GE Consumer & Industrial

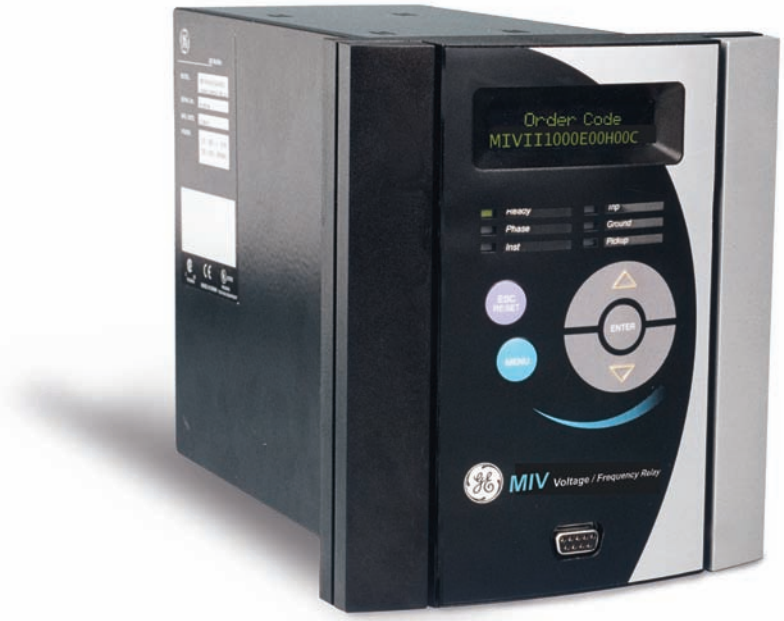
Multilin

MIVII

Digital Voltage and Frequency Relay

Instruction manual

GEK-106616E



ISO9001 REGISTERED

GE Multilin
215 Anderson Avenue
L6E 1B3 Markham, ON -CANADA
Tel: (905) 294 6222 Fax: (905) 294 8512
E-mail: gemultilin@ge.com

GE Multilin
Avda. Pinoa, 10
48170 Zamudio SPAIN
Tel: +34 94 485 88 00 Fax: +34 94 485 88 45
E-mail: gemultilin.euro@ge.com

Internet: www.geindustrial.com/multilin

TABLE OF CONTENTS

TABLE OF CONTENTS

To help ensure years of trouble free operation, please read through the following chapter for information to help guide you through the initial installation procedures of your new relay.

CAUTION: THE OPERATOR OF THIS INSTRUMENT IS ADVISED THAT IF THE EQUIPMENT IS USED IN A MANNER NOT SPECIFIED IN THIS MANUAL, THE PROTECTION PROVIDED BY THE EQUIPMENT MAY BE IMPAIRED

INSTALLATION MUST BE ACCORDING TO THE NATIONAL ELECTRIC CODE OF THE APPROPRIATE COUNTRY

IMPORTANT WARNING: For upgrading the relay firmware to version 4.00 or later, it is mandatory that the EnerVista MII Setup version is 1.10 or higher. For firmware version 5.00 or later, the EnerVista MII Setup version must be 2.10 or later. Otherwise it may result in damage to the relay

It will take a few seconds for the relay to restart after the completion of the update process. Therefore, before unplugging the relay, please make sure that the relay main screen shows the analog inputs values.

1

Open the relay packaging and inspect the relay for physical damage.

Check the label at the side of the relay and check that the relay model is the same model ordered.

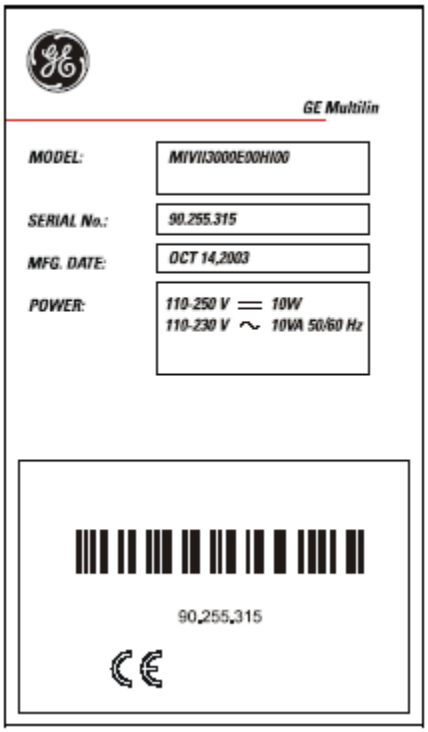


Figure 1–1: RELAY IDENTIFICATION LABEL (A4454P13) (

Ensure that the mounting screws have been included with the relay.

For product information, instruction manual updates, and the latest software updates, please visit the GE Multilin Home Page (www.GEindustrial.com/multilin).

Note: If there is any physical damage detected on the relay, or any of the contents listed are missing, please contact GE Multilin immediately at:

EUROPE, MIDDLE EAST AND AFRICA:

GE MULTILIN

Av. Pinoa, 10

48170 Zamudio, Vizcaya (SPAIN)

Tel.: (34) 94-485 88 54, Fax: (34) 94-485 88 38

E-mail: multilin.tech.euro@ge.com

AMERICA, ASIA AND AUSTRALIA:

GE MULTILIN

215, Anderson Avenue

L6E 1B3 Markham, ON (CANADA)

Tel.: +1 905 294 6222, Fax: +1 905 201 2098

E-mail: multilin.tech@ge.com

The information provided herein does not intend to cover all details of variations of the equipment nor does it take into account the circumstances that may be present in your installation, operating or maintenance activities.

Should you wish to receive additional information, or for any particular problem that cannot be solved by referring to the information contained herein, please contact GENERAL ELECTRIC MULTILIN.

1.2.1 SYSTEM REQUIREMENTS

The EnerVista MII SETUP software interface is the preferred method to edit settings and view actual values because the PC monitor can display more information in a simple comprehensible format.

The following minimum requirements must be met for the EnerVista MII SETUP software to properly operate on a PC:

- Pentium® class or higher processor (Pentium® II 300 MHz or higher recommended)
- Windows® NT 4.0 (Service Pack 3 or higher), Windows® 2000, Windows® XP
- Internet Explorer® 5.0 or higher
- 64 MB of RAM (128 MB recommended)
- 40 MB of available space on system drive and 40 MB of available space on installation drive
- RS232C serial and Ethernet port for communications to the relay

1.2.2 SAFETY INSTRUCTIONS

The ground screw shown in the following figure must be correctly grounded.

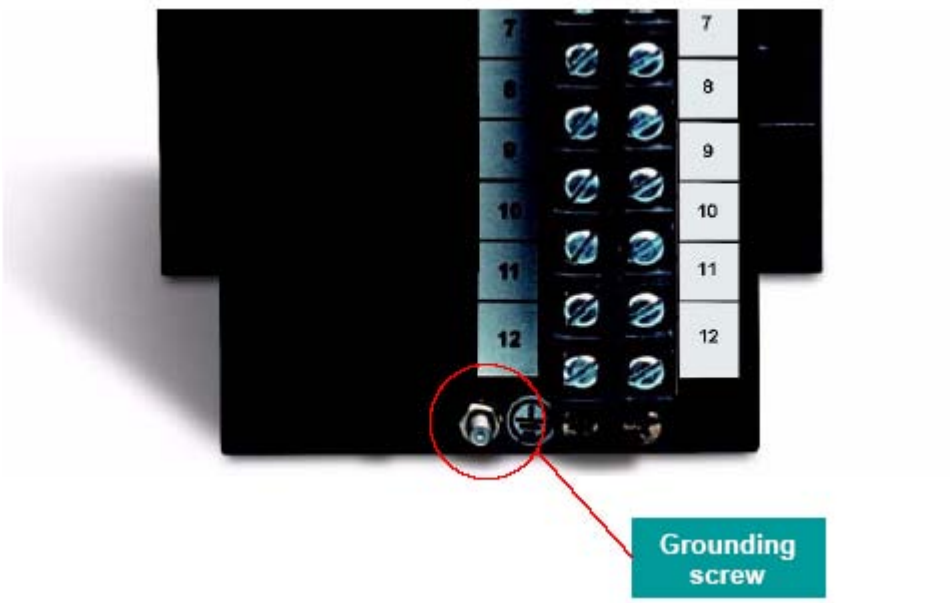


Figure 1–2: GROUNDING SCREW LOCATION

If you want to communicate with the relay using a computer through the front serial port, please ensure that the computer is **grounded to the same ground as the relay**.

In case of using a portable computer, it is recommended to have it disconnected to its power supply, as in many cases they are not correctly grounded either due to the power supply itself or to the connector cables used. Powering the portable PC with its internal battery drastically decreases the possibility of producing permanent damage to the computer or the relay. Beware of the possibility of losing communication in firmware change processes

This is required not only for personal protection, but also for avoiding a voltage difference between the relay serial port and the computer port, which could produce permanent damage to the computer or the relay.

GE Multilin will not be responsible for any damage in the relay or connected equipment whenever this elemental safety rule is not followed.

In case of a firmware flashing process, due to the risk of losing communication, GE Multilin will not be responsible in case of a communication failure if the relay and PC are not grounded to the same point.

1.2.3 INSTALLATION

After ensuring the minimum requirements for using ENERVISTA MII Setup are met (see previous section), use the following procedure to install the ENERVISTA MII Setup from the enclosed GE ENERVISTA CD.

1. Insert the GE ENERVISTA CD into your CD-ROM drive.
2. Click the **Install Now** button and follow the installation instructions to install the no-charge ENERVISTA software.
3. When installation is complete, start the ENERVISTA Launchpad application.
4. Click the **IED Setup** section of the **Launch Pad** window.

Figure 1–3: ENERVISTA LAUNCH PAD WINDOW

5. In the ENERVISTA Launch Pad window, click the **Add Product** button and select the relay from the Install Software window as shown below. Select the “Web” option to ensure the most recent software release, or select “CD” if you do not have a web connection, then click the **Add Now** button to list software items for the corresponding relay model.

1

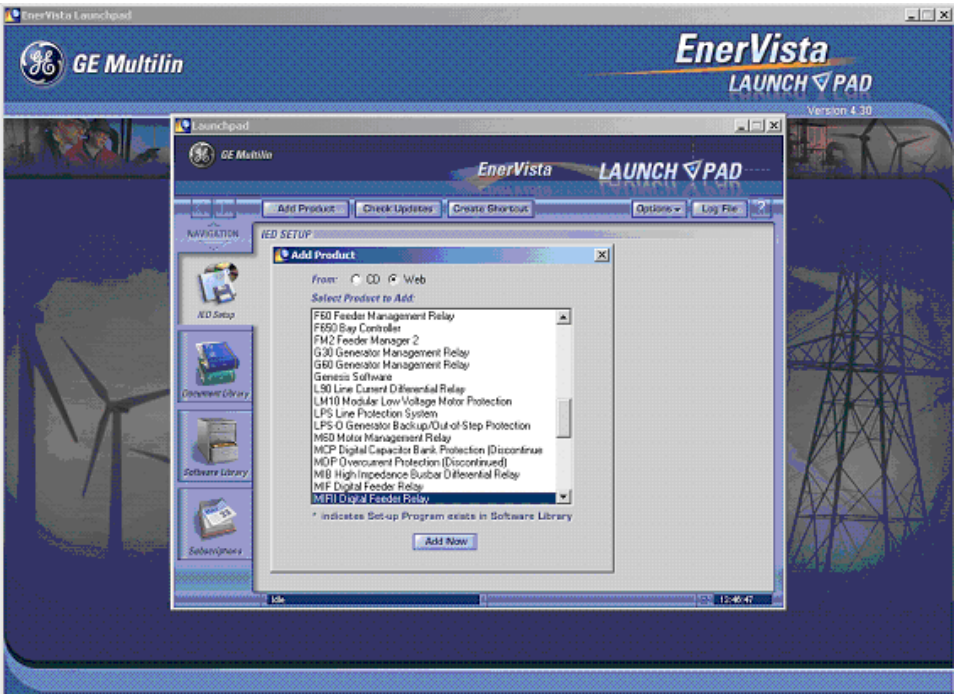


Figure 1–4: ADD PRODUCT

6. If “Web” option is selected, choose from the list the software program related to the specific model and click the **Download Now** button to obtain the installation program.

7. When ENERVISTA detects that there is already a version of the program in the Software Library, you can choose whether to install it directly or to check for more versions.

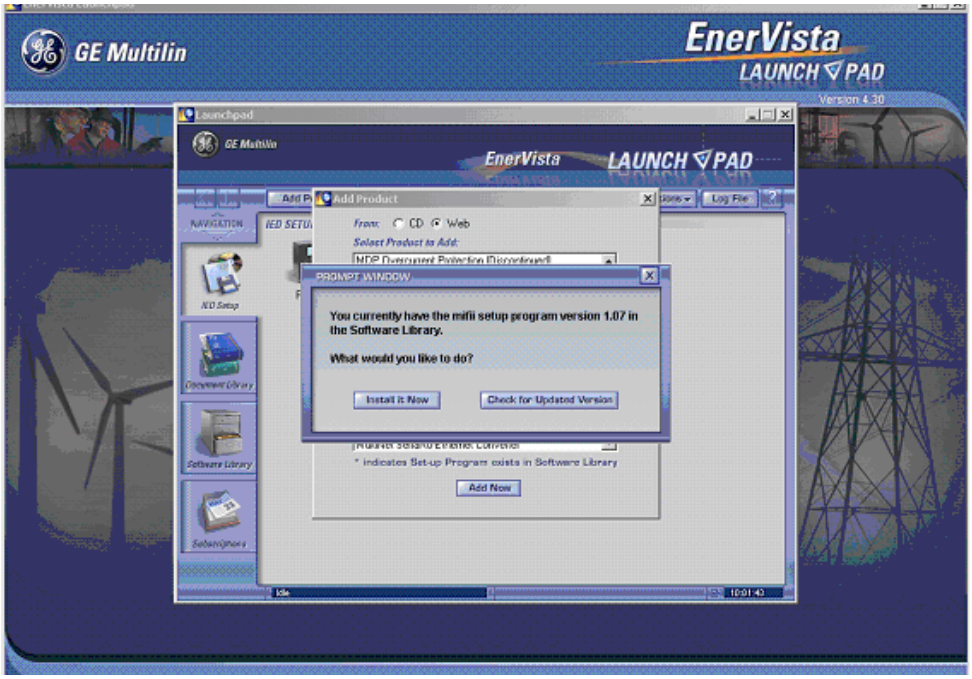
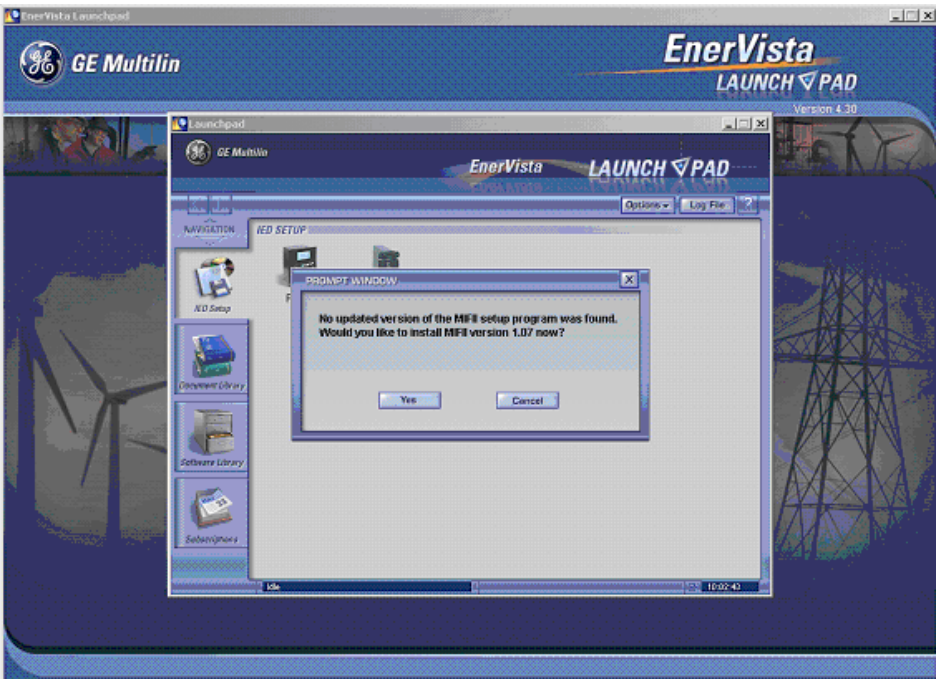
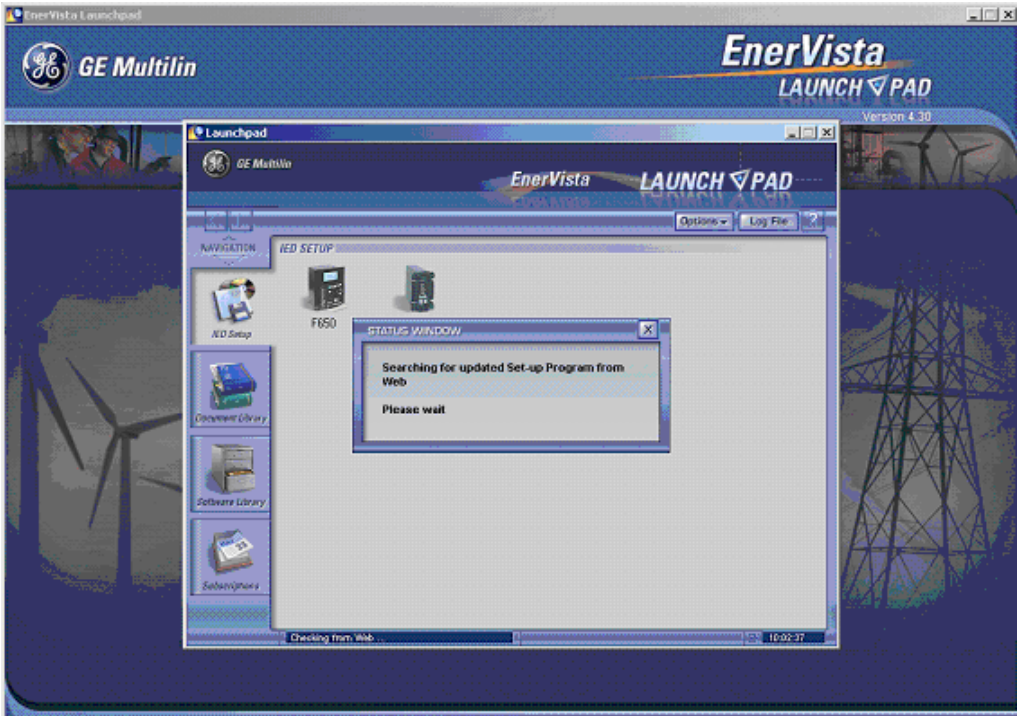


Figure 1–5: CHECK FOR UPDATED VERSIONS?

8. If we click the “Check for Updated Versions” button, the program will proceed to search for the different versions of set-up program from the Web.



9. ENERVISTA Launchpad will obtain the installation program from the Web. If the version you already have is the last one on the Web, the following screen will appear



10. If there were more versions on the Web, ENERVISTA will then show the user the different setup programs available for upgrade, with their version, size and release date.
11. Double-click the installation program once its download is complete, to install the EnerVista MII SETUP software.
12. Select the complete path, including the new directory name, where the EnerVista MII SETUP will be installed.

13. Click on **Next** to begin the installation. The files will be installed in the directory indicated and the installation program will automatically create icons and add EnerVista MII SETUP to the Windows start menu.
14. Follow the on-screen instructions to install the EnerVista MII SETUP software. When the **Welcome** window appears, click on **Next** to continue with the installation procedure.

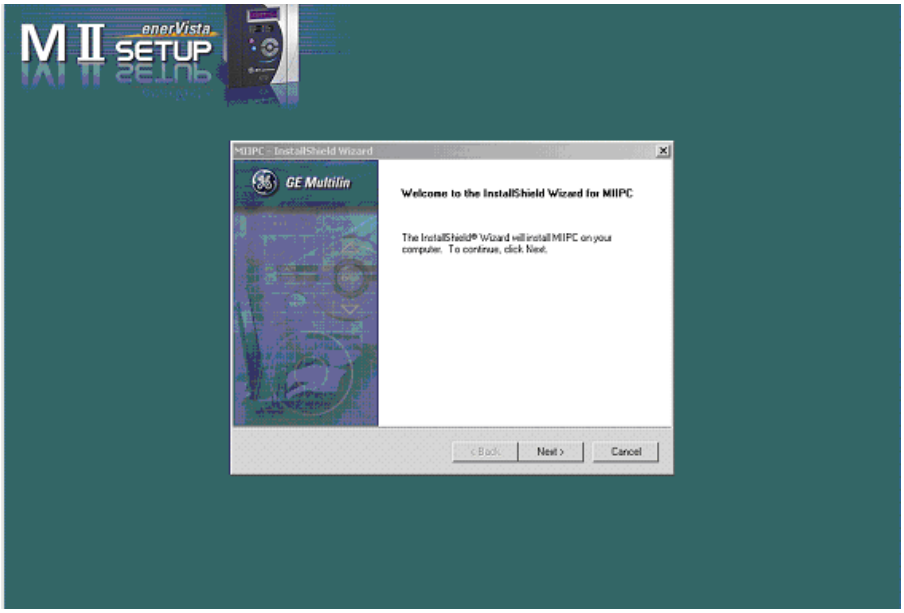


Figure 1–6: WELCOME TO INSTALLATION WINDOW

15. When the **Choose Destination Location** window appears, and if the software is not to be located in the default directory, click **Change…** and type in the complete path name including the new directory name and click **Next** to continue with the installation procedure.

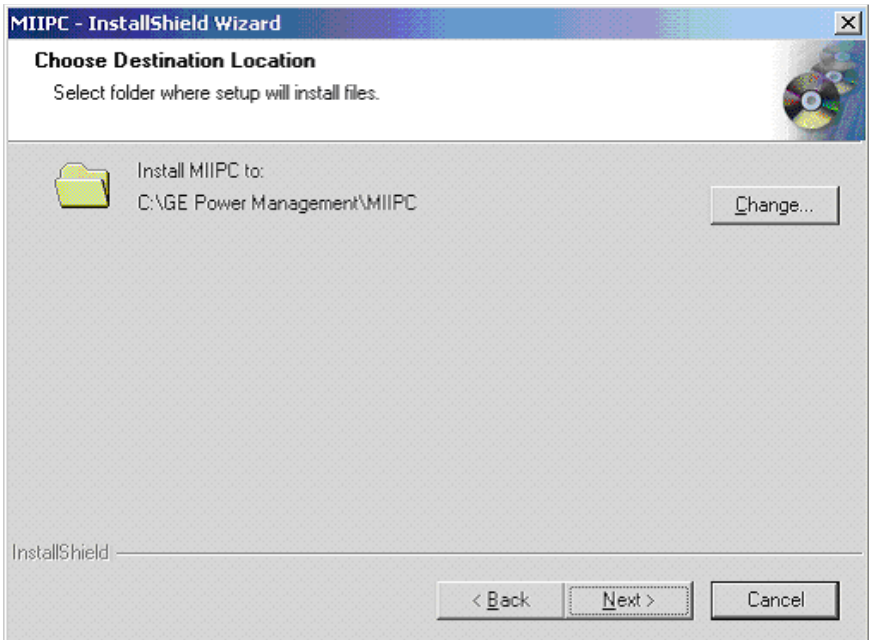


Figure 1–7: CHOOSE DESTINATION LOCATION WINDOW

16. The default program group where the application will be added to is shown in the **Selected Program Folder** window. Click **Next** to begin the installation process, and all the necessary program files will be copied into the chosen directory.

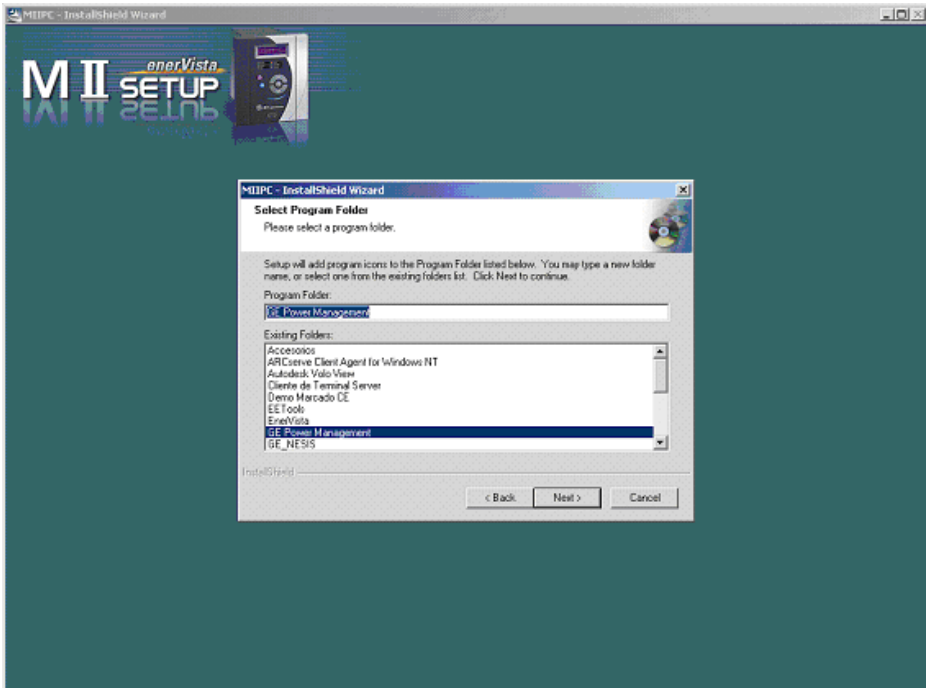


Figure 1–8: PROGRAM FOLDER

17. To finish with the installation process, select the desired language for startup

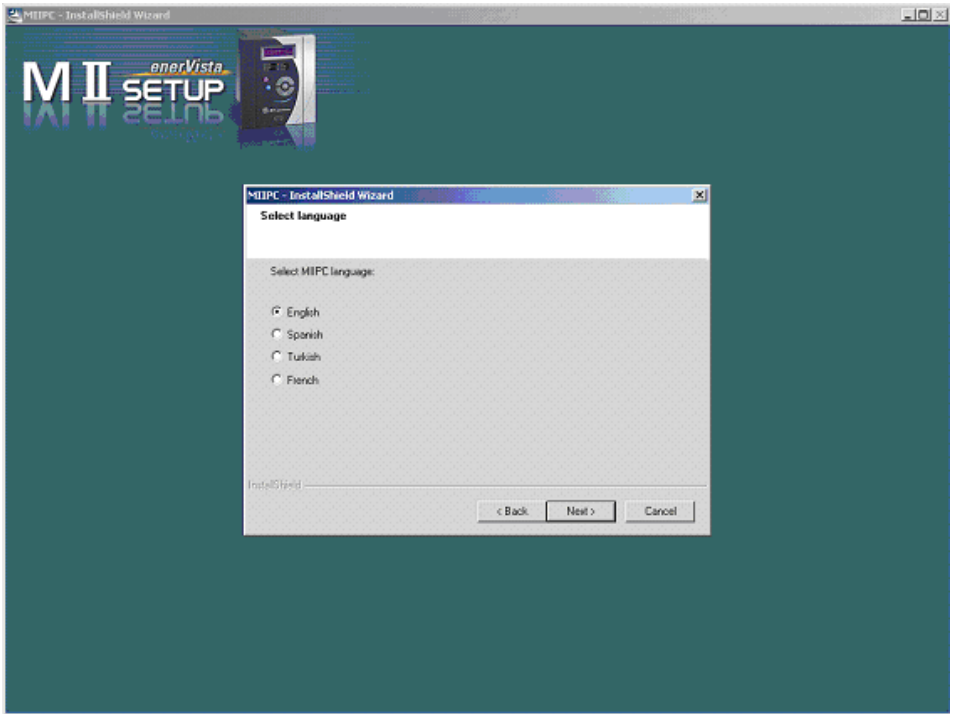


Figure 1–9: LANGUAGE SELECTION

18. Click **Finish** to end the installation. The MII device will be added to the list of installed IEDs in the ENERVISTA Launchpad window, as shown below.

1


EnerVista Launchpad
GE Multilin
EnerVista
LAUNCH PAD
Version 4.30
Launchpad
GE Multilin
EnerVista
LAUNCH PAD
Add Product
Check Updates
Create Shortcut
Options
Log File
NAVIGATION
IED SETUP
IED Setup
Document Library
Software Library
Subscriptions
F650
M Family
MII Family
Idle

1.3.1 MOUNTING & WIRING

Please refer to the HARDWARE chapter for detailed relay mounting and wiring instructions. Review all **WARNINGS and CAUTIONS.**

1.3.2 COMMUNICATIONS

The EnerVista MII SETUP software can communicate to the relay via the faceplate RS232 port, or the rear panel RS485 port. To communicate with the relay via the RS232 port, a standard “straight through” serial cable is used. The DB9 male end is connected to the relay and the DB9 or DB25 female end is connected to the PC COM1 or COM2 port as described in the HARDWARE chapter.

To communicate with the relay’s RS485 port from a computer’s RS232 port, a RS232/RS485 converter box is required. GE Multilin offers F485, DAC300 and RS232/485 converters. This converter box is connected to the computer using a “straight through” serial cable. A shielded twisted pair (20, 22 or 24 AWG; 0.25, 0.34 or 0.5 mm^2) cable is used to connect the converter box to the relay rear communication terminals. The converter box (-, +, GND) terminals are connected to the relay (SDA, SDB, GND) terminals respectively. For long communication cables (longer than 1 Km), the RS485 circuit must be terminated in a RC network (i.e. 120 ohm, 1 nF) as described in the HARDWARE chapter.

1.3.3 FACEPLATE KEYPAD & DISPLAY

Display messages are organized into menus under the main headings: Actual Values, Main Settings, Advanced Settings, Operations and Change Date&Time. A 5-key keypad and a 16x2 character LCD display (shown below) are used as elementary local HMI.

Figure 1–10: RELAY KEYPAD AND DISPLAY

Using this keypad it is possible to access all the different menus in the relay and to view and change settings.

Figure 1–11: MOVING THROUGH THE HIERARCHICAL MENU (

As shown in Figure 1–11:, there are 3 hierarchical levels to access the information in the relay. The first level (Main screen) shows the current value for each phase (V_a, V_b,$V_{c,}$ V_n)

Pressing the Menu button accesses the second level. To access information within the same hierarchical level (horizontal movement), push the up/down arrow buttons. To access the third level push the "**Enter**" button when the desired heading is shown in the display.

To return back to the previous level (from the third to the second level, or from the second to the first one), push the "ESC/ RESET" button.

Refer to chapter 8, for more information on the use of the local keypad and display to access information and change settings.

PROTECTION

MIVII 1000

- Four voltage elements (over / under)
- Two neutral overvoltage elements
- One negative sequence overvoltage element (voltage unbalance)

MIVII 2000

- Four frequency elements (over / under)

MIVII 3000

- Four voltage elements (over / under)
- Two neutral overvoltage elements
- Two frequency elements (over / under)
- One negative sequence overvoltage element (voltage unbalance)

CONTROL

- 2 Setting groups
- Open/close breaker operations

METERING

- Phase to ground voltages (if available)
- Phase to phase voltages
- Neutral voltage
- Negative sequence voltage
- Frequency

INPUTS/OUTPUTS

- 3 voltage inputs
- Two programmable digital inputs
- Four programmable outputs
- Fixed trip contact
- Ready contact available

COMMUNICATIONS

- Front RS232 port
- Rear RS485 port

USER INTERFACE

- 2x16 LCD Display
- 6 LEDs (4 programmable)

SECURITY

- Access password for setting changes
- Local access priority

OTHERS

- 1 Oscillography record
- 24 Event recorder

MIVII is a microprocessor-based protection relaydesigned for the following applications:

- Undervoltage and overvoltage protection and supervision for substations
- Undervoltage and overvoltage protection for Generators
- Undervoltage detection in busbar automatic transfer schemes
- Undervoltage, overvoltage and voltage unbalance protection for Motors
- Presence/lack of voltage condition monitoring in lines and busbars
- Ground fault protection for Generators through ground voltage supervision
- Ground fault monitoring for Lines with isolated group
- Load shedding schemes

Negligible over-travel and a high dropout to pick-up ratio (97% typical), along with the possibility of adjusting a time delay for the instantaneous elements, allow optimal coordination without compromising selectivity.

Both front RS232 port and rear RS485 port may be used to connect a PC for programming settings, monitoring actual values and for retrieving stored information (list of events, oscillography, etc.). All serial ports use the Modbus® RTU protocol and may be connected to system computers with baud rates from 300, 600, 1200, 4800, 9600 and 19200 bps. The rear RS485 port can be converted into an RS232 port or into a fiber optic (plastic or glass) serial port by using GE Multilin **DAC300, F485** or **RS232/485** module, or any other standard converter. The EnerVista MII SETUP communication software is the Windows® based program used to communicate with the relay. A password system has been implemented to restrict setting changes to non-authorized users, both by relay keypad and PC software.

MIVIIuses flash memory technology, which allows field upgrades (through EnerVista MII SETUP software) as new features are added. Upgrades can only be performed through the communications port on the front of the unit.

The following one line (single line) diagram (Figure 2–1:) illustrates the relay functionality using ANSI (American National Standards Institute) device numbers.

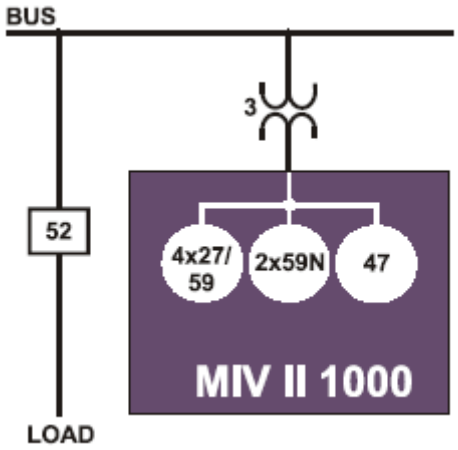


Figure 2–1: MIVII 1000 FUNCTIONAL BLOCK DIAGRAM

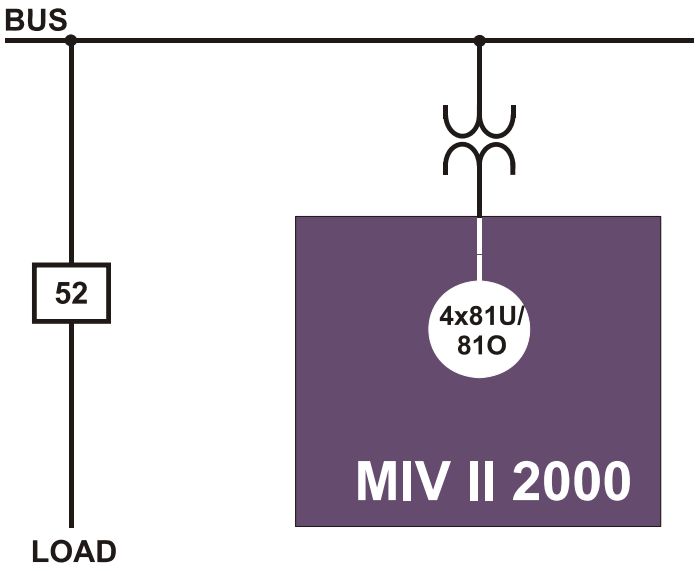


Figure 2–2: MIVII 2000 FUNCTIONAL BLOCK DIAGRAM

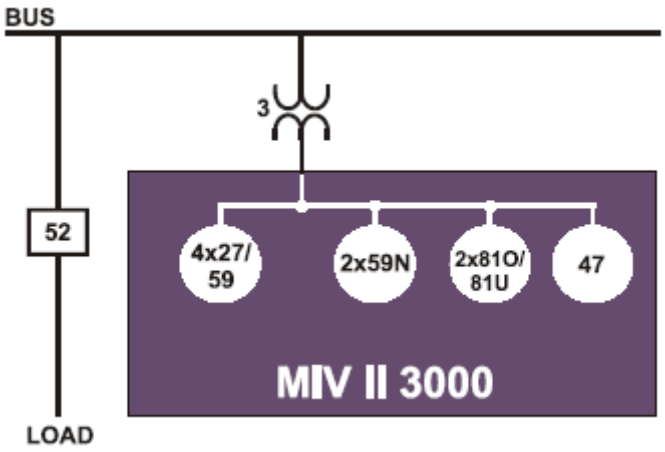


Figure 2–3: MIVII 3000 FUNCTIONAL BLOCK DIAGRAM

MII family relays have several security features to restrict rear port operation when an operator is making changes by the local port or relay keypad, and/or to block access to setting changes for non-authorized users.

The relay has an access priority system, giving priority to local access over remote access. The access mode is **Local** either when the relay display is inside MAIN SETTINGS, ADVANCED SETTINGS or OPERATIONS menu, or when the front port (RS232) communication is established. When the access is local by the RS232 port, the back port is disabled and the relay will not serve any petition or command sent by the rear port. When the access is local by keypad, the back port is not disabled, and actual values can be read, but setting changes and operations will not be allowed by the back port.

Setting changes, either by keypad and display or by communications, are **password protected**: the user has to enter a password to change any setting. When the password is entered, the password protection is disabled and the user can change any setting freely. Thirty minutes after the last setting change performed, or when the ESC/RESET key is pressed for three seconds or more, the relay returns automatically to the password protected status and will ask for the password again if a new attempt to change settings is made.

MIVII incorporates three independent voltage inputs, that can be connected as:

- MIVII 1000: Phase-to-phase, phase-to-ground, single phase or neutral voltage. In case of using single phase or neutral voltage, only VII input must be connected.
- MIVII 2000: Only VII input must be connected as is the input used to measure frequency
- MIVII 3000: Phase-to-phase or phase-to-ground voltages

In order to adequate the relay operation to the desired type of connection, it is requested to set the APPLICATION value in the GENERAL SETTINGS (please refer to section 5-2-1).

2.4.1 VOLTAGE ELEMENTS (59/27)

MIVII incorporates, in models MIVII1000 and MIVII3000, four independent definite time voltage elements. Each of them can be enabled and set independently as overvoltage or undervoltage functions, together with pickup and timing values.

In MIVII 1000 models, these elements can be used as one-phase protection. For this purpose it is necessary to apply voltage only to input VII. For use as three-phase protection, voltage must be applied to the three inputs (VI, VII and VIII). The operation mode, one-phase or three-phase is selected by a setting in the General Settings group.

The associated settings to each voltage element are the following:

Trip Enable

This setting allows enabling or disabling tripping. Disabling the tripping of a certain element involves disabling the general pickup due to the same element; however, it does not disable the element's pickup. This means that if the element pickup has been used for any output configuration, or programmable logic, these will be operational.

Pickup

This setting determines the voltage threshold from which the voltage element picks up starting the timer that will cause the trip. The range of this setting depends on the model, and the limits are as follows:

10.00 - 250.00 V in steps of 0.1 V for high range models.

2.00 - 60.00 V in steps of 0.1 V for low range models.

Function Type

This setting determines if the element works as an overvoltage or as an undervoltage function.

Minimum Voltage Level

If the element has been set as an undervoltage function, this setting determines the minimum voltage to operate. If the voltage falls below this value, the element is automatically disabled. Setting this value to 0, the element is all the time enabled.

Logic

If the element has been set as an undervoltage function and in General Settings-Application WYE CONNECTION or DELTA CONNECTION have been selected, this setting determines the number of necessary phases to trip. Selecting ANY PHASE, only one voltage in fault is necessary to trip; selecting TWO PHASE, two voltages in fault are necessary to trip; selecting ALL PHASE, three voltages in fault are necessary to trip.

Delay

This setting determines the time that must pass between the element pickup and the trip. If once the element has picked up and the timer has been started, voltage falls below the pickup level before the trip occurs, the timer will return to the stand-by status. If a new pickup occurs, the timer will restart from zero. The timing range is as follows:

0 - 600 sec in steps of 0.01 sec.

If this setting is adjusted to 0 sec., the relay will operate in less than 0,030 sec. The tripping time for higher values of the setting will be the set value plus less than 30 ms.

Breaker Supervision

In order to avoid undesired operation when the breaker is open, and the measuring transformer is located on the line side, the MIVII includes a breaker supervision feature that enables or disables the voltage element operation (set as undervoltage) by means of a setting when the breaker is open.

For the breaker supervision feature to operate, three conditions must be present:

The supervision feature must be enabled, by the corresponding setting

One of the relay digital inputs must be assigned the breaker status (52A or 52B)

The breaker status must be physically wired to the corresponding input

2.4.2 GROUND OVERVOLTAGE ELEMENT (59N)

MIVII incorporates, in models MIVII1000 and MIVII3000, two independent definite time ground overvoltage elements. Each of them can be enabled and set independently, both for pickup voltage and timing.

In MIVII 1000 models, depending on the operation mode selected in General Settings-Application, and on the type of connection, the ground overvoltage element will measure in different ways:

- If the selected operation mode is three-phase + ground (WYE CONNECTION), the relay will internally calculate the ground voltage from the voltage value in the three phases
- If the ground mode has been selected, the relay will measure the ground voltage on input VII.

In MIVII 3000 models, neutral voltage is always calculated.

The associated settings to each of the ground overvoltage elements are the following:

Trip Enable

This setting allows enabling or disabling the element trip. Disabling the tripping of a certain element involves disabling the general pickup due to the same element; however, it does not disable the element's pickup. This means that if the element pickup has been used for any output configuration, or programmable logic, these will be operational.

Pickup

This setting determines the voltage threshold from which the voltage element picks up starting the timer that will cause the trip. The range of this setting depends on the model, and the limits are as follows:

10.00 - 250.00 V in steps of 0.1 V for high range models.

2.00 - 60.00 V in steps of 0.1 V for low range models.

Delay

This setting determines the time that must pass between the element pickup and the trip. If once the element has picked up and the timer has been started, voltage falls below the pickup level before the trip occurs, the timer will return to the stand-by status. If a new pickup occurs, the timer will restart from zero. The timing range is as follows:

0 - 600 sec in steps of 0.01 sec.

If this setting is adjusted to 0 sec., the relay will operate in less than 0,030 sec. The tripping time for higher values of the setting will be the set value plus less than 30 ms.

2.4.3 VOLTAGE UNBALANCE ELEMENT (47)

MIVII1000 and MIVII3000 incorporate a voltage unbalance element. This element is based on the negative sequence of the phase-to-ground voltage values, and therefore it is only enabled in the cases where the selected operation mode (application) is WYE connection.

The associated settings to the voltage unbalance element are the following:

Trip Enable

This setting allows enabling or disabling the element trip. Disabling the tripping of a certain element involves disabling the general pickup due to the same element; however, it does not disable the element's pickup. This means that if the element pickup has been used for any output configuration, or programmable logic, these will be operational.

Pickup

This setting determines the voltage threshold that must be over passed for the voltage element to pickup, starting the timer that will cause the trip. This setting has the following limits:

2.00 - 60.00 V in steps of 0.1 V.

Delay

This setting determines the time that must pass between the unbalance element pickup and the trip. If once the element has picked up and the timer has been started, voltage falls below the pickup level before the trip occurs, the timer will return to the stand-by status. If a new pickup occurs, the timer will restart from zero. The timing range is as follows:

0 - 600 sec in steps of 0.01 sec.

If this setting is adjusted to 0 sec., the relay will operate in less than 0,030 sec. The tripping time for higher values of the setting will be the set value plus less than 30 ms.

MIVII incorporates different optional frequency elements depending on the model.

2.5.1 FREQUENCY ELEMENT (81)

MIVII2000 incorporates four independent definite time frequency elements, and MIVII3000 includes two elements. Each of these elements can be independently configured as under or overfrequency. In all cases, frequency is measured using the voltage input VII, so if this input is not connected, the measured frequency will be 0 Hz.

Each frequency element is supervised by an undervoltage element that can be set independently. This means that if voltage at input VII falls below the value adjusted in this setting, the frequency element will be immediately blocked.

With voltage applied the frequency element requires three consecutive cycles below the setpoint to operate. If there is no voltage applied to the relay initially and voltage is then applied with a frequency under the setpoint (eg during testing), it takes an additional 5 cycles to start measuring frequency, resulting in a total operating time of 8 cycles.Associated settings are as follows:

Trip Enable

This setting allows enabling or disabling the frequency element. Disabling the tripping of a certain element involves disabling the general pickup due to the same element; however, it does not disable the element's pickup. This means that if the element pickup has been used for any output configuration, or programmable logic, these will be operational.

Pickup

This setting determines the frequency threshold that must be exceeded (above or below, depending on whether it is an over or underfrequency element) for the frequency element to pickup, starting the timer that will cause the trip.

This setting has the following limits:

42.00 – 67.50 Hz in steps of 0.1 Hz for all models.

Type of Element

With this setting we can select the element to operate as overfrequency or underfrequency.

Delay

This setting determines the time that must pass between the frequency element pickup and the trip. If once the element has picked up and the timer has been started, frequency varies and goes out of the tripping range, before the trip occurs, the timer will return to the stand-by status. If a new pickup occurs, the timer will restart from zero. The timing range is as follows:

0 - 600 sec in steps of 0.01 sec.

If this setting is adjusted to 0 sec., the relay will operate in less than 0,2 sec. The tripping time for higher values of the setting will be the set value plus less than 200 ms.

Voltage Supervision:

This value determines the voltage value at input VII, under which the frequency element is blocked. The ranges for this setting are as follows:

10.0 – 60.0 V in steps of 0.1V for low range

30.0 – 250.0 V in steps of 0.1V for high range

MIVII stores an historical record with the last 24 events. Each event contains the event description, date and time (4 ms accuracy), the current values in phases and ground at that moment, and a summary of the status signals that can produce events, and whether they were active or not in that moment.

In EnerVista MII SETUP there is an "**EVENTS**" menu, where the user can check how many events have been produced since the last time the Events were deleted. If the number of events produced is higher than 24 (maximum number of events stored), this means that only the last 24 will be stored.

This event record is stored in a capacitor backed up RAM memory. Events functionality in MIVII is performed via the EnerVista MII SETUP software.

Inside the ADVANCED SETTINGS group, there is a sub-group called EVENT MASKS, from where the different causes that can produce events can be masked. They are detailed in the SETPOINT – SETPOINT – ADVANCED SETTINGS – EVENT MASK section. The following table shows a list of all possible events.

Table 2–1: LIST OF EVENTS

DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
Voltage P1 pickup / drop out	X		X
Voltage P2 pickup / drop out	X		X
Voltage P3 pickup / drop out	X		X
Voltage P4 pickup / drop out	X		X
59N1 pickup / drop out	X		X
59N2 pickup / drop out	X		X
47 pickup / drop out	X		X
81_1 pickup / drop out		X	
81_2 pickup / drop out		X	
81_3 pickup / drop out		X	
81_4 pickup / drop out		X	
Voltage P1 trip enable / disable by digital input	X		X
Voltage P2 trip enable / disable by digital input	X		X
Voltage P3 trip enable / disable by digital input	X		X
Voltage P4 trip enable / disable by digital input	X		X
59N1 trip enable / disable by digital input	X		X
59N2 trip enable / disable by digital input	X		X
47 trip enable / disable by digital input	X		X
81_1 trip enable / disable by digital input		X	X
81_2 trip enable / disable by digital input		X	X
81_3 trip enable / disable by digital input		X	
81_4 trip enable / disable by digital input		X	
Trip enable / disable by digital input	X	X	X
Voltage P1 trip	X		X
Voltage P2 trip	X		X
Voltage P3 trip	X		X
Voltage P4 trip	X		X
59N1 trip	X		X
59N2 trip	X		X
47 trip	X		X
81_1 trip		X	X
81_2 trip		X	X
81_3 trip		X	
81_4 trip		X	
General trip	X	X	X
Protection status in service / out of service	X	X	X

Table 2–1: LIST OF EVENTS

Output 1 active / non active	X	X	X
Output 2 active / non active	X	X	X
Output 3 active / non active	X	X	X
Output 4 active / non active	X	X	X
Digital input 1 active / non active	X	X	X
Digital input 2 active / non active	X	X	X
Settings change disabled by digital input active / non active	X	X	X
Trip operation by digital input	X	X	X
Trip operation by command	X	X	X
Reset latched auxiliary outputs	X	X	X
Breaker 52B open / closed	X	X	X
Breaker 52A open / closed	X	X	X
Breaker open / closed	X	X	X
Settings group change by digital input	X	X	X
Oscillo trigger by digital input	X	X	X
Oscillo trigger by comm.	X	X	X
Settings Change	X	X	X
EEPROM failure	X	X	X
User settings / default settings	X	X	X

MIVII1000/3000 stores an oscillography record, with a resolution of 8 samples per cycle with a length of 24 cycles (including 2 pre-fault cycles), with the following information:

Instantaneous values of phase . The 2 first cycles are pre-fault cycles.

- Digital information:
  - •Pickups (protection functions)
  - •Trip inhibition by digital input (protection functions)
  - •Trips (protection functions)Ready (protection in service)
  - •Auxiliary digital outputs
  - •Digital inputs
  - •Breaker 52A, Breaker 52B, (status of the digital inputs)
  - • roup 2 selection by digital input
  - •EEPROM failure
  - •Default settings/User settings
  - •Protection functions:

    MIVII1000: P1, P2, P3, P4, 59N1, 59N2, 47

    MIVII3000: P1, P2, P3, P4, 59N1, 59N2, 47, 81_1, 81_2
- Date and time
- Model
- Number of oscillo
- VI, VII, VIII voltages and frequency values
- Active setting group at the moment of the oscillography trigger
- Element settings when retrieving the oscillography record.

MIVII2000 stores an oscillography record, with a resolution of 2 samples per cycle with a length of 432 cycles (the 36 first being pre-fault cycles), with the following information:

- Instantaneous values of voltages (VI, VII, VIII) and frequency (f). The 36 first cycles are pre-fault cycles.
- Digital information:
  - •Pickups (81 functions)
- Trips (81 functions)
- Date and time
- Model
- Number of oscillo
- VI, VII, VIII voltages and frequency at the moment of the oscillography trigger
- Active setting group at the moment of the oscillography trigger
- Element settings when retrieving the oscillography record.

The number of oscillo is a circular counter that increases with each generated oscillography. This value appears on the relay status and is used only for informative purposes.

The oscillography record is stored in a capacitor backed up RAM memory.

MIVII functionality related to oscillography is performed from the ENERVISTA MII SETUP program. The oscillography record obtained is stored on the PC in a COMTRADE-IEEE C37.111-1991 format.

There are four possible causes that can produce an oscillography trigger:

1. Pickup of one of the protection functions
2. Trip of one of the protection functions
3. Oscillography trigger by communications
4. Oscillography trigger by digital input

In the ADVANCED SETTINGS group, there is a sub-group called OSCILLOGRAPHY MASKS, from where the above-mentioned causes can be masked. They are detailed in the SETPOINT – SETPOINT – ADVANCED SETTINGS – OSCILOGRAPHY MASK section.

Two independent Setting Groups are available in the permanent (non-volatile) memory of the MIVII relay. Only one of the two is active at a given time. Users can select which setting group is active using a setting, sending a command to the relay from the communications program, or by a digital input.

Settings are divided in two different categories: Main Settings and Advanced Settings. This makes setting the relay extremely simple for those users who want to use just the Main functions of the MIVII relay. Users who require the full functionality of the relay can use the Advanced Settings.

2.9.1 MEASUREMENT

MIVII provides actual values for phase and ground voltages and frequency, depending on the model

DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
Phase A voltage	X		X
Phase B voltage (VII in MIVII 2000)	X	X	X
Phase C voltage	X		X
Phase AB voltage	X		X
Phase BC voltage	X		X
Phase CA voltage	X		X
Neutral voltage	X		X
Negative Sequence voltage	X		X
Frequency	X	X	X

2.9.2 SELF-TEST

Self-monitoring tests are carried out both when the unit is started up and during normal operation. Any internal problem detected by the self-monitoring function will issue an alarm and the READY output contact will be released, indicating an out of service condition.

There are 6 LED Targets in the front of the relay. The first one is green ('READY' -relay in service-) and cannot be configured; the second one is red and fixed for trip, while the other 4 can be configured by the user. The default configuration of the LEDs is shown in the following figure.

Figure 2–4: MIVII LEDS DEFAULT CONFIGURATION

It is possible to configure the color of the 4 configurable LEDs between red and green using the keypad of the front panel of the relay (for details, refer to Chapter 8).

The indication of each LED is as follows:

READY: The relay is powered up, its power supply is receiving Vdc or Vac, and all the internal circuits are working properly. The relay status setting is set as "RDY" (ready) and at least one of the protection functions is enabled. If the LED is off with the above-mentioned conditions, this indicates a loss of auxiliary supply voltage or an internal HW/SW critical failure condition. Latched LED.

TRIP: The relay has issued a trip, activating the corresponding tripping output contact. Latched LED.

PHASE VOLT: Indicates that the trip has been issued by one of the Phase Protection Latched LED.

GROUNDVOLT: Indicates that the trip has been issued by one of the Ground Fault Protection ElementsLatched LED.**PICKUP:** Indicates that at least one of the protective elements has picked up. Not latched LED.

FREQUENCY: Indicates that the trip has been issued by one of the Frequency Protection Elements. Latched LED.

FREQ. UNIT 1: Trip issued by the 81-1 element. Latched LED.

FREQ. UNIT 2: Trip issued by the 81-2 element. Latched LED.

FREQ. UNIT 3: Trip issued by the 81-3 element. Latched LED.

FREQ. UNIT 4: Trip issued by the 81-4 element. Latched LED.

UNDERVOLTAGE: Trip issued by any voltage element set as undervoltage. Latched LED.

OVERVOLTAGE: Trip issued by any voltage element set as overvoltage. Latched LED.

GND OVERVOLTAGE: Trip issued by any voltage element set as overvoltage. Latched LED.

LEDs associated to tripping functions are latched and once they have been turned on, they remain on until the ESC/RESET button is pressed for more than 3 seconds (RESET) providing that the trip condition has disappeared. The LED associated to *function pickup* is self-reset type, and stays on while the pickup condition (current above setting) exists.

2.10.2 KEYPAD AND DISPLAY

A five-button keypad allows access to MIVII relay information and settings changes. Measurement data (actual values), five last trip information (fault reports) and settings are shown on the 16x2 character LCD display.

The keypad includes the functionality to modify the contrast of the display (refer to Chapter 8 for details).

The event list, oscillography, I/O and logic configuration can be accessed only from the EnerVista MII SETUP program.

2.10.3 COMMUNICATION PORTS

The front RS232 and the rear RS485 port provide interface with the relay. All serial ports use the Modbus® RTU protocol and may be connected to system computers with baud rates from 300 to 19200 bps. Up to 32 MIVII relays can be connected (daisy-chained) on the same communication circuit. Each relay must be assigned a different Modbus Address (using a setting) if multiple relays are connected on the same circuit.

2.10.4 SOFTWARE

MIVII units are supplied together with EnerVista MII SETUP software, a Windows® based software that allows communication with the relay for data viewing and retrieval, as well as oscillography, I/O configuration and logical configuration (in models where these features are available).

MIVII is supplied as 4U high and ¼ of a 19” rack wide. MIVII relays can be mounted in ¼ rack cases, one relay per case.

The information required to completely specify the relay is provided in the following table:

MIVII	-	0	-	0	-	0	0	-	0	0	DESCRIPTION
											Function
	1										Voltage functions
	2										Frequency functions
	3										Voltage and frequency functions
											Voltage Range
			0								10-250 V (all models)
			1								2-60 V (only MIVII1000)
											Relay language
					E						English
					F						French
											Power Supply
								LO			24-48 Vdc (Range: 19~58 Vdc)
								HI			110-250 Vdc (Range: 88~300 Vdc) 110-230 Vac (Range: 88~264 Vac)
									0	0	Standard Model
									1	2	Special model 12 (*)

(*): Please refer to addendum MIVII AD 12 for further information on Special Model 12

ACCESSORIES

A depth-reducing collar can be ordered separately. This collar reduces the mounting depth in 63 mm (2.48 inches).

S1/S2 case adapting collar. This collar provides retrofit solution for installations that have electromechanical relays with S1/S2 case, such as IAC, etc.

