

Specialty Safety Relays

MSR35H/HP Two-Hand Control



Housing with removable terminals shown.

Description

The Minotaur MSR35H/HP is a microprocessor-based, two-hand control monitoring safety relay, with safety-rated, solid-state outputs.

The input of the MSR35H/HP accepts two switches, each containing one normally open and one normally closed. Both switches must be actuated within 0.5 seconds of each other.

The MSR35 can alternatively be wired with two switches with normally open contacts to a Category IIIA application per EN 574.

The reset capability of the MSR35H/HP allows it to be set up for manual or automatic reset.

The outputs include two normally-open safety-rated outputs that can be connected to loads up to 2 A at 24V DC. These outputs can be used to send a safety stop signal to a machine or manufacturing system.

The MSR35H/HP also has one solid-state normally-closed auxiliary output, which must only be used to indicate the status of the MSR35H/HP.

Features

- Category 4 per EN 954-1
- Category IIIC or IIIA per EN 574
- Two solid-state safety outputs
- One solid-state auxiliary output
- Two-hand control input

LED Indicators

Green	Power (Pwr)
Green	K1 Energized
Green	K2 Energized

Specifications

Safety Ratings	
Standards	EN 954-1, ISO 13849-1, EN 574, IEC/EN 60204-1, ANSI B11.19, AS4024.1
Safety Classification	Cat. 4 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 62061, PLe per ISO 13849-1
Functional Safety Data * Note: For up-to-date information, visit http://www.ab.com/Safety/	PFH _D : < 9.2 x 10 ⁻¹⁰ MTTF _D : > 631 years Suitable for performance levels Pl _e (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics
Certifications	CE Marked for all applicable directives, cULus, c-Tick, and TÜV
Power Supply	
Input Power Entry	24V DC SELV
Power Consumption	3 W
Inputs	
Safety Inputs	1 N.C. & 1 N.O. or 2 N.O.
Input Simultaneity	0.5 s
Input Resistance, Max.	200 Ω
Reset	Automatic
Power On Delay/Recovery Time	3 seconds/20 ms
Response Time	15 ms
Outputs	
Safety Contacts	2 N.O., 2 A @ 24V DC
Auxiliary Contacts	1 N.O., 50 mA @ 24V DC
Fuses, Output	External 6 A slow blow or 10 A fast acting
Power LED Diagnostics	3 s Blink: Initialization Constant: Normal Operation 2 Blinks: Configuration change during operation 4 Blinks: Solid state output switch fault Continuous blinking: Internal fault
Environmental and Physical Characteristics	
Enclosure Type Rating/ Terminal Protection	IP40 (NEMA 1), DIN 0470/ IP20, DIN 0470
Operating Temperature [C (F)]	-5...+55 ° (23...131 °)
Vibration	10...55 Hz, 0.35 mm
Shock	10 g, 16 ms, 100 shocks
Mounting	35 mm DIN Rail
Weight [g (lbs)]	130 (0.287)
Conductor Size, Max.	0.2...2.5 mm ² (24...14 AWG)

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:

- Mission time/Proof test interval of 20 years

Product Selection

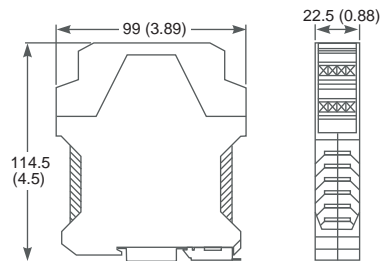
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
2 x 1 N.C. + 1 N.O. (Two-Hand Control) or 2 x N.O.	2 N.O. Solid State Safety; 1 N.O. Solid State Auxiliary	1 N.O. Solid State	Fixed	Automatic	24V DC SELV	440R-D23201
			Removable			440R-D23202

Accessories

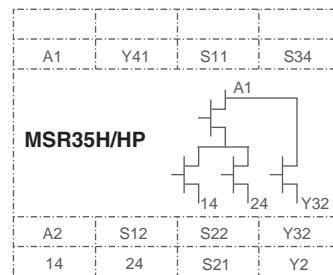
Description	Cat. No.
Bag of 4, 4-Pin Screw Terminal Blocks	440R-A23209
Bag of 4, 4-Pin Spring Clamp Terminal Blocks	440R-A23228

Approximate Dimensions

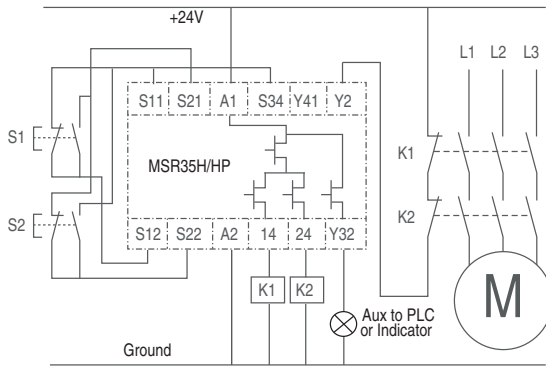
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram

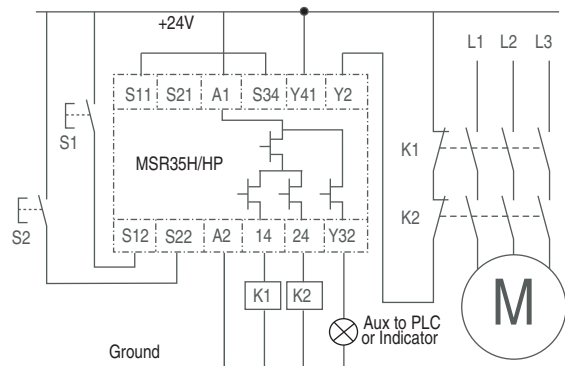


Typical Wiring Diagrams



Switch connection to pulsed signals from S11 and S21, connection between S11 and S34.

Two-Hand Control, Dual Channel Outputs, Output Monitoring



Switch connection direct to 24V DC supply, Y41 to +24V DC, connection between S11 and S34.

Two-Hand Control, Dual Channel Outputs, Output Monitoring

Note: EN 574 IIIC when wired with two sets of N.O./N.C., EN 574 IIIA when wired with two sets of N.O. contacts.

Note: Connect Y41 to +24V to disable pulse testing.



Description

The Allen-Bradley Guardmaster Minotaur MSR125H/HP is a logic unit for monitoring and interfacing two-hand control devices with a safety-related circuit. The MSR125H/HP is for use with mechanical switches and the Rockwell Automation Bulletin 800Z Zero-Force Touch Buttons.

The MSR125H/HP has two normally open safety outputs. The safety outputs have independent and redundant internal contacts to support the safety function.

The MSR125H/HP requires the two switches to be operated within 0.5 seconds of each other and will only authorize the ON state while both switches are held down. If one of the switches is released, the output goes to the OFF state and the machine cannot be restarted until both buttons are released and then operated simultaneously.

The MSR125H/HP conforms to EN 574 Category IIIC, which gives specific requirements for two-hand control units and logic devices.

The MSR125H has fixed terminals and the MSR125HP has removable terminals.

Features

- Category 4 per EN 954-1
- Safety category IIIC per EN 574
- Two-hand control unit
- Two N.O. safety outputs
- Fixed or removable terminals
- 22.5 mm wide housing

LED Indicators

Green	Power on
Green	CH1 Output Active
Green	CH2 Output Active

Specifications

Safety Ratings		
Standards	EN 574, EN 954-1, ISO 13849-1, IEC/EN 60204-1, IEC 60947-4-1, IEC 60947-5-1, ANSI B11.19, AS 4024.1	
Safety Classification	Cat. 4 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 62061, PLe per ISO 13849-1	
Functional Safety Data * Note: For up-to-date information, visit http://www.ab.com/Safety/	PFH _D : < 1.44 x 10 ⁻⁹ MTTF _d : > 385 years Suitable for performance levels Ple (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics	
Certifications	CE Marked for all applicable directives, cULus, c-Tick, and BG	
Power Supply		
Input Power Entry	24V DC, 24V AC, 115V AC, 230V AC	
Power Consumption	2 W	
Inputs		
Safety Inputs	1 N.C. + 1 N.O.	
Input Simultaneity	<0.5 sec	
Input Resistance, Max.	40 Ω	
Reset	Automatic	
Power On Delay/Recovery Time	1 second/500 ms	
Response Time	20 ms	
Outputs		
Safety Contacts	2 N.O.	
Thermal Current/ <i>I_{th}</i>	1 x 6 A or 2 x 4 A nonswitching	
Rated Impulse withstand Voltage	2500V	
Switching Current @ Voltage, Min.	10 mA/10V	
Fuses, Output	External 6 A slow blow or 10 A fast acting	
Electrical Life (Operations)	(With surge suppression) 250V AC/6 A/1500VA cosφ = 0.35...0.1 M 250V AC/2.5 A/625VA cosφ = 0.6...0.5 M 250V AC/1.5 A/375VA cosφ = 0.35...0.3 M 250V AC/5 A/1250VA cosφ = 0.6...0.1 M 24V DC/2 A/48 W = 1 M 10V DC/0.01 A/0.1 W = 2 M	
Mechanical Life	2,000,000 operations	
Utilization Category		
Resistive: AC-1	8 A @ 250V AC	
Resistive: DC-1	6 A/24V DC	
Inductive: AC-15	6 A @ 250V AC	6 A @ 125V AC
Inductive: DC-13	3 A/24V DC	6 A/24V DC @ 6 ops/min
Resistive UL:	B300, R300, 8 A/250V AC, 6 A/24V DC, 30V DC Resistive	
Environmental and Physical Characteristics		
Enclosure Type Rating/ Terminal Protection	IP40 (NEMA 1), DIN 0470/ IP20, DIN 0470	
Operating Temperature [C (F)]	-5...+55 ° (23...131 °)	
Vibration	10...55 Hz, 0.35 mm	
Shock	10 g, 16 ms, 100 shocks	
Mounting	35 mm DIN Rail	
Weight [g (lbs)]	24V DC: 210 (0.46); 115/230V AC: 260 (0.57)	
Conductor Size, Max.	0.2...4 mm ² (24...12 AWG)	

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
- Mission time/Proof test interval of 20 years

Product Selection

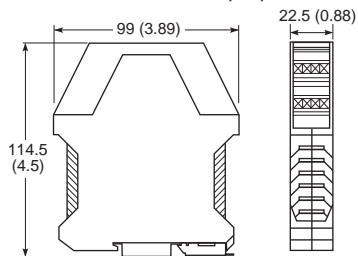
Inputs	Button Type	Safety Outputs	Terminals	Reset Type	Power Supply	Cat. No.
1 N.C. + 1 N.O. (Two-Hand Control)	Mechanical or Bulletin 800Z	2 N.O.	Removable (MSR125HP)	Automatic	24V DC	440R-D23171
					24V AC	440R-D23170
					115V AC	440R-D23169
			Fixed (MSR125H)		230V AC	440R-D23168
					24V DC	440R-D23166
					115V AC	440R-D23164
					230V AC	440R-D23163

Accessories

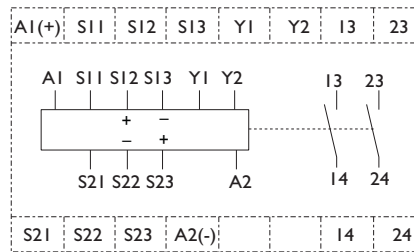
Description	Cat. No.
Bag of 4, 4-Pin Screw Terminal Blocks	440R-A23209
Bag of 4, 4-Pin Spring Clamp Terminal Blocks	440R-A23228

Approximate Dimensions

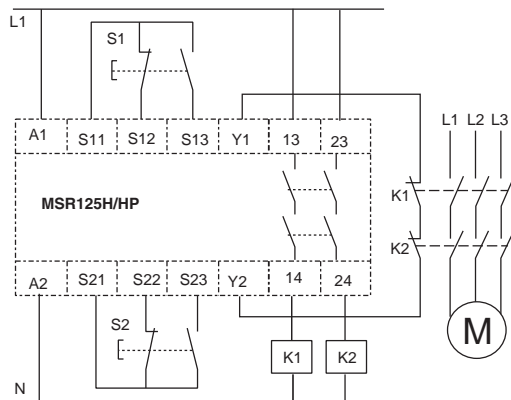
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



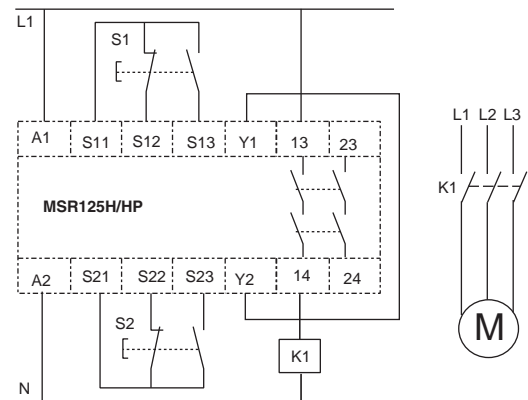
Block Diagram



Typical Wiring Diagrams



**Two-Hand Control, Dual Channel, Auto Reset,
Output Monitoring**



**Two-Hand Control, Dual Channel, Auto Reset,
No Output Monitoring**



Description

The MSR22LM safety monitoring relay is designed to monitor light curtains with the added features of muting and presence sensing device initiation (PSDI). It provides an output to a machine control system when the light curtain is clear. When the inputs to the MSR22LM are closed (conducting), the output relays are closed if the monitoring circuit is satisfied.

The MSR22LM has three sets of dual channel inputs. This allows it to operate in four different configurations:

1. Monitors up to three light curtains in guard only mode.
2. Monitors up to two light curtains with two muting sensors (only one curtain muted).
3. Monitor one light curtain with four muting sensors.
4. Monitors up to three light curtains with PSDI (only one curtain initiated).

The MSR22LM uses microprocessor based technology to offer a wide variety of advanced safety solutions in a small 45 mm DIN rail mounted housing. Internal selector switches provide for easy selection of up to ten different applications. Four LEDs give operational status as well as diagnostic information. Removable terminals reduce wiring and installation costs when replacement is necessary.

