

# HS1B/HS2B Interlock Switches

## Machine stops when the door is opened.

- When mounting the actuator on a movable door and the interlock switch on a machine, opening or closing status of the door can be detected.
- Contact parts degree of protection: IP67 (IEC 60529)
- NC contacts feature direct opening mechanism (IEC/EN 60947-5-1).
- Special actuator prevents defeating (ISO 14119, EN 1088)
- Detects entry to hazardous area when mounted on safety guards.
- Two actuator entry slots and three conduit ports are provided.
- HS1B: Rugged die-cast aluminum housing
- HS2B: Compact and lightweight plastic housing



## Parts and Functions

**HS1B (die-cast aluminum housing)**

- LED Indicator (optional) (green or red)
- M3.5 Screw Terminal Wiring
- Three Conduit Ports (G1/2) Use IP67 conduit or connector (see page 105 for details).
- Two Actuator Entry Slots

**HS2B (plastic housing)**

- Three Conduit Ports (G1/2) Use IP67 conduit or connector (see page 105 for details).
- LED Indicator (optional)
- M3.5 Screw Terminals for Wiring (inside)
- Two Actuator Entry Slots

**Actuators:**

- Straight Actuator (SUS304) HS9Z-A1
- Right-angle Actuator (SUS304) HS9Z-A2
- Angle Adjustable Actuator for hinged doors HS9Z-A3

# HS1B/HS2B Interlock Switches

## Interlock Switch

Model	Contact Configuration	Indicator	Part No.
HS1B	1NC-1NO 	—	HS1B-11R
		With	HS1B-114R-*
HS1B	2NC 	—	HS1B-02R
		With	HS1B-024R-*
HS2B	1NC-1NO 	—	HS2B-11NB
		With	HS2B-114NB-*

The contact configuration represents the status when the actuator is inserted.

- Special key wrench HS9Z-T1 is supplied with the HS1B interlock switch.
- Specify an indicator color code in place of \* in the Part No.  
G: green, R: red
- Actuator is not attached to the interlock switch and must be ordered separately.

## Contact Ratings

Rated Insulation Voltage (Ui)		300V (between LED and ground: 60V)			
Rated Thermal Current (Ith)		10A			
Rated Voltage (Ue)		30V	125V	250V	
Rated Current (Ie) (Note)	AC	Resistive load (AC-12)	10A	10A	6A
		Inductive Load (AC-15)	10A	5A	3A
	DC	Resistive load (DC-12)	8A	2.2A	1.1A
		Inductive Load (DC-13)	4A	1.1A	0.6A

- Minimum applicable load (reference value): 3V AC/DC, 5 mA  
(Applicable range is subject to the operating conditions and load.)

## Specifications

Applicable Standards	ISO14119 EN1088 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed) IEC 60204-1/EN 60204-1 (applicable standards for use)
Applicable Directive	2006/95/EC (Low Voltage Directive) and 2006/42/EC (Machinery Directive)
Operating Temperature	-20 to 70°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Impulse Withstand Voltage	4 kV
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum Between live metal part and ground: 100 MΩ minimum Between live metal parts: 100 MΩ minimum Between terminals of the same pole: 100 MΩ minimum
Electric Shock Protection	HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Damage limits: 1000 m/s <sup>2</sup>
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	11 mm minimum
Direct Opening Force	HS1B, HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum
Operating Frequency	900 operations per hour
Mechanical Life	1,000,000 operations minimum (GS-ET-15)
Electrical Life	100,000 operations minimum (operating frequency 900 operations per hour, load AC-12, 250V, 6A)
Conditional Short-circuit Current	100A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)
Weight (approx.)	HS1B: 280g HS2B: 130g

## Actuators, Special Key Wrench, and Plug

Actuator is not supplied with the interlock switch, and must be ordered separately.

Description	Part No.
Straight Actuator (mainly for sliding doors)	HS9Z-A1
Right-angle Actuator (mainly for hinged doors)	HS9Z-A2
Angle Adjustable Actuator (mainly for hinged doors)	HS9Z-A3
Special Key Wrench for HS1B	HS9Z-T1
Conduit Port Plug for HS2B	HS9Z-P1

Note: Ratings approved by safety agencies: A300: AC-15 3A/250V

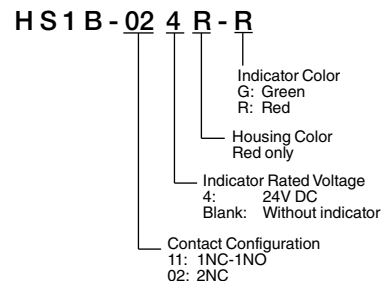
## Indicator

Rated Voltage	24V DC
Rated Current	10 mA
Light Source	LED
Light Color	G (green), R (red)

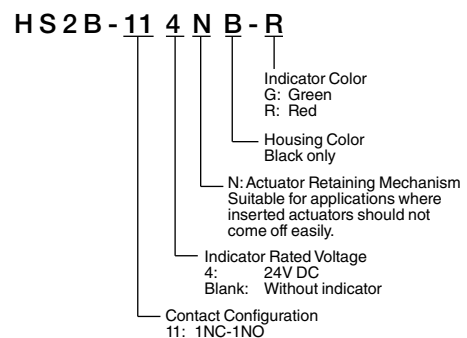
- The lens cannot be replaced.

