Door Interlock Switches

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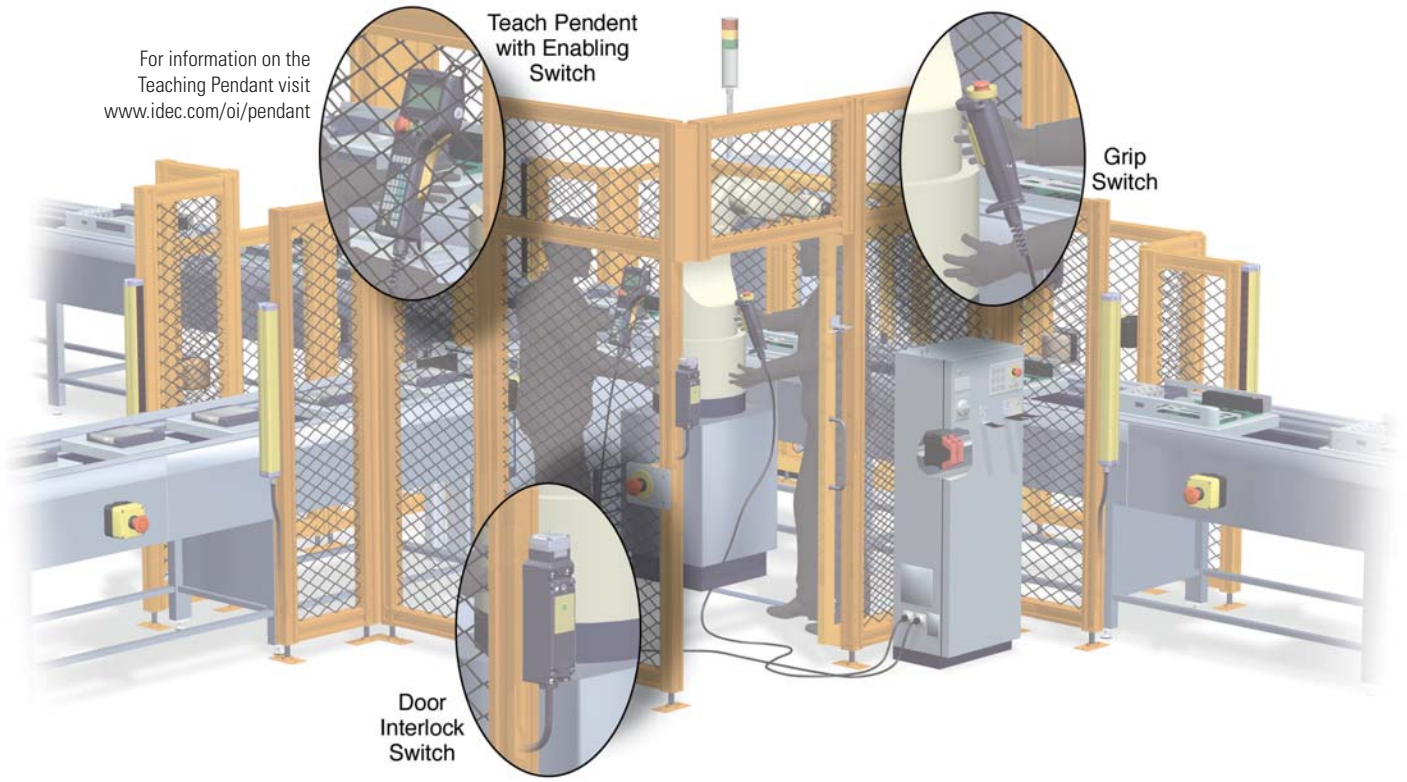
Selection Guide

Door Interlock Switches

Series Model	HS6B	HS5B	HS2B	HS1B	HS6E	HS5E	HS1E	HS1C
Appearance								
Page	345	350	357	361	365	376	384	392
Size (mm)	78 x 15 x 30mm	91 x 30 x 30mm	98 x 57 x 40mm	125 x 64 x 40mm	75 x 15 x 75mm	146 x 35 x 40mm	104mm x 39.7mm x 129mm	125 x 106 x 39.7mm
Body Material	Plastic Housing	Plastic Housing (metallic actuator entry optional)	Plastic Housing	Die-cast aluminum	Plastic Housing	Plastic Housing/ Metallic Actuator Entry	Plastic Housing	Die-cast aluminum
Solenoid (Yes/No)	No	No	No	No	Yes	Yes	Yes	Yes
LED Indicator	No	No	Yes	Yes	Yes	Yes	Yes	Yes

Application Example



HS6B Series Subminiature Interlock Switch

HS6B features:

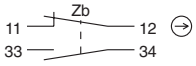
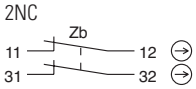
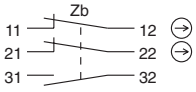
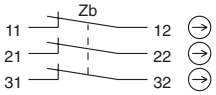
- Only 78 x 30 x 15mm
- Allows highest level of safety by having 3 contacts: dual load contacts + monitoring contact (ISO13849-1, EN954-1)
- Two actuator entrances provide flexibility for installation options
- Integral molded cable reduces wiring time
- IP67 (IEC60529) watertight sealing (contact is 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

GS-ET-15
BG standard in Germany

Direct Opening Action

Double Insulation

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

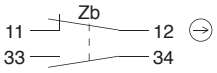
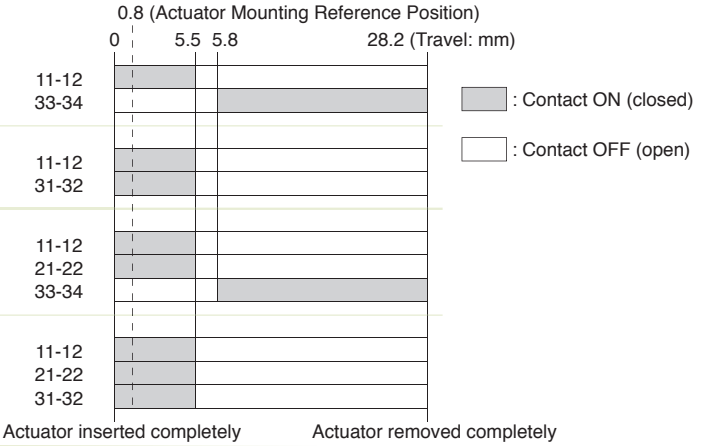
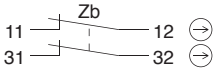
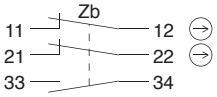
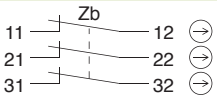
HS6B - 12 B 01

Cable Length
01: 1 meter
03: 3 meters
05: 5 meters

Head Color
B (Black)

Contact Configuration
11: 1NO-1NC
12: 1NO-2NC
02: 2NC
03: 3NC

Contact Configuration & Operation Chart

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

Actuator Keys

Appearance	Part Number	Shape
	HS9Z-A61	Straight (Mainly for sliding doors)
	HS9Z-A62	Right-angle (Mainly for hinged doors)

Appearance	Part Number	Shape
	HS9Z-A65	adjustable actuator 90° angle
	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
	AC	Inductive load (AC15)		–	1.5A	0.75A
	DC	Resistive load (DC12)		2.5A	1.1A	0.55A
	DC	Resistive load (DC12)		(2A)	(0.4)A	(0.2A)
	DC	Inductive load (DC13)		2.3A	0.55A	0.27A
	DC	Inductive load (DC13)		(1A)	(0.22A)	(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

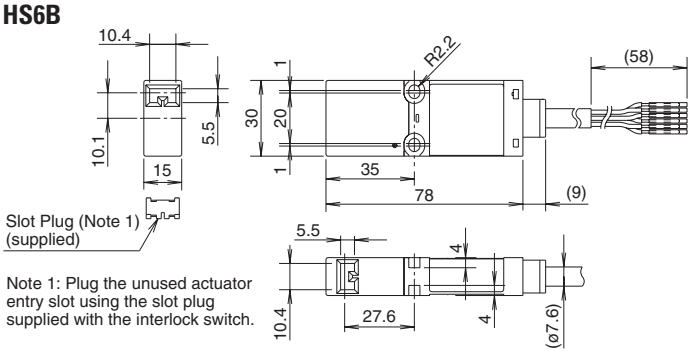
Wiring Designations

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

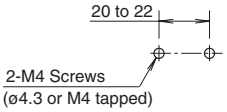
Dimensions (mm)

HS6B



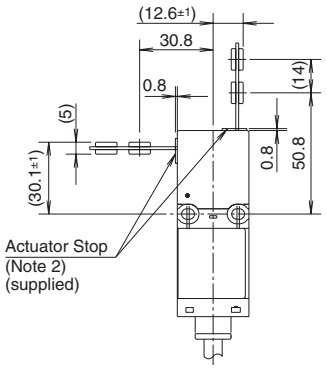
Note 1: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.

Installation

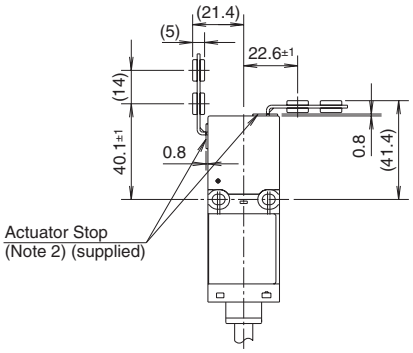


The interlock switch can be mounted in two directions.

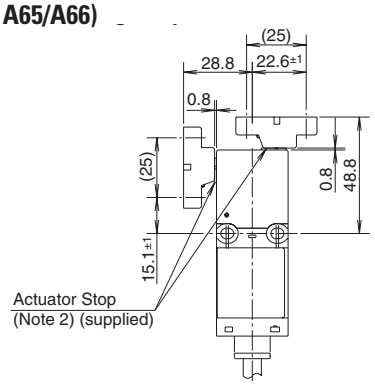
Using straight actuator (HS9Z-A61)



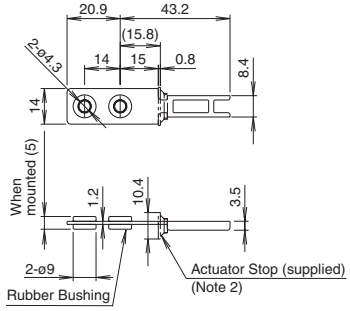
Using Right-angle actuator (HS9Z-A62)



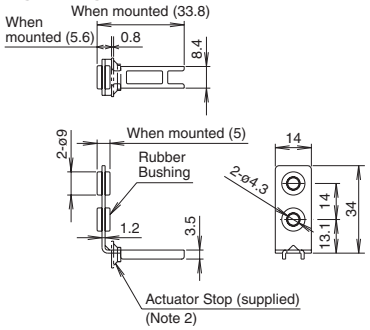
Using Angle Adjustable Actuator (HS9Z-A65/A66)



Straight actuator (HS9Z-A61)

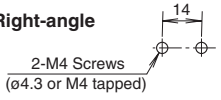


Right-angle actuator (HS9Z-A62)

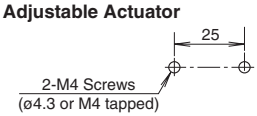


Actuator Installation

Straight/Right-angle Actuator

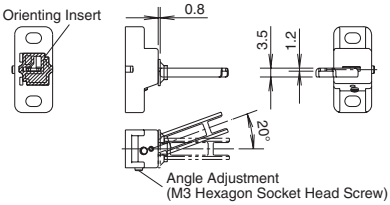


Angle Adjustable Actuator

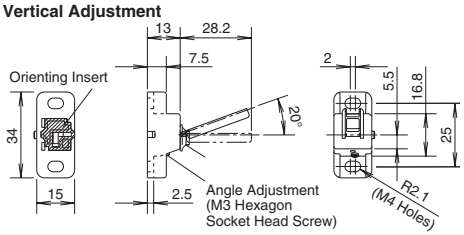


Adjustable Actuator (HS9Z-A65)

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.

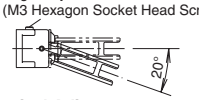
The base is made of glass-reinforced PA66 (66 nylon). Angle adjustment screws are stainless steel. When using adhesive on screws, take material compatibility into consideration.

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

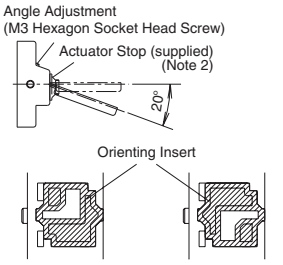
Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment



Vertical Adjustment



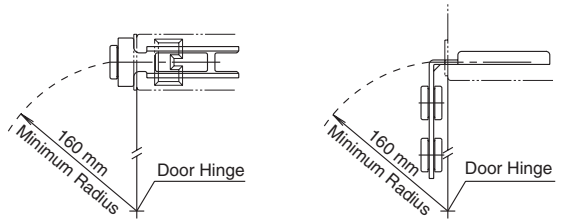
Minimum Radius of Hinged Door

- 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).

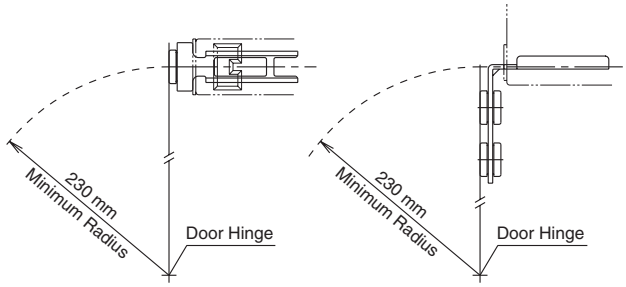
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A62 Actuator

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



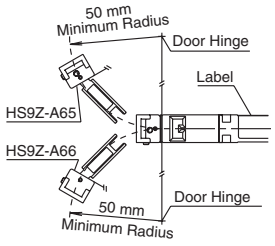
- When the door hinge is on the extension line of the actuator mounting surface:



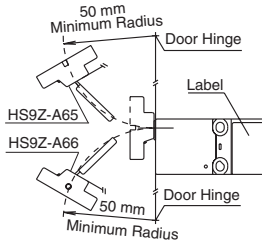
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable (vertical) Actuator

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

Horizontal Swing

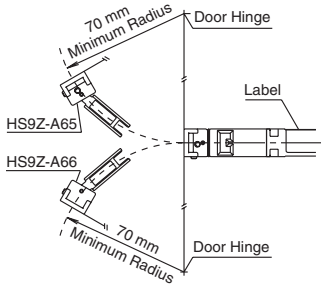


Vertical Swing

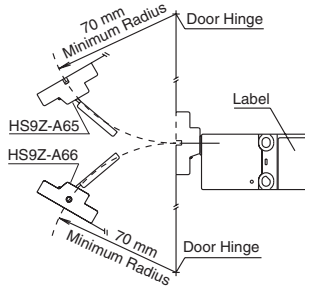


- When the door hinge is on extension line of the actuator mounting surface:

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.

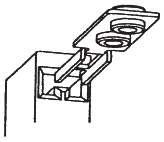
Instructions

- 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/s^2 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.



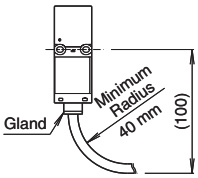
Recommended Screw Tightening Torque

- 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.

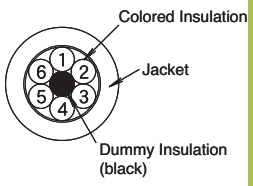
Cable

- 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.

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

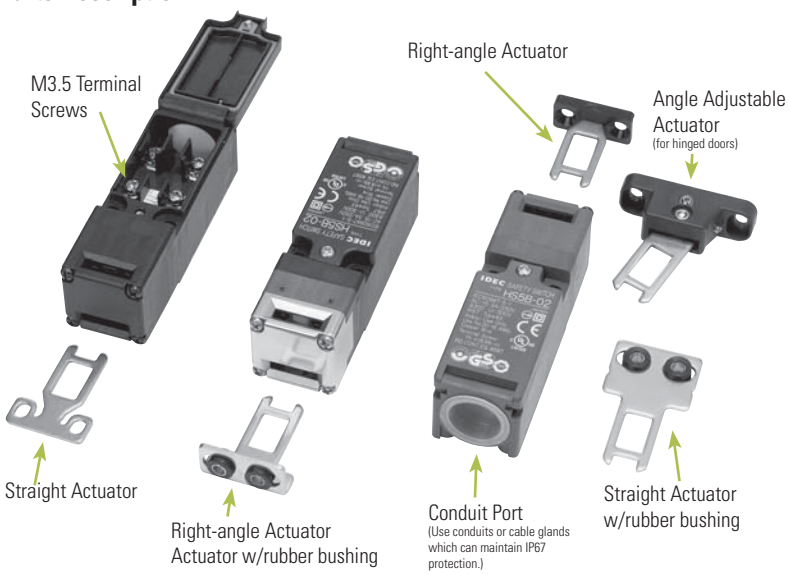
Head Material
blank: Plastic
Z: Metal

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

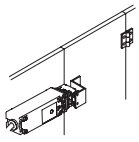
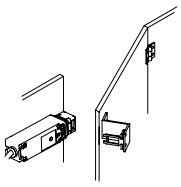
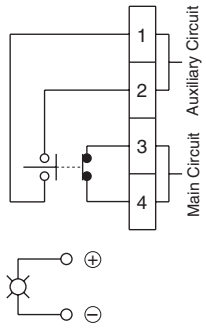
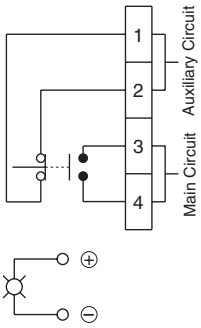
Model	Contact Configuration	Contact Operation Chart	Contact Status
HS5B-11	1NC-1NO Zb 3 4 1 2	Actuator inserted completely Actuator removed completely 3–4 1–2	ON (closed) OFF (open)
HS5B-02	2NC Zb 3 4 1 2	3–4 1–2	

Specifications

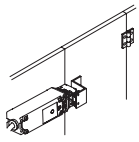
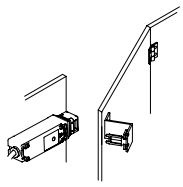
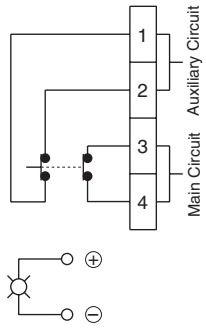
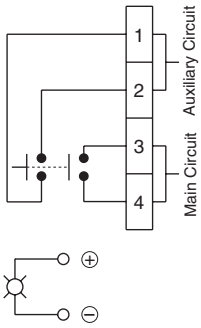
Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508			
Operating Temperature		–20 to +70°C (no freezing)			
Storage Temperature		–40 to +80°C			
Operating Humidity		85% RH maximum (no condensation)			
Altitude		2,000m maximum			
Rated Insulation Voltage (Ui)		300V			
Impulse Withstand 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) Inductive load (AC15)	10A 10A	10A 5A	6A 3A
	DC	Resistive load (DC12) Inductive load (DC13)	8A 4A	2.2A 1.1A	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)

	Status 1	Status 2
Door/ Switch Status	• Door Closed • Machine ready to operate	• 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

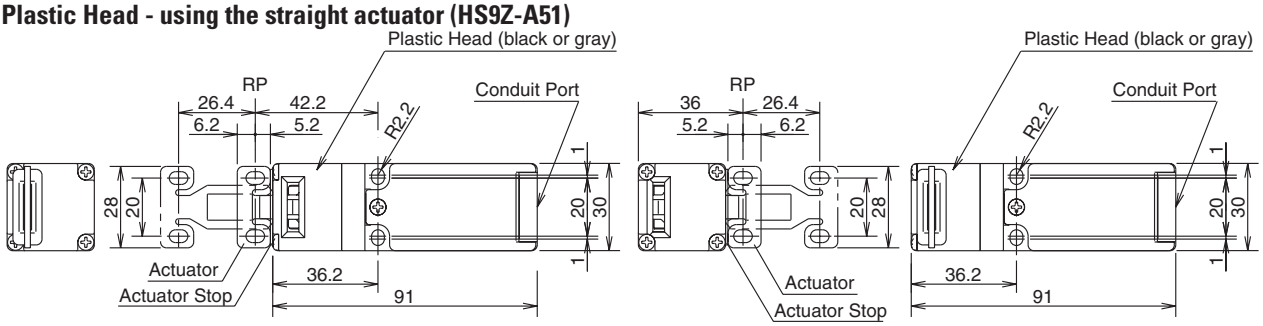
HS5B-02 (2NC)

	Status 1	Status 2
Door/ Switch Status	• Door Closed • Machine ready to operate	• 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

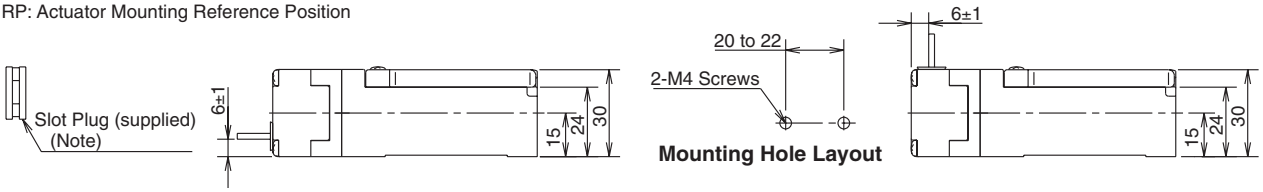
1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.

