

WM2 - DIN / EM2 - DIN

OPERATING INSTRUCTIONS

• General features	2
• WM2-DIN Technical features	3
• EM2-DIN Technical features	9
• Installation	11
• Preliminary operations	12
• Front panel description	12
• Operating mode	14
• Electrical connection diagram	20

Important :

We suggest you keep the original packing in case it is necessary to return the instrument to our Technical Service Department.

In order to achieve the most from your instrument, we recommend you read this instruction manual carefully.

CARLO GAVAZZI Instruments**WM2-DIN / EM2 DIN 16-bit μ P-based universal power analyser / energy meter**

rev. 0

Operating instructions**Important:**

We suggest you keep the original packing for a further shipping of the instrument.

In order to guarantee a correct use of the instrument, we recommend the user to carefully read the present instruction manual.

GENERAL FEATURES

The most important features are:

- TRMS measurements
- 4 input ranges
- Connections to CT (up to 5000/5A)
- WM2-DIN only: Measurements of kWh (total), kVArh (total), kWh (partial), kVArh (partial), kW, kVA, $\cos\phi$, V (L-L) avg, V (L-N), I.
- EM2-DIN only: Measurements of kWh (total), kVArh (total), kWh (partial), kVArh (partial).
- Outputs: WM2-DIN only: DC pulse (programmable pulse for kWh, kVArh), serial RS 485 (MODBUS/JBUS), EM2-DIN only: RS485 with static output

The main programming parameters are:

- Programming of the password

2

- Selection of the electrical system
- Programming of CT ratio
- Programming of the serial output (when present)
- Selection of energy measurement
- Programming of the digital filter
- Programming of the power integration time (Wavg).

WM2-DIN TECHNICAL FEATURES

- INPUT SPECIFICATIONS -**ACCURACY (48 to 62 HZ):**

- Voltage/current: $\pm 1\%$ f.s. includes also frequency and output load influences.
- Energy: $\pm 1\%$ RDG (hour time base). Includes also frequency and output load influences.
- Active power (@ $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, R.H. $\leq 60\%$): $\pm 1\%$ f.s. ($\cos\phi \geq 0.7$ L/C, 0 to 1.2 In, 0.5 to 1.2 Un).
- Reactive power (@ $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, R.H. $\leq 60\%$): $\pm 1\%$ f.s. ($\sin\phi \geq 0.8$ L/C, 0 to 1 In, 0 to 1 Un).
- Power factor ($\cos\phi$) (@ $25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, R.H. $\leq 60\%$): $\pm 1\%$ f.s. ($\cos\phi \geq 0.7$ L/C, 0.6 to 1.2 In, 1 to 1.2 Un).

ADDITIONAL ERRORS:

- Humidity: $< 0.3\%$ f.s., 60% to 90% R.H.
- Power supply: ± 0.5 RDG, -15 +10% power supply
- Magnetic field: $< 0.1\%$ f.s. @ 400 A/m.

RATED INPUT:

- Current: 2 inputs (one/three-phase balanced load); 6 inputs (one/three-phase unbalanced load).
- Voltage: 2 inputs (one/three-phase balanced load); 4 inputs (one/three-phase unbalanced load).

3

- Insulation: among the voltage and the current inputs: 2000Vrms;
Among the current inputs: 2000Vrms.

TEMPERATURE DRIFT: ± 250 ppm/°C

DISPLAY: 3-dgt (instantaneous measurement) (only WM2-DIN)
6-dgt (energies)
Backlighted LCD, h 13mm.

