

HS6B Series Subminiature Interlock Switch

HS6B features:

- Only 78 x 30 x 15mm
- Allows highest level of safety by having 3 contacts: dual load contacts + monitoring contact (ISO13849-1, EN954-1)
- Two actuator entrances provide flexibility for installation options
- Integral molded cable reduces wiring time
- IP67 (IEC60529) watertight sealing (contact is sealed, housing allows drainage)
- Direct Opening Action: Opening the door forces the contacts to disconnect even if the contacts are welded (IEC/EN60947-5-1)
- Actuators comply with ISO14119 and EN1088



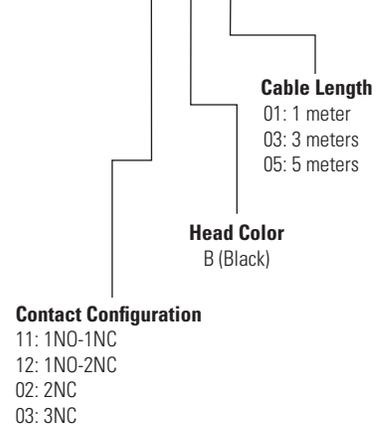
Overview

X Series E-Stops

Part Numbers

Contact Configuration	Cable Length	Part Number (Standard Stock in bold)
1NC-1NO 	1m	HS6B-11B01
	3m	HS6B-11B03
	5m	HS6B-11B05
2NC 	1m	HS6B-02B01
	3m	HS6B-02B03
	5m	HS6B-02B05
2NC-1NO 	1m	HS6B-12B01
	3m	HS6B-12B03
	5m	HS6B-12B05
3NC 	1m	HS6B-03B01
	3m	HS6B-03B03
	5m	HS6B-03B05

Part Number Key HS6B - 12 B 01



Door Interlock Switches

Enabling Switches

Contact Configuration & Operation Chart

Type	Contact Configuration	Contact Operation Chart
HS6B-11	1NC-1NO 	
HS6B-02	2NC 	
HS6B-12	2NC-1NO 	
HS6B-03	3NC 	

0.8 (Actuator Mounting Reference Position)
0 5.5 5.8 28.2 (Travel: mm)

Actuator inserted completely Actuator removed completely

Legend:
 : Contact ON (closed)
 : Contact OFF (open)

Barriers

AS-Interface Safety at Work

Actuator Keys

Appearance	Part Number	Shape	Appearance	Part Number	Shape
	HS9Z-A61	Straight (Mainly for sliding doors)		HS9Z-A65	adjustable actuator 90° angle
	HS9Z-A62	Right-angle (Mainly for hinged doors)		HS9Z-A66	adjustable actuator 180° angle



The actuators are not included, must be ordered separately.

Specifications

Conforming to Standards	EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, IEC60664-1, IEC60204-1, EN60204-1, UL508				
Operating Temperature	-25 to +70°C (no freezing)				
Storage Temperature	-40 to +80°C (no freezing)				
Operating Humidity	45 to 85% RH (no condensation)				
Storage Humidity	95% RH maximum (no condensation)				
Altitude	2,000m maximum				
Pollution Degree	3				
Rated Insulation Voltage (Ui)	300V				
Impulse Withstand Voltage (Uimp)	4kv				
Insulation Resistance	Between live & dead metal parts: 100MΩ maximum Between positive & negative live parts: 100MΩ minimum				
Electric Shock Protection Class	Class II				
Degree of Protection	IP67 (IEC60529)				
Vibration Resistance	Operating Extremes	5 to 55 Hz, half amplitude 0.5 mm			
	Damage Limits	30Hz, half amplitude 1.5mm			
Contact Resistance	300mΩ maximum				
Shock Resistance	Operating Extremes	300m/s ² (30G)			
	Damage Limits	1000m/s ² (100G)			
Direct Opening Travel	8 mm minimum				
Direct Opening Force	60N minimum				
Thermal Current (Ith)	2.5A				
Rated Operating Current (Ie)	Operating Voltage (Ue)		30V	125V	250V
	AC	Resistive load (AC12)	–	2.5A	1.5A
		Inductive load (AC15)	–	1.5A	0.75A
	DC	Resistive load (DC12)	2.5A	1.1A	0.55A
			(2A)	(0.4)A	(0.2A)
		Inductive load (DC13)	2.3A (1A)	0.55A (0.22A)	0.27A (0.1A)
Maximum Actuation Frequency	1200 operations/hour				
Mechanical Life	1,000,000 operations (at full rated load)				
Recommended Actuation Speed	0.05 to 1.0m/s				
Wire Tensile Strength	50N minimum				
Electrical Life	100,000 operations (at full rated load)				
Conditional Short-Circuit Current	50A 250V (IEC60947-5-1, IEC60269-1, -2)				
Weight	120g				

