

HS5B Series Miniature Interlock Switch

HS5B features:

- 30mm x 30mm x 91mm Compact Housing
- Available with 2 Contact Configurations (1NO + 1NC or 2NC)
- Flexible Installation: By turning the head of the switch to the desired angle, the actuator can be accessed from 8 directions
- Plastic Housing: Light weight
- Direct Opening Action: Opening the door forces the contacts to disconnect even if the contacts are welded (IEC60947-5-1)
- Degree of Protection: IP67 (IEC60529)



GS-ET-15
BG standard in Germany

Direct Opening
Action

Double
Installation

Part Numbers

Contact Configuration	Conduit Port Size	Part Number (Standard Stock in bold)	
		Plastic Head Type	Metal Head Type
1NC-1NO 	G1/2	HS5B-11B	HS5B-11ZB
	PG13.5	HS5B-11NP	—
	M20	HS5B-11BM	HS5B-11ZBM
2NC 	G1/2	HS5B-02B	HS5B-02ZB
	PG13.5	HS5B-02NP	—
	M20	HS5B-02BM	HS5B-02ZBM



The actuators are not included, must be ordered separately.

Part Number Key HS5B - 11 Z BM

**Head Housing Color/
Conduit Port**
B: Black / G1/2
BM: Black /M20
NP: Gray PG13.5

Head Material
blank: Plastic
Z: Metal

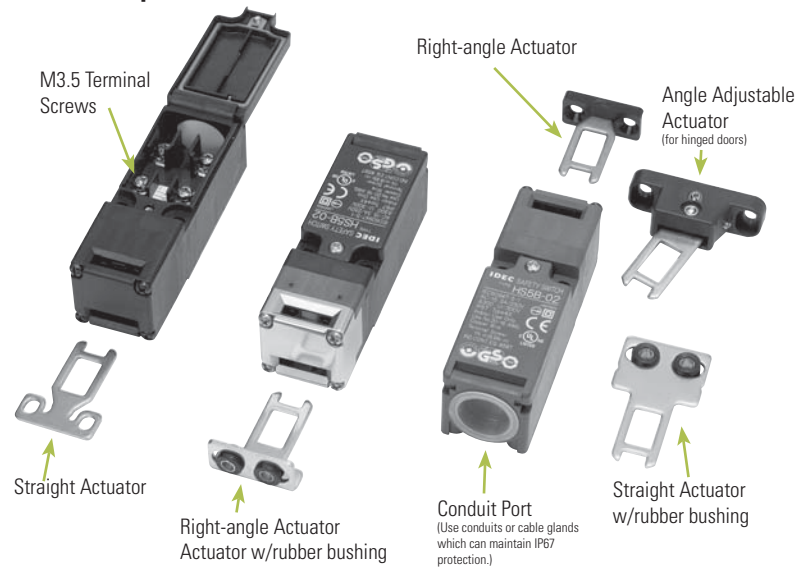
Circuit Code

11: 1NO-1NC
02: 2NC

Actuator Keys

Appearance	Description	Part Number (Package Qty 1)
	Straight	HS9Z-A51
	Straight w/rubber bushings	HS9Z-A51A
	Right-angle	HS9Z-A52
	Right-angle w/rubber bushings	HS9Z-A52A
	Angle Adjustable (for hinged doors)	HS9Z-A55

Parts Description



Accessories

Appearance	Description	Part Number	Weight
	HS5B/HS5E Plug Actuator (allows switch to be used as interlock plug unit)	HS9Z-A5P	35g
	HS5B/HS5E Padlock Hasp (prevents unauthorized insertion of actuator)	HS9Z-PH5	35g

Contact Configuration & Operation Chart

Model	Contact Configuration	Contact Operation Chart	Contact Status
HS5B-11	<p>1NC-1NO</p>		
HS5B-02	<p>2NC</p>		