Dimensions (mm)

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



RP: Actuator Mounting Reference Position

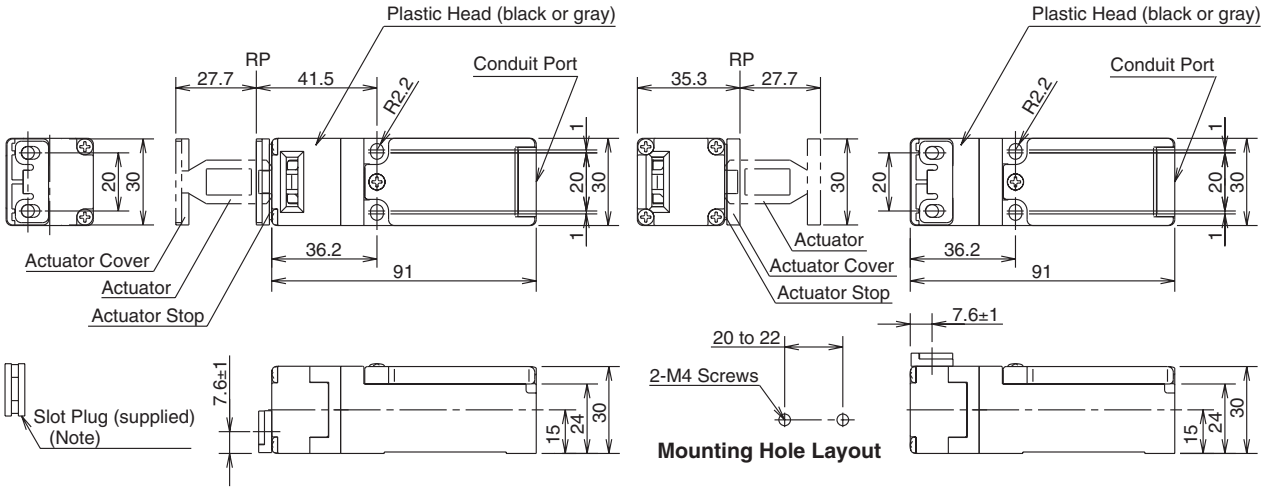


Mounting Hole Layout

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

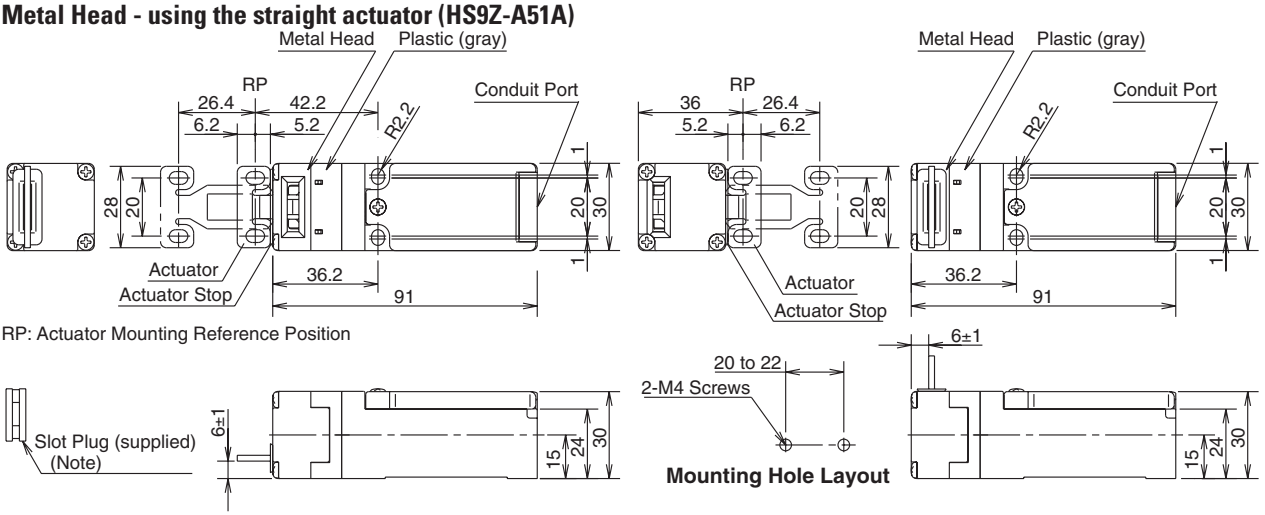
Dimensions (mm), continued

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



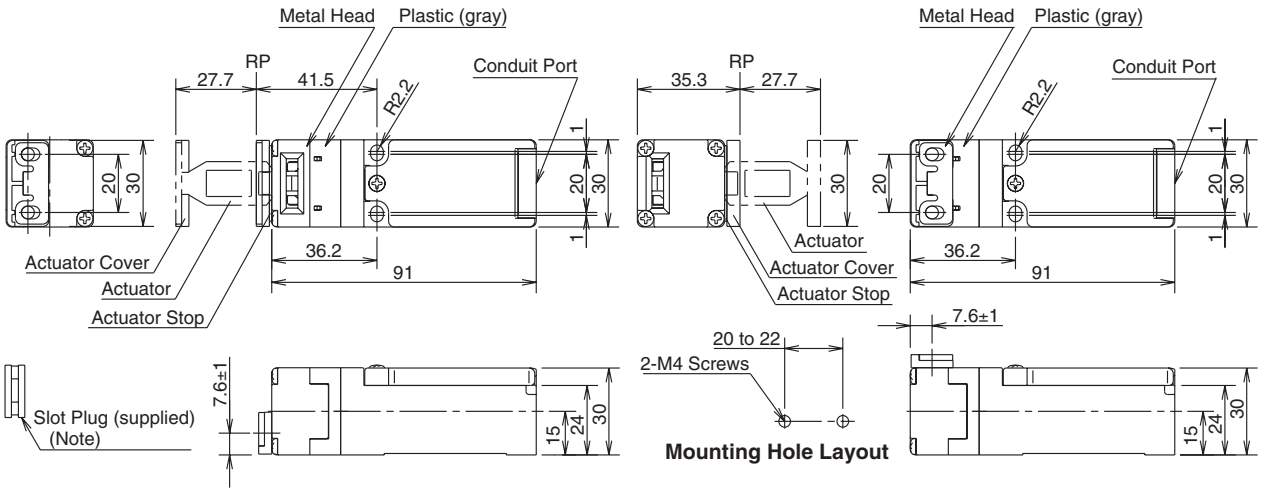
Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.

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



RP: Actuator Mounting Reference Position

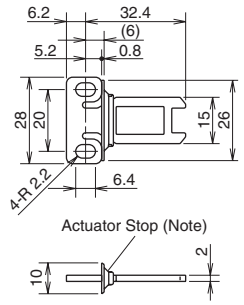
Metal Head – using the Right-angle actuator (HS9Z-A52A)



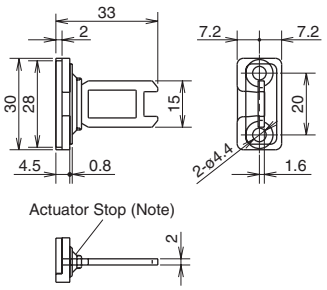
Note: Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Key Dimensions (mm)

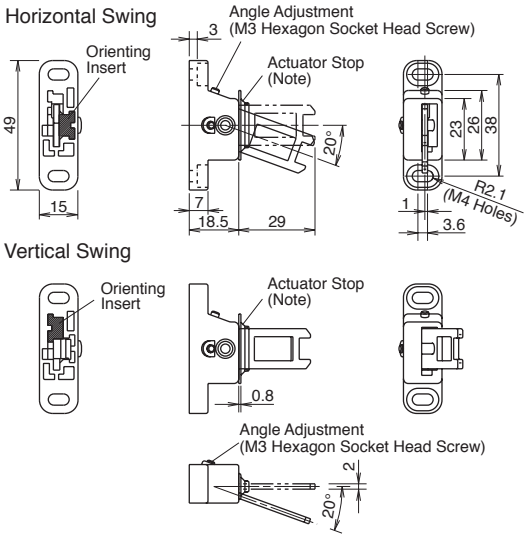
Straight Actuator - HS9Z-A51 (mainly for sliding doors)



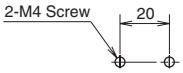
Right-angle Actuator - HS9Z-A52 (mainly for hinged doors)



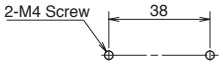
Adjustable Actuator - HS9Z-A55



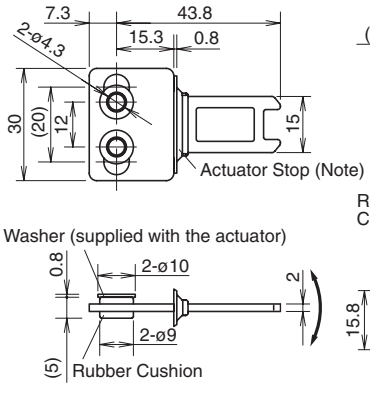
- Actuator Mounting Hole Layout (Straight, Right-angle)



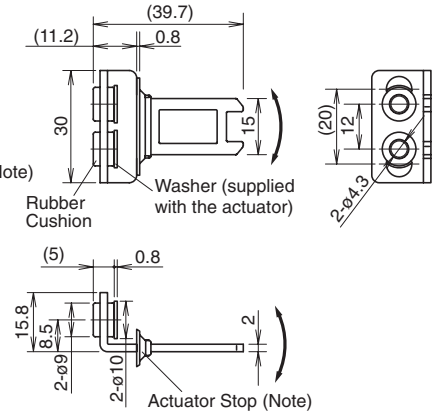
- Actuator Mounting Hole Layout (horizontal/vertical swing)



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



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



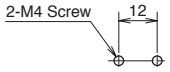
- The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
- The actuator has flexibility to the directions indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

Actuator 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.

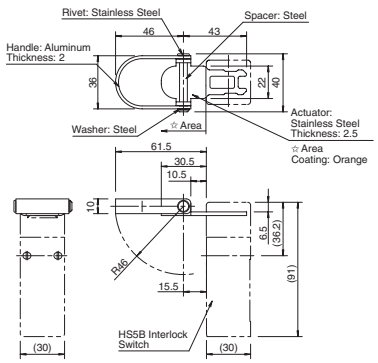
Actuator Mounting Hole Layout (straight with rubber bushing, right-angle with rubber bushing)



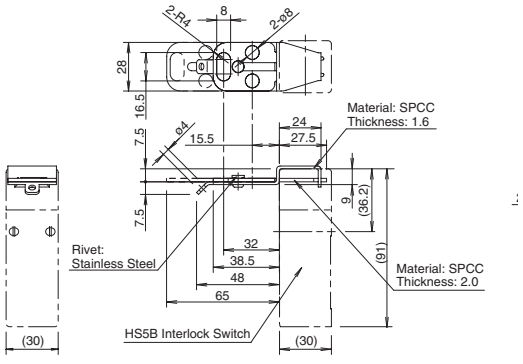
Mounting centers can be widened to 20 mm by moving the rubber cushions.

Accessory Dimensions (mm)

HS9Z-A5P

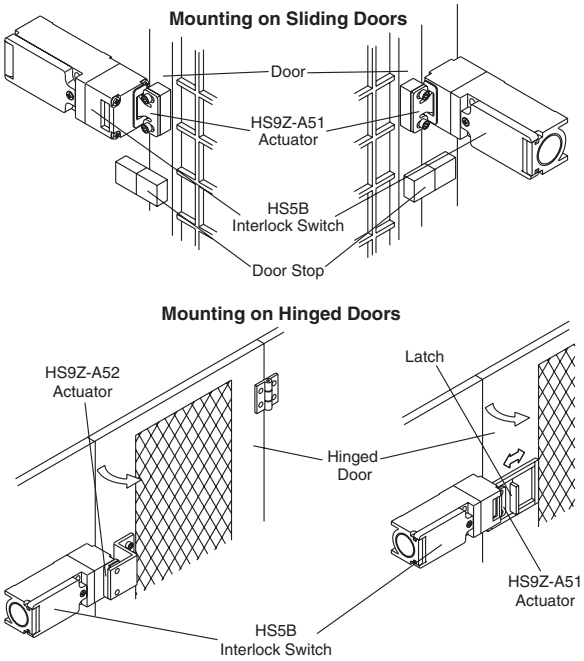


HS9Z-PH5



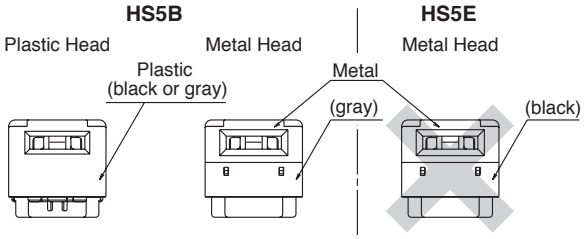
Mounting Examples

Mount the interlock switch as shown in the examples below.



Mounting the HS5B Head

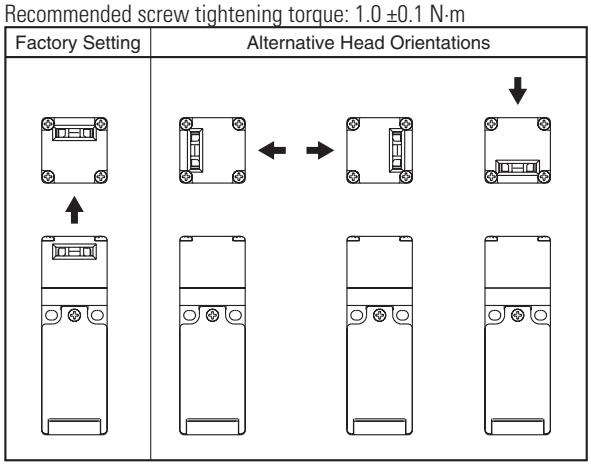
The metal head for the HS5E interlock switch cannot be used on the HS5B. Be sure to use the plastic head or metal head for the HS5B. Take care particularly when using both HS5B and HS5E together.



Rotating the Head

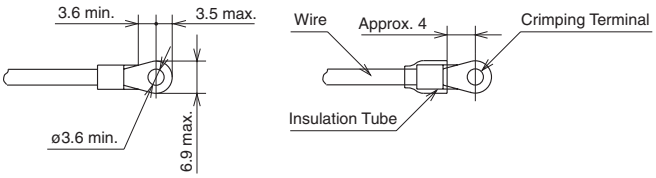
The head of the HS5B can be rotated by removing the four screws from the corners of the HS5B head and reinstalling the head in the desired orientation. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws. If the screws are loose it may cause the 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 mm^2 (AWG20 to AWG16)

Recommended Tightening Torque of Mounting Screws

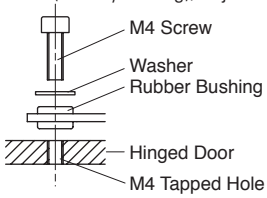
- Interlock Switch: 2.0 ± 0.2 N·m (two M4 screws) *
- Actuator Keys
  -HS9Z-A51: 2.0 ± 0.2 N·m (two M4 screws) *
  -HS9Z-A52: 1.0 ± 0.2 N·m (two M4 Phillips screws)
  -HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws) *
  -HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws) *

*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

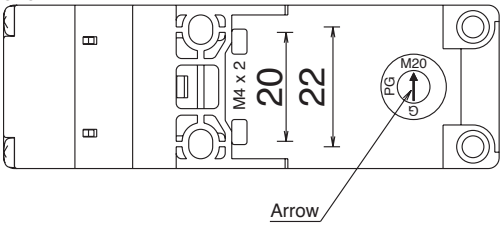
12 mm (factory setting), adjustable to 20 mm



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.

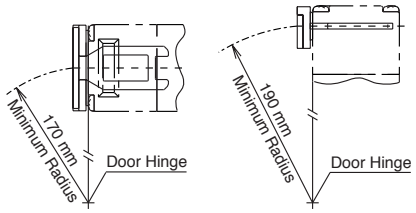
Minimum Radius of Hinged Door

- 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).

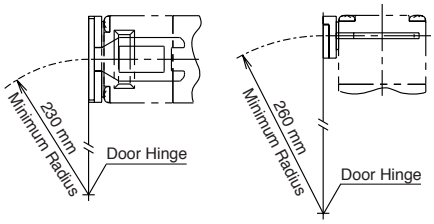
  Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

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



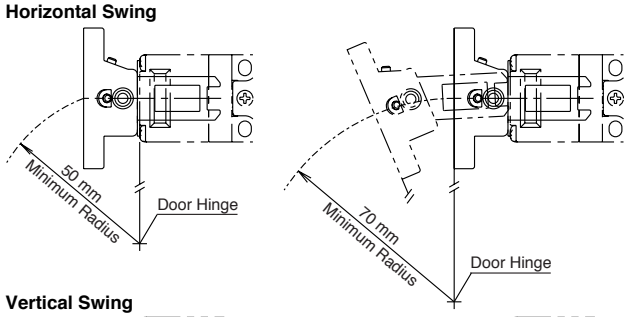
- When door hinge is on the extension line of the actuator mounting surface:



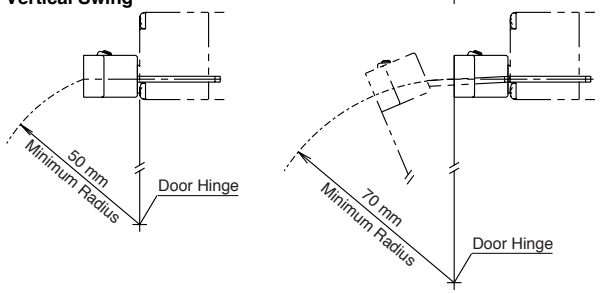
When using the HS9Z-A55 Angle Adjustable Actuator

- 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

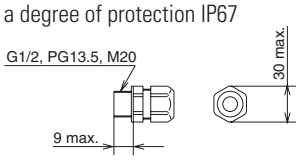


Actuator Angle Adjustment for the HS9Z-A55

- 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.

HS2B Series Full Size Interlock Switch

HS2B features:

- Direct Opening Action: If the door is forced open, the contacts are disconnected even if they are welded or stuck
- Available with or without an indicator (red or green)
- Flexible Installation: Two actuator entries and three conduit ports are provided
- 1NC-1NO contacts
- Compact and lightweight plastic housing
- Degree of Contact Protection: IP67

EN1088
EN60947-5-1
IEC60947-5-1

GS-ET-15
BG standard in Germany

Direct Opening Action

Double Insulation

Part Numbers

Body

Model	Contact Configuration	Pilot Light	Part Number
 HS2B (plastic housing)	1NC-1NO	Without	HS2B-11NB
		With red LED	HS2B-114NB-R
		With green LED	HS2B-114NB-G

Order the actuators separately (not supplied with the switch).

Part Number Key

HS2B - 11 4 N B - R

Indicator Color
R (Red),
G (Green)

Indicator Rated Voltage
4 (24V DC)
Blank (without indicator)

Not necessary to specify color if indicator option not chosen.

Actuator Keys & Accessories

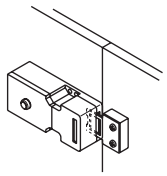
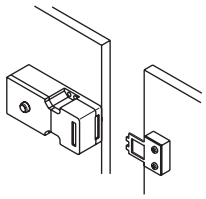
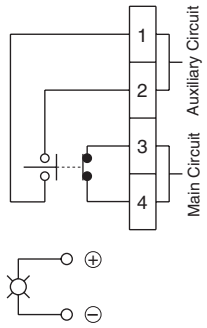
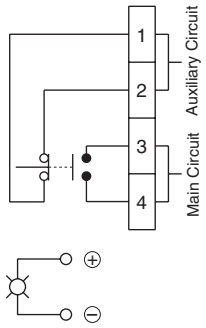
Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator
	HS9Z-P1	Conduit Opening Plug

Specifications

Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508			
Operating Temperature		–25 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 (between LED and ground: 60V)			
Impulse Withstand Voltage (Uimp)		4 kV (between LED and ground: 2.5 kV)			
Insulation Resistance		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 Class		Class II (IEC61140)			
Pollution Degree		3 (IEC60947-5-1)			
Degree of Protection		IP67 (IEC60529)			
Vibration Resistance	**Operating Extremes**	10 to 55 Hz, amplitude 0.5mm			
	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		11 mm minimum			
Positive Opening Force		36N 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)			
Indicator	**Operating Voltage**	24V DC			
	Current	10 mA			
	Light Source	LED lamp			
	Lens Color	Red or Green (12 mm dia. Lens)			
Weight		Approx. 130g			

Application Examples and Circuit Diagrams

HS2B

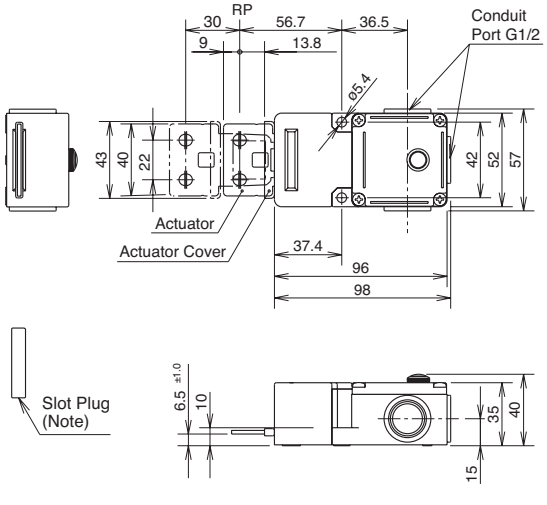
	Status 1	Status 2
Door/ Switch Status	• Door Closed • Machine ready to operate	• Door opened • Machine cannot be started
Door		
HS2B-11 (1NO-1NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

1. Main Circuit: used to enable the machine to start only when the main circuit is closed. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
2. Terminals + and - are used for the LED indicator, and are isolated from door status.