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE

2.12.1 PROTECTION ELEMENTS

2.12.1.1 VOLTAGE ELEMENTS (P1, P2, P3, P4)

Voltage:	Phasor
Function Type:	Overvoltage or Undervoltage selected by setting
Pickup Level:	10.0 to 250.0 in steps of 0.1 V for range 0 models (High range)
	2.0 to 60.0 V in steps of 0.1 V for range 1 models (Low range)
Dropout Level:	97% (typical) of the pickup value for overvoltage
	103% (typical) of the pickup value for undervoltage
Level Accuracy:	±3% in the complete range ±1mA
Timer:	0.00 to 600.00 sec. in steps of 0.01 s
Reset type	Instantaneous
Operation time	< 30 ms at 1.20 x pickup @ 50 Hz
Timing Accuracy	± 3% of operate time or ±30ms (whichever is greater)
Supervision	By minimum voltage (level selected by setting)
	By breaker position (enabled by setting)
Reset Time	One power cycle (typical)

2.12.1.2 GROUND OVERVOLTAGE ELEMENT (59N1, 59N2)

Voltage:	Measured or calculated depending on Application
Pickup Level:	10.0 - 250.0 V in steps of 0.1V for range 0 models
	2.0 – 60.0V in steps of 0.1V for range 1 models
Dropout Level:	97% (typical) of the pickup value
Level Accuracy:	±3% in the complete range.
Operation time:	< 30 ms at 1.20 x pickup @ 50 Hz
Timer:	0 – 600 s in steps of 0.01 s
Reset Type:	Instantaneous
Timing Accuracy:	±3% of operation time or ±30 ms. (whichever is greater)
Reset Time	One power cycle (typical)

2.12.1.3 VOLTAGE UNBALANCE ELEMENT (47)

Voltage:	Negative sequence calculated from phase voltages
Pickup Level:	2.0 - 60.0 V in steps of 0.1 V
Dropout Level:	97% (typical) of the pickup value
Level Accuracy:	±3% in the complete range.
Operation time:	< 30 ms at 1.20 x pickup @ 50 Hz
Timer:	0 – 600 s in steps of 0.01 s
Reset Type:	Instantaneous

2.12.1.3 VOLTAGE UNBALANCE ELEMENT (47)

Timing Accuracy:	±3% of operation time or ±30 ms. (whichever is greater)
Reset Time	One power cycle (typical)

2.12.1.4 FREQUENCY ELEMENTS (81_1, 81_2, 81_3, 81_4)

Function Type:	Underfrequency or overfrequency selected by setting.
Pickup Level:	42.0 - 67.5 Hz in steps of 0.1 Hz.
Level Accuracy:	±10 mHz
Dropout Level:	± 40 mHz of the pickup value
Timer:	0 - 600 s in steps of 0.01 s
Reset Type:	Instantaneous
Timing Accuracy:	±3% of operation time + measuring time
Measuring Time:	Three successive cycles below underfrequency setpoint or three successive cycles above overfrequency setpoint.
Supervision Voltage Level:	30 - 250 V in steps of 0.1 V (range 10 - 250 V)

2.12.2 METERING FUNCTIONS

2.12.2.1 FUNDAMENTAL VOLTAGE

Accuracy:	±1% typical±3% in the complete range

2.12.2.2 FUNDAMENTAL CURRENT VOLTAGE

Accuracy:	±10 mHz

2.12.3 INPUTS

2.12.3.1 AC VOLTAGE

High Range

Secondary Rated Current:	50-240 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	440 Vac continuously

Low Range

Secondary Rated Current:	20-60 Vac
Frequency:	50 / 60 Hz ±3 Hz (The unit can be set to 50 or 60 Hz)
Relay Burden:	< 0.2 VA @ 120 Vac
Voltage Withstand:	250 Vac continuously

2.12.3.2 DIGITAL INPUTS

High Range

Voltage Threshold:	
Maximum Voltage:	75 Vdc
Relay Burden:	300 Vdc
Low Range	5 mA @ 300 Vdc
Voltage Threshold:	
Maximum Voltage:	12 Vdc
Relay Burden:	57 Vdc
	2 mA @ 57 Vdc

2.12.4 POWER SUPPLY

2.12.4.1 LOW RANGE

Rated DC Voltage:	24 to 48 Vdc
Min./Max. DC Voltage:	19 / 58 Vdc

2.12.4.2 HIGH RANGE

Rated DC Voltage:	110 to 250 Vdc
Min./Max. DC Voltage:	88 / 300 Vdc
Rated AC Voltage:	110 to 230 Vac @ 48 - 62 Hz
Min./Max. AV Voltage:	88 / 264 Vac @ 48 - 62 Hz
Power Consumption:	Max. = 10 W
Proper backup time (date, time and log memory) without power supply voltage	> 1 week
Fuse type:	1 A / 250 V

2.12.5 OUTPUTS

Inductive load: 0.30 A @ L / R 40 ms @ 125 Vdc

2.12.5.1 OUTPUT RELAYS

Configuration: 6 Electro-Mechanical Form C

Contact Material: Silver alloy suited for inductive loads

Maximum Operating Voltage: 400 Vac

Continuous Mode Current: 16 A at 250 Vac. general purpose

¾ HP, 124 Vac

1-1/2 HP, 250 Vac

10A, 250 Vac, 0.4 PF,

B300 pilot duty

Make and Carry: 30 A

Breaking: 4000 VA

Inductive load: 0.30 A @ L / R 40 ms @ 125 Vdc

Max. Ratings for 100.000 operations:

VOLTAGE	MAKE&CARRY CONTINUOUS	MAKE&CARRY 0.2 SEC	BREAK	MAX LOAD
DC Resistive				
24 Vdc	16 A	48 A	16 A	384W
48 Vdc	16 A	48 A	2.6 A	125W
125 Vdc	16 A	48 A	0.6 A	75 W
250 Vdc	16 A	48 A	0.5 A	125 W
AC Resistive				
120 Vac	16 A	48 A	16 A	1920 VA
250 Vac	16 A	48 A	16 A	4000 VA
AC Inductive PF = 0.4				
250 Vac	10 A	30 A	10 A	1000 VA

2.12.6 COMMUNICATIONS

FRONT PORT	RS232	300, 600, 1200, 2400, 4800, 9600 or 19200 bps, Modbus® RTU
REAR PORT	RS485	300, 600, 1200, 2400, 4800, 9600 or 19200 bps, Modbus® RTU

2.12.7 ENVIRONMENTAL

Operating Temperatures:	-20º C to +60º C
Ambient Storage Temperatures:	-40º C to +80º C
Maximum relative humidity	95%
Altitude	2000 m. Max
Pollution Degree	2

2.12.8 TYPE TESTS & CERTIFICATIONS

The MIVII system complies with the following standards, which include the standards required by Community Directive 89/336 for the CE marking, in line with European standards. It also complies with the European directive requirements for low voltage, and the environmental and operating requirements established in ANSI standards C37.90, IEC 255-5, IEC 255-6 and IEC 68.

STANDARD	DESCRIPTION	CLASS
ELECTROSTATIC COMPATIBILITY AND INSULATION		
EN 55011 (1991) / EN 61000-6-4 (2001)	Conducted and Radiated Emission	
EN 61000-6-2 (2001)		In the paragraph relating to electrostatic discharges, radiated RF fields, electrical fast transient, surge, injected RF signals and voltage dips and interruption immunity test
EN 55022 (1994)		Class A
EN 55011 (1991) / EN 61000-6-4 (2001)	Radiated Emisión Measurement	Group 1, Class A
ENV 50204 (1995)	Radiated Electromagnetic Fields with Frequency Modulation	10 V/m, 900 MHz
IEC 61000-4-2 (1995) / EN 61000-6-2 (2001)	Electrostatic Discharge Immunity Test	Level 4 CM (8 kV). Level 3 AM (8 kV)
IEC 61000-4-3 (1995) / EN 61000-6-2 (2001) / ENV 50204 (1995)	Radiated RF Fields Immunity Test	Level 3 (10 V/m), 80-1000 MHz.
IEC 61000-4-4 (1995)	Electrical Fast Transient Immunity Test	Level 4 (±4 kV except for communications terminals RS-485 and RS-232 where the level was ±2 kV) with a perfomance criteria A.
IEC 61000-4-5 (1995) / EN 61000-6-2 (2001)	Surge Immunity Test	Level 3 (±2kV CM, ±1kV DM)
IEC 61000-4-6 (1996) / EN 61000-6-2 (2001)	Injected RF Signals Immunity Test	Level 3 (10 V/m), 0.15 – 80 MHz.
IEC 61000-4-11 (1994) / EN 61000-6-2 (2001)	Voltage Dips and Interruptions Immunity Tetst	Duration and Voltage described in the related report.
IEC 60255-22-1 (1988)	1 MHz Burst Disturbance Test	Level 3 (±2.5 kV in common mode and ± 1 kV in differential mode) in the I/O terminals specified in paragraph 4.2 of the corresponding report.
IEC 61000-4-8 (1993) / IEC 61000-4-8 (1993)	50 Hz Magnetic Fields Immunity Test	Level 5 (100 A/m for continuous applications and 1000 A/m for transient applications) with a performance criteria A.
IEC 60255-5 (1977)	Measurement of Insulation Resistance	In the paragraph relating to insulation resistance for all groups defined in paragraph 4 of the report.
IEC 60255-5 (1977)	Impulse Voltage Test	In the paragraph relating to impulse voltage test for ±5 kV applicatios in common mode and ± 1 kV in differential mode (class III) for all the groups defined in paragraph 4 of the correspond report.
IEC 60255-5 (1977)	Dielectric Test	In the paragraph relating to dielectric test for 2 kV, 50 Hz applications for all the groups defined in paragraph 4 of the correspond report.
IEC 60255-11 (1979)	to DC power interruptions	In the paragraph relating to DC power interruptions for the duration described in the corresponding report.
CLIMATIC TESTS		
IEC 60068-2-1 (1990) + A1(1992) + A2(1994)	Test Ad	Cold

IEC 60068-2-2 (1974) + A1(1993) + A2(1994)	Test Bd	Dry Heat
MAKE AND CARRY		
ANSI C37-90:1990	Make and Carry	
VIBRATION, SHOCK AND BUMPS		
IEC 60255-21-1 (1998)	Sinusoidal vibration / Vibration endurance Test	Class I
IEC 60255-21-2 (1998)	Shock response / Shock strength / Bumps Test	Class I

2.12.9 PRODUCTION TESTS

Insulation Test:	IEC255-5 (Tested on CTs, Power Supply terminals, Contact Inputs and Contact Outputs)

2.12.10 APPROVALS

Manufactured under an ISO9001 Registered system

CE Marking

UL listed

WARNING

The system incorporates electronic components that might be affected by electrostatic discharge currents flowing through certain component terminals. The main source of electrostatic discharges is human body, especially under low humidity conditions, with carpet floors or isolating shoes. If such conditions are present special care should be taken while manipulating MIVII modules. Operators, before even touching any components, must make sure that their bodies are not charged by either touching a grounded surface or by using an antistatic grounded wrist bracelet.

units are made up of different modules, such as:

CPU, which includes the power supply, inputs and outputs.

Magnetic module with 4 current transformers(3 for phases and 1 for ground)

Front module with 16x2 LCD display. It also includes the front RS232 communication port.

Figure 3–1: MIVII FRONT VIEW

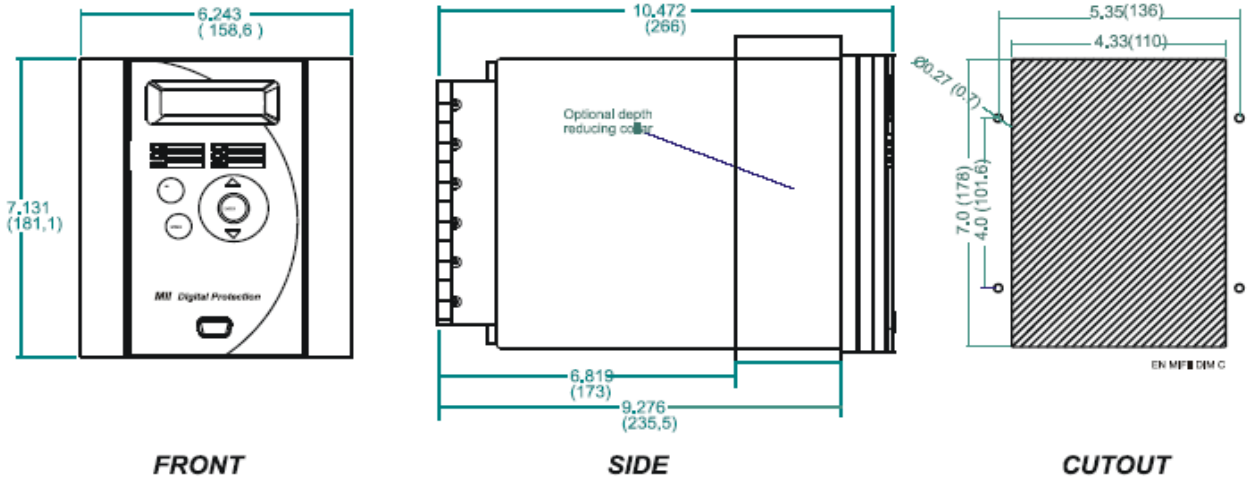
3.1.1 MECHANICAL DESCRIPTION

The metallic case of the unit is highly resistant to corrosion. It is made of stainless steel (AISI 304), coated with an epoxy layer, and the rest of the metallic pieces are covered with a high quality resistive coating that has successfully passed at least 96 hours in the salt spray chamber (S/N ASTM B-117).

The front of the relay is made of a shielded high quality thermoplastic, flame retardant (V0), highly resistive material, which guarantees the unit's immunity to all types of EMI/RFI/ESD interference. As well, an IP52 (IEC 529) protection degree against dust and water through the front and with the relay mounted in the panel.

The modular design of the relay simplifies repair or replacement of its components, without the need to manipulate the wiring. These types of operations must be performed exclusively by qualified personnel and only after removing auxiliary voltage from the unit.

The unit is designed for semi-flush mounting. The relay is secured to the panel with the 4 M6 screws provided with the unit. This allows the user access to the front keypad, display and communication port. The wiring is at the rear of the unit. The drilling dimensions are shown on the drilling dimension diagram.



Note: Dimensions are shown in inches (mm).

Figure 3–2: MOUNTING AND DIMENSIONS DRAWING FOR MODELS WITH DEPTH REDUCING COLLAR

3.1.3 REAR DESCRIPTION

The relay is wired through the terminal blocks located at the rear of the unit. In this terminal board, current terminals are shorted two-by-two when the transformer module is extracted, so that the CT secondary never remains open.

Figure 3–3: REAR VIEW

A grounded antistatic wristband must be used when manipulating the module in order to avoid electrostatic discharges that may cause damage to the electronic components.

In a similar way, when mounting and dismounting the front of the unit, be sure to correctly align the DIN connector of the rear bus with the DIN connectors of the module. A slow and careful insertion must be made until the module is correctly aligned, and then a more firm insertion can be applied, never forcing the module.

Recommended cable section: 12/16 AWG.

Copper conductor only.

Tightening torque: 1.2 Nm.

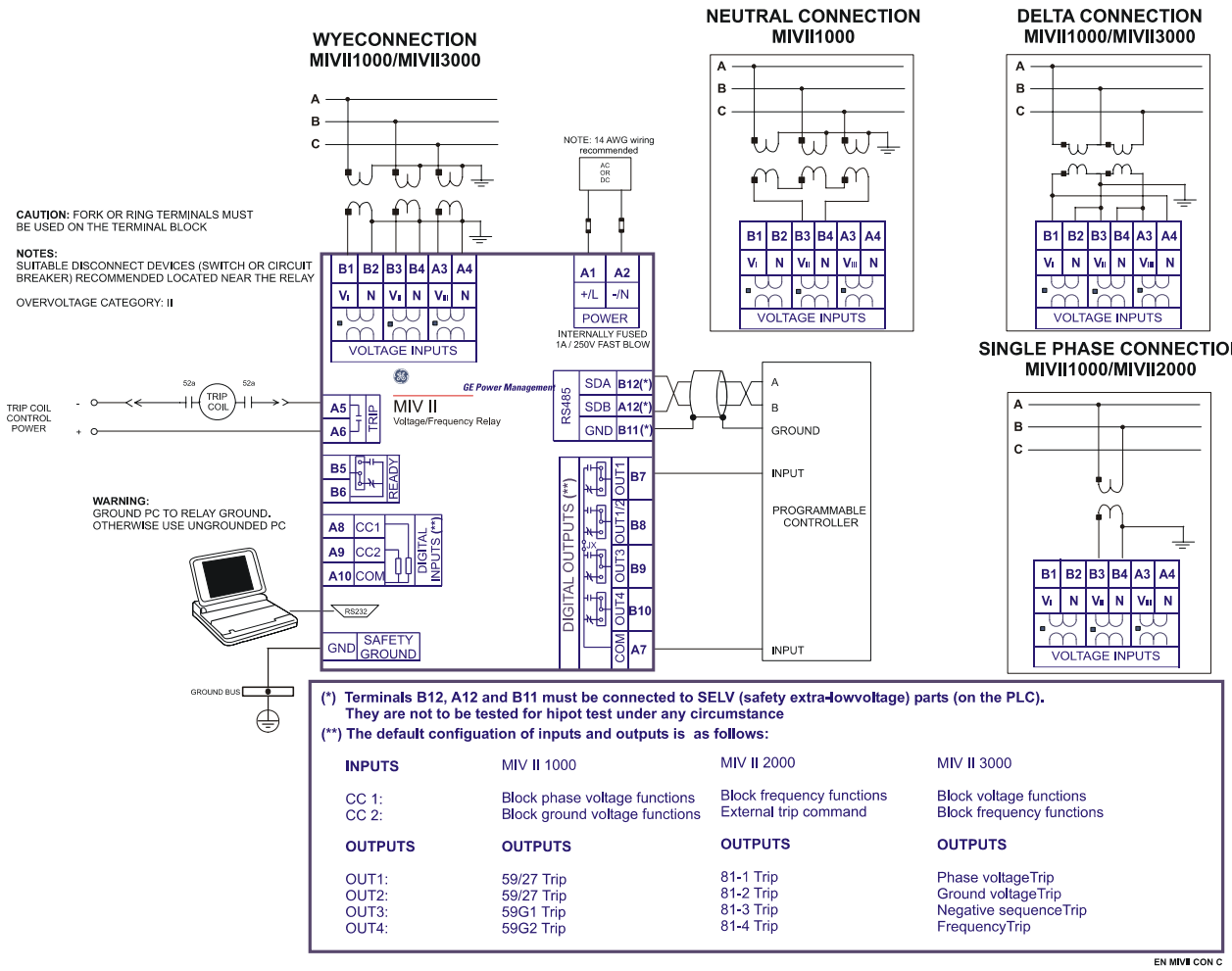


Figure 3–4: TYPICAL WIRING DIAGRAM FOR MIVII RELAY

3.1.5 CONTROL POWER

CAUTION: CONTROL POWER SUPPLIED TO THE RELAY MUST MATCH THE RATED VOLTAGE OF THE RELAY. IF THE VOLTAGE IS APPLIED TO THE WRONG TERMINALS, DAMAGE MAY OCCUR.

RANGE	RATED VOLTAGE	OPERATION RANGE
LO	24/48 Vdc	19.2~57.6 Vdc
HI	110/250 Vdc 110/230 Vac	88~300 Vdc 88~264 Vac

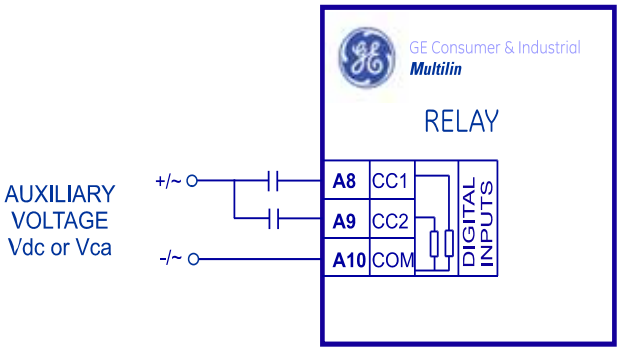


Figure 3–5: CONTACT INPUTS CONNECTIONS

Wet contacts must be connected to the inputs of the relay. A wet contact has one side connected to the positive terminal of an external DC power supply. The other side of this contact is connected to the required contact input terminal (A8 or A9). In addition, the negative side of the external source must be connected to the relay common (negative) terminal (A10). The maximum external voltage source voltage for this arrangement is 300 Vdc for HI models and 57.6 for LO models.

The voltage threshold at which an input will detect a closed contact input depends on the relay model. For low voltage range relays (LO model), the threshold is set to 12 Vdc. For high voltage range relays (HI model), the voltage threshold is 75 Vdc.

In case of using AC voltage, it must be ensured that there is no voltage (less than 10 Vac) between the input common terminal, A10, and the ground terminal. The AC system must be line/neutral type, and not line/line, ensuring that the neutral and ground do not differ in more than 10 Vac. The reason for this is that there might be enough current circulating through the EMC filtering capacitors on these inputs to cause undesired activation.

If it is not possible to ensure the previous conditions, the connection shown below can be used, where lines are wired only to inputs (A8 and A9), and the common (A10) is connected to the unit ground terminal.

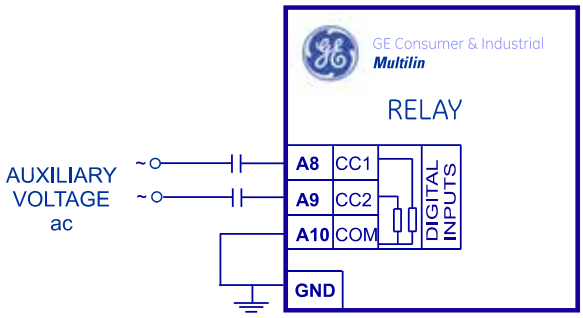


Figure 3–6: CONTACT INPUTS CONNECTIONS (AC ACTIVATION)

MII relays provide one trip contact, one alarm contact and four configurable contacts (option 1 and 2) sharing one common.

An internal jumper, called Jx jumper, has been provided to allow splitting the four configurable outputs into two isolated groups. In this case, the number of outputs is reduced to three.

Jx jumper is closed in the factory default configuration. (It is possible to order relays with Jx removed).

The figure shows the factory default configuration with Jx Jumper closed. It is located on the soldering part of the PCB containing the inputs and outputs.

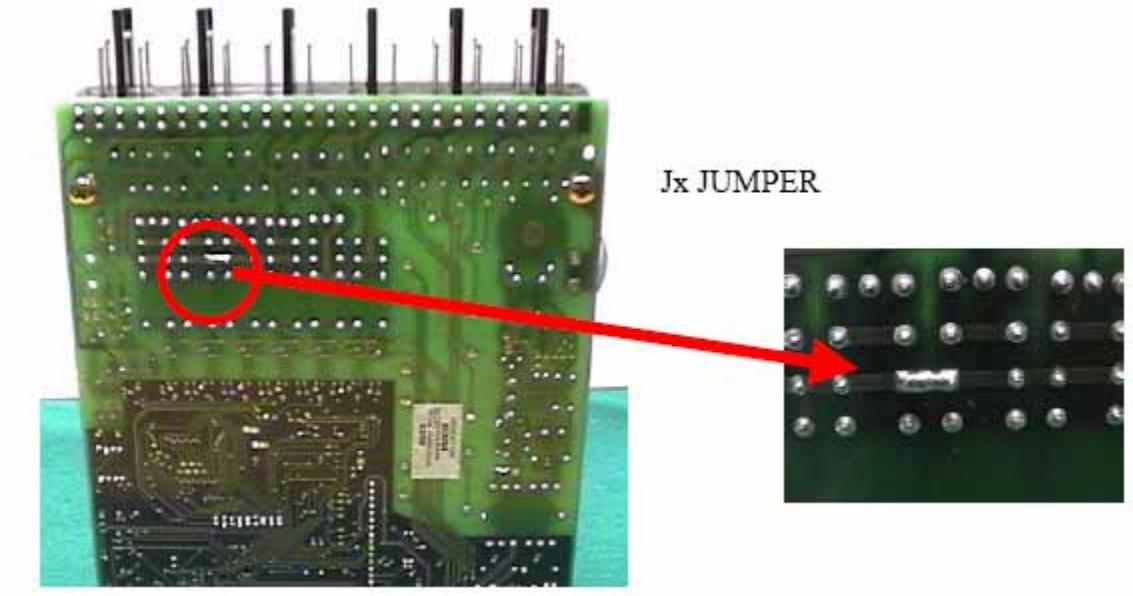
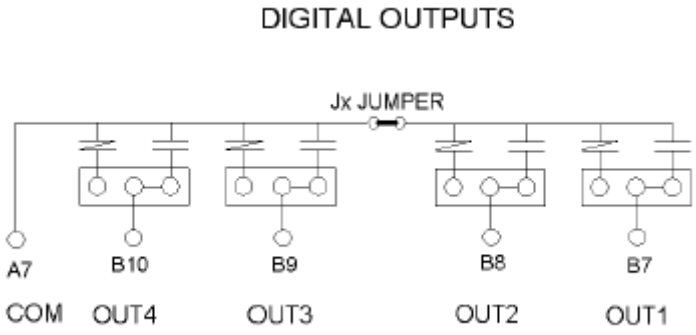


Figure 3–7: JX JUMPER

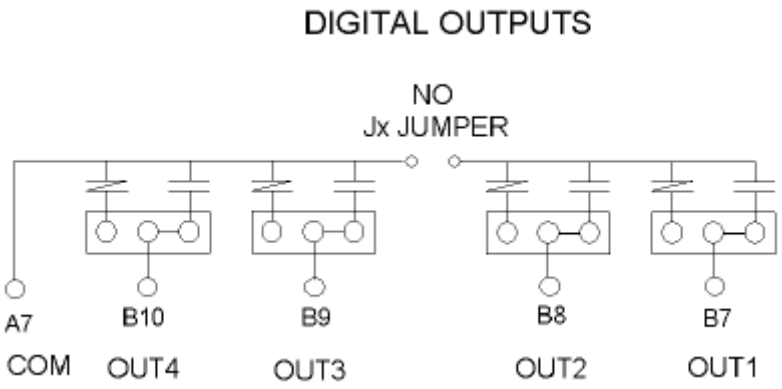
The Jx jumper is a tin-solder jumper easy to remove using a de-soldering tool.

The standard factory default output contact configuration consists of one group of four outputs, with the same common. The figure below shows the configuration:



Each output has a different configuration, and it is able to operate independently to the others.

If Jx jumper is removed, the output contact configuration change as shown in the following figure:



After removing the Jx Jumper, the outputs are divided in two groups: Independent and isolated.

Group1: Terminals B8-B7: Provide one output contact combining OUT1 and OUT2

Group 2: Terminals B9-A7: OUT3 Standard output contact

Terminals B10-A7: OUT4 Standard output contact

3.1.7.1 OUTPUT CONFIGURATION AT TERMINALS B8-B7:

To have a **normally open** contact across terminals B7-B8, configure OUT1 and OUT2 as shown bellow:

- Remove JX internal jumper
- Keep OUT1 and OUT2 as normally open contacts (factory default conf.)
- Using the PC software, configure the two outputs to operate using the same internal signal. The internal signal used in the example is "XX TRIP"

OUT1 and OUT2 must operate together to operate like a single output.

The configuration of OUT1 and OUT2 must be the same so both outputs close simultaneously and operate successfully.

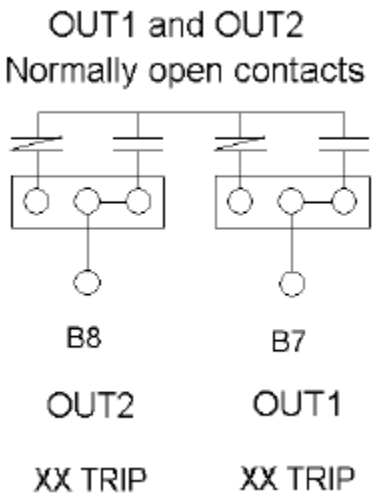


Figure 3–8: OUT1 AND OUT2 CONFIGURATION TO ACT AS A NORMALLY OPEN CONTACT

To have a **normally closed** contact across terminals B7-B8, configure OUT1 and OUT2 as shown below:

- Remove JX internal jumper.
- Change the intrenal jumper of OUT1 and OUT2 from normally open (factory default conf.) to normally closed.
- Using the PC software, configure the two outputs to operate using the same internal signal

Now OUT1 and OUT2 operate together to act like a single output.

.

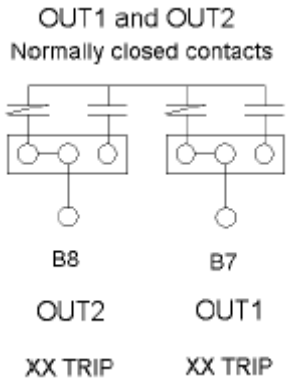
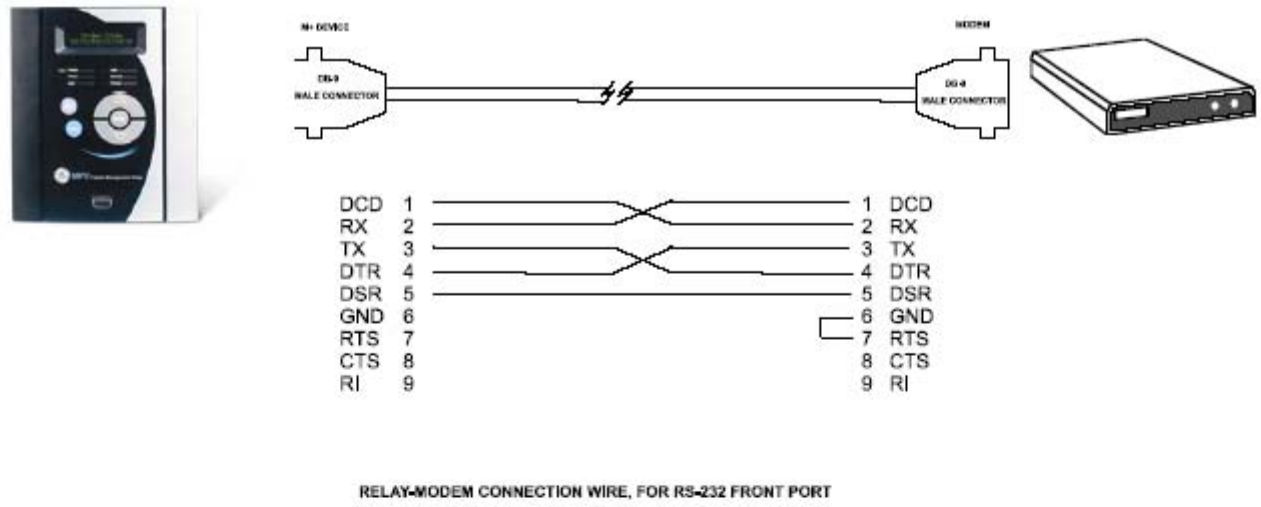


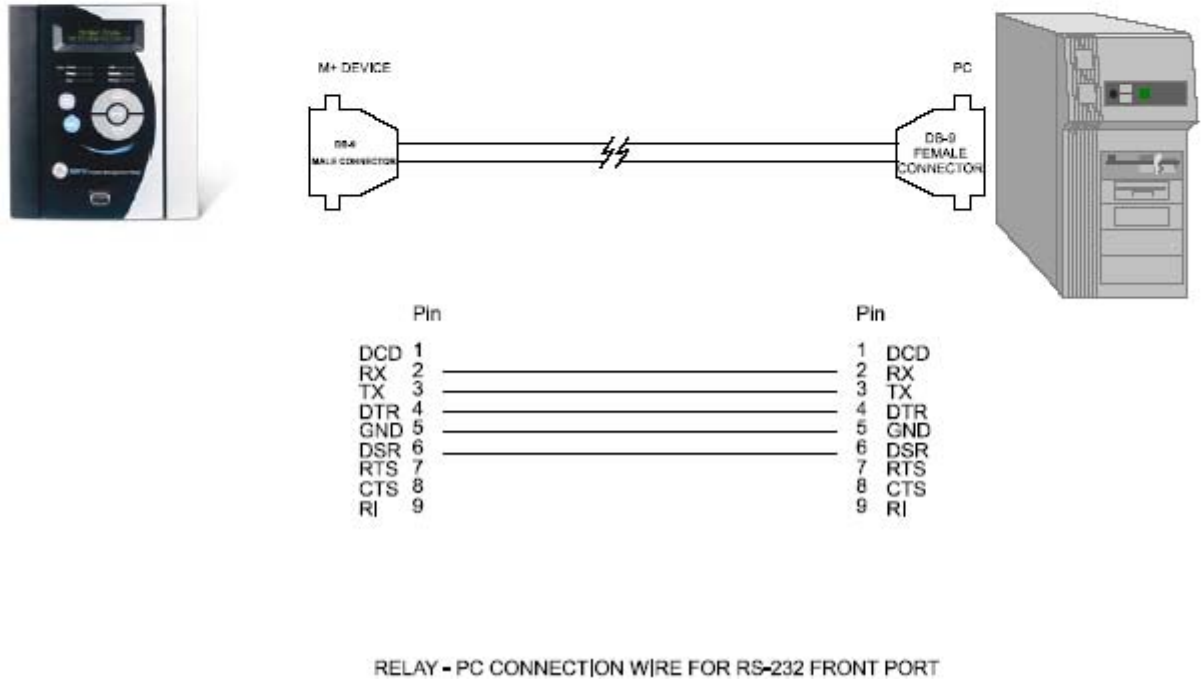
Figure 3–9: OUT2 AND OUT1 CONFIGURATION TO ACT AS A NORMALLY CLOSED CONTACT

3.1.8 RS232 FRONT COMMUNICATIONS PORT

A 9-pin RS232C serial port is located on the front of the relay for programming with a portable (personal) computer. All that is required to use this interface is a personal computer running the EnerVista MII SETUP software. Next figure shows the communications cable configuration.



RELAY-MODEM CONNECTION WIRE, FOR RS-232 FRONT PORT



RELAY - PC CONNECTION WIRE FOR RS-232 FRONT PORT

Figure 3–10: RS232 FRONT PORT CONNECTION

WARNING: IN ORDER TO PREVENT DAMAGE BOTH TO THE PC SERIAL COMMUNICATIONS PORT AND THE RELAY FRONT RS232 PORT, IT IS COMPULSORY TO CONNECT THE RELAY GROUND TO THE SAME GROUND AS THE PC. OTHERWISE, USE AN UNGROUNDED COMPUTER.

FOR THIS PURPOSE, PLEASE FOLLOW THE SAFETY INSTRUCTIONS IN CHAPTER 1

3.1.9 RS485 COMMUNICATIONS PORT

In addition to the front RS232 port, the relay provides the user with an additional RS485 communication port. RS485 data transmission and reception are accomplished over a single twisted pair that transmit and receive data alternating over the same two wires. Through the use of these port, continuous monitoring and control from a remote computer, SCADA system or PLC is possible.

To minimize errors from noise, the use of shielded twisted pair wire is recommended. For a correct operation, polarity must be respected, although if it is not, there is no danger to damage the unit. For instance, the relays must be connected with all RS485 SDA terminals connected together, and all SDB terminals connected together. The RS485 standard refers only to terminals named “A” and “B”, although many devices use terminals named “+” and “-“. As a general rule, terminals “A” should be connected to terminals “-“, and terminals “B” to “+”. There are exceptions to this rule, such as the GE ALPS and DDS family of relays. The GND terminal should be connected to the common wire inside the shield, when provided. Otherwise, it should be connected to the shield. To avoid loop currents, the shield should be grounded at one point only. Each relay should also be daisy chained to the next one in the link. A maximum of 32 relays can be connected in this manner without exceeding driver capability. For larger systems, additional serial channels must be added. It is also possible to use commercially available repeaters to increase the number of relays on a single channel to more than 32. Do not use other connection configurations different than the recommended.

Lightning strikes and ground surge currents can cause large momentary voltage differences between remote ends of the communication link. For this reason, surge protection devices are provided internally. To ensure maximum reliability, all equipment should have similar transient protection devices installed.

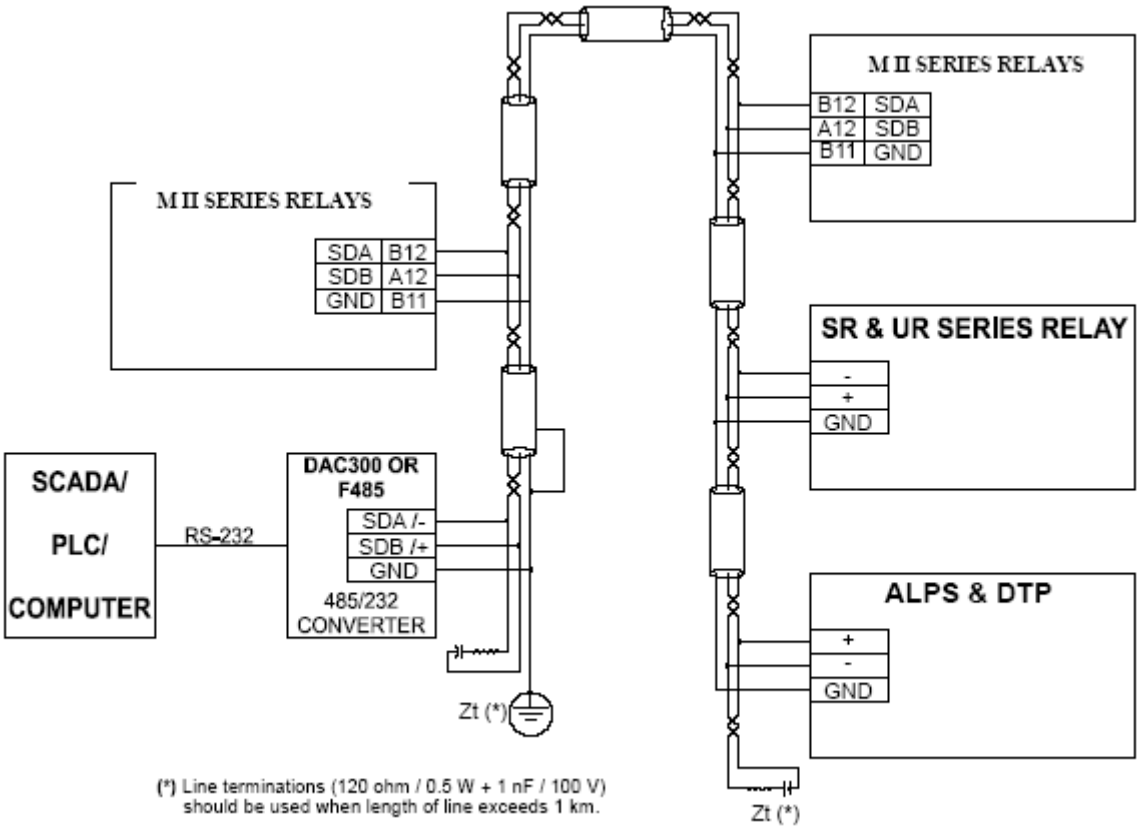


Figure 3–11: RS485 SERIAL CONNECTION (B6366H5)

4.1.1 OVERVIEW

IMPORTANT NOTE: MII FAMILY RELAYS CAN BE USED ONLY WITH ENERVISTA MII SETUP SOFTWARE.

The EnerVista MII SETUP software package uses only ModBus protocols, and is designed to communicate with a single relay at a time. GE Multilin offers different communication software packages, such as GE-POWER and ENERVISTA, which can be used to communicate simultaneously with several relays.

EnerVista MII SETUP software provides an easy way to configure, monitor and manage all MIVII features.

a) Setting files

EnerVista MII SETUP software provides two ways of working with setting files:

1.In off-line mode, disconnected from the relay, creating or editing setting files for a future download to the relay.

2.Modifying directly the relay settings while connected to the relay.

b) Configuration

The configuration of inputs, outputs and LEDs can be modified, and internal logics with the different relay elements can be created.

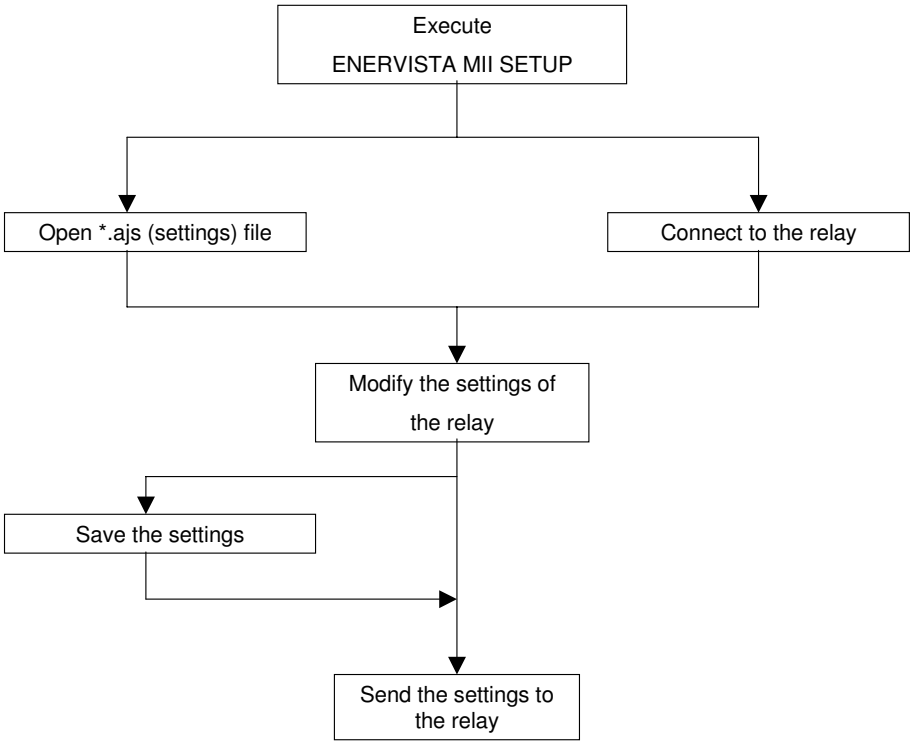
c) All metering values used by the unit can be monitored, as well as the internal states, inputs and outputs status.

d) Performing the different available operations.

e) Firmware updates.

f) Viewing the different records stored in the relay, as events, oscillography, etc.

The simplified use of the EnerVista MII SETUP software is as follows:



4.1.2 STARTING COMMUNICATION

Before the physical connection to the relay, it is important that the user reviews the safety instructions detailed in section 1. This section explains the importance of connecting both relay ground terminal and computer to a good grounding. Otherwise, communication may not be possible, or the relay and/or the computer could be damaged.

To work online, the relay communication parameters (e.g. baud rate, relay address and password) must match the parameters in the computer.

The computer parameters can be modified, in the Communication – Computer menu. Refer to the appropriate section in this same chapter for more details.

4.1.3 MAIN SCREEN

The main screen of EnerVista MII SETUP software includes the following components:

- Title
- Main menu bar
- Main icon bar
- Working area
- Status bar

Figure 4–1: ENERVISTA MII SETUP MAIN SCREEN

4.2.1 NEW

From the **File – New** option, the user can create a new file that will contain all the protection unit settings, as well as the relay configuration (inputs, outputs, events, oscillography, etc.).

When the option is selected, the following screen will be shown. The user must select here a specific relay model matching exactly the relay model to which the settings and configuration will later be downloaded. The mentioned settings and configuration are related to the default factory settings of the relay.

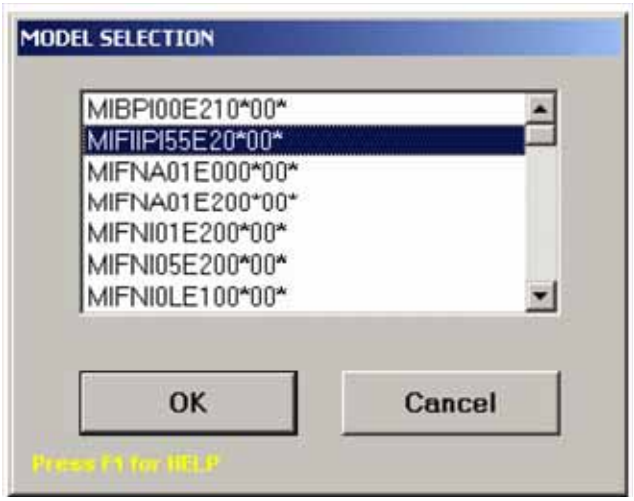


Figure 4–2: MODEL SELECTION

Once the relay model is selected, the software will load the relay structure and will enable the ***Setpoint***, ***Actual***, ***Communication***, ***View*** and ***Help*** menus for configuration.

4.2.2 OPEN

Option that allows to open previously created setting files for their modification.

Once the relay model is selected, the program will enable ***Setpoint***, ***Actual***, ***Communication***, ***View*** and ***Help*** sub-menus.

4.2.3 PROPERTIES

From the **File – Properties** option, the program will show a screen including the relay model information, firmware version, etc., as shown on Figure 4–3:

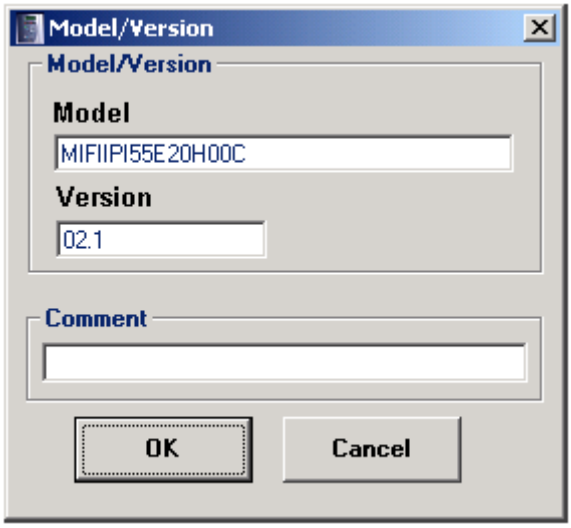


Figure 4–3: MODEL/VERSION

4.2.4 GET INFO FROM RELAY

The **File – Get info from relay** option enables the user to save the relay settings in a file on the hard disk of the computer. This file can later be opened offline to review and modify settings, and send them again to the relay after the modifications.

4.2.5 SEND INFO TO RELAY

The **File – Set info to relay** option enables to send to the relay a settings file stored on the hard disk of the computer.

4.2.6 PRINT SETUP

The **File – Print Setup** option enables the user to configure the print setup for the settings file as shown in Figure 4–4:

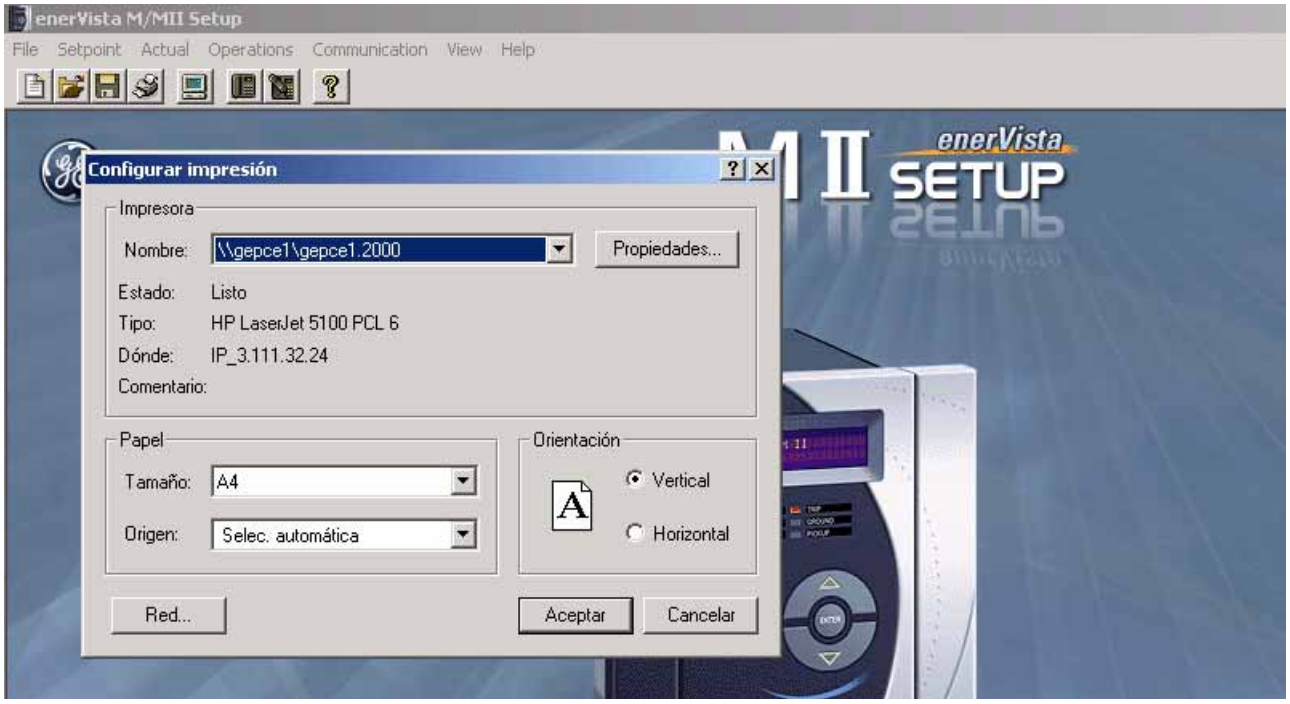


Figure 4–4: PRINTER SETUP

4.2.7 PRINT PREVIEW

The **File – Print Preview** option displays a preview of the settings print-out. It is also provides a quick view of all the relay settings at a glance, without having to navigate through the different menu trees. From this screen it is also possible to configure the printer that will be used, or to directly print the document. Double clicking on the document with the left mouse button will enlarge the document view, and double clicking with the right button will reduce the size.

The available actions in this screen are shown in Figure 4–5:

Figure 4–5: PRINT PREVIEW CONTROLS

4.2.8 PRINT

The **File – Print** option prints the relay settings using Windows default (active) printer.

4.2.9 CLOSE

The **File – Close** option exits the program. It does not prompt for confirmation or save the open file.

Clicking on the Setpoint menu entry gives access to Settings, Configuration, Logic Configuration and Clock.

4.3.1 SETTINGS

The **Settings** sub-menu is the same for all MII family relays, and shows all relay settings divided in two groups: **Main Settings** and **Advanced Settings**. The first settings group has basic settings (main protection functions). The second settings group includes more advanced settings (double settings group, customized curves, etc.), needed only if more complex protection schemes are required

The purpose of this division is to simplify the use of the relay for those users only requiring the basic functionality of the relay.

Figure 4–6: SETTINGS MENU

Once in the corresponding sub-menu, either Main Settings or Advanced Settings, the procedure to enter and modify any setting value is the same:

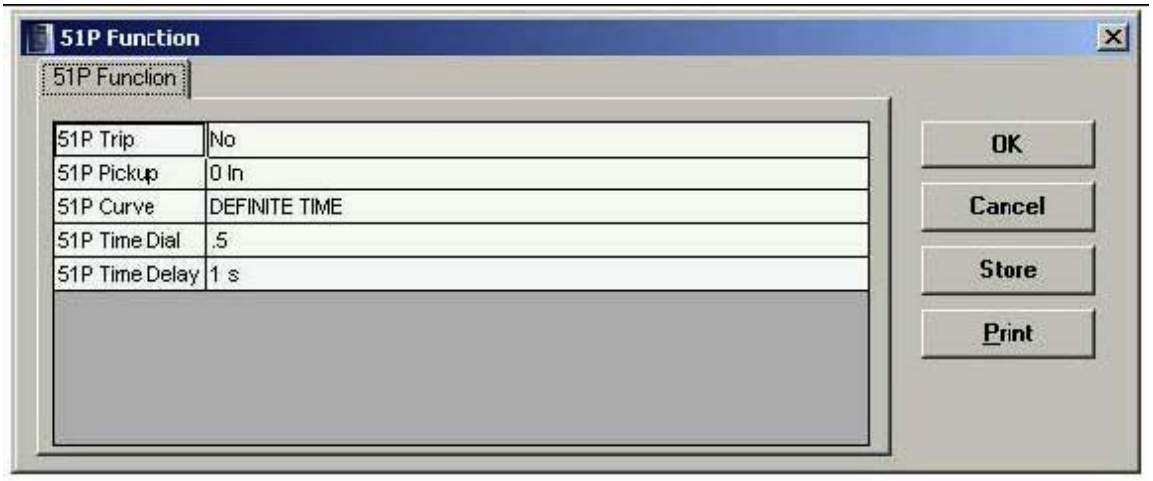
Select the settings group (the function selected in the example is the51P function in a MIFII).

Edit the setting double-clicking on the value (for example, enable).

Modify the value of the setting (see Figure 4–8: to Figure 4–10:).

Confirm/Accept the modified value.

Store the settings in the relay (if working in Emulation mode, this option stores them on the corresponding file) with the **Store** button. If the **OK** button is pressed without having pressed Store (a window asking confirmation will appear), the settings of this group will be discarded.



4

Figure 4–7: FUNCTION MENU

Primarily there are four different setting formats:

Boolean/Logic Settings (only two choices). For Boolean settings, the two possible options are shown so as the user can select which one is the appropriate, clicking with the mouse on the option desired.

Numerical Settings For Numerical settings, a number must be entered. The program shows the minimum and maximum value for each setting, and it will not accept any value out of the corresponding range.

Settings with a set of options For set of options settings, a pop-up window is shown, containing all possible values. Select the appropriate one clicking on it.

Text Setting A text box is shown.

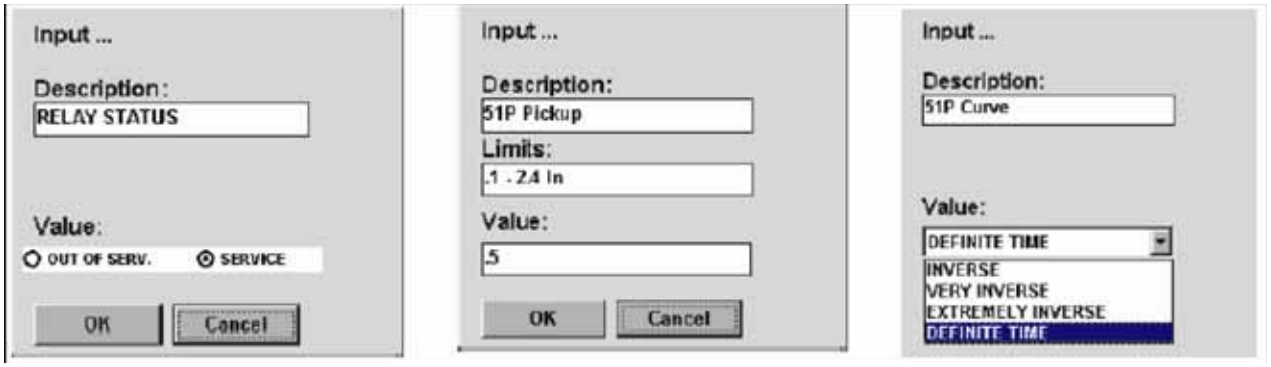


Figure 4–8: LOGIC SETTING. Figure 4–9: NUMERIC SETTING. Figure 4–10: SET OF OPTIONS.

4.3.2 MAIN SETTINGS

4.3.2.1 GENERAL SETTINGS

General settings describe and activate the electric system settings where the relay is going to operate. Some of these settings will be used with measure values presentation purposes; however, some of them are directly applied during the sampling and analogical-numerical conversion process (nominal frequency setting). Therefore, these settings need to be altered so they fit with the system settings.

4.3.2.2 GROUP 1- GROUP 2 FUNCTION SETTINGS

The M family relays provide two independent setting groups. **Group 1** is available in the Main Settings group, while **Group 2** can be accessed in the Advanced Settings group. The setting groups can be selected by digital input, through a communications command or from the EnerVista MII SETUP, or simply selecting it with the relay keypad. The setting that shows the active group can be found in General Advanced Settings.

4.3.3 ADVANCED SETTINGS

4.3.3.1 ADVANCED GENERAL SETTINGS

Advanced General Settings enables configuration of the active setting group as well as the minimum time the trip contact will remain closed, to let the circuit breaker open the circuit so as the contact does not get burnt.

4.3.3.2 OTHER ADVANCED SETTINGS

Besides the Flex Curve values, the user may configure the mask of events that will generate an event report and the events that will generate an oscillography.

Setpoint – Relay Configuration shows a dialog box to configure digital inputs, contact outputs and front panel LEDs, as shown in Figure 4–11:

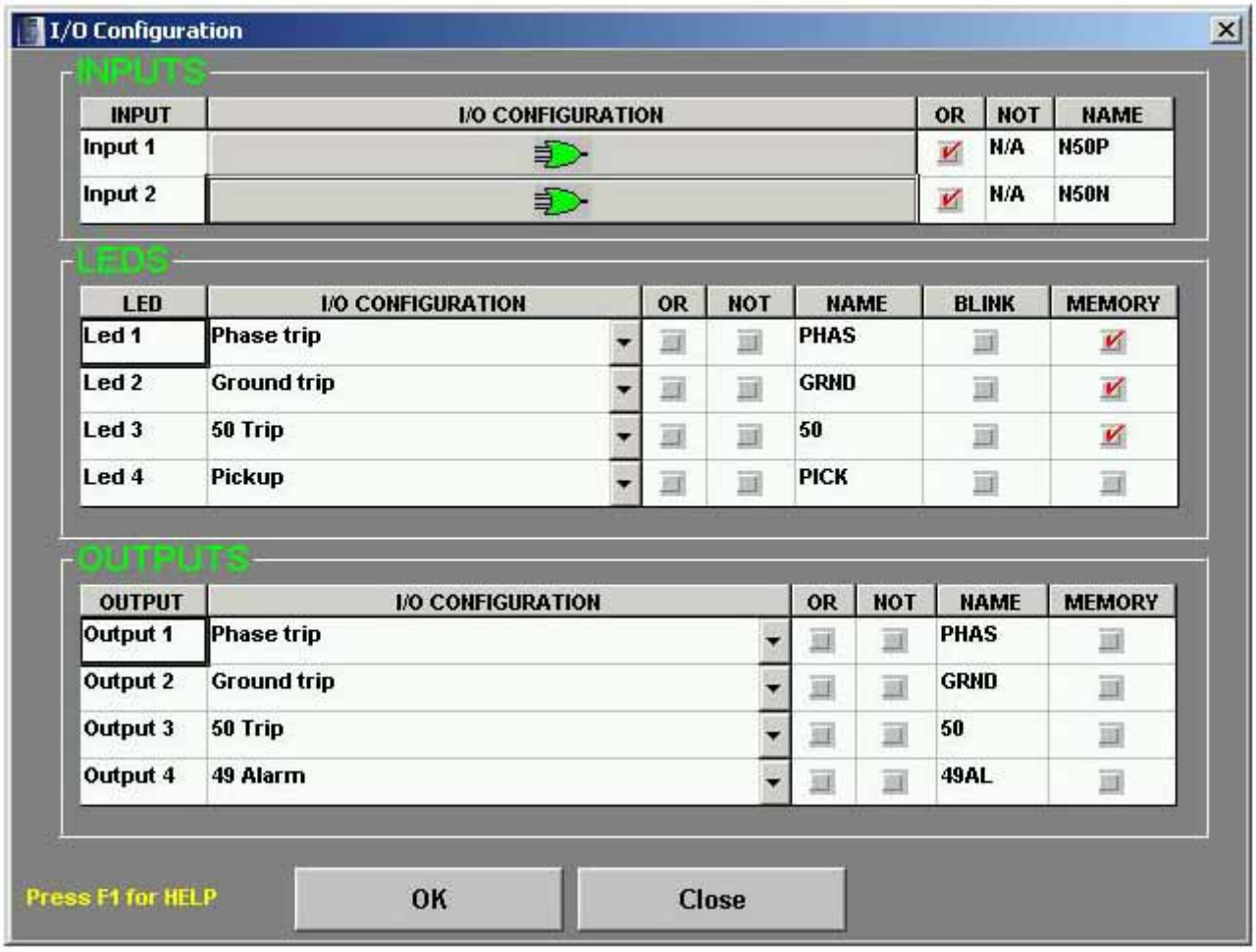


Figure 4–11: RELAY CONFIGURATION SETTINGS

Each input, output and LED can be assigned an individual function (status bit) or an OR of a group of functions. Functions can also be assigned to virtual inputs and outputs, in order to allow greater flexibility when creating complex logics.

The meaning of the different columns is explained below:

- **INPUT/LED/OUTPUT**: Designates the respective element
- **I/O configuration**: the appearance and function of this column can be, depending on the state of the respective OR checkbox column:

  - **OR checkbox** is not checked: the element consists of a drop down list in which the user can select the function that will activate the output or LED, or that will be activated by the input

  - **OR checkbox** is checked: the element consists of a button that will activate a new window (see Figure 4–12:) where the user can choose a sum of several functions that will activate the output or LED, or be activated by the input. These functions are distributed in groups, and only functions in the same group can be chosen for the same OR gate.

