

Reference Manual

Original Instructions



**Allen-Bradley**

Guardmaster®

# Minotaur Safety Relay (MSR) to Guardmaster Safety Relay (GSR) Conversion – Phase 3

Bulletin Number 440R



## Important User Information

Read this document and the documents listed in the additional resources section about installation, configuration, and operation of this equipment before you install, configure, operate, or maintain this product. Users are required to familiarize themselves with installation and wiring instructions in addition to requirements of all applicable codes, laws, and standards.

Activities including installation, adjustments, putting into service, use, assembly, disassembly, and maintenance are required to be carried out by suitably trained personnel in accordance with applicable code of practice.

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

In no event will Rockwell Automation, Inc. be responsible or liable for indirect or consequential damages resulting from the use or application of this equipment.

The examples and diagrams in this manual are included solely for illustrative purposes. Because of the many variables and requirements associated with any particular installation, Rockwell Automation, Inc. cannot assume responsibility or liability for actual use based on the examples and diagrams.

No patent liability is assumed by Rockwell Automation, Inc. with respect to use of information, circuits, equipment, or software described in this manual.

Reproduction of the contents of this manual, in whole or in part, without written permission of Rockwell Automation, Inc., is prohibited

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).

---

	<b>Preface</b>	
	Summary of Changes .....	6
	Additional Resources .....	6
	<b>Chapter 1</b>	
<b>Introduction</b>	GSR Benefits .....	8
	Conversion Concerns .....	8
	<b>Chapter 2</b>	
<b>CU2 Control Unit</b>	Terminal Location and Panel Space .....	12
	Wiring Schematics .....	13
	Output Load Capability .....	14
	<b>Chapter 3</b>	
<b>MSR7R and MSR7C Safety Relay</b>	Terminal Location and Panel Space .....	16
	Wiring Schematics .....	16
	Maximum Input Impedance .....	17
	Response Time.....	18
	Output Load Capability .....	18
	<b>Chapter 4</b>	
<b>MSR9T Safety Relay</b>	Terminal Location and Panel Space .....	19
	Wiring Schematics .....	20
	Maximum Input Impedance .....	21
	Input Simultaneity .....	21
	Response Time.....	21
	Output Load Capability .....	21
	<b>Chapter 5</b>	
<b>MSR33 Safety Relay</b>	Terminal Location and Panel Space .....	23
	Wiring Schematics .....	24
	Input Simultaneity .....	25
	Response Time.....	25
	Output Load Capability .....	25
	<b>Chapter 6</b>	
<b>MSR35 Safety Relay</b>	Terminal Location and Panel Space .....	27
	Wiring Schematics .....	28
	Response Time.....	29
	Output Load Capability .....	29

	<b>Chapter 7</b>	
<b>MSR121RT Safety Relay</b>	Terminal Location and Panel Space.....	31
	Wiring Schematics .....	32
	Response Time.....	35
	Output Load Capability .....	36
	<b>Chapter 8</b>	
<b>MSR124RT Safety Relay</b>	Terminal Location and Panel Space.....	38
	Wiring Schematics .....	38
	Response Time.....	41
	Output Load Capability .....	41
	<b>Index</b> .....	43

A number of older Allen-Bradley Guardmaster® safety relays will be discontinued and no longer be available for sale. This publication suggests examples for how to convert these existing safety relay applications to safety relays with the latest technologies.

The products that are described in this publication can be used in various ways. Therefore, designers must verify that all steps have been taken to verify that each application and use of this control equipment meets all performance and safety requirements. Designers must consider applicable laws, regulations, codes, and standards.

The wiring diagrams in this publication are intended as examples. Because many variables and requirements are associated with any particular installation, Rockwell Automation does not assume responsibility or liability for actual use that is based on these examples.

This publication is intended for machine safeguarding system designers who have been adequately trained in the design and use of safeguarding systems and risk assessments.

The following MSR safety relays will continue to be offered for the foreseeable future (five, or more, years).

MSR Family	Cat. No.	MSR Family	Cat. No.	MSR Family	Cat. No.	
MSR117	440R-B23211	MSR127	440R-N23126	MSR138	440R-M23080	
	440R-D23171		440R-N23129		440R-M23143	
MSR125	440R-D23170		440R-N23125		440R-M23143S	
	440R-D23169		440R-N23128		440R-M23141	
	440R-D23168		440R-N23124		440R-M23140	
	440R-D23166		440R-N23127		440R-M23147	
	440R-D23164		440R-N23132		440R-M23147S	
	440R-D23163		440R-N23135		440R-M23145	
	440R-N23117		440R-N23132S		440R-M23144	
MSR126	440R-N23116		440R-N23135S		440R-M2315	
	440R-N23115		440R-N23131		MSR138	440R-M23149
	440R-N23114		440R-N23134		440R-M23148	
	440R-N23113		440R-N23130		440R-M23084	
	440R-N23112		440R-N23133		440R-M23082	
	440R-N23123		440R-N23213		440R-M23081	
	440R-N23122		MSR132	440R-M23088		
	440R-N23121	440R-E23191		440R-M23086		
	440R-N23120	440R-E23192		440R-M23085		
	440R-N23119	440R-E23193		440R-M23092		
	440R-N23118	440R-E23194		440R-M23090		
MSR131	440R-C23139	440R-E23195		440R-M23089		
	440R-C23139S	440R-E23097		MSR142	440R-G23214	
	440R-C23137	440R-E23159		440R-G23215		
	440R-C23136	440R-E23160		440R-G23216		
		440R-E23098				
		440R-E23161				
		440R-E23162				

## Summary of Changes

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

Topic	Pages
Updated series reference for CU2 Control Units	11
Updated AC voltage in <a href="#">Table 5</a> footnote	19
Updated text	40 and 41

## Additional Resources

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

Resource	Description
Guardmaster EtherNet/IP Network Interface User Manual, publication <a href="#">440R-UM009</a>	Provides detailed information to install, wire, configure, troubleshoot, and use the EtherNet/IP™ module.
Guardmaster Safety Relays User Manual, publication <a href="#">440R-UM013</a>	Provides detailed information to install, wire, configure, troubleshoot, and use Guardmaster safety relays.
System Design for the Control of Electrical Noise Reference Manual, publication <a href="#">GMC-RM001</a>	Provides a thorough review of the installation and grounding of noisy components and what can be done to minimize their potential for injecting noise into the system.
Industrial Automation Wiring and Grounding Guidelines, publication <a href="#">1770-4.1</a>	Provides general guidelines for installing a Rockwell Automation® industrial system.
Product Certifications website, <a href="http://www.rockwellautomation.com/global/certification/overview.page">http://www.rockwellautomation.com/global/certification/overview.page</a>	Provides declarations of conformity, certificates, and other certification details.

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

## Introduction

The next generation Guardmaster safety relay (GSR) family is a high-quality replacement for most of the Minotaur™ safety relay (MSR) family.

The consistent 22.5 mm (0.9 in.) wide housing design and configurable functions for reset and logic of GSR modules let you consolidate various functions of MSR modules with fewer relays. These features help you reduce your stocking requirements.

The MSR family of safety relays typically offers one dedicated safety function, for each safety circuit and actuator. MSR solutions have less connectivity to each other than GSR modules. If you add additional safety circuits, those circuits require additional safety relay modules and safety contacts for cascading to maintain PLd or PLe safety ratings according to EN ISO 13849-1 or SIL 2 or SIL 3 according to IEC 62061.

The GSR family of safety relays offers configurable safety functions and consolidated safety circuits, which result in fewer units, less space, and less cost. Due to the unique capability to cascade single-wire safety (SWS), logic combinations and zones are constructed quickly.

A replacement with GSR modules is meant to be more than just a swap out.

New Machinery Directives have changed machine designs over the years. These changes have harmonized standards and demands of safety solutions that contribute to productivity and flexibility.

This publication offers detailed information to help with your conversion from the legacy MSR family to a smarter and cost-effective machine design in compliance with the latest requirements of Machinery Directive and harmonized standards.

For further assistance in replacing those devices contact [Rockwell Automation Support](#), your local Allen-Bradley distributor, or Rockwell Automation sales office.

## GSR Benefits

The GSR family of safety relays provides the following benefits:

- One or two (dual-channel) inputs
- Single wire safety (SWS) expansion
- Narrow package (less panel space)
- Configurable operation
- Cat 4 PLe and SIL 3 rating on most models
- RoHS compliance

## Conversion Concerns

It is widely recognized that product obsolescence is a part of the industrial business cycle. This publication provides cost-effective recommendations for converting your MSR family of safety relays to the state-of-the-art GSR family, and considers the following major concerns.

### Panel Space

Many control panel designers leave space in their panels for future expansion and improvements. If that extra panel space gets used, then panel space can become tight. With panel space in mind, the recommended conversion is intended to maintain, or even reduce, panel space.

### Wiring Terminal Location

A wire that is moved from the top of the old device to the bottom of the new device in a control panel cannot be taken lightly. Each of the recommended conversions shows the terminal locations of the old and new devices, so you can plan the conversion appropriately.

### Wiring Change

Example schematics that compare the older device and the recommended newer device are provided for each of the applications that the older device can provide.

### Response Time

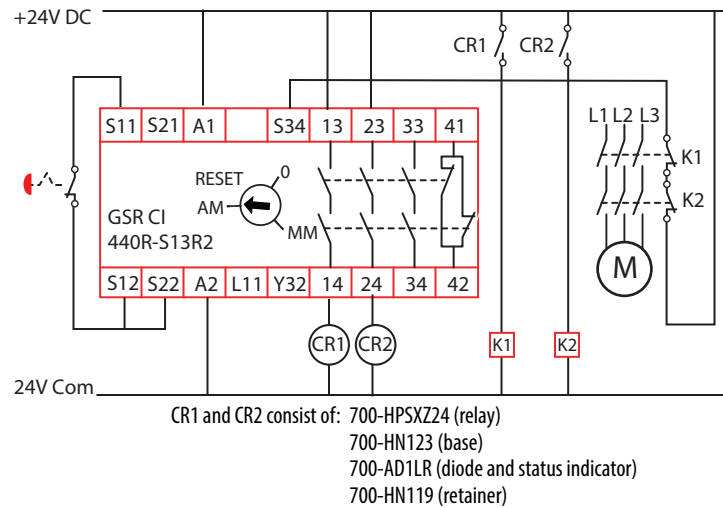
Response time is the time that is required to perform the safety function. For each conversion, the comparable response time is provided. An increase in the response time requires you to adjust the safety distance. This increase is not as much of an issue when a safety gate must be opened manually. However, this additional response time is likely to be an issue when presence-sensing devices like light curtains and safety mats are used.



## Output Load Capability

Every safety relay has limitations on the amount of current the relay can switch or carry. When the load exceeds the rating of the safety relay, interposing relays can be used as shown in [Figure 1](#).

**Figure 1 - Output Load Capability Using Interposing Relays**



**Notes:**

## CU2 Control Unit

**Figure 2 - CU2 Control Unit**



We recommend replacing the CU2 control unit with a GLP (Series A 205 or later) safety relay.

Both the CU2 control unit and GLP safety relay use two proximity sensors to sense the motion of the hazard. The CU2 control unit uses one proximity sensor with an NPN output and the second proximity sensor with a PNP output. The GLP safety relay requires PNP outputs for both proximity sensors.

The GLP safety relay has a multi-position switch that lets you configure the GLP safety relay functionality. Switch positions 5, 6, 7, and 8 reflect the functionality of the CU2 control unit. Additional functionalities (Cat 1 stop, safely-limited speed, single wire safety expansion, unlock request, reset, and lock request) are achieved with logic settings 1, 2, 3, and 4.

