MSR45E Safety Relay Extension Module

Bulletin Number 440R

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.

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

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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).

The following icon may appear in the text of this document.

Identifies information that is useful and can help to make a process easier to do or easier to understand.

Table of Contents

About This Publication

This manual covers the connection and configuration of the Guardmaster® MSR45E Safety Relay Extension Module.

ATTENTION: MSR42 safety module, MSR41 safety module, or MSR45E extension module units can only achieve their function as a safety controller module if the instructions and additional documentation that are given in this instruction manual are exactly followed. You must also consult the valid laws and regulations at the time of installation. Serious injury or death can occur if you do not follow these instructions carefully. The installer or system integrator is fully responsible for a safe integration of this product. Use this instruction manual with the MSR42 safety module, MSR41 safety module, or MSR45E extension module. This instruction must be accessible together with the other machine documentation during its entire lifecycle for all personnel responsible for assembly, installation, operation, and maintenance.

Summary of Changes

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

Topic	Page
Corrected Figure 8	12
Updated Figure 9	17
Updated Declaration of Conformity	17

Additional Resources

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

Resource	Description
System Security Design Guidelines Reference Manual, SECURE-RM001	Provides guidance on how to conduct security assessments, implement Rockwell Automation products in a secure system, harden the control system, manage user access, and dispose of equipment.
UL Standards Listing for Industrial Control Products, publication CMPNTS-SR002	Assists original equipment manufacturers (OEMs) with construction of panels, to help confirm that they conform to the requirements of Underwriters Laboratories.
Industrial Components Preventive Maintenance, Enclosures, and Contact Ratings Specifications, publication IC-TD002	Provides a quick reference tool for Allen-Bradley industrial automation controls and assemblies.
Safety Guidelines for the Application, Installation, and Maintenance of Solid-state Control, publication SGI-1.1	Designed to harmonize with NEMA Standards Publication No. ICS 1.1-1987 and provides general guidelines for the application, installation, and maintenance of solid-state control in the form of individual devices or packaged assemblies incorporating solid-state components.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, rok.auto/certifications.	Provides declarations of conformity, certificates, and other certification details.

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

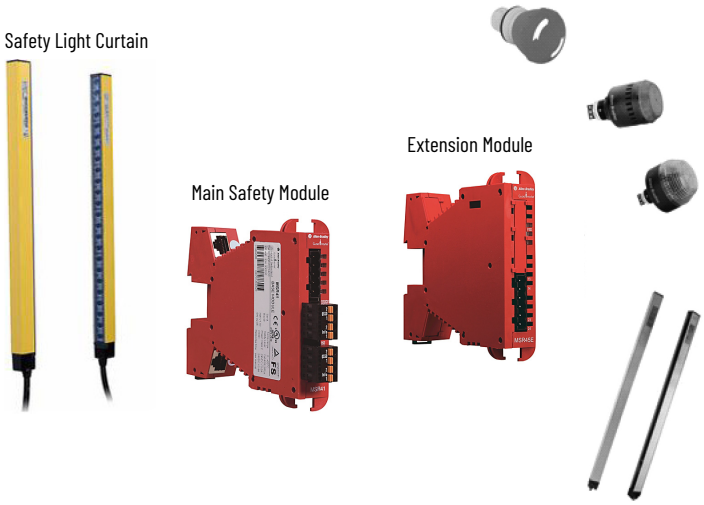
Notes:

Introduction

General Description

The MSR4*x* is a family of compact safety control modules. This main controlling module allows the connection and the control of the compact Allen-Bradley® GuardShield™ Micro400 Safety Light Curtain systems. Depending on the configuration, other safety components can also be connected and monitored simultaneously.

Figure 1 - MSR42 Safety Module and Safety Components



The MSR41 safety module or MSR42 safety module offer two safety PNP outputs (OSSD).

Additional safety relay extension modules can be applied for applications that require more outputs (MSR41 safety modules or MSR42 safety modules) and/or dry contacts (MSR45E extension modules) to switch loads. You can daisy-chain up to three extension modules, which the base module controls.

We also offer models in special configurations, which are described in Terminal Connection Diagrams on page 9.

IMPORTANT	The MSR45E extension module is not a standalone safety relay module. You can only use the unit with either an MSR41 safety module or MSR42 safety module.

