

## EMM-3 MULTIFUNCTION VOLT/AMMETER

### GENERAL

The digital Multifunction Volt/Ammeter series EMM allow monitoring the main electrical parameters present on a distribution line. The local display of the electrical parameters is being made through 3 display with red LED, which grant a good and simultaneous reading of various measures. The intuitive selection of the measures to visualise, which are signalled by their corresponding LED, completes a clear and simple front panel, which offer a lot of useful information.

On top of the instantaneous measuring, these instruments visualise the maximum peak of the main parameters (maximum peak and maximum demand or maximum average value).

Multifunction Volt/Ammeter series EMM replace, in an unique device, all the functions of voltmeters, ammeters and frequency meters, permitting a great economic saving, due to reducing of dimension and wiring, so as optimising the instruments management, since one has most of all in one, for electrical boards, switch-boards and Gen-Sets.



### AVAILABLE MODELS

Several models, with various optional functions and outputs are available, either for flush mounting on front panel and for DIN rail mounting.

### INTRODUCTION

The EMM-3 is only featured for visualising the electrical parameters. The power supply is taken from the measured voltage or self-supplied.

### ACCESSORIES and OPTIONS

**Accessories:** transparent cover for frontal protection.

**Options:** power supply and measure voltages different than standard measuring current inputs with internal CT's

### MESURED PARAMETERS

Parameters	Measuring units	Identification Symbols			
Phase and three phase voltage	[V-kV]	V L1-N	V L2-N	V L3-N	Σ V L-N
Phase to phase and three phase system voltages	[V-kV]	V L1-L2	V L2-L3	V L3-L1	Σ V L-L
Phase and three phase currents	[A-kA]	I L1	I L2	I L3	Σ I
Frequency	[Hz]	Hz L1			
Hour meter	[hr]	hr1	hr2	hr3	
<b>Instantaneous Values:</b>					
Maximum phase voltage	[V-kV]	V L1-N max	V L2-N max	V L3-N max	
Minimum phase voltage	[V-kV]	V L1-N min	V L2-N min	V L3-N min	
Maximum phase to phase voltage	[V-kV]	V L1-L2 max	V L2-L3 max	V L3-L1 max	
Maximum phase current	[A-kA]	I L1 max	I L2 max	I L3 max	
<b>Measured value in 15'</b>					
Average phase current (maximum demand)	[A-kA]	I L1 max (avg)	I L2 max (avg)	I L3 max (avg)	

## INSTALLATION

### WARNING 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 person must comply with the indications and markings contained in the manual. When the instrument is received, before beginning installation, check that it's OK And it has not suffered any damage during transport. When starting installations make sure that the operating voltage and mains voltages are compatible with the device instructions. The instrument power supply must not be earthen. Only qualified and authorised personnel must carry out maintenance and/or repair. If there is ever the suspicious that, 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 instrument doesn't work. - There is clearly visible damage. - After serious damage incurred during transport. - After a storage under unfavourable conditions.**

## WIRING

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

The connections are available on the screw terminal:

### - Auxiliary power supply:

The power supply is take from voltage inputs.

There are 3 different auxiliary supplies:

Vn 110V = 100-125V 50-60Hz

Vn 230V = 220-240V 50-60Hz

Vn 400V = 380-415V 50-60Hz

**In the standard version the voltage is 400V and it's taken between the phases L2-L3.**

In the following table it's possible to see the measurable voltage depending of the type of power supply.

Power supply terminals	Rated voltage	Range of measurable voltage
L2-L3 (phase to phase power supply)	400V	300÷500V phase to phase (175÷290V phase-neutral)
	230V	175÷290V phase to phase (130÷170V phase-neutral)
	110V	85÷145V phase to phase (50÷85V phase-neutral)
L3-N (phase – neutral power supply)	230V	300÷500V phase to phase (175÷290V phase-neutral)
	110V	175÷290V phase to phase (100÷170V phase-neutral)

The standard version allows applying the instrument at all the three-phase network 400V with or without neutral supplied.

For example for application on single phase 230V it will need the L3-N / 230V. While for applications in medium voltage (for example using external voltage transformer 15 / 0.1 kV phase to phase) it will need the version L2-L3 / 110V.