- **OR**: activates the **OR button** for the I/O configuration column (see previous point). The window that appears when the OR button is pressed can be seen in Figure 4–12:

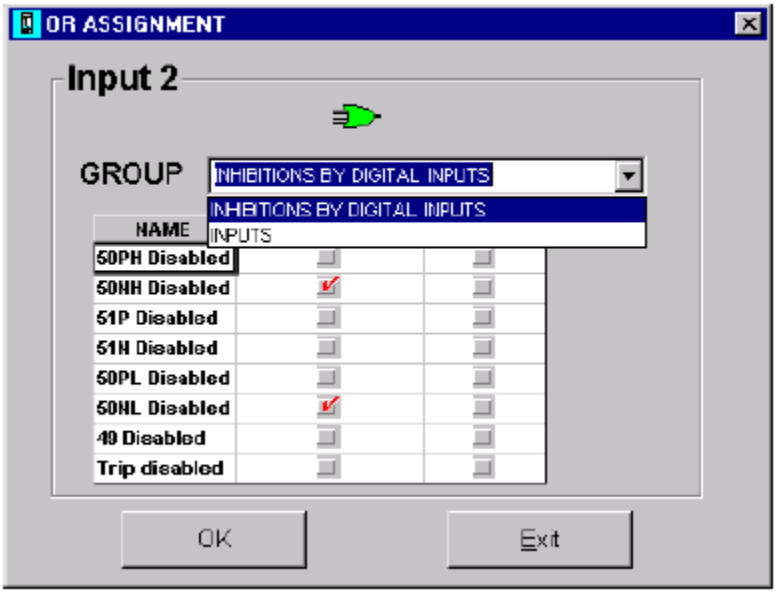


Figure 4–12: OR ASSIGNMENT

- **NOT**: when **NOT** checkbox is enabled, the logic is inverted. The element (input, output, LED) will actuate when the conditions are NOT fulfilled.
- **NAME**: the user can write an identifying label of up to 4 characters that will get stored to be displayed later on.
- **BLINK** (only for LEDs): the selection of **BLINK** checkbox makes the LED blink (alternatively switch ON and OFF) instead of being fixed when it is activated.
- **MEMORY** (only for outputs and LEDs): when **MEMORY** checkbox is enabled, the respective element will be latched. If the cause that generated the activation of the output or LED does no longer exist, the element will remain active until a RESET command is performed.

4.3.5 LOGIC CONFIGURATION

MII family relays can execute simple logic schemes that can be programmed from EnerVista MII SETUP. This logic schemes can be found at **Setpoint – Logic Configuration**.

When one of the logics is selected, a new window will appear where the user can assign up to 8 inputs to the logic circuit. Each of these inputs can be a single function or status, as well as a logical union of several statuses.

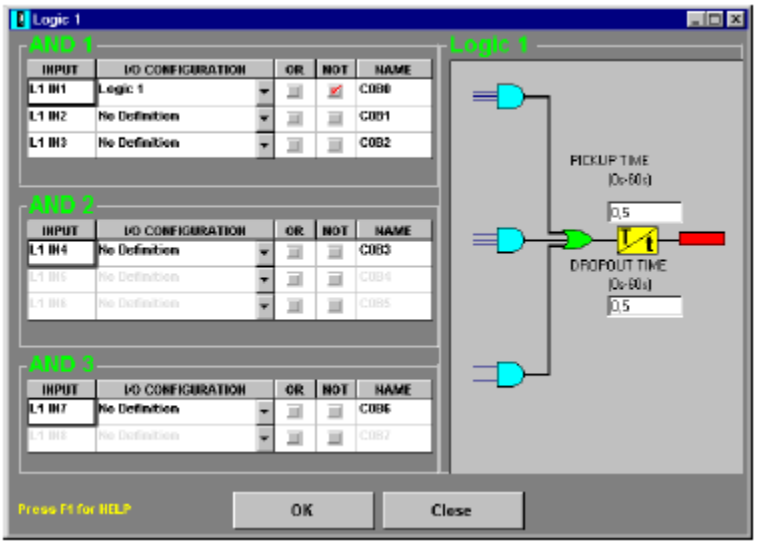


Figure 4–13: LOGIC CONFIGURATION

The way the logic works is illustrated in the diagram at the right of the logic window.

First, depending on the gate, up to 2 or 3 signals (internal flags coming from the status of the relay or from another logic, or external input signals) can be chosen as sources of each **AND gate**. The way they are programmed is similar to the way I/Os are (refer to relay configuration). The device will not take into account entries that are after an empty one. This means that every entry after the first empty one will be ignored. For example, if *L1 IN1* is programmed but *L1 IN2* is left empty, the relay will not take into account *L1 IN3* and will directly evaluate *L1 IN4*. In the same way, the relay will ignore *AND2* if *AND1* is not programmed, and will ignore *AND3* if *AND1* or *AND2* are not programmed.

Then the results from the AND gates are added by an **OR gate** that will produce the result of the logic.

It is possible to set the **pickup and dropout times for output from the OR gate.** Example: for picking time of 10s and a dropout time of 15s, if input of the OR gate changes to 1, this input has to remain for 10s before the result of the logic changes to 1. If result of the OR gate drops to 0, output will be 1 for 15s and after that time output will be 0.

See Chapter 7 for more details on logic configuration.

The **change date/time** option opens a window with two choices:

- Sending the PC date and time to the unit, this is, synchronizing the PC and the unit.
- Selecting a date and a time and sending it to the relay.

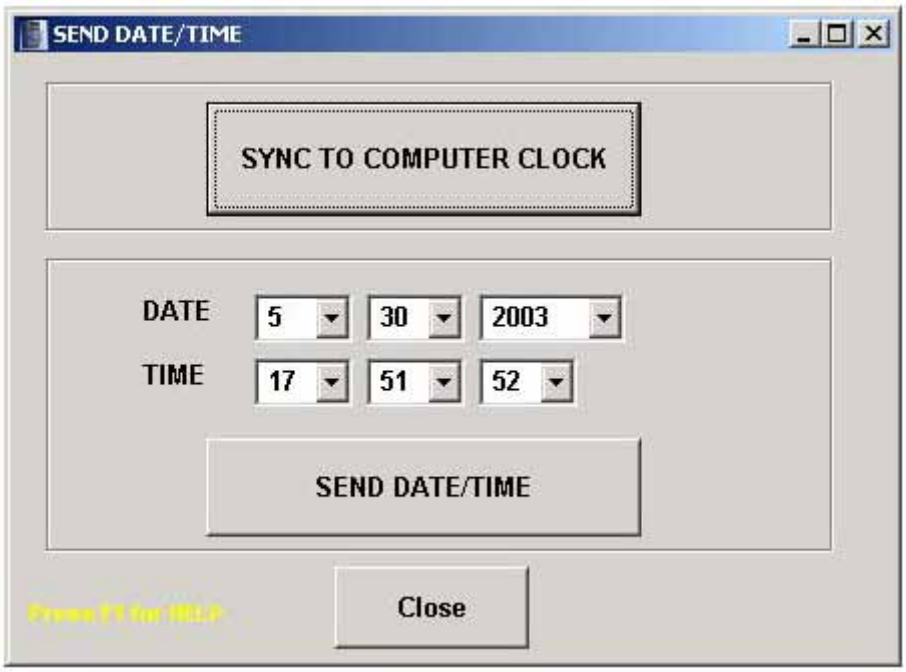


Figure 4–14: CHANGE DATE/TIME

Once the new date and time have been sent, the user can check in the status graph, or even in the relay itself, that the new date/time has been correctly entered.

4.4.1 ACTUAL VALUES

Actual - Actual values menu displays the **Status Window** shown in Figure 4–15:. This window shows internal relay information, measures, function status as well as additional information. There is a vertical scroll bar to navigate up and down the table to reach the desired information:

- Relay model number and firmware version.
- Relay internal date and time.
- Values of currents, voltages and powers (phase and ground).
- Protection function status (pickup / trip for each function).
- Active settings group number.
- Contact inputs and outputs status, and LEDs status.
- Information from the self-test functions of the device.

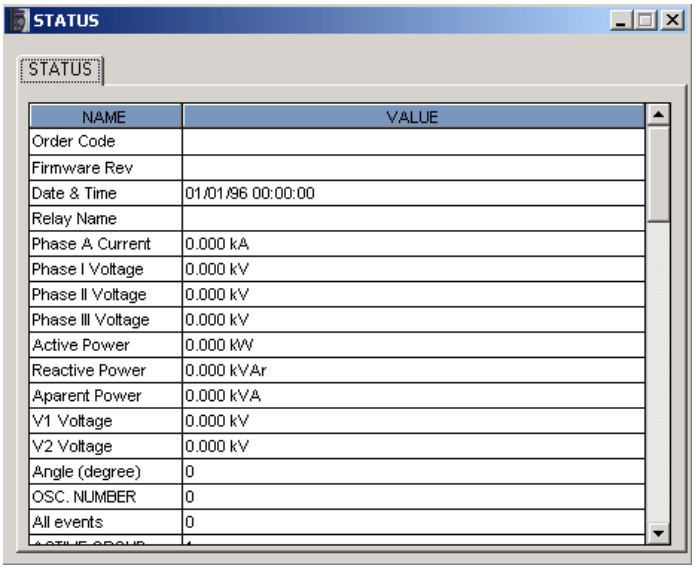


Figure 4–15: STATUS WINDOW

Actual – Event Recorder option makes the last 24 relay events to be retrieved (up to 32 for MIFII) and displayed in the window appearing in Figure 4–16:. Each event record is labeled with date, time (with 1msec. resolution), the cause of the event (pickup, trip of a certain function, etc.), and a list of the status of all inputs, outputs and functions during the event. Additionally, the program also shows current and voltage values for all phases and ground, frequency and single line sequence voltage during the event.

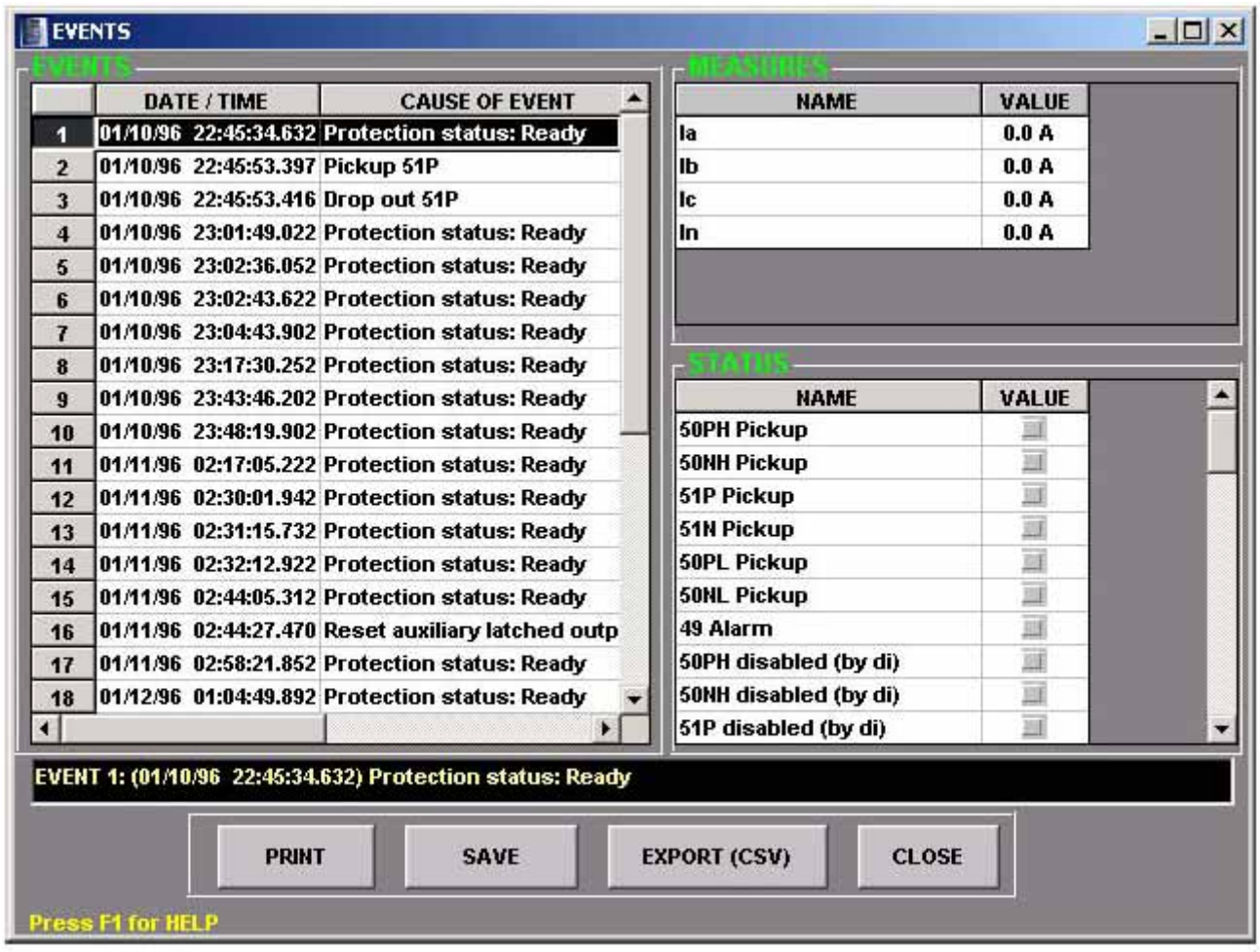


Figure 4–16: EVENTS WINDOW

The retrieved events can be reviewed in this window or also saved to disk (to be opened with EnerVista MII SETUP program) or exported to CSV (Comma Separated Values) format. This is a standard text table format that can be opened with most commercially available database or spreadsheet programs such as MS Access or Excel.

4.4.3 WAVEFORM CAPTURE

In the **Actual - WAVEFORM CAPTURE** option, the user can start the process to retrieve the Oscillography record stored in the relay. The program will request the path and filename where the file is to be stored, by means of the following form:

Figure 4–17: OSCILLOGRAPHY RECORD

This file can be viewed using GE_OSC software (the use of this software is described in manual GEK-105596).

From **Operations** menu the user can perform all possible operation commands.

Figure 4–18: OPERATIONS MENU

The **COMMUNICATION** menu provides configuration options to communicate with the relay, as well as to perform a ModBus communication troubleshooting, or to update the relay with a new firmware.

After making any change, pressing ***Store*** button saves the changes without exiting the window. Pressing ***OK*** saves and exits and pressing ***Cancel*** exits without saving changes.

4.6.1 COMPUTER

In **COMPUTER** dialog the user can configure the necessary adjustments to communicate with the relay from a PC.

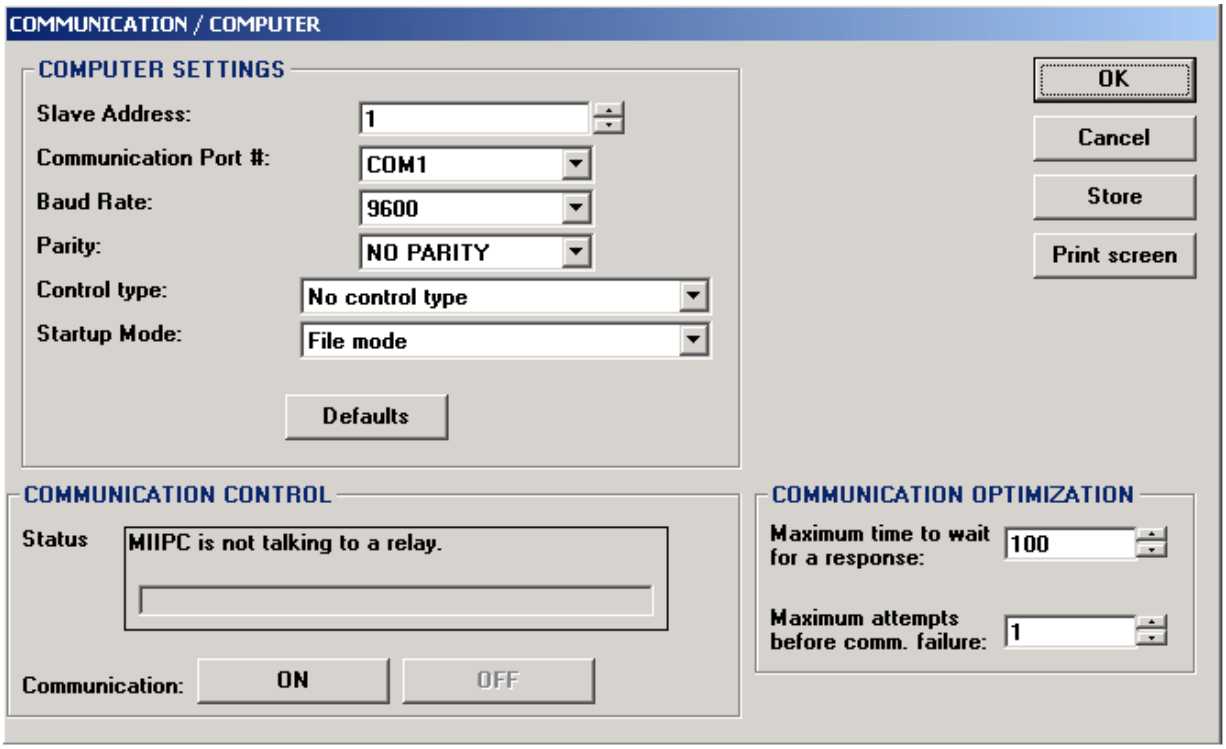


Figure 4–19: COMMUNICATIONS DIALOG

4.6.1.1 COMPUTER SETTINGS

In **COMPUTER SETTINGS** box the user can configure computer communication settings, besides the connection (Control Type) and Startup Mode.

Control Type defines the connection type that is going to be used:

- **No control type** for serial connection (front RS232 or rear RS485),
- **ModBus/TCP** for Ethernet connection (by means of a serial/TCP converter). When this option is chosen, the serial configuration data disappears and a new box appears at the right to configure the IP address, the port number and the unit id.

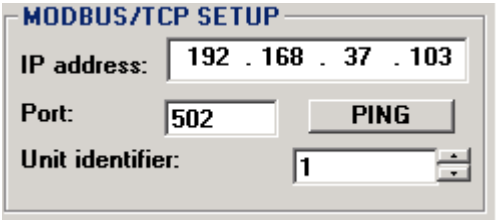


Figure 4–20: MODBUS/TCP SETUP

- **MODEM CONNECTION** for modem serial connection. The modem configuration options appear at the right when this option is chosen.

Defaults button returns the values to the factory default ones.

4.6.1.2 COMMUNICATION CONTROL

In **COMMUNICATIONS CONTROL** box the user can view the communication status (communicating to a relay or not), connect to a relay when the right parameters are entered in the Computer Settings box (**ON** button), or disconnect from the relay when desired (**OFF** button).

Once the connection is established, when the user accesses any Setpoint or Operations, or Actual – Event Recorder[i] menu entries for the first time, the program will ask the relay password. The following window will appear:

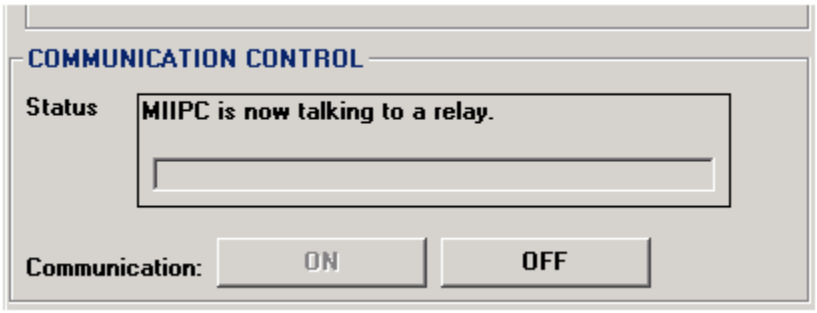


Figure 4–21: COMMUNICATION CONTROL – COMMUNICATING

i. i.e., the first time a writing operation is performed against the relay during the current communication

4.6.1.3 COMMUNICATION OPTIMIZATION

COMMUNICATIONS OPTIMIZATION box allows the user to enter values to control device response to communication attempts. Changing these parameters can improve communication, although it is recommended not to make changes to the default values if it is not required.

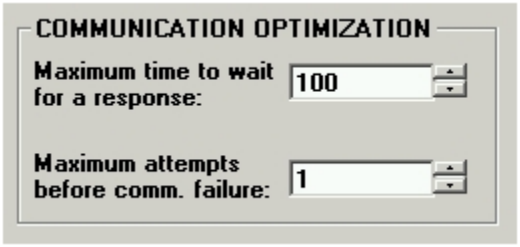


Figure 4–22: COMMUNICATION OPTIMIZATION

4.6.1.4 PRINT SCREEN

When the ***Print Screen*** button is pressed, a new window appears asking if the user wants to capture the entire screen or only the active window (the one with all the communication parameters). *Yes* means capturing the whole screen and *No* means capturing only the communications window.

Then a new window appears allowing to view the captured screen, to save the captured file in BMP or JPG format, or to print it (the print dialog window will appear so as the user can select which printer to use and enter the appropriate printer settings).

Figure 4–23: PRINT SCREEN

The **TROUBLESHOOTING** option is available only when the PC is communicating with a relay. It is intended to check the ModBus communication frames between the PC and the relay. In the upper part, the user can read any readable value from the relay (setpoints, actual values) by entering the desired hexadecimal address[i], the type of data to read (Setpoints, Actual Values), the number of registers (the length of each register is of 2 bytes) and the format of the data (integer, long, float...), checking the checkbox at the left to make the PC start polling that address or unchecking it to stop.

In the lower part, data can be sent to writable addresses of the relay. The working is similar to reading but, to send the data, the user must press the ***SEND*** button.

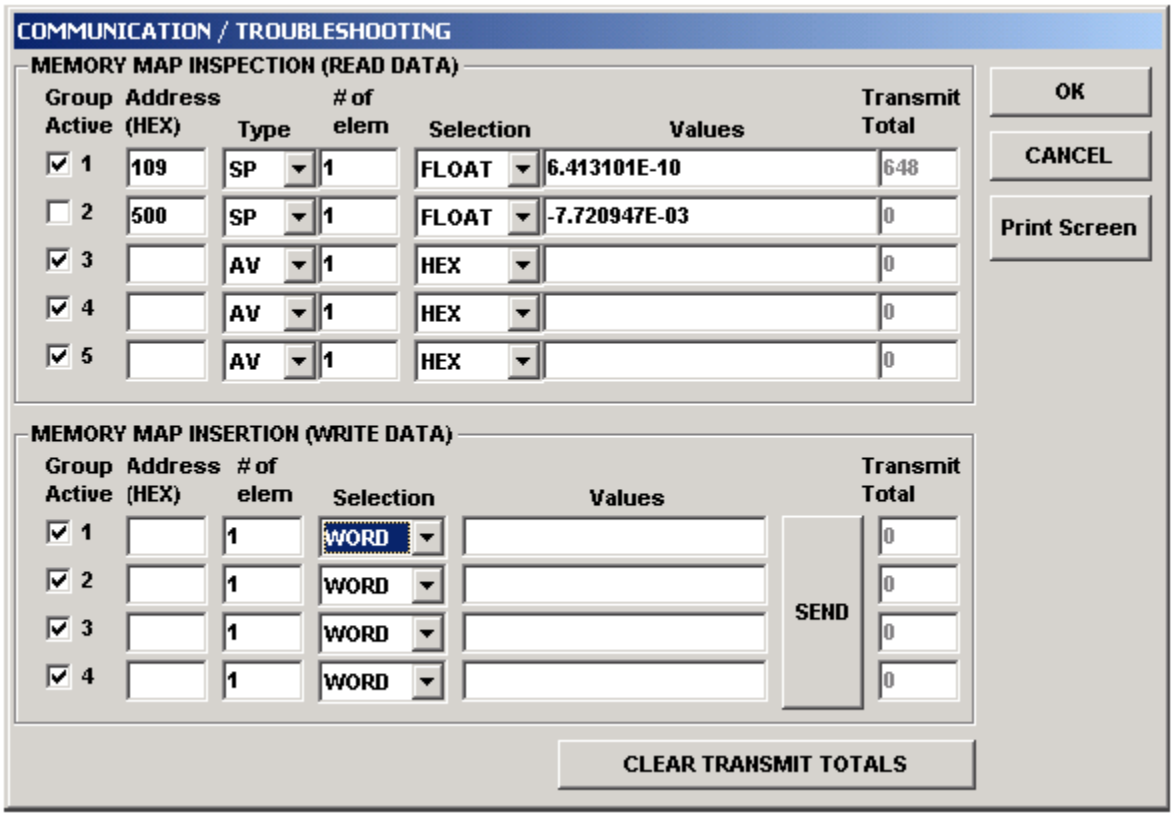


Figure 4–24: TROUBLESHOOTING

Refer to preceding section to learn about ***Print Screen*** button.

i.To check how to read memory map addresses from the relay refer to the corresponding section further in this chapter

IMPORTANT WARNING: For upgrading the relay firmware to version 4.00 or later, it is mandatory that the ENERVISTA MII Setup version is 1.10 or higher. For firmware version 5.00 or later, the ENERVISTA MII Setup version must be 2.10 or later. Otherwise it may result in damage to the relay

The **UPGRADE FIRMWARE VERSION** option is active only when there is no active communication with the relay. If the PC is communicating with the relay, the user must switch communication off in ***Communication > Computer*** menu to activate this option.

When this option is selected, a window appears asking for the new firmware version file to be uploaded to the relay:

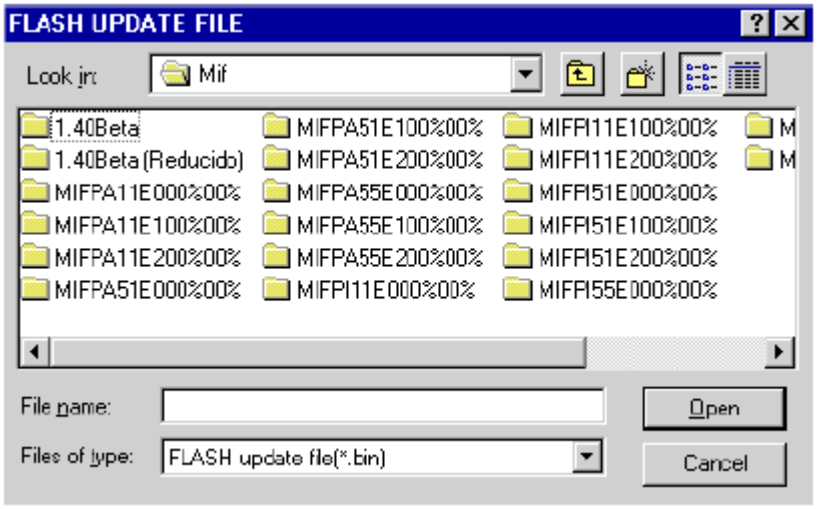


Figure 4–25: FLASH UPDATE FILE

After selecting the file that will be used to update the FLASH memory, the following screen will be displayed:

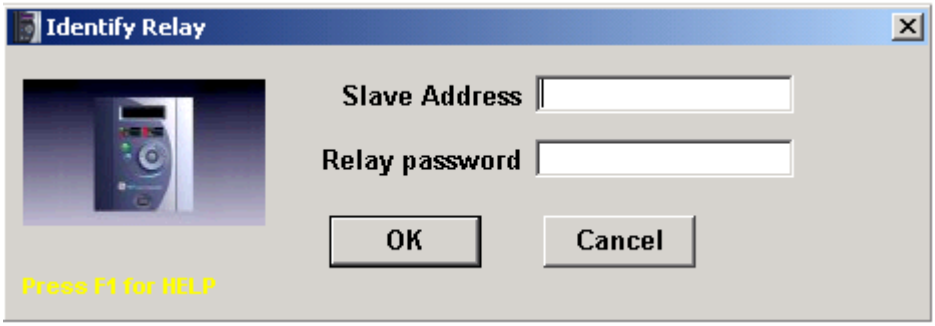


Figure 4–26: RELAY IDENTIFICATION

After introducing the Slave Address and Relay password, the following screen will be displayed, showing details of the old model and the new model:

Figure 4–27: UPDATE FLASH DIFFERENCES

If the update is to a model option with higher functionality (see OPTION 1, OPTION 2 and OPTION R in the model list), the program will request a password. This password can be obtained placing an order with GE Multilin. The following three parameters must be clearly indicated in the order:

- Serial number of the unit.
- Current model option (before memory update).
- Desired model option (after memory update).

In a case where more than one unit needs to be updated, all the serial numbers must be detailed, and a different password will be assigned for each unit.

Figure 4–28: PASSWORD

If the update does not require changes to the functionality of the relay, the program will not request a password.

After completing the previous screen, and during the loading process, the following screen will be displayed, showing the update process status:

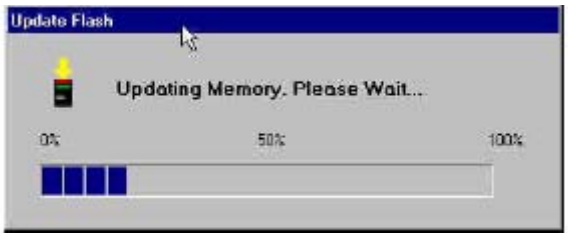


Figure 4–29: UPDATE PROCESS

During the update, the display and LEDs will blink until the total completion of the process. Then the following screen will appear:

Figure 4–30: UPDATE COMPLETED

It will take a few seconds for the relay to restart after the completion of the update process. Therefore, before unplugging the relay, please make sure that the relay main screen shows the analog inputs values.

IMPORTANT NOTICE:

The MODBUS® memory map may change for different firmware versions. As a result, the Flash memory update, when upgrading to a higher model (OPTION 1 or 2), may involve a MODBUS® memory map change. This may result a critical issue when the relay is integrated in a system, and the user should take into account the modifications that will have to be performed in the programs that access the MIVII relay memory maps.

Additionally, when a Flash memory update is performed, the loading program will enter the default settings. This means that the user will need to adapt the settings to the real situation of the protected device. If the user wants to keep the same settings after the memory update, a copy of the settings should be stored in a file before starting the update process.

4.7.1 TRACES

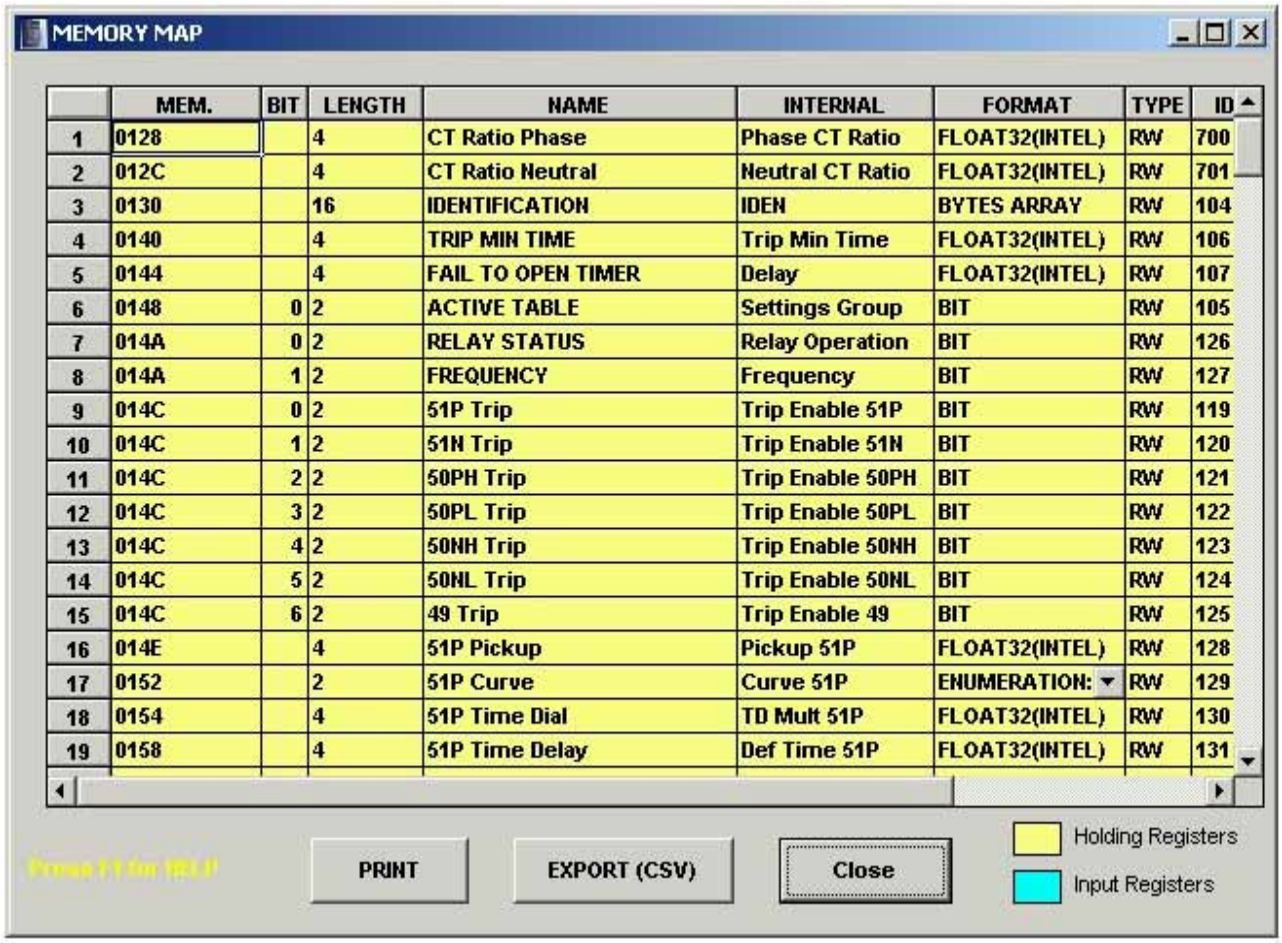
TRACES option is only active when the PC is communicating with the relay. If the communication is not established, to activate this option the user must switch communication on in ***Communication > Computer*** menu.

When **TRACES** are active, the ModBus communication traces will be displayed in the lower part of the screen, as shown in Figure 4–31:

Figure 4–31: MODBUS TRACES

MODBUS MEMORY MAP option is only active when the PC is communicating with the relay. If the communication is not established, to activate this option the user must switch communication on in ***Communication > Computer*** menu.

With **MODBUS MEMORY MAP** option the user can extract the complete memory map from the relay and print or save it in CSV format (to be later opened with any database or spreadsheet program as MS Excel). It is recommended to use this feature as memory map changes with relay model and firmware version so this is the safest way of obtaining the appropriate memory map for every single relay.



	MEM.	BIT	LENGTH	NAME	INTERNAL	FORMAT	TYPE	ID
1	0128		4	CT Ratio Phase	Phase CT Ratio	FLOAT32(INTEL)	RW	700
2	012C		4	CT Ratio Neutral	Neutral CT Ratio	FLOAT32(INTEL)	RW	701
3	0130		16	IDENTIFICATION	IDEN	BYTES ARRAY	RW	104
4	0140		4	TRIP MIN TIME	Trip Min Time	FLOAT32(INTEL)	RW	106
5	0144		4	FAIL TO OPEN TIMER	Delay	FLOAT32(INTEL)	RW	107
6	0148	0	2	ACTIVE TABLE	Settings Group	BIT	RW	105
7	014A	0	2	RELAY STATUS	Relay Operation	BIT	RW	126
8	014A	1	2	FREQUENCY	Frequency	BIT	RW	127
9	014C	0	2	51P Trip	Trip Enable 51P	BIT	RW	119
10	014C	1	2	51N Trip	Trip Enable 51N	BIT	RW	120
11	014C	2	2	50PH Trip	Trip Enable 50PH	BIT	RW	121
12	014C	3	2	50PL Trip	Trip Enable 50PL	BIT	RW	122
13	014C	4	2	50NH Trip	Trip Enable 50NH	BIT	RW	123
14	014C	5	2	50NL Trip	Trip Enable 50NL	BIT	RW	124
15	014C	6	2	49 Trip	Trip Enable 49	BIT	RW	125
16	014E		4	51P Pickup	Pickup 51P	FLOAT32(INTEL)	RW	128
17	0152		2	51P Curve	Curve 51P	ENUMERATION:	RW	129
18	0154		4	51P Time Dial	TD Mult 51P	FLOAT32(INTEL)	RW	130
19	0158		4	51P Time Delay	Def Time 51P	FLOAT32(INTEL)	RW	131

Figure 4–32: MODBUS MEMORY MAP

4.7.3 LANGUAGES

LANGUAGES option is only active when there is no active communication with the relay. If the PC is communicating with the relay, to activate this option the user must switch communication off in ***Communication – Computer*** menu.

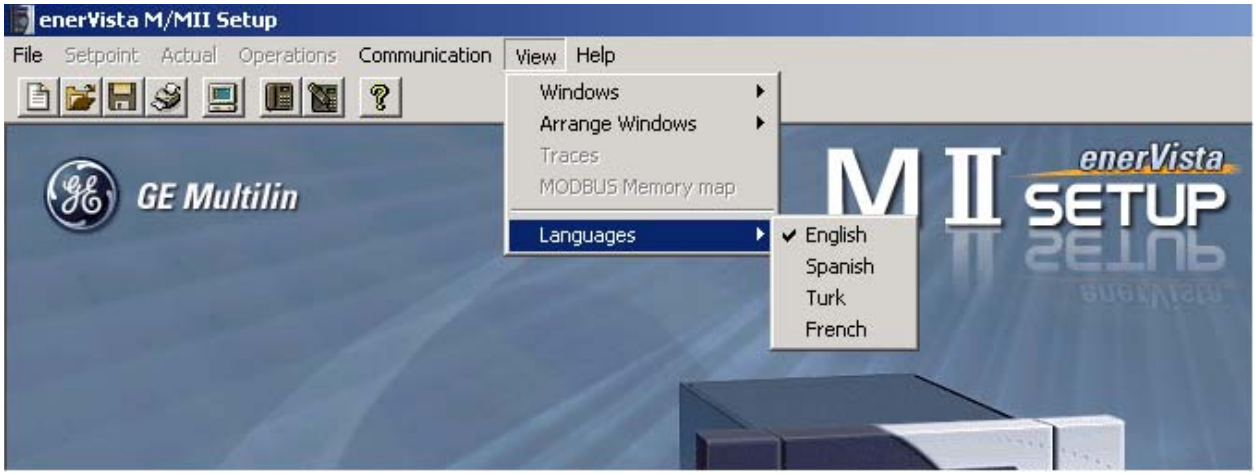


Figure 4–33: LANGUAGES

All the settings of the MIVII relay, together with the procedures to change their value, are described in this chapter. First of all, a complete list of settings is shown; including ranges, units, step and factory default value. Then, the settings requiring more detailed comments are individually explained. In the EnerVista MII SETUP program, the settings are grouped under the Setpoint menu, Setpoint sub-menu entry.

The MIVII relay provides two settings groups (group 2 is accessible in the ADVANCED SETTINGS group), stored in EEPROM memory (permanent memory). Using a setting or through a communications command, it is possible to select which group is active, and then used by the relay protection algorithms.

Settings can be accessed and modified either using the relay faceplate keypad, or using a computer connected to the relay through any of the relay communications ports, and the EnerVista MII SETUP program. The use of the keypad to modify settings is described in Chapter 8. If the computer is used to handle the settings, the following steps must be considered:

Make sure your communication cable matches the scheme shown in Figure 3–10:

Connect the communications cable between the relay (or modem) and the computer serial port.

Run the EnerVista MII SETUP program. The procedure to install and use the EnerVista MII SETUP program is described in section 1.2.2 and in section 4.

Make sure that the communications parameters in the relay match the EnerVista MII SETUP configuration settings (*Communication - Computer* Menu). The communications parameters shown in the relay faceplate display, within the configuration menu are:

Comm Password

Comm Baud Rate

Slave Address

For instructions on how to check and modify EnerVista MII SETUP program communications parameters please refer to chapter 4.

Check that the relay number and password in the MIVII display match the numbers entered in the dialog window of the EnerVista MII SETUP, after clicking on Relay Connection.

CT ratio settings allow the user to view the current measures in primary values.

5

5.2.1 PRODUCT SETUP (MIVII 1000/3000)

PATH: MENU ▲ MAIN SETTINGS ENTER PRODUCT SETUP

MAIN SETTINGS
PRODUCT SETUP

ENTER

PRODUCT SETUP
Relay Operation

Range: Ready/Disable
Default: Disable

▲ ▼

PRODUCT SETUP
Frequency

Range: 50/60
Default: 60 Hz

▲ ▼

PRODUCT SETUP
ModBus Format

Range: Intel/Motorola
Default: Intel

▲ ▼

PRODUCT SETUP
Application

Range: -Wye/Delta connection
-Single phase and neutral (MIVII 1000 only)
Default: Wye

▲ ▼

PRODUCT SETUP
Phase VT Ratio

Range: 1 - 6000
Default: 1
Step: 0.1

▲ ▼

PRODUCT SETUP
Neutral VT Ratio

Range: 1 - 6000
Default: 1
Step: 0.1

▲ ▼

PRODUCT SETUP
HMI Password

Range: 0 - 9999
Default: 0
Step: 1

▲ ▼

PRODUCT SETUP
Comm. Password

Range: 0 - 255
Default: 1
Step: 1

▲ ▼

PRODUCT SETUP
Slave Address

Range: 0 - 255
Default: 1
Step: 1

▲ ▼

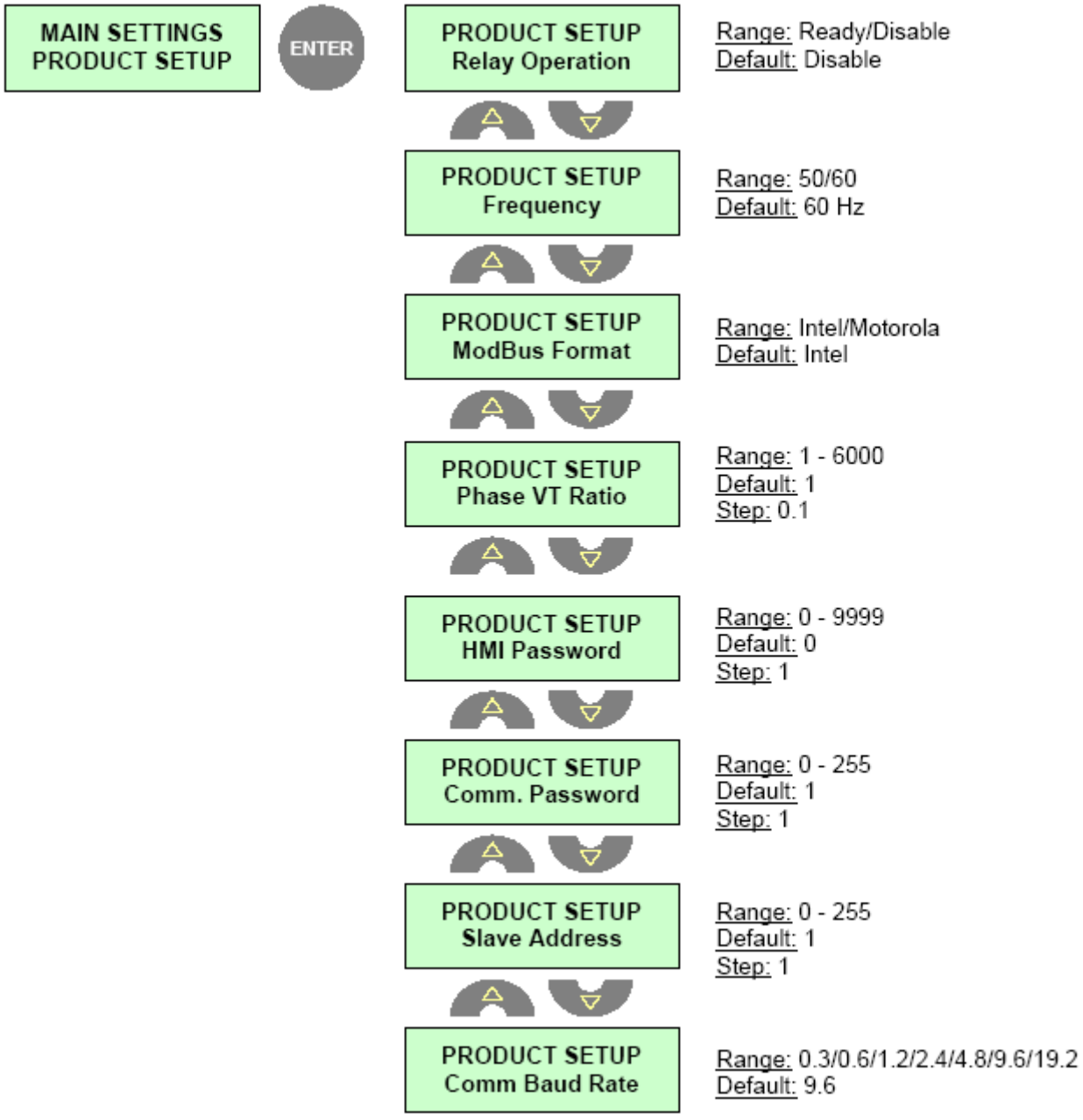
PRODUCT SETUP
Comm Baud Rate

Range: 0.3/0.6/1.2/2.4/4.8/9.6/19.2
Default: 9.6

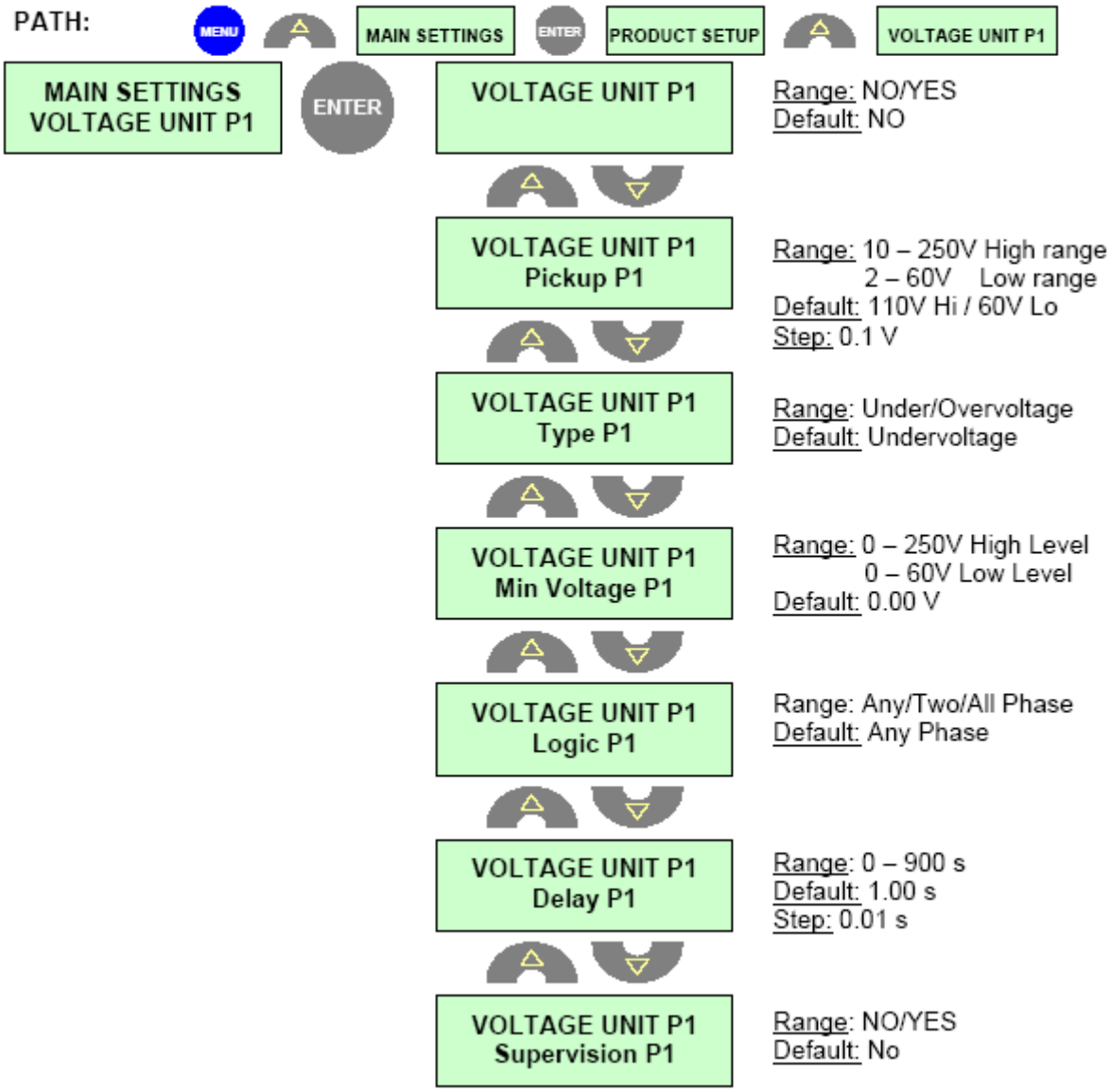
For MIVII 1000 models SINGLE PHASE and NEUTRAL options

5.2.2 PRODUCT SETUP (MIVII 2000)

PATH: MENU → MAIN SETTINGS → ENTER → PRODUCT SETUP



5.2.3 VOLTAGE UNIT P1 (MIVII 1000/3000)



5.2.4 VOLTAGE UNIT P2 (MIVII 1000/3000)

PATH: MENU → MAIN SETTINGS → ENTER → PRODUCT SETUP → VOLTAGE UNIT P1 → VOLTAGE UNIT P2

MAIN SETTINGS
VOLTAGE UNIT P2

ENTER

VOLTAGE UNIT P2

Range: NO/YES
Default: NO

VOLTAGE UNIT P2 Pickup P2

Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

VOLTAGE UNIT P2 Type P2

Range: Under/Overvoltage
Default: Undervoltage

VOLTAGE UNIT P2 Min Voltage P2

Range: 0 – 250V High Level
0 – 60V Low Level
Default: 0.00 V
Step: 0.1 V

VOLTAGE UNIT P2 Logic P2

Range: Any/Two/All Phase
Default: Any Phase

VOLTAGE UNIT P2 Delay P2

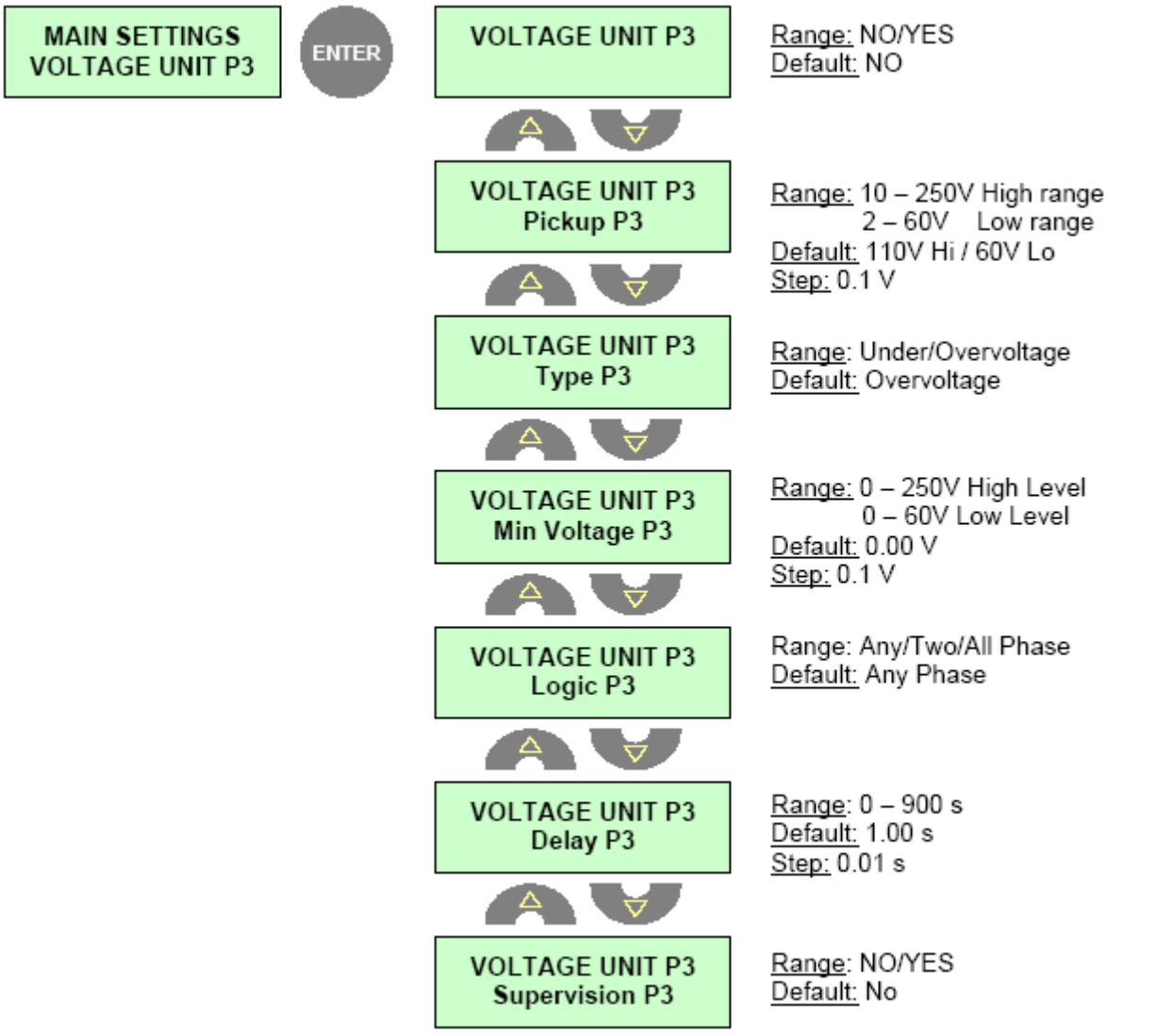
Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

VOLTAGE UNIT P2 Supervision P2

Range: NO/YES
Default: No

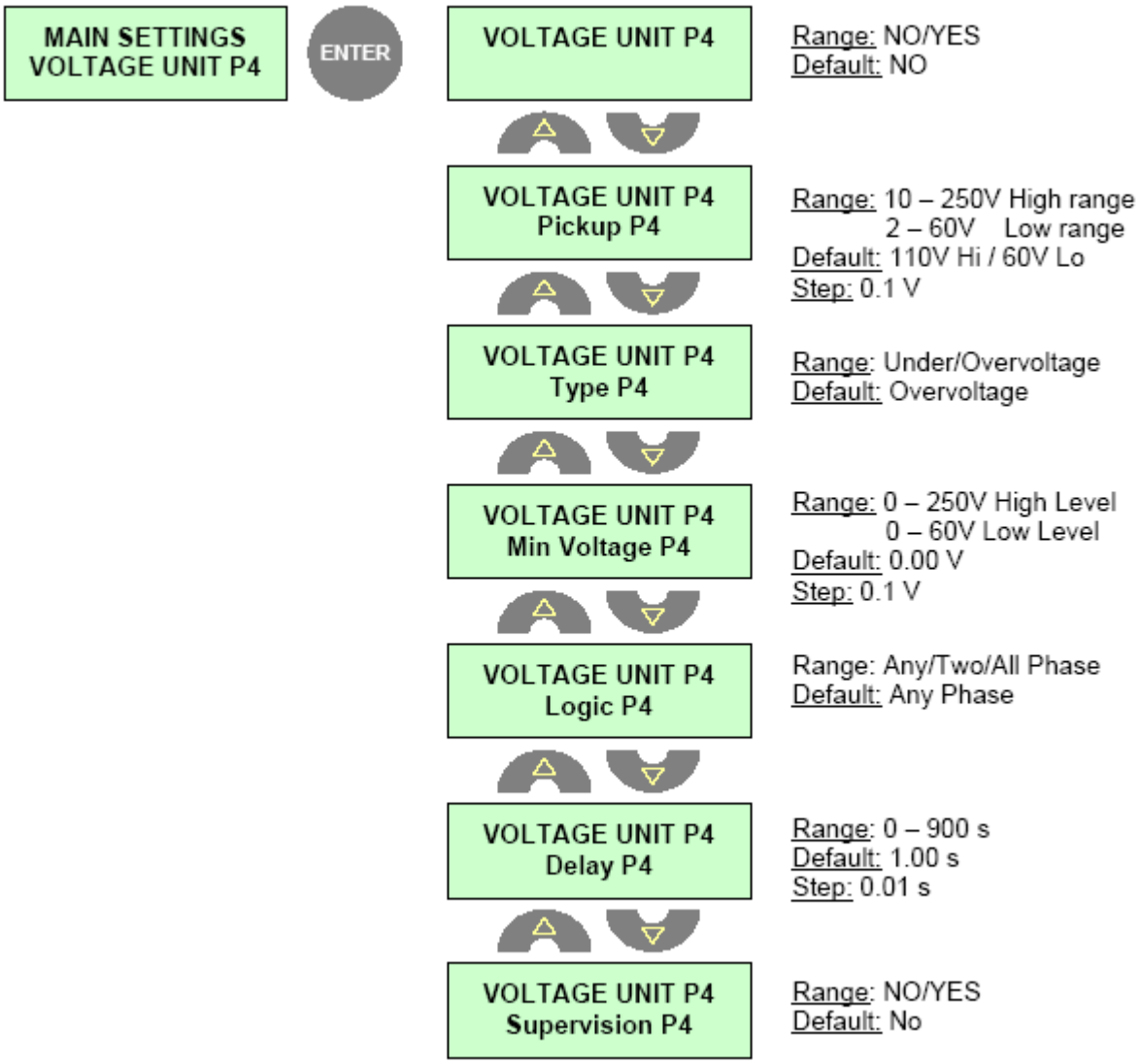
5.2.5 VOLTAGE UNIT P3 (MIVII 1000/3000)

PATH:

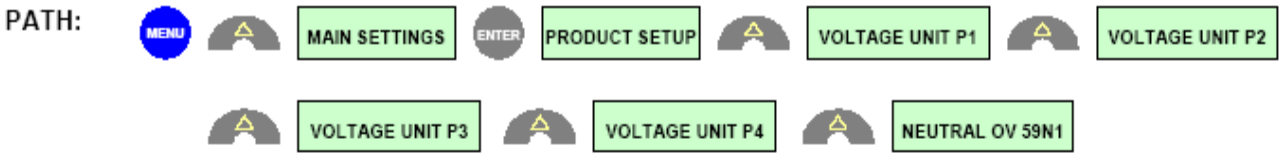


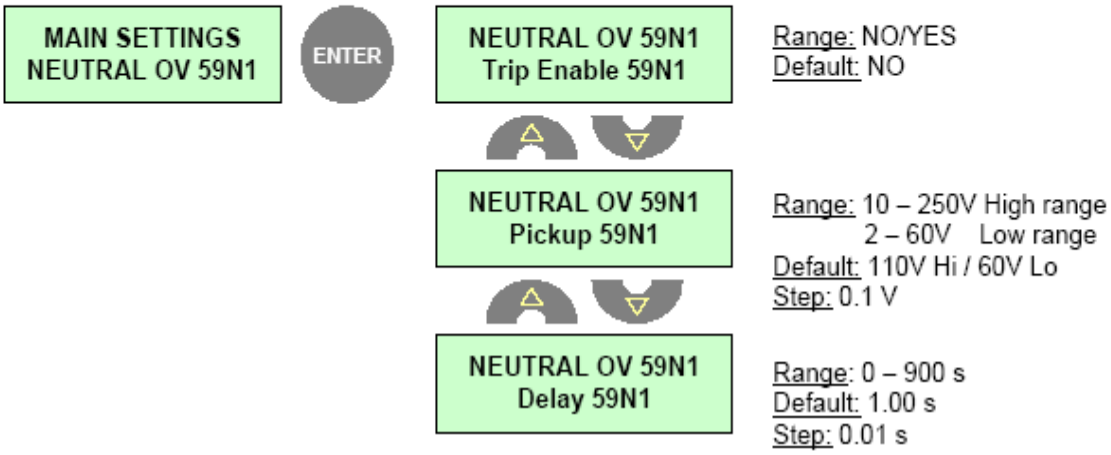
5.2.6 VOLTAGE UNIT P4 (MIVII 1000/3000)

PATH: MENU → MAIN SETTINGS → ENTER → PRODUCT SETUP → VOLTAGE UNIT P1 → VOLTAGE UNIT P2 → VOLTAGE UNIT P3 → VOLTAGE UNIT P4

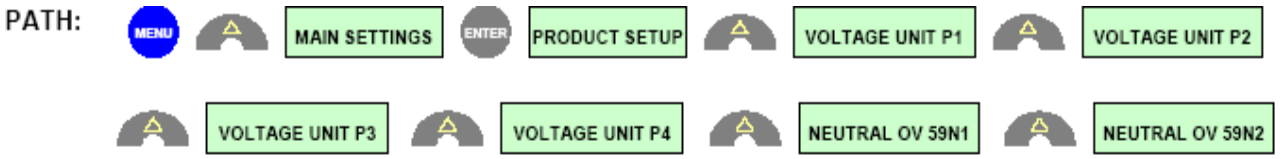


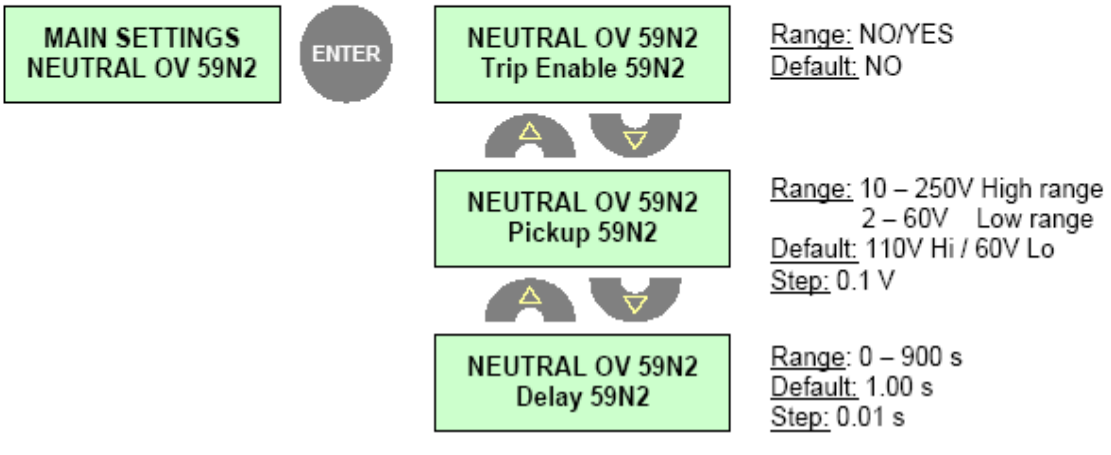
5.2.7 NEUTRAL OVERVOLTAGE 59N1 (MIVII 1000/3000)



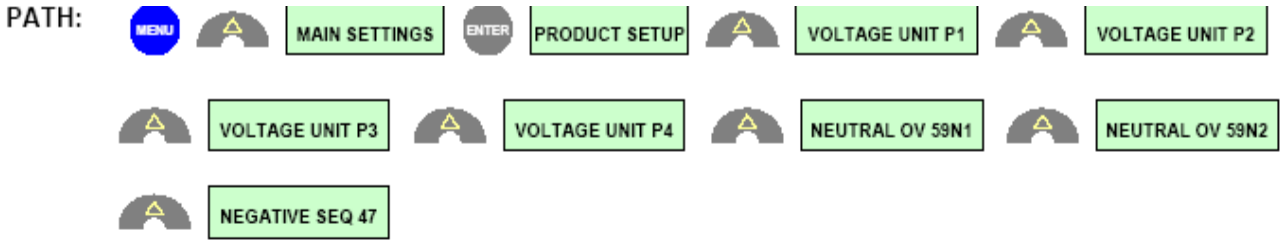


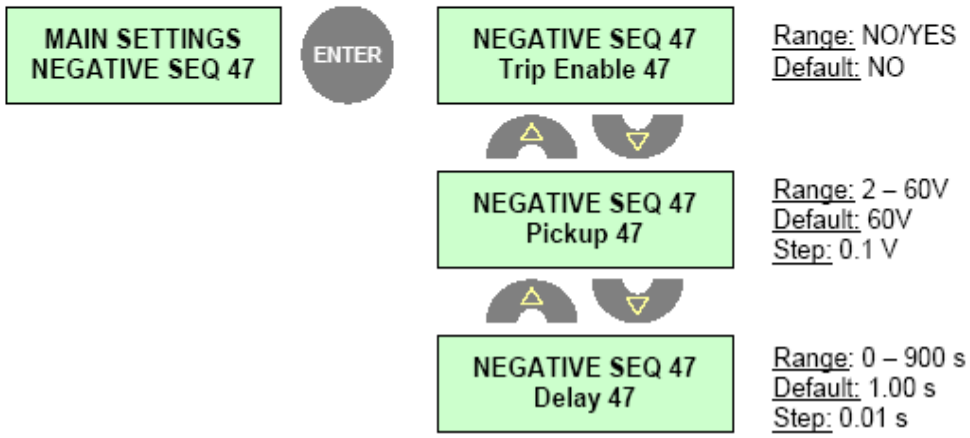
5.2.8 NEUTRAL OVERVOLTAGE 59N2 (MIVII 1000/3000)





5.2.9 NEGATIVE SEQUENCE 47 (MIVII 1000/3000)

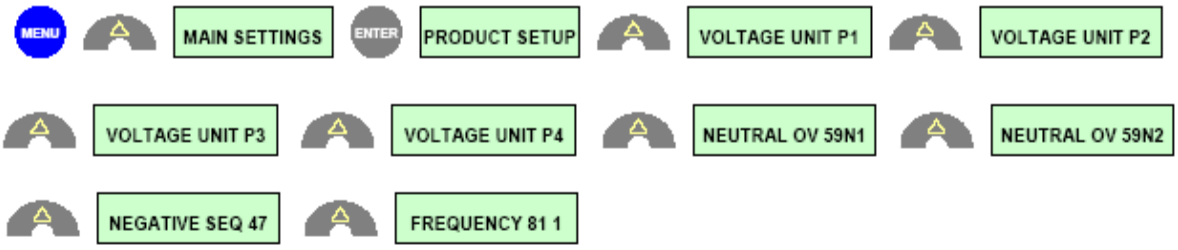


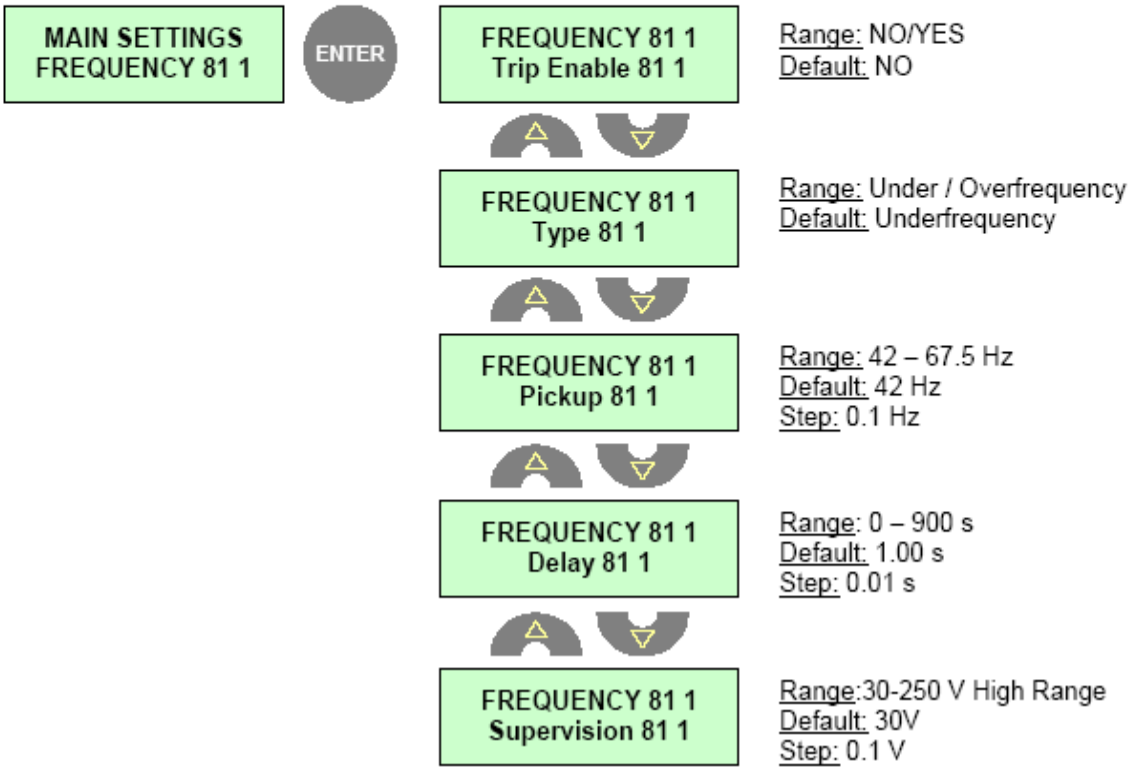


5

5.2.10 FREQUENCY UNIT 81_1 (MIVII 2000/3000)

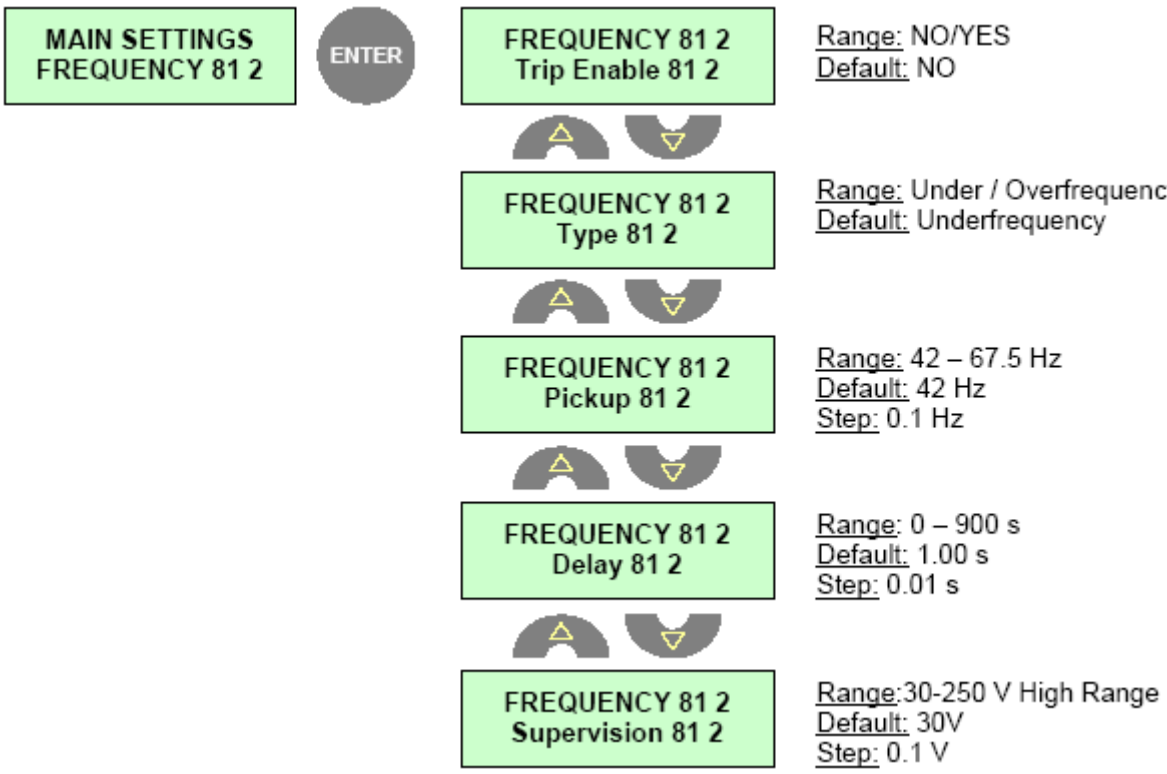
PATH:





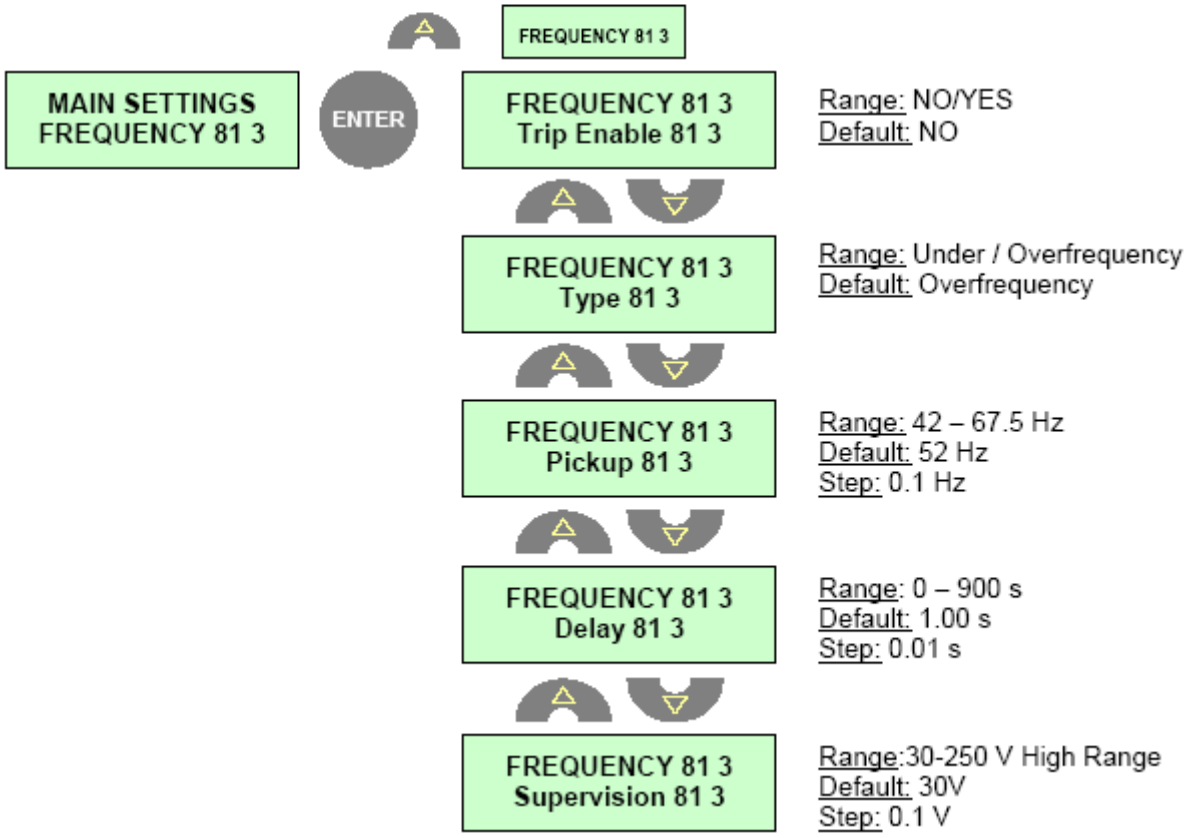
5.2.11 FREQUENCY UNIT 81_2 (MIVII 2000/3000)

PATH: MENU → MAIN SETTINGS → ENTER → PRODUCT SETUP → VOLTAGE UNIT P1 → VOLTAGE UNIT P2 → VOLTAGE UNIT P3 → VOLTAGE UNIT P4 → NEUTRAL OV 59N1 → NEUTRAL OV 59N2 → NEGATIVE SEQ 47 → FREQUENCY 81 1 → FREQUENCY 81 2

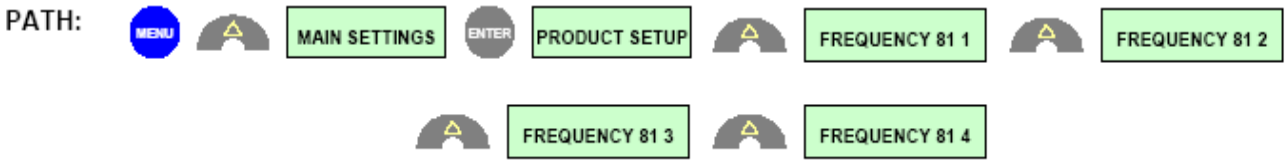


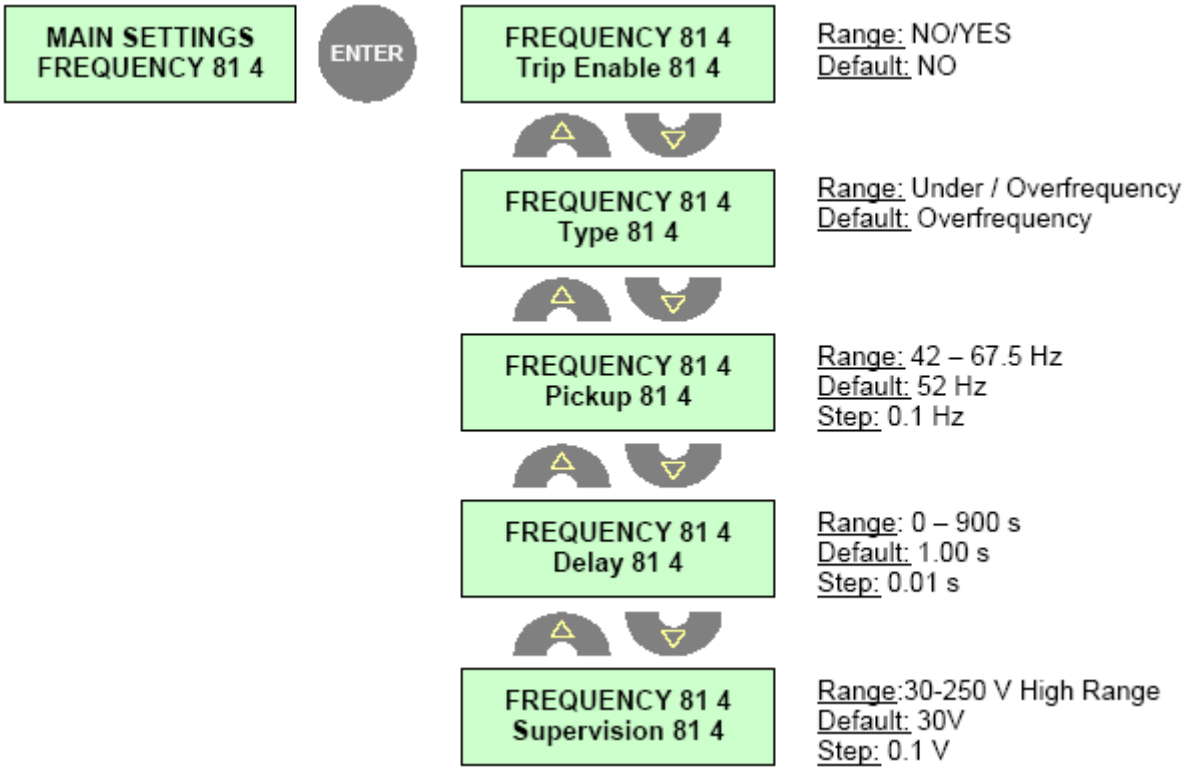
5.2.12 FREQUENCY UNIT 81_3 (MIVII 2000/3000)

PATH: MENU → MAIN SETTINGS → ENTER → PRODUCT SETUP → FREQUENCY 81 1 → FREQUENCY 81 2 → FREQUENCY 81 3

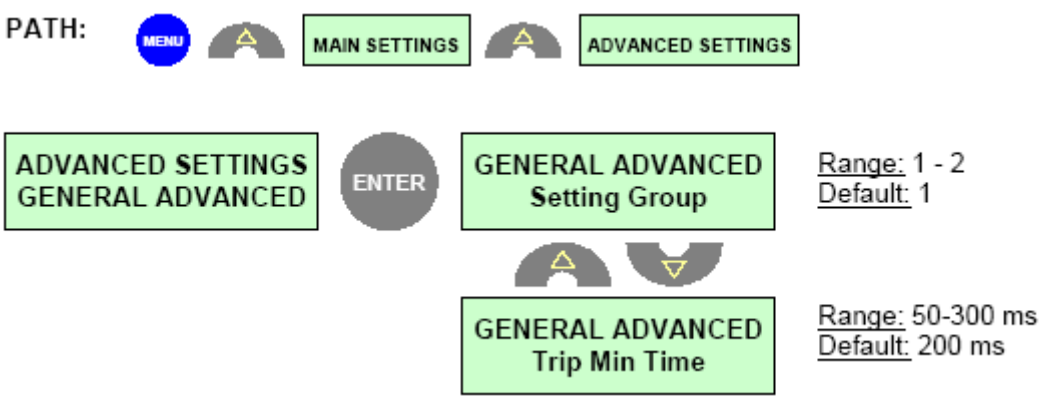


5.2.13 FREQUENCY UNIT 81_4 (MIVII 2000/3000)





5



NOTE ABOUT THE TRIP MIN TIME SETTING:

This setting indicates the time during which the tripping contact will remain closed as a minimum in case of fault. If the fault persists for a longer time than the set value, the tripping contact will remain closed and will be opened immediately after the fault is cleared, while if the fault is shorter than the set time, the relay will maintain the contact closed for this set time.

5.3.1 VOLTAGE UNIT P1 GROUP 2 (MIVII 1000/3000)

PATH: MENU → MAIN SETTINGS → ADVANCED SETTINGS → ENTER → VOLTAGE UNIT P1 GROUP 2

ADVANCED SETTINGS VOLTAGE UNIT P1 → ENTER

VOLTAGE UNIT P1
Range: NO/YES
Default: NO

VOLTAGE UNIT P1 Pickup P1
Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

VOLTAGE UNIT P1 Type P1
Range: Under/Overvoltage
Default: Undervoltage

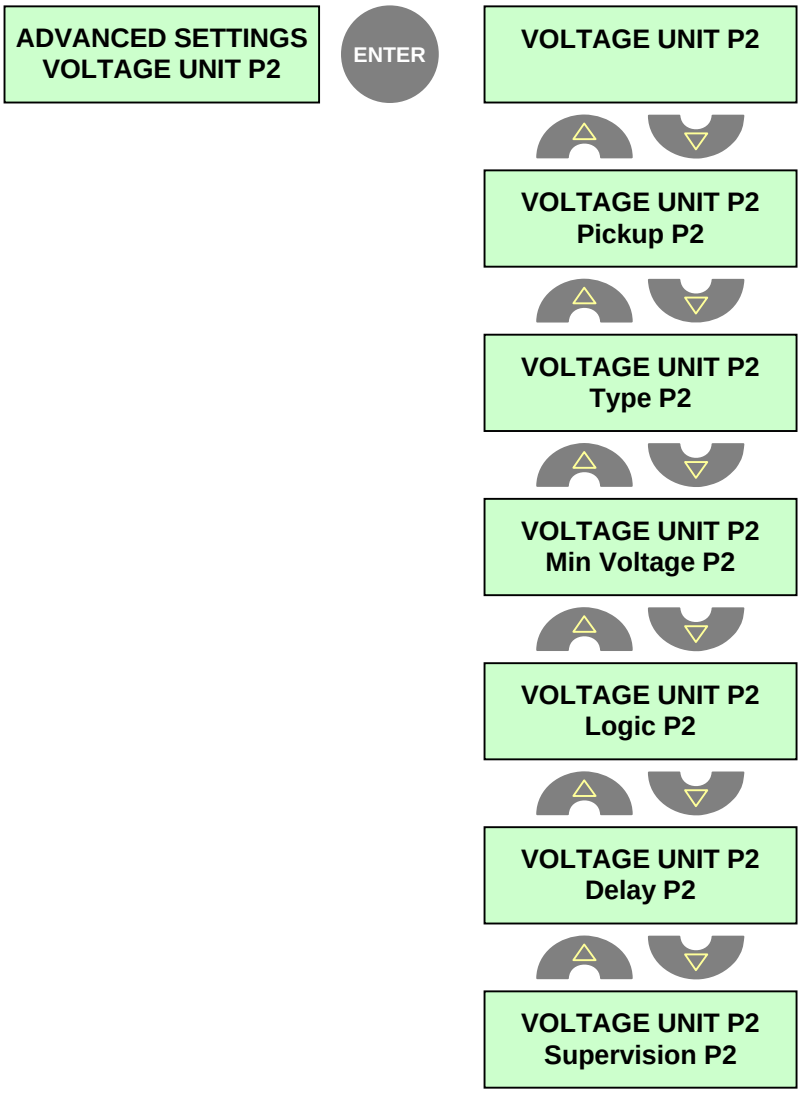
VOLTAGE UNIT P1 Min Voltage P1
Range: 0 – 250V High Level
0 – 60V Low Level
Default: 0.00 V

VOLTAGE UNIT P1 Logic P1
Range: Any/Two/All Phase
Default: Any Phase

VOLTAGE UNIT P1 Delay P1
Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

VOLTAGE UNIT P1 Supervision P1
Range: NO/YES
Default: No

5.3.2 (VOLTAGE UNIT P2 GROUP 2 (MIVII 1000/3000)



Range: NO/YES
Default: NO

Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

Range: Under/Overvoltage
Default: Undervoltage

Range: 0 – 250V High Level
0 – 60V Low Level
Default: 0.00 V
Step: 0.1 V

Range: Any/Two/All Phase
Default: Any Phase

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

Range: NO/YES
Default: No

5.3.3 VOLTAGE UNIT P3 GROUP 2 (MIVII 1000/3000)

PATH: MENU → MAIN SETTINGS → ADVANCED SETTINGS → ENTER → VOLTAGE UNIT P1 GROUP 2 → VOLTAGE UNIT P3 GROUP 2

ADVANCED SETTINGS VOLTAGE UNIT P3 → ENTER

VOLTAGE UNIT P3

Range: NO/YES
Default: NO

VOLTAGE UNIT P3 Pickup P3

Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

VOLTAGE UNIT P3 Type P3

Range: Under/Overvoltage
Default: Overvoltage

VOLTAGE UNIT P3 Min Voltage P3

Range: 0 – 250V High Level
0 – 60V Low Level
Default: 0.00 V
Step: 0.1 V

VOLTAGE UNIT P3 Logic P3

Range: Any/Two/All Phase
Default: Any Phase

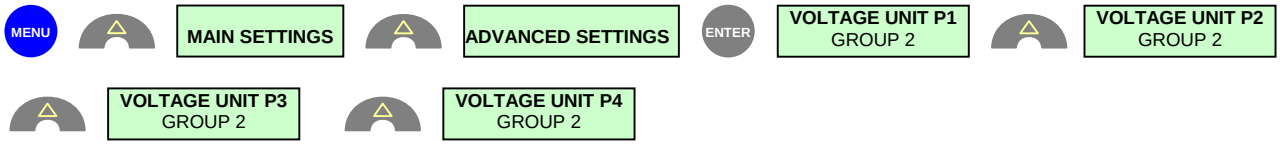
VOLTAGE UNIT P3 Delay P3

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

VOLTAGE UNIT P3 Supervision P3

Range: NO/YES
Default: No

5.3.4 VOLTAGE UNIT P4 GROUP 2 (MIVII 1000/3000)



ADVANCED SETTINGS VOLTAGE UNIT P4 — ENTER

VOLTAGE UNIT P4

Range: NO/YES
Default: NO

VOLTAGE UNIT P4 Pickup P4

Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

VOLTAGE UNIT P4 Type P4

Range: Under/Overvoltage
Default: Overvoltage

VOLTAGE UNIT P4 Min Voltage P4

Range: 0 – 250V High Level
0 – 60V Low Level
Default: 0.00 V
Step: 0.1 V

VOLTAGE UNIT P4 Logic P4

Range: Any/Two/All Phase
Default: Any Phase

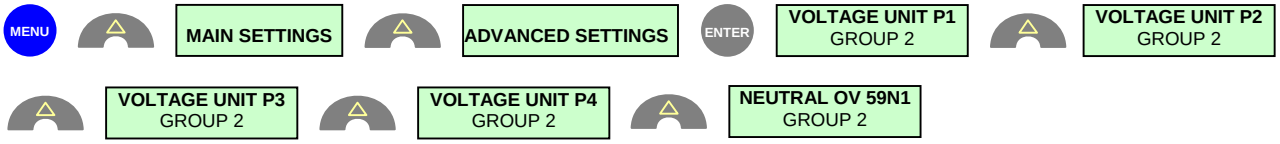
VOLTAGE UNIT P4 Delay P4

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

VOLTAGE UNIT P4 Supervision P4

Range: NO/YES
Default: No

5.3.5 NEUTRAL OVERVOLTAGE 59N1 GROUP 2 (MIVII 1000/3000)



ADVANCED SETTINGS NEUTRAL OV 59N1 → ENTER → **NEUTRAL OV 59N1 Trip Enable 59N1**

Range: NO/YES
Default: NO

NEUTRAL OV 59N1 Pickup 59N1

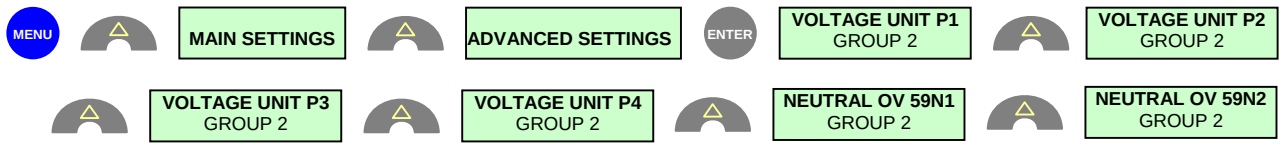
Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

NEUTRAL OV 59N1 Delay 59N1

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

5

5.3.6 NEUTRAL OVERVOLTAGE 59N2 GROUP 2 (MIVII 1000/3000)



ADVANCED SETTINGS NEUTRAL OV 59N2 → ENTER → **NEUTRAL OV 59N2 Trip Enable 59N2**

Range: NO/YES
Default: NO

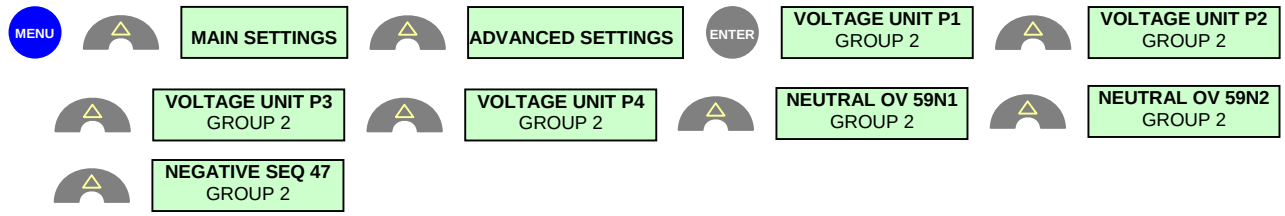
NEUTRAL OV 59N2 Pickup 59N2

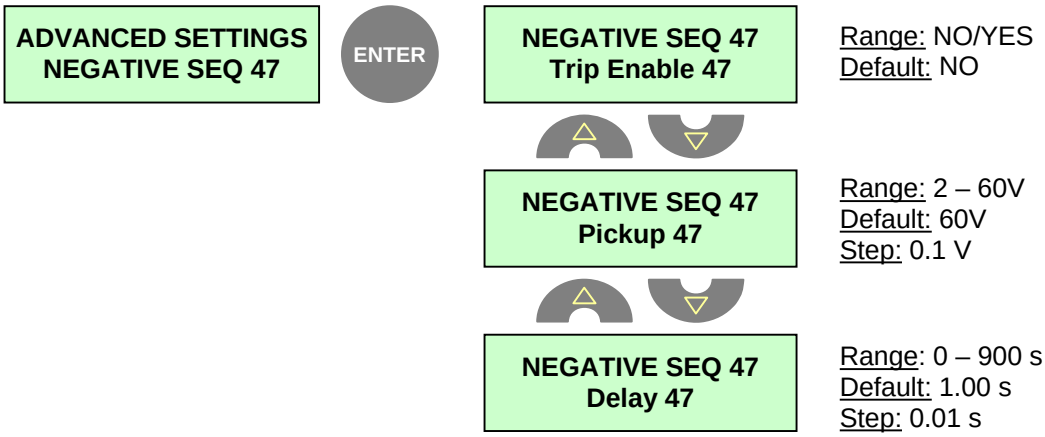
Range: 10 – 250V High range
2 – 60V Low range
Default: 110V Hi / 60V Lo
Step: 0.1 V

NEUTRAL OV 59N2 Delay 59N2

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

5.3.7 NEGATIVE SEQUENCE 47 GROUP 2 (MIVII 1000/3000)





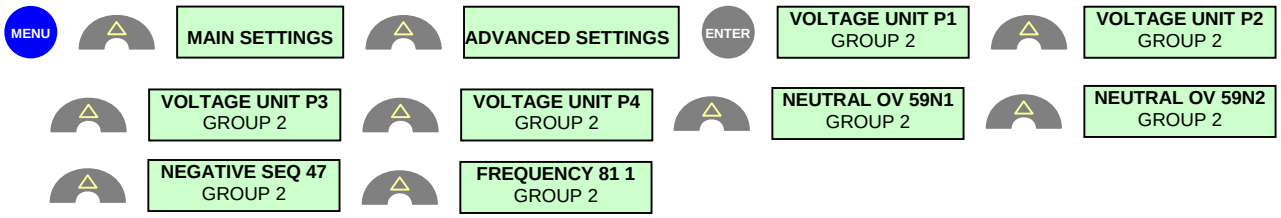
Range: NO/YES
Default: NO

Range: 2 – 60V
Default: 60V
Step: 0.1 V

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

5

5.3.8 FREQUENCY UNIT 81_1 GROUP 2 (MIVII 2000/3000)



ADVANCED SETTINGS
FREQUENCY 81 1

ENTER

FREQUENCY 81 1
Trip Enable 81 1

Range: NO/YES
Default: NO

FREQUENCY 81 1
Type 81 1

Range: Under / Overfrequency
Default: Underfrequency

FREQUENCY 81 1
Pickup 81 1

Range: 42 – 67.5 Hz
Default: 42 Hz
Step: 0.01 Hz

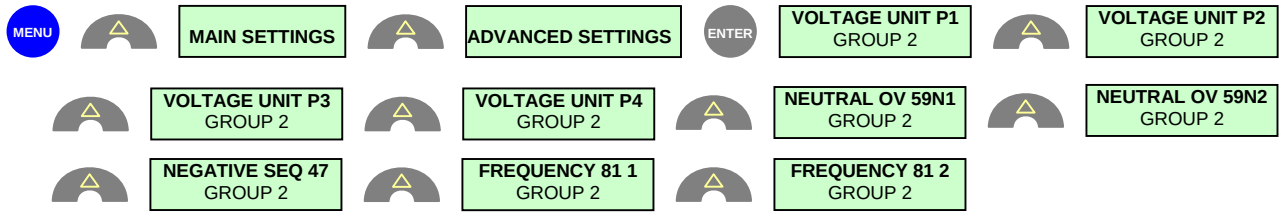
FREQUENCY 81 1
Delay 81 1

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

FREQUENCY 81 1
Supervision 81 1

Range: 30-250 V High Range
Default: 30V
Step: 0.1 V

5.3.9 FREQUENCY UNIT 81_2 GROUP 2 (MIVII 2000/3000)



ADVANCED SETTINGS FREQUENCY 81 2 — ENTER

FREQUENCY 81 2 Trip Enable 81 2
Range: NO/YES
Default: NO

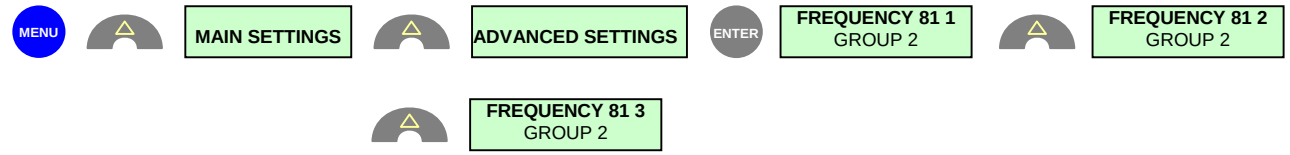
FREQUENCY 81 2 Type 81 2
Range: Under / Overfrequency
Default: Underfrequency

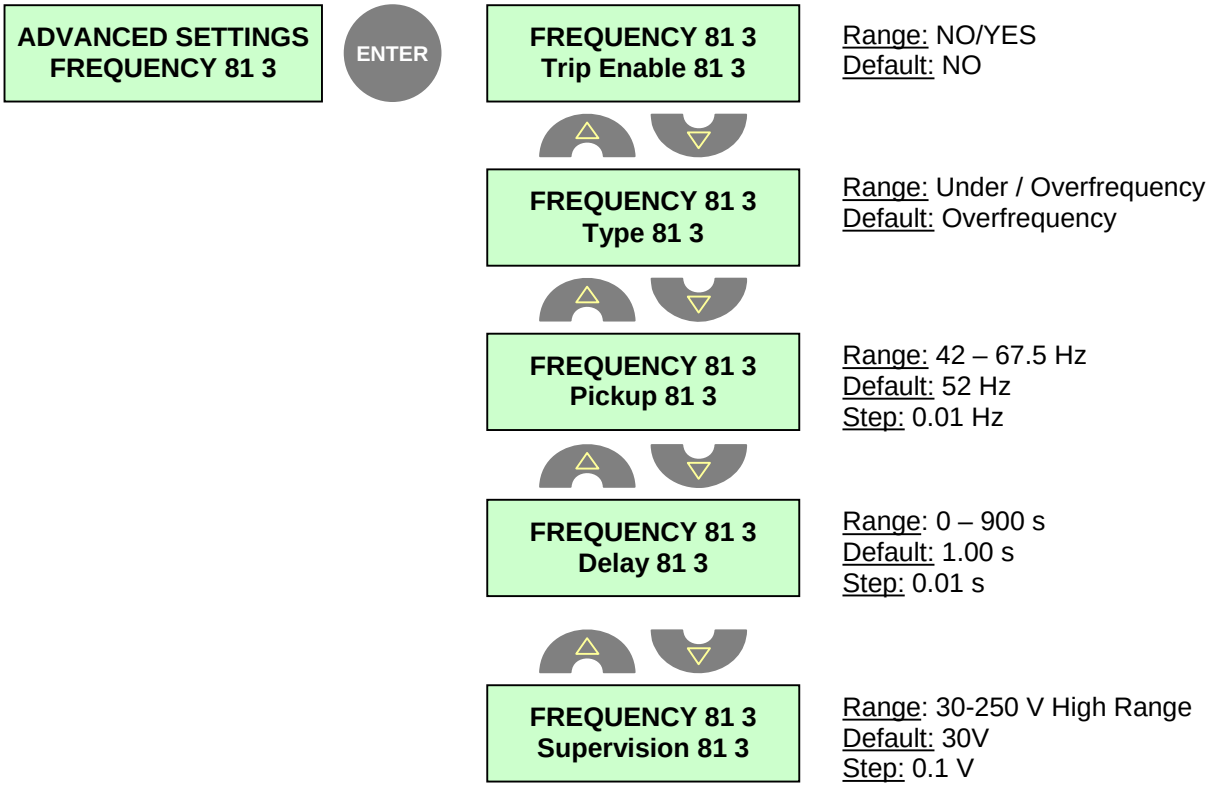
FREQUENCY 81 2 Pickup 81 2
Range: 42 – 67.5 Hz
Default: 42 Hz
Step: 0.01 Hz

FREQUENCY 81 2 Delay 81 2
Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

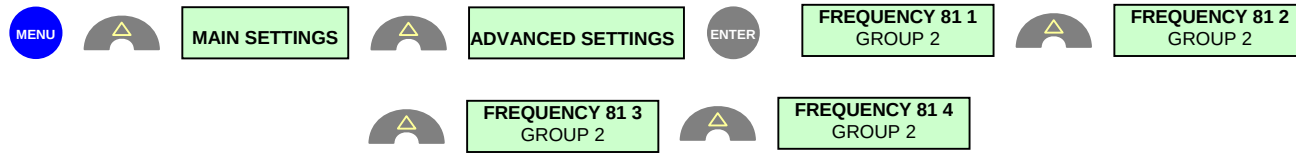
FREQUENCY 81 2 Supervision 81 2
Range: 30-250 V High Range
Default: 30V
Step: 0.1 V

5.3.10 FREQUENCY UNIT 81_3 GROUP 2 (MIVII 2000/3000)





5.3.11 FREQUENCY UNIT 81_4 GROUP 2 (MIVII 2000/3000)



ADVANCED SETTINGS FREQUENCY 81 4

ENTER

FREQUENCY 81 4 Trip Enable 81 4

Range: NO/YES
Default: NO

FREQUENCY 81 4 Type 81 4

Range: Under / Overfrequency
Default: Overfrequency

FREQUENCY 81 4 Pickup 81 4

Range: 42 – 67.5 Hz
Default: 52 Hz
Step: 0.01 Hz

FREQUENCY 81 4 Delay 81 4

Range: 0 – 900 s
Default: 1.00 s
Step: 0.01 s

FREQUENCY 81 4 Supervision 81 4

Range: 30-250 V High Range
Default: 30V
Step: 0.1 V

5.3.12 EVENTS AND OSCILLOGRAPHY MASKS (ONLY ENERVISTA MII SETUP)

Event masks have two possible settings, YES or NO. If an action (e.g. the trip of a protection function) is set as YES, when the trip takes place an event will be generated. If it is set as NO, no event will be generated.

	ENERVISTA MII SETUP	DEFAULT	MIVII1000	MIVII2000	MIVII3000
EVENT MASKS	**EVENT MASKS**				
Voltage P1 Pickup	Pickup Voltage P1	YES	®		®
Voltage P2 Pickup	Pickup Voltage P2	YES	®		®
Voltage P3 Pickup	Pickup Voltage P3	YES	®		®
Voltage P4 Pickup	Pickup Voltage P4	YES	®		®
59N1Pickup	Pickup 59N1	YES	®		®
59N2Pickup	Pickup 59N2	YES	®		®
47 Pickup	Pickup 47	YES	®		®
81_1 Pickup	Pickup 81_1	YES		®	®
81_2 Pickup	Pickup 81_2	YES		®	®
81_3 Pickup	Pickup 81_3	YES		®	
81_4 Pickup	Pickup 81_4	YES		®	
Voltage P1 Disable (by DI)	Voltage P1 Disabled (by D.I.)	YES	®		®
Voltage P2 Disable (by DI)	Voltage P2 Disabled (by D.I.)	YES	®		®
Voltage P3 Disable (by DI)	Voltage P3 Disabled (by D.I.)	YES	®		®
Voltage P4 Disable (by DI)	Voltage P4 Disabled (by D.I.)	YES	®		®
59N1 trip inhibit. Activation / deactivation by digital input	59N1 Disabled (by D.I.)	YES	®		®
59N2 trip inhibit. Activation / deactivation by digital input	59N2 Disabled (by D.I.)	YES	®		®
47 trip inhibit. Activation / deactivation by digital input	47 Disabled (by D.I.)	YES	®		®
81_1 trip inhibit. Activation / deactivation by digital input	81_1 Disabled (by D.I.)	YES		®	®
81_2 trip inhibit. Activation / deactivation by digital input	81_2 Disabled (by D.I.)	YES		®	®
81_3 trip inhibit. Activation / deactivation by digital input	81_3 Disabled (by D.I.)	YES		®	
81_4 trip inhibit. Activation / deactivation by digital input	81_4 Disabled (by D.I.)	YES		®	
General trip inhibit. Activation / deactivation by digital input	Trip Disabled (by D.I.)	YES	®	®	®
Voltage P1 Trip	Voltage P1 Trip	YES	®		®
Voltage P2 Trip	Voltage P2 Trip	YES	®		®
Voltage P3 Trip	Voltage P3 Trip	YES	®		®
Voltage P4 Trip	Voltage P4 Trip	YES	®		®
Trip 59N1	59N1 Trip	YES	®		®
Trip 59N2	59N2 Trip	YES	®		®
Trip 47	47 Trip	YES	®		®
Trip 81_1	81_1 Trip	YES		®	®
Trip 81_2	81_2 Trip	YES		®	®
Trip 81_3	81_3 Trip	YES		®	
Trip 81_4	81_4 Trip	YES		®	
General trip	General Trip	YES	®	®	®
Protection activation /deactivation	Protection Status	YES	®	®	®
Auxiliary output 1 activation / deactivation	Output 1	YES	®	®	®
Auxiliary output 2 activation / deactivation	Output 2	YES	®	®	®

Auxiliary output 3 activation / deactivation	Output 3	YES	®	®	®
Auxiliary output 4 activation / deactivation	Output 4	YES	®	®	®
Digital input 1 activation / deactivation	Digital input 1	YES	®	®	®
Digital input 2 activation / deactivation	Digital input 2	YES	®	®	®
Settings change through input inhibition activation/deactivation	Settings change disable	YES	®	®	®
Trip command activation by digital input	Trip command by input	YES	®	®	®
Trip command activation by command	Trip command by command	YES	®	®	®
Auxiliary contacts latching reset	Reset Latch aux	YES	®	®	®
52 B open/closed	Breaker 52 B	YES	®	®	®
52 A open/closed	Breaker 52 A	YES	®	®	®
52 open/closed	Breaker closed	YES	®	®	®
Oscillography trigger by digital input	Osc. Trigger by D.I.	YES	®	®	®
Oscillography trigger by command	Osc. Trigger by command	YES	®	®	®
Settings change executed	Settings Change	YES	®	®	®
EEprom failure	EEprom failure	YES	®	®	®
User settings / Default settings	User settings	YES	®	®	®

5.3.13 OSCILLOGRAPHY MASKS

OSCILLOGRAPHY MASK	ENERVISTA MII SETUP	DEFAULT	RANGE	STEP
Oscillography masks	**Oscillography mask**			
Oscillo by communications	Oscillo by communic.	NO	Y/N	NA
Oscillo by digital input	Oscillo by Digital Input	NO	Y/N	NA
Oscillo by trip	Oscillo by trip	NO	Y/N	NA
Oscillo by pickup	Oscillo by pickup	NO	Y/N	NA

COMMENTS ON SETTINGS:

The ACTIVE GROUP setting, in the Advanced General Settings, selects which of the two settings groups is active at a given time. Its default value is 1 (GROUP 1).

MIVII includes an internal clock to time tag events. This clock can be either synchronized with the computer clock or set manually using the EnerVista MII SETUP software program (see Setpoints – Clock). It can also be set to a given Date and Time using the faceplate keypad (DATE & TIME menu entry).

incorporates 2 digital inputs, which can be configured using the EnerVista MII SETUP software (***Setpoint > Relay Configuration***). The default input configuration is as follows:

MIVII 1000

Input 1: Phase voltage functions disable (by digital input)

Input 2: Ground voltage functions disable (by digital input)

MIVII 2000

Input 1: Frequency disabled (by digital input)

Input 2: Trip contact closed (pulse)

MIVII 3000

Input 1: Voltage elements trip inhibition (by digital input)

Input 2: Frequency elements trip inhibition (by digital input)

All elements not defined as PULSE are LEVEL inputs.

In LEVEL inputs, while the voltage level is enough to activate the input, the input performs the function stated in its configuration.

PULSE inputs are different. In the configuration menu for each input there are several states already defined as Pulse inputs. When the input recognizes their activation, it performs the function stated in its configuration, independently from the time it remains activated. For the input to perform again the required function, it is required that the input voltage level is reset and reactivated.

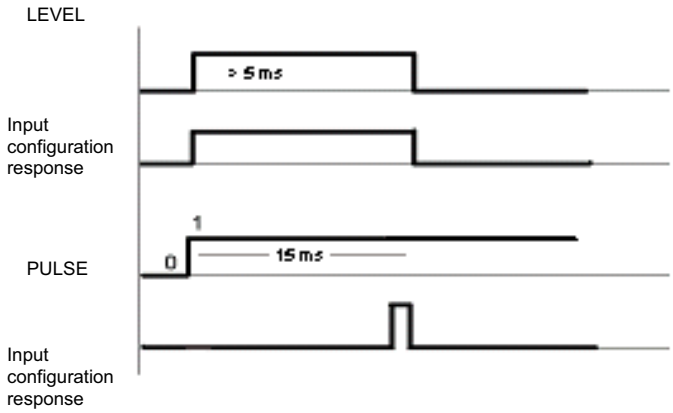


Figure 6–1: INPUT RESPONSE FOR LEVEL AND PULSE OPTIONS

The minimum operation time for a valid PULSE input is over 0.015 seconds.

Input elements are divided into four groups, two of them with eight elements per group, another group with two elements, and the last one with four elements besides the *No definition* one. Up to eight elements can be configured to be activated by the same input, providing that they are all in the same group. Elements belonging to different groups need to be assigned to different inputs.

In order to configure an input with more than one element from the same group, we must first activate the **OR** button, click on the **I/O CONFIGURATION** option and select the desired group, then select the desired elements. For inverting an element, select the **NOT** button. Finally, click the **OK** button.

INPUT CONFIGURATION WITH MORE THAN ONE FUNCTION (OR). EXAMPLE

As shown on the figure below, input 1 is assigned to an OR. Clicking on that OR checkbox, a second screen named "OR ASSIGNMENT" is displayed, where the user can select the group that contains the desired elements (in this example, "INHIBITIONS BY DIGITAL INPUT 1"). This group includes 8 elements, from which we can select the ones we want to operate in the input, and invert them by clicking on the NOT checkbox. In the example below, all functions have been assigned to the input, and all of them have been inverted. Finally, to validate the selected configuration, the user must click on the OK button both in the "OR ASSIGNMENT" and the "I/O CONFIGURATION" screens.

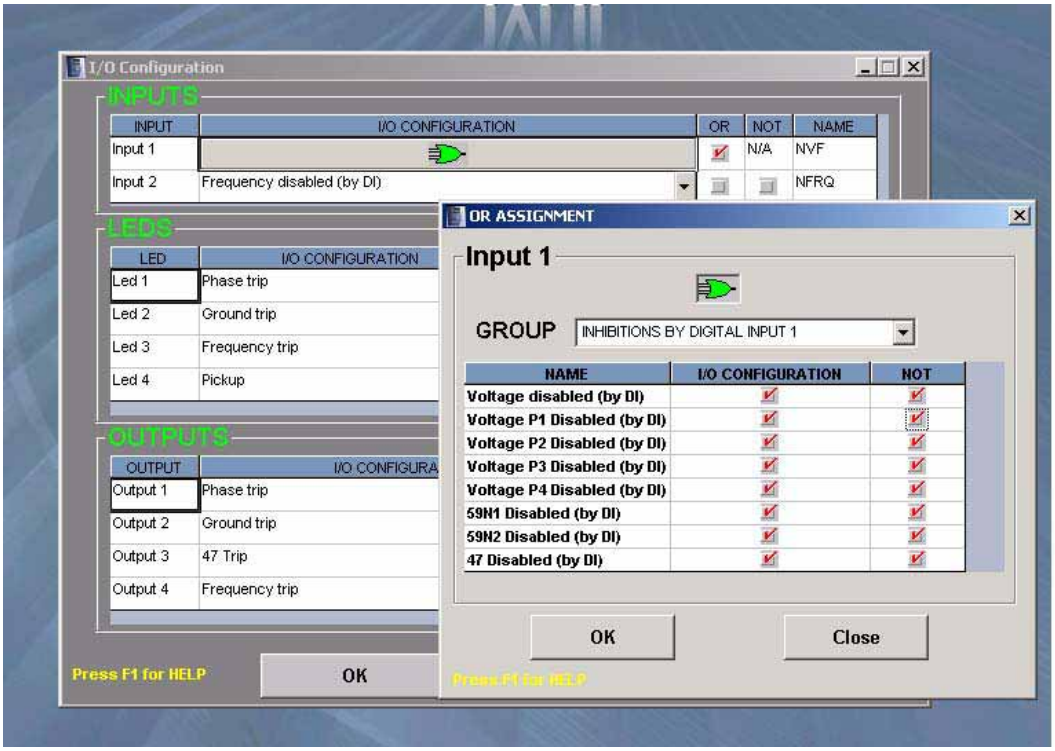


Figure 6–2: INPUT CONFIGURATION WITH MORE THAN ONE FUNCTION (OR)

SIMPLE ACTION INPUT CONFIGURATION (ONE ELEMENT ASSIGNMENT)

To assign breaker status input 52A to a digital input, select Breaker 52a from the I/O configuration selection list. The OR checkbox must not be selected.

The simplest way of programming an input is to assign it to a single element. For this purpose, the user must simply open the I/O configuration selection list of the desired input. Once opened, all possible configuration functions will be shown, and the user will then be able to select one of them.

To invert the selected function, the user must click on the NOT checkbox, to the right of the functions menu.

Figure 6–3: SIMPLE ACTION INPUT CONFIGURATION (ONE ELEMENT ASSIGNMENT)

In the example above, Input 2 has been programmed as 52a, inverted.

In case the user wants to program more than one function for each input, then an OR must be selected, as in the example regarding input configuration with more than one element (OR).

6.1.2 INPUT ELEMENTS

The following table shows the list of elements that can be assigned to each input. The table is divided into groups

GROUP	ENERVISTA MII SETUP	FUNCTIONALITY	MODELS
	NO DEFINITION	**INPUT NOT ASSIGNED**	**ALL**
INHIBITION BY DIGITAL INPUT 1	Voltage disabled (by DI)	Voltage units trip inhibition elements	1000/3000
	Voltage P1 disabled (by DI)	Voltage P1 trip inhibition element	1000/3000
	Voltage P2 disabled (by DI)	Voltage P2 trip inhibition element	1000/3000
	Voltage P3 disabled (by DI)	Voltage P3 trip inhibition element	1000/3000
	Voltage P4 disabled (by DI)	Voltage P4 trip inhibition element	1000/3000
	59N1 disabled (by DI)	59N1 trip inhibition element	1000/3000
	59N2 disabled (by DI)	59N2 trip inhibition element	1000/3000
	47 disabled (by DI)	47 trip inhibition element	1000/3000
VARIOUS 0	Phase Volt Funct disabled (by DI)	All phase voltage trip inhibition element	1000/3000
	Ground Volt Funct disabled (by DI)	Ground voltage trip inhibition element	1000/3000
INHIBITION BY DIGITAL INPUT 2	Frequency disabled (by DI)	Frequency units trip inhibition elements	2000/3000
	81_1 disabled (by DI)	81_1 unit trip inhibition element	2000/3000
	81_2 disabled (by DI)	81_2 unit trip inhibition element	2000/3000
	81_3 disabled (by DI)	81_3 unit trip inhibition element	2000
	81_4 disabled (by DI)	81_4 unit trip inhibition element	2000
	Trip disabled (by DI)	All trip inhibition	ALL
INPUTS	52A status	Active with breaker closed	ALL
	52B status	Active with breaker open	ALL
	Trip contact close (Pulse)	This function allows to close the trip contact	ALL
	Group change	Activating this element means that GROUP 2 will be the active group. When this element is disabled, the active group is the group selected for the ACTIVE GROUP setting.	ALL
	Sett. Change disable	When this function is active, setting and groups cannot be modified. It is only possible to activate GROUP 2using the Group Change digital input.	ALL
	Reset (PULSE)	This element allows resetting the LEDs and the outputs Latches.	ALL
	Oscillo trigger (PULSE)	Oscillography activation	ALL
	General input	Generic function used in the logic configuration	ALL

6.2.1 DESCRIPTION OF OUTPUTS AND LEDS

MIVII incorporates 6 outputs and 6 LED indicators. 4 of the outputs and LED indicators are user configurable, and can only be programmed using EnerVista MII SETUP software (SETPOINT – RELAY CONFIGURATION). The first two LEDs are fixed for READY (System ready) and TRIP. The fixed outputs are programmed for ALARM (System alarm) and TRIP.

The TRIP LED activates when the TRIP contact closes.

The READY LED turns on when all the following conditions are fulfilled:

- The relay status is READY
- At least one of the protection functions of the active table is enabled
- The trip of at least one of the enabled functions is also enabled.

The default configuration for outputs is as follows:

OUTPUT	MIVII1000		MIVII2000		MIVII3000	
	CONFIGURATION	MEMORY	CONFIGURATION	MEMORY	CONFIGURATION	MEMORY
1	Under Voltage Trip	No	81_1 Trip	No	Phase Trip	No
2	Over Voltage Trip	No	81_2 Trip	No	Ground Trip	No
3	59N1 Trip	No	81_3 Trip	No	47 Trip	No
4	59N2 Trip	No	81_4 Trip	No	Frequency Trip	No

The default LED configuration is as follows:

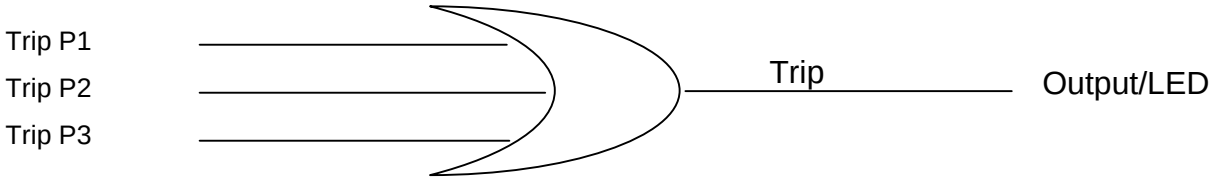
LED	MIVII1000		MIVII2000		MIVII3000	
	CONFIGURATION	MEMORY	CONFIGURATION	MEMORY	CONFIGURATION	MEMORY
1	Under Voltage Trip	Yes	81_1 Trip	Yes	Phase Trip	Yes
2	Over Voltage Trip	Yes	81_2 Trip	Yes	Ground Trip	Yes
3	59N Trip	Yes	81_3 Trip	Yes	Frequency Trip	Yes
4	Pickup	No	81_4 Trip	Yes	Pickup	No

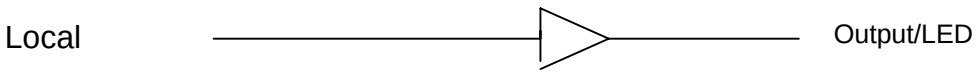
Outputs/LEDs can be configured to be activated by a single element or by a sum of several of them. These elements are divided into eight groups, besides the *No definition* element. Elements belonging to the same group can be assigned to the same output/LED. Elements of different groups need to be assigned to different outputs/LEDs.