DECIMAL POINT POSITION: Instantaneous measurement: automatic selection according to the primary current of the current transformer being connected:

CT \leq 5A :11.11

CT \leq 50.0A :111.1

CT \leq 500.0A :1111

CT \leq 999.9A :11110

Energy measurements:

max. resolution: 1kWh/1VArh

min. resolution: 1kWh/1kVArh

MAX. AND MIN. INDICATION:

- | | | |
|---------------------------|-------------|--------------|
| • Voltage: | Max. 600 | min. 0 |
| • Current (CT ratio = 1): | Max. 6.00 | min. 0.00 |
| • Cos ϕ : | Max. 1.00 | min. 0.00 |
| • Power(CT ratio = 1): | Max. 5.40 | min. 0.00 |
| • Active energy: | Max. 999999 | min. -199999 |
| • Reactive energy: | Max. 999999 | min. 0 |

SAMPLING RATE: 3 times/second

MEASUREMENTS:

- System variables: kW, kVAr, cos ϕ , V $_{\Delta}$, I, kWh $_{tot}$, kVArh $_{tot}$, kWh $_{partial}$, kVArh $_{partial}$
- Single phase variables: kW, kVAr, cos ϕ , V $_{star}$, I
- Measurement method: TRMS measurement of a distorted voltage/current wave.

Coupling type: Direct

Crest factor \geq 3

RANGE (IMPEDANCE):

250V/433V (1M Ω) -

5AAC (\leq 0.3VA / \leq 0.1 Ω)

FREQUENCY RANGE:

48 to 62 Hz

OVER-LOAD PROTECTION:

Continuous: voltage/current: 1.2 x rated input

For 1 s: voltage: 2 x rated input

current: 20 x rated input

KEYBOARD:

4 keys:

:

- to enter into the programming phase;
- for value programming and basic measurement scrolling;

:

- to confirm the new programmed values and go ahead to the next programming step;
- single phase measurement scrolling;

:

- to reset the partially counted active and/or reactive energy.

-OUTPUT SPECIFICATIONS -

PULSE OUTPUT: (ONLY WM2-DIN)

- Type: From 0.1 to 999.9 programmable pulses for kWh, kVArh, open collector (NPN transistor).
V $_{ON}$ = 0.6VDC / max 4mA
V $_{OFF}$ = 26VDC max.

- Pulse duration: 200 ms(ON), ≥ 200 ms (OFF)
- Insulation: By means of optocouplers, 4000 V_{RMS} output to measuring input, 4000 V_{RMS} output to supply input.

SERIAL OUTPUT (on request):

- Type: RS422/RS485; Multidrop bidirectional (static and dynamic variables).
- Connections: 2 or 4 wires, max. distance 1200m termination and /or line bias by means of DIP-switches directly on the instrument.
- Addresses: 255, selectable by key-pad
- Protocol: MODBUS/JBUS
- Data (bidirectional):
 - Dynamic (reading only) System variables: P, Q, $\cos\phi$, V_{L-L}, energies. Single phase variables: P_{L1}, Q_{L1}, $\cos\phi_{L1}$, V_{L1-N}, I_{L1}, P_{L2}, Q_{L2}, $\cos\phi_{L2}$, V_{L2-N}, I_{L2}, P_{L3}, Q_{L3}, $\cos\phi_{L3}$, V_{L3-N}, I_{L3}.
 - Static (writing only) All programming data, reset of energy:
 - partial kWh
 - partial kVAh
 - total kWh
 - total kVAh
 Stored energy (EEPROM) ≤ 999999 kWh ≤ 999999 kVAh
- Data format: 1-start bit, 8-data bit, no parity/even parity, 1-stop bit

- Baud-rate: 1200, 2400, 4800 and 9600 baud, selectable.
- Insulation: By means of optocouplers, 4000 V_{RMS} output to measuring input, 4000 V_{RMS} output to supply input.

