Revalco®

Made in Italy

network analysers
multifunction meters

RAN96 THREE-PHASE MULTIFUNCTION METER

400 400 399
L1 L2 L3 V
108 084 103 A

RANMIS DIGITAL 3-PHASES MULTIMETER
V 380 378 382
L1 L2 L3
A 255 253 255

DIGITAL 3 PHASES MULTIFUNCTION METER
L1 L2 L3
392 393 397
5.6 4.7 1.7

1RM023AV
L1 000
L2 000
L3 000
L-L V
L-N V
A
Down Up

000
000 A
Input 5A
Cl 0.5
1RSDI

2RAE96L4CS THREE-PHASE MULTIFUNCTION METER

3V= 0 F= 0.00
3A= 0.0 0
ΣW=
3Pf= 1.00

Selectable CT
5 = 6000A
Input 5A (x 1.2 max) 2/3 C.T.
2x230 (400)V (500V max) 3/4 Wires
Cl 0.5 V-A- Cl 2 P-kWh
Alarm 1 2 Counts
Alarm

50.0 L-L V
50.0 L-N V
50.0 A

RANM8N DIGITAL 3-PHASES ENERGY ANALYZER
3V= 0 F= 0.00
3A= 0.0 0
ΣW=
3Pf= 1.00

Revalco
THREE-PHASE MULTIFUNCTION METER
V L-L
V L-N
A
197 301
301
Cosφ Hz
Power
1RAEM4CS Energy
Input 5A / 500V
Class 0.5(V-A-Hz)
EN60688
up down

2011

NETWORK ANALYSER

MULTIFUNCTION METERS

PARAMETERS TABLE

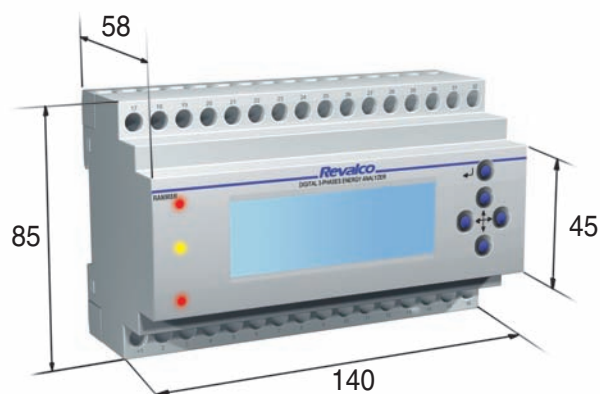|	NETWORK ANALYSER THREE PHASE	SINGLE PHASE									
	1RANM8N 2RAN968N	1RANM2 (ENER·GO)	1RANM2CT	1RANM23	2RAN72C 2RAN96C 2RAN...C-100	2RAN72C485 2RAN96C485 2RAN...C485-C100	1RANM6 2RAN96	1RANM6R 2RAN96R	1RANM6C 2RAN96C	1RANM6CS 2RAN96CS	1RANM6C485 2RAN96C485
DC Voltage 800 V max											
DC Voltage ..../100V by divider											
DC Current .../60mV											
Bidirectional power (kW)											
Bidirectional Total Energy (import/export)											
Bidirectional Ampere-hour Ah (import/export)											
Harmonic distorsion	●										
Total Harmonic distorsion	●										
Voltage / Current crest factor	●										
Active Energy 4 tarifs (+/-)	●										
Reactive Energy 4 tarifs (+/-)	●										
Total integration time (15min)	10,15,20,30,60min selectable										
Voltage phase-neutral	●	●	●	●	●	●	●	●	●	●	●
Voltage phase-phase	●		●	●	●	●	●	●	●	●	●
Medium phase voltage	●			●	●	●					
Current (direct insertion)		●									
Current (insertion by CT)	●		●	●	●	●	●	●	●	●	●
Current on neutral	●			●	●	●					
Medium Current	●										
Power Factor	●	●	●	●	●	●					
Total Power Factor	●			●	●	●			●	●	●
Apparent Power	●			●	●	●					
Total Apparent Power	●		●	●	●	●			●	●	●
Active Power (+/-)	●	●	●	●	●	●					
Total Active Power (+/-)	●			●	●	●			●	●	●
Reactive Power	●			●	●	●					
Total Reactive Power	●			●	●	●			●	●	●
Frequency	●		●	●	●	●			●	●	●
Total Active Energy (import) resettable	●	●	●	●	●	●			●	●	●
Relative Active Energy	●								●	●	●
Total Active Energy (export) resettable	●			●	●	●					
Total Reactive Energy resettable	●		●	●	●	●			●	●	●
Total working hours	●			●	●	●			●	●	●
Partial working hours resettable	●	●	●	●	●	●			●	●	●
Acoustic pre-alarm	●										
Phase sequence	●			●	●	●			●	●	●
Voltage asimmetry				●	●	●					
OUTPUT RELAY (alarm threshold)	●	1	1					2		2	
MODBUS SLAVE RTU RS232											
MODBUS SLAVE RTU RS485	●					●					●
BLUETOOTH ACCESS (max 10 meters - Class 2) Baude rate 115200											
PERMANENT MEMORY (EEPROM)	●										
400V insertion, 3 or 4 wires, 2 or 3 systems (H1)	selectable										
VT..../100V, 3 or 4 wires, 2 or 3 systems (0...9,9kV) (H2)	selectable										
VT..../100V, 3 or 4 wires, 2 or 3 systems (10...100kV) (H3)	selectable										
Software on www.revalco.it	●					●					●
Option Split Core CT (up to 100A)					●	●					
Option **ETHERNET** or **PROFIBUS**											
Dimensions in mm	8 DIN / 96x96	2 DIN		2 DIN	72x72 / 96x96		6 DIN / 96x96				

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THREE PHASE A.C. AND SINGLE PHASE D.C. VERSIONS

Column headers (product codes):

- 1RANM6CS485 / 2RAN96CS485
- 1RANM6C232
- 1RAEM
- 1RAEMC
- 1RAEMCS
- 1RAEMC485
- 1RAEMCS485
- 1RAEMBL485
- 1RAEM4C / 1RAEM4C-C100
- 1RAEM4CS / 1RAEM4CS-C100
- 1RAEM4C485 / 1RAEM4C485-C100
- 1RAEM4CS485 / 1RAEM4CS485-C100
- 1RAEM4CDC / 1RAEM4CSDC
- 1RAEM4C485DC / 1RAEM4CS485DC
- 1RAEM4CHDC / 1RAEM4CSHDC
- 1RAEM4C485HDC / 1RAEM4CS485HDC
- 1RAEM410C - 1RAEM416C / 1RAEM432C - 1RAEM463C
- 1RAEM410CS - 1RAEM416CS / 1RAEM432CS - 1RAEM463CS
- 1RAEM410C485 - 1RAEM416C485 / 1RAEM432C485 - 1RAEM463C485
- 2RAE96L4C / 2RAE72L4C
- 2RAE96L4CS
- 2RAE96L4C485 / 2RAE72L4C485
- 2RAE96L4CS485

Bottom size labels:

| 6 DIN | 6 DIN / 96x96 | 4 DIN | 72x72 / 96x96 | 96x96 |

Note: 96x96 (2RAE96L4C485)

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NETWORK ANALYSERS 1RANM8N / 2RAN968N

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85

140

The 140 mm dimensions correspond to 8 DIN modules
Weight: 0,61 Kg

45

91 +0,8

89

91 +0,8

A

96

96
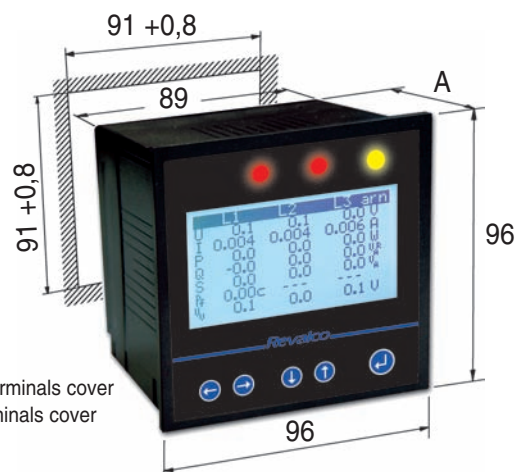
A = 97,3 without terminals cover
A = 116,5 with terminals cover
Weight: 0,55 kg

INSTALLING AND CONNECTING

INSTALLATION PROCEDURE

1. Mount the instrument on DIN rail

2. ⚠ Turn power off before connecting the instrument to current transformers and/or voltage connections.

3. ⚠ Connect current lines to built-in current transformers (CTs). (OPTIONALY). Take care to orient the CTs correctly. Connect the voltage wires to the voltage measurement inputs. Start with the N wire.

4. Connect digital outputs (relay output terminals) to the quipment (if applicable).
5. Connect digital input port to the equipment (if applicable).

6. Connect RS 485 port to the communication network. Verify connect polarization.
7. Power on the instrument

CONNECTION - MEASUREMENT

The instrument incorporates internal current transformer (5 A input current), together with accompanying burden resistor. Pay attention to the polarity of current phases – they need to match the polarity of voltage phases. Instrument monitor will report incorrect power polarity otherwise. For extending voltage and current measuring range, use appropriate voltage and current transformers and set correct voltage and current transformation factors. Primary of voltage transformers have to be rated to handle line voltages and secondary have to match selected instrument voltage range. It is necessary to protect instruments voltage inputs with external fuses or circuit breakers. (not show in connection diagrams), 1 A or smaller fuses with 10 kA interr. current rating. Output of external current transformer will produce dangerous voltages if left open while current is flowing through primary winding. Do not disconnect CT output while it's connected to the live circuit to prevent damage to the CT or the operator.

TROUBLESHOOTING INSTALLATION PROBLEMS

In the case of incorrect power please check:
- verify that the instrument is showing the same current as measured in the 5 A CT loop. If this is not the case, verify current transformation factor set on instrument
  If this factor is set correctly, check the current harmonics.
- verify that the CTs are wired to the correct phases and oriented to match voltage phase orientations.
- verify the setting on the instrument (3-wire, 4 wire or Aaron) match instruments connection scheme.
In the case of inverse polarity of power (on all phase), use option Invert. Pwr. Sign in System setting configuration menu.

LEDS: YELLOW = comunication activity; RED = digital output status or energy pulse output indicators

NETWORK COMMUNICATION

MODBUS PROTOCOL: RAN provides serial communication interface to other systems connected on MODBUS network. MODBUS is standard communications protocol in industry, allowing connecting industrial electronic devices across the network. RAN implements RTU serial transmission mode with CRC (cyclic redundancy check) error correction. ASCII mode is not supported. This allows remote reading and configuring of the meter by a MODBUS controller or PC with special control program. The communication protocol is a subset of Modicon MODBUS, OSI model level 7, providing client/server communication. Client role is provided by the master of network and the slave nodes as servers. The protocol is a master/slave protocol. Only one master and up to 247 slaves can be connected to the RS485 network at a time.

MODBUS communication is always initiated by a master (controller). Slaves never transmit data without a request, and never communicate between each other. Only one transaction is active at a time. The master always addresses one or all slaves (the master doesn't have an address). The master can address each slave individually (unicast mode). Conversation consists of request from the master and reply from the slave. Address of '0' is used for addresing all slaves at the same time (broadcast mode). Each device on MODBUS network must be assigned a unique address between 1 and 247. More than two devices on the same network with the same addresses, the communication will fail. RAN sends and receives data in fixed format. Data byte is binary coded and transmitted with least-significant bit first.

The baud rate is programmable as 4800 bps or 9600 with 8 bit data and 1 stop bit.
Available baud rates: 2400, 4800, 9600, 19200, 38400, 57600
Available formats: none parity / 1 stop bit, none parity / 2 stop bits, even parity / 1 stop bit

RS-485 CONNECTION: RS485 output drivers on RAMN8 supports up to 32 devices at a time, often it is necessary to install repeaters in MODBUS network where more than 32 devices are installed. Single pair of wires is used for connection (2-wire connection system). It is recommended to use screened twisted-pair cable to minimize noise-related signal errors. The cable screen must be connected to the connector housing (e.g. ground) at one side only (preferably at the controller/master). Maximum distance for reliable communication is 1000 m (baud rate 9600 ,2x1.5mm2 gauge). RS-485 requires line termination with two 100..150 Ω/0.5 W resistors. Install one resistor at the controller/master input/output and the other at the most remote device (at each extremity of the cable).
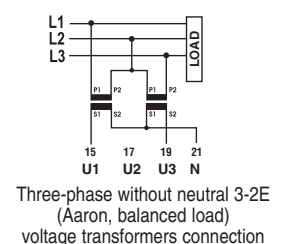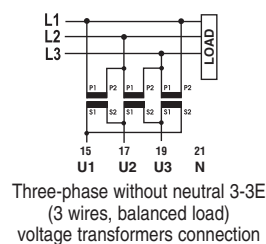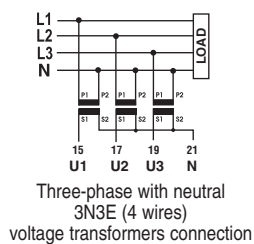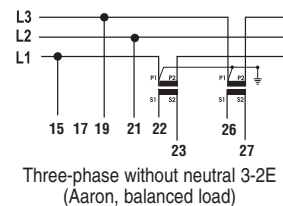Visit web page http://www.modbus.org for more information about MODBUS network, hardware and software specifications.
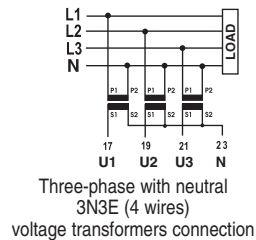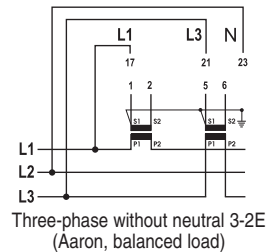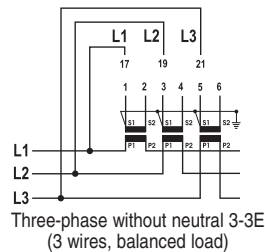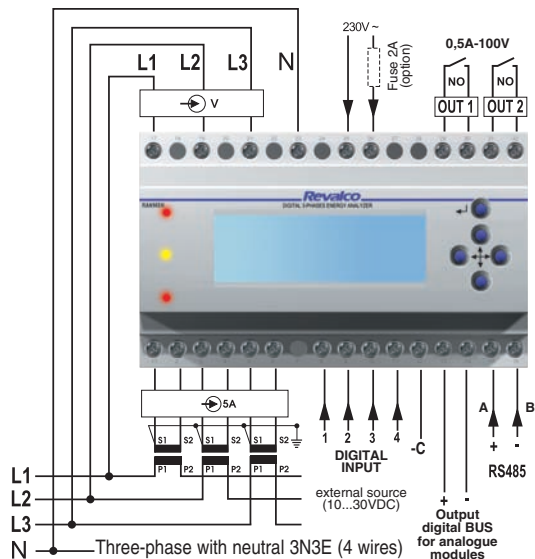It is possible to use standard PC, equipped with suitable program, as a MODBUS controller/master with an RS-485 driver/converter (two-wire, half duplex mode).
Available RS-232 to RS-485 converters handle data direction control automatically.

TROUBLESHOOTING COMMUNICATION PROBLEMS: If Power monitor doesn't communicate with the controller, please check:
- Verify the instrument   - Examine the interconnection cable   - Check that termination resistors (if installed and correct values)
- Verify that communication hardware is properly installed and working (PC or MODBUS controller   - Verify entered registers addresses
- Measure polarisation (d.c.) voltages present on a MODBUS network between D0(+) and D1(-), they should be lower than 7 V d.c.(toward COM/GND)
- If communication fails from time to time, the probable cause is noise on the network. Locate the noise source and remove the cabling from it, lower communication speed, use lower termination resistance.
- Make sure that the number of devices on a MODBUS network doesn't exceed maximum allowed (32 for the standard version of instrument, without repeater).
- Verify that a MODBUS network length doesn't exceed maximum allowed.
- If other devices installed in the network, verify that they conform to MODBUS.

Three-phase without neutral 3-3E
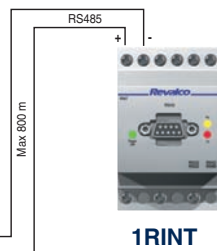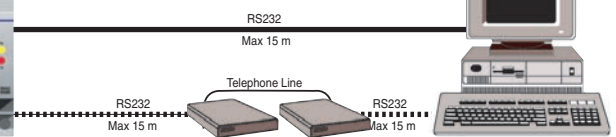(3 wires, balanced load)

Three-phase without neutral 3-2E
(Aaron, balanced load)

Three-phase with neutral
3N3E (4 wires)
voltage transformers connection

Three-phase without neutral
3-3E (3 wires, balanced load)
voltage transformers connection

Three-phase without neutral
3-2E (Aaron, balanced load)
voltage transformers connection

Three-phase with neutral 3N3E (4 wires)

Three-phase without neutral 3-3E
(3 wires, balanced load)

Three-phase without neutral 3-2E
(Aaron, balanced load)

Three-phase with neutral
3N3E (4 wires)
voltage transformers connection

Three-phase without neutral 3-3E
(3 wires, balanced load)
voltage transformers connection

Three-phase without neutral 3-2E
(Aaron, balanced load)
voltage transformers connection

2RAN968N

1RANM8N

1RINT

Scheme n. 1: Connection between instruments and PC for distances up to 800m

Scheme n. 2: Connection via Modem

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INTRODUCTION

RAN is a quadrant power and energy meter for replacing many separate measuring instruments, like ammeters, voltmeters, power factor and power meters, energy counters, etc. The instrument can be used as a single phase or 3-phase meter (aron, star or delta connection).

Instrument performs the following simultaneous measurements:

- true RMS voltage, current measurements
- system voltage and current and neutral wire current (in 3phase systems)
- 4 quadrant power measurements, phase and total power and power factor
- phase voltage and current crest factor measurement,
- current maximum and power inside integration period.
- power on demand (connecting and disconnecting loads, for reducing peek power)

- frequency and phase angle measurements
- voltage phase sequence (in 3phase systems)
- voltage and current THD and harmonic components (up to 31st component),
- active and reactive energy counting,
- current peaks ,voltage sags and dips and thd peaks.

Other instrument features:

- direct connection of current inputs or to current transformers with 5 A output (no problems with wiring positioning and burden resistor)
- wide voltage range from 0 V to 500 V, extended with voltage transformers
- active and reactive energy logging (optionally with built in 32kbyts memory ,up to 42 days of integration period of 15 minutes, with time stamp)
- optionally RealTimeClock(RTC) with battery
- 4 opto-insulated configurable digital inputs
- backlight LCD with 4x20 characters

- RS485 communication port compatible with industry-standard MODBUS protocol,
- 2 digital configurable outputs

Standards:

EN62053-21:2003-1	Class 1 for static active energy meters	EN62053-21:2003-1	Class 2 for static reactive energy meters
EN 61326	Electromagnetic compatibility (EMC)	EN 61010-1	Safety (LVD) CAT II 600V /CAT III 300V

TECHNICAL SPECIFICATIONS

GENERAL:

- **POWER SUPPLY VOLTAGE** 180 V a.c. ÷ 260 V a.c., 50 Hz/60 Hz
- **PROTECTION CLASSIFICATION** double insulation
- **POLLUTION / PROTECTION DEGREE** 3 / IP 40
- **MEMORY / LED** EEPROM 2Mbits / Digital outputs status indicator (Alarms or Energy pulses or Power demand)
- **OVER VOLTAGE CATEGORY** CAT II 600 V / CAT III 300 V
- **LOAD** 5 VA max.
- **DIMENSIONS / WEIGHT** 1RANM8N = 8 DIN modules - 2RAN968N: 96 x 96 x 105 mm / 0,50 kg
- **TEMPERATURE CONDITIONS** range 0 °C ÷ +40 °C; humidity range 30 %RH ÷ 75 %RH, non-condensing
- **OPERATION CONDITIONS** Working temperature range -10 °C ÷ +50 °C. Maximum relative humidity 85 %RH (0 °C ÷ +40 °C), non-condensing
- **STORAGE CONDITIONS** Temperature range -10 °C ÷ +70 °C
  Maximum relative humidity 90 %RH (-10 °C ÷ +40 °C); 70 %RH (+40 °C ÷ +70 °C)

MEASURING SYSTEM:

- **CONFIGURATION** 3 voltage inputs — Voltage input loading: less than 0.1 VA — Line-to-neutral input impedance is 520 kΩ.
  Line-to-line input impedance is 1 MΩ. — Voltage input overload: ×1.2 Un , ×2 Un (for <2 sec)
  3 current inputs — Current transformer (In= 5A) — Current input loading: less than 0.1 VA
  Current input overload: x2 In , ×40 In (for < 0.5 sec)
- **SYSTEM** All system with or without current and/or voltage transformers ,balanced or unbalanced load.
  Single phase (1N1E); 3-phase (3-2E, Aaron); 3-phase (3-3E, with no neutral); 3-phase (3N3E, with neutral)
- **MEASURING PRINCIPLE** TRMS ,4 quadrants, 10 periods, 128 scans/period
- **DISPLAY UPDATE** 1 update/s, harmonics 1 update/2 s

VOLTAGE:

- **TRMS PHASE TO NEUTRAL VOLTAGE L_X – N, AC**

Nominal input range (V)	Phase to neutral voltage range (V)	Resolution (V)	Accuracy
140 / 280 / 500	0.00 U_N ÷ 0.14 U_N	0.1	±0.6 V
140 / 280 / 500	0.15 U_N ÷ 1.10 U_N		±0.5 V

Starting voltage: 0.01 UN
Voltage crest factor is 1.5 × UN (measuring range). Over-range indication with ↑ ↑ ↑ mark. Over-range indicator appears when line voltage is out-of-range.
Accuracy apply for frequency range 45.00 Hz ÷ 65.00 Hz. Line-to-neutral input impedance is 600 kΩ. Line-to-line input impedance is 1200 kΩ.

- **TRMS PHASE TO PHASE VOLTAGE L_X – L_Y, AC**

Nominal input range (V)	Phase to Phase voltage range (V)	Resolution (V)	Accuracy
140			±(1.0 % + 0.2 V)
280	0.00 U_N ÷ 1.10 U_N	0.1	±(1.0 % + 0.5 V)
500			±(1.0 % + 1.0 V)

Input voltage range: L_X – N = 500 VRMS (single phase); 290 VRMS (3-phase); L_X – L_Y = 500 VRMS

- **VOLTAGE INPUT TRANSFORMATION FACTOR**

Nominal input range (V)	Factor	Comment
0.0 ÷ 140.0	1× ÷ 1279×	140 kV @ 110 V input
0.0 ÷ 280.0	1× ÷ 612×	140 kV @ 230 V input
0.0 ÷ 500.0	1× ÷ 351×	140 kV @ 400 V input

Starting voltage: 0.01 U_N * VTF. Voltage TF and current TF are linked together, their product is limited to 20 MW per phase.

CURRENT:

- **TRMS CURRENT**

Current range (A)	Resolution (A)	Accuracy
0.0 – 0.049	0.001	±0.005 A
0.050 ÷ 6.200		±0.5 %

Starting current: 0.04 IN (=0.02A @ direct 5A input)
Nominal current input range is 0 A ÷ 5 A (IN). Current crest factor is 2.0 × IN. Over-range indication with ↑ ↑ ↑ mark.
Accuracy apply for frequency range 45.00 Hz ÷ 65.00 Hz.

- CURRENT INPUT TRANSFORMATION FACTOR

Nominal current range (A)	Factor	Comment
0.0 ÷ 5.0	5 A/5 A ÷ 10000 A/5 A	20 MW max./phase

Starting current: 0.04 IN * CTF (e.g =0.4A @ 5A input through 100/5 current transformer)
Voltage TF and current TF are linked together, their product is limited to 20 MW per phase.
Displayed voltage are max.140 kV (@ max.VTF).   Displayed current are max. 10 kA (@ max.ITF).
VTF and ITF product is limited to 20 MW / phase power ,60 MW total power.

FREQUENCY

Frequency range (Hz)	Resolution (Hz)	Accuracy
45.00 ÷ 65.00 (for voltage range 0.15 Un < U)	0.01	±0.04 Hz

POWER AND ENERGIES

- PHASE ACTIVE POWER (P, Q, S)

Voltage range * voltage TF * current range * current TF	Resolution (W, VA, VAr)	Accuracy
0.0 ÷ 20000000.0	0.1	±(0.4 %FS + 0.5 % of reading)

- TOTAL ACTIVE POWER (Pt, Qt, St)

Voltage range * voltage TF * current range * current TF	Resolution (W, VA, VAr)	Accuracy
0.0 ÷ 60000000.0	0.1	±(0.5 %FS + 1 % of reading)

Accuracy apply for: voltage range 0.15 Un < U < 1.10 Un;   current range 0.01 In < I < 1.2 In;   power factor 0.40 ÷ 1.00;   frequency range 45.00 Hz ÷ 65.00 Hz

- PHASE POWER FACTOR & TOTAL POWER FACTOR

PF range	Resolution	Accuracy
0.00 ÷ 0.39	0.01	±0.04
0.40 ÷ 1.00		±0.02

Accuracy apply for: voltage range 0.15 Un < U < 1.10 Un;   current range 0.01 In < I < 1.2 In;   frequency range 45.00 Hz ÷ 65.00 Hz

- ACTIVE ENERGY AND REACTIVE ENERGY

Voltage range * voltage TF * current range * current TF	Resolution (Wh - VArh)	Accuracy
0 ÷ 1.000.000	10	±(1.5 % + 3 dig)

THD & HARMONICS

- VOLTAGE / CURRENT THD & HARMONICS

VOLTAGE	CURRENT	Resolution (%)	Accuracy
harmonics U < 0.05 Un	harmonics I < 0.05 Un	0.1	±5 %
harmonics U >= 0.05 Un	harmonics I >= 0.05 Un		±1 %
THD	THD		±1 %

DIGITAL INPUTS/OUTPUTS

- DIGITAL INPUTS
Configurable as 40-bit counters triggers (increments of 0.01 ... 100/ pulse of power or any other counting or for counting working hours of external equipment) or as integration period synchronization or tariff selectors (2 or 4 tariffs)

- DIGITAL OUTPUTS
Configurable as alarms (voltage, current, active or reactive power, freq. out of range), as energy pulse output (0.001 kWh/pulse...1 kWh/pulse) or power demand outputs

input voltage (max. AC/DC)	25 V
threshold voltage	6 V
input impedance	2.2 kΩ
activation sequence (IP sync.and counters)	LO-> HI -> LO transition (min. 50ms HI pulse width)

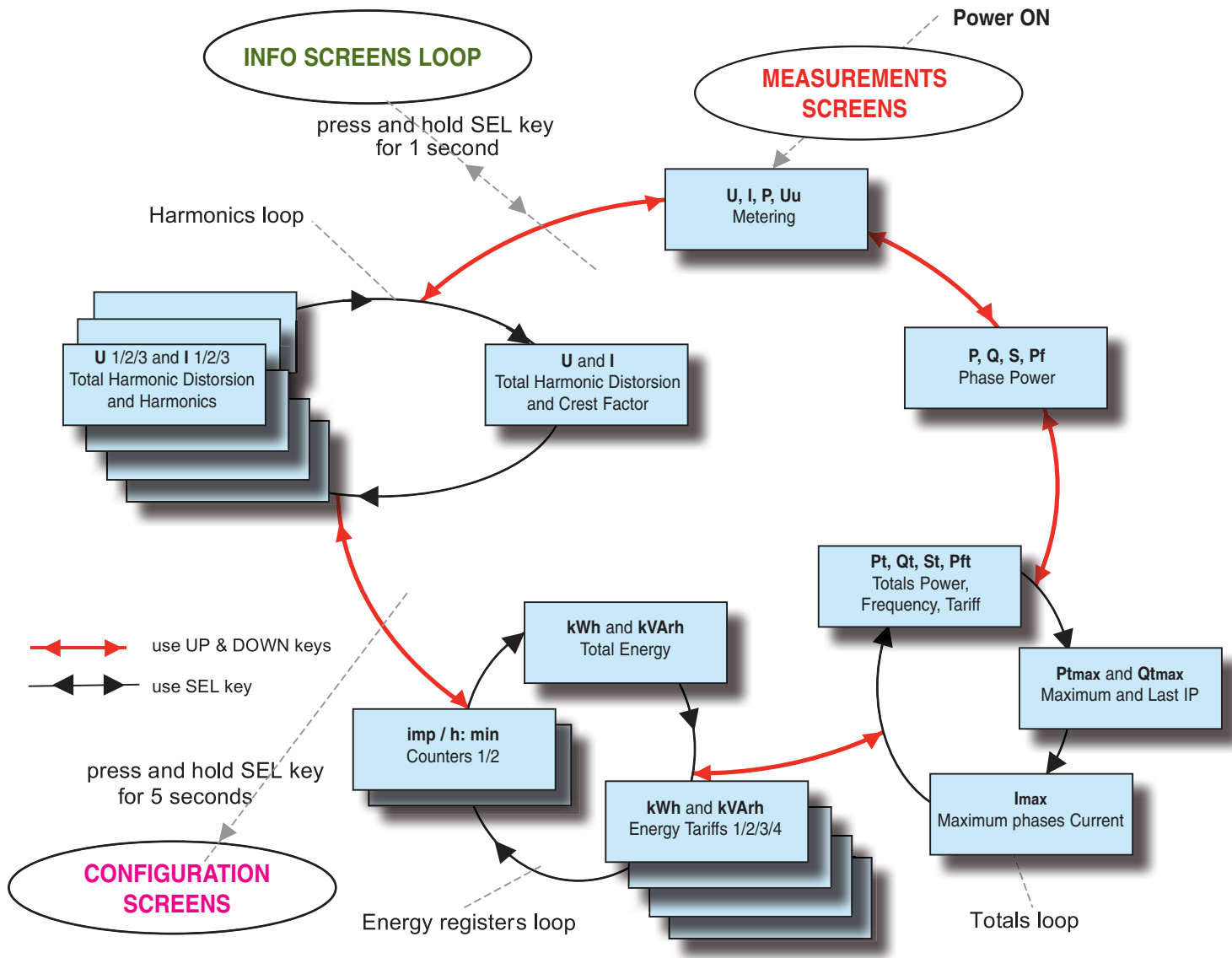| switching voltage (max.AC)	25 V
switching current (max.)	1 A
pulse out width	approx. 50 ms
output type	Relay, normally open (N.O.)

MEASUREMENT METHODS

Measurement methods are based on the digital sampling of the input signals. Each input (3 voltages and 3 currents) is sampled 128 times in each input cycle.
Sampling frequency depends on the frequency at the synchronisation input (one of the 3 voltage inputs). Sampling period is 200mS (e.g. 10 cycles @50Hz).
Basic measured values are calculated at the end of each sampling period. FFT based results are calculated on every 8th input cycle (every 160ms@50Hz).

Measured values (Basic calculations): Phase voltage; Phase current; Phase active power; Phase to phase voltage; Neutral conductor current.

Calculated values (using measured values): Phase apparent power; Phase reactive power; Phase power factor; Phase voltage crest factor; Phase current crest factor; Total active power; Total reactive power; Total apparent power; Total power factor.
In a 3wire systems connection, the following values are not available for displaying: neutral conductor current; phase powers and power factor; crest/thd/harmonics of not applicable signals.

Additional calculation (using FFT transformation): Phase voltage THD; Phase current THD; Phase voltage individual harmonics; Phase current individual harmonics
Energy are calculate every 1 second ,based on average power during all sampling periods of 200 mS (e.g. 5 samples periods/second @50Hz). Energy values are in Ws or VArs.

Power ON

INFO SCREENS LOOP

MEASUREMENTS SCREENS

press and hold SEL key for 1 second

Harmonics loop

U, I, P, Uu Metering

U 1/2/3 and **I** 1/2/3 Total Harmonic Distorsion and Harmonics

U and **I** Total Harmonic Distorsion and Crest Factor

P, Q, S, Pf Phase Power

use UP & DOWN keys

use SEL key

kWh and **kVArh** Total Energy

Pt, Qt, St, Pft Totals Power, Frequency, Tariff

press and hold SEL key for 5 seconds

imp / h: min Counters 1/2

Ptmax and **Qtmax** Maximum and Last IP

CONFIGURATION SCREENS

kWh and **kVArh** Energy Tariffs 1/2/3/4

Imax Maximum phases Current

Energy registers loop

Totals loop

MEASUREMENTS SCREENS

```
V   230.8 232.4 229.8
A   2.583 2.622 2.557
W   518.7 542.4 486.0
Vv  399.8 402.5 398.0
```
Metering (U, I, P, Uu)
Phase Voltage, Current, Power and phase to phase Voltage

```
W    518.7 542.4 486.0
VA   596.2 609.4 587.6
VAr  293.9 277.8 330.2
Pf   0.87i 0.89i 0.84i
```
Phase Power (P, Q, S, Pf)
Phase Active, Reactive, Apparent Power and phase Power Factor (not available in 3wire and Aaron connection)

```
TOTAL 4w  TR1   13/15m
kW   1.547
VA   1.791 50.02Hz   L1
Var  0.902 PfT    0.86I
```
Totals (Frequency, Tariff, Pt, Qt, St, Pft)
Total Active, Reactive, Apparent Power and Total Power Factor, Type of connection, Frequency, current Tariff, remain/selected IP time

```
KW+    max.    1.97
KVAr+  max.    1.04
KW+    lst.    1.63
KVAr+  lst.    0.98
```
Maximum and Last IP Power
Maximum average Active Positive and Reactive Power in any IP and in Last elapsed (based on accumulated IP energy/IP time)

```
I1 max.    2.981 A.
I2 max.    3.018 A
I3 max.    2.756 A
```
Maximum IP Current
Maximum average Current in any IP

```
kWh+   tot >00001207.83
kWh-   tot  00000000.00
kVArh+ tot >00000990.42
kVArh- tot  00000000.00
```
Energy (total/sum. of all tariffs)
cursor (>) is on current Active Energy counter

```
kWh+   TR1 00000807.35
kWh-   TR1 00000000.00
kVArh+ TR1 00000690.26
kVArh- TR1 00000000.00
```
Energy in tariffs 1 to 4 screens (example for tariff 1)
Number of screens depend of selected number of tariffs (2 or 4)

```
Count.1:    00000101.50
            inc/imp:0.50
Count.2:    0000010h52m
            inc/imp: time
```
Counters
Counter 1 is configured as input pulse counter (pulse weight is 0.50)
Counter 2 is configured as time counter (measure working time of external device activity)

```
Uthd 3.45  3.26  3.78
UCRf 1.40  1.46  1.42
Ithd 5.18  6.02  4.59
ICRf 1.78  1.83  1.80
```
Voltage and Current Total Harmonics Distortion (thd) and Crest Factor (CRf)

```
U1:  230.8 V thd:  3.45
 h3:  3.12   h5:  0.61
 h7:  0.18   h9:  0.02
h11:  0.08  h13:  0.00
```
Voltage or Current Harmonics (example for U1)
Displayed are odd harmonics (h3 ...h13)
All harmonics (h2...h31) are available through MODBUS protocol communication.

For quickly reviewed/checked instrument setting ,without to enter in configuration menu, press and hold SEL key for 1 s in any measurement screen. When first information screen is displayed use UP and DOWN keys to browse through instrument settings (abbreviations have the same meaning as in corresponding configuration screens). Instrument automatically returns from info to measurements 10 seconds after last keys activity.

Press and hold SEL key for one second for entering in Info Screens Loop and short press SEL key for Exit from loop

Communication information

Metering information

IP and digital inputs information

Instrument type / version information

Press UP or DOWN keys to browse through info screens

Counters information

Calibration and current time/date

Output 1/2 setting information

Recorder status information

Output 1/2 status information
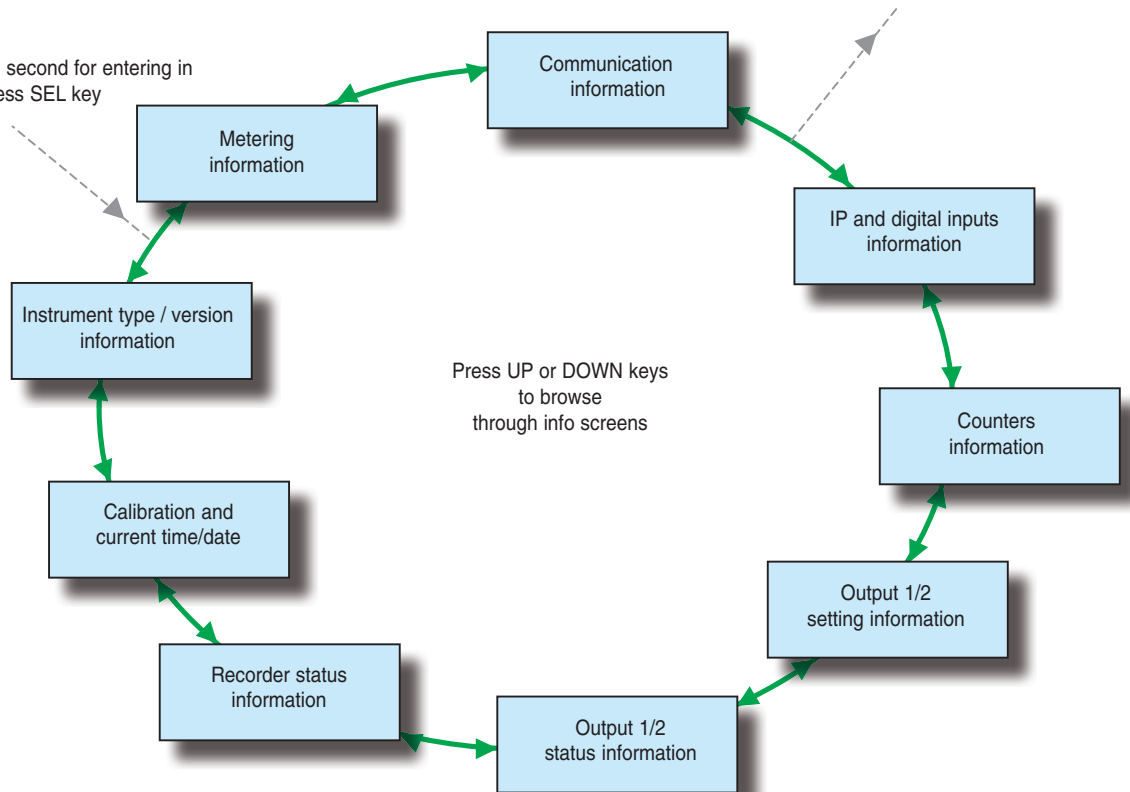
```
R E V A L C O
3ph Energy Analyzer
 RANM8  ver.: 436/1
 ser.no: 00000000
```

Instrument information screen
Manufacturer type, version and serial number of instrument

```
Volt.range:    280 U
Voltage TF:      1 x
Current TF:    5/5A
Conn: 4wire
```

Metering system information screen (example)
Voltage range, Voltage and Current Transformers Factors and type of measurement connection

```
Comm.mode:  MODBUS
Net.addr.:       1
Baud.rate:    9600
```

Communication information screen (example)
Communication setting, net address and speed

```
Energy tariffs:   2
IPsync.:     input3
IPlength:   15 min.
IPremain:   11 min.
```

IP and digital inputs information screen (example)
Selected number of Tariffs, source for Tariffs synchronization, IP length (presetted and remain)

```
Count.1:    STOP
inc/imp:    0.01
Count.2:     RUN
inc/imp:    time
```

Input counters information screen (example)
Counter status, increment factor and mode (pulse or time counter)

```
Record.stat:    STOP
Lap rec.no.:       0
Lap occurred:     No
FreeLapRec:      191
```

Recorder status information screen (example)
Recorder status, number of stored records and info of available free records before lap (circular buffer behavior)

```
Out1: alarm>> [OFF]
Ref.inp.:        I1
Ref.val.:  55.00  A
Delay: 05s
```

Output 1 information (example)
Current output status (OFF/ON), output mode and information depended about selected mode

```
Cal.date: 10.08.08
Current date/time:
 29.04.09 15:28:34
```

Calibration and current instrument date/time
Current time/date only on instruments with build in Real Time Clock

To enter in configuration press and hold SEL key for 5 s in any measurement screen.
Use UP and DOWN keys to select configuration submenu and press SEL. In selected configuration submenu use SEL key for selecting one of available parameters and adjust/modify it with UP and DOWN key. For exit from submenu to main configuration menu and for exit from main configuration menu to measurements, select EXIT and press UP or DOWN. Instrument automatically returns from configuration menu to measurements 3 minutes after last keys activity.

```
 Exit
>Metering system
 Communication.
 Digital inputs.
 Inputs counters
 Digital output 1
 Digital output 2
 Clear regs./counts.
 System settings
 Recorder settings
```

Main configuration screen
UP and DOWN key to move cursor and/or scroll screen through all configuration options.
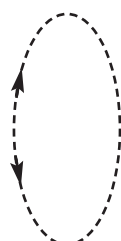
SEL key to enter in selected submenu
Select EXIT for return in measure

Metering system configuration screen

```
Volt.range:    280 V
Voltage TF:      1 x
Current TF:    5/5A
Conn: 4wire    EXIT
```

= Voltage range 140V, 280V or 500V
= Voltage Transformation Factor
= Current Transformation Factor
= select connection, 4wire, 3wire or Aaron

Maximum value of Voltage and Current Transformation Factor are in interaction and depend of voltage range and max power (20MW per phase, 60MW total)

Communication configuration screen

```
Comm.mode:   MODBUS
Net.addr.:        1
Baud.rate:     9600
              EXIT
```

= select MODBUS or OFF
= select network address from 1 to 247
= select communication speed 4800 or 9600

Integration period (IP) and digital inputs configuration screen

```
Energy tariffs:   2




IPsync.:     input3



IPlength:   15 min.
              EXIT
```

= select no.of tariffs , 2 or 4

input 1	input 2	tariff no.
OFF	OFF	1
ON	OFF	2
OFF	ON	3
ON	ON	4

= select source for IP synchronization, internal timer, input 2, input 3 or remote through MODBUS (internal timer is always active in conjunction with selected synchronization source)
= select IP time length (10, 15, 20, 30 or 60 min)

Input counters configuration screen

```
Count.1: STOP
inc/imp:  0.01


Count.2: RUN
inc/imp: time  EXIT
```

= select STOP or RUN
= select increment factor of counter on every input pulse or select time for counting time (hours|minutes) of input activity.
= select STOP or RUN
= select increment factor of counter on every input pulse or select time for counting time (hours|minutes) of input activity.

Counter 1 is connected on input 3, counter 2 on input 4.
If IPsync: input 3, counter 1 count IP periods.

Recorder status configuration screen

```
Record.mode:   STOP
Rec.activ.enr:  eP+



Rec.react.enr:  ---
              EXIT
```

= select STOP or RUN
= select active energy for recording
eP+, positive active energy
eP-, negative active energy
eP+/-, positive and negative active energy
= select reactive energy for recording
eQ+ , positive reactive energy
eQ- , negative reactive energy
eQ+/-, positive and negative reactive energy

If user STOP and RUN recording with different energy selected, instrument prompt warning message before execute/store new settings with deleting old/previous records.

