EMS-96

Electrical Measurement Supervisor

User Manual

IM1200-U v1.0

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This documentation is consigned to the customer to enable the correct and safe operation of the instrument; any other use of documentation is strictly prohibited.

TERMS OF WARRANTY

The warranty is valid for the period of twelve months after material receipt.
The warranty covers free repair or replacement of equipment parts, which are recognized as faulty due to manufacturing defects.
Warranty does not cover those parts which results defective due to misuse or improper use, incorrect installation or maintenance, operation by unauthorized personnel, damage during transportation, or which in any case do not show manufacturing defects of the equipment.
Not included in the warranty terms are technical interventions regarding equipment installation to electrical systems.
The manufacturer declines any responsibility for eventual injury or damage to persons, animals or things as result of failure to follow the instructions in the user manual or caused by improper use of equipment.
The expenses of transport as well as the relative risks of same both to and from the place of repair, will be the sole responsibility of the user.
This warranty expires after the date of purchase and any assistance required after said date including spare parts, labour, transport of personnel and material will be charged to the user following the tariffs in force for Technical Assistance Service at the time of such requested service.
In any case the replacement of the equipment as well as the extension of warranty after such breakdown is excluded.

Description

The EMS (Electrical Measurement Supervisor) has advanced analysis functions that allow the measurement of the main electrical parameters: voltage, current, frequency, power factor, active and reactive power, active and reactive energy. The instrument allows the measurement and analysis in real time of electrical parameters, also verifying the quality of the energy thanks to THD measurement. Bidirectional metering of energy allows both production and consumption of energy to be monitored with a single device. All information monitored by the analyzer can be transmitted to remote locations through communication interfaces RS485, Ethernet with the support of numerous protocols including Modbus RTU, Modbus TCP/IP and Profibus DP. Interaction with the control and supervision systems is possible using inputs and outputs, all programmable. EMS reads and displays the energy values measured in other energy meters connected to the network. This is achieved thanks to digital inputs, which are able to acquire the impulses generated by the counters. In this case, EMS acts as a data concentrator. It not only collects information from the electricity meters but also from the water, gas meters or other. EMS allows a complete, in-depth analysis of the network quality thanks to the measurement of the harmonic distortion (20^{th} order) of the voltage and current signals.

Configuration Models

Model	Class	CT	Neut. CT	Supply	I/O	COM1	COM2	Exp. Mem.
EMS-96	1	**1A**	**Option**	**90÷250 Vac/dc**	2DO **2AO** **2AO+2DO** **4AO** **4AO+2DO**	**RS485**	**RS485** **Profibus** **MBUS** **LON** **ETH/Modbus*** **ETH/Modbus* + Wifi**	---
EMS-96H	1	**5A**		**24÷48 Vac/dc**	2DO **2DO+4DI** **4DO+2DI** **6DO** **2AO** **2AO+2DO** **4AO** **4AO+2DO**	RS485	**/S***** **Wifi** **/S*** + Wifi**	**Option**
EMS-96-ETH/WEB**	**0.5S** **0.2S**	**TT**				RS485		

OPTION STANDARD

* Ethernet port with Modbus TCP/IP protocol

** Ethernet port with Modbus TCP/IP protocol and Web server

*** RS485 managed by ETH port

Software Options

Model	Timeband* & Preset	Harmonics & SAG	Energy Graphics & Log
EMS-96	to enable	to enable	to enable
EMS-96H	enabled	enabled	enabled
EMS-96-ETH/WEB	enabled	enabled	enabled

* 4 Timebands, optionally is possible to choose 8 or 16 Timebands

To enable one or more options it's necessary to input a code (Enable option item) in the instrument setup. If the options are requested at the moment of the order the code is already loaded and showed on the instrument report. After the installation, to enable one or more options it is necessary to request the code to the seller, sending the serial number. The seller will deliver the new code to load in the instrument setup.

Measures Table

Parameters	System	L1	L2	L3	Min-Max Rel.	Min-Max Abs.	Average	Max Demand
Voltage L-N	X	X	X	X	X	X	X	X
Voltage L-L	X	X	X	X	X	X		
Current	X	X	X	X	X	X	X	X
Power Factor	X	X	X	X	X	X	X	X
Cos φ	X	X	X	X	X	X	X	X
Tan φ	X	X	X	X	X	X	X	X
Active Power	X	X	X	X	X	X	X	X
Reactive Power	X	X	X	X	X	X	X	X
Apparent Power	X	X	X	X	X	X	X	X
Frequency	X	X	X	X	X	X	X	X
THD Voltage	X	X	X	X	X	X		
THD Current	X	X	X	X	X	X		
Harmonics		X*	X*	X*				
Active Energy OUT	X	X	X	X				
Reactive Energy IN	X	X	X	X				
Reactive Energy OUT	X	X	X	X				
Apparent Energy	X	X	X	X				
Expected Power	X	X	X	X				
SAG		(X)*	(X)*	(X)*				

(X): only the selected electric line

*: option

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

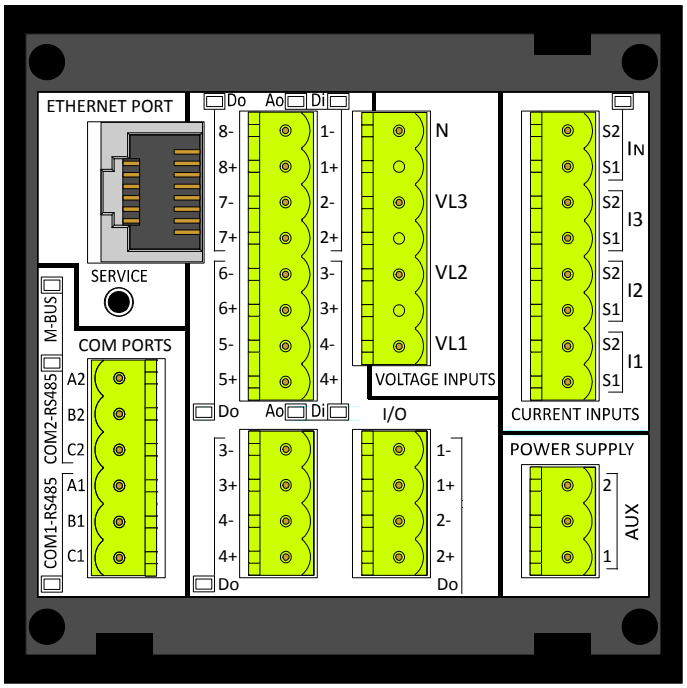
This device has been manufactured and tested in compliance with EN 61010-2 standards. In order to maintain these conditions and to ensure safe operation, it need to comply with the indications and markings contained in the manual.
When the device is received, before beginning installation, check that it's O.K. 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 device power supply must not be earthed.
Maintenance and/or repair must be carried out only by qualified and authorized personnel. If there is ever the suspicious that, that there is a lack of safety, during operation, the device must be disconnected and cautions taken against accidental use.

Operation is no longer safe when:

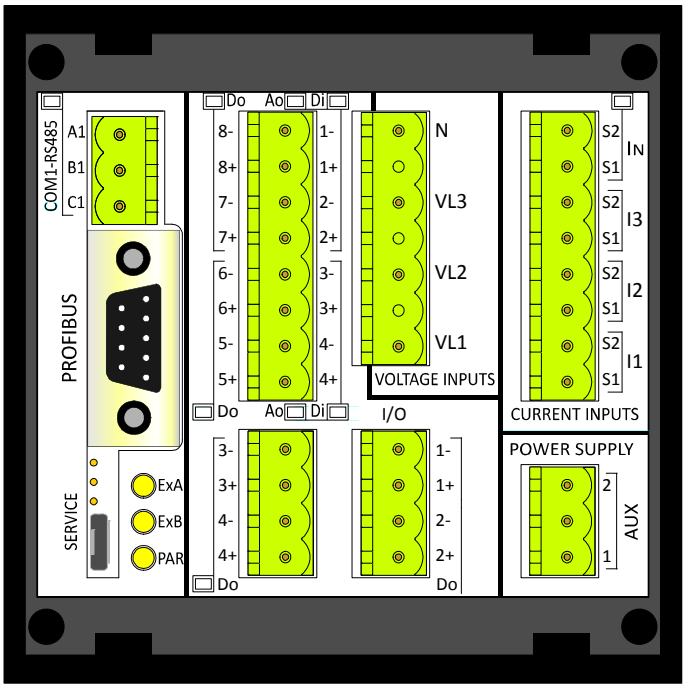
- **The instrument doesn't work.**
- **The measured value are obviously wrong or unreasonable.**
- **There is visible damage.**
- **After serious damage incurred during transport.**
- **After a storage under unfavourable conditions.**

During normal operation of the devices, hazardous voltages at its terminals and in particular on the terminals of voltage and current transformers connected and on the terminals of the digital input and outputs.
The secondary circuits of the voltage and current transformers are capable of generating hazardous voltages and currents when their primary circuit is powered.
Follow the standard safety precautions when performing any installation or service (such as making sure that the power supply is disconnected, disconnecting the fuses of the transformer voltages, short-circuiting the secondary of current transformers etc.).
Don't use the instrument when failure may cause injury or death, or generate sufficient energy to cause a fire.
The instrument is equipped with a fuse on the power supply type: 5x20mm 1A 250V time lag.

Connections

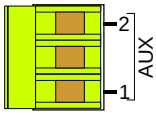


EMS-96-ETH with all I/O and COM ports terminal boards.



EMS-96 or EMS-96H with all I/O, COM port terminal boards and profibus port.

Auxiliary power supply

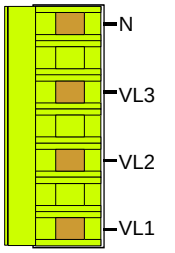


The instrument can be supplied with a voltage independent by the monitoring line. In this case, the instrument continues to operate independently by the voltage present on the lines under control.
Alternatively, only for 90÷250Vca/cc version, it is possible to take the power from the network under test, using the phase and neutral for a 4-wire network, phase to phase in a 3-wire system without neutral or from a VT in a MT application. In this case when the voltage of the monitored line falls below the minimum limit, the instrument turns off.
The instrument can be supplied in two different configurations of power supply:

Standard Version
90÷250 Vac/dc

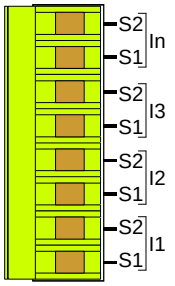
Option Version
24÷48 Vac/dc

Voltage Inputs



4 terminals are available for direct connection to 3 phase network with neutral. In case of a 3 phase balanced system without neutral, or non distributed neutral to leave terminal N free.
3 inputs, range 30 ÷ 400Vac phase to neutral - 52 to 693Vac phase to phase (see Technical Features table for details); over these values must used the external voltage transformers.
Frequency range: 50/60Hz.
Permanent overvoltage allowed: 480Vac phase to neutral - 830VAC phase-phase.
Overvoltage category: II (permanent installations).
Pollution degree: 2 (normally non-conductive, conductive condensation temporary).
Input resistance: > 1.8MΩ.
Load (Burden) for each voltage input: 0.09VA.
Note: To detect the frequency of the network the terminal VL1 must be always connected.

Current Inputs



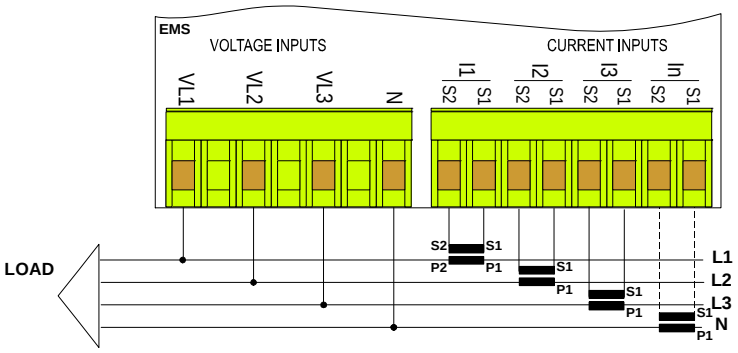
Current measurements can be performed by connecting the terminals of Current inputs.
All current inputs are isolated by current transformers with different ranges depending on the model of the instrument.
They can be interfaced directly to the line to be monitored or to be connected to the output of external CT with higher range.
The connections to the lines to be monitored are described in chapter "**Wiring diagrams**".
With neutral current input option installed, the instrument allows the direct measurement of neutral current in the same way described for the line inputs.
NOTE: it is essential to observe the correct phase sequence, not invert the connections between the phases of the current inputs and voltage (i.e. the CT placed on L1 phase must absolutely match at I1 Current and VL1 voltage). Do not invert the terminals S1 and S2 of the CT because the measurement of power factors, and the powers would no longer be trusted.

Version 5A
Three-phase current inputs isolated by 3 internal current transformers.
Nominal current range 50mA÷5A; over these values must be used the external current transformers.
Load (Burden) for each current input: 0.0009VAmax.

Version 1A
Three-phase current inputs isolated by 3 internal current transformers.
Nominal current range 10mA÷1A; over these values must be used the external current transformers.
Load (Burden) for each current input: 0.0009VAmax.

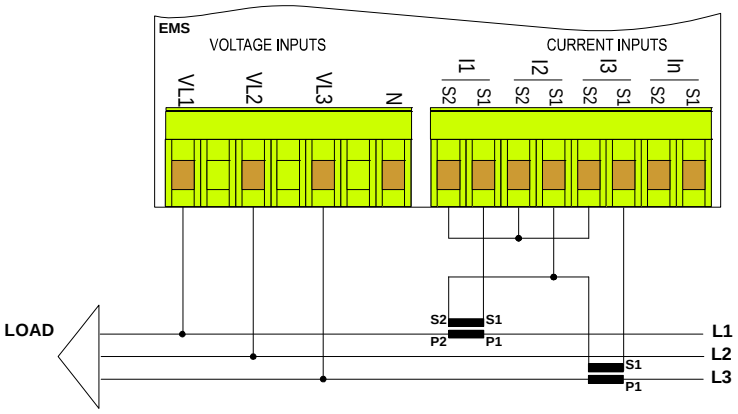
Neutral Current: the nominal current range according with CT version (5A or 1A).

Three-Phase, 4-Wires Y Configuration



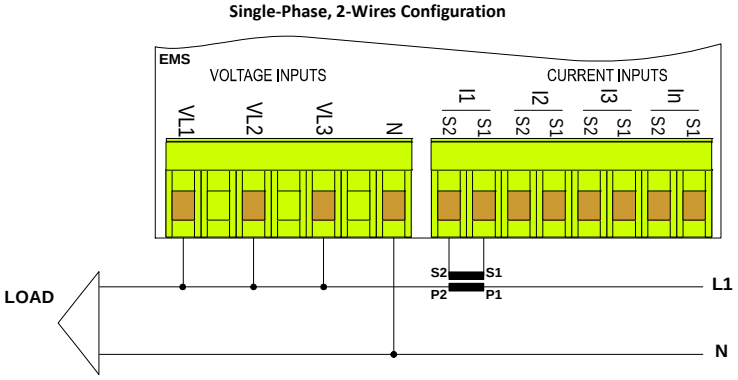
In case of connection in a 3 phase network (without neutral or with neutral not distributed) don't connect the N terminal.

Three-Phase, 3-Wires Δ Configuration. ARON insertion (2CT)



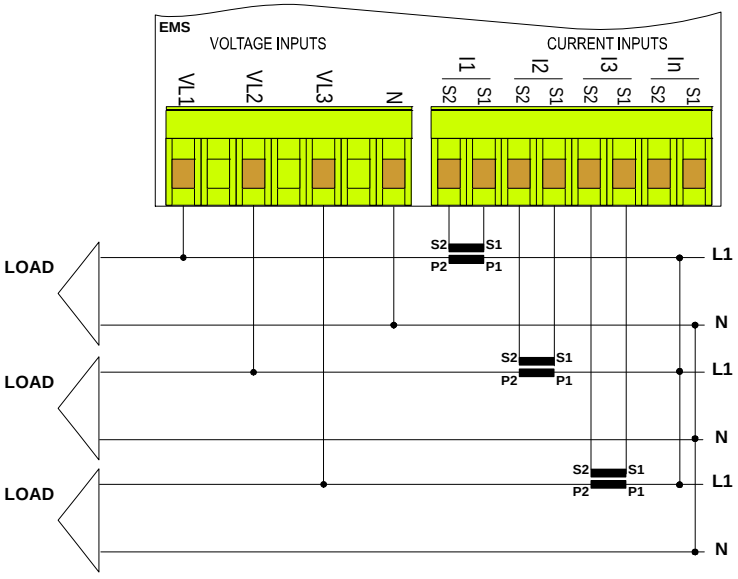
This connection with only 2 CT allows to measure accurately the three-phase currents.

