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Introducing a safety door switch with solenoid interlock that is among the world's thinnest*

Safety is assured during maintenance!



Introducing a range of new safety devices!

Panasonic Industrial Devices SUNX offers comprehensive safety solutions through an extensive selection of safety devices and a robust support system.

SAFETY SOLUTION

NEW Pushbutton type

Emergency stop switch

SG-E1

▶ P.16~



SEMI emergency off (EMO) switch



NEW

Enable grip switch

SG-C1

▶ P.14~

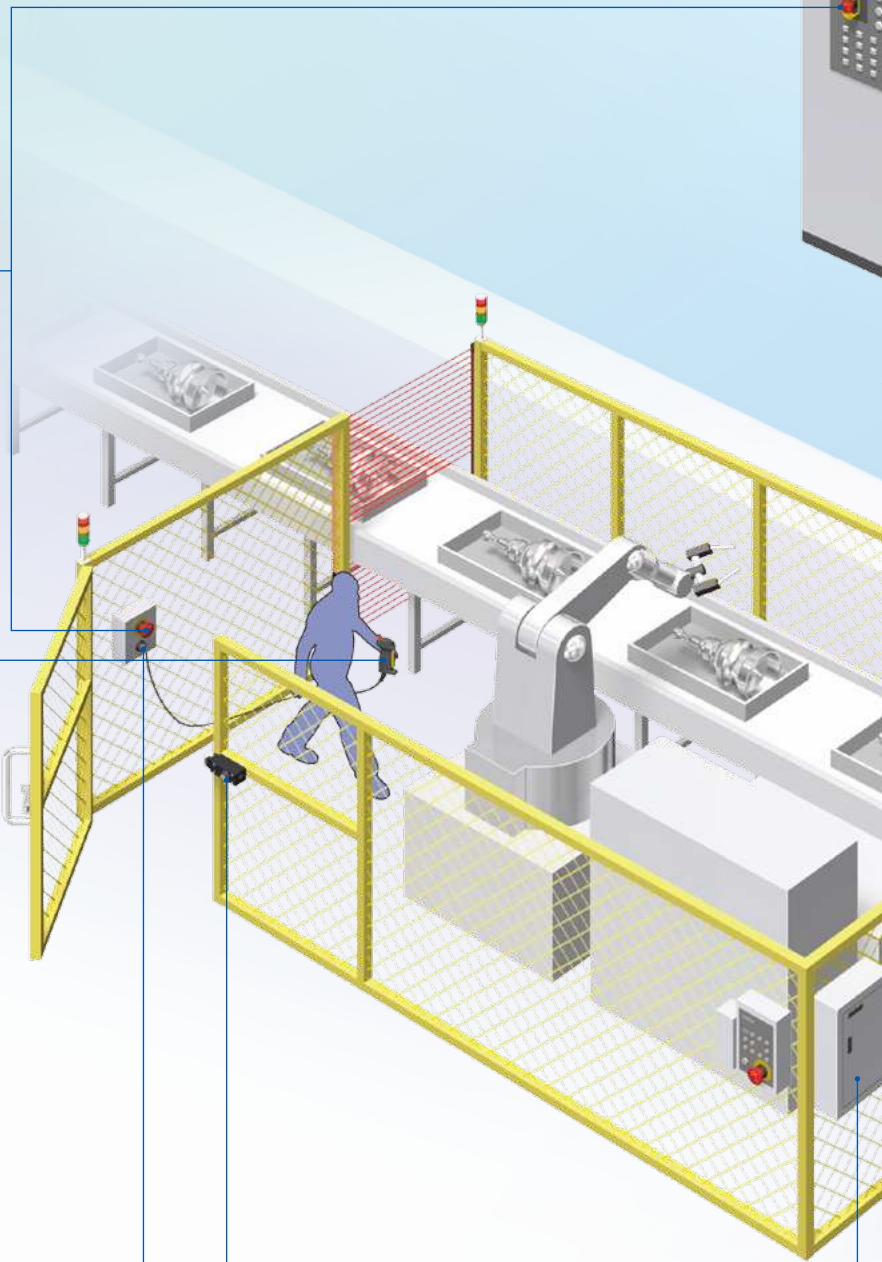


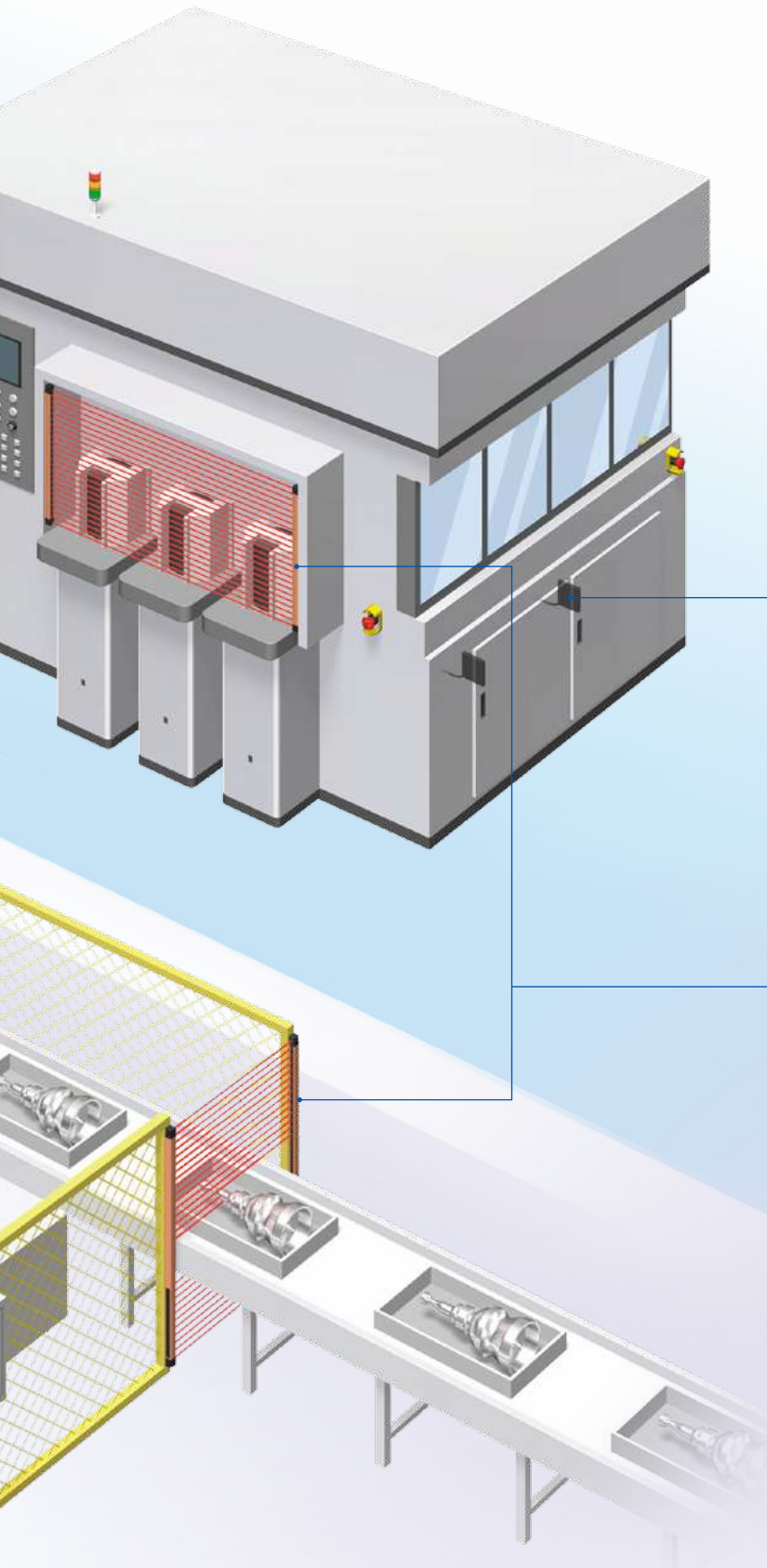
NEW

Safety door switch with key / Key selector switch

SG-B2 / SG-D1

▶ P.8~ / P.12~





NEW Ultra-slim

Safety door switch with solenoid interlock / Safety door switch

SG-B1 / SG-A1

P.4~



Light curtain

SF4B / SF2B



* For product details, please refer to individual product catalogs or our website.

Safety relay unit

SF-AC



* For product details, please refer to individual product catalogs or our website.

Safety door switch with solenoid interlock

SG-B1 Ultra-slim

SERIES



Safety door switch

SG-A1 Ultra-slim

SERIES



Connectable safety relay units



SF-AC Supports up to control category 3
• 2NC inputs, safety output × 3

Introducing a safety door switch with solenoid interlock that is among the world's thinnest*!

With 5 built-in contacts

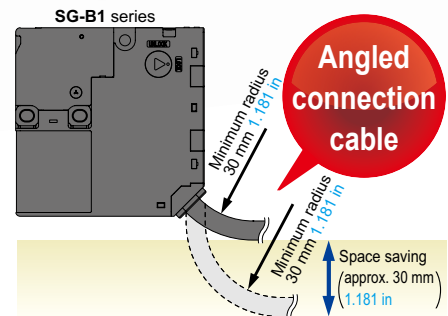
*Based on research conducted by our company as of March 2013.



Manual lock release can be operated from three directions.



Space saving design with angled connection cable



All models come with cables pre-installed.

The **SG-B1** series and **SG-A1** series ship with bundled cables already connected internally. Since there is no need to provide cables separately, and because they are already connected internally, the number of wiring man-hours is cut in half.

● Standard door switch



● Cable



Integrated design

SG-B1 series / SG-A1 series



Ships standard with cables.

Energy-saving design

The **SG-B1** series features an energy-saving design requiring current consumption of just 110 mA at 24 V DC (100 mA for the solenoid and 10 mA for the indicator), even though it also incorporates a solenoid interlock.