-SOFTWARE FUNCTIONS -**PASSWORD:**

- 1st level
- 2nd level

MEASUREMENT SCROLLING:

System:

Numeric code of max 3 digits; 2 protection levels of the programming data. Password "0", no protection. Password from 1 to 255, all data are protected

Single phase:

active power (kW), reactive power (kVAh), power factor ($\cos\phi$), current (A), average phase-phase voltage (V_{L-L}), total and partial active energy (kWh), total and partial reactive energy (kVAh). active power (kW), reactive power (kVAh), power factor ($\cos\phi$), current (A), phase-neutral voltage (V_{L-N}) For CT up to 5000A. 0.1 to 999.9

TRANSFORMER RATIO:**PROGRAMMABLE RATIO:****DIGITAL FILTER:**

- Filter operating range: 0 to 100% of the input electrical scale
- Filtering coefficient: 1 to 64

Filter action: on the display and on the variable being transmitted by the serial communication port.

-SUPPLY SPECIFICATIONS -

AC VOLTAGE: 230 VAC (standard),
-15% + 10% 50/60 Hz
24 VAC, 48 VAC, 115 VAC
(on request),
-15% + 10% 50/60 Hz

POWER CONSUMPTION: ≤ 7VA

-GENERAL SPECIFICATIONS -

OPERATING TEMPERATURE: 0 to +50°C (32 to 122°F)
(R.H.<90% non-condensing)

STORAGE TEMPERATURE: -10 to + 60°C (14 to 140 °F)
(R.H.<90% non-condensing)

INSULATION REFERENCE VOLTAGE: 300 V_{RMS} to ground

INSULATION: 4000 V_{RMS} between all inputs/
outputs to ground

DIELECTRIC STRENGTH: 4000 V_{RMS} for 1 minute

NOISE REJECTION: CMRR

EMC: 100dB, 48 to 62 Hz
EN 50 081-2, EN 50 082-2

SAFETY STANDARDS: IEC 1010-1, EN 61010-1

CONNECTOR: Screw-type,
max. 2.5 mm² wires.

HOUSING:

Dimensions	6-DIN module, 58.5 x 89 x 107mm
Material	ABS,self-extinguishing: UL 94 V-0
DEGREE OF PROTECTION:	Front: IP 40
WEIGHT:	Approx. 500 g (packing included)

EM2-DIN TECHNICAL FEATURES

- SAME AS WM2-DIN EXCEPT FOR:

ACCURACY (48 to 62 HZ):

- Energy: ±1%RDG (hour time base).
- Active power (@ 25°C ±5°C, R.H.≤60%): ±1%f.s.(cosφ ≥ 0.7 L/C, 0 to 1.2 In, 0.5 to 1.2 Un) (only via RS485)
- Reactive power (@ 25°C ±5°C, R.H. ≤ 60%): ±1%f.s.(senφ ≥ 0.8 L/C, 0 to 1 In, 0 to 1 Un) (only via RS485)
- Power factor (cosφ) (@ 25°C ±5°C, R.H.≤60%): ±1%f.s.(cosφ ≥ 0.7 L/C, 0.6 to 1.2 In, 1 to 1.2 Un) (only via RS485)

DISPLAY: only 6-dgt, Backlighted LCD, h 13mm.

DECIMAL POINT POSITION: Automatic selection according to the counted energy.

MAX. AND MIN. INDICATION:

- | | | |
|--------------------|-------------|--------------|
| • Active energy: | Max. 999999 | min. -199999 |
| • Reactive energy: | Max. 999999 | min. 0 |

MEASUREMENTS:

- | | |
|---------------------|------------|
| • Total energies: | kWh, kVArh |
| • Partial energies: | kWh, kVArh |

Measurement method: TRMS measurement of a distorted voltage/current wave.
 Coupling type: Direct
 Crest factor ≥ 3

KEYBOARD:

4 keys:



- to enter into the programming phase;
- for value programming and basic measurement scrolling;



- to confirm the new programmed values and go ahead to the next programming step;
- total or partial energy scrolling;



- to reset to partially counted active and/or reactive energy.

-SOFTWARE FUNCTIONS -

MEASUREMENT SCROLLING:

total and partial active energy (kWh),
 total and partial reactive energy (kVArh).

DIGITAL FILTER:

Filter operating range: 0 to 100% of the input electrical scale
 Filtering coefficient: 1 to 64
 Filter action: only on the variable being transmitted by the serial communication port.

