Installation Instructions

Original Instructions

Allen-Bradley by ROCKWELL AUTOMATION

Guardmaster®

SensaGuard Flat Pack with Integrated Latch (Series B Models only)

Catalog Numbers

Low-level (Standard) Coding: 440N-Z21SS3PA, 440N-Z21SS3PB, 440N-Z21SS3PH, 440N-Z21SS3PJ

High-level (Unique) Coding: 440N-Z21US3PA, 440N-Z21US3PB, 440N-Z21US3PH, 440N-Z21US3PJ

Summary of Changes

This publication contains the following new or updated information. This list includes substantive updates only and is not intended to reflect all changes.

Topic	Page
Updated Functional safety data and Certifications	2
Updated Declaration of Conformity	12

Introduction

Installation must be in accordance with the following instructions and specifications and implemented by suitable competent personnel. Adherence to the recommended maintenance instructions forms part of the warranty.

Do not use this unit as a mechanical stop. You must fit guard stops and guides.

This device is intended to be part of the safety-related control system of a machine. Before installation, you must perform a risk assessment to determine whether the specifications of this device are suitable for all foreseeable operational and environmental characteristics.

ATTENTION: Do not defeat, tamper, remove, or bypass this unit. Severe injury to personnel can result.

ATTENTION: You must provide this device with a 24V DC PELV or SELV power supply that conforms to the requirements of 414-3 of IEC 60364-4-41 where provisions are taken. The voltage at the outgoing terminals cannot exceed 60V DC, even if there is an internal fault.
Improper selection or installation of the device affects the integrity of the safety systems.
Personal injury or death, property damage, or economic loss can result.
Comply with ISO 14119 including accessibility to the installation, arrangement and mounting, possible substitute actuation, access to the escape release, motivation to defeat, and actuation mode.

ATTENTION: Use management controls, working procedures, training, and additional protective measures to minimize the motivation to defeat and to manage the use and availability of spare actuators.
Comply with ISO 13857 and ISO 13855 for guard openings and minimum (safe) distances.
Comply with EN ISO 13849-1, EN ISO 13849-2 and EN 61508 for machinery and functional safety.

ATTENTION: Read this document and the documents that are listed in Additional Resources on page 12 before you install.
Familiarize yourself with the installation and connection instructions and requirements of all applicable codes, laws, and standards.
In accordance with applicable codes of practice, suitably trained personnel must implement installation, adjustments, service initiation, use, assembly, disassembly, and maintenance.
Use of this equipment not specified by the manufacturer can impair the protection that the equipment provides.

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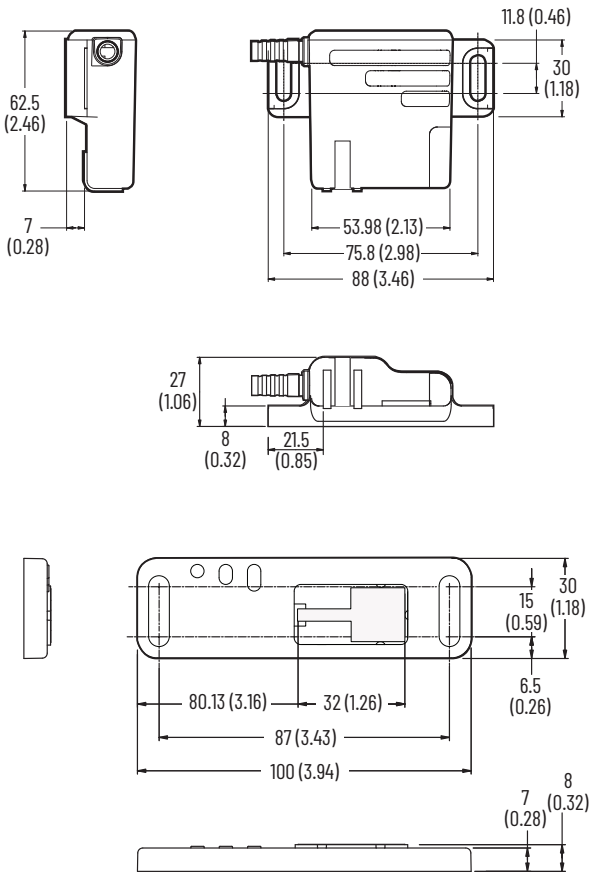
Specifications

Attribute	Value
Safety Ratings	
Standards safety classification	IEC 60947-5-3, Cat. 4 PLe Per ISO 13849-1, Type 4 Interlock Device according to ISO 14119 with either low (standard) or high (unique) coding, SIL CL 3 per IEC 61508
Functional safety data	PFH_D = 1.32E-9 (probability of dangerous failure per hr) T1 = 20 (proof test interval)
Certifications	CE Marked for all applicable EU directives, UKCA Marked for all applicable regulations, cULus Listed (UL 508), TÜV Certified rok.auto/certifications
Operating Characteristics	
Sensing distance [mm (in.)]	• Assured on: 5 (0.2) (see Figure 5 on page 3) • Assured off: 32 (1.25)
Operating voltage	24V DC +10%/-15% Class 2 SELV or PELV power supply
Response time (off)	45 ms
Utilization category according to IEC 60947-5-2	DC-12 and DC-13 Ue: 24V Ie: 200 mA
Frequency of operating cycle	0.25 Hz
Operating current, min	1 mA
Off-state output current	< 0.5 mA
No-load supply current	< 50 mA
Load current, max	200 mA
Voltage drop	< 1.5V
Switches connected in Series	Unlimited (see Commission the Unique Coded Actuator on page 4)
Outputs	
Safe state	De-energized (2 x PNP, 0V), AUX energized (1 x PNP, 24V)
Run state	Energized (2 x PNP, 24V), AUX de-energized (1 x PNP, 0V)
Mechanical	
Material	• Case: Red Grilamid • Actuator: Red Grilamid/PBT
Environmental	
Operating temperature [C° (F°)]	-25...+70 (-13...+158)
Relative humidity	5...95%
Washdown rate	NEMA 3, 4X, 12, 13, IP66, IP67, IP69K
Shock and vibration	IEC 60068-2-27: 30 g, 11 ms IEC 60068-2-6: 10...55 Hz
Pollution degree	IEC 60947-1-3
Electromagnetic Compatibility (EMC)	
Electrostatic discharge ESD	IEC 61000-4-2: 8 kV air discharge; 4 kV contact discharge
Radiated EMF immunity	IEC 61000-4-3: 20V/m; 10V/m (1...6 GHz)
Electrical fast transient/ burst immunity	IEC 61000-4-4: ±2 kV
Conducted immunity	IEC 61000-4-6: 10V
Rated impulse withstand voltage	IEC 60947-1: 1 kV
Protection	• Short circuit • Overload • Reverse polarity • Overvoltage • Loss of ground
Physical Characteristics	
Torque settings, max [N•m (lb•in)]	Switch/actuator mounting nut: 2.20 (19.5)

