



440G-LZ Guardmaster Guard Locking Switch

Catalog Numbers 440G-LZS21SPx, 440G-LZS21SPRx,
440G-LZS21STLx, 440G-LZS21STRx, 440G-LZS21UPLx,
440GLZS21UPRx, 440G-LZS21UTLx, 440G-LZS21UTRx



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.

These 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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Notes:

Summary of Changes

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

Topic	Page
Updated Catalog Numbers.	10
Updated Figure 6 .	19
Updated Connections.	23

Who Should Use This Manual

Use this manual to design, install, program, or troubleshoot systems that use the Guardmaster® 440G-LZ guard lock 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-LZ guard locking switch. It describes the procedures you use to install, wire, and troubleshoot your switch. This manual:

- Explains how to install and wire your 440G-LZ switch, and
- Provides an overview of the Guardmaster 440G-LZ guard locking switch.

Conventions Used in This Manual

The following conventions are used throughout this manual:

- Bulleted lists such as this one provide information, not procedural steps.
- Numbered lists provide sequential steps or hierarchical information.

Additional Resources

The following document offers additional information about related Rockwell Automation products:

Resource	Description
Allen-Bradley Industrial Automation Glossary, publication AG-7.1	Glossary of industrial automation terms and abbreviations

You can view and download publications at rok.auto/literature.

Terminology

The [Industrial Automation Glossary](#) contains terms and abbreviations used by Rockwell Automation to describe industrial automation systems. Below is a list of specific terms and abbreviations used in this manual.

NC	No connection
N.C. (Normally Closed)	An electrical contact whose normal state (for example, no pressure or electrical potential applied) is in the closed position.
N.O. (Normally Open)	An electrical contact whose normal state (i.e., no pressure or electrical potential applied) is in the open position.
PLC	A programmable logic controller or a programmable automation controller.
PTL (Power to Lock)	Apply 24V to the lock command to lock the switch. This command applies to the 440G-LZ switch.
PTL (Power to Release)	Apply 24V to the lock command to unlock the switch. This command applies to the 440G-LZ switch.
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. This means that the safety outputs will turn off within the response time.
RFID	Radio frequency identification.
OSSD (Output Signal Switching Device)	Typically a pair of solid-state signals pulled up to the DC source supply. The signals are usually tested for short circuits to the DC power supply, short circuits to the DC common, and short circuits between the two signals.
Standard coding	Same as Low coding as defined in EN ISO 14119:2013
440G-LZL	440G-LZ power-to-lock guard locking switch
440G-LZR	440G-LZ power-to-release guard locking switch
Unique coding	Same as High coding as defined in EN ISO 14119:2013

General Description

Guardmaster 440G-LZ Safety Switch Overview

This Guardmaster® 440G-LZ guard lock safety switch functions by extending a locking bolt from the switch through a hole in the actuator, which prohibits the opening of a guard.

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 EN ISO 14119. The 440G-LZ safety switches are classified according to ISO 14119 as Type 4 interlocking devices with guard locking. The unique coded actuators are classified as having a high level of coding.

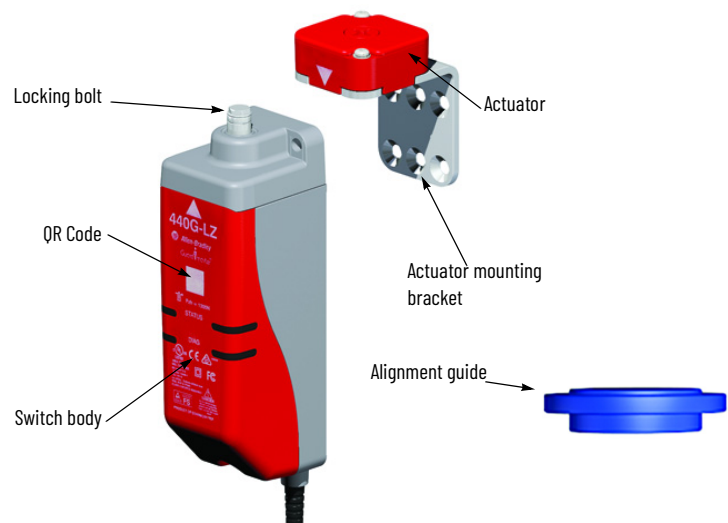
The Guardmaster 440G-LZ guard lock safety switch features OSSD outputs. These outputs are enabled only when the locking bolt is sensed in its extended position in the actuator. This action only happens when the guard is both closed and locked.

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.

Despite the bi-stable design of the locking bolt drive, 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).

Assembly Overview



Catalog Numbers

440G-LZS
21
S
P
R
H

a
b
c
d
e

a		b		c	
Outputs (Safety/Auxiliary)		Actuator Code		Auxiliary Type	
Code	Description	Code	Description	Code	Description
20	Two safety, no aux	S	Standard coding	N	No auxiliary (5-pin model)
21	Two safety, one aux	U	Unique coding	P	Auxiliary - lock status
				T	Auxiliary - door proximity

d		e	
Lock Type		Connection Type	
Code	Description	Code	Description
R	Power to Release	A	3 m (9.8 ft) cable
L	Power to Lock	B	10 m (32.8 ft) cable
		H	M12 8-pin
		J	M12 5-pin

Table 1 - Complete Switches, including Switch Body, Actuator, and Actuator Mounting Bracket

Type	Actuator Coding	Cat. No.				
		Connection				
		3 m lead	10 m lead	6 in. pigtail with M12 5-pin Quick Disconnect	6 in. pigtail with M12 8-pin Quick Disconnect	Auxiliary Type
Power to Release	Standard (Low level to EN ISO 14119:2013)	440G-LZS21SPRA	440G-LZS21SPRB	440G-LZS21SNRJ	440G-LZS21SPRH	Lock Status
	Unique (High level to EN ISO 14119:2013)	440G-LZS21UPRA	440G-LZS21UPRB	440G-LZS21UNRJ	440G-LZS21UPRH	Lock Status
Power to Lock	Standard (Low level to EN ISO 14119:2013)	440G-LZS21SPLA	440G-LZS21SPLB	440G-LZS21SNLJ	440G-LZS21SPLH	Lock Status
	Unique (High level to EN ISO 14119:2013)	440G-LZS21UPLA	440G-LZS21UPLB	440G-LZS21UNLJ	440G-LZS21UPLH	Lock Status
Power to Release	Standard (Low-level EN ISO 14119:2013)	440G-LZS21STRA	440G-LZS21STRB	440G-LZS21SNRJ	440G-LZS21STRH	Door Proximity
	Unique (High-level EN ISO 14119:2013)	440G-LZS21UTRA	440G-LZS21UTRB	440G-LZS21UNRJ	440G-LZS21UTRH	Door Proximity
Power to Lock	Standard (Low-level EN ISO 14119:2013)	440G-LZS21STLA	440G-LZS21STLB	440G-LZS21SNLJ	440G-LZS21STLH	Door Proximity
	Unique (High-level EN ISO 14119:2013)	440G-LZS21UTLA	440G-LZS21UTLB	440G-LZS21UNLJ	440G-LZS21UTLH	Door Proximity

Table 2 - Spare Actuators and Actuator Mounting Bracket

Type	Coding	Cat. No.
Power to Release	Standard (Low-level EN ISO 14119:2013)	440G-LZASPR
	Unique (High-level EN ISO 14119:2013)	440G-LZAUPR
Power to Lock	Standard (Low-level EN ISO 14119:2013)	440G-LZASPL
	Unique (High-level EN ISO 14119:2013)	440G-LZAUPL
Actuator mounting bracket		440G-LZAM1

Table 3 - Accessories

Description	Cat. No.
Switch body mounting bracket	440G-LZAM2

Packaging Contents

The box includes the following components:

Figure 1 - Switch Body Including Connection Lead: 3 m or 10 m Flying Lead or Pigtail Equipped with M12 QD Connector



Figure 2 - Actuator Mounting Bracket



Figure 3 - Actuator

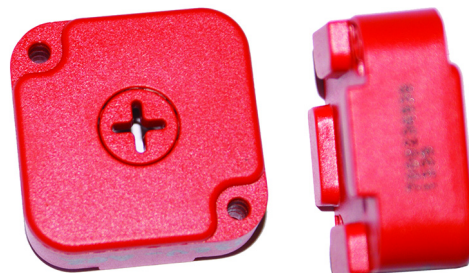


Figure 4 - Mounting Screws: 2 x T10 Torx



Figure 5 - Alignment Guide



Notes:

Safety Concept

Safety Standards

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

- IEC 60947-5-1: 2003+A1: 2009
- IEC 60947-5-3: 1999/A: 2005
- IEC 61508:2010 SIL 3
- IEC 62061:2005 SIL 3
- EN ISO 13849-1:2008/AC: 2009 Performance Level e (PLe), Category 4
- EN ISO 14119:2013
- UL 508 17th Edition dated 3/19/2013

Safety Certification

The Guardmaster 440G-LZ 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 interval of 20 years, and Performance Level 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 Guardmaster 440G-LZ safety switch for use in safety-related applications where Performance Level “e” is required for the door position and lock monitor functions.

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

While the 440G-LZ safety switch can be used for SIL 3, PLe, and Category 4 applications, the installer must comply with guard requirements (for example, EN ISO13854 and EN ISO 13857), and in some cases minimum (safe) distance requirements (for example, EN ISO 13855).



ATTENTION: A risk assessment is required to prove that the selected switch can be used in the desired application. A functional test of the system is necessary to validate that it works as expected (see [Functional Testing on page 21](#)).

Guard locking switches that are activated by the Power to Lock principle, 440G-LZS 21 **L* safety switch, must only be used after a risk assessment has shown that the use of a Power to Release principle, 440G-LZS21**R* safety switch is inappropriate. This assessment is necessary since the guard can be immediately opened after a loss of power supply or upon de-activation of the unlocking signal.

The installed system, including the safety control system and the means by which the machine stops, must achieve the needed safety performance. The 440G-LZ 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

Installation

General Considerations

Installation must be in accordance with the present manual and implemented by qualified personnel exclusively. The 440G-LZ guard locking 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.

Correct Use

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

- The 440G-LZ guard locking safety switch is designed for use on small- and medium-sized guards that are engineered to be rigid without sag and allow partial body access to the safeguarded area.
- The switch is not to be used as a mechanical stop. Check that a separate door stop is used.
- Use in applications where the alignment tolerance falls within the stated specification (± 2.5 mm [0.10 in.] in X, Y, Z directions). 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 hole in the actuator without binding.
- This switch can be used on guards that do not require escape, emergency, or remote releases.
- Use appropriate screws, bolts, or nuts that are fitted by tools to mount the switch and actuators to avoid tampering.
- Do not over torque the mounting hardware.
- The locking bolt must never be extended mechanically. Only extend the bolt electrically. These basic connections are required:
 - Pin 2 (brown wire) must be connected to 24V DC
 - Pin 7 (blue wire) must be connected to 0V (GND)
 - Pin 3 (green wire) is the lock command (0 or 24V DC). See [Lock Command on page 27](#) for description of lock command for PTR and PTL type switches.
- Adjacent switches must be separated by a minimum distance of 200 mm (8 in.), see [Pair Proximity on page 19](#).
- Mount the switch away from any source of metal particles. See [Environmental Considerations on page 19](#).
- The 440G-LZ is designed to be used in a NEC Class 2 circuit. Connect the 440G-LZ to a dedicated Class 2 power supply or use electronic circuit protection (for example, 1692-ZRCLSS) to achieve NEC Class 2 compliance.

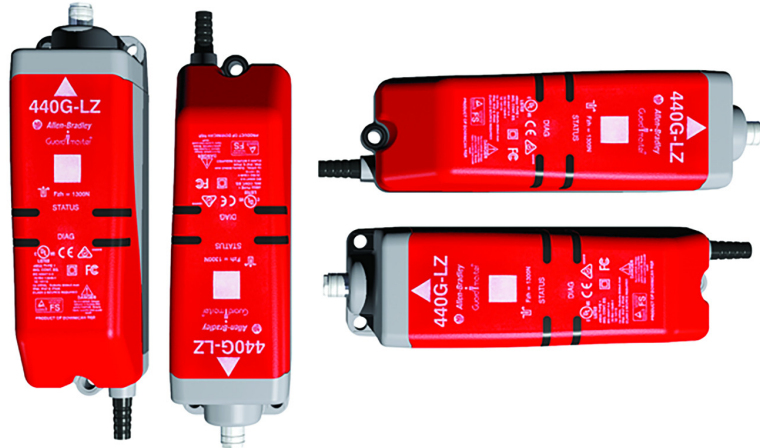


ATTENTION: For the switch, actuator, and actuator mounting bracket:

- Only use the designated mounting holes.
- Never drill or use to support other structures such as a conduit, cable ways, or other hardware.

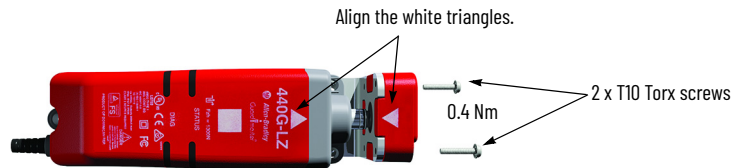
Orientation of Switches

Can be used in all mounting orientations.

