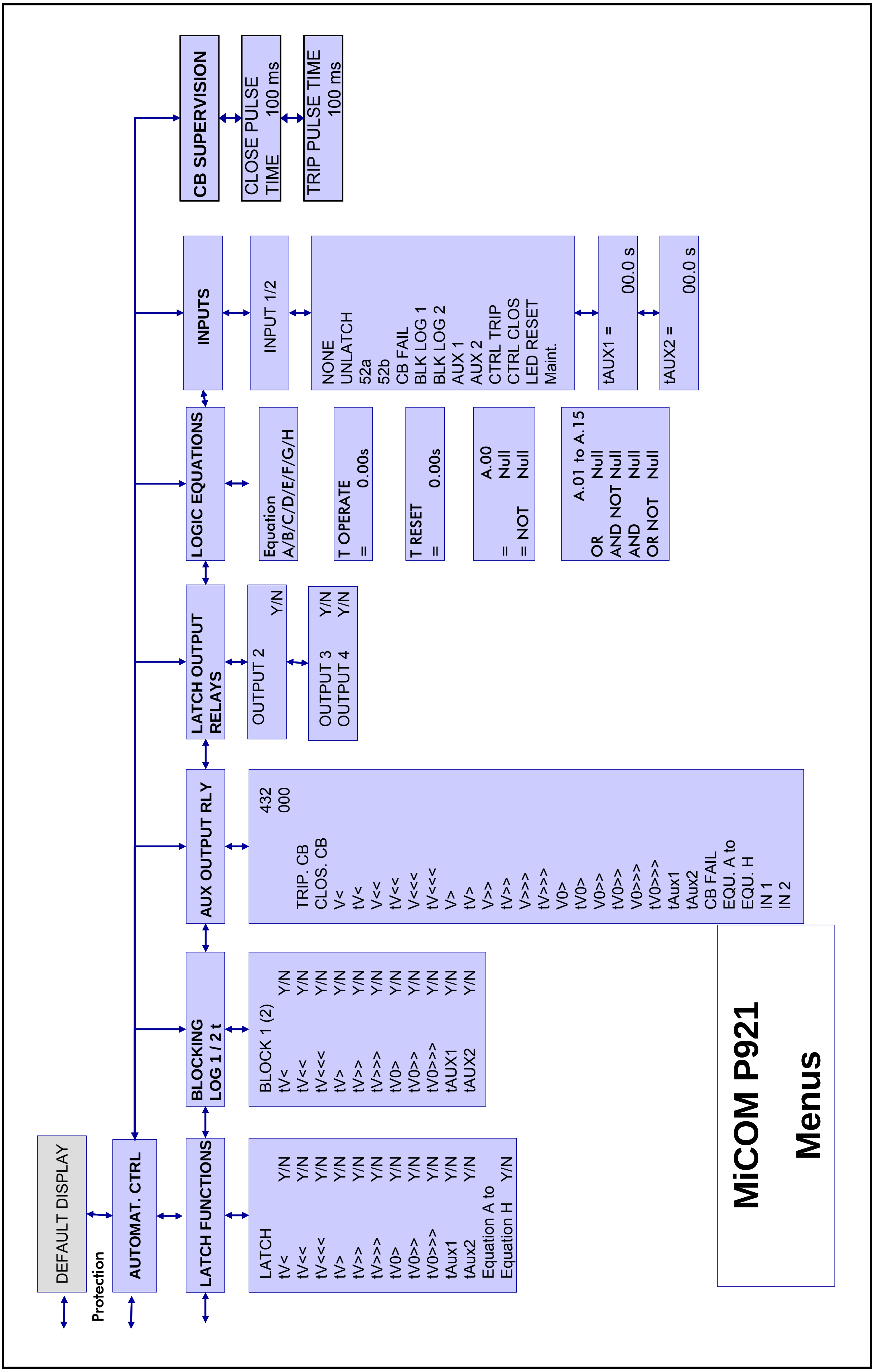
CONTENTS

BLANK PAGE

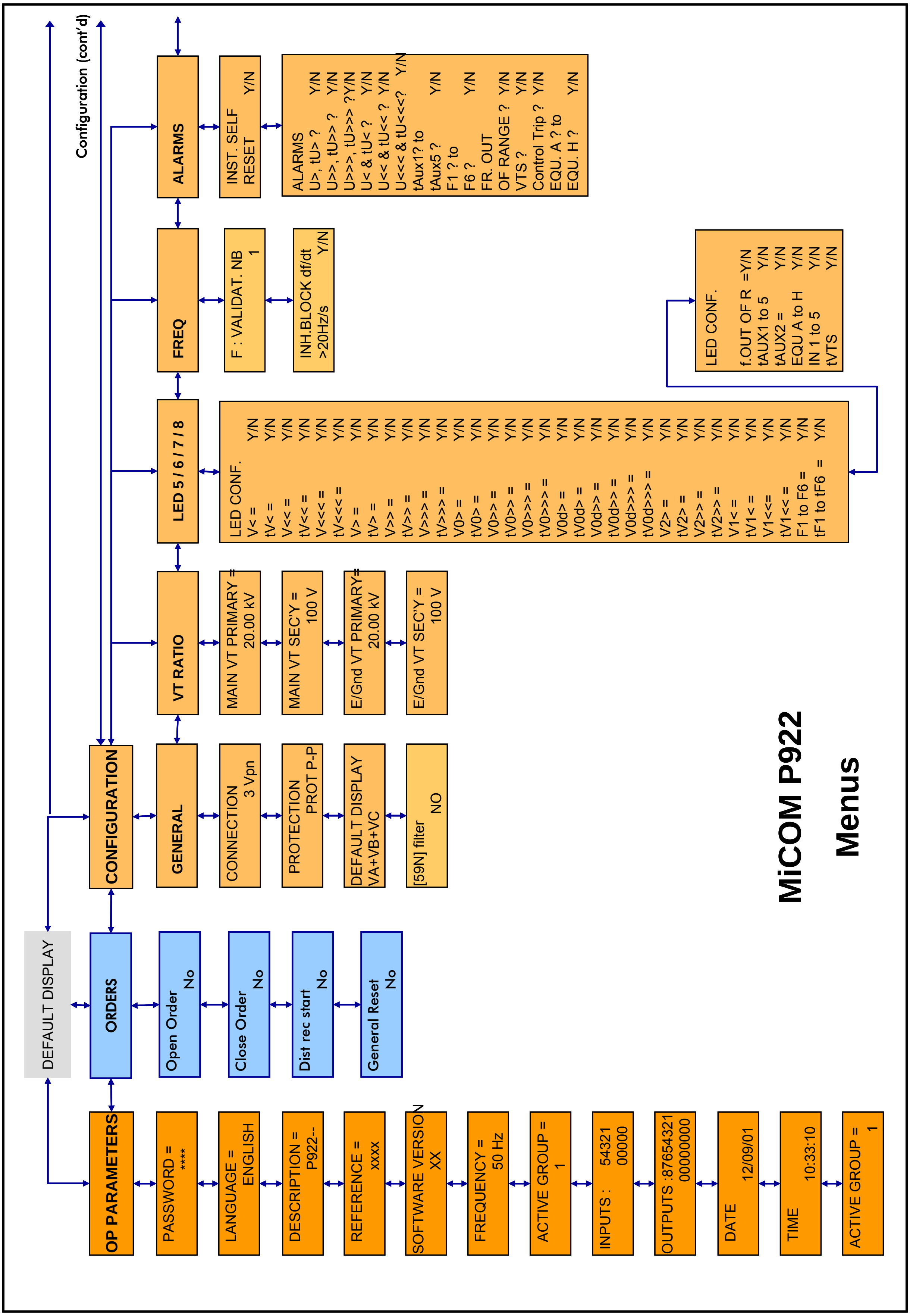
1. MiCOM P921 – V12 SOFTWARE

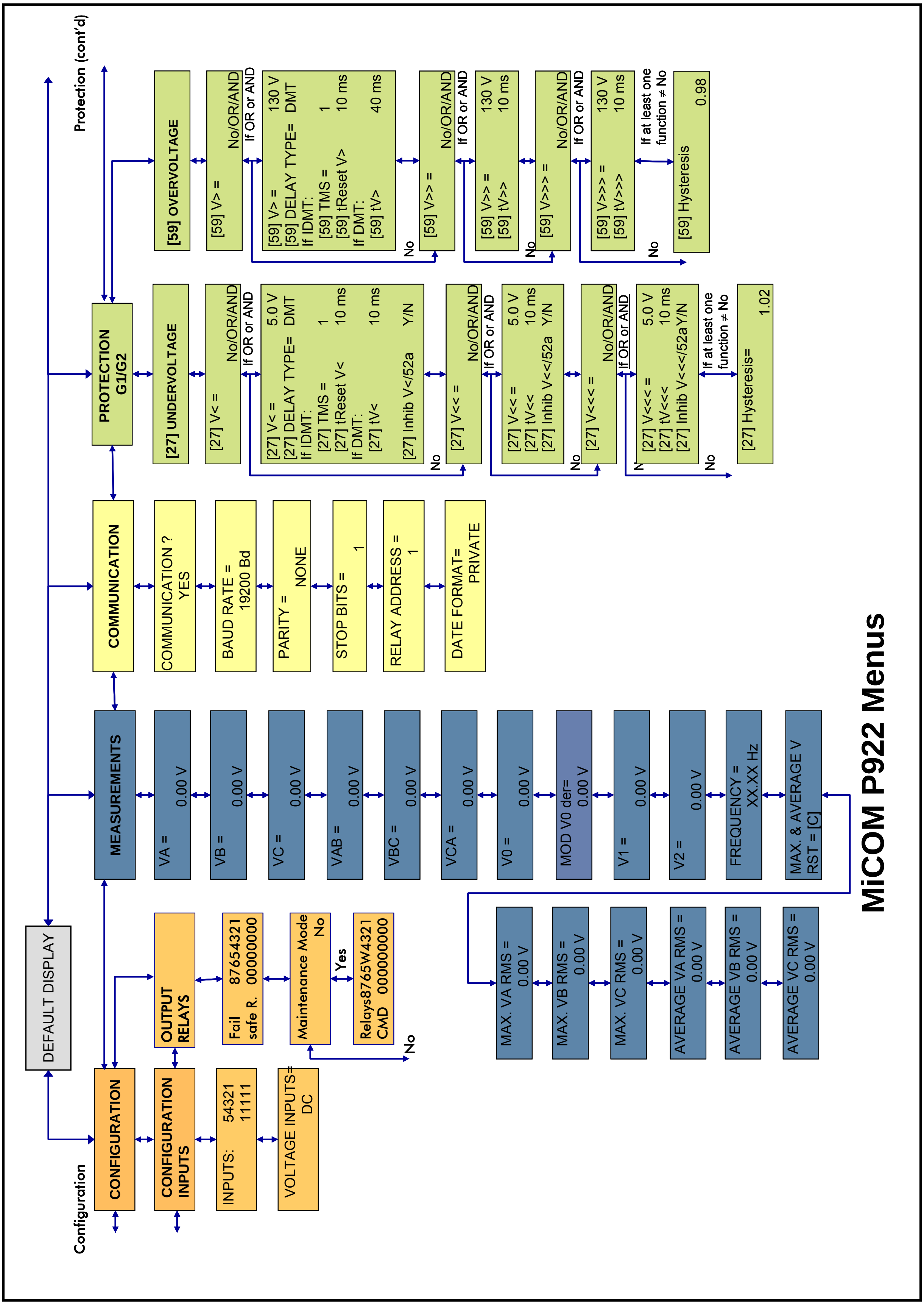


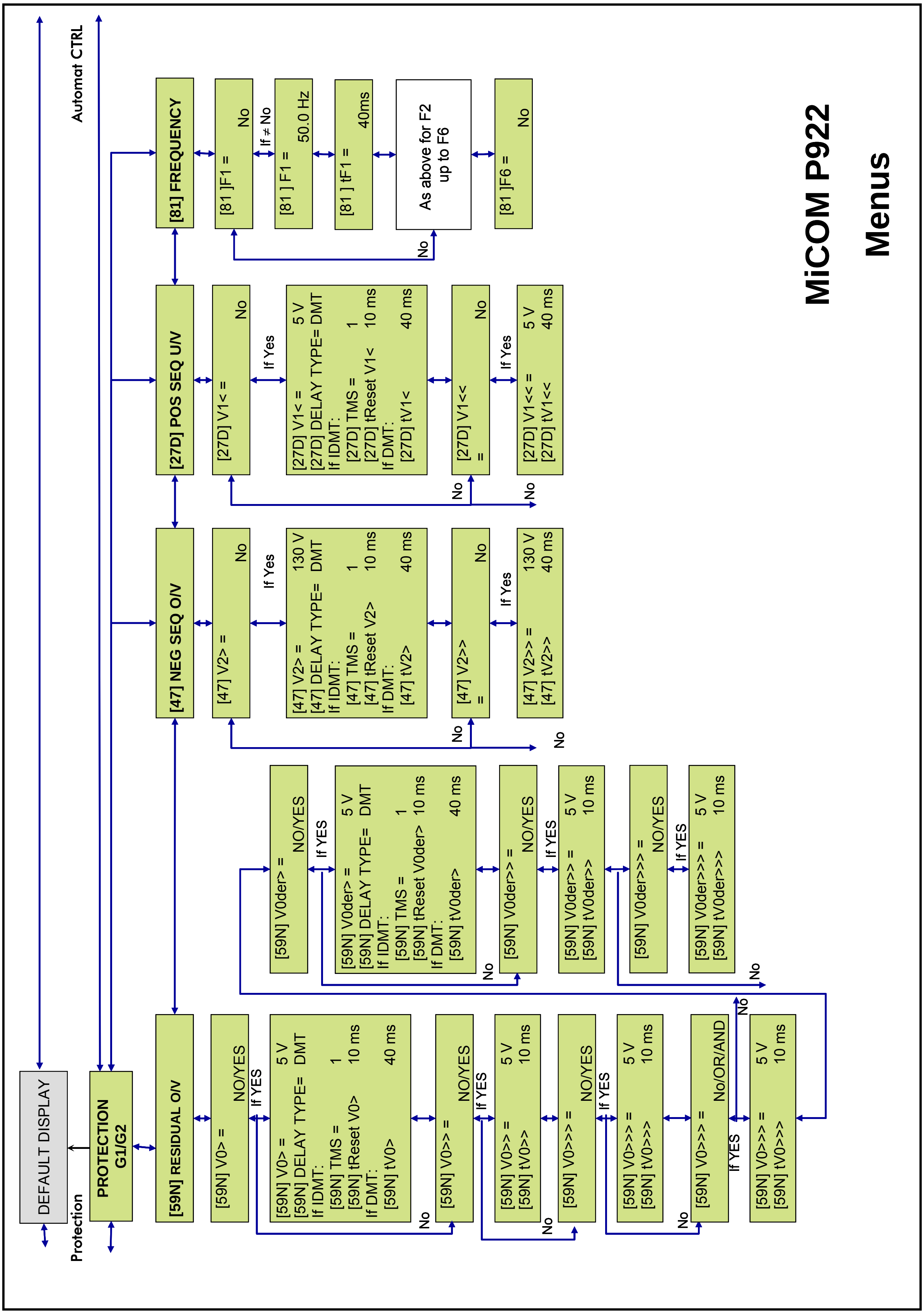

Configuration
Automat CTRL (cont'd)
DEFAULT DISPLAY
MEASUREMENTS
VA = 0.00 V
VB = 0.00 V
VC = 0.00 V
VAB = 0.00 V
VBC = 0.00 V
VCA = 0.00 V
V0 = 0.00 V
FREQUENCY = XX.XX Hz
COMMUNICATION
COMMUNICATION ? YES
BAUD RATE = 19200 Bd
PARITY = NONE
STOP BITS = 1
RELAY ADDRESS = 1
DATE FORMAT= PRIVATE
PROTECTION G1
[27] UNDERVOLTAGE
[27] V< = No/OR/AND
If OR or AND
[27] V< = 5.0 V
[27] DELAY TYPE= DMT
If IDMT:
[27] TMS = 1
[27] tReset V< 10 ms
If DMT:
[27] tV< 10 ms
[27] Inhib V</52a Y/N
No
[27] V<< = No/OR/AND
If OR or AND
[27] V<< = 5.0 V
[27] tV<< 10 ms
[27] Inhib V<</52a Y/N
No
[27] V<<< = No/OR/AND
If OR or AND
[27] V<<< = 5.0 V
[27] tV<<< 10 ms
[27] Inhib V<<</52a Y/N
No
If at least one function ≠ No
[27] Hysteresis= 1.02
[59] OVERVOLTAGE
[59] V> = No/OR/AND
If OR or AND
[59] V> = 130 V
[59] DELAY TYPE= DMT
If IDMT:
[59] TMS = 1
[59] tReset V> 10 ms
If DMT:
[59] tV> 40 ms
No
[59] V>> = No/OR/AND
If OR or AND
[59] V>> = 130 V
[59] tV>> 10 ms
No
[59] V>>> = No/OR/AND
If OR or AND
[59] V>>> = 130 V
[59] tV>>> 10 ms
No
If at least one function ≠ No
[59] Hysteresis 0.98
[59N] RESIDUAL O/V
[59N] V0> = NO/YES
If YES
[59N] V0> = 5 V
[59N] DELAY TYPE= DMT
If IDMT:
[59N] TMS = 1
[59N] tReset V0> 10 ms
If DMT:
[59N] tV0> 40 ms
No
[59N] V0>> = NO/YES
If YES
[59N] V0>> = 5 V
[59N] tV0>> 10 ms
No
[59N] V0>>> = NO/YES
If YES
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
No
[59N] V0>>> = No/OR/AND
If YES
No
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
AUTOMAT. CTRL
TRIP OUTPUT RLY
TRIP Y/N
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tAux1 Y/N
tAux2 Y/N
Equation A Y/N
Equation B Y/N
Equation C Y/N
Equation D Y/N
Equation E Y/N
Equation F Y/N
Equation G Y/N
Equation H Y/N
MiCOM P921
Menus

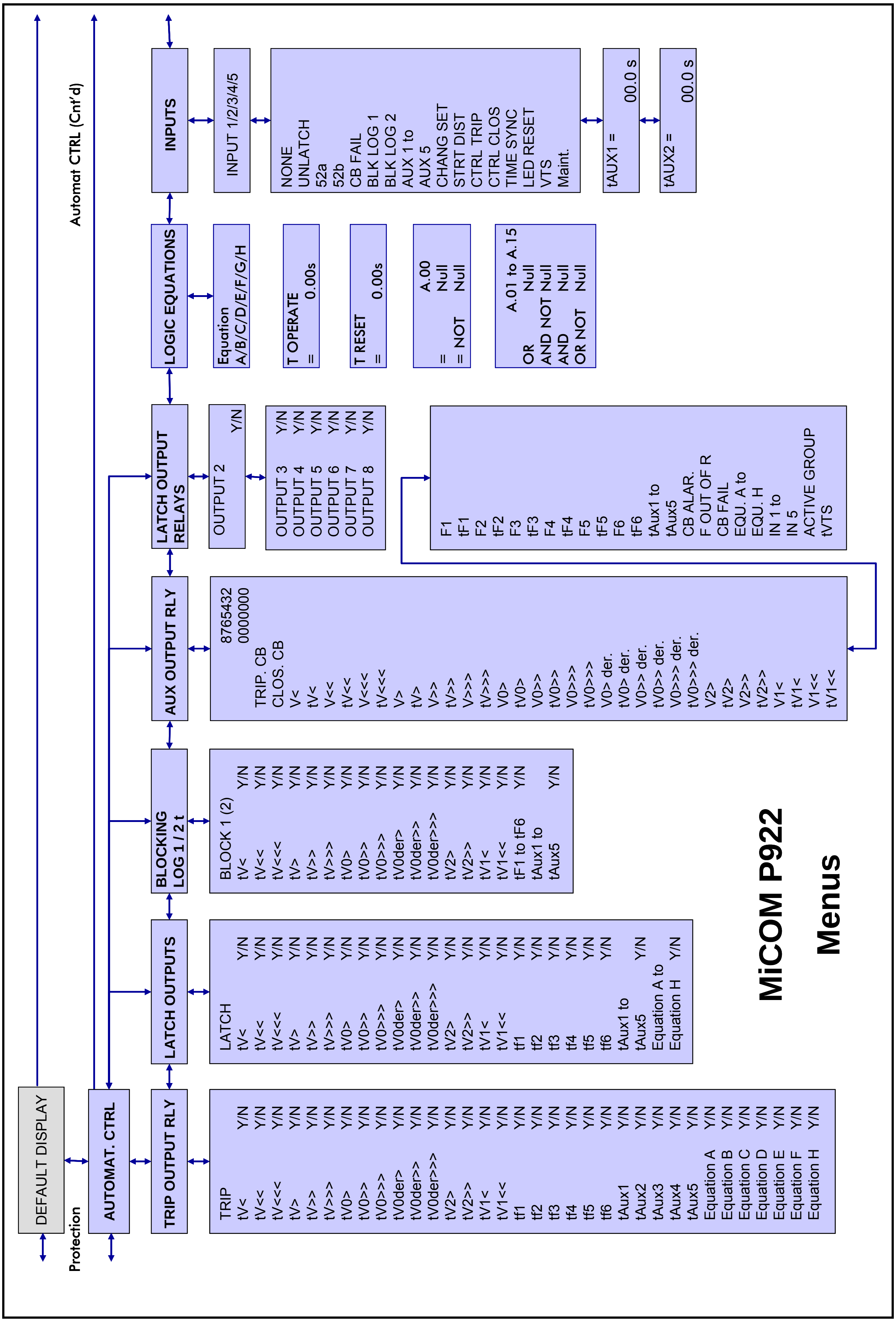

DEFAULT DISPLAY
Protection
AUTOMAT. CTRL
LATCH FUNCTIONS
BLOCKING LOG 1 / 2 t
AUX OUTPUT RLY
LATCH OUTPUT RELAYS
LOGIC EQUATIONS
INPUTS
CB SUPERVISION
CLOSE PULSE TIME 100 ms
TRIP PULSE TIME 100 ms
INPUT 1/2
NONE
UNLATCH
52a
52b
CB FAIL
BLK LOG 1
BLK LOG 2
AUX 1
AUX 2
CTRL TRIP
CTRL CLOS
LED RESET
Maint.
tAUX1 = 00.0 s
tAUX2 = 00.0 s
Equation A/B/C/D/E/F/G/H
T OPERATE = 0.00s
T RESET = 0.00s
= A.00 Null
= NOT Null
A.01 to A.15
OR Null
AND NOT Null
AND Null
OR NOT Null
OUTPUT 2 Y/N
OUTPUT 3 Y/N
OUTPUT 4 Y/N
432
000
TRIP. CB
CLOS. CB
V<
tV<
V<<
tV<<
V<<<
tV<<<
V>
tV>
V>>
tV>>
V>>>
tV>>>
V0>
tV0>
V0>>
tV0>>
V0>>>
tV0>>>
tAux1
tAux2
CB FAIL
EQU. A to EQU. H
IN 1
IN 2
BLOCK 1 (2)
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tAUX1 Y/N
tAUX2 Y/N
LATCH
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tAux1 Y/N
tAux2 Y/N
Equation A to Equation H Y/N
MiCOM P921
Menus

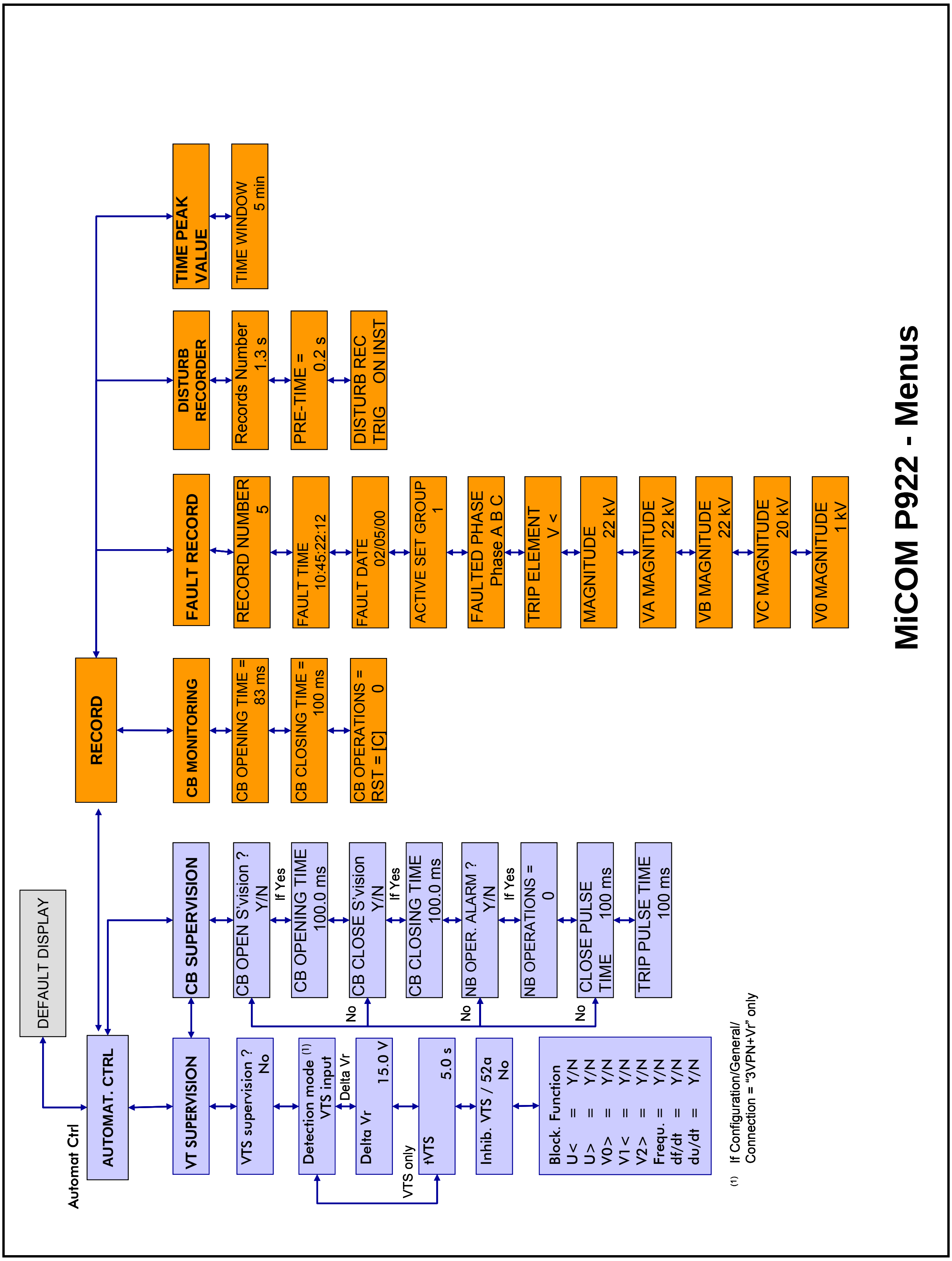
2. MiCOM P922 – V12 SOFTWARE



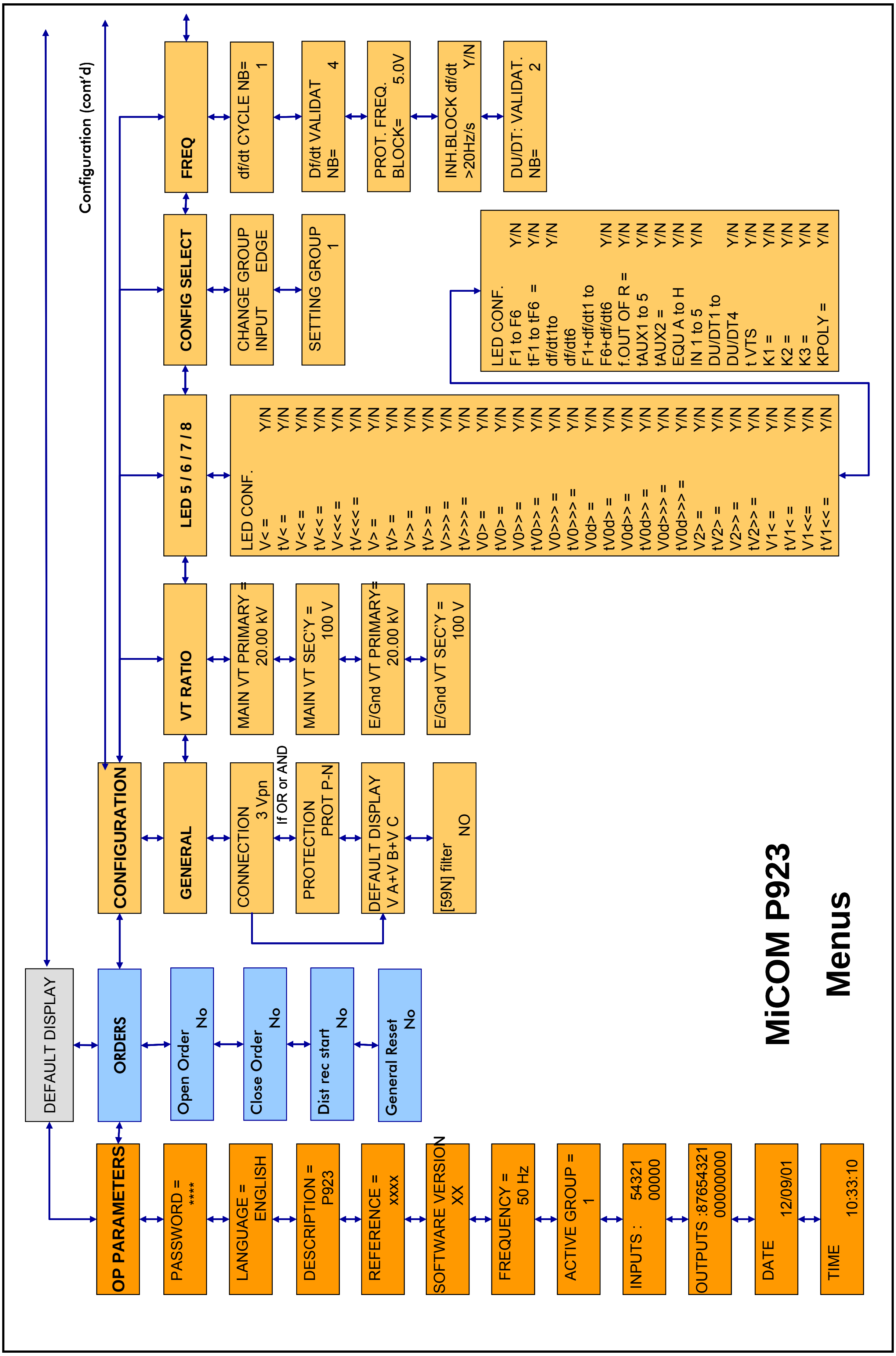

Configuration
Protection (cont'd)
DEFAULT DISPLAY
CONFIGURATION
CONFIGURATION INPUTS
INPUTS: 54321 11111
VOLTAGE INPUTS= DC
OUTPUT RELAYS
Fail safe R. 87654321 00000000
Maintenance Mode No
Yes
Relays CMD 8765W4321 000000000
No
MEASUREMENTS
VA = 0.00 V
VB = 0.00 V
VC = 0.00 V
VAB = 0.00 V
VBC = 0.00 V
VCA = 0.00 V
V0 = 0.00 V
MOD V0 der= 0.00 V
V1 = 0.00 V
V2 = 0.00 V
FREQUENCY = XX.XX Hz
MAX. & AVERAGE V RST = [C]
MAX. VA RMS = 0.00 V
MAX. VB RMS = 0.00 V
MAX. VC RMS = 0.00 V
AVERAGE VA RMS = 0.00 V
AVERAGE VB RMS = 0.00 V
AVERAGE VC RMS = 0.00 V
COMMUNICATION
COMMUNICATION ? YES
BAUD RATE = 19200 Bd
PARITY = NONE
STOP BITS = 1
RELAY ADDRESS = 1
DATE FORMAT= PRIVATE
PROTECTION G1/G2
[27] UNDERVOLTAGE
[27] V< = No/OR/AND
If OR or AND
[27] V< = 5.0 V
[27] DELAY TYPE= DMT
If IDMT:
[27] TMS = 1
[27] tReset V< 10 ms
If DMT:
[27] tV< 10 ms
[27] Inhib V</52a Y/N
No
[27] V<< = No/OR/AND
If OR or AND
[27] V<< = 5.0 V
[27] tV<< 10 ms
[27] Inhib V<</52a Y/N
No
[27] V<<< = No/OR/AND
If OR or AND
[27] V<<< = 5.0 V
[27] tV<<< 10 ms
[27] Inhib V<<</52a Y/N
No
If at least one function ≠ No
[27] Hysteresis= 1.02
[59] OVERVOLTAGE
[59] V> = No/OR/AND
If OR or AND
[59] V> = 130 V
[59] DELAY TYPE= DMT
If IDMT:
[59] TMS = 1
[59] tReset V> 10 ms
If DMT:
[59] tV> 40 ms
No
[59] V>> = No/OR/AND
If OR or AND
[59] V>> = 130 V
[59] tV>> 10 ms
No
[59] V>>> = No/OR/AND
If OR or AND
[59] V>>> = 130 V
[59] tV>>> 10 ms
No
If at least one function ≠ No
[59] Hysteresis 0.98
MiCOM P922 Menus

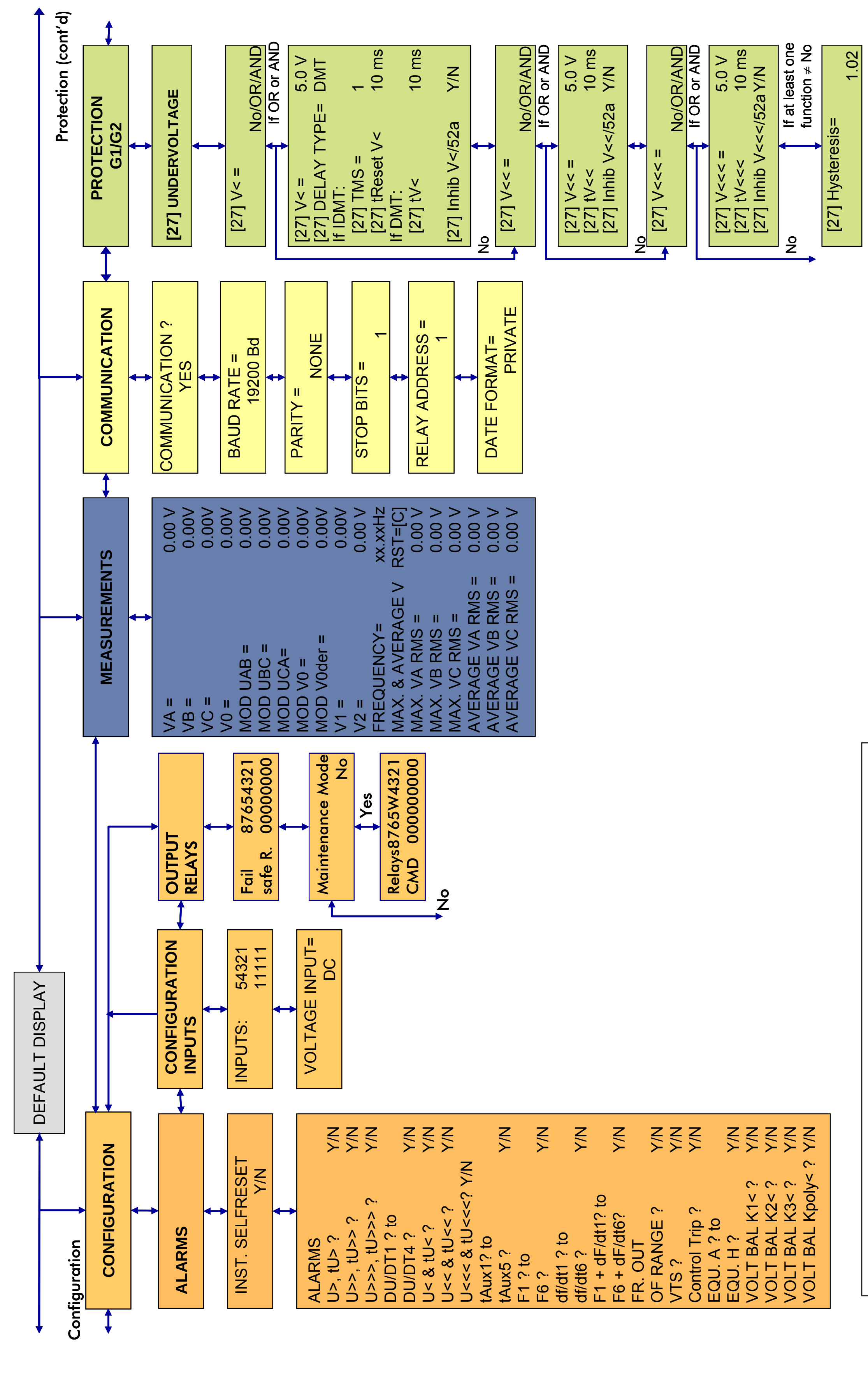

MiCOM P922
Menus
DEFAULT DISPLAY
PROTECTION G1/G2
Protection
Automat CTRL
[59N] RESIDUAL O/V
[59N] V0> =
NO/YES
If YES
[59N] V0> = 5 V
[59N] DELAY TYPE= DMT
If IDMT:
[59N] TMS = 1
[59N] tReset V0> 10 ms
If DMT:
[59N] tV0> 40 ms
No
[59N] V0>> =
NO/YES
If YES
[59N] V0>> = 5 V
[59N] tV0>> 10 ms
No
[59N] V0>>> =
NO/YES
If YES
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
No
[59N] V0>>> =
No/OR/AND
If YES
No
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
[59N] V0der> =
NO/YES
If YES
[59N] V0der> = 5 V
[59N] DELAY TYPE= DMT
If IDMT:
[59N] TMS = 1
[59N] tReset V0der> 10 ms
If DMT:
[59N] tV0der> 40 ms
No
[59N] V0der>> =
NO/YES
If YES
[59N] V0der>> = 5 V
[59N] tV0der>> 10 ms
[59N] V0der>>> =
NO/YES
If YES
[59N] V0der>>> = 5 V
[59N] tV0der>>> 10 ms
No
[47] NEG SEQ O/V
[47] V2> =
No
If Yes
[47] V2> = 130 V
[47] DELAY TYPE= DMT
If IDMT:
[47] TMS = 1
[47] tReset V2> 10 ms
If DMT:
[47] tV2> 40 ms
[47] V2>> =
No
If Yes
[47] V2>> = 130 V
[47] tV2>> 40 ms
No
No
[27D] POS SEQ U/V
[27D] V1< =
No
If Yes
[27D] V1< = 5 V
[27D] DELAY TYPE= DMT
If IDMT:
[27D] TMS = 1
[27D] tReset V1< 10 ms
If DMT:
[27D] tV1< 40 ms
[27D] V1<< =
No
If Yes
[27D] V1<< = 5 V
[27D] tV1<< 40 ms
No
No
[81] FREQUENCY
[81]F1 =
No
If ≠ No
[81] F1 = 50.0 Hz
[81] tF1 = 40ms
As above for F2 up to F6
No
[81]F6 =
No


Automat CTRL (Cnt'd)
Protection
DEFAULT DISPLAY
AUTOMAT. CTRL
TRIP OUTPUT RLY
LATCH OUTPUTS
BLOCKING LOG 1 / 2 t
AUX OUTPUT RLY
LATCH OUTPUT RELAYS
LOGIC EQUATIONS
INPUTS
TRIP Y/N
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tV0der> Y/N
tV0der>> Y/N
tV0der>>> Y/N
tV2> Y/N
tV2>> Y/N
tV1< Y/N
tV1<< Y/N
tf1 Y/N
tf2 Y/N
tf3 Y/N
tf4 Y/N
tf5 Y/N
tf6 Y/N
tAux1 Y/N
tAux2 Y/N
tAux3 Y/N
tAux4 Y/N
tAux5 Y/N
Equation A Y/N
Equation B Y/N
Equation C Y/N
Equation D Y/N
Equation E Y/N
Equation F Y/N
Equation H Y/N
LATCH Y/N
tf1 Y/N
tf2 Y/N
tf3 Y/N
tf4 Y/N
tf5 Y/N
tf6 Y/N
tAux1 to tAux5 Y/N
Equation A to Equation H Y/N
BLOCK 1 (2) Y/N
tF1 to tF6 Y/N
tAux1 to tAux5 Y/N
TRIP. CB
CLOS. CB
8765432
0000000
V<
V<<
V<<<
V>
V>>
V>>>
V0>
V0>>
V0>>>
tV0>>>
V0> der.
tV0> der.
V0>> der.
tV0>> der.
V0>>> der.
tV0>>> der.
V2>
tV2>
V2>>
tV2>>
V1<
tV1<
V1<<
tV1<<
OUTPUT 2 Y/N
OUTPUT 3 Y/N
OUTPUT 4 Y/N
OUTPUT 5 Y/N
OUTPUT 6 Y/N
OUTPUT 7 Y/N
OUTPUT 8 Y/N
F1
tF1
F2
tF2
F3
tF3
F4
tF4
F5
tF5
F6
tF6
tAux1 to tAux5
CB ALAR.
F OUT OF R
CB FAIL
EQU. A to EQU. H
IN 1 to IN 5
ACTIVE GROUP
tVTS
Equation A/B/C/D/E/F/G/H
T OPERATE = 0.00s
T RESET = 0.00s
= A.00
= Null
= NOT Null
A.01 to A.15
OR Null
AND NOT Null
AND Null
OR NOT Null
INPUT 1/2/3/4/5
NONE
UNLATCH
52a
52b
CB FAIL
BLK LOG 1
BLK LOG 2
AUX 1 to AUX 5
CHANG SET
STRT DIST
CTRL TRIP
CTRL CLOS
TIME SYNC
LED RESET
VTS
Maint.
tAUX1 = 00.0 s
tAUX2 = 00.0 s
MiCOM P922
Menus

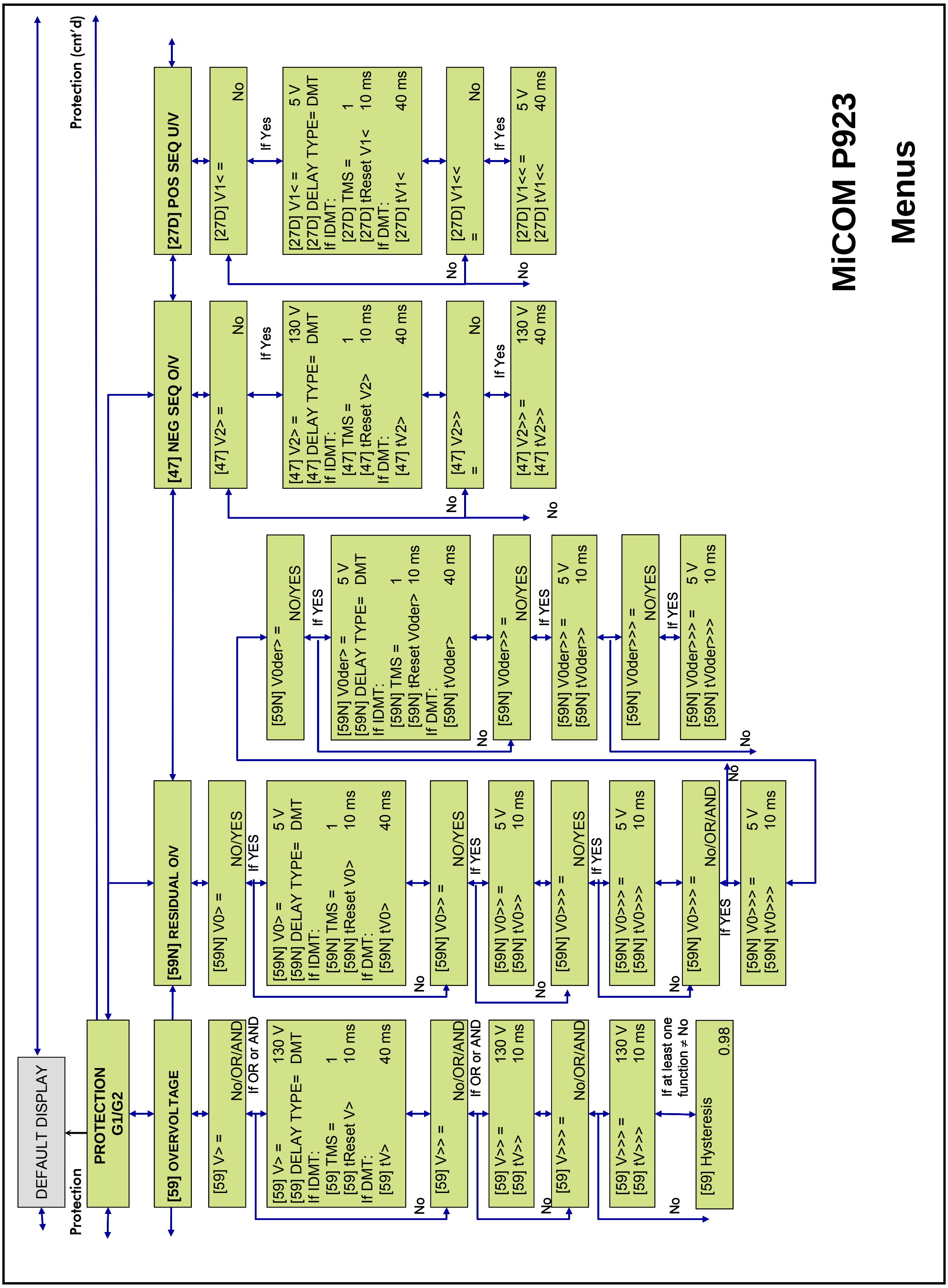

MiCOM P922 - Menus
DEFAULT DISPLAY
Automat Ctrl
AUTOMAT. CTRL
RECORD
VT SUPERVISION
VTS supervision ? No
Detection mode (1) VTS input
Delta Vr
Delta Vr 15.0 V
VTS only
tVTS 5.0 s
Inhib. VTS / 52a No
Block. Function
U< = Y/N
U> = Y/N
V0> = Y/N
V1< = Y/N
V2> = Y/N
Frequ. = Y/N
df/dt = Y/N
du/dt = Y/N
(1) If Configuration/General/ Connection = "3VPN+Vr" only
CB SUPERVISION
CB OPEN S'vision ? Y/N
If Yes
CB OPENING TIME 100.0 ms
CB CLOSE S'vision Y/N
If Yes
CB CLOSING TIME 100.0 ms
NB OPER. ALARM ? Y/N
If Yes
NB OPERATIONS = 0
CLOSE PULSE TIME 100 ms
TRIP PULSE TIME 100 ms
No
No
No
CB MONITORING
CB OPENING TIME = 83 ms
CB CLOSING TIME = 100 ms
CB OPERATIONS = 0 RST = [C]
FAULT RECORD
RECORD NUMBER 5
FAULT TIME 10:45:22:12
FAULT DATE 02/05/00
ACTIVE SET GROUP 1
FAULTED PHASE Phase A B C
TRIP ELEMENT V <
MAGNITUDE 22 kV
VA MAGNITUDE 22 kV
VB MAGNITUDE 22 kV
VC MAGNITUDE 20 kV
V0 MAGNITUDE 1 kV
DISTURB RECORDER
Records Number 1.3 s
PRE-TIME = 0.2 s
DISTURB REC TRIG ON INST
TIME PEAK VALUE
TIME WINDOW 5 min

