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GB INTERFACE PROTECTION SYSTEM

Instructions manual



PMVF 50



ATTENTION!



- Read this manual carefully before installing and using the device.
- This equipment is to be installed by qualified personnel, complying to current standards, for avoid damages and safety hazards.
- Before any service work on the device, disconnect the measuring and power inputs and short-circuit the current transformers.
- The manufacturer cannot be held responsible for electrical safety in case of improper use of the equipment.
- Products illustrated herein are subject to alteration and changes without prior notice. Technical data and descriptions in the document are accurate to the best of our knowledge, but no liabilities for errors, contingencies or omissions arising therefrom are accepted.
- A circuit breaker or cut-off must be installed in the electrical installation of the building. It must be installed close by the equipment and within easy reach of the operator. It must be marked as the disconnecting device of the equipment: IEC/ EN 61010-1 § 6.11.2.1.
- Clean the device with a soft cloth; do not use abrasive products, liquid detergents or solvents.

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INTRODUCTION

The PMVF50 has been designed as an **Interface Protection System (SPI)** in accordance with the **Italian standard CEI 0-21, June 2012 edition**.

It can be used in all LV micro-generation systems (photovoltaic, wind energy, etc.) to control the interface device (DDI) between the energy generation system and the national power grid.

In the event of problems on the grid (for instance power outage), the system quickly opens the DDI (e.g. a contactor) and disconnects the power generation system. In the case of the DDI malfunction, it can also activate a backup device to isolate the generation system.

The device has 4 digital inputs to connect the signals of the power supplier, according to the current standard requirements. The functions implemented and the possibility of further expansion guarantee the provisions for future development of the interface protection system.

The PMVF50 is standard supplied pre-programmed and assembled. Once connected, the default settings can be used to put the device into service immediately in accordance with the Italian standard CEI 0-21 without having to change any programming.

The operating parameters can however be changed in the future if necessary. Setup editing is password protected, so the settings cannot be tampered with by unauthorised personnel.

DESCRIPTION

- Modular version (8U)
- 128x80 pixel, backlit LCD screen with 4 levels of grey
- 4 viewing and setting keys
- 3-phase + neutral voltage measuring inputs
- Operates in the following line configurations:
 - 3-phase + neutral, VL-L voltage control (default)
 - 3-phase + neutral, VL-N voltage control
 - 3-phase without neutral, VL-L voltage control
 - Single-phase, VL-N voltage control
- 4 relay outputs for:
 - OUT1: DDI (Interface Device) coil control
 - OUT2: Backup device control
 - OUT3: Power unbalance limit (LSP) tripping
 - OUT4: Global programmable alarm
- 4 digital inputs for:
 - INP1: DDI feedback (Auxiliary contact for closed signal)
 - INP2: Local Control
 - INP3: Remote frequency threshold selection (External signal)
 - INP4: Remote tripping control
- Optional power unbalance limit (LSP) threshold control.
- Settings lock with 2-level programmable password
- Additional measurements option, with connection of external current transformers (CTs):
 - Current
 - Power
 - Energy output
- Predisposed and ready for future installation of IEC/EN 61850 communications module.

TRIPPING THRESHOLDS

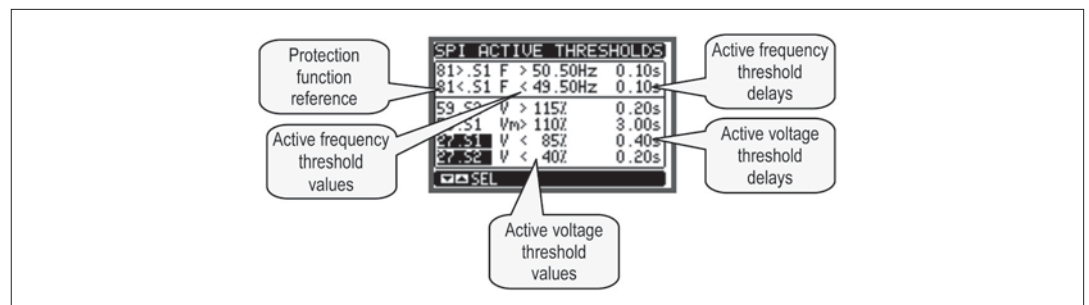
- The default voltage and frequency tripping thresholds, according to Italian standard CEI 0-21 default settings are shown below.

Voltage measurement type	Voltage threshold	Default	Type	Trip	Trip delay	Default
INSTANTANEOUS	$V > 59.S2$	$V > 115\%$	MAX	YES	DEL. 59.S2	0.20 s
MOVING AVERAGE 10 min	$V_{mean} > 59.S1$	$V_{mean} > 110\%$	MAX	YES	DEL. 59.S1	3.00 s
INSTANTANEOUS	$27.S1 \leq V \leq 59.S1$	$85\% \leq V \leq 110\%$	OK	NO	--	--
INSTANTANEOUS	$27.S2 \leq V < 27.S1$	$40\% \leq V < 85\%$	MIN	YES	DEL. 27.S1	0.40 s
INSTANTANEOUS	$V < 27.S2$	$V < 40\%$	MIN	YES	DEL. 27.S2	0.20 s

- The frequency thresholds and the relevant delays may change on the basis of the state of the input signals denominated Local Control and External Signal.
- The OFF condition of both signals is not foreseen/defined. If this should occur, the device will indicate an alarm status.
- The following table indicates the thresholds and relative tripping time in the foreseen operating conditions:

External signal	Local control	Min F threshold	Default	Min F delay	Default	Max F threshold	Default	Max F delay	Default
ON	OFF	$81 < .S2$	47.50 Hz	MINF C DEL	0.10 s	$81 > .S2$	51.50 Hz	MAXF C DEL	0.10 s
OFF	ON	$81 < .S2$	47.50 Hz	MINF L DEL	4.00 s	$81 > .S2$	51.50 Hz	MAXF L DEL	1.00 s
ON	ON	$81 < .S1$	49.50 Hz	MINF C DEL	0.10 s	$81 > .S1$	50.50 Hz	MAXF C DEL	0.10 s

- The thresholds used while the DDI is operating and the relevant delays, are displayed on a specific page:



Note: For field testing using a relay test box, APPLICATION NOTES are available with useful information and recommendations for installation technicians and inspectors. The publication can be requested at our Customer Service (Tel. +39 035 4282422; email: service@LovatoElectric.com).