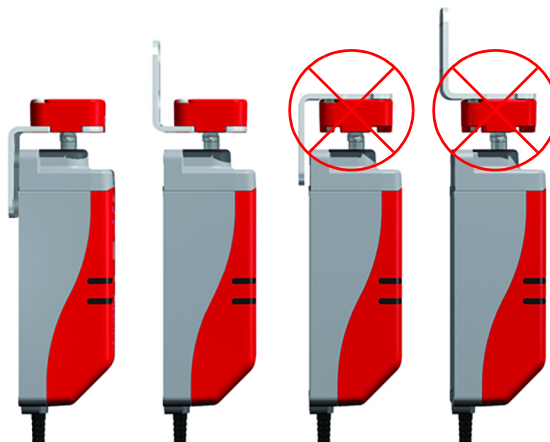


Actuator Mounting

The actuator must be fitted to the actuator mounting bracket in such a manner that the white alignment triangles that are marked on both the actuator and switch body are in the installed position.



Verify that the locking bolt enters the actuator mounting bracket first.

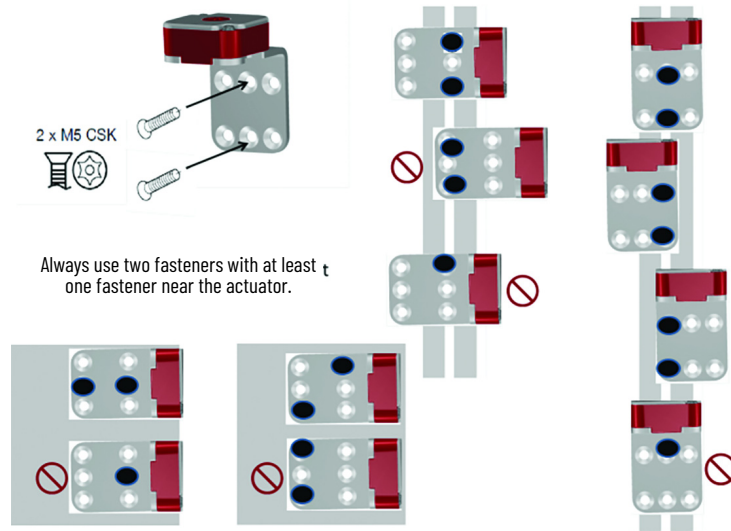


IMPORTANT

The performance of the switch can only be guaranteed if the provided actuator mounting bracket is used. Mounting the actuator without the supplied bracket can result in the reduction of performance.

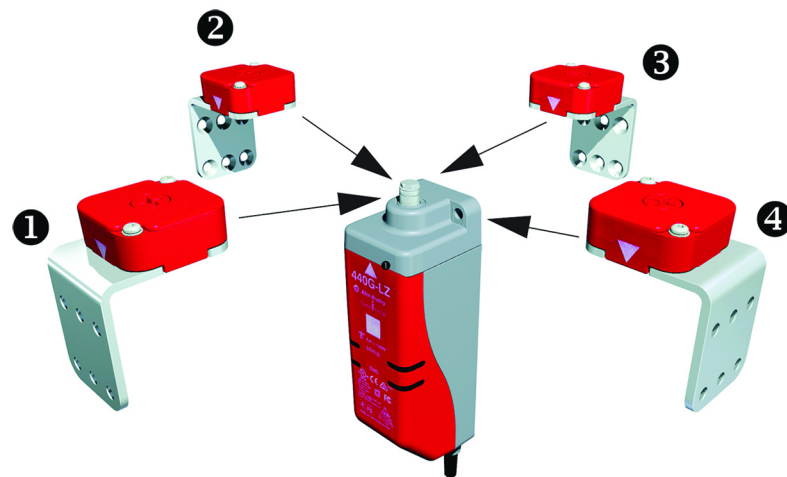
Verify that two fasteners are used with at least one fastener that is fitted close to the actuator bracket bend.

The following drawings show mounting possibilities when attaching to extruded aluminum profile and flat surface guard doors.



Allowable Approach Directions

The actuator can approach the switch from all four directions.



Verify that the white arrow on the actuator aligns with the white arrow on the switch body.

Mounting the Switch Body

Three M5 fasteners (not provided) are required for proper mounting to a rigid guard door frame.



IMPORTANT

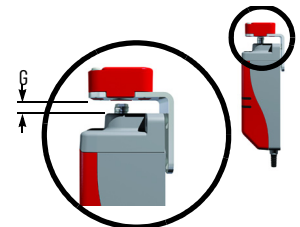
Washers are not required and if used can cause the mounting holes on the switch body to crack.

If it is decided to use a standard thread-locking compound on the mounting screws of the switch body, check the manufacturer's specification. Many standard thread-locking compounds can attack the plastic feet of the switch body, which can cause stress cracks. It is recommended to use cyanoacrylate-type thread-locking compounds.

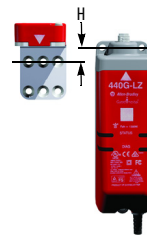
Actuator Alignment

There are three ways to achieve proper alignment.

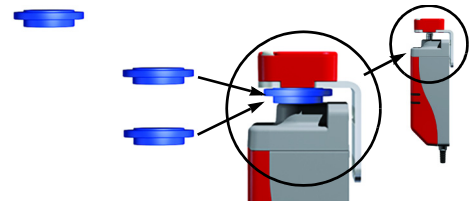
1. By setting gap "G" 2.5 mm (0.09 in.) [0...5 mm (0...0.19 in.)]



2. By mounting hole alignment "H" 6.5 mm (0.25 in.) [4...9 mm (0.15...0.35 in.)]



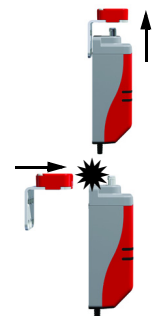
3. Use the alignment guide provided



ATTENTION: After installation, verify that there is no possibility of lifting the actuator over the extended locking bolt.



ATTENTION: After installation, confirm that there is no possibility of collision when the actuator approaches the switch body.



Pair Proximity

Maintain a minimum separation of approximately 200 mm (8 in.) between any two switches and actuators, as indicated in the following illustration.

Figure 6 - Minimum Required Distance Between Two Switches



This restriction applies to both pairs of 440G-LZ safety switches and combinations of 440G-LZ safety switches with the TLS-Z guard locking switches and/or 440N-Z SensaGuard™ noncontact safety switches. All of these devices use inductive field technology for sensing actuator proximity and RFID technology for actuator code identification.

IMPORTANT If the minimum separation distance is not observed, the inductive fields interact causing cross talk. Cross talk results in nuisance faults and false operation.

Environmental Considerations

Mounting for Protection from Particle Build-up

Particle build-up in the vicinity of the locking bolt will likely cause jamming of the locking bolt, which over time causes switch failure. Ferromagnetic metal particles are especially harmful as they are attracted to the permanent magnet at the tip of the locking bolt.

IMPORTANT The correct installation is to mount the switch away from any source of metal particles. Perform preventative maintenance periodically to keep the switch clean of metallic particles. Pay particular attention during installation to be sure that any drilling swarf is excluded from the vicinity of the switch.

Mounting for Protection from Ingress of Liquids

The 440G-LZ safety switch is rated for IP69 in accordance with IEC 60529:192 + A2:2013. 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.

This rating does not promise protection from any liquids other than water and does not promise the mechanical longevity from continuous or frequent exposure.

However, the 440G-LZ safety switch is used in CIP (clean-in-place) applications by virtue of the following features:

- Stainless steel is used for all metal parts including the M12 quick-disconnect.
- The product plastics are resistant to most alkaline cleaners used in CIP.
- An internal nitrile-rolling lip seal guards the locking bolt, which extends and retracts during locking/unlocking.

IMPORTANT To be sure of maximum longevity when exposed to CIP, it is recommended that the switch be mounted in the inverted position with the actuator at the bottom. This position allows liquids to drain away from the locking bolt.

Removing the plug in the middle of the actuator improves drainage (see [Removal of the Actuator Plug](#)).

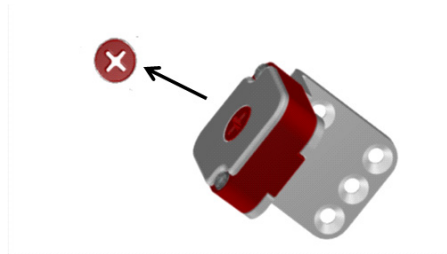
It is also recommended that the switch be thoroughly rinsed with water after exposure to CIP. This step prevents adverse effects that may occur with long-term exposure.

Removal of the Actuator Plug

This plug can be broken out from the actuator if a through-hole is required to avoid a food trap when mounted on the hazard side of a guard door.

Twist the plug with a screwdriver until it comes apart.

Figure 7 - Removal of Actuator Plug

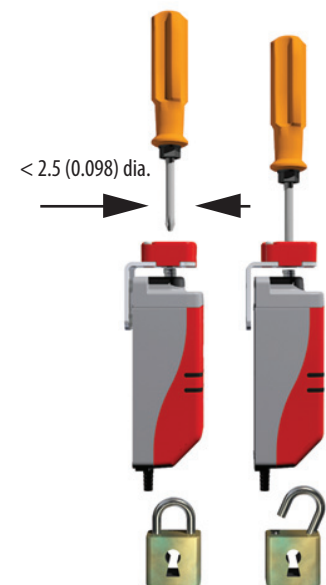


Auxiliary/Manual Release

The manual release is provided to allow you to unlock the guard door if an unforeseen and uncommon circumstance occurs.

If power is supplied to the switch and the switch is in its locked state, if you invoke the auxiliary release, it causes the switch to enter a fault condition (blinking red status indicator).

To reset the switch, simply cycle the power.



Functional Testing

A manual functional electric 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/PLe
 - Less than once a year for SIL 2/PLd



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

1. Confirm that the guard door is open.
2. Connect the 24V DC power to pin 2 and ground (0V) to pin 7. The switch conducts a self-testing routine at the end of which the diagnostic indicator is solid red.
3. Test to confirm that the machine cannot start.
4. Confirm the lock control at pin 3 is set to 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 diagnostic indicator is solid green.
7. Test to confirm that the machine can start.
8. Change the lock control at pin 3 to 24V for PTR and 0V for PTL types.
9. Confirm the machine stops, the guard door is mechanically unlocked, and the machine cannot restart.

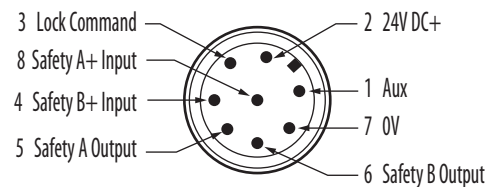
Notes:

Wiring

Connections

The 440G-LZ safety switch is available with an 8-pin DC Micro M12 quick-disconnect connector. [Table 4](#) and [Table 5](#) show the pin assignments and their functions and typical mating cordsets. Other cordsets are available at [DC Micro Cordsets and Patchcords](#).

Table 4 - 8-pin Micro Quick Disconnect Cables



Typical Mating Cordsets	Pin	Color	Function
889D-F8NB-x ⁽¹⁾ (Red, PVC)	1	White	Aux
	2	Brown	24V DC Supply
	3	Green	Lock Command
	4	Yellow	Safety B+ Input
889D-F8AB-x ⁽¹⁾ (Black, PVC)	5	Gray	Safety A Output (OSSD A)
	6	Pink	Safety B Output (OSSD B)
	7	Blue	Ground (0V)
	8	Red	Safety A+ Input

(1) Replace symbol with 2 [2 m (6.56 ft)], 5 [5 m (16.4 ft)], 10 [10 m (32.8 ft)], 15 [15 m (49.2 ft)], 20 [20 m (65.62 ft)] or 30 [30 m (98.4 ft)] for standard cable lengths. The 440G-LZ safety switch has been tested to operate with up to 120 m (393.7 ft) of the mating cables.

Table 5 - 5-pin Micro (M12)



Pin	Color	Function
1	Brown	+24
2	White	Safety OSSD 1 Output
3	Blue	0V
4	Black	Safety OSSD2 Output
5	Gray	Lock Command

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 ArmorBlock® Guard Safety I/O is the 2 m (6.5 ft) catalog number 889D-F5ACDM-2. Replace the 2 with 0M3 [0M3 (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 Inputs

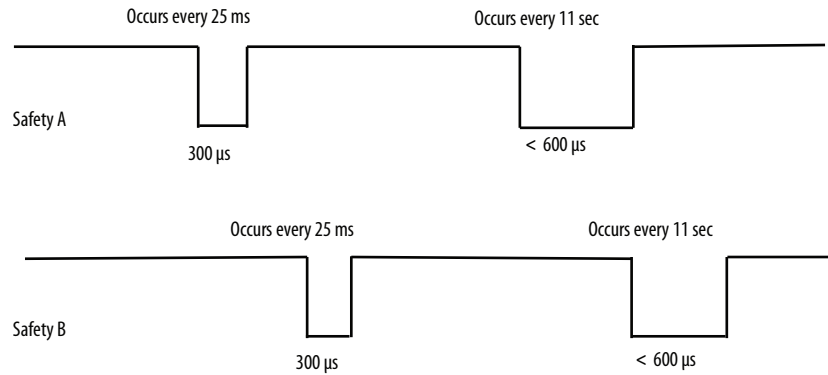
The OSSD inputs are Safety A+ and Safety B+. These inputs are 24V DC signals, which can contain test pulses. The OSSD inputs allow the 440G-LZ safety switches to be connected in series while maintaining a high level of safety performance.

