440G-MZ Guardmaster Guard Locking Switch

Catalog Numbers 440G-MZS20SNRJ, 440G-MZS20SNRJE, 440G-MZS20UNRJ, 440G-MZS20UNRJE, 440G-MZS20SNLJ, 440G-MZS20SNLJE, 440G-MZS20UNLJ, 440G-MZS20UNLJE

Allen-Bradley
by ROCKWELL AUTOMATION

Guardmaster®

User Manual Original Instructions

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.

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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).

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Specifications

Who Should Use This Manual?

Use this manual to design, install, program, or troubleshoot systems that use the Guardmaster® 440G-MZ Guard Locking Safety Switches.

You are required to have a basic understanding of electrical circuitry and familiarity with safety-related control systems. If you do not, obtain the proper training before using this product.

Purpose of This Manual

This manual is a reference guide for the Guardmaster 440G-MZ safety switch. It describes the procedures that you use to install, wire, and troubleshoot your switch. This manual accomplishes the following:

- Explains how to install and wire your 440G-MZ safety switch
- Provides an overview of the Guardmaster 440G-MZ safety switch

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
Added Attention to Auxiliary Release section.	17
Added Attention to Escape Release section.	18
Updated Operating Characteristics table.	53

Terminology

The Industrial Automation Glossary (publication AG-QR071) contains terms and abbreviations that are used by Rockwell Automation to describe industrial automation systems. Table 1 lists specific terms and abbreviations that are used in this manual.

Table 1 - Terms and Abbreviations

Term	Definition
CLU (Command, Lock, and Unlock)	This signal is either static or dynamic. When static, this signal is LO when the system is operational and HI when a demand is placed on the safety system. The signal is dynamic when an unlock or lock command is issued to a GuardLink-enabled guard locking device, such as a 440G-MZ safety switch.
HI	Logic state of being ON or a voltage level to be above the turn-on threshold.
LO	Logic state of being OFF or a voltage level to be below the turn-off threshold.
NC	No connection
Operational state	The switch is in operational state when there is no demand on its safety function (that is, the switch is closed and locked).
OSSD (Output Signal Switching Device)	Typically a pair of solid-state signals pulled up to the DC source supply. The signals are tested for short circuits to the DC power supply, short circuits to the DC common, and short circuits between the two signals.
PLC	A programmable logic controller or a programmable automation controller.
Reaction time	Describes the time between the true state of the input to the ON state of the output.
Response time	Describes the time between the trigger of the input to the OFF state of the output. Throughout this manual, the safety outputs may be described as turning off immediately, which means that the safety outputs turn off within the response time.
RFID	Radio frequency identification
Safe state	The switch is in safe state when there is a demand on its safety function (that is, the switch is unlocked).
Standard coding	Same as Low coding as defined in ISO 14119
Tap	A connection in a GuardLink® circuit that associates a safety device to the GuardLink circuit.
Unique coding	Same as High coding as defined in ISO 14119

Additional Resources

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

Resource	Description
440G-MZ Guard Locking Switch Installation Instructions, publication 440G-IN018	Provides general guidelines for installing a Rockwell Automation® guard locking switch.
Guardmaster EtherNet/IP Network Interface User Manual, publication 440R-UM009	Provides a detailed description of module functionality, configuration, installation procedure, and information on how to use the Guardmaster EtherNet/IP Network Interface (440R-ENETR).
Guardmaster DG Safety Relay and GuardLink System User Manual, publication 440R-UM015	Provides general guidelines for configuring a Rockwell Automation Guardlink safety system.
EtherNet/IP Network Devices User Manual, publication ENET-UM006	Describes how to configure and use EtherNet/IP devices to communicate on the EtherNet/IP™ network.
Ethernet Reference Manual, publication ENET-RM002	Describes basic Ethernet concepts, infrastructure components, and infrastructure features.
System Security Design Guidelines Reference Manual, publication SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley™ industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-State Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
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 rok.auto/literature.

Product Overview

Guardmaster 440G-MZ Safety Switch Overview

This 440G-MZ Guardmaster® safety switch locks a guard door in the closed position and does not release it until the hazardous machine functions that are covered by the guard are in a safe condition. The safety control system allows the hazardous machine functions to operate only when the guard is closed and locked.

The locking bolt drive mechanism and logic confirm that the locking bolt is allowed to extend only when the corresponding actuator is detected within range.

RFID technology enables high precision operation while meeting the requirements to prohibit actuator substitution as described in ISO 14119. The 440G-MZ safety switches are classified as Type 4 interlocking devices with guard locking and the unique coded actuators are classified as having a high level of coding according to ISO 14119.

The 440G-MZ safety switch features two OSSD outputs or a single-wire safety output when connected in a GuardLink® system. These safety outputs are enabled only when the locking bolt is sensed in its extended position. This action only happens when the guard is both closed and locked.

The locking bolt drive mechanism uses a bi-stable solenoid. As a result, the switch consumes little electrical power, with peak currents occurring (only briefly) on startup and after each movement of the locking bolt.

Because of its bi-stable drive, not only does the device consume minimal power, but it also does not produce heat while it is locked or unlocked.

Although the locking bolt drive uses a bi-stable solenoid, the device logic and functionality are configured to replicate the functionality of a Power to Release or Power to Lock solenoid-operated switch (depending on type).

Guard Locking on Power to Release Versions

With a Power to Release switch, the locking bolt extends when the guard is closed with the actuator inserted in the switch and a lock command is issued to the switch:

Table 2 - Lock/Unlock Command

Mode	Description
OSSD	• Unlock: Lock signal (pin 5) is connected to 24V DC. • Lock: Lock signal (pin 5) is connected to 0V DC or has no connection (floating).
GuardLink®	A lock or unlock command is issued to the switch on the CLU signal from a GuardLink safety master.

IMPORTANT If power is removed from a Power to Release switch in the locked position, the locking bolt remains in its extended position (switch locked). Use the auxiliary release to unlock the switch.

ATTENTION: Under normal operating conditions, the locking bolt does not extend in the absence of the actuator. The only exception is when power is removed from a switch in the first 4 seconds of the start-up sequence. In this case, the bolt does extend. If the guard door is closed when the start-up sequence is interrupted, the guard door is locked. Use the auxiliary release to unlock the switch.

Guard Locking on Power to Lock Versions

With a Power to Lock switch, the locking bolt extends when the guard is closed with the actuator inserted in the switch and a lock command is issued to the switch:

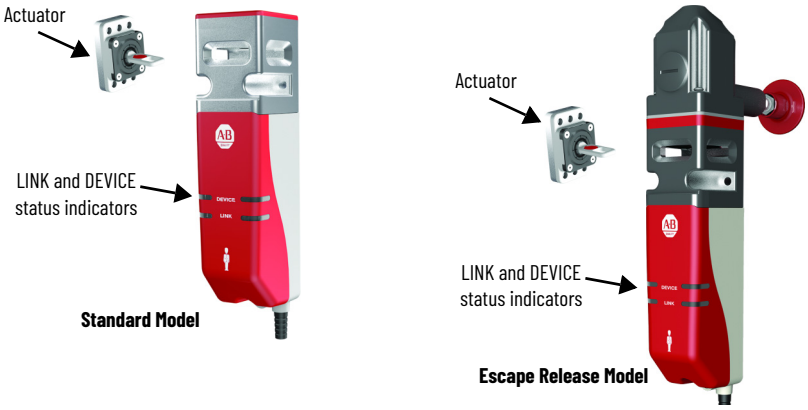
Table 3 - Lock/Unlock Command

Mode	Description
OSSD	Unlock: Lock signal (pin 5) is connected to 0V DC or has no connection (floating). Lock: Lock signal (pin 5) is connected to 24V DC.
GuardLink	A lock or unlock command is issued to the switch on the CLU signal from a GuardLink safety master.

IMPORTANT If power is removed from a Power to Lock switch or a fault occurs while in the locked position, the bolt retracts and the switch unlocks.

ATTENTION: Under normal operating conditions, the locking bolt does not extend in the absence of the actuator. The only exception is when power is removed from a switch in the first 4 seconds of the start-up sequence. In this case, the bolt does extend. If the guard door is closed when the start-up sequence is interrupted, the guard door is locked. Use the auxiliary release to unlock the switch.

Assembly Overview



Product Selection

Table 4 - Catalog Number Explanation

440G-MZS	20	S	N	R	J	E
	a	b	c	d	e	f

a	
Outputs (Safety/Auxiliary)	
Code	Description
20	Two safety/no aux

b	
Actuator Code	
Code	Description
S	Standard code
U	Unique code

c	
Auxiliary Type	
Code	Description
N	No auxiliary

d	
Lock Type	
Code	Description
R	Power to Release
L	Power to Lock

e	
Connection Type	
Code	Description
J	M12 5-pin

f	
Special Features	
Code	Description
Blank	None
E	Escape release

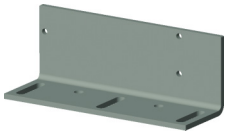
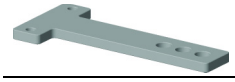
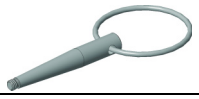
Table 5 - Complete Switches, including Switch Body and Actuator

Type	Actuator Coding	Escape Release	Cat No.
Power to Release	Standard (Low level to ISO 14119)	No	440G-MZS20SNRJ
	Unique (High level to ISO 14119)		440G-MZS20UNRJ
Power to Lock	Standard (Low level to ISO 14119)		440G-MZS20SNLJ
	Unique (High level to ISO 14119)		440G-MZS20UNLJ
Power to Release	Standard (Low level to ISO 14119)	Yes	440G-MZS20SNRJE
	Unique (High level to ISO 14119)		440G-MZS20UNRJE
Power to Lock	Standard (Low level to ISO 14119)		440G-MZS20SNLJE
	Unique (High level to ISO 14119)		440G-MZS20UNLJE

Table 6 - Spare Actuators

Description	Cat. No.
Standard code actuator (Low level to ISO 14119)	440G-MZAS
Unique code actuator (High level to ISO 14119)	440G-MZAU

Table 7 - Accessories

Description			Cat. No.
	Actuator mounting bracket	L-shaped	440G-MZAM1
		Z-shaped	440G-MZAM2
	Switch mounting bracket		440G-MZAM3
	Padlock accessory		440G-MZAL
	Auxiliary release tool		440G-MZAT
	Replacement screw		440G-MZRSC
	Replacement button		440G-MZRBU

Package Contents

The box includes the following components:

Description	Standard Model	Escape Release Model
Switch Body		OR 
Actuator		
Documentation	Installation Instructions: publication 440G-IN018	

Safety Concept

Safety Standards

The Guardmaster® 440G-MZ safety switch satisfies applicable requirements in the following standards that are related to functional safety and machinery assembly:

- EN 60947-5-3
- EN 61508
- EN 62061
- EN ISO 13849-1
- ISO 14119
- UL 508

Safety Certification

The 440G-MZ safety switch is certified for use in safety applications up to and including SIL 3 according to IEC 61508 and IEC 62061 with a proof test interval of 20 years, and Performance Level e (PLe) Category 4 in compliance with ISO 13849-1.

Safety requirements are based on the standards applicable at the time of certification.

The TÜV Rheinland group has approved the 440G-MZ safety switch for use in safety-related applications where PLe is required for the door position monitoring and guard locking functions.

The 440G-MZ safety switch must be installed in accordance with the applicable regulation and standards.

While the 440G-MZ safety switch can be used for SIL 3, PLe, and Category 4 applications, the installation must comply with guard requirements (for example, ISO 13854 and ISO 13857), and in some cases minimum (safe) distance requirements (for example, ISO 13855).

The installed system, including the safety control system and the means by which the machine stops, must achieve the needed safety performance. The 440G-MZ safety switch is one element in the safety system.

Additional guidance on guards, guard locking and guard interlock can be found in:

- EN ISO 12100
- EN ISO 13854
- EN ISO 13855
- EN ISO 13857
- EN ISO 14119
- EN ISO TR 24119
- EN ISO 14120
- Application-specific C-level standards

Notes:

Installation

General Considerations

Installation must be in accordance with the present manual and implemented by qualified personnel exclusively. The 440G-MZ safety switch is intended to be part of the safety-related control system of a machine.

ATTENTION: Before installation, a thorough 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.
A functional test of the system is necessary to validate that it works as expected (see Functional Testing on page 19).
Guard locking switches that use the Power to Lock principle (Cat. No. 440G-MZS20*NLJ*) must only be used after a risk assessment has shown that the use of a Power to Release principle (Cat. No. 440G-MZS20*NRJ*) is inappropriate. This assessment is necessary since the guard can be immediately opened after a loss of power supply or upon deactivation of the unlocking signal.

Correct Use

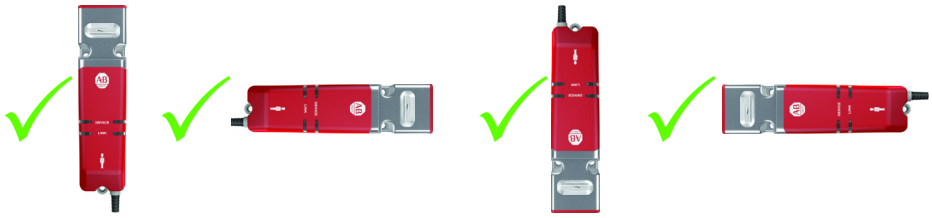
Review the following requirements and guidelines for proper use of the safety switch to achieve optimal performance.

- The 440G-MZ safety switch is designed for use on medium- and full-sized guards including guards where whole-body access to the safeguarded area is possible.
- The switch is not to be used as a mechanical stop. Check that a separate door stop is used.
- A separately mounted latch (for example, magnetic or mechanical) is recommended to maintain proper alignment of the actuator. The locking bolt must be free to enter and withdraw from the actuator without binding.
- Use appropriate screws, bolts, or nuts that are fitted by tools to mount the switch and actuator to avoid tampering.
- Do not over torque the mounting hardware.
- A minimum distance of 100 mm (3.94 in.) must separate adjacent switches, see Switch Orientation and Pair Proximity on page 14.
- The 440G-MZ safety switch is designed for use in a NEC Class 2 circuit. Connect the 440G-MZ safety switch to a dedicated Class 2 power supply or use electronic circuit protection (for example, 1692-ZRCLSS) to achieve NEC Class 2 compliance.

ATTENTION: For the switch, actuator, and actuator mounting bracket:
- Only use the designated mounting holes.
- Never drill or use to support other structures such as a conduit, cable ways, or other hardware.

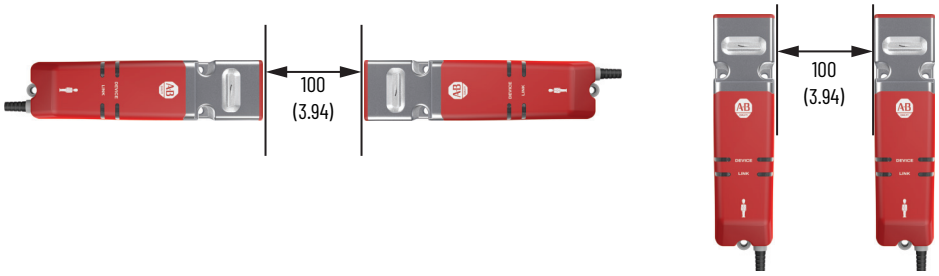
Switch Orientation and Pair Proximity

The switch can be mounted with the actuator opening in any orientation.



As shown in Figure 1, a minimum of 100 mm (3.94 in.) must separate a pair of switches to help achieve correct operation.

Figure 1 - Minimum Distance between Switches [mm (in.)]

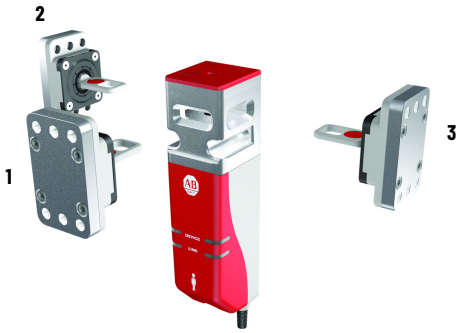


IMPORTANT	If the minimum separation distance is not observed, the electromagnetic fields interact causing crosstalk. Crosstalk can result in nuisance faults and false operation.