### - measuring voltage inputs:

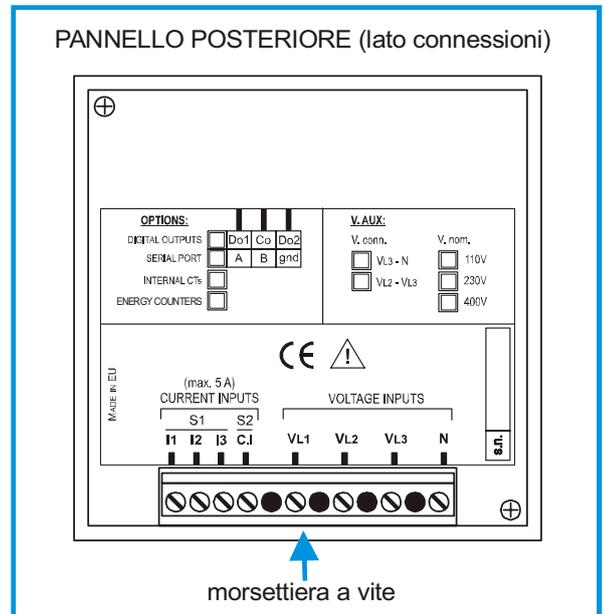
4 terminals are available for the connection to the 3 phase and neutral of the measuring network, the maximum voltage phase to phase shouldn't be over 500 V rms and it will always be depending on the auxiliary power supply.

In case of a 3 phase system without neutral, or non-distributed neutral, to leave terminal N free.

It's possible to use external voltage transformer. In fact the transformation rate of the external transducer can be set in the SETUP of the instrument and the visualisation allows the reading of voltage up to 40,0 kV.

### - measuring current inputs:

4 terminals are available for the connection to 3 external CT's with secondary 5A, it's possible to use 2 CT's on 3 wires system (three phases Aaron wiring). The use of external CT's is always necessary. The transformation rate of the external transducer can be set in the SETUP of the instrument and the visualisation allows the reading of voltage up to 9,99 kA.



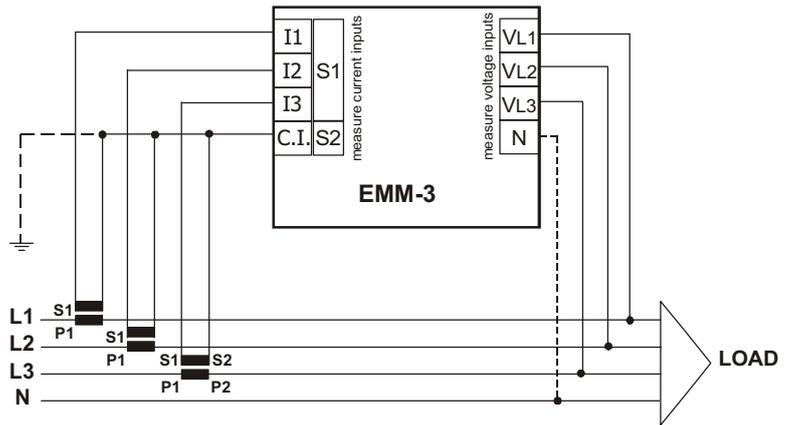
NOTE: It's a must to respect the phase sequence. The connections between current and voltage phase inputs must not be inverted (for example, CT placed on phase L1 must correspond to the I1 input). So as it is not correct to invert S1 and S2 terminals.

To fix the device at the panel, insert the two brackets into their corresponding groove holes, at the side of the enclosure and fix up the screws. It's better to put an external protection with fuses for the voltage inputs and to use adapted cables for the working currents and voltages: section from 0.5 to 2.5 mm<sup>2</sup>.

