Installation Instructions

Original Instructions

Allen-Bradley

Guardmaster®

Lifeline 5 Cable-pull Safety Switch

Catalog Numbers 440E-LL5SS8, 440E-LL5SS5, 440E-LL5SE8, 440E-LL5SE5, 440E-LL5SN8, 440E-LL5SN5

ATTENTION: Read this document and the documents that are 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 and requirements of all applicable codes, laws, and standards.

Suitably trained personnel are required to install, adjust, put into service, use, assemble, disassemble, and maintain this equipment in accordance with the applicable code of practice.

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

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

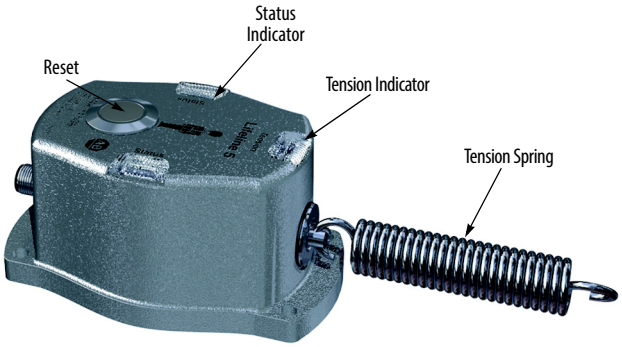
You can view or download publications (including translations) at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation® sales representative.

Introduction

ATTENTION: Do not attempt to install this device unless the installation instructions have been studied and understood. This document acts as a guide for a typical installation and is available in some languages at www.rockwellautomation.com/literature. Select the publication language and type "440E" in the search field. A full user manual is also available.

Standard

Stainless Steel



Installation must be in accordance with these instructions and must be implemented by qualified personnel.

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

Use appropriate screws, bolts, or nuts that are fitted by tools to mount the switch to avoid the risk of tampering. Do not over torque the mounting hardware.

Technical Specifications

Attribute	Aluminum Housing with E-stop	Aluminum Housing without E-stop	Stainless Steel Housing
Safety Ratings			
Standards Safety Classification	PLe Cat 4 according to EN ISO 13849-1, SIL CL3 per IEC 62061 and IEC 61508 The intent of the operational functionality required by EN ISO 13850 and IEC 60947-5-5 is achieved by using electronic technology.		
Functional Safety Data	PLe Cat 4 according to ISO 13849-1 For functional safety data see http://literature.rockwellautomation.com/idc/groups/literature/documents/sr/safety-sr001_-en-e.pdf		
Certifications	CE Marked for all applicable directives, cULus (UL 508), and TÜV. http://www.rockwellautomation.com/certification/overview.page		
Operating Characteristics			
Cable Span	100 m (328 ft)		
Tension Force to Run Position	135 N (30.35 lbs)		
Trip Force	195 N (43.84 lb) maximum		
Operating Voltage	24V DC 10%/-15% Class 2 SELV or PELV power supply		
Response Time (Off)	60 ms		
Switches Connected in Series	Response time off is 5 ms for each additional switch		
Utilization Category According to Ue Ie	DC-12 and DC-13 24V 200 mA		
Frequency of Operating Cycle	0.25 Hz		
Off-state Output Current	< 0.5 mA		
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)		
Tension	Energized (1 x PNP, 24V)		
No-load Supply Current	< 50 mA		
Load Current	200 mA maximum		
Voltage Drop	< 2V		
Mechanical			
Housing Material	Aluminum		Stainless Steel 304
Environmental			
Operating Temperature	-40…+75 °C (-40…167°F)		
Operating Humidity	5…95% relative		
Washdown Rating	IP66	IP66, IP67	IP66, IP67, IP69K
Shock and Vibration	IEC 60068-2-27: 30 g (1.05 oz), 11 ms IEC 60068-2-6: 10…500 Hz		
Pollution Degree	IEC 60947-1: 3		

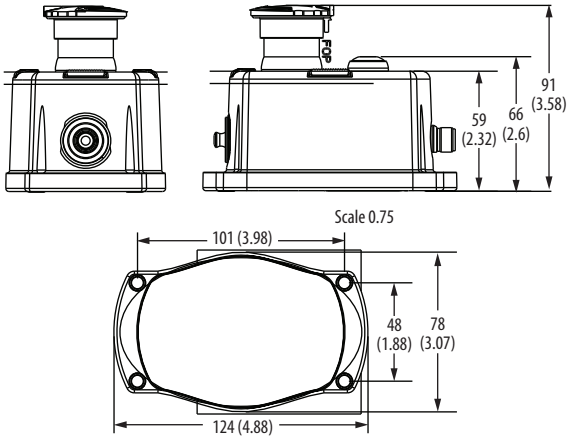
Attribute	440E
Electro-magnetic Compatibility (EMC)	
Electrostatic Discharge ESD	IEC 61000-4-2: air discharge Per IEC 61326-1 (functional): 8 kV Per IEC 61000-6-7 (fail safe): 8 kV
	IEC 61000-4-2: contact discharge Per IEC 61326-1 (functional): 4 kV Per IEC 61000-6-7 (fail safe): 6 kV
Radiated EMF immunity	IEC 61000-4-3 Per IEC 61326-1 (functional): 10 V/m Per IEC 61000-6-7 (fail safe): 20 V/m
Electrical Fast Transient/Burst Immunity	IEC 61000-4-4 Per IEC 61326-1 (functional): 2 kV/5 kHz Per IEC 61000-6-7 (fail safe): 2 kV/5 kHz
Conducted Immunity	IEC 61000-4-6 Per IEC 61326-1 (functional): 10V Per IEC 61000-6-7 (fail safe): 20V
Rated Impulse Withstand Voltage	IEC 60947-1: 1 kV
Protection	Short circuit, overload, reverse polarity, overvoltage, loss of ground

Mounting

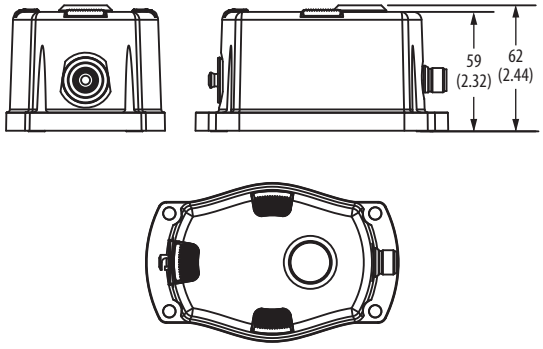
Recommend using M5 or 10-32 bolts to mount the sensor to the frame of the machine

Dimensions [mm (in.)]

