EMA-11N

Network analyzer
with basic power quality analysis

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TERMS OF WARRANTY
The warranty is valid for the period of 24 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.

Safety information

Important information
Read these instructions carefully and look at the equipment to become familiar with the device before trying to install, operate, service or maintain it. The following special messages may appear throughout this bulletin or on the equipment to warn of potential hazards or to call attention to information that clarifies or simplifies a procedure.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Please note
Electrical equipment should be installed, operated, serviced and maintained only by qualified personnel. No responsibility is assumed by Contrel elettronica for any consequences arising out of the use of this material.
A qualified person is one who has skills and knowledge related to the construction, installation, and operation of electrical equipment and has received safety training to recognize and avoid the hazards involved.

Document scope
This manual is intended for use by designers, system builders and maintenance technicians with an understanding of electrical distribution systems and monitoring devices.

Safety precautions
Installation, wiring, testing and service must be performed in accordance with all local and national electrical codes. Carefully read and follow the safety precautions outlined below.

DANGER

HAZARD OF ELECTRIC SHOCK, EXPLOSION
• Apply appropriate personal protective equipment and follow safe electrical work practices.
• This equipment must only be installed and serviced by qualified electrical personnel.
• Turn off all power supplying this device and the equipment in which it is installed before working on the device or equipment.
• Always use a properly rated voltage sensing device to confirm power is off.
• Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested and tagged. Pay particular attention to the design of the power system. Consider all power supply sources, particularly the potential for back-feed.
• Do not exceed the device's ratings for maximum limits.
• Never short the secondary of a voltage transformer (VT).
• Never open circuit a current transformer (CT).

Failure to follow these instructions will result in death or serious injury.

UNINTENDED OPERATION
Do not use the meter for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
Failure to follow these instructions can result in death, serious injury or equipment damage.

Description

The power meter measures currents and voltages and reports real-time RMS values for all 3-phases and neutral. In addition, the power meter calculates power factor, real power, reactive power, and more.

The product functions of power meters provide the various measurement capabilities required to monitor an electrical installation with basic power quality analysis (THD, harmonic analysis up to 63rd order).

The key features are:

- flush-mount housing, 144x144 mm
- true RMS measurements
- high accuracy
- easy and fast navigation
- electrical parameters monitoring such as I, In, U, V, PQS, E, PF, Hz
- power/current demand, peak demand
- basic power quality analysis (THD, harmonics up to 63rd order, dip, swell, interrupts)
- waveforms V, I
- advanced programmable I/O functions
- log memory
- minimum/maximum values for many parameters
- management of up to 16 timebands
- up to 2 digital inputs and 2 digital outputs
- up to 4 analog outputs
- Modbus, ModbusTCP, Profibus, M-Bus communication

The following table lists the metering characteristics of the power meter for the measurement:

	Real-Time	Relative Min/Max	Absolute Min/Max	AVG	Max Demand	Graphics
Voltage L-N	●	●	●	●	●	●
Voltage L-L	●	●	●			
Current	●	●	●	●	●	●
PF	●	●	●	●	●	●
Cos Phi	●	●	●	●	●	
Tan Phi	●	●	●	●	●	
Crest factor	●	●	●			
Active power	●	●	●	●	●	●
Reactive power	●	●	●	●	●	●
Apparent power	●	●	●	●	●	●
Frequency	●	●	●	●		
THD V & A	●					
Harmonics	●					●
Counters	●					
Expected power	●					

Standard configuration

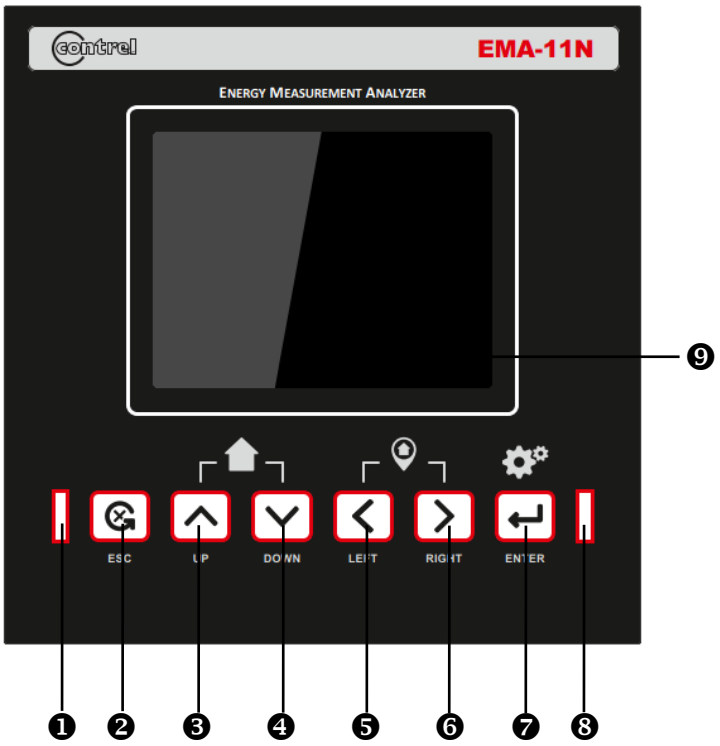
Power supply	90…250 VAC/DC
Current inputs	1 A or 5 A (Requires x/5A or x/1A current transformers)
Measurement accuracy	Class 1 (Active energy)
Digital I/O	2 Digital outputs (photo-mos)
Modbus RS-485	Number of ports: 1
Basic Power Quality	Not available

Additional resources

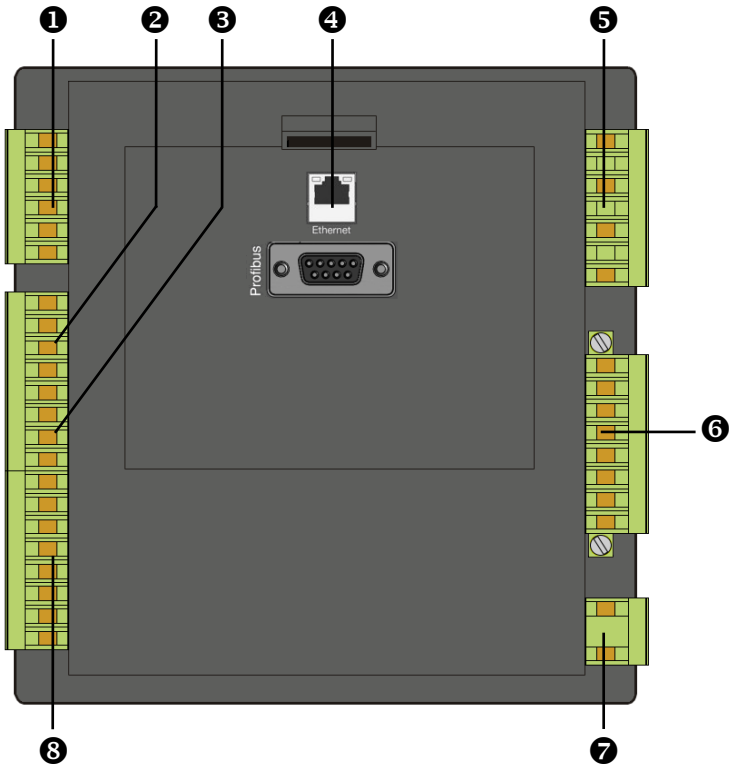
Power supply	20…60 VAC/DC			
Current inputs	1 A or 5 A + Neutral	Rogowski	Rogowski + Neutral	TT / TTA
Measurement accuracy	Class 0,5S		Class 0,2S	
I/O	2 Digital outputs 2 Digital inputs	2 Digital outputs 2 Analog outputs	2 Digital outputs 4 Analog outputs	2 Digital outputs 2 Digital inputs 4 Analog outputs
Communication	Number of RS-485 ports: 2	Modbus RS-485 Mobus TCP	Modbus RS-485 Profibus	Modbus RS-485 M-Bus
Basic Power Quality	H option H+ option			

H option	Waveforms, Harmonics up to 63rd order, DIP/Swell
H+ option	Waveforms, Harmonics up to 63rd order, DIP/Swell, Interrupts (V)

Physical Description



1	Alarm and energy pulsing LED
2	Cancellation key
3	Up key
4	Down key
5	Left key
6	Right key
7	Confirmation key and menu
8	Power ON and energy pulsing LED
9	Display



1	Comm. port (RS-485) or Comm. port x 2 (RS-485) (optional) or Comm port x 1 (RS-485) and M-Bus (optional)
2	Digital outputs x 2
3	Digital inputs x 2 (optional)
4	Ethernet port (RJ45) or Profibus DP (optional)
5	Voltage inputs
6	Current inputs
7	AUX supply
8	Analog outputs x 4 (optional)

Startup (first time and at every system reset)

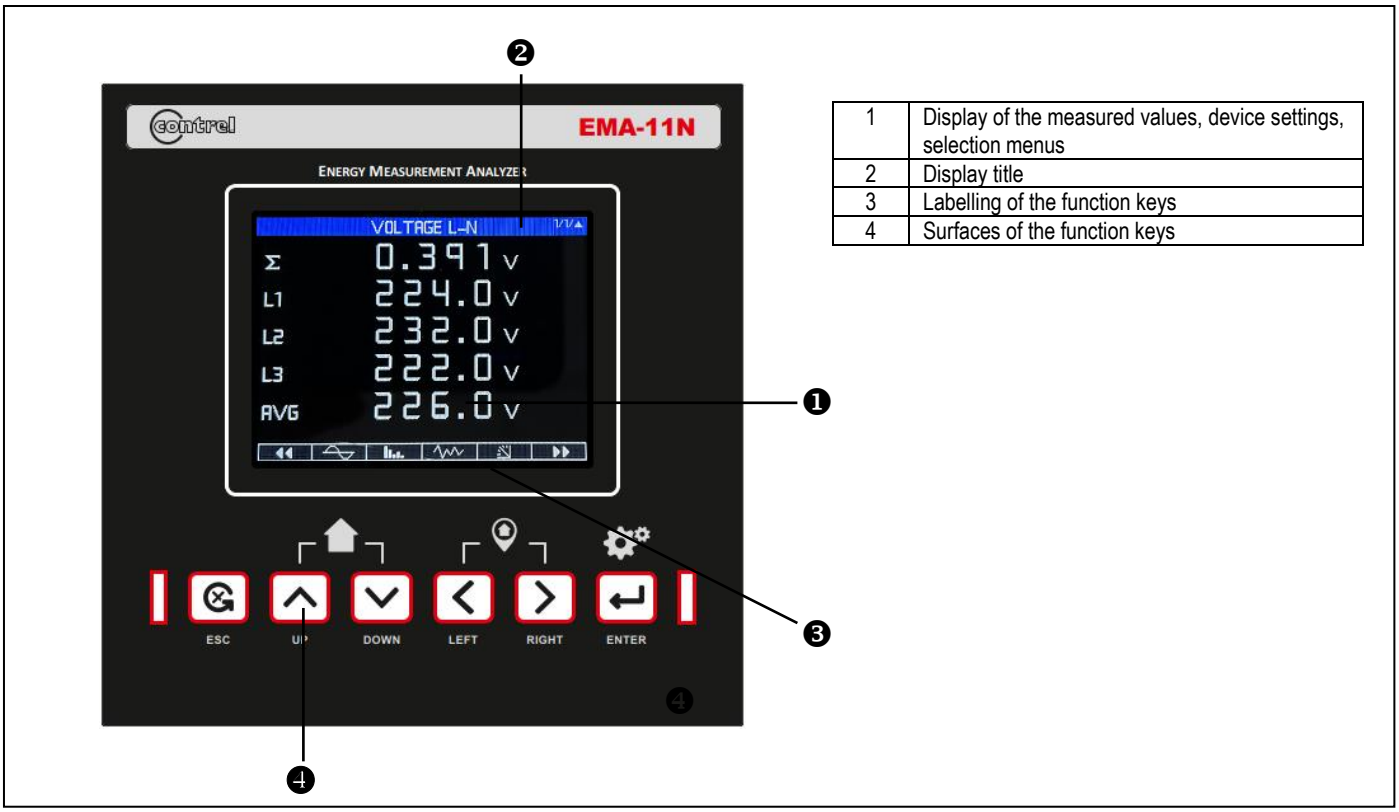
To start up the device, you must specify the operating parameters listed below in the device settings:

Steps for starting up the device
1. Apply the supply voltage
2. Parameterizing the device
   - 2.1 Language selection (set the language in which the display text is to appear)
   - 2.2 Type of wiring connection
   - 2.3 CT primary
   - 2.4 CT secondary
   - 2.5 CT Neutral primary
   - 2.6 CT Neutral secondary
   - 2.7 VT primary
   - 2.8 VT secondary
   - 2.9 Date and time
3. Apply the measuring voltage
4. Apply the measuring current
5. Check the displayed measured values

NOTICE
Check the connections Incorrect connection can result in malfunctions and failure of the device. Before starting up the EMA-11N, check that all connections are correct.

Device interface

The general display of the power meters is shown in the following picture:



1	Display of the measured values, device settings, selection menus
2	Display title
3	Labelling of the function keys
4	Surfaces of the function keys

Display: Display - Display title - Key labelling
The display is structured as follows:
- Display area - represents the real-time measured values, min/max/avg/max demand values, graphics, device settings and selection menus.
- Header area - specifies the information visible in the display area.
- Footer area - specifies the functions assigned to the function keys.

Function keys: Key labelling - Key surfaces
The six function keys enable operator input to the device:
- Navigation in the menus
- Selection of the measured value displays
- Selection of the measured visualization type (numbers, trends, waveform, harmonics, analogical mode)

The keys have multiple assignments. Function assignments and key labelling change according to the context of operator input. The designation of the current key function can be seen above the key number in the footer area of the display.

Harmonic analysis page

- The EMA-11N provides the harmonic analysis up to the 63rd order of the followings measurements:
  - ● phase-to-phase voltages
  - ● phase-to-neutral voltages
  - ● currents
- For each of these measurements, there is a display page that graphically represents the harmonic content through a bar graph.
- Every column is related to one harmonic order, even and odd.
- Every histogram represents each phase L1, L2, L3
- The value of harmonic content is expressed as a percentage.
- It is possible to show the harmonic content in numeric format, pressing ← → keys
- The vertical scale of the graph is automatically selected among full-scale values, depending on te column with the highest value.

Waveforms page

- This page graphically views the waveform of the voltage and current signal reads by the EMA-11N.
- It is possible to see one phase at a time or 3-phase, selecting it with ← → keys.
- The vertical scale is automatically scaled in order to fit the waveform on the screen.

Energy meters page

- Each energy meter page shows the following meters simultaneously:
  - ● active energy Imported, total and each phase L1, L2, L3 meters
  - ● active energy Exported, total and each phase L1, L2, L3 meters
  - ● reactive energy Imported, total and each phase L1, L2, L3 meters
  - ● reactive energy Exported, total and each phase L1, L2, L3 meters
  - ● reactive energy each quadrant (1…4), total and each phase L1, L2, L3 meters
  - ● apparent energy, total and each phase L1, L2, L3 meters
  - ● net energy
- Pressing ← → keys, the display moves to sub-page with timeband meters.
- To clear energy meters, it's necessary to access the commands menu.

Energies and Counters

- For the Energy billing, the EMA-11N can manage 16 different timebands in addition to the total Energy meters.
- The timebands selection is made by external digital inputs or through the dedicated command via communication protocol or internal preset mode.
- In preset control mode, the tariff switching is triggered by the real-time clock. The schedule modes for preset are:
  - Daily mode
  - Period mode
  - Holiday mode
- The preload energy values will be added to the energy meters.

Trend graph page

- The trend graph page allows to show the changes in the time of one following measurements.
  - ● voltages L1-N L2-N L3-N
  - ● currents
- When the maximum storage capacity is exceeded, the newest data will overwrites the oldest, so that the most recent data is always shown.
- The vertical full scale is calculated automatically.

Bar graph page

- The bar graph page allows to show of the following measurements:
  - ● daily active and reactive powers
  - ● active energy consumption (daily, weekly, monthly day by day and yearly), Imported and exported
  - ● reactive energy consumption (daily, weekly, monthly day by day and yearly), Imported and exported
- The vertical full scale is calculated automatically.

Phasor diagram

- The phasor diagram shows voltages and currents in relation to each other. The voltages and currents that belong together are depicted in similar colours (red and orange L1, light-green and purple L2, light-blue and dark-blue L3). In this way, the phase angles can easily be assigned.
- The display shows:
  - ● Voltages VL1, VL2, VL3
  - ● Currents IL1, IL2, IL3
  - ● Phase angle VL1-2, VL2-3, VL3-1
  - ● Phase angle V-A L1, V-A L2, V-A L3

User pages

- The user can create a maximum of 6 customized display pages.
- Each of these pages can view 6 measurements, freely chosen among the available readings of the EMA-11N.
- The title of the page can be freely programmed by the user, allowing, for instance, indicating the part of the plant supervised by the analyzer.
- The footer area of the page can be freely programmed by the user specified the title assigned to the function keys.
- The user pages are placed in a position that allows the reach them easily starting from the first pages, by pressing the keys.
- Like all other pages, it is possible to set the EMA-11N to return automatically to the user page after time has elapsed without keystrokes.

Data logger function

- The data logger allows to store at regular intervals up to 14 variables chosen freely among the analyzer measures.
- Provide two type of data logger: generic and smart. The smart logger store instantaneous value, average value, maximum and minimum value.
- Every record is marked with a time stamp taken from the real-time clock. The minimum sampling period (distance between two records) is of 1 second.
- The recording can be continuous (driven by a regular time intervals) or conditional, driven by the status of one internal variable. It's possible to define starting/stopping of the recording.
- When the memory is full, the user can choose to stop the recording (END MEMORY mode) or to continue overwriting the oldest records (FIFO mode).
- The display page dedicated to the data logger status shows all the fundamental information, like number of measures, total records, available free memory, residual time before the memory is filled.

Logic expression

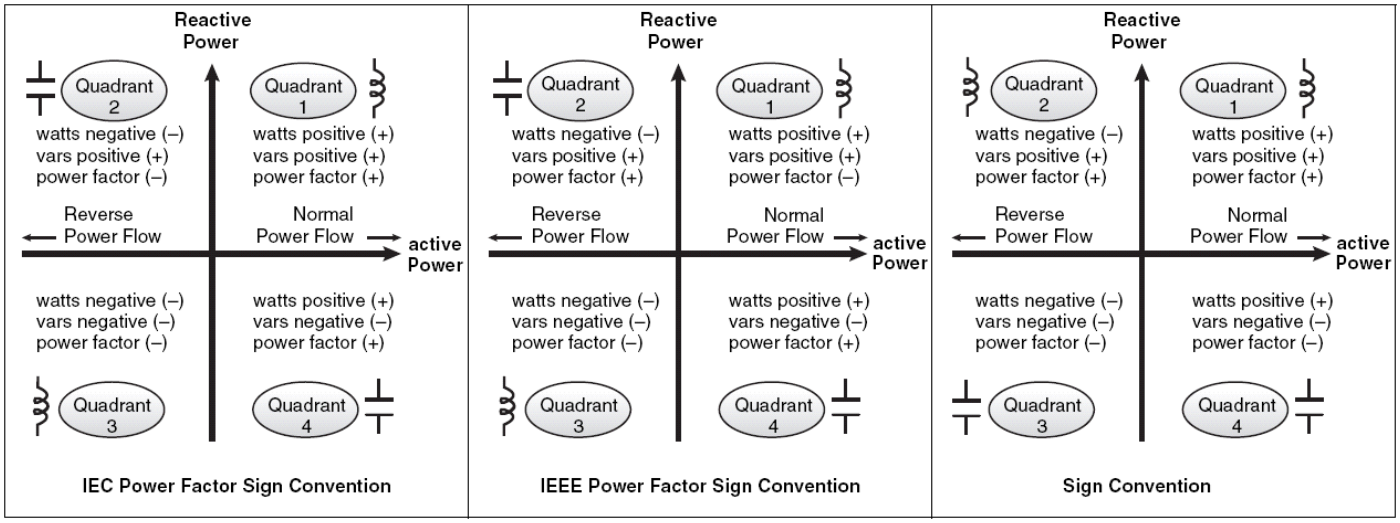
- It is possible to create max 8 internal variables named LE1…8, whose status depends on the combination of limit thresholds, inputs, measurements, etc.
- The operands can be combined each other with the following operators: sum, subtraction, multiplication, division.
- Every logic variable is the result of max 2 operands with 1 operations.
- The LOGIC EXPRESSION page displays, for every variable LE1…8, the status of the final result, that is the status of the selected Logic Expression.