Features

- Category 4 per EN 954-1
- Stop category 0
- Light curtain muting—two or four sensors
- Presence sensing device initiation—up to three breaks
- 45 mm housing
- Removable terminals
- 24V DC supply voltage
- Start/restart interlock

LED Indicators

Power: Green	Ready
K1: Green	K1 Closed
If K1 alone is lit, check for short across reset button	
K2: Green	K2 Closed

Specifications

Safety Ratings		
Standards	EN 954-1, ISO13849-1, IEC/EN 60204-1, IEC 60947-5-1, IEC 61496-1, ANSI B11.19, AS4024.3	
Safety Classification	Cat. 4 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 62061, PLe per ISO 13849-1	
Functional Safety Data *	PFD _D : < See website MTTF _d : > See website Note: For up-to-date information, visit http://www.ab.com/Safety/	
Certifications	CE Marked for all applicable directives and BG	
Power Supply		
Input Power Entry	24V DC	
Power Consumption	4 W	
Inputs		
Safety Inputs	2 N.C. Symmetric or Asymmetric, Switch Selectable	
Input Simultaneity	0.5 seconds	
Input Resistance, Max.	S12-S14: 300 Ω S21-S22: 200 Ω S33-S34: 250 Ω	
Reset	Auto./Manual	
Power On Delay Time	40 ms (Manual Reset); 200 ms (Auto Reset)	
Response Time	15 ms	
Outputs		
Safety Contacts	2 N.O.	
Auxiliary Contacts	1 N.C.	
Thermal Current/ <i>I_{th}</i>	5 A nonswitching	
Switching Current @ Voltage, Min.	1 mA @ 10V	
Fuses, Output	6 A fast acting (external)	
Electrical Life (Operations)	220V AC/4 A/880VA $\cos\phi = 0.35 \dots 0.1$ M 220V AC/1.7 A/375VA $\cos\phi = 0.6 \dots 0.5$ M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M	
Mechanical Life	10,000,000 operations	
Utilization Category (Inductive)		
B500: AC-15	3 A @ 250V AC	3 A @ 120V AC
P300 DC-13	3 A/24V DC	
B300 AC-15	2 A @ 250V AC	2 A @ 120V AC
DC-13	2 A/24V DC	
Environmental and Physical Characteristics		
Enclosure Type Rating/ Terminal Protection	IP40 (NEMA 1), DIN 0470/ IP20, DIN 0470	
Operating Temperature [C (F)]	-15...+55 ° (5...131 °)	
Vibration	0.35 mm 10...55 Hz	
Mounting	35 mm DIN Rail	
Weight [g (lbs)]	220 (0.485)	
Conductor Size, Max.	1 x 2.5 mm ² (14 AWG) stranded, 1 x 4 mm ² (12 AWG) solid	

- * Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
- Mission time/Proof test interval of 20 years
 - Functional test at least once within six-month period

Product Selection

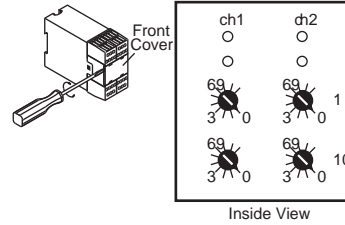
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
3 x 2 N.C.	2 N.O.	1 N.C.	Removable	Auto./Manual	24V DC	440R-P23071

Accessories

Description	Cat. No.
70 mm Tower Light Clear LED Module—Black Enclosure	855T-B24YL7
70 mm Tower Light Clear LED Module—Grey Enclosure	855T-G24YL7

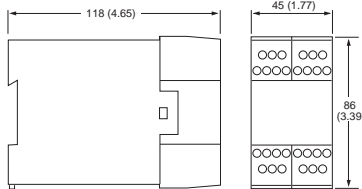
Application Details

Disconnect power. Use a screwdriver to pop open front cover to reveal internal switches.

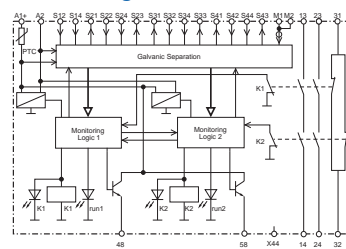


Approximate Dimensions

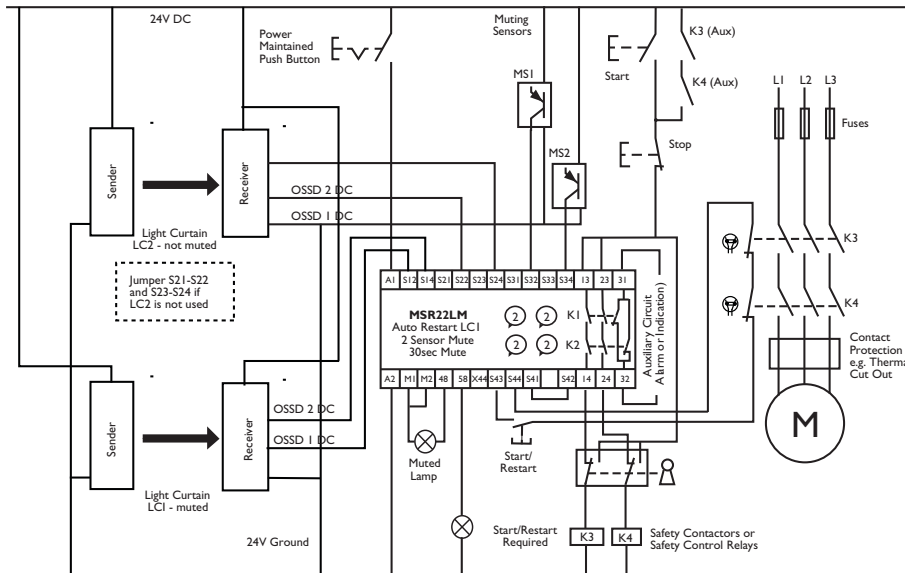
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram

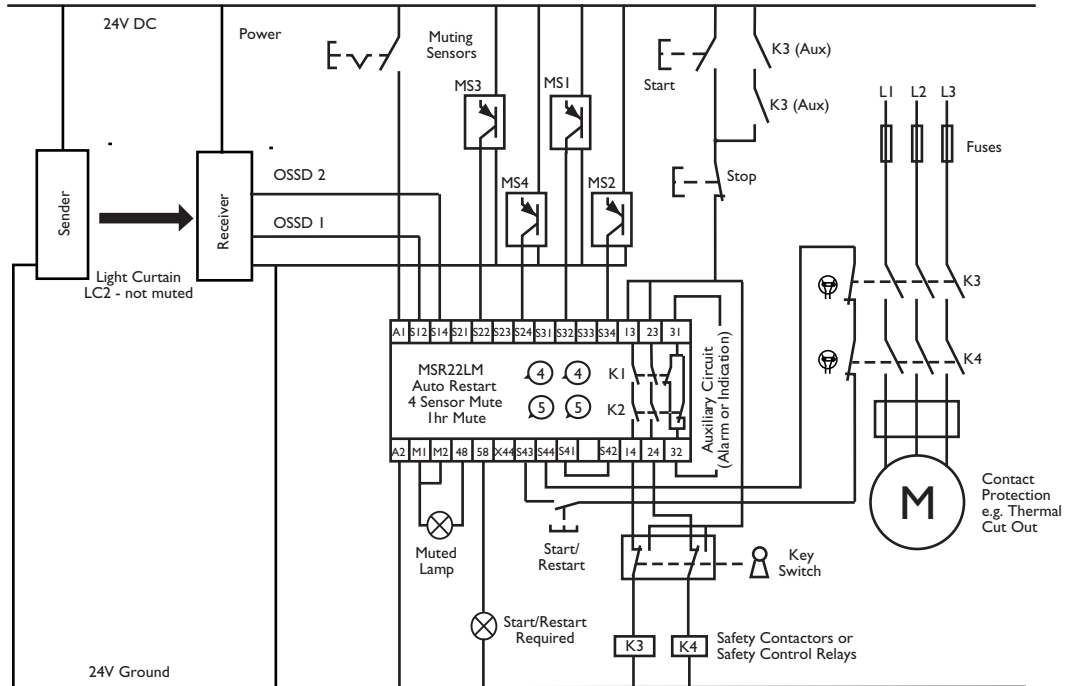


Typical Wiring Diagrams

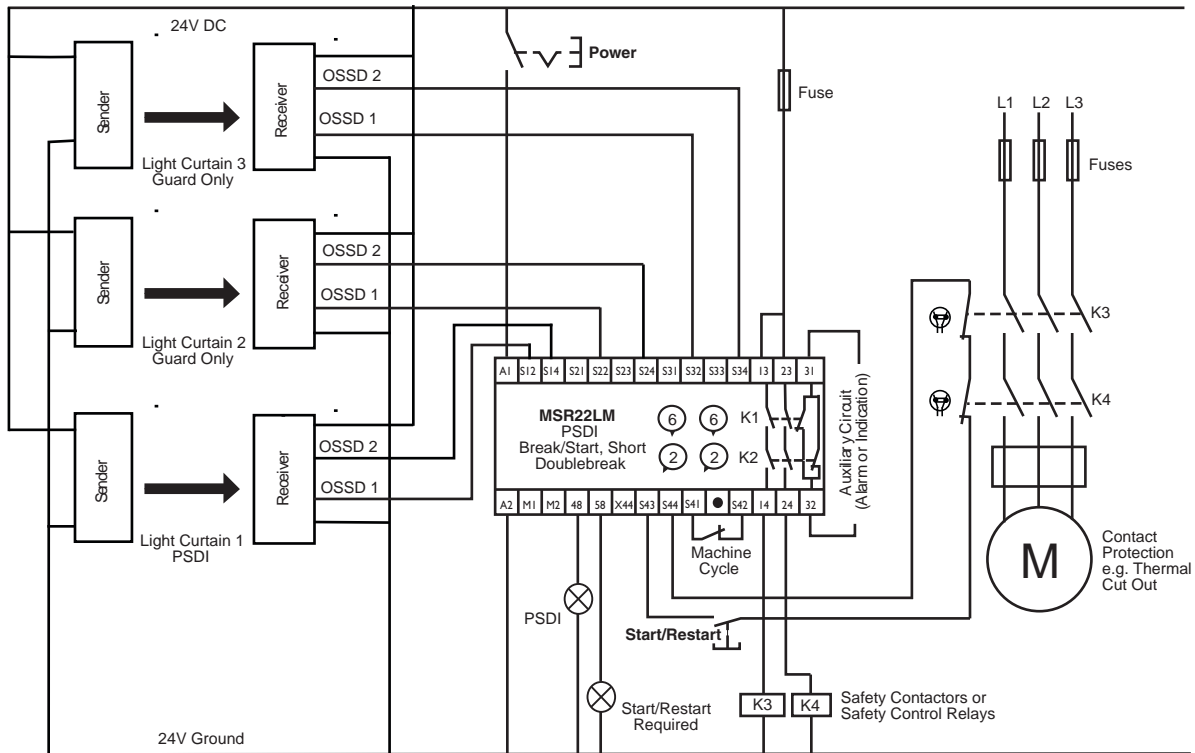


Note: Two light curtains with two-sensor muting and Auto Restart LC1.

Logic
Specialty Safety Relays
 MSR22LM Muting Light Curtain



Note: Typical one light curtain with four-sensor muting and Auto Restart LC1.



Note: Light curtain inputs, Presence Sensing Device Initiation (on LC1) Start/Restart Interlock, Dual Channel Output, Output Monitoring.

5-Safety Relays

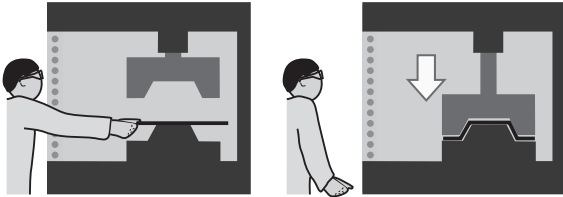
Application Details

MSR22LM—Shown connected to a safety light curtain.

Multiple settings are available offering a variety of advantages. Below are the three most common settings.

Protective Mode

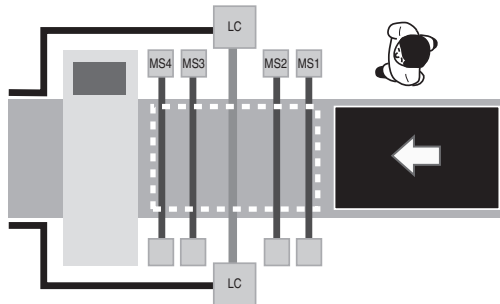
Example shows a press protected by a safety light curtain connected to the MSR22LM.



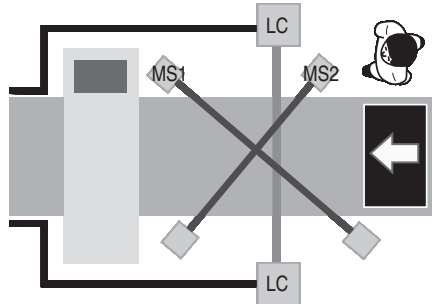
In machine operation, whenever the light curtain beams are broken the press immediately stops to help avoid danger to the operator. Once the beams are cleared the machine can then be started.

Muting Mode

Two examples are shown, both conveyor applications with a safety light curtain protecting the dangerous area. In-line and cross beam muting is used to allow the material to pass through the light curtain without stopping the machine. Any other object or person will be detected by the light curtain which will initiate machine stop.



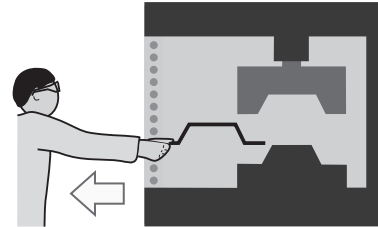
In-line muting requires the material to break the beams in a sequence, as shown. Only if all four MS beams are broken in turn and then clear in turn will the light curtain allow material through without initiating machine stop.



