

EMM-4ep-PF

DIGITAL MULTIMETER

GENERAL INFORMATION

The digital multimeters series EMM allow monitoring all the electrical parameters present on a distribution line. The local display of more than 30 electrical parameters is carried out by four displays with red led. A simple front panel completes the intuitive selection of electrical parameters, with great information. On top of the local measurement, these instruments display the maximum value of the main parameters (maximum peak and maximum demand).

The presence of a profibus-DP port allows the connection with PROFI-DP network, in order to establish easily a centralized network of measure.

Multimeters EMM, replace in a unique device, all the functions of voltmeters, ammeters, energy meters, cos-phi-meters, watt-meters, var-meters and frequency meters permitting a great economic saving of energy, overall dimensions and wiring.



AVAILABLE TYPES

There is available only one type:

- EMM-4ep-PF in flush mounted version for panel DIN 96X96mm with minimize depth

ACCESSORIES AND OPTIONS

accessories: transparent cover for protection type.

options: neutral amperometric input (-n)
currents measure inputs with internal current transformer (-t)

MEASURED PARAMETERS

measured parameters	measuring unit	identification initials			
phase and three phase system voltages	[V-kV]	V L1-N	V L2-N	V L3-N	Σ V L-N
phase to phase voltages	[V-kV]	V L1-L2	V L2-L3	V L3-L1	Σ V L-L
phase and three phase system currents	[A-kA]	I L1	I L2	I L3	Σ I
phase and three phase system power factors		PF L1	PF L2	PF L3	Σ PF
phase and three phase system active powers	[W-kW-MW]	W L1	W L2	W L3	Σ W
phase and three phase system reactive powers	[VAr-kVAr-MVAr]	VAr L1	VAr L2	VAr L3	Σ VAr
phase and three phase system apparent powers	[VA-kVA-MVA]	VA L1	VA L2	VA L3	Σ VA
frequency	[Hz]	Hz L1			
three phase system active energy	[kWh]	Σ kWh			
three phase system reactive energy	[kVArh]	Σ kVArh			
peak values (maximum):					
phase voltages	[V-kV]	V L1-N max	V L2-N max	V L3-N max	
phase currents	[A-kA]	I L1 max	I L2 max	I L3 max	
average phase currents (maximum demand)	[A-kA]	I L1 max (avg)	I L2 max (avg)	I L3 max (avg)	
three phase system powers	[W-VAr-VA (k-M)]	Σ W max	Σ VAr max	Σ VA max	
average three phase system powers (maximum demand)	[W-VAr-VA-(k-M)]	Σ W max (avg)	Σ VAr max (avg)	Σ VA max (avg)	

INSTALLATION

INSTRUCTIONS FOR THE USER

Read carefully the instructions/indications contained in this manual before installing and using the instrument.

The instrument described in this manual is intended for use by properly trained staff only.

SAFETY

This instrument has been manufactured and tested in compliance with EN 61010-1 standards. In order to maintain these conditions and to ensure safe operation, the personnel must comply with the indications and markings contained in the manual. When the instrument is received, and before being installed, check that it's ok. And it has not suffered any damage during transport. When starting installation make sure that the operating voltage and mains voltage are compatible with the device instructions. The auxiliary supply shouldn't be earthed. Maintenance and/or repair must be carried out only by qualified and authorized personnel. If there is ever suspicious that there is a lack of safety, during operation, the instrument must be disconnected and cautions taken against accidental use.

Operation is no longer safe when: - The measured values are obviously wrong or unreasonable. / - The instrument doesn't work. / - There is clearly visible damage. / - After serious damages occurred during transport. / - After lengthy storage under unfavourable conditions.

CONNECTIONS

For a correct use of the device, the wiring diagram contained in the present manual, must be respected.

The connections are same for all type:

- auxiliary power supply:

There are 4 screw terminals for the auxiliary supply:

Vac Version	
Terminals	Power Supply
1-2	0-110V = 100-125V 50-60Hz
1-3	0-230V = 220-240V 50-60Hz
1-4	0-400V = 380-415V 50-60Hz

Vac/cc Version	
Terminals	Power Supply
1-3	20-60V

Vac/cc Version	
Terminals	Power Supply
1-3	85-230V

It's possible, for example, to get the auxiliary supply from a phase to neutral, in a 4 wires system, or phase to phase in 3 wires system, without neutral or from a VT in a MV application.

- measurement voltage inputs:

4 terminals are available for connection to the 3 phases and neutral system. The maximum voltage phase to phase shouldn't be over 500 V rms. In case of three phase system without neutral, or non distributed neutral, leave terminal "N" free.

- measurement current inputs:

There are 6 terminals for connection with external CT's, secondary 5A (**which use is compulsory**). It is also possible to use with 2 CT's in a three wires line (three-phase Aaron connection).