Communication channels

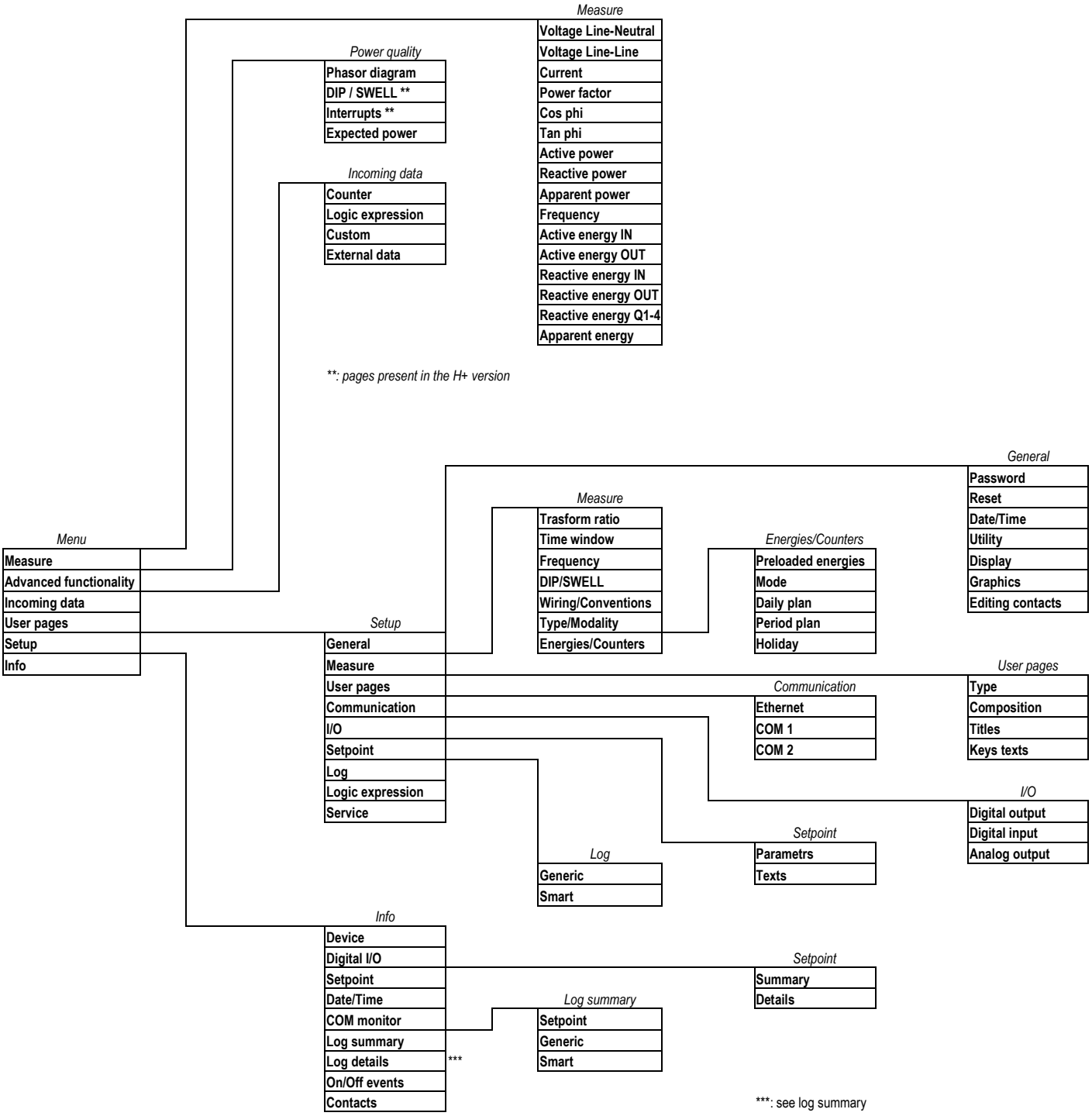
- The EMA-11N supports a maximum of 2 communications protocols.
- The communication channels are completely independent, both for the hardware (physical interface) and for the communication protocol.
- The two channels can communicate at the same time.
- Type of communication:
  - RS485 Modbus RTU
  - Ethernet Modbus TCP
  - Profibus DP
  - M-Bus

Power factor convention

Power factor (PF) is the ratio of active power (P) to apparent power (S), and is a number between 0 and 1. The meter shows positive or negative power factor according to standards.
The following diagrams show the correlation between kW, kVAR, PF, and inductive or capacitive loads for both the IEC, IEEE and SIGN standards.
The EMA-11N permits to select the power factor sign convention.



Display page navigation



Visualization and measures

Navigation STANDARD menu using ← → ↑ ↓ keys

Voltage L-N	Real time	3PH waveform	V1-A1 waveform	V2-A2 waveform	V3-A3 waveform	THD	Crest factor	Trend	Min-Max rel	Min-Max abs	AVG	MD	Analog Graph L1…3
Harmonics V L-N	Harmonics V L1			Harmonics V L2			Harmonics V L3				Harmonics V L-N number format (page 1…4)		
Voltage L-L	Real time		3PH Waveform		THD		Crest factor		Min-Max relative		Min-Max abs		
Harmonics V L-L	Harmonics V L1-2			Harmonics V L2-3			Harmonics V L3-1				Harmonics V L-L number format (page 1…4)		
Current	Real time	3PH waveform	V1-A1 waveform	V2-A2 waveform	V3-A3 waveform	THD	Crest factor	Load bars	Trend	Min-Max rel	Min-Max abs	AVG	MD	Analog Graph 3PH	Analog Graph L1…3
Harmonics I	Harmonics I L1			Harmonics I L2			Harmonics I L3				Harmonics I L-N number format (page 1…4)		
Power Factor	Real time		Min-Max rel		Min-Max abs		AVG		MD		Analog Graph 3PH		Analog Graph L1…3
CosPhi	Real time		Min-Max rel		Min-Max abs		AVG		MD		Analog Graph 3PH		Analog Graph L1…3
TANPhi	Real time		Min-Max rel		Min-Max abs		AVG		MD				
Active Power	Real time	Min-Max rel	Min-Max abs	AVG	MD	Analog mono	Analog L1 mon.	Analog L2 mon.	Analog L3 mon.	Analog 3PH bid.	Analog L1 bid.	Analog L2 bid.	Analog L3 bid.		
Reactive Power	Real time		Min-Max rel		Min-Max abs		AVG		MD		Analog Graph 3PH bid.	Analog Graph L1 bid.	Analog Graph L2 bid.	Analog Graph L3 bid.	
Apparent Power	Real time		Min-Max rel		Min-Max abs		AVG		MD						
Frequency	Real time		Min-Max rel		Min-Max abs		AVG		MD						
Graph Power	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		
Active Energy IN	Total meter		Timeband1 meter		…						Timeband16 meter				
Active Energy OUT	Total meter		Timeband1 meter		…						Timeband16 meter				
Reactive Energy IN	Total meter		Timeband1 meter		…						Timeband16 meter				
Reactive Energy OUT	Total meter		Timeband1 meter		…						Timeband16 meter				
Reactive Energy Q	Quadrant 1			Quadrant 2			Quadrant 3				Quadrant 4				
Apparent Energy	Total meter		Timeband1 meter		…						Timeband16 meter				
NET Energy	Total meter														
Graph Energy	Daily		Weekly		Yearly						January … December				
Table Energy	January Day 01-16		January 1 Day 17-31		…		December Day 01-16				December Day 17-31				

Visualization and measures

Navigation SMART menu with footer area - specifies the functions assigned to the function keys.

	KEY 1	KEY 2	KEY 3	KEY 4	KEY 5	KEY 6
Voltage L-N	PREV.	Instantaneous waveform three-phase waveform V1-A1 waveform V2-A2 waveform V3-A3 THD crest factor	*Harmonics 1 ** *Harmonics 2 ** *Harmonics 3 ** *Harmonics table 1/4 ** *Harmonics table 2/4 ** *Harmonics table 3/4 ** *Harmonics table 4/4 **	Trend Min-Max relative Min-Max ABS AVG Max Demand	Analog Graph L1 Analog Graph L2 Analog Graph L3	NEXT
Voltage L-L	PREV.	Instantaneous waveform three-phase THD crest factor	*Harmonics 12 ** *Harmonics 23 ** *Harmonics 31 ** *Harmonics table 1/4 ** *Harmonics table 2/4 ** *Harmonics table 3/4 ** *Harmonics table 4/4 **	Min-Max relative	Min-Max ABS	NEXT
Current	PREV.	Instantaneous waveform three-phase waveform V1-A1 waveform V2-A2 waveform V3-A3 THD crest factor Load bars	*Harmonics 1 ** *Harmonics 2 ** *Harmonics 3 ** *Harmonics table 1/4 ** *Harmonics table 2/4 ** *Harmonics table 3/4 ** *Harmonics table 4/4 **	Trend Min-Max relative Min-Max ABS AVG Max Demand	Analog Graph 3PH Analog Graph L1 Analog Graph L2 Analog Graph L3	NEXT
Power Factor **Cos Phi**	PREV.	Instantaneous	Min-Max relative Min-Max ABS	AVG Max Demand	Analog Graph 3PH Analog Graph L1 Analog Graph L2 Analog Graph L3	NEXT
Tan Phi	PREV.	Instantaneous	Min-Max relative	Min-Max ABS Min-Max ABS	AVG Max Demand	NEXT
Active Power	PREV.	Instantaneous	Monday Tuesday Wednesday Thursday Friday Saturday Sunday	Min-Max relative Min-Max ABS AVG Max Demand	Analog Graph 3PH-mono Analog Graph L1-mono Analog Graph L2-mono Analog Graph L3-mono Analog Graph 3PH-bidi Analog Graph L1-bidi Analog Graph L2-bidi Analog Graph L3-bidi	NEXT
Reactive Power	PREV.	Instantaneous	Monday … … Sunday	Min-Max relative Min-Max ABS AVG Max Demand	Analog Graph 3PH-bidi Analog Graph L1-bidi Analog Graph L2-bidi Analog Graph L3-bidi	NEXT
Apparent Power **Frequency**	PREV.	Instantaneous	Min-Max relative	Min-Max ABS	AVG Max Demand	NEXT
Active Energy IN **Active Energy OUT** **Reactive Energy IN** **Reactive Energy OUT**	PREV.	Actual TB1 … … TB16	DAY WEEK YEAR	MONTH 1 … … … MONTH 12	MONTH 1 - D01-16 MONTH 1 - D17-31 … MONTH 12 - D01-16 MONTH 12 - D17-31	NEXT
Reactive Energy Q	PREV.	Actual Q1 TB1 … TB16	Actual Q2 TB1 … TB16	Actual Q3 TB1 … TB16	Actual Q4 TB1 … TB16	NEXT
Apparent Energy	PREV.	Instantaneous TB1 … TB16	NET			NEXT

**: option*

Measuring inputs

Current measurement
The device is designed for connection of current transformers with secondary currents of 1 A and 5 A. It is only possible to measure alternating currents. Optionally (during the order phase), Rogowski sensors can be used.

