Description

The GuardShield Micro 400 is an economical three-box (transmitter, receiver and controller) Type 4 safety light curtain offered in a small profile (15 x 20 mm (0.59 x 0.79 in.)) housing. Designed for use in benign industrial environments (IP54), this light-duty safety light curtain system is targeted to the semi-conductor, micro electronic and small assembly machine markets.

Protective heights are offered from 150…1200 mm (5.91…47.2 in.) in 150 mm (5.91 in.) increments. The compact housing size allows the GuardShield Micro 400 to be mounted in areas where standard safety light curtains may not be able to be mounted due to space constraints. It is also possible to recess the GuardShield Micro 400 transmitter and receiver into machine frames.

The Micro 400 requires a dedicated controller. The MSR41 controller is used for on/off application and the MSR42 can also be used as a multi-function safety module, allowing the connection of additional safety light curtains, safety laser scanner, or any safety device with two Output Signal Switch Devices (OSSD) outputs, or two contacts, such as E-stops and enabling switches.

There are a number of operating modes that can be configured with the MSR42 controller. EDM, START/Restart interlock, fixed and floating blanking and muting are possible.

The Micro 400 transmitter and receiver are offered with 8-pin M12 connectors at the end of 500 mm (19.8 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are the same and are offered in 3, 5, and 8 m (9.8, 16.4, and 26.2 ft) lengths. These patchcords are configured on one end with M12 connectors (which mate to the integrated pigtail connectors) and RJ45 connectors on the opposite end (which plug into the MSR42 controller).

Cascadable System

The GuardShield Micro 400 is also offered in a cascadable configuration. GuardShield Cascadable Micro 400 safety light curtains allow the interconnection of multiple segments of the Micro 400 safety light curtain with a common pair of safety outputs. This cascadable configurability of the GuardShield Micro 400 reduces overall system wiring and allows the GuardShield Micro 400 to be fitted into a variety of applications where the safety distances for mounting the light curtain may allow personnel to stand between the sensing field of the light curtain and the hazard or where multiple sided guarding is required and the use of corner mirrors is not possible.

A GuardShield Cascadable Micro 400 safety light curtain system is comprised of one or two pair of Cascadable Micro 400 light curtains as well as a standard Micro 400 pair as the last segment pair in the cascaded system.

GuardShield Micro 400 cascaded pairs are offered in both 14 mm and 30 mm resolutions in limited protected heights which are listed in the table below. It is possible to mix 14 mm and 30 mm resolution pairs in a cascaded Micro 400 system.

IMPORTANT	The standard GuardShield Micro 400 must always be the last segment in a cascaded Micro 400 system.

The cascadable Micro 400 safety light curtains are ordered as pairs (transmitter and receiver) and are shipped under one cat. no. After selecting the appropriate light curtain cat. nos. for a cascaded Micro 400 system, select the standard Micro 400 pair as the last segment in the cascaded system and also select interconnecting patchcords.

A cascadable pair of GuardShield Micro 400 light curtains has a 500 mm (19.8 in.) pigtail with a female M12 QD on the bottom of the Micro 400 light curtain and a 500 mm (19.8 in.) pigtail with a male M12 QD attached to the top of the Micro 400 transmitter and receiver.

The GuardShield Cascadable Micro 400 system operates as a single light curtain pair with a common set of OSSDs. Each segment pair is connected in series making the response time of the complete system the sum of each segment pair, plus the response time of the MSR41 or MSR42 and other safety devices in the stop circuit.

When connecting two cascadable segments together, the resultant cable length between segments is 1000 mm (39.6 in.).

If an additional length between segment pairs is required, Rockwell Automation offers an M12-to-M12 patchcord in 1 m (39.37 in.) and 3 m (118.1 in.) lengths (Cat. Nos. 445L-AC8PC1 or 445L-AC8PC3).

IMPORTANT	The maximum cascaded Micro 400 system length can not exceed 10 m as measured between the RJ45 connection at the MSR42 controller to the last beam in the standard Micro 400, including all cable lengths. The maximum number of beams in a cascaded Micro 400 system can not exceed 255 beams.