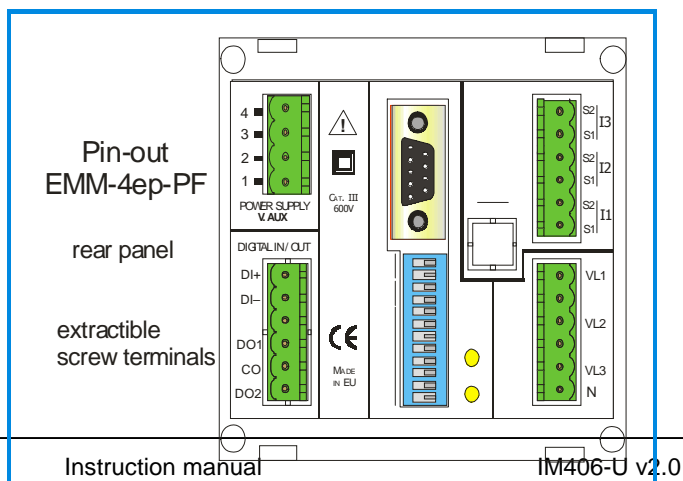
When the instrument is purchased with the Ineutral input option (suffix -n), it's possible connect an external CT, secondary 5A, to directly measure the current flowing into the neutral conductor. In the rear of instrument there are two terminals named In S1 and S2 available for this connection (see wiring diagram).

REMARKS: It's a must to respect the phase sequence. The connections between the current and voltage inputs must no be inverted (for example, CT placed on phase L1 must correspond to the L1 input). So as it is not correct to invert S1 and S2 terminals.

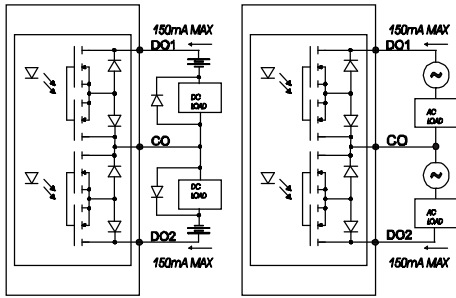
For fixing the flush mount version instrument to the panel, use the fixing devices supplied, by inserting them in the side grooves of the enclosure and tighten the screws.

For safety reasons, place an external fuse protection at the input voltages, and use adequate cables for the working voltages and currents, with a cross sections from 0,5 to 2,5 mm².

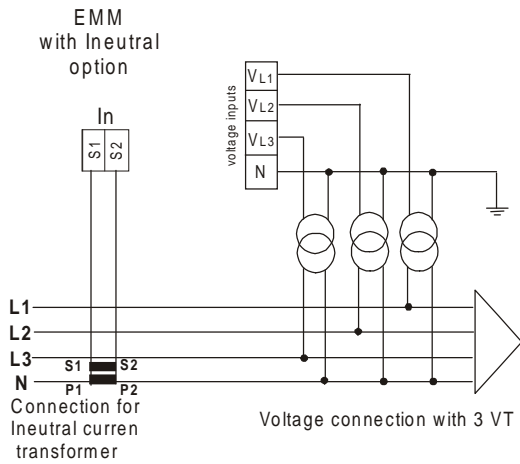
WIRING CONNECTION



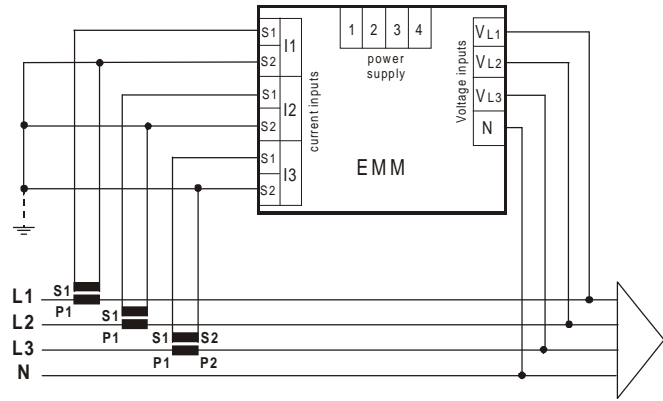
Digital output:
 output DO1 for ACTIVE ENERGY pulses,
 output DO2 for REACTIVE ENERGY pulses.
 Both can be used as ALARM and associated to
 one electrical parameter.