OSSD Outputs

The OSSD outputs are Safety A and Safety B. These outputs are 24V signals that 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.

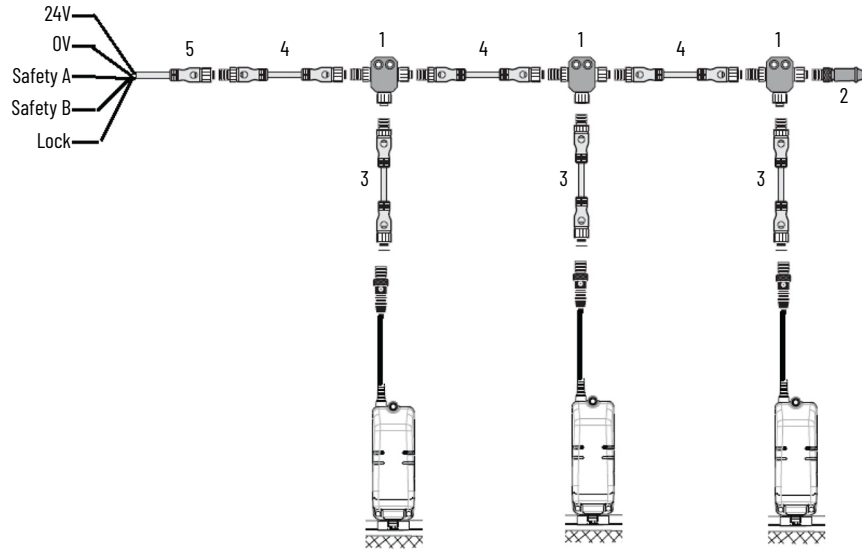
IMPORTANT To prohibit nuisance tripping, mask the OSSD input channels of the safety system with an On to Off delay of at least 6 ms.

Figure 8 - Output Test Pulses






Connections Systems

The following connection system components facilitate connection.



Connection		Cat. No. ⁽¹⁾
1 – Safety-wired Splitter/T-Port		898D-438Y-D8
2 – Safety-wired Shorting Plug		898D-418U-DM
	<p>Pin 1 PWR Pin 2 OSSD 1+ Pin 3 NA Pin 4 OSSD 2+ Pin 5 NA</p>	

Connection		Cat. No. ⁽¹⁾
3 – 8-pin Device Patchcords		
1 meter, 8-pin		889D-F8ABDM-1
2 meters, 8-pin		889D-F8ABDM-2
5 meters, 8-pin		889D-F8ABDM-5
10 meters, 8-pin		889D-F8ABDM-10
4 – 5-pin Patchcords		
1 meter, 5-pin		889D-F5ACDM-1
2 meters, 5-pin		889D-F5ACDM-2
5 meters, 5-pin		889D-F5ACDM-5
10 meters, 5-pin		889D-F5ACDM-10
5 – 5-pin Cordsets		
2 meters, 5-pin		889D-F5AC-2
5 meters, 5-pin		889D-F5AC-5
10 meters, 5-pin		889D-F5AC-10

(1) Add the letter "S" to above catalog numbers for stainless steel connectors; for example, 889DS-F5AC-1.

Auxiliary Output

Table 6 shows the auxiliary output functions. The auxiliary output is a 24V DC logic signal, whose function is dependent on the catalog number selected. The auxiliary signal responds independently of the OSSD safety outputs. The auxiliary output is not a safety-rated signal and must only be used to indicate the status of the switch.

Table 6 - Auxiliary Output Function

Cat. No.	Function	Value
440G-LZS21*P**	Lock Status	24V when switch is unlocked 0V when switch is locked
440G-LZS21*T**	Door Proximity	24V when guard door is open 0V when guard door is closed

Catalog codes for both types are explained in [Catalog Numbers on page 10](#).

IMPORTANT Door proximity models: Auxiliary output changes state when the actuator is in proximity to the switch body. The proximity is such that the actuator is within 20 mm (0.79 in.) (measured centerline of lock bolt to centerline of the hole in the actuator). Can be used for door position if a latch is fitted such that a guard or door is either open or fully closed.

Table 7 - Lock Status Auxiliary Power to Release

Inputs			Outputs		
Door	Lock Control	OSSD Input	Lock Status	AUX	OSSD Output
Open	Off or On	High or Low	Unlocked	High 24V	Low 0V
Closed	Off 0V	Low 0V	Locked	Low 0V	Low 0V
Closed	On 24V	Low 0V	Unlocked	High 24V	Low 0V
Closed	Off 0V	High 24V	Locked	Low 0V	High 24V
Closed	On 24V	High 24V	Unlocked	High 24V	Low 0V

Table 8 - Lock Status Auxiliary Power to Lock

Inputs			Outputs		
Door	Lock Control	OSSD Input	Lock Status	AUX	OSSD Output
Open	Off or On	High or Low	Unlocked	High 24V	Low 0V
Closed	Off 0V	Low 0V	Unlocked	High 24V	Low 0V
Closed	On 24V	Low 0V	Locked	Low 0V	Low 0V
Closed	Off 0V	High 24V	Unlocked	High 24V	Low 0V
Closed	On 24V	High 24V	Locked	Low 0V	High 24V

Table 9 - Door Proximity Auxiliary Power to Release

Inputs			Outputs		
Door	Lock Control	OSSD Input	Lock Status	AUX	OSSD Output
Open	Off or On	High or Low	Unlocked	High 24V	Low 0V
Closed	Off 0V	Low 0V	Locked	Low 0V	Low 0V
Closed	On 24V	Low 0V	Unlocked	Low 0V	Low 0V
Closed	Off 0V	High 24V	Locked	Low 0V	High 24V
Closed	On 24V	High 24V	Unlocked	Low 0V	Low 0V

Table 10 - Door Proximity Auxiliary Power to Lock

Inputs			Outputs		
Door	Lock Control	OSSD Input	Lock Status	AUX	OSSD Output
Open	Off or On	High or Low	Unlocked	High 24V	Low 0V
Closed	Off 0V	Low 0V	Unlocked	Low 0V	Low 0V
Closed	On 24V	Low 0V	Locked	Low 0V	Low 0V
Closed	Off 0V	High 24V	Unlocked	Low 0V	Low 0V
Closed	On 24V	High 24V	Locked	Low 0V	High 24V

Lock Command

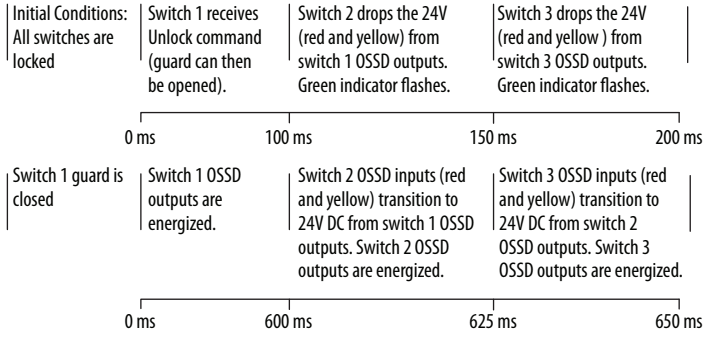
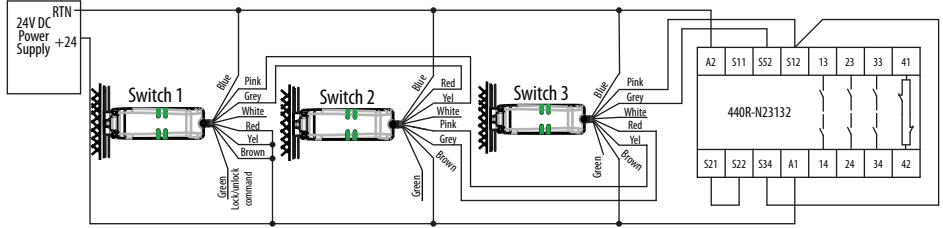
[Table 11](#) shows the lock command function. The lock command is a 24V logic signal with a current of less than 5 mA. The function of the logic signal is dependent on the catalog number. The 24V power supply connection provides the power to operate the locking solenoid, which extends and retracts the locking bolt.

Table 11 - Lock Command Function

Cat. No.	Function	Value
440G-LZS21**R*	Power to release	24V = Unlock 0V = Lock
440G-LZS21**L*	Power to lock	24V = Lock 0V = Unlock

Catalog codes for both types are explained in [Catalog Numbers on page 10](#).

Response Time When Connected in Series Circuit



Notes:

Commissioning

The 440G-LZ 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 need to 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.

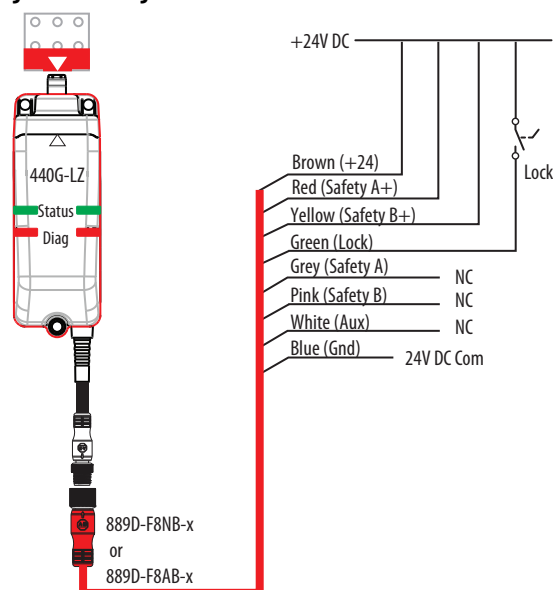
IMPORTANT When the switch learns a new actuator, it no longer recognizes previously learned actuators.

Set-up

During commissioning, connect the switch as shown in [Figure 9](#):

- Connect brown wire (PWR) to 24V DC.
- Connect blue wire (GND) to 0V DC.
- Connect red wire (Safety A+) and yellow wire (Safety B+) to 24V DC.
- Connect green wire (Lock Command) to 24V DC.
- Safety A (gray) and Safety B (pink) — optional, no connection required during commissioning
- Aux (white) — optional, no connection required during commissioning

Figure 9 - Wiring



First Time Learn

Apply power to the switch without the actuator present. After the switch completes the power-sequence (approximately eight seconds), the LED flashes green eight times, indicating the total number of times a new actuator can be learned. This LED sequence repeats until an actuator is placed in the sensing field, or “guard-closed” position, of the switch.

Table 12 - Commissioning Process for Unique Coded Switches

State	Approximate Duration	LED Indicators
Step 1: Actuator Present	15 seconds	Flashing green, slow
Step 2: Verifying Actuator	15 seconds	Flashing red/green, slow
Step 3: Programming Switch	15 seconds	Flashing red/green, fast
Step 4: Program Finalization	15 seconds	Flashing green (number of times a new actuator can be learned)
Step 5: Ready State	–	Solid red (Power to Release) Solid green (Power to Lock)

Learning Additional Replacement Actuators

The switch will automatically start a new learn process when a unique coded replacement actuator is placed in the sensing field, or “guard-closed” position, of the switch.

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

Locking the Actuator Code

If the actuator is removed from the sensing field and then returned to the sensing field during the 15-second Program Finalization stage (see Step 4 in [Table 12](#)), this 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, no additional replacement actuators can be learned by the switch for the remaining life of the switch. If the actuator is lost or damaged, the switch will need to 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

Prove Basic Lock Function

To prove basic lock function and to verify correct actuator alignment, it is necessary to extend the locking bolt electronically.

IMPORTANT Do not extend the locking bolt mechanically. Using a tool to pull the bolt out of the switch can damage or cause misalignment of the magnet at the end of the bolt. This can cause unreliable operation of the switch.

These basic connections are required:

- Pin 2 (brown wire) must be connected to 24V DC
- Pin 7 (blue wire) must be connected to 0V (GND)

Power to Release

With a Power to Release switch, the locking bolt extends when the guard is closed and the actuator is aligned. Connect Pin 3 (green wire) to 24V DC to unlock the switch and withdraw the locking bolt.

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 manual auxiliary release to unlock the switch.

Power to Lock

With a Power to Lock switch, connect pin 3 (green wire) to 24V DC to lock the switch (for example, extend the locking bolt). When you disconnect pin 3, it unlocks the switch.

If power is removed from a Power to Lock switch in the locked position, the switch unlocks.

In either type of lock, the locking bolt never extends in the absence of the actuator.

Notes:

Diagnostics and Troubleshooting

LED Indicators during Power-up Routine

When power is applied to the switch, the green LED indicators flash slowly three times and then fast three times. See [Table 13](#) for LED status at the conclusion of the power-up routine.

LED Indicators during Normal Operation

[Table 13](#) shows the LED status of the Guardmaster® 440G-LZ guard locking safety switch during normal operation.

