High-Voltage Sensor Owner's Manual

Version 1.0

eGauge Systems LLC
1644 Conestoga St, Suite 2
Boulder, CO 80301
https://egauge.net/
877.EGAUGE1
720.545.9767

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1 Introduction

Thank you and congratulations to your purchase of the High-Voltage Sensor!

This section gives a brief overview of the device and this manual. The second section describes the installation of the product. The third section provides operating instructions and is followed by a section on equipment maintenance. The appendices provide the device specifications and a reference to troubleshooting information.

Please visit the eGauge support site to verify you have the latest version of this manual. There, you can also find additional training materials, tutorial videos, and configuration guides.

`https://egauge.net/support/`

1.1 Features

- Measures up to $\pm$1000 VDC or 707 VAC.
- High accuracy of better than 0.5 %.
- Fully isolated input.
- DC to 1.5 kHz frequency range.
- $-30\ldots70$ °C ($-22\ldots158$ °F) operating temperature range.
- Two interface options: RJ-11 (CTid®) or 4-pin terminal block.
- Output signal $\pm$0.5 V or $\pm$2.5 V.
- Single 5V/100mA power supply.
- Low power consumption: $\leq$ 300mW typical at 1000 VDC.
- Accommodates input wires up to AWG 10.
- Compact DIN-rail enclosure for easy installation.
- UL 508 certified.

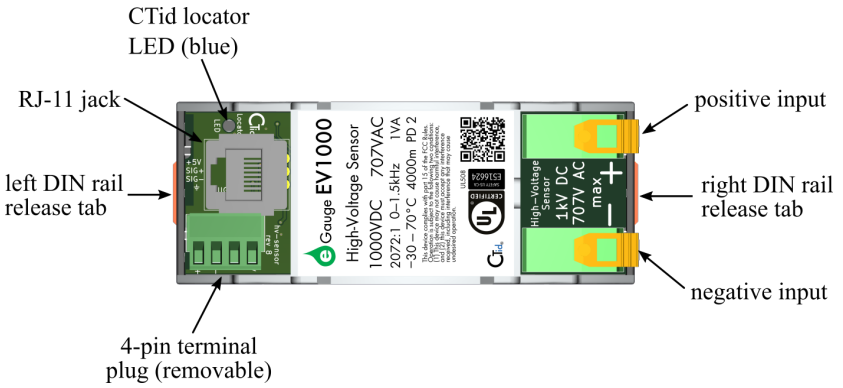

Figure 1: High-Voltage Sensor viewed from above (model EV1000 shown)

1.2 Device Overview

The High-Voltage Sensor is a fully isolated voltage transducer that converts an input voltage in the range of up to ±1000 VDC or 707 VAC to a proportional output voltage in the range of ±0.5 V. For model EV1000:2.5, the output voltage range is ±2.5 V.

The exact input to output transformation ratio depends on the model (see Section B.3). For example, for EV1000, the transformation ratio is 2072:1 meaning that an input voltage of +1000 V would yield an output voltage of +482.6 mV.

The output signal is available through a 4-pin terminal block or through a CTid®-compatible RJ-11 jack.

Figure 1 shows the High-Voltage Sensor as seen from above. The right side shows the high-voltage input terminals. There is a positive and a negative input terminal. These are lever-activated tension-clamps that can accommodate wires from 24 AWG up to 10 AWG.

The left side shows RJ-11 jack and locator LED (for use with CTid®-compatible meters) as well as the 4-pin terminal block (for use with meters that do not support CTid®).

When using the 4-pin terminal, the output voltage is available at the SIG+ and SIG– pins.

Figure 1 also shows the two orange DIN rail release tabs. To remove the device from a DIN rail, please insert a slotted screwdriver into the slot on either tab, angle the screw driver to pull the tab out, then lift the device away from the DIN rail.

2 Installation

Installation must be performed by a licensed electrician according to all applicable local, national, and international codes.

CAUTION: The high-voltage input contacts of the High-Voltage Sensor may carry high voltage. For safety, the device must be installed in an enclosure that is rated for the installation environment. The enclosure must have a screw-on or locking cover that prevents accidental touch of the relay contacts.

