

i-Sense Voltage Monitor

Bulletin Number 1608S

Topic	Page
Important User Information	2
North American Hazardous Location Approval	3
Additional Resources	3
Installation	4
Technical Specifications	10
Standards Compliance and Certifications	12

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).

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>

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, http://www.rockwellautomation.com/rockwellautomation/certification/overview.page	Provides declarations of conformity, certificates, and other certification details.

You can view or download publications at <http://www.rockwellautomation.com/literature/>. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

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 10 inches (250 mm) 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 1 in. (25 mm). Mounting screws 1.5 in. (38 mm) long are recommended.

Electrical Connections

Follow the steps below 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. 600Y/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	Channels	Mains Wires	Wiring Diagram (See Table 2)	Power Supply Jumper JP1
Any single-phase voltage ≤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* (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

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

** 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.

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

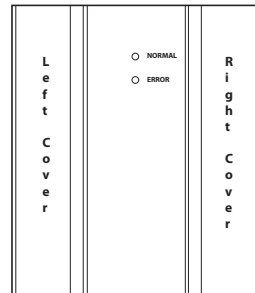
Your Voltage	Nominal Volts per Channel	Channels	Mains Wires	Wiring Diagram (See Table 2)	Power Supply Jumper JP1
380 (L-L for 380Y/220V 3-phase)	380	3	3	LL	Red wires
400 (L-L for 400Y/230V 3-phase)	400	3	3	LL	Red wires
400 (L-N for 690Y/400V 3-phase)	400	3	4	LN	Red wires
415 (L-L for 415Y/240V 3-phase)	415	3	3	LL	Red wires
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

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

** Maximum 480V per channel. 575Y/332V and 600Y/364V 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 wiring 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/364V 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	
S1 Single phase		<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>
S2 Split-phase		<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>
LN 3-phase 4-wire		<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>
LL 3-phase 3-wire		<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

1. Remove the left-side cover (two Phillips screws at the top and bottom).
 - Conduit entry available from top or bottom.
2. Install the appropriate communication cable.

IMPORTANT For more information on communication configuration, refer to publication [1608S-UM001](#).

 8P8C (RJ45) modular Ethernet cable. Pass the Ethernet cable through the included RF filter core, and close the core securely, as shown in [Figure 1](#). Failure to install the cable filter may result in RF emissions beyond the standards of the European Union's electromagnetic compatibility (EMC) directive.



RJ11 telephone line (analog PSTN, applicable to catalog numbers: 1608S-3V480K and 1608S-6V480K only).

Figure 1 - 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	1 to 3 channels, Cat. No.: 1068S-3V480K (3-channel) Up to 6 channels, Cat. No.: 1068S-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 synchronized to UTC (NIST standard) daily, via i-Grid™ and SNTP protocol
Data storage	Non-volatile event storage > 300 events Memory cleared after automatic upload to the i-Grid system.
Voltage deviation event detection trigger.	1/2-cycle rms voltage $\leq 87\%$ or $\geq 115\%$ of set nominal Adaptive waveform deviation detection of transient events.
Voltage deviation event storage	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	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	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	NEMA 1 (IP20). Indoor use only. Only non-conducting pollution (degree II) Dimensions: 11.4" H x 9.7" W x 3.0" D (291 mm H x 247 mm W x 75 mm D)
Weight	8.5 lb (3.6 kg)
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	6,562 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
Modem (optional)	PSTN (Public Switched Telephone Network - analog telephone) RJ11 modular connector, Most global phone systems supported
Indicators	Red and green front-panel LEDs
i-Sense management console	On-board web server for configuration and status, password protected

Standards Compliance and Certifications

Compliance Information

- cTUVus (OSHA NRTL) listed
- Tested to UL and CSA safety standards
- CE mark (Safety and EMC)
- RoHS compliant
- FCC part 68 (Telephone Equipment)
- FCC part 15 (Emissions)
- Industry Canada CS-03 (Telephone Equipment)
- European Union CTR21 (Telephone Equipment)