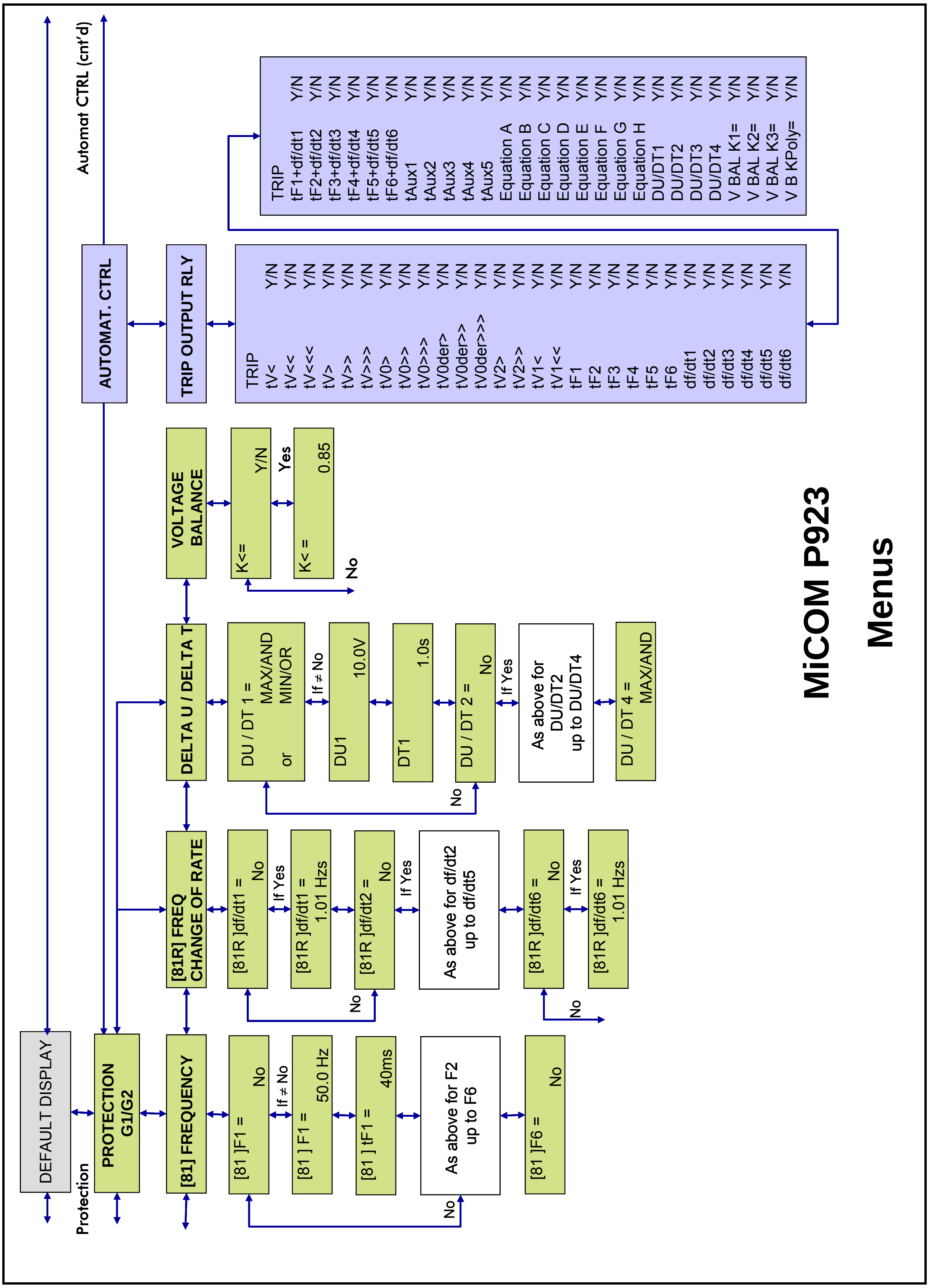
2.1 MiCOM P923 – V12 SOFTWARE

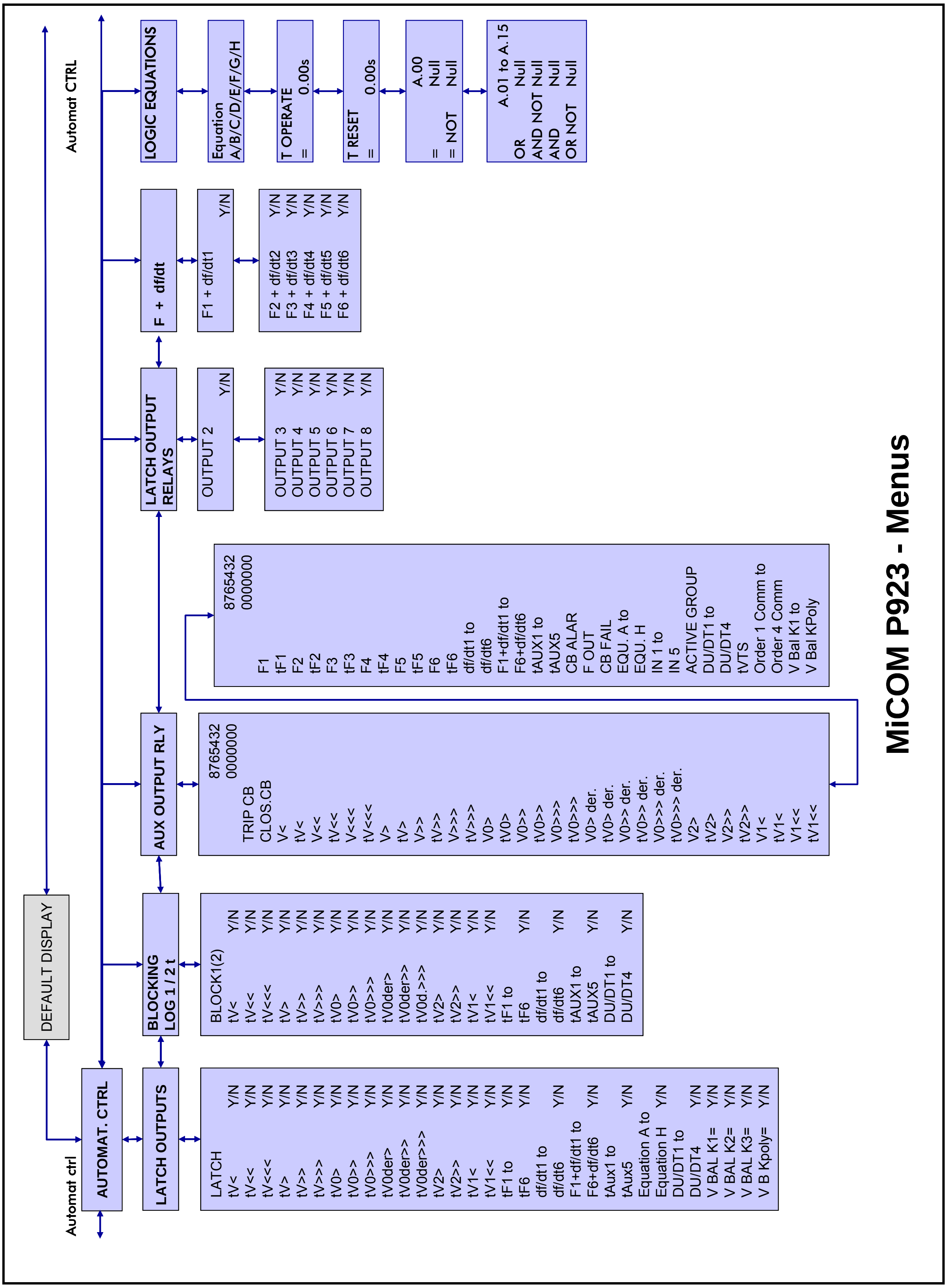


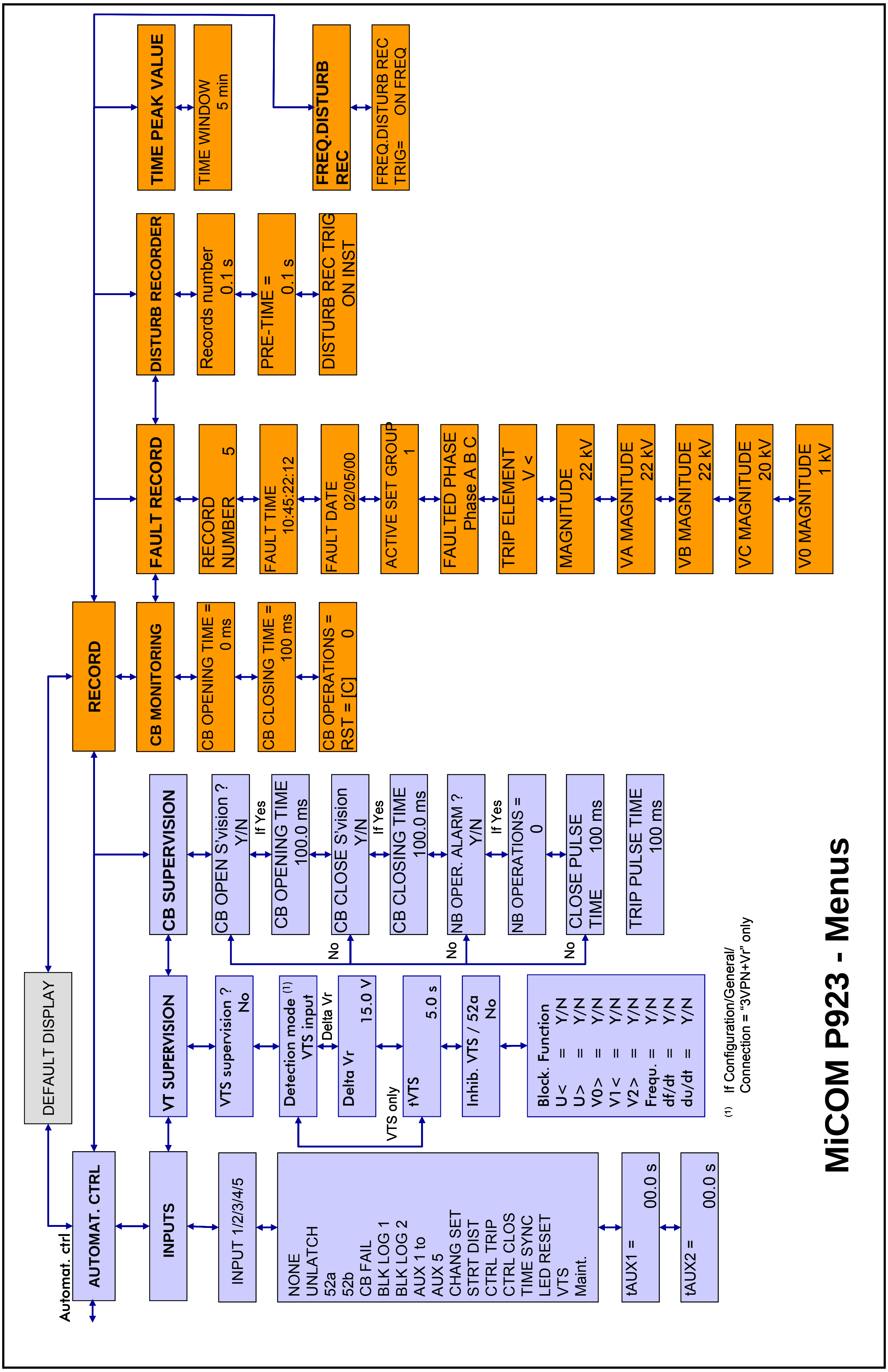


MiCOM P923 Menus


MiCOM P923
Menus
DEFAULT DISPLAY
Protection
PROTECTION G1/G2
Protection (cnt'd)
[59] OVERVOLTAGE
[59] V> = No/OR/AND
If OR or AND
[59] V> = 130 V
[59] DELAY TYPE= DMT
If IDMT:
[59] TMS = 1
[59] tReset V> 10 ms
If DMT:
[59] tV> 40 ms
No
[59] V>> = No/OR/AND
If OR or AND
[59] V>> = 130 V
[59] tV>> 10 ms
[59] V>>> = No/OR/AND
[59] V>>> = 130 V
[59] tV>>> 10 ms
If at least one function ≠ No
[59] Hysteresis 0.98
[59N] RESIDUAL O/V
[59N] V0> = NO/YES
If YES
[59N] V0> = 5 V
[59N] DELAY TYPE= DMT
If IDMT:
[59N] TMS = 1
[59N] tReset V0> 10 ms
If DMT:
[59N] tV0> 40 ms
[59N] V0>> = NO/YES
[59N] V0>> = 5 V
[59N] tV0>> 10 ms
[59N] V0>>> = NO/YES
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
[59N] V0>>> = No/OR/AND
If YES
[59N] V0>>> = 5 V
[59N] tV0>>> 10 ms
[59N] V0der> = NO/YES
[59N] V0der> = 5 V
[59N] DELAY TYPE= DMT
If IDMT:
[59N] TMS = 1
[59N] tReset V0der> 10 ms
If DMT:
[59N] tV0der> 40 ms
[59N] V0der>> = NO/YES
[59N] V0der>> = 5 V
[59N] tV0der>> 10 ms
[59N] V0der>>> = NO/YES
[59N] V0der>>> = 5 V
[59N] tV0der>>> 10 ms
[47] NEG SEQ O/V
[47] V2> = No
If Yes
[47] V2> = 130 V
[47] DELAY TYPE= DMT
If IDMT:
[47] TMS = 1
[47] tReset V2> 10 ms
If DMT:
[47] tV2> 40 ms
[47] V2>> = No
[47] V2>> = 130 V
[47] tV2>> 40 ms
[27D] POS SEQ U/V
[27D] V1< = No
[27D] V1< = 5 V
[27D] DELAY TYPE= DMT
If IDMT:
[27D] TMS = 1
[27D] tReset V1< 10 ms
If DMT:
[27D] tV1< 40 ms
[27D] V1<< = No
[27D] V1<< = 5 V
[27D] tV1<< 40 ms


Automat CTRL (cnt'd)
DEFAULT DISPLAY
Protection
PROTECTION G1/G2
AUTOMAT. CTRL
TRIP OUTPUT RLY
[81] FREQUENCY
[81]F1 = No
If ≠ No
[81] F1 = 50.0 Hz
[81] tF1 = 40ms
As above for F2 up to F6
[81]F6 = No
No
[81R] FREQ CHANGE OF RATE
[81R]df/dt1 = No
If Yes
[81R]df/dt1 = 1.01 Hzs
[81R]df/dt2 = No
If Yes
As above for df/dt2 up to df/dt5
[81R]df/dt6 = No
If Yes
[81R]df/dt6 = 1.01 Hzs
No
DELTA U / DELTA T
DU / DT 1 = MAX/AND or MIN/OR
If ≠ No
DU1 10.0V
DT1 1.0s
DU / DT 2 = No
If Yes
As above for DU/DT2 up to DU/DT4
DU / DT 4 = MAX/AND
No
VOLTAGE BALANCE
K<= Y/N
Yes
K< = 0.85
No
TRIP Y/N
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tV0der> Y/N
tV0der>> Y/N
tV0der>>> Y/N
tV2> Y/N
tV2>> Y/N
tV1< Y/N
tV1<< Y/N
tF1 Y/N
tF2 Y/N
tF3 Y/N
tF4 Y/N
tF5 Y/N
tF6 Y/N
df/dt1 Y/N
df/dt2 Y/N
df/dt3 Y/N
df/dt4 Y/N
df/dt5 Y/N
df/dt6 Y/N
TRIP Y/N
tF1+df/dt1 Y/N
tF2+df/dt2 Y/N
tF3+df/dt3 Y/N
tF4+df/dt4 Y/N
tF5+df/dt5 Y/N
tF6+df/dt6 Y/N
tAux1 Y/N
tAux2 Y/N
tAux3 Y/N
tAux4 Y/N
tAux5 Y/N
Equation A Y/N
Equation B Y/N
Equation C Y/N
Equation D Y/N
Equation E Y/N
Equation F Y/N
Equation G Y/N
Equation H Y/N
DU/DT1 Y/N
DU/DT2 Y/N
DU/DT3 Y/N
DU/DT4 Y/N
V BAL K1= Y/N
V BAL K2= Y/N
V BAL K3= Y/N
V B KPoly= Y/N
MiCOM P923
Menus


DEFAULT DISPLAY
Automat ctrl
Automat CTRL
AUTOMAT. CTRL
LATCH OUTPUTS
LATCH
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tV0der> Y/N
tV0der>> Y/N
tV0der>>> Y/N
tV2> Y/N
tV2>> Y/N
tV1< Y/N
tV1<< Y/N
tF1 to
tF6 Y/N
df/dt1 to
df/dt6 Y/N
F1+df/dt1 to
F6+df/dt6 Y/N
tAux1 to
tAux5 Y/N
Equation A to
Equation H Y/N
DU/DT1 to
DU/DT4 Y/N
V BAL K1= Y/N
V BAL K2= Y/N
V BAL K3= Y/N
V B Kpoly= Y/N
BLOCKING LOG 1 / 2 t
BLOCK1(2)
tV< Y/N
tV<< Y/N
tV<<< Y/N
tV> Y/N
tV>> Y/N
tV>>> Y/N
tV0> Y/N
tV0>> Y/N
tV0>>> Y/N
tV0der> Y/N
tV0der>> Y/N
tV0d.>>> Y/N
tV2> Y/N
tV2>> Y/N
tV1< Y/N
tV1<< Y/N
tF1 to
tF6 Y/N
df/dt1 to
df/dt6 Y/N
tAUX1 to
tAUX5 Y/N
DU/DT1 to
DU/DT4 Y/N
AUX OUTPUT RLY
8765432
0000000
TRIP CB
CLOS.CB
V<
tV<
V<<
tV<<
V<<<
tV<<<
V>
tV>
V>>
tV>>
V>>>
tV>>>
V0>
tV0>
V0>>
tV0>>
V0>>>
tV0>>>
V0> der.
tV0> der.
V0>> der.
tV0>> der.
V0>>> der.
tV0>>> der.
V2>
tV2>
V2>>
tV2>>
V1<
tV1<
V1<<
tV1<<
8765432
0000000
F1
tF1
F2
tF2
F3
tF3
F4
tF4
F5
tF5
F6
tF6
df/dt1 to
df/dt6
F1+df/dt1 to
F6+df/dt6
tAUX1 to
tAUX5
CB ALAR
F OUT
CB FAIL
EQU. A to
EQU. H
IN 1 to
IN 5
ACTIVE GROUP
DU/DT1 to
DU/DT4
tVTS
Order 1 Comm to
Order 4 Comm
V Bal K1 to
V Bal KPoly
LATCH OUTPUT RELAYS
OUTPUT 2 Y/N
OUTPUT 3 Y/N
OUTPUT 4 Y/N
OUTPUT 5 Y/N
OUTPUT 6 Y/N
OUTPUT 7 Y/N
OUTPUT 8 Y/N
F + df/dt
F1 + df/dt1 Y/N
F2 + df/dt2 Y/N
F3 + df/dt3 Y/N
F4 + df/dt4 Y/N
F5 + df/dt5 Y/N
F6 + df/dt6 Y/N
LOGIC EQUATIONS
Equation A/B/C/D/E/F/G/H
T OPERATE
= 0.00s
T RESET
= 0.00s
= A.00
= NOT Null
Null
A.01 to A.15
OR Null
AND NOT Null
AND Null
OR NOT Null
MiCOM P923 - Menus


Automat. ctrl
AUTOMAT. CTRL
DEFAULT DISPLAY
RECORD
INPUTS
INPUT 1/2/3/4/5
NONE
UNLATCH
52a
52b
CB FAIL
BLK LOG 1
BLK LOG 2
AUX 1 to
AUX 5
CHANG SET
STRT DIST
CTRL TRIP
CTRL CLOS
TIME SYNC
LED RESET
VTS
Maint.
tAUX1 = 00.0 s
tAUX2 = 00.0 s
VT SUPERVISION
VTS supervision ? No
Detection mode (1) VTS input
Delta Vr
Delta Vr 15.0 V
VTS only
tVTS 5.0 s
Inhib. VTS / 52a No
Block. Function
U< = Y/N
U> = Y/N
V0> = Y/N
V1< = Y/N
V2> = Y/N
Frequ. = Y/N
df/dt = Y/N
du/dt = Y/N
(1) If Configuration/General/ Connection = "3VPN+Vr" only
CB SUPERVISION
CB OPEN S'vision ? Y/N
If Yes
No
CB OPENING TIME 100.0 ms
CB CLOSE S'vision Y/N
If Yes
No
CB CLOSING TIME 100.0 ms
NB OPER. ALARM ? Y/N
If Yes
No
NB OPERATIONS = 0
CLOSE PULSE TIME 100 ms
TRIP PULSE TIME 100 ms
CB MONITORING
CB OPENING TIME = 0 ms
CB CLOSING TIME = 100 ms
CB OPERATIONS = 0
RST = [C]
FAULT RECORD
RECORD NUMBER 5
FAULT TIME 10:45:22:12
FAULT DATE 02/05/00
ACTIVE SET GROUP 1
FAULTED PHASE Phase A B C
TRIP ELEMENT V <
MAGNITUDE 22 kV
VA MAGNITUDE 22 kV
VB MAGNITUDE 22 kV
VC MAGNITUDE 20 kV
V0 MAGNITUDE 1 kV
DISTURB RECORDER
Records number 0.1 s
PRE-TIME = 0.1 s
DISTURB REC TRIG ON INST
TIME PEAK VALUE
TIME WINDOW 5 min
FREQ.DISTURB REC
FREQ.DISTURB REC TRIG= ON FREQ
MiCOM P923 - Menus

P921 P922 P923 – V12
COMMUNICATIONS
MODBUS MAPPING
COURIER DATABASE
IEC 60870-5-103
DNP3

CONTENTS

BLANK PAGE

1. MODBUS PROTOCOL

The MiCOM P921-P922-P923 relays offer MODBUS TM RTU mode communication via a rear RS485 port.

1.1 MODBUS communication characteristics

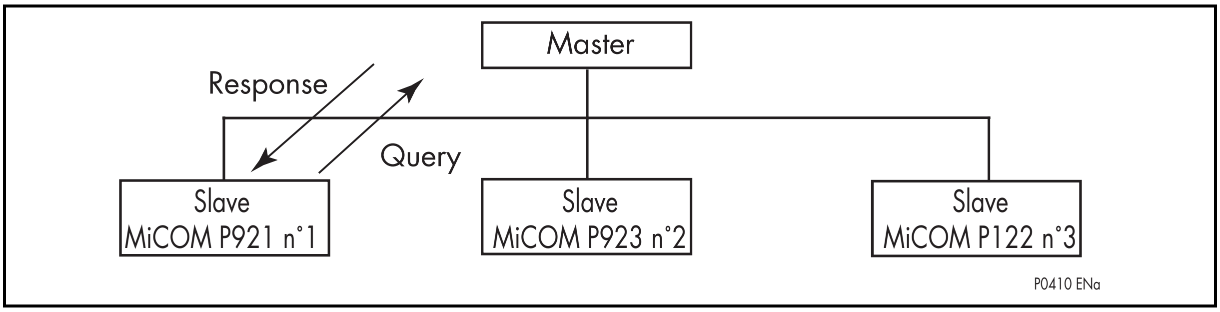
1.1.1 MODBUS network characteristics

The MODBUS protocol is based on the master-slave principle with the MiCOM P921, P922 or P923 relay operating as a slave device.

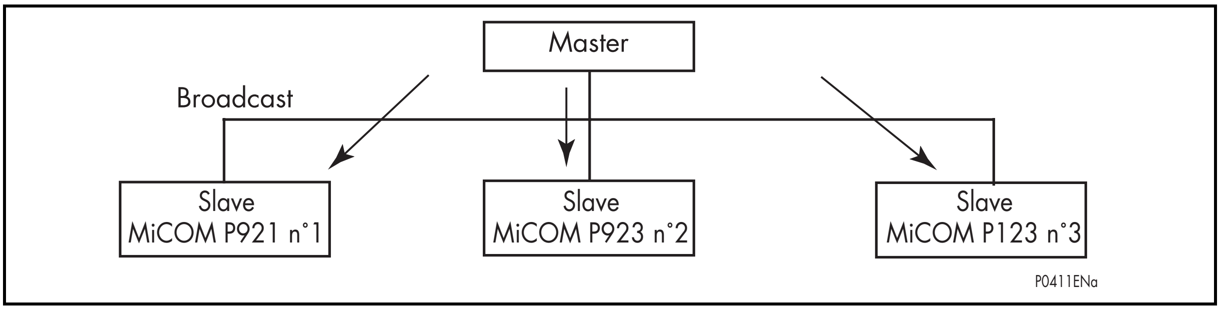
The MODBUS protocol allows the master to read and to write one or several bits, or one or several words, and to control remotely the event logging data.

Access to the network can be:

– either using the query/response principle



– or broadcasting a message from the master to all the slave relays.



In the latter case:

– Broadcast messages are compulsory "write orders",

– Slaves never emit a response to the master,

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

– At the end of each frame, two bytes are used for CRC16 validity checksum.

1.1.2 Parameters of the MODBUS connection

The MODBUS protocol characteristics are:

- Isolated two-point RS485 connection (2kV 50Hz).
- MODBUS line protocol in RTU mode.
- Baud rate available (set using front panel):

Baud rate
300
600
1200
2400
4800
9600
19200
38400

Transmission mode:

Transmission mode
1 start / 8 bits / 1 stop: total 10 bits
1 start / 8 bits / even parity / 1 stop: total 11 bits
1 start / 8 bits / odd parity / 1 stop: total 11 bits
1 start / 8 bits / 2 stop: total 11 bits

1.1.3 Synchronisation of messages

Any 3-bytes length message received after a silence, is considered as a frame start.

1.1.4 Message validity check

The validation of a trame is performed with a 16-bit cyclical redundancy check (CRC).

The generator polynomial is:

$1 + x^2 + x^{15} + x^{16}$ = 1010 0000 0000 0001 binary = A001h

1.1.5 Address of the MiCOM relays

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

1.2 MODBUS functions on the MiCOM relays

The MODBUS functions implemented on the MiCOM relays are:

- Function 1 or 2: Reading of n bits
- Function 3 or 4: Reading of n words
- Function 5: Writing of 1 bit
- Function 6: Writing of 1 word
- Function 7: Fast reading of 8 bits
- Function 8: Reading of the diagnosis counters
- Function 11: Reading of the Event counter
- Function 15: Writing of n bits
- Function 16: Writing of n words

1.3 Presentation of the MODBUS protocol

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

1.3.1 Frame size received by the MiCOM P92x relay

Frame transmitted by the master (query):

Slave number	Function code	Information	CRC16
1 byte	1 byte	n bytes	2 bytes

Slave number:

The slave number is situated between 1 and 255.

Function code:

Requested MODBUS function (1 to 16).

Information:

Contains the parameters of the selected function.

CRC16:

Value of the CRC16 calculated by the master.

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

1.3.2 Format of frames sent by the MiCOM P92x relay

Frame sent by the MiCOM relay (response):

Slave number	Function code	Data	CRC16
1 byte	1 byte	n bytes	2 bytes

Slave number:

The slave number is situated between 1 and 255.

Function code:

Processed MODBUS function (1 to 16).

Data:

Contains the response data to master query.

CRC16:

Value of the CRC16 calculated by the MiCOM relay.

1.3.3 Messages validity check

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

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

Exception frame sent by the MiCOM relay (response):

Slave number	Function code	Error code	CRC16
1 byte	1 byte	1 byte	2 bytes

Slave number:

The slave number is situated between 1 and 255.

Function code:

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

Error code:

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

- code 01: Function code unauthorised or unknown.
- code 03: A value of the data field is unauthorised (incorrect code).
  - Control of pages being read.
  - Control of pages being written.
  - Control of address in pages.
  - Length of request messages.

CRC16:

The CRC16 value is calculated by the slave.

1.4 Modbus request definition used to retrieve the disturbance records

To retrieve a disturbance record, the following requests must be done in the exact given order:

1. (optional): Send a request to know the number of disturbance records available in the saved RAM.
2. To retrieve the data of one channel:

   2a – (compulsory): Send a service request specifying the record number and the channel number which have to be retrieved.

   2b – (compulsory): Send requests to retrieve the data of a disturbance record channel as many time as needed.

   2c – (compulsory): send a request to retrieve the index frame.
3. Process the same operation (as described in the item 2) for each channel.

1.4.1 Request to know the number of available disturbance records in the Saved RAM.

Slave number	Function code	Word address	Word number	CRC
xx	03h	3Dh 00	00 24h	xx.........xx

This request may be answered an error message with the error code:

EVT_NOK (0F): No record available.

NOTE: If there is less than 5 records available, the answer will contain zero value in the non-used words.

1.4.2 Service request

This request shall be send before to retrieve the sample data of a disturbance record channel. It allows to specify the record number and the channel number which have to be retrieved. It allows also to know the number of samples in the channel.

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 0Bh	xx.........xx

This request may be answered an error message. Two error codes are possible:

CODE_DEF_RAM (02): Saved RAM failure.

CODE_EVT_NOK (03): No disturbance record available in the saved RAM.

1.4.3 Request to retrieve the data of a disturbance record channel

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	1 to 7Dh	xx......xx

This request may be answered an error message. Two error codes are possible:

CODE_DEP_DATA (04): The requested sample number is superior than the number of samples in the specified channel.

CODE_SERV_NOK (05): The record number and the channel number have not been specified by a service request.

NOTE: This type of request can retrieve up to125 words. A sample is coded on 1 word (16 bits).

1.4.4 Request to retrieve an index frame

Slave number	Function code	Word address	Word number	CRC
xx	03h	22h 00	00 07h	xx........xx

This event request may be answered an error message with the error code:

CODE_SERV_NOK (05): The record number and the channel number have not been specified by a service request.

1.5 Modbus request definition used to retrieve the event records

Two ways can be followed to retrieve an event record:

1. Send a request to retrieve the oldest non-acknowledge event.
2. Send a request to retrieve a dedicated event.

1.5.1 Request to retrieve the oldest non-acknowledge event

Slave number	Function code	Word address	Word number	CRC
xx	03h	36h 00	00 09h	xx........xx

This event request may be answered an error message with the error code:

EVT_EN_COURS_ECRIT (5): An event is being written into the saved RAM.

NOTE: On event retrieval, two possibilities exist regarding the event record acknowledgement:
a) Automatic event record acknowledgement on event retrieval.
b) Non automatic event record acknowledgement on event retrieval.

a) Automatic event record acknowledgement on event retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 0. On event retrieval, this event record is acknowledged.

b) Non automatic event record acknowledgement on event retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 1. On event retrieval, this event record is not acknowledged.

To acknowledge this event, an other remote order shall be sent to the relay. The bit 13 of this frame (format F9 – mapping address 0400h) shall be set to 1.

1.5.2 Request to retrieve a dedicated event

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 09h	xx........xx

This event request may be answered an error message with the error code:

EVT_EN_COURS_ECRIT (5): An event is being written into the saved RAM.

NOTE: This event retrieval does not acknowledge this event.

1.6 Modbus request definition used to retrieve the fault records

Two ways can be followed to retrieve a fault record:

1. Send a request to retrieve the oldest non-acknowledge fault record.
2. Send a request to retrieve a dedicated fault record.

1.6.1 Request to retrieve the oldest non-acknowledge fault record

Slave number	Function code	Word address	Word number	CRC
xx	03h	3Eh 00	00 0Fh	xx........xx

NOTE: On fault retrieval, two possibilities exist regarding the fault record acknowledgement:

a) Automatic fault record acknowledgement on event retrieval.

b) Non automatic fault record acknowledgement on event retrieval.

a) Automatic fault record acknowledgement on fault retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 0. On fault retrieval, this fault record is acknowledged.

b) Non automatic fault record acknowledgement on fault retrieval:

The bit12 of the remote order frame (format F9 - mapping address 0400h) shall be set to 1. On fault retrieval, this fault record is not acknowledged.

To acknowledge this fault, an other remote order shall be sent to the relay. The bit 14 of this frame (format F9 – mapping address 0400h) shall be set to 1.

1.6.2 Request to retrieve a dedicated fault record

Slave number	Function code	Word address	Word number	CRC
xx	03h	Refer to mapping	00 0Fh	xx........xx

NOTE: This fault value retrieval does not acknowledge this fault record.

1.7 MiCOM P921-P922-P923 database organisation

1.7.1 Description of the MODBUS application mapping

Pages 0 to 8: Contain the MiCOM P921-P922-P923 parameters.

Pages 9 to 3Dh: Contain the data of the event records, data of the fault value records, and data of the disturbance records, these pages are only available for MiCOM P922 and P923.

Pages 40h to 4Ah: Contain the data of the frequency disturbance records MiCOM P923.

These pages are explained in the following way:

Page No	Page content	Access
Page 0	Information of product, remote signalling, remote measurements	Reading
Page 1	Remote settings for general parameters	Reading & writing
Page 2	Remote settings for protection group number 1	Reading & writing
Page 3	Remote settings for protection group number 2	Reading & writing
Page 4	Remote controls	Writing
Page 5	Reserved	Not accessible
Page 6	Reserved	Not accessible
Page 7	Self tests results	Quick reading
Page 8	Synchronisation	Writing
Pages 9h to 21h	Disturbance record data	Reading
Page 22h	Index frame for the disturbance records	Reading
Pages 23h to 34h	Reserved	Not accessible
Page 35h	Event record data	Reading
Page 36h	Data of the oldest event	Reading
Page 37h	Fault value record data	Reading
Pages 38h to 3Ch	Selection of the disturbance record and selection of its channel	Reading
Page 3Dh	Number of available disturbance records	Reading
Page 3Eh	Data of the oldest fault value record	Reading
Pages 40h to 4Ah	Data of the frequency disturbance records	Reading

1.7.2 Page 0: Product information, remote signalling and remote measurements

Read only access

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0000	Product information	Description of the relay characters 1 and 2			-	F10	P9
0001		Description of the relay characters 3 and 4			-	F10	21 or 22 or 23
0002		Description of the relay characters 5 and 6			-	F10	-0 or -1
0003		Factory reference characters 1 and 2			-	F10	SE
0004		Factory reference characters 3 and 4			-	F10	
0005		Software version	10 - xx	1	-	F21	112
0006		Communication type	0-2	1	-	F41	
0007		Internal ratio: numerator				F1	
0008		Internal ratio: denominator				F1	
0009		General start information (VDEW)				F68	
000A		General Trip information (VDEW)	0 to 1	1	-	F1	
000B		Reserved					
000C		LEDs status	0 – FF	1		F73	
000D		Active configuration group	1-2			F1	
000E		Setting mode	0-1	1	-	F24	0
000F		Status of the protection				F45	
0010	Remote signalling	Logic inputs	0 to 3 or 31	1	-	F12	
0011		Logic inputs functional status (Part 1)	0 to 03FF	1	-	F20a	
0012		Internal logics	0 to FFFF	1	-	F22	
0013		Output relays	0 to 1F or 1FF	1	-	F13	
0014		Output information for threshold: V>	0 to FFFF	1	-	F17	
0015		Output information for threshold: V>>	0 to FFFF	1	-	F17	
0016		Output information for threshold: V>>>	0 to FFFF	1	-	F17	
0017		Output information for threshold: V<	0 to FFFF	1	-	F47	
0018		Output information for threshold: V<<	0 to FFFF	1	-	F47	
0019		Output information for threshold: V<<<	0 to FFFF	1	-	F47	
001A		Output information for threshold: V0>	0 to FFFF	1	-	F16	
001B		Output information for threshold: V0>>	0 to FFFF	1	-	F16	
001C		Output information for threshold: V0>>>	0 to FFFF	1	-	F16	
001D		Output information for threshold: V2>, V2>>, V1<, V1<<	0 to FFFF	1	-	F48	
001E		Output information for threshold f1	0 to 7	1	-	F49	
001F		Output information for threshold f2	0 to 7			F49	
0020		Output information for threshold f3	0 to 7			F49	
0021		Output information for threshold f4	0 to 7			F49	
0022		Output information for threshold f5	0 to 7			F49	
0023		Output information for threshold f6	0 to 7			F49	
0024		Output information for: Equations, tAux, CB supervision, Fout	0 to FFFF	1	-	F38a	
0025		Not acknowledged alarms: Equations, tAux, CB supervision, Fout	0 to FFFF	1	-	F38a	

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0026		Number of disturbance records available	0 to 5	1	-	F31	
0027		Trip information (RL1)	0 to 1	0		F1	
0028		Memorisation of the threshold V>	0 to FFFF	1	-	F17	
0029		Memorisation of the threshold V>>	0 to FFFF	1	-	F17	
002A		Memorisation of the threshold V>>>	0 to FFFF	1	-	F17	
002B		Memorisation of the threshold V<	0 to FFFF	1	-	F17	
002C		Memorisation of the threshold V<<	0 to FFFF	1	-	F17	
002D		Memorisation of the threshold V<<<	0 to FFFF	1	-	F17	
002E		Not acknowledged alarms, Part 1				F36	
002F		Not acknowledged alarms, Part 2				F37	

Address	Group	Description	Settings range	Step	Unit	Format	Default settings	Product		
								P921	P922/	P923
0030	Measurements	True RMS phase voltage VA	0 to 500 000 000	1	V/100	F18		X	X	X
0032		True RMS phase voltage VB	0 to 500 000 000	1	V/100	F18		X	X	X
0034		True RMS phase voltage VC	0 to 500 000 000	1	V/100	F18		X	X	X
0036		True RMS residual voltage Vr	0 to 500 000 000	1	V/100	F18		X	X	X
0038		Positive seq. voltage (fundamental)		1	V/100	F18			X	X
003A		Negative seq. voltage (fundamental)		1	V/100	F18			X	X
003C		Signal Period			µsec	F1			X	X
003D		Frequency	4000 - 8000	1	1/100 Hz	F1			X	X
003E		Maximum value of the phase A voltage	0 to 500 000 000	1	V/100	F18			X	X
0040		Maximum value of the phase B voltage	0 to 500 000 000	1	V/100	F18			X	X
0042		Maximum value of the phase C voltage	0 to 500 000 000	1	V/100	F18			X	X
0044		Average value of the phase A voltage	0 to 500 000 000	1	V/100	F18			X	X
0046		Average value of the phase B voltage	0 to 500 000 000	1	V/100	F18			X	X
0048		Average value of the phase C voltage	0 to 500 000 000	1	V/100	F18			X	X
004A		df/dt	-20000 to 20000	1	1/1000 Hz/s	F2				X
004B		Voltage of the reference channel				F1				X
004C to 004F		Reserved						X	X	X
0050	Fourier Module	Module VA			-	F1		X	X	X
0051		Module VB			-	F1		X	X	X
0052		Module VC			-	F1		X	X	X
0053		Module Vo			-	F1		X	X	X
0054	Fourier Argument	Argument VA			-	F1		X	X	X
0055		Argument VB			-	F1		X	X	X
0056		Argument VC			-	F1		X	X	X
0057		Argument Vo			-	F1		X	X	X
0058	Fourier Module	Positive seq. Voltage module			-	F1			X	X
0059		Negative seq. voltage module			-	F1			X	X
005A - 005F		Reserved						X	X	X

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0060	Status	Memorisation of the latched output relays (1)				F6	
0061		Reset of the latched output relays (1)				F6	
0062	Status	Power self-test status				F98	
0063	Status	Transformer self-test status				F99	
0064		df/dt protection information				F58	
0065		Memorization of the df/dt protection information				F58	
0066		du/dt1 information				F61	
0067		du/dt2 information				F61	
0068		du/dt3 information				F61	
0069		du/dt4 information				F61	
006A		Memo of du/dt1 info.				F61	
006B		Memo of du/dt2 info.				F61	
006C		Memo of du/dt3 info.				F61	
006D		Memo of du/dt4 info.				F61	
006E		Non confirmed df/dt info.				F58	
006F		Reserved					
0070	Fourier Module	Module Uab				F1	
0071		Module Ubc				F1	
0072		Module Uca				F1	
0073 - 007F		Reserved					
0080	Fourier Module	Module V0der			-	F1	
0081	Fourier Argument	Argument V0der			-	F1	
0082	Status	F+df/dt information				F67	
0083		Memo of F+df/dt info.				F67	
0084		VTS information				F66	
0085		Memo of VTS info				F66	
0086		Output information for threshold: V0der>	0 – FFFF	1		F16	
0087		Output information for threshold: V0der>>	0 – FFFF	1		F16	
0088		Output information for threshold: V0der>>>	0 – FFFF	1		F16	
0089		Output information for Equations	0 - FFFF	1		F38b	
008A		Not acknowledged alarms for Equations	0 - FFFF	1		F38b	
008B		Logic inputs functional status (Part 2)	0 - FFFF	1		F20b	
008C		Not acknowledged alarms, Part 3	0 – FFFF	1		F75	
008D	Status	Voltage Balance Status	0 to 15	1		F115	0
008E	Values	K1 (voltage balance)		1	0.001	F1	N/A
008F	Values	K2 (voltage balance)		1	0.001	F1	N/A
0090	Values	K3 (voltage balance)		1	0.001	F1	N/A
0091	Status	Voltage Balance Status memorised	0 to 15	1		F115	0
0092-00DF		Not used					
00E0-00EF	HMI screen	HMI screen copy	ASCII			16 x F10	
00F0-00FF		Not used					

1.7.3 Page 1: Remote settings

Read and write access

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0100	Remote settings	Address	1 to 255	1	-	F1	1
0101		Reserved	-	-	-	-	-
0102		Password characters 1 and 2	32 -127	1	-	F10	AA
0103		Password characters 3 and 4	32 -127	1	-	F10	AA
0104		Frequency	50-60	10	Hz	F1	50
0105 to 108		Reserved					
0109		Default display	1 – 8	1		F26	1
010A		User reference (characters 1 and 2)	32-127	1		F10	AL
010B		User reference (characters 3 and 4)	32-127	1		F10	ST
010C		Fault number to be displayed (P922 & P923 only)	1-25	1		F31	25
010D		Configuration of the validation edge of the logic inputs		0		F12	0
010E		Reserved					
010F		Type of input voltage Of the logic inputs	0-1	1		F50	0
	CB supervision	(P922-P923) only					
0110		CB operations number		1		F1	
0111		CB operating time		1	1/100 sec	F1	
0112 – 0117		Reserved					
0118		CB closing time		1	1/100 sec	F1	
0119 to 011E		Reserved					
011F		Latched relays				F14	
	Ratios						
0120		Phase VT: primary value	A: 10 to 100000 B: 22 to 48	1	10 V	F51	A: 2000 B: 22
0122		Phase VT: secondary value	A: 570 to 1300 B: 2200 to 4800	1	V/10	F1	A: 1000 B: 2200
0123		Residual VT: primary value	A: 10 to 100000 B: 22 to 48	1	10 V	F51	A: 2000 B: 22
0125		Residual VT: secondary value	A: 570 to 1300 B: 2200 to 4800	1	V/10	F1	A: 1000 B: 2200
0126	Configuration	Connection	0 to 3	1		F52	0
0127		Protection	0 to 1	1		F53	0
0128	df/dt	Integration time (number of cycles for calculation of the average df/dt)	1 - 200	1		F1	1
0129		Confirmations number for df/dt protection	2 or 4	2		F1	4
012A	Frequency	Under voltage blocking threshold (U<Blk) for frequency elements	to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
012B	du/dt	Confirmations number	2 to 4	1		F1	4
012C	df/dt	Inhib. Block. df/dt>20 Hz/s	0 – 1	1		F24	0
012D – 012E		Reserved					
12F	Output relays	Fail safe relays	0 – 255	1		F114	0
	Communication						
0130		Baud rate	0 to 7	1	-	F4	6 = 19200 bauds
0131		Parity	0 to 2	1	-	F5	0 = without
0132		Reserved					
0133		Number of stop bits	0 to 1	1	-	F29	0 = 1 stop bit

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0134		Comm. available	0 to 1	1	-	F30	1 = COM available
0135		Date Format	0 to 1	1		F33	
0136		Reserved					
0137		Rear port address	1 to 255	1			1
0138-013F		Relay description (Courier)	32-127	1		F10	
0140	Setting group	Active setting group	1 to 2 (P922/P923) 1 (P921)	1	-	F1	1
0141		Validation of instantaneous self resetting	0 to 1	1		F1	0
0142		Configuration of the change of the setting group	0 to 1	1		F60	0
0143		Configuration of Battery and RAM error alarms	0 to 1	1		F1	0
0144	Alarms inhib	U> alarm	0 – 1	1		F24	0
0145		U>> alarm	0 – 1	1		F24	0
0146		U>>> alarm	0 – 1	1		F24	0
0147		Reserved					
0148	Output Relays	du/dt1	0 – 127	1		F14	0
0149		du/dt2	0 – 127	1		F14	0
014A		du/dt3	0 – 127	1		F14	0
014B		du/dt4	0 – 127	1		F14	0
014C – 014F		Do not use					
0150	Leds configuration	Led 5, part 1		1	-	F19a	0
0151		Led 6, part 1		1	-	F19a	0
0152		Led 7, part 1		1	-	F19a	0
0153		Led 8, part 1		1		F19a	0
0154		Led 5, part 2		1		F19b	0
0155		Led 6, part 2		1		F19b	0
0156		Led 7, part 2		1		F19b	0
0157		Led 8, part 2		1		F19b	0
0158		Led 5, part 3		1		F19c	0
0159		Led 6, part 3		1		F19c	0
015A		Led 7, part 3		1		F19c	0
015B		Led 8, part 3		1		F19c	0
015C		Led 5, part 4		1		F19d	0
015D		Led 6, part 4		1		F19d	0
015E		Led 7, part 4		1		F19d	0
015F		Led 8, part 4		1		F19d	0
0160	Logic inputs configuration	Logic input 1	VTA		-	F15a	0
0161		Logic input 2	VTA		-	F15a	0
0162		Logic input 3 (P922-P923)	VTA		-	F15a	0
0163		Logic input 4 (P922-P923)	VTA		-	F15a	0
0164		Logic input 5 (P922-P923)	VTA		-	F15a	0
0165	Output relays (RL2 to RL8)	df/dt1	0 to 127	1	-	F14	0
0166		df/d2	0 to 127	1	-	F14	0
0167		df/dt3	0 to 127	1	-	F14	0
0168		df/dt4	0 to 127	1	-	F14	0
0169		df/dt5	0 to 127	1	-	F14	0
016A		df/dt6	0 to 127	1	-	F14	0
016B – 016F		Do not use					

Address	Group	Description	Settings range	Step	Unit	Format	Default settings	Product		
								P921	P922	P923
0170	Output relays (RL2 to RL8)	Trip	0 - 7 or 0 – 127	1	-	F14	0	X	X	X
0171		Closing order	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0172		tV<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0173		tV<<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0174		tV<<<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0175		tV>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0176		tV>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0177		tV>>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0178		tVo>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0179		tVo>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017A		tVo>>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017B		V<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017C		V<<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017D		V<<<	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017E		V>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
017F		V>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0180		V>>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0181		Vo>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0182		Vo>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0183		Vo>>>	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0184		tAux 1	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0185		tAux 2	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
0186		tV2>	0 - 7 or 0 - 127	1	-	F14	0		X	X
0187		V2>>	0 - 7 or 0 – 127	1	-	F14	0		X	X
0188		tV1<	0 - 7 or 0 - 127	1	-	F14	0		X	X
0189		tV1<<	0 - 7 or 0 - 127	1	-	F14	0		X	X
018A		tf1	0 - 7 or 0 - 127	1	-	F14	0		X	X
018B		tf2	0 - 7 or 0 - 127	1	-	F14	0		X	X
018C		tf3	0 - 7 or 0 - 127	1	-	F14	0		X	X
018D		tf4	0 - 7 or 0 - 127	1	-	F14	0		X	X
018E		tf5	0 - 7 or 0 - 127	1	-	F14	0		X	X
018F		tf6	0 - 7 or 0 - 127	1	-	F14	0		X	X
0190		V2>	0 - 7 or 0 - 127	1	-	F14	0		X	X
0191		V2>>	0 - 7 or 0 - 127	1	-	F14	0		X	X
0192		V1<	0 - 7 or 0 - 127	1	-	F14	0		X	X

Address	Group	Description	Settings range	Step	Unit	Format	Default settings	Product		
								P921	P922	P923
0193		V1<<	0 - 7 or 0 - 127	1	-	F14	0		X	X
0194		f1	0 - 7 or 0 - 127	1	-	F14	0		X	X
0195		f2	0 - 7 or 0 - 127	1	-	F14	0		X	X
0196		f3	0 - 7 or 0 - 127	1	-	F14	0		X	X
0197		f4	0 - 7 or 0 - 127	1	-	F14	0		X	X
0198		f5	0 - 7 or 0 - 127	1	-	F14	0		X	X
0199		f6	0 - 7 or 0 - 127	1	-	F14	0		X	X
019A		CB alarms of operations, closing time, operating time	0 - 7 or 0 - 127	1	-	F14	0		X	X
019B		Frequency out of range	0 - 7 or 0 - 127	1	-	F14	0		X	X
019C		CB failure	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
019D		Boolean equation A	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
019E		Boolean equation B	0 - 7 or 0 - 127	1	-	F14	0	X	X	X
019F		Boolean equation C	0 - 127			F14		X	X	X
01A0		Boolean equation D	0 - 127			F14		X	X	X
01A1		Active group	0 - 127			F14			X	X
01A2 – 01CC		Do not use								
01CD		Trip configuration, part 3	0 to 3FF or FFFF	1		F7b	0		X	X
01CE		Latched functions (3)	0 to 1FFF or 7FFF	1	-	F7b	0		X	X
01CF		Reserved								
01D0	Automat. ctrl	Trip configuration, part 1	0 to 1FFF or 7FFF	1	-	F6	0	X	X	X
01D1		Trip configuration, part 2	0 to 3FF or FFFF			F7a	0		X	X
01D2		Latched functions (1)	0 to 1FFF or 7FFF	1	-	F6	0	X	X	X
01D3		Latched functions (2)	0 to 3FF or FFFF			F7a	0		X	X
01D4		Blocking logic 1, part 1	0 to 1FFF	1	-	F8a	0	X	X	X
01D5		Blocking logic 1, part 2	0 to 3FF or FFFF			F7a	0		X	X
01D6		Blocking logic 2, part 1	0 to 1FFF	1	-	F8a	0	X	X	X
01D7		Blocking logic 2, part 2	0 to 3FF or FFFF			F7a	0		X	X
01D8		Do not use								
01D9		Do not use								
01DA		Do not use								
01DB		Do not use								
01DC		Auxiliary timer 1	0 to 20000	1	1/100 sec	F1	0	X	X	X
01DD		Auxiliary timer 2	0 to 20000	1	1/100 sec	F1	0	X	X	X
01DE		Reserved						X	X	X
01DF		Frequency disturbance record (Trigger configuration)	0-2	1		F57	0			X
01E0	Disturbance records	Pre-time	1 to 29 1 to 29 1 to 49 1 to 69 1 to 89	1	1/10 sec	F1	1		X	X
01E1		Do not use								
01E2		Disturbance record (Trigger Configuration)	0 to 1	1	-	F32	0		X	X

Address	Group	Description	Settings range	Step	Unit	Format	Default settings	Product		
								P921	P922	P923
01E3	CB supervision	Number of operations	0-1	1	-	F24	0		X	X
01E4		Max number of the CB operation	0 - 50000	1	-	F1	0		X	X
01E5		Supervision of the operating time	0-1	1	-	F24	0		X	X
01E6		Max operating time	10 to 500	5	1/100 sec	F1	10		X	X
01E7		Supervision of the closing time	0-1	1	-	F24	0		X	X
01E8		Max closing time	10 to 500	5	1/100 sec	F1	10		X	X
01E9		Time period for average/max values	5 to 60	VTA	min	F42	5		X	X
01EA		Tripping pulse	10 to 500	5	1/100 sec	F1	10	X	X	X
01EB		Closing pulse	10 to 500	5	1/100	F1	10	X	X	X
01EC		Do not use								
01ED		Do not use								
01EE		Do not use								
01EF		Do not use								
01F0	Output Relays	Logic input 1	0 – 127	1		F14	0	X	X	X
01F1		Logic input 2	0 – 127	1		F14	0	X	X	X
01F2		Logic input 3	0 – 127	1		F14	0		X	X
01F3		Logic input 4	0 – 127	1		F14	0		X	X
01F4		Logic input 5	0 – 127	1		F14	0		X	X
01F5 – 01F9		Do not use								
01FA	Alarms inhib.	du/dt1	0 – 1	1		F24	0			X
01FB		du/dt2	0 – 1	1		F24	0			X
01FC		du/dt3	0 – 1	1		F24	0			X
01FD		du/dt4	0 – 1	1		F24	0			X
01FE		Reserve								
01FF		Reserve								

1.7.4 Page 2: Protective functions - Remote settings for group 1.

1.7.4.1 Undervoltage protection (P921- P922 and P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0200	Setting group n°1	V< configuration	0-2	1	-	F55	0
0201		Threshold	V< 50 to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
0202		Type of temporisation	0 to 1	1	-	F27	0
0203		TMS value for V<	5 to 1000	5	1/10	F1	10
0204		tRESET temporisation	0 to 10000	1	1/100 s	F1	10
0205		V< temporisation	0 to 59999	1	1/100 s	F1	4
0206		Inhibition U< by 52a	0 – 1	1		F24	0
0207 to 020F		Reserved					0
0210		V<< configuration	0-2	1	-	F55	0
0211		Threshold V<<	50 to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
0212		V<< temporisation	0 to 59999	1	1/100 s	F1	1
0213		Inhibition U<< by 52a	0 – 1	1		F24	0
0214 to 021F		Reserved					0
0220		V<<< configuration	0-2	1	-	F55	0
0221		Threshold V<<<	50 to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
0222		V<<< temporisation	0 to 59999	1	1/100 s	F1	1
0223		Inhibition U<<< by 52a	0 – 1	1		F24	0
0224 to 022E		Reserved					0
022F		V< Hysteresis	102 to 105	1	% or 1/100	F1	102

1.7.4.2 Overvoltage protection (P921 -P922 and P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0230		V> configuration	0-2	1	-	F55	0
0231		Threshold V>	50 to 2000 or 200 to 7200	1 or 5	V/10	F1	1300 or 4800
0232		Type of temporisation	0 to 1	1	-	F27	0
0233		TMS value for V>	5 to 1000	5	1/10	F1	10
0234		tRESET temporisation	0 to 10000	1	1/100 s	F1	1
0235		V> temporisation	0 to 59999	1	1/100 s	F1	4
0236 to 023F		Reserved					0
0240		V>> configuration	0-2	1	-	F55	0
0241		Threshold V>>	50 to 2600 or 200 to 9600	1 or 5	V/10	F1	1300 or 4800
0242		V>> temporisation	0 to 59999	1	1/100 s	F1	1
0243 to 024F		Reserved					0
0250		V>>> configuration	0-2	1	-	F55	0
0251		Threshold V>>>	50 to 2600 or 200 to 9600	1 or 5	V/10	F1	1300 or 4800
0252		V>>> temporisation	0 to 59999	1	1/100 s	F1	1
0253 to 025E		Reserved					0
025F		V> Hysteresis	95 to 98	1	% or 1/100	F1	98

1.7.4.3 Zero sequence overvoltage protection (P921- P922 and P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0260		Vo> configuration	0-1	1	-	F24	0
0261		Threshold Vo>	5 to 1300 or 20 to 4800	1 or 5	V/10	F1	50 or 200
0262		Type of temporisation	0 to 1	1	-	F27	0
0263		TMS value for Vo>	5 to 1000	5	1/10	F1	10
0264		tRESET temporisation	0 to 10000	1	1/100 s	F1	1
0265		Vo> temporisation	0 to 59999	1	1/100 s	F1	4
0266 to 026F		Reserved					0
0270		Vo>> configuration	0-1	1	-	F24	0
0271		Threshold Vo>>	5 to 1300 or 20 to 4800	1 or 5	V/10	F1	50 or 200
0272		Vo>> temporisation	0 to 59999	1	1/100 s	F1	4
0273 to 027F		Reserved					0
0280		Vo>>> configuration	0-1	1	-	F24	0
0281		Threshold Vo>>>	5 to 1300 or 20 to 4800	1 or 5	V/10	F1	50 or 200
0282		Vo>>> temporisation	0 to 59999	1	1/100 s	F1	4
0283 to 028F		Reserved					0

1.7.4.4 Negative sequence overvoltage protection (P922- P923) and F + df/dt protection (P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
0290		V2> configuration	0-1	1	-	F24	0
0291		Threshold V2>	50 to 2000 or 200 to 7200	1 or 5	V/10	F1	1300 or 4800
0292		Type of temporisation	0 to 1	1	-	F27	0
0293		TMS value for V2>	5 to 1000	5	1/10	F1	10
0294		tRESET temporisation	0 to 10000	1	1/100 s	F1	1
0295		V2> temporisation	0 to 59999	1	1/100 s	F1	4
0296 to 029F		Reserved					0
02A0		V2>> configuration	0-1	1	-	F24	0

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02A1		Threshold V2>>	50 to 2000 or 200 to 7200	1 or 5	V/10	F1	1300 or 4800
02A2		V2>> temporisation	0 to 59999	1	1/100 s	F1	4
02A3 to 02AF		Reserved					0

1.7.4.5 Positive sequence undervoltage protection (P922 – P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02B0		V1< configuration	0-1	1	-	F24	0
02B1		Threshold V1<	50 to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
02B2		Type of temporisation	0 to 1	1	-	F27	0
02B3		TMS value V1<	5 to 1000	5	1/10	F1	10
02B4		tRESET temporisation	0 to 10000	1	1/100 s	F1	1
02B5		V1< temporisation	0 to 59999	1	1/100 s	F1	4
02B6 to 02BF		Reserved					0
02C0		V1<< configuration	0-1	1	-	F24	0
02C1		Threshold V1<<	50 to 1300 or 200 to 4800	1 or 5	V/10	F1	50 or 200
02C2		V1<< temporisation	0 to 59999	1	1/100 s	F1	4

1.7.4.6 V0 derived voltage protection (P922 – P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02C3	V0 derived	V0der> activation	0 – 1	1	-	F24	0
02C4		V0der> threshold	A: 5 – 1300 B: 20 – 4800	1 5	1/10 V	F1	A: 50 B: 200
02C5		V0der> Delay type	0 – 1	1		F27	0
02C6		TMS	5 – 1000	5	1/10	F1	10
02C7		t Reset V0der>	0 – 10000	1	1/100 s	F1	1
02C8		t V0der>	0 – 59999	1	1/100 s	F1	4
02C9		V0der>> activation	0 – 1	1	-	F24	0
02CA		V0der>> threshold	A: 5 – 1300 B: 20 – 4800	1 5	1/10 V	F1	A: 50 B: 200
02CB		t V0der>>	0 – 59999	1	1/100 s	F1	4
02CC		V0der>>> activation	0 – 1	1	-	F24	0
02CD		V0der>>> threshold	A: 5 – 1300 B: 20 – 4800	1 5	1/10 V	F1	A: 50 B: 200
02CE		t V0der>>>	0 – 59999	1	1/100 s	F1	4
02CF		Reserved					0

1.7.4.7 Under/overfrequency (P922 – P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02D0		f1	0-2	1	-	F56	0
02D1		Threshold f1	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02D2		f1 temporisation	0 to 59999	1	1/100 s	F1	4
02D3		f2	0-2	1	-	F56	0
02D4		Threshold f2	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02D5		f2 temporisation	0 to 59999	1	1/100 s	F1	4
02D6		f3	0-2	1	-	F56	0
02D7		Threshold f3	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02D8		f3 temporisation	0 to 59999	1	1/100 s	F1	4
02D9		f4	0-2	1	-	F56	0

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02DA		Threshold f4	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02DB		f4 temporisation	0 to 59999	1	1/100 s	F1	4
02DC		f5	0-2	1	-	F56	0
02DD		Threshold f5	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02DE		f5 temporisation	0 to 59999	1	1/100 s	F1	4
02DF		f6	0-2	1	-	F56	0
02E0		Threshold f6	4000 to 6000 if fn= 50Hz 5000 to 7000 if fn= 60Hz	1	1/100 Hz	F1	5000 or 6000
02E1		f6 temporisation	0 to 59999	1	1/100 s	F1	4

1.7.4.8 Rate of change of frequency (Only MiCOM P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02E2		df/dt1	0-1	1		F24	0
02E3		df/dt1 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02E4		df/dt2	0-1	1		F24	0
02E5		df/dt2 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02E6		df/dt3	0-1	1		F24	0
02E7		df/dt3 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02E8		df/dt4	0-1	1		F24	0
02E9		df/dt4 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02EA		df/dt5	0-1	1		F24	0
02EB		df/dt5 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02EC		df/dt6	0-1	1		F24	0
02ED		df/dt6 threshold	-100 to 100	1	1/10 Hz/s	F2	10
02EE to 02EF		Reserved					

1.7.4.9 Rate of change of Voltage (Only MiCOM P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02F0		du/dt1 activation	0 - 4	1		F62	0
02F1		du/dt1 U threshold	+/- 10 à +/- 2000 +/-40 à +/- 7200	5	1/10 V	F2	A: 100 B: 400
02F2		du/dt1 U threshold	10 à 1000	1	1/100 s	F1	100
02F3		du/dt2 activation	0 - 4	1		F62	0
02F4		du/dt2 U threshold	+/- 10 à +/- 2000 ou +/-40 à +/- 7200	5	1/10 V	F2	A: 100 B: 400
02F5		du/dt2 U threshold	10 à 1000	1	1/100 s	F1	100
02F6		du/dt3 activation	0 - 4	1		F62	0
02F7		du/dt3 U threshold	+/- 10 à +/- 2000 ou +/-40 à +/- 7200	5	1/10 V	F2	A: 100 B: 400
02F8		du/dt3 U threshold	10 à 1000	1	1/100 s	F1	100
02F9		du/dt4 activation	0 - 4	1		F62	0
02FA		du/dt4 U threshold	+/- 10 à +/- 2000 ou +/-40 à +/- 7200	5	1/10 V	F2	A: 100 B: 400
02FB		du/dt4 U threshold	10 à 1000	1	1/100 s	F1	100

1.7.4.10 Voltage balance (Only MiCOM P923)

Address	Group	Description	Settings range	Step	Unit	Format	Default settings
02FC	Voltage balance	Voltage balance activation K<	0-1	1		F24	0
02FD		Voltage balance threshold K<	50 - 100	1	0.01	F1	50
02FE - 2FF		Reserved					

1.7.5 Page 3: Protective functions - Remote settings for group 2.

Access in reading and in writing.