FRONT KEY FUNCTIONS

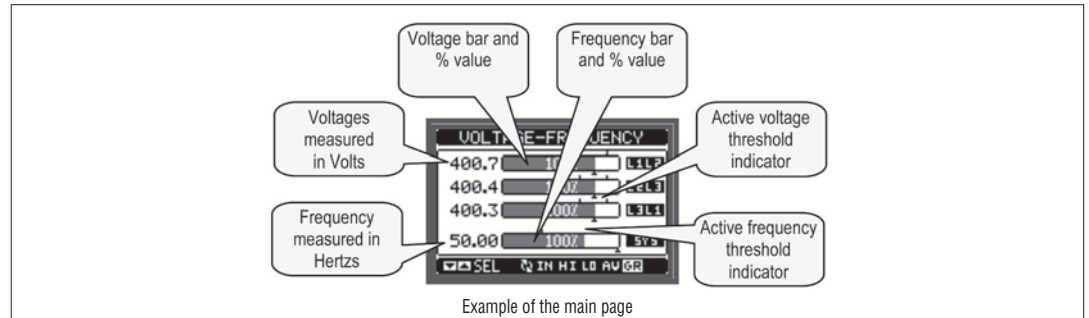
MENU key – To enter or exit the various display and setting menus.

▲ and ▼ keys – To scroll the pages displayed, select the choices on the screen, and change settings (up/down).

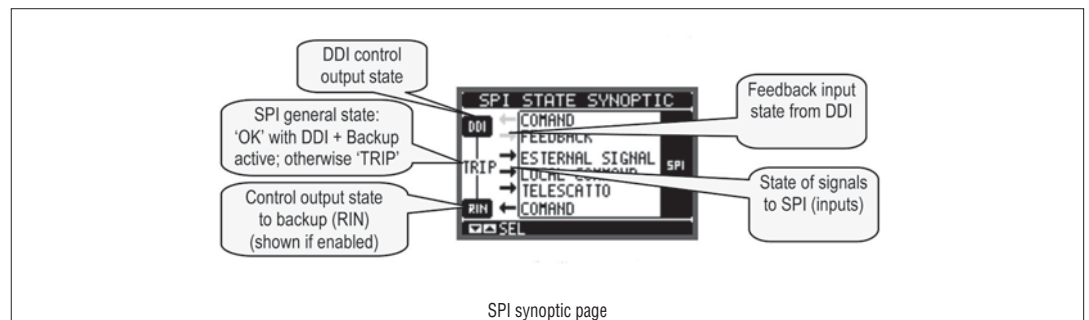
✓ key – To scroll through the sub-pages, confirm a selection and change from one display mode to another.

MEASUREMENT VIEWING

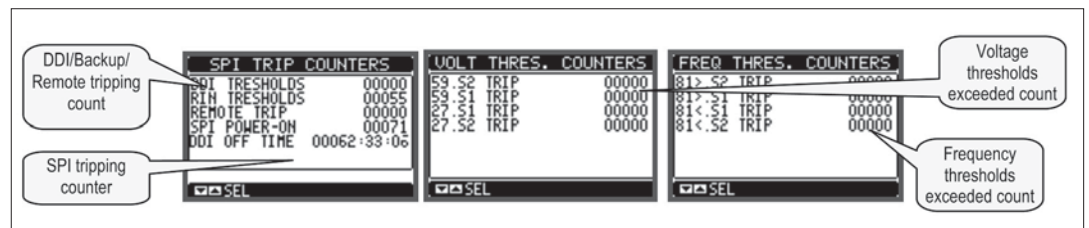
- Keys ▲ and ▼ scroll the measurement pages one by one. The title bar shows the current page.
- The first page displayed (main page) contains the most important information in both numeric and graphic format. The limit thresholds are shown by a small indicator above the bar, while the arrows under the bar indicate the field of variation of the measurement (HI – LO).



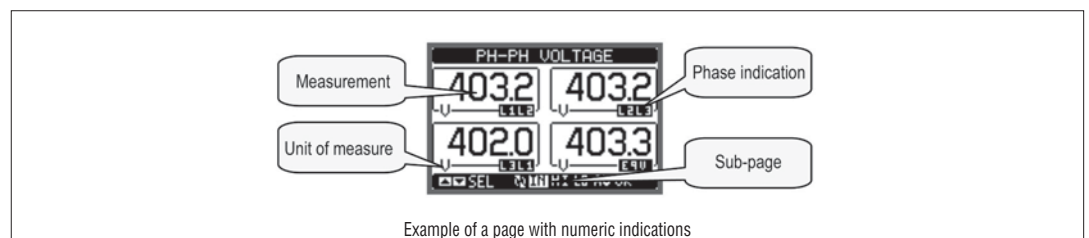
- The following pages display a synopsis of the interface protection system (SPI) state, showing both the state of the outputs for the DDI and the backup, as well as the state of the control inputs. The black arrows indicate an active state, the grey ones show a deactivated state.



- Three pages are displayed with counters showing the number of protection trips, divided by the number of total trips, voltage thresholds exceeded and frequency threshold exceeded. The counters can be cleared using the commands menu.



- The following pages show the measurements in standard numeric format.
- Some measurements may not be shown depending on the device programming and connections (for example if a system without neutral has been programmed, the neutral measurements will not be shown).



- On many pages, the key ✓ gives access to sub-pages (e.g. display the max and min values recorded).
- The correctly displayed sub-page is indicated at the bottom left of the screen by one of the following icons:
 - **IN = Instantaneous value** – Current instantaneous value of the measurement, displayed by default every time the page is changed.
 - **HI = Max instantaneous value** – Highest value measured by the SPI for the relevant measurement. The HIGH values are saved and stored, even when the device is powered down. They can be cleared using the relevant command (see commands menu).
 - **AV = Average value** – The average value of the measurements, with delayed variations (last minute average).
 - **LO = Min instantaneous value** – Lowest value measured by the SPI since power up. Cleared with the same command as the HI values.
 - **GR = Bar graphs** – Bar indicators display the measurements.
- The user can specify which page and which sub-page the display should return to automatically after no keys have been pressed for a certain time.
- The PMVF50 can also be programmed so the display remains where it was last.
- These functions can be set in menu M02 – Utility.