Table 13 - Switch Status during Normal Operation

Guard Status	Lock CMD	OSSD Input	Lock Status (1)	Status Indicator	OSSD Status	State
Open or closed	Unlock	Off or on	Unlocked	Solid red	Off	Safe
Open	Lock	Off or on	Unlocked	Fast flash green	Off	Safety Inputs (Safety A+ and Safety B+) are not connected to 24V DC or there is a demand on the device connected in series.
Closed	Lock	Off	Locked	Slow flash green	Off	Ready. Close guard door to lock
Closed	Lock	On	Locked	Solid green	On	Operational

(1) See [Lock Command on page 27](#).

Diagnosis of Switch Condition Using LED Indicators

LED Indicators Off

When the LED indicators are OFF, Bulletin 440G-LZ is not connected properly to either the 24V power supply or ground. Check the power supply and the wiring to the switch. Check that the input voltage is within specification (measures between 20.4V and 26.4V DC).

LED Indicators Solid Green

When the LED indicators are solid green, the switch is in the operational state. The guard door is closed and locked and the OSSD outputs are ON. This is normal operation and no action is required.

LED Indicators Solid Red

When the LED indicators are solid red, the switch is in safe state, meaning the switch is unlocked.

To transition to operational state, close the door, and turn the lock command ON, see [Lock Command on page 27](#).

LED Indicators Flash Green at 1 Hz

When the LED indicators flash green at a 1 Hz rate, the switch is waiting for 24V DC to be applied to the OSSD input signals.

If the 440G-LZ is the only switch or the first switch in a series connection, check that the safety input signals Safety A+ (red wire) and Safety B+ (yellow wire) are connected to 24V DC.

In a series connection, check for a demand on the prior switch to determine why its OSSD outputs are OFF. See [Troubleshoot Series Circuit on page 38](#).

LED Indicators Flash Green at 4 Hz

When the LED indicators are flashing green at a 4 Hz rate, it indicates the Lock command is ON, but the guard door is in the open position (RFID signal is not detected).

If the guard door is confirmed closed and this condition continues, use a spare actuator to confirm the actuator is working properly.

LED Indicators Repeat Flash Pattern—Green 3x, Red 1x

This LED flash pattern occurs when a condition exists that prevents the switch from locking or unlocking successfully. This condition can happen when the guard door is slightly ajar. Confirm that the guard door is closed all the way.

If the door is misaligned and the bolt cannot enter the actuator freely during locking, or if there is a mechanical load applied to the guard door during unlocking, it can also prevent the switch from locking or unlocking successfully. The locking bolt must be free to enter and withdraw from the hole in the actuator without binding.

Check to see if there is a mechanical load applied to the guard door that prevents the bolt from retracting.

IMPORTANT A separately mounted latch (mechanical or magnetic) is recommended to help maintain proper alignment of the guard door.

LED Indicators Flash Red at 1 Hz

When the LEDs flash red at a 1 Hz rate, it indicates a fault condition caused by a possible short circuit. Check that the OSSD outputs are not shorted to ground (0V), 24V DC, or to each other. Cycle power to reset.

LED Indicators Flash Red at 4 Hz

The LED indicators flash red at a 4 Hz rate when an inconsistency is detected with the RFID sensor. This may also happen when there is a condition that prevents the switch from performing as expected. A number of scenarios can cause this fault indication.

Table 14 - Possible Causes of Flashing Red (4 Hz) Fault

Possible Cause	Solution
Actuator moved out of range	The switch will fault if the actuator moves out of range. Check the guard door is rigid without sag. Alternatively, a separately mounted latch (mechanical or magnetic) is recommended to help maintain proper alignment of the guard door.
Cross talk between two switches	Adjacent switches are mounted too close to one another. Confirm minimum distance between any two adjacent switches is 200 mm (7.87 in.), see Pair Proximity on page 19 .
Faulty actuator	Damage to one or to both of the reeds inside the actuator can cause intermittent behavior of the switch. Use a good actuator (known) with the switch to determine if the installed actuator is working properly.
Magnet misalignment	Do not extend the locking bolt mechanically. Use of a tool to pull the bolt out of the switch can damage or cause misalignment of the magnet at the end of the bolt. This can cause unreliable operation of the switch.
Failure to lock	Confirm that the guard door is closed all the way so that the bolt can enter the opening in the actuator without binding.
Failure to unlock	The locking bolt must be free to enter and withdraw from the hole in the actuator without binding. Check to see if there is a mechanical load applied to the guard door that prevents the bolt from retracting. Alternatively, use a door latch to prevent sagging of the guard door, which can cause binding.
Bolt unable to extend or retract	Confirm the switch isn't mounted near a source of metal particles. An accumulation of debris can prevent the bolt from extending or retracting. Power surges can cause permanent damage to the solenoid driver circuit. The 440G-LZ is designed to be used in a NEC Class 2 circuit. Connect the 440G-LZ to a dedicated Class 2 power supply or use electronic circuit protection (for example, cat. no. 1692-ZRCLSS) to confirm NEC Class 2 compliance. The switch may need to be replaced.
Lock command switched too quickly	It is recommended the locking frequency is limited to a 1 Hz maximum with 50% duty cycle (500 ms Lock, 500 ms Unlock).

Diagnosis of Physical Switch Anomalies

Mounting Holes of the Switch Body Cracked or Broken

The mounting holes 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 needed to properly mount the switch body. Washers are not required and when used can cause the holes to crack or break. Do not over torque the screws.

IMPORTANT Loctite 242 thread-locking adhesive is known to cause stress cracks in the 440G-LZ plastic housing 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.

Locking Bolt Discolored and/or Corroded

Discoloration of the end of the locking bolt might be a sign of corrosion caused by incompatibility with a liquid used in the application.

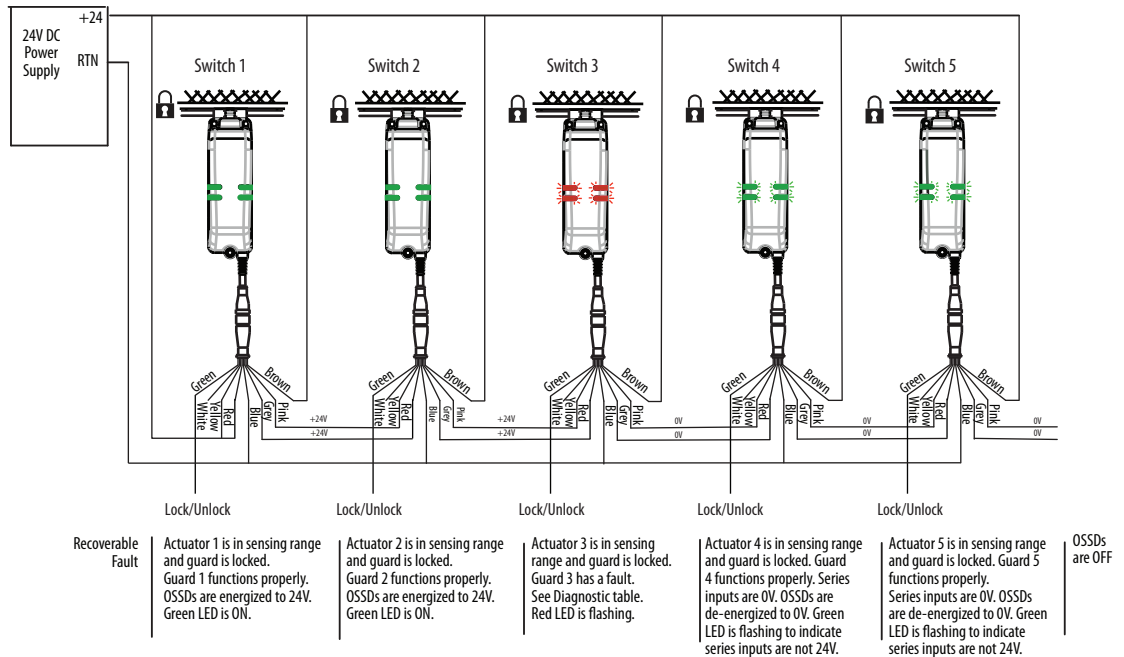
Bulletin 440G-LZ is resistant to most alkaline clean-in-place (CIP) cleaners.

IMPORTANT Synergex is a cleaner that has been identified as marginally compatible.

It is recommended that the switch be thoroughly rinsed with water after exposure to CIP. This step prevents adverse effects that may occur with long-term exposure.

It is also recommended that the switch be mounted in the inverted position with the actuator at the bottom. This position allows liquids to drain away from the locking bolt.

Troubleshoot Series Circuit



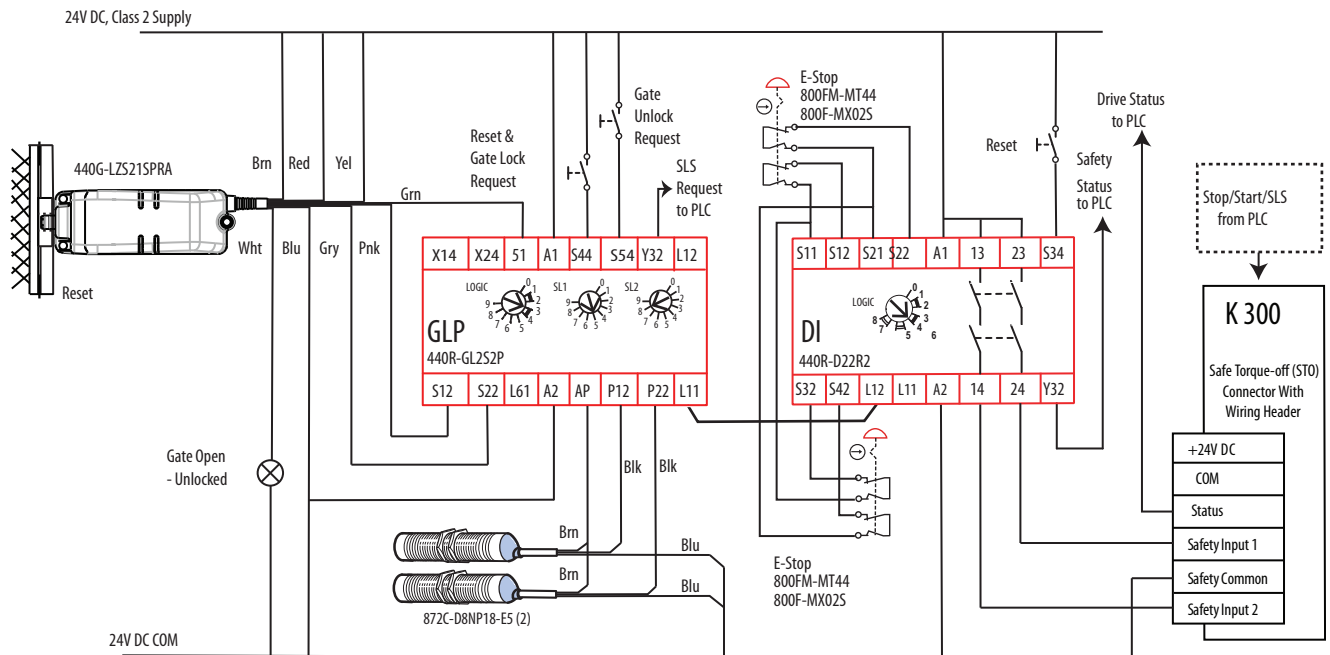
Application Examples

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

Wiring to GLP 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 10](#), the GLP allows the gate to be unlocked when the motor is running at a Safely-limited Speed.

Figure 10 - GLP and 440G-LZ Safety Switch Schematic



Circuit Status as Shown

The gate is open and unlocked. The motor is off. The GLP is ready for reset. The GLP 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.

Safety-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 turns ON and commands the PowerFlex® drive to bring the motor to a safe slow speed (Preset Freq 1). 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.

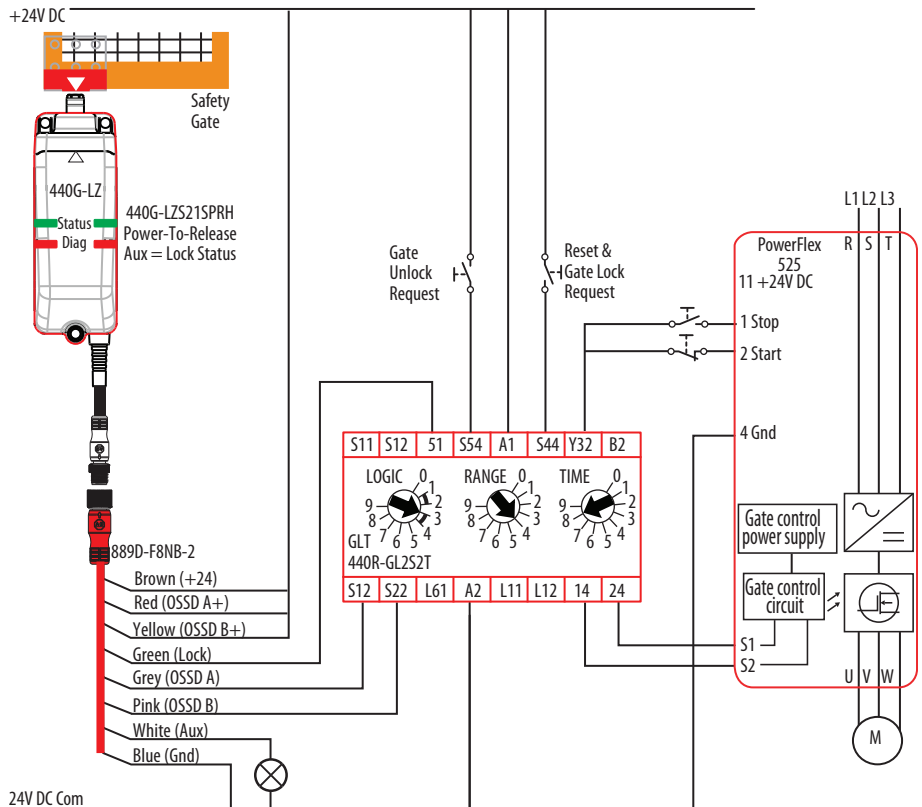
The circuit meets the safety requirements up to Category 3, Performance Level d in accordance with ISO 13849-1 and SIL CL 2 in accordance with IEC 62061.