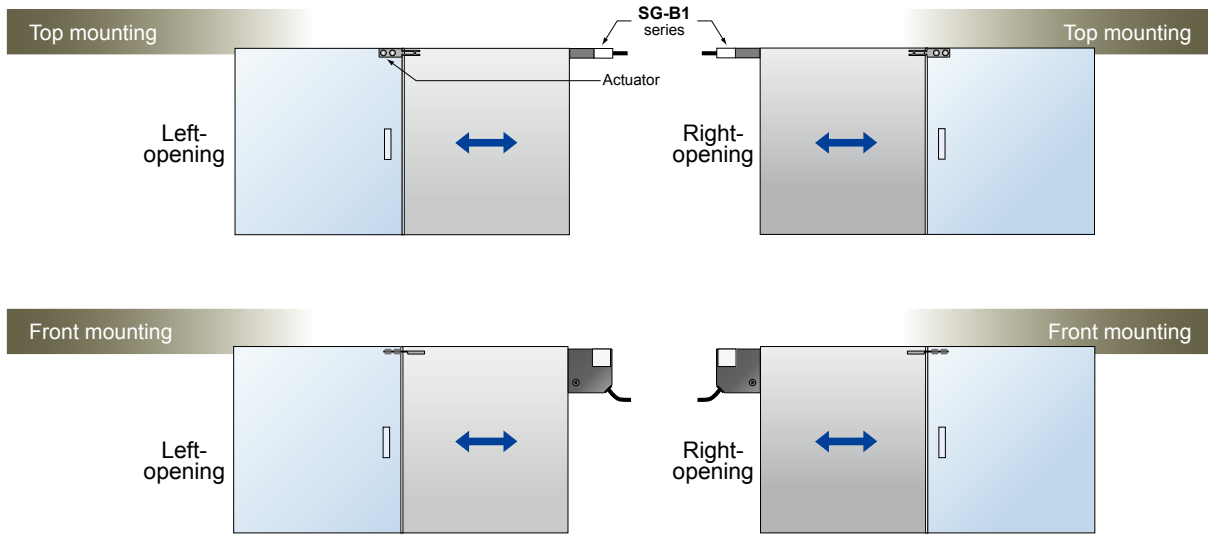


Low power consumption of 110 mA

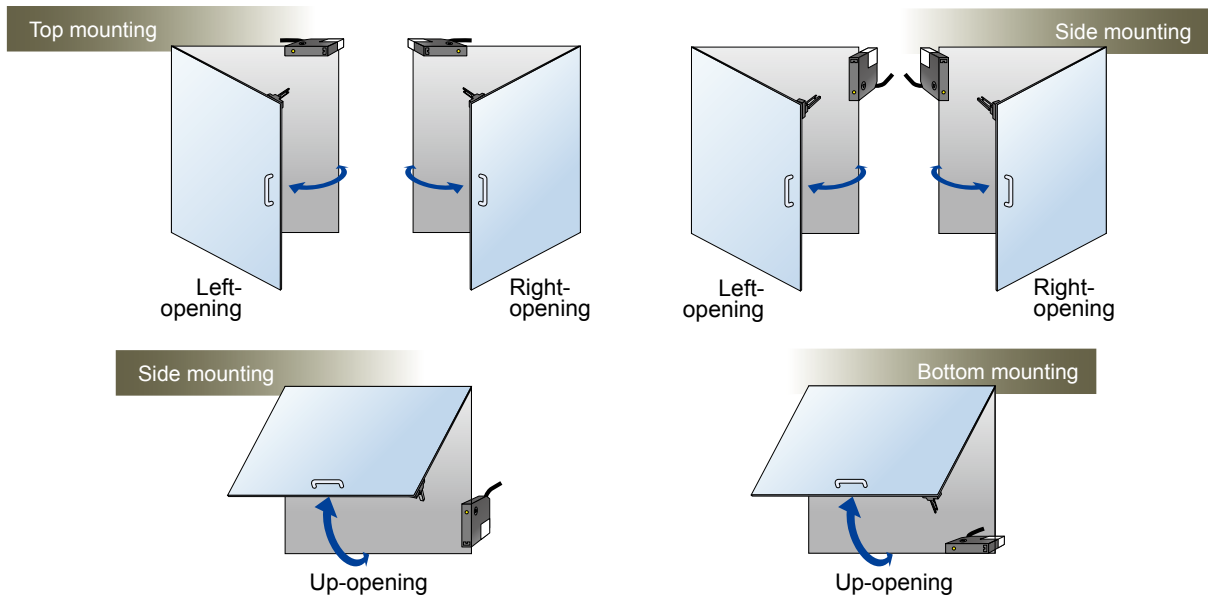
■ Order guide	P.7
■ Contact configuration / Operating patterns	P.18
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■ Dimensions	P.22~

Can be installed on any door.

Sliding doors



Hinged doors



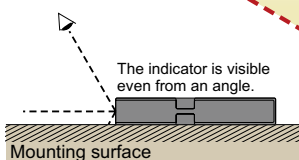
SG-B1 series

■ Choose between two types of locks:

- Spring lock
- Magnet lock

■ Easy-to-see LED operation indicator

Wide viewing angle (approx. 120°)



SG-A1 series

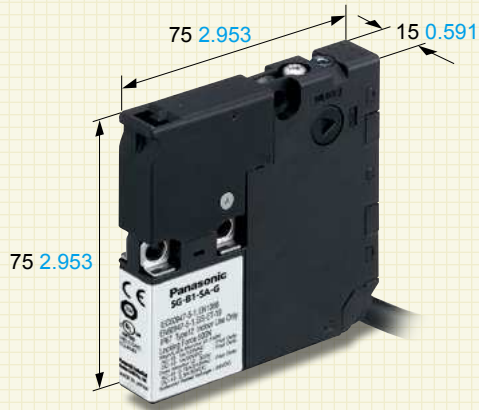
■ Features three built-in contacts yet is among world's smallest designs.

■ Choose from two actuator entry slot orientations.

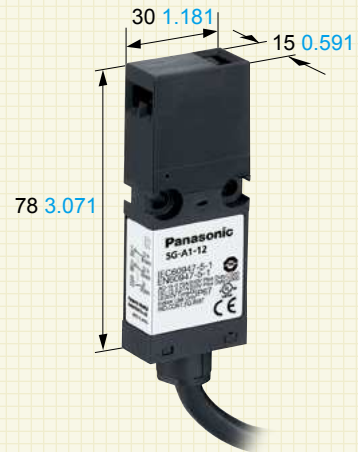


Dimensions (Unit: mm in)

SG-B1 series
(with solenoid interlock)

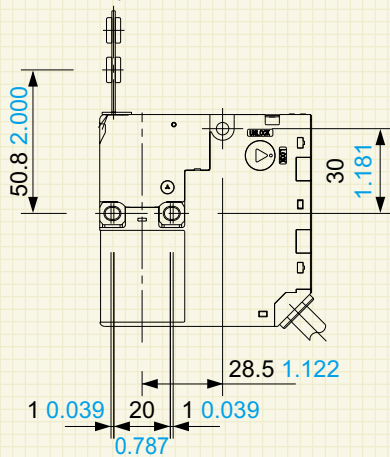


SG-A1 series

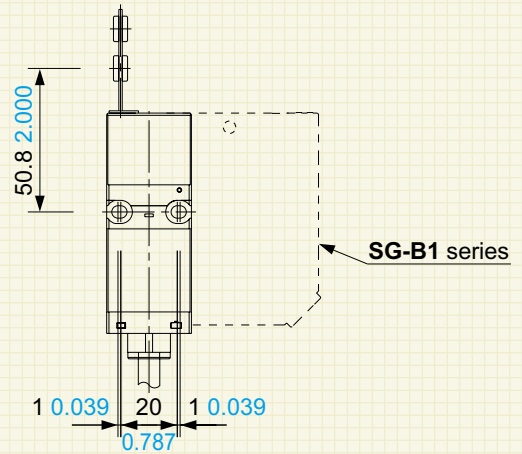


Mounting hole layout (Unit: mm in)

SG-B1 series
(with solenoid interlock)



SG-A1 series



Common actuators

SG-B1 series
(with solenoid interlock)



SG-A1 series



■ Horizontal / Vertical angle adjustable actuators



SG-K13



SG-K14



■ Straight actuator
SG-K11



■ Right-angle actuator
SG-K12



■ Right-angle actuator
(with plate)
SG-K12A

Order guide

Safety door switch with solenoid interlock

Actuators are not included with door switches and must be purchased separately.

Type	Interlock force	Main contacts	Door monitor contacts	Lock monitor contacts	Cable length	Model No.
Spring lock type	500 N or more	1NC + 1NC	2NC	1NC	1 m 3.281 ft	SG-B1-SA-G1
					5 m 16.404 ft	SG-B1-SA-G5
				1NO	1 m 3.281 ft	SG-B1-SB-G1
					5 m 16.404 ft	SG-B1-SB-G5
Magnet lock type	500 N or more	1NC + 1NC	2NC	1NC	1 m 3.281 ft	SG-B1-MA-G1
					5 m 16.404 ft	SG-B1-MA-G5
				1NO	1 m 3.281 ft	SG-B1-MB-G1
					5 m 16.404 ft	SG-B1-MB-G5

Safety door switch

Actuators are not included with door switches and must be purchased separately.

Door monitor contacts	Cable length	Model No.
2NC	1 m 3.281 ft	SG-A1-02-1
	5 m 16.404 ft	SG-A1-02-5
2NC + 1NO	1 m 3.281 ft	SG-A1-12-1
	5 m 16.404 ft	SG-A1-12-5
3NC	1 m 3.281 ft	SG-A1-03-1
	5 m 16.404 ft	SG-A1-03-5

Actuators

Actuators are not included with door switches and must be purchased separately.

Type	Model No.
Straight actuator	SG-K11
Right-angle actuator	SG-K12 (Note 1)
Right-angle actuator (with plate)	SG-K12A
Horizontal / vertical angle adjustable actuators (Note 2)	SG-K13
	SG-K14

• **SG-K11**



• **SG-K12**



• **SG-K12A**



• **SG-K13**



• **SG-K14**



- Notes: 1) The right-angle **SG-K12** actuator's tensile strength is 100 N. Using the device with a load in excess of this value may cause it to fall off the door. If you anticipate that the tensile load during use will exceed 100 N, use the right-angle (with plate) **SG-K12A**.
- 2) Choose a model after verifying the required direction of operation based on the relationship between the door and safety switch. (Refer to p.21)

Safety door switch with key

SG-B2

SERIES



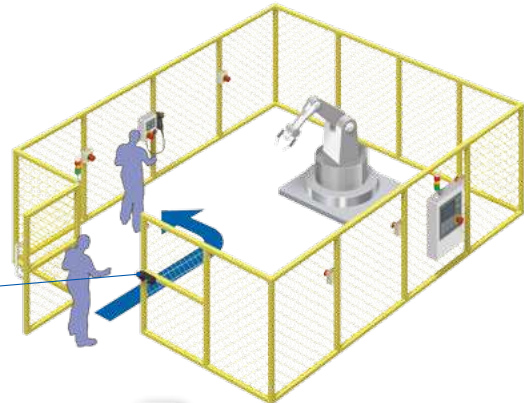
Solve issues related to machine safety and other safety measures with a safety door switch with key!



The safety door switch with key **SG-B2** series locks and unlocks doors with keys. When an operator takes a key into a hazardous area, the safety door switch will not lock, and the equipment will stop, ensuring operator safety by preventing personnel from being closed inside the hazardous area and preventing equipment from starting to operate.

■ Safety worker

Safety door switch with key **SG-B2** series



Hazards of the system and robot are isolated by the safety guard. The worker uses the key to unlock the door and disables the system from starting unexpectedly, then removes the key and brings it into the hazardous area. The system remains off until the worker walks out the door and locks the door with the key. This enables the worker carrying the key to work safely in the hazardous area.