THREE-PHASE LINE WITH 4 WIRES AND 3 VT

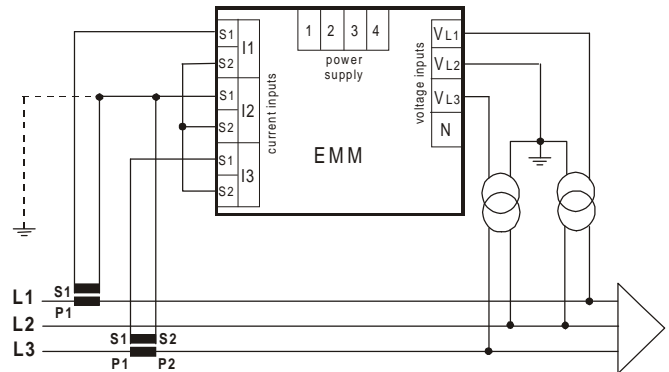


THREE-PHASE LINE WITH 4 WIRES



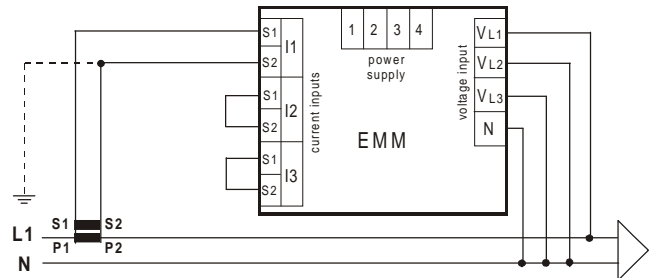
N.B. on 3 wires three-phase network (without neutral or not distributed neutral)
 leave terminal N free

THREE-PHASE LINE WITH 3 WIRES, 2 VT AND 2 CT (AARON wiring) (only for EMM-...t version)



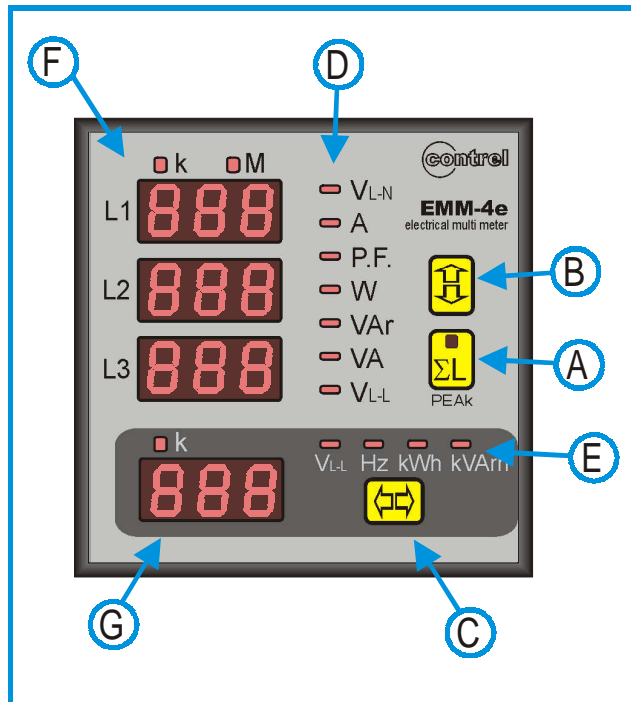
N.B. It's best, where possible, to use 3 CT (most of all for unbalanced loads)

SINGLE PHASE LINE



N.B. If the instruments are used on single phase line, the measures are
 referred to the phase L1. Others are not to be considered.

FRONT PANEL DESCRIPTION



DESCRIPTION:

- A:** push-button for the visualization of the electrical parameters of three-phase system and peak values with the corresponding led indication
- B:** push-button for the selection of the electrical parameter to be displayed on display **F**.
- C:** push-button for the selection of the electrical parameter to be displayed on display **G**.
- D:** led bar for the indication of the electrical parameter displayed on display **F**.
- E:** led bar for the indication of the electrical parameter displayed on display **G**.
- F:** 3 displays for the visualization of the electrical measures of every phase.
When ΣL LED is ON, only the main display will be active showing the three-phase system value of the electrical measure selected. Led **k** and **M** show the eventual multiplying factor (k=kilo=1.000, M=Mega=1.000.000). If so selected they also indicate the active and reactive energy counters.
- G:** display for the visualization of the electrical measure indicated in led **E** (excluding the energy counters).
The voltages value is referred to the three-phase system.
The **k** led displays the reading in kilo (x 1000).
- A+C:** when pressing simultaneously the instrument pass to the menu:
- instrument programming (**SET UP**)
 - visualization of memorized peak values (**PEA**)
 - deleting peak values and energy counters (**RESET**)
 - programming of digital and analogue outputs (**SET DO1** **SET DO 2**).