The same as page 2H except addresses are 03XX instead of 02XX.

1.7.6 Page 4: Remote commands

Writing only access

Address	Group	Description	Values range	Step	Unit	Format	Default settings
0400	Remote control	Remote control word 1	0 to FFFF	1	-	F9	0
0401		Reserved					
0402		Remote control of output relays in maintenance mode	0 to 511	1		F39	0
0403		Remote control word 3	0 to 8191		-	F46	0
0404		Not used					
0405		Keyboard remote control	Binary	1		F74	0

1.7.7 Pages 5: Boolean equations

Address (hex)	Group	Description	Values range	Step	Unit	Format	Def. Value
0500	Bool Equations	Equation A.00 operator	0 - 1	1		F70	0
0501		Equation A.00 operand	0 - 52h	1		F72	0
0502		Equation A.01 operator	0 - 3	1		F71	0
0503		Equation A.01 operand	0 - 52h	1		F72	0
0504		Equation A.02 operator	0 - 3	1		F71	0
0505		Equation A.02 operand	0 - 52h	1		F72	0
0506		Equation A.03 operator	0 - 3	1		F71	0
0507		Equation A.03 operand	0 - 52h	1		F72	0
0508		Equation A.04 operator	0 - 3	1		F71	0
0509		Equation A.04 operand	0 - 52h	1		F72	0
050A		Equation A.05 operator	0 - 3	1		F71	0
050B		Equation A.05 operand	0 - 52h	1		F72	0
050C		Equation A.06 operator	0 - 3	1		F71	0
050D		Equation A.06 operand	0 - 52h	1		F72	0
050E		Equation A.07 operator	0 - 3	1		F71	0
050F		Equation A.07 operand	0 - 52h	1		F72	0
0510		Equation A.08 operator	0 - 3	1		F71	0
0511		Equation A.08 operand	0 - 52h	1		F72	0
0512		Equation A.09 operator	0 - 3	1		F71	0
0513		Equation A.09 operand	0 - 52h	1		F72	0
0514		Equation A.10 operator	0 - 3	1		F71	0
0515		Equation A.10 operand	0 - 52h	1		F72	0
0516		Equation A.11 operator	0 - 3	1		F71	0
0517		Equation A.11 operand	0 - 52h	1		F72	0
0518		Equation A.12 operator	0 - 3	1		F71	0
0519		Equation A.12 operand	0 - 52h	1		F72	0
051A		Equation A.13 operator	0 - 3	1		F71	0
051B		Equation A.13 operand	0 - 52h	1		F72	0
051C		Equation A.14 operator	0 - 3	1		F71	0
051D		Equation A.14 operand	0 - 52h	1		F72	0
051E		Equation A.15 operator	0 - 3	1		F71	0

Address (hex)	Group	Description	Values range	Step	Unit	Format	Def. Value
051F		Equation A.15 operand	0 - 52h	1		F72	0
0520		Equation B.00 operator	0 - 1	1		F70	0
0521		Equation B.00 operand	0 - 52h	1		F72	0
0522		Equation B.01 operator	0 - 3	1		F71	0
0523		Equation B.01 operand	0 - 52h	1		F72	0
0524		Equation B.02 operator	0 - 3	1		F71	0
0525		Equation B.02 operand	0 - 52h	1		F72	0
0526		Equation B.03 operator	0 - 3	1		F71	0
0527		Equation B.03 operand	0 - 52h	1		F72	0
0528		Equation B.04 operator	0 - 3	1		F71	0
0529		Equation B.04 operand	0 - 52h	1		F72	0
052A		Equation B.05 operator	0 - 3	1		F71	0
052B		Equation B.05 operand	0 - 52h	1		F72	0
052C		Equation B.06 operator	0 - 3	1		F71	0
052D		Equation B.06 operand	0 - 52h	1		F72	0
052E		Equation B.07 operator	0 - 3	1		F71	0
052F		Equation B.07 operand	0 - 52h	1		F72	0
0530		Equation B.08 operator	0 - 3	1		F71	0
0531		Equation B.08 operand	0 - 52h	1		F72	0
0532		Equation B.09 operator	0 - 3	1		F71	0
0533		Equation B.09 operand	0 - 52h	1		F72	0
0534		Equation B.10 operator	0 - 3	1		F71	0
0535		Equation B.10 operand	0 - 52h	1		F72	0
0536		Equation B.11 operator	0 - 3	1		F71	0
0537		Equation B.11 operand	0 - 52h	1		F72	0
0538		Equation B.12 operator	0 - 3	1		F71	0
0539		Equation B.12 operand	0 - 52h	1		F72	0
053A		Equation B.13 operator	0 - 3	1		F71	0
053B		Equation B.13 operand	0 - 52h	1		F72	0
053C		Equation B.14 operator	0 - 3	1		F71	0
053D		Equation B.14 operand	0 - 52h	1		F72	0
053E		Equation B.15 operator	0 - 3	1		F71	0
053F		Equation B.15 operand	0 - 52h	1		F72	0
0540		Equation C.00 operator	0 - 1	1		F70	0
0541		Equation C.00 operand	0 - 52h	1		F72	0
0542		Equation C.01 operator	0 - 3	1		F71	0
0543		Equation C.01 operand	0 - 52h	1		F72	0
0544		Equation C.02 operator	0 - 3	1		F71	0
0545		Equation C.02 operand	0 - 52h	1		F72	0
0546		Equation C.03 operator	0 - 3	1		F71	0
0547		Equation C.03 operand	0 - 52h	1		F72	0
0548		Equation C.04 operator	0 - 3	1		F71	0
0549		Equation C.04 operand	0 - 52h	1		F72	0
054A		Equation C.05 operator	0 - 3	1		F71	0
054B		Equation C.05 operand	0 - 52h	1		F72	0
054C		Equation C.06 operator	0 - 3	1		F71	0
054D		Equation C.06 operand	0 - 52h	1		F72	0
054E		Equation C.07 operator	0 - 3	1		F71	0
054F		Equation C.07 operand	0 - 52h	1		F72	0
0550		Equation C.08 operator	0 - 3	1		F71	0
0551		Equation C.08 operand	0 - 52h	1		F72	0
0552		Equation C.09 operator	0 - 3	1		F71	0
0553		Equation C.09 operand	0 - 52h	1		F72	0
0554		Equation C.10 operator	0 - 3	1		F71	0
0555		Equation C.10 operand	0 - 52h	1		F72	0
0556		Equation C.11 operator	0 - 3	1		F71	0
0557		Equation C.11 operand	0 - 52h	1		F72	0
0558		Equation C.12 operator	0 - 3	1		F71	0
0559		Equation C.12 operand	0 - 52h	1		F72	0
055A		Equation C.13 operator	0 - 3	1		F71	0
055B		Equation C.13 operand	0 - 52h	1		F72	0
055C		Equation C.14 operator	0 - 3	1		F71	0
055D		Equation C.14 operand	0 - 52h	1		F72	0
055E		Equation C.15 operator	0 - 3	1		F71	0
055F		Equation C.15 operand	0 - 52h	1		F72	0
0560		Equation D.00 operator	0 - 1	1		F70	0

Address (hex)	Group	Description	Values range	Step	Unit	Format	Def. Value
0561		Equation D.00 operand	0 - 52h	1		F72	0
0562		Equation D.01 operator	0 - 3	1		F71	0
0563		Equation D.01 operand	0 - 52h	1		F72	0
0564		Equation D.02 operator	0 - 3	1		F71	0
0565		Equation D.02 operand	0 - 52h	1		F72	0
0566		Equation D.03 operator	0 - 3	1		F71	0
0567		Equation D.03 operand	0 - 52h	1		F72	0
0568		Equation D.04 operator	0 - 3	1		F71	0
0569		Equation D.04 operand	0 - 52h	1		F72	0
056A		Equation D.05 operator	0 - 3	1		F71	0
056B		Equation D.05 operand	0 - 52h	1		F72	0
056C		Equation D.06 operator	0 - 3	1		F71	0
056D		Equation D.06 operand	0 - 52h	1		F72	0
056E		Equation D.07 operator	0 - 3	1		F71	0
056F		Equation D.07 operand	0 - 52h	1		F72	0
0570		Equation D.08 operator	0 - 3	1		F71	0
0571		Equation D.08 operand	0 - 52h	1		F72	0
0572		Equation D.09 operator	0 - 3	1		F71	0
0573		Equation D.09 operand	0 - 52h	1		F72	0
0574		Equation D.10 operator	0 - 3	1		F71	0
0575		Equation D.10 operand	0 - 52h	1		F72	0
0576		Equation D.11 operator	0 - 3	1		F71	0
0577		Equation D.11 operand	0 - 52h	1		F72	0
0578		Equation D.12 operator	0 - 3	1		F71	0
0579		Equation D.12 operand	0 - 52h	1		F72	0
057A		Equation D.13 operator	0 - 3	1		F71	0
057B		Equation D.13 operand	0 - 52h	1		F72	0
057C		Equation D.14 operator	0 - 3	1		F71	0
057D		Equation D.14 operand	0 - 52h	1		F72	0
057E		Equation D.15 operator	0 - 3	1		F71	0
057F		Equation D.15 operand	0 - 52h	1		F72	0
0580		Equation E.00 operator	0 - 1	1		F70	0
0581		Equation E.00 operand	0 - 52h	1		F72	0
0582		Equation E.01 operator	0 - 3	1		F71	0
0583		Equation E.01 operand	0 - 52h	1		F72	0
0584		Equation E.02 operator	0 - 3	1		F71	0
0585		Equation E.02 operand	0 - 52h	1		F72	0
0586		Equation E.03 operator	0 - 3	1		F71	0
0587		Equation E.03 operand	0 - 52h	1		F72	0
0588		Equation E.04 operator	0 - 3	1		F71	0
0589		Equation E.04 operand	0 - 52h	1		F72	0
058A		Equation E.05 operator	0 - 3	1		F71	0
058B		Equation E.05 operand	0 - 52h	1		F72	0
058C		Equation E.06 operator	0 - 3	1		F71	0
058D		Equation E.06 operand	0 - 52h	1		F72	0
058E		Equation E.07 operator	0 - 3	1		F71	0
058F		Equation E.07 operand	0 - 52h	1		F72	0
0590		Equation E.08 operator	0 - 3	1		F71	0
0591		Equation E.08 operand	0 - 52h	1		F72	0
0592		Equation E.09 operator	0 - 3	1		F71	0
0593		Equation E.09 operand	0 - 52h	1		F72	0
0594		Equation E.10 operator	0 - 3	1		F71	0
0595		Equation E.10 operand	0 - 52h	1		F72	0
0596		Equation E.11 operator	0 - 3	1		F71	0
0597		Equation E.11 operand	0 - 52h	1		F72	0
0598		Equation E.12 operator	0 - 3	1		F71	0
0599		Equation E.12 operand	0 - 52h	1		F72	0
059A		Equation E.13 operator	0 - 3	1		F71	0
059B		Equation E.13 operand	0 - 52h	1		F72	0
059C		Equation E.14 operator	0 - 3	1		F71	0
059D		Equation E.14 operand	0 - 52h	1		F72	0
059E		Equation E.15 operator	0 - 3	1		F71	0
059F		Equation E.15 operand	0 - 52h	1		F72	0
05A0		Equation F.00 operator	0 - 1	1		F70	0
05A1		Equation F.00 operand	0 - 52h	1		F72	0
05A2		Equation F.01 operator	0 - 3	1		F71	0

Address (hex)	Group	Description	Values range	Step	Unit	Format	Def. Value
05A3		Equation F.01 operand	0 - 52h	1		F72	0
05A4		Equation F.02 operator	0 - 3	1		F71	0
05A5		Equation F.02 operand	0 - 52h	1		F72	0
05A6		Equation F.03 operator	0 - 3	1		F71	0
05A7		Equation F.03 operand	0 - 52h	1		F72	0
05A8		Equation F.04 operator	0 - 3	1		F71	0
05A9		Equation F.04 operand	0 - 52h	1		F72	0
05AA		Equation F.05 operator	0 - 3	1		F71	0
05AB		Equation F.05 operand	0 - 52h	1		F72	0
05AC		Equation F.06 operator	0 - 3	1		F71	0
05AD		Equation F.06 operand	0 - 52h	1		F72	0
05AE		Equation F.07 operator	0 - 3	1		F71	0
05AF		Equation F.07 operand	0 - 52h	1		F72	0
05B0		Equation F.08 operator	0 - 3	1		F71	0
05B1		Equation F.08 operand	0 - 52h	1		F72	0
05B2		Equation F.09 operator	0 - 3	1		F71	0
05B3		Equation F.09 operand	0 - 52h	1		F72	0
05B4		Equation F.10 operator	0 - 3	1		F71	0
05B5		Equation F.10 operand	0 - 52h	1		F72	0
05B6		Equation F.11 operator	0 - 3	1		F71	0
05B7		Equation F.11 operand	0 - 52h	1		F72	0
05B8		Equation F.12 operator	0 - 3	1		F71	0
05B9		Equation F.12 operand	0 - 52h	1		F72	0
05BA		Equation F.13 operator	0 - 3	1		F71	0
05BB		Equation F.13 operand	0 - 52h	1		F72	0
05BC		Equation F.14 operator	0 - 3	1		F71	0
05BD		Equation F.14 operand	0 - 52h	1		F72	0
05BE		Equation F.15 operator	0 - 3	1		F71	0
05BF		Equation F.15 operand	0 - 52h	1		F72	0
05C0		Equation G.00 operator	0 - 1	1		F70	0
05C1		Equation G.00 operand	0 - 52h	1		F72	0
05C2		Equation G.01 operator	0 - 3	1		F71	0
05C3		Equation G.01 operand	0 - 52h	1		F72	0
05C4		Equation G.02 operator	0 - 3	1		F71	0
05C5		Equation G.02 operand	0 - 52h	1		F72	0
05C6		Equation G.03 operator	0 - 3	1		F71	0
05C7		Equation G.03 operand	0 - 52h	1		F72	0
05C8		Equation G.04 operator	0 - 3	1		F71	0
050C9		Equation G.04 operand	0 - 52h	1		F72	0
05CA		Equation G.05 operator	0 - 3	1		F71	0
05CB		Equation G.05 operand	0 - 52h	1		F72	0
05CC		Equation G.06 operator	0 - 3	1		F71	0
05CD		Equation G.06 operand	0 - 52h	1		F72	0
05CE		Equation G.07 operator	0 - 3	1		F71	0
05CF		Equation G.07 operand	0 - 52h	1		F72	0
05D0		Equation G.08 operator	0 - 3	1		F71	0
05D1		Equation G.08 operand	0 - 52h	1		F72	0
05D2		Equation G.09 operator	0 - 3	1		F71	0
05D3		Equation G.09 operand	0 - 52h	1		F72	0
05D4		Equation G.10 operator	0 - 3	1		F71	0
05D5		Equation G.10 operand	0 - 52h	1		F72	0
05D6		Equation G.11 operator	0 - 3	1		F71	0
05D7		Equation G.11 operand	0 - 52h	1		F72	0
05D8		Equation G.12 operator	0 - 3	1		F71	0
05D9		Equation G.12 operand	0 - 52h	1		F72	0
05DA		Equation G.13 operator	0 - 3	1		F71	0
05DB		Equation G.13 operand	0 - 52h	1		F72	0
05DC		Equation G.14 operator	0 - 3	1		F71	0
05DD		Equation G.14 operand	0 - 52h	1		F72	0
05DE		Equation G.15 operator	0 - 3	1		F71	0
05DF		Equation G.15 operand	0 - 52h	1		F72	0
05E0		Equation H.00 operator	0 - 1	1		F70	0
05E1		Equation H.00 operand	0 - 52h	1		F72	0
05E2		Equation H.01 operator	0 - 3	1		F71	0
05E3		Equation H.01 operand	0 - 52h	1		F72	0
05E4		Equation H.02 operator	0 - 3	1		F71	0

Address (hex)	Group	Description	Values range	Step	Unit	Format	Def. Value
05E5		Equation H.02 operand	0 - 52h	1		F72	0
05E6		Equation H.03 operator	0 - 3	1		F71	0
05E7		Equation H.03 operand	0 - 52h	1		F72	0
05E8		Equation H.04 operator	0 - 3	1		F71	0
05E9		Equation H.04 operand	0 - 52h	1		F72	0
05EA		Equation H.05 operator	0 - 3	1		F71	0
05EB		Equation H.05 operand	0 - 52h	1		F72	0
05EC		Equation H.06 operator	0 - 3	1		F71	0
05ED		Equation H.06 operand	0 - 52h	1		F72	0
05EE		Equation H.07 operator	0 - 3	1		F71	0
05EF		Equation H.07 operand	0 - 52h	1		F72	0
05F0		Equation H.08 operator	0 - 3	1		F71	0
05F1		Equation H.08 operand	0 - 52h	1		F72	0
05F2		Equation H.09 operator	0 - 3	1		F71	0
05F3		Equation H.09 operand	0 - 52h	1		F72	0
05F4		Equation H.10 operator	0 - 3	1		F71	0
05F5		Equation H.10 operand	0 - 52h	1		F72	0
05F6		Equation H.11 operator	0 - 3	1		F71	0
05F7		Equation H.11 operand	0 - 52h	1		F72	0
05F8		Equation H.12 operator	0 - 3	1		F71	0
05F9		Equation H.12 operand	0 - 52h	1		F72	0
05FA		Equation H.13 operator	0 - 3	1		F71	0
05FB		Equation H.13 operand	0 - 52h	1		F72	0
05FC		Equation H.14 operator	0 - 3	1		F71	0
05FD		Equation H.14 operand	0 - 52h	1		F72	0
05FE		Equation H.15 operator	0 - 3	1		F71	0
05FF		Equation H.15 operand	0 - 52h	1		F72	0

1.7.8 Pages 6: Remote settings

Read and write access

Address	Group	Description	Values	Step	Unit	For-mat	Default	Product
0600	Output relays	F1 + df/dt1	0 - 127	1	-	F14	0	P923
0601		F2 + df/dt2	0 - 127	1	-	F14	0	P923
0602		F3 + df/dt3	0 - 127	1	-	F14	0	P923
0603		F4 + df/dt4	0 - 127	1	-	F14	0	P923
0604		F5 + df/dt5	0 - 127	1	-	F14	0	P923
0605		F6 + df/dt6	0 - 127	1	-	F14	0	P923
0606		tAux 3	0 - 127	1	-	F14	0	P922-3
0607		tAux 4	0 - 127	1	-	F14	0	P922-3
0608		tAux 5	0 - 127	1	-	F14	0	P922-3
0609		tVTS	0 - 127	1	-	F14	0	P922-3
060A		V0der>	0 - 127	1	-	F14	0	P922-3
060B		tV0der>	0 - 127	1	-	F14	0	P922-3
060C		V0der>>	0 - 127	1	-	F14	0	P922-3
060D		tV0der>>	0 - 127	1	-	F14	0	P922-3
060E		V0der>>>	0 - 127	1	-	F14	0	P922-3
060F		tV0der>>>	0 - 127	1	-	F14	0	P922-3
0610		Boolean equation E	0 - 127	1	-	F14	0	P921-2-3
0611		Boolean equation F	0 - 127	1	-	F14	0	P921-2-3
0612		Boolean equation G	0 - 127	1	-	F14	0	P921-2-3
0613		Boolean equation H	0 - 127	1	-	F14	0	P921-2-3
0614	Communication orders	Communication order 1	0 - 127	1	-	F14	0	P922-3
0615		Communication order 2	0 - 127	1	-	F14	0	P922-3
0616		Communication order 3	0 - 127	1	-	F14	0	P922-3
0617		Communication order 4	0 - 127	1	-	F14	0	P922-3
0618	Output relays	Voltage Balance K1<	0 - 127	1	-	F14	0	P923
0619		Voltage Balance K2<	0 - 127	1	-	F14	0	P923
061A		Voltage Balance K3	0 - 127	1	-	F14	0	P923
061B		Voltage Balance K< Poly	0 - 127	1	-	F14	0	P923

Address	Group	Description	Values	Step	Unit	For-mat	Default	Product
061C-061F		Not used						
0685	Alarm inhibition	Voltage Balance K1<	0 – 1	1		F24	0	P923
0686		Voltage Balance K2<	0 – 1	1		F24	0	P923
0687		Voltage Balance K3<	0 – 1	1		F24	0	P923
0688	Alarm inhibition	Voltage Balance Kpoly<	0 – 1	1		F24	0	P923
0689 – 068F		Not used						
0620	LEDs config	LED 5 part 5		1		F19e	0	P922-3
0621		LED 6 part 5		1		F19e	0	P922-3
0622		LED 7 part 5		1		F19e	0	P922-3
0623		LED 8 part 5		1		F19e	0	P922-3
0624		LED 5 part 6		1		F19f	0	P921-2-3
0625		LED 6 part 6		1		F19f	0	P921-2-3
0626		LED 7 part 6		1		F19f	0	P921-2-3
0627		LED 8 part 6		1		F19f	0	P921-2-3
0628-062F		Not used						
0630	Timers values	Timer aux 3	0 – 20000	1	1/100 sec	F1	0	P922-3
0631		Timer aux 4	0 – 20000	1	1/100 sec	F1	0	P922-3
0632		Timer aux 5	0 - 20000	1	1/100 sec	F1	0	P922-3
0633-063F		Not used						
0640	Blocking logic	Blocking logic 1, part 3	0-FFFF	1		F8b	0	P922-3
0641		Blocking logic 2, part 3	0-FFFF	1		F8b	0	P922-3
0642	Trip	Trip configuration, part 4	0 to FFFF	1		F7c	0	P921-2-3
0643	Latch	Latched functions (4)	0 to FFFF	1		F7c	0	P921-2-3
0644	Disturbance records	Records number	1 – 5	1		F1	5	P922-3
0645		Not used						
0646	Communication IEC-103	GI selection	0 – 1	1		F76	0	P922-3
0647	Communication IEC-103	Type of uploaded spontaneous events	0 – 3	1		F77	0	P922-3
0648	Communication IEC-103	Type of Measurements	0 – 7	1		F78	0	P922-3
0649	Communication IEC-103	Signal & measurement / Commands blocking	0 – 3	1		F79	0	P922-3
064A – 064F		Not used						
0650	VTS	VTS activation	0 – 1	1	-	F24	0	P922-3
0651		VTS Temporization	0 - 10000	1	1/100 s	F1	500	P922-3
0652		Delta V0 threshold	A: 20 – 1300 B:100 - 4800	1	1/10 V	F1	A: 150 B: 500	P922-3
0653		Blocked functions	0 – FFh	1		F64	0	P922-3
0654		Detection mode	1 – 3	1		F65	1	P922-3
0655		Inhibition by 52a	0 – 1	1		F1	0	P922-3
0656-065F		Not used						
0660	Alarms inhibition	U<	0 – 1	1		F24	0	P921-2-3
0661		U<<	0 – 1	1		F24	0	P921-2-3
0662		U<<<	0 – 1	1		F24	0	P921-2-3
0663		tAux1	0 – 1	1		F24	0	P921-2-3
0664		tAux2	0 – 1	1		F24	0	P921-2-3
0665		tAux3	0 – 1	1		F24	0	P922-3
0666		tAux4	0 – 1	1		F24	0	P922-3
0667		tAux5	0 – 1	1		F24	0	P922-3
0668		F1	0 – 1	1		F24	0	P922-3
0669		F2	0 – 1	1		F24	0	P922-3
066A		F3	0 – 1	1		F24	0	P922-3
066B		F4	0 – 1	1		F24	0	P922-3
066C		F5	0 – 1	1		F24	0	P922-3
066D		F6	0 – 1	1		F24	0	P922-3

Address	Group	Description	Values	Step	Unit	For-mat	Default	Product
066E		df/dt1	0 – 1	1		F24	0	P923
066F		df/dt2	0 – 1	1		F24	0	P923
0670		df/dt3	0 – 1	1		F24	0	P923
0671		df/dt4	0 – 1	1		F24	0	P923
0672		df/dt5	0 – 1	1		F24	0	P923
0673		df/dt6	0 – 1	1		F24	0	P923
0674		F+df/dt1	0 – 1	1		F24	0	P923
0675		F+df/dt2	0 – 1	1		F24	0	P923
0676		F+df/dt3	0 – 1	1		F24	0	P923
0677		F+df/dt4	0 – 1	1		F24	0	P923
0678		F+df/dt5	0 – 1	1		F24	0	P923
0679		F+df/dt6	0 – 1	1		F24	0	P923
067A		Bool. equation A	0 – 1	1		F24	0	P921-2-3
067B		Bool. equation B	0 – 1	1		F24	0	P921-2-3
067C		Bool. equation C	0 – 1	1		F24	0	P921-2-3
067D		Bool. equation D	0 – 1	1		F24	0	P921-2-3
067E		Bool. equation E	0 – 1	1		F24	0	P921-2-3
067F		Bool. equation F	0 – 1	1		F24	0	P921-2-3
0680		Bool. equation G	0 – 1	1		F24	0	P921-2-3
0681		Bool. equation H	0 – 1	1		F24	0	P921-2-3
0682		Frequency out	0 – 1	1		F24	0	P922-3
0683		tVTS	0 – 1	1		F24	0	P922-3
0684		Ctrl Trip	0 – 1	1		F24	0	P922-3
0685	Alarm inhibition	Voltage Balance K1<	0 – 1	1		F24	0	P923
0686		Voltage Balance K2<	0 – 1	1		F24	0	P923
0687		Voltage Balance K3<	0 – 1	1		F24	0	P923
0688		Voltage Balance Kpoly<	0 – 1	1		F24	0	P923
0689		Confirmation number	1 - 12	1		F1	1	P922 P923
068A – 068F		Not used						
0690	Configuration	[59N] Filter activation	0 – 1	1		F24	0	P922-3
0691	Logic inputs configuration	Logic input 1	VTA			F15b	0	P922-3
0692		Logic input 2	VTA			F15b	0	P922-3
0693		Logic input 3 (P922-P923)	VTA			F15b	0	P922-3
0694		Logic input 4 (P922-P923)	VTA			F15b	0	P922-3
0695		Logic input 5 (P922-P923)	VTA			F15b	0	P922-3
0696-069F		Not used						
06A0	Boolean Equa.	Pick-up timer eq. A	0 - 360000	1	1/100 s	F1	0	P921-2-3
06A2		Drop-off timer eq. A	0 – 360000	1	1/100 s	F1	0	P921-2-3
06A4		Pick-up timer eq. B	0 – 360000	1	1/100 s	F1	0	P921-2-3
06A6		Drop-off timer eq. B	0 – 360000	1	1/100 s	F1	0	P921-2-3
06A8		Pick-up timer eq. C	0 – 360000	1	1/100 s	F1	0	P921-2-3
06AA		Drop-off timer eq. C	0 – 360000	1	1/100 s	F1	0	P921-2-3
06AC		Pick-up timer eq. D	0 – 360000	1	1/100 s	F1	0	P921-2-3
06AE		Drop-off timer eq. D	0 – 360000	1	1/100 s	F1	0	P921-2-3
06B0		Pick-up timer eq. E	0 – 360000	1	1/100 s	F1	0	P921-2-3
06B2		Drop-off timer eq. E	0 – 360000	1	1/100 s	F1	0	P921-2-3
06B4		Pick-up timer eq. F	0 – 360000	1	1/100 s	F1	0	P921-2-3
06B6		Drop-off timer eq. F	0 – 360000	1	1/100 s	F1	0	P921-2-3
06B8		Pick-up timer eq. G	0 – 360000	1	1/100 s	F1	0	P921-2-3
06BA		Drop-off timer eq. G	0 – 360000	1	1/100 s	F1	0	P921-2-3

Address	Group	Description	Values	Step	Unit	For-mat	Default	Product
06BC		Pick-up timer eq. H	0 – 360000	1	1/100 s	F1	0	P921-2-3
06BE		Drop-off timer eq. H	0 - 360000	1	1/100 s	F1	0	P921-2-3
06C0	F + df/dt	F1+df/dt1 activation	0 – 1	1	-	F24	0	P923
06C1		F2+df/dt2 activation	0 – 1	1	-	F24	0	P923
06C2		F3+df/dt3 activation	0 – 1	1	-	F24	0	P923
06C3		F4+df/dt4 activation	0 – 1	1	-	F24	0	P923
06C4		F5+df/dt5 activation	0 – 1	1	-	F24	0	P923
06C5		F6+df/dt6 activation	0 – 1	1	-	F24	0	P923
06C6-06CF		Not used						
06D0	Communication orders	tComm 1 delay	0 - 60000	1	1/100 s	F1	0	P922-3
06D1	Communication orders	tComm 2 delay	0 - 60000	1	1/100 s	F1	0	P922-3
06D2	Communication orders	tComm 3 delay	0 - 60000	1	1/100 s	F1	0	P922-3
06D3	Communication orders	tComm 4 delay	0 - 60000	1	1/100 s	F1	0	P922-3

1.7.9 Page 7: Self tests results of the relay MiCOM

Quick reading access only

Address	Group	Description	Settings group	Step	Unit	Format	Default settings
0700	Protection Status	Description of the protection autocontrols		1	-	F23	0

1.7.10 Page 8: Time synchronisation

Time synchronisation: access in writing for n words (function 16). The time synchronisation format is based on 8 bits (4 words).

Timer	@page	Nb bits	Values range	Unit
Year pF + pf	8	2		year
Month	8	1	1 - 12	month
Day	8	1	1 - 31	day
Hour	8	1	0 - 23	hour
Minute	8	1	0 - 59	minute
Millisecond pF + pf	8	2	0 - 59999	ms

1.7.11 Page 9 to 21h: Disturbance records data (25 pages) (MiCOM P922 and P923 only)

Disturbance records data (25 pages). Access in words writing, each disturbance mapping page contains 250 words.

Address	Contents	Format
0900 to 09FAh	250 disturbance data words	F101
0A00 to 0AFAh	250 disturbance data words	F101
0B00 to 0BFAh	250 disturbance data words	F101
0C00 to 0CFAh	250 disturbance data words	F101
0D00 to 0DFAh	250 disturbance data words	F101
0E00 to 0EFAh	250 disturbance data words	F101
0F00 to 0FFAh	250 disturbance data words	F101
1000 to 10FAh	250 disturbance data words	F101
1100 to 11FAh	250 disturbance data words	F101
1200 to 12FAh	250 disturbance data words	F101
1300 to 13FAh	250 disturbance data words	F101
1400 to 14FAh	250 disturbance data words	F101
1500 to 15FAh	250 disturbance data words	F101
1600 to 16FAh	250 disturbance data words	F101
1700 to 17FAh	250 disturbance data words	F101
1800 to 18FAh	250 disturbance data words	F101
1900 to 19FAh	250 disturbance data words	F101
1A00 to 1AFAh	250 disturbance data words	F101
1B00 to 1BFAh	250 disturbance data words	F101
1C00 to 1CFAh	250 disturbance data words	F101

Address	Contents	Format
1D00 to 1DFAh	250 disturbance data words	F101
1E00 to 1EFAh	250 disturbance data words	F101
1F00 to 1FFAh	250 disturbance data words	F101
2000 to 20FAh	250 disturbance data words	F101
2100 to 21FAh	250 disturbance data words	F101

N.B.:
- The disturbance data pages contain values of one channel from one given disturbance record.
- significance of the value according to the type of channel:
  VA, VB, VC = 16 bits values
  Frequency = time between 2 samples in ms
  Logic channel =
  - bit 0 = RL1 (Trip Relay)
  - bit 1 = RL2
  - bit 2 = RL3
  - bit 3 = RL4
  - bit 4 = watchdog
  - bit 5 = RL5
  - bit 6 = RL6
  - bit 7 = RL7
  - bit 8 = RL8
  - bit 9 = reserved
  - bit 10 = logic input 1
  - bit 11 = logic input 2
  - bit 12 = logic input 3
  - bit 13 = logic input 4
  - bit 14 = logic input 5
  - bit 15 = reserved

1.7.12 Page 22h: Disturbance record index frame (MiCOM P922 and P923 only)

Read access only.

Address	Contents	Format
2200h	Disturbance data index frame	F102

1.7.13 Page 35h: Events record (MiCOM P922 and P923 only)

Read access only.

Address	Contents	Format	Address	Contents	Format	Address	Contents	Format
3500h	EVT n°1	F103	3519h	EVT n°26	F103	3532h	EVT n°51	F103
3501h	EVT n°2	F103	351Ah	EVT n°27	F103	3533h	EVT n°52	F103
3502h	EVT n°3	F103	351Bh	EVT n°28	F103	3534h	EVT n°53	F103
3503h	EVT n°4	F103	351Ch	EVT n°29	F103	3535h	EVT n°54	F103
3504h	EVT n°5	F103	351Dh	EVT n°30	F103	3536h	EVT n°55	F103
3505h	EVT n°6	F103	351Eh	EVT n°31	F103	3537h	EVT n°56	F103
3506h	EVT n°7	F103	351Fh	EVT n°32	F103	3538h	EVT n°57	F103
3507h	EVT n°8	F103	3520h	EVT n°33	F103	3539h	EVT n°58	F103
3508h	EVT n°9	F103	3521h	EVT n°34	F103	353Ah	EVT n°59	F103
3509h	EVT n°10	F103	3522h	EVT n°35	F103	353Bh	EVT n°60	F103
350Ah	EVT n°11	F103	3523h	EVT n°36	F103	353Ch	EVT n°61	F103
350Bh	EVT n°12	F103	3524h	EVT n°37	F103	353Dh	EVT n°62	F103
350Ch	EVT n°13	F103	3525h	EVT n°38	F103	353Eh	EVT n°63	F103
350Dh	EVT n°14	F103	3526h	EVT n°39	F103	353Fh	EVT n°64	F103
350Eh	EVT n°15	F103	3527h	EVT n°40	F103	3540h	EVT n°65	F103
350Fh	EVT n°16	F103	3528h	EVT n°41	F103	3541h	EVT n°66	F103
3510h	EVT n°17	F103	3529h	EVT n°42	F103	3542h	EVT n°67	F103
3511h	EVT n°18	F103	352Ah	EVT n°43	F103	3543h	EVT n°68	F103
3512h	EVT n°19	F103	352Bh	EVT n°44	F103	3544h	EVT n°69	F103
3513h	EVT n°20	F103	352Ch	EVT n°45	F103	3545h	EVT n°70	F103
3514h	EVT n°21	F103	352Dh	EVT n°46	F103	3546h	EVT n°71	F103
3515h	EVT n°22	F103	352Eh	EVT n°47	F103	3547h	EVT n°72	F103
3516h	EVT n°23	F103	352Fh	EVT n°48	F103	3548h	EVT n°73	F103
3517h	EVT n°24	F103	3530h	EVT n°49	F103	3549h	EVT n°74	F103
3518h	EVT n°25	F103	3531h	EVT n°50	F103	354Ah	EVT n°75	F103

1.7.14 Page 36h: Oldest event data (MiCOM P922 and P923 only)

Read access only.

Address	Contents	Format
3600h	Most older event data	F103

1.7.15 Page 37h: 5 last fault records data (MiCOM P922 and P923 only)

Read access only.

Address	Contents	Format
3700h	Fault record values n°1	F104
3701h	Fault record values n°2	F104
3702h	Fault record values n°3	F104
3703h	Fault record values n°4	F104
3704h	Fault record values n°5	F104

1.7.16 Pages 38h to 3Ch: Selection of the disturbance record and channel (MiCOM P922 and P923 only)

Read access only.

Address	Disturbance record number	Channel	Format
38x0h	1	VA	F105
38x1h	1	VB	F105
38x2h	1	VC	F105
38x3h	1	V0	F105
38x4h	1	Frequency	F105
38x5h	1	Logic input and outputs	F105
39x0h	2	VA	F105
39x1h	2	VB	F105
39x2h	2	VC	F105
39x3h	2	V0	F105
39x4h	2	Frequency	F105
39x5h	2	Logic input and outputs	F105
3Ax0h	3	VA	F105
3Ax1h	3	VB	F105
3Ax2h	3	VC	F105
3Ax3h	3	V0	F105
3Ax4h	3	Frequency	F105
3Ax5h	3	Logic input and outputs	F105
3Bx0h	4	VA	F105
3Bx1h	4	VB	F105
3Bx2h	4	VC	F105
3Bx3h	4	V0	F105
3Bx4h	4	Frequency	F105
3Bx5h	4	Logic input and outputs	F105
3Cx0h	5	VA	F105
3Cx1h	5	VB	F105
3Cx2h	5	VC	F105
3Cx3h	5	V0	F105
3Cx4h	5	Frequency	F105
3Cx5h	5	Logic input and outputs	F105

If x = 0, the first 6250 words are selected; if x = 1, the following 6250 words are selected, and so on…

1.7.17 Page 3Dh: Number of disturbance records available (MiCOM P922 and P923 only)

Read access only.

Address	Contents	Format
3D00h	Number of disturbance records available	F106

1.7.18 Page 3Eh: Oldest fault record data (MiCOM P922 and P923 only).

Address	Contents	Format
3E00h	Oldest fault record data	F104

1.7.19 Page 40h: Status Frame of Frequency Disturbance Record (MiCOM P923 only).

Read access only

Address	Contents	Format
4000h	Status of Frequency disturbance record	F110

1.7.20 Page 41h: selection of Frequency Disturbance Record and channel (MiCOM P923 only).

Read access only

Address	Contents	Format
4100h	Average Va Vb Vc	F111
4101h	Measured period	F111
4102h	Logic inputs/outputs	F111
4103h	Sample period	F111

1.7.21 Pages 42h to 49h: Datas of Frequency Disturbance Record (MiCOM P923 only).

Read access only

Address	Contents	Format
4200 to 42FAh	250 frequency disturbance data words	F112
4300 to 43FAh	250 frequency disturbance data words	F112
4400 to 44FAh	250 frequency disturbance data words	F112
4500 to 45FAh	250 frequency disturbance data words	F112
4600 to 46FAh	250 frequency disturbance data words	F112
4700 to 47FAh	250 frequency disturbance data words	F112
4800 to 48FAh	250 frequency disturbance data words	F112
4900 to 49FAh	250 frequency disturbance data words	F112

N.B.:
- The disturbance data pages contain values of one channel from one given disturbance record.
- significance of the value according to the type of channel:
  VA, VB, VC = 16 bits values
  Period = time between 2 samples in ms
  Logic channel =
    bit 0 = RL1 (Trip Relay)
    bit 1 = RL2
    bit 2 = RL3
    bit 3 = RL4
    bit 4 = watchdog
    bit 5 = RL5
    bit 6 = RL6
    bit 7 = RL7
    bit 8 = RL8
    bit 9 = reserved
    bit 10 = logic input 1
    bit 11 = logic input 2
    bit 12 = logic input 3
    bit 13 = logic input 4
    bit 14 = logic input 5
    bit 15 = Validity of the frequency measurement

1.7.22 Page 4Ah: Frequency Disturbance Record Frame index and acknowledgment (MiCOM P923 only).

Read access only

Address	Contents	Format
4A00h	Freq disturbance record frame index and acknowledgement	F113

1.8 Description of the mapping format

Code	Description	Products		
		P921	P922	P923
F1	Unsigned integer - numerical data: 1 - 65535	X	X	X
F2	Signed integer - numerical data: 32768 - 32767	X	X	X
F3	not used	X	X	X
F4	Unsigned integer: Modbus speed	X	X	X
	0: 300			
	1: 600			
	2: 1200			
	3: 2400			
	4: 4800			
	5: 9600			
	6: 19200			
	7: 38400			
F5	Unsigned integer: parity	X	X	X
	0: without			
	1: even			
	2: odd			
F6	Trip configuration and Latched functions (part 1)			
	bit 0: tV<	X	X	X
	bit 1: tV<<	X	X	X
	bit 2: tV<<<	X	X	X
	bit 3: tV>	X	X	X
	bit 4: tV>>	X	X	X
	bit 5: tV>>>	X	X	X
	bit 6: tVo>	X	X	X
	bit 7: tVo>>	X	X	X
	bit 8: tVo>>>	X	X	X
	bit 9: tAux1	X	X	X
	bit 10: tAux2	X	X	X
	bit 11: t Equation A	X	X	X
	bit 12: t Equation B	X	X	X
	bit 13: t Equation C	X	X	X
	bit 14: t Equation D	X	X	X
	bit 15: Reserved	X	X	X
F7a	Trip configuration and Latched functions (part 2)			
	Blocking logic 1 & 2 (part 2)			
	bit 0: tV2>		X	X
	bit 1: tV2>>		X	X
	bit 2: tV1<		X	X
	bit 3: tV1<<		X	X
	bit 4: tf1		X	X
	bit 5: tf2		X	X
	bit 6: tf3		X	X
	bit 7: tf4		X	X
	bit 8: tf5		X	X
	bit 9: tf6		X	X
	bit 10: df/dt1			X
	bit 11: df/dt2			X
	bit 12: df/dt3			X
	bit 13: df/dt4			X
	bit 14: df/dt5			X
	bit 15: df/dt6			X
F7b	Trip configuration and Latched functions (part 3)			
	bit 0: DV/DT1			X
	bit 1: DV/DT2			X
	bit 2: DV/DT3			X
	bit 3: DV/DT4			X
	bit 4: F1 + df/dt1			X
	bit 5: F2 + df/dt2			X
	bit 6: F3 + df/dt3			X
	bit 7: F4 + df/dt4			X
	bit 8: F5 + df/dt5			X
	bit 9: F6 + df/dt6			X
	bit 10: tAux3		X	X
	bit 11: tAux4		X	X
	bit 12: tAux5		X	X
	bit 13: tV0der>		X	X
	bit 14: tV0der>>		X	X
	bit 15: tV0der>>>		X	X

Code	Description	Products		
		P921	P922	P923
F7c	Trip configuration and Latched functions (part 4)			
	bit 0: t Equation E	X	X	X
	bit 1: t Equation F	X	X	X
	bit 2: t Equation G	X	X	X
	bit 3: t Equation H	X	X	X
	Bit 4: Voltage Balance K1<			X
	Bit 5: Voltage Balance K2<			X
	Bit 6: Voltage Balance K3<			X
	Bit 7: Voltage Balance K< Poly			X
	Bits 8 to 15: Not used			X
F8a	Blocking logic (part 1)			
	bit 0: tV<	X	X	X
	bit 1: tV<<	X	X	X
	bit 2: tV<<<	X	X	X
	bit 3: tV>	X	X	X
	bit 4: tV>>	X	X	X
	bit 5: tV>>>	X	X	X
	bit 6: tVo>	X	X	X
	bit 7: tVo>>	X	X	X
	bit 8: tVo>>>	X	X	X
	bit 9: tAux1	X	X	X
	bit 10: tAux2	X	X	X
	bit 11: Reserved			
	bit 12: du/dt1			X
	bit 13: du/dt2			X
	bit 14: du/dt3			X
	bits 15: du/dt4			X
F8b	Blocking logic (part 3)			
	Bit 0: tAux3		X	X
	Bit 1: tAux4		X	X
	Bit 2: tAux5		X	X
	Bit 3: tV0der>		X	X
	Bit 4: tV0der>>		X	X
	Bit 5: tV0der>>>		X	X
	Bits 6 to 15: Not used			
F9	Unsigned integer: Remote commands			
	bit 0: Tripping contact delatched (RL1)	X	X	X
	bit 1: 1 st alarm acknowledgement	X	X	X
	bit 2: All alarms acknowledgement	X	X	X
	bit 3: Remote tripping (to RL1)	X	X	X
	bit 4: Remote closing (to programmed output contacts)	X	X	X
	bit 5: Setting group change		X	X
	bit 6: Average and max values reset		X	X
	bit 7: Reserved	X	X	X
	bit 8: Disturbance record remote start		X	X
	bit 9: Maintenance mode start	X	X	X
	bit 10: Remote Command Frequency Disturbance			X
	bit 11: Reserved	X	X	X
	bit 12: Manual event/fault acknowledgement mode		X	X
	bit 13: Remote acknowledgement of the oldest event record		X	X
	bit 14: Remote acknowledgement of the oldest fault record		X	X
	bit 15: Remote acknowledgement of the "RAM error" alarm		X	X
F10	2 characters ASCII	X	X	X
	32 - 127 = ASCII character 1			
	32 - 127 = ASCII character 2			
F11	Reserved	X	X	X
F12	Logic inputs status and configuration			
	bit 0: logic input number 1	X	X	X
	bit 1: logic input number 2	X	X	X
	bit 2: logic input number 3		X	X
	bit 3: logic input number 4		X	X
	bit 4: logic input number 5		X	X
	bits 5 to 15: reserved			
F13	Unsigned integer: Logic output status and Fail safe mode			
	bit 0: logic output number RL1 (tripping)	X	X	X
	bit 1: logic output number RL2	X	X	X
	bit 2: logic output number RL3	X	X	X
	bit 3: logic output number RL4	X	X	X
	bit 4: logic output number RL0 (watchdog)	X	X	X
	bit 5: logic output number RL5		X	X
	bit 6: logic output number RL6		X	X
	bit 7: logic output number RL7		X	X
	bit 8: logic output number RL8		X	X
	bits 9 to 15: reserved			

Code	Description	Products		
		P921	P922	P923
F14	Unsigned integer: logic outputs configuration (excepted RL1)			
	bit 0: selection logic output number RL2	X	X	X
	bit 1: selection logic output number RL3	X	X	X
	bit 2: selection logic output number RL4	X	X	X
	bit 3: selection logic output number RL5		X	X
	bit 4: selection logic output number RL6		X	X
	bit 5: selection logic output number RL7		X	X
	bit 6: selection logic output number RL8		X	X
F15a	Logic inputs allocation (part 1)			
	bit 0: delatch (UNLATCH)	X	X	X
	bit 1: 52a	X	X	X
	bit 2: 52b	X	X	X
	bit 3: external CB failure (CB fail)	X	X	X
	bit 4: Aux 1	X	X	X
	bit 5: Aux 2	X	X	X
	bit 6: blocking logic 1 (BLK LG1)	X	X	X
	bit 7: blocking logic 2 (BLK LG2)	X	X	X
	bit 8: change of active setting group (CHANG SET)		X	X
	bit 9: external start of the disturbance recorder (DIST TRIG)		X	X
	bit 10: Aux 3		X	X
	bit 11: Aux 4		X	X
	bit 12: Aux 5		X	X
	bit 13: Control Trip		X	X
	bit 14: Control Close		X	X
	bit 15: Time synchro		X	X
F15b	Logic inputs allocation (part 2)			
	bit 0: Reset LEDs	X	X	X
	bit 1: VTS		X	X
	bit 2: Maintenance mode active	X	X	X
	bits 3 to 15: Not used			
F16	Unsigned integer: Information generated by the zero sequence overvoltage function	X	X	X
	bit 0: instantaneous information (V0>) or (V0>>) or (V0>>>)			
	bit 1 to 4: reserved			
	bit 5: instantaneous information (V0>) or (V0>>) or (V0>>>)			
	bit 6: time delayed information (tV0>) or (tV0>>) or (tV0>>>)			
	bits 7 to 15: reserved			
F17	Unsigned integer: Information generated by the overvoltage function	X	X	X
	bit 0: instantaneous information (V>) or (V>>) or (V>>>)			
	bit 1: instantaneous information VA			
	bit 2: instantaneous information VB			
	bit 3: instantaneous information VC			
	bit 4: reserved			
	bit 5: instantaneous information (V>) or (V>>) or (V>>>)			
	bit 6: time delayed information (V>) or (V>>) or (V>>>)			
	bits 7 to 15: reserved			
F18	Long integer	X	X	X
F19a	Unsigned integer: LED configuration (Part 1)			
	Bit 0: V<	X	X	X
	Bit 1: tV<	X	X	X
	Bit 2: V<<	X	X	X
	Bit 3: tV<<	X	X	X
	Bit 4: V<<<	X	X	X
	Bit 5: tV<<<	X	X	X
	Bit 6: V>	X	X	X
	Bit 7: tV>	X	X	X
	Bit 8: V>>	X	X	X
	Bit 9: tV>>	X	X	X
	Bit 10: V>>>	X	X	X
	Bit 11: tV>>>	X	X	X
	Bit 12: Vo>	X	X	X
	Bit 13: tVo>	X	X	X
	Bit 14: Vo>>	X	X	X
	Bit 15: tVo>>	X	X	X
F19b	Unsigned integer: LED configuration (Part 2)			
	Bit 0: Vo>>>	X	X	X
	Bit 1: tVo>>>	X	X	X
	Bit 2: taux1	X	X	X
	Bit 3: taux2	X	X	X
	Bit 4: V2>		X	X
	Bit 5: tV2>		X	X
	Bit 6: V2>>		X	X
	Bit 7: tV2>>		X	X
	Bit 8: V1<		X	X
	Bit 9: tV1<		X	X
	Bit 10: V1<<		X	X
	Bit 11: tV1<<		X	X

Code	Description	Products		
		P921	P922	P923
	Bit 12: f1		X	X
	Bit 13: tf1		X	X
	Bit 14: f2		X	X
	Bit 15: tf2		X	X
F19c	Unsigned integer: LED configuration (Part 3)		X	X
	Bit 0: f3		X	X
	Bit 1: tf3		X	X
	Bit 2: f4		X	X
	Bit 3: tf4		X	X
	Bit 4: f5		X	X
	Bit 5: tf5		X	X
	Bit 6: f6		X	X
	Bit 7: tf6		X	X
	Bit 8: Frequency out of range		X	X
	Bit 9: df/dt1			X
	Bit 10: df/dt2			X
	Bit 11: df/dt3			X
	Bit 12: df/dt4			X
	Bit 13: df/dt5			X
	Bit 14: df/dt6			X
	Bit 15: Not used			
F19d	LEDs configuration (part 4)			
	Bit 0: Boolean equation A	X	X	X
	Bit 1: Boolean equation B	X	X	X
	Bit 2: Boolean equation C	X	X	X
	Bit 3: Boolean equation D	X	X	X
	Bit 4: Logic input 1	X	X	X
	Bit 5: Logic input 2	X	X	X
	Bit 6: Logic input 3		X	X
	Bit 7: Logic input 4		X	X
	Bit 8: Logic input 5		X	X
	Bit 9: du/dt 1			X
	Bit 10: du/dt 2			X
	Bit 11: du/dt 3			X
	Bit 12: du/dt 4			X
	Bit 13 to 15: Not used			
F19e	Unsigned long: LEDs configuration, part 5			
	Bit 0: F1 + df/dt1			X
	Bit 1: F2 + df/dt2			X
	Bit 2: F3 + df/dt3			X
	Bit 3: F4 + df/dt4			X
	Bit 4: F5 + df/dt5			X
	Bit 5: F6 + df/dt6			X
	Bit 6: tAux3		X	X
	Bit 7: tAux4		X	X
	Bit 8: tAux5		X	X
	Bit 9: V0der>		X	X
	Bit 10: tV0der>		X	X
	Bit 11: V0der>>		X	X
	Bit 12: tV0der>>		X	X
	Bit 13: V0der>>>		X	X
	Bit 14: tV0der>>>		X	X
	Bit 15: tVTS		X	X
F19f	Unsigned long: LEDs configuration, part 6			
	Bit 0: Boolean equation E	X	X	X
	Bit 1: Boolean equation F	X	X	X
	Bit 2: Boolean equation G	X	X	X
	Bit 3: Boolean equation H	X	X	X
	Bit 4: Voltage Balance K1<			X
	Bit 5: Voltage Balance K2<			X
	Bit 6: Voltage Balance K3<			X
	Bit 7: Voltage Balance K< Poly			X
	Bits 8 to 15: Not used			X