Special Features

The characteristics of the MSR41 safety module and MSR42 safety module:

- Category 4, PLe according to EN ISO 13849-1
- Type 4 according to EN 61496-1/-2
- SIL 3 according to IEC 61508
- SIL CL 3 according to EN 62061
- Short response times

- Up to three extension modules per main safety module
- Adjustable stop delay time
- Different safety components suitable for connection (MSR42 safety module only)

Typical Applications

Typical MSR41 and MSR42 safety module applications are:

- Presses
- Robotic cells with automatic insertion
- Assembly lines
- Indexing tables
- Conveyor systems
- Automatic storage facilities

Application Restrictions

MSR4*x* modules are not intended for application in explosive (EX) or in radioactive environments.

System Configuration

Terminal Connection Diagrams

Figure 2...Figure 4 on page 10 show the safety output contact configuration of the available MSR45E extension modules. The control and expansion module housings snap together. Use a ribbon cable to electronically link the devices.

Figure 2 - MSR45E Extension Module (Cat. No. 440-P4NANS)

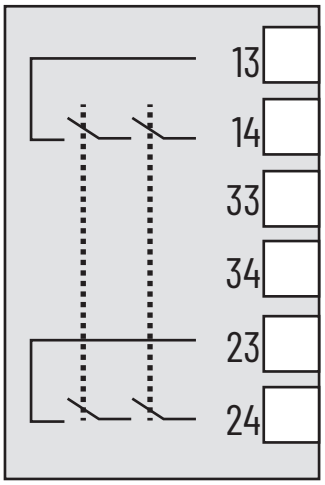


Figure 3 - MSR45E (3C 3NO) Extension Module (Cat. No. 445L-104860)

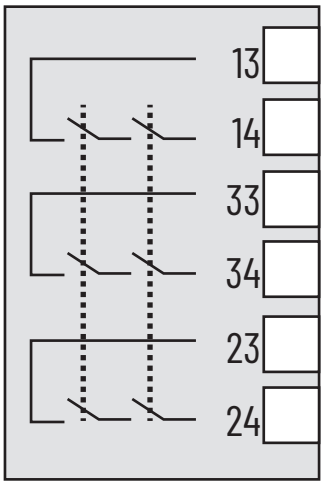
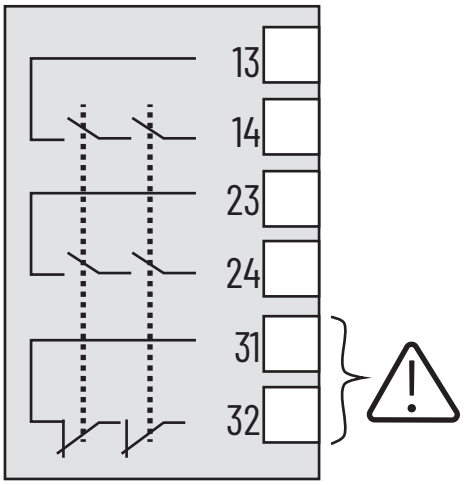


Figure 4 - MSR45E (3C 2NO 1NC) Extension Module (Cat. No. 445L-105938)



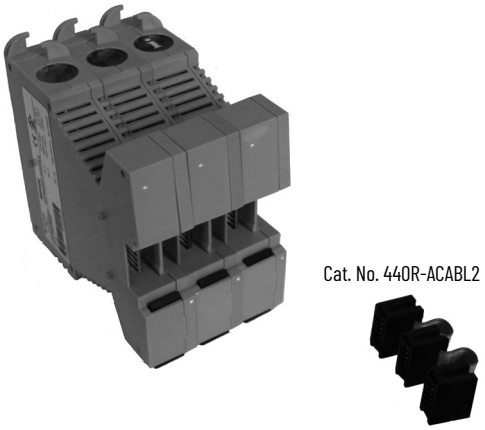
ATTENTION: Only use the normally closed contacts (NC) of an extension module for status feedback from the machine controller. NC contacts cannot be used for any safety function. Integration with the safety circuit of a machine is not allowed.

Connecting Hardware

Figure 5 and Figure 6 on page 11 show a main module and extension modules.

Figure 5 - Ribbon Cable for One Extension Module

Figure 6 - Ribbon Cable for Two Extension Modules



Status Indicator Display Elements

Table 1 shows information about the two final switching device (FSD) status indicators that are integrated into the MSR45E extension module.