Single-Phase, 2-Wires Configuration



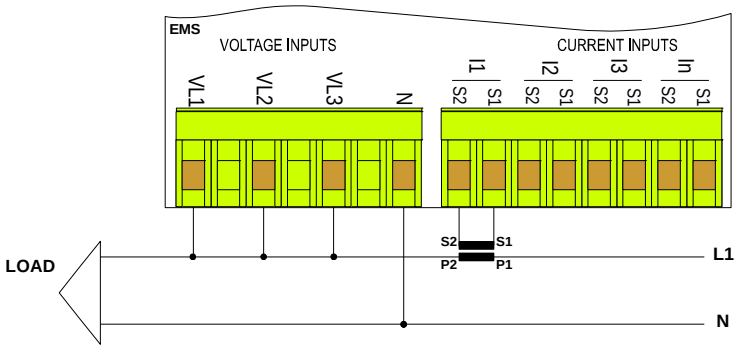
This connection can be used with distributed and equal loads.
It is possible to measure the current on one phase (using only one CT). The unmonitored phase currents are mathematically calculated.
The measurement of neutral current is optional.

Single-Phase, 3 multiple loads in the same network, 2-Wires Configuration



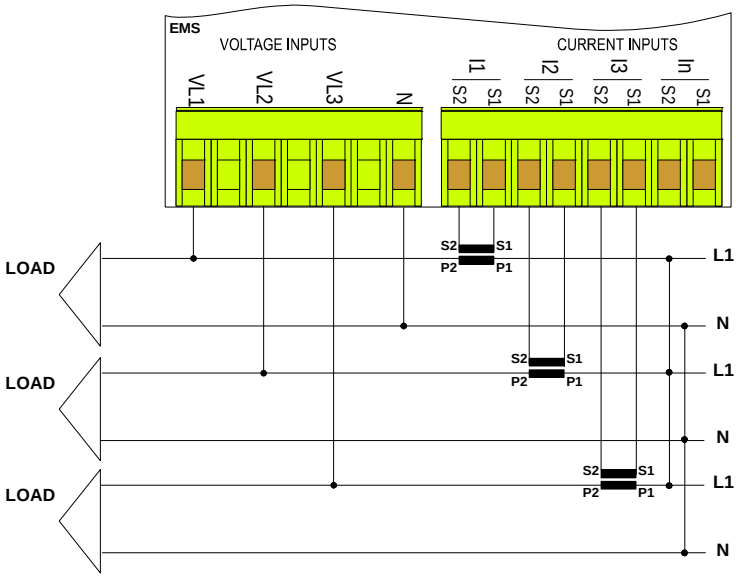
In presence of multiple balanced loads in a three-phase network, the instrument calculates the electrical parameters checking a single phase current for each load, allowing to limit the number of CT used.

Single-Phase, 2-Wires Configuration



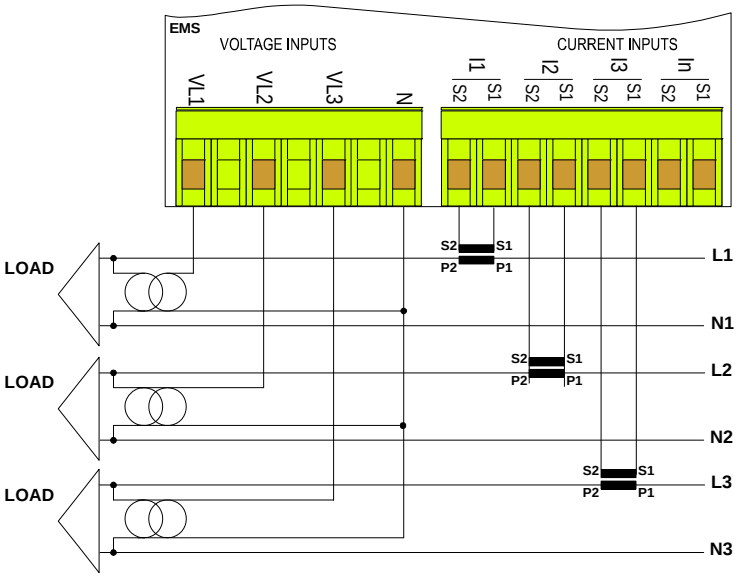
It is mandatory to connect the current input I1 and voltage input VL1.

Single-Phase, 3 multiple loads in the same network, 2-Wires Configuration



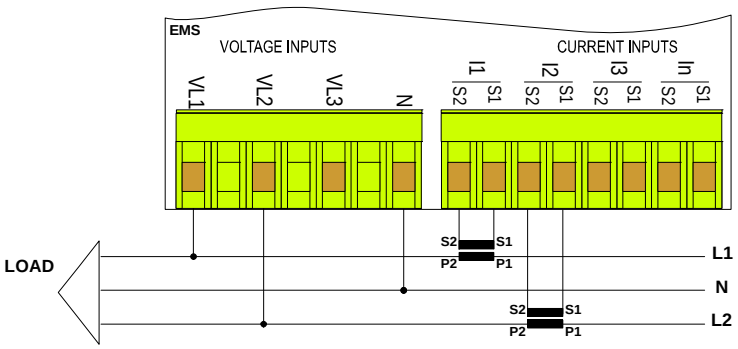
The electrical parameters are measured for individual loads.
For correct calculation of power and energy, is mandatory to connect the voltage inputs related to the used current inputs.

Multiple Single-Phase, 3 multiple loads in 3 different networks, 6-Wires Configuration

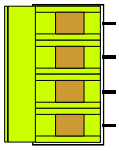


If necessary to apply a multiplier factor “K” to adapt the measure read, please consider that only one K for voltages and only one K for currents can be set.

Two-Phase, 3-Wires Configuration



Digital Outputs



2 pulse / state digital outputs are available on the device. In option it is possible to have others pulse / state digital outputs or simply others state digital outputs.
The technical features are:
- Compliance with CEI EN62053-31 (Class A devices)
- Maximum of digital output available: 8
- Isolation level: $4KV_{RMS}$ for 60 sec.
- Output type: Photo-MOS (solid state); a *"non-closed Output"* is comparable to an open contact
- Output voltage/current: $10\div300V_{DC}$ $150mA_{max}$; $12\div250V_{AC}$ $150mA_{max}$
- R_{ON} = 8Ωtyp. ($12\Omega_{MAX}$)
- ***"Pulse"*** output mode:
- T_{ON_min} 30ms; T_{OFF_min} 30ms
- Pulse output period adjustable from 60ms to 1000ms
- Pulse polarity programmable (active closed or active open)
- Programmable pulse "weight".

Output protections: varistor for transients; ***current limiting to be provided externally.***
The PhotoMOS have a behaviour identical to a mechanical contact which closes. Therefore, there are not problems with the polarity.

Digital Inputs (option)

The EMS can be equipped with isolated Digital Inputs.
The Digital Inputs are available only with the relative option.
The technical feature are:
- Number of Digital Input: 2 or 4 depending on the option version
- Input Configuration: independent inputs (no common pins)
- Isolation level $3.5KV_{RMS}$ for 60 sec
- Voltage Input Range: 24, 48, 115, 230Vac/dc (only one of the available options to choose in the order)
- Nominal Input Current: max 5mA each @ all nominal voltages
- Input Filter: Digital
- Basic Operation Mode: pulse counter, status, change of time-band
- T_{ON_min} 30ms; T_{OFF_min} 30ms;

The Voltage input must be defined before to order the instrument.
The AC/DC digital input are independent (no common pin) and can be wired without polarity care.

Analog outputs (opzione)

The instrument can be equipped with analog outputs. The options available allow to have 2 or 4 analog outputs matched or not with 2 digital outputs. Each output can operate independently of others in voltage or current. The technical features are:
- Isolation level: $3.5KV_{RMS}$ for 60 sec
- Lenght of connection: up to 1200m
- Resolution: 12 bit (4096 values)

- Range*:	0÷20mA or 4÷20mA	0÷10V or -10÷10V or 0÷5V or -5÷5V
- Load*:	Max: 600Ω	Min: 1KΩ
- Settling time*:	50µs (0÷20mA) @R_{LOAD}=1KΩ, C_{LOAD}=200pF, L_{LOAD}=1mH	50µs (-10 ÷10V) @R_{LOAD}=1KΩ, C_{LOAD}=200pF
- Error*:	Max 0.5 on E.S. Typical 0.2 on E.S.	Max 0.3 on E.S. Typical 0.1 on E.S.

- Linearity:0.01 on E.S.
- Thermal stability: 0.01 on E.S.

* The values indicated in the left column are referred to the current analog output; in the right column to the voltage analog output.
The analog outputs are polarized.

I/O options

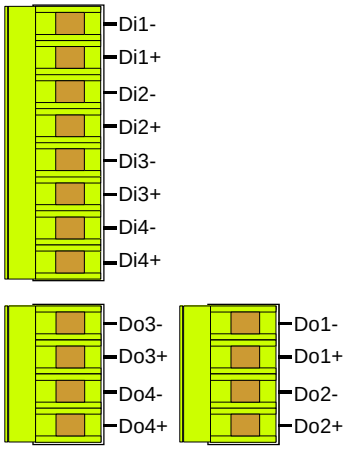
It's possible to add 7 optional configurations of I/O at the standard configuration:

a) 4 digital inputs and 2 digital outputs
b) 6 digital outputs
c) 2 digital inputs, 4 digital outputs
d) 2 analog outputs
e) 2 analog outputs and 2 digital outputs
f) 4 analog outputs
g) 4 analog outputs and 2 digital outputs

4 digital inputs and 2 digital outputs (option)

With this option the instrument will be equipped with:

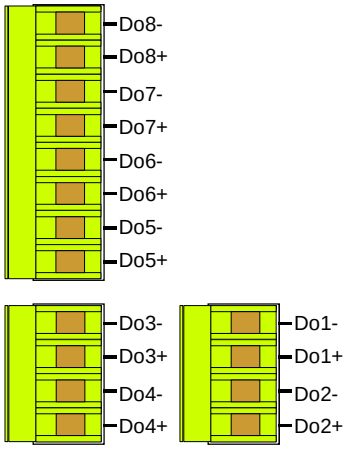
- 4 digital inputs
- 4 pulse / state digital outputs.



6 digital outputs (option)

With this option the instrument will be equipped with 8 digital outputs divided in the following way:

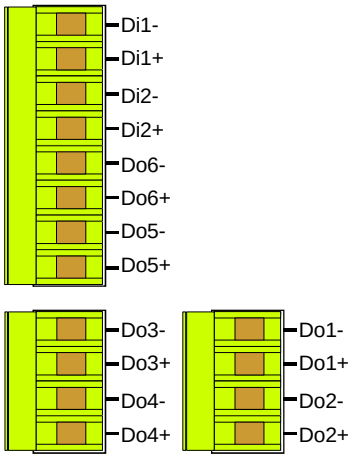
- 4 digital outputs
- 4 pulse / state digital outputs.



2 digital inputs, 4 digital outputs (option)

With this option the instrument will be equipped with:

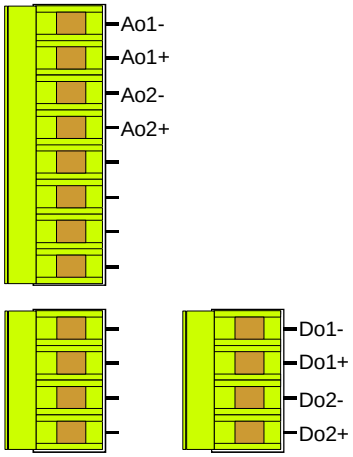
- 2 digital inputs
- 2 digital outputs
- 4 pulse / state digital outputs.



2 analog outputs (option)

With this option the instrument will be equipped with:

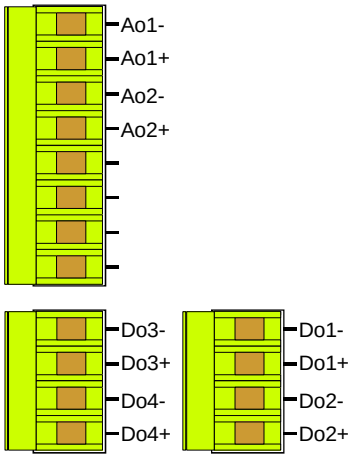
- 2 pulse / state digital outputs
- 2 analog outputs.



2 analog outputs, 2 digital outputs (option)

With this option the instrument will be equipped with:

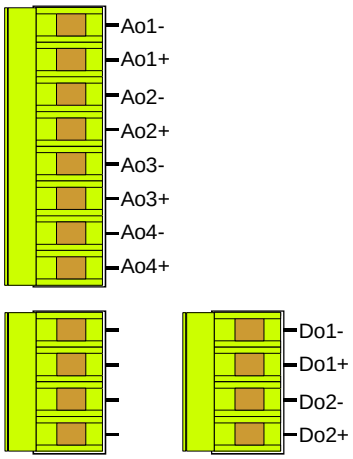
- 4 pulse / state digital outputs
- 2 analog outputs.



4 analog outputs (option)

With this option the instrument will be equipped with:

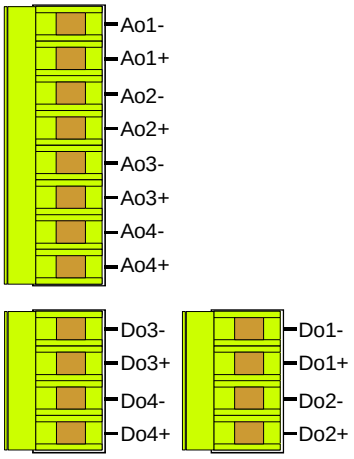
- 2 pulse / state digital outputs
- 4 analog outputs.

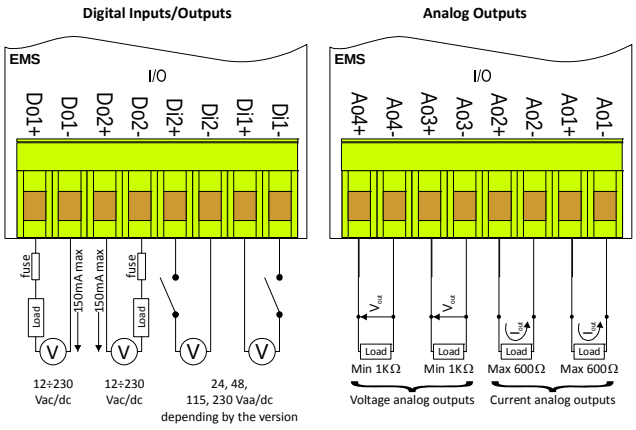


4 analog outputs, 2 digital outputs (option)

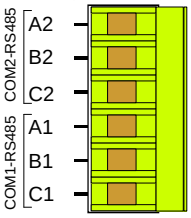
With this option the instrument will be equipped with:

- 4 pulse / state digital outputs
- 4 analog outputs.





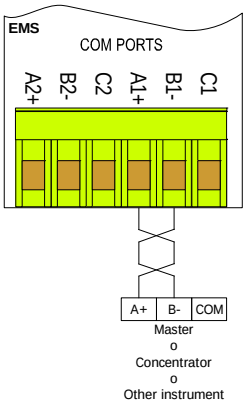
Serial ports (option)



Depending on the version, the instrument can be equipped with one or two isolated half duplex RS485 serial interface.
Two options are available:
1 serial port RS485 2 serial ports RS485
With these options the instrument can communicate with the external with the **Modbus protocol**. The two ports are independent and they can perform the same operations. The presence of the serial port RS485 allows the **software update**.