The CU2 control unit offers automatic/manual reset with the Y1/Y2 terminals. When the GLP safety relay is configured for logic settings 5, 6, 7, or 8, the GLP safety relay ignores the S44 reset input and operates in automatic mode.

[Table 1](#) shows the recommended conversions. With 110/230V AC supply voltages, many other Bulletin 1606 power supplies can be used. If voltage-free contacts are needed, the single wire safety signal from the GLP safety relay can drive the EM safety relay.

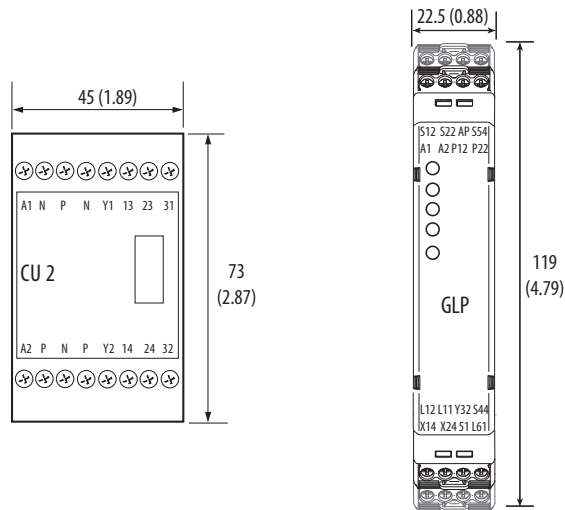
**Table 1 - Conversion Table**

Supply Voltage	CU2 Cat. No.	GLP Cat. No.	EM Cat. No.
24V AC/DC	440R-S07139	440R-GL2S2P	440R-EM4R2
110/230V AC	440R-S07140	440R-GL2S2P with 1606-XLP15E	

## Terminal Location and Panel Space

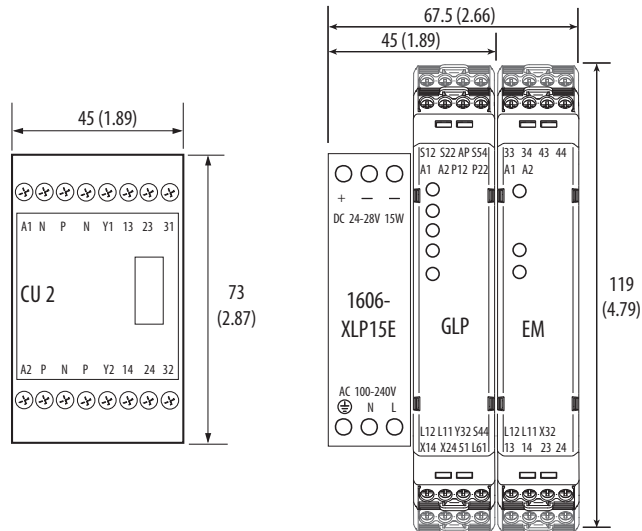
The CU2 control unit is 45 mm (1.8 in.) wide and has one row of terminals at the top and bottom. The GLP safety relay is only 22.5 mm (0.9 in.) wide and has two rows of terminals at the top and bottom.

**Figure 3 - DC Powered Terminals and Panel Space [mm (in.)]**



The CU2 control unit can also be ordered with a 110/230V AC power supply. Because the GLP safety relay is DC powered, a power supply (catalog number 1606-XLP15E) must be used to convert the AC supply to 24V DC. This configuration occupies the same amount of space as one CU2 control unit.

**Figure 4 - AC Powered Terminals and Panel Space [mm (in.)]**

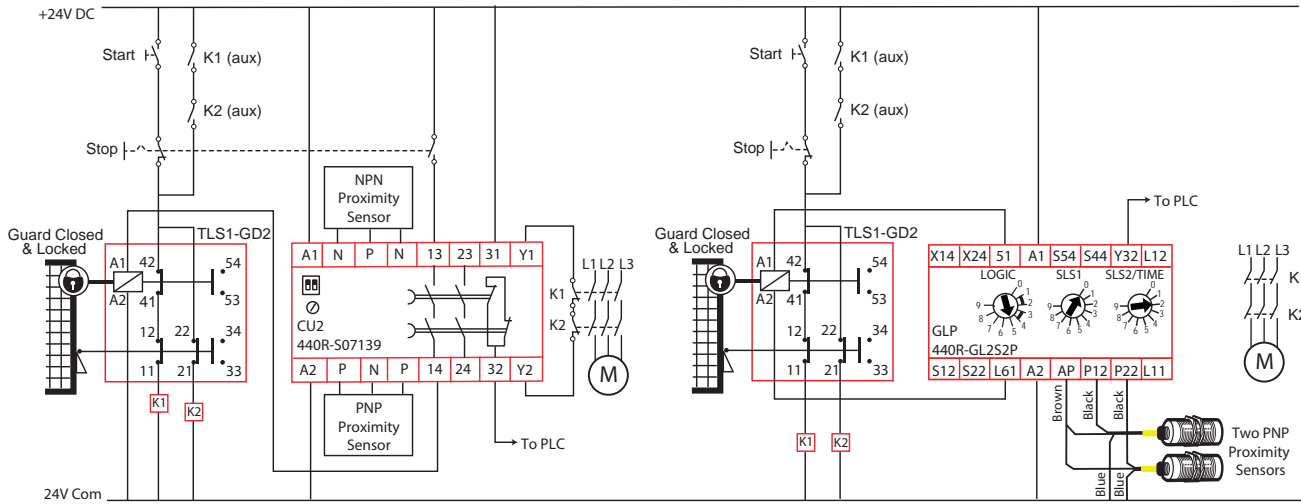


# Wiring Schematics

The following schematics compare the wiring of your existing MSR module to the recommended newer devices for each application that the existing device provides.

## DC Powered

Figure 5 - DC Powered Schematic



## AC Powered

Figure 6 - AC Powered Schematic

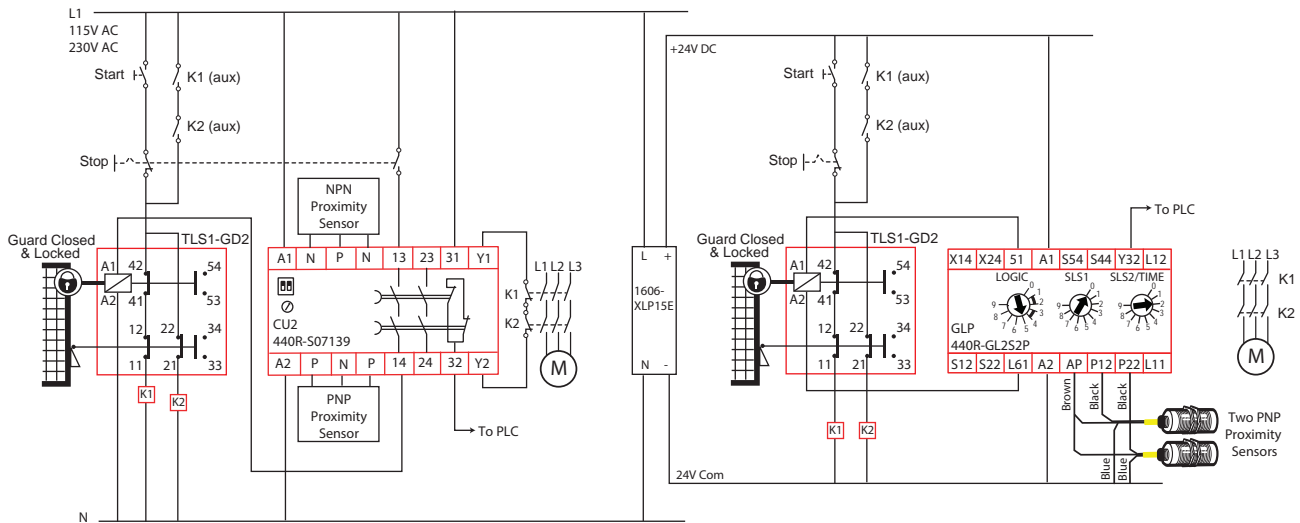
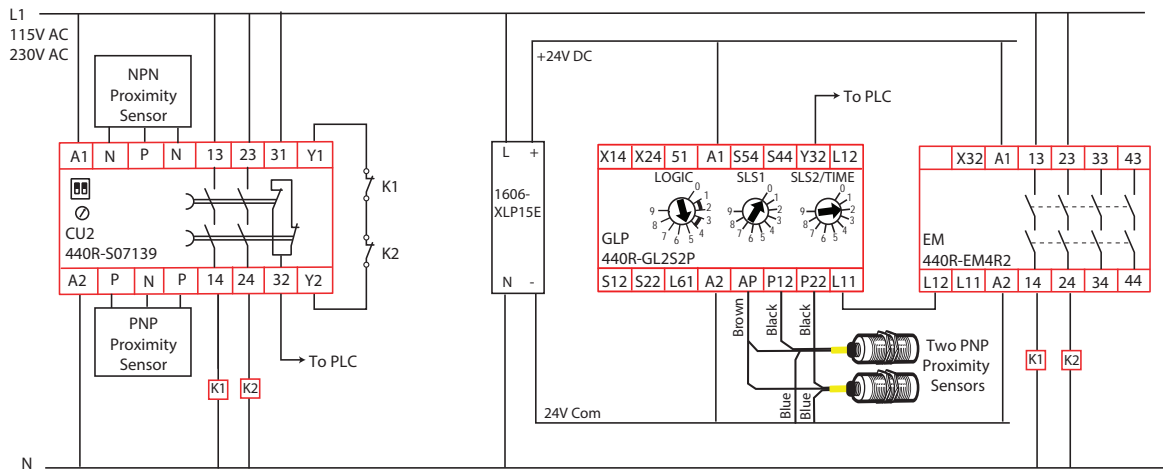


Figure 7 - AC Powered Loads Schematic



## Output Load Capability

The CU2 control unit has voltage-free output contacts, while the GLP safety relay has solid-state outputs. The GLP safety relay can easily expand its output capability with the single wire safety connection to an EM expansion relay, which has voltage-free contacts. Use an interposing relay if additional current capability is needed. [Table 2](#) shows the current capability of the three relays.

Table 2 - Current Capability

Load Type	CU2	GLP	EM
AC Inductive	B300, AC-15 5 A/120,250V	—	B300 AC-15 1.5 A / 250V AC
DC	DC-13 3 A/24V DC	0.5 A/24V DC	DC13 2 A/24V DC (0.1 Hz)
Thermal (non-switching)	4 A	0.5 A	1 x 6 A

## MSR7R and MSR7C Safety Relay

Figure 8 - MSR7R and MSR7C Safety Relay



We recommend replacing both the MSR7R and MSR7C safety relays with the MSR125H/HP safety relay. The replacement catalog numbers are shown in [Table 3](#). The MSR125H/HP safety relay is one of the MSR relays that will remain available for five or more years.

The MSR7R and MSR7C safety relays are logic units for monitoring and interfacing two-hand control devices with a safety-related circuit. The MSR7R safety relay is for use with mechanical switches and Bulletin 800Z Zero-Force Touch Buttons™. The MSR7C safety relay is for use with electronic-sensing (for example, capacitive or photoelectric) palm buttons because the MSR7C safety relay does not turn its output ON if a power interruption occurs while hands are on the buttons.