Connectable safety relay units



SF-AC Supports up to control category 3
• 2NC inputs, safety output × 3

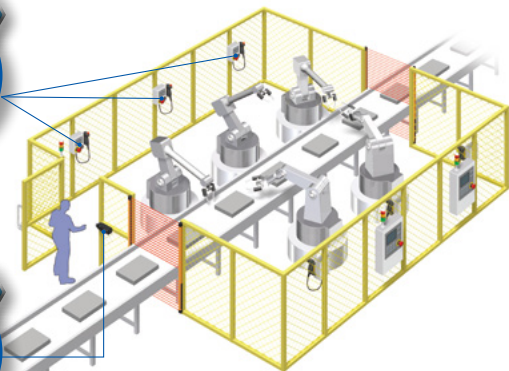
Additionally, the key selector switch **SG-D1** series can be used to switch equipment modes and unlock door locks with a single key.

■ Partial mode change

Key selector switch **SG-D1** series



Safety door switch with key **SG-B2** series



Hazards of the system and robot are isolated by the safety guard. When a worker needs to work inside the hazardous area for maintenance, the worker unlocks the safety guard using a key, disables the system from starting (1), removes the key and brings it into the hazardous area, and then changes the operation mode of each system to maintenance mode (2). While the worker is carrying out maintenance work in the hazardous area, the safety guard cannot be locked and the system cannot be turned on. This enables the worker to work safely in the hazardous area.

■ Order guide	P.10
■ Options	P.11
■ Contact configuration / Operating patterns	P.25
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■ Precautions for proper use	P.26~
■ Dimensions	P.28~

Energy-saving design, no power supply required

Since doors are locked and unlocked with a key, there is no need to supply power to the safety door switch.

Head removal detection function

Head removal detection function is employed in the **SG-B2**. With this innovative function, the monitor circuit (41-42) turns off when the head is removed from the switch, such as when removing the head to change the head direction.

With the head installed on the switch, monitor circuits 41-42 and 51-52 operate in synchronization while the key locks / unlocks the actuator. When the head is removed, 41-42 turns off and 51-52 turns on.

This disagreement is detected by the head removal detection function.



Monitor circuit	Actuator unlocked	Actuator locked	When the head removed
LOCK UNLOCK Monitor circuit (NC) Pink \rightarrow 41 \leftarrow 42 Pink / White	OFF	ON	OFF
Monitor circuit (NC) Brown \rightarrow 51 \leftarrow 52 Brown / White	OFF	ON	ON

Note: Head removal detection function is not direct opening.

Disagreement

High-security pin tumbler key types are used



Available with rear unlocking button

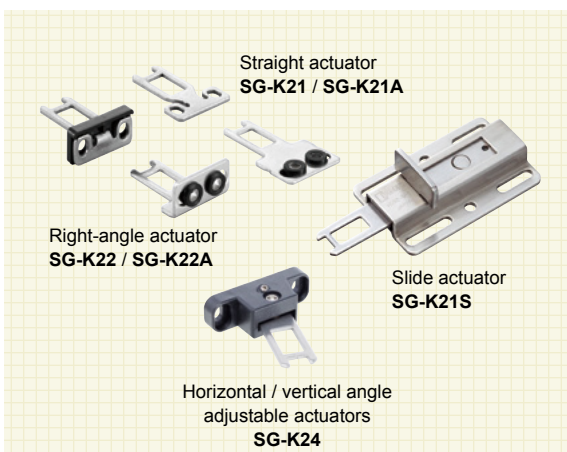


Models with a rear unlocking button allow the door to be unlocked from the inside in the event a worker is left in the hazardous area.

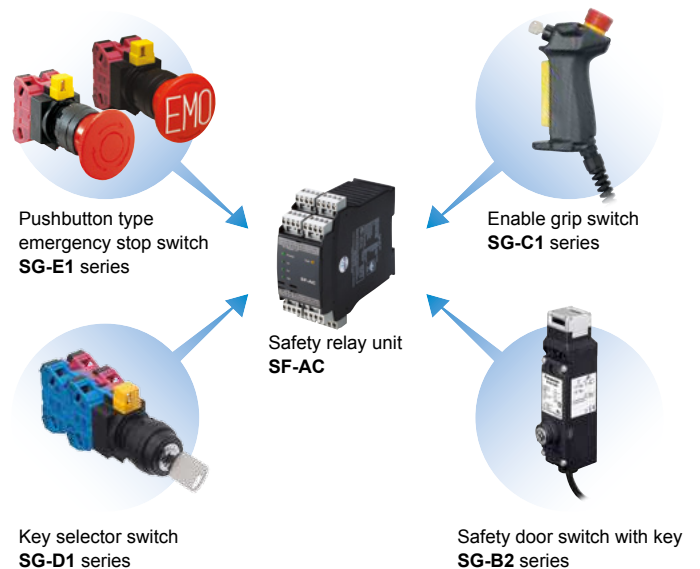
All models come with cables pre-installed.

Double-insulated design eliminates the need for grounding wires.

Choose an actuator based on the door shape and application.



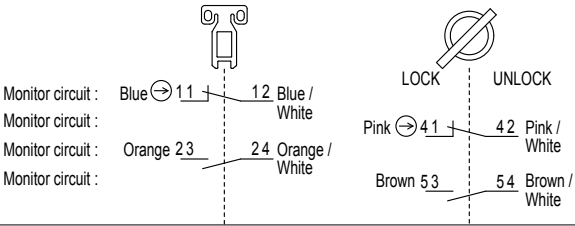
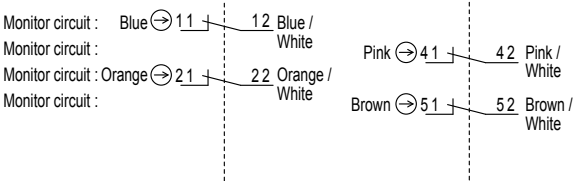
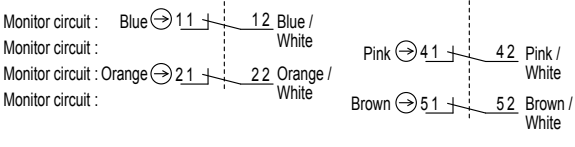
Equipment combination examples related to machine safety



Order guide

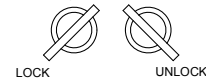
Safety door switch with key

Actuators are not included with door switches and must be purchased separately.

Rear unlocking button	Contact arrangement (Note)	Cable length	Key removal position	Model No.	
Without		5 m 16.404 ft	A (removable in all positions)	SG-B2-K2AC-5	
			B (removable in UNLOCK position)	SG-B2-K2BC-5	
			C (removable in LOCK position)	SG-B2-K2CC-5	
	With		5 m 16.404 ft	A (removable in all positions)	SG-B2-K2AD-5
				B (removable in UNLOCK position)	SG-B2-K2BD-5
				C (removable in LOCK position)	SG-B2-K2CD-5
With		5 m 16.404 ft	A (removable in all positions)	SG-B2-K2AD-L5	
			B (removable in UNLOCK position)	SG-B2-K2BD-L5	
			C (removable in LOCK position)	SG-B2-K2CD-L5	

Note: The contact configuration shows the status when the actuator is inserted and the switch is locked. Key LOCK and UNLOCK positions are as shown on the right.

Switches incorporate two detents so that they stop in each position.



Actuators

Actuators are not included with door switches and must be purchased separately.

Type	Description	Model No.
Straight actuator	The actuator tensile strength when using this product is 1,400 N.	SG-K21
Straight actuator with rubber bushings		SG-K21A
Slide actuator		SG-K21S
Right-angle actuator		SG-K22
Right-angle actuator with rubber bushings		SG-K22A
Horizontal / vertical angle adjustable actuators	The actuator tensile strength when using this product is 500 N.	SG-K24

Note: When using a safety door switch with key on a hinged door, see page 27 for more information about the minimum door radius with which the switch can be used.

• **SG-K21**



• **SG-K21A**



• **SG-K21S**



• **SG-K22**



• **SG-K22A**



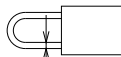
• **SG-K24**



Options

Type	Model No.
Padlock hasp (Note 1)	SG-PH2
Mounting plate (for mounting on an aluminum frame)	MS-SG-21
Rear unlocking button kit for a frame (Note 2)	MS-SG-22
	MS-SG-23

Notes: 1) The shackle diameter for compliant padlocks ranges from $\varnothing 5.5$ to $\varnothing 7.5$ mm $\varnothing 0.217$ to $\varnothing 0.295$ in.



Shackle diameter: $\varnothing 5.5$ to $\varnothing 7.5$ mm $\varnothing 0.217$ to $\varnothing 0.295$ in

2) For more information about selecting a back manual unlock button kit for a frame, see the following table:

Model No.	Mounting part* thickness (X) (mm in)
	Rear unlocking button type When installing an SG-B2-K2□D-L5 with a rear unlocking button directly
MS-SG-22	$33 < X \leq 43$ $1.299 < X \leq 1.693$
MS-SG-23	$23 < X \leq 33$ $0.906 < X \leq 1.299$

* The mounting part is a frame or a panel that the product is mounted on.

Padlock hasp

- **SG-PH2**



Mounting plate (for mounting on an aluminum frame)

- **MS-SG-21**



Rear unlocking button kit for a frame

- **MS-SG-22**
- **MS-SG-23**



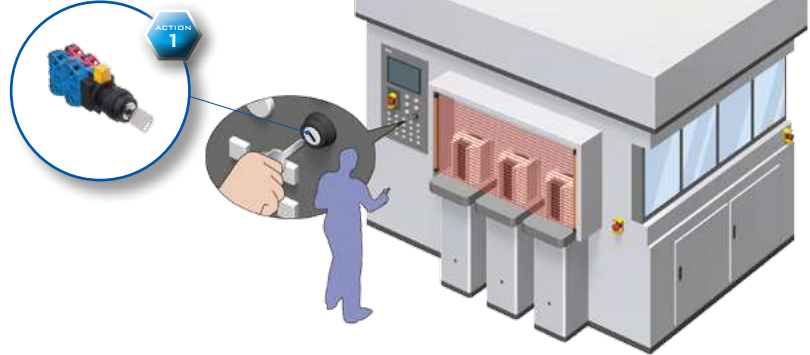
Key selector switch
SG-D1
 SERIES



Key selector switch with direct open operation function
 Pin tumbler design for high security

Mode change

Key selector switch
 SG-D1 series

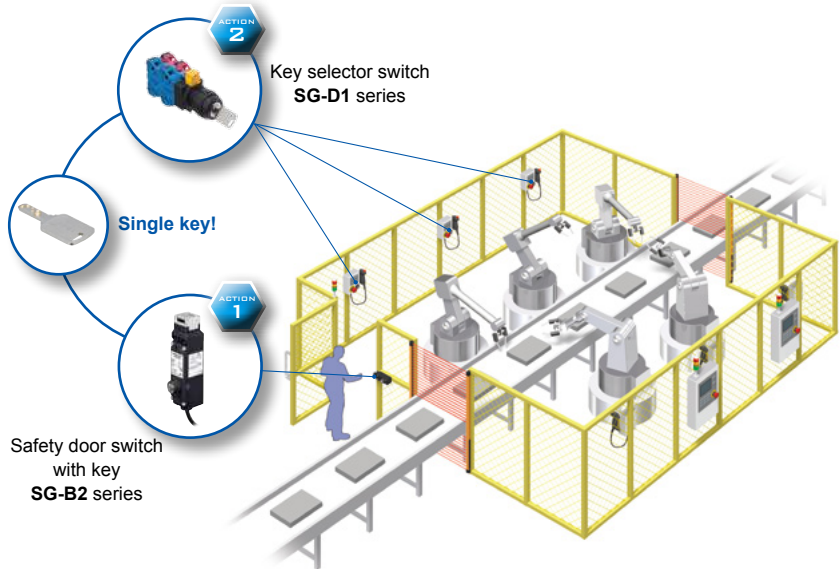


ACTION 1 Mode change

Workers can be limited by using a key selector switch to switch modes when performing maintenance and program overwrites. Additionally, since the NC contact (b-contact) use direct open operation, the circuit will be reliably shut off by forcibly separating the NC contact, even if they have melted together.