Specifications

Conforming to Standards	EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508				
Operating Temperature	-20 to +70°C (no freezing)				
Storage Temperature	-40 to +80°C				
Operating Humidity	85% RH maximum (no condensation)				
Altitude	2,000m maximum				
Rated Insulation Voltage (Ui)	300V				
Impulse Withstand Voltage (Uimp)	4 kV				
Insulation Resistance	100MΩ minimum (500V DC megger)				
Electric Shock Protection Class	Class II (IEC61140)				
Pollution Degree	3 (IEC60664-1)				
Degree of Protection	IP67 (IEC60529)				
Vibration Resistance	Operating Extremes	10 to 55 Hz, amplitude 0.5 mm			
	Damage Limits	60 m/sec ² (approx. 6G)			
Shock Resistance	1,000 m/sec ² (approx. 100G)				
Actuator Operating Speed	1 m/sec maximum				
Positive Opening Travel	8 mm minimum				
Positive Opening Force	60N minimum				
Thermal Current (Ith)	10A				
Rated Operating Current (Ie)	Operating Voltage (Ue)		30V	125V	250V
	AC	Resistive load (AC12)	10A	10A	6A
		Inductive load (AC15)	10A	5A	3A
	DC	Resistive load (DC12)	8A	2.2A	1.1A
Inductive load (DC13)		4A	1.1A	0.6A	
Operating Frequency	900 operations/hour				
Mechanical Life	1,000,000 operations				
Electrical Life	100,000 operations (rated load)				
Conditional Short-circuit Current	100A (IEC60947-5-1)				
Recommended Short Circuit Protection	250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)				
Weight	Approx. 80g				

Application Examples and Circuit Diagrams

HS5B-11 (1NO-1NC)

HS5B-02 (2NC)

Overview

X Series E-Stops

Door Interlock Switches

Enabling Switches

Barriers

AS-Interface Safety at Work

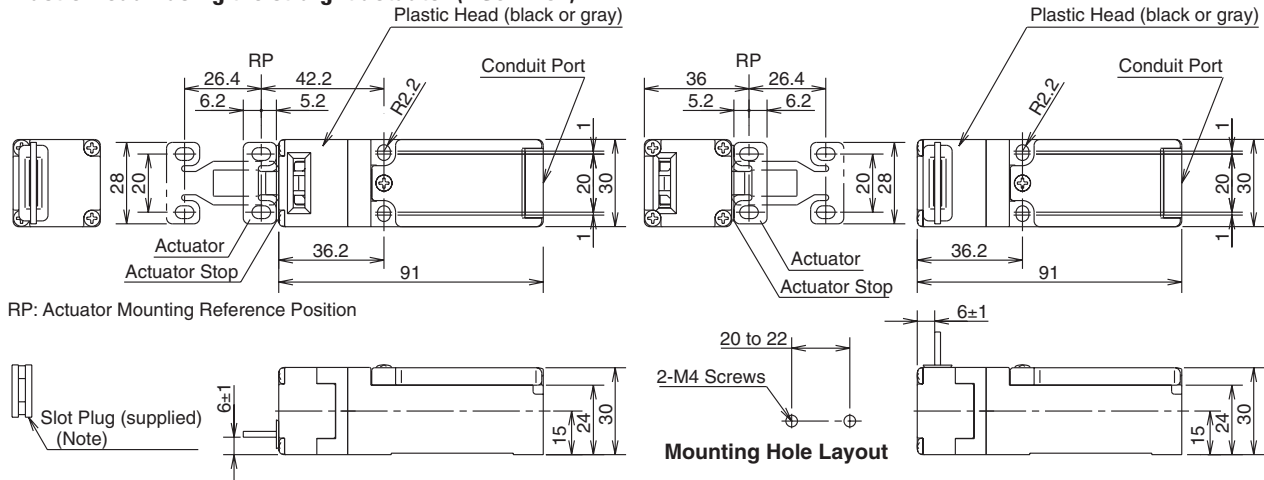
	Status 1	Status 2
Door/ Switch Status	<ul style="list-style-type: none"> Door Closed Machine ready to operate 	<ul style="list-style-type: none"> Door opened Machine cannot be started
Door		
Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

	Status 1	Status 2
Door/ Switch Status	<ul style="list-style-type: none"> Door Closed Machine ready to operate 	<ul style="list-style-type: none"> Door opened Machine cannot be started
Door		
Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Open

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.

Dimensions (mm)

Plastic Head - using the straight actuator (HS9Z-A51)