Table 3 - Conversion Table

Type	Supply Voltage	MSR7 Cat. No.	MSR125 Cat. No.	
			Fixed Terminals	Removable Terminals
MSR7R	24V DC	440R-D23021	440R-D23166	440R-D23171
	24V AC		440R-D23165	440R-D23171 or 440R-D23170
	110/115V AC	440R-D23022	440R-D23164	440R-D23169
	230V AC	440R-D23023	440R-D23163	440R-D23168
MSR7C	24V DC	440R-D23024	440R-D23166	440R-D23171
	24V AC		440R-D23165	440R-D23171 or 440R-D23170
	110/115V AC	440R-D23025	440R-D23164	440R-D23169
	230V AC	440R-D23026	440R-D23163	440R-D23168



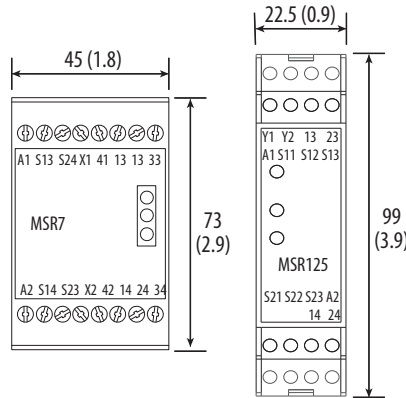
**ATTENTION:** A risk assessment must be performed when converting MSR7C safety relay to MSR125 safety relay. The risk assessment must include an evaluation of a hands-on-the-buttons during a power interruption.

## Terminal Location and Panel Space

The MSR7 safety relay is 45 mm (1.8 in.) wide and has one row of terminals at the top and bottom. The MSR125 safety relay is only 22.5 mm (0.9 in.) wide with two rows of terminals on the top and bottom.

The MSR125 safety relay is available with either fixed or removable terminals; the MSR7 safety relay only has fixed terminals.

**Figure 9 - Terminals and Panel Space [mm (in.)]**



## Wiring Schematics

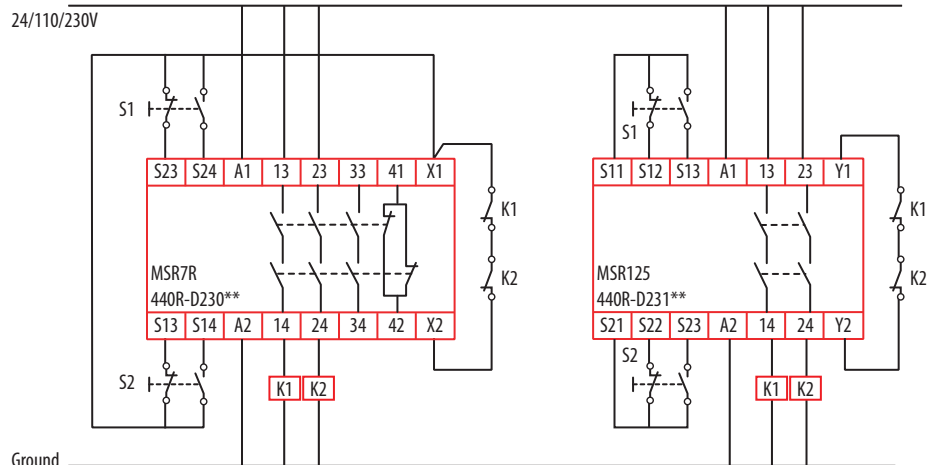
The MSR7 and MSR125 safety relays are available in the following power supplies:

- 24V AC
- 24V DC
- 110V AC
- 230V AC

The wiring schematics are the same for each voltage supply.

### MSR7R

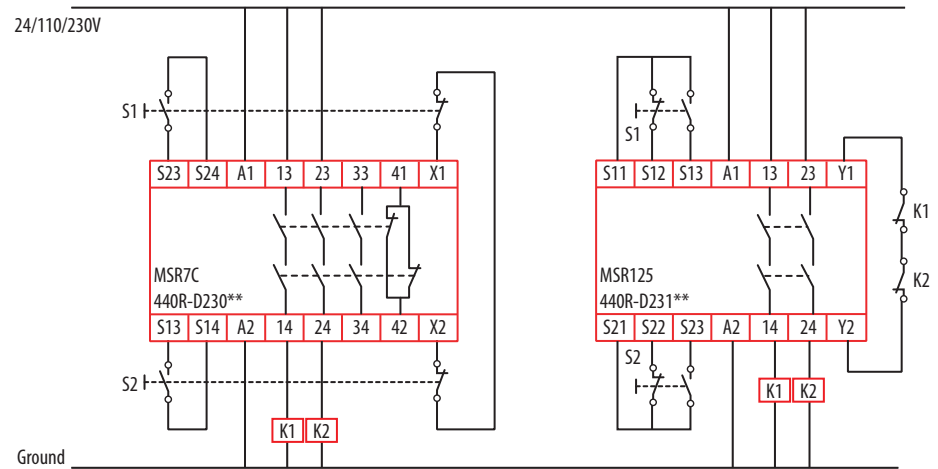
**Figure 10 - MSR7R Schematic**





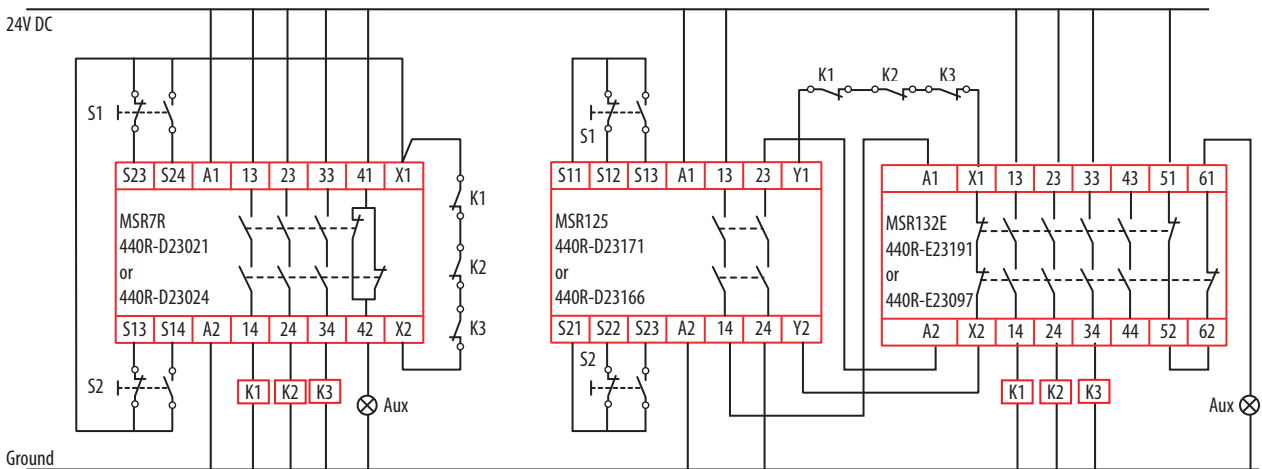
## MSR7C

Figure 11 - MSR7C Schematic



## MSR7 — All Contacts Used

Figure 12 - MSR125 with Expansion Relay



## Maximum Input Impedance

The MSR7 safety relay can tolerate up to 500 ohms of resistance on its input circuits. The MSR125 safety relay is limited to 40 ohms. This difference is not likely to be an issue as the typical cable resistance of 18 AWG (0.75 mm<sup>2</sup>) wire is 20.95 ohms per 1000 meters (6.4 ohms per 1000 feet).

## Response Time

Response time applies when at least one hand is removed from the two-hand controls and the operator reaches towards the hazard.

If the MSR132 expansion relay is not used, the response time of the MSR125 safety relay is faster than the MSR7 safety relay, and the distance from the two-hand controls to the hazard can remain unchanged.

If the MSR132 expansion relay is used, the response time of the relay is 20 ms longer; the safety distance must be recalculated and the two-hand controls may have to be moved further away from the hazard. Using the standard speed constant of 1600 mm/sec (63 in./sec), the additional 20 ms requires an additional 32 mm (1.25 in.) of spacing from the hazard.

Safety Relay	Response Time
MSR7	50 ms
MSR125	20 ms
MSR132	50 ms

## Output Load Capability

The MSR125 safety relay has a higher current capability than the MSR7 safety relay.

**Table 4 - Current Capability**

Load Type	MSR7	MSR125	MSR132
AC Inductive	BC300, AC-15 4 A	B300, AC-15 6 A	AC-15 6 A
DC	P300, DC-13 2 A/24V DC	P300, DC-13 3 A/24V DC	DC-13 3 A/24V DC
Thermal (non-switching)	4 A	1 x 6 A 2 x 4 A	2 x 6 A 4 x 4 A

## MSR9T Safety Relay

Figure 13 - MSR9T Safety Relay



We recommend replacing the MSR9T safety relay with a Sipa™ 2 controller. The replacement catalog numbers are shown in [Table 5](#).

The MSR9T safety relay was used in older applications, where the input device employed the diversity concept of one normally closed contact and one normally open contact. The Sipa 2 controller employs the same diversity approach and can easily be applied to contact-type switches and the Sipa non-contact switches.

These controllers are similar in the type of inputs and the number of outputs.

Table 5 - Conversion Table

Supply Voltage	MSR9T Cat. No.	Sipa 2 Cat. No.
24V AC/DC <sup>(1)</sup>	440R-F23027	440N-S32021
110/230V AC	440R-F23028	

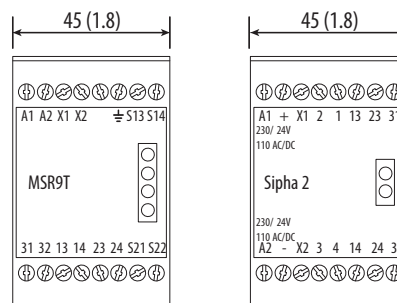
(1) For 24V, the Sipa 2 controller can only operate at 24V DC. When the MSR9T is powered by 115/230V AC, you must provide an AC/DC converter.

## Terminal Location and Panel Space

The MSR9T safety relay and Sipa 2 controller are both 45 mm (1.8 in.) wide and have one row of terminals at the top and bottom.

There is a significant difference in the location of the terminals for the power, inputs, outputs, and monitoring. Numerous wires must be moved from the top of the relay to the bottom and vice versa.

Figure 14 - Terminals and Panel Space [mm (in.)]



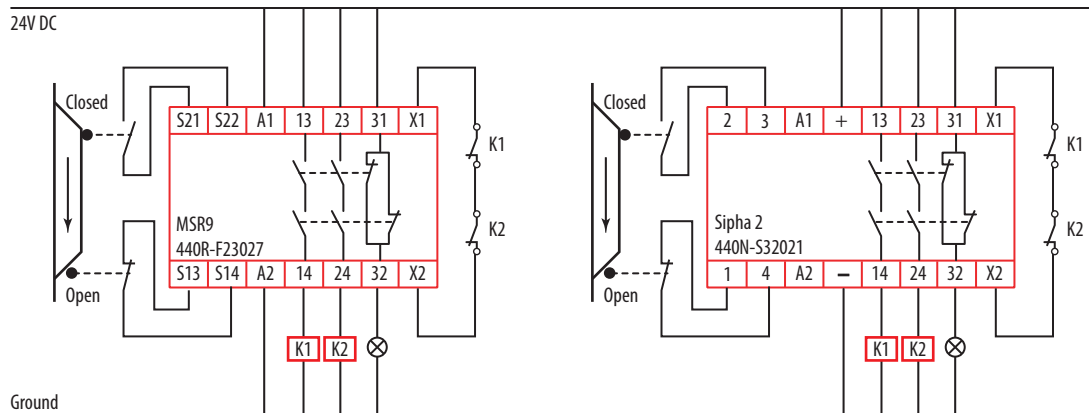
## Wiring Schematics

The following schematics compare the wiring of your existing MSR module to the recommended newer devices for each application that the existing device provides.

### 24V AC/DC Powered

When powered by 24V AC/DC, the power supply connections are made to + and – terminals of the Sipher controller; the A1 and A2 terminals must have no connections.