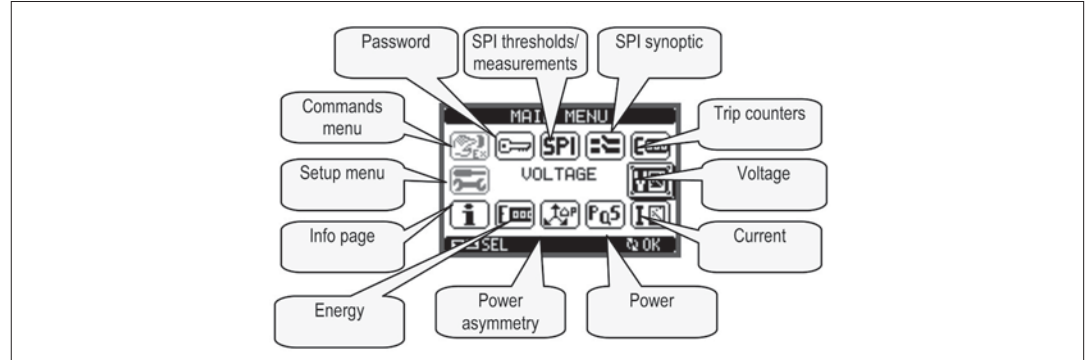
DISPLAY PAGE TABLE

No.	Select with ▲ and ▼ PAGES	Select with ✓ SUB-PAGES			
		HI	LO	AV	GR
1	VOLTAGE, FREQUENCY V(L1-L2), V(L2-L3), V(L3-L1), F(Hz)	HI	LO	AV	GR
2	SPI STATE SYNOPSIS STATE OF DDI/STANDBY OUTPUTS, FEEDBACK INPUTS, EXTERNAL SIGNAL, REMOTE TRIPPING				
3	ACTIVE THRESHOLDS – DELAY V/F THRESHOLDS AND ANY ACTIVE DELAY				
4	SPI TRIPPING COUNTERS DDI TRIP CNT, STANDBY TRIP CNT				
5	COUNTERS - EXCEEDED VOLTAGE THRESHOLDS CNT 59.S2, CNT 59.S1, CNT 27.S1, CNT 59.S2				
6	COUNTERS - EXCEEDED FREQUENCY THRESHOLDS CNT 81>.S2, CNT 81>.S1, CNT 81<.S1, CNT 81<.S2				
7	LINE VOLTAGES V(L1-L2), V(L2-L3), V(L3-L1), V(LL)EQV	HI	LO	AV	GR
8	PHASE VOLTAGES V(L1-N), V(L2-N), V(L3-N), V(L-N)EQV	HI	LO	AV	GR
9	MOVING AVERAGE VOLTAGE VM(L1-L2), VM(L2-L3), VM(L3-L1)	HI	LO		
10	PHASE AND NEUTRAL CURRENT I(L1), I(L2), I(L3), I(N)	HI	LO	AV	GR
11	ACTIVE POWER P(L1), P(L2), P(L3), P(TOT)	HI	LO	AV	GR
12	ACTIVE POWER UNBALANCE kWP1-P2, kWP2-P3, kW P3-P1	HI	LO	AV	GR
13	TREND GRAPH P(TOT) LAST 24h				
14	ACTIVE ENERGY – ACTIVE POWER – BAR GRAPH kWh (TOT) – kW (TOT) – kW (TOT) BAR				
15	REACTIVE POWER Q(L1), Q(L2), Q(L3), Q(TOT)	HI	LO	AV	GR
16	APPARENT POWER S(L1), S(L2), S(L3), S(TOT)	HI	LO	AV	GR
17	POWER FACTOR PF(L1), PF(L2), PF(L3), PF(TOT)	HI	LO	AV	GR
18	ENERGY METERS kWh+(TOT), kWh-(TOT), kvarh+(TOT), kvarh-(TOT), kVA(TOT)	PARTIAL			
19	PHASE L1 ENERGY METERS kWh+L1(TOT), kWh-L1(TOT)	PARTIAL			
20	PHASE L2 ENERGY METERS kWh+L2(TOT), kWh-L2(TOT)	PARTIAL			
21	PHASE L3 ENERGY METERS kWh+L3(TOT), kWh-L3(TOT)	PARTIAL			
22	EXPANSION MODULES				
23	INFO-REVISION LEVELS-SERIAL NO. MODEL, SW REVISION, HW REVISION, SERIAL NO.				
24	LOGO				

- **Note:** Some of the pages listed above may not be displayed if the relevant function is disabled. For example, if no external CT is connected or programmed, the pages highlighted in grey will not be displayed.
- **Note:** The moving average voltage measurement will not be available for the first 10 minutes after powering up or rebooting the system. During this time, the display shows a dotted line and a countdown indicating the time remaining to display the measurements.

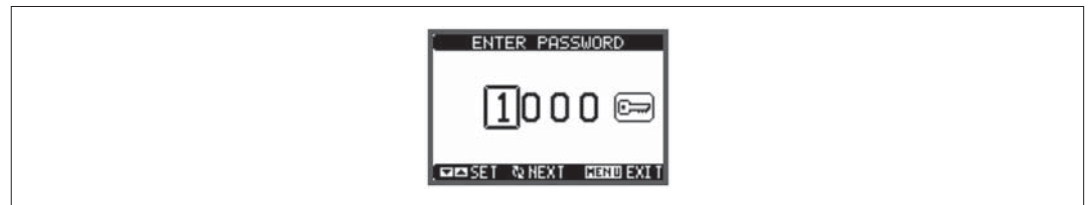
MAIN MENU

- The main menu has a series of icons for quick access to measurements and settings.
- Click **MENU** in normal measurement display. The display shows the quick-start menu:
- Click **▲** or **▼** to select the required function. The selected icon is highlighted and the text in the central part of the display describes the function.
- Click **✓** to activate the selected function.
- If some functions are unavailable, the corresponding icon is disabled, and coloured grey.
- etc. - act as shortcuts for quick access to the measurement pages, going directly to the group of measurements selected, from where you can go to the next or previous page as usual.
- - Numeric code setting for access to password protected functions (parameter settings, execute commands).
- - Parameters programming access point. See relevant chapter
- - Commands menu access, where the authorised user can carry out reset and/or clearing operations.



PASSWORD PROTECTED ACCESS

- New devices come from the factory with default password settings: 1000 (user access) and 2000 (advanced access).
- See the parameter settings chapter to change the access codes.
- There are two access levels, depending on the code entered:
 - **User level access** – permits viewing and clearing of recorded values but no change of the device settings.
 - **Advanced level access** – same access rights as user, but settings can be changed.
- On the normal measurements display page, click **MENU** to call up the main menu. Then, select the password icon and click **✓**.
- The password settings window will be displayed:



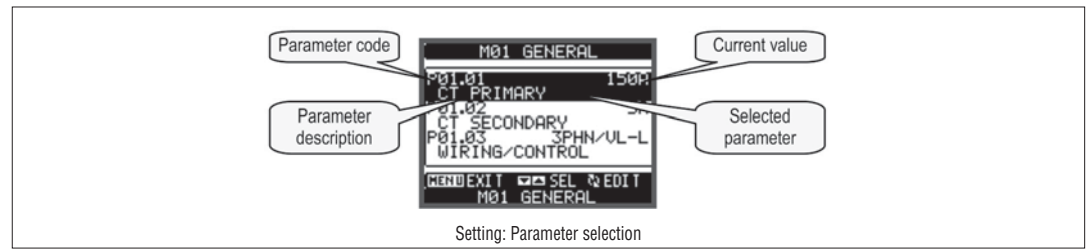
- Use keys **▲** or **▼** to change the numeric value selection.
- Key **✓** confirms the figure, and the cursor moves to the next.
- Enter the password, then click the key icon.
- When the password entered matches the User or Advanced level password, the relevant unlocking message is displayed.
- When the password has been unlocked, access remains enabled until:
 - The device is powered down.
 - The device is reset (after exiting the settings menu).
 - If no keys are used for 2 minutes.
- The **MENU** key exits password settings.