# WIRING DIAGRAM

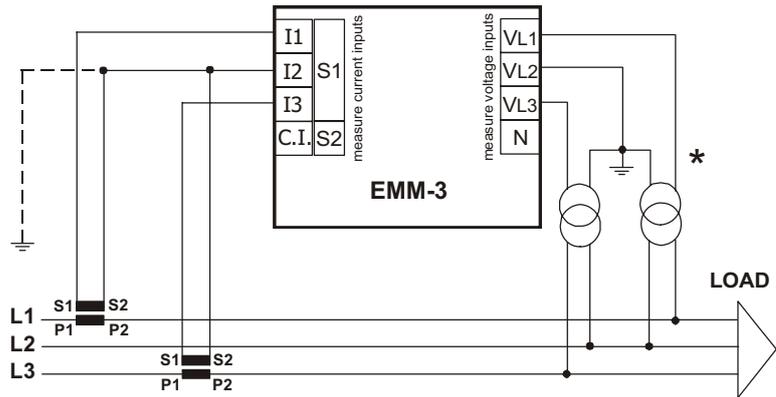
## THREE PHASE LINE WITH 3 OR 4 WIRES

on lines with 3 wires (without neutral or with neutral not supplied) the N terminal must not be connected

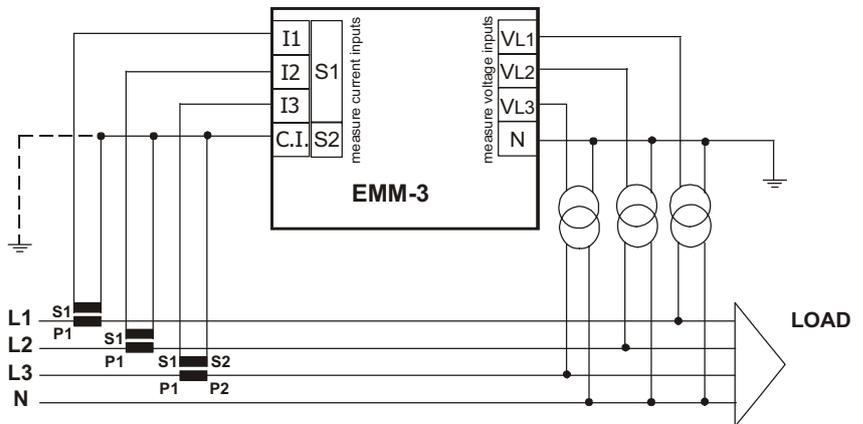


## THREE PHASE LINE WITH 3 WIRES AND 2 CT's (AARON wiring)

\*the voltage wiring with 2 VT is possible only for the version with internal CT's