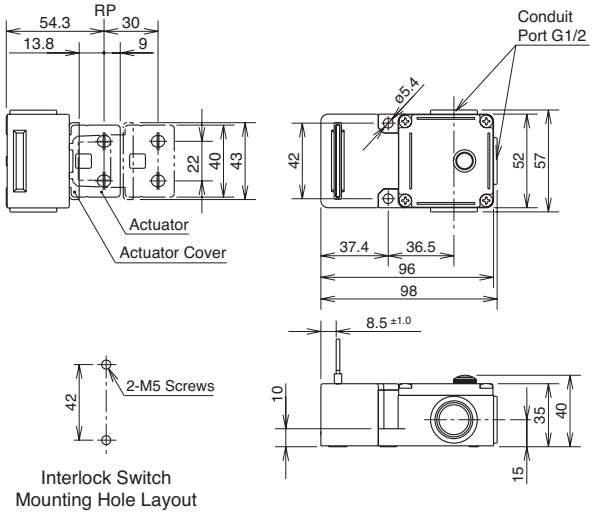
Dimensions (mm)

HS2B - using the straight actuator (HS9Z-A1)

(Horizontal Mounting)



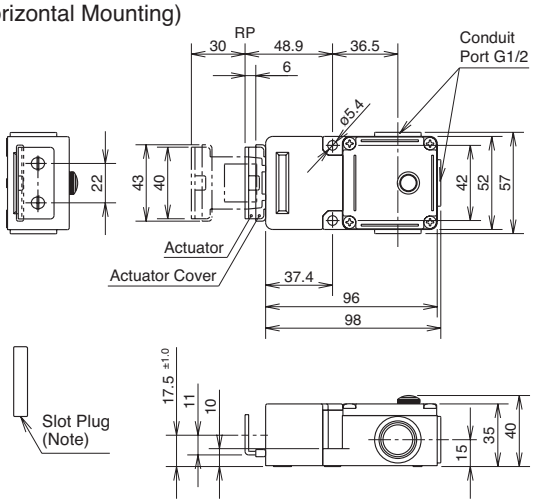
(Vertical Mounting)



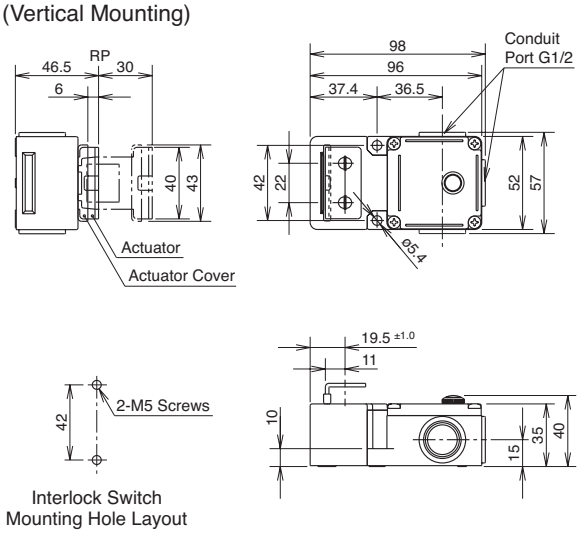
Dimensions (mm), continued

HS2B - using the Right-angle actuator (HS9Z-A2)

(Horizontal Mounting)



(Vertical Mounting)

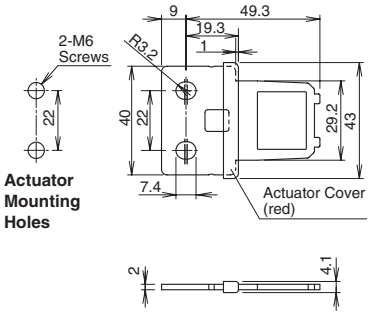


Interlock Switch
Mounting Hole Layout

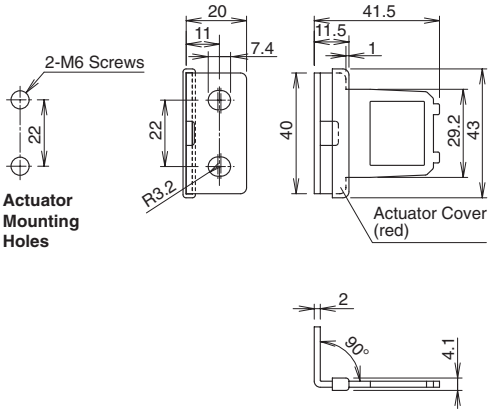
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

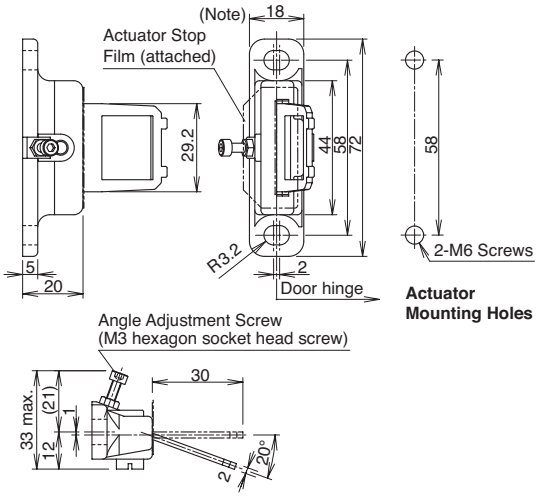
Straight Actuator HS9Z-A1



Right-angle Actuator HS9Z-A2



Angle-adjustable Actuator HS9Z-A3



Adjustable Actuator

The actuator angle is adjustable (0˚ to 20˚) for hinged doors.

The minimum radius of the door opening can be as small as 100mm.

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.

HS1B Series Full Size Interlock Switch

HS1B features:

- Rugged aluminum die-cast housing
- Direct Opening Action: If the door is forced open, the contacts are disconnected even if they are welded or stuck
- Available with or without an indicator (red or green)
- Flexible Installation: Two actuator entries and three conduit ports are provided
- Select from two circuit configurations (1NO-1NC or 2NC).
- Degree of Contact Protection: IP67

EN1088
EN60947-5-1
IEC60947-5-1

GS-ET-15
BG standard in Germany

Direct Opening Action

Part Numbers

Body

Model	Contact Configuration	Pilot Light	Part Number
HS1B (alum. die-cast housing) 	1NC-1NO	Without	HS1B-11R
		With red LED	HS1B-114R-R
		With green LED	HS1B-114R-G
	2NC	Without	HS1B-02R
		With red LED	HS1B-024R-R
		With green LED	HS1B-024R-G

1. The special key wrench (HS9Z-T1) for removing the cover and manual unlocking is included with the switch.
2. Order the actuators separately (not supplied with the switch).

Part Number Key

HS1B - 02 4 R - R

- **Indicator Color**: R (Red), G (Green)
- **Housing Color**: R (Red)
- **Indicator Rated Voltage**: 4 (24V DC), Blank (without indicator)
- **Circuit Configuration**: 11: 1NO-1NC, 02: 2NC

Not necessary to specify color if indicator option not chosen.

Actuator Keys and Accessories

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug

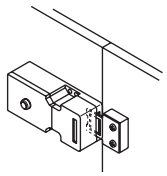
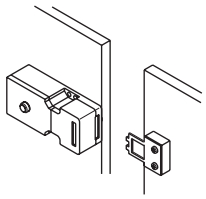
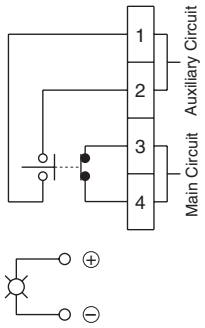
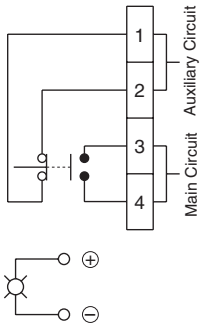
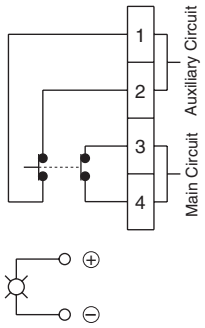
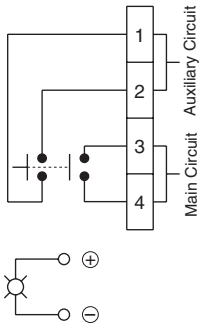
*Torx is a registered trademark of Camcar Textron.

Specifications

Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508			
Operating Temperature		–25 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 (between LED and ground: 60V)			
Impulse Withstand Voltage (Uimp)		4 kV (between LED and ground: 2.5 kV)			
Insulation Resistance		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 Class		Class I (IEC61140)			
Pollution Degree		3 (IEC60947-5-1)			
Degree of Protection		IP67 (IEC60529)			
Vibration Resistance	**Operating Extremes**	10 to 55 Hz, amplitude 0.5mm p-p			
	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		11 mm minimum			
Positive Opening Force		20N 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)			
Indicator	**Operating Voltage**	24V DC			
	Current	10 mA			
	Light Source	LED lamp			
	Lens Color	Red or Green (12 mm dia. Lens)			
Weight		Approx. 280g			

Application Examples and Circuit Diagrams

HS1B

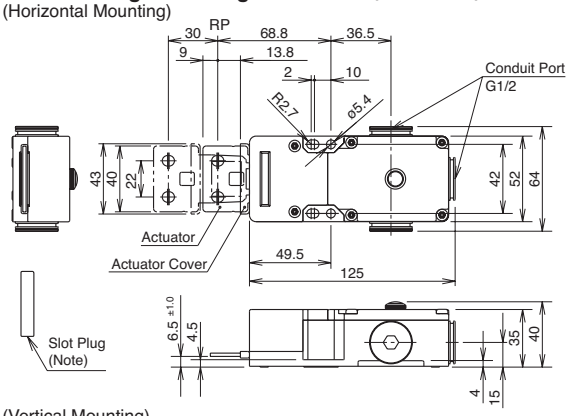
	Status 1	Status 2
Door/ Switch Status	• Door Closed • Machine ready to operate	• Door opened • Machine cannot be started
Door		
HS1B-11 (1NO-1NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed
HS1B-02 (2NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
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. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
2. Terminals + and - are used for the LED indicator, and are isolated from door status. Wire the terminals only when needed.

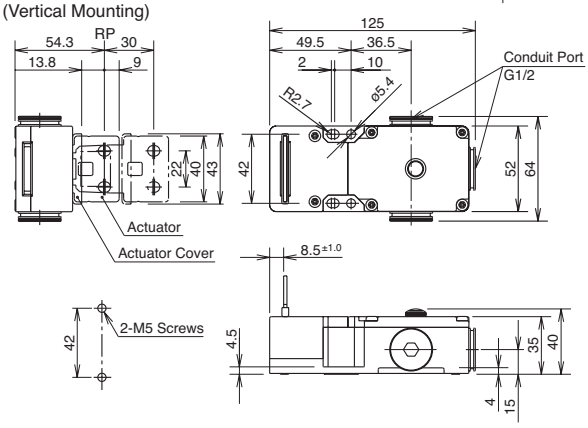
Dimensions (mm)

HS1B - using the straight actuator (HS9Z-A1)

(Horizontal Mounting)

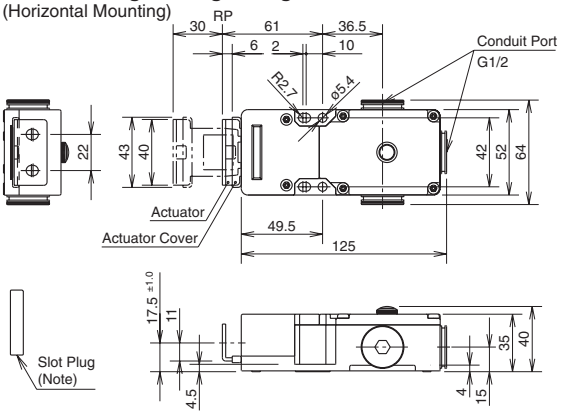


(Vertical Mounting)

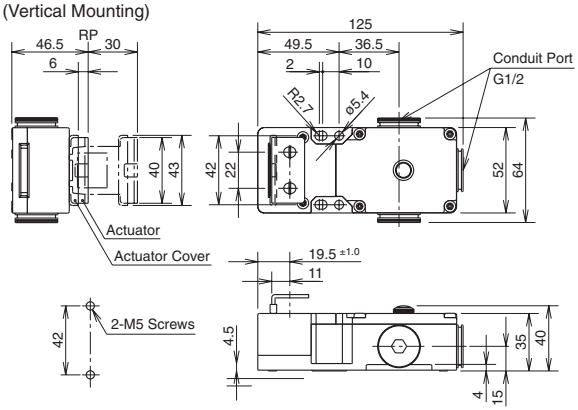


HS1B - using the Right-angle actuator (HS9Z-A2)

(Horizontal Mounting)



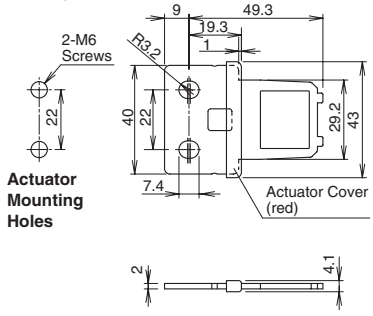
(Vertical Mounting)



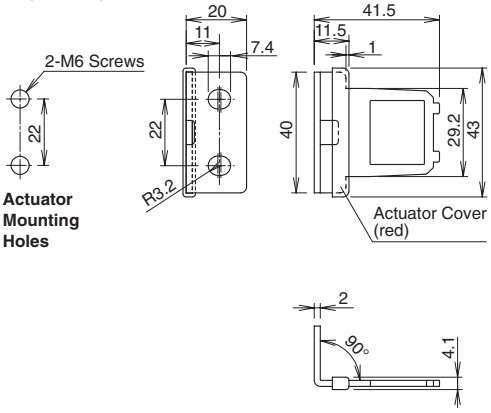
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

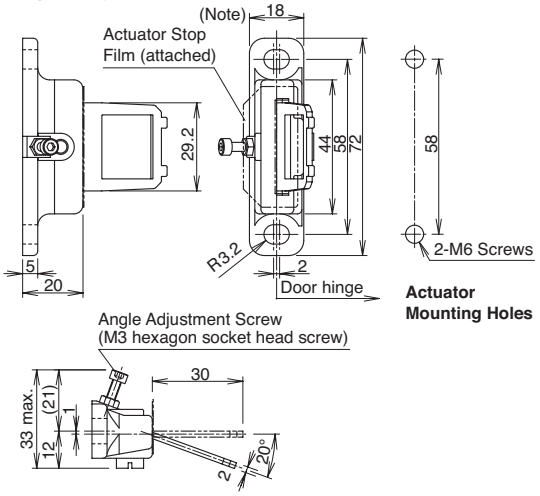
Straight Actuator HS9Z-A1



Right-angle Actuator HS9Z-A2



Angle-adjustable Actuator HS9Z-A3



Adjustable Actuator

The actuator angle is adjustable (0˚ to 20˚) for hinged doors.

The minimum radius of the door opening can be as small as 100mm.

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.

HS6E Subminiature Interlock Switches with Solenoid

HS6E features:

- Compact body: 75 × 15 × 75 mm
  15-mm-wide, thinnest solenoid type interlock switch in the world.
- Reversible mounting and angled cable allow four actuator insertion directions.
- Energy saving. 24V DC, 110 mA (solenoid: 100 mA, LED: 10 mA)
- Manual unlocking possible on three sides.
- RoHS compliant
- LED indicator shows solenoid operation

Spring Lock Type

- Automatically locks the actuator without power applied to the solenoid
- After the machine stops, unlocking is completed by the solenoid
- Manual unlocking is possible on three sides in the event of power failure or maintenance

Solenoid Lock Type

- The actuator is locked when energized.
- The actuator is unlocked when de-energized.
- Flexible locking function can be achieved, for an application where locking is not required and sudden stopping of a machine must be prevented

Direct Opening Action

Double Installation

Part Numbers

Lock Mechanism	Circuit Number	Contact Configuration	Cable Length	Part Number (Standard Stock in bold)
Spring Lock	L	Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NO Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 53 54 Monitor Circuit: 31 32	1m **3m** 5m	HS6E-L44B01-G **HS6E-L44B03-G** HS6E-L44B05-G
	M	Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NC Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 53 52 Monitor Circuit: 31 32	1m **3m** 5m	HS6E-M44B01-G **HS6E-M44B03-G** HS6E-M44B05-G
	N	Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 53 54 Monitor Circuit: 33 34	1m **3m** 5m	HS6E-N44B01-G **HS6E-N44B03-G** HS6E-N44B05-G
	P	Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NC Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 51 52 Monitor Circuit: 33 34	1m **3m** 5m	HS6E-P44B01-G **HS6E-P44B03-G** HS6E-P44B05-G

(Actuator inserted) (Solenoid OFF) (+) A2 (–) A1

The contact configurations show the contact status when the actuator is inserted and locked.
LED color is G (green) only.
Actuator keys are not supplied with the interlock switch and must be ordered separately.

Part Number Key

HS6E - L 4 4 B 01 - G

- **Indicator Color**: G (Green)
- **Cable Length**: 01: 1m, 03: 3m, 05: 5m
- **Housing Color**: B (Black)
- **Indicator Rated Voltage**: 4 (24V DC), Blank (without indicator)
- **Solenoid Unit Voltage/ Lock Mechanism**: 4: Spring Lock, 7Y: Solenoid Lock
- **Circuit Code**

Main Circuit	Door Monitor Circuit	Lock Monitor Circuit
L: 1NC + 1NC	2NC	1NO
M: 1NC + 1NC	2NC	1NC
N: 1NC + 1NC	1NC, 1NO	1NO
P: 1NC + 1NC	1NC, 1NO	1NC

Lock Mechanism	Circuit Number	Contact Configuration	Cable Length	Part Number (Standard Stock in bold)
Solenoid Lock	L	Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NO (Actuator inserted) (Solenoid ON) (+) A2 (–) A1 Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 53 54 Monitor Circuit: 31 32	1m **3m** 5m	HS6E-L7Y4B01-G **HS6E-L7Y4B03-G** HS6E-L7Y4B05-G
	M	Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NC Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 51 52 Monitor Circuit: 31 32	1m **3m** 5m	HS6E-M7Y4B01-G **HS6E-M7Y4B03-G** HS6E-M7Y4B05-G
	N	Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 53 54 Monitor Circuit: 33 34	1m **3m** 5m	HS6E-N7Y4B01-G **HS6E-N7Y4B03-G** HS6E-N7Y4B05-G
	P	Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1N0/1NC Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 51 52 Monitor Circuit: 33 34	1m **3m** 5m	HS6E-P7Y4B01-G **HS6E-P7Y4B03-G** HS6E-P7Y4B05-G

The contact configurations show the contact status when the actuator is inserted and locked.
LED color is G (green) only.
Actuator keys are not supplied with the interlock switch and must be ordered separately.