## Part No. Development

### HS1B



### HS2B



# HS1B/HS2B Interlock Switches

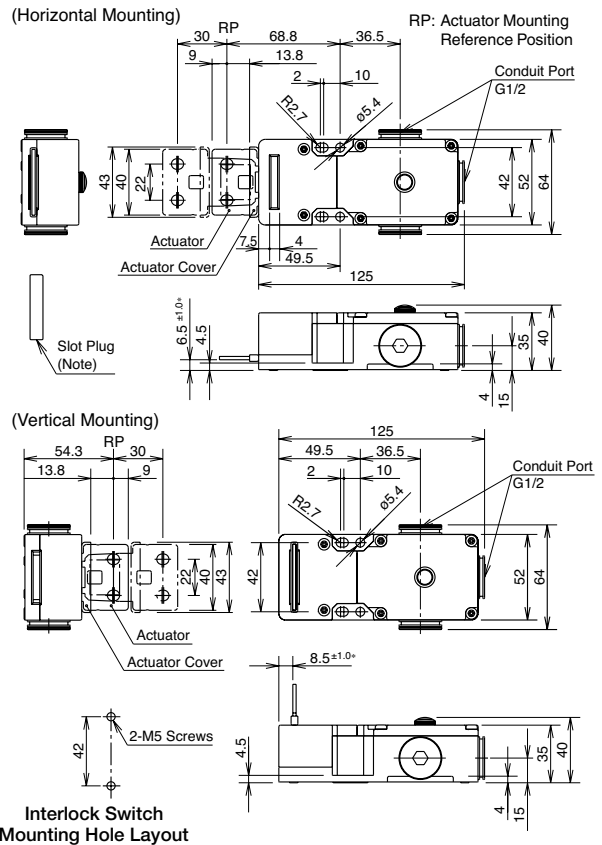
## Circuit Diagram and Operating Characteristics

Interlock Switch Status		Status 1	Status 2
		<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine ready to operate</li> </ul>	<ul style="list-style-type: none"> <li>Door open</li> <li>Machine cannot be started</li> </ul>
Door			
HS1B-11 HS2B-11 (1NC-1NO)	Circuit Diagram		
	Main Circuit	3-4: Closed	3-4: Open
	Monitor Circuit	1-2: Open	1-2: Closed
HS1B-02 (2NC)	Circuit Diagram		
	Main Circuit	3-4: Closed	3-4: Open
	Monitor Circuit	1-2: Closed	1-2: Open

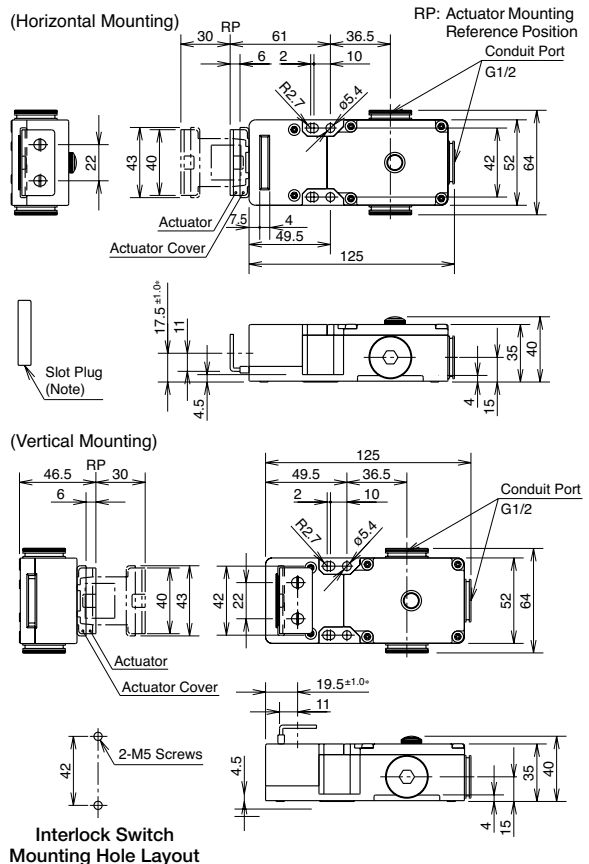
The LED indicator terminal is independent of door status, and thus can be wired as necessary.

## Dimensions

### HS1B using the Straight Actuator (HS9Z-A1)



### HS1B using the Right-angle Actuator (HS9Z-A2)



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

\* Actuator center position



# HS1B/HS2B Interlock Switches

## Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and establish a safety circuit which satisfies the requirement 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 the 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/s<sup>2</sup> may cause damage to the interlock switch.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- 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 breakdown.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The HS1B cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.