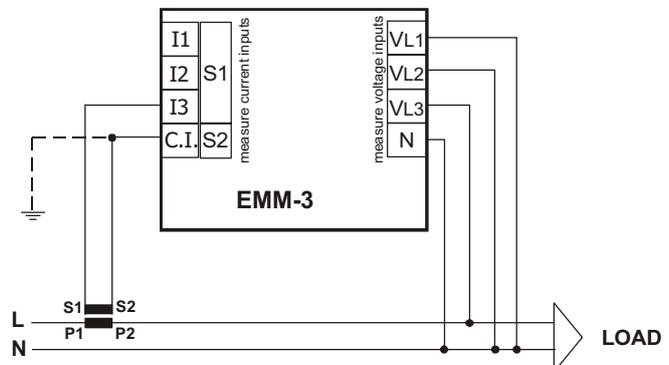


## THREE PHASE LINE WITH 4 WIRES AND 3 VT

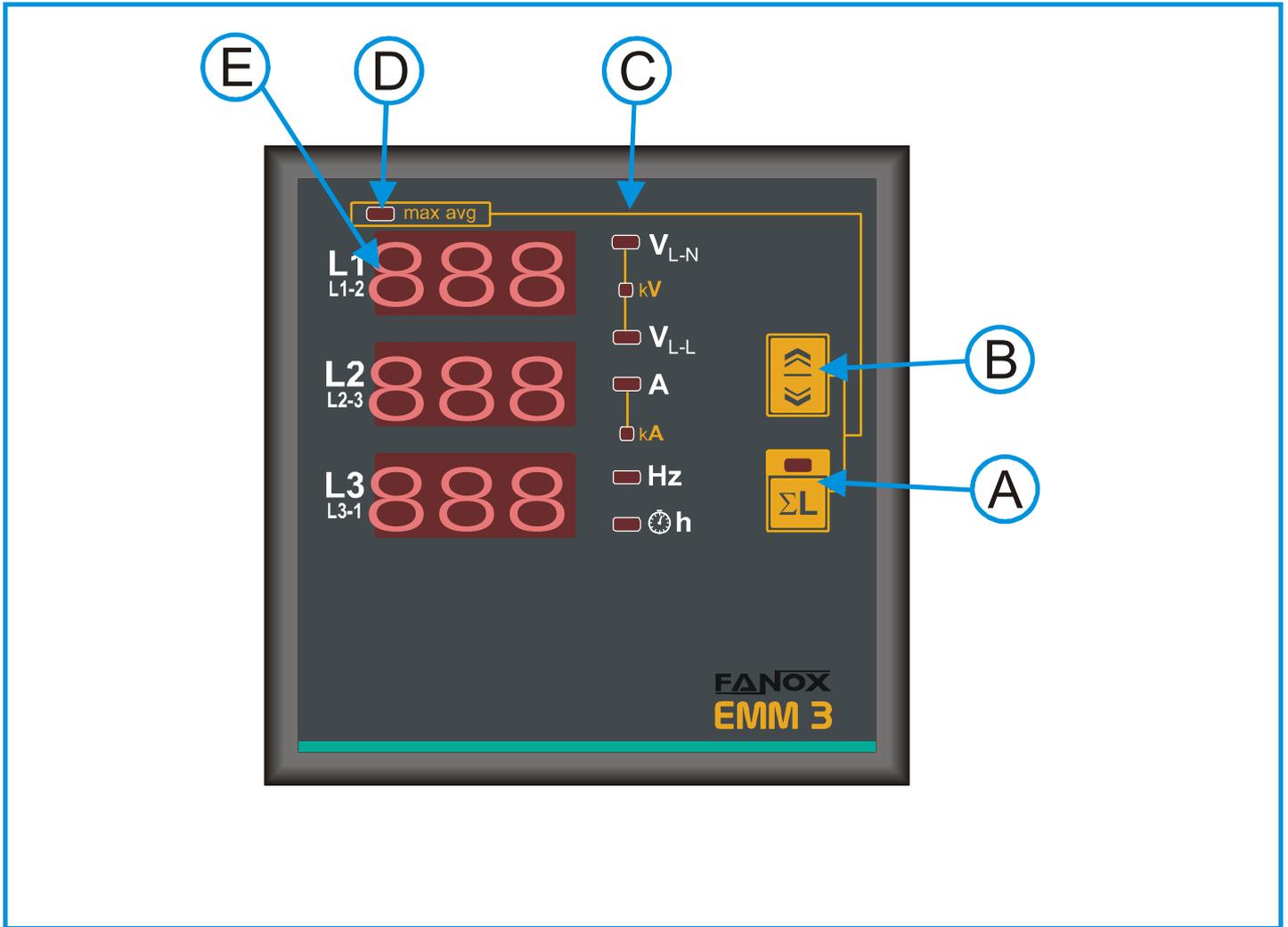


## SINGLE PHASE LINE

If the instruments are used on single phase line, the measures are referred to the L3 phase. Don't consider the other data displayed regarding to the three phase value system.



## FRONT PANEL DESCRIPTION



### DESCRIPTION:

- A:** Push-button for visualising of the three phase system parameters with the corresponding indication LED. By pressing during 5 seconds, user accedes to programming the instrument (**SETUP**).
- B:** Push-button for selecting the measures to visualise on display **E**.
- C:** LED's for indicating the measures visualised on display **E** and the eventual multiplier factor of each parameter (reading k =kilo x1000).
- D:** LED for indicating the visualisation of the memorised peak values.
- E:** Three displays for visualising the measures, subdivided by phases. Should the LED  $\Sigma L$  be glowing, it indicates the three-phase system value of the selected parameter.
- A+B:** By pressing the two keys simultaneously at the visualisation mode, it accedes to the visualisation of the memorised peak values.

## MENU OF INSTRUMENT PROGRAMMING (SETUP)

For a correct use of the instruments it's necessary to program the transformation rate of the CT's and the transformation rate of the eventually voltage transformers. The values set are hold also in absence of the auxiliary power supply.