Actuator Orientation

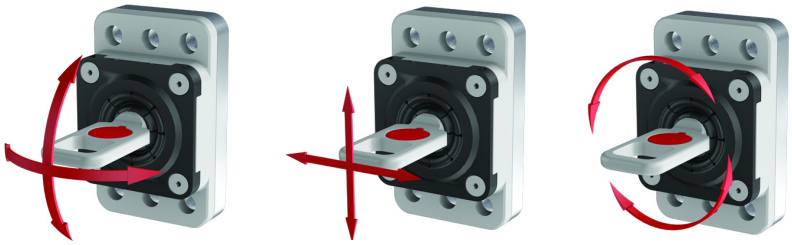
The actuator can approach the switch from three directions (Figure 2).

Figure 2 - Three Directions of Approach



The flexible actuator can move in multiple axes to accommodate guard door misalignment (Figure 3). For optimal performance, verify that the locking bolt can enter and withdraw from the tongue actuator without binding. A separately mounted door latch is recommended to avoid door misalignment.

Figure 3 - Actuator Function



Environmental Considerations

The 440G-MZ safety switch is rated for IP69K in accordance with ISO 20653 and IP69 per IEC 60529. This rating involves a short-term test that is made with high-pressure water jets at 80 °C (176 °F). The test is passed if no water enters the enclosure of the switch that contains the electrical components and the switch function is not impaired.

The 440G-MZ safety switch is constructed of stainless steel materials and plastics that are resistant to various machining fluids, oils, and food industry soils and cleaners.

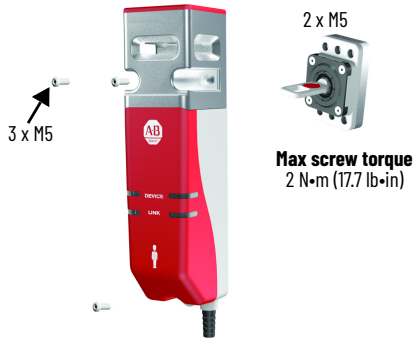
IMPORTANT To help prevent adverse effects that can occur with long-term exposure to cleaners used in CIP (clean-in-place) applications, thoroughly rinse the switch with water after cleaning.

Mount the Switch and Actuator

ATTENTION: Do not defeat, tamper, remove, or bypass this unit. Severe injury to personnel could result.
The presence of spare actuators can compromise the integrity of the safety systems. Personal injury or death, property damage, or economic loss can result. Appropriate management controls, working procedures, and alternative protective measures should be introduced to control their use and availability.

Three M5 fasteners (not provided) are required for proper mounting of the switch to a rigid guard door frame (Figure 4). Two M5 fasteners (not provided) are required to mount the actuator.

Figure 4 - Required Mounting Hardware for Switch and Actuator



IMPORTANT Do not use a washer with the screw at the base of the switch body. The use of a washer causes the plastic to crack.
Loctite 242 thread-locking adhesive is known to cause stress cracks in the plastic housing of the 440G-MZ safety switch and should not be used. Lab tests have determined that Loctite 425, a cyanoacrylate adhesive, does not cause cracking and can be considered if the faster cure time is acceptable in the application.

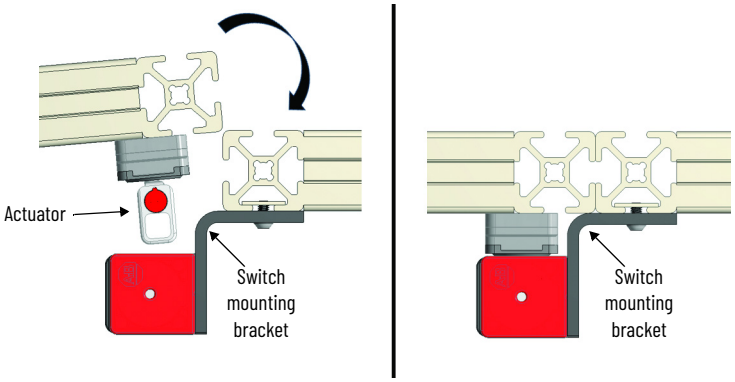
Check the manufacturer specifications of any thread-locking compound used to secure the screws. It is recommended to use a cyanoacrylate-type compound. Other compounds can cause stress cracks in the plastic feet of the switch.

Typical Applications

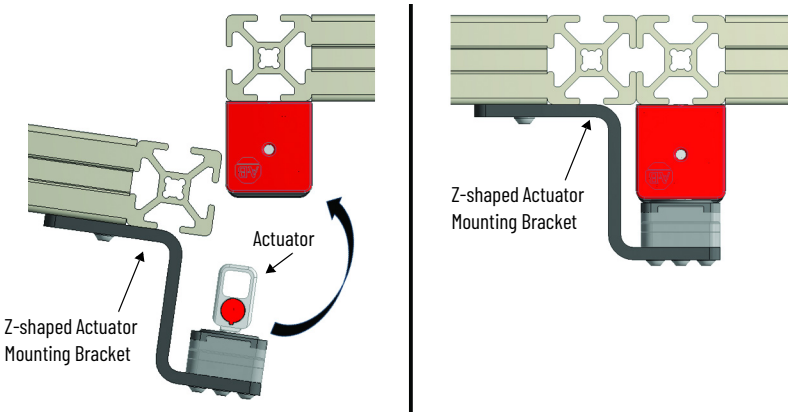
The 440G-MZ safety switch can be mounted on the inside or outside of a hinged or sliding guard door. The following examples show the switch and actuator mounted to a hinged or sliding guard door.

Standard Model

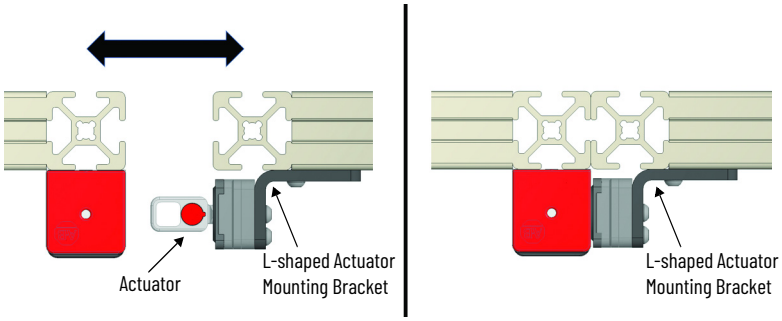
- Mount the switch on the inside of a hinged door



- Mount the switch on outside of a hinged door

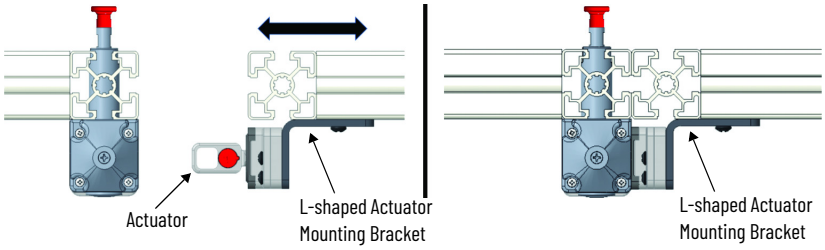


- Mount the switch on a sliding door

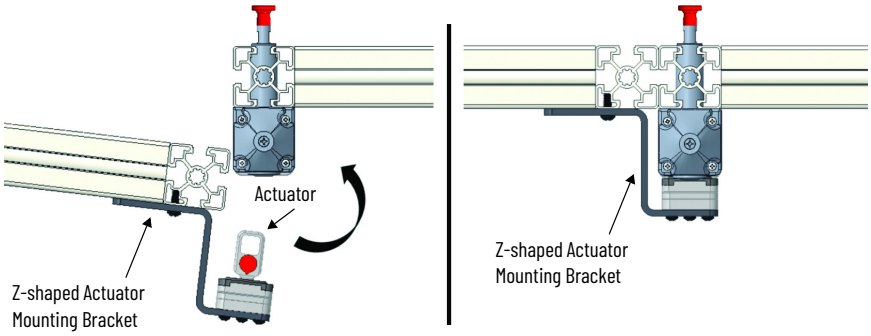


Escape Release Models

- Mount the escape release switch on a sliding door



- Mount the escape release switch on a hinged door



Auxiliary Release

Operation of the auxiliary release causes a fault condition.

To reset the switch, cycle the power or issue a RESET command over the link in a GuardLink® safety system.

ATTENTION: For infrequent use only. The auxiliary release is not intended for routine access or maintenance. It is intended to be used in exceptional cases only, such as when power is lost and an emergency release is unavailable.
- Do not operate the machine while the auxiliary tool is attached to the switch.
- To help prevent accumulation of debris inside the switch, return the screw that is removed in step 1 on page 18 immediately after using the auxiliary release tool and tighten the screw to 0.56 N•m (5 lb•in).

Figure 5 - Auxiliary Release Operation — Standard Model [mm (in.)]

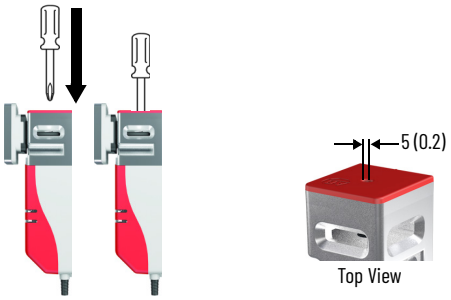
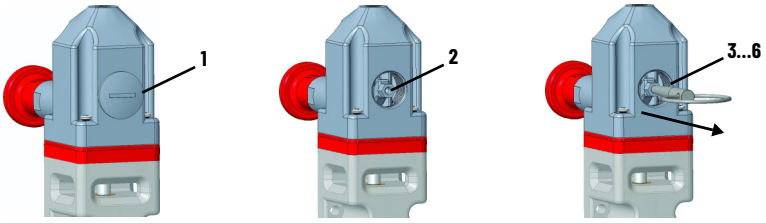


Figure 6 - Auxiliary Release Operation — Escape Release Model [mm (in.)]



1. Remove screw.
2. Engage 2...3 threads of the auxiliary release tool into the release key.
3. Use the tool to pull the release forward to retract the locking bolt.
4. Reset the release key by pushing the key back to the original position. The actuator can now be removed from the switch.

A built-in spring assists with reset of the release key.

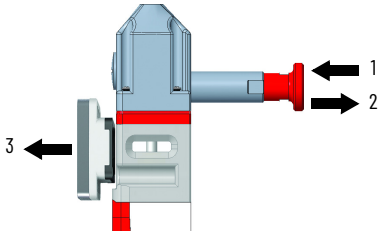
5. Open the guard door. If the guard door does not open, repeat step 3 and step 4.
6. Unscrew the auxiliary release tool and replace the screw that was removed in step 1.

Escape Release

The escape release is used to open a locked safety guard from inside the safe-guarded area without tools.

ATTENTION: Do not remove the M4 screw that seals the opening at the top of the switch.

Figure 7 - Actuate the Escape Release



1. Actuate the escape release by pushing the red button to the end stop. This action turns the safety outputs OFF and causes a fault condition.
2. Reset the escape release by pulling out the red button to the original position. The actuator can now be removed from the switch.

A built-in spring assists with reset of the escape release.

3. Open the guard door. If the guard door does not open, repeat step 1 and step 2.

IMPORTANT
- The escape release meets the requirements of Cat. B according to EN ISO 13849.
- The escape release must only be accessible from inside the safe-guarded area. The installation must not allow access to the escape release from outside the safe-guarded area.
- A manual functional test of the escape release is required after installation and after any maintenance or change of components.

Operation of the escape release causes a fault condition. To reset the switch, cycle the power or issue a RESET command over the link in a GuardLink safety system.

Padlock Accessory

The padlock accessory (Figure 8) can be inserted through the actuator opening of the 440G-MZ safety switch to help prevent the locking of the guard door and restarting of the machine while an operator is inside the safeguarded area. The padlock accessory accommodates up to three nominal 6.35 mm (0.25 in.) locks.

Figure 8 - Padlock Accessory (Cat. No. 440G-MZAL)

Functional Testing

A manual functional test must be made:

- After installation
- After any maintenance or change of component
- If the guard is used infrequently
  - Less than once a month for SIL 3, cat. 3 or cat. 4, PLe
  - Less than once a year for SIL 2, cat. 3, PLd

ATTENTION: During the functional test, verify that there are no persons in the danger area and that the machine startup does not cause a hazard.

OSSD Mode

1. Confirm that the guard door is open.
2. Connect the 24V DC power to pin 1 and ground (0V) to pin 3. The switch conducts a self-testing routine at the end of which the device status indicator is steady red (if lock signal is set to UNLOCK) or flashing amber (if lock signal is set to LOCK).
3. Test to confirm that the machine cannot start.
4. Confirm the lock signal at pin 5 is set to LOCK (0V for PTR and 24V for PTL types).
5. Test again to confirm that the machine cannot start.
6. Close the guard door and then confirm that the guard is mechanically locked and the device status indicator is steady green.
7. Test to confirm that the machine can start.
8. Change the lock signal at pin 5 to UNLOCK (24V for PTR and 0V for PTL types).
9. Confirm the machine stops, the guard door is mechanically unlocked, and the machine cannot restart.

GuardLink Mode

1. To begin a functional test of the 440G-MZ safety switch when connected in a GuardLink system, all other devices on the link must be in the operational state.
2. Confirm that the guard door is open.
3. Test to confirm that the machine cannot start.
4. Send a lock command to the 440G-MZ safety switch over the link.
5. Test again to confirm that the machine cannot start.
6. Close the guard door.
7. Send a lock command to the switch over the link.
8. Confirm that the switch is mechanically locked and the Device status indicator is steady green.

A flashing green status indicator on the device indicates that another device on the link is tripped. To proceed, verify that all other devices on the link are in operational state.

9. Test to confirm that the machine can start.
10. Send an unlock command to this 440G-MZ safety switch only over the link.
11. Confirm that the machine stops, the guard door is mechanically unlocked, and the machine cannot restart.

Escape Release (GuardLink Mode or OSSD Mode)

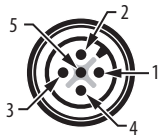
1. Confirm that the guard is mechanically closed and locked and that the device status indicator is steady green.
2. Actuate the escape release by pressing the red button (see Escape Release on page 18).
3. Confirm that the OSSD safety outputs turn OFF and the safety switch faults (the device status indicators are flashing red).
4. Reset the escape release by pulling out the red button to the original position.
5. Confirm that the actuator can be removed from the switch and the guard door can be opened.

Wiring and System Integration

Pin Assignment and Function

The 440G-MZ safety switch is available with a 5-pin DC Micro M12 quick-disconnect connector. Table 8 shows the pin assignments and their functions and typical mating cordsets. Other cordsets are available at DC Micro Cordsets and Patchcords.

Table 8 - 5-pin Micro (M12) (1)



Pin	Color	Function	
		OSSD Mode	GuardLink® Mode
1	Brown	+24V	+24V
2	White	Safety A	Safety In
3	Blue	0V	0V
4	Black	Safety B	Safety Out
5	Gray	Lock Command	CLU

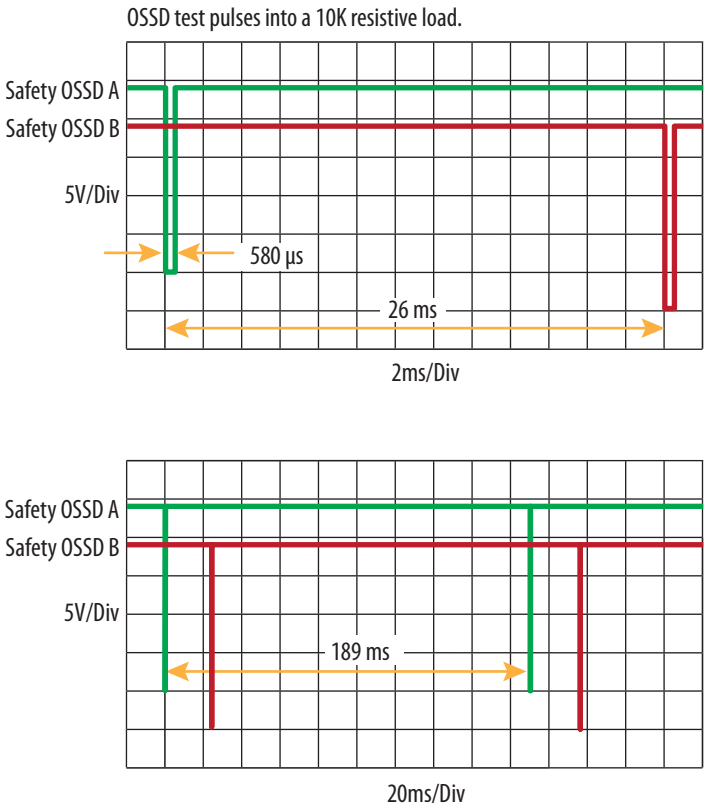
(1) The recommended cordset is catalog number 889D-F5AC-2 (2 m [6.5 ft]). For additional lengths, replace the 2 with 5 [5 m (16.4 ft)] or 10 [10 m (32.8 ft)] for standard cable lengths.
The recommended patchcord for use with GuardLink® and ArmorBlock® Guard Safety I/O is the 2 m (6.5 ft) catalog number 889D-F5NCDM-2. Replace the 2 with OM3 [OM3 (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.