Approximate Dimensions

Figure 1 - Switch and Actuator [mm (in.)]



Diagnostics

Table 1 - Signal from Status/Diagnostic Indicator

State	Status	Troubleshooting
Off	Not powered	–
Red	OSSD not active	–
Green	OSSD active	–
Green flash	Power up test or OSSD inputs not valid	Check 24V DC on OSSD inputs (yellow and red wire)
Red flash	1 Hz flash OSSD fault 4 Hz flash internal fault	OSSD fault: Check that OSSD outputs are not shorted to GND, 24V DC, or each other. Cycle power.

See Unique Coded Diagnostic on page 4 for learning process errors.

Installation

IMPORTANT Do not over torque the mounting hardware. See Torque settings, max on page 2.

1. Position the switch and actuator so they align with each other.
2. Mount the switch and actuator to the removable guard, door, or gate. The recommended fastener size is M6.

Figure 2 - Nut Torque Specification [a]

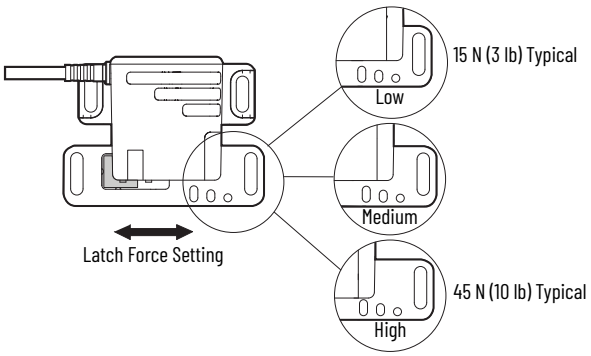


Figure 3 - Sliding Door

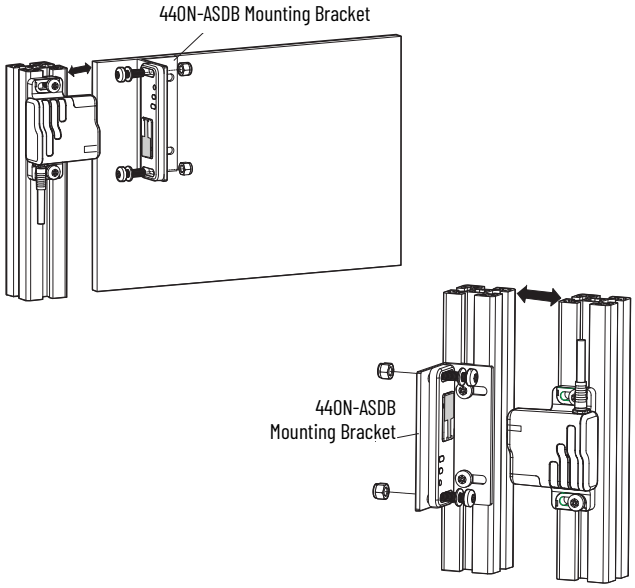
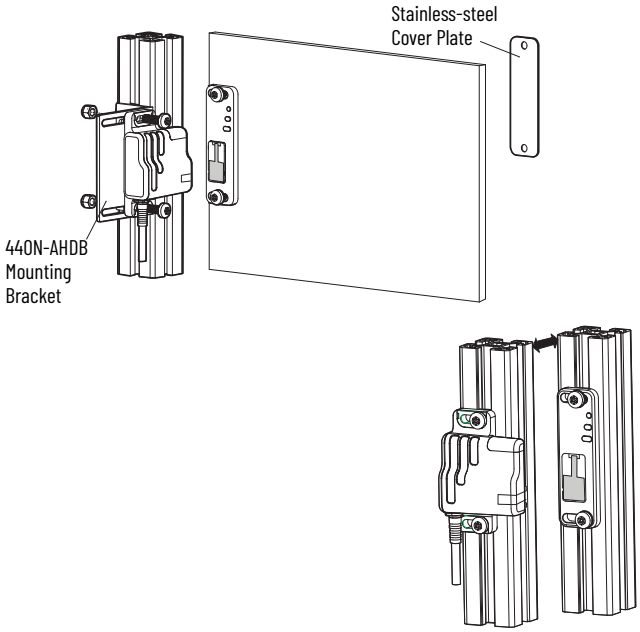


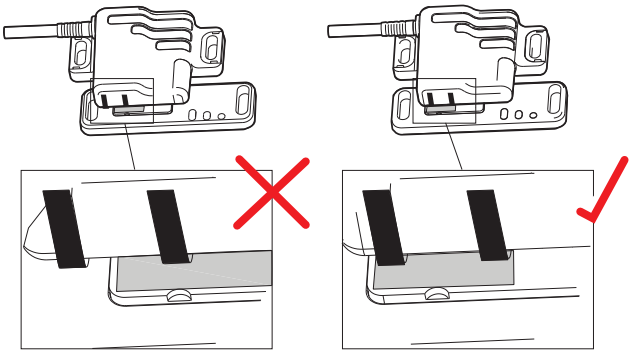
Figure 4 - Hinged Door



Misalignment

50 mm (1.97 in.) side-to-side orientation.

