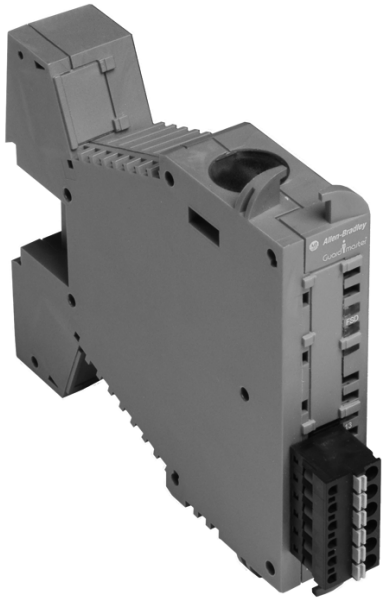
MSR45E Safety Relay Expansion Module User Manual

Allen-Bradley



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Important User Information

Because of the variety of uses for the products described in this publication, those responsible for the application and use of this control equipment must satisfy themselves that all necessary steps have been taken to assure that each application and use meets all performance and safety requirements, including any applicable laws, regulations, codes and standards.

The illustrations, charts, sample programs and layout examples shown in the guide are intended solely for purposes of example. Since there are many variables and requirements associated with any particular installation, Rockwell Automation does not assume responsibility or liability (to include intellectual property liability) for actual use based upon the examples shown in this publication.

Rockwell Automation publication SGI-1.1, Safety Guidelines for the Application, Installation and Maintenance of Solid-State Control (available from your local Rockwell Automation sales office), describes some important differences between solid-state equipment and electromechanical devices that should be taken into consideration when applying products such as those described in this publication.

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Throughout this manual 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.
IMPORTANT	Identifies information that is critical for successful application and understanding of the product.
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 consequences.
SHOCK HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that dangerous voltage may be present.
BURN HAZARD	Labels may be on or inside the equipment (for example, drive or motor) to alert people that surfaces may reach dangerous temperatures.

It is recommended that you save this user manual for future use.

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Approvals and Conformity

The safety approval, performed by TÜV Rheinland is available on www.ab.com. The actual list of relevant safety data and applied standards is given in these documents.

ATTENTION	MSR42, MSR41 or MSR45E units can only achieve their function as a safety controller module, if the instructions given in this instruction manual and the within mentioned documents are exactly followed, as well as consulting the valid laws and regulations at the time of installation. Should these instructions not be carefully followed, serious injury or death may occur. The installer or system integrator is responsible for a safe integration of this product. This instruction manual is to be used in conjunction with the MSR42, MSR41 and MSR45E module. It must be kept accessible together with the other machine documentation during its entire life cycle for all personnel responsible for assembly, installation, operation and maintenance.

Introduction

The MSR4x is a family of compact safety modules. The main controlling module allows the connection and the control of the GuardShield Micro400 safety light curtain systems (Figure 1). Depending on the configuration, other safety components can also be connected and monitored simultaneously.

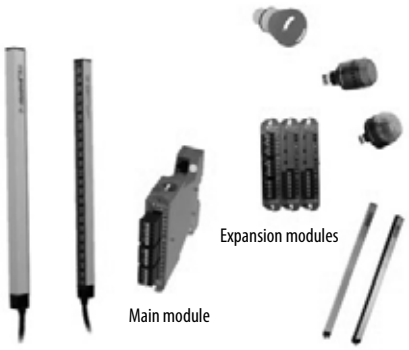


Figure 1: MSR42 controller with all safety components which can be connected (depending on individual configuration)

Both the MSR42 and MSR41 offer two safety PNP outputs. Additional safety relay expansion modules can be applied for applications, which require more outputs (MSR41 or 42) and/or dry contacts (MSR45e) to switch loads. Up to three expansion modules can be controlled and daisy chained to one main module.

In addition to the expansion relays, models are offered in special configurations which are described in the appendix at the end of this manual.

Note: The MSR45E safety relay expansion module is not a standalone safety relay module. It can only be used in conjunction with either an MSR41 or MSR42 control module.