REAR PANEL DESCRIPTION

Dip-switch settings:

Function	Dip Switch							
	1	2	3	4	5	6	7	8
Profibus Address Settings								
Address 00	ON	ON	ON	ON	ON	ON	ON	ON
Address 01	OFF	ON	ON	ON	ON	ON	ON	ON
...
Address 127	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON

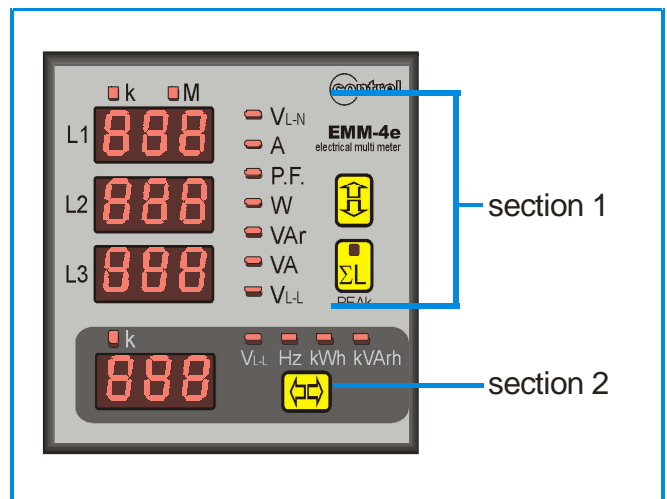
Function	Dip Switch	
Profibus Baud Rate Settings	11	12
Baud Rate : 9600	ON	ON
Baud Rate : 19200	OFF	ON
Baud Rate : 93700	ON	OFF
NOT USED	OFF	OFF

Dip-switches 9 and 10 not used.

MEASURES VISUALIZATION

The digital multimeters EMM-4ep-PF is divided into two sections: the first one is composed by three displays **F**, keys **A** and **B** and **D** led; the second one (in the gray zone) is composed by the display **G**, **C** key and the **E** led.

The two sections can be considered as two separated instruments in a unique device. Actually, it is possible to work in any section without modifying the display of the other one (excluding the displaying of peak values and the energy counters).



Display of section 1

The measures are visualized on displays **F** (respectively L1, L2 and L3) and the **D** led indicate the parameter. Regarding to the phase to phase voltage (VL-L), the three measures are respectively VL1-L2, VL2-L3, VL3-L1.

Select the different parameters by pressing the key **B** (they will always be signalled by the led **D**). By pressing the key **A**, the selected parameter in three-phase value (average of single phase for voltages, currents, power factors and the addition of the single phases for power) will be visualized on central display **F** (L2) with the corresponding glowing of its internal led. By pressing the same key again, it will return to visualize the phase parameters. The units of the measure can be expressed in kilo or Mega by the glowing of the corresponding led. To display the neutral current (under request) from measure visualization, it's necessary to press **B** key when the phase current are displayed: immediately on display **F** will appear the message INeUTR and after the neutral current's value measured by the input In S1 and S2. To set the correct current transformer ratio for this input, refer to section INSTRUMENT PROGRAMMING. The visualization of the capacitive power factor is represented by the – symbol before the first digit of the display (for example the reading -.95 indicates a capacitive power factor of 0.95).

Display of section 2

As considered in section 1 with the key **C** you can select the parameter to display, indicated by LED **E** (three phase system voltage values, the frequency of L1).

Display of energy counter

The active and reactive energy counters reading appears on the display **F**, selecting this feature with the push-button **C** (in this case, the display **G** remains without any function).

The reading of the energy counters uses the 9 digit (maximum reading 99999999.9) of the **F** display: the measure is displayed in the way that the L1 display will show the first 3 digit, the L2 display the second 3 digit and the L3 display the last 3 digit. For example if: L1=000, L2=028, L3=53.2 the reading is 2853.2 kWh.

Remarks on the measures

The refresh time of the display is less than one second and it corresponds anyhow to the calculation time of the measures, according to the measuring methodology used, thus providing an easy reading of the values also in presence of sudden variations of the measuring parameters.

In case the measures indicated by the instrument should not be reliable, it is necessary to verify the connection of the currents and voltages measure inputs, as it is absolutely important to respect the phases sequence, the compliance of currents and voltages of the same phase (on the L1 input must be connected the L1 phase voltage and the CT set on the L1 phase) as well as the current direction flow (the S1 terminals of the CT must be connected to the corresponding S1 terminals on the instrument).

In some applications, where the CT secondary circuit is connected to other instruments, besides the EMM multimeter, there might be some measurement problems regarding the typology of the current inputs. In this case it is advisable to use the optional (-t) version with internal current transformers.

Should you have any problem, please contact the Technical Assistance.