2.1 What's included in the box

- 1× eGauge High-Voltage Sensor device
- 1× RJ-11 cable (2 m long)
- 1× 4-pin 3.5mm terminal plug

2.2 Materials required for installation

The High-Voltage Sensor is designed for installation inside an enclosure with a DIN rail (35 mm top-hat). The enclosure and DIN rail must be provided by the installer. Additionally, the following materials may be required:

- eGauge sensor hub: When using the RJ-11 interface, an eGauge sensor hub device with a free input port is required.
- Power-supply: When using 4-pin terminal block interface, a 5 V/100 mA power-supply must be provided.

- Stranded wire: Gauge, length, and isolation-voltage depending on installation location and voltage range measured. Thermal resistance to at least 75 °C. Wire gauge needs to be selected according to the breaker or fuse that protects the wires connected high-voltage input. For example, AWG 12 copper wire is required when using 20 A breakers.
- Electrical tape.
- Conduit and couplings as needed.
- Mounting and wire organization hardware as needed.
- Appropriately rated enclosure (e.g., IPX4/NEMA4 for outdoor use).

2.3 Tools required for installation

- #1 slotted screwdriver

2.4 Nomenclature and Symbols

The following table describes the symbols used on the device:

Symbol:	Description:
	Caution, risk of danger.

2.5 Safety Warnings

Please follow the installation instructions in this manual. To reduce the risk of electric shock:

- Do not connect high-voltage input contacts to circuits operating at voltages greater than 1000 VDC or 707 VAC.
- Always disconnect circuits from Power Distribution System of building before performing any wiring work.

2.6 Installation Location

The High-Voltage Sensor is usually installed near the meter that is intended to measure the high voltage lines.

The High-Voltage Sensor is a listed device and must be installed inside a suitable enclosure. The enclosure must be rated according to the environment it is used in. For example, outdoor installations require an outdoor-rated enclosure such as IPX4/NEMA4.

Select an installation location that is not exposed to direct sunlight or the elements. Otherwise, warranty may be voided.

Best accuracy is achieved with the sensor at room temperature (see Section B.3 for details).

2.6.1 Noise Considerations

By definition, RMS (AC) voltage measurements are more sensitive to noise than average (DC) measurements or power-measurements. If noise is an issue at a particular installation site, consider the following mitigation options:

- Minimize cable-length between the sensor and the meter.
- Consider using shielded cables.
- Place the sensor(s) and the meter in a closed metallic enclosure.
- Use a low-noise 5V DC adapter to power the sensor. When used in combination with an eGauge meter, using one of the USB ports to power the sensor usually yields the best results.

Note that noise does cancel out for power measurements, so even in situations where there is considerable noise, the measured power is typically correct even if the RMS AC voltage reported for the sensor may be off by a considerable amount.

2.7 Installation Steps

1. If the sensor is to be mounted inside an existing enclosure with available space on a DIN-rail, skip to the next step. Otherwise, mount an enclosure that is rated for the environment and install a DIN-rail inside the enclosure.

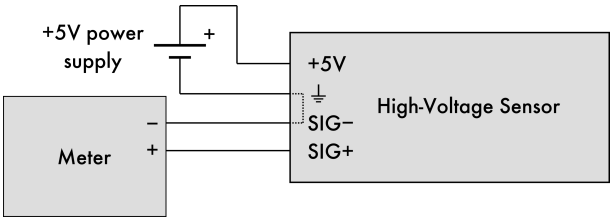

Figure 2: Recommended 4-pin Terminal Wiring

2. Mount the High-Voltage Sensor onto the DIN-rail by angling it and sliding it towards the DIN-rail until it comes to a stop, then pushing down on the sensor until it snaps onto the rail.

3. When using a CTid®-compatible meter, push one connector of the supplied RJ-11 cable into the RJ-11 jack of the sensor, then connect the other end of the cable to the meter. With eGauge meters, the cable is typically plugged into an eGauge sensor hub, which is then connected to the meter.

4. When using a traditional meter without CTid® support, wire the 4-pin terminal plug as shown in Figure 2. As indicated by the dotted line, the SIG– pin is internally connected to the ⏚ pin of the sensor. However, for accuracy, it is important to use separate wires to those two pins, as shown in the figure.

5. Wire the high-voltage input terminals to the conductors carrying the high voltage that is to be measured. To insert a wire into a terminal, open its clamp by pulling up the orange lever. Once open, insert the wire, then push the lever down until it snaps in place and is horizontal.

6. Close the enclosure with a screw-on or locking top to prevent any accidental contact with high-voltage conductors or the high-voltage input terminals.

3 Operation

The sensor is operational as soon as it is powered by +5 V. Power can be supplied via the RJ-11 connector or via the 4-pin terminal block.

Use a suitably-rated voltmeter to confirm proper operation. If the input voltage is *x* volts, then the output voltage measured between the SIG+ and SIG– pins should

be x/N volts, where N is the input to output ratio of the sensor (see Section B.3). For example, with an EV1000 sensor (N=2071.99) and 60 V applied to the inputs, the output voltage should be 60 V/2071.99=0.02896 V or almost 29 mV.

When using the RJ-11 connector with a meter that is CTid® compatible, it is possible to:

- Flash the blue LED to locate/identify the sensor connected to a particular metering port.
- Read the sensor's manufacturing and calibration information such as the voltage range or serial number.

The steps required to perform these actions is meter-dependent. For eGauge meters compatible with CTid® (e.g., eGauge Core and eGauge Pro meters), connect to the meter's web-server and then navigate to **Settings**→**Installation**→**CTid**. On that page, you select one or more sensor ports to scan or you can select to blink the LED of a particular port.

4 Maintenance

The High-Voltage Sensor is designed to be maintenance free. No preventive maintenance or inspections are required. There are no user-replacable parts, such as fuses or batteries, inside the device.

Should it become necessary to clean the High-Voltage Sensor, disconnect it from the building supply by turning off the breaker wired to the high-voltage inputs, unplug the RJ-11 connector or 4-pin terminal block, remove the device and then clean it with a soft cloth. If a cleaning fluid is needed, use 70 % isopropyl alcohol. Wait until all cleaning fluid has evaporated before reinstalling the device and turning the breakers back on.

The device has no replaceable batteries and no replaceable fuses.

CAUTION: If the equipment is used in a manner not specified by this manual, the protection provided by the equipment may be impaired.

A EMI Compliance

A.1 FCC Compliance Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

CAUTION: Modifications not expressly approved by eGauge Systems LLC could void the user's authority to operate the equipment under FCC rules.

A.2 Canada ICES-003 Compliance

CAN ICES-3 (B)/NMB-3(B)

B Specifications

B.1 Applicable Model Numbers

This manual applies to eGauge High-Voltage Sensor models:

EV250, EV500, EV1000, and EV1000:2.5.

B.2 Mechanical Specifications

- Enclosure compatible with 35 mm wide, 7.5 mm tall DIN rails.
- Dimensions: $90\times36\times60$ mm^3 (l×w×h).
- Weight: 60 g.

B.3 Electrical Ratings

- Input:
  - Frequency range: 0...1.5 kHz.
  - EV250: $\pm$250 VDC, 0...177 VAC, 8 mVA.
  - EV500: $\pm$500 VDC, 0...354 VAC, 31 mVA.
  - EV1000, EV1000:2.5: $\pm$1000 VDC, 0...707 VAC, 125 mVA.
- Output:
  - EV250, EV500, EV1000: $\pm$0.5 V, $<$200 Ω output resistance.
  - EV1000:2.5: $\pm$2.5 V, $<$200 Ω output resistance.
- Input to output ratio:
  - EV250: 503.49:1
  - EV500: 1009.00:1
  - EV1000: 2071.99:1
  - EV1000:2.5: 402.61:1

- DC error:
  - Max. of ± 0.3 % of reading, $\pm$ 0.2 % of range (typical at 25°C).
  - Max. of ± 0.5 % of reading, $\pm$ 0.3 % of range (-30°C... 70°C).
- Signal delay
  - Input to 4-pin output: 114.2μs (typical)
  - Input to CTid® output: 116.3μs (typical)
- Power supply: 5 VDC $\pm$ 10 %, 100 mA max.

B.4 Environmental Conditions

Suitable for indoor and outdoor use. Enclosure with suitable rating for installation environment required. Pollution Degree 2, Overvoltage Category III. Not to be used at altitudes above 4000 m. Voltage fluctuations not to exceed $\pm 10\%$. Temperature range: $-30...70$ °C ($-22...158$ °F). Maximum relative humidity 80 % up to 31 °C, decreasing linearly to 50 % at 40 °C.

B.5 CE Immunity Statement

Performance criteria: At field-strengths up to 10V/m, no change of state or stored data.

B.6 Regulatory Certificates

UL CERTIFIED SAFETY US CA E516624	UL File Number E516624 UL 508 Edition 18 - Issue Date 2018/03/30
FC	FCC's Title 47 CFR Part 15 Subpart B Class B ICES-003 Information Technology Equipment Class B