Actuator Keys

Appearance	Item	Ordering Part Number	Remarks
	Straight Actuator	HS9Z-A61	The retention force of HS9Z-A61 actuator is 500N maximum. Do not apply excessive load.
	Right-angle Actuator	HS9Z-A62	The retention force of HS9Z-A62 actuator is 100N maximum. Do not apply excessive load. When retention force of 100N or more is required, use the HS9Z-A62S actuator.
	Right-angle Actuator with Mounting Plate	HS9Z-A62S	The retention force of HS9Z-A62S actuator is 500N maximum. Do not apply excessive load.
	Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A65	The HS9Z-A65 and HS9Z-A66 have their metal actuator installed in opposite directions. Select actuator by determining the required moving direction in consideration of the door and interlock switch. See pages 370 and 373 for more information. The retention force of HS9Z-A65 and HS9Z-A66 500N maximum.
	Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A66	

Accessory

Description	Part Number
Manual Unlock Key (long type)	HS9Z-T3

Specifications

Conforming to Standards		UL 508 (UL listed), CSA C22.2, No. 14 (c-UL listed), ISO 14119 IEC 60947-5-1, EN 60947-5-1 (TÜV approval), EN 1088 (TÜV approval), GS-ET-19 IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature		–25 to +50°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Operating Humidity		45 to 85% (no condensation)
Rated Insulation Voltage (Ui)		300V (between LED and ground: 60V)
Impulse Withstand Voltage (Uimp)		Main & lock monitor circuits: 1.5 KV Door monitor circuit: 2.5 kV Between solenoid/LED and ground: 0.5 kV
Insulation Resistance (500V DC megger)		Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum.
Contact Resistance		300 mΩ maximum (initial value, 1m cable) 500 mΩ maximum (initial value, 3m cable) 700 mΩ maximum (initial value, 5m cable)
Electric Shock Protection Class		Class II (IEC 61140)
Pollution Degree		3
Degree of Protection		IP67 (IEC 60529)
Vibration Resistance	**Operating Extremes**	10 to 55 Hz, amplitude 0.35mm
	Damage Limits	30 Hz, amplitude 1.5 mm
Shock Resistance	**Operating Extremes**	100 m/s^2 (10G)
	Damage Limits	1000 m/s^2 (100G)
Actuator Operating Speed		0.05 to 1.0 m/s
Direct Opening Travel		8.0 mm minimum
Direct Opening Force		60N minimum
Actuator Retention Force		500N maximum (GS-ET-19)
Operating Frequency		900 operations/hour
Mechanical Life		1,000,000 operations minimum (GS-ET-19)
Electrical Life		100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA) (operating frequency 900 operations/hr)
Conditional Short-circuit Current		50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)
Cable		UL2464, No. 22 AWG (12-core: 0.3 mm^2 or equivalent/core)
Cable Diameter		ø7.6 mm
Weight		Approx. 200g

Solenoid/Indicator

Locking Mechanism		Spring Lock Type or Solenoid Lock Type
Rated Voltage		24V DC
Current		110 mA (solenoid 100 mA, LED 10 mA)
Solenoid	**Coil Resistance**	240Ω (at 20°C)
	Pickup Voltage	Rated voltage × 85% maximum (at 20°C)
	Dropout Voltage	Rated voltage × 10% minimum (at 20°C)
	Maximum Continuous Applicable Voltage	Rated voltage × 110%
	Maximum Continuous Applicable Time	Continuous
	Insulation Class	Class F
Indicator	**Light Source**	LED
	Illumination Color	Green

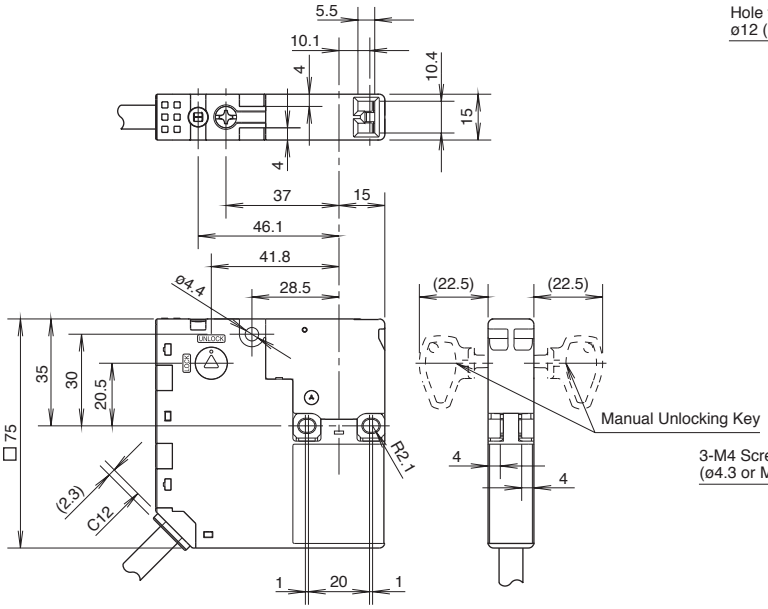
Contact Ratings

Rated Insulation Voltage (Ui)			300V (door monitor contact) 150V (lock monitor contact) 30V (between LED or solenoid and ground)			
Rated Thermal Current (Ith)	Operating temperature (–25 to 35°C)		2.5A (up to 2 circuits) 1.0A (3 or more circuits)			
	Operating temperature (35 to 50°C)		1.0A (1 circuit) 0.5A (2 or more circuits)			
Rated Operating Current (Ie)	Operating Voltage (Ue)			30V	125V	250V
	Main and Lock Monitor Circuits	AC	Resistive load (AC12) Inductive load (AC15)	–	2A 1A	–
		DC	Resistive load (DC12) Inductive load (DC13)	2A 1A	0.4A 0.22A	–
	Door Monitor Circuit	AC	Resistive load (AC12) Inductive load (AC15)	–	2.5A 1.5A	1.5A 0.75A
		DC	Resistive load (DC12) Inductive load (DC13)	2.5A 2.3A	1.1A 0.55A	0.55A 0.27A

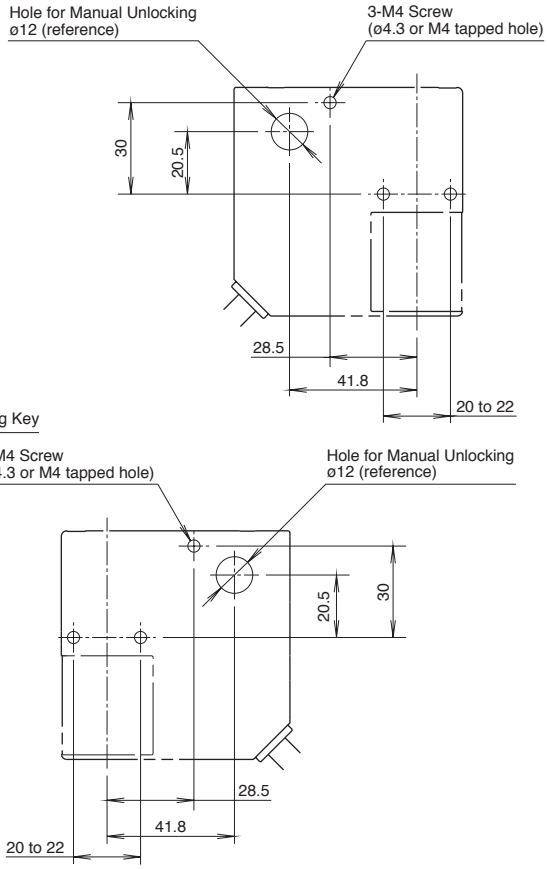
Minimum applicable load (reference value): 3V AC/DC, 5 mA
UL, c-UL rating
Main/Lock monitor circuit:125V AC, 1A Pilot duty
125V DC, 0.22A Pilot duty
Door monitor circuit:240V AC, 0.75A Pilot duty
250V DC, 0.27A Pilot duty
TÜV rating
Main/Lock monitor circuit: AC-15 125V/1A, DC-13 125V/0.22A
Door monitor circuit: AC-15 240V/0.75A, DC-13 250V/0.27A

Dimensions

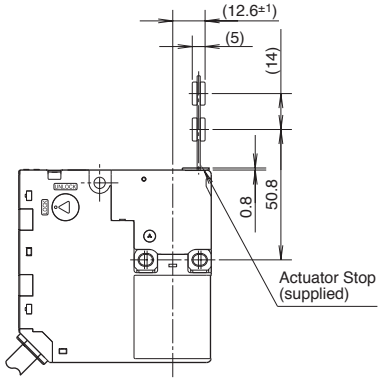
Interlock Switch



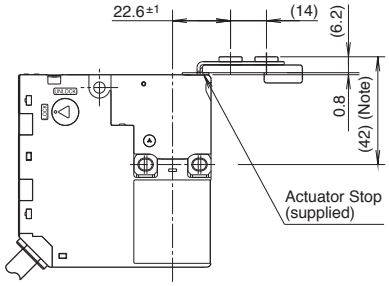
Mounting Hole Layout



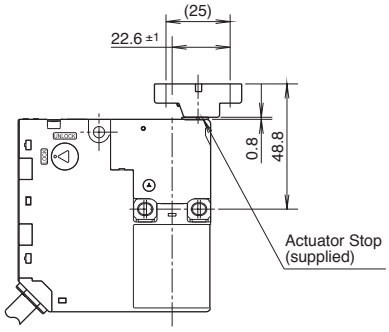
When using straight actuator (HS9Z-A61)



When using right-angle actuator (HS9Z-A62)



When using horizontal/vertical angle adjustable actuator (HS9Z-A65/A66)

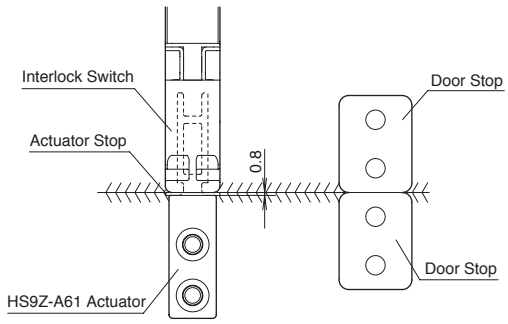


Actuator Mounting Reference Position

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

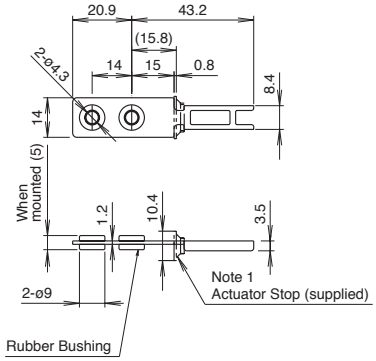
The actuator stop on the actuator lightly touches the interlock switch.

After mounting the actuator, remove the actuator stop from the actuator.



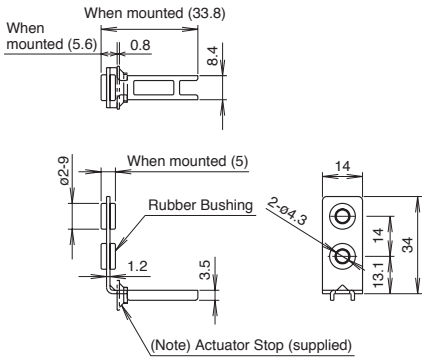
Actuator Key Dimensions (mm)

Straight Actuator (HS9Z-A61)



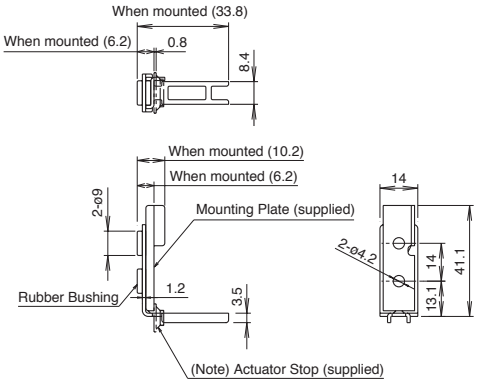
Straight Actuator (HS9Z-A61) Right-angle Actuator (HS9Z-A62)

The retention force of the HS9Z-A62 actuator is 100N. When tensile force exceeding 100N is expected, use the HS9Z-A62S actuator.



Right-angle Actuator with Mounting Plate (HS9Z-A62S)

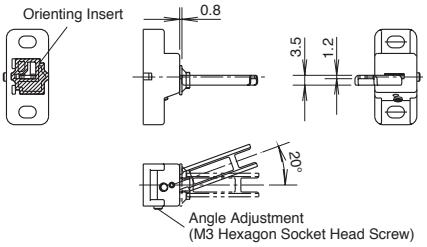
Note: See page 373 for actuator installation.



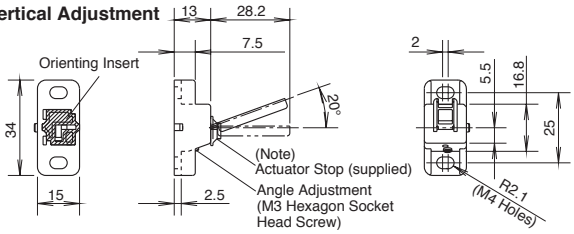
The actuator stop is used to adjust the actuator position. Remove after the actuator position is mounted.

Angle Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment



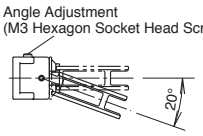
Vertical Adjustment



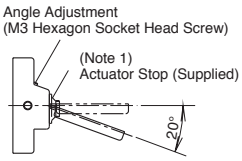
Angle Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment

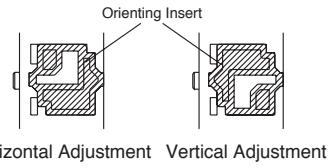


Vertical Adjustment

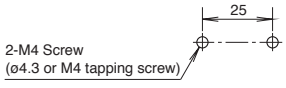


Actuator Adjustment Orientation

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

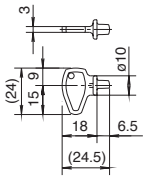


Angle Adjustable Actuator (HS9Z-A65)

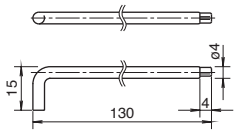


Manual Unlock Key (plastic)

(supplied with switch, not replaceable)



Manual Unlock Key, HS9Z-T3 (metal)

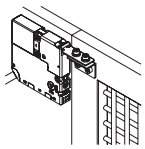
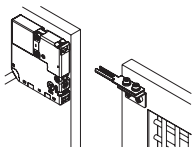
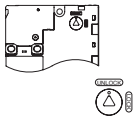
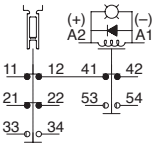
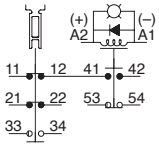
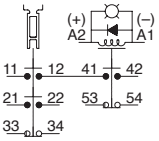
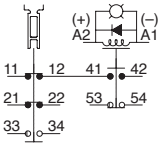


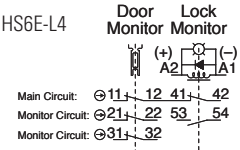
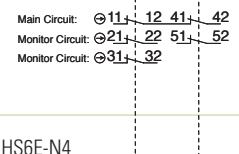
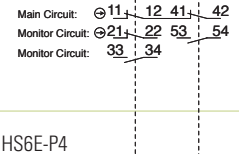
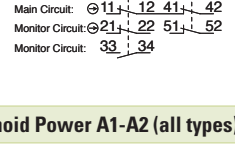
Accessory

Description	Part Number
Manual Unlock Key (long type)	HS9Z-T3

Circuit Diagrams and Operating Characteristics

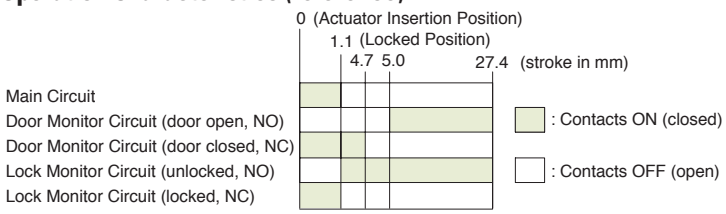
Spring Lock Type

	Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status	• Door closed • **Machine ready to operate** • Solenoid de-energized	• Door opened • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid de-energized	• Door closed • Machine cannot be operated • Solenoid de-energized
Door Status					
Circuit Diagram (Example: HS6E-N4)					

Door			Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Part Number and Circuit Diagram	HS6E-L4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	HS6E-M4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	HS6E-N4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	HS6E-P4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)			**OFF (de-energized)**	**ON (energized)**	**ON (energized)**	**OFF (de-energized)**	**OFF (de-energized)**

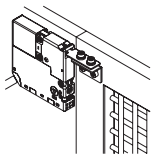
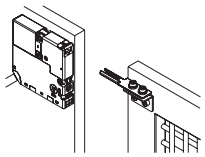
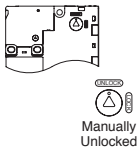
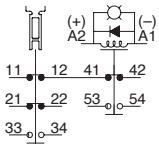
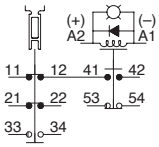
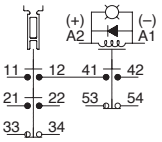
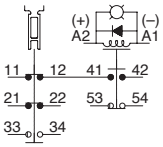
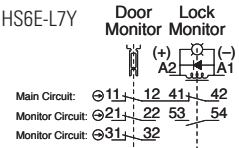
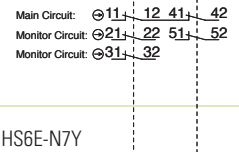
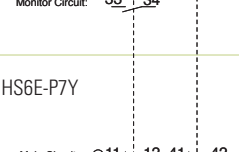
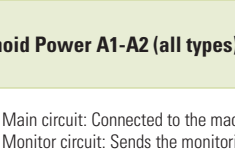
Main circuit: Connected to the machine drive control circuit, sending the interlock signals of the protective door.
Monitor circuit: Sends the monitoring signals of open/closed and lock/unlocked statuses of the protective door.

Operation Characteristics (reference)



The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

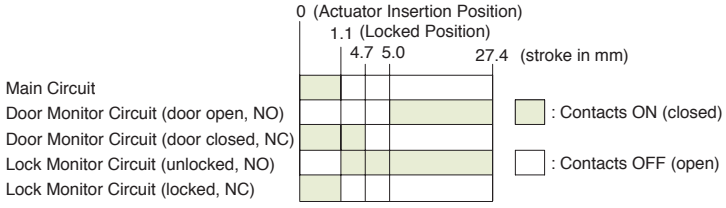
Solenoid Lock Type

	Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status	• Door closed • **Machine ready to operate** • Solenoid energized	• Door closed • Machine cannot be operated • Solenoid de-energized	• Door open • Machine cannot be operated • Solenoid de-energized	• Door open • Machine cannot be operated • Solenoid de-energized	• Door open • Machine cannot be operated • Solenoid de-energized
Door Status					
Circuit Diagram (Example: HS6E-N7Y)					
Door	**Closed (locked)**	**Closed (unlocked)**	**Open**	**Open**	**Closed (unlocked)**
Part Number and Circuit Diagram					
HS6E-L7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-M7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS6E-N7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-P7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	**ON (energized)**	**OFF (de-energized)**	**OFF (de-energized)**	**ON (energized) (Note 2)**	OFF (de-energized) to ON (re-energized) (Note 1) (Note 2)

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

Note 1: Do not attempt manual unlocking while the solenoid is energized.
Note 2: Do not energize the solenoid for a long period of time while the door is open or while the door is unlocked manually using the manual unlock key.

Operation Characteristics (reference)



The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

Operating Instructions

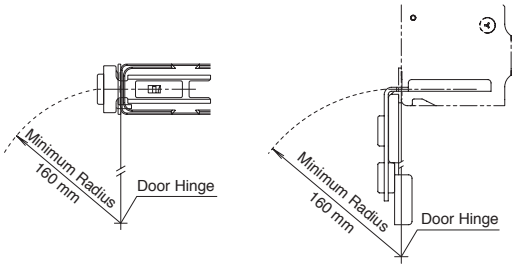
Minimum Radius of Hinged Door

- 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-A65 and HS9Z-A66).

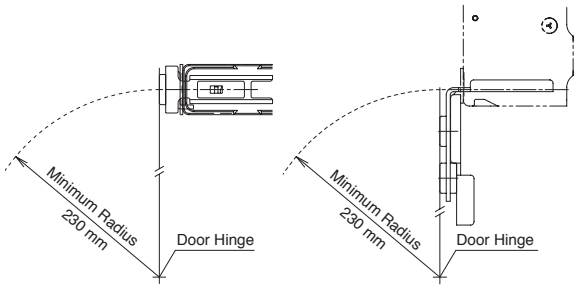
  Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When Using the HS9Z-A62/A62S Right-angle Actuator

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



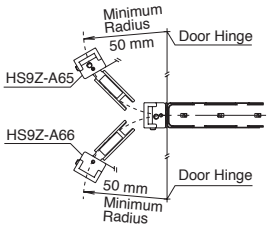
- When door hinge is on the extension line of the actuator mounting surface:



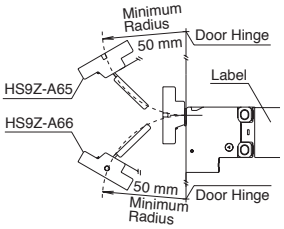
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable Actuator

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

Horizontal Adjustment

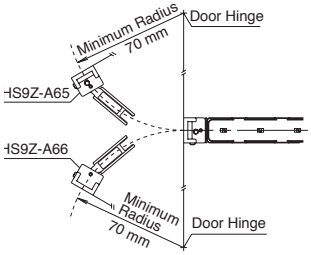


Vertical Adjustment

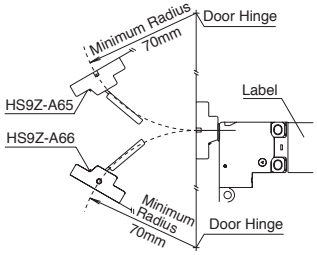


- When door hinge is on the extension line of the actuator mounting surface

Horizontal Adjustment



Vertical Adjustment

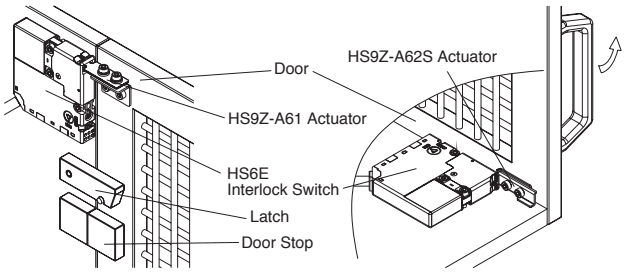


Actuator Angle Adjustment for the HS9Z-A65/HS9Z-A66

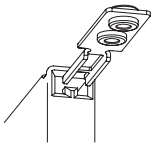
- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).
  Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator 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.