Special features

The outstanding characteristics of the MSR42 and MSR41 controller:

- Category 4, PL e according EN ISO 13849-1
- Type 4 according EN 61496-1/-2
- SIL 3 according IEC 61508
- SIL CL 3 according EN 62061
- Short response times
- Up to 3 safety relay expansion modules per main module
- Adjustable stop delay time
- Different safety components suitable for connection (MSR42)

Applications

Typical applications

MSR42 and MSR41 controller modules are developed and conceived for typical applications like:

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

Application restrictions

All MSR4x modules are not intended for application in explosive (EX) or in radioactive environments.

Dimensions

The dimensions of the housing for MSR45E are illustrated in Figure 2.

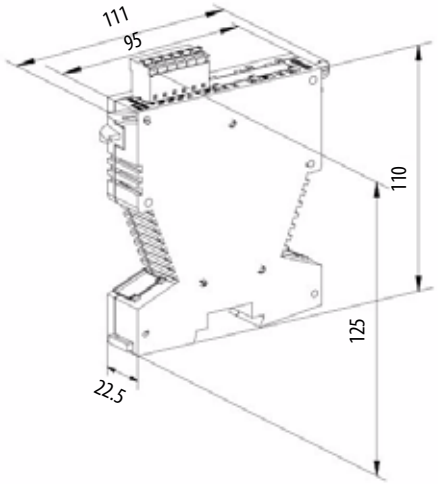


Figure 2: Expansion module dimensions are the same for main module

Terminal Configurations

The safety output contact configuration of the MSR45E.

Snap control & expansion housing module together. Use ribbon cable to electronically link devices.

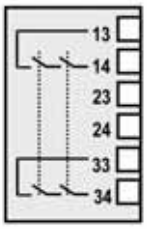
Type of Expansion module	Schematic
MSR45E Safety Relay Expansion Cat.-No. 440-P4NANAS	

Figure 3: MSR45E Expansion module.

Connecting Hardware

Main module + one Expansion module

Figure 4: Ribbon Cable for one expansion module. (Cat. No 440R-ACABL1)

Figure 5: Ribbon cable for two expansion modules.

LED display elements

MSR45E Expansion module

Only two LED is integrated in the MSR45E expansion modules (FSD):

Color LED "FSD"	Status
Green	Corresponding contacts of module are closed (active)
Red	Corresponding contacts of module are opened (not active, NC contact)

Color LED "FSD"	Status
Off	No power at main module or no internal bus (e.g. no ribbon cable connection)

Table 1

Selection tables

Cat. No.	Controller / Expansion modules
440R-P221AGS	MSR41 Micro400 controller
440R-P226AGS-NNR	MSR42 Light Curtain multifunction safety controller
440R-P4NANAS	MSR45E 2C, Standard Safety Relay Expansion Module

Table 2

Accessories / Components

Cat. No.	Description
440R-ACABL1	Ribbon Cable – connects two modules
440R-ACABL2	Ribbon Cable – connects three modules
440R-ACABL3	Ribbon Cable – connects four modules
440R-ATERM2P	Terminal Block Kit - MSR42
440R-ATERM2C	Terminal Block Kit - MSR45E
440R-ATERM1P	Terminal Block Kit – MSR41

Table 3

Inspection and service

The MSR45E modules have no serviceable components.

Inspections

The MSR45E modules have to be tested periodically – in accordance with valid regulations - by qualified and trained personnel to discover prohibited manipulations or unauthorized modifications.

Decommissioning

The MSR45E modules can only be removed, when the machine or the equipment is shut down completely and can no longer be operated without tools. If a controller has to be disposed, it can be simply dismantled. The separated materials can be recycled according to state of the art technology and corresponding regulations of the country it was used in.

Product labels

All the necessary safety information can be found on the product labels, which can be found on every controller module (example):