PARAMETER SETUP

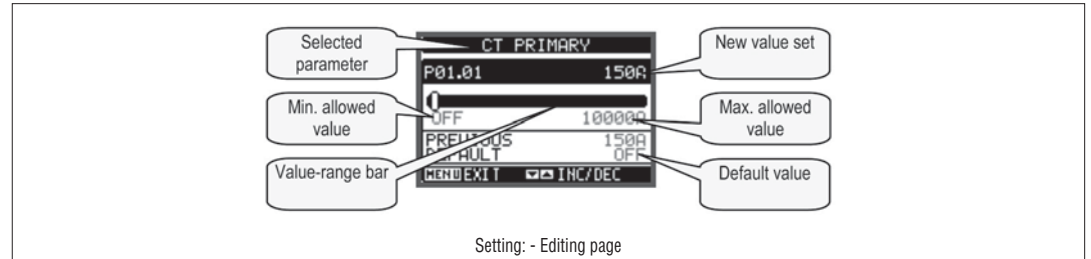
- From normal page display, click **MENU** to call up the main menu, then select the icon and click **✓** to display the settings menu.
- The table shown below is displayed, with the settings sub-menus of all the parameters on the basis of their function.
- Select the required menu with keys **▲** **▼** and confirm with **✓**.
- Click **MENU** to return to the measurement page.
- The following table lists the available submenus:

Code	MENU	DESCRIPTION
M01	GENERAL	System specifications
M02	UTILITIES	Language, brightness, display pages, etc.
M03	PASSWORD	Enable password protection
M04	SPI THRESHOLDS	SPI delays and thresholds
M05	COMMUNICATION (COMn)	COM ports
M06	ALARMS	Alarm enabling

- Select the sub-menu and click ✓ to display the parameters.
- All the parameters are displayed with the code, description, and current value.



- To change a parameter value, select it then click ✓.
- You must enter the Advanced level password to open the parameters editing page. A "no access" message is displayed if you do not enter this password.
- After access, the editing page will be displayed.



- When in editing mode, the value can be changed with keys ▲ and ▼. A bar indicating the setting range, the allowed min and max values, the previous value, and the default value are also shown.
- Clicking ▲ and ▼ simultaneously resets the value to default.
- Click MENU to return to the parameters selection. The value entered will be saved.
- Click MENU again to save changes and exit settings. The SPI will reset and return to its normal state.
- **N.B.:** When rebooting after changing parameters or commands, the output relays will be momentarily de-energised.
- If no key is clicked for 2 consecutive minutes, the setup menu will automatically close and the SPI returns to its normal state.

TABLE OF PARAMETERS

M01 - GENERAL		UoM	Default	Range
P01.01	CT Primary	A	OFF	OFF/1-10000
P01.02	CT Secondary	A	5	1 or 5
P01.03	Connection/voltage control		3-phase+N / VLL	3-phase+N / VL-L 3-phase+N / VL-N 3-phase / VL-L Single-phase / VL-N
P01.04	Rated power of the system	kW	AUT.	AUT/ 1-10000
P01.05	DDI activation delay after SPI power up	s	4.00	4.00 – 300.00
P01.06	Power unbalance limit (LSP) control output		OUT3	OFF OUT1 OUT3 OUT1+OUT3
P01.07	LSP 1 threshold	kW	6.0	OFF / 1.0 – 10.0
P01.08	LSP 1 delay	s	1800	1 - 3.600
P01.09	LSP 2 threshold	kW	10.0	OFF / 1.0 – 20.0
P01.10	LSP 2 delay	s	60	1 - 3.600
P01.11	LSP automatic reset time	min	5	OFF / 1- 60
P01.12	OUT4 output function		Global alarm	OFF DDI RIN (Backup device) LSP Global Alarm 59.S1 threshold 59.S2 threshold 27.S1 threshold 27.S2 threshold 81>.S1 threshold 81>.S2 threshold 81<.S1 threshold 81<.S2 threshold Alarm A01 Alarm A02 Alarm A03 Alarm A04 Alarm A05 Alarm A06
P01.13	Backup device control mode		MODE A	OFF MODE A MODE B MODE C
P01.14	Backup device control pulse time	s	3.0	1.0 - 60.0

P01.01 – CT primary rated current. If no CT is installed, leave OFF. The current and power pages are only displayed when CTs are used.

P01.02 – CT secondary current.

P01.03 – Type of connection and voltage control. Program in accordance with wiring.

P01.04 – Rated active power of the system. If set to AUT, the value is calculated by multiplying P01.01 x 230 x 3 (phase current x phase voltage x 3 phases).

P01.05 – DDI energising delay after PMVF50 power up.

P01.06 – LSP protection control output selection: OUT1 (DDI open); OUT3 (independent); OUT1+OUT3 (both).

P01.07 – **P01.08** – LSP threshold and delay at first level (LSP1).

P01.09 – **P01.10** – LSP threshold and delay at second level (LSP2).

P01.11 – Defines the automatic reset time after LSP trips. If set to OFF, it can only be reset manually by pressing keys ▲ ▼ together.

P01.12 – If an additional relay module is installed, this defines the function of output OUT4 from those in the list. The output is activated when conditions are normal (threshold not tripped, alarm not activated, etc.).

P01.13 – Defines the backup device control mode, on the basis of the logic in the Backup device activation modes diagram on the last pages of the manual. If backup is not used, set to OFF.

P01.14 – Backup opening pulse time, when used in Mode C.

M02 – UTILITY		UoM	Default	Range
P02.01	Language		Italiano	English Italiano
P02.02	LCD contrast	%	60	0-100
P02.03	Display backlight intensity high	%	100	0-100
P02.04	Display backlight intensity low	%	30	0-50
P02.05	Time to switch to low backlighting	s	30	5-600
P02.06	Return to default page	s	60	OFF / 10-600
P02.07	Default page		SPI MEASUREMENTS	SPI – SYN – EVE ...
P02.08	Default sub-page		GR	IN / HI / LO / AV / GR
P02.09	Display update time	s	0.5	0.1 – 5.0

P02.06 – If set to OFF, the display remains on the page where the user last left it. If set to a value, after this time the display returns to the page set in P02.07.

P02.07 – Start page code at power up and to which the display returns automatically every time P02.06 expires after last key activation.

P02.08 – Type of sub-page to which the display returns after P02.06.

M03 – PASSWORD		UoM	Default	Range
P03.01	Password use		ON	OFF-ON
P03.02	User level password		1000	0-9999
P03.03	Advanced level password		2000	0-9999

P03.01 – If set to OFF, password management is disabled.