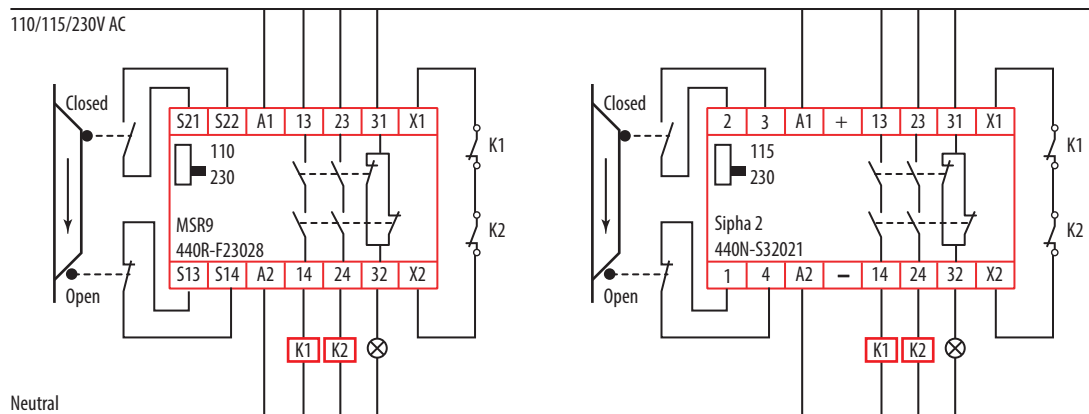
Figure 15 - 24V AC/DC Powered Schematic



### 110/115/230V AC Powered

An internal, user-selectable switch is used to set the input voltage of both the MSR9 safety relay and Sipher 2 controller. Remove the front cover and set the switch to either 110/115V or 230V AC. Figure 16 shows the conversion schematics; in this case the power to the relay is connected to A1 and A2.

Figure 16 - AC Powered



## Maximum Input Impedance

The MSR9T tolerates up to 500 ohms of resistance on its input circuits. The Sipa 2 controller tolerates 200 ohms on terminals 1...4 and 150 ohms on terminals 2...3. This difference is not likely to be an issue as the typical cable resistance of 18 AWG (0.75 mm<sup>2</sup>) wire is 20.95 ohms per 1000 meters (6.4 ohms per 1000 feet).

## Input Simultaneity

Input simultaneity is a measure of the difference in time between the change in state of the two channels to enable the relay to energize its outputs.

The MSR9T safety relay is specified to have input simultaneity of 500 ms; the dual-inputs must change state with 500 ms of each other. The Sipa 2 controller has historically been specified with a minimum approach speed of 17 mm/s (0.67 in./s).

The following describes how a Sipa 2 controller works:

- If the N.O. contact opens first, then the N.C. contact can close at any time afterwards.
- If the N.C. contact closes first, then the N.O. contact must open within 1.4 seconds.

## Response Time

Because the response time of the Sipa 2 controller is faster than the MSR9T safety relay, the safety distance calculation does not require recalculation.

Safety Relay	Response Time
MSR9T	50 ms
Sipa 2	40 ms

## Output Load Capability

[Table 6](#) compares the output load capability of the MSR9T to the replacement relays. See [Output Load Capability on page 9](#) for a wiring example of using interposing relays for applications where the load exceeds the capability of the replacements.

**Table 6 - Current Capability**

Load Type	MSR9T	Sipa 2
AC Inductive	B300, AC-15 4 A/250V AC 4 A/120V AC	B300, AC-15 4 A/250V AC
DC	P300, DC-13 3 A/24V DC	P300, DC-15 2 A/24V DC
Thermal (non-switching)	4 A	—

**Notes:**

## MSR33 Safety Relay

Figure 17 - MSR33 Safety Relay



We recommend replacing the MSR33 safety relay with a Sipa 2 controller.

The MSR33 safety relay is offered with either fixed or removable terminals. The Sipa 2 controller only has fixed terminals. The MSR33 safety relay has solid-state outputs, while the Sipa 2 controller has electromechanical outputs.

The MSR33 safety relay has a feature that is called Startup Test. The wiring configures the startup test. Upon initial power-up, the input device must be cycled once to energize the safety outputs. The Sipa 2 controller does not support this feature.

Table 7 - Conversion Table

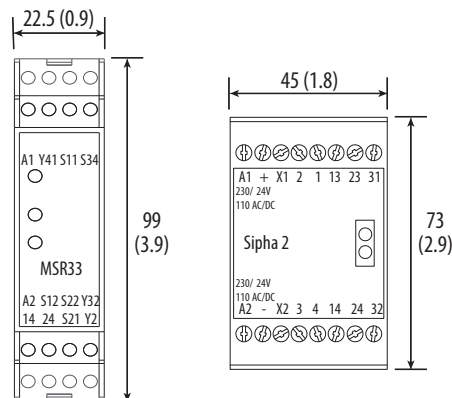
Terminals	MSR33 Cat. No.	Sipa 2 Cat. No.
Fixed	440R-F23199	440N-S32021 (only fixed terminals)
Removable	440R-F23200	

### Terminal Location and Panel Space

The Sipa 2 controller requires twice as much panel space as its width is 45 mm (1.8 in.) compared to the 22.5 mm (0.9 in.) for the MSR33 safety relay. The difference in relay height must be considered but is not significant.

The terminal locations for the inputs, outputs, and monitoring circuits require movement of the wiring from the top to the bottom of the relay and vice versa.

Figure 18 - Terminals and Panel Space [mm (in.)]



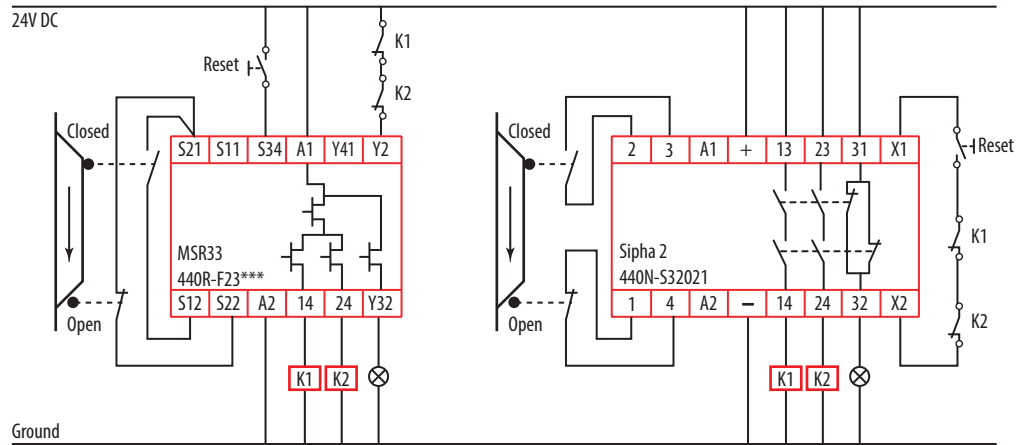
## Wiring Schematics

The following schematics compare the wiring of your existing MSR module to the recommended newer devices for each application that the existing device provides.

### Manual Reset

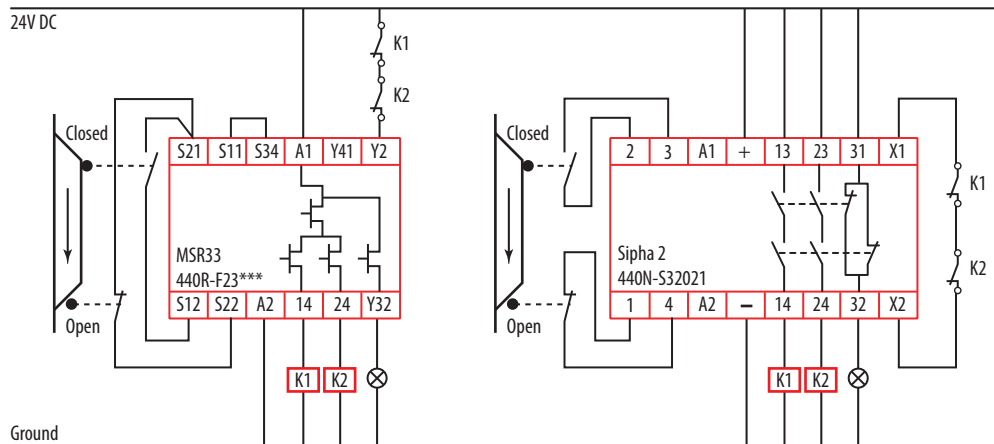
In the manual reset examples, the MSR33 safety relay has monitored reset, where the Reset button must be pressed and released. The reset action occurs when the button is released. With the Sipha 2 controller, the reset occurs when the button is pressed.

Figure 19 - Manual Reset



### Automatic Reset

Figure 20 - Automatic Reset





## Auxiliary Output

The auxiliary output of the MSR33 is normally open. When the safety outputs are OFF, the auxiliary output is OFF.

The Sipa 2 auxiliary output is normally closed. When the safety outputs are open (OFF), the auxiliary output is closed (ON).

## Input Simultaneity

Input simultaneity is a measure of the difference in time between the changes in state of the two channels to enable the relay to energize its outputs.

The MSR33 safety relay allows an infinite amount of time between the changes of state of the two inputs. The Sipa 2 controller has historically been specified with a minimum approach speed of 17 mm/s (0.67 in./s).

The following describes how a Sipa 2 controller works:

- If the N.O. contact opens first, then the N.C. contact can close at any time afterwards.
- If the N.C. contact closes first, then the N.O. contact must open with 1.4 seconds.

## Response Time



**ATTENTION:** Because the response time of the MSR33 safety relay is 25 ms faster than the Sipa 2 controller, the safety distance must be examined closely and adjusted, if necessary.

Safety Relay	Response Time
MSR33	15 ms
Sipa 2	40 ms

## Output Load Capability

The load capability table only compares DC loads because the MSR33 safety relay can only accommodate DC loads.

**Table 8 - Current Capability**

Load Type	MSR33	Sipa 2
DC	2 A/24V DC	2 A/24V DC

**Notes:**

## MSR35 Safety Relay

Figure 21 - MSR35 Safety Relay



We recommend replacing the MSR35 safety relay with an MSR125 safety relay. The MSR125H/HP safety relay is one of the MSR relays that will remain available for five or more years.

The MSR35H/HP safety relay is an electronic two-hand control relay that is offered with either fixed or removable terminals. It is only available with 24V DC power.

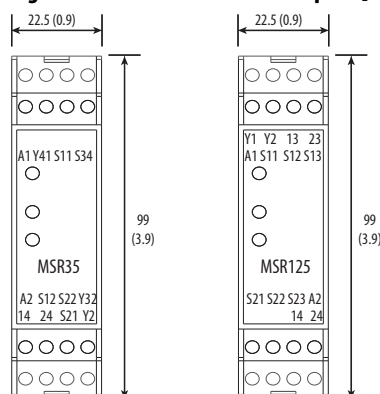
Table 9 - Conversion Table

Terminals	MSR35 Cat. No.	MSR125 Cat. No.
Fixed	440R-D23201	440R-D23171
Removable	440R-D23202	440R-D23166

### Terminal Location and Panel Space

The MSR35RT safety relay has a 22.5 mm (0.9 in.) wide body, with two rows of terminals at the top and bottom. The MSR125 safety relay also has two rows of terminals at the top and bottom and is 22.5 mm (0.9 in.) wide.

Figure 22 - Terminals and Panel Space [mm (in.)]