INSTALLATION

Overall dimensions and panel cut-out

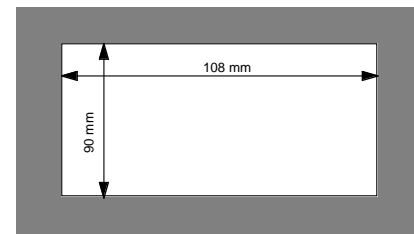
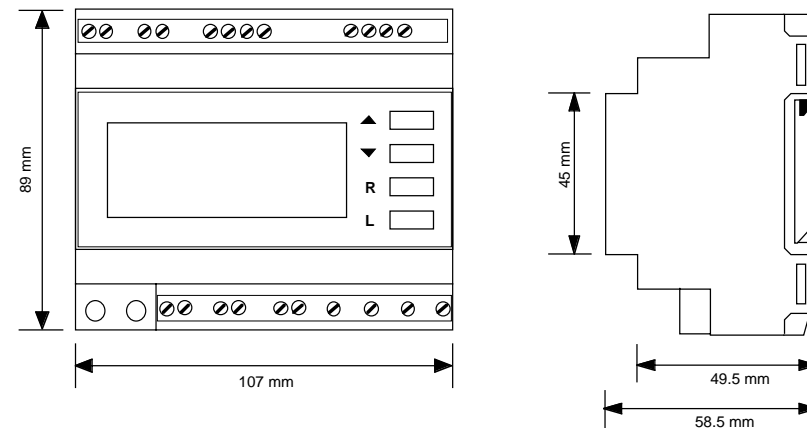


Fig. 1

Mounting

The instrument is to be mounted on DIN-rail.

Connections

See the wiring diagrams on the appendix.

PRELIMINARY OPERATIONS

Before supplying the instrument, make sure that the power supply voltage correspond to what is shown in the label.

Example:

WM2-DIN.AV5.3.D.P.S

SER-N. 983000/20115

Serial Number.

POWER 230VAC 50-60Hz

Power supply voltage.

PULSE max.4mA-max.26VDC

Pulse output (open collector)

Max. 4mA I_{ON} current and max. 26VDC V_{OFF} voltage,

OPTIONAL RS485 SERIAL OUTPUT

FRONT PANEL DESCRIPTION

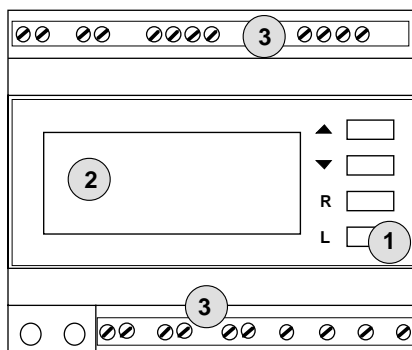


Fig. 2

1. Key-pad

Functions available outside the programming phase.

Key(s) to be pressed:

- scroll to the previously displayed system variable.
- scroll to the next displayed system variable
- Pressed together: access to the programming phase.
- scrolls the single phase values of the selected system variable.
- if pressed while WM2-DIN is displaying partial energy, resets the displayed value.

Functions available in the programming phase.

Key to be pressed:

- Increase of password value.
Increase of the value for each parameter within its range.
- Decrease of password value.
Decrease of the value for each parameter within its range.
- Password confirmation
goes to the next programming step.

2. Display

Alphanumeric indication by means of max 6-digit, 7-segment LCD:

- of the programming parameters;
- of the measured variables.

3. Terminal blocks

For the connection of measuring inputs, signal outputs and power supply

OPERATING MODE

WM2-DIN performs the following instantaneous measurements: voltage, current, active and reactive power and $\cos\phi$ on each phase and on the whole system. Active and reactive energy is also available. Every measure can be displayed alternatively. The scrolling is carried out by means of the keyboard as shown in the "WM2-DIN display flowchart".