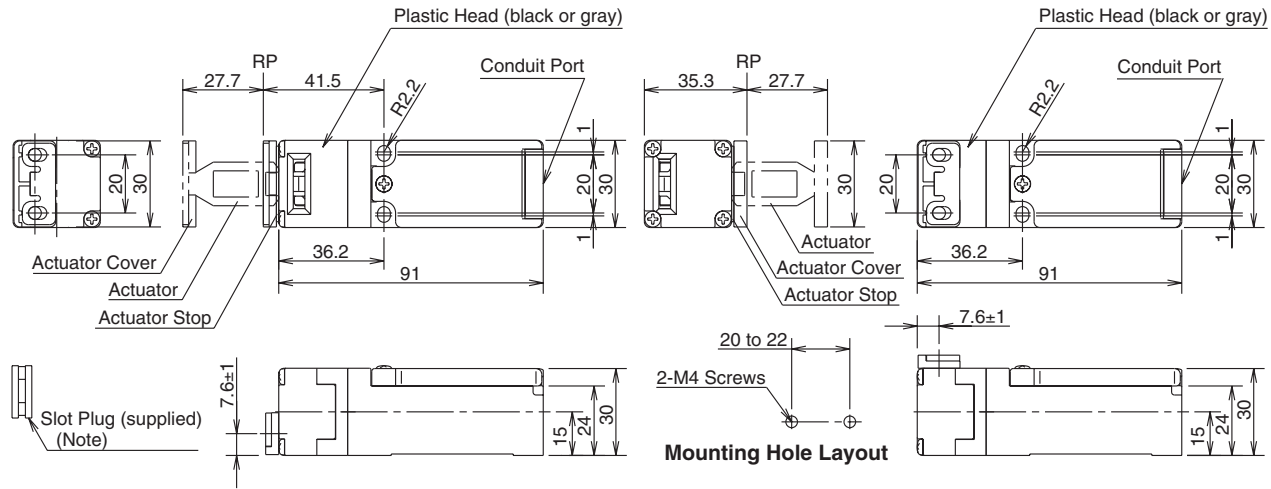


Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.



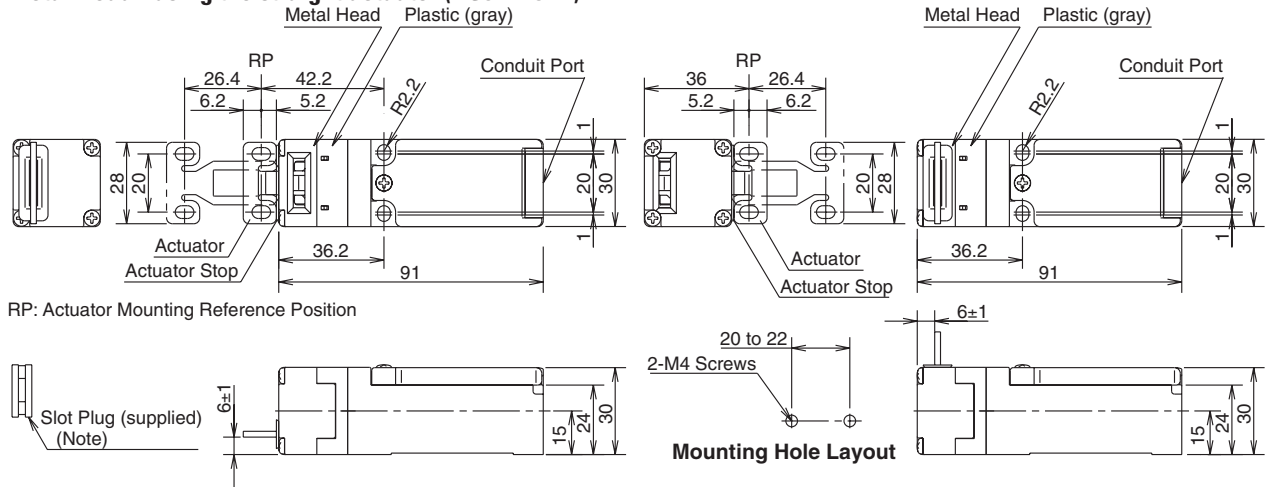
Dimensions (mm), continued

Plastic Head – using the Right-angle actuator (HS9Z-A52)