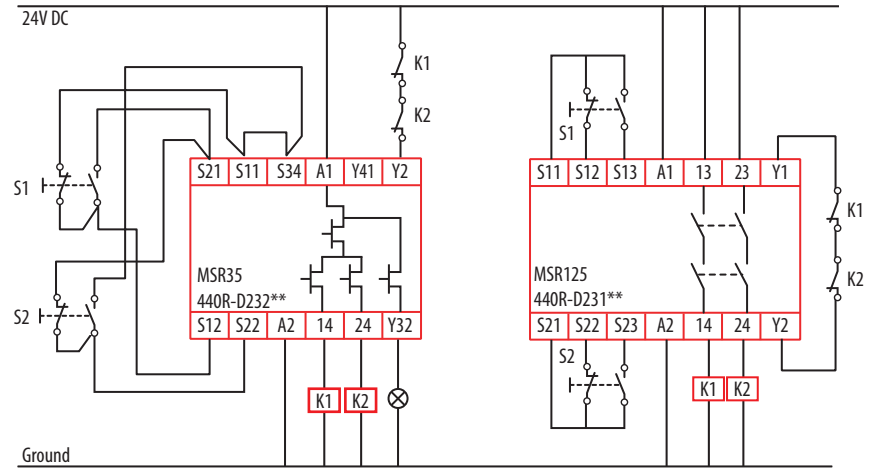


# Wiring Schematics

The output is a significant difference between the two relays. The MSR35 safety relay has solid-state outputs, while the MSR125 safety relay has voltage-free contacts.

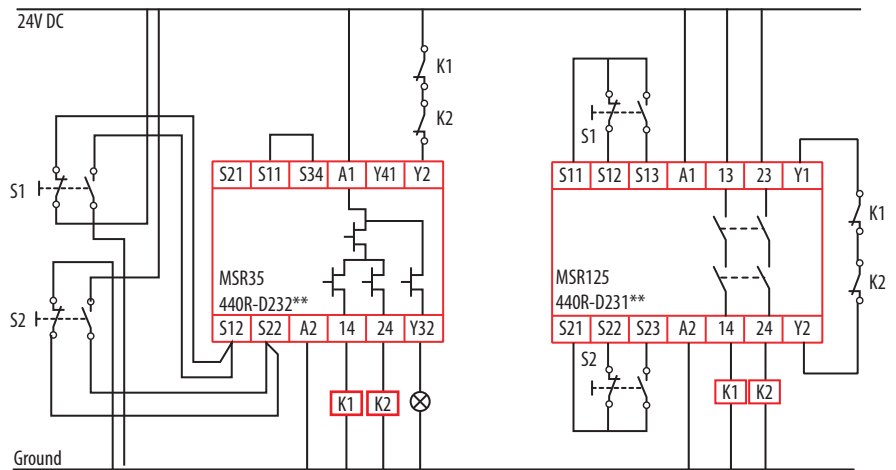
## Category IIIC

Figure 23 - Category IIIC Per EN574



## Category IIIA

Figure 24 - Category IIIA Per EN574



## Response Time



**ATTENTION:** Because the response time of the MSR35RT is faster than the MSR125 relay, the safety distance must be examined closely and adjusted if necessary.

Safety Relay	Response Time
MSR35	15 ms
MSR125	20 ms

## Output Load Capability

The MSR125 safety relay has a higher current capability than the MSR35H/HP safety relay, as shown in [Table 10](#).

**Table 10 - Current Capability**

Load Type	MSR35	MSR125
DC	2 A/24V DC	3 A/24V DC

**Notes:**

## MSR121RT Safety Relay

Figure 25 - MSR121RT Safety Relay



We recommend replacing the MSR121RT safety relay with a CI safety relay.

The MSR121RT safety relay can be wired for automatic or monitored reset. The CI safety relay is configured for automatic or monitored reset by a rotary switch on its front face.

The MSR121RT safety relay is only available with a 24V AC/DC power supply.

Table 11 - Conversion Table

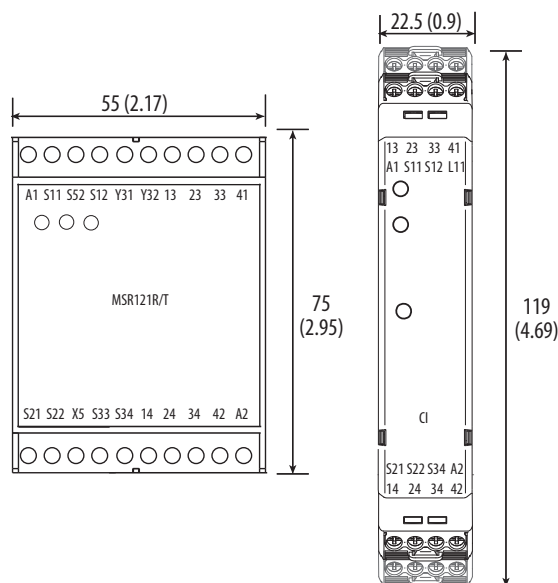
Supply Voltage	MSR121RT Cat. No.	CI Cat. No.
24V AC/DC <sup>(1)</sup>	440R-J23102	440R-S13R2

(1) For 24V, the CI safety relays can only operate at 24V DC. When the MSR121RT is powered by 24V AC, you must provide an AC/DC converter.

## Terminal Location and Panel Space

The MSR121RT safety relay has a 55 mm (2.17 in.) wide body, with one row of terminals at the top and one at the bottom. The CI safety relay has a 22.5 mm (0.9 in.) wide body with two rows of terminals at the top and bottom.

Figure 26 - Terminals and Panel Space [mm (in.)]



## Wiring Schematics

The following schematics compare the wiring of your existing MSR module to the recommended newer devices for each application that the existing device provides.

### Dual Channel Input

Figure 27 - Monitored Reset

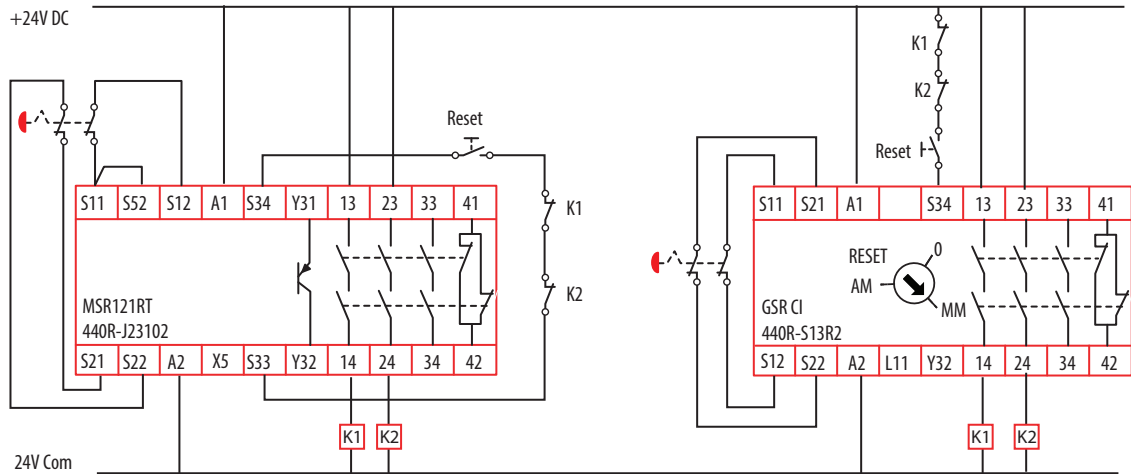
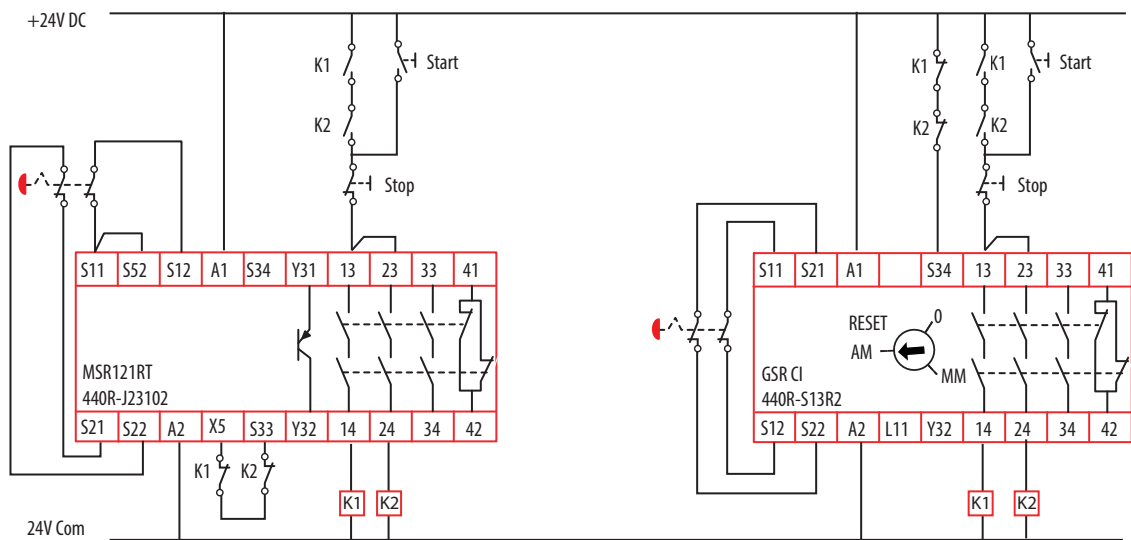


Figure 28 - Automatic Reset





## Single Channel Input

Figure 29 - Monitored Reset

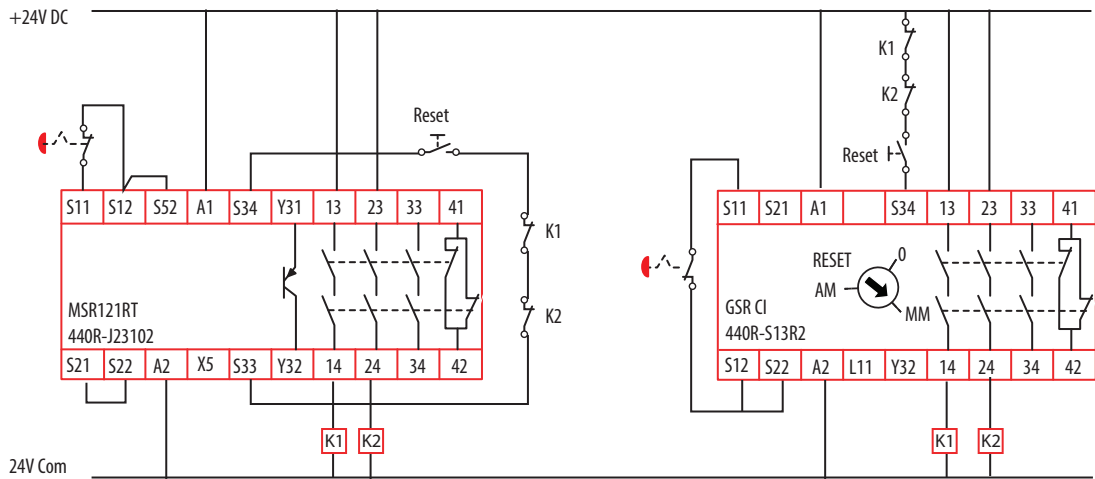
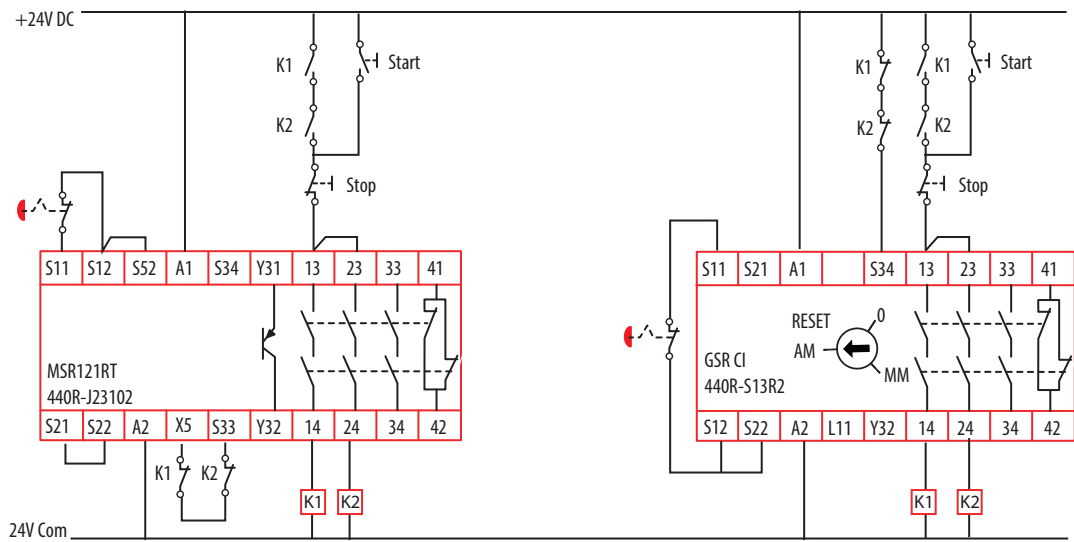