Features

- Very small profile 15 x 20 mm (0.59 x 0.79 in.)
- M12 connector on 20 inch pigtails
- Minimal dead space of optic heads

Applications

- Light assembly machines/equipment
- Semi-conductor
- Micro-electronics
- Pharmaceutical

2-Opto-electronics

POC Type 4 Safety Light Curtains

GuardShield Micro 400

Specifications

2-Opto-electronics

Safety Ratings

Standards	IEC/EN61496 Parts 1 and 2. UL61496 Parts 1 and 2, UL1998
Safety Classification	Type 4 per IEC/EN61496. Category 4 device per EN 954-1, SIL 3 per IEC 61508, PLe per EN/ISO 13849
Certifications	cULus Listed, TÜV, CE Marked for all applicable directives
Power Supply	Input power from MSR41 or MSR42 controller
Input Power, Max.	24V DC ±15%
Maximum Residual Ripple	5% of Vss
Power Consumption	0.07 A max. (no load)

Outputs

Micro 400 Outputs	Data output to controller (MSR41 or MSR42)
MSR41/MSR42 Outputs	Two 400 mA OSSD
Non-Safety Outputs	Auxiliary outputs from MSR41 or MSR42 controller—2 configurable 100 mA, outputs
Switching Current @ Voltage, Max.	400 mA @ 24V DC

Operating Characteristics

Response Time	14 mm: 14…42 ms; 30 mm; 12…23 ms, varies by protective height and resolution
Indicator LEDs—light curtains	ON -State, OFF-State, Intensity
Protected Height [mm (in.)]	150…1200 mm (5.91…47.24 in.) in 150 mm increments
Resolution [mm (in.)]	14 (0.55), 30 (1.18)
Scanning Range/Resolution	14 mm (0.55 in.) resolution: 0…5 m (16.4 ft) 30 mm (1.18 in.) resolution: 0…5 m (16.4 ft)
Synchronization	Electrical through MSR41 or MSR42
Wavelength	940 nm

Environmental

Enclosure Type Rating	Micro 400 is IP54; MSR41 and MSR42 are IP20
Relative Humidity	15…95% (noncondensing)
Operating Temperature [C (F)]	0…55 ° (14…131 °)
Vibration	IEC 60068-2-6; Frequency 10…55 Hz; Amplitude 0.35 mm (0.01 in.)
Shock	IEC 60068-2-29; Acceleration 10 g, pulse duration 16 ms 10…55 Hz; Amplitude 0.35 mm (0.01 in.)

Physical Characteristics

Mounting	180° adjustable mounting brackets supplied
Weight	Varies by protective height
Housing Cross Section	15 mm x 20 mm (0.59…0.79 in.)
Connection Type	Transmitter/receiver: 8-pin M12 micro QD
Cable Length	For MSR41 and MSR42: 3, 5, and 8 m (9.8, 16.4, and 26.2 ft), max. Total system length can not exceed 10 m (32.8 ft).
Cascadable Patchcords	1 and 3 m (39.37 and 118.1 in.) M12 to M12 patchcords. Total system length cannot exceed 10 m (32.8 ft) including protective height of Micro 400 (500 mm (19.8 in.)), integrated cables and patchcords from M12 connector to MSR41 or MSR42.

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Guardmaster®

Product Selection

IMPORTANT	The maximum length of a GuardShield Micro 400 system is limited to 10 m. This total length includes the length from the last beam in the light curtain housing plus the length of the pigtail cable and the patchcord length.

