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Interlock Switches Interlock Plugs



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Actuator with Plastic Holder



Interlock Switches Selection Guide

Product	Interlock Switches		
	HS1B Interlock Switches	HS2B Interlock Switches	
Shape	Disconnects circuits when the door is opened.	Disconnects circuits when the door is opened.	
Applicable Standards	ISO14119 EN1088 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed)		
Mark			
Page	100	100	



Interlock Switches Selection Guide

Product	Interlock Switc	h with Solenoid
	HS1L Interlock Switches with Solenoid 3000N locking strength; six contacts in a compact housing.	HS1E-K Interlock Switches with Solenoid and Hostage Key Door/key are locked without failure during operation. Removing the key unlocks the door, maintaining the circuits disconnected.
Shape		
	1001/110	
Applicable Standards	IEC60947-5-1 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL listed) CSA C22.2 No. 14 (c-UL listed) GB14048.5 (CCC approved)	IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed) GB14048.5 (CCC approved)
Mark		
Page	84	92

Product	Interlock Switc	h with Solenoid
Shape	HS1C Interlock Switches with Solenoid Locks door during machine operation. The door is unlocked by a solenoid lock-release signal indicating that the machine has stopped completely, and disconnecting the circuit.	HS1C-K Interlock Switches with Solenoid and Hostage Key Locks the door/key during machine operation. Removing the key unlocks the door, maintaining the circuits disconnected.
Applicable Standards	ISO14119, EN1088, IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed) GB14048.5 (CCC approved)	
Mark		
Page	106	114

Interlock Plugs/Interlock Switch Accessories Selection Guide

Product	Interlock Plugs			
FIOUUCI	Box Type with Cable		Door Lock	Panel Mounting
Shape	HS1P (interlock plug unit) Used to detect the open/close door status by chaining the guard door.	HS1P (solenoid interlock plug unit) Used to detect the open/close door status by chaining the guard door. Door is locked during operation.	HS1C-P (door lock interlock plug unit) Removing the plug unlocks the door, maintaining the circuit disconnected. Solenoid type locks the plug during operation.	HS2P (panel mounting interlock plug) Ideal for using as a portable plug to bring into hazardous areas.
Applicable Standards	UL498, UL508 (UL Listed), CSA C22.2 No.14 (c-UL Listed), CSA C22.2 No. 182.1			
Mark				
Page	119	119	122	128

Product	HS5 Series Door Handle Actuator	HS5 Series Sliding Actuator	HS5 Series Plug Actuator
Shape			
Page	68	76	78

Product	HS5 Series Padlock Hasp	HS9Z ø22/ø33mm Padlock Cover	Actuator with Plastic Holder
Shape			
Page	80	82	130

ISO 12100-2 Model / Shape Applicable Standards Marks Page ISO14119 EN1088 IEC60947-5-1 HS6B Thin Plastic Guard and protective devices shall On small equip-be used to protect General Plant EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) ment with small 8 persons whenever Environment €⊖⊡ mounting space UL508 (UL-listed) CSA C22.2 No. 14 (c-UL-listed) GB14048.5 inherently safe design does not reasonably make EN ISO14119 HS5D it possible either EN ISC14115 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) Miniature to remove hazards Plastic or to sufficiently 25 UL508 (UL listed) CSA C22.2 No. 14 (c-UL reduce risks. listed) GB14048.5 (CCC approved) ISO 12100-2 ISO14119 HS2B Plastic 5.2 Selection and EN1088 IEC60947-5-1 implementation of IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) UL508 (UL listed) CSA C22.2 No.14 guards and protec-100 On large equipment tive devices 5.2.1 General As the need for (c-UL listed) frequency of HS1B Rugged Die-cast ISO14119, EN1088 IEC60947-5-1 EN60947-5-1 access increases Aluminum this inevitably leads (TÜV approved) GS-ET-15 (TÜV approved) to the fixed quard 100 €⊖⊡ Sputtering or blow not being replaced. UL508 (UL listed) CSA C22.2 No.14 This requires the (c-UL listed) use of an alterna-ISO14119 IEC60947-5-1 tive protective HS6E with Solenoid measure (movable Interlock On small and Locking necessary EN60947-5-1 (TÜV approved) interlocking guard, : 🕕 us 🕑 EN1088 (TÜV approved) GS-ET-19 (TÜV approved) lightweight door for production 12 sensitive protective C€⊖□ with small mountpurposes (not for equipment). UL508 (c-UL listed) ing space safety reasons) CSA C22.2 No. 14 (c-UL listed) ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV HS5E with ISO 14119 Solenoid On aluminum approved) EN1088, GS-ET-19 (TÜV (EN 1088) Interlock "N" 🕑 🎯 frame quard or EN1088, GS-EI-19 (TUV approved), UL508 (UL recognized) CSA C22.2 No. 14 (c-UL recognized), GB14048.5 (CCC approved) 31 5.7 Design to small equipment €⊖⊡ minimize defeat with small mountpossibilities ing space Interlocking ISO14119, IEC60947-5-1 devices shall be HS5E-K with designed and EN60947-5-1 Key Interlock (TÜV approved) instructions for .RL°. 🕑 EN1088, GS-ET-19 their installation 50 (TÜV approved) €⊖⊡ and maintenance UL508 (UL recognized) CSA C22.2 No. 14 shall be given so that they cannot be defeated in a (c-UL recognized) ISO14119 HS1L with IEC60947-5-1 simple manner. Solenoid EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) c 🔍 us 🕑 🞯 Interlock 84 General Plant UL508 (UL listed) €⊖⊡ CSA C22.2 No. 14 (c-UL listed) Environment GB14048.5 (CCC approved Note: Can be used as a safety product only when using in combination with safety relay module

ISO / IEC Standards and Interlock Switches

Continued on the next page

ISO / IEC Standards and Interlock Switches



HS6B Subminiature Interlock Switches

World-class compactness with three poles of contacts.

- World's smallest switch: $30 \times 15 \times 78$ mm
- Dual contacts and monitor contacts achieve the highest safety category (ISO 13849-1, EN 954-1)
- Two actuator entry slots provide flexibility for installation options.
- Integral cable design minimizes wiring, preventing wiring mistakes.
- Can be mounted in two directions.
 Degree of protection (contacts): IP67 (IEC 60529)
- Degree of protection (conta Housing allows drainage.
- NC contacts are direct opening action (IEC/EN 60947-5-1).
- Proprietary actuators prevent unauthorized opening of the contacts (ISO14119, EN1088).



Interlock Switch

Contact Configuration	Cable Length	Part No. (Package quantity: 1)
1NC-1NO	1m	HS6B-11B01
11 <u></u> 12 ⊖	3m	HS6B-11B03
33 34	5m	HS6B-11B05
2NC	1m	HS6B-02B01
11 <u></u> 12 ⊖	3m	HS6B-02B03
31 → 32 ⊖	5m	HS6B-02B05
2NC-1NO	1m	HS6B-12B01
	3m	HS6B-12B03
31 - 32	5m	HS6B-12B05
3NC	1m	HS6B-03B01
	3m	HS6B-03B03
$\begin{array}{c} 21 - 22 \\ 31 - 32 \end{array}$	5m	HS6B-03B05

• Contact configuration shows the status when the actuator is inserted.

Actuators

Description	Part No. (Package quantity: 1)
Straight Actuator	HS9Z-A61
Right-angle Actuator	HS9Z-A62
Horizontal/vertical Angle Adjustable	HS9Z-A65
Actuator (for hinged doors) (Note)	HS9Z-A66

Note: Select an actuator that moves in the direction required by the hinged door and interlock switch (see pages 9 and 10).

Contact Ratings

Rated Insulation Voltage (Ui)			300V		
Rated Current (Ith)		2.5A			
Rated Voltage (Ue) *		30V	125V	250V	
Rated Current (le) *	10	Resistive load (AC-12)	_	2.5A	1.5A
	Inductive Load (AC-15)	-	1.5A	0.75A	
	DO	Resistive load (DC-12)	2.5A	1.1A	0.55A
	DC	Inductive Load (DC-13)	2.3A	0.55A	0.27A

• Minimum applicable load (reference): 3V AC/DC, 5mA

Approved ratings

ΤÜV	AC-15 240V/0.75A DC-13 250V/0.27A
	DC-13 30V/2.3A
	240V AC/0.75A Pilot Duty
,	250V DC/0.27A Pilot Duty
UL/c-UL	C300
	Q300
000	AC-15 240V/0.75A
	DC-13 30V/2.3A



Specifications

Applicable Standards	ISO14119 EN1088 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜVapproved) UL508 (UL-listed) CSA C22.2 No. 14 (c-UL-listed) GB14048.5 (CCC approved) IEC 60204-1/ EN 60204-1 (applicable standards for uso)
Applicable Directive	2006/95/EC (Low Voltage Directive)
	2006/42/EC (Machinery Directive)
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	4 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 m Ω maximum (initial value, 1m cable) 500 m Ω maximum (initial value, 3m cable) 700 m Ω maximum (initial value, 5m cable)
Electric Shock Protection Class	Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Operating extremes: 300 m/s² (30G) Damage limits: 1000 m/s² (100G)
Vibration Resistance	Operating extremes: 5 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	8 mm minimum
Direct Opening Force	60N minimum
Operating Frequency	1200 operations/h
Mechanical Durability	1,000,000 operations minimum (GS-ET-15)
Electrical Durability	100,000 operations minimum (operating frequency 1200 operations/h, load AC-12 250V/1.5A, DC-12 250V/0.2A) 1,000,000 operations minimum (operating frequency 1200 operations/h,load 24V AC/DC, 100mA)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short- circuit protection.)
Housing Color	Black
Cable	UL2464 No. 20 AWG (6-core)
Weight (approx.)	120g (HS6B-***01, cable length 1m) 270g (HS6B-***03, cable length 3m) 420g (HS6B-***05, cable length 5m)

HS6B Subminiature Interlock Switches

Dimensions



Using the HS9Z-A61 Straight Actuator



Using the HS9Z-A62 Right-angle Actuator

⊕

22.6±1*

(5)

0.8

(14)

40.1±1*

Actuator Stop

 \bigcirc

15

(Note 2) (supplied)

Using the HS9Z-A65/A66 Angle Adjustable Actuator (25) 22.6±1* 28.8 0.8 (25) 48.8 8.0 1=1* <u>ى</u> Actuator Stop (Note 2) (supplied)

20 to 22

Actuator Dimensions



Right-angle Actuator (HS9Z-A62)



Angle Adjustmentable Actuator (HS9Z-A65)



2.5

on screws, take material compatibility into consideration.

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

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

Angle Adjustment (M3 Hexagon Socket Head Screw)

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

(MA Holes)

(41.4)

0.8

Horizontal Adjustment

(HS9Z-A66)

Angle Adjustment (M3 Hexagon Socket Head Screw)

Angle Adjustmentable Actuator



Vertical Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)





Horizontal Adjustment Vertical Adjustment

Actuator Mounting Hole Layout



2-M4 Screws (ø4.3 or M4 tapped)

Contact Configuration and Operation Chart

Model	Contact Configuration	Contact Operation C art				
HS6B-11	$1NC-1NO \qquad 11 \qquad 12 \qquad 33 \qquad 34$	0.8 (Actuator Mounting Reference Position) 0 1 5.5 5.8 28.2 (Travel: mm) 11-12 33-34 :				
HS6B-02	2NC $11 \xrightarrow{Zb} 12 \ominus 31 \xrightarrow{Zb} 32 \ominus$	11-12 Image: Contact OFF (open) 31-32 Image: Contact OFF (open)				
HS6B-12	$2NC-1NO \qquad \begin{array}{c} 11 & - & 12 \\ 21 & - & 22 \\ 33 & - & 34 \end{array}$	11-12 1 21-22 1 33-34 1				
HS6B-03	$3NC \qquad \begin{array}{c} 11 \xrightarrow{} Zb \\ 11 \xrightarrow{} 12 \xrightarrow{} \\ 21 \xrightarrow{} 12 \xrightarrow{} \\ 31 \xrightarrow{} 32 \xrightarrow{} \end{array}$	11-12 1 21-22 1 31-32 1 Actuator inserted completely				
		Actuator inserted completely Actuator removed completely				

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 Right-angle Actuator

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



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



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

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

Vertical Adjustment

Horizontal Adjustment



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

Horizontal Adjustment

10

HS9Z-A65

HS9Z

Adjustment Vertical Adjustment

Door Hinge

nn

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

Door Hinge

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 9). 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.

HS6B Subminiature Interlock Switches

Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wiring, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, use only safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and make a safety circuit which satisfies the requirements of the safety category.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.

Mounting

Mount the interlock switch on the machine. Mount the actuator on the hinged door.



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

Recommended Screw Tightening Torque

- Interlock switch (M4 screw): 1.0 to 1.5 N·m
- Actuator (M4 screw): 1.0 to 1.5 N·m
- Mounting bolts are not supplied, and must be purchased separately by the user.
- Note: The above recommended tightening torque of the mounting screw is the value with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.

Cable

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



- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where a human body may come into contact. Otherwise injury may occur.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- Cover the unused actuator entry slot using the slot plug supplied with the interlock switch.

Wire Identification

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

				\sim /
No.	Insulation Color	No.	Insulation Color	(6)2 Jacket
1	Orange/White	4	Brown	
2	Blue/White	5	Blue	
3	Brown/White	6	Orange	Dummy Insu
				(black)

Terminal Number Identification

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



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

Small interlock switch with five poles and solenoid.

Ideal for applications in tight spaces.

- Compact body: $75 \times 15 \times 75$ mm
- 15-mm-wide, thinnest solenoid interlock switch in the world.
- Reversible mounting and angled cable allow four actuator insertion directions.
- Energy saving. 24V DC, 110 mA (solenoid: 100 mA, LED: 10 mA). Can be driven directly by a controller.
- Manual unlocking possible on three sides.
- LED indicator shows solenoid operation

Spring Lock

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

Solenoid Lock

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



Ratings

Contact Ratings

Rateo	d Insul	ation '	Voltage (Ui) (Note 1)	300V (door monitor contact) 150V (lock monitor contact) 30V (between LED or solenoid and ground)			
Rateo	d Ther	mal C	urrent (Ith)	Operating temperature –25 to 35°C 2.5A (up to 2 circuits) 1.0A (3 or more circuits) Operating temperature 35 to 50°C 1.0A (1 circuit) 0.5A (2 or more circuits)			
Rated Voltage (Ue)			e)	30V	125V	250V	
	k uits	10	Resistive load (AC-12)	—	2A	—	
*	Circe		Inductive Load (AC-15)	—	1A	—	
(le)	ain 8 nitor	D O	Resistive load (DC-12)	2A	0.4A	_	
rent	₽ŝ	DC	Inductive Load (DC-13)	1A	0.22A	_	
Our	tor	10	Resistive load (AC-12)	_	2.5A	1.5A	
ated	Aoni		Inductive Load (AC-15)	—	1.5A	0.75A	
ä	Cir		Resistive load (DC-12)	2.5A	1.1A	0.55A	
	å	DC	Inductive Load (DC-13)	2.3A	0.55A	0.27A	

• Minimum applicable load (reference value): 3V AC/DC, 5 mA

Approved ratings

	ΤÜV	UL/c-UL	CCC
Door Monitor Contact Lock Monitor Contact	AC-15 240V/0.75A DC-13 250V/0.27A DC-13 30V/2.3A	240V AC/0.75A Pilot Duty 250V DC/0.27A Pilot Duty C300 Q300	AC-15 240V/0.75A DC-13 30V/2.3A
	AC-15 125V/1A DC-13 125V/0.22A DC-13 30V/1A	125V AC/1A Pilot Duty 125V DC/0.22A Pilot Duty DC-13 30V/1A Pilot Duty	AC-15 125V/1A DC-13 30V/1A

Solenoid/Indicator

Locking Mechanism			Spring Lock	Solenoid Lock			
Rated Voltage			24V DC (100% duty cycle)				
Rated Current		ed Current	110 mA (solenoid 100 mA, LED 10 mA) (initial value)				
		Coil Resistance	240Ω (at 20°C)				
		Pickup Voltage	Rated voltage × 85% maximum (at 20°C)				
	<u>e</u>	Dropout Voltage	Rated voltage × 10% minimum (at 20°C)				
	soleno	Maximum Continuous Applicable Voltage	Rated voltage × 110%				
	0	Maximum Continuous Applicable Time	Continuous				
		Insulation Class	Class F				
	ator	Light Source	LED				
	Indic	Illumination Color	Green				



Specifications

Applicable Standards	ISO14119 IEC60947-5-1 EN60947-5-1 (TÜV approved) EN1088 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (c-UL listed) CSA C22.2 No. 14 (c-UL listed) IEC 60204-1/EN 60204-1 (applicable standards for use)				
Operating Temperature	-25 to +50°C (no freezing)				
Relative Humidity	45 to 85% (no condensation)				
Storage Temperature	-40 to +80°C (no freezing)				
Pollution Degree	3				
Impulse Withstand Voltage	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 M Ω minimum Between terminals of different poles: 100 M Ω minimum				
Contact Resistance	300 m Ω maximum (initial value, 1m cable) 500 m Ω maximum (initial value, 3m cable) 700 m Ω maximum (initial value, 5m cable)				
Electric Shock Protection	Class II (IEC 61140)				
Degree of Protection	IP67 (IEC 60529)				
Shock Resistance	Operating extremes: 100 m/s ² (10G) Damage limits: 1000 m/s ² (100G)				
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	8.0 mm minimum				
Direct Opening Force	60N minimum				
Actuator Retention Force	500N minimum (GS-ET-19)				
Operating Frequency	900 operations/h				
Mechanical Durability	1,000,000 operations minimum (GS-ET-19)				
Electrical Durability	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA) (operating frequency 900 operations/h)				
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)				
Cable	UL2464, No. 22 AWG (12-core: 0.3 mm ² or equivalent/core)				
Cable Diameter	ø7.6 mm				
Weight (approx.)	220g (1m cable) 410g (3m cable) 600g (5m cable)				

Standard

Lock Mechanism	Circuit Number	Contact Configuration	Cable Length	Part No.
		(When inserted) (When ON)	1m	HS6E-L44B01-G
	L	Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC Lock Monitor Circuit: 1NO	3m	HS6E-L44B03-G
		Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 53 54 Monitor Circuit: $\bigcirc 31$ 32	5m	HS6E-L44B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC Lock Monitor Circuit: 1NC	1m	HS6E-M44B01-G
	М	Main Circuit: $\bigcirc 11$ + 12 41 + 42 Monitor Circuit: $\bigcirc 21$ + 22 51 + 52	3m	HS6E-M44B03-G
Spring Lock		Monitor Circuit: $\bigcirc 31 + 32$	5m	HS6E-M44B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO Lock Monitor Circuit: 1NO	1m	HS6E-N44B01-G
	Ν	Main Circuit: $\bigcirc 11 + 12 + 41 + 42$ Monitor Circuit: $\bigcirc 21 + 22 - 53 - 54$	3m	HS6E-N44B03-G
		Monitor Circuit: $33 34$ Monitor Circuit: $33 34$	5m	HS6E-N44B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO Lock Monitor Circuit: 1NC	1m	HS6E-P44B01-G
	Р	Main Circuit: $\bigcirc 11$ 124142Monitor Circuit: $\bigcirc 21$ 22 51 52 Monitor Circuit: 33 34	3m	HS6E-P44B03-G
			5m	HS6E-P44B05-G
	L	(When inserted) (When ON)	1m	HS6E-L7Y4B01-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC Lock Monitor Circuit: 1NO	3m	HS6E-L7Y4B03-G
		Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 53 54 Monitor Circuit: $\bigcirc 31$ 32	5m	HS6E-L7Y4B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC Lock monitor Circuit: 1NC	1m	HS6E-M7Y4B01-G
	М	Main Circuit: $\bigcirc 11$ + 12 41 + 42 Monitor Circuit: $\bigcirc 21$ + 22 51 + 52	3m	HS6E-M7Y4B03-G
Solenoid Lock		Monitor Circuit: ⊕31 + 32	5m	HS6E-M7Y4B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO Lock Monitor Circuit: 1NO	1m	HS6E-N7Y4B01-G
	N	Main Circuit: $\ominus 11 + 12 + 41 + 42$ Monitor Circuit: $\ominus 21 + 22 - 53 - 54$	3m	HS6E-N7Y4B03-G
		Monitor Circuit: 33 34	5m	HS6E-N7Y4B05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO Lock Monitor Circuit: 1NC	1m	HS6E-P7Y4B01-G
	Р	Main Circuit: $\bigcirc 11$ 12 41 42	3m	HS6E-P7Y4B03-G
		Monitor Circuit: 33 34	5m	HS6E-P7Y4B05-G

• The contact configurations show the contact status when the actuator is inserted and locked.

