Interlock Switches

IDEC

www.IDEC.com/safety

Selection Guide

Standard Interlock Safety Switches

Series	Subminiature	Miniature		Full Size	
	HS6B	HS5B	HS5D	HS2B	HS1B
Appearance					
Page	297	www.IDEC.com/safety	302	309	313
Size (mm)	30 x 15 x 78mm	91 x 30 x 30mm	30 x 30 x 90mm	52 x 35 x 98mm	52 x 35 x 125mm
Contacts	2 or 3	2	2 or 3	2	2
Termination	Integrated cable	Screw	Screw	Screw	Screw
Material	Plastic body	Plastic body	Metal or plastic head	Plastic head	Die-cast aluminum body

Solenoid Locking Safety Switches

Series	Subminiature	Miniature	Full Size		
	HS6E	HS5E	HS1E	HS1C	HS1L
Appearance					
Page	316	325	341	347	352
Size (mm)	75 x 15 x 75mm 500N	35 x 40 x 146mm 1400N	104 x 35 x 129mm 1500N	106 x 35 x 125mm 1500N	104 x 35 x 129mm 3000N
Contacts	5	4	3 or 4	3 or 4	6
Termination	Integrated cable	Integrated cable	Screw	Screw	Screw
Material	Plastic body	Metal head, plastic body	Plastic body	Die-cast aluminum body	Plastic body

Key Locking Safety Switch

Series	HS5E-K
Appearance	
Page	355
Size (mm)	35 x 40 x 146
Contacts	4
Termination	Integrated cable
Material	Metal head, plastic body

Non-contact Safety Switch

HS7A-DMC	HS7A-DMP	HS3A
		
368	372	376
7 x 16 x 51	13 x 25 x 88	40 x 47 x 70mm
2	3	3
Integrated cable	Integrated cable	M12
PBT	PBT	PBT

HS6B Subminiature Interlock Switches

Key features:

- Only 78 x 30 x 15mm
- Two actuator entrances provide flexibility for installation options
- Integrated molded cable reduces wiring time
- IP67 (IEC60529)
- Direct Opening Action
- 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
1NC-1NO Zb 11 — 12 33 — 34	1m	HS6B-11B01
	3m	HS6B-11B03
	5m	HS6B-11B05
2NC Zb 11 — 12 31 — 32	1m	HS6B-02B01
	3m	HS6B-02B03
	5m	HS6B-02B05
2NC-1NO Zb 11 — 12 33 — 34	1m	HS6B-12B01
	3m	HS6B-12B03
	5m	HS6B-12B05
3NC Zb 11 — 12 21 — 22 31 — 32	1m	HS6B-03B01
	3m	HS6B-03B03
	5m	HS6B-03B05

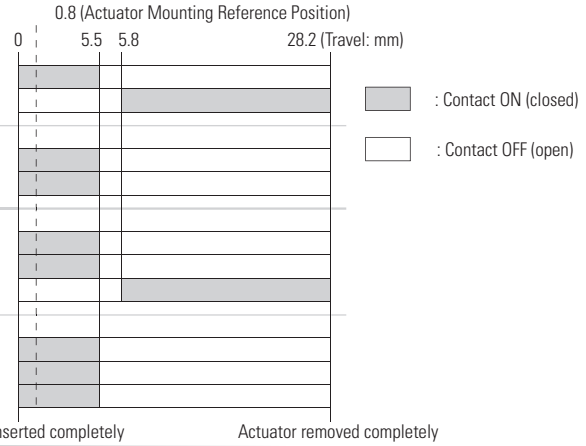
Actuator Keys (order separately)

Appearance	Part Number	Shape
	HS9Z-A61	Straight
	HS9Z-A62	Right-angle
	HS9Z-A65	Adjustable actuator 90° angle
	HS9Z-A66	Adjustable actuator 180° angle

Actuators are not included and must be ordered separately.

Contact Configuration & Operation Chart

Type	Contact Configuration	Contact Operation Chart
HS6B-11	1NC-1NO Zb 11 — 12 33 — 34	11-12 33-34
HS6B-02	2NC Zb 11 — 12 31 — 32	11-12 31-32
HS6B-12	2NC-1NO Zb 11 — 12 21 — 22 33 — 34	11-12 21-22 33-34
HS6B-03	3NC Zb 11 — 12 21 — 22 31 — 32	11-12 21-22 31-32



Specifications

Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, IEC60664-1, IEC60204-1, EN60204-1, UL508, CSA C22.2 No. 14
Operating Temperature		–25 to +70°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Relative Humidity		45 to 85% RH (no condensation)
Storage Humidity		95% maximum (no condensation)
Altitude		2,000m maximum
Pollution Degree		3
Rated Insulation Voltage (U_i)		300V
Impulse Withstand Voltage (U_{imp})		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/s² (30G)
	Damage Limits	1000m/s² (100G)
Direct Opening Travel		8mm minimum
Direct Opening Force		60N minimum
Thermal Current (I_{th})		2.5A
Operating Frequency		1200 operations/hour
Mechanical Life		1,000,000 operations (GS-ET-15)
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

Contact Ratings

Rated Operating Current (I_e)	Operating Voltage (U_e)		30V	125V	250V
	AC	Resistive load (AC-12)	–	2.5A	1.5A
		Inductive load (AC-15)	–	1.5A	0.75A
	DC	Resistive load (DC-12)	2.5A	1.1A	0.55A
			(2A)	(0.4)A	(0.2A)
		Inductive load (DC-13)	2.3A	0.55A	0.27A
			(1A)	(0.22A)	(0.1A)

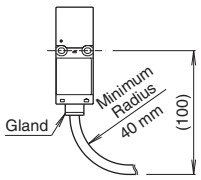
Installation Notes

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

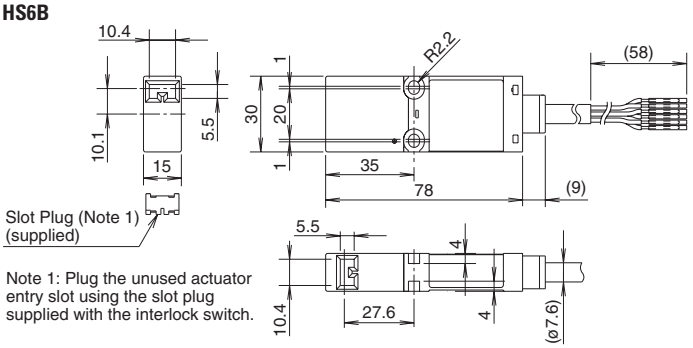


Wiring Designations

Part Number	Contact	Terminal #	Color
HS6B-12B01 (2NC-1NO)	NC	11-12	blue-blue/white
	NC	21-22	brown-brown/white
	NO	33-34	orange-orange/white
HS6B-03B01 (3NC)	NC	11-12	blue-blue/white
	NC	21-22	brown-brown/white
	NC	31-32	orange-orange/white
HS6B-11B01 (1NC-1NO)	NC	11-12	blue-blue/white
	NO	33-34	orange-orange/white
HS6B-02B01 (2NC)	NC	11-12	blue-blue/white
	NC	31-32	orange-orange/white

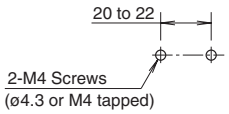
Dimensions (mm)

HS6B



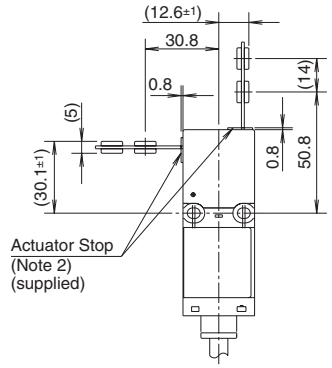
Note 1: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.

Installation

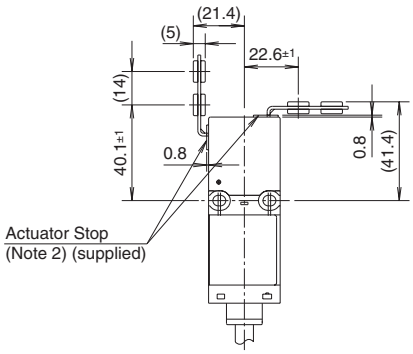


The interlock switch can be mounted in two directions.

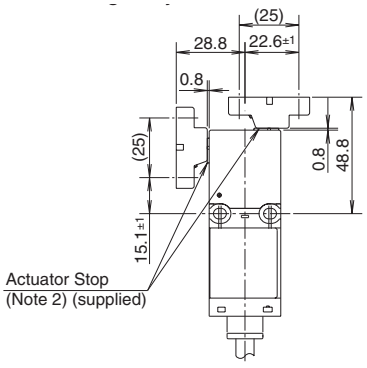
Using straight actuator (HS9Z-A61)



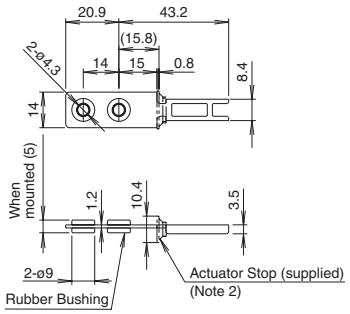
Using Right-angle actuator (HS9Z-A62)



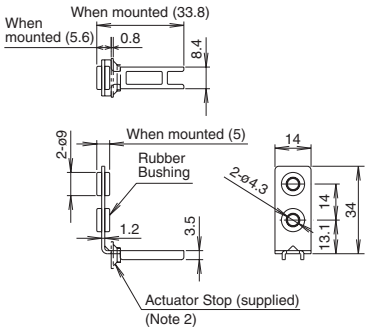
Using Angle Adjustable Actuator (HS9Z-A65/A66)



Straight actuator (HS9Z-A61)

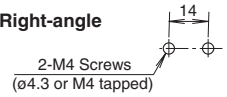


Right-angle actuator (HS9Z-A62)

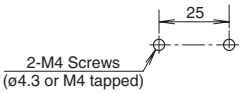


Actuator Installation

Straight/Right-angle Actuator

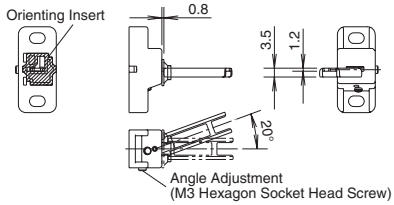


Angle Adjustable Actuator

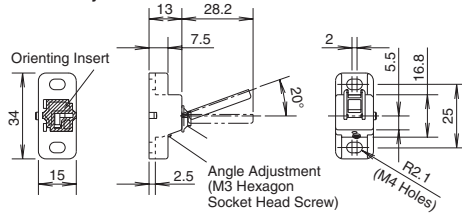


Adjustable Actuator (HS9Z-A65)

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.

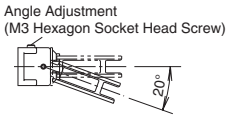
The base is made of glass-reinforced PA66 (66 nylon). Angle adjustment screws are stainless steel. When using adhesive on screws, take material compatibility into consideration.

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

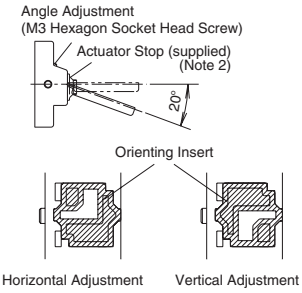
Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment



Vertical Adjustment



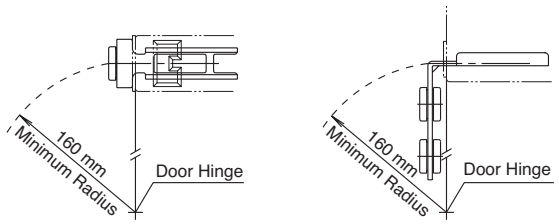
Minimum Radius of Hinged Door

- 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).

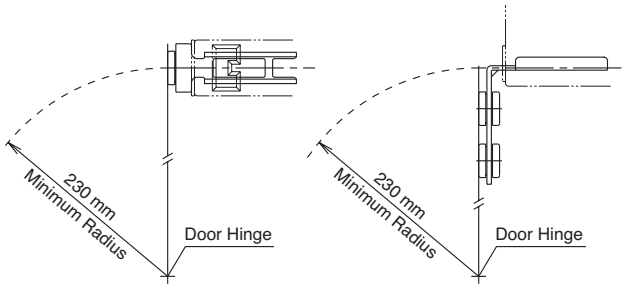
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A62 Actuator

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



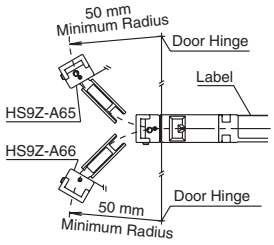
- When the door hinge is on the extension line of the actuator mounting surface:



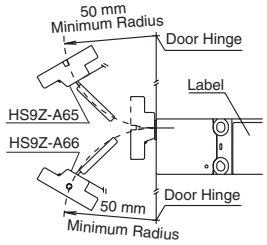
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable (vertical) Actuator

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

Horizontal Swing

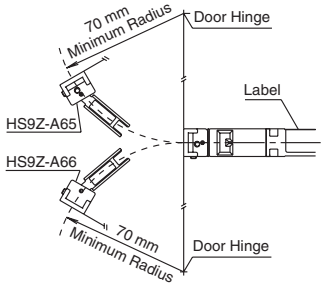


Vertical Swing

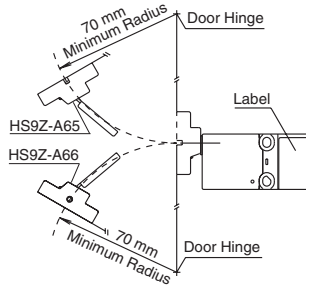


- When the door hinge is on extension line of the actuator mounting surface:

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.

HS5D Miniature Interlock Switches

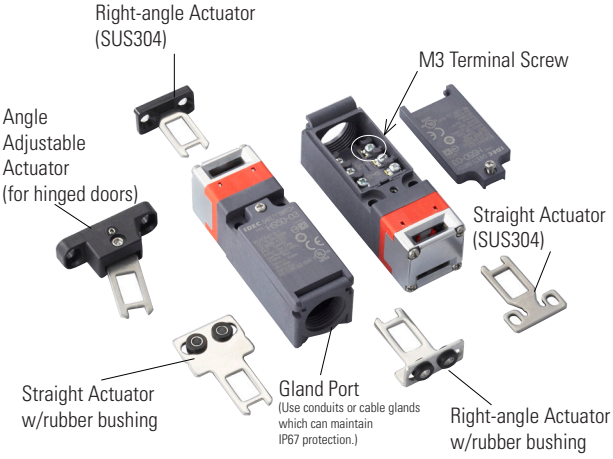
Key features:

- Detects detachment of head for enhanced safety
- Compact dimensions with up to three contacts
- The head orientation can be rotated, allowing 8 different actuator entries
- NC contacts with direct opening action (IEC/EN60947-5-1)
- M3 terminal screws for easy wiring
- Gold-plated contacts suitable for small loads

Part Numbers

Contact Configuration	Gland Port Size	Plastic Head Type	Metal Head Type
1NC-1NO Zb Main Circuit 11 12 Monitor Circuit 23 24	G1/2	HS5D-11RN	HS5D-11ZRN
	PG13.5	HS5D-11RNP	HS5D-11ZRNP
	M20	HS5D-11RNM	HS5D-11ZRNM
2NC Zb Main Circuit 11 12 Monitor Circuit 21 22	G1/2	HS5D-02RN	HS5D-02ZRN
	PG13.5	HS5D-02RNP	HS5D-02ZRNP
	M20	HS5D-02RNM	HS5D-02ZRNM
2NC-1NO Zb Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 33 34	G1/2	HS5D-12RN	HS5D-12ZRN
	PG13.5	HS5D-12RNP	HS5D-12ZRNP
	M20	HS5D-12RNM	HS5D-12ZRNM
3NC Zb Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 31 32	G1/2	HS5D-03RN	HS5D-03ZRN
	PG13.5	HS5D-03RNP	HS5D-03ZRNP
	M20	HS5D-03RNM	HS5D-03ZRNM

Parts Description



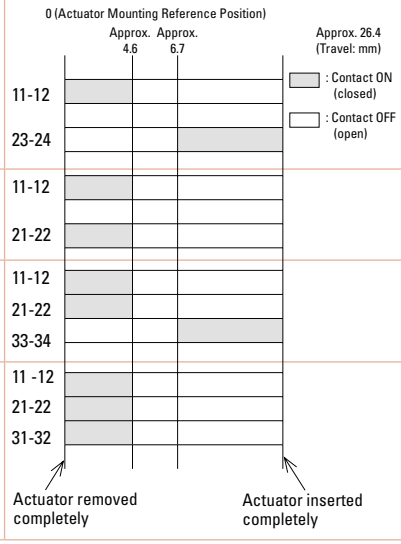
Actuator Keys (order separately)

Item	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A51A	Straight w/rubber bushings
	HS9Z-A52	Right-angle
	HS9Z-A52A	Right-angle w/rubber bushings
	HS9Z-A55	Angle Adjustable (vertical/horizontal)
	HS9Z-A5P	Plug Actuator
	HS9Z-SH5	Sliding Actuator
	HS9Z-PH5	Padlock Hasp

Actuators are not included and must be ordered separately.

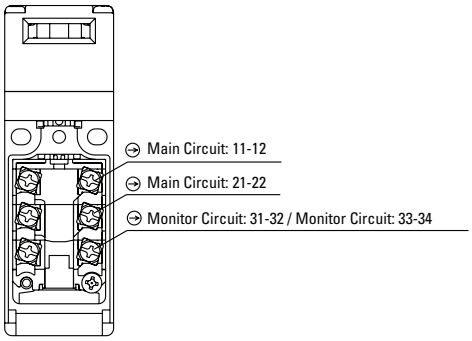
Contact Configuration & Operation Chart

Type	Contact Configuration	Contact Operation Chart (reference)
HS5D-11*	Main Circuit 11 12 Monitor Circuit 23 24	11-12 23-24
HS5D-02*	Main Circuit 11 12 Main Circuit 21 22	11-12 21-22
HS5D-12*	Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 33 34	11-12 21-22 33-34
HS5D-03*	Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit	11 -12 21-22 31-32



The operation characteristics shown in the chart above are for the HS9Z-A51. For other actuator types, add 1.3 mm.
The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch

Terminal Arrangement



Specifications

Applicable Standards	ISO14119, EN1088, IEC60947-5-1, EN60947-5-1 (TÜV approval), GS-ET-15 (TÜV approval), UL508, CSA C22.2 No. 14, GB14048.5 (CCC approval), IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	–30 to +70°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	3
Impulse Withstand Voltage	4 kV
Contact Resistance	50 mΩ maximum (initial value)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum
Electric Shock Protection Class	Class II (IEC61140)
Degree of Protection	IP67 (IEC60529)
Shock Resistance	Damage limits: 1000 m/s^2
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	10 mm minimum
Direct Opening Force	50N minimum
Operating Frequency	900 operations per hour
Mechanical Durability	1,000,000 operations minimum (GS-ET-15)
Electrical Durability	100,000 operations minimum (AC-12 250V, 6A) 1,000,000 operations minimum (24V AC/DC,100 mA) (operation frequency: 900 operations per hour)
Performance of Terminals 11-12 of Removed Head Unit	Mechanical damage limits: 10 operations min. Insulation resistance: 100 MΩ (initial value) Dielectric strength: 1000V, 1 minute (initial value)
Conditional Short-circuit Current	100A (250V) (note)
Weight (approx.)	Plastic head: 80g Metal head: 110g

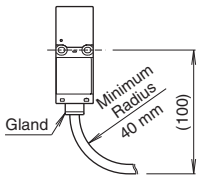
Contact Ratings

Rated Operating Current (I_e)	Operating Voltage (U_e)		30V	125V	250V
	AC	Resistive load (AC-12)	–	2.5A	1.5A
		Inductive load (AC-15)	–	1.5A	0.75A
	DC	Resistive load (DC-12)	2.5A	1.1A	0.55A
			(1A)	(0.22A)	(0.1A)

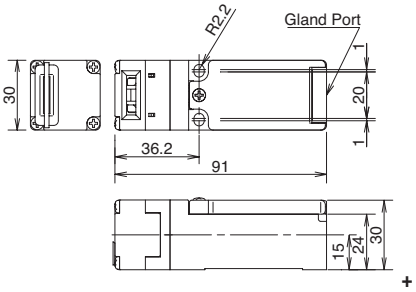
Installation Notes

Recommended Screw Torque

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

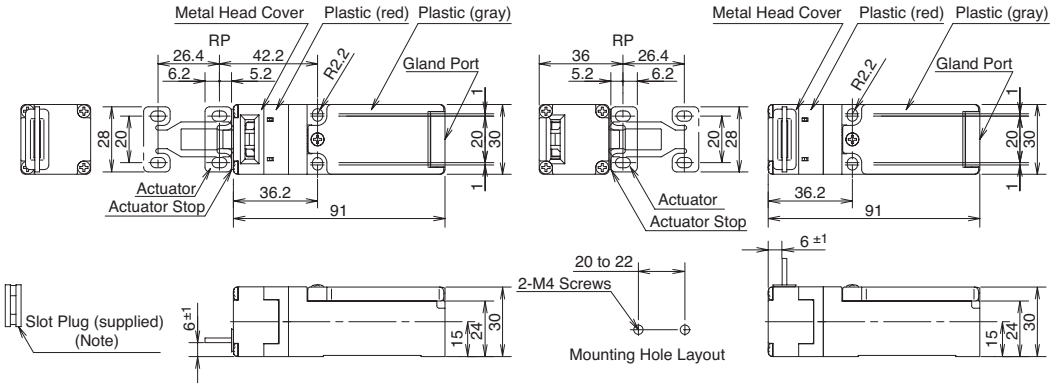


Dimensions and Mounting Hole Layouts

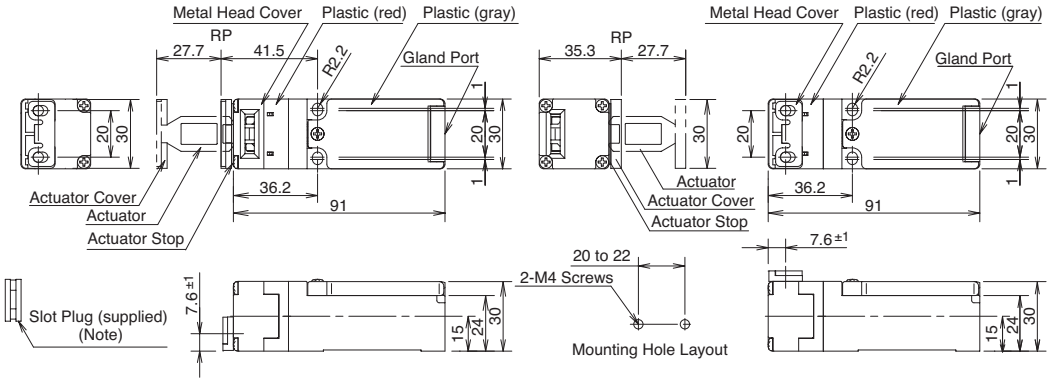


HS5D-□□ZRN□ (Metal Head)
With HS9Z-A51 Straight Actuator

RP: Reference mounting position.

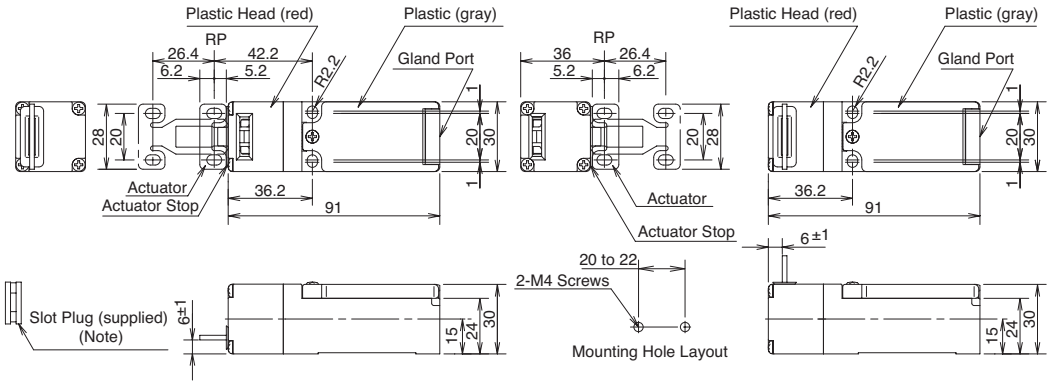


With HS9Z-A52 Right-angle Actuator

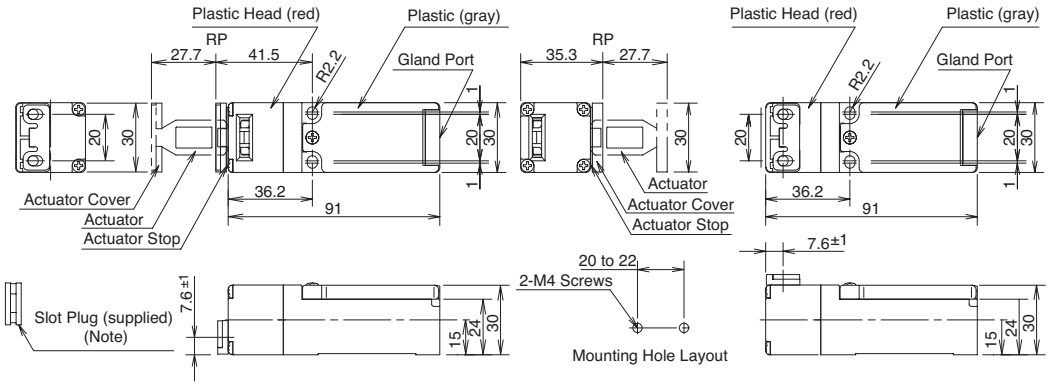


All dimensions in mm.

HS5D-□□RN□ (Plastic Head)
With HS9Z-A51 Straight Actuator



With HS9Z-A52 Right-angle Actuator

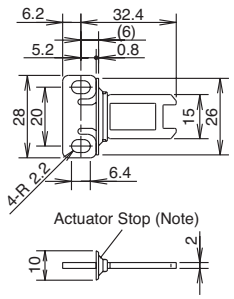


All dimensions in mm.

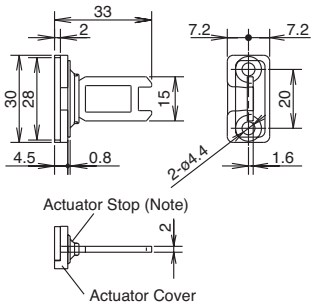
Note: Plug the unused actuator insertion slot using the slot plug supplied with the safety interlock switch.

Actuator Dimensions

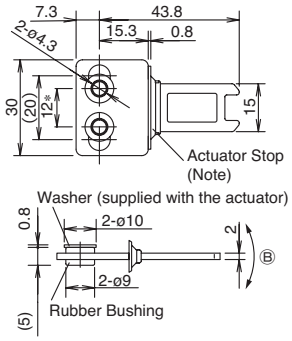
Straight (HS9Z-A51)



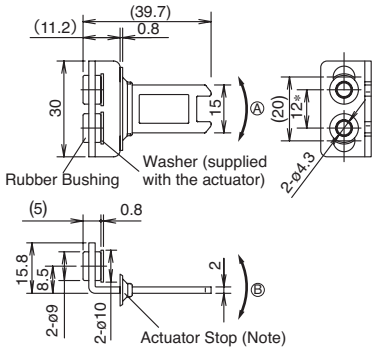
Right-angle (HS9Z-A52)



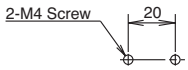
Straight w/rubber bushing (HS9Z-A51A)



Right-angle w/rubber bushing (HS9Z-A52A)

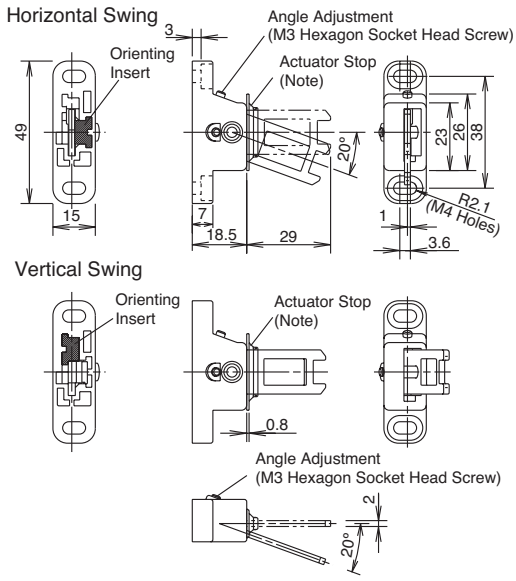


Actuator Mounting Hole Layout (Straight, Right-angle)

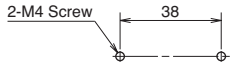


The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
ⒶⒷ The actuator has flexibility to the directions indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

Angle Adjustable (HS9Z-A55)

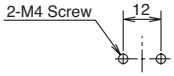


Actuator Mounting Hole Layout (Straight, Right-angle)



Note: 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 w/rubber bushing) (Right-angle w/rubber bushing)

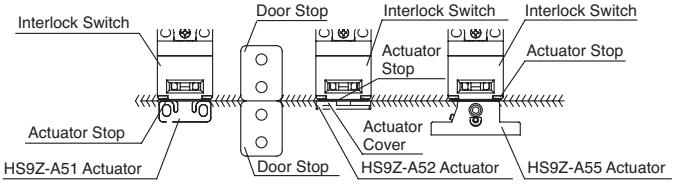


*Mounting centers can be widened to 20 mm by moving the rubber cushions.

Actuator Mounting Reference Position

As shown in the figure below, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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



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.

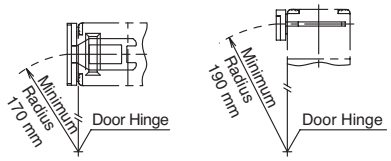
Minimum Radius of Hinged Door

- 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 (HS9Z-A55).

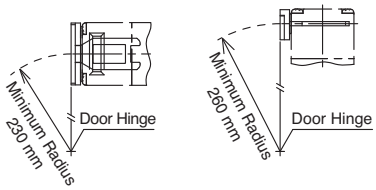
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

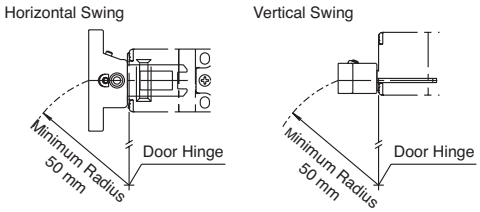


- When the door hinge is on the extension line of the actuator mounting surface:

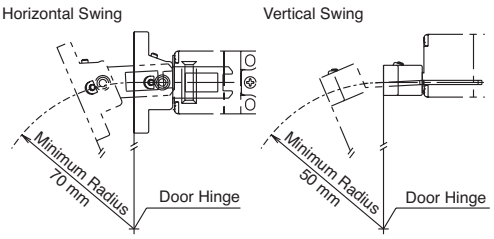


When using the HS9Z-A55 Angle Adjustable Actuator

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



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



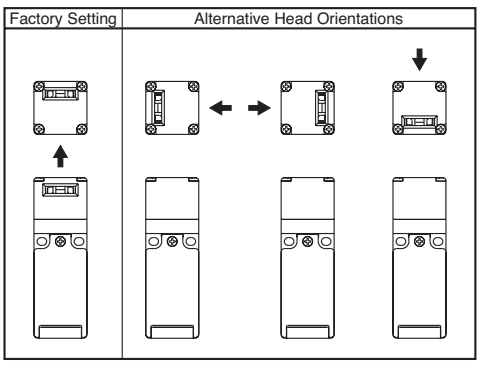
Actuator Angle Adjustment for the HS9Z-A55

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures "Actuator Dimensions" on page 13). 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.

Instructions

Rotating the Head

- The head of the HS5D can be rotated by removing the four screws from the corners of the HS5D 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 tightly, because loose tightening may cause malfunction.
- Recommended screw tightening torque: 0.9 to 1.1 N·m



Head Removal Detection Function

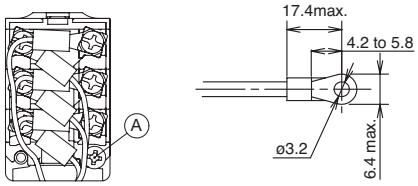
Only the NC contact of the main circuit (11-12) turns OFF (open) when the head is removed, such as when rotating the head. Because NC contacts of other than the main circuit (11-12) turn ON (closed), be sure to connect the main circuit (11-12) to the safety circuit.

Recommended Tightening Torque

- Interlock Switch Mounting Screw: 1.8 ± 2.2 N·m (two M4 screws)
- Housing Lid Screw: 0.2 to 0.4 N·m (M3 screw)
- Terminal Screw: 0.6 to 0.8 N·m (M3 screw)
- Connector: 2.7 to 3.3 N·m
- Actuators
  - HS9Z-A51: 1.8 ± 2.2 N·m (two M4 screws)
  - HS9Z-A52: 0.8 ± 1.2 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 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 be installed in an unremovable manner, for example using special screws or welding the screws.

Applicable Crimping Terminal

When using crimping terminals, be sure to install insulation tubes on the crimping terminals to prevent electric shocks. When using stranded wires, make sure that loose wires do not cause short circuit. Also do not solder the terminal to prevent loose wires.



Applicable wire size (with insulation tube): 0.2 to 0.5 mm^2 (20 ~ 24 AWG)

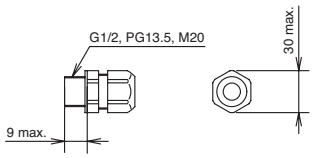
Note: Do not remove screw A during wiring. Removing the screw may cause malfunction or damage.

Applicable Wire Size

0.5 to 1.5 mm^2 (16 ~ 20 AWG)

Applicable Cable Glands

Use a cable gland with a degree of protection IP67.



HS2B Full Size Interlock Switches

Key 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

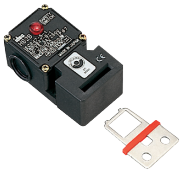
GS-ET-15
BG standard in Germany

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).
Standard stock items in bold.