Standard System

The Allen-Bradley Guardmaster GuardShield Micro 400 safety light curtains are offered in 14 and 30 mm resolution, are ordered as pairs (transmitter and receiver) and are shipped under one cat. no. Each GuardShield Micro 400 pair is shipped with 180° adjustable mounting brackets. After selecting the appropriate pair by cat. no., ensure that the dedicated safety controller (MSR42), required cables, interfaces and accessories are ordered as needed.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
150 (5.9)	14 (0.55)	15	445L-P4C0150FP	150 (5.9)	30 (1.18)	6	445L-P4E0150FP
300 (11.8)	14 (0.55)	30	445L-P4C0300FP	300 (11.8)	30 (1.18)	12	445L-P4E0300FP
450 (17.7)	14 (0.55)	45	445L-P4C0450FP	450 (17.7)	30 (1.18)	18	445L-P4E0450FP
600 (23.6)	14 (0.55)	60	445L-P4C0600FP	600 (23.6)	30 (1.18)	24	445L-P4E0600FP
750 (29.5)	14 (0.55)	75	445L-P4C0750FP	750 (29.5)	30 (1.18)	30	445L-P4E0750FP
900 (35.4)	14 (0.55)	90	445L-P4C0900FP	900 (35.4)	30 (1.18)	36	445L-P4E0900FP
1050 (41.3)	14 (0.55)	105	445L-P4C1050FP	1050 (41.3)	30 (1.18)	42	445L-P4E1050FP
1200 (47.2)	14 (0.55)	120	445L-P4C1200FP	1200 (47.2)	30 (1.18)	48	445L-P4E1200FP

IMPORTANT	The GuardShield Micro 400 requires a dedicated controller (MSR41 or MSR42) as well as transmitter and receiver patchcords.

### Cascadable System

The Allen Bradley Guardmaster GuardShield Cascadable Micro 400 safety light curtains are offered in limited protective heights in 14 mm and 30 mm resolutions.They are most commonly ordered as pairs (cascadable transmitter and cascadable receiver) and are shipped under one part number. Each GuardShield Cascadable Micro 400 pair is shipped with mounting brackets. After selecting the appropiate cascadable pair cat. no., ensure that the dedicated safety controller (MSR41 or MSR42), appropiate cables, interfaces and accessories are ordered as well.

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.	Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
150 (5.9)	14 (0.55)	15	445L-C4C0150FP	150 (5.9)	30 (1.18)	6	445L-C4E0150FP
300 (11.8)	14 (0.55)	30	445L-C4C0300FP	300 (11.8)	30 (1.18)	12	445L-C4E0300FP
450 (17.7)	14 (0.55)	45	445L-C4C0450FP	600 (23.6)	30 (1.18)	24	445L-C4E0600FP
600 (23.6)	14 (0.55)	60	445L-C4C0600FP	900 (35.4)	30 (1.18)	36	445L-C4E0900FP
900 (35.4)	14 (0.55)	90	445L-C4C0900FP	1200 (47.2)	30 (1.18)	48	445L-C4E1200FP
1200 (47.2)	14 (0.55)	120	445L-C4C1200FP			—	

Micro 400 Patchcord for Interconnecting Cascaded Segments (if required)
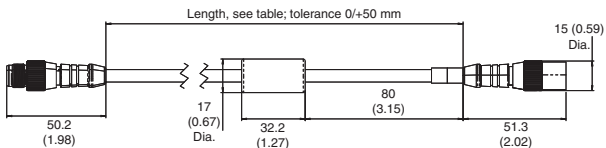
Cascadable Patchcords

Description	Cat. No.
1 m (39.37 in.) patchcord	445L-AC8PC1
3 m (118.11 in.) patchcord	445L-AC8PC3
5 m (196.85 in.) patchcord	445L-AC8PC5

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Micro 400 IP69K Light Curtains

The GuardShield Micro 400 is offered with the transmitter and receiver sealed in clear acrylic tubes with an environmental rating of IP69K. These IP69K Micro 400 light curtains are factory sealed and are ordered as pairs. They are offered in a 14 mm resolution in protected heights of 300 mm (11.8 in.), 600 mm (23.6 in.), 900 mm (35.4 in.) and 1200 mm (47.2 in.) with an operating range of five meters.

The required MSR 41 or MSR42 controllers maintain the IP20 rating and must be mounted in a suitable enclosure.

The Micro 400 IP69K transmitter and receiver are both offered with eight pin M12 connectors at the end of 500 mm (19.8 in.) integrated cables. The patchcords to connect the transmitter and receiver to the controller are the same cat. no. and are offered in 3 m (9.8 ft), 5 m (16.4 ft), and 8 m (26.2 ft) lengths.

These patchcords are configured on one end with M12 connectors, which mate to the integrated pigtail connectors and RJ45 connectors on the opposite end. These connectors plug into the MSR41 or MSR42 controller.