Use in combination with the safety door switch
 with key SG-B2 series to enable hostage control.

Partial mode change



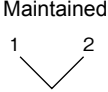
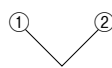
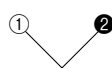

ACTION 1 Door unlocked (safety output off) **ACTION 2** Mode change

Hazards of the system and robot are isolated by the safety guard. When a worker needs to work inside the hazardous area for maintenance, the worker unlocks the safety guard using a key, disables the system from starting (1), removes the key and brings it into the hazardous area, and then changes the operation mode of each system to maintenance mode (2). While the worker is carrying out maintenance work in the hazardous area, the safety guard cannot be locked and the system cannot be turned on. This enables the worker to work safely in the hazardous area.

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Order guide

Key selector switch

Position	Contact configuration	Contact block		Operator position		Model No.	Key removal position
		Mounting position (Note)	Contact	1	2		
Maintained  (Manual) 90 degree, 2-position	1NO / 1NC (11)	①	NO		●	SG-D1-2A11	A: All positions 
		②	NC	●			
	2NO / 2NC (22)	①	NO		●	SG-D1-2A22	
		②	NC	●			
		③	NO		●		
		④	NC	●			
	1NO / 1NC (11)	①	NO		●	SG-D1-2B11	B: Left position (Not removable in right position) 
		②	NC	●			
	2NO / 2NC (22)	①	NO		●	SG-D1-2B22	
		②	NC	●			
		③	NO		●		
		④	NC	●			
1NO / 1NC (11)	①	NO		●	SG-D1-2C11	C: Right position (Not removable in left position) 	
	②	NC	●				
2NO / 2NC (22)	①	NO		●	SG-D1-2C22		
	②	NC	●				
	③	NO		●			
	④	NC	●				

Note: Contact blocks are attached as shown below:



Options

Type	Model No.	Description
Locking ring wrench	SG-ET1	Used to tighten the locking ring when installing the unit onto a panel. Material: Brass Weight: approx. 150 g * Tighten the locking ring to a torque of 2.0 N·m.

Locking ring wrench

• SG-ET1



Enable grip switch

SG-C1

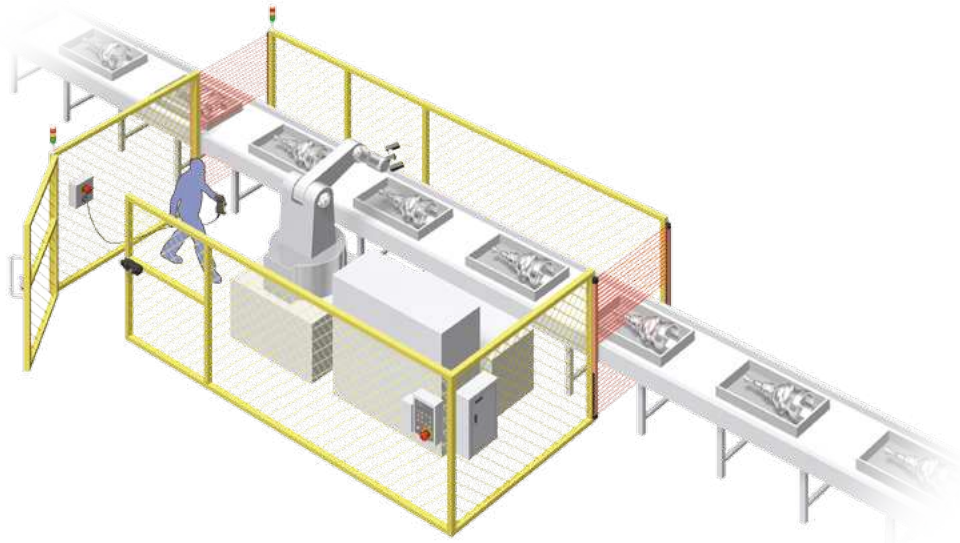
SERIES



(Push monitor switch)



Compact, light weight grip switches designed to fit comfortably in the hand



This product line includes models with control units suited to a variety of applications.

The compact, light weight grip profile was designed based on human engineering considerations.

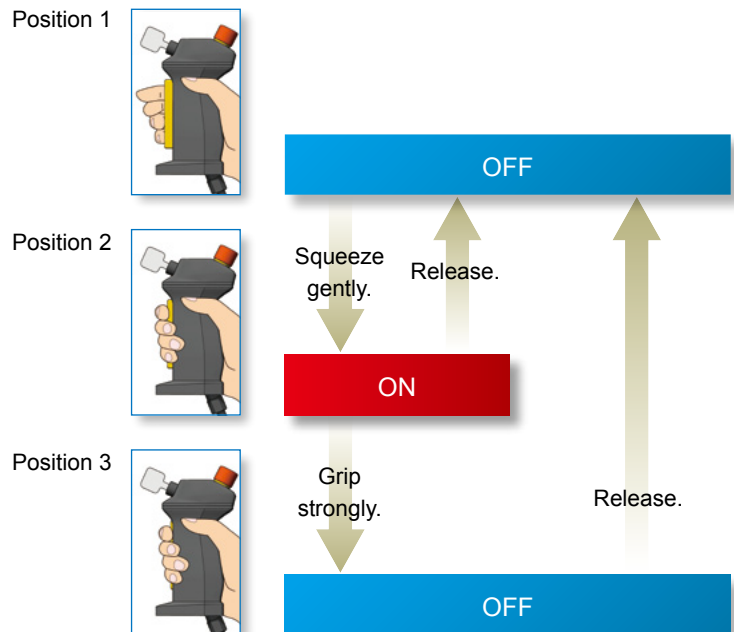
The compact profile fits the hand perfectly, ensuring comfortable operation. Thanks to its light weight design (**SG-C1-21**: approx. 140 g) and compact size, it is easy to hold even for individuals with small hands, and it can also be used in confined work locations.

Reduced impact during extended operation

We reduced the impact during extended operation by lowering the holding load in position 2 (ON).

Pleasant, clear button operation

Tactile clicking feedback allows easy recognition of switch operation when shifting from position 1 (contact OFF) to position 2 (contact ON).



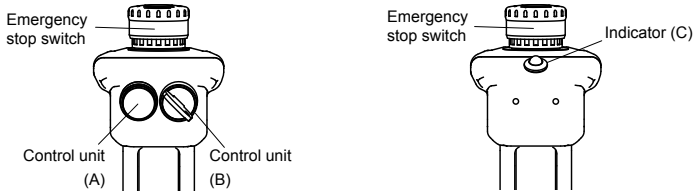
■ Order guide	P.15
■ Contact configuration / Operating patterns	P.15
■ Specifications	P.31
■ Precautions for proper use	P.31~
■ Dimensions	P.32

Order guide

Enable grip switch

Contact configuration						Rubber boot material / Color	Wiring style	Model No.	
3 position enabling switch	Push monitor switch	Additional control units							
		Emergency stop switch	Control unit (A)	Control unit (B)	Indicator (green) (C)				
2 contacts	With (1NC)	Without				Without	Silicone rubber / (Yellow) (Note)	Solder terminal	SG-C1-21
		With (2NC)	Without		With				SG-C1-21-E
		Without	Momentary pushbutton switch (2c)	Momentary pushbutton switch (2c)	Without	SG-C1-21-EG			
		With (2NC)				Key selector switch (2c)			SG-C1-21-MM
								SG-C1-21-EMM	
								SG-C1-21-EMK	

Additional control unit layout



Note: Silicone rubber: Can be used in general factories. Remains flexible in cold temperatures. Suitable in applications with a wide operating temperature range.

Contact configuration / Operating patterns

Grip switch (during operation of center of the rubber boot)

	Terminal No. Solder terminal	Position 1	Position 2	Position 3
Push (Position 1→2→3) →	NO1-C1	ON	OFF	OFF
	31-32	OFF	ON	ON
	NO2-C2	OFF	OFF	ON
Release (Position 2→1) ←	NO1-C1	OFF	ON	ON
	31-32	ON	OFF	OFF
	NO2-C2	ON	ON	OFF
Release (Position 3→1) ←	NO1-C1	OFF	OFF	ON
	31-32	ON	ON	OFF
	NO2-C2	ON	ON	OFF

3 position enabling switch: 2 contacts; pin No.: NO1-C1, NO2-C2
Push monitor switch: 0, 1 contacts: pin No.: 31-32 (SG-C1-21□)

Note: Push monitor switch (terminal No.31-32) will be positive opening circuit (⊕) when the switch operates from position 2 to 3. Use contacts of terminal No. NO1-C1 and NO2-C2 for the output of enabling system.

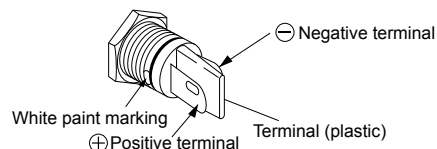
The above operating characteristics illustrate the performance when the center of the rubber boot is pressed. Pressing the edge activates one of the two 3 position enabling switches inside earlier than the other, and may cause a delay in the operation.

Key selector switch

Operator position & contact operation (top view)					
Position	Key removal position	↖ (Left)		↗ (Right)	
Maintained 1 2	Removable in all positions	Left contact NO1	Right contact NO2	Left contact NO1	Right contact NO2
		NC1	NC2	NC1	NC2
		C1	C2	C1	C2

Indicator

Pay attention to the polarity of the power supply as SG-C1-21-EG do not contain a diode for protection against reverse polarity. On solder terminal units, the terminal with a white paint marking is positive.