LED color is G (green) only.
Actuators are not supplied with the interlock switch and must be ordered separately.

5-circuit Independent Output

Lock Mechanism	Circuit Number	Contact Configuration	Cable Length	Part No.
		Door Monitor (When inserted) (When solenoid is OFF)	1m	HS6E-VL44B01-G
	VL	Door monitor circuit: 3NC Lock monitor circuit: 1NC, 1NO	3m	HS6E-VL44B03-G
		Monitor Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 53 54 Monitor Circuit: $\bigcirc 31$ 32	5m	HS6E-VL44B05-G
		Door monitor circuit:3NC Lock monitor circuit: 2NC	1m	HS6E-VM44B01-G
	VM	Monitor Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 51 52	3m	HS6E-VM44B03-G
Spring Lock			5m	HS6E-VM44B05-G
		Door monitor circuit: 2NC, 1NO Lock monitor circuit: 1NC, 1NO	1m	HS6E-VN44B01-G
	VN	Monitor Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 53 54 Monitor Circuit: $\bigcirc 33$ 34	3m	HS6E-VN44B03-G
			5m	HS6E-VN44B05-G
	VP	Door monitor circuit: 2NC, 1NO Lock monitor circuit: 2NC Monitor Circuit: $\bigcirc 11 + 12 + 41 + 42$ Monitor Circuit: $\bigcirc 21 + 22 + 51 + 52$ Monitor Circuit: 33 - 34	1m	HS6E-VP44B01-G
			3m	HS6E-VP44B03-G
			5m	HS6E-VP44B05-G
	VL	Door monitor (When inserted) (When solenoid is off) (When solenoid is off) (When solenoid is off) (When solenoid is off) ($+2$ -2 -2 Monitor circuit: 3NC Lock monitor circuit: 1NC, 1NO Monitor Circuit: $\bigcirc 11$ -12 -12 -41 -42 -22 -53 -54 Monitor Circuit: $\bigcirc 31$ -32	1m	HS6E-VL7Y4B01-G
			3m	HS6E-VL7Y4B03-G
			5m	HS6E-VL7Y4B05-G
	VM	Door monitor circuit: 3NC Lock monitor circuit: 2NC	1m	HS6E-VM7Y4B01-G
		Monitor Circuit: $\bigcirc 11$ + 12 41 + 42 Monitor Circuit: $\bigcirc 21$ + 22 51 + 52 Monitor Circuit: $\bigcirc 31$ + 32	3m	HS6E-VM7Y4B03-G
Solenoid Lock			5m	HS6E-VM7Y4B05-G
		Door monitor circuit: 2NC, 1NO Lock monitor circuit: 1NC, 1NO	1m	HS6E-VN7Y4B01-G
	VN	Monitor Circuit: \bigcirc 11 + 12 41 + 42 Monitor Circuit: \bigcirc 21 + 22 53 54 Master Circuit: \bigcirc 33 34	3m	HS6E-VN7Y4B03-G
			5m	HS6E-VN7Y4B05-G
		Door monitor circuit: 2NC, 1NO Lock monitor circuit: 2NC	1m	HS6E-VP7Y4B01-G
	VP	Monitor Circuit: \bigcirc 11 + 12 41 + 42 Monitor Circuit: \bigcirc 21 + 22 51 + 52 Monitor Circuit: \bigcirc 33 24	3m	HS6E-VP7Y4B03-G
		Monitor Circuit: <u>33</u> <u>34</u>	5m	HS6E-VP7Y4B05-G

• The contact configurations show the contact status when the actuator is inserted and locked.

LED color is G (green) only.
Actuators are not supplied with the interlock switch and must be ordered separately.

Actuator

Shape	Part No.	Remarks		
Straight Actuator	HS9Z-A61	The retention force of HS9Z-A61 actuator is 500N maximum. Do no apply excessive load, otherwise the actuator may fall off the door.		
Right-angle Actuator	HS9Z-A62	The retention force of HS9Z-A62 actuator is 100N maximum. Do no apply excessive load, otherwise the actuator may fall off the door. 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 no apply excessive load, otherwise the actuator may fall off the door.		
Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A65	The HS9Z-A65 and HS9Z-A66 have the metal key installed in opposite directions. Select actuator by determining the required moving direction in consideration of the door and interlock switch.		
Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A66	See pages 17, 22, and 23. The retention force of HS9Z-A65 and HS9Z-A66 actuators is 5001 maximum.		

Part No. Development



4: 24V DC/Spring Lock 7Y: 24V DC/Solenoid Lock

Dimensions

Interlock Switch



When using straight actuator (HS9Z-A61) (12.6^{±1})* (5)



When using right-angle actuator (HS9Z-A62Š)



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



Note 1: Remove the actuator stop after mounting the actuator. Note 2: 41.4 when using HS9Z-A62.

* The retention force of the HS9Z-A62 actuator is 100N. When tensile force exceeding 100N is expected, use the HS9Z-A62S actuator (with a mounting plate).

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

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



Dimensions

Straight Actuator (HS9Z-A61)

20.9 43.2 (15.8) 14 15 0.8 t (15.8) Note 1 Actuator Stop (supplied) Rubber Bushing

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 23 for actuator installation.

Actuator Adjustment

The orientation of actuator adjustment

using the orienting insert (white plastic)

Orienting Insert

Horizontal Adjustment Vertical Adjustment

(horizontal/vertical) can be changed

installed on the back of the actuator.

Orientation



Angle Adjustable Actuator

The HS9Z-A65 and HS9Z-A66

(HS9Z-A66)

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

Angle Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment have the metal key inserted in opposite directions. Orienting Insert 0.8 0 Horizontal Adjustment Angle Adjustment (M3 Hexagon Socket Head Screw) Angle Adjustment (M3 Hexagon Socket Head Screw) Vertical Adjustment Vertical Adjustment 13 28.2 Angle Adjustment (M3 Hexagon Soc gon Socket Head Screw) 7.5 Orienting Inser (Note 1) Actuator Stop (Supplied) Ο Note) Actuator Stop (supplied) \bigcirc l∣∰ Angle Adjustment (M3 Hexagon Socket Head Screw) MA A: 15 2.5



Actuator Mounting Hole Layout (horizontal/vertical swing)



Accessory

Description	Part No.
Manual Unlock Key (long)	HS9Z-T3





Manual Unlock Key (long) (metal)



All dimensions in mm.

Circuit Diagrams and Operating Characteristics

Standard – Spring Lock

		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 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							Manually Unlocked
Cir	ouit Diagram (Example: H	SEE NA)		$\begin{array}{c c} & (+) & (-) \\ \hline & A2 & H \\ 11 & 12 & 41 + 42 \end{array}$			$\begin{array}{c c} & (+) & (-) \\ A & A & A \\ \hline \\ 11 & 12 & 41 & 42 \end{array}$
	cuit Diagram (Example, H	30L-114)	$\begin{array}{c} 1 & 2 \\ 21 & 22 \\ 33 \\ 0 \\ 0 \end{array} \begin{array}{c} 53 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ $	$\begin{array}{c} 1 & 12 & 11 \\ 21 & 22 & 53 \\ 33 & 54 \\ 33 & 34 \end{array}$	$\begin{array}{c} 11 & 12 \\ 21 & 22 \\ 33 & 0 & 34 \end{array}$	$53 \xrightarrow{6}{10} 54$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Do	or		Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
	HS6E-L4 (When inserted) (When ON)	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Lock Monitor Monitor	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	A2 <u>4</u> A1 Main Circuit: ⊕1 <u>1+ 12 41+ 4</u> 2	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Monitor Circuit: $\textcircled{O21} + 22 53 54$ Monitor Circuit: $\textcircled{O31} + 32$	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)
E		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Diagra	Main Circuit: $\ominus 1_1 + 1_2 + 1_1 + 4_2$ Monitor Circuit: $\ominus 2_{1+} + 2_2 + 5_2$ Monitor Circuit: $\ominus 3_{1+} + 3_2$	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
rcuit [Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
und Ci	HS6E-N4	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
odel a	Main Circuit: ⊕1 <u>1 + 12 41 + 4</u> 2	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Ž	Monitor Circuit: $\ominus 21$, 22 53 54 Monitor Circuit: 33 34	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)
	Main Circuit: $\oplus 11 + 12 + 41 + 42$	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Monitor Circuit: 33 34	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 model)			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.

Standard – Solenoid Lock

				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 energized 	 Door closed Machine cannot be operated Solenoid de-energized
Door Status							Manually Unlocked	
Circuit Diagram (Example: HS6E-N7Y)			$\begin{array}{c} & (+) & (-) \\ & A2 & (-) \\ & A2 & (-) \\ & A3 & (-) \\ & A4 & (-)$	$\begin{array}{c} & (+) & (+) & (-) \\ & A2 & (-) \\ & A2 & (-) \\ & A3 & (-) \\ & A2 & (-) \\ & A4 & (-) \\ & A4$	$11 \rightarrow 12$ $21 \rightarrow 22$ $33 \rightarrow 34$	$\begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} - \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ \end{array} \\$	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	
Do	or			Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
	HS6E-L7Y (When inserted) (When	n ON)	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Lo Monitor Mor 남 (+) 다	ick nitor ∑⊣(–)	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	$\begin{array}{c c} & & & & & & \\ \hline & & & & & & \\ \hline & & & &$	<u></u> Àí 42	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		2 55	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)
ш		<u>2 41, 4</u> 2 22 5 <u>1, 5</u> 2 32	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Diagra	Main Circuit: $\bigcirc 11 + 12 + 11$ Monitor Circuit: $\bigcirc 21 + 22 + 51 + 22$ Monitor Circuit: $\bigcirc 31 + 32$		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
rcuit [Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
and Ci	HS6E-N7Y		Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
odel a	Main Circuit: ⊕1 <u>1 + 12 41</u> +	<u>4</u> 2	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Σ	Monitor Circuit: $\ominus 2\underline{1}$ 22 5 <u>3</u> Monitor Circuit: 3 <u>3</u> 34	<u>5</u> 4	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)
	Main Circuit: $\ominus 1 + 12 + 41 + 12 + 51$	<u>4</u> 2	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Monitor Circuit: 33 34		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)
So	Solenoid Power A1-A2 (all model)		ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (Note 2)	OFF (de-energized) to ON (re-energized) (Note 1) (Note 2)	

Connected to the machine drive control circuit, sending the interlock signals of the protective door. Main circuit:

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.

5-circuit Independent Output - Spring Lock

			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 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						Manually unlocked	
Circuit Diagram (Example: HS6E-VN4)		$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array}\\ \end{array}\\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} \begin{array}{c} (+) \\ $	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array}\\ \end{array}\\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	
Do	or		Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
	HS6E-VL4	Door Monitor Circuit (door closed) 11-12					
	Door monitor Lock moi (When inserted) (When o に、 (+) ロワー	TOOr Monitor Circuit (door closed) 21-22					
	Monitor Circuit: ⊕11+ 12 41+	Áí Door Monitor Circuit (door closed) 31-32					
	Monitor Circuit: ⊕2 <u>1</u> + <u>22</u> 5 <u>3</u> Monitor Circuit: ⊕3 <u>1</u> + <u>3</u> 2	4 Lock Monitor Circuit (locked) 41-42					
		Lock Monitor Circuit (unlocked) 53-54					
	HS6E-VM4	Door Monitor Circuit (door closed) 11-12					
ы		Door Monitor Circuit (door closed) 21-22					
uratio	Monitor Circuit: $\bigcirc 11 + 12 + 41 + 41$ Monitor Circuit: $\bigcirc 21 + 22 + 51 + 42$	2 Door Monitor Circuit (door closed) 31-32					
onfig	Monitor Circuit: ⊕3 <u>1+, 3</u> 2	Lock Monitor Circuit (locked) 41-42					
act C		Lock Monitor Circuit (locked) 51-52					
Conta	HS6E-VN4	Door Monitor Circuit (door closed) 11-12					
and (Door Monitor Circuit (door closed) 21-22					
odel	Monitor Circuit: $\bigcirc 11 + 12 41 + 12$ Monitor Circuit: $\bigcirc 21 + 22 53$	Door Monitor Circuit (door open) 33-34					
Σ		Lock Monitor Circuit (locked) 41-42					
		Lock Monitor Circuit (unlocked) 53-54					
	HS6E-VP4	Door Monitor Circuit (door closed) 11-12					
		Door Monitor Circuit (door closed) 21-22					
	Monitor Circuit: $\bigcirc 11_{1}_{1}_{1}_{1}_{1}_{2}_{2}_{2}_{1}_{1}_{1}_{1}_{2}_{2}_{3}_{1}_{1}_{1}_{1}_{2}_{2}_{3}_{1}_{1}_{1}_{1}_{2}_{2}_{3}_{1}_{1}_{1}_{1}_{2}_{2}_{1}_{1}_{1}_{1}_{1}_{2}_{2}_{1}_{1}_{1}_{1}_{1}_{2}_{1}_{1}_{1}_{1}_{1}_{1}_{1}_{1}_{2}_{1}_{1}_{1}_{1}_{1}_{1}_{1}_{1}_{1}_{1$	Door Monitor Circuit (door open) 33-34					
		Lock Monitor Circuit (locked) 41-42					
L		Lock Monitor Circuit (locked) 51-52					
So	lenoid Power A1-A2 (all	model)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

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.

5-circuit Independent Output - Solenoid Lock

				r	r		
			Status 1	Status 2	Status 3	Status 4	When using Manual Unlock Key
Int	Interlock Switch Status		 Door closed Machine ready to operate Solenoid energized 	Door closed Machine cannot be operated Solenoid de- energized	 Door closed 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
Do	ot Status						Manually unlocked
Circuit Diagram (Example: HS6E-VN7Y)		$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array}\\ \end{array}\\ 11 \\ 11 \\ \end{array}\\ 11 \\ \end{array}\\ 11 \\ \end{array}\\ 11 \\ \end{array}\\ 22 \\ \end{array}\\ 21 \\ \end{array}\\ 22 \\ 21 \\ \end{array}\\ 22 \\ 23 \\ 0 \\ \end{array}$	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} & (+) & (-) \\ 1 & (+) & (-) \\ 1 & (-) & (-) & (-) \\ 1 & (-) & (-) & (-) \\ 1 & (-) & (-) \\ 1 & (-) & (-) & (-) \\ 1 & (-) & (-) & (-) \\ 1$	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array}\\ \end{array}\\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	
Do	or		Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
	HS6E-VL7Y	Door Monitor Circuit (door closed) 11-12					
	Door Monitor Lock M (When inserted) When לכל (+) רכ	ON ON (door closed) 21-22					
		A1 Door Monitor Circuit					
	Monitor Circuit: $\bigcirc 11$, 12 41, Monitor Circuit: $\bigcirc 21$, 22 53 Monitor Circuit: $\bigcirc 31$, 32	<u>42</u> <u>54</u> Lock Monitor Circuit (locked) 41-42					
		Lock Monitor Circuit (unlocked) 53-54					
	HS6E-VM7Y	Door Monitor Circuit (door closed) 11-12					
ы		Door Monitor Circuit (door closed) 21-22					
Jurati	Monitor Circuit: $\bigcirc 1_1$, 12 41, Monitor Circuit: $\bigcirc 2_1$, 22 51, Monitor Circuit: $\bigcirc 3_1$, 32	42Door Monitor Circuit52(door closed) 31-32					
Sonfig	Worker Orcait. 9011 02	Lock Monitor Circuit (locked) 41-42					
act C		Lock Monitor Circuit (locked) 51-52					
Cont	HS6E-VN7Y	Door Monitor Circuit (door closed) 11-12					
and	Monitor Circuit: Q11, 12, 41,	Door Monitor Circuit (door closed) 21-22					
lodel	Monitor Circuit: Θ_{1}^{-1} , 22 , 53 Monitor Circuit: 33 , 34	54 Door Monitor Circuit (door open) 33-34					
2		Lock Monitor Circuit (locked) 41-42					
		Lock Monitor Circuit (unlocked) 53-54					
	HODE-VP/Y	Door Monitor Circuit (door closed) 11-12					
	Monitor Circuit: Q11, 12, 41,	42 Door Monitor Circuit (door closed) 21-22					
	Monitor Circuit: $\bigcirc 21 + 22 51 + 12$ Monitor Circuit: $\bigcirc 33 + 34$	52 Door Monitor Circuit (door open) 33-34					
		Lock Monitor Circuit (locked) 41-42					
		Lock Monitor Circuit (locked) 51-52					
So	lenoid Power A1-A2 (a	ll model)	ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (Note 2)	(Note 1) (Note 2) OFF (de-energized) \rightarrow ON (energized)

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)

(0 0.8 (Actuator Insertion Position)					
	1.9 (Locked Position)					
		5.5	5.8	3 28.	2 (stroke in mm)	
Door Monitor Circuit (door open, NO)					: Contacts ON (closed)	
Door Monitor Circuit (door closed, NC)						
Lock Monitor Circuit (unlocked, NO)					: Contacts OFF (open)	
Lock Monitor Circuit (locked, NC)						

• 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.

Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wiring, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, use only safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and make a safety circuit which satisfies the requirements of the safety category.
- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- When unlocking, the switch may not be unlocked if a load is applied to the actuator.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere, or in an area subjected to direct sunlight.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- For correct operation, install the interlock switch on a flat surface and provide sufficient strength to the surface so that it is not disfigured. Do not insert any object between the interlock switch and installation surface.
- Do not cut the actuator. modification of the actuator may cause damage.
- The locking strength is rated at 500N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of another interlock switch without lock (such as the HS6B/HS7A interlock switch) or a sensor to detect door opening and stop the machine.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the switch temperature rises approximately 35°C above the ambient temperature (to approximately 85°C while the ambient temperature is 50°C). Do not touch to prevent burns. If cables come into contact with the switch, use heat-resistant cables.
- Solenoid has polarity. Be sure of correct polarity when wiring, otherwise solenoid will be damaged. Do not apply voltage over the rated voltage, otherwise the solenoid will be burnt.
- Bouncing will occur on the lock monitor contact during locking and unlocking (reference value: 20 ms).

- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in a location where a human body may come into contact. Otherwise injury may occur.
- Solenoid lock is locked when energized, and unlocked when de-energized. When energization is interrupted due to wire disconnection or other failures, the interlock switch may be unlocked causing possible danger to the operators. Solenoid lock must not be used in applications where locking is strictly required for safety. Perform a risk assessment and determine whether solenoid lock is appropriate.
- Although the HS9Z-A61/A62/A62S actuators alleviate shock when the actuator enters a slot in the interlock switch, make sure that excessive shock is not applied. If the rubber bushings become deformed or cracked, replace with new ones.

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 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 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



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

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 17).
 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

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



For Manual Unlocking

Spring lock

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

The HS6E can be unlocked manually in emergency.

When using the manual unlock key



- When locking or unlocking the interlock switch manually, turn the key fully using the manual unlock key supplied with the 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 switch will keep the main circuit disconnected and the door unlocked).
- Do not apply excessive force (0.45 N·m or more) to the manual unlock part, otherwise the manual unlock part will become damaged.
- Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can always be unlocked while the machine is in operation.



(supplied with the interlock switch)

When unlocking pushing the plate inside the interlock switch

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



Caution

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

Recommended Tightening Torque of Mounting Screws

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



Cables

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



Gland

Wire Identification

• Wires can be identified by the 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

Note: Wires of gray or gray/white are not used and should not be connected. Colored Insulation



Terminal Number Identification

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

Mo el	ontact Arrange ent			
	Door Monitor Lock Monitor			
HS6E-L	Main circuit: Blue \bigoplus 11 + 12 + 41 + 42 Blue/White Monifor circuit: Blue \bigoplus 22 BrownAlbite Bink 53 + 54 Blue/Mhite			
	Monitor circuit: Orange → <u>31</u> <u>32</u> Orange/White			
HS6E-M	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-N	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-P	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-VL	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-VM	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-VN	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			
HS6E-VP	$\begin{array}{c c c c c c c c c c c c c c c c c c c $			

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

HS5D Miniature Interlock Switches

Head removal detection for safer performance.

- Head removal detection function turns OFF the main circuit (11-12) when the head of the HS5D is removed.
- The HS5D is the same size as 2 contact interlock switches (HS5B). 3 contact with dual enabling contacts and a monitor contact are available. Can be installed in narrow spaces. ($30W \times 30D \times 91H$ mm)
- The actuator is interchangeable with HS5B and HS5E.
- Double insulation structure eliminates the need for grounding.
- The head orientation can be rotated, allowing 8 different actuator entries.
- Degree of protection (contacts): IP67 (IEC60529)
- NC contacts with direct opening action (IEC/EN60947-5-1)
 Proprietary actuators prevent invalidation of the contacts (ISO14119, EN1088).
- M3 terminal screws for easy wiring.
- Gold-plated contacts suitable for small loads.