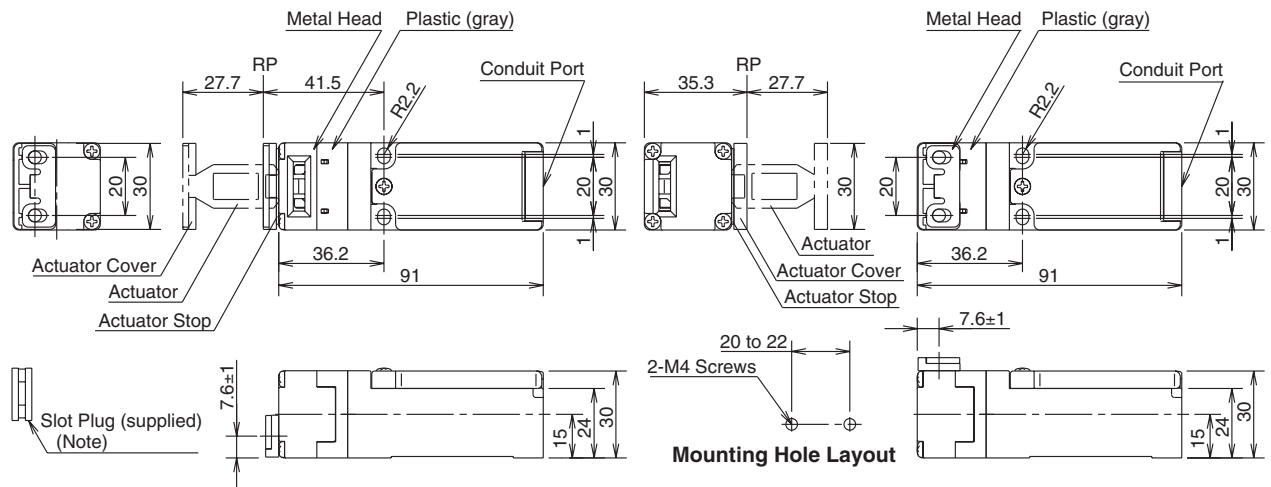
Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.

Metal Head - using the straight actuator (HS9Z-A51A)



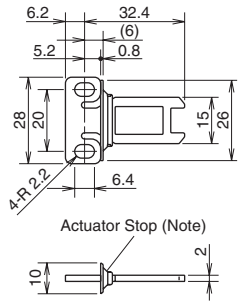
RP: Actuator Mounting Reference Position

Metal Head – using the Right-angle actuator (HS9Z-A52A)

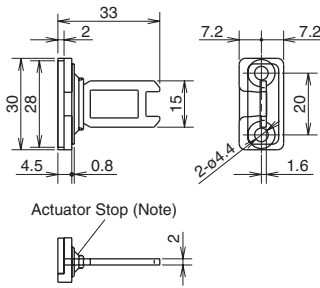


Note: Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

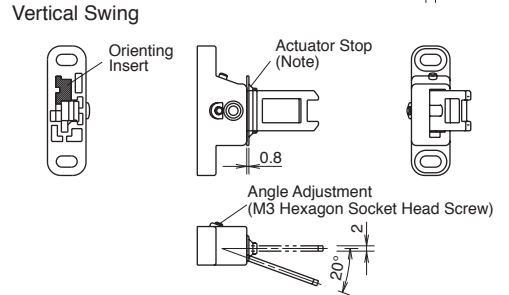
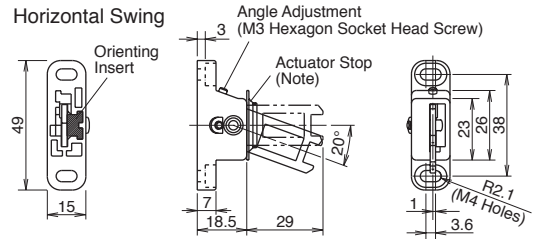
Straight Actuator - HS9Z-A51
(mainly for sliding doors)



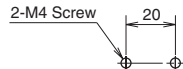
Right-angle Actuator - HS9Z-A52
(mainly for hinged doors)



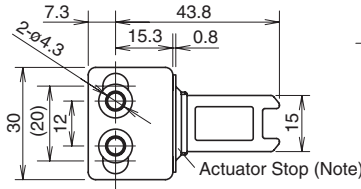
Adjustable Actuator - HS9Z-A55



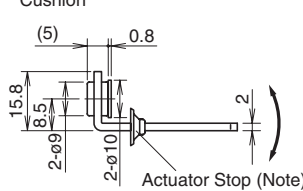
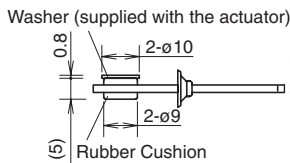
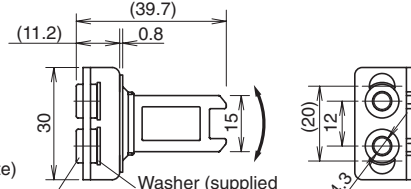
• Actuator Mounting Hole Layout
(Straight, Right-angle)



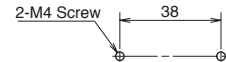
Straight Actuator with rubber bushings - HS9Z-A51A
(mainly for sliding doors)



Right-angle Actuator with rubber bushings - HS9Z-A52A
(mainly for hinged doors)



• Actuator Mounting Hole Layout
(horizontal/vertical swing)



Actuator Orientation (Angle Adjustable)

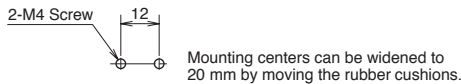
The angle of actuator swing can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the orienting insert, otherwise the actuator will not operate properly.