OSSD Mode Safety Signals

In OSSD mode, safety outputs Safety A and Safety B are OFF (0V) when the switch is in safe state (that is, the switch is unlocked). When the switch is in operational state (that is, closed and locked), safety outputs Safety A and Safety B are ON (24V) and contain test pulses. The test pulses are used to detect short circuits to 24V, to 0V and cross faults (from Safety A to Safety B). This description of the test pulses is provided for informational purposes; you cannot modify them.

IMPORTANT To prohibit nuisance tripping, mask the OSSD input channels of the safety system with an On to Off delay of at least 1 ms.

Figure 9 - Output Test Pulses



GuardLink Mode Safety Signals

When the 440G-MZ safety switch is connected in a GuardLink system, the safety signals are Safety In and Safety Out. These signals are dynamic signals in operational state and two-way communication signals in the safe state.

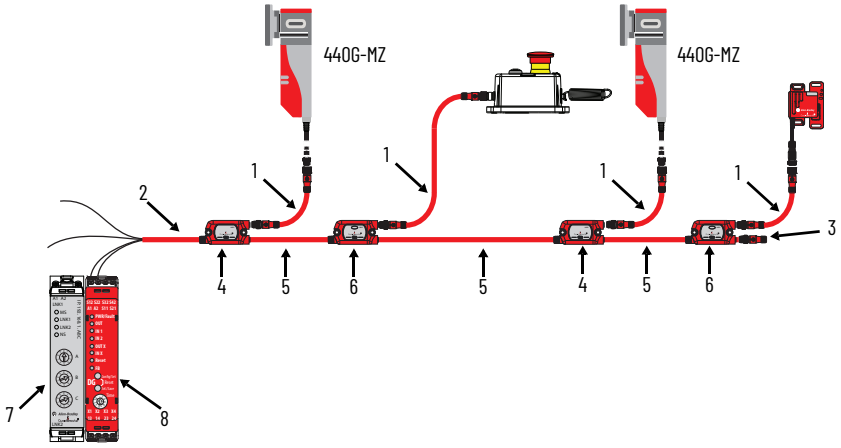
GuardLink System Integration

ATTENTION: For information on a known anomaly, see Knowledgebase Article *Unlocked 440G-MZ switch on GuardLink doesn't respond to lock command on power up*. This anomaly is present with Dual GuardLink (DG) safety relay with firmware revision 1.001 only. The anomaly was fixed with DG firmware revision 1.02.1.

Figure 10 on page 23 shows the basic components of a GuardLink system with a DG safety relay master. The 440G-MZ safety switch, with embedded GuardLink technology, connects to the link with a passive tap (as shown in Figure 10 on page 23) or a passive power tap (catalog number 440S-PF5D4). Different types and versions of GuardLink enabled and passive taps can be connected in any order and can be mixed on the same link. For more information about the configuration a GuardLink safety system, see publication 440R-UM015.

Both the Power to Release and Power to Lock versions of the 440G-MZ safety switch can be connected to a GuardLink safety system.

Figure 10 - GuardLink System Components



Item	Description	Cat. No.
1	5-pin device patchcord (1)	889D-F5NCDM-x (2) (3)
2	Cordset	889D-F4NE-y (4)
3	Terminator	898D-418U-DM2
4	GuardLink passive tap	440S-PF5D (5) (6)
5	4-pin link patchcords	889D-F4NEDM-x (3) (7)
6	GuardLink enabled tap	440S-SF5D (6)
7	EtherNet/IP™ Network Interface	440R-ENETR
8	DG Safety Relay	440R-DG2R2T

(1) Optional: Device can be connected directly to the passive tap.
(2) 10 m (32.8 ft) length, max.
(3) Replace x with 0M3 (300 mm [0.98 ft]), 0M6 (600 mm [1.97 ft]), 1 (1 m [3.3 ft]), 2 (2 m [6.6 ft]), 5 (5 m [16.4 ft]), or 10 (10 m [32.8 ft]) for standard cable lengths.
(4) Replace y in order number with 2 (2 m [6.6 ft]), 5 (5 m [16.4 ft]), 10 (10 m [32.8 ft]), 15 (15 m [49.2 ft]), 20 (20 m [65.6 ft]), or 30 (30 m [98.4 ft]) for standard cable lengths.
(5) A passive power tap (Cat. No. 440S-PF5D4) can also be used.
(6) Mounting brackets sold separately. Cat. No. 440S-GLTAPBRK1 (pack of 1) or Cat. No. 440S-GLTAPBRK5 (pack of 5).
(7) 30 m (98.4 ft) length, max

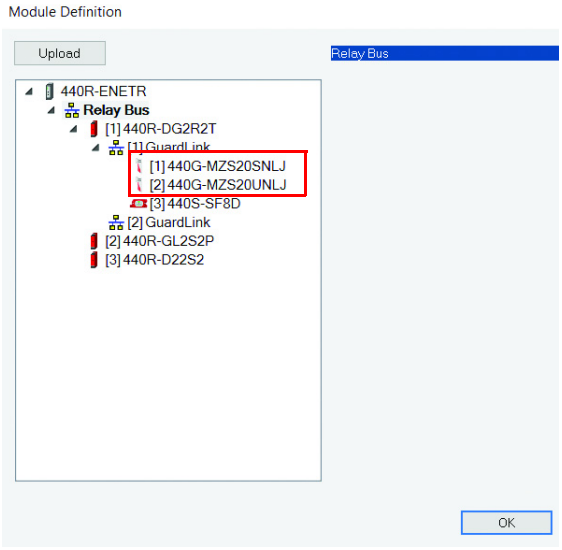
Add Device to a Studio 5000 Project

Information about how to add a 440G-MZ safety switch to a GuardLink system in a Studio 5000® project can be found in the user manual for the GuardLink safety master. See publication 440R-UM009 for information about using the upload method or manual method to add a 440G-MZ safety switch in a GuardLink circuit controlled by a Guardmaster® DG safety relay.

Upload Method

After the upload is complete, the position and type of connected 440G-MZ safety switches is shown in the Module Definition tab as shown in Figure 11.

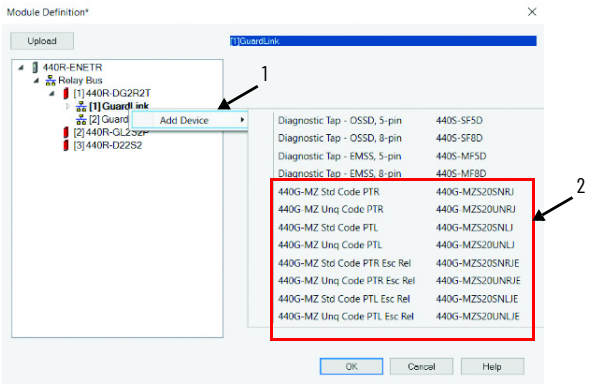
Figure 11 - Upload Method



Manual Method

With the manual method, a 440G-MZ safety switch can be added to a GuardLink circuit in steps as shown in Figure 12.

Figure 12 - Manual Method



1. Right-click the GuardLink and select Add Device.
2. Select the correct catalog number from the device list

Lock Command

OSSD Mode

Table 9 shows the lock command function. The lock command is a 24V logic signal with a current of less than 2 mA. The function of the logic signal is dependent on the catalog number.

Table 9 - Lock Command Function

Cat. No.	Function	Value
440G-MZS20*M**R***	Power to Release	24V = Unlock 0V = Lock
440G-MZS20*M**L***	Power to Lock	24V = Lock 0V = Unlock

Catalog codes for both types are explained in Table 4 on page 9.

GuardLink Mode

In a GuardLink system, the GuardLink safety master (for example a DG safety relay) issues lock and unlock commands to the 440G-MZ safety switch via the GuardLink Control, Lock, and Unlock (CLU) signal. This signal is either static or dynamic. When static, this signal is LO when the system is operational and HI when a demand is placed on the safety system. The signal is dynamic when an unlock or lock command is issued to the 440G-MZ safety switch.

When multiple guard locking devices are installed in a GuardLink system, the GuardLink safety master inserts a short delay between commands to each successive device to minimize the momentary inrush current to the solenoids. The device closest to the master receives the command first. The device furthest away from the master receives the command last.

See publication 440R-UM015 for more information.

Notes:

Commission the Safety Switch

The 440G-MZ safety switch is available with standard coded actuators or unique coded actuators.

- Switches with standard coded actuators are ready for use and do not require commissioning.
- Switches with unique coded actuators must be commissioned before use. The actuator teach process is not performed at the factory and must be performed when the switch is first put into use. After the first-time learn, this process can be repeated up to seven more times with unique coded replacement actuators.

IMPORTANT	When the switch learns a new actuator, it no longer recognizes previously learned actuators.

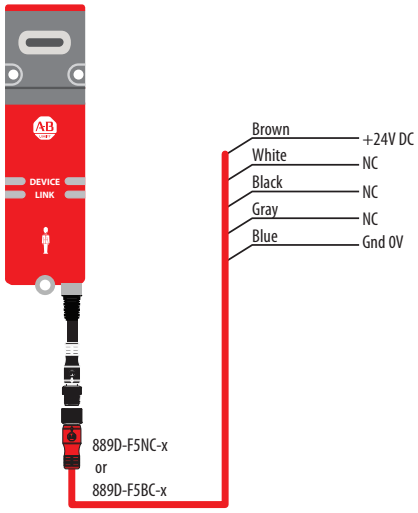
Setup

The 440G-MZ safety switch can be set up in OSSD mode or GuardLink® mode.

IMPORTANT	If the 440G-MZ safety switch is connected in a GuardLink system, verify that the GuardLink is powered ON and the switch is unlocked to insert the actuator and initiate the teach process.

During commissioning, connect the switch as shown in Figure 13.

Figure 13 - Wiring



First-time Learn

Apply power to the switch without the actuator present. After the switch completes the power-sequence (approximately 8 seconds), the status indicator flashes green eight times, indicating the total number of times a new actuator can be learned. This status indicator sequence repeats until an actuator is inserted in the switch (in the guard closed position).

Table 10 - Commissioning Process for Unique Coded Switches

Step	State	Approximate Duration	Status Indicators
1	Actuator Present	15 s	Flashing 8x green, repeating (1) Steady red (learning a replacement actuator)
2	Verifying Actuator	15 s	Flashing red/green, slow
3	Programming Switch	15 s	Flashing red/green, fast
4	Program Finalization	15 s	Flashing green (number of times a new actuator can be learned)
5	Run Mode (2)	–	Steady red

(1) Out of box condition only.
(2) When teaching an actuator, the switch must be unlocked to insert the actuator. At the end of the finalization step, the switch remains unlocked and in the safe state.

IMPORTANT After teaching a new actuator, a power cycle is required to complete the process.

Perform a functional test of the switch to validate that it works as expected (see Functional Testing on page 19).

Learn Additional Replacement Actuators

The switch automatically starts a new teach process when a unique coded replacement actuator is inserted in the switch (in the guard closed position).

IMPORTANT When the switch learns a new actuator, it no longer recognizes previously learned actuators.

Lock the Actuator Code

If the actuator is removed from the switch and then reinserted into the switch during the 15-second Program Finalization stage (see Step 4 in Table 10), this action triggers the switch to LOCK the actuator code. This action can be performed during any of the eight unique coded actuator learn cycles.

IMPORTANT After a unique coded actuator is locked using this method, the switch cannot learn additional replacement actuators for the remaining life of the switch. If the actuator is lost or damaged, the switch must be replaced.

Error Codes during the Commissioning Process

The following indicator patterns repeat until a Power Off/On cycle is completed.

Status/Diagnostic Indicator	Error Code
Flashing green	OSSD inputs not valid
Red-red-red-green	Cannot learn a standard actuator
Red-red-red-green-green	Actuator already learned
Red-red-red-green-green-green	Bad RFID; actuator 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

Device Status and Troubleshooting

Status Indicators during Power-up Routine

When power is applied to the switch, the DEVICE status indicator is steady red for 2.5 seconds, then the DEVICE and LINK status indicators flash red/green for 1 second, and then the DEVICE status indicator is steady red for 3 seconds. At the conclusion of the start-up sequence, the state of the status indicators is determined by whether there is a demand on the safety function and the status of the lock signal. See Table 11.

Status Indicators During Run Mode

Table 11 shows the status of the 440G-MZ safety switch during run mode.

Table 11 - Switch Status Indication During Run Mode

Indicator	State	Description
Device	Steady green	The switch is in the operational state with no demand on the safety function (that is, closed and locked).
	Flashing green @ 1 Hz (1)	The switch is in the operational state with no demand on the safety function, but the link is in the safe state due to a demand on another device in the link.
	Flashing amber @ 1 Hz	The switch is ready to be locked, or attempting to lock. The lock command is set to LOCK but the door is in the open position or slightly ajar. Check that the door is closed.
	Steady red	The switch is in the safe state due to a demand on the safety function (that is, unlocked).
	Flashing red @ 1 Hz	The switch is in the fault state.
Link (2)	Off	Indicates no communication to the DG safety relay over the link. The switch is wired directly to I/O and is not part of a GuardLink® system.
	Steady green	The link is in the operational state. This switch and all other devices on the link are in the operational state.
	Steady red	The link is in the safe state due to a demand or fault on this switch or another device in the link.
	Flashing red @ 1 Hz	The link is faulted.

(1) This state occurs when connected to a GuardLink system only

(2) The Link status indicator is only used when the 440G-MZ safety switch is connected in a GuardLink system. It is OFF when the 440G-MZ safety switch is connected directly to an I/O device or safety relay (OSSD mode).

Diagnostic/Fault Codes

When connected in a GuardLink system, the 440G-MZ safety switch communicates information about its current state with diagnostic and fault codes.

Diagnostic codes (Table 12) warn that a condition exists which prevents the switch from transitioning to the operational state (for example, the switch is a unique coded switch that must be commissioned), or causes the switch to fault (for example, the input voltage is approaching the minimum value) if not addressed.

Fault codes (Table 13 on page 31) provide information about why the switch is in the faulted state (as indicated by the DEVICE status indicator flashing red.) When a fault is present, perform the recommended action, if stated. Issue a RESET command to the 440G-MZ safety switch over the link to clear the fault.

IMPORTANT When a Power to Lock switch faults in the locked position, the bolt retracts and the switch unlocks.

Diagnostic Codes

Table 12 - Diagnostic Codes

Decimal (Hex)	Description	Recommended Action
00 (00)	No diagnostic	No action required.
04 (04)	Input voltage is approaching minimum (20.4V DC)	Evaluate input voltage. Input voltage must be 20.4...26.4V under all electrical load conditions.
31 (1F)	Ready to lock	A lock command has been sent to the device but the guard door is open or ajar. Check the actuator alignment or close the guard door.
32 (20)	Device is attempting to lock	Check actuator alignment. Check the wiring for the lock feedback input.
33 (21)	Device is attempting to unlock	Check for load on actuator or bolt. Check the wiring for the lock feedback input.
38 (26)	Actuator not paired	Unique coded switch has not been paired with an actuator yet. Insert a unique coded actuator (Cat. No. 440G-MZAU) to start the commissioning process.
40 (28)	Guard door open	The actuator is not detected (RFID is not present). Close the guard door to lock.