Cross-beam muting requires the material to break the beams in a sequence. MS1 first and then MS2. Only if the beams are broken in turn and then clear in turn will the light curtain allow material through without initiating machine stop.

Auto Initiation Sequence (Stepping)—Double Break Shown

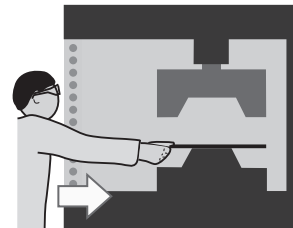
Auto initiation allows the machine to start and stop according to the number of times the light curtain beams are broken and cleared. Illustrated below is the MSR22LM set to auto initiation double break mode (after initial start-up sequence). Single- or three-break modes can also be selected.



First break—processed material removed

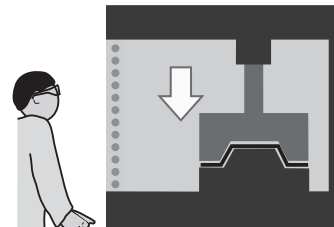
First clear—light curtain clear

Machine remains in stop mode



Second break—new material inserted

Machine remains in stop mode



Second clear—light curtain clear

Machine starts. Upon completion of cycle first break will start sequence again.



Description

The MSR42 multi-function safety relay is the control module for the GuardShield Micro 400 safety light curtain, but can also be used with any light curtain. This versatile Category 4 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 MSR42 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 MSR42 to each of the MSR45E modules for a series of interconnections for two PNP OSSDs, and six N.O. relay outputs.

The MSR42 has four software configurable inputs. These configurable safety inputs allow the connection of a multitude of safety devices such as safety light curtains, safety laser scanners, e-stops, safety switches, etc.

This 22.5 mm DIN mount multi-function safety module has both hard wired and software configurable operating modes. The removable spring terminal connectors on the MSR42 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 basic configuration examples).

Features such as two or four sensor muting, connecting up to two additional safety light curtains or other safety devices and configuring one or two auxiliary outputs are easily configured using the optical interface with the supplied software.

The MSR42 and Micro 400 light curtains support fixed blanking which is only available in the basic configuration mode and configured through a "teach-in" selector switch via the GPIO pins.

Features

- Category 4 per EN 954-1
- SIL CL3 IEC 61508, IEC 62061
- 22.5 mm housing
- Stop category 0, 1
- 24V DC supply voltage
- Manual, monitored or automatic reset
- Thirteen diagnostic LEDs
- Unique design allows for easy addition of relay expansion modules
- Removable terminal blocks
- One or two configurable auxiliary, standard outputs
- Connection of one or two additional safety devices
- RJ45 connections for Micro 400 safety light curtain
- Two or four sensor muting (Micro 400 only)
- Fixed blanking (Micro 400 only)
- Two sensor muting all GuardShield light curtains
- Supports up to three MSR45E expander units
- Free configuration software can be downloaded at www.ab.com/safety

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/	PFH _D : < 9.00E-10 MTTF _D : > 331 years 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	2 N.C. or 2 OSSD, Micro 400 software selectable
Input Resistance, Max.	—
Reset	Auto./manual or manual monitored
Power On Delay Time	Determined by configuration
Response Time	Determined by configuration
Outputs	
Safety Contacts	2 PNP, 400 mA each
Auxiliary Contacts	2 PNP, configurable
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 mm ² (14 AWG) stranded

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

LED Indicators (Basic Configuration) *❄

LED	Green	Red
Lamp	—	—
GPI04	Automatic start	Manual start (off)
GPI03	Manual or automatic start	Manual start (off)
GPI02	Configurable	Configurable
GPI01	Configurable	Configurable
OSSD2	Output active	Output inactive
OSSD1	Output active	Output inactive
Info2 (LED)	Configurable	Configurable
Info1 (LED)	Configurable	Configurable
IN2	Start release	No start release signal
IN1	No test input	Test input
0V	—	—
+24V	Power connected	No power connected

* All I/O is configurable except OSSD1 and OSSD2.

❄ LED behavior depends on configuration (see instruction sheet for details).

Product Selection

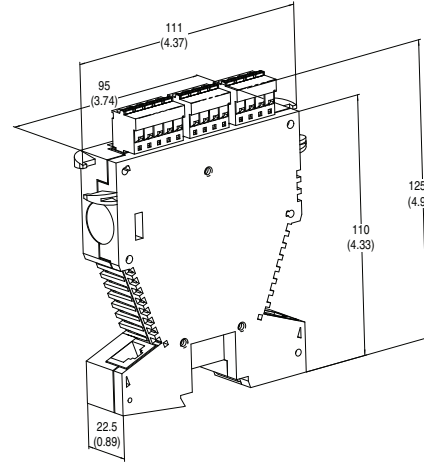
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
GuardShield Micro 400 and 4 x GPIO	2 PNP	2 PNP, configurable	Removable	Auto./manual or manual monitored	24V DC	440R-P226AGS-NNR

Accessories

Description	Cat. No.
MSR45E—Safety Relay for MSR41 or MSR42 (requires ribbon cable connection)	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—MSR42	440R-ATERM2P
Replacement terminal block kit—MSR45E	440R-ATERM2C
USB optical interface software configuration tool used to configure the MSR42	445L-AF6150
Replacement suction cup	445L-AF6151
Optical interface fastener	445L-AF6152

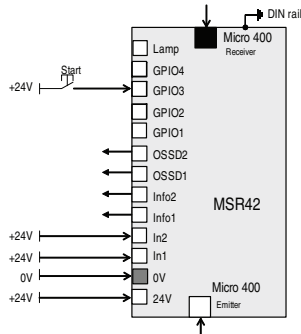
Approximate Dimensions

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

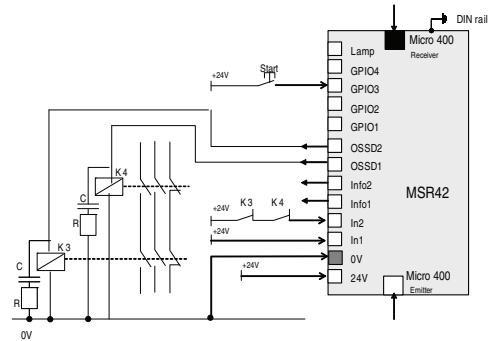


Typical Wiring Diagrams

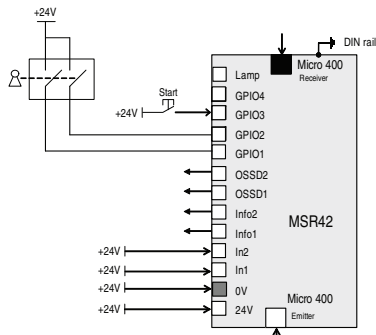
Basic Configurations (No Software)



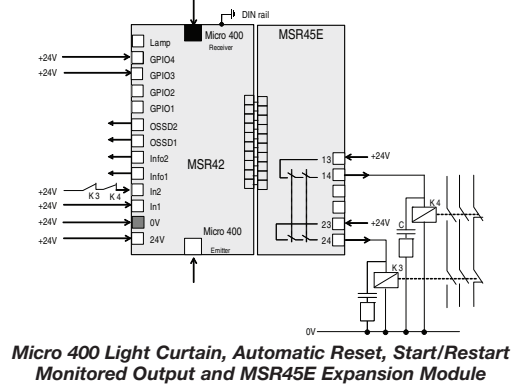
Micro 400 Light Curtain, Manual Reset, No Output Monitoring



Micro 400 Light Curtain, Manual Reset, Start/Restart Monitored Output



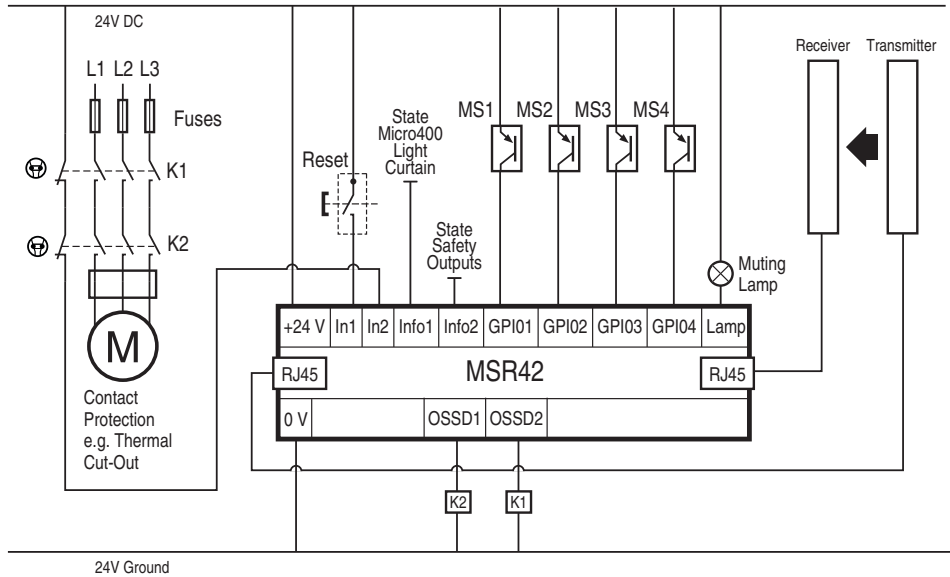
Fixed Blanking, Micro 400 Light Curtain, Manual Reset, No Output Monitoring



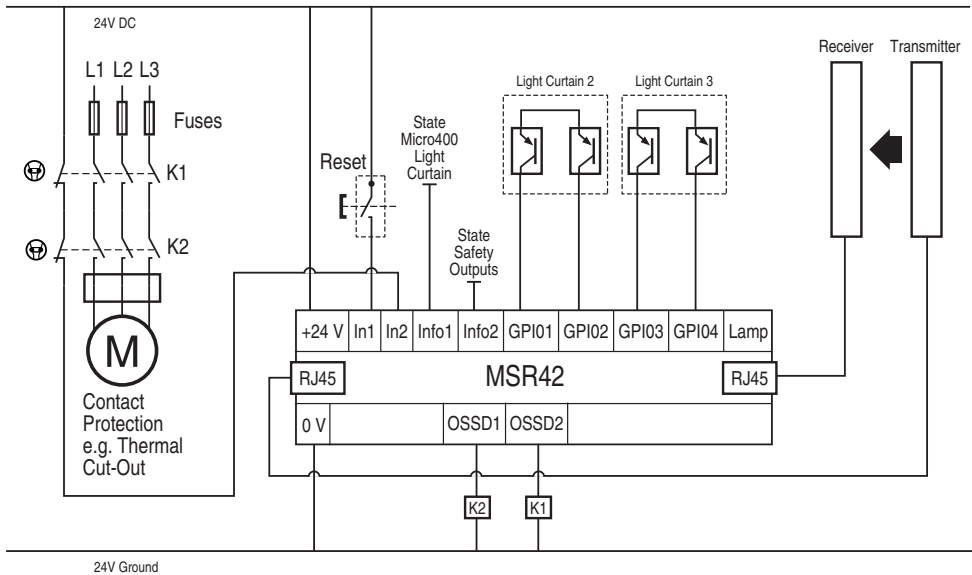
Micro 400 Light Curtain, Automatic Reset, Start/Restart Monitored Output and MSR45E Expansion Module

5-Safety Relays

Software Configurations



Note: Four Sensor T-type muting; GuardShield Micro 400, four muting PNP sensors, manual reset, output monitoring



Note: Three-light curtain application: GuardShield Micro 400 light curtain, two GuardShield light curtains, manual reset, output monitoring

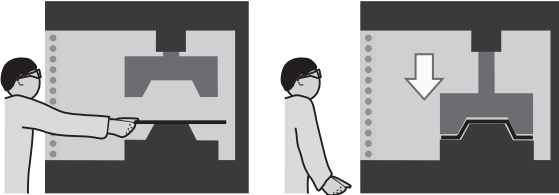
Application Details

MSR42—Shown connected to safety light curtains.

Multiple settings are available offering a variety of advantages.

Protective Mode

Example shows a press protected by a safety light curtain connected to the MSR42.

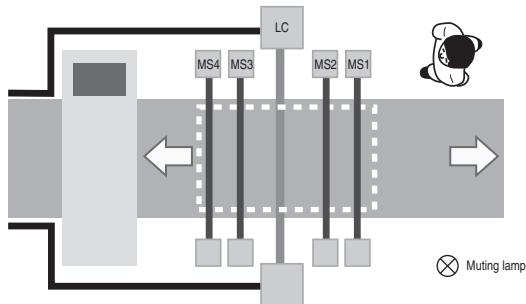


In machine operation, whenever the light curtain beams are broken the press immediately stops to help avoid danger to the operator. Once the beams are cleared the machine can then be started.

Muting Modes

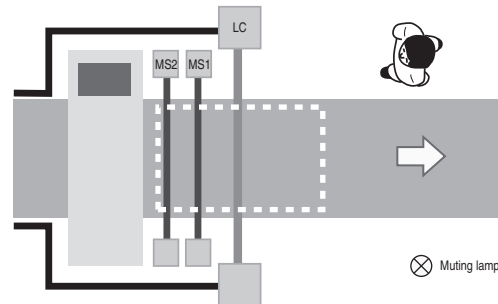
Four conveyor examples: All conveyor applications shown with a safety light curtain helping protect the dangerous area. In-line and cross beam muting is used to allow the material to pass through the light curtain without stopping the machine. Any other object or person will be detected by the light curtain which will initiate machine stop.

Four Sensor T-type



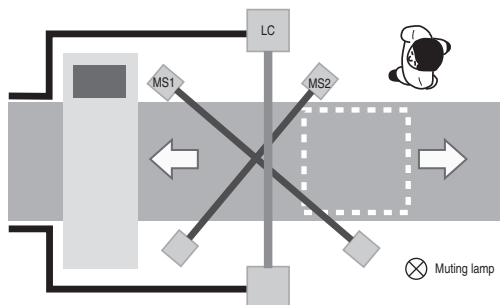
Bi-directional muting: In-line muting requires the material to break the beams in a sequence, as shown. Only if all four muting sensor (MS) beams are broken in turn and then clear in turn will the light curtain allow material through without initiating machine stop.