Actuator Keys & Accessories (order separately)

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

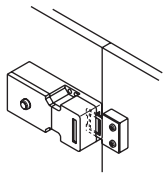
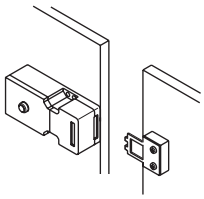
Specifications

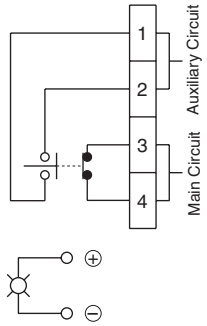
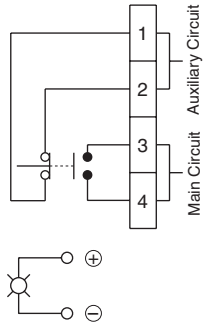
Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508
Operating Temperature		–25 to +70°C (no freezing)
Storage Temperature		–40 to +80°C
Operating Humidity		85% RH maximum (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (Ui)		300V (between LED and ground: 60V)
Impulse 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
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

Contact Ratings

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

Application Examples and Circuit Diagrams

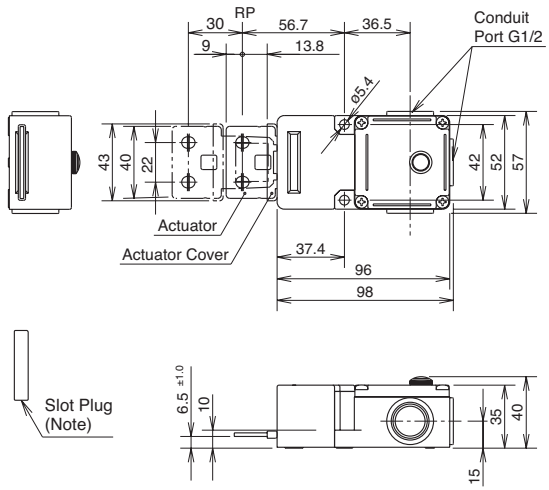
	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
Door		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

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

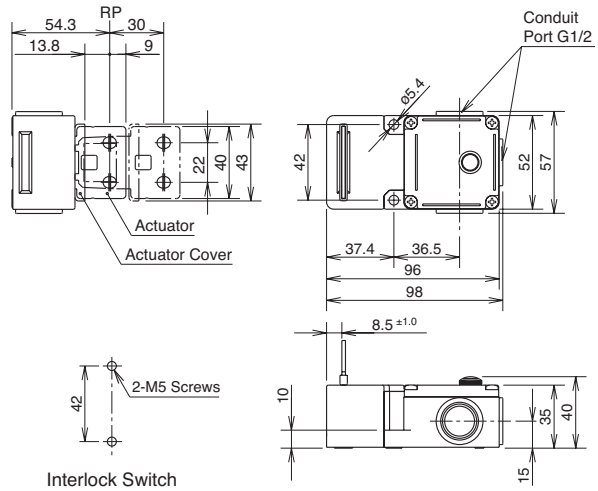
1. Main Circuit: used to enable the machine to start only when the main circuit is closed. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
2. Terminals + and - are used for the LED indicator, and are isolated from door status.

Dimensions (mm)
Using the straight actuator (HS9Z-A1)

(Horizontal Mounting)



(Vertical Mounting)

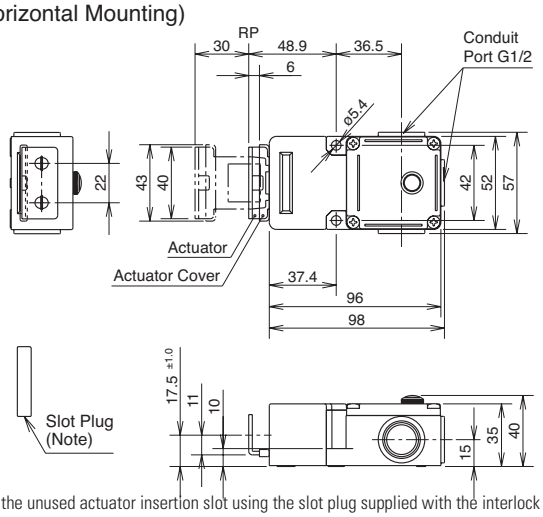


Interlock Switch Mounting Hole Layout

Dimensions (mm), continued

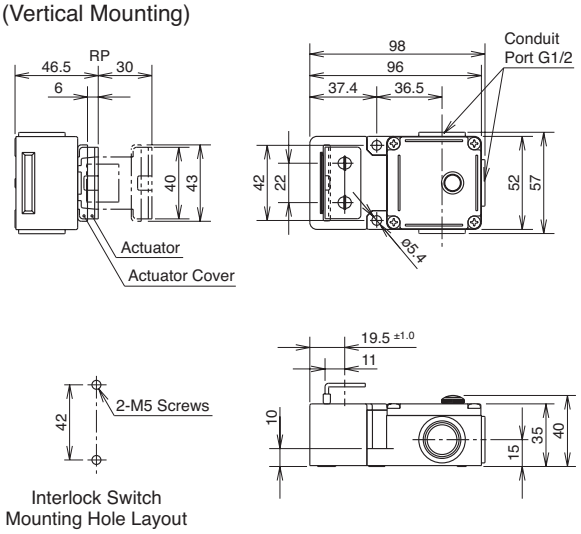
Using the Right-angle actuator (HS9Z-A2)

(Horizontal Mounting)



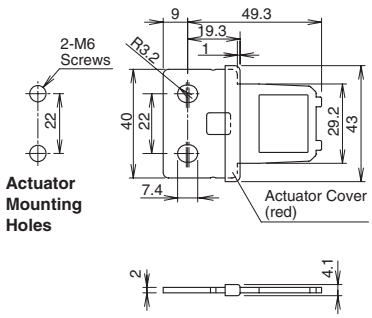
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

(Vertical Mounting)

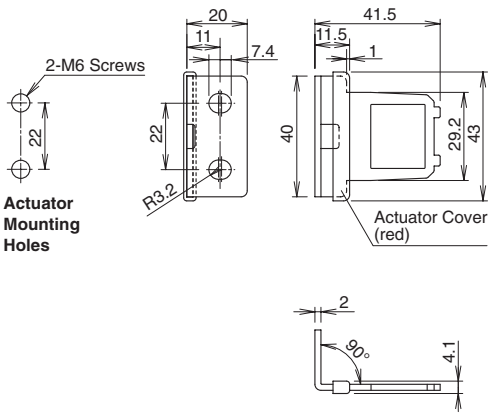


Actuator Dimensions

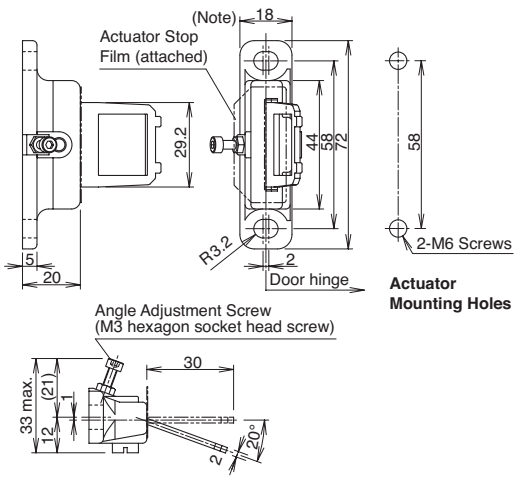
Straight Actuator HS9Z-A1



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

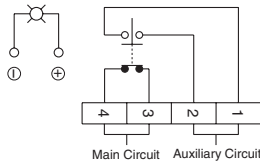
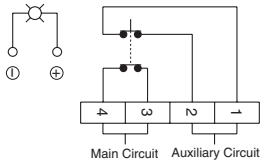
- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0˚) to 20˚
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then 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 Full Size Interlock Switches

Key features:

- Rugged aluminum die-cast housing
- Direct Opening Action
- 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).
- IP67

Part Numbers
Body

Model	Contact Configuration	Pilot Light	Part Number
	1NC-1NO	Without	**HS1B-11R**
		Red LED	HS1B-114R-R
		Green LED	HS1B-114R-G
	2NC	Without	**HS1B-02R**
		Red LED	HS1B-024R-R
		Green LED	**HS1B-024R-G**

Standard stock items in bold.

Actuator Keys and Accessories (order separately)

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

Actuators are not included and must be ordered separately.

Specifications

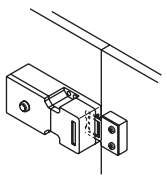
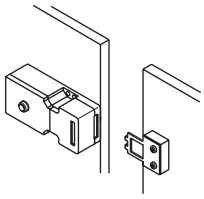
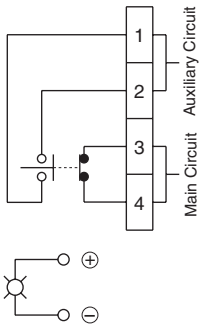
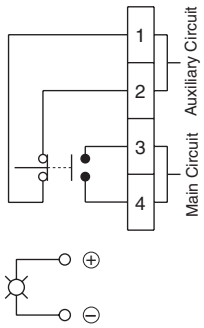
Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508, CSA C22.2 No. 14
Operating Temperature		–20 to +70°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		45 to 85% (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (U_i)		300V (between LED and ground: 60V)
Impulse Withstand Voltage (U_{imp})		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)

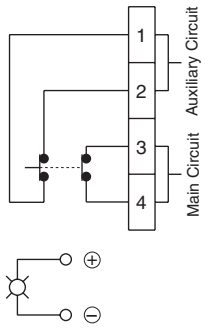
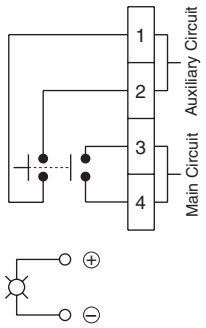
Shock Resistance		1,000 m/sec^2 (approx. 100G)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11 mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		10A
Operating Frequency		900 operations/hour
Mechanical Life		1,000,000 operations
Electrical Life		100,000 operations (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

Contact Ratings

			30V	125V	250V
Rated Operating Current (I_e)	Operating Voltage (U_e)				
	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

Application Examples and Circuit Diagrams

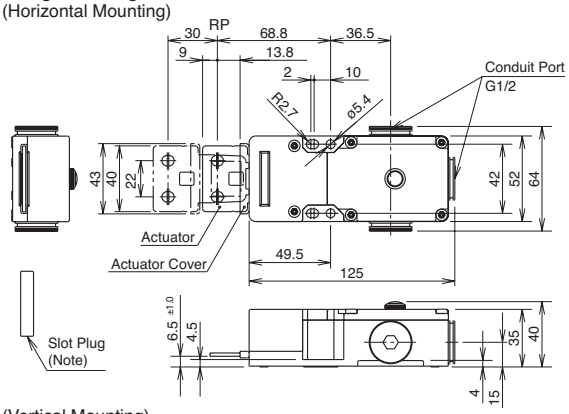
	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
Door		
HS1B-11 (1NO-1NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
HS1B-02 (2NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Open

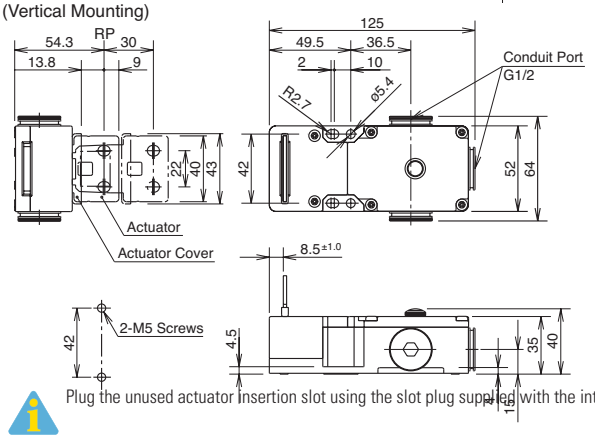
1. Main Circuit: used to enable the machine to start only when the main circuit is closed. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
2. Terminals + and - are used for the LED indicator, and are isolated from door status. Wire the terminals only when needed.

Dimensions (mm)

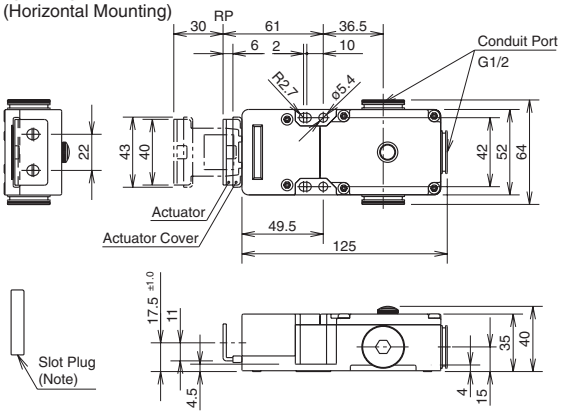
Using the straight actuator (HS9Z-A1)
(Horizontal Mounting)



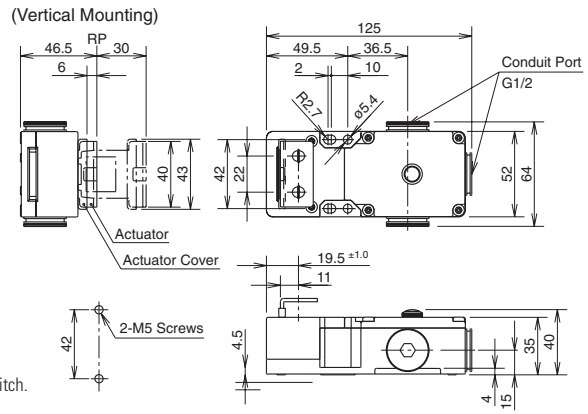
(Vertical Mounting)



Using the Right-angle actuator (HS9Z-A2)
(Horizontal Mounting)



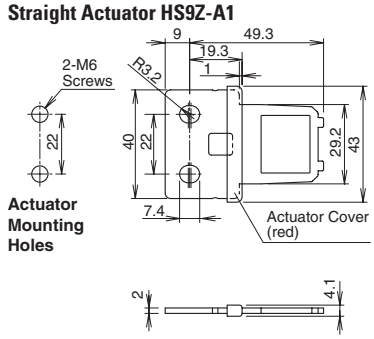
(Vertical Mounting)



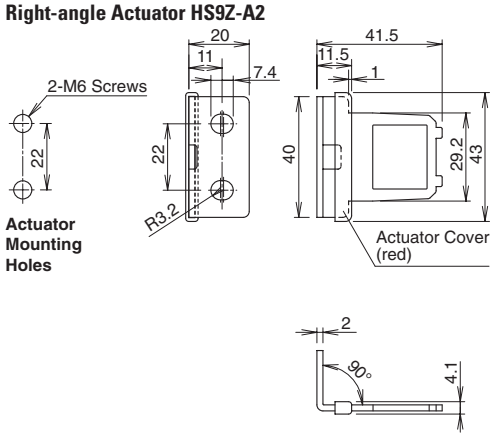
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

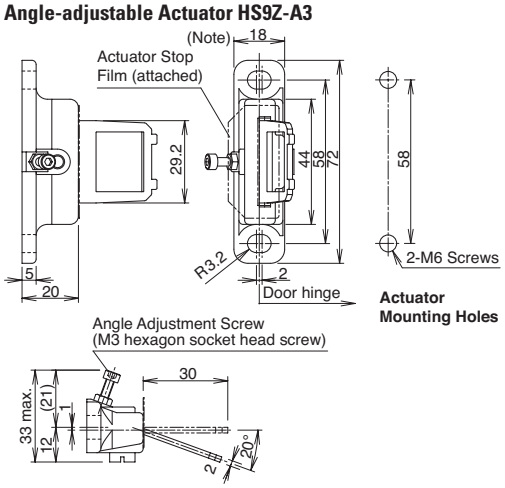
Straight Actuator HS9Z-A1



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.

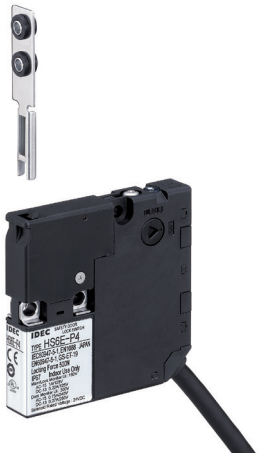
Actuator Angle Adjustment

- 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.

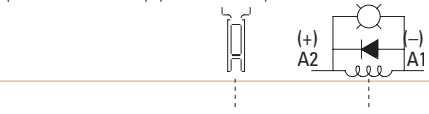
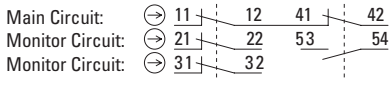
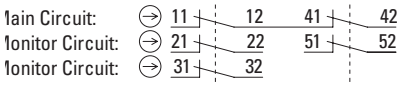
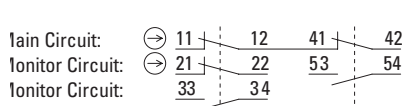
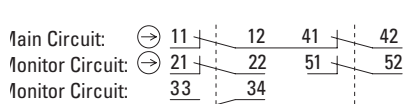
HS6E Subminiature Interlock Switches with Solenoid

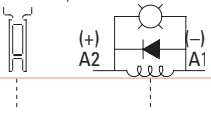
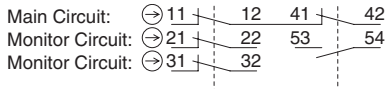
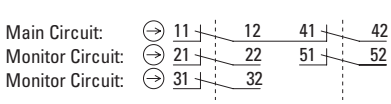
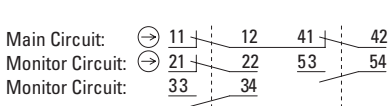
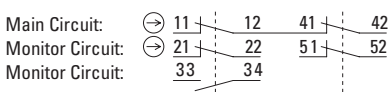
Key features:

- Compact body: 75 × 15 × 75mm
  15mm wide, thinnest solenoid interlock switch in the world
- Reversible mounting and angled cable allow four actuator insertion directions
- Energy saving: 24V DC, 110mA (solenoid: 100mA, LED: 10mA)
- Manual unlocking possible on three sides
- LED indicator shows solenoid operation
- 500N locking retention force



Part Numbers

Mechanical Spring Lock (power solenoid to unlock)		
Contact Configuration	Cable Length	Part Number
(Actuator inserted) (Solenoid OFF) 		
	1m 3m 5m	HS6E-L44B01-G **HS6E-L44B03-G** **HS6E-L44B05-G**
	1m 3m 5m	**HS6E-M44B01-G** **HS6E-M44B03-G** **HS6E-M44B05-G**
	1m 3m 5m	**HS6E-N44B01-G** **HS6E-N44B03-G** HS6E-N44B05-G
	1m 3m 5m	HS6E-P44B01-G **HS6E-P44B03-G** **HS6E-P44B05-G**

Solenoid Lock (remove power to solenoid to unlock)		
Contact Configuration	Cable Length	Part Number
(Actuator inserted) (Solenoid ON) 		
	1m 3m 5m	**HS6E-L7Y4B01-G** **HS6E-L7Y4B03-G** **HS6E-L7Y4B05-G**
	1m 3m 5m	**HS6E-M7Y4B01-G** **HS6E-M7Y4B03-G** **HS6E-M7Y4B05-G**
	1m 3m 5m	**HS6E-N7Y4B01-G** **HS6E-N7Y4B03-G** **HS6E-N7Y4B05-G**
	1m 3m 5m	HS6E-P7Y4B01-G **HS6E-P7Y4B03-G** HS6E-P7Y4B05-G

1. Contact configuration shows the contact status when actuator is inserted and solenoid off for spring lock.
2. Contact configuration shows the contact status when actuator is inserted and solenoid on for solenoid lock.
3. Indicator LED color is green.
4. Actuator keys are not supplied with the interlock switch and must be ordered separately.
5. Manual unlock key is included with the interlock switch.
6. Standard stock items in bold.

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 page 320 for more information. The retention force of HS9Z-A65 and HS9Z-A66 500N maximum.
	Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A66	

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 (U_i)		300V (between LED and ground: 60V)
Impulse Withstand Voltage (U_{imp})		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	22 AWG (12-core: 0.3 mm^2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight	Approx. 200g

1. 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 duty250V DC, 0.27A Pilot duty
2. 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

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

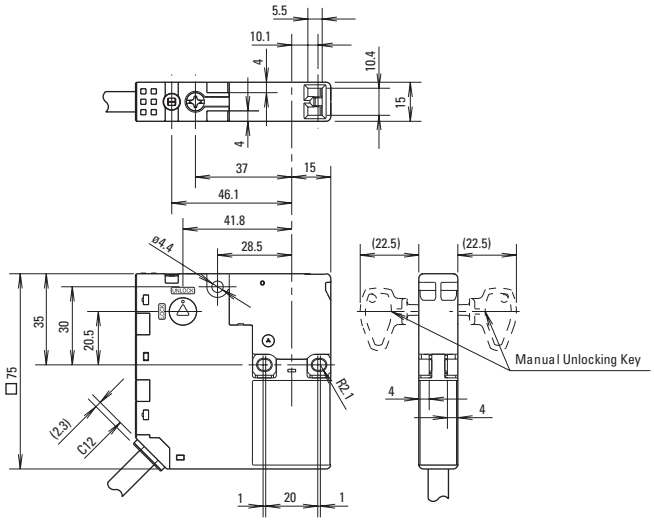
Contact Ratings

	Operating Voltage (U_e)			30V	125V	250V
Rated Operating Current (I_e)	Main and Lock Monitor Circuits	AC	Resistive load (AC-12) Inductive load (AC-15)	–	2A 1A	–
		DC	Resistive load (DC-12) Inductive load (DC-13)	2A 1A	0.4A 0.22A	–
	Door Monitor Circuit	AC	Resistive load (AC-12) Inductive load (AC-15)	–	2.5A 1.5A	1.5A 0.75A
		DC	Resistive load (DC-12) Inductive load (DC-13)	2.5A 2.3A	1.1A 0.55A	0.55A 0.27A

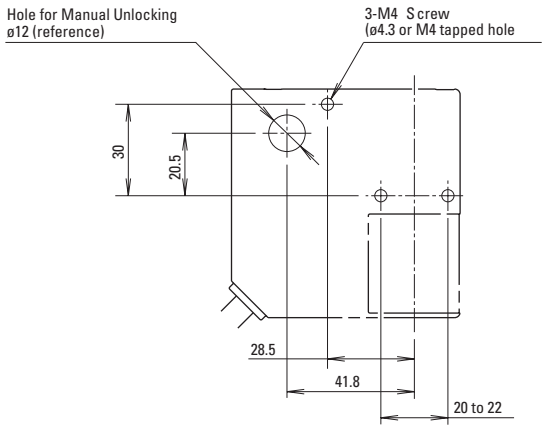
1. UL, c-UL rating: Main/Lock monitor circuit: 125V AC, 1A Pilot duty, 125V DC, 0.22A Pilot duty
   Door monitor circuit:240V AC, 0.75A Pilot duty250V DC, 0.27A Pilot duty
2. TÜV rating: Main/Lock monitor circuit: AC-15 125V/1A, DC-13 125V/0.22A
   Door monitor circuit: AC-15 240V/0.75A, DC-13 250V/0.27A

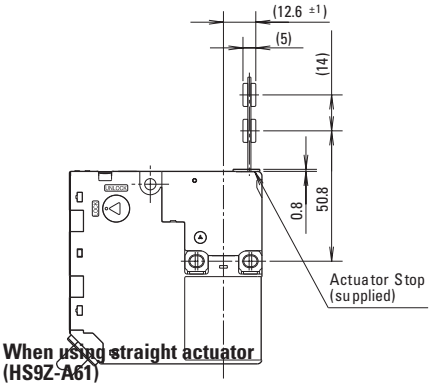
Dimensions (mm)

Interlock Switch

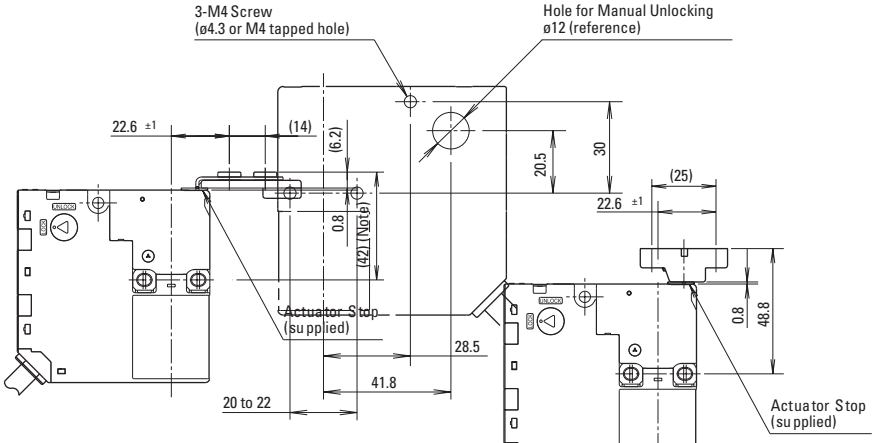


Mounting Hole Layout





When using straight actuator (HS9Z-A61)



When using right-angle actuator (HS9Z-A62)

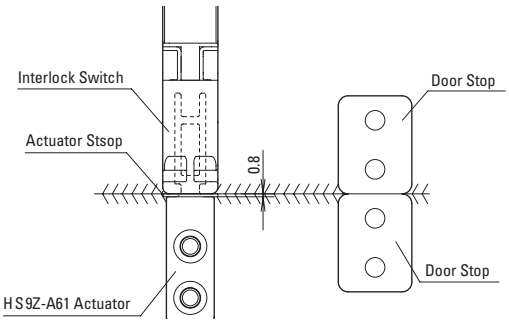
When using horizontal/vertical angle adjustable actuator (HS9Z-A65/A66)

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:

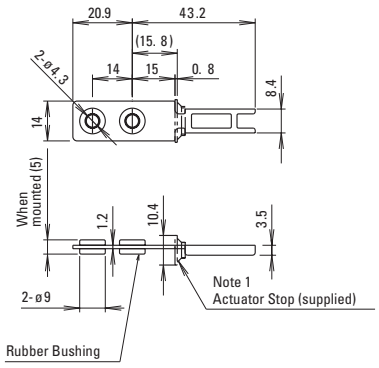
The actuator stop on the actuator lightly touches the interlock switch.

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



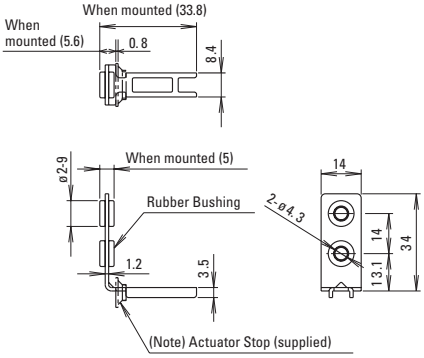
Actuator Key Dimensions (mm)

Straight Actuator (HS9Z-A61)



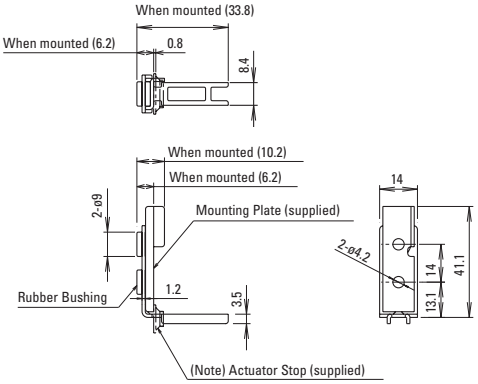
Straight Actuator (HS9Z-A61) Right-angle Actuator (HS9Z-A62)

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)

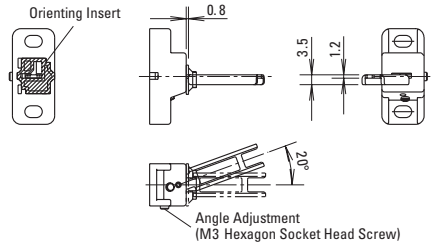
Note: See page 323 for actuator installation.



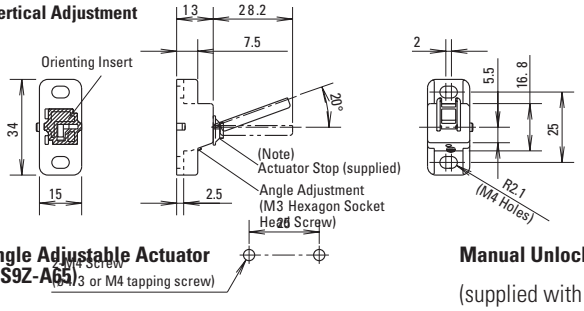
The actuator stop is used to adjust the actuator position. Remove after the actuator position is mounted.

Angle Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment



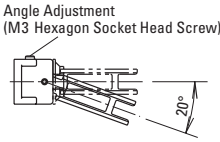
Vertical Adjustment



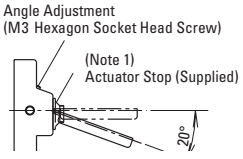
Angle Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment

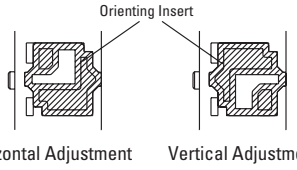


Vertical Adjustment



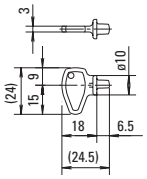
Actuator Adjustment Orientation

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

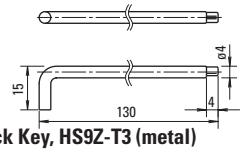


Manual Unlock Key (plastic)

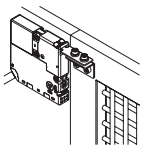
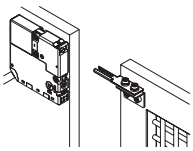
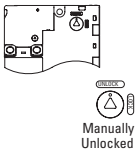
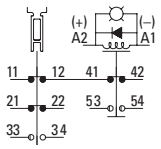
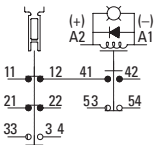
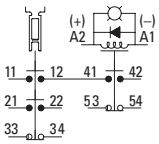
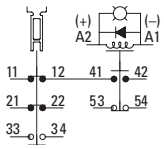
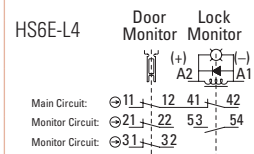
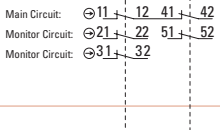
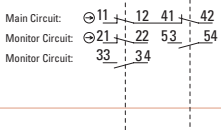
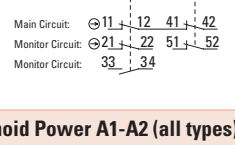
(supplied with switch, not replaceable)



Manual Unlock Key, HS9Z-T3 (metal)

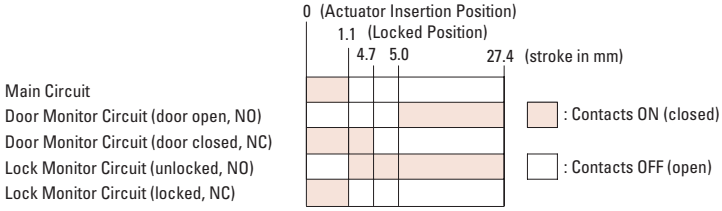


Circuit Diagrams and Operating Characteristics

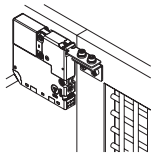
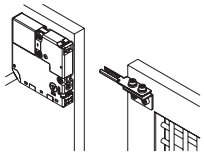
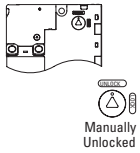
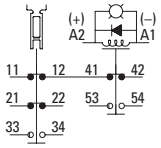
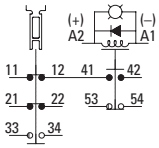
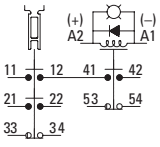
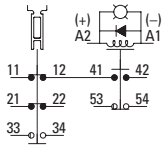
Spring Lock Type	Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status	Door closed **Machine ready to operate** Solenoid de-energized	Door opened Machine cannot be operated Solenoid energized	Door open Machine cannot be operated Solenoid energized	Door open Machine 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)



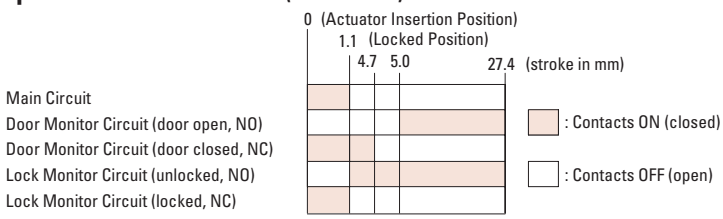
The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

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

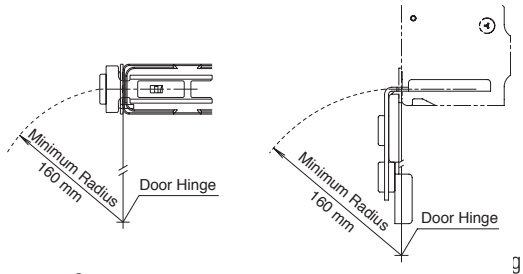
Minimum Radius of Hinged Door

- 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).

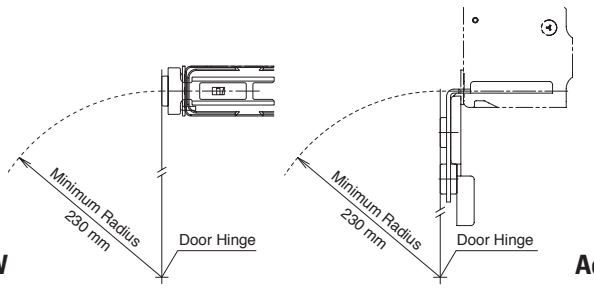
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

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

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



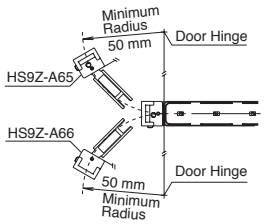
- g surface:



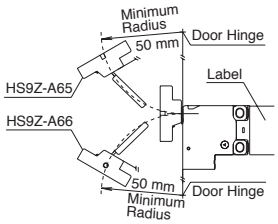
W **Actuator**

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

Horizontal Adjustment

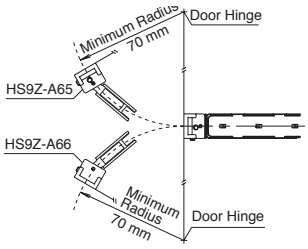


Vertical Adjustment

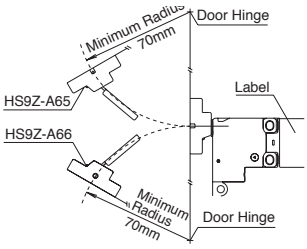


- When door hinge is on the extension line of the actuator mounting surface

Horizontal Adjustment



Vertical Adjustment

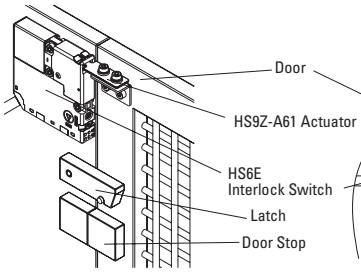


Actuator Angle Adjustment for the HS9Z-A65/HS9Z-A66

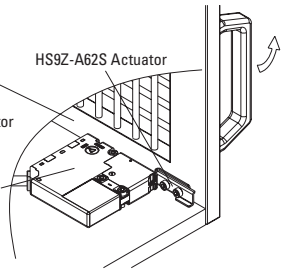
- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).
  Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator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

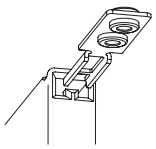
Application on Sliding Doors



Application on Hinged Doors

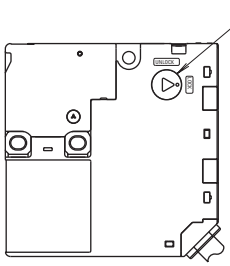


Note: When mounting the actuator, make sure that the actuator enters the slot in the correct direction, as shown on the right.