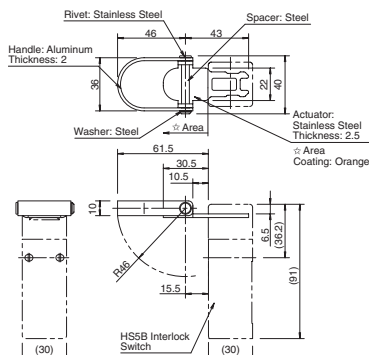
The actuator stop is supplied with the actuator and used when adjusting the actuator position. Remove the actuator stop after the actuator position is determined.

- The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
- The actuator has flexibility to the directions indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

Actuator Mounting Hole Layout
(straight with rubber bushing, right-angle with rubber bushing)

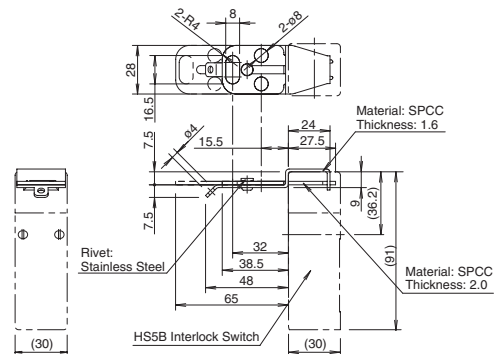


HS9Z-A5P



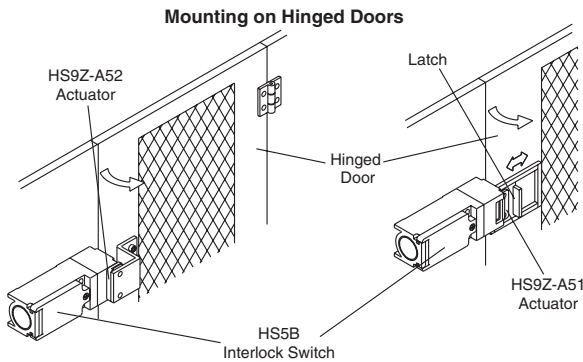
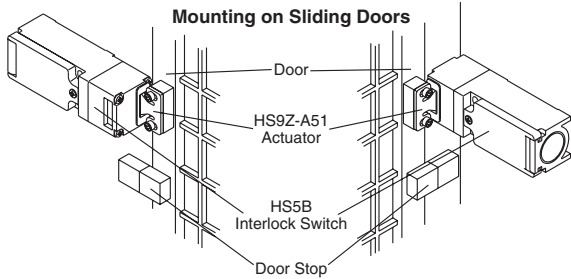
Accessory Dimensions (mm)

HS9Z-PH5



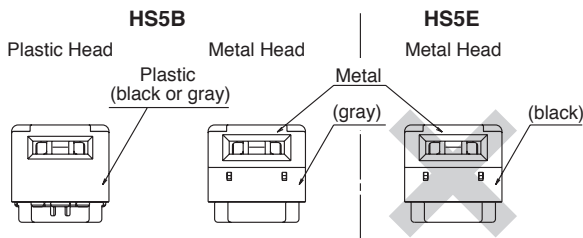
Mounting Examples

Mount the interlock switch as shown in the examples below.



Mounting the HS5B Head

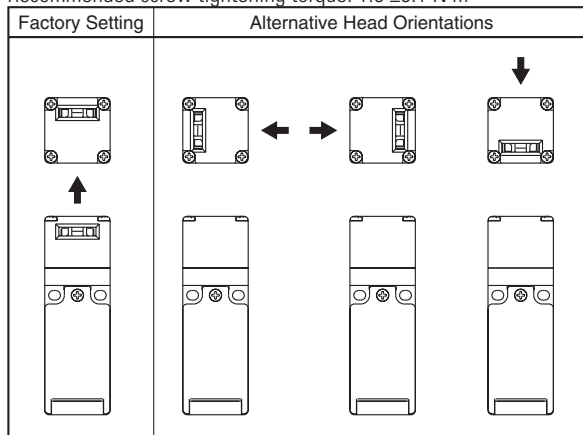
The metal head for the HS5E interlock switch cannot be used on the HS5B. Be sure to use the plastic head or metal head for the HS5B. Take care particularly when using both HS5B and HS5E together.



