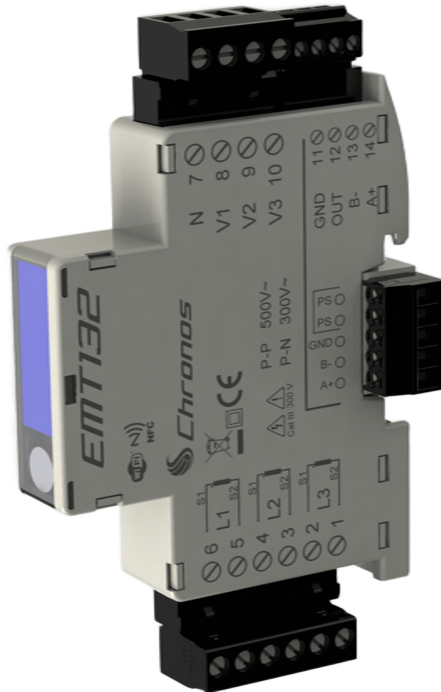


## INTRODUCTION

### Product description

Self-powered three-phase network analyzer, 85 to 265 V<sub>L-N</sub>, 147 to 450 V<sub>L-L</sub>, 5 (6) A. 160x80 pixel color graphic display, RS485 port, WiFi, NFC, pulse/alarm output.







### Product Features

- Equivalent to EN62053-22 class 0.5S (kWh)
- Equivalent to EN62053-24 class 0.5S (kVARh)
- Accuracy:  $\pm 0.5\%$  RDG
- Bidirectional energy meter
- TRMS measurement of distorted waveforms (voltage/current)
- Neutral current measurement
- One (MOSFET) output for alarms or pulse output
- WiFi Station and Access Point (Modbus TCP)
- RS485 serial output (Modbus RTU)
- NFC for reading configuration parameters
- 16-bit color display, 160x80 pixels, with touch button
- Sampling frequency: 6400 samples @ 50 Hz
- 1 DIN module size
- Chronos CTs can be directly associated via App to correct phase shift and signal amplitude
- Complete harmonic analysis (amplitudes and phases)
- Flash logging up to 1 MB
- MQTT available
- Two versions for CTs: 5 A current input or voltage input (333 mV/Rogowski)
- Internal integrator for Rogowski probes
- Available in two different variants: Base, Full



## SYMBOLS

|   |  |   |   |
|---|--|---|---|
|  | <b>DANGER:</b><br>Failure to follow the instructions may cause damage to property, people, or animals. |  | <b>WARNING, DANGEROUS VOLTAGE:</b><br>Presence of electrical voltage. Disconnect the power supply before performing any work. |
|  | <b>DOUBLE INSULATION:</b><br>Class II equipment. No grounding connection is required.                  |  | <b>WEEE:</b><br>Do not dispose of with household waste. Deliver to authorized collection centers.                             |

## MEASUREMENTS AND LOGGING DATA

| Realtime Measurement   | BASE | FULL |
|--|------|------|
| VRMS LL e VRMS LN[V]   | •    | •    |
| IRMS [A]   | •    | •    |
| Active Power P [W]   | •    | •    |
| Reactive Power Q [VAR]   | •    | •    |
| Apparent Power S [VA]  | •    | •    |
| Cos $\varphi$  | •    | •    |
| Tan $\varphi$  | •    | •    |
| Crest factor   | •    | •    |
| Frequency [Hz]   | •    | •    |
| Internal temperature [°C]  | •    | •    |
| Phase sequence   | •    | •    |
| RSSI Wifi  | •    | •    |
| Counters   | BASE | FULL |
| Active Power [Wh] (pos, neg, total)  | •    | •    |
| Reactive Power [VARh] (pos, neg, total)  | •    | •    |
| Apparent Power [VAh] (pos, neg, total)   | •    | •    |
| Installation time [h]  | •    | •    |
| Average, max and min values  | BASE | FULL |
| VRMS LL average, max and min   | •    | •    |
| VRMS LN average, max and min   | •    | •    |
| IRMS average, max and minmedia, massima e minima                                   | •    | •    |
| Active Power P average, max and min  | •    | •    |
| Reactive Power Q average, max and min  | •    | •    |
| Apparent Power S average, max and min  | •    | •    |
| Cos $\varphi$ average, max and min   | •    | •    |
| Crest factor average, max and min  | •    | •    |
| Frequency average, max and min   | •    | •    |
| VLL Peak   | •    | •    |
| VLN Peak   | •    | •    |
| I Peak   | •    | •    |
| MAX demand   | •    | •    |
| Moving average over P, P_Plus, P_neg, Q_plus_ind, Q_plus_cap, Q_neg_ind, Q_neg_cap | •    | •    |
| Logging and connectivity   | BASE | FULL |
| Real-time measurement logging exportable via the web server                        |      | •    |
| Oscilloscope function accessible via RS485   |      | •    |
| Oscilloscope function accessible via Webserver                                     |      | •    |
| Direct MQTT connection   |      | •    |



| Power quality                          | BASE | FULL |
|--|------|------|
| Harmonics up to the 63rd order         |      | •    |
| InterHarmonics up to the 63rd order    |      | •    |
| Power quality                          |      | •    |
| - Sag                                  |      | •    |
| - Swell                                |      | •    |
| - Interruption                         |      | •    |
| Distortion power factor                |      | •    |
| Voltage THD, TDD                       |      | •    |
| Current THD, TDD                       |      | •    |
| Efficiency between phase 1 and phase 2 |      | •    |
| K-factor                               |      | •    |

| Power supply specifications |  |
|-----------------------------|--|
| Type                        | Auxiliar low voltage supply  |
| Rated voltage range L-N     | 10 - 36 Vdc, 13 - 26 Vac   |
| Working frequency           | DC / 1 - 65 Hz   |
| Power Consumption           | < 1.5 W  |
| Cable cross-section         | 2.5 mm <sup>2</sup> or less using FG16 cable (or equivalent) over the grey terminal. |

| Input specifications                |  |
|-------------------------------------|--|
| Voltage                             |  |
| Rated voltage range L-N             | 85 - 265 Vac   |
| Rated voltage range L-L             | 150 - 450 Vac  |
| Working frequency                   | DC / 1 - 65 Hz   |
| Current                             |  |
| Connection                          | With CTs with 5 A current output or voltage output (333 mV / Rogowski) |
| CT with current output              |  |
| Starting current (I <sub>st</sub> ) | 5 mA   |
| Minimum current (I <sub>n</sub> )   | 50 mA  |
| Rated current (I <sub>n</sub> )     | 5 A <sub>AC</sub>  |
| Maximum current (I <sub>MAX</sub> ) | 6 A <sub>AC</sub>  |
| Crest factor                        | < 4 (20 A <sub>PK</sub> MAX)   |
| Burden                              | < 1 VA per phase   |
| Overload for 500 ms                 | 40 A <sub>AC</sub>   |
| CT with voltage output              |  |
| Starting current (I <sub>st</sub> ) | 0.33 mV <sub>AC</sub>  |
| Minimum current (I <sub>n</sub> )   | 3.33 mV <sub>AC</sub>  |
| Rated voltage (V <sub>n</sub> )     | 333 mV <sub>AC</sub>   |
| Maximum current (V <sub>MAX</sub> ) | 500 mV <sub>AC</sub>   |
| Crest factor                        | < 3 (1 V <sub>PK</sub> MAX)  |
| Burden                              | 220 KΩ   |
| Overload for 500 ms                 | 6 V <sub>PK</sub>  |

| Accuracy (@25 ± 5°C; frequency = 50 Hz)       |   | Refresh time   |
|---|---|--|
| Frequency                                     | ± 0,01 Hz (45..65 Hz)   | 100 ms   |
| Voltage                                       | ± 0,2% rdg  | Configurable from 1 to 65535 periods (from 20 ms to 21.8 minutes if frequency = 50 Hz) |
| Current                                       | ± 0,3% rdg  |  |
| Active and apparent power (PF = 0.5L .. 0.5C) | ± 0,3% rdg (In o Vn from 5% to 100%)  |  |
|   | ± 0,4% rdg (In o Vn from 1% to 5%)  |  |
| Reactive power (sinφ = 0.5L .. 0.5C)          | ± 0,3% rdg (In o Vn from 5% to 100%)  |  |
|   | ± 0,4% rdg (In o Vn from 1% to 5%)  |  |
| Active energy                                 | class C according to EN50470-1/3<br>class 0.5 S according to EN62053-22   |  |
| Reactive energy (when measured, see below)    | class 0.5 S according to EN62053-24   |  |
| Power factor                                  | ± (0,001 + 1%(1.00-PF))   |  |
| Bandwidth (-3dB)                              | > 2KHz  | Not applicable   |
| Thermal drift                                 | <100 ppm/°C   | 100 ms   |
| THD   | ±0.3%   |  |
| Harmonics                                     | ±3% amplitude up to the 16th harmonic<br>±5% amplitude from the 17th harmonic to the 63rd harmonic<br>±5° phase shift up to the 16th harmonic<br>±10° phase shift from the 17th harmonic to the 63rd harmonic |  |

| General specifications |  |
|------------------------|--|
| Operating temperature  | -25°C... +65°C   |
| Storage temperature    | -40°C... +85°C   |
| Humidity               | 10...90% non condensing  |
| Altitude               | Up to 2000 m s.l.m.  |
| Measurement category   | III 300V   |
| Overvoltage category   | III  |
| Isolation              | 0 kVRMS between power supply and measurement inputs<br>4 kVRMS between RS485 and measurement inputs<br>4 kVRMS between power supply and RS485    |
| Enclosure              |  |
| Connections            | n°1 screw terminal block, 3.5 mm pitch, 4 poles<br>n°1 screw terminal block, 5 mm pitch, 4 poles<br>n°1 screw terminal block 5 mm pitch, 6 poles |
| Dimensions             | 90x61x72 mm  |
| Material               | PBT, gray  |
| Protection rating      | IP20   |
| Mounting system        | On DIN rail, designed for bus mounting   |
| Configuration          | Via integrated Webservice (accessible from AP 192.168.4.1 or from IP assigned in the local network)<br>Via Cloud (FULL version only)             |

| Standards                                      |  |
|--|--|
| Electrostatic discharge (EN 61000-4-2)         | 8 kV contact<br>15 kV air  |
| Radiated immunity (EN 61000-4-3)               | 10 V/m   |
| Immunity to fast transients EFT (EN 61000-4-4) | 2 kV   |
| Surge immunity (EN 61000-4-5)                  | 2 kV on power supply<br>1 kV on current measurement inputs, RS485 and digital output   |
| Conducted disturbances immunity (EN 61000-4-6) | 10 V   |
| Conducted and radiated emissions (EN 55032)    | Class B  |
| Safety   | EN61010-1; EN61010-2-030;  |
| Certifications                                 | <br><br> |

| RS485 port               |   |
|--------------------------|---|
| Protocol                 | Modbus RTU  |
| Number of addresses      | Up to 247 (Default 1)   |
| Baudrate                 | From 1200 to 115200 Baud (Default 9600)   |
| Configuration parameters | Address<br>Baudrate<br>Parity<br>Stop bit   |
| Connection               | Via 3-poles terminal block 3.81mm pitch   |
| Cable cross-section      | 0.2 mm <sup>2</sup> or less recommended. Recommended Belden 9841 cables or equivalent |

| WiFi port                |  |
|--------------------------|--|
| Protocol                 | Modbus TCP<br>HTTP<br>MQTT   |
| Number of clients        | Up to 10   |
| Frequency                | 2.4 Ghz 802.11 b/g/n   |
| Number of clients        | Webserver<br>Firmware update<br>Communication<br>Logging<br>MQTT (advanced version only) |
| Configuration parameters | IP address<br>Subnet mask<br>Gateway address<br>TCP port<br>DHCP<br>MQTT                 |

| Software functions        |  |
|---------------------------|--|
| Measurement type          | TRMS   |
| Sampling time             | 6400 samples/s @ 50 Hz,<br>7280 samples/s @ 60 Hz  |
| Measurement update        | Software programmable;<br>Default: every 50 cycles (AC)<br>MAX: 65535 cycles   |
| Transformation ratio      | CT and VT ratios default 1.0; adjustable by software or via APP  |
| Transformation delays     | 0.0° @ 50 Hz default; adjustable by software or via APP  |
| Minimum display threshold | adjustable on voltage, current and power   |
| Internal calendar         | Both via NTP and via RTC. When the module is powered off, the RTC is powered by a 1220 coin cell battery. It can be replaced by lifting the display cover. |

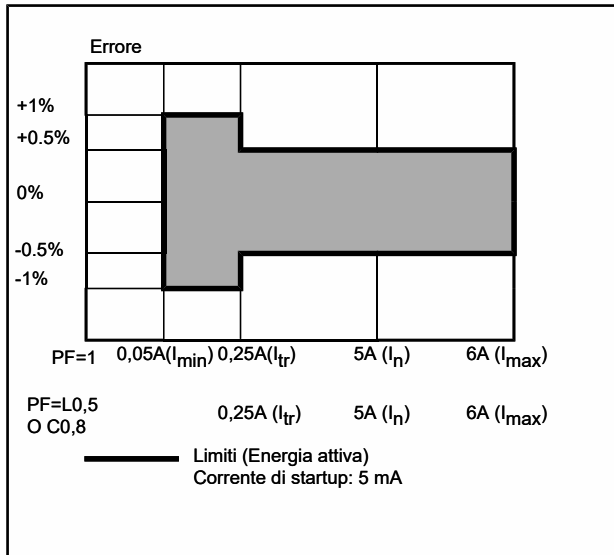
1) Batteria interna usata per il calendario se non c'è il Wifi. La durata si riferisce alla durata minima se la scheda non viene alimentata

| Digital output      |   |
|---------------------|---|
| Use                 | Alarm or pulses/kWh   |
| Number              | 1   |
| Type                | Solid state (opto-mos)  |
| Rating              | < 40 V, < 100 mA  |
| Connection          | Via 5 mm pitch screw terminal   |
| Cable cross-section | 0.2 mm <sup>2</sup> or less recommended. Recommended Belden 9841 cables or equivalent |

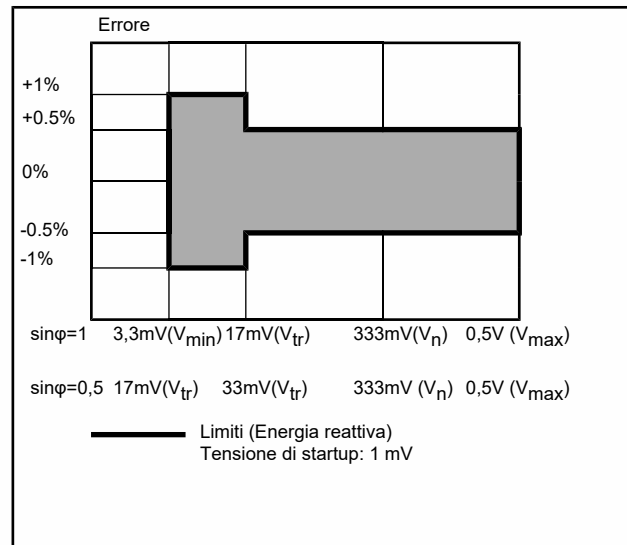
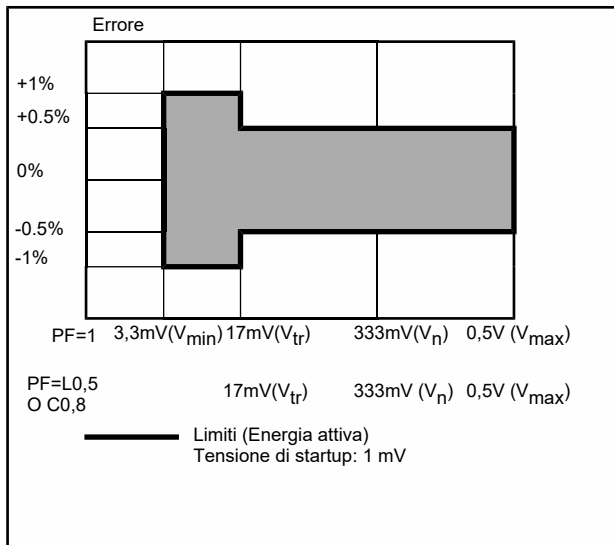
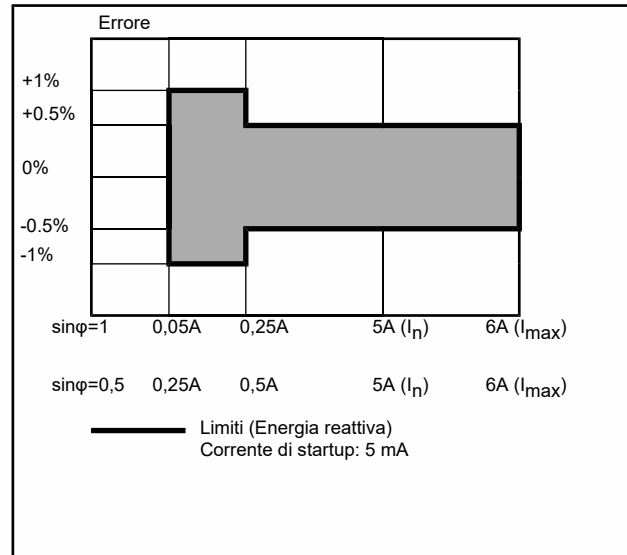
## SUPPLEMENTARY INFORMATION

### ACCURACY (according to EN50470-3 and EN62053-24)

Wh, accuracy as a function of load (CT with current output)



VARh, accuracy as a function of load (CT with current output)



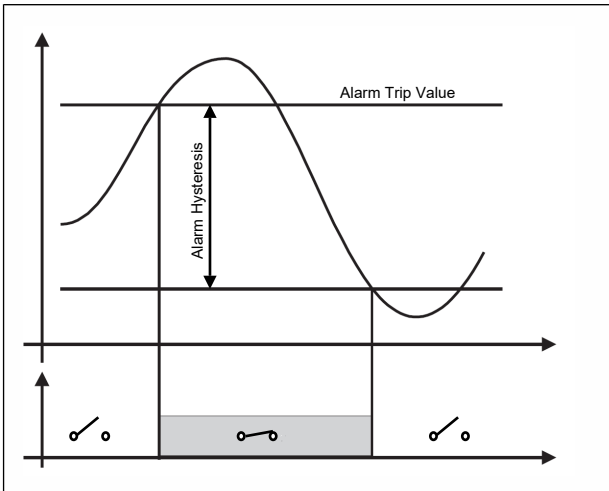
**Note:** Reactive power accuracy is guaranteed provided that the instrument is set for Q calculation using the Budeanu formula.

**DIGITAL OUTPUT**

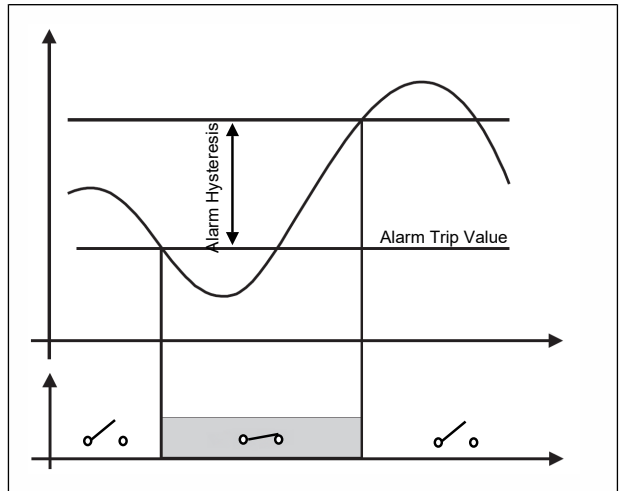
The digital output can be set to operate as an alarm or pulse output.

**ALARMS**

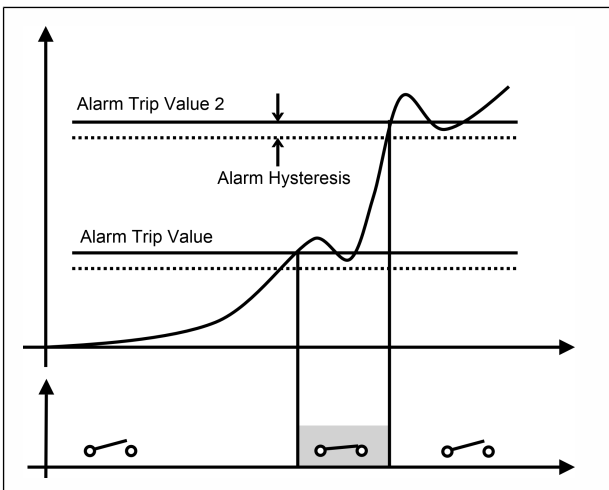
Rising edge: Normally open contact



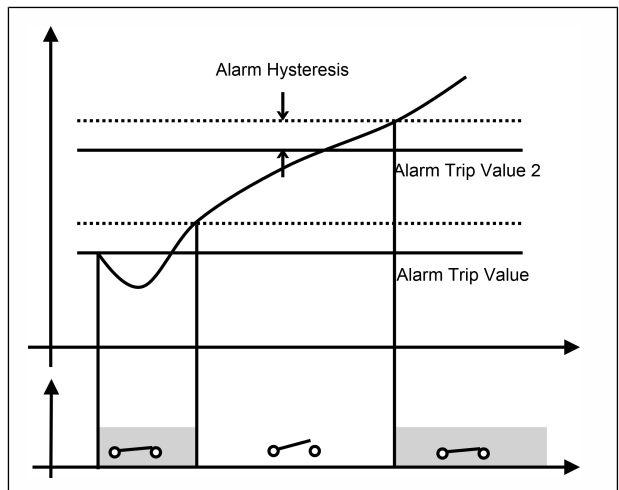
Falling edge: Normally closed contact



Window: contact closed between thresholds

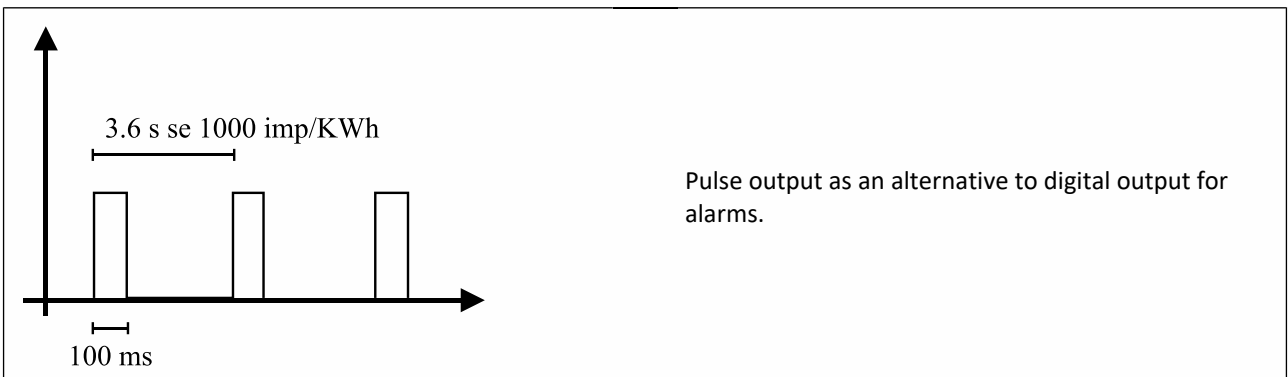


Window: contact closed outside thresholds



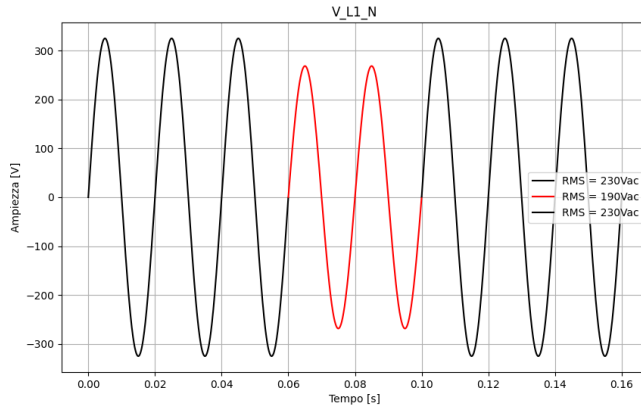
Note: A buzzer can be associated with alarms to provide an audible alarm.

**PULSE OUTPUT**

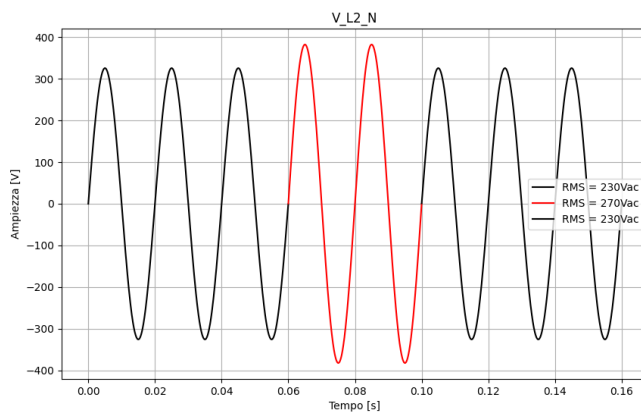


**POWER QUALITY**

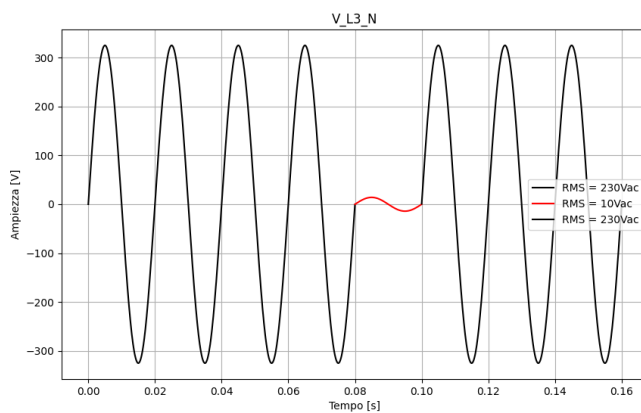
| Event | Valori EMT430 |
|-------|---------------|
|-------|---------------|

**SAG**


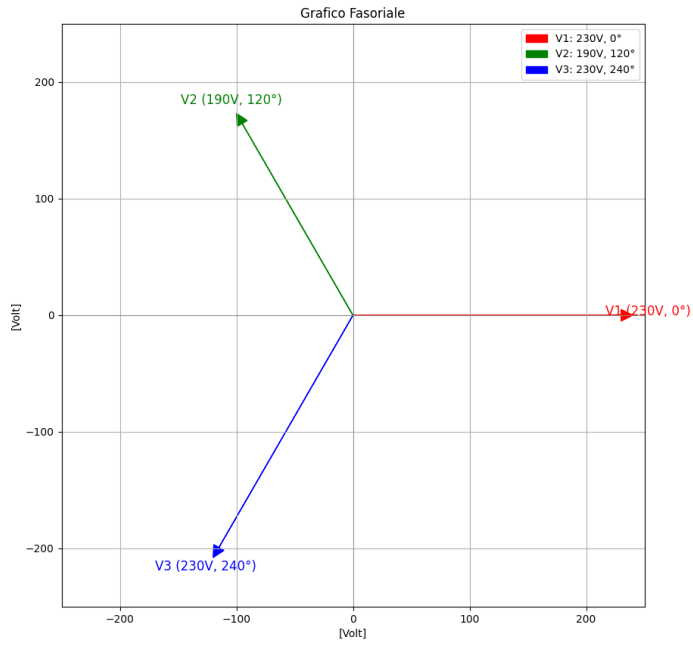
- Type: Sag
- Value: 190 V
- Query: 1 (V\_L2\_N)
- Duration: 40 ms

**SWELL**


- Type: Swell
- Value: 270 V
- Query: 2 (V\_L2\_N)
- Duration: 40 ms

**INTERRUPTION**


- Type: Interruption
- Value: 10 V
- Query: 3 (V\_L3\_N)
- Duration: 20 ms

**UNBALANCE**

- Unbalance: 6.15%

## REALTIME WAVEFORMS

The analyzer can record up to 10 waveforms (3 star-connected voltage channels, 3 line-to-line voltages, 4 line currents).

128 waveform periods are sampled for each period. Sampling is performed at 6400 sps @ 50 Hz.

They can be displayed directly via the webserver. It is also possible to access values via Modbus registers, either through RS485 (Modbus RTU) or through WiFi (Modbus TCP, recommended due to higher speed).

## INSULATION BETWEEN INPUTS AND OUTPUTS

|                    | Power supply | Measurement inputs | RS485  | Digital output |
|--------------------|--------------|--------------------|--------|----------------|
| Power supply       |              | 0 KV               | 4 KV   | 4 KV           |
| Measurement inputs | 0 KV         |                    | 4 KV   | 4 KV           |
| RS485              | 4 KV         | 4 KV               |        | 1,5 KV         |
| Digital output     | 4 KV         | 4 KV               | 1,5 KV |                |

## PROGRAMMAZIONE AVANZATA

In addition to Modbus RTU and TCP and the integrated webserver, the instrument exposes a list of Application Programming Interface (API) functions for easy management of measurements and settings, formatted in JSON. To use them, enter the device IP in a browser followed by the function to be used. For example, [http://192.168.178.30/get\\_measurements\\_status](http://192.168.178.30/get_measurements_status)

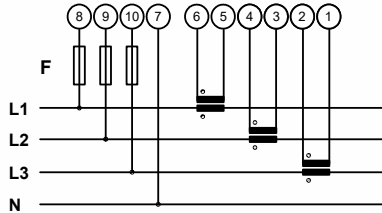
The list of functions is provided in the documentation available on the website

| Funzione          | Descrizione  |
|-------------------|--|
| api_http_gets     | GET type APIs exposed by the device                    |
| api_http_posts    | POST type APIs exposed by the device                   |
| api_mqtt_getposts | GET type APIs exposed by the device available via MQTT |

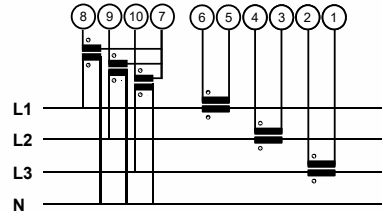
| CALCULATION FORMULAS USED  |   |   |
|--|---|---|
| Phase variables  | System variables                            | Energy counting   |
| <i>RMS voltage</i>   | <i>Average voltage</i>                      | <i>Active energy</i>  |
| $V_i = \sqrt{\frac{1}{N} * \sum_1^N (v_L)_i^2}$  | $V_{AVG} = \frac{V_1 + V_2 + V_3}{3}$       | $Wh_i = \int_{t_1}^{t_2} P_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} P(n)_i$  |
| <i>RMS current</i>   | <i>Average current</i>                      | <i>Reactive energy</i>  |
| $I_i = \sqrt{\frac{1}{N} * \sum_1^N (i_L)_i^2}$  | $I_{AVG} = \frac{I_1 + I_2 + I_3}{3}$       | $VARh_i = \int_{t_1}^{t_2} Q_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} Q(n)_i$  |
| <i>Active power</i>  | <i>Three-phase active power</i>             | <i>Apparent energy</i>  |
| $P_i = \frac{1}{N} * \sum_1^N v_{Li} * i_{Li}$   | $P_{3PH} = P_1 + P_2 + P_3$                 | $VAh_i = \int_{t_1}^{t_2} S_i(t) dt \approx \Delta t \sum_{n_1}^{n_2} S(n)_i$   |
| <i>Apparent power</i>  | <i>Three-phase apparent power</i>           | <i>Voltage unbalance</i>  |
| $S_i = V_i * I_i$  | $S_{3PH} = S_1 + S_2 + S_3$                 | $V_{UNB} = \frac{MAX(V_i - V_{AVG})}{V_{AVG}}$  |
| <i>Reactive power</i>  | <i>Three-phase reactive power</i>           | Where:<br>i = considered phase (L1, L2 or L3);<br>P = active power;<br>Q = reactive power;<br>t1, t2 = start and end of the counting period;<br>n = time unit;<br>t = time unit width;<br>n1, n2 = first and last time unit in the counting period. |
| $Q_i = \frac{1}{N} * \sum_1^N v_{Li} \hat{i}_{Li}$ Budeanu<br>$Q_i = \sqrt{S_i^2 - P_i^2}$ triangolo | $Q_{3PH} = Q_1 + Q_2 + Q_3$                 |   |
| <i>Power factor</i>  | <i>Three-phase power factor</i>             |   |
| $\cos \phi_i = \frac{P_i}{S_i}$  | $\cos \phi_{3PH} = \frac{P_{3PH}}{S_{3PH}}$ |   |

## WIRING DIAGRAMS

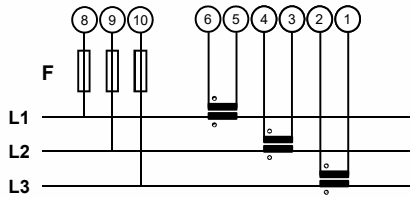
Three-phase, 4-wire, connection with 3 CTs



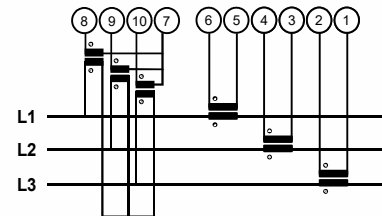
Three-phase, 4-wire, connection with 3 CTs and 3 VTs



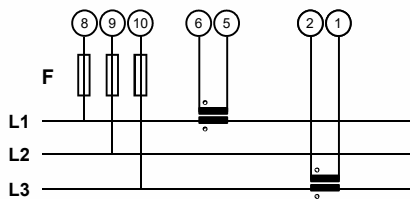
Three-phase, 3-wire, connection with 3 CTs



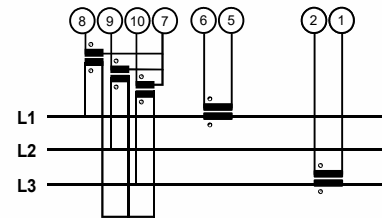
Three-phase, 3-wire, connection with 3 CTs and 3 VTs



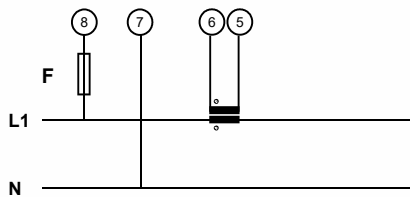
Three-phase, 3-wire, connection with 2 CTs (Aron)



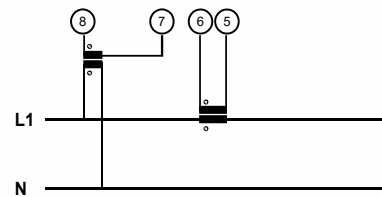
Three-phase, 3-wire, connection with 2 CTs and 3 VTs (Aron)



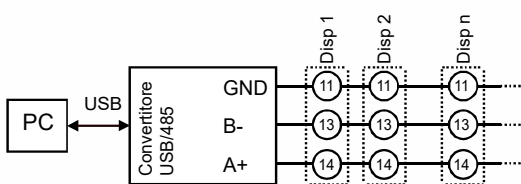
Single-phase, 2-wire, connection with 1 CT



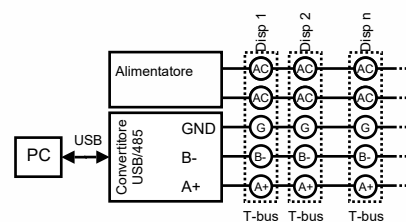
Single-phase, 2-wire, connection with 1 CT and 1 VT



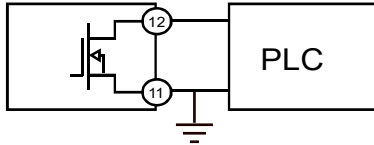
Communication via RS485



Digital output and Power supply



## Uscita digitale su morsetto estraibile



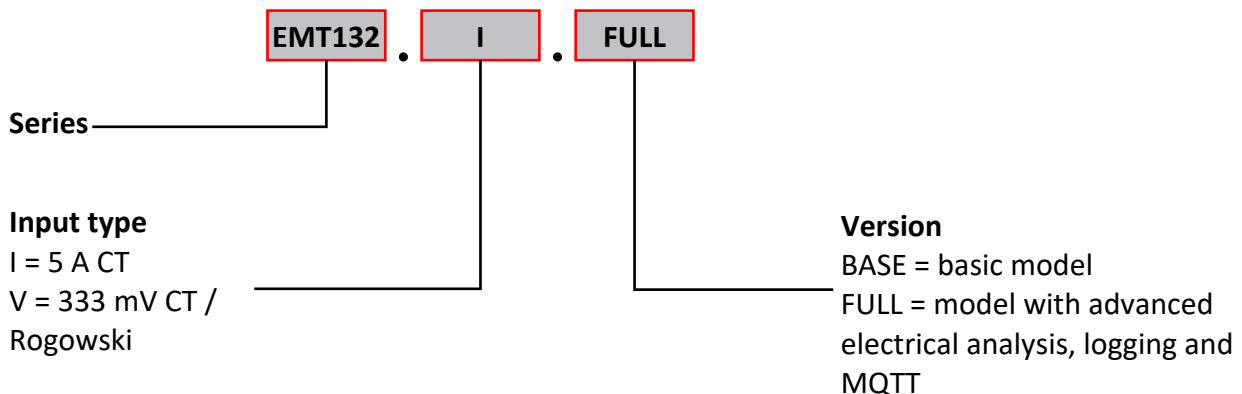
N.B.: Since the device is Class II, according to standard "EN 61140:2004-05 Protection against electric shock - Common aspects for installations and equipment - Equipotential bonding", grounding the device is not recommended, as it could reduce installation safety. Any grounding must ensure that no current flows between terminal 7 (N) and PE earth. Device intended exclusively for indoor installation in an electrical panel (protection rating ensured by the panel).

## FIRST CONNECTION

1. To connect to the instrument via WiFi, follow these steps:
2. Connect to the exposed AP (default EMT132\_SerialNumber) using a smartphone
3. Disable mobile data connection
4. Open a browser such as Chrome and enter the address 192.168.4.1
5. Enter username and password: "admin", "admin"
6. Inside the integrated webserver, in the WiFi connections page, enter the target SSID and target Password of the WiFi network being used.
7. Restart the instrument, which will be directly visible on the local network. Proper operation can be verified by accessing the internal webserver, where the main electrical quantities can be monitored, which should match the expected values.

## ORDERING CODES

Example: EMT132 with 5 A CT input and model with advanced analysis, logging and MQTT.



## CHRONOS SRL

|  |   |
|--|---|
| <b>Sede legale:</b>  | <b>Sede operativa</b>   |
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