Voltage measurement
The EMA-11N with multi-range power supply is designed for measuring in systems with rated AC voltages to:
● 400 V phase-to-neutral
● 690 V phase-to-phase

Power supply
A supply voltage is required to operate the device. Please consult the technical data or the type plate for the type and level of the possible supply voltage.
The EMA-11N can be supplied with an AC / DC multi-range power supply or a AC / DC extra-low voltage power supply:

- AC/DC multi-range power supply:
  Supply by 90 to 250 VAC ±10 % / 50 / 60 Hz or
  90 to 250 VDC ±10 %.

- Extra-low voltage AC/DC power supply:
  Supply by 20 to 60 VAC ±10 % / 50 / 60 Hz or
  20 to 60 VDC ±10 %.

CAUTION
Observe limit values
Failure to do so may result in damage to the device and the equipment.
The limits given in the technical data and on the type plate must not be exceeded even at startup or when testing the device.
If a supply voltage is applied that does not comply with the specifications on the type plate, this can result in malfunctioning and failure of the device.

Wiring settings

- Set wiring parameters according to the used wiring diagram. See wiring diagrams at the end of the manual.
- The Device status page allows to verify if the connection of the EMA-11N device has been executed properly.
- The wiring status page and phasor diagram allows to verify the following points:
  ● reading of the three phases
  ● voltage phases (angles between phases is different by 120°)
  ● reverse polarity of each CT
  ● mismatch between voltage and current phases
- If something not succeed, the display shows NOT CORRECT otherwise CORRECT

PARAMETERS MENU

Configuration

Setup → General

PASSWORD	Range	Default
Level 1 [visual] If set to 0, password is disabled and the access to all viewing and setup is allowed	0 ÷ 999999999	0 (OFF)
Level 2 [setup] If set, value to be specified to get setup parameters access	0 ÷ 999999999	0 (OFF)
Validity key [min] Keys enabling time after setup parameters access	1 ÷ 60	5
Keys protection When enabled, value to be specified to get setup parameters access	YES / NO	NO
Communication protection When enabled, value to be specified before to sending set parameters	YES / NO	NO
Enable options Special code value to enable software features (switch off/on the device to enable them)	0 ÷ 999999999	0

RESET	Range	Default
Global All device parameters are resetted to factory default value	YES / NO	-
Default setup All setup parameters are resetted to factory default value	YES / NO	-
All energies Clears energy meters	YES / NO	-
TB energies Clears tariff energy meters (excluded total energies)	YES / NO	-

Counters Clears counters	YES / NO	-
TB counters Clears all counters timebands (excluded total counters).	YES / NO	-
Min-Max Reset of MIN and MAX of all readings	YES / NO	-
Max demand Reset of Max Demand of all readings	YES / NO	-
Log energies Clears all energy meters logs	YES / NO	-
Log setpoint Clears all alarm setpoint logs	YES / NO	-
All logs Clears all logs	YES / NO	-
ON/OFF events Clears all switching on / off device logs	YES / NO	-
Manual reset SP-DO Reset of the digital outputs used in setpoint menu	YES / NO	-

DATE / TIME	Range	Default
Hour	0 ÷ 23	-
Minute	0 ÷ 59	-
Seconds	0 ÷ 59	-
Day of week	Monday ÷ Sunday	-
Day	1 ÷ 31	-
Month	January ÷ December	-
Year	2000 ÷ 2099	-

UTILITY	Range	Default
Language	English / Italian / German / Polish / French / Swedish	English
Colour theme	blue-white … gray-black	Blue-black
Text dimension	normal / big	Normal
Setpoint advice	YES / NO	NO
Page visualization If set Advanced, footer area - specifies the functions assigned to the function keys	STD / SMART	SMART

DISPLAY	Range	Default
Brightness Backlight level	1 ÷ 15	15
Back default page [min] If set to a time delay, after that time the display page goes back to page set as default	1 ÷ 30	5
Standby	OFF / ON	ON
Standby delay [min] If standby set to ON, after that time the display page goes to standby	1 ÷ 60	10
Refresh [1 = 250 ms] Display update time	1 ÷ 60	4 (1 sec)
SX Led	Metrological (0.1 kWh) – Setpoint	Metrological (0.1 kWh)
DX Led	Metrological (0.1 kVArh) – Status	Status

GRAPHICS	Range	Default
Clear max bar Reset the max value of bar graphs	YES / NO	NO

Measurements

Setup → Measure

TRANSFORM RATIO	Range	Default
CT primary CT primary winding rated current	1 ÷ 400000	1
CT secondary CT secondary winding rated current	1 ÷ 400000	1
CT N primary CT Neutral primary winding rated current	1 ÷ 400000	1
CT N secondary CT Neutral secondary winding rated current	1 ÷ 400000	1
VT primary VT primary winding rated voltage	1 ÷ 400000	1
VT secondary VT secondary winding rated voltage	1 ÷ 400000	1

MEASURE WINDOW	Range	Default
Upgrade time [min]	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
Selection of average reading calculation method: **Fixed =** Readings are integrated for the set time. Every time the integration time elapses, the Average value is updated with the result of the last integration **Shifting =** The values are integrated for a period time. Every time this interval elapses, the oldest value is replaced with the new one just calculated		

FREQUENCY	Range	Default
Fundamental [Hz]	50 / 60 / 50 (fixed) / 60 (fixed)	50
System frequency network.		

DIP/SWELL	Range	Default
DIP threshold [mV]	10000 ÷ 2000000000	190000
Value under which the voltage must go down to be considered as an event		
DIP cycles [1 = 10 ms]	1 ÷ 10000	250
Time for which the voltage value must be above the set limit [1 = 10 ms @50Hz - 1 = 8.33 ms @60Hz]		
SWELL threshold [mV]	10000 ÷ 2000000000	270000
Value above which the voltage must rise to be considered as an event.		
SWELL cycles	1 ÷ 10000	250
Time for which the voltage value must be above the set limit. [1 = 10 ms @50Hz - 1 = 8.33 ms @60Hz]		
Interruptions [mV]	10000 ÷ 2000000000	205000
Hysteresis interruptions [mV]	10000 ÷ 2000000000	215000
Storage	FIFO End memory	End memory
When the memory is full, the user can choose to stop the recording (End memory mode) or to continue overwriting the oldest records (FIFO mode)		

WIRING / CONVENTION	Range	Default
Wiring See the wiring table	3 phases [4 o 3 wires] … Balanced 3 wires	3 phases [4 o 3 wires]
4° inputs current	Measured / Computed / Differential	Measured
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 / IEEE	SIGN
See the following picture for details on the selected configuration.		
Setpoint timing	1 s / 0,1 s	1 s
Checking time for setpoint		
Rogowski full scale	175 mV / 350 mV / 700 mV	350 mV
Full scale range value for Rogowski coil sensor		

TYPE / MODALITY	Range	Default
Unit measure Unit of measure of the measurements	mV / mA / mW / Wh mV / mA / W / kWh V / A / kW / MWh	mV / mA / W / kWh
Modality	Monodirectional / Bidirectional	Bidirectional
If set Bidirectional, the energy meters shows imported and exported		
Compute Isum (I 1+2+3+4)	YES / NO	NO
Viewing the SUM of current inputs		
THD avg	1…10	1
Selection of average THD samples calculation		

Energies and Counters

Setup → Measure → Energies/Counters

PRELOAD ENERGY	Range	Default
ΣWh IN [1 = 0.1kWh]	0÷1000000000	0
ΣWh OUT [1 = 0.1kWh]	0÷1000000000	0
ΣVArh IN [1 = 0.1kVArh]	0÷1000000000	0
ΣVArh OUT [1 = 0.1kVArh]	0÷1000000000	0
ΣVAh [1 = 0.1kAh]	0÷1000000000	0
Wh IN L1 [1 = 0.1kWh]	0÷1000000000	0
Wh OUT L1 [1 = 0.1kWh]	0÷1000000000	0
VArh IN L1 [1 = 0.1kVArh]	0÷1000000000	0
VArh OUT L1 [1 = 0.1kVArh]	0÷1000000000	0
VAh L1[1 = 0.1kAh]	0÷1000000000	0
Wh IN L2 [1 = 0.1kWh]	0÷1000000000	0
Wh OUT L2 [1 = 0.1kWh]	0÷1000000000	0
VArh IN L2 [1 = 0.1kVArh]	0÷1000000000	0
VArh OUT L2 [1 = 0.1kVArh]	0÷1000000000	0
VAh L2 [1 = 0.1kAh]	0÷1000000000	0
Wh IN L3 [1 = 0.1kWh]	0÷1000000000	0
Wh OUT L3 [1 = 0.1kWh]	0÷1000000000	0
VArh IN L3 [1 = 0.1kVArh]	0÷1000000000	0
VArh OUT L3 [1 = 0.1kVArh]	0÷1000000000	0
VAh L3 [1 = 0.1kVAh]	0÷1000000000	0

MODE [TIMEBAND]	Range	Default
Energy changing	manual / from DI / preset	manual
Timeband switching: - Manual - From DI: the combination of digital inputs selects the actual timeband (TB) used (see the following table) - 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 selects the actual timeband (TB) used (see the following table).		

DI4	DI3	DI2	DI1	TB
0	0	0	0	1
0	0	0	1	2
0	0	1	0	3
0	0	1	1	4

DI4	DI3	DI2	DI1	TB
0	1	0	0	5
0	1	0	1	6
0	1	1	0	7
0	1	1	1	8

DI4	DI3	DI2	DI1	TB
1	0	0	0	9
1	0	0	1	10
1	0	1	0	11
1	0	1	1	12

DI4	DI3	DI2	DI1	TB
1	1	0	0	13
1	1	0	1	14
1	1	1	0	15
1	1	1	1	16

DAILY PLAN (from 1 to 16)	Range	Default
Start Hour 1 Hour at which the timeband will be changed.	00 ÷ 23	0
Start Minute 1 Minute at which the timeband will be changed.	00 ÷ 59	0
Timeband Used 1 New timeband set. * XX in TB-XX, depends from the number of the Timeband enabled.	not used ÷ TB-XX* (band)	not used
……..		
Start Hour 16 Hour at which the timeband will be changed.	00 ÷ 23	0
Start Minute 16 Minute at which the timeband will be changed.	00 ÷ 59	0
Timeband Used 16 New timeband set. * XX in TB-XX, depends from the number of the Timeband enabled.	not used ÷ TB-XX* (band)	not used

PERIOD PLAN (from 1 to 16)	Range	Default
Enable Enable or disable the plan. ***WARNING***: Set all the following parameters before to enable it.	yes / no	no
Start Month Month at which the period start.	January ÷ December	January
Start Day Day at which the period start.	1 ÷ 31	1
End Month Month at which the period finish.	January ÷ December	December
End Day Day at which the period finish.	1 ÷ 31	31

Monday Plan Plan used for this day.	Plan 1 ÷ Plan 16	Plan 1
…… ……		
Sunday Plan Plan used for this day.	Plan 1 ÷ Plan 16	Plan 1