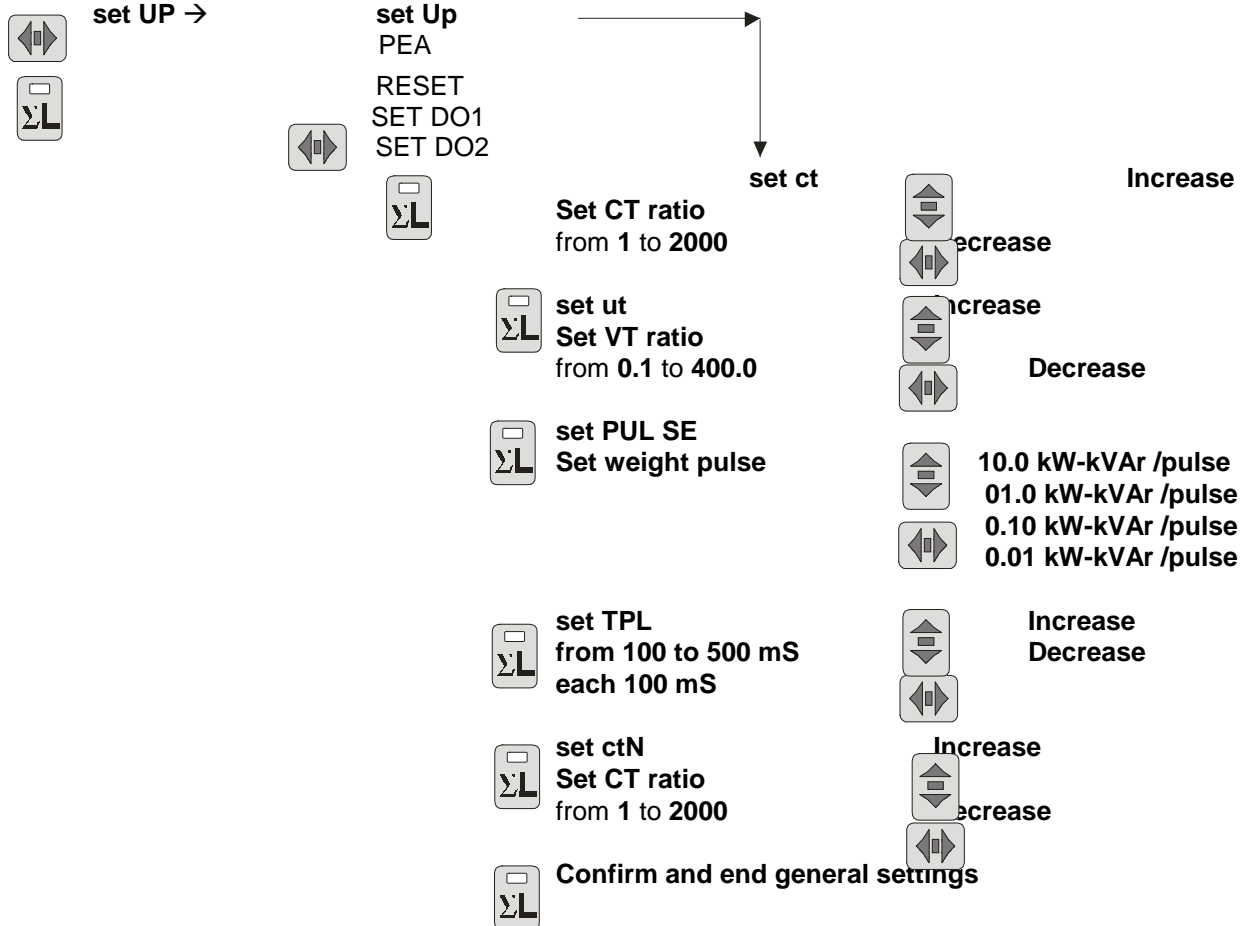
INSTRUMENT PROGRAMMING (SETUP) MENU

For a correct use of the multimeters, it is necessary to program the transformation ratio of the used current transformers and the transformation ratio of the eventual external voltage transformer. The set values are kept stored also in absence of the auxiliary power supply.

The setting of the pulse weight (**Set Pul Se**) and the time of the pulse duration (**Set Tpl**) are the same for both digital outputs. The function of each digital output is set in the menu **Set Do1** and **Set Do2** where is possible to choose between **PULSE** (emission of pulse proportional to the active/reactive energy counted) and **ALR** (activation of the output of threshold set).

SET GENERAL PARAMETER (SET UP)

Entry to menu:



Programming of the transformation ratio of the external current transformers (SET CT)

The programming of the CT ratio, intended as the ratio between the primary and the secondary circuit (example: with CT 1000/5 it must be set 200), has to be performed by using the front keys. Once the instrument is switched on, you should wait a few seconds (when the device is switched on, all led's and displays will flash alternatively with the indication of the firmware version), then press simultaneously the **A** and **C** keys; on the **G** display it will appear the **set (SETUP)** message, on the **F** display the **CT** (current transformer) message and the transformation ratio value (set to 1 by the manufacturer).

Press **B** or **C** keys to increase or decrease the value respectively (the variation is performed unit by unit). In order to speed up the operation, keep the **B** or **C** key pressed, the variation will be performed by tens and hundreds. To increase or decrease the value by unit, it is necessary to release and to press the button again.