Output 1 and Output 2 configuration screen (example for alarms)

```
Out1 mode: alarm>>
Ref.inp.:        I1
Ref.val.:  55.00  A
Delay: 05s    EXIT
```

= Out 1/2 mode: select output function (*see table)
= select reference signal (*see table)
= select reference signal value (alarm threshold)
= select output action delay (1..12 seconds) (minimum condition time)

Alarm is signaled if reference quantity (ref.inp.) is equal/higher or lower than preset value. Output relay is closed as long as such condition lasts or for minimum condition time

Output 1 and Output 2 configuration screen (example for pulse out)

```
Out1 mode: puls.out
Ref.inp.:      Ptot+
Puls.wgt: 2.500 kWh
              EXIT
```

= Out 1/2 mode: pulse output (for ext. energy counter)
= Total Active Positive Energy
= select pulse weight (amount energy per pulse)

Output relay is closed for approx. 50 ms whenever predefined energy value is reached

Output 1 and Output 2 configuration screen (example for Power demand)

```
Out1 mode: pwr.dem.
Max.IPpwr: 1.000 kW
Con.pwr1.: 2.500 kW
              EXIT
```

= Out 1/2 mode: Power demand
= select maximum Power in IP time
= select power of controlled load (connected on output 1/2)

Output relay is closed if Power trends is lower than preset value (MaxIPpwr). Relay goes into open state if IP Power trends go higher than preset value. Connection Power (Con.pwr.) is set for each output independently. Instrument checks Power on each input every minutes and will disconnect only one load if calculation shows this is adequate (output 1 has priority) and same when the possibility to reconnect any of the loads.

Clear registers / counters screen

```
Clr.energy cnt.
Clr.IP max.
Clr.counters
Clr.rec.data   EXIT
```

= clear Energy counters, Total and Tariff Energy
= clear IP max Power and max Current registers
= clear Counter 1 and 2
= clear Energy recorder data/memory

If recorder memory in not empty instrument prompt warning and clear confirmation message.

System settings screen

```
Password   DISABLED
Change password




Reinit / Invert.Pwr.Signal



Adj.RTC        EXIT
```

Password / Change password
User can disable or enable or change password for entering in configuration screens. This action always required entering current password.
Password are four keys (or double keys) sequence. Initial password is four SEL keys.
= toggled on pressing SEL key
   Reinit = load default parameters (see default table)
   Invert. Pwr. Sign. = inverting powers signs
= adjust instrument time/date
(only on instruments with build on Real Time Clock)

Adjust current instrument date/time (with build on Real Time Clock only)

```
              EXIT
Adjust DATE/TIME:.
29.04.09 15:28:34
```

Use SEL key for moving cursor on desired date/time part and adjust using UP/DOWN keys.
Select EXIT for save changes and exit.

Ouput mode	Reference signal	Referred value units
alarm >> (alarm ON, higher or equal the setted value)	see table	
alarm >> (alarm ON, lower the setted value)	see table	
pulse output (Energy pulse out)	Ptot+ (Total Active positive Energy)	Wh, kWh ,MWh
Power demand	Ptot+ (Total Active positive Power)	
OFF (force OFF status)	-	
ON (force ON status)	-	

| Reference signal		Referred value units
Ptot+	Total Active positive Power	W ,kW ,MW
Qtot+	Total Reactive positive Power	Var ,kVAr ,MVAr
I1	Current on line/phase1 (I1)	A ,kA
Ix	Current on any line/phase (I1 or I2 or I3)	A ,kA
U1	Voltage on line/phase1 (U1)	V ,kV
Ux	Voltage on any line/phase (U1 or U 2 or U3)	V ,kV
Freq	Frequency	Hz

ANALOGUE OUTPUT MODULES

1RUAN3

- With this three modules device it is possible to select four **positive** DC outputs only, between 0-20mA; 4/20mA: 0-10V; 0-5V through the minidips situated under the cover
- 2 outputs are galvanically insulated from the other 2 and all are galvanically insulated from output RS485
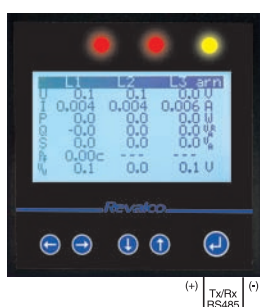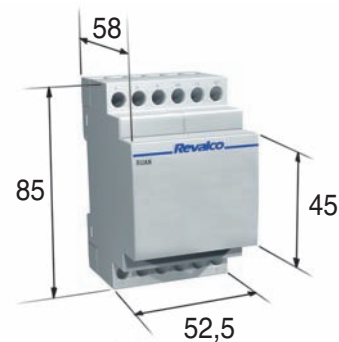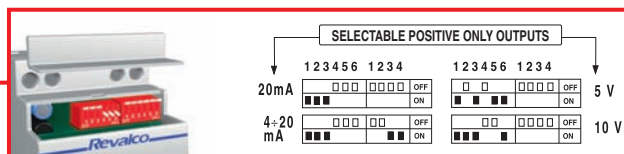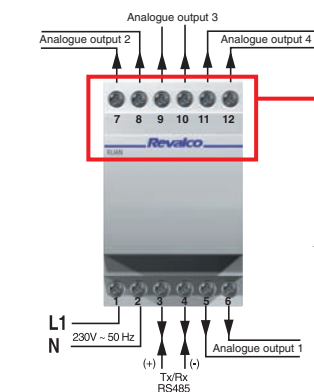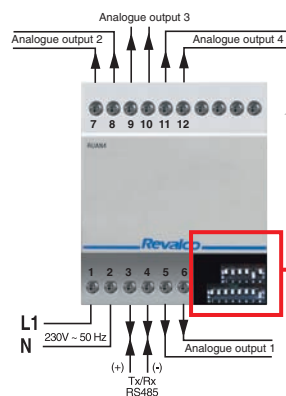

- Using 3 devices it is possible to have up to 12 analogue outputs maximum
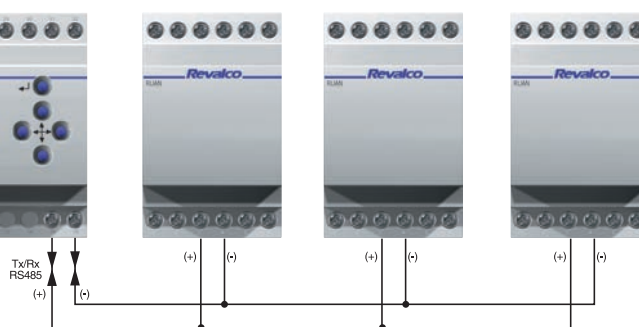
1RUAN4

- With this four modules device it is possible to select four **positive and negative** DC outputs, between 0-20mA; 4/20mA: 0-10V; 0-5V through the minidips situated under the cover
- 2 outputs are galvanically insulated from the other 2 and all are galvanically insulated from output RS485.
- Using 3 devices it is possible to have up to 12 analogue outputs maximum
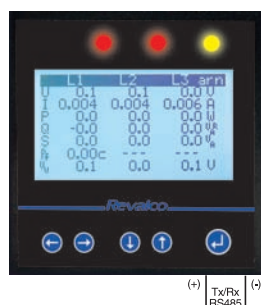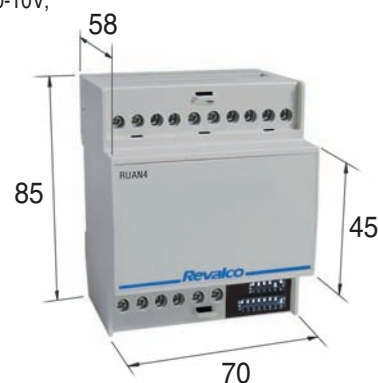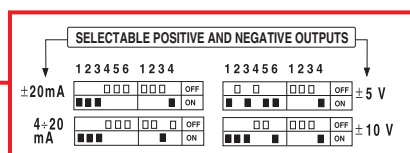
- Using 3 devices it is possible to have up to 12 analogue outputs maximum
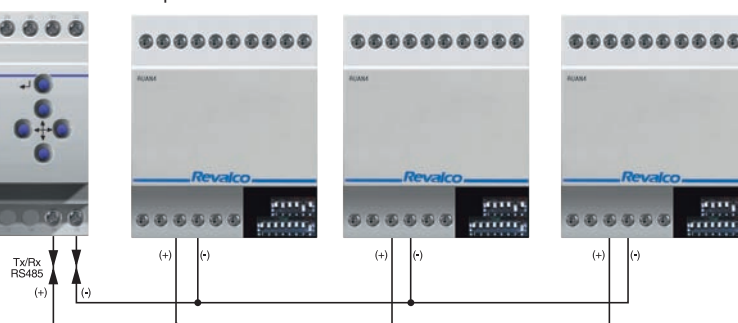
LED MULTIFUNCTION METERS - TRUE RMS

SINGLE PHASE

ENER·GO

- Two display 3 digit each
- Easy and immediate reading without possible incomprehensions or further elaborations.
- The use of one button only permits to change the measurements pages in natural way.
- During the program phase, the instrument shows the different possibilities present in the device, so it is not necessary to have in hands the user's manual all the time.
- The "power supply" page can be used in all the cases on which is important **the information of "power supply loss"** (e.g. in refrigerating machines and/or cold storage).
- The 2 modules dimension is the right compromise between the necessity to reduce the space and a good readability of measurements that it is one off the main scope in an electrical net.
- The possibility to reset the energy and contemporary the hour/minutes value permits, in easy way, to see the relative consumption in a fixed time.
- **1RANM2 model is usable as priority relay 16A**

1RANM2   **1RANM2CT**

DIMENSIONS in mm

The 35 mm dimension correspond to 2 DIN modules
Weight kg. 0,30

58
85
45
35

CONNECTION DIAGRAMS

N.C. max 10A, 250VAC

LOAD
5 6 7 8
1RANM2
1   4
N   L
L 230V N

5A
N.O. max 10A, 250VAC

S1 S2
P1 P2
LOAD
5 6 7 8
1RANM2CT
1   4
N   L
V
L 230V N
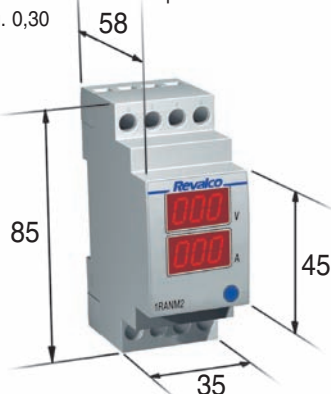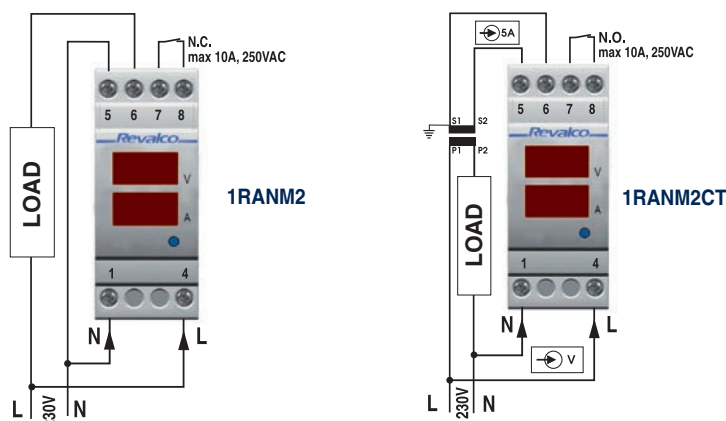
TECHNICAL CHARACTERISTICS

- PARAMETERS		1RANM2	1RANM2CT
- Ph-N voltage	V	●	●
- Current (direct connection)	A	●	
- Current (connection by means of C.T.)	A		●
- Power factor	ind/cap	●	●
- Apparent power	PVA		●
- Active power	PW	●	●
- Reactive power	Pvar		●
- Frequency	Hz		●
- Active Energy (resettable capacity)	kW/h	●	●
- Reactive Energy (resettable capacity)	kvar/h		●
- Partial working time (resettable capacity)	hh	●	●
- Acoustical pre-alarm		●	●
- **OUTPUT RELAYS** (contact 250V-2500W) selectable on principal measures (V-A-Hz-Pw)		**N.C.16A**	**N.O. 10A**

Auxiliary power supply
- nominal value U AUX   230V 50/60 Hz
- range   0.9...1.1 UAUX
- max absorbed power   2 VA

Input voltmeter circuit   Ph-N voltage
- direct insertion (Ph-N)   max 300 V
- permanent overload   120%
- thermic overload (1 s)   150%
- input impedance of voltmeter circuit 1,5MΩ Ph-N

Input ammeter circuit
- current: direct insertion   max 32A
              insertion by means of C.T. 5A
- permanent overload   120%
- thermic overload (1 s)   200%
- range adjustment, CT ratio   5...999

Voltage measurement range
- VLN measurement range (voltage phase, direct insertion) 0...250 V
- accuracy class   0.5% f.s ± 2 digit

Current Measurement range:
- measurement range:
    direct insertion   0,1...26A
    accuracy class on range 0,1... 26A 0.5% f.s ± 2 digit

- measurement range:
    insertion by means of C.T.   0,05...5A
    accuracy class on range 0,05...5 A 0.5% f.s ± 2 digit

Frequency Measurement range:
- nominal value   50/60Hz
- range   45...65 Hz
- accuracy class   0.3% vm ± 1 digit
- response time   < 300mS

Active Power
- range   direct insertion   8 kW
               insertion by means of C.T. 500 kW
- accuracy class   1% f.s ± 2 digit

Reactive Power
- range   250 kvar
- accuracy class   1% f.s ± 2 digit

Apparent Power
- range   250 kVA
- accuracy class   1% f.s ± 2 digit

Active Energy (Wh)
- resettable visualization   Two separate
- calculating period   15 minutes
- energy counting   direct insertion   9,99 / 999 kWh
                    insertion by means of C.T. 9,99 / 999 kWh
- accuracy class with current 0,05...1.0 In 2% fs ± 2 digit

Reactive Energy (varh)
- energy counting resettable   9,99 / 999 kvarh
- calculating period   15 minutes
- accuracy class with current 0.05...1.0 In   2% fs ± 2 digit

Power Factor
- range cosφ   0...1...0
- accuracy class with current 0.1...1.0 In and voltage 0.8...1.2 Un   2% fs ± 2 digit

Working time
- Partial working time   hh:mm (from previous reset)

Digital filter
- Average   1...15

Compatible current transformers
- Nominal current   5 A
- Ratio   1...200

Visualization
- display   2 numerical lines
- number of characters   6 on two lines
- colour   RED

Mechanical characteristics
- mounting   on DIN rail DIN50022
- protection   IP20/ frontal IP30

Electrical characteristics, options   Galvanic insulation
- alarm relay coil-contact   3kV

Relay characteristics (1RANM2)
- **N.C.** contact maxV....maxI....maxP   250VAC,**16A** (resistive load), 2500W

Relay characteristics (1RANM2CT)
- **N.O.** contact maxV....maxI....maxP   250VAC,**10A** (resistive load), 2500W

⚠️ **When loads more than 10A are present, it is necessary to use (relays)   auxiliary contactors**

Environment conditions
Ambient temperature:
- nominal temperature   0...+45 °C
- range   -5...+55 °C
- storage temperature   -10...+70 °C
- humidity   10...95 %
- atmospheric pressure   70...110 kPa

Standards CEI
- Safety CEI EN 61010-1   300V CAT III
- Accuracy class CEI EN 60688
- Electromagnetic compatibility (immunity) CEI EN 61000-6-2 (ex EN 50082-2)
- Electromagnetic compatibility (emission) CEI EN 61000-6-4 (ex EN 50081-2)
- Protection IP CEI EN 60529

MEASUREMENT'S TYPOLOGY
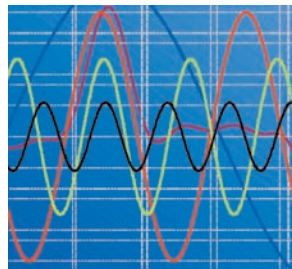
■ True RMS up to the 20th harmonic wave
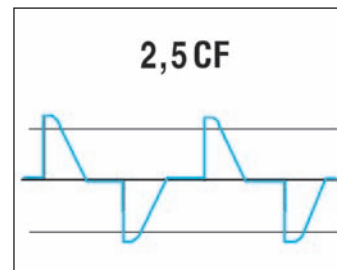
■ Crest factor up to 2,5 (Voltage and Current)

ALARM RELAYS

One relay with normally closed or normally open contact.
Possibility to set the intervention threshold:
- "Hi" more of .... (>) and "Lo" less of... (<)
- delayed to the excitation " ˳ - ¯ " or to the disexcitation " ¯ - ˳ "

MEASURE'S CHANEL TO WHICH THE THRESHOLD IS REFERRED:
- min or max line Voltage
- min or max line Current
- min or max Frequency (1RANM2CT only)
- min or max Active Power
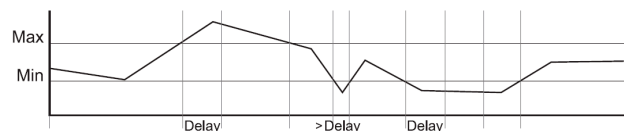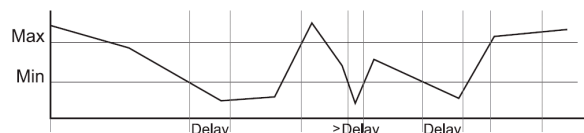
USABLE AS:

- **motor protection**	- **priority relay**
- **overload**	- **anomaly of frequency**
- **low consumption**	- **high consumption**
- **not presence of phase**	- **min voltage**

1RANM2	**1RANM2CT**
- Single phase multifunction meter direct insertion, 230V - 26A (usable on domestic homes and low loads) - Instrument furnished already calibrated with the following data: selected cource = ACTIVE POWER maximum threshold = 4,0 kW acoustic alarm = 8 sec time isteresis = 10 min	Single phase multifunction meter by means of CT, 230V - from 5A to 1000/5A (for industrial use)

OPERATION: Measurements displaning.
The measurements and signalling pages which appear (pushing and releasing the frontal button) are the following:

PUSHED BUTTON	RELEASED	DESCRIPTION
		This FLASHING signal appears only if: - this page is selected as "default page" (see the correspondent configuration chapter) and the instruments is just light-on or if the auxiliary supply failed, immediately light-on or the parameters configuration is finished. After the changement of this page, it disappears from the selection pages.
 "Blank" page		This page is selected in case of the display's light is extremely high; selectable as "default page" also. The sole line light-on, means that the device is in any case working.
 voltage / current		On the upper line the value of the voltage (V) is displayed. On the downer line the value of the current (A) is displayed.	On the upper line the value of the voltage (V) is displayed. On the downer line the value of the current (A) is displayed. The decimal point is in function of the selected CT value. 100/5A = 99.9 indication over 100/5A = 999 indication

	1RANM2	1RANM2CT
PUSHED BUTTON **RELEASED**	**DESCRIPTION**	

PUSHED BUTTON / RELEASED	DESCRIPTION
frequency	On the downer line the value of the frequency (Hz) is displayed with one decimal resolution
active power	On the downer line the value of the Active Power (kW) is displayed. 1RANM2 model has always the centesimal resolution (<9,99 kW max) Active Power can be POSITIVE or NEGATIVE depending by the sense of the current. If a red point (in the lower part of the extreme right) is light-on, it means that the value is NEGATIVE. **It is necessary to verify the corrent insertion of the instruments.**
power factor	Power Factor (Cos φ). It is the Phase displacement between voltage and current. When the showed value is 1,00 PF indication means that the phase displacement is ZERO (not capacitive or inductive but resistive only). Phase displacement is POSITIVE (current is delayed to the voltage = Inductive). Phase displacement is NEGATIVE (voltage is delayed to the current = Capacitive). **It is necessary to verify the corrent insertion of the instruments.**
reactive power	On the downer line the value of the Reactive Power (kvar) is displayed, with or without decimal points (decimal or centesimal resolution). The Reactive Power can be POSITIVE or NEGATIVE like the Power Factor (Cos φ). If a red point (in the lower part of the extreme right) is light-on, it means that the value is NEGATIVE. **It is necessary to verify the corrent insertion of the instruments.**
apparent power	On the downer line the value of the Apparent Power (kVA) is displayed, with or without decimal points (decimal or centesimal resolution). Apparent Power is always positive (Vrms x Irms).
active energy	On the entire display the Active Energy (kWh positive and/or negative) value appears, 6 numbers. The example shows 134.261 kWh. To grant long duration of the instrument's memory, automatic backup is effected every 15 minutes. **If the instrument is light-off, the sum related to the last 15 minutes can be losed.** ⚠️ The sum can be resetted by a long pressure of the frontal button. The value starts to flash, and after few seconds the numbers show permanentely ZERO.
reactive energy	On the entire display the Reactive Energy (kvarh positive and/or negative) value appears, 6 numbers. The example shows 1583 kvarh. To grant long duration of the instrument's memory, automatic backup is effected every 15 minutes. ⚠️ **If the instrument is light-off, the sum related to the last 15 minutes can be lossed.** The sum can be resetted by a long pressure of the frontal button. The value starts to flash, and after few seconds the numbers show permanentely ZERO.
partial hour-counter	On the entire display the Partial Hour-counter(hh) appears, 6 numbers. The example shows 4.320 hours from the last zeroing. To grant long duration of the instrument's memory, automatic backup is effected every 15 minutes. **If the instrument is light-off, the sum related to the last 15 minutes can be losed.** ⚠️ The sum can be resetted by a long pressure of the frontal button. The value starts to flash, and after few seconds the numbers show permanentely ZERO.

PUSHED BUTTON	RELEASED	DESCRIPTION

out / OFF
Situation of output relay
Off = rest relay (closed contact), **this situation is present with light-off instrument**

out / On
On = Active relay (open contact)

Note: all the pages flash during the intervention of threshold
The showed light point shows that the intervention condition is present.
This point light-on on all the other pages too.

output situation

- The activation of relay is evidenced by the display's flash, every page is displayed.
The threshold intervention can be delayed during the configuration phase.
The immediate overpassing of the selected value is displayed by the presence of a red point situated on the extreme right of the upper diplay, contemporary an acoustic alarm (pre-alarm) is emitted. This acoustic signal continue until the intervention of the relay.

The acoustic alarm is always inhibited within the firts 10 seconds starting from the powering of the device. ⚠️

PROGRAMMING: Make a long pressure (4 seconds about) on the frontal button staying in a page where the reset of parameter is not allowed.
So not on the pages of Energy and Hour-counter.

The following page appears: the flashing point means that it is possible now the configuration.

SEt. / 00.0

After 4 seconds the pages with configuration parameters start to be displayed; one page every 4 seconds showing the actual selected value.
If it is necessary to see the values without any modification don't touch nothing until the automatic end of the showed pages.
To change the values of parameters, it is enough to press the button while this parameter is displayed.
The value change immediately and closed to him a flashing point appears meaning that the value is in modification phase.
To fast forward maintain pressure on the front button. When the needed value is displayed release the button and after 4 seconds the further parameter appears, the modified value is automatically saved permanently.

DEFAULT PARAMETER	POSSIBLE VALUES	DESCRIPTION
tSh.	**tSh. / Hi**	Output will be activated when the value of selected measure will be HIGHER than the value of selected threshold (MAX THRESHOLD). Default setting.
	tSh. / Lo	Output will be activated when the value of selected measure will be LOWER than the value of selected threshold (MIN THRESHOLD).
	tSh. / OFF	Output will be NEVER activated. In this case, all the parameters related to the threshold CANNOT be displayed, so not settable

threshold mode

| **AVAILABLE IF tSh IS DIFFERENT FROM OFF ONLY**
 dd. | **dd. / ⌐** | The delay time will be applied to the ACTIVATION, the output light-off after the programmed delay time only. (DELAYED TO THE EXCITATION). |
| | **dd. / ⌐** | The delay time will be applied to the DEACTIVATION, the output light-off after the programmed delay time only. (DELAYED TO THE DISEXCITATION). |

delay setting

| **AVAILABLE IF tSh IS DIFFERENT FROM OFF ONLY**
 dLY / 10 | **VALUE**
 from 0 to 999 | It is the delayed value with which the alarm contact come back to the close situation after an eventual intervention. It is particular usefull to avoid continuous interventions of the device. Esxpressed in seconds. Default setting = 600 |

delay

	1RANM2	1RANM2CT

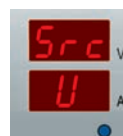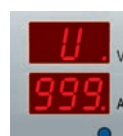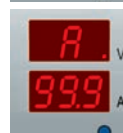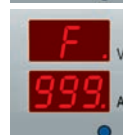| DEFAULT PARAMETER	POSSIBLE VALUES	DESCRIPTION	
AVAILABLE IF tSh IS DIFFERENT FROM OFF ONLY ALt 10 max sound duration	VALUE from 0 to 255	It is the delayed value with which the alarm contact works after the overpassing of the selected level. This acoustic signal (pre-alarm) is always present together with the delay. Default setting = 8	
AVAILABLE IF tSh IS DIFFERENT FROM OFF ONLY Src threshold source		Src U — VOLTAGE threshold. Src A — CURRENT threshold. Src P — ACTIVE POWER threshold. Default setting.	Src U — VOLTAGE threshold. Src A — CURRENT threshold. Src F — FREQUENCY threshold. Src P — ACTIVE POWER threshold.
AVAILABLE IF tSh IS DIFFERENT FROM OFF ONLY UAL 3.00 threshold value		U 999 — "Src" selected for VOLTAGE. Selection range from 0 to 999 V without decimal points. A 99.9 — "Src" selected for CURRENT. Selection range from 0 to 99,9 A P 99.9 — "Src" selected for ACTIVE POWER. Selection range from 0 to 99,9 kW (decimal point depends by the Power value). Default setting = 2,80 kW	U 999 — "Src" selected for VOLTAGE. Selection range from 0 to 999 V without decimal points. A 99.9 — A"Src" selected for CURRENT. Selection range from 0 to 999 A with or without decimal point depending by the selected CT F 999 — "Src" selected for FREQUENCY. Selection range from 0 to 99,9 Hz with decimal point. P 99.9 — "Src" selected for ACTIVE POWER. Selection range from 0 to 99,9 kW (decimal point depends by the Power value).
AUE 3 average	VALUE from 1 to 15	It is the number (n) of single measures effected on the electrical parameter before it's visualization on the display. Practically it is the filter of the measure stabilization. The numbering rise up from 1 to 15; more higher is the selected number, more slow are the eventual variations of reading. This is valid for all the measured parameters.	
dEF PAg Default page	ONE OF THE AVAILABLE PAGES	Select the main page that you want to see after the initial powering of the instrument.	
ct 25 current transformer secondary 5A	VALUE from 5 to 999 every 5 steps		Select the ratio .../5A of the current transformer.
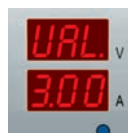
1RANM23

2RAN72C - 2RAN72C485

2RAN96C - 2RAN96C485

- 2 modules DIN (the smaller present on the market) is the best solution in order to save space on cabinets and in meantime to have a good readability of measures; main scope of multifunction meters in an electrical net.
- Nine red leds with high intensity on three lines, permit to show 3 measurements at the same time.
- Two buttons on front permit to change the measurement pages easily and in natural way.
- During the setting phase, the instrument shows the different possibilities present in the device; so it is not necessary to have in the hands the user's manual all the time.
- "Power supply" page can be used in all the cases on which is important the information of **"lost power supply"** (example in refrigerating machines and/or cold storage)
- The possibility to reset the energy consumption and time, permits to show in easy way the relative consumption in a certain time
- **Current on neutral wire:** meaning of $I_{unbalanced}$ measurement (unbalanced current). It is frequent now, also in normal distribution nets, the use of devices on which the load is not linear. With the scope to calculate correctly the neutral cable and to verify the correspondence with the project data, measurement of current on neutral (or unbalanced current measure) become fundamental.

These loads absorb not sinusoidal currents, generating harmonic waves as consequence. Third harmonic waves and their multiples, in a 3phase system, are in phase between them constituting homopolar terns.

In a 4 wire systems these homopolar terns (I_O) makes an aritmetical sum and go along the neutral cable; as result the current on it is: $I_{no}=3*Io.$ So, as example, a third harmonic component I3, present on 3 phases with amplitude 40% respect to the fundamental, causes on neutral a current higher than the fundamental (1,2*Inom)

It was in the past a rare situation. Current on neutral was caused principally by the unbalanced loads and the solution was to calculate the section of neutral cables equal or less to the phase cables section.

Now the standard CEI 64-8 art. 524.3, explain well that: neutral cable in multiphase circuits, on which the phase cables have section more than $16mm^2$ (copper wire) or $25mm2$ (aluminium cable), can have less section (min $16mm^2$ or $25mm^2$ in any case) on condition that the section supports the current present on neutral: **unbalanced current added of eventual harmonic waves**, Our device 1RANM23 is able to measure this current.
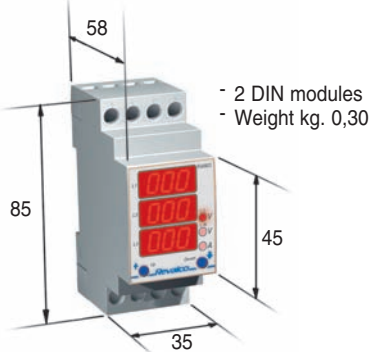
True RMS measurements reading up to 20th harmonic wave
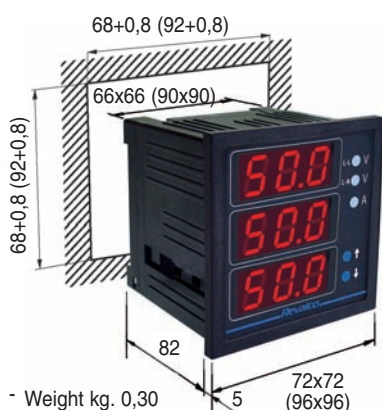
2RAN72C...C100
2RAN96C...C100

NEW
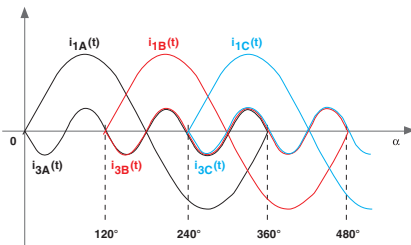
These codes (....-C100) are supplied together with a mini split core transformer in class 1 able to measure **up to 100A** and powers up to 23kW single phase. This solution permits a quick installation in already existing panels or nets as that it is not necessary to disconnect the power cable as needed by the classic current transformers. This CT accepts a cable diameter 12mm.
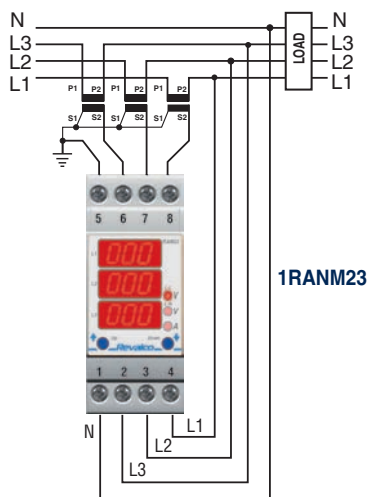
DIMENSIONS in mm

- 2 DIN modules
- Weight kg. 0,30

58
85
45
35

68+0,8 (92+0,8)
66x66 (90x90)
68+0,8 (92+0,8)
82
72x72 (96x96)
5
- Weight kg. 0,30

CONNECTION DIAGRAMS

1RANM23

Option for model
2RAN72C485
2RAN96C485

RS485 B A

2RAN72C
2RAN96C

Option for model
2RAN72C485...C100
2RAN96C485...C100
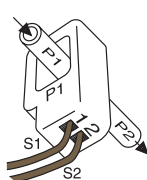
RS485 B A

ø12mm max
100A max

2RAN72C....C100
2RAN96C....C100

79

- Ph-Ph voltage	VL1, VL2, VL3	- Total Apparent Power	Pva
- Ph-N voltage	VL1-N, VL2-N, VL3-N	- Total Active Energy (import)	+kW/h*
- Medium voltage of phase	medium VL	- Total Active Energy(export)	-kW/h*
- Phase current	I1, I2, I3	- Total Reactive Energy	kvar/h*
- Medium current of phase	medium I	- Total and Partial working time	hh:mm*
- Current on neutral	Iun (< unbalance >)	- Phase Power Factor	ind/cap L1, L2, L3
- Phase Active Power (+/-)	L1, L2, L3	- Total Equivalent Power factor	Total ind/cap
- Total Active Power (+/-)	Pw	- Frequency	Hz
- Phase Reactive Power	L1, L2, L3	- Sequence of phases	L1>L2>L3 (symbol only)
- Total Reactive Power	Pvar	- Phase-neutral Asimmetry voltage	(>L1 L2 L3-N) - (<L1 L2 L3-N)
- Phase Apparent Power	L1, L2, L3	*resettable parameters	

Auxiliary power supply
- nominal value U AUX — 230V 50/60 Hz selfsupplied
- range — 0.6...1.1 Uaux
- max absorbed power — 2 VA

Input voltmeter circuit — Ph-Ph voltage
- direct insertion — max 500 V
- permanent overload — 120%
- thermic overload (1 s) — 150%
- input impedance — 2MΩ Ph-N/Ph-Ph

Input ammeter circuit — Current:
- nominal current — 5 A
- permanent overload — 120%
- thermic overload (1 s) — 200%
- range adjustment, CT ratio — 5…1000

Voltage measurement — Range:
- VLN measurement range (voltage phase, direct insertion) 0...290 V
- accuracy class — 0.5% f.s ± 2 digit

Current measurement — range:
- insertion by means of C.T. — 0.05...5.00 A
- accuracy class on range 0.05...5.00 A — 0.5% f.s ± 2 digit

Frequency measurement — range:
- nominal value — 50 / 60 Hz
- range — 45...80 Hz
- accuracy class — 0.3% vm ± 1 digit
- response time — < 300mS

Apparent Power measurement (S1, S2, S3)
- range — 870 KVA
- accuracy class — 1% f.s ± 2 digit

Active Energy measurement (Wh)
- import / export kWhmeter — 2, different
- resettable — yes
- calculating period — 15 minutes
- energy counting — 999.999 kWh
- accuracy class with current 0.05...1.0 In — 2% fs ± 2 digit

Reactive Energy measurement (varh)
- energy counting — 999.999 kVARh
- resettable — yes
- calculating period — 15 minutes
- accuracy class with current 0.05...1.0 In — 2% fs ± 2 digit

Power Factor measurement
- cosφ range — -1…0…+1
- accuracy class with current 0.1...1.0 In and voltage 0.8...1.2 Un 2% fs ± 2 digit
- cosφ value measured in continuous wave (from 0,00 to 1,00 in all quadrants) permits to display the Active Power in import and export, as consequence inductive and catacitive Reactive Power too.

Phase/phase voltages measurement (medium value) V=(V12+V23+V31)/3
Phase current measurement (medium value) A=(A12+A23+A31)/3

Working time
- Total working time (with presence of voltage) — hh 999.999
- Partial working time (from previous reset) — hh 999.999

Digital filter
- Average (to stabilize the measures) — 1…15

Compatible current transformers
- Nominal current — 5 A
- Ratio — 1...200

Visualization
- display — 3 numerical lines LED
- number of characters — 9 on three lines
- colour — red

Mechanical characteristics
- mounting — on DIN rail DIN50022
- protection — IP20/ frontal IP30

Environment conditions — Ambient temperature:
- nominal temperature — 0...+45 °C
- range — -5...+55 °C
- storage temperature — -10...+70 °C
- humidity — 10...95 %
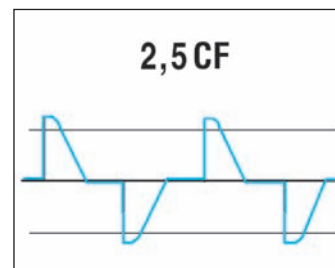- atmospheric pressure — 70...110 kPa

Standards CEI
- Safety CEI EN 61010-1   300V CAT III
- Accuracy class CEI EN 60688
- Electromagnetic compatibility (immunity) CEI EN 61000-6-2
- Electromagnetic compatibility (emission) CEI EN 61000-6-4
- Protection IP CEI EN 60529

MEASUREMENT'S TYPOLOGY

■ True RMS up to the 20th harmonic wave

2,5 CF
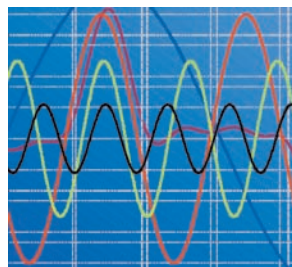
■ Crest factor up to 2,5 (Voltage and Current)

OPERATION: Instrument furnished already calibrated with the following data: Average = 3; default page = lost voltage; Current transformer = 25/5A; Nominal voltage = 213V (ph-n) and 400V (ph-ph)
- When powered the device makes a self test (all segments of leds light-on for some seconds).
  Changement of pages can be effected "FORWARD" by short pressure of right button, or "BACKWARD" by short pressure of left button.
  Maintaining pressure on buttons you can have: fast forward, reset or configuration of parameters. When one of the button is pressed, the "title" of the page is shown.
- Measurements displaing
  The measurements and signalling pages that appear (pushing and releasing the frontal button) are the following:
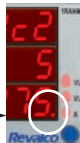
PUSHED BUTTON	RELEASED	DESCRIPTION
		This FLASHING signal appears only if: - this page is selected as "default page" (see the correspondent configuration chapter) and the instruments is just light-on or if the auxiliary supply light-off and immediately light-on, or the parameters configuration is finished. After the changement of this page, it disappears from the selection pages.
 medium voltage phase-phase		On the downer line the value of the voltage in Volt is displayed

PUSHED BUTTON	RELEASED	DESCRIPTION
phase-phase voltages		Measurement of voltage in Volt; the first upper led lights-on If the small points, on the right, light-on (close to each value of the voltage) it means that the sequence of the phases is WRONG.
phase-neutral voltages		Measurement of voltage in Volt; the central led lights-on If the small points, on the right, light-on (close to each value of the voltage) it means that the sequence of the phases is WRONG.
phase-phase voltage asimmetry		On the downer line the value of asimmetry in Volt is displayed.
medium current		On the downer line the value of current in Ampere is displayed.
phase-phase currents		Values of current in Ampere. The bottom led lights-on
current on neutral		On the downer line the value of current in Ampere is displayed.
frequency		On the downer line the value of frequency in Hz is displayed.
active power - phase 1		Measurement of Actice Power in Watt. The example shows 5775 W (5,775kW).
active power - phase 2		If on the right side of the value, a little point lights-on it means that the value is NEGATIVE
active power - phase 3		
total active power		Measurement of Actice Power in Watt. The example shows 17325 W (17,325kW). If on the right side of the value, a little point lights-on it means that the value is NEGATIVE

PUSHED BUTTON	RELEASED	DESCRIPTION	
power factor - phase 1		Power factor (cosφ). 4 quadrants value, between 0.00 and +/- 1.00. If the displacement is POSITIVE (inductive) the indications on the display will be <ind> and a point on the right lower side will be lights-off.	
power factor - phase 2		If the displacement is NEGATIVE (capacitive) the indications on the display will be <cap> and a point on the right lower side will be lights-on. When the value is 1.00, the indication conventionally will be <ind>.	
power factor - phase 3			
total power factor		Power factor (cosφ). 4 quadrants value, between 0.00 and +/- 1.00. If the displacement is POSITIVE (inductive) the indications on the display will be <ind> and a point on the right lower side will be lights-off.	If the displacement is NEGATIVE (capacitive) the indications on the display will be <cap> and a point on the right lower side will be lights-on. When the value is 1.00, the indication conventionally will be <ind>.
reactive power - phase 1		Measurement of Reactive Power in Var. The example shows 954 var (0,954kvar).	
reactive power - phase 2		If on the right side of the value, a little point lights-on it means that the value is NEGATIVE, so the measured value is CAPACITIVE instead of INDUCTIVE.	
reactive power - phase 3			
total reactive power		Measurement of Reactive Power in Var. The example shows 2862var (2,862kvar).	If on the right side of the value, a little point lights-on it means that the value is NEGATIVE, so the measured value is CAPACITIVE instead of INDUCTIVE.
apparent power - phase 1		Measurement of Apparent Power in VA. The example shows 5775 VA (5,775kVA). apparent power - phase 2 apparent power - phase 3	
total apparent power		Measurement of Apparent Power in VA. The example shows 17325 VA (17,325kVA).	

PUSHED BUTTON	RELEASED	DESCRIPTION
active energy (import)		Measurement of Energy in kWh. The example shows 12521 KWh. When 999999 is displayed, counting start again from 0. RESET: By a long pressure of right button only, the value flashes, and after few seconds it will be resetted.
active energy (export)		Measurement of Energy in kWh. The example shows 327 KWh. When 999999 is displayed, counting start again from 0. RESET: By a long pressure of right button only, the value flashes, and after few seconds it will be resetted.
reactive energy		Measurement of Energy in kvarh. The example shows 2543 kvarh. When 999999 is displayed, counting start again from 0. RESET: By a long pressure of right button only, the value flashes, and after few seconds it will be resetted.
total hourmeter		Measurements of hours (h). It shows the total working time (from powering of instrument). The example shows 37820 h. When 999999 is displayed, counting start again from 0.
partial hourmeter		Measurements of hours (h). It shows the partial working time (from last reset of instrument). The example shows 249 h. When 999999 is displayed, counting start again from 0. RESET: By a long pressure of right button only, the value flashes, and after few seconds it will be resetted.

PROGRAMMING: Make a long pressure (4 seconds about) on the RIGHT button, while you stay in a page where the resettable parameters are NOT allowed. So not on the pages of Energy or Hour-counter otherwise you obtain the reset of these values without enter on the configuration pages.

The following page appears:

Where in the central line you'll see the device type and release n°. Dot on upper right side of display flashes, three leds light-on meaning the configuration mode. This situation will remain until the end of procedure.

After 4 seconds the pages with configuration parameters start to be displayed; one page every 4 seconds showing the actual selected value.

If it is necessary to see the values without any modification don't touch nothing until the automatic end of the showed pages.

To change the values of parameters, it is enough to press the RIGHT button while this parameter is displayed.

The value change immediately and closed to him a flashing points appear meaning that the value is in modification phase.

To fast forward maintain pressure on the RIGHT button.

The following can be made by pressing the left button:
- pressed during the automatic display of the pages, it increases the time you stay on this page until it is released.
- pressed during the setting of some value (when all the points on the right flashes) decrease step by step this value and it increases the time you stay on this page until it is released.

The modified value is automatically saved in permanent way when the automatic display of the pages starts again.

The following pages can be present or not depending by the model of instruments.