Mounting Examples

Application on Sliding Doors **Application on Hinged Doors**



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



For Manual Unlocking

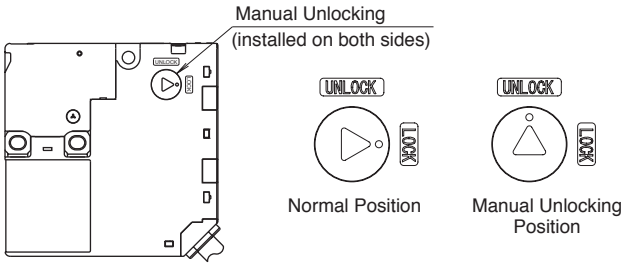
Spring lock type

The HS6E allows manual unlocking of the actuator to pre-check proper door operation before wiring or turning power on, as well as for emergency use such as a power failure.

Solenoid lock type

The HS6E can be unlocked manually in an emergency.

When using the manual unlock key



- When locking or unlocking the interlock switch manually, turn the actuator fully using the manual unlock key supplied with the switch.
- Using the interlock switch with the actuator not fully turned (less than 90°) may cause damage to the interlock switch or operation failures (when manually unlocked, the switch will keep the main circuit disconnected and the door unlocked).
- Do not apply excessive force (0.45 N·m or more) to the manual unlock part, otherwise the manual unlock part will become 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.


Manual Unlock Key
(supplied with the interlock switch)

When unlocking pushing the plate inside the interlock switch

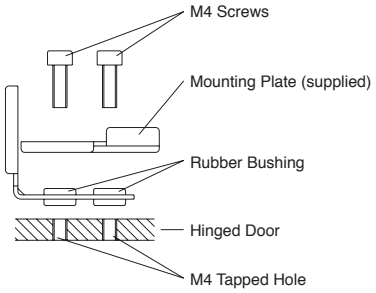
- Remove the screw at the side of the interlock switch (the same side where actuator is inserted) and insert a small screwdriver.
- Push the plate inside the interlock switch toward the LED indicator using a screwdriver until the actuator is unlocked.
- Tighten the screw to a proper torque (0.3 to 0.5 N·m). Do not tighten with excessive force, otherwise the interlock switch will be damaged. Be sure to reinstall the screw, otherwise the waterproof capability will be lost.

Caution

Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of the interlock switch with solenoid is lost. While the solenoid is energized, do not unlock the switch manually (solenoid lock type).

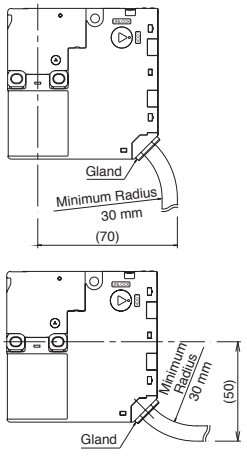
Recommended Tightening Torque of Mounting Screws

- Interlock switch: 1.0 to 1.5 N·m (three M4 screws)
- Actuators: 1.0 to 1.5 N·m (two M4 screws)
- The above recommended tightening torques of the mounting screws are the values 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.
- Mounting bolts are not supplied with the interlock and must be supplied by the user.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator are installed in an unremovable manner, for example using special screws, rivets, or welding the screws.
- When installing the HS9Z-A62S actuator, use the mounting plate (supplied with the actuator) on the hinged door, and secure the actuator tightly using two M4 screws.
- The mounting plate has an orientation.
- Do not lose the mounting plate.



Cables

- Do not fasten or loosen the gland at the bottom of the interlock switch.
- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm minimum.
- When wiring, make sure that water or oil does not enter from the end of the cable.
- Do not open the lid of the interlock switch. Otherwise the interlock switch will be damaged.
- The solenoid has polarity. Make sure of the correct polarity when wiring.



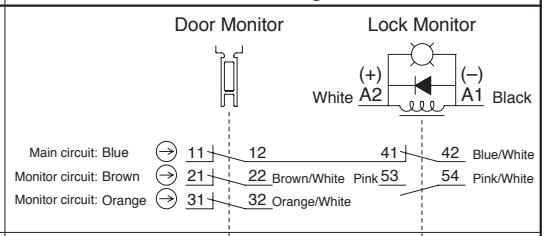
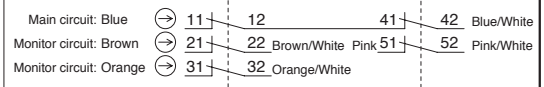
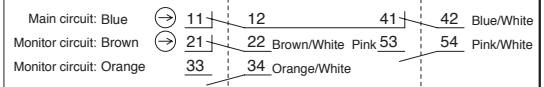
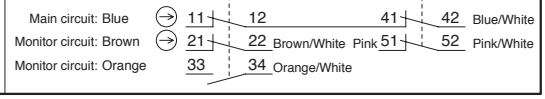
Wire Identification

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

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

Terminal Number Identification

- When wiring, identify the terminal number of each contact by the color of the insulation.
- The following table shows the identification of terminal numbers.
- When wiring, cut unused wires to avoid incorrect wiring.

Type	Contact Arrangement
HS6E-L	
HS6E-M	
HS6E-N	
HS6E-P	

Note: The contact arrangements show the contact status when the actuator is inserted and locked.

HS5E Series Miniature Solenoid Locking Switches

HS5E features:

- World's smallest 4 contact solenoid interlock switch. (35 x 40 x 146 mm)
- Four contacts
- Gold-plated contacts
- Spring lock type (unlocks when the solenoid is energized) and solenoid lock type (locks when solenoid is energized) are available
- Flexible installation - the head can rotate, allowing 8 different actuator entries
- Metal actuator entry slot ensures long life
- Actuator locking strength is 1000N minimum (GS-ET-19)
- Integral molded cable reduces wiring time
- LED pilot light indicates the solenoid status
- RoHS Directive Compliant
- Contacts are IP67 (IEC60529)
- NC contacts are direct opening (IEC/EN60947-5-1)
- Only proprietary actuators can be used, preventing unauthorized access (ISO14119, EN1088)
- Double insulation structure - no grounding required

Spring Lock Type

- Automatically locks the actuator without power to the solenoid
- After the machine stops, unlocking is accomplished by energizing the solenoid, providing a high level of safety
- Manual unlocking is possible in the event of power failure or maintenance

Solenoid Lock Type

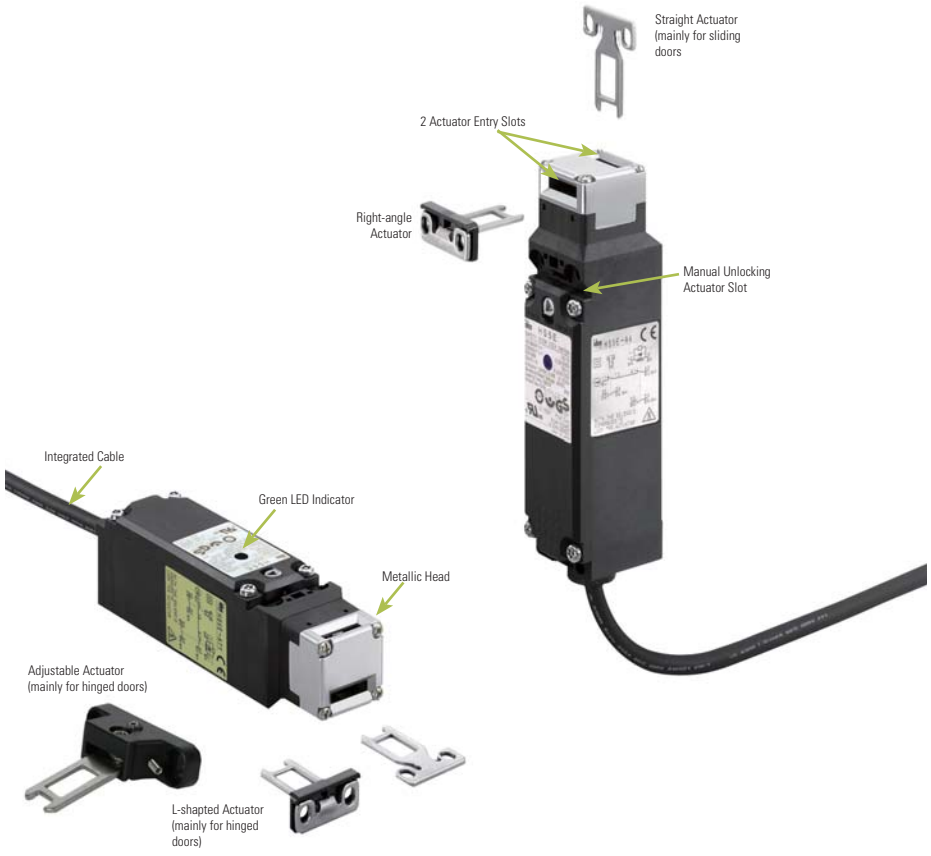
- The actuator is locked when energized
- The actuator is unlocked when de-energized

EN1088
EN60947-5-1
IEC60947-5-1

GS-ET-15
BG standard in Germany

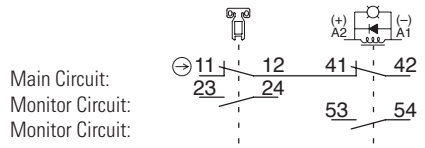
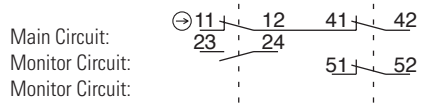
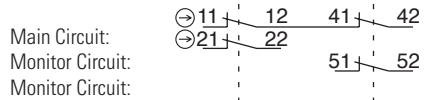
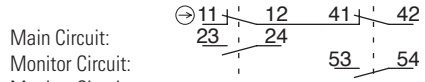
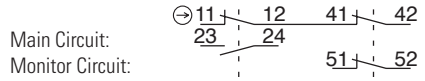
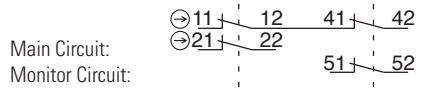
Direct Opening Action

Double Insulation



Part Numbers

Body

Lock Mechanism	Circuit Number	Contact Arrangement	Pilot Light	Cable Length	Part Number
Spring Lock	A	Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO  Main Circuit: 11 12 41 42 Monitor Circuit: 23 24 Monitor Circuit: 53 54	Without	1 m **3m** 5m	HS5E-A4001 **HS5E-A4003** HS5E-A4005
			With	1 m **3m** 5m	HS5E-A4401-G **HS5E-A4403-G** HS5E-A4405-G
	B	Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NC  Main Circuit: 11 12 41 42 Monitor Circuit: 23 24 Monitor Circuit: 51 52	Without	1 m **3m** 5m	HS5E-B4001 **HS5E-B4003** HS5E-B4005
			With	1 m **3m** 5m	HS5E-B4401-G **HS5E-B4403-G** HS5E-B4405-G
	D	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NC  Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 Monitor Circuit: 51 52	Without	1 m **3m** 5m	HS5E-D4001 **HS5E-D4003** HS5E-D4005
			With	1 m **3m** 5m	HS5E-D4401-G **HS5E-D4403-G** HS5E-D4405-G
Solenoid Lock	A	Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO  Main Circuit: 11 12 41 42 Monitor Circuit: 23 24 Monitor Circuit: 53 54	Without	1 m **3m** 5m	HS5E-A7Y001 **HS5E-A7Y003** HS5E-A7Y005
			With	1 m **3m** 5m	HS5E-A7Y401-G **HS5E-A7Y403-G** HS5E-A7Y405-G
	B	Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NC  Main Circuit: 11 12 41 42 Monitor Circuit: 23 24 Monitor Circuit: 51 52	Without	1 m **3m** 5m	HS5E-B7Y001 **HS5E-B7Y003** HS5E-B7Y005
			With	1 m **3m** 5m	HS5E-B7Y401-G **HS5E-B7Y403-G** HS5E-B7Y405-G
	D	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NC  Main Circuit: 11 12 41 42 Monitor Circuit: 21 22 Monitor Circuit: 51 52	Without	1 m **3m** 5m	HS5E-D7Y001 **HS5E-D7Y003** HS5E-D7Y005
			With	1 m **3m** 5m	HS5E-D7Y401-G **HS5E-D7Y403-G** HS5E-D7Y405-G

Contact configuration shows the contact status when actuator is inserted and solenoid off for for spring lock or solenoid on for solenoid lock.

Actuator Keys

Item	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A52	Right-angle
	HS9Z-A55	Horizontal/vertical operation (for hinged doors) (see note below)

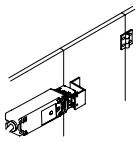
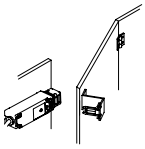
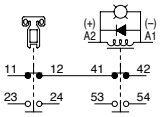
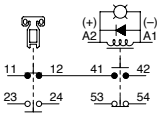
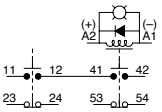
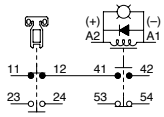
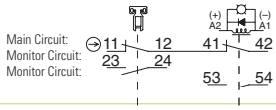
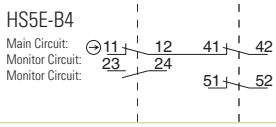
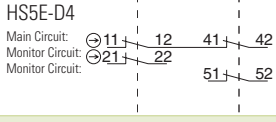
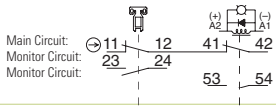
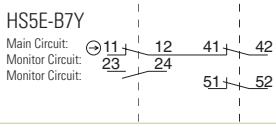
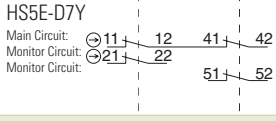
The actuator tensile strength is 500N minimum.

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

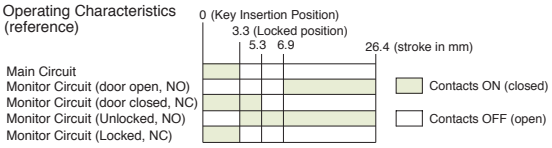
Part Number	Description
HS9Z-SP51	Mounting Plate
HS9Z-T3	Manual unlock key (long type)

Circuit Diagrams

		Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status		• Door closed • **Machine ready to operate** • Solenoid de-energized	• Door opened • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid energized	• Door open • Machine cannot be operated • Solenoid de-energized	• Door closed • Machine cannot be operated • Solenoid de-energized
Door Status						
Circuit Diagram (Example: HS5E-A4)						
Door		**Closed (locked)**	**Closed (unlocked)**	**Open**	**Open**	**Closed (unlocked)**
Spring Lock Type Safety Switch	HS5E-A4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	HS5E-B4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Monitor Circuit (unlocked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	HS5E-D4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Monitor Circuit (unlocked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)			OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)
Door			**Closed (locked)**	**Closed (unlocked)**	**Open**	**Open**	**Closed (unlocked)**
Solenoid Lock Safety Switch	HS5E-A7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	HS5E-B7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	HS5E-D7Y 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (door open) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)			ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (note 4)	OFF (de-energized) to ON (energized) (see note 3) (see note 4)

1. Main circuit: Connected to the control circuit of machine drive part, sending the interlock signals to the protective door.
2. Monitor circuit: Sends ON/OFF signals of main circuit and monitoring signals of open/closed status of protective door.
3. Do not attempt manual unlock when energized.
4. Do not energize the solenoid for a prolonged period of time when the door is open and when unlocking the door manually.

Operating Characteristics (reference)



The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

Specifications

Conforming Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (BG approval), UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized)
Application Standards	IEC60204-1/EN60204-1
Operating Temperature	–25 to 50°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Operating Environment	Degree of pollution: 3
Impulse Withstand Voltage	2.5 kV (between LED, solenoid and grounding: 0.5 kV)
Insulation Resistance (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 Class	Class II (IEC61140)
Degree of Protection	IP67 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s^2 (10 G) Damage limits: 1000 m/s^2 (100 G)
Vibration Resistance	Operating extremes: 10 to 55 H, amplitude 0.35 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
Actuator Operating Speed	0.05 to 1.0 m/s
Positive Opening Travel	Actuator HS9Z-A51: 11 mm minimum Actuator HS9Z-A52/A55: 12 mm minimum
Positive Opening Force	80N minimum
Tensile Strength when Locked	1000 N minimum (GS-ET-19)
Operating Frequency	900 operations per hour
Mechanical Life	1,000,000 operations minimum (GS-ET-19)
Electrical Life	100,000 operations minimum (operating frequency 900 operations per hour, rated load AC-12, 250V, 1A)
Conditional Short-circuit Current	50A (250V) (Note: Use 250V/10A fast acting type fuse for short circuit protection.)
Cable	UL2464, No. 21 AWG (8-core: 0.5 mm^2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	400 g (HS5E-***01)

Part Number Key

HS5E - A 4 4 01 - G

- **Pilot Light Color**
  - G (Green)
- **Cable Length**
  - 01: 1m
  - 03: 3m
  - 05: 5m
- **Pilot Light Voltage**
  - 4: 24V DC
  - 0: without pilot light
- **Solenoid Unit Voltage/ Lock Mechanism**
  - 4: 24V DC/Spring Lock
  - 7Y: 24V DC/Solenoid Lock
- **Circuit Code**

Door Monitor Circuit	Lock Monitor Circuit
A: 1NC + 1NC	1NO + 1NO
B: 1NC + 1NC	1NO + 1NC
D: 1NC + 1NC	1NC + 1NC

Specifications

Locking Mechanism	Spring Lock/Solenoid Lock
Rated Voltage	24V DC
Current	266 mA
Coil Resistance	90Ω (at 20°C)
Operating Voltage	Rated voltage x 85% or less (at 20°C)
Return Voltage	Rated voltage x 10% or more (at 20°C)
Maximum Continuous Applying Voltage	Rated voltage x 110%
Maximum Continuous Applying Time	Continuous
Insulation Class	Class F

Pilot Light

Rated Voltage	24V DC
Current	10 mA
Light Source	LED
Light Color	Green

Current Ratings

Rated Insulation Voltage (Ui) (see note 2)			250V (between LED, solenoid and grounding: 30V)		
Current (Ith)			2.5A		
Rated Voltage (Ue)			30V	125V	250V
Rated Current (Ie) (see note 3)	**AC**	**Resistive load (AC12)**	—	2A	1A
		Inductive Load (AC15)	—	1A	0.5A
	DC	**Resistive load (DC12)**	2A	0.4A	0.2A
		Inductive Load (DC13)	1A	0.22A	0.1A

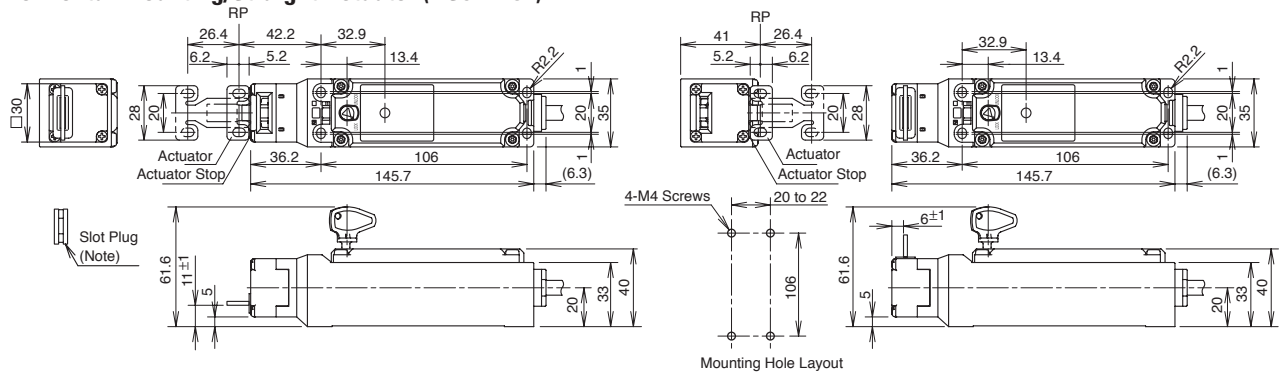
1. Minimum applicable load (reference value): 3V AC/DC, 5 mA
2. UL rating: 125V
3. TUV, BG rating: AC-15, 0.5A/250V, DC-13, 0.22A/125V
   UL, c-UL rating: Pilot duty AC 0.5A/125V, Pilot duty DC 0.22A/125V

Dimensions (mm) and Mounting Hole Layouts

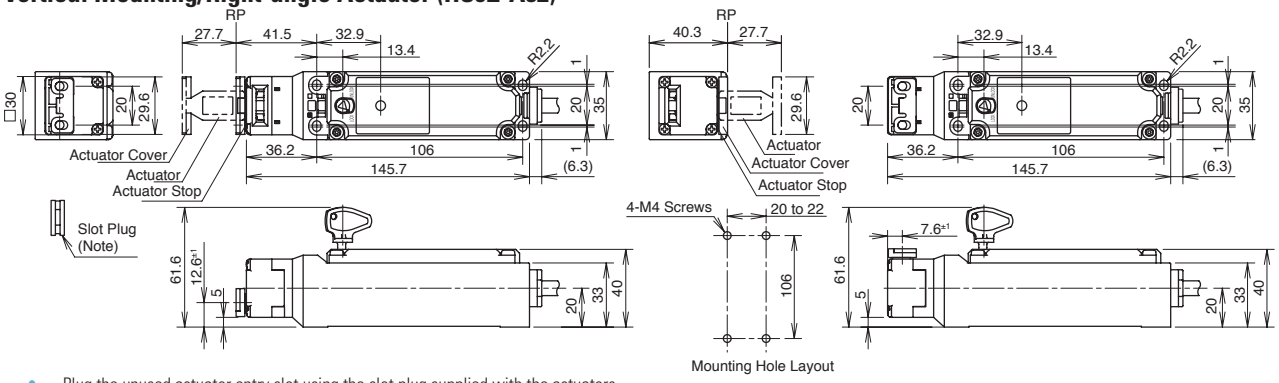
Actuator Keys

HS5E-**4*G (w/pilot light)

Horizontal Mounting/Straight Actuator (HS9Z-A51)



Vertical Mounting/Right-angle Actuator (HS9Z-A52)



Plug the unused actuator entry slot using the slot plug supplied with the actuators.