Standard Housing



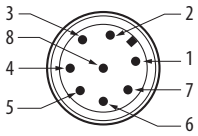
Stainless Steel Housing



Wiring Diagram

Connections

8-Pin Unit

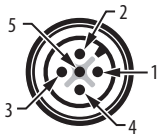


Pin Number	Wire Color	Signal
1	White	Auxiliary Output
2	Brown	24V DC
3	Green	Tension Output
4	Yellow	Safety OSSD 2 Input
5	Gray	Safety OSSD 1 Output
6	Pink	Safety OSSD 2 Output
7	Blue	0V
8	Red	Safety OSSD 1 Input

Description	Temperature Rating [C (F)]	Jacket Material	Coupling Nut	Cat. No.
M12 8-pin cordset	-20…+105 -4…+221)	PVC	Epoxy-coated Zinc	889D-F8AB-2
			Stainless Steel	889DS-F8AB-2

Replace the 2 with 5 (5 m [16.4 ft]) or 10 (10 m [32.8 ft]) for standard cable lengths.

5-Pin Unit



Pin Number	Color	Signal
1	Brown	+24V
2	White	Safety OSSD 1 Output
3	Blue	0V
4	Black	Safety OSSD 2 Output
5	Gray	Auxiliary Output

Description	Temperature Rating [C (F)]	Jacket Material	Coupling Nut	Cat. No.
M12 5-pin cordset	-20…+105 -4…+221)	PVC	Epoxy-coated Zinc	889D-F5AC-2
			Stainless Steel	889DS-F5AC-2
M12 4-pin cordset	-50…+105 (-58…+221)	TPE	Stainless Steel	889DS-F4HJ-2

Replace the 2 with 5 (5 m [16.4 ft]) or 10 (10 m [32.8 ft]) for standard cable lengths.

IMPORTANT	If the user does not require the auxiliary signal, a 4-pin cordset (889D-F4AC-2) can be used. For low temperature applications, use a 4-pin cordset (889DS-F4HJ-2).

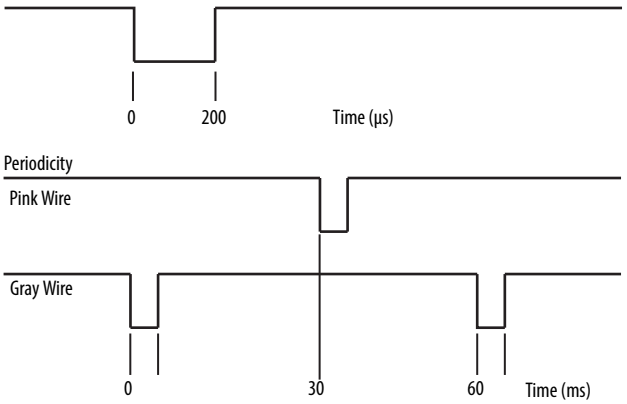
The recommended patchcord for use with ArmorBlock® Guard Safety I/O is 2 m (6.5 ft) - 889D-F4ACDM-2. Replace the 2 with 0M3 (0.3 m [0.98 ft]), 1 (1 m [3.28 ft]), 5 (5 m [16.4 ft]), or 10 (10 m [32.8 ft]) for standard cable lengths.

IMPORTANT	Do not use a 5-pin patchcord with the ArmorBlock.

OSSD Test Pulses

Test pulses will appear on each OSSD output. These pulses are approximately every 60 ms. The times shown are approximiate and depend on the processing of the safety-related status.

Individual Pulses



Diagnostic

Unit Indicators

	State	Status	Troubleshooting
Status/Diagnostic Indicator	Off	Not powered	N/A
	Red	OSSD not active	N/A
	Green	OSSD active	N/A
	Green flash	Power up test or OSSD inputs not valid	Check 24V DC or OSSD inputs (yellow or red wire)
	Red flash	1 Hz flash OSSD fault	OSSD fault—check OSSD outputs are not shorted to GND, 24V DC or each other.
		4 Hz flash internal fault	Cycle power.

Function Overview

A Lifeline 5 cable pull system consists of the Lifeline 5 safety cable pull switch, red colored rope/cable, and supports (eye-bolts & pulleys). The Lifeline 5 meets the intent of the international requirements according IEC 60947-5-5 and EN ISO 13850.

Function Safety

The table describes the demand on the safety switch that results in a stop function and how to reset that function.

Safety

Function	Result	Restore to Normal Operation
Actuation of Rope/Cable	Safety Outputs OFF State	Press the Reset Button
E-stop Pressed		Rotating the E-stop Button Clockwise
Safety OSSD Inputs Off and not Floating		Turn OSSD Inputs On

Integrated Emergency Stop Push Button

The Lifeline 5 safety cable pull switch is offered with a twist release emergency stop push button that can be pressed in emergency situations to stop the machine. After E-stop actuation, the safety outputs remain in the off state and can only be reset manually by rotating the emergency stop push button clockwise.

Indication of Rope Tension

During installation/adjustment of the rope/cable assembly, the correct tension of the rope can be checked by observing the tension indicator. During setup, the tension indicator will flash at 1 Hz and the tension output will pulse at the same rate. This output can be wired to an indicator light to help with initial setup and diagnostics. As the tension is increased on the rope/cable, the tension indicator flash rate will increase. When the tension indicator turns off, the sensor is properly tensioned.

Margin Indication the Rope Tension

If the status indicator is green and the tension indicator is flashing amber, the rope/cable requires maintenance/adjustment before the machine shuts down. This output can be used as an indication signal or be connected directly to an indicator light.