P03.02 – With P03.01 enabled, this is the value to enter to access user level. See Password access chapter.

P03.03 – As for P03.02 but referred to Advanced level access.

M04 – SPI THRESHOLDS		UoM	Default	Range
P04.01	MAX V 59.S2 threshold	%	115	100 - 130
P04.02	MAX V 59.S1 threshold	%	110	100 - 120
P04.03	MIN V 27.S1 threshold	%	85	20 - 100
P04.04	MIN V 27.S2 threshold	%	40	5 - 100
P04.05	MAX V 59.S2 delay	s	0.20	0.05 - 5.00
P04.06	MAX V 59.S1 delay	s	3.00	0.20 - 10.00
P04.07	MIN V 27.S1 delay	s	0.40	0.05 - 5.00
P04.08	MIN V 27.S2 delay	s	0.20	0.05 - 5.00
P04.09	MAX F 81>.S2 threshold	Hz	51.50	50.0 - 52.0
P04.10	MAX F 81>.S1 threshold	Hz	50.50	50.0 - 52.0
P04.11	MIN F 81<.S1 threshold	Hz	49.50	47.0 - 50.0
P04.12	MIN F 81<.S2 threshold	Hz	47.50	47.0 - 50.0
P04.13	MAX F long delay	s	1.00	0.05 - 5.00
P04.14	MAX F short delay	s	0.10	0.05 - 5.00
P04.15	MIN F short delay	s	0.10	0.05 - 5.00
P04.16	MIN F long delay	s	4.00	0.05 - 5.00
P04.17	Backup activation delay	s	0.5	0.1 – 10.0
P04.18	Local control		OFF	OFF - ON
P04.19	SPI reset time (drop-off)	s	0.08	0.04 – 300.00

P04.01...P04.16 – Regulation of tripping thresholds and delay time defined by Italian standard CEI 0-21.

P04.17 – Max standby time for DDI opening, before the same is acknowledged as DDI lock with the consequent backup opening command.

P04.18 – Local control setting via parameter. Functions in OR mode with the input of the corresponding function.

P04.19 – DDI reset time (drop-off). Delay for reclosing DDI after all thresholds are within limits.

M05 – COMMUNICATION		UoM	Default	Range
P05.01	Node serial address		01	01-255
P05.02	Serial speed	bps	9600	1200 2400 4800 9600 19200 38400 57600 115200
P05.03	Data format		8 bit – n	8 bit, no parity 8 bit, odd parity 8 bit, even parity 7 bit, odd parity 7 bit, even parity
P05.04	Stop bits		1	1 - 2
P05.05	Protocol		RTU Modbus	RTU Modbus ASCII Modbus TCP Modbus
P05.06	IP address		000.000.000.000	000.000.000.000 - 255.255.255.255
P05.07	Subnet mask		000.000.000.000	000.000.000.000 - 255.255.255.255
P05.08	IP port		1001	0-9999
P05.09	Gateway Function		OFF	OFF - ON

P05.01 – Serial (node) address of communication protocol.

P05.02 – Communication port transmission speed.

P05.03 – Data format. 7-bit settings can be used for ASCII protocol only.

P05.04 – Stop bit number.

P05.05 – Communication protocol setting.

P05.06...P05.08 – TCP-IP coordinates for applications with Ethernet interface. Not used with other types of communication modules.

P05.09 – Enable gateway function.

M06 – ALARMS		UoM	Default	Range
P06.01	Enable alarm A01		ON	ON - OFF
P06.02	Enable alarm A02		ON	ON - OFF
P06.03	Enable alarm A03		ON	ON - OFF
P06.04	Enable alarm A04		ON	ON - OFF
P06.05	Enable alarm A05		ON	ON - OFF
P06.06	Enable alarm A06		ON	ON - OFF

P06.01...P06.06 – Enables or disables the corresponding alarm.

Note: We recommend also using the DDI feedback auxiliary contact in installations where a backup device is not used. All the same if feedback control is not used, alarm A03 must be disabled by setting P06.03 to OFF.

COMMANDS MENU

- The commands menu allows to perform operations, such as resetting/clearing measurements, counters, meters, alarms, etc.
- If the advanced access password has been entered, automatic functions to configure the device can be made through the commands menu.
- The following table shows the functions in the commands menu, listed according to the access level required.

CODE	COMMAND	ACCESS LEVEL	DESCRIPTION
C.01	RESET HI-LO	User / Advanced	Clears HI and LO peak values of all measurements
C.02	RESET TRIP COUNTERS	User / Advanced	Clears trip counters
C.03	RESET PARTIAL ENERGY	User / Advanced	Clears the partial energy meters
C.11	RESET TOTAL ENERGY	Advanced	Clears the total, partial and tariff energy meters
C.12	DEFAULT PARAMETERS	Advanced	Resets all the settings to default
C.13	PARAMETERS BACKUP	Advanced	Saves a backup copy of the settings
C.14	RESET PARAMETERS	Advanced	Reloads the settings saved in the backup copy
C.15	27.S2 THRESHOLD TESTING	Advanced	Changes 27.S1 threshold momentarily to allow testing of 27.S2 threshold. See note below.

Note: Using a relay test box, command C.15 permits the testing of 27.S2 threshold, normally 'concealed' by 27.S1 and therefore impossible to test using normal procedures. This command sets 27.S1 threshold momentarily at the minimum allowed value (20% Un), which is lower than the 27.S2 default value (40% Un) so it can be tested. The threshold is changed for no longer than 5 minutes, during which time the changed value is displayed on the Active thresholds page. Switching the PMVF50 off and on again, or waiting for the time to elapse (sufficient to do the test) returns 27.S1 threshold to the normal set value.

ALARM INDICATIONS

- In the case of an anomaly, the PMVF50 displays a pop-up window.
- If the user presses the front panel keys, the alarm is momentarily hidden so the display pages can be seen.
- The alarm remains displayed until the anomaly has been solved.