DEFAULT PARAMETER	POSSIBLE VALUES	DESCRIPTION
average	VALUE from 1 to 15	It is the number (n) of single measures effected on the electrical parameter before it's visualization on the display. Practically it is the filter of the measure stabilization. The numbering rise up from 1 to 15; more higher is the selected number, more slow are the eventual variations of reading. This is valid for all the measured parameters.
Default page	ONE OF THE AVAILABLE PAGES	Select the main page that you want to see after the initial powering of the instrument.
CT .../5A	VALUE from 5 to 999 every 5 steps	Select the ratio .../5A of the current transformer.
voltage setting	VALUE from 200 to 262	It represent the NOMINAL voltage value of end scale value. Phase-phase voltage on the central line. Phase-neutral voltage on the lower line. **The default value (calibrated in factory) is 231V (400V phase-phase).**

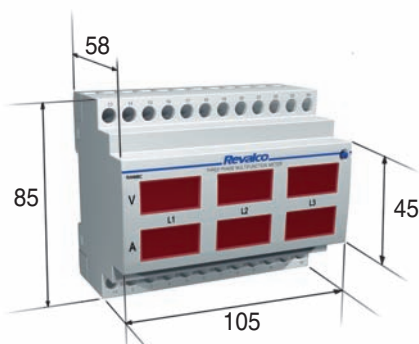# THREE PHASE LED MULTIFUNCTION METERS
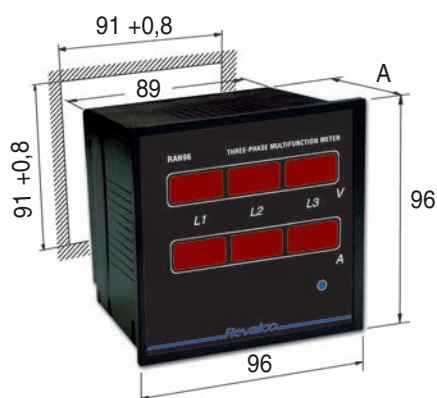

1RANM6....

2RAN96....

DIMENSIONS in mm

The 105 mm dimensions correspond to 6 DIN modules

A = 97,3 without terminals cover
A = 116,5 with terminals cover
Weight: 0,55 kg

TECHNICAL CHARACTERISTICS

MODULAR VERSION SWITCHBOARD VERSION	1RANM6 2RAN96	1RANM6R 2RAN96R	1RANM6C 2RAN96C	1RANM6CS 2RAN96CS	1RANM6C485 2RAN96C485	1RANM6CS485 2RAN96CS485	1RANM6C232
ELECTRICAL PARAMETERS							
- Phase-phase Voltage	●	●	●	●	●	●	●
- Phase-neutral Voltage	●	●	●	●	●	●	●
- Current	●	●	●	●	●	●	●
- Total Active Power			●	●	●	●	●
- Total Reactive Power			●	●	●	●	●
- Total Apparent Power			●	●	●	●	●
- Total Active Energy			●	●	●	●	●
- Partial Active Energy			●	●	●	●	●
- Total Reactive Energy			●	●	●	●	●
- Power Factor			●	●	●	●	●
- Frequency			●	●	●	●	●
- Phase sequence			●	●	●	●	●
- Partial and Total working hours			●	●	●	●	●
Possibility to use the output contacts by software (for example: turn-on or turn-off an engine)						●	
The software is available, free of charge, on our internet address www.revalco.it					●	●	●
STANDARD POWER SUPPLY				230 VAC 50/60Hz			

NOMINAL INPUT VALUES

Voltage	500V
Primary current	from 5A to 6000A selectable by button located at the front
Secondary current	5A (1A on request)
Frequency	from 40 to 60 Hz

SELECTABLE CAPACITIES	from 5A to 1000A with steps of 5A – from 1000A to 6000A with steps of 50A
PRECISION CLASS	2% ± 2 digit (Power and Energy) 0,5% ± 2 digit (all other values)
CONSUMPTION	4VA
FRONT PROTECTION DEGREE	IP20
INSULATION CLASS	II
WORKING TEMPERATURE	-5°C .... +50°C
STORAGE TEMPERATURE	-20°C .... +70°C
TEST VOLTAGE	2kV at 50Hz for 1 minute
MEMORY	EEPROM

	1RANM6 2RAN96	1RANM6R 2RAN96R	1RANM6C 2RAN96C	1RANM6CS 2RAN96CS	1RANM6C485 2RAN96C485	1RANM6CS485 2RAN96CS485	1RANM6C232
TWO OUTPUT REED RELAYS with high power (max 20VA), switching voltage (1000VDC) or peak AC	NA (0,5A-1000V)			NA (0,5A-1000V)		NA (0,5A-1000V)	
SERIAL OUTPUT					RS485		RS232
PROTOCOL					MODBUS SLAVE RTU		MODBUS SLAVE RTU **ASCI on request**
INSULATION VOLTAGE				3kV			
WEIGHT kg				0,50			

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1RANM6 - 2RAN96

- Powering the instrument you can see the following page

  Main fault

- By pressing the front button, the introduction page of this analyser appears, on which the actual version is also identified.

  ⚠ **In this position, the configuration selection menu page will appear (see at the bottom of this page)**
  To enter into the configuration menu maintain pressure on the front button for a few seconds

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button the measurements will be shown

  three voltages phase/phase

  three currents

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button the measurements will be shown

  three voltages phase/neutral

  three currents

CONFIGURATION SELECTION MENU

- By pressing the front button for a few seconds a flashing page appears, indicating that you are entering into the configuration selection menu, and you will see for example:

  Maintain pressure on the front button untill the following page is displayed.
  Releasing the button the further pages will be **automatically** shown

- After a few seconds the CT selection page appears, by pressing the front button you can select the required CT value. From 5A up to 999A with steps of 5A

  From 1000A up to 6000A with steps of 50A for their display it is necessary to refer in kA values where this unit measurement is indicated by the illumination of the light located on the extreme right of the display . To fast forward maintain pressure on the front button

  The example shows the displays of a 1200A CT

- After a few seconds the page of the mathematical medium n° of samples appears; practically it is the stability filter of the measurement. The numbering goes from 1 to 60; the higher is the selected number the slower is the change of displays.

- Automatically the following page appears: here it is possible to select and memorise the main page that you want to see after the initial energising of the instrument. By pressing in succession the front button, the various titles of the pages available appear and when you see the one required release the button to memorise it.
  After 5 seconds the next page appears.

CONNECTION DIAGRAMS
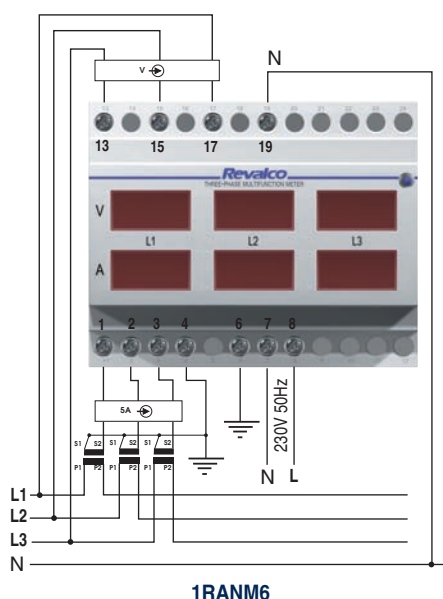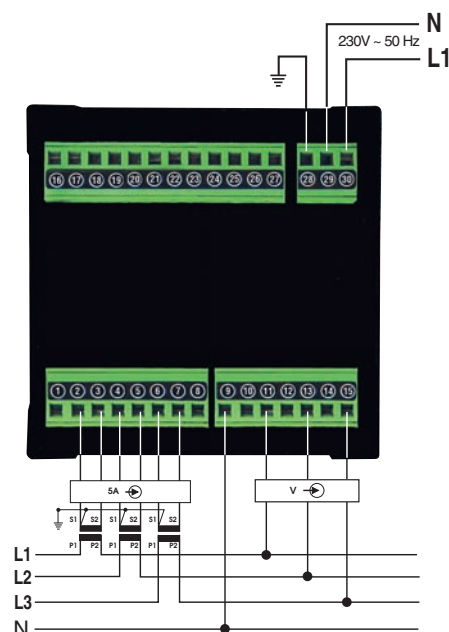
1RANM6

2RAN96

1RANM6R - 2RAN96R

OPERATION

- Powering the instrument you can see the following page   **Main fault**

- By pressing the front button, the introduction page of this analyser appears, on which the actual version is also identified.

> ⚠️ **In this position, the configuration selection menu page will appear (see at the bottom of this page)**
> **To enter into the configuration menu maintain pressure on the front button for a few seconds**

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button the measurements will be shown   three voltages phase/phase

  three currents

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button the measurements will be shown   three voltages phase/neutral

  three currents

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button ,the activation(ON) or the deactivation(OFF) of the two thresholds (th1 and th2) appears   Showing the actual situation of the thresholds

CONFIGURATION SELECTION MENU

- By pressing the front button for a few seconds a flashing page appears, indicating that you are entering into the configuration selection menu, and you will see for example:

  Maintain pressure on the front button untill the following page is displayed.
  Releasing the button further pages will be **automatically** shown

- After a few seconds the CT selection page appears, by pressing the front button you can select the required CT value. From 5A up to 999A with steps of 5A

  From 1000A up to 6000A with steps of 50A for their display it is necessary to refer in kA values where this unit measurement is indicated by the illumination of the light located on the extreme right of the display . To fast forward maintain pressure on the front button   The example shows the displays of a 1200A CT

- After a few seconds the page of the mathematical medium n° of samples appears; practically it is the stability filter of the measurement. The numbering goes from 1 to 60; the higher is the selected number the slower is the change of displays.
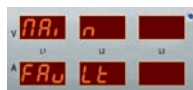
- Automatically the following page appears: here it is possible to select and memorise the main page that you want to see after the initial energising of the instrument. By pressing in succession the front button, the various titles of the pages available appear and when you see the one required release the button to memorise it.
  After 5 seconds the next page appears.

  1st alarm threshold configuration page
  When pressing the front button it is possible to choose between: OFF,
  Hi (max alarm),
  Lo (min alarn)
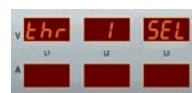
- On the further page it is possible to select the delay time of the 1st threshold
  When pressing the front button it is possible to choose between: OFF - On (excitation relay delay) or
  On - OFF (disexcitation relay delay)

- On the further page it is possible to select the delay time up to max 30 seconds

On the further page it is possible to select the parameter to which applies the **1st** alarm threshold between:

3U alarm applied simultaneously to the three phase-neutral voltages, where is enough that one of the three voltages exceeds the selected value to activate the alarm

3UF alarm applied simultaneously to the three phase-phase voltages, where is enough that one of the three voltages exceeds the selected value to activate the alarm

3i alarm applied simultaneously to the three currents, where is enough that one of the three currents exceeds the selected value to activate the alarm

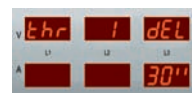|		
i1 alarm applied to the L1 current phase	**i2** alarm applied to the L2 current phase	**i3** alarm applied to the L3 current phase
U1 alarm applied to the L1 phase-neutral voltage phase	**U2** alarm applied to the L2 phase-neutral voltage phase	**U3** alarm applied to the L3 phase-neutral voltage phase
U12 alarm applied to the L1-L2 voltage phase	**U23** alarm applied to the L2-L3 voltage phase	**U31** alarm applied to the L3-L1 voltage phase

The further page shows also the percentage value of the alarm.It is possible to modify the percentage value of the alarm; by pressing the front button the percentage is varied with steps of 1%(to fast forward maintain pressure on the front button) and displayed on the page is the equality between the numerical value and the percentage.
Example: having choosen the parameter 3UF, the percentage 51% correspond to 255V

Now the 2nd alarm threshold configuration page appears
Where it is necessary to act exactly as explained above

CONNECTION DIAGRAMS
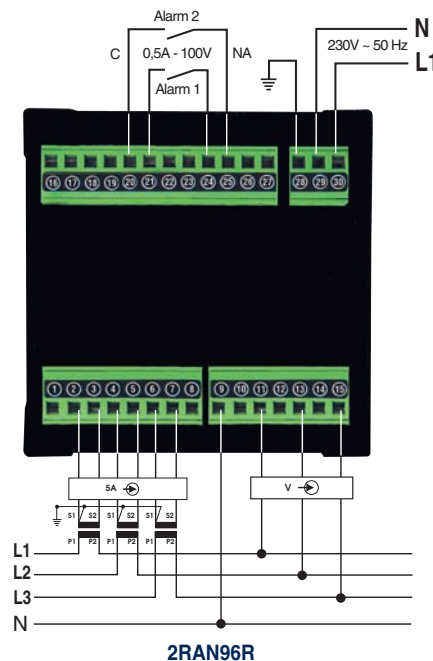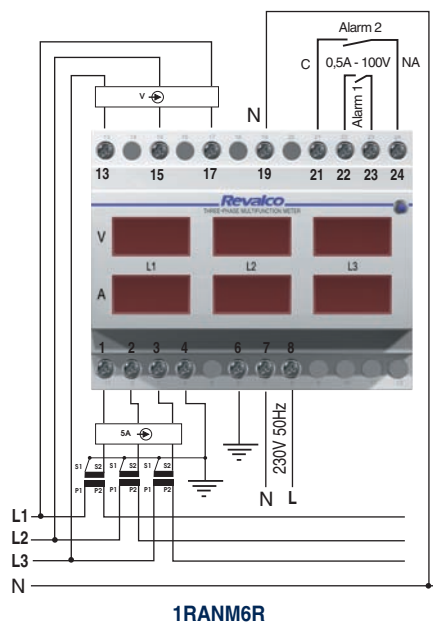
1RANM6R

2RAN96R

1RANM6C / 1RANM6C485 / 1RANM6C232
2RAN96C / 2RAN96C485

- Powering the instrument you can see the following page   `MA, n` `FAu Lt`   Main fault

- By pressing the front button, the introduction page of this analyser appears on which the actual version is also identified.   `6 c` `1`   or   `6 c` `485 5 1`   or   `6 c` `232 5 1`

⚠️ **In this position, the configuration selection menu page will appear (see at the bottom of this page)**
To enter into the configuration menu maintain pressure on the front button for a few seconds

- Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown   `U12 U23 U31` three voltages phase/phase
`1 2 3` three currents

- Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown   `U1 U2 U3` three voltages phase/neutral
`1 2 3` three currents

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown   `tot Act` Total Active Power, expressed in Watt

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown   `tot rEA` Total Reactive Power expressed in Var
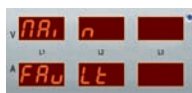
- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown   `tot APP` Total Apparent Power, expressed in VA

- Maintaining pressure on the front button you will see the parameter displayed on this page
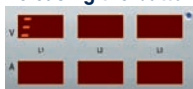**Releasing the button the measurement will be shown**   `tot Act EnE` Total Active Energy expressed in kWh

- Maintaining pressure on the front button you will see the parameter displayed on this page
showing the quantity of energy used in 15 min
Releasing the button the measurement will be shown   `rEL Act EnE` Relative Active Energy, expressed in kWh, memorised every 15 min.

`:`   The flashing symbol means that the instrument is counting the used energy during 15 minutes; when the symbol becomes static it means that the 15 minutes are passed and the final value is shown. To zero this value, maintain pressure on the front button.

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown   `tot rEA EnE` Total Reactive Energy expressed in kVar

- Maintaining pressure on the front button you will see the parameters displayed on this page
Capacitive (`cAP`) or Inductive Power Factor (`ind`) in number (`coS`), or in electrical degrees (`dE9`)
Frequency from 30hz to 70Hz (`Fr E`)
Releasing the button the measurement will be shown   `coS dE9 FrE`

- Maintaining pressure on the front button you will see the parameters displayed on this page   `SE9` Phase sequence
Releasing the button this indication appears `no` (not correct sequence)
or `YES` (correct sequence)

- Maintaining pressure on the front button you will see the parameter displayed on this page
Hourmeter indicating the working hours of the instrument, the memorising of the time occurs every 15 min
Releasing the button the measurement will be shown   `tot h`

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown   `rEL h` Partial hourmeter indicating the working hours of the instrument

(zeroing in the next page)   `rEL h rES` `'00`

- Maintaining pressure on the front button you will see the parameters displayed on this page: `Act rA tio` Actual analogue bar of the Active Power respect to the Total Apparent Power
Releasing the button the measurement will be shown   `rEA rA tio` Actual analogue bar of the Reactive Power respect to the Total Apparent Power

This page serves to give an immediate visual display showing the situation of the installation
Releasing the button you can see for example at cosφ1 the following display: `||||| ||||| |||||` Active Power
`--- --- ---` Reactive Power

If the value of the cosphi goes down, the phase displacement angle is immediately displayed, and the Active Power's bar goes down while the Reactive Power's bar will increase as for example in the figure:

Active Power

Reactive Power

- Maintaining pressure on the front button you see the parameter displayed on this page
  Visual simulation of the rotation of the electromechanical active kWh-meter indicating how much energy you are using at that time
  Releasing the button the graphics will be shown

- Maintaining pressure on the front button you see the parameter displayed on this page
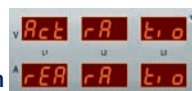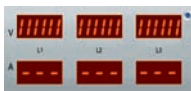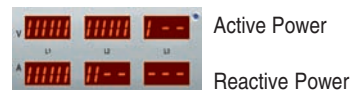 **Releasing the button the graphics will be shown**

  Analogue display bar of the Active Power (settable)

If for example the selected CT is 50/5A but it is well known that the installation is already at 100% with 40A, You'll set the instrument in the way that with 40A the bar shows 100%

CONFIGURATION SELECTION MENU

- By pressing the front button for few seconds a flashing page appears, indicating that you are entering into the configuration selection menu, and you will see for example: or   or

  Maintain pressure on the front button untill the following page is displayed.
  Releasing the button the further pages will be **automatically** shown

- After a few seconds the CT selection page appears, by pressing the front button you can select the required CT value.
  From 5A up to 999A with steps of 5A

  From 1000A up to 6000A with steps of 50A and for their display it is necessary to refer in kA values where this unit measurement is indicated by the illumination of the light located on the extreme right of the display . To fast forward maintain pressure on the front button
  The example shows the displays of a 1200A CT

- After a few seconds the page of the mathematical medium n° of samples appears; practically it is the stability filter of the measurement. The numbering goes from 1 to 60; the higher is the selected number the slower is the change of displays.

- After a few seconds the following page appears, on which it is possible to select the end scale value of the analogue bar of the Active Power (Act Ratio). The indicated example shows a value of 92% that can be modified (with steps of 1%) by pressing the front button(To fast forward maintain pressure on the front button)

  Releasing the button the page will show also the numerical equality in Watt of the percentage choosen
  In function of the nominal calibration data. If for example the CT 50/5A is selected and the percentage is 92% you'll see:
  where 6900W correspond to the end scale (92%)
  calculated as follow: 92%   =   Vnom   x   CT value   x   3
                                  230V ph/n   50/5A   230 x 50 = 11500   11.500 : 5 = 2300   2300 x 3 = 6900
                                  (400V ph/ph)

- Automatically the following page appears: here it is possible to select and memorise the main page that you want to see after the initial energising of the instrument. . By pressing in succession the front button, the various titles of the pages available appear and when you see the one required release the button to memorise it.
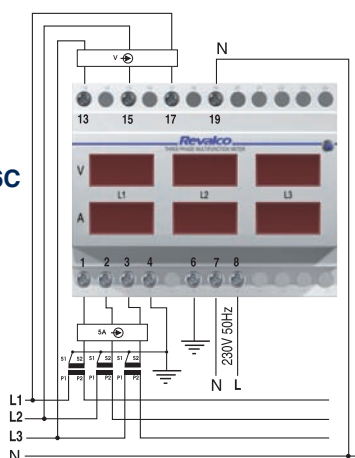
- After 5 seconds the next page appears(version 1RANM6C485 only)
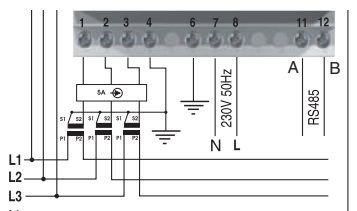 on which, by pressing the front button, it is possible to change the address to assign)   serial address

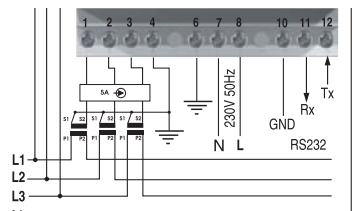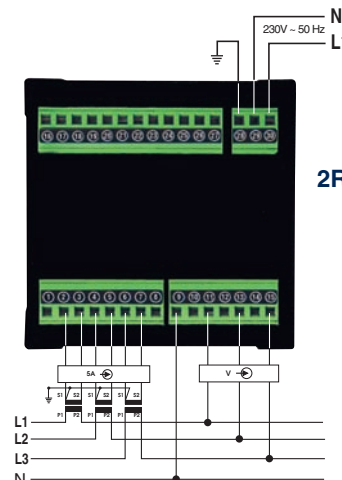## CONNECTION DIAGRAMS - For serial communication, see the proper pages
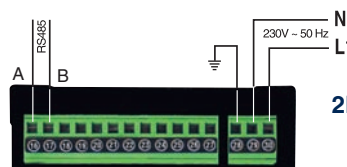
1RANM6C
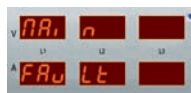
2RAN96C

1RANM6C485

1RANM6C232

2RAN96C485

89

1RANM6CS / 1RANM6CS485
2RAN96CS / 2RAN96CS485

OPERATION

- Powering the instrument you can see the following page

MA n / FAu Lt — Main fault

- By pressing the front button, the introduction page of this analyser appears, on which the actual version is also identified.

6 c5 / 1   or   6 c5 / 485 5 1

⚠ **In this position, the configuration selection menu page will appear (see at the bottom of this page)**
To enter into the configuration menu maintain pressure on the front button for a few seconds

- Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown

U12 U23 U31 — three voltages phase/phase
1 2 3 — three currents

- Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown

U1 U2 U3 — three voltages phase/neutral
1 2 3 — three currents

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

tot Act — Total Active Power, expressed in Watt

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

tot rEA — Total Reactive Power expressed in Var

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

tot APP — Total Apparent Power, expressed in VA

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

tot Act EnE — Total Active Energy expressed in kWh

- Maintaining pressure on the front button you will see the parameter displayed on this page showing the quantity of energy used in 15 min
Releasing the button the measurement will be shown

rEL Act EnE — Relative Active Energy expressed in kWh memorised every 15 min.

The flashing symbol means that the instrument is counting the used energy during 15 minutes; when the symbol becomes static it means that the 15 minutes are passed and the final value is shown. To zero this value, maintain pressure on the front button.

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

tot rEA EnE — Total Reactive Energy expressed in kVar,

- Maintaining pressure on the front button you will see the parameters displayed on this page
Capacitive (cAP) or Inductive Power Factor (ind) in number (coS), or in electrical degrees (dE9)
Frequency from 30Hz to 70Hz (FrE)
Releasing the button the measurement will be shown

coS dE9 FrE

- Maintaining pressure on the front button you will see the parameter displayed on this page

SE9 — Phase sequence
Releasing the button this indication appears : no (not correct sequence)
or YES (correct sequence)

- Maintaining pressure on the front button you will see the parameter displayed on this page
Hourmeter indicating the working hours of the instrument, the memorising of the time occurs every 15 min
Releasing the button the measurement will be shown

tot h

- Maintaining pressure on the front button you will see the parameter displayed on this page
Releasing the button the measurement will be shown

rEL h — Partial hourmeter indicating the working hours of the instrument

(zeroing in the next page)

rEL h rES / '00

- Maintaining pressure on the front button you will see the parameter displayed on this page

thr ESh oLd / StA tuS — Actual situation of the thresholds
Releasing the button, the activation (**ON**) or the deactivation (**OFF**) of the two thresholds (th1 and th2) appears showing

- Maintaining pressure on the front button you see the parameters displayed in this page
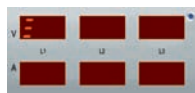 **Releasing the button the measurement will be shown**
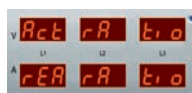
  `Act rA t.o` Actual analogue bar of the Active Power respect to the Total Apparent Power

  `rEA rA t.o` Actual analogue bar of the Reactive Power respect to the Total Apparent Power

This page serves to give an immediate visual situation of the installation
Releasing the button you can see for example at cosφ1 the following display

Active Power

Reactive Power

If the value of the cosphi goes down, the phase displacement angle is immediately displayed, and the Active Power's bar goes down while the Reactive Power's bar will increase as for example in the figure:

Active Power

Reactive Power

- Maintaining pressure on the front button you see the parameter displayed on this page
  Visual simulation of the rotation of the electromechanical active kWh-meter indicating how much energy you are using at that time
  Releasing the button the graphics will be shown

  `tot Act dSc`

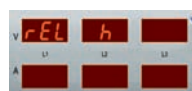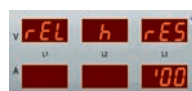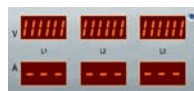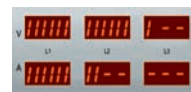- Maintaining pressure on the front button you see the parameter displayed on this page
  Releasing the button the graphics will be shown

  `tot Act bAr` Analogue display bar of the Active Power (settable)

If for example the selected CT is 50/5A but it is well known that the installation is already at 100% with 40A,
You'll set the instrument in the way that with 40A the bar shows 100%

CONFIGURATION SELECTION MENU

- By pressing the front button for a few seconds a flashing page appears, indicating that you are entering into the configuration selection menu, and you will see for example:

  `6 cS` / `485 1 Prg`   or   `6 cS` / `Prg`

  Maintain pressure on the front button untill the following page is displayed.
  Releasing the button the further pages will be **automatically** shown

  `Pro grA n` / `Nod E`

- After a few seconds the CT selection page appears, by pressing the front button you can select the required CT value. From 5A up to 999A with steps of 5A

  `ct SEt` / `50.0`

From 1000A up to 6000A with steps of 50A and for their display it is necessary to refer in kA values where this unit measurent is indicated by the illumination of the light located on the extreme right of the display. To fast forward maintain pressure on the front button

`120. 120. 120.`   The example shows the display of a 1200A CT

- After a few seconds the page of the mathematically medium n° of samples appears; practically it is the stability filter of the measurement. The numbering goes from 1 to 60; the higher is the selected number the slower is the change of displays.

  `AUE rA9 E` / `30`

- After a few seconds the following page appears, on which it is possible to select the end scale value of the analogue bar of the Active Power (Act Ratio). The indicated example shows a value of 92% that can be modified (with steps of 1%) by pressing the front button
  (To fast forward maintain pressure on the front button).

  `FS Act SEt` / `FSA oro 92`

  Releasing the button the page will show also the numerical equality in Watt of the percentage choosen
  In function of the nominal calibration data. If for example the CT 50/5A is selected and the percentage is 92% you'll see:
  where 6900W correspond to the end scale (92%)

  `690 00.0` / `FSA oro 92`

  Calculated as follow: 92%   =   Vnom   x   CT value   x   3
                        230V ph/n   50/5A   230 x 50 = 11500   11.500 : 5 = 2300   2300 x 3 = 6900
                        (400V ph/ph)

- Automatically the following page appears: here it is possible to select and memorise the main page that you want to see after the initial energising of the instrument. By pressing in succession the front button, the various titles of the pages available appear and when you see the one required release the button to memorise it.

  `dEF AuL t` / `PA9 E`

- After 5 seconds the next page appears. (version 1RANM6CS485 only)
  on which, by pressing the front button, it is possible to change the address to assign

  `485 Add rES` / `85`   serial address

1st alarm threshold configuration page
Where pressing the front button it is possible to choose between: OFF
                                           Hi (max alarm),
                                           Lo (min alarn)

`thr 1 SEL`
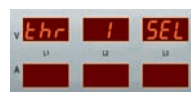
- On the further page it is possible to select the delay time of the 1st threshold
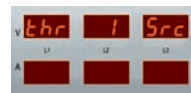 Where pressing the front button it is possible to choose between: OFF - On (excitation relay delay) or
                                                       On - OFF (disexcitation relay delay)

  `thr 1 ddY`

- On the further page it is possible to select the delay time up to max 30 seconds

  `thr 1 dEL` / `30"`
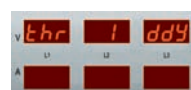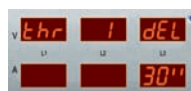
■ On the further page it is possible to select the parameter to which apply the **1st** alarm threshold between:

3U alarm applied simultaneously to the three phase-neutral voltages, where is enough that one of the three voltages exceeds the selected value to activate the alarm
3UF alarm applied simultaneously to the three phase-phase voltages, where is enough that one of the three voltages exceeds the selected value to activate the alarm
3i alarm applied simultaneously to the three currents, where is enough that one of the three currents exceeds the selected value to activate the alarm

i1 alarm applied to the L1 current phase	**i2** alarm applied to the L2 current phase	**i3** alarm applied to the L3 current phase
U1 alarm applied to the L1 phase-neutral voltage phase	**U2** alarm applied to the L2 phase-neutral voltage phase	**U3** alarm applied to the L3 phase-neutral voltage phase
Act alarm applied to the Active Power	**rEA** alarm applied to the Reactive Power	**APP** alarm applied to the Apparent Power
U12 alarm applied to the L1-L2 voltage phase	**U23** alarm applied to the L2-L3 voltage phase	**U31** alarm applied to the L3-L1 voltage phase

FrE alarm applied to the frequency
deg alarm applied to the electrical degrees of the Power factor
CoS alarm applied to the COSphi of the Power Factor

■ The further page shows also the percentage value of the alarm.It is possible to modify the percentage value of the alarm; by pressing the front button the percentage is varied with steps of 1%(to fast forward maintain pressure on the front button) and displayed on the page is the equality between the numerical value and the percentage. Example: having choosen the parameter 3UF, the percentage 51% correspond to 255V

Now the 2nd alarm threshold configuration page appears
Where it is necessary to act exactly as explained before
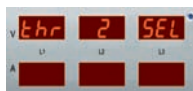
⚠ **If in the configuration phase you decide NOT to use one or both threshold, these will remain available to be controlled via MODBUS SLAVE RTU, by the controll software.**

CONNECTION DIAGRAMS

1RANM6CS

2RAN96CS

1RANM6CS485

2RAN96CS485
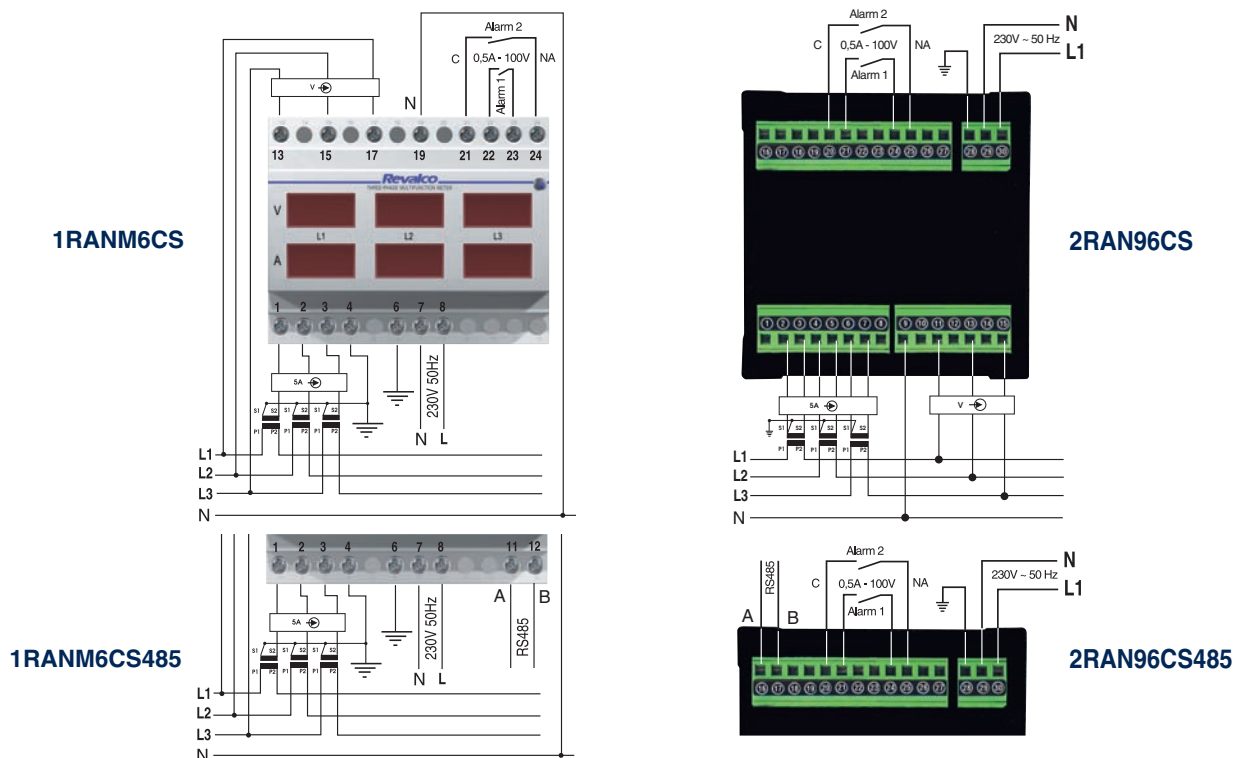
SERIAL COMMUNICATION

Scheme n. 1: Connection between instruments and PC for distances up to 800m

2RAN96C485
2RAN96CS485

1RANM6C485
1RANM6CS485

1RINT

Scheme n. 2: Connection via Modem

2RAN96C485
2RAN96CS485

1RANM6C485
1RANM6CS485

1RINT
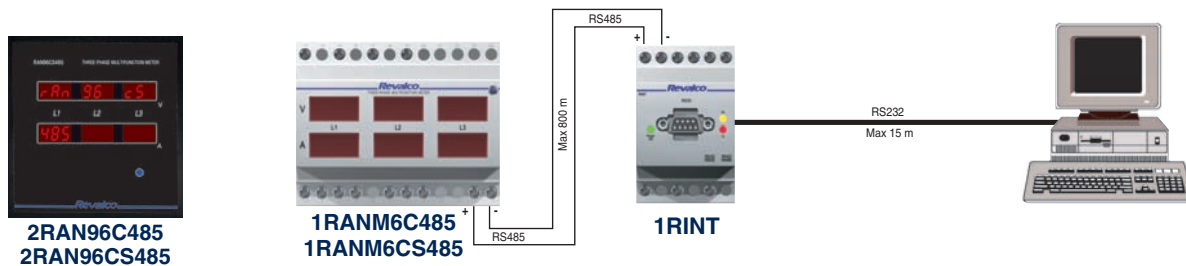
MODEM   MODEM
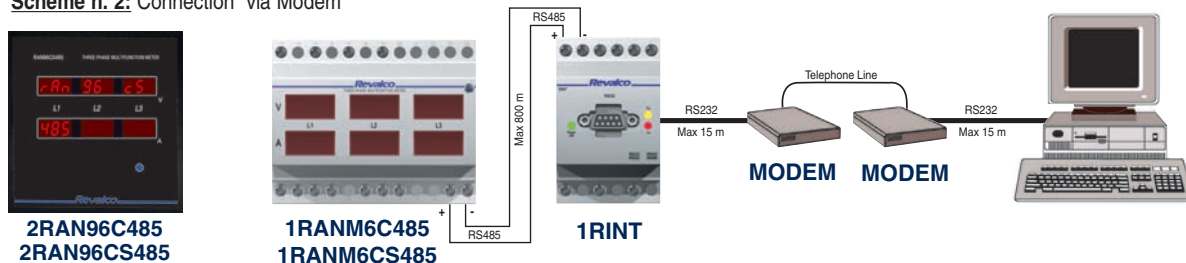
LCD THREE-PHASE DIGITAL MULTIFUNCTION METER WITH COMMAND FOR ANALOGUE MODULES - TRUE RMS

1RAEMCS485-UA

1RUA1

GENERAL DESCRIPTION

The 6 DIN modules instrument is suitable for use in industrial environments. Simple and compact, has an alphanumeric display with 2 lines / 16 characters each, and 3 buttons to select the display and programming keyboard. The simplicity of the customization operations and clarity of information on the display make it not necessary the use of the instruction manual, which is very rarely available, especially in the field. This instrument is suitable for measures of AC voltages and currents only; internally in fact there is the presence of 3 current tansformers which cannot permit the measures of DC components. The device correctly installed, supports (on the terminals) a maximum current of 6A and a maximum phase-neutral voltage of 290VAC. Input Voltages can be direct or through VTs.
Instrument has the programmability of both nominal value of the primary VT (85.....10000Vp) and secondary (.../100Vp or ... 400Vp).
In case of direct connection, the primary must be set at 400Vp (= 231Vn) and secondary at.... / 400Vp.
All voltage measurements have a resolution of 0,1 V. Input Currents can be direct(up to 5A, max 400Vp) or through CTs.
Instrument has the programmability of both nominal value of the primary CT (5.....6000A) and secondary (.../1A or .../5A).
In case of direct connection, the primary must be set at 5A and secondary a t.... /5A.
All current measurements have a resolution of 0,1 A. The range of "standard " measures is available which is deemed useful to have in an industrial, high precision environment. The details concerning the Powers and Power Factor, are provided with a sign on four quadrants according to Annex E of the standard EN61268. The resolution for the Powers is 1W -1VAR - 1VA
The accumulation of the energies, individually resettable (consumed, produced and reactive), can be useful where you have to plan interventions to the system and / or periodical checks of the lines operation, detect the consumption of the area, establish cost centers, etc.. etc..
The accumulation of energy has a resolution of 1kWh (1kvarh).

⚠️ **The instrument uses a simple aggregation of energies for diagnostic / statistics. In no way the instrument is to be considered a substitute of an energy kW-hour meter.**

Also available: 2 Hour-counters -Total hours reader (not resettable) and partial hours reader (resettable),
    1 programmable Interface RS485 opto-insulated 3kV high speed , MODBUS RTU.protocol
    1 high speed (max load 150mA) interface for connection with analogue modules series 1RUA1 or equivalent

FEATURES SUMMARY

	1RAEMCS485-UA
- Measure of 3 Phase/Phase voltages and 3 Phase/Neutral voltages	●
- Measure of threephase average voltage	●
- Measure of asymmetric Phase/Phase voltages	●
- Measure of 3 currents and average current	●
- Measure of Frequency	●
- Measure of 3 Active and Reactive Powers, 4 quadrants	●
- Measure of Total Active and Reactive Power, 4 quadrants	●
- Measure of 3 Apparent Powers and Total Apparent Power	●
- Measure of 3 lines Cosphi and Total Cosphi	●
- Totalization of consumed and produced Active Energy, resettable	●
- Totalization of Total Reactive Energy, resettable	●
- Total and partial working hours counter (Partial resettable)	●
- 2 programmable thresholds as alarm or as implusive outputs proportional to Active or Reactive energy - N.O. contact (0,5A/1000V-20VA)	●
-Summary page of the thresholds state	●
- Indication of correct voltage phase sequence	●
- Indication of power failure	●
- RS485 High-Speed Interface, 5 speed, 3KV opto-insulated	●
- MODBUS RTU and ASCII full-compliance protocol	●
- Programmable parameters from menu and keyboard	●
- Programmable parameters, Energy reset, Partial hours counter reset, Output relay commands (if threshold in OFF) in MODBUS way	●
- Programmable password for programm access	●
- Factory parameters reset function	●
- First page setting	●
- CT Primary current setting, from 5 A to 6000A, step 5A and VT Primary voltage setting, from 87V to 10000V	●
- CT Secondary current setting (.../1 A or ..../5 A) and VT Secondary voltage setting, (400V or 100V)	●
- Analogue average setting (V, I and P)	●
- Bootloader firmware upgrade by RS485	●
Features controls for analog modules 1RUA1	
- Up to 15 modules1 RUA individually managed 1RUA1	●
Parameters and control of each module	
- Page display of module status	●
- Choosing of measuring source of each module between 18 possible quantities	●
- Setting of 4 points output: beginning scale measure-beginning analogue output scale / end scale measure-end analogue output	●
- **PERMANENT MEMORY FOR SET POINT AND ENERGIES** (EEPROM)	●
- **DIMENSIONS**	6 DIN modules

Auxiliary Power Supply
- Nominal voltage (Vaux) — 90…250 VAC or VDC
- Maximum Power Consumption — 2 VA

Voltage circuit (Instrument for direct insertion)
- Maximum permissible voltage (Vmax) — 290V Ph/N(500V Ph/Ph)
- Nominal voltage of measure (Vnom) — 400 V Ph/Ph (231V Ph/N)
- Measuring direct range 0-290V Ph/N (500Vff) TRMS up to 20th harmonic wave
- Input impedance — $\approx 2M\Omega$ Ph/N and Ph/Ph
- VT range — =Vnom
- Class — 0.5%*Vmax ± 2 digit

Voltage circuit (Instrument for insertion by VT... /100V)
- Maximum permissible voltage (Vmax) — 75V Ph/N (130V Ph/Ph)
- Nominal voltage of measure (Vnom) — 57,75V Ph/N (100V Ph/Ph)
- Measuring direct range 0-75V Ph/N (130V Ph/Ph) TRMS up to 20th harmonic wave
- Input impedance — $\approx 500K\Omega$ Ph/N and Ph/Ph
- VT range (primary) — 86,5…10000V Ph/Ph (50…5774V Ph/N)
- Class — 0.5%*Vmax ± 2 digit

Compatible Voltage transformers
- Nominal voltage (secondary) — .../100 V or .../400V

Current circuits for CT .../5A
- Maximum permissible current (Imax) — 6A
- Nominal current of measure (Inom) — 5A
- Direct measuring range — 0.03...6A
- Input impedance — $\approx 20m\Omega \pm 1\%$
- Permanent overload — 110% (Inom)
- Thermal overload (1 s) — 200% (Inom)
- CT range (primary) — 5…6000A with steps of 5A
- Class — 0.5%*Imax ± 2 digit

Compatible Current transformers
- Nominal current (secondary) — ...../5 A or ...... /1A

Frequency
- Frequency range — 19.50...100.00Hz
- Operation range (V1) — 35 – 290V Ph/N
- Class — 0.05% ± 1 digit

Lines Power
- Measurement for each line — ±54MW /±54Mvar /54MVA
- Class (0.05 > Inom > 1.0) — 1 % f.s ± 2 digit

Total Powers
- Measurement — ±162MW /±162Mvar /162MVA
- Class (0.05 > Inom > 1.0) — 1 % f.s ± 2 digit

Power Factor (all)
- Measuring range cosφ — -1.00…0.00…+1.00
- Class (0.1 > Inom > 1.0, 0.8 > Vnom >1.2) — 2% fs ± 2 digit

Energy totalization
- Counting capacity — 999999999kWh /kvarh
- Counting period — 15 min.
- Reset possibility — YES
- Class (0.05 > Inom > 1.0) — 2% Max

Total Hours counter
- Counting capacity — 999999:59 hhhhhh:mm
- Counting period — 15 min.
- Reset possibility — NO
- Class — 2% Max

Partial Hours counter
- Counting capacity — 999999:59 hhhhhh:mm
- Counting period — 15 min.
- Reset possibility — YES
- Class — 2% Max

Display
- LCD back illuminated, 16 characters x 2 lines, temp. -20°/+70°.