Fault Codes

Table 13 - Fault Codes

Decimal (Hex)	Description	Recommended Action
00 (00)	No fault.	No action required.
05 (05)	Power error	Evaluate input voltage. Input voltage must be 20.4...26.4V under all electrical load conditions.
07 (07)	Failure to detect device type (OSSD or GuardLink)	Check wiring and cycle power to the switch. If error persists, replace the switch.
08 (08)	Internal memory (ROM) fault	Internal memory fault. Reset the device. If error persists, replace it.
09 (09)	Runtime memory (RAM) fault	Internal memory fault. Reset the device. If error persists, replace it.
10 (0A)	Internal memory (CPU) fault	Internal memory fault. Reset the device. If error persists, replace it.
15 (0F)	No response on GuardLink	Check GuardLink wiring and connections.
31 (1F)	GuardLink application fault	GuardLink system fault. Reset the device. If error persists, replace it.
32 (20)	Product application fault	Product Application fault. Reset the device. If error persists, replace it.
40 (28)	Unique code actuator is locked	A new actuator cannot be learned because the current actuator is locked.
41 (29)	Invalid actuator detected	Cannot teach a standard actuator to a unique coded switch.
42 (2A)	No learns left	Teaching is not possible. The switch has learned 8 actuators and cannot learn any more actuators.
43 (2B)	Actuator relearn	Switch cannot learn a previously learned actuator. Use a new actuator.
44 (2C)	Actuator teach fault	Actuator moved out of range during teach process or the switch has detected an invalid RFID tag. Keep actuator within sensing range during learn process.
56 (38)	Bolt detection fault	During operational state, the device failed to detect the bolt. On escape release models, this fault can be caused by engaging the escape release. It can also occur if the auxiliary release was actuated. Inspect the bolt. Disengage the escape release mechanism (if applicable). Reset the device if the fault is not cleared.
57 (39)	Failure to lock	Device attempted to lock for specified lock attempt length, but lock status input did not indicate that the device locked. Check guard door and actuator alignment.
58 (3A)	Failure to unlock	Device attempted to unlock for specified unlock attempt length, but lock status input did not indicate that the device unlocked. Check the device. Verify that door is not applying a side load on the locking bolt.
59 (3B)	Actuator detection fault	During operational state, the device failed to detect the RFID tag in the actuator. Inspect the actuator and RFID tag for signs of damage. Fault reset the device. If the error persists, replace the actuator.
255 (FF)	Internal fault	An internal device fault has occurred. Reset the device. If error persists, replace it.

Troubleshooting

Mounting Holes of the Switch Body Cracked or Broken

The mounting hole of the switch body can crack when washers are used to mount the switch or when an incompatible thread locking compound is used to secure the mounting hardware. Three M5 fasteners are required to mount the switch body properly. Do not over torque the screws.

IMPORTANT Do not use a washer with the screw at the base of the switch body. Using a washer causes the plastic to crack.
Loctite 242 thread-locking adhesive is known to cause stress cracks in the plastic housing of the 440G-MZ safety switch and should not be used. Lab tests have determined that Loctite 425, a cyanoacrylate adhesive, does not cause cracking and can be considered if the faster cure time is acceptable in the application.

Check the manufacturer specifications of any thread-locking compound used to secure the screws. It is recommended to use a cyanoacrylate-type compound. Other compounds can cause stress cracks in the plastic feet of the switch.

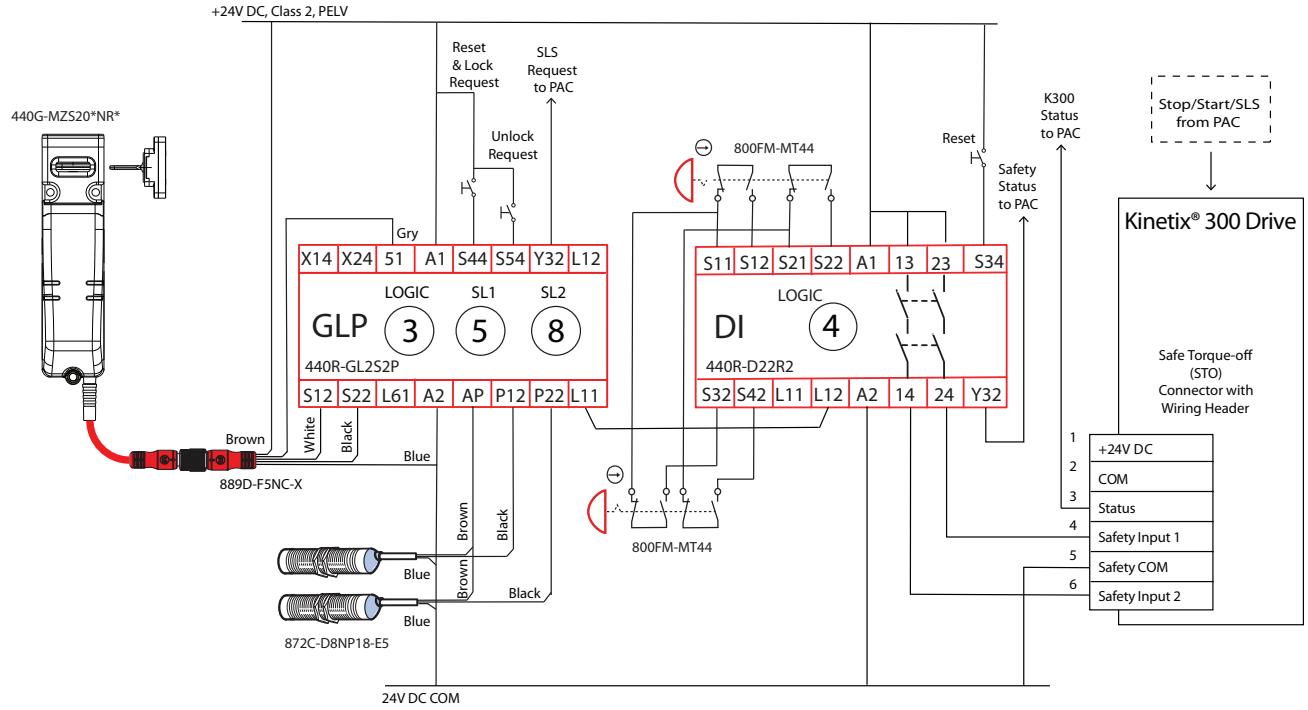
Application Examples

The following application and wiring examples are intended to show how the 440G-MZ safety switch products can be applied. If you are the user or the designer, you may require variations to these examples to meet your specific requirements.

Wire to GLP Safety Relay

The GLP safety relay is designed to operate with Power to Release (PTR) switches. To use a Power to Lock (PTL) switch, you must use an interposing relay on the lock command at GLP terminal 51. In the example shown in Figure 14, the GLP safety relay allows the gate to be unlocked when the motor is running at a Safely-limited Speed.

Figure 14 - GLP and 440G-MZ Safety Switch Schematic



Circuit Status as Shown

The gate is open and unlocked. The motor is off. The GLP safety relay is ready for reset. The GLP safety relay has a Logic setting of 3: (Safely-limited Speed with Logic IN OFF), a Safely-limited Speed (SLS1) setting of 5 (5 Hz) and a maximum (SLS2) speed setting of 8 (2000 Hz). The safety outputs (X14 & X24), the single wire safety output (L11), and the auxiliary output (Y32) are OFF.

IMPORTANT Start the GLP logic configuration from "0" to configure X14 and X24 for use as safety outputs.

Starting

Close the gate and press Reset to lock the gate and turn on the GLP safety outputs. Press Start to turn the motor ON.

Safely-limited Speed

A normal production stop is performed by pressing Stop. Access through the safety gate is initiated by pressing Gate Unlock Request. The Y32 output of the GLP safety relay turns ON, which makes an SLS request to the PAC. The PAC commands the Kinetix® drive to bring the motor to a safe slow speed. When the proximity sensors detect the speed has dropped below the Safely-limited Speed (5 Hz), the gate becomes unlocked. The operator can enter the machine cell, as the motor continues to run at the safe slow speed. After you leave the cell and close the gate, press Reset to lock the gate and return the machine to production speeds.

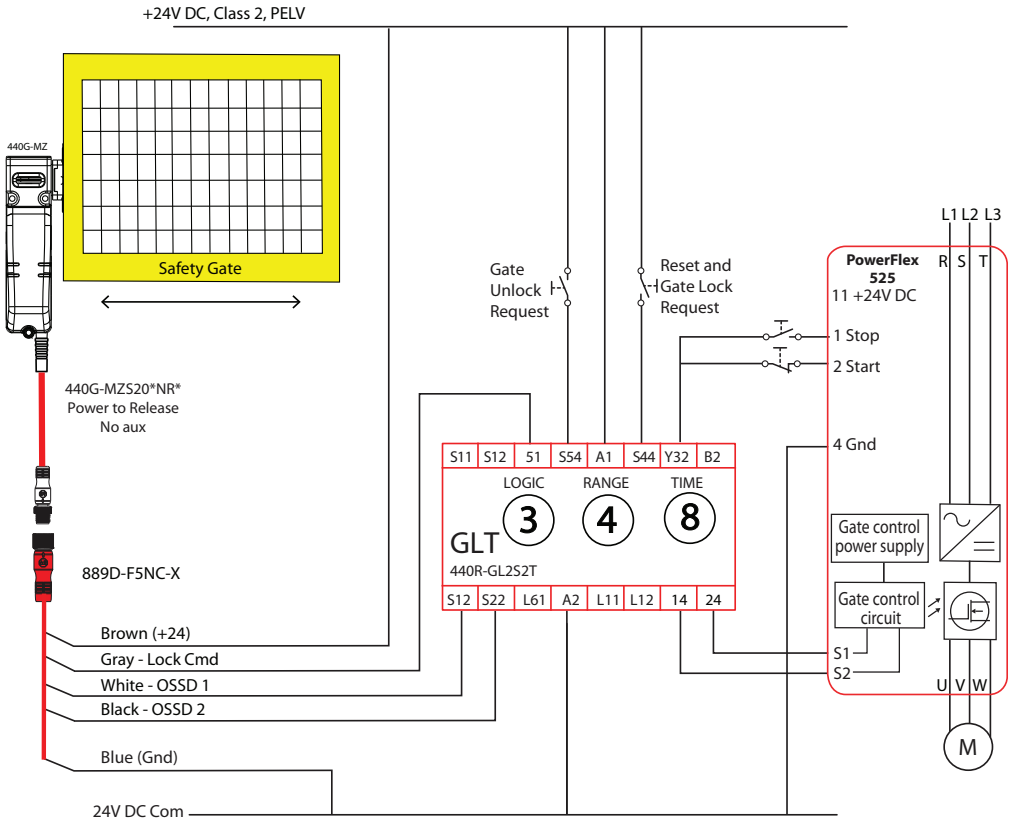
The circuit meets the safety requirements up to Category 3, Performance Level d in accordance with ISO 13849-1 and SIL CL 2 in accordance with IEC 62061.

Wire to GLT Safety Relay

The GLT safety relay is designed to operate with PTR switches. To use a PTL switch, you must use an interposing relay on the lock command at terminal 51 of the GLT safety relay.

In this example shown in Figure 15, the GLT safety relay sends an immediate command to the drive to turn OFF. After 8 seconds, the GLT safety relay turns off its safety outputs and unlocks the gate. The risk assessment must determine adequate time delay for the machine to achieve a safe state before unlocking the gate.

Figure 15 - GLT and 440G-MZ Safety Switch Schematic



Circuit status as shown: The gate is open and unlocked. The motor is off. The GLT safety relay is ready for reset. The GLT safety relay has a Logic setting of 3: (Category 1 Stop), a Range setting of 4 (10 seconds) and a Time setting of 8 (80%). The Y32 output turns OFF immediately; 8 seconds later, the safety outputs turn OFF.

The safety outputs (14 and 24) and the single wire safety output (L11) are OFF and the auxiliary output (Y32) is ON.

IMPORTANT	Start the GLT logic configuration from 0 to configure 14 and 24 for use with pulse testing; the PowerFlex® 525 drive can operate with pulse tested inputs to S1 and S2.

Starting

Close the gate. Press Reset and Gate Lock Request to lock the gate and turn on the GLT safety outputs. Press Start to turn the motor ON.

Stopping

Normal production stops are performed by pressing Stop. Access through the safety gate is initiated by pressing the Gate Unlock Request. The Y32 output of the GLT safety relay turns OFF, which commands the PowerFlex® drive to bring the motor to a stop. After the configured time delay (8 seconds) expires, the GLT safety outputs turn off, and the gate becomes unlocked. After you leave the cell and close the gate, press Reset to lock the gate and return the machine to a production state.

The circuit meets the safety requirements up to Category 3, Performance Level d in accordance with ISO 13849-1 and SIL CL 2 in accordance with IEC 62061.

Wire to DI and EMD Safety Relay

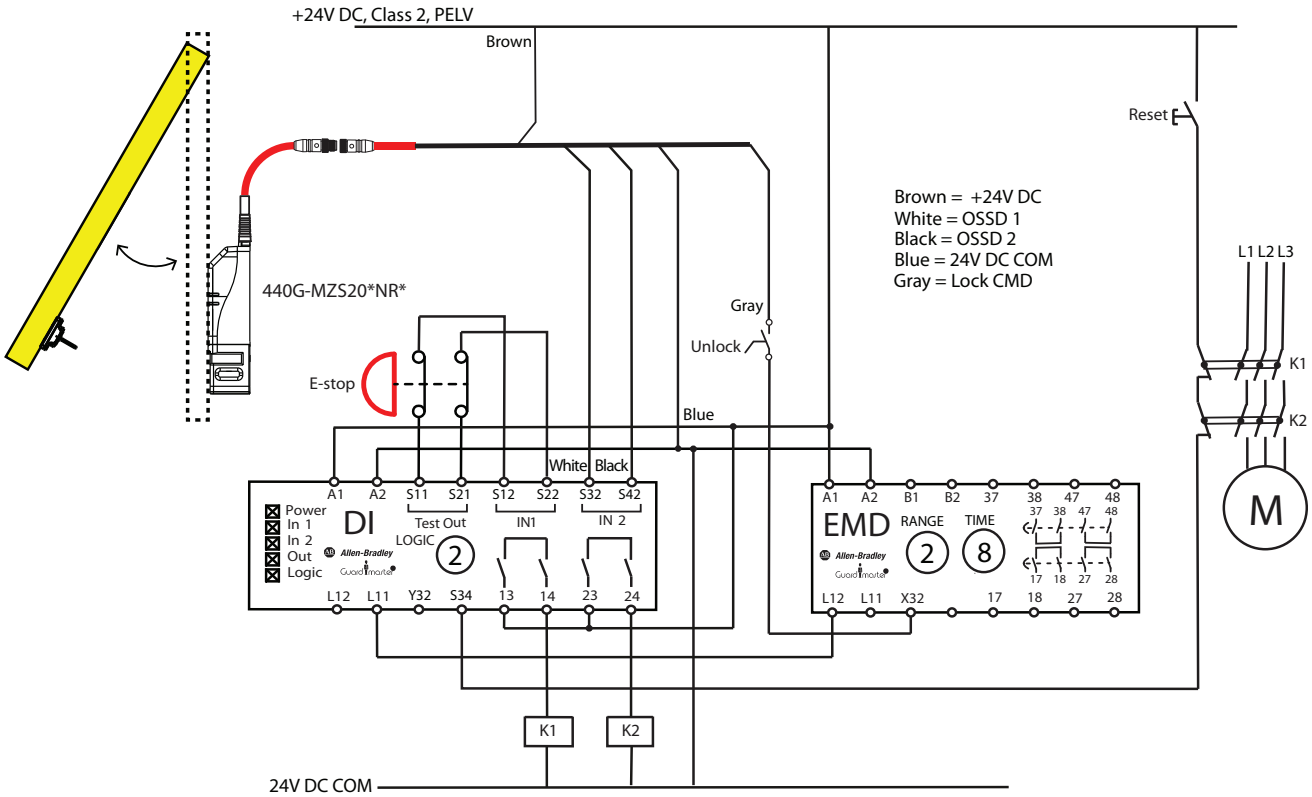
The 440G-MZ safety switch can be connected to the DI and EMD safety relays. The DI safety relay monitors the safety outputs of the safety switch and the EMD enables the gate to be unlocked after a configured delay time expires.

B1 is connected to B2 to allow for retriggering. If you open and close the E-stop and press Reset before the delay expires, the EMD timer resets.

Upon initial power-up, the safety switch must be cycled for the DI to recognize the safety switch OSSD signals.