For Manual Unlocking

When using the manual unlock key



Normal Position

Manual Unlocking Position

- 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.

Manual Unlock Key
(supplied with the interlock switch)

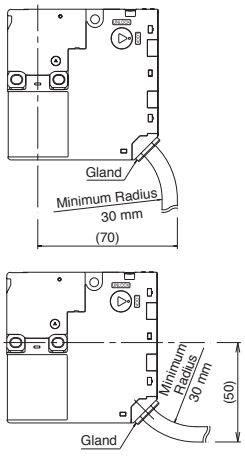
See instruction manual for full details.

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)

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	Door Monitor / Lock Monitor (+) White A2 (–) A1 Black Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 53 54 Pink/White Monitor circuit: Orange 31 32 Orange/White
HS6E-M	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 51 52 Pink/White Monitor circuit: Orange 31 32 Orange/White
HS6E-N	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 53 54 Pink/White Monitor circuit: Orange 33 34 Orange/White
HS6E-P	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 51 52 Pink/White Monitor circuit: Orange 33 34 Orange/White

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

HS5E Miniature Interlock Switches with Solenoid

Spring Lock Type Features:

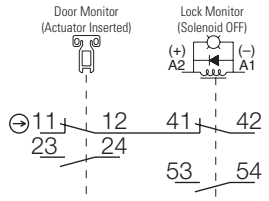
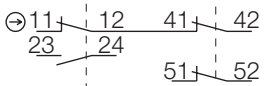
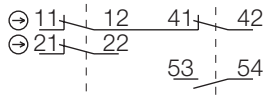
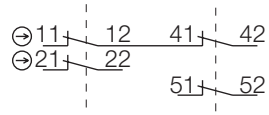
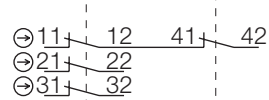
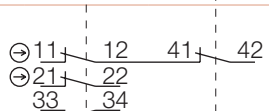
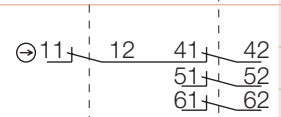
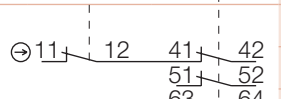
- Automatically locks the actuator without power applied to the solenoid
- After the machine stops, unlocking is completed by the solenoid, providing high safety features
- Manual unlocking is possible in the event of power failure or maintenance
- Gold-plated contacts

Solenoid Lock Type Features:

- 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 machine must be prevented
- Gold-plated contacts

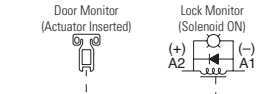
Part Numbers

Spring Lock Type (Power Solenoid to Unlock)

Circuit Code	Contact Configuration	Cable Length	Part Number		
			Without LED	With LED	With LED and Rear Unlock Button
A **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NO**		1m	**HS5E-A4001**	**HS5E-A4401-G**	HS5E-A44L01-G
		3m	**HS5E-A4003**	**HS5E-A4403-G**	HS5E-A44L03-G
		5m	**HS5E-A4005**	**HS5E-A4405-G**	HS5E-A44L05-G
B **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NC**		1m	HS5E-B4001	HS5E-B4401-G	
		3m	HS5E-B4003	HS5E-B4403-G	
		5m	HS5E-B4005	**HS5E-B4405-G**	
C **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NO**		1m	**HS5E-C4001**	HS5E-C4401-G	HS5E-C44L01-G
		3m	**HS5E-C4003**	HS5E-C4403-G	HS5E-C44L03-G
		5m	**HS5E-C4005**	**HS5E-C4405-G**	HS5E-C44L05-G
D **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NC**		1m	**HS5E-D4001**	**HS5E-D4401-G**	**HS5E-D44L01-G**
		3m	**HS5E-D4003**	**HS5E-D4403-G**	**HS5E-D44L03-G**
		5m	**HS5E-D4005**	**HS5E-D4405-G**	**HS5E-D44L05-G**
F **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	**HS5E-F4001**	**HS5E-F4401-G**	**HS5E-F44L01-G**
		3m	**HS5E-F4003**	**HS5E-F4403-G**	**HS5E-F44L03-G**
		5m	HS5E-F4005	**HS5E-F4405-G**	**HS5E-F44L05-G**
G **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-G4001	**HS5E-G4401-G**	HS5E-G44L01-G
		3m	HS5E-G4003	HS5E-G4403-G	HS5E-G44L03-G
		5m	**HS5E-G4005**	**HS5E-G4405-G**	HS5E-G44L05-G
H **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-H4001	HS5E-H4401-G	
		3m	HS5E-H4003	HS5E-H4403-G	
		5m	HS5E-H4005	HS5E-H4405-G	
J **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-J4001	HS5E-J4401-G	
		3m	HS5E-J4003	HS5E-J4403-G	
		5m	HS5E-J4005	HS5E-J4405-G	

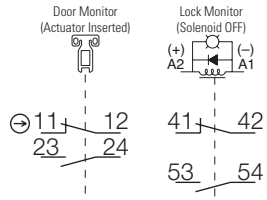
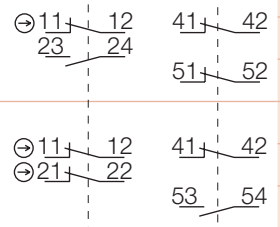
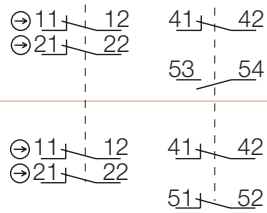
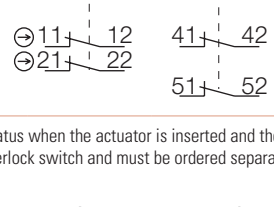
The contact configuration shows the status when the actuator is inserted and the switch is locked.
The contact configuration shows the status when the indicator is installed.
Actuators are not supplied with the interlock switch and must be ordered separately.
Standard stock items in bold

Dual Safety Circuit type

Circuit Code	Contact Configuration	Cable Length	Part Number
DD **Main Circuit: 1NC+1NC** **1NC+1NC**		1m	**HS5E-DD4401-G**
		3m	**HS5E-DD4403-G**
		5m	**HS5E-DD4405-G**

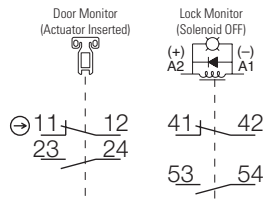
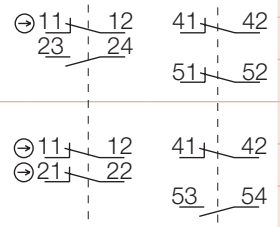
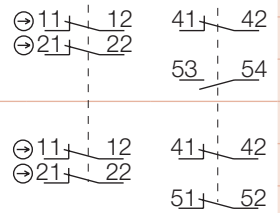
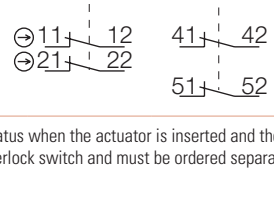
1. The contact configuration shows the status when the actuator is inserted and the switch is locked.
2. Manual unlock key is included with the interlock switch.
3. Actuators are not supplied with the interlock switch and must be ordered separately.
4. Standard stock items in bold

Four-circuit Independent Output Type (Spring Lock)

Circuit Code	Contact Configuration	Cable Length	Part Number
VA **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 1NC, 1NO**		1m	**HS5E-VA4401-G**
		3m	HS5E-VA4403-G
		5m	HS5E-VA4405-G
VB **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 2NC**		1m	HS5E-VB4401-G
		3m	HS5E-VB4403-G
		5m	HS5E-VB4405-G
VC **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 1NC, 1NO**		1m	HS5E-VC4401-G
		3m	HS5E-VC4403-G
		5m	HS5E-VC4405-G
VD **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 2NC**		1m	HS5E-VD4401-G
		3m	HS5E-VD4403-G
		5m	**HS5E-VD4405-G**

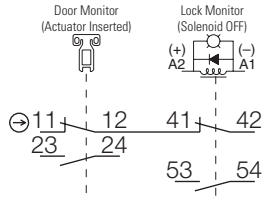
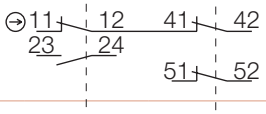
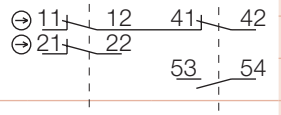
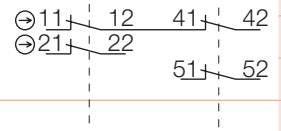
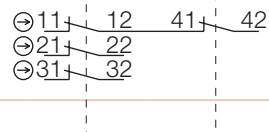
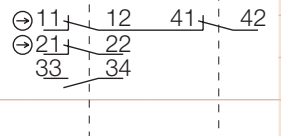
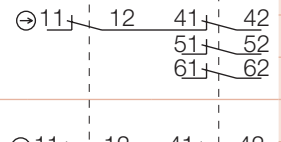
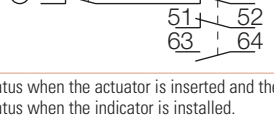
The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with the interlock switch and must be ordered separately.
Standard stock items in bold.

Four-circuit Independent Output Type (Solenoid Lock)

Circuit Code	Contact Configuration	Cable Length	Part Number
VA **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 1NC, 1NO**		1m	**HS5E-VA7Y401-G**
		3m	HS5E-VA7Y403-G
		5m	**HS5E-VA7Y405-G**
VB **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 2NC**		1m	HS5E-VB7Y401-G
		3m	HS5E-VB7Y403-G
		5m	HS5E-VB7Y405-G
VC **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 1NC, 1NO**		1m	**HS5E-VC7Y401-G**
		3m	HS5E-VC7Y403-G
		5m	HS5E-VC7Y405-G
VD **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 2NC**		1m	**HS5E-VD7Y401-G**
		3m	**HS5E-VD7Y403-G**
		5m	**HS5E-VD7Y405-G**

The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with the interlock switch and must be ordered separately.
Standard stock items in bold.

Solenoid Lock Type (Remove Power to Unlock)

Circuit Code	Contact Configuration	Cable Length	Part Number	
			Without LED	With LED
A **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NO**		1m	**HS5E-A7Y001**	**HS5E-A7Y401-G**
		3m	**HS5E-A7Y003**	**HS5E-A7Y403-G**
		5m	**HS5E-A7Y005**	**HS5E-A7Y405-G**
B **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NC**		1m	HS5E-B7Y001	HS5E-B7Y401-G
		3m	HS5E-B7Y003	HS5E-B7Y403-G
		5m	HS5E-B7Y005	HS5E-B7Y405-G
C **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NO**		1m	**HS5E-C7Y001**	**HS5E-C7Y401-G**
		3m	**HS5E-C7Y003**	**HS5E-C7Y403-G**
		5m	HS5E-C7Y005	**HS5E-C7Y405-G**
D **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NC**		1m	**HS5E-D7Y001**	**HS5E-D7Y401-G**
		3m	**HS5E-D7Y003**	**HS5E-D7Y403-G**
		5m	**HS5E-D7Y005**	**HS5E-D7Y405-G**
F **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	**HS5E-F7Y001**	**HS5E-F7Y401-G**
		3m	**HS5E-F7Y003**	**HS5E-F7Y403-G**
		5m	**HS5E-F7Y005**	**HS5E-F7Y405-G**
G **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	**HS5E-G7Y001**	HS5E-G7Y401-G
		3m	**HS5E-G7Y003**	**HS5E-G7Y403-G**
		5m	**HS5E-G7Y005**	**HS5E-G7Y405-G**
H **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-H7Y001	HS5E-H7Y401-G
		3m	HS5E-H7Y003	HS5E-H7Y403-G
		5m	HS5E-H7Y005	HS5E-H7Y405-G
J **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-J7Y001	HS5E-J7Y401-G
		3m	HS5E-J7Y003	HS5E-J7Y403-G
		5m	HS5E-J7Y005	HS5E-J7Y405-G

The contact configuration shows the status when the actuator is inserted and the switch is locked.
The contact configuration shows the status when the indicator is installed.
Actuators are not supplied with the interlock switch and must be ordered separately.
Standard stock items in bold

Actuator Keys & Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A52	Right-angle
	HS9Z-A53	Angle adjustable vertical operation
	HS9Z-A55	Angle adjustable horizontal/vertical operation [1]
	HS9Z-A5P	Plug Actuator (allows switch to be used as interlock plug unit)

Item	Part Number	Description
	HS9Z-PH5	Padlock Hasp (prevents unauthorized insertion of actuator)
	HS9Z-SP51	Mounting Plate (allows easy mounting to aluminum frames)
	HS9Z-T3	Manual unlock key (long type - metal)
	HS9Z-SH5	Sliding Actuator

1. The actuator tensile strength is 500N minimum.
2. Actuators are not included and must be included separately.

Specifications

Conforming Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (BG approval), UL508, CSA C22.2, No. 14, GB 140485.5 (CCC approval) IEC60204-1/EN60204-1
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 1.0m/s
Direct Opening Travel	Actuator HS9Z-A51: 11mm minimum Actuator HS9Z-A52/A53/A55: 12mm minimum
Direct Opening Force	80N minimum
Actuator Retention Force	1400N 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	21AWG - 8-core: 0.5mm^2 or equivalent/core (HS5E-V types: No. 22AWG - 12-core :0.3mm^2 on equivalent/ core)
Cable Diameter	ø7.6 mm
Weight (approx.)	400g - 1m cable type, 580g - 3m cable type, 760g - 5m cable type

Specifications

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%
Insulation Class	Class F

Current Ratings

Rated Insulation Voltage (U_i) [2]			250V (between LED, solenoid and grounding: 30V)		
Thermal Current (I_{th})			2.5A		
Rated Voltage (U_e)			30V	125V	250V
Rated Current (Ie) [3]	AC	Resistive load (AC12)	—	2.5A	1.5A
		Inductive Load (AC15)	—	1.5A	0.75A
	DC	Resistive load (DC12)	2.5A	1.1A	0.55A
		Inductive Load (DC13)	2.3A	0.55A	0.27A

Pilot Light

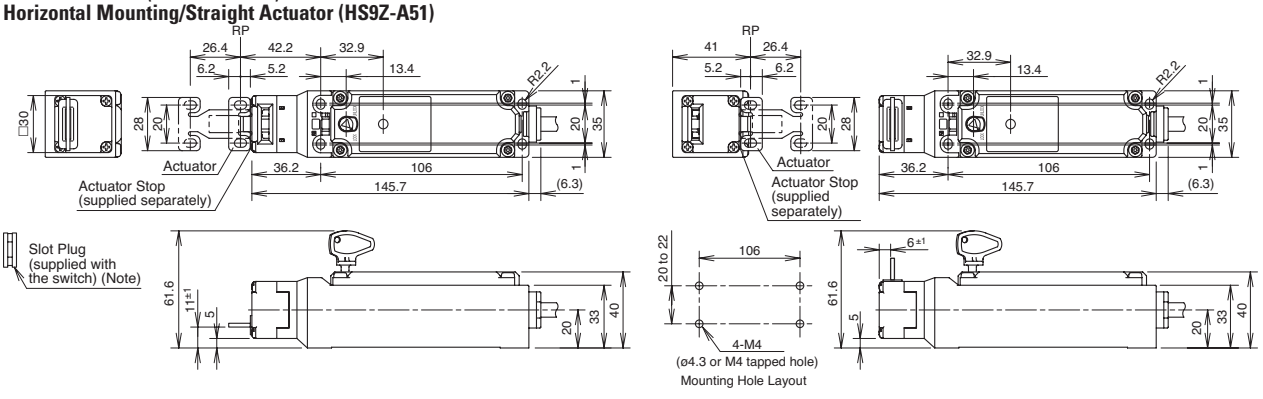
Rated Voltage	24V DC
Current	10mA
Light Source	LED
Light Color	Green

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

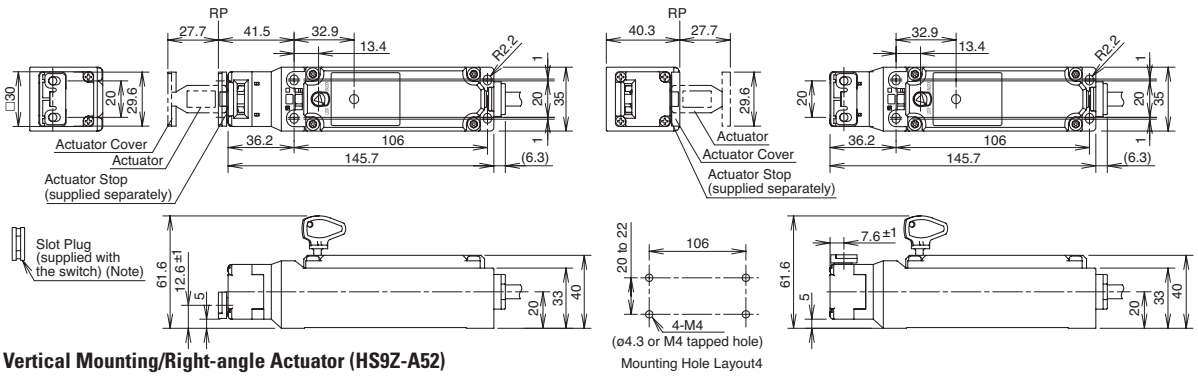
Dimensions (mm) and Mounting Hole Layouts

HS5E-□□4□-G (with indicator)

Horizontal Mounting/Straight Actuator (HS9Z-A51)

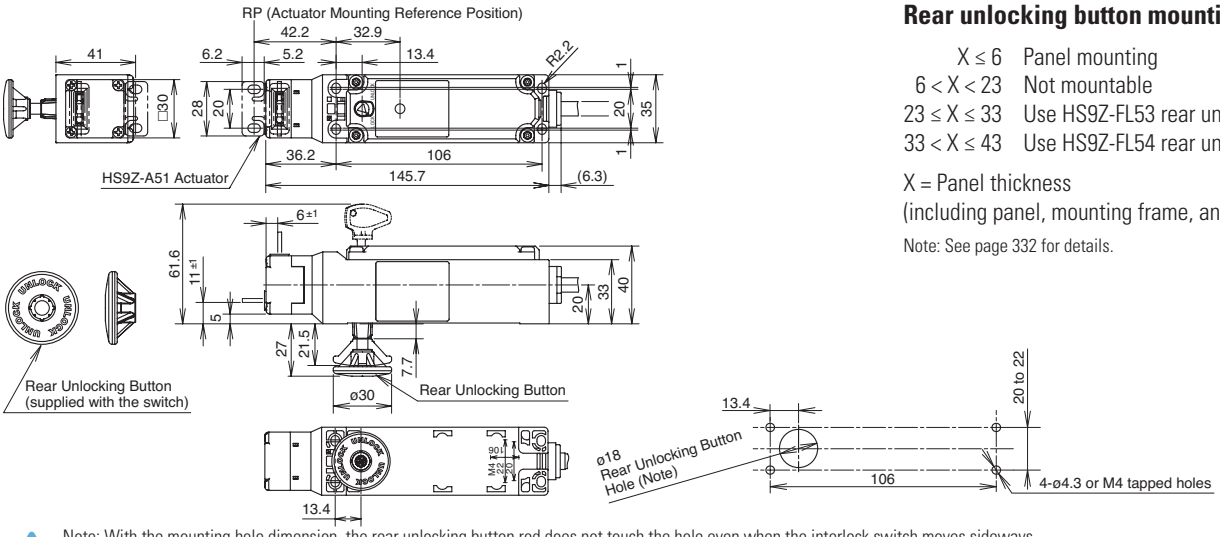


Vertical Mounting/Right-angle Actuator (HS9Z-A52)



HS5E-□44L□-G (rear unlocking button type)

Horizontal Mounting/Straight Actuator (HS9Z-A51)



Rear unlocking button mounting

X ≤ 6	Panel mounting
6 < X < 23	Not mountable
23 ≤ X ≤ 33	Use HS9Z-FL53 rear unlocking button kit (Note)
33 < X ≤ 43	Use HS9Z-FL54 rear unlocking button kit (Note)

X = Panel thickness
(including panel, mounting frame, and mounting plate)

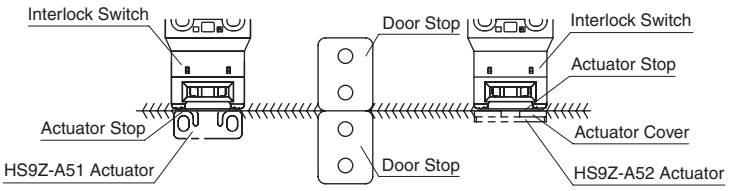
Note: See page 332 for details.

Note: With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

Actuator Mounting Reference Position

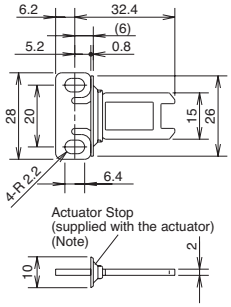
As shown in the figure on the right, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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

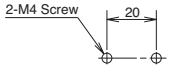


Dimensions and Mounting Hole Layouts, continued

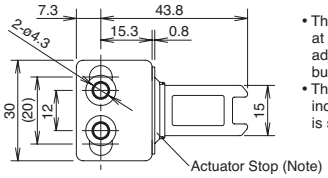
Straight Actuator (HS9Z-A51)



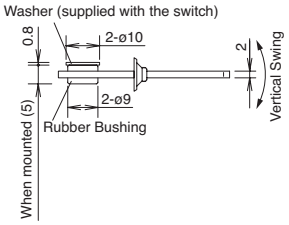
• Actuator Mounting Hole Layout
(Straight, L-shaped)



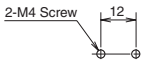
Straight Actuator w/Rubber Bushings (HS9Z-A51A)



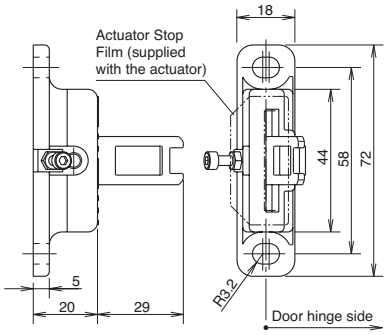
- The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
- The actuator has flexiblity to the direction indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

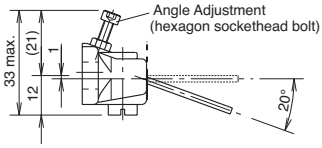


• Actuator Mounting Hole Layout
Straight type (with rubber bushings)
Right-angle type (with rubber bushings)

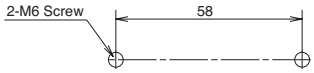


Note: Mounting centers can be widened to 20 mm by moving the rubber bushings.





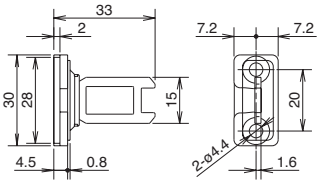
• Actuator Mounting Hole Layout
(vertical swing)

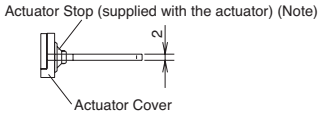


Actuator Orientation

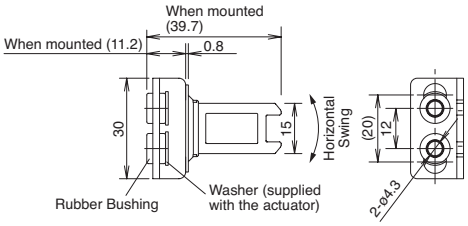
The orientation of actuator swing (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the orientating insert, otherwise the actuator will not swing properly.

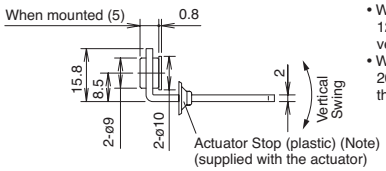
Right-angle Actuator (HS9Z-A52)



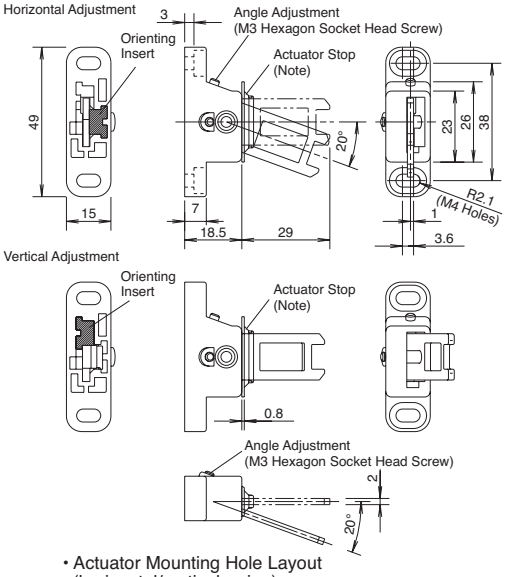


Right-angle Actuator w/Rubber Bushings (HS9Z-A52A)

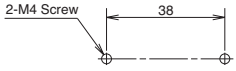




- When the mounting center distance is set to 12 mm, the actuator has flexibility both vertically and horizontally.
- When the mounting center distance is set to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber bushings.

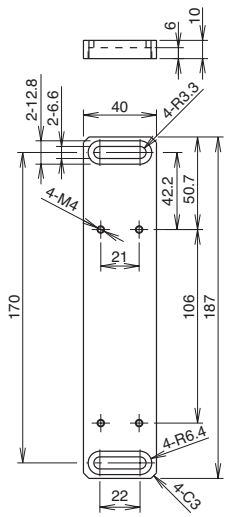


• Actuator Mounting Hole Layout
(horizontal/vertical swing)

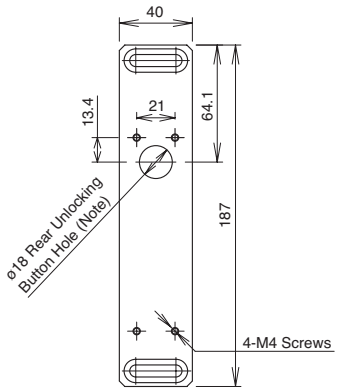


Dimensions and Mounting Hole Layouts, continued

Mounting Plate (HS9Z-SP51)

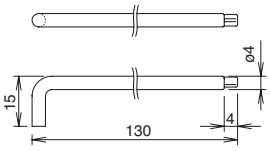


Drilling Rear Unlocking Button Hole

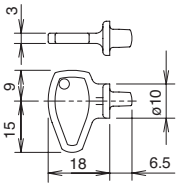


When installing the HS5E-□44L□-G (rear unlocking button type), provide a rear unlocking button hole on the HS9Z-SP51.

Manual Unlocking Key (Metal) (HS9Z-T3)

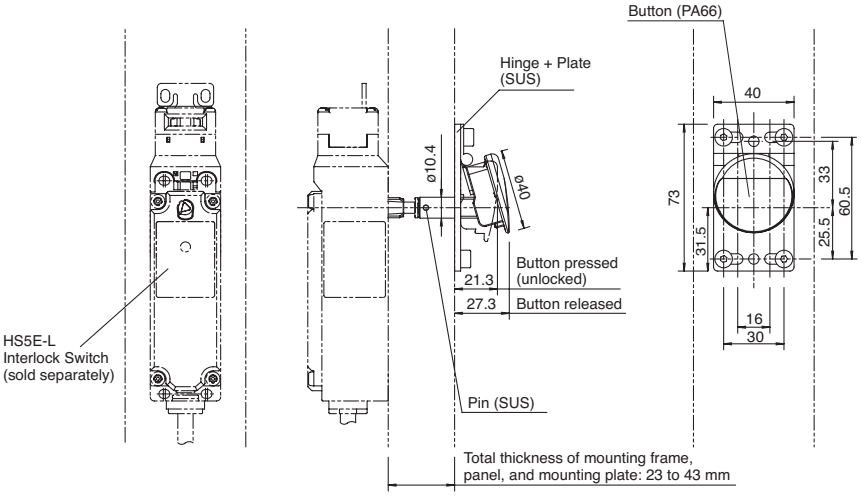


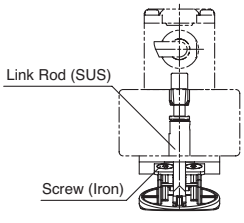
Manual Unlocking Key (plastic)



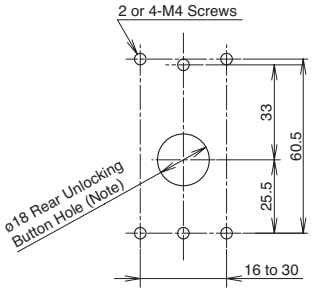
Material: Anodized aluminum A6063
Weight: Approx. 180g

Rear Unlocking Button Kit (HS9Z-FL5□)





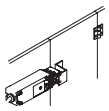
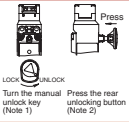
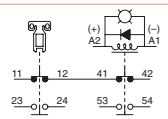
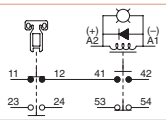
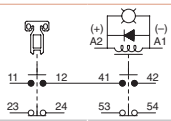
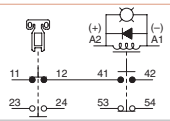
Rear Unlocking Button Kit Mounting Hole Layout



Note: With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

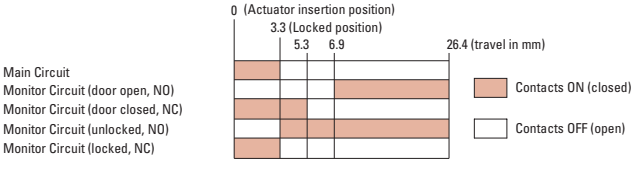
Circuit Diagrams and Operating Characteristics

Standard and Rear Unlocking Type - Spring Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-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 energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-A4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration — HS5E-A4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-A4 — Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-A4 — 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)
HS5E-B4 — Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-B4 — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-C4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-C4 — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-C4 — Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-D4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-D4 — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-D4 — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-F4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-F4 — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-F4 — Monitor Circuit (door closed) 31–32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-G4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-G4 — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-G4 — Monitor Circuit (door open) 33–34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-H4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-H4 — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-H4 — Monitor Circuit (locked) 61–62	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J4 — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J4 — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J4 — Monitor Circuit (unlocked) 63–64	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

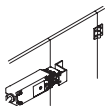
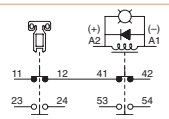
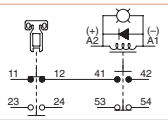
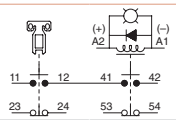
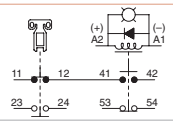
Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

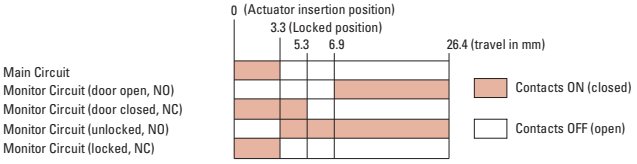
Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-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 energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-A7Y)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration — HS5E-A7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-A7Y — Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-A7Y — 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)
HS5E-B7Y — Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-B7Y — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-C7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-C7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-C7Y — Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-D7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-D7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-D7Y — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-F7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-F7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-F7Y — Monitor Circuit (door closed) 31–32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-G7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-G7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-G7Y — Monitor Circuit (door open) 33–34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-H7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-H7Y — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-H7Y — Monitor Circuit (locked) 61–62	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J7Y — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J7Y — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J7Y — Monitor Circuit (unlocked) 63–64	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
Solenoid Power A1-A2 (all types)	ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized)[2]	OFF to ON [1, 2]

The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

1: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.
2: When the operator is confined in a hazardous zone, the actuator can be unlocked manually by pressing the rear unlocking button.

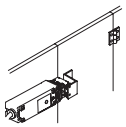
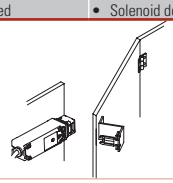
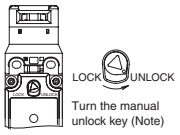
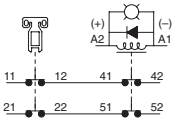
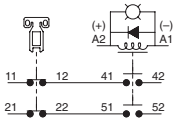
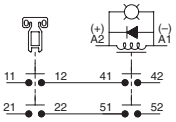
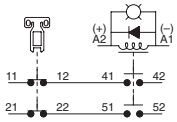
Operation Characteristics (reference)

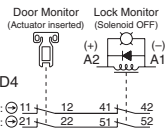


The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

Dual Safety Circuit Type

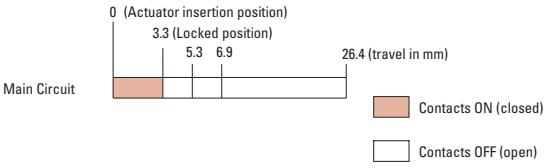
Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized
Door Status					
Circuit Diagram (HS5E-A7Y)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Contact Configuration — Main Circuit 21–52	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)



The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

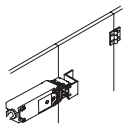
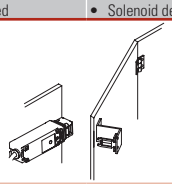
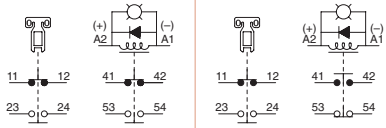
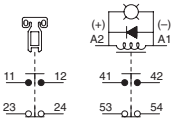
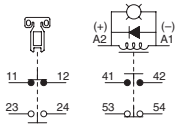
Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

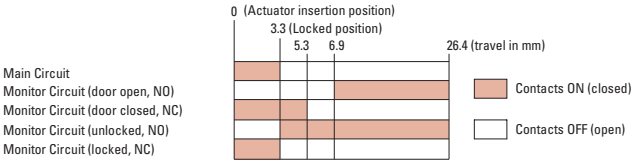
Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • 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 (HS5E-VA4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration – HS5E-VA4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VA4 – Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-VA4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VA4 – Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VB4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VB4 – Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-VB4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VB4 – Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC4 – Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC4 – Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VD4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD4 – Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VD4 – 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)

The above contact configuration shows the status when the actuator is inserted and locked.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

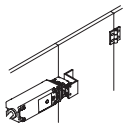
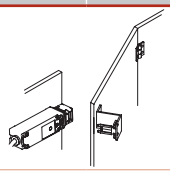
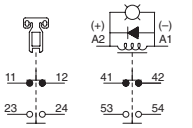
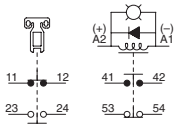
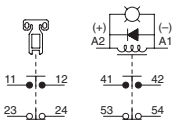
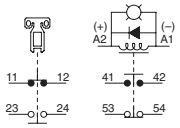
Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

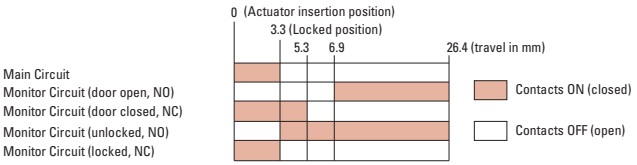
Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• 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 energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-VA4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration: HS5E-VA7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VA7Y — Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-VA7Y — Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VA7Y — Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VB7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VB7Y — Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-VB7Y — Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VB7Y — Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC7Y — Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC7Y — Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VD7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD7Y — Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD7Y — Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VD7Y — 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)

The above contact configuration shows the status when the actuator is inserted and locked.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

Operating Instructions

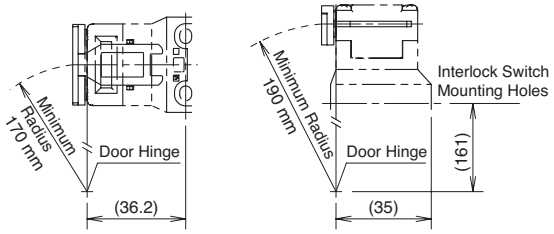
Minimum Radius of Hinged Door

- 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 (HS9Z-A53 or HS9Z-A55).