Two Sensor L-type



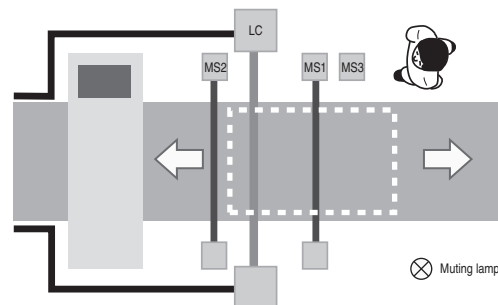
Uni-directional muting: This will allow material to exit the machine but not allow material or personnel to enter the machine without a fault condition. Only if both MS beams are broken in-turn and then cleared in-turn, will the light curtain allow material through without initiating a machine stop.

Two Sensor T-type



Bi-directional muting: Cross-beam muting requires the material to break the beams in a sequence. MS1 first and then MS2. Only if the beams are broken in turn and then clear in turn will the light curtain allow material through without initiating machine stop.

Two Sensor T-type with Enable



Bi-directional muting: The MS3 is an input to the MSR42 from a PLC output card. The MS3 enables the muting function to be performed. If a high signal is not detected on MS3, the muting function will not operate even if the MS1 and MS2 beams are broken. Only if MS3 is high and both MS beams are broken in-turn and then cleared in-turn, will the light curtain allow material through without initiating a machine stop.

Specialty Safety Relays

CU2 Stop Motion Monitors



Description

The CU2 control unit is a compact timing and stop motion detector interface module. By utilizing two independent inductive proximity inputs, which monitor the movement of two metal parts of the machine (e.g., sprockets, cams or linkages). The control unit detects when hazardous motion has ceased. When the hazardous motion has stopped the unit will send a signal to unlock guard locking devices. It has been developed to integrate guard locking interlock switches on machines which have variable or unpredictable run down cycles.

A removable cover allows access to the DIP switches and potentiometer which control the timing. The on-delay may be adjusted between 0.1 seconds to 40 minutes, through a series of 4 broad time ranges. The final adjustment is made by a potentiometer.

The Y1/Y2 terminals provide a check of contactors at machine power up. This is only relevant to certain special applications. For normal use these terminals should be linked. After all motion has ceased, the normally open safety on contacts close, which may be used to energize electrically operated solenoid locking guard switches. In addition the normally closed contacts open to indicate the unit's status.

LED indication in the unit displays power, timer on, and outputs.

Features

- Category 1 per EN 954-1
- Stop category 1
- NPN and PNP inputs
- Timed off-delay 0.1 s...40 min
- Two N.O. safety outputs
- One N.C. auxiliary output

LED Indicators

Red	Power on
Red/Green	Timing/Output On

Specifications

Safety Ratings		
Standards	EN 954-1, ISO 13849-1, IEC/EN 60204-1, IEC 60947-5-1, ANSI B11.19, AS4024.1	
Safety Classification	Cat. 1 per EN 954-1 (ISO 13849-1), SIL CL1 per EN IEC 62061, PL c per ISO 13849-1	
Certifications	CE Marked for all applicable directives, cULus, c-Tick, and TÜV	
Power Supply		
Input Power Entry	24V AC/DC or 110/230V AC	
Power Consumption	<4 VA	
Inputs		
Safety Inputs	1 NPN and 1 PNP, Normally Open	
Input Resistance, Max.	500 Ω	
Reset	Automatic/Manual	
Outputs		
Safety Contacts	2 N.O.	
Auxiliary Contacts	1 N.C.	
Rated Impulse withstand Voltage	2500V	
Switching Current @ Voltage, Min.	10 mA @ 10V	
Fuses, Output	5 A quick acting (external)	
Electrical Life (Operations)	220V AC/4 A/880VA $\cos\phi = 0.35...0.1$ M 220V AC/1.7 A375VA $\cos\phi = 0.6...0.5$ M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M	
Mechanical Life	2,000,000 operations	
Utilization Category		
Inductive: B300: AC-15	5 A @ 250V AC	5 A @ 120V AC
Inductive: DC-13	3 A/24V DC	
Environmental and Physical Characteristics		
Enclosure Type Rating/ Terminal Protection	IP40 (NEMA 1), DIN 0470/ IP20, DIN 0470	
Operating Temperature [C (F)]	-10...+55 ° (14...131 °)	
Vibration	0.75 mm (0.30 in) peak, 10...55 Hz	
Shock	30 g, 11 ms half-sine	
Mounting	35 mm DIN Rail	
Weight [g (lbs)]	360 (0.79)	
Conductor Size, Max.	1 x 2.5 mm ² (14 AWG) stranded, 1 x 4 mm ² (12 AWG) solid	

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:

- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

Product Selection

Description	Sensor Voltage	Sensor Size (mm)	Sensing Distance (mm)	Terminals	Reset Type	Control Unit Voltage	Cat. No.
Controller and Sensors	24V DC supplied by Control Unit	12	3	Fixed	Automatic/Manual	24V AC/DC	440R-S07279
						110/230V AC	440R-S07280
		18	5			24V AC/DC	440R-S07281
						110/230V AC	440R-S07282
		30	10			24V AC/DC	440R-S07283
					110/230V AC	440R-S07284	

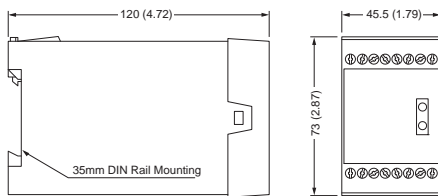
When you order a combination Cat. No.	You will receive a control unit, an NPN sensor and a PNP sensor.
440R-S07279	440R-S07139, 872C-D3NN12-E2, and 872C-D3NP12-E2
440R-S07280	440R-S07140, 872C-D3NN12-E2, and 872C-D3NP12-E2
440R-S07281	440R-S07139, 872C-D5NN18-E2, and 872C-D5NP18-E2
440R-S07282	440R-S07140, 872C-D5NN18-E2, and 872C-D5NP18-E2
440R-S07283	440R-S07139, 872C-D10NN30-E2, and 872C-D10NP30-E2
440R-S07284	440R-S07140, 872C-D10NN30-E2, and 872C-D10NP30-E2

Accessories

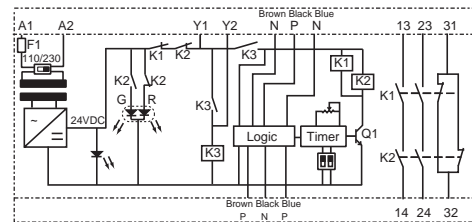
Description	Power Supply	Size (mm)	Output Type	Cat. No.
Control Unit Only	24V AC/DC	45	2 N.O. & 1 N.C.	440R-S07139
	110/230V AC		2 N.O. & 1 N.C.	440R-S07140
Sensor Only	24V DC supplied by Control Unit	12	NPN	872C-D3NN12-E2
			PNP	872C-D3NP12-E2
		18	NPN	872C-D5NN18-E2
			PNP	872C-D5NP18-E2
		30	NPN	872C-D10NN30-E2
PNP	872C-D10NP30-E2			
500 mA fuse—Bussmann Cat. No. ETF-500 mA				440R-A31562

Approximate Dimensions

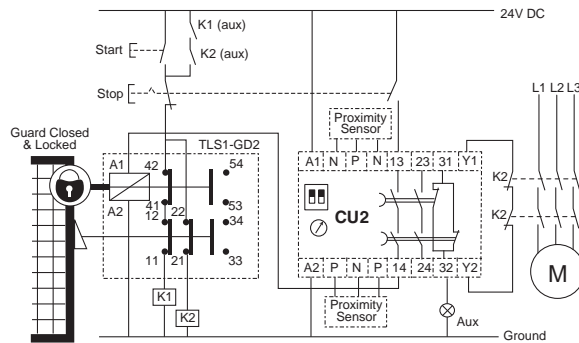
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram



Typical Wiring Diagrams



Guard Locking Safety Gates, Motion Sensors, Delayed Gate Release, Automatic Reset, Monitored Output

5-Safety Relays

Specialty Safety Relays

CU2 Sensor Details, Stop Motion Monitors



Description

Bulletin 872C WorldProx inductive proximity sensors are self-contained, general purpose, solid-state devices designed to sense the presence of ferrous and nonferrous metal objects without touching them.

The switch body consists of a plastic face and a nickel-plated brass barrel. It meets NEMA 1, 2, 3, 4, 6P, 12, 13 and IP67 (IEC 529) enclosure standards. The electronic circuitry is fully potted for protection against shock, vibration, and contamination.

The CU2 is designed to operate with one normally-open NPN and one normally-open PNP inductive proximity sensor.

The sensors translucent end caps glow when the LED indicator is on, and are visible from almost every angle.

The sensors contained in this section are some of the more popular size inductive proximity sensors. See the Rockwell Automation/Allen-Bradley Sensors catalog for an extensive range of proximity sensors.

LED Indicators

Amber	Output energized, 360° visibility
-------	-----------------------------------

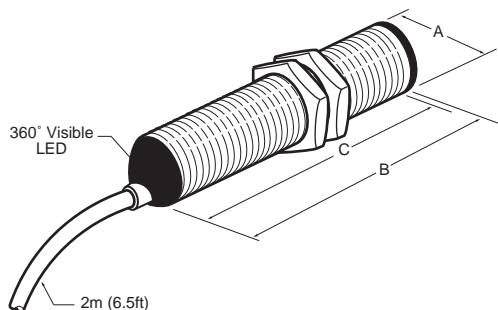
Specifications

Standards	EN 954-1, ISO 13849-1, IEC/EN 60204-1, IEC 60947-5-1, ANSI B11.19, AS4024.1
Safety Classification	Cat. 1 per EN 954-1 (ISO 13849-1)
Certifications	CE Marked for all applicable directives, cULus, c-Tick, and TÜV
Operating Voltage	10...30V DC
Sensing Distance	2, 5 or 10 mm
Correction Factors	Mild Steel = 1.0 Stainless Steel = 0.7...0.8 Brass = 0.4...0.5 Aluminum = 0.3...0.4 Copper = 0...0.3
Load Current, Max.	200 mA
Outputs	NPN or PNP normally open
Leakage Current	≤10 mA
Sensor Voltage Drop	≤1.64V
Repeatability	≤2%
Hysteresis	≤10% typical
Status Indicators	Red = Output energized
Operating Temperature [C (F)]	-25...+70 ° (-13...+158 °)
Relative Humidity	95%
Enclosure Type Rating	NEMA 1, 2, 3, 4, 6P, 12, 13, IP67
Protection	False pulse on power, transient noise, reverse polarity, short circuit, overload
Cable Size	3 x 1 mm ² (26 AWG) stranded
Cable Length	2 m (6.5 ft)
Material	Plastic-faced, nickel-plated brass barrel
Mounting	M12, M18 or M30 Flush Fitting (Shielded Sensing)/IP20, DIN 0470
Shock	30 g, 11 ms half-sine
Vibration	1 mm peak, 10...55 Hz

Note: See Output Ratings on page 1-39 for details. Consult factory for ratings not shown.

Approximate Dimensions

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



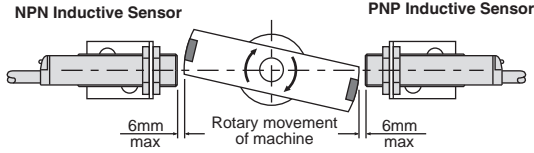
Thread Size	Shielded	mm (inches)		
		A	B (max)	C (min)
M12 x 1	Yes	12 (0.47)	50.8 (2.00)	46.7 (1.84)
M18 x 1		18 (0.71)		
M30 x 1		30 (1.18)		

Application Details

Application Accessories



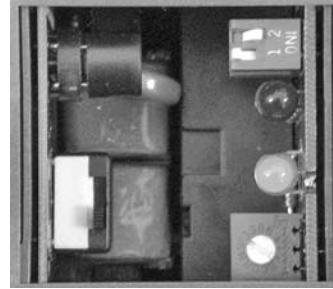
PNP and NPN Inductive Sensors for use with CU2
Sensors detect when motion has ceased by monitoring two targets on moving metal parts. When motion has ceased the CU2 begins timing down. Once preset time limit has been passed the CU2 sends a signal allowing locked guard to be opened.



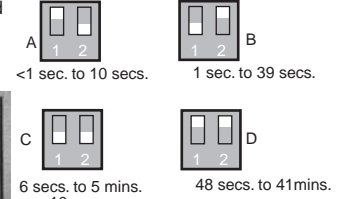
CU1 remote indication unit:
A remote indication unit to indicate the status of the circuit can be connected to the CU 1s, R1, R2 and R3 connections.

Adjustable Time Delay

DIP switches general time setting and the potentiometer fine tunes the time settings. Easy access 500 mAAT replaceable fuse.



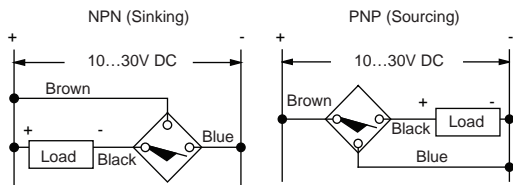
General time settings via DIP switches



Fine adjustment time setting via potentiometer



Typical Wiring Diagrams



Specialty Safety Relays

MSR57P Safe Speed and Standstill Monitor



Description

The MSR57P speed monitoring safety relay is designed to solve motion applications which require interaction by personnel during operation. It connects to any drive and monitors the speed using currently installed encoders. The MSR57P can be configured to unlock the access door only when the machine is either stopped or at a safe speed defined by the user. If required, the speed monitoring relay can monitor an enabling switch to constantly monitor personnel while in the hazardous area. Other supported functions are safe maximum speed and zero speed detection.

