

Panasonic[®] INSTRUCTION MANUAL

Safety Door Switch with Solenoid Interlock / Ultra-slim SG-B1 Series

ME-SGB1 No.0102-08V



Thank you very much for purchasing Panasonic products. Read this Instruction Manual carefully and thoroughly for the correct and optimum use of this product. Kindly keep this manual in a convenient place for quick reference. English is original instructions.

1 SAFETY CAUTIONS Always observe

In this operating instruction sheet, safety precautions are categorized to Warning and Caution:

- ⚠ WARNING** Risk of death or serious injury.
- ⚠ CAUTION** Risk of minor injury or property damage.

2 TYPE

Model No. : **SG-B1-MA-G1**

Locking principle
M : Magnet lock
S : Spring lock

Cable length
1 : 1m
5 : 5m

Contacts	Door monitor contacts	Lock monitor contacts
A : 1NC+1NC	2NC	1NC
B : 1NC+1NC	2NC	1NO

3 SPECIFICATIONS AND RATINGS

Applicable Standards	EN 60947-5-1: 2017, GS-ET-19: 2019					
Standards for Use	IEC 60204-1/ EN 60204-1, ISO 14119, EN ISO 14119, IEC 60947-5-1, UL508, CSA C22.2 No.14					
Interlocking device Type / the level of coded	Type 2 Interlocking device / low level coded actuator (EN ISO / ISO 14119)					
Conformity Directive(s)	Machinery Directive (2006/42/EC) , Supply of Machinery (Safety) Regulations (2008/1597)					
Operating Condition	Operating Temperature	-25 to +50°C (no freezing)				
	Operating Humidity	45 to 85%RH (no condensation)				
	Pollution Degree	3 (Inside2)				
	Altitude	2000m maximum				
Rated Insulation voltage <U>	150V(Main,Lock monitor circuit) 300V(Door monitor circuit) 30V(Between ground and LED,solenoid circuit)					
Impulse withstand voltage <Uimp>	1.5kV(Main,Lock monitor circuit) 2.5kV(Door monitor circuit) 0.5kV(Between ground and LED,solenoid circuit)					
Thermal Current <Ith>	-25°C < Operating temperature < 35°C 2.5A (< 2 circuits) 1.0A (> 3 circuits) 35°C < Operating temperature < 50°C 1.0A (1 circuit) 0.5A (> 2 circuits)					
Contact Ratings (Reference Values) < Ue , Ie >	Main Circuit, Lock monitor circuit	AC	Resistive load(AC-12)	-	2A	-
			Inductive load(AC-15)	-	1A	-
	Door monitor circuit	DC	Resistive load(DC-12)	2A	0.4A	-
			Inductive load(DC-13)	1A	0.22A	-
		AC	Resistive load(AC-12)	-	2.5A	1.5A
			Inductive load(AC-15)	-	1.5A	0.75A
DC	Resistive load(DC-12)	2.5A	1.1A	0.55A		
	Inductive load(DC-13)	2.3A	0.55A	0.27A		
Class of Protection	Class II (IEC61140) (Note1)					
Degree of Protection	IP67 (IEC60529)					
Operating Frequency	900 operations/hour					
Operating Speed	0.05 to 1.0 m/s					
B _{int}	2,000,000 (EN ISO 13849-1)					
Mechanical Durability	1,000,000 operations minimum (GS-ET-19)					
Electrical Durability	1,000,000 operations minimum. (GS-ET-19)					
	100,000 operations minimum. (900 operations / hour,AC-12 125V 2A, DC-12 125V 0.4A)					
	1,000,000 operations minimum. (900 operations / hour,24V AC/DC 0.1A Resistive Load)					
Actuator Tensile Strength when Locked	500N minimum (GS-ET-19)(Note2)					
Direct Opening Travel	8 mm minimum					
Direct Opening Force	60 N minimum					
Contact Resistance	300 mΩ maximum (Initial value, at cable length 1m)					
Short-Circuit Protective Device	Use 250V / 10A fast acting type fuse					
Solenoid / Indicator	Rated Operating Voltage	DC24V 100% duty cycle				
	Rated Current	110 mA (solenoid 100mA, LED 10mA : initial value)				
	Turn ON Voltage	Rated voltage x 85% maximum (at 20°C)				
	Turn OFF Voltage	Rated voltage x 10% minimum (at 20°C)				
	Light Source	LED				
Light Source	LED					
Illumination Color	Green					
Rated Power Consumption	Approx. 2.7W					

Notes: 1)Basic insulation of 2.5kV, 1.5kV 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 230V 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.