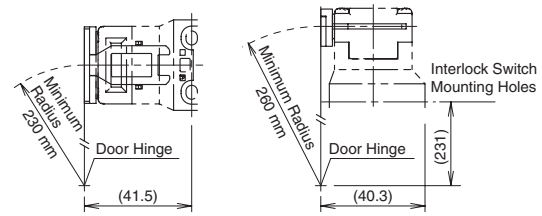
Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

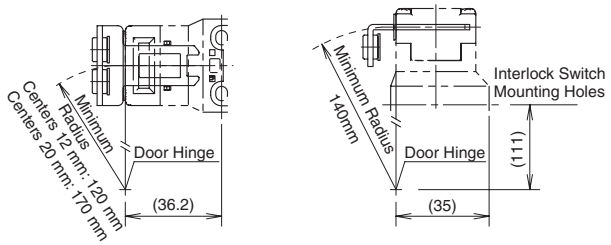


When the door hinge is on the extension line of the actuator mounting surface:

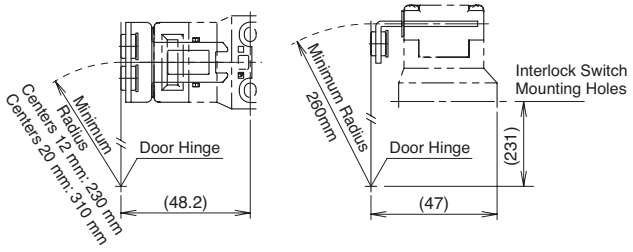


HS9Z-A52 Actuator (w/rubber bushings)

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:



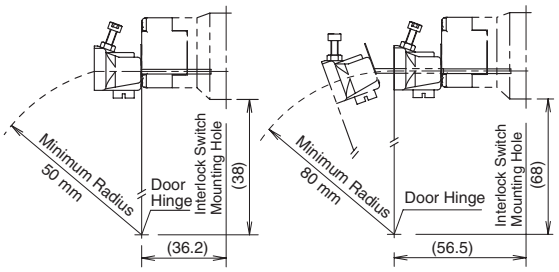
Actuator Angle Adjustment

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on pagepage 330).
  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 move.

When using the HS9Z-A53 Angle Adjustable (vertical) Actuator

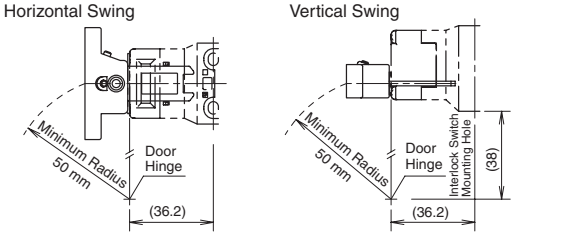
When the door hinge is on the extension line of the interlock switch surface: 50 mm

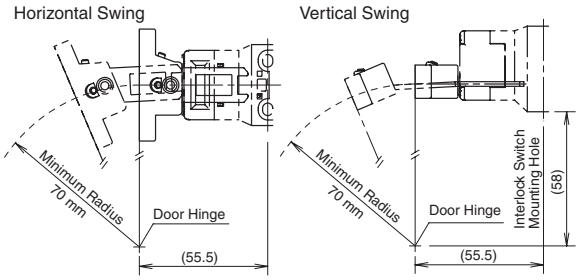
When the door hinge is on the extension line of the actuator mounting surface: 80 mm



When using the HS9Z-A55 Angle Adjustable (vertical/horizontal) Actuator

When the door hinge is on the extension line of the interlock switch surface: 50 mm

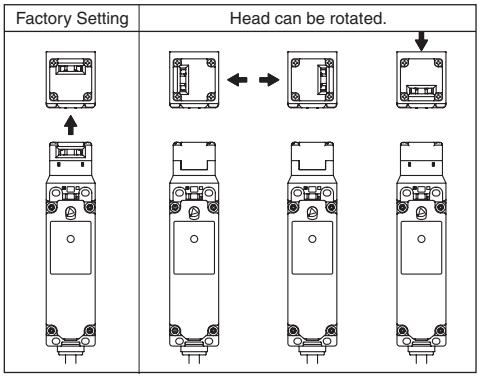




When the door hinge is on the extension line of the actuator mounting surface: 70 mm

Rotating the Head

The head of the HS5E can be rotated 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 if necessary. Before replacing the head, turn the manual unlock to the UNLOCK position using the manual unlock key. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws tightly, without leaving space between the head and body, otherwise the interlock switch may malfunction.
Recommended tightening torque: 0.9 to 1.1 N·m.



Instructions, continued

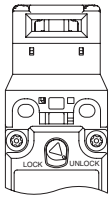
For Manual Unlocking

Spring lock type

The HS5E allows manual unlocking of the actuator to pre-check proper door movement before wiring or turning power on, as well as for emergency use such as a power failure.

Solenoid lock type

The solenoid lock type interlock switch normally does not need the manual unlock. However, only when the interlock switch would not release the actuator even though the solenoid is de-energized, the interlock switch can be unlocked manually. Unlock the interlock switch manually only when the solenoid is de-energized. Do not unlock the interlock switch manually when the solenoid is energized.



Normal Position

Manual Unlocking Position

When locking or unlocking the interlock switch manually, turn the key fully using the manual unlock key supplied with the interlock switch.

Using the interlock switch with the key not fully turned (less than 90°) may cause damage to the interlock switch or operation failures (when manually unlocked, the interlock switch will keep the main circuit disconnected and the door unlocked).

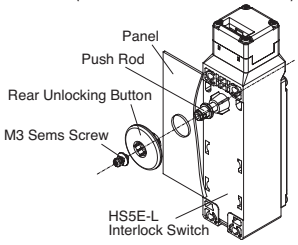
Do not apply excessive force to the manual unlock, otherwise the manual unlock will become damaged.

Do not leave the manual unlock key attached to the interlock switch during operation. This is dangerous because the interlock switch can always be unlocked while the machine is in operation.

Manual Unlocking Key
(supplied with the switch)

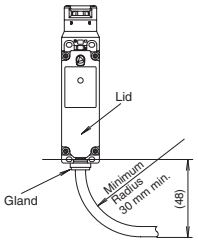
Installing the Rear Unlocking Button

After installing the interlock switch on the panel, place the rear unlocking button (supplied with the switch) on the push rod on the back of the interlock switch, and fasten the button using the M3 sems screw. Rear unlocking button can be installed alone when the total thickness of mounting frame and panel is 6 mm or less. When the total thickness of mounting frame, panel, and mounting plate is 23 to 43 mm, use the rear unlocking button kit (HS9Z-FL53 or HS9Z-FL54) sold separately.



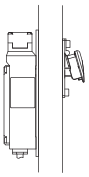
Cables

- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm minimum.
- Solenoid has polarity. Be sure of the correct polarity when wiring.

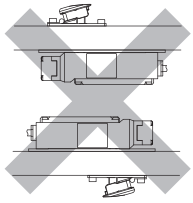


Safety Precautions

Install the rear unlocking button kit in the correct direction as shown below. Do not install the kit in incorrect directions, otherwise malfunction will be caused.



Correct

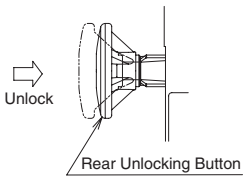


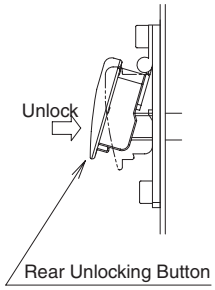
Incorrect

Do not apply strong force exceeding 100 m/s2 to the interlock switch while the rear unlocking button is not pressed, otherwise malfunction will be caused.

Manual Unlocking using the Rear Unlocking Button

The rear unlocking button is used by the operator confined in a hazardous area for emergent escape.





How to operate

When the rear unlocking button is pressed, the interlock switch is unlocked and the door can be opened.

To lock the interlock switch, pull back the button.

When the button remains pressed, the interlock switch cannot be locked even if the door is closed, and the main circuit remains open.

Recommended Tightening Torque

- HS5E interlock switch: 1.8 to 2.2 N·m (four M4 screws) (Note)
- Rear unlocking button: 0.5 to 0.7 N·m
- Rear unlocking button kit: 4.8 to 5.2 N·m (M5 screw)
- Actuators
  HS9Z-A51: 1.8 to 2.2 N·m (two M4 screws)
  HS9Z-A52: 0.8 to 1.2 N·m (two M4 Phillips screws)
  HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws)
  HS9Z-A53: 4.5 to 5.5 N·m (two M6 screws)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)

Note: The above recommended tightening torque 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.

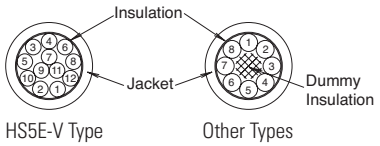
Instructions, continued

Wire Identification

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

- HS5E-V: Wires of gray and gray/white insulation cannot be used.
- HS5E-DD: Wires of brown and brown/white insulation cannot be used.

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



Terminal Number Identification

- When wiring, the terminal number of each contact can be identified by wire color.
- The following table shows the identification of terminal numbers.

Type	Circuit Diagram
HS5E-A	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-B	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-C	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-D	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-F	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 31 32 Brown/White
HS5E-G	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 33 34 Brown/White
HS5E-H	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Brown 51 52 Brown/White Monitor Circuit: Orange 61 62 Orange/White
HS5E-J	Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Brown 51 52 Brown/White Monitor Circuit: Orange 63 64 Orange/White
HS5E-DD	Main Circuit: Blue 11 12 41 42 Blue/White Main Circuit: Orange 21 22 51 52 Orange/White

When wiring, cut unnecessary wires such as the dummy insulation (white) and any unused wires.

Type	Circuit Diagram
HS5E-VA	Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-VB	Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-VC	Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-VD	Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 51 52 Brown/White

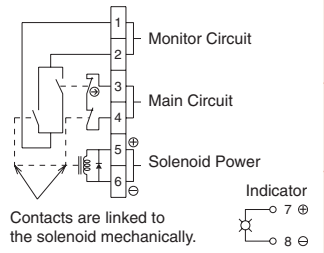
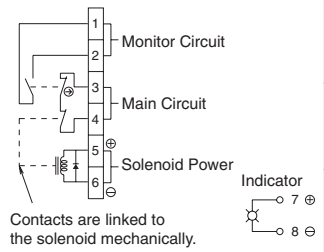
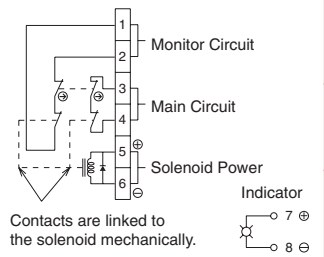
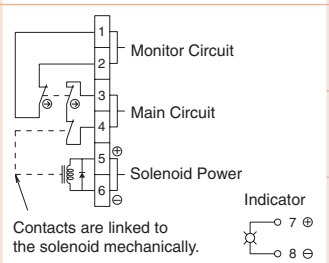
The above contact configuration shows the status when the actuator is inserted and locked.

HS1E Full Size Solenoid Locking Switches

Key features:

- Plastic Housing: Lightweight
- 1500N locking retention force
- Available with a red or green indicator
- Choose from 4 circuit configurations
- Flexible Installation: The actuator can be accessed from two directions
- Ease of Wiring: M3.5 termination screws

Part Numbers (Mechanical Spring Lock Only)

Contact Configuration		LED	Standard	Manual Unlock Key
Main circuit: 1NC + 1NC Monitor circuit: 1NO/1NO		None	HS1E-40R	HS1E-40KR
		Green	HS1E-44R-G	HS1E-44KR-G
		Red	HS1E-44R-R	HS1E-44KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NO		None	HS1E-140R	HS1E-140KR
		Green	HS1E-144R-G	HS1E-144KR-G
		Red	HS1E-144R-R	HS1E-144KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NC + 1NC		None	HS1E-240R	HS1E-240KR
		Green	HS1E-244R-G	HS1E-244KR-G
		Red	HS1E-244R-R	HS1E-244KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NC		None	HS1E-340R	HS1E-340KR
		Green	HS1E-344R-G	HS1E-344KR-G
		Red	HS1E-344R-R	HS1E-344KR-R

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator
	HS9Z-A2	Right-angle Actuator
	HS9Z-A3	Adjustable Actuator
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

1. Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.
2. Actuator is not supplied with the interlock switch, and must be ordered separately.
3. Manual unlock key is included with the interlock switch.
4. TORX is a registered trademark of Camcar Textron.

Specifications

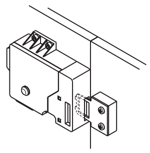
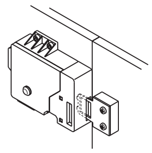
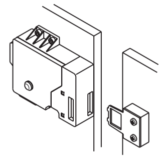
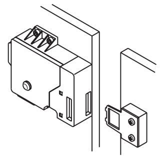
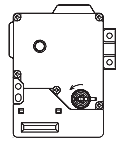
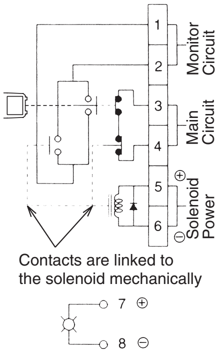
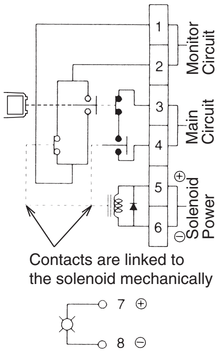
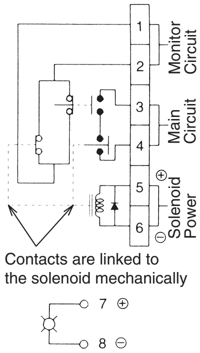
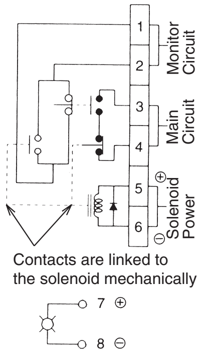
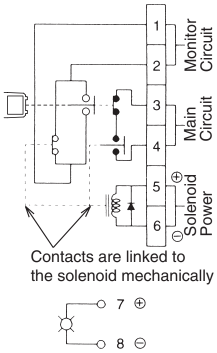
Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1(TUV), ISO14119, GS-ET-19 (BG), UL508, CSA C22.2 No. 14, GB14048.5 (CCC approval), IEC60204-1, EN60204-1 (applicable standards for use)
Operating Temperature		–20 to +40°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		40 - 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 Retention Force		1,500N minimum (per GS-ET-19)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		Main circuit: 10A, Auxiliary circuit: 3A
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 (initial value)
	Coil Resistance	102Ω (at 20°C)
	Pickup Voltage	20.4V maximum (at 20°C)
	Drop Out Voltage	2.4V minimum (at 20°C)
	Allowable Voltage	26.4V max (continuous)
	Insulation Class	Class F
Indicator	Operating Voltage	24V DC
	Current	10mA
	Light Source	LED lamp
	Lens Color	Red or Green
Weight (approx.)		500g

Contact Ratings

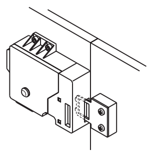
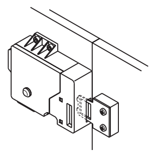
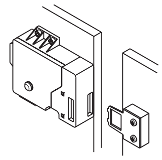
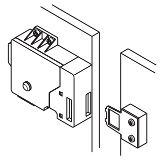
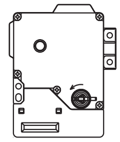
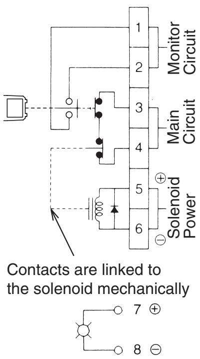
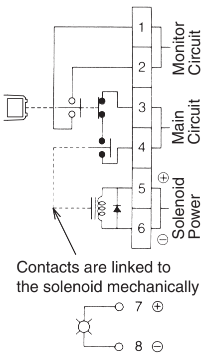
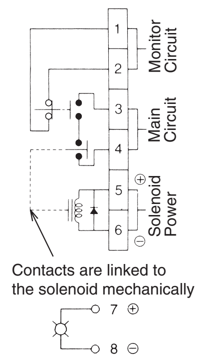
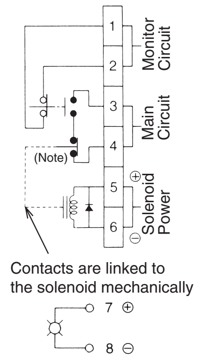
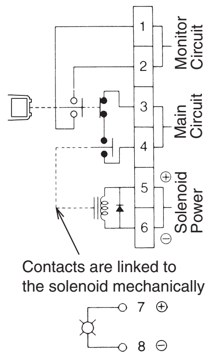
				30V	125V	250V
Rated Operating Current (Ie)	Operating Voltage (Ue)					
	Main Circuit	AC	Resistive load (AC12)	10A	10A	6A
			Inductive load (AC15)	10A	5A	3A
		DC	Resistive load (DC12)	6A	–	–
			Inductive load (DC13)	3A	0.9A	–
	Auxiliary Circuit	AC	Resistive load (AC12)	–	3A	3A
			Inductive load (AC15)	–	–	3A
		DC	Resistive load (DC12)	3A	–	–
			Inductive load (DC13)	–	0.9A	–

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 de-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

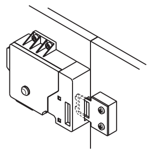
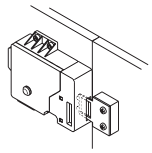
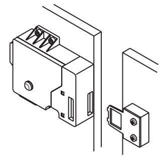
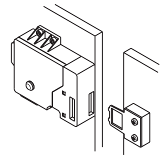
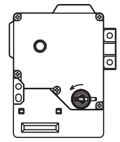
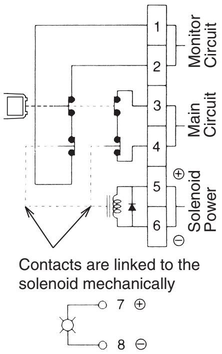
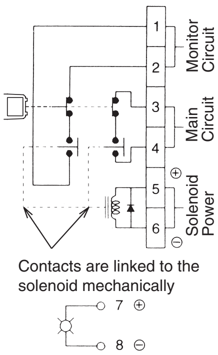
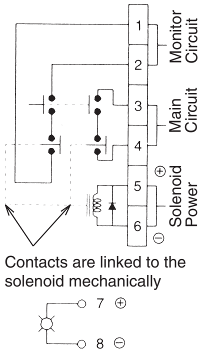
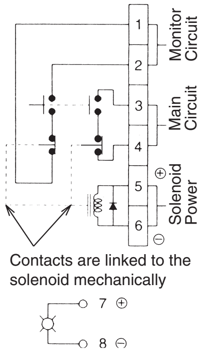
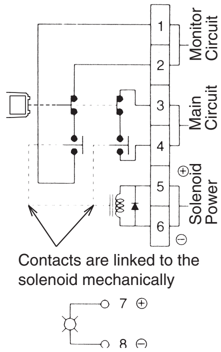
HS1E-14 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO)

	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

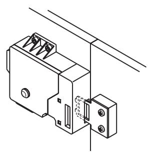
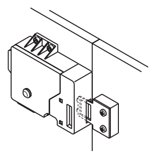
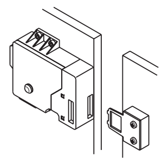
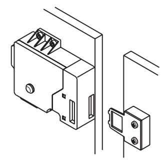
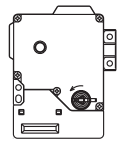
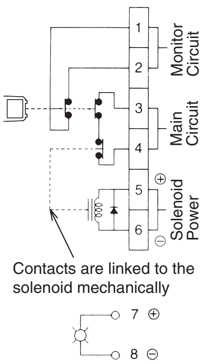
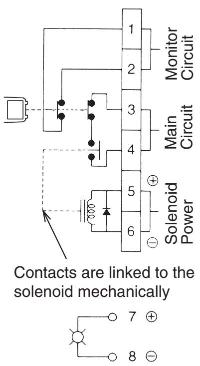
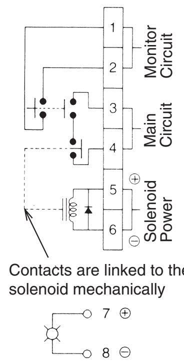
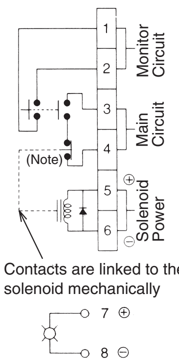
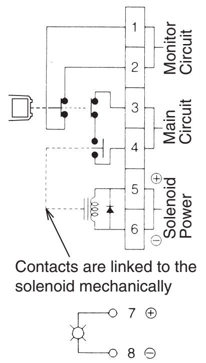
1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid and door status.

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)

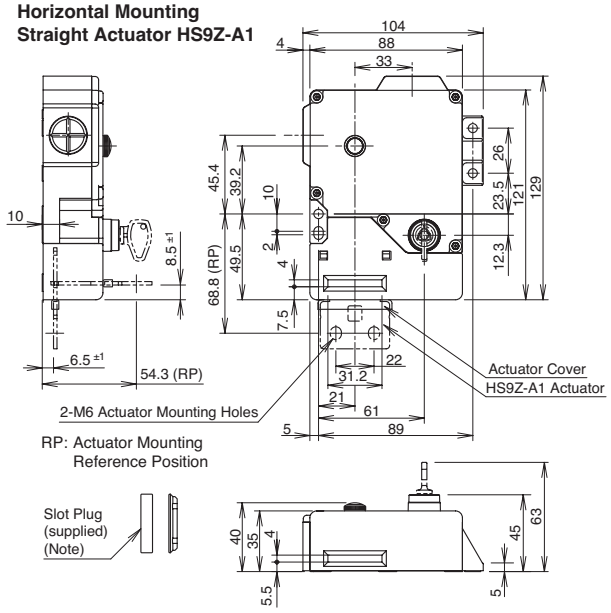
	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	Door Closed Machine ready to operate Solenoid de-energized	Door Closed Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid de-energized	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.

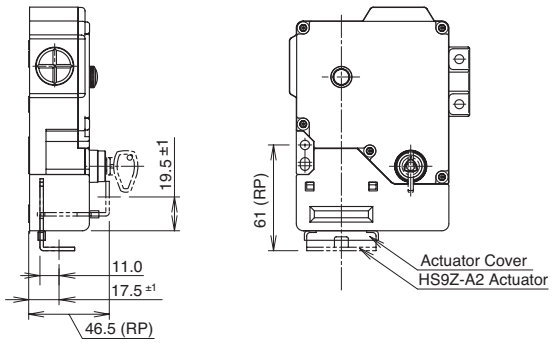
Dimensions (mm)

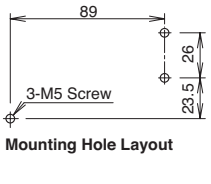
HS1E with indicator - using 1500N operating force

Horizontal Mounting
Straight Actuator HS9Z-A1



Vertical Mounting
Right-angle Actuator HS9Z-A2



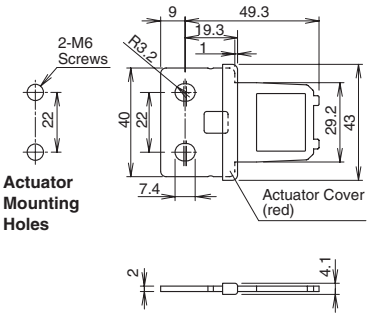


Mounting Hole Layout

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

Accessories

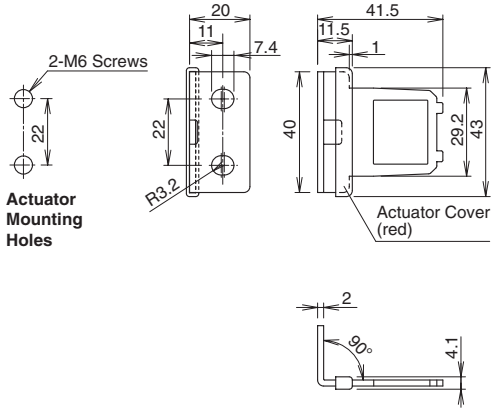
Straight Actuator (mainly for sliding doors) HS9Z-A1



Actuator Mounting Holes

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

*After installing the actuator, remove the actuator cover.

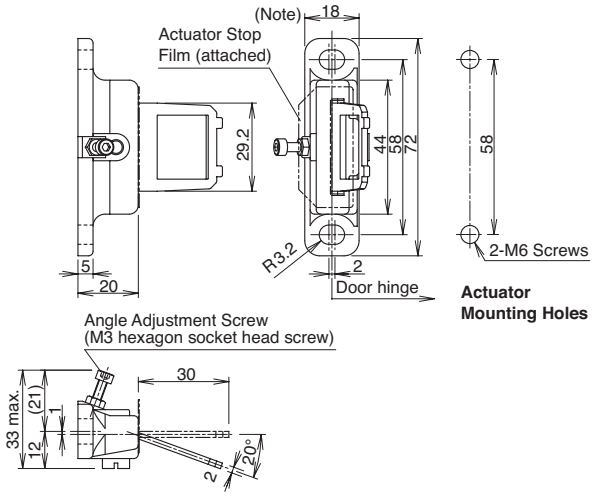


Actuator Mounting Holes

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

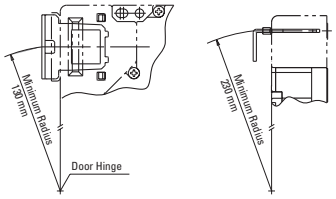
Minimum Radius of Hinged Door

- 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).

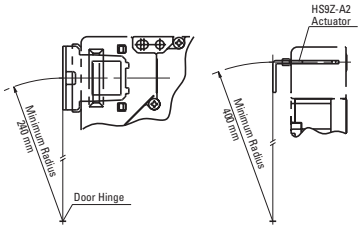
  Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A2 Actuator

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

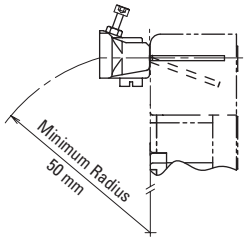


- When the door hinge is on the extension line of the actuator mounting surface:

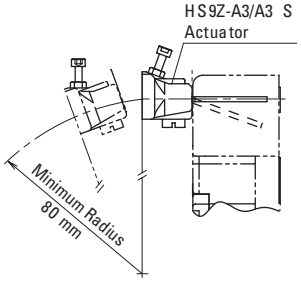


When using the HS9Z-A3 Angle Adjustable (vertical) Actuator

- 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:

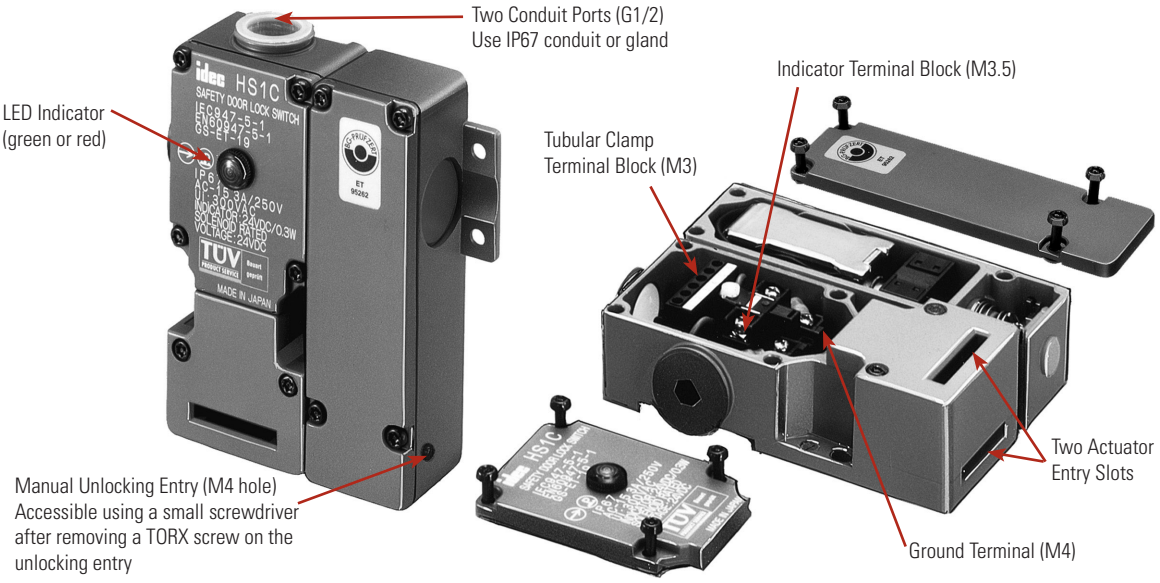


HS1C Full Size Solenoid Locking Switches

Key features:

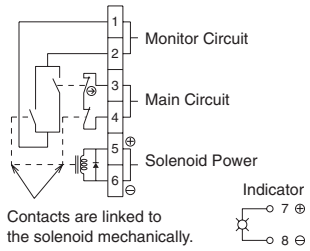
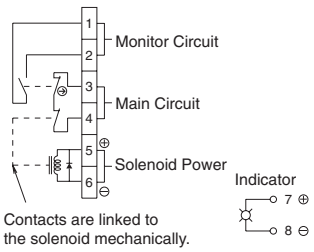
- Rugged aluminum die-cast housing
- 1500N locking retention force
- Flexible Installation: The actuator can be accessed from two directions
- Select from four different circuit configurations
- IP67

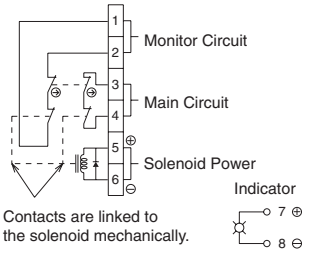
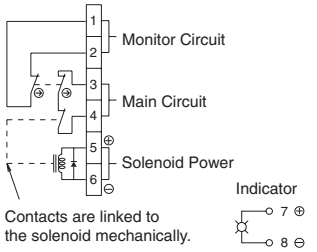
HS1C Series Functionality



TORX is a registered trademark of Camcar Textron.