Outputs relays
- Type of contact — N. O.
- Contact — 1000VAC / 0,5 A AC(residual load) / 20VA max.
- Insulation coil- contact — 4.25kVAC
- Remote operation by MODBUS — YES (programmable)

Serial RS485 interface
- Insulation — 3kV
- Max speed communication — 115.200 bps
- Communication protocol — MODBUS RTU Full-compliant / JBUS
- Remote Programmability and commands — YES

Special functions
- Securing access to the programming parameters by a 3-digit password
- Black-out indicator system

Mechanical Characteristics
- Dimensions — Standard 4 DIN modules
- Mounting type — DIN50022
- Protection degree — IP20/ Frontal IP30

Environmental conditions
- Operating temperature — 0...+45 °C
- Extreme range — -5...+55 °C
- Storage temperature — -10...+70 °C
- Relative humidity — 10...95 %
- Atmospheric pressure — 70...110 kPa

CEI Standards:
- Safety CEI EN 61010-1   300V CAT III
- Precision CEI EN 60688
- EMC (immunity) CEI EN 61000-6-2 (ex EN 50082-2)
- EMC (emission) CEI EN 61000-6-4 (ex EN 50081-2)
- IP Protection degree CEI EN 60529
- Powers and Cosφ measurement CEI EN 61268 All. "E" – EN 60375

Modbus:
- MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b, 28.12.2006.

SUMMARY POWERS DIAGRAM:
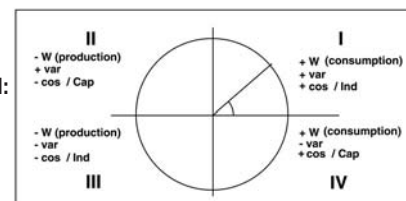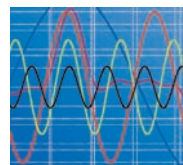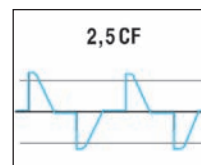
II - W (production) + var - cos / Cap	**I** + W (consumption) + var + cos / Ind
III - W (production) - var - cos / Ind	**IV** + W (consumption) - var + cos / Cap

MEASUREMENT'S TYPOLOGY:

True RMS up to the 20th harmonic wave

2,5 CF — Crest factor up to 2,5 (Voltage and Current)

SERIAL INTERFACE
- RS 485 galvanically insulated (3 kV), suitable for conventional net

COMMUNICATION DATA
- MODBUS RTU Protocol — Address from 1 to 255
- Selectable speed on "485" (bps) version: 9600, 19200, 38400, 57600, 115200
- Selectable speed on "BT" (bps) version: standard 115200; on request 9600, 19200, 38400, 57600
- Parity: N; Bits: 8; Stop Bit: 1
- The MODBUS registers table of instrument is available on request or on the web site.

CONNECTION DIAGRAM
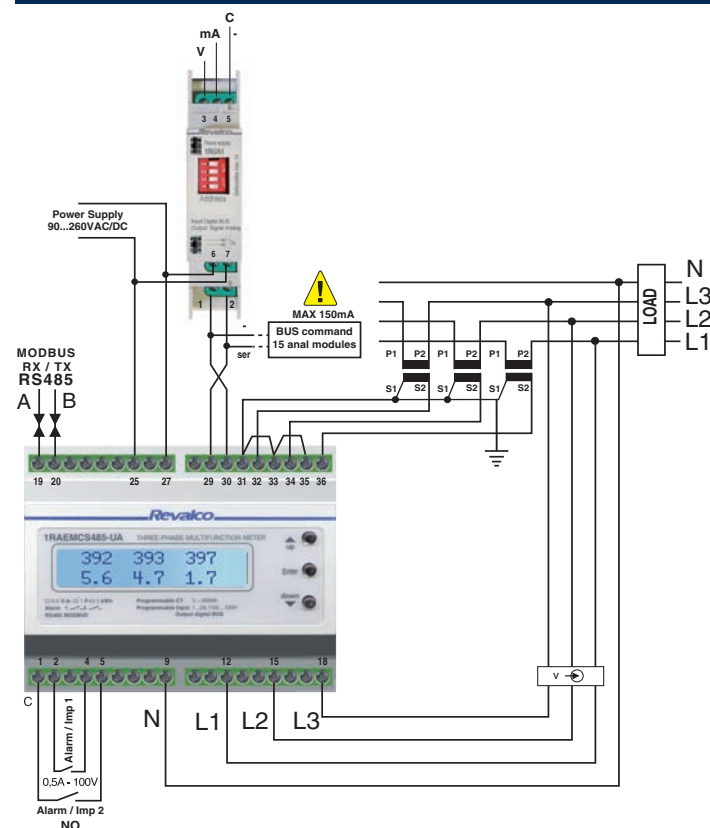
FUNCTIONS

The instrument measures in real time the electrical parameters of the system to which it is connected, and it is able to show them on a page of measure, selectable by short pressures on the keys, down pressures to "forward" and up pressure to go "back ". The first page to be displayed on the front is programmable

The instrument has two independent thresholds, allowing you to set for each threshold the parameter you wish to control; the type of threshold (off, maximum or), the threshold value (1/1000 of the full scale of the controlled parameter), the application of any delay on energization or de-energization and the delay time in decimal seconds up to 25.5 Sec (0 = no delay).

Please refer to "Programming Keyboard Standard parameters" for details on the values of programming and the "Operation of programmable thresholds.

The instrument can be plugged into an RS485 network of instruments that communicates with MODBUS RTU or MODBUS ASCII. For reliability of communication, you should use all the tricks in implementing network RS485 (polarizations, termination, etc. ..) especially when using many devices each ring and the distances are considerable (hundreds of meters). Please note that any converters to be used must have highand proven quality to maximize the features of the network instruments

The communication speed is programmable between 9600bps and 115.200bps. Where in the ring are present only these instruments, we strongly recommend to use the fastest communication. If the speed is too low and the demands are very frequent and / or the number of registers required is high, it can get slow interactions with the instrument. All measurements and parameters are available simultaneously on read command MODBUS RTU or MODBUS ASCII. You do not need any selection protocol because the instrument automatically adjusts the response to the application format.

Please note that by its nature, the ASCII communication is slower than the RTU, given the greater consistency of telegrams.

The instrument also provides the setting "on the fly" by remote control of the operating parameters via MODBUS write command to its registers which allow it.

It is permitted, under certain conditions, to perform some major-operations and commands, such as restoring factory settings on models which support it, the reset of the counters, the direct control of on / off output relays for models with a threshold etc. etc.. For details of the MODBUS communication, refer to the relevant section below.

The instrument also automatically accepts a program in "menù" way that allows you to instantly configure a large number of parameters and quickly set up many instruments to be all equal. Refer to the appropriate section of this manual. A page of black-out report is present

It 's a page like the measuring but with flashing content, which must be programmed as the first to be shown when the device is lights-on. When you act on the keys to change the measurements page, the "black-out "condition is cleared which also reappears at the end of any programming parameters from the keyboard.

The instrument has 2 hour counters ; one for the total operating time (life of the instrument) and the second resettable useful to take into account for example,the average consumption, if cleared, together with one or more counters of energy. It is provided that the change of operating parameters and the reset of the counters are protected by a 3 digits password (disabled) This password is not oriented to a total protection, but only to prevent accidental access to the programming and the subsequent alteration of the parameters unwanted by unauthorized personnel. The password, when present, protects the remote functionality of programming and command.

If the password is set and then forgotten, there is a quick way to recover or delete it. You will need to scan any combination, or resend the product to the factory for reprogramming. The display section of the situation of 15 analog outputs managed, which can be accessed with a short press on "Enter" button, permits to control the output values of analogue modules eventually connected. Keep in mind that: The voltage and current values shown (inter-related, not independent) are the ones who the instrument send as implementation and not the effective present on the output of the relative module. If the relative module is absent or on failure, the instrument not diagnostic it and continues to behave as if it is present. There is no feedback between instrument and connected modules on the output bus.

More analog modules connected to the bus output can have the same address. It means that if for example there are 5 modules with address 2, they will behave in an identical manner in accordance with the planning for the module number 2 and their progress will be visible on the display page of module 2.

OPERATION

- When switched-on the info firmware page appears for 2 seconds:

| 14.04.11 | Date (dd-mm-yy) |
| 01.15.01 | FW version (mod-rev) |

- Immediately after, the selected measuring page will be presented with the parameter "Default Page". If the first page is the "black-out" , the following flashing message will appear:

| PowerOn |
| Ready |

The display (flashing) occurs only once after power-on or when this page is selected as the start page and exit the programming of standard parameters. When you press a button it disappears from the selection of display pages

- When the first measurement page appears, you can immediately start to work with the keys to scroll through the available pages. The sliding may be "forward" with short press on the DOWN button or "BACK" with the UP button.
The prolonged duration of pressure on "down" button causes, as well as the advancement of the page, also the entrance into the programming of the "standard" parameters of the instrument.

- To see the status of analogue modules, is sufficient that starting from the vision of the standard measures, you briefly press the" Enter" key. The correspondent page to the currently selected module, appears (e.g. 1):

PRESSED BUTTON	RELEASED BUTTON	DESCRIPTION
Analog Output01	An01(Act) 87.0% I17.40 V08.70	Percentage value of considered measurement Real value on the module output. mA and V

To see the pages related to the other outputs, press "DOWN " to go on (02,03, ...) or "UP" to go back (15,14, ...).

On the first line appears: Number of the module AnXX and in parenthesis the name of the represented parameter (i.e. Act = Active Power)

          Percentage value of the instantaneous measurement with mark (from 100,0% to -100.0%)

On the second line appears: Instantaneous forecasted values to the outputs of the correspondent module, current (mA) and voltage (V).

⚠️ **The values of voltage and current are not independent but related between them (1 mA = 0.5 V)**

To return to the standard measurement display , simply press SHORTLY the "ENTER" key. Releasing it you go back to the standard measurement previously selected.
The prolonged duration of pressure on the "Enter" key, causes the entry to the programming of the parameters of analog modules connected to the instrument

DISPLAY OF STANDARD MEASURES

- The measurement and reporting pages which appear by briefly pressing and releasing in succession the "DOWN" button, as example may be as follows:

PRESSED BUTTON	RELEASED BUTTON	DESCRIPTION
RAEM UA CS >> 485 : 001	RAEM UA CS >> 485 : 001	Instrument name – Options – SQZ MODBUS Node number

The view is the same if button is pressed or released

PRESSED BUTTON	RELEASED BUTTON	DESCRIPTION
Uavg(V) ²P (kW) Iavg(A) Pf(tot)	U=400.0 ²P=69.3 I=100.0 Pf-0.99I	Three-phase average voltage (V) – Three-phase Active Power (kW) Three-phase average Current (A) – Power factor
In(A) DVp(V) Fre(Hz)	In 0.0 DV 0.0 F=50.00	Current in Neutral wire – Asymmetry Vp Frequency (Hz)
Up(V) V12 V23 V31	Up(V) 1=400.0 2=400.0 3=400.0	Voltage V1/V2 Voltage V2/V3 – Voltage V3/V1
Un(V) V1 V2 V3	Un(V) 1=231.0 2=231.0 3=231.0	Voltage V1 Voltage V2 – Voltage V3
I(A) I1 I2 I3	I(A) 1=100 2=100.0 3=100.0	Current line 1 Current line 2 – Current ine 3
PfLine Pf1 Pf2 Pf3	PfLine 1=-0.99I 2=-0.99I 3=-0.99I	Power Factor line 1 Power Factor line 2 – Power Factor line 3
L1 Act Power	L1 Act Power W 23100.0	Active Power line 1 (Title) Active Power line 1 (Value)
L2 Act Power	L2 Act Power W 23100.0	Active Power line 2 (Title) Active Power line 2 (Value)
L3 Act Power	L3 Act Power W 23100.0	Active Power line 3 (Title) Active Power line 3 (Value)
Total Act Power	Total Act Power W 69300.0	Total Active Power (Title) Total Active Power (Value)
L1 Rea Power	L1 Rea Power var 0.0	Reactive Power line 1 (Title) Reactive Power line 1 (Value)
L2 Rea Power	L2 Rea Power var 0.0	Reactive Power line 2 (Title) Reactive Power line 2 (Value)
L3 Rea Power	L3 Rea Power var 0.0	Reactive Power line 3 (Title) Reactive Power line 3 (Value)
Total Rea Power	Total Rea Power var 69300.0	Total Reactive Power (Title) Total Reactive Power (Value)
L1 App Power	L1 App Power VA 23100.0	Apparent Power line 1 (Title) Apparent Power line 1 (Value)
L2 App Power	L2 App Power VA 23100.0	Apparent Power line 2 (Title) Apparent Power line 2 (Value)
L3 App Power	L3 App Power VA 23100.0	Apparent Power line 3 (Title) Apparent Power line 3 (Value)
Total App Power	Total App Power VA 69300.0	Total Apparent Power (Title) Total Apparent Power (Value)

PRESSED BUTTON	RELEASED BUTTON	DESCRIPTION
Total Act Ene(+)	Total Act Ene(+) kWh 999999999	Total Active Energy Buyed [+] (Title) Total Active Energy Buyed [+] (Value)
Total Act Ene(-)	Total Act Ene(-) kWh 0	Total Active Energy Selled [-] (Title) Total Active Energy Selled [-] (Value)
Total Rea Ene	Total Rea Ene kvarh 0	Total Reactive Energy (Title) Total Reactive Energy (Value)
Total Time	Total Time hh:mm 999999:59	Total hours-counter (Title) Total hours-counter (Value)
Relative Time	Rel Time hh:mm 999999:59	Partial hours-counter (Title) Partial hours-counter (Value)
Relais Outputs	Relais1 (W+)=ON Relais2 (V12)=OFF	Relay outputs (Title) / Status Relay 1 Status relay 2

SPECIAL INDICATIONS ON THE DISPLAY

These indications relate solely to the display and not the values detected by the remote, which remain unchanged

Numerical values out of the scale

It may happen that some areas of the display don't permit the representation of the numerical value due to the limited space available. In this case the digits are replaced with the characters "^ ".

Measurement values out of scale

If the device detects a signal of excessive measure,   the value of the parameter flashes (voltage or current) associated to its measurement. In the presence of such information is necessary to verify that you are not exceeding the maximum input signal for the instrument, it can be damage.
This condition can be detected remotely on specific registers.

Indications related to the Power Factor (Pf)

In absence of its apparent power (VA = 0), the indication of the Power Factor is displayed with small lines "-,--" and quadrant "I" or "C" disappear.
However from remote the survey is continuous and may not be significant.
In addition, the sign of the Power Factor from remote, must be taken from its relative Active Power and from relative indicator in the appropriate register for the quadrant

PROGRAMMING FROM KEYBOARD OF "STANDARD" PARAMETERS

To enter in programming phase , press and hold the DOWN button (more than 4 seconds)
When the input request is recognized, the confirmation page appears at the entrance of the programming.
Releasing the button, the display flashes (indicates that you are in programming phase)
If the "Password" is enabled (different from 000), the password request page appears, if not chosen correctly with the UP and DOWN buttons, let you exit from programming mode after few seconds, returning to the standard display mode.
Otherwise, the programming pages begin to flow slowly (one every 4 sec. about) showing the title and the current setting. If you do not touch UP or DOWN at the end of the last page, the meter returns to normal display without any physical changes.
During this scrolling (but not during a modification), speeding up the return to standard mode, simply press the ENTER button briefly
To make changes, simply press a key when you see the desired page, respectively: UP key = increases the value and DOWN key = decrease the value.
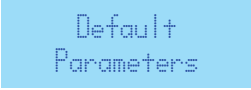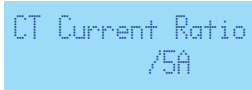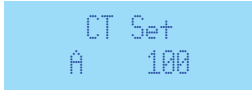At that point (when the button is pressed), the display is stable for easy reading and setting; the value advances unit by unit
For values far from the needed, you can use the fast forward by holding down the button for more than 2 seconds.
The longer it stays down and more scroll speed increse (4 speeds).
All values are 'roll' type; once reached the maximum value allowed them restart from the minimum and vice-versa.
When the value is correct, simply release the button for more than 4 seconds, so the scrolling of pages restart and the modified value is automatically stored

▬ Programming entry   [1]
      Program
      Mode

▬ Password Input. Appears only if "CHANGE PASSWORD" has been modified and is different from 000. If you do not respond to the request with the correct value, you return to normal viewing of the measures.
[1] Enter Password
   000

▬ Default parameters. Back to factory settings (except the hours and energy counters, if present).
[1] Default
Parameters

▬ It appears only if the instrument has been calibrated also for use of current transformation ratio ... / 1A.
Secondary adjustment: .../ 5A= 0   or .../1 A=1. Default = .../5A
CT Current Ratio
   /5A

▬ Nominal value of primary CT, in steps of 5A. Represents the displayed value of current when on the input terminals is present the nominal value of secondary current. Primary adjustment from 5 to 6000. Default = 100
From remote, the value in reading / writing must be considered with one decimal (Default = 100.0A)
CT Set
A   100

- It appears only if the instrument has been calibrated also for use of voltage transformation ratio ... /100V
  Secondary adjustment : .../400V=0 or .../100V=1   Default = .../400V

```
UT Voltage Ratio
           /400U
```

- In direct connection the value must be set to the phase/phase nominal voltage. During the adjustment, above the Vp value, the equivalent Vn (phase/neutral) value appear. Adjustment from 86 to 10000Vp. Default = 400Vp (231Vn). **From remote, the value in reading / writing is the phase/neutral value, in Modbus and menu' mode with one decimal (Default=231.0 Vn).**

```
UT Set              Un    231
Up    400           Up    400
```

| **COVER** | **PRESSED BUTTON (adjustment)** |

- Average analogue measurements (V, I and P).
  Number of readings on which the measurement is made. More it is large and more the updating measures is slow.
  Adjustment from 1 to 15. Default = 3

```
Average
       3
```

- Page displayed when instrument is powered. Number of page which must be displayed when the instrument is turned-on. Please refer to the numbers of pages. Adjustment from 0 to the number of the last page. Default = 0 (black-out

```
Default Page
           0
```

- Set / Change Password. Numbers from 000 to 999 to block the access to the programming of parameters. With 000 (Default numbers) it is inactive, so the password request don't appear and any request by remote are permitted. Default = 0 (off) [2]

```
Change Password
             0
```

COVER	**PRESSED BUTTON (> 4 sec)**	**DESCRIPTION**
`Act Ene(+) Reset` `kWh      1523`	`Act Ene(+) Reset` `kWh         0` [1]	Reset consumed Energy (+). Press and hold the DOWN button (> 4 sec) to perform the reset. During the pressure, the display stops flashing and just keeps flashing the message "Reset ". When the value goes to zero, release the button
`Act Ene(-) Reset` `kWh       871`	`Act Ene(-) Reset` `kWh         0` [1]	Reset produced Energy (-). Press and hold the DOWN button (> 4 sec) to perform the reset. During the pressure, the display stops flashing and just keeps flashing the message "Reset ". When the value goes to zero, release the button
`Rea Ene Reset` `kvarh     203`	`Rea Ene Reset` `kvarh       0` [1]	Reset Reactive Energy. Press and hold the DOWN button (> 4 sec) to perform the reset. During the pressure, the display stops flashing and just keeps flashing the message "Reset ". When the value goes to zero, release the button
`Rel Time Reset` `1854:03`	`Rel Time Reset` `0:00` [1]	Reset Partial hours-counter. Press and hold the DOWN button (> 4 sec) to perform the reset. During the pressure, the display stops flashing and just keeps flashing the message "Reset ". When the value goes to zero, release the button

- Selection of a Threshold 1 function. Adjustable between: Hi = Maximum Threshold (1), Lo = Minimum Threshold (2) Off= Threshold off (0). If the threshold is Off, the following pages relate to it WILL BE NOT PRESENT. Default = Hi (maximum).

```
Th1 Sel
        Hi
```

- This page is present only if Th1 Sel is different from Off. Value of delay time of output relay, expressed in seconds. Adjustable between 0.0 and 25.5 in steps of 0,1. Default = 0.1

```
Th1 Dly
        0.1
```

- This page is present only if Th1 Sel is different from Off. Assignment of delay time of output relay. The delay time is applicable at the beginning of the intervention condition of the threshold (Off-On, 0), or to the end (On-Off, 1). Default = Off-On (beginning)

```
Th1 DD
        Off-On
```

- This page is present only if Th1 Sel is different from Off. Assignment of parameter to which the threshold acts. Selectable between: 3Vp, V12, V23, V31,DVp, 3Vn, V1, V2, V3, 3I, I1, I2, I3, In, W+, W-, Hz. Default = W+

```
Th1 Src
        W+
```

- This page is present only if Th1 Sel is different from Off. Adjustment of threshold value as a percentage of full scale, adjustable between 0.0% and 120.0%. During the adjustment, on the second line above the percentage value, the equivalent value appears. Default = 50.0%

```
Th1 Val%            34650.0
W+     50.0%        W+    50.0%
```

| **COVER** | **PRESSED BUTTON (adjustment)** |

- Selection of a Threshold 2 function. Adjustable between: Hi = Maximum Threshold (1), Lo = Minimum Threshold (2), Off= Threshold off (0). If the threshold is Off, the following pages relate to it WILL BE NOT PRESENT. Default = Hi (maximum).

```
Th2 Sel
        Hi
```

- This page is present only if Th2 Sel is different from Off. Value of delay time of output relay, expressed in seconds. Adjustable between 0.0 and 25.5 in steps of 0,1. Default = 0.1

```
Th2 Dly
        0.1
```

- This page is present only if Th2 Sel is different from Off. Assignment of delay time of output relay. The delay time is applicable at the beginning of the intervention condition of the threshold (Off-On, 0), or to the end (On-Off, 1). Default = Off-On (beginning)

```
Th2 DD
        Off-On
```

- This page is present only if Th2 Sel is different from Off. Assignment of parameter to which the threshold acts. Selectable between: 3Vp, V12, V23, V31,DVp, 3Vn, V1, V2, V3, 3I, I1, I2, I3, In, W+, W-, Hz. Default = W+

```
Th2 Src
        W+
```

- This page is present only if Th2 Sel is different from Off. Adjustment of threshold value as a percentage of full scale, adjustable between 0.0% and 120.0%. During the adjustment, on the second line above the percentage value, the equivalent value appears. Default = 50.0%

```
Th2 Val%            34650.0
W+     50.0%        W+    50.0%
```

| **COVER** | **PRESSED BUTTON (adjustment)** |

- MODBUS node number (and ID in menu' way). It is the identification number of the instrument for serial communications of various instruments in series. Adjustment from 1 to 255. Default = 1 [1]

```
Node
        1
```

- Serial port speed. The type of interface changes depending on the model. The meaning of values from 0 to 4 is: 0 = 9600 1 = 19200 2 = 38400 3 = 57600, 4 = 115 200 bps. Default = 4 [1]

```
Speed
        4
```

NOTE [1]: The parameter is not accessible in menu'.
NOTE [2]: Parameter "Write-Only" from remote (not readable in serial way).

To enter into the programming of the parameters of one of the 15 modules, select its page, then press and hold the ENTER key (more than 4 sec).

The following behavior is similar to the described for the programming of "standard" parameters, however, we repeat it for clarity.

When the request to enter in programming is recognized, the confirmation page appears at the entrance of the programming.

Releasing the button, the display flashes (indicates that you are in programming phase). If the "Password" is enabled (different from 000), the password request page appears, if not chosen correctly with the UP and DOWN buttons, let you exit from programming mode after few seconds, returning to the standard display mode. Otherwise, the programming pages begin to flow slowly (one every 4 sec. about) showing the title and the current setting. If you do not touch UP or DOWN at the end of the last page, the meter returns to normal display without any physical changes. During this scrolling (but not during a modification), speeding up the return to standard mode, simply press the ENTER button briefly. To make changes, simply press a key when you see the desired page, respectively: UP key = increases the value and DOWN key = decrease the value. At that point (when the button is pressed), the display is stable for easy reading and setting; the value advances unit by unit

For values far from the needed, you can use the fast forward by holding down the button for more than 2 seconds.

The longer it stays down and more scroll speed increase (4 speeds). All values are 'roll' type; once reached the maximum value allowed them restart from the minimum and vice-versa. When the value is correct, simply release the button for more than 4 seconds, so the scrolling of pages restart and the modified value is automatically stored. Displayed pages for ONE module only, as example (equal for every other module)

■ Access to programming of parameters for ONE module (eg 01). Press and hold the ENTER button (> 4 sec) to enter. When the right-hand page appears, release the button. It starts flashing, then start the programming sequence

Analog Output 01	Analog Output 01 Program Mode
PRESSED BUTTON (< 4 sec)	**PRESSED BUTTON (> 4 sec)**

■ Password Input. Appears only if "CHANGE PASSWORD" has been modified and is different from 000. If you do not respond to the request with the correct value, you return to normal viewing of the module status.

Enter Password 000

■ Selection of measurement source for the analogue output
Sources Available: OFF, Vpa, V12, V23, V31, V1, V2, V3, Ia, I1, I2, I3, In, Act, Rea, App, PF, Hz,
Default = OFF

An01 Select SRC (OFF)

COVER	PRESSED BUTTON (adjustment)	DESCRIPTION
An01 SRC MinVal (Act) 0.0%	An01 34650.0 (Act)Min 50.0%	This page is present only if SRC Sel. is different from OFF Minimum % value of the parameter pointed by SRC. Range: depending on SRC, from 0.0% to 100.0%, or from -100.0% to 100.0%. Default = 0%
An01 OUT MinVal I 0.00 V 0.00	An01 V 0.00 OUTMin I 0.00	This page is present only if SRC Sel is different from OFF Minimum value at the output of "SRC MinVal" Range: + / - 20.00mA, with steps of 0.01mA (= +/- 10.00V with steps of 0.005V). Default = 0.00mA (0.00V)
An01 SRC MaxVal (Act) 100.0%	An01 69300.0 (Act)Max 100.0%	This page is present only if SRC Sel. is different from OFF Maximum % value of the parameter pointed by SRC Range: depending on SRC, from 0.0% to 100.0%, or from -100.0% to 100.0%. Default = 100%
An01 OUT MaxVal I 20.00 V 10.00	An01 V 10.00 OUTMax I 20.00	This page is present only if SRC Sel is different from OFF. Maximum value at the output of "SRC MaxVal" Range: + / - 20.00mA, with steps of 0.01mA (= +/- 10.00V with steps of 0.005V). Default = 20.00mA (10.00V)

To calculate the absolute number of parameter: Standard Parameters number+1+ [(Module number -1) x5]+ Relative number of parameter

OPERATION OF THE ANALOGUE CONTROL MODULES

The instrument, through the control bus, sends in sequence the command codes to each module in cyclical way. The commands are write-only, and are in any case sent f whether the modules are connected or not and their reference source (SRC) is set to OFF. The command sent to a module whose source of reference is OFF, forces the outputs to electrical zero (0mA - 0V). This ensures uniformity of the update times of the modules, regardless the increase or decrease of their number. The typical time to update the full potential block of 15 units is 750 msec. It is provided that the modules must operate near the instrument and that the bus does not exceed the length of several meters. However, if the modules must be removed and / or communication is infrequent / difficult, it may be necessary to use a line termination resistor with value between 120 and 470 Ohm, to connect in parallel to the 2 wires . Please note that the bus is not protected from short –circuits and that it is planned for the maximum load of 15 units plus the eventual termination resistance. Do not apply more loads or different loads than the required. Let's describe how to use the modules: Each module can have a valid address from 1 to 15 (with zero, it not answer and goes to electrical zero). More modules can have the same address.

Their outputs will have identical behavior in response to the command to them address. The outputs of the modules are bidirectional (positive and negative) and related to each other, then not independent. The value at terminals is: 1 mA = 0.5 V. The comfort is to have available on terminal V or I, with the same reference, the simultaneous parameters which can also be used simultaneously. The operating range of the outputs is between -20 and +20 mA to the terminal "I" and as consequence, -10 and +10 V to terminal "V." The values of out scale can reach 8-9% above the nominal full scale.

The measures that are converted by the instrument for the control of analogue modules, and programmed on the relative parameters 'SRC' are the following:

N.	Parameter choice (Select SRC)	Forecasted Full Scale (= 100.0%)	Description	N.	Parameter choice (Select SRC)	Forecasted Full Scal (= 100.0%)	Description
0	OFF	0	Code sending for outputs with electrical zero	10	I1	CT Set	I1
1	Vpa	VT Set (value f/f)	Average of phase/phase voltage	11	I2	CT Set	I2
2	V12	VT Set (value f/f)	V12	12	I3	CT Set	I3
3	V23	VT Set (value f/f)	V23	13	In	CT Set	Current in Neutral
4	V31	VT Set (value f/f)	V31	14	Act	CT Set * VT Set(f/n) *3	Three-phase Active Power (with mark)
5	DVp	VT Set (value f/f)	Voltage asymmetry (f/f)	15	Rea	CT Set * VT Set(f/n) *3	Three-phase Reactive Power (with mark)
6	V1	VT Set (value f/n)	V1	16	App	CT Set * VT Set(f/n) *3	Three-phase Apparent Power
7	V2	VT Set (value f/n)	V2	17	Pf	1.00	Power Factor (with mark)
8	V3	VT Set (value f/n)	V3	18	Hz	100.00Hz	Frequency (measured on V1 line)
9	Ia	CT Set	Average Current				

Choose the parameter in SRC, you then choose his minimum percentage value (SRC MinVal) to which correspond an output value OUT MinVal expressed in mA with corresponding Volt. Same thing for the maximum value of the parameter (MaxVal SRC) to which the value OUT MaxVal will be associated

The calculation of current value to the analogue output is the following:

Hence knowing that 1mA = 0.5 V: Vout = Iout value / 2

If ,for any reason, the transmission of the value to the respective module stops, after 2 seconds about of non-communication, it carry the outputs to electric zero .

$$Iout = OUT\,MinVal + \left[\frac{Measure\% - SRC\,MinVal) * (OUT\,MaxVal - OUT\,MinVal)}{SRC\,MaxVal - SRC\,MinVal} \right]$$

OPERATION OF PROGRAMMABLE THRESHOLDS

The instrument I can apply two independent thresholds, maximum or minimum to the value, as percentage of a chosen parameter,, compared to its expected full scale.

N.	Parameter choice (Th1 Src / Th2 Src)	Forecasted Full Scale (= 100.0%)	Description	N.	Parameter choice (Th1 Src / Th2 Src)	Forecasted Full Scale (= 100.0%)	Description
0	3Vp	VT Set (value f/f)	Max or Min for one of the ph/ph voltages	9	3I	CT Set	Max or Min for one of the currents
1	V12	VT Set (value f/f)	Max or Min for V12	10	I1	CT Set	Max or Min for A1
2	V23	VT Set (value f/f)	Max or Min for V23	11	I2	CT Set	Max or Min for A2
3	V31	VT Set (value f/f)	Max or Min for V31	12	I3	CT Set	Max or Min for A3
4	DVp	VT Set (value f/f)	Max or Min for ph/ph asymmetry voltage	13	In	CT Set	Max or Min for the current on neutral
5	3Vn	VT Set (value f/n)	Max or Min for one of the ph/n voltages	14	W+	CT Set * VT Set(f/n) * 3	Max or Min for the instantaneous Active Power consumed
6	V1	VT Set (value f/n)	Max or Min for V1	15	W-	CT Set * VT Set(f/n) * 3	Max or Min for the instantaneous Active Power produced
7	V2	VT Set(value f/n)	Max or Min for V2	16	Hz	100.00Hz	Max or Min for the Frequency (measured on V1 line)
8	V3	VT Set (value f/n)	Max or Min for V3				

The following description refers to the threshold 1, but also exactly applicable to threshold 2.

The operating point of the threshold ("threshold active") is provided for condition "greater than Th1 Val" if Th1 Sel = Hi, otherwise "less-than Th1 Val" if Th1 Sel = Lo.

The condition of "active threshold' attempts to act on the CLOSURE of N.O. contacts of the respective relay, which happens with delay if in Th1 Dly page, Th1 DD is "Off-On"; otherwise the closure is instantaneous. The rest point of the threshold ("threshold at rest") is provided for condition "less than or equal to Th1 Val" if Th1 Sel = Hi, or "greater than or equal to Th1 Val" if Th1 Sel = Lo.

The condition of "threshold at rest" try to act on OPENING of N.O. contact of its relay, which happens with delay if in Th1 Dly page, Th1 DD is "On-Off", otherwise the closure is instantaneous. There are two cases in which the output relays do not reflect its status as a threshold, namely:

1) in the first 10 seconds from the switch-on of the instrument, when the relays are forced to rest to avoid unwanted interventions during the stabilization of the measures

2) in all programming of parameters from keyboard, where they are kept in the state wherethem were when you access to procedures, to avoid the partial modification of the parameters could cause the undesired change of status.
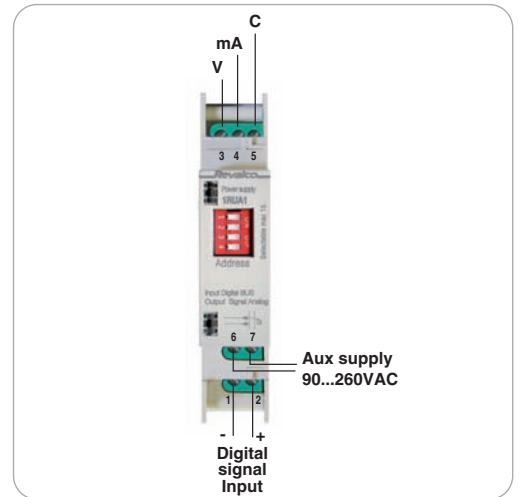
The relay status is showed on the display on the proper page. When Th (n) Sel = Off (threshold off), a possibility to control directly the relay from appropriate Modbus commands for instantaneous opening and closure of relay, not subjected to selection of Th(n) and Dly Th(n) DD, is given. On the page of the status of relay, into parenthesis, instead of the source code, the letters "Rem" (REMOTE) appears, to indicate the availability of remote access of the relay.
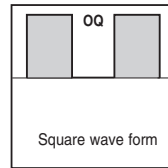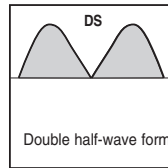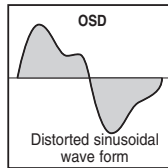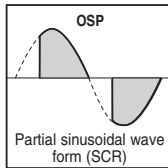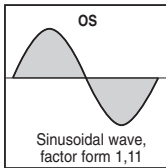
ANALOGUE OUTPUTS MODULE - 1RUA1

BUS INTERFACE TO ANALOGUE MODULES
- Up to 15 modules presents on bus
- Galvanic insulation between all modules (each module is independent from the others)
- Modules can be added or removed every time without influences on the complessive functioning
- **AUXILIARY SUPPLY**   90...260VAC 40 / 60 Hz
- **Analogue outputs selectable on the multifunction instruments (by software) to link to the needed parameter:**
  0,5 - 1 - 2 - 2,5 - 5 - 10 V (connection between terminals C and V)
  1 - 2 - 4...20 - 5 - 10 - 20 mA (connection between terminals C and mA)
- **MODULE ADDRESS**   from 1 to 15 selectable by frontal minidip
- **TEMPERATURE** working: -10°C ÷ +55 °C; storage: -20°C ÷ 80°C
- **TEST VOLTAGE**   2kV at 50Hz for 1 min (relay-supply)
- **PROTECTION DEGREE**   IP 20 on terminals - IP40 on front
- **INSULATION CLASS**   II
- **SIGNALLINGS**   GREEN led: device correctly powered
                        YELLOW led: active communication
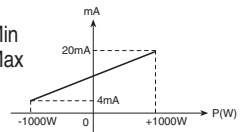- **DIMENSIONS**   1 DIN module

WAVEFORM:

OS	OSP	OSD	DS	OQ
Sinusoidal wave, factor form 1,11	Partial sinusoidal wave form (SCR)	Distorted sinusoidal wave form	Double half-wave form	Square wave form

ESAMPLE:
To select output 4/20mA linked to Active Power as the following:
Input Min   Output Min
Input Max   Output Max

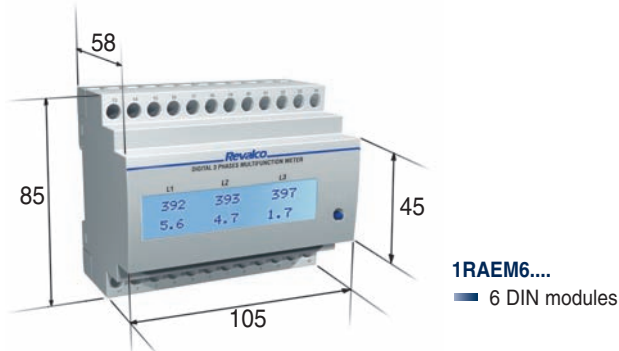## MODULES CONNECTION EXAMPLE

AUXILIARY SUPPLY
230VAC

MULTIFUNCTION INSTRUMENT

1   2   3 15
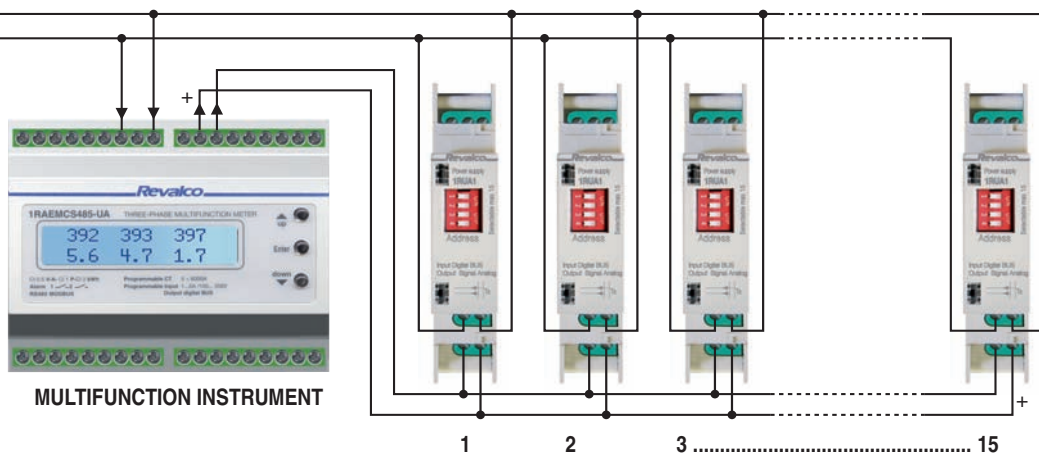
UP TO 15 ANALOGUE OUTPUT MODULES LINKED TO A ELECTRICAL PARAMETER FROM MULTIFUNCTION INSTRUMENT

DIMENSIONS IN mm

58
85
45
105

1RAEMCS485-UA
■ 6 DIN modules

58
85
45
17,5

1RUA1
■ 1 DIN module
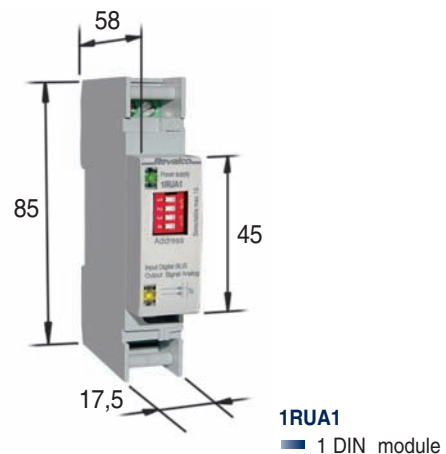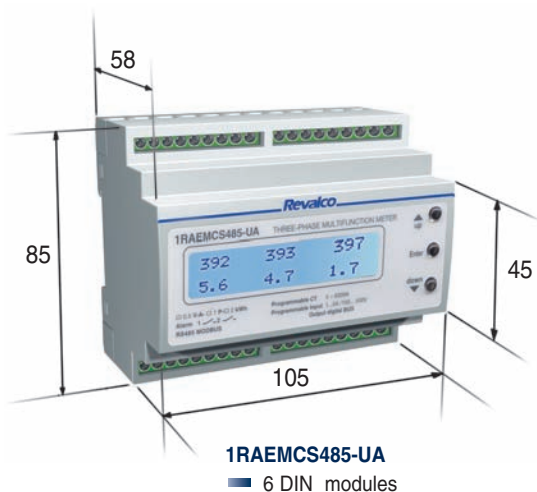
THREE PHASE LCD MULTIFUNCION METERS - TRUE RMS

DIMENSIONS in mm

58
85
45
105

1RAEM6....
■ 6 DIN modules

GENERAL DESCRIPTION

- Advanced technology of light blue display and blue leds, has visibility and luminosity comparable with the conventional red led display of previous generation.
- All the electrical measurements are represented in their natural form without the use of any multiplicator factor or other artificies for scale change or measuring units.
- Easy and immediate reading without possible incomprehensions or further elaborations.
- The use of one button only permits to change the measurements pages in natural way. The button is lighted to permit the use in darkness ambient also.
- During the program phase, the instrument shows the different possibilities present in the device, so it is not necessary to have in hands the user's manual all the time.
- The first powered page can be selected in the program phase. The "power supply" page can be used in all the cases on which is important **the information of "power supply loss"** (e.g. in refrigerating machines and/or cold storage).
- The possibility to reset the energy and contemporary the hour/minutes value permits, in easy way, to see the relative consumption in a fixed time.
- The possibility to communicate by the rs485 modbus protocol permits to enter , as peripheric bus, into an automation net. **This is one of the " faster" instrument present in the market due the 115200 BAUDE RATE**.
- The software to install on the PC, showed free of charge on the web site, is simple and extremely potent. It permits to visualize, in RS485 MODBUS connection, by a double wire or by BLUETOOOH technology, all the measurements showed by the instrument to diagnose with simplicity the status of an electrical net.

   By the double possibilities: visualizer and 3-Phase Voltage and Current Oscilloscope

   It permits a complete diagnosis of the electrical system showing the wave form without interferences against the normal functions of the instrument(measurement and memorization mode).

In presence of critical situations or not easy diagnoseable phenomena with available numerical data, exixt the possibility to send to the instrument a command of normal activity suspension and enter in the **"quick voltage/current oscilloscope"** mode.

In this mode the isntrument is able to show graphically, in real time, the needed wave form (voltage/current sysncroinized wave of phase L1 or in combination with phases L2 and L3; therefore 6 sinusoidal waves visualized) and see **what actually is happening** on the net.