Installation Notes

Recommended Screw Torque

- Safety switch body installation (M4 screw): 1.0~1.5N-m
- Actuator installation (M4 screw): 1.0~1.5N-m

Handling Cables

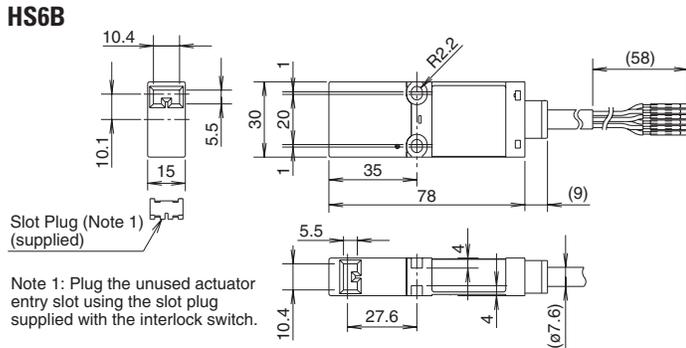
- Do not tighten or loosen the fastened cable conduit of the safety switch
- Minimum bend radius of installed cable: 40mm

Wiring Designations

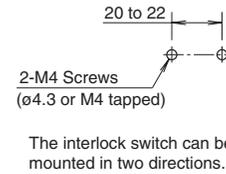
Part Number	Color	Contact
HS6B-12B01 (2NC-1NO)	blue-blue/white	NC
	brown-brown/white	NC
	orange-orange/white	NO
HS6B-03B01 (3NC)	blue-blue/white	NC
	brown-brown/white	NC
	orange-orange/white	NC

Part Number	Color	Contact
HS6B-11B01 (1NC-1NO)	blue-blue/white	NC
	orange-orange/white	NO
HS6B-02B01 (2NC)	blue-blue/white	NC
	orange-orange/white	NC

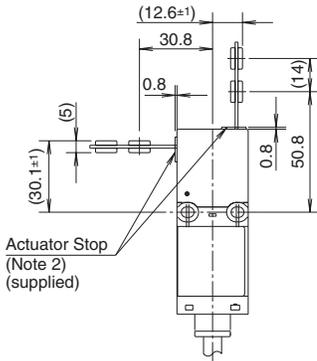
Dimensions (mm)



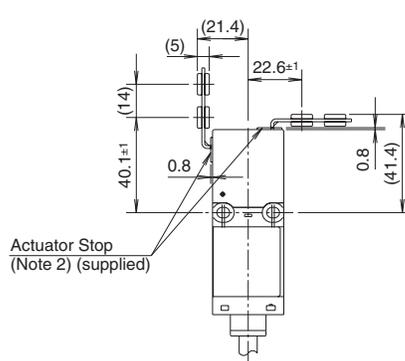
Installation



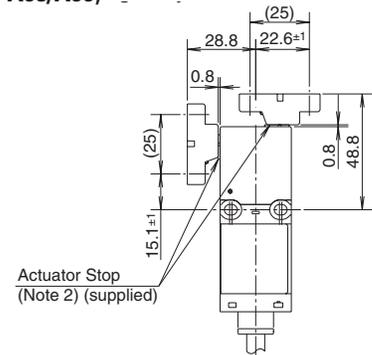
Using straight actuator (HS9Z-A61)



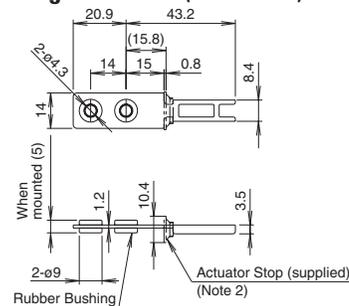
Using Right-angle actuator (HS9Z-A62)