The MSR57P can be configured and monitored via two methods: drive explorer using a PC and the standard HIM device. During configuration, the user can set a variety of parameters to the specific requirements of their application including type of input devices, quantity, door locking and monitoring, enabling switches and a maintenance (safe speed) mode.

The MSR57P can easily be adapted to current installations with standard drives or drives with the safe-off feature. The safety relay uses standard outputs to control the drives speed but uses safety outputs to control the outputs of the drive. The speed is determined by using an encoder(s). This device can monitor the encoder data which is already transmitting to the drive, assuming an encoder is already installed, or a new encoder can be installed and only connected to the MSR57P. Two encoders are needed for Category 4, SIL 3 applications which cannot exclude shaft slippage and breakage.

This device also supports multiple axis applications. During configuration, it can be setup to be the first, middle or last axis in the chain. This is important since the input devices will all be installed on the first unit only while the output devices are connected to the last MSR57P in the chain.

Features

- SIL 3 IEC 61508
- Category 4 per EN 954-1
- Stop category 0, 1, 2
- Six N.O. solid-state safety outputs
- Four solid-state auxiliary outputs
- One or two encoders (sin/cos and TTL)
- Eight diagnostic LEDs
- DPI configuration port
- 67.5 mm DIN Rail housing
- Removable terminals

Specifications

Safety Ratings	
Standards	EN 954-1, ISO 13849-1, ISOTR 12100, IEC/EN 60204-1, ANSI B11.19, AS4024.1
Safety Classification	Cat. 4 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 62061, PLe per ISO 13849-1
Functional Safety Data *	PFD _o : See website MTTF _d : See website Note: For up-to-date information, visit http://www.ab.com/Safety/ Suitable for performance levels PLe (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics
Certifications	cULus, c-Tick, and TÜV
Power Supply	
Input Power Entry	24V DC, 0.8...1.1 x rated voltage PELV/SELV
Power Consumption	5 W
Inputs	
Safety Inputs	1 N.C. & 1 N.O., 2 N.C., 1 N.C., 2 OSSD
Input Simultaneity	Infinite or 3 sec (configurable)
Input Resistance, Max.	4 K Ω
Reset	Auto./Manual or Manual Monitored
Response Time	Configurable
Outputs	
Safety Contacts	6 N.O. Solid State
Auxiliary Contacts	4 N.O. Solid State
Current, Max	Outputs 14, 24, 68, 78 24V DC, 2 A, short-circuit protected Outputs 34, 44 24V DC, 100 mA, short-circuit protected Outputs Y35, Y37 24V DC, 50 mA, short-circuit protected Door switches 51, 52 24V DC, 750 mA, short-circuit protected Outputs Y1, Y32, Y33 24V DC, 100 mA, short-circuit protected Pulse Outputs S11, S21 24V DC, 100 mA, short-circuit protected Pulse Inputs S12, S22, S32, S42, S52, S62, S72, S82, X32, X42, S34, Y2 8.5 mA per input
Environmental and Physical Characteristics	
Enclosure Type Rating/Terminal Protection	IP40 (NEMA 1)/IP20, DIN 0470
Operating Temperature [C (F)]	-5...+55 ° (23...131 °)
Vibration	10...55 Hz, 0.35 mm
Shock	10 g, 16 ms, 100 shocks
Mounting	35 mm DIN Rail
Weight [g (lbs)]	335 (0.74)
Conductor Size, Max.	0.2...2.5 mm ² (24...12 AWG)

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:

- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

Product Selection

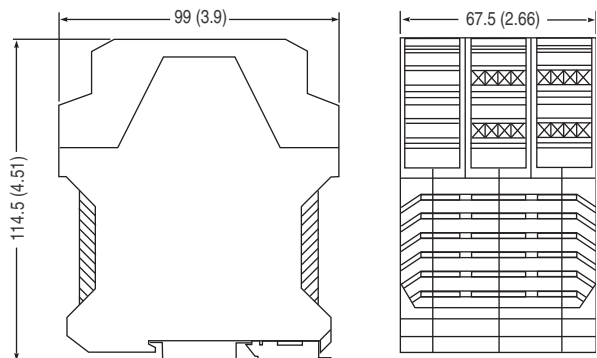
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
5 x 1 N.C., 2 N.C., LC, 1 N.O. + 1 N.C.	6 N.O. Solid State	4 N.O. Solid State	Removable	Auto/Manual or Manual Monitored	24V DC	440R-S845AER-NNL

Accessories

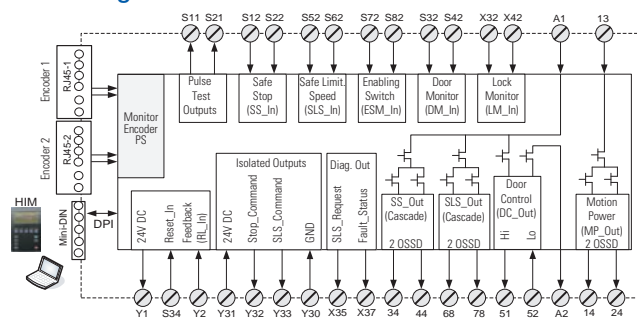
Description	Cat. No.
MSR57 Encoder cable with flying leads (2.5 meters)	1585J-M8RB-2M5
3 meter cable HIM	1202-C30
1 meter cable HIM	1202-C10
AnaCANda serial converter (RS232)	1203-SSS
AnaCANda USB converter	1203-USB
HIM full numeric LCD IP20 (NEMA 1)	20-HIM-A3
Kinetix 6000/7000 low profile connector kit	2090-K6CK-Dxxx
Kinetix 2000 low profile connector kit	2090-K2CK-D15M
HIM to MSR 57 cable (1 meter)	20-HIM-H10
Sin/Cos encoder (1024 PPR)	842HR-xJxxx15FWY2
TTL encoder (size 20)	845T-xxxxxxx
TTL encoder (size 25)	845H-SJxxx4xxYxx

Approximate Dimensions

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

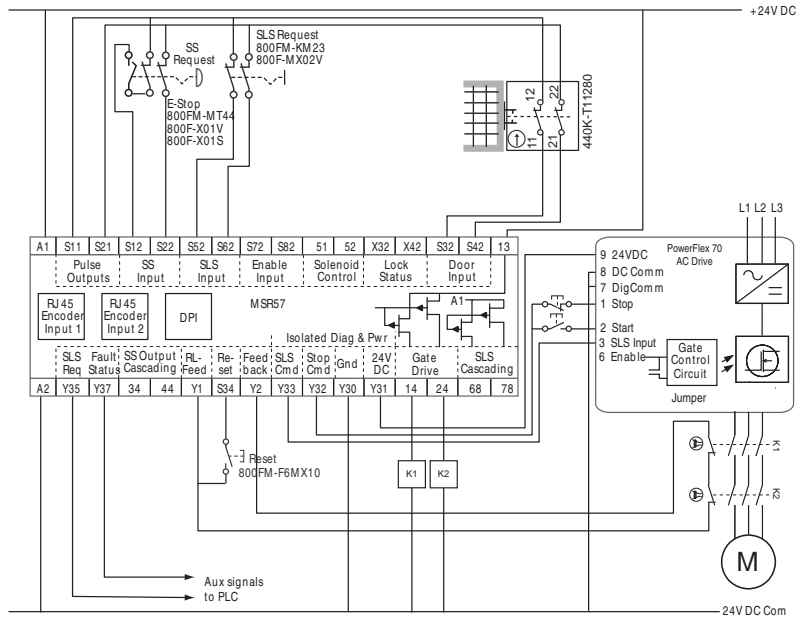


Block Diagram

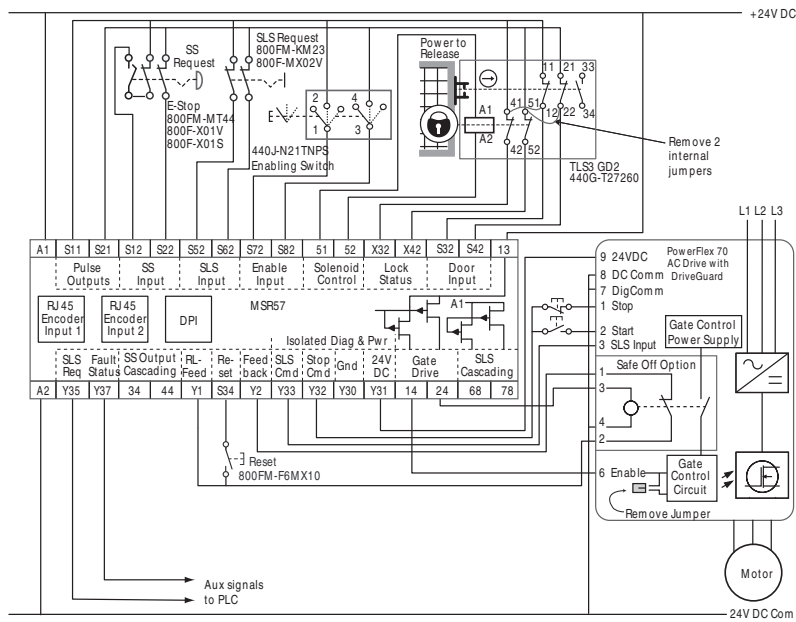


Logic
Specialty Safety Relays
 MSR57P Safe Speed and Standstill Monitor

Typical Wiring Diagrams

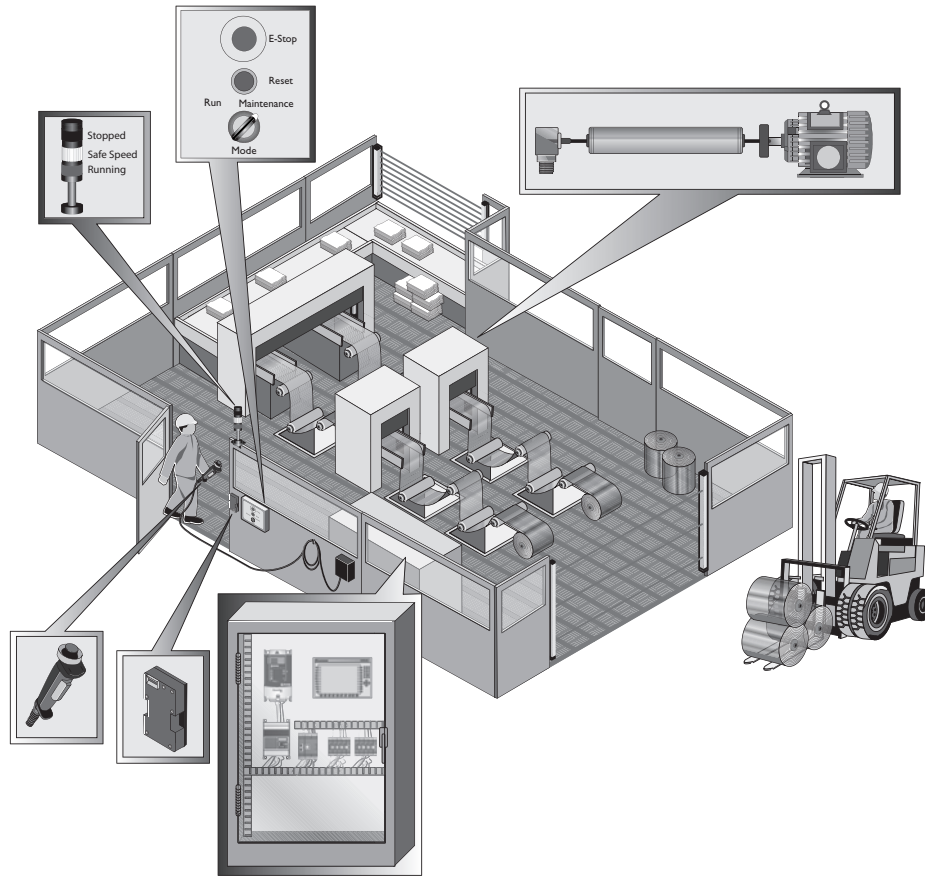


Note: Cat. 1 stop, 1 encoder, door monitoring, safe limited speed, PowerFlex 70 without safe off.



Note: Cat. 1 stop, 1 encoder, door monitoring, enabling switch, safe limited speed, PowerFlex 70 with safe off.

Application Details



Operating Conditions

- The door is closed and locked with a TLS3 safety switch
- The machine is running at normal speed

Maintenance Conditions

- In order to remove a jam condition or during start-up personnel must enter the hazardous area.
- The operator moves Limited Speed Selector switch to "enable."
- The MSR57 monitors speed profile and verifies drive is reducing speed per the preconfigured profile.
- Once the speed is equal to or below limited speed value, the door is unlocked.
- If configured, user must hold enabling switch in the middle position before opening door. Otherwise the machine will shutdown.
- The operator performs maintenance on the machine.
- Once maintenance is complete, the operator exits machine, closes door and moves the safe limited speed switch to "maintenance" mode BEFORE releasing the enabling switch.
- The machine will resume normal speed according to the drive profile.

Remarks

- The MSR57 can also monitor if the speed has exceeded a preconfigured value and shutdown the process.
- The MSR57 is compatible with all drives and uses standard inputs on the drive to perform controlled start and stop sequences.
- Pressing the E-stop at any time, will cause the machine to stop according to the preconfigured stop mode.
- The MSR57 can also be used in cascading applications with multiple MSR57s and drives.



Description

The CU3 is a control unit which detects stopped motion and is ideal for use with guard locking interlock switches. It is designed to interface with single or three-phase induction motors by measuring the drive voltage and the back electro-magnetic field (emf) of the motor.

The front window of the CU3 can be popped off to reveal a replaceable fuse and a potentiometer. The potentiometer sets the threshold voltage measured at terminals Z1/Z2. The maximum threshold voltage is approximately 2.5V peak (potentiometer turned fully CCW). When the voltage at Z1/Z2 exceeds the threshold voltage, the safety outputs de-energize, and the safety contacts at terminals 13/14 and 23/24 open.