Wiring to GLT 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 GLP.

In this example shown in [Figure 11](#), the GLT sends an immediate command to the drive to turn OFF. After eight seconds, the GLT 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 11 - GLT and 440G-LZ Safety Switch Schematic



Circuit status as shown: The gate is open and unlocked. The motor is off. The GLT is ready for reset. The GLT 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 PF525 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 turns OFF, which commands the PowerFlex drive to bring the motor to a stop. After the configured time delay (eight 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.

Wiring to DI and EMD Relay

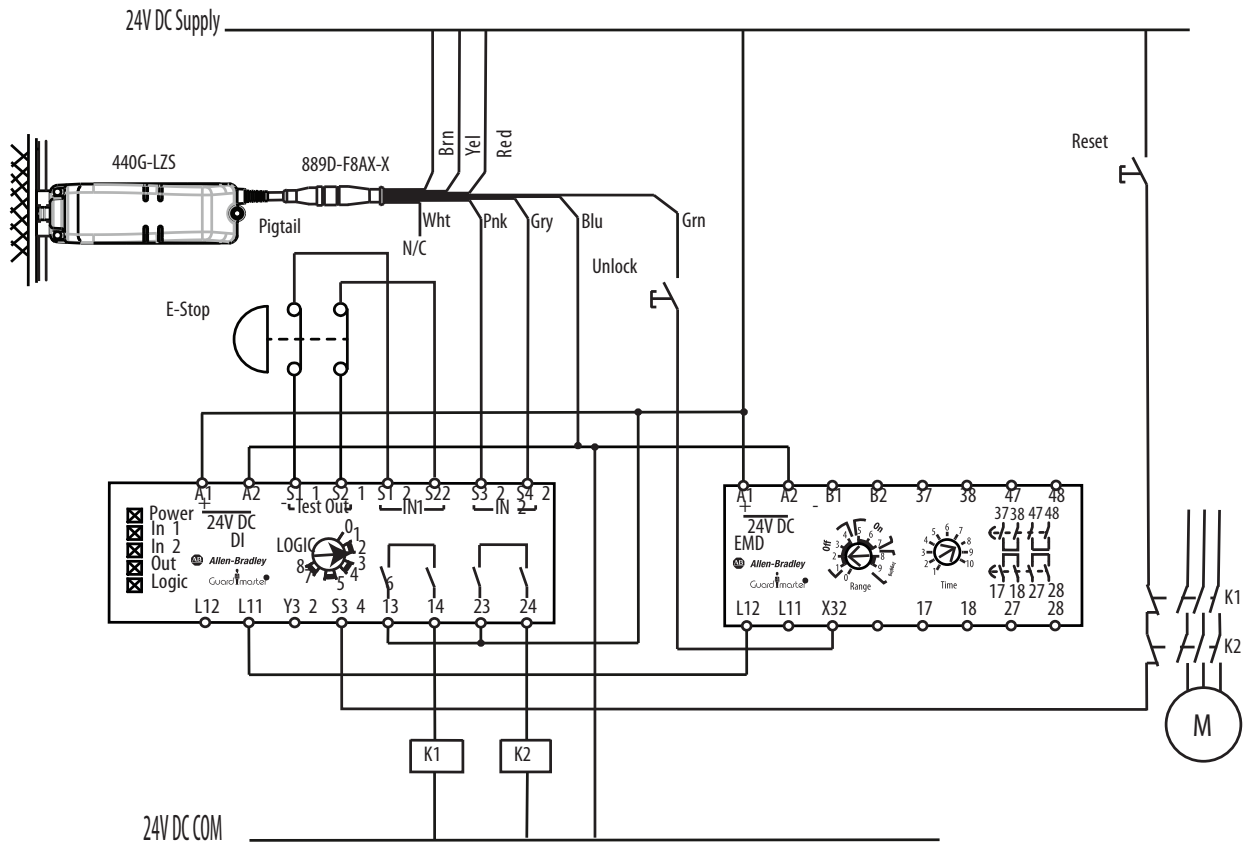
The 440G-LZ safety switch can be connected to the DI and EMD safety relays. The DI monitors the safety outputs of the safety switch and the EMD enables the gate to be unlocked after a configured delay time expires.

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 12 on page 42](#), 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 12 - DI with EMD and 440G-LZ Safety Switch Schematic



Circuit Status as Shown

The E-stop is released. The gate is open and unlocked. K1, K2, K3, and K4 are OFF. The DI is configured for two inputs with monitored manual reset. The EMD 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 (L11) to the EMD (L12) also turns off immediately, and the EMD starts the off-delay timer. After 8 seconds, contactors K3 and K4 turn OFF and X32 goes to 24V. The unlock switch is enabled, and the gate can be unlocked. While the gate is unlocked, the DI 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.

Wiring to DG Relay

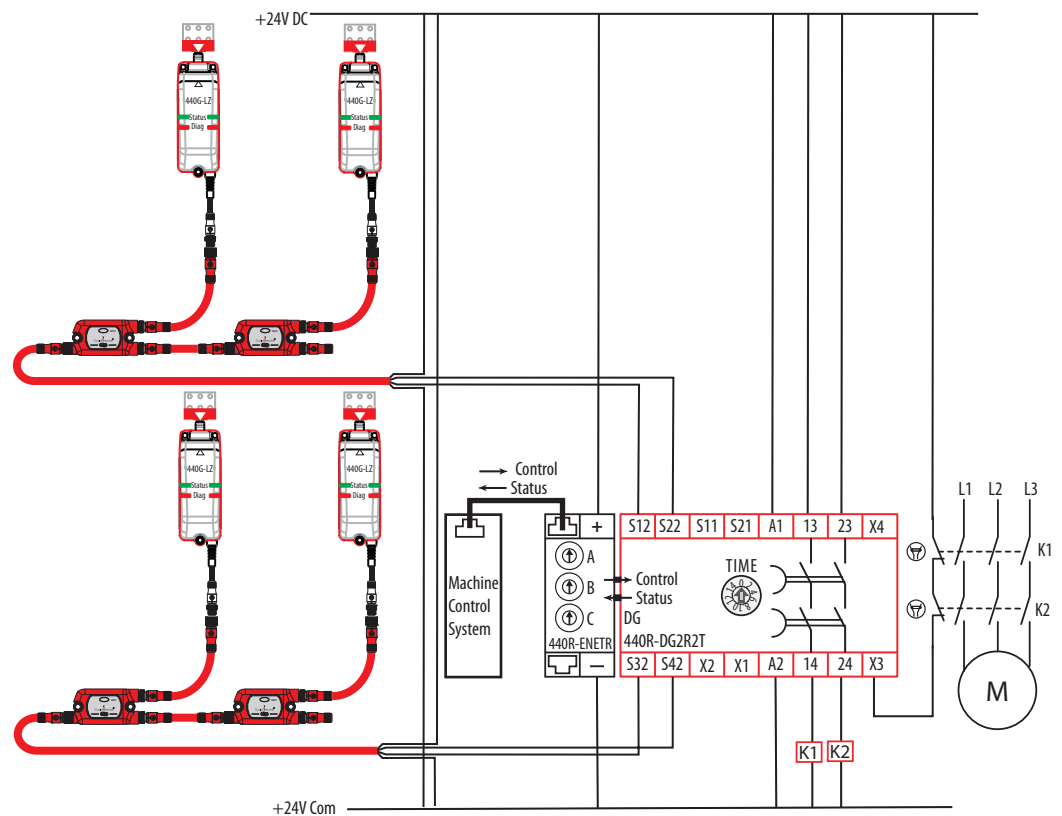
The 440G-LZ safety switch can be used in GuardLink® applications. The GuardLink system:

- 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 13 shows four 440G-LZ safety switches that are connected on two GuardLink circuits from one DG relay. The DG 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 13 - DG with 440G-LZ Safety Switch Schematic



Wiring to CR30 Relay

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

Figure 14 shows an example schematic. The CR30 monitors the motor running signal from the PowerFlex 525. When the motor is not running, the safety gate can be unlocked, and the PowerFlex 525 goes to a Safe Torque Off state.

Figure 14 - CR30 Schematic

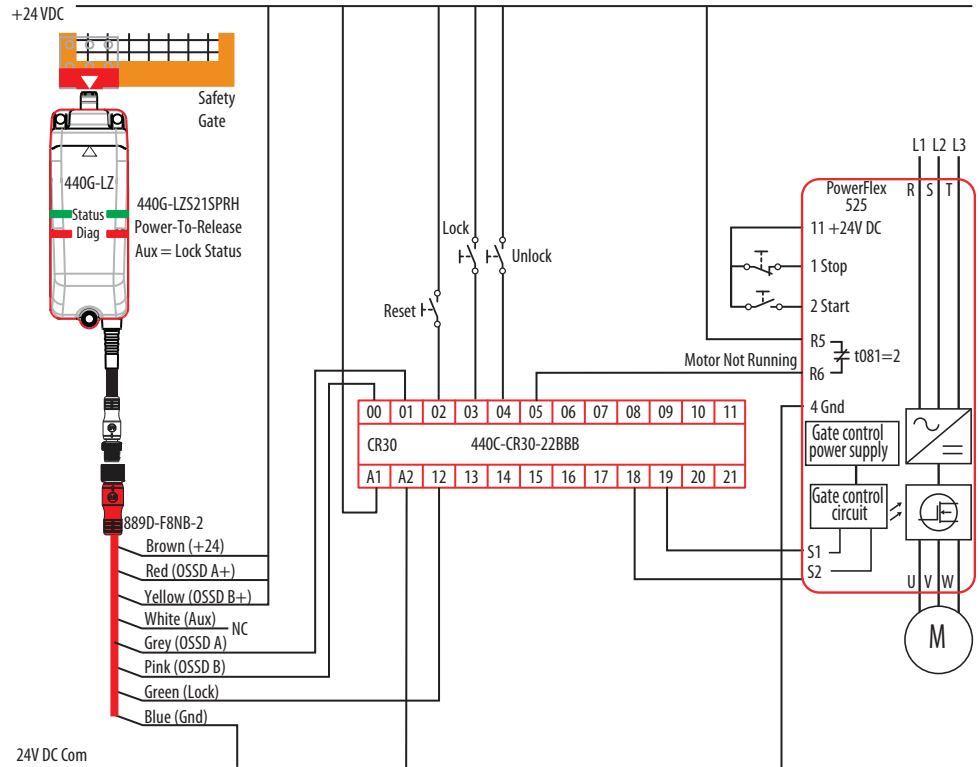
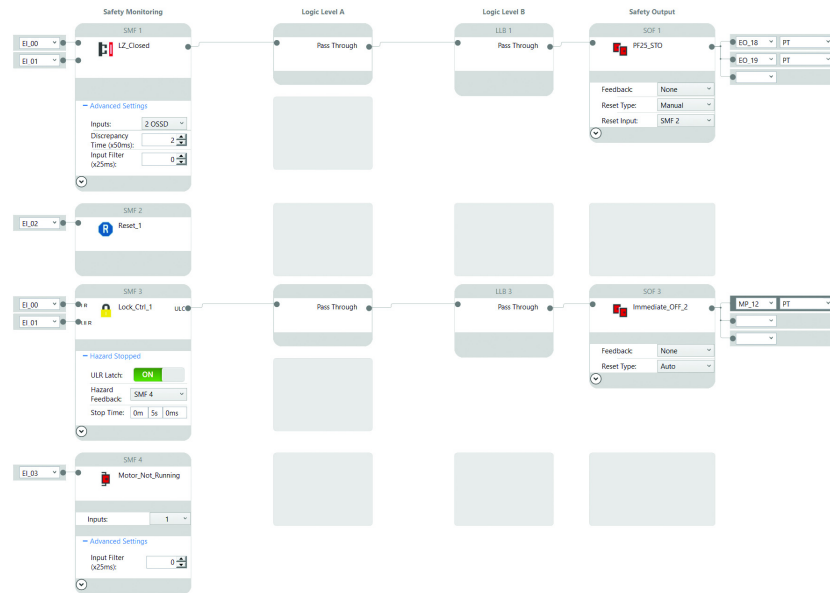


Figure 15 on page 45 shows an example CR30 configuration that works with the schematic in Figure 14.