Emergency stop switch

SG-E1

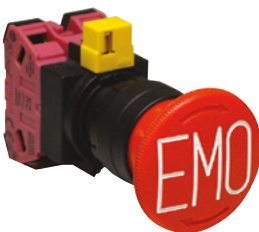
Pushbutton type

SERIES



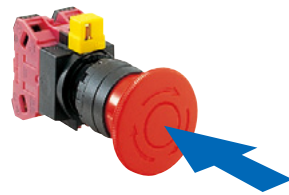
SEMI emergency off (EMO) switch

Pushbutton type

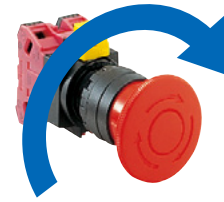


Push to lock, turn to reset

Switches feature simple operation: Push the pushbutton to lock the switch, and turn the switch in the direction shown by the arrow to reset it.



Push to lock



Turn to reset

The product line includes a SEMI emergency off (EMO) switch.



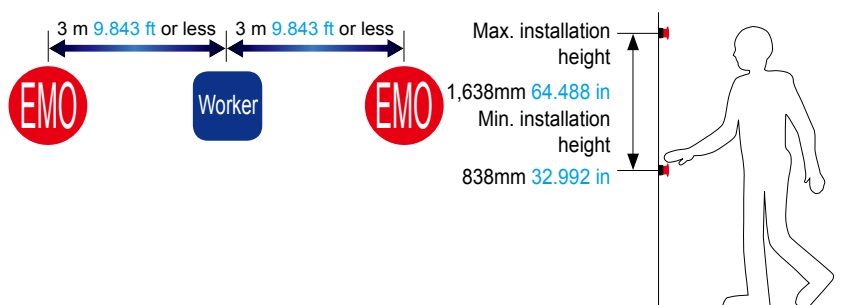
SEMI semiconductor industry safety standards

SEMI standards comprise a series of guidelines put together by an industry group consisting of manufacturers of semiconductor manufacturing equipment, flat-panel displays, and associated materials. In the semiconductor industry, these guidelines have achieved the status of de facto international standards.

Section 12.1 of the SEMI standards (S2 0706) states, "Equipment should incorporate an emergency off (EMO) circuit. When the EMO actuator (button) is triggered, the equipment should transition to a safe state in which no new hazard is posed to workers or equipment." This provision likely stems from the need to address the possibility of secondary hazards that could occur when processing power and other inputs are stopped, reflecting the industry's extensive use of materials such as solvents and chemicals, many of which contain hazardous or toxic substances. Consequently, SEMI standards require that normal emergency stop switches, which shut off the supply of energy, including power, be augmented with separate emergency off switches that shut off only the portion of the load that created the hazardous state while maintaining operation of other safety-related equipment (smoke detectors, gas / water leak detectors, pressure measurement equipment, etc.).

When there is the possibility that the emergency off switch could be operated mistakenly, a guard must be installed and the switch must use direct opening operation. The button must be red with a yellow background, and the switch itself must include the letters "EMO."

- When installing a SEMI emergency off (EMO) switch on semiconductor manufacturing equipment, it should be installed at a height of 838 to 1,638 mm **32.992 to 64.488 in.** (SEMI S8-0705)
- According to SEMI standards, the EMO emergency stop switch must be installed within 3 m **9.843 ft** of the work location. (SEMI S2-0706 12.5.2)



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■ Options	P.17
■ Specifications	P.33
■ Precautions for proper use	P.33
■ Dimensions	P.34

Order guide

Emergency stop switch

Type	Contact configuration	Button color	Model No.
Pushlock Turn reset	2NC	Red	SG-E1-02
	1NO / 2NC		SG-E1-12

SEMI emergency off (EMO) switch

Type	Main contacts (NC contacts)	Monitor contacts (NO contacts)	Button color / text color	Model No.
Pushlock Turn reset	2NC	—	Red / White	SG-E1-02-E
	2NC	1NO		SG-E1-12-E

Options

Type	Model No.	Description	
Emergency stop nameplate	SG-EP1	Legend	(Blank)
	SG-EP2		EMERGENCY STOP
	SG-EP3		非常停止 (Japanese)
		Background: Yellow Legend: Black Applicable panel thickness: 0.8 to 4.5 mm 0.031 to 0.177 in Material: Polyamide	
Locking ring wrench	SG-ET1	Used to tighten the locking ring when installing the unit onto a panel. Material: Brass, Weight: approx. 150 g * Tighten the locking ring to a torque of 2.0 N·m.	
SEMI guard ring	MS-SG-GR1	For SEMI emergency off (EMO) switches. Specifically designed for use with semiconductor manufacturing equipment.	

Emergency stop nameplate

- SG-EP1
- SG-EP2
- SG-EP3



Locking ring wrench

- SG-ET1



SEMI guard ring

- MS-SG-GR1



●Caution

SEMI guard rings are designed specifically for use with semiconductor manufacturing equipment and should not be used as emergency stop switches for machine tools, food processing machinery, or other equipment.

(The European Machinery Directive, IEC 60204-1, JIS B9960-1, and other standards require that emergency stop switches be easy to approach and operate, and use of SEMI standard-compliant switch guards is not currently approved.)



Contact configuration / Operating patterns

Safety door switch with solenoid interlock

■ : Closed □ : Open

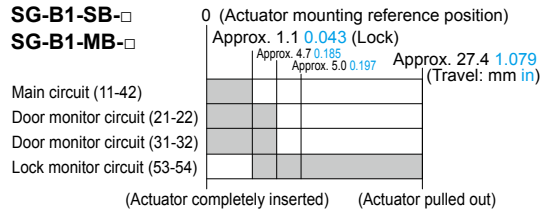
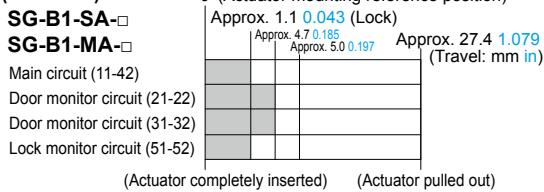
		Status 1	Status 2	Status 3	Status 4	Unlocking using manual unlocking key
Safety switch status		• Door closed • Machine ready to operate • Solenoid de-energized	• Door closed • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid de-energized	• Door closed • Machine cannot be operated • Solenoid de-energized
Door status						
Door		• Closed (locked)	• Closed (unlocked)	• Open	• Open	• Closed (unlocked)
Model No. and contact configuration	Spring lock type SG-B1-SA -□ Magnet lock type SG-B1-MA -□	Main circuit 11-42				
	Door monitor circuit (door closed) 21-22					
	Door monitor circuit (door closed) 31-32					
	Lock monitor circuit (locked) 51-52					
Spring lock type SG-B1-SB -□ Magnet lock type SG-B1-MB -□	Main circuit 11-42					
	Door monitor circuit (door closed) 21-22					
	Door monitor circuit (door closed) 31-32					
	Lock monitor circuit (unlocked) 53-54					
Spring lock type Solenoid power A1-A2 (same for all models)		• OFF (de-energized)	• ON (energized)	• ON (energized)	• OFF (de-energized)	• OFF (de-energized)
Magnet lock type Solenoid power A1-A2 (same for all models)		• ON (energized)	• OFF (de-energized)	• OFF (de-energized)	• ON (energized) (Note 2)	• OFF (de-energized) to ON (re-energized) (Note 1) (Note 2)

Main circuit: Connected to the machine drive control circuit, sending the interlock signals of the protective door.
Monitor circuit: Sends the monitoring signals of open / closed and lock / unlocked statuses of the protective door.

Notes: 1) Do not attempt manual unlocking while the solenoid is energized.

2) Do not energize the solenoid for a long period of time while the door is open or while the door is unlocked manually.

• **Operation characteristics** ■ : Contact ON (closed) □ : Contact OFF (opened) (reference)



• The operation characteristics show the contact status when the actuator enters an entry slot of a safety switch.

• The operation characteristics shown in the chart above are of the **SG-K11** / **SG-K12** / **SG-K13** and **SG-K14** actuators. For the **SG-K12A** actuator, subtract 0.6 mm 0.024 in.

Safety door switch

Model No.	Contact configuration	Operation characteristics
SG-A1-02 -□	2NC 11-12 31-32	0.8 0.031 (Actuator mounting reference position) Approx. 5.5 0.217 Approx. 5.8 0.228 Approx. 28.2 1.110 (Travel: mm in)
SG-A1-12 -□	2NC + 1NO 11-12 21-22 33-34	
SG-A1-03 -□	3NC 11-12 21-22 31-32	

■ : Contact ON (closed)
□ : Contact OFF (opened)

(Actuator completely inserted) (Actuator pulled out)



Specifications

Designation		Safety door switch with solenoid interlock					
Item	Series	SG-B1 series					
Applicable standards		EN 1088, IEC 60947-5-1, EN 60947-5-1, GS-ET-19, UL 508, CSA C22.2 No.14					
Standards for use		IEC 60204-1, EN 60204-1					
Applicable directives		Machinery directive (2006/42/EC) Low voltage directive (2006/95/EC)					
Operating condition	Ambient temperature	-25 to +50 °C -13 to +122 °F (No dew condensation or icing allowed) Storage: -40 to +80 °C -40 to +176 °F					
	Ambient humidity	45 to 85 % RH					
	Pollution degree	3 (Inside 2)					
	Altitude	2,000 m 6,561.68 ft max.					
Rated insulation voltage (Ui)		300 V (Door monitor circuit) 150 V (Main, Lock monitor circuit) 30 V (Between ground and LED, solenoid circuit)					
Impulse withstand voltage (Uimp)		2.5 kV (Door monitor circuit) 1.5 kV (Main, Lock monitor circuit) 0.5 kV (Between ground and LED, solenoid circuit)					
Thermal current (Ith)		Ambient temperature: -25 to +35 °C -13 to +95 °F 2.5 A (up to 2 circuits) 1.0 A (3 or more circuits)			Ambient temperature 35 to +50 °C 95 to +122 °F 1.0 A (1 circuit) 0.5 A (2 or more circuits)		
Rated operational voltage (Ue) / Rated operational current (Ie)		Ie		Ue		30 V 125 V 250 V	
		Main circuit, lock monitor circuit	AC	Resistive load (AC-12)	-	2 A	-
				Inductive load (AC-15)	-	1 A	-
			DC	Resistive load (DC-12)	2 A	0.4 A	-
				Inductive load (DC-13)	1 A	0.22 A	-
		Door monitor circuit	AC	Resistive load (AC-12)	-	2.5 A	1.5 A
				Inductive load (AC-15)	-	1.5 A	0.75 A
			DC	Resistive load (DC-12)	2.5 A	1.1 A	0.55 A
Inductive load (DC-13)	2.3 A			0.55 A	0.27 A		
Electric shock protection class		Class II (IEC 61140) (Note 1), (double insulated)					
Operating frequency		900 operations/hour					
Actuator operating speed		0.05 to 1.0 m/sec.					
B _{10d}		2,000,000 (ISO 13849-1 Annex C Table C.1)					
Mechanical durability		1,000,000 operations min. (GS-ET-19) 100,000 operations min. (900 operations/hour, AC-12 125 V 2A, DC-12 125 V 0.4 A)					
Electrical durability		1,000,000 operations min. (900 operations/hour, 24 V AC/DC 0.1 A resistive load)					
Interlock force		500 N min. (GS-ET-19) (Note 2)					
Direct opening travel		8 mm 0.315 in min.					
Direct opening force		60 N min.					
Contact resistance		300 mΩ max. (initial value, 1 m 3.281 ft cable) 700 mΩ max. (initial value, 5 m 16.404 ft cable)					
Protection		IP 67 (IEC 60529)					
Shock resistance		Malfunction: 100 m/s ² , Destruction: 1,000 m/s ²					
Vibration resistance		Malfunction: 10 to 55 Hz, half amplitude 0.35 mm 0.014 in Destruction: 30 Hz, half amplitude 1.5 mm 0.059 in					
Short-circuit protective device		Use 250 V / 10 A fast acting type fuse					
Material		Enclosure: PA66					
Cable		UL style 2464, No.22 AWG 12-core					
Solenoid / Indicator	Rated operating voltage	DC 24 V 100% duty cycle					
	Rated current	110 mA (solenoid 100 mA, LED 10 mA : initial value)					
	Turn on voltage	Rated voltage × 85 % max. (at 20 °C 68 °F)					
	Turn off voltage	Rated voltage × 10 % min. (at 20 °C 68 °F)					
Indicator		Green LED					
Weight		SG-B1-□-G1: Approx. 220 g, SG-B1-□-G5: Approx. 600 g					