Rotating the Head

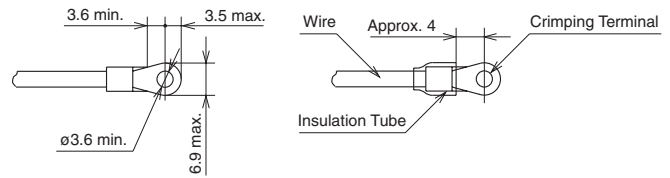
The head of the HS5B can be rotated by removing the four screws from the corners of the HS5B head and reinstalling the head in the desired orientation. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws. If the screws are loose it may cause the switch to malfunction.

Recommended screw tightening torque: 1.0 ± 0.1 N·m



Applicable Crimping Terminal

When using crimping terminals, be sure to install insulation tubes on the crimping terminals to prevent electric shocks.



Applicable Wire Size

- 0.5 to 1.25 mm² (AWG20 to AWG16)

Recommended Tightening Torque of Mounting Screws

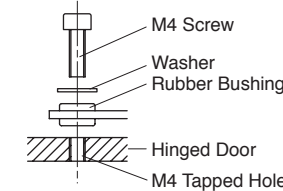
- Interlock Switch: 2.0 ± 0.2 N·m (two M4 screws) *
- Actuator Keys
 - HS9Z-A51: 2.0 ± 0.2 N·m (two M4 screws) *
 - HS9Z-A52: 1.0 ± 0.2 N·m (two M4 Phillips screws)
 - HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws) *
 - HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws) *

*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.

- Mounting bolts must be provided by user.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator be installed in an unremovable manner, for example using special screws or welding the screws.
- When installing HS9Z-A51A or HS9Z-A52A actuator keys, use the washer (supplied with the actuator) on the hinged door, and mount tightly using two M4 screws.

Mounting Centers

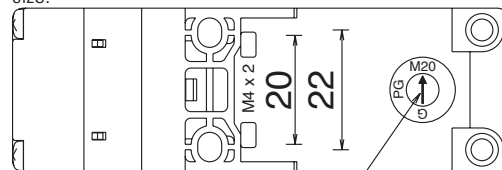
12 mm (factory setting), adjustable to 20 mm



Note: Choose mounting centers either 12 mm or 20 mm.

Conduit Port Size Identification

Conduit port size is identified by the arrow on the back of the HS5B interlock switch. The following example shows the identification of the M20 conduit port size.



Marking	Conduit Port Size
G	G1/2
PG	PG13.5
M20	M20

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 to prevent it from loosening.

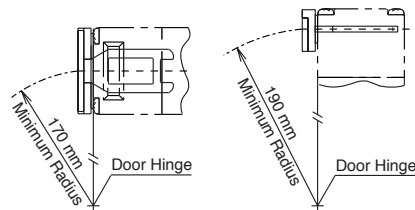
Minimum Radius of Hinged Door

- 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).

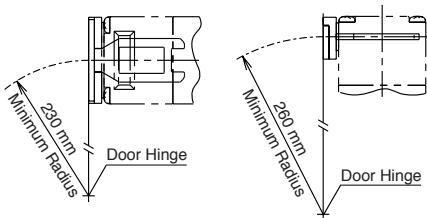
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

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



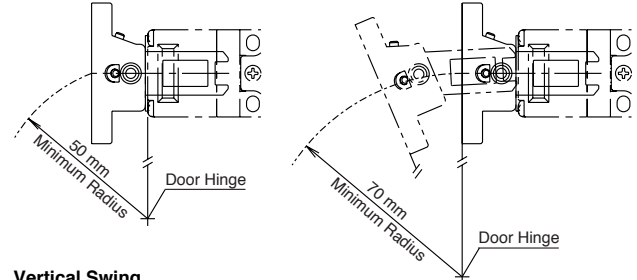
- When door hinge is on the extension line of the actuator mounting surface:



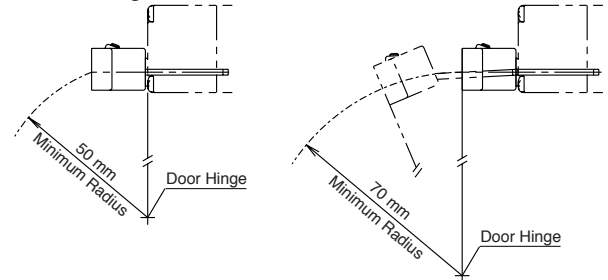
When using the HS9Z-A55 Angle Adjustable Actuator

- 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

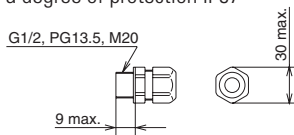


Actuator Angle Adjustment for the HS9Z-A55

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 354). 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 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)

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)

- 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.