Notes: 2)The actuator locking strength is rated at 500N of static load. 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.

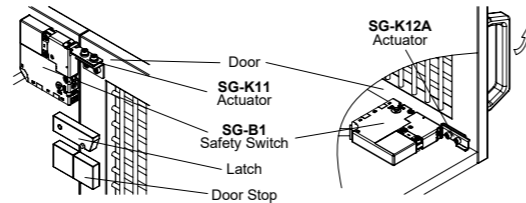
Ratings approved by safety agencies

- TÜV rating
 Main, Lock Monitor AC-15: 1A, 125 V AC
 DC-13: 0.22A, 125 V DC / 30V DC, 1A
 Door Monitor AC-15: 0.75A, 240 V AC
 DC-13: 0.27A, 250 V DC / 30V DC, 2.3A
- UL , c-UL rating
 Main, Lock Monitor 125 V AC, 1 A Pilot duty 125 V DC, 0.22 A Pilot duty / 30V DC, 1A Pilot duty
 Door Monitor C300 Q300 240 V AC, 0.75 A Pilot duty 250 V DC, 0.27 A Pilot duty

4 MOUNTING EXAMPLES

- Install the interlock switch on the immovable machine or guard, and install the actuator on the movable door. Do not install both interlock switch and actuator on the movable door, otherwise failure will occur.
- See the figures below.

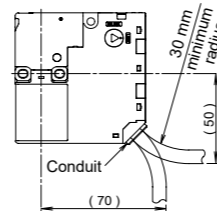
(Examples of Mounting on Sliding Doors) (Examples of Mounting on Hinged Doors)



5 PRECAUTIONS FOR OPERATION

For Mounting

- Regardless of door types, do not use the safety switch as a door stop. Install a mechanical door stop to the end of the door to protect the safety switch against excessive force. When a higher load works on the lock portion of the safety switch, the actuator may not unlock.
- Do not apply an excessive shock to the safety switch when opening or closing the door. A shock to the safety switch exceeding 1,000m/s² may cause failure.
- Regardless of door types, do not use the safety switch as a door lock. Install a separate lock as shown in " 3 Mounting Examples."
- Entry of foreign objects in the actuator entry slot may affect the mechanism of the switch and cause a breakdown. If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the switch through the actuator entry slots.
- While the solenoid is energized, the switch temperature rises approximately 35°C above the ambient temperature (to approximately 85°C while the ambient temperature is 50°C). Keep hands off to prevent burns. If cables come into contact with the switch, use heat-resistant cables.
- When the actuator is locked or unlocked, the NC lock monitor contacts and NO unlock monitor contacts cause bouncing. When designing a control circuit, take the bouncing into consideration (reference values: 20ms).
- Solenoid has polarity. Be sure to wire correctly and do not apply reverse voltage otherwise the solenoid will be damaged. Do not apply voltage that exceed the rated voltage, otherwise the solenoid will be burnt out.
- Do not fasten or loosen the conduit at the bottom of the safety switch.
- When wiring, make sure that liquid such as water and oil does not intrude from the end of the cable.
- When bending the cable during wiring, secure the cable radius of 30 mm at the minimum. Do not apply an excessive shock, such as tensile and compressing force, to the connection part of the cable and switch.
- Use the proprietary actuators only. Other actuators will cause damage to the switch.
- Ensure that the safety switch is installed on a flat mounting surface, and provide sufficient strength to the mounting surface so that it will not be distorted during operation. Make sure that no foreign objects are caught between the safety switch and mounting surface. Uneven surface, distorted surface, or foreign objects may result in the malfunction of safety switch.