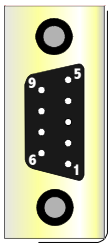
COM1
A1: +data
B1: -data
C1: common

COM2
A2: +data
B2: -data
B2: common



The instrument communicates via a asynchronous isolated serial interface in the standard RS485 Half-duplex that allows a connection in a network up to 247 nodes. This allows to implement a communication network between different instruments and a master unit (data concentrator) for a detailed control of an electrical installation.
The maximum length of the line depends on variables such as the transmission rate and characteristics of the cables used. It's recommend to use a shielded twisted pair cable with low attenuation, with a minimum section of 0.36mm^2 (22AWG) and capacity of less than 60pF / m.
The maximum length is about 1200m. For longer distances it's need to use signal amplifiers (repeaters). High networking length and/or where environments are electrically "noisy", it requires the use of two termination resistors (at the beginning and end of the line) of 100-120Ω. The use of repeaters is also necessary in the case of networks with more than 32 nodes.
At each repeater can be connected 32 units.
Please note that complex networks with large number of nodes cause a slower speed of response by the instruments.
Connection type: half-duplex (2 wires + common).
Isolation: opto-couples (3750 Vrms min.).
In the figure is showed a connection with a not shielded cable. In the shielded cable connection it's necessary to connect the shield to COM terminal.

Profibus port (option)



Profibus-DP is a multi-master systems. In the networks it's possible to have up to 126 devices on the same bus. In profibus-DP networks, the interchange of data between peripheral modules and the master is made automatically by the profibus controller, which 'virtualise' the data exchange memory of the DP devices in the memory of the master. In the following picture the pin-out of the Profibus-DP port:

1	Not connected	4	RTS	7	Not connected
2	Not connected	5	Gnd	8	RxD/TxD-N (A)
3	RxD/TxD-P (B)	6	Alimentazione (+5V)	9	Not connected

The profibus interface detects automatically the baud rate of the network; the baud rate available are:

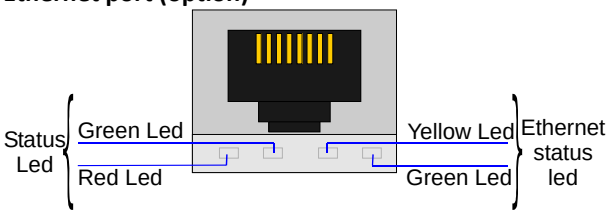
9.6 Kbit/s	19.2 Kbit/s	45.45 Kbit/s	93.75 Kbit/s	187.5 Kbit/s	500 Kbit/s	1.5 Mbit/s	3 Mbit/s

It's possible to request to the manufacturer application examples, GSD files and protocol manual (IM157).

The 3 yellow led on the back have the following meanings:
- instrument not parameterized: the 3 led turn on continuously in the sequence PAR - ExB - ExA
- instrument parameterized: led PAR turned on
- instrument parameterized and in communication: led PAR on, led ExA and ExB turn on independently

Service: port used by the manufacturer only.

Ethernet port (option)



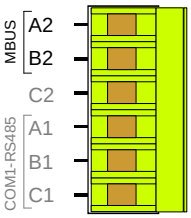
The Ethernet port (RJ45 connector) of EMS96 incorporates 4 LED (2 status LED and 2 Ethernet status LED).
The green LED of Ethernet status, Link/Data, is turned on when the Ethernet cable is plugged into the device. The LED blinks whenever an Ethernet pack is received. The yellow LED of the Ethernet status, 100BaseT, is turned on when the device links with the hub at 100Mb. The LED is off when the link is established at 10Mb.
The status LED indicates the communication in transmission TX (green LED) and the communication in receiving RX (red LED).

The SERVICE button has the function to restore the factory parameters following this steps: turn off the instrument, turn on the instrument, wait for end of blinking green LED, press and hold the button for at least 10 seconds, turn off and turn on the instrument.

The options available with the Ethernet port are:

a) Ethernet port with Modbus TCP/IP protocol
b) Ethernet port and Wifi with Modbus TCP/IP protocol
c) Ethernet port with Modbus TCP/IP protocol and Web server built
d) Ethernet port with Modbus TCP/IP protocol, Web server and an additional RS485 serial port used as Modbus RTU-TCP/IP converter
e) Ethernet port and Wifi with Modbus TCP/IP protocol, Web server and an additional RS485 serial port used as Modbus RTU-TCP/IP converter.

MBUS (option)

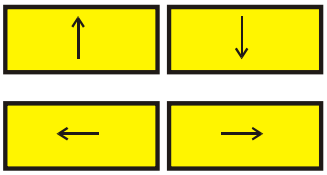


The wiring is performed using two conductors (MBUS1 and MBUS2 connected to A2 and B2) that are used for the data transmission and power supply of the MBUS communication module. The connection is independent of the polarity.

Function keys

Directional keys (Up/Down/Left/Right)

The directional keys are used to change the pages in Measures, Graphics, Info Device e Setup. In the next chapters the maps show how to move between pages. At the same time the directional keys allow to move and select items inside the Menu.

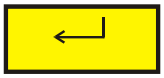


The **Up** and **Down** keys are used to increases and decrease or simply to change the set values in the Setup pages.

Pressing at the same time the **Left** and the **Right** keys it's possible to define the **default page**. The title page will change the colour and the "home icon" will appear near the text to confirm the new default.

Pressing at the same **Up** and **Down** keys to return to **default** from the actual page.

Enter key



The **Enter** key when pressed in Measures, Graphics, Info Device and Setup pages allows to enter in the Menu and it is used to confirm the item selected. In the Setup it allows to modify and to confirm the set value.

Esc key

This key is used:

- to skip without to confirm the modify
- when a page of Measures, Graphics, Info Device and Setup is displayed, pressing Esc the display will show all levels path to reach the last page opened by using the menu from the turning on of the instrument.

Frontal led

On the frontal panel there are two led that blink proportionally to the energy read.

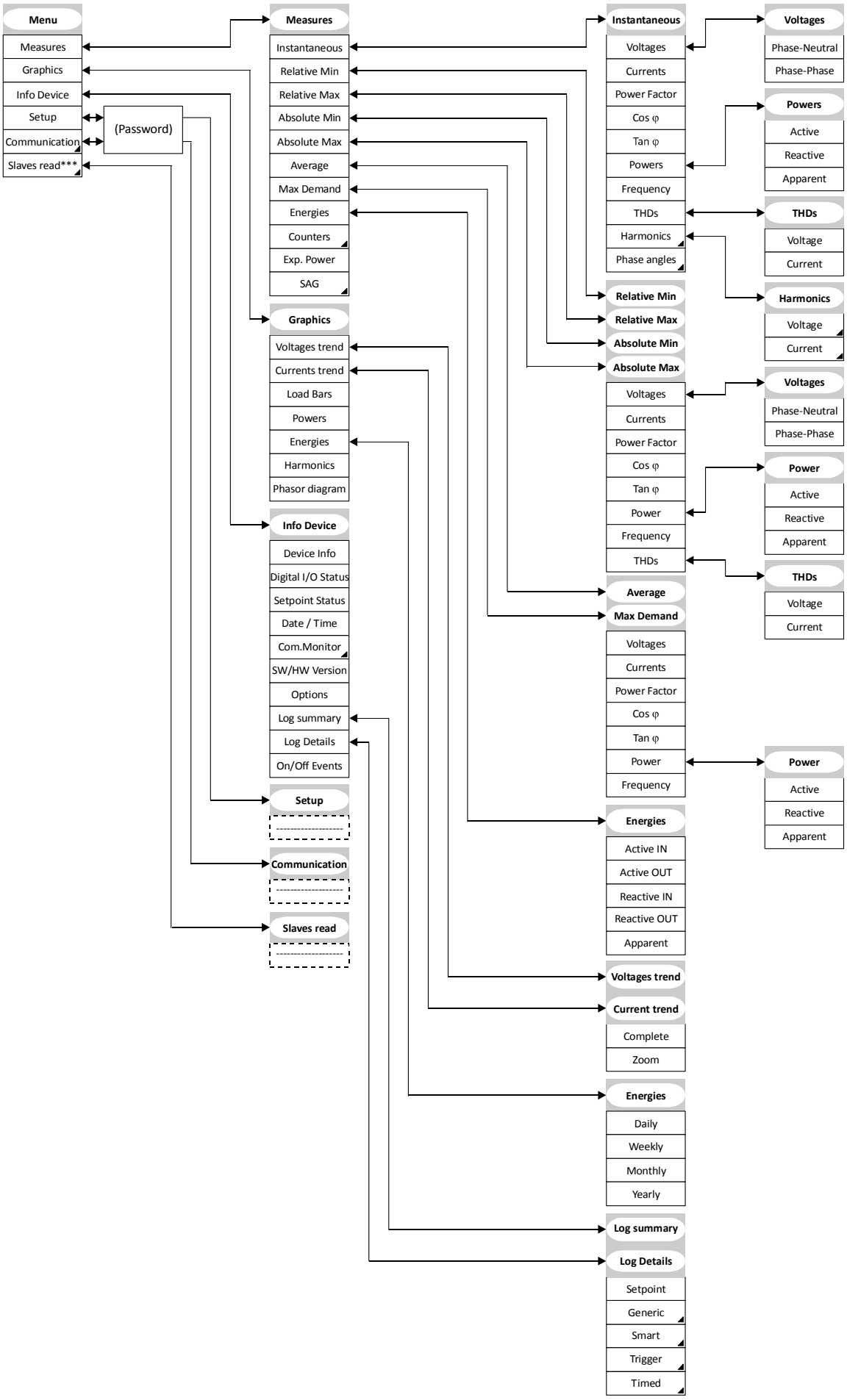
For default the right red led shows the "System Active Energy IN" and the left red led shows the "System Reactive Energy IN". In the setup is possible to modify the default set with the following parameters:

- System Active Energy IN
- System Active Energy OUT
- System Reactive Energy IN
- System Reactive Energy OUT
- System Apparent Energy

The weight of the pulses of these led is 0.1 Wh, VArh, VAh for each pulse. This value is not modifiable.

Maps

Menu



◢: this item is selectable only with the presence of relative option.

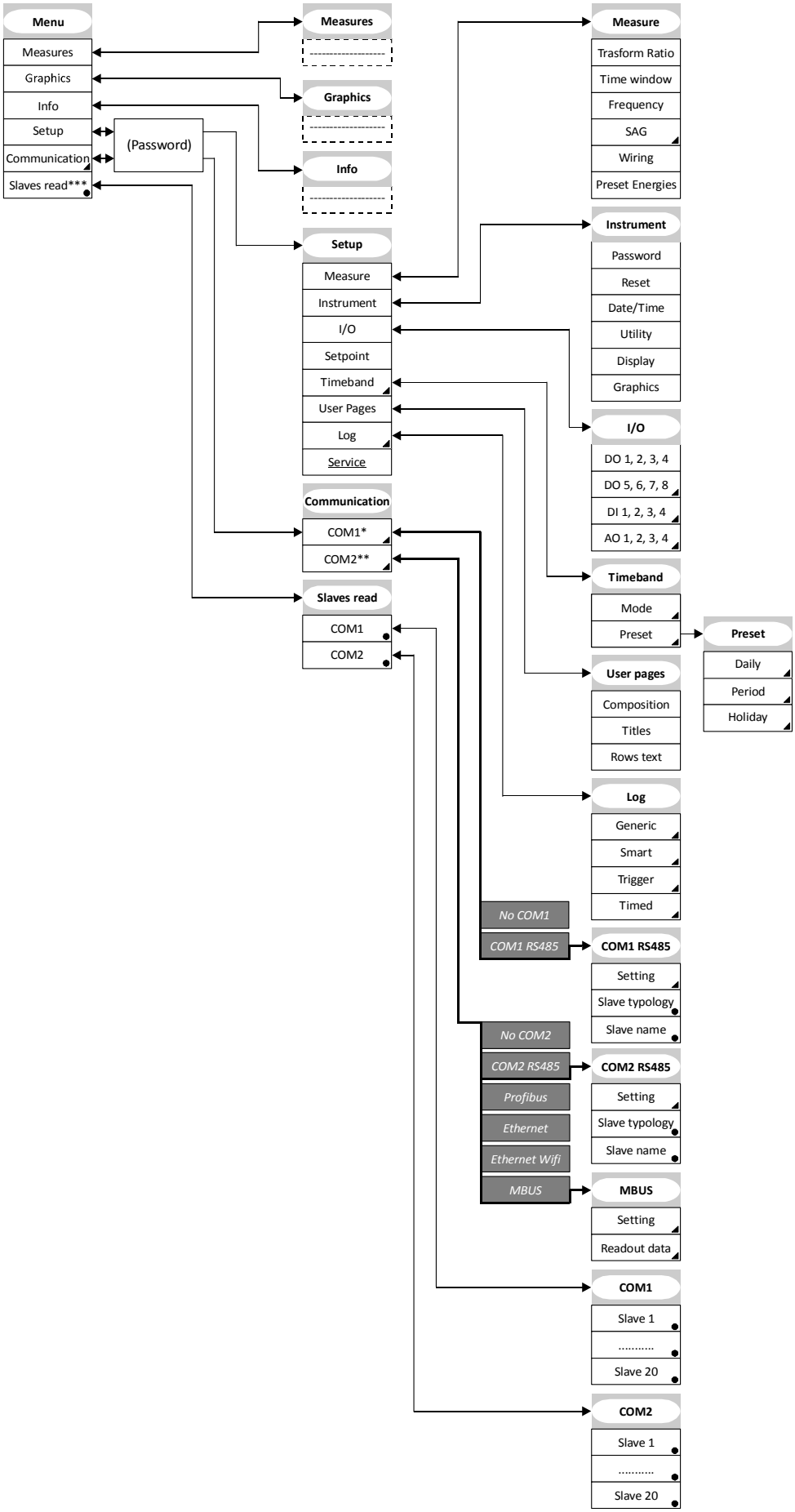
***: this item is selectable only if COM1 or COM2 is present and in Master mode.

To move inside the menu it's necessary to use the directional keys.

The arrow near the items indicates the presence of submenu (with right or enter key it's possible to enter).

Pressing Enter key to go to show the page or the item selected.

The cursor position is showed with different color text.



◢: this item is selectable only with the presence of relative option.

●: this item is selectable only if the relative COM is set as Master mode.