To confirm the set value, press the **A** button; in this way it is possible to enter the next programming. If none key is pressed for 10 seconds, the instrument will automatically leave the programming menu and the eventual setting SHALL NOT be stored.

Programming of the transformation ratio of the external voltage transformers (SET UT)

After the previous programming step, on the **F** display it will appear the **Ut** (voltage transformer) message, and the value indicating the transformation ratio of the external VT (set to 1 by the Manufacturer), intended as the ratio between the primary and the secondary circuit (example with VT 15/0.1 kV the value to be set will be 150). This value can be set in the same way as it is done for the programming of the CT ratio. In case no external VT should be used, the value to be set will be 1.

REMARKS: When the set transformation ratio exceeds 999 in the setting of CT ratio or 99.9 in the VT ratio, the display L2 is also used to set the value. The digit of display L2 plus the digit of display L3 will show the value set.

Programming of the weight of the active and reactive energy pulse (seT PULSE)

After the above mentioned programming, by pressing the **A** key again, on the **F** display will appear the message **Pulse** and the value of the weight of one pulse settable on three values: **0,01 - 0,1 - 1 - 10** kWh or kVArh (for each pulse emitted the instrument has counted 0,01 - 0,1 - 1 - 10 kWh o kVArh).

Press the **B** key to increase the value or **C** key to decrease the value.

Programming of the duration pulse (SET TPL)

The message **TPL** will appear together the value of the duration pulse expressed in mS. It's possible to select the value from 100 mS to 500 mS, with 100 ms steps by using **B** key (to increase the value) and **C** (to decrease the value). Confirm the value pressing the **A** key.

Programming the transformation ratio of the current transformer for the neutral current input (CTN)

Remark: This menu is active only if the instrument has this option.

On the **G** display will appear the message **SET** and on the first **F** display the message **CTN** (Current Transformer Neutral ratio). Proceed in the same way as for programming the CT ratio as described before (i.e. with TA 1000/5 it'll set 200).

Confirm and go on to next setting by pressing the **A** key.

The menu is cyclic, after these setting, the first voices will appear again. It is always possible to get out of the programming and to come back to the measures visualization mode, by pressing the **A** and **C** keys simultaneously.

DISPLAY OF THE INSTANTANEOUS AND AVERAGE (MAXIMUM) PEAK VALUES (PEA)

From the measures visualization mode, press the **A** key for at least 5 seconds, on the **G** displays will appear the message **PEA**. Pressing the **B** button, it's possible to visualize on the **F** display the (maximum) peak value stored with the following sequence with the glowing of the corresponding LED for the displayed measure:

electric parameter	identification initials			display G
phase voltages	V L1-N max	V L2-N max	V L3-N max	PEA
phase currents	I L1 max	I L2 max	I L3 max	PEA
average phase currents	I L1 max avg	I L2 max avg	I L3 max avg	15'
three phase system powers	ΣW max	ΣVAr max	ΣVA max	PEA
average maximum three phase system powers	ΣW max avg	ΣVAr max avg	ΣVA max avg	15'
average three phase system powers	ΣW avg	ΣVar avg	ΣVA max avg	avg

To escape from setting and returning to measure visualisation, it's necessary to wait 8 seconds without to act on the buttons.

The integration of the average current calculation on 15' time comes synchronised at every switching on of the instrument.

Remark: The acquisition time of instantaneous peak values corresponds to 1 second.

DELETING OF THE PEAK VALUES AND THE ENERGY COUNTERS (RESET)

Pressing the **A** and **C** keys simultaneously the message **SET-UP** will appear on display **F**, press the key **C** until the message **RESET** appears on display **F**. To reach the menu, press the **A** key.

It is possible now to select the cancellation type by pressing the **C** key, according with following possibilities:

- RESET PEA** instantaneous values cancellation only
- RESET 15'** average values in 15' cancellation only
- RESET En** cancellation of energy meters
- RESET All** cancellation of instantaneous values, average and energy meters

To enable the chosen type, press the **B** key to change the indication on display **G** from **no** to **yes**.