Specifications

Applicable Standards	EN ISO14119 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) UL508 (UL listed)		
	GB14048.5 (CCC approved) 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 M Ω minimum Between terminals of different poles: 100 M Ω 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 M Ω (initial value) Dielectric strength: 1000V, 1 minute (initial value)		
Conditional Short-circuit Current	100A (250V) (note)		
Weight (approx.)	Plastic head: 80g Metal head: 110g		

Note: Use a 250V/10A fast-blow fuse as a short-circuit protector.



Contact Ratings

Rated Insulation Voltage (Ui)			300V		
Thermal Current (Ith)			10A		
Rated Voltage (Ue)			30V	125V	250V
_	10	Resistive load (AC-12)	10A	10A	6A
Rated	AC	Inductive Load (AC-15)	10A	5A	ЗA
(le) *	DC	Resistive load (DC-12)	8A	2.2A	1.1A
()	DC	Inductive Load (DC-13)	4A	1.1A	0.6A

 Minimum applicable load (reference): 5V AC/DC, 1 mA (Applicable range may vary with operating conditions and load types.)

*TÜV rating: AC-15 3A/250V, DC-13 4A/30V

Part No. Development



HS5D Miniature Interlock Switches

Miniature Safety Interlock Switch Package Quantity: 1 Part No. **Contact Configuration Gland Port Size** Plastic Head Metal Head 1NC-1NO G1/2 HS5D-11RN HS5D-11ZRN Main Circuit ⊖ 11+ 12 PG13.5 HS5D-11RNP HS5D-11ZRNP Monitor Circuit 23 24 M20 HS5D-11RNM HS5D-11ZRNM 1NC-1NO G1/2 HS5D-02RN HS5D-02ZRN Zb Main Circuit ⊕ 11⊦ 12 PG13.5 HS5D-02RNP HS5D-02ZRNP <u>23</u> Monitor Circuit 24 HS5D-02RNM HS5D-02ZRNM M20 2NC-1NO G1/2 HS5D-02RN HS5D-02ZRN $\begin{array}{c} \ominus 11 + 12 \\ \ominus 21 + 22 \end{array}$ Main Circuit PG13.5 HS5D-02RNP HS5D-02ZRNP Main Circuit G 33 34 M20 HS5D-02RNM HS5D-02ZRNM 3NC G1/2 HS5D-03RN HS5D-03ZRN Θ Main Circuit 11+ 12 PG13.5 HS5D-03RNP HS5D-03ZRNP Main Circuit ⊖ <u>21</u> 22 HS5D-03RNM HS5D-03ZRNM 32 M20

Bookago Ouentitu: 1

Actuator

/ lotadioi	i ackage Quantity. I
Name	Part No.
Straight	HS9Z-A51
Straight w/rubber bushings	HS9Z-A51A
Right-angle	HS9Z-A52
Right-angle w/rubber bushings	HS9Z-A52A
Angle Adjustable (vertical/horizontal)	HS9Z-A55

Terminal Arrangement



Head Removal Detection Function

All HS5D models are equipped with "Head Removal Detection Function." When the head is removed, such as when the head is rotated, the main circuit (11-12) turns OFF.

HS5D-12 (example)

When the actuator is removed or inserted, the operation of the main circuits (11-12, 21-22) are the same. However, when the head is removed, disparity is detected (11-12: OFF, 21-22: ON). The disparity of the contacts detects the removal of the head.







HS5D-12

		When actuator is removed	When actuator is inserted	When head is removed		Disparity
Main circuit (NC)	⊕11, 12	OFF	ON	OFF	<	
Main circuit (NC)	$\ominus 21$ 22	OFF	ON	ON	<	

Note: Head removal detection function is not a direct opening action mechanism.

Existing Interlock Switches

		When actuator is removed	When actuator is inserted	When head is removed
Main circuit (NC)	\ominus 3 4	OFF	ON	ON
Monitor circuit (NC)	⊖1,2	OFF	ON	ON

RP: Reference mounting position

Dimensions and Mounting Hole Layouts

HS5D-DDZRND (Metal Head) With HS9Z-A51 Straight Actuator



With HS9Z-A52 Right-angle Actuator



HS5D-DDRND (Plastic Head) With HS9Z-A51 Straight Actuator



With HS9Z-A52 Right-angle Actuator



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

All dimensions in mm.

Actuator Dimensions

Straight (HS9Z-A51)

Right-angle (HS9Z-A52)





Actuator Cover

Actuator Mounting Hole Layout (Straight, Right-angle)

2-M4 Screw

Angle Adjustable (HS9Z-A55)



2-M4 Screw 38

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.

Contact Configuration and Operation Chart



Straight w/rubber bushing (HS9Z-A51A)

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



*The mounting center distance is set to 12 mm at factory. When 20mm distance is required, adjust the distance by moving the rubber bushings.

(A) (B): The actuator has flexibility to the directions indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

Actuator Mounting Hole Layout (Straight 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.

- 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.

Safety Precautions

- In order to avoid electric shock or fire, turn the power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, use only safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and make up a safety circuit which satisfies the requirements of the safety category.
- . For wiring, use wires of a proper size to meet the voltage and current requirements. Tighten the terminal screws to

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- Do not open the lid of the interlock switch. Loosening the screws may cause damage to the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- Safety function of the door interlock switch will be lost if a spare key is inserted into the interlock switch. Make sure that a spare key is not used on the interlock switch.
- Ensure that the actuator is firmly fastened to the door (by welding, rivet, or special screws) in the appropriate location, so that the actuator cannot be removed.
- Do not cut the actuator. Modification of the actuator may cause damage.

Mounting Examples



a recommended torgue of 0.6 to 0.8 N·m. Improper soldering or failure to tighten the terminal screw may cause overheating and fire.

- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not install the actuator in the location where a human body may come in contact. Otherwise injury may occur.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.

Installing the Head

Do not use the plastic and metal head of the HS5B interlock switches and metal head of the HS5E interlock switch on the HS5D.

When using these HS5D and HS5E interlock switches adjacently, ensure that the heads are not interchanged.



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.

When using the 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 inter-





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



Actuator Angle Adjustment for the HS9Z-A55

- \bullet Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 28). 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.

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
- Connector: 2.7 to 3.3 N Actuators
- HS9Z-A51: $1.8 \pm 2.2 \text{ N·m}$ (two M4 screws)HS9Z-A52: $0.8 \pm 1.2 \text{ N·m}$ (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.



Recommended manufacturer: JST

Part No.: N0.5-3

Applicable wire size (with insulation tube): 0.2 to 0.5 mm²

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

Applicable Wire Size

0.5 to 1.5 mm²

Applicable Cable Glands

Use a cable gland with a degree of protection IP67.



When Using Flexible Conduits (Example)

• Flexible conduit example: VF-03 (made by Nihon Flex)

Gland Port Sizo	Plastic Cable Gland	Motal Cable Gland
Gianu Fort Size	Flastic Cable Glariu	Wetal Cable Glariu
G1/2	_	RLC-103 (Nihon Flex)
PG13.5	—	RBC-103PG13.5 (Nihon Flex)
M20	—	RLC-103EC20 (Nihon Flex)

When Using Multi-core Cables (Example)

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

- Different cable glands are used depending on the cable sheath diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath diameter.
- When using a 1/2-14NPT cable gland, use the HS5D interlock switch with M20 gland port (Part No.: HS5D-***BM) together with an adaptor (Part No.: MA-M/NPT 20X1.5 5402-0110, LAPP) and a gasket (Part No.: GP M20, LAPP). Install a gasket between the interlock switch and the adaptor. Apply sealing tape between the cable gland and the adaptor to make sure of IP67 protection for the enclosure.

Small safety switch with four poles and solenoid. Ideal for applications in tight spaces.

- Compact body. $35 \times 40 \times 146$ mm.
- Rear unlocking button for emergency escape available. Also available is the rear unlocking button kit.
- A variety of circuits—dual safety circuit and four-circuit independent outputs available.
- Gold-plated contacts.
- Spring lock and solenoid lock are available.
- The head orientation can be rotated, allowing 8 different actuator entries.
- A metal entry slot ensures high durability.
- An actuator with rubber bushings alleviates the impact of actuator entry into the slot.
- The actuator retention force is 1400N minimum (GS-ET-19).
- Integral cable design minimizes wiring, preventing wiring mistakes.
- LED indicator indicates the solenoid status.
- Double insulation structure.

Spring Lock

- 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.

Solenoid Lock

- 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.





Specifications

Applicable Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approved) EN1088, GS-ET-19 (TÜV approved), UL508 (UL recognized) CSA C22.2 No. 14 (c-UL recognized), GB14048.5 (CCC approved) IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	-25 to +50°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 (between LED, solenoid and grounding: 0.5 kV)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: $100 M\Omega$ minimum Between live metal part and ground: $100 M\Omega$ minimum Between live metal parts: $100 M\Omega$ minimum Between terminals of the same pole: $100 M\Omega$ minimum
Electric Shock Protection	Class II (IEC61140)
Degree of Protection	IP67 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s2 (10G) Damage limits: 1000 m/s2 (100G)
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.35 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
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	1400N minimum (GS-ET-19) (See page 38 for actuator retention force.)
Operating Frequency	900 operations per hour
Rear Unlock Button Mechanical Durability	3000 operations minimum (HS5E-**L)
Mechanical Durability	1,000,000 operations minimum (GS-ET-19)
Electrical Durability	100,000 operations minimum (operating frequency 900 operations per hour, load AC-12, 250V, 1A) 1,000,000 operations minimum (operating frequency 900 operations per hour, load 24V AC/DC. 100mA)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast acting type fuse for short-circuit protection.)
Cable	UL2464 HS5E-V: AWG22 (12-core, 0.3 mm2/core) Others: AWG21(8-core: 0.5 mm2/core)
Cable Outside Diameter	ø7.6 mm
Weight (approx.)	400g (1m cable), 580g (3m cable), 770g (5m cable) . Add 20g for rear unlocking button.

Ratings

Contact Ratings

		-					
Rated Insulation Voltage (Ui)			250V (between LED or solenoid and ground: 30V)				
			2.5A				
Rated Thermal Current (Ith) Four- Indep (HS5		circuit pendent Output E-V)	Operating temp.: Operating temp.: -25°C to 35°C (not included) 35 2.5A (1 or 2 circuits) 1.0 1.0A (3 or 4 circuits) 0.3		Opera 35°C t 1.0A (0.5A ()perating temp.: 5°C to 50°C .0A (1 circuit) .5A (2 to 4 circuits)	
Rated Vol	tage (L	Je)	30V	12	5V	250V	
	AC	Resistive Load (AC-12)	-	2.	5A	1.5A	
Rated Current (Ie)		Inductive Load (AC-15)	-	1.	5A	0.75A	
		Resistive Load (DC-12)	2.5A	1.1A		0.55A	
	DC	DC	Inductive Load (DC-13)	2.3A	0.5	55A	0.27A

Minimum applicable load (reference value): 3V AC/DC, 5 mA

(Applicable range may vary with operating conditions and load types.)

TÜV rating:	AC-15 250V/0.75A
	DC-13 125V/0.22A
	DC-13 30V/2.3A
UL/c-UL rating:	125V AC/1.5A Pilot Duty
	125V DC/0.22A Pilot Duty
CCC rating:	AC-15 250V/0.75A
-	DC-13 125V/0.22A
	DC-13 30V/2.3A

Part No. Development

Solenoid Unit

Locking Mechanism	Spring Lock	Solenoid Lock			
Rated Operating Current	24V DC (100% duty cycle)				
Rated Current	266 mA (initial value)				
Coil Resistance	90Ω (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

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

		HS5E-A4	4L01-G
Circuit Cod	e ———		Indicator Color
Main Circuit	Door Monitor Circuit	Lock Monitor Circuit	G: Green
A: 1NC + 1NC	1NO	1NO	
B: 1NC + 1NC	1NO	1NC	Cable Length
C: 1NC + 1NC	1NC	1NO	01: 1m
D: 1NC + 1NC	1NC	1NC	03: 3m
F: 1NC + 1NC	2NC	-	05: 5m
G: 1NC + 1NC	1NC, 1NO	-	
H: 1NC + 1NC	-	2NC	Rear Unlocking Button
J: 1NC + 1NC	-	1NC, 1NO	L: With rear unlocking button
DD: 1NC + 1NC 1NC + 1NC			Blank: Without rear unlocking button
VA: —	1NC, 1NO	1NC, 1NO	LED Indicator Rated Voltage

2NC

2NC

1NC, 1NO

Solenoid Unit Voltage/Lock Mechanism -

1NC, 1NO

2NC

2NC

4: 24V DC/Spring Lock

_

_

_

VB:

VC:

VD:

7Y: 24V DC/Solenoid Lock

4: 24V DC

0: Without indicator

Standard

Lock Mechanism	Circuit Code	Contact Configuration	Indicator	Cable Length	Part No.
		Door Monitor Lock Monitor		1m	HS5E-A4001
			Without	3m	HS5E-A4003
		H A2⊥ <u>m</u> _LA1 Main Circuit: 1NC+1NC. Door Monitor Circuit: 1NO.		5m	HS5E-A4005
	A	Lock Monitor Circuit: 1NO		1m	HS5E-A4401-G
		Main Circuit: $\ominus 11$, 12 , 41 , 42 Monitor Circuit: 23, 24	With	3m	HS5E-A4403-G
		Monitor Circuit: 5 <u>3</u> 54		5m	HS5E-A4405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NO,		1m	HS5E-B4001
		Lock Monitor Circuit: 1NC	Without	3m	HS5E-B4003
		Main Circuit: $\ominus 11 + 12 + 41 + 42$		5m	HS5E-B4005
	В	Monitor Circuit: <u>23</u> <u>24</u> Monitor Circuit: <u>51</u> <u>5</u> 2		1m	HS5E-B4401-G
			With	3m	HS5E-B4403-G
				5m	HS5E-B4405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC,		1m	HS5E-C4001
			Without	3m	HS5E-C4003
	C	Main Circuit: ⊖1 <u>1 12 41 4</u> 2		5m	HS5E-C4005
	U	Monitor Circuit: $\ominus 21 + 22$		1m	HS5E-C4401-G
			With	3m	HS5E-C4403-G
				5m	HS5E-C4405-G
	D	Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC,		1m	HS5E-D4001
			Without	3m	HS5E-D4003
		Main Circuit: $\ominus 11$ 12 41 42		5m	HS5E-D4005
		Monitor Circuit: $\ominus 21 + 22$ Monitor Circuit: 51 + 52	With	1m	HS5E-D4401-G
				3m	HS5E-D4403-G
Spring Lock				5m	HS5E-D4405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC	Without	1m	HS5E-F4001
				3m	HS5E-F4003
	F	Main Circuit: $\ominus 11+12 + 12 + 12$ Monitor Circuit: $\ominus 21+22$ Monitor Circuit: $\ominus 31+32$		5m	HS5E-F4005
				1m	HS5E-F4401-G
				3m 5m	HS5E-F4403-G
		Main Circuit: 1NC 1NC Door Monitor Circuit: 1NC 1NO		1m	HS5E-F4405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO	Without	2m	HS5E-G4003
		Main Circuit: ⊖11 + 12 41+ 42	without	5m	HS5E-G4005
	G	Monitor Circuit: $\Theta 21 + 22$		1m	HS5E-G4401-G
		Monitor Circuit: 33334	With	3m	HS5E-G4403-G
				5m	HS5E-G4405-G
		Main Circuit: 1NC+1NC. Lock Monitor Circuit: 2NC		1m	HS5E-H4001
			Without	3m	HS5E-H4003
		Main Circuit: $\ominus 11 + 12 + 41 + 42$		5m	HS5E-H4005
	Н	Monitor Circuit: $51 + 52$		1m	HS5E-H4401-G
			With	3m	HS5E-H4403-G
				5m	HS5E-H4405-G
		Main Circuit: 1NC+1NC, Lock Monitor Circuit: 1NC, 1NO		1m	HS5E-J4001
			Without	3m	HS5E-J4003
	J	Main Circuit: $\ominus 11 + 12 + 41 + 42$		5m	HS5E-J4005
		Ivionitor Circuit: 51+52 Monitor Circuit: 63	With	1m	HS5E-J4401-G
				3m	HS5E-J4403-G
				5m	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

Lock Mechanism	Circuit Code	Contact Configuration	Indicator	Cable Length	Part No.
		Door Monitor (Actuator inserted) (Solenoid ON)		1m	HS5E-A7Y001
			Without	3m	HS5E-A7Y003
		L A2A1 Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NO		5m	HS5E-A7Y005
	A	Lock Monitor Circuit: 1NO		1m	HS5E-A7Y401-G
		Main Circuit: $\ominus 11 + 12 + 41 + 42$ Monitor Circuit: 23 24	With	3m	HS5E-A7Y403-G
		Monitor Circuit: $53 54$		5m	HS5E-A7Y405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NO,		1m	HS5E-B7Y001
		Lock Monitor Circuit: 1NC	Without	3m	HS5E-B7Y003
				5m	HS5E-B7Y005
	В	Main Circuit: $\ominus 11 + 12 + 14 + 42$ Monitor Circuit: 23 24		1m	HS5E-B7Y401-G
		Monitor Circuit: 51+ 52	With	3m	HS5E-B7Y403-G
				5m	HS5E-B7Y405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC,		1m	HS5E-C7Y001
		Lock Monitor Circuit: 1NO	Without	3m	HS5E-C7Y003
		Main Circuit: $\ominus 11 + 12 + 41 + 42$		5m	HS5E-C7Y005
		Monitor Circuit: $\ominus 21 + 22$		1m	HS5E-C7Y401-G
			With	3m	HS5E-C7Y403-G
				5m	HS5E-C7Y405-G
	D	Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC,		1m	HS5E-D7Y001
		Lock Monitor Circuit: 1NC	Without	3m	HS5E-D7Y003
		Main Circuit: ⊖11+ 12 41+ 42		5m	HS5E-D7Y005
		Monitor Circuit: $\Theta 21 + 22$	With	1m	HS5E-D7Y401-G
		Monitor Circuit: $51+52$		3m	HS5E-D7Y403-G
Solenoid Lock				5m	HS5E-D7Y405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC	Without	1m	HS5E-F7Y001
				3m	HS5E-F7Y003
	F	Main Circuit: $\ominus 11 + 12 + 41 + 42$		5m	HS5E-F7Y005
	•	Monitor Circuit: $\ominus 21 + 22$ Monitor Circuit: $\ominus 31 + 32$	With	1m	HS5E-F7Y401-G
				3m	HS5E-F7Y403-G
				5m	HS5E-F7Y405-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO		1m	HS5E-G7Y001
	G		Without	3m	HS5E-G7Y003
		Main Circuit: $\ominus 11 + 12 + 41 + 42$ Monitor Circuit: $\ominus 21 + 22$		5m	HS5E-G7Y005
		Monitor Circuit: 33 34		1m	HS5E-G7Y401-G
			With	3m	HS5E-G7Y403-G
				5m	HS5E-G7Y405-G
		Main Circuit: 1NC+1NC, Lock Monitor Circuit: 2NC		1m	HS5E-H7Y001
		Main Circuit: $\ominus 11 \downarrow 12 41 \downarrow 42$	Without	3m	HS5E-H7Y003
	н	Monitor Circuit: $51 + 52$		5m	HS5E-H7Y005
		Monitor Circuit: 61+ 62		1m	HS5E-H7Y401-G
			With	3m -	HS5E-H7Y403-G
				5m	HS5E-H/Y405-G
		main Gircuit: 1NG+1NG, Lock Monitor Circuit: 1NC, 1NO		1m	
		Main Circuit: ⊖11 ↓ 12 41 ↓ 42	Without	3m	HS5E-J/Y003
	J	Monitor Circuit: $51 + 52$		5m	
		Monitor Circuit: $63 + 64$	14/211	1m 2m	
			VVILII	5111	HOJE-J/ 1403-G
			1	1 501	HOUE-U/ 1400-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.