Holiday	Range	Default
Month holiday 1	January ÷ December	January
Day holiday 1	1 ÷ 31	1
Plan holiday 1 Plan used for this holiday. When the plane setting is different from --- the Holiday Plan is enabled.	--- ÷ plan 16	---
……..		
Month holiday 48	January ÷ December	January
Day holiday 48	1 ÷ 31	1
Plan holiday 48 Plan used for this holiday. When the plane setting is different from --- the Holiday Plan is enabled.	--- ÷ plan 16	---

User pages

Setup → User page

TYPE	Range	Default
User page 1	instant / averages / energies / setpoint	instant
User page 2	instant / averages / energies / setpoint	instant
User page 3	instant / averages / energies / setpoint	instant
User page 4	instant / averages / energies / setpoint	instant
User page 5	instant / averages / energies / setpoint	instant
User page 6	instant / averages / energies / setpoint	instant

USER PAGE X (from 1 to 6)	Range	Default
Row 1 Selection of the measure displayed on the 1st row of the user page X.	If the type is: instant →see Acronym table of Instantaneous group averages → see Acronym table of Averages group energies → see Acronym table of Energy group setpoint → 1 ÷ 32	---
Row 2 Selection of the measure displayed on the 2nd row of the user page X.	See Row 1	---
Row 3 Selection of the measure displayed on the 3th row of the user page X.	See Row 1	---
Row 4 Selection of the measure displayed on the 4th row of the user page X.	See Row 1	---
Row 5 Selection of the measure displayed on the 5th row of the user page X.	See Row 1	---
Row 6 Selection of the measure displayed on the 6th row of the user page X.	See Row 1	---

EDIT TITLES	Range	Default
Title of user page 1	---	VOLTAGES
Title of user page 2	---	PHASE - PHASE
Title of user page 3	---	CURRENTS
Title of user page 4	---	POWER FACTOR
Title of user page 5	---	ACTIVE POWER
Title of user page 6	---	REACTIVE POWER

EDIT KEYS TEXTS	Range	Default
Key n°1	---	L-N
Key n°2	---	L-L
Key n°3	---	A
Key n°4	---	P.F.
Key n°5	---	W
Key n°6	---	VAr

Communication

Setup → Communication

COMn (n=1 and n=2)	Range	Default
Mode	SLAVE MASTER	SLAVE
Slaves to read Number of devices slave connected (only for MASTER mode)	1 ÷ 20	1
Master Timeout [ms] 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)	0 ÷ 10000	800
Scan rate [ms] Delay between two master requests (Master mode). ***Note:*** *this value must be greater than TIMEOUT*	0 ÷ 10000	1000
Node address Serial address (node number) for the communication protocol (only in Slave Mode)	1 ÷ 247	1
Baud rate [kbit/s] Serial communication speed	4800 / 9600 / 19200 / 38400 / 57600 / 115200	38400
Stop bits Number of stop bits	1-2	1
Data format	8 bit, no parity 8 bit, odd 8 bit, even	8 bit, no parity
Min. response delay [ms] Modify this value if use a slow external converter	5 ÷ 100	10

MENU AVAILABLE ONLY FOR MASTER MODE SELECTION

COM 1 & 2 SLAVE TIPOLOGY	Range	Default
Slave node 1 Type of device connected to the address 1	TTC-V / CTT-4 / …	---
	……..	
Slave node 20 Type of device connected to the address 20	TTC-V / CTT-4 / ...	---

MENU AVAILABLE ONLY FOR MASTER MODE SELECTION

COM 1 & 2 EDITING SLAVES NAME	Range	Default
Slave name node 1		Slave 1
The name of the device slave can be freely programmed by the user		
	……..	
Slave name node 20		Slave 20

MENU AVAILABLE IF **PROFIBUS PORT** IS AVAILABLE

PROFIBUS	Range	Default
Address [profibus node]	1 ÷ 126	1

MENU AVAILABLE IF **ETHERNET PORT** IS AVAILABLE

ETHERNET	Range	Default
IP address	0.0.0.0 ÷ 255.255.255.255	10.0.0.100
Subnet mask	0.0.0.0 ÷ 255.255.255.255	255.0.0.0
IP gateway	0.0.0.0 ÷ 255.255.255.255	10.0.0.254
Port TCP #1	0 ÷ 65535	502
Port TCP #2	0 ÷ 65535	503
DHCP	enable or disable	disable
Timeout [s]	10 ÷ 100000	4200

MENU AVAILABLE IF **M-BUS PORT** IS AVAILABLE

M-BUS	Range	Default
Node [address MBUS]	1 ÷ 250	1
Baudrate [kbit/s]	300 / 600 / 1200 / 2400 / 4800 / 9600 / 19200 / 38400	2400
Stop bits	1 / 2 stop bit	1 stop
Data format	8-None / 8-Odd / 8-Even	8-Even
Min. response delay [ms] Modify this value if use a slow external converter.	5 ÷ 100	35

M-BUS FRAME A	Range	Default
Group 1 Group of the 1st measure read.	See Acronym Group table	Energies
Measure 1 1st measure read	See acronym in the table of the group selected	ΣWh IN
……..		
Group 18 Group of the 18th measure read.	See Acronym Group table	not used

Measure 18 18th measure read.	See acronym in the table of the group selected	not used

M-BUS FRAME B	Range	Default
Group 1 Group of the 1st measure read.	See Acronym Group table	Instantaneous
Measure 1 1st measure read	See acronym in the table of the group selected	V1
……..		
Group 18 Group of the 18th measure read.	See Acronym Group table	not used
Measure 18 18th measure read.	See acronym in the table of the group selected	not used

Factoy setting frame A	Group	Measure
1	Energies	ΣWh IN
2	Energies	ΣVArh IN
3	Instantaneous	W
4÷18	not used	not used

Factory setting frame B	Group	Measure
1	Instantaneous	V1
2	Instantaneous	V2
3	Instantaneous	V3
4	Instantaneous	A1
5	Instantaneous	A2
6	Instantaneous	A3
7÷18	not used	not used

I/O

Setup → I/O

DIGITAL OUTPUT (n=1…2)	Range	Default
State Select 1 for close the DO, 0 to open	0 / 1	0
Level Normal status of the output. Allows to reverse the logic of the output function	Active low / Active high	Active high
Mode Function of the output: Status: Status of the output Pulse: Energy pulses Setpoint: Status of a limit threshold setpoint	Status / Pulse / Setpoint	Status
Pulse weight [Wh-VArh] Quantity of energy each pulse (e.g. 10Wh, 100Wh etc.)	1 ÷ 10000	100
Pulse duration [ms] The pulse has a duty cycle of 50% (Ton equal Toff) and the duration selected	60 ÷ 1000	500
Associated Associated measure to the digital output DO	See the acronym table of measurements	-

DIGITAL INPUT (n=1…2)	Range	Default
Mode DI-4=0, DI-3=0 DI-2=1, DI-1=1 - Timeband selected is 0011bin -> TB 3	Status Counter Change energy timeband Change counter timeband Change energy and counter timeband External trigger Reset setpoint DO Inhibition	Status
Multiplier If the digital inputs mode is **Counter** this parameter multiply the input pulse for the coefficient set	1 ÷ 100000	1
Divider If the digital input mode is **Counter** this parameter divide the input pulse for the coefficient set	1 ÷ 100000	1
Level action Status of the input for activation	Normally Open Normally Closed	Normally Open
SP-DO level The output set in **SP-DO reset** will go backt to the initial status	active high / active low	active high
SP-DO reset If is set **SP-DO reset** mode on the input, this parameter allows to set the outputs that will be reset when the input status is the same indicated in the **SP-DO Level** set	DO1…8	disabled
Measure unit Measure unit displayed during the use of the Digital Input in the **Counter** mode	-	-
Name The name of the input can be freely programmed by the user	-	-

ANALOG OUTPUT (n=1…8)	Range	Default
Range Defines the type of the analog outputs connected	0…20mA 4…20mA	0…20mA
Source	Internal measures / External node (only for COM Master mode)	Internal measures
Group Selection of the measurements group	Instantaneous	-
Associated measure Electrical parameter that controls the value of the analog output	See acronym in the table	-
High threshold Maximum value associated to the high threshold associated	-9999…+9999	0
High threshold unit Unit measure of threshold Voltage: mV-V-kV-MV Current: mA-A-kA-MA Apparent Power: VA-kVA-MVA-GVA	See below Active Power: W-kW-M-GW Reactive Power: VAr-kVAr-MVAr-GVAr Frequency: mHz	See below underlined Temperature: °C THD and harmonics: %*100 Angle: degree*10
Low threshold Minimum value associated to the low threshold	9999…+9999	0
Low threshold unit Unit measure of threshold Voltage: mV-V-kV-MV Current: mA-A-kA-MA Apparent Power: VA-kVA-MVA-GVA	See below Active Power: W-kW-M-GW Reactive Power: VAr-kVAr-MVAr-GVAr Frequency: mHz	See below underlined Temperature: °C THD and harmonics: %*100 Angle: degree*10

Alarm setpoint

Setup → Setpoint

SETPOINT (n=1…32)	Range	Default
Enable Enable or disable the setpoint function.	Yes / No	No
Source Select the instrument from which the measure to analyze it will be read.	Internal measures / Measures node X	Internal measures
Group Selection of the group for the actual setpoint if it is set **Internal measures** as **Source**.	See Acronyms Group table	---
Item Selection of the measure in the selected **Measure Group** of the actual setpoint.	See acronym in the table of the group selected	---
High threshold The **Action** is executed if the measure exceed the set value.	± 9999	0
High threshold unit 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 Current: mA-A-kA-MA Apparent power:VA-kVA-MVA-GVA Active power: W-kW-MW-GW	See below Reactive power: VAr-kVAr-MVAr–GVAr Frequency: mHz Temperature: °C THD and harmonics: %*100 Angle: degree*10 Apparent energy: VAh*100-kVAh-MVAh-GVAh Active energy: Wh*100-kWh-MWh-GWh Reactive energy: VArh*100-kVArh-MVArh-GVArh	See below underlined
Low threshold The **Action** is executed if the measure is lower than the set value.	± 9999	0
Low threshold unit See the description of **High threshold unit**.	See below	See below underlined
Over debounce [seconds] 0: instantaneous execution of the **Action** 1÷10000: execution of the **Action** if the condition is kept for the time set	0 ÷ 10000	0
Entry debounce [seconds] 0: instantaneous execution of the **Action** 1÷10000: execution of the **Action** if the condition is kept for the time set	0 ÷ 10000	0
Hysteresis (for high & low threshold) Setting a value different by 0, the hysteresis is enabled with a percentage value set.	See below	0
Logic operation over - 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.	See below	no logic
Logic operation entry - 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.	See below	no logic
Operands (1-16) Setpoint 1: select Yes to include the setpoint 01 in the logic. - - - - - - - - - - - - - - - - - - Setpoint 16: select Yes to include the setpoint 16 in the logic.	See below	No Operands
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 It possible to select one, more or anything action: - Display and save the event. - Change the DO-X state. - Increase a variable that indicates the number of events. - Increase a variable that indicates the duration time of the event.	See below	None
Action entry It possible to select one, more or anything action: - Display and save the event. - Change the DO-X state	See below	None
DO used 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).*	See below	None