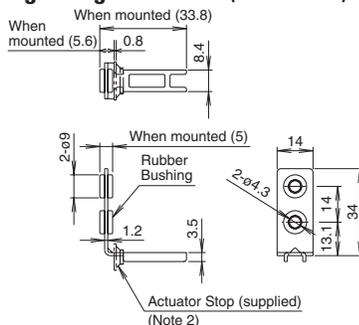
Using Angle Adjustable Actuator (HS9Z-A65/A66)



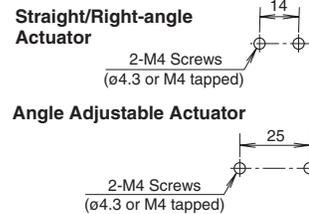
Straight actuator (HS9Z-A61)



Right-angle actuator (HS9Z-A62)

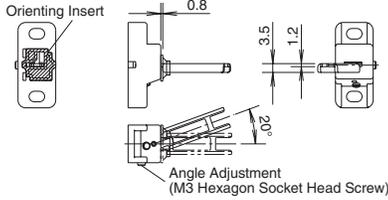


Actuator Installation

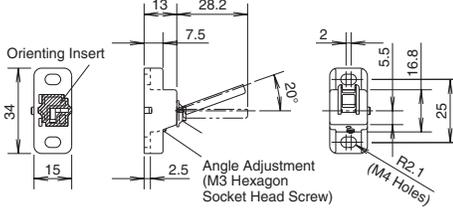


Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment



Vertical Adjustment



The orientation of actuator adjustment (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator.

The base is made of glass-reinforced PA66 (66 nylon). Angle adjustment screws are stainless steel. When using adhesive on screws, take material compatibility into consideration.

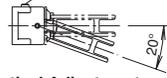
Note 2: After mounting the actuator, remove the actuator stop from the interlock switch.

Adjustable Actuator (HS9Z-A66)

The HS9Z-A65 and HS9Z-A66 have the metal key inserted in opposite directions.

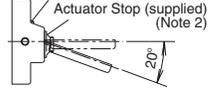
Horizontal Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)



Vertical Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)



Orienting Insert



Horizontal Adjustment Vertical Adjustment

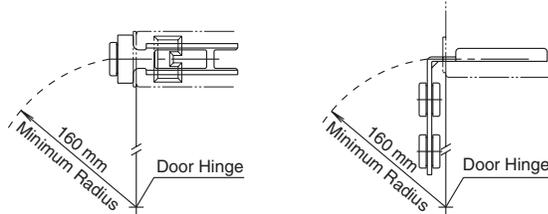
Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For doors with small minimum radius, use angle adjustable actuators (HS9Z-A65 or HS9Z-A66).

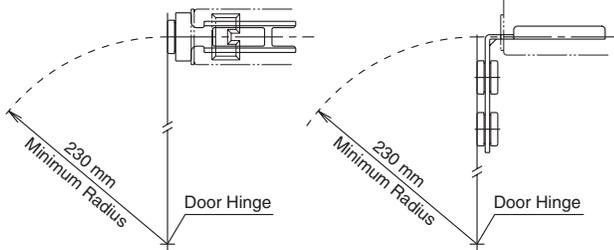
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A62 Actuator

- When the door hinge is on the extension line of the interlock switch surface:



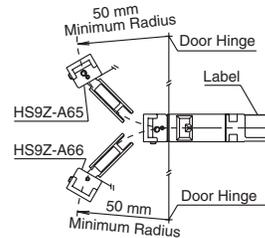
- When the door hinge is on the extension line of the actuator mounting surface:



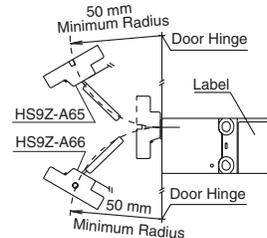
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable (vertical) Actuator

- When the door hinge is on the extension line of the interlock switch surface:

Horizontal Swing

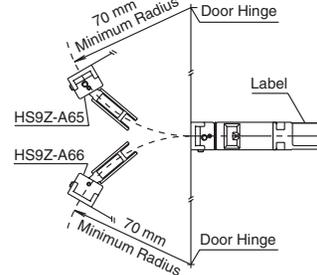


Vertical Swing

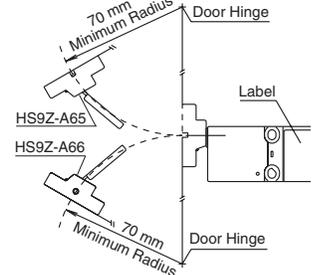


- When the door hinge is on extension line of the actuator mounting surface:

Horizontal Swing



Vertical Swing



Actuator Angle Adjustment for the HS9Z-A65/HS9Z-A66

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).
- 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 enter properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not become loose.