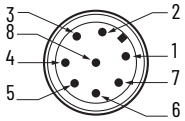
Figure 5 - Striker Plate



Both pole pieces must contact the striker plate.

Typical Wiring

Table 2 - 8-pin Diagram



Pin	Color	Signal
1	White	Auxiliary Output C
2	Brown	+24V DC
3	Green	–
4	Yellow	OSSD 2 Input
5	Gray	OSSD 1 Output
6	Pink	OSSD 2 Output
7	Blue	0V
8	Red	OSSD 1 Input

The recommended connection cable is 2 m (6.5 ft) (catalog number 889D-F8AB-2). Replace the 2 with 5 (5 m [16.4 ft]) or 10 (10 m [32.8 ft]) for standard cable lengths.

(a) See Torque settings, max.

Commission the Unique Coded Actuator

Power the Sensor

Connect the sensor to 24V DC (see Typical Wiring on page 3).

IMPORTANT The unique coded sensor Status/Diagnostic indicator, flashes green eight times then repeats, which indicates that the sensor has not yet learned an actuator.

You can lock the unique coded sensor so it cannot learn another actuator, see Teach the Unique Actuator.

Teach the Actuator

Quick Start

1. Power up the sensor and bring an actuator into the sensing range.
2. Leave the actuator in the sensing field for a minimum of 2 minutes.
3. The learn process is complete

IMPORTANT The sensor can learn a new actuator up to eight times. The Status/Diagnostic indicator flashes the number of actuators left that a sensor can learn.

Ability to Learn an Additional Actuator

The sensor automatically starts the learn process once an actuator enters the sensing range.

Table 3 - Learn Sequence

Step		Description
1	Target present	Status/Diagnostic indicator flashes green 1 Hz rate
2	Verifying actuator	Status/Diagnostic indicator flashes green/red 1 Hz rate (15 s)
3	Program sensor	Status/Diagnostic indicator flashes green/red 4 Hz rate (15 s)
4	Program complete	Status/Diagnostic indicator flashes green/1 Hz rate (number of learns left) (15 s)
5	Ready state	Status/Diagnostic indicator shows steady green
6	Learn is completed	–

Teach the Unique Actuator

(one-time learn only; unit locked)

Initial Teach of the Actuator

The sensor automatically starts the learn process once an actuator enters the sensing range.

Table 4 - Learn Sequence

Step		Description
1	Target present	Status/Diagnostic indicator flashes green 1 Hz rate
2	Verifying actuator	Status/Diagnostic indicator flashes green/red 1 Hz rate (15 s)
3	Program sensor	Status/Diagnostic indicator flashes green/red 4 Hz rate (15 s)
4	Program locking	Status/Diagnostic indicator flashes green (number of learns left) (15 s)
5	Remove the actuator from the sensing field	Status/Diagnostic indicator shows steady red
6	Replace the actuator back into the sensing field	Status/Diagnostic indicator flashes green 1 Hz rate (number of learns that remain)
7	Ready state	Status/Diagnostic indicator shows steady green
8	Learn is complete.	–

Learn a New Unique Coded Actuator

- To learn a replacement actuator, bring the actuator to be taught into the sensing range of the safety switch.
- The learn sequence is the same as the sequence for Teach the Actuator.
- A sensor cannot relearn a previously learned actuator or a standard SensaGuard™ actuator.
- The sensor only recognizes the most recently learned actuator.

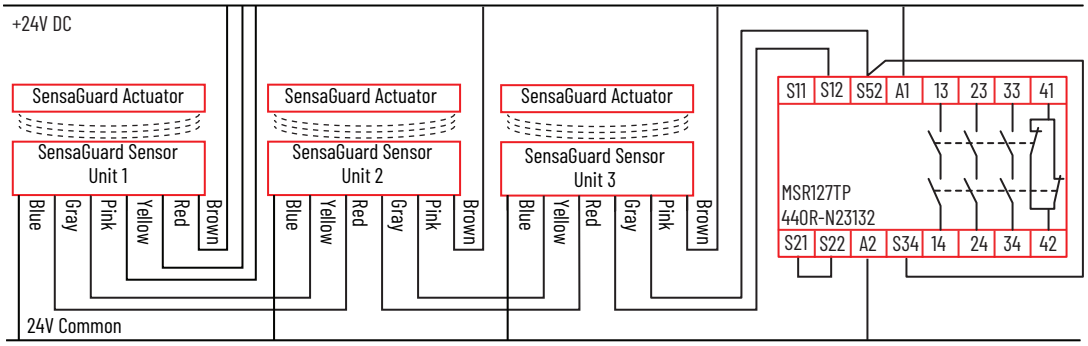
Unique Coded Diagnostic

Error codes for learn process. Cycle power to clear the fault.

Table 5 - Signal from Status/Diagnostic Indicator

Flashes (4 Hz)	Error Code
Green	OSSD inputs not valid.
Red-red-red-green	Cannot learn a standard SensaGuard actuator.
Red-red-red-green-green	Actuator already learned.
Red-red-red-green-green-green	Bad RFID. Target moved out of range.
Red-red-red-green-green-green-green	Exceeded learning eight actuators.
Red-red-red-green-green-green-green-green	Unit locked. Cannot learn another actuator.

Timing Diagram



Response Time: Safety outputs turn off.
Initial conditions: All actuators are in sensing distance.