Data logger function

Setup → Log

GENERIC LOG	Range	Default
Enable Before enabling the log function, it is necessary to disable the other enabled logs. Only one type of log can be used at a time. How to use: - always: the log is active immediately after setting; - in the period: the log is active (on the selected days of the week) in the selected period only (month and day); - in the timetable: the log is active (on the selected days of the week) in the set time; - in the period and in the timetable: the log is active (on the selected days of the week) in the selected period and time; - trigger: the log is active when the status set is verified;	none ÷ trigger	none
Sampling Acquisition timing.	1sec/…/60min/end of day/end of week/end of month/end of year	15 min
Storage Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.	FIFO / end memory	end memory
Start month	January ÷ December	January
Start day	1 ÷ 31	1
Start hour	0 ÷ 23	0
Start minute	0 ÷ 59	0
End month	January ÷ December	January
End day	1 ÷ 31	1
End hour	0 ÷ 23	23
End minute	0 ÷ 59	59
Monday Enable or disable the log for this day.	yes / no	no
……..		
Saturday Enable or disable the log for this day.	yes / no	no
Trigger input Input that triggers the log.	DI high level, DI low level, Setpoint	DI high level
DI used Digital input used for the trigger input.	1 ÷ 8	1
Setpoint used Setpoint used for the trigger input.	1 ÷ 32	1
Source 1 Source select of the 1st measure sampled	internal measure / measure node x	internal measure
Group 1 Group select of the 1st measure sampled	See Acronym Group table	---
Measure 1 Measure select of the 1st measure sampled		
……..		
Source 14 Source select of the 14th measure sampled	internal measure / measure node x	internal measure
Group 14 Group select of the 14th measure sampled	See Acronym Group table	---
Measure 14 Measure select of the 14th measure sampled		

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

SMART LOG	Range	Default
Enable	yes / no	no
Before enabling the log function, it is necessary to disable the other enabled logs. Only one type of log can be used at a time.		
Sampling	1min/…/60min/end of day/end of week/end of month/end of year	15 min
Acquisition timing.		
Storage	FIFO / end memory	end memory
Type of storage. Note: FIFO after 10 consecutive cycles is automatically disabled.		
Group 1	See Acronym Group table	---
Group select of the 1st measure sampled		
Measure 1		
Measure select of the 1st measure sampled		
……..		
Group 14	See Acronym Group table	---
Group select of the 14th measure sampled		
Measure 14		
Measure select of the 14th measure sampled		

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

Logic expression

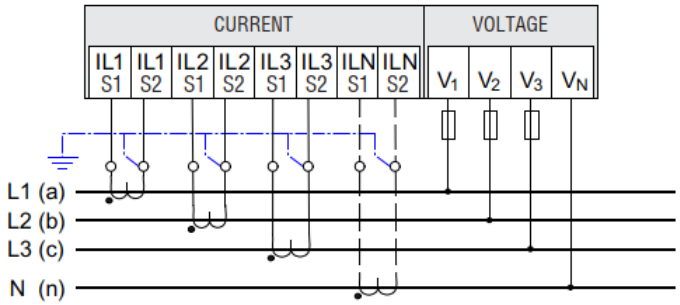
Setup → Math

MATH (N=1…8)	Range	Default
Enable	yes / no	no
Enable or disable the math X.		
Compute timing	1sec / … / 60min / end of day / end of week / end of month	1 sec
Time to update the results of math.		
Source 1	Internal measures / Measure node X	Internal measures
Select the instrument from which the measure to analyze is required.		
Group 1	--- / instantaneous / average / energies / digital input / counters /analog input / math	---
Selection of the group for the first operand if it is set **Internal measures** as **Source**.		
Item 1	If the selected **Group** is instantaneous or average or energies, see the acronym in the relative table.	---
Inside the **Group** chosen before, select the measure to check.		
Multiplier 1	1 ÷ 100000	1
Setting of the multiply factor for the operand before to perform the operation.		
Divisor 1	1 ÷ 100000	1
Setting of the division factor for the operand before to perform the operation.		
Operation	sum / subtraction / multiplication / division	sum
Select the operation to be performed.		
Source 2	Internal measures / Measure node X	Internal measures
Select the instrument from which the measure to analyze is required.		
Group 2	--- / instantaneous / average / energies / digital input / counters /analog input / math	---
Selection of the group for the first operand if it is set **Internal measures** as **Source**.		
Item 2	If the selected **Group** is instantaneous or average or energies, see the acronym in the relative table.	---
Inside the **Group** chosen before, select the measure to check.		
Multiplier 2	1 ÷ 100000	1
Setting of the multiply factor for the operand before to perform the operation.		
Divisor 2	1 ÷ 100000	1
Setting of the division factor for the operand before to perform the operation.		

Wiring connection

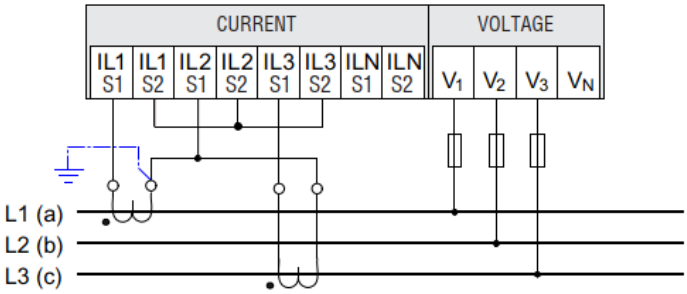
(1) Three-phase measuring, four conductors, unbalanced load, without voltage transformers, with current transformers.

Connection type 3PH-4W



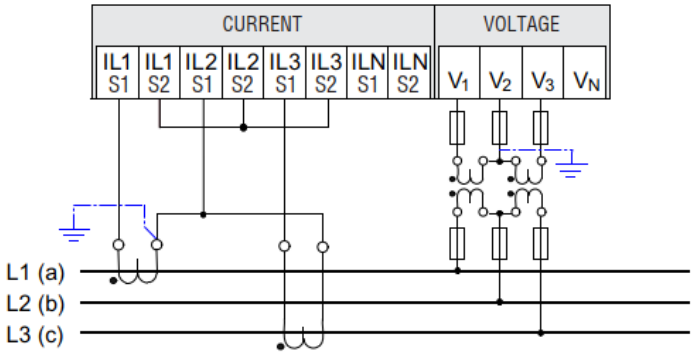
(2) Three-phase measuring, three conductors, unbalanced load, without voltage transformers, with two current transformers. (ARON)

Connection type ARON



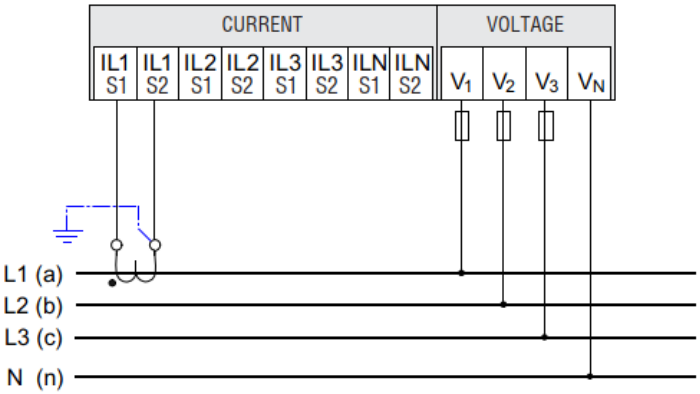
(3) Three-phase measuring, three conductors, unbalanced load, with voltage transformers, with two current transformers. (ARON)

Connection type ARON



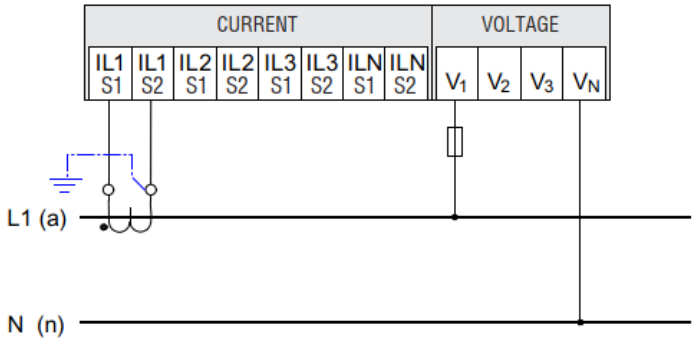
(4) Three-phase measuring, three conductors, balanced load, without voltage transformers, with one current transformer.

Connection type 3PH BAL



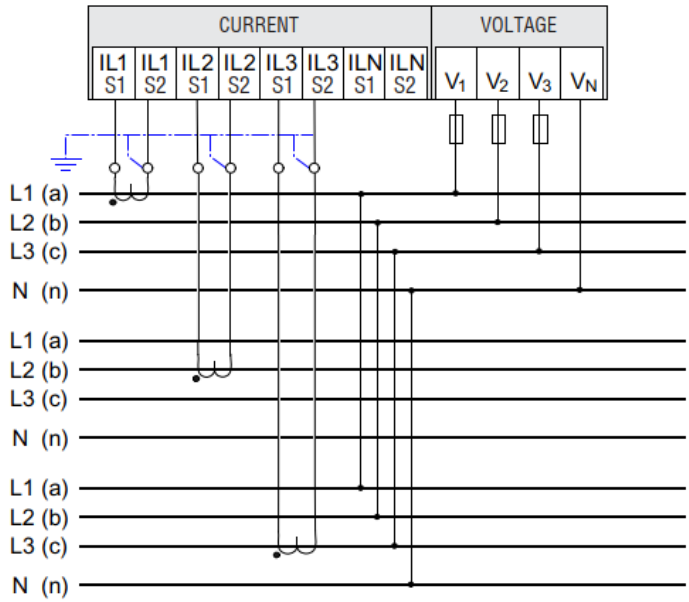
(5) Single-phase measuring, two conductors, without voltage transformers, with one current transformer.