CODE	ALARMS / SIGNALS	DESCRIPTION / POSSIBLE CAUSES
A01	EXTERNAL SIGNAL / LOCAL CONTROL COMBINATION NOT ALLOWED	Both External signal and Local control OFF (combination not allowed by standard). Local control must be ON (jumpered) if required by operating regulations. If Local control is OFF, the External signal must be ON.
A02	DDI OPENING ERROR	The SPI sends the opening command to the DDI, but the auxiliary (feedback) contact remains closed, so the SPI sends the opening command to the backup device. Check DDI and its auxiliary (feedback) contact.
A03	DDI CLOSING ERROR	<ul style="list-style-type: none"> – SPI sends the closing command to the DDI, but it does not close. Check OUT1 wiring and/or DDI coil. – DDI (feedback) auxiliary contact malfunction. – DDI (feedback) auxiliary contact not correctly connected to terminal INP1. – DDI (feedback) auxiliary contact is not installed since not indicated in the wiring diagram. Disable alarm A03 by setting P06.03 to OFF. NOTE: It is recommended to always use the feedback input.
A04	CONFIGURATION ERROR OF HW - MODULES	PMVF50 does not recognise the required expansion modules. Check if they are installed correctly on the base unit side, as illustrated in the figure on page 11.
A05	LSP1 TRIPPED - CLICK ▲ ▼ TO RESET	Power unbalance limit protection LSP1 tripped. Wait for automatic delayed reset or reset it manually.
A06	LSP2 TRIPPED - CLICK ▲ ▼ TO RESET	Power unbalance limit protection LSP2 tripped. Wait for automatic delayed reset or reset it manually.

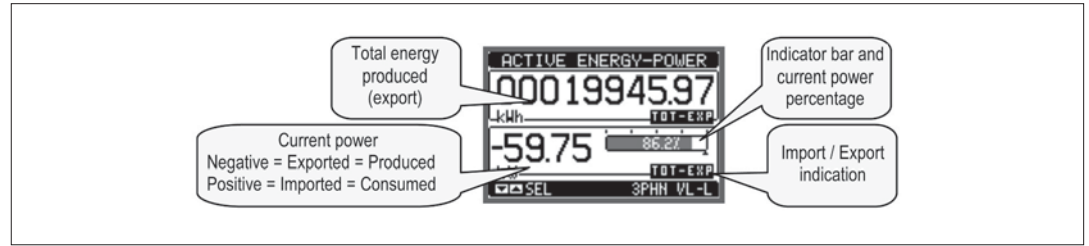
- All the alarms/warnings except A04 are non-retentive. In other words, they automatically reset when the anomaly is resolved after the relative reset delay.
- If a non-retentive alarm is generated, the device will still function.
- Output OUT4 can be programmed to signal any active alarm (global alarm function).

SELF-DIAGNOSIS

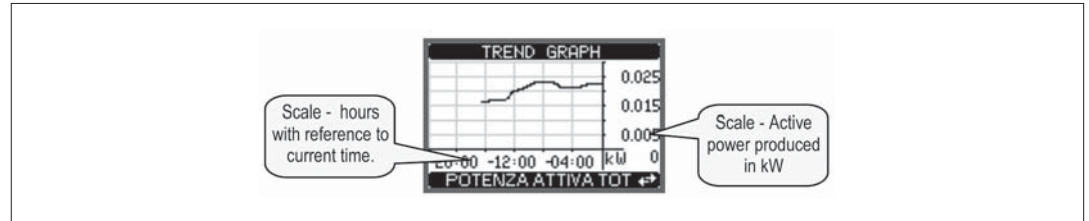
- The PMVF50 can run a series of self-diagnosis tests. If one of these tests fails, a System Error Exx window is displayed, where xx indicates the malfunction. If this warning is displayed, contact our Customer Service Office (Tel. +39 035 4282422; email: service@LovatoElectric.com) indicating the code reference displayed.

CURRENT, POWER AND ENERGY MEASUREMENTS

- If CTs are connected to the current inputs and the reading of the same is enabled by setting parameter P01.01 to a value other than OFF, the device will measure the current, power and energy values that can be referred to energy exchange (CT installed at delivery point) or to energy produced (CT installed on generation line), depending on where the CTs are installed.
- The active power produced (export, fed into the grid) **will be displayed with a conventional negative sign** (ex: -6.5kW). The amount of energy produced by the generating system will be accumulated on the Export energy meter.



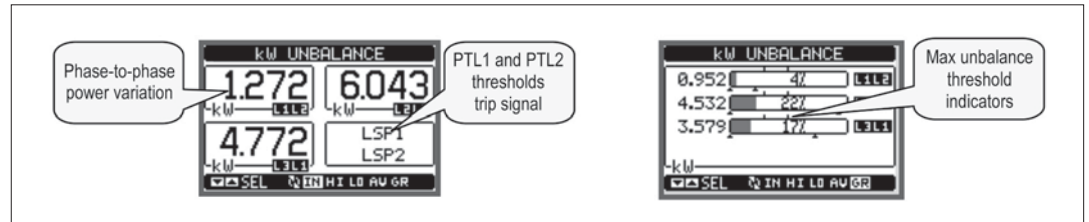
- The Trend Graph page can also be displayed to show the energy production trend in the last 24 hours.



- The power measurements allow to monitor the generating production parameters and display them on the screen, or send them to a supervision system (if installed) to read them through one of the optional communication modules supported.

POWER UNBALANCE LIMIT (LSP) CONTROL

- In 3-phase+neutral systems with CTs installed, the PMVF50 can also be programmed to provide power unbalance limit protection (LSP), as specified in Italian CEI 0-21 standard § 8.3.1.2.
- In this case, when an unbalance is measured between the active phase power values (difference between the highest and lowest power values measured) greater than 6kW for >30 minutes or an unbalance over 10kW for >1 minute, the LSP protection will trip.



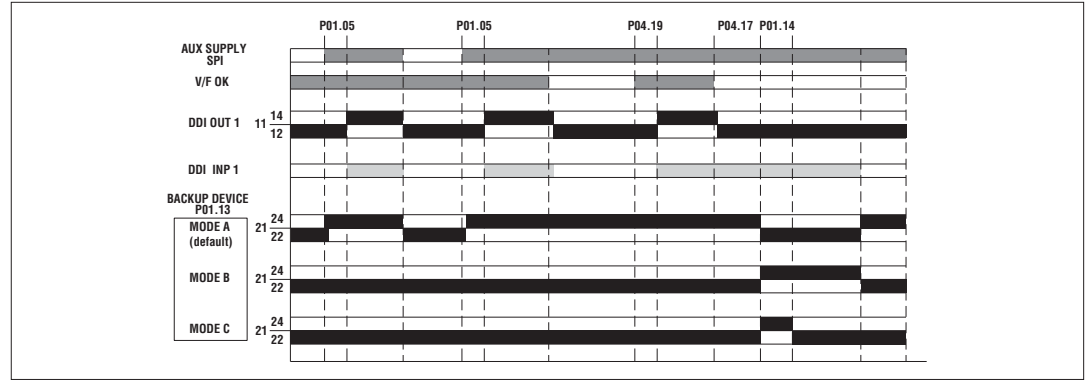
- This protection can be programmed to open relay OUT3 or open the DDI using output OUT1.
- See parameters P01.06 to P01.11.
- When the LSP trips, A05 and A06 alarms are displayed (respectively for the unbalance tripping of thresholds LSP1=6kW and LSP2=10kW).
- The device can be reset manually by clicking keys ▲ ▼ simultaneously, or resets automatically after the time set for P01.11.