Code	Description	Products		
		P921	P922	P923
F20a	Logic inputs functional status (Part 1)			
	bit 0: Blocking logic 1 (BLK LG1)	X	X	X
	bit 1: Blocking logic 2 (BLK LG2)	X	X	X
	bit 2: Unlatched of the output contacts (UNLATCH)	X	X	X
	bit 3: 52a	X	X	X
	bit 4: 52b	X	X	X
	bit 5: CB failure (CB fail)	X	X	X
	bit 6: Auxiliary input 1 (AUX 1)	X	X	X
	bit 7: Auxiliary input 2 (AUX 2)	X	X	X
	bit 8: Change of active setting group (CHANG SET)		X	X
	bit 9: External start of the disturbance recorder (DIST TRIG)		X	X
	bit 10: tAux 3		X	X
	bit 11: tAux 4		X	X
	bit 12: tAux 5		X	X
	bit 13: Control Trip		X	X
	bit 14: Control Close		X	X
	bits15: Time synchro		X	X
F20b	Logic inputs functional status (Part 2)			
	bit 0: Reset LEDs	X	X	X
	bit 1: VTS		X	X
	bit 2: Maintenance mode active	X	X	X
	bits 3 to 15: Not used			
F21	Unsigned integer: Software version 10: version 1.A 11: version 1.B 20: version 2.A etc ...	X	X	X
F22	Unsigned integer: internal logic data bit 0: trip output contact latched (RL1) bit 1: reserved	X	X	X
F23	Unsigned integer: Self tests results bit 0: Protection in Service bit 1: Minor fault bit 2: Not acknowledged event record bit 3: Time synchronisation status bit 4: Disturbance record available bit 5: Fault record available bit 6: Reserved bit 7: Reserved	X X X X X	X X X X X X X X X	X X X X X X X X X
F24	Unsigned integer: Status of the relay functions 0: Disabled 1: Enabled	X	X	X
F25	2 characters ASCII	X	X	X
F26	Selection of the default display 1: RMS value Va or Uab 2: RMS value Vb or Ubc 3: RMS value Vc or Uca 4: RMS value V0 5: Frequency 6: V1 7: V2 8: RMS values Va (or Uab), Vb (or Ubc), Vc (or Uca), V0	 X X X X X X	 X X X X X X X X	 X X X X X X X X
F27	Unsigned integer: Selection of the type of temporisation 0: DMT time delay 1: IDMT time delay	X	X	X
F28	Reserved	X	X	X
F29	Unsigned integer: Modbus communication 0: 1 bit stop 1: 2 bits stop	X	X	X
F30	Unsigned integer: Rear communication 0: Communication non available 1: Communication available	X	X	X
F31	Unsigned integer: Number of disturbance records available 0: None ... 25: 25 Disturbance Records available		X	X
F32	Unsigned integer: Selection of the trigger mode for the disturbance recorder 0: Instantaneous information 1: Time delayed information		X	X
F33	Unsigned integer: type of date used by the modbus communication 0: Modbus date 1: IEC date	X	X	X

Code	Description	Products		
		P921	P922	P923
F34	Unsigned integer: Latch of auxiliary output relays	X	X	X
	bit 0: selection of the auxiliary output relay no 2	X	X	X
	bit 1: selection of the auxiliary output relay no 3	X	X	X
	bit 2: selection of the auxiliary output relay no 4	X	X	X
	bit 3: selection of the auxiliary output relay no 5		X	X
	bit 4: selection of the auxiliary output relay no 6		X	X
	bit 5: selection of the auxiliary output relay no 7		X	X
	bit 6: selection of the auxiliary output relay no 8		X	X
F35	Unsigned integer: Disturbance recorder status		X	X
	0: No record in progress			
	1: Record in progress			
F36	Unsigned integer: Alarm status (1)			
	Bit 0: V0 >	X	X	X
	Bit 1: tV0 >	X	X	X
	Bit 2: V0 >>	X	X	X
	Bit 3: tV0 >>	X	X	X
	Bit 4: V0 >>>	X	X	X
	Bit 5: tV0 >>>	X	X	X
	Bit 6: V2 >		X	X
	Bit 7: tV2 >		X	X
	Bit 8: V2 >>		X	X
	Bit 9: tV2 >>		X	X
	Bit 10: V1 <		X	X
	Bit 11: t V1 <		X	X
	Bit 12: V1 <<		X	X
	Bit 13: tV1 <<		X	X
	Bit 14: Control Trip	X	X	X
F37	Unsigned integer: Alarm status (2)		X	X
	Bit 0: instantaneous information f1			
	Bit 1: time delayed information f1			
	Bit 2: instantaneous information f2			
	Bit 3: time delayed information f2			
	Bit 4: instantaneous information f3			
	Bit 5: time delayed information f3			
	Bit 6: instantaneous information f4			
	Bit 7: time delayed information f4			
F37	Bit 8: instantaneous information f5			
	Bit 9: time delayed information f5			
	Bit 10: instantaneous information f6			
	Bit 11: time delayed information f6			
F38a	Alarm status for Boolean equations and miscellaneous (Aux inputs, CB supervision, Fout), part 1			
	Bit 0: Boolean equation A	X	X	X
	Bit 1: Boolean equation B	X	X	X
	Bit 2: Boolean equation: time delayed information"	X	X	X
	Bit 3: time delayed information "tAUX1"	X	X	X
	Bit 4: time delayed information "tAUX2"	X	X	X
	Bit 5: Max CB operating time reached		X	X
	Bit 6: Max CB operations reached		X	X
	Bit 7: Max CB closing time reached		X	X
	Bit 8: CB alarm (logic "OR" between bits 5, 6 and 7)		X	X
	Bit 9: Frequency out of range: fmeasured > fn+20Hz or fmeasured < fn-20Hz		X	X
	Bit 10: Boolean equation C	X	X	X
	Bit 11: Boolean equation D	X	X	X
	Bit 12: Frequency out of range due to undervoltage blocking			X
	Bit 13: time delayed information "tAUX3"		X	X
	Bit 14: time delayed information "tAUX4"		X	X
	Bit 15: time delayed information "tAUX5"		X	X
F38b	Alarm status for Boolean equations, part 2			
	Bit 0: Boolean equation E	X	X	X
	Bit 1: Boolean equation F	X	X	X
	Bit 2: Boolean equation G	X	X	X
	Bit 3: Boolean equation H	X	X	X
	Bits 4 to 15: Not used	X	X	X
F39	Output relays command in Maintenance mode	X	X	X
	bit 0: RL1 (trip)			
	bit 1: RL2			
	bit 2: RL3			
	bit 3: RL4			
	bit 4: RL0 (watch-dog)			
	bit 5: RL5			
	bit 6: RL6			
	bit 7: RL7			
	bit 8: RL8			
F40	Reserved			

Code	Description	Products		
		P921	P922	P923
F41	Unsigned integer: Rear communication protocol (RS485) 0: Modbus RTU 1: Courier KBus 2: IEC 60870-5-103	X	X	X
F42	Unsigned integer: Time period for calculation of average/max values 5, 10, 15, 30 or 60 min		X	X
F45	Unsigned integer: MiCOM relay status Bit 0: Watchdog Bit 1: Communication failure Bit 2: EEPROM data failure Bit 3: Analog failure Bit 4: Datation Bit 5: EEPROM calibration failure Bit 6: RAM memory failure Bit 7: reserve 7 Bit 8: Maintenance mode Bit 9: Default settings Bit 10: main power supply Bit 11: auxiliary power supplies Bit 12: transformers offset failure Bit 13 to 15: reserved	X	X	X
F46	Unsigned integer: Remote controls 3			
	Bit 0: Reserved			
	Bit 1: Reserved (R&D)		X	X
	Bit 2: Acknowledgement of the oldest disturbance record (manually)	X	X	X
	Bit 3: CB operations number Reset	X	X	X
	Bit 4: Reserved	X	X	X
	Bit 5: Reserved	X	X	X
	Bit 6: LEDs reset		X	X
	Bit 7: End of Maintenance mode		X	X
	Bit 8: Communication order 1	X	X	X
	Bit 9: Communication order 2	X	X	X
	Bit 10: Communication order 3		X	X
	Bit 11: Communication order 4		X	X
	Bit 12: Data records reset		X	X
	Bit 13: Reserved		X	X
	Bit 14: Reserved		X	X
	Bit 15: Reserved		X	X
			X	X
F47	Unsigned integer: Information generated by the undervoltage protection Bit 0: instantaneous information threshold phase (V<) or (V<<) or (V<<<) Bit 1: instantaneous information VA Bit 2: instantaneous information VB Bit 3: instantaneous information VC Bit 4: reserved Bit 5: instantaneous information (V<) or (V<<) or (V<<<) Bit 6: time delayed information (tV<) or (tV<<) or (tV<<<) Bits 7 to 15: reserved	X	X	X
F48	Unsigned integer: Information generated by the "Negative seq. Overvoltage" and "Positive seq. undervoltage" Bit 0: instantaneous information threshold V2> Bit 1: instantaneous information V2> Bit 2: time delayed information V2> Bit 3: instantaneous information threshold V2>> Bit 4: instantaneous information V2>> Bit 5: time delayed information V2 >>		X	X

Code	Description	Products		
		P921	P922	P923
F48	Bit 6: instantaneous information threshold V1< Bit 7: instantaneous information V1< Bit 8: time delayed information V1< Bit 9: instantaneous information threshold V1<< Bit 10: instantaneous information V1<< Bit 11: time delayed information V1<< Bits 12 to 15 reserved			
F49	Unsigned integer: Information generated by the frequency protection Bit 0: Frequency protection Bit 1: Instantaneous information Bit 2: Time delayed information of the frequency protection Bit 3 to Bit 15: Reserved		 X X X	 X X X
F50	Unsigned integer: type of the voltage applied to the logic inputs 0: DC voltage 1: AC voltage	X	X	X
F51	Unsigned long integer	X	X	X
F52	Unsigned integer: Voltage connection 0: Connection "3Vpn" 1: Connection "3Vpn+Vr" 2: Connection "2Upp+Vr" 3: Connection "3Upp+Vr"	X	X	X
F53	Unsigned integer: Configuration of the voltage protection 0: "PROTECT P-N" = phase voltage protection 1: "PROTECT P-P" = line voltage protection	X	X	X
F54	Do not use			
F55	Unsigned integer: Configuration of the under/overvoltage thresholds 0: Disabled 1: "OR" detection 2: "AND" detection	X	X	X
F56	Unsigned integer: Configuration of the frequency thresholds 0: Disabled 1: Underfrequency 2: Overfrequency		 X X X	 X X X
F57	Unsigned integer: trigger mode of the frequency disturbance record 0: start of a time delayed df/dt information 1: activation of a logic equation 2: closing of the tripping relay contact (RL1)			X
F58	Unsigned integer: information generated by the rate of change of frequency function Bit 0: df/dt1 instantaneous information Bit 1: df/dt2 instantaneous information Bit 2: df/dt3 instantaneous information Bit 3: df/dt4 instantaneous information Bit 4: df/dt5 instantaneous information Bit 5: df/dt6 instantaneous information			X
F59	Unsigned integer: selection of the Date format 0: Private date format 1: Date Format IEC		X	X
F60	Active group changing 0: Remote control, or HMI order.(MENU) 1: On LEVEL (high or low) of a logic input.		X	X
F61	du/dt state bit 0: Reserved bit 1: Instantaneous information Ua bit 2: Instantaneous information Ub bit 3: Instantaneous information Uc bit 4: Reserved bit 5: Start bits 6 à 15: Reserved			X
F62	du/dt activation: 0: Not activated 1: MIN OR: Logic OR on negative du/dt 2: MIN AND: Logic AND on negative du/dt 3: MAX OR: Logic OR on positive du/dt 4: MAX AND: Logic AND on positive du/dt			
F63	Measurements transmission enabling for IEC870-5-103 communication 0: None 1: On trip protection 2: On instantaneous protection 3: On communication order 4: On logic input order 5: No disturbance			

Code	Description	Products		
		P921	P922	P923
F64	VTS, Blocked functions (Unsigned integer) Bit 0: U< blocked by VTS Bit 1: U> blocked by VTS Bit 2: V0> blocked by VTS Bit 3: V1< blocked by VTS Bit 4: V2> blocked by VTS Bit 5: F blocked by VTS Bit 6: df/dt blocked by VTS Bit 7: du/dt blocked by VTS Bits 8 to 15: Reserved		X	X
F65	VTS, Detection mode (Unsigned integer) Bit 0: VTS Input Bit 1: V0 Measure		X	X
F66	VTS status (Unsigned integer) Bits 0 to 4: Not used Bit 5: Start Bit 6: Trip Bits 7 to 15: Not used		X	X
F67	F + df/dt status (Unsigned integer) Bits 0: F1 + df/dt1 Bits 1: F2 + df/dt2 Bits 2: F3 + df/dt3 Bits 3: F4 + df/dt4 Bits 4: F5 + df/dt5 Bits 5: F6 + df/dt6 Bits 6 to 15: Not used			X
F68	Status IEC103 (Unsigned integer) Bit 0: General start Bit 1:			
F69	Not used			
F70	First operator for boolean equations 0: Nothing 1: NOT	X	X	X
F71	Others than first operator for boolean equations 0: OR 1: OR NOT 2: AND 3: AND NOT	X	X	X
F72	Equations operands 0000h: NULL (Default) 0001h: U< 0002h: tU< 0003h: U<< 0004h: tU<< 0005h: U<<< 0006h: tU<<< 0007h: U> 0008h: tU> 0009h: U>> 000Ah: tU>> 000Bh: U>>> 000Ch: tU>>> 000Dh: Vo> 000Eh: tVo> 000Fh: Vo>> 0010h: tVo>> 0011h: Vo>>> 0012h: tVo>>> 0013h: V2> 0014h: tV2> 0015h: V2>> 0016h: tV2>> 0017h: V1< 0018h: tV1< 0019h: V1<< 001Ah: tV1<< 001Bh: f1 001Ch: tf1 001Dh: f2 001Eh: tf2 001Fh: f3 0020h: tf3	X	X	X

Code	Description	Products		
		P921	P922	P923
F72 (cont'd)	0021h: f4 0022h: tf4 0023h: f5 0024h: tf5 0025h: f6 0026h: tf6 0027h: tAux1 0028h: tAux2 0029h: tAux3 002Ah: tAux4 002Bh: tAux5 002Ch: CB ALARM 002Dh: CB FAIL 002Eh: df/dt 1 002Fh: df/dt 2 0030h: df/dt 3 0031h: df/dt 4 0032h: df/dt 5 0033h: df/dt 6 0034h: Input 1 0035h: Input 2 0036h: Input 3 0037h: Input 4 0038h: Input 5 0039h: DU/DT1 003Ah: DU/DT2 003Bh: DU/DT3 003Ch: DU/DT4 003Dh: Output of Equation A 003Eh: Output of Equation B 003Fh: Output of Equation C 0040h: Output of Equation D 0041h: Output of Equation E 0042h: Output of Equation F 0043h: Output of Equation G 0044h: Output of Equation H 0045h: tVTS 0046h: F1+ df/dt1 0047h: F2 + df/dt2 0048h: F3 + df/dt3 0049h: F4 + df/dt4 004Ah: F5 + df/dt5 004Bh: F6 + df/dt6 004Ch: Frequency out 004Dh: Vo der> 004Eh: tVo der> 004Fh: Vo der>> 0050h: tVo der>> 0051h: Vo der>>> 0052h: tVo der>>> 0053h: K1< 0054h: K2< 0055h: K3< 0056h: K< Poly	X	X	X
F73	LEDs status (bit = 1 if LED lighted)			
	Bit 0 – Trip LED	X	X	X
	Bit 1 – Alarm LED	X	X	X
	Bit 2 – Warning LED	X	X	X
	Bit 3 – Healthy LED (always active)	X	X	X
	Bit 4 – LED 5	X	X	X
	Bit 5 – LED 6	X	X	X
	Bit 6 – LED 7	X	X	X
	Bit 7 – LED 8	X	X	X

Code	Description	Products		
		P921	P922	P923
F74	Keyboard remote control Activation of only one bit at a time. The activated bit simulates a key pressure. bit 0: CLEAR key bit 1: ALARM key bit 2: UP key bit 3: RIGHT key bit 4: ENTER key bit 5: DOWN key bit 6: LEFT key bit 7: bit 8: bit 9: bit 10: bit 11: bit 12: bit 13: bit 14: bit 15: Dialog re-init (factory test reserved)	X	X	X
F75	Unsigned integer: Alarm status (3)			
	Bit 0: V0 der >		X	X
	Bit 1: tV0 der >		X	X
	Bit 2: V0 der >>		X	X
	Bit 3: tV0 der >>		X	X
	Bit 4: V0 der >>>		X	X
	Bit 5: tV0 der >>>		X	X
	Bits 6 to 15: Not used		X	X
F76	IEC-103 protocol: GI selection (General Interrogation) 0 – Basic GI 1 – Advanced GI		 X X	 X X
F77	IEC-103 protocol: Type of uploaded spontaneous events (0 = transmission disabled, 1 = transmission enabled) Bit 0 – IEC Bit 1 – Private		 X X	 X X
F78	IEC-103 protocol: Type of Measurements (0 = transmission disabled, 1 = transmission enabled) Bit 0 – ASDU 3.4 Bit 1 – ASDU 9 Bit 2 – other ASDUs (ASDU 77)		 X X X	 X X X
F79	IEC-103 protocol: Signal & Measurements / Commands blocking (0 = unblocked, 1 = blocked) Bit 0 – Signals & measurements Bit 1 – Commands		 X X	 X X

F80 to F97 not yet defined.

Code	Description	Products		
		P921	P922	P923
F98	Auxiliary power self-test status Bit 0: -3V3 out of range Bit 1: 5V0 out of range Bit 2: 3V3 out of range Bit 3: 12V out of range Bit 4: 1V3 out of range Bit 5: 0V out of range	X	X	X
F99	Transformer self-test status bit 0: transformer 1 fault bit 1: transformer 2 fault bit 2: transformer 3 fault bit 3: transformer 4 fault bit 4: transformer 5 fault bit 5: transformer 6 fault bit 6: transformer 7 fault bit 7: transformer 8 fault bit 8: transformer 9 fault	X	X	X

1.9 Specific formats for the records files (P922 and P923 only)

Code	Description
F101	Conversion rules for the voltage values of the disturbance record * In order to obtain the phase voltages values at the VT primary, apply the following formula: « Read value » x « VT primary value » / « VT secondary value » x $\frac{100\sqrt{2}}{coef}$ * In order to obtain the Vo value at the residual VT primary, apply the following formula: « Read value » x « Residual VT primary value »/« Residual VT secondary value » x $\frac{100\sqrt{2}}{coef}$ where: coef = 12600 for the range (57-130V) and 3400 for the range (220-480V)
F102	Disturbance records data 1st word: Disturbance record number 2nd word: Disturbance recording trig time (sec): number of seconds since the 01/01/1994 3rd word: Disturbance recording trig time (sec): number of seconds since the 01/01/1994 4th word: Disturbance recording trig time (ms) 5th word: Disturbance recording trig time (ms) 6th word: Cause of the disturbance record trigging 1: Relay n°1 operation (trip) 2: Instantaneous information 3: Remote trigger 4: Trig order received through a logic input 7 th word: Frequency at the beginning of the post time
F103	Events records data 1st word: Event type: refer to format F107 2nd word: Associated value type: refer to format F107 3rd word: Modbus address (use of different version of VDEW)- refer to paragraph 1.5 4th word: Courier cell address (use of different version of VDEW)- refer to paragraph 1.5 5 th word: event occurrence date (second): number of seconds since the 01/01/1994 6 th word: event occurrence date (second): number of seconds since the 01/01/1994 7 th word: event occurrence date (ms) 8 th word: event occurrence date (ms) 9 th word: acknowledgement: (0 = non acknowledged event ; 1 = acknowledged event)
F104	Fault record data 1 st word: Fault record number 2 nd word: Fault date (sec): number of seconds since 01/01/94 3 rd word: Fault date (sec): number of seconds since 01/01/94 4 th word: Fault date (ms) 5 th word: Fault date (ms) 6 th word: Fault date (season ; 0 = winter, 1 = summer, 2 = non defined) 7 th word: Active setting group while the fault occurrence (1 or 2) 8 th word: Faulty phase: (0 = none, 1 = phase A, 2 = phase B, 3 = phase C, 4 = phases AB, 5 = phases AC, 6 = phases BC, 7 = phases A-B-C, 8 = earth) 9 th word: Cause of the fault record: refer to format F109 (Code of the fault) 10 th word: Fault value magnitude (fundamental value): refer to format F108 11 th word: Phase A voltage magnitude (True RMS value): refer to format F108 12 th word: Phase B voltage magnitude (True RMS value): refer to format F108 13 th word: Phase C voltage magnitude (True RMS value): refer to format F108 14 th word: Zero sequence voltage magnitude (True RMS value): refer to format F108
F105	Disturbance records data 1st word: Samples number contained in the mapping 2nd word: Pre-time sample number 3rd word: Post-time sample number 4 th word: Primary value of phase CT 5 th word: Secondary value of phase CT 6 th word: Primary value of residual CT 7 th word: Secondary value of residual CT 8 th word: Internal ratio of phase CT 9 th word: Internal ratio of residual CT 10 th word: Primary phase VT value (LSB) 11 th word: Primary phase VT value (MSB) 12 th word: Secondary phase VT value 13 th word: Primary residual VT value (LSB) 14 th word: Primary residual VT value (MSB) 15 th word: Secondary residual VT value 16 th word: Internal ratio-numerator (100) 17 th word: Internal ratio-denominator (12600 or 3400) 18 th word: Address of the last page containing samples 19 th word: Words number contained in the last page

Code	Description
F106	Data for the available disturbance records
	1st word: Number of disturbance records available 2nd word: Oldest disturbance record number 3rd word: Oldest disturbance record date (sec): number of seconds since the 01/01/1994 4 th word: Oldest disturbance record date (sec): number of seconds since the 01/01/1994 5 th word: Oldest disturbance record date (ms) 6 th word: Oldest disturbance record date (ms) 7 th word: Cause of the oldest disturbance record: 1: Relay n°1 operation 2: Instantaneous information 3: Remote trigger. 4: Trig order received through a logic input 8 th word: Acknowledgement 9 th word: Previous disturbance record number 10 th word: Previous disturbance record date (sec): number of seconds since the 01/01/1994 11 th word: Previous disturbance record date (sec): number of seconds since the 01/01/1994 12 th word: Previous disturbance record date (ms) 13 th word: Previous disturbance record date (ms) 14 th word: Cause of the previous disturbance record: 1: Relay n°1 operation 2: Instantaneous information 3: Remote trigger 4: Trig order received through a logic input 15 th word: Acknowledgement And so on, regarding the other disturbance records…

Code	Events description	Type	Address Modbus	Cellule Courier
F107	Events and associated values			
00	"No event"	-		
01	"Remote closing"	F9	013H	021
02	"Remote tripping"	F9	013H	021
03	"Start of disturbance record"	F9	-	-
04	"Trip output unlatched"	F9	013H	021
05	"Settings change" address	addres	-	-
06	"V >"	F17	014H↑↓	023
07	"V >>"	F17	015H↑↓	023
08	"V >>>"	F17	016H↑↓	023
09	"V <"	F47	017H↑↓	023
10	"V <<"	F47	018H↑↓	023
11	"V <<<"	F47	019H↑↓	023
12	"V0 >"	F16	01AH↑↓	023
13	"V0 >>"	F16	01BH↑↓	023
14	"V0 >>>"	F16	01CH↑↓	023
15	"tU >"	F17	014H↑↓	023
16	"tU >>"	F17	015H↑↓	023
17	"tU >>>"	F17	016H↑↓	023
18	"tU <"	F47	017H↑↓	023
19	"tU <<"	F47	018H↑↓	023
20	"tU <<<"	F47	019H↑↓	023
21	"tV0 >"	F16	01AH↑↓	024
22	"tV0 >>"	F16	01BH↑↓	024
23	"tV0 >>>"	F16	01CH↑↓	024
24	"t AUX1"	F38a	024H↑↓	024
25	"t AUX2"	F38a	024H↑↓	024
26	"t Logic equation A"	F38a	024H↑↓	024
27	"t Logic equation B"	F38a	024H↑↓	024
28	"Logic inputs"	F12	010H↑↓	020
29	"Blocking logic 1"	F20	011H↑↓	020
30	"Blocking logic 2"	F20	011H↑↓	020
31	52a	F20	011H↑↓	020
32	52b	F20	011H↑↓	020
33	"CB failure"	F20	011H↑↓	020
34	"Change of active setting group"	F20	011H	020
35	"trip: tV >"	F13	013H	021
36	"trip: tV >>"	F13	013H	021
37	"trip: tV >>>"	F13	013H	021
38	"trip: tV <"	F13	013H	021
39	"trip: tV <<"	F13	013H	021
40	"trip: tV <<<"	F13	013H	021
41	"trip: tV0 >"	F13	013H	021
42	"trip: tV0 >>"	F13	013H	021
43	"trip: tV0 >>>"	F13	013H	021
44	"trip: t AUX1"	F13	013H	021

Code	Events description	Type	Address Modbus	Cellule Courier
45	"trip: t AUX2"	F13	013H	021
46	"trip: t logic equation A"	F13	013H	021
47	"trip: t logic equation B "	F13	013H	021
48	"Trip of auxiliary output contacts"	F39	013H	021
49	"Alarm acknowledgement from the HMI"	-	-	-
50	"Global alarm acknowledgement from the HMI"	-	-	-
51	"Alarm acknowledgement from the communication"	-	-	-
52	"Global alarm acknowledgement from the communication"	-	-	-
53	"Major hardware alarms"	F45	00FH↑↓	022
54	"Minor hardware alarms"	F45	00FH↑↓	022
55	"V2>"	F48	01DH↑↓	024
56	"V2 >>"	F48	01DH↑↓	024
57	"V1 <"	F48	01DH↑↓	024
58	"V1 <<"	F48	01DH↑↓	024
59	"f1"	F49	01EH↑↓	024
60	"f2"	F49	01FH↑↓	024
61	"f3"	F49	020H↑↓	024
62	"f4"	F49	021H↑↓	024
63	"f5"	F49	022H↑↓	024
64	"f6"	F49	023H↑↓	025
65	"tV2>"	F48	01DH↑↓	025
66	"tV2 >>"	F48	01DH↑↓	025
67	"tV1 <"	F48	01DH↑↓	025
68	"tV1 <<"	F48	01DH↑↓	025
69	"tf1"	F49	01EH↑↓	025
70	"tf2"	F49	01FH↑↓	025
71	"tf3"	F49	020H↑↓	025
72	"tf4"	F49	021H↑↓	025
73	"tf5"	F49	022H↑↓	025
74	"tf6"	F49	023H↑↓	025
75	"Frequency out of range"	F38a	024H↑↓	025
76	"CB operating time"	F38a	024H↑↓	025
77	"Number of operations"	F38a	024H↑↓	025
78	"CB closing time"	F38a	024H↑↓	025
79	"trip: tV2>"	F13	013H	021
80	"trip: tV2 >>"	F13	013H	021
81	" trip: tV1 <"	F13	013H	021
82	" trip: tV1 <<"	F13	013H	021
83	" trip: tf1"	F13	013H	021
84	" trip: tf2"	F13	013H	021
85	" trip: tf3"	F13	013H	021
86	" trip: tf4"	F13	013H	021
87	" trip: tf5"	F13	013H	021
88	" trip: tf6"	F13	013H	
89	“General Start” only for VDEW,otherwise 0			
90	“General trip” only for VDEW, otherwise 0			
91	“Local setting “ only for VDEW, otherwise 0			
92	“ t Logic equation C”	F38a	024H↑↓	025
93	“ t Logic equation D”	F38a	024H↑↓	025
94	“df/dt1”	F58	064H↑↓	026
95	“df/dt2”	F58	064H↑↓	026
96	“df/dt3”	F58	064H↑↓	026
97	“df/dt4”	F58	064H↑↓	026
98	“df/dt5”	F58	064H↑↓	026
99	“df/dt6”	F58	064H↑↓	026
100	“trip: C boolean equation”	F13	064H↑↓	
101	“trip: D boolean equation”	F13	064H↑↓	
102	“trip: df/dt1”	F13	013H↑↓	021
103	“trip: df/dt2”	F13	013H↑↓	021
104	“trip: df/dt3”	F13	013H↑↓	021
105	“trip: df/dt4”	F13	013H↑↓	021
106	“trip: df/dt5”	F13	013H↑↓	021
107	“trip: df/dt6”	F13	013H↑↓	021
108	“Latch of the relays “	F34	060H	
109	"du/dt1"	F61	066H↑↓	026
110	"du/dt2"	F61	067H↑↓	026
111	"du/dt3"	F61	068H↑↓	026
112	"du/dt4"	F61	069H↑↓	026
113	"Trip du/dt1"	F13	013H	021
114	"Trip du/dt2"	F13	013H	021
115	"Trip du/dt3"	F13	013H	021
116	"Trip du/dt4"	F13	013H	021
117	"df/dt1 non confirmé"	F58	069H↑↓	
118	"df/dt2 non confirmé"	F58	069H↑↓	
119	"df/dt3 non confirmé"	F58	069H↑↓	

Code	Events description	Type	Address Modbus	Cellule Courier
120	"df/dt4 non confirmé"	F58	069H↑↓	
121	"df/dt5 non confirmé"	F58	069H↑↓	
122	"df/dt6 non confirmé"	F58	069H↑↓	
123	tVTS	F66	084H↑↓	027
124	Maintenance mode	F45	000FH↑↓	
125	Command of output relays in maintenance mode	F39	0013H	
126	F1 + df/dt1	F67	06EH↑↓	026
127	F2 + df/dt2	F67	06EH↑↓	026
128	F3 + df/dt3	F67	06EH↑↓	026
129	F4 + df/dt4	F67	06EH↑↓	026
130	F5 + df/dt5	F67	06EH↑↓	026
131	F6 + df/dt6	F67	06EH↑↓	026
132	Trip F1 + df/dt1	F13	013H↑↓	
133	Trip F2 + df/dt2	F13	013H↑↓	
134	Trip F3 + df/dt3	F13	013H↑↓	
135	Trip F4 + df/dt4	F13	013H↑↓	
136	Trip F5 + df/dt5	F13	013H↑↓	
137	Trip F6 + df/dt6	F13	013H↑↓	
138	"tAUX3"	F38a	024H↑↓	027
139	"tAUX4"	F38a	024H↑↓	027
140	"tAUX5"	F38a	024H↑↓	027
141	"trip: tAUX3"	F13	013H	021
142	"trip: tAUX4"	F13	013H	021
143	"trip: tAUX5"	F13	013H	021
144	"V0der >"	F16	086H↑↓	027
145	"V0der >>"	F16	087H↑↓	027
146	"V0der >>>"	F16	088H↑↓	027
147	"tV0der >"	F16	086H↑↓	027
148	"tV0der >>"	F16	087H↑↓	027
149	"tV0der >>>"	F16	088H↑↓	027
150	"trip: tV0der >"	F13	013H	021
151	"trip: tV0der >>"	F13	013H	021
152	"trip: tV0der >>>"	F13	013H	021
153	"t Logic equation E"	F38b	634H↑↓	027
154	"t Logic equation F"	F38b	634H↑↓	027
155	"t Logic equation G"	F38b	634H↑↓	027
156	"t Logic equation H"	F38b	634H↑↓	027
157	"trip: t logic equation E"	F13	013H	021
158	"trip: t logic equation F"	F13	013H	021
159	"trip: t logic equation G"	F13	013H	021
160	"trip: t logic equation H"	F13	013H	021
161	“General Earth start“ only for VDEW, otherwise 0	F68	0009H↑↓	
162	Time synchro when Δt > 10 s	F23	0700H	
163	Reset Leds (IEC-103 comm.)	F46	0403H	-
164	“RL1 Trip relay Latch “	F22	012H↑↓	-
165	Signals & measurements blocked (IEC-103 comm.)	F79	0649H ↑↓	-
166	Commands blocked (IEC-103 comm.)	F79	0649H ↑↓	-
167	Communication order 1	F46	0403H	-
168	Communication order 2	F46	0403H	-
169	Communication order 3	F46	0403H	-
170	Communication order 4	F46	0403H	-
171	Voltage Balance K1<	F115	008D	
172	Voltage Balance K2<	F115	008D	
173	Voltage Balance K3<	F115	008D	
174	Voltage Balance K< Poly	F115	008D	
175	Trip Voltage Balance K1<	F13	013H	021
176	Trip Voltage Balance K2<	F13	013H	021
177	Trip Voltage Balance K3<	F13	013H	021
178	Trip Voltage Balance K< Poly	F13	013H	021
179	Hardware alarm with main power supply	F2 unit mV	00FH	No
180	Hardware alarm with -3.3v power supply	F2 unit mV	062H	No
181	Hardware alarm with 5.0v power supply	F2 unit mV	062H	No
182	Hardware alarm with 3.3v power supply	F2 unit mV	062H	No
183	Hardware alarm with 12v power supply	F2 unit mV	062H	No
184	Hardware alarm with 1.3v power supply	F2 unit mV	062H	No
185	Hardware alarm with 0 v power supply	F2 unit mV	062H	No
186	Hardware alarm with transformer 1 (offset excess)	F2 unit CAN	063H	No
187	Hardware alarm with transformer 2 (offset excess)	F2 unit CAN	063H	No
188	Hardware alarm with transformer 3 (offset excess)	F2 unit CAN	063H	No
189	Hardware alarm with transformer 4 (offset excess)	F2 unit CAN	063H	No
190	Hardware alarm with transformer 5 (offset excess)	F2 unit CAN	063H	No
191	Hardware alarm with transformer 6 (offset excess)	F2 unit CAN	063H	No
192	Hardware alarm with transformer 7 (offset excess)	F2 unit CAN	063H	No
193	Hardware alarm with transformer 8 (offset excess)	F2 unit CAN	063H	No
194	Hardware alarm with transformer 9 (offset excess)	F2 unit CAN	063H	No
195				

N.B.: The double arrow ↑↓ means the event is generated on event occurrence and another is generated on event disappearance.
On event occurrence, the corresponding bit of the associated format is set to "1".
On event disappearance, the corresponding bit of the associated format is set to "0".

Code	Description
F108	Conversion rules for the fault records
	In order to obtain phase and residual voltages at primary VT, apply the following formula: Range 57 to 130V: "Read value".* ("primary phase VT" / " Secondary phase VT ") * 1/63 Range 220 to 480V: "Read value".* 1/17 Conversion formula (fault magnitude in case of a frequency fault): 1000000/ "Read value"
F109	Faults
00	"No fault"
01	"Remote tripping order"
02	"Trip output contact for: tV>"
03	"Trip output contact for: tV>>"
04	"Trip output contact for: tV>>>"
05	"Trip output contact for: tV<"
06	"Trip output contact for: tV<<"
07	"Trip output contact for: tV<<<"
08	"Trip output contact for: tV0>"
09	"Trip output contact for: tV0>>"
10	"Trip output contact for: tV0>>>"
11	"Trip output contact for: t AUX1"
12	"Trip output contact for: t AUX2"
13	"Trip output contact for: t EQU.A"
14	"Trip output contact for: t EQU.B"
15	"Trip output contact for: tV2>"
16	"Trip output contact for: tV2>>"
17	"Trip output contact for: tV1<"
18	"Trip output contact for: tV1<<"
19	"Trip output contact for: tf1"
20	"Trip output contact for: tf2"
21	"Trip output contact for: tf3"
22	"Trip output contact for: tf4"
23	"Trip output contact for: tf5"
24	"Trip output contact for: tf6"
25	“Trip output contact for: t EQU C”
26	“Trip output contact for: t EQU D”
27	“Trip output contact for: df/dt1”
28	“Trip output contact for: df/dt2”
29	“Trip output contact for: df/dt3”
30	“Trip output contact for: df/dt4”
31	“Trip output contact for: df/dt5”
32	“Trip output contact for: df/dt6”
33	“Trip output contact for: du/dt1”
34	“Trip output contact for: du/dt2”
35	“Trip output contact for: du/dt3”
36	“Trip output contact for: du/dt4”
37	"Trip output contact for: tVTS"
38	"Trip output contact for: F1 + df/dt1"
39	"Trip output contact for: F2 + df/dt2"
40	"Trip output contact for: F3 + df/dt3"
41	"Trip output contact for: F4 + df/dt4"
42	"Trip output contact for: F5 + df/dt5"
43	"Trip output contact for: F6 + df/dt6"
44	"Trip output contact for: tAux3"
45	"Trip output contact for: tAux4"
46	"Trip output contact for: tAux5"
47	"Trip output contact for: tV0der>"
48	"Trip output contact for: tV0der>>"
49	"Trip output contact for: tV0der>>>"
50	“Trip output contact for: t EQU E”
51	“Trip output contact for: t EQU F”
52	“Trip output contact for: t EQU G”
53	“Trip output contact for: t EQU H”
54	Trip Voltage Balance K1<
55	Trip Voltage Balance K2<
56	Trip Voltage Balance K3<
57	Trip Voltage Balance K< Poly

1.10 Specific formats for the frequency disturbance records files (P923 only)

Code	Description
F110	Stauts Frame of the frequency disturbance record
	1st Word: Flag of Presence of the frequency disturbance (0: absent , 1: present , 2 under recording). 2nd Word: date of the oldest record (sec , MSB) 3rd Word: date of the oldest record (sec, LSB) 4th Word: date of the oldest record (msec , MSB) 5th Word: date of the oldest record (msec, LSB) 6th Word: Cause of frequency disturbance trigger: Control Commande order for Starting frequency disturbance record Specific logic input: Start disturbance record Instantaneous rate of change of frequency element or a time delayed frequency threshold. Time delayed information of a logic equation Closing of the tripping contact (RL1) 7th Word: Acknowledgement
F111	Frequency disturbance record data
	1st Word: Samples number contained in the mapping 2nd Word: Pre-time sample number 3rd Word: Post-time sample number 4th Word: Primary value of the phase VT (LSB) 5th Word: Primary value of the phase VT (MSB) 6th Word: Secondary value of the phase VT 7th Word: Primary value of the residual VT (LSB) 8th Word: Primary value of the residual VT (MSB) 9th Word: Secondary value of the residual VT 10th Word: Internal ratio- numerator (100) 11th Word: Internal ratio- denominateur (6300 or 1700) 12th Word: Address of the last page in the mapping (containning samples) 13th Word: Words number contained in the last page of the mapping
F112	Conversion rules for the voltage values of the frequency disturbance record
	* In ordre to obtain the phase voltages values at the VT primary, apply the following formula: "Read value" x ("VT primary value" / "VT secondary value") x Internal ratio numerator *In order to obtain the Vo value at the residual VT primary, apply the following formula: "Read value" x ("Residual VT primary value" / "Residual VT secondary value") x Internal ratio numerator Internal ratio numerator=100/internal ratio denominator Internal ration denominator=6300 for the range(57-130V) or 1700 for the range(220-480V) Measured frequency= 1000000/measured cycle
F113	Frequency disturbance record data
	1st Word: disturbance record end time (sec – MSB) 2nd Word: disturbance record end time (sec – LSB) 3rd Word: disturbance record end time (msec – MSB) 4th Word: disturbance record end time (msec – LSB) 5th Word: Cause of frequency disturbance trigger: Control Commande order for Starting frequency disturbance record Specific logic input: Start disturbance record Time delayed information of a logic equation Closing of the tripping contact (RL1) 6th Word: Frequency at the beginning of Post-time

Code	Description	Products		
		P921	P922	P923
F114	Unsigned integer: Logic output status and Fail safe mode			
	bit 0: logic output number RL1 (tripping)	X	X	X
	bit 1: logic output number RL2	X	X	X
	bit 2: logic output number RL3	X	X	X
	bit 3: logic output number RL4	X	X	X
	bit 4: logic output number RL5		X	X
	bit 5: logic output number RL6		X	X
	bit 6: logic output number RL7		X	X
	bit 7: logic output number RL8		X	X
	bits 8 to 15: reserved			
F115	Voltage Balance Status Bit 0: Votage Balance K1< Bit 1: Votage Balance K2< Bit 2: Votage Balance K3< Bit 3: Votage Balance K< Poly			

COURIER DATABASE

BLANK PAGE

1. K-BUS PROTOCOL AND COURIER LANGUAGE

The serial communications are transmitted on K-Bus, a multi –drop network proposing an instantaneous interface with the IEC 870-5 FT1.2 standards. The language and the communication protocol used are Courier. this concept permits especially to the generic programs of the principal units to access to a high number of different relays without need to change permanently the principal unit program for each relay type. The relays form a distributed database in which the principal workstation proceeds to a selective call of the slave relays in order to know all necessary information.

Courier is designed to work using a selective call feature which forbids any slave periphery to communicate directly with the central unit when a particular information about an event needs to be transmitted. The slave workstation has to wait that the principal workstation asks for the information. With Courier protocol, each information is given into a box with a code of the length and the database type. By knowing the database format, the reception periphery can read them.

1.1 K-BUS

K-Bus is a communication system developed for connecting the slave peripheries to the central unit, permitting them to execute all remote monitoring and remote control functions using the appropriate communication language. K-Bus is not able to permit a direct communication between the slave peripheries. Only a communication between the central unit and the slave peripheries can be established. The principal characteristics of the K-Bus are the profitability, high security level, his installation facility and his user friendliness.

1.1.1 K-Bus Transmission Layer

The communication port RS485 is based on several levels of reception and transmission voltages with galvanic isolation given by a transformer. A selective call protocol is used. No relay unit is allowed to transmit before having received a validation message without any error detection. The transmission is synchronous on a pair of isolated waves. The data are coded FM0 with a clock signal to eliminate all CC-component, allowing the signal to cross the transformers.

With the exception of the central units, each network node is passive. The defective units can not interfere with the communication established with the other healthy units. The message format is HDLC. The data transmission speed is 64 Kbits/s.

1.1.2 K-Bus Connection

The connection on the K-Bus port is realized by screwed terminals of 4 mm of MIDOS standards or by FASTON-connectors. A cabled pair is sufficient to realize the connection, Knowing that the polarity is not important. It is recommended to use an external screen earth linked at the end of the principal workstation only. The screen has to be fixed with a M4 screw following the wiring scheme. The functioning of the K-BUS network is guaranteed for 32 units connected on 1000 meters of cables. Thanks to the data code method, the polarity of the Bus cable connection is not important.

Note: the K-Bus network has to finish with a 150 ohms resistance on each end of the bus. The principal workstation can be placed anywhere on the network. This command point has to be unique.

1.1.3 Auxiliary equipment

For communication with the relay it is necessary to have at least one converter case K-Bus/IEC870-5 of the type KITZ and a computer suitable software, an interconnection cable RS232 for connecting the KITZ to the computer and a software conform to the specification of the Courier protocol.

1.2 Relay Courier Database

The Courier database is two dimensional structure with each cell in a database being referenced by a row and a column address. Both the column and the row can take a range from 0 to 255. Addresses in the database are specified as hexadecimal values, eg 0A02 is column 0A (10 decimal) row 02. Associated settings /data will be part of the same column, row zero of the column contains a text string to identify the contents of the column.

This database is given in section 2.

1.2.1 Main Reference Cells

Cell 0020: description on paragraph 1.4.6

Cell 0021: description on paragraph 1.4.7

Cell 0022: description on paragraph 1.4.8

Cell 0023: description on paragraph 1.4.9

Cell 0024: description on paragraph 1.4.9

Cell 0025: description on paragraph 1.4.9

Cell 0026: description on paragraph 1.4.9

(see section 2).

1.2.2 List of events generated by the relay MiCOM P922 and P923

See Format F107 described in MODBUS section.

NOTE: When the cell reference is different from 0, this means that an event is generated the event takes place and another event is generated when the event disappears.

When the cell reference is equal to zero, only the event is generated.

Twelve bits are available in the character String to describe the content of a Courier cell.

When the event appears, the corresponding bit of the associated format changes to “1”.

When the event disappears, the corresponding bit of the associated format changes to “0”.

1.3 Setting Changes

This uses a combination of three commands to perform a settings change:

Enter Setting Mode- checks that the cell is settable and returns to the limits.

Pre-load Setting- Place a new value in the cell, this value is echoed to ensure that no setting changes has taken place, the confirmation of the new setting value does not achieved by this action.

Execute Setting- Confirms the setting change, if the change is valid then a positive response will be returned, if the setting change fails then an error response will be returned.

Abort Setting- This command can be used to abandon the setting change.

This is the most secure method and is ideally suited to on-line editors as the setting limits are taken from the relay before the setting change is made. However this method can be slow if many settings are being changed as three commands are required for each change.

1.4 Systems Integration Data

1.4.1 Address of the relay

The relays can have any address between 1 and 254 included. The address 255 corresponds to the global address to which all relays and all the other slave peripheries respond. The Courier protocol specifies that no response can be resent from the slave periphery to the global message. This permits to avoid that all peripheries respond at the same time creating by this way a conflict on the bus.

Each relay possesses an address settled on 255 in order to guarantee that in case of his connection to the operating network, his address cannot create any conflict with the address of another periphery already in exploitation. In order to permit to a new periphery to be entirely operational, his address has to be settled. The address can be modified manually in capturing the password, than in following the method of the setting change through the user interface on the front plate of the relay.

Similarly, if the computerized system used takes in charge the auto addressing, the relay address can be settled on 0 by activating the auto-addressing characteristics of the computer software. The relay receives then the next valid address on the bus.

If the address is 255 or not known, it can be modified by sending a new address, with a global message, to a periphery possessing a particular serial number. This method is used for those peripheries which do not have any user interface for reading or changing the address in process.

1.4.2 Measured Values

Each measured value can be periodically extracted by a selective call of MiCOM P921, P922 and P923 relays.

1.4.3 Status word

Each response of a slave periphery contains an octet of status. This octet is resent by the relay at the beginning of each message for signaling important data. The principal workstation can be designed to respond automatically to these important data.

The contained indications are the following:

Bit 0: 1=Recording of disturbance available for retrieval

Bit 1: 1=Change of the unit status word

Bit 2: 1=Change of the control status word

Bit 3: 1=Relay busy, no response possible in time

Bit 4: 1=Relay out of service

Bit 5: 1=Recording of events available for retrieval

Bit 6: 1=Switched Alarm indicator

Bit 7: 1=Switched tripping indicator

1.4.4 Unit Status word

The unit status word is located in the menu 000C

Each bits pair of the unit status word serves to indicate the status (position) of the unit elements checked through the relay.

This functionality is not supported on MiCOM P921,P922 and P923 relays.

1.4.5 Control status word

The control status word is located in the cell of the menu 000D

It is used for transmitting the control information of the slave periphery to the central unit. Nevertheless, the relays described in this manual are protection relays , which do not use this control characteristic.

1.4.6 Logic input status word

The logical control input status can be observed in proceeding to a selective call from the cell of menu 0020. The 2 bits inferior of the returned value indicating the status of each of the 2 logic inputs. This cell is accessible only in reading.

Bit 0: Logic input 1

Bit 1: Logic input 2

Bit 2: Logic input 3

Bit 3: Logic input 4

Bit 4: Logic input 5

1.4.7 Output Relay Status word

The output relay status can be observed in proceeding to a selective call from the cell of menu 0021. The 8 bits inferior to the returned value indicating the status of each of the seven output relays . This cell is accessible only in reading.

Bit 0: relay 1 (TRIP)

Bit 1,2,3: programmable relays n° 2,3,4,

Bit 4: Watchdog

Bit 5,6,7,8: programmable relays n° 5,6,7,8

1.4.8 Alarm Information

The status of internal controls triggered by the auto-control program of the relays can be observed in proceeding to a selective call of the cell of menu 0022.

The bits 0 to 6 indicate the material controls of the product.

Bit 0 Watchdog Error

Bit 1 Communication Error

Bit 2 Setting error

Bit 3 VT Error

Bit 4 Clock Error

Bit 5 Calibration error

Bit 6 Statistics Reset

Bit 9 Default settings.

1.4.9 Protection Indication

The protection indications provide the status of different protection elements in the relay; and thus the fault indications are so generated. In case of a fault recording, these indications are transmitted to an events recorder. This is the only way to access to these indications.

The status of the internal protection indication of the relays can be observed in proceeding to a selective call of the cell of menu 0023 , 0024, 0025 and 0026.

The next table presents the list of the protection indications of the cell 0023:

Bit Position	Protection Function
0	U<
1	U<<
2	U<<<
3	U>
4	U>>
5	U>>>
6	V0>
7	V0>>
8	tU<
9	tU<<
10	tU<<<
11	tU>
12	tU>>
13	tU>>>
14	tV0>
15	tV0>>

The next table presents the list of the protection indications of the cell 0024:

Bit Position	Protection Function
0	V0>>>
1	tV0>>>
2	t Aux1
3	t Aux2
4	t Equ A
5	t Equ B
6	Frequency (Not measurable)
7	Open operation time
8	Trip operation Nb
9	Close operation time
10	F1
11	tF1
12	F2
13	tF2
14	F3
15	tF3

The next table presents the list of the protection indications of the cell 0025:

Bit Position	Protection Function
0	F4
1	tF4
2	F5
3	tF5
4	F6
5	tF6
6	V2>
7	V2>>
8	V1<
9	V1<<
10	tV2>
11	tV2>>
12	tV1<
13	tV1<<
14	t Equ C
15	t Equ D

The next table presents the list of the protection indications of the cell 0026: (Only MiCOM P923)

Bit Position	Protection Function
0	df/dt1
1	df/dt2
2	df/dt3
3	df/dt4
4	df/dt5
5	df/dt6
6	dU/dt1
7	dU/dt2
8	dU/dt3
9	dU/dt4
10	F1 + df/dt1
11	F2 + df/dt2
12	F3 + df/dt3
13	F4 + df/dt4
14	F5 + df/dt5
15	F6 + df/dt6

The next table presents the list of the protection indications of the cell 0027:

Bit Position	Protection Function
0	tVTS
1	V0der>
2	tV0der>
3	V0der>>
4	tV0der>>
5	V0der>>>
6	tV0der>>>
7	tAux3
8	tAux4
9	tAux5
10	t Equation E
11	t Equation F
12	t Equation G
13	t Equation H

1.4.10 Control and supervision

The control functions through the relays can be executed using a serial link. These functions particularly constitute the changes of an individual relay setting parameters, the changes of the setting group, the remote control of the circuit breaker, as well as the functions and the locking of the selected output relays.

The remote control is limited to the selected control functions in the table of the relay menu. In order to modify this selection, a corresponding password is needed. The CRC and the controls of the message length are used every time a message is received . No response is given for message received with an error detection. The principle unit can be re-initialized in order to send again an order, as often as it seems necessary, if it does not receive any response or have received a response with an error detection.

NOTE: The control commands are generally materialized by the change of the cell value. They dispose the same inherent security. No response is allowed for the global orders to avoid any conflict in the bus. For this type of order, a double transmission is used by the relay for the verification of the message. The relay transmits then a confirmation indicating that the control order or the change of setting is accepted. If this is not the case, the relay sends an error message.

1.4.11 Remote Change of setting

When using the serial port, the relay responds to the orders of setting changes only if the SD0 Link =1 is selected.

- The selection of the SD0 Link =1 blocks all the remote changes of settings with the exception of the SC logical Links and the password capture.
- When the SD0 Link =0 is selected, the remote setting changes are protected by the password.

To make a remote changes of settings, a password is needed to be captured (remotely), and then the SD and SD0 function Links have to be set equal to 1.

1.5 Events Extraction (MiCOM P922 and P923 only)

Events can be extracted either manually or automatically. For automatic extraction all events are extracted in sequential order using the standard Courier mechanism, this includes Faults. The manual approach allows the user to select events and faults randomly from the stored records.

1.5.1 Automatic Event Extraction

This method is intended for continuous extraction of events and fault information as it is produced via the rear port.

When a new event information is created, the event bit is set within the status byte. This indicates to the Master device that an event information is available. The oldest (and not extracted) event can be extracted from the relay using the Send Event Command. The relay will respond with the event data, which will be either a Courier Type 0 or Type 3 event. The latest type is used for the fault records.

Once an event is extracted from the relay, the Accept Event can be used to confirm that this event has been successfully extracted. If all the events are extracted, then the event bit will reset. If there are more events to be extracted, the next one can be accessed using the Send Event Command as before.

1.5.2 Events Types

Events will be created by the relay under the following circumstances:

- Change of state of output contact
- Change of state of opto input
- Protection element operation
- Alarm condition
- Setting change
- Fault record (Type 3 Courier Event)

1.5.3 Event Format

The Send Event Command results in the return of the following fields by the relay:

- Cell Reference
- Time stamp
- Cell text
- Cell value

The list of events created by the relay (section 1.2.2) indicates how the content of the above mentioned fields are interpreted. The fault event will return a Courier Type 3 event which contains the above fields together with two additional fields:

- Event extraction column
- Event number

These fields contain additional information which are extracted from the relay using the referenced extraction column. Row 01 of the extraction column contains a setting which allows the selection of the fault record. This setting should be set to the event number value returned within the record, the extended data can be extracted from the relay by uploading the text and data from the column.

1.5.4 Manual record Extraction

Column 02 of the database can be used to manually view the fault records. The contents of this column will depend of the nature of the record selected. It is possible to select directly a fault record.

Fault record selection (Row 01) – this cell can be used to directly select a fault record using a value between 0 and 4 to select one of the five stored fault records (0 will be the most recent fault while 4 is the oldest one). The column will then contain the details of the fault record selected (row 02 to 0A).

It should be noted that if this column is used to extract event information from the relay, the number associated with a particular record will change when a new fault occurs.

1.6 Disturbance Record Extraction

The stored disturbance records within the relay are accessible via the Courier interface.

Select Record Number (Row 01) – this cell can be used to select the record to be extracted. Record 0 will be the oldest un-extracted record, older records will be assigned positive values, and negative values will be used for more recent records. To facilitate automatic extraction via the rear port, the disturbance bit of the Status byte is set by the relay whenever there are un-extracted disturbance records.

Once a record has been selected, using the above cell, the time and date of the record can be read from the cell 02. The disturbance record itself can be extracted using the block transfer mechanism from cell B00B.

As it has been stated, the rear Courier port can be used to automatically extract disturbance records as they occur. This is possible when using the standard Courier mechanism defined in chapter 8 of the Courier User Guide.