In the example shown in Figure 16, an E-stop initiates the machine shutdown. After an eight-second delay, the safety switch is allowed to be unlocked and the hazards that remain are turned OFF. A selector switch is required to maintain the gate in an unlock state. The risk assessment must determine adequate time delay for the machine to achieve a safe state before unlocking the gate.

Figure 16 - DI Safety Relay with EMD Safety Relay and 440G-MZ Safety Switch Schematic



Circuit Status as Shown

The E-stop is released. The gate is open and unlocked. K1 and K2 are OFF. The DI safety relay is configured for two inputs with monitored manual reset. The EMD safety relay is configured for 8-second off-delay; Range setting of 2 is 10 s, Time setting of 8 is 80% of the range. The X32 terminal is ON because the EMD safety outputs are OFF.

Starting

With the Unlock switch open, close the gate. Press Reset to lock the gate and turn on the K1…K4 safety contactors.

Stopping

Stopping is initiated by pressing the E-stop. K1 and K2 contactors turn off immediately. The single wire safety signal from the DI safety relay (L11) to the EMD safety relay (L12) also turns off immediately, and the EMD starts the off-delay timer. After 8 seconds, X32 goes to 24V. The unlock switch is enabled, and the gate can be unlocked. While the gate is unlocked, the DI safety relay cannot turn the safety outputs back ON. After you leave the cell and close the gate, open the unlock switch to lock the gate, and release the E-stop.

The circuit can meet the safety requirements up to Category 4, Performance Level e in accordance with ISO 13849-1 and SIL CL 3 in accordance with IEC 62061.

Wire to DG Safety Relay

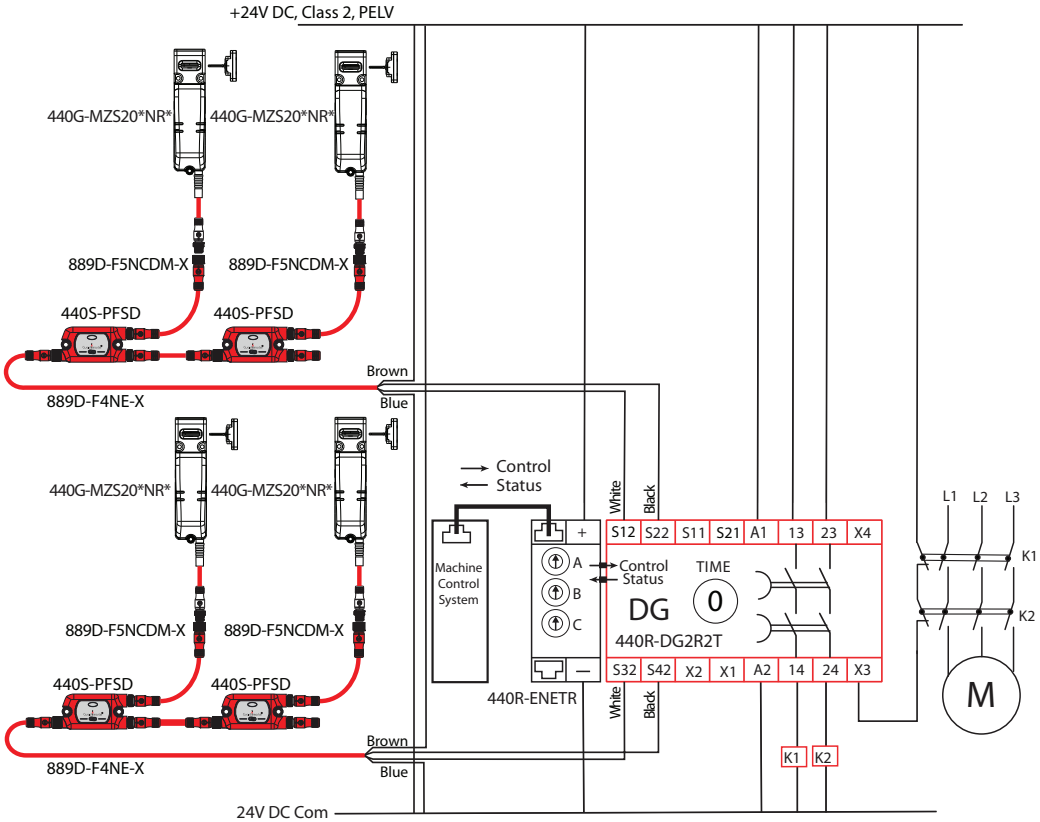
The 440G-MZ safety switch can be used in GuardLink® applications. The GuardLink system:

- Is designed to operate with Power to Release switches.
- Uses taps to connect a series of devices to one relay.
- Provides control and status information between the machine control system and the safety system.

Figure 17 shows four 440G-MZ safety switches that are connected on two GuardLink circuits from one DG safety relay. The DG safety relay can accommodate up to 32 devices on each input. The devices can be a mix of many different safety devices. When guard locking devices are included in the GuardLink system, the lock/unlock command must come from the machine control system through the 440R-ENETR module.

See publication 440R-UM015 for further details.

Figure 17 - DG Safety Relay with 440G-MZ Safety Switch Schematic



Wire to CR30 Safety Relay

The CR30 safety relay is a software configurable safety relay that can easily interface with the 440G-MZ safety switch. Version 10 and later of the Connected Components Workbench™ software has a locking function that is useful for guard locking applications.

Figure 18 shows an example schematic. The CR30 safety relay monitors the motor running signal from the PowerFlex 525 drive. When the motor is not running, the safety gate can be unlocked, and the PowerFlex 525 drive goes to a Safe Torque Off state.

Figure 18 - CR30 Safety Relay with 440G-MZ Safety Switch Schematic

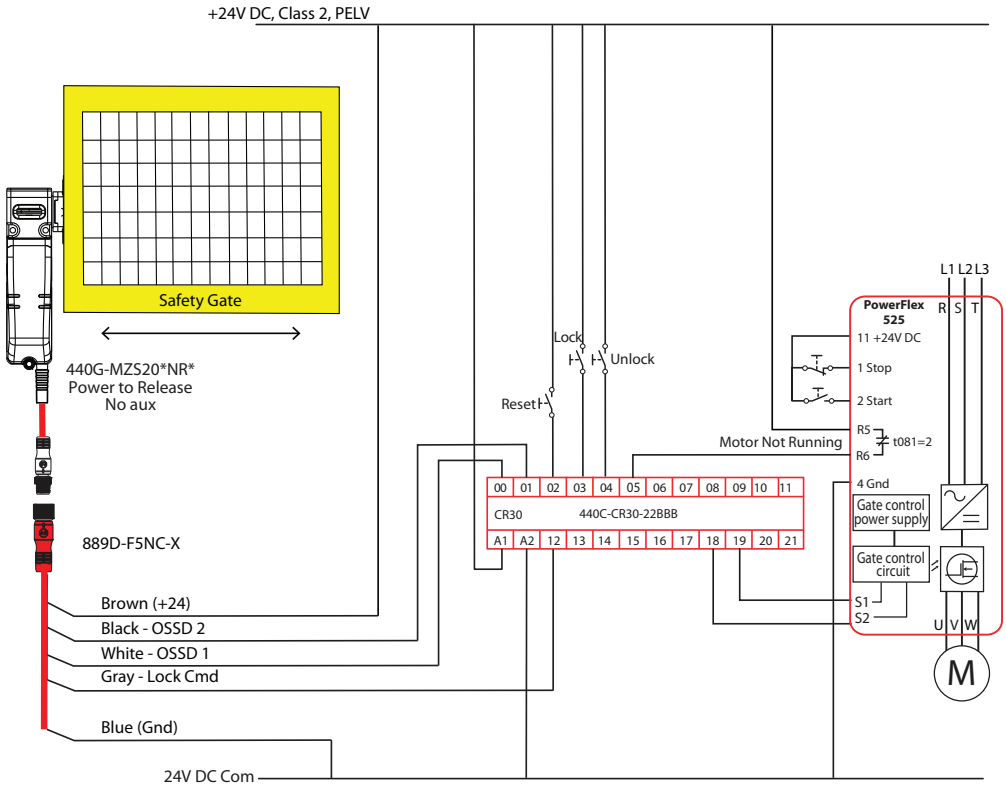
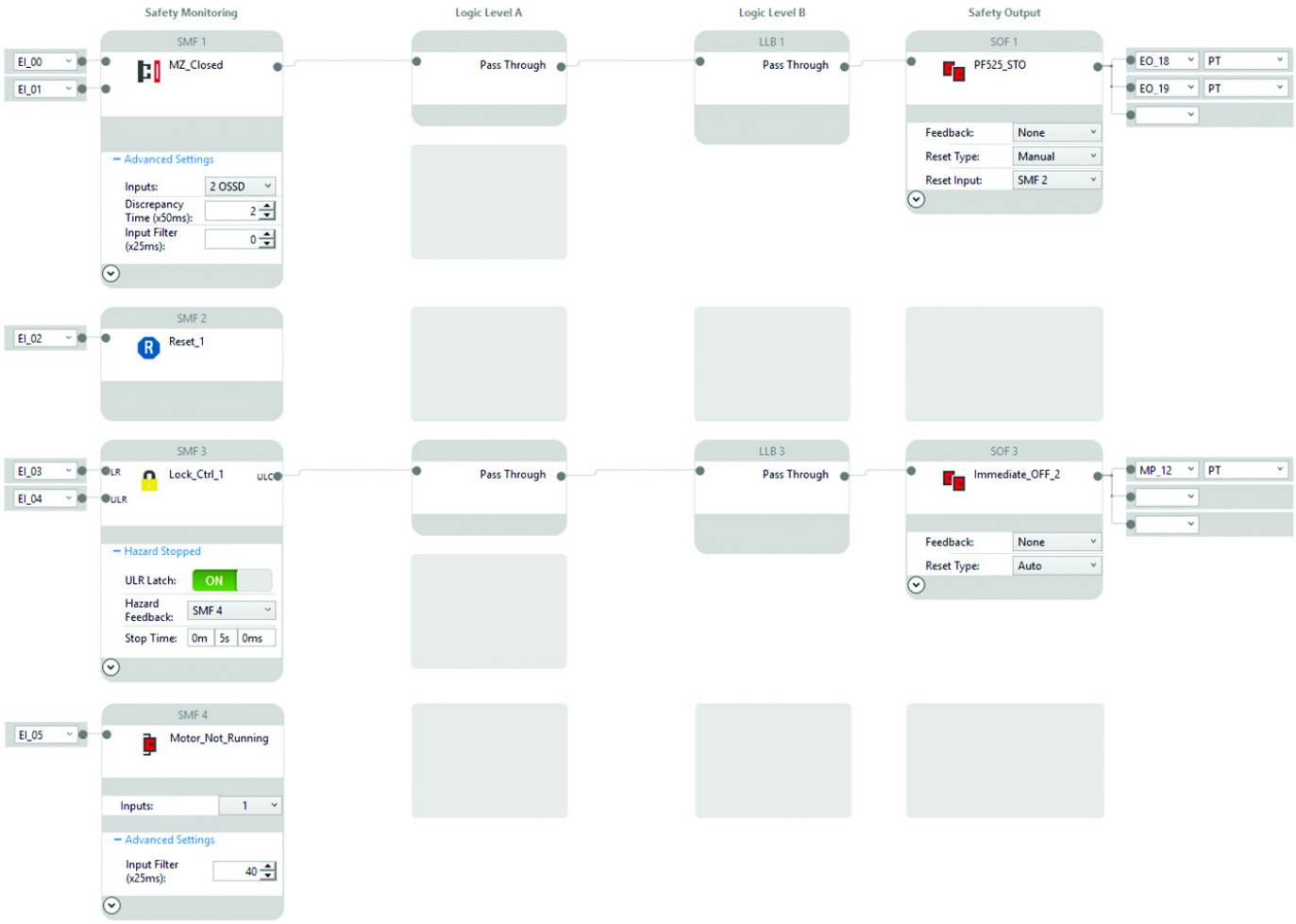


Figure 19 on page 41 shows an example CR30 safety relay configuration that works with the schematic in Figure 18.

The safety switch OSSD outputs drive the Safe Torque Off (STO) signals of the PowerFlex 525 drive. The STO is enabled after the gate is locked and the Reset is pressed. The PowerFlex 525 drive STO inputs can tolerate the pulse test that is generated by the CR30 outputs.

The Lock_Ctrl_1 block controls the unlock command to the safety switch. The unlock Stop Time delay is set to 5 seconds, and the ULR Latch (Unlock Request) is set to ON. When an unlock request is made, the command is issued 5 seconds after the motor stops running, and the unlock request is latched ON.

Figure 19 - CR30 Configuration in CCW



Wire to POINT Guard I/O Module

Figure 20 shows a wiring example of a 440G-MZ Power to Release safety switch that is connected to a 1734 POINT Guard I/O™ module.

Figure 20 - 1734 Module and 440G-MZ Safety Switch Schematic

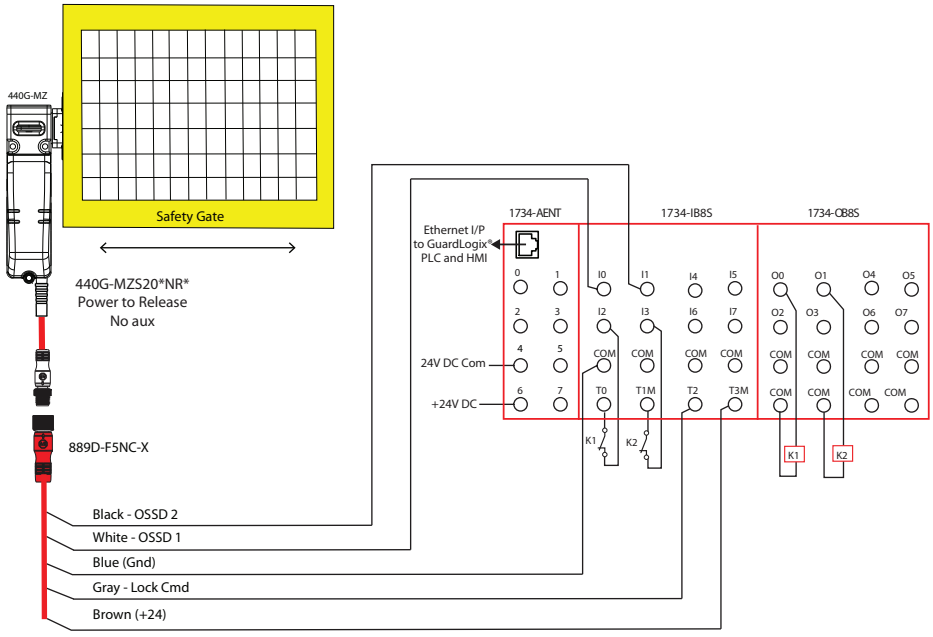


Figure 21 shows the General tab of the 1734-AENTR module properties.

The Input Status can be set to Rack Optimization, Enhanced Rack Optimization, or Combined Status - Power - Muting as these settings are used by the Dual Channel Input Stop (DCS) logic block to verify that the 1734-IB8S switch is operational. The Output Data must be set to Test, as the test outputs are used to generate test pulses for the output contactors, K1 and K2.

Figure 21 - 1734-AENTR Module Properties - General

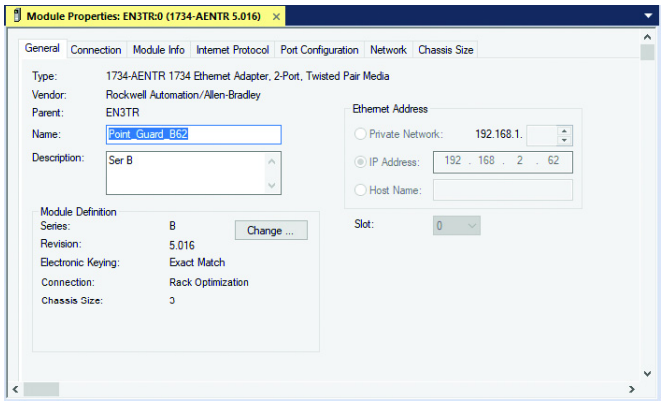


Figure 22 shows the 1734-IB8S General tab. Set the Module Definition with the following settings:

- Input Data: Safety
- Output: Test
- Input Status: Pt. Status-Power-Muting-Test Output

Figure 22 - 1734-IB8S Module Properties - General

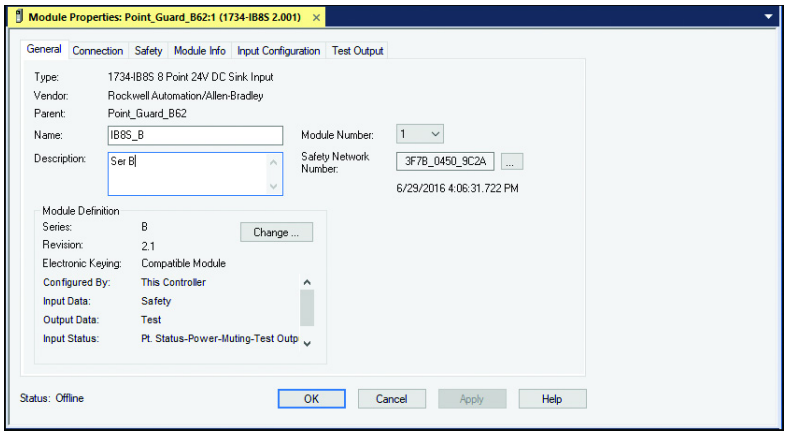


Figure 23 shows the Input Configuration tab of the 1734-IB8S switch module properties.