EM2-DIN displays only the energy measurements and the displaying is done by means of the keyboard as shown in the "EM2-DIN display flowchart".

When the instrument is powered-up or when exiting from the programming phase, the system power (default measurement) is displayed.

During the programming phase it is possible to set the instrument either in the automatic scrolling or manual scrolling mode.

Automatic scrolling mode: (only WM2-DIN)

If this function is enabled (see the programming procedure flowchart), horizontal scrolling is carried out automatically. When the last value of the row is displayed, the instrument cycles on the first value of the same row. Press \blacktriangle or \blacktriangledown to select the other basic measurement.

During the programming phase it is possible to choose the display time of the measure: from 3 seconds up to 10 seconds.

By pressing \square you can stop the scrolling, when releasing it, the scrolling will start again after the display time of the measure.

The automatic scrolling is available only for instantaneous values, not for energy measures, therefore it is not possible with the EM2-DIN.

Manual scrolling

If the parameter "SCAN TIME" is set to 0, the instrument operates in manual scrolling. This latter working mode allows the cycling among the system and single phase measurements by pressing the \square key on the keyboard. Press \blacktriangle or \blacktriangledown to select the further basic measurement. The \square can be used to reset both partially counted active and reactive energies only while displayed by the display.

- EM2-DIN DISPLAY FLOWCHART -

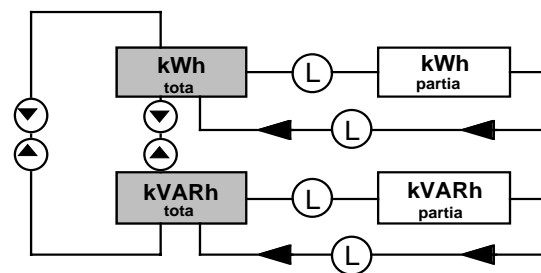


Fig. 3

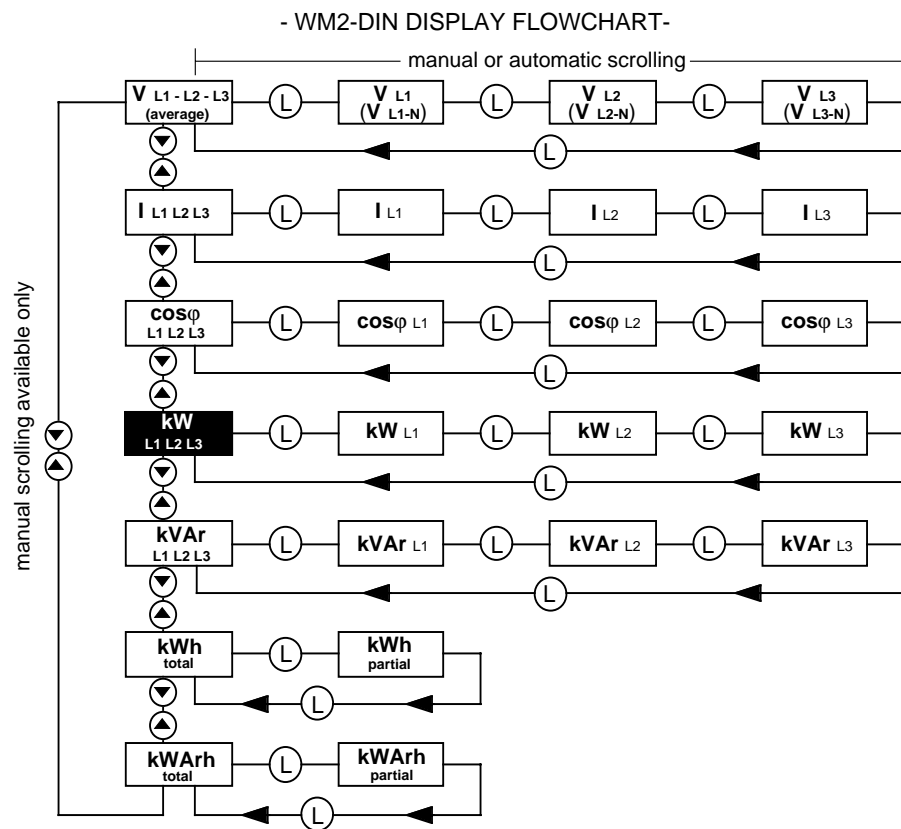


Fig. 4

Programming phase

To enter the programming phase, press in the meantime the \blacktriangle and \blacktriangledown keys.

Please refer to the " Programming procedure flowchart" in the central pages of this manual for a programming steps overview; In every step, keys \blacktriangle and \blacktriangledown allow to set the desired value, while the \square key is used to confirm the values and go to the next programming step.

If no key is used within 5 minutes, the instrument will automatically exit the programming phase, storing only the changed values subsequently confirmed by the \square key.

Programming steps.

STEP 1: a password between 0 and 255 is required. If the selected value matches the stored one, you go to step 2, otherwise you will go back to the measurement phase and the system reactive power (default measurement) will be displayed.

STEP 2: it is possible to change the password. The display will show: $n_P\ 0$. The number can be changed by pressing the \blacktriangle and \blacktriangledown keys.

Once the new value is selected, by pressing the \square key you confirm the new password and go to STEP 3. To keep the old value, press the \square key without changing the current value.

STEP 3: This step allows you to choose the manual or the automatic scrolling of the system and single phase measurements. If you set the parameter to 0 (zero), the instrument will be in the manual scrolling mode.

The values: 3, 4, 5, 6, 7, 8, 9 and 10 will enable the automatic scrolling mode and are expressed in seconds as duration

time of every displayed electrical parameter.

This working mode is not available in EM2-DIN (energy cannot be displayed in the automatic scrolling mode).

STEP 4 here you select the electrical system being measured by the instrument.

Available selections are:

1 = 1-PHASE system

2 = 3-PHASE system - balanced load

3 = 3-PHASE system - unbalanced load (default value)

Set the value related to the connection of the instrument (see "Electrical connection diagrams" for details).

STEP 5 it is possible to set a CT (current transformer) ratio between 0.1 and 999.9. The default value is 1.0.

Even if it's possible to work with a ratio < 1, it's advisable to work with ratio > 1 to fulfill the accuracy specification.

EM2-DIN only: steps 6 and 7 are not available since the pulse output is not equipped.

STEP 6 pressing , the kWh will be displayed and the consumed active energy will be retransmitted, while pressing , the reactive energy will be retransmitted and the kVArh will be displayed. The default value configures the instrument to retransmit the active energy (kWh).

STEP 7 In this step it is possible to program the number of pulses generated by the related output. The default value is 999.9 that means one pulse every Wh or VArh (maximum resolution).

Step 8, 9, 10 are enabled only if the instrument is equipped with RS485.

STEP 8 the value of this parameter is the address of the instrument in a monitoring network formed by several instruments.

STEP 9 this parameter allows to set the communication speed of the information performed by instrument.

STEP 10 this parameter allows to enable or disable the kind of error control on the serial communication. Pressing , "EVE" will be displayed and "even" parity check is enabled, while pressing , parity check will be disabled and "no" will be displayed.

STEP 11 In this step you set the working range of the digital filter. The value is given as percentage of the full-scale value. By setting the parameter to 0 (zero) the filter is disabled. The default value is 2%.

STEP 12 this is the filtering coefficient connected to the updating time of the display. The programming range is 0 to 255. The higher the value, the lower the updating time of the display. The default value is 4.

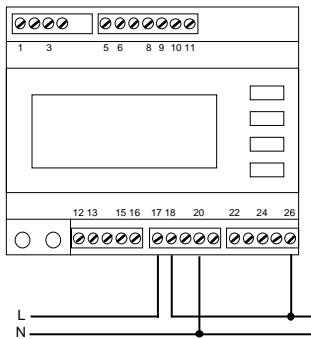
STEP 13 in this step you can reset both totally and partially counted energies (KWh and KVarh) until that moment. The default value is "no" to prevent accidental erasing. Pressing the display will show you "YES". Subsequently pressing the the reset will be confirmed. This procedure has to be repeated twice to reset the energies. If you don't want to reset the energies press .

Parameter	Default Value	Range	Description
n_P	0	0 to 255	password
St	0	0/3 to 10	MANUAL / automatic scrolling time
SYS	3	1 to 3	electrical system
Ct	1.0	0.1 to 999.9	current transformer ratio
EnErGY	kWh	kVArh to kWh	energy pulse - output
PU	999.9	0.1 to 999.9	number of pulses per kWh / kVArh
Adr	1	1 to 255	serial communication port address
bdr	9.6 (9600)	1.2/2.4/4.8/9.6	(k) baud rate
PAr	NO	NO / EVE	parity
FI S	2	0% to 100%	filtering range
FI C	4	1 to 64	filtering coefficient

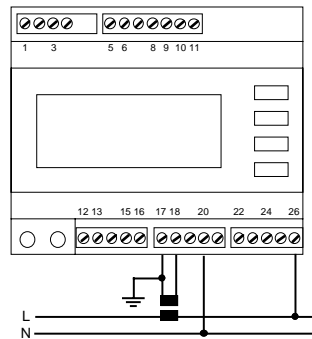
Table 1: programming parameters

ELECTRICAL CONNECTIONS DIAGRAM

SINGLE PHASE INPUT CONNECTIONS

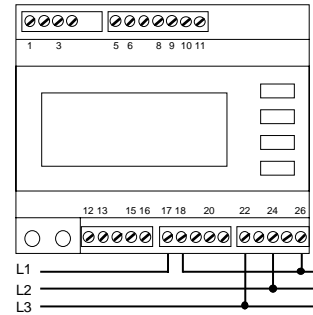


direct connection
Fig. 5

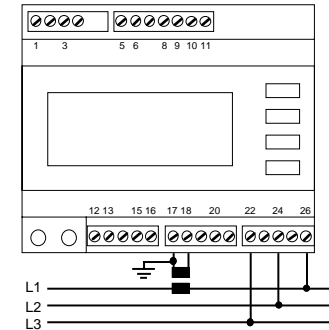


CT connection
Fig.6

3-PHASE / 3-WIRE INPUT CONNECTIONS - BALANCED LOADS

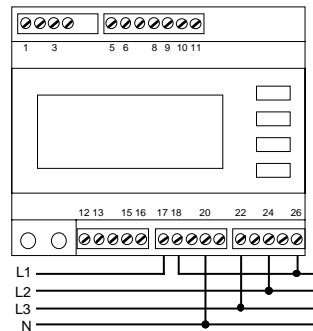


direct connection (3-wire system)
Fig. 7

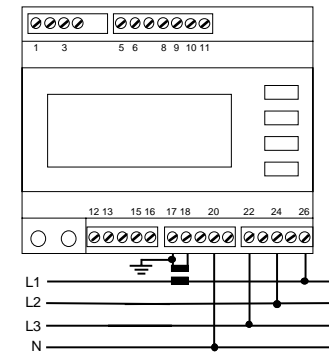


CT connection (3-wire system)
Fig. 8

3-PHASE / 4-WIRE INPUT CONNECTIONS - BALANCED LOADS

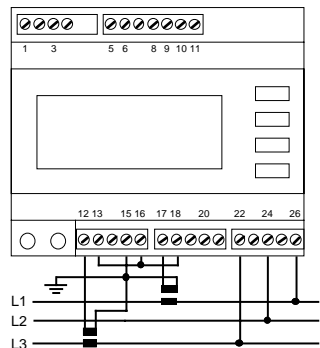


direct connection (4-wire system)
Fig. 9



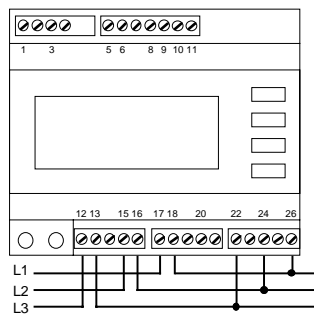
CT connection (4-wire system)
Fig. 10

3-PHASE / 3-WIRE INPUT ARON CONNECTIONS - UNBALANCED LOADS



CT (3-wire system)

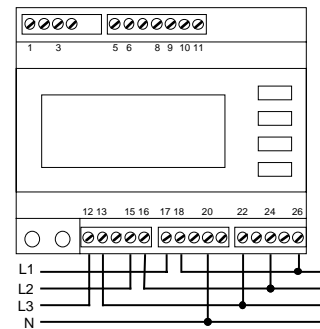
Fig. 11



Direct connection (3-wire system)

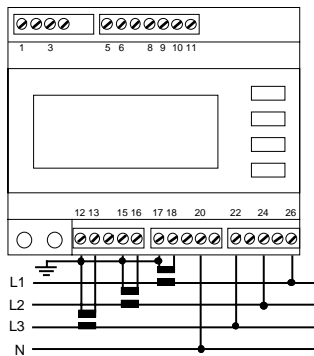
Fig. 12

3-PHASE / 4 -WIRE INPUT CONNECTIONS - UNBALANCED LOADS



Direct connection (4-wire system)

Fig. 13



CT (4-wire system)

Fig. 14

Labels layout

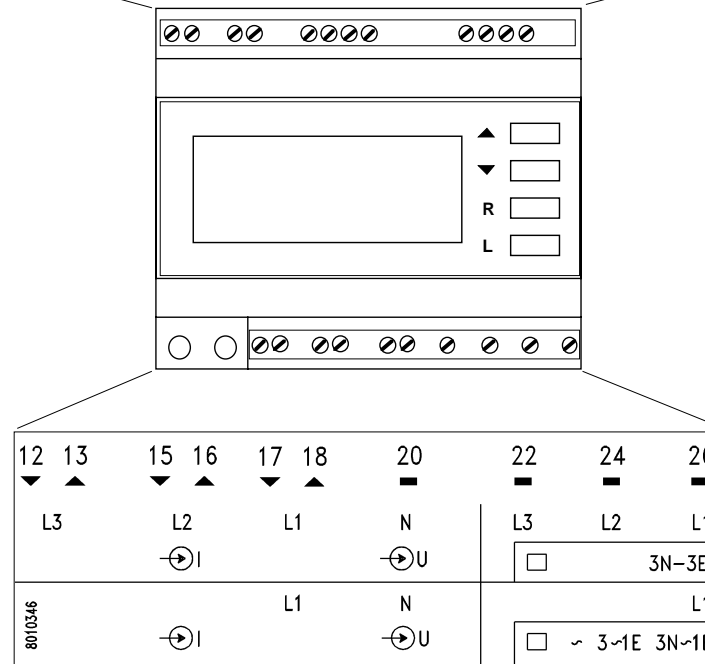
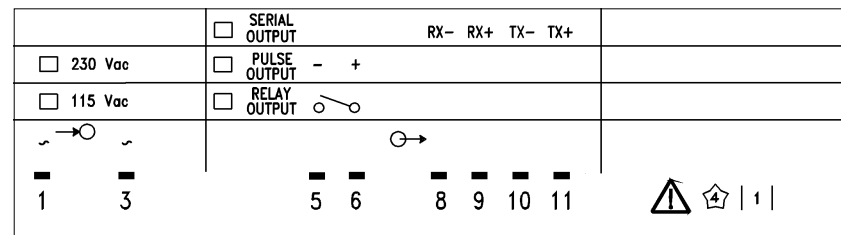


Fig.15