2. COURIER DATABASE

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
00	00	SYSTEM DATA						
	01	Language	Ver>: Indexed String	0 1 2 3	Lang1 (French) Lang2 (English) * Lang3 (German) Lang4 (Spanish)		Setting	0/3/1
	02	Password	ASCII Password(4 bytes)		AAAA		Setting	32/127/1
	03	Fnlinks: NON IMPLEMENTE						
	04	Description	ASCII Text (6 bytes)		"P922xy" or "P921xy", with: x = S or – y = 0 or 1 (V. Gam)		Setting	32/127/1
	05	Plant Reference	ASCII Text (4 bytes)		"Pref"		Setting	32/127/1
	06	Model Number	ASCII Text (16 bytes)		"Model Number"		Data	
	07	Firmware Number: NON IMPLEMENTE						
	08	Serial Number	ASCII Text (16 bytes)		"Serial Number"		Data	
	09	Frequency	Unsigned Integer (2 bytes)		XXXX Hz		Setting	50/60/10
	0A	Communication Level	Unsigned Integer (2 bytes)		1		Data	
	0B	Address	Unsigned Integer (2 bytes)		1*		Setting	1/255/1
	0C	Plant Status Word: NON IMPLEMENTE						
	0D	Control Status Word: NON IMPLEMENTE						
	0E	Setting Group	Unsigned Integer				Data	
	0F	Load shed Stage: NON IMPLEMENTE						
	10	Circuit Breaker Control	NON IMPLEMENTE					
	11	Software Reference	ASCII Text (16 characters)				Data	
	12-1F	Unused, reserved						
	20	Logic input Status	Binary flag (5 bits / 2 bits)		0: log input 1 1: log input 2 2: log input 3 3: log input 4 4: log input 5		Data	

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	21	Relay Output Status	Binary flag (9 bits / 5 bits)		0: relay 1 (trip) 1: relay 2 2: relay 3 3: relay 4 4: watchdog relay 5: relay 5 6: relay 6 7: relay 7 8: relay 8		Data	
	22	Alarm	Binary flag (16 bits)		0: Watchdog err 1: Comm error 2: Setting error 3: Vt error 4: Clock error 5: Calibration error 6: Stats reset 7: reserved 8: maintenance mode 9: Default settings		Data	
	23	Pseudo Logic input Status group 1	Binary flag (16 bits)		0: U< 1: U<< 2: U<<< 3: U> 4: U>> 5: U>>> 6: V0> 7: V0>> 8: t U< 9: t U<< 10: t U<<< 11: t U> 12: t U>> 13: t U>>> 14: t V0> 15: t V0>>		Data	

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	24	Pseudo Logic input Status group 2	Binary flag (16 bits / 6 bits)		0: V0>>> 1: tV0>>> 2: t Aux 1 3: t Aux 2 4: t Equ A 5: t Equ B 6: Freq. Non measurable 7: Open Operating Time 8: Trip operation Nb 9: Close operating time 10: F1 11: tF1 12: F2 13: tF2 14: F 3 15: tF3		Data	
	25	Pseudo Logic input Status group 3	Binary flag (16 bits)		0: F4 1: tF4 2: F5 3: tF5 4: F6 5: tF6 6: V2> 7: V2>> 8: V1< 9: V1<< 10: tV2> 11: tV2>> 12: tV1< 13: tV1<< 14: t Equ C 15: t Equ D			

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	26	Pseudo Logic input Status group 4	Binary flag (16 bits)		0: DFDT1 1: DFDT2 2: DFDT3 3: DFDT4 4: DFDT5 5: DFDT6 6: DUDT1 7: DUDT2 8: DUDT3 9: DUDT4 10: F1 + DFDT1 11: F2 + DFDT2 12: F3 + DFDT3 13: F4 + DFDT4 14: F5 + DFDT5 15: F6 + DFDT6			
	27	Pseudo Logic input Status group 5	Binary flag (14 bits)		0: tVTS 1: V0der> 2: V0der>> 3: V0der>>> 4: tV0der> 5: tV0der>> 6: tV0der>>> 7: tAux3 8: tAux4 9: tAux5 10: Equ. E 11: Equ. F 12: Equ. G 13: Equ. H			

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
01	00	USER CONTROL						
	01	Remote control 1	Binary flag (16 bits / 10 bits)		0: Unlock trip cont. 1: Ack first alarm 2: Ack all alarms 3: TRIP 4: CLOSE 5: Setting Change 6: RMS over&max Reset 7: Reserved 8: Dist. Rec. Trig 9: Maintenance start 10: Freq. dist. Rec. trig 11: Reserved 12: Reserved 13: Reserved 14: Reserved 15: Stats reset ack.		Setting	0/ 31/ 1 or 0/65535/1
	02	Remote control 2	Binary flag (9 bits / 5 bits)		0: Relay 1: Trip 1: Relay 2 2: Relay 3 3: Relay 4 4: Relay watch-dog 5: Relay 5 6: Relay 6 7: Relay 7 8: Relay 8		Setting	0/ 31/ 1 or 0/511/1
	03	Remote control 3	Binary flag (16 bits)		0: Reserved 1: Reserved 2: Reserved 3: CB operation nb reset 4: Reserved 5: Reserved 6: Reset Leds 7: Maintenance stop 8: Comm. Order 1 9: Comm. Order 2 10: Comm. Order 3 11: Comm. Order 4 12: Data record reset 13: Reserved 14: Reserved 15: Reserved		Setting	0/ 31/ 1 or 0/65535/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
02	00	VIEW RECORDS						
	01	Record number	Unsigned Integer (2 bytes)			5 *	Setting	1/5/1
	02	Occur date	Unsigned Integer (2 bytes)					
	03	Active set group	Unsigned Integer (2 bytes)					
	04	Phase in fault	ASCII Text					
	05	Fault Id	ASCII Text					
	06	Magnitude	Courier floating point number					
	07	Ua magnitude	Courier floating point number					
	08	Ub magnitude	Courier floating point number					
	09	Uc magnitude	Courier floating point number					
	0A	V0 magnitude	Courier floating point number					
03	00	MEASUREMENTS						
	01	Ua/Uab RMS	Courier floating point number				Data	
	02	Ub/Ubc RMS	Courier floating point number				Data	
	03	Uc/Uca RMS	Courier floating point number				Data	
	04	V0 RMS	Courier floating point number				Data	
	05	V1 (Vdirect)	Courier floating point number				Data	
	06	V2 (Vinv)	Courier floating point number				Data	
	07	FREQUENCY	Courier floating point number				Data	
	08	Reset Max & Moy RMS						
	09	MAX RMS Ua/Uab	Courier floating point number				Data	
	0A	MAX RMS Ub/Ubc	Courier floating point number				Data	
	0B	MAX RMS Uc/Uca	Courier floating point number				Data	
	0C	Ua/Uab RMS AVERAGE	Courier floating point number				Data	
	0D	Ub/Ubc RMS AVERAGE	Courier floating point number				Data	
	0E	Uc/Uca RMS AVERAGE	Courier floating point number				Data	
	0F	Frequency Changeof rate	Courier floating point number				Data	
	10	Uab module	Courier floating point number				Data	
	11	Ubc module	Courier floating point number				Data	
	12	Uca module	Courier floating point number				Data	

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	13	V0 module	Courier floating point number				Data	
	14	V0der module	Courier floating point number				Data	
06	00	SW MONITORING						
	01	SW operation time	Courier floating point number		0.0 s		Data	
	02	SW Closing time	Courier floating point number				Data	
	03	SW operation nb	Unsigned Integer (2 bytes)				Data	
08	00	TIME:						
	01	Date/Time	IEC870 Time & Date				Data	
	02	Date Format (IEC/no)	Indexed String		0: Private * 1: IEC		Setting	0 (Private) / 1 (IEC)
0C	00	FAIL-SAFE RELAYS SETTING						
	01	Positive sense	Binary flag (9 bits / 5 bits)		0: Relay 1: Trip 1: Relay 2 2: Relay 3 3: Relay 4 4: Relay watch-dog 5: Relay 5 6: Relay 6 7: Relay 7 8: Relay 8		Setting	0/ 31/ 1 or 0/511/1
0D	00	SETTING CHOICE						
	01	Voltage wiring type	Unsigned Integer (2 bytes)		3 Vpn * / 3 Vpn + Vr / 2 Vpp + Vr / 3 Vpp + Vr		Setting	0/ 3/ 1
	02	Protection type (PN-PP)	Unsigned Integer (2 bytes)		0 *	0D01 < 2	Setting	0 (P-N) / 1 (P-P)/1
	03	[59N] filter activation	Binary flag (1 bit)		Disabled * / Enabled		Setting	0 / 1 /1
	10	FREQUENCY & DF/DT SETTINGS						
	11	DF/DT cycle number	Unsigned Integer (2 bytes)		1 *		Setting	1 / 200 / 1
	12	DF/DT validation number	Unsigned Integer (2 bytes)		4 *		Setting	2 / 4 / 2
	13	Frequency protection blocking threshold	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V		Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	14	DU/DT validation number	Unsigned Integer (2 bytes)		2 *		Setting	2 / 4 / 1
	15	dF/dT inhib. Block.> 20 Hz/s	Binary flag (1 bit)		Disabled * / Enabled		Setting	0 / 1 /1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
0E	00	VT RATIOS						
	01	Phase VT Primary	Unsigned Integer (2 bytes)		2000 *		Setting	10/100000/1 if 1000KV Range else 22/48/1
	02	Phase VT Secondary (1000 KV Range)	Unsigned Integer (2 bytes)		1000 *		Setting	570/1300/1 if 1000KV Range
	03	Neutral VT Primary	Unsigned Integer (2 bytes)		2000 *	0D01 != 0	Setting	10/100000/1 if 1000KV Range else 22/48/1
	04	Neutral VT Secondary (1000 KV Range)	Unsigned Integer (2 bytes)		1000 *	0D01 != 0	Setting	570/1300/1 if 1000KV Range
0F	00	SETTING GROUPS						
	01	Setting group toggle	Indexed String		0: Edge * 1: Level		Setting	0 (Edge) / 1 (Level)
	02	Select setting group	Unsigned Integer (2 bytes)		1*	0F01 = 0	Setting	1/2
	03	Group 1 visible	Indexed String		0: YES * 1: NO		Setting	0 (YES) / 1 (NO)
	04	Group 2 visible	Indexed String		0: YES 1: NO *		Setting	0 (YES) / 1 (NO)
		Protection Group n° 1						
20	00	PHASE UNDERVOLTAGE						
	01	Stage 1 Undervoltage	(Sub Heading)					
	02	Max U<	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	03	Threshold U<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2002 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2002 != 0	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	2004=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	2004 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay U<	Courier floating point number		0.04 s *	2004=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Undervoltage	(Sub Heading)					

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	11	Max U<<	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	12	Threshold U<<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2011 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay U<<	Courier floating point number		0.01 s *	2011 != 0	Setting	0 / 599.9 / 0.01 s
	14-1F	Reserved						
	20	Stage 3 Undervoltage	(Sub Heading)					
	21	Max U<<<	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	22	Threshold U<<<	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2021 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	23	Delay U<<<	Courier floating point number		0.01 s *	2021 != 0	Setting	0 / 599.9 / 0.01 s
	24	Hysteresis U<	Unsigned Integer (2 bytes)		102 % *	2002 != 0 or 2011 !=0 or 2021 !=0	Setting	102 / 105 / 1 (%)
21	00	PHASE OVERVOLTAGE						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max U>	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	03	Threshold U>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2102 != 0	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2102 != 0	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	2104=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	2104 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay U>	Courier floating point number		0.04 s *	2104=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max U>>	Indexed String	0	0 = NO*/1 = OR/2 = AND		Setting	0/2/1
	12	Threshold U>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2111 != 0	Setting	5.0 / 260.0 / 0.1 if 1000KV Range else 20.0 / 960.0 / 0.5
	13	Delay U>>	Courier floating point number		0.01 s *	2111 != 0	Setting	0 / 599.9 / 0.01 s

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	14-1F	Reserved						
	20	Stage 3 Overvoltage	(Sub Heading)					
	21	Max U>>>	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	22	Threshold U>>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2121 != 0	Setting	5.0 / 260.0 / 0.1 if 1000KV Range else 20.0 / 960.0 / 0.5
	23	Delay U>>>	Courier floating point number		0.01 s *	2121 != 0	Setting	0 / 599.9 / 0.01 s
	24	Hysteresis U>	Unsigned Integer (2 bytes)		98 % *	2102 != 0 or 2111 !=0 or 2121 !=0	Setting	95 / 98 / 1 (%)
22	00	EARTH FAULT						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max V0>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	03	Threshold V0>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2202=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2202=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	2204=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	2204 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V0>	Courier floating point number		0.04 s *	2204=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max V0>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V0>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2211=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay V0>>	Courier floating point number		0.04 s *	2211=1	Setting	0 / 599.9 / 0.01 s
	14-1F	Reserved						
	20	Stage 3 Overvoltage	(Sub Heading)					
	21	Max V0>>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	22	Threshold V0>>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2221=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	23	Delay V0>>>	Courier floating point number		0.04 s *	2221=1	Setting	0 / 599.9 / 0.01 s
	30	Stage 1 Residual derived Overvoltage	(Sub Heading)					
	31	Max V0der>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	32	Threshold V0der>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2231=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	33	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2231=1	Setting	0/1/1
	34	TMS	Courier floating point number		1.0 *	2233=1	Setting	0.5/100.0/0.5
	35	T RESET V0der>	Courier floating point number		0.1 s *	2233 = 1	Setting	0 / 1000.0 / 0.1 s
	36	Delay V0der>	Courier floating point number		0.04 s *	2233=0	Setting	0 / 599.9 / 0.01 s
	37-3F	Reserved						
	40	Stage 2 Residual derived Overvoltage	(Sub Heading)					
	41	Max V0der>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	42	Threshold V0der>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2241=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	43	Delay V0der>>	Courier floating point number		0.04 s *	2241=1	Setting	0 / 599.9 / 0.01 s
	44-4F	Reserved						
	50	Stage 3 Residual derived Overvoltage	(Sub Heading)					
	51	Max V0der>>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	52	Threshold V0der>>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2251=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	53	Delay V0der>>>	Courier floating point number		0.04 s *	2251=1	Setting	0 / 599.9 / 0.01 s
23	00	V2 (Vinverse) OVERVOLTAGE						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max V2>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	03	Threshold V2>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2302=1	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2302=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	2304=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	2304 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V2>	Courier floating point number		0.04 s *	2304=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max V2>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V2>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	2311=1	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	13	Delay V2>>	Courier floating point number		0.04 s *	2311=1	Setting	0 / 599.9 / 0.01 s
24	00	V1 (Direct) UNDERVOLTAGE						
	01	Stage 1 Undervoltage	(Sub Heading)					
	02	Max V1<	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	03	Threshold V1<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2402=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	2402=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	2404=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	2404 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V1<	Courier floating point number		0.04 s *	2404=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Undervoltage	(Sub Heading)					
	11	Max V1<<	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V1<<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	2411=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay V1<<	Courier floating point number		0.04 s *	2411=1	Setting	0 / 599.9 / 0.01 s

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
25	00	FREQUENCY						
	01	F1	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	02	Threshold F1	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	2501 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	03	Delay F1	Courier floating point number		0.04 s *	2501 != 0	Setting	0 / 599.9 / 0.01 s
	04	F2	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	05	Threshold F2	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	2504 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	06	Delay F2	Courier floating point number		0.04 s *	2504 != 0	Setting	0 / 599.9 / 0.01 s
	07	F3	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	08	Threshold F3	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	2507 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	09	Delay F3	Courier floating point number		0.04 s *	2507 != 0	Setting	0 / 599.9 / 0.01 s
	0A	F4	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	0B	Threshold F4	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	250A != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	0C	Delay F4	Courier floating point number		0.04 s *	250A != 0	Setting	0 / 599.9 / 0.01 s
	0D	F5	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	0E	Threshold F5	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	250D != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	0F	Delay F5	Courier floating point number		0.04 s *	250D != 0	Setting	0 / 599.9 / 0.01 s
	10	F6	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	11	Threshold F6	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	2510 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	12	Delay F6	Courier floating point number		0.04 s *	2510 != 0	Setting	0 / 599.9 / 0.01 s
26	00	FREQUENCY CHANGE OF RATE						
	01	df/dt 1	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	02	Threshold df/dt 1	Courier floating point number		1.0 Hz /s *	2601 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	03	df/dt 2	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	04	Threshold df/dt 2	Courier floating point number		1.0 Hz /s *	2603 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	05	df/dt 3	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	06	Threshold df/dt 3	Courier floating point number		1.0 Hz /s *	2605 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	07	df/dt 4	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	08	Threshold df/dt 4	Courier floating point number		1.0 Hz /s *	2607 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	09	df/dt 5	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0A	Threshold df/dt 5	Courier floating point number		1.0 Hz /s *	2609 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	0B	df/dt 6	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0C	Threshold df/dt 6	Courier floating point number		1.0 Hz /s *	260B != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
27	00	DELTA U / DELTA T						
	01	dU/dt 1	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	02	Threshold dU 1	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	2701 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	03	Threshold dT 1	Courier floating point number		1.0 s *	2701 != 0	Setting	0.1 / 10.0 / 0.02 s
	04	dU/dt 2	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	05	Threshold dU 2	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	2704 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	06	Threshold dT 2	Courier floating point number		1.0 s *	2704 != 0	Setting	0.1 / 10.0 / 0.02 s
	07	dU/dt 3	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	08	Threshold dU 3	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	2707 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	09	Threshold dT 3	Courier floating point number		1.0 s *	2707 != 0	Setting	0.1 / 10.0 / 0.02 s
	0A	dU/dt 4	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0B	Threshold dU 4	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	270A != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	0C	Threshold dT 4	Courier floating point number		1.0 s *	270A != 0	Setting	0.1 / 10.0 / 0.02 s
		Protection Group n° 2						

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
40	00	PHASE UNDERVOLTAGE						
	01	Stage 1 Undervoltage	(Sub Heading)					
	02	Max U<	Indexed String	0	0 = NO*/1 = OR/2 = AND		Setting	0/2/1
	03	Threshold U<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4002 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4002 != 0	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	4004=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	4004 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay U<	Courier floating point number		0.04 s *	4004=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Undervoltage	(Sub Heading)					
	11	Max U<<	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	12	Threshold U<<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4011 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay U<<	Courier floating point number		0.01 s *	4011 != 0	Setting	0 / 599.9 / 0.01 s
	14-1F	Reserved						
	20	Stage 3 Undervoltage	(Sub Heading)					
	21	Max U<<<	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	22	Threshold U<<<	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4021 != 0	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	23	Delay U<<<	Courier floating point number		0.01 s *	4021 != 0	Setting	0 / 599.9 / 0.01 s
	24	Hysteresis U<	Unsigned Integer (2 bytes)		102 % *	4002 != 0 or 4011 !=0 or 4021 !=0	Setting	102 / 105 / 1 (%)
41	00	PHASE OVERVOLTAGE						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max U>	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	03	Threshold U>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4102 != 0	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4102 != 0	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	4104=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	4104 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay U>	Courier floating point number		0.04 s *	4104=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max U>>	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	12	Threshold U>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4111 != 0	Setting	5.0 / 260.0 / 0.1 if 1000KV Range else 20.0 / 960.0 / 0.5
	13	Delay U>>	Courier floating point number		0.01 s *	4111 != 0	Setting	0 / 599.9 / 0.01 s
	14-1F	Reserved						
	20	Stage 3 Overvoltage	(Sub Heading)					
	21	Max U>>>	Indexed String	0	0 = NO* / 1 = OR / 2 = AND		Setting	0/2/1
	22	Threshold U>>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4121 != 0	Setting	5.0 / 260.0 / 0.1 if 1000KV Range else 20.0 / 960.0 / 0.5
	23	Delay U>>>	Courier floating point number		0.01 s *	4121 != 0	Setting	0 / 599.9 / 0.01 s
	24	Hysteresis U>	Unsigned Integer (2 bytes)		98 % *	4102 != 0 or 4111 !=0 or 4121 !=0	Setting	95 / 98 / 1 (%)
42	00	EARTH FAULT						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max V0>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	03	Threshold V0>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4202=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4202=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	4204=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	4204 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V0>	Courier floating point number		0.04 s *	4204=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max V0>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V0>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4211=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay V0>>	Courier floating point number		0.04 s *	4211=1	Setting	0 / 599.9 / 0.01 s
	14-1F	Reserved						
	20	Stage 3 Overvoltage	(Sub Heading)					
	21	Max V0>>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	22	Threshold V0>>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4221=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	23	Delay V0>>>	Courier floating point number		0.04 s *	4221=1	Setting	0 / 599.9 / 0.01 s
	30	Stage 1 Residual derived Overvoltage	(Sub Heading)					
	31	Max V0der>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	32	Threshold V0der>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4231=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	33	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4231=1	Setting	0/1/1
	34	TMS	Courier floating point number		1.0 *	4233=1	Setting	0.5/100.0/0.5
	35	T RESET V0der>	Courier floating point number		0.1 s *	4233 = 1	Setting	0 / 1000.0 / 0.1 s
	36	Delay V0der>	Courier floating point number		0.04 s *	4233=0	Setting	0 / 599.9 / 0.01 s
	37-3F	Reserved						

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	40	Stage 2 Residual derived Overvoltage	(Sub Heading)					
	41	Max V0der>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	42	Threshold V0der>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4241=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	43	Delay V0der>>	Courier floating point number		0.04 s *	4241=1	Setting	0 / 599.9 / 0.01 s
	44-4F	Reserved						
	50	Stage 3 Residual derived Overvoltage	(Sub Heading)					
	51	Max V0der>>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	52	Threshold V0der>>>	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4251=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	53	Delay V0der>>>	Courier floating point number		0.04 s *	4251=1	Setting	0 / 599.9 / 0.01 s
43	00	V2 (Vinverse) OVERVOLTAGE						
	01	Stage 1 Overvoltage	(Sub Heading)					
	02	Max V2>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	03	Threshold V2>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4302=1	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4302=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	4304=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	4304 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V2>	Courier floating point number		0.04 s *	4304=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Overvoltage	(Sub Heading)					
	11	Max V2>>	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V2>>	Courier floating point number		130.0 V * if 1000KV Range else 480.0 V	4311=1	Setting	5.0 / 200.0 / 0.1 if 1000KV Range else 20.0 / 720.0 / 0.5
	13	Delay V2>>	Courier floating point number		0.04 s *	4311=1	Setting	0 / 599.9 / 0.01 s
44	00	V1 (Direct) UNDERVOLTAGE						
	01	Stage 1 Undervoltage	(Sub Heading)					

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	02	Max V1<	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	03	Threshold V1<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4402=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	04	Delay Type	Indexed String	0 1	0: definite time * 1: inverse time	4402=1	Setting	0/1/1
	05	TMS	Courier floating point number		1.0 *	4404=1	Setting	0.5/100.0/0.5
	06	T RESET	Courier floating point number		0.1 s *	4404 = 1	Setting	0 / 1000.0 / 0.1 s
	07	Delay V1<	Courier floating point number		0.04 s *	4404=0	Setting	0 / 599.9 / 0.01 s
	08-0F	Reserved						
	10	Stage 2 Undervoltage	(Sub Heading)					
	11	Max V1<<	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	12	Threshold V1<<	Courier floating point number		5.0 V * if 1000KV Range else 20.0 V	4411=1	Setting	5.0 / 130.0 / 0.1 if 1000KV Range else 20.0 / 480.0 / 0.5
	13	Delay V1<<	Courier floating point number		0.04 s *	4411=1	Setting	0 / 599.9 / 0.01 s
45	00	FREQUENCY						
	01	F1	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	02	Threshold F1	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	4501 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	03	Delay F1	Courier floating point number		0.04 s *	4501 != 0	Setting	0 / 599.9 / 0.01 s
	04	F2	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	05	Threshold F2	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	4504 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	06	Delay F2	Courier floating point number		0.04 s *	4504 != 0	Setting	0 / 599.9 / 0.01 s
	07	F3	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	08	Threshold F3	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	4507 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	09	Delay F3	Courier floating point number		0.04 s *	4507 != 0	Setting	0 / 599.9 / 0.01 s
	0A	F4	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	0B	Threshold F4	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	450A != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	0C	Delay F4	Courier floating point number		0.04 s *	450A != 0	Setting	0 / 599.9 / 0.01 s
	0D	F5	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	0E	Threshold F5	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	450D != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	0F	Delay F5	Courier floating point number		0.04 s *	450D != 0	Setting	0 / 599.9 / 0.01 s
	10	F6	Indexed String	0	NO* / 81< / 81>		Setting	0/2/1
	11	Threshold F6	Courier floating point number		50.00 Hz * if Fn = 50 Hz else 60.00 Hz	4510 != 0	Setting	40.00 / 60.00 / 0.01 if Fn = 50 Hz else 50.00 / 70.00 / 0.01
	12	Delay F6	Courier floating point number		0.04 s *	4510 != 0	Setting	0 / 599.9 / 0.01 s
46	00	FREQUENCY CHANGE OF RATE						
	01	df/dt 1	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	02	Threshold df/dt 1	Courier floating point number		1.0 Hz /s *	4601 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	03	df/dt 2	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	04	Threshold df/dt 2	Courier floating point number		1.0 Hz /s *	4603 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	05	df/dt 3	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	06	Threshold df/dt 3	Courier floating point number		1.0 Hz /s *	4605 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	07	df/dt 4	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	08	Threshold df/dt 4	Courier floating point number		1.0 Hz /s *	4607 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	09	df/dt 5	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0A	Threshold df/dt 5	Courier floating point number		1.0 Hz /s *	4609 != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
	0B	df/dt 6	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0C	Threshold df/dt 6	Courier floating point number		1.0 Hz /s *	460B != 0	Setting	-10.0 / 10.0 / 0.1 Hz/s
47	00	DELTA U / DELTA T						
	01	dU/dt 1	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	02	Threshold dU 1	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	4701 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	03	Threshold dT 1	Courier floating point number		1.0 s *	4701 != 0	Setting	0.1 / 10.0 / 0.02 s

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	04	dU/dt 2	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	05	Threshold dU 2	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	4704 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	06	Threshold dT 2	Courier floating point number		1.0 s *	4704 != 0	Setting	0.1 / 10.0 / 0.02 s
	07	dU/dt 3	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	08	Threshold dU 3	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	4707 != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	09	Threshold dT 3	Courier floating point number		1.0 s *	4707 != 0	Setting	0.1 / 10.0 / 0.02 s
	0A	dU/dt 4	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	0B	Threshold dU 4	Courier floating point number		10.0 V * if 1000KV Range else 40.0 V *	470A != 0	Setting	1.0 / 200.0 / 0.5 V if 1000KV Range else 4.0 / 720.0 / 0.5 V
	0C	Threshold dT 4	Courier floating point number		1.0 s *	470A != 0	Setting	0.1 / 10.0 / 0.02 s
60	00	AUTOMATISM						
	01	Trip Configuration	Binary (15 bits)	0 *	0: t U< 1: t U<< 2: t U<<< 3: t U> 4: t U>> 5: t U>>> 6: t V0> 7: t V0>> 8: t V0>>> 9: t Aux 1 10: t Aux 2 11: t Equ 1 12: t Equ 2 13: t Equ 3 14: t Equ 4		Setting	0/32767/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	02	Trip Configuration (2)	Binary (10 bits / 16 bits)	0 *	0: tV2> 1: tV2>> 2: tV1< 3: tV1<< 4: tF1 5: tF2 6: tF3 7: tF4 8: tF5 9: tF6 10: DFDT1 11: DFDT2 12: DFDT3 13: DFDT4 14: DFDT5 15: DFDT6		Setting	0/1023/1 or 0/65535/1
	03	Latched Configuration	Binary (15 bits)	0 *	0: t U< 1: t U<< 2: t U<<< 3: t U> 4: t U>> 5: t U>>> 6: t V0> 7: t V0>> 8: t V0>>> 9: t Aux 1 10: t Aux 2 11: t Equ 1 12: t Equ 2 13: t Equ 3 14: t Equ 4		Setting	0/32767/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	04	Latched Configuration (2)	Binary (10 bits / 16 bits)	0 *	0: tV2> 1: tV2>> 2: tV1< 3: tV1<< 4: tF1 5: tF2 6: tF3 7: tF4 8: tF5 9: tF6 10: DFDT1 11: DFDT2 12: DFDT3 13: DFDT4 14: DFDT5 15: DFDT6		Setting	0/1023/1 or 0/65535/1
	05	Blocking 1 Configuration	Binary (11 bits/ 16 bits)	0 *	0: t U< 1: t U<< 2: t U<<< 3: t U> 4: t U>> 5: t U>>> 6: t V0> 7: t V0>> 8: t V0>>> 9: t Aux 1 10: t Aux 2 11: Reserved 12: DUDT1 13: DUDT2 14: DUDT3 15: DUDT4		Setting	0/2047/1 or 0/65535/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	06	Blocking 1 Configuration (2)	Binary (10 bits/ 16 bits)	0 *	0: tV2> 1: tV2>> 2: tV1< 3: tV1<< 4: tF1 5: tF2 6: tF3 7: tF4 8: tF5 9: tF6 10: DFDT1 11: DFDT2 12: DFDT3 13: DFDT4 14: DFDT5 15: DFDT6		Setting	0/1023/1 or 0/65535/1
	07	Blocking 2 Configuration	Binary (11 bits/ 16 bits)	0 *	As "Blocking 1 Configuration"		Setting	0/2047/1 or 0/65535/1
	08	Blocking 2 Configuration (2)	Binary (10 bits/ 16 bits)	0 *	As "Blocking 1 Configuration (2)"		Setting	0/1023/1 or 0/65535/1
	09	Trip Configuration (3)	Binary (16 bits)	0 *	0: DUDT1 1: DUDT2 2: DUDT3 3: DUDT4 4: F1 + DFDT1 5: F2 + DFDT2 6: F3 + DFDT3 7: F4 + DFDT4 8: F5 + DFDT5 9: F6 + DFDT6 10: tAux3 11: tAux4 12: tAux5 13: tV0der> 14: tV0der>> 15: tV0der>>>		Setting	0/65535/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	0A	Latched Configuration (3)	Binary (16 bits)	0 *	0: DUDT1 1: DUDT2 2: DUDT3 3: DUDT4 4: F1 + DFDT1 5: F2 + DFDT2 6: F3 + DFDT3 7: F4 + DFDT4 8: F5 + DFDT5 9: F6 + DFDT6 10: tAux3 11: tAux4 12: tAux5 13: tV0der> 14: tV0der>> 15: tV0der>>>		Setting	0/65535/1
	0B	Trip Configuration (4)	Binary (5 bits)	0 *	0: t Equ E 1: t Equ F 2: t Equ G 3: t Equ H 4: Reserved		Setting	0/31/1
	0C	Latched Configuration (4)	Binary (5 bits)	0 *	0: t Equ E 1: t Equ F 2: t Equ G 3: t Equ H 4: Reserved		Setting	0/31/1
	0D	Blocking 1 Configuration (3)	Binary (6 bits)	0 *	0: tAux3 1: tAux4 2: tAux5 3: tV0der> 4: tV0der>> 5: tV0der>>>		Setting	0/63/1
	0E	Blocking 2 Configuration (3)	Binary (6 bits)	0 *	0: tAux3 1: tAux4 2: tAux5 3: tV0der> 4: tV0der>> 5: tV0der>>>		Setting	0/63/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
61	00	LOGIC INPUT ALLOCATION						
	01	Logic input allocation 1	Indexed String	0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19	0: nothing * 1: unlatch 2: 52 a 3: 52 b 4: external CB failure 5: External input 1 6: External input 2 7: Blocking logic 1 8: Blocking logic 2 9: Setting change 10: Disturbance trig 11: External input 3 12: External input 4 13: External input 5 14: Control Trip 15: Control Close 16: Time synchronisation 17: Reset Leds 18: VTS 19: Maintenance mode		Setting	0 / 19 / 1
	02	Logic input allocation 2	Indexed String	--	As "Logic input allocation 1"		Setting	0 / 19 / 1
	03	Logic input allocation 3	Indexed String	--	As "Logic input allocation 1"		Setting	0 / 19 / 1
	04	Logic input allocation 4	Indexed String	--	As "Logic input allocation 1"		Setting	0 / 19 / 1
	05	Logic input allocation 5	Indexed String	--	As "Logic input allocation 1"		Setting	0 / 19 / 1
	06	Timer aux 1	Courier floating point number		0 *		Setting	0 / 200.0 / 0.01 s
	07	Timer aux 2	Courier floating point number		0 *		Setting	0 / 200.0 / 0.01 s
	08	TS setting (Edge type)	Binary (5 bits / 2 bits)		Bit 0 to 4 = 0: Rising edge Bit 0 to 4 = 1: Falling edge		Setting	0/31/1 or 0/3/1
	09	TS voltage	Indexed String		0 * = DC 1 = AC		Setting	0/1/1
	0A	Timer aux 3	Courier floating point number		0 *		Setting	0 / 200.0 / 0.01 s
	0B	Timer aux 4	Courier floating point number		0 *		Setting	0 / 200.0 / 0.01 s
	0C	Timer aux 5	Courier floating point number		0 *		Setting	0 / 200.0 / 0.01 s
64	00	AUX OUTPUT RELAYS SETTINGS						
	01	GENERAL TRIP	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	02	CLOSE	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	03	U<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	04	t U<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	05	U<<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	06	t U<<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	07	U<<<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	08	t U<<<	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	09	U>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0A	t U>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0B	U>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0C	t U>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0D	U>>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0E	t U>>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	0F	V0>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	10	t V0>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	11	V0>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	12	t V0>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	13	V0>>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	14	t V0>>>	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	15	V2>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	16	t V2>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	17	V2>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	18	t V2>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	19	V1<	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1A	t V1<	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1B	V1<<	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1C	t V1<<	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1D	F1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1E	t F1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	1F	F2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	20	t F2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	21	F3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	22	t F3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	23	F4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	24	t F4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	25	F5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	26	t F5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	27	F6	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	28	t F6	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	29	DF/DT 1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2A	DF/DT 2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2B	DF/DT 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2C	DF/DT 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2D	DF/DT 5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2E	DF/DT 6	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	2F	tAux 1	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	30	tAux 2	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	31	Breaker alarm	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	32	Frequency non measurable	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	33	Ext. Breaker failure	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	34	Equation A	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	35	Equation B	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	36	Equation C	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	37	Equation D	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	38	TC Active Setting Group	Binary (7 bits)		0000000 * bit 0 to 6 =0: Group 1 bit 0 to 6 =1: Group 2		Setting	0/127/1
	39	TC lock setting	Binary (3 bits / 7 bits)		000 * / 0000000 * bit 0 to 2 / bit 0 to 6 =1: TC Locked		Setting	0 / 7 / 1 or 0/127/1
	3A	Logic input 1	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	3B	Logic input 2	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	3C	Logic input 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	3D	Logic input 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	3E	Logic input 5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	3F	DU/DT 1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	40	DU/DT 2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	41	DU/DT 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	42	DU/DT 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	43	F1 + DF/DT 1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	44	F2 + DF/DT 2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	45	F3 + DF/DT 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	46	F4 + DF/DT 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	47	F5 + DF/DT 5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	48	F6 + DF/DT 6	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	49	tAux 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4A	tAux 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4B	tAux 5	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4C	t VTS	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4D	V0der>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4E	t V0der>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	4F	V0der>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	50	t V0der>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	51	V0der>>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	52	t V0der>>>	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	53	Equation A	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	54	Equation B	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	55	Equation C	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	56	Equation D	Binary (3 bits / 7 bits)		000 * / 0000000 *		Setting	0 / 7 / 1 or 0 / 127 / 1
	57	Comm. Order 1	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	58	Comm. Order 2	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	59	Comm. Order 3	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1
	5A	Comm. Order 4	Binary (7 bits)		0000000 *		Setting	0 / 127 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
65	00	LEDS CONFIGURATION						
	01	Led 5 (1)	Binary (16 bits)	0 *	0: U< 1: t U< 2: U<< 3: t U<< 4: U<<< 5: t U<<< 6: U> 7: t U> 8: U>> 9: t U>> 10: U>>> 11: t U>>> 12: V0> 13: t V0> 14: V0>> 15: t V0>>		Setting	0/ 65535/ 1
	02	Led 6 (1)	Binary (16 bits)	--	As "Led 5 (1)"		Setting	0/ 65535/ 1
	03	Led 7 (1)	Binary (16 bits)	--	As "Led 5 (1)"		Setting	0/ 65535/ 1
	04	Led 8 (1)	Binary (16 bits)	--*	As "Led 5 (1)"		Setting	0/ 65535/ 1
	05	Led 5 (2)	Binary (4 bits / 16 bits)	0 *	0: V0>>> 1: t V0>>> 2: t Aux 1 3: t Aux 2 4: V2> 5: tV2> 6: V2>> 7: tV2>> 8: V1< 9: tV1< 10: V1<< 11: tV1<< 12: F1 13: tF1 14: F2 15: tF2		Setting	0/ 15/ 1 or 0/ 65535 /1
	06	Led 6 (2)	Binary (4 bits / 16 bits)	--	As "Led 5 (2)"		Setting	0/ 15/ 1 or 0/ 65535 /1
	07	Led 7 (2)	Binary (4 bits / 16 bits)	--	As "Led 5 (2)"		Setting	0/ 15/ 1 or 0/ 65535 /1
	08	Led 8 (2)	Binary (4 bits / 16 bits)	--	As "Led 5 (2)"		Setting	0/ 15/ 1 or 0/ 65535 /1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	09	Led 5 (3)	Binary (9 bits / 15 bits)	0 *	0: F3 1: tF3 2: F4 3: tF4 4: F5 5: tF5 6: F6 7: tF6 8: Freq. Non measurable 9: DFDT1 10: DFDT2 11: DFDT3 12: DFDT4 13: DFDT5 14: DFDT6		Setting	0/ 511/ 1 or 0/32767/1
	0A	Led 6 (3)	Binary (9 bits / 15 bits)	--	As "Led 5 (3)"		Setting	0/ 511/ 1 or 0/32767/1
	0B	Led 7 (3)	Binary (9 bits / 15 bits)	--	As "Led 5 (3)"		Setting	0/ 511/ 1 or 0/32767/1
	0C	Led 8 (3)	Binary (9 bits / 15 bits)	--	As "Led 5 (3)"		Setting	0/ 511/ 1 or 0/32767/1
	0D	Led 5 (4)	Binary (6 bits / 9 bits / 13 bits)	0 *	0: t Equ A 1: t Equ B 2: t Equ C 3: t Equ D 4: log input 1 5: log input 2 6: log input 3 7: log input 4 8: log input 5 9: DUDT1 10: DUDT2 11: DUDT3 12: DUDT4		Setting	0/ 63/ 1 or 0/ 511/ 1 or 0/8191/1
	0E	Led 6 (4)	Binary (6 bits / 9 bits / 13 bits)	--	As "Led 5 (4)"		Setting	0/ 63/ 1 or 0/ 511/ 1 or 0/8191/1
	0F	Led 7 (4)	Binary (6 bits / 9 bits / 13 bits)	--	As "Led 5 (4)"		Setting	0/ 63/ 1 or 0/ 511/ 1 or 0/8191/1
	10	Led 8 (4)	Binary (6 bits / 9 bits / 13 bits)	--	As "Led 5 (4)"		Setting	0/ 63/ 1 or 0/ 511/ 1 or 0/8191/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	11	Led 5 (5)	Binary (16 bits)	0 *	0: F1 + DFDT1 1: F2 + DFDT2 2: F3 + DFDT3 3: F4 + DFDT4 4: F5 + DFDT5 5: F6+ DFDT6 6: t Aux 3 7: t Aux 4 8: t Aux 5 9: V0der> 10: tV0der> 11: V0der>> 12: tV0der>> 13: V0der>>> 14: tV0der>>> 15: tVTS		Setting	0/65535/1
	12	Led 6 (5)	Binary (16 bits)	--	As "Led 5 (5)"		Setting	0/65535/1
	13	Led 7 (5)	Binary (16 bits)	--	As "Led 5 (5)"		Setting	0/65535/1
	14	Led 8 (5)	Binary (16 bits)	--	As "Led 5 (5)"		Setting	0/65535/1
	15	Led 5 (6)	Binary (4 bits)	0 *	0: t Equ E 1: t Equ F 2: t Equ G 3: t Equ H		Setting	0/ 15/ 1
	16	Led 6 (6)	Binary (4 bits)	--	As "Led 5 (6)"		Setting	0/ 15/ 1
	17	Led 7 (6)	Binary (4 bits)	--	As "Led 5 (6)"		Setting	0/ 15/ 1
	18	Led 8 (6)	Binary (4 bits)	--	As "Led 5 (6)"		Setting	0/ 15/ 1
66	00	ALARMS						
	01	Instant. alarm self-reset	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	03	U> and tU> alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	04	U>> and tU>> alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	05	U>>> and tU>>> alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	06	dU/dT1 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	07	dU/dT2 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	08	dU/dT3 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	09	dU/dT4 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	0A	U< and tU< alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	0B	U<< and tU<< alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	0C	U<<< and tU<<< alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	0D	tAux1 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	0E	tAux2 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	0F	tAux3 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	10	tAux4 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	11	tAux5 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	12	F1 and tF1 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	13	F2 and tF2 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	14	F3 and tF3 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	15	F4 and tF4 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	16	F5 and tF5 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	17	F6 and tF6 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	18	Freq. Out alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	19	dF/dT1 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1A	dF/dT2 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1B	dF/dT3 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1C	dF/dT4 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1D	dF/dT5 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1E	dF/dT6 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	1F	F1 + dF/dT1 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	20	F2 + dF/dT2 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	21	F3 + dF/dT3 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	22	F4 + dF/dT4 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	23	F5 + dF/dT5 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	24	F6 + dF/dT6 alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	25	tVTS alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	26	Control Trip alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	27	Equation A alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	28	Equation B alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	29	Equation C alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	2A	Equation D alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	2B	Equation E alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	2C	Equation F alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	2D	Equation G alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
	2E	Equation H alarm	Binary (1 bits)		Enabled=0 * / Disabled		Setting	0/1/1
67	00	VTS SUPERVISION						
	01	VTS enable?	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	02	VTS detection mode	Binary (2 bits)	1 *	0: VTS Input 1: Delta Vr	6701 = 1	Setting	0/ 3/ 1
	03	V0 threshold	Courier floating point number		15.0 V * if 1000KV Range else 50.0 V	6701 = 1 & 0D01 = 1 & (6702 = 2 or 6702 = 3)	Setting	2.0 / 130.0 / 0.1 V if 1000KV Range Else 10.0 / 480.0 / 0.1 V
	04	VTS delay	Courier floating point number		5.00 s*	6701 = 1	Setting	0.0 / 100.0 / 0.01 s
	05	Inhib. By 52A ?	Binary (1 bit)	0 *	Disabled * / Enabled	6701 = 1	Setting	0/1/1
	06	VTS blocked functions	Binary (8 bits)	0 *	0: U< blocked 1: U> blocked 2: V0> blocked 3: V1> blocked 4: V2> blocked 5: F blocked 6: dF/dT blocked 7: dU/dT blocked	6701 = 1	Setting	0/ 255/ 1
68	00	F + DF/DT						
	01	F1 + dF/dT1 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	02	F2 + dF/dT2 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	03	F3 + dF/dT3 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	04	F4 + dF/dT4 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	05	F5 + dF/dT5 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
	06	F6 + dF/dT6 ?	Binary (1 bits)		Disabled * / Enabled		Setting	0/1/1
69	00	SW SUPERVISION						
	01	SW Operating time?	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	02	SW Operating time	Courier floating point number		0.10 s*	6901 = 1	Setting	0.10 / 5.0 / 0.05 s
	03	SW Closing time ?	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	04	SW Closing time	Courier floating point number		0.10 s*	6903 = 1	Setting	0.10 / 5.0 / 0.05 s
	05	SW Operating number?	Binary (1 bit)	0	Disabled * / Enabled		Setting	0/1/1
	06	SW Operating number	Unsigned Integer (2 bytes)		0 *	6905 = 1	Setting	0/ 50000/ 1
	07	TRIP t	Courier floating point number		0.1 s*		Setting	0.1 / 5.0 / 0.05 s
	08	CLOSE t	Courier floating point number		0.1 s*		Setting	0.1 / 5.0 / 0.05 s
6A	00	COMM. ORDERS DELAYS						
	01	t Comm1	Courier floating point number		0.1 s*	6457 != 0	Setting	0.1 / 600.0 / 0.05 s
	02	t Comm2	Courier floating point number		0.1 s*	6458 != 0	Setting	0.1 / 600.0 / 0.05 s
	03	t Comm3	Courier floating point number		0.1 s*	6459 != 0	Setting	0.1 / 600.0 / 0.05 s
	04	t Comm4	Courier floating point number		0.1 s*	645A != 0	Setting	0.1 / 600.0 / 0.05 s
6C	00	BOOLEAN EQUATIONS 1/2						
6C	10	EQUATION A						
	11	Operator 00	Indexed String	0 * 1	0: (Space) * 1 NOT		Setting	0 / 1 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	12	Operand 00	Indexed String	0 *	0: NULL		Setting	0 / 82 / 1 or 0 / 69 / 1
				1	1: U<			
				2	2: t U<			
				3	3: U<<			
				4	4: t U<<			
				5	5: U<<<			
				6	6: t U<<<			
				7	7: U>			
				8	8: t U>			
				9	9: U>>			
				10	10: t U>>			
				11	11: U>>>			
				12	12: t U>>>			
				13	13: V0>			
				14	14: t V0>			
				15	15: V0>>			
				16	16: t V0>>			
				17	17: V0>>>			
				18	18: t V0>>>			
				19	19: V2>			
				20	20: tV2>			
				21	21: V2>>			
				22	22: tV2>>			
				23	23: V1<			
				24	24: tV1<			
				25	25: V1<<			
				26	26: tV1<<			
				27	27: F1			
				28	28: tF1			
				29	29: F2			
				30	30: tF2			
				31	31: F3			
				32	32: tF3			
				33	33: F4			
				34	34: tF4			
				35	35: F5			
				36	36: tF5			
				37	37: F6			
				38	38: tF6			
				39	39: t Aux 1			
				40	40: t Aux 2			
				41	41: t Aux 3			
				42	42: t Aux 4			
				43	43: t Aux 5			

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	12	Operand 00	Indexed String	44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82	44: CB Alarm 45: CB Fail 46: DFDT1 47: DFDT2 48: DFDT3 49: DFDT4 50: DFDT5 51: DFDT6 52: Input 1 53: Input 2 54: Input 3 55: Input 4 56: Input 5 57: DUDT1 58: DUDT2 59: DUDT3 60: DUDT4 61: t Equ A 62: t Equ B 63: t Equ C 64: t Equ D 65: t Equ A 66: t Equ B 67: t Equ C 68: t Equ D 69: t VTS 70: F1 + DFDT1 71: F2 + DFDT2 72: F3 + DFDT3 73: F4 + DFDT4 74: F5 + DFDT5 75: F6 + DFDT6 76: Freq. Non measurable 77: V0der> 78: t V0der> 79: V0der>> 80: t V0der>> 81: V0der>>> 82: t V0der>>>		Setting	0 / 82 / 1 or 0 / 69 / 1
	13	Operator 01	Indexed String	0 * 1 2 3	0: OR * 1: OR NOT 2: AND 3: AND NOT		Setting	0 / 3 / 1
	14	Operand 01	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	15	Operator 02	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	16	Operand 02	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	17	Operator 03	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	18	Operand 03	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	19	Operator 04	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	1A	Operand 04	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	1B	Operator 05	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	1C	Operand 05	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	1D	Operator 06	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	1E	Operand 06	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	1F	Operator 07	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	20	Operand 07	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	21	Operator 08	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	22	Operand 08	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	23	Operator 09	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	24	Operand 09	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	25	Operator 10	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	26	Operand 10	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
1	27	Operator 11	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	28	Operand 11	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	29	Operator 12	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	2A	Operand 12	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	2B	Operator 13	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	2C	Operand 13	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	2D	Operator 14	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	2E	Operand 14	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
	2F	Operator 15	Indexed String	--	As Operator 01		Setting	0 / 3 / 1
	30	Operand 15	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6C	40	EQUATION B						
	41	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	42	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	43	Operator 01	Indexed String	--	As "Operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	5F	Operator 15	Indexed String	--	As "Operator 01"		Setting	0 / 3 / 1
	60	Operand 15	Indexed String	-	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6C	70	EQUATION C						
	71	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	72	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	73	Operator 01	Indexed String	--	As "Operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	8F	Operator 15	Indexed String	--	As "Operator 01"		Setting	0 / 3 / 1
	90	Operand 15	Indexed String	-	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6C	A0	EQUATION D						
	A1	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	A2	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	A3	Operator 01	Indexed String	--	As "Operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	BF	Operator 15	Indexed String	--	As "Operator 01"		Setting	0 / 3 / 1
	C0	Operand 15	Indexed String	-	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6D	00	BOOLEAN EQUATIONS 2/2						
6D	10	EQUATION E						
	11	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	12	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	13	Operator 01	Indexed String	--	As "Operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	2F	Operator 15	Indexed String	--	As "Operator 01"		Setting	0 / 3 / 1
	30	Operand 15	Indexed String	-	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6D	40	EQUATION F						
	41	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	42	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	43	Operator 01	Indexed String	--	As "Operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	5F	Operator 15	Indexed String	--	As "Oerator 01"		Setting	0 / 3 / 1
	60	Operand 15	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6D	70	EQUATION G						
	71	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	72	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	73	Operator 01	Indexed String	--	As "Operator 01"- equationA		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	8F	Operator 15	Indexed String	--	As "Oprator 01		Setting	0 / 3 / 1
	90	Operand 15	Indexed String	--	As "operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6D	A0	EQUATION H						
	A1	Operator 00	Indexed String	--	As "Operator 00" - equation A		Setting	0 / 1 / 1
	A2	Operand 00	Indexed String	--	As "Operand 00" - equation A		Setting	0 / 82 / 1 or 0 / 69 / 1
	A3	Operator 01	Indexed String	--	As "operator 01" - equation A		Setting	0 / 3 / 1
	…	…	…	…	…	…	…	…
	BF	Operator 15	Indexed String	---	As "Operator 01"		Setting	0 / 3 / 1

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	C0	Operand 15	Indexed String	--	As "Operand 00"		Setting	0 / 82 / 1 or 0 / 69 / 1
6E	00	LOGIC EQUATIONS DELAYS						
	01	Equation A operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	02	Equation A reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	03	Equation B operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	04	Equation B reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	05	Equation C operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	06	Equation C reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	07	Equation D operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	08	Equation D reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	09	Equation E operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0A	Equation E reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0B	Equation F operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0C	Equation F reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0D	Equation G operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0E	Equation G reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	0F	Equation H operation delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s
	10	Equation H reset delay	Extended Courier floating point number		0 *		Setting	0 / 3600.0 / 0.01 s

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
70	00	RECORDER CONTROL	(VERSION P922 et >)					
	01	Start/Trigger recorder	Indexed String	0 1 2	Stopped Trigerred Running *		Setting	1/2/1
	02	Recorder Source	Indexed String	0	Samples *		Data	
	20	Pretemps	Courier floating point number		0.1 secondes		Setting	0.1 / 3.0 / 0.1 s
	21	Postemps	Courier floating point number		0.1 secondes		Setting	0.1 / 3.0 / 0.1 s
	22	Disturbance rec. trig	Indexed String	0	ON INST* / ON TRIG		Setting	0 / 1 / 1
	30	Measurement period (Max & Moy)	Unsigned Integer (2 bytes)	0	5 mn *		Setting	5 / 10 / 15/ 30/ 60 mn
80	00	DISTURBANCE REC	(MiCOM P922 & P923)					
	01	Record Number	Unsigned integer (1 byte)		0*		Setting	0/5/1 (selon contexte)
	02	Trigger Time	IEC870 Time & Date		dd/mm/yy hh:mm		Data	
	03	Available Channel Bit Mask	Binary Flag Indexed String	 0 1 2 3 4	11111 "Ua" "Ub" "Uc" "V0" "Inputs/Outputs"		Data	
	04	Channel Types	Binary Flag 0: digital, 1: analogue		01111		Data	
	05	Channel Offsets	Repeated group of Courier numbers		Upload Offsets		Data	
	06	Scaling Factors	Repeated group of Courier numbers		Upload Scal. Factors		Data	
	07-0F	NON IMPLEMENTED - reserved						
	10	Record Length	Integer (2 bytes)				Data	
	11	Trigger position	Integer (2 bytes)				Data	
	12	Time Base	Courier floating point number				Data	
	13	NON IMPLEMENTED - reserved						
	14	Upload Timer	Repeated group of Integers				Data	
	15-1F	NON IMPLEMENTED - reserved						
	20	Upload Channel 0	Repeated group of Integers				Data	
	21	Upload Channel 1	Repeated group of Integers				Data	
	22	Upload Channel 2	Repeated group of Integers				Data	

Col	Row	Menu Text	Data Type	Ind	Values (*: default)	Depend	Cell Type	Min/Max/Step
	23	Upload Channel 3	Repeated group of Integers				Data	
	24	Upload Channel Inputs/Outputs	Repeated group of Integer/Bin. flags				Data	
90	00	AUTOMAT. FLT	(MiCOM P922 & P923)					
	01	Record number	Unsigned Integer (2 bytes)				Setting (automatic)	
	02	Occur fault date	Unsigned Integer (2 bytes)				Data	
	03	Active set group	Unsigned Integer (2 bytes)		1		Data	
	04	Phase in fault	ASCII Text (10 bytes)		"PHASE A"		Data	
	05	Fault Id	ASCII Text (18 bytes)		"U >>"		Data	
	06	Magnitude	Courier floating point number		12.34 V		Data	
	07	Ua Magnitude	Courier floating point number		12.34 V		Data	
	08	Ub Magnitude	Courier floating point number		12.34 V		Data	
	09	Uc Magnitude	Courier floating point number		12.34 V		Data	
	0A	V0 Magnitude	Courier floating point number		12.34 V		Data	
BF	00	COMM SYSTEM DATA						
	01	Dist Record Cntrl Ref	Menu Cell (2)		0x7000		Data	
	02	Dist Record Extract Ref	Menu Cell (2)		0x8000		Data	
	03	Setting Transfert	Unsigned Integer (2 bytes)		0 *		Data	0 / 1 / 1
	04	Reset Demand Timers	NON IMPLEMENTED					
	05	Reset Event Report	NON IMPLEMENTED					

BLANK PAGE

IEC 60870-5-103

BLANK PAGE

1. IEC60870-5-103 INTERFACE

The IEC60870-5-103 interface is a master/slave interface with the relay as the slave device. This protocol is based on the VDEW communication protocol. The relay conforms to compatibility level 2, compatibility level 3 not supported.