Indicators

8-pin Connector Functions

Function	Switch Outputs			Status Indicators	
	Safety	Auxiliary	Tension	Status	Tension
E-stop Pressed	Off	On	Off	Red	Off
Sensor not Tensioned/Cable Cut	Off	On	On	Red	Flashing Amber
Low Tension Indication	On	Off	On	Green	Flashing Amber
Sensor Tensioned Properly	On	Off	Off	Green	Off
High Tension Indication	On	Off	On	Green	Flashing Amber
Cable Pulled/Tripped	Off	On	Off	Red	Off
Safety OSSD Inputs not Connected	Off	On	Off	Red	Off

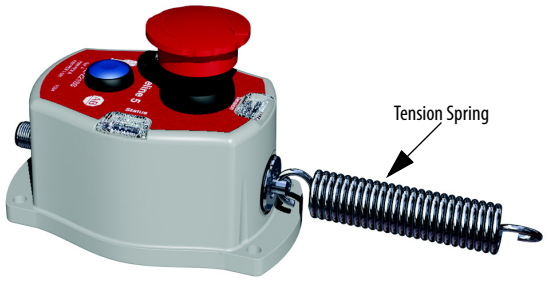
5-pin Connector Functions

5-pin Connector Version	Switch Outputs		Status Indicators	
Function	Safety	Auxiliary	Status	Tension
E-stop Pressed	Off	On	Red	Off
Sensor not Tensioned/Cable Cut	Off	On	Red	Flashing Amber
Low Tension Indication	On	Off	Green	Flashing Amber
Sensor Tensioned Properly	On	Off	Green	Off
High Tension Indication	On	Off	Green	Flashing Amber
Cable Pulled/Tripped	Off	On	Red	Off
Safety OSSD Inputs not Connected	Off	On	Off	Red

Flashing red on status indicator, see Diagnostic on page 3.

Installation of Rope/Cable

Attach the "tension spring" to the eye hook to the front of the switch, as shown.



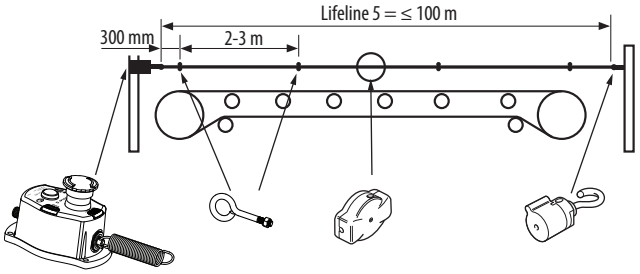
ATTENTION: The sensor must NOT be used without this spring attached.

IMPORTANT The first eye bolt must be located 300 mm (11.8 in.) from the switch eyelet. This provides for a straight and efficient pulling action on the sensor.

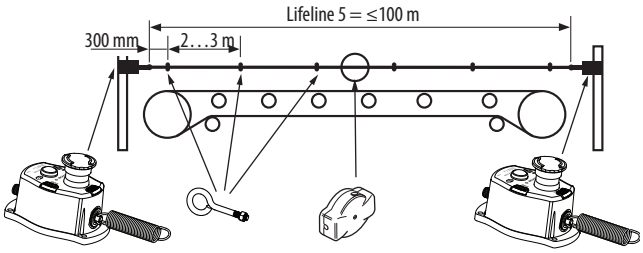
Additional eye bolts should be spaced 2…3 m (6…9 ft) apart to help keep the perpendicular pull force within IEC 60947-5-5 specifications of 200 N (45 lbs) and 400 mm (15.75 in.).

EN ISO 13850 requires that the full length of cable to be within view when the reset is pressed to the run position or the machine must be inspected over the whole length of the cable, both before and after resetting.

Install inside and outside pulley for cable going around corners or whenever direction is changed, even slightly.



The choice between using two switches or one switch is a matter of a risk assessment while taking into consideration the probability of a trapped rope along the span.



Setting/Adjusting the Cable Tension

Power up the Switch (Application Wiring Examples (M12 8-pin Version) on page 7)

The status indicator becomes solid red and the tension indicator begins to blink amber/1 Hz rate.

Slowly increase the tension on the cable. The tension indicator blink rate increases as the tension is increased. When the tension indicator turns off, the sensor is properly set.

Press the reset button. The status indicator turns green (the reset button must be pressed between 125 msec and 3 seconds for the sensor to be reset).

The tension is set.

Verifying the System

When the installation is complete, it is essential that a thorough functional test is made. This test includes checking all types and directions of pull over the length of the cable.

IMPORTANT EN ISO 13850 requires the full length of cable to be within view when the reset is pressed. If it is not, the machine must be inspected over the whole length of the cable, both before and after resetting.

Cable Considerations/Thermal Expansion

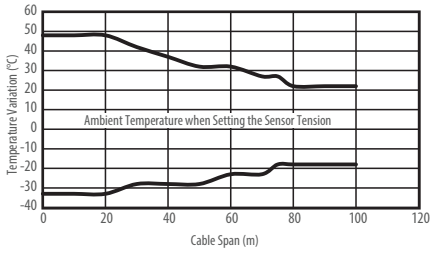
The cable is the actual interface with the user. It is typically red plastic coated and less than 4 mm (0.16 in.) in diameter. The cable is installed between the switch at one end and a support at the opposite end. It is important that the support for the cable be sturdy enough to handle the force required to operate the switch.

Temperature effects on the cable are important to note when configuring a system.

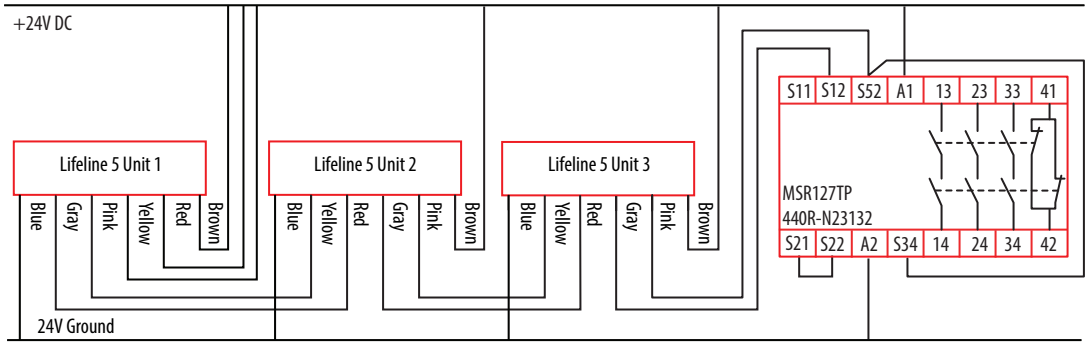
Example:

A cable run along a conveyor is 20 meters. After the tension is adjusted properly, the Lifeline 5 safety cable pull switch can accommodate a temperature swing from +48 °C (118 °F) to -32 °C (-26 °F) without requiring re-adjustment (see figure below).

Another consideration of the cable is that when it is pulled with great force, the cable can initially expand or stretch and affect system setup. It is usually recommended that the cable be forcefully pulled prior to tuning the cable tension with the turnbuckle. This will expose areas in the system that will initially stretch or expand. Adjustments can then be made to take up the added slack.