Notes: 1) Basic insulation of 2.5 kV, 1.5 kV impulse withstand voltage is ensured between different contact circuits and between contact circuits and LED or solenoid in the enclosure. When both SELV (safety extra low voltage) or PELV (protective extra low voltage) circuits and other circuits (such as 230 V AC circuits) are used for the solenoid power and contact circuits at the same time, the SELV or PELV requirements are not met any more.

2) The actuator locking strength is rated at 500 N of static load. Do not apply a load higher than the rated value.
Do not apply a load higher than the rated value.
When a higher load is expected to work on the actuator, provide an additional system consisting of another safety switch without lock (such as the SG-A1 safety switch) or a sensor to detect door opening and stop the machine.

Designation		Safety door switch					
Item	Series	SG-A1 series					
Applicable standards		EN 1088, IEC 60947-5-1, EN 60947-5-1, GS-ET-15, UL 508, CSA C22.2 No.14					
Standards for use		IEC 60204-1, EN 60204-1					
Applicable directives		Machinery directive (2006/42/EC) Low voltage directive (2006/95/EC)					
Operating condition	Ambient temperature	-25 to +70 °C -13 to +158 °F (No dew condensation or icing allowed) Storage: -40 to +80 °C -40 to +176 °F					
	Ambient humidity	45 to 85 % RH					
	Pollution degree	3 (Inside 2)					
	Altitude	2,000 m 6,561.68 ft max.					
Impulse withstand voltage (Uimp)		4 kV					
Rated insulation voltage (Ui)		300 V					
Thermal current (Ith)		2.5 A					
Rated operational voltage (Ue) / Rated operational current (Ie)		Ie		Ue		30 V 125 V 250 V	
		AC	Resistive load (AC-12)		-	2.5 A	1.5 A
			Inductive load (AC-15)		-	1.5 A	0.75 A
		DC	Resistive load (DC-12)		2.5 A	1.1 A	0.55 A
Inductive load (DC-13)			2.3 A	0.55 A	0.27 A		
Electric shock protection class		Class II (IEC 61140), (double insulated)					
Protection		IP 67 (IEC 60529)					
Shock resistance		Malfunction: 300 m/s ² Destruction: 1,000 m/s ²					
Vibration resistance		Malfunction: 5 to 55 Hz, half amplitude 0.5 mm 0.020 in Destruction: 30 Hz, half amplitude 1.5 mm 0.059 in					
Operating frequency		1,200 operations/hour					
Actuator operating speed		0.05 to 1.0 m/sec.					
B _{10d}		2,000,000 (ISO 13849-1 Annex C Table C.1)					
Mechanical durability		1,000,000 operations min. (GS-ET-15)					
Electrical durability		100,000 operations min. (AC-12, 250 V 1.5 A, DC-12 250 V 0.2 A) 1,000,000 operations min. (AC/DC 24 V 100 mA) (1,200 operations/hour)					
Direct opening travel		8 mm 0.315 in min.					
Direct opening force		60 N min.					
Contact resistance		300 mΩ max. (initial value, 1 m 3.281 ft cable) 700 mΩ max. (initial value, 5 m 16.404 ft cable)					
Short-circuit protective device		Use 250 V / 10 A fast acting type fuse					
Conditional short-circuit current		50 A (250 V)					
Material		Enclosure: PA66					
Cable		UL style 2464, No.20 AWG 6-core					
Weight		SG-A1-□-1: Approx. 120 g, SG-A1-□-5: Approx. 420 g					

Safety door switch with solenoid interlock

SG-B1
SG-A1

Safety door switch with key

SG-B2

Enable grip switch

SG-C1

Emergency stop switch

SG-E1

Key selector switch

SG-D1



Precautions for proper use

- This catalog is a guide to select a suitable product. Be sure to read the instruction manual attached to the product prior to its use.

- In order to avoid electric shock or fire, turn the power off before installation, removal, wire connection, maintenance, or inspection of the safety switch.
- If relays are used in the circuit between the safety switch and the load, consider the danger and use safety relays, since welding or sticking contacts of standard relays may invalidate the functions of the safety switch.
- Do not place a PLC in the circuit between the safety switch and the load. Safety and security can be endangered in the event of a malfunction of the PLC.



- Do not disassemble or modify the safety switch, otherwise a breakdown or an accident may occur.
- Do not install the actuator in a location where the human body may come in contact. Otherwise injury may occur.
- Magnet lock type is locked when energized, and unlocked when de-energized. When energization is interrupted due to wire disconnection or other failures, the safety switch may be unlocked causing possible danger to the operators. Magnet lock type must not be used in applications where locking is strictly required for safety. Perform a risk assessment and determine whether solenoid lock type is appropriate.

Both series

- Regardless of door types, do not use the safety switch as a door stop. Install a mechanical door stop at the end of the door to protect the safety switch against excessive force.
- Do not apply external force on the actuator while unlocking, otherwise the actuator may not be unlocked.
- Do not apply excessive shock to the safety switch when opening or closing the door. A shock to the safety switch exceeding 1,000 m/s² may cause damage to the safety switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the safety switch through the actuator entry slots. Entry of a considerable amount of foreign objects into the safety switch may affect the mechanism of the safety switch and cause a malfunction.
- Do not store the safety switches in a dusty, humid, or organic-gas atmosphere, or in an area subjected to direct sunlight.
- Use proprietary actuators only. When other actuators are used, the safety switch may be damaged.

SG-B1 series

- The locking strength is rated at 500 N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of another safety switch without lock (such as the SG-A1 safety switch) or a sensor to detect door opening and stop the machine.
- Regardless of door types, do not use the safety switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the switch temperature rises approximately 35 °C 95 °F above the ambient temperature (to approximately 85 °C 185 °F while the ambient temperature is 50 °C 122 °F). Do not touch to prevent burns. If cables come into contact with the switch, use heat-resistant cables.
- Bouncing will occur on the lock monitor contact during locking and unlocking (reference value: 20 ms).

- Although the SG-K11 / SG-K12 / SG-K12A actuators alleviate shock when the actuator enters a slot in the safety switch, make sure that excessive shock is not applied. If the rubber bushings become deformed or cracked, replace with new ones.

SG-A1 series

- Cover the unused actuator entry slot using the slot plug supplied with the safety switch.

Minimum radius of hinged door

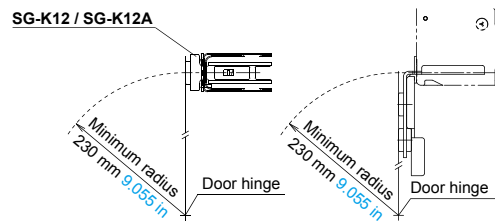
- When using the safety switch on hinged doors, refer to the minimum radius of doors shown below. When using on doors with small minimum radius, use the angle adjustable actuator (SG-K13 / SG-K14).

Note: The values indicated in the figures below assume that there is no mechanical interference between the actuator and the safety switch when the door is opened or closed. Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

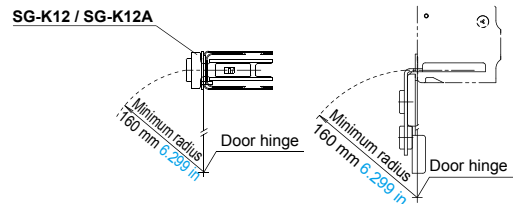
When using the right-angle actuator (SG-K12 / SG-K12A)

SG-B1 series

<When the door hinge is on the extension line of the actuator mounting surface>

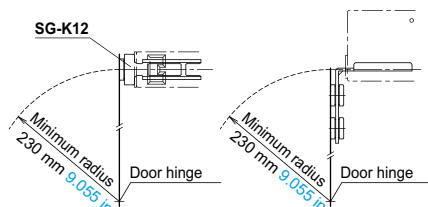


<When the door hinge is on the extension line of the safety switch surface>

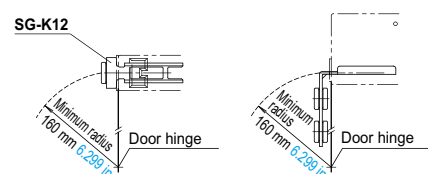


SG-A1 series

<When the door hinge is on the extension line of the actuator mounting surface>



<When the door hinge is on the extension line of the safety switch surface>



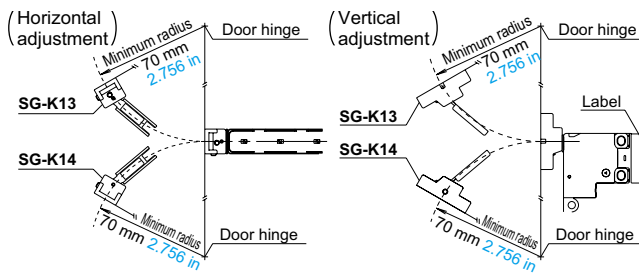
Precautions for proper use

When using the (SG-K13 / SG-K14) angle adjustable (vertical / horizontal) actuator

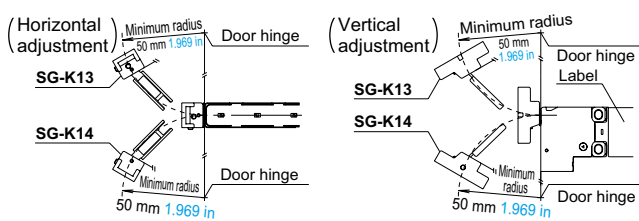
- When the door hinge is on the extension line of the actuator mounting surface: 70 mm 2.756 in
- When the door hinge is on the extension line of the safety switch surface: 50 mm 1.969 in