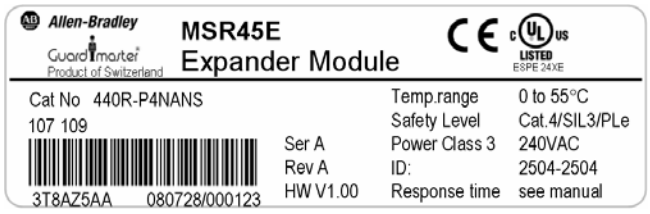


Figure 5: Product label MSR4E Expansion module

Technical Data

General data	
Nominal working mode	Continuous process
Temperature range	Environment temp.: 0 ... +55°C Stock temp.: -25 ... +70°C
Enclosure rating according EN 60529 Housing Terminals	 IP20 IP20
Conductor connection: 6-pin terminal strip	Wire cross section: max 2.5 mm^2 spring clamping technology min. 12 mm ferrule or wire length
Quick mounting	Top hat rail 35 mm (EN 50022)
Net weight	MSR45E: 150 g
Housing dimensions	111 x 22,5 x 125 mm (incl. plugs)
Housing material	Polyamide
Vibration according to EN60068-2-6	Amplitude: 0.35 mm Frequency: 10 … 55 Hz
Shock resistant according to EN 60068-2-29	Acceleration: 100 ms^{-2} Impulse length: 16 ms Number of shocks: 1'000 per direction
Installation position	No restrictions
Approvals	TÜV, CE, cULus

Weight and packaging	
Dispatch packaging	280 mm x 200 mm x 70 mm
Dispatch weight	Net weight + 220 g

Relay Outputs of Expansion Modules	
Max. number of expansion modules	3 per main module
Number of contacts	2NO, 3NO or 2NO1NC
Additional max. response time t(em) with U_N protective mode	≤ 6 ms
Contact type	Relay, force guided (EN 50205)
Contact material	$AgSNO_2$ + 0.2 µm AU plated
Min. switching capacity	0.06 VA
Max. switching capacity	250 V(AC) 8A, [AC1] = 2'000 VA
Min. switching current	10 mA
Max. switching current	8 A
Max. switching voltage	2NO: AC 250V; DC 300V 3NO or 2NO1NC: AC 120V; DC 170V
Output nominal voltage	DC: see arc-limiting graph
2C: Continuous current I_{th} With simultaneous switching With 1 expansion-module With 2 or more exp.-modules	 8 A (1 contact) 6 A (≥ 2 contacts) 4 A (≥ 2 contacts)
Switching capacity acc. DC 13 (EN 60947-5-1, 0.1 Hz, 24 V)	MSR45E: 6 A DC / 24 V
Switching capacity acc. AC 15 (EN 60947-5-1, 0.1 Hz, 220 V)	2NO: 3A AC / 230V 3NO or 2NO1NC: 3A AC / 120V
Electronic lifespan according AC 15 at 2 A, 230 VAC	2C or 3C: 10^5 operating cycles (EN 60947-5-1) see graphics below (arc limiting graph)
Allowed switching capacity	2C or 3C: Max. 900 switching / h
Mechanical lifespan	10^6

Relay Outputs of Expansion Modules	
Switch on delay after switching on the power supply	< 3 s
Switch off delay after switching off the power supply	< 40 ms

Safety Related Parameter		
Probability of a dangerous failure per hour PFH	6.0 E-9 1/h	MSR4x Main M. & MSR45e Ext & Micro400
	9.0 E-10 1/h	MSR4x Main M.
	3.0 E-10 1/h	MSR45E
	4.0 E-9 1/h	Micro400

Arc-limiting graph

Characteristic curves for DC and AC applications (2C relay expansion module):

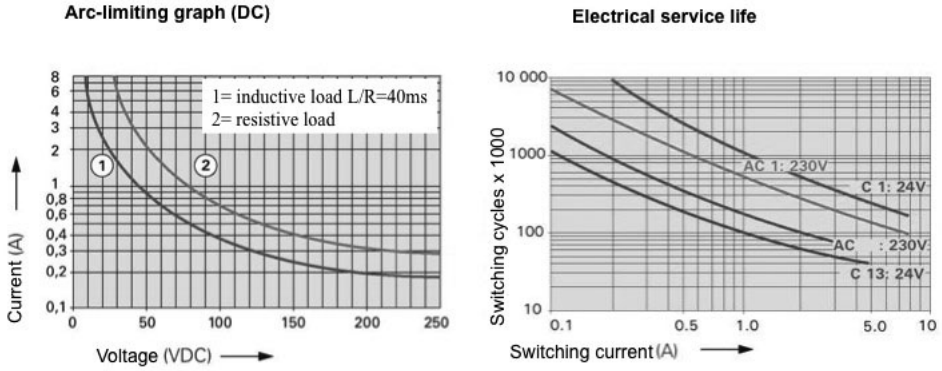


Figure 6: Arc-limiting graph and lifespan curve for MSR45E expansion modules (secure off switching, no standing arc, max. 1 operating cycle / s)