When the supply to a motor is disconnected, motor speed will reduce to zero. During the run down period the back emf generated by the motor is monitored by the CU3. When the level of the back emf dips below the threshold voltage, the safety outputs close. This enables the output device (e.g., solenoid locking or unlocking switch) to be activated.

If the Z1/Z2 circuit opens, the CU3 goes into a fault state, indicated by the fault led. The fault must be corrected and the power to the CU3 cycled to clear the fault state.

The 24V DC version must be operated with an isolated supply. The CU3 is not intended for use with variable frequency drives.

Features

- Category 1 per EN 954-1
- Stop category 1
- Two N.O. safety outputs
- One N.C. auxiliary output
- Automatic/manual, monitored reset supported
- Motor voltage up to 500V max.

LED Indicators

Red	Power on
Red/Green	Timing/Output On
Yellow	Fault
Red	Motor Running

Specifications

Safety Ratings		
Standards	EN 954-1, ISO 13849-1, IEC/EN 60204-1, IEC 60947-5-1, ANSI B11.19, AS4024.1	
Safety Classification	Cat. 1 per EN 954-1 (ISO 13849-1), SIL CL1 per EN IEC 62061, PL c per ISO 13849-1	
Functional Safety Data *	PFH _D : See website MTTFD: See website Suitable for performance levels Pl _e (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics http://www.ab.com/Safety/	
Certifications	CE marked for all applicable directives, cULus, c-Tick, and TÜV	
Power Supply		
Input Power Entry	24V AC/DC, 115/230V AC	
Power Consumption	<4 VA	
Motor Voltage	500V max.	
Inputs		
Safety Inputs	Z1/Z2 Motor Voltage	
Reset	Automatic/Manual	
Outputs		
Safety Contacts	2 N.O.	
Auxiliary Contacts	1 N.C.	
Rated Impulse withstand Voltage	2500V	
Switching Current @ Voltage, Min.	10 mA/10V	
Fuses, Output	5 A quick acting (external)	
Electrical Life (Operations)	220V AC/4 A/880VA $\cos\phi = 0.35...0.1$ M 220V AC/1.7 A375VA $\cos\phi = 0.6...0.5$ M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M	
Mechanical Life	2,000,000 operations	
Utilization Category		
Inductive: B300: AC-15	5 A @ 250V AC	5 A @ 120V AC
Inductive: DC-13	3 A/24V DC	
Environmental and Physical Characteristics		
Enclosure Type Rating/ Terminal Protection	IP40, DIN 0470/ IP20 DIN 0470	
Operating Temperature [C (F)]	-10...+55 ° (14...131 °)	
Vibration	0.75 mm (0.30 in) peak, 10...55 Hz	
Shock	30 g, 11 ms half-sine	
Mounting	35 mm DIN Rail	
Weight [g (lbs)]	510 (1.12)	
Conductor Size, Max.	1 x 2.5 mm ² (14 AWG) stranded, 1 x 4 mm ² (12 AWG) solid	

- * Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
- Mission time/Proof test interval of 20 years
 - Functional test at least once within six-month period

Product Selection

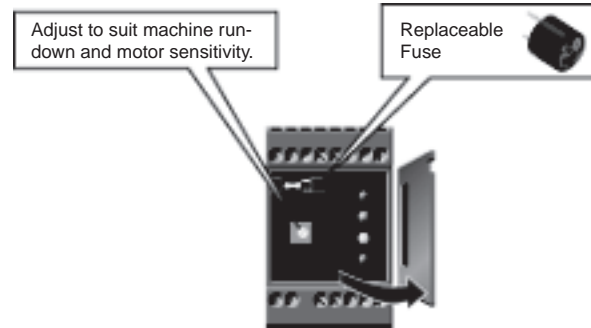
Safety Outputs	Auxiliary Outputs	Power Supply	Terminals	Reset Type	Cat. No.
2 N.O.	1 N.C.	24V AC/DC*	Fixed	Monitored Manual, Automatic/Manual	440R-S35001
2 N.O.	1 N.C.	110V AC			440R-S35002
2 N.O.	1 N.C.	230V AC			440R-S35003

* The 440R-S35001 requires an isolated supply when operating on 24V DC.

Accessories

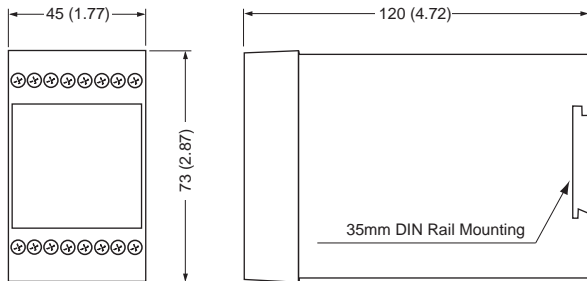
Description	Cat. No.
500 mA Fuse—Bussmann Cat. No. ETF-500 mA	440R-A31562

Application Details

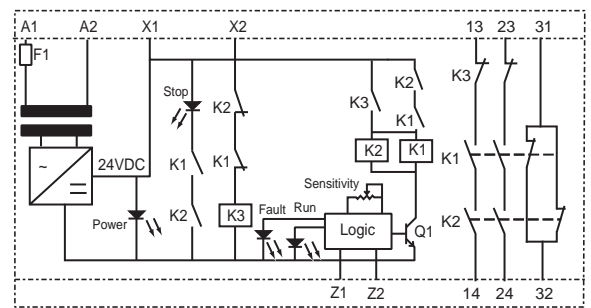


Approximate Dimensions

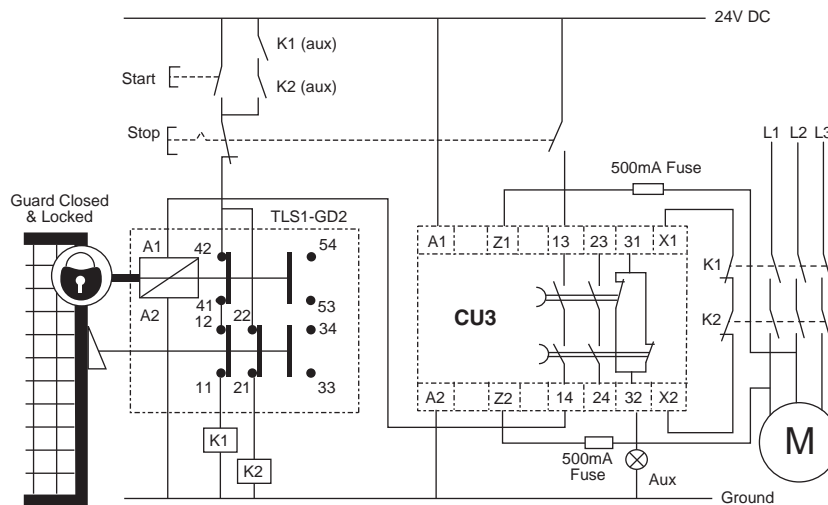
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram



Typical Wiring Diagrams

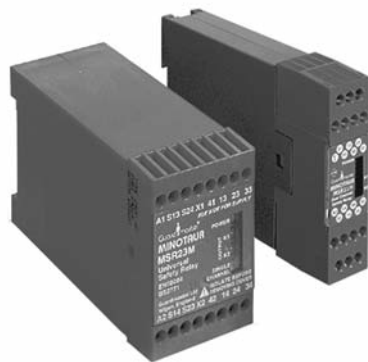


Guard Locking Safety Gate, Back EMF Detection, Automatic Reset, Monitored Output

5-Safety Relays

Specialty Safety Relays

MSR23M Mat Controllers



Description

The MSR23M control unit is designed to monitor four-wire safety mats that are connected together to form a safeguarded zone. The size of the safeguarded zone is limited by the total input impedance (100 ohms maximum) created by the wiring and connections. The controller is designed to interface with the control circuit of the machine and includes two safety relays to help provide control redundancy.

The controller detects a presence on the mat, a short circuit, or an open circuit. Under each of these conditions, the safety output relays turn off. When interfaced properly, the machine or hazardous motion receives a stop signal, and an auxiliary output turns ON.

Features

- Category 4
- Stop category 0
- Removable terminals
- Monitored or automatic/manual reset
- Four-wire safety mats sensing

LED Indicators

Power: Green	Ready, Red = Mat Activated
K1: Green	K1 Closed. If K1 alone is lit, check for short across reset button.
K2: Green	K2 Closed

Specifications

Safety Ratings		
Standards	EN 954-1, ISO 13849-1, IEC/EN 60204-1, IEC 60947-5-1, ANSI B11.19, AS 4024.5	
Safety Classification	Cat. 3 per EN 954-1 (ISO 13849-1), SIL CL2 per EN IEC 62061, PLe per ISO 13849-1	
Functional Safety Data *	PFH _D : See website MTTFD: See website Note: For up-to-date information, visit http://www.ab.com/Safety/ Suitable for performance levels PLe (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics	
Certifications	CE Marked for all applicable directives, BG, and CSA (24V only)	
Power Supply		
Input Power Entry	24V AC/DC or 115V AC	
Power Consumption	2 W	
Inputs		
Safety Inputs	2 N.C., 4-Wire SM	
Input Resistance, Max.	100 Ω	
Reset	Auto./Manual or Monitored Manual	
Power On Delay Time	40 ms (Manual Reset); 200 ms (Auto Reset)	
Response Time	15 ms	
Outputs		
Safety Contacts	2 N.O.	
Auxiliary Contacts	1 N.C.	
Thermal Current/ <i>I_{th}</i>	1 x 8 A or 2 x 7 A nonswitching	
Switching Current @ Voltage, Min.	1 mA/10V	
Fuses, Output	6 A fast acting (external)	
Electrical Life (Operations)	220V AC/4 A/880VA $\cos\phi = 0.35 \dots 0.1$ M 220V AC/1.7 A/375VA $\cos\phi = 0.6 \dots 0.5$ M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M	
Mechanical Life	10,000,000 operations	
Utilization Category (Inductive)		
N.O.—B300 AC-15	3 A @ 250V AC	3 A @ 120V AC
P300 DC-13	3 A @ 24V DC	
N.C.—B300 AC-15	2 A @ 250V AC	2 A @ 120V AC
DC-13	2 A @ 24V DC	
Environmental and Physical Characteristics		
Enclosure Type Rating/ Terminal Protection	IP40 (NEMA 1) DIN 0470/ IP20, DIN 0470	
Operating Temperature [C (F)]	-15...+55 ° (5...131 °)	
Vibration	10 g 10...55 Hz	
Shock	30 g, 11 ms half-sine	
Mounting	22.5 mm housing, 35 mm DIN Rail	
Weight [g (lbs)]	220 (0.485)	
Conductor Size, Max.	1 x 2.5 mm ² (14 AWG) stranded, 1 x 4 mm ² (12 AWG) solid	

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:

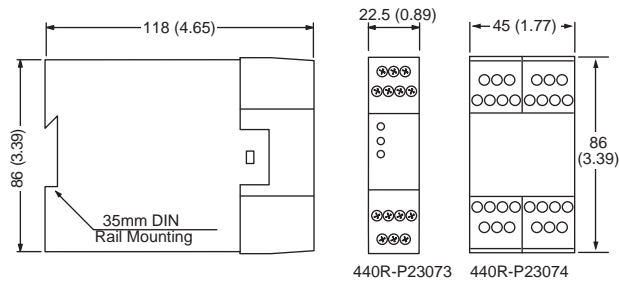
- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

Product Selection

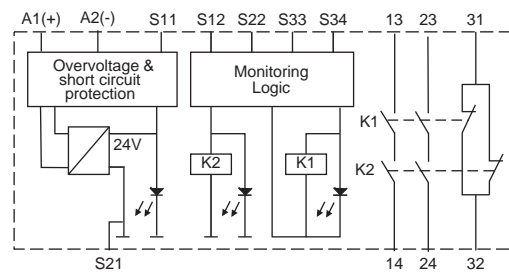
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
4-Wire Safety Mat	2 N.O.	1 N.C.	Fixed	Automatic/Manual	24V AC/DC	440R-P23073
				Monitored Manual	115V AC	440R-P23074

Approximate Dimensions

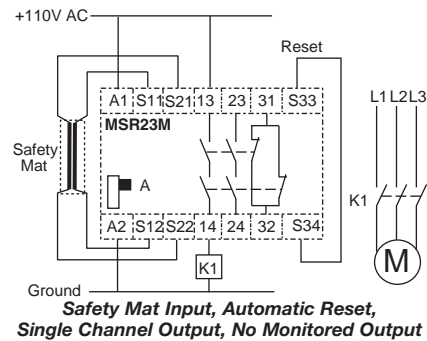
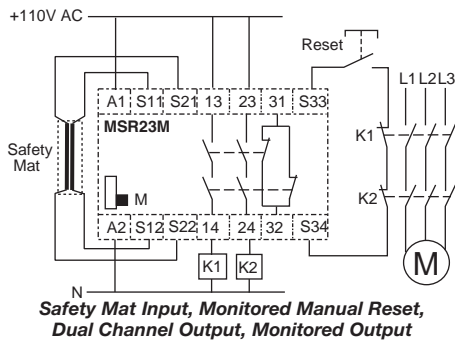
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram

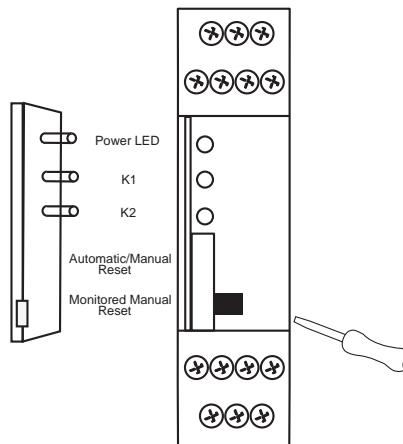


Typical Wiring Diagrams



Application Details

Disconnect power. Use a screwdriver to pop open cover to reveal internal switches.