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.

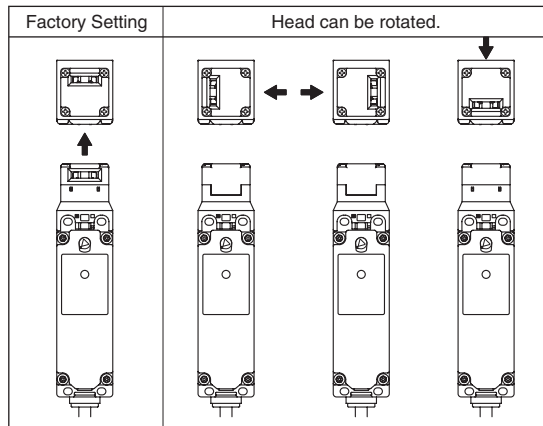
Operation Precautions - for all series

- 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

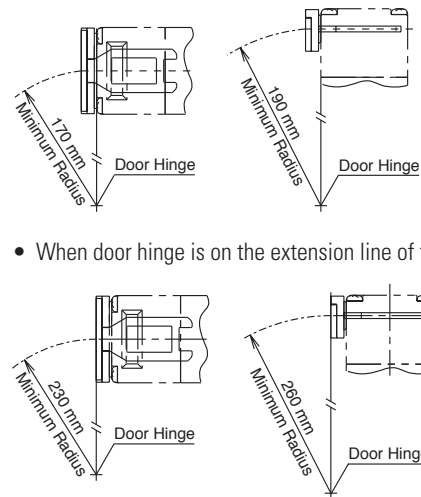
For Rotating Head Directions

- 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).



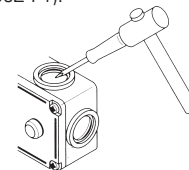
- When door hinge is on the extension line of the actuator mounting surface:

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.

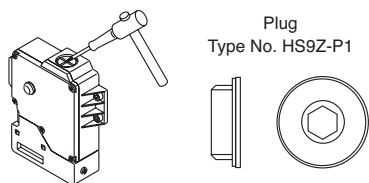
- Cracks or burrs on the conduit entry may deteriorate the housing protection against water.
- When changing to another conduit port, close the unused opening with an optional plug (Part No. HS9Z-P1).



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).

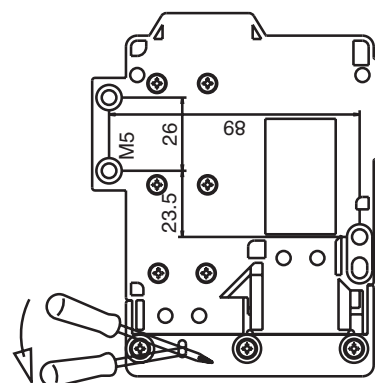
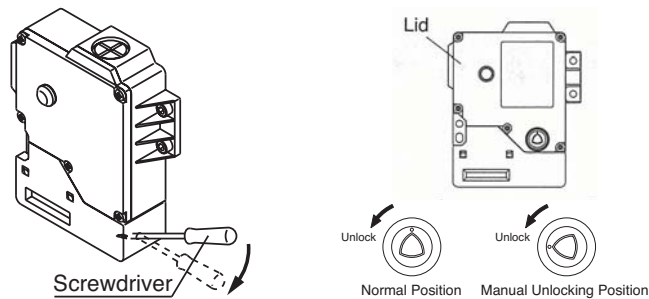


Manual Unlocking

- 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).



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.

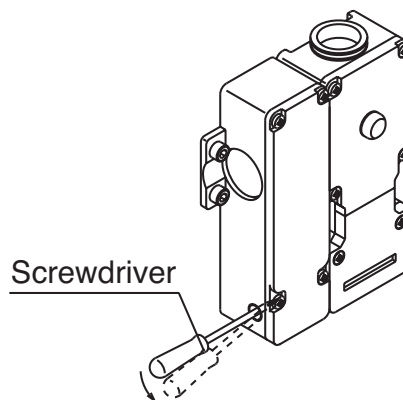


HS1C Precautions

- 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).