⚠ WARNING

- Turn off the power to the safety switch before starting installation, removal, wiring, maintenance, and inspection on the safety switch. Failure to turn power off may cause electrical shocks or fire hazard.
- Do not disassemble or modify the switch. Also do not attempt to disable the interlock switch function, otherwise a breakdown or an accident will result.

⚠ CAUTION

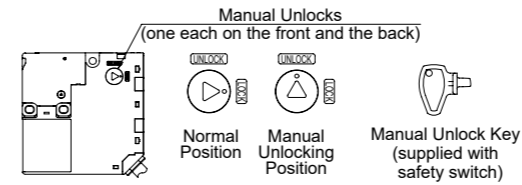
- Mount the actuator so that it will not hit the operator when the door is open, otherwise injury may be caused.
- Pay attention to the management of spare actuator. Safety function of door interlock switch will be lost in case the spare actuator is inserted into the interlock switch.
- Ensure that the actuator is firmly fastened to the door (welding, rivet, special screw) in the appropriate location, so that the actuator cannot be removed easily.
- Do not cut or remodel the actuator, otherwise failure will occur.
- Performance Level according to EN ISO 13849-1 is reduced with series connected safety components due to decreased fault recognition.
- The overall concept of control system, into which the safety components has been integrated, must be validated in accordance with EN ISO 13849-2.

Magnet lock type

- This safety switch is designed to lock the actuator while the solenoid is energized and to release it when deenergized.
- When the power to the solenoid is interrupted by accident, such as disconnection, the lock is released before a machine stops completely. Then, the worker may be exposed to hazards.
- This safety switch can be used only for limited applications which do not especially need to be locked for safety.

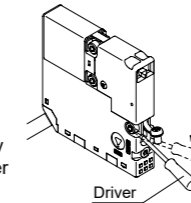
For Manual Unlocking

- Spring lock type : The **SG-B1** allows manual unlocking of the actuator to precheck proper door operation before wiring or turning power on, as well as for emergency use such as a power failure.
- Magnet lock type : If the actuator is not unlocked although the solenoid is deenergized, the actuator can be unlocked manually.



Manual Unlocking Method

- When using the manual unlock key :
 To change the normal position to the manual unlocking position as shown above, turn the key fully (90 degrees) using the proprietary key supplied with the switch. Using the switch with the key being not fully turned (less than 90 degrees) may cause damage to the switch or errors. When manually unlocked, the switch will keep the main circuit disconnected and the door unlocked.
- When unlocking by pushing the plate inside the safety switch :
 Remove the screw at the side of the safety switch and insert a small screwdriver. Push the plate inside the safety switch toward the LED pilot light using a small screwdriver until the actuator is unlocked. See the figure on the right.



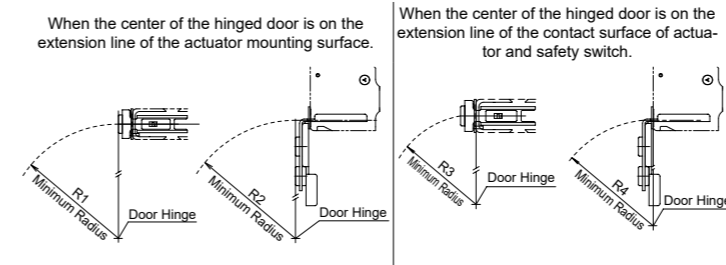
⚠ CAUTION

- Before manually unlocking the safety switch, make sure the machine has come to a complete stop. Manual unlocking during operation may unlock the switch before the machine stops, and the function of safety door switch with solenoid interlock is lost.
- While the solenoid is energized, do not unlock the actuator manually (magnet lock type).
- Do not apply excessive force (0.45 N · m or more) to the manual unlock key. Otherwise the manual unlock switch will be damaged.
- Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can always be unlocked while the machine is in operation. Do not attach the key to the switch intentionally (the key is designed to fall off when the operator's hand is off the key).
- Unlocking by pushing the plate inside the safety switch must be performed in emergency only. After unlocking, make sure to tighten the M4 screw to the tightening torque of 0.3 to 0.5 N · m. Do not apply excessive force to the M4 screw. Otherwise the safety switch is damaged. Make sure that all screws are installed, otherwise the waterproof capability is lost.