Rear Unlocking Button

Lock Mechanism	Circuit Code	Contact Configuration	Indicator	Cable Length	Part No.
		Door Monitor Lock Monitor (Actuator inserted) (Solenoid OFF)		1m	HS5E-A44L01-G
	А	Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NO, Lock Monitor Circuit: 1NO Main Circuit: 011		3m	HS5E-A44L03-G
		Monitor Circuit: 23 24 Monitor Circuit: 53 54		5m	HS5E-A44L05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, Lock Monitor Circuit: 1NO		1m	HS5E-C44L01-G
	С	Main Circuit: $\ominus 11 + 12 + 41 + 42$		3m	HS5E-C44L03-G
		Monitor Circuit: $52 - 53 - 54$		5m	HS5E-C44L05-G
	D	Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, Lock Monitor Circuit: 1NC		1m	HS5E-D44L01-G
Spring Lock		Main Circuit: $\ominus 11 + 12 + 41 + 42$	With	3m	HS5E-D44L03-G
		Monitor Circuit: $51 + 52$		5m	HS5E-D44L05-G
	F	Main Circuit: 1NC+1NC, Door Monitor Circuit: 2NC		1m	HS5E-F44L01-G
		Main Circuit: $\bigcirc 1_1$, 12 4_1 , 42 Monitor Circuit: $\bigcirc 2_1$, 22		3m	HS5E-F44L03-G
				5m	HS5E-F44L05-G
		Main Circuit: 1NC+1NC, Door Monitor Circuit: 1NC, 1NO		1m	HS5E-G44L01-G
	G	Main Circuit: $\bigcirc 11$, 12 , 41 , 42 Monitor Circuit: $\bigcirc 21$, 22 Monitor Circuit: $\bigcirc 32$, 34		3m	HS5E-G44L03-G
				5m	HS5E-G44L05-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.

Dual Safety Circuit

Lock Mechanism	Circuit Code	Contact Configuration	Indicator	Cable Length	Part No.
Spring Lock DD		Door Monitor Lock Monitor (Actuator inserted) (Solenoid OFF) ©© (+) ┌◯┐(-)		1m	HS5E-DD4401-G
	DD	للا A₂A1 Main Circuit: 1NC+1NC 1NC+1NC	With	3m	HS5E-DD4403-G
		Main Circuit $\textcircled{0}: \textcircled{0}: \textcircled{1}_{1} + \underbrace{12}_{2} + \underbrace{41}_{4} + \underbrace{42}_{4}$ Main Circuit $\textcircled{0}: \textcircled{0}: \textcircled{2}_{1} + \underbrace{22}_{5} + \underbrace{51}_{5} + \underbrace{52}_{5}$		5m	HS5E-DD4405-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.

Four-circuit Independent Output

Lock Mechanism	Circuit Code	Contact Configuration	Indicator	Cable Length	Part No.
		Door Monitor (Actuator inserted) (Solenoid OFF)		1m	HS5E-VA4401-G
	VA	Door Monitor Circuit: 1NC, 1NO, Lock Monitor Circuit: 1NC, 1NO Monitor Circuit: ⊖11 ↓ 12 41 ↓ 42		3m	HS5E-VA4403-G
		Monitor Circuit: 2 <u>3</u> 24 Monitor Circuit: 5 <u>3</u> 5 <u>4</u>		5m	HS5E-VA4405-G
		Door Monitor Circuit: 1NC, 1NO, Lock Monitor Circuit: 2NC		1m	HS5E-VB4401-G
	VB	Monitor Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: 23 24		3m	HS5E-VB4403-G
		Monitor Circuit: $51 + 52$	1451	5m	HS5E-VB4405-G
Spring Lock		Door Monitor Circuit: 2NC, Lock Monitor Circuit: 1NC, 1NO	With	1m	HS5E-VC4401-G
	VC	Monitor Circuit: $\bigcirc 11 + 12 + 41 + 42$ Monitor Circuit: $\bigcirc 21 + 22$ Monitor Circuit: $\bigcirc 53 - 54$		3m	HS5E-VC4403-G
				5m	HS5E-VC4405-G
	VD	Door Monitor Circuit: 2NC, Lock Monitor Circuit: 2NC		1m	HS5E-VD4401-G
		Monitor Circuit: $\bigcirc 11$ 12 41 42Monitor Circuit: $\bigcirc 21$ 22Monitor Circuit: 51		3m	HS5E-VD4403-G
				5m	HS5E-VD4405-G
	VA	Door Monitor (Actuator inserted) (Solenoid ON)		1m	HS5E-VA7Y401-G
		لب A ² ⊥ <u>س</u> A ¹ Door Monitor Circuit: 1NC, 1NO, Lock Monitor Circuit: 1NC, 1NO Monitor Circuit: ⊕11↓ 12 41↓ 42		3m	HS5E-VA7Y403-G
		Monitor Circuit: 2 <u>3</u> 24 Monitor Circuit: 5 <u>3</u> 54		5m	HS5E-VA7Y405-G
	VB	Door Monitor Circuit: 1NC, 1NO, Lock Monitor Circuit: 2NC		1m	HS5E-VB7Y401-G
		Monitor Circuit: $\bigcirc 11$, 12 41, 42 Monitor Circuit: 23 24 Monitor Circuit: 51, 52		3m	HS5E-VB7Y403-G
Solonoid Look			With	5m	HS5E-VB7Y405-G
Solenoid Lock		Door Monitor Circuit: 2NC, Lock Monitor Circuit: 1NC, 1NO	vvitii	1m	HS5E-VC7Y401-G
	VC	Monitor Circuit: $\bigcirc 11$, 12 41, 42 Monitor Circuit: $\bigcirc 21$, 22 Monitor Circuit: $\bigcirc 53$ 54		3m	HS5E-VC7Y403-G
				5m	HS5E-VC7Y405-G
	VD	Door Monitor Circuit: 2NC, Lock Monitor Circuit: 2NC		1m	HS5E-VD7Y401-G
		Monitor Circuit: $\bigcirc 11 + 12 + 41 + 42$ Monitor Circuit: $\bigcirc 21 + 22$ Monitor Circuit: $\bigcirc 51 + 52$		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.
Dimensions





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

Rear Unlocking Button (supplied with the switch)

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.

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



Actuators

Description	Actuator Retention Force	Part No.]
Straight		HS9Z-A51	
Straight w/rubber bushings		HS9Z-A51A	
Right-angle	1400N minimum	HS9Z-A52	
Right-angle w/rubber bushings		HS9Z-A52A	
Angle Adjustable (vertical)		HS9Z-A53	
Angle Adjustable (vertical/horizontal) (Note 1)	500N minimum	HS9Z-A55	Note 1: When rete
Sliding Actuator (Note 2)	1000N minimum	HS9Z-SH5	500N is re Note 2: For details

Note 1: When retention force of more than 500N is required, use HS9Z-A53. Note 2: For details, see page 76.

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Actuator Mounting Hole Layout

38

(horizontal/vertical swing)

2-M4 Scr

Dimensions and Mounting Hole Layouts



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

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.

Accessories

[Description	Part No.	Remarks						
Sliding Actuator		HS9Z-SH5	See page 76 for details.						
	Handle unit for right-hand door	HS9Z-DH5RH	Chappe apporting to the required opening side						
(See page 68)	Handle unit for left-hand door	HS9Z-DH5LH	Choose according to the required opening side.						
	Switch cover unit	HS9Z-DH5C	Used for installing the interlock switch inside.						
Plug Actuator		HS9Z-A5P							
Padlock Hasp		HS9Z-PH5							
Mounting Plate (Note 1)		HS9Z-SP51	When using the HS5E- <u></u> 44L <u></u> -G, provide a mounting hole for the unlocking button as shown below in the mounting plate mounting hole layout.						
		HS9Z-FL53	Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 23 < X \leq 33 (20 < X \leq 30 when switch cover unit HS9Z-DH5C is used)						
Rear Unlocking Button	Unlocking Button Kit (Note 2)		Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 33 < X \le 43 (30 < X \le 40 when switch cover unit HS9Z-DH5C is used)						
		HS9Z-FL55	Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 43 < X \le 53 (40 < X \le 50 when switch cover unit HS9Z-DH5C is used)						

Note 1: When mounting HS5E-KVA0L (rear unlocking button) using a mounting plate, provide mounting holes on the mounting plate as shown below and use Rear Unlocking Button Kit (HS9Z-FL5□).

Note 2: See the table at right for choosing rear unlocking button kit.

Dimensions

HS5E-L Interlock Switch (sold separately)

Link Rod (SUS)

Screw (Iron)

Mounting Plate (HS9Z-SP51) Manual Unlocking Key (metal) (HS9Z-T3) Drilling Rear Unlocking Button Hole 12 130 l ig 4 21 Manual Unlocking Key (plastic) 2 106 5 R6 4-M4 Screws 6.5 When installing the HS5E-□44L□-G (rear unlocking button), provide a rear unlocking button hole on the HS9Z-SP51. 18 22 KQ. Material: Anodized aluminum A6063 Weight: Approx. 180g Rear Unlocking Button Kit (HS9Z-FL5D) Button (PA66) Hinge + Plate (SUS) 0 Button pressed (unlocked)





Example:

When mounting on 30mm-thick frame using HS9Z-SP51 mounting plate, the panel thickness is 40 (10 + 30). Select HS9Z-FL54 rear unlocking button kit.

Circuit Diagrams and Operating Characteristics

Standard and Rear Unlocking - Spring Lock

						Status 1	Status 2	Status 3	Status 4	Manual Unlock		
Ir	terlock Switc	h Sta	tus			Door Closed Machine ready to operate Selencid do operatized	Door Closed Machine cannot be operated Selengid energized	Door Open Machine cannot be operated Selencid energized	Door Open Machine cannot be operated Selengid de energized	Door Closed Machine cannot be operated Solenoid de-energized		
Door Status							LOCK UNLOCK Turn the manual Notes 1y Notes 1y Notes 1y Notes 1y Notes 2y Notes 1y Notes 2y Notes 2y No					
Circuit Diagram (HS5E-A4)							(+) $(+)$					
D	oor				1	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)		
	Door I (Actuato	Monitor r Inserted)	Lock Mc (Solenoid	OFF)	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)		
	Main Circuit: ⊖ <u>11</u> Monitor Circuit: 2 <u>3</u> Monitor Circuit:	24	53	<u>42</u> 54	Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)		
	HS5E-B4	IS5E-B4			Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
	Main Circuit: $\ominus 11 + 12$ Monitor Circuit: 23 24 Monitor Circuit:	12 24	41	42	Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)		
			51	52	Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
	HS5E-C4 Main Circuit: ⊖11 + 12 Monitor Circuit: ⊖21 + 22 Monitor Circuit:					Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)	
		12 22	41 }	42	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)		
			53	54	Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)		
	HS5E-D4	1	41 + 4		Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
ation	Main Circuit: ⊖ <u>11</u> Monitor Circuit: ⊖ <u>21</u>	12 22			41+	42	_42	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)
nfigur			3U		Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
lct Co	HS5E-F4	1			Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
Conta	Main Circuit: ⊖11+ Monitor Circuit: ⊖21+ Monitor Circuit: ⊖31+	12 22 32	41	42	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)		
					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)		
	Main Circuit: ⊕11+ Monitor Circuit: ⊕21+ Monitor Circuit: 33	12 22 34	41	42	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)		
					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)		
	Main Circuit: \bigcirc <u>11</u> Monitor Circuit: Monitor Circuit:	12	41 51 61	42 52 62	Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
					Monitor Circuit (locked) 61–62	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
	HS5E-J4	HS5E-J4 Main Circuit: ⊖ <u>11 + 12 41 +</u> Monitor Circuit: 51 + Monitor Circuit: 63		40	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
	Monitor Circuit:			42 52 64	Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)		
	Monitor Circuit (unlocked) 63–64		OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)					
	Solenoid Pov	ver A	1-A2	(all ı	model)	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 Chracteristics (reference)

Main Circuit Monitor Circuit (door open, NO) Monitor Circuit (door closed, NC) Monitor Circuit (unlocked, NO) Monitor Circuit (locked, NC)



Note 1: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

Note 2: When the operator is confined in a hazardous zone, the actuator can be unlocked manually by pressing the rear unlocking button.

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

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

Standard - Solenoid Lock

			Status 1	Status 2	Status 3	Status 4	Unlocked with Manual Unlocking Key
In	terlock 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 energized	 Door Closed Machine cannot be operated Solenoid de-energized → energized
Door Status			AL II	8	Sec. Com		Lock Manual Unlock Status
Circuit Diagram (HS5E-A7Y)						$(+) \qquad (+) $	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $
D	oor		Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
	Door Monitor (Actuator inserted) (Solenoid ON)	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	HS5E-A7Y A2 A1 Main Circuit: @11 + 12 41 + 42	(door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Monitor Circuit: 23 24 Monitor Circuit: 53 54	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)
	Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: 23 24 Monitor Circuit: 51 52	Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	HS5E-C7Y	Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 Monitor Circuit: $\bigcirc 53$ 54	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		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)
ation	Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 Monitor Circuit: 51 52	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open).	ON (closed)
nfigur		Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
ict Co	HS5E-F7Y	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Conta	Main Circuit: $\bigcirc 11 + 12 + 41 + 42$ Monitor Circuit: $\bigcirc 21 + 22$ Monitor Circuit: $\bigcirc 31 + 32$	Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		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)
	Main Circuit: $\bigcirc 11$ 12 41 42 Monitor Circuit: $\bigcirc 21$ 22 Monitor Circuit: 33 34	Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		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)
	Main Circuit: $\bigcirc 11$ 124142Monitor Circuit: 51 52 Monitor Circuit: 61 62	Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		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)
	Main Circuit: \bigcirc 11 + 12 41 + 42 Monitor Circuit: 51 + 52 Monitor Circuit: 63 64	Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (unlocked) 63–64	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
Solenoid Power A1-A2 (all model)		nodel)	ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (Note 2)	OFF to ON (Note 1) (Note 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.

Operation Chracteristics (reference)

Main Circuit Monitor Circuit (door open, NO) Monitor Circuit (door closed, NC) Monitor Circuit (unlocked, NO) Monitor Circuit (ulocked, NC)



Note 1: Do not attempt manual unlocking when

the solenoid is energized. Note 2: Do not energize the solenoid for a long time while the door is open or when the door is unlocked manually.

• The operation characteristics shown in the chart above are

of the HS9Z-A51. For other actuators, 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

	Status 1	Status 2	Status 3	Status 4	Unlocked with Manual Unlocking Key
Interlock Switch Status	 Door Closed Machine ready to operate Solenoid de-energized 	Door Closed • Door Closed • Door Closed • Door Open • Door Open Machine ready to operated • Machine cannot be operated • Machine cannot be operated		 Door Open Machine cannot be operated Solenoid de-energized 	 Door Closed Machine cannot be operated Solenoid de-energized
Door Status	A CO			LOCK UNLOCK Turn the manual unlock key (Note)	
Circuit Diagram (HS5E-DD4)		$\begin{array}{c c} & & & & & \\ \hline & & & & & \\ \hline & & & & & \\ \hline & & & &$		$\begin{array}{c} (+) \\ A2 \\ \hline \\ 41 \\ 51 \\ \hline \\ 51 \\ \hline \\ 52 \end{array}$	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Door Monitor (Actuator Inserted) (Solenoid OFF) (Actuator Inserted) (Solenoid OFF) (Actuator Inserted) (Solenoid OFF) (-) (-)	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
O HS5E-DD4 Main Main Circuit 0: ⊕11 + 12 41 + 42 Main Circuit 0: ⊕21 + 22 51 + 52 Main Circuit 0: 21-52 Main Circuit 0: ⊕21 + 22 51 + 52 Circuit 0: 21-52 Circuit 0: 21-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all model)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

Contacts OFF (open)

• 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.

Operation Chracteristics (reference)

0 (Actuator insertion position) 3.3 (Locked position) 5.3 6.9 26.4 (travel in mm) Contacts ON (closed) Main Circuit

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

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

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

Four-circuit Independent Output - Spring Lock

		Status 1		Stat	us 2	Statu	s 3	Stat	us 4	Unlocked Unloc	with Manual king Key			
In	terlock Switch	n Sta	tus		 Door Closed Machine ready to operate Solenoid de-energized 		 Door Close Machine ca operated Solenoid et 	ed annot be nergized	 Door Open Machine can operated Solenoid ene 	not be ergized	 Door Open Machine ca operated Solenoid d 	annot be e-energized	 Door Closed Machine cannot be operated Solenoid de-energized 	
Door Status				St. La								CK UNLOCK rn the manual lock key (Note)		
Circuit Diagram (HS5E-VA4)				(+) A2 (+) A2 (+) A1 (-) A1 (1		(+) $A2$ 41 41 42 53 0 54			(+) A2 41 41 41 42 53 abc 54		
D	oor				Closed	(locked)	Closed (u	Inlocked)	Ope	n	Op	en	Closed (unlocked)
	Door I (Actuato	Monitor r Inserted)	Lock Monitor (Solenoid OFF)	Monitor Circuit (door closed) 11–12	ON (closed)	ON (c	losed)	OFF (c	pen)	OFF	(open)	ON (closed)
	HS5E-VA4 Monitor Circuit: ⊖11 Monitor Circuit: 23 Monitor Circuit:	₩ (• - -		Monitor Circuit (door open) 23–24	OFF	(open)	OFF	(open)	ON (clo	osed)	ON (c	closed)	OFF	(open)
		12	4 <u>1 + 42</u>	Monitor Circuit (locked) 41-42	ON (closed)	OFF	(open)	OFF (o	pen)	OFF	(open)	OFF	(open)
			5 <u>3 54</u>	Monitor Circuit (unlocked) 53–54	OFF	(open)	ON (c	losed)	ON (clo	osed)	ON (c	closed)	ON (closed)
				Monitor Circuit (door closed) 11–12	ON (closed)	ON (c	losed)	OFF (o	pen)	OFF	(open)	ON (closed)
	HS5E-VB4			Monitor Circuit (door open) 23–24	OFF	(open)	OFF	(open)	ON (clo	osed)	ON (c	closed)	OFF	(open)
ration	Monitor Circuit: ⊖11 Monitor Circuit: 23 Monitor Circuit:	12 24	4 <u>1 42</u> 5 <u>1 52</u>	Monitor Circuit (locked) 41-42	ON (closed)	OFF	(open)	OFF (a	pen)	OFF	(open)	OFF	(open)
nfigu				Monitor Circuit (locked) 51–52	ON (closed)	OFF	(open)	OFF (a	pen)	OFF	(open)	OFF	(open)
act Co				Monitor Circuit (door closed) 11–12	ON (closed)	ON (c	losed)	OFF (a	pen)	OFF	(open)	ON (closed)
Cont	HS5E-VC4			Monitor Circuit (door closed) 21–22	ON (closed)	ON (c	losed)	OFF (a	pen)	OFF	(open)	ON (closed)
	Monitor Circuit: ⊖11+ Monitor Circuit: ⊖21+ Monitor Circuit:	12	4 <u>1 42</u> 5 <u>3 54</u>	Monitor Circuit (locked) 41-42	ON (closed)	OFF	(open)	OFF (c	pen)	OFF	(open)	OFF	(open)
				Monitor Circuit (unlocked) 53–54	OFF	(open)	ON (c	losed)	ON (clo	osed)	ON (c	closed)	ON (closed)
				Monitor Circuit (door closed) 11-12	ON (closed)	ON (c	losed)	OFF (a	pen)	OFF	(open)	ON (closed)
	HS5E-VD4			Monitor Circuit (door closed) 21–22	ON (closed)	ON (c	losed)	OFF (c	pen)	OFF	(open)	ON (closed)
	Monitor Circuit: ⊖11+ Monitor Circuit: ⊖21+ Monitor Circuit:	12	4 <u>1 + 42</u> 5 <u>1 + 52</u>	Monitor Circuit (locked) 41–42	ON (closed)	OFF	(open)	OFF (c	pen)	OFF	(open)	OFF	(open)
	Monitor Circuit (locked) 51–52		ON (closed)	OFF	(open)	OFF (o	pen)	OFF	(open)	OFF	(open)		
	Solenoid Pow	ver A	1-A2 (all	model)	OFF (de-	energized)	ON (ene	ergized)	ON (ener	gized)	OFF (de-e	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.