In this example, Points 0 and 1 monitor the OSSD outputs of the 440G-MZ safety switch. The Type is set to Single and the Mode must be set to Safety. Set the On->Off delay time to 6 ms to filter out the test pulses from the 440G-MZ safety switch.

Points 2 and 3 monitor the status of the output contactors, K1 and K2. The Type should be set to Single. Set Mode to Safety Pulse Test. Safety pulse testing is used to detect potential faults in the monitoring circuit.

Figure 23 - 1734-IB8S Module Properties - Input Configuration

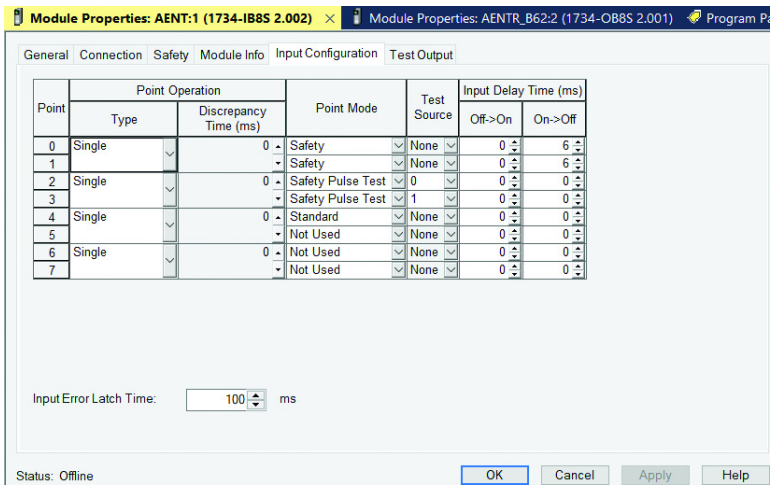


Figure 24 shows the Test Output tab of the 1734-IB8S module properties.

In this example, Points 0 and 1 are set to Pulse Test as these points help check the integrity of the contactors K1 and K2, to be sure they are off before the logic program energizes the contactors.

Points 2 and 3 are set to Standard. Point 2 is the LOCK command. Point 3 applies power to the safety switch. By setting it to Standard, you can programmatically turn these points OFF and ON, in case a nonrecoverable fault occurs with the switch.

Figure 24 - 1734-IB8S Module Properties - Test Output

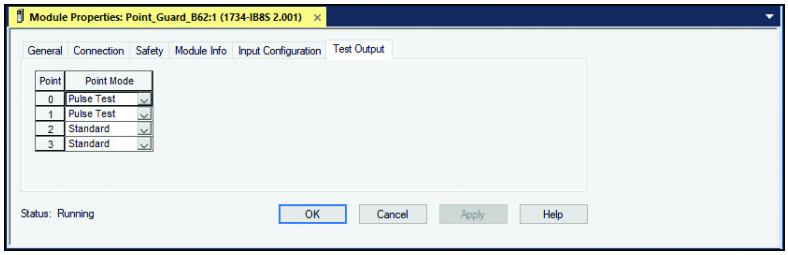


Figure 25 shows the General tab of the 1734-OB8S module properties. Set the Module Definition with the following settings:

- Input Data: None
- Output: Safety
- Input Status: Pt. Status

Figure 25 - 1734-OB8S Module Properties - General

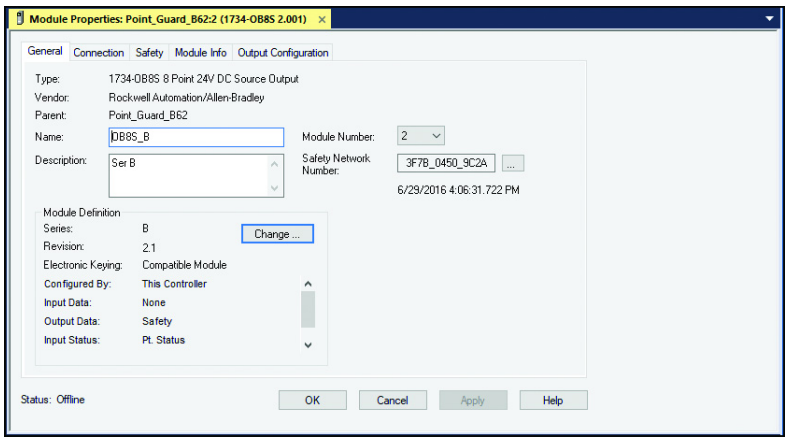


Figure 26 shows the Output Configuration tab of the 1734-OB8S switch module properties.

Points 0 and 1 drive the output contactors K1 and K2. For both points, Type is set to Dual, and the Mode is set to Safety Pulse Test.

Figure 26 - Module Properties - Output Configuration

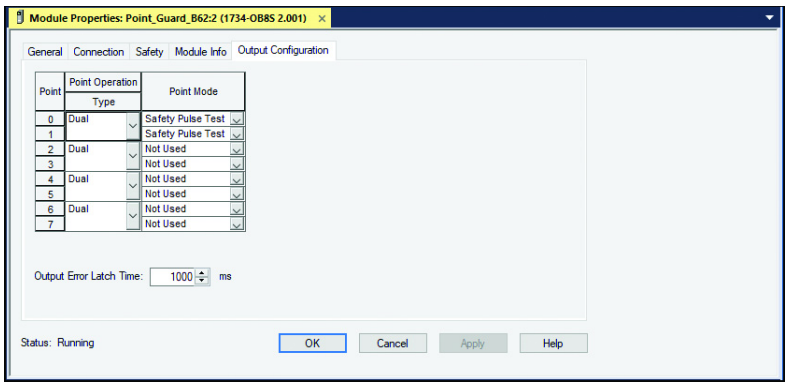
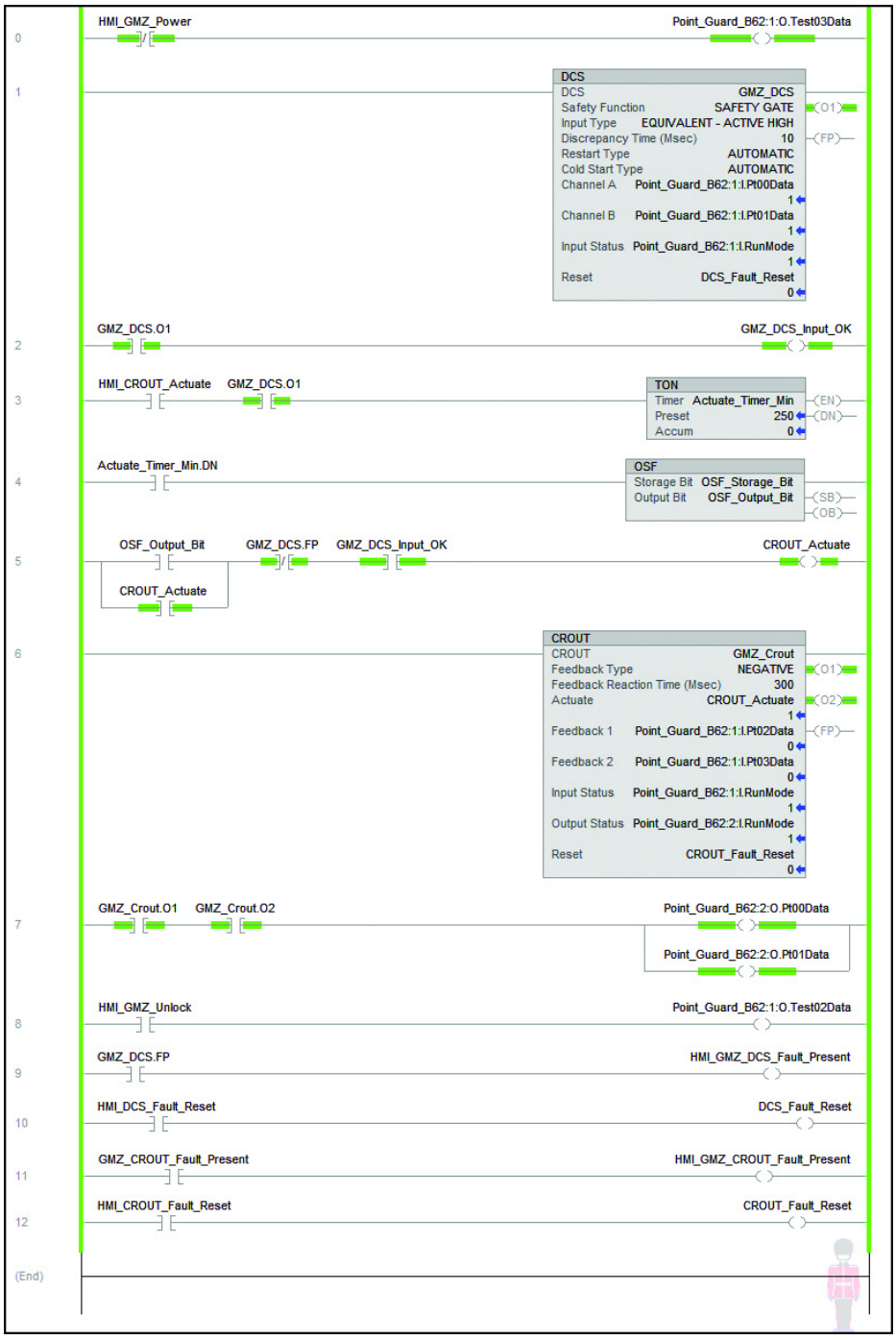


Figure 27 on page 46 shows an example program. A Dual Channel Input Stop function block monitors the 440G-MZ safety switch, and a Configurable Redundant Output function block controls two contactors. This example can be used as a starting point for implementation; you must incorporate additional logic that is based on the risk assessment for the machine.

Rung	Description
0	With the Test Data output setup set as Standard, an HMI input can cycle power ON and OFF to the 440G-MZ safety switch to recover from a fault, if necessary. Upon powerup, the N.C. contact automatically applies power to the 440G-MZ safety switch.
1	The Dual Channel Input Stop monitors the outputs of the 440G-MZ safety switch. The DCS block is set for automatic start on powerup (cold start) and automatic restart each time the switch is locked.
2	The output of the DCS in Rung 1 provides a tag that shows the input 440G-MZ input status is OK. This tag is used in Rung 4 to enable the Configurable Output to be reset.
3	A momentary contact from an HMI input starts a short on delay timer. HMI input must be held long enough for the timer to expire. This timer is intended to help prevent inadvertent reset. The preset value can be adjusted to suit the application.
4	When the timer is done, the OSF_Storage_Bit is set. When the HMI_CROUT_Actuate button in Rung 4 is released, the OSF_Storage_Bit goes LO and the OSF_Output_Bit goes HI.
5	When the OSF_Output_Bit goes HI, the CROUT_Actuate tag is set. The CROUT_Actuate tag is self-sealing because the OSF_Output_Bit is HI only momentarily.
6	The GMZ_Crout block is set for negative feedback. The CROUT block output cannot go HI unless the external contactor status at Feedback 1 and 2 is HI.
7	The two CROUT outputs turn ON the ArmorBlock® outputs, which energize the external contactors.
8	From an HMI input, you can lock or unlock the 440G-MZ safety switch. The HMI input must be a maintained switch.
9	Notify the HMI if a fault is present on the DCS block.
10	An HMI input can reset the DCS if a fault is present.
11	Notify the HMI if a fault is present on the CROUT block.
12	An HMI input can reset the CROUT if a fault is present.

Figure 27 - 1734 Example Studio 5000® Program



Wire to ArmorBlock Guard I/O Module

The 440G-MZ safety switch can be connected to a 1732ES/1732DS ArmorBlock Guard I/O™ module by using a catalog number 889D-F5NCDM-x 5-wire patchcord. An example schematic is shown in Figure 28.

Figure 28 - ArmorBlock Schematic

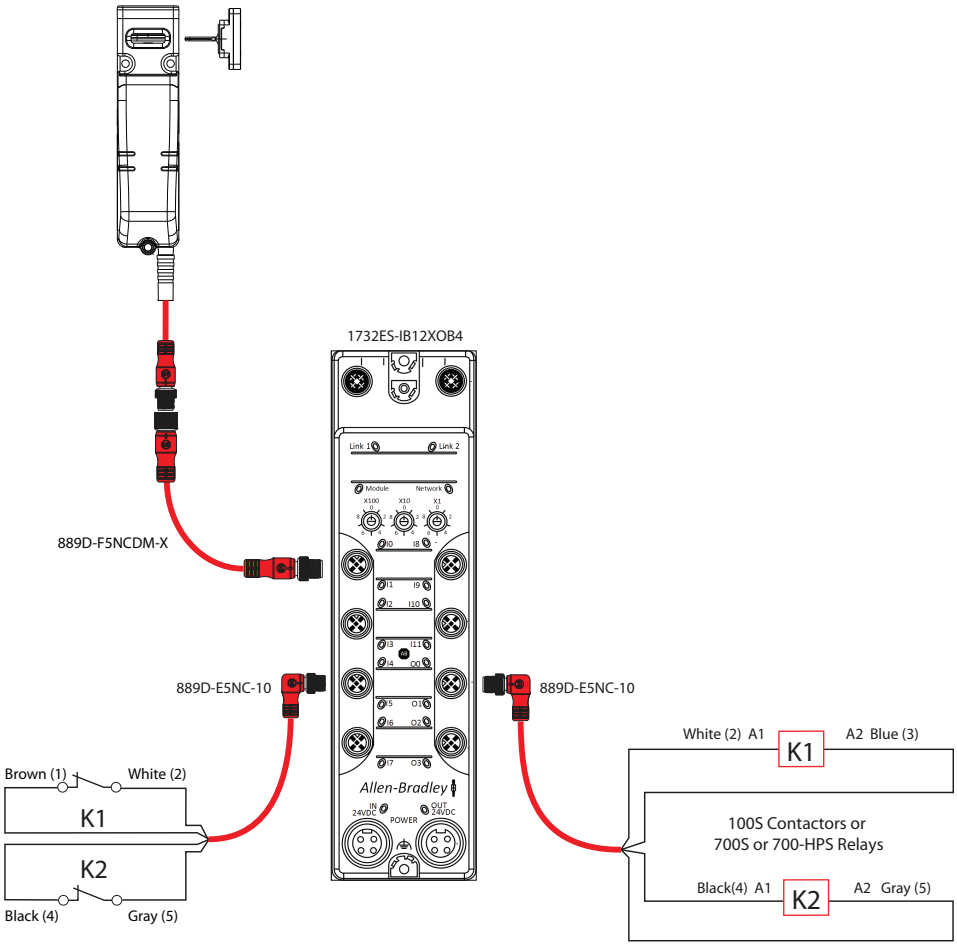


Figure 29 shows the General tab of the ArmorBlock module properties. The Input Status must be set to Combined Status - Muting and the Output Data must be set to Combined.