6 ADJUSTMENTS

Minimum Radius of Hinged Door

- When using the safety switch for a hinged door, the minimum radius of the applicable door is shown in the following figures.



	Minimum Radius			
	R1	R2	R3	R4
SG-K12 / SG-K12A	230mm	230mm	160mm	160mm
SG-K13 / SG-K14	70mm(Horizontal Swing)	70mm(Vertical Swing)	50mm(Horizontal Swing)	50mm(Vertical Swing)

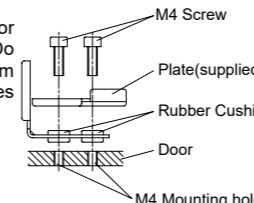
⚠ CAUTION

- The values shown above are based on the condition that the actuator enters and exits the actuator entry slot smoothly when the door is closed or opened. Since there may be deviation or dislocation of the hinged door, make sure of correct operation in the actual application before installation. When inserting an actuator into the slot, make sure to arrange the shapes in the same direction, as shown on the right.



Mounting SG-K12A actuator

- Using two M4 screws and plate, fasten the actuator securely on the door. Plate has directionality. Do not lose the plate. The actuator may fall off from the door if there is no plate, and the actuator does not properly.

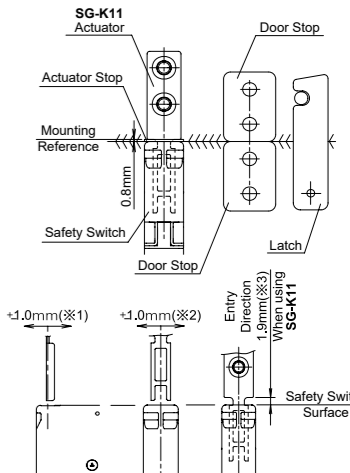


⚠ CAUTION

- 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.

Installing the Safety Switch and Actuator

- When installing the actuator, position the actuator using the actuator stop (for positioning the entry slot center and mounting reference position).
- As shown on the right, the mounting reference position of the actuator when inserted in the safety switch is where the actuator stop touches the actuator.
- Install a door stop as shown on the right to protect the safety switch and actuator against excessive force. Do not use the safety switch as a door stop, otherwise the safety switch will be damaged.
- After removing the actuator stop, ensure that the actuator is installed within the tolerances shown below. From the entry slot center of the safety switch (※1,2) : ±1.0mm The gap between the actuator shoulder and the safety switch surface (※3)
SG-K11 / SG-K12 / SG-K13 / SG-K14 : 1.9mm or shorter
SG-K12A : 1.3mm or shorter
- To ensure correct operation, it is recommended to fasten the door using a latch to achieve the above tolerance values.
- Perform operation test before starting operation in order to confirm the open/close operation of contacts and locking/unlocking operation.
- When the actuator is pulled while locked in the safety switch, the actuator moves within the range shown below.
SG-K11 / SG-K12 / SG-K13 / SG-K14 : 4.1mm maximum from the safety switch surface
SG-K12A : 3.5mm maximum from the safety switch surface
 The open/close status of the contacts are maintained within the range. When a gap is caused because of actuator relocation, make sure that the gap does not lead to new risks.



Recommended Screw Tightening Torque

Name or Use	Recommended Screw Tightening Torque
For mounting the safety switch (M4 screw)	1.0 to 1.5 N · m
For mounting the actuator (M4 screw)	1.0 to 1.5 N · m

⚠ CAUTION

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

For the Adjustable (vertical/horizontal) Actuator

- Using the angle adjustment screw (M3 hexagon socket set screw), the actuator angle can be adjusted up to 20°(refer to dimensions).
- The larger the actuator angle, the smaller the applicable radius of the door swing. After installing the actuator, open the door. Then adjust the actuator angle so that the actuator enters the entry slot of the safety switch properly.
- After adjusting the actuator angle, apply loctite or the like on the adjustment screw to prevent loosening. Use screw locking agent that is compatible with the base material.
 Base: PA66 (66 nylon) of glass reinforced grade
 Angle adjustment screws: stainless steel