Safety Precautions

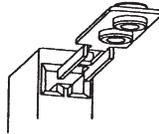
- In order to avoid electric shock or fire, turn power off before installation, removal, wiring, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, use only safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and make a safety circuit which satisfies the requirements of the safety category.
- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where a human body may come into contact. Otherwise injury may occur.

Instructions

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

Mounting

Mount the interlock switch on the machine. Mount the actuator key on the hinged door.
 Note: When mounting an actuator key, make sure that the actuator enters into the slot in the correct direction, as shown on the right.

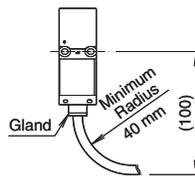


Recommended Screw Tightening Torque

- Interlock switch (M4 screw): 1.0 to 1.5 N·m
- Actuator key (M4 screw): 1.0 to 1.5 N·m
- Mounting bolts are not supplied, and must be purchased separately by the user.
 Note: The above recommended tightening torque of the mounting screw is the value with hex 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.

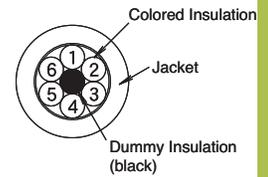
Cable

- Do not fasten or loosen the gland at the bottom of the interlock switch.
- When bending cable during wiring, make sure that the cable radius is kept at 40 mm minimum.
- When wiring, make sure that water or oil does not enter from the end of cable.



Wire Identification

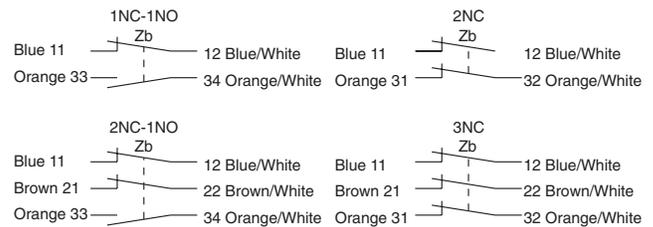
No.	Insulation Color	No.	Insulation Color
1	Orange/White	4	Brown
2	Blue/White	5	Blue
3	Brown/White	6	Orange



- Wires can be identified by color and/or a white line printed on the wire.

Terminal Number Identification

- When wiring, the terminal number on each contact can be identified by wire color.
- The following diagrams show a safety (main) contact and one or two auxiliary contacts for two-contact and three-contact types.



- When wiring, cut any dummy insulation (black) and any unused wires at the end of the jacket to avoid incorrect wiring.

Safety Precautions

- In order to avoid electric shock or a fire, turn the power off before installation, removal, wire connection, maintenance, or inspection of the switch.
- If relays are used in the circuit between the safety switch and the load, consider degrees of the danger and use safety relays, since welded 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. The safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the switch. It may cause a breakdown or an accident.

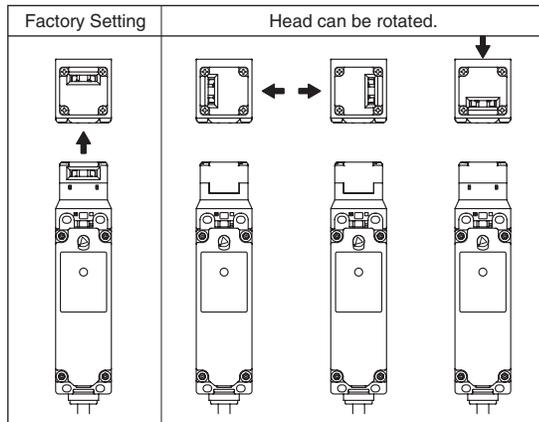
Operation Precautions - for all series

- 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 excessive shock to the switch when opening or closing the door.
- A shock to the door exceeding 1,000 m/sec² (approx. 100G) may cause the contacts of the switch to chatter, and a malfunction of the switch may occur.
- For connection of wires, unscrew the cover. Unnecessary loosening of other screws may cause a malfunction of the switch.
- Prevent foreign objects such as dust and liquids from entering the switch while connecting conduit or wiring.
- 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.
- Entry of a considerable amount of foreign objects into the switch may affect the mechanism of the switch and cause a breakdown.
- Do not store the switches in a dusty, humid, or organic-gas atmosphere.