In order to assign several elements to activate an output/LED, we first activate the **OR** button, next, click on the **I/O CONFIGURATION** frame and select the desired element group, then choose the desired elements. In order to invert an element, select the **NOT** button. Finally, click on the **OK** button.

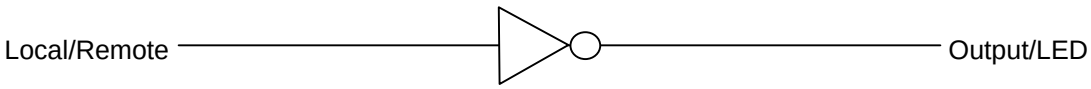
The Output/LED logic can inverted selecting the general **NOT** button. Outputs can be latched, and LEDs can be set to be fixed or blinking.

If we want to assign a phase differential trip to an output or LED, the output or LED must be programmed with elements"Trip P1", "Trip P2" and "Trip P3".





If we want an output or LED to be active when function is Remote, we must program the output or LED with the Local/ Remote function inverted with NOT.



Elements from different groups cannot be included in an OR type logic.

6.2.2 OUTPUT AND LED ELEMENTS

The list of elements that can be assigned to the different outputs and LEDs is divided into the following groups:

GROUP	ENERVISTA MII SETUP	FUNCTIONALITY	MODELS
	NO DEFINITION	**OUTPUT OR LED NOT CONFIGURED**	**ALL**
CONFIGURATION	Logic 1	Output signal from the logic block 1	ALL
	Logic 2	Output signal from the logic block 2	ALL
	Logic 3	Output signal from the logic block 3	ALL
	Logic 4	Output signal from the logic block 4	ALL
VARIOUS 3	Phase A trip	Phase A trip signal	1000/3000
	Phase B trip	Phase B trip signal	1000/3000
	Phase C trip	Phase C trip signal	1000/3000
	Phase Trip	Phase Trip signal	1000/3000
	Ground Trip	Ground Trip signal	1000/3000
ELEMENT TRIP 2	Frequency Trip	Frequency Trip signal	2000/3000
	81_1 Trip	81_1 element trip signal	2000/3000
	81_2 Trip	81_2 element trip signal	2000/3000
	81_3 Trip	81_3 element trip signal	2000
	81_4 Trip	81_4 element trip signal	2000
	General trip	Trip of any element	ALL
VARIOUS 0	Over Voltage trip	Over voltage trip signal	1000/3000
	Under Voltage trip	Under voltage trip signal	1000/3000
	59N trip	59N trip signal	1000/3000
PHASE TRIPS 1	Voltage P1 Phase A trip	Voltage P1 Phase A trip signal	1000/3000
	Voltage P1 Phase B trip	Voltage P1 Phase B trip signal	1000/3000
	Voltage P1 Phase B trip	Voltage P1 Phase C trip signal	1000/3000
	Voltage P2 Phase A trip	Voltage P2 Phase A trip signal	1000/3000
	Voltage P2 Phase B trip	Voltage P2 Phase B trip signal	1000/3000
	Voltage P2 Phase B trip	Voltage P2 Phase C trip signal	1000/3000
PHASE TRIPS 2	Voltage P3 Phase A trip	Voltage P3 Phase A trip signal	1000/3000
	Voltage P3 Phase B trip	Voltage P3 Phase B trip signal	1000/3000
	Voltage P3 Phase B trip	Voltage P3 Phase C trip signal	1000/3000
	Voltage P4 Phase A trip	Voltage P4 Phase A trip signal	1000/3000
	Voltage P4 Phase B trip	Voltage P4 Phase B trip signal	1000/3000
	Voltage P4 Phase B trip	Voltage P4 Phase C trip signal	1000/3000
ELEMENT TRIP 1	Voltage P1 trip	Voltage P1 trip signal	1000/3000
	Voltage P2 trip	Voltage P2 trip signal	1000/3000
	Voltage P3 trip	Voltage P3 trip signal	1000/3000
	Voltage P4 trip	Voltage P4 trip signal	1000/3000
	59N1 trip	59N1 trip signal	1000/3000
	59N2 trip	59N2 trip signal	1000/3000
	47 trip	47 trip signal	1000/3000
PHASE PICKUPS 1	Voltage P1 Phase A pickup	Voltage P1 Phase A pickup signal	1000/3000
	Voltage P1 Phase B pickup	Voltage P1 Phase B pickup signal	1000/3000
	Voltage P1 Phase B pickup	Voltage P1 Phase C pickup signal	1000/3000
	Voltage P2 Phase A pickup	Voltage P2 Phase A pickup signal	1000/3000
	Voltage P2 Phase B pickup	Voltage P2 Phase B pickup signal	1000/3000
	Voltage P2 Phase B pickup	Voltage P2 Phase C pickup signal	1000/3000

PHASE PICKUPS 2	Voltage P3 Phase A pickup	Voltage P3 Phase A pickup signal	1000/3000
	Voltage P3 Phase B pickup	Voltage P3 Phase B pickup signal	1000/3000
	Voltage P3 Phase B pickup	Voltage P3 Phase C pickup signal	1000/3000
	Voltage P4 Phase A pickup	Voltage P4 Phase A pickup signal	1000/3000
	Voltage P4 Phase B pickup	Voltage P4 Phase B pickup signal	1000/3000
	Voltage P4 Phase B pickup	Voltage P4 Phase C pickup signal	1000/3000
ELEMENT PICKUPS 1	Voltage P1 pickup	Voltage P1 pickup signal	1000/3000
	Voltage P2 pickup	Voltage P2 pickup signal	1000/3000
	Voltage P3 pickup	Voltage P3 pickup signal	1000/3000
	Voltage P4 pickup	Voltage P4 pickup signal	1000/3000
	59N1 pickup	59N1 pickup signal	1000/3000
	59N2 pickup	59N2 pickup signal	1000/3000
	47 pickup	47 pickup signal	1000/3000
ELEMENT PICKUPS 2	81_1 pickup	81_1 pickup signal	2000/3000
	81_2 pickup	81_2 pickup signal	2000/3000
	81_3 pickup	81_3 pickup signal	2000
	81_4 pickup	81_4 pickup signal	2000
	Pickup	Pickup of any element	ALL
PHASE VIRTUAL TRIPS 1	Voltage P1 Phase A Virtual Trip	Virtual Trip of Voltage P1 Phase A element	1000/3000
	Voltage P1 Phase B Virtual Trip	Virtual Trip of Voltage P1 Phase B element	1000/3000
	Voltage P1 Phase C Virtual Trip	Virtual Trip of Voltage P1 Phase C element	1000/3000
	Voltage P2 Phase A Virtual Trip	Virtual Trip of Voltage P2 Phase A element	1000/3000
	Voltage P2 Phase B Virtual Trip	Virtual Trip of Voltage P2 Phase B element	1000/3000
	Voltage P2 Phase C Virtual Trip	Virtual Trip of Voltage P2 Phase C element	1000/3000
PHASE VIRTUAL TRIPS 2	Voltage P3 Phase A Virtual Trip	Virtual Trip of Voltage P3 Phase A element	1000/3000
	Voltage P3 Phase B Virtual Trip	Virtual Trip of Voltage P3 Phase B element	1000/3000
	Voltage P3 Phase C Virtual Trip	Virtual Trip of Voltage P3 Phase C element	1000/3000
	Voltage P4 Phase A Virtual Trip	Virtual Trip of Voltage P4 Phase A element	1000/3000
	Voltage P4 Phase B Virtual Trip	Virtual Trip of Voltage P4 Phase B element	1000/3000
	Voltage P4 Phase C Virtual Trip	Virtual Trip of Voltage P4 Phase C element	1000/3000
ELEMENT VIRTUAL TRIPS 1	Voltage P1 Virtual Trip	Virtual Trip of Voltage P1 Virtual Trip element	1000/3000
	Voltage P2 Virtual Trip	Virtual Trip of Voltage P2 Virtual Trip element	1000/3000
	Voltage P3 Virtual Trip	Virtual Trip of Voltage P3 Virtual Trip element	1000/3000
	Voltage P4 Virtual Trip	Virtual Trip of Voltage P4 Virtual Trip element	1000/3000
	59N1 Virtual Trip	Virtual Trip of 59N1 element	1000/3000
	59N2 Virtual Trip	Virtual Trip of 59N2 element	1000/3000
	47 Virtual Trip	Virtual Trip of 47 element	1000/3000
ELEMENT VIRTUAL TRIPS 2	81_1 Virtual trip	Virtual trip signal of 81_1 element	2000/3000
	81_2 Virtual trip	Virtual trip signal of 81_2 element	2000/3000
	81_3 Virtual trip	Virtual trip signal of 81_3 element	2000
	81_4 Virtual trip	Virtual trip signal of 81_4 element	2000
	General Virtual Trip	Virtual trip of any element	ALL
INPUTS AND OUTPUTS	Input 1	Digital Input 1	ALL
	Input 2	Digital Input 2	ALL
VARIOUS 1	EEprom failure	Activated when a failure is detected in the EEPROM management	ALL
	User settings	This element is inactive when the unit is using the default settings. When settings are modified by the user, this function is activated.	ALL
LEDS	READY	Active when the relay is in service and at least one protection unit has trip enabled.	ALL
MISCELÁNEOUS 2	Close breaker	It activates and creates a pulse when the close breaker operation is performed.	ALL
VARIOUS 2	Active Group	Group 1 or Group 2	ALL
	Local	This is LOCAL when the HMI is on the Main Settings, Advanced Settings or Operation menu.	ALL

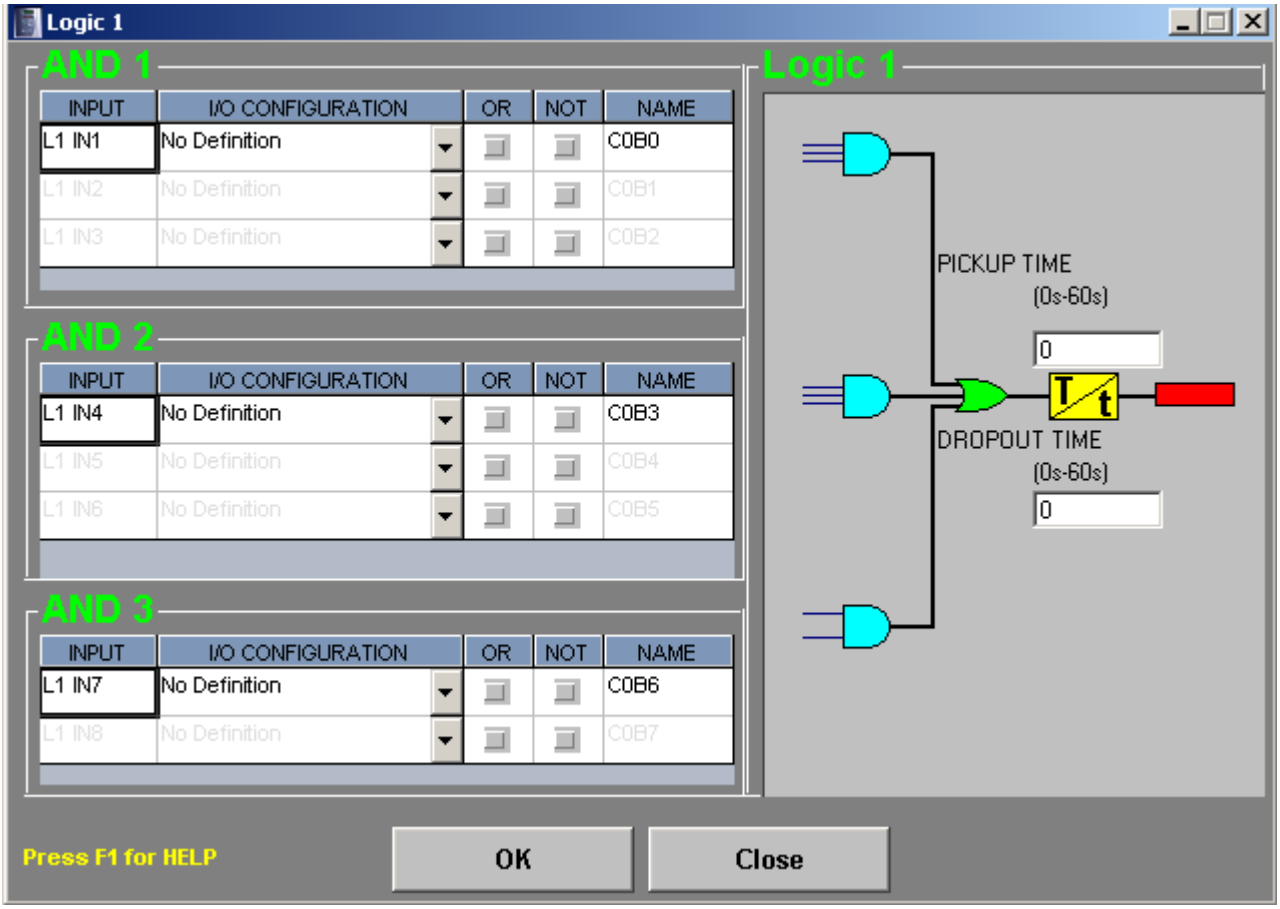
Virtual trip signals are activated as soon as the protection unit trip conditions are present, independently from the enable setting. This signal can be used to activate LEDs or auxiliary outputs. If the user wants the protection unit to trip, then the trip enable setting must be activated. In this case, the relay will activate the trip contact.

MIVII incorporates 4 logic diagrams that can be configured independently using the EnerVista MII SETUP software (***Setpoint> Logic Configuration***).

The default logic configuration is the following:

LOGIC	I/O CONFIGURATION	PICKUP TIME	DROPOUT TIME
1	No Definition	0	0
2	No Definition	0	0
3	No Definition	0	0
4	No Definition	0	0

We can configure up to eight signals in the same Logic box with the following structure:



Each signal has the same configuration structure as the signals in outputs/LEDs.

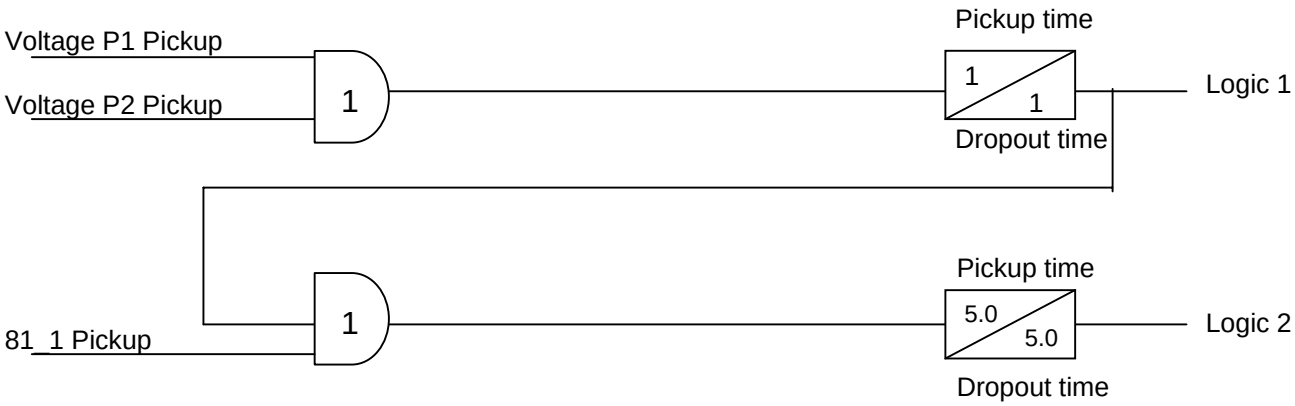
To configure a logic box, we can proceed in the same way as for the outputs/LEDs configuration per signal. If we want to assign more than one function to each signal, they must be all in the same group. We must click on the OR button, next on I/O CONFIGURATION, and then select the desired group, etc.

There are two timers, pickup and dropout timers, which can be assigned to each logic box.

IMPORTANT NOTE

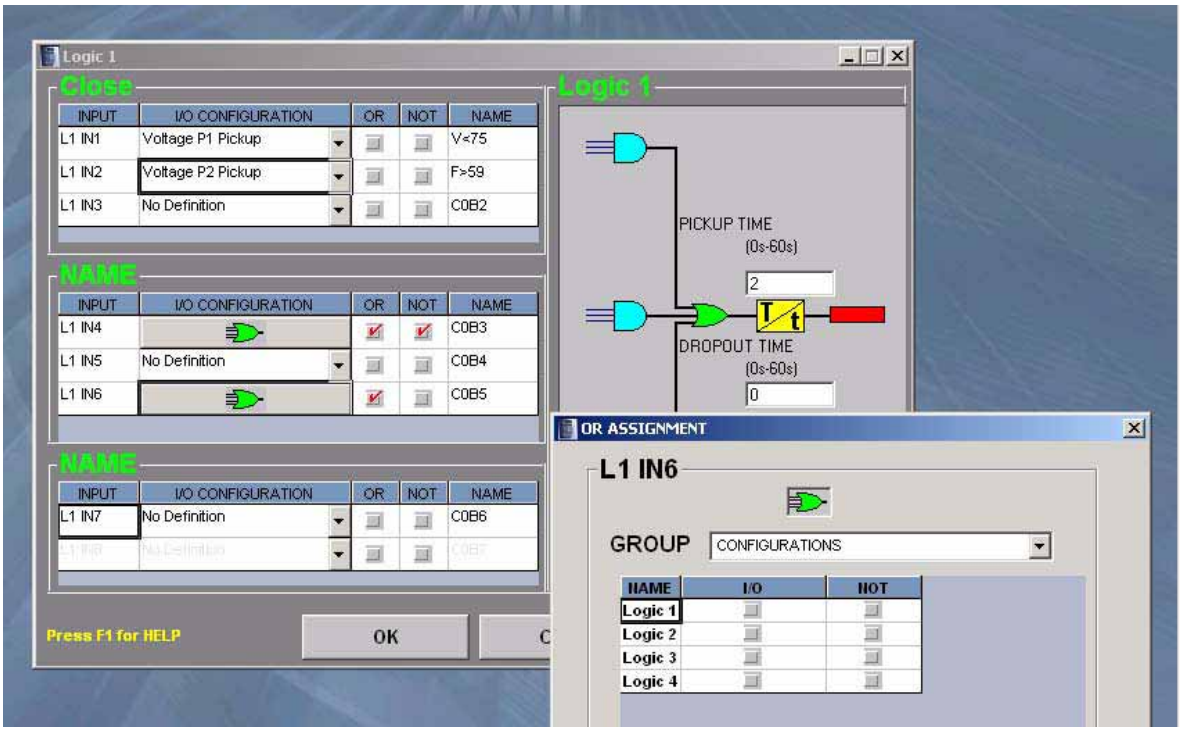
Signals must be used in order, starting with L1 IN1. If we want to use more than one signal in the same AND gate, use L1 IN2 first and then L1 IN3. If we want to use another AND gate, use AND 2 first, and then AND3.

For instance, we can configure the next logic



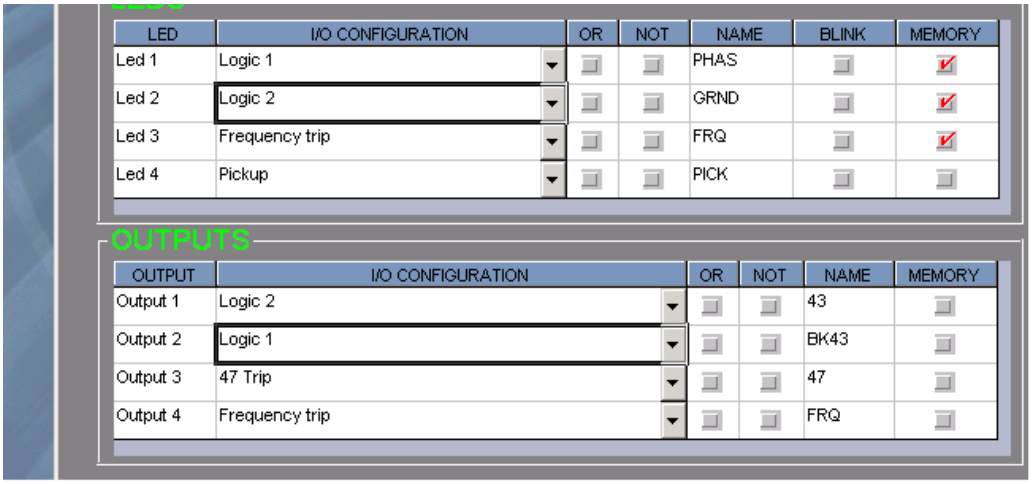
The LOGIC 1 AND is programmed as Voltage P1 Pickup and Voltage P2 Pickup. When these two pickup conditions occur, LOGIC 1 waits for a period of 1 second and then activates its status. When this status is activated, and if there is an 81_1 unit pickup (the LOGIC 2 AND is programmed as 81_1 pickup), after 5 seconds the Logic 2 status is activated.

The dropout time corresponds to the time that the logic signal will take to deactivate after the logic conditions are not met any more. In the example above, the system will take a second from the moment Voltage P1 and Voltage P2 dropout, until the logic is deactivated. In this same way, since the LOGIC 2 conditions are not met anymore, the system will take 5 seconds to deactivate the logic status.



As shown on the example above, it is also possible to apply logic ORs to each AND logic input, as well as to invert the AND outputs. For this purpose, please refer to the "I/O Configuration" section in this manual.

Logics can be assigned both to LEDs or outputs, so that each user can create the desired configuration for a specific application.



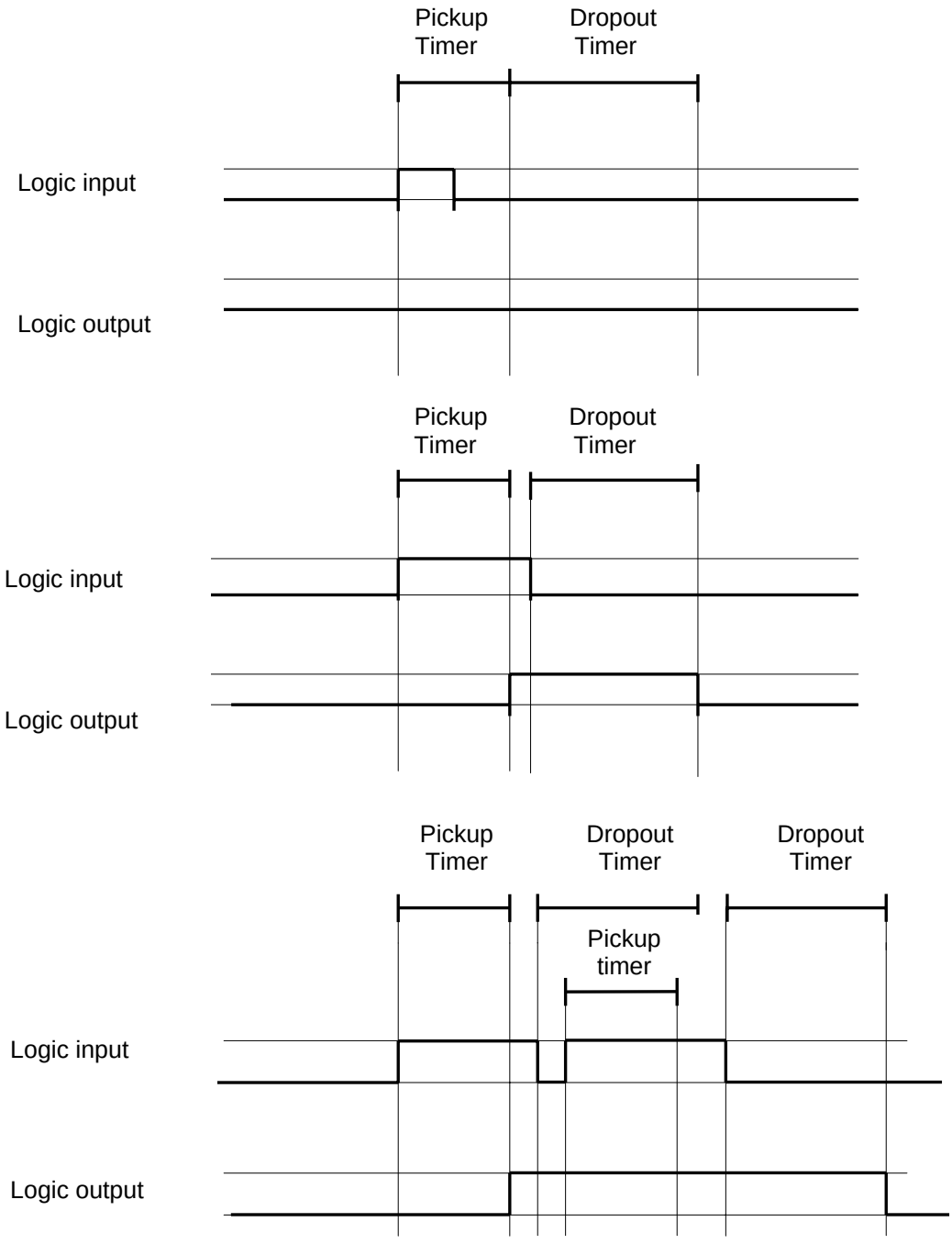
LED	I/O CONFIGURATION	OR	NOT	NAME	BLINK	MEMORY
Led 1	Logic 1	☐	☐	PHAS	☐	☑
Led 2	Logic 2	☐	☐	GRND	☐	☑
Led 3	Frequency trip	☐	☐	FRQ	☐	☑
Led 4	Pickup	☐	☐	PICK	☐	☐

OUTPUTS

OUTPUT	I/O CONFIGURATION	OR	NOT	NAME	MEMORY
Output 1	Logic 2	☐	☐	43	☐
Output 2	Logic 1	☐	☐	BK43	☐
Output 3	47 Trip	☐	☐	47	☐
Output 4	Frequency trip	☐	☐	FRQ	☐

The "Application Notes" section in this manual describes several real application examples.

Time diagram for the logic configuration:



The list of elements that can be assigned in the configurable logic is divided into the following groups:

GROUP	NO DEFINITION	OUTPUT OR LED NOT ASSIGNED	MIVII MODEL
CONFIGURATIONS	Logic 1	Output signal from logic 1	ALL
	Logic 2	Output signal from logic 2	ALL
	Logic 3	Output signal from logic 3	ALL
	Logic 4	Output signal from logic 4	ALL
MIXED 3	Phase trip	Any trip of 50P1, 50P2 elements	1000/3000
	Ground trip	Any trip of 50G1, 50G2 elements	1000/3000
	Phase A trip	Trip of any Phase A element	1000/3000
	Phase B trip	Trip of any Phase B element	1000/3000
	Phase C trip	Trip of any Phase C element	1000/3000

GROUP	NO DEFINITION	OUTPUT OR LED NOT ASSIGNED	MIVII MODEL
ELEMENT TRIPS 2	Frequency Trip	Frequency Trip signal	2000/3000
	81_1 Trip	81_1 element trip signal	2000/3000
	81_2 Trip	81_2 element trip signal	2000/3000
	81_3 Trip	81_3 element trip signal	2000
	81_4 Trip	81_4 element trip signal	2000
	General trip	Any trip of the above mentioned elements	ALL
MIXED 0	Over Voltage Trip	Over voltage trip signal	1000/3000
	Under Voltage Trip	Under voltage trip signal	1000/3000
	59N trip	59N trip signal	1000/3000
	Voltage P1 Phase A trip	Voltage P1 Phase A trip signal	1000/3000
	Voltage P1 Phase B trip	Voltage P1 Phase B trip signal	1000/3000
PHASE TRIPS 1	Voltage P1 Phase C trip	Voltage P1 Phase C trip signal	1000/3000
	Voltage P2 Phase A trip	Voltage P2 Phase A trip signal	1000/3000
	Voltage P2 Phase B trip	Voltage P2 Phase B trip signal	1000/3000
	Voltage P2 Phase C trip	Voltage P2 Phase C trip signal	1000/3000
	Voltage P3 Phase A trip	Voltage P2 Phase A trip signal	1000/3000
	Voltage P3 Phase B trip	Voltage P3 Phase B trip signal	1000/3000
PHASE TRIPS 2	Voltage P3 Phase C trip	Voltage P3 Phase C trip signal	1000/3000
	Voltage P4 Phase A trip	Voltage P4 Phase A trip signal	1000/3000
	Voltage P4 Phase B trip	Voltage P4 Phase B trip signal	1000/3000
	Voltage P4 Phase C trip	Voltage P4 Phase C trip signal	1000/3000
	Voltage P1 trip	Voltage P1 trip signal	1000/3000
	Voltage P2 trip	Voltage P2 trip signal	1000/3000
ELEMENT TRIPS 1	Voltage P3 trip	Voltage P3 trip signal	1000/3000
	Voltage P4 trip	Voltage P4 signal	1000/3000
	59N1 trip	59N1 trip signal	1000/3000
	59N2 trip	59N2 trip signal	1000/3000
	47 trip	47 trip signal	1000/3000
	59N trip	59N trip signal	1000/3000
	Voltage P1 Phase A trip	Voltage P1 Phase A trip signal	1000/3000
	Voltage P1 Phase A trip	Voltage P1 Phase B trip signal	1000/3000
	Voltage P1 Phase C trip	Voltage P1 Phase C trip signal	1000/3000
PHASE PICKUPS 1	Voltage P1 Phase A pickup	Voltage P1 Phase A pickup signal	1000/3000
	Voltage P1 Phase B pickup	Voltage P1 Phase B pickup signal	1000/3000
	Voltage P1 Phase C pickup	Voltage P1 Phase C pickup signal	1000/3000
	Voltage P2 Phase A pickup	Voltage P2 Phase A pickup signal	1000/3000
	Voltage P2 Phase B pickup	Voltage P2 Phase B pickup signal	1000/3000
PHASE PICKUPS 2	Voltage P2 Phase C pickup	Voltage P2 Phase C pickup signal	1000/3000
	Voltage P3 Phase A pickup	Voltage P3 Phase A pickup signal	1000/3000
	Voltage P3 Phase B pickup	Voltage P3 Phase B pickup signal	1000/3000
	Voltage P3 Phase C pickup	Voltage P3 Phase C pickup signal	1000/3000
	Voltage P4 Phase A pickup	Voltage P4 Phase A pickup signal	1000/3000
	Voltage P4 Phase B pickup	Voltage P4 Phase B pickup signal	1000/3000
ELEMENT PICKUPS 1	Voltage P1 pickup	Voltage P1 pickup signal	1000/3000
	Voltage P2 pickup	Voltage P2 pickup signal	1000/3000
	Voltage P3 pickup	Voltage P3 pickup signal	1000/3000
	Voltage P4 pickup	Voltage P4 pickup signal	1000/3000
	59N1 pickup	59N1 pickup signal	1000/3000
	59N2 pickup	59N2 pickup signal	1000/3000
	47 pickup	47 pickup signal	1000/3000

ELEMENT PICKUPS 2	Frequency pickup	Frequency pickup signal	2000/3000
	81_1 pickup	81_1 pickup signal	2000/3000
	81_2 pickup	81_2 pickup signal	2000/3000
	81_3 pickup	81_3 pickup signal	2000
	81_4 pickup	81_4 pickup signal	2000
	General pickup	Pickup of any element	ALL
PHASE VIRTUAL TRIPS 1	Voltage P1 Phase A Virtual Trip	Voltage P1 Phase A Virtual Trip	1000/3000
	Voltage P1 Phase B Virtual Trip	Voltage P1 Phase B Virtual Trip	1000/3000
	Voltage P1 Phase C Virtual Trip	Voltage P1 Phase C Virtual Trip	1000/3000
	Voltage P2 Phase A Virtual Trip	Voltage P2 Phase A Virtual Trip	1000/3000
	Voltage P2 Phase B Virtual Trip	Voltage P2 Phase B Virtual Trip	1000/3000
	Voltage P2 Phase C Virtual Trip	Voltage P2 Phase C Virtual Trip	1000/3000
PHASE VIRTUAL TRIPS 2	Voltage P3 Phase A Virtual Trip	Voltage P3 Phase A Virtual Trip	1000/3000
	Voltage P3 Phase B Virtual Trip	Voltage P3 Phase B Virtual Trip	1000/3000
	Voltage P3 Phase C Virtual Trip	Voltage P3 Phase C Virtual Trip	1000/3000
	Voltage P4 Phase A Virtual Trip	Voltage P4 Phase A Virtual Trip	1000/3000
	Voltage P4 Phase B Virtual Trip	Voltage P4 Phase B Virtual Trip	1000/3000
	Voltage P4 Phase C Virtual Trip	Voltage P4 Phase C Virtual Trip	1000/3000
ELEMENT VIRTUAL TRIPS 1	Voltage P1 Virtual Trip	Voltage P1 Virtual Trip	1000/3000
	Voltage P2 Virtual Trip	Voltage P2 Virtual Trip	1000/3000
	Voltage P3 Virtual Trip	Voltage P3 Virtual Trip	1000/3000
	Voltage P4 Virtual Trip	Voltage P4 Virtual Trip	1000/3000
	59N1 Virtual Trip	59N1 Virtual Trip	1000/3000
	59N2 Virtual Trip	59N2 Virtual Trip	1000/3000
	47 Virtual Trip	47 Virtual Trip	1000/3000
ELEMENT VIRTUAL TRIPS 2	Frequency Virtual Trip	Frequency Virtual Trip	2000/3000
	81_1 Virtual trip	81_1 Virtual trip	2000/3000
	81_2 Virtual trip	81_2 Virtual trip	2000/3000
	81_3 Virtual trip	81_3 Virtual trip	2000
	81_4 Virtual trip	81_4 Virtual trip	2000
	General Virtual Trip	General Virtual Trip	ALL
INHIBITION BY DIGITAL INPUT 1	Voltage disabled (by DI)	Inhibition of all voltage elements by digital input	1000/3000
	Voltage P1 disabled (by DI)	Inhibition of Voltage P1 by digital input	1000/3000
	Voltage P2 disabled (by DI)	Inhibition of Voltage P2 by digital input	1000/3000
	Voltage P3 disabled (by DI)	Inhibition of Voltage P3 by digital input	1000/3000
	Voltage P4 disabled (by DI)	Inhibition of Voltage P4 by digital input	1000/3000
	59N1 disabled (by DI)	Inhibition of 59N1 by digital input	1000/3000
	59N2 disabled (by DI)	Inhibition of 59N2 by digital input	1000/3000
	47 disabled (by DI)	Inhibition of 47 by digital input	1000/3000
INHIBITION BY DIGITAL INPUT 2	Frequency disabled (by DI)	Inhibition of all frequency elements by digital input	2000/3000
	81_1 disabled (by DI)	Inhibition of 81_1 by digital input	2000/3000
	81_2 disabled (by DI)	Inhibition of 81_2 by digital input	2000/3000
	81_3 disabled (by DI)	Inhibition of 81_3 by digital input	2000
	81_4 disabled (by DI)	Inhibition of 81_4 by digital input	2000
	Trip disabled (by DI)	All trips inhibition	ALL
INPUTS/OUTPUTS	Output 1	Digital Output 1	ALL
	Output 2	Digital Output 2	ALL
	Output 3	Digital Output 3	ALL
	Output 4	Digital Output 4	ALL
	Input 1	Digital input 1	ALL
	Input 2	Digital input 2	ALL
INPUTS	General input	General input element	ALL

	Sett. change disable	Active means that settings or groups cannot be changed. It is only possible to switch to Group 2 by digital input Group change	ALL
	52A	Active signal with breaker closed	ALL
	52B	Active signal with breaker open	ALL
	Group change	Active means that active group is Group2 Not active means that active group is the group defined in General Settings group	ALL
	E2PROM failure	Active when a failure is detected in EEPROM management	ALL
	User settings	This element is green when the default settings are active and red when the user's settings are active	ALL

GROUP	NO DEFINITION	OUTPUT OR LED NOT ASSIGNED	MIVII MODEL
LEDS	READY	Active when the relay is in service and at least one element has its trip enabled	ALL
MIXED 2	Active Group	Group 2 settings active	ALL
	Local/Remote	It's Local when the HMI is inside the MAIN SETTINGS, ADVANCED SETTINGS or OPERATIONS menu	ALL

:

has five types of display messages: actual values, main settings, advanced settings, operations and date & time. Actual values are values that are measured by the relay, such as currents; digital values of the relay, and can be digital inputs, outputs status and others; or internal information as the firmware revision. Main settings and advanced settings comprise product setup, communications and protection elements adjustments. Operations are the available commands that can be performed in the relay.

These types of messages are located within a menu structure that groups the information into categories. This chapter describes the way to navigate this menu structure and shows the complete structure so that the user can reach certain screens quickly.

The faceplate keypad is made up of five keys, as shown in Figure 8–1:

Figure 8–1: KEYPAD

The **main screen** is the one that shows the three phase and neutral currents. If the relay is not showing the main screen, you can return to it from any other screen by pressing the **Escape** key as many times as necessary until exiting the menu structure.

From the main screen, the **Menu** key enters the menu structure. From that point on, the user can navigate through the menu structure using **Up** and **Down** arrows to move horizontally, **Enter** to enter submenus and **Escape** to exit to the upper level.

8.3.1 DISPLAY

The faceplate display of the relay is a 16 column x 2-row characters alphanumeric LCD display. Messages in the display are shown in the English language.

Figure 8–2: DISPLAY

The **display contrast** can be modified simultaneously pressing **Escape** + **arrow**:

- **Escape** + **up arrow** increases the contrast
- **Escape** + **down arrow** decreases the contrast

If the keypad is not in use during 15 minutes, the display turns automatically off and returns to the main screen. Pressing ESC/RESET key, the display is automatically turned on and it shows the main screen with phase and groundvoltages.

Pressing any other key, corresponding screen in the menu structure is shown. As an example, pressing ENTER key the Thermal Capacity Used screen is shown, as pressing this key the display enters in One Key Operation menu.

8.3.2 LEDS

The faceplate of the relay has six LEDs that show the relay status, as well as pickup and trip status. LEDs are grouped in two columns and three rows, as shown in the following figure:

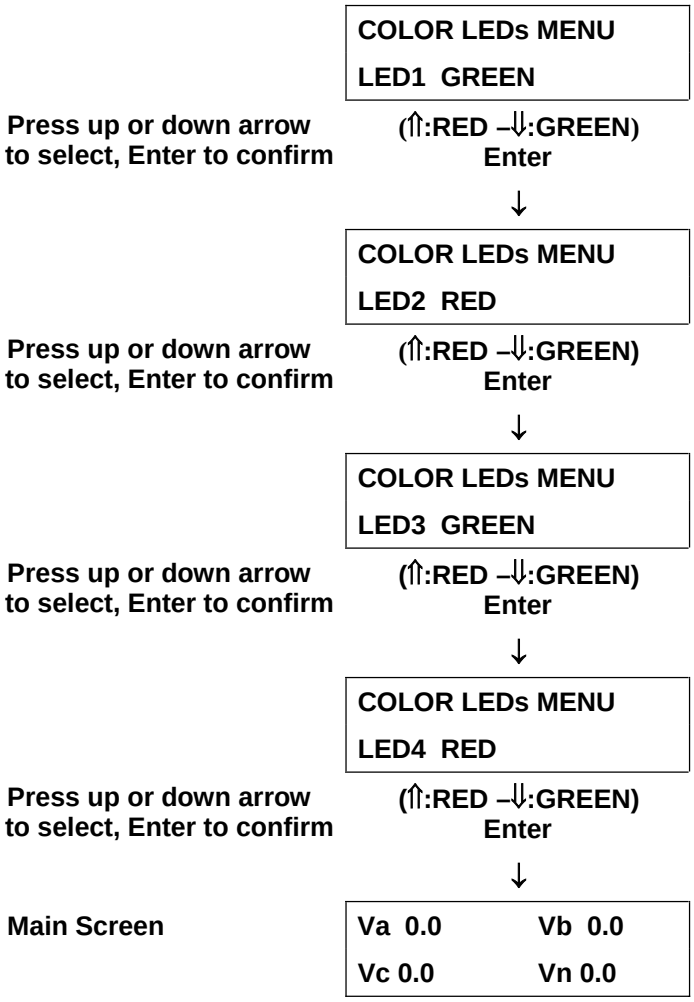
MIVII1000 DEFAULT LED CONFIGURATION

MIVII2000 DEFAULT LED CONFIGURATION

MIVII3000 DEFAULT LED CONFIGURATION

Figure 8–3: LEDS

The two LEDs in the first row (**Ready** and **Trip**) are not configurable. ForMIVII relays the other four LEDs are configurable by the user, using EnerVista MII SETUP program. See Chapter 4 for more information on how to configure LEDs.The **color** of the four **LEDs** in rows 2 and 3 can be changed between red and green in any relay model. The way to do this is to press simultaneously **up** and **down arrow** keys for more than 2 seconds. Then a new menu appears:

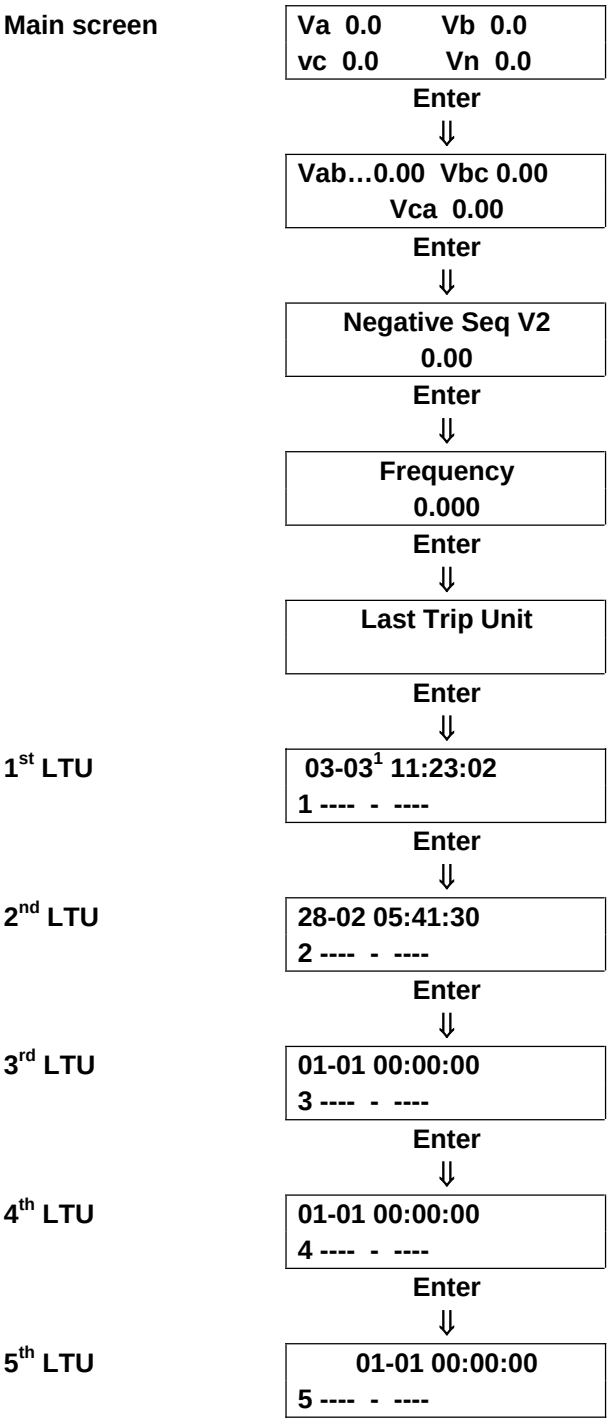


8.4.1 ONE KEY OPERATION AND LAST TRIP DATA

From the main screen, pressing Enter key the display shows a **one-key operation menu** that presents measures, thermal image value and up to **five latest trip element** data with the element that has tripped,and the secondary current value (not affected by CT ratio), with the day, month and time of the trip.

When a fault occurs, trip information is automatically shown in the display. Pressing ENTER key, main screen will be shown again. In order to perform a RESET operation, display must be in main screen showing phase and ground currents, in this situation, pressing ESC/RESET key for more than 3 seconds a RESET operation will be performed.

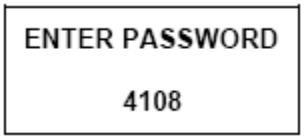
1. Day - month



8.4.2 HMI PASSWORD

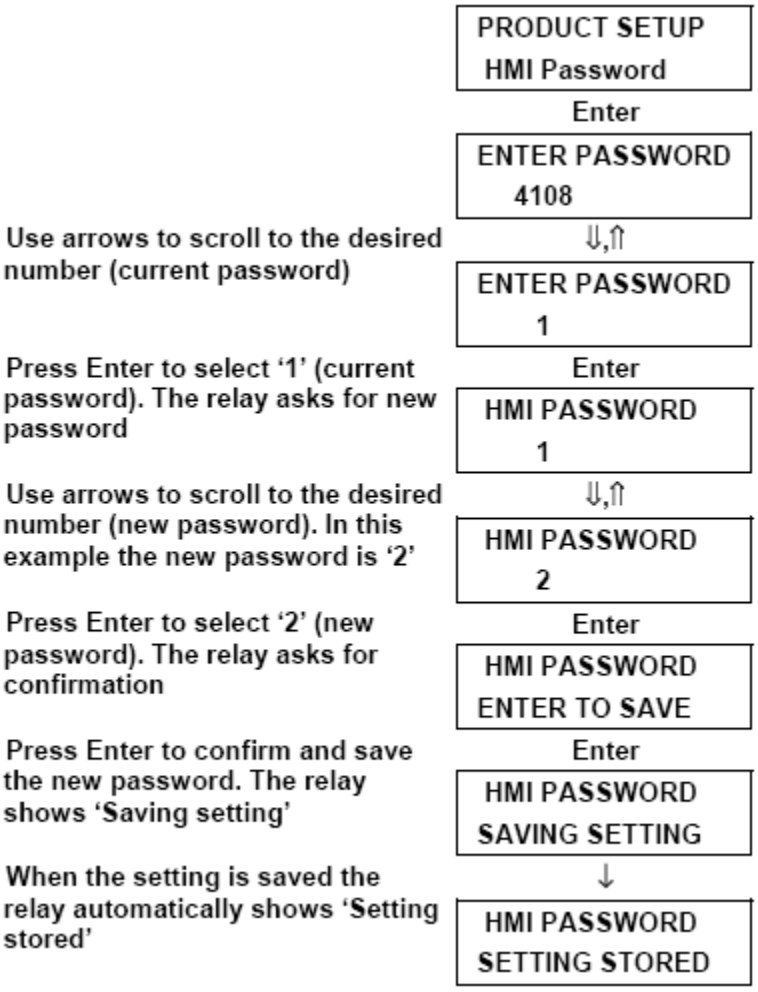
The relay allows settings protection by password. This password is called **HMI password** and it is disabled by default (value 0). If you change this value to other than 0, the HMI password will be enabled and required to change settings. **When the password is enabled, a value between 1 and 9999 is shown on the screen. This number is the password value shown in a coded format.**

When a setting is being changed, after pressing the Enter key to store the modified value the relay shows the following screen:

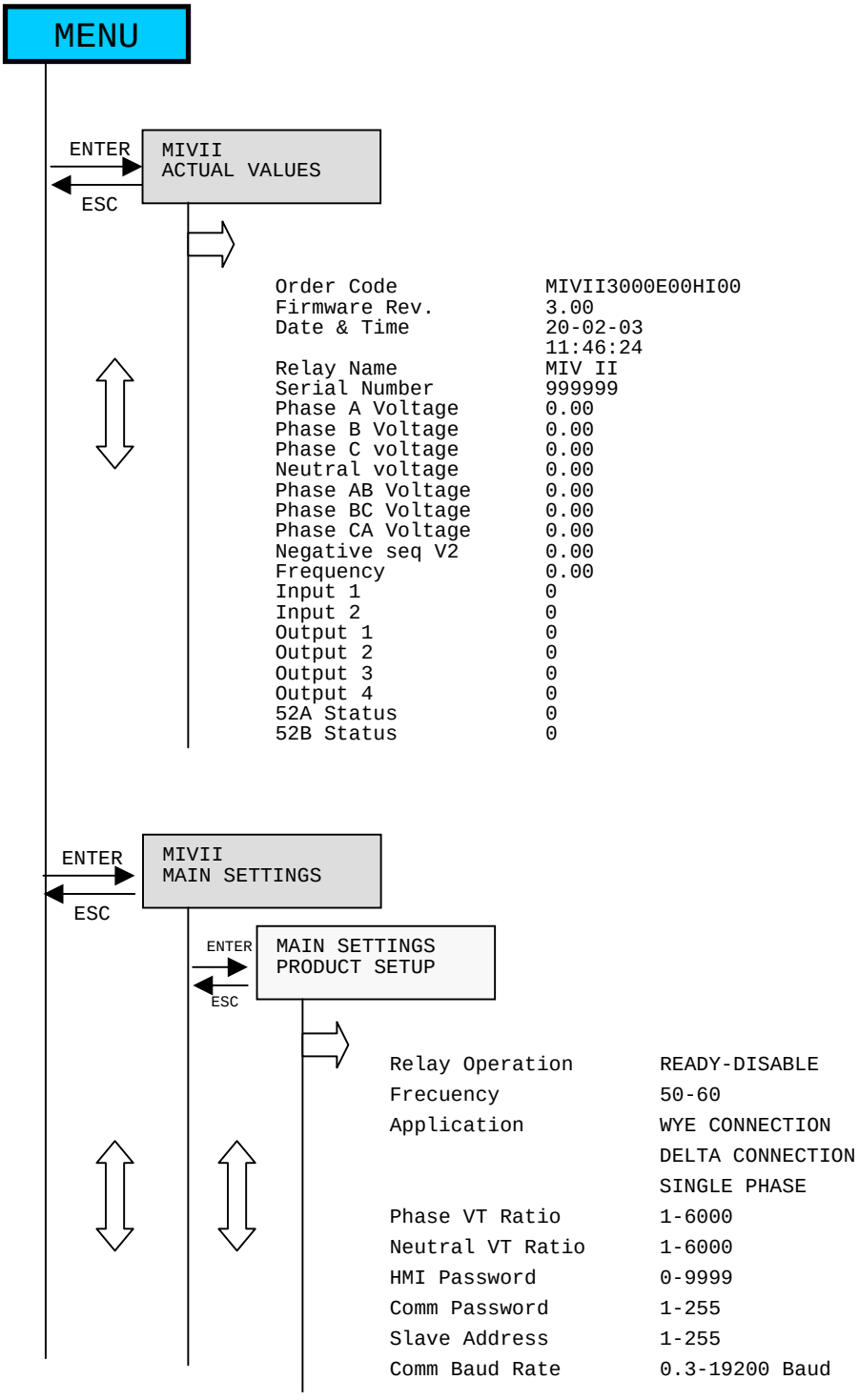


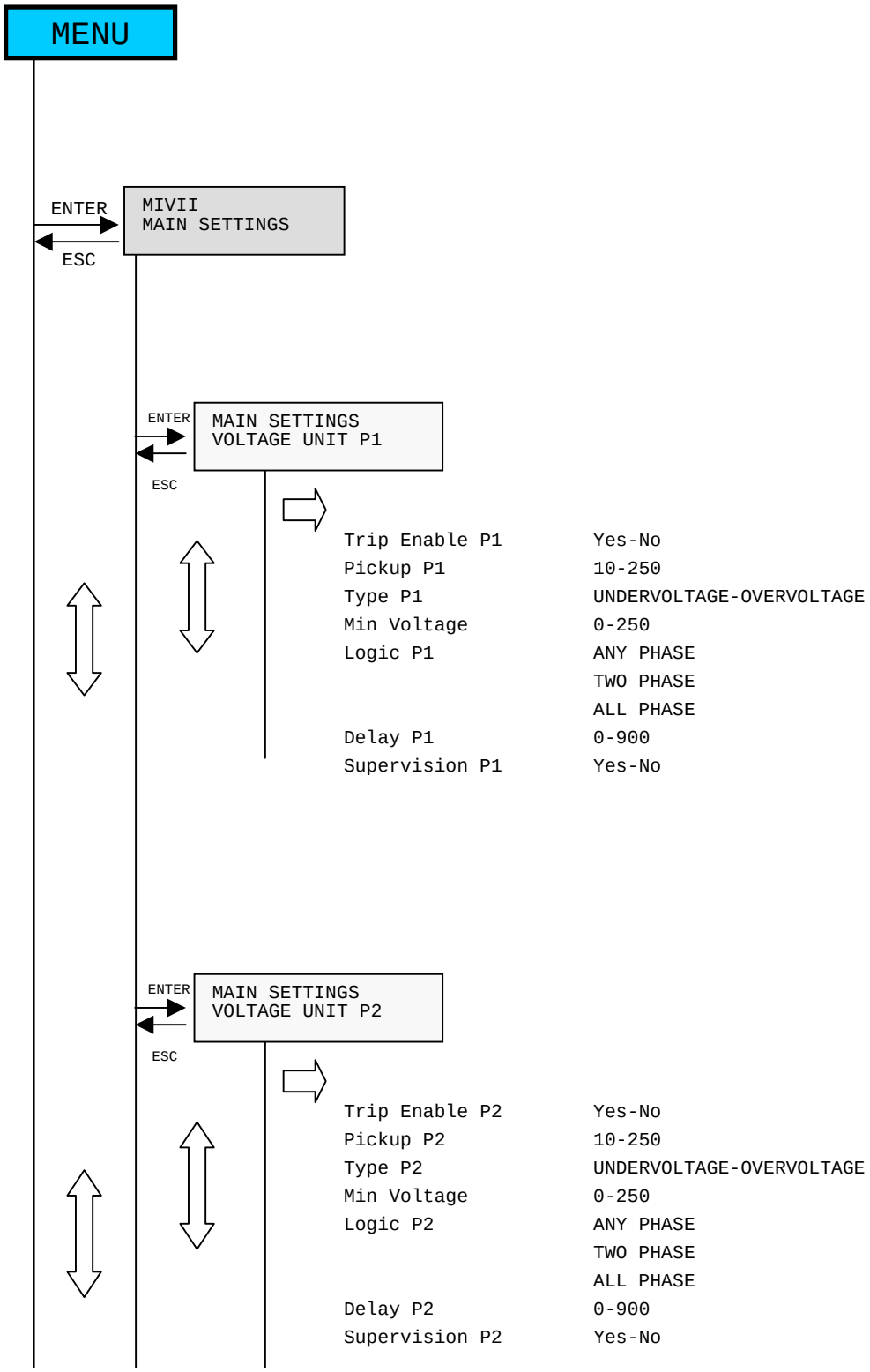
Scroll up and down with the arrow keys until the screen shows the desired password; next, press enter for confirmation and the relay will accept and store the setting change. The setting password protection will then be disabled for **15 minutes** after the last setting change is made to the relay, or until a **reset operation** (the same as to reset LEDs, pressing Esc for more than 3 seconds from the main screen) is performed.