Figure 29 - Module Properties - General

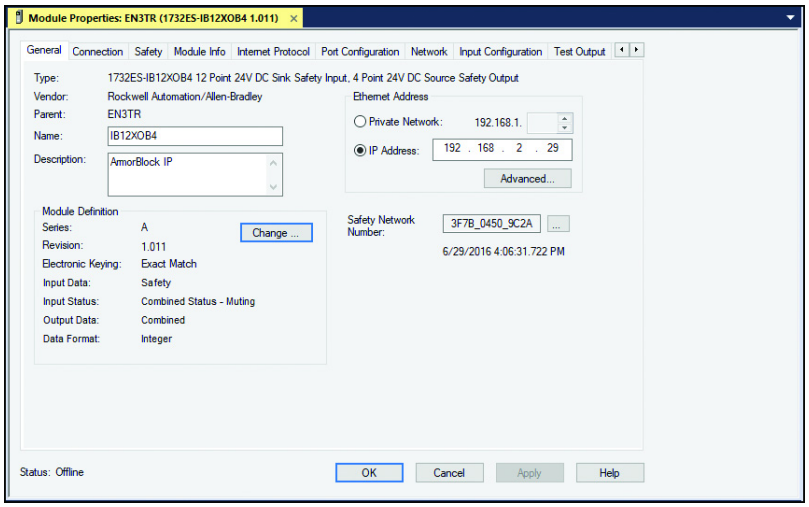


Figure 30 shows the Input Configuration tab of the ArmorBlock module properties. In this example, Points 0 and 1 monitor the OSSD outputs of the safety switch. The Type should be set to Single and the Mode must be set to Safety. Set the On->Off delay time to 6 ms to filter out the test pulses from the 440G-MZ safety switch.

Points 4 and 5 monitor the status of the output contactors K1 and K2. These points should also be set to Single and Safety Pulse Test. The Test Source must agree with the Test Output tab.

Figure 30 - Module Properties - Input Configuration

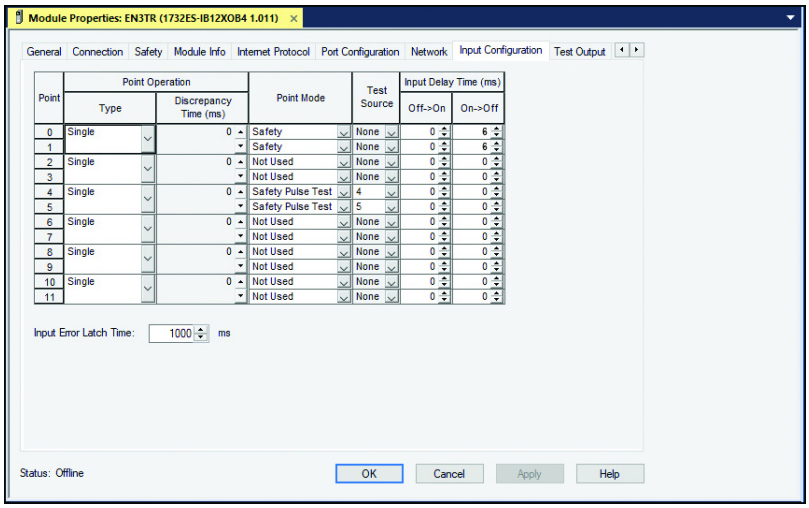


Figure 31 shows the Test Output tab of the ArmorBlock Module Properties. In this example, Points 0 and 1 are set to Standard, which allows the program to control these points. Point 0 applies power to the 440G-MZ safety switch. By setting it to standard, you can programmatically turn this point off and on if the 440G-MZ safety switch has a fault condition. Point 1 is the lock/unlock command. In this example, the 440G-MZ safety switch is a PTR type, so 24V unlocks the switch. Points 4 and 5 are used to monitor the contactor outputs and are set to Pulse Test.

Figure 31 - Module Properties - Test Output

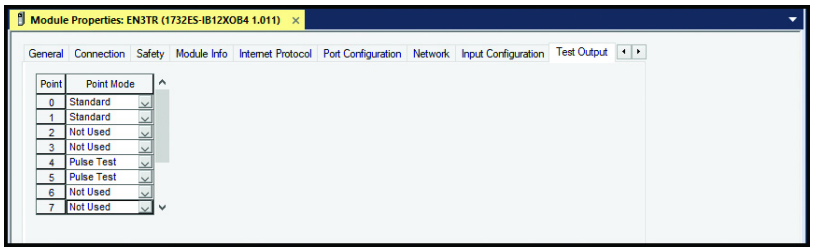


Figure 32 shows the Output Configuration tab of the ArmorBlock module properties. Points 0 and 1 drive the output contactors K1 and K2. The point Types are set to Dual, and the Modes are set to Safety.

Figure 32 - Module Properties - Output Configuration

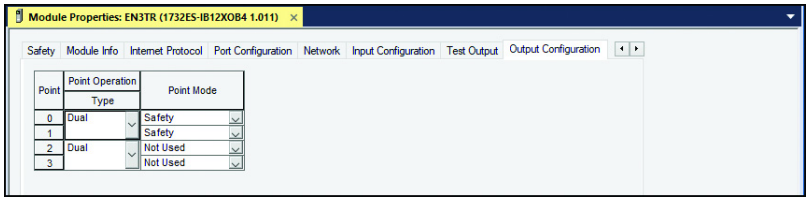
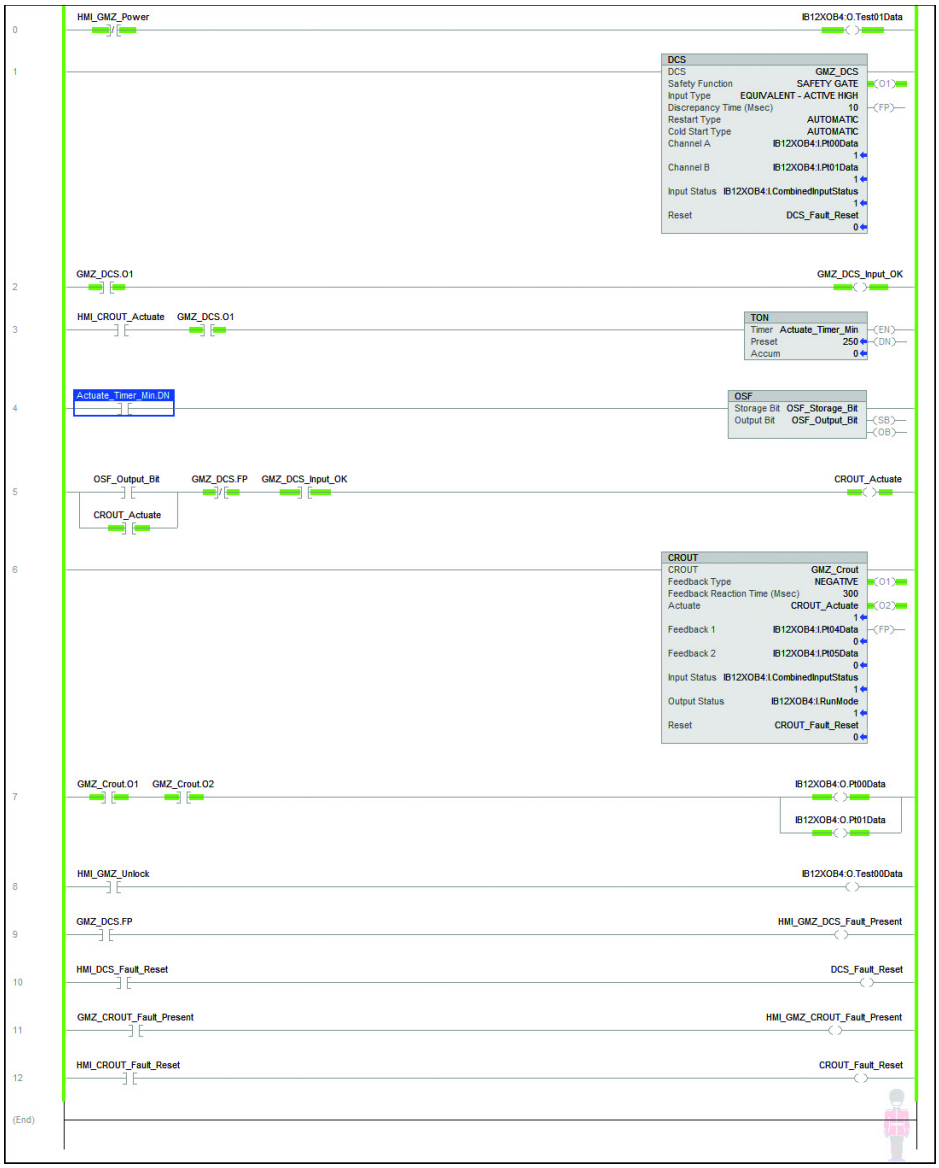


Figure 33 on page 50 shows an example program. A Dual Channel Input Stop function block monitors the 440G-MZ safety switch, and a Configurable Redundant Output function block controls two contactors. This example can be used as a starting point for implementation; you must incorporate additional logic that is based on the risk assessment for the machine.

Rung	Description
0	With the Test Data output setup set as Standard, an HMI input can cycle power ON and OFF to the 440G-MZ safety switch to recover from a fault, if necessary. Upon powerup, the N.C. contact automatically applies power to the 440G-MZ safety switch.
1	The Dual Channel Input Stop monitors the outputs of the 440G-MZ safety switch. The DCS block is set for automatic start on powerup (cold start) and automatic restart each time the switch is locked.
2	The output of the DCS in Rung 1 provides a tag that shows the input 440G-MZ input status is OK. This tag is used in Rung 4 to enable the Configurable Output to be reset.
3	A momentary contact from an HMI input starts a short on delay timer. HMI input must be held long enough for the timer to expire. This timer is intended to help prevent inadvertent reset. The preset value can be adjusted to suit the application.
4	When the timer is done, the OSF_Storage_Bit is set. When the HMI_CROUT_Actuate button in Rung 4 is released, the OSF_Storage_Bit goes LO and the OSF_Output_Bit goes HI.
5	When the OSF_Output_Bit goes HI, the CROUT_Actuate tag is set. The CROUT_Actuate tag is self-sealing because the OSF_Output_Bit is HI only momentarily.
6	The GMZ_Crout block is set for negative feedback. The CROUT block output cannot go HI unless the external contactor status at Feedback 1 and 2 is HI.
7	The two CROUT outputs turn ON the ArmorBlock outputs, which energize the external contactors.
8	From an HMI input, you can lock or unlock the 440G-MZ safety switch. The HMI input must be a maintained switch.
9	Notify the HMI if a fault is present on the DCS block.
10	An HMI input can reset the DCS if a fault is present.
11	Notify the HMI if a fault is present on the CROUT block.
12	An HMI input can reset the CROUT if a fault is present.

Figure 33 - Example Studio 5000 Program

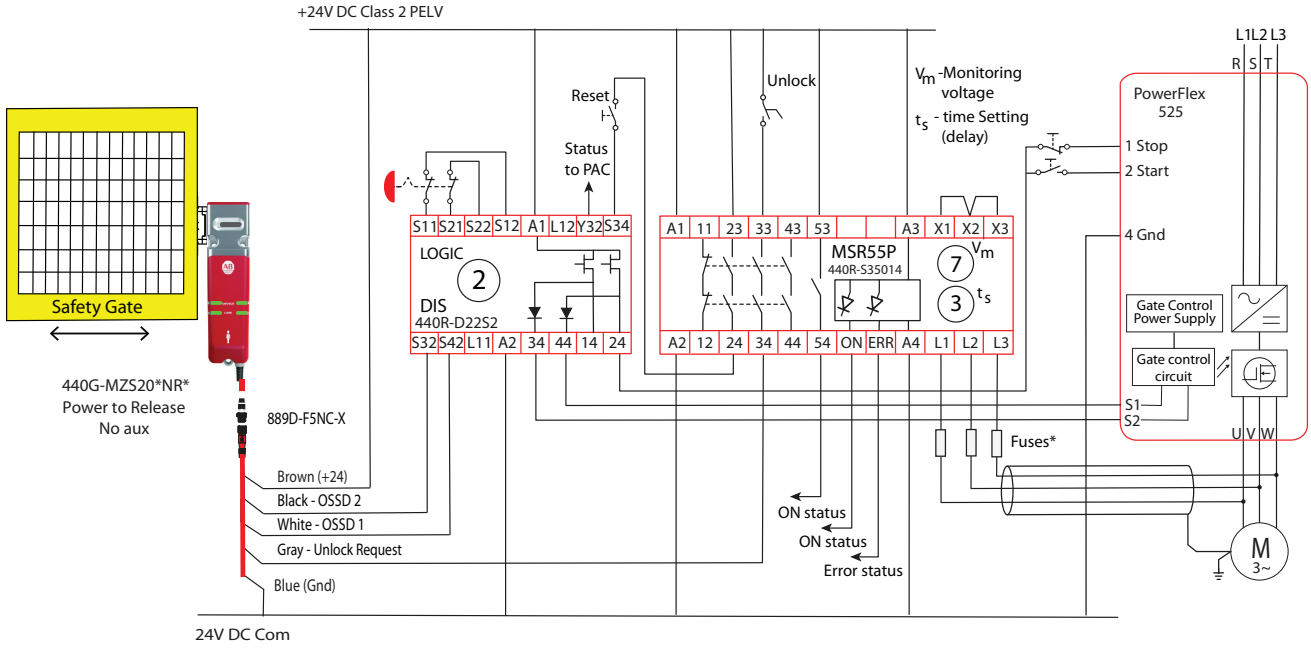


Wire to MSR55P Back EMF Safety Relay

A PowerFlex 525 drive controls the speed and direction of the motor. The MSR55P safety relay allows access to the hazard after the motor has achieved its standstill settings. The DI safety relay monitors the guard locking switch and the E-stop push button.

The DI safety relay enables the drive to restart after the gate is closed and locked and the E-stop is released.

Figure 34 - MSR55P Back EMF Relay Schematic



Notes:

Specifications

This appendix provides the specifications and safety ratings for the 440G-MZ safety switch.

Safety Ratings

Attribute	Value
Standards	IEC 60947-5-3, IEC 61508, ISO 13849-1, IEC 62061, ISO 14119, UL 508
Safety classification	Type 4 interlocking device with guard locking per ISO 14119 with low (standard) and high (unique) coding per ISO 14119 Suitable for use in applications up to and including PLe Cat 4 per ISO 13849-1, SIL CL 3 per IEC 62061, and SIL 3 per IEC 61508
Functional safety	• OSSD mode [1] Proof test interval = 20 years PFHd = 3.17E-09 PFD = 3.67E-04 • GuardLink® mode[2] Proof test interval = 20 years PFHd = 2.93E-09 PFD = 3.59E-04
Certifications	CE Marked for all applicable EU directives, c-UL-us, TÜV

(1) This data is given for the 440G-MZ safety switch when used in OSSD mode (connected to a safety I/O or safety logic device).
(2) This data is given for the 440G-MZ safety switch when used in a GuardLink safety system.

Operating Characteristics

Attribute	Value
Torque for M5 mounting of switch and actuator mounting bracket	2 N•m (17.7 lb•in) max
Torque, auxiliary release access screw (escape release model)	0.56 N•m (5 lb•in)
Locking bolt alignment tolerance X, Y, Z	±5 mm (0.2 in.) max
Door radius, min	457.2 mm (18 in.)
Holding force F_{max} (ISO 14119)	3250 N
Holding force F_{zh} (ISO 14119)	2500 N
Output current, max (each output)	200 mA
Quiescent power consumption, locked or unlocked	1.5 W
Lock signal current	1 mA
Peak current and duration, at turn on or after lock/unlock operation	150 mA for approximately 800 ms following lock/unlock operation.
Steady state current, max	• OSSD mode: 40 mA • GuardLink mode: 50 mA
Operating voltage Ue	24V DC +10%/-15% Class 2 PELV
Operating cycle frequency, max	0.2 Hz
Dwell time between subsequent locking/unlocking	2.5 s
Response time (Off) (IEC 60947-5-3)	275 ms
Start up time (availability)	8 s
Utilization category (IEC 60947-5-2)	DC-13 24V 200 mA
Insulation voltage U_i (IEC 60947-5-1)	75V
Impulse withstand voltage U_{imp} (IEC 60947-5-1)	1 kV
Pollution degree (IEC 60947-5-1)	3
Auxiliary release	Built-in
Escape release	Built-in (select models)
Protection class (IEC 61140)	Class II
Mechanical life	500,000 cycles

Outputs (Guard Door Closed and Locked)

Attribute	Value
Safety outputs (OSSD mode)	2 x PNP, 0.2 A max / ON (+24V DC)

Environmental

Attribute	Value
Operating temperature	0…55 °C (32…131 °F)
Storage temperature	-25…+75 °C (-13…+167 °F)
Operating humidity	5…95%, noncondensing
Enclosure ingress rating	• IP65 • IP66 • IP67 • IP69 • IP69K
Shock and vibration	• IEC 60068-2-27 30 g (1.06 oz), 11 ms • IEC 60068-2-6 10…55 Hz, 1 mm (0.04 in.)
Radio frequency/EMC	IEC 60947-5-3, FCC-1 (Parts 18 and 15), RED

General

Attribute	Value	
Materials	Switch	• Housing: ABS • Front brace and escape release: SS304 (machined), SS316 (cast)
	Actuator	• Housing and housing cover: SS304 • Spring: SS302 • Grommet: nitrile rubber • Screws: stainless steel • Tongue: SS410
	Brackets	High-strength low alloy steel
	Accessories	• Padlock: SS410 • Button: Aluminum, powder painted • Auxiliary release tool: SS304 with SS201 key ring • Screw: Steel
Weight [kg (lb)]	• Switch: 0.75 (1.7) • Switch with escape release: 1.59 (3.5) • Actuator: 0.27 (0.6) • Actuator L mounting bracket: 0.27 (0.6) • Actuator Z bracket: 0.54 (1.2) • Switch L bracket: 1 (2.2) • Button: 0.025 (0.06) • Auxiliary release tool: 0.018 (0.04) • Screw: 0.014 (0.03)	
Protection Type	• Short-circuit • Current limitation • Overload • Reverse polarity • Overvoltage (up to 60V max) • Thermal shutdown/restart	

Certifications

Visit rok.auto/certifications for Declaration of Conformity, Certificates, and other certification details.