### - Programming of the transformation rate of the external CT's

The programming of the CT's rate considered as the rate between primary and secondary (example: with CT 1000/5, we must set 200), must be done with the push-button on the front panel.

After the connecting the power supply to the instrument and waiting few seconds (all LED's will glow and the first indication of the firmware appears on the display and all segments will glow later), press and keep pressing the key **A** during 5 seconds, when the message **seT Up** will appear on the display **E**. By pressing the key **A** again it will appear the message **CT** (current transformer) and the value of the transformation rate (set to 1 by the manufacturer).

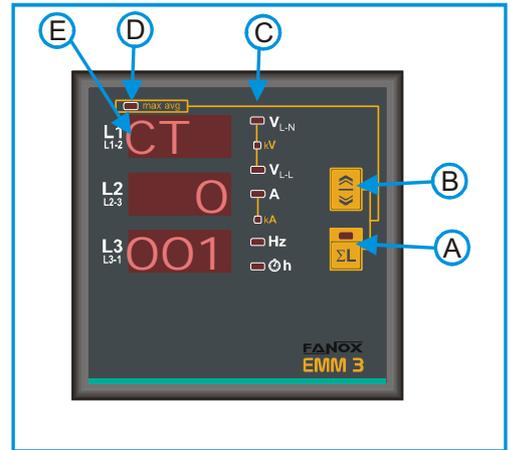
To increase the value press the **B** button or **A** button reduce the value (the variation is unit for unit).

To increase the speed up the value setting, it's necessary to hold pressed the **B** or **A** button, the variation will happen successively by tens and hundreds.

To come back to increase or to reduce the value on unit by unit way, it's necessary to release and to press the key again.

To confirm the value set press the **A** button; in this way the instrument will pass to the successive programming.

If no key is pressed during a 10-second interval of time, the instrument will exit automatically from programming, without saving the selected value.



### - Programming of the transformation rate of the external voltage transformers

After the precedent programming, the message **VT** (voltage transformer) will appear on display **E** together with the value of the transformation rate of the external VT (set to 1 by the manufacturer), considered as the rate between primary and secondary (example with VT 15/o.1 kV the value will be 150).

In the same way as programming the CT's rate, it will be possible to set this value. If external VT are not used the value to set will be 1.

To confirm the value press the **A** button. The instrument will exit from programming and it will enter in the visualisation modality.

### -Activating or cancelling the automatic scrolling

This allows selecting ON for activating or OFF for cancelling the automatic scrolling of the measures visualisation.

## MEASURES VISUALISATION

The measures reading is visualised on the display **E**, showing the three phase measures (L1, L2 y L3 respectively) of the indicated parameter by the **C** LED. For measuring the phase to phase voltage (V L-L), the three measures are understood V L1-L2, V L2-L3, V L3-L1 respectively, as indicated on the front plate.

The selection of the parameter to be visualised is made by pressing the key **B**. It will be indicated by the **C** LED.

By pressing the key **A**, the selected parameters will be visualised on display **E**, as three phase values (average of the individual phases for voltages and currents) with the corresponding lighting of the LED, placed internally in the key. In this case, by pressing the key **B** it will be possible to show: either the three-phase voltage, calculated as the average of the phase voltage, or the phase to phase voltages (it will be indicated by the corresponding LED **C**). In the mode of visualisation of the three-phase system (LED ΣL glowing), we will have following lights and readings:

- LED **VL-N** or (**VL-L**) and the display **L1** will show the average phase voltage (or average phase to phase)
- LED **A** and the display **L2** will show the average current
- LED **Hz** and the display **L3** will show the frequency on line L1

By pressing the **A** key again, it will return to visualise the phase values.

Please note that the unit value may be expressed in kilo, when the corresponding LED **C** are glowing (indicated in the front plate as **k**).

The visualised frequency is referred to the line L1.

## HOURLY METER VISUALISATION

Pressing the **B** key, after the frequency visualisation, the phase hours counter will appear on the displays. The led **h** is on. The reading of the meters uses the 6 digits (maximum reading 99999.9) of the display **E**: the measure comes visualised in such a way that, the display L1 will show the first 3 digits, the display L2 the second 3 digits and the display L3 the identification of the corresponding hour meter (hL1, hL2 or hL3).