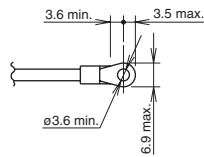
Caution: After the unlocking operation, put the screw back into the unlocking entry for safety.



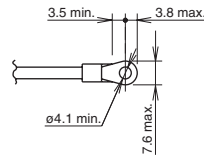
Operation Precautions

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



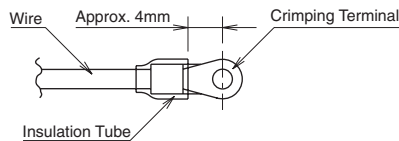
Crimping Terminal 1



Crimping Terminal 2

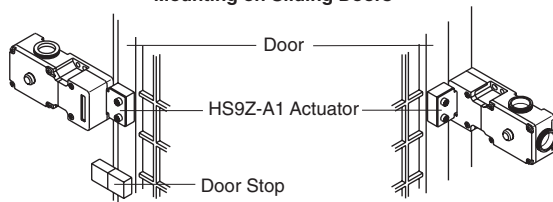


Use an insulation tube on the crimping terminal.

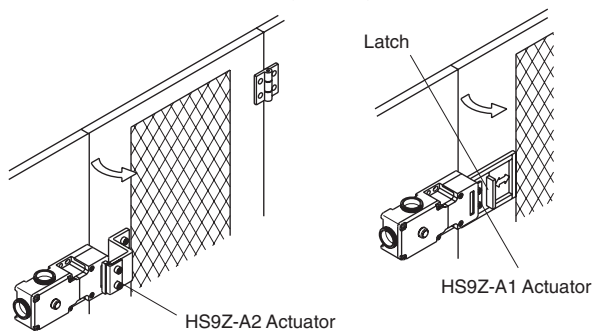


Installation Examples (see the diagrams below)

Mounting on Sliding Doors

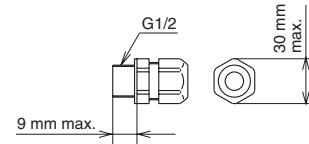


Mounting on Hinged Doors



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.

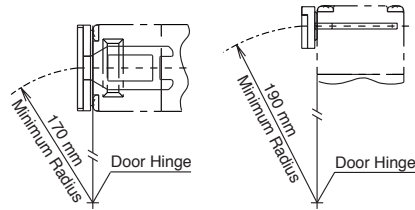
Minimum Radius of Hinged Door

- 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).

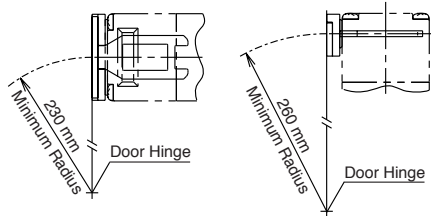
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

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



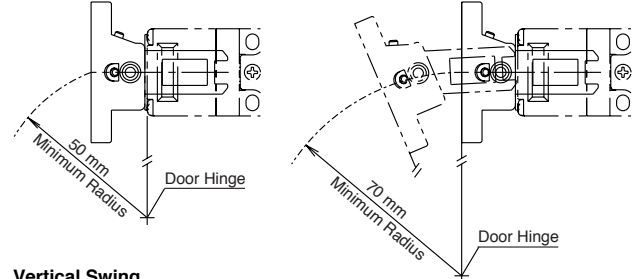
- When door hinge is on the extension line of the actuator mounting surface:



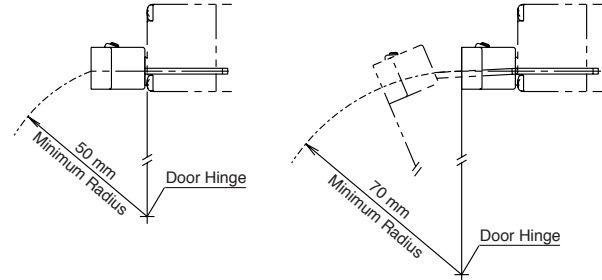
When using the HS9Z-A55 Angle Adjustable Actuator

- 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

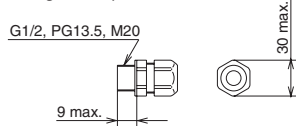


Actuator Angle Adjustment for the HS9Z-A55

- 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 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)

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)

- 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.