Part Numbers (Mechanical Spring Lock Only)

Contact Configuration	Indicator LED	Part Number
	Green	**HS1C-R44R-G**
	Red	**HS1C-R44R-R**
	Green	HS1C-R144R-G
	Red	**HS1C-R144R-R**

Contact Configuration	Indicator LED	Part Number
	Green	**HS1C-R244R-G**
	Red	**HS1C-R244R-R**
	Green	**HS1C-R344R-G**
	Red	**HS1C-R344R-R**

Standard stock items in bold

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator
	HS9Z-A2	Right-angle Actuator
	HS9Z-A3	Adjustable Actuator

Appearance	Part Number	Description
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

Specifications

Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-19, UL508, GB 140485.5 (CCC approval), CSA C22.2 No. 14
Operating Temperature		–20 to +40°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		40 to 85% (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (U_i)		300V (between LED or solenoid and ground: 60V)
Impulse Withstand Voltage (U_{imp})		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/sec^2 (approx. 6G)
Shock Resistance		1,000 m/s^2 (approx. 100G)
Actuator Retention Force		1,500N minimum
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		Main circuit: 10A, Auxiliary circuit: 3A
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)

Specifications, con't

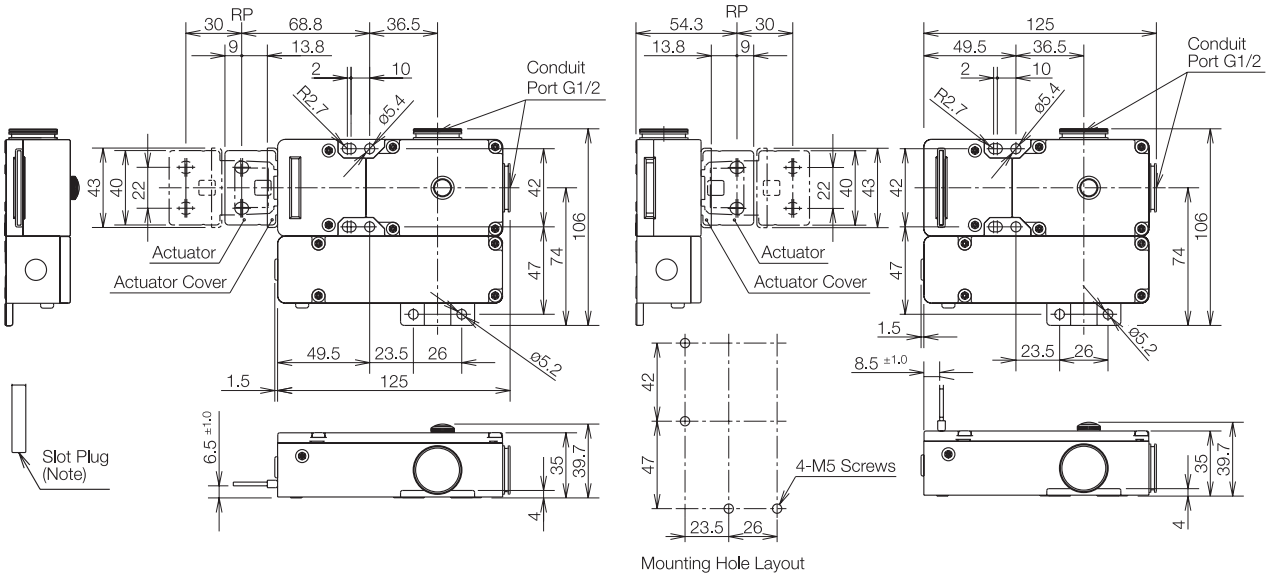
Solenoid Unit	Operating Voltage	24V DC (100% duty cycle)
	Current	415mA (initial value)
	Coil Resistance	58Ω (at 20°C)
	Energizing Voltage	Rated voltage x 85% maximum (at 20°C)
	De-energizing Voltage	Rated voltage x 10% minimum (at 20°C)
	Continuous Applicable Voltage	Rated voltage x 110%
	Insulation Class	Class B
Indicator	Operating Voltage	24V DC
	Current	10 mA
	Light Source	LED lamp
	Lens Color	Red or Green
Weight (approx.)		660g

Contact Ratings

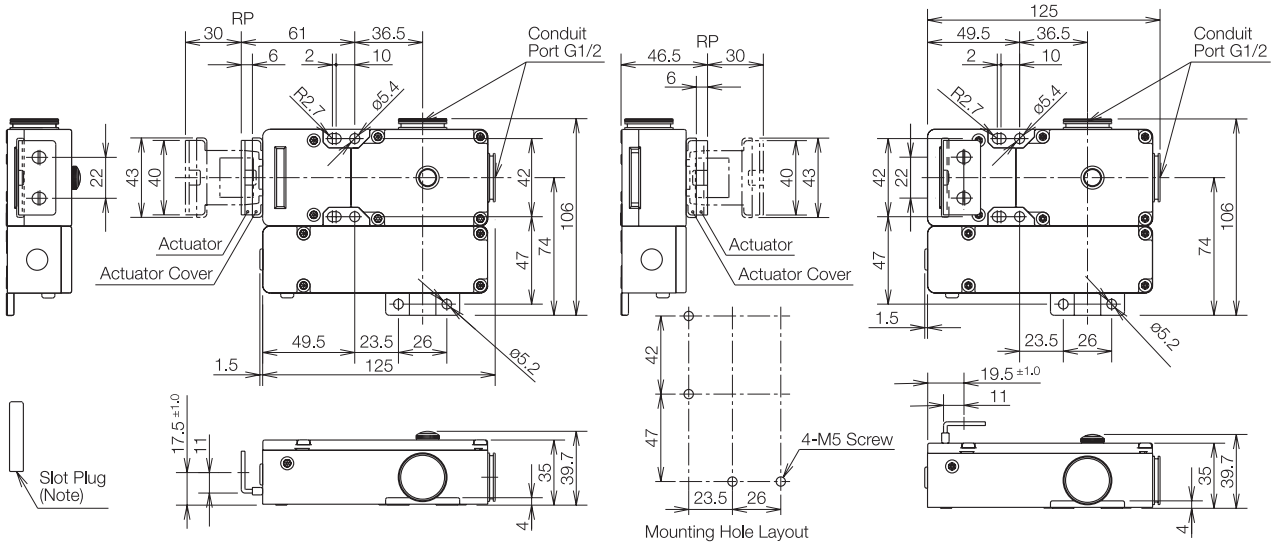
Rated Operating Current (Ie)	Operating Voltage (Ue)			30V	125V	250V
	Main Circuit	AC	Resistive load (AC12)	10A	10A	6A
			Inductive load (AC15)	10A	5A	3A
		DC	Resistive load (DC12)	6A	–	–
			Inductive load (DC13)	3A	0.9A	–
	Auxiliary Circuit	AC	Resistive load (AC12)	–	3A	3A
			Inductive load (AC15)	–	–	3A
		DC	Resistive load (DC12)	3A	–	–
			Inductive load (DC13)	–	0.9A	–

Dimensions (mm)

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

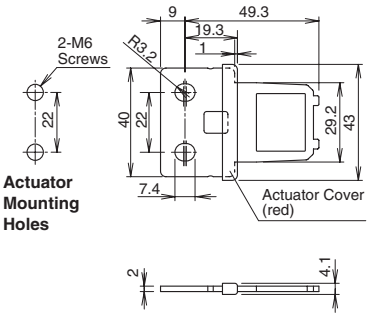


HS1C-R44R-* - using the Right-angle actuator (HS9Z-A2)



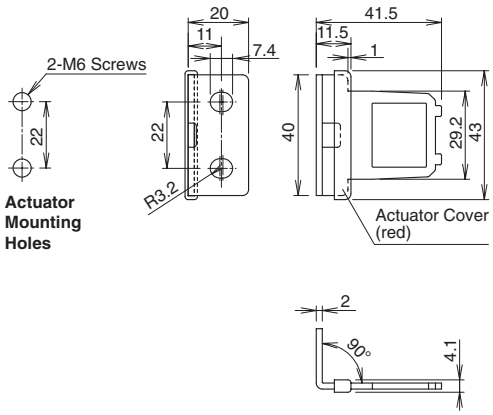
Accessories

Straight Actuator (mainly for sliding doors)
HS9Z-A1



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

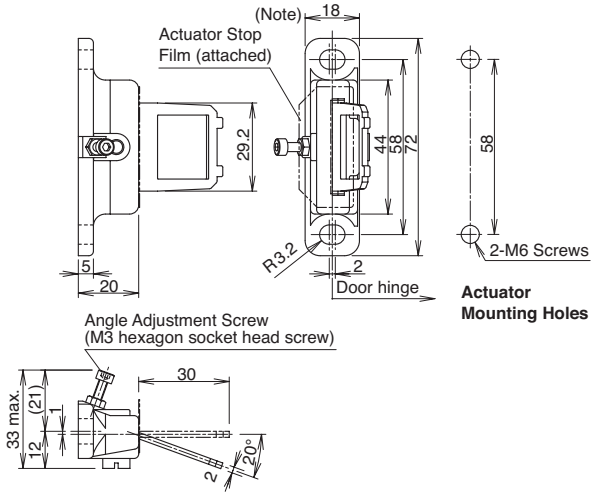
*After installing the actuator, remove the actuator cover.



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.

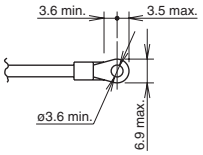
For HS1/HS2 Series (HS9Z-A3)



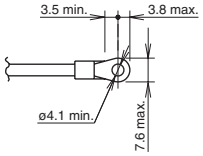
All dimensions in mm.

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

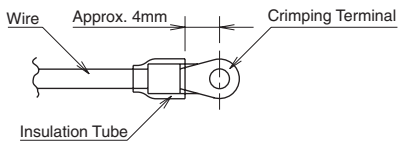


Crimping Terminal 1



Crimping Terminal 2

Use an insulation tube on the crimping terminal.



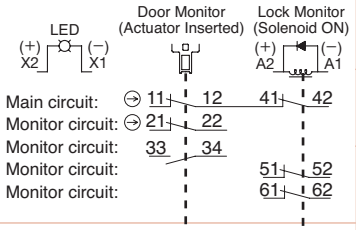
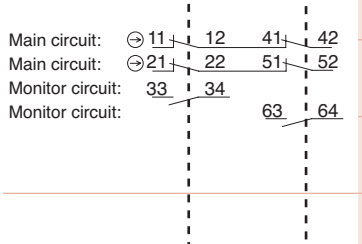
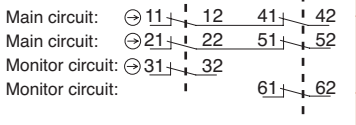
HS1L Interlock Switches with Solenoid

Key features:

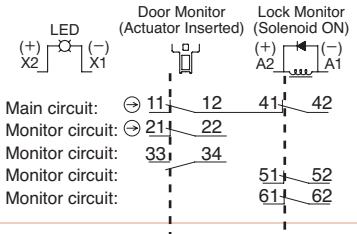
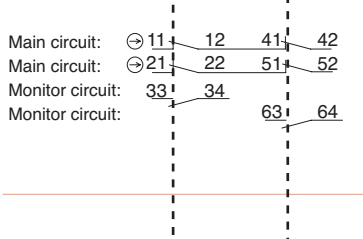
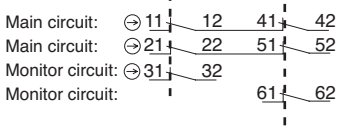
- 3,000N locking retention force
- LED indicator
- Energy-efficient solenoid
- 6 contacts with easy-to-wire terminations
- M3 terminal screws for easy wiring

Part Numbers

Mechanical Spring Lock (power solenoid to unlock)

Contact Configuration	Conduit Size	LED	Part Number
	G1/2	Red	**HS1L-R44KMSR-R**
		Green	**HS1L-R44KMSR-G**
	PG13.5	Red	**HS1L-R44KMSRP-R**
		Green	HS1L-R44KMSRP-G
	M20	Red	**HS1L-R44KMSRM-R**
		Green	**HS1L-R44KMSRM-G**
	G1/2	Red	**HS1L-DQ44KMSR-R**
		Green	**HS1L-DQ44KMSR-G**
	PG13.5	Red	**HS1L-DQ44KMSRP-R**
		Green	**HS1L-DQ44KMSRP-G**
	M20	Red	HS1L-DQ44KMSRM-R
		Green	**HS1L-DQ44KMSRM-G**
	G1/2	Red	**HS1L-DT44KMSR-R**
		Green	**HS1L-DT44KMSR-G**
	PG13.5	Red	**HS1L-DT44KMSRP-R**
		Green	**HS1L-DT44KMSRP-G**
	M20	Red	**HS1L-DT44KMSRM-R**
		Green	**HS1L-DT44KMSRM-G**

Solenoid Lock (Remove Power to Unlock)

Contact Configuration	Conduit Size	LED	Part Number
	G1/2	Red	**HS1L-R7Y4KMSR-R**
		Green	**HS1L-R7Y4KMSR-G**
	PG13.5	Red	HS1oh yL-R7Y4KMSRP-R
		Green	HS1L-R7Y4KMSRP-G
	M20	Red	HS1L-R7Y4KMSRM-R
		Green	HS1L-R7Y4KMSRM-G
	G1/2	Red	**HS1L-DQ7Y4KMSR-R**
		Green	**HS1L-DQ7Y4KMSR-G**
	PG13.5	Red	HS1L-DQ7Y4KMSRP-R
		Green	**HS1L-DQ7Y4KMSRP-G**
	M20	Red	HS1L-DQ7Y4KMSRM-R
		Green	HS1L-DQ7Y4KMSRM-G
	G1/2	Red	**HS1L-DT7Y4KMSR-R**
		Green	**HS1L-DT7Y4KMSR-G**
	PG13.5	Red	HS1L-DT7Y4KMSRP-R
		Green	**HS1L-DT7Y4KMSRP-G**
	M20	Red	**HS1L-DT7Y4KMSRM-R**
		Green	HS1L-DT7Y4KMSRM-G

1. Contact configuration shows the contact status when actuator is inserted and solenoid off for spring lock.
2. Contact configuration shows the contact status when actuator is inserted and solenoid on for solenoid lock.
3. Actuator keys are not supplied with the interlock switch and must be ordered separately.
4 Manual unlock key is included with the interlock switch.
5. Standard stock items in bold

Actuator Keys & Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A1S	Straight Actuator
	HS9Z-A2S	L-shaped Actuator
	HS9Z-A3S	Angle Adjustable Actuator (vertical operation only)

Appearance	Part Number	Description
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

Specifications

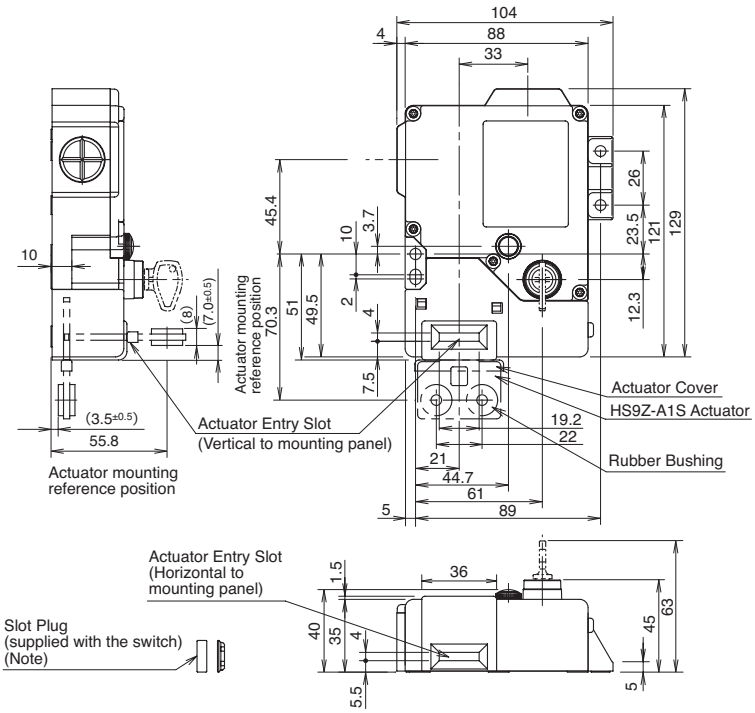
Conforming to Standards		ISO14119, IEC60947-5-1. EN60947-5-1 (TÜV approval), GS-ET-19 (TÜV approval). UL508, CSA C22.2 No. 14 IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature		–20 to +55°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Relative Humidity		45 to 85% (no condensation)
Rated Insulation Voltage (Ui)		300V
Overvoltage Category		III
Electric Shock Protection		Class II (IEC 61140)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		Damage limits: 1000m/s^2
Actuator Retention Force		3000N minimum (GS-ET-19)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		50N minimum
Thermal Current (Ith)		10A
Operating Frequency		900 operations per hour
Mechanical Life		1,000,000 operations minimum (GS-ET-19)
Electrical Life		100,000 operations minimum (AC-15 3A/250V) 1,000,000 operations minimum (24V AC/DC, 100mA) (operating frequency 900 operations per hour)
Solenoid Unit	Rated Operating Voltage	24V DC (100% duty cycle)
	Rated Current	200mA (initial value)
Indicator	Rated Operating Voltage	24V DC
	Rated Current	10mA
	Light Source	LED
	Illumination Color	Green (G), Red (R)
Weight (approx.)		450g (HS1L-DQ44)

Contact Ratings

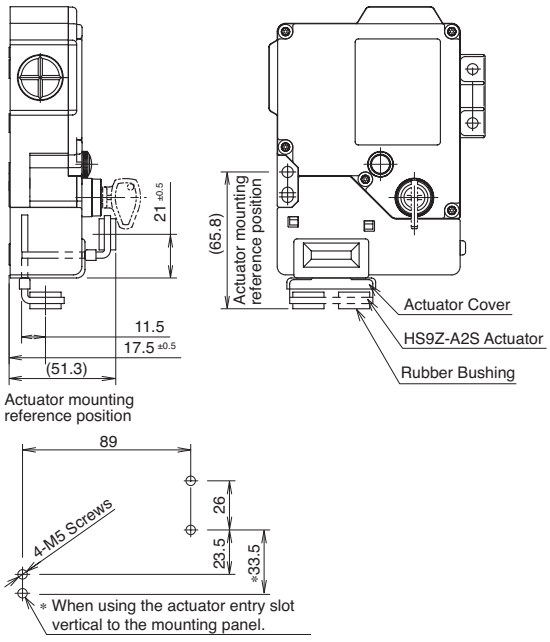
Rated Operating Current (I_e)	Rated Voltage (U_e)		30V	125V	250V
	AC	Resistive load (AC12)	10A	10A	6A
		Inductive load (AC15)	10A	5A	3A
	DC	Resistive load (DC12)	8A	2.2A	1.1A
		Inductive load (DC13)	4A	0.9A	0.6A

Dimensions (mm) and Mounting Hole Layouts

Interlock switch when using straight actuator (HS9Z-A1S)



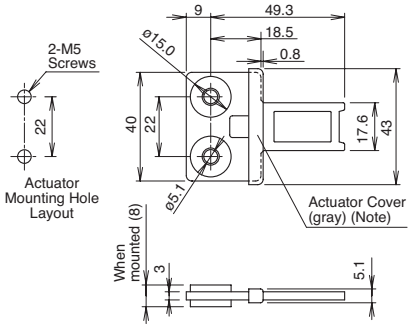
Interlock switch when using L-shaped actuator (HS9Z-A2S)



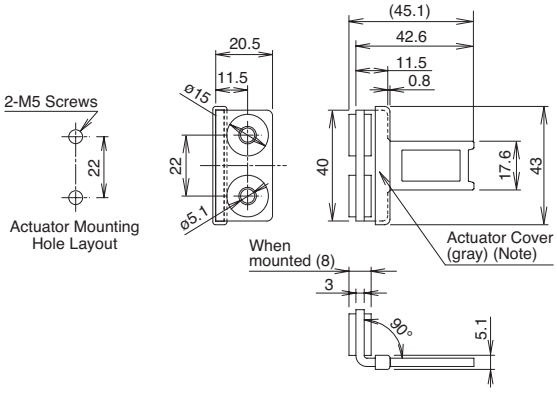
Interlock Switch Mounting Hole Layout

Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
* Install the interlock switch using four mounting screws when using the actuator entry slot vertical to the mounting panel, and three mounting screws when using the actuator entry slot horizontal to the mounting panel.

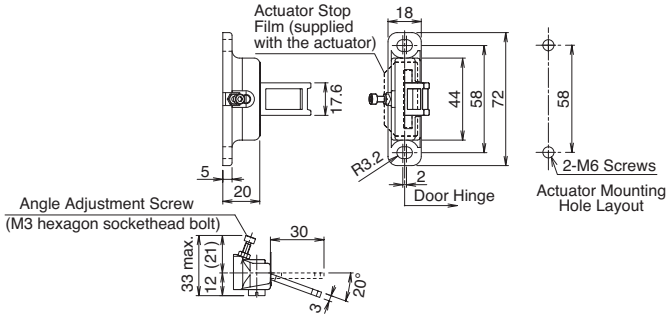
Straight Actuator (HS9Z-A1S)



L-shaped Actuator (HS9Z-A2S)



Angle Adjustable (vertical) Actuator (HS9Z-A3S)



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

HS5E-K Key Locking Safety Interlock Switches

Key features:

- Head removal detection circuitry.
- High-security pin tumbler key types are used. Sixteen types of key numbers are available, see page 356.
- Available with rear unlocking button for emergency escape.
- Accessory available for aluminum frame mounting.
- Gold-plated contacts.
- The locking strength is 1400N minimum. (GS-ET-19)
- The head orientation can be rotated, allowing 8 different actuator entries.
- Metal actuator entry slot ensures high durability.
- Actuator with rubber bushings alleviates the impact of the actuator entry slot.
- Environmentally-friendly. RoHs directive compliant.
- Double insulation structure. No need for grounding.
- Compact body: 35 × 40 × 146 mm

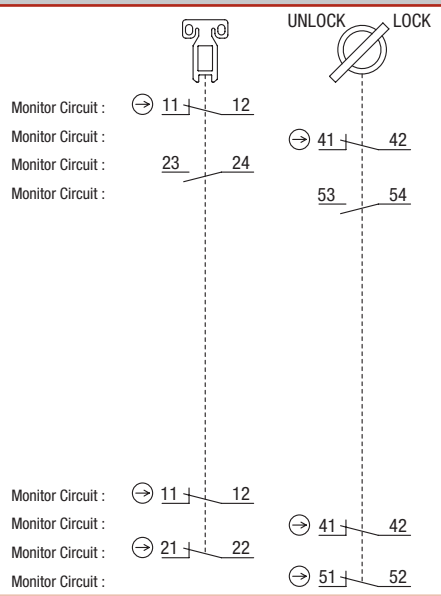
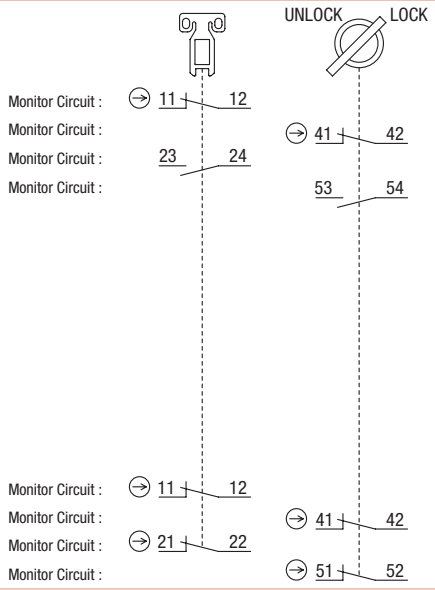
A single key used for interlock switch and selector switch prevents itself from being left in the lock.

Hostage key ensures that the person holding the key is not locked inside the hazardous area.

Hostage key prevents the machine from starting unexpectedly.

HS5E-K key interlock switches use a key to lock and unlock a door of safeguard. When the key is taken into a dangerous area, the interlock switch cannot be locked and the machine does not operate. Therefore, workers can be prevented from being locked in a dangerous area, and the system is prevented from restarting unexpectedly. Furthermore, because the key used for HS5E-K key interlock switches can also be used for HW series key selector switches (pin tumbler type), switching operation modes of systems and door unlocking can be performed using a single key. 16 types of key numbers are available, so that each system can have its own key, and a higher level of safety can be achieved.

Spring Lock Type (Power Solenoid to VA Lock)

Circuit Code	Contact Configuration	Key Removal Position	Cable Length	Part Number	
				Standard	With Rear Unlock Button
VA		A (removable in all positions)	3m	HS5E-KVA003-2A	HS5E-KVA0L03-2A
			5m	HS5E-KVA005-2A	HS5E-KVA0L05-2A
		B (removal in UNLOCK position)	3m	HS5E-KVA003-2B	HS5E-KVA0L03-2B
			5m	HS5E-KVA005-2B	HS5E-KVA0L05-2B
		C (removable in LOCK position)	3m	HS5E-KVA003-2C	HS5E-KVA0L03-2C
			5m	HS5E-KVA005-2C	HS5E-KVA0L05-2C
VD		A (removable in all positions)	3m	HS5E-KVD003-2A	HS5E-KVD0L03-2A
			5m	HS5E-KVD005-2A	HS5E-KVD0L05-2A
		B (removal in UNLOCK position)	3m	HS5E-KVD003-2B	HS5E-KVD0L03-2B
			5m	HS5E-KVD005-2B	HS5E-KVD0L05-2B
		C (removable in LOCK position)	3m	HS5E-KVD003-2C	HS5E-KVD0L03-2C
			5m	HS5E-KVD005-2C	HS5E-KVD0L05-2C

The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with interlock switches and must be ordered separately.
Key number 500 is supplied as the default key in table above (500 not added to part number).

To order additional key types, specify key number at end of part number (special order).
Example: HS5E-KVA003-2A501
501 to 515
Note: The key number is engraved on the cylinder.

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A52	Right-angle
	HS9Z-A53	Angle adjustable vertical operation

Appearance	Part Number	Description
	HS9Z-A55	Angle adjustable horizontal/vertical operation [1]
	HS9Z-A5P	Plug Actuator (allows switch to be used as interlock plug unit)
	HS9Z-PH5	Padlock Hasp (prevents unauthorized insertion of actuator)

Appearance	Part Number	Description
	HS9Z-SP51	Mounting Plate (allows easy mounting to aluminum frames)
	HS9Z-T3	Manual unlock key (long type - metal)
	HS9Z-SH5	Sliding Actuator

1. The actuator tensile strength is 500N minimum.
2. Actuators are not included and must be included separately.

Specifications

Applicable Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (TÜV approval), UL508 (UL recognition), CSA C22.2 No. 14 (c-UL recognized)
	IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	-25 to +70°C (No freezing)
Relative Humidity	45 to 85% (No condensation)
Storage Temperature	-40 to +80°C (No freezing)
Pollution Degree	3
Impulse Withstand Voltage	2.5 kV
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum (500V DC megger) Between live metal part and ground: 100 MΩ minimum (500V DC megger) Between live metal parts: 100 MΩ minimum (500V DC megger) Between terminals of the same pole: 100 MΩ minimum
Electric Shock Class	Class II (IEC61140)
Degree of Protection	IP65 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s^2 Damage limits: 1,000 m/s^2
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.35 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	Actuator HS9Z-A51: 11 mm minimum Actuator HS9Z-A51A/A52/A52A/A53/A55: 12 mm minimum
Direct Opening Force	80N minimum
Actuator Retention Force [1]	1,400N minimum (GS-ET-19)
Operating Frequency	900 operations per hour
Rear Unlocking Button Mechanical Durability	3,000 operations minimum (HS5E-K□L)
Mechanical Durability	1,000,000 operations minimum (GS-ET-19)
Electrical Durability	100,000 operations minimum (AC-12, 250V, 1A) 1,000,000 operations minimum (24V AC/DC, 100 mA) (Operating frequency: 900 operations per hour)
Performance between 41 and 42 when head is removed	Mechanical durability: 10 operations minimum Insulation resistance: 100 MΩ (initial value) Withstand voltage: 1,000V for 1 minute (initial value)
Conditional Short-circuit Current	50A (250V) [2]
Cable	22 AWG (12-core, 0.3 mm^2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	400g (HS5E-KVA003)

1. See page 356 for actuator retention force.
2. Use 250V/10A fast-blow fuse for short-circuit protection.

Key Cylinder Specifications

Operating Method	2-position maintained
Mechanical Durability	100,000 operations minimum
Insertion/Removal Durability	10,000 operations minimum
Operator Strength	1.0 N·m minimum
Direct Opening Force	0.6 N·m minimum
Direct Opening Angle	60° minimum

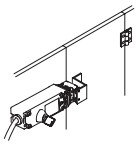
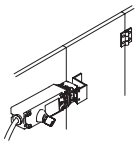
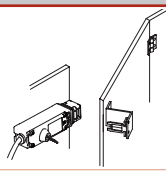
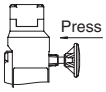
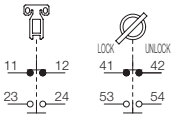
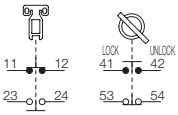
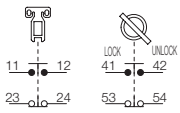
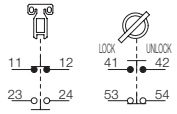
Contact Rating

Rated Insulation Voltage (U_i) [1]			250V		
Rated Thermal Current (I_{th})			Operating temperature: –25°C to 60°C: 2.5A max. 60° to 65°C: 1.5A max. 65°C to 70°C: 1.0A max.		
Rated Voltage (U_e)			30V	125V	250V
Rated Current (Ie) [2]	AC	Resistive load (AC12)	—	2.5A	1.5A
		Inductive Load (AC15)	—	1.5A	0.75A
	DC	Resistive load (DC12)	2.5A	1.1A	0.55A
		Inductive Load (DC13)	2.3A	0.55A	0.27A

Minimum applicable load (reference value) = 3V AC/DC, 5 mA
(Applicable range may vary with operating conditions and load types.)

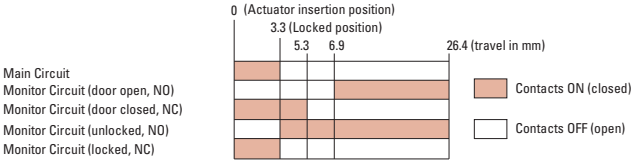
1: UL rating: 125V
2: TÜV rating: AC-15, 0.5A/250V, DC-13, 0.22A/125V
UL, c-UL rating: Pilot Duty AC 0.5A/125V,
Pilot Duty DC 0.22A/125V

Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Manual Unlock
	• 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 Closed • Machine cannot be operated • Solenoid de-energized energized
Door Status				 Press rear unlocking button. (Note)
Circuit Diagram (HS5E-KVA)				
Door		Closed (locked)	Closed (unlocked)	Open	Closed (unlocked)
Type No. and Contact Configuration	HS5E-KVA — Main Circuit (door closed) 11–12	ON (closed)	ON (closed)	OFF (open)	ON (closed)
	HS5E-KVA — Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	OFF (open)
	HS5E-KVA — Monitor Circuit (locked) 41-42	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	HS5E-KVA — Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)
	HS5E-KVD — Main Circuit (door closed) 11–12	ON (closed)	ON (closed)	OFF (open)	ON (closed)
	HS5E-KVD — Monitor Circuit (door open) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)
	HS5E-KVD — Monitor Circuit (locked) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)
	HS5E-KVD — Monitor Circuit (unlocked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)

Note: When the operator is confined in a hazardous area, the actuator can be unlocked manually by pressing the rear unlocking button, which should be accessed easily by the operator.
The above contact configuration shows the status when the actuator is inserted and the switch is locked.
Monitor circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

Operation Characteristics (reference)



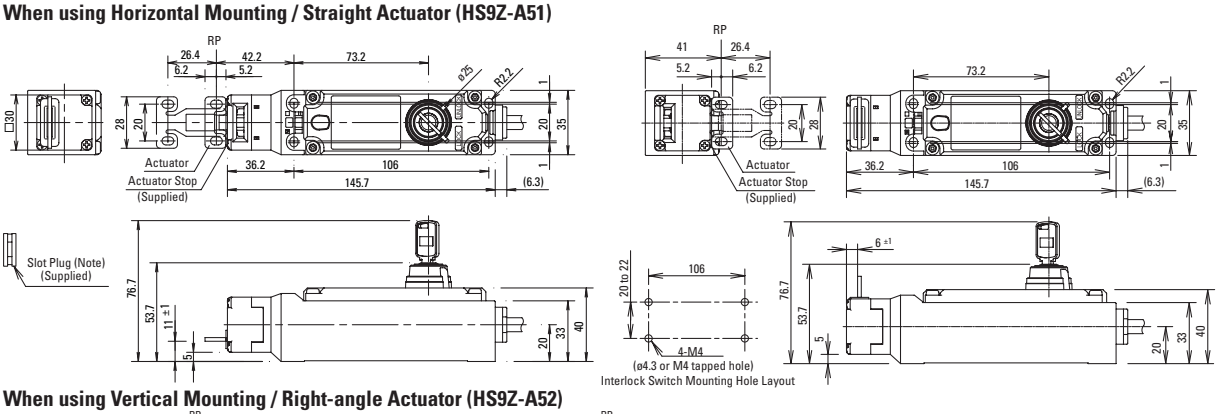
The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.

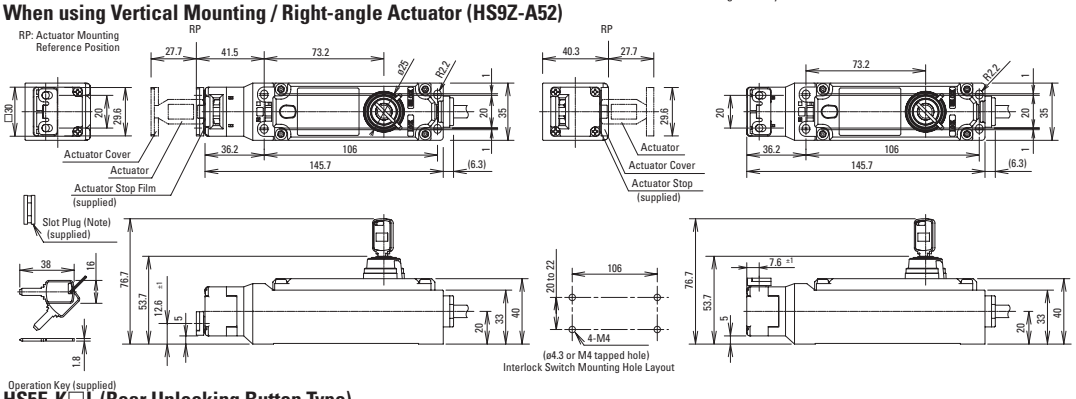
Dimensions (mm) and Mounting Hole Layouts

HS5E-K□

When using Horizontal Mounting / Straight Actuator (HS9Z-A51)

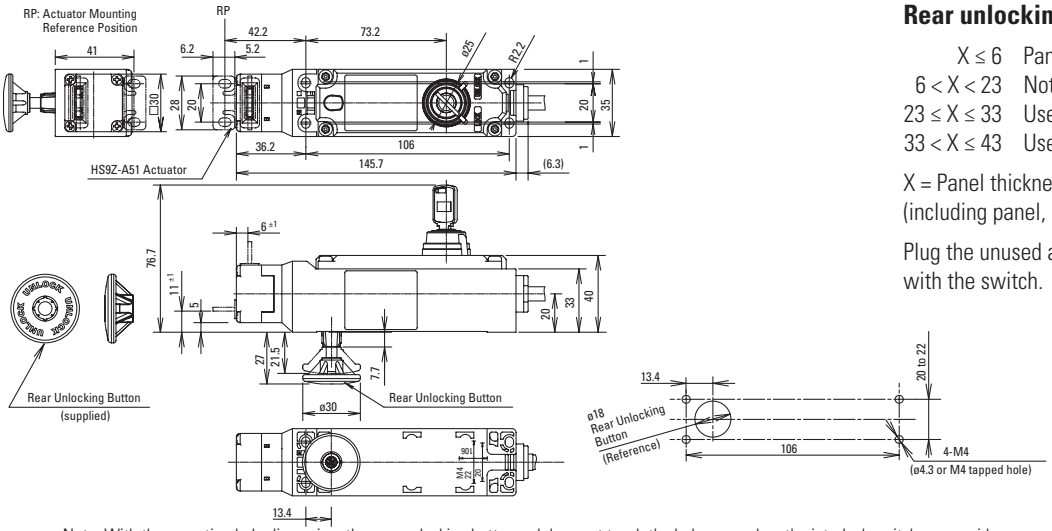


When using Vertical Mounting / Right-angle Actuator (HS9Z-A52)



HS5E-K□L (Rear Unlocking Button Type)

When using Horizontal Mounting / Straight Actuator (HS9Z-A51)



Rear unlocking button mounting

X ≤ 6	Panel mounting
6 < X < 23	Not mountable
23 ≤ X ≤ 33	Use HS9Z-FL53 rear unlocking button kit (Note)
33 < X ≤ 43	Use HS9Z-FL54 rear unlocking button kit (Note)

X = Panel thickness
(including panel, mounting frame, and mounting plate)

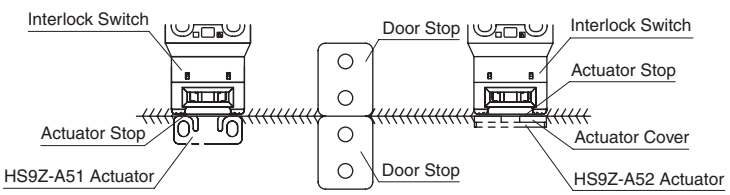
Plug the unused actuator entry slot using the plug supplied with the switch.