The hours counter is activated when the current of the corresponding phase exceeds the 1% of the end-scale.

## VISUALISING THE INSTANTANEOUS AND AVERAGE PEAK (MAXIMUM) VALUES

By pressing the **A** and **B** keys simultaneously, the instrument enters into the visualisation of the peak (maximum) values: The LED **D** will glow. The memorised peak (maximum) values, which might be selected by the **B** key, will be shown on the display **E**.

The indication of the value and the value itself will be visualised alternatively on the display **E**.

If no key is pressed during an interval of time of 10 seconds, the instrument will return automatically to the visualisation of measures.

There are two types of the maximum memorised values:

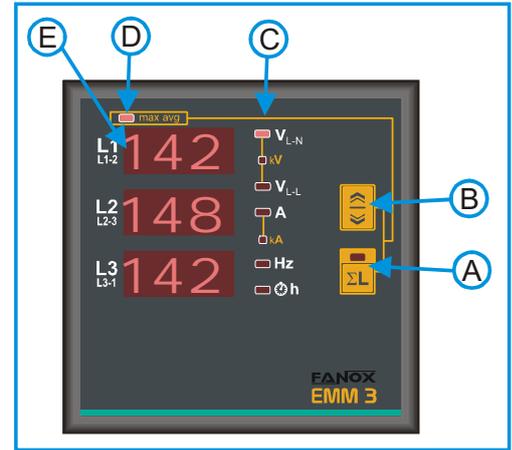
The instantaneous maximum memorised value is the maximum reached value of the parameter, during 1-second at least.

The average maximum values (maximum demand) memorise the maximum average value of the parameter, reached during the last 15 minutes.

The integration for calculating the average values is synchronised every time that the instrument is switched on.

During the visualisation of the maximum memorised values, the values are visualised by alternating the indication of the visualised parameter with the measured values.

The maximum values of the parameters, which are selectable with the **B** key, are as follows:



Parameter	Display	Signalling LED
VL-N maximum instantaneous	IST HI	VL-N
VL-N minimum instantaneous	IST LO	VL-N
VL-L maximum instantaneous	IST HI	VL-L
I phase maximum instantaneous	IST LO	A
I phase average maximum	15' HI	A

### Cancellation of the peak values

Enter in programming mode (**SETUP**), press the key **B** until the message **ReseT** appears on the display **E**, then press the key **A** and the message **RES ALL NO** will appear on display **E**. By pressing the key **B** the message will change to **RES ALL yes**. If confirmation is made with the key **A**, all memorised data will be cancelled. The exit of the cancellation menu is made automatically.

### **NOTE regarding the measures**

The refresh time of display is lower than 1 second and it corresponds to the processing time of measure according to the used measuring methodology, allowing a comfortable reading of values, also in presence of unexpected deviation of the measured parameters.

Should the case be that the instrument is being used in a single-phase line, please bear in mind that the valid values are referred to phase L3. Other visualised values shouldn't be considered, since they correspond to three-phase system.

In case that the indicated measures aren't reliable or they are absurd, it's important to check carefully the current and voltage inputs connection, so as the phase sequence. Check that current and voltage correspond to the same phase (on input L1 it will be connected phase voltage L1 and the CT will be placed on phase L1), thence terminal S1 of CT will be wired to the relative terminal S1 on the instrument.