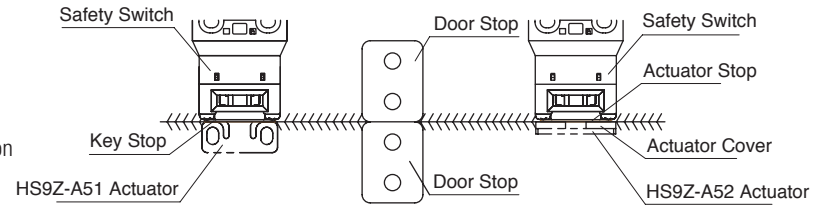
Actuator Key Mounting Reference Position

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

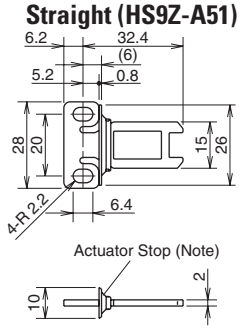
HS9Z-A51: The actuator lightly touches the actuator stop placed on the safety switch.

HS9Z-A52: The actuator cover lightly touches the actuator stop placed on the safety switch.

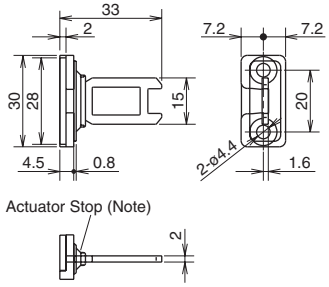
After mounting the actuator, remove the actuator stop from the safety switch.



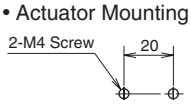
Straight (HS9Z-A51)



Right-angle type (HS9Z-A52)



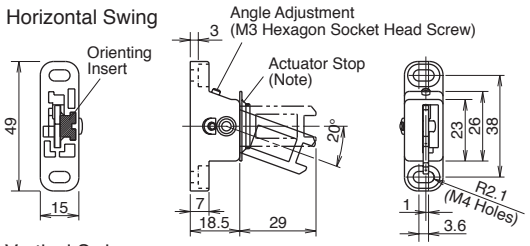
• Actuator Mounting Hole Layout (Straight, L-shaped)



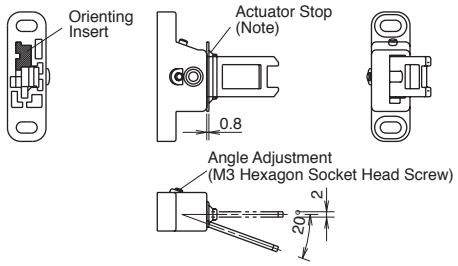
Dimensions and Mounting Hole Layouts, continued

Vertically/Horizontally Movable Actuator (HS9Z-A55)

Horizontal Swing



Vertical Swing



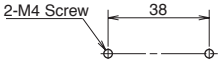
Actuator Orientation

The orientation of the actuator operation (horizontal/vertical) can be changed with the orientation part (white plastic part) installed on the back of the actuator.

Do not loose the orientation part, otherwise the actuator will not operate properly.

The actuator stop film and actuator stop are used when adjusting the actuator position, and must be removed after adjustment.

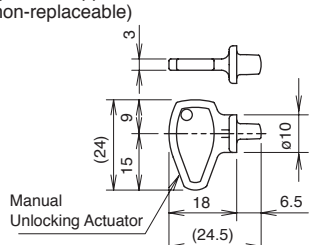
• Actuator Mounting Hole Layout (horizontal/vertical swing)



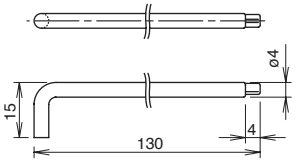
Accessory Dimensions (mm)

Actuator Type	Part Number
Mounting Plate	HS9Z-SP51
Manual Unlocking Key (long)	HS9Z-T3

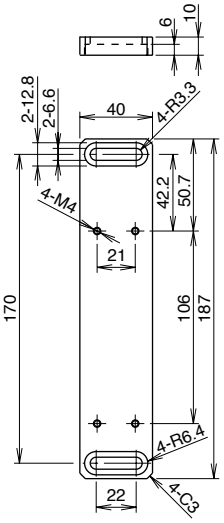
• Manual Unlocking Key
(plastic, supplied with the switch, non-replaceable)



• HS9Z-T3 Manual Unlocking Key
(metal, long-shaped)

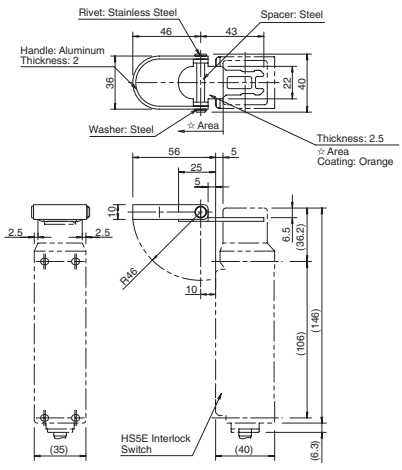


• Mounting Plate (HS9Z-SP51)

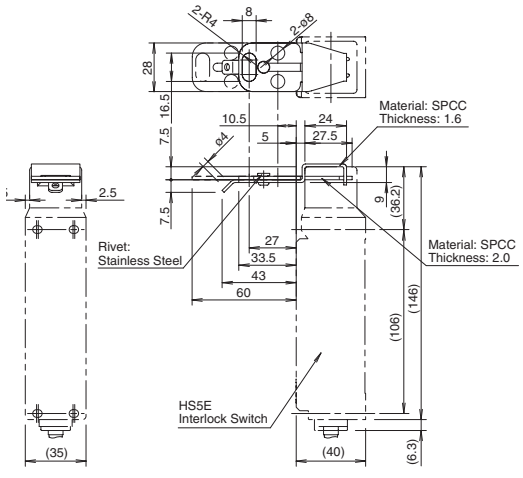


Material: Anonized A6063□
Weight: approx. 180 g

HS9Z-A5P



HS9Z-PH5



Operating Instructions

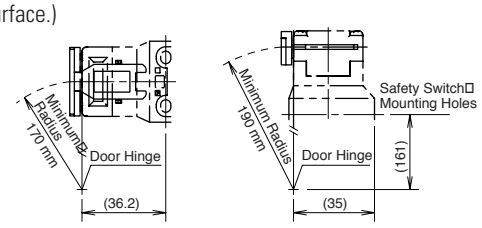
Minimum Radius of Hinged Door

- When using the safety switch for a hinged door, refer to the minimum radius of doors as shown below. For doors with small minimum radius, use adjustable actuators (HS9Z-A55).

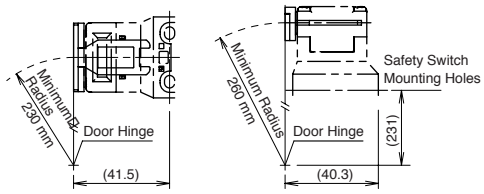
Because deviation or dislocation of a hinged door may occur, make sure of correct operation of the actual application before installation.

HS9Z-A52 Actuator

(When the center of the hinged door is on the extension line of the actuator mounting surface.)

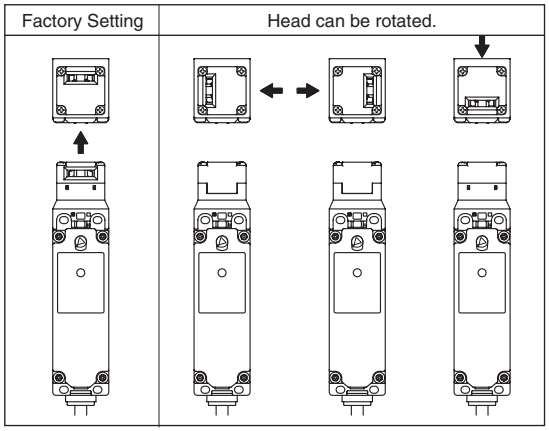


(When the center of the hinged door is on the extension line of the contact surface of actuator and safety switch.



Changing the Orientation of the Head

- The head of the HS5E can be mounted in four ways by removing the four screws from the corners of the HS5E head and reinstalling the head in the desired orientation. Before wiring the HS5E, replace the head. Before replacing the head, turn the manual unlock part to the UNLOCK position using the manual unlock key. When reinstalling the head, make sure that no foreign objects enter the safety switch. Tighten the screws, without leaving space between the head and body, otherwise the safety switch may malfunction.
- Recommended tightening torque: 1.0 ±0.1 N·m

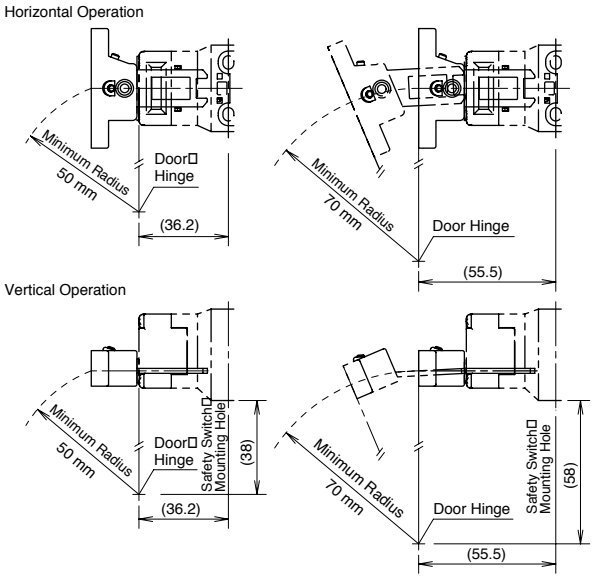


Actuator Angle Adjustment

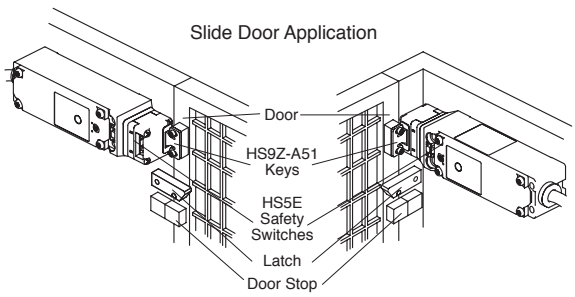
- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing).
  Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.
- After adjusting the actuator angle, apply loctite to the adjustment screw so that the screw will not loosen.

When using the HS9Z-A55 horizontally-movable actuator

- When the center of the hinged door is on the extension line of the contact surface of actuator and safety switch: 50 mm
- When the center of the hinged door is on the extension line of the actuator mounting surface: 70 mm



Mounting Examples



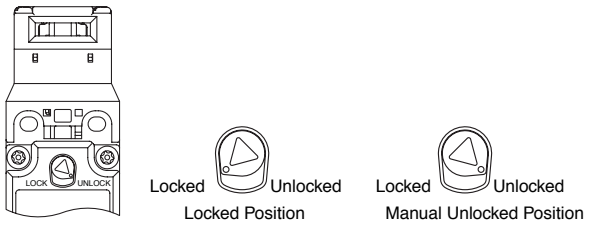
Safety Precautions

- 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 protection of the safety switch with solenoid is lost. While the solenoid is energized, do not unlock the actuator manually (solenoid lock type).

Instructions, continued

For Manual Unlocking

- **Spring lock type**
  The HS5E allows manual unlocking of the actuator to pre-check proper door operation before wiring or turning power on, as well as for an emergency or a power failure.
- **Solenoid lock type**
  If the actuator is not unlocked although the solenoid is de-energized, the actuator can be unlocked manually.



- To change from the locked to the manual unlocked position as shown above, turn the actuator fully 90° using the proprietary actuator supplied with the switch.
- Using the safety switch with the actuator not fully turned (less than 90°) may cause damage to the switch or errors (when manually unlocked, the switch will keep the main circuit disconnected and the door unlocked).
- Do not apply excessive force (0.45 N·m or more) to the manual unlock part, otherwise the manual unlock part will be damaged. Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can be unlocked while the machine is in operation.

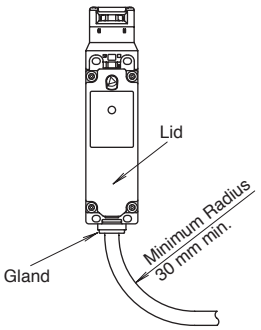

Manual Unlocking Key
(supplied with the switch)

Recommended Tightening Torque of Mounting Screws

- Safety Switch: 2.0 ± 0.2 N·m (two M4 screws)
- Actuators
  HS9Z-A51: 2.0 ± 0.2 N·m (two M4 screws)
  HS9Z-A52: 1.0 ± 0.2 N·m (two M4 Phillips screws)
  HS9Z-A55: 1.0 ± 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 become loose after mounting.
- Mounting bolts must be provided by the users.
- To avoid unauthorized or unintended removal of safety switch and the actuator, it is recommended that the safety switch and the actuator are installed in an unremovable manner, for example using special screws or welding the screws.

Cables

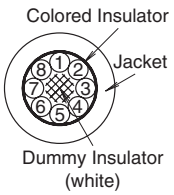
- Do not fasten or loosen the gland at the bottom of the safety switch.
- When bending the cable during wiring, make sure that the cable radius is kept at least 30mm.
- When wiring, make sure that water or oil does not enter the cable.
- Do not open the lid of the safety switch. Otherwise the switch may become damaged.
- Solenoid has polarity. Observe the correct polarity when wiring.



Wire Identification

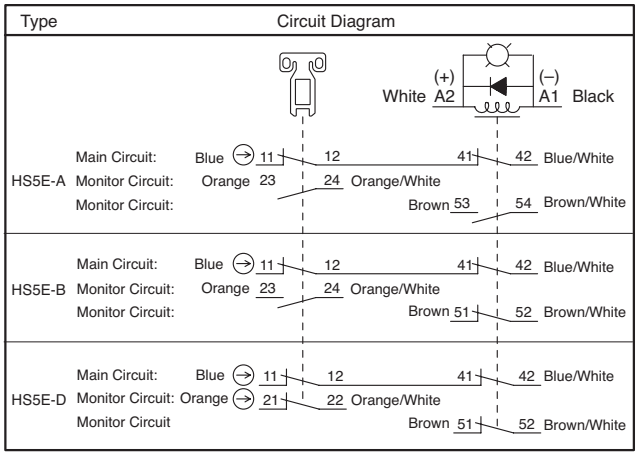
- Wires can be identified by the color and white line printed on the wire.

No.	Insulator Color	No	Insulator Color
1	white	5	brown/white
2	black	6	orange
3	brown	7	blue/white
4	blue	8	orange/white



Terminal Number Identification

- When wiring, identify the terminal number of each contact with the color of insulator.
- The following table shows the identification of terminal numbers.
- When wiring, cut unnecessary wires such as dummy insulator (white) and/or unused wires to avoid incorrect wiring.



HS1E Series Full Size Solenoid Locking Switches

HS1E features:

- Basic unit and solenoid unit in one housing
- Plastic Housing: Light weight
- Ease of Wiring: All the terminal screws are M3.5
- Available with a red or green indicator
- Choose from 4 circuit configurations
- When mounting the actuator on a movable door, and the switch on a machine body, the door can be mechanically locked when closed
- Greater Safety: The door is unlocked by a solenoid lock-release signal from a PLC or other source after the machine has stopped
- In the event of power failure or for machine maintenance, the door can be unlocked using a special tool
- Flexible Installation: The actuator can be accessed from two directions

EN1088
EN60947-5-1
IEC60947-5-1

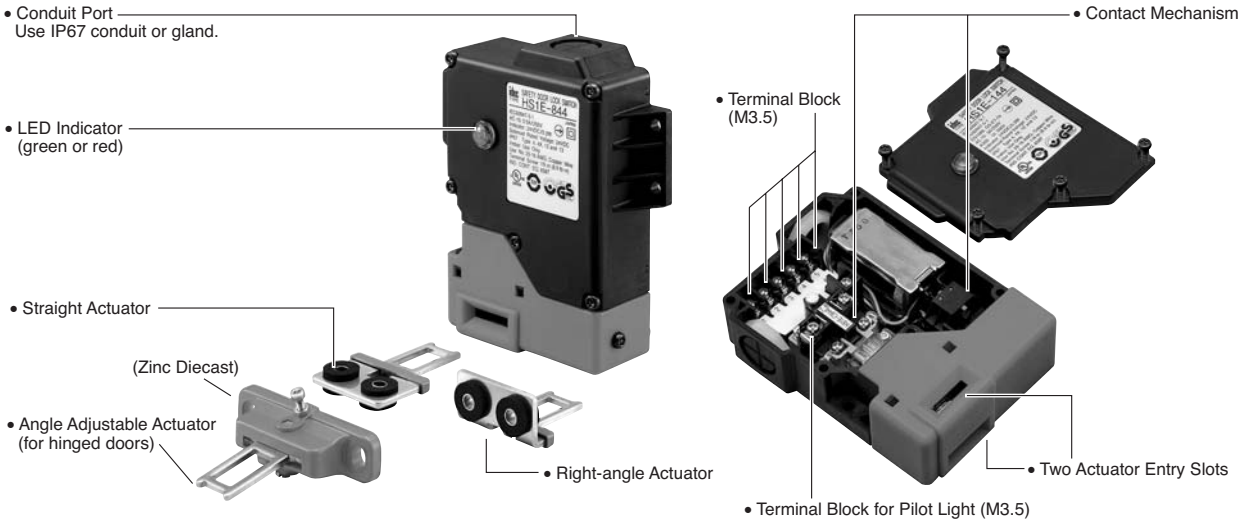
GS-ET-15
BG standard
in Germany

Certificate No.
20005010305145656

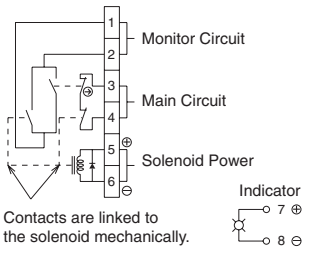
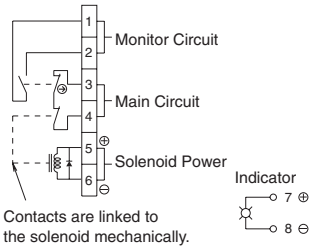
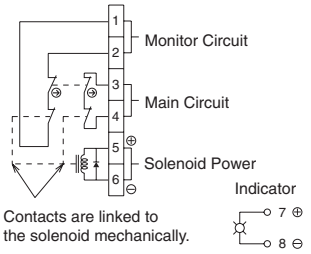
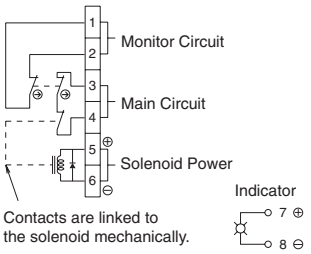
Direct Opening Action

Double Insulation

HS1E Series Functionality



Part Numbers

Actuator Retention Force	Lock Mechanism	Contact Configuration		Conduit Port Size	Model: Indicator	Model: Manual Unlock Key	Part Number
1500N (when locked)	Spring Lock	Main circuit: 1NC + 1NC Monitor circuit: 1NO/1NO		G1/2	—	—	HS1E-40R
					With	—	HS1E-44R-②
					—	With	HS1E-40KR
					With	With	HS1E-44KR-②
		Main circuit: 1NC + 1NC Monitor circuit: 1NO		G1/2	—	—	HS1E-140R
					With	—	HS1E-144R-②
					—	With	HS1E-140KR
					With	With	HS1E-144KR-②
		Main circuit: 1NC + 1NC Monitor circuit: 1NO + 1NC		G1/2	—	—	HS1E-240R
					With	—	HS1E-244R-②
					—	With	HS1E-240KR
					With	With	HS1E-244KR-②
		Main circuit: 1NC + 1NC Monitor circuit: 1NC		G1/2	—	—	HS1E-340R
					With	—	HS1E-344R-②
					—	With	HS1E-340KR
					With	With	HS1E-344KR-②

1. Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.
2. Specify color code in place of ② in the part number. G: green, R: red
3. Actuator is not supplied with the interlock switch, and must be ordered separately.
4. TORX is a registered trademark of Camcar Textron.