Timing Diagram



Response Time: Safety Outputs Turn OFF

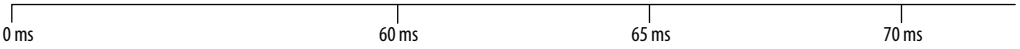
Initial Conditions: All Lifeline 5 and tensioned properly.

Unit 1 sensor is tripped.

Unit 1 OSSD outputs (gray and pink) turn OFF. Sensor 1 indicator turns solid red.

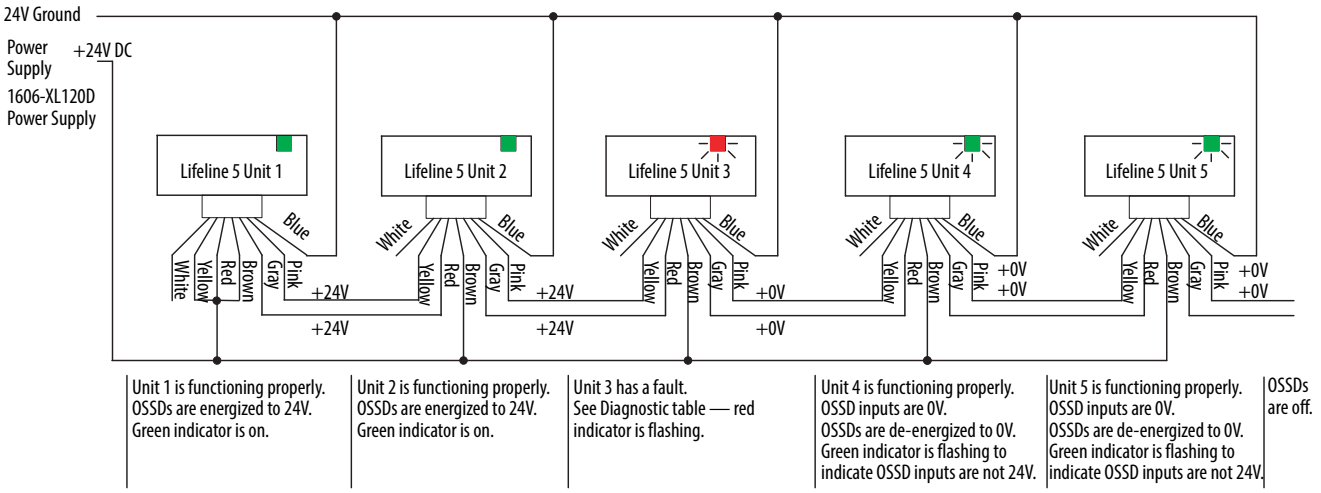
Unit 2 OSSD outputs (gray and pink) turn OFF. Sensor 2 indicator flashes green.

Unit 3 OSSD outputs (gray and pink) turn OFF. Sensor 3 indicator flashes green.

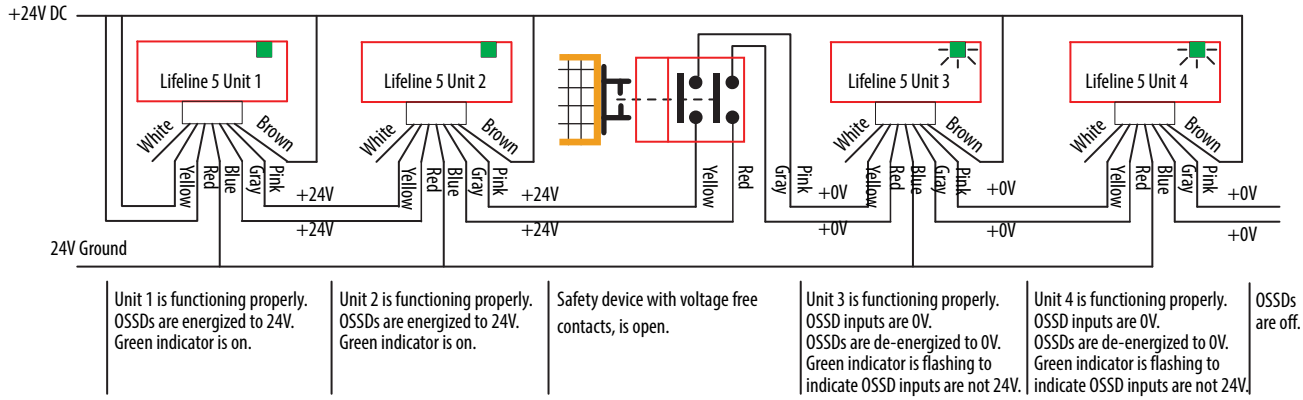


Series Circuit

Consideration must be given to the protection of the wiring (for example, by using wiring duct, conduit, shielded cable, separation, or other means) to prevent faults or to ensure detection of faults (see ISO 13849-2, Table D.4.



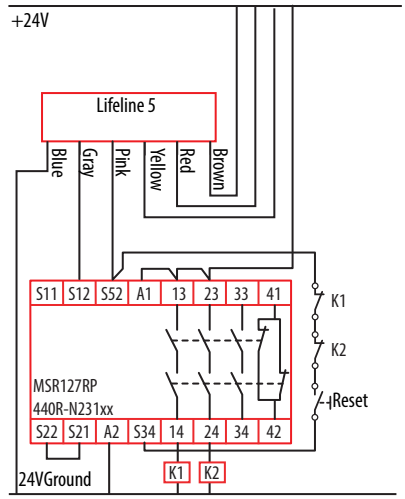
Safety Rating Note: Series circuits that contain only devices having OSSD outputs can be used in safety functions requiring up to PLe per ISO 13849-1.



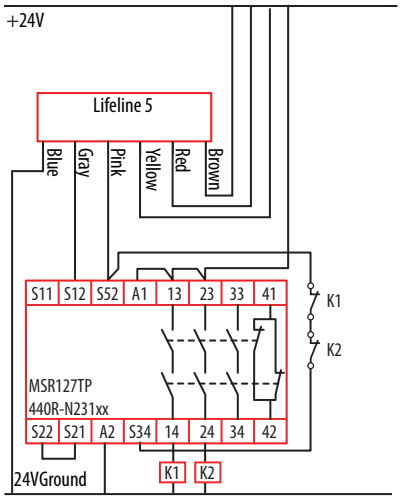
Safety Rating Note: A maximum safety function rating of PLd is achievable depending on the installation details when wiring the series circuits that contains voltage from contacts.