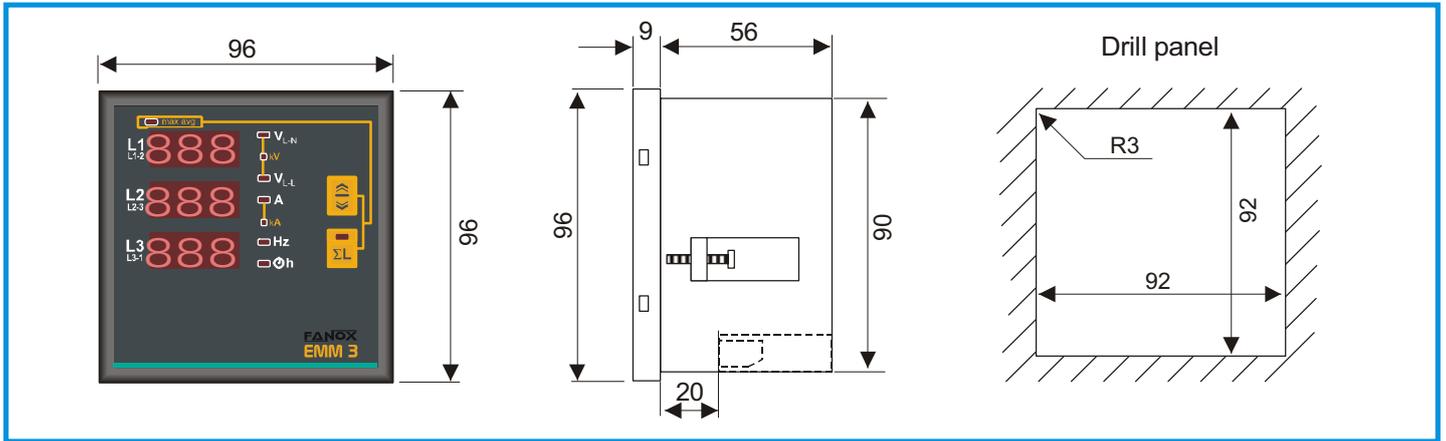
If the secondary of the CT is connected to other instruments also, it can be experienced some measuring problems, according with the typology of current inputs. Should that be the case, the user should select the option of the instruments type (T) with internal CT's.

## TECHNICAL CHARACTERISTICS

MEASURES, ACCURACY	
Voltage	True rms for the phase, phase to phase and three-phase voltage Total measuring range: 20÷500V trms phase-phase - 290V rms phase-neutral, depending always to the power supply voltage. Visualization (0,02÷50,0kV) – measuring accuracy: ±0,5% ±1 digit
Current	True rms for the phase and three-phase currents. Measuring range: 0,02÷5A trms - accuracy: ±0,5% ±1 digit Visualization 0,02÷9990A
Frequency	Frequency of the phase L1 – measuring range: 30÷500Hz accuracy: ±0,5% ±1 digit
AUXILIARY POWER SUPPLY -INPUTS	
Aux. power supply	Standard 380-415V ±15% - options 100-125 / 220-240V ±15% Frequency 50-60Hz - absorption 3VA Voltage taken from the measuring voltage inputs
Voltage inputs	from 20 to 500V phase-phase (always depending on the auxiliary supply); permanent overload +20% - impedance at the input: 1 MΩ Three-phase wiring with 3 or 4 wires, and single-phase wiring MV connection through external VT with programmable transformation ratio from 1 to 400
Current inputs	From 0,02 to 5A; permanent overload 30% - from external CT's with secondary 5A primary programmable from 5 to 10000A – self consumption <0,5VA
GENERAL	
Display and keyboard	3 display with red LED of 10 mm each, made of 3 digits of 7 segments 2 keys for selection of measures and programming
Mechanical	Protection degree: IP52 frontal - IP20 enclosure and terminals - weight: approx. 0,5 kg. Wiring through terminals for screws, cross section cable of 2,5 mm <sup>2</sup> Self-extinguishing plastic enclosure –Flush mounting DIN 96x96mm, depth 56mm
Environment	Working temperature: -10÷60°C; relative humidity <90% Storage temperature: -25÷70°C Isolation test: 3 kV during 1 minute
Standards of reference and Marking	CEI EN 50081-2; CEI EN 61000-6-2; CEI EN 61010-1



## DIMENSIONS



For other applications, please contact with FANOX technical assistance department.

### NOTE

Due to the continuous evolution of standards and products, the company reserves itself the rights of modifying the characteristics of the present product, at any time.

The manufacturer's liability due to damages caused by defects of the product... might be reduced or superseded (...) when the damage has been caused jointly, by a product's defect or/and by cause of the injured party or a person under the injured party's responsibility" (Article 8, 85/374/CEE).