Figure 30 - Automatic Reset



## OSSD Input

Figure 31 - Monitored Reset

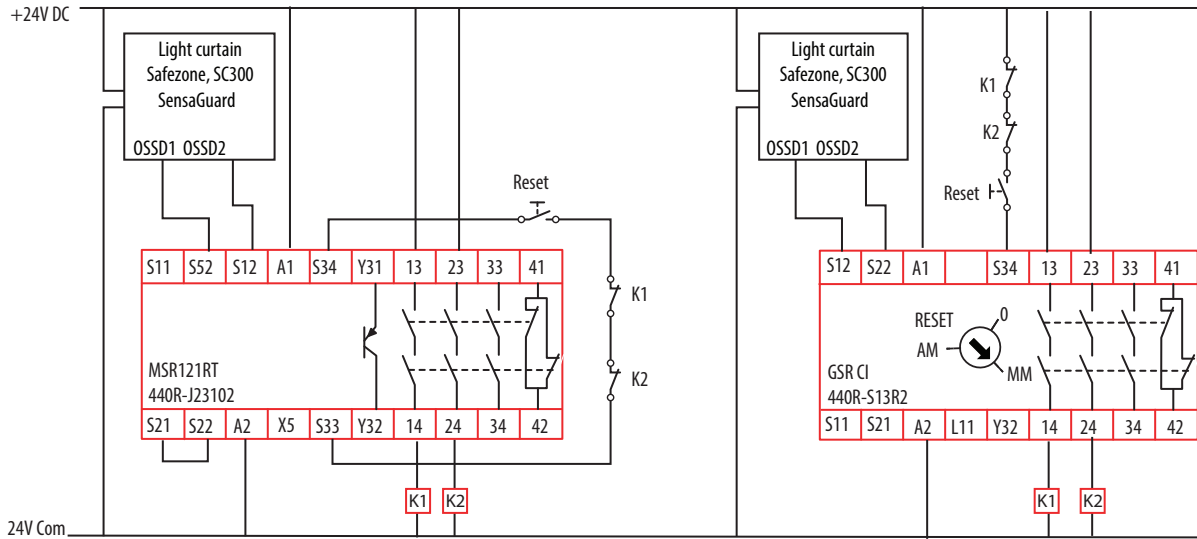
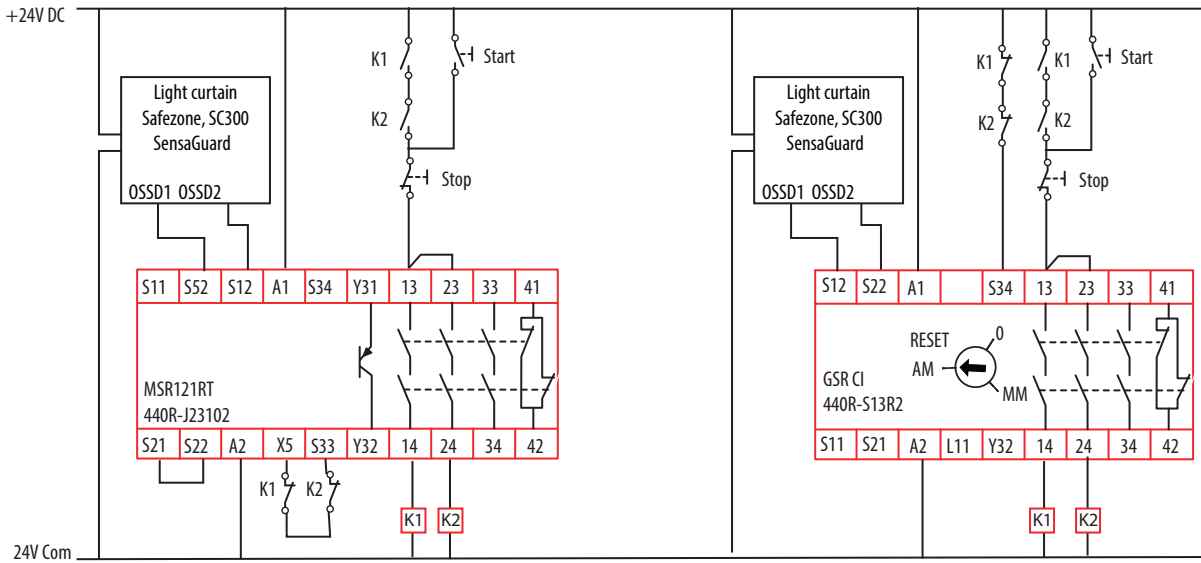
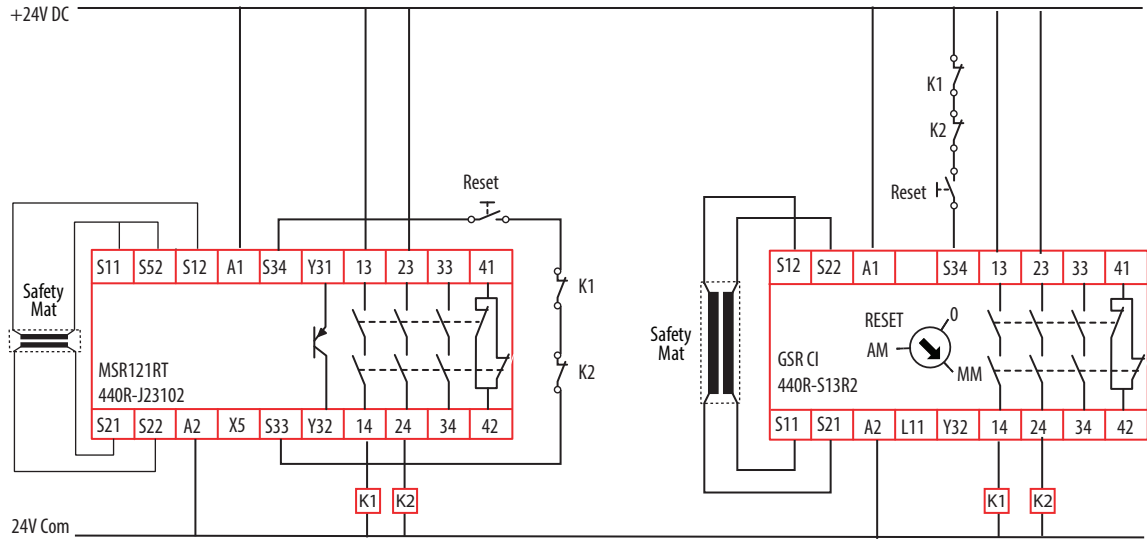


Figure 32 - Automatic Reset

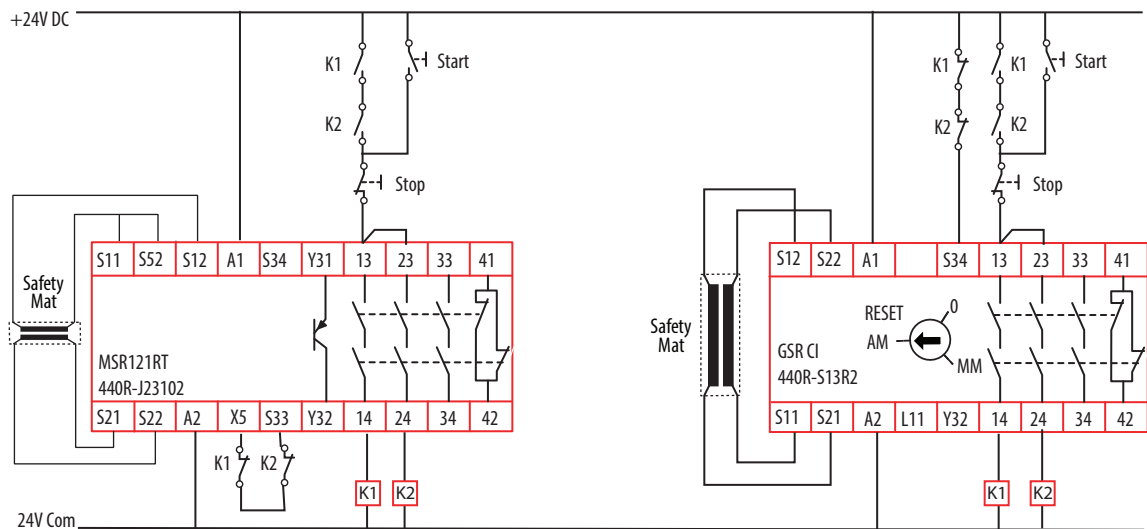


## Safety Mat Input

**Figure 33 - Monitored Reset**



**Figure 34 - Automatic Reset**



## Response Time



**ATTENTION:** Because the response time of the MSR121RT safety relay is faster than the CI safety relay, the safety distance must be examined closely and adjusted if necessary.

Safety Relay	Response Time
MSR121RT	15 ms (24V AC/DC)
CI	35 ms (mechanical and OSSD inputs); 45 ms (safety mat inputs)

## Output Load Capability

The MSR121RT safety relay has a higher current capability than the CI safety relay, as shown in [Table 12](#). See [Output Load Capability on page 9](#) for a wiring example of using interposing relays for applications where the load exceeds the CI safety relay capability.

**Table 12 - Current Capability**

Load Type	MSR121RT	CI
AC Inductive	B300, AC-15 6 A/250V AC	C300, AC-15 1.5 A
DC	R300, DC-13 6 A/240V DC	2 A @ 24V DC
Thermal (non-switching)	6 A	2 A

## MSR124RT Safety Relay

Figure 35 - MSR124RT Safety Relay



We recommend replacing the MSR124RT safety relay with a CI and EM safety relay.

The MSR124RT has the following design characteristics:

- Single- or dual-channel inputs
- Can accommodate mechanical and OSSD (light curtain) inputs
- Five electromechanical safety outputs
- One solid-state auxiliary output
- Reset can operate automatically or monitored manual.

The MSR124RT safety relay is a safety monitoring relay that provides versatile inputs and monitoring capability with many safety outputs in a 100 mm (3.93 in.) package.

The MSR124RT safety relay can be connected as either a single- or dual-channel safety gate or E-stop. It can also be connected to a light curtain that provides cross fault detection.

The wiring configuration determines the Reset and output monitoring. Automatic/manual reset can use a jumper or can be used to check operation of the contacts. Monitored manual requires the use of a manually operated normally open momentary switch to activate the outputs.

The outputs include five normally open safety rated outputs and one auxiliary output. The safety outputs have independent and redundant internal contacts to help verify the safety function. The auxiliary output is not safety rated and must only be used for indication purposes.