* options:
- No COM1
- COM1 RS485

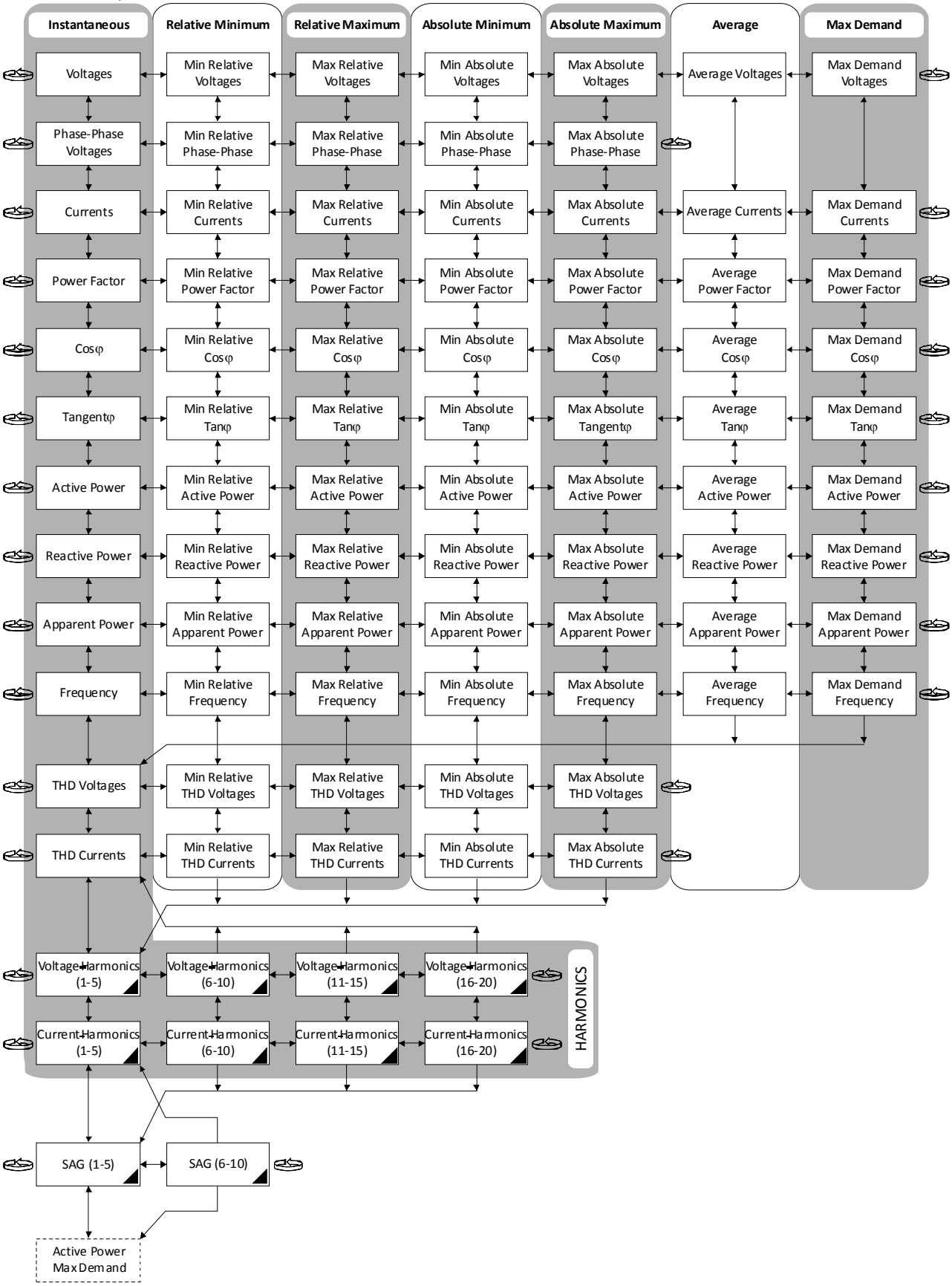
** options:
- No COM2
- COM2 RS485
- Profibus
- Ethernet
- Ethernet wifi
- MBUS

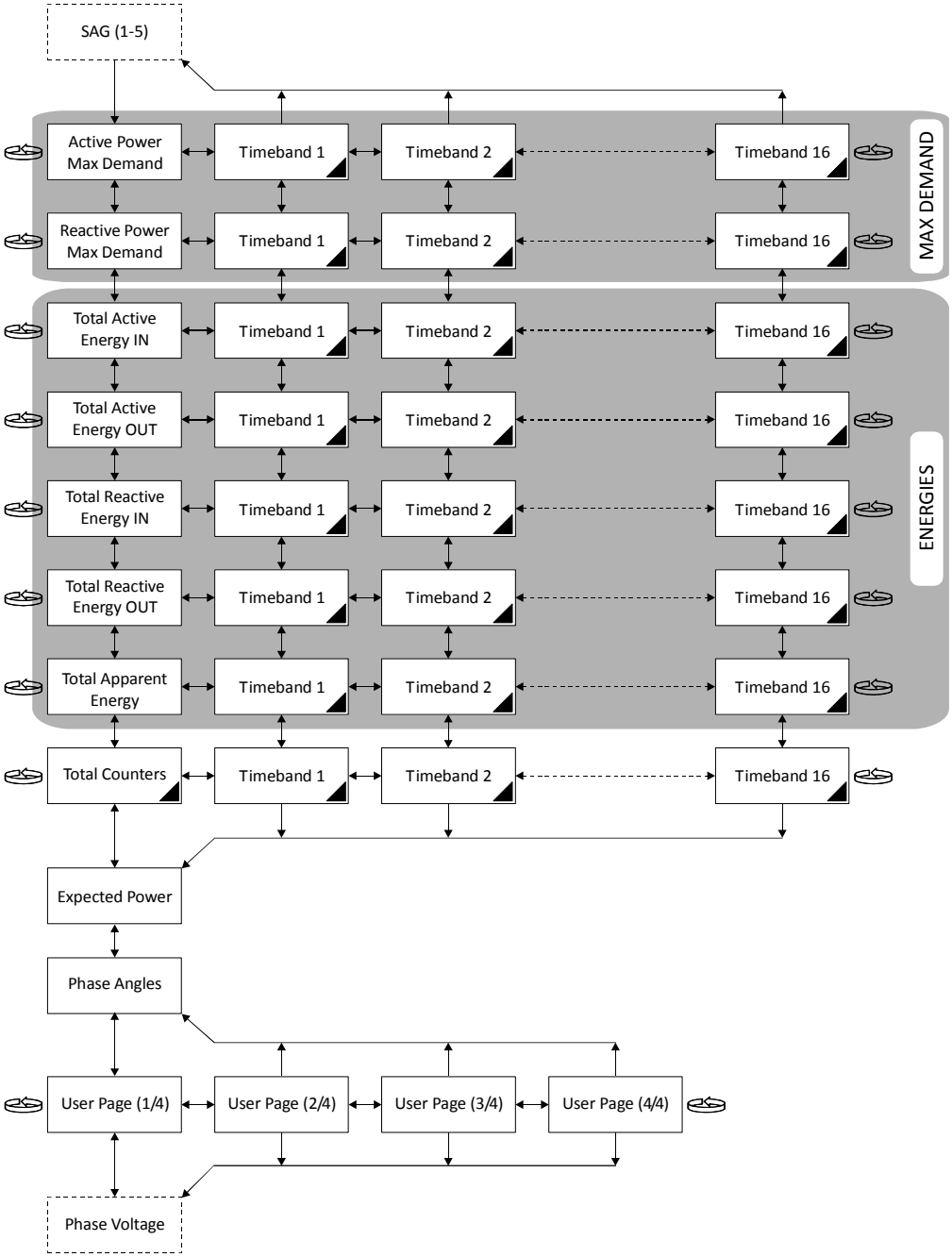
***: this item is selectable only if COM1 or COM2 is present and in Master mode.

The item Service is underlined because it is available only for the constructor.

Measures

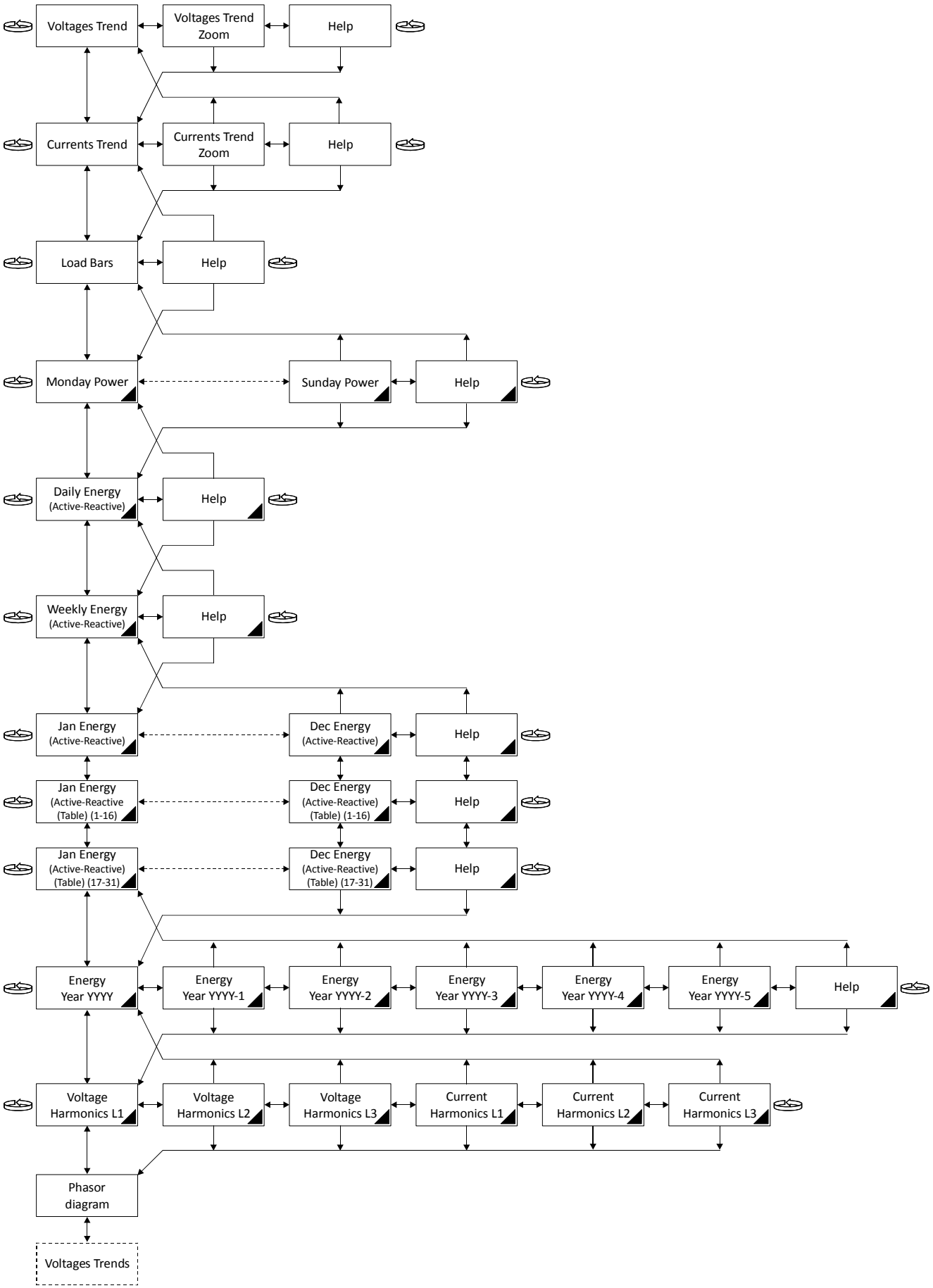
The default page showed at the power on is “Phase Voltage”. It’s possible to change it using the keys (left and right pressed at the same time).



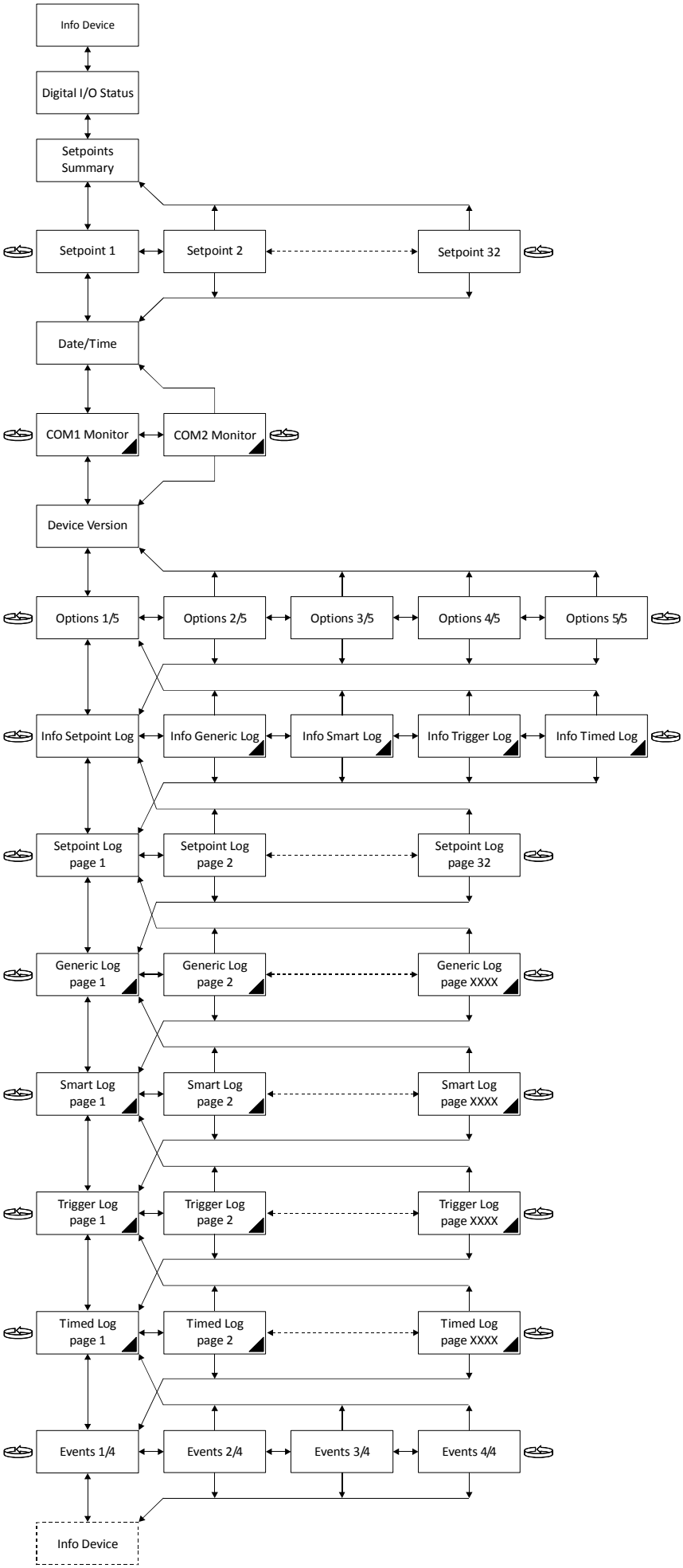


◢: this item is selectable only with the presence of relative option.

Graphics


Voltages Trend
Voltages Trend Zoom
Help
Currents Trend
Currents Trend Zoom
Help
Load Bars
Help
Monday Power
Sunday Power
Help
Daily Energy (Active-Reactive)
Help
Weekly Energy (Active-Reactive)
Help
Jan Energy (Active-Reactive)
Dec Energy (Active-Reactive)
Help
Jan Energy (Active-Reactive (Table) (1-16)
Dec Energy (Active-Reactive) (Table) (1-16)
Help
Jan Energy (Active-Reactive) (Table) (17-31)
Dec Energy (Active-Reactive) (Table) (17-31)
Help
Energy Year YYYY
Energy Year YYYY-1
Energy Year YYYY-2
Energy Year YYYY-3
Energy Year YYYY-4
Energy Year YYYY-5
Help
Voltage Harmonics L1
Voltage Harmonics L2
Voltage Harmonics L3
Current Harmonics L1
Current Harmonics L2
Current Harmonics L3
Phasor diagram
Voltages Trends

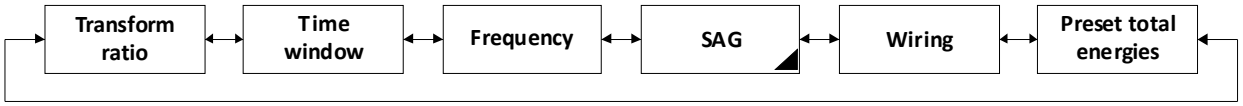
Device


Info Device
Digital I/O Status
Setpoints Summary
Setpoint 1
Setpoint 2
Setpoint 32
Date/Time
COM1 Monitor
COM2 Monitor
Device Version
Options 1/5
Options 2/5
Options 3/5
Options 4/5
Options 5/5
Info Setpoint Log
Info Generic Log
Info Smart Log
Info Trigger Log
Info Timed Log
Setpoint Log page 1
Setpoint Log page 2
Setpoint Log page 32
Generic Log page 1
Generic Log page 2
Generic Log page XXXX
Smart Log page 1
Smart Log page 2
Smart Log page XXXX
Trigger Log page 1
Trigger Log page 2
Trigger Log page XXXX
Timed Log page 1
Timed Log page 2
Timed Log page XXXX
Events 1/4
Events 2/4
Events 3/4
Events 4/4
Info Device

Setup

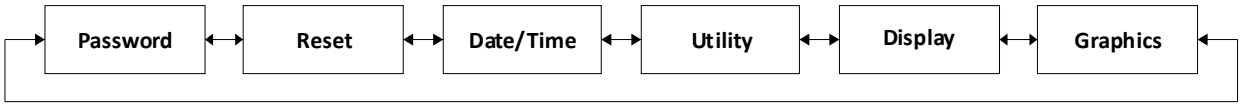
To move inside the Setup pages it's necessary to use left and the right keys. Press the Enter key to go to see the item to set.