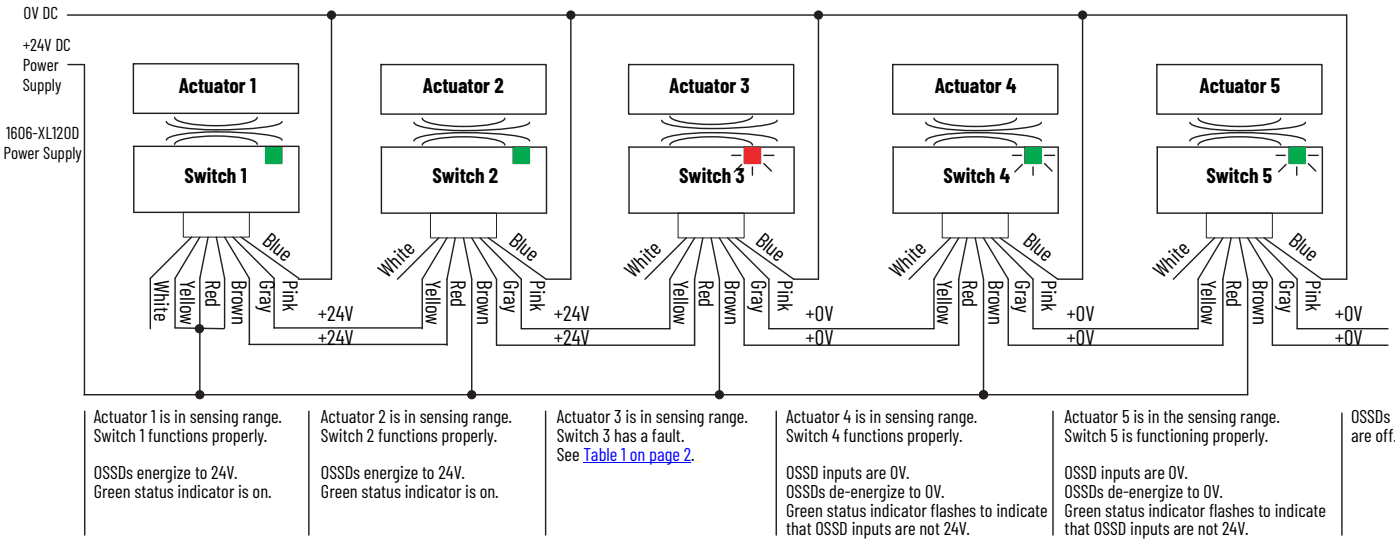
Actuator 1 moves out of sensing range.	Sensor 1 OSSD outputs (gray and pink) turn off. Sensor 1 status indicator turns steady red.	Sensor 2 OSSD outputs (gray and pink) turn off. Sensor 2 status indicator flashes green.	Sensor 3 OSSD outputs (gray and pink) turn off. Sensor 3 status indicator flashes green.

Response Time: Safety outputs turn on
Initial conditions: Actuator 1 is out of sensing range. Sensor 1 status indicator is steady red. Actuators 2 and 3 are in sensing range. Sensor 2 and 3 status indicators flash green.

Actuator 1 moves into sensing range.	Sensor 2 OSSD inputs (red and yellow) transition to 24V DC from Sensor 1 OSSD outputs. Sensor 1 status indicator turns steady green.	Sensor 3 OSSD inputs (red and yellow) transition to 24V DC from Sensor 2 OSSD outputs. Sensor 2 status indicator turns steady green.	Sensor 3 OSSD outputs (gray and pink) are energized. Sensor 3 status indicator turns steady green.

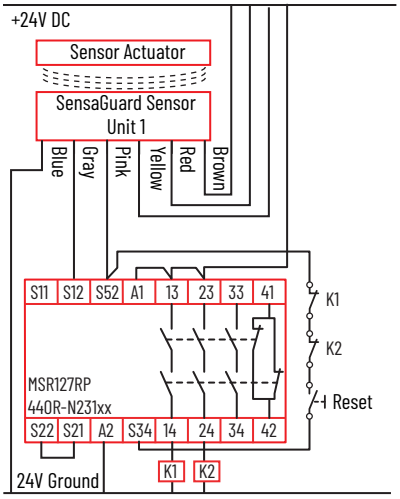
Troubleshooting

Figure 6 - Series Circuit

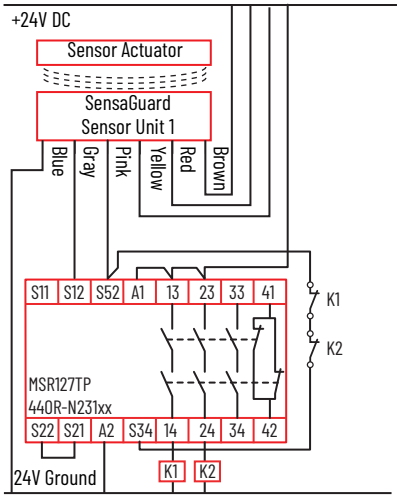


Application Wiring Examples

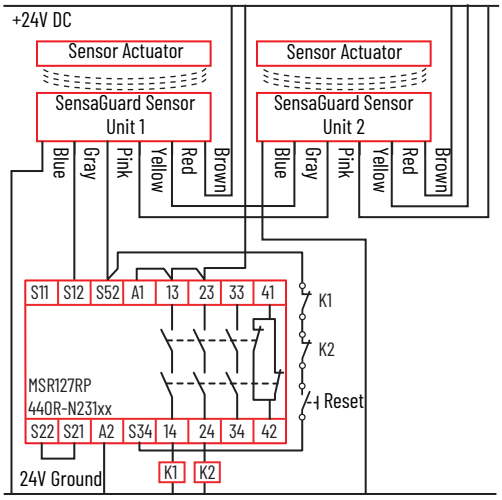
Figure 7 - Wiring to MSR127 Safety Relay Driving 100S or 700S Safety Relays