Actuator Keys & Accessories

Item	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator

Item	Part Number	Description
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug
	HS9Z-KEY1	Replacement Manual Unlocking Key

Specifications

Conforming to Standards					EN1088, IEC60947-5-1, EN60947-5-1(TUV), ISO14119, GS-ET-19 (BG), UL508, CSA C22.2 No. 14 (c-UL)	
Applicable Use					IEC60204-1, EN60204-1	
Operating Temperature					–20 to +40°C (no freezing)	
Storage Temperature					–40 to +80°C	
Operating Humidity					40 - 85% RH (no condensation)	
Altitude					2,000m maximum	
Rated Insulation Voltage (Ui)					300V (between LED or solenoid and ground: 60V)	
Impulse Withstand Voltage (Uimp)					4 kV (between LED or solenoid and ground: 2.5 kV)	
Insulation Resistance (measured with 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					Class II (according to IEC61140)	
Pollution Degree					3 (IEC60947-5-1)	
Degree of Protection					IP67 (IEC60529)	
Vibration Resistance	**Operating Extremes**				10 to 55 Hz, minimum (amplitude 0.35 mm)	
	Damage Limits				50 m/sec^2 (approx. 5G)	
Shock Resistance					1,000 m/sec^2 (approx. 100G)	
Actuator Tensile Strength when Locked					1,500N minimum (per GS-ET-19)	
Actuator Operating Speed					1 m/sec maximum	
Positive Opening Travel					11 mm minimum	
Positive Opening Force					20N minimum	
Thermal Current (Ith)					Main circuit: 10A, Auxiliary circuit: 3A	
Rated Operating Current (Ie)	Operating Voltage (Ue)				30V	125V	250V
	Main Circuit	AC	Resistive load (AC12) Inductive load (AC15)		10A 10A	10A 5A	6A 3A
		DC	Resistive load (DC12) Inductive load (DC13)		6A 3A	– 0.9A	– –
	Auxiliary Circuit	AC	Resistive load (AC12) Inductive load (AC15)		– –	3A –	3A 3A
		DC	Resistive load (DC12) Inductive load (DC13)		3A –	– 0.9A	– –
Contact Gap					Main circuit: 1.7 mm min., Auxiliary circuit: 1.2 mm min.	
Operating Frequency					900 operations/hour max.	
Mechanical Life					1,000,000 operations min. (at full rated load) 900 ops/hr (AC-12/250V, 6A)	
Electrical Life					100,000 operations (rated load)	
Conditional Short-circuit Current					100A (per IEC60947-5-1)	
Recommended Short Circuit Protection					250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)	
Solenoid Unit	**Operating Voltage**				24V DC	
	Current				292mA	
	Coil Resistance				102Ω (at 20°C)	
	Pickup Voltage				20.5V maximum (at 20°C)	
	DropOut Voltage				2.4 minimum (at 20°C)	
	Allowable Voltage				26.4V max (continuous)	
	Insulation Class				Class F	
Indicator	**Operating Voltage**				24V DC	
	Current				10 mA	
	Light Source				LED lamp	
	Lens Color				Red or Green (12 mm dia. Lens)	
Weight					Approx. 500g	

Part Number Key

HS1E - 2 4 4 K R - R

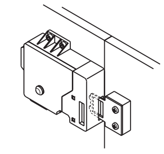
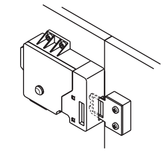
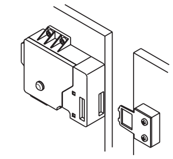
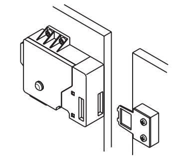
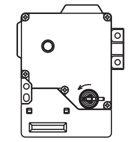
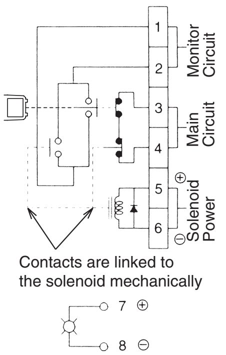
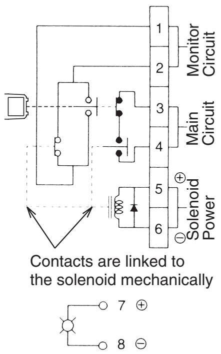
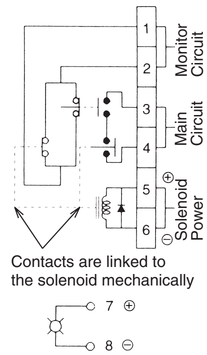
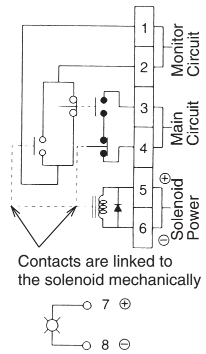
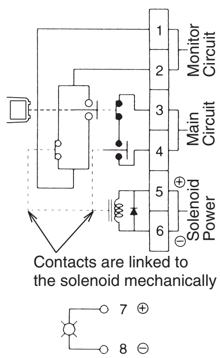
- **Circuit Code**

	Main Circuit	Auxiliary Circuit
Blank:	1NC + 1NC	1NO/1NO
1:	1NC + 1NC	1NO
2:	1NC + 1NC	1NC + 1NC
3:	1NC + 1NC	1NC

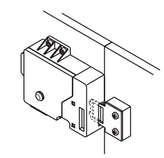
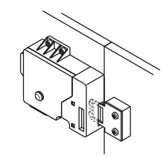
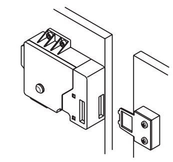
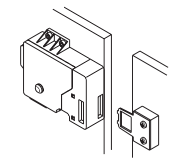
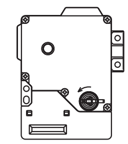
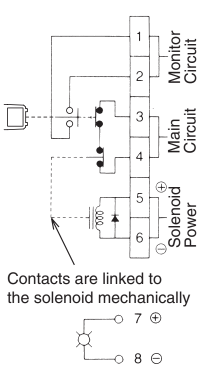
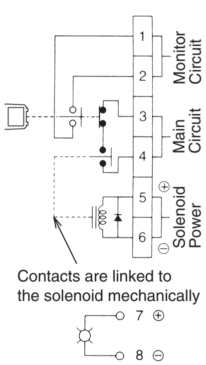
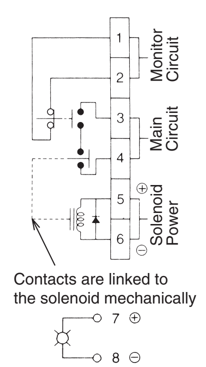
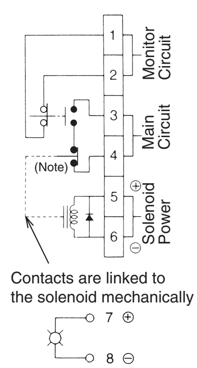
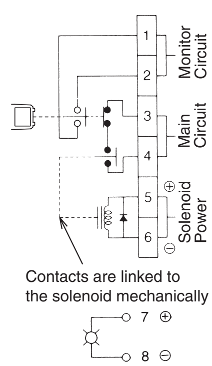
- **Indicator Rated Voltage**
  - 4 (24V DC)
  - Blank (without indicator)
- **Manual Unlock Key**
  - K (with actuator)
  - 0 (without actuator)
- **Indicator Color:**
  - R (Red)
  - G (Green)

Application Examples and Circuit Diagrams

HS1E-4 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO/1NO)

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed	1-2: Closed	1-2: Closed	1-2: Closed
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

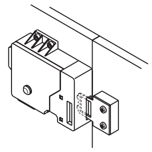
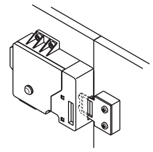
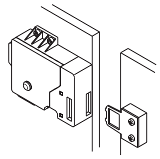
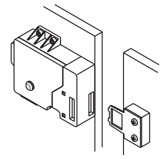
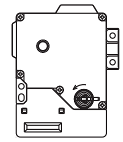
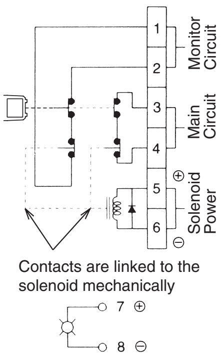
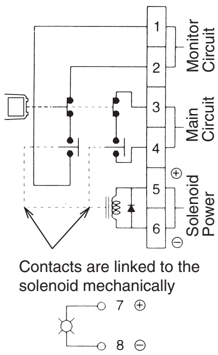
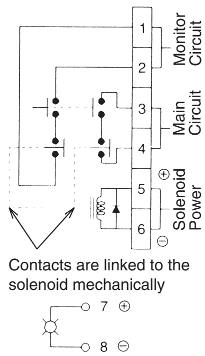
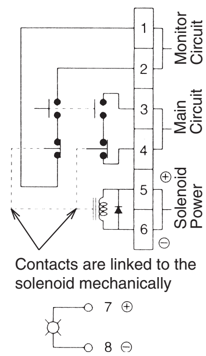
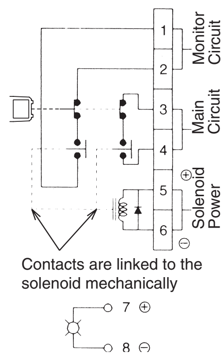
HS1E-14 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO)

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Open	1-2: Open	1-2: Closed	1-2: Closed	1-2: Open
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

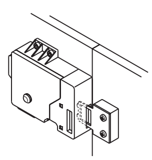
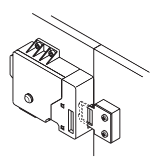
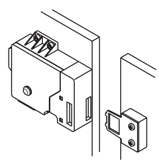
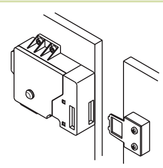
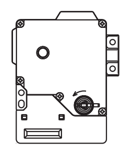
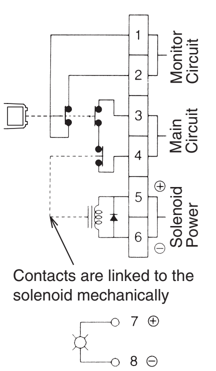
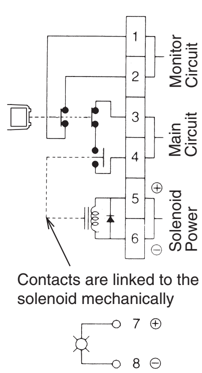
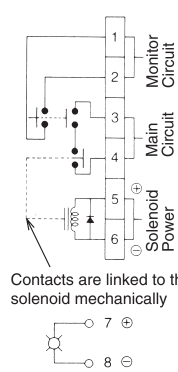
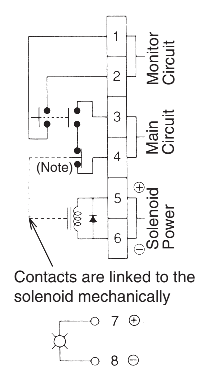
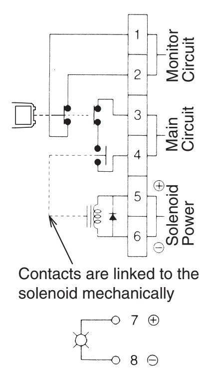
1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid and door status.

Application Examples and Circuit Diagrams, continued

HS1E-24 (Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC+NC)

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Open	1-2: Open	1-2: Open	1-2: Open
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

HS1E-34 (Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC)

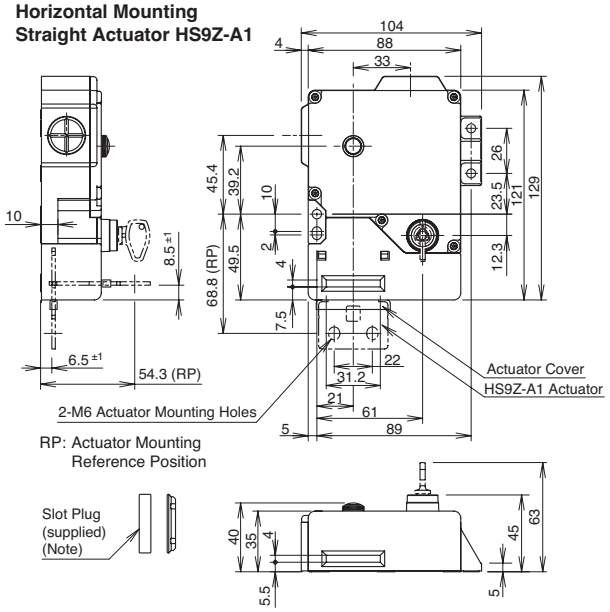
	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid energized	• Door Opened • Machine cannot be started • Solenoid de-energized	• Door Closed • Machine cannot be started • Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Closed	1-2: Open	1-2: Open	1-2: Closed
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

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.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid or door status.

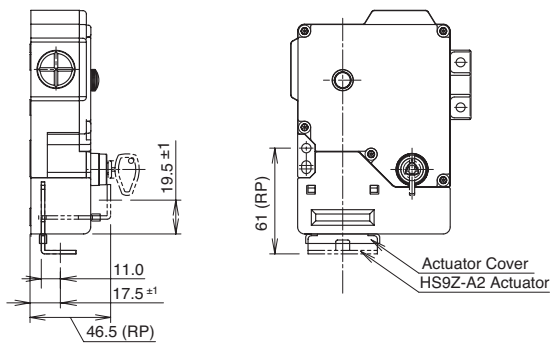
Dimensions (mm)

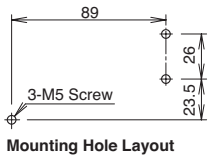
HS1E with indicator - using 1500N operating force

Horizontal Mounting
Straight Actuator HS9Z-A1



Vertical Mounting
Right-angle Actuator HS9Z-A2



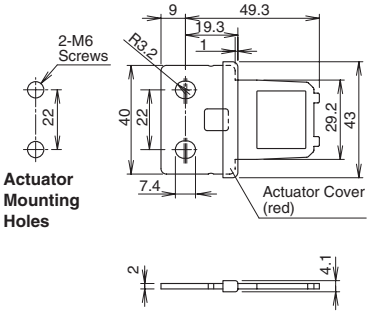


Mounting Hole Layout

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

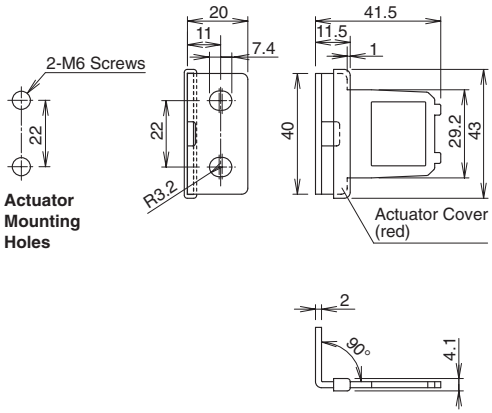
Accessories

Straight Actuator (mainly for sliding doors) HS9Z-A1



Right-angle Actuator (mainly for hinged doors) HS9Z-A2

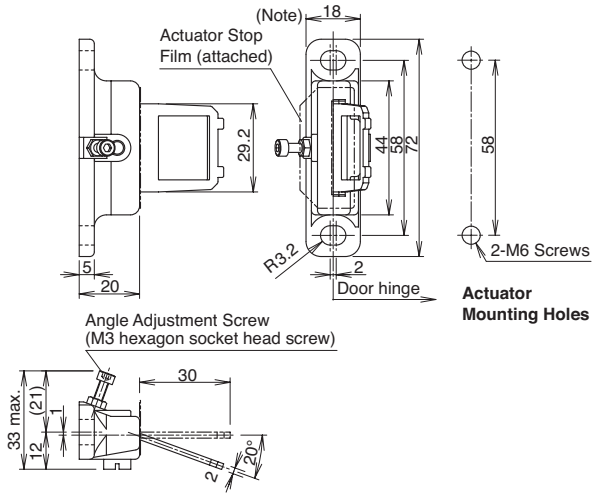
*After installing the actuator, remove the actuator cover.



Adjustable Actuator

- The actuator angle is adjustable (0° to 20°) for hinged doors.
- The minimum radius of the door opening can be as small as 100mm.

For HS1/HS2 Series (HS9Z-A3)



All dimensions in mm.

Accessories, continued

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.

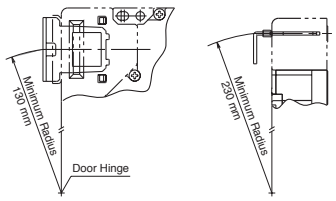
Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use angle adjustable actuators (HS9ZA3 or HS9Z-A3S).

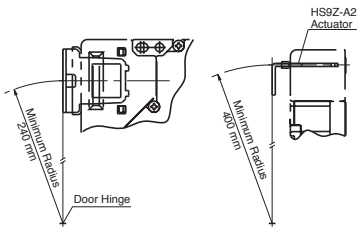
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A2 Actuator

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

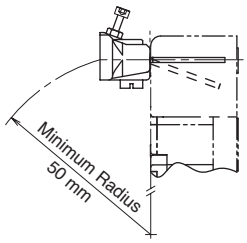


- When the door hinge is on the extension line of the actuator mounting surface:

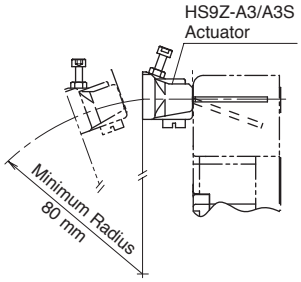


When using the HS9Z-A3 Angle Adjustable (vertical) Actuator

- 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:



HS1C Series Full Size Solenoid Locking Switches

HS1C features:

- Rugged Aluminum Die-cast Housing
- With the actuator mounted on a movable door, and the switch on a machine, the door can be mechanically locked when closed.
- Greater Safety: The door is unlocked by a solenoid lock-release signal from a PLC or another source after the machine has stopped.
- In the event of power failure or for machine maintenance, the door can be unlocked using a special tool.
- Flexible Installation: The actuator can be accessed from two directions.
- Select from four different circuit configurations.
- IP67 Protection

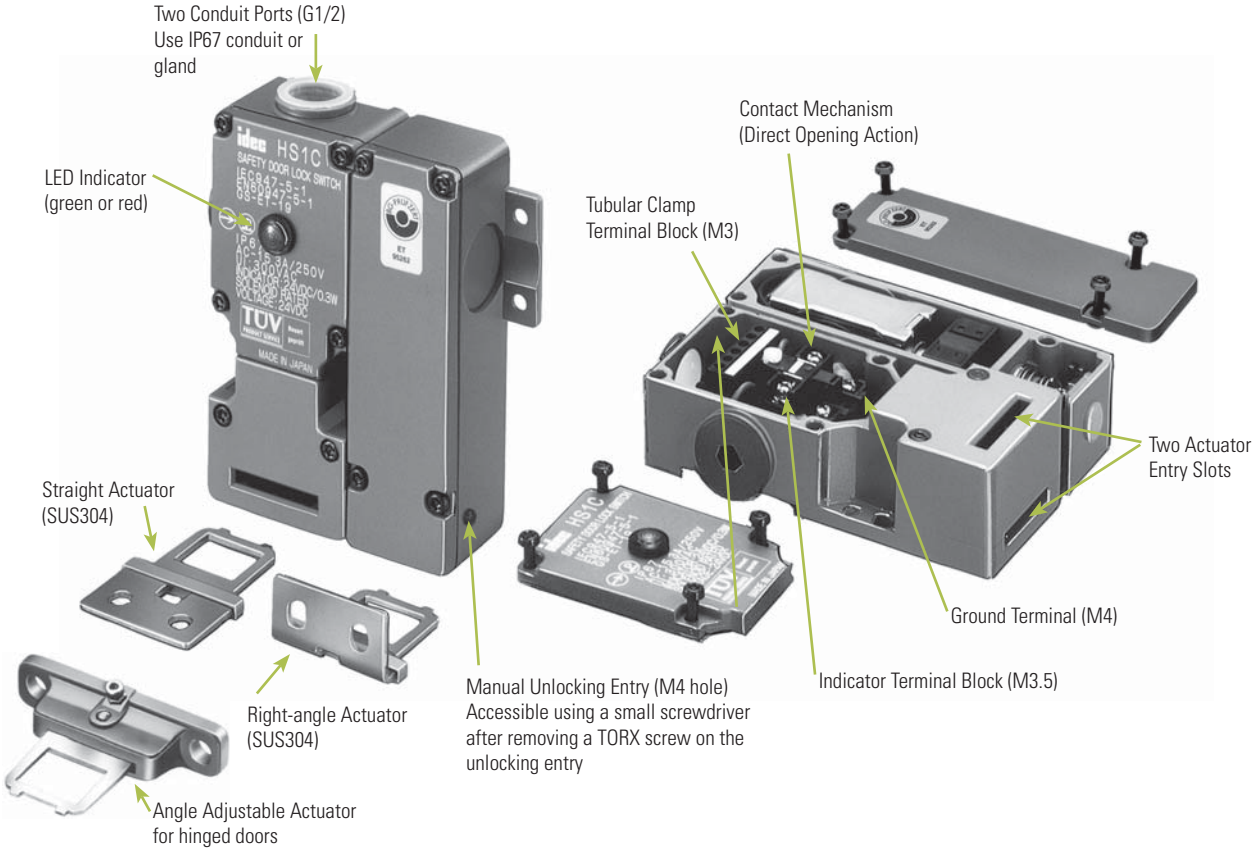
EN1088
EN60947-5-1
IEC60947-5-1

GS-ET-15
BG standard in Germany

Certificate No.
20005010305145652

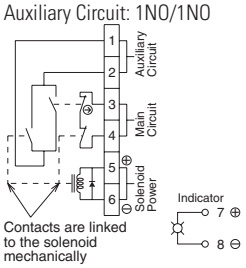
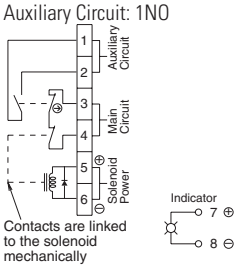
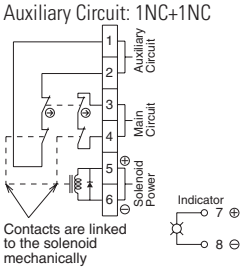
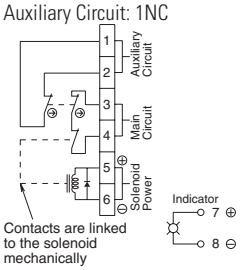
Direct Opening Action

HS1C Series Functionality



TORX is a registered trademark of Camcar Textron.

