



i-Sense Voltage Monitor

Catalog Numbers 1608S-3V480E, 1608S-3V480K, and 1608S-6V480K

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Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

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

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

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Throughout this manual, when necessary, we use notes to make you aware of safety considerations.



WARNING: Identifies information about practices or circumstances that can cause an explosion in a hazardous environment, which may lead to personal injury or death, property damage, or economic loss.



ATTENTION: Identifies information about practices or circumstances that can lead to personal injury or death, property damage, or economic loss. Attentions help you identify a hazard, avoid a hazard, and recognize the consequence.

IMPORTANT Identifies information that is critical for successful application and understanding of the product.

Labels may also be on or inside the equipment to provide specific precautions.



SHOCK HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that dangerous voltage may be present.



BURN HAZARD: Labels may be on or inside the equipment, for example, a drive or motor, to alert people that surfaces may reach dangerous temperatures.




ARC FLASH HAZARD: Labels may be on or inside the equipment, for example, a motor control center, to alert people to potential Arc Flash. Arc Flash will cause severe injury or death. Wear proper Personal Protective Equipment (PPE). Follow ALL Regulatory requirements for safe work practices and for Personal Protective Equipment (PPE).

Summary of Changes

This publication contains new and updated information as indicated in the following table.

Topic	Page
Removed modem communication information.	Throughout

North American Hazardous Location Approval

The following information applies when operating this equipment in hazardous locations.	Informations sur l'utilisation de cet équipement en environnements dangereux.
<p>Products marked "CL I, DIV 2, GP A, B, C, D" are suitable for use in Class I Division 2 Groups A, B, C, D, Hazardous Locations and nonhazardous locations only. Each product is supplied with markings on the rating nameplate indicating the hazardous location temperature code. When combining products within a system, the most adverse temperature code (lowest "T" number) may be used to help determine the overall temperature code of the system. Combinations of equipment in your system are subject to investigation by the local Authority Having Jurisdiction at the time of installation.</p>	<p>Les produits marqués "CL I, DIV 2, GP A, B, C, D" ne conviennent qu'à une utilisation en environnements de Classe I Division 2 Groupes A, B, C, D dangereux et non dangereux. Chaque produit est livré avec des marquages sur sa plaque d'identification qui indiquent le code de température pour les environnements dangereux. Lorsque plusieurs produits sont combinés dans un système, le code de température le plus défavorable (code de température le plus faible) peut être utilisé pour déterminer le code de température global du système. Les combinaisons d'équipements dans le système sont sujettes à inspection par les autorités locales qualifiées au moment de l'installation.</p>
<div style="display: flex; align-items: center;">  <div> <p>WARNING: Explosion Hazard –</p> <ul style="list-style-type: none"> • Do not disconnect equipment unless power has been removed or the area is known to be nonhazardous. • Do not disconnect connections to this equipment unless power has been removed or the area is known to be nonhazardous. Secure any external connections that mate to this equipment by using screws, sliding latches, threaded connectors, or other means provided with this product. • Substitution of components may impair suitability for Class I, Division 2. • If this product contains batteries, they must only be changed in an area known to be nonhazardous. </div> </div>	<div style="display: flex; align-items: center;">  <div> <p>AVERTISSEMENT: Risque d'Explosion –</p> <ul style="list-style-type: none"> • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher l'équipement. • Couper le courant ou s'assurer que l'environnement est classé non dangereux avant de débrancher les connecteurs. Fixer tous les connecteurs externes reliés à cet équipement à l'aide de vis, loquets coulissants, connecteurs filetés ou autres moyens fournis avec ce produit. • La substitution de composants peut rendre cet équipement inadapté à une utilisation en environnement de Classe I, Division 2. • S'assurer que l'environnement est classé non dangereux avant de changer les piles. </div> </div>

Installation

This section includes information about the following:

- Pre-installation
- Environmental conditions
- Mounting
- Electrical connections
- Nominal voltage configurations
- Communications connections
- Final check
- External power supply
- Initial battery charge time



Pre-installation

1. Inspect the device for shipping damage.
2. Record the i-Sense® monitor serial number.
3. Register the monitor at www.igrid.com.
4. Configure the monitor hardware for the service voltage.
5. Configure the communication software using the Ethernet port (this can be done after installation and power-up).



WARNING: Do not apply power to the monitor until the wiring is completed and right-side cover is replaced. Installation must be performed by an electrician, in accordance with all local, and national codes.