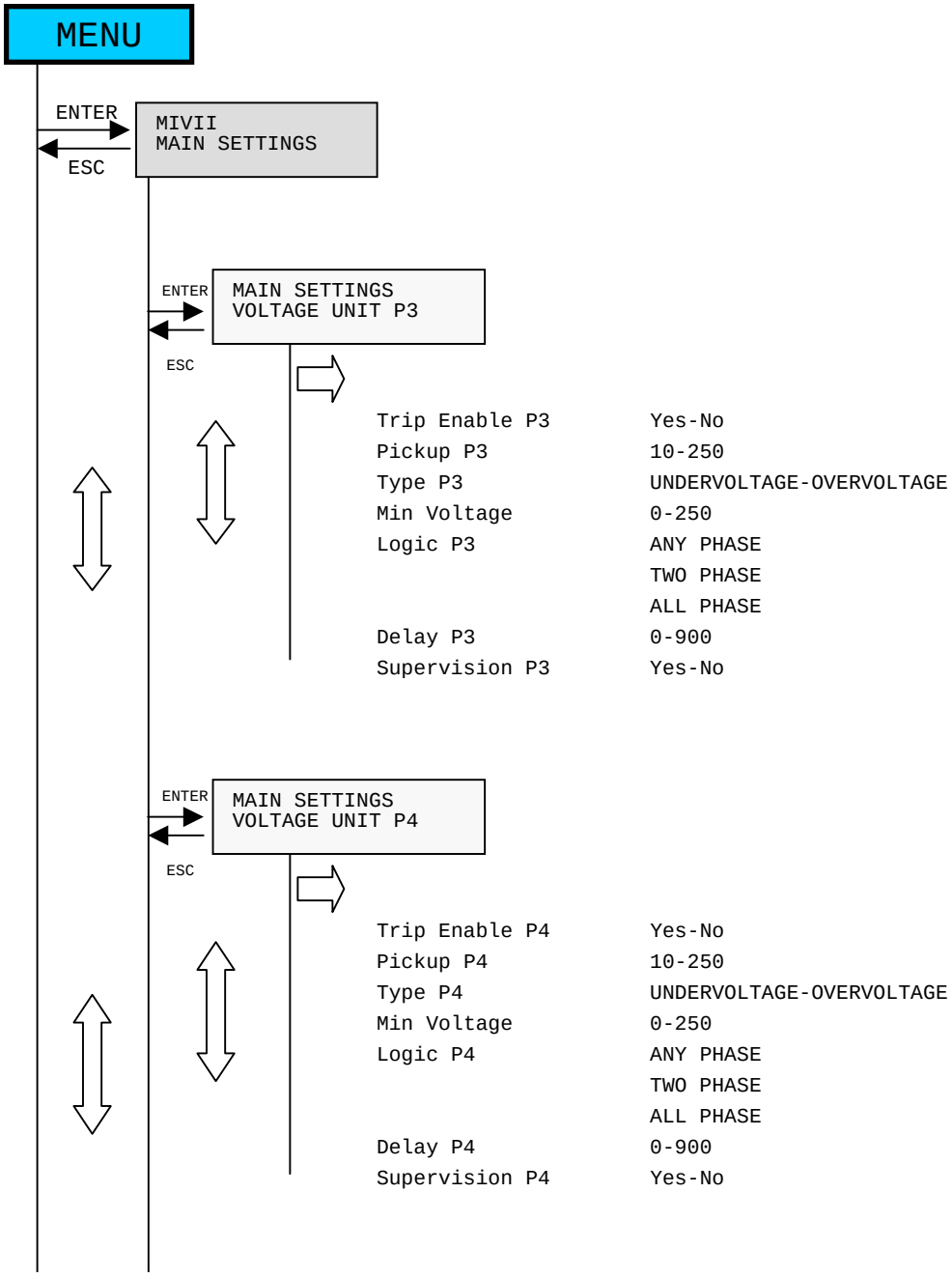
The password can be modified in the ***Main Settings > Product Setup > HMI password*** menu. The relay then asks for the current password. Once it has been entered, the relay asks for the new password. Here is an example of how to change from HMI password value 1 to 2:

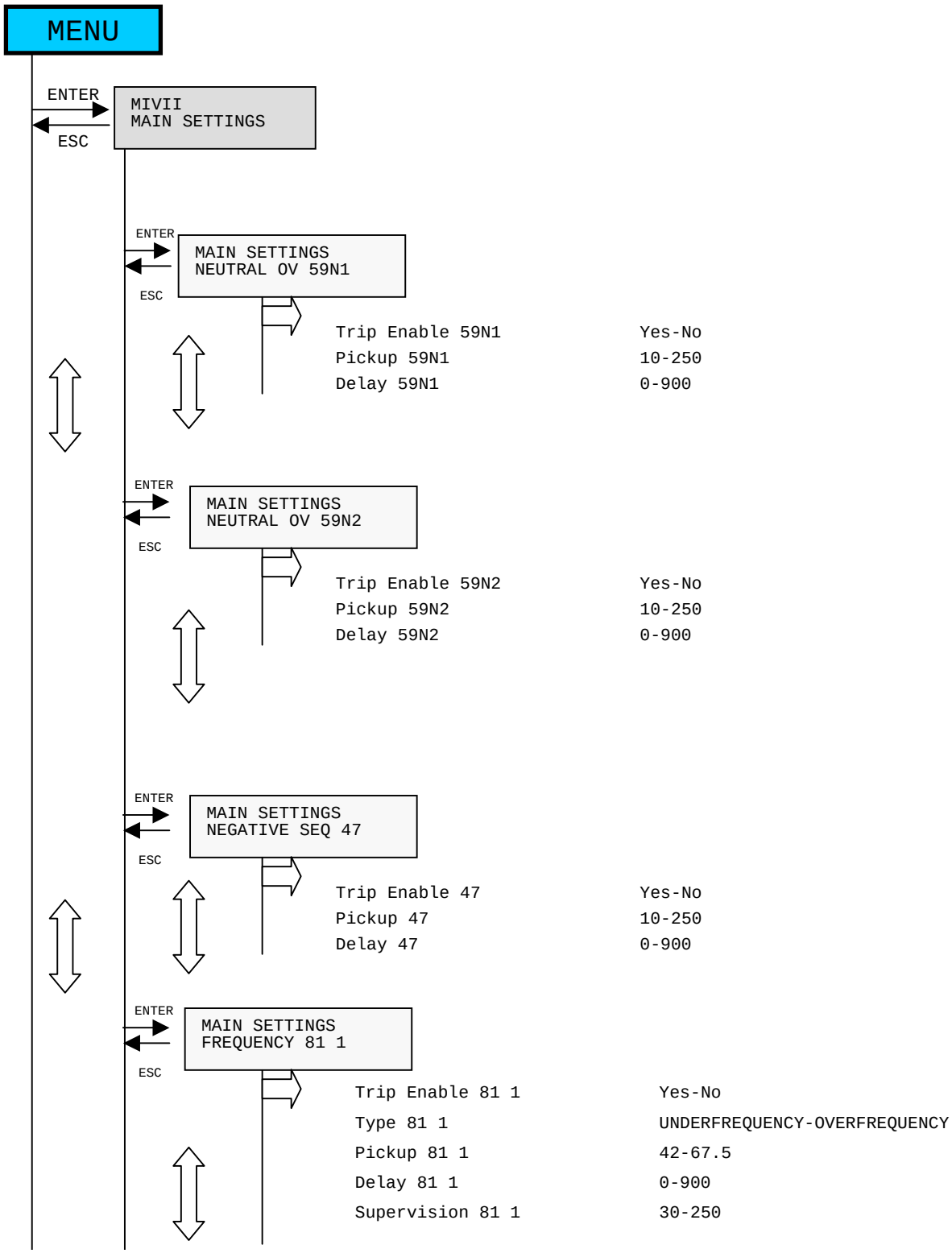


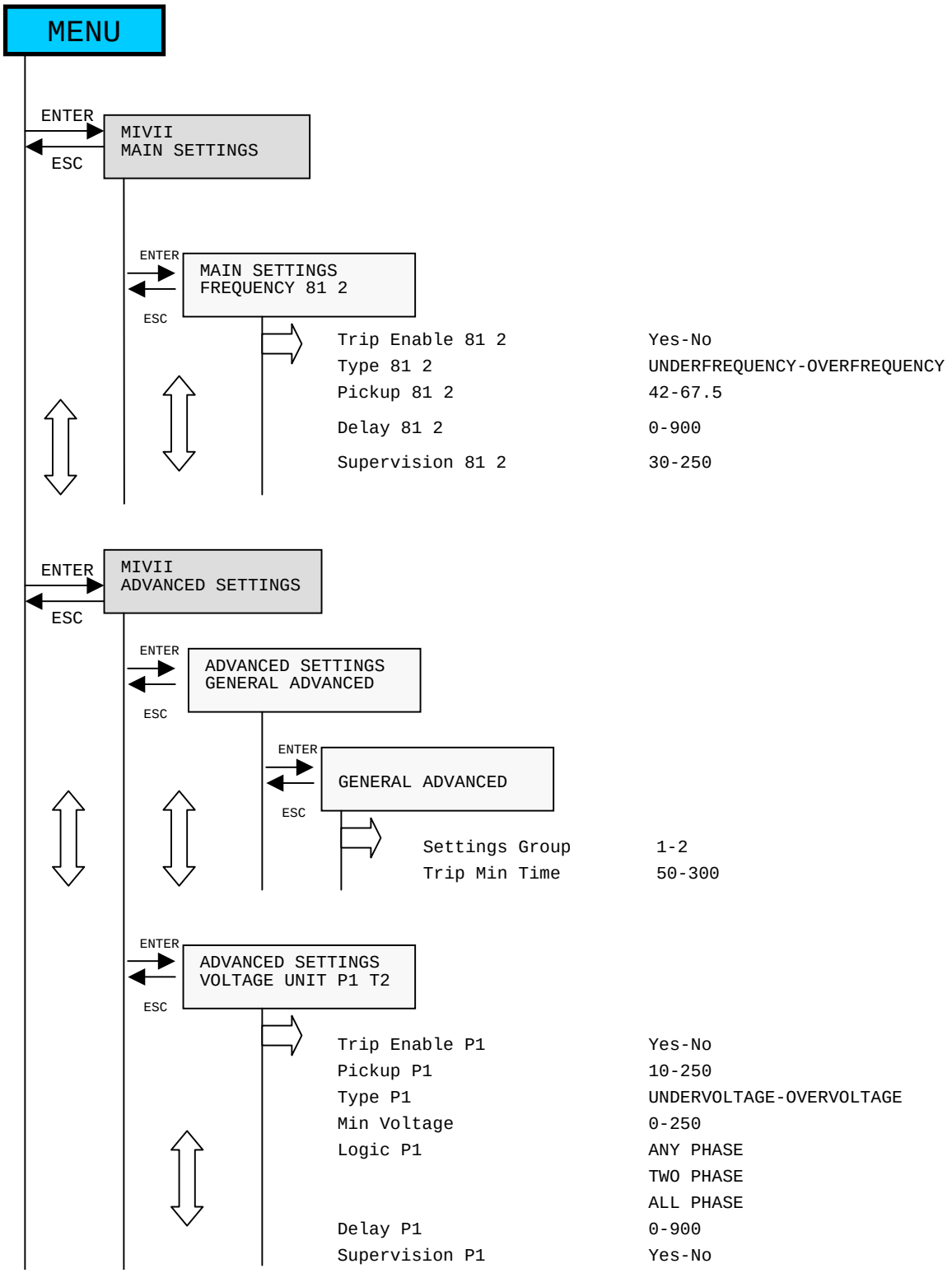
If you don't know the programmed password please contact GE Multilin Technical Service and have the encoded password value shown in ***Main Settings > Product Setup > HMI*** handy.

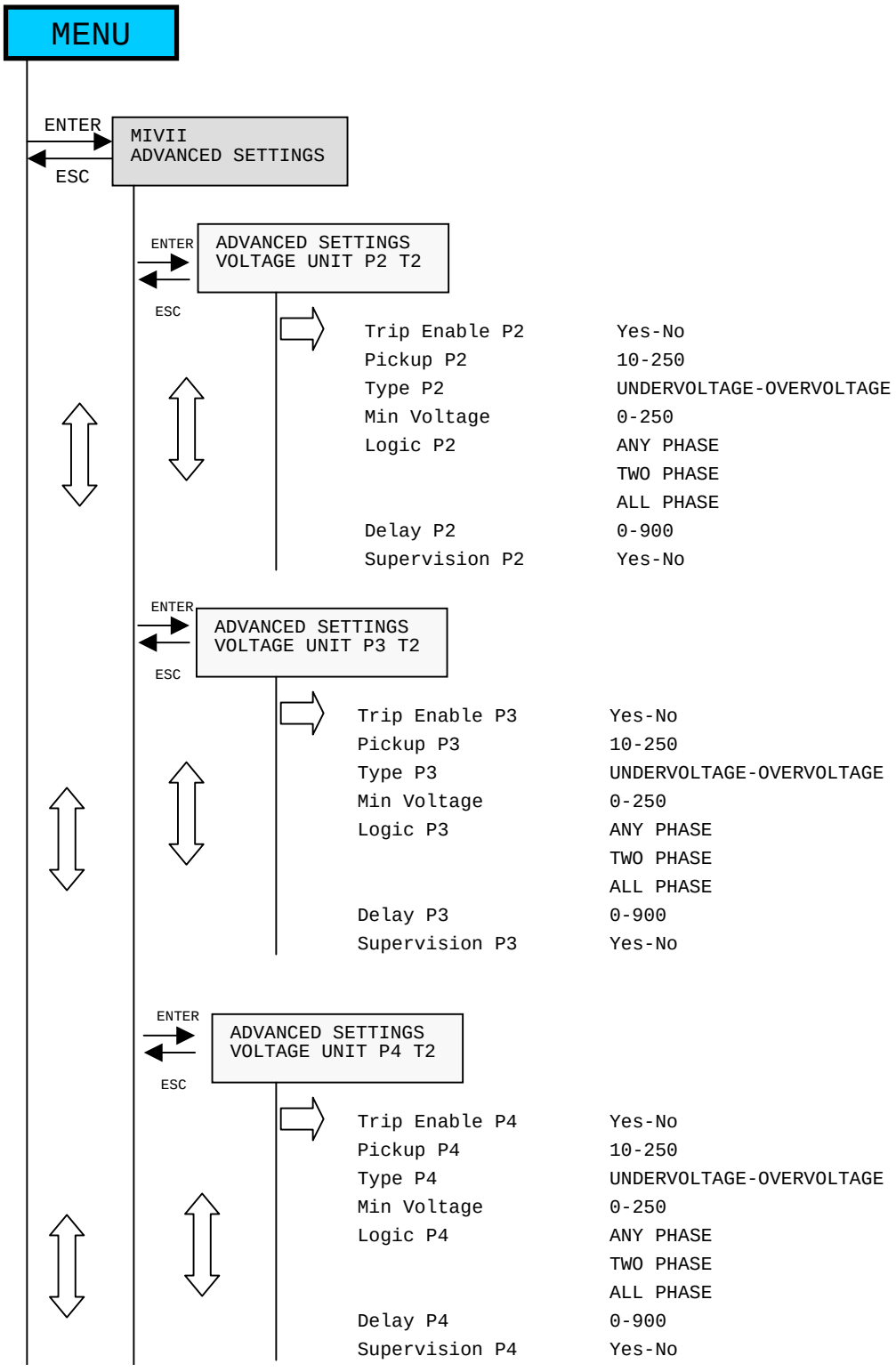

MENU
ENTER
ESC
MIVII
ACTUAL VALUES
Order Code MIVII3000E00HI00
Firmware Rev. 3.00
Date & Time 20-02-03
11:46:24
Relay Name MIV II
Serial Number 999999
Phase A Voltage 0.00
Phase B Voltage 0.00
Phase C voltage 0.00
Neutral voltage 0.00
Phase AB Voltage 0.00
Phase BC Voltage 0.00
Phase CA Voltage 0.00
Negative seq V2 0.00
Frequency 0.00
Input 1 0
Input 2 0
Output 1 0
Output 2 0
Output 3 0
Output 4 0
52A Status 0
52B Status 0
ENTER
ESC
MIVII
MAIN SETTINGS
ENTER
ESC
MAIN SETTINGS
PRODUCT SETUP
Relay Operation READY-DISABLE
Frecuency 50-60
Application WYE CONNECTION
DELTA CONNECTION
SINGLE PHASE
Phase VT Ratio 1-6000
Neutral VT Ratio 1-6000
HMI Password 0-9999
Comm Password 1-255
Slave Address 1-255
Comm Baud Rate 0.3-19200 Baud

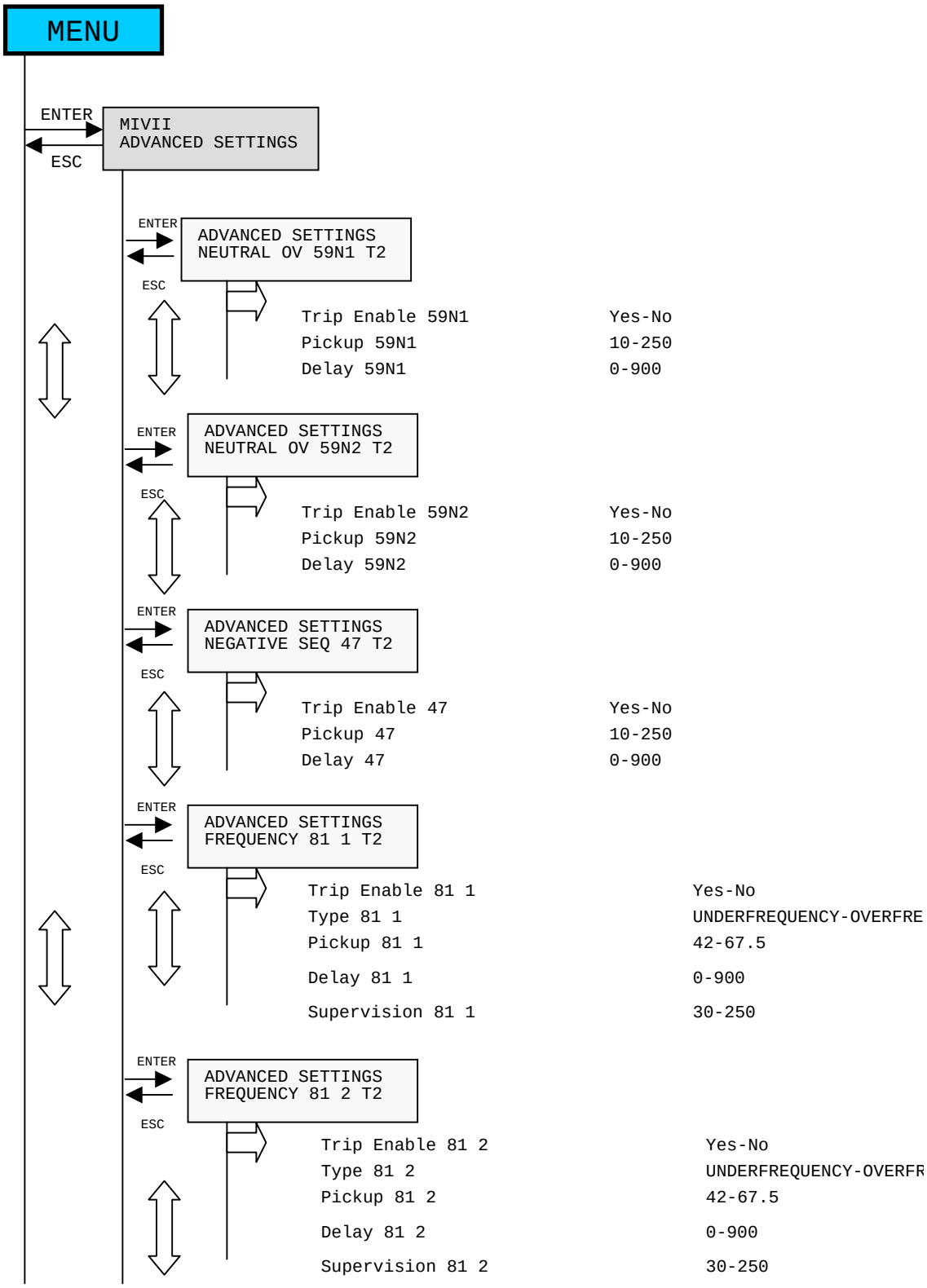

MENU
ENTER
ESC
MIVII
MAIN SETTINGS
ENTER
ESC
MAIN SETTINGS
VOLTAGE UNIT P1
Trip Enable P1 Yes-No
Pickup P1 10-250
Type P1 UNDERVOLTAGE-OVERVOLTAGE
Min Voltage 0-250
Logic P1 ANY PHASE
TWO PHASE
ALL PHASE
Delay P1 0-900
Supervision P1 Yes-No
ENTER
ESC
MAIN SETTINGS
VOLTAGE UNIT P2
Trip Enable P2 Yes-No
Pickup P2 10-250
Type P2 UNDERVOLTAGE-OVERVOLTAGE
Min Voltage 0-250
Logic P2 ANY PHASE
TWO PHASE
ALL PHASE
Delay P2 0-900
Supervision P2 Yes-No

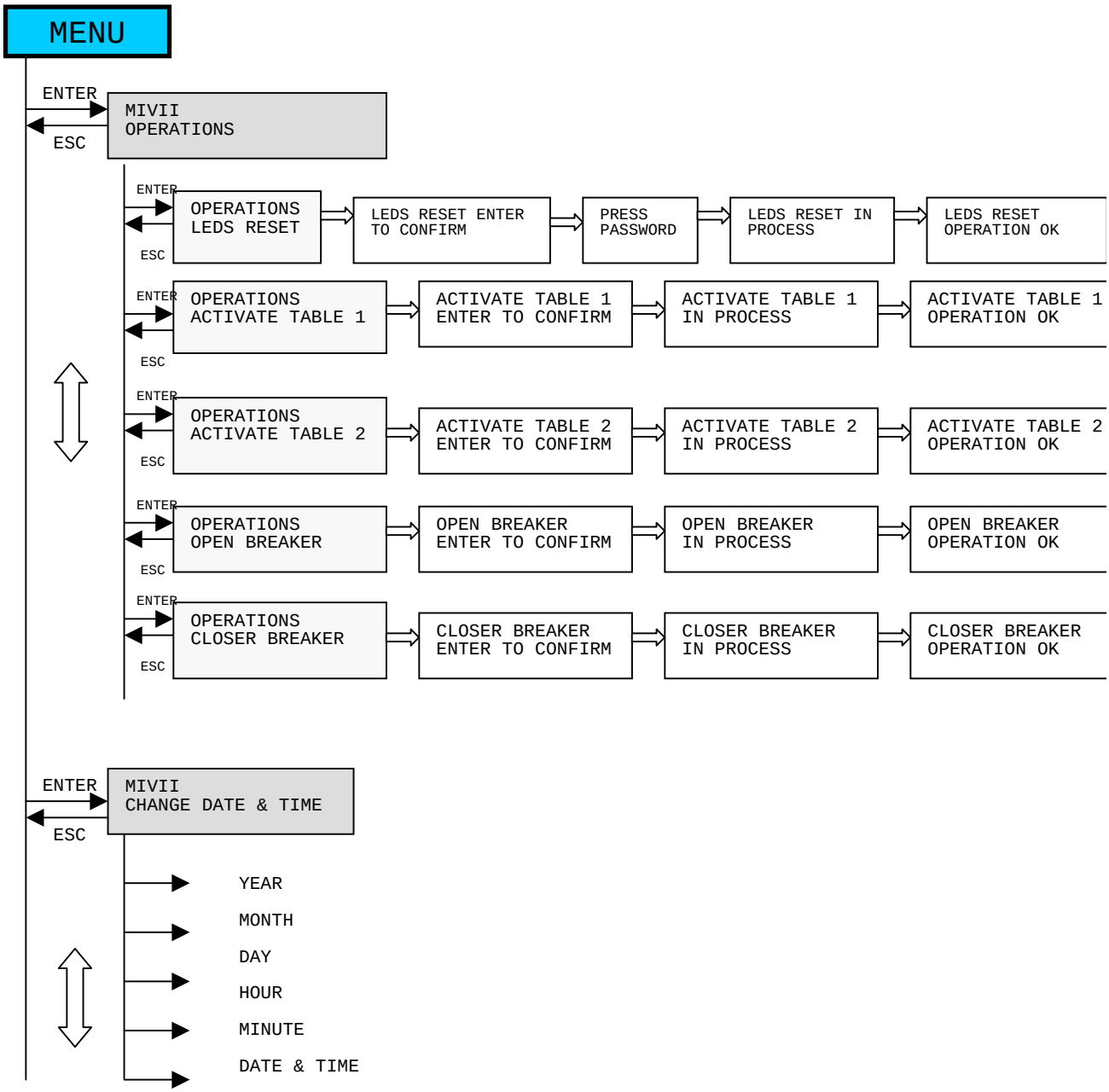

MENU
ENTER
ESC
MIVII
MAIN SETTINGS
ENTER
ESC
MAIN SETTINGS
VOLTAGE UNIT P3
Trip Enable P3
Yes-No
Pickup P3
10-250
Type P3
UNDERVOLTAGE-OVERVOLTAGE
Min Voltage
0-250
Logic P3
ANY PHASE
TWO PHASE
ALL PHASE
Delay P3
0-900
Supervision P3
Yes-No
ENTER
ESC
MAIN SETTINGS
VOLTAGE UNIT P4
Trip Enable P4
Yes-No
Pickup P4
10-250
Type P4
UNDERVOLTAGE-OVERVOLTAGE
Min Voltage
0-250
Logic P4
ANY PHASE
TWO PHASE
ALL PHASE
Delay P4
0-900
Supervision P4
Yes-No


MENU
ENTER
ESC
MIVII
MAIN SETTINGS
ENTER
ESC
MAIN SETTINGS
NEUTRAL OV 59N1
Trip Enable 59N1
Yes-No
Pickup 59N1
10-250
Delay 59N1
0-900
ENTER
ESC
MAIN SETTINGS
NEUTRAL OV 59N2
Trip Enable 59N2
Yes-No
Pickup 59N2
10-250
Delay 59N2
0-900
ENTER
ESC
MAIN SETTINGS
NEGATIVE SEQ 47
Trip Enable 47
Yes-No
Pickup 47
10-250
Delay 47
0-900
ENTER
ESC
MAIN SETTINGS
FREQUENCY 81 1
Trip Enable 81 1
Yes-No
Type 81 1
UNDERFREQUENCY-OVERFREQUENCY
Pickup 81 1
42-67.5
Delay 81 1
0-900
Supervision 81 1
30-250


MENU
ENTER
ESC
MIVII
MAIN SETTINGS
ENTER
ESC
MAIN SETTINGS
FREQUENCY 81 2
Trip Enable 81 2
Yes-No
Type 81 2
UNDERFREQUENCY-OVERFREQUENCY
Pickup 81 2
42-67.5
Delay 81 2
0-900
Supervision 81 2
30-250
ENTER
ESC
MIVII
ADVANCED SETTINGS
ENTER
ESC
ADVANCED SETTINGS
GENERAL ADVANCED
ENTER
ESC
GENERAL ADVANCED
Settings Group
1-2
Trip Min Time
50-300
ENTER
ESC
ADVANCED SETTINGS
VOLTAGE UNIT P1 T2
Trip Enable P1
Yes-No
Pickup P1
10-250
Type P1
UNDERVOLTAGE-OVERVOLTAGE
Min Voltage
0-250
Logic P1
ANY PHASE
TWO PHASE
ALL PHASE
Delay P1
0-900
Supervision P1
Yes-No


MENU
ENTER
ESC
MIVII
ADVANCED SETTINGS
ENTER
ESC
ADVANCED SETTINGS
VOLTAGE UNIT P2 T2
Trip Enable P2
Pickup P2
Type P2
Min Voltage
Logic P2
Delay P2
Supervision P2
Yes-No
10-250
UNDERVOLTAGE-OVERVOLTAGE
0-250
ANY PHASE
TWO PHASE
ALL PHASE
0-900
Yes-No
ENTER
ESC
ADVANCED SETTINGS
VOLTAGE UNIT P3 T2
Trip Enable P3
Pickup P3
Type P3
Min Voltage
Logic P3
Delay P3
Supervision P3
Yes-No
10-250
UNDERVOLTAGE-OVERVOLTAGE
0-250
ANY PHASE
TWO PHASE
ALL PHASE
0-900
Yes-No
ENTER
ESC
ADVANCED SETTINGS
VOLTAGE UNIT P4 T2
Trip Enable P4
Pickup P4
Type P4
Min Voltage
Logic P4
Delay P4
Supervision P4
Yes-No
10-250
UNDERVOLTAGE-OVERVOLTAGE
0-250
ANY PHASE
TWO PHASE
ALL PHASE
0-900
Yes-No


MENU
ENTER
ESC
MIVII
ADVANCED SETTINGS
ENTER
ESC
ADVANCED SETTINGS
NEUTRAL OV 59N1 T2
Trip Enable 59N1
Pickup 59N1
Delay 59N1
Yes-No
10-250
0-900
ENTER
ESC
ADVANCED SETTINGS
NEUTRAL OV 59N2 T2
Trip Enable 59N2
Pickup 59N2
Delay 59N2
Yes-No
10-250
0-900
ENTER
ESC
ADVANCED SETTINGS
NEGATIVE SEQ 47 T2
Trip Enable 47
Pickup 47
Delay 47
Yes-No
10-250
0-900
ENTER
ESC
ADVANCED SETTINGS
FREQUENCY 81 1 T2
Trip Enable 81 1
Type 81 1
Pickup 81 1
Delay 81 1
Supervision 81 1
Yes-No
UNDERFREQUENCY-OVERFRE
42-67.5
0-900
30-250
ENTER
ESC
ADVANCED SETTINGS
FREQUENCY 81 2 T2
Trip Enable 81 2
Type 81 2
Pickup 81 2
Delay 81 2
Supervision 81 2
Yes-No
UNDERFREQUENCY-OVERFR
42-67.5
0-900
30-250


MENU
ENTER
ESC
MIVII
OPERATIONS
ENTER
ESC
OPERATIONS
LEDS RESET
LEDS RESET ENTER
TO CONFIRM
PRESS
PASSWORD
LEDS RESET IN
PROCESS
LEDS RESET
OPERATION OK
ENTER
ESC
OPERATIONS
ACTIVATE TABLE 1
ACTIVATE TABLE 1
ENTER TO CONFIRM
ACTIVATE TABLE 1
IN PROCESS
ACTIVATE TABLE 1
OPERATION OK
ENTER
ESC
OPERATIONS
ACTIVATE TABLE 2
ACTIVATE TABLE 2
ENTER TO CONFIRM
ACTIVATE TABLE 2
IN PROCESS
ACTIVATE TABLE 2
OPERATION OK
ENTER
ESC
OPERATIONS
OPEN BREAKER
OPEN BREAKER
ENTER TO CONFIRM
OPEN BREAKER
IN PROCESS
OPEN BREAKER
OPERATION OK
ENTER
ESC
OPERATIONS
CLOSER BREAKER
CLOSER BREAKER
ENTER TO CONFIRM
CLOSER BREAKER
IN PROCESS
CLOSER BREAKER
OPERATION OK
ENTER
ESC
MIVII
CHANGE DATE & TIME
YEAR
MONTH
DAY
HOUR
MINUTE
DATE & TIME

Unpack the relay and verify that no parts are broken and that the relay has not suffered any damage during transit. Verify that the model number indicated on the faceplate corresponds to the model ordered.

All devices that work with alternating current are influenced by frequency. Since a non-sinusoidal waveform results from a fundamental frequency wave plus a series of harmonics of this fundamental wave, it can be concluded that devices working with alternating current (relays) are influenced by the applied waveform.

In order to correctly test relays that operate under alternating current, it is fundamental to use a sinusoidal current and/or voltage wave. The purity of the sinusoidal wave (the lack of harmonics) cannot be expressed in a specific form for a given relay. Each relay that is provided with tuned circuits, R-L and R-C circuits or non-linear elements (such a inverse time overcurrent relays) will be affected by non-sinusoidal waveforms.

These relays respond to the current waveform in a different way from most AC ampere-meters. If the power supply network that is used for the test contains a considerable amount of harmonics, the ampere-meter and relay responses will be different.

The relays are calibrated by the manufacturer using a 50 or 60 Hz power supply network with minimum harmonic contents. When the reception or installation tests are carried out, a power supply network with a harmonic-free waveform must be used.

Ampere-meters and stop-watches that are used for carrying out the test must be calibrated and their accuracy must be better than that of the relay. The power supply network used for the tests must remain stable, mainly at levels close to the test pick-up current, as well as for the time for which the relay operates according to the curve under test.

It is important to stress that the test accuracy depends on the power supply network conditions as well as on the instruments used. Functional tests carried out under inappropriate power supply conditions or using inappropriate instruments can be used for ensuring that the relay works roughly correctly and, therefore, for verifying its characteristics in an **approximate** manner.

Here follows a list of tests that can be used to check that the unit is fully operational. For a more limited test for the reception of units we recommend carrying out only the tests listed in sections:

INSULATION TESTS

Progressively apply 2000 RMS volts across all the terminals of a group, short-circuited, and the case for one second.

The independent groups on the relay are as follows:

Group 1:	A1, A2	Power Supply
Group 3:	B1 to B4, A3, A4	Voltage Transformers
Group 3:	A8, A9, A10	Contact Inputs
Group 4:	A5, A6	Trip
Group 5:	B7, B8, B9, B10, A7	Contact Outputs

NOTE:

In case of performing this test on all terminals at the same time, have in mind that the consumption will increase, due to the impedance of the capacitors inside the relay, used to derive high frequency surges to ground. The consumption will be approximately, 3 mA at 2000 Volts for each input.

In case the Hi-Pot device used to test the relay trips due to excessive consumption, apply the test between each group and ground one at a time.

NOTE: Do not test insulation on terminals B12, A12 and B11 (RS485). These terminals must be grounded during the test.

DURING TESTS, GND TERMINAL MUST BE GROUNDED FOR SAFETY REASONS

Necessary equipment:

- 1 AC current source .
- 1 DC voltage power supply.
- 1 timing device.
- 1 Multi-meter.
- Optionally, it is advisable to have a PC available, with the EnerVista MII SETUP software installed.

Relay wiring diagram.

Connect the relay as shown in

For safety reasons, the external protection earth terminal should be securely grounded.

Supply the unit through terminals A1andA2 at the rated DC voltage.

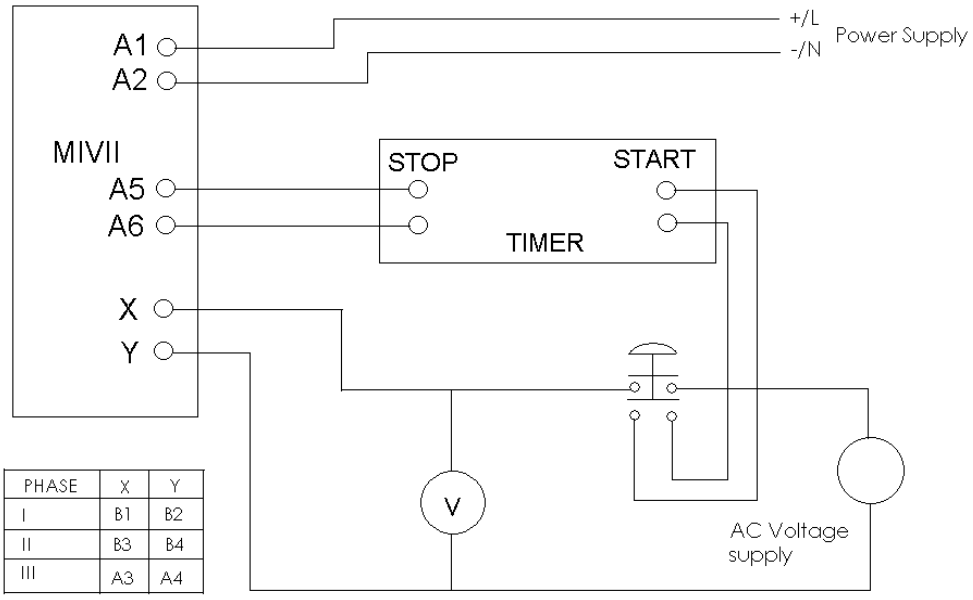


Figure 9–1: TEST CONNECTIONS FOR MIVII (RELAY

Check that pressing the “ESC/RESET” button for more than 3 seconds, all the front target LEDs light up and reset.

Connect the relay to a power supply at rated voltage Put the relay in service by setting the Relay Status setting in General Settings as Ready, and set frequency as line frequency.

For MIVII 1000 and MIVII 3000 models, enable the following elements: Voltage P1, P2, P3 and P4 setting them as Overvoltage with the Pickup Level to the minimum possible value For MIVII 2000 models enable functions 81_1, 81_2, 81_3 and 81_4. Set these elements as Underfrequency with the Pickup Level at the maximum possible value.B the rated voltage and frequency. All the auxiliary outputs corresponding to the elements enabled.Under these tripping conditions check that the ALARM (READY) output is open, and that the relay can communicate with the PC. Check this point requesting the relay model number from the PC.

Voltage test and maximum consumption is shown below:

Model “LO” (24 - 48 Vdc)	
Voltage (Vdc)	Maximum Consumption (mA)
18	650
48	300
58	265

Model “HI” (110 - 250 Vdc 120-230 Vac)	
Voltage (Vdc)	Maximum Consumption (mA)
88	130
110	105
250	55
Voltage (Vac)	Maximum Consumption (mA)
110	165
220	95

Shown values are only illustrative, as due to the nature of the internal power supply (switched power supply), the consumption currents are high frequency currents, and the meters used measure these values with a poor accuracy.

The communication test checks that the 2 communications ports (the front RS232 and the rear RS485) work properly. To perform this test is necessary to establish the connection between the PC and the relay (refer to figure 3-10). If the front port is used, a straight through cable is needed. If the rear RS485 port is used, an RS485/RS232 converter is needed. GE Multilin offers DAC300, F485 or RS232/485 converters.

The communications parameters that have to be set in the computer should match the relay default communication settings.

The factory default settings for the MIVII relay are:

COMMUNICATIONS			
NAME	**VALUE**	**UNITS**	**RANGE**
Slave Address	1		1 - 255
Communication Port	COM1		COM1 – COM*
Baud Rate	9.600	Bauds	300 – 19 200
Parity	NONE		NONE – ODD - EVEN
Control type	No control type		No control type, Modem connection, MODBUS/TCP
Start up mode	File Mode		Communicate with relay – File mode

Using the EnerVista MII SETUP program, communicate with the relay and in the Status window check that the communications are not lost at any time. Perform this test on both communications ports.

When the relay is shipped from the factory, it comes with a default set of settings, which act as the starting point for the following tests.

Since the MIVII relay has a large number of settings, a list of all the settings necessary for all tests will not be given here, but rather only the specific settings required for each test indicated.

These tests are only valid for the default factory configuration. Different configurations involving modifications in certain elements, such as different contact configuration, will require a subsequent modification of the test procedure.

Sequentially apply the rated voltage to input CC1 and CC2 (A8-A10 and A9-A10).

Check that when voltage is applied to one contact input, only this input gets active, and the other one remains inactive. Use the INFORMATION menu on the faceplate or a PC and the ACTUAL VALUES menu in the EnerVista MII SETUP program (***Actual> Actual Values***) to easily check which input gets active for each test.

Repeat this test at minimum and maximum permissible voltages.

9.9.1 MIVII 1000

Check that all the outputs are open.

Enable only unit voltage P1, and set its pickup level to the minimum value, time delay to the minimum admissible value and function type to undervoltage. Inject rated voltage and frequency through voltage II (B3, B4) to trip the relay. Check that the trip output (terminals A5-A6) andcloseand the **PICKUP, TRIP** and UNDERVOLTAGE LEDs light up.

Set in the Voltage P1 element, its pickup to the minimum admissible value and function type to overvoltage. Inject rated voltage and frequency through voltage II terminals (B3-B4) to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT2 (terminals A7-B8) close, and the **PICK UP**, **TRIP and OVERVOLTAGE** LEDs light up. Disable Voltage P1 element.

Enable only 59N1 element, and set its pickup to the minimum admissible value. Inject rated voltage and frequency through voltage II terminals (B3-B4) to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT3 (terminals A7-B9) close, and the **PICK UP**, **TRIP and 59N** LEDs light up. Disable 59N1 element.

Enable only 59N2 element, and set its pickup to the minimum admissible value. Inject rated voltage and frequency through voltage II terminals (B3-B4) to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT4 (terminals A7-B10) close, and the **PICK UP**, **TRIP and 59N** LEDs light up. Disable 59N2 element.

9.9.2 MIVII 2000

Check that all the outputs are open.

Enable only unit 81_1, and set its pickup and time delay to the maximum admissible values. Inject rated voltage and frequency through voltage II terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT1 (terminals A7-B7) close, and the **TRIP, and 81_1** LEDs light up.

Enable only unit 81_2, and set its pickup and time delay to the maximum admissible values. Inject rated voltage and frequency through voltage II terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT2 (terminals A7-B8) close, and the **TRIP, and 81_2** LEDs light up.

Enable only unit 81_3, and set its pickup and time delay to the maximum admissible values. Inject rated voltage and frequency through voltage II terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT3 (terminals A7-B9) close, and the **TRIP, and 81_3** LEDs light up.

Enable only unit 81_4, and set its pickup and time delay to the maximum admissible values. Inject rated voltage and frequency through voltage II terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT4 (terminals A7-B10) close, and the **TRIP, and 81_4** LEDs light up.

9.9.3 MIVII 3000

Check that all the outputs are open.

Enable only Voltage P1 and P2 elements. Set Voltage P1 element as undervoltage and Voltage P2 element as overvoltage. Set Voltage P1 pickup level to the maximum admissible value and Voltage P2 pickup level to the minimum admissible value. Inject rated voltage and frequency through voltage II terminals (B3-B4) to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT1 (terminals A7-B7) close, and the **PICKUP, TRIP, and PHASE** LEDs light up.

Enable only 59N1 element, and set its pickup to the minimum admissible value. Inject rated voltage and frequency through phase A terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT2 (terminals A7-B8) close, and the **PICK UP**, **TRIP and GROUND** LEDs light up.

Enable only 47 element, and set its pickup to the minimum admissible value. Inject rated voltage and frequency through phase A terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT3 (terminals A7-B9) close, and the **PICK UP**, **TRIP and PHASE** LEDs light up.

Enable 81_1 and 81_2 elements, and set its pickup to the maximum admissible value. Inject rated voltage and frequency through phase A terminals to trip the relay. Check that the trip output (terminals A5-A6) and auxiliary output OUT4 (terminals A7-B10) close, and the **PICK UP**, **TRIP and FREQ** LEDs light up.

Remove the Power Supply from the relay and check that the Alarm Output Contact (terminals B5-B6) closes. Set the power supply back to the relay terminals and check that the Alarm Output Contact opens.

9.9.4 VOLTAGE METERING

PHASE VOLTAGE

Set the relay to WYE CONNECTION as Application. Apply the following voltage values:

MAGNITUDE	PHASE	1	2	3	4	5
VI (V)	0º	2	64	70	120	150
VII (V)	120º	2	64	70	120	150
VIII (V)	240º	2	64	70	120	150

Check that the relay measures the three magnitudes with an accuracy of 5%, looking to phase-to-ground voltages in Actual Values using HMI or EnerVista MII Setup program.

9.9.5 FREQUENCY METERING

Apply 110V at 50 Hz through voltaga II input.

Check that the frequency value measured by the relay is between 49.98 Hz and 50.02 Hz.

Set the relay to 60Hz and repeat the test.

Enable only Voltage element P1 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Undervoltage
Pickup Level	10 V
Delay	0.20 sec.

Apply 15 V across the three voltage inputs and check that the relay does not trip.

Apply 5 V across the three voltage inputs and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Undervoltage
Pickup Level	100V
Delay	0.20 sec.

Apply 110 V across the three voltage inputs and check that the relay does not trip.

Apply 90 V across the three voltage inputs and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only Voltage element P2 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows

:

VOLTAGE SETTINGS GROUP	
Type	Undervoltage
Pickup Level	10 V
Delay	0.20 sec.

Apply 15 V across the three voltage inputs and check that the relay does not trip.

Apply 5 V across the three voltage inputs and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Undervoltage
Pickup Level	100V
Delay	0.20 sec.

Apply 110 V across the three voltage inputs and check that the relay does not trip.

Apply 90 V across the three voltage inputs and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only voltage element P3 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Overvoltage
Pickup Level	10 V
Delay	0.20 sec.

Apply 8 V across the three phases and check that the relay does not trip.

Apply 12 V across the three phases and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Overvoltage
Pickup Level	100V
Delay	0.20 sec.

Apply 90 V across the three phases and check that the relay does not trip.

Apply 110 V across the three phases and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only Voltage element P4 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Overvoltage
Pickup Level	10 V
Delay	0.20 sec.

Apply 8 V across the three phases and check that the relay does not trip.

Apply 12 V across the three phases and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Type	Overvoltage
Pickup Level	100V
Delay	0.20 sec.

Apply 90 V across the three phases and check that the relay does not trip.

Apply 110 V across the three phases and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only unit 59N1 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Pickup Level	10 V
Delay	0.20 sec.

Apply 8 V through voltage I input and check that the relay does not trip.

Apply 12 V through voltage I input and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Pickup Level	100V
Delay	0.20 sec.

Apply 90 V through voltage I input and check that the relay does not trip.

Apply 110 V through voltage I input and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only unit 59N2 and its trip.

Low Voltage Range (2-60 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Pickup Level	10 V
Delay	0.20 sec.

Apply 8 V through voltage I input and check that the relay does not trip.

Apply 12 V through voltage I input and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

High Voltage Range (10-250 V)

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Pickup Level	100V
Delay	0.20 sec.

Apply 90 V through voltage I input and check that the relay does not trip.

Apply 110 V through voltage I input and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only unit 47 and its trip.

Set the relay as follows:

VOLTAGE SETTINGS GROUP	
Pickup Level	2 V
Delay	0.20 sec.

Apply 5 V through voltage I input and check that the relay does not trip.

Apply 7 V through voltage I input and check that the relay trips.

In this last case, check that the operation time is between 0,175 and 0,250 sec.

Enable only unit 81_1 and its trip

Set the relay as follows:

81_1 SETTINGS GROUP	
Type	Underfrequency
Pickup	47,5 Hz
Delay	2 sec.
Supervision	38.5 V

Apply 110 Vac through voltage II terminals, increasing frequency from 46 Hz to 54 Hz inclusive in steps of 1 Hz.

Check that the relay trips when frequency is at 46 and 47 Hz.

In the last case, check that the operation time is between 1.95 and 2.30 sec.

Apply 36 Vac through voltage II terminals, with a frequency of 46 Hz. The relay must not trip due to the undervoltage supervision.

Repeat the test enabling only unit 81_2 with the same settings defined for 81_1.

Repeat the test enabling only unit 81_3 with the same settings defined for 81_1.

Repeat the test enabling only unit 81_4 with the same settings defined for 81_1.

Enable only unit 81_1 and its trip

Set the relay as follows:

81_1 SETTINGS GROUP	
Type	Overfrequency
Pickup	52,5 Hz
Delay	2 sec.
Supervision	38.5 V

Apply 110 Vac through voltage II terminals, changing frequency from 46 Hz to 54 Hz inclusive in steps of 1 Hz.

Check that the relay trips when frequency is at 53 and 54 Hz.

In the last case, check that the operation time is between 1.95 and 2.30 sec.

Apply 36 Vac through voltage II terminals, with a frequency of 54 Hz. The relay must not trip due to the undervoltage supervision.

Repeat the test enabling only unit 81_2 with the same settings defined for 81_1.

Repeat the test enabling only unit 81_3 with the same settings defined for 81_1.

Repeat the test enabling only unit 81_4 with the same settings defined for 81_1.

Synchronize the relay date and time with the PC, using the EnerVista MII SETUP communications program (SETPOINT – CLOCK). Check using the keypad and display that the relay is actually in synchronism with the computer.

The following pages intend to be useful to register the user settings. They can be used as a guide or template or to record the relay settings.

9.20.1 MAIN SETTINGS

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
PRODUCT SETUP	**PRODUCT SETUP**	**PRODUCT SETUP**			
Relay status	Relay status	Relay Operation		READY / DISABLE	NA
Frequency	Frequency	Frequency		50/60 Hz	NA
Application type	Application	Application		WYE CONNECTION/ DELTA CONNECTION/ SINGLE PHASE/ NEUTRAL	NA
Phase VT Ratio	Phase VT Ratio	Phase VT Ratio		1-6000	0,01
Neutral VT Ratio	Neutral VT Ratio	Neutral VT Ratio		1-6000	0,01
HMI Password	---	HMI Password		1-9999	1
Comm. Password	---	Comm Password		1 – 255	1
Slave Address	---	Slave Address		1 – 255	1
Communication baud rate	---	Comm Baud Rate		0.3, 0.6, 1.2, 2.4, 4.8, 9.6, 19.2	NA
UNIT P1	**VOLTAGE UNIT P1**	**VOLTAGE UNIT P1**			
Trip permission P1	Trip Enable P1	Trip Enable P1		Yes/No	NA
Pickup P1	Pickup P1	Pickup P1		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P1	Type P1	Type P1		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P1	Minimum voltage P1	Min Voltage P1		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P1	Logic P1	Logic P1		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P1	Delay P1	Delay P1		0 – 900.0 s	0.01
Supervisión P1	Supervisión P1	Supervisión P1		Yes/No	NA
UNIT P2	**VOLTAGE UNIT P2**	**VOLTAGE UNIT P2**			
Trip permission P2	Trip Enable P2	Trip Enable P2		Yes/No	NA
Pickup P2	Pickup P2	Pickup P2		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P2	Type P2	Type P2		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P2	Minimum voltage P2	Min Voltage P2		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P2	Logic P2	Logic P2		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P2	Delay P2	Delay P2		0 – 900.0 s	0.01
Supervisión P2	Supervisión P2	Supervisión P2		Yes/No	NA

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
UNIT P3	**VOLTAGE UNIT P3**	**VOLTAGE UNIT P3**			
Trip permission P3	Trip Enable P3	Trip Enable P3		Yes/No	NA
Pickup P3	Pickup P3	Pickup P3		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P3	Type P3	Type P3		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P3	Minimum voltage P3	Min Voltage P3		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P3	Logic P3	Logic P3		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P3	Delay P3	Delay P3		0 – 900.0 s	0.01
Supervisión P3	Supervisión P3	Supervisión P3		Yes/No	NA
UNIT P4	**VOLTAGE UNIT P4**	**VOLTAGE UNIT P4**			
Trip permission P4	Trip Enable P4	Trip Enable P4		Yes/No	NA
Pickup P4	Pickup P4	Pickup P4		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P4	Type P4	Type P4		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P4	Minimum voltage P4	Min Voltage P4		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P4	Logic P4	Logic P4		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P4	Delay P4	Delay P4		0 – 900.0 s	0.01
Supervisión P4	Supervisión P4	Supervisión P4		Yes/No	NA
UNIT 59N1	**UNIT 59N1**	**NEUTRAL OV 59N1**			
Trip permission 59N1	Trip Enable 59N1	Trip Enable 59N1		Yes/No	NA
Pickup 59N1	Pickup 59N1	Pickup 59N1		10 – 250 (HIGH) 2 – 60 (LOW)	0.01
Definite time 59N1	Delay 59N1	Delay 59N1		0 – 900.0 s	0.01
UNIT 59N2	**UNIT 59N2**	**NEUTRAL OV 59N2**			
Trip permission 59N2	Trip Enable 59N2	Trip Enable 59N2		Yes/No	NA
Pickup 59N2	Pickup 59N2	Pickup 59N2		10 – 250 (HIGH) 2 – 60 (LOW)	0.01
Definite time 59N2	Delay 59N2	Delay 59N2		0 – 900.0 s	0.01
UNIT 47	**UNIT 47**	**NEGATIVE SEQ 47**			
Trip permission 47	Trip Enable 47	Trip Enable 47		Yes/No	NA
Pickup 47	Pickup 47	Pickup 47		2 – 60	0.01
Definite time 47	Delay 47	Delay 47		0 – 900.0 s	0.01
FREQUENCY UNIT 81_1	**FREQUENCY 81_1**	**FREQUENCY 81_1**			
Trip permission 81_1	Trip Enable 81_1	Trip Enable 81_1		Yes/No	NA
Unit type 81_1	Type 81_1	Type 81_1		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_1	Pickup 81_1	Pickup 81_1		42 – 67.5 Hz	0.1
Definite time 81_1	Delay 81_1	Delay 81_1		0 – 900.0 s	0.01
Supervision 81_1	Supervision 81_1	Supervision 81_1		30 _ 250 V	0.01

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
FREQUENCY UNIT 81_2	**FREQUENCY 81_2**	**FREQUENCY 81_2**			
Trip permission 81_2	Trip Enable 81_2	Trip Enable 81_2		Yes/No	NA
Unit type 81_2	Type 81_2	Type 81_2		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_2	Pickup 81_2	Pickup 81_2		42 – 67.5 Hz	0.1
Definite time 81_2	Delay 81_2	Delay 81_2		0 – 900.0 s	0.01
Supervision 81_2	Supervision 81_2	Supervision 81_2		30 _ 250 V	0.01
FREQUENCY UNIT 81_3	**FREQUENCY 81_3**	**FREQUENCY 81_3**			
Trip permission 81_3	Trip Enable 81_3	Trip Enable 81_3		Yes/No	NA
Unit type 81_3	Type 81_3	Type 81_3		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_3	Pickup 81_3	Pickup 81_3		42 – 67.5 Hz	0.1
Definite time 81_3	Delay 81_3	Delay 81_3		0 – 900.0 s	0.01
Supervision 81_3	Supervision 81_3	Supervision 81_3		30 _ 250 V	0.01
FREQUENCY UNIT 81_4	**FREQUENCY 81_4**	**FREQUENCY 81_4**			
Trip permission 81_4	Trip Enable 81_4	Trip Enable 81_4		Yes/No	NA
Unit type 81_4	Type 81_4	Type 81_4		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_4	Pickup 81_4	Pickup 81_4		42 – 67.5 Hz	0.1
Definite time 81_4	Delay 81_4	Delay 81_4		0 – 900.0 s	0.01
Supervision 81_4	Supervision 81_4	Supervision 81_4		30 _ 250 V	0.01

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
GENERAL ADVANCED SETTINGS	**GENERAL ADVANCED SETTINGS**	**GENERAL ADVANCED**			
Identification	IDENTIFICATIONI	---		Text	NA
Active group	Settings Group	Settings Group		1 / 2	NA
Tripping contact – Minimum Closing time	Trip Min Time	Trip Min Time		50 – 300 ms.	1 ms.
UNIT P1 (GROUP 2)	**VOLTAGE UNIT P1 (GROUP 2)**	**VOLTAGE UNIT P1**			
Trip permission P1	Trip Enable P1 T2	Trip Enable P1		Yes/No	NA
Pickup P1	Pickup P1 T2	Pickup P1		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P1	Type P1 T2	Type P1		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P1	Minimum voltage P1 T2	Min Voltage P1		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P1	Logic P1 T2	Logic P1		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P1	Delay P1 T2	Delay P1		0 – 900.0 s	0.01
Supervisión P1	Supervisión P1 T2	Supervisión P1		Yes/No	NA
UNIT P2 (GROUP 2)	**VOLTAGE UNIT P2 (GROUP 2)**	**VOLTAGE UNIT P2**			
Trip permission P2	Trip Enable P2 T2	Trip Enable P2		Yes/No	NA
Pickup P2	Pickup P2 T2	Pickup P2		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P2	Type P2 T2	Type P2		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P2	Minimum voltage P2 T2	Min Voltage P2		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P2	Logic P2 T2	Logic P2		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P2	Delay P2 T2	Delay P2		0 – 900.0 s	0.01
Supervisión P2	Supervisión P2 T2	Supervisión P2		Yes/No	NA
UNIT P3 (GROUP 2)	**VOLTAGE UNIT P3 (GROUP 2)**	**VOLTAGE UNIT P3**			
Trip permission P3	Trip Enable P3 T2	Trip Enable P3		Yes/No	NA
Pickup P3	Pickup P3 T2	Pickup P3		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P3	Type P3 T2	Type P3		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P3	Minimum voltage P3 T2	Min Voltage P3		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P3	Logic P3 T2	Logic P3		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P3	Delay P3 T2	Delay P3		0 – 900.0 s	0.01
Supervisión P3	Supervisión P3 T2	Supervisión P3		Yes/No	NA

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
UNIT P4 (GROUP 2)	**VOLTAGE UNIT P4 (GROUP 2)**	**VOLTAGE UNIT P4**			
Trip permission P4	Trip Enable P4 T2	Trip Enable P4		Yes/No	NA
Pickup P4	Pickup P4 T2	Pickup P4		10 -250 V (HIGH) 2 – 60 V (LOW)	0.01 V
Function type P4	Type P4 T2	Type P4		UNDERVOLTAGE/ OVERVOLTAGE	NA
Minimum voltage P4	Minimum voltage P4 T2	Min Voltage P4		0 – 250 V (HIGH) 2 – 60 V (LOW)	0.01
Tripping logic P4	Logic P4 T2	Logic P4		ANY PHASE/ TWO PHASE/ ALL PHASE	NA
Definite time P4	Delay P4 T2	Delay P4		0 – 900.0 s	0.01
Supervisión P4	Supervisión P4 T2	Supervisión P4		Yes/No	NA
UNIT 59N1 (GROUP 2)	**UNIT 59N1 (GROUP 2)**	**NEUTRAL OV 59N1**			
Trip permission 59N1 T2	Trip Enable 59N1 T2	Trip Enable 59N1		Yes/No	NA
Pickup 59N1 T2	Pickup 59N1 T2	Pickup 59N1		10 – 250 (HIGH) 2 – 60 (LOW)	0.01
Definite time 59N1 T2	Delay 59N1 T2	Delay 59N1		0 – 900.0 s	0.01
UNIT 59N2 (GROUP 2)	**UNIT 59N2 (GROUP 2)**	**NEUTRAL OV 59N2**			
Trip permission 59N2 T2	Trip Enable 59N2 T2	Trip Enable 59N2		Yes/No	NA
Pickup 59N2 T2	Pickup 59N2 T2	Pickup 59N2		10 – 250 (HIGH) 2 – 60 (LOW)	0.01
Definite time 59N2 T2	Delay 59N2 T2	Delay 59N2		0 – 900.0 s	0.01
UNIT 47 (GROUP 2)	**UNIT 47 (GROUP 2)**	**NEGATIVE SEQ 47**			
Trip permission 47 T2	Trip Enable 47 T2	Trip Enable 47		Yes/No	NA
Pickup 47 T2	Pickup 47 T2	Pickup 47		2 – 60	0.01
Definite time 47 T2	Delay 47 T2	Delay 47		0 – 900.0 s	0.01
FREQUENCY UNIT 81_1 (GROUP 2)	**FREQUENCY 81_1 (GROUP 2)**	**FREQUENCY 81_1**			
Trip permission 81_1 T2	Trip Enable 81_1 T2	Trip Enable 81_1		Yes/No	NA
Unit type 81_1 T2	Type 81_1 T2	Type 81_1		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_1 T2	Pickup 81_1 T2	Pickup 81_1		42 – 67.5 Hz	0.1
Definite time 81_1 T2	Delay 81_1 T2	Delay 81_1		0 – 900.0 s	0.01
Supervision 81_1 T2	Supervision 81_1 T2	Supervision 81_1		30 _ 250 V	0.01
FREQUENCY UNIT 81_2 (GROUP 2)	**FREQUENCY 81_2 (GROUP 2)**	**FREQUENCY 81_2**			
Trip permission 81_2 T2	Trip Enable 81_2 T2	Trip Enable 81_2		Yes/No	NA
Unit type 81_2 T2	Type 81_2 T2	Type 81_2		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_2 T2	Pickup 81_2 T2	Pickup 81_2		42 – 67.5 Hz	0.1
Definite time 81_2 T2	Delay 81_2 T2	Delay 81_2		0 – 900.0 s	0.01
Supervision 81_2 T2	Supervision 81_2 T2	Supervision 81_2		30 _ 250 V	0.01

	ENERVISTA MII SETUP	HMI	USER SETTING	RANGE	STEP
FREQUENCY UNIT 81_3 (GROUP 2)	**FREQUENCY 81_3 (GROUP 2)**	**FREQUENCY 81_3**			
Trip permission 81_3 T2	Trip Enable 81_3 T2	Trip Enable 81_3		Yes/No	NA
Unit type 81_3 T2	Type 81_3 T2	Type 81_3		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_3 T2	Pickup 81_3 T2	Pickup 81_3		42 – 67.5 Hz	0.1
Definite time 81_3 T2	Delay 81_3 T2	Delay 81_3		0 – 900.0 s	0.01
Supervision 81_3 T2	Supervision 81_3 T2	Supervision 81_3		30 _ 250 V	0.01
FREQUENCY UNIT 81_4 (GROUP 2)	**FREQUENCY 81_4 (GROUP 2)**	**FREQUENCY 81_4**			
Trip permission 81_4 T2	Trip Enable 81_4 T2	Trip Enable 81_4		Yes/No	NA
Unit type 81_4 T2	Type 81_4 T2	Type 81_4		UNDERFREQUENCY/ OVERFREQUENCY	NA
Pickup 81_4 T2	Pickup 81_4 T2	Pickup 81_4		42 – 67.5 Hz	0.1
Definite time 81_4 T2	Delay 81_4 T2	Delay 81_4		0 – 900.0 s	0.01
Supervision 81_4 T2	Supervision 81_4 T2	Supervision 81_4		30 _ 250 V	0.01

9.20.2.1 EVENT MASKS

	ENERVISTA MII SETUP	USER SETTING	MIVII1000	MIVII2000	MIVII3000
EVENT MASKS	**EVENT MASKS**				
Voltage P1 Pickup	Pickup Voltage P1		®		®
Voltage P2 Pickup	Pickup Voltage P2		®		®
Voltage P3 Pickup	Pickup Voltage P3		®		®
Voltage P4 Pickup	Pickup Voltage P4		®		®
59N1Pickup	Pickup 59N1		®		®
59N2Pickup	Pickup 59N2		®		®
47 Pickup	Pickup 47		®		®
81_1 Pickup	Pickup 81_1			®	®
81_2 Pickup	Pickup 81_2			®	®
81_3 Pickup	Pickup 81_3			®	
81_4 Pickup	Pickup 81_4			®	
Voltage P1 Disable (by DI)	Voltage P1 Disabled (by D.I.)		®		®
Voltage P2 Disable (by DI)	Voltage P2 Disabled (by D.I.)		®		®
Voltage P3 Disable (by DI)	Voltage P3 Disabled (by D.I.)		®		®
Voltage P4 Disable (by DI)	Voltage P4 Disabled (by D.I.)		®		®
59N1 trip inhibit. Activation / deactivation by digital input	59N1 Disabled (by D.I.)		®		®
59N2 trip inhibit. Activation / deactivation by digital input	59N2 Disabled (by D.I.)		®		®
47 trip inhibit. Activation / deactivation by digital input	47 Disabled (by D.I.)		®		®
81_1 trip inhibit. Activation / deactivation by digital input	81_1 Disabled (by D.I.)			®	®
81_2 trip inhibit. Activation / deactivation by digital input	81_2 Disabled (by D.I.)			®	®
81_3 trip inhibit. Activation / deactivation by digital input	81_3 Disabled (by D.I.)			®	
81_4 trip inhibit. Activation / deactivation by digital input	81_4 Disabled (by D.I.)			®	
General trip inhibit. Activation / deactivation by digital input	Trip Disabled (by D.I.)		®	®	®
Voltage P1 Trip	Voltage P1 Trip		®		®
Voltage P2 Trip	Voltage P2 Trip		®		®
Voltage P3 Trip	Voltage P3 Trip		®		®
Voltage P4 Trip	Voltage P4 Trip		®		®
Trip 59N1	59N1 Trip		®		®
Trip 59N2	59N2 Trip		®		®
Trip 47	47 Trip		®		®
Trip 81_1	81_1 Trip			®	®
Trip 81_2	81_2 Trip			®	®
Trip 81_3	81_3 Trip			®	
Trip 81_4	81_4 Trip			®	
General trip	General Trip		®	®	®
Protection activation /deactivation	Protection Status		®	®	®
Auxiliary output 1 activation / deactivation	Output 1		®	®	®
Auxiliary output 2 activation / deactivation	Output 2		®	®	®
Auxiliary output 3 activation / deactivation	Output 3		®	®	®
Auxiliary output 4 activation / deactivation	Output 4		®	®	®

	ENERVISTA MII SETUP	USER SETTING	MIVII1000	MIVII2000	MIVII3000
Digital input 1 activation / deactivation	Digital input 1		®	®	®
Digital input 2 activation / deactivation	Digital input 2		®	®	®
Settings change through input inhibition activation/deactivation	Settings change disable		®	®	®
Trip command activation by digital input	Trip command by input		®	®	®
Trip command activation by command	Trip command by command		®	®	®
Auxiliary contacts latching reset	Reset Latch aux		®	®	®
52 B open/closed	Breaker 52 B		®	®	®
52 A open/closed	Breaker 52 A		®	®	®
52 open/closed	Breaker closed		®	®	®
Oscillography trigger by digital input	Osc. Trigger by D.I.		®	®	®
Oscillography trigger by command	Osc. Trigger by command		®	®	®
Settings change executed	Settings Change		®	®	®
EEprom failure	EEprom failure		®	®	®
User settings / Default settings	User settings		®	®	®

9.20.2.2 OSCILLOGRAPHY MASKS

OSCILLOGRAPHY MASK	ENERVISTA MII SETUP	USER SETTING	RANGE
Oscillo by communications	Oscillo by comm.		Yes / No
Oscillo by digital input	Oscillo by digital input		Yes / No
Oscillo by trip	Oscillo by trip		Yes / No
Oscillo by pickup	Oscillo by pickup		Yes / No

The relay should be installed in a clean, dry and dust-free place, with no vibrations. It should also be well lit to facilitate inspection and testing.