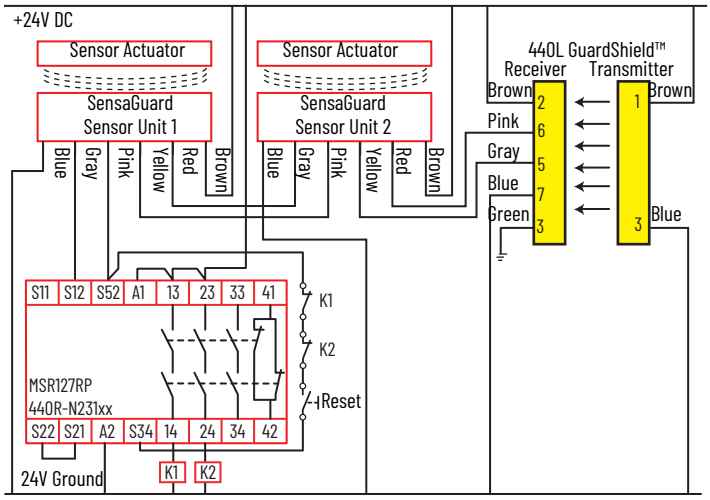
One Sensor, Monitored Manual Reset



One Sensor, Automatic Reset



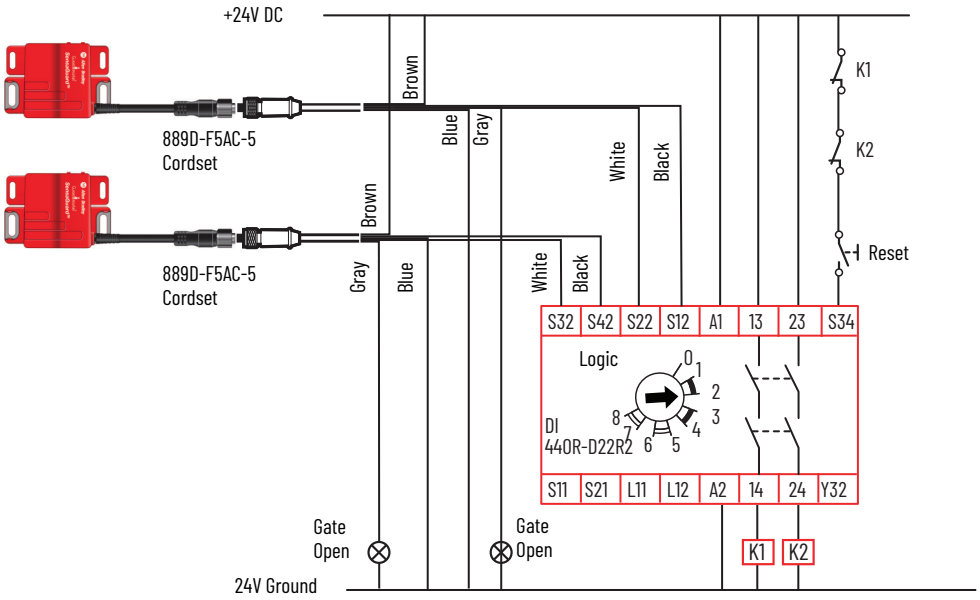
Two Sensors in Series, Monitored Manual Reset



Two Sensors and One 440L Safety Light Curtain in Series, Monitored Manual Reset

IMPORTANT The safety light curtain must be last (farthest from the safety relay).

Figure 8 - Guardmaster SI or DI Safety Relay Wiring with M12 5-pin Version



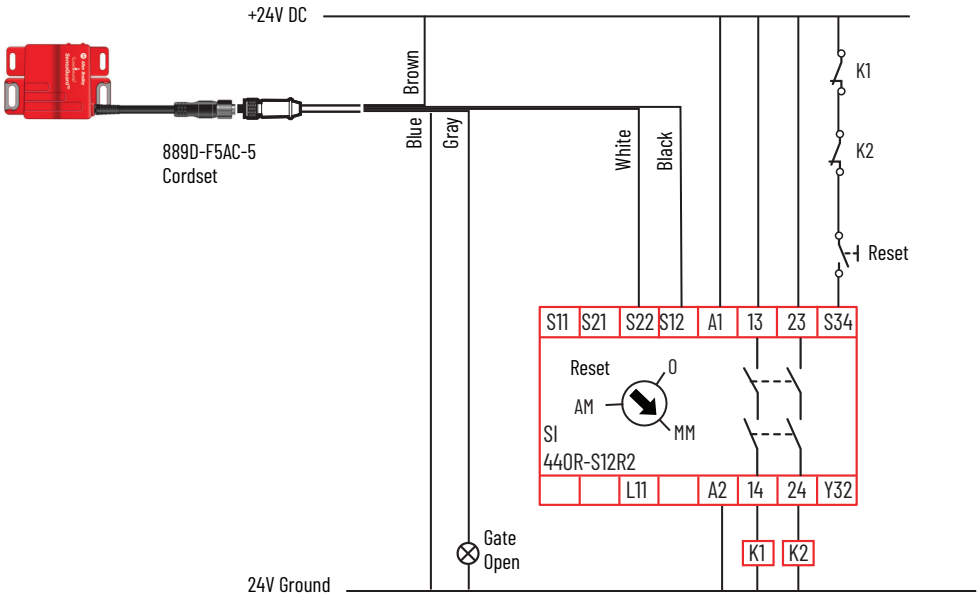
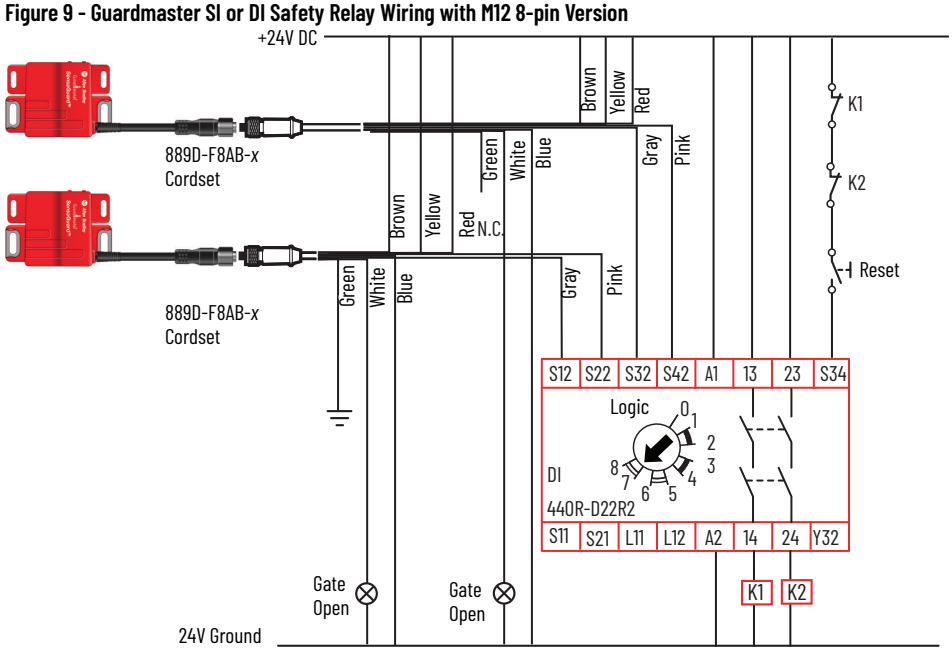