Operation Chracteristics (reference)



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

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

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

Four-circuit Independent Output - Solenoid Lock

					Statu	s 1	Stat	tus 2	Statu	s 3	Stat	us 4	Unlock Ur	ed with Manual		
In	terlock Switc	h Sta	atus		Door Closed Machine ready to operate Solenoid energized Solenoid construction		ed annot be le-energized	 Door Open Machine can operated Solenoid de- 	not be energized	 Door Open Machine ca operated Solenoid en 	annot be nergized	 Door C Machin operate Solenoi → ener 	iosed e cannot be id id de-energized gized			
Door Status				St (1)	8							LOCK UNLOCK				
Circuit Diagram (HS5E-VA7Y)							(+) $(+)$	1		(+) $(-)$			$(+) \qquad (-) $			
D	oor				Closed (I	ocked)	Closed (unlocked)	Ope	n	Ор	en	Close	d (unlocked)		
	Door M (Actuator	Monitor Inserted)	Lock Monitor (Solenoid ON)	Monitor Circuit (door closed) 11–12	ON (clo	osed)	ON (closed)	OFF (o	pen)	OFF	(open)	0	N (closed)		
	HS5E-VA7Y			Monitor Circuit (door open) 23–24	OFF (c	pen)	OFF	(open)	ON (clo	osed)	ON (c	losed)	0	FF (open)		
	Monitor Circuit: @11+ Monitor Circuit: 23	12	41 + 42	Monitor Circuit (locked) 41-42	ON (clo	osed)	OFF	(open)	OFF (o	pen)	OFF	(open)	0	FF (open)		
	Monitor Circuit:		5354	Monitor Circuit (unlocked) 53–54	OFF (c	pen)	ON (closed)	ON (clo	osed)	ON (c	losed)	0	N (closed)		
				Monitor Circuit (door closed) 11–12	ON (clo	osed)	ON (closed)	OFF (o	pen)	OFF	(open)	0	N (closed)		
	HSSE-VB/Y		$\frac{12}{24}$ $\frac{41}{51}$ $\frac{42}{52}$	Monitor Circuit (door open) 23–24	OFF (c	pen)	OFF	(open)	ON (clo	osed)	ON (c	losed)	0	FF (open)		
ration	Monitor Circuit: ⊖ <u>11</u> Monitor Circuit: 2 <u>3</u> Monitor Circuit:	12 24		$\begin{array}{cccccccccccccccccccccccccccccccccccc$	12 41 42 42 51 52 52	2 41 + 42 4 51 + 52	Monitor Circuit (locked) 41–42	ON (clo	osed)	OFF	(open)	OFF (a	pen)	OFF	(open)	0
nfigu				Monitor Circuit (locked) 51–52	ON (clo	osed)	OFF	(open)	OFF (a	pen)	OFF	(open)	0	FF (open)		
act Co				Monitor Circuit (door closed) 11–12	ON (clo	osed)	ON (closed)	OFF (a	pen)	OFF	(open)	0	N (closed)		
Conta				Monitor Circuit (door closed) 21–22	ON (clo	osed)	ON (closed)	OFF (a	pen)	OFF	(open)	0	N (closed)		
	Monitor Circuit: ⊕ 11+ Monitor Circuit: ⊕21+ Monitor Circuit:	22	4 <u>1</u> 42 53 54	Monitor Circuit (locked) 41–42	ON (clo	osed)	OFF	(open)	OFF (o	pen)	OFF	(open)	0	FF (open)		
				Monitor Circuit (unlocked) 53–54	OFF (c	pen)	ON (closed)	ON (clo	osed)	ON (c	losed)	0	N (closed)		
	HS5E-VD7Y			Monitor Circuit (door closed) 11–12	ON (clo	osed)	ON (closed)	OFF (a	pen)	OFF	(open)	0	N (closed)		
				Monitor Circuit (door closed) 21–22	ON (clo	osed)	ON (closed)	OFF (a	pen)	OFF	(open)	0	N (closed)		
	Monitor Circuit: ⊕11+ Monitor Circuit: ⊕21+ Monitor Circuit:	Monitor Circuit: $\bigcirc 11 + 12$ Monitor Circuit: $\bigcirc 21 + 22$ Monitor Circuit:		Monitor Circuit (locked) 41-42	ON (clo	osed)	OFF	(open)	OFF (o	pen)	OFF	(open)	0	FF (open)		
				Monitor Circuit (locked) 51–52	ON (clo	osed)	OFF	(open)	OFF (o	pen)	OFF	(open)	0	FF (open)		
Solenoid Power A1-A2 (all model)			ON (ener	gized)	OFF (de-	energized)	OFF (de-energized) ON (energized) (Note 2)		OFF (d ON (Not	e-energized) to (energized) e 1) (Note 2)						

• 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 1: Do not attempt manual unlocking when the solenoid is energized. Note 2: Do not energize the solenoid for a long time while the door is open or when the door is unlocked manually.





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

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

A Safety Precautions

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

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- Do not open the lid of the interlock switch. Loosening the screws may cause damage to the interlock switch.
- The actuator retention force is 1400N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of another interlock switch without lock (such as the HS5B interlock switch) or a sensor to detect door opening and stop the machine.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the interlock switch temperature rises approximately 40°C above the ambient temperature (to approximately 90°C while the ambient temperature is 50°C). To prevent burns, do not touch. If cables come into contact with the interlock switch, use heat-resistant cables.
- Solenoid has polarity. Be sure of the correct polarity when wiring, otherwise solenoid will be damaged. Do not apply voltage over the rated voltage, otherwise the solenoid will be burnt.
- Although the HS9Z-A51A and HS9Z-A52A actuators (w/ rubber bushings) alleviate the shock when the actuator enters a slot in the interlock switch, make sure that excessive shock is not applied. If the rubber bushings become deformed or cracked, replace with new ones.

- Solenoid lock is locked when energized, and unlocked when de-energized. When energization is interrupted due to wire disconnection or other failures, the interlock switch may be unlocked causing possible danger to the operators. Solenoid lock must not be used in applications where locking is strictly required for safety. Perform a risk assessment and determine whether solenoid lock is appropriate.
- When changing the head orientation, disconnect the cable and turn the manual unlock to the UNLOCK position in advance. If the head orientation is changed when the cable is connected and the manual unlock is in the LOCK position, machines may start to operate, causing danger to the operators.
- When using the four-circuit independent output type as an input to safety circuit, connect the door monitor circuits (11-12, 21-22, 31-32) → and lock monitor circuits (41-42, 51-52, 61-62) in series.

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).
- 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:



HS9Z-A52A 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 page 45).
 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



Mounting Examples



Installing the Head

Do not use the plastic and metal head of he HS5B interlock switches on the HS5E. The metal heads of the HS5E and HS5B interlock switches look similar. When using these interlock switches adjacently, ensure that the heads are not interchanged.



The HS5E metal head can be distinguished easily with the black plastic part (HS5E metal head has gray plastic part).

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

For Manual Unlocking

Spring lock

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

Solenoid lock

The solenoid lock 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.



Lock Unlock 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.



Safety Precautions

Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch with solenoid is lost.

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 53 mm, use the rear unlocking button kit (HS9Z-FL5*) sold separately.



Safety Precautions

After installing the rear unlocking button, apply Loctite to the screw so that the screw does not become loose. The button is made of glass-reinforced PA66 (66 nylon). The screw is made of iron. Take the compatibility of the plastic material and Loctite into consideration.

Installing the Rear Unlocking Button Kit

- 1. Install the connecting rod onto the push rod on the HS5E-L rear unlocking button interlock switch.
- A pin is attached to the connecting rod. Insert the pin into the hole in the push rod, using pliers.
- 3. Pull the connecting rod from the hole in the mounting frame, and turn the button operating pin to the horizontal Connecting Rod





Safety Precautions

Ensure that the connecting rod is pulled out completely and it is horizontal to the interlock switch, otherwise the unlocking button cannot be installed.

Note: Frame must be supplied by the user.

For the mounting hole layout of interlock switches, see page 44. When using the mounting plate HS9Z-SP51, provide a hole for the connecting rod in the plate according to the mounting plate mounting hole layout shown on page 46.

4. Install the unlocking button on the connecting rod by fitting the pin to the grooves on the back of the button, and fasten the base plate on the mounting frame using the screws.



5. After fastening the screws, check if locking and unlocking operations can be performed.

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.



Do not apply strong force exceeding 100 m/s^2 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.



Rear Unlocking Button

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.

Safety Precautions

- Install the rear unlocking button in the place where only the operator inside the hazardous area can use it. Do not install the button in the place where an operator outside the hazardous area can use it, otherwise the interlock switch can be unlocked during usual machine operation, causing danger.
- Operate the rear unlocking button by hand only. Do not operate using a tool or with excessive force. Do not apply force to the button from the direction other than the proper direction, otherwise the button will be damaged.

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

Mounting centers:

12 mm (factory setting), adjustable to 20 mm



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

Cables

- Do not fasten or loosen the gland at the bottom of the safety switch.
- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm minimum.
- When wiring, make sure that water or oil does not enter the cable.
- Do not open the lid of the interlock switch. Otherwise the interlock switch will be damaged.



HS5E Miniature Interlock Switches with Solenoid

Model

Instructions

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.

Model	Circ	cuit Diagram
	Door M	Monitor Lock Monitor
		White (+) (-) A1 Black
HS5E-A	Main Circuit:Blue \bigcirc 11Monitor Circuit:Orange 23Monitor Circuit:	12 41 42 Blue/White 24 Orange/White Brown 53 54 Brown 53 54 Brown/White
HS5E-B	Main Circuit: Blue → 11 Monitor Circuit: Orange 23 Monitor Circuit:	12 41 42 Blue/White 24 Orange/White Brown 51 52 Brown/White
HS5E-C	Main Circuit: Blue \bigoplus 11 Monitor Circuit: Orange \bigoplus 21 Monitor Circuit: Orange \bigoplus 21	12 41 42 Blue/White 22 Orange/White Brown 53 54 Brown/White
HS5E-D	Main Circuit: Blue $\bigoplus 11$ Monitor Circuit: Orange $\bigoplus 21$ Monitor Circuit:	12 41 42 Blue/White 22 Orange/White 52 Brown/White
HS5E-F	Main Circuit: Blue 11 Monitor Circuit: Orange 21 Monitor Circuit: Brown 31	12 41 42 Blue/White 22 Orange/White 32 Brown/White
HS5E-G	Main Circuit: Blue 11 Monitor Circuit: Orange 21 Monitor Circuit: Brown 33	12 41 42 Blue/White 22 Orange/White 34 Brown/White
HS5E-H	Main Circuit: Blue \bigoplus 11 Monitor Circuit: Monitor Circuit:	12 41 42 Blue/White Brown 51 52 Brown/White Orange 61 62 Orange/White
HS5E-J	Main Circuit: Blue → 11 Monitor Circuit: Monitor Circuit:	12 41 42 Blue/White Brown 51 52 Brown/White Orange 63 64 Orange/White
HS5E-DD	Main Circuit \mathbb{O} : Blue $\bigoplus 11$ Main Circuit \mathbb{O} : Orange $\bigoplus 21$	12 41 42 Blue/White 22 51 52 Orange/White

	6						
	Doc	or Monitor	Lock Monitor				
	(U White		–) A1_Black			
HS5E-VA	Monitor Circuit: Blue $\bigoplus 11$ Monitor Circuit: Orange 23	12 Blue/White Pir	nk 4 <u>1 + 42</u>	Pink/White			
	Monitor Circuit:	I Brow	m 5 <u>3 54</u>	Brown/White			
	Monitor Circuit: Blue 🔿 <u>11</u>	12 Blue/White Pir	nk41 42	Pink/White			
HS5E-VB	Monitor Circuit: Orange 23 Monitor Circuit:	24 Orange/White	n <u>51 – 52</u>	Brown/White			
	Monitor Circuit: Blue $\bigoplus_{i=1}^{i} \frac{11}{2}$	12 Blue/White Pir	nk41 42	Pink/White			
HS5E-VC	Monitor Circuit: Orange → 21 -	Crange/White	m 5 <u>3 54</u>	Brown/White			
	Monitor Circuit: Blue $\bigoplus_{i=1}^{i} 11$	12 Blue/White Pir	nk41 42	Pink/White			
HS5E-VD	Monitor Circuit: Orange (→) <u>21</u> Monitor Circuit:	22 Orange/White Brow	m 5 <u>1 52</u>	Brown/White			

Circuit Diagram

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

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

HS5E-K Interlock Switches with Key

New interlock switches that can be locked and unlocked with a key.

- Head removal detection circuitry.
- High-security pin tumbler key is used. Sixteen types of key numbers are available.
- 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

Ratings

Contact Rating

Rated Insulation Voltage (Ui) (Note 1)			250V			
Rated Thermal Current (Ith)			Operating temperature: -25°C to 60°C: 2.5A max. 60°C to 65°C: 1.5A max. 65°C to 70°C: 1.0A max.			
Rated Voltage (Ue)			30V	125V	250V	
Rated AC Current (Ie)		Resistive Load (AC-12)	-	2.5A	1.5A	
	Inductive Load (AC-15)	-	1.5A	0.75A		
		Resistive Load (DC-12)	2.5A	1.1A	0.55A	
(Note 2)	DC	Inductive Load (DC-15)	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.)

Approved ratings

TÜV	AC-15 250V/0.75A DC-13 125V/0.22A DC-13 30V/2.3A
UL/c-UL	AC 125V/1.5A Pilot Duty DC 125V/0.22A Pilot Duty

Key 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

Part No. Development





General Specifications

Applicable Standards	ISO14119, IEC60947-5-1 EN60947-5-1 (TÜV approved) EN1088, GS-ET-19 (TÜV approved) UL508 (UL recognized) CSA C22.2 No. 14 (c-UL recognized) IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	$-25 \text{ to } +70^{\circ}\text{C}$ (No freezing)
Belative Humidity	45 to 85% (No condensation)
Storage Temperature	-40 to $\pm 80^{\circ}$ C (No freezing)
Pollution Degree	3
Impulse Withstand	2.5 kV
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 M Ω minimum (500V DC megger) Between live metal part and ground: 100 M Ω minimum (500V DC megger) Between live metal parts: 100 M Ω minimum (500V DC megger) Between terminals of the same pole: 100 M Ω minimum
Electric Shock Class	Class II (IEC61140)
Degree of Protection	IP65 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s² Damage limits: 1,000 m/s²
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 (Note 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 M Ω (initial value) Withstand voltage: 1,000V for 1 minute (initial value)
Conditional Short-	50A (250V) (Note 2)
Cable	UL2464, No. 22 AWG (12-core, 0.3 mm2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	510g (3m cable), 680g (5m cable)
Note 1: See page 54 for	actuator retention force.

Note 2: Use 250V/10A fast-blow fuse for short-circuit protection.

Head Removal Detection Circuitry (patented)

Head removal detection circuitry is employed in the HS5E-K. With this innovative function, the monitor circuit (41-42) turns off when the head is removed from the switch, such as when removing the head to change the head direction (applicable with all models of HS5E-K).

With the head installed on the switch, monitor circuits 41-42 and 51-52 operate in synchronization while the key locks/unlocks the actuator. When the head is removed, 41-42 turns off and 51-52 turns on. This disagreement is detected by the head removal detection function.





Monitor circuit (41-42) with head removal detection function

Actuator	unlocked

Actuator locked

	-
Head	removed

LOCK UNLOCK Monitor Circuit Pink $\textcircled{O} 41, 42$ Pink/White	OFF	ON	OFF	Disagreement
Monitor Circuit Brown → 51 + 52 Brown/White (NC)	OFF	ON	ON +	1 ~.
Note: Head removal detection functior	n is not direct	opening.		
	Actuator unlocked	Actuator locked	Head removed	
(t) Monitor Circuit Pink 41, 42 Pink/White	OFF	ON	ON	
Monitor Circuit Brown 51, 52 Brown/White	OFF	ON	ON	

Actuator

unlocked

Actuator

locked

Head

removed



Interlock Switch Package Quantity:						
Rear Unlocking Button	Circuit Code	Contact Configu	uration	Key Removal Position	Cable Length	Part No.
				A (removable in all	3m	HS5E-KVA003-2A
		0 <u>0</u>	LOCK UNLOCK $\ominus 41 + 42$	positions)	5m	HS5E-KVA005-2A
				B (removal in UNLOCK	3m	HS5E-KVA003-2B
	VA	Monitor Circuit : Monitor Circuit : Monitor Circuit : 23 24		position)	5m	HS5E-KVA005-2B
		Monitor Circuit :	<u>53</u> 54	C (removable in LOCK	Зm	HS5E-KVA003-2C
				position)	5m	HS5E-KVA005-2C
without				A (removable in all	3m	HS5E-KVD003-2A
				positions)	5m	HS5E-KVD005-2A
	VD		$\begin{array}{c c} & & \\ \hline \\ \hline$	B (removal in UNI OCK	3m	HS5E-KVD003-2B
		Monitor Circuit : \bigcirc <u>11</u> <u>12</u> Monitor Circuit : \bigcirc Monitor Circuit : \bigcirc <u>21</u> <u>22</u> Monitor Circuit : \bigcirc		position)	5m	HS5E-KVD005-2B
				C (removable in LOCK position)	Зm	HS5E-KVD003-2C
					5m	HS5E-KVD005-2C
		Monitor Circuit : \bigcirc 11 12 Lo \bigcirc 11 \bigcirc 12 Lo \bigcirc 11 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc 11 \bigcirc 11 \bigcirc 12 \bigcirc 11 \bigcirc	LOCK UNLOCK $\Rightarrow 41 + 42$ 53 - 54	A (removable in all positions)	3m	HS5E-KVA0L03-2A
					5m	HS5E-KVA0L05-2A
				B (removal in UNLOCK position)	3m	HS5E-KVA0L03-2B
	VA				5m	HS5E-KVA0L05-2B
				C (removable in I OCK	Зm	HS5E-KVA0L03-2C
With				position)	5m	HS5E-KVA0L05-2C
VVIII				A (removable in all	3m	HS5E-KVD0L03-2A
				positions)	5m	HS5E-KVD0L05-2A
	VD	Monitor Circuit : \bigcirc <u>11</u> <u>12</u> Monitor Circuit : \bigcirc <u>41</u> <u>42</u> Monitor Circuit : \bigcirc <u>21</u> <u>22</u> Monitor Circuit : \bigcirc <u>51</u> <u>52</u>	$\begin{array}{c} \ominus \underline{41} + \underline{42} \\ \hline \ominus \underline{51} + \underline{52} \end{array}$	B (removal in UNLOCK position)	Зm	HS5E-KVD0L03-2B
					5m	HS5E-KVD0L05-2B
				C (removable in LOCK	3m	HS5E-KVD0L03-2C
			position)	5m	HS5E-KVD0L05-2C	

HS5E-K Interlock Switches with Key

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

• Key LOCK and UNLOCK positions are as shown on the right.

• Actuators are not supplied with interlock switches and must be ordered separately.

• To select key numbers, specify numbers 501 to 515 after the Part No.

When a key number is not specified, key number 500 is supplied as the default key.

Example: HS5E-KVA003-2A<u>501</u>

500 (default key) to 515

Note: The key number is engraved on the cylinder.



HS5E-K Interlock Switches with Key

Dimensions and Mounting Layouts

All dimensions in mm.

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)

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



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

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 the position where the actuator stop placed on the actuator lightly touches the side surface of the interlock switch. Note: After mounting the actuator, remove the actuator stop





moves sideways.

Actuators

Description	Part No.	Actuator Retention Force
Straight	HS9Z-A51	
Straight with rubber bushings	HS9Z-A51A	
Right-angle	HS9Z-A52	1,400N minimum
Right-angle with rubber bushings	HS9Z-A52A	
Angle Adjustable (vertical)	HS9Z-A53	
Angle Adjustable (vertical/horizontal)	HS9Z-A55	500N minimum When a retention force of 500N or more is required, use HS9Z-A53.

• For actuator dimensions, see page 55.

• See "Minimum Radius of Hinged Door" on page 59 and 60 when using the HS5E-K on hinged doors.

Accessories

Package Quantity: 1

Description		Part No.	Remarks
Sliding Actuator		HS9Z-SH5	See page 76 for details.
	Handle Unit (for right-hand door)	HS9Z-DH5RH	Choose according to the required opening direction.
Door Handle	Handle Unit (for left-hand door)	HS9Z-DH5LH	See page 68 for details.
, lotautoi	Switch Cover Unit	HS9Z-DH5C	Used for installing the interlock switch inside.
Plug Actuator		HS9Z-A5P	
Padlock Hasp	•	HS9Z-PH5	
Mounting Plate (Note 1)		HS9Z-SP51	Can be used for mounting on aluminum frames.
Rear Unlocking Button Kit		HS9Z-FL53	Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 23 < X \leq 33 (20 < X \leq 30 when switch cover unit HS9Z-DH5C is used)
		HS9Z-FL54	Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 33 < X \leq 43 (30 < X \leq 40 when switch cover unit HS9Z-DH5C is used)
		HS9Z-FL55	Used when the total thickness of mounting frame, panel, and mounting plate $*$ is: 43 < X \leq 53 (40 < X \leq 50 when switch cover unit HS9Z-DH5C is used)

* The mounting part is a frame or a panel that the product is mounted on.

Note 1: When mounting HS5E-KVA0L (rear unlocking button) on an aluminum frame using the mounting plate, provide a mounting hole (see page 57) on the mounting plate and use the manual rear unlocking kit (HS9Z-FL5D).