Application Wiring Examples (M12 8-pin Version)

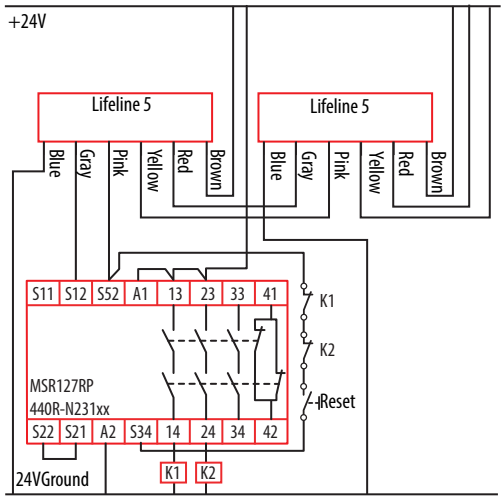
Wiring to MSR127 Safety Relay



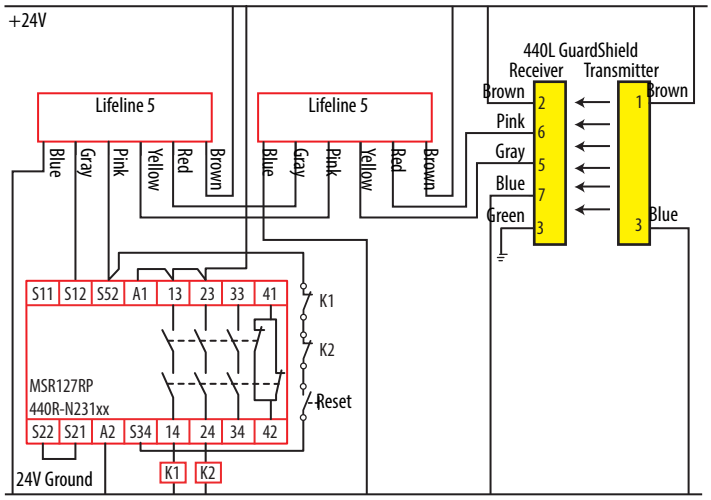
MSR127RP with 1 Sensor, Monitored Manual Reset, Driving 100S or 700S Safety Relays.



MSR127RP with 1 Sensor, Automatic Reset, Driving 100S or 700S Safety Relays.



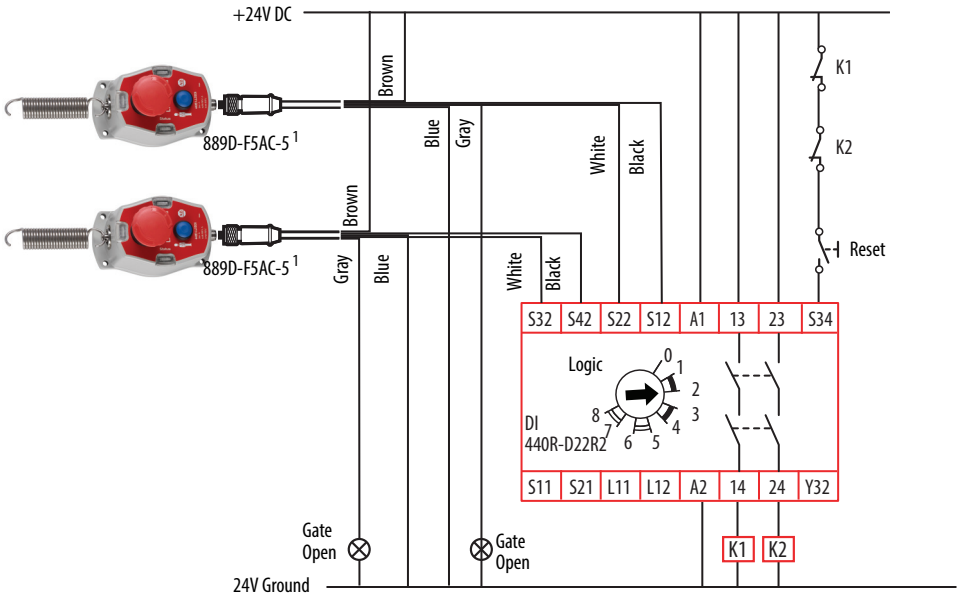
MSR127RP with 1 Sensor, Monitored Manual Reset, Driving 100S or 700S Safety Relays.

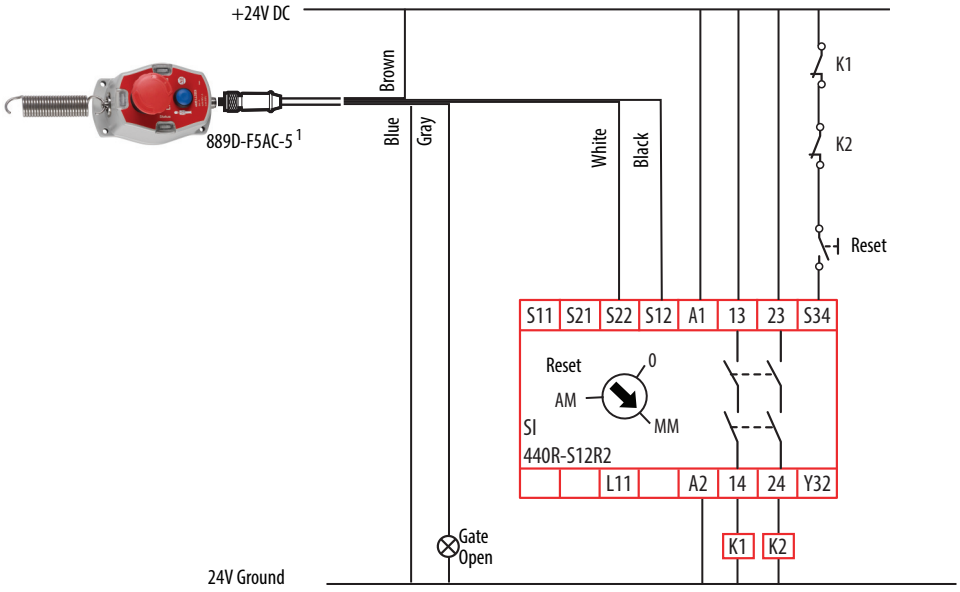


MSR127RP with 2 Sensors and 1 440L Light Curtain in Series, Monitored Manual Reset, Driving 100S or 700S Safety Relays.

IMPORTANT The light curtain must be last (the furthest from MSR127).