Note: With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

Actuator Mounting Reference Position

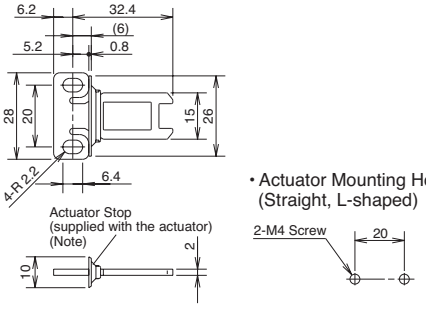
As shown in the figure on the right, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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



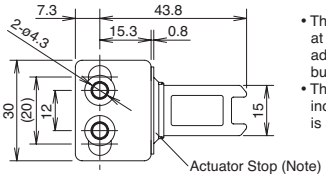
Dimensions and Mounting Hole Layouts, continued

Straight Actuator (HS9Z-A51)

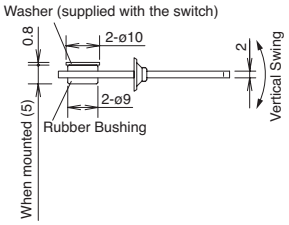


• Actuator Mounting Hole Layout
(Straight, L-shaped)

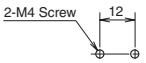
Straight Actuator w/Rubber Bushings (HS9Z-A51A)



- 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 flexiblity to the direction indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

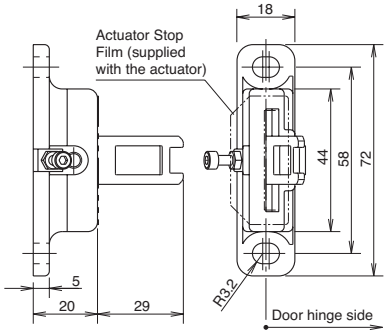


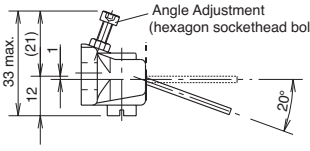
• Actuator Mounting Hole Layout
Straight type (with rubber bushings)
Right-angle type (with rubber bushings)



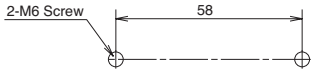
Note: Mounting centers can be widened to 20 mm by moving the rubber bushings.

Angle Adjustable Actuator (Vertical) (HS9Z-A53)





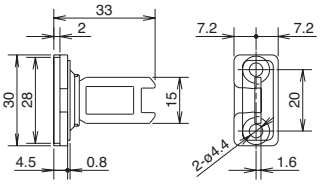
• Actuator Mounting Hole Layout
(vertical swing)

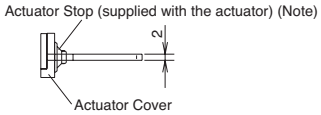


Actuator Orientation

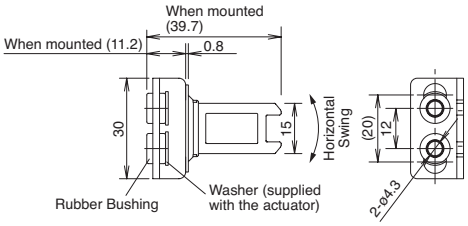
The orientation of actuator swing (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the orientating insert, otherwise the actuator will not swing properly.

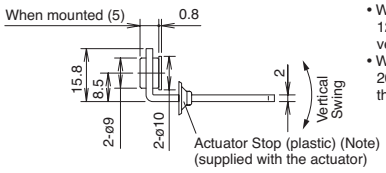
Right-angle Actuator (HS9Z-A52)





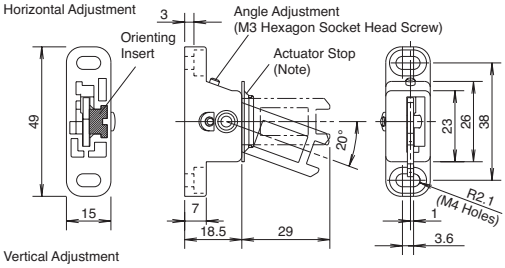
Right-angle Actuator w/Rubber Bushings (HS9Z-A52A)

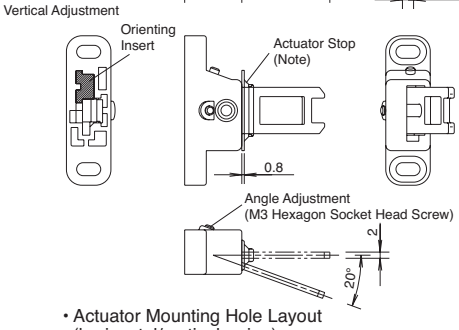




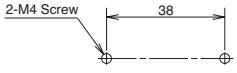
- When the mounting center distance is set to 12 mm, the actuator has flexibility both vertically and horizontally.
- When the mounting center distance is set to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber bushings.

Angle Adjustable Actuator (Horizontal/Vertical) (HS9Z-A55)

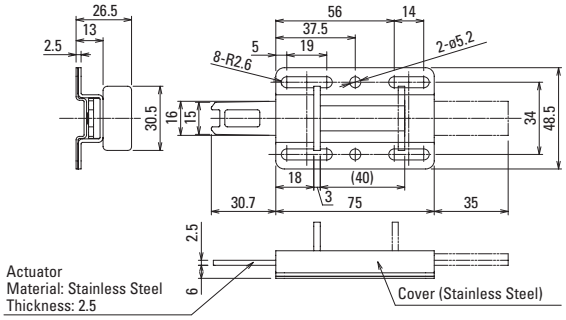




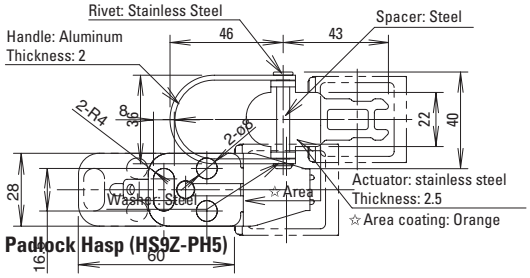
• Actuator Mounting Hole Layout
(horizontal/vertical swing)



Sliding Actuator (HS9Z-SH5)

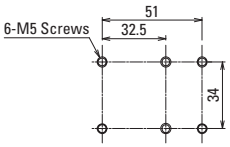


Plug Actuator (HS9Z-A5P)

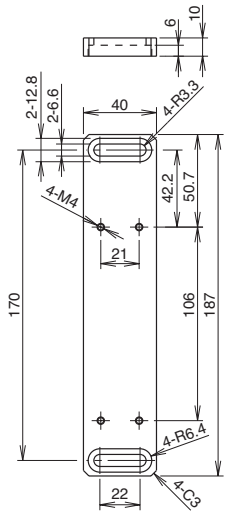


Padlock Hasp (HS9Z-PH5)

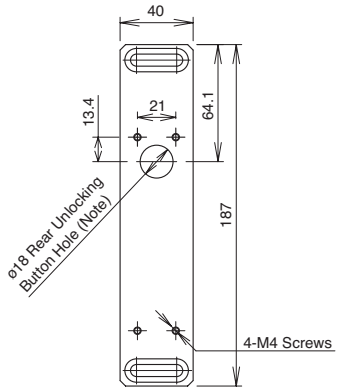
Panel Cut-out



Mounting Plate (HS9Z-SP51)

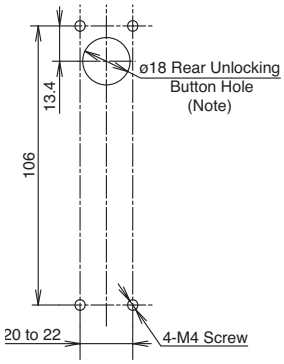


Drilling Rear Unlocking Button Hole



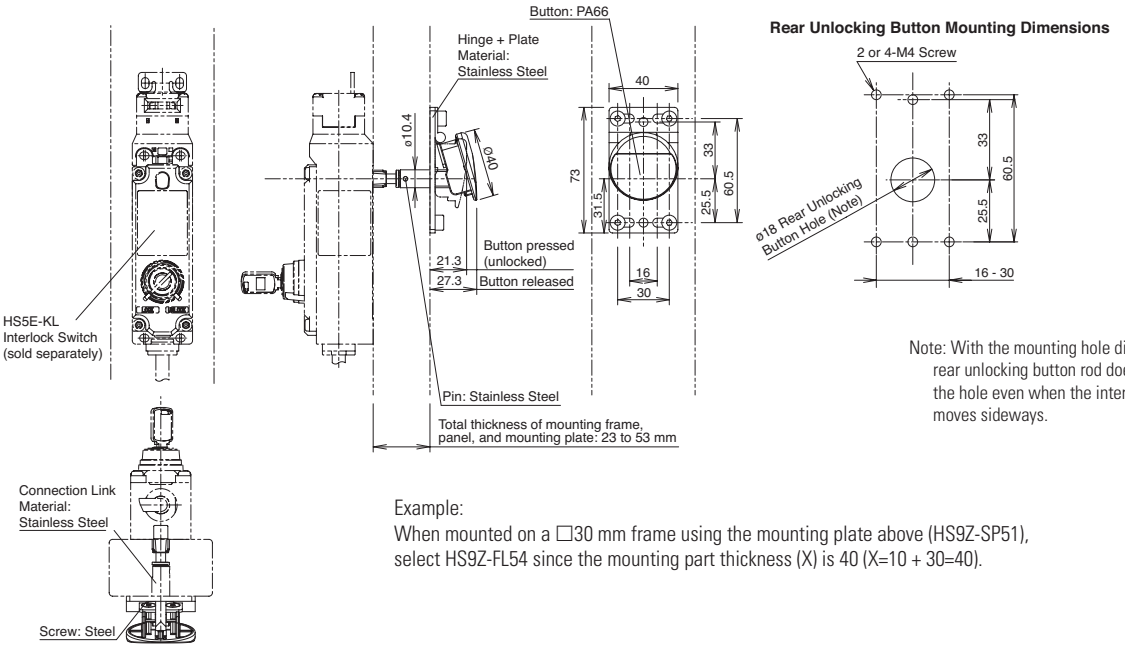
When installing the HS5E-□44L□-G (rear unlocking button type), provide a rear unlocking button hole on the HS9Z-SP51.

Manual Unlocking Key (Metal) (HS9Z-T3)



Material: Anodized aluminum A6063
Weight: Approx. 180g

Rear Unlocking Button Kit (HS9Z-FL5□)



Rear Unlocking Button Mounting Dimensions

Note: With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

Example:
When mounted on a □30 mm frame using the mounting plate above (HS9Z-SP51), select HS9Z-FL54 since the mounting part thickness (X) is 40 (X=10 + 30=40).

Operating Instructions

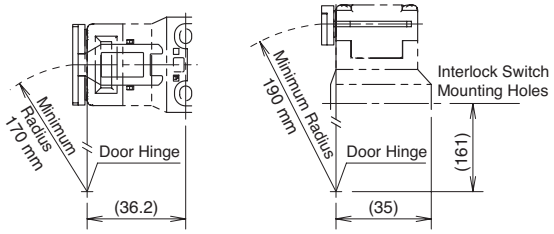
Minimum Radius of Hinged Door

- 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 (HS9Z-A53 or HS9Z-A55).

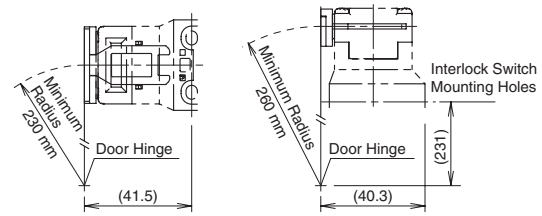
Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

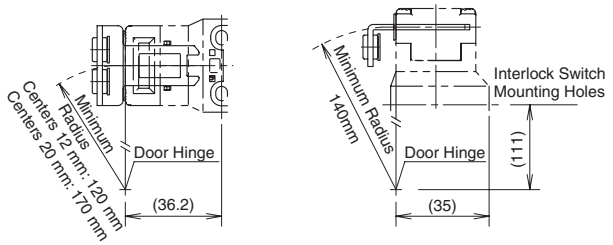


When the door hinge is on the extension line of the actuator mounting surface:

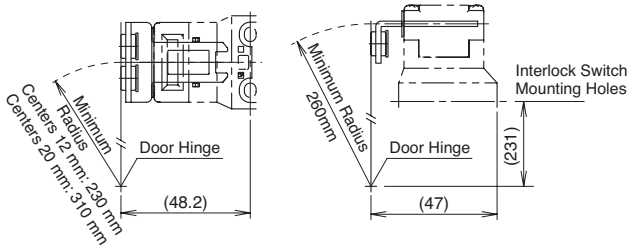


HS9Z-A52 Actuator (w/rubber bushings)

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:



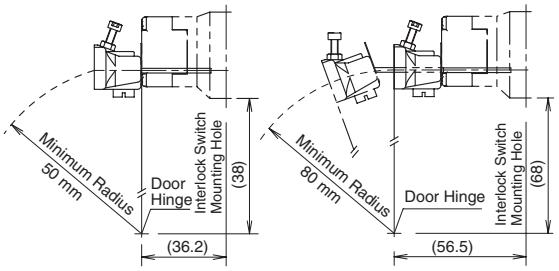
Actuator Angle Adjustment (vertical/horizontal)

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on page 359).
  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 move.

When using the HS9Z-A53 Angle Adjustable (vertical) Actuator

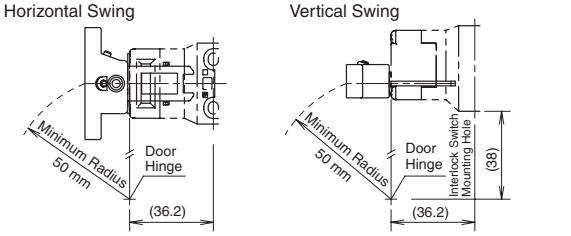
When the door hinge is on the extension line of the interlock switch surface: 50 mm

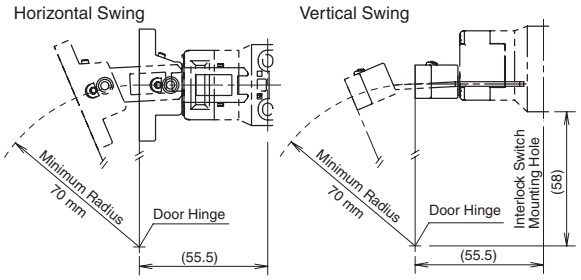
When the door hinge is on the extension line of the actuator mounting surface: 80 mm



When using the HS9Z-A55 Angle Adjustable (vertical/horizontal) Actuator

When the door hinge is on the extension line of the interlock switch surface: 50 mm

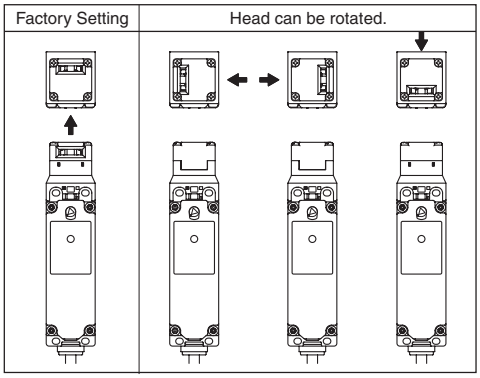




When the door hinge is on the extension line of the actuator mounting surface: 70 mm

Rotating the Head

The head of the HS5E can be rotated 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 if necessary. Before replacing the head, turn the manual unlock to the UNLOCK position using the manual unlock key. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws tightly, without leaving space between the head and body, otherwise the interlock switch may malfunction.
Recommended tightening torque: 0.9 to 1.1 N·m.



Instructions, continued

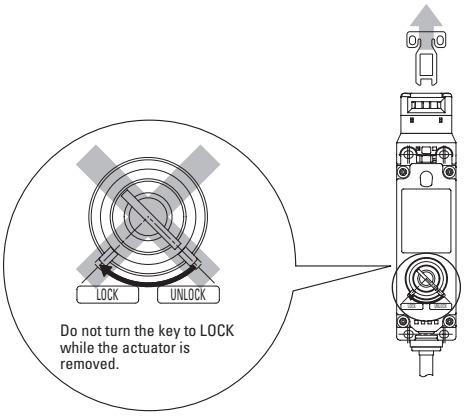
Head Removal Detection Circuitry

- Only the lock monitor circuit 41-42 turns off (open) when the head is removed, such as when the head is rotated. The other monitor circuit 51-52 turns ON (close). Be sure to connect the lock monitor circuit (41-42) to a safety circuit.
- When connecting the HS5E-K to a safety circuit, connect the door monitor circuits (11-12)⊖ and the lock monitor circuits (41- 42)⊖ in series. (GS-ET-19)
- When rotating the head, make sure that the interlock switch is not wired or that the key position is in the UNLOCK position.

Key

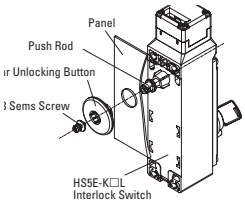
Follow the instructions below to avoid operating failures and damage.

- Insert the key completely.
- Do not remove or insert the key while turning the key.
- Other than the standard key number (500), 15 types of key numbers are available. Use a key with the same number as the number on the cylinder.
- Do not apply excessive force when turning the key. Otherwise operating failures and damage may occur.
- Do not turn the key to the LOCK side while the actuator is removed (door open). Otherwise, operating failures and breakdowns may occur.



Installing the Rear Unlocking Button (HS5E-K□L)

- After installing the interlock switch on the panel, place the rear unlocking button (supplied with the switch) on the push rod on the back of the interlock switch, and fasten the button using the screw supplied with the switch. Rear unlocking buttons can be installed alone when the total thickness of mounting frame and panel is 6 mm or less. When the total thickness of mounting frame, panel, and mounting plate is 23 to 53 mm, use the rear unlocking button kit (HS9Z-FL53, HS9Z-FL54, or HS9Z-FL55) sold separately.



Recommended Tightening Torque for Mounting Screws

- HS5E interlock switch: 1.8 to 2.2 N·m (four M4 screws) (Note)
- Rear unlocking button: 0.5 to 0.7 N·m
- Rear unlocking button kit: 4.8 to 5.2 N·m (M5 screw)
- Actuators
  HS9Z-A51: 1.8 to 2.2 N·m (two M4 screws)
  HS9Z-A52: 0.8 to 1.2 N·m (two M4 Phillips screws)
  HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws)
  HS9Z-A53: 4.5 to 5.5 N·m (two M6 screws)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)

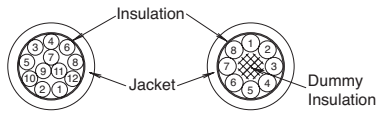
Note: The above recommended tightening torque of the mounting screws are the values with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.

Wire Identification

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

- HS5E-V: Wires of gray and gray/white insulation cannot be used.
- HS5E-DD: Wires of brown and brown/white insulation cannot be used.

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



Circuit Code Identification

- Circuit codes can be identified by the insulation color in each contact configuration.
- The following table shows the identification of circuit numbers.
- When wiring, cut unnecessary wires such as the dummy insulation (white) and any unused wires.

Type	Circuit Diagram
HS5E-KVA	UNLOCK LOCK Monitor Circuit: Blue ⊖11 12 Blue/White Monitor Circuit: Pink ⊖41 42 Pink/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-KVD	Monitor Circuit: Blue ⊖11 12 Blue/White Monitor Circuit: Pink ⊖41 42 Pink/White Monitor Circuit: Orange ⊖21 22 Orange/White Monitor Circuit: Brown ⊖51 52 Brown/White

The contact configuration shows the status where the actuator is inserted and the switch is locked.

ø22 HW Key Switch

Key features:

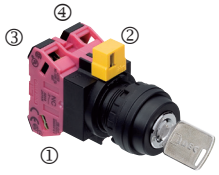
- Key Selector Switches with Direct Opening Action Mechanism
- High-security Pin Tumbler Key
- The NC contact is opened by direct opening action mechanism ⊖. Mode selection enables easy construction of safety systems.
- The single key enables the hostage control of combining HW series key selector switch (pin tumbler type) and HS5E-K interlock key switch. High-security pin tumbler key is used. Sixteen types of key numbers are available.
- Selection of 2-position and 3-position, maintained, spring-return types and key retained variety is available.
- Degree of Protection: IP65 (IEC60529)

Applicable Standards	Mark	File No. or Organization
UL508	UL LISTED	UL Listing File No. E68961
CSA C22.2 No.14	SP	CSA166730 (LR92374)
EN60947-5-1	TÜV	TÜV Rheinland R50054316
	CE	Self-declaration Low Voltage Directive of Europe

Two-position Key Switch (90°)

Contact Code	Contact Block		Standard Logic			Inverse Logic		
			Logic Table		Maintained 1 2	Logic Table		Maintained 2 1
	Mounting Position	Contact	1	2		1	2	
1NO (10)	①	NO		●	HW1K-2PA10	●		HW1K-2JPA10
	②	–	Dummy Block			Dummy Block		
1NC (01)	①	NC	●		HW1K-2PA01		●	HW1K-2JPA01
	②	–	Dummy Block			Dummy Block		
2NO (20)	①	NO		●	HW1K-2PA20	●		HW1K-2JPA20
	②	NO		●		●		
2NC (02)	①	NC	●		HW1K-2PA02		●	HW1K-2JPA02
	②	NC	●				●	
1NO-1NC (11)	①	NO		●	HW1K-2PA11	●		HW1K-2JPA11
	②	NC	●				●	
2NO-2NC (22)	①	NO		●	HW1K-2PA22	●		HW1K-2JPA22
	②	NC	●				●	
	③	NO		●		●		
	④	NC	●				●	

Contact Block Mounting Position

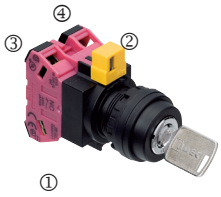


For contact block mounting position, see the figure to the right of the table.
Each key selector switch is supplied with two keys.
Key number 500 is supplied as the default key in table above (500 not added to part number).
To order additional key types, specify key number at end of part number (special order).
Example: HS5E-KVA003-2A501
501 to 515
Note: The key number is engraved on the cylinder.

Three-position Key Switch (45°)

Contact Code	Contact Block No.	Contact Block Contact	Logic Table 1	Logic Table 0	Logic Table 2	Cam Code	Maintained (1 0 2)
2NC (02)	①	NC		●		–	HW1K-3PA02
	②	NC	●				
2NO-2NC (22N1)	①	NO	●			–	HW1K-3PA22N1
	②	NO			●		
	③	NC		●			
	④	NC	●				
2NO (02)	①	NO	●			–	HW1K-3PA20
	②	NO			●		
2NO-1NC (21N1)	①	NO	●			J	HW1K-3JPA21N1
	②	NO			●		
	③	NC		●			
☆	④	–	Dummy Block				
2NO-2NC (22N9)	①	NC			●	S	HW1K-3SPA22N9
	②	NC	●				
	③	NO	●				
☆	④	NO			●		
4NC (04)	①	NC			●	S	HW1K-3SPA04
	②	NC	●				
	③	NC			●		
☆	④	NC	●				

Contact Block Mounting Position



On the contact arrangement marked with ☆ in the table above, the rated current (load switching current) is reduced to a half of the rated current of the contact block. The rated insulation voltage and the rated thermal current remain unchanged.

For models with ☆, contacts may overlap when the operator position is changed.

For contact block mounting position, see the figure on the right.

Each key selector switch is supplied with two keys.

15 types of key numbers are available in addition to standard (500) key.

Key number 500 is supplied as the default key in table above (500 not added to part number).

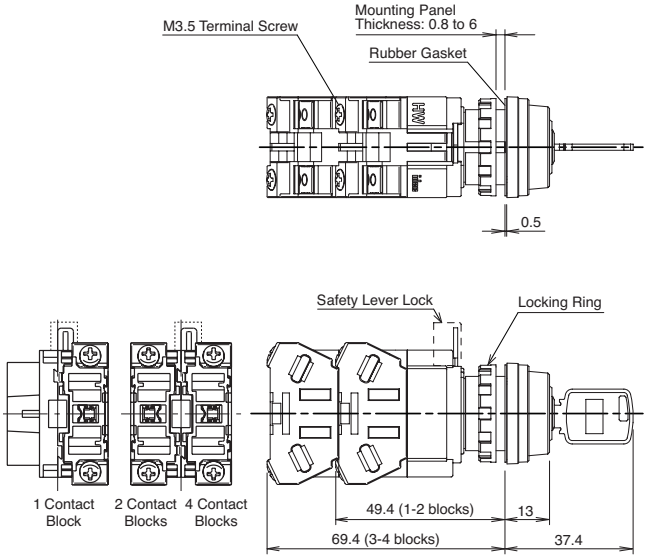
To order additional key types, specify key number at end of part number (special order).

Example: HS5E-KVA003-2A501

501 to 515

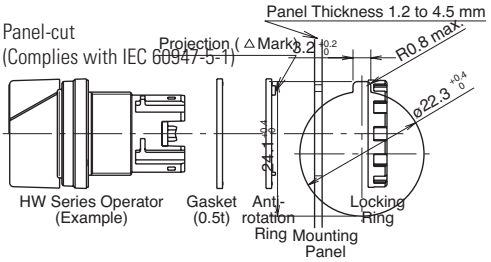
Note: The key number is engraved on the cylinder.

Dimensions (mm)



Anti-rotation Ring and Panel cut-out

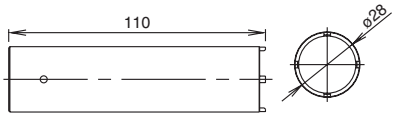
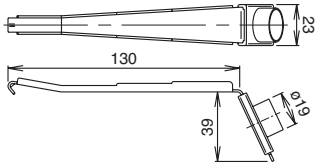
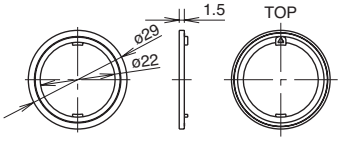
Align the TOP marking on the operator and the TOP mark on the anti-rotation ring with the recess in the mounting panel.

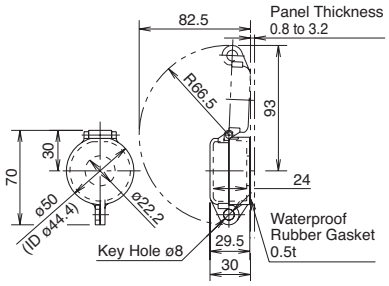
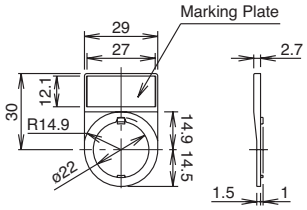
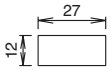


Replacement Parts

Item	Material	Part No.	Remarks
Contact Block 	1NO contact 	HW-G10	Housing color: blue Push rod: green
	1NC contact 	HW-G01	Housing color: purple Push rod: red
Dummy Block 	Nylon	TW-DB	Used when using contact blocks in odd numbers.
Spare Key 	Metal (nickel-plated brass)	LW9Z-SK-500	Standard key number
		LW9Z-SK-□	Key number 501 to 515
Locking Ring 	Polyamide	HW9Z-LN	Black
Safety Lever Lock 	Polyacetal	HW9Z-LS	Yellow One safety lever lock is supplied as standard.
Gasket 	Polyacetal	HW9Z-WM	Black

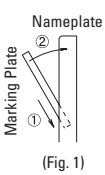
Accessories

Item	Material	Part No.	Dimensions
Locking Ring Wrench 	Metal (brass) Weight: approx. 150g	MW9Z-T1	Used to tighten the locking ring when installing the HW switch onto a panel. Tighten the locking ring to a torque of 2.0 N·m. 
Contact Block Removal Tool 	Metal (copper-zinc plating) / Nitrile Rubber	TW-KC1	Used to remove the contact block and the transformer, and also to install or remove the pilot light lens. Also used to adjust the panel thickness (1, 1.6, 2, 2.3, 3.2, and 5 mm). 
Anti-rotation Ring 	Ring: Nylon Gasket: Nitrile Rubber	HW9Z-RL	Used to prevent the operator from turning. 

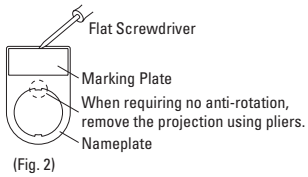
Item	Material	Part No.	Dimensions
Padlock Cover 	Body: Polyarylate Gasket: Nitrile Rubber	HW9Z-KL1	
Nameplate 	Plastic (black) 1.5 mm thick	HWAM	Order marking plate (HWNP-☐) separately. 
Marking Plate 	Aluminum (black) 1.0 mm thick	HWNP-☐	White letters on black background  Specify a legend code in place of ☐ in the Type No.

Code	Legend
31	OFF-ON
35	HAND-AUTO
53	HAND-OFF-AUTO

To install the marking plate on a nameplate, see Fig. 1.
To remove the marking plate, insert a flat screwdriver between the marking plate and nameplate as shown in Fig. 2.
When using a nameplate, mounting panel thickness is decreased by 1.5 mm.
When an anti-rotation ring on the nameplate is not required, remove the projection using pliers as shown in Fig. 2.



(Fig. 1)



(Fig. 2)

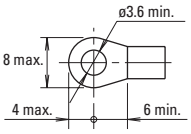
Operating Instructions

Applicable Wiring

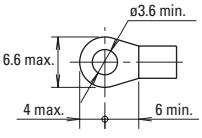
1. The applicable wire size is 14 AWG maximum (Solid wire 16 AWG max.). One or two wires can be connected.

Applicable Crimping Terminal

Crimping Terminal for Ⓐ

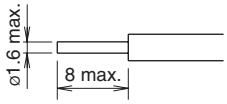


Crimping Terminal for Ⓑ



Be sure to use an insulation tube or cover on the crimping part of the crimping terminal to prevent electrical shocks.

Solid Wire



2. Tighten the M3.5 terminal screw to a recommended tightening torque of 1.0 to 1.3 N·m.

HS7A-DMC Magnetic Safety Switches

Key features:

- Compact size and easy positioning.
- Combination with proprietary relay modules achieves safety category 4 (EN954-1).
- Compact size (7 × 16 × 51mm)
- Positioning for installation is easy.
- Up to 36 sets can be connected.
  (safety relay module: HR1S-DME)
- Degree of protection: IP67

Part Numbers

HS7A Non-contact Magnetic Interlock Switches

Contact Configuration	Cable Length	LED	Part Number	Applicable Safety Relay Module
1NO + 1NC	2m	Without	HS7A-DMC5902	HR1S-D☐
		With	HS7A-DMC5912	
	5m	Without	HS7A-DMC5905	
		With	HS7A-DMC5915	
	10m	Without	HS7A-DMC59010	
		With	HS7A-DMC59110	
2NO	2m	Without	HS7A-DMC7902	HR1S-AF☐
		With	HS7A-DMC7912	
	5m	Without	HS7A-DMC7905	
		With	HS7A-DMC7915	
	10m	Without	HS7A-DMC79010	
		With	HS7A-DMC79110	

The HS7A-DMC non-contact interlock switch is supplied with an HS9Z-ZC1 actuator.
The contact configuration in the table above shows the contact status when the non-contact interlock switch is not activated.

HR1S Safety Relay Modules for Non-contact Interlock Switches

Safety Relay Module	Voltage	Number of Inputs	Max. Number of Connectable Non-contact Interlock Switches
HR1S-DMB☐32	24V DC –20 to +20%	2	12
HR1S-DME☐32		6	36
HR1S-AF☐30B	24V AC –15 to +10% 50/60 Hz 24V DC –15 to +10%	1	6

Safety category 3 can be achieved when connecting two or more non-contact interlock switches per one input.
When connecting multiple non-contact interlock switches (HS7A-DMC790☐), use HR1S-AF51☐.
(HS7A-DMC791☐ cannot be connected in multiple numbers.)

Accessory

Name	Part Number
Actuator	HS9Z-ZC1

One HS9Z-ZC1 is supplied with each HS7A-DMC non-contact interlock switch.

Maximum Number of Connectable Non-contact Interlock Switches per Input of Safety Relay Module

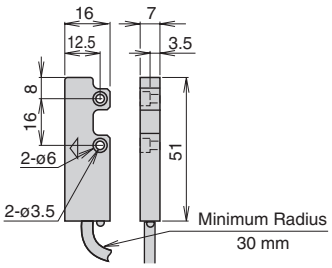
Non-contact Interlock Switch	HS7A-DMC59☐☐		HS7A-DMC79☐☐	
	Without LED	With LED	Without LED	With LED
HR1S-D☐	6	3	–	–
HR1S-AF☐	–	–	6	1

Specifications

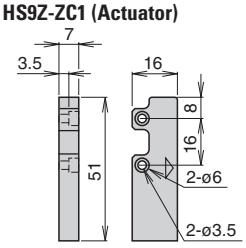
Applicable Standards		IEC/EN 60947-5-1 UL508 (UL listed) CSA C22.2, No. 14
Operating Temperature		–25 to 85°C (no freezing)
Relative Humidity		30 to 85% RH (no condensation)
Storage Temperature		–40 to +85°C (no freezing)
Pollution Degree		3
Electric Shock Protection		Class II (IEC 60536)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		300 m/s^2 (11 ms) (IEC 60068-2-7)
Vibration Resistance		100 m/s^2 (10 to 150 Hz) (IEC 60068-2-6)
Rated Voltage (Ue)		24V DC
Rated Current (Ie)		100 mA
Repeat Accuracy		10% maximum
Maximum Operating Frequency		150 Hz
Voltage Drop	I = 10 mA	0.1V (without LED) / 2.4V (with LED)
	I = 100 mA	1V (without LED) / 4.2V (with LED)
Housing Material		PBT
Housing Color		Red
Cable		AWG23 × 4 Cable length: 2m, 5m, 10m
Weight (approx.)		HS7A-DMC: 100g (cable length: 2m) HS9Z-ZC1: 9g

Dimensions (mm)

HS7A-DMC
(Non-contact Interlock Switch)



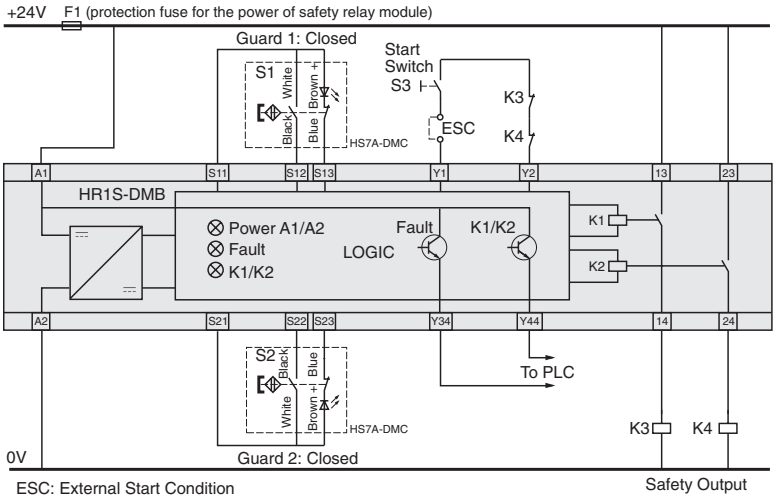
HS9Z-ZC1 (Actuator)

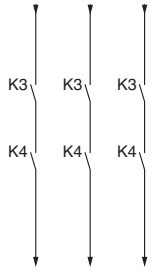


Example Wiring Diagram

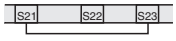
The following diagrams show the contact statuses when the non-contact interlock switches are activated by the actuators.