SG-B1 series

<When the door hinge is on the extension line of the actuator mounting surface>

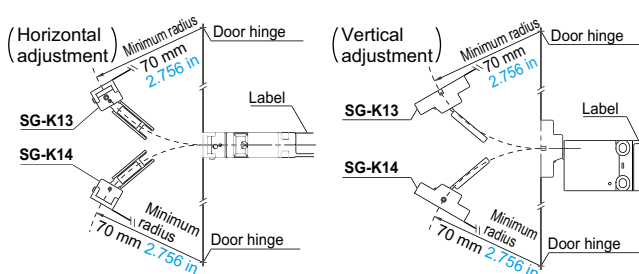


<When the door hinge is on the extension line of the safety switch surface>

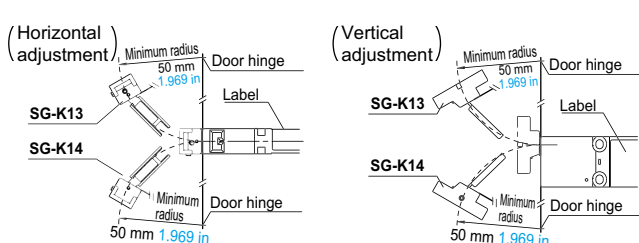


SG-A1 series

<When the door hinge is on the extension line of the actuator mounting surface>



<When the door hinge is on the extension line of the safety switch surface>

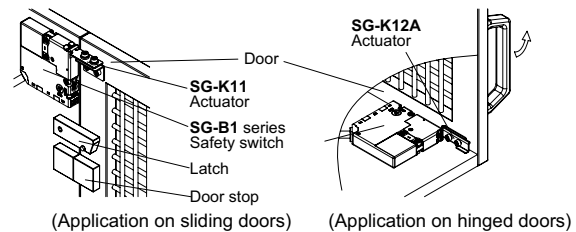


Actuator angle adjustment (vertical / horizontal)

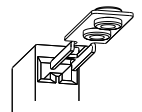
- Using the angle adjustment screw (M3 hexagon-socket-head screw), the actuator angle can be adjusted. (refer to the dimensions on page 24)
Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening. After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the safety switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not move.

Mounting

- Mount the safety switch on a fixed piece of machinery or guard and the actuator on a hinged door. Avoid mounting both the safety switch and actuator on a hinged door. Doing so may cause equipment failure. For more information about how to mount the devices, see the following diagram:



Note: When mounting the actuator, make sure that the actuator enters the slot in the correct direction, as shown on the right figure.



Recommended tightening torque for mounting screws

Safety switch: 1.0 to 1.5 N·m (Three M4 screws)*

Actuator: 1.0 to 1.5 N·m (Two M4 screws)*

*The above recommended tightening torques of the mounting screws are the values confirmed with hexagon-socket-head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.

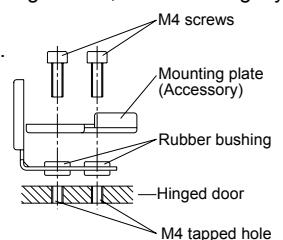
- Mounting bolts must be provided by the users.
- To avoid unauthorized or unintended removal of the safety switch and the actuator, it is recommended that the safety switch and actuator are installed in a secure manner, for example using special screws or welding the screws.

- When installing the **SG-K12A** actuator, use the mounting plate (supplied with the actuator) on the hinged door, and mount tightly using two M4 screws.

The mounting plate has orientation.

Do not lose the mounting plate.

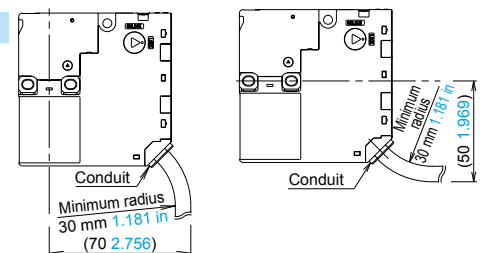
Adequate performance cannot be obtained without the plate as the actuator may fall off the door.



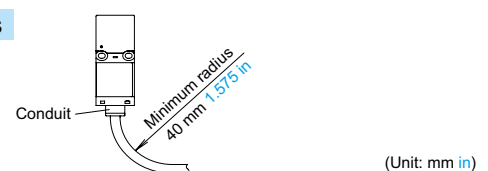
Cables

- Do not fasten or loosen the gland at the bottom of the safety switch.
- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm 1.181 in minimum.
- When wiring, make sure that water or oil does not enter the cable.
- The solenoid has polarity. Make sure of the correct polarity when wiring.

SG-B1 series



SG-A1 series

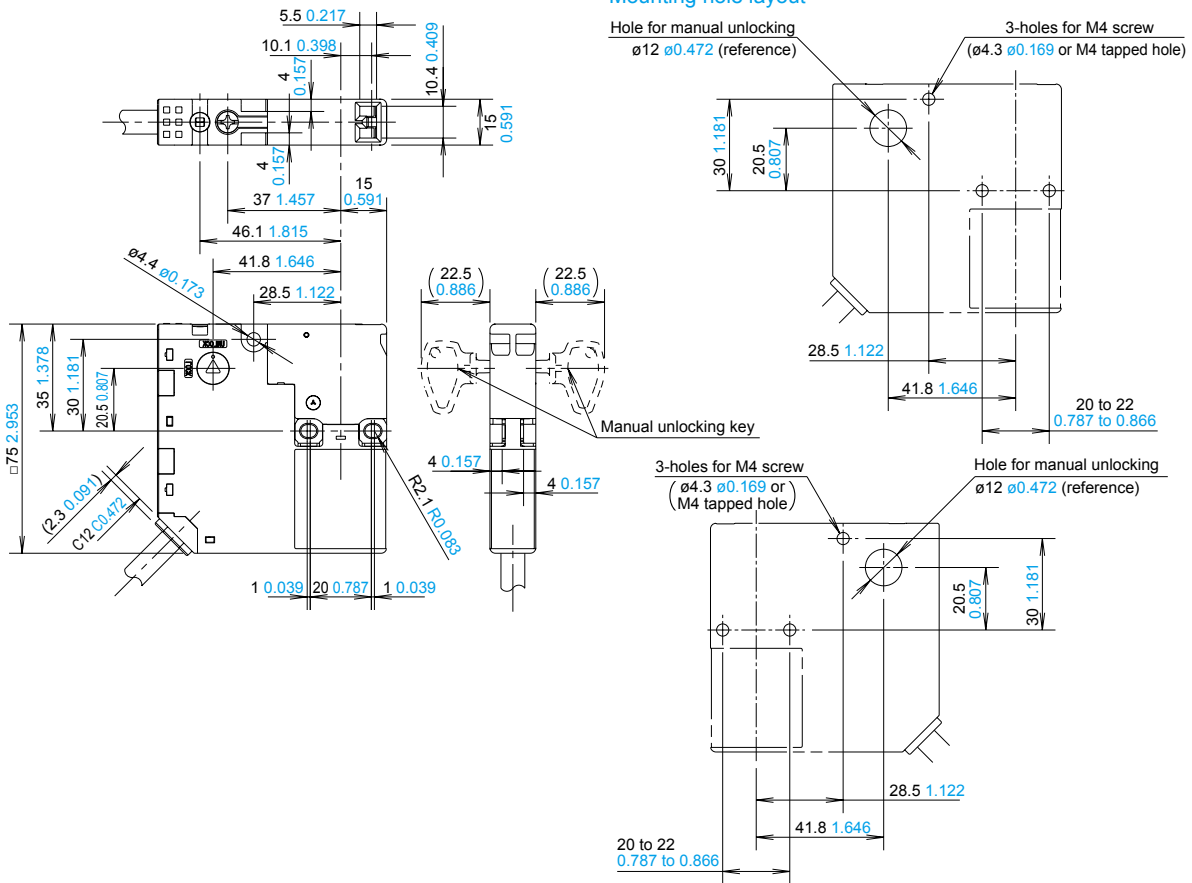


(Unit: mm in)



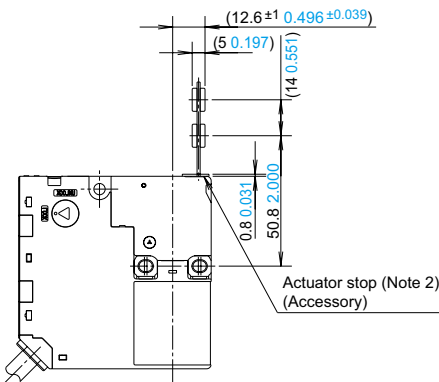
Dimensions (Unit: mm in)

SG-B1 Safety door switch with solenoid interlock

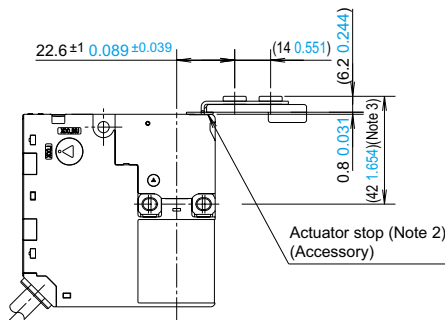


Note 1: Drill mounting holes so that they are properly aligned for the orientation in which the safety switch will be used.

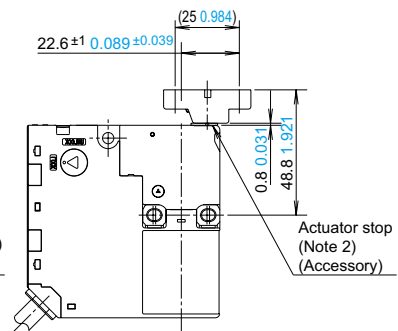
When using straight actuator (SG-K11)



When using the right-angle actuator (SG-K12 / SG-K12A)



When using the angle adjustable actuator (horizontal / vertical) (SG-K13 / SG-K14)



Notes: 2) The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.
3) 41.4 1.63 when using SG-K12

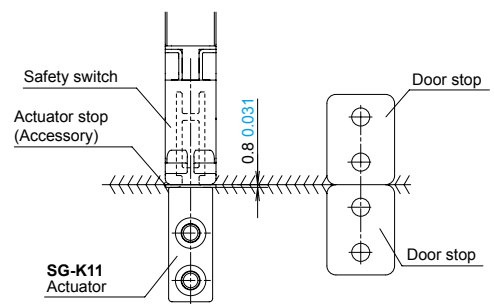
* The tensile strength of the SG-K12 actuator is 100N. If an excessive tensile force is applied, the actuator may fall off the door. When a tensile force exceeding 100N is expected, use the SG-K12A actuator with a plate.

Actuator mounting reference position

As shown in the figure on the right, the mounting reference position of the actuator when inserted in the safety switch is:

The actuator stop on the actuator lightly touches the safety switch.