HS5E/HS5B Precautions

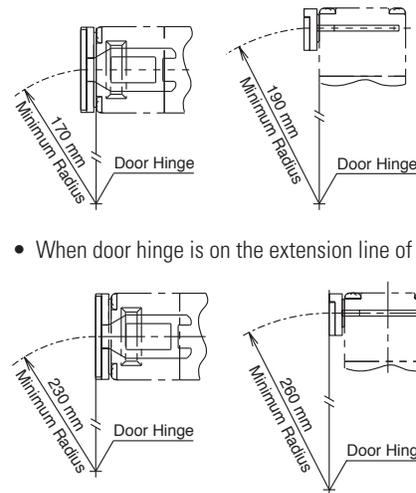
For Rotating Head Directions

- The heads of the HS5E/HS5B can be rotated in 90° increments after removing the 4 screws on the corners of the head. Prevent entry of foreign objects into the switch during removal of the head. Tighten these screws with torque designated in the instruction sheet. Improper torque may cause errors.



Minimum Radius of Hinged Doors

- When using the interlock 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 (HS9Z-A55).



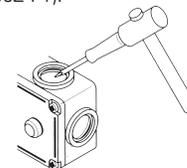
- When door hinge is on the extension line of the actuator mounting surface:

HS2B Precautions

Wire Connection

- The HS2B has 3 conduit ports, which are closed as a part of the molded switch housing.
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block or other parts inside the switch.

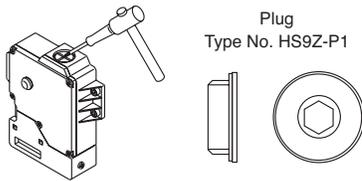
- Cracks or burrs on the conduit entry may deteriorate the housing protection against water.
- When changing to another conduit port, close the unused opening with an optional plug (Part No. HS9Z-P1).



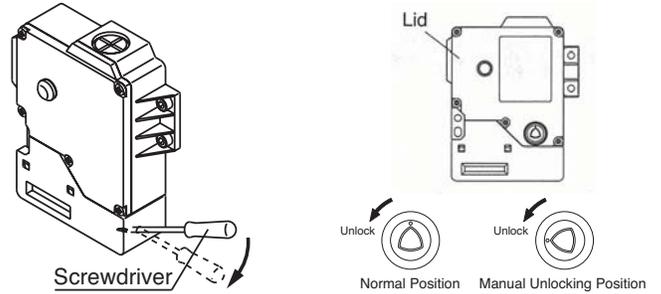
HS1E Precautions

Wire Connection

- Make an opening for wire connection by breaking one of the conduit-port knockouts on the switch housing using a screwdriver.
- Before breaking the knockout, temporarily remove the connector-fixing lock nut from the switch.
- When breaking the knockout, take care not to damage the contact block or other parts inside the switch.
- Cracks or burrs on the conduit entry may deteriorate the housing protection.
- When changing to the other conduit port, close the unused opening with an optional plug (accessory).



1. This unlocking method is intended for an escape from a machine when a person is locked in. For access to the unlocking entry, an access hole should be opened on the mounting panel. When opening the hole, apply proper protection against water or other foreign objects.
2. Caution: After the unlocking operation, put the screw back into the unlocking entry for safety.

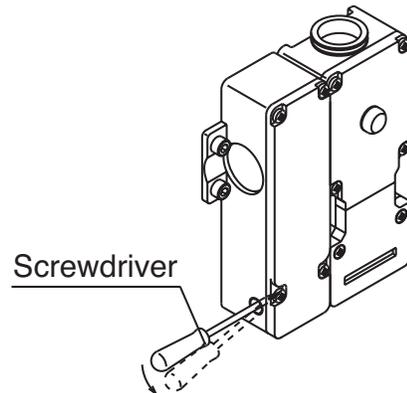


Manual Unlocking

- Remove the screw located on the unlocking entry at the side of the switch using the key wrench included with the switch. Then insert a small screwdriver into the switch to push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).
- Insert a small screwdriver into the elliptical hole on the back of the switch, then push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).