The following IEC60870-5-103 facilities are supported by this interface:

- Initialization (Reset)
- Time synchronization
- Event Record Extraction
- General Interrogation
- Cyclic Measurements
- General Commands

1.1 Physical Connection and Link Layer

Connection is available for IEC60870-5-103 through the rear RS485 port. It is possible to select the relay address and baud rate using the front panel interface. Following a change, a reset command is required to re-establish communications.

The parameters of the communication are the following:

- Even Parity
- 8 Data bits
- 1 stop bit
- Data rate 9600 or 19200 bauds.

1.2 Initialization

Whenever the relay is powered up, or when the communication parameters are modified, a reset command is required to initialize the communications. The relay will respond to either of the two reset commands (Reset CU or Reset FCB), the difference being that the Reset CU will clear any message which is not sent in the relay's transmit buffer.

The relay will respond to the reset command with an identification message ASDU5, the cause of transmission (COT) of this response will be either Reset CU or Reset FCB depending on the nature of the reset command. The following information will be contained in the data section of this ASDU:

Manufacturer Name: Schneider Electric

The Software Identification Section will contain the first four characters of the relay model number to identify the type of relay, e.g. P923.

In addition to the above identification message, if the relay has been powered up, it will also produce a power up event.

1.3 Time Synchronization (P922 & P923 only)

The relay time and date can be set using the time synchronization feature of the IEC60870-5-103 protocol. The relay will correct the transmission delay as specified in the IEC60870-5-103. If the time synchronization message is sent as a send/confirm message then the relay will respond with a confirm. If the time synchronization message is sent as a sent/confirm or broadcast (send/no reply) message, a time synchronization message will be returned as class 1 data.

1.4 Spontaneous Events (P922 & P923 only)

The event created by the relay will be passed using the standard function type/information numbers to the IEC60870-5-103 master station. Private codes are not used, thus any event that can not pass using standardized messages will not be sent

Events are categorized using the following information:

- Common Address
- Function type
- Information number

Section 2 contains a complete listing of all events produced by the relay. The common address is used to differentiate in circumstances where the relay produces more events of a certain type than can be passed using the standardized messages. For example if the relay produces starts and trips for three stages of overcurrent only two stages can pass using the standardized messages.

Using the different common address for two of the overcurrent stages allows each stage to be indicated. The table in section2 shows the common address as an offset value. The common address offset will be added to the station address in order to pass these events.

1.5 General Interrogation

The GI request can be used to read the status of the relay. The function numbers, information numbers and common address offsets that will be returned during the GI cycle are indicated in Section 2.

1.6 Cyclic Measurements

The relay will produce measured value using ASDU 9 on a cyclic basis, this can be read from the relay using a class 2 poll (note ASDU 3 is not used).

It should be noted that the measurands transmitted by the relay are sent as a proportion of either 1.2 or 2.4 times the rated value of the analogue value. The selection of either 1.2 or 2.4 for a particular value is indicated in section 2.

1.7 Commands

A list of the supported commands is contained in section 2. The relay will respond to other commands with an ASDU 1, with a cause of transmission (COT) of negative acknowledgement of a command.

1.8 Disturbance Records (P922 & P923 only)

The disturbance records stored by the relay can be extracted using the mechanism defined in the IEC60870-5-103 standard. An ASDU 23 is transmitted at the end of each record creation.

1.9 Blocking of Monitor Direction

The relay support a facility to block messages in the Monitor direction (setting by HMI or communication protocol).

1.10 Blocking of Control Direction

The relay support a facility to block messages in the Control direction (setting by HMI or communication protocol).

2. IEC60870-5-103 DATABASE

2.1 IEC 60870-5-103 DATABASE

These messages include a sub-assembly of events which are generated on the relay, because some generated events are not registrated in IEC870-5-103. They are the most prioritary messages

An event is always generated on the rising edge of the information.

Some events can be generated on the rising or lowering edge.

In the list below, events only generated on rising edge will be tagged with a '*'.

Remark: Events in italic only exist for MICOM P922 and P923.
Events in italic and bold only exist for MICOM P923.

2.1.1 List of Events produced by the relay

Two types of ASDU can be generated for events: ASDU 1 (time-tagged message) or ASDU 2 (time-tagged message with relative time).

The next processed events list is the list with the private option active, for all protection functions for Voltage and Frequency, with the associated FUNCTION Type, INFORMATION NUMBER, ASDU TYPE and CAUSE OF TRANSMISSION:

FUN <161>: Function type in Public range (compatible)

FUN <169>: Function type in Private range (Reserved for Voltage and Frequency Protections.

<u>Status indications (monitor direction):</u>

- Leds reset: FUN<161>,INF <19>; TYP <1>; COT<1>,*
- Local parameter Setting active: FUN<161>,INF <22>; TYP <1>; COT<1> ↑↓
- Maintenance mode: FUN<169>,INF <7>; TYP <1>; COT<1> ↑↓
- Setting Group number 1 active: FUN<161>,INF <23>; TYP <1>; COT<1> ↑↓
- Setting Group number 2 active: FUN<161>,INF <24>; TYP <1>; COT<1> ↑↓
- Auxiliary input 1: FUN<161>,INF <27>; TYP <1>; COT<1> ↑↓
- Auxiliary input 2: FUN<161>,INF <28>; TYP <1>; COT<1> ↑↓
- Auxiliary input 3: FUN<161>,INF <29>; TYP <1>; COT<1> ↑↓
- Auxiliary input 4: FUN<161>,INF <30>; TYP <1>; COT<1> ↑↓
- Auxiliary input 5: FUN<169>,INF <54>; TYP <1>; COT<1> ↑↓
- Logic input 1: FUN<169>,INF <160>; TYP <1>; COT<1> ↑↓
- Logic input 2: FUN<169>,INF <161>; TYP <1>; COT<1> ↑↓
- Logic input 3: FUN<169>,INF <162>; TYP <1>; COT<1> ↑↓
- Logic input 4: FUN<169>,INF <163>; TYP <1>; COT<1> ↑↓
- Logic input 5: FUN<169>,INF <164>; TYP <1>; COT<1> ↑↓
- Logic output 1: FUN<169>,INF <176>; TYP <1>; COT<1> ↑↓
- Logic output 2: FUN<169>,INF <177>; TYP <1>; COT<1> ↑↓
- Logic output 3: FUN<169>,INF <178>; TYP <1>; COT<1> ↑↓
- Logic output 4: FUN<169>,INF <179>; TYP <1>; COT<1> ↑↓
- Logic output 5 (WD): FUN<169>,INF <180>; TYP <1>; COT<1> ↑↓
- Logic output 6: FUN<169>,INF <181>; TYP <1>; COT<1> ↑↓
- Logic output 7: FUN<169>,INF <182>; TYP <1>; COT<1> ↑↓
- Logic output 8: FUN<169>,INF <183>; TYP <1>; COT<1> ↑↓
- Logic output 9: FUN<169>,INF <184>; TYP <1>; COT<1> ↑↓
- Lock relays: FUN<169>,INF <230>; TYP <1>; COT<1>,*
- Unlock relays: FUN<169>,INF <231>; TYP <1>; COT<1>,*
- Time synchronisation: FUN<169>,INF <226>;TYP <1>; COT<1>,*

Supervision Indications (monitor direction):

- Group warning (minor hardware alarm): FUN<161>,INF <46>; TYP <1>; COT<1> ↑↓
- Group alarm (major hardware alarm): FUN<161>,INF <47>; TYP <1>; COT<1> ↑↓

Fault Indications (monitor direction):

- Start U>: FUN<169>,INF <9>; TYP <2>; COT<1>, ↑↓
- Start U>>: FUN<169>,INF <10>; TYP <2>; COT<1>, ↑↓
- Start U>>>: FUN<169>,INF <11>; TYP <2>; COT<1>, ↑↓
- Start / pick-up Vn: FUN<169>,INF <67>; TYP <2>; COT<1> ↑↓
- General Trip: FUN<161>,INF <68>; TYP <2>; COT<1>,*
- Start V0>: FUN<169>,INF <12>; TYP <2>; COT<1> ↑↓
- Start V0>>: FUN<169>,INF <13>; TYP <2>; COT<1> ↑↓
- Start V0>>>: FUN<169>,INF <14>; TYP <2>; COT<1> ↑↓
- Start V0der>: FUN<169>,INF <15>; TYP <2>; COT<1> ↑↓
- Start V0der>>: FUN<169>,INF <16>; TYP <2>; COT<1> ↑↓
- Start V0der>>>: FUN<169>,INF <17>; TYP <2>; COT<1> ↑↓
- General Start / pick-up: FUN<161>,INF <84>; TYP <2>; COT<1> ↑↓
- Trip U>: FUN<169>,INF <90>; TYP <2>; COT<1> ↑↓
- Trip U>>: FUN<169>,INF <91>; TYP <2>; COT<1> ↑↓
- Trip U>>>: FUN<169>,INF <19>; TYP <2>; COT<1> ↑↓
- Trip V0>: FUN<169>,INF <92>; TYP <2>; COT<1> ↑↓
- Trip V0>>: FUN<169>,INF <93>; TYP <2>; COT<1> ↑↓
- Trip V0>>>: FUN<169>,INF <22>; TYP <2>; COT<1> ↑↓
- Trip V0der>: FUN<169>,INF <24>; TYP <2>; COT<1> ↑↓
- Trip V0der>>: FUN<169>,INF <25>; TYP <2>; COT<1> ↑↓
- Trip V0der>>>: FUN<169>,INF <26>; TYP <2>; COT<1> ↑↓
- Start U<: FUN<169>,INF <73>; TYP <2>; COT<1> ↑↓
- Start U<<: FUN<169>,INF <100>; TYP <2>; COT<1> ↑↓
- Start U<<<: FUN<169>,INF <102>; TYP <2>; COT<1> ↑↓
- Trip U<: FUN<169>,INF <23>; TYP <2>; COT<1> ↑↓
- Trip U<<: FUN<169>,INF <101>; TYP <2>; COT<1> ↑↓
- Trip U<<<: FUN<169>,INF <103>; TYP <2>; COT<1> ↑↓
- Logic equation A: FUN<169>,INF <144>; TYP <2>; COT<1> ↑↓
- Logic equation B: FUN<169>,INF <145>; TYP <2>; COT<1> ↑↓
- Logic equation C: FUN<169>,INF <146>; TYP <2>; COT<1> ↑↓
- Logic equation D: FUN<169>,INF <147>; TYP <2>; COT<1> ↑↓
- Logic equation E: FUN<169>,INF <234>; TYP <2>; COT<1> ↑↓
- Logic equation F: FUN<169>,INF <235>; TYP <2>; COT<1> ↑↓
- Logic equation G: FUN<169>,INF <236>; TYP <2>; COT<1> ↑↓
- Logic equation H: FUN<169>,INF <237>; TYP <2>; COT<1> ↑↓
- Start V1<: FUN<169>,INF <104>; TYP <2>;COT<1> ↑↓
- Start V1<<: FUN<169>,INF <106>; TYP <2>; COT<1> ↑↓
- Trip V1<: FUN<169>,INF <105>; TYP<2>;COT<1> ↑↓
- Trip V1<<: FUN<169>,INF <107>; TYP <2>; COT<1> ↑↓
- Start V2>: FUN<169>,INF <108>; TYP <2>; COT<1> ↑↓
- Start V2>>: FUN<169>,INF <110>; TYP <2>; COT<1> ↑↓
- Trip V2>: FUN<169>,INF <109>; TYP <2>; COT<1> ↑↓
- Trip V2>>: FUN<169>,INF <111>; TYP <2>; COT<1> ↑↓
- Start F1: FUN<169>,INF <112>; TYP <2>; COT<1> ↑↓
- Start F2: FUN<169>,INF <114>; TYP <2>; COT<1> ↑↓
- Start F3: FUN<169>,INF <116>; TYP <2>; COT<1> ↑↓
- Start F4: FUN<169>,INF <118>; TYP <2>; COT<1> ↑↓
- Start F5: FUN<169>,INF <120>; TYP <2>; COT<1> ↑↓
- Start F6: FUN<169>,INF <122>; TYP <2>; COT<1> ↑↓
- Trip F1: FUN<169>,INF <113>; TYP <2>; COT<1> ↑↓

- Trip F2: FUN<169>,INF <115>; TYP <2>; COT<1> ↑↓
- Trip F3: FUN<169>,INF <117>; TYP <2>; COT<1> ↑↓
- Trip F4: FUN<169>,INF <119>; TYP <2>; COT<1> ↑↓
- Trip F5: FUN<169>,INF <121>; TYP <2>; COT<1> ↑↓
- Trip F6: FUN<169>,INF <123>; TYP <2>; COT<1> ↑↓
- Frequency non measurable: FUN<169>,INF <124>; TYP <2>; COT<1> ↑↓
- df/dt 1: FUN<169>,INF <128>; TYP <2>; COT<1> ↑↓
- df/dt 2: FUN<169>,INF <129>; TYP <2>; COT<1> ↑↓
- df/dt 3: FUN<169>,INF <130>; TYP <2>; COT<1> ↑↓
- df/dt 4: FUN<169>,INF <131>; TYP <2>; COT<1> ↑↓
- df/dt 5: FUN<169>,INF <132>; TYP <2>; COT<1> ↑↓
- df/dt 6: FUN<169>,INF <133>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 1: FUN<169>,INF <138>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 2: FUN<169>,INF <139>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 3: FUN<169>,INF <140>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 4: FUN<169>,INF <141>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 5: FUN<169>,INF <142>; TYP <2>; COT<1> ↑↓
- Unconfirmed df/dt 6: FUN<169>,INF <143>; TYP <2>; COT<1> ↑↓
- F1 + df/dt 1: FUN<169>,INF <94>; TYP <2>; COT<1> ↑↓
- F2 + df/dt 2: FUN<169>,INF <95>; TYP <2>; COT<1> ↑↓
- F3 + df/dt 3: FUN<169>,INF <96>; TYP <2>; COT<1> ↑↓
- F4 + df/dt 4: FUN<169>,INF <97>; TYP <2>; COT<1> ↑↓
- F5 + df/dt 5: FUN<169>,INF <98>; TYP <2>; COT<1> ↑↓
- F6 + df/dt 6: FUN<169>,INF <99>; TYP <2>; COT<1> ↑↓
- dU/dt 1: FUN<169>,INF <134>; TYP <2>; COT<1> ↑↓
- dU/dt 2: FUN<169>,INF <135>; TYP <2>; COT<1> ↑↓
- dU/dt 3: FUN<169>,INF <136>; TYP <2>; COT<1> ↑↓
- dU/dt 4: FUN<169>,INF <137>; TYP <2>; COT<1> ↑↓
- Trip VTS: FUN<169>,INF <202>; TYP <2>; COT<1> ↑↓
- CB operating time: FUN<169>,INF <59>; TYP <2>; COT<1> ↑↓
- CB operating number: FUN<169>,INF <60>; TYP <2>; COT<1> ↑↓
- CB closing time: FUN<169>,INF <63>; TYP <2>; COT<1> ↑↓

<u>Auto-recloser Indications (monitor direction):</u>

- CB in O/O (« closed ») position: FUN<169>,INF <33>; TYP <1>; COT<1> ↑↓
- CB in F/O (« open ») position: FUN<169>,INF <34>; TYP <1>; COT<1> ↑↓
- Trip TC: FUN<169>,INF <1>; TYP <1>; COT<1> ↑↓
- Close TC: FUN<169>,INF <2>; TYP <1>; COT<1> ↑↓

2.1.2 System State

List of processed data, following a General interrogation, is given below: it is a sub-assembly of the spontaneous messages.

<u>Status indications (monitor direction):</u>

- Local parameter Setting active: FUN<161>,INF <22>; TYP <1>; COT<9>
- Maintenance mode: FUN<169>,INF <7>; TYP <1>; COT<9>
- Setting Group number 1 active: FUN<161>,INF <23>; TYP <1>; COT<9>
- Setting Group number 2 active: FUN<161>,INF <24>; TYP <1>; COT<9>
- Auxiliary input 1: FUN<161>,INF <27>; TYP <1>; COT<9>
- Auxiliary input 2: FUN<161>,INF <28>; TYP <1>; COT<9>
- Auxiliary input 3: FUN<161>,INF <29>; TYP <1>; COT<9>
- Auxiliary input 4: FUN<161>,INF <30>; TYP <1>; COT<9>
- Auxiliary input 5: FUN<169>,INF <54>; TYP <1>; COT<9>
- Logic input 1: FUN<169>,INF <160>; TYP <1>; COT<9>

- Logic input 2: FUN<169>,INF <161>; TYP <1>; COT<9>
- Logic input 3: FUN<169>,INF <162>; TYP <1>; COT<9>
- Logic input 4: FUN<169>,INF <163>; TYP <1>; COT<9>
- Logic input 5: FUN<169>,INF <164>; TYP <1>; COT<9>
- Logic output 1: FUN<169>,INF <176>; TYP <1>; COT<9>
- Logic output 2: FUN<169>,INF <177>; TYP <1>; COT<9>
- Logic output 3: FUN<169>,INF <178>; TYP <1>; COT<9>
- Logic output 4: FUN<169>,INF <179>; TYP <1>; COT<9>
- Logic output 5 (WD): FUN<169>,INF <180>; TYP <1>; COT<9>
- Logic output 6: FUN<169>,INF <181>; TYP <1>; COT<9>
- Logic output 7: FUN<169>,INF <182>; TYP <1>; COT<9>
- Logic output 8: FUN<169>,INF <183>; TYP <1>; COT<9>
- Logic output 9: FUN<169>,INF <184>; TYP <1>; COT<9>

<u>Supervision Indications (monitor direction):</u>

- Group warning (minor hardware alarm): FUN<161>,INF <46>; TYP <1>; COT<9>
- Group alarm (major hardware alarm): FUN<161>,INF <47>; TYP <1>; COT<9>

<u>Fault Indications (monitor direction):</u>

- Start U>: FUN<169>,INF <9>; TYP <2>; COT<9>
- Start U>>: FUN<169>,INF <10>; TYP <2>; COT<9>
- Start U>>>: FUN<169>,INF <11>; TYP <2>; COT<9>
- Start V0>: FUN<169>,INF <12>; TYP <2>; COT<9>
- Start V0>>: FUN<169>,INF <13>; TYP <2>; COT<9>
- Start V0>>>: FUN<169>,INF <14>; TYP <2>; COT<9>
- Start / pick-up Vn: FUN<169>,INF <67>; TYP <2>; COT<9>
- General Start / pick-up: FUN<161>,INF <84>; TYP <2>; COT<9>
- Start U<: FUN<169>,INF <73>; TYP <2>; COT<9>
- Start U<<: FUN<169>,INF <100>; TYP <2>; COT<9>
- Start U<<<: FUN<169>,INF <102>; TYP <2>; COT<9>
- Start V0der>: FUN<169>,INF <15>; TYP <2>; COT<9>
- Start V0der>>: FUN<169>,INF <16>; TYP <2>; COT<9>
- Start V0der>>>: FUN<169>,INF <17>; TYP <2>; COT<9>
- Start V1<: FUN<169>,INF <104>; TYP <2>; COT<9>
- Start V1<<: FUN<169>,INF <106>; TYP <2>; COT<9>
- Start V2>: FUN<169>,INF <108>; TYP <2>; COT<9>
- Start V2>>: FUN<169>,INF <110>; TYP <2>; COT<9>
- Start F1: FUN<169>,INF <112>; TYP <2>; COT<9>
- Start F2: FUN<169>,INF <114>; TYP <2>; COT<9>
- Start F3: FUN<169>,INF <116>; TYP <2>; COT<9>
- Start F4: FUN<169>,INF <118>; TYP <2>; COT<9>
- Start F5: FUN<169>,INF <120>; TYP <2>; COT<9>
- Start F6: FUN<169>,INF <122>; TYP <2>; COT<9>
- Frequency non measurable: FUN<169>,INF <124>; TYP <2>; COT<9>
- df/dt 1: FUN<169>,INF <128>; TYP <2>; COT<9>
- df/dt 2: FUN<169>,INF <129>; TYP <2>;COT<9>
- df/dt 3: FUN<169>,INF <130>; TYP <2>; COT<9>
- df/dt 4: FUN<169>,INF <131>; TYP <2>; COT<9>
- df/dt 5: FUN<169>,INF <132>; TYP <2>; COT<9>
- df/dt 6: FUN<169>,INF <133>; TYP <2>; COT<9>
- dU/dt 1: FUN<169>,INF <134>; TYP <2>; COT<9>
- dU/dt 2: FUN<169>,INF <135>; TYP <2>;COT<9>
- dU/dt 3: FUN<169>,INF <136>; TYP <2>; COT<9>
- dU/dt 4: FUN<169>,INF <137>; TYP <2>; COT<9>

Auto-recloser Indications (monitor direction):

- CB in O/O (« closed ») position: FUN<169>,INF <33>; TYP <1>; COT<9>,
- CB in F/O (« open ») position: FUN<169>,INF <34>; TYP <1>; COT<9>,
- Trip TC: FUN<169>,INF <1>; TYP <1>; COT<9>,
- Close TC: FUN<169>,INF <2>; TYP <1>; COT<9>

3. PROCESSED COMMANDS

3.1 System Commands

– Synchronization Command (ASDU 6):

FUN<255>, INF <0>, TYP <6>, COT<8>

This command can be sent to a specific relay, or global, it only exists on the P922 and P923. The time sent by master is the time of the first bit of the frame. The relay synchronizes with this time, corrected by the frame transmission delay. After updating its time, the relay send back an acknowledge to the master, by giving its new current time. This acknowledge message will be an event of ASDU 6 type.

– General Interrogation Initialization command (ASDU 7):

FUN<255>, INF <0>, TYP <7>, COT<9>

This command starts the relay interrogation:

The relay then sends a list of data containing the relay state (see list described above). The GI command contains a scan number which will be included in the answers of the GI cycle generated by the GI command.

If a data has just changed before extracted by the GI, the new state is sent to the master station.

When an event is generated during the GI cycle, the event is sent in priority, and the GI cycle is temporarily interrupted. The end of the GI consists in sending an ASDU 8 to the master station.

If, during a General Interrogation cycle, another GI Initialization command is received, the precedent answer is stopped, and the new GI cycle started.

3.2 General Commands (ASDU 20) (Control direction)

- Leds Reset: This command acknowledge all alarms on Front Panel :
- FUN<161>,INF<19>, TYP<20>, COT <20>
- Setting groupe number 1: FUN<161>,INF<23>, TYP<20>, COT <20>
- Setting groupe number 2: FUN<161>,INF<24>, TYP<20>, COT <20>
- Trip TC: FUN<169>,INF <1>; TYP <20>; COT<20>
- Close TC: FUN<169>,INF <2>; TYP <20>; COT<20>
- Unlock relays: FUN<169>,INF <231>; TYP <20>; COT<20>
- General data reset: FUN<169>,INF <232>; TYP <20>; COT<20>
- First alarm acknowledge: FUN<169>,INF <53>; TYP <20>; COT<20>
- All alarms acknowledge: FUN<169>,INF <52>; TYP <20>; COT<20>
- Communication Order 1: FUN<169>,INF <234>; TYP <20>; COT<20>
- Communication Order 2: FUN<169>,INF <235>; TYP <20>; COT<20>
- Communication Order 3: FUN<169>,INF <227>; TYP <20>; COT<20>
- Communication Order 4: FUN<169>,INF <228>; TYP <20>; COT<20>

After executing one of these commands, the relay sends an acknowledge message, which contains the result of command execution.

If a state change is the consequence of the command, it must be sent in a ASDU 1 with COT 12 (remote operation).

If the relay receive another command message from the master station before sending the acknowledge message, it will be discarded.

Commands which are not processed by the relay are rejected with a negative acknowledge message.

3.3 Private commands – Setting management (Control direction)

All the command ASDUs used for setting management are described in the document: MiCOMACAPart4_IEC60870-5-103, rev. G.

1/ ASDUs for setting read:

ASDU 140 (8Ch) 16 or 32 bits value read:

FUN field contains the offset of the measure or of the parameter defined from the beginning of the page, and INF field contains the page number.

ASDUs of answer to setting read:

- ASDU 17 (11h): 16 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte, then a 4 byte time tag is transmitted.

This ASDU is used for all parameter pages: 1, 2, 3, 5, 6.

- ASDU 49 (31h): 16 bits analog protection signal:

FUN and INF: same definition than ASDU 140, parameter is transmitted in MW field, first low-byte, then high byte, then a 4 byte time tag is transmitted.

This ASDU is used for signals and measurements in page 0.

- ASDU 169 (A9h): 32 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word, then a QDS quality descriptor, then a 4 byte time tag is transmitted.

This ASDU is used for all parameter pages: 1, 2, 3, 6.

- ASDU 4: 32 bits floating-point analog protection parameter:

FUN and INF: same definition than ASDU 140, floating-point parameter is transmitted first low-word (low-byte, then high byte), then high word, then relative date field forced to 0, then FAN field forced to 0, then a 4 byte time tag is transmitted.

This ASDU is used for signals and measurements page 0.

2/ ASDUs for setting write:

ASDU 144 (90h) 16 bits analog protection value write:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte.

ASDU of answer to ASDU 144 setting write:

- ASDU 17 (11h): 16 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-byte, then high byte, then a 4 byte time tag is transmitted.

ASDU 201 (C9h) 32 bits analog protection value write:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word.

ASDU of answer to ASDU 201 setting write:

- ASDU 169 (A9h): 32 bits analog protection parameter:

FUN and INF: same definition than ASDU 140, parameter is transmitted first low-word (low-byte, then high byte), then high word, then a QDS quality descriptor, then a 4 byte time tag is transmitted.

3/ Error messages:

All errors detected in settings management are returned to the master in a special message called "Rejection telegram", which is a special ASDU 49 with FUN = 7Fh and INF = FFh, and the error code (rejection cause") contained in the MW value.
List of rejection causes used for P922/P923:

CAUSE OF REJECTION	MEANING
80H 01H	Message received with command or indication lock active
80H 06H	Unknown command; Structure type (DT field) invalid
80H 07H	Unknown parameter address
80H 0AH	Wrong value in receive message
80H 0BH	Hardware or software option does not exist
80H 15H	Date, time invalid (>30 days, >24 hours etc.)
80H 30H	Wrong Data TYPE in message
80H 33H	Wrong INF field in Message
80H 64H	Invalid command: function group is not configured
80H 72H	Control function cannot be assigned

4. RELAY RE-INITIALIZATION

In case of relay re-initialization, the relay send to the master station:

– A message indicating relay start (FUN<161>,INF <5>; TYP <5> COT <6>)

– or a message indicating Reset CU (FUN<161>,INF <5>; TYP <3> COT <4>)

– or a message indicating Reset FCB (FUN<161>,INF <5>; TYP <2> COT <3>)

– Each identification message of the relay (ASDU 5) contains the manufacturer name in 8 ASCII characters and. 4 characters including: 921 or 922 or 923 in numeric in the first 2 characters, to describe the protection, and the release number in the 2 last characters, for example 62 in the lower and 0 in the higher for release “6.C” (“C” is equivalent to 2).

5. CYCLIC MESSAGES (ASDU 9 AND ASDU 77)

Only measurands can be stored in these messages.

The measurands values are stored in lower levels of communication, before polling by master station.

Several of the fields in the ASDU 9 (FUN<161>, INF <148>) are unused in the P921/P922/P923 relay (Current and Power values), so they are set to 0: Only RMS Ua, Ub, Uc values and frequency are stored (with a rate such as: 2,4 * nominal value = 4096).

The second ASDU is ASDU3.4 (FUN<161>, INF<147>), which contains in second position Vn earth voltage value in rated format (with a rate such as: 2,4 * nominal value = 4096). In value does not exist, so the first position value in ASDU3.4 is set to « unused «.

Another ASDU, ASDU 77 (FUN<169>, INF <209>), which is a private ASDU, contains 6 other measurands (Only P922/P923): V1 (V direct) and V2 (V inverse) values, and Uab module, Ubc module, Uca module, V0 module values, in Volts, and in «short floating-point » format (IEEE 32 bits floating-point format). These values are not rated.

6. IEC870-5-103 MESSAGES FOR DISTURBANCE RECORD EXTRACTION (ONLY P922/923)

Only measurands can be stored in these messages.

The disturbance extraction procedure with IEC870-5-103 in MICOM Px2x relays is in conformance with IEC870-5-103 standard definition.

The maximum disturbance record number stored in a P922/P923 is 5.

The disturbance record mapping for P922 and P923 is the following:

– Number of analog channels transmitted: 4, which are:

- Channel 1: Ua current (Phase L1).
- Channel 2: Ub current (Phase L2).
- Channel 3: Uc current (Phase L3).
- Channel 4: Vn current (Earth).

– Identifiers of tags (14) transmitted in ASDU 29 (logical informations) for P922 or P923:

- Tag number 1: VN>: FUN <169> INF <67>
- Tag number 2: General start: FUN <161> INF <84>
- Tag number 3: General Trip: FUN <161> INF <68>
- Tag number 4: tU>: FUN <169> INF <90>
- Tag number 5: tU>>: FUN <169> INF <91>

- Tag number 6: tU>>>: FUN <169> INF <19>
- Tag number 7: tV0> (Earth): FUN <169> INF <92>
- Tag number 8: tV0>> (Earth): FUN <169> INF <93>
- Tag number 9: tV0>>> (Earth): FUN <169> INF <22>
- Tag number 10: Log input 1: FUN <169> INF <160>
- Tag number 11: Log input 2: FUN <169> INF <161>
- Tag number 12: Log input 3: FUN <169> INF <162>
- Tag number 13: Log input 4: FUN <169> INF <163>
- Tag number 14: Log input 5: FUN <169> INF <164>

7. IEC870-5-103 FAULT DATA RECORD EXTRACTION (ONLY P922/923)

The fault data are extracted with IEC870-5-103 in MICOM Px2x relays in conformance with AREVA IEC870-5-103 private definitions described in document: MiCOMACAPart4_IEC60870-5-103_G.
These data are uploaded through ASDU 4 messages, containing the following values in IEEE 32 bits floating-point format, at the end of disturbance record upload, before the acknowledgement of the record:

- fault number: FUN <243> INF <1>
- active group (1 to 2): FUN <243> INF <2>
- phase origin (F1x): FUN <243> INF <3>
- fault code (F109): FUN <243> INF <4>
- fault magnitude: FUN <243> INF <5>
- fault Va magnitude (unit= V): FUN <243> INF <6>
- fault Vb magnitude (unit= V): FUN <243> INF <7>
- fault Vc magnitude (unit= V): FUN <243> INF <8>
- fault Vn magnitude (unit= V): FUN <243> INF <9>

Format F1x:
0: None, 1: Phase A, 2: Phase B, 3: Phase C, 4: Phase AB, 5: Phase AC, 6: Phase BC, 7: Phase A B C, 8: Earth

DNP3.0

BLANK PAGE

1. INTRODUCTION

The purpose of this document is to describe the specific implementation of the Distributed Network Protocol (DNP) 3.0 within P92x.

P92x uses the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library Version 2.18.

This document, in conjunction with the DNP 3.0 Basic 4 Document Set, and the DNP Subset Definitions Document, provides complete information on how to communicate with P92.x via the DNP 3.0 protocol.

This implementation of DNP 3.0 is fully compliant with DNP 3.0 Subset Definition Level 2, contains many Subset Level 3 features, and contains some functionality even beyond Subset Level 3.

2. DNP V3.00 DEVICE PROFILE

The next table provides a “Device Profile Document” in the standard format defined in the DNP 3.0 Subset Definitions Document. While it is referred to in the DNP 3.0 Subset Definitions as a “Document,” it is only a component of a total interoperability guide. This table, in combination with the following should provide a complete interoperability/configuration guide:

– the Implementation Table (section 3, page 124),

– the Point List Tables (section 4, page 128),

– and a description of configuration methods and user-interface in Sections

DNP V3.00 DEVICE PROFILE DOCUMENT (Implementation Table, Section 3, page 124)	
Vendor Name: Schneider Electric	
Device Name: SERIAL 20 Platform using the Triangle MicroWorks, Inc. DNP 3.0 Slave Source Code Library, Version **2.18**.	
Highest DNP Level Supported: For Requests: Level 2 For Responses: Level 2	Device Function: ☒ Master ☐ Slave
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): For static (non-change-event) object requests, request qualifier codes 00 and 01 (start-stop), 07 and 08 (limited quantity), and 17 and 28 (index) are supported in addition to request qualifier code 06 (no range – or all points). Static object requests received with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Static object requests received with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event object requests, qualifiers 17 or 28 are always responded. 16-bit and 32-bit Analog Change Events with Time may be requested. The read function code for Object 50 (Time and Date), variation 1, is supported.	
Maximum Data Link Frame Size (octets): Transmitted: 292 Received 292	Maximum Application Fragment Size (octets): Transmitted: 2048 Received: 2048
Maximum Data Link Re-tries: ☒ None ☐ Fixed at 2 ☒ Configurable	Maximum Application Layer Re-tries: ☐ None ☒ Configurable
Requires Data Link Layer Confirmation: ☐ Never Always Sometimes Configurable	
Requires Application Layer Confirmation: Never Always ☐ When reporting Event Data ☐ When sending multi-fragment responses Sometimes Configurable	
Timeouts while waiting for: Data Link Confirm: None ☐ Fixed at 100 ms Variable Configurable. Complete Appl. Fragment: ☐ None Fixed at ____ Variable Configurable Application Confirm: None ☐ Fixed at 1s Variable Configurable Complete Appl. Response: ☐ None Fixed at ____ Variable Configurable Others: Binary input change scanning period: 5ms Analog input change scanning period: 1s	

DNP V3.00
DEVICE PROFILE DOCUMENT
(Implementation Table, Section 3, page 124)

Sends/Executes Control Operations:

WRITE Binary Outputs	☐ Never	Always	Sometimes	Configurable
SELECT/OPERATE	Never	☐ Always	Sometimes	Configurable
DIRECT OPERATE	Never	☐ Always	Sometimes	Configurable
DIRECT OPERATE – NO ACK	Never	☐ Always	Sometimes	Configurable
Count > 1	☐ Never	Always	Sometimes	Configurable
Pulse On	Never	☐ Always	Sometimes	Configurable
Pulse Off	☐ Never	Always	Sometimes	Configurable
Latch On	☐ Never	Always	Sometimes	Configurable
Latch Off	☐ Never	Always	Sometimes	Configurable
Queue	☐ Never	Always	Sometimes	Configurable
Clear Queue	☐ Never	Always	Sometimes	Configurable

Reports Binary Input Change Events when no specific variation requested: Never ☐ Only time-tagged for P922 and P923 ☐ Only non-time-tagged for P921 Configurable	Reports time-tagged Binary Input Change Events when no specific variation requested: ☐ Never for P921 ☐ Binary Input Change With Time for P922 and P923 Binary Input Change With Relative Time Configurable (attach explanation)
Sends Unsolicited Responses: . ☐ Never Configurable Only certain objects Sometimes (attach explanation) ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ☐ Never When Device Restarts When Status Flags Change No other options are permitted.
Default Counter Object/Variation: No Counters Reported Configurable ☐ Default Object: 20 Default Variation: 5 Point-by-point list attached	Counters Roll Over at: No Counters Reported Configurable (attach explanation) ☐ 16 Bits ☐ 32 Bits Other Value: _____ ☐ Point-by-point list attached

Sends Multi-Fragment Responses:

☐ Yes

No

3. IMPLEMENTATION TABLE

The next table identifies the variations, function codes, and qualifiers supported in both request messages and in response messages.

For static (non-change-event) objects, requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. Static object requests sent with qualifiers 17 or 28 will be responded with qualifiers 17 or 28. For change-event objects, qualifiers 17 or 28 are always responded.

Gray text: Level 3 subset indicates a Level 3 functionality (under 2nd level)

Dark gray text: < Subset Level 3 indicates a functionality under 3rd level.

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
1	0	Binary Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
1	1 (default – see note 1)	Binary Input	1 (read) 22	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
1	2	Binary Input with Status	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
2	0	Binary Input Change (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
2	1(default – see note 1 for P921)	Binary Input Change without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)
2 (only P922-P923)	2 (default – see note 1)	Binary Input Change with Time	1 (read)	06(no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)
10	0	Binary Output Status (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)		
10	2 (default – see note 1)	Binary Output Status	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
12	1	Control Relay Output Block	3 (select) 4(operate) 5 (direct op) 6 (dir. op, noack)	00, 01 (start-stop) 07, 08 (limited qty) 17, 28 (index)	129(response)	echo of request
20 (only P922-P923)	0	Binary Counter (Variation 0 is used to request default variation)	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)		
20 (only P922-P923)	1	32-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20 (only P922-P923)	2	16-Bit Binary Counter	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20 (only P922-P923)	5	32-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
20 (only P922-P923)	6	16-Bit Binary Counter without Flag	1 (read) 7 (freeze) 8 (freeze noack) 9 (freeze clear) 10 (frz. cl. Noack)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21 (only P922-P923)	0	Frozen Counter (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)		
21 (only P922-P923)	1	32-Bit Frozen Counter	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21 (only P922-P923)	2	16-Bit Frozen Counter	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
21 (only P922-P923)	9	32-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
21 (only P922-P923)	10	16-Bit Frozen Counter without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	0	Analog Input (Variation 0 is used to request default variation)	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)		
30	1 (default – see note 1	32-Bit Analog Input	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	2	16-Bit Analog Input	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	3	32-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
30	4	16-Bit Analog Input without Flag	1 (read)	00, 01 (start-stop) 06 (no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
32	0	Analog Change Event (Variation 0 is used to request default variation)	1 (read)	06 (no range, or all) 07, 08 (limited qty)		
32	1 (default – see note 1)	32-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)
32	2	16-Bit Analog Change Event without Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)
32 (only P922-P923)	3	32-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)
32 (only P922-P923)	4	16-Bit Analog Change Event with Time	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129(response)	17, 28 (index)

OBJECT			REQUEST (Library will parse)		RESPONSE (Library will respond with)	
Object Number	Variation Number	Description	Function Codes (dec)	Qualifier Codes (hex)	Function Codes (dec)	Qualifier Codes (hex)
50 (only P922-P923)	0	Time and Date	1 (read)	00, 01 (start-stop) 06(no range, or all) 07, 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
50 (only P922-P923)	1 (default – see note 1)	Time and Date	1 (read) 2 (write)	00, 01 (start-stop) 06 (no range, or all) 07 (limited qty=1) 08 (limited qty) 17, 28 (index)	129(response)	00, 01 (start-stop) 17, 28 (index – see note 2)
52	2	Time Delay Fine			129(response)	07 (limited qty) (qty = 1)
60	0	Class 0, 1, 2, and 3 Data	1 (read)	06 (no range, or all)		
60	1	Class 0 Data	1 (read)	06 (no range, or all)	129	17,28
60	2	Class 1 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
60	3	Class 2 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
60	4	Class 3 Data	1 (read)	06 (no range, or all) 07, 08 (limited qty)	129	17,28
80	1	Internal Indications	2 (write)	00 (start-stop) (index must =7)		
		No Object (function code only) –See Note 3	13 (cold restart)			
		No Object (function code only)	14 (warm restart)			
		No Object (function code only)	23 (delay meas.)			

Note 1: A Default variation refers to the variation responded when variation 0 is requested and/or in class 0, 1, 2, or 3 scans.

Note 2: For static (non-change-event) objects, qualifiers 17 or 28 are only responded when a request is sent with qualifiers 17 or 28, respectively. Otherwise, static object requests sent with qualifiers 00, 01, 06, 07, or 08, will be responded with qualifiers 00 or 01. (For change-event objects, qualifiers 17 or 28 are always responded.)

Note 3: For MiCOM P92x relays, a cold restart is implemented as a warm restart – the executable is not restarted, but the DNP process is restarted.

4. POINT LIST

This section identifies all the individual data points provided by this implementation of DNP 3.0. The MiCOM P92x relays use the database protection.

4.1 Binary Input Points

Every Binary Input Status points are included in class 0 polls, because they are included in one of classes 1, 2 or 3.

Binary Input Points
Static (Steady-State) Object Number: 1
Change Event Object Number: 2
Request Function Codes supported: 1 (read)
Static Variation reported when variation 0 requested: 1 (Binary Input without status)
Change Event Variation reported when variation 0 requested: 1 for P921 and 2 (Binary Input Change with Time) for P922 and P923

P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
0	0	0	Output relay 1 (trip)	0	1
1	1	1	Output relay 2	0	2
2	2	2	Output relay 3	0	2
3	3	3	Output relay 4	0	2
4	4	4	Output relay 0 (watch dog)	0	2
	5	5	Output relay 5	0	2
	6	6	Output relay 6	0	2
	7	7	Output relay 7	0	2
	8	8	Output relay 8	0	2
5	9	9	Opto isolator 1	0	2
6	10	10	Opto isolator 2	0	2
	11	11	Opto isolator 3	0	2
	12	12	Opto isolator 4	0	2
	13	13	Opto isolator 5	0	2
7	14	14	Phase overvoltage stage 1 start	0	1
8	15	15	Phase overvoltage stage 1 trip	0	1
9	16	16	Phase overvoltage stage 2 start	0	1
10	17	17	Phase overvoltage stage 2 trip	0	1
11	18	18	Phase overvoltage stage 3 start	0	1
12	19	19	Phase overvoltage stage 3 trip	0	1
13	20	20	Phase undervoltage stage 1 start	0	1
14	21	21	Phase undervoltage stage 1 trip	0	1
15	22	22	Phase undervoltage stage 2 start	0	1
16	23	23	Phase undervoltage stage 2 trip	0	1
17	24	24	Phase undervoltage stage 3 start	0	1
18	25	25	Phase undervoltage stage 3 trip	0	1
19	26	26	Earth overvoltage stage 1 start	0	1
20	27	27	Earth overvoltage stage 1 trip	0	1
21	28	28	Earth overvoltage stage 2 start	0	1
22	29	29	Earth overvoltage stage 2 trip	0	1
23	30	30	Earth overvoltage stage 3 start	0	1
24	31	31	Earth overvoltage stage 3 trip	0	1
25	32	32	Taux1	0	1
26	33	33	Taux2	0	1
27	34	34	Logic equation A	0	1
28	35	35	Logic equation B	0	1
29	36	36	Blocking logic 1	0	1
30	37	37	Blocking logic 2	0	1
31	38	38	52a	0	1
32	39	39	52b	0	1
33	40	40	Breaker failure	0	1
34	41	41	De latching of the Tripping output relay & aux. relays by remote control or by front panel	0	1
35	42	42	Closing order by remote control	0	1
36	43	43	Tripping order by remote control	0	1
37	44	44	Major material Alarms	0	1
38	45	45	Minor material Alarms	0	1
	46	46	Negative sequence overvoltage stage 1 start	0	1
	47	47	Negative sequence overvoltage stage 1 trip	0	1

Binary Input Points Static (Steady-State) Object Number: 1 Change Event Object Number: 2 Request Function Codes supported: 1 (read) Static Variation reported when variation 0 requested: 1 (Binary Input without status) Change Event Variation reported when variation 0 requested: 1 for P921 and 2 (Binary Input Change with Time) for P922 and P923					
P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
	48	48	Negative sequence overvoltage stage 2 start	0	1
	49	49	Negative sequence overvoltage stage 2 trip	0	1
	50	50	Positive sequence undervoltage stage 1 start	0	1
	51	51	Positive sequence undervoltage stage 1 trip	0	1
	52	52	Positive sequence undervoltage stage 2 start	0	1
	53	53	Positive sequence undervoltage stage 2 trip	0	1
	54	54	Frequency stage 1 start	0	1
	55	55	Frequency stage 1 trip	0	1
	56	56	Frequency stage 2 start	0	1
	57	57	Frequency stage 2 trip	0	1
	58	58	Frequency stage 3 start	0	1
	59	59	Frequency stage 3 trip	0	1
	60	60	Frequency stage 4 start	0	1
	61	61	Frequency stage 4 trip	0	1
	62	62	Frequency stage 5 start	0	1
	63	63	Frequency stage 5 trip	0	1
	64	64	Frequency stage 6 start	0	1
	65	65	Frequency stage 6 trip	0	1
	66	66	Frequency out of range	0	1
	67	67	Number of CB operation	0	1
	68	68	CB operation time alarm	0	1
	69	69	CB close time alarm	0	1
53	98	70	Logic equation C	0	1
54	99	71	Logic equation D	0	1
		72	Rate of change of frequency stage 1	0	1
		73	Rate of change of frequency stage 2	0	1
		74	Rate of change of frequency stage 3	0	1
		75	Rate of change of frequency stage 4	0	1
		76	Rate of change of frequency stage 5	0	1
		77	Rate of change of frequency stage 6	0	1
39	70	78	Latching of Relay	0	2
40	71	79	Phase overvoltage stage 1 trip (latched)	0	3
41	72	80	Phase overvoltage stage 2 trip (latched)	0	3
42	73	81	Phase overvoltage stage 3 trip (latched)	0	3
43	74	82	Phase undervoltage stage 1 trip (latched)	0	3
44	75	83	Phase undervoltage stage 2 trip (latched)	0	3
45	76	84	Phase undervoltage stage 3 trip (latched)	0	3
46	77	85	Earth overvoltage stage 1 trip (latched)	0	3
47	78	86	Earth overvoltage stage 2 trip (latched)	0	3
48	79	87	Earth overvoltage stage 3 trip (latched)	0	3
49	80	88	Taux1 (latched)	0	3
50	81	89	Taux2 (latched)	0	3
51	82	90	Logic equation A (latched)	0	3
52	83	91	Logic equation B (latched)	0	3
	84	92	Negative sequence overvoltage stage 1 trip (latched)	0	3
	85	93	Negative sequence overvoltage stage 2 trip (latched)	0	3
	86	94	Positive sequence undervoltage stage 1 trip (latched)	0	3
	87	95	Positive sequence undervoltage stage 2 trip (latched)	0	3
	88	96	Frequency stage 1 trip (latched)	0	3
	89	97	Frequency stage 2 trip (latched)	0	3
	90	98	Frequency stage 3 trip (latched)	0	3
	91	99	Frequency stage 4 trip (latched)	0	3
	92	100	Frequency stage 5 trip (latched)	0	3
	93	101	Frequency stage 6 trip (latched)	0	3
	94	102	Frequency out of range (latched)	0	3
	95	103	Number of CB operation (latched)	0	3
	96	104	CB operation time alarm (latched)	0	3
	97	105	CB close time alarm (latched)	0	3

Binary Input Points
Static (Steady-State) Object Number: 1
Change Event Object Number: 2
Request Function Codes supported: 1 (read)
Static Variation reported when variation 0 requested: 1 (Binary Input without status)
Change Event Variation reported when variation 0 requested: 1 for P921 and 2 (Binary Input Change with Time) for P922 and P923

P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
55	100	106	Logic equation C (latched)	0	3
56	101	107	Logic equation D (latched)	0	3
		108	Rate of change of frequency stage 1 (latched)	0	3
		109	Rate of change of frequency stage 2 (latched)	0	3
		110	Rate of change of frequency stage 3 (latched)	0	3
		111	Rate of change of frequency stage 4 (latched)	0	3
		112	Rate of change of frequency stage 5 (latched)	0	3
		113	Rate of change of frequency stage 6 (latched)	0	3
		113	Rate of change of frequency stage 6 (latched)	0	3
		114	DV/DT1	0	1
		115	DV/DT2	0	1
		116	DV/DT3	0	1
		117	DV/DT4	0	1
		118	DV/DT1 (latched)	0	3
		119	DV/DT2 (latched)	0	3
		120	DV/DT3 (latched)	0	3
		121	DV/DT4 (latched)	0	3
		122	Unconfirmed rate of change of frequency stage 1	0	1
		123	Unconfirmed rate of change of frequency stage 2	0	1
		124	Unconfirmed rate of change of frequency stage 3	0	1
		125	Unconfirmed rate of change of frequency stage 4	0	1
		126	Unconfirmed rate of change of frequency stage 5	0	1
		127	Unconfirmed rate of change of frequency stage 6	0	1
		128	F + dF/dT stage 1	0	1
		129	F + dF/dT stage 2	0	1
		130	F + dF/dT stage 3	0	1
		131	F + dF/dT stage 4	0	1
		132	F + dF/dT stage 5	0	1
		133	F + dF/dT stage 6	0	1
57	102	134	Logic equation E	0	1
58	103	135	Logic equation F	0	1
59	104	136	Logic equation G	0	1
60	105	137	Logic equation H	0	1
	106	138	tVTS	0	1
61	107	139	Maintenance mode active	0	1
	108	140	Taux3	0	1
	109	141	Taux4	0	1
	110	142	Taux5	0	1
	111	143	Derived earth overvoltage stage 1 start	0	1
	112	144	Derived earth overvoltage stage 2 start	0	1
	113	145	Derived earth overvoltage stage 3 start	0	1
	114	146	Derived earth overvoltage stage 1 trip	0	1
	115	147	Derived earth overvoltage stage 2trip	0	1
	116	148	Derived earth overvoltage stage 3trip	0	1
62	117	149	Logic equation E (latched)	0	3
63	118	150	Logic equation F (latched)	0	3
64	119	151	Logic equation G (latched)	0	3
65	120	152	Logic equation H (latched)	0	3
	121	153	Taux3 (latched)	0	3
	122	154	Taux4 (latched)	0	3
	123	155	Taux5 (latched)	0	3
	124	156	Derived earth overvoltage stage 1 trip (latched)	0	3
	125	157	Derived earth overvoltage stage 2 trip (latched)	0	3
	126	158	Derived earth overvoltage stage 3 trip (latched)	0	3
	127	159	tVTS (latched)	0	3
		160	F + dF/dT stage 1 (latched)	0	3
		161	F + dF/dT stage 2 (latched)	0	3
		162	F + dF/dT stage 3 (latched)	0	3
		163	F + dF/dT stage 4 (latched)	0	3
		164	F + dF/dT stage 5 (latched)	0	3

Binary Input Points Static (Steady-State) Object Number: 1 Change Event Object Number: 2 Request Function Codes supported: 1 (read) Static Variation reported when variation 0 requested: 1 (Binary Input without status) Change Event Variation reported when variation 0 requested: 1 for P921 and 2 (Binary Input Change with Time) for P922 and P923					
P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	init val.	Change Event Class (1, 2, 3 or none)
		165	F + dF/dT stage 6 (latched)	0	3
66	128	166	Trip relay latched (RL1)	0	1
	129	167	Remote communication order 1	0	1
	130	168	Remote communication order 2	0	1
	131	169	Remote communication order 3	0	1
	132	170	Remote communication order 4	0	1

4.2 Binary Output Status Points and Control Relay Output Blocks

The next table lists both the Binary Output Status Points (Object 10) and the Control Relay Output Blocks (Object 12).

Binary Output Status points are not included in class 0 polls.

Binary Output Status Points Object Number: 10 Request Function Codes supported: 1 (read) Default Variation reported when variation 0 requested: 2 (Binary Output Status) Control Relay Output Blocks Object Number: 12 Request Function Codes supported: 3 (select), 4 (operate), 5 (direct operate), 6 (direct operate, noack)					
P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	Initial Status Value	Supported Control Relay Output Block Fields
0	0	0	Unlatch of relays	0	Pulse On
1	1	1	Acknowledgement of the 1st alarm	0	Pulse On
2	2	2	Acknowledgement of all the alarms	0	Pulse On
3	3	3	Remote control Tripping	0	Paired Trip
4	4	4	Remote control Closing	0	Paired Close
	5	5	Change of Active Group	0	Pulse On
	6	6	Average and Max rms values resetting	0	Pulse On
	7	7	Acknowledge of stats reset alarm	0	Pulse On
5	8	8	Maintenance mode start	0	Pulse On
6	9	9	Maintenance mode stop	0	Pulse On
	10	10	General reset	0	Pulse On
	11	11	Remote communication order 1	0	Pulse On
	12	12	Remote communication order 2	0	Pulse On
	13	13	Remote communication order 3	0	Pulse On
	14	14	Remote communication order 4	0	Pulse On

4.3 Counters

The next table lists both Binary Counters (Object 20) and Frozen Counters (Object 21). When a freeze function is performed on a Binary Counter point, the frozen value is available in the corresponding Frozen Counter point.

Binary Counters and Frozen Counters are not included in class 0 polls.

MiCOM P921 relay does not support binary Counters and Frozen Counters.

Binary Counters
Static (Steady-State) Object Number: 20
Change Event Object Number: not supported
Request Function Codes supported: 1 (read), 7 (freeze), 8 (freeze noack)
9 (freeze and clear), 10 (freeze and clear, noack)
Static Variation reported when variation 0 requested: 5 (32-Bit Binary Counter without Flag
Change Event Variation reported when variation 0 requested: none-not supported
Frozen Counters
Static (Steady-State) Object Number: 21
Change Event Object Number: not supported
Request Function Codes supported: 1 (read)
Static Variation reported when variation 0 requested: 9 (32-Bit Frozen Binary without Flag)
Change Event Variation reported when variation 0 requested: none-not supported

P922 Point Index	P923 Point Index	Name/Description	Data type
0	0	Max RMS voltage phase A	D1
1	1	Max RMS voltage phase B	D1
2	2	Max RMS voltage phase C	D1
3	3	Average RMS voltage phase A	D1
4	4	Average RMS voltage phase B	D1
5	5	Average RMS voltage phase C	D1
6	6	CB operation number	D2

4.4 Analog Inputs

The next table lists Analog Inputs (Object 30). It is important to note that 16-bit and 32-bit variations of Analog Inputs, Analog Output Control Blocks, and Analog Output Statuses are transmitted through DNP as signed numbers. Even for analog input points that are not valid as negative values, the maximum positive representation is 32767. For each point, the “Scaling and Units” column indicates the value of a transmitted 32767. This also implies the value of a transmitted –32767. The entry in the column does not imply a valid value for the point.

Always indicating the representation of 32767 in the tables below is a consistent method for representing scale, applicable to all scaling possibilities.

The “Default Deadband,” and the “Default Change Event Assigned Class” columns are used to represent the absolute amount by which the point must change before an analog change event will be generated, and once generated in which class poll (1, 2, 3) will the change event be reported. Only the default values for these columns are documented here because the values may change in operation due to either local (user-interface) or remote (through DNP) control.

Analog Inputs points are included in class 0 polls, because they are included in one of classes 1, 2 or 3.

