INTRODUCTION

Product description

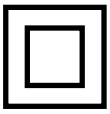
Three-phase network analyzer with power supply 90 - 350 VDC or 85 - 265 VAC, 5 (6) A or 333mV/Rogowski. 320x240 pixel color graphic display, RS485 port, Ethernet, USB, SD card Wifi, NFC, pulse output, RTC.

Product features

- Equivalent to class 0.2S (kWh) of EN 62053-22
- Equivalent to class 0.2S (kvarh) of EN 62053-24
- Accuracy ±0.2% RDG
- Bidirectional energy meter
- TRMS measurement of distorted waveforms (voltage/current)
- Neutral current calculation
- One opto-MOS output for alarms or pulses
- Wi-Fi Station and Access Point (Modbus TCP)
- Ethernet (Modbus TCP)
- RS485 serial output (Modbus RTU)
- NFC
- Logging via USB or SD card (or internal memory) with timestamp
- 2.2” color display, 16-bit, 320x240 pixels, capacitive touchscreen
- Sampling frequency: 6400 samples @ 50 Hz
- Dimensions: 4 DIN modules
- Direct association of Chronos CTs via App to correct phase shift and signal amplitude
- Complete harmonic analysis (amplitudes and phases)
- Two versions for CT input: 5 A current or voltage (333 mV/Rogowski)
- Internal integrator for Rogowski coils
- Available in two variants: Base, Full

MADE IN ITALY CE

SYMBOLS

	**DANGER:** Failure to follow the instructions may cause damage to property, people, or animals.		**WARNING, DANGEROUS VOLTAGE:** Presence of electrical voltage. Disconnect the power supply before performing any work.
	**DOUBLE INSULATION:** Class II equipment. No grounding connection is required.		**WEEE:** 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 φ	•	•
Tan φ	•	•
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 φ 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 high voltage supply
Rated voltage range L-N	85 - 265 Vac
Working frequency	DC / 1 - 65 Hz
Power Consumption	< 4.5 W
Cable cross-section	2.5 mm² 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 (Ist)	5 mA
Minimum current (In)	50 mA
Rated current (In)	5 A_{AC}
Maximum current (I_{MAX})	6 A_{AC}
Crest factor	< 4 (20 A_{PK} MAX)
Burden	< 1 VA per phase
Overload for 500 ms	40 A_{AC}
CT with voltage output	
Starting current (Ist)	0.33 mV_{AC}
Minimum current (In)	3.33 mV_{AC}
Rated voltage (Vn)	333 mV_{AC}
Maximum current (V_{MAX})	500 mV_{AC}
Crest factor	< 3 (1 V_{PK} MAX)
Burden	220 KΩ
Overload for 500 ms	6 V_{PK}

Accuracy (@25 ± 5°C; frequency = 50 Hz)		Refresh time
Frequency	± 0,01 Hz (45..65 Hz)	100 ms
Voltage	± 0,1% rdg	Configurable from 1 to 65535 periods (from 20 ms to 21.8 minutes if frequency = 50 Hz)
Current	± 0,1% rdg	
Active and apparent power (PF = 0.5L .. 0.5C)	± 0,1% rdg (In o Vn from 5% to 100%)	
	± 0,2% rdg (In o Vn from 1% to 5%)	
Reactive power (sinφ = 0.5L .. 0.5C)	± 0,1% rdg (In o Vn from 5% to 100%)	
	± 0,2% rdg (In o Vn from 1% to 5%)	
Active energy	class 0.2 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	
THD	±0.3%	100 ms
Harmonics	±1% amplitude up to the 16th harmonic ±2% amplitude from the 17th harmonic to the 63rd harmonic ±5° phase shift up to the 16th harmonic ±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 4 kVRMS between RS485 and measurement inputs 4 kVRMS between power supply and RS485
Enclosure	
Connections	n°1 screw terminal block, 3.81 mm pitch, 3 poles n°1 screw terminal block, 7.5 mm pitch, 4 poles n°2 screw terminal block 5 mm pitch 6 poles n°1 RJ45 Ethernet connector
Dimensions	90x61x72 mm
Material	PBT, gray
Protection rating	IP20
Mounting system	On DIN rail, designed for bus mounting
Configuration	Via integrated Webserver (accessible from AP 192.168.4.1 or from IP assigned in the local network) Via Cloud (FULL version only)

Standards	
Electrostatic discharge (EN 61000-4-2)	8 kV contact 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 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	CE UKCA

RS485 port	
Protocol	Modbus RTU
Number of addresses	Up to 247 (Default 1)
Baudrate	From 1200 to 115200 Baud (Default 9600)
Configuration parameters	Address Baudrate Parity Stop bit
Connection	Via 3-poles terminal block 3.81mm pitch
Cable cross-section	0.2 mm² or less recommended. Recommended Belden 9841 cables or equivalent

Ethernet port	
Protocol	Modbus TCP HTTP MQTT SNTP
Number of clients	Up to 10
Speed	10/100 Mbit/s
Associated features	Webserver Firmware update Communication Waveform display (advanced version only) Logging (advanced version only) MQTT (advanced version only)
Configuration parameters	IP address Subnet mask Gateway address TCP port DHCP MQTT Transmission power

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

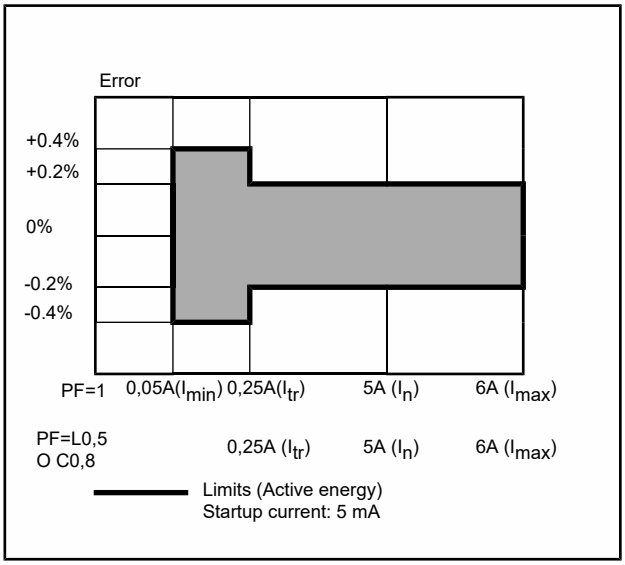
Software functions	
Measurement type	TRMS
Sampling time	6400 samples/s @ 50 Hz, 7280 samples/s @ 60 Hz
Measurement update	Software programmable; Default: every 50 cycles (AC) MAX: 65535 cycles
Transformation ratio	CT and VT ratios default 1.0; adjustable by software or via APP
Transformation delays	0.0° @ 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.

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 mm² or less recommended. Recommended Belden 9841 cables or equivalent

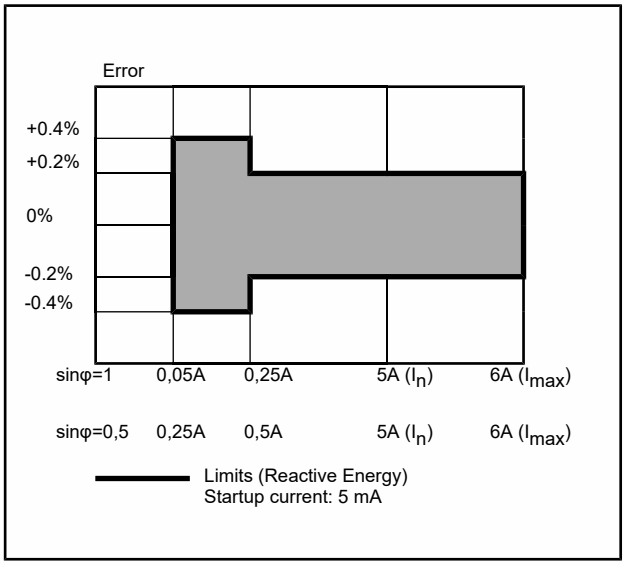
SUPPLEMENTARY INFORMATION

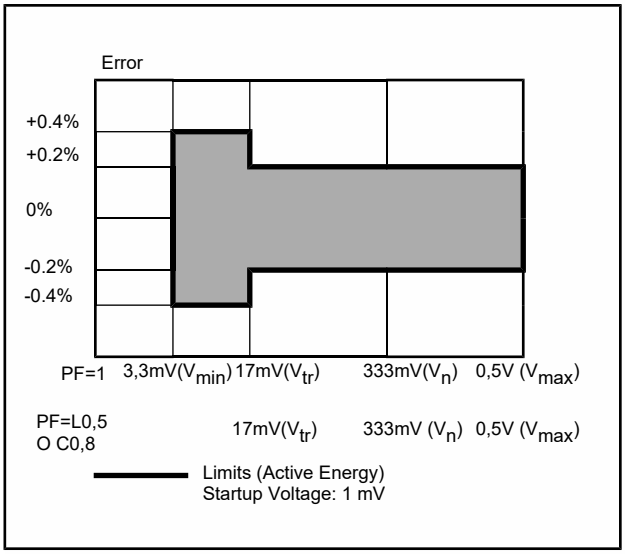
ACCURACY (according to EN62053-22)

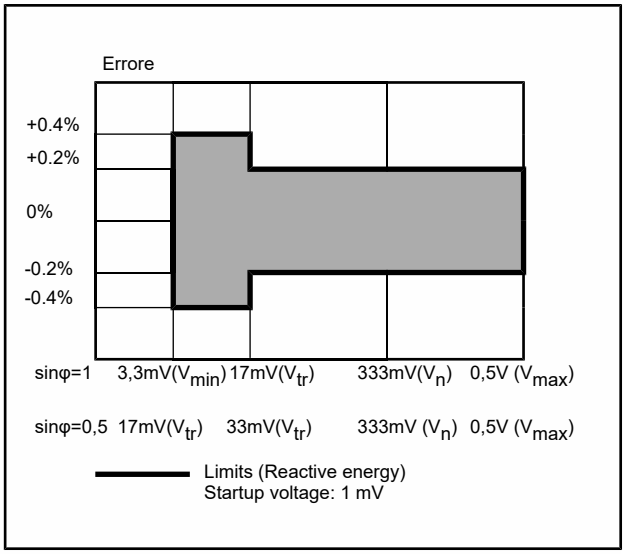
Wh, accuracy as a function of load (CT with current output)



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







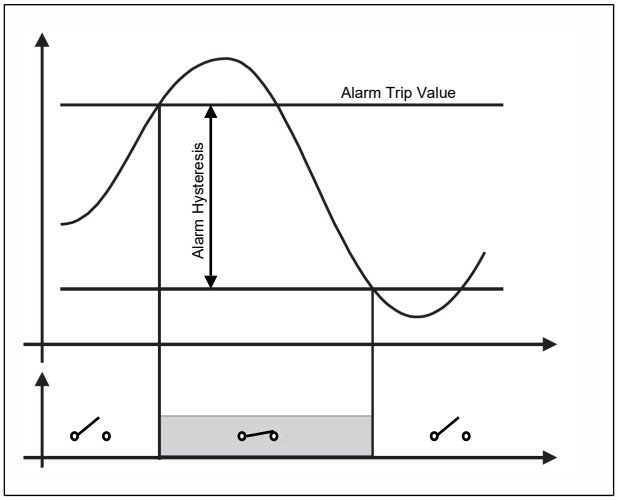
Note: Reactive power accuracy is guaranteed provided that the instrument is set for Q calculation using the Budeanu formula.

DIGITAL OUTPUT

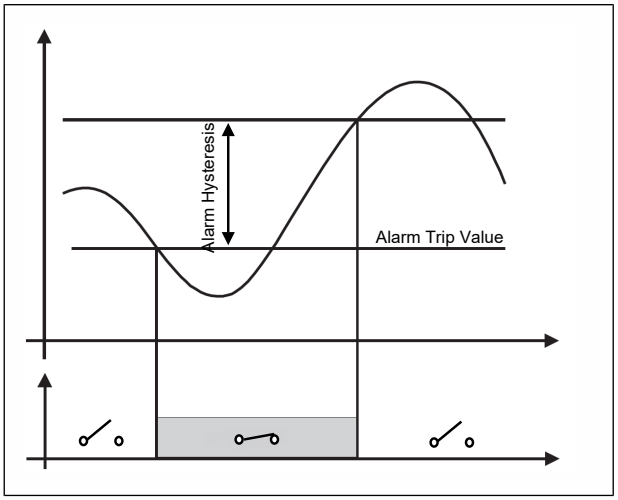
The digital output can be set to operate as an alarm or pulse output.

ALARMS

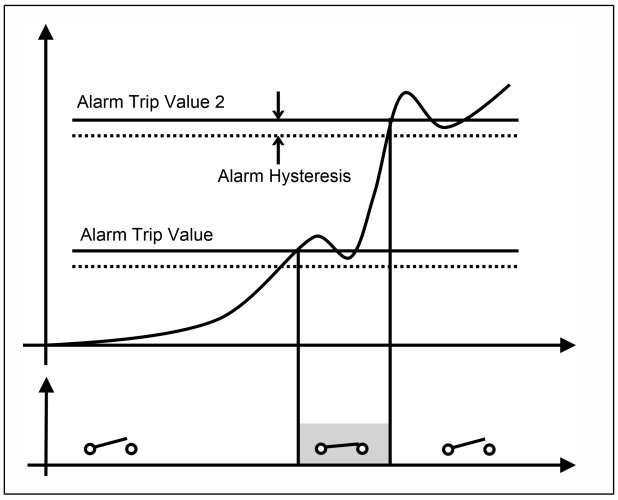
Rising edge: Normally open contact



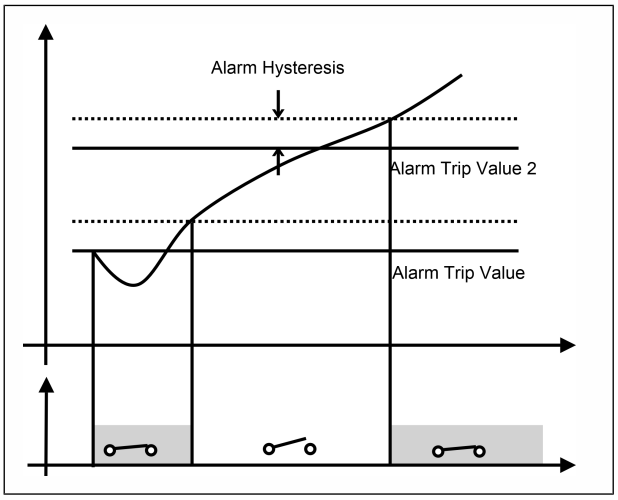
Falling edge: Normally closed contact



Window: contact closed between thresholds

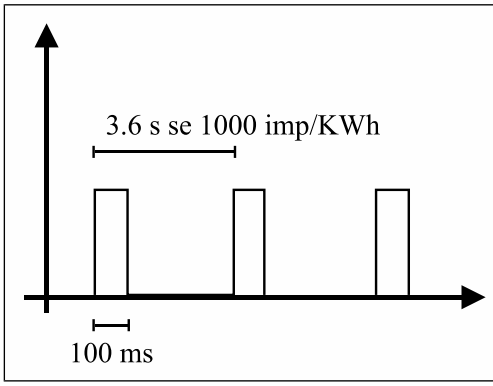


Window: contact closed outside thresholds



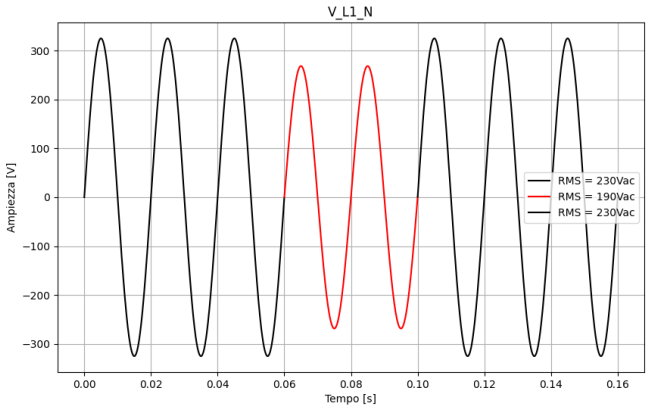
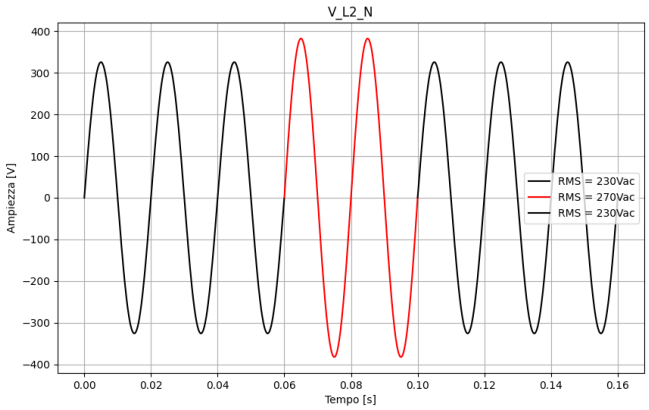
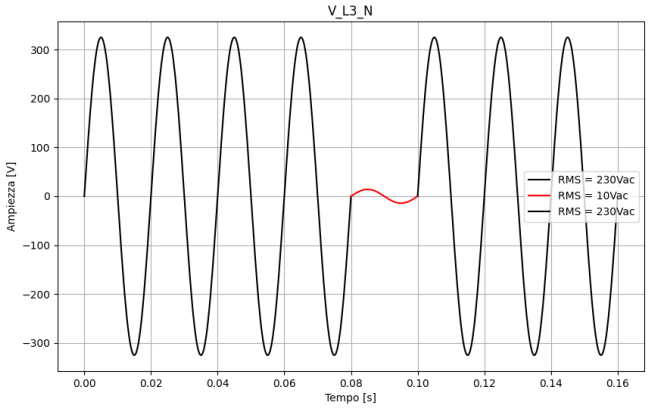
Note: A buzzer can be associated with alarms to provide an audible alarm.

PULSE OUTPUT

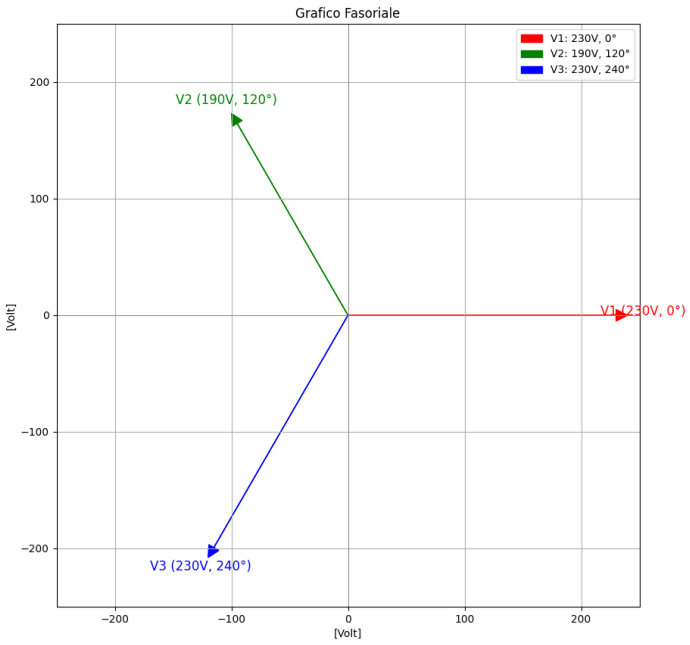


Pulse output as an alternative to digital output for alarms.

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%

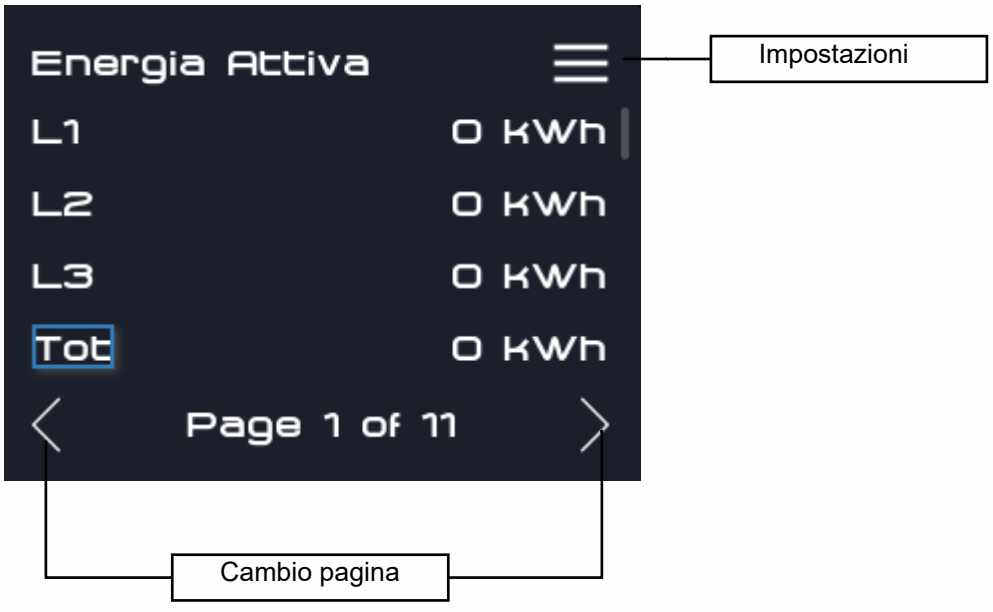
REALTIME WAVEFORMS

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

GRAPHICS INTERFACE



CALCULATION FORMULAS USED

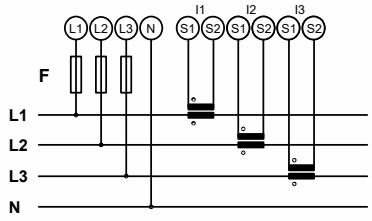
Phase variables	System variables	Energy counting
RMS voltage	*Average voltage*	*Active energy*
$V_i = \sqrt{\frac{1}{N} * \sum_{1}^{N} (v_L)_i^2}$	$V_{AVG} = \frac{V_1 + V_2 + V_3}{3}$	$Wh_i = \int_{t_1}^{t_2} P_i(t)\,dt \approx \Delta t \sum_{n_1}^{n_2} P(n)_i$
RMS current	*Average current*	*Reactive energy*
$I_i = \sqrt{\frac{1}{N} * \sum_{1}^{N} (i_L)_i^2}$	$I_{AVG} = \frac{I_1 + I_2 + I_3}{3}$	$VARh_i = \int_{t_1}^{t_2} Q_i(t)\,dt \approx \Delta t \sum_{n_1}^{n_2} Q(n)_i$
Active power	*Three-phase active power*	*Apparent energy*
$P_i = \frac{1}{N} * \sum_{1}^{N} v_{Li} * i_{Li}$	$P_{3PH} = P_1 + P_2 + P_3$	$VAh_i = \int_{t_1}^{t_2} S_i(t)\,dt \approx \Delta t \sum_{n_1}^{n_2} S(n)_i$
Apparent power	*Three-phase apparent power*	*Voltage unbalance*
$S_i = V_i * I_i$	$S_{3PH} = S_1 + S_2 + S_3$	$V_{UNB} = \frac{MAX(V_i - V_{AVG})}{V_{AVG}}$

Reactive power	*Three-phase reactive power*	Where:
		i = considered phase (L1, L2 or L3);
		P = active power;
		Q = reactive power;
		t1, t2 = start and end of the counting period;
		n = time unit;
		t = time unit width;
		n1, n2 = first and last time unit in the counting period.

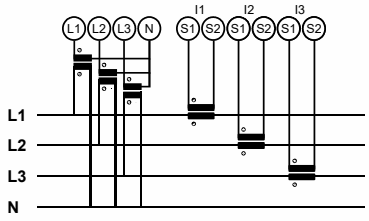
$Q_i = \frac{1}{N} * \sum_{1}^{N} v_{Li}\,\hat{i}_{Li}$ *Budeanu* $Q_i = \sqrt{S_i^2 - P_i^2}$ *triangolo*	$Q_{3PH} = Q_1 + Q_2 + Q_3$	
Power factor	*Three-phase power factor*	
$\cos\phi_i = \frac{P_i}{S_i}$	$\cos\phi_{3PH} = \frac{P_{3PH}}{S_{3PH}}$	

WIRING DIAGRAMS

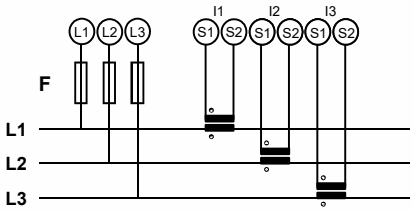
Three-phase, 4-wire, connection with 3 CTs



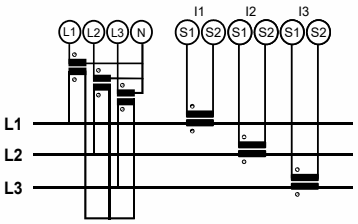
Three-phase, 4-wire, connection with 3 CTs and 3 VTs



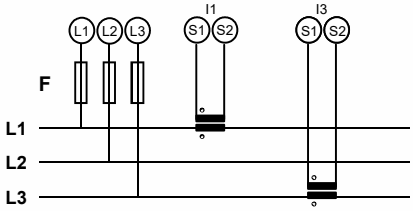
Three-phase, 3-wire, connection with 3 CTs



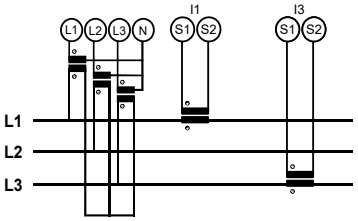
Three-phase, 3-wire, connection with 3 CTs and 3 VTs



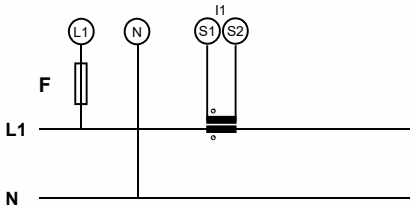
Three-phase, 3-wire, connection with 2 CTs (Aron)



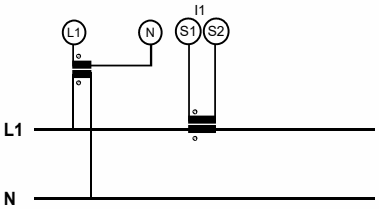
Three-phase, 3-wire, connection with 2 CTs and 3 VTs (Aron)



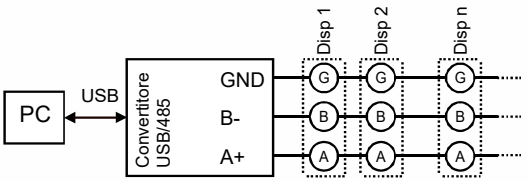
Single-phase, 2-wire, connection with 1 CT



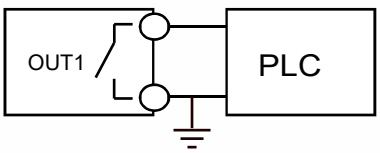
Single-phase, 2-wire, connection with 1 CT and 1 VT



Communication via RS485

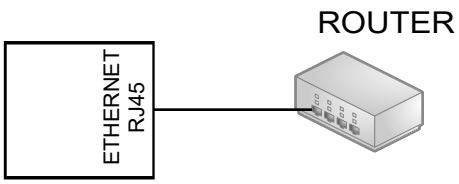


Digital output



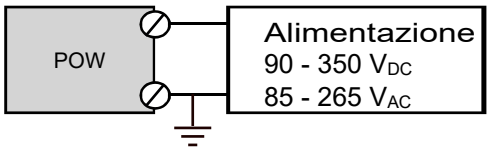
N.B.: Since the device is Class II, according to standard “EN 61140:2004-05
Protection against electric shock - Common aspects for installations and equipment - Equipotential bonding”, grounding the device is not recommended, as it could reduce installation safety. Any grounding must ensure that no current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

Ethernet connection



When connected correctly, the green LED (LINK) is steadily on, and the yellow LED (ACTIVITY) blinks intermittently.

Power Supply



N.B.: Since the device is Class II, in accordance with the standard “EN 61140:2004-05 ‘Protection against electric shock - Common aspects for installation and equipment - Equipotential bonding’”, grounding the instrument is not recommended, as it may reduce the safety of the installation. Any eventual grounding must ensure that no current flows between terminal 7 (N) and the PE earth.

FIRST CONNECTION

1. To connect to the instrument via WiFi, follow these steps:
2. Connect to the exposed AP (default EMT431_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: EMT431 with 5 A CT input and model with advanced analysis, logging and MQTT.

EMT431 . **I** . **FULL**

Series

Input type
I = 5 A CT
V = 333 mV CT / Rogowski

Version
BASE = basic model
FULL = model with advanced electrical analysis, logging and MQTT

CHRONOS SRL

Sede legale:	Sede operativa
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