HS5E-K Interlock Switches with Key

Actuator Dimensions and Mounting Hole Layouts

Straight Actuator (HS9Z-A51)



Actuator Mounting Hole Layout

Straight Actuator (with Rubber Bushings) (HS9Ž-A51A)



0.8

6

mounted

When



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

Actuator Mounting Hole Layout Straight actuator (with rubber bushing) Right-angle actuator (with rubber bushing)



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

Angle Adjustable Actuator (Vertical) (HS9Z-A53)



Right-angle Actuator (HS9Z-A52)



Right-angle Actuator (with 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

All dimensions in mm.

to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber

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



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 orienting insert, otherwise the actuator will not operate properly.

Accessory Dimensions

Door Handle Actuator

HS9Z-DH5RH (for right-hand door) / Actuator with Key HS5E-K Interlock Switch



Panel Cut-out

Right-hand Door Handle Unit (HS9Z-DH5RH)



Mounting Position Tolerance



All dimensions in mm.



HS5E-K Interlock Switches with Key



Circuit Diagrams and Operating Characteristics

			Status 1	Status 2	Status 3	Rear Manual Unlock
Interlock Switch Status		Door closed	Door closed	Door opened	Door closed	
		Machine ready to operate	 Machine cannot be operated 	 Machine cannot be operated 	 Machine cannot be operated 	
Door Status		ALCOM S	ALCON A	ACCOR A	Press rear unlocking button. (Note)	
Circuit Diagram (Example: HS5E-KVA)						
Do	or		Closed (locked)	Closed (unlocked)	Opened	Closed (unlocked)
		Monitor Circuit (door closed) 11-12				
Ľ		Monitor Circuit (door open) 23-24				
figuratic	ISSE-KVA	Monitor Circuit (locked) 41-42				
act Con		Monitor Circuit (unlocked) 53-54				
d Conta		Monitor Circuit (door closed) 11-12				
del anc		Monitor Circuit (door closed) 21-22				
Ŭ		Monitor Circuit (locked) 41-42				
		Monitor Circuit (locked) 51-52				

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 operating characteristics shown in the chart above are of the HS9Z-A51 actuator. For other actuators, add 1.3 mm.

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

Safety Precautions

- In order to avoid electric shock or fire, turn the power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welding or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and establish a safety circuit that satisfies the requirement of the safety category.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots. Entry of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Using the slot plugs supplied with the interlock switch, plug the unused actuator entry slots.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use proprietary actuators only. Using other actuators may damage the interlock switch.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- Do not open the lid of the interlock switch. Loosening the screws may damage the interlock switch.
- The actuator retention force is 1,400N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of another interlock switch without lock (such as the HS5D/HS5B interlock switch) or a sensor to detect the door opening and stop the machine.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or take other measures.
- Although the HS9Z-A51A and HS9Z-A52A actuators (w/ rubber bushings) alleviate the shock when the actuator enters the slot on the interlock switch, make sure that excessive shock is not applied. If the rubber bushings become deformed or cracked, replace with new ones.
- Do not mount the interlock switch facing down as shown in the figure below. Otherwise, the key may fall off due to shock.



- Do not place a PLC in the circuit between the interlock switch and the load. Safety and security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a breakdown or an accident may occur.
- Do not install the actuator in a location where the human body may come in contact. Otherwise injury may occur.

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 a small minimum radius, use angle adjustable actuators (HS9Z-A53 or HS9Z-A55).

Note: Because deviation or dislocation of a 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-A52A Actuator (with 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 55). 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

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



Mounting Examples

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



Installing the Head

Do not use plastic and metallic heads of HS5D/HS5B interlock switches on the HS5E-K. Be sure to use HS5E metallic heads. The metal heads of the HS5E, HS5D, and HS5B look similar. When using these interlock switches adjacently, ensure that the heads are not interchanged.



* The metal head can be distinguished easily by the color of the plastic.

Rotating the head

The head can be rotated by removing the four screws from the corners of the head and reinstalling the head in the desired orientation. Before wiring the HS5E-K, replace the head. 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 a space between the head and body, otherwise the interlock switch may malfunction.

(Recommended tightening torque: 0.9 to 1.1 N·m)



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 UN-LOCK 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.



Safety Precautions

After installing the rear unlocking button, apply Loctite to the screw so that the screw dose not become loose. The button is made of glass-reinforced PA66 (66 nylon). The screw is made of iron. Take the compatibility of the plastic material and Loctite into consideration.

Mounting the Rear Unlocking Button Kit

- 1. Install a connecting rod onto the push rod on the HS5E-K rear unlocking button interlock switch (HS5E-K□L, sold separately).
- 2. A pin is attached to the connecting rod. Insert the pin into the hole in the push rod, using pliers.

3. Pull the connection rod from the hole in the mounting frame, and turn the

button operating pin to the horizontal

Push Rod Connecting Rod HS5E-K□L Interlock Pin Switch



Safety Precautions

Ensure that the connecting rod is pulled out completely and it is horizontal to the interlock switch, otherwise the unlocking button cannot be installed.

Note: Frame or panel must be supplied by the user. For the mounting hole layout of interlock switches, see page 57.

When using the mounting plate HS9Z-SP51, provide a hole for the connecting rod in the plate according to the mounting plate mounting hole layout shown on page 57.

- 4. Install the unlocking button on the connecting rod by fitting the pin to the grooves on the back of the button, and fasten the base plate on the mounting frame using the screws.
- 5. After fastening the screws, check if locking and unlocking operations can be performed.



Safety Precautions

Install the rear unlocking button kit in the correct direction as shown below. Do not install the kit in incorrect directions, otherwise a malfunction may occur.



Do not apply strong force, exceeding 100 m/s^2 , to the interlock switch while the rear unlocking button is not pressed, otherwise a malfunction may occur.

Manual Unlocking using the Rear Unlocking Button

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

Safety Precautions

- Install the rear unlocking button in a place where only the operator inside the hazardous area can use it. Do not install the button in a place where an operator outside the hazardous area can use it, otherwise the interlock switch may be unlocked during usual machine operation, causing danger.
- Operate the rear unlocking button by hand only. Do not operate using a tool or with excessive force. Do not apply force to the button from the direction other than the proper direction, otherwise the button will be damaged.

Recommended Tightening Torque for Mounting Screws

- HS5E-K 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) (Note)
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) (Note)
HS9Z-A53:	4.5 to 5.5 N·m (two M6 screws) (Note)
HS9Z-A55:	1.0 to 1.5 N·m (two M4 screws) (Note)

- Note: The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.
- Mounting bolts must be provided by the users.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and actuator are installed in a secure manner, for example using special screws or welding the screws.

• When installing the HS9Z-A51A and HS9Z-A52A actuators, use the washer (supplied with the actuator) on the hinged door, and mount tightly using two M4 screws.



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

HS5E-K Interlock Switches with Key

Instructions

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 the cable.
- Do not open the lid of the interlock switch. Otherwise the interlock switch will be damaged.



Wire Identification

- Wires can be identified by color and white line printed on the wire.
- Wires whose colors are white, black, gray and gray/white 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.



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

Logic Circuit using FS1A Safety Controller

Example 1: Hostage control (one robot)

Turn the key selector switch to Teach Mode and remove the key. Unlock HS5E-K using the same key, then remove the key and open the door to enter.

Gripping the enabling switch in the enabling position enables the robot to operate.



Example 2: Partial Mode Change (Multiple Robots)

Three FS1A safety controllers are required for two robots and four FS1A safety controllers for three robots.

Turn the key selector switch of the first robot (logic no. 103) to Teach Mode and remove the key. Unlock the HS5E-K interlock switch using the same key and open the door to enter. Using the same key, Turn the key selector switches of the second (logic No. 13b) or subsequent robots to be operated to Teach Mode. Gripping the enabling switch in the enabling position enables the robot to operate.

- Note 1: Teaching is possible with one robot at a time. Teaching multiple robots is not possible at the same time.
- Note 2: The emergency stop switch connected to the first FS1A safety controller is effective for all robots.
- Note 2: The integrate states outputs Y2 and Y3 (solid state outputs) of the first FS1A safety controller to the RF1V force guided relay (K1, K2), and connect its NO contact to the safety output Y0, Y1 of the second and the subsequent FS1A safety controllers. Connect NC contact to the EDM input of the first FS1A safety controller.

The required number of RF1V (K1, K2):

- For two robots: 2NO2NC
- For three robots: 3NO1NC For four robots: 4NO2NC
- Note 4: The emergency stop switch connected to the second and subsequent FS1A safety controllers are effective for the robot only.

Note 5: Connect the NC contacts of K3 and K4 to EDM input of the second FS1A safety controller. Connect the NC contacts of K5 and K6 to the EDM input of the third FS1A safety controller. Select force guided relays for K3, K4, K5 and K6 according to the operation control circuits of the robots.



Door Handle Actuator Configuration

Interlock Switches



HS5E-*44L**-G Rear Unlocking Button



HS5E-K*L Rear Unlocking Button



HS5D-*Z Metal Head





00

HS5B-**Z

Metal Head

HS9Z-DH5C

Selection Chart

Mounting Panel Thickness X



HS5 Series Door Handle Actuator



HS5 Series Door Handle Actuator

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).

Specifications

Applicable Interlock Switch	HS5D Metal Head Interlock witch (Note 1) HS5B Metal Head Interlock Switch (Note 1) HS5E Rear Unlocking Button Interlock Switch with Solenoid (Note 3) HS5E-K Rear Unlocking Button Interlock Switch with Key (Note 4)			
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)			
Weight	HS9Z-DH5LH/RH: 1000g HS9Z-DH5C: 900g HS9Z-DH5B: 30g			
 Note 1: HS5D-**ZRN*				



Note 3: HS5E-*44L**-G
Note 4: HS5E-K**0L**-2****
 Interlock switch is not supplied with the actuator and must be ordered separately.

Description		Part No.	Remarks		
Handle Unit	For right-hand door HS9Z-DH5RH		Change according to the required energing side		
	For left-hand door	HS9Z-DH5LH			
Switch Cover Unit		HS9Z-DH5C	Used for installing the interlock switch inside.		
HS5D/HS5B Installation Kit		HS9Z-DH5B	Contains a mounting plate and two spacers.		
Rear Unlocking Button Kit (Note 1)		HS9Z-FL53	Contains a button with base plate and a connecting rod	Mounting panel thickness (X): $20 \le X \le 30$ mm (Note 2)	
		HS9Z-FL54		Mounting panel thickness (X): $30 < X \le 40$ mm (Note 2)	
		HS9Z-FL55		Mounting panel thickness (X): $40 < X \le 50$ mm (Note 2)	

Note 1: Use the kit in combination with the HS5E-+44L++-G rear unlocking button interlock switch.

Note 2: Mounting panel is a frame or a panel.

Parts Description

Note 2: HS5B-**ZB, HS5B-**ZBM



Dimensions

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





sús





HS9Z-DH5RH (right-hand door) and HS5D-**Z/HS5B-**Z Interlock Switch

HS9Z-DH5LH (left-hand door) and HS5D-**Z/HS5B-**Z Interlock Switch



HS5 Series Door Handle Actuator

Panel Cut-out



Door Gap

<
Front View



HS9Z-DH5LH left-hand door handle unit

(7 to 9) (47.5) 36 to 46 6 to 16 (26) 13 to 20 <u>8 to 20</u> When using the HS5E-*44L**-G on the mounting panel of 3 mm or less in thickness (use the rear unlocking button). 26 56 \bigcirc <u>6-M5</u> <Rear View: Door gap Door gap <Front Viewa 7 to 9 (7 to 9) (47.5) 47.5 36 to 46 6 to 16 When using the HS5E-*44L**-G on (26) 13 to 20 <u>8 to 20</u> the mounting panel of 20 to 40 mm in thickness. 26 • Use the rear unlocking button kit 8 (HS9Z-FL5*). • In the figure shown on the right, 8 11 to 18 □40mm frame is used. œ 256 4 (34 to 41) 4(6)-M5

4(6)-M5

□40 □40

Door gap

Note 1:

Required when using the HS5E-*44L-**-G. Not required when using the HS5D-**Z or HS5B-**Z (without locking function) (70mmthick is necessary for mounting panel). Note 2:

Ensure that the hole in the mounting panel does not interfere with the rear handle shaft.

All dimensions in mm.

<Front View>

□40 □40

<Rear View>

Door gap

Vote (2) p

4(6)-M5

140 Door Gap

<Rear Viewa

Dimensions

Screws (iron)

Rear Unlocking Button Kit (HS9Z-FL53/HS9Z-FL54/HS9Z-FL55) (Use with the HS5E-*44L**-G Interlock Switch)



HS5D/HS5B Installation Kit (HS9Z-DH5B)



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

All dimensions in mm.
HS5 Series Door Handle Actuator

Instructions

- The door handle actuator can be used with the HS5D-**Z, HS5B-**Z (metal head), and HS5E-*44L**-G (rear unlocking button) only. Do not use with other interlock switches.
- · When using the door handle actuator in the safety-related part of the system, make sure of proper operation while observing the safety standards and regulations of the relevant country or region where the actual machine/system is used. Also, perform a risk assessment before operation.
- · Read the instruction sheet of interlock switch before installing the door handle actuator.
- · Install the switch cover unit and handle unit on the outside of the door. Do not install them inside the door, otherwise the door cannot be opened or closed by the operator, affecting the operation and causing danger to the operator.
- · Install the door handle actuator in the direction as shown on the right, so that the cable faces downward. Do not install in any other direction, otherwise malfunction will be caused.
- · Do not modify or disassemble the door handle actuator.

Padlocking

- When padlocking the HS9Z-DH5, lift the knob on the front of the HS9Z-DH5. A tab will appear. Install padlock(s) or a hasp on the tab.
- Make sure that the total load by the padlocks and hasp does not exceed 30N. Otherwise the door handle actuator will become deformed or damaged.
- The applicable shackle diameter of padlock is ø6.0 to 7.5 mm.



- Manual Unlocking
- When using the HS5E-*44L**-G interlock switch, attach the manual unlock label on the front of the switch cover unit.
- · For manual unlocking, refer to the specifications for the HS5E interlock switch with solenoid.

Handle Operation

• Push the handle, and turn the handle to insert the actuator.

1.00

Handle Operation



- Note: Do not force to turn the handle without pushing in the handle, otherwise damage will occur.
- Do not close the door when the actuator is in the locked status, otherwise the actuator will hit the door, resulting in deformation or damage.
- · When turning the handle, make sure that your hands or fingers are not caught by the door.

Manual Unlock Labe 0 1.00 Normal Status Unlocked Status

Installation

· Check wether the following parts are included.

Unit	Part	Quantity
	Mounting Bracket	1
	Switch Cover	1
Switch Cover Unit	Blind Cap	1
HS9Z-DH5C	Screw A *	1
	Screw B *	2
	Screw C	4
Handle Unit HS9Z-DH5RH HS9Z-DH5LH	Actuator Cover	1
	Front Handle (black)	1
	Rear handle (yellow)	1
	Rear handle Shaft	1
	Rear handle Plate	1
	Rear handle Base	1
	Screw D *	2
	Screw E	2
HS5B Installation Kit	Mounting Plate	1
HS9Z-DH5B	Spacer	2

*Screws A and B are loosely attached to the switch cover. Screws D are loosely attached to the handles

Installing the Switch Cover Unit (HS9Z-DH5C)

- 1. Remove one Screw A and two Screw A Screws B from the switch cover and remove the switch cover from the mounting bracket. Switch Co
- 2. [HS5E-*44L**-G Interlock Switch] Using four Screws C, install the interlock switch on the mounting bracket (panel thickness 3 mm or less). When installing on a mounting panel (X) of $20 \le X \le 50$ mm, install HS5E-*44L**-G the connecting rod onto the push



Mounting

Bracket

rod and press the pin into the hole in the push rod as described in the "Installing the Rear Unlocking Button Kit" on page 74, before installing the switch on the mounting bracket.

Screws

[HS5D-**Z and HS5B-**Z Interlock Switch] Install the interlock switch using the HS5B Installation Kit (HS9Z-DH5B) and two Screws C.



Inside

Switch Cover

Blind Cap

- Outside

Blind Cap

Screw A

- 3. Plug the unused actuator entry slot using the blind cap. To do so, attach the tab on one end to the switch cover, and bending the blind cap, attach the other end on the switch cover.
- 4. Install the switch cover on the mounting plate using one Screw A and two Screws B.

rews B



Padlock Tab

Cabl

Instructions

 Install the switch cover unit on the mounting frame and panel. Mounting screws or nuts are not supplied and must be provided by the user.



Installing the rear unlocking button

When the total thickness of mounting panel is 3.0 mm or less: Install the rear unlocking button on the rod on the back of the switch. For details, see the instruction sheet for the HS5E.

When the total thickness of mounting frame or panel is 20 mm or more: Install the rear unlocking button kit (HS9Z-FL5*) sold separately. For installation, see the instruction sheet for the HS9Z-FL5.

Installing the Handle Unit HS9Z-DH5RH

1. Install the front handle (black) on the shaft on the actuator cover as shown below. Handle Position



- Tighten Screw D attached to the handle using a hexagonal wrench (size: 2.5). Apply Loctite to the screw so that it does not become loose.
- Install the handle unit on the mounting frame and panel, aligning the handle unit and switch cover unit as illustrated under "Actuator Mounting Reference Position." Mounting screws and nuts are not supplied and must be provided by the user.



4. Cut the rear handle shaft according to the thickness of the mounting frame and panel.



 Align the rear handle plate, rear handle shaft, and the rear handle base as shown below, and fasten them using two Screws E. Apply Loctite to the screws so that they do not become loose.



6. Install the rear handle (yellow) on the rear handle shaft.



 Tighten Screw D attached to the handle using a hexagonal wrench (size: 2.5). Apply Loctite to the screw so that it does not become loose.



- 8. Turn the handle to the locked position, and insert the rear handle shaft into the actuator cover. The rear handle should be in the locked position.
- While adjusting to ensure smooth operation of the rear handle, fasten the rear handle unit on the mounting frame and panel.
- Install the HS9Z-DH5LH in a similar fashion as the HS9Z-DH5RH. Note that the handle direction becomes opposite.



 Mounting screws and nuts are not supplied and must be provided by the user.

Actuator Mounting Reference Position

• The mounting reference position and allowable mounting range are as shown below.



• Use the square dot pattern as a guide of the allowable mounting range.



Installing the Rear Unlocking Button Kit

- 1. Install the connecting rod onto the push rod on the HS5E-*44L**-G rear Push unlocking button interlock switch.
- 2. A pin is attached to the connecting rod. Using pliers, press the pin into the hole in the push rod.
- 3. Pull out the connecting rod from the connecting hole in the mounting frame, and turn the button operating pin to the horizontal position.



Connecting Rod Connecting Rod Orientation Pull Correct Incorrect

atm-treichl.de +49 2166 958545

HS5 Series Door Handle Actuator

Instructions

Safety Precautions

Ensure that the connecting rod is pulled out completely and it is horizontal to the interlock switch, otherwise the unlocking button cannot be installed. Frame or panel must be supplied by the user.

4. Install the unlocking button on the connecting rod by fitting the pin to the grooves on the back of the button, and fasten the base plate on the mounting frame using the screws.



 After tightening the mounting screws to a torque of 4.8 to 5.2 N·m, check if locking and unlocking operations can be performed.

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.



Do not apply strong force exceeding 100 m/s² to the rear unlocking button kit, 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.
- While the button remains pressed, the interlock switch cannot be locked even if the door is closed, and the main circuit remains open.

Safety Precautions

- Install the rear unlocking button in the place where only the operator inside the hazardous area can use it. Do not install the button in the place which can be reached by an operator outside the hazardous area, otherwise the interlock switch may be unlocked during machine operation, causing danger.
- Operate the rear unlocking button by hand only. Do not operate using a tool or with excessive force. Do not apply force to the button from the direction other than the proper direction, otherwise the button will be damaged.

Recommended Tightening Torque

	Screw	Recommended Tightening Torque
HS	S9Z-DH5C Switch Cover Unit	
	One Screw A (M4) and two Screws B (M5) to install the switch cover on the mounting bracket	1.0 to 1.2 N⋅m
	Four Screws C (M4) to install the interlock switch on the mounting bracket	1.5 to 1.8 N⋅m
	Three M5 screws to install the switch cover unit on the mounting frame and panel (not supplied and must be provided by the user)	4.5 to 5.0 N⋅m
HS	S9Z-DH5*H Handle Unit	
	One Screw D (M5) to fasten handle	2.5 to 3.0 N·m
	Two Screws E (M5) to install the rear handle base on the rear handle plate	4.5 to 5.0 N⋅m
	Two M5 screws each to install the front and rear handles on the mounting frame and panel (not supplied and must be provided by the user)	4.5 to 5.0 N⋅m

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

HS5 Series Sliding Actuator

Part No.

HS9Z-SH5

Sliding actuators allow for easy installation and adjustment.