The safety switch OSSD outputs drive the Safe Torque Off (STO) signals of the PowerFlex 525. The STO is enabled after the gate is locked and the Reset is pressed. The PowerFlex 525 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 five seconds, and the ULR Latch (Unlock Request) is set to ON. When an unlock request is made, the command is issued five seconds after the motor stops running, and the unlock request is latched ON.

Figure 15 - CR30 Configuration in CCW

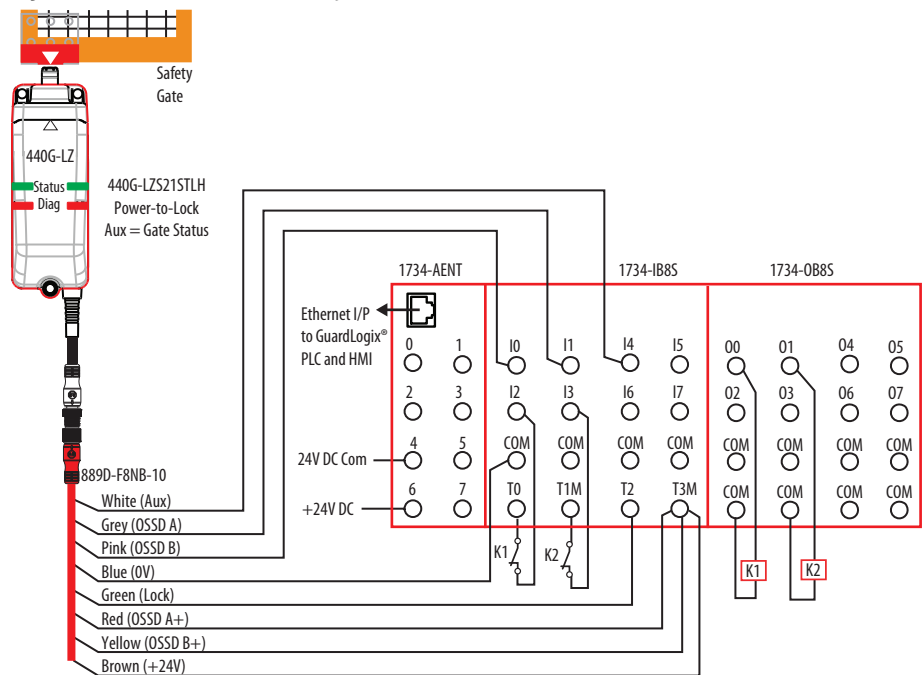


Wiring to 1734 POINT Guard I/O

The 440G-LZ safety switch can be connected to a 1734 POINT Guard I/O™. The cordset (catalog number 889D-F8NB) has 24 AWG wires, which allows three wires to be connected to one terminal.

Figure 16 shows a wiring example of a Power-to-Lock switch with a Door Status auxiliary signal. The PLC logic checks to see if the door is closed before issuing a lock command. The schematic for this example is shown in Figure 21 on page 48.

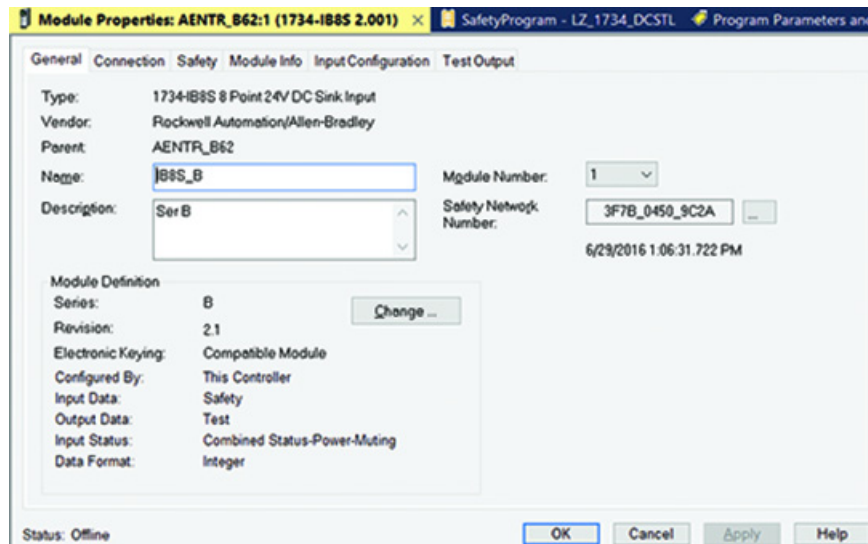
Figure 16 - 1734 and 440G-LZ Safety Switch Schematic



[Figure 17](#) shows the General tab of the 1734-IB8S Module Properties.

The Input Status must be set to “Combined Status – Power – Muting” as this setting is 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 17 - 1734-IB8S Module Properties - General



[Figure 18 on page 47](#) 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-LZ 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-LZ safety switch.

Points 2 and 3 monitor the status of the output contactors, K1 and K2. The Type should be set to Single. The discrepancy time will be dependent on the contactor device. A value other than 30 ms is suggested to prevent nuisance faults over the life of the contactors; other values can be more appropriate. Set Mode to Safety Pulse Test. Safety pulse testing is used to detect potential faults in the monitoring circuit.

Point 4 monitors the auxiliary output of the safety switch. The auxiliary output indicates whether or not the gate is closed. Set Type to Single and Mode to Standard.

Figure 18 - 1734-IB8S Module Properties - Input Configuration

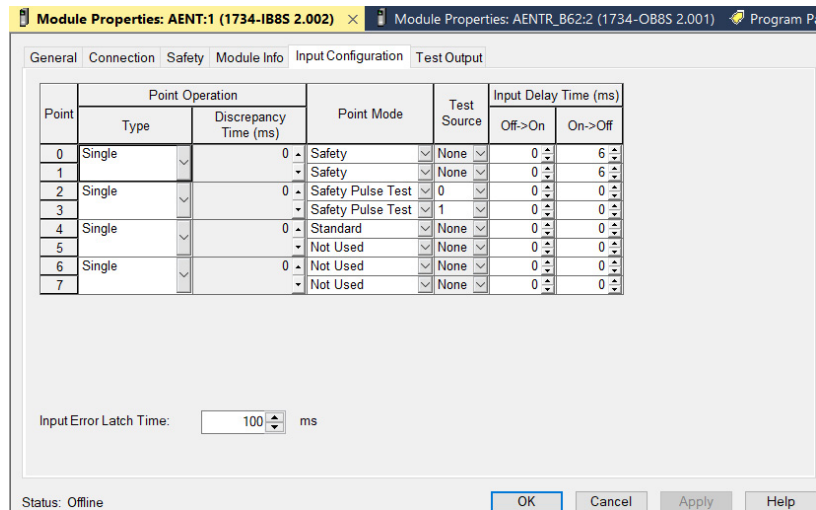
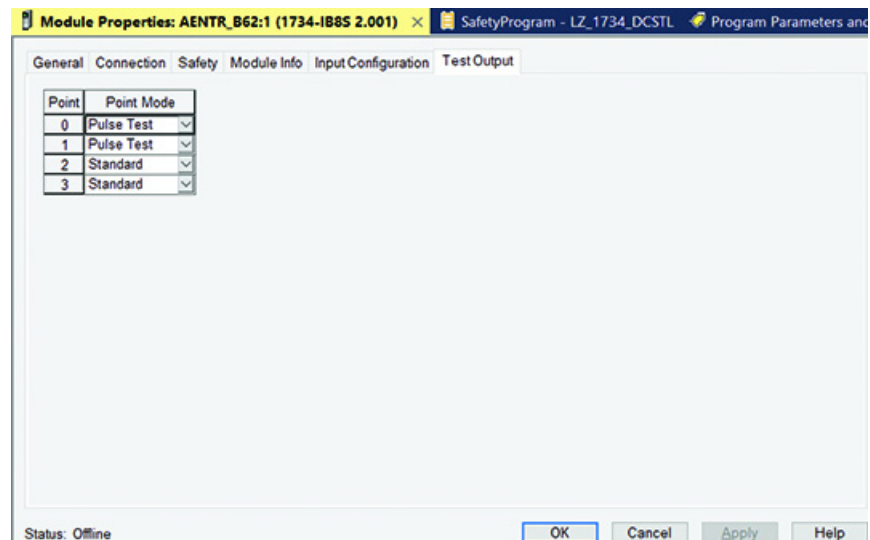


Figure 19 shows the Test Output tab of the 1734-IB8S Module Properties.

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, as well as, supplies power to the OSSD inputs. By setting it to Standard, you can programmatically turn these points OFF and ON.

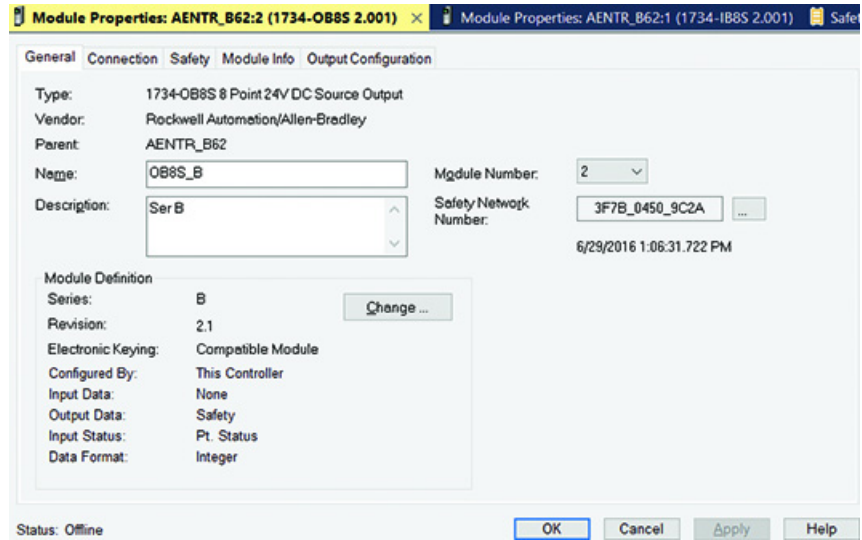
Figure 19 - 1734-IB8S Module Properties - Test Output



[Figure 20](#) shows the General Tab of the 1734-OB8S Module Properties.

The Input Data Status can be set to None. The Output Data must be set to Safety, as it is controlling the output safety contactors.

Figure 20 - 1734-OB8S Module Properties - General



[Figure 21](#) 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 21 - 1734-OB8S Module Properties - Output Configuration

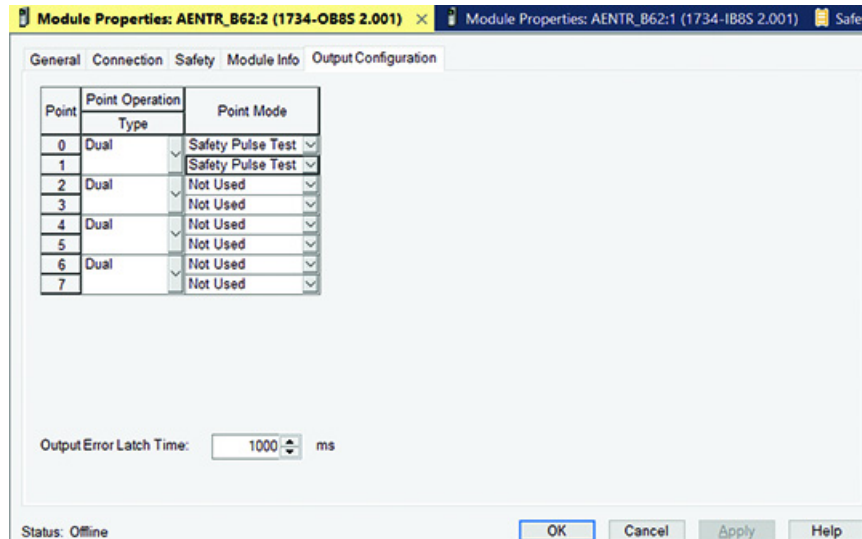
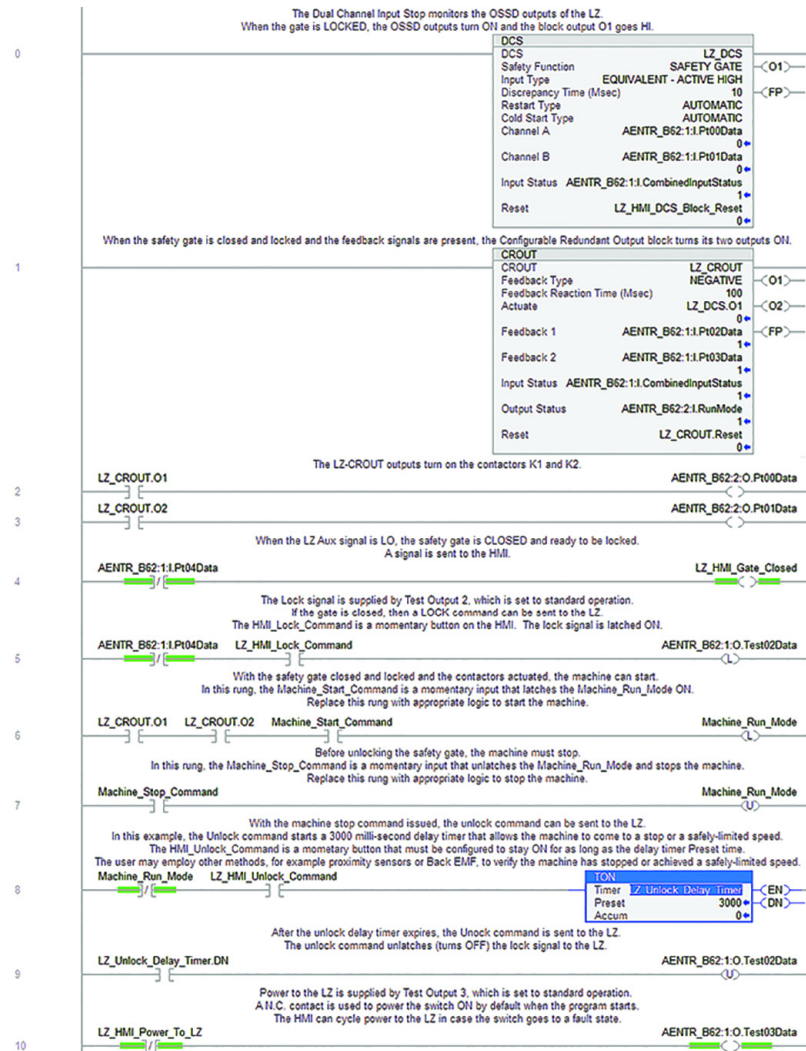


Figure 22 shows an example logic program.