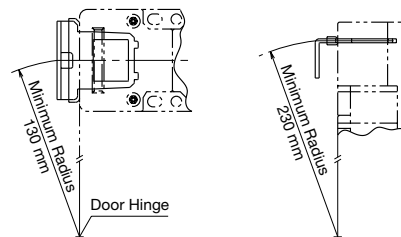
## Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use the angle adjustable actuator (HS9Z-A3).

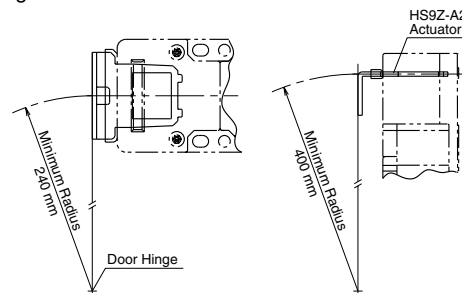
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

## When using the HS9Z-A2 Right-angle Actuator

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

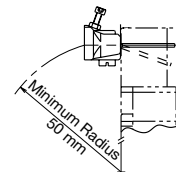


- When the door hinges on the extension line of the actuator mounting surface:

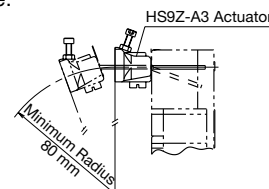


## When using the Angle-adjustable HS9Z-A3 Actuator

- 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:

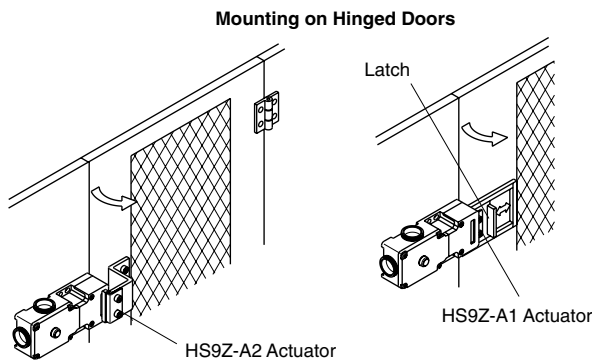
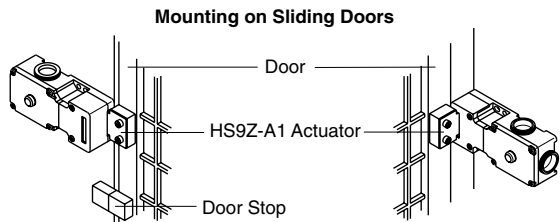


# HS1B/HS2B Interlock Switches

## Instructions

### Mounting Examples

Mount the interlock switch on a fixed machine or guard, and mount the actuator on the hinged door. Do not mount both interlock switch and actuator on the hinged doors, otherwise malfunction will occur.



### Applicable Crimping Terminal

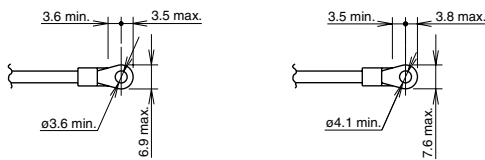
#### HS1B

Use Crimping Terminal 1 for terminals other than the ground terminal.

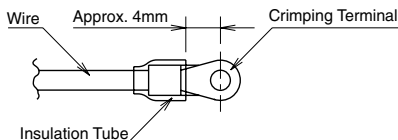
Use Crimping Terminal 2 for the ground terminal.

#### HS2B

Use Crimping Terminal 1 for all terminals.



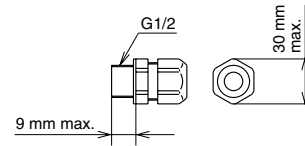
- Use an insulation tube on the crimping terminal.



- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

### Applicable Cable Glands

- Use IP67 cable gland.



### When Using Flexible Conduits (Example)

- Flexible conduit example: VF-03 (Nihon Flex)
- Metal conduit example: (G1/2) RLC-103 (Nihon Flex)

### When Using Multi-core Cables (Example)

- Plastic cable gland: (G1/2) SCS-10\* (Seiwa Electric)
- Metal cable gland: (G1/2) ALS-16 (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.

### Applicable Wire Size

- 0.5 to 1.25 mm<sup>2</sup> (AWG20 to AWG16)

### Recommended Tightening Torque of Mounting Screws

- Interlock Switches  
HS1B: 4.5 to 5.5 N·m (two M5 screws)  
HS2B: 3.2 to 3.8 N·m (two M6 screws)
- Terminal screw: 0.9 to 1.1 N·m (M3.5 screws)
- Actuators (HS9Z-A1/A2/A3)  
4.5 to 5.5 N·m (two M6 screws)
- Mounting bolts must be provided by users.
- 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.

### Conduit Port Opening (HS2B)

- The HS2B has three conduit ports, which are molded without opening.
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the interlock switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block and other parts inside the housing.
- 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).