7 CONTACT OPERATION AND WIRING

Contact Configuration and Operation

Type	Contact Configuration
SG-B1-□A	<p>Door Monitor Lock Monitor</p> <p>Main Circuit: BU ⊕ 11 12 41 42 BU/WH Monitor Circuit: BN ⊕ 21 22 BN/WH Monitor Circuit: OG ⊕ 31 32 OG/WH Monitor Circuit: PK 51 52 PK/WH</p>
SG-B1-□B	<p>Main Circuit: BU ⊕ 11 12 41 42 BU/WH Monitor Circuit: BN ⊕ 21 22 BN/WH Monitor Circuit: OG ⊕ 31 33 OG/WH Monitor Circuit: PK 53 54 PK/WH</p>

Type	Contact Operation (reference)
SG-B1-□A	<p>0 (Actuator Mounting Reference Position) (Travel: mm)</p> <p>Approx.1.1 (Lock) Approx.4.7 Approx.5.0 Approx.27.4</p> <p>11-42 21-22 31-32 51-52</p> <p>■ Contact closed □ Contact open</p>
SG-B1-□B	<p>11-42 21-22 31-32 53-54</p> <p>(Actuator Completely Inserted) (Actuator Pulled Out)</p>

- Contact operation is based on the condition that the actuator is inserted into the center of the safety switch slot.
- Contact operation shows the SG-K11, SG-K12, SG-K13, SG-K14 actuators. (For SG-K12A actuator, decreases 0.6mm to contact operations)
- Terminals 12-41 are connected together internally. Use terminals 11-42 for safety circuit inputs. Indicator turns on when solenoid is energized.

Operation Cycle

- Spring Lock Type (SG-B1-S□)

Door States	Closed	Closed	Open	Closed
Door Manual Unlock Key	-	-	-	Turn the key to unlock position.
Main Circuit	11-42	Open	Open	Open
Door Monitor Circuit	21-22 31-32	Open	Open	Closed
Lock Monitor Circuit	51-52	Open	Open	Open
Lock Monitor Circuit	53-54	Open	Open	Open
Solenoid Power	A1-A2	Off	On	Off/On
		Door is locked. The machine can be operated.	Door is unlocked. The machine can not be operated.	The machine can not be operated. Door is unlocked. The machine can not be operated.

- Magnet Lock Type (SG-B1-M□)

Door States	Closed	Closed	Open	Closed
Door Manual Unlock Key	-	-	-	Turn the key to unlock position.
Main Circuit	11-42	Open	Open	Open
Door Monitor Circuit	21-22 31-32	Open	Open	Closed
Lock Monitor Circuit	51-52	Open	Open	Open
Lock Monitor Circuit	53-54	Open	Open	Open
Solenoid Power	A1-A2	On	Off	Off/On(※2)
		Door is locked. The machine can be operated.	Door is unlocked. The machine can not be operated.	The machine can not be operated. Door is unlocked. The machine can not be operated.

CAUTION

- (※1) Do not attempt manual unlocking when the solenoid is energized.
- (※2) Do not energize the solenoid for a long time while the door is open or when the door is unlocked manually.

Wiring

- Cable specifications
UL style 2464, 12c×No.22AWG, (80°C 300V)
- Wire identification
Wires are identified by the color and white line printed on the wire.
- Do not use wire which is Gray, Gray / White.