- UL Listed Industrial Control Equipment, Certified for US and Canada
- CE Marked for all applicable directives
- RCM Marked
- TÜV Certified for Functional Safety up to SIL 3 Category 4 for use in safety applications up to and including SIL 3. Also in accordance with IEC 61508 and EN 62061, Performance Level e and Category 4 in accordance with ISO 13849-1, both for guard position monitoring and for guard locking according to ISO 14119.
- FCC Notice (for U.S. Customers)
  This device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:
  a. This device many not cause harmful interference, and
  b. This device must accept any interference received, including interference that may cause undesired operation.

  Changes and Modifications not expressly approved by Rockwell Automation can void your authority to operate this equipment under Federal Communications Commissions rules.
- This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.
  Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Compliance to European Union Directives

This product bears the CE marking and is approved for installations within the European Union and EEA regions. It has been designed and tested to meet the Machine Safety and EMC directives.

Approximate Dimensions

Figure 35 - Switch Body — Standard Model [mm (in.)]

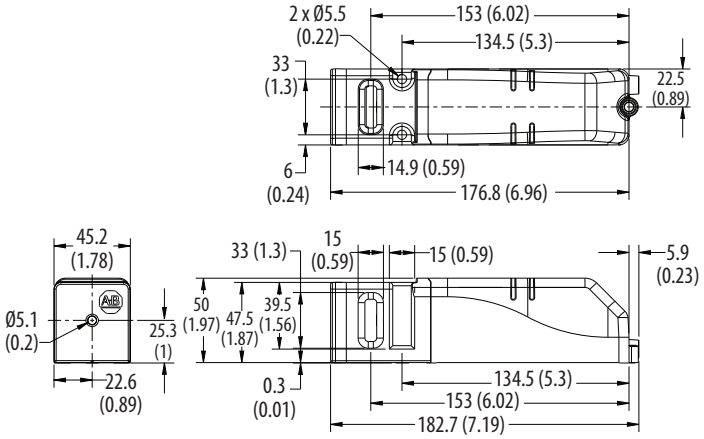


Figure 36 - Switch Body — Escape Release Model [mm (in.)]

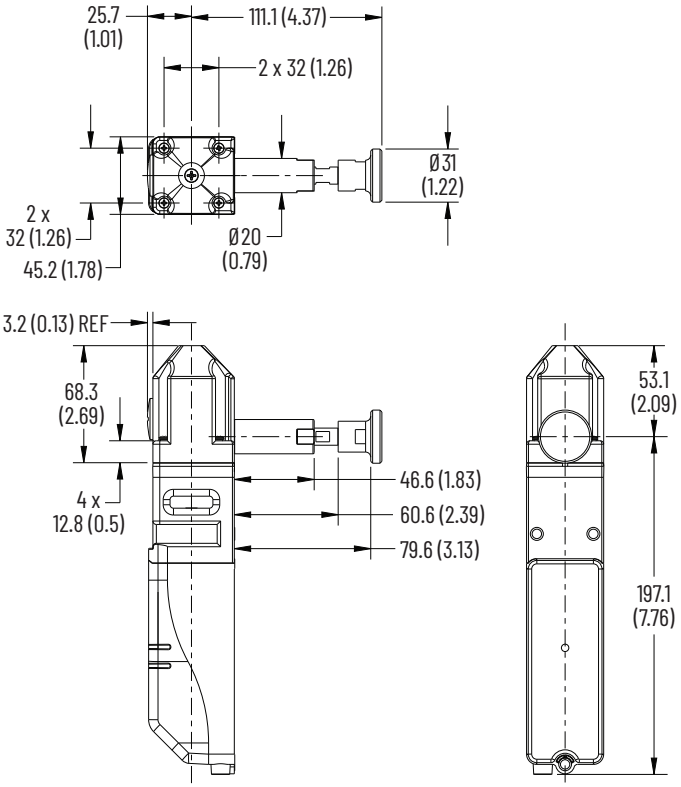


Figure 37 - Actuator [mm (in.)]

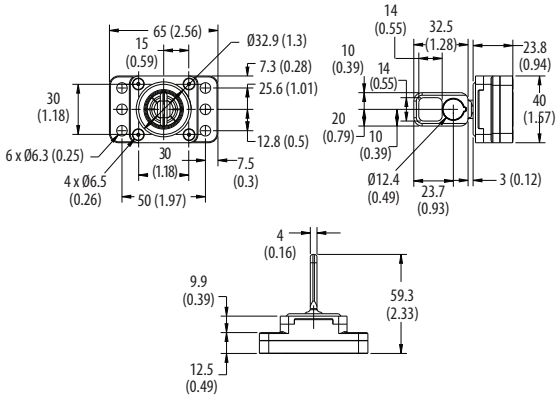


Figure 38 - Actuator on Z Bracket [mm (in.)]

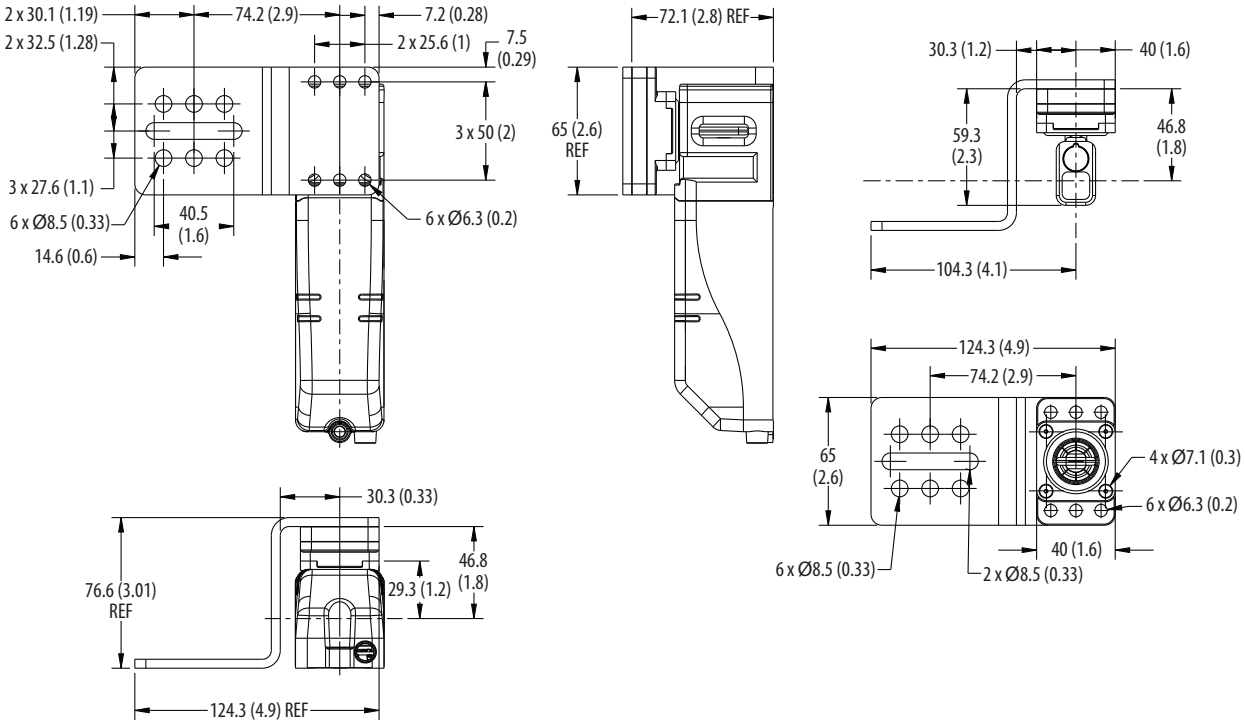


Figure 39 - Actuator on L Bracket [mm (in.)]

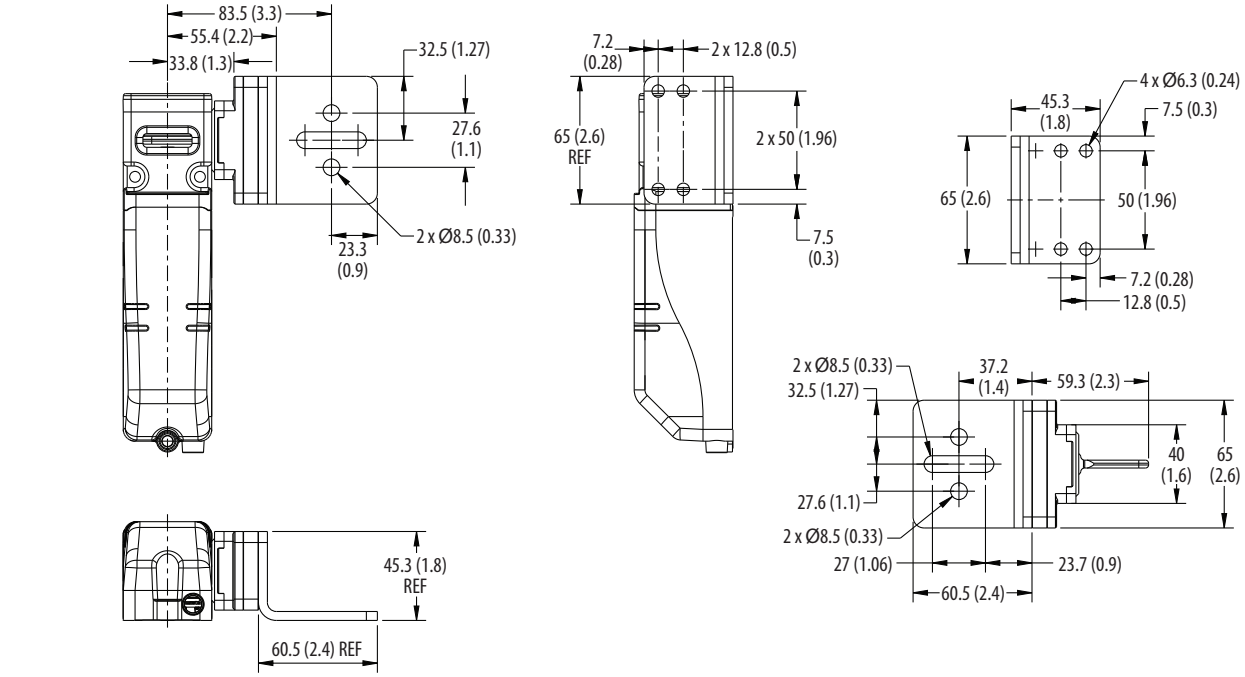


Figure 40 - Switch on L Bracket [mm (in.)]

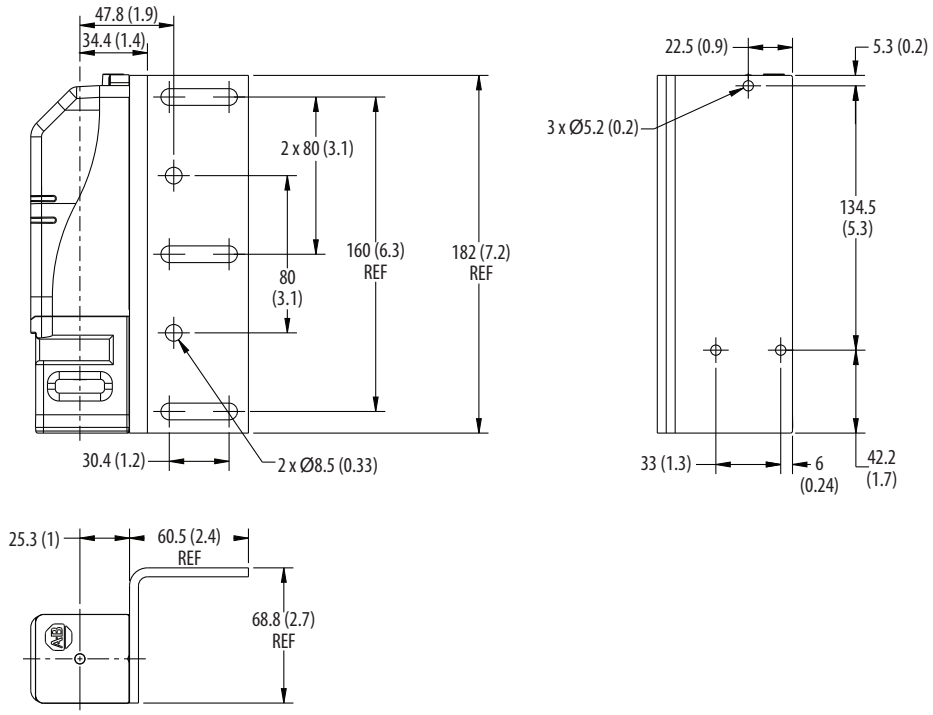
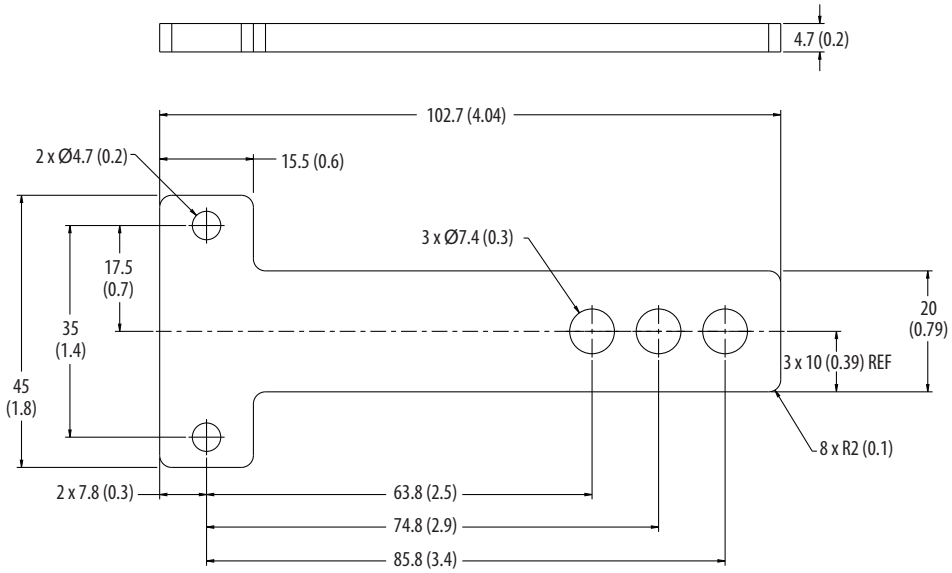


Figure 41 - Padlock Accessory [mm (in.)]



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Notes:

Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Get help determining how products interact, check features and capabilities, and find associated firmware.	rok.auto/pcdc

Documentation Feedback

Your comments help us serve your documentation needs better. If you have any suggestions on how to improve our content, complete the form at rok.auto/docfeedback.

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 information on its website at rok.auto/pec.

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

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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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