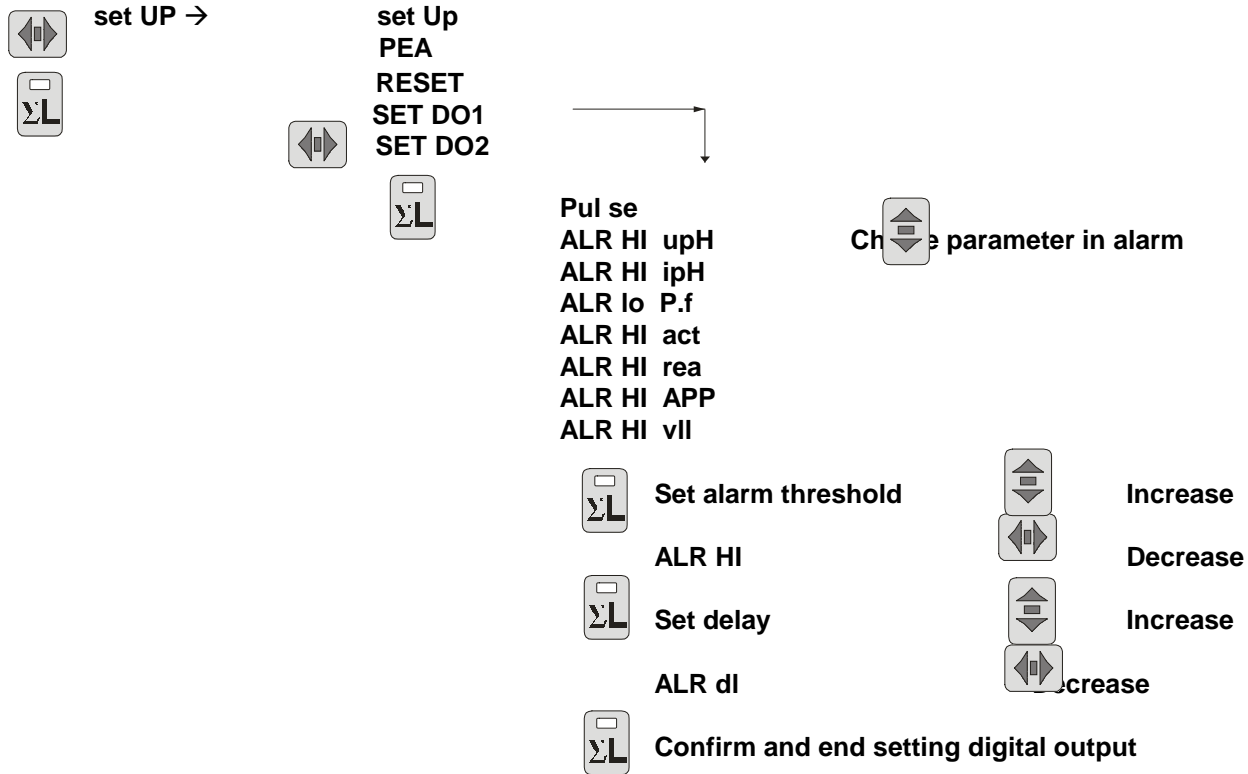
Confirm enabling cancellation, by pressing the **A** key.

The indication on display **G** change from **yes** to ---.

To escape from the deleting menu and to return to the measures visualising, press the **A** and **C** keys simultaneously.

PROGRAMMING OF THE ALARM OUTPUT (SET DO1 SET DO2)

Entry to menu:

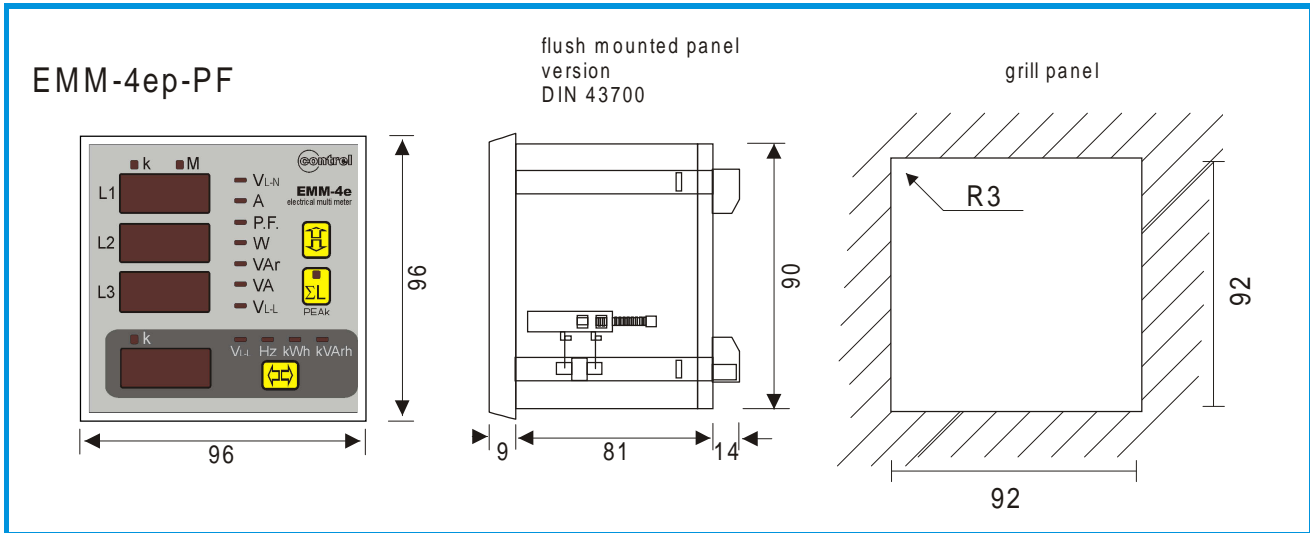


From the measures visualization, press at the same time the **A** and **C** keys, on the **F** displays will appear the message **Set Up**; press repeatedly the **C** key until the message **Set DO1** appears on the **F** display. Press the **A** key to select this setting. Select the parameters associated to the alarm output; by pressing the **B** and **C** keys until the parameter choice appears on the third part (L3) of **F** display and the glowing the corresponding led on the **D** bar. On the first part (L1) of **F** display will appear the message **ALR** while on the second part (L2) of the same display, it will appear **Hi** (for all parameters) or **Lo** (only for the power factor) to indicate the high or the low levels overcoming of the threshold. If the parameter is set on **PULSE**, the digital output works in emission pulse proportionally to the counted energies. The programming will be referred to the digital output indicated on **G** display (**DO1** o **DO2**). Press the **A** key to confirm, after the setting of threshold will be allowed. The value will be increased pressing the **B** button and decreased with the **C** key; the range depends on the selected parameter and on the CT and VT ratio set. Press **A** key to confirm. Now it's possible to set the delay that will pass between the alarm condition set and the activation of digital output. On **F** display will appear **ALR**, **DLY** and the value expressed in seconds (range 1÷900). The modification of the value is done in the same way of the threshold set. After the confirmation (**A** key) it will be possible to manage the output 2 (**DO2**). The set of the threshold of the parameter is linked to the CT and VT ratios sets. Make this operation after the set of CT and VT ratios. When the set of CT and VT are changed, it's necessary to confirm once again the full-scale values.

PROFIBUS-DP-V0 interface.

For operation and information about use in DP networks (GSD files, examples and others), please contact our sales department at contrel@contrel.it.

DIMENSIONS



TECHNICAL FEATURES

MEASURES, PRECISIONS	
voltage	true RMS of the phase voltages and voltages between lines and values of the three phase system; total measurement range : 20÷500V trms phase-phase - 290V rms phase-neutral, according to the auxiliary power supply voltage; display (0,02÷50,0kV) - measure precision: ±0,5% ±1 digit
current	true RMS of the phase currents and of the three phase system value; measurement range: 0,02÷5A trms display 0,02÷9990A - measure precision: ±0,5% ±1 digit
frequency	frequency of the L1 phase – measurement range: 40÷500Hz precision: ±0,5% ±1 digit
powers	Active, reactive, apparent phase power, three-phase system power; measurement range : 0,001÷9990kW - 0,001÷9990kVA - 0,001÷9990kVA; - precision: ±1% ±1 digit
power factor	phase and three phase system power factor; measurement range : -0,1÷0,1 - precision: ±1% ±1 digit
energy	three-phase active and reactive energy measurement range: 0÷99999999,9 kWh (kVArh) class 2 (IEC 61036) - precision: ±1%
AUXILIARY POWER SUPPLY, INPUTS	
auxiliary power supply	100-125 / 220-240V / 380-415V ±10% (others voltage on request) frequency 50-60Hz - consumption 3VA
voltage inputs	from 20 to 500V phase-phase (according to the auxiliary power supply voltage); permanent overload +20% - input impedance: 1 MΩ connection on three phase lines with 3 wires, three phase lines with 4 wires and single phase lines, MV connection with external VT and programmable transformation ratio from 0.1 to 400
current inputs	from 0,02 to 5A; permanent overload 30% - from external CT with secondary circuit 5A, programmable primary circuit from 5 to 10000A - auto-consumption <0,5VA
GENERAL INFORMATION	
display, operators	4 red LED displays (10mm each one) composed by 3 digits / 7 segments 3 push buttons for the selection of measures and programming
mechanical	protection degree: IP52 frontal side - IP20 enclosure and terminal board - weight: about 0,5 kg - connections with terminal boards for cable 2,5 mm ² thermoplastic self-extinguishing enclosure - built-in mounting DIN 96x96mm, depth 95mm
environmental	operating temperature: -10÷60°C; humidity <90% storage temperature: -25÷80°C insulation test: 3 kV for 1 minute
standards	CEI EN 50081-2; CEI EN 61000-6-2; CEI EN 61036-1; CEI EN 61010-1

Remark

In consideration of the evolution of the products and standards, the company reserves the right to modify at any time the features of the product described in this literature, therefore we recommend to always verify them beforehand. The manufacturer's liability for damages resulting from product defects "may be reduced or deleted (...) when the damage is attributable jointly to a product defect and to the negligence of the injured party or of a third party for whom the injured party is responsible" (Article 8, 85/374/CEE).