Figure 9 - Guardmaster SI or DI Safety Relay Wiring with M12 8-pin Version



IMPORTANT The green wire connects to the housing of the stainless-steel SensaGuard sensor only; it has no connection for the plastic SensaGuard sensor.

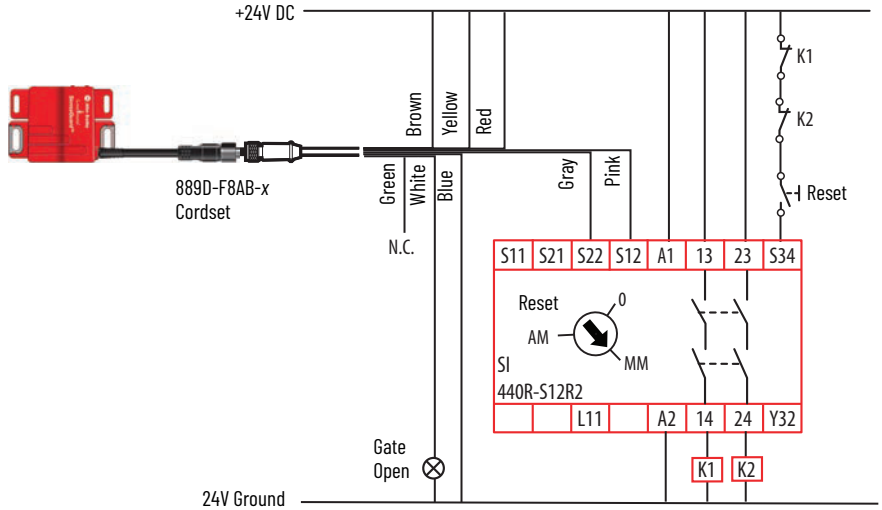


Figure 10 - CR30 Software Configurable Relay Wiring

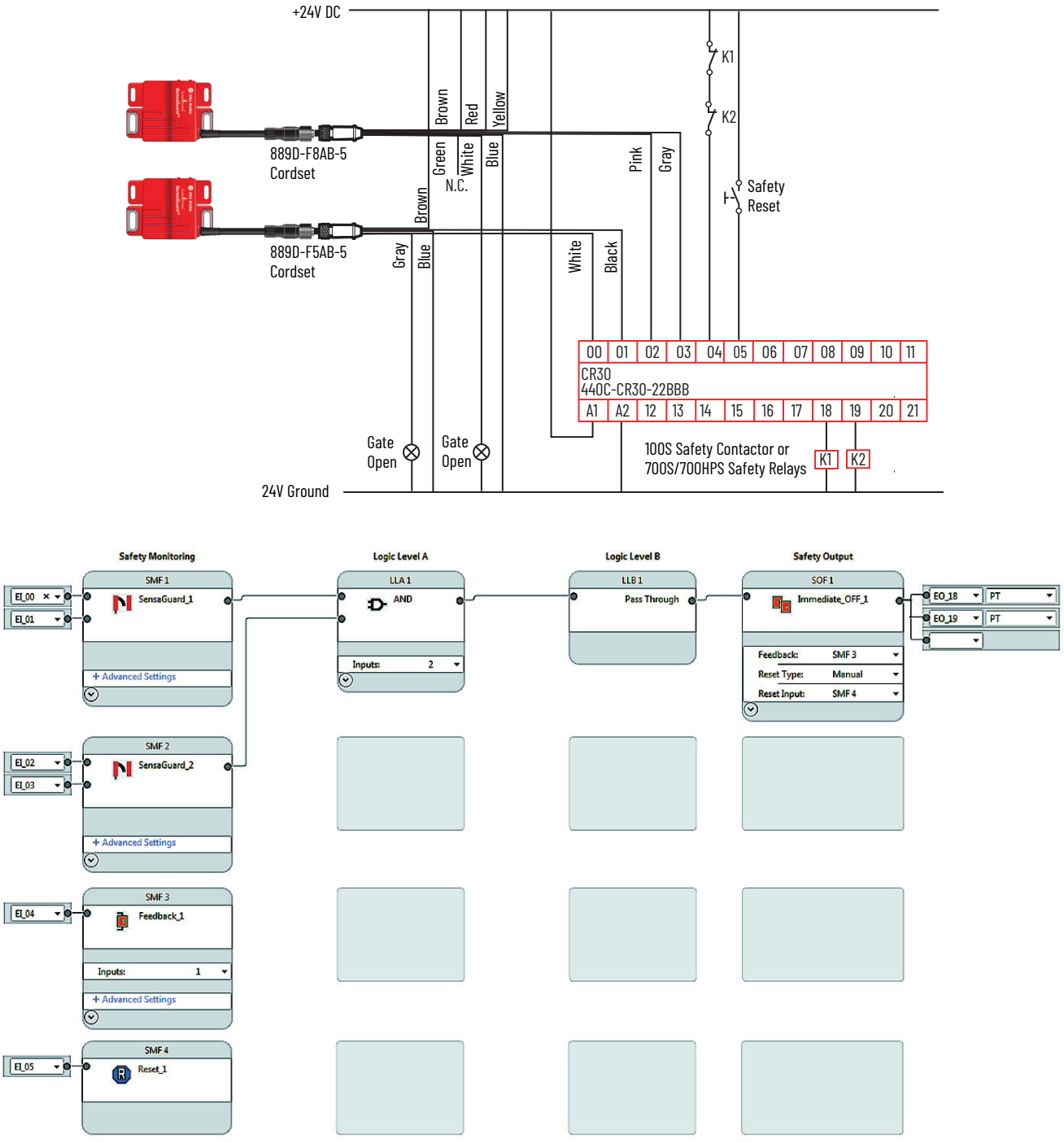
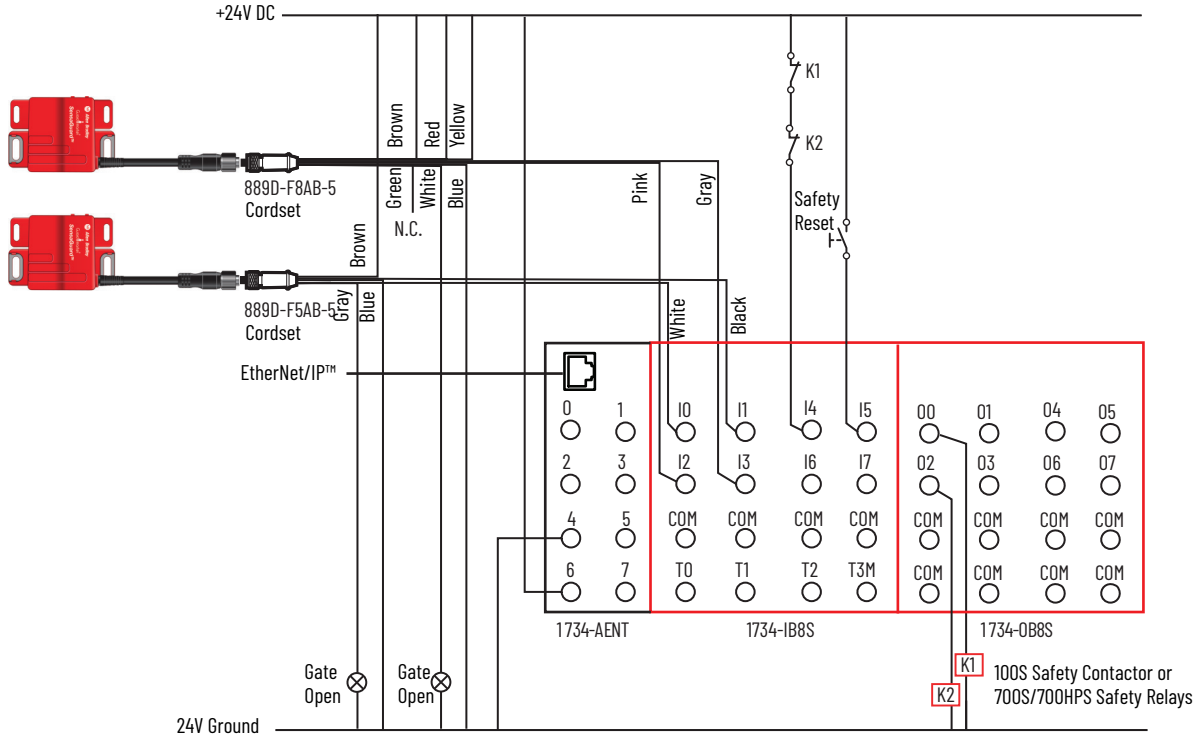