Table 1 - Status Indicator Description

Color	Status
Green	Corresponding contacts of the module are closed (active)
Red	Corresponding contacts of the module are opened (not active, NC contact)
Off	No power at the main module or no internal bus (no ribbon cable connection)

Arc-limiting Graphs

Figure 7 and Figure 8 on page 12 show arc-limiting graphs and lifespan curves for MSR45E extension modules with secure-off switching, no standing arc, and a maximum of one operating cycle. Each figure is a set of characteristic curves for DC and AC applications.

Figure 7 - 2C Relay Expansion Module

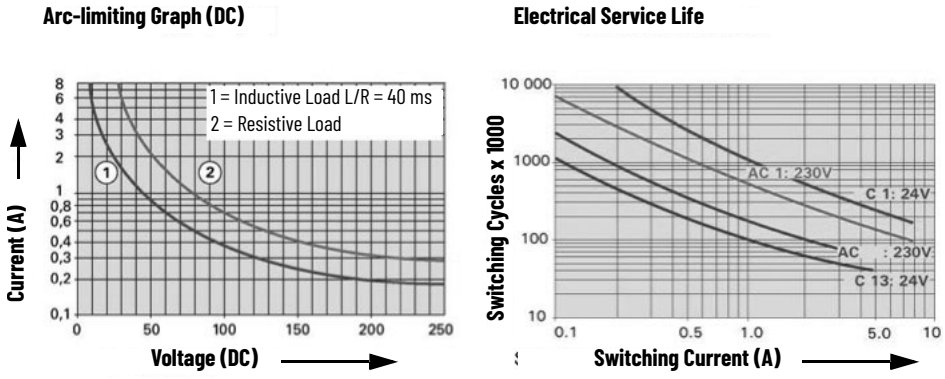
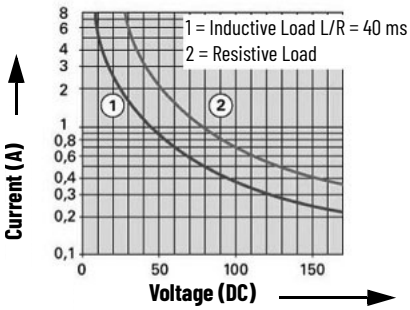
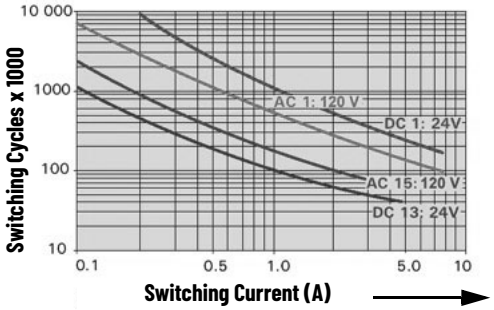


Figure 8 - 3C Relay Expansion Module

Arc-limiting Graph (DC)



Electrical Service Life



Maintenance

Service

MSR45E extension modules have no serviceable components.

Inspection

Qualified and trained personnel must periodically test the MSR45E extension module, in accordance with valid regulations, to discover prohibited manipulations or unauthorized modifications.

Decommission

Only remove the MSR45E extension module when the machine or the equipment is shut down completely and can no longer operate without tools. Dismantle a controller if disposal is necessary. The separated materials can be recycled according to state-of-the-art technology and the corresponding regulations of the country where the unit is used.

Notes:

Specifications

Technical Specifications

Table 2 - Technical Specifications

Attribute	Value
Probability of a dangerous failure per hour PFH	6.0 E-9 1/h: MSR42 safety module, MSR45E extension module, and Micro400 safety light curtain
	9.0 E-10 1/h: MSR42 safety module and MSR41 safety module
	3.0 E-10 1/h: MSR45E extension module
	4.0 E-9 1/h: Micro400 safety light curtain
Performance Level PL	PLe, Cat. 4 (EN ISO 13849-1)
Safety Integrity Level	SIL CL 3 (IEC 61508/IEC 62061)
Approvals	CE Marked for all applicable EU directives, UKCA marked for all applicable regulations, cULus Listed, TÜV Certified rok.auto/certifications
General	
Nominal working mode	Continuous process
Temperature	• Environmental: 0…55 °C (32…131 °F) • Operating: 0…55 °C (32…131 °F) • Storage: -25…+70 °C (-13…+158 °F)
Enclosure rating (EN 60529)	• Housing: IP20 • Terminals: IP20
Conductor connection, max	6-pin, terminal strip Wire cross section: 2.5 mm^2 (14 AWG) stranded, spring clamping technology, Minimum 12 mm (0.47 in.) ferrule or wire length
Mounting	Quick mount: 35 mm (1.38 in.) top hat rail (EN 50022)
Weight	Net: 150 g (0.33 lb)
Housing dimensions	111 mm x 22.5 mm x 125 mm (4.37 in. x 0.89 in. x 4.92 in.) (including plugs), see Approximate Dimensions on page 17
Housing material	Polyamide
Vibration (EN60068-2-6)	• Amplitude: 0.35 mm (0.1 in.) • Frequency: 10…55 Hz
Shock resistant (EN 60068-2-29)	• Acceleration: 100 ms^{-2} • Impulse length: 16 ms • Number of shocks: 1000 per direction
Installation position	No restrictions
Shipping	
Packaging	280 mm x 200 mm x 70 mm (11.02 in. x 7.87 in. x 2.76 in.)
Shipping weight	Net + 220 g (8.66 in.)
Outputs	
Number of expansion modules, max	3 per main module
Number of contacts	2NO, 3NO, or 2NO/1NC
Additional response time t(em) with U_N Protective mode, max	≤ 6 ms
Contact type	Force guided relay (EN 50205)
Contact material	$AgSNO_2$ + 0.2 µm AU plated
Switching capacity	• Min: 0.06VA • Max: 250V AC 8 A, [AC1] = 2000VA • DC 13 (EN 60947-5-1, 0.1 Hz, 24V): 6 A DC/24 V • AC 15 (EN 60947-5-1, 0.1 Hz, 220V): – 2NO: 3 A AC/230V – 3NO or 2NO/1NC: 3 A AC/120V • Allowed 2C or 3C: 900 switching /h, max

Table 2 - Technical Specifications (Continued)

Attribute	Value
Switching current	• Min: 10 mA • Max 8 A
Switching voltage, max	• 2NO: AC 250V; DC 300V • 3NO or 2NO/1NC: AC 120V; DC 170V
Output nominal voltage	DC: See Arc-limiting Graphs on page 11
2C	• Continuous current I_{th}: 8 A (1 contact) • With simultaneous switching (1 extension module): 6 A (≥ 2 contacts) • With simultaneous switching (2 or more extension modules): 4 A (≥ 2 contacts)
Switching capacity	According to DC 13 (EN 60947-5-1, 0.1 Hz, 24V) 6 A DC/24 V
Electronic lifespan	According to AC 15 at 2 A, 230V AC 2C or 3C: 10^5 operating cycles (EN 60947-5-1), see Arc-limiting Graphs on page 11
Mechanical lifespan	10^6
Switch on delay after switching on the power supply	< 3 s
Switch off delay after switching off the power supply	< 40 ms

Catalog Numbers

Table 3 - Catalog Numbers

	Cat. No. (1)	Description
	440R-P221AGS	MSR41 On/Off Safety Module • Mounting: 35 mm (1.34 in.) DIN Rail • Size: 22.5 mm (0.98 in.)
	440R-P226AGS-NNR	MSR42 Start/Restart Safety Module • Mounting: 35 mm (1.34 in.) DIN Rail • Size: 22.5 mm (0.98 in.)
	445L-104794-B*xxx* (2)	
	440-P4NANS	MSR45E 2C Safety Relay Extension Module (optional) • Input voltage: Supplied by MSR41 safety module or MSR42 safety module • Reset: Determined by MSR41 safety module or MSR42 safety module • Outputs: Two NO
	445L-1*xxxx* (2)	

(1) All series.
(2) *x* = Customer configurable options that do not impact the standards or directives cited in Declaration of Conformity on page 17.