Characteristic curves for DC and AC applications (3C relay expansion module):

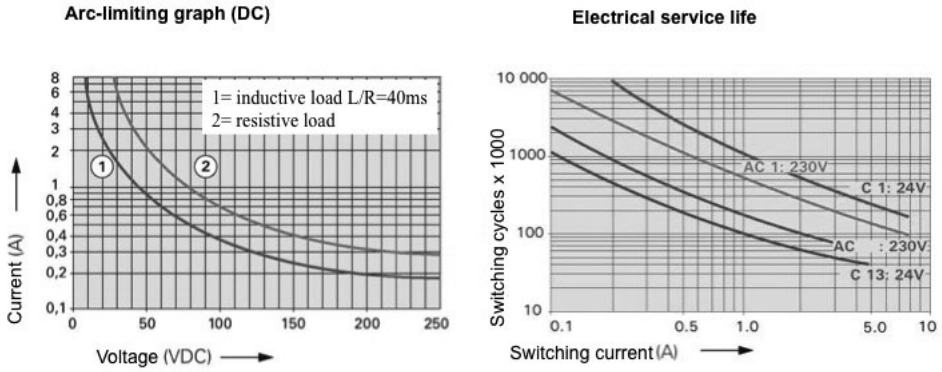


Figure 7: Arc-limiting graph and lifespan curve for MSR45E expansion modules (secure off switching, no standing arc, max. 1 operating cycle / s)

Appendix

Special MSR45E modules for existing customers.

Selection Table

Cat. No.	Controller / Expansion modules
445L-105938	MSR45E-3C 2NO1NC, special safety relay Expansion Module
445L-104860	MSR45E-3C 3NO, special safety relay Expansion Module

Terminal Configurations

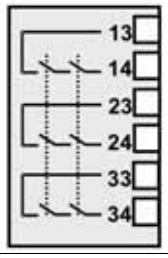
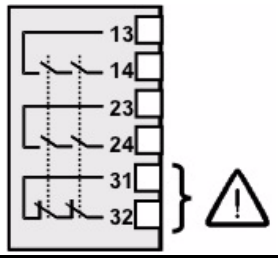
Type of Expansion module	Schematic
MSR45E 3C 3NO Safety Relay Expansion Cat.-No. 445L-104860	
MSR45E 2NO1NC Safety Relay Expansion Cat.-No. 445L-105938 NC contacts are not safety contacts	

Figure 8: MSR45E Expansion modules.

ATTENTION	The normally-closed contacts (NC) of an expansion module may only be used for status feedback from the machine controller. They may not be used for any safety function. Any integration with a machine's safety circuit is not allowed.

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EC Declaration of Conformity

The undersigned, representing the manufacturer	*and the authorised representative established within the Community*
Rockwell Automation, Inc. ***2 Executive Dr.*** ***Chelmsford, MA 01824*** ***USA***	***Rockwell Automation BV*** ***Rivium 1e Straat, 23*** ***2909 LE Capelle aan den IJssel*** ***Netherlands***
Herewith declare that the Products:	***MSR4x Safety Base / MSR4xE Expander Controller Modules***
Product identification (brand and catalogue number/part number):	***Allen-Bradley 440R-P and 445L-1 Series*** *(reference the attached list of catalogue numbers)*
Product Safety Function	***The MSR4x safety base control devices and the MSR4xE extension modules can be used in applications up to Safety Category 4 (EN 954-1)/ SIL3/SIL CL3 (EN 61508 / EN 62061) and PL e (EN ISO 13849-1).***

are in conformity with the essential requirements of the following EC Directive(s) when installed in accordance with the installation instructions contained in the product documentation:

2006/42/EC	*Machinery Directive*
2004/108/EC	*EMC Directive*

and that the standards and/or technical specifications referenced below have been applied:

EN 61496-1:2004 + A1:2008	*Safety of machinery – Electro-sensitive protective equipment – Part 1: General requirements and tests*
IEC 61496-2:2006	*Safety of machinery – Electro-sensitive protective equipment – Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPD's)*
EN ISO 13849-1:2008	*Safety of machinery – Safety-related parts of control systems – Part 1: General principles for design*
EN 61508 Parts 1-7:1998-2000	*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*