Table 13 - Conversion Table

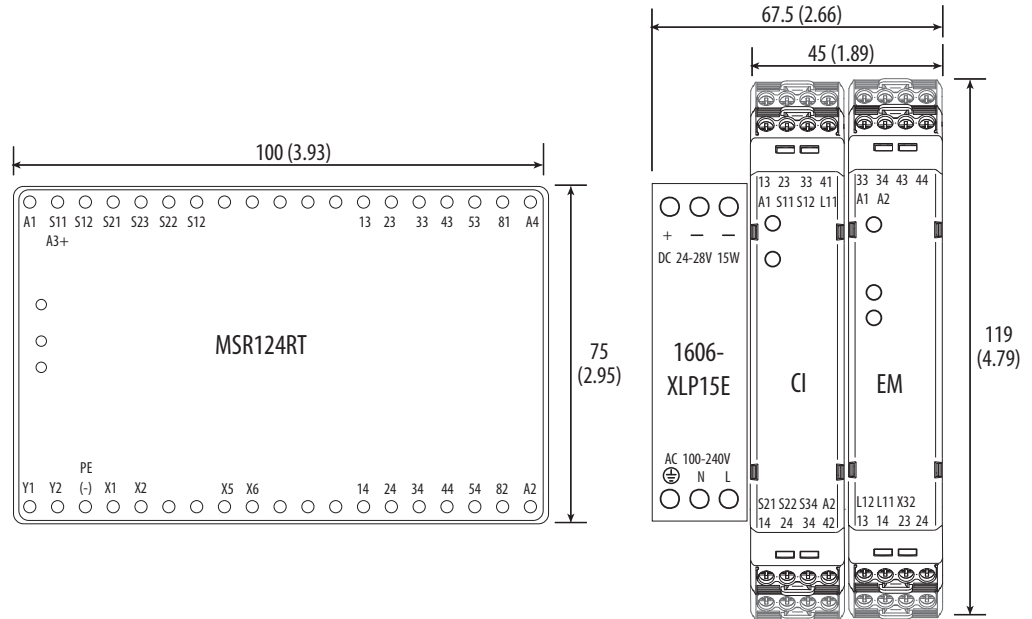
Supply Voltage	MSR124 Cat. No.	CI Cat. No.	EM Cat. No.	Power Supply Cat. No.
24V AC/DC <sup>(1)</sup>	440R-G23110	440R-513R2	440R-EM4R2	—
115V AC/ 24V DC	440R-G23108			1606-XLP15E
230V AC/24V DC	440R-G23107			

(1) For 24V, the CI and EM safety relays can only operate at 24V DC. When the MSR124RT is powered by 24V AC, you must provide an AC/DC converter.

## Terminal Location and Panel Space

For DC applications, the combination of the CI and EM safety relay is smaller than the MSR124RT safety relay. For AC applications, a 1606-XLP15E power supply can be used; this combination still occupies less panel space than an MSR124RT safety relay.

Figure 36 - Terminals and Panel Space [mm (in.)]



## Wiring Schematics

The following schematics compare the wiring of your existing MSR module to the recommended newer devices for each application that the existing device provides.

### Dual Channel

Figure 37 - Monitored Reset, DC Powered

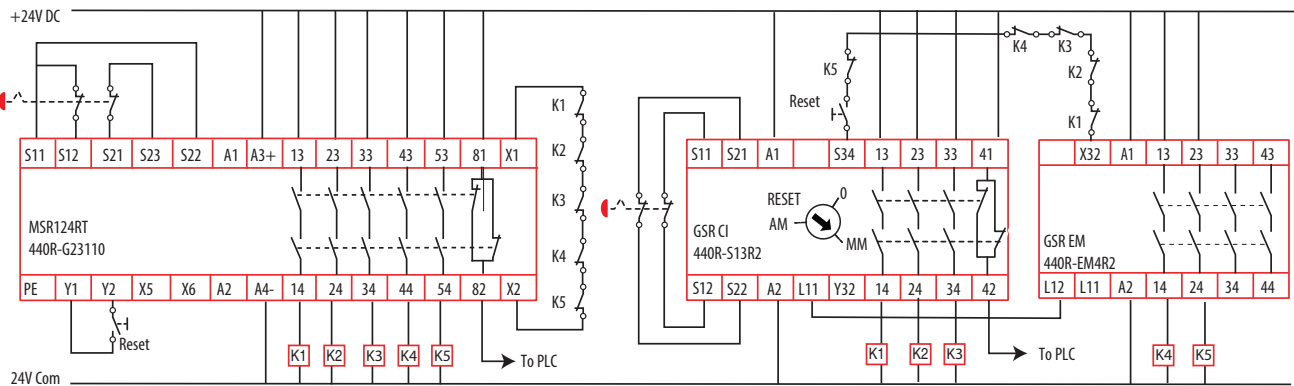
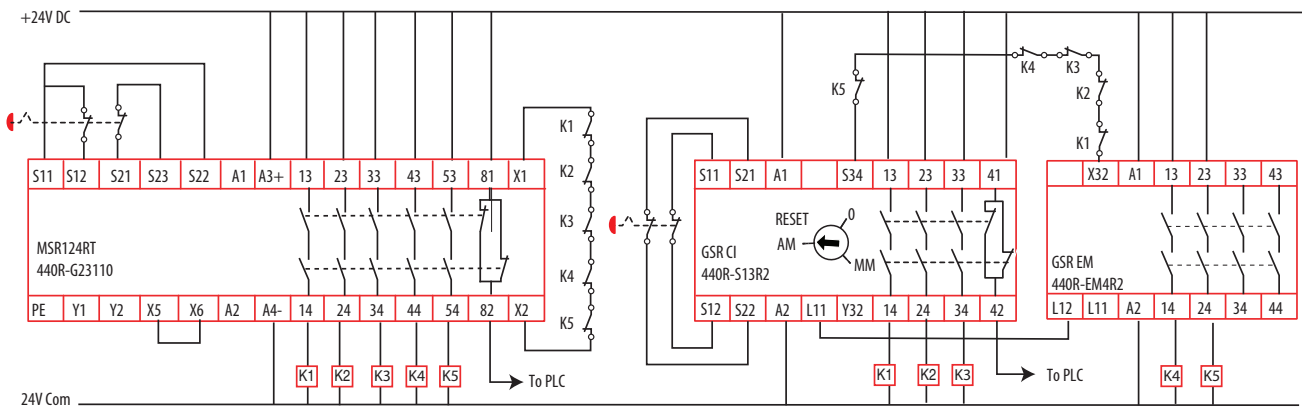


Figure 38 - Automatic Reset, DC Powered



### Single Channel

Figure 39 - Monitored Reset, DC Powered

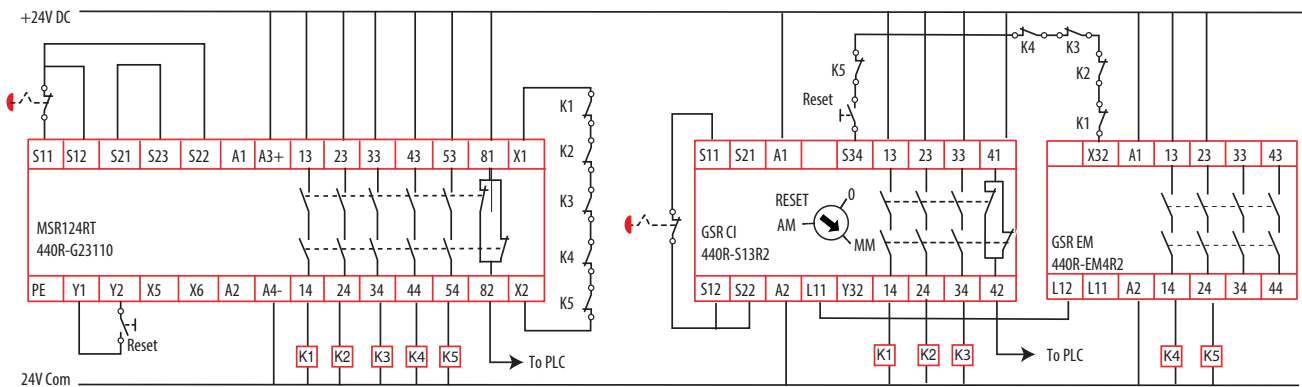
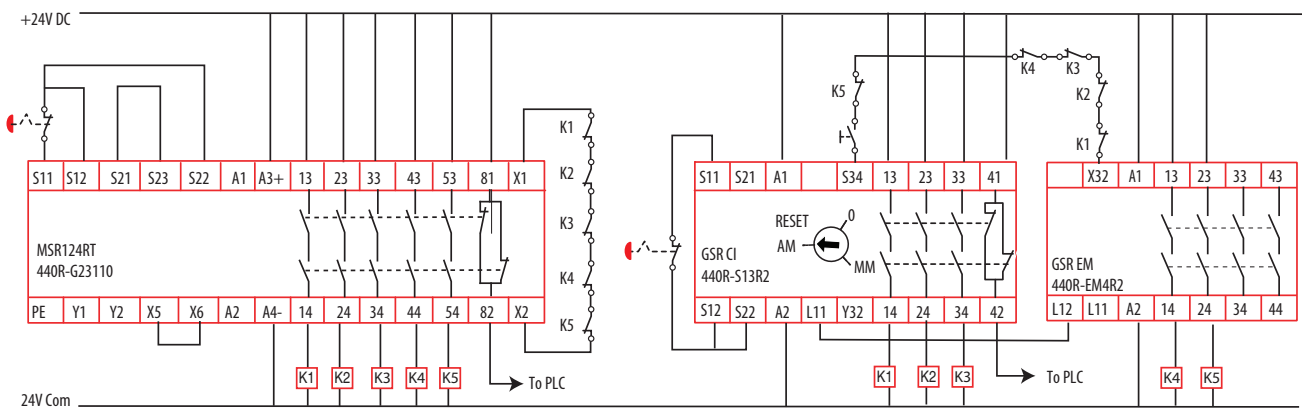