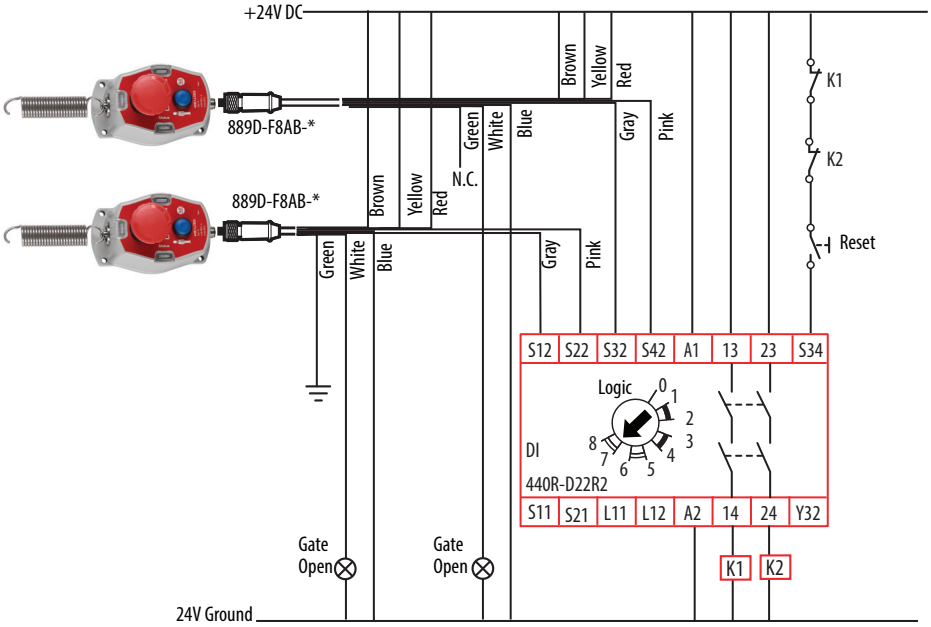
Guardmaster® SI or DI Safety Relay Wiring (M12 5-pin Version)

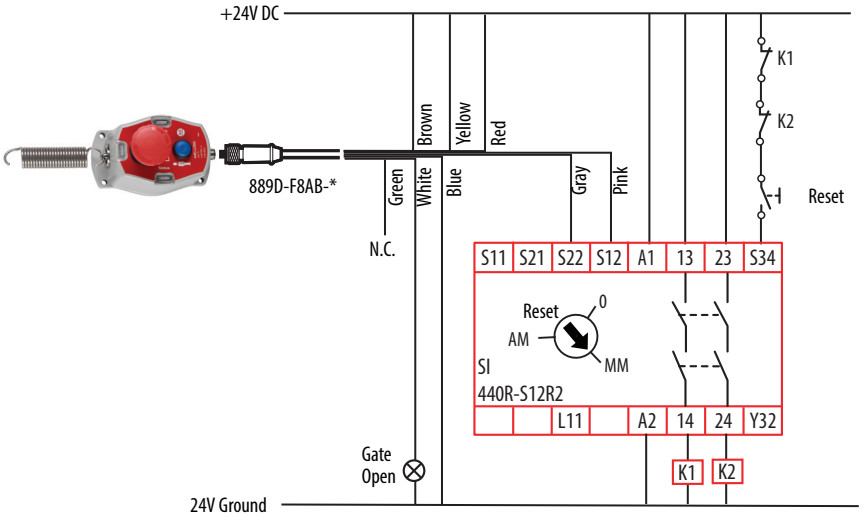




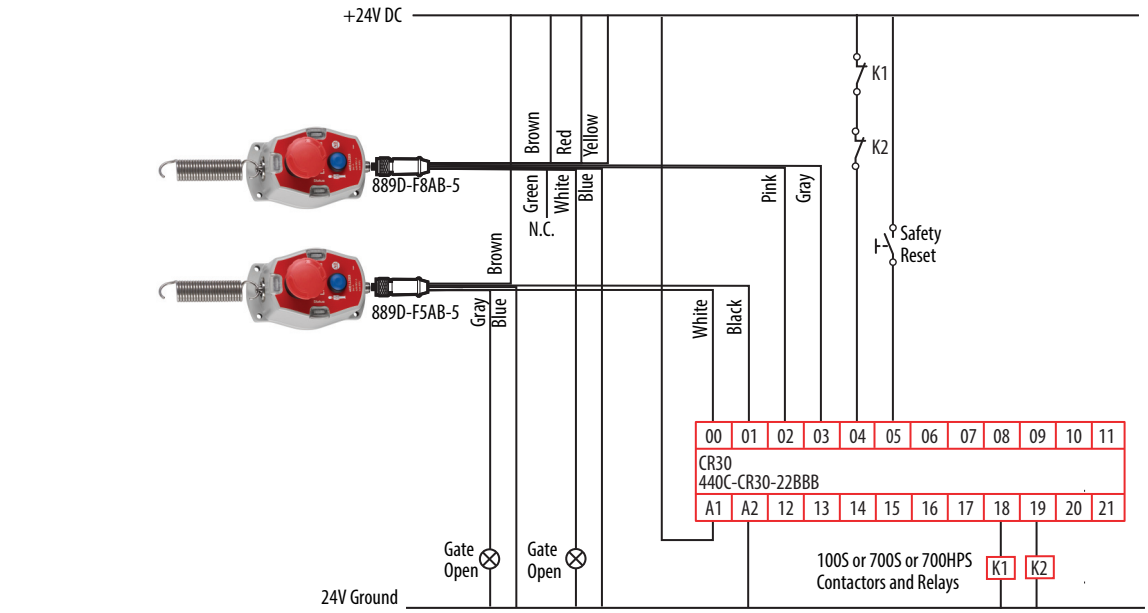
1 For low temperature applications, use 889DS-F4HJ-2 instead of 889D-F5AC-5.