Measure

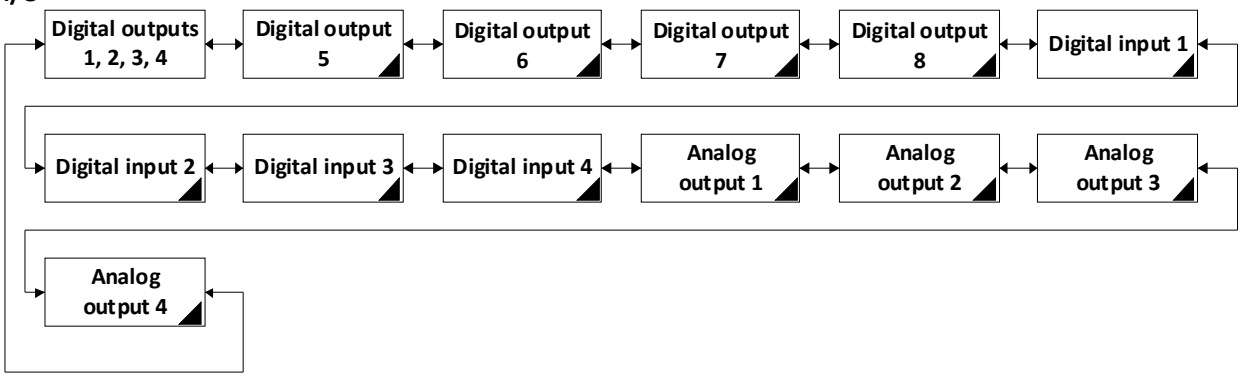


◢ : this item is selectable only with the presence of relative option.

Instrument

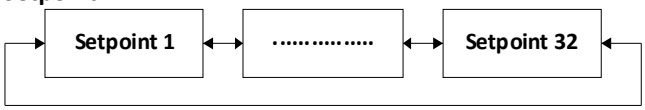


I/O

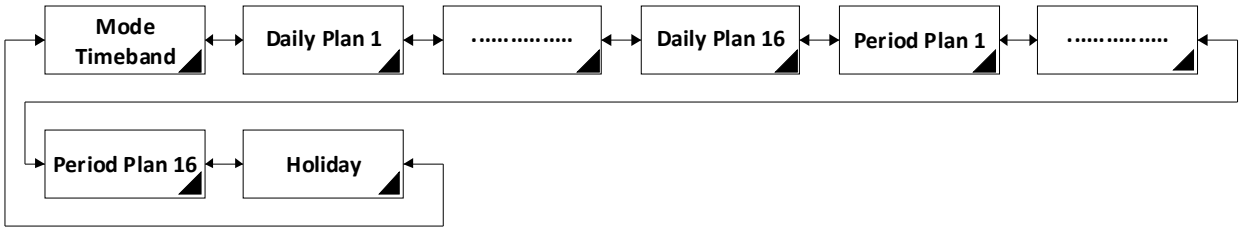


◢ : this item is selectable only with the presence of relative option.

Setpoint

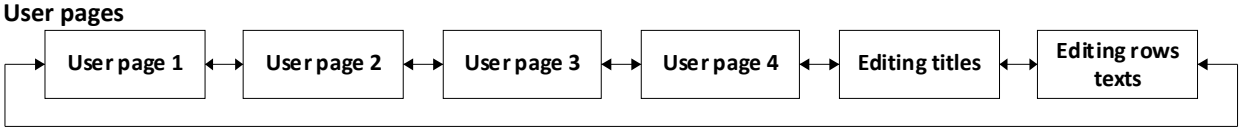


Timeband

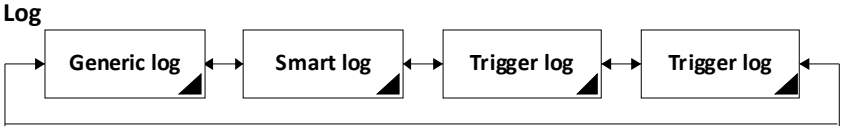


◢ : this item is selectable only with the presence of relative option.

User pages

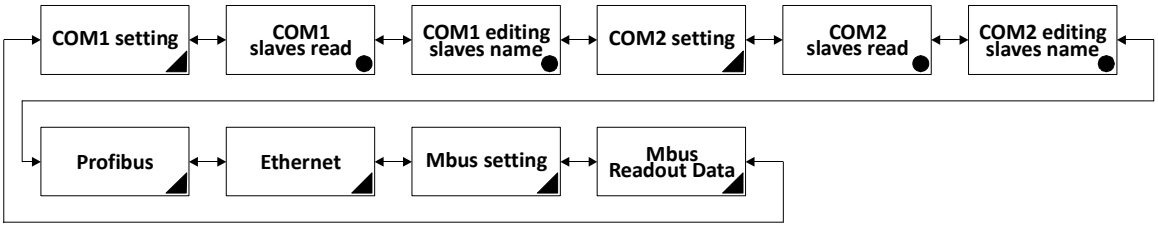


Log



◢ : this item is selectable only with the presence of relative option.

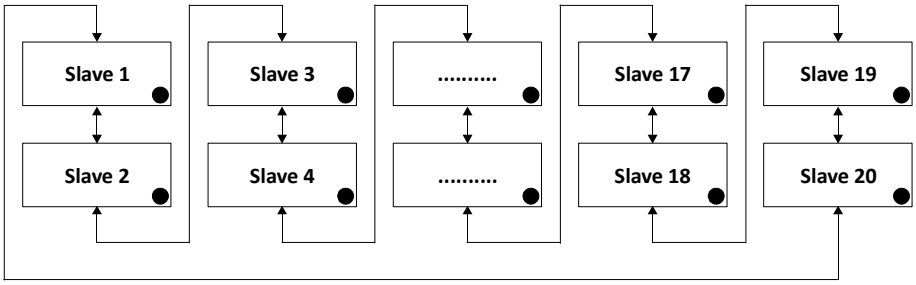
Communication



◢ : this item is selectable only with the presence of relative option.

● : this item is selectable only if the relative COM is present and in Master mode.

Slaves read map



● : this item is selectable only if the relative COM is present and in Master mode.

The number of Slaves displayable (from 1 to 20) depends from the set of “Slaves to read”.

Setup Items

Measure

Transform Ratio	Range	Default
CT ratio	1 ÷ 10000	1
It's the ratio between the primary and the secondary circuit of the external current transformers.		
CT-N ratio	1 ÷ 10000	1
It's the ratio between the primary and the secondary circuit of the external neutral current transformers.		
VT ratio	1 ÷ 5000	1
It's the ratio between the primary and the secondary circuit of the voltage transformers.		

Time window	Range	Default
Upgrade time [minutes]	1 / 2 / 3 / 5 / 6 / 10 / 12 / 15 / 20 / 30 / 60	15
The time used to calculate the average, maximum, minimum values and the expected power.		
Type	Shifting / Fixed	Shifting
The type of the window to calculate the average values and expected power.		

Frequency	Range	Default
Fundamental [Hz]	50 / 60	50
Select the base frequency of the inputs (voltages and currents).		
Phase monitored	L1 / L2 / L3	L1
It's the phase that will be monitored to detect of SAG and to read the actual frequency.		

SAG (option)	Range	Default
Threshold [RMS voltage]	30 ÷ 400	210
If the voltage value drops below the setting, the software considers the event as SAG.		
Time [ms]	1 ÷ 1000	32
If the voltage value drops below for a time greater than the setting, the software considers the event as SAG.		

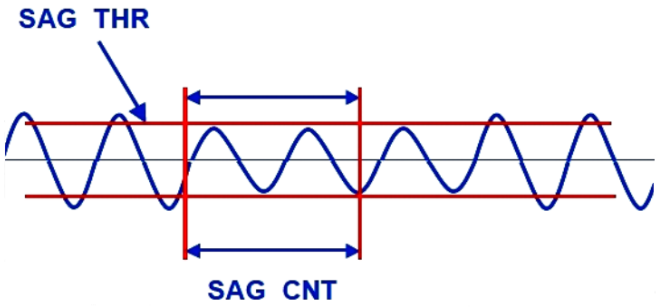


Fig.1: Sag parameters

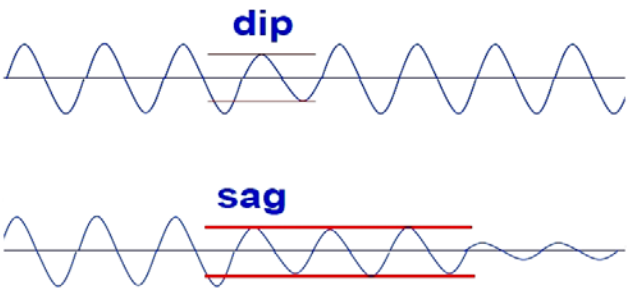


Fig.2: Sag Explanation

A sag is defined as an under voltage condition that persists for more than one period of base frequency. A shorter under voltage condition is called a dip (see Fig. 2). The occurrence of sag could announce an impending loss of power.
To set the sag register the voltage must be under the **Threshold** value for a minimum time defined in **Time**.

Wiring	Range	Default
Type of wiring	3-phase Aron / balanced 3 phase / 3-ph multiload balanced / Single-phase / 1-phase multiload / Multi single-phase / 2-phase 3 wires	3-phase Aron
See table below.		
Neutral current	Measured / Computed	See below
On this item appears **Measured** if the CT is present or **Computed** if the CT is not present. The user can change the set showed.		
Power factor convention	SIGN / IEC / DIN IEEE	SIGN
See the following picture for details on the selected configuration.		

Wiring Parameters

Description Wiring	Three Phase	Aron	Three Phase Balanced	Three Phase Multi Load Balanced	Single Phase	Single Phase Multi Load	Multi Single Phase	Two Phase 3 Wires
SYSTEM VOLTAGE	X	X	X	X				
PHASE VOLTAGE L_{1-N}	X	X	X	X	X	X	X	X
PHASE VOLTAGE L_{2-N}	X	X	X	X		X	X	X
PHASE VOLTAGE L_{3-N}	X	X	X	X		X	X	
LINE TO LINE VOLTAGE L_{1-2}	X	X	X	X				
LINE TO LINE VOLTAGE L_{2-3}	X	X	X	X				
LINE TO LINE VOLTAGE L_{3-1}	X	X	X	X				
SYSTEM CURRENT	X	X	calculated	X				
LINE CURRENT L_1	X	X	X	x3	X	X	X	X
LINE CURRENT L_2	X	X	calculated	x3		X	X	X
LINE CURRENT L_3	X	X	calculated	x3		X	X	
SYSTEM POWER FACTOR	X	X	calculated	X				
POWER FACTOR L_1	X	X	X	X	X	X	X	X
POWER FACTOR L_2	X	X	calculated	X		X	X	X
POWER FACTOR L_3	X	X	calculated	X		X	X	
SYSTEM COS ϕ	X	X	calculated	X				
PHASE COS ϕ_1	X	X	X	X	X	X	X	X
PHASE COS ϕ_2	X	X	calculated	X		X	X	X
PHASE COS ϕ_3	X	X	calculated	X		X	X	
SYSTEM APPARENT POWER	X	X	calculated	X				
APPARENT POWER L_1	X	X	X	x3	X	X	X	X
APPARENT POWER L_2	X	X	calculated	x3		X	X	X
APPARENT POWER L_3	X	X	calculated	x3		X	X	
SYSTEM ACTIVE POWER	X	X	calculated	X				
ACTIVE POWER L_1	X	X	X	x3	X	X	X	X
ACTIVE POWER L_2	X	X	calculated	x3		X	X	X
ACTIVE POWER L_3	X	X	calculated	x3		X	X	
SYSTEM REACTIVE POWER	X	X	calculated	X				
REACTIVE POWER L_1	X	X	X	x3	X	X	X	X
REACTIVE POWER L_2	X	X	calculated	x3		X	X	X
REACTIVE POWER L_3	X	X	calculated	x3		X	X	
NEUTRAL CURRENT$_{(according\ with\ version)}$	X	X	X	X	X	X	X	X
THD VOLTAGE L_1	X	X	X	X	X	X	X	X
THD VOLTAGE L_2	X	X	X	X		X	X	X
THD VOLTAGE L_3	X	X	X	X		X	X	
THD CURRENT L_1	X	X	X	X	X	X	X	X
THD CURRENT L_2	X	X	calculated	X		X	X	X
THD CURRENT L_3	X	X	calculated	X		X	X	
ANGLE $_{1-2}$	X	X	X	X	X	X	X	X
ANGLE $_{2-3}$	X	X	X	X	X	X	X	X
ANGLE $_{3-1}$	X	X	X	X	X	X	X	X
SYSTEM TANGENT ϕ	X	X	calculated	X				
PHASE TANGENT ϕ_1	X	X	X	X	X	X	X	X
PHASE TANGENT ϕ_2	X	X	calculated	X		X	X	X
PHASE TANGENT ϕ_3	X	X	calculated	X		X	X	
SAG	X	X	X	X	X	X	X	X
SYSTEM ACTIVE ENERGY IN	X	X	calculated	x3	X	X	X	X
SYSTEM ACTIVE ENERGY OUT	X	X	calculated	x3	X	X	X	X
SYSTEM REACTIVE ENERGY IN	X	X	calculated	x3	X	X	X	X
SYSTEM REACTIVE ENERGY OUT	X	X	calculated	x3	X	X	X	X
SYSTEM APPARENT ENERGY	X	X	calculated	x3	X	X	X	X
ACTIVE ENERGY IN L_1	X	X	X	x3	X	X	X	X
ACTIVE ENERGY OUT L_1	X	X	X	x3	X	X	X	X
REACTIVE ENERGY IN L_1	X	X	X	x3	X	X	X	X
REACTIVE ENERGY OUT L_1	X	X	X	x3	X	X	X	X
APPARENT ENERGY L_1	X	X	X	x3	X	X	X	X
ACTIVE ENERGY IN L_2	X	X	calculated	x3		X	X	X
ACTIVE ENERGY OUT L_2	X	X	calculated	x3		X	X	X
REACTIVE ENERGY IN L_2	X	X	calculated	x3		X	X	X

REACTIVE ENERGY OUT L_2	X	X	calculated	x3		X	X	X
REACTIVE ENERGY OUT L_2	X	X	calculated	x3		X	X	X
APPARENT ENERGY L_2	X	X	calculated	x3		X	X	X
ACTIVE ENERGY IN L_3	X	X	calculated	x3		X	X	
ACTIVE ENERGY OUT L_3	X	X	calculated	x3		X	X	
REACTIVE ENERGY IN L_3	X	X	calculated	x3		X	X	
REACTIVE ENERGY OUT L_3	X	X	calculated	x3		X	X	
APPARENT ENERGY L_3	X	X	calculated	x3		X	X	

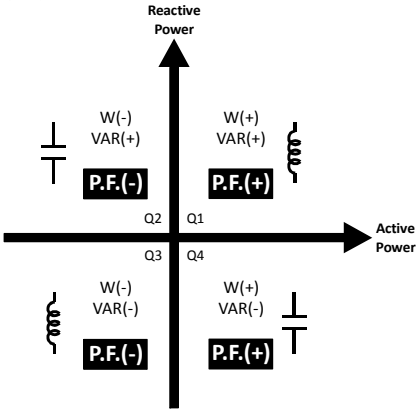
: the values read in this configuration aren't significant.

In the **WIRING** setup page it's possible to modify the wiring type and in the **DEVICE STATUS** page it's showed the voltage and current wiring state.

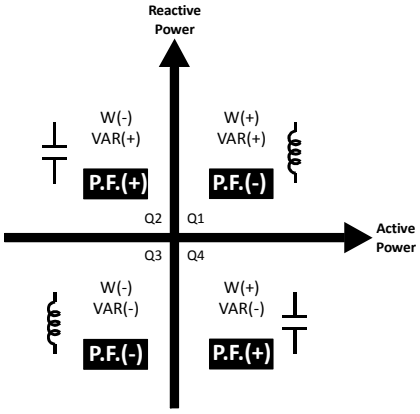
For the voltage wiring item it is possible to have the following option:
- Correct.
- Not Correct.
  The order of voltage connections is not correct (the angles between phases is different by 120°) in the following insertion: Three phase, Three phase balanced, Three phase multi load balanced, Single phase multi load and Multi single phase.
- Not applied.
  All voltage inputs must be apply.

For the current wiring item it possible to have the following option:
- Correct.
- Not correct: the order of current connections not be correct in the following insertion: Three phase, Three phase balanced, Three phase multi load balanced, Single phase multi load and Multi single phase.
  L1 reverse: the current of the L1 phase has the opposite sign respect others two phases.
  L2 reverse: the current of the L2 phase has the opposite sign respect others two phases.
  L3 reverse: the current of the L3 phase has the opposite sign respect others two phases.
- Not applied.
  All current must be apply and the loads must be balanced.

