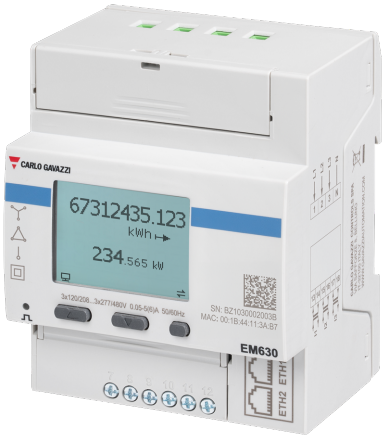
# EM630

## Energy meter for single phase, two phase and three phase systems




## Description

EM630 is an energy analyser connected through 5 A current transformers or 333 mV current sensors, for three phase, two phase and single phase systems up to 480 V L-L.
Modbus TCP/IP and HTTPS rest API communication are available via Ethernet port.

## Benefits

- **Quick configuration.** The configuration wizard which runs when the system is started up for the first time allows you to commission the unit without errors in a matter of seconds. The UCS configuration software is available for download free of charge.
- **User-friendly interface.** The 128x96 matrix LCD with backlit display ensures perfect visibility and readability of the information. Page configuration and browsing are very intuitive, thanks to the user interface with 3 mechanical keys. Finally, the page filter allows you to hide the unnecessary information.
- **Flexible installation.** It can be installed in Single-phase, two-phase and three-phase (with and without neutral). It also permits the monitoring of 3 loads in single-phase systems.
- **Robust design.** Able to work in an extremely wide temperature range, up to 70 °C / 158 °F, thanks to the temperature drift compensation and up to 3000 m / 9842.5 ft altitude.
- **Multi-interface communication.** EM630 is able to transmit and receive data through Modbus TCP/IP or HTTPS rest API via Ethernet.

## Applications

EM630 can be installed in any low-voltage switchboard, to monitor the energy consumption, the main electrical variables and the harmonic distortion. Compatible with any current transformer with 5 A secondary current, it can be installed in systems with rated current up to 10 kA, even in retrofit applications if used with openable transformers like CTA, CTD S or CTVs.

If used to monitor a single machine, it provides all the main electrical variables to identify any possible malfunction in its early stage and can correlate the energy consumption with the hours of operation, to plan maintenance and prevent failures. The partial meter reset function, allows you to monitor each individual machine cycle.

Thanks to the measurement refresh time (100 ms) and to the high resolution of the variables available through Modbus communication modules, it can also be used as data source for control actions, such as avoiding feeding energy into the electricity grid in a photovoltaic installation with energy storage.

EM630 B is the perfect solution when Ethernet connection is needed in combination with inverter and energy storage systems or installed in machines and industrial environments to monitor single loads or total consumption.

## Main functions

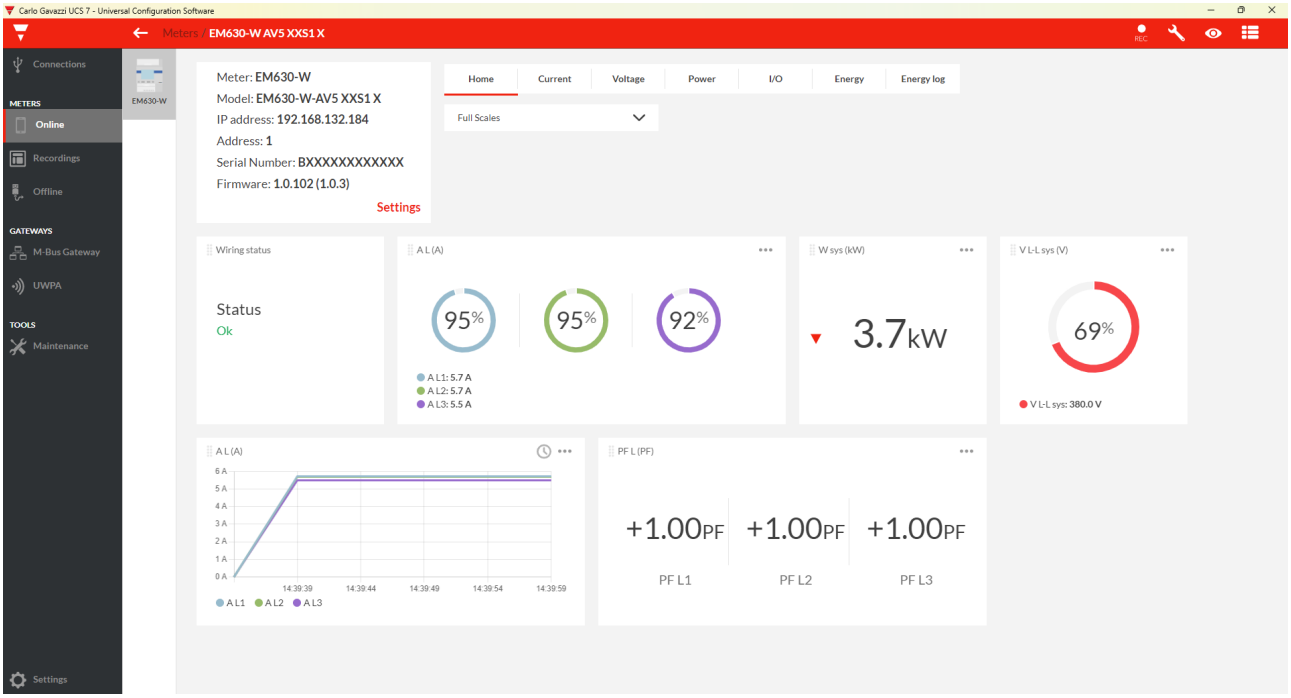
- Active, reactive and apparent energy measurement
- Main electrical variables measurement
- Load run hours and total ON time
- Total harmonic distortion (THD) of current and voltages measurement
- Measured variables visualisation on the display

## Main features

- System and phase variables (V L-L, V L-N, A, W/var, VA, PF, Hz)
- Displaying of the active energy with a resolution of 0.001 kWh
- 0.001 Hz frequency resolution
- Average value calculation (dmd) for current and power (kW / kVA)
- Streamlined user interface featuring 3 mechanical buttons
- Modbus TCP/IP (100 ms refresh time) and HTTPS rest API
- Dual Ethernet port (internal switch) for easy daisy chain connection without an external switch (E2 versions)
- Continuous sampling of each voltage and current
- Backlit display
- cULus approved (UL 61010)
- SunSpec compliance
- Operating temperature up to 70 °C / 158 °F temperature
- Operating altitude up to 3000 m / 9842.5 ft

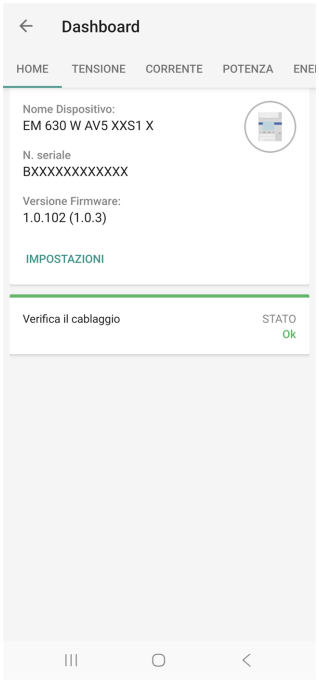
## UCS software

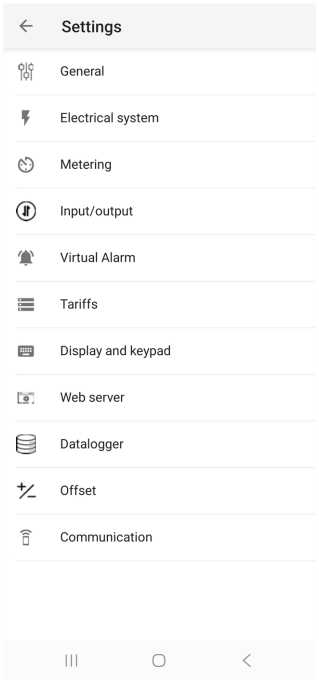
- Free download from Carlo Gavazzi website
- Configuration through RS485 from PC or trough UWP3.0 via LAN or the web (UWP Secure Bridge function)
- Setups can be saved offline for serial programming with a single command
- Real time data view for testing and diagnostics
- Notification of possible wiring errors and display of the corrective steps, reassignment of the correct association of the phases or the direction of the currents via software control

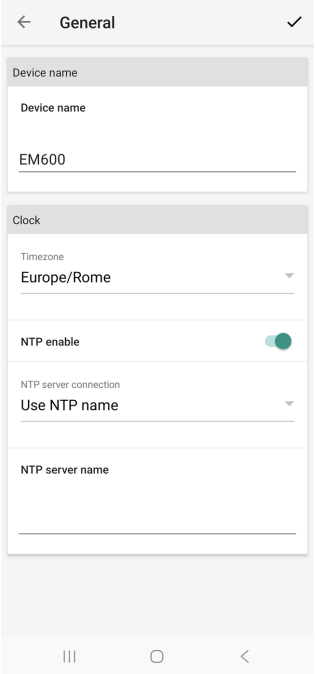


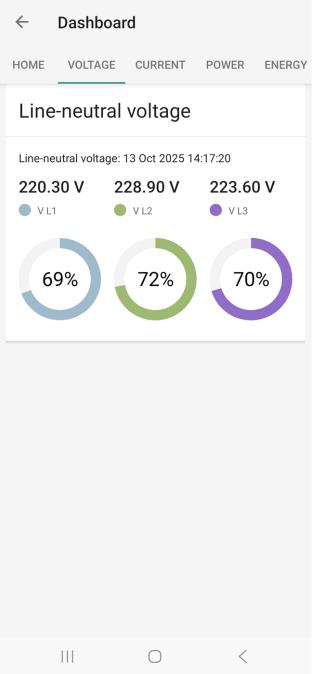
## UCS mobile APP

- Free download from Google Play Store
- Configuration through Wi-Fi from Android® mobile phone or tablet
- Setups can be saved offline for recurrent programming with a single command
- Real time data view for testing and diagnostics




General
Device name
Device name
EM600
Clock
Timezone
Europe/Rome
NTP enable
NTP server connection
Use NTP name
NTP server name


Dashboard
HOME
VOLTAGE
CURRENT
POWER
ENERGY
Line-neutral voltage
Line-neutral voltage: 13 Oct 2025 14:17:20
220.30 V
V L1
228.90 V
V L2
223.60 V
V L3
69%
72%
70%

# Structure

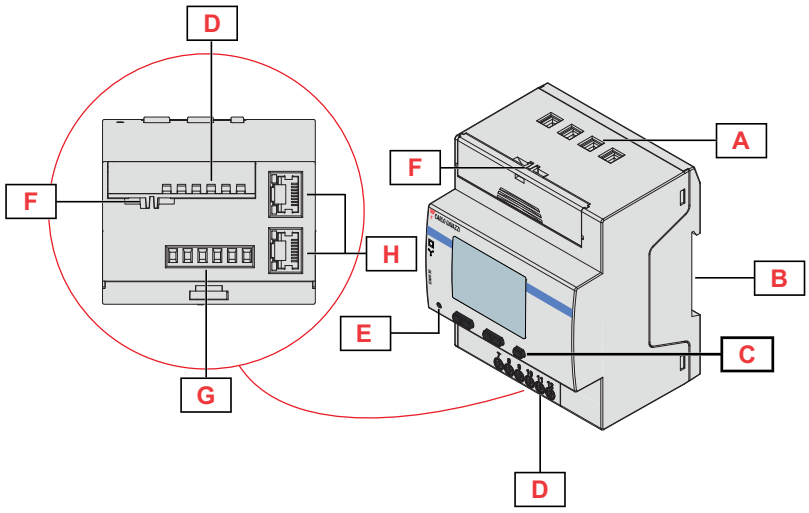



***Fig. 1*** *EM630*

| Area | Description |
|---|---|
| **A** | Voltage inputs |
| **B** | DIN rail mounting bracket |
| **C** | Browsing and configuration buttons |
| **D** | Sliding terminal cover |
| **E** | LED |
| **F** | Seal housings |
| **G** | Current inputs |
| **H** | Ethernet RJ45 ports (if present) |

# Features

## General

| | |
|---|---|
| **Material** | Housing: PBT<br>Transparent cover: polycarbonate |
| **Protection degree*** | Front: IP51<br>Terminals: IP20 |
| **Protective class** | Class II |
| **Terminals** | Voltage inputs: 0.2 to 2.5 $mm^2$ / 13 to 24 AWG, 0.45 Nm / 3.98 lbin max.<br>Current inputs: 0.2 to 2.5 $mm^2$ / 13 to 24 AWG, 0.45 Nm / 3.98 lbin max. |
| **Overvoltage/Measurement category** | Cat. III |
| **Rated impulse voltage** | 4kV |
| **Pollution degree** | 2 |
| **Mounting** | DIN rail |
| **Weight** | 300 g / 0.66 lb (packaging included) |
| **Dimensions** | 4 DIN modules |

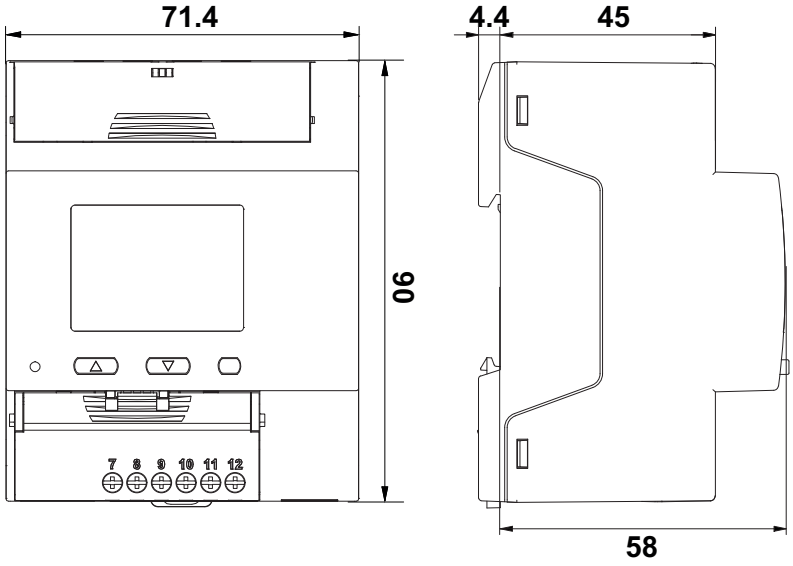



*Fig. 2*

## Environmental specifications

| | |
|---|---|
| **Operating temperature** | From -25 to +70 °C / from -13 to +158 °F |
| **Storage temperature** | From -30 to +70 °C / from -22 to 158 °F |
| **Altitude** | 3000 m / 9842.5 ft |

***Note**: R.H. < 90 % non-condensing @ 40 °C / 104 °F.*

## Input and output insulation

| Type | CT inputs | Voltage input | Ethernet Modbus TCP |
|---|---|---|---|
| **CT inputs** | - | Basic | Double/ Reinforced |
| **Voltage input** | Basic | - | Double/ Reinforced |
| **Ethernet** | Double/ Reinforced | Double/ Reinforced | - |

According to: EN IEC 61010-1. Overvoltage category III. Pollution degree 2.

## Compatibility and conformity

| | |
|---|---|
| **Directives** | 2014/35/EU (LVT - Low Voltage)<br>2014/30/EU (EMC - Electro Magnetic Compatibility)<br>2011/65/EU, 2015/863/EU (Electric-electronic equipment hazardous substances) |
| **Standards** | **Electromagnetic compatibility (EMC) - emissions and immunity**: EN 301 489-1 V2.2.3, EN 301 489-17 V3.2.4, EN 62052-11.2021, EN IEC 61000-6-3, EN IEC 61000-6-2<br>**Electrical safety**: EN IEC 61010-1, EN IEC 62052-31<br>**Metrology**: EN IEC 62053-22, EN IEC 62053-23, ANSI C12.1, |
| **Approvals** | CE c UL us LISTED |

***Note**: the equipment must be installed and operated with minimum distance of 20 cm of the human body.*

## Electrical specifications

| Electrical system | |
|---|---|
| **Managed electrical system** | Single-phase<br>Three single-phase<br>Two-phase (3-wire)<br>Three-phase with neutral (4-wire)<br>Three-phase without neutral (3-wire)<br>Wild leg system (three-phase, four-wire delta) |
| **MID managed electrical system** | Three-phase with neutral (4-wire)<br>Three-phase without neutral (3-wire) |

| Voltage inputs | |
|---|---|
| **Voltage connection** | Direct |
| **Rated voltage L-N ($U_n$ minimum to $U_n$ maximum)** | 120 to 277 V |
| **Rated voltage L-L ($U_n$ minimum to $U_n$ maximum)** | 208 to 480 V |
| **Voltage tolerance** | From 0.8 to 1.15% $U_n$ |
| **Overload** | Continuous: 1.15 $U_n$ max. |
| **Input impedance** | Refer to “Power supply” |
| **Frequency** | 50/60 Hz |

***Note**: EM630 can also be installed in a wild leg system (three phases, four delta wires), where one of the phase-neutral voltages is higher than the other two.*

## AV5

| Current inputs | CT |
|---|---|
| Current connection | Via CT |
| CT transformation ratio | 2000 max. |
| Primary current | 10 kA max. |
| Rated current ($I_n$) input | 5 A |
| Minimum current ($I_{min}$) | 0.05 A (0.01 $I_n$) |
| Maximum current ($I_{max}$) | 6 A (1.2 $I_n$) |
| Start-up current ($I_{st}$) | 5 mA (0.001 $I_n$) |
| Threshold current ($I_{tr}$) | 0.25 A (0.05 $I_n$) |
| Overload | For 500 ms: 120 A (20 $I_{max}$) |
| Input impedance | < 0.3 VA |
| Crest factor | 3 |
| Measurement type | with external current transformers |

## MV5

| Current inputs | MV5 |
|---|---|
| Current connection | Via 333 mV current sensor |
| CT transformation ratio | - |
| Primary current | 10 kA max. |
| Rated current ($I_n$) input | 333 mV |
| Minimum current ($I_{min}$) | 0.03 V (0.01 $I_n$ ) |
| Maximum current ($I_{max}$) | 0.4 V (1.2 $I_n$) |
| Start-up current ($I_{st}$) | 0.003 V (0.001 $I_n$) |
| Threshold current ($I_{tr}$) | 0.017 V (0.05 $I_n$) |
| Overload | For 500 ms: 8 V |
| Input impedance | 100 kΩ |
| Crest factor | 1.414 @ $I_{max}$ |
| Measurement type | with external current sensors |

## Power supply

| Type | Self power supply |
|---|---|
| Consumption | 3 W / 5.5 VA |
| Frequency | 50/60 Hz |

## Measurements

| | |
|---|---|
| **Method** | TRMS measurements of distorted waveforms |

## Energy metering

Energy metering depends on the measurement type you chose.

### A measurement (Easy connection)

Irrespective of the current direction, the power always has a plus sign and contributes to increase the positive energy meter. The negative energy meter is not available.

### B measurement (Bidirectional)

For each measuring time interval, the individual phase energies with a plus sign are summed to increase the positive energy meter (kWh+), while the others increase the negative one (kWh-).

Example:
P L1= +2 kW, P L2= +2 kW, P L3= -3 kW
Integration time = 1 hour
kWh+ = (2+2) x1h = 4 kWh
kWh- = 3 x 1h= 3kWh

### C measurement (Net Bidirectional)

For every measuring interval time, the energies of the single phases are summed; according to the sign of the result, the positive (kWh+) or negative totalizer (kWh-) is increased.

Example:
P L1= +2 kW, P L2= +2 kW, P L3= -3 kW
Integration time = 1 hour
kWh+=(+2+2-3)x1h=(+1)x1h=1 kWh
kWh- =0 kWh

## Available measurements

| Active energy | Unit | System | Phase |
|---|---|---|---|
| Imported (+) Total | kWh+ | ● | ● |
| Imported (+) partial | kWh+ | ● | - |
| Exported (-) Total | kWh- | ● | ● |
| Exported (-) partial | kWh- | ● | - |
| Imported (+) Total by tariff (t1, t2) | kWh+ | ● | - |
| Quadrant I, II, III, iV | kW | ● | - |

| Reactive energy | Unit | System | Phase |
|---|---|---|---|
| Imported (+) Total | kvarh+ | ● | ● |
| Imported (+) partial | kvarh+ | ● | - |
| Exported (-) Total | kvarh- | ● | ● |
| Exported (-) partial | kvarh- | ● | - |
| Quadrant I, II, III, iV | kvarh | ● | - |

| Apparent energy | Unit | System | Phase |
|---|---|---|---|
| Total | kVAh | ● | - |
| Partial | kVAh | ● | - |
| Quadrant I, II, III, iV | kVAh | ● | - |

| Run hour meter | Unit | System | Phase |
|---|---|---|---|
| Total (kWh+) | hh:mm | ● | - |
| Partial (kWh+) | hh:mm | ● | - |
| Total (kWh-) | hh:mm - | ● | - |
| Partial (kWh-) | hh:mm - | ● | - |
| Total ON time | hh:mm | ● | - |

| Electrical variable | Unit | System | Phase |
|---|---|---|---|
| Voltage L-N | V | ● | ● |
| Voltage L-L | V | ● | ● |
| Current | A | ● | ● |
| DMD | A | - | ● |
| DMD MAX | A | - | ● |
| Neutral current | A | ● | - |
| Active power | W | ● | ● |
| DMD | W | ● | - |
| DMD MAX | W | ● | - |

| Electrical variable | Unit | System | Phase |
|---|---|---|---|
| **Apparent power** | VA | ● | ● |
| **DMD** | VA | ● | - |
| **DMD MAX** | VA | ● | - |
| **Reactive power** | Var | ● | ● |
| **Power factor** | PF | ● | ● |
| **Frequency** | Hz | ● | - |
| **THD Current*** | THD A % | - | ● |
| **THD Voltage L-N*** | THD L-N % | - | ● |
| **THD Voltage L-L*** | THD L-L % | - | ● |

* Up to 31$^{st}$ harmonic

***Note**: the available variables depend on the type of system set.*

## Measurement accuracy

| **Phase-phase voltage** | |
|---|---|
| **From $U_n$ minimum -20% to $U_n$ maximum +15%** | +/- 0.2% rdg |

| **Phase-neutral voltage** | |
|---|---|
| **From $U_n$ minimum -20% to $U_n$ maximum +15%** | +/- 0.2% rdg |

| **Frequency** | |
|---|---|
| **From 45 to 65 Hz** | +/- 0.1% rdg |

## AV5

| **Current** | |
|---|---|
| **From 0.05 $I_n$ to $I_{max}$** | +/- 0.3% rdg |
| **From 0.01 $I_n$ to 0.05 $I_n$** | +/- 0.6% rdg |

| **Active and apparent power** | |
|---|---|
| **From 0.05 $I_n$ to $I_{max}$ (PF=1)** | +/- 0.5% rdg |
| **From 0.01 $I_n$ to 0.05 $I_n$ (PF=1)** | +/- 1% rdg |
| **From 0.1 $I_n$ to $I_{max}$ (PF=0.5 L - 0.8 C)** | +/- 0.6% rdg |
| **From 0.02 $I_n$ to 0.1 $I_n$ (PF=0.5 L - 0.8 C)** | +/- 1% rdg |
| **Active energy** | Class 0.5 S (EN IEC 62053-22) |

| Reactive power | |
|---|---|
| From 0.1 $I_n$ to $I_{max}$ (sinϕ=0.5 L - 0.5 C)<br>From 0.05 $I_n$ to $I_{max}$ (sinϕ=1) | +/- 2% rdg |
| From 0.05 $I_n$ to 0.1 $I_n$ (sinϕ=0.5 L - 0.5 C)<br>From 0.02 $I_n$ to 0.05 $I_n$ (PF=1) | +/- 2.5% rdg |
| Reactive energy | Class 2 (EN IEC 62053-23) |

## MV5

| Current | |
|---|---|
| From $I_{min}$ to 0.05 $I_n$ (PF=1) | +/- 1% rdg |
| From 0.05 $I_n$ to $I_{max}$ (PF=1) | +/- 0.5% rdg |
| From 0.05 $I_n$ to 0.1 $I_n$ (PF=0.5 L - 0.8 C) | +/- 1% rdg |
| From 0.1 $I_n$ to $I_{max}$ (PF=0.5 L - 0.8 C) | +/- 0.6% rdg |

| Active and apparent power | |
|---|---|
| From 0.05 $I_n$ to $I_{max}$ (PF=1) | +/- 0.5% rdg |
| From 0.01 $I_n$ to 0.05 $I_n$ (PF=1) | +/- 1% rdg |
| From 0.1 $I_n$ to $I_{max}$ (PF=0.5 L - 0.8 C) | +/- 0.6% rdg |
| From 0.02 $I_n$ to 0.1 $I_n$ (PF=0.5 L - 0.8 C) | +/- 1% rdg |
| Active energy | Equivalent to Class 0.5 (EN IEC 62053-21) |

| Reactive power | |
|---|---|
| From 0.1 $I_n$ to $I_{max}$ (sinϕ=0.5 L - 0.5 C)<br>From 0.05 $I_n$ to $I_{max}$ (sinϕ=1) | +/- 2% rdg |
| From 0.05 $I_n$ to 0.1 $I_n$ (sinϕ=0.5 L - 0.5 C)<br>From 0.02 $I_n$ to 0.05 $I_n$ (PF=1) | +/- 2.5% rdg |
| Reactive energy | Equivalent to Class 2 (EN IEC 62053-23) |

## Measurement resolution

| Variable | Display resolution | Resolution by serial communication |
|---|---|---|
| **Energy** | 0.001 kWh/kvarh/kVAh | 0.0001 kWh/kvarh/kVAh |
| **Single phase energy** | 0.001 kWh | 0.001 kWh |
| **Power** | 0.001 kW/kvarkVA | 0.1 W/var/VA |
| **Current** | 0.001 A | |
| **Voltage** | 0.1 V | |
| **Frequency** | 0.001 Hz | |
| **THD** | 0.01 % | |
| **Power factor** | 0.01 | 0.001 |

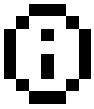
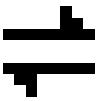
**Note*: value referred to CT ratio =1.*

## Display

| | |
|---|---|
| **Type** | Matrix LCD 128 x 96 pixels |
| **Refresh time** | 500 ms |
| **Description** | Backlit LCD |
| **Variable readout** | Instantaneous: 5+1 dgt or 5+3 dgt<br>Power factor: 1+2 dgt<br>Energy: 8+3 dgt |

### Display icons description

The table reports the icons that can appear on the display.

| Icon | Description |
|---|---|
|  | Off: Ethernet link inactive (cable disconnected or no link)<br>ON: Ethernet link active (cable connected and link detected)<br>Note: The icon shows only the physical link status. Correct network settings required for communication. |
|  | Wiring information: virtual correction via UCS |
|  | Current range exceeded: the measured value is still displayed |
|  | Voltage range exceeded: the measured value is still displayed |
|  | Undervoltage: the measured value is displayed anyway |
|  | Frequency in an out-of-range condition |
|  | Fixed: internal failure<br>Blinking: alarm signal |
|  | Wiring error |
|  | Reading or writing command is addressed to EM630 |

## LED

### AV5

The LED is Red coloured. Pulse weight: proportional to positive energy (display page 1) or negative energy (display page 2) and depending on the CT ratio, 16 Hz maximum frequency.

| Weight (kWh per pulse) | CT ratio |
|---|---|
| 0.001 | CT ≤ 7 |
| 0.01 | 7 < CT ≤ 70 |
| 0.1 | 70 < CT ≤ 700 |
| 1 | 700 < CT ≤ 2000 |

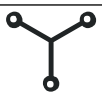
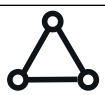
### MV5

The LED is Red coloured. Pulse weight: proportional to positive energy (display page 1) or negative energy (display page 2) and depending on Primary current ($I_n$), 16Hz maximum frequency.

| Weight (kWh per pulse) | Primary current ($I_n$) |
|---|---|
| 0.001 | $I_n \leq 35$ |
| 0.01 | $35 < I_n \leq 350$ |
| 0.1 | $350 < I_n \leq 3500$ |
| 1 | $I_n > 3500$ |

# Symbols

The table describes all the symbols that you can find in the documents and on the product.

| Symbol | Description |
|---|---|
|  | Dangerous voltage |
|  | Danger, live parts |
|  | Caution |
|  | Provides essential information on completing the task that should not be neglected |
|  | Manual symbol |
|  | Safety sign notice |
|  | The product is not to be discarded with normal household waste |
|  | Double insulation |
|  | Single phase |
|  | Three phase (four-wire) |
|  | Three phase (three-wire) |

# Communication ports

## Ethernet port

| | |
|---|---|
| **Protocol** | Modbus TCP/IP<br>HTTPS REST API<br>DHCP<br>mDNS |
| **Devices on the same bus** | Maximum 5 connections simultaneously |
| **Connection type** | RJ45 connector (10 Base-T, 100 Base-TX),<br>maximum distance 100 m,<br>Integrated switch function to connect another Ethernet device |
| **Configuration parameters** | DHCP client<br>mDNS<br>Modbus TCP enablng<br>HTTPS REST API |
| **Cable type** | Minimum Cat 5, Standard EIA/TIA T568B<br>Ethernet Patch Cable or Ethernet Crossover Cable (autodetection) |
| **Refresh time** | Modbus TCP/IP: ≤ 100 ms<br>HTTPS Rest API: ≤ 200 ms |
| **Configuration mode** | Via keypad, UCS software/APP |

# Connection Diagrams

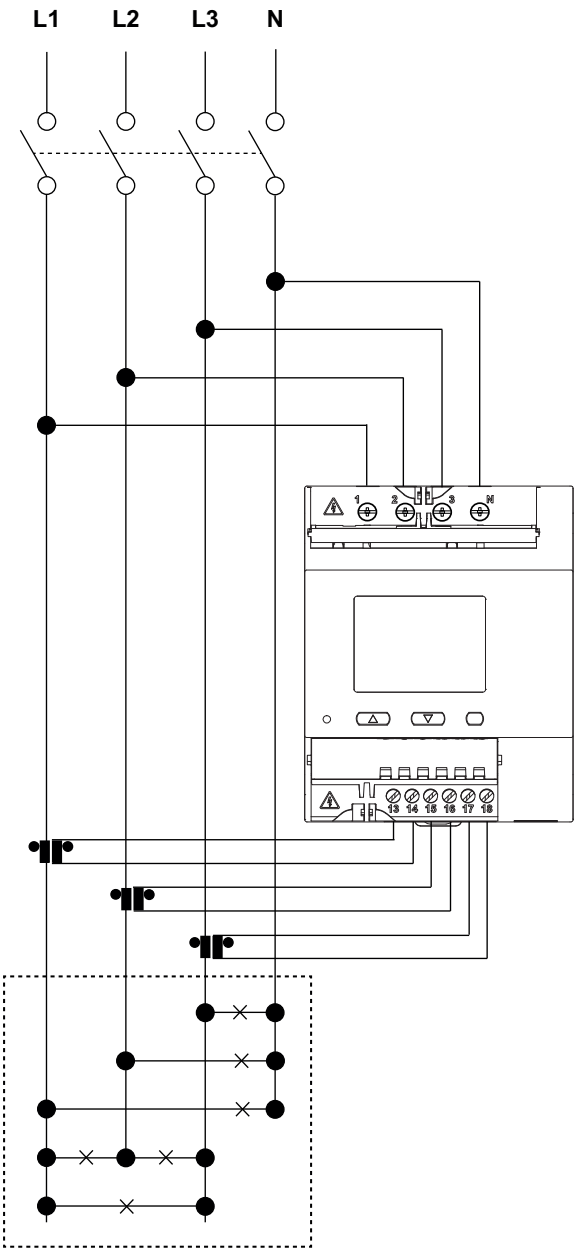



***Fig. 3*** *Three-phase with neutral (4-wire).*

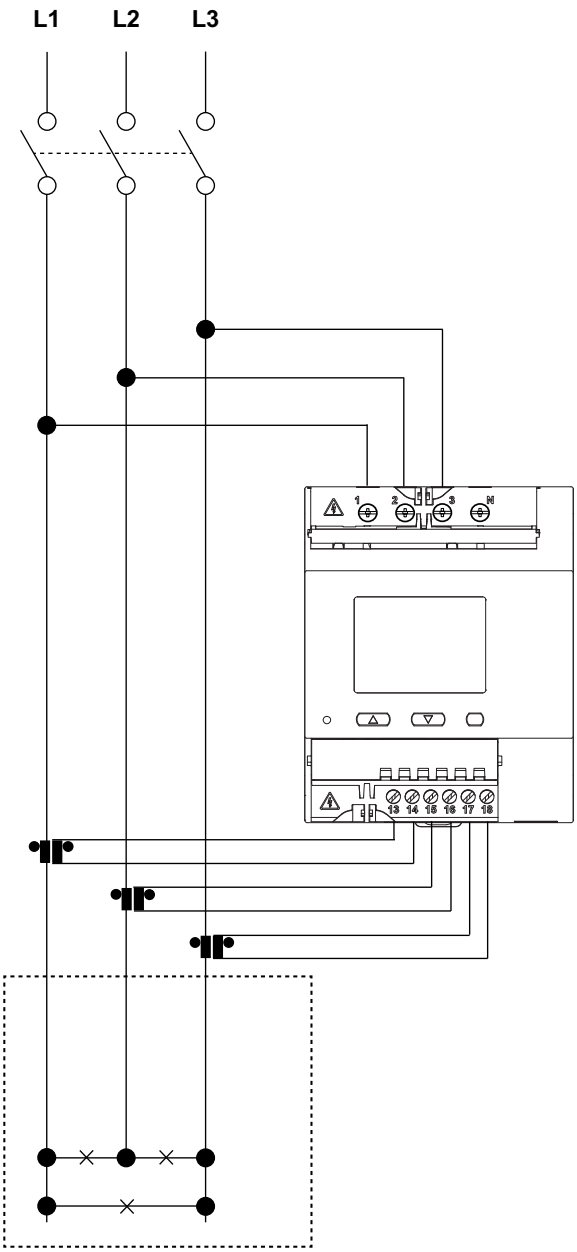



***Fig. 4*** *Three-phase without neutral (3-wire).*

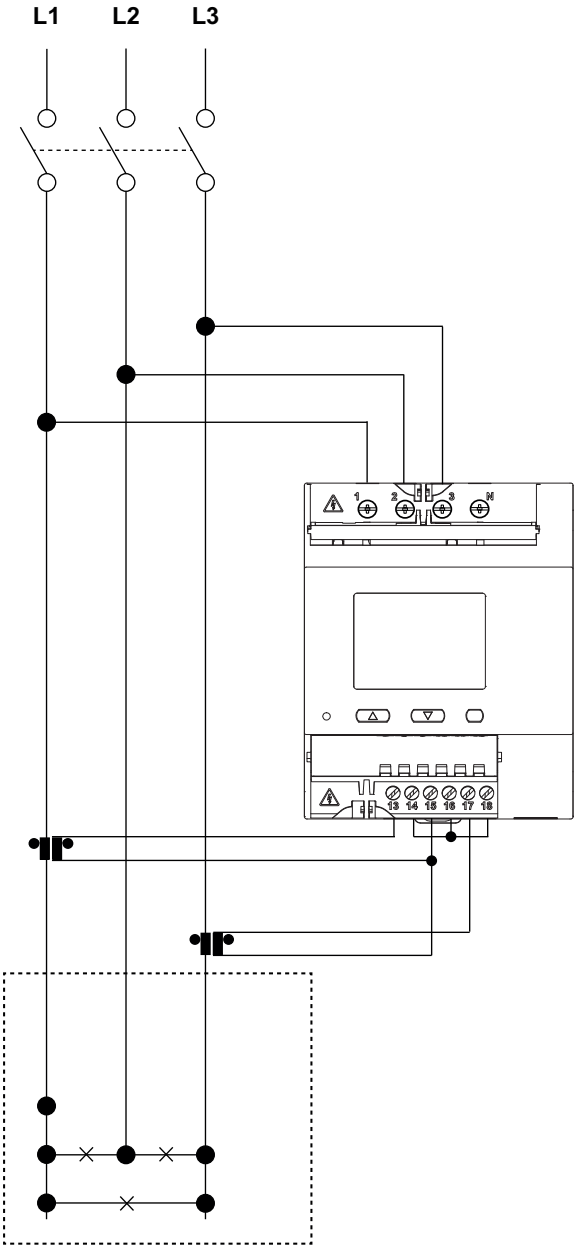



***Fig. 5*** *Three-phase without neutral (3-wire).*

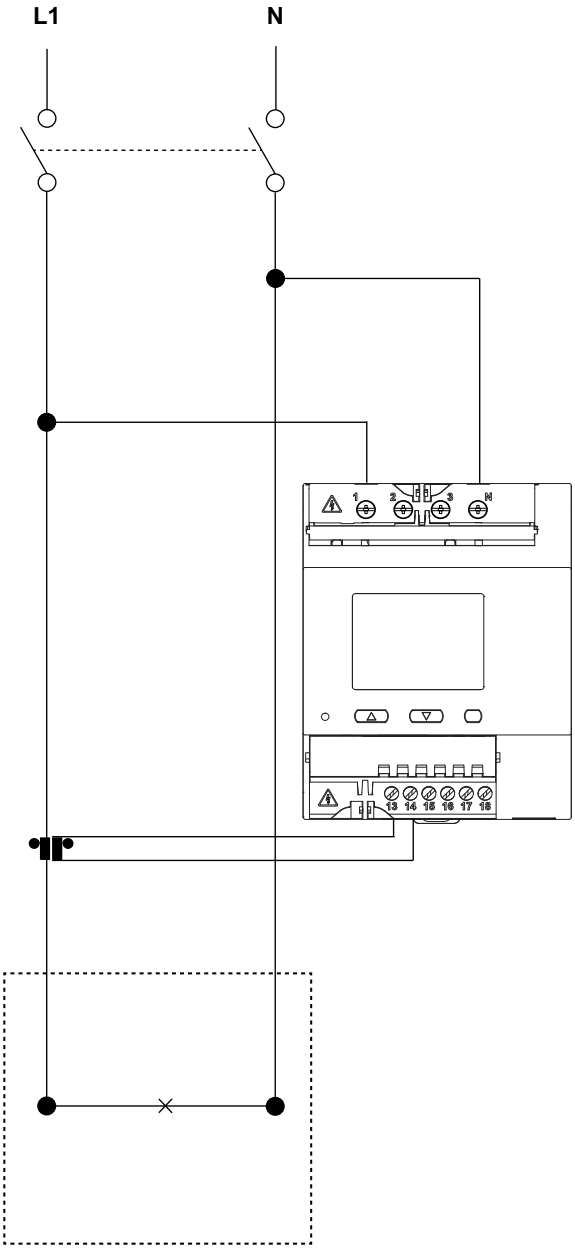



***Fig. 6*** *Single-phase system.*

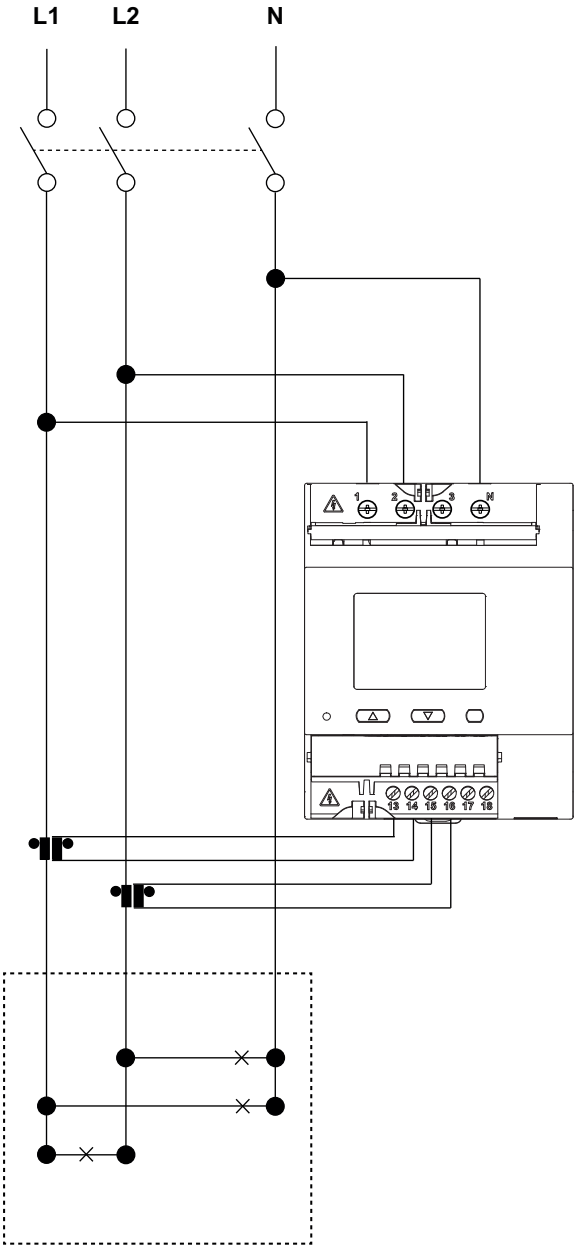



***Fig. 7*** *Two-phase system with neutral (3-wire).*

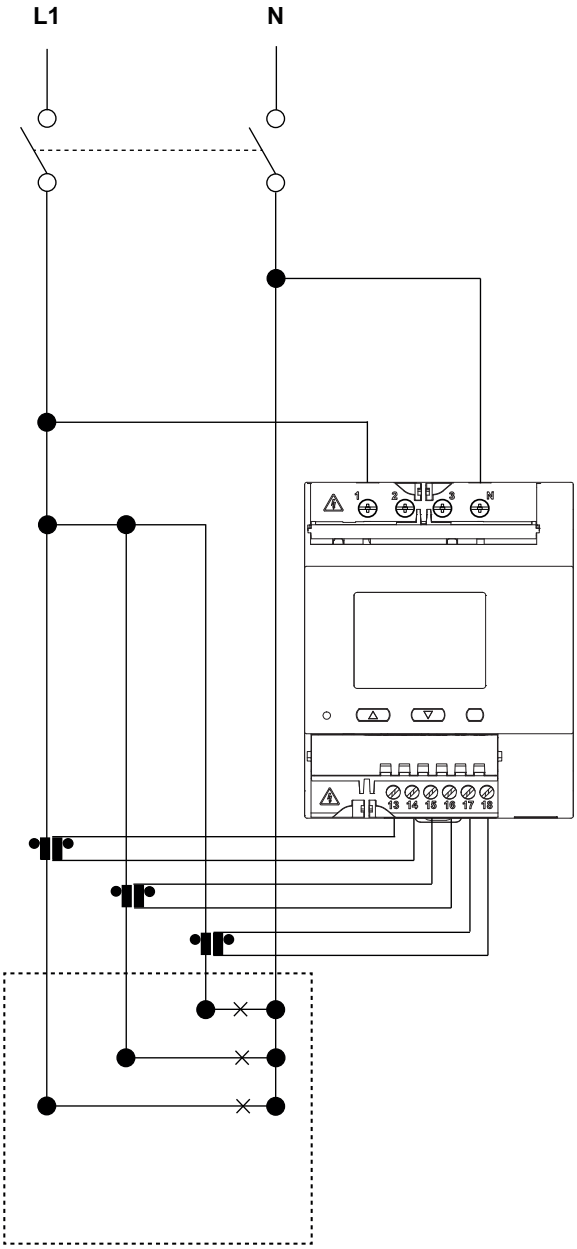



***Fig. 8*** *Single-phase system, 3 loads*

# References

## Order code

**EM630 B ☐ 3X E2 XX X**

Enter the code option instead of ☐

| Code | Options | Description |
|---|---|---|
| EM630 B | - | - |
| ☐ | AV5 | 5 A current transformer |
| | MV5 | 333 mV current sensor |
| 3X | - | Three phase, self power supply |
| E2 | - | Two Ethernet Modbus TCP ports |
| XX | - | - |
| X | - | CE, cULus |

## CARLO GAVAZZI compatible components

| Purpose | Component name/code key | Notes |
|---|---|---|
| Configure analyzer via desktop application | UCS software | Available for free download at www.gavazziautomation.com |
| Aggregate, store and transmit data to other systems | UWP | For further information please refer to www.gavazziautomation.com |
| CT series | CTA, CTD, CTV | For further information please refer to www.gavazziautomation.com |