No.	Insulator Color	No.	Insulator Color	No.	Insulator Color
1	Blue / White	5	Orange / White	9	Pink / White
2	Gray	6	Gray / White	10	Brown / White
3	Pink	7	White	11	Brown
4	Orange	8	Black	12	Blue

Terminal number identification

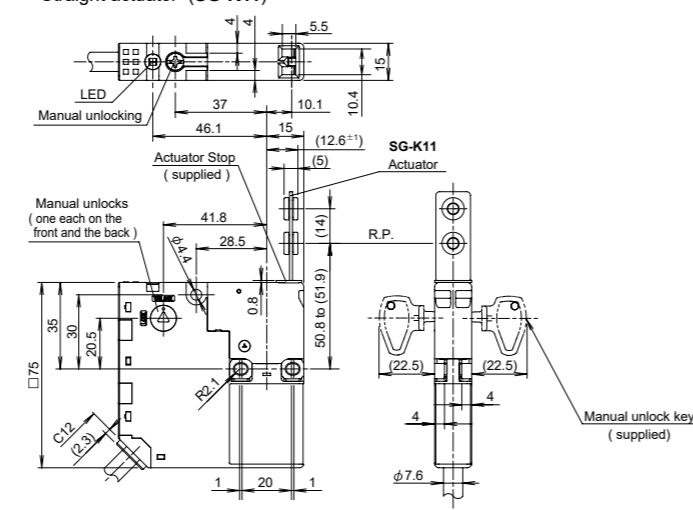
- When wiring, the terminal number on each contact is identified by wire color. The following table shows the identification of terminal numbers.
- When wiring, cut unnecessary wires such as unused wires to avoid incorrect wiring.

Circuit No.	Insulator Color	Circuit No.	Insulator Color
11	Blue	31	Orange
42	Blue / White	32	Orange / White
21	Brown	51,53	Pink
22	Brown/White	52,54	Pink / White
		A1(-)	Black
		A2(+)	White

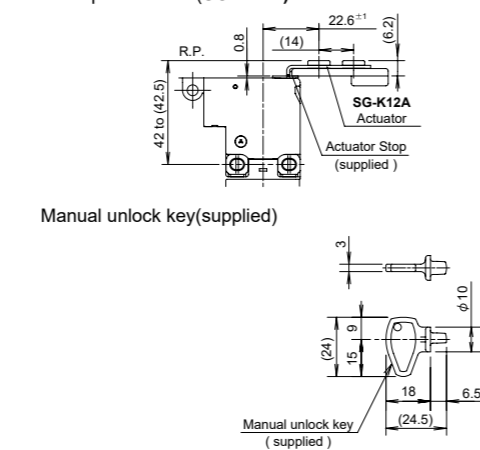
8 DIMENSIONS (mm)

Dimensions

Straight actuator (SG-K11)



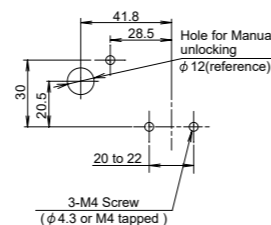
L-shaped Actuator (SG-K12A)



Mounting Hole Layout

(when mounted on the front side)(Note 1)

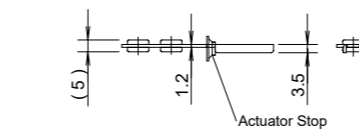
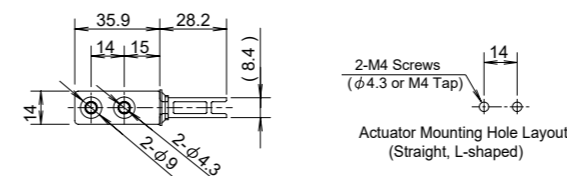
- Provide mounting holes as specified, and install the safety switch using three mounting screws. Do not install the switch using only one or two mounting screws, otherwise the safety switch will not be fixated properly, resulting in the malfunction of safety switch.



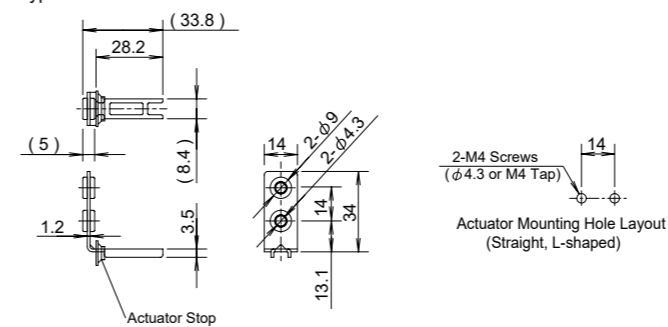
Notes: 1) Reversible Mounting Possible

Actuator (Sold separately)