HS1C Precautions

- Regardless of door type, do not use the safety switch as a locking device. Install a locking device independently, for example, using a metal latch (also applicable to HS1E).
- The safety switch cover can be only removed with the special key wrench supplied with the switch or with the optional screwdriver (also applicable to HS1B and HS1E).
- Remove the screw located on the unlocking entry at the side of the switch using the key wrench included with the switch. Then insert a small screwdriver into the switch to push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).

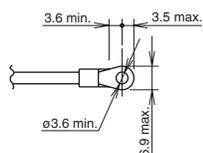


Caution: After the unlocking operation, put the screw back into the unlocking entry for safety.

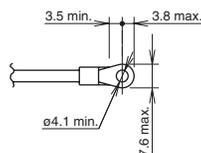
Operation Precautions

Applicable Crimping Terminals

- (Refer to the Crimping Terminal 1 or 2 shown in the drawing below.)
- HS1C
Terminals No. 1 to 6: Use solid or stranded wires only (crimping terminals not applicable).
Terminals No. 7 and 8: Crimping Terminal 1
Ground Terminal: Crimping Terminal 2
- HS1B
Ground Terminal: Crimping Terminal 2
Other Terminals: Crimping Terminal 1
HS2B, HS5B, and HS1E
Crimping Terminal 1

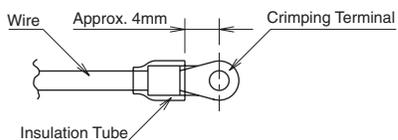


Crimping Terminal 1



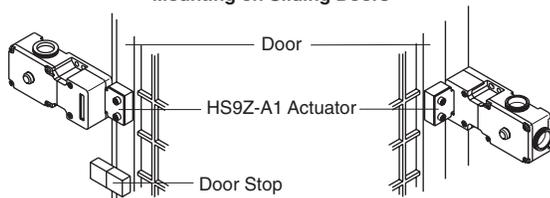
Crimping Terminal 2

Use an insulation tube on the crimping terminal.

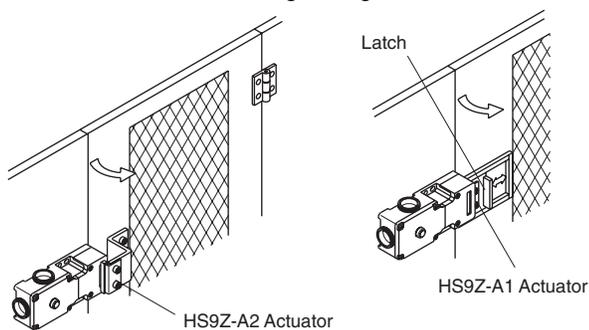


Installation Examples (see the diagrams below)

Mounting on Sliding Doors

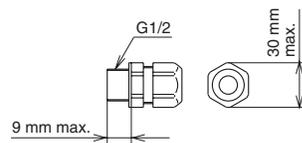


Mounting on Hinged Doors



Applicable Connectors (As shown below)

- Use connectors which maintain the IP67 protection.
- Applicable Connector Dimensions
- Flex Conduit: VF03 (Japan Flex) www.nipolex.co.jp
- Steel Connector (G1/2): ALC-103 (PF13.5): RBC-103PG13.5



Recommended Screw Tightening Torque

- HS1C: 5.0±0.5 N-m (approx. 50±5 kgf-cm)
(4 or 6 pcs of M5 hex socket head cap screws)
- HS1B: 5.0±0.5 N-m (approx. 50±5 kgf-cm)
(2 or 4 pcs. of M5 hex socket head cap screws)
- HS2B: 5.0±0.5 N-m (approx. 50±5 kgf-cm)
(2 pcs of M5 hex socket head cap screws)
- HS5B: 4.0±0.4 N-m (approx. 40±4 kgf-cm)
(2 pcs of M4 hex socket head cap screws)
- HS1E: 5.0±0.5 N-m (approx. 50±5 kgf-cm)
(4 or 6 pcs of M5 hex socket head cap screws)
- Actuator (HS9Z-A1/A2)
5.0±0.5 N-m (approx. 50±5 kgf-cm)
- (2 pcs. of M6 hex socket head cap screws)
Actuator (HS9Z-A51/A52)
- 2.0±0.2 N-m (approx. 20±2 kgf-cm)
(2 pcs of M4 hex socket head cap screws)
- 1.0±0.2 N-m (approx. 10±2 kgf-cm)
(2 pcs of M4 Phillips screws)

The screws are supplied by the user.