Figure 11 - 1734 POINT Guard I/O Wiring



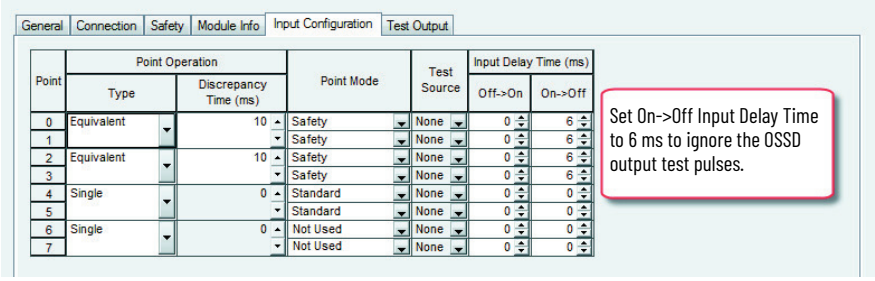


Figure 12 - 1732DS/ES ArmorBlock Guard I/O Wiring

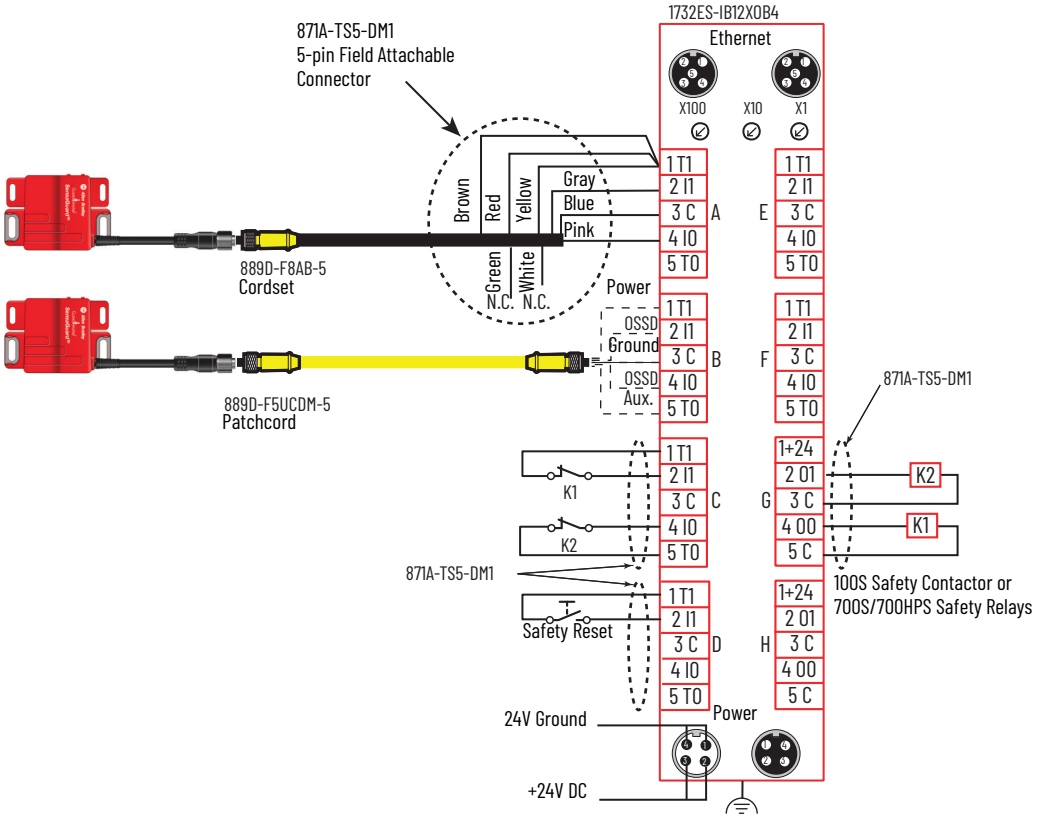
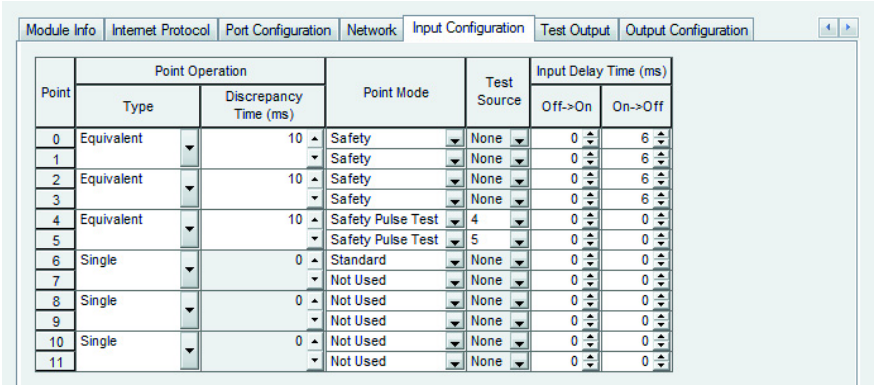
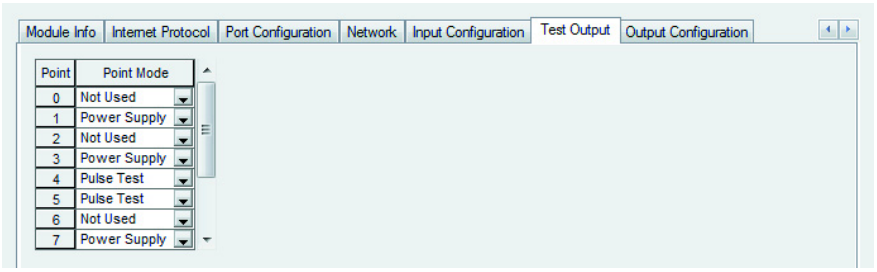
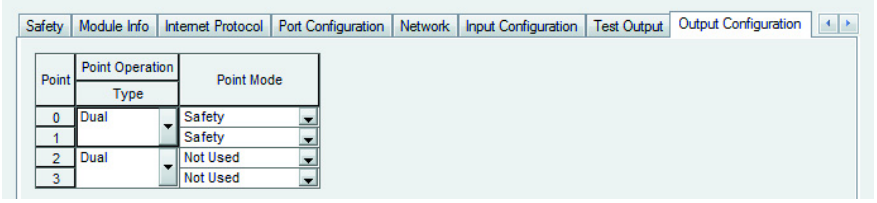


Figure 13 - Input and Output Configuration for the 1732ES Module







Recommended Safety Control Interfaces

- Guardmaster® safety relays:
  - Dual-input (DI)
  - Dual-input solid-state output (DIS)
  - Single input (SI)
  - CR30 software configurable
- Minotaur™ safety relays:
  - MSR126
  - MSR127
  - MSR131
  - MSR138
- SmartGuard™ controller
- 1791DS/ES CompactBlock™ Guard I/O™ module
- 1732DS/ES ArmorBlock® Guard I/O module
- 1734 POINT Guard I/O™ module

Maintenance

Monthly: check the correct operation of the switching circuit. Also check for signs of abuse or alterations. Inspect the switch casing for damage. Inspect the magnet poles and clean off any dirt or debris.

Repair

If there is any malfunction or damage, do not repair. Replace the unit before you allow machine operation.

Declaration of Conformity

CE Conformity

Rockwell Automation declares that the products that are shown in this document conform with the 2014/30/EU Electromagnetic Compatibility Directive (EMC) and 2006/42/EC Machinery Directive (MD) and that the respective standards and/or technical specifications have been applied.

For a comprehensive CE certificate visit: rok.auto/certifications

UKCA Conformity

Rockwell Automation declares that the products that are shown in this document are in compliance with 2016 No. 1091 Electromagnetic Compatibility Regulations and 2008 No. 1597 Supply of Machinery (Safety) Regulations and that the respective standards and/or technical specifications have been applied.

For a comprehensive UKCA certificate visit: visit: rok.auto/certifications

Additional Resources

Resource	Description
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 (including translations) at rok.auto/literature.

Waste Electrical and Electronic Equipment (WEEE)

At the end of life, this equipment should be collected separately from any unsorted municipal waste.

Rockwell Automation maintains current product environmental compliance information on its website at rok.auto/pec.

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Publication 440N-IN009C-EN-P - May 2023 | Supersedes Publication 440N-IN009B-EN-P - March 2020