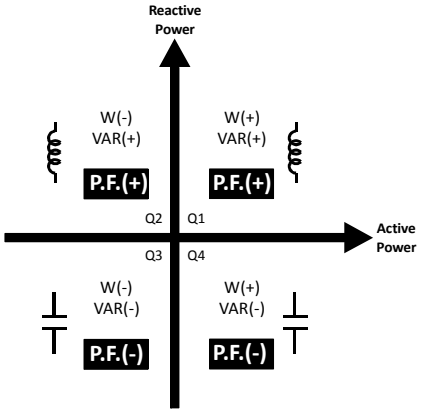
Sign power factor convention



IEC Power Factor Sign Convention



DIN/IEEE Power Factor Sign Convention



SIGN Power Factor Sign Convention

Preset Total Energies	Range	Default
Wh IN [0.1kWh]	0 ÷ 1000000000	0
Value to add at the actual system active energy IN counter.		
Wh OUT [0.1kWh]	0 ÷ 1000000000	0
Value to add at the actual system active energy OUT counter.		
VArh IN [0.1kVArh]	0 ÷ 1000000000	0
Value to add at the actual system reactive energy IN counter.		
VArh OUT [0.1kVArh]	0 ÷ 1000000000	0
Value to add at the actual system reactive energy OUT counter.		
VAh [0.1kAh]	0 ÷ 1000000000	0
Value to add at the actual system apparent energy counter.		
Wh IN L1	0 ÷ 1000000000	0
Value to add at the actual L1 active energy IN counter.		
Wh OUT L1	0 ÷ 1000000000	0
Value to add at the actual L1 active energy OUT counter.		
VArh IN L1	0 ÷ 1000000000	0
Value to add at the actual L1 reactive energy IN counter.		
VArh OUT L1	0 ÷ 1000000000	0
Value to add at the actual L1 reactive energy OUT counter.		
VAh L1	0 ÷ 1000000000	0
Value to add at the actual L1 apparent energy counter.		
Wh IN L2	0 ÷ 1000000000	0
Value to add at the actual L2 active energy IN counter.		
Wh OUT L2	0 ÷ 1000000000	0
Value to add at the actual L2 active energy OUT counter.		
VArh IN L2	0 ÷ 1000000000	0
Value to add at the actual L2 reactive energy IN counter.		
VArh OUT L2	0 ÷ 1000000000	0
Value to add at the actual L2 reactive energy OUT counter.		
VAh L2	0 ÷ 1000000000	0
Value to add at the actual L2 apparent energy counter.		
Wh IN L3	0 ÷ 1000000000	0
Value to add at the actual L3 active energy IN counter.		
Wh OUT L3	0 ÷ 1000000000	0
Value to add at the actual L3 active energy OUT counter.		
VArh IN L3	0 ÷ 1000000000	0
Value to add at the actual L3 reactive energy IN counter.		
VArh OUT L3	0 ÷ 1000000000	0
Value to add at the actual L3 reactive energy OUT counter.		
VAh L3	0 ÷ 1000000000	0
Value to add at the actual L3 apparent energy counter.		

Instrument

Password	Range	Default
Access key	0 ÷ 999999999	0
The code to enter to modify the setup.		
Validity key [minutes]	1 ÷ 60	5
Time of free use of the setup after one access with password.		
Keys protect	Yes / No	No
If is enabled, to modify the setup (from keys) it's necessary insert the password.		
Communication protect	Yes / No	No
If it's enabled, to modify the setup (from communication interface) send the password command before another setup command.		
Enable options	0 ÷ 999999999	0
After the insertion of the code, switch off/on the instrument to enable software options.		

Reset	Range	Default
Global	Yes / No	No
Reset to factory settings.		
Default setup	Yes / No	No
Reset all settings in setup.		
All energies	Yes / No	No
Reset all energies counted.		
TB energies	Yes / No	No
Reset all energies timebands (not total energies).		
Counters	Yes / No	No
Reset all counters.		
TB counters	Yes / No	No
Reset all counters timebands. (not total counters).		
Min-Max	Yes / No	No
Reset all min and max values.		
Max demand	Yes / No	No
Reset max demand values.		
Energies log	Yes / No	No
Reset energies log.		
Setpoint log	Yes / No	No
Reset setpoint log.		
G/S/T log	Yes / No	No
Reset generic and smart log.		
Events log	Yes / No	No
Reset events log.		

Date / Time	Range	Default
Hour	0 ÷ 23	XX
Actual hour.		
Minute	0 ÷ 59	XX
Actual minutes.		
Second	0 ÷ 59	XX
Actual seconds.		
Day of Week	Monday ÷ Sunday	XX
Actual day of week.		
Day	1 ÷ 31	XX
Actual day.		
Month	January ÷ December	XX
Actual month.		
Year	2000 ÷ 2099	XX
Actual year.		

Utility	Range	Default
Language	English / (optional language)	English
Language used for the display text.		
Theme	Winter / Winter night / Autumn / Autumn night / Summer / Summer night	Winter
Theme is a different combination of colour.		
Text dimension	Normal / Big	Normal
Set the dimension of the char of the instantaneous values showed in the display.		
Led left 0.1 Wh/VArh/VAh	See Acronym table of Energy	Varh IN
Measured associated at the left frontal led.		
Led right 0.1 Wh/VArh/VAh	See Acronym table of Energy	Wh IN
Measured associated at the right frontal led.		
LED min period [ms]	10 ÷ 100	60
Pulse period associated at frontal led.		

Display	Range	Default
Return default page [min]	1 ÷ 30	5
After this time the instrument comes back to default page.		
Backlight keys	Off / In standby / Always on	In standby
Set the type of the key illumination.		
Standby	No / Yes / Short bright / Change page	Yes
Set the type of the standby mode.		
Standby entry [min]	1 ÷ 60	10
After this time the instrument goes in the standby mode, as selected in the previous item.		
Short bright on period [s]	1 ÷ 600	5
In **Short bright** mode the display will stay on for this time.		
Short bright off period [s]	1 ÷ 600	55
In **Short bright** mode the display will stay off for this time.		
Change page [s]	1 ÷ 600	10
In **Change page** mode the instrument will change the page after this time.		
Category page 1	Measure / Graphics	Graphics
Category of the 1st page showed in **Change page** mode.		
Page 1	See the table of displayable pages	Voltages zoom
1st page showed in **Change page** mode.		
Category page 2	Measure / Graphics	Graphics
Category of the 2nd page showed in **Change page** mode.		
Page 2	See the table of displayable pages	Currents zoom
2nd page showed in **Change page** mode.		
Category page 3	Measure / Graphics	Graphics
Category of the 3rd page showed in **Change page** mode.		
Page 3	See the table of displayable pages	Daily energy
3rd page showed in **Change page** mode.		
Category page 4	Measure / Graphics	Graphics
Category of the 4th page showed in **Change page** mode.		
Page 4	See the table of displayable pages	Weekly energy
4th page showed in **Change page** mode.		

Table of the displayable pages in the Change page mode

Measures				Graphics	
voltages	active power	Wh in	user page 1	voltages trend	phasor diagram
phase-phase voltages	reactive power	Wh out	user page 2	currents trend	
currents	apparent power	VArh in	user page 3	load bars	
power factor	frequency	VArh out	user page 4	daily energy	
cos-phi	thd voltages	Vah		weekly energy	
tan-phi	thd currents	expected power		yearly energy	

Graphics	Range	Default
V/A sampling [Seconds]	1 ÷ 60	5
Sampling time for the voltage and current graphic trend.		
Clear max bar	Yes / No	No
Reset the maximum signal on the graphic bars.		

I/O

Digital Outputs 1, 2, 3, 4 (pulse/state)	Range	Default
Level	Active low / Active high	Active high
Active Low: initial state high level. Active High: initial state low level.		
Mode	Status / Pulse / Setpoint	Status
Status: see the **Status** item set. Pulse: see the measure associated (**Associated DO-1**). Setpoint: the digital output to be controlled by setpoint functionality.		
Pulse weight [Wh-VArh]	1 ÷ 10000	100
The pulse is generated every time that the energy selected is increased of the selected value.		
Duration [ms]	60 ÷ 1000	500
The pulse has a duty cycle of 50% (Ton equal Toff) and the duration selected.		
Status DO-1	0 / 1	0
Select ON to close the output, OFF to open it.		
Associated DO-1	See Acronym table of Energy	Wh IN
Associated measure to the digital output DO-1.		
Status DO-2	0 / 1	0
Select 1 to close the output, 0 to open it.		
Associated DO-2	See Acronym table of Energy	Wh OUT
Associated measure to the digital output DO-2.		
Status DO-3	0 / 1	0
Select 1 to close the output, 0 to open it.		
Associated DO-3 (option)	See Acronym table of Energy	VArh IN
Associated measure to the digital output DO-3.		
Status DO-4	0 / 1	0
Select 1 to close the output, 0 to open it.		
Associated with DO-4 (option)	See Acronym table of Energy	VArh OUT
Associated measure to the digital output DO-4.		

Digital output X* (option)	Range	Default
Status	0 / 1	0
Select 1 to close the output, 0 to open it.		
Level	Active low / Active high	Active high
Active Low: initial state high level. Active High: initial state low level.		
Mode	Status / Not used / Setpoint	Status
Status: see the **Status** item set. Not used. Setpoint: the digital output to be controlled by setpoint functionality.		

* These settings are used for the optional digital outputs from DO-5 to DO-8.

Digital input X* (option)	Range	Default
Mode	See below	Status
- Status - Counter - Change energy timeband actually used (see example) - Change counter timeband actually used (see example) - Change energy and counter timeband actually used (see example) - External trigger Example: DI-4 = 1, DI-3, = 0 DI-2 = 0, DI-1 = 1 The timeband selected is 1001bin -> TB 9 DI-4 = 0, DI-3, = 0 DI-2 = 1, DI-1 = 1 The timeband selected is 0011bin -> TB 3		
Multiplier	1 ÷ 1000	1
If the digital inputs mode is **counter** this parameter multiply the input pulse for the coefficient set.		

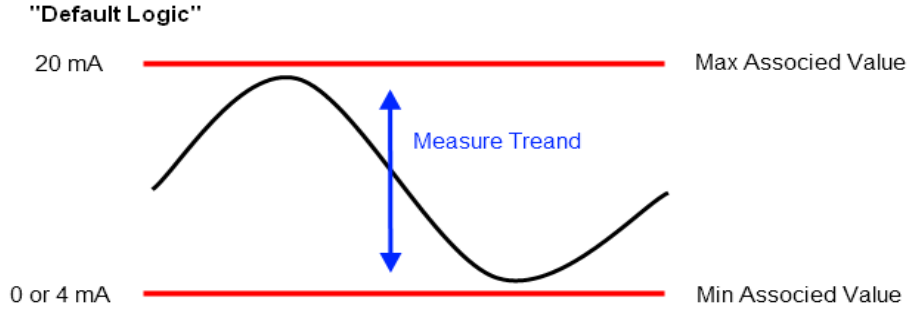
* These settings are used for the optional digital inputs from DI-1 to DI-4.

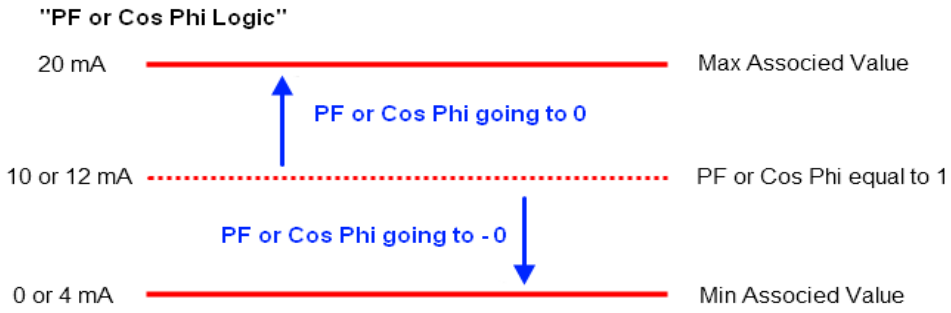
Analog output X* (option)	Range	Default
Range	0÷5V / 0÷10V / ±5V / ±10V / 4÷20mA / 0÷20mA	0 ÷5V
Selection of the modality of the output (current or voltage) and relative limits.		
Measure group	See Acronyms Group table	
Selection of the group for the actual analog output.		
Measure associated	See acronym in the table of the group selected	---
Selection of the measure to associate of the actual analog output, inside the selected **Measure group**.		
High threshold	± 9999	0
Maximum value associated to the high threshold associated.		
High threshold unit	See below	See below underlined
Unit measure of threshold. Voltage: mV-V-kV-MV Current: mA-A-kA-MA Apparent Power: VA-kVA-MVA-GVA	 Active Power: W-kW-M-GW Reactive Power: VAr-kVAr-MVAr-GVAr Frequency: mHz	 Temperature: °C THD and harmonics: %*100 Angle: degree*10
Low threshold	± 9999	0
Minimum value associated to the low threshold.		
Low threshold unit	See below	See below underlined
Unit measure of threshold. Voltage: mV-V-kV-MV Current: mA-A-kA-MA Apparent Power: VA-kVA-MVA-GVA	 Active Power: W-kW-M-GW Reactive Power: VAr-kVAr-MVAr-GVAr Frequency: mHz	 Temperature: °C THD and harmonics: %*100 Angle: degree*10

* These settings are used for the optional analog outputs from AO-1 to AO-4.

Example: to associate the L1 phase voltage to the analog output it is necessary select instantaneous for the item **Measure group** and the acronym V L1 for the item **Measure associated**. If the maximum value is set to 300V and 100V to the minimum, with the scale of 0÷20mA, it will have that with 200V as measured voltage, the output will be 10 mA.

Only for the power factor, cosϕ and tanϕ is used a different logic (see the following example).





Selecting the cosϕ or the power factor as a measure to associate to the analog output, the intermediate output value (10 or 12 mA) is set to cosϕ=1 (and coinciding with cosϕ=-1). The value of the output signal will trend to increase when the positive values of cosϕ decrease from 1 to 0 while for the negative values, it will decrease when the value trend to 0.

Example: Setting +800 and -800 as maximum and minimum values when cosϕ=0.9 the value will be 15 mA, while when the cosϕ=-0.9 it will be 5 mA.

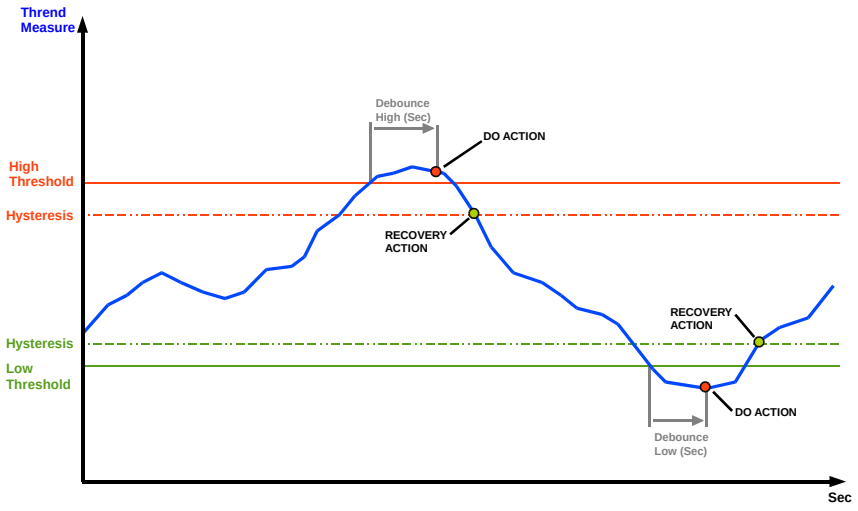
In the case of selection of tanϕ the intermediate output value (10 or 12 mA) is set to tanϕ=0 and the output signal will be directly proportional to the variation of the measure.