Connection type 1PH



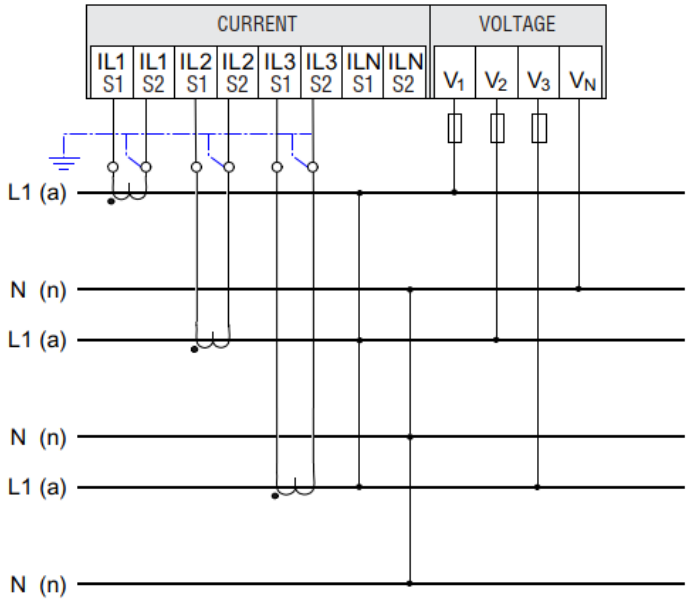
(6) Three-phase measuring, four conductors, balanced multiple loads, with three current transformers.

Connection type 3PH ML BAL



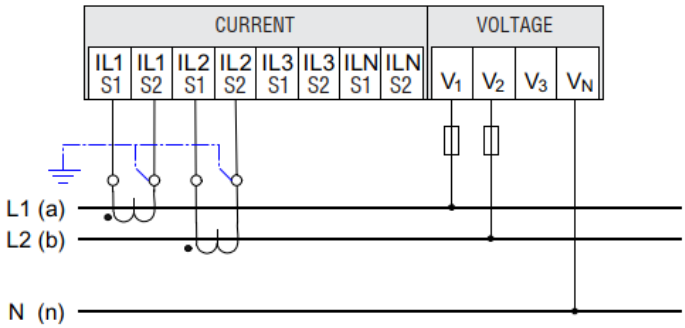
(7) Single-phase measuring, two conductors, without voltage transformers, with one current transformer.

Connection type 1PH ML



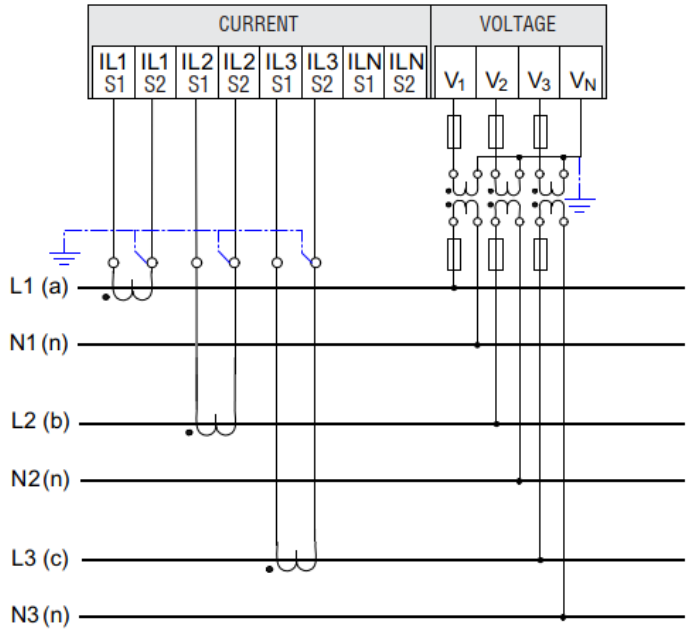
(8) Two-phase measuring, three conductors, unbalanced loads, without voltage transformers with two current transformers.

Connection type 2PH 3W



(9) Single-phase measuring, two conductors, with voltage transformers, with three current transformer.

Connection type 3X1PH



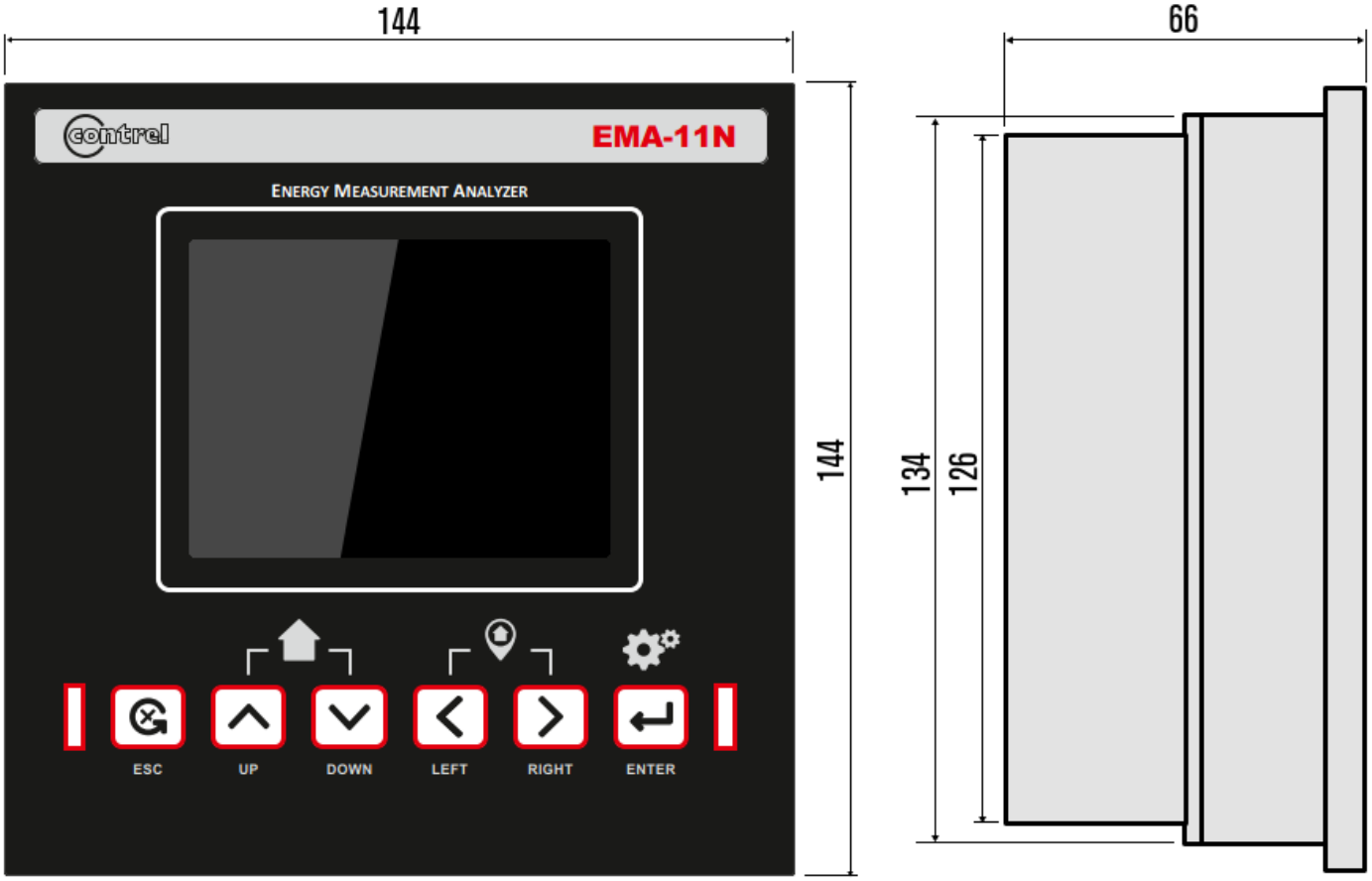
Wiring table

	3 phases [4 or 3 wires]	ARON	3-phase balanced	3- phase multiload balanced	single-phase	1-phase multiload	multi Single-phase	2-phase 3 wires
SYSTEM VOLTAGE	●	●	●	●				
PHASE VOLTAGE L_{1-N}	●	●	●	●	●	●	●	●
PHASE VOLTAGE L_{2-N}	●	●	●	●		●	●	●
PHASE VOLTAGE L_{3-N}	●	●	●	●		●	●	
LINE TO LINE VOLTAGE L_{1-2}	●	●	●	●				
LINE TO LINE VOLTAGE L_{2-3}	●	●	●	●				
LINE TO LINE VOLTAGE L_{3-1}	●	●	●	●				
SYSTEM CURRENT	●	●	calculated	●				
LINE CURRENT L_1	●	●	●	x3	●	●	●	●
LINE CURRENT L_2	●	●	calculated	x3		●	●	●
LINE CURRENT L_3	●	●	calculated	x3		●	●	
SYSTEM POWER FACTOR	●	●	calculated	●				
POWER FACTOR L_1	●	●	●	●	●	●	●	●
POWER FACTOR L_2	●	●	calculated	●		●	●	●
POWER FACTOR L_3	●	●	calculated	●		●	●	
SYSTEM COS φ	●	●	calculated	●				
PHASE COS φ_1	●	●	●	●	●	●	●	●
PHASE COS φ_2	●	●	calculated	●		●	●	●
PHASE COS φ_3	●	●	calculated	●		●	●	
SYSTEM APPARENT POWER	●	●	calculated	●				
APPARENT POWER L_1	●	●	●	x3	●	●	●	●
APPARENT POWER L_2	●	●	calculated	x3		●	●	●
APPARENT POWER L_3	●	●	calculated	x3		●	●	
SYSTEM ACTIVE POWER	●	●	calculated	●				
ACTIVE POWER L_1	●	●	●	x3	●	●	●	●
ACTIVE POWER L_2	●	●	calculated	x3		●	●	●
ACTIVE POWER L_3	●	●	calculated	x3		●	●	
SYSTEM REACTIVE POWER	●	●	calculated	●				
REACTIVE POWER L_1	●	●	●	x3	●	●	●	●
REACTIVE POWER L_2	●	●	calculated	x3		●	●	●
REACTIVE POWER L_3	●	●	calculated	x3		●	●	
NEUTRAL CURRENT	calculated or measured (option)							
THD VOLTAGE L_1	●	●	●	●	●	●	●	●
THD VOLTAGE L_2	●	●	●	●		●	●	●
THD VOLTAGE L_3	●	●	●	●		●	●	
THD CURRENT L_1	●	●	●	●	●	●	●	●
THD CURRENT L_2	●	●	calculated	●		●	●	●
THD CURRENT L_3	●	●	calculated	●		●	●	
ANGLE $_{1-2}$	●	●	●	●	●	●	●	●
ANGLE $_{2-3}$	●	●	●	●	●	●	●	●
ANGLE $_{3-1}$	●	●	●	●	●	●	●	●
SYSTEM TANGENT φ	●	●	calculated	●				
PHASE TANGENT φ_1	●	●	●	●	●	●	●	●
PHASE TANGENT φ_2	●	●	calculated	●		●	●	●
PHASE TANGENT φ_3	●	●	calculated	●		●	●	
SYSTEM ACTIVE ENERGY IN	●	●	calculated	x3	●	●	●	●
SYSTEM ACTIVE ENERGY OUT	●	●	calculated	x3	●	●	●	●
SYSTEM REACTIVE ENERGY IN	●	●	calculated	x3	●	●	●	●
SYSTEM REACTIVE ENERGY OUT	●	●	calculated	x3	●	●	●	●
SYSTEM APPARENT ENERGY	●	●	●	x3	●	●	●	●
ACTIVE ENERGY IN L_1	●	●	●	x3	●	●	●	●
ACTIVE ENERGY OUT L_1	●	●	●	x3	●	●	●	●
REACTIVE ENERGY IN L_1	●	●	●	x3	●	●	●	●
REACTIVE ENERGY OUT L_1	●	●	●	x3	●	●	●	●
APPARENT ENERGY L_1	●	●	calculated	x3		●	●	●
ACTIVE ENERGY IN L_2	●	●	calculated	x3		●	●	●
ACTIVE ENERGY OUT L_2	●	●	calculated	x3		●	●	●
REACTIVE ENERGY IN L_2	●	●	calculated	x3		●	●	●
REACTIVE ENERGY OUT L_2	●	●	calculated	x3		●	●	●
REACTIVE ENERGY OUT L_2	●	●	calculated	x3		●	●	●
APPARENT ENERGY L_2	●	●	calculated	x3		●	●	
ACTIVE ENERGY IN L_3	●	●	calculated	x3		●	●	