Analog Inputs
Static (Steady-State) Object Number: 30
Change Event Object Number: 32
Request Function Codes supported: 1 (read)
Static Variation reported when variation 0 requested: 1 (32-Bit Analog Input)
Change Event Variation reported when variation 0 requested: 1 (32-Bit Analog Change Event w/o Time)
Change Event Scan Rate: The scan rate for analog input change events is fixed at 1s

P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	Initial Value	Scaling and Units (representation of 32767–see above)	Valid Range	Change Event Deadband	Initial Change Event Class (1, 2, 3 or none)
	0	0	Active Group	1	32767	1 à 2	1	1
0	1	1	Magnitude VA	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
1	2	2	Magnitude VB	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
2	3	3	Magnitude VC	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
3	4	4	Magnitude Vo	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
4	5	5	rms VA	0A	327.67V	0 to 500000000 V/100	2%	3
5	6	6	rms VB	0A	327.67V	0 to 500000000 V/100	2%	3
6	7	7	rms VC	0A	327.67V	0 to 500000000 V/100	2%	3
7	8	8	rms Vo	0A	327.67V	0 to 500000000 V/100	2%	3
	9	9	Frequency	0	327,67 Hz	30Hz to 80 Hz and 99.99Hz= ERROR	0.1Hz	3
	10	10	Magnitude V2	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3

Analog Inputs
Static (Steady-State) Object Number: 30
Change Event Object Number: 32
Request Function Codes supported: 1 (read)
Static Variation reported when variation 0 requested: 1 (32-Bit Analog Input)
Change Event Variation reported when variation 0 requested: 1 (32-Bit Analog Change Event w/o Time)
Change Event Scan Rate: The scan rate for analog input change events is fixed at 1s

P921 Point Index	P922 Point Index	P923 Point Index	Name/Description	Initial Value	Scaling and Units (representation of 32767–see above)	Valid Range	Change Event Dead-band	Initial Change Event Class (1, 2, 3 or none)
	11	11	Magnitude V1	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3
	12	12	Tripping Time	0	327.67s	0 to 10.00s	10 ms	3
	13	13	Closing Time	0	327.67s	0 to 10.00s	10 ms	3
	14	14	Fault number	0	32767	0 to 65535	1	2
	15	15	group	0	32767	1 to 2	each new fault	2
	16	16	phase fault	0	32767	0 to (F1)	each new fault	2
	17	17	origin fault	0	32767	0 to (F2)	each new fault	2
	18	18	Fault magnitude	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
	19	19	Fault magnitude VA	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
	20	20	Fault magnitude VB	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
	21	21	Fault magnitude VC	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
	22	22	Fault magnitude Vo	0	260V G1* 960V G2*	0 to 260V 0 to 960V	each new fault	2
	23	23	Magnitude derived Vo	0	260V G1* 960V G2*	0 to 260V 0 to 960V	0.5V 2V	3

G1 = Range A: Un = 57V-130V
G2 = Range B: Un = 220V-480V

Format:

F1:
0: None, 1: Phase A, 2: Phase B, 3: Phase C, 4: Phase AB, 5: Phase AC, 6: Phase BC, 7: Phase A B C, 8: Earth

F2:
See format F109 (MODBUS).

BLANK PAGE

INSTALLATION

CONTENTS

BLANK PAGE

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 external damage has been sustained in transit. If damage has been sustained, a claim should be made to the transport contractor and Schneider Electric should be promptly notified.

Relays that are supplied unmounted and not intended for immediate installation should be returned to their protective polythene bags and delivery carton. Section 3 of this chapter gives more information about the storage of relays.

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, although not always immediately apparent, will reduce the reliability of the circuit. This is particularly important to consider where the circuits use complementary metal oxide semiconductors (CMOS), as is the case with these relays.

The relay's electronic circuits are protected from electrostatic discharge when housed in the case. Do not expose them to risk by removing the front panel or printed circuit boards unnecessarily.

Each printed circuit board incorporates the highest practicable protection for it's semiconductor devices. However, if it becomes necessary to remove a printed circuit board, the following precautions should be taken to preserve the high reliability and long life for which the relay has been designed and manufactured.

1. Before removing a printed circuit board, ensure that you are at the same electrostatic potential as the equipment by touching the case.
2. Handle analogue input modules by the front panel, frame or edges of the circuit boards. Printed circuit boards should only be handled by their edges. Avoid touching the electronic components, printed circuit tracks 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 anti-static surface, or on a conducting surface which is at the same potential as yourself.
5. If it is necessary to store or transport printed circuit boards removed from the case, place them individually in electrically conducting anti-static bags.

In the unlikely event that you are making measurements on the internal electronic circuitry of a relay 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 to 10MΩ. If a wrist strap is not available you should maintain regular contact with the case to prevent a build-up of electrostatic potential. Instrumentation which may be used for making measurements should also be earthed to the case whenever possible.

More information on safe working procedures for all electronic equipment can be found in BS EN 100015:Part 1:1992. 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 aforementioned British Standard document.

3. 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 is exposed to ambient conditions and may be restored by gently heating the bag for about an hour prior to replacing it in the carton. Care should be taken on subsequent unpacking that any dust which has collected on the carton does not fall inside. In locations of high humidity the carton and packing may become impregnated with moisture and the de-humidifier crystals will lose their efficiency.

Prior to installation, relays should be stored at a temperature of between –25° to +70°C.

Sustained exposure to high humidity during storage may cause damage to electronics and reduce the lifetime of the equipment.

Therefore, once the MiCOM products have been unpacked, we recommend that they are energized within the three following months.

Where electrical equipment is being installed, sufficient time should be allowed for acclimatisation to the ambient temperature of the environment, before energisation.

4. UNPACKING

Care must be taken when unpacking and installing the relays so that none of the parts are damaged and additional components are not accidentally left in the packing or lost.

Relays must only be handled by skilled persons.

The site should be well lit to facilitate inspection, clean, dry and reasonably free from dust and excessive vibration. This particularly applies to installations which are being carried out at the same time as construction work.

5. RELAY MOUNTING

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

Individual relays are normally supplied with an outline diagram showing the dimensions for panel cut-outs and hole centres. This information can also be found in the product publication.

Secondary front covers can also be supplied as an option item to prevent unauthorised changing of settings and alarm status. They can be ordered under the reference GEN0055 (size 20TE).

The design of the relay is such that the fixing holes in the mounting flanges are only accessible when the access top and bottom covers are open and hidden from sight when the covers are closed.

If an MMLG test block is to be included, it is recommended that, when viewed from the front, it is positioned on the right-hand side of the relay (or relays) with which it is associated. This minimises the wiring between the relay and test block, and allows the correct test block to be easily identified during commissioning and maintenance tests.

5.1 Rack Mounting

MiCOM relays may be rack mounted using single tier rack frames (our part number FX0021 001), as illustrated in Figure 1. These frames have been designed to have dimensions in accordance with IEC60297 and are supplied pre-assembled ready to use. On a standard 483 mm rack system this enables combinations of widths of case up to a total equivalent of size 80TE to be mounted side by side.

The two horizontal rails of the rack frame have holes drilled at approximately 26 mm intervals and the relays are attached via their mounting flanges using No.4 recessed head self-tapping screws.

Once the tier is complete, the frames are fastened into the racks using mounting angles at each end of the tier.

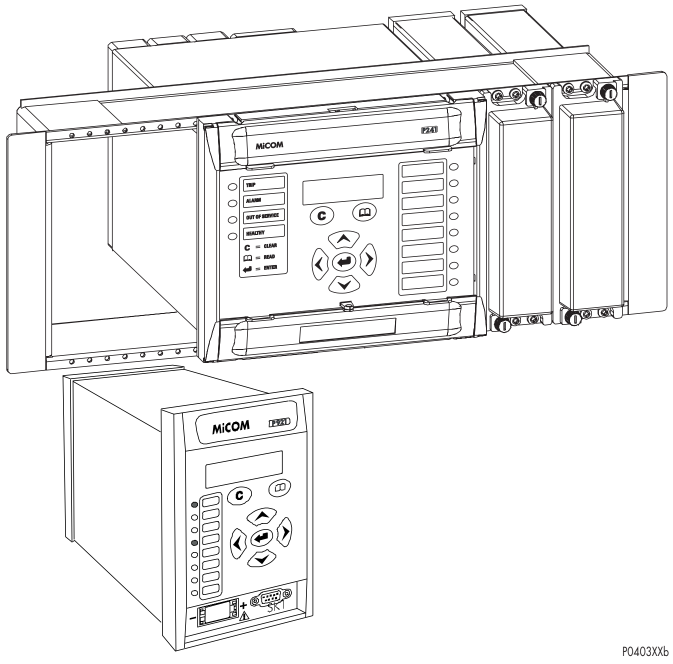


FIGURE 1: RACK MOUNTING OF RELAYS

Relays can be mechanically grouped into single tier (4U) or multi-tier arrangements by means of the rack frame. This enables schemes using products from the MiCOM and MiDOS product ranges to be pre-wired together prior to mounting.

Where the case size summation is less than 80TE on any tier, or space is to be left for installation of future relays, blanking plates may be used. These plates can also be used to mount ancillary components. Figure 1 shows the sizes that can be ordered.

NOTE: Blanking plates are only available in black.

Further details on mounting MiDOS relays can be found in publication R7012, “MiDOS Parts Catalogue and Assembly Instructions”.

Width	Part number
5TE	GJ2028 001
10TE	GJ2028 002
15TE	GJ2028 003
20TE	GJ2028 004
25TE	GJ2028 005
30TE	GJ2028 006
35TE	GJ2028 007
40TE	GJ2028 008

TABLE 1: BLANKING PLATES

5.2 Panel Mounting

The relays can be flush mounted into panels using self-tapping screws passing through the front mounting flanges. Alternatively tapped holes can be used if the panel has a minimum thickness of 2.5 mm.

For applications where relays need to be semi-projection or projection mounted, a range of collars are available. Further details can be obtained from the Contracts Department of Schneider Electric.

Where several relays are to mounted in a single cut-out in the panel, it is advised that they are mechanically grouped together horizontally and/or vertically to form rigid assemblies prior to mounting in the panel.

NOTE: It is not advised that MiCOM relays are fastened using pop rivets as this will not allow the relay to be easily removed from the panel in the future if repair is necessary.

If it is required to mount a relay assembly on a panel complying to BS EN60529 IP52, it will be necessary to fit a metallic sealing strip between adjoining relays (Part no GN2044 001) and a sealing ring selected from Table 2 around the complete assembly.

Width	Single Tier	Double Tier
10TE	GJ9018 002	GJ9018 018
15TE	GJ9018 003	GJ9018 019
20TE	GJ9018 004	GJ9018 020
25TE	GJ9018 005	GJ9018 021
30TE	GJ9018 006	GJ9018 022
35TE	GJ9018 007	GJ9018 023
40TE	GJ9018 008	GJ9018 024
45TE	GJ9018 009	GJ9018 025
50TE	GJ9018 010	GJ9018 026
55TE	GJ9018 011	GJ9018 027
60TE	GJ9018 012	GJ9018 028
65TE	GJ9018 013	GJ9018 029
70TE	GJ9018 014	GJ9018 030
75TE	GJ9018 015	GJ9018 031
80TE	GJ9018 016	GJ9018 032

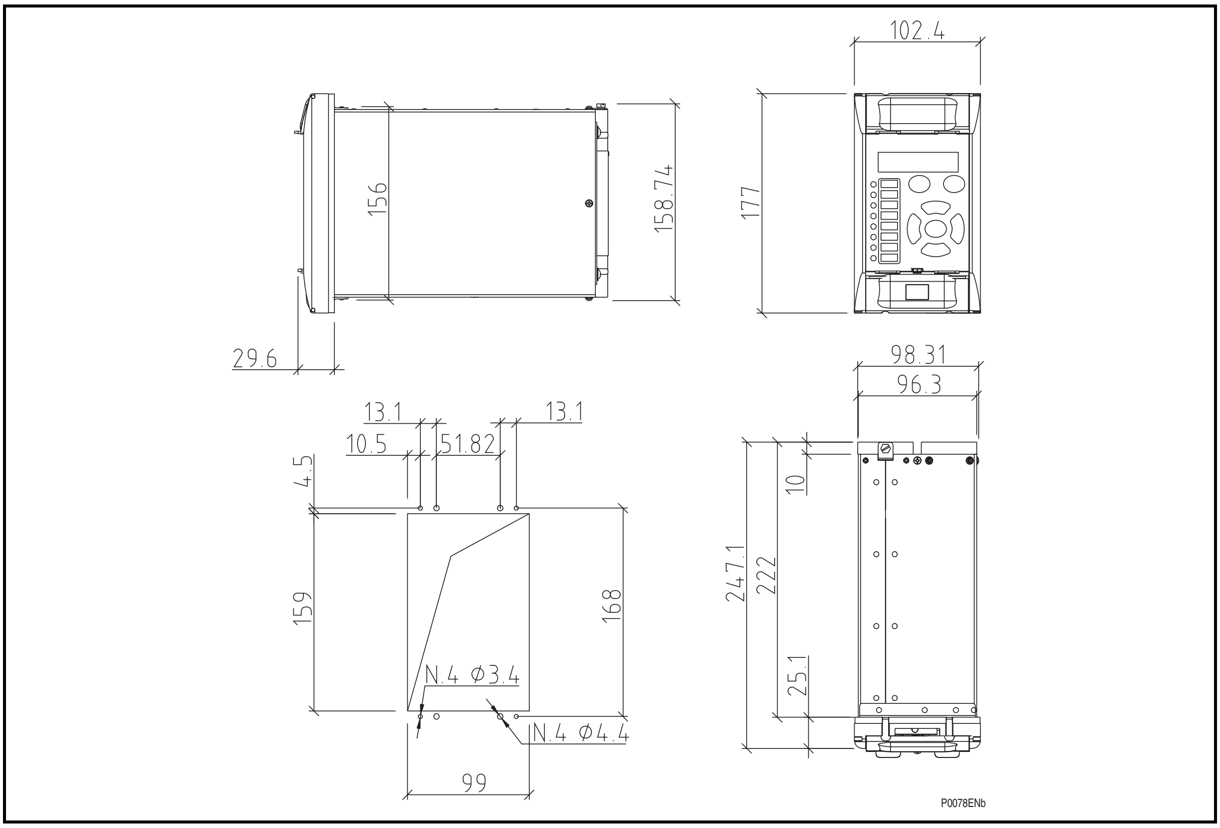
TABLE 2: IP52 SEALING RINGS

Further details on mounting MiDOS relays can be found in publication R7012, "MiDOS Parts Catalogue and Assembly Instructions".

6. CASE DIMENSIONS

MiCOM P921, P922 and **P923** relays are available in a 4U metal case for panel or flush mounting.

Weight: 1.7 to 2.1 Kg



MiCOM P921, P922 AND P923 RELAYS CASE DIMENSIONS

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

7. RELAY WIRING

This section serves as a guide to selecting the appropriate cable and connector type for each terminal on the MiCOM relay.

Before carrying out any work on the equipment the user should be familiar with the contents of the Safety Section/Safety Guide SFTY/4LM/D11 or later issue and the ratings on the equipment's rating label.

7.1 Medium and Heavy Duty Terminal Block Connections

Loose relays are supplied with sufficient M4 screws for making connections to the rear mounted terminal blocks using ring terminals, with a recommended maximum of two ring terminals per relay terminal.

If required, Schneider Electric can supply M4 90° crimp ring terminals in five different sizes depending on wire size (see Table 3 and Table 4). Each type is available in bags of 100.

Part number	Wire Size	Insulation Colour
ZB9124 901	0.25 – 1.65 mm^2 (22-16AWG) 	Red
ZB9124 900	1.04 – 2.63 mm^2 (16-14AWG) 	Blue
ZB9124 904	2.53 - 6.64 mm^2 (12-10AWG)	Uninsulated*

TABLE 3: M4 90° CRIMP RING TERMINALS

Part number	Wire Size
ZB9128 015	0.75 – 1.5 mm^2 
ZB9128 016	1.5 –2.5 mm^2 

TABLE 4: M4 CRIMP RING TERMINALS

* To maintain the terminal block insulation requirements for safety, an insulating sleeve should be fitted over the ring terminal after crimping.

The following minimum wire sizes are recommended:

- Auxiliary Supply, Vx — 1.5 mm^2
- RS485 port — See separate section
- Other circuits — 1.0 mm^2

Due to the limitations of the ring terminal, the maximum wire size that can be used for any of the medium or heavy duty terminals is 6.0 mm^2 using ring terminals that are not pre-insulated. Where it required to only use pre-insulated ring terminals, the maximum wire size that can be used is reduced to 2.63 mm^2 per ring terminal. If a larger wire size is required, two wires should be used in parallel, each terminated in a separate ring terminal at the relay.

The wire used for all connections to the medium and heavy duty terminal blocks, except the RS485 port, should have a minimum voltage rating of 300Vrms.

It is recommended that the auxiliary supply wiring should be protected by a 16A high rupture capacity (HRC) fuse of type NIT or TIA. For safety reasons, current transformer circuits must never be fused. Other circuits should be appropriately fused to protect the wire used.

7.2 RS485 Port

Connections to the RS485 port are made using ring terminals. It is recommended that a 2 core screened cable is used with a maximum total length of 1000m or 200nF total cable capacitance.

A typical cable specification would be:

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

Refer to chapter P92x/EN CO, paragraph 2.2 for references of RS232/RS485 converters.

7.3 Protective Conductor (Earth) Connection

Every relay must be connected to the local earth bar using the M4 earth studs in the bottom left hand corner of the relay case. The minimum recommended wire size is 2.5 mm^2 and should have a ring terminal at the relay end. Due to the limitations of the ring terminal, the maximum wire size that can be used for any of the medium or heavy duty terminals is 6.0 mm^2 per wire. If a greater cross-sectional area is required, two parallel connected wires, each terminated in a separate ring terminal at the relay, or a metal earth bar could be used.

NOTE: To prevent any possibility of electrolytic action between brass or copper earth conductors and the rear panel of the relay, precautions should be taken to isolate them from one another. This could be achieved in a number of ways, including placing a nickel-plated or insulating washer between the conductor and the relay case, or using tinned ring terminals.

COMMISSIONING GUIDE

CONTENTS

FIGURES

1. INTRODUCTION

The MiCOM P921-P922-P923 protection relays are fully numerical in their design, implementing many protection and non-protection functions. The relays periodically conduct self-checking and, in the unlikely event of a failure, will trigger an alarm. As a result of this, the commissioning tests do not need to be as extensive as with non-numeric electronic or electro-mechanical relays.

To commission numeric relays, it is only necessary to verify that the hardware is functioning correctly and the application-specific software settings have been applied to the relay. It is considered unnecessary to test every function of the relay if the settings have been verified by one of the following methods:

- Extracting the settings applied to the MiCOM relay using appropriate setting software (Preferred method)
- Via the operator interface

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 relay.

Blank commissioning test and setting records are provided in chapter P92x/EN RS for completion as required.

The commissioning tests must always be performed in conformity with the rules and regulations of the country of use.

Before carrying out any work on the equipment the user should be familiar with the contents of the Safety Section/Safety Guide SFTY/4LM/D11 or later issue and the ratings on the equipment's rating label.

2. SETTING FAMILIARISATION

When commissioning a MiCOM P921, P922 or P923 relay for the first time, sufficient time should be allowed to become familiar with various menus containing the settings.

The "User Guide" section (Chapter P92x/EN FT) of this technical guide gives a detailed description of the menu structures for the MiCOM P921, P922 and P923 relays.

With the plastic front cover in place all keys except the ↵ key are accessible. All menu cells can be read. LEDs and alarms can be reset. However, no protection or configuration settings can be changed.

Removing the cover allows access to all keys so that settings can be changed. However, certain settings with protected access will require the appropriate password to be entered before changes can be made.

Alternatively, if a portable PC is available together with suitable setting software (such as MiCOM S1), the settings can be viewed a page at a time and printed. This software also allows settings to be entered more easily, saved to a file on disk for future reference or printed to produce a setting record.

3. EQUIPMENT REQUIRED FOR COMMISSIONING

3.1 Minimum equipment required

Voltmeter test set with chronometer (range: 0 to 240 VAC).

Supply voltage of 48-125 VDC or 220 VAC.

Multimeter with suitable AC current range, and AC/DC voltage ranges of 0 - 250V respectively.

Continuity tester (if not included in multimeter)

Phasemeter.

Indicates the order of succession of phases.

NOTE: Modern test equipment may contain many of the above features in one unit.

3.2 Optional equipment

Multi-finger test plug type MMLB01 (if test block type MMLG installed).

An electronic or brushless insulation tester with a dc output not exceeding 500V (for insulation resistance testing when required).

A portable PC, with appropriate software (this enables the rear communications port to be tested, if this is to be used, and will also save considerable time during commissioning).

KITZ K-Bus to RS232 protocol converter (if RS485 K-Bus port is being tested and one is not already installed).

RS485 to RS232 converter (if RS485 Modbus port is being tested). Part numbers RS-CONV1 or RS-CONV32 (please contact us for more information).

A printer (for printing a setting record from the portable PC).

4. PRODUCT CHECKS

These product checks cover all aspects of the relay which should be checked to ensure that it has not been physically damaged prior to commissioning, is functioning correctly and all input quantity measurements are within the stated tolerances.

If the application-specific settings have been downloaded to the relay prior to commissioning, it is advisable to make a copy of the settings so as to allow their restoration later. To do this use one of the methods described below:

- Obtain a setting file on a diskette from the customer (this requires a portable PC with appropriate setting software, e.g. MiCOM S1).
- Extract the settings from the relay itself (this again requires a portable PC with appropriate setting software).
- Manually create a setting record. This can be done using a copy of the setting record located in chapter P92x/EN RS to record the settings as the relay's menu is sequentially stepped through via the front panel user interface.

If password protection is enabled and the customer has changed the password to prevent changes to some of the settings, either the revised password should be provided, or the customer should restore the original password prior to commencement of testing.

NOTE: In the event that the password has been lost, a recovery password can be obtained from Schneider Electric by quoting the serial number of the relay.

4.1 With the relay de-energised

THE FOLLOWING GROUP OF TESTS SHOULD BE CARRIED OUT WITHOUT THE AUXILIARY SUPPLY CONNECTED TO THE RELAY AND WITH THE TRIP CIRCUIT ISOLATED.

The voltage transformer connections must be isolated from the relay for these checks. If an MMLG test block is provided, the required isolation can easily be achieved by inserting test plug type MMLB01 which effectively open-circuits all wiring routed through the test block.

Before inserting the test plug, reference should be made to the scheme (wiring) diagram to ensure that this will not potentially cause damage or a safety hazard.

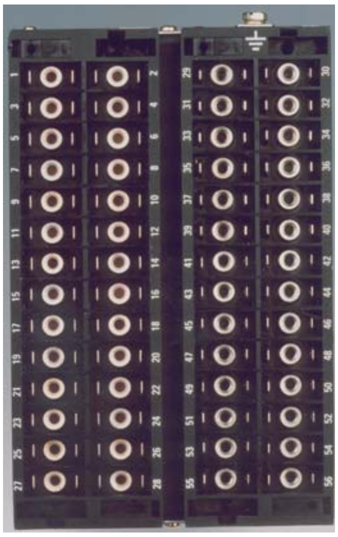
If a test block is not provided, the voltage transformer supply to the relay should be isolated by means of the panel links or connecting blocks. Where means of isolating the auxiliary supply and trip circuit (e.g. isolation links, fuses, MCB, etc.) are provided, these should be used. If this is not possible, the wiring to these circuits will have to be disconnected and the exposed ends suitably terminated to prevent them from being a safety hazard.

4.1.1 Visual inspection

Carefully examine the relay to see that no physical damage has occurred since installation.

The rating information given under the top cover on the front of the relay should be checked to ensure it is correct for the particular installation.

Ensure that the case protective conductor terminal upper right-hand corner at the rear of the relay case, is used to connect the relay to a local earth bar using an adequate conductor, minimum size 1.5mm^2.



P0386XXa

FIGURE 1: REAR TERMINAL BLOCKS ON SIZE 20TE CASE

4.1.2 Insulation

Insulation resistance tests are only necessary during commissioning if it is required for them to be done and they haven't been performed during installation.

Isolate all wiring from the earth and test the insulation with an electronic insulation tester at a DC voltage not exceeding 500V. Terminals of the same circuits should be temporarily connected together.

The main groups of relay terminals are:

a) Voltage transformer circuits.

b) Auxiliary voltage supply.

c) External voltage output and opto-isolated inputs.

d) Relay contacts.

e) RS485 communication port.

f) Case earth.

The insulation resistance should be greater than 100MΩ at 500V.

4.1.3 On completion of the insulation resistance tests, ensure all external wiring is correctly reconnected to the relay.

4.1.4 External wiring

Check that the external wiring is correct to the relevant connection diagram or scheme diagram.

If an MMLG test block is provided, the connections should be checked against the scheme (wiring) diagram. It is recommended that the supply connections are to the live side of the test block (coloured orange with the odd numbered terminals (1, 3, 5, 7 etc.)). The auxiliary supply is normally routed via terminals 13 (supply positive) and 15 (supply negative), with terminals 14 and 16 connected to the relay's positive and negative auxiliary supply terminals respectively. However, check the wiring against the schematic diagram for the installation to ensure compliance with the customer's normal practice.

4.1.5 Watchdog contacts

Using a continuity tester, check that the normally closed watchdog contacts are in the states given in Table 1 for a de-energised relay.

Terminals	Watchdog contacts	
	Relay de-energised	Relay energised
35-36	Closed	Open
36-37	Open	Closed

TABLE 1: WATCHDOG CONTACT STATUS

4.1.6 Auxiliary supply

The relay can be operated from either a DC only or an AC/DC auxiliary supply depending on the relay's nominal supply rating. The voltage must be within the operating range specified in Table 2.

Without energising the relay, measure the auxiliary supply to ensure it is within the operating range.

Nominal supply rating DC [AC RMS]		DC operating range	AC operating range
24-60 Vdc	[-]	19 to 72 V	-
48–250 Vdc / 100– 50 Vac	[100/250 V]	104 to 300 V	88 to 300 V

TABLE 2: OPERATIONAL RANGE OF AUXILIARY SUPPLY

It should be noted that the relay can withstand an AC ripple of up to 12 % of the upper rated voltage on the DC auxiliary supply.

DO NOT ENERGISE THE RELAY USING THE BATTERY CHARGER WITH THE BATTERY DISCONNECTED AS THIS CAN IRREPARABLY DAMAGE THE RELAY'S POWER SUPPLY CIRCUITRY

ENERGISE THE RELAY IF THE AUXILIARY SUPPLY IS WITHIN THE OPERATING RANGE. IF AN MMLG TEST BLOCK IS PROVIDED, IT MAY BE NECESSARY TO LINK ACROSS THE FRONT OF THE TEST PLUG TO CONNECT THE AUXILIARY SUPPLY TO THE RELAY.

4.2 With the relay energised

THE FOLLOWING GROUP OF TESTS VERIFY THAT THE RELAY HARDWARE AND SOFTWARE IS FUNCTIONING CORRECTLY AND SHOULD BE CARRIED OUT WITH THE AUXILIARY SUPPLY APPLIED TO THE RELAY.

THE VOLTAGE TRANSFORMER CONNECTIONS MUST REMAIN ISOLATED FROM THE RELAY FOR THESE CHECKS.

4.2.1 Watchdog contacts

Using a continuity tester, check the watchdog contacts are in the states given in Table 1 for an energised relay.

4.2.2 Date and time

Set the date and time to the correct values. Refer to Chapter P92x/EN FT of the Technical guide.

4.2.3 Light Emitting Diodes (LEDs)

On power up the green LED should have illuminated and stayed on indicating that the relay is healthy. The relay has non-volatile memory which remembers the state (on or off) of the alarm and trip LEDs when the relay was last energised from an auxiliary supply. Therefore these indicators may also illuminate when the auxiliary supply is applied.

If any of these LEDs are on then they should be reset before proceeding with further testing. If the LEDs successfully reset (the LED goes out), there is no testing required for that LED because it is known to be operational.

4.2.3.1 Testing the alarm LED

To do this, activate the "Undervoltage" function, 1^{st} stage.

If there is no voltage across the VT inputs, the "alarm" LED begins to flash and a message appears on the front panel.

4.2.3.2 Testing the trip LED

Repeat the previous test and allocate the time-delayed information (tV<) to the trip relay. Check that the trip LED has illuminated.

4.2.3.3 Testing the user-programmable LEDs

Repeat the previous test and allocate the instantaneous information (V<) to LED 5, then to LEDs 6, 7 and 8. Check that each LED has illuminated.

4.2.4 Opto-isolated inputs

This test checks that all the opto-isolated inputs on the relay are functioning correctly. (2 opto-isolated inputs for the P921 and 5 opto-isolated inputs for the P922 and P923).

The opto-isolated inputs should be energised one at a time. Ensuring correct polarity, connect the auxiliary voltage to the appropriate terminals for the input being tested. The opto-isolated input terminal allocations are given in Table 3.

The line "INPUTS" in the "OP. PARAMETERS" menu gives the state of each input, a '1' indicating an energised input and a '0' indicating a de-energised input. When each input is energised one of the digits on the bottom line of the display will change to the value shown in Table 3 to indicate the new state of the inputs.

	Inputs	Apply a continuous voltage across terminals		Inputs				
		negative	positive					
	Opto input 1	24	22	0	0	0	0	1
	Opto input 2	28	26	0	0	0	1	0
P922-P923	Opto input 3	19	17	0	0	1	0	0
	Opto input 4	23	21	0	1	0	0	0
	Opto input 5	27	25	1	0	0	0	0

TABLE 3: OPTO-ISOLATED INPUT TERMINALS

4.2.5 Output relays

This test checks that all the output relays are functioning correctly. (4 output relays for the P921 and 8 output relays for the P922-P923).

The output relays should be energised one at a time.

Connect a continuity tester across the terminals corresponding to output relay 1 given in Table 4.

To actuate each output relay, activate the "Undervoltage" function, 1st stage.

Allocate the instantaneous information (V<) to the relay to be tested; for example, enter the following settings in the "OUTPUTS" sub-menu of the "CONTROL SYSTEMS" menu:

V<	**8 7 6 5 4 3 2**
	0 0 0 0 0 0 1

to control relay no. 2.

Repeat the test for each relay, modifying the allocation of the instantaneous information (V<).

To validate relay RL1 (trip relay), allocate the time-delayed information (tV<) to the relay in the "CONF DEC" sub-menu of the "CONTROL SYSTEMS" menu.

Operation will be confirmed by the continuity tester operating for a normally open contact and ceasing to operate for a normally closed contact.

NOTE: It should be ensured that thermal ratings of anything connected to the output relays during the test procedure is not exceeded by the associated output relay being operated for too long. It is therefore advised that the time between application and removal of relay testing is kept to the minimum.

	Output relays	Monitor terminals		Output relays states							
		N/C	N/O	8	7	6	5	4	3	2	1
	Relay 1	2-4	2-6	0	0	0	0	0	0	0	1
	Relay 2	8-10	8-12	0	0	0	0	0	0	1	0
	Relay 3	-	14-16	0	0	0	0	0	1	0	0
	Relay 4	-	18-20	0	0	0	0	1	0	0	0
P922-P923	Relay 5	-	1-3	0	0	0	1	0	0	0	0
	Relay 6	-	5-7	0	0	1	0	0	0	0	0
	Relay 7	-	9-11	0	1	0	0	0	0	0	0
	Relay 8	-	13-15	1	0	0	0	0	0	0	0

TABLE 4: RELAY OUTPUT TERMINALS

4.2.6 Rear communications port

This test should only be performed where the relay is to be accessed from a remote location and will vary depending on the communications standard being adopted.

It is not the intention of the test to verify the operation of the complete system from the relay to the remote control centre, just the relay's rear communications port and any protocol converter necessary.

The protocol available for remote communication appears on the label on the relay front panel (under the top cover).

4.2.6.1 Courier communications

If a K-Bus to RS232 KITZ protocol converter is installed, connect a portable PC running the appropriate software to the incoming (remote from relay) side of the protocol converter.

If a KITZ protocol converter is not installed, it may not be possible to connect the PC to the type installed. In this case a KITZ protocol converter and portable PC running appropriate software should be temporarily connected to the relay's K-Bus port. The terminal numbers for the relay's K-Bus port are given in Table 5. However, as the installed protocol converter is not being used in the test, only the correct operation of the relay's K-Bus port will be confirmed.

Connection		Terminal
KBUS	Modbus or VDEW	
Screen	Screen	30
1	positive	31
2	negative	32

TABLE 5: RS485 TERMINALS

The relay's Courier address in the "COMMUNICATIONS" menu must be set to a value between 1 and 255.

Check that communications can be established with this relay using the portable PC.

4.2.6.2 Modbus communications

Connect a portable PC ("master station") running the appropriate Modbus Master Station software to the relay's RS485 port via a RS485 to RS232 interface converter. The terminal numbers for the relay's RS485 port are given in Table 5.

Ensure that the relay address, baud rate and parity settings in the Modbus software are set the same as on the MiCOM relay (see "COMMUNICATIONS" menu).

Check that communications with this relay can be established.

4.2.6.3 IEC60870-5-103 (VDEW) communications

IEC60870-5-103/VDEW communication systems are designed to have a local Master Station. This should be used to verify that the relay's fibre optic or RS485 port, as appropriate, is working.

Ensure that the relay address, baud rate and parity settings in the Master Station software are set the same as on the MiCOM relay (see "COMMUNICATIONS" menu).

Check that, using the Master Station, communications with the relay can be established.

4.2.7 Voltage inputs

This test verifies the accuracy of voltage measurement is within the acceptable tolerances.

4 types of connection are possible for the MiCOM P921, P922 and P923 relays: 3VT (phase-neutral), 3VT (phase-phase) + residual VT, 3VT (phase-neutral) + residual VT, 2VT (phase-phase) + residual VT.

⚠ **THE FOLLOWING TESTS ARE PERFORMED WITH A 3VT CONNECTION (PHASE-PHASE) CORRESPONDING TO THE MOST FREQUENT CONFIGURATION.**

Apply the rated voltage to each voltage input. Check its magnitude using a multimeter. Refer to Table 6 for the corresponding reading in the relay's "MEASUREMENTS" menu and record the value displayed.

MEASUREMENTS menu	Voltage applied to
VA (RMS value)	41-42
VB (RMS value)	43-44
VC (RMS value)	45-46

TABLE 6: VOLTAGE INPUT TERMINALS

The measured voltage values on the relay will be in primary volts.

The measurement accuracy of the relay is ±1%. Nevertheless, additional allowance must be made for the accuracy of the test equipment being used.

5. SETTING CHECKS

The setting checks ensure that all of the relay settings (i.e. the relay's protection and control settings and programmable logic equations) for the particular installation have been correctly applied to the relay.

5.1 Applying the settings to the relay

There are two methods of applying the settings:

- Transfer them from a pre-prepared setting file to the relay using a portable PC running the appropriate software via the relay's front RS232 port, located under the bottom cover, or via the rear communications port.
  This method is preferred for transferring function settings as it is much faster and there is less margin for error.

  NOTE: If a setting file has been created for the particular application and provided on a diskette, this will further reduce the commissioning time.

- Enter them manually via the relay's operator interface.

5.2 Checking the relay settings

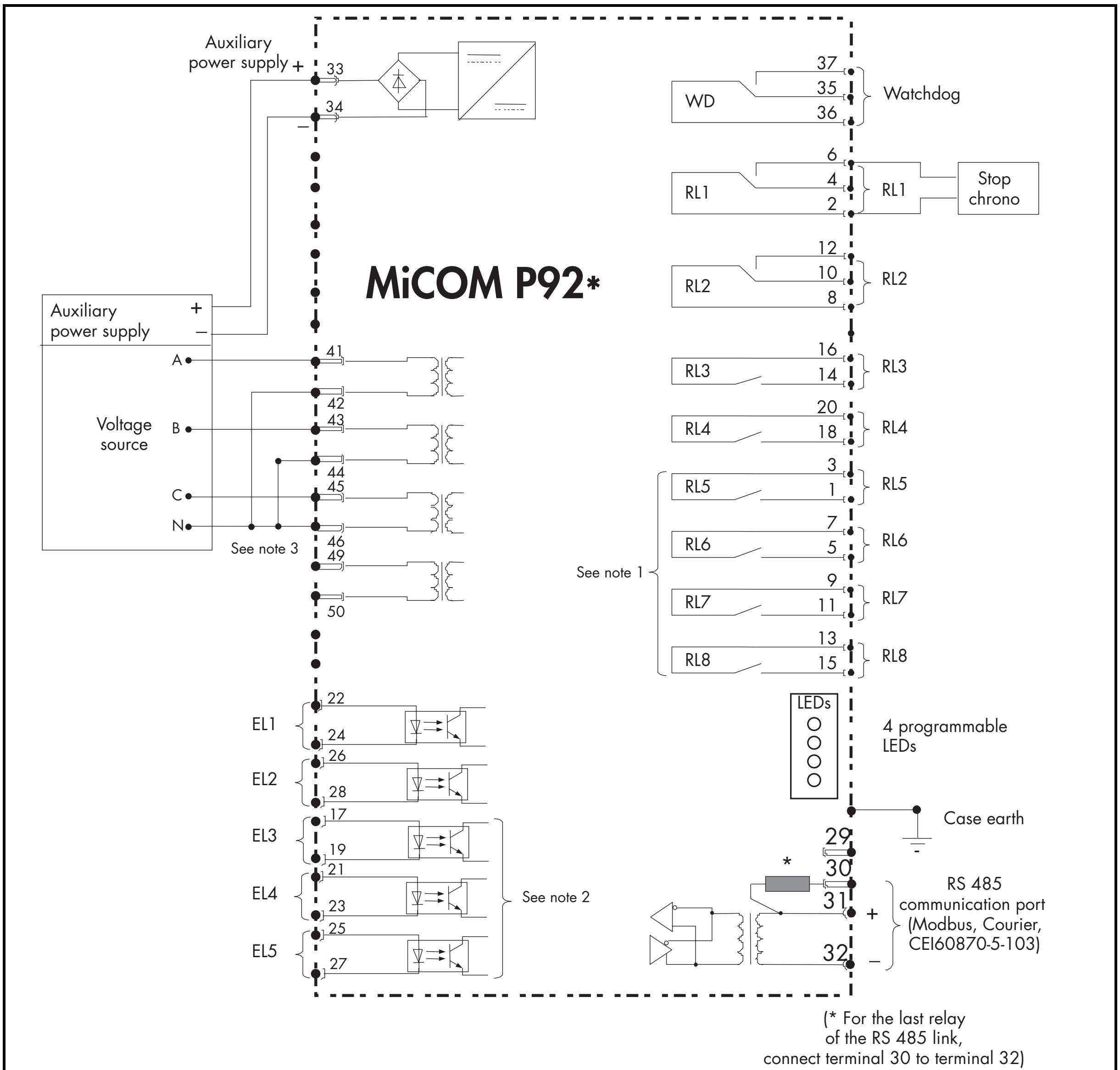
The settings applied to the relay should be carefully checked to ensure they have been entered correctly.

There are two methods of checking the settings:

- Extract the settings from the relay using a portable PC running the appropriate software via the front RS232 port, located under the bottom cover, or via the rear communications port:
  - with a KITZ protocol converter connected if the rear protocol is Kbus,
  - with a standard RS232/RS485 converter if the rear protocol is Modbus.
- Compare the settings taken from the relay with the original application-specific settings (for cases where the customer has only provided a printed copy of the required settings but a portable PC is available).
- Step through the settings using the relay's operator interface and compare them with the original settings.

5.3 Testing the "Phase overvoltage protection" and "Phase undervoltage protection" functions

5.3.1 Wiring diagram



Notes :

(1) Supplementary hardware for MiCOM P922-P923 relay
(2) Supplementary hardware for MiCOM P922-P923 relay
(3) 3VT assembly, Phase-Neutral

FIGURE 2: (V>) AND (V>>) STAGE TEST

5.3.2 MiCOM P921-P922-P923 relay parameters

Note the settings of the MiCOM P921-P922-P923 relays in the tables below.

[59] OVERVOLTAGE	*Default values*	*Settings*	
		Group 1	*Group 2 (P922-P923)*
1st stage activated	No	No / AND / OR *	No / AND / OR *
1st overvoltage stage	130.0V if H1** 480.0V if H2	V	V
Time delay type	DMT	DMT/IDMT *	DMT/IDMT *
TMS	1.0		
tRESET V>	0.01s	Secs	Secs
tV>=	0.04s	Secs	Secs
2nd stage activated	No	No / AND / OR *	No / AND / OR *
2nd overvoltage stage	130.0V if H1** 480.0V if H2	V	V
tV>>=	0.01s	Secs	Secs
3rd stage activated	No	No / AND / OR *	No / AND / OR *
3rd overvoltage stage	130.0V if H1** 480.0V if H2	V	V
tV>>>=	0.01s	Secs	Secs
Hysteresis	0.98		

[27] UNDERVOLTAGE	*Default values*	*Settings*	
		Group 1	*Group 2 (P922-P923)*
1st stage activated	No	No / AND / OR *	No / AND / OR *
1st undervoltage stage	5.00V if H1** 20.0V if H2	V	V
Time delay type	DMT	DMT/IDMT *	DMT/IDMT *
TMS	1.0		
tRESET V<	0.01s	Secs	Secs
tV<=	0.04s	Secs	Secs
2nd stage activated	No	No / AND / OR *	No / AND / OR *
2nd undervoltage stage	5.00V if H1** 20.0V if H2	V	V
tV<<=	0.01s	Secs	Secs
3rd stage activated	No	No / AND / OR *	No / AND / OR *
3rd undervoltage stage	5.00V if H1** 20.0V if H2	V	V
tV<<<=	0.01s	Secs	Secs
Hysteresis	1.02		

* Delete as appropriate
** H1 = 57-130V voltage range H1 = 220-480V voltage range

5.3.3 Configuration with 3 single voltages ("3Vpn") and "AND" detection logic

Do not exceed a maximum voltage of 2xVn in the following tests.

In view of the detection logic ("AND"), the voltages must be injected into the 3 phase inputs to cause tripping to occur.

5.3.3.1 Stages (V>) or (V<) with definite time delay

Values to be measured:

1. stage (V>) or (V<)
2. time delay (tV>) or (tV<)

Stage (V>) check:

1. If time delay (tV>) is short, gradually inject the voltage into the 3 phases up to the stage value: tripping should occur for a voltage equal to the stage (V>) to within ±2%
2. If time delay (tV>) is long, inject a voltage equal to 0.98x(V>) into the 3 phases and check that tripping does not occur. Then inject 1.2x(V>) and check that tripping occurs.
3. Gradually reduce the voltage on one of the phases and measure the value of the drop-off stage (V>): the function must reset for a voltage less than or equal to the programmed hysteresis.

Stage (V<) check:

1. If time delay (tV<) is short, gradually reduce the voltage on the 3 phases from the rated voltage to the stage value: tripping should occur for a voltage equal to the stage (V<) to within ±2%
2. If time delay (tV<) is long, inject a voltage equal to 1.02x(V<) into the 3 phases and check that tripping does not occur. Then inject 0.8x(V<) and check that tripping occurs.
3. Gradually increase the voltage on one of the phases and measure the value of the drop-off stage (V<): the function must reset for a voltage greater than or equal to 1.02x(V<).

Action check:

1. appearance of an alarm message on the display
2. flashing of the "Alarm" LED
3. illumination of the "Trip" LED if tripping is programmed
4. illumination of the LEDs associated with instantaneous information (V>) and (V<) and time-delayed information (tV>) and (tV<) if programmed
5. trip relay operation (RL1) if programmed
6. operation of output relay associated with stages (V>) and (V<) if programmed

Time delay (tV>) check:

1. Preset the injection voltage to a value equal to 2x(V>).
2. Inject the voltage into the 3 phases simultaneously.
3. Measure the time delay (tV>): it must be equal to the parametered value ±2% (or a minimum of ±20ms).

Time delay (tV<) check:

1. Disconnect the previously injected voltage.
2. Measure the time delay (tV<): it must be equal to the parametered value ±2% (or a minimum of ±20ms).

5.3.3.2 Stages (V>) or (V<) with inverse time delay

Values to be measured: time delays (tV>) and (tV<)

Action check: see above.

Time delays (tV>) and (tV<) check:

The time delay is measured for two injected voltages, for example at 1.1x(V>) and 1.4x(V>).

Injected voltage	Rated trip time for TMS=1 (in seconds)
1.2x(U>)	5
1.4x(U>)	2.5

The time delay measured must be equal to the parametered value ±5% (or a minimum of ±40ms).

The time delay is measured for two injected voltages, for example at 0.9x(V<) and 0.6x(V<).

Injected voltage	Rated trip time for TMS=1 (in seconds)
0.9x(V<)	10
0.6x(U<)	2.5

The time delay measured must be equal to the parametered value ±5% (or a minimum of ±40ms).

5.3.4 Configuration with 3 single voltages (“3Vpn”) and “OR” detection logic

Repeat the tests described in paragraph 5.3.3, injecting the voltage into one phase only. In view of the detection logic (“OR”), tripping should occur in these conditions.

5.4 "Under/overfrequency" function tests

5.4.1 Wiring diagram

Refer to the diagram used for the "Phase over/undervoltage protection" function tests.

5.4.2 MiCOM P922-P923 relay parameters

Only configure the frequency for one of the six stages available.

[81] FREQUENCY	*Default values*	*Settings*	
		Group 1	*Group 2*
1st stage activated	No	No / 81< / 81> *	No / 81< / 81> *
1st frequency stage	50 Hz	Hz	Hz
1st stage time delay	0.04s	Secs	Secs
2nd stage activated	No	No / 81< / 81> *	No / 81< / 81> *
2nd frequency stage	50 Hz	Hz	Hz
2nd stage time delay	0.04s	Secs	Secs
3rd stage activated	No	No / 81< / 81> *	No / 81< / 81> *
3rd frequency stage	50 Hz	Hz	Hz
3rd stage time delay	0.04s	Secs	Secs
4th stage activated	No	No / 81< / 81> *	No / 81< / 81> *
4th frequency stage	50 Hz	Hz	Hz
4th stage time delay	0.04s	Secs	Secs
5th stage activated	No	No / 81< / 81> *	No / 81< / 81> *
5th frequency stage	50 Hz	Hz	Hz
5th stage time delay	0.04s	Secs	Secs
6th stage activated	No	No / 81< / 81> *	No / 81< / 81> *
6th frequency stage	50 Hz	Hz	Hz
6th stage time delay	0.04s	Secs	Secs

5.4.3 Test example: stage (f1>) or (f1<)

First program the 1st frequency stage at (81>) (overfrequency), then configure it at (81<) (underfrequency). Then measure the values given below.

<u>Values to be measured:</u>

1. stage (f1>) or (f1<)
2. time delay (tf1>) or (tf1<)

* Delete as appropriate

Stage (f1>) check:

1. If time delay (tf1>) is short, gradually increase the frequency from the nominal frequency fn to the value of the stage (f1>): tripping should occur for a frequency in the range [(f1>) – 10mHz, (f1>) + 10mHz].

2. If time delay (tf1>) is long, adjust the frequency to [(f1>) – 50mHz] and check that tripping does not occur. Increase the frequency to 1.2x(f1>) and check that tripping occurs.

3. Gradually reduce the frequency and measure the value of the drop-off stage (f1>): the function must reset for a frequency less than or equal to [(f1>) – 50mHz].

Stage (f1<) check:

1. If time delay (tf1<) is short, gradually reduce the frequency from the nominal frequency fn to the value of the stage (f1<): tripping should occur for a frequency in the range [(f1<) – 10mHz, (f1<) + 10mHz].

2. If time delay (tf1<) is long, adjust the frequency to [(f1<) + 50mHz] and check that tripping does not occur. Reduce the frequency to 0.8x(f1<) and check that tripping occurs.

3. Gradually increase the frequency and measure the value of the drop-off stage (f1<): the function must reset for a frequency greater than or equal to [(f1<) +50mHz].

Action check:

1. appearance of an alarm message on the display

2. flashing of the “Alarm” LED

3. illumination of the “Trip” LED if tripping is programmed

4. illumination of the LEDs associated with instantaneous information (f1>) and (f1<) and time-delayed information (tf1>) and (tf1<) if programmed

5. trip relay operation (RL1) if programmed

6. operation of output relay associated with stages (f1>) and (f1<) if programmed

5.5 "Rate of change of frequency" function tests

5.5.1 Wiring diagram

Refer to the diagram used for "Phase over/under voltage protection" functions tests.

5.5.2 MiCOM P923 relay parameters

Only configure the rate of change of frequency for 2 of the 6 stages available (one with positive sign and the other with negative sign).

[81R] Rate of change of frequency	*Default values*	*Settings*
		Group 1/2
1st stage activated	No	No/Yes
1st stage	1.0 Hz/s	Hz/s
2nd stage activated	No	No/Yes
2nd stage	1.0 Hz/s	Hz/s
3rd stage activated	No	No/Yes
3rd stage	1.0 Hz/s	Hz/s
4th stage activated	No	No/Yes
4th stage	1.0 Hz/s	Hz/s
5th stage activated	No	No/Yes
5th stage	1.0 Hz/s	Hz/s
6th stage activated	No	No/Yes
6th stage	1.0 Hz/s	Hz/s

5.5.3 Test example: stage df/dt1 & df/dt2

First program the first stage of df/dt at +0.5 Hz/s and the second stage at –0.5 Hz/s.

NOTE: the setting of the Δt should be low as mush as it is possible than the period in order to detect the small variation within the time.

Select for example a range of frequency from 50 Hz to 51 Hz with a variation of 1 mHz every 1 ms. The result is shown in the table (1st line). If you assign the 1st threshold to the tripping relay (RL1), so tripping will occur.

Repeat the test with a range of (50 – 49 Hz), now the 2nd threshold will operate.

Also you can assign these threshold to output relays and LEDs and verify the functioning of these elements.

Nominal frequency selected	Frequency	df	dt	df/dt
50	51 Hz	1 mHz	1 ms	1 Hz/s
50	49 Hz	–1 mHz	1 ms	–1 Hz/s

Action check: (if output relays and LEDs are associated)

1. Appearance of an Alarm message on the display
2. Flashing of the "Alarm" LED
3. Illumination of the "TRIP" LED if tripping is programmed
4. Illumination of the LEDs associated with the stages df/dt1 & df/dt2
5. Trip relay operation RL1 if programmed
6. Operation of output relay associated with the stages df/dt1 & df/dt2

6. ON-LOAD CHECKS - VOLTAGE INPUT CONNECTIONS

The following on-load measuring checks ensure the external wiring to the voltage inputs is correct but can only be carried out if there are no restrictions preventing the energisation of the plant being protected.

REMOVE ALL TEST LEADS, TEMPORARY SHORTING LEADS, ETC. AND REPLACE ANY EXTERNAL WIRING THAT HAS BEEN REMOVED TO ALLOW TESTING.

IF IT HAS BEEN NECESSARY TO DISCONNECT ANY OF THE EXTERNAL WIRING FROM THE RELAY IN ORDER TO PERFORM ANY OF THE FOREGOING TESTS, IT SHOULD BE ENSURED THAT ALL CONNECTIONS ARE REPLACED IN ACCORDANCE WITH THE RELEVANT EXTERNAL CONNECTION OR SCHEME DIAGRAM.

USING A MULTIMETER, MEASURE THE VOLTAGE TRANSFORMER SECONDARY VOLTAGES TO ENSURE THEY ARE CORRECTLY RATED. CHECK THAT THE SYSTEM PHASE ORDER IS CORRECT USING A PHASE METER.

COMPARE THE VALUES OF THE SECONDARY PHASE VOLTAGES WITH THE RELAY'S MEASURED VALUES, WHICH CAN BE FOUND IN THE MEASUREMENTS MENU.

The values measured by the MiCOM relay should be within 1% of the applied primary voltages. However, an additional allowance must be made for the accuracy of the test equipment being used.

7. FINAL CHECKS

The tests are now complete.

REMOVE ALL TEST OR TEMPORARY SHORTING LEADS, ETC. IF IT HAS BEEN 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 REPLACED IN ACCORDANCE WITH THE RELEVANT EXTERNAL CONNECTION OR SCHEME DIAGRAM.

If the relay is in a new installation or the circuit breaker has just been maintained, the circuit breaker maintenance counters should be reset to zero. To do this, go to the "CB DATA" menu (P922-P923).

If an MMLG test block is installed, remove the MMLB01 test plug and replace the MMLG cover so that the protection is put into service.

Ensure that all event records (P922-P923), fault records (P922-P923), disturbance records (P922-P923), alarms and LEDs have been reset before leaving the relay.

If applicable, replace the secondary front cover on the relay.

8. PREVENTATIVE MAINTENANCE

8.1 Maintenance period

It is recommended that products supplied by Schneider Electric receive periodic monitoring after installation. As with all products some deterioration with time is inevitable. In view of the critical nature of protective relays and their infrequent operation, it is desirable to confirm that they are operating correctly at regular intervals.

Schneider Electric protective relays are designed for a life in excess of 20 years.

The MiCOM P921-P922-P923 protection relays are self-checking. They thus require less maintenance than models using earlier technologies. Most problems will result in an alarm so that remedial action can be taken. However, some periodic tests should be done to ensure that the relay is functioning correctly and the external wiring is intact.

If a preventative maintenance policy exists within the customer's organisation then the recommended product checks should be included in the regular programme. Maintenance periods will depend on many factors, such as:

- the operating environment
- accessibility of the site
- amount of available manpower
- importance of the installation in the power system
- consequences of failure

8.2 Maintenance checks

Although some functionality checks can be performed from a remote location by utilising the communications ability of the relays, these are predominantly restricted to checking that the relay is measuring the applied voltages accurately, and checking the circuit breaker maintenance counters. Therefore it is recommended that maintenance checks are performed locally (i.e. at the substation itself).

Before carrying out any work on the equipment the user should be familiar with the contents of the Safety Section/Safety Guide SFTY/4LM/D11 or later issue and the ratings on the equipment's rating label.

8.2.1 Alarms

The alarm status LED should first be checked to identify if any alarm conditions exist. If so, press the read key repeatedly to display the alarms individually. Clear the alarms (key ⓒ) to extinguish the LED.