Figure 40 - Automatic Reset, DC Powered



## OSSD Inputs

Figure 41 - Monitored Reset, DC Powered

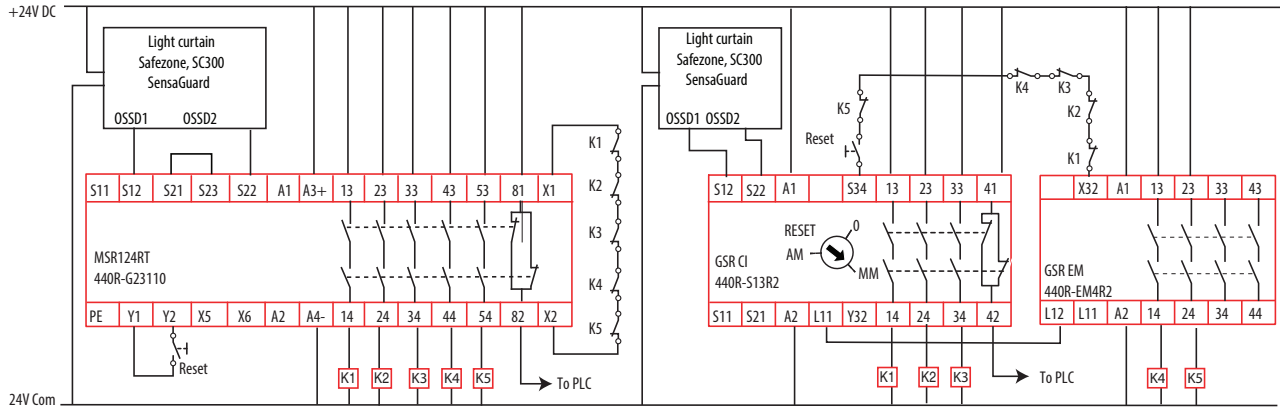
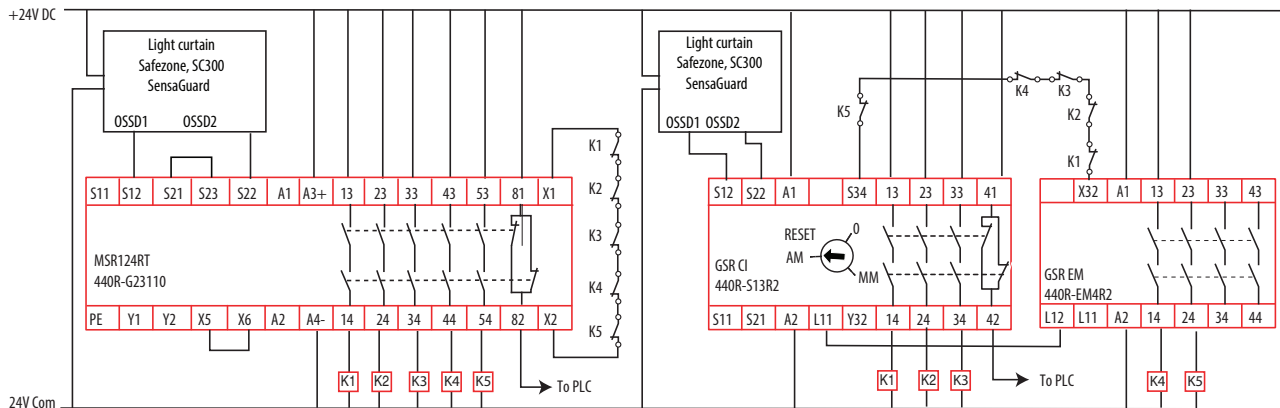


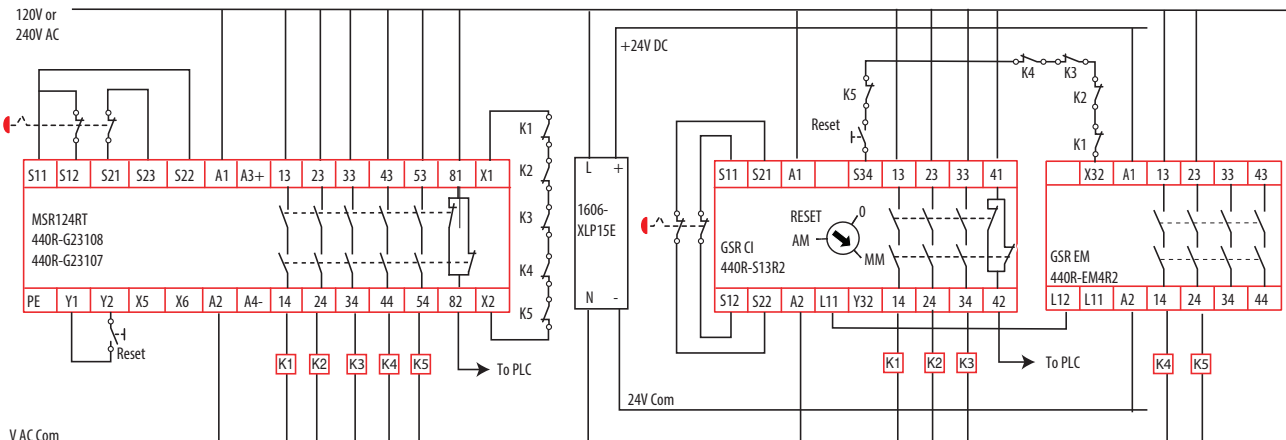
Figure 42 - Automatic Reset, DC Powered



## AC Powered

A Bulletin 1606-XLP15E power supply can be used to provide the 24V DC to power the CI and EM safety relays.

Figure 43 - AC Powered





## Response Time



**ATTENTION:** Because the MSR124RT safety relay is faster than the CI and EM safety relays, the safety distance must be examined closely and adjusted if necessary.

Safety Relay	Response Time
MSR124RT	20 ms
CI	35 ms for the inputs, and 25 ms for the SWS to the EM
EM	35 ms

For example, the total response time of the EM safety relay is  $25 + 35 = 60$  ms.

## Output Load Capability

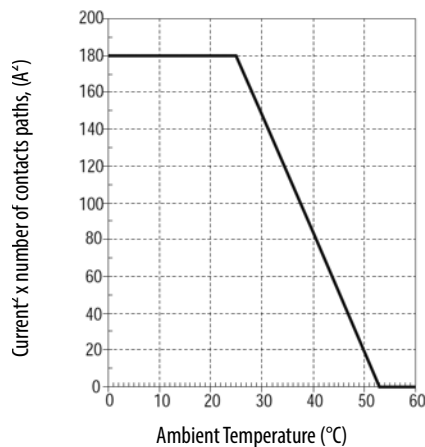
The outputs of the CI safety relay may require interposing relays, depending in the load being switched by the MSR124RT safety relay. See [Output Load Capability on page 9](#) for a wiring example of using interposing relays for applications where the load exceeds the capability of the CI or EM safety relay.

**Table 14 - Current Capability**

Load Type	MSR124RT	CI	EM
AC Inductive	A300, AC-15 5 A/250V AC	C300, AC-15 1.5 A/250V AC	2 x B300, AC-15 4 A/250V AC
DC	N300, DC-13 4 A @ 24V DC	DC-13 2 A/24V DC	P300, DC-13 2 A/24V DC
Thermal (non-switching)	10 A (max in one circuit) See current limit curve in <a href="#">Figure 44</a>	1 x 6 A	2 A

The current through all contacts in the MSR124RT safety relay must be adjusted to its current limit curve, which is shown in [Figure 44](#).

**Figure 44 - Current Limit Curve**



**Notes:**

**B**

**benefit**  
GSR 8

**C**

**capability**  
output load 9

**change**  
wiring 8

**concern**  
conversion 8

**control unit**  
CU2 11

**conversion**  
concern 8

**CU2**  
control unit 11

**current capability**  
CU2 14  
MSR121RT 36  
MSR124RT 41  
MSR33 25  
MSR35 29  
MSR7C 18  
MSR7R 18  
MSR9T 21

**G**

**GSR**  
benefit 8

**I**

**input impedance**  
MSR7C 17  
MSR7R 17  
MSR9T 21

**input simultaneity**  
MSR33 25  
MSR9T 21

**introduction** 7

**L**

**location**  
wiring terminal 8  
CU2 12  
MSR121RT 31  
MSR124RT 38  
MSR33 23  
MSR35 27  
MSR7C 16  
MSR7R 16  
MSR9T 19

**M**

**MSR121RT**  
response time 35  
safety relay 31

**MSR124RT**  
response time 41  
safety relay 37

**MSR33**  
input simultaneity 25  
response time 25  
safety relay 23

**MSR35**  
response time 29  
safety relay 27

**MSR7C**  
input impedance 17  
response time 18  
safety relay 15

**MSR7R**  
input impedance 17  
response time 18  
safety relay 15

**MSR9T**  
input impedance 21  
input simultaneity 21  
response time 21  
safety relay 19

**O**

**output load capability** 9  
CU2 14  
MSR121RT 36  
MSR124RT 41  
MSR33 25  
MSR35 29  
MSR7C 18  
MSR7R 18  
MSR9T 21

**P**

**panel space** 8  
CU2 12  
MSR121RT 31  
MSR124RT 38  
MSR33 23  
MSR35 27  
MSR7C 16  
MSR7R 16  
MSR9T 19

**R****response time** 8

- MSR121RT 35
- MSR124RT 41
- MSR33 25
- MSR35 29
- MSR7C 18
- MSR7R 18
- MSR9T 21

**S****safety relay**

- MSR121RT 31
- MSR124RT 37
- MSR33 23
- MSR35 27
- MSR7C 15
- MSR7R 15
- MSR9T 19

**schematic**

- wiring
  - CU2 13
  - MSR121RT 32
  - MSR124RT 38
  - MSR33 24
  - MSR35 28
  - MSR7C 16
  - MSR7R 16
  - MSR9T 20

**space**

- panel 8
  - CU2 12
  - MSR121RT 31
  - MSR124RT 38
  - MSR33 23
  - MSR35 27
  - MSR7C 16
  - MSR7R 16
  - MSR9T 19

**T****terminal location**

- CU2 12
- MSR121RT 31
- MSR124RT 38
- MSR33 23
- MSR35 27
- MSR7C 16
- MSR7R 16
- MSR9T 19

**time**

- response 8

**W****wiring**

- change 8
- terminal location 8

**wiring schematic**

- CU2 13
  - AC powered 13
  - DC powered 13
- MSR121RT 32
  - dual channel input 32
  - OSSD input 34
  - safety mat input 35
  - single channel input 33
- MSR124RT 38
  - AC powered 40
  - dual channel 38
  - OSSD inputs 40
  - single channel 39
- MSR33 24
  - automatic reset 24
  - auxiliary output 25
  - manual reset 24
- MSR35 28
  - category IIIA 28
  - category IIIC 28
- MSR7C 16
- MSR7R 16
- MSR9T 20
  - 110/115/230V AC powered 20
  - 24V AC/DC powered 20



## Rockwell Automation Support

Use the following resources to access support information.

<b>Technical Support Center</b>	Knowledgebase Articles, How-to Videos, FAQs, Chat, User Forums, and Product Notification Updates.	<a href="https://rockwellautomation.custhelp.com/">https://rockwellautomation.custhelp.com/</a>
<b>Local Technical Support Phone Numbers</b>	Locate the phone number for your country.	<a href="http://www.rockwellautomation.com/global/support/get-support-now.page">http://www.rockwellautomation.com/global/support/get-support-now.page</a>
<b>Direct Dial Codes</b>	Find the Direct Dial Code for your product. Use the code to route your call directly to a technical support engineer.	<a href="http://www.rockwellautomation.com/global/support/direct-dial.page">http://www.rockwellautomation.com/global/support/direct-dial.page</a>
<b>Literature Library</b>	Installation Instructions, Manuals, Brochures, and Technical Data.	<a href="http://www.rockwellautomation.com/global/literature-library/overview.page">http://www.rockwellautomation.com/global/literature-library/overview.page</a>
<b>Product Compatibility and Download Center (PCDC)</b>	Get help determining how products interact, check features and capabilities, and find associated firmware.	<a href="http://www.rockwellautomation.com/global/support/pcdc.page">http://www.rockwellautomation.com/global/support/pcdc.page</a>

## Documentation Feedback

Your comments will help us serve your documentation needs better. If you have any suggestions on how to improve this document, complete the How Are We Doing? form at [http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002\\_-en-e.pdf](http://literature.rockwellautomation.com/idc/groups/literature/documents/du/ra-du002_-en-e.pdf).

Rockwell Automation maintains current product environmental information on its website at <http://www.rockwellautomation.com/rockwellautomation/about-us/sustainability-ethics/product-environmental-compliance.page>.

Allen-Bradley, Guardmaster, Minotaur, Rockwell Automation, Rockwell Software, Sipa, and Zero-Force Touch Buttons are trademarks of Rockwell Automation, Inc.

EtherNet/IP is a trademark of ODVA, Inc.

Trademarks not belonging to Rockwell Automation are property of their respective companies.

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

**[www.rockwellautomation.com](http://www.rockwellautomation.com)**

### Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444

Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640

Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication 440R-RM002B-EN-P - November 2018

Supersedes Publication 440R-RM002A-EN-P – July 2018

Copyright © 2018 Rockwell Automation, Inc. All rights reserved. Printed in the U.S.A.