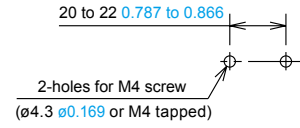
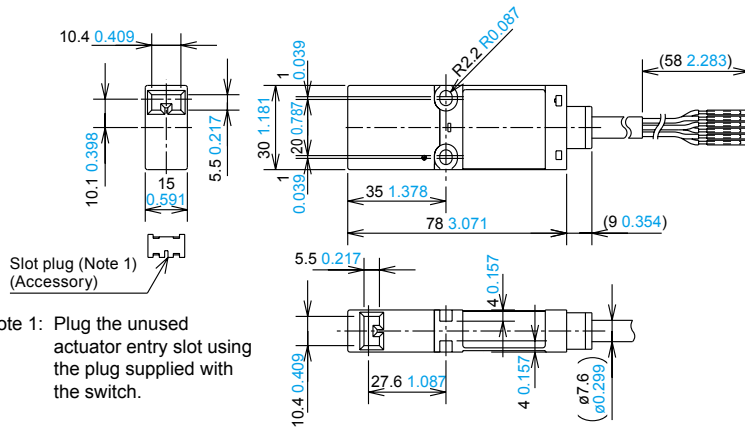
* The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.



Dimensions (Unit: mm in)

SG-A1 □ Safety door switch

Mounting hole layout



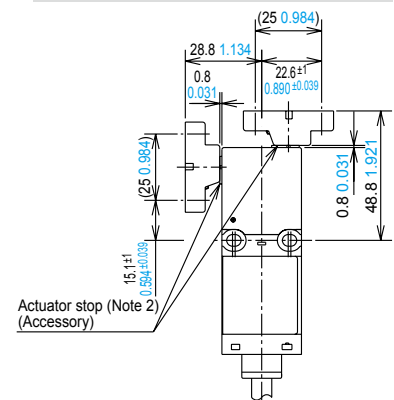
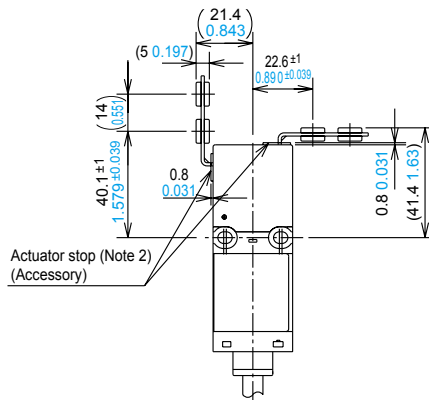
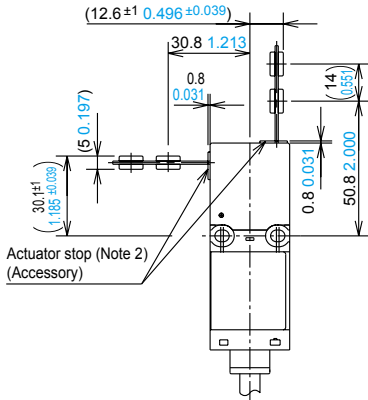
*The safety switch can be mounted in two directions.

Note 1: Plug the unused actuator entry slot using the plug supplied with the switch.

When using straight actuator (SG-K11)

When using the right-angle actuator (SG-K12)

When using the angle adjustable actuator (horizontal / vertical) (SG-K13 / SG-K14)



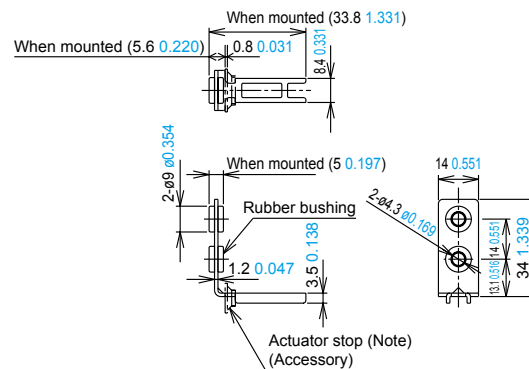
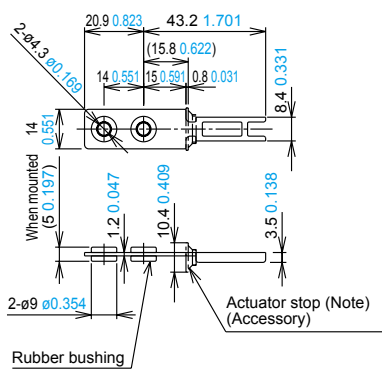
Note 2: The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.

SG-K11 / SG-K12 Actuator

Straight actuator (SG-K11)

Right-angle actuator (SG-K12)

* The tensile strength of the SG-K12 actuator is 100N. If an excessive tensile force is applied, the actuator may fall off the door. When a tensile force exceeding 100N is expected, use the SG-K12A actuator with a plate.



Note: The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.

Actuator mounting hole layout (Straight actuator, right-angle actuator)



Safety door switch
Safety door switch with solenoid interface

SG-B1
SG-A1

Safety door switch with key

SG-B2

Enable grip switch

SG-C1

Emergency stop switch

SG-E1

Key selector switch

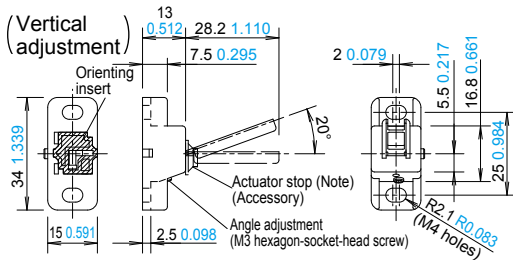
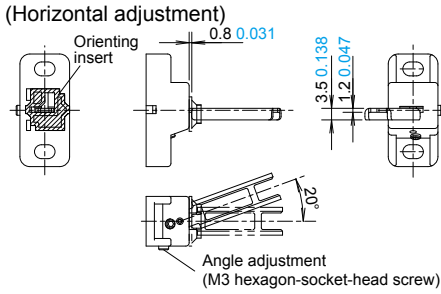
SG-D1



Dimensions (Unit: mm in)

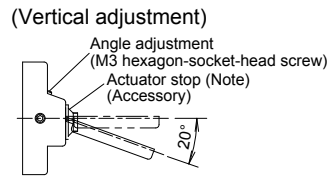
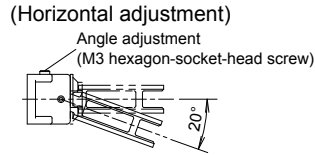
SG-K13 / SG-K14 Actuator

Horizontal / vertical angle adjustable actuators (SG-K13)



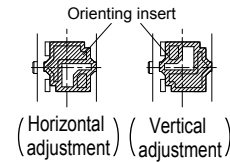
Horizontal / vertical angle adjustable actuators (SG-K14)

* The SG-K14 differs from the SG-K13 in that the direction in which the metal parts on the tip of the actuator are embedded is reversed by 180°.



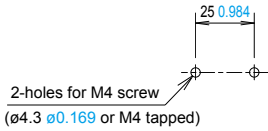
Changes in the orientation of adjustment for angle adjustable (horizontal / vertical) actuators

The orientation of actuator adjustment (horizontal / vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the mounting plate.

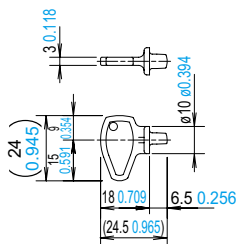


* The base is made of glass-reinforced PA66 (66 nylon). Angle adjustment screws are stainless steel (SUS).
When using adhesive on screws, take material compatibility into consideration.
Note: The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.

Actuator mounting hole layout (horizontal / vertical angle adjustable actuators)



• Manual unlocking key (Accessory: plastic)



Safety door switch
Safety door switch with solenoid interface

SG-B1
SG-A1

Safety door switch with key

SG-B2

Enable grip switch

SG-C1

Emergency stop switch

SG-E1

Key selector switch

SG-D1



Contact configuration / Operating patterns

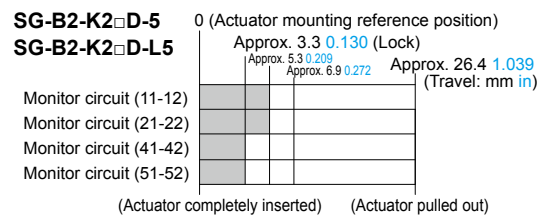
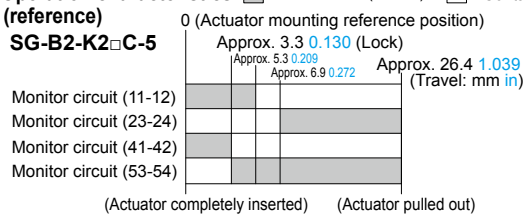
■ : Closed □ : Open

	Status 1	Status 2	Status 3	Rear manual unlock	
Safety switch status	• Door closed • Machine ready to operate	• Door closed • Machine cannot be operated	• Door open • Machine cannot be operated	• Door closed • Machine cannot be operated	
Door status				 • Press rear unlocking button. (Note 1)	
Circuit diagram (Example: SG-B2-K2□D-L5)					
Door	• Closed (locked)	• Closed (unlocked)	• Open	• Closed (unlocked)	
Model No. and contact configuration	SG-B2-K2□C-5 Monitor circuit : ⊕ 11 — 12 Monitor circuit : ⊕ 23 — 24 Monitor circuit : ⊕ 41 — 42 Monitor circuit : ⊕ 53 — 54	Monitor circuit (door closed) 11-12			
		Monitor circuit (door open) 23-24			
		Monitor circuit (locked) 41-42			
		Monitor circuit (unlocked) 53-54			
	SG-B2-K2□D-5 Monitor circuit : ⊕ 11 — 12 Monitor circuit : ⊕ 21 — 22 Monitor circuit : ⊕ 41 — 42 Monitor circuit : ⊕ 51 — 52	Monitor circuit (door closed) 11-12			
		Monitor circuit (door closed) 21-22			
		Monitor circuit (locked) 41-42			
		Monitor circuit (locked) 51-52			
	SG-B2-K2□D-L5 Monitor circuit : ⊕ 11 — 12 Monitor circuit : ⊕ 21 — 22 Monitor circuit : ⊕ 41 — 42 Monitor circuit : ⊕ 51 — 52	Monitor circuit (door closed) 11-12			
		Monitor circuit (door closed) 21-22			
		Monitor circuit (locked) 41-42			
		Monitor circuit (locked) 51-52			

- Notes: 1) When the operator is confined in a hazardous area, the actuator can be unlocked manually by pressing the rear unlocking button, which should be accessed easily by the operator.
 2) The above contact configuration shows the status when the actuator is inserted and the switch is locked.
 3) Monitor circuit: Sends monitoring signals of protective door open / closed status or protective door lock / unlock status.

• Operation characteristics

■ : Contact ON (closed) □ : Contact OFF (opened)



- The characteristics show the contact status when the actuator enters an entry slot of a safety switch.
- The characteristics shown in the chart above are of the SG-K21 actuator. For the others actuator, add 1.3 mm 0.051 in.



When connecting the SG-B2 series to a safety circuit, connect the door monitor circuits (11-12) ⊕ and the lock monitor circuits (41-42, 51-52) in series. (GS-ET-19)