Description

The MatGuard Control Unit monitors all of the mats which are connected together to form a safeguarded zone. The safeguarded zone can be up to a total of 100 m² and made from any number of mats. The controller is designed to interface with the control circuit of the machine and includes two safety relays to help provide control redundancy.

The controller detects a presence on the mat, a short circuit, or an open circuit. Under each of these conditions, the safety output relays turn off. When interfaced properly, the machine or hazardous motion will receive a stop signal, and an auxiliary output relay turns ON.

The controller comes in two different package styles, a plastic case for surface or wall mounting, and a steel case for surface or wall mounting. Each style offers many of the same basic features. Each controller accepts power supplies of 24V AC/DC, and 110/230V AC. The plastic and steel-cased styles include reset buttons. The steel-cased controller offers extra protection against inadvertent impacts.

Alternatively, see the Product Selection table for safety relays that can also control and monitor safety mats.

Features

- Selectable voltage supply
- Auto/manual reset
- Four-wire system to detect opens and shorts
- Third party approval—AMTRI, TÜV

LED Indicators

Green	Power
Green	Auto Reset Mode
Green	Manual Reset Mode
Green	Machine Enabled

Specifications

Safety Ratings	
Standards	EN1760-1, EN 954-1, ISO13849-1, IEC/EN 60204-1, ANSI RIA R15.06, ANSI B11.19, AS 4024.5
Safety Classification	Cat. 3 per EN 954-1 (ISO 13849-1), SIL CL2 per EN IEC 62061, PLe per ISO 13849-1
Functional Safety Data *	PFH _D : See website MTTF _d : See website Note: For up-to-date information, visit http://www.ab.com/Safety/
Certifications	CE Marked for all applicable directives, cULus, and TÜV
Power Supply	
Input Power Entry	24V AC/DC or 115/230V AC
Power Consumption	6 W, 9V A
Inputs	
Safety Inputs	Safety Mats
Reset	Monitored Manual or Automatic/Manual
Response Time	35 ms, Mat pressed to output open
Outputs	
Safety Contacts	2 N.O.
Auxiliary Contacts	1 N.C.
Switching Current @ Voltage, Min.	10 mA @ 10V
Fuses, Output	5 A fast acting (external)
Electrical Life (Operations)	220V AC/4 A/880VA cosφ = 0.35...0.1 M 220V AC/1.7 A/375VA cosφ = 0.6...0.5 M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M
Mechanical Life	10,000,000 operations
Environmental and Physical Characteristics	
Enclosure Type Rating/	4000P: IP65 (NEMA 13); 4000S: IP62 (NEMA 12)/ IP20, DIN 0470
Terminal Protection	
Operating Temperature [C (F)]	-10...+45 ° (14...113 °)
Vibration	0.15 mm, 10...55 Hz
Mounting	Surface (Wall) Mount
Weight [g (lbs)]	4000P: 880 (1.94); 4000S: 3200 (7.05)
Conductor Size, Max.	4000P, 4000S: 1 x 1.5 mm ² (16 AWG), max.

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:

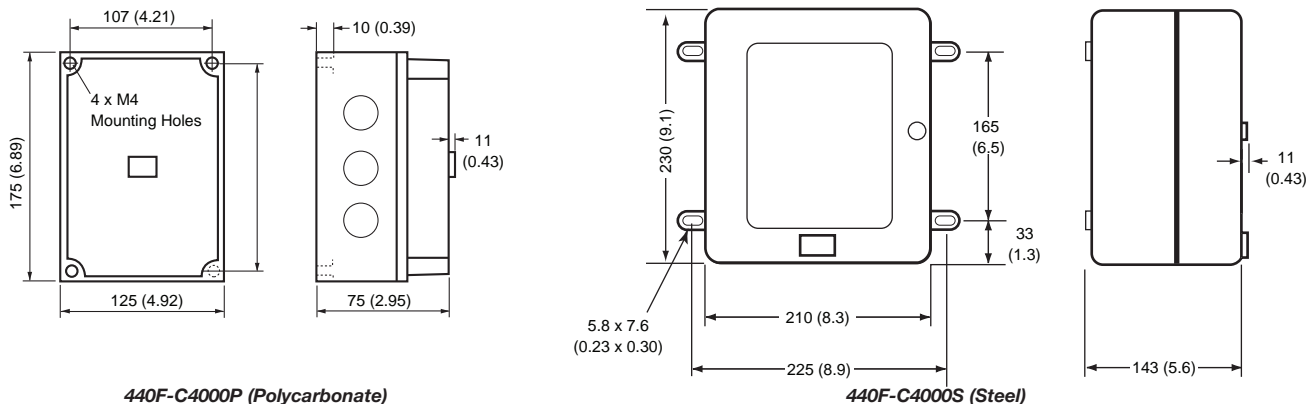
- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

Product Selection

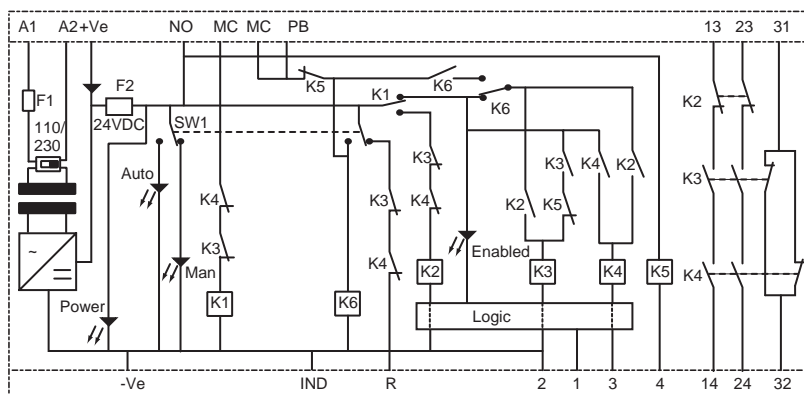
Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
SM	2 N.O.	1 N.C.	NA	Monitored Manual or Automatic/Manual	24V AC/DC or 115/230V AC	440F-C4000P 440F-C4000S

Approximate Dimensions

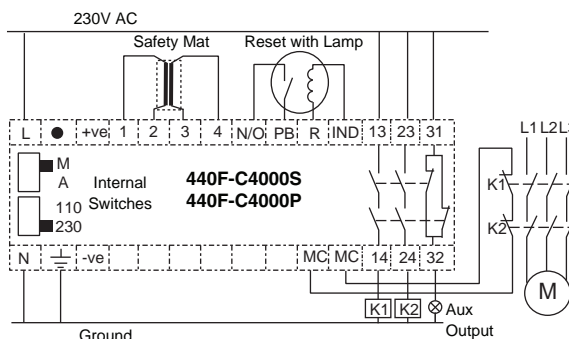
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



Block Diagram



Typical Wiring Diagrams



5-Safety Relays



Description

The Safety Mat Manager is designed to monitor multiple safety mats, each with its own connection. The Safety Mat Manager accepts up to eight individual mats with four-pin micro quick disconnect connectors.

The Safety Mat Manager provides an LED status indication for each of the mat connections. Since the LEDs indicate whether the mat is shorted or open, troubleshooting and replacement of a damaged mat within a mat system, is much quicker when compared to a traditional mat system where multiple mats are wired in series.

An internal switch allows for the setting of the reset to automatic/manual or monitored manual. When set to automatic/manual, the reset circuit can be jumpered, connected auxiliary contacts, or connected to an unmonitored manual reset by adding a momentary normally open switch in the monitoring loop. When set to monitored manual, the monitoring circuit must be closed and then opened to activate the outputs.

Stepping on any one of the mats deactivates the safety outputs. The outputs include two or six normally open safety rated outputs used to shut down the machine and one normally closed or normally open auxiliary output to indicate the status of the Mat Manager. The safety outputs have independent and redundant internal contacts to support the safety function.

Features

- Accepts up to eight individual mats
- Two or six safety output contacts
- One auxiliary output contact
- Automatic/manual or monitored manual reset

LED Indicators

Green	Power
Green	Machine Enabled
Green	Auto Reset Mode
Green	Manual Reset Mode
Mat Status:	
Green	Run Condition
Red	Stop Condition, Mat Pressed
Off	Not Used/Mat Disabled

Specifications

Safety Ratings	
Standards	EN 1760-1, EN 954-1, ISO 13849-1, IEC/EN 60204-1, ANSI RIA R15.06, ANSI B11.19, AS 4024.5, E 1760-1
Safety Classification	Cat. 3 per EN 954-1 (ISO 13849-1), SIL CL3 per EN IEC 62061, PLe per ISO 13849-1
Functional Safety Data * Note: For up-to-date information, visit http://www.ab.com/Safety/	PFH _D : < 2.59 x 10 ⁻⁹ MTTF _d : > 290 years Suitable for performance levels PLe (according to ISO 13849-1:2006) and for use in SIL3 systems (according to IEC 62061) depending on the architecture and application characteristics
Certifications	CE Marked for all applicable directives, cULus, c-Tick, and TÜV
Power Supply	
Input Power Entry	24V AC/DC, 115/230V AC 50/60 Hz
Power Consumption	12 W or 9 VA
Inputs	
Safety Inputs	8, 4-Pin Micro-QD M12 Inputs (4 wire mats)
Input Resistance, Max.	500 Ω
Mat Size [mm (in.)]	100 m ² (1076 ft ²) max.
Reset	Auto./Manual Monitored Manual
Power On Delay/Recovery Time	3 s/48 ms
Response Time	35 ms
Outputs	
Safety Contacts	2 N.O. or 6 N.O.
Auxiliary Contacts	1 N.C. or 1 N.O.
Output Rating*	B300, AC15, 4 A/250V AC; R300, DC13, 2 A/30V DC
Rated Impulse withstand Voltage	2500V
Switching Current @ Voltage, Min.	10 mA @ 10V
Fuses, Output	External 6 A slow blow or 10 A fast acting
Electrical Life (Operations)	220V AC/4 A/880VA cosφ = 0.35...0.1 M 220V AC/1.7 A/375VA cosφ = 0.6...0.5 M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M
Mechanical Life	10,000,000 operations
Environmental and Physical Characteristics	
Enclosure Type Rating/Terminal Protection	IP65 (NEMA 13) steel with polycarbonate face plate/ —
Operating Temperature [C (F)]	-25...45° (-13...113°)
Vibration	0.15 mm, 10...55 Hz
Shock	10 g, 11 ms, half-sine
Mounting	Surface (Wall) Mount
Weight [g (lbs)]	3200 (7)
Conductor Size, Max.	0.2...2.5 mm ² (24...14 AWG), max.

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
 - Mission time/Proof test interval of 20 years
 - Functional test at least once within six-month period

* Ratings vary due to output connectors. See installation instructions for details.

Product Selection

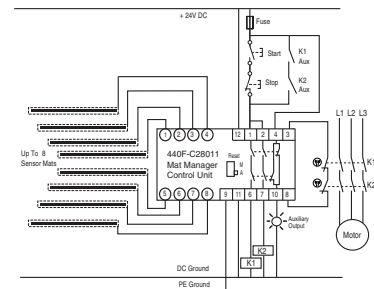
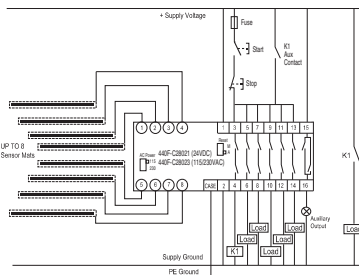
Safety Inputs	Safety Outputs	Aux. Outputs	Reset	Output Current	Connection Type	Power Supply	Cat. No.
8, 4-pin micro-QD M12 Inputs (4-wire mats)	2 N.O.	1 N.C.	Auto./Manual Monitored Manual	4 A	12-pin Brad Harrison	24V DC	440F-C28011
						115V or 230V AC	440F-C28012
	6 N.O.	1 N.O.		4 A	24-pin Harting	24V DC, 115V AC, or 230V AC	* 440F-C28013
						24V DC	440F-C28021
8 Cable Grips	2 N.O.	1 N.C.	2 A	8-pin Lumberg M12 Micro	24V DC	* 440F-C28024	
8, 4-pin micro-QD M12 Inputs (4-wire mats)	2 N.O.	1 N.C.	4 A	12-pin M23	24V DC	440F-C28025	440F-C28026

* Manual reset button located on front of unit.

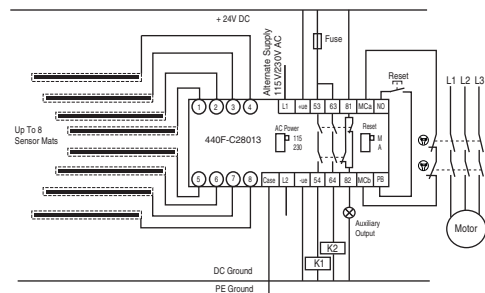
Accessories

Description	Approximate Dimensions [mm (in.)]	Wiring	Cat. No.
Y-Cable			879D-F4ACDM-B0M3
Shorting Plug			440F-A28639
500 mA Fuse			440R-A31562
Fuse, 1 A—Bussman Cat. No. ETF-1			440R-A70972

Typical Wiring Diagram



Safety Mat System, Automatic Reset, Dual Channel Output, Output Monitoring



Safety Mat System, Monitored Manual Reset, Dual Channel Output, Output Monitoring

5-Safety Relays



Description

The Safedge controllers are designed to operate with the Safedge profiles. The controller continuously monitors the profile for actuation and generates an output signal when the profile is depressed.

The Safedge controller provides a low voltage to the profile. When the profile is pressed, the controller detects a change in resistance and turns off its output relays. When pressure is released from the profile, the output relays of the controller return to an on state. The controller has redundant voltage free positively-guided output relays, which can be used to interface with a machine control system.

The 251 controller comes capable of operating at 24V AC/DC, or 120/230V AC from separate terminals. An internal switch changes the operating voltage from 120V AC to 230V AC. The 252 controller operates at 24V AC/DC.