TECHNICAL CHARACTERISTICS

6 DIN MODULAR VERSION	1RAEM	1RAEMC	1RAEMCS	1RAEMC485	1RAEMCS485	1RAEMBL485
⁃ PARAMETERS						
- Ph-N voltage	●	●	●	●	●	●
- Ph-Ph voltage	●	●	●	●	●	●
- Medium voltage of phases	●	●	●	●	●	●
- Current	●	●	●	●	●	●
- Power factor		●	●	●	●	●
- Total equivalent power factor		●	●	●	●	●
- Apparent power		●	●	●	●	●
- Total Apparent power		●	●	●	●	●
- Active power (+/-)		●	●	●	●	●
- Total Active power (+/-)		●	●	●	●	●
- Reactive power		●	●	●	●	●
- Total Reactive power		●	●	●	●	●
- Frequency	●	●	●	●	●	●
- Total Active Energy (import) resettable parameter	●	●	●	●	●	●
- Total Active Energy (export) resettable parameter		●	●	●	●	●
- Reactive Total energy resettable parameter		●	●	●	●	●
- Total working time resettable parameter		●	●	●	●	●
- Partial working time parametro azzerabile		●	●	●	●	●
- Sequence of phases		●	●	●	●	●
- Voltage asymmetry (Ph-N)		●	●	●	●	●
⁃ TWO ALARM OUTPUT RELAYS (contact N.O. 1000V-0,5A-20VA)			●		●	●
⁃ PROTOCOL MODBUS SLAVE RTU						
Baude rate 9600 - 19200 - 38400 - 56800 - 115200				●	●	
⁃ ACCESS BLUETOOTH POINT (max 10 meters - Class 2) Baude rate 115200						●
⁃ The software is available, free of charge, on our internet address www.revalco.it				●	●	●
⁃ PERMANENT MEMORY FOR SET POINT AND ENERGIES (EEPROM)		●	●	●	●	●

Auxiliary power supply

- nominal value U AUX	230	230V, 50/60 Hz
	-P1	22..36VAC and 19...70VDC
	-P2	44..130VAC and 70...240VDC
- range		0.9...1.1 UAUX
- max absorbed power		2 VA

Input voltmeter circuit — Phase-phase voltage:

- direct insertion	max 500 V
- permanent overload	120%
- thermic overload (1 s)	150%
- input impedance of voltmeter circuit	≈ 2 MΩ Ph-N/Phase-Phase

Input ammeter circuit

- nominal current	5 A
- permanent overload	120%
- thermic overload (1 s)	200%
- range adjustment, CT ratio	5...6000

Voltage measurement range

- VLN measurement range (voltage phase, direct insertion) 0...290 V	
- accuracy class	0.5% f.s ± 2 digit

Current Measurement range:

- measurement range insertion on CT secondary	0.05...5.00 A
- accuracy class on range 0,05.....5A	0.5% f.s ± 2 digit

Frequency Measurement range:

- nominal value	50/60Hz
- range	45...80 Hz
- accuracy class	0.3% vm ± 1 digit
- response time	< 300mS

Active Power (P1, P2, P3)

- range	85 MW
- accuracy class	1% f.s ± 2 digit

Reactive Power (Q1, Q2, Q3)

- range	85 Mvar
- accuracy class	1% f.s ± 2 digit

Apparent Power (S1, S2, S3)

- range	85 MVA
- accuracy class	1% f.s ± 2 digit

Active Energy (Wh)

- import / export counters resettable	Two separate
- calculating period	15 minutes
- energy counting	4.294.967.295 kWh
- accuracy class with current 0.05...1.0 In	2% fs ± 2 digit

Reactive Energy (varh)

- energy counting resettable	4.294.967.295 kvarh
- calculating period	15 minutes
- accuracy class with current 0.05...1.0 In	2% fs ± 2 digit

Power Factor

- range cosφ	-1...0...+1
- accuracy class with current 0.1...1.0 In and voltage 0.8...1.2 Un 2% fs ± 2 digit	

Phase/phase voltages measurement (medium value) V=(V12+V23+V31)/3

Phase current measurement (medium value) A=(A12+A23+A31)/3

Working time

- Total working time	hh:mm (in presence of aux power supply)
- Partial working time	hh:mm (from previous reset)

Digital filter

- Average	1...15

Compatible current transformers

- Nominal current	5 A
- Ratio	1...1200

Visualization

- display	LCD with white leds
- number of characters	18 on two lines
- colour	BLUE

Mechanical characteristics

- mounting	on DIN rail DIN50022/ encased DIN43700
- protection	IP20/ frontal IP30

Electrical characteristics, options — Galvanic insulation

- alarm relay coil-contact	4.25kV
- RS 485	3kV

Relay characteristics

- N.O. contacts maxV....maxI....maxP	1000V 0.5A 20VA

Environment conditions

|	
- ambient temperature:	0...+45 °C
- range	-5...+55 °C
- storage temperature	-10...+70 °C
- humidity	10...95 %
- atmospheric pressure	70...110 kPa

Standards CEI

- Safety CEI EN 61010-1   300V CLASS III
- Accuracy class CEI EN 60688
- Electromagnetic compatibility (immunity) CEI EN 61000-6-2 (ex EN 50082-2)
- Electromagnetic compatibility (emission) CEI EN 61000-6-4 (ex EN 50081-2)
- Protection IP CEI EN 60529
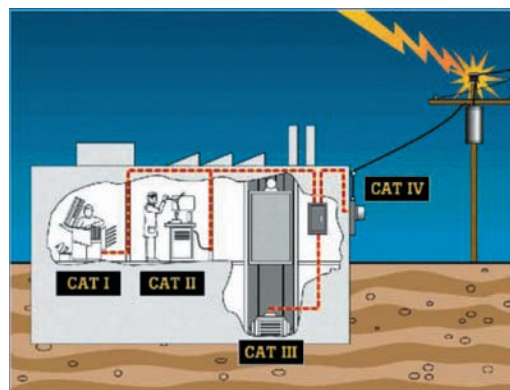
MEASUREMENT'S TYPOLOGY:
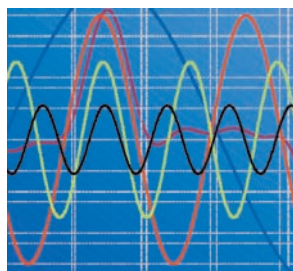
■ True RMS up to the 20th harmonic wave
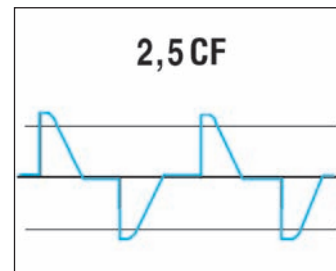
■ Crest factor up to 2,5 (Voltage and Current)

SERIAL INTERFACE

■ Two types are forecasted:
1) "485" version: Serial interface RS 485 galvanically insulated (3 kV), suitable for conventional net.
2) "BL" (BLUETOOTH) version: BLUETOOTH interface class 2E. RS 485 interface, galvanically insulated(3 kV). This version permits to execute an access point on net RS485 also, with a fixed speed on demand.
The standard type has 115.200 bps.
A115200bps BLUETOOH interface only permits to have the oscilloscope function, and eventually RS485 also if connected with the same speed (115200bps).
Version "BL" in any case can be connected and used as "485", independently by the bluetooh option present.

COMMUNICATION DATA

■ MODBUS RTU Protocol
■ Address from 1 to 255
■ Selectable speed on "485" (bps) version:
  9600, 19200, 38400, 57600, 115200
■ Selectable speed on "BT" (bps) version:
  standard 115200; on request 9600, 19200, 38400, 57600
■ Parity: N; Bits: 8; Stop Bit: 1
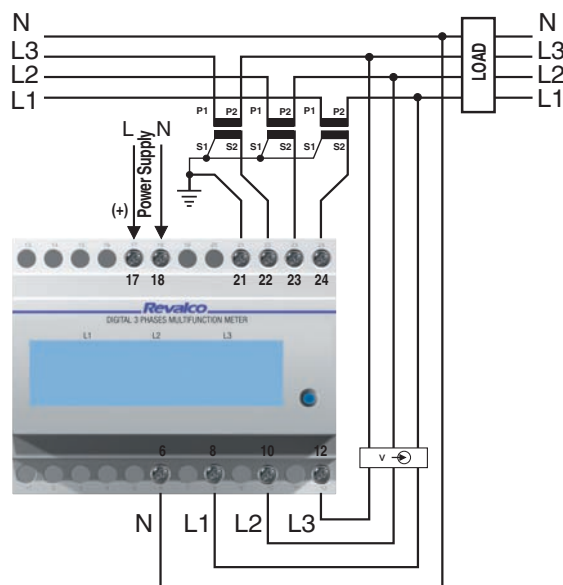■ The MODBUS registers table of instrument is available on request or on the web site.

1RAEM

- Powering the instrument you can see the following page

  `27.12.04` `22.0`

  Software date revision and version.
  Update

- First powering page. A different page can be selected within the available page present on this type.
  At first powering the display shows automatically this page

  `PowerOn Ready`

- Introduction page.

  `RAE TRMS 22.0`

- `RAE TRMS Prog`

  Program page.Entering in this page and maintaining pressed the button, it is possible to program the parameters of instruments. "Prog" flashes until to enter in program phase. (*)

- Maintaining pressure on the front button you will see the parameters displayed on this page
  Releasing the button the measurements will be shown

  `3V:    F:` `I1  I2  I3`

  Medium phase voltage (L1+L2+L3)/3   Frequency
  Current I1, I2, I3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
  Releasing the button the measurements will be shown

  `Vp V12 V23 V31` `A I1 I2 I3`

  Phase-phase voltage L1-L2, L2-L3, L3-L1
  Current I1, I2, I3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
  Releasing the button the measurements will be shown

  `Vn V1 V2 V3` `A I1 I2 I3`

  Phase-neutral voltage L1-N, L2-N, L3-N
  Current I1, I2, I3

CONFIGURATION SELECTION MENU

- To enter in program phase, see "**OPERATION**" (**red rectangle**)

- The sliding of "programmation parameters" pages is automatic.
  To intervene on one or more of these pages it is enough to press the button and start with a serie of short pressure and releases to increase the numbers one by one; to fasr forward maintain pressure on the front button.
  Once selected the needed number, release the button and the actual page will advance to the next. At the end of the forecasted pages the instrument will go itself to "measurement visualization" mode and, in case of any modification madde, will save the new values in the permanent memory.

- (*) `Program mode` Program mode page.

- Selection of current transformer ratio.

  `CT Set 1000`

- `VT Set 231` End scale, nominal measurement ph-n. Calibrated in factory. This page is used on models with voltage transformer only.

- Mathematical medium n° of samples, practically it is the stability filter of the measurements. Calibrated in factory. In case of not stabilized measurement, increase the number.

  `Average 3`

- `Default Page` Choose of first page at first powering. "Power On Ready" page selected in factory is useful when it is important to know if an electric interruption occoured.

CONNECTION DIAGRAM

1RAEMC / 1RAEMC485

- Powering the instrument you can see the following page

`27.12.04`
`22.0`

Software date revision and version.
Update

- First powering page. A different page can be selected within teh available page present on this type.
At first powering the display shows automatically this page

`PowerOn`
`Ready`

- Introduction page.

`RAE    TRMS  C`
`22.0`

or

`RAE    TRMS  C`
`485  Adr: 001`

Correct sequence of phases indication.
Light OFF = correct sequence

- `RAE    TRMS  C`
`Prog`

or

`RAE    TRMS  C`
`485 Adr:001 prog`

Program page.Entering in this page and maintaining pressed the button, it is possible to program the parameters of instruments. "Prog" flashes until to enter in program phase.
(*)

- Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown

`3U:      F:`
`I1    I2    I3`

Medium phase voltage (L1+L2+L3)/3   Frequency

Current I1, I2, I3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Up V12 V23 V31`
`A   I1   I2   I3`

Phase-phase voltage L1-L2, L2-L3, L3-L1

Current I1, I2, I3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Un  V1   V2   V3`
`A   I1   I2   I3`

Phase-neutral voltage L1-N, L2-N, L3-N

Current I1, I2, I3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Pf1 Pf2 Pf3`
`1.00 1.00 1.00`

| Phase Cosφ | Ind/Cap | Ind/Cap | Ind/Cap |
| | L1 | L2 | L3 |

- Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    Act Power`
`W          0`

`L2    Act Power`
`W          0`

`L3    Act Power`
`W          0`

Active power L1   Active power L2   Active power L3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`T.Act.P     Pf`
`W       I+1.00`

Total Active power   I/C Total Cosφ
(L1+L2+L3)   (I=Ind, C=Cap)

- Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    Rea Power`
`var        0`

`L2    Rea Power`
`var        0`

`L3    Rea Power`
`var        0`

Reactive power L1   Reactive power L2   Reactive power L3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Tot  Rea  Power`
`var        0`

Total Reactive power

- Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    App Power`
`UA         0`

`L2    App Power`
`UA         0`

`L3    App Power`
`UA         0`

Apparent power L1   Apparent power L2   Apparent power L3

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Tot  App  Power`
`UA         0`

Total Apparent power

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`T.Act +Ene  kWh`
`0`

Total Active Energy (Import)

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Tot Act +Ene Res`
`0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`T.Act -Ene  kWh`
`0`

Total Active Energy (Export)

- Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

`Tot Act -Ene Res`
`0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`T.Rea Ene kvarh`
`0`

Total Reactive Energy

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Tot Rea Ene Res`
`0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Tot Time`
`0h 21m`

Working hours and minutes with powered instrument.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Rel Time`
`1h 52m`

Working hours and minutes with powered instrument and from the last reset.Counting time between two resets.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Rel Time    Res`
`0    0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Asym V`
`0`

Phase asymmetry. Max L1 Phase-neutral voltage value or L2 or L3 less the minimum value of L1 or L2 or L3. The difference determine the voltage lack between the phases.

CONFIGURATION SELECTION MENU

- To enter in program phase, see "**OPERATION**" (**red rectangle**)

- The sliding of "programmation parameters" pages is automatic.
To intervene on one or more of these pages it is enough to press the button and start with a serie of short pressure and releases to increase the numbers one by one; to fasr forward maintain pressure on the front button.
Once selected the needed number, release the button and the actual page will advance to the next. At the end of the forecasted pages the instrument will go itself to "measurement visualization" mode and, in case of any modification madde, will save the new values in the permanent memory.

(*****) `Program mode`   Program mode page.

- Selection of current transformer ratio.

`CT Set`
`1000`

`VT Set`
`231`

End scale, nominal measurement ph-n. Calibrated in factory. This page is used on models with voltage transformer only.

- Mathematical medium n° of samples, practically it is the stability filter of the measurements. Calibrated in factory. In case of not stabilized measurement, increase the number.

`Average`
`3`

- `Default Page` Choose of first page at first powering. "Power On Ready" page selected in factory is useful when it is important to know if an electric interrumption occoured.
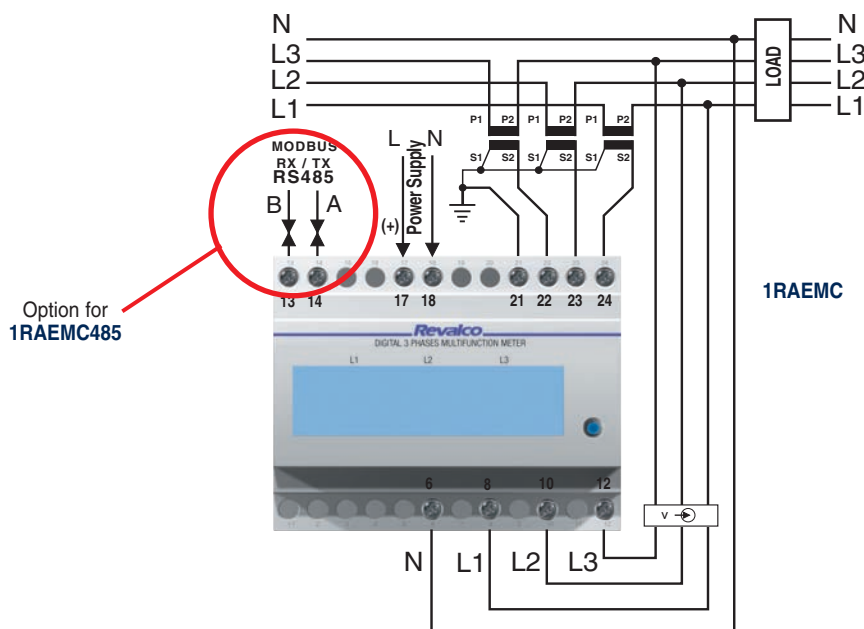
- Serial speed 0=9600, 1=19200, 2=38400, 3=57600, 4=115200
Baude rate = selected speed: N.8.1

`485 Speed`
`1`

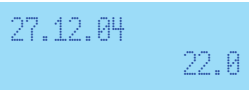- `485 Address`
`58`

MODBUS RTU address (froom 1 to 255)

CONNECTION DIAGRAMS

1RAEMCS
1RAEMCS485 - 1RAEMBL485
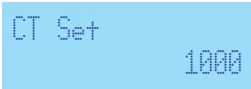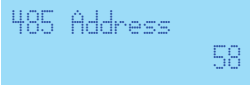
OPERATION

■ Powering the instrument you can see the following page

| `27.12.04` |
| `22.0` |

Software date revision and version.
Update

■

| `PowerOn` |
| `Ready` |

First powering page. A different page can be selected within teh available page present on this type.
At first powering the display shows automatically this page

■ Introduction page.

| `RAE  TRMS  CS` |
| `22.0` |

or

| `RAE    TRMS  CS` |
| `485   Adr: 001` |

or

| `RAE    TRMS  CS` |
| `BL    Adr: 001` |

→ Correct sequence of phases indication.
Light OFF = correct sequence

■

| `RAE  TRMS  CS` |
| `Prog` |

or

| `RAE    TRMS  CS` |
| `485 Adr:001 Prog` |

or

| `RAE    TRMS  CS` |
| `BL  Adr:001 Prog` |

Program page.Entering in this page and maintaining pressed the button, it is possible to program the parameters of instruments. "Prog" flashes until to enter in program phase.   (*)

■ Maintaining pressure on the front button you will see the parameters displayed on this page
Releasing the button the measurements will be shown

| `3U:     F:` |
| `I1   I2   I3` |

Medium phase voltage (L1+L2+L3)/3   Frequency
Current I1, I2, I3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Up U12 U23 U31` |
| `A   I1   I2   I3` |

Phase-phase voltage L1-L2, L2-L3, L3-L1
Current I1, I2, I3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Un  U1   U2   U3` |
| `A   I1   I2   I3` |

Phase-neutral voltage L1-N, L2-N, L3-N
Current I1, I2, I3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Pf1  Pf2  Pf3` |
| `1.00 1.00 1.00` |

Phase Cosφ   Ind/Cap Ind/Cap Ind/Cap
                  L1   L2   L3

■ Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    Act Power`	`L2    Act Power`	`L3    Act Power`
`W           0`	`W           0`	`W           0`
Active power L1	Active power L2	Active power L3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `T.Act.P     Pf` |
| `W     I+1.00` |

Total Active power   I/C Total Cosφ
(L1+L2+L3)   (I=Ind, C=Cap)

■ Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    Rea Power`	`L2    Rea Power`	`L3    Rea Power`
`var         0`	`var         0`	`var         0`
Reactive power L1	Reactive power L2	Reactive power L3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Tot  Rea  Power` |
| `var         0` |

Total Reactive power

■ Maintaining pressure on the front button you will see the parameters displayed on these pages.
Releasing the button the measurements will be shown

`L1    App Power`	`L2    App Power`	`L3    App Power`
`UA          0`	`UA          0`	`UA          0`
Apparent power L1	Apparent power L2	Apparent power L3

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Tot  App  Power` |
| `UA          0` |

Total Apparent power

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `T.Act +Ene  kWh` |
| `0` |

Total Active Energy (Import)

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `Tot Act +Ene Res` |
| `0` |

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

■ Maintaining pressure on the front button you will see the parameters displayed on this page.
Releasing the button the measurements will be shown

| `T.Act -Ene  kWh` |
| `0` |

Total Active Energy (Export)

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Tot Act -Ene Res`
`            0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`T.Rea Ene kvarh`
`            0`

Reattiva Total Reactive Energy

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Tot Rea Ene Res`
`            0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Tot Time`
`        0h 21m`

Working hours and minutes with powered instrument.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Rel Time`
`        1h 52m`

Working hours and minutes with powered instrument and from the last reset.Counting time between two resets.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Rel Time    Res`
`        0    0`

Energy counter reset. Maintaining pressure on button, word "Res" flashes until the end of the reset.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Asym V`
`            0`

Phase asymmetry. Max L1 Phase-neutral voltage value or L2 or L3 less the minimum value of L1 or L2 or L3. The difference determine the voltage lack between the phases.

- Maintaining pressure on the front button you will see the parameters displayed on this page. **Releasing the button the measurements will be shown**

`Out1      Out2`
`Off       Off`

Thresholds status with output relays. " On" means that the alarm is active and the contact is closed (the relay is normally open)

CONFIGURATION SELECTION MENU

- To enter in program phase, see "**OPERATION**" (**red rectangle**)

- The sliding of "programmation parameters" pages is automatic.
  To intervene on one or more of these pages it is enough to press the button and start with a serie of short pressure and releases to increase the numbers one by one; to fasr forward maintain pressure on the front button.
  Once selected the needed number, release the button and the actual page will advance to the next. At the end of the forecasted pages the instrument will go itself to "measurement visualization" mode and, in case of any modification madde, will save the new values in the permanent memory.

(*****) `Program`
`  mode`

Program mode page.

- Selection of current transformer ratio.

`CT Set`
`       1000`

`UT Set`
`       231`

End scale, nominal measurement ph-n. Calibrated in factory. <u>This page is used on models with voltage transformer only.</u>

- Mathematical medium n° of samples, practically it is the stability filter of the measurements. Calibrated in factory. In case of not stabilized measurement, increase the number.

`Average`
`       3`

- `Default`
  `  Page`

Choose of first page at first powering. "Power On Ready" page selected in factory is useful when it is important to know if an electric interruption occoured.

- Serial speed 0=9600, 1=19200, 2=38400, 3=57600, 4=115200
  Baude rate = selected speed: N.8.1

`485 Speed`
`        1`

- `485 Address`
  `        58`

MODBUS RTU address (froom 1 to 255)

- **QUALIFICATION OF RELAY 1** as threshold. If "Off" is selected, this relay can be used by serial way as a peripheric to command another net.

`Th1 Sel`
`        Off`

- `Th1 Sel`
  `     Hi`

Threshold 1 qualified.
Function selection: "Hi" intervention for higher values.
Threshold higher. Lower or equal value is the stand-by condition.

- Threshold 1 qualified.
  Function selection: "Lo" intervention for lower values.
  Threshold lower. Higher or equal value is the stand-by condition.

`Th1 Sel`
`        Lo`

- `Th1 DD`
  `    Off-On`

Delay type of threshold 1.
"Off-On" delay to the excitation = delay from hold to work.

- **Delay type of threshold 1.**
  "On-Off" delay to the disexcitation = delay from work to hold.

`Th1 DD`
`      On-Off`

- **Th1 Dly** `0.2`
  Delay time of threshold 1.
  From 0.0 sec, to 25.0 sec- steps 0.1 sec

- **Parameters to which the threshold 1 is related.**
  - **3Vff** = min or max value of 3 phase-phase voltages.
  - **3I** = min or max value of currents.
  - **Pim+** = min or max value of buyed power (+, import).
  - **Vas** = min or max value of voltage asymmetry.
  - **V23** = min or max value of phase-phase voltage L2.
  - **V1** = min or max value of phase-neutral voltage L1.
  - **V3** = min or max value of phase-neutral voltage L3.
  - **I2** = min or max value of current L2.

  - **3Vn** = min or max value of 3 phase-neutral voltages.
  - **Fre** = min or max value of frequency.
  - **Pex-** = min or max value of selled power (-, export).
  - **V12** = min or max value of phase-phase voltage L1.
  - **V31** = min or max value of phase-phase voltage L3.
  - **V2** = min or max value of phase-neutral voltage L2.
  - **I1** = min or max value of current L1.
  - **I3** = min or max value of current L3.

- Threshold 1 selected as alarm on buyed power. Selected on the 50% of the nominal value.
  Nominal value= (CT value) x (ph-n voltage value) x 3.

  Th1 Val 346500.0
  PIm+ 50%

- **QUALIFICATION OF RELAY 2** as threshold. If "Off" is selected, this relay can be used by serial way as a peripheric to command another net.

  Th2 Sel Off

- **Th2 Sel** `Hi`
  Threshold 2 qualified.
  Function selection: "Hi" intervention for higher values.
  Threshold higher. Lower or equal value is the stand-by condition.

- Threshold 2 qualified.
  Function selection: "Lo" intervention for lower values.
  Threshold lower. Higher or equal value is the stand-by condition.

  Th2 Sel Lo

- **Th2 DD** `Off-On`
  Delay type of threshold 2.
  "Off-On" delay to the excitation = delay from hold to work.

- **Delay type of threshold 2.**
  "On-Off" delay to the disexcitation = delay from work to hold.

  Th2 DD On-Off

- **Th2 Dly** `0.2`
  Delay time of threshold 2.
  From 0.0 sec, to 25.0 sec- steps 0.1 sec

- **Parameters to which the threshold 2 is related.**
  - **3Vff** = min or max value of 3 phase-phase voltages.
  - **3I** = min or max value of currents.
  - **Pim+** = min or max value of buyed power (+, import).
  - **Vas** = min or max value of voltage asymmetry.
  - **V23** = min or max value of phase-phase voltage L2.
  - **V1** = min or max value of phase-neutral voltage L1.
  - **V3** = min or max value of phase-neutral voltage L3.
  - **I2** = min or max value of current L2.

  - **3Vn** = min or max value of 3 phase-neutral voltages.
  - **Fre** = min or max value of frequency.
  - **Pex-** = min or max value of selled power (-, export).
  - **V12** = min or max value of phase-phase voltage L1.
  - **V31** = min or max value of phase-phase voltage L3.
  - **V2** = min or max value of phase-neutral voltage L2.
  - **I1** = min or max value of current L1.
  - **I3** = min or max value of current L3.

- Threshold 2 selected as alarm on frequency. Selected 50 Hz.Value of selected parameter as reference for the correspondent selected alarm value. Being it an absolute value, the selection correspond to the real value.

  Th2 Val 50.0
  Fre 50.0

CONNECTION DIAGRAMS

Option for **1RAEMCS485** versions
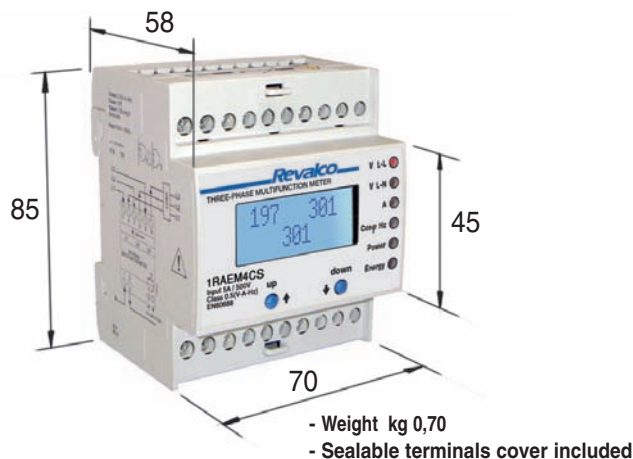
1RAEMBL485

BLUETOOTH
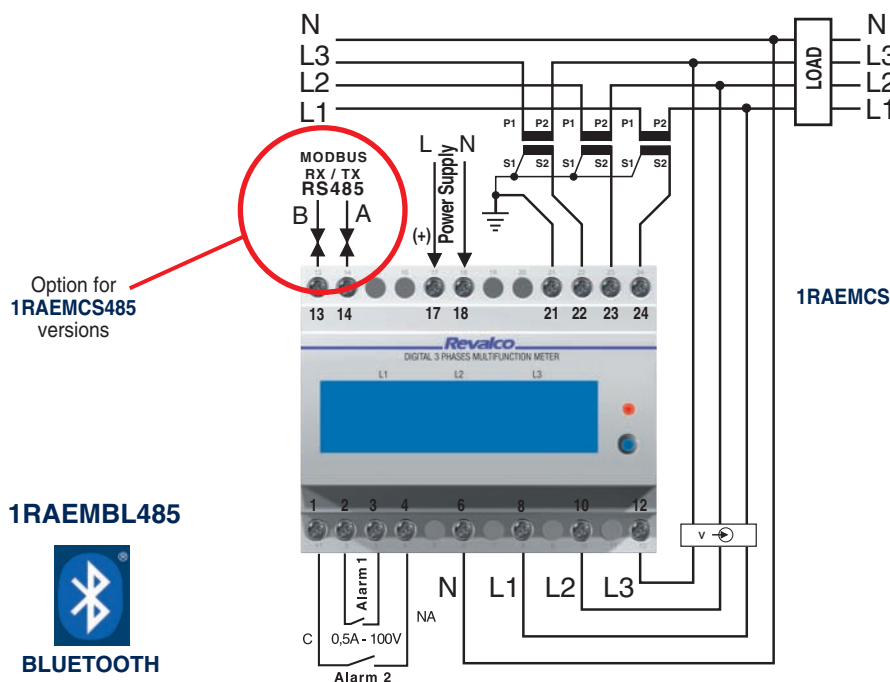
If on 1RAEMBL485 version, RS485 is not connected, it is necessary to mount a 120 Ohm resistance between terminals 13 and 14.

THREE PHASE LCD MULTIFUNCTION METERS - 4 DIN
TRUE RMS - INPUT 5A + option "Split current CT"

DIMENSIONS in mm

58
85
45
70

1RAEM4CS
Input 5A / 500V
Class 0.5(V-A-Hz)
EN60688

197 301
301

- Weight kg 0,70
- Sealable terminals cover included

NEW

These codes (....-C100) are supplied together with 3 mini split core transformers in class 1 able to measure **up to 100A** and powers up to 70kW three phase. This solution permits a quick installation in already existing panels or nets as that it is not necessary to disconnect the power cable as needed by the classic current transformers. This CT accepts a cable diameter 12mm maximum.

PARAMETERS

	1RAEM4C 1RAEM4C-C100	1RAEM4CS 1RAEM4CS-C100	1RAEM4C485 1RAEM4C485-C100	1RAEM4CS485 1RAEM4CS485-C100
- 3 phase-to-phase voltages, direct or from VT (optional)	●	●	●	●
- 3 phase-to-neutral voltages, direct or from VT (optional)	●	●	●	●
- 3 currents from CT..../5A (1 decimal)	●	●	●	●
- Current in neutral from CT..../5A (1 decimal)	●	●	●	●
- Frequency with 2 decimals	●	●	●	●
- 3 x Active Powers with 4 dialsi	●	●	●	●
- Total Active Powers with 4 dials	●	●	●	●
- 3 x Reactive Powers with 4 dials	●	●	●	●
- Total Reactive Powers with 4 dials	●	●	●	●
- 3 x Apparent Powers	●	●	●	●
- Total Apparent Power	●	●	●	●
- Power Factor of the 3 phases	●	●	●	●
- Total Power Factor	●	●	●	●
- Total Active Energy (import) resettable parameter	●	●	●	●
- Total Active Energy (export) resettable parameter	●	●	●	●
- Total Reactive Energy resettable parameter	●	●	●	●
- Total operation counter	●	●	●	●
- Partial operation counter resettable parameter	●	●	●	●
- Programmable threshold with "NO" relay output 500mA/1000V		●		●
- Threshold status summary page		●		●
- Threshold activation signal		●		●
- Indication of the correct voltage phase sequence	●	●	●	●
- Indication of failed voltage supply	●	●	●	●
- RS485 3kV optoinsulated high-speed 5-speed interface			●	●
- **MODBUS RTU SLAVE PROTOCOL** Full compliance			●	●
- Keypad configurable settings	●	●	●	●
- Remote configurable settings			●	●
- Remote resetting of the energies			●	●
- Remote resetting of the partial counter			●	●
- Remote relay output control (if the threshold is OFF)				●
- Configurable password for access to programming	●	●	●	●
- Restore factory settings	●	●	●	●
- Programming of initial page upon start-up	●	●	●	●
- Programming of CT.../5A of 5 to 6000A with step of 5A	●	●	●	●
- Programming of VT (optional) with double indication L-L and L-N	●	●	●	●
- Programming of the analog average (V, A and P)	●	●	●	●
- **Download the software for free from our website www.revalco.it**			●	●

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GENERAL DESCRIPTION

The 4 DIN instrument is suited for use in an industrial environment. Simple and extremely compact, it features an alphanumerical display with 2 eight-character lines, 6 auxiliary LEDs and 2 buttons for display selection and keyboard programming. The machine is extremely user-friendly and information is presented clearly on the display. It is unlikely you will need to consult instruction manual which is not generally kept readily available at the site. When properly installed, the instrument can accept full intake flow from external CT 5A to 6A max. Voltage can be direct, max 290Vac Phase/Neutral (=230Vac+25%), or from VT (optional). In this case it is possible to program the full scale value for equivalent voltage at up to 400Vfn (=690Vcc), with guarantee of the displayed values up to 25% more (500Vfn/860Vff).
For direct connection, the Vt must be the same as the rated phase/neutral voltage, normally 231Vac.
There is a "standard" range of measurements for a high precision industrial environment.
The power and power factor data are indicated on 4 dials according to annex E in standard EN61268.
The individually resettable energies (consumed, produced and reactive) can be easily calculated when you need to service the system and/or test line operation, determine zone consumption values, establish cost centres, etc.
NOTE: The instrument uses simple energy totalizing methods for purposes of diagnostics and statistics.
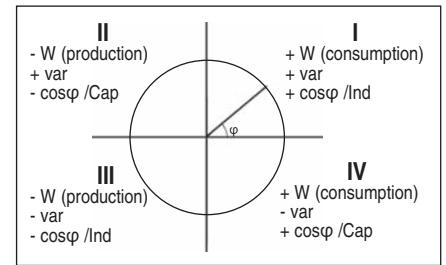The instrument cannot replace an energy counter. The following are provided according to model:
2 counters (non-resettable total and resettable partial value)
1 threshold with output on "NO" control relay (500mA/1000V), fully programmable.
1 x RS485 3kV optoinsulated programmable high speed interface with MODBUS RTU protocol.
The operating instructions, measurements and technical specifications are given below.

II	I
- W (production)	+ W (consumption)
+ var	+ var
- cosφ /Cap	+ cosφ /Ind
III	IV
- W (production)	+ W (consumption)
- var	- var
- cosφ /Ind	+ cosφ /Cap

TECHNICAL SPECIFICATIONS

Auxiliary power supply
- UAUX nominal value	230	230V 50/60 Hz
	-P1	22...36VCA and 19...70VCC
	-P2	44...130VCA and 70....240VCC
- max rated consumption		2 VA

Amp measuring circuits for CT /5
- Max applicable current (Imax)	6A
- Rated current measurement (Inom)	5A
- Direct current range	0.03...6A
- Input impedance	approx 20mΩ ± 1%
- Permanent overload	110% (Inom)
- Thermal overload (1 s)	200% (Inom)
- Current transformer (Ct) control range (/5)	5…6000A at steps of 5A (0...100A on models ....-C100)
- Precision	0.5%*Imax ± 2 digits

Compatible amp transformers
- rated current	5 A
- Transformer ratio	1…1200

Voltmeter measuring circuits (instrument for direct insertion)
- Max applicable voltage (Vmax)	300 Vf n (5 20 Vff)
- Rated voltage measurement (Vnom)	231Vfn(400Vff)
- Direct measuring field	0-300Vfn (520Vff) TRMS up to 20ma arm.
- Input impedance of voltage circuit	approx 2MΩ Phase/Neutral and Phase/Phase
- Vt control range	=Vnom
- Precision	0.5%*Vmax ± 2 digits

Voltmeter measuring circuits (instrument for insertion from VT /100)
- Maximum applicable voltage (Vmax)	75Vfn(130Vff)
- Rated voltage measurement (Vnom)	57,75 Vfn(100Vff)
- Direct measuring range	0-75Vfn(130Vff) TRMS up to 20ma arm.
- Imput impedance	500KΩ Phase/Neutral and Phase/Phase about
- Control range VT	50…400Vfn(86,5…692Vff)
- Class	0.5%*Vmax ± 2 digit

Compatible voltmeter transformers
- Rated voltage	100 V
- Transformer ratio	1...6

Frequency measurement
- Frequency measuring range	9.50...100.00Hz
- Operating range (V1)	35 – 300 Vfn
- Precision	0.1% ± 1 digit

Single power measurement
- Measurement capacity per line	±2.88 MW /±2.88Mvar /2.88MVA
- Precision (0.05 > Inom > 1.0)	1 % full scale ± 2 digits

Total power measurements
- Measuring capacity	±8.64 MW /±8.64Mvar /8.64MVA
- Precision (0.05 > Inom > 1.0)	1 % ± 2 digits

Power factor measurement (all)
- Measuring range cosφ	-1.00…0.00…+1.00
- Precision (0.1 > Inom > 1.0, 0.8 > Vnom >1.2)	2% full scale ± 2 digits

Energy totalizing
- Counting capacity	99999999kWh /kvarh
- Counting period	15 minutes
- Resettable	YES
- Precision (0.05 > Inom > 1.0)	2% Max

Operating counter
- Counting capacity	99999:59 hhhhhh:mm
- Counting period	15 minutes
- Resettable	NO
- Precision	2% Max

Partial counter
- Counting capacity	99999:59 hhhhhh:mm
- Counting period	15 minutes
- Resettable	YES
- Precision	2% Max

Screens
- Display	Backlit LCD, 8 characters x 2 lines, temp. -20°/+70°
- Auxiliary signals	6 red LEDs

Relay control output (only "S" models)
- Type of contact — NO
- Contact specifications — 1000Vac / 0.5Aac(res. load) / 20VA max
- Reel-contact insulation — 4.25kVac
- Remote operation via MODBUS — YES, only for "S485" models

RS485 serial interface (only "485" models)
- Insulation — 3kV
- Max communication speed — 115.200 bps
- Communication protocol — MODBUS RTU Full-compliant / JBUS
- Programmability and remote controls — YES

Special functions
- 3-digit password for programming the settings
- Black-out indicator system

Terminal specifications
- Rated current — 30A
- Cable cross-section — 22-10AWG 4mm²
- Torque — 0.5Nm (4.5lb.in)

Mechanical properties
- Dimensions — Standard 4 DIN modules
- Type of assembly — DIN50022 guide
- Degree of protection — for entire device: IP20/ Front IP30

Environmental conditions
- Operating temperature:
    Nominal range — 0...+45 °C
    Extreme range — -5...+55 °C
- Storage temperature — -10...+70 °C
- Relative humidity — 10...95 %
- Atmospheric pressure — 70...110 kPa

Standards of reference
- Safety — CEI EN 61010-1 — 300V CAT III
- Precision — CEI EN 60688 — (ex EN 50082-2)
- Electromagnetic compatibility (immunity) — CEI EN 61000-6-2 — (ex EN 50081-2)
- Electromagnetic compatibility (emission) — CEI EN 61000-6-4
- Cover protection (IP code) — CEI EN 60529

Modbus:
- Protocol specifications — V1.1b, 28.12.2006

GENERAL OPERATION (FOR ALL MODELS)

The instrument calculates and monitors the electrical measurements of the plant to which it is connected. It displays the information on one of the pages on the display, selected by quickly pressing one of the buttons. The right button is for "next" and the left button is for "previous". The 6 LEDs on the right help to indicate the main electrical measurement pages and switch on according to the type of measurement shown on the display at the time. The first measurement page that appears upon start-up can be programmed.

The "S" models with threshold allow you to configure the measurement to be controlled, the type of threshold (off, maximum or minimum), the millesimal threshold value in relation to the full scale of the controlled measurement, time delay upon activation or deactivation, if applicable, and the time delay in tenths of a second up to 25.5 seconds (0=no delay)

Refer to the "Programming" section for details on programming values and the "Operation of the programmable threshold" section.

The "485" models with RS485 interface can communicate via a network when they are assigned a programmable address of between 1 and 255. You are advised not to put more than 32 devices on a network so as to ensure reliable communication.

If this is not adequate, there are "special" versions able to support more than 64 devices.

Communication speed can be set at between 9600bps and 115,200bps.

You are advised to set the communication speed at maximum if only these devices are used.

If the speed is set too low and there are frequent requests and/or there is a high number of required records, interactions with the instrument may also slow down. All measurements and parameters can be viewed on the MODBUS RTU reader interface.

The instrument also enables "on the fly" remote programming of the work settings via the MODBUS writer interface with the respective records that support it. In certain situations you are also allowed to carry out some macro-operations and controls, such as restoring the factory settings of models that enable this, resetting of the totalizers or direct switching on and off of the output relay for models with threshold. Note: the "485" models offer additional measurements via Modbus, in particular single phase measurements of the powers and cosφ values. Some models feature a blackout indication page.

It is like the measurement page but with flashing content which has to be programmed like the initial page shown on start-up.

When you press the keys to change the measurement page, the "blackout" condition is reset. This is proposed again after any programming of the settings on the keyboard. Some models feature 2 counters – one for total operation and another that can be reset. The latter allows you to check the average consumption if reset together with one or more energy totalizers.

Some models require a 3-digit password (that can be excluded) to change the work settings and reset the counters.

This password is not intended to guarantee full protection but to prevent accidental access to the programming area and ensure the settings are not changed by someone not authorized to do so.

There is no easy way to recover or cancel a password that has been configured and then forgotten. You will have to try all the combinations or return the product to the factory for reprogramming.

NOTES AND OPERATING INSTRUCTIONS

DO NOT PRESS ANY OF THE KEYS while switching on the instrument (i.e. when connecting it to the auxiliary power supply).

Otherwise you may accidentally start the calibration procedure normally carried out at the factory which, if the instrument is connected to the system rather than to the respective calibration devices, could cause the instrument to be permanently uncalibrated. In the interest of safety, **ALWAYS WAIT FOR THE INITIAL DIAGNOSTICS TO FINISH** (scanning of the LEDs) before pressing any of the keys.

"S" instruments with threshold: The threshold relay is blocked for the first ten seconds after the instrument is switched on.

The relay is "frozen" until you have finished configuring the settings.

OPERATION

When you start up the device, the firmware information page appears for a few seconds and all the LEDs switch on in order (initial diagnostics).

You will then see, for a few seconds, the page with the "title" of the measurements that will appear on the display, and the respective LED will switch on if the page requires it to do so. When the first measurement page appears, you can press the buttons to scroll through the available pages.

You can scroll FORWARDS by QUICKLY PRESSING the RIGHT-HAND button, or BACKWARDS by pressing the LEFT-HAND button.
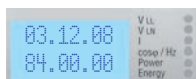
Pressing and holding the right-hand button will take you to the next page as well as allow you to program the instrument's settings.

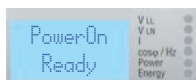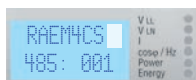Pressing one of the 2 buttons quickly displays the "title" of the measurement page to be displayed.

OPERATION

The measurement and indication pages that can be accessed by pressing and QUICKLY releasing the RIGHT-HAND button are as follows:

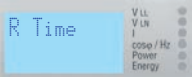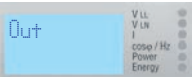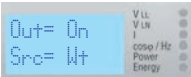|	
`03.12.08` `84.00.00`	Appears only for about 3 seconds when the instrument is switched on. Provides information on the instrument's firmware and operating details. When this page is displayed, the LEDs flash quickly to indicate they are working properly.
`PowerOn` `Ready`	**Black-out page** For this to appear, it has to be configured as the default page. Appears only when the instrument is switched on. It disappears as soon as the display is moved. It reappears after the settings are configured using the keypad.
`RAEM4CS` `485: 001`	**INFO page.** Indicates the instrument model and version. The lit-up square (first line on the right) indicates the voltage phases are OUT OF SEQUENCE. The square does not appear when the sequence is correct. Only in the case of the "485" models does the last value at the bottom on the right indicate the node number of the instrument on the MODBUS network.