COMMUNICATIONS

- The PMVF50 can be equipped with an optional standard communication module from those of the list below. When a communication module is installed, it must be configured in the relevant menu M05.
- Modbus protocol currently supported in RTU, ASCII and TCP variants.
- The device is already predisposed for communication according to IEC/EN 61850 standards, which will be available after the installation of the specific module.

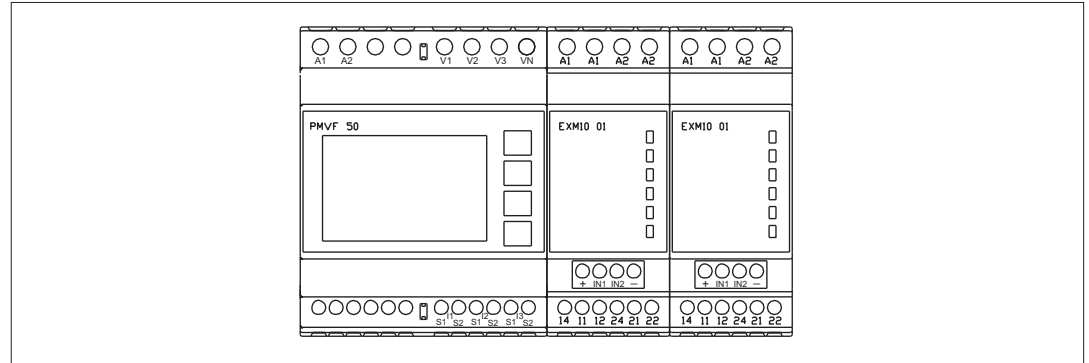
TYPE OF MODULE	ORD/CODE	FUNCTION	MAX. NO.
COMMUNICATION	EXM 10 10	USB	1
	EXM 10 11	RS232	
	EXM 10 12	RS485	
	EXM 10 13	ETHERNET	

BACKUP DEVICE ACTIVATION MODES

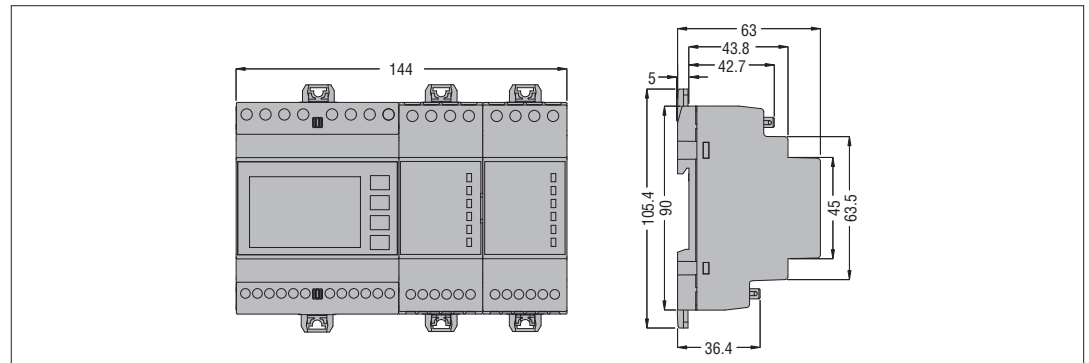


Nota: The default backup device control mode is Mode A. See parameter P01.13.

TERMINAL ARRANGEMENT



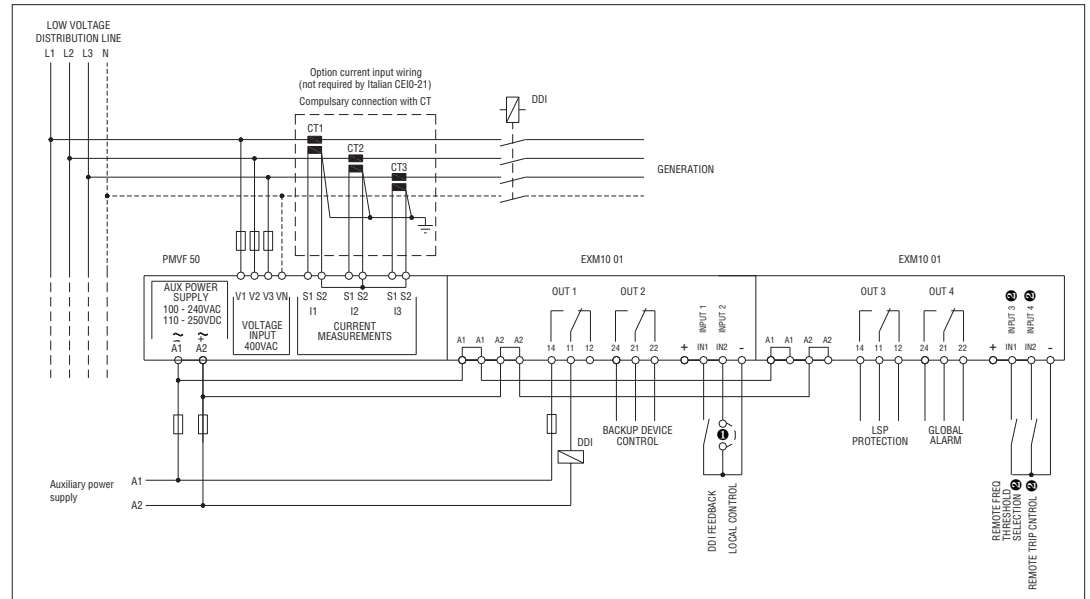
MECHANICAL DIMENSIONS [mm]



WIRING DIAGRAM

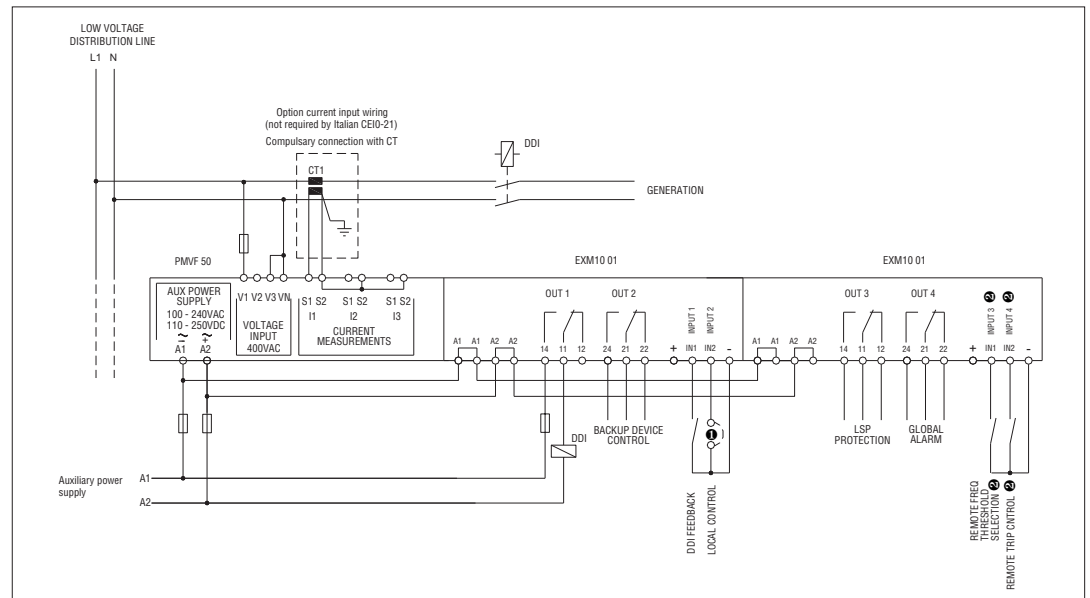
3-phase connection, with or without neutral