A Dual Channel Input Stop (DCS) function block monitors the safety switch and a Configurable Redundant Output (CROUT) function block control contactors K1 and K2.

Figure 22 - Studio 5000® Example Logic Program



Wiring to 1732 ArmorBlock Guard I/O

The 440G-LZ can be connected to a 1732ES or 1732DS ArmorBlock® by using an 871A-TS5-DM1 field attachable connector. The cordset 889D-F8NB has 24 AWG wires; which allows three wires connected to one pin. An example schematic is shown in Figure 23 on page 50.

As an alternative, the user can use an 871A-TS8-D1 field attachable connector at the 440G-LZ and a 5-wire cordset (889D-M5NC-x)

Figure 23 - ArmorBlock Schematic

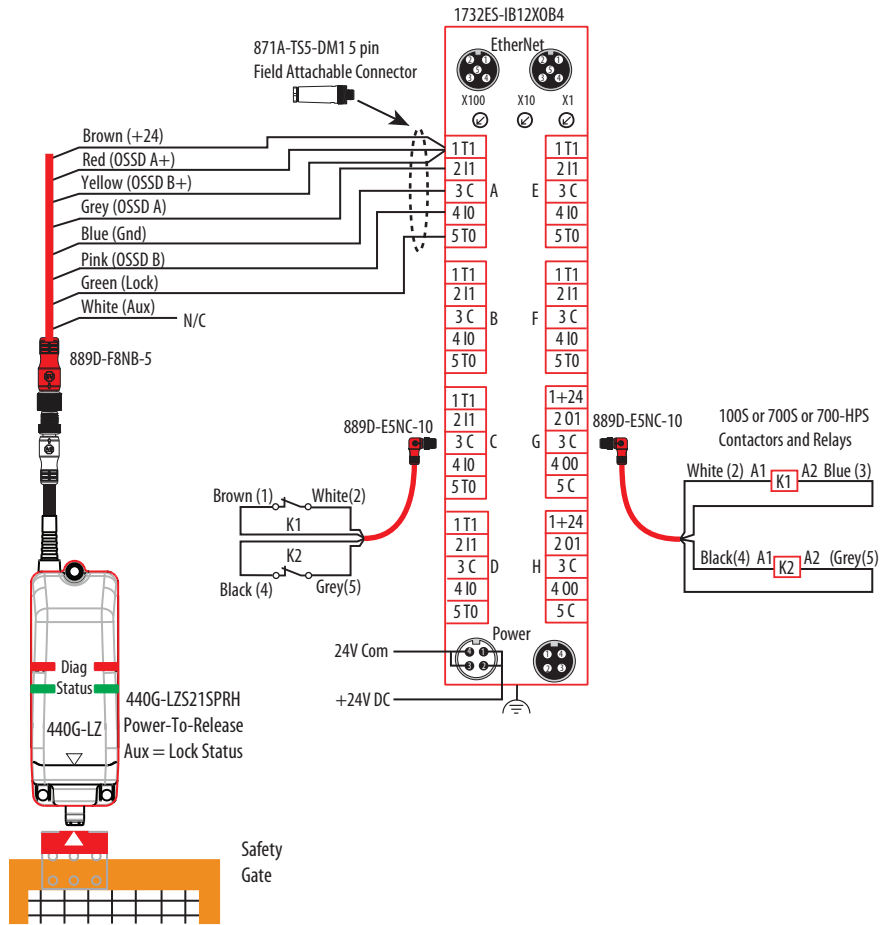


Figure 24 shows the General Tab of the ArmorBlock Module Properties. The Input Status must be set to “Combined Status – Muting” and the Output Data must be set to “Combined.”

Figure 24 - Module Properties – General

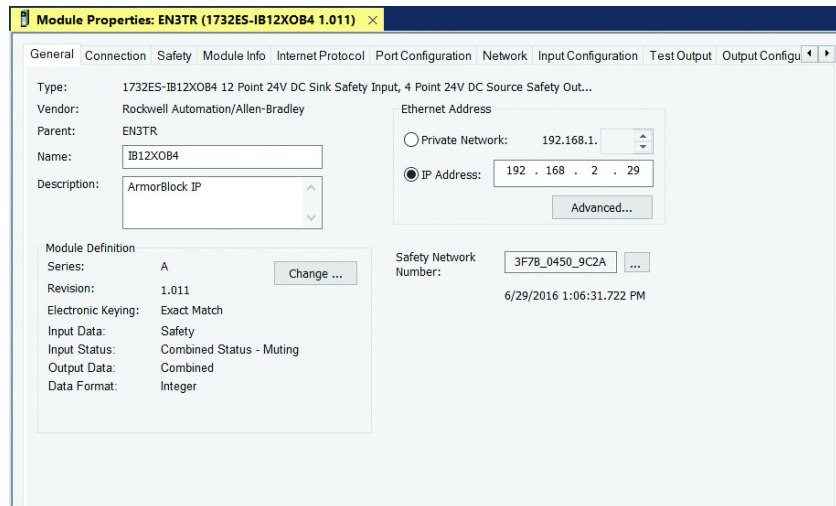


Figure 25 shows the Input Configuration tab of the ArmorBlock Module Properties. In this example, Points 0 and 1 monitor the OSSD outputs of the safety switch. The Type must be set to Equivalent, and Mode must be set to Safety. Points 4 and 5 monitor the status of the output contactors K1 and K2. The Type should be set to Equivalent. The discrepancy time will be dependent on the contactor device — a value other than 30 may be needed. Safety pulse testing is used to detect potential faults in the monitoring circuit.

Figure 25 - Module Properties – Input Configuration

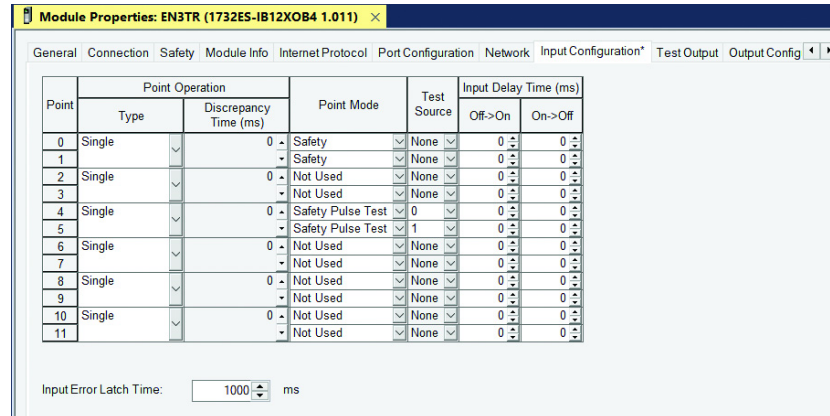


Figure 26 shows the Test Output tab of the ArmorBlock Module Properties. In this example, Points 0 and 1 are set to Standard. This allows these points to be controlled by the program. Point 0 applies power to the 440G-LZ. By setting it to standard, the user can programmatically turn this point off and on if the 440G-LZ switch has a fault condition. Point 1 is the lock/unlock command. In this example, the 440G-LZ 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 26 - Module Properties - Test Output



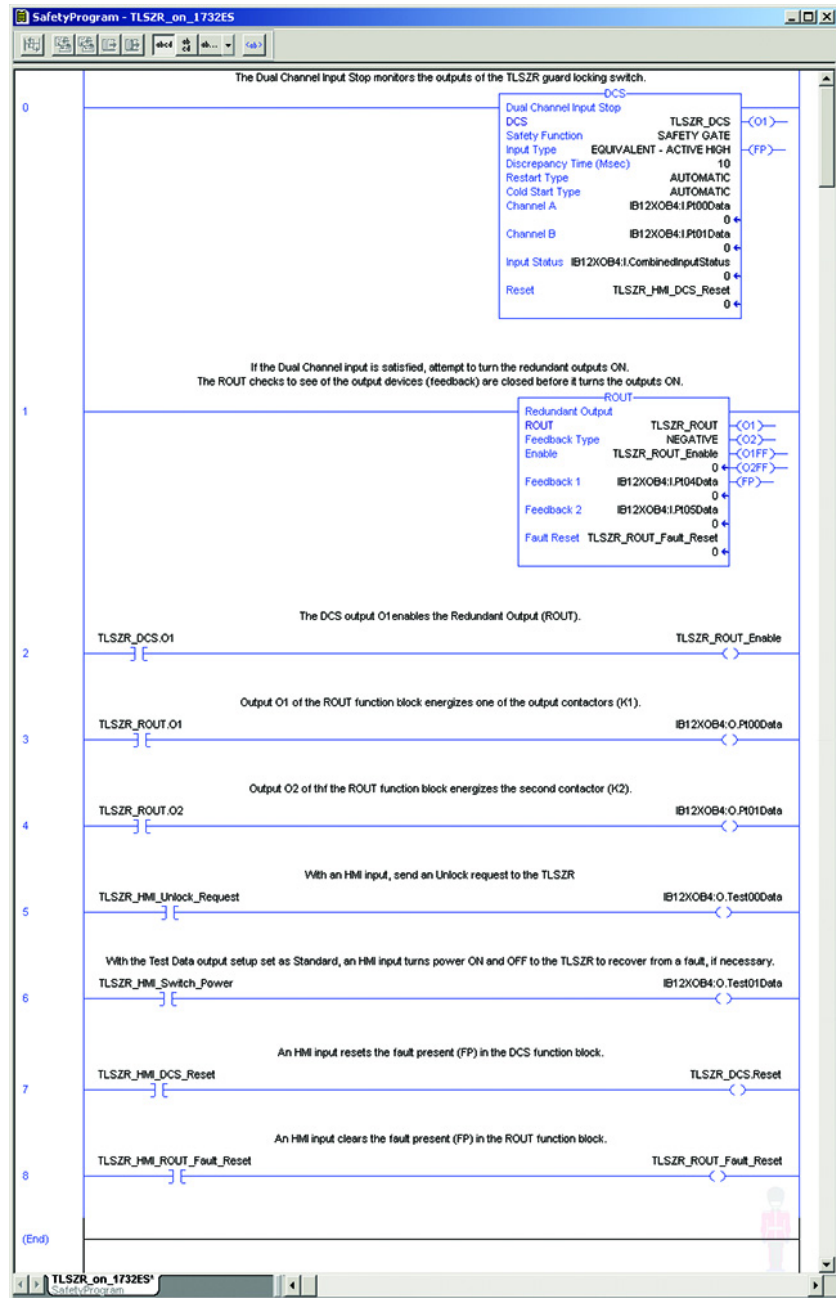
Figure 27 shows the Output Configuration tab of the ArmorBlock Module Properties. Points 0 and 1 drive the output contactors K1 and K2. The point Types are set to Dual, and the Modes are set to Safety.

Figure 27 - Module Properties – Output Configuration



Figure 28 shows an example program. A Dual Channel Input Stop function block monitors the 440G-LZ and a Redundant Output function block controls two contactors. This example can be used as a starting point for implementation; users must incorporate additional logic based on the risk assessment for the machine.

Figure 28 - Example Studio 5000 Program



Specifications and Safety Ratings

Introduction

This appendix provides the specifications and safety ratings for the Guardmaster® 440G-LZ guard locking safety switch.