Type : SG-K11

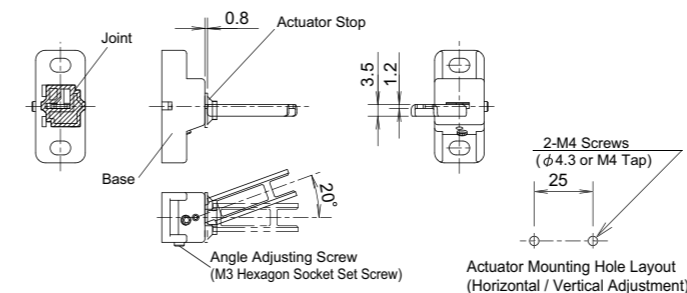


Type : SG-K12

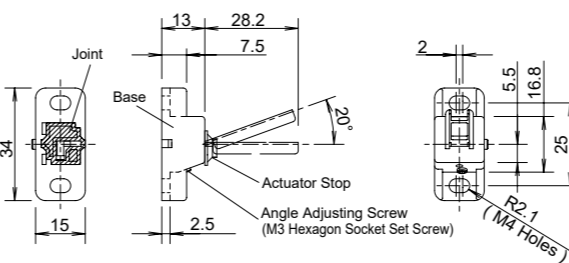


Type : SG-K13

(Horizontal Adjustment)

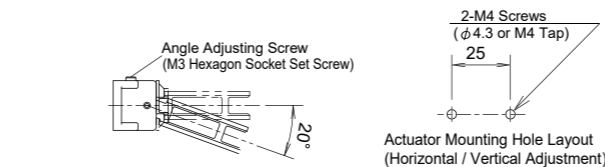


(Vertical Adjustment)

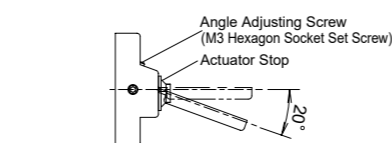


Type : SG-K14

(Horizontal Adjustment)

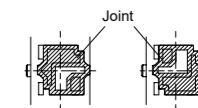


(Vertical Adjustment)



Notes: 1) SG-K13 and SG-K14 are different in the insertion direction of the metal key (180°).

- The direction of adjustable angle can be changed (vertical or horizontal) by changing the insertion direction of the joint (white plastic part). See the figures below. Do not lose the joints. Actuators do not operate normally without a joint.



9 PRECAUTION FOR DISPOSAL

Dispose of SG-B1□ as an industrial waste.

10 CE MARKING DECLARATION OF CONFORMITY

Itemized Essentials of EU Declaration of Conformity

Manufacturer's Name: Panasonic Industry Co., Ltd.
Manufacturer's Address: 1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8506, Japan
EU Representative's Name: Panasonic Marketing Europe GmbH Panasonic Testing Centre
EU Representative's Address: Winsbergring 15, 22525 Hamburg, Germany
Product: Safety Door Switch with Solenoid Interlock
Model Name: SG-B1 Series
Trade Name: Panasonic
Application of Council Directive: 2006/42/EC Machinery Directive
 2011/65/EU RoHS Directive
Applicable standards: EN 60947-5-1
 GS-ET-19
 EN IEC 63000

11 UKCA MARKING DECLARATION OF CONFORMITY

Itemized Essentials of UK Declaration of Conformity

Manufacturer's Name: Panasonic Industry Co., Ltd.
Manufacturer's Address: 1006, Oaza Kadoma, Kadoma-shi, Osaka 571-8506, Japan
Product Name: Safety Door Switch with Solenoid Interlock
Trade Name: Panasonic
Model Number: SG-B1 Series
Statutory Instruments: 2008 No.1597 Supply of Machinery (Safety) Regulations 2008
 2012 No.3032 RoHS Regulations 2012
Designated Standards: EN 60947-5-1
 GS-ET-19
 EN IEC 63000

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