P01.03 = Three-phase



Single-phase connection

P01.03 = Single phase



NOTES

- ① Local control.
- ② Terminal numbering on the product indicate IN1 and IN2 which respectively correspond to IN3 and IN4 functions described.

- Recommended fuses:
- Auxiliary power supply and voltage measuring input F1A (fast-acting).
- Contactor control: Max F5A (fast-acting)

- Terminals S2 are jumpered internally.
- The DDI auxiliary (feedback) contact must be connected.
- If installing multiple DDIs, the DDI feedback contact must be one connected parallel with all the DDI auxiliary contacts.
- For single-phase installations, connect terminal V3 to VN.



ATTENTION: Terminals A1 of EXM10 01 modules are jumpered internally; the same is valid for terminals A2.
 Free terminals A1 and A2 can only be used to power other EXM... modules (Max 1 extra).
 Maximum current 500mA.
 Max. current rating of fuses: F1A.

TECHNICAL CHARACTERISTICS

Auxiliary power supply	
Rated control supply voltage Us	100 - 240V~ / 110 - 250V=
Operating limits	85 - 264V~ / 93.5 - 300V=
Frequency	45 - 55Hz
Power consumption/dissipation	Us 110 V~ 8.5VA 4.4W max Us 230 V~ 12.5VA 5W max Us 110V= 43mA 4.3W max Us 250V= 19mA 4.7W max
Micro-breaking immunity	≤200ms con Us 230VAC ≤50ms con Us 110VAC
Overload category	II
Rated insulation voltage Ui	250V~
Rated impulse withstand voltage Uimp	4.8kV
Power frequency withstand voltage (in AC 50Hz)	2kV
Voltage inputs	
Type of input	3-phase + neutral
Maximum rated operating voltage Ue	400V~ phase-phase 230V~ phase-neutral
Measuring range	20 - 480V~ phase-phase 10 - 276V~ phase-phase
Rated frequency	50Hz
Frequency range	45 - 55Hz
Type of measurement	True RMS
Type of connection	3-phase with or without neutral
Overload category	IV
Rated insulation voltage Ui	400V~
Rated withstand impulse voltage Uimp	7.3kV
Power frequency withstand voltage (in AC 50Hz)	2kV
Current inputs (optional)	
Rated operational current Ie	1A~ or 5A~
Measuring range	for 1A scale: 0.010-1.2A~; for 5A scale: 0.010-6A~
Type of input	Shunts powered by external current transformer (low voltage) 5A max.
Type of measurement	RMS
Overload capacity	+20% Ie
Overload peak	50A for 1 second
Burden (per phase)	≤ 0.6W
Accuracy	
Measuring conditions: Temperature	+23°C ±2°C
Phase voltage	± 0.2% (160...480V~) ±0.5 digit / ± 0.5% (50...160V~) ±0.5 digit
Phase-to-phase voltage	± 0.2% (277...830V~) ±0.5 digit / ± 0.5% (80...277V~) ±0.5 digit
Current	± 0.2% (0.1...1.2In) ±0.5 digit
Active energy	Class 0.5S (IEC/EN 62053-22)
Reactive energy	Class 2 (IEC/EN 62053-23)
Additional errors	
Temperature	0.03%/°K per V, A, W
Uscite a relè	
Relay outputs	4 ^①
Type of output	1 changeover contact
Rated operating voltage	250V~
IEC/EN 60947-5-1 designation	C300 / NO contact 5A 250V~ AC1 / 5A 30V= NC contact 2A 250V~ AC1 / 2A 30V=
Durata elettrica	NO contact 2x10 ⁴ operations NC contact 10 ⁴ operations
Mechanical life	10 ⁷ operations
Overload category	II
Rated insulation voltage Ui	250V~
Rated impulse withstand voltage Uimp	4.8kV
Power frequency withstand voltage (in AC 50Hz)	2kV

Digital inputs	
Number of inputs	4
Type of input	Negative (NPN)
Input voltage	24V= isolated
Input current	7mA
Low input signal (ON)	≤1.5V (typical 2.9V)
High input signal (OFF)	≥5.3V (typical 4.3V)
Rated insulation voltage Ui	24V=

Ambient conditions	
Operating temperature	-20 to +60°C
Storage temperature	-30 to +80°C
Relative humidity	<80% (IEC/EN 60068-2-78)
Maximum pollution degree	2
Altitude	≤2000m

Supply/voltage measuring circuit connections	
Type of terminals	Screw (fixed)
Number of terminals	2 + 4 + 4 for power supply 4 for voltage measurements
Conductor section (min - max)	0.2-4.0 mm ² (24-12 AWG)
Tightening torque	0.8Nm (7lbin)

Current measuring circuit connections	
Type of terminal	Screw (fixed)
Number of terminals	6
Conductor section (min - max)	0.2-2.5 mm ² (24-12 AWG)
Tightening torque	0.44 Nm (4 lbin)

Relay output connection	
Type of terminal	Screw (fixed)
Number of terminals	6 + 6
Conductor section (min - max)	0.2-2.5 mm ² (24-12 AWG)
Tightening torque	0.44 Nm (4 lbin)

Digital input connection	
Type terminal	Screw (removable)
Number of terminals	4 + 4
Conductor section (min - max)	0.2-2.5 mm ² (24-12 AWG)
Tightening torque	0.5 Nm (4.5 lbin)

Housing	
Type of housing	8 module (DIN 43880)
Mounting	On 35mm DIN rail (IEC/EN 60715) or by screw using extractable clips
Material	RAL 7035 Polyamide
Degree of protection	IP40 front; IP20 housing/terminals
Weight	615g

Certifications and compliance	
Comply with standards	Italian CEI 0-21 (June 2012), Italian CEI 0-21; V1 (Dec. 2012), IEC/EN 60255-5, IEC/EN 60255-26,

① Single isolation between relays Both relay outputs must be used with the same voltage group.