PRESSED BUTTON	WHEN RELEASED	DESCRIPTION
`V12 V23` `V31` **Phase-to-phase voltages**	`400 400` `400`	Value of each phase-to-phase voltage (V)
`V1 V2` `V3` **Phase-to-neutral voltages**	`231 231` `231`	Value of each phase-to-neutral voltage (V)
`A1` `A2` **Currents of Lines 1 and 2**	`A1=100.0` `A2=100.0`	Value of A1 and A2 (A) The values have decimal points if the selected CT is less than 1000A (/5), otherwise they are whole.
`A3` `An` **Current of Line 3 / Current in neutral**	`A3=100.0` `An=200.0`	Value of A3 and Neutral Current (A) The values have decimal points if the selected CT is less than 1000A (/5), otherwise they are whole.
`Hz` **Frequency**	`Hz` `50.00`	Frequency (Hz) This is measured by V1.
`ΣW` **Total active power**	`ΣW` `46170`	Total active power (W) The measurement is POSITIVE for consumed power, NEGATIVE for power produced.
`Pf tot` **Power factor**	`Pf tot` `-1.00`	Three-phase power factor (Cosφ) The value is the same as the active line power. The offset is void without the indicators "C" (capacitive) or "I" (inductive).
`Σvar` **Reactive power**	`Σvar` `-796`	Measurement of Three-phase Reactive Power (var) The measurement is POSITIVE for dials 1 and 2, NEGATIVE for dials 3 and 4.
`ΣVA` **Three-phase apparent power**	`ΣVA` `46177`	Value of Three-phase Apparent Power (VA)
`ΣkWh+` **Totalizing of total active energy consumed**	`ΣkWh+` `78973588`	Total Active Energy consumed (kWh)
`ΣkWh-` **Totalizing of total active energy produced**	`ΣkWh-` `1347`	Total active energy produced (kWh)
`Σkvarh` **Totalizing of total reactive energy**	`Σkvarh` `45921`	Total reactive energy (kvarh)
`T Time` **Total counter**	`T Time` `97163:58`	The instrument's operating time in hours and minutes (hhhhh:mm)

R Time	R Time 80445:21	Time since last reset in hours and minutes (hhhhh:mm)

Partial counter

Out	Out= On Src= W+	**ONLY FOR "S" MODELS** Status of output relay contact (On=closed) and source of the threshold

Relay

OPERATION OF THE PROGRAMMABLE THRESHOLD. The "S" models allow you to apply a max or min threshold as a percentage of the required size, in relation to its intended full scale.

Required size (Th1 Src)	Full scale (= 100.0%)	Description	Required size (Th1 Src)	Full scale (= 100.0%)	Description
W+	CT Set * VT Set * 3	Max/Min instantly consumed active power	V1	VT Set	Max/Min V1
W-	CT Set * VT Set * 3	Max/Min instantly produced active power	V2	VT Set	Max or Min of V2
Hz	100Hz	Max/Min frequency measured on V1	V3	VT Set	Max or Min of V3
3Vf	VT Set * 1,73	Max/Min a phase-to-phase voltage	3A	CT Set	Max or Min of a current
V12	VT Set * 1,73	Max/Min V12	A1	CT Set	Max or Min of A1
V23	VT Set * 1,73	Max/Min V23	A2	CT Set	Max or Min of A2
V31	VT Set * 1,73	Max/Min V31	A3	CT Set	Max or Min of A3
3Vn	VT Set	Max/Min phase-to-neutral voltage	An	CT Set * 3	Max or Min of An

The threshold activation (threshold active) point is the condition "more than Th1 Val" if Th1 Sel = Hi; otherwise "less than Th1 Val" if Th1 Sel = Lo. The threshold's quiescent operating (threshold inactive) point is the condition "less than or equal to Th1 Val" if Th1 Sel=Hi; otherwise "more than or equal to Th1 Val" if Th1 Sel=Lo. The "active threshold" condition attempts to CLOSE the relay's "NO" contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "Off-On". The "inactive threshold" condition attempts to OPEN the relay's "NO" contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "On-Off".

There are 2 cases whereby the output relay does NOT mirror the threshold condition. These are as follows:
• During the first 10 seconds from starting up the instrument, when the relay is kept inactive to avoid unwanted operation while the measurements are stabilized, and
• when the settings are being programmed on the keypad, it is kept at the same status at the time of starting the procedure, to prevent partial modification of the settings from causing unwanted change to its status.

Relay status is shown on the display at page "OUT", together with the title of the size of the threshold selected in Th1 Src.

Closing of the relay also determines flashing of the LED associated with the selected size (when applicable), providing the selected measurement page is not the one associated with the LED, in which case the LED light remains steady.
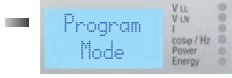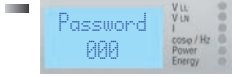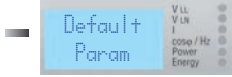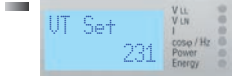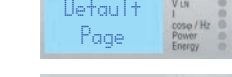
"S485" Models: when Th1 Sel=OFF (threshold OFF), there is the option of controlling the relay directly by means of MODBUS commands to open and close INSTANTLY, regardless of the Th1 Dly and Th1 DD settings. "Src=REM"(REMOTE) appears on the OUT page to indicate remote access of the relay.
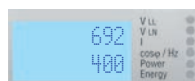
PROGRAMMING

For programming, press and hold the RIGHT-HAND button (for 4 seconds or more). The first page to appear when you are granted access to the programming mode is the one of programmable values. Releasing the button will make the display flash (to indicate you are in programming mode) and the pages begin to scroll through slowly (one every 4 seconds or so), indicating the title and value of the current set-point. If you do not touch the button when you get the last page, normal operation is restored without saving any changes. To make a change, simply press one of the buttons when the required page appears, respectively:

LEFT-HAND button = DECREASES the value; **RIGHT-HAND button** = INCREASES the value.

At that point (after pressing the button) the display remains steady so you can check the modification and the value changes by one unit. If you have to modify a value quite considerably, you can press and hold the button for more than 2 seconds to speed up the process. The longer you hold down the button, the faster you can scroll through the numbers (4 speeds). They are all "roll" values so when you get to the maximum permitted value you restarted from the minimum value, and vice versa. When you have set the value as required, release the button and wait for over 4 seconds. The pages then continue scrolling and the modification is automatically saved. Modifiable pages then follow.

Program Mode	indicates you have entered the setting configuration phase.
Password 000	**A password is only requested if NewPassw is set at a value other than 0** (see below). Select the correct number and wait for the next page. In the case of a missing or incorrect entry, the instrument returns to normal operation after about 4 seconds.
Default Param	By pressing a key when this page is shown, all value parameters return equal to the factory programming, except totalizer resetting one by one.
CT Set 100	Select the CT value (/5) in Ampères. Between 5 and 6000 in steps of 5. Default = 100
VT Set 231	Select the voltage full-scale value. If in direct connection, it must be settable between 87 and 692 at steps of 1 V (default = 400) equal to the rated value of the phase-to-neutral line voltage.

692 400	During configuration, above is the phase-to-phase value settable between 87 and 692, at steps of 1 V (Default = 400). Below is the phase-to-neutral value settable between 50 and 400 at steps of 1 V (Default = 231)

Average 3	Average of the analog values measured (V, A and P). To stabilize the displayed values. The higher the number, more of the measurements are stable – although they will be slow to update. Settable between 1 and 15 at steps of 1. Default = 3
Default Page	Configuration of the first measurement page to be viewed upon start-up. Using the buttons to scroll through displays the "titles" of the available pages – the same ones that appear when you press the right-hand button in sequence. Settable on all the available pages. **Default = Blackout detection page, if available, otherwise the INFO page.**
NewPassw 0	Setting this at zero disables password protection for programming with the keypad. The same applies for password protection for programming by remote control. Settable between 0 and 999 at steps of 1. **Default = 0 (disabled)**

ΣkWh+ ->0 78973588	Resetting the Totalizer of the Total Active Energy consumed	Σ kWh+ 0 / 0
		Pressing and holding the right-hand button for more than 4 seconds reset the value
ΣkWh- ->0 1347	Resetting the Totalizer of the Total Active Energy produced	Σ kWh- 0 / 0
		Pressing and holding the right-hand button for more than 4 seconds reset the value
Σkvarh->0 45921	Resetting the Totalizer of the Total Reactive Energy	Σ kvarh->0 0
		Pressing and holding the right-hand button for more than 4 seconds reset the value
R Time->0 80445:21	Resetting the Partial counter	R Time->0 0:00
		Pressing and holding the right-hand button for more than 4 seconds reset the value

THE WINDOWS BELOW APPLY ONLY TO THE "S" MODELS

Th1 Sel Hi — **Selecting the threshold operation mode**. Settable between: Hi=High threshold, Lo=Low threshold and Off=threshold disabled. If the threshold is OFF, you will not view the following pages. **Default = Hi (high threshold).**

Th1 Dly 0.1 — **Delay time for activation of the output relay** (page displayed only if Th1 Sel is not Off) In seconds. Settable between 0.0 and 25.5 in steps of 0.1. **Default = 0.1**

Th1 DD Off-On — **Assigning the delay time for activating the threshold** (page displayed only if Th1 Sel is not Off) The delay time is applicable from the start of threshold activation (Off-On) or at the end (On-Off). **Default = Off-On (at the start)**

Th1 Src W+ — **Assigning the size for activating the threshold** (page displayed only if Th1 Sel is not Off) Settable at: W+, W-, Hz, 3Vf, V12, V23, V31, 3Vn, V1, V2, V3, 3A, A1, A2, A3,An. **Default = W+**

Th1 Val% W+ 50.0 — **Regulating the threshold value as a percentage of the full scale** (page displayed only if Th1 Sel is not Off)

34650 W+ 50.0 — At the top is the effective value of the threshold for the selected size. Settable between: 0.0 and 100.0, in steps of 0.1. **Default = 50.0(%)**

THE WINDOWS BELOW APPLY ONLY TO THE "485" MODELS

Node 1 — **Assigning the MODBUS address node number** (of the "INFO" page). Settable between 1 and 255. **Default = 1**

Speed 4 — **Configuring the speed of the RS485 serial port (bps).** Settable between 0 and 4. **Default = 4** (0=9600, 1=19200, 2=38400, 3=57600, 4=115200)

CONNECTION DIAGRAMS

THREE PHASE LCD MULTIFUNCTION METERS - 4 DIN
TRUE RMS - DIRECT INPUT 10A, 16A, 32A, 63A

DIMENSIONS in mm

58

85

45

70

- Weight kg 0,70
- Sealable terminals cover included

GENERAL DESCRIPTION

These instruments are compatible with the correspondent currents of magneto-thermic switches present on the distribution boards and requested by the market.
The 4 DIN instrument is suited for use in an industrial and civil market. Simple and extremely compact, it features an alphanumerical display with 2 eight-character lines, 6 auxiliary LEDs and 2 buttons for display selection and keyboard programming. The machine is extremely user-friendly and information is presented clearly on the display. It is unlikely you will need to consult instruction manual which is not generally kept readily available at the site. The instruments are self-supplied; they keep the auxiliary supply from the same connections used for the measure. The current measure is direct and it is not necessary to use external transformers.
There is a "standard" range of measurements for a high precision industrial environment.
The power and power factor data are indicated on 4 dials according to annex E in standard EN61268.
The individually resettable energies (consumed, produced and reactive) can be easily calculated when you need to service the system and/or test line operation, determine zone consumption values, establish cost centres, etc.
NOTE: The instrument uses simple energy totalizing methods for purposes of diagnostics and statistics.
The instrument cannot replace an energy counter. The following are provided according to model: 2 counters (non-resettable total and resettable partial value); 1 threshold with output on "NO" control relay (500mA/1000V), fully programmable (for model ...CS); 1 x RS485 3kV optoinsulated programmable high speed interface with MODBUS RTU protocol (for model ...C485). The operating instructions, measurements and technical specifications are given below.

II	I
- W (production)	+ W (consumption)
+ var	+ var
- cosφ /Cap	+ cosφ /Ind
III	IV
- W (production)	+ W (consumption)
- var	- var
- cosφ /Ind	+ cosφ /Cap

PARAMETERS

	1RAEM463C	1RAEM463CS	1RAEM463C485
- direct insertion **63A**	1RAEM463C	1RAEM463CS	1RAEM463C485
- direct insertion **32A**	1RAEM432C	1RAEM432CS	1RAEM432C485
- direct insertion **16A**	1RAEM416C	1RAEM416CS	1RAEM416C485
- direct insertion **10A**	1RAEM410C	1RAEM410CS	1RAEM410C485
- 3x voltages Phase-phase	●	●	●
- Medium voltage three-phase	●	●	●
- Voltage asimmetry	●	●	●
- 3 phase-to-neutral voltages	●	●	●
- 3x currents, 2 decimals	●	●	●
- Medium current, 2 decimals	●	●	●
- Current in neutral, 2 decimals	●	●	●
- Frequency with 2 decimals	●	●	●
- 3 x Active Powers, 4 dials	●	●	●
- Total Active Powers, 4 dials	●	●	●
- 3 x Reactive Powers, 4 dials	●	●	●
- Total Reactive Powers, 4 dials	●	●	●
- 3 x Apparent Powers	●	●	●
- Total Apparent Power	●	●	●
- Power Factor of the 3 phases, 4 dials	●	●	●
- Total Power Factor, 4 dials	●	●	●
- Total Active Energy (import) resettable parameter	●	●	●
- Total Active Energy (export) resettable parameter	●	●	●
- Total Reactive Energy resettable parameter	●	●	●
- Total operation counter	●	●	●
- Partial operation counter resettable parameter	●	●	●
- Programmable threshold with "NO" relay output 500mA/1000V		●	
- Threshold status summary page		●	
- Threshold activation signal		●	
- RS485 3kV optoinsulated high-speed 5-speed interface			●
- MODBUS RTU SLAVE PROTOCOL Full compliance			●
- Remote configurable settings			●
- Remote resetting of the energies			●
- Remote resetting of the partial counter			●
- Indication of the correct voltage phase sequence	●	●	●
- Indication of failed voltage supply	●	●	●
- Keypad configurable settings	●	●	●
- Configurable password for access to programming	●	●	●
- Restore factory settings	●	●	●
- Programming of initial page upon start-up	●	●	●
- Programming of the analog average (V, A and P)	●	●	●
- Download the software for free from our website www.revalco.it	●	●	●

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Auxiliary power supply
- UAUX nominal value	230	230V 50/60 Hz
	-P1	22...36VCA and 19...70VCC
	-P2	44...130VCA and 70....240VCC
- max rated consumption		2 VA

Voltmeter measuring circuits (instrument for direct insertion)
- Max applicable voltage (Vmax) — 300 Vf n (5 20 Vff)
- Rated voltage measurement (Vnom) — 231Vfn(400Vff)
- Direct measuring field — 0-300Vfn (520Vff) TRMS up to 20ma arm.
- Input impedance of voltage circuit — approx 2MΩ Phase/Neutral and Phase/Phase
- Precision — 0.5%*Vmax ± 2 digits

Current direct measuring circuits (1RAEM463... and 1RAEM432...)
- Max applicable current (Imax) — 70A
- Rated current measurement (Inom) — 63A (32A)
- Direct current range — 0.20...70.00A (0.20…35.00A)
- Resolution — 200mA
- Permanent overload — 110% (Inom)
- Thermal overload (1 s) — 200% (Inom)
- Precision — 0.5%*Imax ± 2 digits

Current direct measuring circuits (1RAEM416... and 1RAEM410...)
- Max applicable current (Imax) — 21A
- Rated current measurement (Inom) — 16A (10A)
- Direct current range — 0.10...21.00A (0.10…11.00)
- Resolution — 100mA
- Permanent overload — 110% (Inom)
- Thermal overload (1 s) — 200% (Inom)
- Precision — 0.5%*Imax ± 0,1A

Frequency measurement
- Frequency measuring range — 9.50...100.00Hz
- Operating range (V1) — 35 – 300 Vfn
- Precision — 0.1% ± 1 digit

Single power measurement
- Measurement capacity per line — ±18 kW /±18 kvar / 18kVA
- Precision (0.05 > Inom > 1.0) — 1 % full scale ± 2 digits

Total power measurements
- Measuring capacity — ±55 kW /±55 kvar / 55kVA
- Precision (0.05 > Inom > 1.0) — 1 % ± 2 digits

Power factor measurement (all)
- Measuring range cosφ — -1.00…0.00…+1.00
- Precision (0.1 > Inom > 1.0, 0.8 > Vnom >1.2) — 2% full scale ± 2 digits

Energy totalizing
- Counting capacity — 99999999kWh /kvarh
- Counting period — 15 minutes
- Resettable — YES
- Precision (0.05 > Inom > 1.0) — 2% Max

Operating counter
- Counting capacity — 99999:59 hhhhhh:mm
- Counting period — 15 minutes
- Resettable — NO
- Precision — 2% Max

Partial counter
- Counting capacity — 99999:59 hhhhhh:mm
- Counting period — 15 minutes
- Resettable — YES
- Precision — 2% Max

Screens
- Display — Backlit LCD, 8 characters x 2 lines, temp. -20°/+70°
- Auxiliary signals — 6 red LEDs

Relay control output (only "S" models)
- Type of contact — NO
- Contact specifications — 1000Vac / 0.5Aac(res. load) / 20VA max
- Reel-contact insulation — 4.25kVac

RS485 serial interface (only "485" models)
- Insulation — 3kV
- Max communication speed — 115.200 bps
- Communication protocol — MODBUS RTU Full-compliant / JBUS
- Programmability and remote controls — YES

Special functions
- 3-digit password for programming the settings
- Black-out indicator system

Terminal specifications
- Rated Current — 70A
- Wire range — 2,5mm² - 16mm²
- Torque min. / max — 1.2Nm / 1.5Nm
- Strip lenght — 12mm

Mechanical properties
- Dimensions — Standard 4 DIN modules
- Type of assembly — DIN50022 guide
- Degree of protection — for entire device: IP20/ Front IP30

Environmental conditions
- Operating temperature: Nominal / Extreme range — 0...+45 °C / -5...+55 °C
- Storage temperature — -10...+70 °C
- Relative humidity / Atmospheric pressure — 10...95 % / 70...110 kPa

Standards of reference

- Safety	CEI EN 61010-1	300V CAT III
- Precision	CEI EN 60688	(ex EN 50082-2)
- Electromagnetic compatibility (immunity)	CEI EN 61000-6-2	(ex EN 50081-2)
- Electromagnetic compatibility (emission)	CEI EN 61000-6-4	
- Cover protection (IP code)	CEI EN 60529	

Modbus:

- Protocol specifications	V1.1b, 28.12.2006

GENERAL OPERATION (FOR ALL MODELS)

The instrument calculates and monitors the electrical measurements of the plant to which it is connected. It displays the information on one of the pages on the display, selected by quickly pressing one of the buttons. The right button is for "next" and the left button is for "previous". The 6 LEDs on the right help to indicate the main electrical measurement pages and switch on according to the type of measurement shown on the display at the time. The first measurement page that appears upon start-up can be programmed.

The "S" models with threshold allow you to configure the measurement to be controlled, the type of threshold (off, maximum or minimum), the millesimal threshold value in relation to the full scale of the controlled measurement, time delay upon activation or deactivation, if applicable, and the time delay in tenths of a second up to 25.5 seconds (0=no delay)

Refer to the "Programming" section for details on programming values and the "Operation of the programmable threshold" section.

The "485" models with RS485 interface can communicate via a network when they are assigned a programmable address of between 1 and 255. You are advised not to put more than 32 devices on a network so as to ensure reliable communication.

If this is not adequate, there are "special" versions able to support more than 64 devices.

Communication speed can be set at between 9600bps and 115,200bps.

You are advised to set the communication speed at maximum if only these devices are used.

If the speed is set too low and there are frequent requests and/or there is a high number of required records, interactions with the instrument may also slow down. All measurements and parameters can be viewed on the MODBUS RTU reader interface.

The instrument also enables "on the fly" remote programming of the work settings via the MODBUS writer interface with the respective records that support it. In certain situations you are also allowed to carry out some macro-operations and controls, such as restoring the factory settings of models that enable this, resetting of the totalizers. Some models feature a blackout indication page.

It is like the measurement page but with flashing content which has to be programmed like the initial page shown on start-up.

When you press the keys to change the measurement page, the "blackout" condition is reset. This is proposed again after any programming of the settings on the keyboard. Some models feature 2 counters – one for total operation and another that can be reset. The latter allows you to check the average consumption if reset together with one or more energy totalizers.

Some models require a 3-digit password (that can be excluded) to change the work settings and reset the counters.

This password is not intended to guarantee full protection but to prevent accidental access to the programming area and ensure the settings are not changed by someone not authorized to do so.

There is no easy way to recover or cancel a password that has been configured and then forgotten. You will have to try all the combinations or return the product to the factory for reprogramming.

NOTES AND OPERATING INSTRUCTIONS

DO NOT PRESS ANY OF THE KEYS while switching on the instrument (i.e. when connecting it to the auxiliary power supply).

Otherwise you may accidentally start the calibration procedure normally carried out at the factory which, if the instrument is connected to the system rather than to the respective calibration devices, could cause the instrument to be permanently uncalibrated. In the interest of safety, **ALWAYS WAIT FOR THE INITIAL DIAGNOSTICS TO FINISH** (scanning of the LEDs) before pressing any of the keys.

"S" instruments with threshold: The threshold relay is blocked for the first ten seconds after the instrument is switched on.

The relay is "frozen" until you have finished configuring the settings.

OPERATION

When you start up the device, the firmware information page appears for a few seconds and all the LEDs switch on in order (initial diagnostics).

You will then see, for a few seconds, the page with the "title" of the measurements that will appear on the display, and the respective LED will switch on if the page requires it to do so. When the first measurement page appears, you can press the buttons to scroll through the available pages.

You can scroll FORWARDS by QUICKLY PRESSING the RIGHT-HAND button, or BACKWARDS by pressing the LEFT-HAND button.
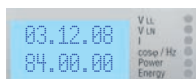
Pressing and holding the right-hand button will take you to the next page as well as allow you to program the instrument's settings.

Pressing one of the 2 buttons quickly displays the "title" of the measurement page to be displayed.
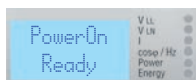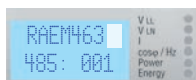
1RAEM4..C / 1RAEM4..CS / 1RAEM4..C485

The measurement and indication pages that can be accessed by pressing and QUICKLY releasing the RIGHT-HAND button are as follows:

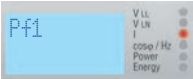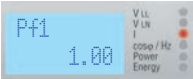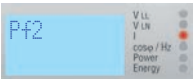|	
`03.12.08` `84.00.00`	Appears only for about 3 seconds when the instrument is switched on. Provides information on the instrument's firmware and operating details. When this page is displayed, the LEDs flash quickly to indicate they are working properly.
`PowerOn` `Ready`	**Black-out page** For this to appear, it has to be configured as the default page. Appears only when the instrument is switched on. It disappears as soon as the display is moved. It reappears after the settings are configured using the keypad.
`RAEM463` `485: 001`	**INFO page.** Indicates the instrument model and version. The lit-up square (first line on the right) indicates the voltage phases are OUT OF SEQUENCE. The square does not appear when the sequence is correct. Only in the case of the "485" models does the last value at the bottom on the right indicate the node number of the instrument on the MODBUS network.

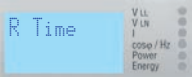| PRESSED BUTTON	WHEN RELEASED	DESCRIPTION
`V12 V23` `V31` Phase-to-phase voltages	`400 400` `400`	Value of each phase-to-phase voltage (V)
`V3p` `Dvp` 3 phase medium voltage and phase-phase voltage asimmetry	`V3p=400` `Dvp= 0`	Phase-phase voltage (V)
`V1 V2` `V3` Phase-to-neutral voltages	`231 231` `231`	Value of each phase-to-neutral voltage (V)
`A1` Current of Line 1	`A1` `63.00`	Value of A1 (A) The value has 2 decimals
`A2` Current of Line 2	`A2` `63.00`	Value of A2 (A) The value has 2 decimals
`A3` Current of Line 3	`A3` `63.00`	Value of A3 (A) The value has 2 decimals
`Aa` `An` 3 phase medium Current and current on neutral	`Aa=63.00` `An=0.00`	Value of medium Current and current on neutral (A) The values have 2 decimals
`Hz` Frequency	`Hz` `50.00`	Frequency (Hz) This is measured by V1.
`W1` Active power of line 1	`W1` `14553`	Active power of line 1 (W) The measurement is POSITIVE for consumed power, NEGATIVE for produced power.
`W2` Active power of line 2	`W2` `14553`	Active power of line 2 (W) The measurement is POSITIVE for consumed power, NEGATIVE for produced power.
`W3` Active power of line 3	`W3` `14553`	Active power of line 3 (W) The measurement is POSITIVE for consumed power, NEGATIVE for produced power.
`ΣW` Total active power	`ΣW` `46170`	Total active power (W) The measurement is POSITIVE for consumed power, NEGATIVE for produced power.

		Value of Pf1 (A)
Pf1	Pf1 1.00	The mark is the same of the line active power. Without the indicators "C" or "I" the deplacement is null. If some lines appear, the value is not possible to measure.

Power factor of Line 1

		Value of Pf2 (A)
Pf2	Pf2 1.00	The mark is the same of the line active power. Without the indicators "C" or "I" the deplacement is null. If some lines appear, the value is not possible to measure.

Power factor of Line 2

		Value of Pf3 (A)
Pf3	Pf3 1.00	The mark is the same of the line active power. Without the indicators "C" or "I" the deplacement is null. If some lines appear, the value is not possible to measure.

Power factor of Line 3

		Three-phase power factor (Cosφ)
Pf tot	Pf tot 1.00	The mark is the same of the line active power. Without the indicators "C" or "I" the deplacement is null. If some lines appear, the value is not possible to measure.

Power factor

		Reactive power of Line 1 (var)
var 1	var 1 0	The measurement is POSITIVE for dials 1 and 2, NEGATIVE for dials 3 and 4.

Reactive power of Line 1

		Reactive power of Line 2 (var)
var 2	var 2 0	The measurement is POSITIVE for dials 1 and 2, NEGATIVE for dials 3 and 4.

Reactive power of Line 2

		Reactive power of Line 3 (var)
var 3	var 3 0	The measurement is POSITIVE for dials 1 and 2, NEGATIVE for dials 3 and 4.

Reactive power of Line 3

		Measurement of Three-phase Reactive Power (var)
Σvar	Σvar 0	The measurement is POSITIVE for dials 1 and 2, NEGATIVE for dials 3 and 4.

Reactive power

		Value of Apparent power of Line 1 (VA)
VA1	VA1 14553	

Apparent power of Line 1

		Value of Apparent power of Line 2 (VA)
VA2	VA2 14553	

Apparent power of Line 2

		Value of Apparent power of Line 3 (VA)
VA3	VA3 14553	

Apparent power of Line 3

		Value of Three-phase Apparent Power (VA)
ΣVA	ΣVA 46177	

Three-phase apparent power

		Total Active Energy consumed (kWh)
ΣkWh+	ΣkWh+ 78973588	

Totalizing of total active energy consumed

		Total active energy produced (kWh)
ΣkWh-	ΣkWh- 1347	

Totalizing of total active energy produced

		Total reactive energy (kvarh)
Σkvarh	Σkvarh 45921	

Totalizing of total reactive energy

		The instrument's operating time in hours and minutes (hhhhh:mm)
T Time	T Time 97163:58	

Total counter

R Time	R Time 80445:21	Time since last reset in hours and minutes (hhhhh:mm)

Partial counter

Out	Out= On Src= Wt	**ONLY FOR "S" MODELS** Status of output relay contact (On=closed) and source of the threshold

Relay

OPERATION OF THE PROGRAMMABLE THRESHOLD. The "S" models allow you to apply a max or min threshold as a percentage of the required size, in relation to its intended full scale.

Required size (Th1 Src)	Full scale (= 100.0%)	Description	Required size (Th1 Src)	Full scale (= 100.0%)	Description
W+	Inom * Vnom * 3	Max/Min instantly consumed active power	V1	Vnom	Max/Min V1
W-	Inom * Vnom * 3	Max/Min instantly produced active power	V2	Vnom	Max or Min of V2
Hz	100Hz	Max/Min frequency measured on V1	V3	Vnom	Max or Min of V3
3Vp	Vnom * 1,73	Max/Min of one phase voltage	3A	Inom	Max or Min of one phase current
V12	Vnom * 1,73	Max/Min of V12	A1	Inom	Max or Min of A1
V23	Vnom * 1,73	Max/Min of V23	A2	Inom	Max or Min of A2
V31	Vnom * 1,73	Max/Min of V31	A3	Inom	Max or Min of A3
3Vn	Vnom	Max/Min phase-to-neutral voltage	An	Inom * 3	Max or Min of An
DVp	Vnom * 1,73	Max/Min voltage asimmetry phase-phase			

Inom is the nominal value of current. For models 63 and 32 Inom = 63A; for models 16 and 10 Inom = 16A
Vnom is the nominal voltage phase/neutral = 231V

The threshold activation (threshold active) point is the condition "more than Th1 Val" if Th1 Sel = Hi; otherwise "less than Th1 Val" if Th1 Sel = Lo. The threshold's quiescent operating (threshold inactive) point is the condition "less than or equal to Th1 Val" if Th1 Sel=Hi; otherwise "more than or equal to Th1 Val" if Th1 Sel=Lo. The "active threshold" condition attempts to CLOSE the relay's "NO" contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "Off-On". The "inactive threshold" condition attempts to OPEN the relay's "NO" contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "On-Off".

There are 2 cases whereby the output relay does NOT mirror the threshold condition. These are as follows:
• During the first 10 seconds from starting up the instrument, when the relay is kept inactive to avoid unwanted operation while the measurements are stabilized, and
• when the settings are being programmed on the keypad, it is kept at the same status at the time of starting the procedure, to prevent partial modification of the settings from causing unwanted change to its status.

Relay status is shown on the display at page "OUT", together with the title of the size of the threshold selected in Th1 Src.

Closing of the relay also determines flashing of the LED associated with the selected size (when applicable), providing the selected measurement page is not the one associated with the LED, in which case the LED light remains steady.
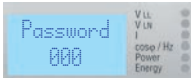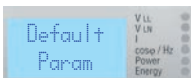
"S485" Models: when Th1 Sel=OFF (threshold OFF), there is the option of controlling the relay directly by means of MODBUS commands to open and close INSTANTLY, regardless of the Th1 Dly and Th1 DD settings. "Src=REM"(REMOTE) appears on the OUT page to indicate remote access of the relay.

PROGRAMMING

For programming, press and hold the RIGHT-HAND button (for 4 seconds or more). The first page to appear when you are granted access to the programming mode is the one of programmable values. Releasing the button will make the display flash (to indicate you are in programming mode) and the pages begin to scroll through slowly (one every 4 seconds or so), indicating the title and value of the current set-point. If you do not touch the button when you get the last page, normal operation is restored without saving any changes. To make a change, simply press one of the buttons when the required page appears, respectively:

LEFT-HAND button = DECREASES the value; **RIGHT-HAND button** = INCREASES the value.

At that point (after pressing the button) the display remains steady so you can check the modification and the value changes by one unit. If you have to modify a value quite considerably, you can press and hold the button for more than 2 seconds to speed up the process. The longer you hold down the button, the faster you can scroll through the numbers (4 speeds). They are all "roll" values so when you get to the maximum permitted value you restarted from the minimum value, and vice versa. When you have set the value as required, release th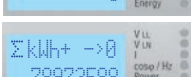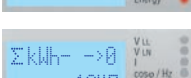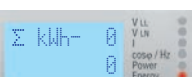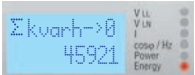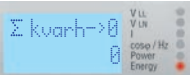e button and wait for over 4 seconds. The pages then continue scrolling and the modification is automatically saved. Modifiable pages then follow.

Program Mode	indicates you have entered the setting configuration phase.
Password 000	**A password is only requested if NewPassw is set at a value other than 0** (see below). Select the correct number and wait for the next page. In the case of a missing or incorrect entry, the instrument returns to normal operation after about 4 seconds.
Default Param	By pressing a key when this page is shown, all value parameters return equal to the factory programming, except totalizer resetting one by one.
Average 3	Average of the analog values measured (V, A and P). To stabilize the displayed values. The higher the number, more of the measurements are stable – although they will be slow to update. Settable between 1 and 15 at steps of 1. Default = 3
Default Page	Configuration of the first measurement page to be viewed upon start-up. Using the buttons to scroll through displays the "titles" of the available pages – the same ones that appear when you press the right-hand button in sequence. Settable on all the available pages. **Default = Blackout detection page, if available, otherwise the INFO page.**
NewPassw 0	Setting this at zero disables password protection for programming with the keypad. The same applies for password protection for programming by remote control. Settable between 0 and 999 at steps of 1. **Default = 0 (disabled)**

ΣkWh+ ->0 78973588	Resetting the Totalizer of the Total Active Energy consumed	Σ kWh+ 0 0	Pressing and holding the right-hand button for more than 4 seconds reset the value
ΣkWh- ->0 1347	Resetting the Totalizer of the Total Active Energy produced	Σ kWh- 0 0	Pressing and holding the right-hand button for more than 4 seconds reset the value

Σkvarh->0 / 45921	Resetting the Totalizer of the Total Reactive Energy	Σkvarh->0 / 0 — Pressing and holding the right-hand button for more than 4 seconds reset the value
R Time->0 / 80445:21	Resetting the Partial counter	R Time->0 / 0:00 — Pressing and holding the right-hand button for more than 4 seconds reset the value

THE WINDOWS BELOW APPLY ONLY TO THE "S" MODELS

Th1 Sel — Hi
Selecting the threshold operation mode. Settable between: Hi=High threshold, Lo=Low threshold and Off=threshold disabled. If the threshold is OFF, you will not view the following pages. **Default = Hi (high threshold).**

Th1 Dly — 0.1
Delay time for activation of the output relay (page displayed only if Th1 Sel is not Off) In seconds. Settable between 0.0 and 25.5 in steps of 0.1. **Default = 0.1**

Th1 DD — Off-On
Assigning the delay time for activating the threshold (page displayed only if Th1 Sel is not Off) The delay time is applicable from the start of threshold activation (Off-On) or at the end (On-Off). **Default = Off-On (at the start)**

Th1 Src — W+
Assigning the size for activating the threshold (page displayed only if Th1 Sel is not Off) Settable at: W+, W-, Hz, 3Vf, V12, V23, V31, 3Vn, V1, V2, V3, 3A, A1, A2, A3,An. **Default = W+**

Th1 Val% — W+ 50.0
Regulating the threshold value as a percentage of the full scale (page displayed only if Th1 Sel is not Off)

34650 / W+ 50.0
At the top is the effective value of the threshold for the selected size. Settable between: 0.0 and 100.0, in steps of 0.1. **Default = 50.0(%)**

THE WINDOWS BELOW APPLY ONLY TO THE "485" MODELS

Node — 1
Assigning the MODBUS address node number (of the "INFO" page). Settable between 1 and 255. **Default = 1**

Speed — 4
Configuring the speed of the RS485 serial port (bps). Settable between 0 and 4   **Default = 4** (0=9600, 1=19200, 2=38400, 3=57600, 4=115200)

CONNECTION DIAGRAMS

1RAEM463C
1RAEM432C
1RAEM416C
1RAEM410C

1RAEM463C485
1RAEM432C485
1RAEM416C485
1RAEM410C485

1RAEM463CS
1RAEM432CS
1RAEM416CS
1RAEM410CS

N.A. 0,5A - 1000V - 20VA

LCD MULTIFUNCTION METERS · 4 DIN MODULES D.C. VERSION

- Weight kg 0,70
- Sealable terminals cover included

58
85
45
70

NEW

1RAEM4C485DC   up   down

GENERAL DESCRIPTION

The 4 DIN instrument is suited for use in industrial and civil market, specially on sectors related to the production of alternative energy (photovoltaic, wind energy). Simple and extremely compact, it features an alphanumerical display with 2 lines of eight-character lines, 6 auxiliary LEDS and 2 buttons for display selection and keyboard programming. The machine is extremely user-friendly and information is presented clearly on the display. It is unlikely you will need to consult instruction manual which is not generally kept readily available at the site. When properly installed, the instrument measures the current from external shunt ..60mV. The instruments have the possibility to select the current end scale value between 5,0 A to 3000 A DC by steps of 5,0A.

Two principal families (direct and "H" insertion) forecast respectively the voltmeter measure in DC direct insertion (-800,.0 / + 800,0 VDC) or by external voltage divider …../ 100VDC. Other executions can be manufactured on request (ex. 24VDC, 48VDC, 150VDC etc) but must be considered as "special executions" with different costs. The instruments related to "H" family have the possibility to select the voltage end scale value between 10.0V to 3000 V DC by steps of 1,0V.

The high accuracy class measures offered by each instrument are the most used on the DC field. Every direct measure (Voltage, Current and Power) is bidirectional; so the inversion of polarity is shown and the measured range is the same in positive or negative case; practically if the end scale is 3000.0A, these instruments are able to measure from + 3000,0A to – 3000,0 ADC.

The individually resettable Energies and Ampere Hour can be easily calculated when you need to service the system and/or periodical test line operation, determine zone consumption values, establish cost centres, etc.

⚠️ **NOTE: The instruments use simple Energy and Ampere Hour totalizing methods for purposes of diagnostics and statistics. These instruments cannot be considered as substitute of Energy kWhmeters.**

The following are provided according to model:

1 threshold with output on "N.O." control relay (500mA/1000V), fully programmable (model "S")

1 x RS485 3kV optoinsulated programmable high speed interface with MODBUS RTU protocol (model "RS485)

PARAMETERS

Electrical parameters	1RAEM4C DC	1RAEM4C SDC	1RAEM4C 485DC	1RAEM4C S485DC	1RAEM4C HDC	1RAEM4C HSDC	1RAEM4C H485DC	1RAEM4C HS485DC
- DC Voltage 800.0 V max	•	•	•	•				
- DC Voltage ..../100V by divider					•	•	•	•
- DC Current .../60mV	•	•	•	•	•	•	•	•
- Bidirectional power (kW)	•	•	•	•	•	•	•	•
- Total active energy (Import) resettable parameter	•	•	•	•	•	•	•	•
- Total active energy (Export) resettable parameter	•	•	•	•	•	•	•	•
- Ampère-hour Ah+ (Import) resettable parameter	•	•	•	•	•	•	•	•
- Ampère-hour Ah- (Export) resettable parameter	•	•	•	•	•	•	•	•
- Total working hours	•	•	•	•	•	•	•	•
- Partial working hours settable parameter	•	•	•	•	•	•	•	•
- Indication of failed voltage supply	•	•	•		•		•	
- Programmed threshold V-A-W		•		•		•		•
- Output relay NO (500mA/1000V)		•		•		•		•
- Threshold activation signal		•		•		•		•
- Threshold status summary page		•		•		•		•
- Interface RS485 3kV optoinsulated 9600...115200bps			•	•			•	•
- MODBUS SLAVE RTU full compliance			•	•			•	•
- Remote configurable settings			•	•			•	•
- Keypad configurable settings	•	•			•	•		
- Remote resetting of energies - ampere/hour - counter			•	•			•	•
- Remote relay output control (if the threshold is OFF)				•				•
- Configurable password for access to programming	•	•	•	•	•	•	•	•
- Restore factory settings	•	•	•	•	•	•	•	•
- Programming of initial page upon start-up	•	•	•	•	•	•	•	•
- Programming of current 5 to 3000ADC with step of 5A	•	•	•	•	•	•	•	•
- Programming of voltage from 10 to 3000.0VDC step 1V					•	•	•	•
- Programming of analog average (VDC, ADC and W)	•	•	•	•	•	•	•	•

- Download the software for free from our website www.revalco.it

TECHNICAL SPECIFICATIONS

Auxiliary power supply
- UAUX nominal value   110   110V 50/60Hz
    230   230V 50/60 Hz
    -P1   22...36VAC and 19...70VDC
    -P2   44...130VAC and 70....240VDC
- max rated consumption 2 VA

Voltmeter measuring circuits (instrument for direct insertion)
- Max applicable voltage (Vmax)   +/- 960 VDC
- Rated voltage measurement (Vnom)   +/- 800 VDC
- Direct measuring field   +/- 960 VDC
- Input impedance of voltage circuit   approx 2MΩ
- Accuracy class   0.2% *2Vmax ± 2 digits

Voltmeter measuring circuits
(models "H" instruments; insertion from Voltage divider… /100VDC)
- Max. applicable voltage (Vmax)   +/- 125 mVDC
- Rated voltage measurement (Vnom)   +/- 100 mVDC
- Direct measuring range   +/- 125 mVDC.
- Imput impedance   about 250 KΩ
- End scale Range   FsV   +/-10VDC.....+/-3000VDC   step 1V
- Accuracy Class   0.2%*Vmax ± 2 digit

Ammeter measuring circuits for Shunt …/60mV
- Max applicable current (Vmax)   +/- 72 mVDC
- Rated voltage measurement (Vnom)   +/- 60 mVDC
- Direct measuring range   +/- 72 mVDC.
- Imput impedance   about 50 KΩ
- End scale Range   FsA   +/-15ADC.....+/-3000ADC   step 5A
- Accuracy Class   0.2%*2Vmax ± 2 digit

Power measurement
- Measurement capacity for direct insertion (end scale)   ±3,57 MW
- Measurement capacity for "H" models (end scale)   ±12,96 MW
- Accuracy class   0,5 % full scale ± 2 digits

Energy totalizing
- Counting capacity   99999999kWh
- Counting period   15 minutes
- Reset   YES
- Accuracy class   2 % max.

Ampere-Hour totalizing
- Counting capacity   99999999 Ah
- Counting period   15 minutes
- Reset   YES
- Accuracy class   2 % max.

Operating counter
- Counting capacity   99999:59 hhhhhh:mm
- Counting period   15 minutes
- Reset   NO
- Accuracy class   2 % max.

Partial counter
- Counting capacity   99999:59 hhhhhh:mm
- Counting period   15 minutes
- Reset   YES
- Accuracy class   2 % max.