Areas of Use
- Light assembly machines/equipment
- Semi-conductor
- Micro-electronics
- Pharmaceutical
- Filling systems
- Clean rooms
- Food processing

Protected Height [mm (in.)]	Resolution [mm (in.)]	Number of Beams	Cat. No.
300 (11.8)	14 (0.55)	30	445L-P4C0300KD
600 (23.6)	14 (0.55)	60	445L-P4C0600KD
900 (35.4)	14 (0.55)	90	445L-P4C0900KD
1200 (47.2)	14 (0.55)	120	445L-P4C1200KD

Required Micro 400 Controller—Select One

	Mounting	Size	Cat. No.
MSR41—ON/OFF	35 mm DIN Rail	22.5 mm	**440R-P221AGS**
MSR42—Multi-functional module	35 mm DIN Rail	22.5 mm	**440R-P226AGS-NNR**
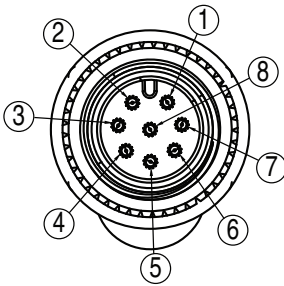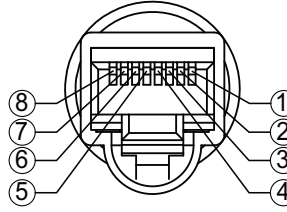
Optional Safety Relay Interfaces

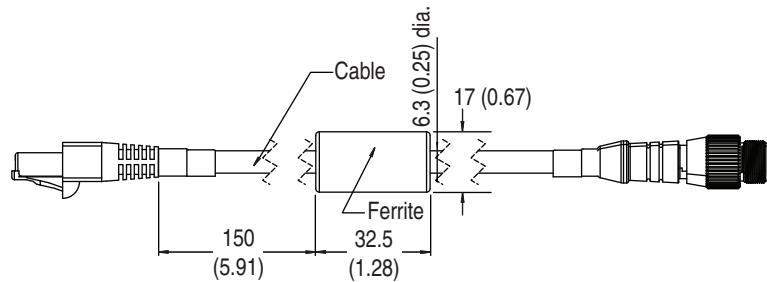| Relay	Input Voltage	Reset	Outputs	Cat. No.
MSR45E Safety Relay Expansion Model	Supplied by MSR41 or MSR42	Determined by MSR41 or MSR42	2 N.O.	**440R-P4NANS**

Possible Logic Interfaces

Description	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. Page No.	Cat. No.
Single-Function Safety Relays for 2 N.C. Contact Switch							
MSR127RP	3 N.O.	1 N.C.	Removable (Screw)	Monitored Manual	24V AC/DC	5-26	**440R-N23135**
MSR127TP	3 N.O.	1 N.C.	Removable (Screw)	Auto./Manual	24V AC/DC	5-26	**440R-N23132**
MSR126	2 N.O.	None	Fixed	Auto./Manual	24V AC/DC	5-24	**440R-N23117**

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Standard Micro 400 Patchcords—Required (Transmitters and receivers both use 8-pin M12 to RJ45 patchcords)

Face View M12 Connector	Face View RJ45 Connector	Description	Cat. No.
		1 m patchcord, PVC jacket	445L-AC8RJ1
		2 m patchcord, PVC jacket	445L-AC8RJ2
		3 m patchcord, PVC jacket	445L-AC8RJ3
		5 m patchcord, PVC jacket	445L-AC8RJ5
		8 m patchcord, PVC jacket	445L-AC8RJ8

Pinning table (M12):
1: blue
2: grey
3: green
4: white
5: black
6: pink
7: brown
8: yellow
Shield: Braid wires

Pinning table (RJ45):
1: blue
2: grey
3: green
4: white
5: black
6: pink
7: brown
8: yellow
Shield: Braid wires

Patchcord [mm (in.)]

Cable
6.3 (0.25) dia.
17 (0.67)
Ferrite
150 (5.91)
32.5 (1.28)

## Optional Safety Relay Interface (accessories for MSR41 or MSR42 Controllers)

The MSR41 or MSR42 can have up to three MSR45E safety relays inter-connected. Each module requires a ribbon cable connector to make the interconnection. The table shows the cat. no. for each ribbon cable connector as well as the optical interface for the programming of the MSR42. Programming of the MSR42 is only necessary for advanced operating modes or connection of additional devices.