Table 15 - Operating Characteristics

Attribute	Value
Switch function	OSSDs enable when guard closed and locked
Torque for M5 mounting of switch and actuator mounting bracket	2 N•m (17.7 lb•in) max
Lock bolt insertion for assured lock and hold force	5 mm (0.19 in.) min, 10 mm (0.39 in.) max
Approach speed	2 mm/s, min
Lock bolt alignment tolerance X, Y, Z	± 2.5 mm (0.1 in.), max
Hold force F_{max} (EN ISO 14119)	1,690 N
Hold force F_{zh} (EN ISO 14119) ⁽¹⁾	1,300 N
Maximum output current (each output)	200 mA
Quiescent power consumption, locked or unlocked	2.5 W
Lock signal current	3.5 mA signal on green lock/unlock wire
Peak current, during turn-on or after Lock/Unlock operation	400 mA
Duration of peak current, at turn-on or after Lock/Unlock operation	100 ms
Number of switches connectable in series	Unlimited, see Response Time When Connected in Series Circuit on page 28
Operating voltage U_e	24V DC + 10%/-15% Class 2 SELV
Frequency of operating cycles	0.2 Hz, max
Dwell time between subsequent locking/unlocking	2.5 s
Response time (Off)	100 ms first switch, +50 ms for each additional switch
Risk time	100 ms (according to IEC 60947-5-3)
Start-up time	5 s (availability)
Usage category	DC-13 24V 200 mA, (IEC 60947-5-2)
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
Manual (auxiliary) release	Built-in
Emergency release	No
Escape release	No
Protection class (IEC 61140)	Class II
Mechanical life	500,000 cycles

(1) The holding force F_{zh} is in accordance to EN ISO 14119:2013, clause 5.7.4. Additional validation was performed in accordance with IEC 60947-5-1:2009, clause C.1.2.2.

Table 16 - Safety Ratings

Category	Safety Rating
Standards	IEC 60947-5-3, IEC 60947-5-1, IEC 61508, EN ISO 13849-1, IEC 62061, EN/ISO14119, UL 508
Safety Classification: Guard door sensing and lock monitoring	Type 4 Interlocking Device with Guard Locking with low (standard) and high (unique) coding per ISO 14119 PLe Category 4 per ISO 13949-1, SIL 3 per IEC 61508 and IEC 62061
Functional Safety Data: Guard door sensing and lock monitoring	PFHD: 9.1×10^{-10} Dual channel interlock is suitable for use in applications up to PLe (in accordance with ISO 13849-1) and for use up to SIL 3 systems (in accordance with IEC 62061), depending on application characteristics. Mission time/PT: 20 years

Table 17 - Outputs

Guard Closed and Locked	Description/Status
Safety	2 x PNP, 0.2 A max / ON (+24V DC)
Auxiliary	1 x PNP, 0.2 A max / OFF (+0V DC)

Table 18 - Environmental

Attribute	Value
Operating temperature	0...55 °C (+32...131 °F)
Storage temperature	-25...+75 °C (-13...+167 °F)
Operating humidity	5...95%, relative
Enclosure ingress rating	NEMA 3, 4x, 12, 13, IP66, IP67, IP69K
Shock and vibration	IEC 68-2-27 30 g (1.06 oz), 11 ms/IEC 68-2-6 10...55 Hz
Hygienic	ISO 14159:2004 and EN 1672-2005 (for part of the machine that is defined as food splash area)
Washdown	Suitable for sodium hydroxide-based washdown fluids
Radio frequency / EMC	IEC-60947-5-3, FCC-1 (Parts 18 & 15), R&TTE

Table 19 - General

Attribute	Value
Materials	ABS, lock bolt and mount bracket 304 stainless steel
Weight switch/actuator	Switch 400 g (14.1 oz), actuator 22 g (0.78 oz), actuator mounting bracket 60 g (2.12 oz)
Connection	Flying lead or pigtail with M12 8-pin QD connector (stainless steel)

Table 20 - Protection

Attribute	Value
Short circuit protection	Incorporated
Current limitation	Incorporated
Overload protection	Incorporated
Reverse polarity protection	Incorporated
Overvoltage protection	Incorporated (up to 60V max.)
Thermal shutdown/restart ⁽¹⁾	Incorporated

(1) The OSSD outputs are semi-conductor PNP transistors and are safeguarded against over-temperature at the semi-conductor junction. They are rated at 0.2 A and don't exceed the trip temperature unless the current significantly exceeds this rated value. This protection does not trip out the complete switch when it is exposed to ambient temperatures greater than 55 °C (131 °F). It would only switch off the OSSDs and the LED indicators would flash red to indicate a non-recoverable fault.

Certifications

See the Product Certification link at 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
- C-Tick 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 and for lock monitor according to EN ISO 14119:2013.

Compliance to European Union Directives

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

For a complete list of standards used (including Machine Safety Directive and EMC Directive), See [Compliance to European Union Directives on page 55](#) of this manual.

Dimensions

Figure 29 - Switch Body

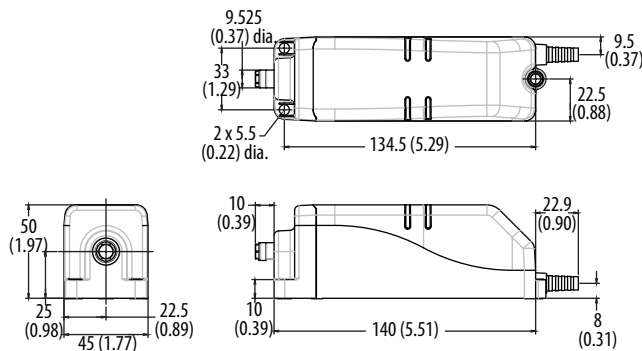


Figure 30 - Actuator and Actuator Mounting Bracket

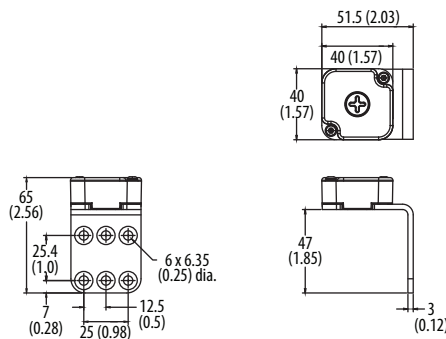
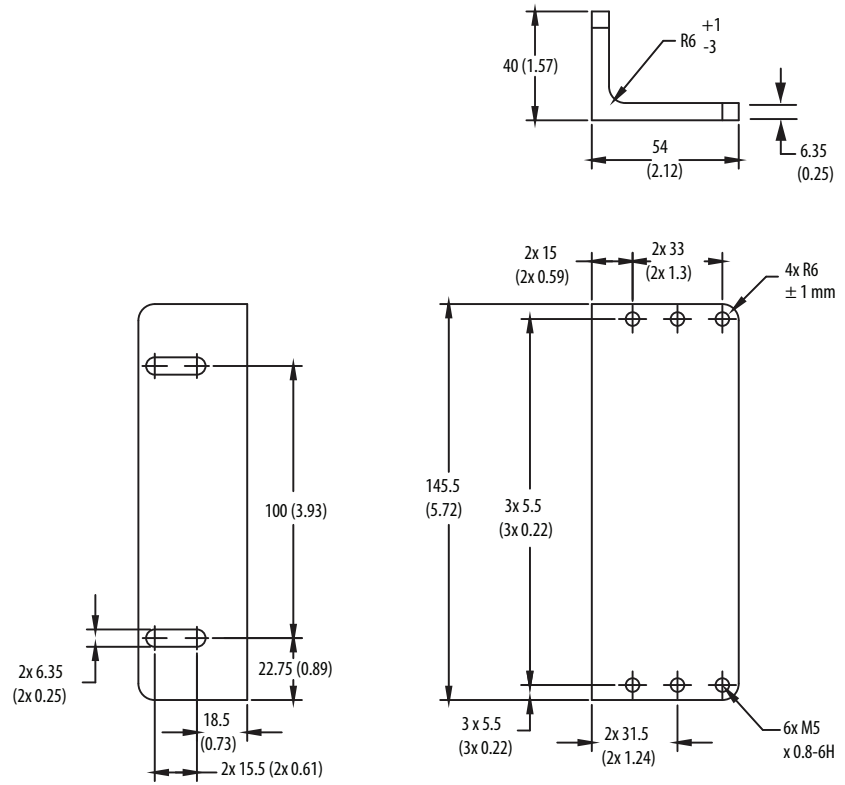


Figure 31 - Switch Mounting Bracket 440G-LZAM2

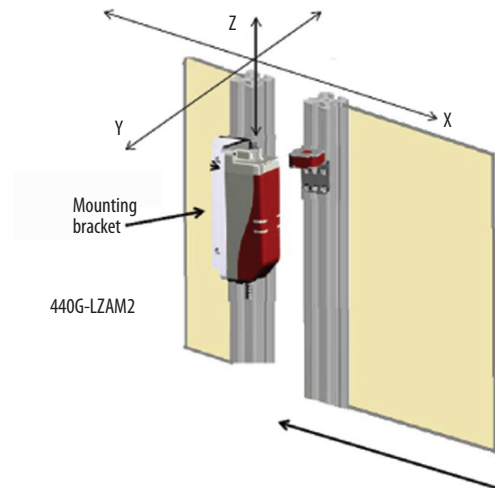


Typical Installations

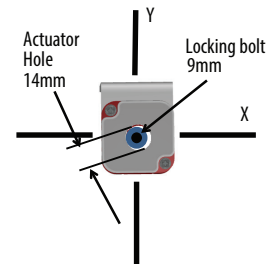
Switch Mounted Parallel to Hinge Axis

The X and Y positions can be adjusted using the slotted holes of the mounting bracket and appropriate selection of the three pairs of actuator bracket holes, once the bracket is centered.

The tolerance to misalignment is ± 2.5 mm (0.10 in.).



The Z (height) position is adjusted by sliding the actuator bracket up/down on the profile. If the setting gap is centered between the minimum of 0 mm and the maximum of 5 mm (0.20 in.), a tolerance to misalignment of ± 2.5 mm (0.10 in.) is achieved.



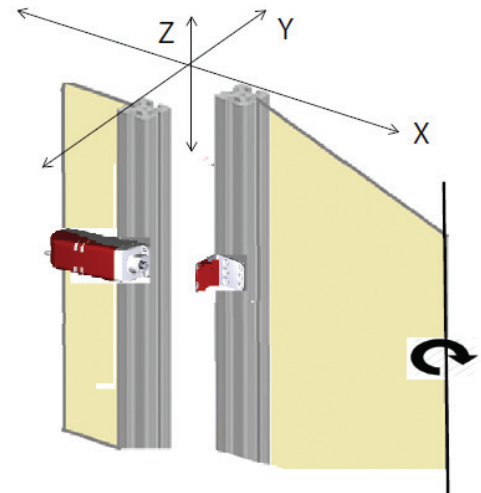
The Z position can be carefully selected to offset the anticipated door sag or door drop. Simultaneously, be sure that the alignment is such that it is not possible to lift the door up and off the locking bolt. Also make sure that there is no possibility that the actuator would collide with the switch when the guard door is being closed. It is essential to check the alignment periodically throughout the use of the guard locking switch.

Switch Mounted Perpendicularly to Hinge Axis

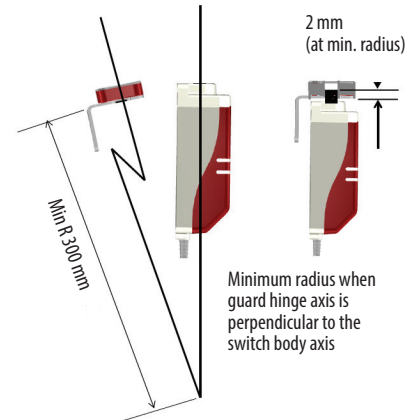
The Z (height) position is adjusted by sliding the actuator bracket up/down on the profile. If the setting gap is centered between the minimum of 0 mm and the maximum of 5 mm (0.20 in.), a tolerance to misalignment of ± 2.5 mm (0.10 in.) is achieved.

The X and Y positions can be adjusted using spacers underneath the switch and appropriate selection of the three pairs of actuator bracket holes, once the bracket is centered.

The tolerance to misalignment is ± 2.5 mm (0.10 in.).



The Z position can be carefully selected to offset the anticipated door sag or door drop. Simultaneously, be sure that the alignment is such that it prohibits lifting the door up and off the locking bolt. Also check to be sure there is no possibility that the actuator would collide with the switch when closing the guard door. It is essential to check the alignment periodically throughout the use of the guard locking switch.

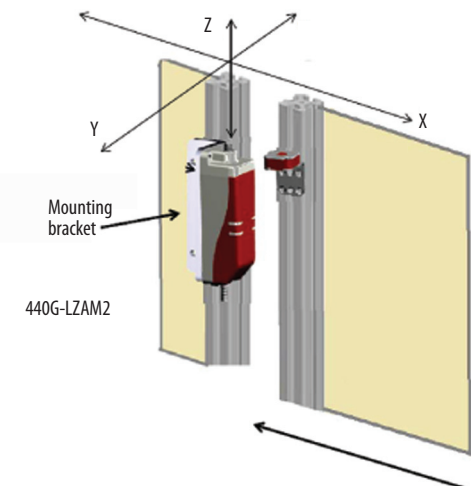


Switch Mounted to a Sliding Guard Door

The Z (height) position is adjusted by sliding the actuator bracket up/down on the profile. If the setting gap is centered between the minimum of 0 mm and the maximum of 5 mm (0.20 in.), a tolerance to misalignment of ± 2.5 mm (0.10 in.) is achieved.

The X and Y positions can be adjusted using the slotted holes of the mounting bracket and appropriate selection of the three pairs of actuator bracket holes, once the bracket is centered.

The tolerance to misalignment is ± 2.5 mm (0.10 in.).



EU Declaration of Conformity

For Product Certifications, visit our website at rok.auto/certifications.

Notes:

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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)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

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