Screens
- Back-lighted Display LCD, 8 characters x 2 lines, temp. -20°/+70°
- Auxiliary signals   6 red LEDS

Relay control output ("S" models only)
- Type of contact   N.O.
- Contact specifications   1000VAC / 0.5A AC(resistive. load) / 20VA max
- Reel-contact insulation   4.25kVAC
- Remote operation via MODBUS   YES, only for "S485" models

RS485 serial interface ("RS485" models only)
- Insulation   3kV
- Max communication speed   115.200 bps
- Communication protocol   MODBUS RTU Full-compliant / JBUS
- Programmability and remote controls   YES

Special functions
- 3-digit password for programming the settings
- Black-out indicator system

Mechanical properties
- Dimensions   Standard 4 DIN modules
- Type of mounting   DIN50022 bar
- Degree of protection   complete device IP20
    Front IP30

Environmental conditions
- Operating temperature: Nominal range   0...+45 °C
    Extreme range   -5...+55 °C
- Storage temperature   -10...+70 °C
- Relative humidity   10...95 %
- Atmospheric pressure   70...110 kPa

Standards
- Safety CEI EN 61010-1 300V CAT III
- Accuracy class CEI EN 60688 (ex EN 50082-2)
- Electromagnetic compatibility (immunity) CEI EN 61000-6-2 (ex EN 50081-2)
- Electromagnetic compatibility (emission) CEI EN 61000-6-4
- Cover protection (IP code) CEI EN 60529

Modbus:
- Protocol specifications V1.1b, 28.12.2006

GENERAL OPERATION (FOR ALL MODELS)

The instrument calculates and monitors the electrical measurements of the plant to which it is connected. It displays the information on the selected pages of display by quick pressure of the buttons. The right button is for "next" and the left button is for "previous" page.

The 6 LEDS on the right help to indicate the main electrical measurement pages and switch on according to the type of measurement shown on the display at the time.

The first measurement page that appears upon start-up can be programmed.

The "S" models with threshold allow you to configure the measurement to be controlled, the type of threshold (off, maximum or minimum), the millesimal threshold value in relation to the full scale of the controlled measurement, time delay upon activation or deactivation, if applicable, and the time delay in tenths of a second up to 25.5 seconds (0=no delay). Refer to the "Programming" section for details on programming values and the "Operation of the programmable threshold" section.

The "RS485" models with RS485 interface can communicate via network when they are assigned a programmable address between 1 and 255. You are advised not to put more than 32 devices on a network so as to ensure reliable communication. If this is not adequate, there are "special" versions able to support more than 64 devices. Communication speed can be set at between 9600bps and 115,200bps.You are advised to set the communication speed at maximum if only these devices are used. If the speed is set too low and there are frequent requests and/or there is a high number of required records, interactions with the instrument may also slow down. Allmeasurements and parameters can be viewed on the MODBUS RTU reader interface.

The instrument also enables "on the fly" remote programming of the work settings via the MODBUS writer interface with the respective records that support it. In certain situations you are also allowed to carry out some macro-operations and controls, such as restoring the factory settings of models that enable this, resetting of the totalizers or direct switching on and off of the output relay for models with threshold.

⚠️ **Note: the "RS485" models offer additional measurements via MODBUS, in particular the TRUE RMS values to verify the presence or not of ripple or alternate components residuals.**

All models feature a blackout indication page. It is like the measurement page but with flashing content which has to be programmed like the initial page shown on start-up.

When you press the keys to change the measurement page, the "blackout" condition is reset. This is proposed again after any programming of the settings on the keyboard. All models feature 2 hour counters; one for total operation and another that can be resetted. The latter allows you to check the average consumption if resetted together with one or more Energy totalizers.

All models require a 3-digit password (that can be excluded) to change the work settings and reset the counters.

This password is not intended to guarantee full protection but to prevent accidental access to the programming area and ensure the settings are not changed by someone not authorized to do so.

There is no easy way to recover or cancel a password that has been configured and then forgotten. You will have to try all the combinations or return the product to the factory for reprogramming.

DO NOT PRESS ANY OF THE KEYS while switching on the instrument (i.e. when connecting it to the auxiliary power supply).

Otherwise you may accidentally start the calibration procedure normally carried out at the factory which, if the instrument is connected to the system rather than to the respective calibration devices, could cause the instrument to be permanently not calibrated.

⚠️ In the interest of safety, **ALWAYS WAIT FOR THE INITIAL DIAGNOSTICSTO FINISH (scanning of the LEDS) before pressing any of the keys.**

"S" instruments with threshold:
The threshold relay is blocked for the first ten seconds after the instrument is switched on.
The relay is "frozen" until you have finished configuring the settings.

1RAEM4C DC / ...SDC / ...485DC / ...S485DC
1RAEM4C HDC / ...HSDC / ...H485DC / ...HS485DC

OPERATION

When you start up the device, the firmware information page appears for a few seconds and all the LEDS switch on in sequence (initial diagnostics).
You will then see, for a few seconds, the page with the "title" of the measurements that will appear on the display, and the respective LED will switch on if the page requires it to do so. When the first measurement page appears, you can press the buttons to scroll through the available pages.
You can scroll FORWARDS by QUICKLY PRESSING the RIGHT-HAND button, or BACKWARDS by pressing the LEFT-HAND button.
Pressing and holding the right-hand button will take you to the next page as well as allow you to program the instrument's settings.
Pressing one of the 2 buttons quickly displays the "title" of the measurement page to be displayed
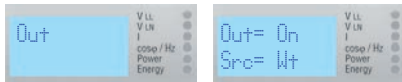
The measurement and indication pages which can be accessed by pressing and Quickly releasing the RIGHT-HAND button are the follows:

03.12.08 84.00.00	Appears only for about 3 seconds when the instrument is switched on. Provides information on the instrument's firmware and operating details. When this page is displayed, the LEDS flash quickly to indicate they are working properly.
PowerOn Ready	Black-out page. For this to appear, it has to be configured as the default page. Appears only when the instrument is switched on. It disappears as soon as the display is moved. It reappears after the settings are configured using the keypad.
RAECSDCH 485:001	INFO page. Indicates the instrument model and version. The lightt-up square (first line on the right) indicates the voltage phases are OUT OF SEQUENCE. The square does not appear when the sequence is correct. Only in the case of the "RS485" models does the last value at the bottom on the right indicate the node number of the instrument on the MODBUS network.

PRESSED BUTTON	WHEN RELEASED	DESCRIPTION
Vol+ DC	Vol+ DC 100.0	Value of DC Voltage component, with + or - (V)
DC Voltage measure		
Amp DC	Amp DC -100.0	Value of DC Current component, with + or - (A)
DC Current measure		
kW DC	kW DC -10.00	Value of DC Power component, with + or - (kW)
DC Power measure		
Σ kWh+	Σ kWh+ 78973588	Total positive Energy (kWh)
Positive Energy totalizing		
Σ kWh-	Σ kWh- 1347	Total negative Energy (kWh)
Negative Energy totalizing		
Σ Ah+	Σ Ah+ 1546170	Total positive Ampere-hour (Ah)
Positive Ampere-hour totalizing		
Σ Ah-	Σ Ah- 2723	Total negative Ampere-hour (Ah)
Negative Ampere-hour totalizing		
T Time	T Time 97163:58	Operating time in hours and minutes (hhhhh:mm)
Total counter		

R Time	R Time 80445:21	Time since last reset, in hours and minutes (hhhhh:mm)

Partial counter

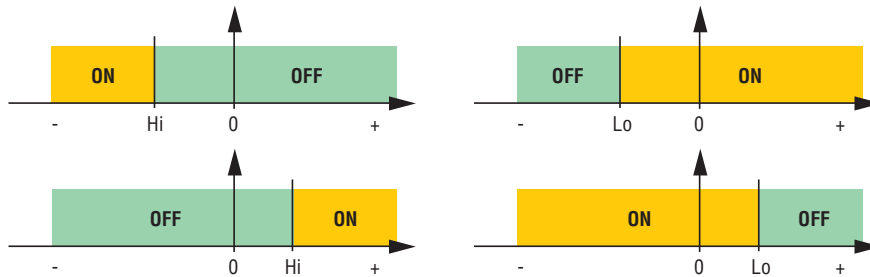|		
Out	Out= On Src= Wt	**FOR "S" MODELS ONLY** Status of output relay contact (On=closed) and source of the threshold

Relay

OPERATION OF THE PROGRAMMABLE THRESHOLD ("S" models only). These models allow you to apply a max or min threshold as a percentage of the required size, in relation toits intended full scale.

Required parameter (Th1 Src)	Full scale (= 100.0%)	Description
kW+	FsA * FsV	Max/Min instantly consumed positive Active Power
kW-	FsA * FsV	Max/Min instantly consumed negative Active Power
A+	FsA	Max/Min positive current
A-	FsA	Max/Min negative current
V+	FsV	Max/Min positive voltage
V-	FsV	Max/Min negative voltage

The threshold activation (threshold active) point is the condition "more than Th1 Val" if Th1 Sel = Hi; otherwise "less than Th1 Val" if Th1 Sel = Lo
The threshold's quiescent operating (threshold inactive) point is the condition "less than or equal to Th1 Val" if Th1 Sel=Hi; otherwise "more than or equal to Th1 Val" if Th1 Sel=Lo.

The "active threshold" condition attempts to CLOSE the relay's "N.O." contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "Off-On"
The "inactive threshold" condition attempts to OPEN the relay's "N.O." contacts and this occurs instantly unless there is the delay Th1 Dly if Th1 DD is "On-Off".

There are 2 cases whereby the output relay does NOT mirror the threshold condition. These are as follows:
- During the first 10 seconds from starting up the instrument, when the relay is kept inactive to avoid unwanted operation while the measurements are stabilized, and
- when the settings are being programmed on the keypad, it is kept at the same status at the time of starting the procedure, to prevent partial modification of the settings from causing unwanted change to its status.
Relay status is shown on the display at page "OUT", together with the title of the size of the threshold selected in Th1 Src.
Closing of the relay also determines flashing of the LED associated with the selected size (when applicable), providing the selected measurement page is not the one associated with the LED, in which case the LED light remains steady.

"RS485" Models:
when Th1 Sel=OFF (threshold OFF), there is the option of controlling the relay directly by means of MODBUS commands to open and close
INSTANTLY, regardless of the Th1 Dly and Th1 DD settings. "Src=REM"(REMOTE) appears on the OUT page to indicate remote access of the relay.

PROGRAMMING

For programming, press and hold the RIGHT-HAND button (for 4 seconds or more). The first page to appear when you are granted access to the programming mode is the one of programmable values. Releasing the button will make the display flash (to indicate you are in programming mode) and the pages begin to scroll through slowly (one every 4 seconds or so), indicating the title and value of the current set-point. If you do not touch the button when you get the last page, normal operation is restored without saving any changes. To make a change, simply press one of the buttons when the required page appears, respectively:
LEFT-HAND button = DECREASES the value; **RIGHT-HAND** button = INCREASES the value.
At that point (after pressing the button) the display remains steady so you can check the modification and the value changes by one unit. If you have to modify a value quite considerably, you can press and hold the button for more than 2 seconds to speed up the process. The longer you hold down the button, the faster you can scroll through the numbers (4 speeds). They are all "roll" values so when you get to the maximum permitted value you restarted from the minimum value, and vice versa. When you have set the value as required, release the button and wait for over 4 seconds. The pages then continue scrolling and the modification is automatically saved. Modifiable pages then follow.

Program Mode	Indicates you have entered the setting configuration phase.
Password 000	**A password is only requested if NewPassw is set at a value other than 0 (see below).** Select the correct number and wait for the next page. In the case of a missing or incorrect entry, the instrument returns to normal operation after about 4 seconds.
Default Param	By pressing a key when this page is shown, all value parameters return equal to the factory programming, except totalizer resetting one by one.
FsA Set 100	To set the Current end scale value (…./60mVDC)in Ampere. Settable between 5 and 3000 at steps of 5 Default = 100

THE WINDOWS BELOW APPLY ONLY TO THE "H" MODELS

FsV Set 100 — To select the Voltage end scale value from voltage divider. Selectable from 10.0V to 3000 V DC by steps of 1,0V. Default=100

Average 25 — Average of the analogue values measured (V, A and P). To stabilize the displayed values. More higher is the number, more stable are the measurements , although they will be slow to update. Settable between 1 and 15 at steps of 1. Default = 25

Default Page — Configuration of the first measurement page to be viewed upon start-up. Using the buttons to scroll through displays the "titles" of the available pages – the same ones that appear when you press the right-hand button in sequence. Settable on all the available pages. Default = Blackout detection page

NewPassw 0 — Setting this at zero disables password protection for programming with the keypad. The same applies for password protection for programming by remote control. Settable between 0 and 999 at steps of 1. Default = 0 (disabled)

ΣkWh+ –>0 78973588 — Resetting the Totalizer of positive Energy

ΣkWh+ –>0 0 — Pressing and holding the right-hand button for more than 4 seconds, the value will be resetted

ΣkWh– –>0 1347 — Resetting the Totalizer of negative Energy

ΣkWh– –>0 0 — Pressing and holding the right-hand button for more than 4 seconds, the value will be resetted

ΣAh+ –>0 1546170 — Resetting the Totalizer of positive Ampere-hour

ΣAh+ –>0 0 — Pressing and holding the right-hand button for more than 4 seconds, the value will be resetted

ΣAh– –>0 2723 — Resetting the Totalizer of negative Ampere-hour

ΣAh– –>0 0 — Pressing and holding the right-hand button for more. than 4 seconds, the value will be resetted

R Time->0 80445:21 — Resetting the Partial counter

R Time->0 0:00 — Pressing and holding the right-hand button for more than 4 seconds, the value will be resetted

THE WINDOWS BELOW APPLY ONLY TO THE "S" MODELS

Th1 Sel Hi — **Selecting the threshold operation mode.** Settable between: Hi=High threshold, Lo=Low threshold and Off=threshold disabled. If the threshold is OFF, you will not view the following pages. **Default = Hi (high threshold).**

Th1 Dly 0.1 — **Delay time for activation of the output relay** (page displayed only if Th1 Sel is not Off) Expressed in seconds. Settable between 0.0 and 25.5 in steps of 0.1. **Default = 0.1**

Th1 DD Off-On — **Assigning the delay time for activating the threshold** (page displayed only if Th1 Sel is not Off) The delay time is applicable from the start of threshold activation (Off-On) or at the end (On-Off). **Default = Off-On (at the start)**

Th1 Src W+ — **Assigning the size for activating the threshold** (page displayed only if Th1 Sel is not Off) Settable at: kW +, k W -, V+, V-, A +, A -. **Default =k W+**

Th1 Val% kW 50.0 — **Regulating the threshold value as a percentage of the full scale** (page displayed only if Th1 Sel is not Off)

5.00 kW+ 50.0 — At the top is the effective value of the threshold for the selected parameter. Settable between: 0.0 and 100.0, in steps of 0.1. **Default = 50.0 (%)**

THE WINDOWS BELOW APPLY ONLY TO THE "485" MODELS

Node 1 — Assigning the MODBUS address node number (of the "INFO", ADR: nnn page). Settable between 1 and 255. **Default = 1**

Speed 4 — Configuring the speed of the RS485 serial port (bps) Settable between 0 and 4 (0=9600, 1=19200, 2=38400, 3=57600, 4=115200). **Default = 4**
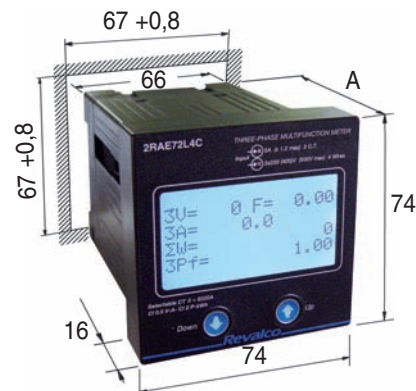
CONNECTION DIAGRAM
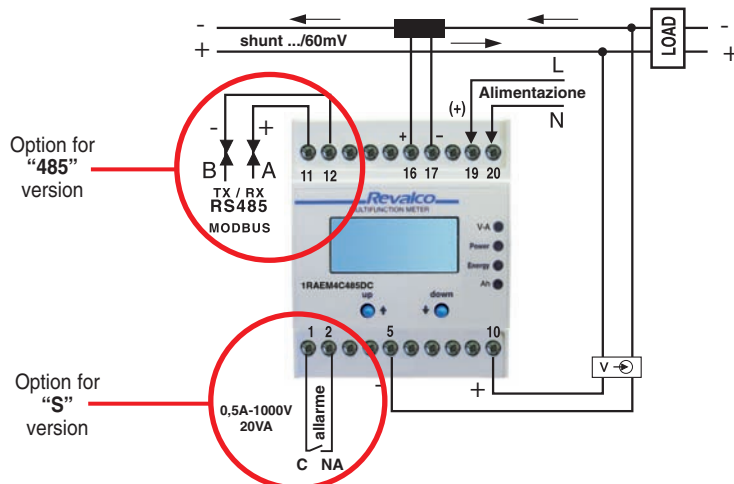
THREE PHASE LCD 4 LINES (LED 7 display) MULTIFUNCTION METERS - TRUE RMS

DIMENSIONS in mm

A = 97,3 without terminals cover   A = 107 with terminals cover
Weight: 0,55 kg

A = 82 without terminals cover   A = 97 with terminals cover
Weight: 0,50 kg

TECHNICAL CHARACTERISTICS

⚠ **Instruments available with secondary current 1A and prices on request. The ordering code is obtained changing ..L4.. with ..L1... Example: 2RAE96L1C**

	2RAE96L7C 2RAE96L4C 2RAE72L4C*	2RAE96L7CS 2RAE96L4CS	2RAE96L7C485* 2RAE96L4C485* 2RAE72L4C485	2RAE96L7CS485* 2RAE96L4CS485*
96X96 VERSION - 7 LED DISPLAYES				
96X96 VERSION				
72X72 VERSION				
- PARAMETERS				
- Ph-N voltage and Ph-Ph voltage	●	●	●	●
- Medium voltage of phases	●	●	●	●
- Current	●	●	●	●
- Power factor	●	●	●	●
- Total equivalent power factor	●	●	●	●
- Apparent power / Active power (+/-) / Reactive power	●	●	●	●
- Total Apparent power / - Total Active power (+/-) / Total Reactive power	●	●	●	●
- Frequency	●	●	●	●
- Total Active Energy (import) resettable parameter	●	●	●	●
- Total Active Energy (export) resettable parameter	●	●	●	●
- Reactive Total energy resettable parameter	●	●	●	●
- Total working time resettable parameter	●	●	●	●
- Partial working time parametro azzerabile	●	●	●	●
- Sequence of phases	●	●	●	●
- Voltage asymmetry (Ph-N)	●	●	●	●
- **TWO ALARM OUTPUT RELAYS** (contact N.O. 1000V-0,5A-20VA)		●		●
- **PROTOCOL MODBUS SLAVE RTU**				
Baude rate 9600 - 19200 - 38400 - 56800 - 115200			●	●
- The software is available, free of charge, on our internet address www.revalco.it			●	●
- **PERMANENT MEMORY FOR SET POINT AND ENERGIES** (EEPROM)	●	●	●	●

- **400V insertion, 3 or 4 wires line, 2 or 3 systems** (pages 121/122 and 125)

| 2RAE96L4CH1 | | | 2RAE96L4CS485H1* |
| 2RAE72L4CH1 | | 2RAE72L4C485H1 | |

- **VT..../100V insertion, 3 or 4 wires line, 2 or 3 systems** (pages 121/122 and 125)

⚠ Primary voltage up to 9,9 kV

| 2RAE96L4CH2 | | | 2RAE96L4CS485H2* |
| 2RAE72L4CH2 | | 2RAE72L4C485H2 | |

- **VT..../100V insertion, 3 or 4 wires line, 2 or 3 systems** (pages 121/122 and 125)

⚠ Primary voltage from 10 to 100 kV

| 2RAE96L4CH3 | | | 2RAE96L4CS485H3* |
| 2RAE72L4CH3 | | 2RAE72L4C485H3 | |

* ETHERNET OPTION from serial transducer **(suffix ETH2S)** - *** ETHERNET OPTION** from web server **(suffix ETH2WS)**
* PROFIBUS OPTION (suffix PROF) not for code 2RAE72L4C

2RAE72L4C / 2RAE72L4C485 - 2RAE96L4C / 2RAE96L4C485

OPERATION

■ Powering the instrument you can see the following page

```
PowerOn
Ready
```

First powering page. A different page can be selected within the available page present on this type. At first powering the display shows automatically this page

■ By pressing "UP" front button, the introduction page appears showing: instruments type, interface type, node number and software release.

```
RAE TRMS CS
485 Adr: 001 64.00
```

→ Correct sequence of phases indication.
Light OFF = correct sequence

■ By pressing again "UP" front button, the page shows phase-phase Medium Voltage values, Frequency, 3 Currents L1-L2-L3, Total Active Power and Total Power Factor (Cosφ).

```
3V: 400   F:   50.0
A.   1000 1000 1000
W:        693000.0
PfTot:   IND +0.99
```

■ By pressing again "UP" front button, the page shows the phase-phase Voltage L12-L23-L31, phase-neutral Voltages L1-L2-L3, Phase-Neutral asimmetry Voltage and 3 Currents L1-L2-L3.

```
Vp  400  400  400
Vn  231  231  231
DV  0
A   1000 1000 1000
```

■ By pressing again "UP" front button, the page shows Power Factor (Cosφ) of each phase and the Total Power Factor (Cosφ).

```
Pf1:     IND +0.99
Pf2:     IND +0.99
Pf3:     IND +0.99
PfTot:   IND +0.99
```

- By pressing again "UP" front button, the page shows the Active Powers of L1-L2-L3.

```
Active      Pwr(W)
L1:        231000.0
L2:        231000.0
L3:        231000.0
```

- By pressing again "UP" front button, the page shows the Reactive Powers of L1-L2-L3.

```
React.     Pwr(var)
L1:             0.0
L2:             0.0
L3:             0.0
```

- By pressing again "UP" front button, the page shows the Apparent Powers L1-L2-L3.

```
Apparent   Pwr (VA)
L1:        231000.0
L2:        231000.0
L3:        231000.0
```

- By pressing again "UP" front button, the page shows the Total Powers (Active, Reactive and Apparent).

```
Total       Powers
W:         693000.0
var:            0.0
VA:        693000.0
```

- By pressing again "UP" front button, the page shows the Active Energy (Import +). Settable parameter from programming page

```
Total      Active
Energy     (+)
               kWh
           347670.0
```

- By pressing again "UP" front button, the page shows the Active Energy (Export -). Settable parameter from programming page

```
Total      Active
Energy     (-)
               kWh
               0.0
```

- By pressing again "UP" front button, the page shows the Total Active Energy. Settable parameter from programming page

```
Total      Reactive
Energy
               kvarh
            8630.0
```

- By pressing again "UP" front button, the page shows the Total and Partial Working Time
  Partial working time is a settable from programming page

```
     Time
             hh:mm
Tot:     11327:53
Rel:      3420:21
```

PARTICULAR VISUALIZATIONS RELATED TO THE POWER FACTOR
- When Apparent Power is "0" some lines are displayed
- When Cosφ = 1 the mark is displayed
- When Cosφ = 0 no mark is displayed
- 2nd quadrant indication (seling Power) has φ = 120°

```
Pf1:            -.--
Pf2:          +1.00
Pf3:           0.00
PfTot:   CAP -0.50
```

CONFIGURATION SELECTION MENU'

- To enter in programming phase press the right-hand button (UP) more than 4 seconds. "Program Mode" page will be displayed and after 4 seconds the other pages with actual values will be showed. If it is necessary to modify the parameters, press the button when it appears on the display. To increase the value press "UP" to decrease it press "DOWN". Maintaining pressure on the button the sliding is automatic and the speed increase automatically; once the needed value is displayed release the button (the new value will be saved in a permanent memory)

INPUT PASSWORD ADMITTING
This page will be displayed only if parameter "Password" was modified and it is different from "000". To enter in programming phase it is necessary to write the same memorized number otherwise you'll go out from this page

```
Enter Password:
           000
```

CURRENT TRANSFORMER SELECTION (…/5A or .../1A)
In this page it is possible to select the primary value of CT in Ampere and it represent the end scale value of currents when 5A or 1A income. The possible range is from 5A to 6000A with 5A steps.
The default value is 1000A.

```
CT  Set
           1000
```

VOLTAGE TRANSFORMER SELECTION (…/100V)
In this page it is possible to select the primary value of VT in Volts and it represent the end scale value of voltage when 100V income. Directly connected, this is the value of Phase-Neutral nominal voltage.
The possible range is from 50V to 4615V (8000V for Phase-Phase voltage V-ff). The default value 231V

```
VT  Set
           231
```

AVERAGE
In this page it is possible to select the reading numbers to which calculate the medium value. Practically it is the stability filter of measurements. Increasing the number, stability increases too. Regulation is possible from 1 to 15 and the default number is 3.

```
Average
           3
```

DEFAULT PAGE
First powering page. A different page can be selected within the available pages.
The default page is 0.

```
Default
page         0
```

SERIAL PORT SPEED
In this page it is possible to select the interface type which changes by the model chosen.
The meaning table is: 0= 9600 - 1=19200 – 2=38400 – 3=57600 – 4 =115200 bps. Default number is "0"

```
485 Speed
             0
```

NODE ADDRESS (MODBUS PROTOCOL)
It is the instrument identification number for serial communications in the net.
The address numbers are included from 1 to 255. Default value is 1.

```
485 Address
             1
```

PASSWORD
In this page it is possible to change the password in order to be able to enter in programming pages;
it is constituted by 3 numbers between 000 and 999. Default value is "000"

```
Password
           000
```

POSITIVE ACTIVE ENERGY RESET
It is enough to press one of the button to reset the value

```
TotalActive
Energy (+)
Reset      kWh
             0.0
```

```
TotalActive
Energy (-)
Reset      kvarh
             0.0
```

NEGATIVE ACTIVE ENERGY RESET
It is enough to press one of the button to reset the value

REACTIVE ENERGY RESET
It is enough to press one of the button to reset the value

```
TotalReactive
Energy Reset
           kvarh
             0.0
```
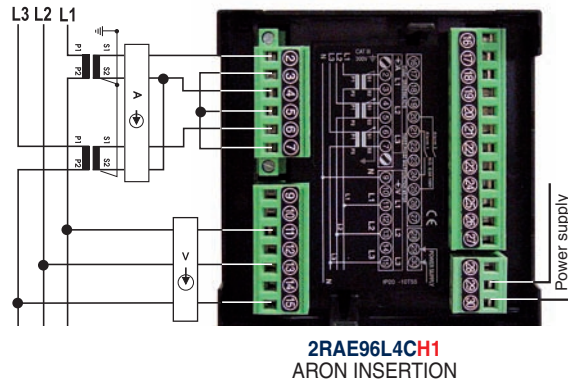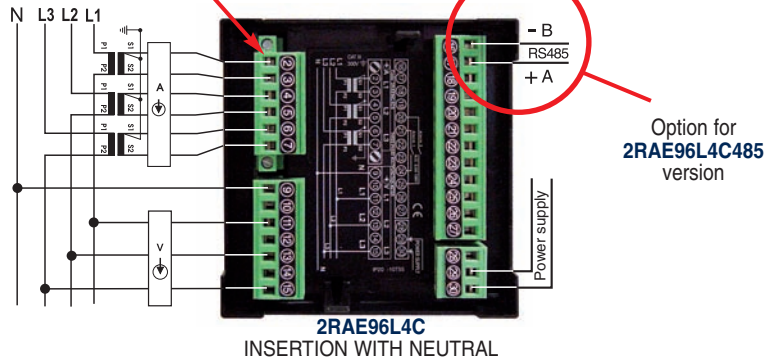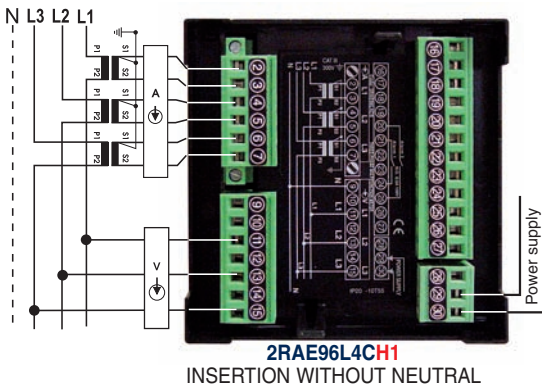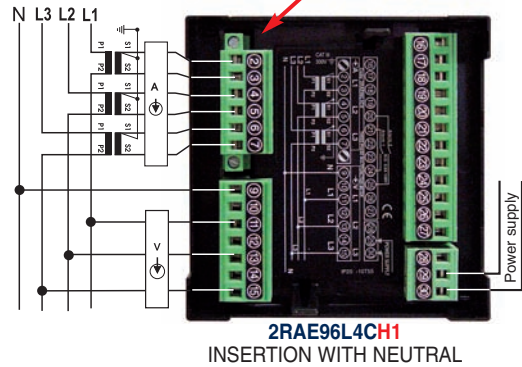
```
   Rel. Time
Reset
           hh:mm
R:         0.0
```

PARTIAL HOURS RESET
It is enough to press one of the button to reset the value
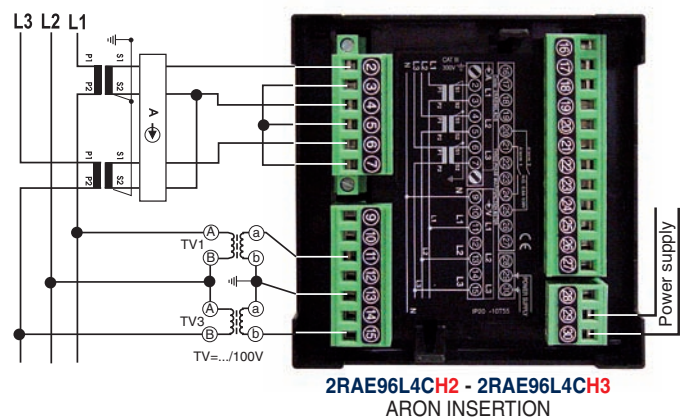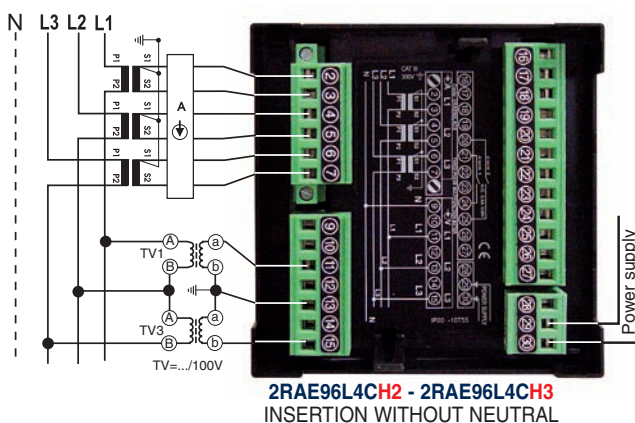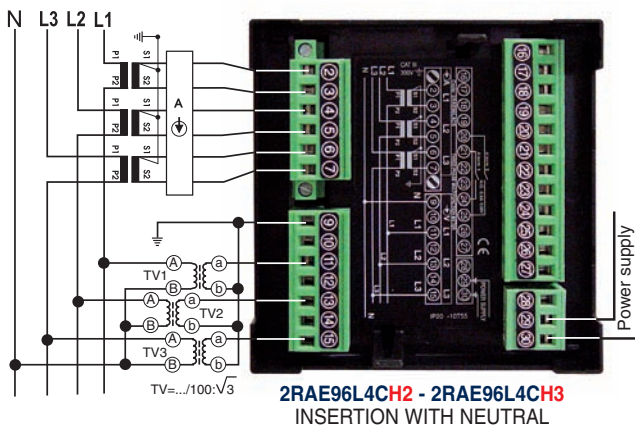
NEW

Differently from the others, the CT connecting terminal is fixed to avoid errors of insertion or damages caused by a possible secondary terminals CT opening

2RAE96L4C
INSERTION WITH NEUTRAL

Option for
2RAE96L4C485
version

2RAE96L4CH1
INSERTION WITH NEUTRAL

2RAE96L4CH1
ARON INSERTION

2RAE96L4CH1
INSERTION WITHOUT NEUTRAL

The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument
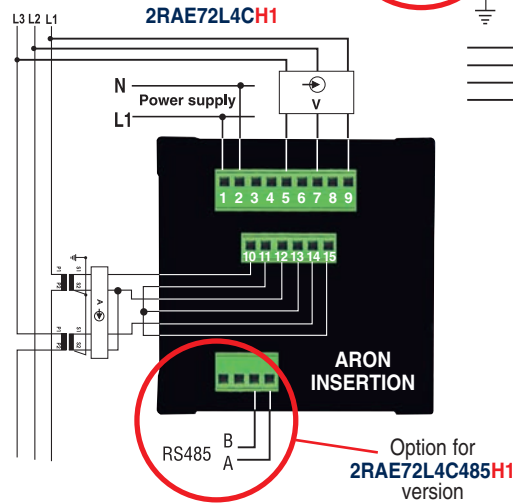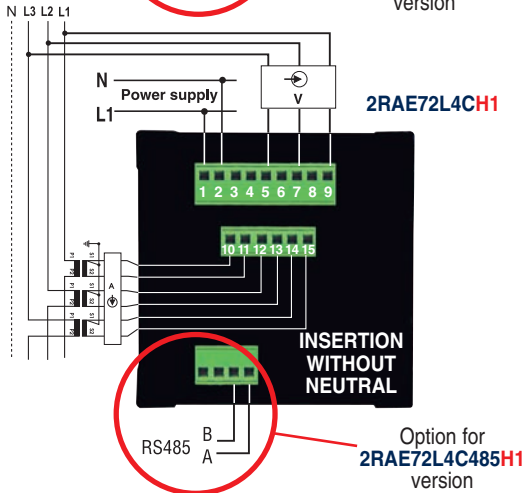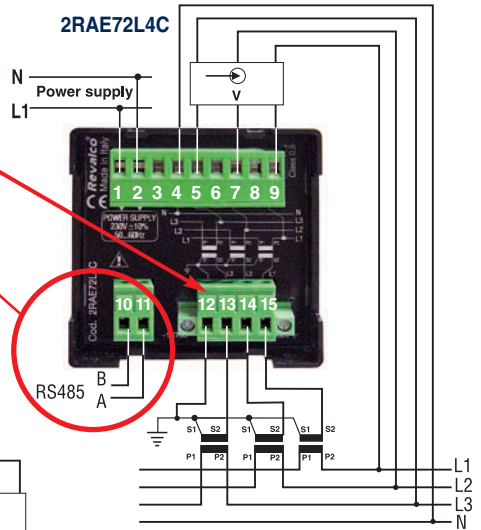
Instruments with code ...CH2 show primary voltages up to 9,9kV
Instruments with code ...CH3 show primary voltages from 10kV to 100kV

TV=.../100:√3
2RAE96L4CH2 - 2RAE96L4CH3
INSERTION WITH NEUTRAL

TV=.../100V
2RAE96L4CH2 - 2RAE96L4CH3
ARON INSERTION

TV=.../100V
2RAE96L4CH2 - 2RAE96L4CH3
INSERTION WITHOUT NEUTRAL

The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument

CONNECTION DIAGRAMS 72x72
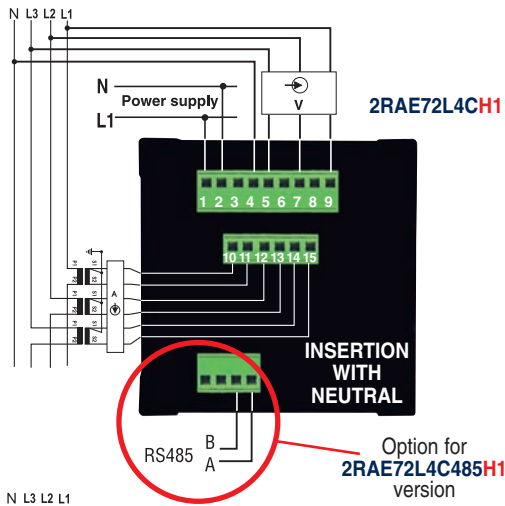
2RAE72L4CH1

INSERTION WITH NEUTRAL

RS485 B A

Option for **2RAE72L4C485H1** version

Differently from the others, the CT connecting terminal is fixed to avoid errors of insertion or damages caused by a possible secondary terminals CT opening
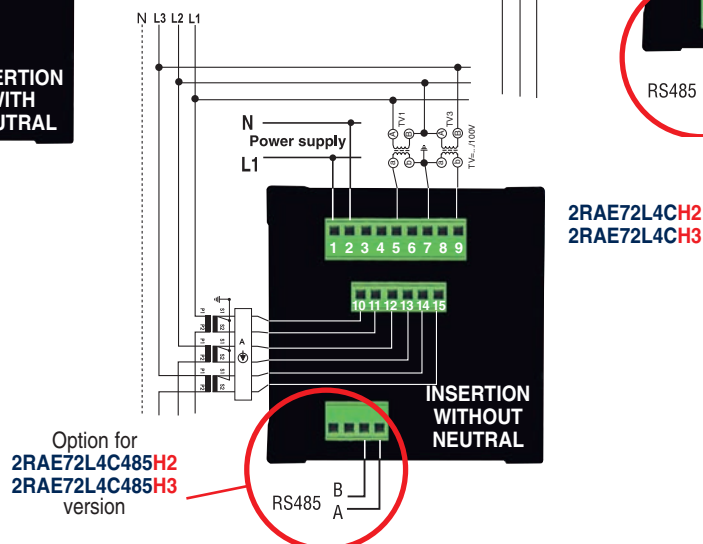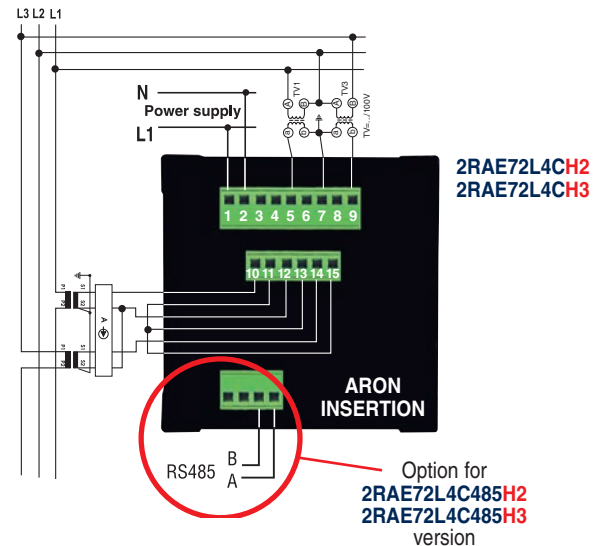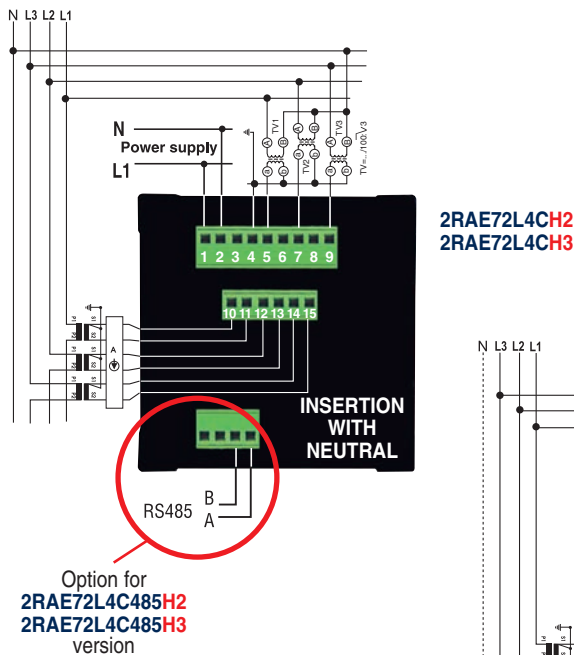
NEW

2RAE72L4C

Option for **2RAE72L4C485** version

RS485 B A

2RAE72L4CH1

INSERTION WITHOUT NEUTRAL

RS485 B A

Option for **2RAE72L4C485H1** version

2RAE72L4CH1

ARON INSERTION

RS485 B A

Option for **2RAE72L4C485H1** version

The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument

VT CONNECTION DIAGRAMS 72x72

- The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument
- Instruments with code ...CH2 show primary voltages up to 9,9kV
- Instruments with code ...CH3 show primary voltages from 10kV to 100kV

2RAE72L4CH2
2RAE72L4CH3

INSERTION WITH NEUTRAL

RS485 B A

Option for **2RAE72L4C485H2** **2RAE72L4C485H3** version

2RAE72L4CH2
2RAE72L4CH3

INSERTION WITHOUT NEUTRAL

RS485 B A

Option for **2RAE72L4C485H2** **2RAE72L4C485H3** version

2RAE72L4CH2
2RAE72L4CH3

ARON INSERTION

RS485 B A

Option for **2RAE72L4C485H2** **2RAE72L4C485H3** version

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2RAE96L4CS / 2RAE96L4CS485

OPERATION

- Powering the instrument you can see the following page

```
PowerOn
Ready
```

This is the first powering page. A different page can be selected within the available page present. At first powering the display shows automatically this page

- By pressing the frontal button "UP" the first page appears indicating: instrument code, interface type, node number and software revision

```
RAE TRMS CS
485 Adr: 001 64.00
```

→ Correct sequence of phases indication
light-out = correct sequence

- By pressing again the frontal button "UP", the second page appears showing the 3 phase-phase voltages (medium value, Frequency, 3 currents L1 L2 L3, Total Active Power and Total Power Factor.

```
3V: 400    F:   50.0
A.  1000 1000 1000
W:        693000.0
PfTot:   IND +0.99
```

- By pressing again the frontal button "UP", the third page appears showing the 3 phase-phase voltages L12-L23-L31, 3 phase-neutral voltages L1-L2-L3, difference of the phase-neutral voltages (asymmetry) and 3 currents L1 L2 L3.

```
Vp  400   400   400
Vn  231   231   231
DV  0
A   1000 1000 1000
```

- By pressing again the frontal button "UP", the fourth page appears indicating the phase-phase and total Power Factor.

```
Pf1:     IND +0.99
Pf2:     IND +0.99
Pf3:     IND +0.99
PfTot:   IND +0.99
```

- The fifth page will display the L1-L2-L3 Active Powers

```
Active     Pwr(W)
L1:      231000.0
L2:      231000.0
L3:      231000.0
```

- The sixth page will display the L1-L2-L3 Reactive Powers

```
React.    Pwr(var)
L1:           0.0
L2:           0.0
L3:           0.0
```

- The seventh page will display the L1-L2-L3 Apparent Powers

```
Apparent  Pwr (VA)
L1:      231000.0
L2:      231000.0
L3:      231000.0
```

- By pressing again the frontal button "UP", the new page appears showing the all powers (Active, Reactive and Apparent)

```
Total      Powers
W:        693000.0
var:           0.0
VA:       693000.0
```

- By pressing again the frontal button "UP", the new page appears indicating the Active Energy (Import +). It is possible to reset this parameter on the programming page.

```
Total      Active
Energy     (+)
           kWh
         347670.0
```

- By pressing again the frontal button "UP", the new page appears indicating the Active Energy (Export -). It is possible to reset this parameter on the programming page.

```
Total      Active
Energy     (-)
           kWh
            0.0
```

- By pressing again the frontal button "UP", the eleventh page appears indicating the Total Reactive Energy. It is possible to reset this parameter on the programming page.

```
Total     Reactive
Energy
           kvarh
          8630.0
```