Description	Cat. No.
Ribbon cable—for one MSR45E	**440R-ACABL1**
Ribbon cable—for two MSR45Es	440R-ACABL2
Ribbon cable—for three MSR45Es	440R-ACABL3
USB optical interface software configuration tool used to configure the MSR42	**445L-AF6150**

Note: The configuration software can be downloaded at *www.ab.com/safety*.

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Single-Function Safety Relays
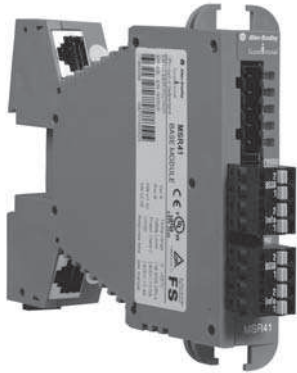
MSR41

Description

The MSR41 safety relay is a simple on/off control module for the GuardShield Micro 400 safety light curtain. This Category 4, SIL CL3 safety device has a pair of PNP solid state, 400 mA OSSDs for direct connection to the final switching device. When safety relay outputs are required, the MSR41 easily accommodates the interconnection of up to three MSR45E safety relay expansion modules, each providing a pair of safety relay outputs. Simply connect ribbon cable connectors from the back of the MSR41 to each of the MSR45E modules for a series of interconnections for two PNP OSSDs, and six N.O. relay outputs.

This 22.5 mm DIN mount safety relay can only be configured through hard-wired configurations. This relay module does not support configuration through the software but can be used for diagnostics only. The removable spring terminal connectors on the MSR41 allow for ease of wiring of the device as well as hard-wired operating mode configuration.

Manual/automatic reset and start/restart can be configured by simply changing the wiring (see examples).

Features

- Category 4 per EN 954-1
- SIL CL3 IEC 61508, IEC 62061
- 22.5 mm housing
- Stop category 0
- 24V DC supply voltage
- Manual or automatic reset
- Eight diagnostic LEDs
- Unique design allows for easy addition of relay expansion modules
- Removable terminal blocks
- Two auxiliary and standard outputs
- RJ45 connections for Micro 400 safety light curtain
- Supports up to three MSR45E expander units

LED Indicators (Default Configuration)

LED	Green	Red
OSSD2	Output active	Output inactive
OSSD1	Output active	Output inactive
Info2 (LED)	System OK	Lockout
Info1 (LED)	Safety Outputs ON	Safety Outputs OFF
IN2	Reset OK	Waiting for reset signal
IN1	—	—
0V	—	—
+24V	Power connected	No power connected

Specifications

Safety Ratings

Standards	EN 954-1, IEC/EN 60204-1, IEC 61496-1
Safety Classification	Cat. 4 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 61508, PLe per ISO 13849-1
Functional Safety Data ∗ **Note**: For up-to-date information, visit *http://www.ab.com/Safety/*	PFD: 2.92E-09 (w LC) SFF: 96.40% (w LC) For use in SIL3 systems (according to IEC 61508) depending on the architecture and application characteristics
Certifications	CE Marked for all applicable directives, cULus, and TÜV

Power Supply

Input Power Entry	24V DC
Power Consumption	2.4 W (semi-conductor outputs unloaded)

Inputs

Safety Inputs	GuardShield Micro 400 Light Curtain
Input Resistance, Max.	—
Reset	Auto./manual
Power On Delay Time	Determined by configuration
Response Time	Determined by configuration

Outputs

Safety Contacts	2 PNP, 400 mA each
Auxiliary Contacts	2 PNP

Environmental and Physical Characteristics

Enclosure Type Rating/ Terminal Protection	IP20/ IP20
Operating Temperature [C (F)]	0…55 ° (32…131 °)
Vibration	0.35 mm 10…55 Hz
Mounting	35 mm DIN Rail
Weight [g (lbs)]	130 (0.287)
Conductor Size, Max.	1 x 2.5 mm2 (14 AWG) stranded