Setpoint

Setpoint XX (from 1 to 32)	Range	Default
Enable	Yes / No	No
Enable or disable the setpoint function.		
Source	Internal measures / Measures node X	Internal measures
Select the instrument from which the measure to analyze it will be read.		
Measure group	See Acronyms Group table	---
Selection of the group for the actual setpoint if it is set **Internal measures** as **Source**.		
Measure controlled	See acronym in the table of the group selected	---
Selection of the measure in the selected **Measure Group** of the actual setpoint.		
High threshold	± 9999	0
The **Action** is executed if the measure exceed the set value.		
High threshold unit	See below	See below underlined
With **Measure node X** as **Source**, the multiplier factor will be 1, 1000, 1000000 while with **Internal measures** there will be: Voltage: mV-V-kV-MV Reactive power: VAr-kVAr-MVAr–GVAr Angle: degree*10 Current: mA-A-kA-MA Frequency: mHz Apparent energy: VAh*100-kVAh-MVAh-GVAh Apparent power:VA-kVA-MVA-GVA Temperature: °C Active energy: Wh*100-kWh-MWh-GWh Active power: W-kW-MW-GW THD and harmonics: %*100 Reactive energy: VArh*100-kVArh-MVArh-GVArh		
Low threshold	± 9999	0
The **Action** is executed if the measure is lower than the set value.		
Low threshold unit	See below	See below underlined
See the description of **High threshold unit**.		
Over debounce [seconds]	0 ÷ 10000	0
0: instantaneous execution of the **Action** 1÷10000: execution of the **Action** if the condition is kept for the time set		
Entry debounce [seconds]	0 ÷ 10000	0
0: instantaneous execution of the **Action** 1÷10000: execution of the **Action** if the condition is kept for the time set		
Hysteresis (for high & low threshold)	See below	---
--- 50,000% 25,000% 12,500% 6,250% 3,125%		
Logic operation over	See below	Disabled
- No logic: the **Action** is executed without to verify the status of others setpoint [Default]. - OR logic: the **Action** is execute after the check of result of the OR logic operation with the setpoint selected in operands. - AND logic: the **Action** is execute after the check of result of the AND logic operation with the setpoint selected in operands. ***WARNING:*** it's not possible to set OR logic for logic operation over and logic operation entry at the same time.		
Logic operation entry	See below	Disabled
- No logic: the **Action** is executed without to verify the status of others setpoint [Default]. - OR logic: the **Action** is execute after the check of result of the OR logic operation with the setpoint selected in operands. - AND logic: the **Action** is execute after the check of result of the AND logic operation with the setpoint selected in operands. ***WARNING:*** it's not possible to set OR logic for logic operation over and logic operation entry at the same time.		
Operands (1-16)	See below	No Operands
Setpoint 1: select Yes to include the setpoint 01 in the logic. - - - - - - - - - - - - - - - - - - Setpoint 16: select Yes to include the setpoint 16 in the logic.		
Operands (17-32)	See below	No Operands
Setpoint 17: select Yes to include the setpoint 17 in the logic. - - - - - - - - - - - - - - - - - - Setpoint 32: select Yes to include the setpoint 32 in the logic.		
Action over	See below	None
It possible to select one, more or anything action: - Display and save the event. - Increase a variable that indicates the number of events. - Change the DO-X state. - Increase a variable that indicates the duration time of the event.		
Action entry	See below	None
It possible to select one, more or anything action: - Display and save the event. - Change the DO-X state		
DO used	See below	None
It possible to select (with Yes) one or more DO: DO-1, DO-2, DO-3, DO-4, DO-5, DO-6, DO-7, DO-8. ***WARNING:*** *for a correct functioning before to select the output it's necessary to set the SETPOINT mode under the item MODE in the setup page of the DO group (DO-1, 2, 3, 4 or DO-5, 6, 7, 8).*		

Setpoint setup:

- Select the **Source** of the measure to control between internal measures and external (via Modbus network in Master mode).
- In order to simplify the selection of the parameter is divided in **Measure group** and **Measure controlled** so that, for example, to monitor the active power (internal measure) it's necessary to select **Instantaneous + W**.
- After the selection of the measure, it's necessary to decide what are the limits that the measure should not exceed (**High threshold** + **High threshold unit** and **Low threshold** + **Low threshold unit**).
- In case of exceeding the limits set before, it's possible to make one or more operations (**Actions over**):
  - save the event;
  - change the state of one or more digital outputs;
  - increment a counter that indicate how many times the parameter exceeded the limits;
  - enable a counter that indicate show many time the parameter exceeded the limits.



If it's necessary, there is also the possibility to save the event and/or to switch another time the digital outputs in case of resetting of alarm condition (**Action entry**).

- To avoid continuous switching or saves, at the minimum variation of the parameter near at the thresholds set, it's possible to modify the parameters of **Over/Entry debounce** and **Hysteresis** (see the following picture) that are left at zero for default.
- To allow to control more parameters at the same time and to have a single action if limits are exceeded, it's possible to relate more setpoint using the two main logical operations (AND and OR). It's necessary to set more setpoint with the limits chosen by the user and to define in one of them the list of setpoint to consider and the logic used.

See the next picture for an example of logic applied to three setpoints.

Operands:
- Setpoint 1 (with parameter Line Voltage 1)
- Setpoint 2 (with parameter Line Voltage 2)
- Setpoint 3 (with parameter Line Voltage 3)

Logic Set: V1 **AND** V2 **AND** V3

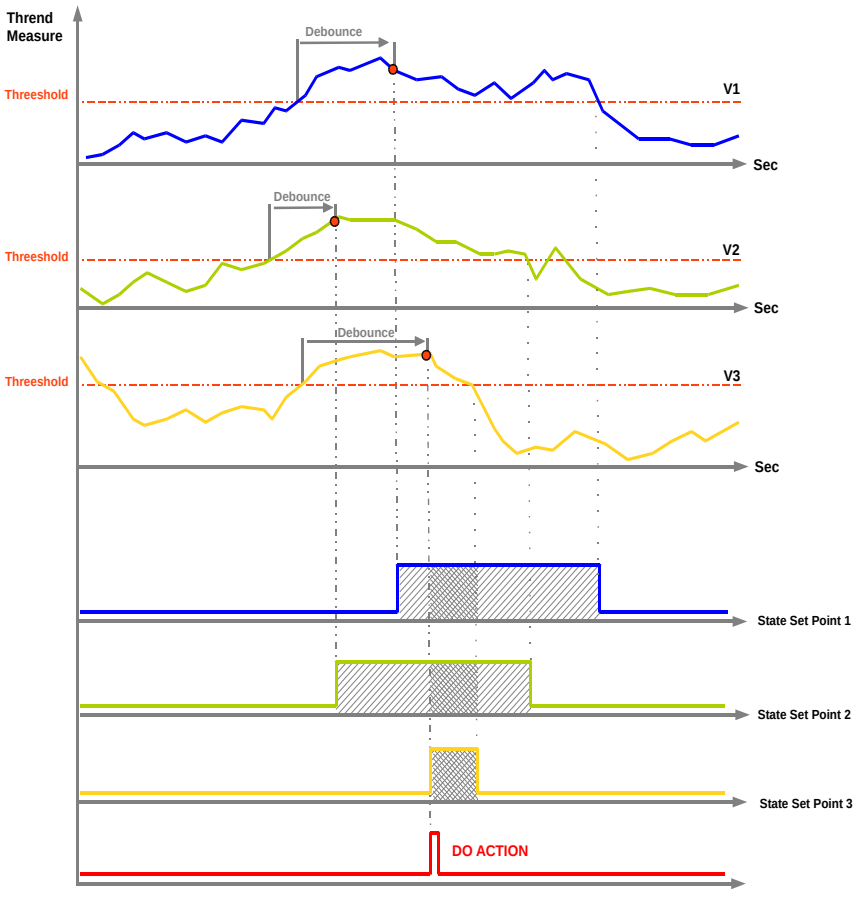
After the setting of the parameters of the setpoint, and <u>only</u> at the end, it's necessary to select **yes** for the item **Enable**.

Example of setting (in the correct order) to set an alarm when the power exceed 1000W on phase 1 with saving of the date and time of the event and the switching of a digital output when the alarm is present and when it disappear.
Source: Internal
Measure group: instantaneous
Measure controlled: W L1
High threshold: 1000
High threshold unit: W
Acton over:
- **save the event**: yes
- **change DO**: yes

Action entry:
- **save the event**: yes
- **change DO**: yes

DO used:
- **DO-1**: yes

Enable: yes



Timeband

Timeband (option)	Range	Default
Energy changing	Manual / From DI / Preset	Manual
It's possible to select the modality to change the timeband: - Manual. - From DI: the combination of digital inputs select the actual timeband used. - Preset (see timeband Daily and Period plan for more information).		
Counter changing	Manual / From DI	Manual
It's possible to select the modality for change the timeband: - Manual. - From DI: the combination of digital input select the actual timeband used.		

Daily Plan X (from 1 to 16) (option)	Range	Default
Start Hour 1	00 ÷ 23	0
Hour at which the timeband will be changed.		
Start Minute 1	00 ÷ 59	0
Minute at which the timeband will be changed.		
Timeband Used 1	Not used ÷ Timeband 16	Not used
New Timeband set.		
……..		
……..		
Start Hour 16	00 ÷ 23	0
Hour at which the timeband will be changed.		
Start Minute 16	00 ÷ 59	0
Minute at which the timeband will be changed.		
Timeband Used 16	Not used ÷ Timeband 16	Not used
New Timeband set.		

Period Plan X (from 1 to 16) (option)	Range	Default
Enable	Disabled / Enabled	Disabled
Enable or disable the plan. ***WARNING***: Set all the following parameters before to enable it.		
Start Month	January ÷ December	January
Month at which the period start.		
Start Day	1 ÷ 31	1
Day at which the period start.		
End Month	January ÷ December	December
Month at which the period finish.		
End Day	1 ÷ 31	31
Day at which the period finish.		
Monday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Tuesday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Wednesday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Thursday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Friday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Saturday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		
Sunday Plan	Plan 1 ÷ Plan 16	Plan 1
Plan used for this day.		

Holiday (option)	Range	Default
Month Holiday 1	January ÷ December	January
Month in which the holiday is present.		
Day Holiday 1	1 ÷ 31	1
Day in which the holiday is present.		
Plan Holiday 1	Not Used ÷ Plan 16	---
Plan used for this holiday. When the plane setting is different from --- the Holiday Plan is enabled.		
……..		
……..		
Month Holiday 48	January ÷ December	January
Month in which the holiday is present.		
Day Holiday 48	1 ÷ 31	1
Day in which the holiday is present.		
Plan Holiday 48	Not Used ÷ Plan 16	---
Plan used for this holiday. When the plane setting is different from --- the Holiday Plan is enabled.		

User pages

User Page X (from 1 to 4)	Range	Default
Row 1 – Group	See Acronym Group table	Instantaneous
Selection of the group for the 1st measure on the User Page XX.		
Row 1 – Measure	See acronym in the table of the group selected	V
Selection of the measure showed on the 1st row of the User Page XX in the **Row 1 - Group**.		
Row 2 – Group	See Acronym Group table	Instantaneous
Selection of the group for the 2nd measure on the User Page XX.		
Row 2 – Measure	See acronym in the table of the group selected	A
Selection of the measure showed on the 2nd row of the User Page XX in the **Row 2 - Group**.		
Row 3 – Group	See Acronym Group table	Instantaneous
Selection of the group for the 3rd measure on the User Page XX.		
Row 3 – Measure	See acronym in the table of the group selected	W
Selection of the measure showed on the 3rd row of the User Page XX in the **Row 3 - Group**.		
Row 4 – Group	See Acronym Group table	Instantaneous
Selection of the group for the 4th measure on the User Page XX.		
Row 4 – Measure	See acronym in the table of the group selected	Var
Selection of the measure showed on the 4th row of the User Page XX in the **Row 4 - Group**.		
Row 5 – Group	See Acronym Group table	Energies
Selection of the group for the 5th measure on the User Page XX.		
Row 5 – Measure	See acronym in the table of the group selected	Wh IN
Selection of the measure showed on the 5th row of the User Page XX in the **Row 5 - Group**.		
Row 6 – Group	See Acronym Group table	Energies
Selection of the group for the 6th measure on the User Page XX.		
Row 6 – Measure	See acronym in the table of the group selected	VArh IN
Selection of the measure showed on the 6th row of the User Page XX in the **Row 6 - Group**.		

Editing Titles	Range	Default
Title in User Page X.	---	---
Title showed in the User Page X.		

Note: X indicates the number of user page from 1 to 4.

Editing rows texts	Range	Default
Text 1	---	---
Text showed in the row 1 of the User Page.		
Text 2	---	---
Text showed in the row 2 of the User Page.		
Text 3	---	---
Text showed in the row 3 of the User Page.		
Text 4	---	---
Text showed in the row 4 of the User Page.		
Text 5	---	---
Text showed in the row 5 of the User Page.		
Text 6	---	---
Text showed in the row 6 of the User Page.		

Log

Generic Log (option)	Range	Default
Enable	Yes / No	No
Enable or disable the generic log.		
Sampling	1 sec / 2 sec / 3 sec / 5 sec / 6 sec / 10 sec / 12 sec / 15 sec / 20 sec / 30 sec / 1 min / 2 min / 3 min / 5 min / 6 min / 10 min / 12 min / 15 min / 20 min / 30 min / 60 min / end of day / end of week / end of month	15 min
Acquisition timing.		
Storage Type	FIFO / End memory	End memory
Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.		
Group 1	See Acronym Group table	---
Selection of the group for the 1st measure sampled for the generic log.		
Measure 1	See acronym in the table of the group selected	---
Selection of the 1st measure sampled for the generic log.		
……..		
……..		
Group 15	See Acronym Group table	---
Selection of the group for the 15st measure sampled for the generic log.		
Measure 15	See acronym in the table of the group selected	---
Selection of the 15st measure sampled for the generic log.		

Warning: All recordings for all log will be lost if any parameter is changed.

Smart Log (option)	Range	Default
Enable	Yes / No	No
Enable or disable the smart log.		
Analyse window	1 min / 2 min / 3 min / 5 min / 6 min / 10 min / 12 min / 15 min / 20 min / 30 min / 60 min / end of day / end of week / end of month / end of year	15 min
Acquisition timing		
Storage Type	FIFO / End memory	End memory
Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.		
Group 1	See Acronym Group table	---
Selection of the group for the 1st measure sampled for the smart log.		
Measure 1	See acronym in the table of the group selected	---
Selection of the 1st measure sampled for the smart log.		
……..		
……..		
Group 15	See Acronym Group table	---
Selection of the group for the 15st measure sampled for the smart log.		
Measure 15	See acronym in the table of the group selected	---
Selection of the 15st measure sampled for the smart log.		

Warning: All recordings for all log will be lost if any parameter is changed.

Trigger Log (option)	Range	Default
Enable	Yes / No	No
Enable or disable the trigger log.		
Sampling [seconds]	1 ÷ 3600	10
Acquisition timing.		
Storage Type	FIFO / End memory	End memory
Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.		
Trigger input	DI active high, DI active low, Setpoint	DI active high
Input that active the log.		
DI used	1 ÷ 4	1
Digital input used for the trigger.		
Setpoint used	1 ÷ 32	1
Setpoint used for the trigger.		
Group 1	See Acronym Group table	---
Selection of the group for the 1st measure sampled for the trigger log.		
Measure 1	See acronym in the table of the group selected	---
Selection of the 1st measure sampled for the trigger log.		
…….		
…….		
Group 15	See Acronym Group table	---
Selection of the group for the 15st measure sampled for the trigger log.		
Measure 15	See acronym in the table of the group selected	---
Selection of the 15st measure sampled for the trigger log.		

Warning: All recordings for all log will be lost if any parameter is changed.

Timed Log (Option)	Range	Default
Enable	Yes / No	No
Enable or disable the timed log.		
Sampling	1 sec / 2 sec / 3 sec / 5 sec / 6 sec / 10 sec / 12 sec / 15 sec / 20 sec / 30 sec / 1 min / 2 min / 3 min / 5 min / 6 min / 10 min / 12 min / 15 min / 20 min / 30 min / 60 min / end of day / end of week / end of month	15 min
Acquisition timing.		
Storage Type	FIFO / End memory	End memory
Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.		
Start hour	0 ÷ 23	0
Start time of log.		
Start minute	0 ÷ 59	0
Start time of log.		
End Hour	0 ÷ 23	23
End time of log.		
End minute	0 ÷ 59	59
End time of log.		
Monday	Yes / No	No
Enable or disable the log in this day of the week.		
…….		
…….		
Sunday	Si / No	No
Enable or disable the log in this day of the week.		
Group 1	See Acronym Group table	---
Selection of the group for the 1st measure sampled for the timed log.		
Measure 1	See acronym in the table of the group selected	---
Selection of the 1st measure sampled for the timed log.		
…….		
…….		
Group 15	See Acronym Group table	---
Selection of the group for the 15st measure sampled for the timed log.		
Measure 15	See acronym in the table of the group selected	---
Selection of the 15st measure sampled for the timed log.		