Applicable Wire Size

- HS1C: 0.5 to 0.75 mm² (Terminals No.1, 2, 5 to 8)
1.0 to 1.25 mm² (Terminals No.3, 4, and grounding terminal)
- HS5B: 0.5 to 1.25 mm²
- HS1E: 0.5 to 1.25 mm²

Actuator Angle Adjustment

- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). 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 entry slot of the safety switch.
- Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)
- After adjusting the actuator angle, apply loctite or the like to the adjustment screw so as to prevent its loosening.

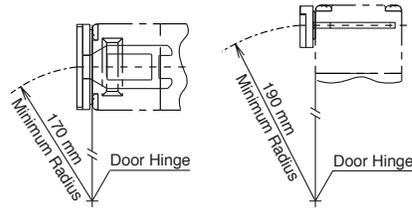
Minimum Radius of Hinged Door

- When using the interlock 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 (HS9Z-A55).

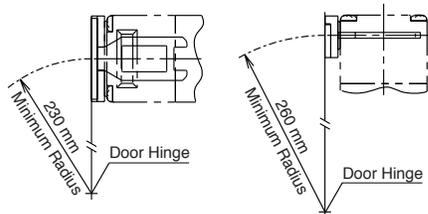
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

- When the door hinge is on the extension line of the interlock switch surface:



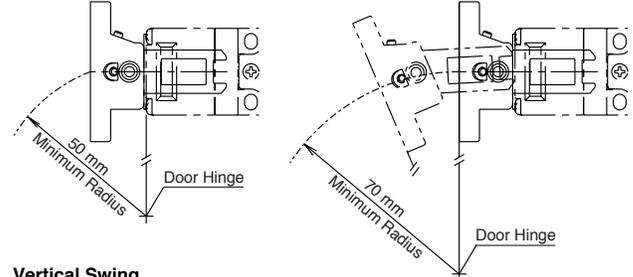
- When door hinge is on the extension line of the actuator mounting surface:



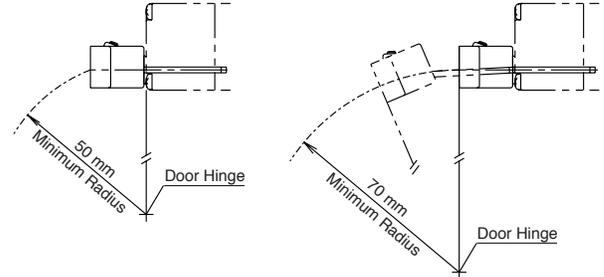
When using the HS9Z-A55 Angle Adjustable Actuator

- When door hinge is on the extension line of the interlock switch surface: 50 mm
- When door hinge is on the extension line of the actuator mounting surface: 70 mm

Horizontal Swing



Vertical Swing

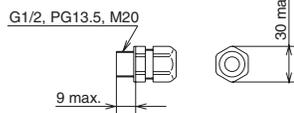


Actuator Angle Adjustment for the HS9Z-A55

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370). 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 interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.

Applicable Cable Glands

Use a cable gland with a degree of protection IP67



all dimensions in mm

When Using Multi-core Cables (Example)

Conduit Port Size	Plastic Cable Gland	Metal Cable Gland
G1/2	SCS-10* (Seiwa Electric)	ALS-16** (Nihon Flex)
PG13.5	ST13.5 (K-MECS)	ABS-**PG13.5 (Nihon Flex)
M20	ST-M20X1.5 (K-MECS)	ALS-**EC20 (Nihon Flex)

When Using Flexible Conduits (Example)

Flexible conduit example: VF-03 (Nihon Flex)

Conduit Port Size	Plastic Cable Gland	Metal Cable Gland
G1/2	—	RLC-103 (Nihon Flex)
PG13.5	—	RBC-103PG13.5 (Nihon Flex)
M20	—	RLC-103EC20 (Nihon Flex)

- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.
- When using a 1/2-14NPT cable gland, use the HS5B interlock switch with M20 conduit port (Part No.: HS5B-***BM) together with an adapter (Part No.: MA-M/NPT 20X1.5 5402-0110, K-MECS) and a gasket (Part No.: GP M20, K-MECS). Install a gasket between the interlock switch and the adapter. Apply sealing tape between the cable gland and the adapter to make sure of IP67 protection for the enclosure.