- By pressing again the frontal button "UP", the new page appears indicating the Total and Partial hours counters It is possible to reset the Partial hours parameter on the programming page.

```
         Outputs
         State
Out1            Out2
Off              On
```

- By pressing again the frontal button "UP", the thirteenth page appears indicating the alarm relay situation. The status of relay cannot be "ON" during the first 10 seconds after powering and cannot change during the parameters programming.

```
      Time
           hh:mm
Tot:    11327:53
Rel:     3420:21
```

PARTICULAR DISPLAYING OF POWER FACTOR

- When the Apparent power is null, little lines are displayed
- When Cos phi =1 the mark is displayed
- When Cos phi =0 no marks are displayed
- The indication of 2nd quadrant (Power export) is displayed with Cos φ=120°

```
Pf1:          -.--
Pf2:         +1.00
Pf3:          0.00
PfTot:    CAP -0.50
```

- To enter in programming phase press the right-hand button (UP) more than 4 seconds. "Program Mode" page will be displayed and after 4 seconds the other pages with actual values will be showed. If it is necessary to modify the parameters, press the button when it appears on the display. To increase the value press "UP", to decrease it press "DOWN". Maintaining pressure on the button the sliding is automatic and the speed increase automatically; once the needed value is displayed release the button (the new value will be saved in a permanent memory)

- **INPUT PASSWORD ADMITTING**
This page will be displayed only if parameter "Password" was modified and it is different from "000". To enter in programming phase it is necessary to write the same memorized number otherwise you'll go out from this page

```
Enter Password:
          000
```

- **THRESHOLD 1/THRESHOLD 2 SELECTION**
⚠️ In this page it is possible to select the threshold type (Hi=max, Lo=min) and if it must remain light-out (OFF). In case   OFF is selected, all the pages related to the threshold will be not present. It will be possible to act the relay by a MODBUS command from serial line.

```
Th1 Sel          Th2 Sel
         Hi               Hi
```

- **THRESHOLD 1/THRESHOLD 2 DELAY TYPE APPLICATION**
In this page it is possible to select the delay threshold type which can be OFF-ON or ON-OFF. This page will be displayed if Th1/Th2 different from OFF

```
Th1 DD           Th2 DD
      Off-On           Off-On
```

- **THRESHOLD 1/THRESHOLD 2 DELAY TIME**
In this page it is possible to select the delay time threshold which can be selected from 0,0 to 25,5 seconds. This page will be displayed if Th1/Th2 different from OFF

```
Th1 Dly          Th2 Dly
         0.1              0.1
```

- **THRESHOLD 1/THRESHOLD 2 PARAMETER**
In this page it is possible to select the parameter to which associate the threshold between: 3Vn,3A, F, W+, W-, DW, V12,V23,V31, V1,V2, V3, A1, A2 and A3. 3 Phase-Phase voltages (Vff) is selected by default. This page will be displayed if Th1/Th2 different from OFF

```
Th1 Src          Th2 Src
       3Vff             3Vff
```

- **THRESHOLD 1/THRESHOLD 2 PERCENTAGE VALUE**
This page shows the selected parameter and its value . Default page = 50%. Starting with the selection, over the percentage value , you'll see the real equivalent value. This page will be displayed if Th1/Th2 different from OFF

```
Th1 Val          Th2 Val
3Vff      50%    3Vff      50%
```

- **CURRENT TRANSFORMER SELECTION (…/5A or …/1A)**
In this page it is possible to select the primary value of CT in Ampere and it represent the end scale value of currents when 5A or 1A income. The possible range is from 5A to 6000A with 5A steps. The default value is 1000A.

```
CT  Set
          1000
```

- **VOLTAGE TRANSFORMER SELECTION (…/100V)**
In this page it is possible to select the primary value of VT in Volts and it represent the end scale value of voltage when 100V income. Directly connected, this is the value of Phase-Neutral nominal voltage. The possible range is from 50V to 4615V (8000V for Phase-Phase voltage V-ff). The default value 231V

```
VT  Set
           231
```

- **AVERAGE**
In this page it is possible to select the reading numbers to which calculate the medium value. Practically it is the stability filter of measurements. Increasing the number, stability increases too. Regulation is possible from 1 to 15 and the default number is 3.

```
Average
             3
```

- **DEFAULT PAGE**
First powering page. A different page can be selected within the available pages. The default page is 0.

```
Default
page         0
```

- **SERIAL PORT SPEED**
In this page it is possible to select the interface type which changes by the model chosen. The meaning table is: 0= 9600 - 1=19200 – 2=38400 – 3=57600 – 4 =115200 bps. Default number is "0"

```
485 Speed
             0
```

- **NODE ADDRESS (MODBUS PROTOCOL)**
It is the instrument identification number for serial communications in the net. The address numbers are included from 1 to 255. Default value is 1.

```
485 Address
             1
```

- **PASSWORD**
In this page it is possible to change the password in order to be able to enter in programming pages; it is constituted by 3 numbers between 000 and 999. Default value is "000"

```
Password
           000
```

- **POSITIVE ACTIVE ENERGY RESET**
It is enough to press one of the button to reset the value

```
TotalActive
Energy (+)
Reset      kWh
           0.0
```

```
TotalActive
Energy (-)
Reset      kvarh
           0.0
```
- **NEGATIVE ACTIVE ENERGY RESET**
It is enough to press one of the button to reset the value

- **REACTIVE ENERGY RESET**
It is enough to press one of the button to reset the value

```
TotalReactive
Energy Reset
           kvarh
           0.0
```

```
Rel. Time
Reset
         hh:mm
R:        0.0
```
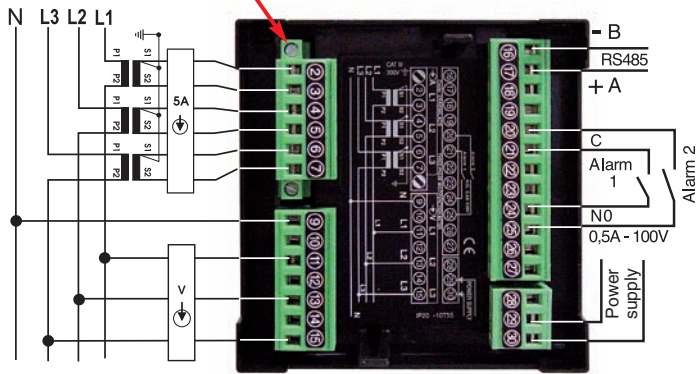- **PARTIAL HOURS RESET**
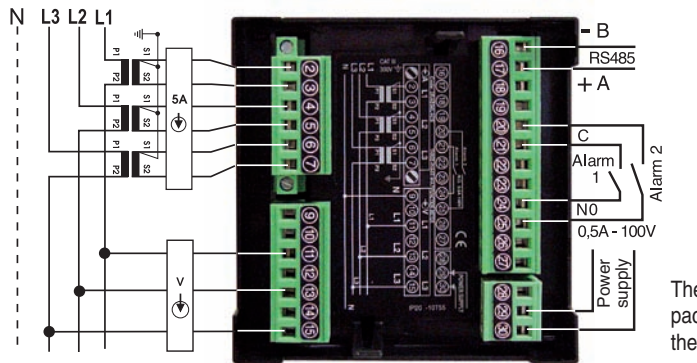It is enough to press one of the button to reset the value

NEW

Differently from the others, the CT connecting terminal is fixed to avoid errors of insertion or damages caused by a possible secondary terminals CT opening
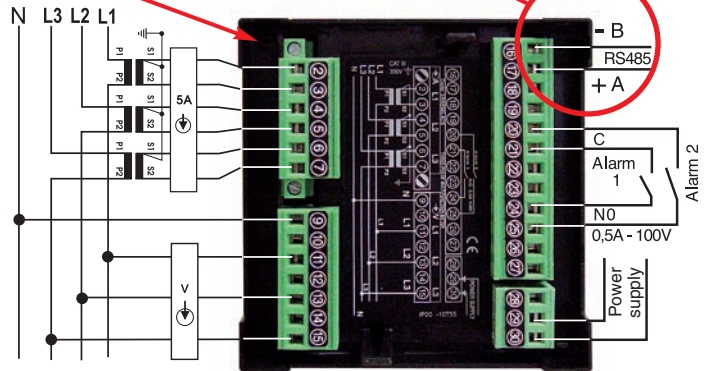
Option for
2RAE96L4CS485 version

Differently from the others, the CT connecting terminal is fixed to avoid errors of insertion or damages caused by a possible secondary terminals CT opening
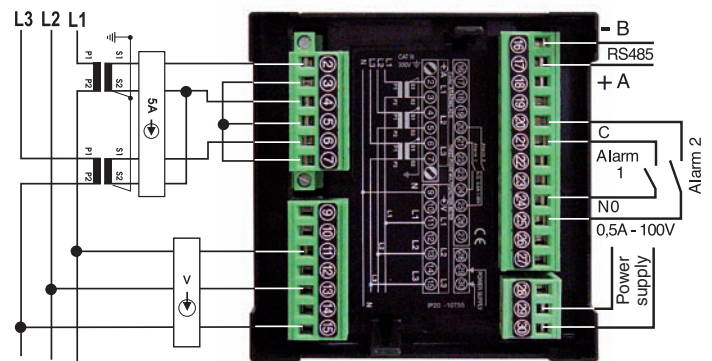

2RAE96L4CS485H1
INSERTION WITH NEUTRAL
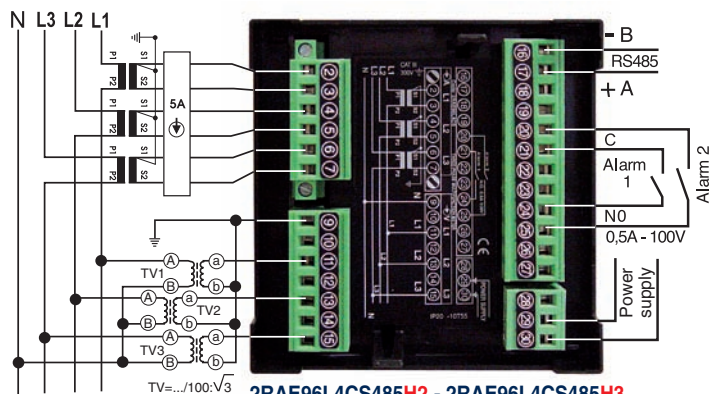

2RAE96L4CS
INSERTION WITH NEUTRAL

2RAE96L4CS485H1
INSERTION WITHOUT NEUTRAL

2RAE96L4CS485H1
ARON INSERTION

The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument
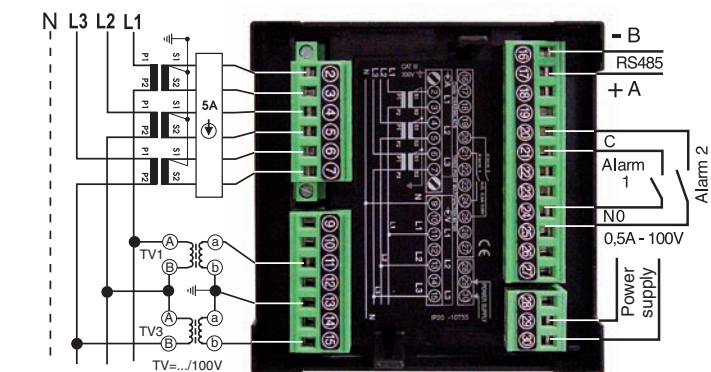
2RAE96L4CS485H2 - 2RAE96L4CS485H3
INSERTION WITH NEUTRAL

■ Instruments with code ...CH2 show primary voltages up to 9,9kV
■ Instruments with code ...CH3 show primary voltages from 10kV to 100kV
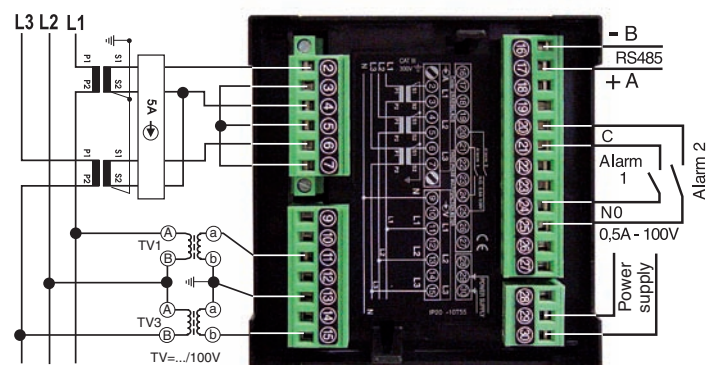
2RAE96L4CS485H2 - 2RAE96L4CS485H3
ARON INSERTION

2RAE96L4CS485H2 - 2RAE96L4CS485H3
INSERTION WITHOUT NEUTRAL

The same instrument can be connected in three different ways. For this reason (into the packing box) you'll find 3 different connection labels. So depending by the chosen connection the customer has to fix the proper label on the back side of instrument

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FOR MODELS 2RAE96L4C485, 2RAE96L4CS485, 2RAE96L4CS485H2 AND 2RAE96L4CS485H3
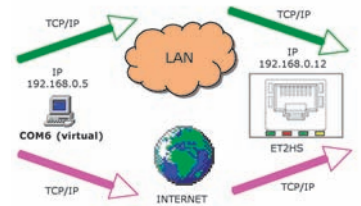
FOR MODEL 2RAE72L4C

- PCB provided by an embedded RJ45 Ethernet socket and software
- Installing the software on a PC it is possible to have a series of tools which permit, passing through the Ethernet net (LAN or Internet), to establish together with the instrument a connection similar to a COM port (standard communications port) generated in virtual way, taking advantage as signal transport by the TCP/IP protocol.
- Hardware characteristics:
  - Transmission speed from 150 to 115.200 baud
  - Standard Ethernet socket RJ45
  - Ethernet port speed: 10/100 Mbit
  - Working situation controlled by 4 diagnostic leds
  - Ethernet port galvanically insulated
  - Not powered by the Ethernet cable or by the data net
  - Supports (without virtual COM port) UDP, ICMP(ping) and DHCP protocols
  - Working temperature: from -5°C to 55°C
- In particular way, after the connection of instrument to the net, the software permits to:
  - To assign an univocal IP address (example: 192.168.0.12)
  - Starting from IP address, to generate o PC a virtual port "COMx" (example: COM6) to which refer using the forms of this hardware. Every supervision software (SCADA or other) which dispose of Modbus RTU communication protocol will be able to converse with this device through this port avoiding the TCP/IP translation but under the condition that the device be reachable in the net (Intranet or Internet) by its IP (example by its address ping)

- ORDER EXAMPLES: 2RAE96L4C485230ETH2S; 2RAE96L4CS485-P1ETH2S; 2RAE96L4CS485H2-P2ETH2S

FOR MODELS 2RAE96L4C485, 2RAE96L4CS485, 2RAE96L4CS485H2 AND 2RAE96L4CS485H3

FOR MODEL 2RAE72L4C

- PCB provided by an embedded RJ45 Ethernet socket and software which permits under a request by a normal browser (example Internet Explorer) to enter in a Web server organized in web pages (HTML)
- Hardware characteristics:
  - Standard Ethernet socket RJ45
  - Ethernet port speed: 10/100 Mbit
  - Working situation controlled by 4 diagnostic leds
  - Ethernet port galvanically insulated
  - Not powered by the Ethernet cable or by the data net
  - Working temperature: from -5°C to 55°C
- In particular way, after the connection of instrument to the net, the software permits to:
 - To assign an univocal IP address (example: 192.168.0.12)
  - To assign an alphanumerical name to the product (example Substation SUD)
  - Enter to a Web server like a normal internet site simply dialling its IP address in a browser (example: Internet Explorer). In a simply graphic form (table) the main measures will be shown
  - Up to 8 contemporaneous sessions (8 different users contemporary connected)
  - Connect to this device through its IP but under the condition that the device be rea chable in the net (Intranet or Internet) (example by its address ping)
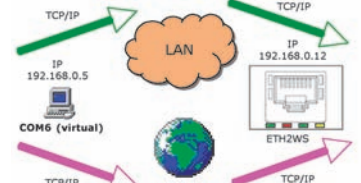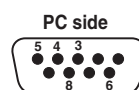
- ORDER EXAMPLES: 2RAE96L4C485230ETH2WS; 2RAE96L4CS485-P1ETH2WS; 2RAE96L4CS485H2-P2ETH2WS

FOR MODELS 2RAE96L4C485, 2RAE96L4CS485, 2RAE96L4CS485H2 AND 2RAE96L4CS485H3
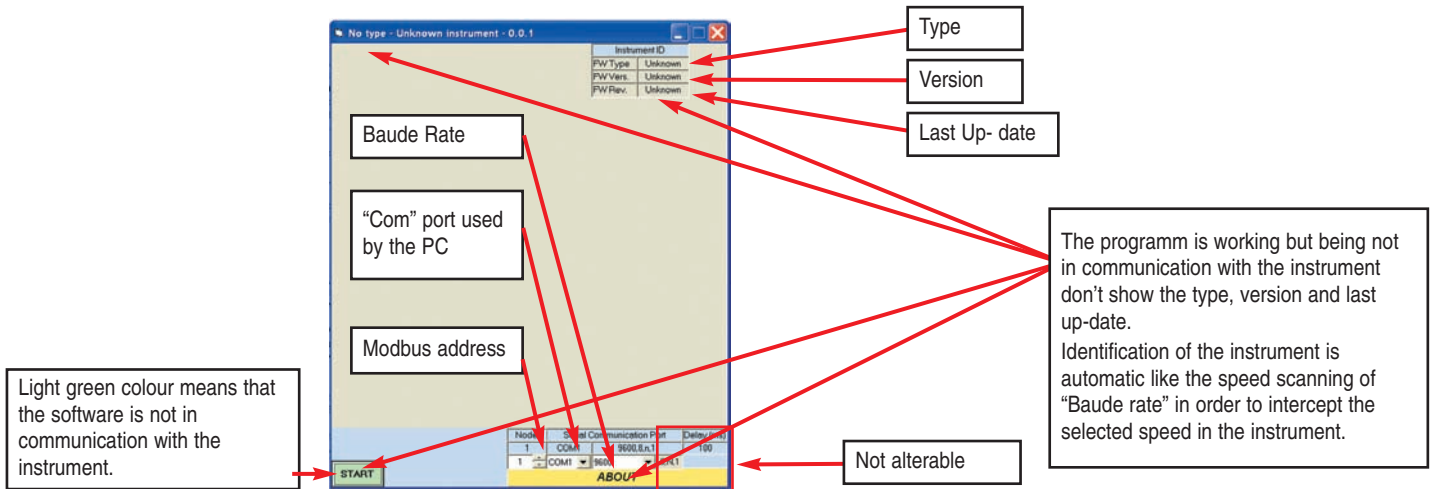- ORDER EXAMPLES: 2RAE96L4C485230PROF; 2RAE96L4CS485-P1PROF; 2RAE96L4CS485H2-P2PROF
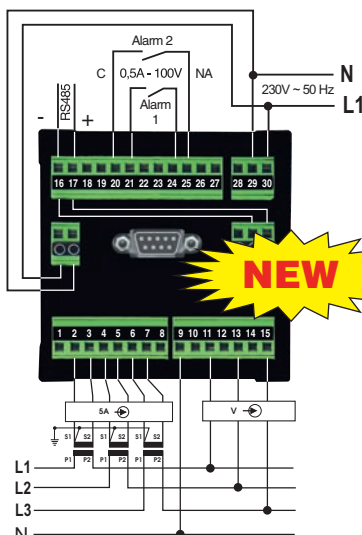
| DB9F PROFIBUS CONNECTOR	
Pin	Signal
1	
2	
3	Line B
4	RTS
5	GND BUS (Insulated)
6	+5V BUS (Insulated output max 100mA)
7	
8	Line A
9	

PC side

SOFTWARE USE

INSTRUCTIONS: Use of software equiped to the types provided by communication interface RS485, BL or RS485 and BL. After the download from CD or from the INTERNET WEB SITE the free software(it permits to see the main measurements available on the instrument) proceed to its installation. Once installed the software, execute the application. In "run" mode, the software will show this display:
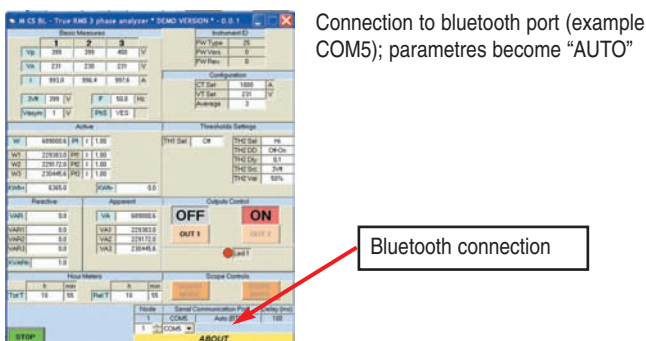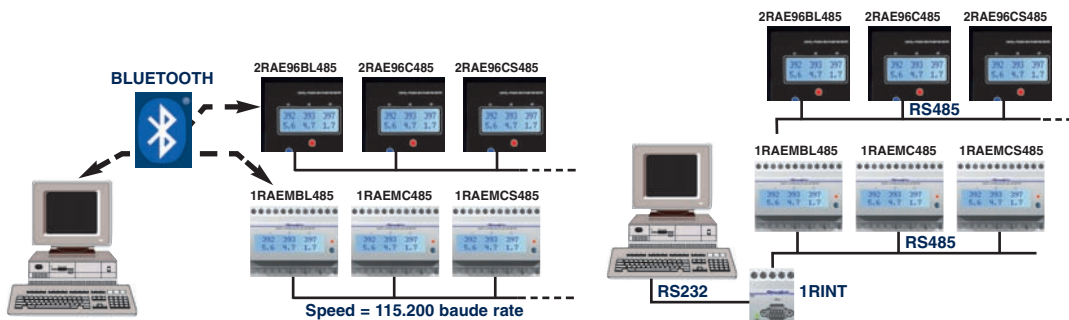
Type

Version

Last Up- date

Baude Rate

"Com" port used by the PC

Modbus address

The programm is working but being not in communication with the instrument don't show the type, version and last up-date.
Identification of the instrument is automatic like the speed scanning of "Baude rate" in order to intercept the selected speed in the instrument.

Light green colour means that the software is not in communication with the instrument.

Not alterable

By the mouse press start............
The instrument in this example is the BL type (the "Top" in our range). The software starts the scanning (self-identification) and it connect itself to the instrument.

Model

Type   Version   Last Up- date
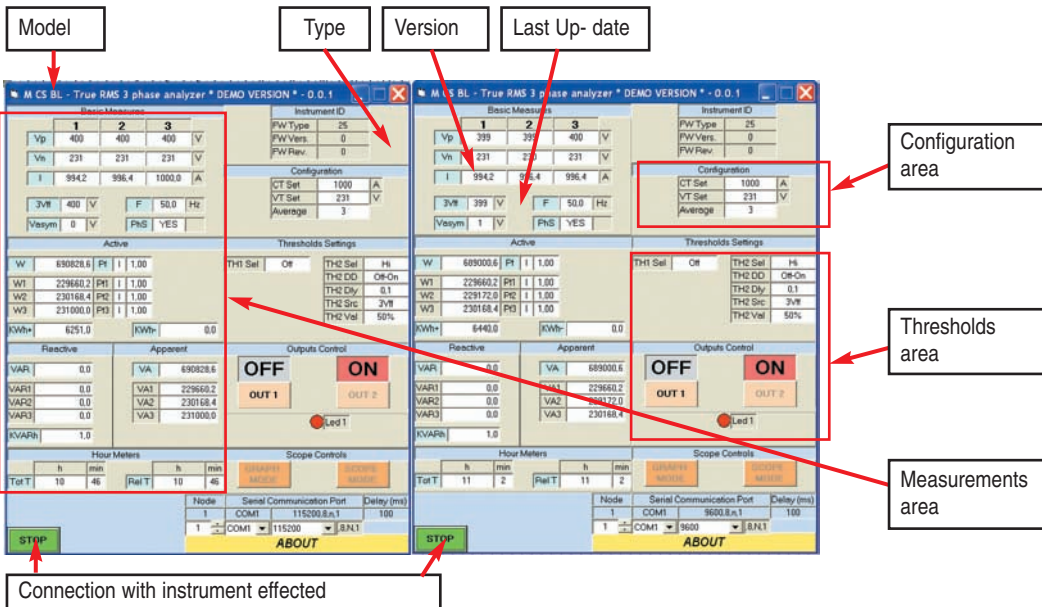
Founded the connection by cableat 115200 bps or at 9600. Configured the display, it visualize the data............OR

Configuration area

Possibility to use the "access point" in Bluetooth standard (peripheric inserted on USB port or on PC). In this way it is possible to have a wireless connection with this type of instrument with the advantage to access to the instrument by everybody know the PIN CODE (printed on the back of the instrument).
More, being present the RS485 interface it is possible the conversion from BLUETOOTH to RS485. It is possible to realize a WIRELESS connection with the first instrument in a chain of instruments having the RS485 interface only and by this access to the others. Alternatively it is possible connect in RS485 this instrument also and proceed to the pothers,if present, by a classic connection with two standard wires.

Thresholds area

Measurements area

Connection with instrument effected

BLUETOOTH

Speed = 115.200 baude rate

RS485

RS485

RS232   1RINT

Connection to bluetooth port (example COM5); parametres become "AUTO"

By pressing STOP button the word changes to START; the colour change (light green = stop). From the display the data disappear being the connection with the instrument suspended. In this condition it is possible to push one of the two graphic buttons. Press GRAPH MODE.

Bluetooth connection

"Oscilloscope" visualization mode

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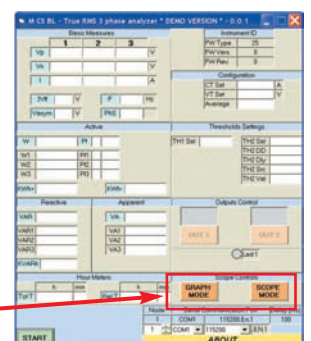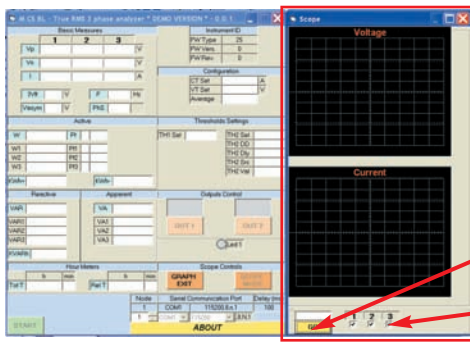
The software visualizes contemporary the measurements in numerical form and their wave form like the oscilloscope. It is capable to manage the synchronism of phase L1 and to visualize by six different traces, the relative three voltages and currents.

"Oscilloscope" visualization mode

"Start of communication "button"

Insertion of phases to visualize (voltage and current)

Indipendently by the previous "Com" speed, it is forced and blocked on 115200 bps.
The connection with the instrument continues in "MODBUS RTU" as before.

By pressing the "GO button, the connection with instrument starts.

Measurements and curves are simultaneous. Colours are equal for the voltage phase and relative current. The n. 1 (relative to phase L1) is blue-light blue, the n. 2 (relative to phase L2) is red-light red, the n. 3(relative to phase L3) is green-light green By pressing the left side of the mouse on a graphic, the thickness of the line increase, by pressing the right side id decrease.

Line 1 only is selected
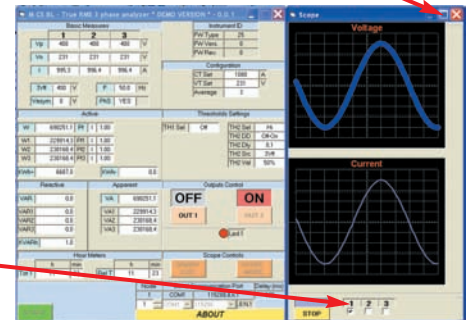
"Enlarge" the window.

By pressing the left side of the mouse on the graphic, thickness of line increase; by pressing the right side of the mouse it decrease.
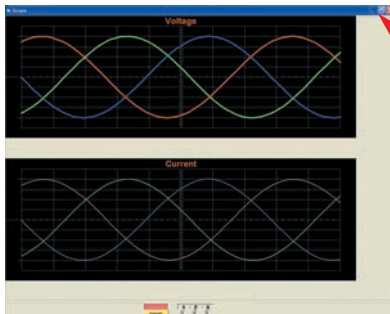
Close

Reduce

It is possible tu visualize the curves on the big display using the "enlarge" button.
By "Reduce" the display come back small, while the button "Close" the application is NOT CLOSED but it shows the original display with measurements and graphic (the graphic is setted up again as "Default").
To stop, press "STOP"; to exit press "GRAPH EXIT" in meantime actived.

Coming back in measurement mode, when the button START/STOP is green, it is possible to use the output relay 1 (this is permitted when the output is not used as alarm).

It means that during the programm phase threshold 1 remains in "off" so it is possible to control it from remote as an available resource for generic use (swith-on or switch-off lamps or machines etc.)
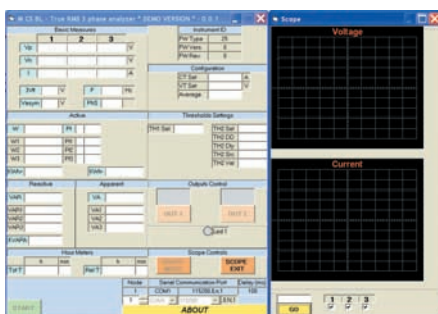
Th1 Sel
                    Off

Push STOP to restore the graphic access keys .
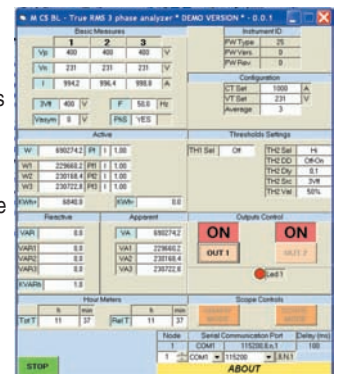
OSCILLOSCOPE FUNCTION

Press "SCOPE MODE"

After "SCOPE MODE" is pressed the graphic display works as before but:
1) The numerical measurements are not displayed
2) The connection with the instrument is not MODBUS RTU but propietary
3) The display shows frequently a lot of graphic informations

The scope of this software resource, is to obtain the visualization of temporary phenomena in real time having an "oscilloscope with six quick traces" .
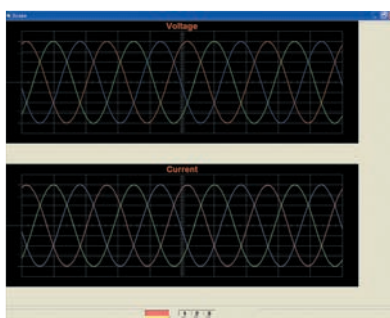
This software version is FREEWARE.

In a next future, on the web site, you'll find a PRO (professional) software to obtain a more complete electrical analysys of the data furnished by the instrument. It will be enriched by measurements as result of mathematical and geometrical the wave form analysys of the electrical signal.
The PRO version will be under use's licence and not Freeware

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COMPUTER INTERFACE

1RINT

Is an interface for use with personal computers compatible with IBM AT via a serial cable RS232 CANNON DB9 with the following characteristics:

- PC Entry,   female connectors, nine pin
- Interface Entry,   male connectors, nine pin
- In cases of Line Disturbance, connect the "S" wire (contained in the cable) to ground, on one side.

RINT SIDE RS232

Tx = 2 → Rx = 2
Rx = 3 ← Tx = 3
GND = 5 → GND = 5
S ——— S

PC SIDE
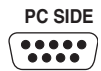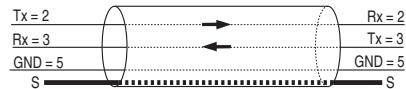
This converter can work with either 422 or 485 which are selectable by means of a switch located in the upper part of the device (under the slide).
The device works also as galvanic separation between serial lines.

Switch to the left — RS485

Switch to the right — RS422

When the interface is powered, the working green led lights (Power ON), while during the comunication, the yellow led lights (Rx) for the input signal and the red led lights (Tx) for the output signal.
The speed of the serial comunication is selfconfigured, between 1200 baud and 19200 baud. It adapts to the speed of the instrument to which the converter is connected.
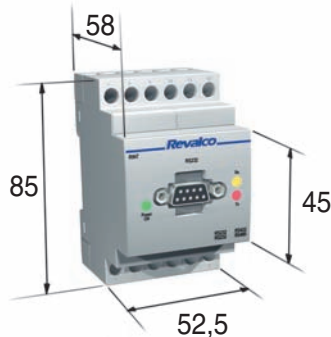
TEST VOLTAGE	2 kV a 50Hz for 1 minute	
POWER SUPPLY	230V +/- 10% 50/60Hz	
WORKING TEMPERATURE	-5°C...+ 50°C	
STORAGE TEMPERATURE	- 20°C...+ 80°C	
PROTECTION DEGREE	IP 20	

CONSUMPTION	3VA
BIDIRETIONAL SERIAL COMMUNICATION	selectable between RS 232 / RS 422 and RS 232 / 485
DIMENSIONS	3 rail DIN modules

DIMENSIONS in mm

58
85
45
52,5

CONNECTION

Tx/Rx RS485 (+) (-) | Rx RS422 (+) (-) | Tx RS422 (+) (-) | GND

7 8 9 10 11 12

1   3   5

L1
N   230V ~ 50 Hz
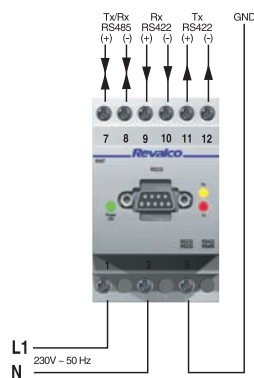
SERIAL COMMUNICATION

- **Example of application:** connection for distances more than 15 meters

Max 15 m
RS232
RS232
RS485 Max 800 m
RS232 Max 15 m
1RINT   1RINT
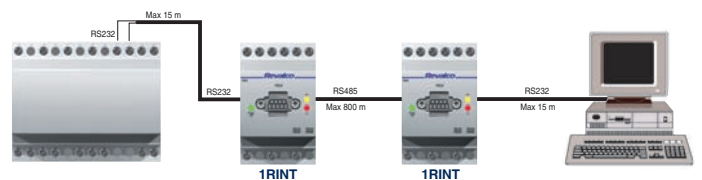
RINTC

The USB Serial Converter permits the installation of a virtual serial port (COM) by the use of a PC USB port.
New installed port will be "sen" by the operative Windows system as an additional COM port and it can be used in every application. This device is supplied in a standard kit which includes:
- 485 cable which permits the use as converter from RS232 to RS485 interface
- 2323 adapter cable able to create the virtual serial port starting from an USB port.
Kit is comprehensive of software driver for Windows XP and Windows Vista.

Software available on our web site www.revalco.it

PC side
USB 2.0 interface full speed compatible
UART (Integrated serial interface) 7 or 8 bit with parity Odd/Even/Mark space/No parity
Hardware compatibility (RTS#/CTS#) or X-On/X-OFF software handshaking
Power supply from USB interface (max 50mA) only

RS485 Communication data
- Communication with hardware interface, 2 wires (A and B)
- Up to 32 devices contemporary
- Ring with 800 meters max extension
- 3kV galvanic insulation
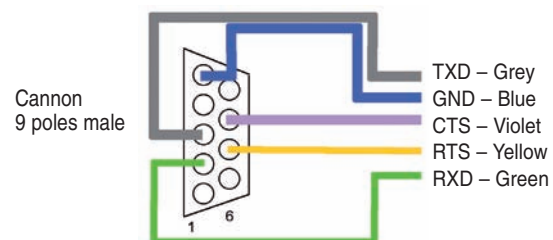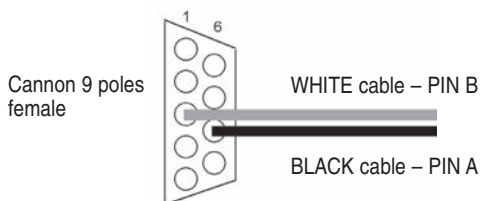- Baud rate from 1200 to 115200 bps

ADAPTER Side
- Status indication " FRAME TRANSMISSION ON AIR!"
- Two, not contemporaneous possibilities of use are possible:
  1) RS485 Serial Interface galvanically insulated (3kV) for conventional net, two wires
  2) RS232 Serial Interface for conventional net, 5 wires

RS232 Communication data
- Communication with hardware interface, 5 wires (RX-TX-CTS-RTS-GND)
- Point-point Connection
- Ring with15 meters max extension
- No galvanic insulation
- Baud rate from 1200 to 115200 bps

Cannon 9 poles female
WHITE cable – PIN B
BLACK cable – PIN A

Cannon 9 poles male
TXD – Grey
GND – Blue
CTS – Violet
RTS – Yellow
RXD – Green

Ambient conditions
Ambient temperature: nominal range 0….+45°C – extreme range: -5…+55°C – storage temp.: -10….+70°C
Relative humidity: 10….95% - Atmospheric pressure: 70…110 kPa
**Standards**
Safety:
Electromagnetic Compatibility (immunity): CEI EN 61000-6-2 (ex EN 50082-2) - Electromagnetic Compatibility (emission):: CEI EN 61000-6-4 (ex EN 50081-2)

Ethernet connection

By the use of a TRP transducer, it is possible to connect the electrical measurement station in a more wide net of ethernet resources.

From one side TRP will communicate in MODBUS RTU RS485 with the station or with the ring of stations present in the net

From the other it will be inserted by a RJ45 connector in an ethernet ring.IP address is settable on the TRP transducer.
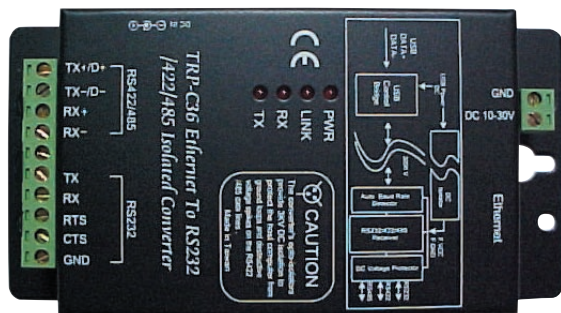

The transducer is galvanically insulated up to 3kV DC between two interfaces and it is protected by the surge of interface RS422/485. It is therefore recommanded in case of long wires connection and/or in case on whichit is possible to have differences of potential between the devices.

This TRP transducer has the I/F ethernet on the connector RJ45 and terminals for connection of I/F RS232/422/485 and power supply. It incorporate an "http" server; it permits to enter on all function's (communication parameters set also), directly through the ethernet way from a normal browser (example: Internet Explorer).
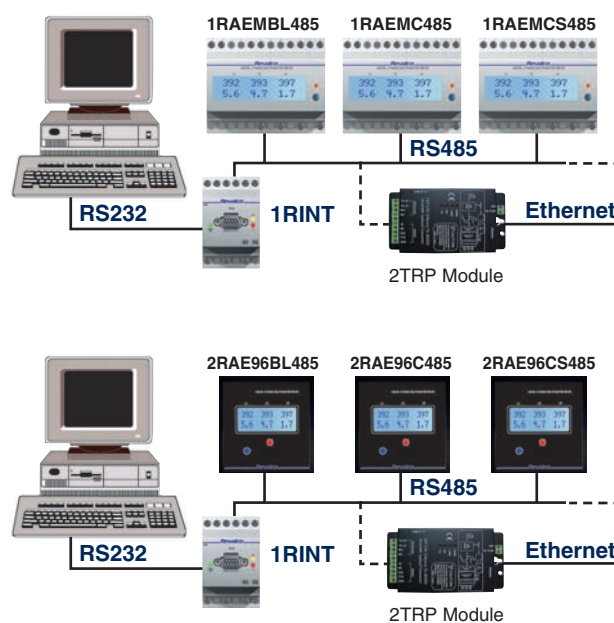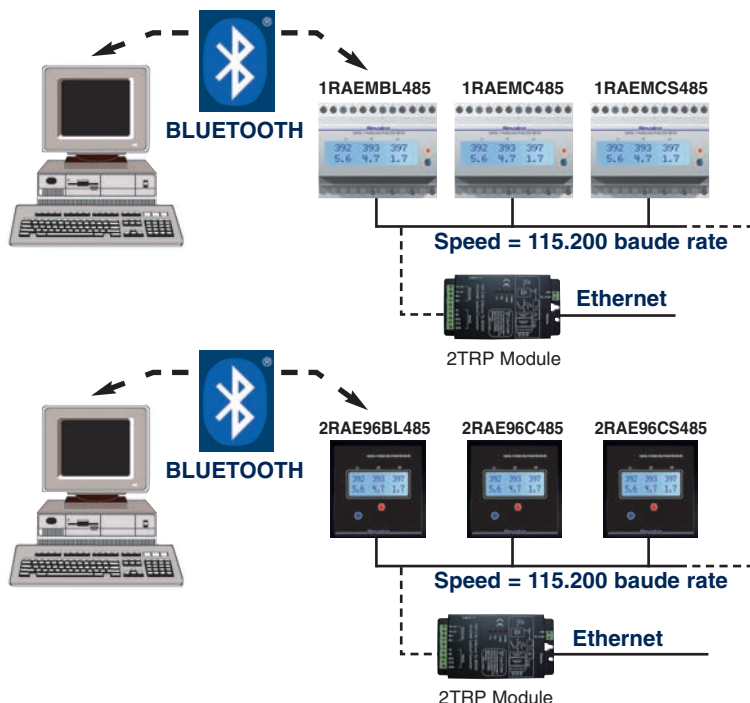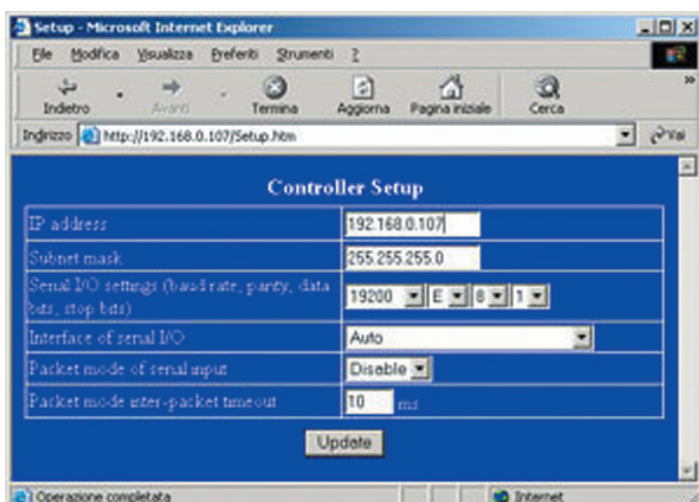
Auxiliary power supply	10-30Vdc 1.2W
Interface data	Ethernet RJ45 10Mbps RS232 RS422/485
Baud rate	from 1200bps to 115Kbps
Protocols	ARP,UDP, TCP, ICMP, HTTP, DHCP, IP
Status indicators	Power ON Link RX/TX Activity
Galvanic insulation	3000Vdc
Working temperature	from -20 to +75°C Humidity: 10-95%
Dimensions	75x150x25mm
Weight	240g
Standards	EN 55022 EN 55024 EN 61000-3-2 EN 61000-3-3