ACTIVE ENERGY OUT L_3	●	●	calculated	x3		●	●	
REACTIVE ENERGY IN L_3	●	●	calculated	x3		●	●	
REACTIVE ENERGY OUT L_3	●	●	calculated	x3		●	●	

Values read in this configuration aren't significant.

Mechanical dimensions (mm)



Appendix 1

Acronyms group table

Acronym
Instantaneous
Average
Energies
Setpoint

Acronyms table of Instantaneous group

Acronym	Description
ΣV	System Voltage
V1	Voltage L1
V2	Voltage L2
V3	Voltage L3
V1-V2	L1-L2 Voltage
V2-V3	L2-L3 Voltage
V3-V1	L3-L1 Voltage
ΣA	System Current
A1	Current L1
A2	Current L2
A3	Current L3
ΣPF	System Power Factor
PF1	Power Factor L1
PF2	Power Factor L2
PF3	Power Factor L3
ΣCOS	System COS
COS1	COS L1
COS2	COS L2
COS3	COS L3

Acronym	Description
ΣVA	System Apparent Power
VA1	Apparent Power L1
VA2	Apparent Power L2
VA3	Apparent Power L3
ΣW	System Active Power
W1	Active Power L1
W2	Active Power L2
W3	Active Power L3
ΣVar	System Reactive Power
Var1	Reactive Power L1
Var2	Reactive Power L2
Var3	Reactive Power L3
4° A	4th Current Input
FREQ	Frequency
INT TEMP	internal temperature
THD V1	THD Voltage L1
THD V2	THD Voltage L2
THD V3	THD Voltage L3
THD A1	THD Current L1

Acronym	Description
THD A2	THD Current L2
THD A3	THD Current L3
DEG V1-V2	Phase Angle L1-L2
DEG V2-V3	Phase Angle L2-L3
DEG V3-V1	Phase Angle L3-L1
ΣTAN	System Tangent
TAN1	Tangent L1
TAN2	Tangent L2
TAN3	Tangent L3
ΣEXP W	System Expected Power
EXP W1	Expected Power L1
EXP W2	Expected Power L2
EXP W3	Expected Power L3
DEG V-A 1	Phase Angle V1-A1
DEG V-A 2	Phase Angle V2-A2
DEG V-A 3	Phase Angle V3-A3

Acronyms table of Average group

Acronym	Description
AVG ΣV	System Average Voltage
AVG V1	Average Voltage Phase 1
AVG V2	Average Voltage Phase 2
AVG V3	Average Voltage Phase 3
AVG ΣA	System Average Current
AVG A1	Average Current L1
AVG A2	Average Current L2
AVG A3	Average Current L3
AVG ΣPF	System Average Power Factor
AVG PF1	Average Power Factor L1
AVG PF2	Average Power Factor L2
AVG PF3	Average Power Factor L3

Acronym	Description
AVG ΣCOS	Average COS L1
AVG COS1	Average COS L2
AVG COS2	Average COS L3
AVG-COS3	System Average Apparent Power
AVG ΣVA	Average Apparent Power L1
AVG VA1	Average Apparent Power L2
AVG VA2	Average Apparent Power L3
AVG VA3	System Average Active Power
AVG ΣW	Average Active Power L1
AVG W1	Average Active Power L2
AVG W2	Average Active Power L3
AVG W3	Average COS L1

Acronym	Description
AVG ΣVAr	System Average Reactive Power
AVG VAr1	Average Reactive Power L1
AVG VAr2	Average Reactive Power L2
AVG VAr3	Average Reactive Power L3
AVG 4° A	4th Current Input
AVG Hz	Average Frequency
AVG ΣTAN	Average System Tan
AVG TAN1	Average Tangent L1
AVG TAN2	Average Tangent L2
AVG TAN3	Average Tangent L3

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

Acronym	Description
ΣWh IN	System Active Energy IN
ΣWh OUT	System Active Energy OUT
ΣVArh IN	System Reactive Energy IN
ΣVArh OUT	System Reactive Energy OUT
ΣVAh	System Apparent Energy
Wh IN 1	Active Energy L1 IN
Wh OUT 1	Active Energy L1 OUT

Acronym	Description
VArh IN 1	Reactive Energy L1 IN
VArh OUT 1	Reactive Energy L1 OUT
VAh 1	Apparent Energy L1
Wh IN 2	Active Energy L2 IN
Wh OUT 2	Active Energy L2 OUT
VArh IN 2	Reactive Energy L2 IN
VArh OUT 2	Reactive Energy L2 OUT

Acronym	Description
VAh 2	Apparent Energy L2
Wh IN 3	Active Energy L3 IN
Wh OUT 3	Active Energy L3 OUT
VArh IN 3	Reactive Energy L3 IN
VArh OUT 3	Reactive Energy L3 OUT
VAh 3	Apparent Energy L3

Technical characteristics

Auxiliary supply	
Voltage range	90÷250 VAC/DC 20÷60 VAC / 24÷85 VDC
Frequency	50/60 Hz
Protection fuse	5x20 mm – 1 A time lag (option 90÷250 VAC/DC) 5x20 mm – 3.15 A time lag (option 20÷60 VAC/DC)
Power consumption	10 VA max – 3 VA min
Measurement accuracy	
Active energy	IEC62053-21 – Class 1 (1%) IEC62053-22 – Class 0.5s (optional) IEC 62053-22 – Class 0.2s (optional)
Frequency	40 ÷ 70 Hz
Power factor	± 1.000
Cosφ	± 1.000
Tanφ	± tan 89.9°
THD	IEC62053-22 compliant
Harmonics	up to 63rd Harmonics – IEC62053-22
Refresh rate	~ 200 ms
Voltage inputs	
Type of input	Three phase + Neutral
Measurement range	30 ÷ 400 VAC L-N 52 ÷ 693 VAC L-L
Frequency range	50 - 60 Hz ***Note: V1 terminal must be connected***
Method of measuring	True RMS value
Over-voltage	480 VAC L-N 830 VAC L-L Over-voltage category: III
Input resistance	>1.8 MΩ
Burden	0.12 VA for each input
Current inputs	
Rated current	1 A or 5 A Rogowski coil sensors (optional)
Measurement range	for 1A scale: 10 mA ÷ 1 A for 5A scale: 50 mA ÷ 5 A
Type of input	Isolated inputs by internal CT
Method of measuring	True RMS value
Overload peak	for 1A scale: 1.3 A for 5A scale: 6.5 A
Burden	0.001 VA_{MAX} for each input
Digital output	
Number	2
Type	Photo-MOS (solid state); R_{ON}= 8Ω typ. (12Ω MAX)
Range Voltage/Current	10 ÷ 300 VDC 150 mA_{MAX}; 12 ÷ 250Vca 150 mA_{MAX}
Isolation voltage	4KV per 60 sec.

Output functionality	Programmable output as pulse / status / alarm
Pulse duration	T_{ON_min} 30ms, T_{OFF_min} 30ms
Digital input	
Number	2
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	3.5 kV for 60 sec.
Input filter	Digital
Pulse duration	T_{ON_min} 30ms, T_{OFF_min} 30ms
Analog output	
Number of analog outputs	2 or 4
Auxiliary power supply	Not required
Insulation level	3.5KV for 60 s
Maximum length of connection	1200 m
Resolution	12 bit (4096 values)
Analog outputs type	Current
Mode	0÷20mA or 4÷20mA
Load	Max 600 Ω
Error	Max: 0.5% full-scale - Typical 0.2% full-scale Linearity: 0.3% full-scale
Setting time	50µs(0÷20mA)@R_{LOAD}=1K, C_{LOAD}=200pF, L_{LOAD}=1mH
Communication RS485	
Number of ports	1 + 1 (optional)
Protocol	Modbus RTU
Standard	RS485 half-duplex with optical isolation
Baud rate	4800 – 9600 – 19200 – 38400 – 57600 – 115200 kbps
Parity	Even - Odd – None
Number of stop bits	1, 2
Communication Profibus	
Protocol	Slave DP-V0
Baud rate	9.6 Kbits/s – 3 Mbits/s
Node	0-126
Connector	DB9 female connector
Communication Ethernet	
Protocol	Modbus TCP
Connector	RJ45
Communication M-Bus	
Baud rate	0.3 - 0.6 - 1.2 - 2.4 - 4.8 - 9.6 - 19.2 - 38.4 kbps
Node	0-250
Parity	Even - Odd – None
Stop bit	1, 2
Real-time clock	
Type	Quartz crystal based
Update	Through communication command and front keys
Retention (in absence of voltage)	7 days backup guaranteed
Data recording	
Memory	100 KB (standard) Maximum: 4 MB (optional)
Housing	
Version	144 x 144 mm
Degree of protection	IP50 on front IP20 housing and terminals
Weight	430 gr
Ambient conditions	
Operating temperature	-10… +60°C
Storing temperature	-20… +70°C
Relative humidity	5…95%
Certifications and compliance	
Reference standards	CEI EN 61000-6-2:2006 CEI EN 61000-6-4:2007 CEI EN 61010-1:2013

For further details please contact:

Contrel elettronica s.r.l.
Via San Fereolo, 9
I-26900 Lodi
Tel: +39 0371 30207 / 30761 / 35386