8.2.2 Opto-isolated inputs

The opto-isolated inputs can be checked to ensure that the relay responds to their energisation by repeating the commissioning test detailed in Section 4.2.4 of this chapter.

8.2.3 Output relays

The output relays can be checked to ensure that they operate by repeating the commissioning test detailed in Section 4.2.5 of this chapter.

8.2.4 Measurement accuracy

If the power system is energised, the values measured by the relay can be compared with known system values to check that they are in the approximate range expected. If they are then the analogue/digital conversion and calculations are being performed correctly by the relay. Suitable test methods can be found in Section 6 of this chapter.

Alternatively, the values measured by the relay can be checked against known values injected into the relay via the test block, if fitted, or injected directly into the relay terminals. Suitable test methods can be found in Section 7 of this chapter. These tests will prove the calibration accuracy is being maintained.

8.3 Method of repair

If the relay should develop a fault while energised, depending on the nature of the fault, the watchdog contacts will change state and an alarm will be generated. Due to the use of surface-mount components, faulty PCBs should be replaced as it is not possible to perform repairs on damaged circuits. Thus either the complete relay or just the faulty PCB, identified by the relay's diagnostic software, can be replaced. Refer to Chapter P92x/EN FT of this Technical Guide for more information on alarms.

The preferred method is to replace the complete relay as it ensures that the internal circuitry is protected against electrostatic discharge and physical damage at all times and overcomes the possibility of incompatibility between replacement PCBs. However, it may be difficult to remove an installed relay due to limited access in the back of the cubicle and rigidity of the scheme wiring: to avoid such difficulties, the MiCOM P921-P922-P923 relays are designed to be removed while energised for fast replacement of the live part of the relay, thus minimising the absence of protection.

BEFORE CARRYING OUT ANY WORK ON THE EQUIPMENT THE USER SHOULD BE FAMILIAR WITH THE CONTENTS OF THE SAFETY SECTION/SAFETY GUIDE SFTY/4LM/D11 OR LATER ISSUE AND THE RATINGS ON THE EQUIPMENT'S RATING LABEL. THIS SHOULD ENSURE THAT NO DAMAGE IS CAUSED BY INCORRECT HANDLING OF THE ELECTRONIC COMPONENTS.

8.3.1 Replacing the complete relay

The MiCOM P921-P922-P923 relays can be removed and replaced if necessary without having to disconnect the rear terminals.

This is possible while the relay is energised. It is however recommended that all auxiliary supplies are isolated before working on the relay.

8.4 Changing the battery (for Phase 1 only)

Each relay Phase 1 has a battery to maintain records (P922-P923) and the correct time in case the auxiliary supply fails. The data maintained in a P922-P923 relay thus includes event, fault and disturbance records at the time of failure.

This battery will periodically need changing, although an alarm will be given as part of the relay's periodic self-monitoring in the event of a low battery condition.

8.4.1 Instructions for replacing the battery

Open the bottom cover on the front of the relay.

Gently extract the battery from its socket. If necessary, use a small screwdriver to prize the battery free.

Ensure that the 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, taking care to ensure that the polarity markings on the battery agree with those adjacent to the socket.

NOTE: Only use a type ½AA lithium battery with a nominal voltage of 3.7V.

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 bottom cover on the front of the relay.

8.4.2 Post modification tests

To ensure that the replacement battery will maintain the date and time if the auxiliary supply fails, change the date and time on the relay, then disconnect and reconnect the auxiliary supply. The date and time should be maintained.

8.4.3 Battery disposal

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.

8.5 Cleaning

Before cleaning the equipment ensure that all inputs (auxiliary supply, current, voltage) are isolated to prevent any risk of electric shock.

The equipment may be cleaned using a clean, damp cloth. Do not use detergents, solvents or abrasive cleaners as they may damage the relay's surface and leave a conductive residue.

TEST REPORT

CONTENTS

1. COMMISSIONING TEST RECORD

Date ____________ Operator name ____________

Substation name ____________ Circuit ____________

Nominal network frequency ____________

Front plate information

Protection relay	**P92**
Model number	
Serial number	
Nominal voltage Vn	
Auxiliary supply Vaux	
Communication protocol	

*Delete as appropriate

Have you followed all of the safety instructions?	Yes/No*

* Delete or complete as appropriate

2. PRODUCT CHECKS

2.1 Relay de-energised

2.1.1 Visual inspection

Relay damaged?	Yes/No*
Rating information in conformity with installation?	Yes/No*
Earth terminals on case connected?	Yes/No*

2.1.2 External wiring

Wiring checked against diagram?	Yes/No*
Test unit connections checked?	Yes/No/Not used*

2.1.3 Insulation resistance >100MΩ at 500V DC	Yes/No/Not tested*

2.1.4 Watchdog contacts (auxiliary supply disconnected)

Terminals 35 and 36	Contact closed?	Yes/No*
	Contact resistance	____Ω/Not measured*
Terminals 36 and 37	Contact open?	Yes/No*

2.1.6 Auxiliary supply measured	______V AC/DC*

* Delete or completeas appropriate

2.2 Relay energised

2.2.1 Watchdog contacts (auxiliary supply connected)

Terminals 35 and 36	Contact open?	Yes/No*
Terminals 36 and 37	Contact closed?	Yes/No*
	Contact resistance	____Ω/Not measured*

2.2.2 Date and Time

Clock set to local time?	Yes/No*
Information stored with auxiliary supply cut off?	Yes/No*

2.2.3 Indicator LEDs

Relay operation OK indicator LED (green) on?	Yes/No*
Alarm indicator LED (yellow) on?	Yes/No*
Relay hardware fault indicator LED (yellow) on?	Yes/No*
Trip indicator LED (red) on?	Yes/No*
Operation of the 4 programmable LEDs OK?	Yes/No*

2.2.4 Opto-isolated inputs

Operation of opto-isolated input 1 OK?	Yes/No*
Operation of opto-isolated input 2 OK?	Yes/No*
Operation of opto-isolated input 3 **(P922-P923)** OK?	Yes/No*
Operation of opto-isolated input 4 **(P922-P923)** OK?	Yes/No*
Operation of opto-isolated input 5 **(P922-P923)** OK?	Yes/No*

2.2.5 Output relays

Relay 1	Operation OK?		Yes/No*
	Contact resistance	(N/C)	____Ω/Not measured*
		(N/O)	____Ω/Not measured*
Relay 2	Operation OK?		Yes/No*
	Contact resistance	(N/C)	____Ω/Not measured*
		(N/O)	____Ω/Not measured*
Relay 3	Operation OK?		Yes/No*
	Contact resistance		____Ω/Not measured*
Relay 4	Operation OK?		Yes/No*
	Contact resistance		____Ω/Not measured*
Relay 5 **(P922-P923)**	Operation OK?		Yes/No*
	Contact resistance		____Ω/Not measured*

* Delete or complete as appropriate

Relay 6 **(P922-P923)**	Operation OK?	Yes/No*
	Contact resistance	____Ω/Not measured*
Relay 7 **(P922-P923)**	Operation OK?	Yes/No*
	Contact resistance	____Ω/Not measured*
Relay 8 **(P922-P923)**	Operation OK?	Yes/No*
	Contact resistance	____Ω/Not measured*

2.2.6 Rear communications port

Communication standard	K-Bus/Modbus/ IEC60870-5-103*
Communication established?	Yes/No*
Protocol converter tested?	Yes/No/Not used*

2.2.7 Phase voltage inputs

Type of wiring parametered in the relay	3Vpn 3Vpn+Vr 3Vpp+Vr 2Vpp+Vr *
Main VT ratio $\left(\frac{[\text{Primaire TP principal}]}{[\text{ Sec. TP principal}]}\right)$	_______V/Not used*

Input voltage	Measured value	Displayed value
Va	_______V	_______V
Vb	_______V	_______V
Vc	_______V	_______V

2.2.8 Residual input voltage

Residual VT ratio $\boxed{\left(\frac{[\text{Primaire TP résiduel}]}{[\text{ Sec. TP résiduel}]}\right)}$	_______V/Not used*

Input voltage	Measured value	Displayed value
Vr	_______V	_______V

* Delete or completeas appropriate

3. SETTING CHECKS

3.1	**Application-specific settings?**	Yes/No*
	Programmable **application-specific** logic equations?	Yes/No/Not used*
	If settings made using a portable PC, which software (and version) was used?	____________________
	Programmable application-specific logic equations validated?	Yes/No/Not used*

3.2	**Application-specific settings verified?**	Yes/No/Not used*

3.3	**Protection function time delay test?**	Yes/No*
	Overvoltage protection type	
	Applied voltage	______V/Not applicable*
	Expected operating time	_________s*
	Measured operating time	_________s*

* Delete or complete as appropriate

4. ON-LOAD CHECKS

4.1 Test cables disconnected?

Test cables disconnected?	Yes/No/Not used*
Wiring modified by client re-checked?	Yes/No/Not used*
On-load tests performed?	Yes/No*

4.2 "Voltage" input wiring checked?

"Voltage" input wiring checked?	Yes/No/Not used*
Type of wiring parametered in the relay?	3Vpn 3Vpn+Vr 3Vpp+Vr 2Vpp+Vr *
Phase order OK?	Yes/No*
Voltage display values	Primary/Secondary*
Main VT ratio $\left(\frac{\text{[Primaire TP principal]}}{\text{[Sec. TP principal]}}\right)$	_______V/Not used*

Voltages:	Measured value	Displayed value
Va	_______V	_______V*
Vb	_______V	_______V*
Vc	_______V	_______V*

Residual VT ratio $\left(\frac{\text{[Primaire TP résiduel]}}{\text{[Sec. TP résiduel]}}\right)$	_______V/Not used*

Voltage:	Measured value	Displayed value
Vr	_______V	_______V*

* Delete or completeas appropriate

5. RELAY SETTINGS INFORMATION

OPERATION	*Default values*	*Settings*
Password	AAAA	________
Model	MiCOM P92-	________
Part number		________
Frequency	50 Hz	50 Hz/60 Hz*

DATE AND TIME (P922-P923)	*Default values*	*Settings*
Date	01 Jan 1994	____________________
Time	00 :00 :00	____________________

* Delete or complete as appropriate

6. CONFIGURATION

CONFIGURATION	*Default values*	*Settings*
GENERAL		
Connection	3Vpn	3Vpn 3Vpn+Vr 3Vpp+Vr 2Vpp+Vr *
Protection	PROT P-P	PROT P-P PROT P-N*
Default display	RMS VA	V_A, V_B, V_C V_o V_{ab}, V_{bc}, V_{ca} V_1 (P922-P923) V_2 (P922-P923) Frequency* (P922-P923)

CONFIGURATION	*Default values*	*Settings*
VT RATIO		
Main VTprimary =	20.00 kV	
Main VT Sec'y =	100 V	
E/Gnd VT Primary =	20.00 kV	
E/Gnd VT Sec'y=	100 V	

* Delete or completeas appropriate

6.1 LED

Function	P921	P922	P923	LED x
a		•	•	❑
b			•	☑
	• =applicable to the P92x relay.			❑ = No ☑ = Yes

Complete the following ❑.

Function	P921	P922	P923	LED 5	LED 6	LED 7	LED 8
V<	•	•	•	❑	❑	❑	❑
tV<	•	•	•	❑	❑	❑	❑
V<<	•	•	•	❑	❑	❑	❑
tV<<	•	•	•	❑	❑	❑	❑
V<<<	•	•	•	❑	❑	❑	❑
tV<<<	•	•	•	❑	❑	❑	❑
V>	•	•	•	❑	❑	❑	❑
tV>	•	•	•	❑	❑	❑	❑
V>>	•	•	•	❑	❑	❑	❑
tV>>	•	•	•	❑	❑	❑	❑
V>>>	•	•	•	❑	❑	❑	❑
tV>>>	•	•	•	❑	❑	❑	❑
V0>	•	•	•	❑	❑	❑	❑
tV0>	•	•	•	❑	❑	❑	❑
V0>>	•	•	•	❑	❑	❑	❑
tV0>>	•	•	•	❑	❑	❑	❑
V0>>>	•	•	•	❑	❑	❑	❑
tV0>>>	•	•	•	❑	❑	❑	❑
V0d>		•	•	❑	❑	❑	❑
tV0d>		•	•	❑	❑	❑	❑
V0d>>		•	•	❑	❑	❑	❑
tV0d>>		•	•	❑	❑	❑	❑
V2>		•	•	❑	❑	❑	❑
tV2>		•	•	❑	❑	❑	❑
V2>>		•	•	❑	❑	❑	❑
tV2>>		•	•	❑	❑	❑	❑
V1<		•	•	❑	❑	❑	❑

* Delete or complete as appropriate

Function	P921	P922	P923	LED 5	LED 6	LED 7	LED 8
tV1<		•	•	❑	❑	❑	❑
V1<<		•	•	❑	❑	❑	❑
tV1<<		•	•	❑	❑	❑	❑
F1		•	•	❑	❑	❑	❑
tF1		•	•	❑	❑	❑	❑
F2		•	•	❑	❑	❑	❑
tF2		•	•	❑	❑	❑	❑
F3		•	•	❑	❑	❑	❑
tF3		•	•	❑	❑	❑	❑
F4		•	•	❑	❑	❑	❑
tF4		•	•	❑	❑	❑	❑
F5		•	•	❑	❑	❑	❑
tF5		•	•	❑	❑	❑	❑
F6		•	•	❑	❑	❑	❑
tF6		•	•	❑	❑	❑	❑
df/dt1			•	❑	❑	❑	❑
df/dt2			•	❑	❑	❑	❑
df/dt3			•	❑	❑	❑	❑
df/dt4			•	❑	❑	❑	❑
df/dt5			•	❑	❑	❑	❑
df/dt6			•	❑	❑	❑	❑
F1+df/dt1			•	❑	❑	❑	❑
F2+df/dt2			•	❑	❑	❑	❑
F3+df/dt3			•	❑	❑	❑	❑
F4+df/dt4			•	❑	❑	❑	❑
F5+df/dt5			•	❑	❑	❑	❑
F6+df/dt6			•	❑	❑	❑	❑
F OUT OF R		•	•	❑	❑	❑	❑
tAux1	•	•	•	❑	❑	❑	❑
tAux2	•	•	•	❑	❑	❑	❑
tAux3		•	•	❑	❑	❑	❑
tAux4		•	•	❑	❑	❑	❑
tAux5		•	•	❑	❑	❑	❑
Equation A	•	•	•	❑	❑	❑	❑

* Delete or completeas appropriate

Function	P921	P922	P923	LED 5	LED 6	LED 7	LED 8
Equation B	•	•	•	❑	❑	❑	❑
Equation C	•	•	•	❑	❑	❑	❑
Equation D	•	•	•	❑	❑	❑	❑
Equation E	•	•	•	❑	❑	❑	❑
Equation F	•	•	•	❑	❑	❑	❑
Equation G	•	•	•	❑	❑	❑	❑
Equation H	•	•	•	❑	❑	❑	❑
Input 1	•	•	•	❑	❑	❑	❑
Input 2	•	•	•	❑	❑	❑	❑
Input 3			•	❑	❑	❑	❑
Input 4			•	❑	❑	❑	❑
Input 5			•	❑	❑	❑	❑
DU / DT 1			•	❑	❑	❑	❑
DU / DT 2			•	❑	❑	❑	❑
DU / DT 3			•	❑	❑	❑	❑
DU / DT 4			•	❑	❑	❑	❑
tVTS		•	•	❑	❑	❑	❑
K1=			•	❑	❑	❑	❑
K2=			•	❑	❑	❑	❑
K3=			•	❑	❑	❑	❑
KPOLY=			•	❑	❑	❑	❑

6.2 Group Select

CONFIGURATION	*Default values*	*Settings*
GROUP SELECT (P922 & P923 only)		
Change group input	Edge	Edge/Level*
Setting group	1	1/2*

* Delete or complete as appropriate

6.3 FREQ

CONFIGURATION	*Default values*	*Settings*
FREQ.		
F : VALIDAT. NB = (P923)	1	_______ (1 to 12)*
df/dt : CYCLE NB (P923)	1	_______ (1 to 200)*
df/dt : Validat. NB (P923)	4	_______ (2 to 12)*
PROTECTION BLOCK (P923)	5 if H1 20 if H2	(5-130) _______ (20-480)*
Inh. Block df/dt >20Hz (P922, P923)		Yes/No*
DU/DT Validation (P923)	2	_______

6.4 Alarms

Inst. Self Reset	❑ YES	❑ NO
Reset Led on fault	❑ YES	❑ NO

Inhibited alarms	**P921**	**P922**	**P923**
	YES	**YES**	**YES**
Alarms V>, tV> ?	❑	❑	❑
Alarms V>>, tV>> ?	❑	❑	❑
Alarms V>>>, tV>>> ?	❑	❑	❑
Alarms DU/DT1			❑
Alarms DU/DT2			❑
Alarms DU/DT3			❑
Alarms DU/DT4			❑
Alarms U<, tU< ?	❑	❑	❑
Alarms U<<, tU<< ?	❑	❑	❑
Alarms U<<<, tU<<< ?	❑	❑	❑
Alarms tAux1 ?	❑	❑	❑
Alarms tAux2 ?	❑	❑	❑
Alarms tAux3 ?		❑	❑
Alarms tAux4 ?		❑	❑
Alarms tAux5 ?		❑	❑

* Delete or completeas appropriate

Inhibited alarms	P921	P922	P923
	YES	YES	YES
Alarms F1 ?		❑	❑
Alarms F2 ?		❑	❑
Alarms F3 ?		❑	❑
Alarms F4 ?		❑	❑
Alarms F5 ?		❑	❑
Alarms F6 ?		❑	❑
Alarms dF/dt1 ?			❑
Alarms dF/dt2 ?			❑
Alarms dF/dt3 ?			❑
Alarms dF/dt4 ?			❑
Alarms dF/dt5 ?			❑
Alarms dF/dt6 ?			❑
Alarms F1+dF/dt1 ?			❑
Alarms F2+dF/dt2 ?			❑
Alarms F3+dF/dt3 ?			❑
Alarms F4+dF/dt4 ?			❑
Alarms F5+dF/dt5 ?			❑
Alarms F6+dF/dt6 ?			❑
Alarms FR.OUT OF RANGE?		❑	❑
Alarms VTS ?		❑	❑
Alarms Control trip ?		❑	❑
Alarms EQU. A ?	❑	❑	❑
Alarms EQU. B ?	❑	❑	❑
Alarms EQU. C ?	❑	❑	❑
Alarms EQU. D ?	❑	❑	❑
Alarms EQU. E ?	❑	❑	❑
Alarms EQU. F ?	❑	❑	❑
Alarms EQU. G ?	❑	❑	❑
Alarms EQU. H ?	❑	❑	❑
VOLT BAL K1< ?			❑
VOLT BAL K2< ?			❑
VOLT BAL K3< ?			❑
VOLT BAL Kpoly< ?			❑

* Delete or complete as appropriate

6.4.1 Inputs configuration

❑ = 0, ☑ = 1

Inputs (P921only)			2 ❑		1 ❑
Inputs (P922 and P923)	5 ❑	4 ❑	3 ❑	2 ❑	1 ❑
Voltage input DC	❑ DC		❑ AC		

6.4.2 Output relays configuration

					← ❑ P921 →				
		← ❑ P922 & P923 →							
Fail Safe Relay		8	7	6	5	4	3	2	1
Maintenance Mode	❑ YES				❑ NO				
				← ❑ P921 →					
	← ❑ P922 & P923 →								
Relays CMD	8	7	6	5	W	4	3	2	1

7. PROTECTION MENU

7.1 Protection G1

7.1.1 Undervoltage[27] menu

7.1.1.1 [27] V<

V< ?	❑ No	
	❑ AND	❑ OR
V< =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [27] V< DMT

tV< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

b) [27] V< IDMT

TMS	_______ *	
tReset V<	_______ s *	
Inhib U</52a	❑ Yes	❑ No

7.1.1.2 [27] V<<

V<< ?	❑ No	
	❑ AND	❑ OR
V<< =	_______ V *	
tV<< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

7.1.1.3 [27] V<<<

V<<< ?	❑ No	
	❑ AND	❑ OR
V<<< =	_______ V *	
tV<<< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

7.1.1.4 [27] Hysteresis

Hysteresis =	_______

* Delete or complete as appropriate

7.1.2 Overvoltage [59] menu

7.1.2.1 [59] V>

V> ?	❑ No	
	❑ AND	❑ OR
V> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59] V> DMT

tV> =	_______ ms *

b) [59] V> IDMT

TMS	_______ *
tReset V>	_______ s *

7.1.2.2 [59] V>>

V>> ?	❑ No	
	❑ AND	❑ OR
V>> =	_______ V *	
tV>> =	_______ ms *	

7.1.2.3 [59] V>>>

V>>> ?	❑ No	
	❑ AND	❑ OR
V>>> =	_______ V *	
tV>>> =	_______ ms *	

7.1.2.4 [59] Hysteresis

Hysteresis =	________

* Delete or completeas appropriate

7.1.3 Residual overvoltage [59N] menu

7.1.3.1 [59N] V0>

V0> ?	❑ Yes	❑ No
V0> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59N] V0> DMT

tV0> =	_______ ms *

b) [59N] V0> IDMT

TMS	_______ *
tReset V0>	_______ s *

7.1.3.2 [59N] V0>>

V0>> ?	❑ Yes	❑ No
V0>> =	________ V *	
tV0>> =	________ ms *	

7.1.3.3 [59N] V0>>>

V0>>> ?	❑ Yes	❑ No
V0>>> =	________ V *	
tV0>>> =	________ ms *	

7.1.3.4 [59N] V0der> (P922&P923)

V0der> ?	❑ Yes	❑ No
V0der> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59N] V0der> DMT

tV0der> =	_______ ms *

b) [59N] V0der> IDMT

TMS	_______ *
tReset V0der>	_______ s *

* Delete or complete as appropriate

7.1.3.5 [59N] V0der>> (P922&P923)

V0der>> ?	❑ Yes	❑ No
V0der>> =	________ V *	
tV0der>> =	________ ms *	

7.1.3.6 [59N] V0der>>> (P922&P923)

V0der>>> ?	❑ Yes	❑ No
V0der>>> =	________ V *	
tV0der>>> =	________ ms *	

7.1.4 Zero sequence overvoltage [47] menu (P922 & P923)

7.1.4.1 [47] V2>

V2> ?	❑ Yes	❑ No
V2> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [47] V2> DMT

tV2> =	_______ ms *

b) [47] V2> IDMT

TMS	_______ *
tReset V2>	_______ s *

7.1.4.2 [47] V2>>

V2>> ?	❑ Yes	❑ No
V2>> =	_______ V *	
tV2>> =	_______ ms *	

* Delete or completeas appropriate

7.1.5 Positive sequence undervoltage [27D] menu (P922 & P923)

7.1.5.1 [27D] V1<

V1< ?	❑ Yes	❑ No
V1< =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [27D] V1< DMT

tV1< =	_______ ms *

b) [27D] V1< IDMT

TMS	_______ *
tReset V1<	_______ s *

7.1.5.2 [27D] V1<<

V1<< ?	❑ Yes	❑ No
V1<< =	_______ V *	
tV1<< =	_______ ms *	

7.1.6 Frequency [81] menu (P922 & P923)

	Fx			**Fx =**	**tFx**
	No	**81>**	**81<**	**Hz ***	**ms ***
[81] F1	❑	❑	❑	_______	_______
[81] F2	❑	❑	❑	_______	_______
[81] F3	❑	❑	❑	_______	_______
[81] F4	❑	❑	❑	_______	_______
[81] F5	❑	❑	❑	_______	_______
[81] F6	❑	❑	❑	_______	_______

* Delete or complete as appropriate

7.1.7 Rate of change of frequency [81R] (P923)

	Df/dt	df / dt x =
	Yes	**Hz /s ***
[81R] df/dt 1	❑	_______
[81R] df/dt 2	❑	_______
[81R] df/dt 3	❑	_______
[81R] df/dt 4	❑	_______
[81R] df/dt 5	❑	_______
[81R] df/dt 6	❑	_______

7.1.8 Delta U / Delta t menu (P923)

	Fx					DUx =	DTx =
	No	**MIN/ OR**	**MIN/ AND**	**MAX/ OR**	**MAX/ AND**	**V ***	**s ***
DU / DT 1	❑	❑	❑	❑	❑	_______	_______
DU / DT 2	❑	❑	❑	❑	❑	_______	_______
DU / DT 3	❑	❑	❑	❑	❑	_______	_______
DU / DT 4	❑	❑	❑	❑	❑	_______	_______

7.1.9 Voltage balance (P923)

	K<=	K<=
	Yes	**(setting) ***
V balance	❑	_______

* Delete or completeas appropriate

7.2 Protection G2 (P922&P923)

7.2.1 Undervoltage[27] menu

7.2.1.1 [27] V<

V< ?	❑ No	
	❑ AND	❑ OR
V< =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [27] V< DMT

tV< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

b) [27] V< IDMT

TMS	_______ *	
tReset V<	_______ s *	
Inhib U</52a	❑ Yes	❑ No

7.2.1.2 [27] V<<

V<< ?	❑ No	
	❑ AND	❑ OR
V<< =	_______ V *	
tV<< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

7.2.1.3 [27] V<<<

V<<< ?	❑ No	
	❑ AND	❑ OR
V<<< =	________ V *	
tV<<< =	_______ ms *	
Inhib U</52a	❑ Yes	❑ No

7.2.1.4 [27] Hysteresis

Hysteresis =	_______

* Delete or complete as appropriate

7.2.2 Overvoltage [59] menu

7.2.2.1 [59] V>

V> ?	❑ No	
	❑ AND	❑ OR
V> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59] V> DMT

tV> =	_______ ms *

b) [59] V> IDMT

TMS	_______ *
tReset V>	_______ s *

7.2.2.2 [59] V>>

V>> ?	❑ No	
	❑ AND	❑ OR
V>> =	_______ V *	
tV>> =	_______ ms *	

7.2.2.3 [59] V>>>

V>>> ?	❑ No	
	❑ AND	❑ OR
V>>> =	_______ V *	
tV>>> =	_______ ms *	

7.2.2.4 [59] Hysteresis

Hysteresis =	________

* Delete or completeas appropriate

7.2.3 Residual overvoltage [59N] menu

7.2.3.1 [59N] V0>

V0> ?	❑ Yes	❑ No
V0> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59N] V0> DMT

tV0> =	_______ ms *

b) [59N] V0> IDMT

TMS	_______ *
tReset V0>	_______ s *

7.2.3.2 [59N] V0>>

V0>> ?	❑ Yes	❑ No
V0>> =	________ V *	
tV0>> =	________ ms *	

7.2.3.3 [59N] V0>>>

V0>>> ?	❑ Yes	❑ No
V0>>> =	________ V *	
tV0>>> =	________ ms *	

7.2.3.4 [59N] V0der> (P922&P923)

V0der> ?	❑ Yes	❑ No
V0der> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [59N] V0der> DMT

tV0der> =	_______ ms *

b) [59N] V0der> IDMT

TMS	_______ *
tReset V0der>	_______ s *

* Delete or complete as appropriate

7.2.3.5 [59N] V0der>> (P922&P923)

V0der>> ?	❑ Yes	❑ No
V0der>> =	________ V *	
tV0der>> =	________ ms *	

7.2.3.6 [59N] V0der>>> (P922&P923)

V0der>>> ?	❑ Yes	❑ No
V0der>>> =	________ V *	
tV0der>>> =	________ ms *	

7.2.4 Zero sequence overvoltage [47] menu (P922 & P923)

7.2.4.1 [47] V2>

V2> ?	❑ Yes	❑ No
V2> =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [47] V2> DMT

tV2> =	_______ ms *

b) [47] V2> IDMT

TMS	_______ *
tReset V2>	_______ s *

7.2.4.2 [47] V2>>

V2>> ?	❑ Yes	❑ No
V2>> =	_______ V *	
tV2>> =	_______ ms *	

* Delete or completeteas appropriate

7.2.5 Positive sequence undervoltage [27D] menu (P922 & P923)

7.2.5.1 [27D] V1<

V1< ?	❑ Yes	❑ No
V1< =	_______ V *	
Delay Type	❑ IDMT	❑ DMT

a) [27D] V1< DMT

tV1< =	_______ ms *

b) [27D] V1< IDMT

TMS	_______ *
tReset V1<	_______ s *

7.2.5.2 [27D] V1<<

V1<< ?	❑ Yes	❑ No
V1<< =	_______ V *	
tV1<< =	_______ ms *	

7.2.6 Frequency [81] menu (P922 & P923)

	Fx			**Fx =**	**tFx**
	No	**81>**	**81<**	**Hz ***	**ms ***
[81] F1	❑	❑	❑	_______	_______
[81] F2	❑	❑	❑	_______	_______
[81] F3	❑	❑	❑	_______	_______
[81] F4	❑	❑	❑	_______	_______
[81] F5	❑	❑	❑	_______	_______
[81] F6	❑	❑	❑	_______	_______

* Delete or complete as appropriate

7.2.7 Rate of change of frequency [81R] (P923)

	Df/dt	df / dt x =
	Yes	**Hz /s ***
[81R] df/dt 1	❑	_______
[81R] df/dt 2	❑	_______
[81R] df/dt 3	❑	_______
[81R] df/dt 4	❑	_______
[81R] df/dt 5	❑	_______
[81R] df/dt 6	❑	_______

7.2.8 Delta U / Delta t menu (P923)

	Fx					DUx =	DTx =
	No	**MIN/ OR**	**MIN/ AND**	**MAX/ OR**	**MAX/ AND**	**V ***	**s ***
DU / DT 1	❑	❑	❑	❑	❑	_______	_______
DU / DT 2	❑	❑	❑	❑	❑	_______	_______
DU / DT 3	❑	❑	❑	❑	❑	_______	_______
DU / DT 4	❑	❑	❑	❑	❑	_______	_______

7.2.9 Voltage balance (P923)

	K<=	K<=
	Yes	**(setting) ***
V balance	❑	_______

* Delete or completeas appropriate

8. AUTOMATIC CONTROL MENU

8.1 "TRIP OUTPUT RLY" menu

tFunction	P921	P922	P923
	Yes	Yes	Yes
tU<	❑	❑	❑
tU<<	❑	❑	❑
tU<<<	❑	❑	❑
tU>	❑	❑	❑
tU>>	❑	❑	❑
tU>>>	❑	❑	❑
tV0>	❑	❑	❑
tV0>>	❑	❑	❑
tV0>>>	❑	❑	❑
tV0der>		❑	❑
tV0der>>		❑	❑
tV0der>>>		❑	❑
tV2>		❑	❑
tV2>>		❑	❑
tV1<		❑	❑
tV1<<		❑	❑
tF1		❑	❑
tF2		❑	❑
tF3		❑	❑
tF4		❑	❑
tF5		❑	❑
tF6		❑	❑
df/dt 1			❑
df/dt 2			❑
df/dt 3			❑
df/dt 4			❑
df/dt 5			❑
df/dt 6			❑
F1+df/dt 1			❑
F2+df/dt 2			❑
F3+df/dt 3			❑

* Delete or complete as appropriate

tFunction	P921	P922	P923
	Yes	Yes	Yes
F4+df/dt 4			❑
F5+df/dt 5			❑
F6+df/dt 6			❑
tAux1	❑	❑	❑
tAux2	❑	❑	❑
tAux3		❑	❑
tAux4		❑	❑
tAux5		❑	❑
Equation A	❑	❑	❑
Equation B	❑	❑	❑
Equation C	❑	❑	❑
Equation D	❑	❑	❑
Equation E	❑	❑	❑
Equation F	❑	❑	❑
Equation G	❑	❑	❑
Equation H	❑	❑	❑
DU / DT 1			❑
DU / DT 2			❑
DU / DT 3			❑
DU / DT 4			❑
V BAL K1=			❑
V BAL K2=			❑
V BAL K3=			❑
V B KPoly=			❑

* Delete or completeas appropriate

8.2 "LATCH FUNCTIONS" menu

tFunction	P921	P922	P923
	Yes	Yes	Yes
tU<	❑	❑	❑
tU<<	❑	❑	❑
tU<<<	❑	❑	❑
tU>	❑	❑	❑
tU>>	❑	❑	❑
tU>>>	❑	❑	❑
tV0>	❑	❑	❑
tV0>>	❑	❑	❑
tV0>>>	❑	❑	❑
tV0der>		❑	❑
tV0der>>		❑	❑
tV0der>>>		❑	❑
tV2>		❑	❑
tV2>>		❑	❑
tV1<		❑	❑
tV1<<		❑	❑
tF1		❑	❑
tF2		❑	❑
tF3		❑	❑
tF4		❑	❑
tF5		❑	❑
tF6		❑	❑
df/dt1			❑
df/dt2			❑
df/dt3			❑
df/dt4			❑
df/dt5			❑
df/dt6			❑
F1+df/dt1			❑
F2+df/dt2			❑
F3+df/dt3			❑
F4+df/dt4			❑
F5+df/dt5			❑

* Delete or complete as appropriate

tFunction	P921	P922	P923
	Yes	Yes	Yes
F6+df/dt6			❑
tAux1	❑	❑	❑
tAux2	❑	❑	❑
tAux3		❑	❑
tAux4		❑	❑
tAux5		❑	❑
Equation A	❑	❑	❑
Equation B	❑	❑	❑
Equation C	❑	❑	❑
Equation D	❑	❑	❑
Equation E	❑	❑	❑
Equation F	❑	❑	❑
Equation G	❑	❑	❑
Equation H	❑	❑	❑
DU / DT 1			❑
DU / DT 2			❑
DU / DT 3			❑
DU / DT 4			❑
V BAL K1=			❑
V BAL K2=			❑
V BAL K3=			❑
V B KPoly=			❑

8.3 "BLOCKING LOG" menu

tFunction	BLOCKING LOG1			BLOCKING LOG2		
	P921	P922	P923	P921	P922	P923
	Yes	Yes	Yes	Yes	Yes	Yes
tU<	❑	❑	❑	❑	❑	❑
tU<<	❑	❑	❑	❑	❑	❑
tU<<<	❑	❑	❑	❑	❑	❑
tU>	❑	❑	❑	❑	❑	❑
tU>>	❑	❑	❑	❑	❑	❑
tU>>>	❑	❑	❑	❑	❑	❑

* Delete or completeas appropriate

tFunction	BLOCKING LOG1			BLOCKING LOG2		
	P921	P922	P923	P921	P922	P923
	Yes	Yes	Yes	Yes	Yes	Yes
tV0>	❑	❑	❑	❑	❑	❑
tV0>>	❑	❑	❑	❑	❑	❑
tV0>>>	❑	❑	❑	❑	❑	❑
tV0>		❑	❑		❑	❑
tV0>>		❑	❑		❑	❑
tV0>>>		❑	❑		❑	❑
tV2>		❑	❑		❑	❑
tV2>>		❑	❑		❑	❑
tF1		❑	❑		❑	❑
tF2		❑	❑		❑	❑
tF3		❑	❑		❑	❑
tF4		❑	❑		❑	❑
tF5		❑	❑		❑	❑
tF6		❑	❑		❑	❑
df/dt1			❑			❑
df/dt2			❑			❑
df/dt3			❑			❑
df/dt4			❑			❑
df/dt5			❑			❑
df/dt6			❑			❑
tAux1	❑	❑	❑	❑	❑	❑
tAux2	❑	❑	❑	❑	❑	❑
tAux3		❑	❑		❑	❑
tAux4		❑	❑		❑	❑
tAux5		❑	❑		❑	❑
DU / DT 1			❑			❑
DU / DT 2			❑			❑
DU / DT 3			❑			❑
DU / DT 4			❑			❑

* Delete or complete as appropriate

8.4 "AUX OUTPUT RLY" menu

								← P921 →		
				← P922 and P923 →						
Function	**P921**	**P922**	**P923**	**Output relay**						
				8	**7**	**6**	**5**	**4**	**3**	**2**
TRIP. CB	•	•	•	❑	❑	❑	❑	❑	❑	❑
CLOS. CB	•	•	•	❑	❑	❑	❑	❑	❑	❑
V<	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV<	•	•	•	❑	❑	❑	❑	❑	❑	❑
V<<	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV<<	•	•	•	❑	❑	❑	❑	❑	❑	❑
V<<<	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV<<<	•	•	•	❑	❑	❑	❑	❑	❑	❑
V>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V0>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV0>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V0>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV0>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V0>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
tV0>>>	•	•	•	❑	❑	❑	❑	❑	❑	❑
V0d>		•	•	❑	❑	❑	❑	❑	❑	❑
tV0d>		•	•	❑	❑	❑	❑	❑	❑	❑
V0d>>		•	•	❑	❑	❑	❑	❑	❑	❑
tV0d>>		•	•	❑	❑	❑	❑	❑	❑	❑
V0d>>>		•	•	❑	❑	❑	❑	❑	❑	❑
tV0d>>>		•	•	❑	❑	❑	❑	❑	❑	❑
V2>		•	•	❑	❑	❑	❑	❑	❑	❑
tV2>		•	•	❑	❑	❑	❑	❑	❑	❑
V2>>		•	•	❑	❑	❑	❑	❑	❑	❑
tV2>>		•	•	❑	❑	❑	❑	❑	❑	❑

* Delete or completeas appropriate

								← P921 →		
				← P922 and P923 →						
Function	**P921**	**P922**	**P923**	**Output relay**						
				8	**7**	**6**	**5**	**4**	**3**	**2**
V1<		•	•	❑	❑	❑	❑	❑	❑	❑
tV1<		•	•	❑	❑	❑	❑	❑	❑	❑
V1<<		•	•	❑	❑	❑	❑	❑	❑	❑
tV1<<		•	•	❑	❑	❑	❑	❑	❑	❑
F1		•	•	❑	❑	❑	❑	❑	❑	❑
tF1		•	•	❑	❑	❑	❑	❑	❑	❑
F2		•	•	❑	❑	❑	❑	❑	❑	❑
tF2		•	•	❑	❑	❑	❑	❑	❑	❑
F3		•	•	❑	❑	❑	❑	❑	❑	❑
tF3		•	•	❑	❑	❑	❑	❑	❑	❑
F4		•	•	❑	❑	❑	❑	❑	❑	❑
tF4		•	•	❑	❑	❑	❑	❑	❑	❑
F5		•	•	❑	❑	❑	❑	❑	❑	❑
tF5		•	•	❑	❑	❑	❑	❑	❑	❑
F6		•	•	❑	❑	❑	❑	❑	❑	❑
tF6		•	•	❑	❑	❑	❑	❑	❑	❑
df/dt1			•	❑	❑	❑	❑	❑	❑	❑
df/dt2			•	❑	❑	❑	❑	❑	❑	❑
df/dt3			•	❑	❑	❑	❑	❑	❑	❑
df/dt4			•	❑	❑	❑	❑	❑	❑	❑
df/dt5			•	❑	❑	❑	❑	❑	❑	❑
df/dt6			•	❑	❑	❑	❑	❑	❑	❑
tAux1	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux2	•	•	•	❑	❑	❑	❑	❑	❑	❑
tAux3		•	•	❑	❑	❑	❑	❑	❑	❑
tAux4		•	•	❑	❑	❑	❑	❑	❑	❑
tAux5		•	•	❑	❑	❑	❑	❑	❑	❑
CB ALAR.		•	•	❑	❑	❑	❑	❑	❑	❑
F OUT		•	•	❑	❑	❑	❑	❑	❑	❑
CB FAIL	•	•	•	❑	❑	❑	❑	❑	❑	❑
EQU A	•	•	•	❑	❑	❑	❑	❑	❑	❑
EQU B	•	•	•	❑	❑	❑	❑	❑	❑	❑

* Delete or complete as appropriate

								← P921 →		
				← P922 and P923 →						
Function	**P921**	**P922**	**P923**	**Output relay**						
				8	**7**	**6**	**5**	**4**	**3**	**2**
EQU C	•	•	•	❑	❑	❑	❑	❑	❑	❑
EQU D	•	•	•	❑	❑	❑	❑	❑	❑	❑
EQU C	•	•	•	❑	❑	❑	❑	❑	❑	❑
EQU D	•	•	•	❑	❑	❑	❑	❑	❑	❑
IN 1	•	•	•	❑	❑	❑	❑	❑	❑	❑
IN 2	•	•	•	❑	❑	❑	❑	❑	❑	❑
IN 3		•	•	❑	❑	❑	❑	❑	❑	❑
IN 4		•	•	❑	❑	❑	❑	❑	❑	❑
IN 5		•	•	❑	❑	❑	❑	❑	❑	❑
Active group		•	•	❑	❑	❑	❑	❑	❑	❑
DU / DT 1			•	❑	❑	❑	❑	❑	❑	❑
DU / DT 2			•	❑	❑	❑	❑	❑	❑	❑
DU / DT 3			•	❑	❑	❑	❑	❑	❑	❑
DU / DT 4			•	❑	❑	❑	❑	❑	❑	❑
tVTS		•	•	❑	❑	❑	❑	❑	❑	❑
Order 1 com		•	•	❑	❑	❑	❑	❑	❑	❑
Order 2 com		•	•	❑	❑	❑	❑	❑	❑	❑
Order 3 com		•	•	❑	❑	❑	❑	❑	❑	❑
Order 4 com		•	•	❑	❑	❑	❑	❑	❑	❑
B Bal K1			•	❑	❑	❑	❑	❑	❑	❑
B Bal K2			•	❑	❑	❑	❑	❑	❑	❑
B Bal K3			•	❑	❑	❑	❑	❑	❑	❑
B Bal KPoly			•	❑	❑	❑	❑	❑	❑	❑

* Delete or completeas appropriate

8.5 "LATCH OUTPUT RELAYS" Menu

Latch output relays	P921	P922	P923
	Yes	Yes	Yes
Output 2	❑	❑	❑
Output 3	❑	❑	❑
Output 4	❑	❑	❑
Output 5		❑	❑
Output 6		❑	❑
Output 7		❑	❑
Output 8		❑	❑

8.6 "F + df/dt" (Frequency change of rate of frequency) submenu

F + df/dt	P923
	Yes
F1 + df/dt1	❑
F2 + df/dt2	❑
F3 + df/dt3	❑
F4 + df/dt4	❑
F5 + df/dt5	❑
F6 + df/dt6	❑

* Delete or complete as appropriate

8.7 "LOGIC EQUATION" Menu

Equ. A	Boolean	Logic
A.00	❑ = / ❑ = NOT	
A.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
A.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ B	Boolean	Logic
B.00	❑ = / ❑ = NOT	
B.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
B.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

* Delete or completeas appropriate

Equ. C	Boolean	Logic
C.00	❑ = / ❑ = NOT	
C.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
C.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. D	Boolean	Logic
D.00	❑ = / ❑ = NOT	
D.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
D.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

* Delete or complete as appropriate

Equ. E	Boolean	Logic
E.00	❑ = / ❑ = NOT	
E.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
E.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. F	Boolean	Logic
F.00	❑ = / ❑ = NOT	
F.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
F.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

* Delete or completeas appropriate

Equ. G	Boolean	Logic
G.00	❑ = / ❑ = NOT	
G.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
G.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

Equ. H	Boolean	Logic
H.00	❑ = / ❑ = NOT	
H.01	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.02	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.03	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.04	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.05	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.06	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.07	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.08	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.09	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.10	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.11	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.12	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.13	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.14	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
H.15	❑ OR / ❑ = OR NOT / ❑ AND / ❑ = AND NOT	
T Operate	ms	
T Reset	ms	

* Delete or complete as appropriate

8.8 "INPUTS" menu

	←P921 to P922→				
	← P923 →				
Input	**1**	**2**	**3**	**4**	**5**
NONE	❑	❑	❑	❑	❑
UNLATCH	❑	❑	❑	❑	❑
52a	❑	❑	❑	❑	❑
52b	❑	❑	❑	❑	❑
CB FAIL	❑	❑	❑	❑	❑
BLK LOG1	❑	❑	❑	❑	❑
BLK LOG2	❑	❑	❑	❑	❑
AUX 1	❑	❑	❑	❑	❑
AUX 2	❑	❑	❑	❑	❑
AUX 3 (P922 and P923)	❑	❑	❑	❑	❑
AUX 4 (P922 and P923)	❑	❑	❑	❑	❑
AUX 5 (P922 and P923)	❑	❑	❑	❑	❑
CHANG SET (P922 and P923)	❑	❑	❑	❑	❑
STRT DIST (P922 and P923)	❑	❑	❑	❑	❑
CTRL TRIP	❑	❑	❑	❑	❑
CTRL CLOSE	❑	❑	❑	❑	❑
TIME SYNC (P922 and P923)	❑	❑	❑	❑	❑
LED RESET	❑	❑	❑	❑	❑
VTS (P922 and P923)	❑	❑	❑	❑	❑
Maint. (P922 and P923)	❑	❑	❑	❑	❑
tAux 1	________ s *				
tAux 2	________ s *				

* Delete or completeas appropriate

8.9 "VT SUPERVISION" menu (P922/P923)

VTS supervision	❑ Yes	❑ No
Detection mode	_______ *	
Delta Vr	_______ V *	
tVTS	_______ ms *	
Inhib. VTS / 52a?	❑ Yes	❑ No
Block function U<	❑ Yes	❑ No
Block function U>	❑ Yes	❑ No
Block function V1<	❑ Yes	❑ No
Block function V0>	❑ Yes	❑ No
Block function Frequ.	❑ Yes	❑ No
Block function df/dt	❑ Yes	❑ No
Block function du/dt	❑ Yes	❑ No

8.10 "CB SUPERVISION" menu

CB OPEN S'Vision	❑ Yes	❑ No
CB OPENING TIME =	_______ ms *	
CB CLOSE S'Vision =	❑ Yes	❑ No
CB CLOSING TIME	_______ ms *	
NB OPER ALARM ?	❑ Yes	❑ No
NB OPERATION =	_______ *	
CLOSE PULSE TIME	_______ ms *	
CLOSE PULSE TIME	_______ ms *	

* Delete or complete as appropriate

BLANK PAGE

* Delete or completeas appropriate

FIRMWARE AND SERVICE MANUAL
VERSION HISTORY

P92x Hardware/Software Version History								
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**P921**	**P922**	**P923**
Major	Minor							
01	A	HARD 4	03/2000	Software changes implemented in this version - Original issue.	V2.05	X		
01	B	HARD 4	05/2000	Software changes implemented in this version - Original issue.	V2.05		X	
01	C	HARD 4	07/2000	Hardware changes implemented in this version - P922S new product. Software changes implemented in this version - Evolution for EDF. - Analogic auto control 0V added.	V2.05	X	X X	
01	D	HARD 4	11/2000	Software changes implemented in this version - New communication (Courier and IEC 103) protocols added. - Spanish, German, Italian, polish and Russian languages added. - Setting of hysteresis of maximum voltage protection modified.	V2.05	X X X	X X X	
01	E	HARD 4	02/2001	Software changes implemented in this version - Czech new language. - Setting of hysteresis of minimum voltage protection evolution.	V2.05	X X	X X	
04	D	HARD 4	08/2001	Software changes implemented in this version - Original issue. - Evolution according to P92x_V4_uk.doc document. - Change of signification of Bit 0 of status of modbus .	V2.07	X X	X X	X

P92x Hardware/Software Version History								
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**P921**	**P922**	**P923**
Major	Minor							
04	E	HARD 4	01/2002	Software changes implemented in this version	V2.07			
				- Development of new communication (DNP3).		X	X	X
				- Change of management of alarm major at start for communication.		X	X	X
04	F	HARD 4	06/2002	Software changes implemented in this version	V2.07			
				- COURIER: Modifications in disturbance extraction.		X	X	X
				- IEC 60870-5-103: disturbance channel extraction fixed. Fixed real data format in ASDU 77 and ASDU 27. Modification of ASDU 8 (end of GI).		X	X	X
04	G	HARD 4	10/2002	Software changes implemented in this version	V2.07			
				- Private messages option o (for non-standard protection functions) in IEC 60870-5-103 communication added.		X	X	X
				- Problem in logical blocking of frequency protection fixed.			X	X
06	B	HARD 4	09/2003	Software changes implemented in this version	V2.10			
				- Dutch language added.		X	X	X
				- “Out of Frequency” alarm correction.			X	X
				- Periodic self-test of EEPROM data / calibration added.		X	X	X
				- “Default settings” alarm added.		X	X	X
				- E2PROM reading optimized.		X	X	X
				- Data storage circuit breaker in E2PROM replaced by a storage in backup RAM.			X	X
				- Dating software modified.			X	X
				- ASDU 3.4 for measurement VN added, instead of private ASDU 77.		X	X	X

Software Version Major	Software Version Minor	Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	P921	P922	P923
06	C	HARD 4	06/2004	<u>Software changes implemented in this version</u>	V2.10			
				- Inhibition of under-voltage by circuit breaker position.		X	X	X
				- Possibility to suppress over-voltage alarm.		X	X	X
				- Automatism with logic inputs added.		X	X	X
				- Extensive range threshold voltage protection and drop-off.		X	X	X
				- Upload fault record on DNP3 communication.		X	X	X
				- Input logic EA approval option added,		X	X	X
				- Bug corrections.		X	X	X
06	F	HARD 4	11/2005	<u>Software changes implemented in this version</u>	V2.13			
				- Communication type for DNP3 added.		X	X	X
				- IEC 60870-5-103 communication: filtering of Function Type in “order for disturbance data transmission” requests added.			X	X
06	G	HARD 4	04/2007	<u>Software changes implemented in this version</u>	V2.13			
				- Frequency Out' alarm on Auto-Acknowledge setting added.				X
				- New DNP3 address parameter taken into account after a reboot.		X	X	X
				- Disturbance record channel numbers (ACC) correction (IEC 103).			X	X
				- DNP3 rear port address and Modbus front port address parameters modified.		X	X	X

-

P92x Hardware/Software Version History

Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	P921	P922	P923
Major	Minor							
10	D	HARD 5	09/2006	Software changes implemented in this version - This software is the first of the hardware phase II of P92x products.	V2.13	X	X	X
10	E	HARD 5	04/2007	Software changes implemented in this version - Protection DU/DT modification. - Chinese Language added. - Date & event logic input deletion enhancement. - Communication Modbus correction. - Disturbance record channel numbers (ACC) correction. - Address correction.	V2.13	 X X	 X X X X X	X X X X X X
10	F	HARD 5	08/2007	Software changes implemented in this version - Improvement of offset: calibration modified. - Frequency "out of alarm" added on auto-acknowledge setting.	V2.14	X	X	X X
10	G	HARD 5	02/2008	Software changes implemented in this version - Portuguese Language added. - HMI control function has been added (sfi_control_menus()) in "sf init.c" to verify the HMI texts integrity for all languages. - Czech text corrections. - Communication modbus: minor corrections.	V2.14	X X X	X X X X	X X X X
10	H	HARD 5	11/2008	Software changes implemented in this version - df/dt validation range increases to 20. - Addition of frequency block/unblock when df/dt exceeds 20Hz/s.	V2.14			X X

P92x Hardware/Software Version History								
Software Version		**Hardware Suffix**	**Original Date of Issue**	**Description of Changes**	**S1 Compatibility**	**P921**	**P922**	**P923**
Major	Minor							
10	I	HARD 5	03/2009	Software changes implemented in this version	V2.14			
				Software changes:				
				- The number of events is increased from 75 to 250.			X	X
				- The number of fault records is increased from 5 to 25.			X	X
				- Enhancement event records of F, df/dt.			X	X
				Corrections:				
				- In all rear port communication, the reception function doesn't process all cases of blocking error.		X	X	X
				- If the frequency validity is OFF the tempo for tFx is not frozen and interpeptide trips can occur			X	X
11	B	HARD 5	07/2010	Software changes implemented in this version	V2.14			
				- VT Supervision added.			X	X
				- New combination of Fi and df/dti protections.				X
				- Additional tAux functions.			X	X
				- New 8 Boolean equations (with new operands, results usable as an operand).		X	X	X
				- New Fail safe option.		X	X	X
				- Addition of a bandpass filter on 59N function.			X	X
				- Additional alarm inhibition.		X	X	X
				- Addition of a new menu ORDER added.			X	X
				- Digital input assignation to “Ctrl trip” and “Ctrl close” functions.			X	X
				- Modification of CB operation counting.			X	X
				- Addition of clock synchro. from a logic input.			X	X
				- Addition of derived V0 sequence overvoltage stage.			X	X
				- Addition of df/dt blocking inhibition.			X	
				- New disturbance records durations.			X	X
				- New default display.		X	X	X
				- Addition of LED reset function.		X	X	X
				- Addition of maintenance mode of relays.		X	X	X

P92x Hardware/Software Version History								
Software Version		Hardware Suffix	Original Date of Issue	Description of Changes	S1 Compatibility	P921	P922	P923
Major	Minor							
11	D	HARD 5	12/2010	Software changes implemented in this version	V2.14			
				- Rebranded with Schneider Electric.		X	X	X
				Fixed DTS				
				- When the frequency suddenly jumps from 50Hz to 75Hz, in some spefific conditions, "F out of range" alarm is not activiated.		X	X	X
				- With IEC 103 protocol, magnitudes in a fault record are expressed in hundreadths of volt, instead of volts.			X	X
				- With IEC 103 protocol, frequency in a fault record is expressed in hundredths of Hz or thousandths of Hz, instead of Hz.			X	X
12	A	HARD 5	04/2011	Software changes implemented in this version	V2.14			
				- Added “Balance Voltage” protection for PCCN V2.				X
				- Added “General Reset” facility.			X	X
				- Added Frequency protection confirmation number.			X	X
12	C	HARD 5	05/2012	Software changes implemented in this version	V2.14			
				- Update firmware code for the deriver of Chinese LCD.		X	X	X
				Fixed DTS				
				- Measurement display of Vr isn't correct when connection scheme configures "3Vpp+Vr".		X	X	X
12	D	HARD 5	04/2014	Software changes implemented in this version	V2.14			
				- Update firmware code for the deriver of Chinese LCD.		X	X	X

Customer Care Centre

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

Schneider Electric

35 rue Joseph Monier
92506 Rueil-Malmaison
FRANCE

Phone: +33 (0) 1 41 29 70 00
Fax: +33 (0) 1 41 29 71 00

www.schneider-electric.com

Publication: P92x/EN M/J62

Publishing: Schneider Electric
01/2018