Manufacturer:	*Authorised Representative in the Community:*
Daniel L. Nachtigall	
Signature	***Signature***
Name: Daniel L. Nachtigall	*Name:* Viktor Schiffer
Position: Supv – Product Certification Engineering	*Position:* Engineering Manager
Date: 01-Mar-2011	*Date:* 08-Mar-2011

Document Control Number: SEN-0394-B-EN 1 / 2

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Catalogue number [1]	*Series* [2]	*Description*
440R-P221AGS		*MSR41 base module*
440R-P226AGS-NNR		*MSR42 base module*
445L-104794-B***		*MSR42 base module customer configuration*
440R-P4NANS		*MSR45E expander module*
445L-1****		*MSR45E expander module customer configuration*

*1) *Denotes characters representing options that do not impact the standards or directives cited on this DoC*

2) If no series number is given, then all series are covered

Technical Support / Technische Unterstützung / Assistance technique / Assistenza tecnica / Asistencia técnica	
ENGLISH	Installation of this product must not take place until the installer has obtained a copy of the manufacturer's instructions in a language which he can understand. This instruction sheet is available in multiple languages at http://rockwellautomation.com/literature.
DEUTSCH	Dieses Produkt darf erst installiert werden, wenn der Installateur eine Kopie der Instruktionen des Herstellers in der Sprache eingeholt hat, die er versteht. Diese Instruktionen sind mehrsprachig erhältlich unter: http://rockwellautomation.com/literature.
FRANÇAIS	Ce produit ne peut être installé avant l'obtention d'un duplicata des instructions du fabricant dans une langue compréhensible. La fi che d'instructions est disponible en plusieurs langues depuis le lien http://rockwellautomation.com/literature.
ITALIANO	Non si deve procedere all'installazione di questo prodotto fin quando l'installatore non abbia ottenuto una copia delle istruzioni del produttore in una lingua che l'installatore possa capire. La presente scheda di istruzioni è disponibile in linguaggi multipli sul sito web http://rockwellautomation.com/literature.
ESPAÑOL	Absténgase de instalar este producto a menos que el instalador disponga de un ejemplar de las instrucciones del fabricante en un idioma que pueda comprender. En http://rockwellautomation.com/literature puede encontrar esta hoja de instrucciones en varios idiomas.
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SVENSKA	Denna produkt får inte installeras förrän installatören har skaff at ett exemplar av tillverkarens instruktioner på ett språk som han/hon förstår. Detta instruktionsblad fi nns på fl era språk på http://rockwellautomation.com/literature.
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MAGYAR	Ez a termék csak akkor helyezhető üzembe, ha az üzembehelyezést végző személy rendelkezésére áll a gyártó használati utasítása az általa ismert nyelven. Az utasítás több nyelven megtalálható itt: http://rockwellautomation.com/literature
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MALTI	L-installazzjoni ta' dan il-prodott mgħandux isir qabel ma l-installatur jakwista kopja tal-istruzzjonijiet tal-manifattur f'lingwa li tista' tiftiehem. Il-karta tal-istruzzjonijiet hija disponibbli f'ħafna lingwi f'http://rockwellautomation.com/literature.
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ROMÂNĂ	Produsul nu trebuie să fi e instalat până când cel care instalează produsul nu a obținut o copie a manualului de utilizare , în limba pe care o poate înțelege. Aceste instrucțiuni sunt valabile în mai multe limbi la adresa http://rockwellautomation.com/literature.
SLOVENSKY	Inštalácia tohto výrobku nesmie prebehnúť, dokiaľ inštalujúca osoba nedostane pokyny výrobca v jazyku ktorému rozumie. Tieto pokyny sú k dispozícii v niekoľkých jazykoch na http://rockwellautomation.com/literature.
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TÜRKÇE	Bu ürünün kurulmasının, ürünü kuracak kişinin üreticinin hazırladığı talimatların bir kopyasını, ki bu talimatlar bu kişinin anlayacağı bir dilde olacaktır, elde edene kadar gerçekleşmemesi gerekir. Bu talimatlar pek çok dilde şu web-sayfasında mevcuttur: http://rockwellautomation.com/literature

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