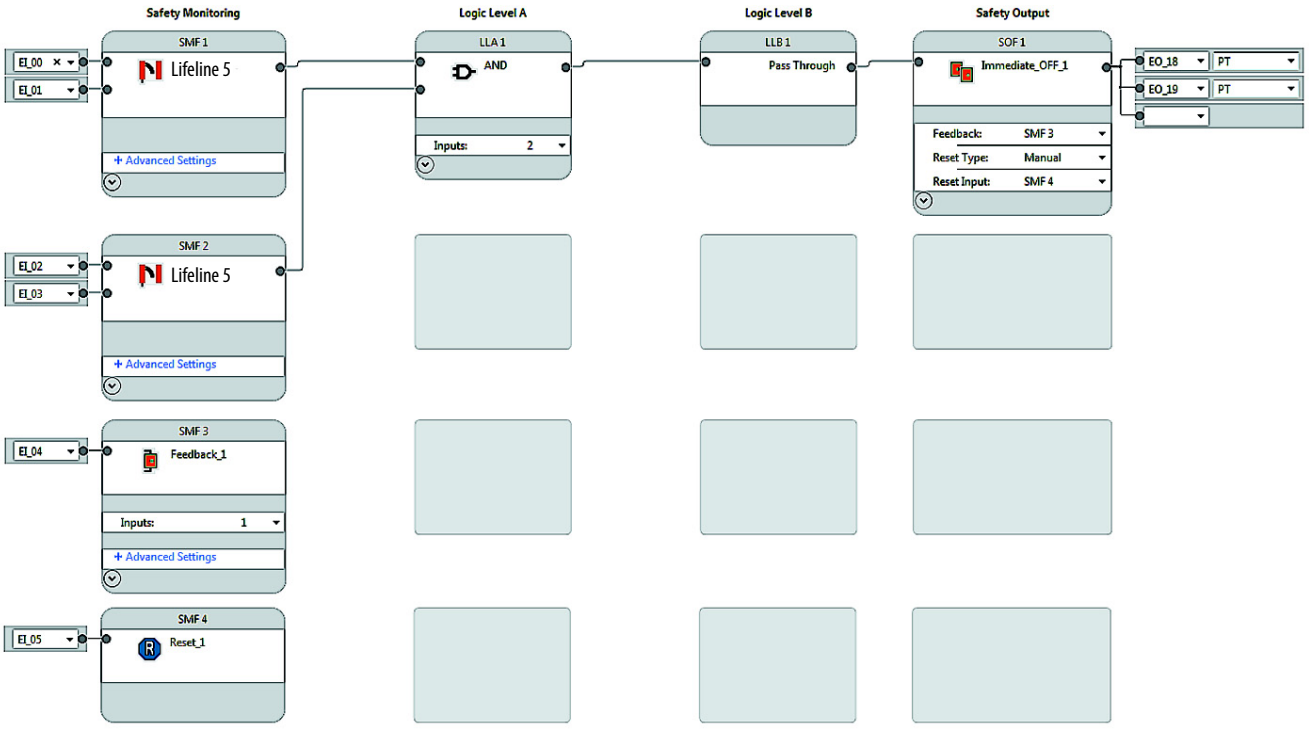
Guardmaster® SI or DI Safety Relay Wiring (M12 8-pin Versions)



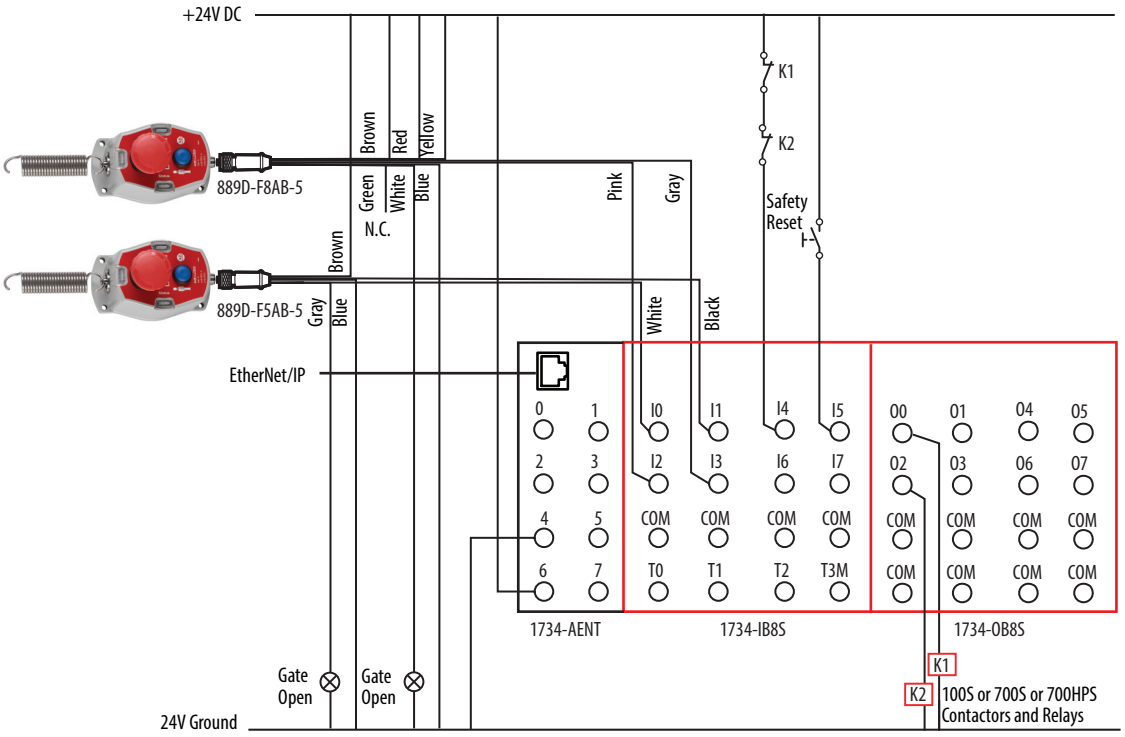


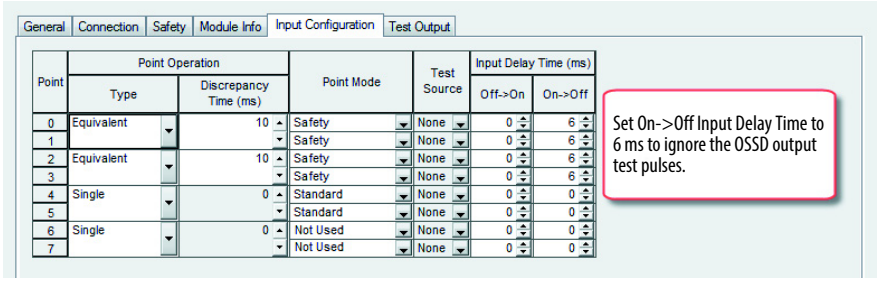
CR30 Software Configurable Relay Wiring (M12 5-pin Versions)