Warning: All recordings for all log will be lost if any parameter is changed.

Communication

COM1/2 setting (option)	Range	Default
Mode	Slave / Master	Slave
Slaves to read	1 ÷ 20	1
Number of slave connected in master mode.		
Master Timeout [ms]	0 ÷ 10000	800
Time after than it will be set the no slave response flag and increase the NO RESPONSE COUNTER if the answer isn't received (Master Mode).		
Scan rate [ms]	0 ÷ 10000	1000
Delay between two master request (Master mode). **Note:** this value must be greater than TIMEOUT.		
Node address	1 ÷ 247	1
Instrument identifier on the modbus network. **Note:** valid only in Slave Mode.		
Baud rate [kbit/s]	4800 / 9600 / 19200 / 38400 / 57600 / 115200	38400
The communication speed.		
Stop bits	1 / 2 stop	1 stop
Communication parameters.		
Parity	None / Odd / Even	None
Communication parameters.		
Min. response delay [ms]	5 ÷ 100	10
Modify this value if use a slow external converter.		

COM1/2 Slave read (option)	Range	Default
Slave node 1	TTC-V / CTT-4 / CTT-8 / HRI / EMM-h / EMT-4s / EMS-96 / RI-SM	---
Type of slave (instrument) connected to the address 1.		
…….		
…….		
Slave node 20	TTC-V / CTT-4 / CTT-8 / HRI / EMM-h / EMT-4s / EMS-96 / RI-SM	---
Type of slave (instrument) connected to the address 20.		

Note: Accessible only with COM in master mode. The number of slave node is equal of the value set in "**Slave to read**".

COM1/2 Editing Slaves name (option)	Range	Default
Slave node 1		Slave 1
Edit the name of the slave.		
…….		
…….		
Slave node 20		Slave 20
Edit the name of the slave.		

Note: Accessible only with COM in master mode.

Profibus (option)	Range	Default
Address [node]	1 ÷ 126	1
Instrument identifier on the profibus network.		

Ethernet (option)	Range	Default
Address [node]	1 ÷ 247	1
Identification instrument in the Modbus network.		
IP address	0.0.0.0 ÷ 255.255.255.255	10.0.0.100
IP address associated to the instrument.		
Subnet mask	0.0.0.0 ÷ 255.255.255.255	255.0.0.0
Subnet mask associated to the instrument.		
IP gateway	0.0.0.0 ÷ 255.255.255.255	10.0.0.254
IP address of the gateway associated to the instrument.		
IP Port	0 ÷ 65535	502
Number of the TCP port for the Modbus communication.		
IP Wifi	0.0.0.0 ÷ 255.255.255.255	1.0.0.1
IP Wifi address associated to the instrument.		

M-Bus (option)	Range	Default
Address [node]	0 ÷ 250	1
Instrument identifier on the M-BUS network.		
Baud rate [kbit/s]	300/600/1200/2400/4800/9600/19200/38400	2400
Communication speed.		
Stop bits	1 / 2 stop bits	1 stop
Communication parameters.		
Parity	None / Odd / Even	Even
Communication parameters.		
Min Response delay [ms]	0 ÷100	10
If set 0 the instrument responds as soon as possible.		

M-Bus Readout Data (option)	Range	Default (*)
Group 1	See Acronym Group table	Instantaneous
Group of the 1st measure read.		
Measure 1	See acronym in the table of the group selected	V
1st measure read.		
…….		
…….		
Group 20	See Acronym Group table	Energies
Group of the 20st measure read.		
Measure 20	See acronym in the table of the group selected	VArh OUT
20th measure read.		

(*) Default Table Group / Measure of M-BUS Readout Data

Number of Group and Measure	Group	Measure
1	Instantaneous	V
2	Instantaneous	V L1
3	Instantaneous	V L2
4	Instantaneous	V L3
5	Instantaneous	A
6	Instantaneous	A L1
7	Instantaneous	A L2
8	Instantaneous	A L3
9	Instantaneous	PF
10	Instantaneous	PF L1
11	Instantaneous	PF L2
12	Instantaneous	PF L3
13	Instantaneous	W
14	Instantaneous	VAR
15	Instantaneous	N
16	Instantaneous	Hz
17	Energies	Wh IN
18	Energies	Wh OUT
19	Energies	VArh IN
20	Energies	VArh OUT

Acronym tables

Acronyms group table

Acronym
Instantaneous
Average
Energies
Text*
Energies TB-1
Energies TB-2
Energies TB-3

Acronym
Energies TB-4
Energies TB-5
Energies TB-6
Energies TB-7
Energies TB-8
Energies TB-9
Energies TB-10

Acronym
Energies TB-11
Energies TB-12
Energies TB-13
Energies TB-14
Energies TB-15
Energies TB-16

*: only for User pages

Acronyms table of Instantaneous group

Acronym	Explanation
V	System Voltage
V L1	Voltage L1
V L2	Voltage L2
V L3	Voltage L3
V L1-L2	L1-L2 Voltage
V L2-L3	L2-L3 Voltage
V L3-L1	L3-L1 Voltage
A	System Current
A L1	Current L1
A L2	Current L2
A L3	Current L3
PF	System Power Factor
PF L1	Power Factor L1
PF L2	Power Factor L2
PF L3	Power Factor L3
COS	System COSϕ
COS L1	COSϕ L1

Acronym	Explanation
COS L2	COSϕ L2
COS L3	COSϕ L3
VA	System Apparent Power
VA L1	Apparent Power L1
VA L2	Apparent Power L2
VA L3	Apparent Power L3
W	System Active Power
W L1	Active Power L1
W L2	Active Power L2
W L3	Active Power L3
VAR	System Reactive Power
VAR L1	Reactive Power L1
VAR L2	Reactive Power L2
VAR L3	Reactive Power L3
N	Neutral Current
Hz	Frequency
TEMP	Temperature

Acronym	Explanation
THD V L1	THD Voltage L1
THD V L2	THD Voltage L2
THD V L3	THD Voltage L3
THD A L1	THD Current L1
THD A L2	THD Current L2
THD A L3	THD Current L3
DEG L1-L2	Phase Angle L1-L2
DEG L2-L3	Phase Angle L2-L3
DEG L3-L1	Phase Angle L3-L1
TAN	System Tanϕ
TAN L1	Tanϕ L1
TAN L2	Tanϕ L2
TAN L3	Tanϕ L3
EXP W	System Expected Power
EXP W L1	Expected Power L1
EXP W L2	Expected Power L2
EXP W L3	Expected Power L3

Acronyms table of Energies and TB (from 1 to 16) groups

Acronym	Explanation
Wh IN	System Active Energy IN
Wh OUT	System Active Energy OUT
VArh IN	System Reactive Energy IN
VArh OUT	System Reactive Energy OUT
VAh	System Apparent Energy
Wh L1 IN	Active Energy L1 IN
Wh L1 OUT	Active Energy L1 OUT

Acronym	Explanation
VArh L1 IN	Reactive Energy L1 IN
VArh L1 OUT	Reactive Energy L1 OUT
VAh L1	Apparent Energy L1
Wh L2 IN	Active Energy L2 IN
Wh L2 OUT	Active Energy L2 OUT
VArh L2 IN	Reactive Energy L2 IN
VArh L2 OUT	Reactive Energy L2 OUT

Acronym	Explanation
VAh L2	Apparent Energy L2
Wh L3 IN	Active Energy L3 IN
Wh L3 OUT	Active Energy L3 OUT
VArh L3 IN	Reactive Energy L3 IN
VArh L3 OUT	Reactive Energy L3 OUT
VAh L3	Apparent Energy L3

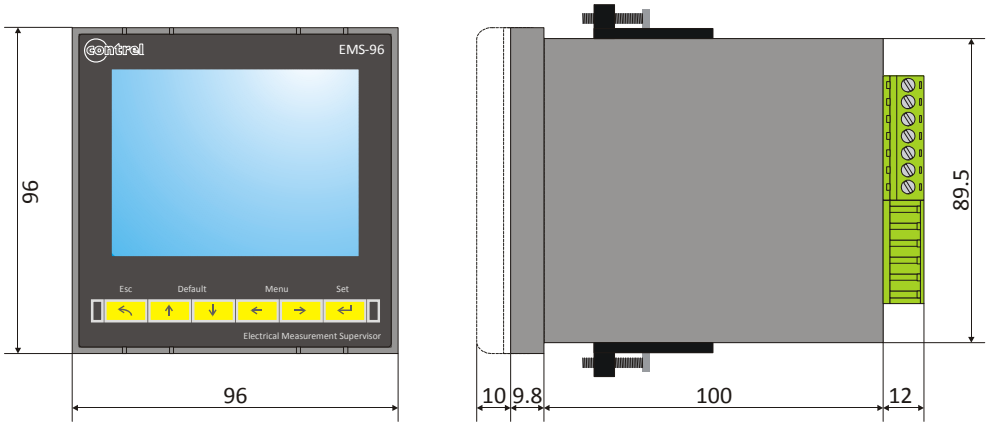
Acronyms table of Average group

Acronym	Explanation
AVG V	System Average Voltage
AVG V L1	Average Voltage Phase 1
AVG V L2	Average Voltage Phase 2
AVG V L3	Average Voltage Phase 3
AVG A	System Average Current
AVG A L1	Average Current L1
AVG A L2	Average Current L2
AVG A L3	Average Current L3
AVG PF	System Average Power Factor
AVG PF L1	Average Power Factor L1
AVG PF L2	Average Power Factor L2
AVG PF L3	Average Power Factor L3
AVG COS	System Average COSϕ

Acronym	Explanation
AVG COS L1	Average COSϕ L1
AVG COS L2	Average COSϕ L2
AVG-COS-3	Average COSϕ L3
AVG VA	System Average Apparent Power
AVG VA L1	Average Apparent Power L1
AVG VA L2	Average Apparent Power L2
AVG VA L3	Average Apparent Power L3
AVG W	System Average Active Power
AVG W L1	Average Active Power L1
AVG W L2	Average Active Power L2
AVG W L3	Average Active Power L3
AVG VAR	System Average Reactive Power
AVG VAR L1	Average Reactive Power L1

Acronym	Explanation
AVG VAR L2	Average Reactive Power L2
AVG VAR L3	Average Reactive Power L3
AVG N	Average Neutral Current
AVG Hz	Average Frequency
AVG TAN	Average System Tanϕ
AVG TAN L1	Average Tanϕ L1
AVG TAN L2	Average Tanϕ L2
AVG TAN L3	Average Tanϕ L3
EXP W	System Expected Active Power
EXP W L1	Expected Active Power L1
EXP W L2	Expected Active Power L2
EXP W L3	Expected Active Power L3

Dimensions



For fixing the flush mount version instrument to the panel, use the fixing devices supplied, by inserting them in the side groves 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 mm^2.

Technical features

Auxiliary power supply	
Voltage range	90÷250 Vac/dc 24÷48 Vac/dc
Frequency range	50/60 Hz
Protection fuse	1A Time Lag
Power consumption	8VA max – 1VA min (depending on the options and activities)
Measures / precision	
Energy	Factory Default: CEI EN 62053-21 compliant – Class 1 (1%) CEI EN 62053-22 compliant – Class 0.5 S (0.5%) CEI EN 62053-22 compliant – Class 0.2 S (0.2%)
Frequency	40÷70 Hz
Power factor	± 1.000
Cosϕ	± 1.000
Tanϕ	± tan 89.9°
THD	IEC62053-22 Compliant
Harmonics	Up to 20th Harmonics – IEC62053-22
Measurement range	
Voltage	30÷400VAc phase to neutral (52÷693 Vac phase to phase)
Current 1A	10mA÷1A (for 1, 0.5S or 0.2S Class accuracy, depending on the option)
Current 5A	50mA÷5A (for 1, 0.5S or 0.2S Class accuracy, depending on the option)
Installation	
Distributionnetworks	low and medium voltage - single phase connection - three phase with neutral - three phase without neutral
Voltageinputs	
Inputs type	3 phase inputs + Neutral
Permitted over voltage	480 Vac phase to neutral (830Vac continuous phase to phase) Over-voltage category: III (permanent installations)
Input resistance	>1.8MΩ
Frequency range	50/60 Hz Note: V1 terminal must be connected
Load (Burden) for each input	0.09 VA
Current inputs	
Inputs type	3 inputs isolated by internal current transformers additional input for neutral current with the same characteristics to the phase inputs
Maximum continuous overload 1A	1.3A
Maximum continuous overload 5A	6.5A
Load (Burden) for each input	0.00055 VA_{MAX}
Mechanical	
Overall dimension	96x96x130 mm
Weight	450 gr
Communication RS485	
Protocol	Modbus RTU
Standard	RS485 half-duplex with optical isolation
Baud rate	4.8 - 9.6 - 19.2 - 38.4 - 57.6 - 115.2 kbps
Node ID	1÷247
Parity	Even - Odd – None
Stop bit	1, 2

Communication Profibus		
Protocol	Profibus with slave DP-V0	
Baud rate	9.6Kbits/s - 3Mbits/s	
Address	0-126	
Connector	DB 9 female connector	
Communication Ethernet		
Protocol	ModbusTCP, SNMP	
Connector	RJ45, WiFi	
Communication Mbus		
Baud rate	0.3 - 0.6 - 1.2 - 2.4 - 4.8 - 9.6 - 19.2 - 38.4 kbps	
Address	0-250	
Parity	Even - Odd - None	
Stop bit	1, 2	
Digital Inputs		
Number of digital inputs	2, 4	
Input voltage range	Input rated voltage V_{INPUT} 24, 48, 115, 230 Vac/dc (only one defined in the order)	
Input current	Rated input current I_{INPUT} @ V_{INPUT}: $5mA_{MAX}$ @ V_{INPUT}=all voltages	
Inputs configuration	2 terminals (A-K) for each input: NPN, PNP	
Isolation voltage	3.5KV for 60 sec.	
Input filter	Digital	
Pulse duration	$T_{ON\ min}$ 30ms, $T_{OFF\ min}$ 30ms	
Digital Outputs		
Number of digital outputs	2, 4, 6, 8	
Type	Photo-MOS (solid state); RON= 8Ω typ. (12Ω MAX)	
Voltage/Current range	10÷300Vdc $150mA_{MAX}$; 12÷250Vac $150mA_{MAX}$	
Voltage isolation	4KV for 60 sec.	
Output functionality	Digital Output programmed as alarm Selectable pulse period 60ms÷1000ms Programmable pulse polarity (active close or active open) Programmable pulse "weight"	
Pulse duration	$T_{ON\ min}$ 30ms, $T_{OFF\ min}$ 30ms	
Analog outputs		
Number of analog outputs	2, 4	
Auxiliary power supply	Not required	
Insulation level	3.5KV for 60 sec.	
Maximum lenght of connection	1200m	
Resolution	12bit (4092 valori)	
Analog outputs type	Current	Voltage
Mode	0÷20mA or 4÷20mA	0÷10V or -10÷10V or 0÷5V or -5÷5V
Load	Max 600Ω	Min 1KΩ
Error	Max: 0.5% on E.S. – Typical 0.2% on E.S.	Max: 0.3% on E.S. – Typical 0.1% on F.S.
	Linearity: 0.01 on F.S. - Thermal stability: 0.01 on F.S.	
Settling time	50µs(0÷20mA)@R_{LOAD}=1KΩ, C_{LOAD}=200pF, L_{LOAD}=1mH	50µs(-10 ÷10V)@R_{LOAD}=1KΩ, C_{LOAD}=200pF
Clock calendar		
Data	Hours, minutes, seconds, day of week, date, month, year	
Update	Through modbus command and synchronization from digital inputs	
Data retention in absence of voltage	1 week backup guaranteed	
Storage		
Type of memory	Internal memory (factory default) – MicroSD card (option)	

CE COMPLIANCE AND STANDARDS

The instrument was tested in compliance with EMC 89/336/EEC and complies with the following standards:
EMISSIONS = EN 50081-2, 1992 - EN 55022-CLASS B CISPR 22
IMMUNITY = EN 50082-1, 1992 - EN 61000-6-2
SAFETY = EN 61010-2

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