- Angle adjustment is not required, enabling easy positioning.
 Installation is possible both vertically and horizontally, and
- Installation is possible both vertically and horizontally, and also on any type of doors.
- Can be used on the HS5D/HS5B metal head and HS5E/ HS5E-K interlock switches.
- Safety measures can be provided easily on existing facilities.



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Applicable Model	HS5D-**Z/HS5B-**Z Metal Head Interlock Switches HS5E Interlock Switches HS5E-K Interlock Switches with key	
Weight	125g	
Mechanical Durability	100,000 operations minimum	
Operation Stroke	40 mm	
Direct Opening Force	HS5D: 60N min imum HS5B: 80N minimum HS5E: 90N minimum HS5E-K: 80N minimum	

Dimensions

Description

HS5 Series Sliding Actuator



Note: HS5D/HS5B/HS5E/HS5E-K interlock switches are not supplied with the sliding actuators and must be ordered separately.

Mounting Hole Layout



All dimensions in mm.

Installation

When using with HS5S-**Z/HS5B-**Z interlock switch



Fasten the actuator cover on at least two oblong holes using mounting screws.

Instructions

Operating Instructions

- When using the sliding actuator in a safety-related part of the system, make sure of proper operation while observing the safety standards and regulations of the relevant country or region where the actual machine/system is used. Also, perform a risk assessment before operation.
- Read the instruction sheet of the interlock switch carefully before installation or operation.
- The actuator has projections on the end. Take care not to injure hands.
- Regardless of door types, do not use the sliding actuator as a door stop.
- When the actuator is inserted to an interlock switch in the different direction from the open/close direction of the door, do not open the door with excessive force, otherwise failure or damage will be caused.
- When an operator enters the hazardous zone, take a safety measure such as using padlock hasp HS9Z-PH5 so that the operator is not trapped inside and the machine is not operated while the operator is in the hazardous zone.
- Do not install the sliding actuator as shown below, otherwise the actuator may be removed from the interlock switch due to shocks.



- Ensure to slide the sliding actuator completely. Incomplete insertion of the actuator may cause unstable contact operation of the interlock switch. Also, door may not be opened, damaging the actuator.
- Do not close the door when the actuator is slid out of the cover, otherwise the actuator may damaged.
- When using the sliding actuator, take care so that fingers or hands are not caught between the actuator and interlock switch.





Fasten the actuator cover on at least two rectangular holes and two round mounting holes using mounting screws. The thickness adjustment plate requires mounting holes.

 When installing the sliding actuator over the interlock switch as shown below, do not apply a shock exceeding 100 m/s² to the actuator, otherwise the actuator may be inserted to the interlock switch and cause unintended machine operation.



- Use the sliding actuator with HS5D/ HS5B/HS5E/HS5E-K interlock switches only. Do not use with other products.
- Do not modify or disassemble the sliding actuator.

Adjustment

- 1. Mounting Reference Position
- The mounting reference position of sliding actuator is shown below.



- 2. Recommended Tightening Torque of Mounting Screws
- M5 screws for mounting the sliding actuator: 4.5 to 5.5 N·m
- M4 screws for mounting the interlock switch: 1.8 to 2.2 N·m
- 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.

HS5 Series Plug Actuator

Allows HS5 series interlock switches to be used as interlock plug units.

- By chaining a plug actuator to a guard door for use with the HS5 series interlock switches, the open/close status of a guard door can be detected.
- Unlike interlock plugs, the plug actuators can be removed/ installed while power is applied.
- Defeating-prevention structure is provided within the HS5 series interlock switches.
- Selection of with or without locking function is possible by selecting HS5 series interlock switches.
- Contact configuration of the HS5 series interlock switches remains the same.
- IP67 protection of the HS5 series interlock switches remains the same.
- Usage of the HS9Z-PH5 padlock hasps allows the interlock plug to be used as a hostage control unit.

Description	Part No.
HS5 series Plug Actuator	HS9Z-A5P

Note: The HS5B/HS5E interlock switches are ordered separately.



Specifications

Applicable Model	HS5D/HS5B Miniature Interlock Switches HS5E Miniature Interlock Switches with Solenoid HS5E-K Interlock Switches with Key HS5L Interlock Switches with Solenoid
Weight (approx)	35g

Note: Refer to the specifications of each interlock switch.

Dimensions When used with the HS5D/HS5B interlock switch

When using with the HS5E/HS5E-K interlock switch



All dimensions in mm.

HS5 Series Plug Actuator

Precautions for Installation

- When using the HS9Z-A5P for safety-related equipment in a control system, refer to the safety standards and regulations in each country to make sure of correct operation. Also, perform a risk assessment to ensure safety before starting operation.
- · Read the instruction sheet of the interlock switch to be used.
- Note the projections on the HS9Z-A5P to prevent injury.
- Regardless of door types, do not use the HS9Z-A5P as a door lock. Install a separate lock such as a metal latch.
- When the direction to insert the HS9Z-A5P into the interlock switch is different from the opening/closing direction of the door, do not open the door while the HS9Z-A5P remains in the interlock switch.
- Do not insert the HS9Z-A5P from the lower side as shown in the following figure. Otherwise the HS9Z-A5P may fall because of vibration.



- The HS9Z-A5P is used for HS5D/HS5B/HS5E/HS5E-K/HS5L interlock switches only. Do not use the HS9Z-A5P with other products.
- Do not modify or disassemble the HS9Z-A5P.

When linking the HS9Z-A5P to the door with a chain



- Connect the chain to the handle of the HS9Z-A5P and the door firmly.
- Use a chain which has welded joints and does not break apart easily. Stop using the interlock device when the chain breaks.
- Give proper slack to the chain, and do not apply excessive force to the HS9Z-A5P. Determine the proper length of the chain so that the door does not open wide and that the danger zone can not be accessed by the operator.
- Refer to the following standards for safety distances and safety gaps.

ISO13857 (Safety distances to prevent hazard zones being reached by upper and lower limbs)

ISO13854 (Minimum gaps to avoid crushing of parts of the human body.)

• When an operator enters the danger zone, take measures such as using a Padlock Hasp (HS9Z-PH5) so that the operator is not trapped, and the machine can not be started by mistake.

When inserting the HS9Z-A5P into a part of the door



 The thickness of a door to insert the HS9Z-A5P depends upon the insertion direction as shown in the following figure. When placing a thicker objects, the HS9Z-A5P cannot enter sufficiently, causing malfunction of the interlock switch.



- Refer to the standard (ISO13852 through 13854) for safety distances and safety gaps.
- When an operator enters the danger zone, take measures such as using a Padlock Hasp (HS9Z-PH5) so that the operator is not trapped, and the machine can not be started by mistake.

When using the HS9Z-A5P as a hostage key



- Do not use two or more HS9Z-A5P for one interlock switch.
- Treat the HS9Z-A5P with care, and ensure that the HS9Z-A5P is not inserted into other interlock switches.

When an operator enters the danger zone, take measures such as using a Padlock Hasp (HS9Z-PH5) so that the operator is not trapped, and the machine can not be started by mistake.

HS5 Series Padlock Hasp

Padlock hasps prevent unauthorized insertion of actuators.

Part No.

HS9Z-PH5

- Ideal to prevent machines from operating when two or more operators are inside the danger zone.
- Accommodates up to four padlocks when the hasp is installed on the interlock switch.
- By providing each operator with a padlock to install on the hasp before entering the danger zone, the machine can not restart until all operators have left the zone and removed their padlocks (use a hasp for five or more operators).
- Note: Use of padlocks to ensure safety requires strict observance of opening rules. Safety cannot be ensured if the rules are neglected, such as failing to install the padlocks.



Specifications

Applicable Model	HS5D/HS5B Miniature Interlock Switches HS5E Miniature Interlock Switches with Solenoid HS5E-K Interlock Switches with Key
Shackle Diameter of Applicable Padlock	ø5.5 to 7.5 mm
Withstand Force	30N maximum
Weight (approx)	35g

When using with the HS5E/HS5E-K interlock switch

Dimensions

When used with the HS5D/HS5B interlock switch

Note: The HS5B/HS5E interlock switches are ordered separately.

Description

HS5 Series Padlock Hasp





All dimensions in mm.

Precautions for Installation

- When using the HS9Z-PH5 for safety-related equipment in a control system, refer to the safety standards and regulations in each country to make sure of correct operation. Also, perform a risk assessment to ensure safety before starting operation.
- Read the instruction sheet of the interlock switch to be used.
- Note the projections on the HS9Z-PH5 when using to prevent injury.
- Insert the HS9Z-PH5 in the direction as shown in the following figure. Do not insert from any other direction. Also, do not use the slot plug supplied with the interlock switch.



- Do not deform the HS9Z-PH5. The HS9Z-PH5 may come off from the interlock switch even if a padlock is installed. Stop using immediately if the HS9Z-PH5 becomes deformed.
- The shackle diameter of the applicable padlock (refer to the following figure) is ø5.5 to 7.5 mm.



• When using a hasp or special padlock, make sure that the sliding tab does not slide 3 mm or more in the direction shown below, otherwise the HS9Z-PH5 may come off the interlock switch.



 When using a hasp such as shown below, make sure that the hasp is installed in round holes not in the oblong hole. Otherwise the sliding tab may slide 3 mm or more. Check periodically that the narrow gap between the jaws is not widened, so that the HS9Z-PH5 does not fall off from the hasp.



- Keep the weight of padlocks and hasps to a maximum of 1500g on one tab hole, and at a maximum of 3000g for the total of all tab holes. Using padlocks and hasps weighing over the maximum allowable weight may cause deformation of the HS9Z-PH5, and the interlock switch may be damaged.e interlock switch, otherwise failure or damage may be caused.
- Do not apply excessive shock to the HS9Z-PH5 while installing it on the interlock switch, otherwise failure or damage may be caused.
- Do not apply excessive vibration while padlocks or hasps are installed, otherwise failure or damage may be caused.
- The HS9Z-PH5 is used for HS5D/HS5B/HS5E/HS5E-K interlock switches. Do not use the HS9Z-PH5 for any other products.
- Make sure that locking and unlocking the padlock and hasp do not interfere with other products in close proximity.
- Do not modify or disassemble the HS9Z-PH5.
- Padlocks and hasps are available from the following manufacturers.

Panduit Corporation (http://www.panduit.com/) Master Lock Company (http://www.masterlock.com/)

HS9Z ø22/30 mm Padlock Cover

Prevents unauthorized operation of key switches and interlock plugs used as hostage controls.

- Ideal to prevent machines from operating when two or more operators are inside the danger zone.
- When padlocked, the padlock covers prevent keys or plugs from being inserted into the locks.
- By providing each operator with a padlock to install onto the hasp before entering the danger zone, the machine can not restart until all operators have left the zone and removed their padlocks (use a hasp for three or more operators).
- Note: Use of padlocks to ensure safety requires strict observance of operating rules. Safety cannot be ensured if the rules are neglected, such as failing to install the padlocks.

Padlock Covers

Specifications

Description	Part No.
ø22 mm Padlock Cover	HS9Z-PC22
ø30 mm Padlock Cover	HS9Z-PC30

Notes

Key selector switch and interlock plug are ordered separately.

 HS9Z-PC22 (ø22mm) cannot be used on HW1K and LW*K. The nameplates for HW series cannot be used on HS9Z-PC22.

Applicable	ø22 mm	ASW*K
Model	ø30 mm	HS2P, ASN*K, ASTN*K, ASD*K
Shackle Diameter of Applicable Padlock		ø5.5 to 7.5 mm
Withstand Force		30N maximum
Weight (approx.)		55g

Note: For the specifications of key selector switches and interlock plugs, refer to the specifications of HS2P interlock plugs, ASW*K, ASN*K, ASTN*K, and ASD*K key selector switches.

Dimensions



60



HS9Z-PC22



HS9Z-PC30



HS9Z ø22/30 mm Padlock Cover

Instructions

Mounting

• The direction to install the padlock cover is as shown in the figure on the right.

<HS9Z-PC22>

Installation with ASW*K

- Do not use an anti-rotation ring (OGL-31) or nameplate which is an optional accessory for the ASW*K.
- Install the HS9Z-PC22 padlock cover between the panel and the bezel (see below). For panel mounting, refer to the instructions for the TW series control units.

UP

DOWN



• When using the panel thickness adjustment ring, add the thickness of the HS9Z-PC22 (2.0 mm) to the adjustment value.

<HS9Z-PC30>

Installation for HS2P

 Install the HS9Z-PC30 padlock cover between the panel and the bezel (see below). Refer to the panel mounting method of the HS2P interlock plug. When adjusting the number of gaskets to suit the mounting panel thickness, add the thickness of the HS9Z-PC30 (2.0 mm) to the adjustment value.



Installation for the ASN*K, ASTN*K, and ASD*K

- (1) When using no nameplate
- To prevent the selector switch from turning, use of an anti-rotation ring (OGL-11) is recommended.
- Install the HS9Z-PC between the panel and the bezel (see below). For panel mounting, refer to the instructions for ø30 mm control units.



(2) When using a nameplate

 Install the HS9Z-PC30 padlock cover between the nameplate and the bezel (see below). Do not interchange the order of parts, otherwise the padlock cover cannot be installed securely. Antirotation ring (OGL-11) is not necessary when using NA or NALO nameplates. When using the CQN nameplate, use of an antirotation ring (OGL-11) is recommended.



• Symbols and marks can be engraved in the engraving area shown in the figures below.



 When adjusting the rubber washer thickness to suit the mounting panel thickness, add the thickness of anti-rotation ring (0.8 mm), nameplate (0.5 to 2.0 mm), and the HS9Z-PC30 (2.0 mm) to the adjustment value.

Precautions for Installation

- When using the HS9Z-PC for safety-related equipment in a control system, refer to the safety standards and regulations in each country to make sure of correct operation. Also, perform a risk assessment to ensure safety before starting operation.
- Read directions of the interlock plug and the key selector switch used.
- Make sure that the following requirements are satisfied when using the HS9Z-PC.
- I When a plug is installed on the HS2P interlock plug, or a key is inserted to the key selector switch, the HS9Z-PC cannot be closed, and the HS9Z-PC cannot be locked using a padlock or a hasp.
- I When the HS9Z-PC is closed on the HS2P interlock plug or on the key selector switch, the plug cannot be installed on the HS2P interlock plug, and a key cannot be inserted into the key selector switch.
- Before closing the HS9Z-PC, make sure that the plug is removed from the HS2P interlock plug, and the key is removed from key selector switch. When the plug of the HS2P interlock plug or the key of key selector switch is deformed or damaged, replace it with a new one immediately. Otherwise the HS9Z-PC may be closed while the plug or key is installed, initiating operation.
- The applicable shackle diameter of padlock is ø5.5 to 7.5 mm.



 When using a hasp as shown below, check periodically that the narrow gap between the jaws is not widened, so that the HS9Z-PC does not fall off the hasp.



- Because a variety of shapes are available on the market for padlocks and hasps, make sure that the requirements shown with I are satisfied when choosing the padlocks and hasps.
- Keep the weight of padlocks and hasps to a maximum of 1500g on one side, and at a maximum of 3000g total of both sides. Using padlocks and hasps weighing over the maximum allowable weight may cause deformation of the padlock, and the HS2P interlock plug and key selector switch may be damaged.
- Do not apply excessive shock to the HS9Z-PC, otherwise failure or damage may be caused.
- Do not apply vibration while padlocks or hasps are installed, otherwise failure or damage may be caused.
- The HS9Z-PC is used for following applicable models. Do not use the padlock cover for other products.

Applicable model of the HS9Z-PC22 Key Selector Switch ASW*K

Applicable model of the HS9Z-PC30 Interlock Plug: HS2P

- Key Selector Switch: ASN*K, ASTN*K, ASD*K • Ensure that locking and unlocking the padlock and hasp do not
- interfere with other products in close proximity.
- Do not modify or disassemble the padlock cover. Stop using immediately if the padlock cover is deformed.
- Padlocks and hasps are available from the following manufacturers.

Panduit Corporation (http://www.panduit.com/) Master Lock Company (http://www.masterlock.com/)

HS1L Interlock Switches with Solenoid

3000N locking strength (largest in class)!

Suitable for large and heavy doors.

- Same actuator as HS1E (actuator retention force 3000N)
- Six contacts in a compact housing (same size as HS1E)
- Same dimensions and mounting hole layouts as HS1E (Size: $35 \times 104 \times 129$ mm)
- Door open, closed, and locked statuses can be monitored for various applications.
- Energy efficient new solenoid unit. 32% less solenoid current consumption compared with HS1E.
- Manual unlock key and LED indicator are standard.
- Manual unlock key allows for manual unlocking in the event of power failure or maintenance.
- Indicator has an independent circuit, and can be used for various purposes.
- Two locking mechanisms to choose from—spring lock (unlocked with energized solenoid) or solenoid lock (locked with energized solenoid).
- M3 terminal screws for wiring.
- Wide operating temperature range (-20 to +55°C).



Ratings

Contact Ratings

		-			
Rated Insulation Voltage (Ui)		300V			
Rated Operating Current (Ith)		10A			
Rated Operating Voltage (Ue)		30V	125V	250V	
Datad		Resistive Load (AC-12)	10A	10A	6A
Operating	AC	Inductive Load (AC-15)	10A	5A	ЗA
Current		Resistive Load (DC-12)	8A	2.2A	1.1A
(Ie) DC	DC	Inductive Load (DC-13)	4A	1.1A	0.6A

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

TÜV rating: AC-15 3A/250V, DC-13 4A/30V UL, c-UL rating: A300

-OL rating: A300 Pilot duty: AC 3A/250V

Pilot duty: DC 4A/30V

• CCC rating: AC 15 3A/250V, DC-13 4A/30V

Solenoid Unit and LED Indicator

Lock Mechanism		Spring Lock	Solenoid Lock	
Rated Operating Voltage		24V DC (100% duty cycle)		
	Rated Current	200 mA (initial valu	ue)	
	Coil Resistance	120Ω (at 20°C)		
	Pickup Voltage	Rated voltage × 8	5% max. (at 20°C)	
Solenoid	Dropout Voltage	Rated voltage × 10	0% max. (at 20°C)	
	Maximum Continuous Applicable Voltage	Rated voltage × 1	10%	
	Maximum Continuous Applicable Time	Continuous		
Insulation Class		Class F		
Rated Operating Voltage		24V DC		
LED	Rated Current	10 mA		
	Light Source	LED		
	Illumination Color	Green (G), Red (F	?)	



Specifications

Applicable Standard	ISO14119 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL listed) CSA C22.2 No. 14 (c-UL listed) GB14048.5 (CCC approved) IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	–20 to +55°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Overvoltage Category	Ш
Impulse Withstand Voltage	4.0 kV (between LED, solenoid and ground: 1.5 kV)
Contact Resistance	50 m Ω maximum (initial value)
Insulation Resistance	Between live and dead metal parts: 100 MΩ minimum (500V DC megger) Between terminals of different poles: 100 MΩ minimum (500V DC megger)
Electric Shock Protection	Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Damage limits: 1000 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	11 mm minimum
Direct Opening Force	50N minimum
Actuator Retention	3000N minimum (GS-ET-19)
Operating Frequency	See page 87 for differisions.
Mochanical Durability	1 000 000 operations minimum (GS-ET-10)
Electrical Durability	100,000 operations minimum (CS-E1-19) 100,000 operations minimum (AC-15 3A/250V) 1,000,000 operations minimum (24V AC/DC, 100mA) (operating frequency 900 operations per hour)
Conditional Short-circuit Current	100A (250V) (Use 250V/10A fast acting type fuse for short-circuit protection.)
Weight (approx.)	450g (HS1L-DQ44)

Parts and Functions

L-shaped Actuator (3000N) (SUS304)

HS1L Interlock Switches with Solenoid

HS1L

Two Actuator Entry Slots

(Zinc Diecast)

Part No. Development



Angle Adjustable (vertical) Actuator (3000N) (SUS304)

Terminal Numbers



- 11-42: Main circuit
- 21: Main circuit or monitor circuit (door monitor)
- 22: Monitor circuit (door monitor)
- 31/33: Monitor circuit (door monitor)
- 32/34: Monitor circuit (door monitor)
- 51: Monitor circuit (lock monitor)
- 52: Main circuit or monitor circuit (lock monitor)
- 61/63: Monitor circuit (lock monitor)
- 62/64: Monitor circuit (lock monitor)
- A1: Solenoid (-)
- A2: Solenoid (+)
- X1: LED (-)
- X2: LED (+)
- \ast There is no wiring between 22-51 with circuit code R.