∗ Usable for IEC 62061. Data is based on the following assumptions:
 - Mission time/Proof test interval of 20 years

Product Selection

Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
GuardShield Micro 400	2 PNP	2 PNP	Removable	Auto./manual	24V DC	**440R-P221AGS**

Accessories

| Description	Cat. No.
MSR45E—expander for MSR41 and MSR42	440R-P4NANS
Ribbon cable—for one MSR45E	**440R-ACABL1**
Ribbon cable—for two MSR45Es	440R-ACABL2
Ribbon cable—for three MSR45Es	440R-ACABL3
Replacement terminal block kit—MSR41	440R-ATERM1P
Replacement terminal block kit—MSR45E	440R-ATERM2C

Approximate Dimensions

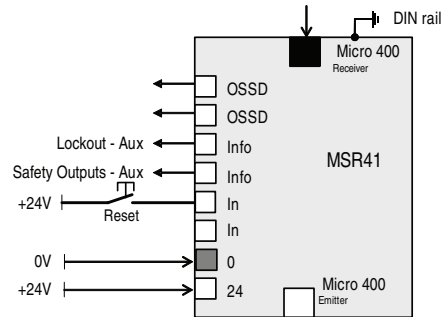*Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.*
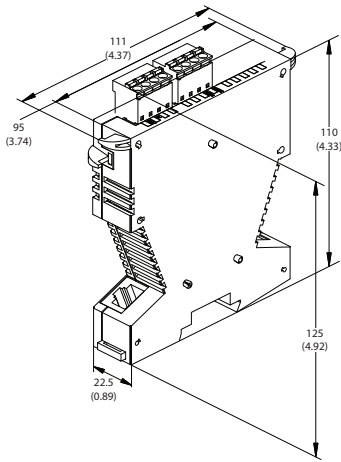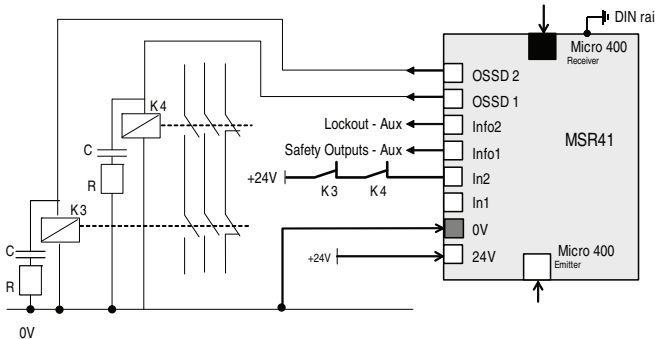

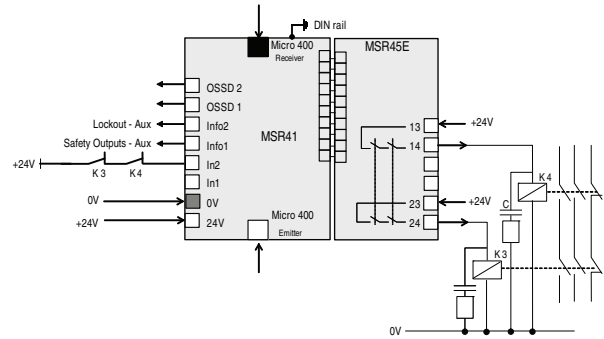## Typical Wiring Diagrams
Default Configurations (No Software)
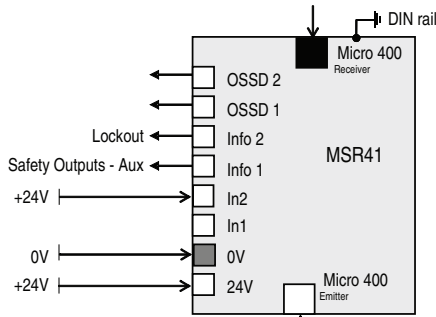
Micro 400 Light Curtain, Automatic Reset, No Output Monitoring

Micro 400 Light Curtain, Manual Reset, No Output Monitoring

Micro 400 Light Curtain, Manual Reset, Output Monitoring

Micro 400 Light Curtain, Automatic Reset, Output Monitoring

5-Safety Relays

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