Part Numbers

Contact Configuration	Indicator LED	Part Number
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NO/1NO  Contacts are linked to the solenoid mechanically	Green	HS1C-R44R-G
	Red	HS1C-R44R-R
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NO  Contacts are linked to the solenoid mechanically	Green	HS1C-R144R-G
	Red	HS1C-R144R-R
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NC+1NC  Contacts are linked to the solenoid mechanically	Green	HS1C-R244R-G
	Red	HS1C-R244R-R
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NC  Contacts are linked to the solenoid mechanically	Green	HS1C-R344R-G
	Red	HS1C-R344R-R

Actuator Keys & Accessories

Item	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator
	HS9Z-T1	Key Wrench (included with switch)

Specifications

Conforming to Standards			EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-19, UL508			
Operating Temperature			–20 to +40°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 (between LED or solenoid and ground: 60V)			
Impulse Withstand Voltage (Uimp)			4 kV (between LED or solenoid and ground: 2.5 kV)			
Insulation Resistance			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 Class			Class 1 (IEC61140)			
Pollution Degree			3 (IEC60947-5-1)			
Degree of Protection			IP67 (IEC60529)			
Vibration Resistance	**Operating Extremes**		10 to 55 Hz, amplitude 0.5 mm			
	Damage Limits		60 m/sec² (approx. 6G)			
Shock Resistance			1,000 m/s² (approx. 100G)			
Actuator Tensile Strength when Locked			1,500N minimum			
Operating Speed			1 m/sec maximum			
Positive Opening Travel			11 mm minimum			
Positive Opening Force			20N minimum			
Thermal Current (Ith)			Main circuit: 10A, Auxiliary circuit: 3A			
Rated Operating Current (Ie)			Operating Voltage (Ue)	30V	125V	250V
	Main Circuit	AC	Resistive load (AC12) Inductive load (AC15)	10A 10A	10A 5A	6A 3A
		DC	Resistive load (DC12) Inductive load (DC13)	6A 3A	– 0.9A	– –
	Auxiliary Circuit	AC	Resistive load (AC12) Inductive load (AC15)	– –	3A –	3A 3A
		DC	Resistive load (DC12) Inductive load (DC13)	3A –	– 0.9A	– –
Contact Opening Distance			Main circuit: 1.7 mm max., Auxiliary circuit: 1.2 mm min.			
Operating Frequency			900 operations/hour max.			
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)			
Solenoid Unit	**Operating Voltage**		24V DC			
	Current		415 mA			
	Coil Resistance		58Ω (at 20°C)			
	Energizing Voltage		Rated voltage x 85% maximum (at 20°C)			
	De-energizing Voltage		Rated voltage x 10% minimum (at 20°C)			
	Continuous Applicable Voltage		Rated voltage x 110%			
	Continuous Applicable Duration		Not specifically limited			
	Insulation Class		Class B			
Indicator	**Operating Voltage**		24V DC			
	Current		10 mA			
	Light Source		LED lamp			
	Lens Color		Red or Green (12 mm dia. Lens)			
Weight			Approx. 660g			

Part Number Key

HS1C - R 1 4 4 R - R

Indicator Color
R (Red)
G (Green)

Housing Color
R (Red)

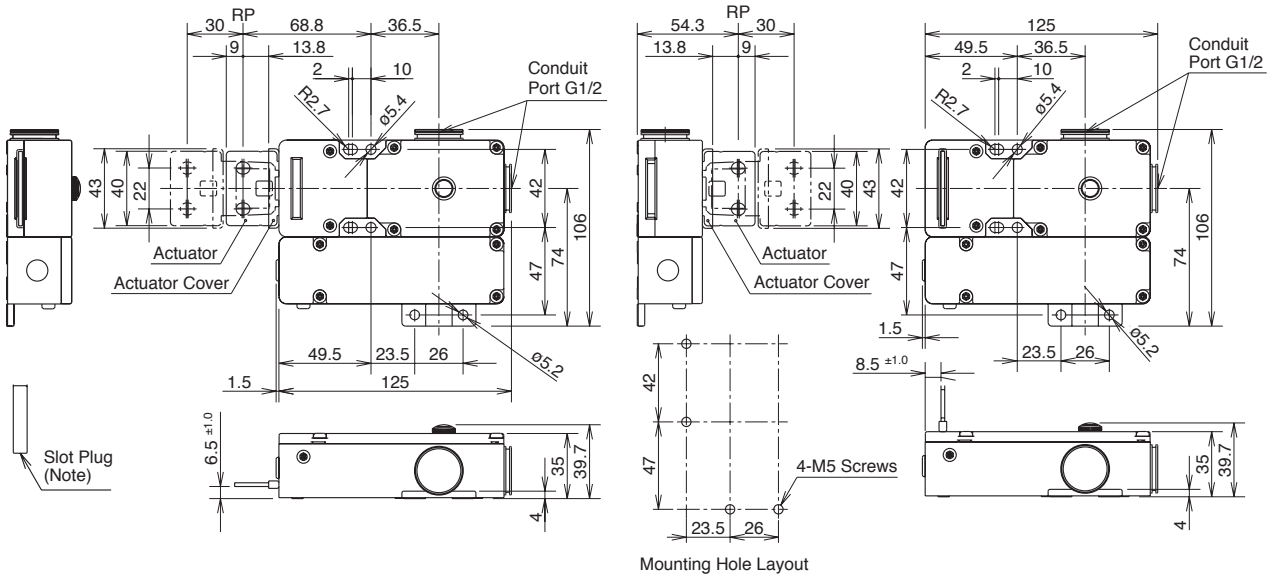
Solenoid and LED Voltage
4 (24V DC)

Circuit Code

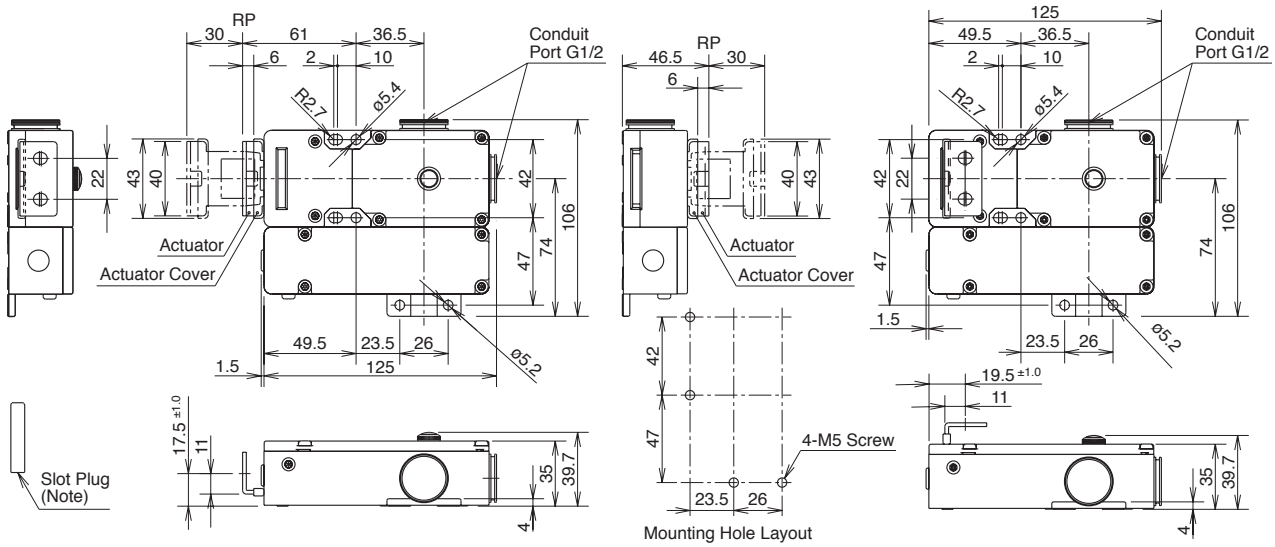
	Main Circuit	Auxiliary Circuit
Blank:	1NC + 1NC	1NO/1NO
1:	1NC + 1NC	1NO
2:	1NC + 1NC	1NC + 1NC
3:	1NC + 1NC	1NC

Dimensions (mm)

HS1C-R44R-* - using the straight actuator (HS9Z-A1)

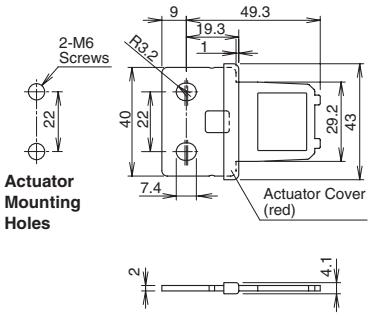


HS1C-R44R-* - using the Right-angle actuator (HS9Z-A2)



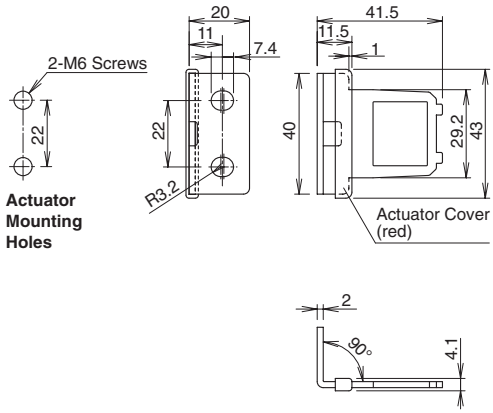
Accessories

Straight Actuator (mainly for sliding doors)
HS9Z-A1



Right-angle Actuator (mainly for hinged doors)
HS9Z-A2

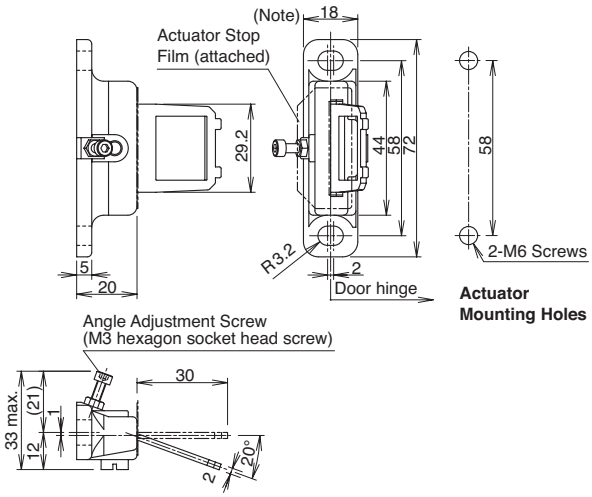
*After installing the actuator, remove the actuator cover.



Adjustable Actuator

- The actuator angle is adjustable (0° to 20°) for hinged doors.
- The minimum radius of the door opening can be as small as 100mm.

For HS1/HS2 Series (HS9Z-A3)



All dimensions in mm.

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.

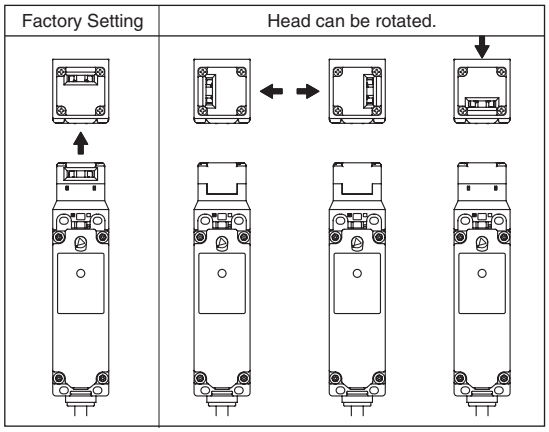
Operation Precautions - for all series

- 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/sec^2 (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.



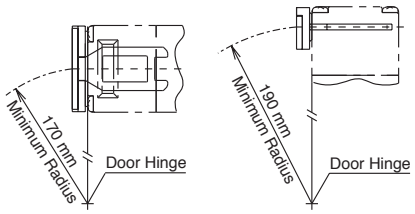
Minimum Radius of Hinged Doors

- 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).

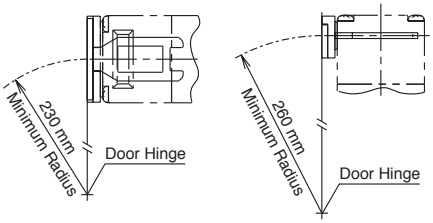
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

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



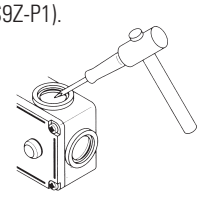
- When door hinge is on the extension line of the actuator mounting surface:



HS2B Precautions

Wire Connection

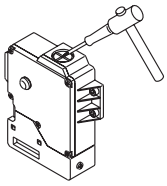
- The HS2B has 3 conduit ports, which are closed as a part of the molded switch housing.
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block or other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



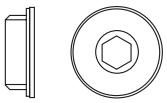
HS1E Precautions

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).



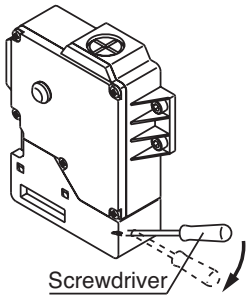
Plug
Type No. HS9Z-P1

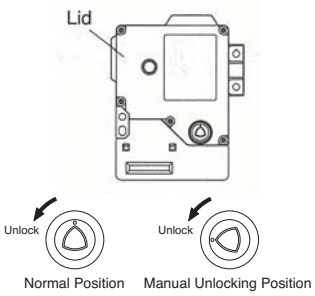


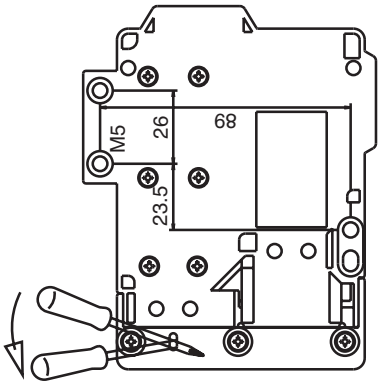
Manual Unlocking

- 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.



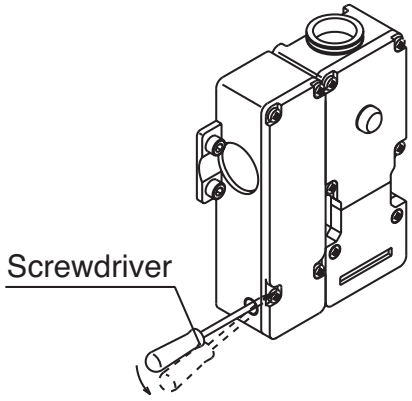




HS1C Precautions

- 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).

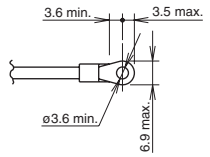
Caution: After the unlocking operation, put the screw back into the unlocking entry for safety.



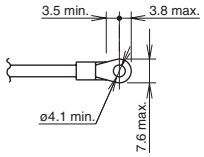
Operation Precautions

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

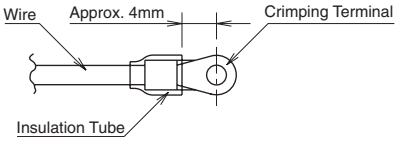


Crimping Terminal 1



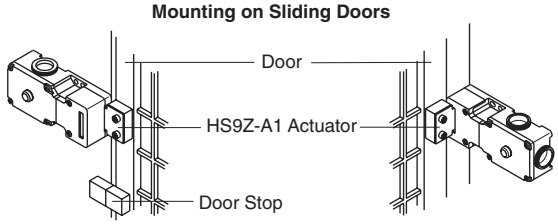
Crimping Terminal 2

Use an insulation tube on the crimping terminal.

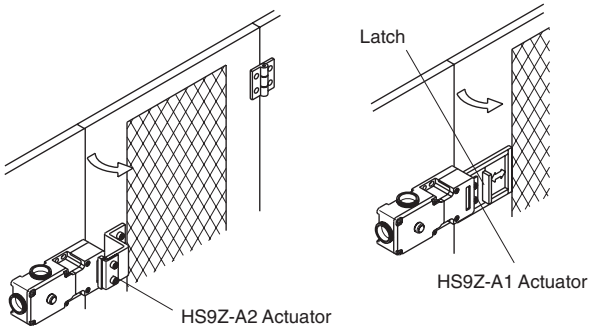


Installation Examples (see the diagrams below)

Mounting on Sliding Doors

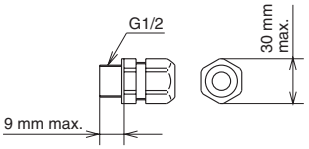


Mounting on Hinged Doors



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

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.

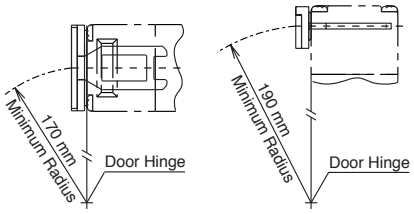
Minimum Radius of Hinged Door

- 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).

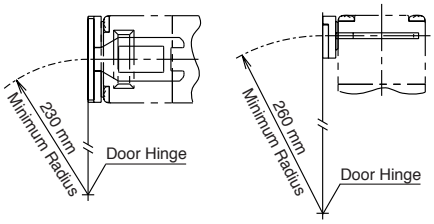
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When using the HS9Z-A52 Actuator

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



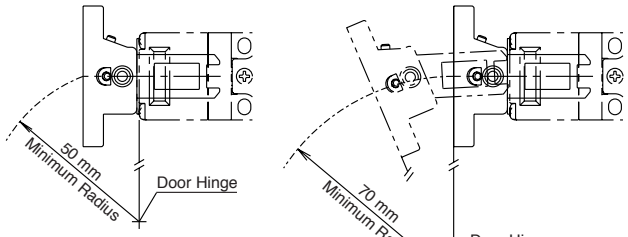
- When door hinge is on the extension line of the actuator mounting surface:



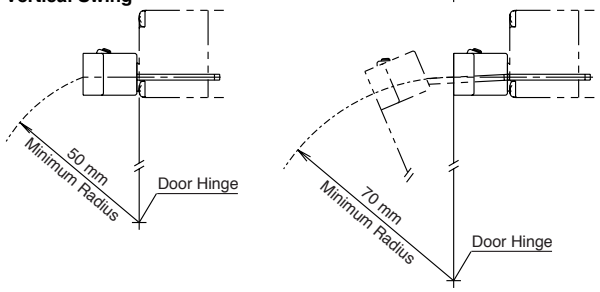
When using the HS9Z-A55 Angle Adjustable Actuator

- 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

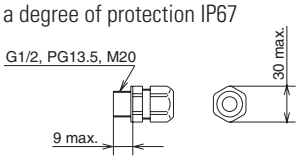


Actuator Angle Adjustment for the HS9Z-A55

- 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.