Operational conditions as defined in section 3 must not be exceeded in any case.

The relay should be mounted on a vertical surface. Figure 3–2: shows the diagram for panel drilling and mounting.

Given that the design of the MIVII unit is based on high performance digital technology it is not necessary to recalibrate the relay. However if the tests show that it is necessary to readjust the relay, it is recommended that the unit should be returned to the manufacturer to have this done.

Threaded plug labelled as GND (refer to 1.3) should be correctly grounded, so that the disturbance suppression circuits in the system work correctly. This connection should be as short as possible (preferably 25 cm or less) to guarantee maximum protection. In this way capacitors that are internally connected between the inputs and ground divert high frequency disturbances directly to ground without passing through the electronic circuits, with the result that the circuits are perfectly protected.

In addition this connection also guarantees the physical safety of the personnel who have to touch the relay, since the whole case is connected to ground.

ATTENTION: Every time a PC is connected to the relay, the PC must be grounded to the same ground as the relay.

Given the important role that the protection relays play in the operation of any installation, a periodical program of tests is highly recommended. The unit incorporates built-in diagnostic functions that permit immediate identification with only the aid of the keypad and display, the detection of some of the most likely circuit failures. Testing the unit is recommended at intervals of 2 years or more. Although the built-in diagnosis does not reduce the average time between failures, it does increase the availability of the protection because it allows a drastic reduction in the average interruption time involved in detecting and repairing the fail.

The set of tests that can be carried out to test that all the features of the MIVII unit function properly is described in detail in the chapter entitled COMMISSIONING.

In case of detecting accumulated pollution, the unit can be cleaned with a clean cloth, either dry or slightly dampened with a cleaner containing alcohol.

Abrasive cleaners must be avoided, as these can damage the metallic surface or the electrical connection elements.

Q1 I have powered my MIVII unit to its rated voltage and the READY LED on the front remains turned off, although the screen is lit up and showing measures.

A1 If the READY LED is unlit, it means that the unit will not trip in case of a fault. Three conditions must be present for the unit to be in service:

1.No internal error must occur.

2.The STATUS setting in the Main Settings – General Settings group must be set to RDY (ready, in service).

3. At least one of the protection elements must be enabled.

All MIVII units are received from the factory with all protection elements disabled, in order to avoid undesired trips during commissioning, before the user has set the pickup values for each protection element. For this reason, the READY LED is off when a new unit is powered up

Make sure also that the enabled protection element belongs to the active settings group. If there is a protection element enabled in settings group 1 but no protection element enabled in settings group 2 and the active group is group 2, there will be no protection element active at the moment, and the READY LED will be off until either group 1 is active or any group 2 protection function is enabled.

Q2 I have tried to change a setting via HMI, but when I press the enter button to store the setting, the HMI shows the "ENTER PASSWORD" message. What I have to do?

A2 The settings configuration via HMI is secured by a password, so no unauthorized person can change any setting. The relay password by default is 1, so when the relay asks to "ENTER PASSWORD", you have to select with the up arrow-button the number 1 and then press the enter button.

Q3 What can I do if I forget the HMI password?

A3 Using the HMI it is possible to see an encrypted numerical value corresponding to the current HMI password. This value can be viewed in the MAIN SETTINGS – PRODUCT SETUP – HMI Password menu. Please contact GE Multilin Technical Support to decrypt this value and obtain the HMI password.

Q4 How can I change the HMI Password?

A4 In the MAIN SETTINGS – PRODUCT SETUP menu of the HMI, choose the HMI Password menu by pressing the enter button. Enter the current password, and then choose a new password number between 1 and 9999 and press enter. The new Password will be stored.

Q5 I have just received an MIVII unit, and I do not know which communication parameters I should set in the program.

A5 The default communication baud rate is **9600** baud, for the EnerVista MII SETUP program as well as for the relay. When starting the connection, the program will request the relay address and password; the value to be entered here is **1** in both cases.

Q6 I have followed the previous steps, but I cannot communicate with the relay using the front port.

A6 Check the following points:

- Communications port in EnerVista MII SETUP (COM1, COM2, etc.)
- Baud rate must be the same for EnerVista MII SETUP and the relay.
- Relay address and password must be the same for EnerVista MII SETUP and the relay.
- The communications wire must be direct; do not use null modems, as this type of modem crosses pins 2 and 3.

Check that the wire connections follow the table below[i]:

	CONNECTOR	PIN	PIN	PIN	PIN	PIN
MIVII	DB9	2	3	4	5	6
PC	DB9	2	3	4	5	6

Q7 How do I connect MIVII terminals SDA - SDB to an RS485/RS232 converter?

A7 The RS485 standard defines terminals “A” and “B” for communication, therefore, the connection will be MIVIISDA with converter’s terminal A, and MIVII SDB with converter’s terminal B. However it is usual to identify terminals as “+” and “-“, taking for granted that terminal “A” will correspond to “-“, and terminal “B” with “+”. In this case, connections must be: MIVII terminal SDA with “-“, and terminal SDB with “+”.

Anyway, it is recommended to check the converter’s documentation to confirm the manufacturer’s criterion. For the concrete case of GE PM’s F485 converter, connections are SDA with “-“and SDB with “+”.

Q8 After the previous steps, I cannot communicate through the rear RS485 port.

A8 Check the following:

Communications port in EnerVista MII SETUP (COM1, COM2, etc.)

Baud rate is the same for EnerVista MII SETUP, the relay and the converter (if a setting is available)

Relay number and password is the same in the PC and the relay

Check the connections of SDA and SDB terminals in MIVII with the converter.

Selection of the converter’s device type DTE/DCE.

Is the RS485 wire grounded in order to reduce noise?

Q9 How can I get the last version of firmware, PC software and instruction manual?

A9 **Urgent**: Via Internet on our website www.geindustrial.com/multilin Make sure you subscribe to all MIVII data, in order to be informed about updates by e-mail.

Post: Sending a fax to GE Multilin (+34 94 485 88 45)

Q10 My MIVII unit has been powered off and I do not know if the stored information will be lost.

A10 MIVII relays have three different types of memory: FLASH, where the protection program is stored; this memory is maintained indefinitely without power supply; EEPROM, where the protection settings are stored; this memory is also maintained indefinitely; and RAM, where events and oscillography records are stored. The RAM memory is maintained for 48 hours without power supply, and after this time data will be lost. The unit date and time is also maintained for 48 hours without power supply.

Q11 Once the program events have been checked, I would like to analyze them more in detail. Can I export these data and work with them with a different application?

A11 EnerVista MII SETUP software allows saving events in a CSV format file. This format is used by different applications (e.g. Microsoft Excel‰), and consists of a series of data separated by comas. Once the information is saved in this format, they can be analyzed using all tools that accept this file format.

i. The rest of pins are not used.

Q12 My MIVII unit has tripped clearing a system fault, and I would like to analyze oscillography, should I use special software?

A12 EnerVista MII SETUP software allows saving oscillography in a COMTRADE format file (IEEE C37.111 / IEC 60255-24: Common format for transient data exchange for power systems). As the COMTRADE format chosen is ASCII, these files can be viewed in any application accepting ASCII format ("Microsoft Excel“), as well as specific applications for viewing oscillography records, as GE Multilin’s GE OSC software.

Q13 My MIVII unit has the display off but the Ready LED is ON; does that mean the relay needs to be repaired?

A13 No, it doesn’t. MII relays automatically turn off the display if in 15 minutes no key has been pressed. By pressing any key the display turns on again.

Q14 I want to pint/view all the relay settings in one window, how can I do it?

A14 In ENERVISTA MII Setup it is possible to see all the settings in a single window. After the communication with the relay, from the FILE menu of the program you can PRINT or PREVIEW the settings.

Q15 Do harmonics influence the MIVIImeasure?

A15 No, they don’t. MIVII uses a complete cycle recursive DFT (Discrete Fourier Transformation) in order to obtain the resulting measure phasor. The Fourier transformation consists of decomposing a signal into a series of sinusoidal signals with frequencies that are multiples of the fundamental frequency. Once these signals have been obtained, harmonics are extracted to get the phasor value corresponding to the fundamental frequency; therefore, it acts as a digital harmonic filter and all the relay protection elements work only with the fundamental component of each signal.

Q16Which is the frequency measuring time in MIVII?

A16MIVII uses a frequency measurement algorithm that averages 8 cycles, this gives intrinsic filtering to false reading due to harmonics.

Frequency is only measured on phase "B" regardless of the input configuration.

Q17I am using MIVIII for single phase and the relay doesn’t show any measurement.

A17MIVII has three voltage inputs for the three phases quantities. The relay calculates neutral quantities internally from the three-phase value. For single-phase application, only phase "B" input is used.

WARNING:

When communicating with the RS232 front port of the relay, ensure that the relay is properly grounded (ground must be at the same level of the PC). Otherwise, use ungrounded PC.

- **Read the instruction manual carefully before installing the device.**

- **Check the power supply rating before applying power to the relay.**

  Applying voltage greater than the maximum rating of the power supply (the actual rated voltage for an MIVII relay is indicated in the front panel) can result in permanent component damage to the relay's power supply.

- **Ensure that the source VT secondary matches the relay VT rated currentvoltage.**

  MIVII can be ordered with either Low range (2-60V) or High range (10-250) Verify that the relay rated voltage (indicated in the front panel) matches the secondary rating of the connected VTs. Unmatched VTs may result in equipment damage or inadequate protection.

- **Check the correct polarity of the RS-485 connections.**

  Different manufacturers of Modbus® compatible devices including RS-485 ports can use different criteria for defining port polarities. In order to avoid misuse of the MIVII rear communication port, please verify connections in accordance with information provided in the MIVII instruction book.

- **Do not connect to the RS232 front port of the relay until being ensured that the relay ground is at the same level of PC ground.**

- **Do not upgrade the relay firmware without first ensuring that relay Settings and Configuration have been downloaded and saved to a file.**

  Whenever a firmware download is performed into the flash memory, upon startup, the relay will automatically go back to factory default settings. A saved file will be a record of previously existing settings and relay configuration (I/O, LEDs and logic). In case the firmware download has not modified the Modbus® memory map of the relay, the previously saved file can be directly downloaded to the upgraded relay, if the memory map has been modified a new file has to be generated using EnerVista MII SETUP software.

- **Do not configure the two digital inputs in MIVII to the same logical value.**

  If done, MIVII will evaluate and monitor only the second digital input, resulting in the first input being useless. There are two exceptions to this rule; configuring both inputs to the same value is allowed whenever:

  1. The assigned value is "No definition". In this case the inputs are not defined and thus not evaluated by the MIVII relay.
  2. The assigned value is "General input". In this case, the activation of inputs does not activate any element in the MIVII protection logic, but the input values (active/non active) are evaluated and can be used with any purpose in the MIVII configurable logic.

MIVII units have been designed and verified using the most advanced and reliable equipment. Mounting and testing automation ensure a high consistency of the final product. Before sending a unit back to the factory, we strongly recommend you follow the recommendations below.

Even if it will not always solve the problem, at least they will help define it better for a quicker repair.

If you need to send a unit back to the factory for repair, please use the appropriate RETURN MATERIAL AUTHORIZATION process, and follow the shipping instructions provided by our Service Department, especially in the case of international shipments. This will lead to a faster and efficient solution of your problem.

CATEGORY	SYMPTOM	POSSIBLE CAUSE	RECOMMENDED ACTION
PROTECTION	The relay does not trip	- Element not enabled - Output not assigned - Inappropriate setting group	-Set the element permission to ENABLE -Program the output to the desired element using ENERVISTA MII SETUP-SETPOINT-RELAY CONFIGURATION - Make sure that desired group is active (group 1 or group 2) and/or that there is no settings group change input that could modify the active group
GENERAL	When feeding the unit, no indicator is light up	- Insufficient power supply - Fused fuse - Loose fuse - Incorrect wiring	- Verify the voltage level using a multimeter in the power supply terminals, and check that it is within the model range. - Remove the power supply board and replace the fuse.
COMMUNICATIONS	The relay does not communicate via the front RS232 port	- Incorrect cable - Damaged cable - Relay or PC not grounded - Incorrect baud rate, port, address, etc.	- Make sure you are using a straight cable. - Replace the cable - Ensure ground connection - Make sure that the communication parameters in the computer match the ones in the relay.
	The relay does not communicate via the RS485 port	- Relay or PC not grounded - Incorrect polarity - Incorrect baud rate, address, etc.	- Ensure ground connection - Invert polarity - Test other baud rate, etc.

13

When an Electrical System operates in a normal condition at the rated frequency, the total mechanical power of the generator turbines equals the sum of all the connected loads, plus the power losses in the System. Any variation in load or generation will produce a change in frequency. The enormous masses of the generation equipment are depository of all the kinetic energy, so that when there is not enough generation mechanical power, rotors rotate more slowly trying to provide the missing power; in the same way, when there is exceeding mechanical energy, rotor accelerate to absorb this energy surplus. Any variation in the generator rotors rotating speed will cause a proportional variation in frequency.

Although all these variations can be compensated by the regulation equipment installed in the generators, there are circumstances where the generation deficit or surplus cannot be compensated by these equipment due to the load variation magnitude. In these cases, there is a quick and strong frequency variation, which, if maintained, may cause an Electrical System breakdown.

Therefore, in these circumstances, there is a clear need to manage appropriately and quickly the installed loads (shedding or reset), in order to maintain the integrity of the rest of the System.

A.1.1 ELECTRICAL SYSTEM OPERATION LIMITS

Great part of the main equipment in the Electrical System is designed to operate at rated frequencies of 50 or 60 Hz, with a small variation range around these rated values.

Mainly, the generation groups are the most sensitive to frequency variations and their effects. They can be described as follows:

Auxiliary motors powering the refrigeration water pumps or ventilation equipment at reduced frequency, lower they speed and subsequently their output power, causing a reduction in the maximum power admissible in the generator, due to overheating. The majority of generation plants at 60 Hz can operate in these circumstances with a variation range of 56,5 to 57,5 Hz.

Some types of turbines, particularly gas and steam turbines, incorporate low-pressure buckets designed to operate without resonance only at the rated power. If a 60Hz turbine is operated at 58.5 Hz or less, we find a condition where the steam excitation frequency is close to the resonance frequency, causing a severe vibration and subsequently, mechanical fatigue. This situation must not be maintained form more that 10 minutes during the whole turbine life. Otherwise the turbine would be destroyed, taking into account that mechanical fatigue is accumulative. In these cases, every caution must be observed to avoid operation in the range of 58 to 58.5 Hz.

A

Load increases in the Electrical System, if within the generation capacity limits, are controlled by the regulation elements that produce the use of the rotative generation reserve.

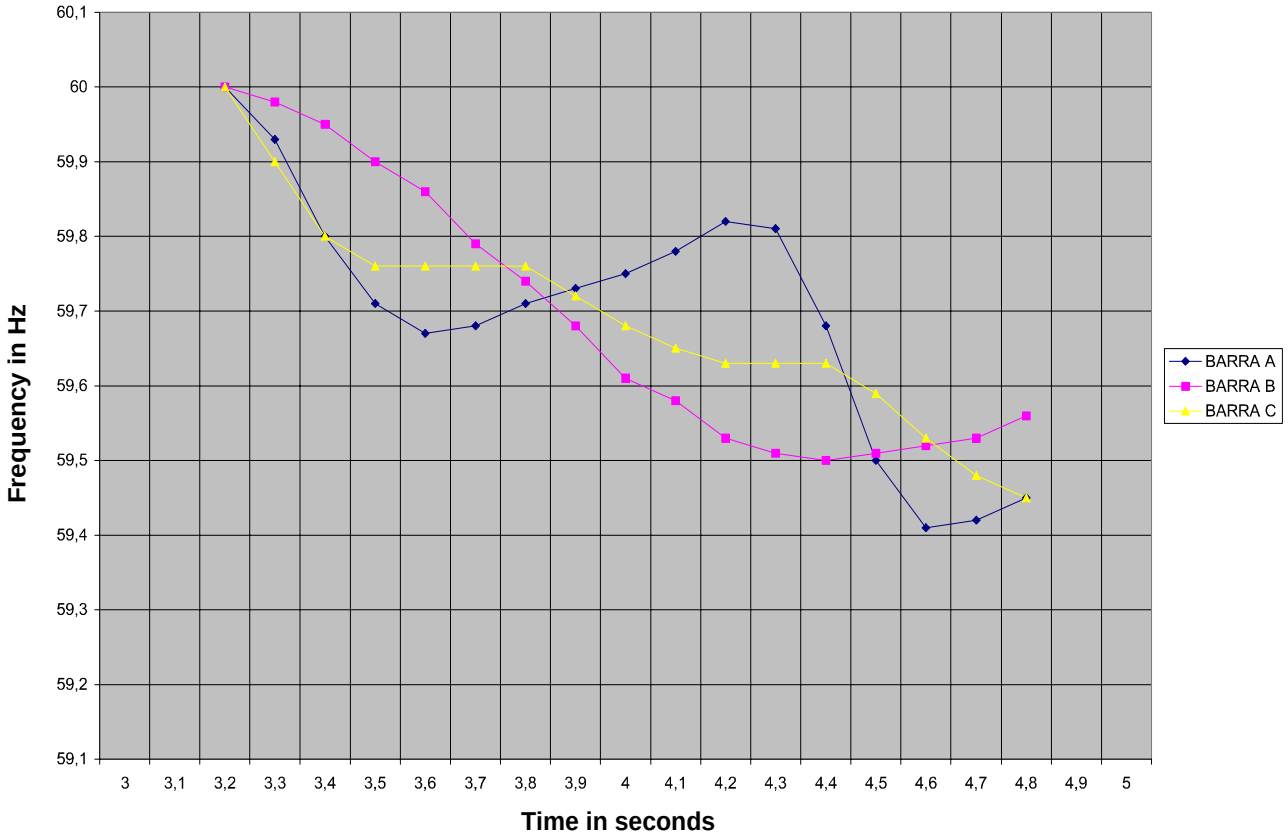
When the magnitude of the load increase exceeds the System rotative reserve power, regulators have reached their limits, and in these circumstances, when the power loads exceed generation, there is a decrease of the System frequency.

In the case of a quick variation in frequency due to a strong overload, it is usually necessary to make a selective shedding of those low-priority loads for the Electrical System to recover its rated operation frequency. Once the situation has returned to normality, the following step is to connect the different loads (depending on the available generation) in order to return to normal operation conditions.

Frequency is the most reliable indicator of an overload condition. Therefore, frequency is the parameter used for detecting this situation and automatically disconnecting the programmed loads.

The purpose of load shedding is balancing the load with the generation in the balance point where all parameters are at their normal operation values. As it is not possible to measure the quantity of overload, load shedding is performed sequentially in blocks and at different frequency levels, until frequency returns at least at the minimum operation value. In the case of an Electrical System at 60 Hz, the first block will be shedded between 59.4 and 59.7 Hz. If the first block shedding is not enough and frequency continues to fall, a second block is shedded, and this way on until the System is balanced.

Time-frequency characteristic in an Electrical System when losing 5% of Generation



A.3.1 HIGH SPEED RECLOSURE

A possible case is a line that incorporates high-speed reclose on both ends, and a load formed by motors in the middle of the line. In case of an internal failure, the line normally trips at both ends and starts a reclose of at least one of them. It is important to disconnect all the motor loads and the plant generators during the line opening previous to the reclose, as it would be very rare for them to remain in synchronism with the rest of the network during the dead time of the reclose, due to the generation deficit in the disconnected side.

This is a typical application for a frequency relay; when shedding the low-priority loads, this fact allows maintaining at least part of the motors in service until the manual or automatic reset of the situation previous to the failure.

A.3.2 CRITERIA FOR A LOAD SHEDDING SCHEME

When starting a load-shedding scheme, we need to determine the maximum overload level allowed by the Electrical System to maintain system balance, the maximum load level we can shed, the frequency level that will start the shedding program, and the minimum frequency we can reach.

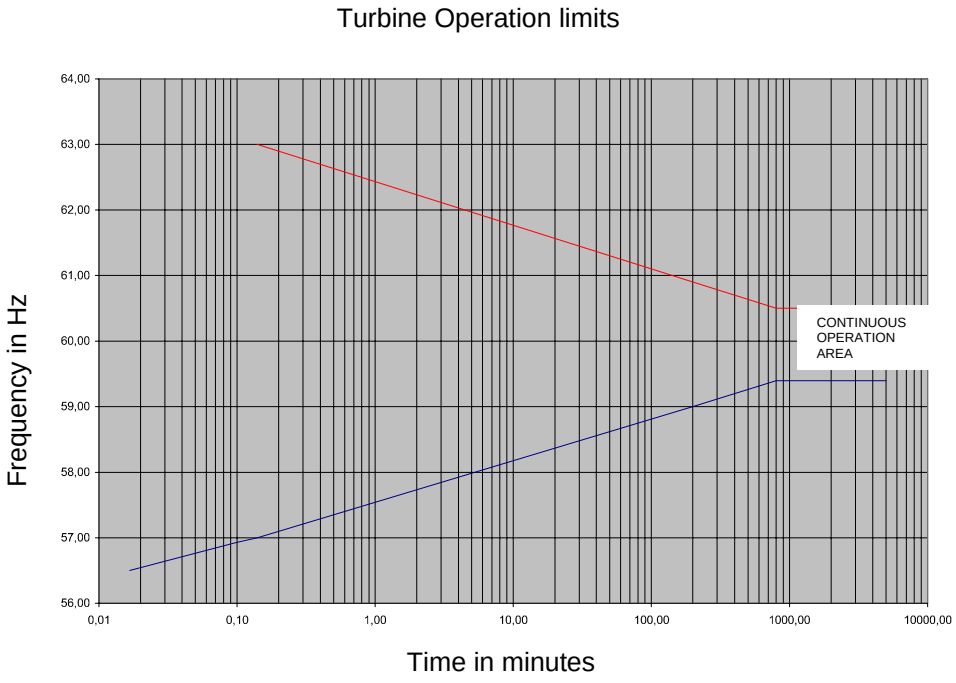
Electrical System maximum overload

In industrial systems including their own generation, and connected to the Electrical System through a feeder, it is quite easy to determine the overload level, but in the case of interconnections and big Electrical Systems it is more complicated, as levels and situations change during the day.

This is why, in these cases, usually stability studies are carried out for concrete events, such as the loss of big generation blocks, or the opening of critical interconnections, in order to determine the response of the System to different generation and load variations

Maximum load level to be shedded

The load quantity to be shedded must be enough to take the system frequency back to the rated values, or close values (around 59Hz in systems at 60 Hz). Usually the load quantity to be shedded is close to the overload value, as we can see in the following diagram:



Frequency does not need to reach exactly 60Hz (or 50Hz) after a load shedding. If, for example frequency reaches 59Hz, the rotative generation reserve can compensate the load and leave the speed regulators adjust frequency to the rated values. If there is not enough rotative reserve, the system can operate at low frequency (taking into account the limitations for gas and steam turbines) for a period of time long enough for the operator to manually shed the required load, and bring the system back to its rated frequency value.

Usually, load-shedding schemes are designed for disconnecting loads in several stages. On the other hand, as these stages are located in different points of the network, the possibility of power oscillations that can cause undesired trips in transmission lines or important interconnections is minimized.

Start level of the load shedding scheme

There is no pre-established criterion for fixing the starting level for load shedding, as this depends on several factors. In general, the scheme must start at values lower than the minimum operation values in emergency conditions.

The following frequency values can be established as shedding stages (for 60Hz systems):

Group 1	59.5Hz
Group 2	59.0 Hz
Group 3	58.5 Hz
Group 4	58.0 Hz

Another fact to be taken into account is the frequency deviations that can exist during power oscillations. The bigger the power oscillations are, the bigger will be the transitory frequency deviations.

Admissible Operation Frequency Reduction

According to the performed tests, power that can be generated in a plant decreases sensibly at 59 Hz, and reaches a limit condition at 53 to 55 Hz. In order to foresee a sufficient margin, the frequency fall is limited to 57Hz, and in extreme cases to 56 Hz. The load shedding must be always started at values higher than these limits, due to the delay caused by the operation time of associated protection equipment and breakers.

The **ModBus Format (**Intel/Motorola) setting**,** in General Settings, provides with different ways to access and/or modify the relay information

Differences between selecting the Intel or Motorola setting are explained in the following table:

	INTEL	MOTOROLA
ModBus Map Addressing	One byte at a time	One word at a time
Data presentation	High Byte – Low Byte	Low Byte – High Byte
Operations	Selection + Confirmation	Confirmation

The ModBus® function used is number 3 (READ HOLDING REGISTERS). The message request command is generated as follows:

Request:

FIELD	LENGTH
Relay address	1 Byte
Function	1 Byte (03h)
Beginning address	1 word (High Byte – Low Byte)
Number of registers	1 word (High Byte – Low Byte)
CRC	1 word

Reply:

FIELD	LENGTH
Relay address	1 Byte
Function	1 Byte
Nº of bytes	1 Byte (Number of registers * 2)
Value of the registers	n data bytes
CRC	1 word

Example:

Reading 75 registers (150 bytes) beginning from address 04FEH (word with 027F address)

IntelRequest:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	03H	04FEH	004BH	653DH

Intel Reply

ADDRESS	FUNCTION	BYTES	DATA0	...	DATA74	CRC
01H	03H	96H	500DH		0200H	84D5H

Motorola Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	03H	027FH	004BH	359DH

Motorola Reply:

ADDRESS	FUNCTION	BYTES	DATA0	...	DATA74	CRC
01H	03H	96H	0D50H		0002H	2783H

Commands with ModBus® Intel format setting are executed in two steps: **selection and confirmation**. First, send the command or operation selection command. When the relay response arrives, send the confirmation. It is necessary to send the relay password. The structure for both commands is the same; the only variation is the related code.

When Motorola is the selected ModBus format setting, commands only need the **confirmation** step.

The ModBus® function used is 16 (10h), PRESET MULTIPLE SETPOINTS. It consists of a writing of the operation code in address 0 (000H). The available commands list is as follows:

INTEL SELECTION

	INTEL		MOTOROLA
COMMAND	**SELECTION**	**CONFIRMATION**	**CONFIRMATION**
Setting change	01H	02H	02H
Open breaker	07H	08H	08H
LEDs reset	09H	0AH	0AH
Change to group 1	0DH	0EH	0EH
Change to group 2	0FH	10H	10H
Oscillography trigger	17H	18H	18H
Close breaker	39H	3AH	3AH
Time synchronization	0FEH	Not applicable	0FEH

Intel Request:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (000H) (High byte – low byte)
Number of registers	1 word (0001H) (High byte – low byte)
Number of bytes	1 byte (02H)
Value of the registers	Register1=> (INTEL) Command code (Low byte – High byte)
CRC	1 word

Intel Reply:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (000H) (High byte – low byte)
Nº of registers	1 word (0003H) (High byte – low byte)
CRC	1 word

Example:

We send the Group-related command. For instance, to activate Group 2, the selection command will be 15 (0F00H)

Intel Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES	DATA0	CRC
01H	10H	0000H	0001H	02H	0F00H	A3A0H

Intel Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0001H	01C9H

CONFIRMATION:

Intel Request:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (0000H) (High byte – low byte)
Number of registers	1 word (0001H) (High byte – low byte)
Number of bytes	1 byte (06H)
Value of the registers	Register1=>Command code (Low byte – High byte). Register2=>Relay password (Low byte – High byte). Register3=>Constant value
CRC	1 word

Intel Reply:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (0000H) (High byte – low byte)
Number of registers	1 word (0003H) (High byte – low byte)
CRC	1 word

Motorola Request:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (000H) (High byte – low byte)
Number of registers	1 word (0001H) (High byte – low byte)
Number of bytes	1 byte (02)
Value of the registers	Register1=>Command code (Low byte – High byte).
CRC	1 word

Motorola Reply:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (0000H) (High byte – low byte)
Number of registers	1 word (0001H) (High byte – low byte)
CRC	1 word

Example:

Request:

To activate Group 2, the selection command will be 0FH; therefore the operation to be performed is a writing of word 0F 00H at the address 00 00H.

The operation confirmation code for Group 2 activation is 16 (10h). In this case, it is necessary to send the relay password

Intel Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES	DATA0	DATA1	DATA2	CRC
01H	10H	0000H	0003H	06H	10 00H	01 00H	00 00H	E5ECH

Intel Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0003H	8008H

Motorola Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	BYTES	DATA0	CRC
01H	10H	0000H	0001H	02H	10 00H	AB90H

Motorola Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0001H	01C9H

To synchronize the date and time of a relay we use a command with the following characteristics:

1. The command is executed in broadcast mode (relay address = 00H)
2. Date and time are included in the message. The date and time format length is 6 bytes.
3. No answer is expected from the relay.

FIELD	LENGTH
Relay address	1 byte (00H – broadcast)
Function	1 byte (10H)
Beginning address	1 word (0000H) (High Byte – low byte)
Number of registers	1 word (0004H) (High Byte – low byte))
Number of bytes	1 byte (08H) (High Byte – low byte))
Value of the registers	Register 1=>Command code (Low byte –High byte). Register 2...4=>Date and time
CRC	1 word

Example:

To send the date and time of June 15th, 2005 at 00:015:09.000

Intel Synchronization:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES	DATA0	DATA1	DATA2	DATA3	CRC
00H	10H	0000H	0004H	08H	FE 00H	C8CAH	7476H	4500H	B950H

Motorola Synchronization:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES	DATA0	DATA1	DATA2	DATA3	CRC
00H	10H	0000H	0004H	08H	FE 00H	0045H	7674H	CAC8H	3919H

There are three steps to write a setting:

1. Execute a selection command using the corresponding code (See command execution)
2. Change the setting
3. Execute a confirmation command using the corresponding code (See command execution)

For Motorola format, only the last two steps are necessary

To modify a setting, use function 10H (PRESET MULTIPLE REGISTERS in MODBUS)

Request:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word (High Byte – low byte)
Number of registers	1 word (High Byte – low byte)
Number of bytes	1 byte
Value of the registers	Low byte- high byte
CRC	1 word

Reply:

FIELD	LENGTH
Relay address	1 byte
Function	1 byte (10H)
Beginning address	1 word
Number of registers	1 word
CRC	1 word

Example:

In this example we are going to modify the relay identification, which is a 16 characters text in the 0128H position for Intel or 94H for Motorola.

SETTING CHANGE SELECTION (LIKE IN A COMMAND):

I**ntel Request**:

ADDRESS	FUNCTION	BEGINNING	#REGS	BYTES	DATA0	CRC
01H	10H	0000H	0001H	02H	0100H	A7C0H

Intel Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0001H	01C9H

SETTING CHANGE

Intel Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES
01H	10H	0128H	0008H	10H

DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	CRC
5052H	5545H	4241H	2020H	2020H	2020H	2020H	2020H	A0A2H

Data0 => 5152H (PR)Data4 => 2020H

Data1 => 5545H (UE)Data5 => 2020H

Data2 => 4241H (BA)Data6 => 2020H

Data3 => 2020HData7 => 2020H

Intel Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0128H	0008H	403BH

Motorola Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	#BYTES
01H	10H	0094H	0008H	10H

DATA0	DATA1	DATA2	DATA3	DATA4	DATA5	DATA6	DATA7	CRC
5052H	5545H	4241H	2020H	2020H	2020H	2020H	2020H	FA94H

Data0 => 5152H (PR)Data4 => 2020H

Data1 => 5545H (UE)Data5 => 2020H

Data2 => 4241H (BA)Data6 => 2020H

Data3 => 2020HData7 => 2020H

Motorola Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0094H	0008	8023H

SETTING CHANGE CONFIRMATION (LIKE IN A COMMAND)

Intel Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	BYTES	#DATA0	DATA1	DATA2	CRC
01H	10H	0000H	0003H	06H	0200H	0100H	0000H	E69EH

Intel Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0003H	8008H

Motorola Request:

ADDRESS	FUNCTION	BEGINNING	#REGS	BYTES	#DATA0	CRC
01H	10H	0000H	0001H	02H	0200H	A730H

Motorola Reply:

ADDRESS	FUNCTION	BEGINNING	#REGS	CRC
01H	10H	0000H	0001H	01CFH

When any of the previous commands produce an error in the slave the following frame is received:

ADDRESS	FUNCTION + 80 H	COD. ERROR	CRC
01H	90H	07H	0DC2H

We can receive the following values in the error code field:

01	ILLEGAL FUNCTION
02	ILLEGAL DATA ADDRESS
03	ILLEGAL DATA VALUE
04	SLAVE DEVICE FAILURE
05	ACK.
06	SLAVE BUSY
07	NEGATIVE ACKNOWLEDGE
08	MEMORY PARITY ERROR

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
0138	009C		Phase VT Ratio	Phase TT Ratio	4	FLOAT32
013C	009E		Neutral VT Ratio	Neutral TT Ratio	4	FLOAT32
0140	00A0		IDEN	IDENTIFICATION	16	
0150	00A8		Trip Min Time	Trip Min Time	4	FLOAT32
0154	00AA	0	Settings Group	Settings Group	2	BIT
0156	00AB	0	Relay Operation	Relay Operation	2	BIT
0156	00AB	1	Frequency	Frequency	2	BIT
015A	00AD		Application	Application	2	ENUMERATION:
015C	00AE	0	Trip Enable P1	Trip Enable P1	2	BIT
015C	00AE	1	Trip Enable P2	Trip Enable P2	2	BIT
015C	00AE	2	Trip Enable P3	Trip Enable P3	2	BIT
015C	00AE	3	Trip Enable P4	Trip Enable P4	2	BIT
015C	00AE	4	Trip Enable 59N1	59N1 Trip	2	BIT
015C	00AE	5	Trip Enable 59N2	59N2 Trip	2	BIT
015C	00AE	6	Trip Enable 47	47 Trip	2	BIT
015C	00AE	8	Trip Enable 81 1	81_1 Trip	2	BIT
015C	00AE	9	Trip Enable 81 2	81_2 Trip	2	BIT
015C	00AE	10	Trip Enable 81 3	81_3 Trip	2	BIT
015C	00AE	11	Trip Enable 81 4	81_4 Trip	2	BIT
015E	00AF	1	Supervision P3	Supervision P3	2	BIT
015E	00AF	2	Supervision P4	Supervision P4	2	BIT
015E	00AF	3	Supervision P1	Supervision P1	2	BIT
015E	00AF	4	Supervision P2	Supervision P2	2	BIT
0160	00B0		Pickup P1	Pickup P1	4	FLOAT32
0164	00B2		Delay P1	Delay P1	4	FLOAT32
0168	00B4		Type P1	Type P1	2	ENUMERATION:
016A	00B5		Min Voltage P1	Minimum Voltage P1	4	FLOAT32
016E	00B7		Logic P1	Logic P1	2	ENUMERATION:
0174	00BA		Pickup P2	Pickup P2	4	FLOAT32
0178	00BC		Delay P2	Delay P2	4	FLOAT32
017C	00BE		Type P2	Type P2	2	ENUMERATION:
017E	00BF		Min Voltage P2	Minimum Voltage P2	4	FLOAT32
0182	00C1		Logic P2	Logic P2	2	ENUMERATION:
0188	00C4		Pickup P3	Pickup P3	4	FLOAT32
018C	00C6		Delay P3	Delay P3	4	FLOAT32
0190	00C8		Type P3	Type P3	2	ENUMERATION:
0192	00C9		Min Voltage P3	Minimum Voltage P3	4	FLOAT32
0196	00CB		Logic P3	Logic P3	2	ENUMERATION:
019C	00CE		Pickup P4	Pickup P4	4	FLOAT32
01A0	00D0		Delay P4	Delay P4	4	FLOAT32
01A4	00D2		Type P4	Type P4	2	ENUMERATION:
01A6	00D3		Min Voltage P4	Minimum Voltage P4	4	FLOAT32
01AA	00D5		Logic P4	Logic P4	2	ENUMERATION:
01B0	00D8		Pickup 59N1	59N1 Pickup	4	FLOAT32
01B4	00DA		Delay 59N1	59N1 Time Delay	4	FLOAT32
01B8	00DC		Pickup 59N2	59N2 Pickup	4	FLOAT32
01BC	00DE		Delay 59N2	59N2 Time Delay	4	FLOAT32
01C0	00E0		Pickup 47	47 Pickup	4	FLOAT32

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
01C4	00E2		Delay 47	47 Time Delay	4	FLOAT32
01C8	00E4		Type 81 1	81_1 Type	2	ENUMERATION:
01CA	00E5		Pickup 81 1	81_1 Pickup	4	FLOAT32
01D2	00E9		Delay 81 1	81_1 Time Delay	4	FLOAT32
01D6	00EB		Supervision 81 1	81_1 Supervision	4	FLOAT32
01DA	00ED		Type 81 2	81_2 Type	2	ENUMERATION:
01DC	00EE		Pickup 81 2	81_2 Pickup	4	FLOAT32
01E4	00F2		Delay 81 2	81_2 Time Delay	4	FLOAT32
01E8	00F4		Supervision 81 2	81_2 Supervision	4	FLOAT32
01EC	00F6		Type 81 3	81_3 Type	2	ENUMERATION:
01EE	00F7		Pickup 81 3	81_3 Pickup	4	FLOAT32
01F6	00FB		Delay 81 3	81_3 Time Delay	4	FLOAT32
01FA	00FD		Supervision 81 3	81_3 Supervision	4	FLOAT32
01FE	00FF		Type 81 4	81_4 Type	2	ENUMERATION:
0200	0100		Pickup 81 4	81_4 Pickup	4	FLOAT32
0208	0104		Delay 81 4	81_4 Time Delay	4	FLOAT32
020C	0106		Supervision 81 4	81_4 Supervision	4	FLOAT32
0210	0108	0	Trip Enable P1	Trip Enable P1 T2	2	BIT
0210	0108	1	Trip Enable P2	Trip Enable P2 T2	2	BIT
0210	0108	2	Trip Enable P3	Trip Enable P3 T2	2	BIT
0210	0108	3	Trip Enable P4	Trip Enable P4 T2	2	BIT
0210	0108	4	Trip Enable 59N1	59N1 Trip T2	2	BIT
0210	0108	5	Trip Enable 59N2	59N2 Trip T2	2	BIT
0210	0108	6	Trip Enable 47	47 Trip T2	2	BIT
0210	0108	8	Trip Enable 81 1	81_1 Trip T2	2	BIT
0210	0108	9	Trip Enable 81 2	81_2 Trip T2	2	BIT
0210	0108	10	Trip Enable 81 3	81_3 Trip T2	2	BIT
0210	0108	11	Trip Enable 81 4	81_4 Trip T2	2	BIT
0212	0109	1	Supervision P3	Supervision P3 T2	2	BIT
0212	0109	2	Supervision P4	Supervision P4 T2	2	BIT
0212	0109	3	Supervision P1	Supervision P1 T2	2	BIT
0212	0109	4	Supervision P2	Supervision P2 T2	2	BIT
0214	010A		Pickup P1	Pickup P1 T2	4	FLOAT32
0218	010C		Delay P1	Delay P1 T2	4	FLOAT32
021C	010E		Type P1	Type P1 T2	2	ENUMERATION:
021E	010F		Min Voltage P1	Minimum Voltage P1 T2	4	FLOAT32
0222	0111		Logic P1	Logic P1 T2	2	ENUMERATION:
0228	0114		Pickup P2	Pickup P2 T2	4	FLOAT32
022C	0116		Delay P2	Delay P2 T2	4	FLOAT32
0230	0118		Type P2	Type P2 T2	2	ENUMERATION:
0232	0119		Min Voltage P2	Minimum Voltage P2 T2	4	FLOAT32
0236	011B		Logic P2	Logic P2 T2	2	ENUMERATION:
023C	011E		Pickup P3	Pickup P3 T2	4	FLOAT32
0240	0120		Delay P3	Delay P3 T2	4	FLOAT32
0244	0122		Type P3	Type P3 T2	2	ENUMERATION:
0246	0123		Min Voltage P3	Minimum Voltage P3 T2	4	FLOAT32
024A	0125		Logic P3	Logic P3 T2	2	ENUMERATION:
0250	0128		Pickup P4	Pickup P4 T2	4	FLOAT32
0254	012A		Delay P4	Delay P4 T2	4	FLOAT32

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
0258	012C		Type P4	Type P4 T2	2	ENUMERATION:
025A	012D		Min Voltage P4	Minimum Voltage P4 T2	4	FLOAT32
025E	012F		Logic P4	Logic P4 T2	2	ENUMERATION:
0264	0132		Pickup 59N1	59N1 Pickup T2	4	FLOAT32
0268	0134		Delay 59N1	59N1 Time Delay T2	4	FLOAT32
026C	0136		Pickup 59N2	59N2 Pickup T2	4	FLOAT32
0270	0138		Delay 59N2	59N2 Time Delay T2	4	FLOAT32
0274	013A		Pickup 47	47 Pickup T2	4	FLOAT32
0278	013C		Delay 47	47 Time Delay T2	4	FLOAT32
027C	013E		Type 81 1	81_1 Type T2	2	ENUMERATION:
027E	013F		Pickup 81 1	81_1 Pickup T2	4	FLOAT32
0286	0143		Delay 81 1	81_1 Time Delay T2	4	FLOAT32
028A	0145		Supervision 81 1	81_1 Supervision T2	4	FLOAT32
028E	0147		Type 81 2	81_2 Type T2	2	ENUMERATION:
0290	0148		Pickup 81 2	81_2 Pickup T2	4	FLOAT32
0298	014C		Delay 81 2	81_2 Time Delay T2	4	FLOAT32
029C	014E		Supervision 81 2	81_2 Supervision T2	4	FLOAT32
02A0	0150		Type 81 3	81_3 Type T2	2	ENUMERATION:
02A2	0151		Pickup 81 3	81_3 Pickup T2	4	FLOAT32
02AA	0155		Delay 81 3	81_3 Time Delay T2	4	FLOAT32
02AE	0157		Supervision 81 3	81_3 Supervision T2	4	FLOAT32
02B2	0159		Type 81 4	81_4 Type T2	2	ENUMERATION:
02B4	015A		Pickup 81 4	81_4 Pickup T2	4	FLOAT32
02BC	015E		Delay 81 4	81_4 Time Delay T2	4	FLOAT32
02C0	0160		Supervision 81 4	81_4 Supervision T2	4	FLOAT32
02C4	0162	0	O1	Oscillo by communic.	2	BIT
02C4	0162	1	O2	Oscillo by digital input	2	BIT
02C4	0162	2	O3	Oscillo by tripping	2	BIT
02C4	0162	3	O4	Oscillo by pickup	2	BIT
02C6	0163	0	sAPCOM	Trip operation by command	2	BIT
02C6	0163	1	sRLATC	Reset latch aux	2	BIT
02C8	0164	9	E PROT	Protection status	2	BIT
02C8	0164	10	aux1	Output 1	2	BIT
02C8	0164	11	aux2	Output 2	2	BIT
02C8	0164	12	aux3	Output 3	2	BIT
02C8	0164	13	aux4	Output 4	2	BIT
02C8	0164	14	ENT 1	Digital Input 1	2	BIT
02C8	0164	15	ENT 2	Digital Input 2	2	BIT
02CA	0165	1	ihca	Sett. change disable	2	BIT
02CA	0165	2	ORD D	Trip operation by input	2	BIT
02CA	0165	4	ED 52B	Breaker 52B	2	BIT
02CA	0165	5	ED 52A	Breaker 52A	2	BIT
02CA	0165	6	C TAB	Settings group change	2	BIT
02CA	0165	7	Gosc	Oscillo trigg by DI	2	BIT
02CA	0165	9	est INTE	Breaker Closed	2	BIT
02CA	0165	10	STOC	Oscillo trigg by comm	2	BIT
02CA	0165	13	C AJUS	Settings change	2	BIT
02CA	0165	14	SE2P	EEPROM Failure	2	BIT
02CA	0165	15	Adef	User settings	2	BIT

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
02CC	0166	0	sAR Vol P1	Voltage P1 Pickup	2	BIT
02CC	0166	1	sAR Vol P2	Voltage P2 Pickup	2	BIT
02CC	0166	2	sAR Vol P3	Voltage P3 Pickup	2	BIT
02CC	0166	3	sAR Vol P4	Voltage P4 Pickup	2	BIT
02CC	0166	4	sAR 59NH	59N1 Pickup	2	BIT
02CC	0166	5	sAR 59NL	59N2 Pickup	2	BIT
02CC	0166	6	sAR 47	47 Pickup	2	BIT
02CC	0166	8	sAR 81 1	81_1 Pickup	2	BIT
02CC	0166	9	sAR 81 2	81_2 Pickup	2	BIT
02CE	0167	0	sIN Vol P1	Voltage P1 Disabled (by DI)	2	BIT
02CE	0167	1	sIN Vol P2	Voltage P2 Disabled (by DI)	2	BIT
02CE	0167	2	sIN Vol P3	Voltage P3 Disabled (by DI)	2	BIT
02CE	0167	3	sIN Vol P4	Voltage P4 Disabled (by DI)	2	BIT
02CE	0167	4	sIN 59NH	59N1 Disabled (by DI)	2	BIT
02CE	0167	5	sIN 59NL	59N2 Disabled (by DI)	2	BIT
02CE	0167	6	sIN 47	47 Disabled (by DI)	2	BIT
02CE	0167	8	sIN 81 1	81_1 Disabled (by DI)	2	BIT
02CE	0167	9	sIN 81 2	81_2 Disabled (by DI)	2	BIT
02CE	0167	15	D INH	Trip disabled (by DI)	2	BIT
02D0	0168	0	sDI Vol P1	Voltage P1 Trip	2	BIT
02D0	0168	1	sDI Vol P2	Voltage P2 Trip	2	BIT
02D0	0168	2	sDI Vol P3	Voltage P3 Trip	2	BIT
02D0	0168	3	sDI Vol P4	Voltage P4 Trip	2	BIT
02D0	0168	4	sDI 59NH	59N1 Trip	2	BIT
02D0	0168	5	sDI 59NL	59N2 Trip	2	BIT
02D0	0168	6	sDI 47	47 Trip	2	BIT
02D0	0168	8	sDI 81 1	81_1 Trip	2	BIT
02D0	0168	9	sDI 81 2	81_2 Trip	2	BIT
02D0	0168	15	DISGEN	General trip	2	BIT

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
0548	02A4		Date & Time	Date & Time	6	
054E	02A7		Firmware Rev	Firmware Rev	6	
0554	02AA		Order Code	Order Code	16	
0564	02B2		Relay Name	Relay Name	16	
057E	02BF		Z2	Last phase trip	4	
0582	02C1		Z3	Last trip current	4	FLOAT32
0586	02C3		f h	LTU Date & Time	6	
05A0	02D0	0	LD	Trip LED	2	BIT
05A0	02D0	1	LR	READY	2	BIT
05A0	02D0	2	L1	LED 1	2	BIT
05A0	02D0	3	L2	LED 2	2	BIT
05A0	02D0	4	L3	LED 3	2	BIT
05A0	02D0	5	L4	LED 4	2	BIT
05A0	02D0	8	c1	Logic 1	2	BIT
05A0	02D0	9	c2	Logic 2	2	BIT
05A0	02D0	10	c3	Logic 3	2	BIT
05A0	02D0	11	c4	Logic 4	2	BIT
05A2	02D1	8	d	TRIP	2	BIT
05A2	02D1	9	al	ALARM	2	BIT
05A2	02D1	10	Output 1	Output 1	2	BIT
05A2	02D1	11	Output 2	Output 2	2	BIT
05A2	02D1	12	Output 3	Output 3	2	BIT
05A2	02D1	13	Output 4	Output 4	2	BIT
05A2	02D1	14	Input 1	Input 1	2	BIT
05A2	02D1	15	Input 2	Input 2	2	BIT
05A4	02D2	1	EDICAJ	Sett. change disable	2	BIT
05A4	02D2	6	EDCTAB	Group change	2	BIT
05A4	02D2	9	EST52	Breaker Closed	2	BIT
05A4	02D2	14	F1	EEPROM failure	2	BIT
05A4	02D2	15	AU	User Settings	2	BIT
05A6	02D3	3	T AC	ACTIVE GROUP	2	BIT
05A6	02D3	4	frec	Frequency	2	BIT
05A6	02D3	5	LOCREM	Local	2	BIT
05A8	02D4	0	ARR Vol P1 A	Voltage P1 Phase A Pickup	2	BIT
05A8	02D4	1	ARR Vol P1 B	Voltage P1 Phase B Pickup	2	BIT
05A8	02D4	2	ARR Vol P1 C	Voltage P1 Phase C Pickup	2	BIT
05A8	02D4	4	ARR Vol P2 A	Voltage P2 Phase A Pickup	2	BIT
05A8	02D4	5	ARR Vol P2 B	Voltage P2 Phase B Pickup	2	BIT
05A8	02D4	6	ARR Vol P2 C	Voltage P2 Phase C Pickup	2	BIT
05A8	02D4	8	ARR Vol P3 A	Voltage P3 Phase A Pickup	2	BIT
05A8	02D4	9	ARR Vol P3 B	Voltage P3 Phase B Pickup	2	BIT
05A8	02D4	10	ARR Vol P3 C	Voltage P3 Phase C Pickup	2	BIT
05A8	02D4	12	ARR Vol P4 A	Voltage P4 Phase A Pickup	2	BIT
05A8	02D4	13	ARR Vol P4 B	Voltage P4 Phase B Pickup	2	BIT
05A8	02D4	14	ARR Vol P4 C	Voltage P4 Phase C Pickup	2	BIT
05AE	02D7	0	DIS Vol P1 A	Voltage P1 Phase A Trip	2	BIT
05AE	02D7	1	DIS Vol P1 B	Voltage P1 Phase B Trip	2	BIT
05AE	02D7	2	DIS Vol P1 C	Voltage P1 Phase C Trip	2	BIT

INTEL ADDRESS	MOTOROLA ADDRESS	BITS	NAME	DESCRIPTION	Nº OF BYTES	FORMAT
05AE	02D7	4	DIS Vol P2 A	Voltage P2 Phase A Trip	2	BIT
05AE	02D7	5	DIS Vol P2 B	Voltage P2 Phase B Trip	2	BIT
05AE	02D7	6	DIS Vol P2 C	Voltage P2 Phase C Trip	2	BIT
05AE	02D7	8	DIS Vol P3 A	Voltage P3 Phase A Trip	2	BIT
05AE	02D7	9	DIS Vol P3 B	Voltage P3 Phase B Trip	2	BIT
05AE	02D7	10	DIS Vol P3 C	Voltage P3 Phase C Trip	2	BIT
05AE	02D7	12	DIS Vol P4 A	Voltage P4 Phase A Trip	2	BIT
05AE	02D7	13	DIS Vol P4 B	Voltage P4 Phase B Trip	2	BIT
05AE	02D7	14	DIS Vol P4 C	Voltage P4 Phase C Trip	2	BIT
05B0	02D8	4	ARR 59NH	59N1 Pickup	2	BIT
05B0	02D8	5	ARR 59NL	59N2 Pickup	2	BIT
05B0	02D8	6	ARR 47	47 Pickup	2	BIT
05B0	02D8	8	ARR 81 1	81_1 Pickup	2	BIT
05B0	02D8	9	ARR 81 2	81_2 Pickup	2	BIT
05B0	02D8	15	ARR V F	Pickup	2	BIT
05B8	02DC	0	DIS Vol P1	Voltage P1 Trip	2	BIT
05B8	02DC	1	DIS Vol P2	Voltage P2 Trip	2	BIT
05B8	02DC	2	DIS Vol P3	Voltage P3 Trip	2	BIT
05B8	02DC	3	DIS Vol P4	Voltage P4 Trip	2	BIT
05B8	02DC	4	DIS 59NH	59N1 Trip	2	BIT
05B8	02DC	5	DIS 59NL	59N2 Trip	2	BIT
05B8	02DC	6	DIS 47	47 Trip	2	BIT
05B8	02DC	8	DIS 81 1	81_1 Trip	2	BIT
05B8	02DC	9	DIS 81 2	81_2 Trip	2	BIT
05BA	02DD		Phase A Voltage	Va	4	FLOAT32
05BE	02DF		Phase B Voltage	Vb	4	FLOAT32
05C2	02E1		Phase C Voltage	Vc	4	FLOAT32
05C6	02E3		Neutral Voltage	Vn	4	FLOAT32
05CA	02E5		Phase AB Voltage	Vab	4	FLOAT32
05CE	02E7		Phase BC Voltage	Vbc	4	FLOAT32
05D2	02E9		Phase CA Voltage	Vca	4	FLOAT32
05D6	02EB		Negative Seq V2	V2	4	FLOAT32
05DA	02ED		Frequency	Frequency	4	FLOAT32
05E2	02F1		OS	OSC. NUMBER	2	UINT16
05E6	02F3		St	All events	2	UINT16
061E	030F		SUCt	ALL EVENTS BUFFER	1056	BUFFER
0A6E|017EE 1800	0537|0BF7 0C00		OSC	OSCILLOGRAPHY BUFFER	3456|18 16	BUFFER

If we wish to connect the relay to a remote PC, it will be necessary to previously link two modems to the telephone line. The modem on the relay side will receive the call, and the modem on the PC side will make the call.

This way, both modems will be configured in different ways: the modem on the PC side will receive the commands from the PC for starting or ending communication, and therefore it will make the call. The modem connected to the relay will not receive any command from it; it will only accept communication whenever it is requested. Therefore, this last modem will be configured in “dumb” mode, which means that it does not receive commands, and is in auto-reply mode.

The EnerVista MII SETUP is a DCE device (Tx=3, Rx=2 signals), so as regards TX and RX it works as a modem (which is also a DCE device). Therefore, it is not necessary to cross the TX and RX signals in direct connection to the PC, which is a DTE device (TX=2, RX=3 signals). However, in case of a connection via modem, it will be necessary to cross the wire in the relay by means of a null modem, so that RX and TX signals are inverted, as we will be connecting two DCE devices.

In addition, we must check whether the relay is directly connected to the modem via its RS232 port, or via an RS232/RS485 converter. In this last case, we will have to verify whether the converter output is DTE or DCE, and use a null modem in the second case. For example, the DAC300 converter incorporates two ports, a DCE and a DTE. In the case of a F485 converter, an internal selector detects whether it is connected directly to a modem or relay (DCE) or to a PC (DTE).

As regards the modem-modem, PC-modem, and Relay-modem communication baud rates, in the first cases, it is recommended to set them at the same baud rate as the relay. The baud rate between relay and modem will always be the one set for the relay.

In case of communication problems between both modems, it is recommended to reduce the line baud rate.

In order to establish communication between two HAYES modems, both of them must accept HAYES commands. This is compulsory, as the PC will send specific commands for this type of modem. We must place the AT command before every command. It is possible to group several commands inside an only command line (e.g. ATB1 and ATE1 equals ATB1E1).

However, we must take into account that each manufacturer will implement only one sub-group of the HAYES commands, and therefore we cannot indicate an initiation command valid for every equipment. It is the customer's responsibility to determine which commands are accepted by a particular modem.