FCC PART 68

IMPORTANT	Applicable to catalog numbers 16085-3V480K and 16085-6V480K only.
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- This equipment complies with Part 68 of the FCC rules and the requirements adapted by the Administrative Council for Terminal Attachments (ACTA). The finished product containing this equipment must display a product identifier in the format [US: 3A4MM00BTM]. If requested, this information must be provided to the telephone company.
- This equipment uses the Universal Service Ordering Code (USOC) jacks: RJ11C
- A plug and jack used to connect this equipment to the premises wiring and telephone network must comply with the applicable FCC Part 68 rules and requirements adopted by the ACTA. This equipment is designed for connection to a compatible modular jack that is also compliant. See installation instructions for details.
- The Ringer Equivalence Number (REN) is used to determine the number of devices that may be connected to the telephone line. Excessive REN on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN should not exceed five (5.0). To be certain of the number of devices that may be connected to a line, as determined by the total REN, contact the local telephone company. The REN for this product is part of the product identifier that has the format: [US: 3A4MM00BTM] The digits shown after MM are the REN without decimal point. (for example, 00 is a REN of 0.0)

- If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved. The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications to maintain uninterrupted service.
- The Telephone Consumer Protection Act of 1991 makes it unlawful for any person to use a computer or other electronic device including fax machines, to send any message unless such message clearly contains in a margin at the top or bottom of each transmitted page or on the first page of transmission, the date and time it was sent and an identification of the business or other entity, or other individual sending the message and the telephone number of the machine or such business, other entity, or individual. (The telephone number provided may not be a 900 number or any other number for which charges exceed local or long-distance transmission charges.)
- Advisory notice: It is suggested that the customer use a surge arrestor on the AC power lines to which this device is connected. Telephone companies report that electrical surges, typically lightning transients, are very destructive to customer terminal equipment connected to AC power sources. This has been identified as a major nationwide problem.

Industry Canada Notice

IMPORTANT Applicable to catalog numbers 16085-3V480K and 16085-6V480K only.

- This product meets the applicable Industry Canada technical specifications. This is confirmed by the registration number. The abbreviation, IC, before the registration number signifies that registration was performed based on a Declaration of Conformity indicating that Industry Canada technical specifications were met. It does not imply that Industry Canada approved the equipment.
- *Le présent matériel est conforme aux spécifications techniques applicable d'Industrie Canada.*
- The Ringer Equivalence Number (REN) for this terminal equipment is 0.0. The REN assigned to each terminal equipment provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the Ringer Equivalence Numbers of all the devices does not exceed five.

- *L'indice d'équivalence de la sonnerie (IES) sert à indiquer le nombre maximal de terminaux qui peuvent être raccordés à une interface téléphonique. La terminaison d'une interface peut consister en une combinaison quelconque de dispositifs, à la seule condition que la somme d'indices d'équivalence de la sonnerie de tous les dispositifs n'exécède pas 5.*

FCC Part 15 Class A Digital Equipment

- Operation of this device is subject to the following two conditions:
 - This device must not cause harmful interference.
 - This device must accept any interference received including interference that may cause undesired operation.
- This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. This equipment generates, uses, and can radiate radio-frequency energy. If not installed and used in accordance with the instructions, it can cause harmful interference to radio communication. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause 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:
 1. If it can be done safely, try to reorient or relocate the receiving antenna.
 2. Increase the separation between the modem and the receiver.
 3. Connect the modem to an outlet on a different circuit from the receiver.
 4. Consult the dealer or an experienced radio/TV technician for help.



ATTENTION: This is a class A product that is intended for use in an industrial environment. This product is not intended to be installed in a residential, commercial or light industrial environment, it may cause radio interference in these environments.

CTR21 (Common Technical Regulation) Statement

IMPORTANT

Applicable to catalog numbers 16085-3V480K and 16085-6V480K only.

This equipment has been approved to [Council Decision 98/482/EC-“CTR 21”h] for pan-European single terminal connection to the Public Switched Telephone Network (PSTN). However, due to differences between the individual PSTN's provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN termination point. In the event of a problem, you should contact your equipment supplier in the first instance.

Contact your local Rockwell Automation sales office or Allen-Bradley distributor for use in other locations not specified in the compliance information listed above.

Notes:

Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products.

At <http://www.rockwellautomation.com/support> you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at <https://rockwellautomation.custhelp.com/> for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit <http://www.rockwellautomation.com/services/online-phone>.

Installation Assistance

If you experience a problem within the first 24 hours of installation, please review the information that's contained in this manual. You can also contact a special Customer Support number for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview_page , or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete this form, publication [RA-DU002](#), available at <http://www.rockwellautomation.com/literature/>.

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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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

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