Environmental Conditions

The monitor is rated for installation in the following environment:

- Indoor use only, no conductive pollution.
- Altitude up to 2000 m (6500 ft).
- Temperature range 0...40 °C (32...104 °F).
- Maximum relative humidity 95%, non-condensing.

Mounting

- Provide 250 mm (10 in.) clearance around the monitor for cooling and access.
- Remove the left and right covers (four Phillips screws, two at the top and two at the bottom).
- Mount the monitor to a vertical surface using the four mounting holes. Two of the four mounting screws should penetrate into studs at least 25 mm (1 in.).
- Mounting screws 38 mm (1.5 in.) long are recommended.

Electrical Connections

Follow these steps when making the electrical connections to the voltage detector:

1. Install branch protection: upstream fuse or circuit breaker protection rated 20 A or less is required.
 - Protection rated less than 5 A is not recommended.
 - Conduit entry available from the top or bottom.
2. Connect the Ground (Earth) wire to the #10-32 stud near the bottom knock-out.
3. Connect mains line to the INPUT_1 terminal block, according to the proper wiring diagram from [Table 1](#).
4. (Optional for the 6-channel version only) If the INPUT_2 terminal block is present, wire the second 3-phase set using the same wiring diagram.
5. Verify that the JP1 plug is properly configured, per [Table 1](#):
 - The plug with RED wires must be installed if the channel voltage is greater than 250V AC.



WARNING: This unit is not rated for 600V AC or 690V AC L-L installations. 600V/346V installations require 4-wire L-N wiring method. The neutral must be connected as shown in [Table 2](#).

6. Replace the right-side cover and tighten the two screws.

Nominal Voltage Configurations

Table 1 - Nominal Voltage Configurations (shipped standard with 480V (L-L))

Your Voltage	Nominal Volts per Channel ⁽²⁾	Channels	Mains Wires	Wiring Diagram	Power Supply Jumper JP1
Any single-phase voltage $\leq 240V$	nominal	1	2	S1	White wires
100 (L-N for 100/200V split-phase)	100	2	3	S2	White wires
105 (L-N for 105/210V split-phase)	105	2	3	S2	White wires
110 (L-N for 190Y/110V 3-phase)	110	3	4	LN	White wires
115 (L-N for 200Y/115V 3-phase)	115	3	4	LN	White wires
115 (L-N for 115/230V split-phase)	115	2	3	S2	White wires
120 (L-N for 208Y/120V 3-phase)	120	3	4	LN	White wires
120 (L-N for 120/240V split-phase)	120	2	3	S2	White wires
125 (L-N for 216Y/125V 3-phase)	125	3	4	LN	White wires
127 (L-N for 220Y/127V 3-phase)	127	3	4	LN	White wires
133 (L-N for 230Y/133V 3-phase)	133	3	4	LN	White wires
139 (L-N for 240Y/139V 3-phase)	139	3	4	LN	White wires
190 (L-L for 190Y/110V 3-phase)	190	3	3	LL	White wires
200 (L-L for 100/200V split-phase)	200	1	2	S1	White wires
208 (L-L for 208Y/120V 3-phase)	208	3	3	LL	White wires
210 (L-L for 105/210V split-phase)	210	1	2	S1	White wires
216 (L-L for 216Y/125V 3-phase)	216	3	3	LL	White wires
220 (L-L for 380Y/220V 3-phase)	220	3	3	LL	White wires
230 (L-L for 230Y/133V 3-phase)	230	3	3	LL	White wires
230 (L-N for 400Y/230V 3-phase)	230	3	4	LN	White wires
240 (L-L for 120/240V split-phase)	240	3	3	LL	White wires
240 (L-N for 415Y/240V 3-phase)	240	3	4	LN	White wires
254 ⁽¹⁾ (L-N for 440Y/254V 3-phase)	254	3	4	LN	Red wires
277 (L-N for 480Y/277V 3-phase)	277	3	4	LN	Red wires
346 (L-N for 600Y/346V 3-phase)	346	3	4	LN	Red wires
346 (L-L for 346Y/200V 3-phase)	346	3	3	LL	Red wires
380 (L-L for 380Y/220V 3-phase)	380	3	3	LL	Red wires
400 (L-L for 400Y/230V 3-phase)	400	3	3	LL	Red wires
400 (L-N for 690Y/400V 3-phase)	400	3	4	LN	Red wires
415 (L-L for 415Y/240V 3-phase)	415	3	3	LL	Red wires

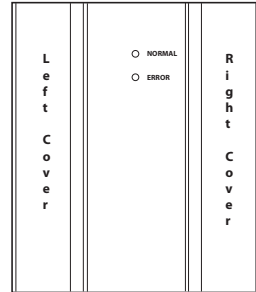
Your Voltage	Nominal Volts per Channel ⁽²⁾	Channels	Mains Wires	Wiring Diagram	Power Supply Jumper JP1
440 (L-L for 440Y/254V 3-phase)	440	3	3	LL	Red wires
440 (L-L for 220/440V split-phase)	440	3	3	LL	Red wires
460 (L-L, at point of use)	460	3	3	LL	Red wires
480 (L-L for 480Y/277V 3-phase)	480	3	3	LL	Red wires
600 (L-L 3-phase) not allowed	No	No	No	No	No
690 (L-L 3-phase) not allowed	No	No	No	No	No

(1) Nominal 254V source must operate normally at > 240V (95% of nominal)

(2) Maximum 480V per channel. 575Y/332V and 600Y/346V systems must use the 346 (L-N) configuration. 690Y/400V systems must use the 346 (L-N) configuration.

To set nominal voltage, follow these steps.

1. Select your voltage configuration from [Table 1](#) and follow the instructions in the corresponding wiring diagram from [Table 2](#).
2. Use the appropriate diagram and jumper wire positions.
 - The monitor is shipped with jumper wires in the LL configuration.
 - The LL and LN diagrams are also shown inside the monitor cover.
3. Move or remove jumper wires as needed.



- IMPORTANT** • There should be no more than one wire installed at each terminal block position.
- Maximum 480V per channel.
 - 575Y/332V and 600Y/346V systems must use the 346 (L-N) configuration.
 - 690Y/400V systems must use the 400 (L-N) configuration.

Table 2 - Wiring Diagrams

Source Type	Wiring Diagram	
<p>S1 Single phase</p>	<p>L1 (N or L2)</p>	<p>GND</p> <p>1 channel sensing 2 wires + ground required No jumper wires Use 0.50...2.5 mm² (AWG 14...22), 600V AC conductors Tighten screws to 0.9 N·m (8 lb·in) Tighten ground stud nut to 3.4 N·m (30 lb·in) The ground stud is #10-32.</p>
<p>S2 Split-phase</p>	<p>L1 N L2</p>	<p>GND</p> <p>2 channel sensing 3 wires + ground required Jumper pins 3-5 Use 0.50...2.5 mm² (AWG 14...22), 600V AC conductors Tighten screws to 0.9 N·m (8 lb·in) Tighten ground stud nut to 3.4 N·m (30 lb·in) The ground stud is #10-32.</p>
<p>LN 3-phase 4-wire</p>	<p>L1 N L2 L3</p>	<p>GND</p> <p>3 channel sensing 4 wires + ground required Jumper pins 3-5 & 6-8 Use 0.50...2.5 mm² (AWG 14...22), 600V AC conductors Tighten screws to 0.9 N·m (8 lb·in) Tighten ground stud nut to 3.4 N·m (30 lb·in) The ground stud is #10-32.</p>
<p>LL 3-phase 3-wire</p>	<p>L1 L2 L3</p>	<p>GND</p> <p>3 channel sensing 3 wires + ground required Jumper pins 1-6 & 3-7 & 4-9 Use 0.50...2.5 mm² (AWG 14...22), 600V AC conductors Tighten screws to 0.9 N·m (8 lb·in) Tighten ground stud nut to 3.4 N·m (30 lb·in) The ground stud is #10-32.</p>

IMPORTANT For more information on setting nominal voltage, refer to publication [1608S-UM001](#).

Communication Connections

IMPORTANT i-Sense to i-Grid communication is through Ethernet only, modem communication is not supported. For more information on communication configuration, refer to publication [1608S-UM001](#).

1. Remove the left-side cover (two Phillips screws at the top and bottom).
 - Conduit entry available from top or bottom.
2. Install the 8P8C (RJ45) modular Ethernet cable. Pass the Ethernet cable through the included RF filter core, and close the core securely, as shown below. Failure to install the cable filter may result in RF emissions beyond the standards of the European Union's electromagnetic compatibility (EMC) directive.

Ethernet Cable Filter Installation



The clip-on filter core is supplied with the monitor.

Final Check

1. Check all connections
2. Replace left and right-side covers

External Power Supply



The external 9V DC power supply (not provided) is used only during configuration; it should not be used in normal operation. Remove the left-side cover to access the 9V DC jack.

Initial Battery Charge Time

The rechargeable batteries can become discharged after some time on the shelf. Allow 30 minutes charge time after powerup before the monitor is ready to record voltage interruption events.

Technical Specifications

Table 3 - Electrical Specifications

Attribute	Value
Nominal voltage	User-selectable, 100V-480Vrms, 1-phase or 3-phase immune to voltage fluctuation up to $\pm 10\%$ of nominal and transient over voltages typically present on mains supply (impulse withstand Category II of IEC 60364-4-443)
Frequency	45...65 Hz, auto-sensing
Measurement inputs	<ul style="list-style-type: none"> 1...3 channels, Cat. No.: 10685-3V480K (3-channel) Up to 6 channels, Cat. No.: 10685-6V480K (6-channel)
RMS voltage measurement accuracy	0.2% typical, $\pm 2\%$ maximum (of full-scale) True rms
Sample rate	5760 sample/second
Waveform capture rate	32 samples/cycle
Time stamp	± 0.1 seconds typical accuracy Real-time clock that is synchronized to UTC (NIST standard) daily, via i-Grid [®] and SNTP protocol
Data storage	<ul style="list-style-type: none"> Non-volatile event storage > 300 events Memory that is cleared after automatic upload to the i-Grid system
Voltage deviation event detection trigger.	<ul style="list-style-type: none"> 1/2-cycle rms voltage $\leq 87\%$ or $\geq 115\%$ of set nominal Adaptive waveform deviation detection of transient events
Voltage deviation event storage	<ul style="list-style-type: none"> 8 cycles waveform data (-1...+3 cycles at event start and -3...+1 cycles at the event end) Continuous rms voltage trend, up to 2 minutes
Periodic (PRMS) data logging	<ul style="list-style-type: none"> Minimum, maximum, and average rms voltage recorded for each 10-minute period Min/max are lowest/highest sliding 1/2 -cycle rms period
Power supply and battery backup	<ul style="list-style-type: none"> Powered from Channel 1 (L1-L2 or L1-N), < 25VA load 9V DC external power supply (not provided - for configuration only) Rechargeable batteries enable measurement and communication during power interruptions for up to 2 minutes

Table 4 - Mechanical and Environmental Specifications

Attribute	Value
Enclosure	<ul style="list-style-type: none"> NEMA 1 (IP20) Indoor use only Only non-conducting pollution (degree II) Dimensions (H x W x D): 11.4 x 9.7 x 3.0 in. (291 x 247 x 75 mm)
Weight	3.6 kg (8.5 lb)
Operating temperature	0...40 °C (32...104 °F)
Storage temperature	-40...+75 °C (-40...+167 °F)
Relative humidity	0...95%, non-condensing
Altitude 2000 m	2000 m (6562 ft) at 40 °C (104 °F)

Table 5 - Communication Specifications

Attribute	Value
Internet communication	Over port 80 via HTTP protocol, outgoing only
Ethernet	IEEE 802.3 10 Base-T (10 Mb/s), 8P8C (RJ45) modular connector
Indicators	Red and green, front-panel status indicators
i-Sense management console	On-board web server for configuration and status, password protected

Additional Resources

These documents contain additional information concerning related products from Rockwell Automation.

Resource	Description
i-Sense® Voltage Monitor User Manual, publication 1608S-UM001	Provides information to install, configure, maintain, and troubleshoot voltage monitor.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications .	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/literature/>.

Rockwell Automation Support

Use the following resources to access support information.

Technical Support Center	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	https://rockwellautomation.custhelp.com/
Local Technical Support Phone Numbers	Locate the phone number for your country.	http://www.rockwellautomation.com/global/support/get-support-now.page
Direct Dial Codes	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	http://www.rockwellautomation.com/global/support/direct-dial.page
Literature Library	Installation Instructions, Manuals, Brochures, and Technical Data.	http://www.rockwellautomation.com/global/literature-library/overview.page
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	http://www.rockwellautomation.com/global/support/pcdc.page

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf.

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

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