As a general rule, it is recommended to disable any data compression, hardware protocols, flux control or error control. Some modems allow a command, e.g. &Q0, which selects the direct asynchronous mode.

The local modem configuration, that is, the configuration of the modem that makes the call, will be performed by EnerVista MII SETUP software, by means of the provided initiation command. In order to configure the remote modem (connected to the relay), we need a communications program that allows sending HAYES commands. Any Windows® version includes a program called HYPERTERMINAL (HYPERTRM.EXE) which allows to send HAYES commands by the selected serial port. Besides, we can use any communications program allowing sending commands, such as Procomm Plus or LAPLink. Once the modem is connected to the selected port in the program, and after setting the communication parameters, we can send the required commands.

Later in this document we will detail the configuration that must be entered in some HAYES modems already tested.

EnerVista MII SETUP software allows the modem making the call to accept V.25bis commands. In this case, the modem on the relay side could be either HAYES or V.25bis, as it will not need to process any relay command.

The configuration of this kind of modem is performed by means of microswitches that set its operation. This way, the software window for entering the modem initiation commands will only be operative if a HAYES modem has been selected.

In the following sections, we will detail some communications parameters, already tested for the following modems.

C.3.1 SPORTSTER FLASH X2 MODEM (HAYES)

Initiation commands for the modem on the PC side:

We will add the following commands to the default configuration:

&AnEnable/disable the ARQ result codes	Disable the ARQ result codes	&A0
&HnSets the flux control for the data transfer (TD).	Flux control disabled	&H0
&InSets the software flux control for the data reception (RD).	Software flux control disabled.	&I0
&KnEnable/Disable data compression	Data compression disabled	&K0
&MnSets the error control (ARQ) for 1200 bps and higher.	Normal mode, error control disabled	&M0
&RnConfigures the hardware flux control for data reception (DR) and transfer request (RTS)	Modem ignores RTS.	&R1
S15Record with bit representation.	Disable ARQ/MNP for V.32/V.32bis.	S15=4
S32Record with bit representation.	Disable V.34. modulation	S32=8

Initiation commands for the modem on the RELAY side:

The following options must be added to the default configuration:

&AnEnable/disable the ARQ result codes	ARQ result codes are disabled	&A0
&DnControl the DTR operations	About DTR control.	&D0
&HnSets the flux control for the data transfer (TD).	Flux control disabled	&H0
&InSets the software flux control for the data reception (RD).	Software flux control disabled.	&I0
&KnEnable/Disable data compression	Data compression disabled	&K0
&MnSets the error control (ARQ) for 1200 bps and higher.	Normal mode, error control disabled	&M0
&RnConfigures the hardware flux control for data reception (DR) and transfer request (RTS)	Modem ignores RTS.	&R1
S0Sets the number of rings necessary for answering in automatic answering mode	The modem will answer to the first ring.	S0=1
S15Record with bit representation.	Disable ARQ/MNP for V.32/V.32bis.	S15=4
S32Record with bit representation.	Disable V.34. modulation	S32=8

Initiation commands for the PC modem:

Commands:

B0 E0 L1 M1 N1 Q0 T V0 W0 X1 Y0

&C1&D2&G0&J0&K3&Q5&R1&S0&T5&X0&Y0

S Registers:

S00:001	S01:000	S02:043	S03:013	S04:010	S05:008	S06:002	S07:050	S08:002	S09:006
S10:014	S11:095	S12:050	S18:000	S25:005	S26:001	S36:007	S37:000	S38:020	S44:020
S46:138	S48:007	S95:000							

Initiation commands for the RELAY modem:

Commands:

B1 E0 L1 M1 N1 Q0 T V0 W0 X4 Y0

&C1 &D3 &G0 &J0 &K0 &Q5 &R1 &S1 &T4 &X0 &Y0

S Registers:

S00:001	S01:000	S02:043	S03:013	S04:010	S05:008	S06:002	S07:050	S08:002	S09:006
S10:014	S11:095	S12:050	S18:000	S25:005	S26:001	S36:007	S37:000	S38:020	S44:020
S46:138	S48:007	S95:000							

C.3.3 MODEM SATELSA MGD-2400-DHE (V.25BIS)

In this case, the modem initial configuration is set by changing the microswitches located in three sets on the bottom of the units.

Location of modem microswitches on the PC side:

Set 1

Nº	DESCRIPTION	VALUE
1	112 ETD/OFF ON: Circuit 112 connected to ETD OFF: Circuit 112 connected to ETD	ON
2	112 ETD/ON ON: 108 circuit forced to CLOSED. OFF: 108 circuit follows ETD's 108 circuit	OFF
3	105 ETD/ON ON: Circuit 105 forced to CLOSED. OFF: Circuit 105 follows ETD's 105circuit	ON
4	TXA/TXB in a peer-to-peer line (PP) ON: In PP transfers through high channel. OFF: In PP transfers through low channel.	OFF
5&6	Baud rate selection for data transfer ON-ON1200 OFF-ON2400 ON-OFFAutomatic. OFF-OFFAutomatic.	ON-OFF
7&8	Automatic disconnection. ON-ONNo automatic disconnection. OFF-ONCircuit 105. ON-OFFCircuit 109. OFF-OFFCircuits 105 and 109.	ON-OFF

Set 2

Nº	DESCRIPTION	VALUE
1	Synchronous format of protocol V25bis in option 108.2. ON: Character oriented format (BSC). OFF: Bit oriented format (HDLC).	ON
2&3	Asynchronous character format for data transfer ON-ON8 OFF-ON9 ON-OFF10 OFF-OFF11	ON-OFF
4	Reception permission for remote loop 2 ON: Not permitted. OFF: Permitted.	OFF
5&6	Exploitation mode. ON-ONPoint-to-point line OFF-ONAutomatic call as per 108.1. ON-OFFRTC line without automatic call. OFF-OFFAutomatic call as per 108.2.	OFF-OFF
7	Number of calls for automatic answer ON: 1 call. OFF: 2 calls.	ON
8	112 ETD/OFF ON: Asynchronous operation. OFF: Synchronous operation.	ON

Set 3

Nº	DESCRIPTION	VALUE
1&2	Transmission timer selection. ON-ON114 OFF-ON113 ON-OFF114/5 OFF-OFF113	ON-ON
3	RTC Dialing system ON: Multi-frequency dialing. OFF: Loop opening pulse dialing	ON
4	Status of circuit 109, during protocol V.25bis in RTC, option 108.2. ON: Status of circuit 108 remains. OFF: Remains open.	OFF
5	Selection, when starting, of manual or automatic answering mode. ON: Automatic. OFF: Manual.	OFF
6	Protocol selection. ON: HAYES Protocol. OFF: V.25bis Protocol.	OFF
7&8	Modem transmission level. ON-ON-6 dBm OFF-ON-10 dBm ON-OFF-6 dBm OFF-OFF-15 dBm	ON-ON

Location of modem microswitches on the RELAY side:

Set 1

Nº	DESCRIPTION	VALUE
1	112 ETD/OFF ON: Circuit 112 connected to ETD OFF: Circuit 112 connected to ETD	ON
2	112 ETD/ON ON: 108 circuit forced to CLOSED. OFF: 108 circuit follows ETD's 108 circuit	ON
3	105 ETD/ON ON: Circuit 105 forced to CLOSED. OFF: Circuit 105 follows ETD's 105circuit	ON
4	TXA/TXB in a peer-to-peer line (PP) ON: In PP transfers through high channel. OFF: In PP transfers through low channel.	ON
5&6	Baud rate selection for data transfer. ON-ON1200 OFF-ON2400 ON-OFFAutomatic. OFF-OFFAutomatic.	ON-OFF
7&8	Automatic disconnection. ON-ONNo automatic disconnection. OFF-ONCircuit 105. ON-OFFCircuit 109. OFF-OFFCircuits 105 and 109.	OFF-OFF

Set 2

Nº	DESCRIPTION	VALUE
1	Synchronous format of protocol V25bis in option 108.2. ON: Character oriented format (BSC). OFF: Bit oriented format (HDLC).	ON
2&3	Asynchronous character format for data transfer ON-ON8 OFF-ON9 ON-OFF10 OFF-OFF11	ON-OFF
4	Reception permission for remote loop 2 ON: Not permitted. OFF: Permitted.	OFF
5&6	Exploitation mode. ON-ONPoint-to-point line OFF-ONAutomatic call as per 108.1. ON-OFFRTC line without automatic call. OFF-OFFAutomatic call as per 108.2.	ON-OFF
7	Number of calls for automatic answer ON: 1 call. OFF: 2 calls.	OFF
8	112 ETD/OFF ON: Asynchronous operation. OFF: Synchronous operation.	ON

Set 3

Nº	DESCRIPTION	VALUE
1&2	Transmission timer selection. ON-ON114 OFF-ON113 ON-OFF114/5 OFF-OFF113	ON-ON
3	RTC Dialling system ON: Multi-frequency dialling. OFF: Loop opening pulse dialling	OFF
4	Status of circuit 109, during protocol V.25bis in RTC, option 108.2. ON: Status of circuit 108 remains. OFF: Remains open.	OFF
5	Selection, when starting, of manual or automatic answering mode. ON: Automatic. OFF: Manual.	ON
6	Protocol selection. ON: HAYES Protocol. OFF: V.25bis Protocol.	OFF
7&8	Modem transmission level. ON-ON-6 dBm OFF-ON-10 dBm ON-OFF-6 dBm OFF-OFF-15 dBm	ON-ON

NAME	DESCRIPTION	MIVII 1000	MIVII 2000	MIVII 3000
Order Code	Relay model	X	X	X
Firmware Rev.	Firmware Flash memory version	X	X	X
Date & time	Current date and time	X	X	X
Relay Name	Value entered in the “identification” setting (general advanced group)	X	X	X
Va	Va Voltage	X		X
Vb	Vb Voltage	X	X	X
Vc	Vc Voltage	X		X
V_n	V_n Voltage	X		X
Vab	Vab phase-to-phase voltage	X		X
Vbc	Vbc phase-to-phase voltage	X		X
Vca	Vca phase-to-phase voltage	X		X
V2	Negative sequence voltage	X		X
Frequency	Measured Frequency		X	X
OSC. NUMBER	Historical oscillography number			
All Events	Number of events since the last time events were deleted			
ACTIVE GROUP	Shows which settings group is active (Group 1 or Group 2)			
Frequency	Value entered on the “Frequency” setting (general settings group)			
Voltage P1 Phase A Pick up	Pickup of Voltage unit P1 phase A	X		X
Voltage P1 Phase B Pick up	Pickup of Voltage unit P1 phase B	X		X
Voltage P1 Phase C Pick up	Pickup of Voltage unit P1 phase C	X		X
Voltage P2 Phase A Pick up	Pickup of Voltage unit P2 phase A	X		X
Voltage P2 Phase B Pick up	Pickup of Voltage unit P2 phase B	X		X
Voltage P2 Phase C Pick up	Pickup of Voltage unit P2 phase C	X		X
Voltage P3 Phase A Pick up	Pickup of Voltage unit P3 phase A	X		X
Voltage P3 Phase B Pick up	Pickup of Voltage unit P3 phase B	X		X
Voltage P3 Phase C Pick up	Pickup of Voltage unit P3 phase C	X		X
Voltage P4 Phase A Pick up	Pickup of Voltage unit P4 phase A	X		X
Voltage P4 Phase B Pick up	Pickup of Voltage unit P4 phase B	X		X
Voltage P4 Phase C Pick up	Pickup of Voltage unit P4 phase C	X		X
Pickup 59N1	Pickup of unit 59N1	X		X
Pickup 59N2	Pickup of unit 59N2	X		X
Pickup 47	Pickup of unit 47	X		X
Pickup 81_1	Pickup of unit 81_1		X	X
Pickup 81_2	Pickup of unit 81_2		X	X
Pickup 81_3	Pickup of unit 81_3		X	
Pickup 81_4	Pickup of unit 81_4		X	
Pickup	Active when any protection function with trip enabled picks up	X	X	X
Voltage P1 Phase A Trip	Trip of Voltage unit P1 phase A	X		X
Voltage P1 Phase B Trip	Trip of Voltage unit P1 phase B	X		X
Voltage P1 Phase C Trip	Trip of Voltage unit P1 phase C	X		X
Voltage P2 Phase A Trip	Trip of Voltage unit P2 phase A	X		X
Voltage P2 Phase B Trip	Trip of Voltage unit P2 phase B	X		X
Voltage P2 Phase C Trip	Trip of Voltage unit P2 phase C	X		X
Voltage P3 Phase A Trip	Trip of Voltage unit P3 phase A	X		X
Voltage P3 Phase B Trip	Trip of Voltage unit P3 phase B	X		X
Voltage P3 Phase C Trip	Trip of Voltage unit P3 phase C	X		X

NAME	DESCRIPTION	MIVII 1000	MIVII 2000	MIVII 3000
Voltage P4 Phase A Trip	Trip of Voltage unit P4 phase A	X		X
Voltage P4 Phase B Trip	Trip of Voltage unit P4 phase B	X		X
Voltage P4 Phase C Trip	Trip of Voltage unit P4 phase C	X		X
Voltage P1 Trip	Trip of Voltage unit P1	X		X
Voltage P2 Trip	Trip of Voltage unit P2	X		X
Voltage P3 Trip	Trip of Voltage unit P3	X		X
Voltage P4 Trip	Trip of Voltage unit P4	X		X
59N1 Trip	Trip of unit 59N1	X		X
59N2 Trip	Trip of unit 59N2	X		X
47 Trip	Trip of unit 47	X		X
81_1 Trip	Trip of unit 81_1		X	X
81_2 Trip	Trip of unit 81_2		X	X
81_3 Trip	Trip of unit 81_3		X	
81_4 Trip	Trip of unit 81_4		X	
ALARM	Alarm contact status. This contact is active when “Protection” is out of service, or when trip is disabled for all units or general trip is disabled (by settings or digital input)	X	X	X
Trip	Trip contact status	X	X	X
Output 1	Status of auxiliary output 1	X	X	X
Output 2	Status of auxiliary output 2	X	X	X
Output 3	Status of auxiliary output 3	X	X	X
Output 4	Status of auxiliary output 4	X	X	X
Input 1	Status of digital input 1	X	X	X
Input 2	Status of digital input 2	X	X	X
READY	Status of the READY LED. Opposite for the alarm contact.	X	X	X
Trip LED	Status of the TRIP LED	X	X	X
LED 1	Status of LED 1	X	X	X
LED 2	Status of LED 2	X	X	X
LED 3	Status of LED 3	X	X	X
LED 4	Status of LED 4	X	X	X
Logic 1	Output status of logic 1	X	X	X
Logic 2	Output status of logic 2	X	X	X
Logic 3	Output status of logic 3	X	X	X
Logic 4	Output status of logic 4	X	X	X
Group change	Shows whether the Setting Group 2 selection by digital input is active. In this case, Setting Group 2 will be activated. Otherwise, the set group will be activated.	X	X	X
Settings change disable	Shows whether the settings change inhibition by digital input is active. If this input is active, no settings change or setting group change can be done from the PC or HMI. The setting group change can be done by digital input.	X	X	X
Breaker closed	Status of the breaker closed	X	X	X
Local	Active when the HMI is in the settings or operations menu.	X	X	X
EEprom failure	Active when an e2prom failure is detected	X	X	X
User settings	Active when the default settings are modified.	X	X	X

NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
No definition	Input configuration not defined	X	X	X
Voltage Disabled (by DI)	Voltage elements disabled	X		X
Phase Volt. Func. Disabled (by DI)	Phase Voltage elements disabled (by digital input)	X		X
Ground Volt. Func. Disabled (by DI)	Ground Voltage elements disabled (by digital input)	X		X
Frequency disabled (by DI)	Frequency disabled (by digital input)		X	X
Voltage P1 disables (by DI)	Voltage P1 element disabled (by digital input)	X		X
Voltage P2 disables (by DI)	Voltage P2 element disabled (by digital input)	X		X
Voltage P3 disables (by DI)	Voltage P3 element disabled (by digital input)	X		X
Voltage P4 disables (by DI)	Voltage P4 element disabled (by digital input)	X		X
59 N1 disabled (by DI)	Ground Voltage element disabled (by digital input)	X		X
59 N2 disabled (by DI)	Ground Voltage element disabled (by digital input)	X		X
47 disabled (by DI)	Inverse sequence element disabled (by digital input)	X		X
81-1 disabled (by DI)	Frequency element disabled (by digital input)		X	X
81-2 disabled (by DI)	Frequency element disabled (by digital input)		X	X
81-3 disabled (by DI)	Frequency element disabled (by digital input)		X	
81-4 disabled (by DI)	Frequency element disabled (by digital input)		X	
Trip disabled (by DI)	Trip disabled (by digital input)	X	X	X
52A Status	Breaker closed status	X	X	X
52B Status	Breaker open status	X	X	X
Trip Contact Close (by DI)	Trip contact close (by digital input)	X	X	X
Group change	Change of the setting group	X	X	X
Sett. Change disable	Setting change disable	X	X	X
Reset (Pulse)	Reset	X	X	X
Oscillo trigger (Pulse)	Oscillography trigger (Pulse)	X	X	X
General Input	General Input	X	X	X

NAME	DESCRIPTION	MIVII 1000	MIVII 2000	MIVII 3000
No definition	Not defined	X	X	X
Logic 1	Assigned to Logic 1	X	X	X
Logic 2	Assigned to Logic 2	X	X	X
Logic 3	Assigned to Logic 3	X	X	X
Logic 4	Assigned to Logic 4	X	X	X
Phase A Trip	Phase A Trip	X		X
Phase B Trip	Phase B Trip	X		X
Phase C Trip	Phase C Trip	X		X
Phase Trip	Phase Trip	X		X
Ground Trip	Ground Trip	X		X
Frequency Trip	Frequency Trip	X		X
Overvoltage Trip	Overvoltage Trip	X		X
Undervoltage Trip	Undervoltage Trip	X		X
59N Trip	Activation after 59N Trip	X		X
Voltage P1 Phase A Trip	Trip of Voltage unit P1 phase A	X		X
Voltage P1 Phase B Trip	Trip of Voltage unit P1 phase B	X		X
Voltage P1 Phase C Trip	Trip of Voltage unit P1 phase C	X		X
Voltage P2 Phase A Trip	Trip of Voltage unit P2 phase A	X		X
Voltage P2 Phase B Trip	Trip of Voltage unit P2 phase B	X		X
Voltage P2 Phase C Trip	Trip of Voltage unit P2 phase C	X		X
Voltage P3 Phase A Trip	Trip of Voltage unit P3 phase A	X		X
Voltage P3 Phase B Trip	Trip of Voltage unit P3 phase B	X		X
Voltage P3 Phase C Trip	Trip of Voltage unit P3 phase C	X		X
Voltage P4 Phase A Trip	Trip of Voltage unit P4 phase A	X		X
Voltage P4 Phase B Trip	Trip of Voltage unit P4 phase B	X		X
Voltage P4 Phase C Trip	Trip of Voltage unit P4 phase C	X		X
Voltage P1 Trip	Trip of Voltage unit P1	X		X
Voltage P2 Trip	Trip of Voltage unit P2	X		X
Voltage P3 Trip	Trip of Voltage unit P3	X		X
Voltage P4 Trip	Trip of Voltage unit P4	X		X
59N1 Trip	Trip of unit 59N1	X		X
59N2 Trip	Trip of unit 59N2	X		X
47 Trip	Trip of unit 47			X
81_1 Trip	Trip of unit 81_1		X	X
81_2 Trip	Trip of unit 81_2		X	X
81_3 Trip	Trip of unit 81_3		X	
81_4 Trip	Trip of unit 81_4		X	
General Trip	Generic trip	X	X	X
Voltage P1 Phase A Pick up	Pickup of unit Voltage unit P1 phase A	X		X
Voltage P1 Phase B Pick up	Pickup of unit Voltage unit P1 phase B	X		X

NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
Voltage P1 Phase C Pick up	Pickup of unit Voltage unit P1 phase C	X		X
Voltage P2 Phase A Pick up	Pickup of unit Voltage unit P2 phase A	X		X
Voltage P2 Phase B Pick up	Pickup of unit Voltage unit P2 phase B	X		X
Voltage P2 Phase C Pick up	Pickup of unit Voltage unit P2 phase C	X		X
Voltage P3 Phase A Pick up	Pickup of unit Voltage unit P3 phase A	X		X
Voltage P3 Phase B Pick up	Pickup of unit Voltage unit P3 phase B	X		X
Voltage P3 Phase C Pick up	Pickup of unit Voltage unit P3 phase C	X		X
Voltage P4 Phase A Pick up	Pickup of unit Voltage unit P4 phase A	X		X
Voltage P4 Phase B Pick up	Pickup of unit Voltage unit P4 phase B	X		X
Voltage P4 Phase C Pick up	Pickup of unit Voltage unit P4 phase C	X		X
Pickup 59N1	Pickup of unit 59N1	X		X
Pickup 59N2	Pickup of unit 59N2	X		X
Pickup 47	Pickup of unit 47	X		X
Pickup 81_1	Pickup of unit 81_1		X	X
Pickup 81_2	Pickup of unit 81_2		X	X
Pickup 81_3	Pickup of unit 81_3		X	
Pickup 81_4	Pickup of unit 81_4		X	
Pickup	Active when any protection function with trip enabled picks up	X	X	X
Voltage P1 Phase A virtual Trip	Virtual Trip of unit Voltage unit P1 phase A	X		X
Voltage P1 Phase B virtual Trip	Virtual Trip of unit Voltage unit P1 phase B	X		X
Voltage P1 Phase C virtual Trip	Virtual Trip of unit Voltage unit P1 phase C	X		X
Voltage P2 Phase A virtual Trip	Virtual Trip of unit Voltage unit P2 phase A	X		X
Voltage P2 Phase B virtual Trip	Virtual Trip of unit Voltage unit P2 phase B	X		X
Voltage P2 Phase C virtual Trip	Virtual Trip of unit Voltage unit P2 phase C	X		X
Voltage P3 Phase A virtual Trip	Virtual Trip of unit Voltage unit P3 phase A	X		X
Voltage P3 Phase B virtual Trip	Virtual Trip of unit Voltage unit P3 phase B	X		X
Voltage P3 Phase C virtual Trip	Virtual Trip of unit Voltage unit P3 phase C	X		X
Voltage P4 Phase A virtual Trip	Virtual Trip of unit Voltage unit P4 phase A	X		X
Voltage P4 Phase B virtual Trip	Virtual Trip of unit Voltage unit P4 phase B	X		X
Voltage P4 Phase C virtual Trip	Virtual Trip of unit Voltage unit P4 phase C	X		X
Voltage P1 virtual Trip	Virtual Trip of Voltage unit P1	X		X
Voltage P2 virtual Trip	Virtual Trip of Voltage unit P2	X		X
Voltage P3 virtual Trip	Virtual Trip of Voltage unit P3	X		X
Voltage P4 virtual Trip	Virtual Trip of Voltage unit P4	X		X
59N1 virtual Trip	Virtual Trip of unit 59N1	X		X

NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
59N2 virtual Trip	Virtual Trip of unit 59N2	X		X
47 virtual Trip	Virtual Trip of unit 47	X		X
81_1 virtual Trip	Virtual Trip of unit 81_1		X	X
81_2 virtual Trip	Virtual Trip of unit 81_2		X	X
81_3 virtual Trip	Virtual Trip of unit 81_3		X	X
81_4 virtual Trip	Virtual Trip of unit 81_4		X	X
Input 1	Input 1	X	X	X
Input 2	Input 2	X	X	X
EEPROM Failure	Active when an e2prom failure is detected	X	X	X
User setting	Active when the default settings are modified.	X	X	X
READY	Ready status (opposite alarm state)	X	X	X
Close Breaker	Activation with close breaker command	X	X	X
Active group	Activation with group change	X	X	X
Local	Active when the HMI is in the settings or operations menu.	X	X	X

NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
No definition	No definition	X	X	X
Logic 1	Logic 1	X	X	X
Logic 2	Logic 2	X	X	X
Logic 3	Logic 3	X	X	X
Logic 4	Logic 4	X	X	X
Phase A Trip	Phase A Trip	X		X
Phase B Trip	Phase B Trip	X		X
Phase C Trip	Phase C Trip	X		X
Phase Trip	Phase Trip	X		X
Ground Trip	Ground Trip	X		X
Frequency Trip	Frequency Trip	X		X
Overvoltage Trip	Overvoltage Trip	X		X
Undervoltage Trip	Undervoltage Trip	X		X
59N Trip	59N Trip	X		X
Voltage P1 Phase A Trip	Trip of Voltage unit P1 phase A	X		X
Voltage P1 Phase B Trip	Trip of Voltage unit P1 phase B	X		X
Voltage P1 Phase C Trip	Trip of Voltage unit P1 phase C	X		X
Voltage P2 Phase A Trip	Trip of Voltage unit P2 phase A	X		X
Voltage P2 Phase B Trip	Trip of Voltage unit P2 phase B	X		X
Voltage P2 Phase C Trip	Trip of Voltage unit P2 phase C	X		X
Voltage P3 Phase A Trip	Trip of Voltage unit P3 phase A	X		X
Voltage P3 Phase B Trip	Trip of Voltage unit P3 phase B	X		X
Voltage P3 Phase C Trip	Trip of Voltage unit P3 phase C	X		X
Voltage P4 Phase A Trip	Trip of Voltage unit P4 phase A	X		X
Voltage P4 Phase B Trip	Trip of Voltage unit P4 phase B	X		X
Voltage P4 Phase C Trip	Trip of Voltage unit P4 phase C	X		X
Voltage P1 Trip	Trip of Voltage unit P1	X		X
Voltage P2 Trip	Trip of Voltage unit P2	X		X
Voltage P3 Trip	Trip of Voltage unit P3	X		X
Voltage P4 Trip	Trip of Voltage unit P4	X		X
59N1 Trip	Trip of unit 59N1	X		X
59N2 Trip	Trip of unit 59N2	X		X
47 Trip	Trip of unit 47	X		X
81_1 Trip	Trip of unit 81_1		X	X
81_2 Trip	Trip of unit 81_2		X	X
81_3 Trip	Trip of unit 81_3		X	
81_4 Trip	Trip of unit 81_4		X	
General Trip	General Trip	X	X	X
Voltage P1 Phase A Pick up	Pickup of unit Voltage unit P1 phase A	X		X
Voltage P1 Phase B Pick up	Pickup of unit Voltage unit P1 phase B	X		X
Voltage P1 Phase C Pick up	Pickup of unit Voltage unit P1 phase C	X		X
Voltage P2 Phase A Pick up	Pickup of unit Voltage unit P2 phase A	X		X
Voltage P2 Phase B Pick up	Pickup of unit Voltage unit P2 phase B	X		X
Voltage P2 Phase C Pick up	Pickup of unit Voltage unit P2 phase C	X		X
Voltage P3 Phase A Pick up	Pickup of unit Voltage unit P3 phase A	X		X
Voltage P3 Phase B Pick up	Pickup of unit Voltage unit P3 phase B	X		X
Voltage P3 Phase C Pick up	Pickup of unit Voltage unit P3 phase C	X		X
Voltage P4 Phase A Pick up	Pickup of unit Voltage unit P4 phase A	X		X
Voltage P4 Phase B Pick up	Pickup of unit Voltage unit P4 phase B	X		X
Voltage P4 Phase C Pick up	Pickup of unit Voltage unit P4 phase C	X		X

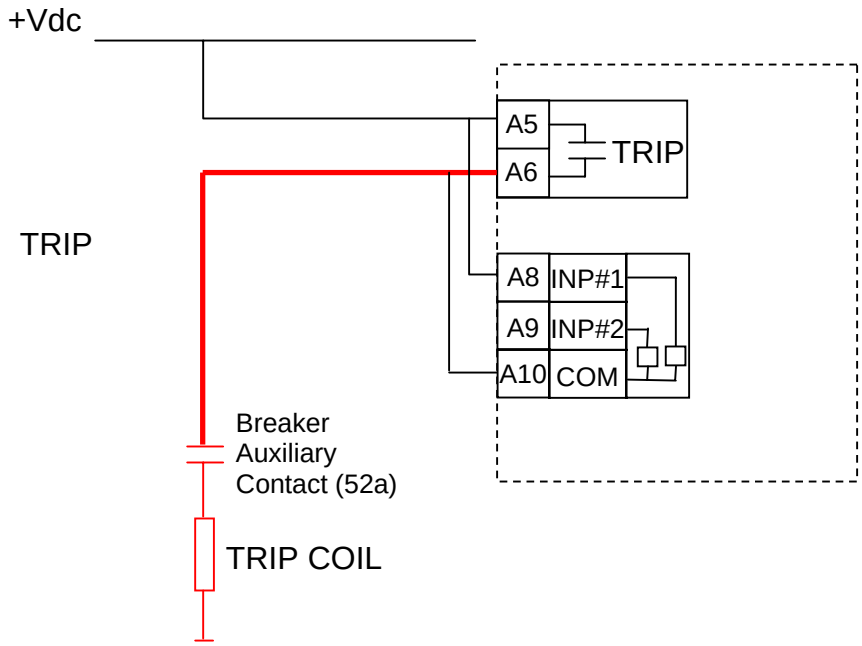
NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
Pickup 59N1	Pickup of unit 59N1	X		X
Pickup 59N2	Pickup of unit 59N2	X		X
Pickup 47	Pickup of unit 47	X		X
Pickup 81_1	Pickup of unit 81_1		X	X
Pickup 81_2	Pickup of unit 81_2		X	X
Pickup 81_3	Pickup of unit 81_3		X	
Pickup 81_4	Pickup of unit 81_4		X	
Pickup	Active when any protection function with trip enabled picks up	X	X	X
Voltage P1 Phase A virtual Trip	Virtual Trip of unit Voltage unit P1 phase A	X		X
Voltage P1 Phase B virtual Trip	Virtual Trip of unit Voltage unit P1 phase B	X		X
Voltage P1 Phase C virtual Trip	Virtual Trip of unit Voltage unit P1 phase C	X		X
Voltage P2 Phase A virtual Trip	Virtual Trip of unit Voltage unit P2 phase A	X		X
Voltage P2 Phase B virtual Trip	Virtual Trip of unit Voltage unit P2 phase B	X		X
Voltage P2 Phase C virtual Trip	Virtual Trip of unit Voltage unit P2 phase C	X		X
Voltage P3 Phase A virtual Trip	Virtual Trip of unit Voltage unit P3 phase A	X		X
Voltage P3 Phase B virtual Trip	Virtual Trip of unit Voltage unit P3 phase B	X		X
Voltage P3 Phase C virtual Trip	Virtual Trip of unit Voltage unit P3 phase C	X		X
Voltage P4 Phase A virtual Trip	Virtual Trip of unit Voltage unit P4 phase A	X		X
Voltage P4 Phase B virtual Trip	Virtual Trip of unit Voltage unit P4 phase B	X		X
Voltage P4 Phase C virtual Trip	Virtual Trip of unit Voltage unit P4 phase C	X		X
Voltage P1 virtual Trip	Virtual Trip of Voltage unit P1	X		X
Voltage P2 virtual Trip	Virtual Trip of Voltage unit P2	X		X
Voltage P3 virtual Trip	Virtual Trip of Voltage unit P3	X		X
Voltage P4 virtual Trip	Virtual Trip of Voltage unit P4	X		X
59N1 virtual Trip	Virtual Trip of unit 59N1	X		X
59N2 virtual Trip	Virtual Trip of unit 59N2	X		X
47 virtual Trip	Virtual Trip of unit 47	X		X
81_1 virtual Trip	Virtual Trip of unit 81_1		X	X
81_2 virtual Trip	Virtual Trip of unit 81_2		X	X
81_3 virtual Trip	Virtual Trip of unit 81_3		X	X
81_4 virtual Trip	Virtual Trip of unit 81_4		X	X
General virtual trip				
Voltage disable (by DI)				
Phase Volt. Func. Disabled (by DI)	Phase Voltage elements disabled (by digital input)	X		X
Ground Volt. Func. Disabled (by DI)	Ground Voltage elements disabled (by digital input)	X		X
Frequency disabled (by DI)	Frequency disabled (by digital input)		X	X
Voltage P1 disables (by DI)	Voltage P1 element disabled (by digital input)	X		X
Voltage P2 disables (by DI)	Voltage P2 element disabled (by digital input)	X		X
Voltage P3 disables (by DI)	Voltage P3 element disabled (by digital input)	X		X
Voltage P4 disables (by DI)	Voltage P4 element disabled (by digital input)	X		X
59 N1 disabled (by DI)	Ground Voltage element disabled (by digital input)	X		X
59 N2 disabled (by DI)	Ground Voltage element disabled (by digital input)	X		X
47 disabled (by DI)	Inverse sequence element disabled (by digital input)	X		X
81-1 disabled (by DI)	Frequency element disabled (by digital input)		X	X
81-2 disabled (by DI)	Frequency element disabled (by digital input)		X	X
81-3 disabled (by DI)	Frequency element disabled (by digital input)		X	
81-4 disabled (by DI)	Frequency element disabled (by digital input)		X	
Trip disabled (by DI)	Trip disabled (by digital input)	X	X	X
Output 1	Output 1	X	X	X
Output 2	Output 2	X	X	X
Output 3	Output 3	X	X	X

NAME	DESCRIPTION	MIVII1000	MIVII2000	MIVII3000
Output 4	Output 4	X	X	X
Input 1	Input 1	X	X	X
Input 2	Input 2	X	X	X
General Input	General Input	X	X	X
Sett. Change disable	Shows whether the settings change inhibition by digital input is active. If this input is active, no settings change or setting group change can be done from the PC or HMI. The setting group change can be done by digital input.	X	X	X
52A Status	Breaker closed status	X	X	X
52B Status	Breaker open status	X	X	X
Group Change	Shows whether the Setting Group 2 selection by digital input is active. In this case, Setting Group 2 will be activated. Otherwise, the set group will be activated.	X	X	X
READY	Ready status (opposite alarm state)	X	X	X
Active Group	Active group operation	X	X	X
EEPROM failure	Active when an e2prom failure is detected	X	X	X
User setting	Active when the default settings are modified.	X	X	X
Local	Active when the HMI is in the settings or operations menu.	X	X	X

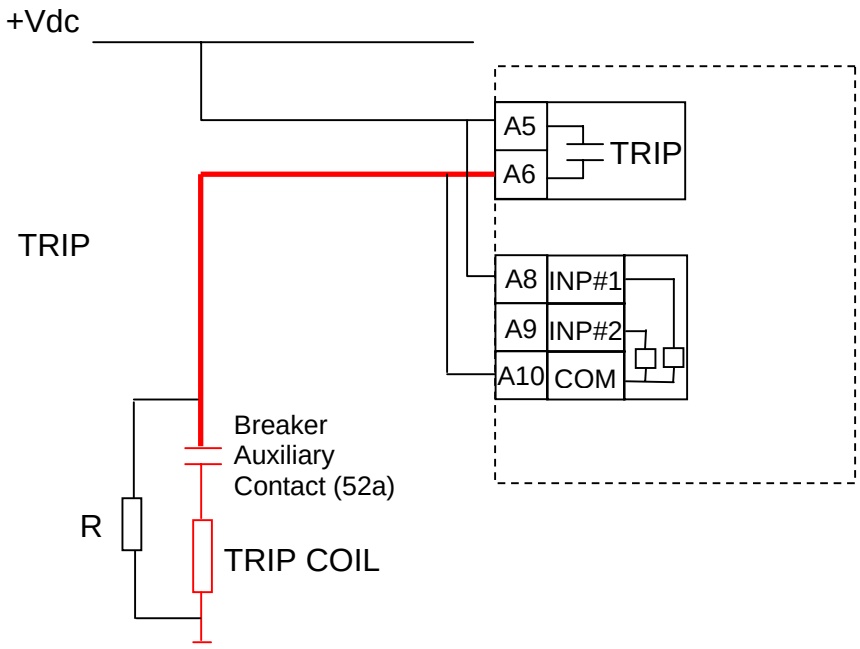
D

MII Family relays can be used to monitor Trip circuit integrity. The circuit is basically a Voltage Monitor connected to contact 52a. The circuit is continuously monitoring the voltage level. The circuit below is designed to monitor the complete trip circuit. It includes the tripping coil of the breaker and the trip circuit, the wiring between the relays, and the circuit breaker.

An alarm can be issued when the circuit is open. The figure below shows the typical wiring diagram that will provide trip circuit monitoring while the circuit breaker is closed.



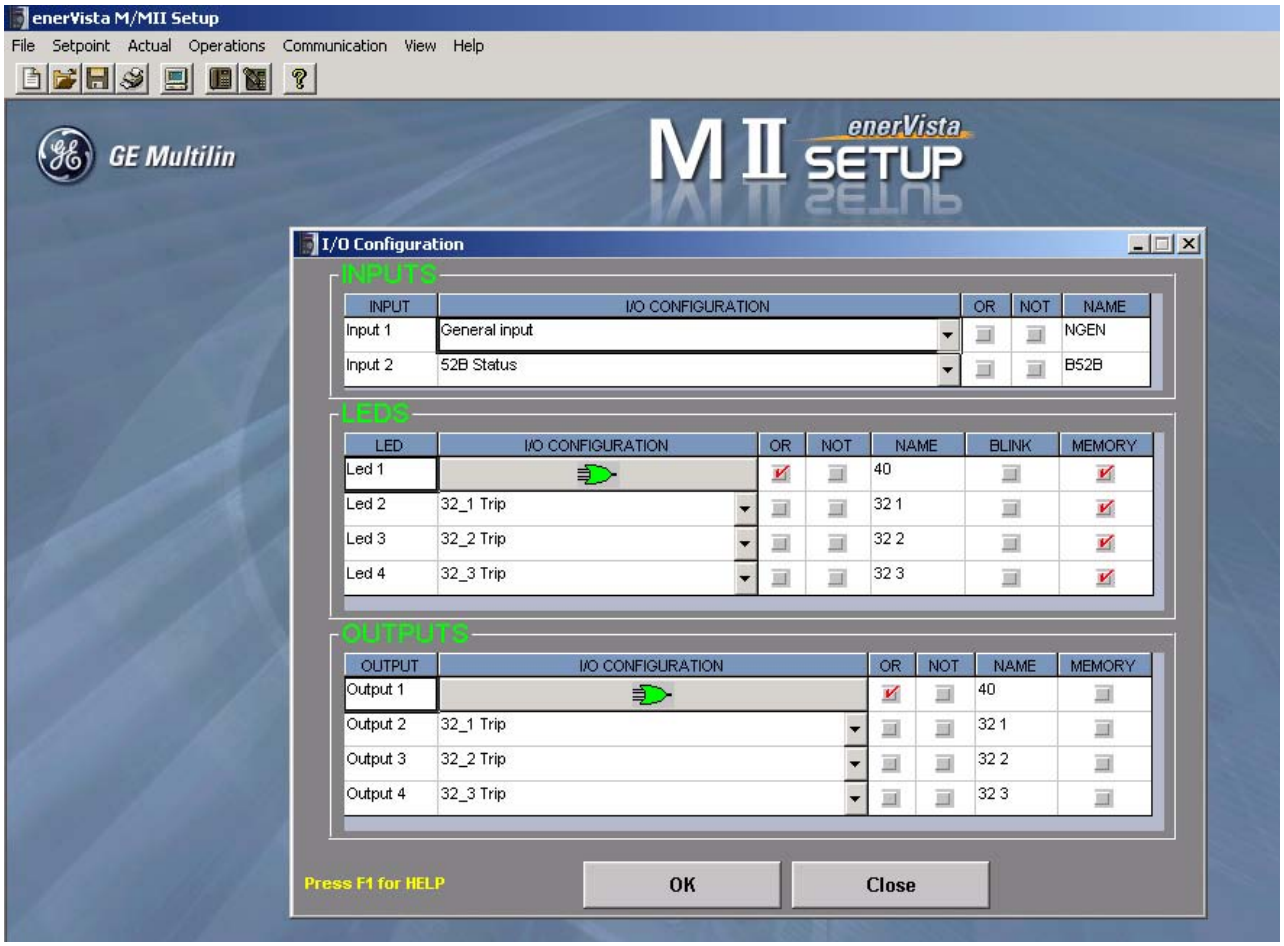
For monitoring the trip circuit while the breaker is open and when it is closed, a resistor must be added in parallel to the 52a contact, as shown below:



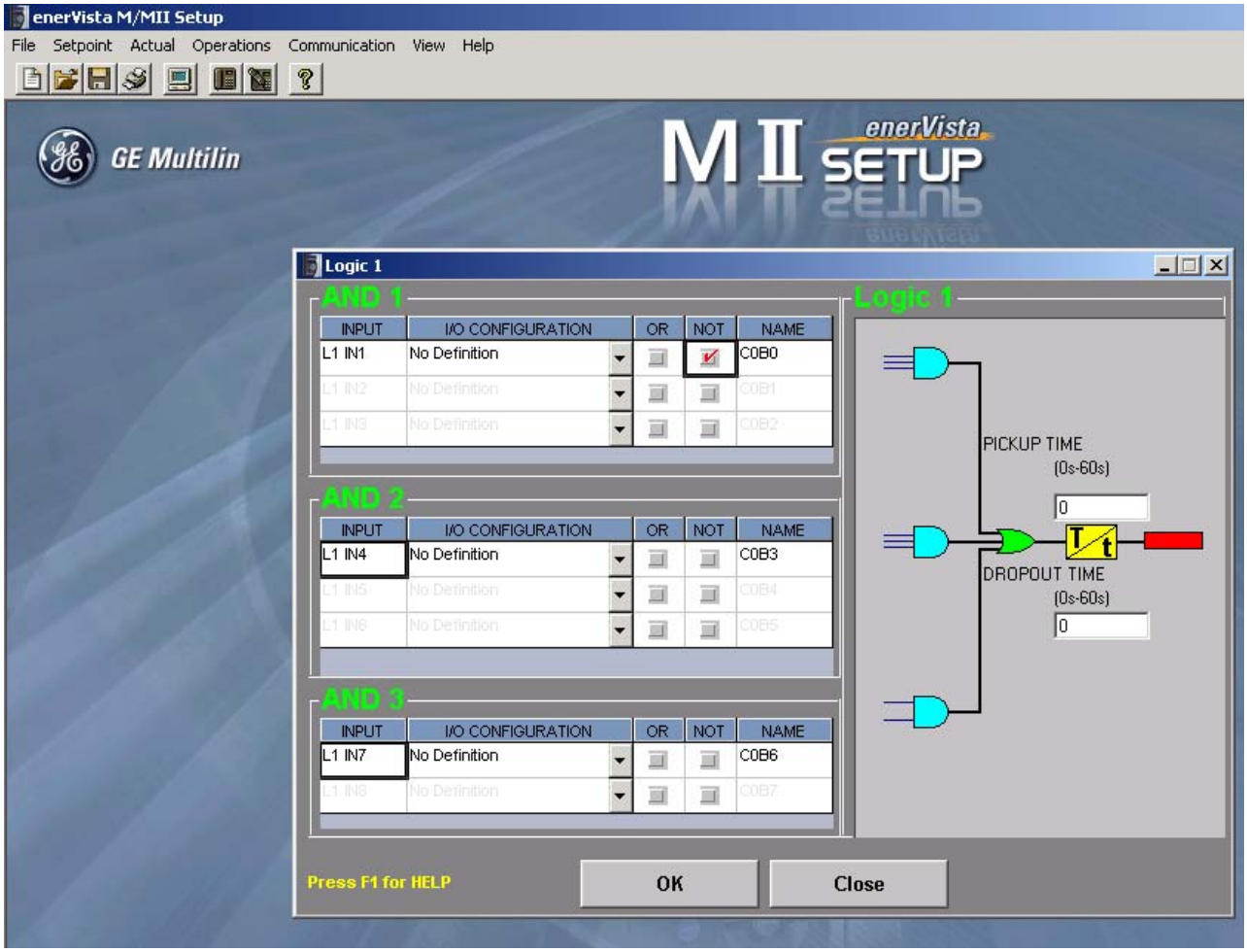
VALUE OF RESISTOR R		
Supply	Ohms	Watts
48 Vdc	10 K	2
125 Vdc	25 K	5
250 Vdc	50 K	5

Settings and configuration related to this function are described below:

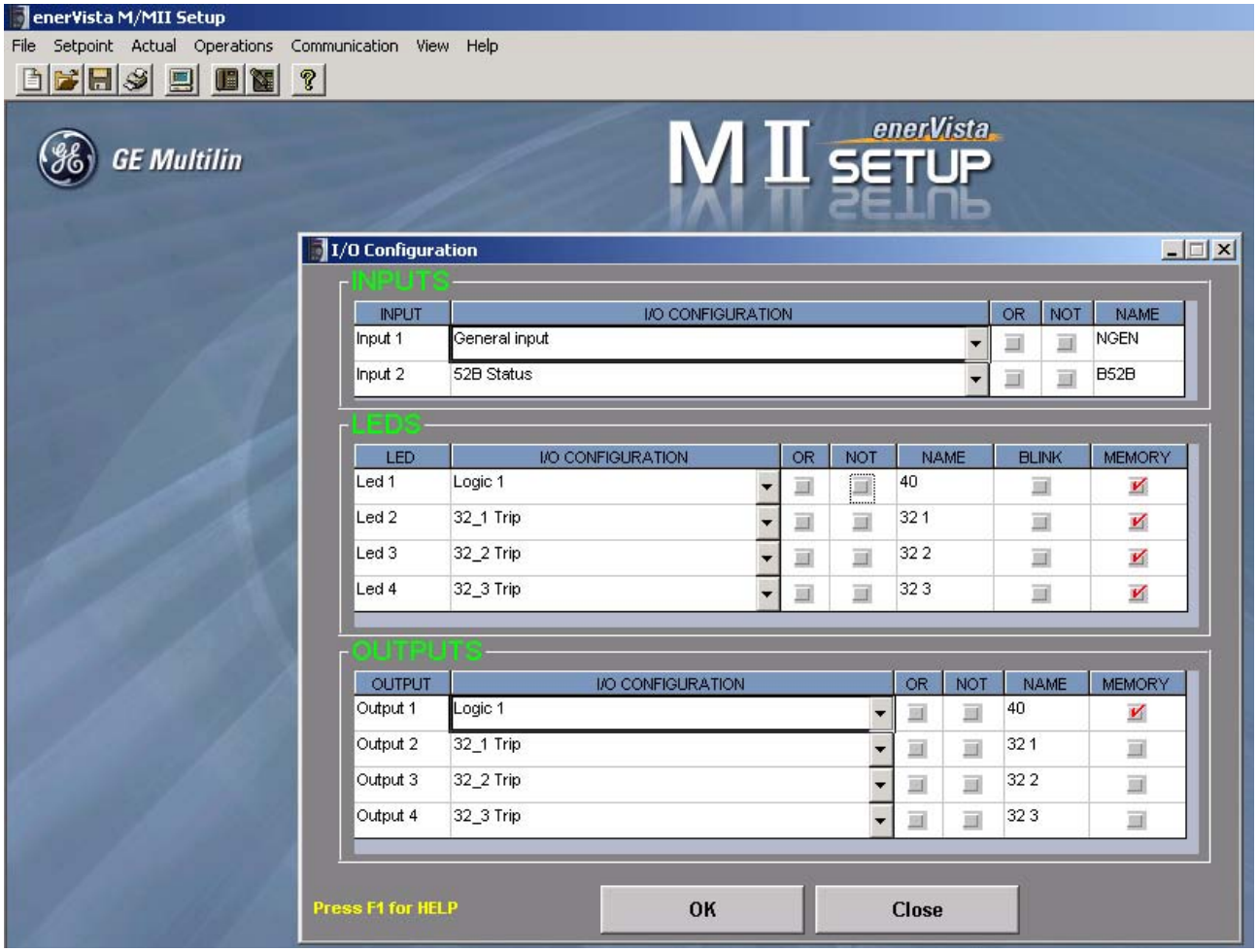
1. Under I/O CONFIGURATION, Input#1 must be configured as 'General Input'. It will be used to monitor the permanent presence of voltage.



2. Under LOGIC CONFIGURATION, LOGIC#1, Invert Input#1 and set the timer to the time delay to produce the Trip Circuit Supervision Alarm, for example 15 seconds



3. Under I/O Configuration, configure LEDs and outputs as required. In this example, LED#1 and configurable output#1 are configured to operate when a Trip Circuit failure is detected. They are also configured to have memory, so they will remain active even if the Trip Circuit failure disappears.



Example of Configuration:

If voltage is above 90% and Frequency is above 59 Hz, then don't activate. If Voltage falls below 75% and freq is above 59 Hz., then activate through timer, BUT if voltage is below 75% and freq. is below 59 Hz, then activate immediate. Also want to send signals to other bus breakers to close and transfer for other conditions.

First of all, MIVII used must be of 3000, which have both Under / Over voltage and frequency elements.

On the other hand, it is necessary to configure the protection elements. We can give the following values:

Voltage P1	Undervoltage	Pickup: 0.75 Vn (nominal voltage)
Voltage P2	Overvoltage	Pickup: 0.9 Vn (nominal voltage)
81_1	Overfrequency	Pickup: 59 Hz

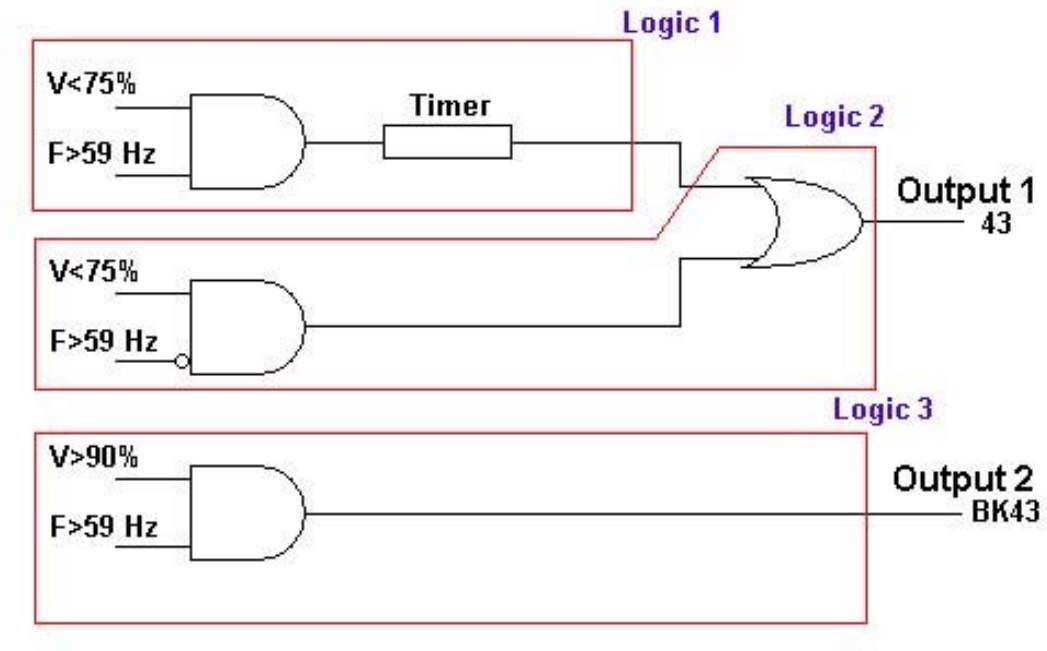
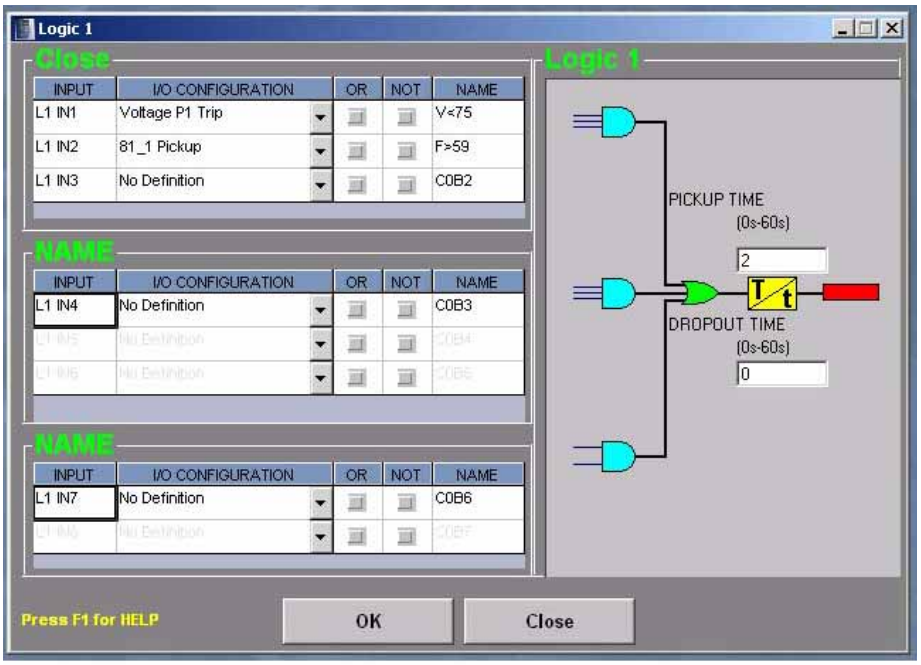
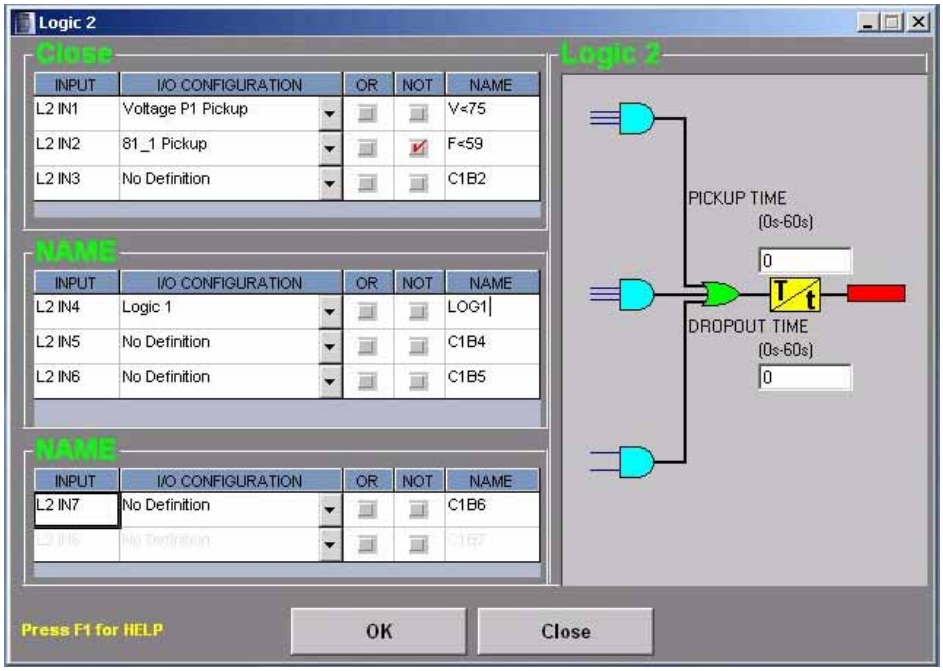


Figure E–1: LOAD SHEDDING LOGIC DIAGRAM

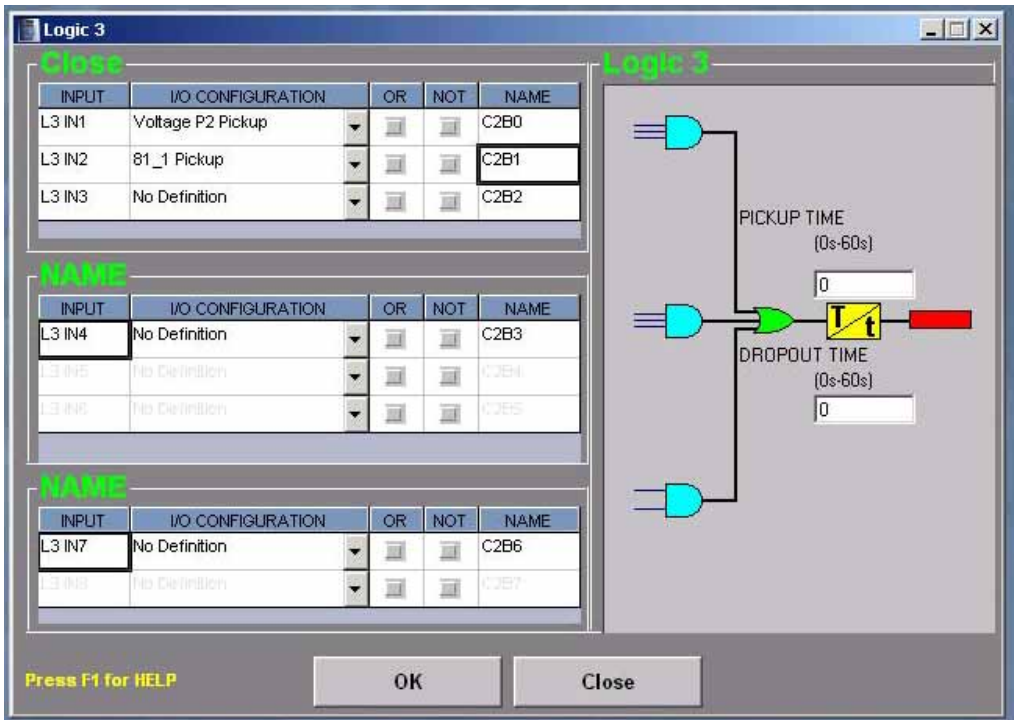
The logic boxes are marked in red, Output 1 represents function 43, and Output 2 is a separate output to block the 43 function.

Each Logic box has been programmed as is shown in the following pictures:


Logic 1
Close
INPUT
I/O CONFIGURATION
OR
NOT
NAME
L1 IN1
Voltage P1 Trip
V<75
L1 IN2
81_1 Pickup
F>59
L1 IN3
No Definition
C0B2
NAME
L1 IN4
No Definition
C0B3
NAME
L1 IN7
No Definition
C0B6
Logic 1
PICKUP TIME
(0s-60s)
2
DROPOUT TIME
(0s-60s)
0
Press F1 for HELP
OK
Close


Logic 2
Close
INPUT
I/O CONFIGURATION
OR
NOT
NAME
L2 IN1
Voltage P1 Pickup
V<75
L2 IN2
81_1 Pickup
F<59
L2 IN3
No Definition
C1B2
NAME
L2 IN4
Logic 1
LOG1
L2 IN5
No Definition
C1B4
L2 IN6
No Definition
C1B5
NAME
L2 IN7
No Definition
C1B6
Logic 2
PICKUP TIME
(0s-60s)
0
DROPOUT TIME
(0s-60s)
0
Press F1 for HELP
OK
Close

E



E

Then you need to program the auxiliary outputs

: