
# EVAR

## *Line Analizer & Protection*

CE

**Metering & Protection for Feeders, Generators & Industry**

## DESCRIPTION

The EVAR relay has been designed for the continuous monitoring of electrical parameters in medium or low-voltage 1-phase or 3-phase systems. It allows direct or remote monitoring of the system's general conditions as it immediately signals any fault. EVAR can also be used to control the production process thanks to the programmable contacts suitable for various applications.

## APPLICATIONS

- Metering of distribution feeders, transformers, generators, capacitor banks and motors.
- Commercial & industrial utility.
- Flexible control for demand load shedding, power factor, etc.
- Power quality analysis.

## PROTECTION AND FUNCTIONALITY

Configurable setpoints of:

- Phase Under & Over Current
- Ground overcurrent
- Phase Under & Over Voltage
- Phase sequence
- Current & Voltage Total harmonic distortion (THD)
- Under & Over frequency
- Positive & Negative Active power
- Positive & Negative Reactive power
- Voltage & current Unbalance
- Power factor (leading or lagging)
- Demand readings for:
  - phase current ..... (A)
  - active power ..... (kW)
  - reactive power..... (kvar)
  - apparent power ... (kVA)

## COMMUNICATION

- Remote communication using a PC or a PLC by 1 RS232 & 2 RS485 ports.
- Remote programming of the setpoints.
- Protocol used: Modbus RTU.

## DIGITAL MEASUREMENT

1. True RMS Phase & Ground Current
2. True RMS Phase & Line voltage
3. Energy
4. Positive & negative Active power (kW) & Reactive power (kvar)
5. Last & Maximum Demand readings for:
   - phase current (A)
   - active power (kW)
   - reactive power (kvar)
   - apparent power (kVA)
6. Frequency (Hz)
7. Voltage & Current Unbalance.
8. Voltage & current harmonic analysis up to the 13$^{th}$
9. K value measurement.
9. Event recorder.

## SIGNALLING AND PROGRAMMING

- LCD & LED display indication.
- Indication and storage of fault conditions and their values.
- Indication on the system status:
  - NORMAL
  - CURRENT FAULT
  - VOLTAGE FAULT
  - UNBALANCE FAULT
  - POWER FAULT
  - POWER FACTOR FAULT
  - DEMAND FAULT
  - THD FAULT
  - FREQUENCY FAULT

## SPECIFICATIONS

**SUPPLY VOLTAGE**
24÷310 Vdc, –15%, +10%
24÷240 Vac, -15%, +20% 50/60Hz

**MAX. POWER CONSUPTION**
12VA (7W)

**TEMPERATURE RANGE**
Operational: 0 °C a +50 °C
Storage: –20 °C a + 70 °C

**RELATIVE HUMIDITY**
Max. 90% (non condensing)

**DIELECTRIC WITHSTAND VOLTAGE**
2 kVac, 60 s

**BURN IN**
48 hours at 50 °C

**CONSTRUCTION**
According to VDE, UL, CEI standards

**OUTPUT CONTACT**
*Rated load:* 8A
DC 150W resistive or 90W inductive (L/R=40 ms)
AC 2000VA resistive or 800VA inductive (PF=0.4)
*Max. operating Voltage:* 250 Vac, 125 Vdc

**SWITCH INPUT**
*Type:* Dry contacts only, 500 Ohm Max ON resistance
(12 Vdc @ 10 mA provided by relay)

**LED INDICATORS**
*Relay status:* Alarm
AUX.1
AUX.2

*System status:* Normal.
Fault: Current, Voltage, Unbalance, Frequency, Power, Power Factor Demand, THD.

*Display (LCD):* 16 x 2 digits

**COMMUNICATIONS**
*Type:* 1 RS232 port + 2 RS485 ports, Half duplex, 1200 → 57600 baud
*Protocol:* Modbus RTU
*Functions:* Reading/Writing setpoints
Reading actual values
Executing command

**TERMINAL BLOCK**
Fixed, back connection terminals with 4-mm$^2$-section cable (12 AWG).

**FRAME**
In ABS auto-extinguish with frontal in polycarbonate (IP54).

**ASSEMBLY**
The relay has to be fixed to the structure with the help of the stirrup with screws.

**DIMENSION**
144 x 144 x 141 mm

**FRONT PANEL CUTOUT**
137 x 137 mm

**WEIGHT**
1.5 Kg

**APPLICABILITY**
*System*: one and three and four-wire;
*Frequency*: 50 and 60 Hz;
*Current*: max. 5000 A;
*Voltage*: max. 69 KV

**PHASE AND GROUND CT INPUTS**
*Source CT (In)*: CT (In) 5 A to 5000 A, Steps: 5 A.
*CT secondary*: CT 1 A or 5 A (specify with order).
*Sampling*: True RMS, 32 sample/s.
*CT burden*: 0.25 VA per phase at rated secondary current.
*Continuous*: 2xIn Amps.
*Current withstand capac.*: 20 times In curr. value per 1 sec.
*Range*: 1 to 600% of In.
*Frequency*: up to 13$^{th}$ harmonic.
*Accuracy*: ± 0.5% of full scale, true RMS.

**VOLTAGE INPUT**
*Sampling:* True RMS, 32 samples/cycle.
*VT input:* Secondary: 55 to 254 Vac, Steps: 1V;
Primary (Un): 0.10 to 69 kV, Steps 0.01kV.
*Input range:* 10 to 400 Vac (direct)
*VT burden:* 1 VA max.
*Max. Continuous:* 320 Vac phase-neutral.
*Range:* 20 to 125% of Un.
*Frequency:* up to 13$^{th}$ harmonic.
*Accuracy:* ± 0.5% of full scale, true RMS.

**PHASE UNDERCURRENT MONITORING**
*Pickup level* : 2% → 100% of In, Steps: 1%
*Dropout level:* 1% → 100% of In, Steps: 1%
*Delay time:* 0.5 s → 600.0 s, Steps: 0.5 s
*Accuracy:* see: current input
*Timing accuracy:* ± 0.5 s

**PHASE & GROUND OVERCURRENT MONITORING**
*Pickup level:* 2% → 500% di In, Steps: 1%
*Dropout level:* 1% → 100% di In, Steps: 1%
*Delay time:* 0.5 s → 600.0 s, Steps: 0.5 s
*Accuracy:* see: current input
*Timing accuracy:* ± 0.5 s

**UNDERVOLTAGE MONITORING**

| | |
|---|---|
| *Required voltage:* | >20% Un, applied in all phases |
| *Pickup level:* | 30% → 100% of Un, Steps: 1% |
| *Dropout level:* | 1% → 100% of Un, Steps 1% |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Phases:* | Any one, any two, all three (programmable) |
| *Accuracy:* | see: voltage input |
| *Timing accuracy*: | ± 0.5 s |

**OVERVOLTAGE MONITORING**

| | |
|---|---|
| *Pickup level:* | 101% → 125% of Un, Steps: 1% |
| *Dropout level:* | 1% → 25% of Un, Steps 1% |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Phases:* | Any one, any two, all three (programmable) |
| *Accuracy:* | see: voltage input |
| *Timing accuracy:* | ± 0.5 s |

**CURRENT / VOLTAGE UNBALANCE MONITORING**

| | |
|---|---|
| *Pickup level:* | 1% → 100% of In / Un, Steps: 1% |
| *Dropout level:* | 1% → 100% of In / Un, Steps 1% |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Accuracy:* | ±1% of full scale |
| *Timing accuracy:* | ± 0.5 s |

**POWER MONITORING**

| | |
|---|---|
| *Positive Pickup level:* | 10kW/kvar → 650000 kW/kvar, Steps: 10,100,1000 kW/kvar |
| *Negative Pickup level:* | -10kW/kvar → -650000 kW/kvar, Steps: 10,100,1000kW/kvar |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Accuracy*: | ±1% of full scale |
| *Timing accuracy:* | ± 0.5 s |

**CURRENT TOT. HARMONIC DISTORTION (THD) MONITORING**

| | |
|---|---|
| *Pickup level*: | 0.5% → 100,0%, Steps: 0.5% |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Accuracy:* | ±2% of full scale |
| *Timing accuracy:* | ± 0.5 s |

**VOLTAGE TOT. HARMONIC DISTORTION (THD) MONITORING**

| | |
|---|---|
| *Pickup level:* | 0.5% → 100.0%, Steps: 0.5% |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Accuracy:* | ±2% of full scale |
| *Timing accuracy:* | ± 0.5 s |

**OVER / UNDERFREQUENCY MONITORING**

| | |
|---|---|
| *Required voltage:* | >20% of Un, applied in phase A |
| *Pickup level:* | 40.00Hz → 70.00 Hz, Steps:0.01Hz |
| *Dropout level:* | 0.01 Hz → 5.00 Hz, Steps: 0.01 Hz |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Accuracy:* | ±0.02 Hz |

**PULSE COUNTER PROTECTION**

| | |
|---|---|
| *Pickup level:* | 1 → 65000 pulse, Step: 1 pulse |
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Timing accuracy:* | ± 0.5 s |

**PHASE REVERSAL MONITORING**

| | |
|---|---|
| *Delay time:* | 0.5 s → 600.0 s, Steps: 0.5 s |
| *Timing accuracy:* | ± 0.5 s |

**POWER FACTOR MONITORING**

| | |
|---|---|
| *Required voltage:* | >20% di Un, applied in phase A |
| *Pickup level:* | 0.05 Lag → 0.05 Lead, Steps: 0.01 |
| *Dropout level:* | 0.01 → 1.00, Steps: 0.01 |

**DEMAND MONITORING** (Accuracies based on less than 6xIn and 125% Un inputs)

| | | |
|---|---|---|
| *Measured values:* | Phase A, B, C Current | [A] |
| | 3ϕ Real power | [kW or MW] |
| | 3ϕ Reactive power | [kvar or Mvar] |
| | 3ϕ Apparent power | [kVA or MVA] |
| *Measurement type:* | Block interval | |
| | Time interval (programmable): 5 to 60 min. | |
| *Pickup level:* | *Phase A, B, C, Gnd Current demand* | |
| | 2% → 500% of In, Steps: 1% | |
| | *KW demand* | |
| | 10kW → 650MW, Steps: 10,100,1000kW | |
| | *kvar demand* | |
| | 10kvar→650Mvar, Steps: 10,100,1000kvar | |
| | *KVA demand* | |
| | 10kVA→650MVA, Steps: 10,100,1000kVA | |

**EMISSION TEST**

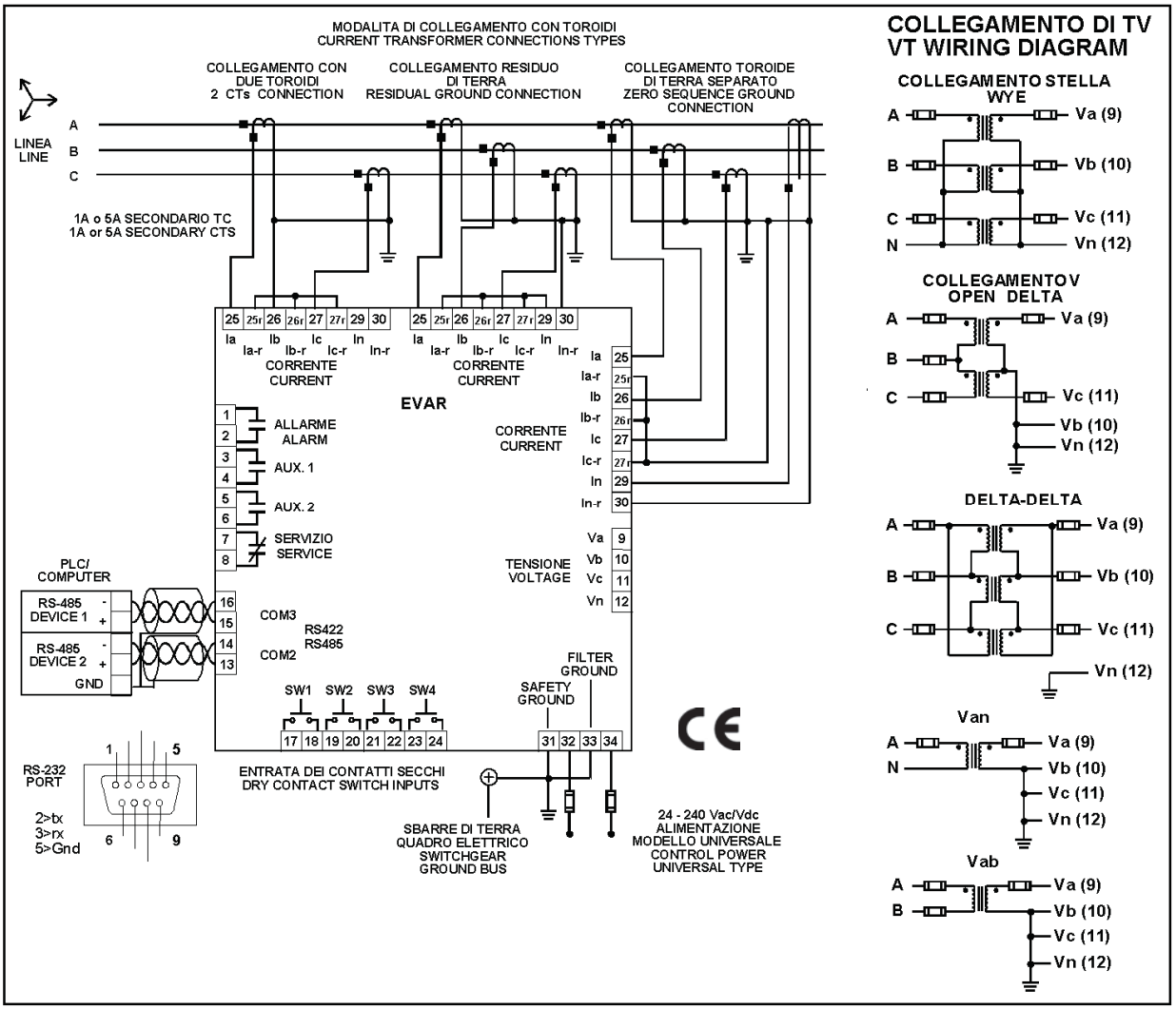
- Radiated emissions
  References: EN 55011; Port : enclosure; Class A, at 10m
- Conducted emissions
  References: EN 55011; Port: AC mains; Class A

**MEASURED PARAMETERS** (Accuracies based on 100% In and 100% Un inputs)

| | |
|---|---|
| *Current:* | Phase A, B, C Currents<br>Accuracy: ± 0.5% |
| *Voltage:* | A-N (A-B), B-N (B-C), C-N (C-A),<br>Accuracy: ± 0.5% |
| *Voltage unbalance:* | Range: 0 → 100%<br>Accuracy: ± 1% |
| *Current unbalance:* | Range: 0 → 100%<br>Accuracy: ± 1% |
| *Frequency:* | Across phase A-N (A-B) voltage.<br>Range: 40.00 Hz → 70.00 Hz<br>Accuracy: ± 0.02 Hz |
| *3ϕ Real power:* | -1000 MW → +1000 MW<br>Accuracy: ±1% |
| *3ϕ Reactive power:* | -1000 Mvar → +1000 Mvar<br>Accuracy: ±1% |
| *3ϕ Apparent power:* | 0 MVA → +1000 MVA<br>Accuracy: ±1% |
| *Power factor:* | Lag: 0,00 → 1.00<br>Lead: 0,00 → 1.00<br>Accuracy: ± 0.01 |
| *Watthours:* | Total, 1 hour<br>0 GWh → 4200 GWh<br>Accuracy: ±2% |
| *Varhours:* | Total, 1 hour<br>0 Gvahr → 4200 Gvarh<br>Accuracy: ±2% |
| *Demand*<br>Range: | see: Demand Monitoring<br>0 MW → 1000 MW<br>0 MVA →1500 MVA |

**IMMUNITY TEST**

- Conducted disturbances induced by RF field
  References: EN 61000-4-6; Port: AC mains and signal lines
- Radiated electromagnetic field
  References: EN 61000-4-3; Port: enclosure
- Electrostatic discharge
  References: EN 61000-4-2; Port: enclosure
- Fast transients (burst)
  References: EN 61000-4-4 ; Port: AC mains and signal lines
- Surge
  References: EN 61000-4-5 ; Port: AC mains
- Voltage dips and short interruptions
  References : EN 61000-4-11 ; Port: AC mains




## ORDER CODE

EVAR – X

PHASE AND GROUND CT SECONDARY

**1:** 1 A CTs **5:** 5 A CTs