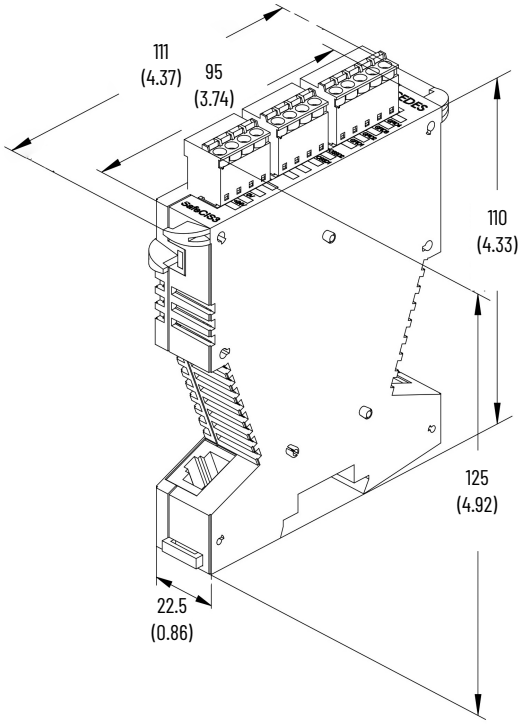
Product Labels

The necessary safety information is on the product label, which is on every MSR45E extension module.

Figure 9 - Example Product Label

Approximate Dimensions

Figure 10 - MSR42 Safety Module and MSR45E Extension Module [mm (in.)]



Declaration of Conformity

CE Conformity

Rockwell Automation declares that the products that are shown in this document conform with the Essential Health and Safety Requirements (EHSRs) of the European Machinery Directive (2006/42/EC) and the EMC Directive (2014/30/EU).

- EN 61496-1:2012 Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests
- IEC 61496-2:2013 Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)
- EN ISO 13849-1:2015 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- EN 61508 Parts 1-7:2010 Functional safety of electrical/electronic/programmable electronic safety-related systems

- EN 954-1:1997 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- EN 50178:1997 Electronic equipment for use in power installations
- EN 62061:2005 Safety of machinery – Functional safety of safety-related electrical, electronic, and programmable electronic control systems
- EN 60204-1:2006 Safety of machinery – Electrical equipment of machines – General requirements
- EN 61000-6-4:2007 Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments (Class A)
- EN 61000-6-2:2005 Electromagnetic Compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

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

UKCA Conformity

Rockwell Automation declares that the products that are shown in this document are in compliance with the Supply of Machinery (Safety) Regulations (2008 No. 1597) and Electromagnetic Compatibility Regulations (2016 No. 1091).

- EN 61496-1:2013 Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests
- IEC 61496-2:2013 Safety of machinery – Electro-sensitive protective equipment – Part 2:
- Particular requirements for equipment using active opto-electronic protective devices (AOPDs)
- EN ISO 13849-1:2015 Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design
- EN 61508 Parts 1-7:2010 Functional safety of electrical/electronic/programmable electronic safety-related systems
- EN 62061:2005 Safety of machinery – Functional safety of safety-related electrical, electronic, and programmable electronic control systems
- EN 60204-1:2006 Safety of machinery – Electrical equipment of machines – General requirements
- EN 61000-6-4:2007 Electromagnetic compatibility (EMC) – Part 6-4: Generic standards – Emission standard for industrial environments (Class A)
- EN 61000-6-2:2005 Electromagnetic Compatibility (EMC) – Part 6-2: Generic standards – Immunity for industrial environments

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

Accessories

Additional Components

Table 4 - Catalog Numbers

	Cat. No.	Description
	440R-ACABL1	Ribbon cable – two modules
	440R-ACABL2	Ribbon cable – three modules
	440R-ACABL3	Ribbon cable – four modules
	440R-ATERM1P	Terminal block kit for MSR41 safety module replacement
	440R-ATERM2P	Terminal block kit for MSR42 safety module replacement
	440R-ATERM2C	Terminal block kit for MSR45E extension module

Notes:

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Rockwell Automation Support

Use these resources to access support information.

Technical Support Center	Find help with how-to videos, FAQs, chat, user forums, and product notification updates.	rok.auto/support
Knowledgebase	Access Knowledgebase articles.	rok.auto/knowledgebase
Local Technical Support Phone Numbers	Locate the telephone number for your country.	rok.auto/phonesupport
Literature Library	Find installation instructions, manuals, brochures, and technical data publications.	rok.auto/literature
Product Compatibility and Download Center (PCDC)	Download firmware, associated files (such as AOP, EDS, and DTM), and access product release notes.	rok.auto/pcdc

Documentation Feedback

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

Waste Electrical and Electronic Equipment (WEEE)

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

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

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