Example: Safety Category 4 (ISO 13849-1) Circuit, HR1S-DMB + HS7A-DMC591□ (1NO+1NC) + HS9Z-ZC1

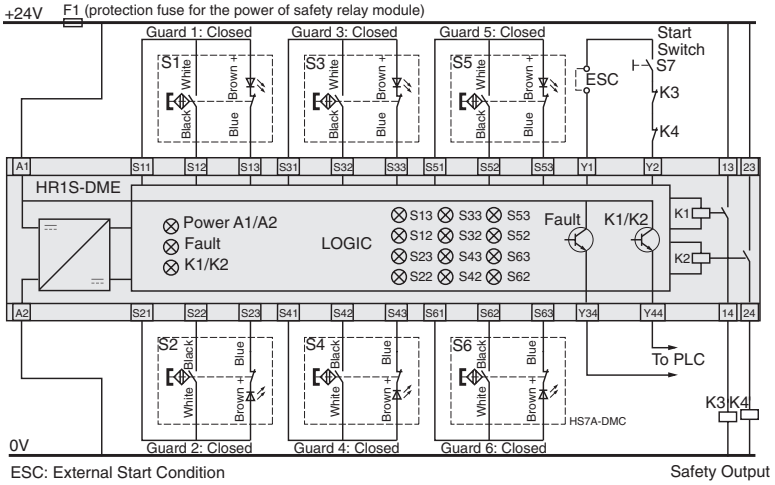


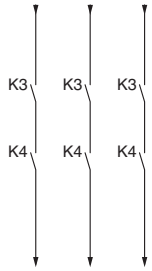


Short-circuit unused input terminals.



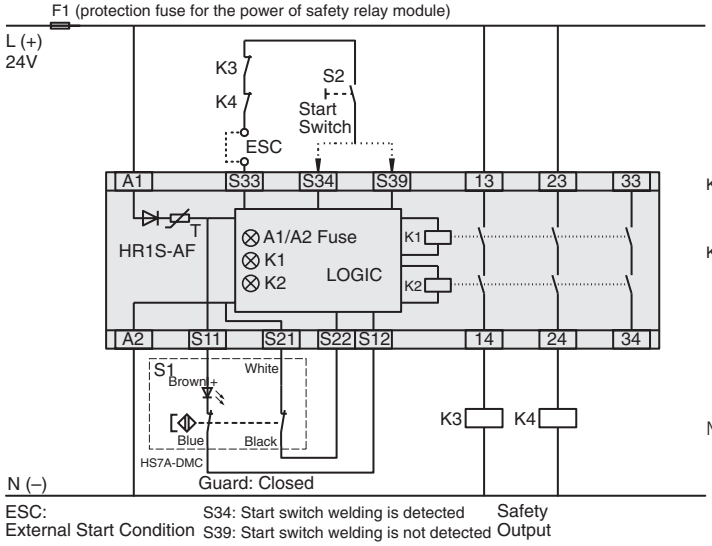
Example: Safety Category 4 (EN 13849-1) Circuit, HR1S-DME + HS7A-DMC591□ (1NO+1NC) + HS9Z-ZC1

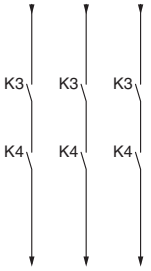




Short-circuit unused input terminals.

Example: Safety Category 4 (EN 13849-1) Circuit, HR1S-DME + HS7A-DMC591□ (1NO+1NC) + HS9Z-ZC1

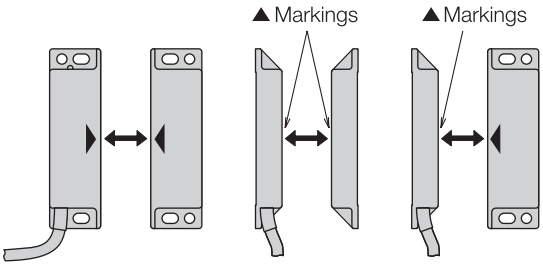




Note: The circuit example shown on the left (HR1S-AF and HS7A-DMC79□□ may not conform to safety category 4 depending on the operating conditions, such as the frequency of safety function check. Perform risk assessment of your system before operation.

Operating Instructions

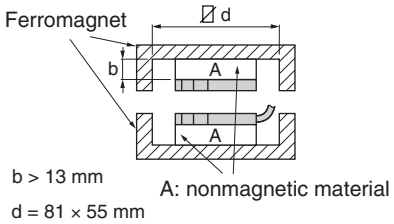
Operating Direction



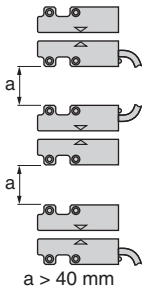
Safety output ON distance (SAO): 3mm.

Precautions for Installation

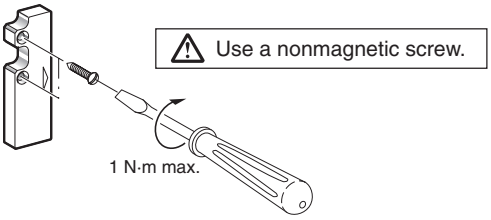
When installing on a ferromagnet



Close mounting

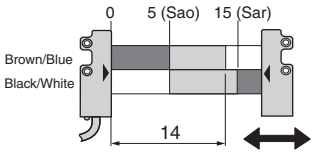


Tightening Torque

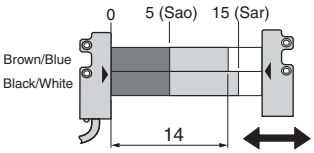


Operation Chart

HS7A-DMC59□□(1NO+1NC)



HS7A-DMC79□□(2NO)



Dimensions: mm

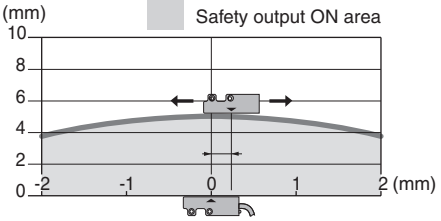
Contact Status

	Contact Closed (1)
	Contact Open (0)
	Transient State

Sao: Assured operating distance where the safety output is sure to turn on.
Sar: Assured release distance where the safety output is sure to turn off.

Note: When the transfer time between the actuator's Sao-Sar is 500 ms or longer, the time lag is detected as an error.

Operation Area



HS7A-DMP Magnetic Safety Switches

Key features:

- Three-contact models.
  Auxiliary contacts enable PLCs to monitor the door status.
- Operation signals from auxiliary contacts can be read directly by controllers such as PLCs, allowing for monitoring HS7A-DMP non-contact interlock switches.
- Ideal for installation on guard doors where positioning is difficult.
- Conformable up to safety category 4 (EN ISO 13849-1)
  (Combining with proprietary safety relay module achieves safety category 4.)
- A maximum of 36 sets can be connected (safety relay module: HR1S-DME)
- Degree of protection: IP67

The HS7A-DMP non-contact interlock switches can be used as interlock switches when used in combination with safety relay modules specified by IDEC.

Part Numbers

HS7A Non-contact Interlock Switches

Contact Configuration	Cable Length	LED	Ordering Type No.	Applicable Safety Relay Module
1NO+2NC	2m	Without	HS7A-DMP5002	HR1S-D☐
		With	HS7A-DMP5012	
	5m	Without	HS7A-DMP5005	
		With	HS7A-DMP5015	
2NO+1NC	2m	Without	HS7A-DMP7002	HR1S-AF☐
		With	HS7A-DMP7012	
	5m	Without	HS7A-DMP7005	
		With	HS7A-DMP7015	

The HS7A-DMP non-contact interlock switch is supplied with an HS9Z-ZP1 actuator.
The contact configuration in the table above shows the contact status when the non-contact interlock switch is not activated.

HR1S Safety Relay Modules for Non-contact Interlock Switches

Safety Relay Module	Number of Inputs	Max. Number of Connectable Non-contact Interlock Switches
HR1S-DMB☐	2	12
HR1S-DME☐	6	36
HR1S-AF☐	1	6

When connecting multiple non-contact interlock switches (HS7A-DMP700☐), use HR1S-AF☐.
(HS7A-DMP701☐ cannot be connected in multiple numbers.)

Accessory

Name	Part Number
Actuator	HS9Z-ZP1

One HS9Z-ZP1 is supplied with each HS7A-DMP non-contact interlock switch.

Maximum Number of Connectable Non-contact Interlock Switches per Input of Safety Relay Module

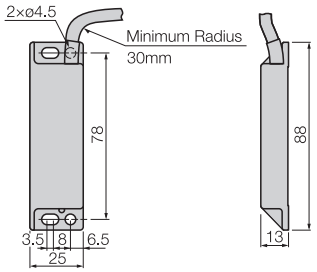
Non-contact Interlock Switch	HS7A-DMP50☐☐		HS7A-DMP70☐☐	
	Without LED	With LED	Without LED	With LED
HR1S-DM☐	6	3	–	–
HR1S-AF☐	–	–	6	1

Specifications

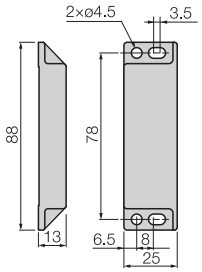
Applicable Standards		IEC/EN 60947-5-1 UL508 (UL listed) CSA C22.2, No. 14
Operating Temperature		–25 to 85°C (no freezing)
Relative Humidity		35 to 85% RH (no condensation)
Storage Temperature		–40 to +85°C (no freezing)
Pollution Degree		3
Electric Shock Protection		Class II (IEC 60536)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		300 m/s^2 (11 ms) (IEC 60068-2-7)
Vibration Resistance		100 m/s^2 (10 to 150 Hz) (IEC 60068-2-6)
Rated Voltage (Ue)		24V DC
Rated Current (Ie)		100 mA
Repeat Accuracy		10% maximum
Maximum Operating Frequency		150 Hz
Voltage Drop	I = 10 mA	0.1V (without LED) / 2.4V (with LED)
	I = 100 mA	1V (without LED) / 4.2V (with LED)
Electrical Durability		1,200,000 operations minimum
Housing Material		PBT
Housing Color		Red
Cable		AWG23 × 6 Cable length: 2m, 5m
Weight (approx.)		HS7A-DMP: 180g (cable length: 2 m) HS9Z-ZP1: 50g

Dimensions (mm)

HS7A-DMP□□□□ (Non-contact Interlock Switch)



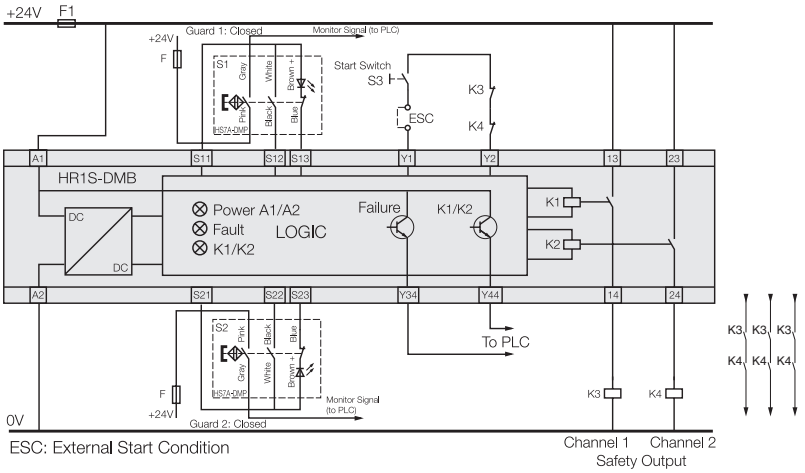
HS7A-ZP1 (Actuator)



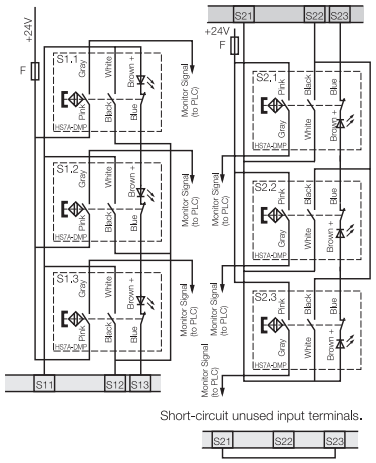
Example Wiring Diagram

The following diagrams show the contact statuses when the non-contact interlock switches are activated by the actuators.

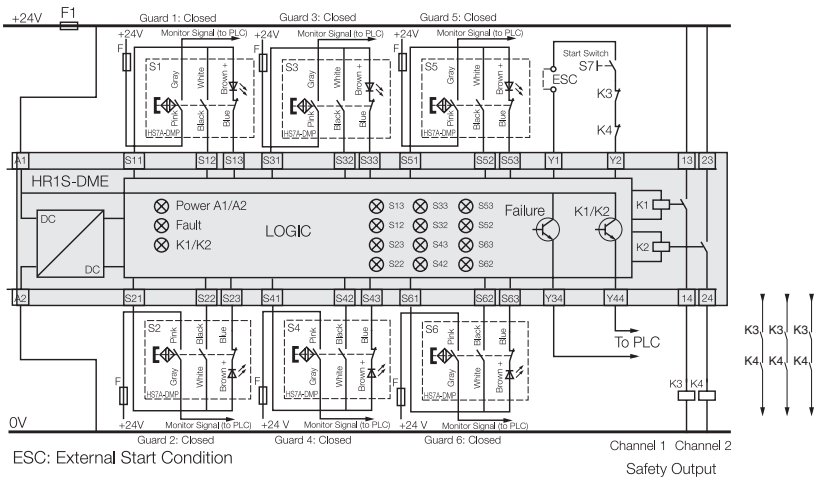
Example: Safety Category 4 (ISO 13849-1) Circuit
HR1S-DMB + HS7A-DMP50□□ (1NO+2NC) + HS9Z-ZP1



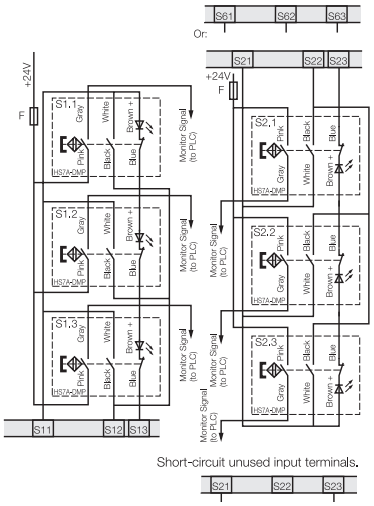
Example: Safety Category 3 (EN ISO 13849-1) Circuit
HR1S-DMB



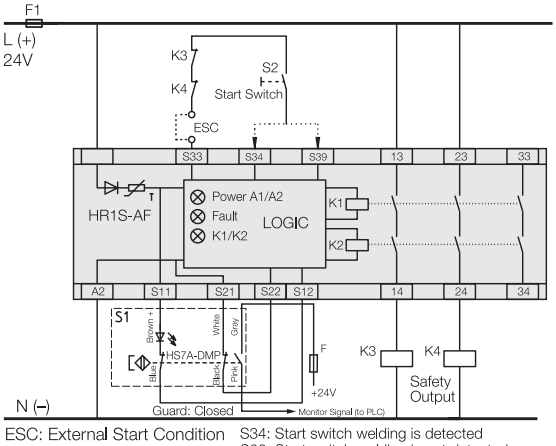
Example: Safety Category 4 (ISO 13849-1) Circuit
HR1S-DME + HS7A-DMP50□□ (1NO+2NC) + HS9Z-ZP1



Example: Safety Category 3 (ISO 13849-1) Circuit
HR1S-DME



Example: Safety Category 4 (ISO 13849-1) Circuit
HR1S-AF + HS7A-DMP70□□ (2NO+1NC) + HS9Z-ZP1



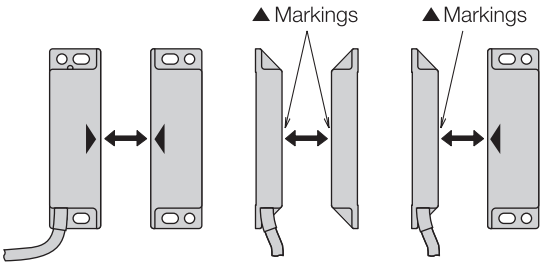
F1: Protection fuse for the power of safety relay module

F: Protection fuse for monitor signal contacts (max. 500mA gG (gL))

Note: The circuit example shown on the left (HR1S-AF and HS7A-DMP70□□) may not conform to safety category 4 depending on the operating conditions, such as the frequency of safety function check. Perform risk assessment of your system before operation.

Operating Instructions

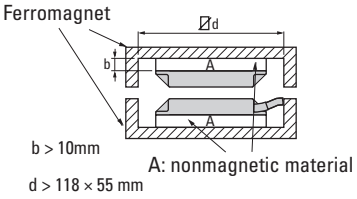
Operating Direction



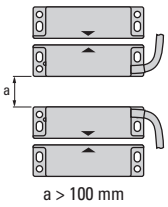
Safety output ON distance (SAO): 3mm.

Precautions for Installation

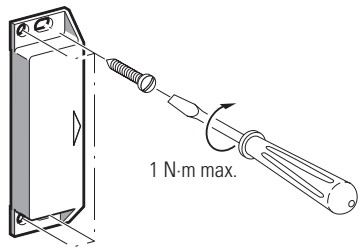
When installing on a ferromagnet



Close mounting



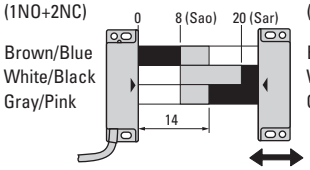
Tightening Torque



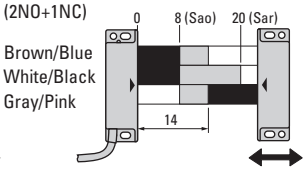
⚠ Use a nonmagnetic screw.

Operation Chart

HS7A-DMP50□□ (1NO+2NC)



HS7A-DMP70□□ (2NO+1NC)



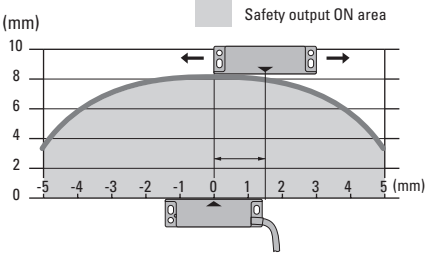
Contact Status

■	Contact closed (1)
	Contact open (0)
▒	Transient area

Sao: Assured operating distance where the safety output is sure to turn on.
Sar: Assured release distance when the safety output is sure to turn off.

Note: When the transfer time between the actuator's Sao-Sar is 500 ms or longer, the time lag is detected as an error.

Operation Area



HS3A Non-contact RFID Safety Switches

Key features:

- RFID non-contact interlock switch, Category 4 and PLe (EN/ISO 13849-1) compliant.
- The sensor head with built-in safety function (redundant solid state output with internal monitoring) eliminates the need for a designated safety module.
- RFID ensures detection of slow-moving, open, sliding, and rattling doors.
- Multicode and unicode sensor heads are available. Unicode sensor head (one sensor head corresponds to one actuator) prevents tampering with the use of an unassigned spare actuator.
- Sensor head can be installed in 5 directions.
- Degree of protection IP67. Actuator IP67, IP69K (Note)

Note: IP69K is a degree of protection specified by Deutsches Institüt für Normung (DIN), DW 40050 Part 9 for hot and high-pressure water.

Interlock Switch
(Sensor Head)

Actuator

Part Numbers

HS3A Non-contact RFID Safety Switches

Outputs	Type	Part Number
Safety output: 2 Monitor output: 1	Multicode	HS3A-H21M4
	Unicode	HS3A-H21U4

Accessories

Name			Part Number	Remarks
Actuator			HS9Z-ZH31	Actuator for both multicode and unicode sensor heads. Supplied with two M5 × 10 mounting screws (stainless steel)
Terminal Plug (For serial connection)			HS9Z-H3TP	Used on Y-branch connector when connecting two or more switches in series.
Y-branch Connector (For serial connection)			HS9Z-H3YD	Used when connecting two or more switches in series. Plug connector: 8-pin (switch side), 5-pin (cable side)
M12 Plug Connection Cable		 For connecting two or more switches in series	5-pin, 5m	HS9Z-H3F505	Used when connecting two or more switches in series. 5-pin plug connector is provided at one end.
			5-pin, 10m	HS9Z-H3F510	
		 For connecting a single switch	8-pin, 5m	HS9Z-H3F805	Used when connecting a single switch. 8-pin plug connector is provided at one end.
			8-pin, 10m	HS9Z-H3F810	
M12 Plug Connection Cable (For serial connection)			5-pin, 5m	HS9Z-H3F5M05	Used when connecting two or more switches in series. 5-pin plug connectors are provided at both ends.
			5-pin, 10m	HS9Z-H3F5M10	

See below for an example of accessories required when connecting N number of HS3A switches in series.

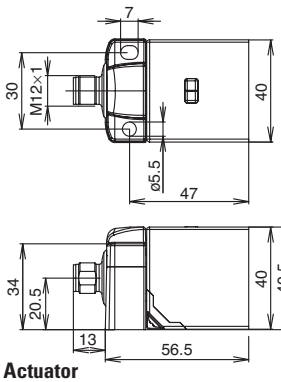
HS3A non-contact interlock switch (HS3Z-H21☐4): N pcs.
Actuator (HS9Z-ZH31): N pcs.
Terminal plug (HS9Z-H3TP): 1 pc.
Y-branch connector (HS9Z-H3YD): N pcs.
M12 plug connection cable, open end (HS9Z-H3F5☐☐): 1 pc.
M12 plug connection cable, plug connectors at both ends (HS9Z-H3F5M☐☐): N–1 pcs.

Specifications

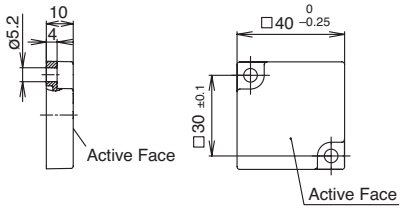
Applicable Standards		EN60947-5-3 (IFA approval) EN954-1 EN ISO13849-1 EN62061 GS-ET-14 (IFA approval) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed)
Operating Temperature		–20 to +55°C (no freezing)
Relative Humidity		5 to 80% (no condensation)
Storage Temperature		–25 to +70°C
Pollution Degree		3
Sensor Classification		PDF-M (EN60947-5-3)
Performance Level (PL)		e (EN ISO 13849-1)
Safety Category		4 (EN ISO 13849-1)
Safety Integrity Level (SIL)		3 (EN 62061)
Degree of Protection	Interlock Switch (sensor head)	IP67
	Actuator	IP67, IP69K (Note)
Rated Voltage (UB)		24V DC ±15%
Current Consumption		80mA (at no load)
Dielectric Strength		500V AC
Output Specifications	Safety Output	Semiconductor output, P-channel Output voltage: Max: UB [V], Min.: UB-1.5 [V] Maximum output current per safety output: 400 mA
	Monitor Output	Semiconductor output, P-channel Output voltage: Max: UB [V], Min.: 0.8×UB [V] Maximum output current: 200 mA
Operation Distance	Turn-on Distance	15mm (typ.)
	Assured Turn-on Distance (Sao)	13mm
	Maximum Turn-off Distance (Sar)	58mm
Response Time	When using a single switch	260 ms (actuator removed)
		150 ms (non-identical input signal at IA/IB)
		150 ms (non-identical enabling input state at IA/IB)
		300 ms (short-circuit or cross-circuit at OA/OB, or internal error)
	When using two or more switches (max.)	360 ms (actuator removed)
		250 ms (non-identical input signal at IA/IB)
		400 ms (non-identical enabling input state at IA/IB)
		400 ms (short-circuit or cross-circuit at OA/OB, or internal error)
Shock Resistance		Operating extremes: 300 m/s^2 (11 ms)
Vibration Resistance		10 to 55 Hz, amplitude 0.5 mm
Material		PBT
Cable		M12 plug connection cable, 8-pin
Weight (approx.)		400g (HS3A-H21☐☐)
Attachment		System Manual (CD-ROM)

Dimensions (mm)

Sensor Head

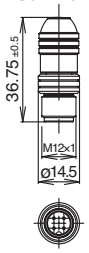


Actuator

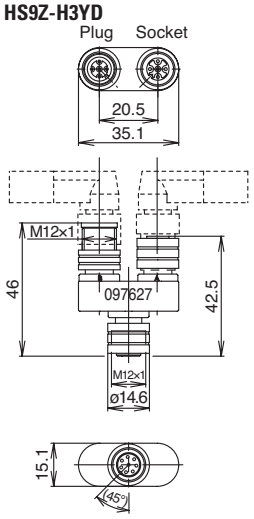


Supplied with two mounting screws (M5 × 10).

Terminal Plug HS9Z-H3TP

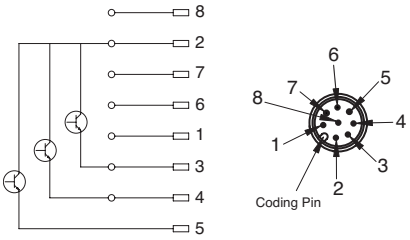


Y-branch Connector HS9Z-H3YD



Specifications

Non-contact Interlock Switch



Plug Connection Cable

HS9Z-H3FB

Pin	Wire	Legend	Description
1	White	IB	Enabling input (channel 2)
2	Brown	UB	Power supply (24V DC)
3	Green	OA	Safety output (channel 1)
4	Yellow	OB	Safety output (channel 2)
5	Gray	OUT	Monitoring output
6	Pink	IA	Enabling input (channel 1)
7	Blue	0V	0V
8	Red	RST	Reset input for hardware

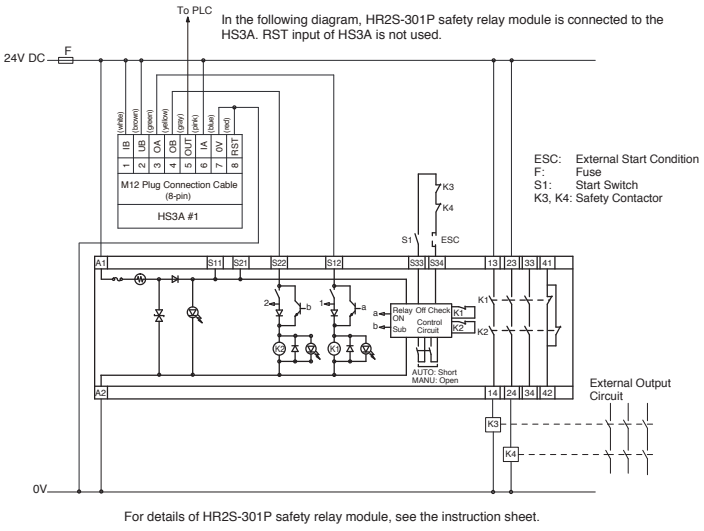
HS9Z-H3FS

Pin	Wire	Legend
1	Brown	UB
2	White	OA
3	Blue	0V
4	Black	0B
5	Gray	RST

Wiring Diagram

When using a single HS3A

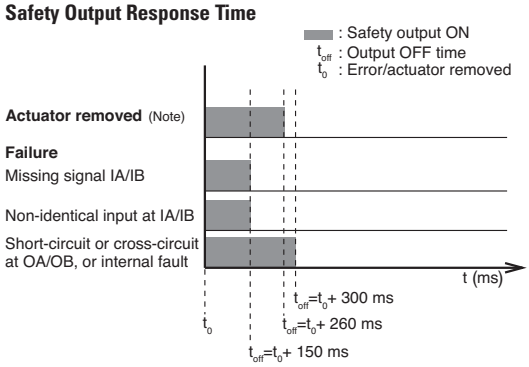
When using a single HS3A, connect as shown in the figure below (Note). The OUT output can be connected to a control system, to a PLC for example, as a monitoring output.
The HS3A can be reset via the RST input. To reset, apply 24V DC for at least 3 seconds. When not using the RST input, connect the RST input to 0V.



For details of HR2S-301P safety relay module, see the instruction sheet.

Note: Safety performance of the actual system is determined by performing a risk assessment on the entire system. Depending on the risk level the system may entail, K1 and K2 need to be monitored to prevent serious accidents.

Safety Output Response Time



Note: The time required for the safety output to turn off after the actuator moves outside the operating distance of the HS3A switch.

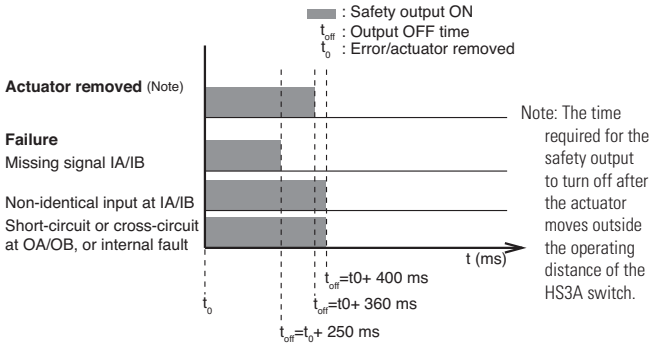
When using two or more HS3A in series

A maximum of 20 can be connected in series.
Pay attention to the contact resistance at the connection points.

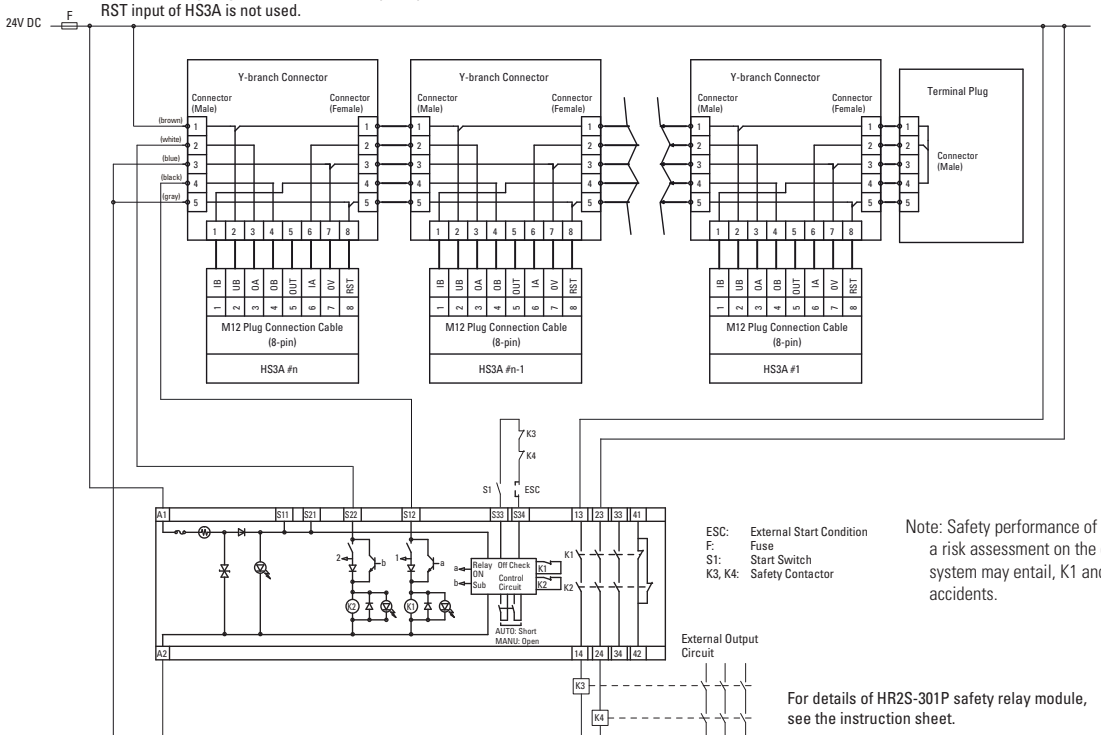
The HS3A switches can be connected in series using plug connection cables and Y-branch connectors as shown in the figure below (Note). When any of the HS3A switches detects that the safety guard is open, or when a failure has occurred on any of the switches, the system tuns off the machine. However, the external control system cannot detect which safety guard is open or where a failure has occurred.

The HS3A can be reset via the RST input. To reset, apply 24V DC for at least 3 seconds. When not using the RST input, connect the RST input to 0V.

Safety Output Response Time



In the following diagram, HR2S-301P safety relay module is connected to the HS3A.
RST input of HS3A is not used.



ESC: External Start Condition
F: Fuse
S1: Start Switch
K3, K4: Safety Contactor

Note: Safety performance of the actual system is determined by performing a risk assessment on the entire system. Depending on the risk level the system may entail, K1 and K2 need to be monitored to prevent serious accidents.

For details of HR2S-301P safety relay module, see the instruction sheet.

Operation Distance and Response Time

When installing the HS3A, ensure the safety of the door opening area by paying attention to the operation distance (Table 1) and response time (Table 2) shown below.

Table 1: Operation Distance [1]

Distance	Value (mm)		
	Min.	Typ.	Max.
Turn-on distance	—	15 [2]	—
Assured turn-on distance Sa0	13	—	—
Switching hysteresis	1.5	2.5	—
Assured turn-off distance Sar	—	—	58

1. When the off-center displacement of the interlock switch (sensor head) and actuator is 0 mm.
2. When surface-mounted on aluminum. When using by embedding in metal, pay attention to the operation distance affected by the metal. In non-metallic environment, the typical turn-on distance increases to 30mm.

Table 2: Response Time

Response Time	When connecting a single switch (max.)	260 ms (actuator removed)
		150 ms (missing enabling input IA/IB)
		150 ms (non-identical enabling input state at IA/IB)
		300 ms (short-circuit or cross-circuit at OA/OB, or internal fault)
	When connecting two or more switches (max.)	360 ms (actuator removed)
		250 ms (missing signal enabling input IA/IB)
		400 ms (non-identical enabling input state at IA/IB)
		400 ms (short-circuit or cross circuit at OA/OB or internal fault)

Note: To ensure safety, both safety outputs (OA and OB) must always be evaluated. Single-channel use of the safety outputs as shown below leads to a reduction of safety category stipulated in EN954-1.