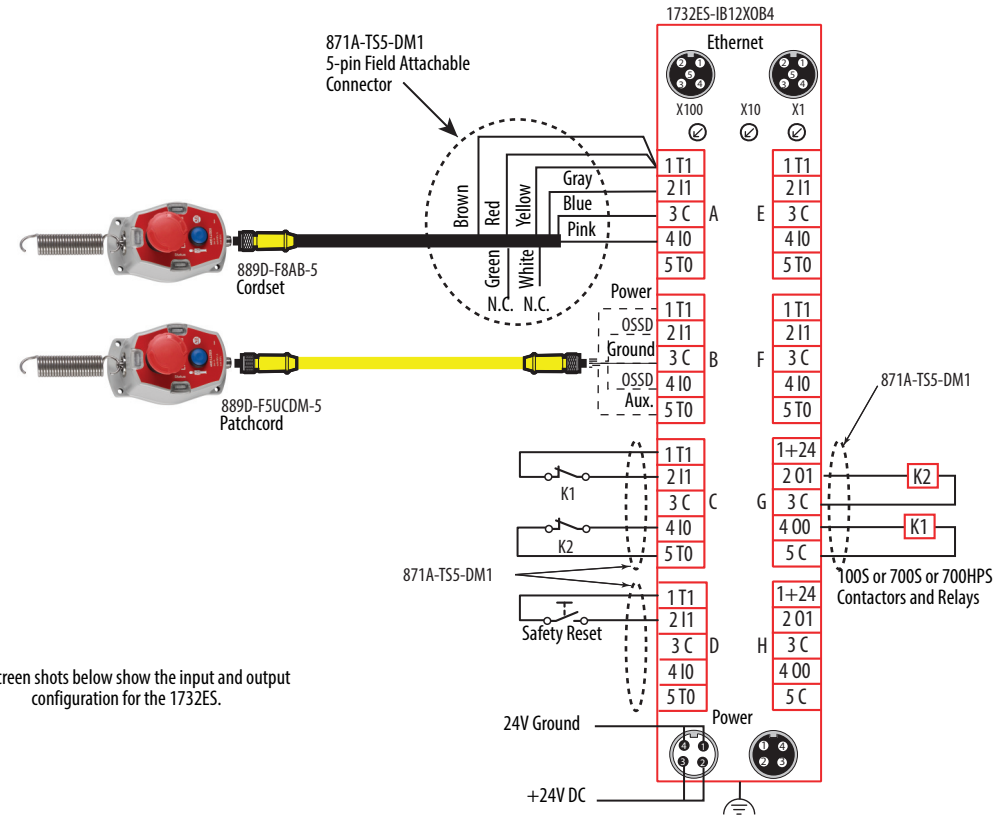


1734 POINT Guard I/O™ Wiring (M12 5-pin Versions)

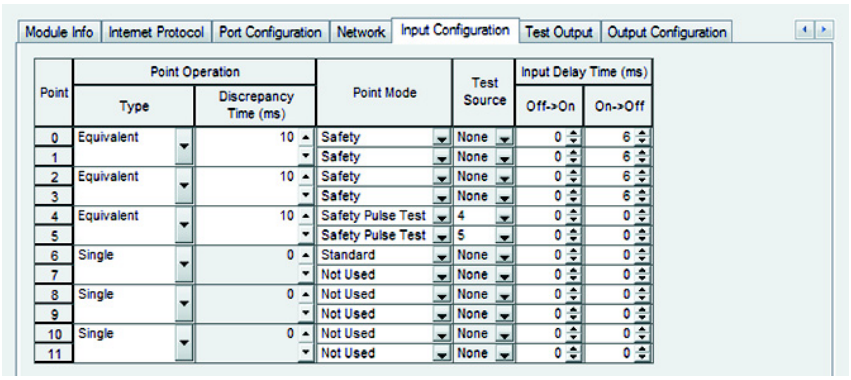


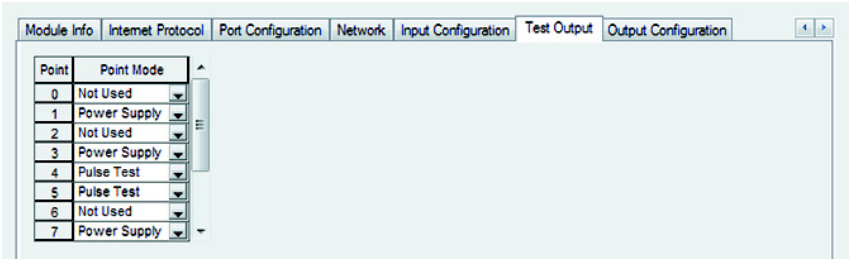


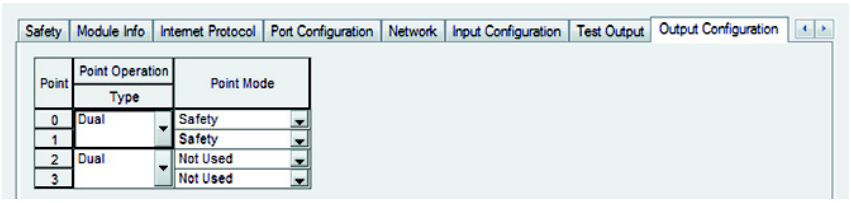
1732DS/ES ArmorBlock® Guard Safety I/O Wiring (M12 5-pin Versions)



The screen shots below show the input and output configuration for the 1732ES.







List of Recommended Safety Control Interfaces

GSR DI, GSR DIS, GSR SI, CR30, MSR126, MSR127, MSR131, MSR138, SmartGuard™, 1791DS/ES CompactBlock™ Guard Safety I/O, 1732DS/ES ArmorBlock® Guard Safety I/O. Relay must have OSSD (light curtain) inputs.

Maintenance

Every Month

Check the correct operation of the switching circuit. Also check for signs of abuse or tampering. Inspect the switch casing for damage.

Every Five Years

Check the correct operation of the switching circuit. Also check for signs of abuse or tampering. Inspect the switch casing for damage. The switch must be disconnected and readjusted.

Repair

If there is any malfunction or damage, no attempts at repair can be made. The unit can be replaced before machine operation is allowed.

Declaration of Conformity

This declaration is to declare that the products that are shown in this document conform with the Essential Health and Safety Requirement (EHSRs) of the European

Machinery Directive 2006/42/EC. These products also conform to EN 60947-5-3, EN ISO 12100, EN 60204-1 and have Third Party Approval.

Visit http://www.rockwellautomation.com/certification/overview.page

Notes:

Notes:

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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Publication 440E-IN008A-EN-P - January 2017