An auxiliary output relay is available to provide a signal about the controller's status. Three LEDs indicate whether the controller is in RUN, STOP or OPEN condition. The controller operates in manual or automatic reset mode.

Features

- One N.O. or two N.O. safety outputs
- One N.C. auxiliary output
- 24V AC/DC or 120/240V AC
- Output monitoring
- LED indicators for RUN, STOP, and OPEN
- Automatic/manual reset

LED Indicators

Green	Run
Yellow	Open Circuit
Red	Stop

Specifications

Safety Ratings	
Standards	EN1760-2, EN954-1, ISO 13849-1, AS 4024.5, EN 954-1, ANSI B11.19
Safety Classification	Cat. 3 per EN 954-1
Certifications	CE Marked for all applicable directives, cULus, and TÜV
Power Supply	
Input Power Entry	251: 24V AC/DC or 115/230V AC 50/60 Hz; 252: 24V AC/DC 50/60 Hz
Power Consumption	251: < 6 VA 252: < 4 VA
Inputs	
Safety Inputs	Profile: 6 kΩ, 12V DC open circuit, 4V DC run condition Monitoring: 1 N.O.
Response Time	13 ms, max.
Outputs	
Safety Contacts	251: 2 N.O.; 252: 1 N.O.
Auxiliary Contacts	1 N.C.
Rated Impulse withstand Voltage	2500V
Switching Current @ Voltage, Min.	10 mA @ 10V
Fuses, Output	4 A on AC, 2 A on DC (external)
Electrical Life (Operations)	220V AC/4 A/880VA cosφ = 0.3... 0.1 M 220V AC/1.7 A/375VA cosφ = 0.6...0.5 M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M
Environmental and Physical Characteristics	
Enclosure Type Rating/ Terminal Protection	251D, 252D: IP40 (NEMA 1); 251P: IP65 (NEMA 13)/ IP20 DIN 0470
Operating Temperature [C (F)]	-10...55° (-14...131°)
Vibration	0.15 mm, 10...55 Hz
Shock	10 g, 11 ms, half-sine
Mounting	Surface mount 35 mm or DIN Rail
Weight [g (lbs)]	251D: 450 (1.0) 252D: 181 (0.4) 251P: 650 (1.4)
Conductor Size, Max.	251D, 252D: 1 x 4 mm ² (10 AWG) stranded, 1 x 4 mm ² (10 AWG) solid 251P: 1 x 1.1 mm ² (18 AWG) stranded, 1 x 1.5 mm ² (16 AWG) solid

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

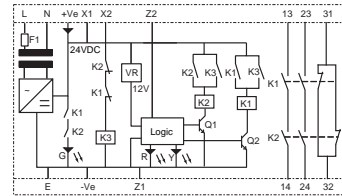
Product Selection

Inputs	Safety Outputs	Auxiliary Outputs	Terminals	Reset Type	Power Supply	Cat. No.
Safedge	2 N.O.	1 N.C.	Fixed	Automatic/Manual	24V AC/DC or 115/230V AC	440F-C251D
	1 N.O.				24V AC/DC	440F-C252D
	2 N.O.				24V AC/DC or 115/230V AC	440F-C251P

Accessories

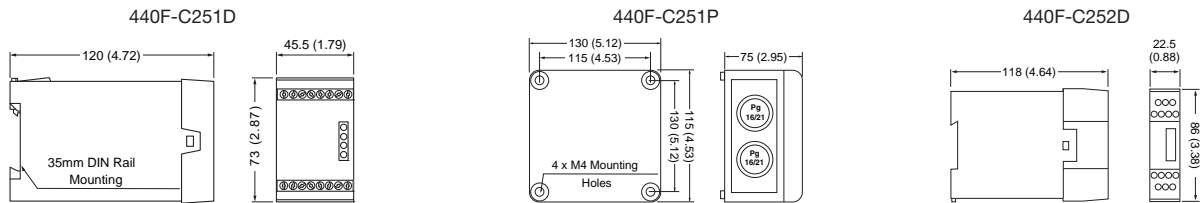
Description	Cat. No.
500 mA Fuse—Bussmann Cat. No. ETF-500 mA	440R-A31562
Fuse, 2 A—Bussmann Cat. No. ETF-2	440A-A09197

Block Diagram

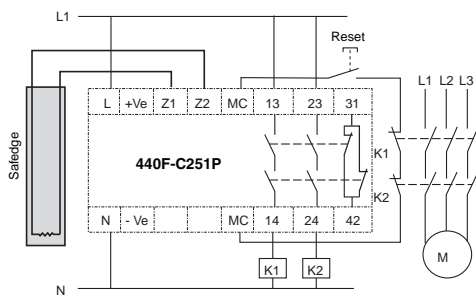


Approximate Dimensions

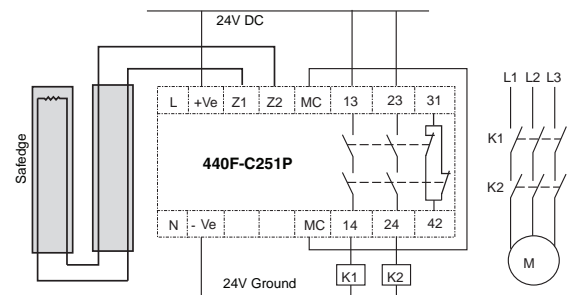
Dimensions are shown in mm (in.). Dimensions are not intended to be used for installation purposes.



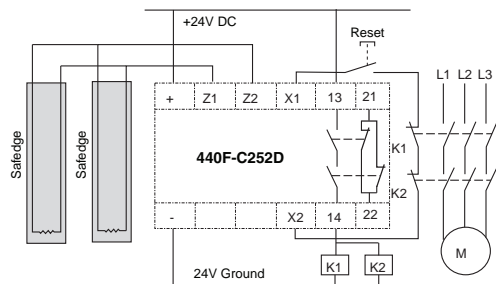
Typical Wiring Diagrams



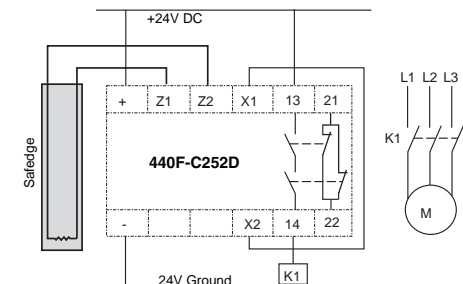
Series Terminated, Safedge Input, Manual Reset, Dual Channel Output, Monitored Output



Series Terminated, Cascaded, Safedge Input, Automatic Reset, Dual Channel Output, No Output Monitored



Parallel Terminated, Safedge Input, Manual Reset, Dual Channel Output, Monitored Output



Series Terminated, Safedge Input, Automatic Reset, Single Channel Output, No Output Monitored

5-Safety Relays



Description

With the increasing speed and complexity of applications a simple magnetic switch may be insufficient to meet the increased risks, therefore Sipha's design incorporates several magnetically sensitive elements which must be triggered in a particular sequence to operate correctly. The Sipha sensor, designed to operate with its own actuator, helps prevent defeatability by a simple magnet.

The control unit is available in three types. The Sipha 1 control unit operates on 24V AC/DC and offers one normally open safety output and one normally closed solid-state auxiliary output. The Sipha 2 control unit operates on either 24V AC/DC, 110V AC or 230V AC and offers two normally open safety outputs and one normally closed auxiliary output. The Sipha 6 has wiring terminals for up to six sensors, a delayed output for Category 1 stops and offers the same wide range of power supply capability as the Sipha 2 control unit. Between two and six Sipha sensors can be directly connected to the Sipha 6 control unit. An internal DIP switch mutes the unused connections to sensors 1, 2, 3 and 4. This allows for individual monitoring to each interlock and provides enhanced safety integrity when compared to six interlocks running off a single Sipha 2 control unit.

The Sipha control units are designed to operate with the Sipha sensors and actuators. The controllers have automatic reset.

Features

- Noncontact actuation
- Magnetic coded sensing
- Control unit acts as safety relay
- Four types of switches

LED Indicators

Green LED	Power on
Green LED	Output Closed

Specifications

Safety Ratings	
Standards	EN954-1, ISO13849-1, IEC/EN60204-1, NFPA79, EN1088, ISO14119, IEC/EN60947-5-1, ANSI B11.19, AS4024.1
Safety Classification	Sipha 1 & 2: Cat. 3 per EN954-1 Sipha 6: Cat. 4 per EN954-1
Certifications	CE Marked for all applicable directives, cULus, and TÜV
Power Supply	
Input Power Entry	Sipha 1: 24V AC/DC; Sipha 2 & 6: 24V AC/DC and 115/230V AC
Power Consumption	Sipha 1: <2VA Sipha 2 & 6: <4VA
Inputs	
Safety Inputs	Sipha 1: 1 N.C. & 1 N.O. Sipha 2 & 6: 6 x (1 N.C. & 1 N.O.)
Input Resistance, Max.	Terminals 1...4: 200 Ω Terminals 2...3: 150 Ω
Outputs	
Safety Contacts	Sipha 1: 1 N.O. Sipha 2: 2 N.O. Sipha 6: 2 N.O. + 1 N.O. Delayed (0.6...30 sec.)
Auxiliary Contacts	1 N.C.
Rated Impulse withstand Voltage	2500V
Switching Current @ Voltage, Min.	10 mA @ 10V
Fuses, Output	External 5 A quick blow AC, 3 A quick blow DC
Electrical Life (Operations)	220V AC/4 A/880VA cosφ = 0.35...0.1 M 220V AC/1.7 A375VA cosφ = 0.6...0.5 M 30V DC/2 A/60 W = 1 M 10V DC/0.01 A/0.1 W = 2 M
Mechanical Life	2,000,000 operations
Environmental and Physical Characteristics	
Operating Temperature [C (F)]	-10...+55° (+14...+131°)
Vibration	1 mm, 10...55 Hz
Shock	30 g, 11 ms half-sine
Mounting	35 mm DIN Rail
Weight [g (lbs)]	Sipha 1: 140 (0.31) Sipha 2: 410 (0.90) Sipha 6: 675 (1.49)
Conductor Size, Max.	0.2...2.5 mm ² (24...14 AWG)

* Usable for ISO 13849-1:2006 and IEC 62061. Data is based on the following assumptions:
- Mission time/Proof test interval of 20 years
- Functional test at least once within six-month period

Application Details

See Sipha Sensors for details.

Product Selection

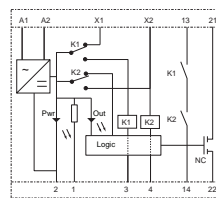
Housing	Supply Voltage	Safety Contacts	Auxiliary Contacts	Housing	Type	Cat. No.
	24V AC/DC	1 N.O.	1 N.C. Solid State	22.5 mm	Control Unit 1	440N-S32013
	24V AC/DC; 115/230V AC	2 N.O.	1 N.C.	45 mm	Control Unit 2	440N-S32021
	24V AC/DC; 115/230V AC	3 N.O. 1 N.O. Delayed	1 N.C.	90 mm	Sipha 6	440N-S32052

Accessories

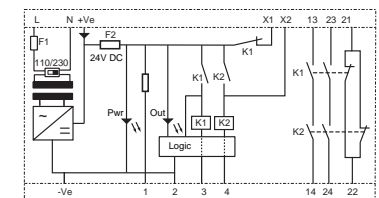
Description	Cat. No.
Replacement Fuse, 500 mA	440R-A31562

Block Diagrams

Sipha 1



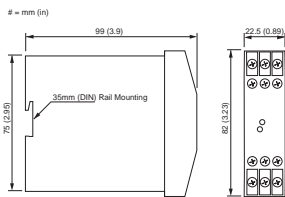
Sipha 2



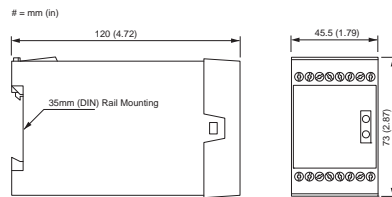
Approximate Dimensions

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

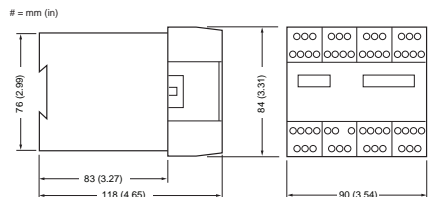
Sipha Control Unit Type 1



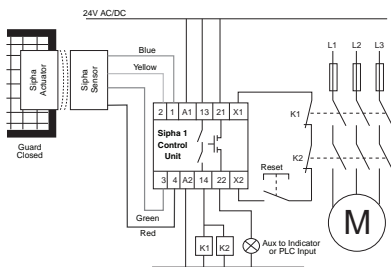
Sipha Control Unit Type 2



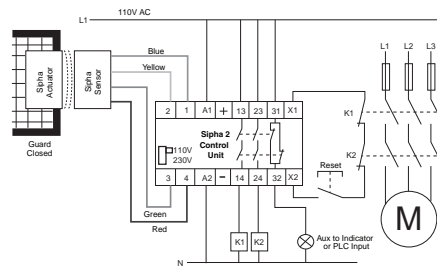
Sipha 6 Control Unit



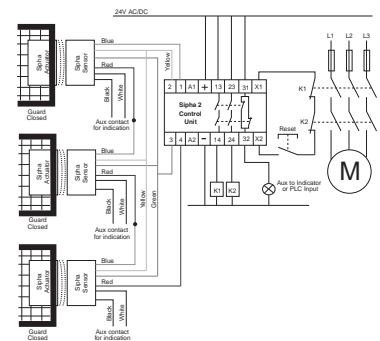
Typical Wiring Diagrams



Single Sipha Sensor, 24V Supply, Dual Channel Output, Manual Reset, Monitored Output



Single Sipha Sensor, 110V Supply, Dual Channel Output, Manual Reset, Monitored Output



Multiple Sipha Sensor, Manual Reset, Dual Channel Output, Monitored Output

5-Safety Relays