HS5B/HS5E Door Handle Actuator

Key features:

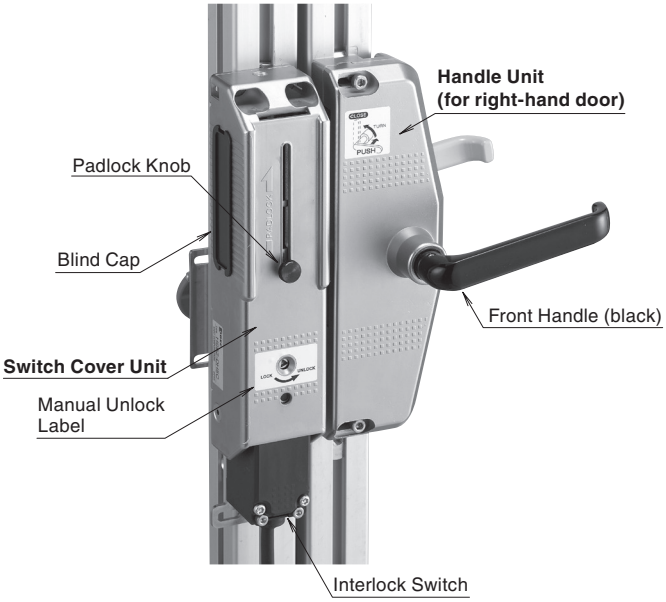
- Easy and secure operation
- Rattling doors can be locked smoothly and securely.
- A door can be locked with an actuator by pushing and turning the handle.
- Padlock tab is provided to ensure operator safety.
- Interlock switch with or without solenoid lock can be installed.
- LED shows solenoid status
  (when using HS5E-☐44L☐☐-G).

Part Numbers

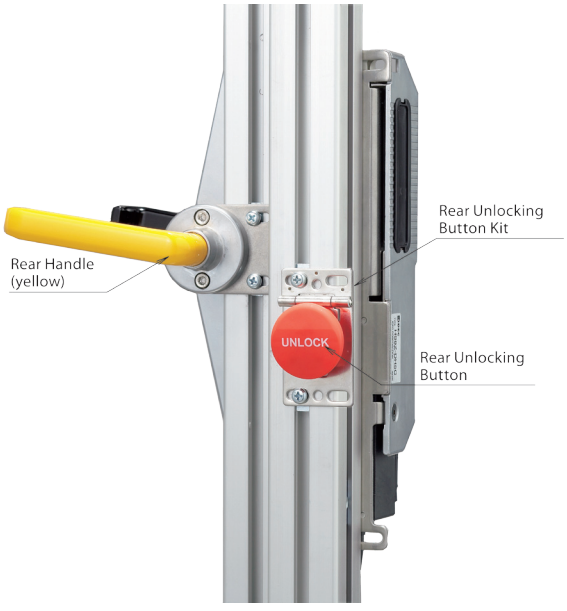
Description		Ordering Type No.	Remarks	
Handle Unit	For right-hand door	HS9Z-DH5RH	Choose according to the required opening side.	
	For left-hand door	HS9Z-DH5LH		
Switch Cover Unit		HS9Z-DH5C	Used for installing the interlock switch inside.	
HS5B Installation Kit		HS9Z-DH5B	Contains a mounting plate and two spacers.	
Rear Unlocking Button Kit [1]		HS9Z-FL53	Contains a button with base plate and a connecting rod	Mounting panel thickness (X): 20 ≤ X ≤ 30mm [2]
		HS9Z-FL54		Mounting panel thickness (X): 30 ≤ X ≤ 40mm [2]

1. Use the kit in combination with the HS5E-☐44L☐☐-G rear unlocking button type interlock switch.
2. Mounting panel is a frame or a panel.

Parts Description



Front View



Rear View

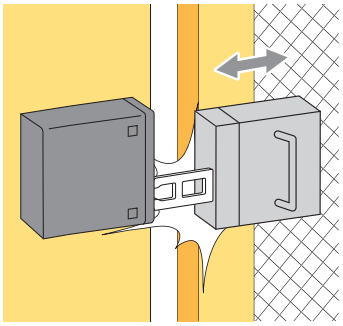
Specifications

Applicable Interlock Switch	HS5B Metal Head Interlock Switch [1] HS5E Rear Unlocking Button Type Interlock Switch with Solenoid [2]
Operating Temperature	–25 to +70°C (no freezing)
Mechanical Durability	100,000 operations minimum
Applicable Shackle Diameter of Padlock	ø6 to 7.5 mm
Withstand Load of Padlock Tab	30N maximum
Handle Operation Angle	77° (removed position ⟷ inserted position)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum.

1. HS5B-☐☐ZB, HS5B-☐☐ZBM
2. HS5E-☐44L☐☐-G
Interlock switch is not supplied with the actuator and must be ordered separately.
For the specifications of interlock switches, see pages XX, XX, and XX.

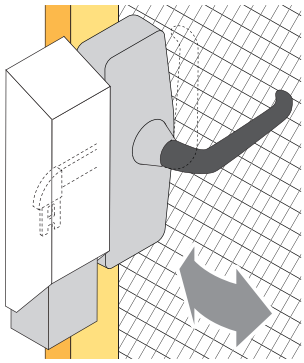
Rotational handle actuator can be inserted/removed smoothly on rattling doors.

Conventional Sliding Actuator



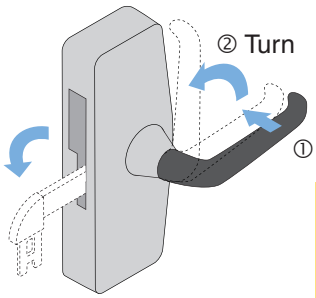
IDEC's Door Handle Actuator

Rattling doors can be locked smoothly and securely.

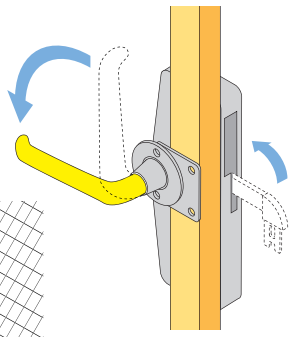


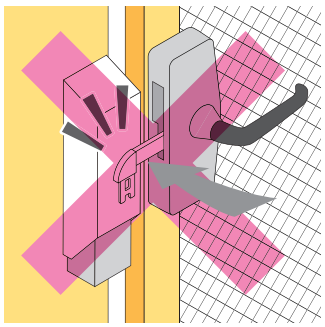
The door can be locked and unlocked by pushing and turning the handle.

The actuator can be inserted into the interlock switch by pushing and turning the front handle. The actuator can be removed from the interlock switch by turning the front handle.

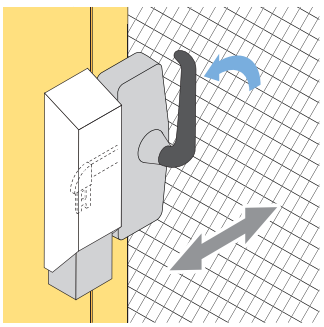


The rear handle can remove the actuator, but cannot insert the actuator.





Because the handle can be turned only while it is pushed, the actuator is prevented from hitting the switch cover unit.



Sliding doors can also be locked securely.

Padlockable tab ensures operator's safety.

When padlocks are installed on the padlock tab, the machine cannot be started because the actuator entry slot is blocked and the actuator cannot enter the interlock switch. By requiring all operators to have their own padlock and installing them on the door handle actuator before entering the hazardous area, the door will not be closed unless all padlocks are removed—i.e. all operators have left the hazardous area.

Note: Operators must observe rules in the workplace in order to ensure safety. Residual risk such as failure to install padlocks must be taken into consideration.

Interlock switch with/without solenoid locking can be selected.

HS5E

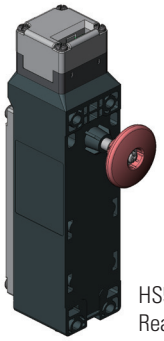
(HS5E-☐44L☐☐-G)

HS5B

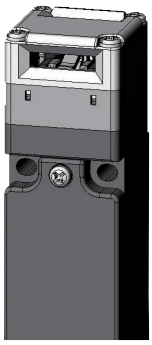
(HS5B-☐☐Z)

Door Handle Actuator Configuration

Interlock Switches



HS5E-☐44L☐☐-G
Rear Unlocking
Button Type

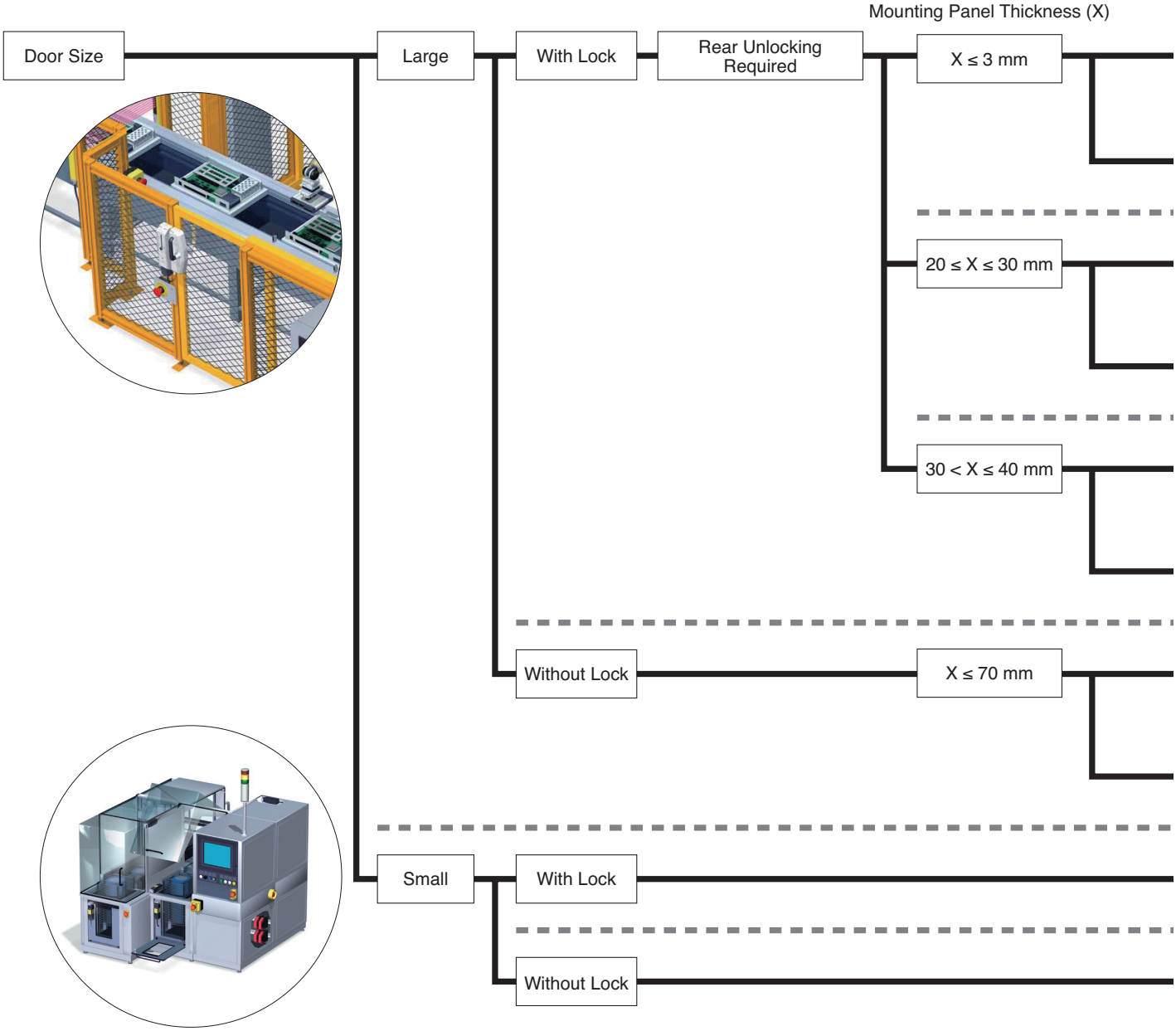


HS5B-☐☐Z
Metal Head Type

Switch Cover Unit

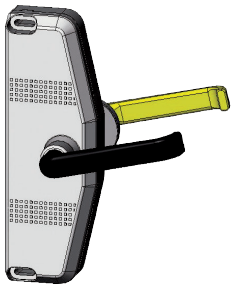
HS9Z-DH5C

Selection Chart



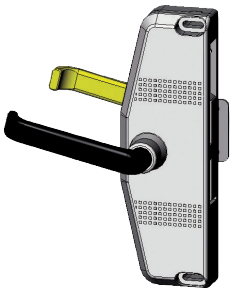
Handle Unit

Right-hand Door



HS9Z-DH5RH

Left-hand Door



HS9Z-DH5LH

Accessories

Rear Unlocking Button Kit

HS9Z-FL53
HS9Z-FL54

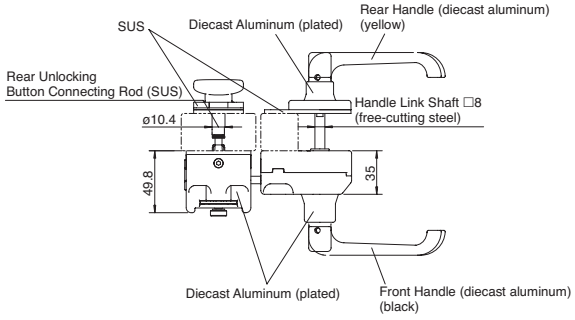
HS5B Installation Kit

HS9Z-DH5B

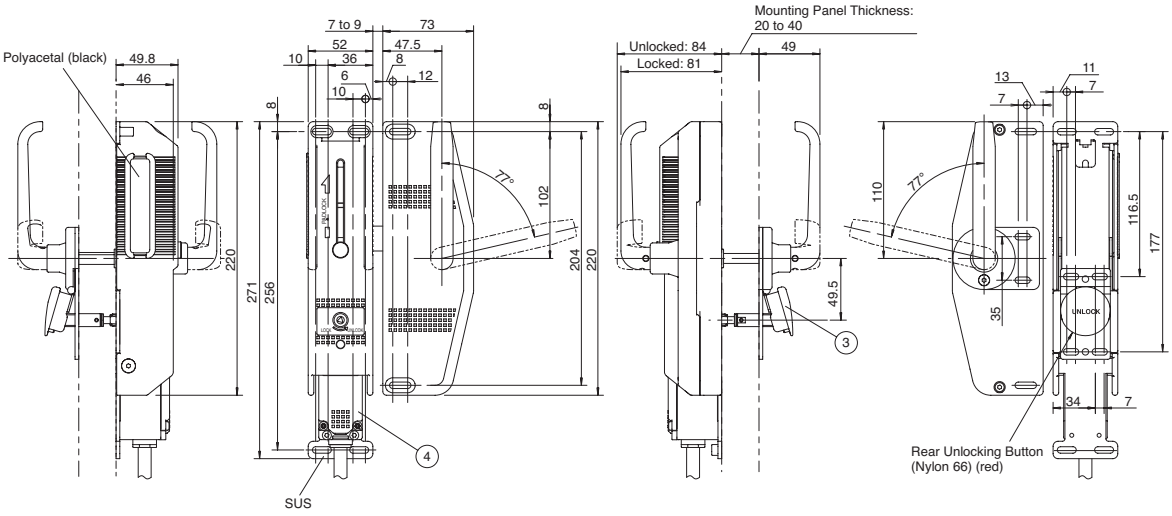
Handle Unit			Switch Cover Unit	Accessories	Interlock Switch
Right-hand Door	 HS9Z-DH5RH	+	 HS9Z-DH5C	+	+	 HS5E-∗44L∗∗-G (Rear Unlocking Button Type)
Left-hand Door	 HS9Z-DH5LH	+		+	+	
Right-hand Door	 HS9Z-DH5RH	+		+	 Rear Unlocking Button Kit HS9Z-FL53	+	
Left-hand Door	 HS9Z-DH5LH	+		+	+	
Right-hand Door	 HS9Z-DH5RH	+		+	 Rear Unlocking Button Kit HS9Z-FL54	+	
Left-hand Door	 HS9Z-DH5LH	+		+	+	
Right-hand Door	 HS9Z-DH5RH	+		+	 HS5B Installation Kit HS9Z-DH5B	+	 HS5B-∗∗Z (Metal Head Type)
Left-hand Door	 HS9Z-DH5LH	+		+	+	
	 Sliding Actuator HS9Z-SH5	+		+		+	HS5E (All types) 
		+		+		+	HS5B-∗∗Z (Metal Head Type) 

Dimensions (mm)

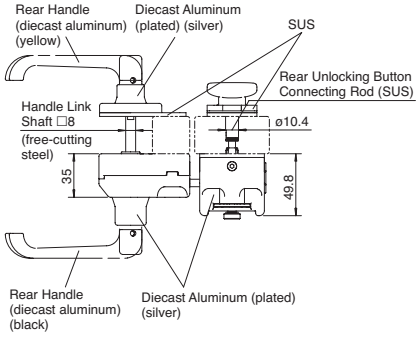
HS9Z-DH5RH (right-hand door) and HS5E-□44L□□-G Interlock Switch with Solenoid



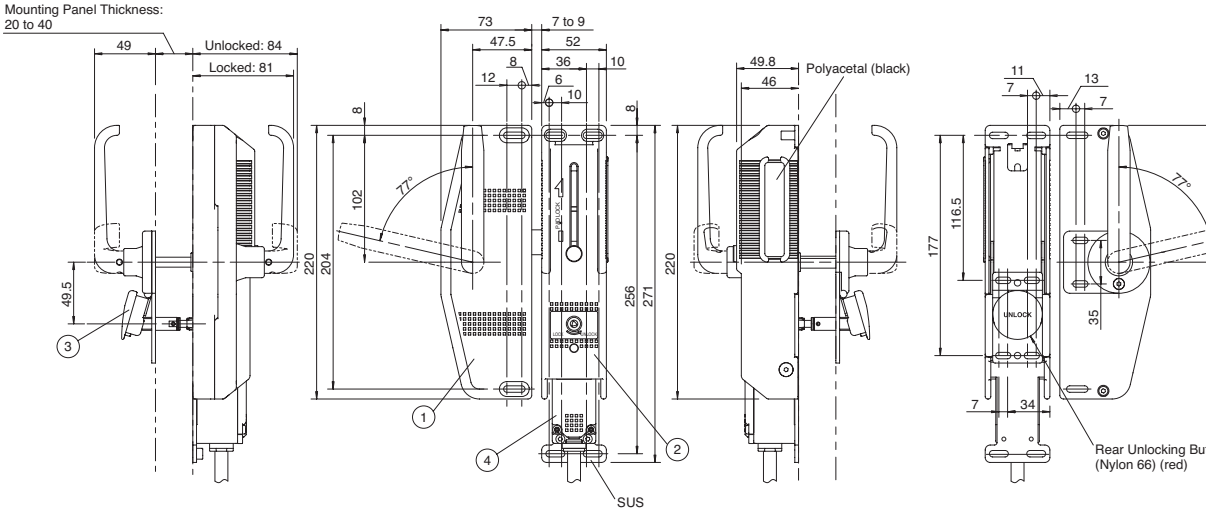
Legend	Description
1	Right-hand Door Handle Unit HS9Z-DH5RH
2	Switch Cover Unit HS9Z-DH5C
3	Rear Unlocking Button Kit HS9Z-FL5□
4	Interlock Switch HS5E-□44L□□-G



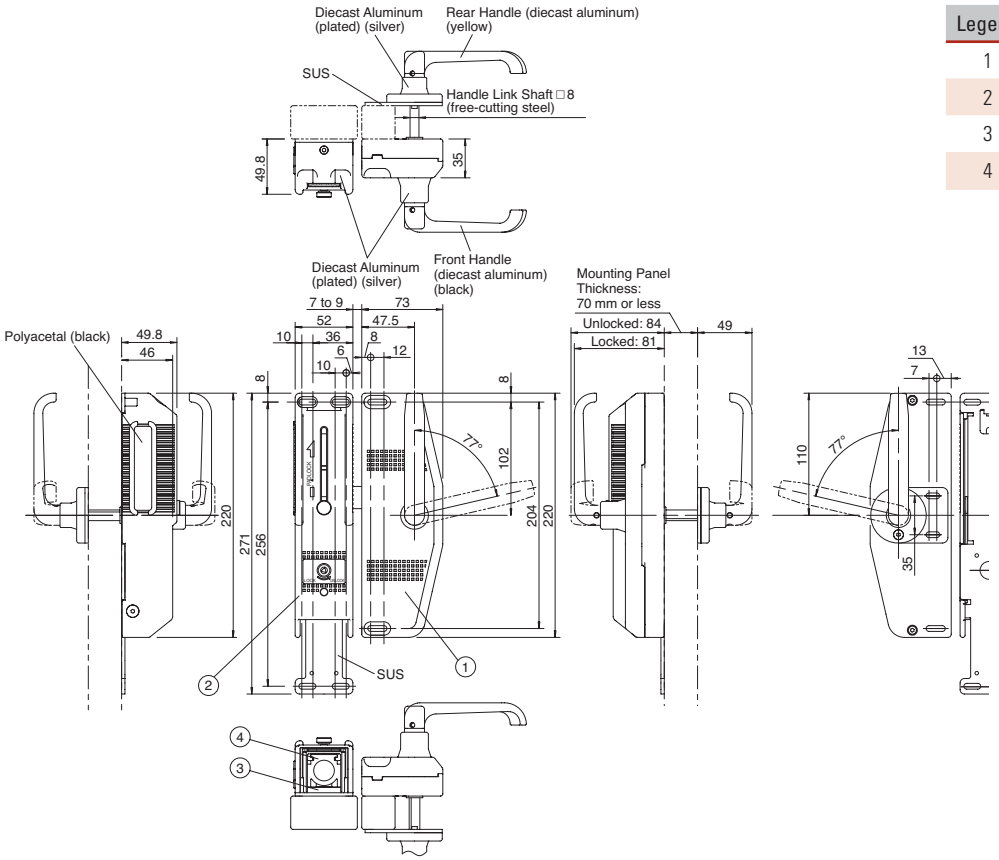
HS9Z-DH5LH (left-hand door) and HS5E-□44L□□-G Interlock Switch with Solenoid



Legend	Description
1	Left-hand Door Handle Unit HS9Z-DH5LH
2	Switch Cover Unit HS9Z-DH5C
3	Rear Unlocking Button Kit HS9Z-FL5□
4	Interlock Switch HS5E-□44L□□-G

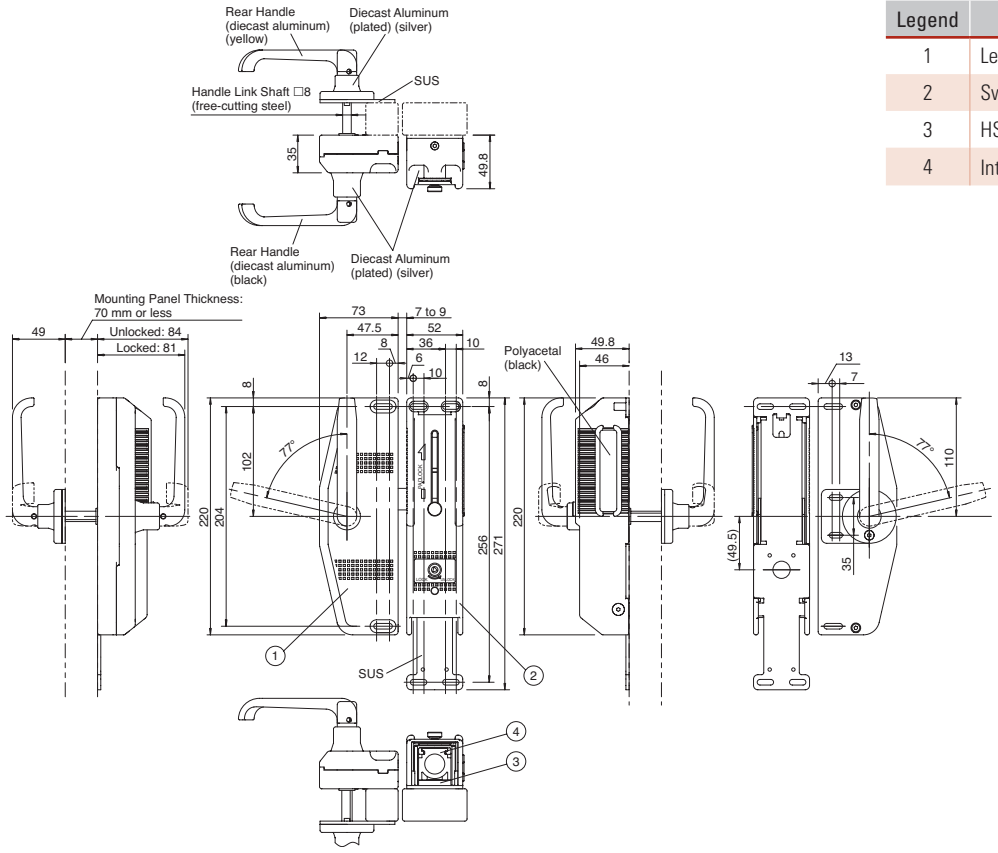


HS9Z-DH5RH (right-hand door) and HS5B-□□Z Interlock Switch



Legend	Description
1	Right-hand Door Handle Unit HS9Z-DH5RH
2	Switch Cover Unit HS9Z-DH5C
3	HS5B Installation Kit HS9Z-DH5B
4	Interlock Switch HS5B-□□Z

HS9Z-DH5LH (left-hand door) and HS5B-□□Z Interlock Switch

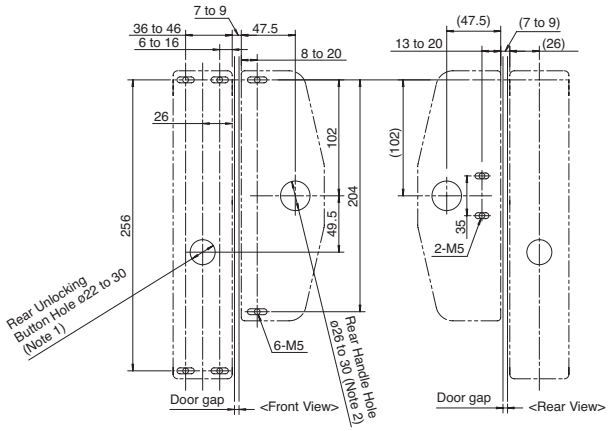


Legend	Description
1	Left-hand Door Handle Unit HS9Z-DH5LH
2	Switch Cover Unit HS9Z-DH5C
3	HS5B Installation Kit HS9Z-DH5B
4	Interlock Switch HS5B-□□Z

Panel Cut-out
HS9Z-DH5RH right-hand door handle unit

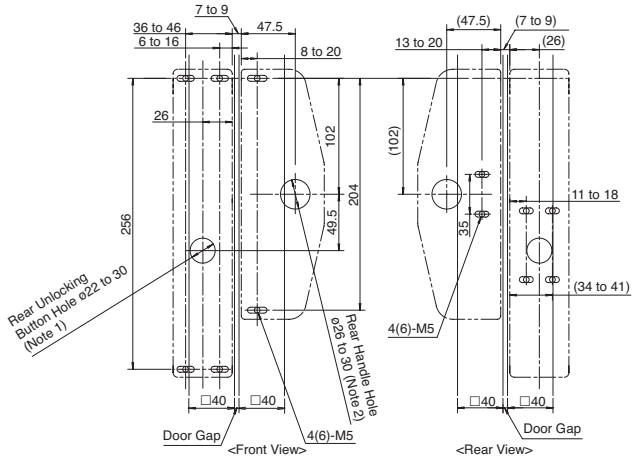
When using the HS5E-☐44L☐☐-G on the mounting panel of 3 mm or less in thickness (use the rear unlocking button).

When using the HS5B-☐Z (mounting panel thickness X ≤70mm).



When using the HS5E-☐44L☐☐-G on the mounting panel of 20 to 40 mm in thickness.

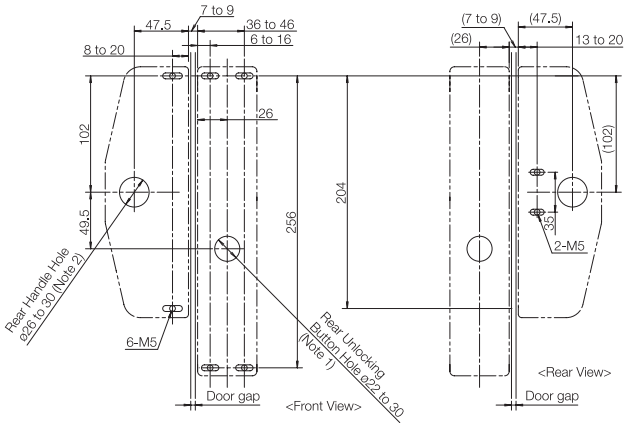
- Use the rear unlocking button kit (HS9Z-FL5☐).
- In the figure shown on the right, ☐40mm frame is used.



HS9Z-DH5LH left-hand door handle unit

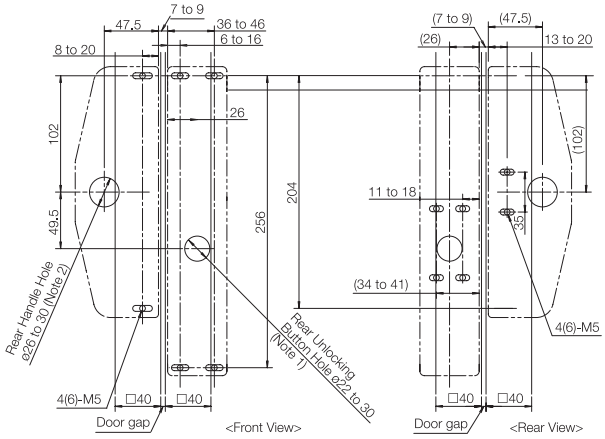
When using the HS5E-☐44L☐☐-G on the mounting panel of 3 mm or less in thickness (use the rear unlocking button).

When using the HS5B-☐Z (mounting panel thickness X ≤ 70mm).

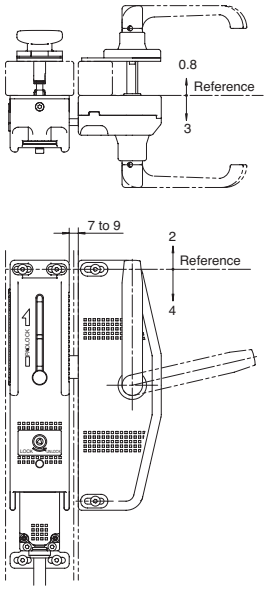


When using the HS5E-☐44L☐☐-G on the mounting panel of 20 to 40 mm in thickness.

- Use the rear unlocking button kit (HS9Z-FL5☐).
- In the figure shown on the right, ☐40mm frame is used.

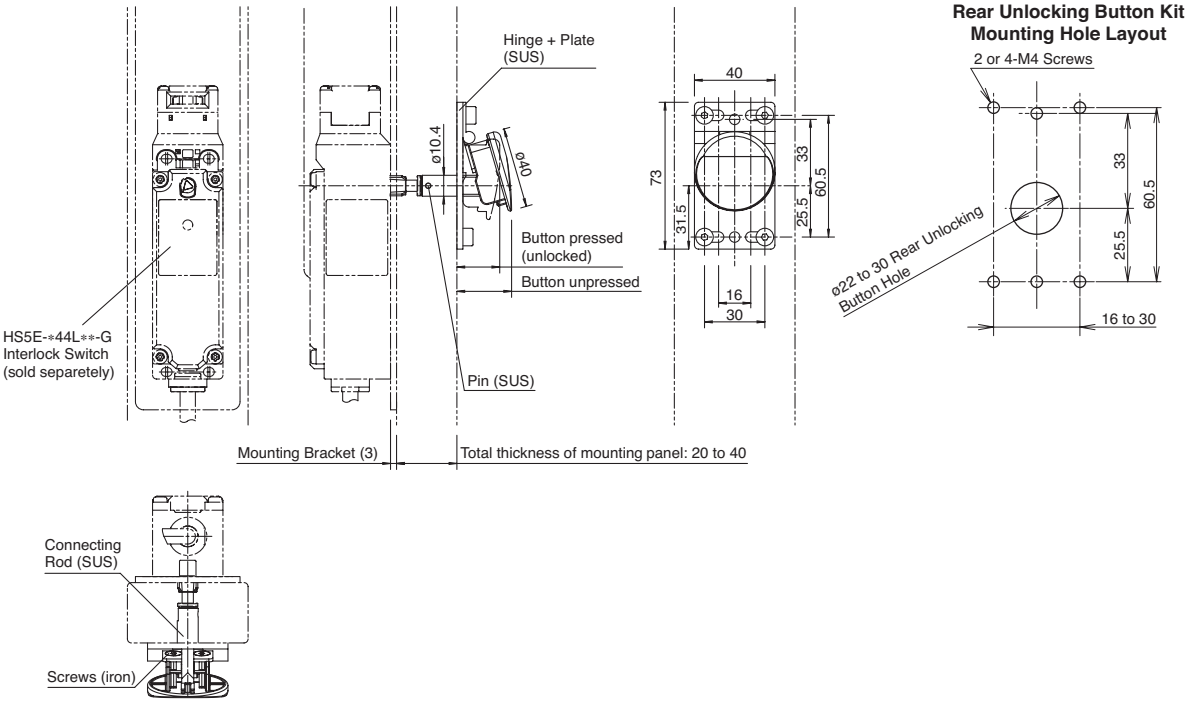


Mounting Position Tolerance

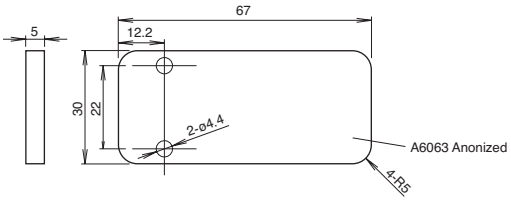


Note 1: Required when using the HS5E-☐44L-☐☐-G.
Not required when using the HS5B-☐☐Z (without locking function).
Note 2: Ensure that the hole in the mounting panel does not interfere with the rear handle shaft.

Rear Unlocking Button Kit
(HS9Z-FL53/HS9Z-FL54) (Use with the HS5E-*44L-G Interlock Switch)**



HS5B Installation Kit (HS9Z-DH5B)



Note: The illustration kit contains the aluminum mounting plate shown above and two spacers.

For more information, download instruction sheet from web.