HS1L Interlock Switches with Solenoid

Interlock Switch

Lock Mechanism	Circuit Code	Contact Configuration	Conduit Port Size	LED Indicator	Manual Unlocking Key	Part No.
		LED (Actuator Inserted) (Solenoid OFF) (+) C- (-) Let (-) (+) C- (-) (+) (+) (-) (+) (-) (+) (-) (-) (+) (+) (-) (+) (+) (-) (+) (+) (+) (+) (+) (+) (+) (+) (+) (+	G1/2			HS1L-R44KMSR-@
	R	Main: 1NC+1NC Lock monitor: 1NO/1NC Lock monitor: 2NC Main circuit: ⊕ 11+ 12 41+ 42 Monitor circuit: ⊕ 21+ 22	PG13.5			HS1L-R44KMSRP-@
		Monitor circuit:3334Monitor circuit: $51 + 52$ Monitor circuit: $61 + 62$	M20			HS1L-R44KMSRM-@
Spring Lock		Main: 1NC+1NC Door monitor: 1NO 1NC+1NC Lock monitor: 1NO	G1/2	With	With	HS1L-DQ44KMSR-@
opg _oon	DQ	Main circuit:	PG13.5		VVIII	HS1L-DQ44KMSRP-@
		Monitor circuit: <u>33</u> <u>34</u> Monitor circuit: <u>63</u> <u>64</u>	M20			HS1L-DQ44KMSRM-2
	DT	Main: 1NC+1NC Door monitor: 1NC 1NC+1NC Lock monitor: 1NC	G1/2			HS1L-DT44KMSR-2
		Main circuit: $\bigcirc 11 + 12 + 42$ Main circuit: $\bigcirc 21 + 22 + 51 + 52$	PG13.5			HS1L-DT44KMSRP-@
		Monitor circuit: $\bigcirc 31 + 32$ Monitor circuit: <u>61 + 62</u>	M20			HS1L-DT44KMSRM-2
		$\begin{array}{c} \text{Door Monitor} \\ \text{LED} (\text{Actuator Inserted}) (\text{Solenoid ON}) \\ (+) $	G1/2	G1/2		HS1L-R7Y4KMSR-@
	R	Main: 1NC+1NC Door monitor: 1NO/1NC Lock monitor: 2NC Main circuit: ⊕ 11+ 12 41+ 42 Manitor circuit: ⊕ 21+ 22	PG13.5			HS1L-R7Y4KMSRP-@
		Monitor circuit: 33 Monitor circuit: $51 + 52$ Monitor circuit: $61 + 62$	M20			HS1L-R7Y4KMSRM-2
Solenoid Lock		Main: 1NC+1NC Door monitor: 1NO 1NC+1NC Lock monitor: 1NO	G1/2	With	With	HS1L-DQ7Y4KMSR-@
Solenoid Lock	DQ	Main circuit: $\bigcirc 11 + 12 + 41 + 42$ Main circuit: $\bigcirc 21 + 22 + 51 + 52$	PG13.5			HS1L-DQ7Y4KMSRP-@
		Monitor circuit: 33 34 Monitor circuit: 63 64	M20			HS1L-DQ7Y4KMSRM-@
		Main: 1NC+1NC Door monitor: 1NC 1NC+1NC Lock monitor: 1NC	G1/2			HS1L-DT7Y4KMSR-@
	DT	Main circuit: $\bigcirc 11 + 12 + 41 + 42$ Main circuit: $\bigcirc 21 + 22 + 51 + 52$	PG13.5			HS1L-DT7Y4KMSRP-@
		Monitor circuit: $(\Rightarrow)31+(32)$ Monitor circuit: <u>61+62</u>	M20			HS1L-DT7Y4KMSRM-@

• Specify an LED indicator color code in place of 2 in the Part No. G: green, R: red

• 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.

Actuator

Description	Part No.
Straight Actuator	HS9Z-A1S
L-shaped Actuator	HS9Z-A2S
Angle Adjustable (vertical) Actuator (for hinged door)	HS9Z-A3S
Package quantity: 1	

Accessories

Description	Part No.
Key Wrench for TORX Screw (L-shaped)	HS9Z-T1
Conduit Port Plug (Size: G1/2 only)	HS9Z-P1

• Package quantity: 1

• Key Wrench for TORX Screw is supplied with the interlock switch.

HS1L Interlock Switches with Solenoid

Dimensions and Mounting Hole Layouts



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)



Angle Adjustable (vertical) Actuator (HS9Z-A3S)



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 cover and the actuator stop film.

L-shaped Actuator (HS9Z-A2S)



Note: 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.

All dimensions in mm.



Circuit Diagrams and Operating Characteristics

Spring Lock

	Status 1	Status 2	Status 3	Status 4	Manual Unlock
Interlock Switch Status	 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					Unlock position
Circuit Diagram (HS1L-DQ4)	$\begin{array}{c} \begin{array}{c} & & & \\ & & & \\ & & & \\ & & & \\ \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \\ \begin{array}{c} & & & \\ & & & \\ \end{array} \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \\ \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \end{array} \end{array} \\ \end{array} \\ \begin{array}{c} & & & \\ \end{array} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} $ \\ \begin{array}{c} & & & & \\ \end{array} \end{array} \\ \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \end{array} \\ \end{array} \\	$\begin{array}{c} \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	$\begin{array}{c} \begin{array}{c} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} & & & (+) \\ & & & & (-) \\ & & & & & & (-) \\ & & & & & & (-) \\ & & & & & & (-) \\ & & & & & & (-) \\ & & & & & & (-) \\ & & & & & & (-) \\ &$
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
HS1L-DQ4 Main Circui	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
LED (Actuator (Solenoid) inserted OFF LED (Actuator (Solenoid) OFF 21-52 X2 X1 TO A2 III A1 A2 III A1	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
OO Image: Constraint of the second seco	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
Monitor Circuit: 63 64 Circuit (unlocked) 63-64	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
Solenoid Power A1-A2	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

Solenoid Lock

		Statue 1	Statue 2	Statue 3	Status /	Manual Linlock
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 energized	Door Closed Machine cannot be operated Solenoid de-energized to energized
Door Status					Real Providence of the second se	Unlock position
Circuit Diagram (HS1L-DQ7Y)		$\begin{array}{c} & & () \\ & & ($	$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	$\begin{array}{c} \textcircled{0}_{0} \textcircled{0} \textcircled{0} \textcircled{0} \textcircled{0} \textcircled{0} \textcircled{0} \textcircled{0} \textcircled$	$\begin{array}{c} \begin{array}{c} \begin{array}{c} 0 \\ \end{array} \\ \end{array} \\ \begin{array}{c} 0 \\ \end{array} \\ \end{array} \\ \begin{array}{c} \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (-) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} (+) \\ \end{array} \\ $	$\begin{array}{c} & & & (+) & (-) \\ & & & & A2 \\ \hline & & $
Door		Closed (locked)	Closed (unlocked)	Open Open		Closed (unlocked)
HS1L-DQ7Y	Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
$\begin{array}{c c} \textbf{C} \textbf{C} \textbf{C} \textbf{C} \textbf{C} \textbf{C} \textbf{C} C$	Main Circuit 21–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (Door Open) 33–34	OFF (open)	OFF (open)	ON (closed) ON (closed)		OFF (open)
	Lock Monitor Circuit (unlocked) 63-64	OFF (open)	ON (closed)	ON (closed) ON (closed)		ON (closed)
Solenoid Power A1-A2		ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (Note 2)	OFF to ON (Note 1) (Note 2)

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.

Operation Characteristics (reference)



• The operation characteristics show the contact status when the

actuator enters into the center of the entry slot.

• The circuit No. 12-41 and 22-51 are interconnected. Use circuits 11-42 and 21-52 for safety circuits (In HS1L-R model, circuit 12-41 is interconnected.)

HS1L Interlock Switches with Solenoid

A Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and establish a safety circuit which satisfies the requirement of the safety category.
- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a breakdown or an accident may occur.

• Do not install the actuator in a location where the human body may come in contact. Otherwise injury may occur.

- Install the actuator where it does not touch human body when the door is opened/closed. Otherwise injury may occur.
- Solenoid lock is locked when energized, and unlocked when de-energized. When energization is interrupted due to wire disconnection or other failures, the interlock switch may be unlocked causing possible danger to the operators. Solenoid lock must not be used in applications where locking is strictly required for safety. Perform a risk assessment and determine whether solenoid lock is appropriate.
- In order to prevent the interlock switch and actuator from being removed without authorization, it is recommended to install an one-way screw or a screw that needs a special tool for removal. Welding or rivet is also recommended.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Make sure that no force is applied on the actuator, otherwise the actuator may not be unlocked properly.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots. Entry of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere, or the switches are subject to direct sunlight.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwse it will damage the interlock switch.
- The actuator retention force is 3000N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of other interlock switch without lock (such as the HS5D interlock switch) or a sensor to detect door opening and stop the machine.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the interlock switch temperature rises approximately 40°C above the ambient temperature (to approximately 95°C while the ambient temperature is 55°C). To prevent burns, do not touch. If cables come into contact with the interlock switch, use heat-resistant cables.
- Solenoid has polarity. Be sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.

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-A3S).

Note: The following values apply when the actuator does not interfere with the interlock switch when opening and closing the door. Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

When using HS9Z-A2S 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 HS9Z-A3S 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



Actuator Angle Adjustment

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on page 87).
 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.

Instructions

Mounting Examples

Install the interlock switch and actuator referring to the figures below.



For Manual Unlocking

Spring lock

The HS1L allows manual unlocking of the actuator to precheck proper door movement before wiring or turning power on, as well as for emergency use such as a power failure.

Solenoid lock

The solenoid lock 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.

Using manual unlock key

- 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. Main circuit and lock monitor circuit remain open.
- Do not leave the manual unlock key attached to the interlock switch during operation. This is dangerous and does not satisfy the requirement by safety standards, because the interlock switch can always be unlocked while the machine is in operation.



Unlocking from the back of interlock switch

Insert the tip of a small screwdriver into the oblong hole on the back of the interlock switch, and tilt toward the center of the switch until the actuator is unlocked.

Note: Provide a hole on the mounting panel for unlocking from the back. When making a hole in the panel, take waterproof characteristics into consideration.



Safety Precautions

Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch with solenoid is lost.

On the solenoid lock, manual unlocking is provided for the situation where the switch cannot be unlocked even though the solenoid has turned off. Do not attempt manual unlocking while the solenoid is energized.

Precautions for Opening and Closing the Lid

- When opening the lid before wiring, make sure to open only the lid shown the following figure. Removing unnecessary screws may cause a failure of the interlock switch.
- Use HS9Z-T1 key wrench for TORX screw when removing and installing the lid.
- Make sure that no foreign objects such as dust, water, or oil enter the interlock switch when wiring.



Applicable Crimping Terminal



- Use an insulation tube on the crimping terminal.
- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

Applicable Crimping Terminal	Applicable Wire
N0.5-3 / FN0.5 (JST)	0.2 to 0.5 mm ²
N1.25-MS3 (JST)	0.25 to 1.65 mm ²
V1.25-YS3A (JST)	0.25 to 1.65 mm ²

Applicable Wire Size

• 0.5 to 1.5 mm²

HS1L Interlock Switches with Solenoid

Instructions

Applicable Cable Glands



When Using Flexible Conduit (Example)

Flexible conduit example: VF-03 (Nihon Flex)

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

When Using Multi-core Cables (Example)

Flexible conduit example: VF-03 (Nihon Flex)

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

· Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

Note: When using the ST-M20X1.5 cable gland, use together with a gasket (Part No.: GPM20, K-MECS).

Conduit Port Opening

- · Make an opening for wire connection by breaking one of the conduit-port knockouts on the interlock switch housing using a screwdriver.
- · Before opening the conduit port, remove the locking ring for cable gland inside the interlock switch.
- When breaking the conduit port, take care not to damage the contact block or other parts inside the interlock switch. Also, take care not to damage the internal wiring. Cut wires cause operation failure.
- · Cracks or burrs on the conduit entry may deteriorate protection against water.
- · When changing to another conduit port, close the unused opening with an optional plug (Part No.: HS9Z-P1)



Recommended Tightening Torque

- HS1L interlock switch: 3.2 to 3.8 N·m (four M5 screws) (Note)
- Lid: 0.9 to 1.1 N·m (M4 screws)
- Terminal: 0.6 to 0.8 N·m (M3 screws) 2.7 to 3.3 N·m
- Cable gland:
- Actuators

HS9Z-A1S/A2S: 2.7 to 3.3 N·m (two M5 screws) (Note) HS9Z-A3S: 4.5 to 5.5 N·m (two M6 screws) (Note)

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 Length Inside the Interlock Switch

	Screw	Through C	onduit Port
	Terminal No.	1	2
Wire Length	11	95 ± 2	45 ± 2
L1 (mm)	21	85 ± 2	35 ± 2
	22	60 ± 2	70 ± 2
	31/33	75 ± 2	35 ± 2
	32/34	50 ± 2	60 ± 2
	42	65 ± 2	95 ± 2
	51	45 ± 2	70 ± 2
	52	55 ± 2	85 ± 2
	61/63	35 ± 2	60 ± 2
	62/64	45 ± 2	75 ± 2
	A1	50 ± 2	45 ± 2
	A2	60 ± 2	40 ± 2
	X1	70 ± 2	35 ± 2
	X2	80 ± 2	35 ± 2
Wire Stripping Length: L2 (mm)		7 :	±1



Note:

HS1L-R

Do not remove the wire between terminals 12-41, because these terminals are interconnected for safety circuit input. Use terminals 11-42 for safety circuit inputs. (GS-ET-19)

HS1L-DQ and HS1L-DT

Do not remove the wires between terminals 12-41 and 22-51, because these terminals are interconnected for safety circuit inputs. Use terminals 11-42 and 21-52 for safety circuit inputs. (GS-ET-19)

P

Dual main circuit + lock monitor circuit provide more safety to your system

- Basic unit and solenoid unit in one housing
- Lightweight plastic housing
- All terminal screws are M3.5, allowing easy wiring.
- Two main circuits 1NC+1NC and a monitor circuit 1NC realizes duplicated main circuit and lock monitor.
- Hostage control can be achieved using the hostage key.
- Guard door can be locked automatically by installing the actuator on the guard and interlock switch on the machine.
- Equipped with two actuator entry slots.
- Double insulation structure
- 30 different numbers are available for key, so that neighboring switches cannot be operated by the same key.

Actuator Retention Force 3000N

- Ideal locking mechanism and robust actuators for large doors.
- Accommodation of actuator entry slots to rattling doors is enhanced.

Spring Lock

- 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.







Interlock Switch

Lask		Quartat		Style			
Mechanism	Contact Configuration	Port Size	Indicator	Manual Unlock Key	Hostage Key	Part No.	
Spring Lock	Door Monitor Lock Monitor (Actuator inserted) (Solenoid OFF)	C1/2	_	—	With	HS1E-K840MSR-□	
	Main circuit ⁽¹⁾ : 1NC+1NC, Lock monitor circuit: 1NC Main circuit ⁽²⁾ : 1NC+1NC	With	_	With	HS1E-K844MSR-②-□		
		PG13.5 With	_	With	HS1E-K840MSRP-□		
	Main circuit $0: \ominus 1$ $1 \leftarrow 2$ Main circuit $0: \ominus 3$ 4 Monitor circuit: $5 \leftarrow 6$		With	_	With	HS1E-K844MSRP-②-□	

• Specify a key number in place of □ in the Part No. (T001 to T030)

• Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.

• Specify an indicator color code in place of 2 in the Part No.

G: green, R: red

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

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

Actuator / Key Wrench for TORX Screws

Name	Specification	Part No.	Ordering No.	Package Quantity
Straight Actuator		HS9Z-A1S	HS9Z-A1S	
Right-angle Actuator		HS9Z-A2S	HS9Z-A2S	
Angle Adjustable Actuator (for hinged door)		HS9Z-A3S	HS9Z-A3S	1
Key Wrench for TORX Screws		HS9Z-T1	HS9Z-T1	
Conduit Port Plug		HS9Z-P1	HS9Z-P1	
Locking Ring for Gland	M20 thread	HW9Z-NM20	HW9Z-NM20PN05	5

• When using M20 size gland, order locking ring HW9Z-NM20 separately.

Part No. Development H S 1 E - K 8 4 4 MS R P - R - T001



* Retention force for horizontal direction (parallel to the mounting panel)

Ratings

Contact Ratings

Rated Insulat	300V (between LED or solenoid and ground: 60V)					
Rated Thermal Current (Ith)						
Rated Voltage (Ue)				30V	125V	250V
Rated Current (le) (Note)	Main Circuit		Resistive load (AC-12)	—	2.5A	1.5A
		AC	Inductive Load (AC-15)	—	1.5A	0.75A
		Circuit	Resistive load (DC-12)	2.5A	1.1A	0.55A
		DC	Inductive Load (DC-13)	2.3A	0.55A	0.27A

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

(Applicable lange is subject to operating conduct					
TÜV rating	UL/c-UL rating				
AC-15 250V/0.5A	250V AC/0.5A Pilot Duty				
DC-13 125V/0.22A	30V DC/1.0A Pilot Duty				
AC-15 240V/0.75A	240V AC/0.75A Pilot Duty				
DC-13 30V/2.3A	C300				
	Q300				
CCC rating					
AC-15 240V/0.75A					
DC-13					
301//2 34					

Solenoid

Model	HS1F-K
Rated Voltage	24V DC (100% duty cycle)
Rated Current	206 mA
Coil Resistance	116Ω (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

Specifications

Applicable Standards	ISO14119, EN1088 IEC60947-5-1, EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved), UL508 (UL listed) CSA C22.2 No.14 (c-UL listed) GB14048.5 (CCC approved) IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature	-20 to 40°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 (between LED or solenoid and grounding: 2.5 kV)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 M Ω minimum Between live metal part and ground: 100 M Ω minimum Between live metal parts: 100 M Ω minimum Between terminals of the same pole: 100 M Ω minimum
Electric Shock Protection	Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Damage limits: 1000 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	11 mm minimum
Direct Opening Force	20N minimum
Actuator Retention Force	3000N minimum (GS-ET-19) (2800N in the direction vertical to the mounting panel)
Operating Frequency	900 operations per hour
Mechanical Life	1,000,000 operations minimum (GS-ET-19) 30,000 operations minimum (key operation)
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100mA, operating frequency 900 operations per hour)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)
Weight (approx.)	500g

Indicator

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

• The lens cannot be replaced.

Example of Safety Circuit + Monitoring using 3-circuit Interlock Switches (safety category 3)

Before operation of the following circuit, it is recommended for the entire safety-related system to undergo a third party evaluation.



N1 (–)

Dimensions



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:

The actuator cover lightly touches the interlock switch.

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

Actuator Dimensions

Straight Actuator (HS9Z-A1S)

Right-angle Actuator (HS9Z-A2S)



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



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 \bigcirc \bigcirc

Actuator Cover

Actuator

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0

Door Stop

Circuit Diagrams and Operating Characteristics

Spring Lock

HS1E-K84 MSR-* (Main Circuit: 1NC+1NC, 1NC+1NC, Monitor Circuit: 1NC)

	-	01-1	01-1-1-0	01-10	01-1	01-1 5	01-1-1-0
		Status 1	Status 2	Status 3	Status 4	Status 5	Status 6
Interlock Switch Status		 Door closed Key is installed Solenoid de-energized 	 Door closed Key is installed Solenoid energized 	 Door closed Key is removed Solenoid energized 	 Door open Key is removed Solenoid de- energized 	 Door open Key is removed Solenoid de-energized 	 Door closed Key is removed Solenoid de-energized
Door				a a a a a a a a a a a a a a a a a a a		o o o o o o o o o o o o o o o o o o o	Co Co
Circuit Diagram			$\begin{array}{c} \begin{array}{c} \begin{array}{c} \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \end{array} \\ \end{array} $	CO (+) C (-) 7 C 2 3 C 2 3 C 4 5 C 6 Removing the key maintains the switch in OFF status	(1) 2 3 5 6 6 7 1 6 7 8 1 6 7 8 1 6 7 8 1 6 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 7 8 8 7 8 8 7 8 8 7 8 8 8 8 8 8 8 8 8 8 8 8 8	(+) (-) (-) (-) (-) (-) (-) (-) (-) (-) (-	$\begin{array}{c} \hline \begin{array}{c} \hline \\ \hline $
Contact Configuration Door Monitor Lock Monitor (Actuator inserted) (Solenoid OFF) (+)	Main Circuit	1-2, 3-4: Closed	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open
T 2 Main Circuit 0:⊙ 1 2 Main Circuit 0:⊙ 3 4 Monitor Circuit: 5	Monitor Circuit	5-6: Closed	5-6: Open	5-6: Open	5-6: Open	5-6: Open	5-6: Open
Solenoid Power		7-8: Power OFF	7-8: Power ON	7-8: Power ON	7-8: Power OFF	7-8: Power OFF	7-8: Power OFF
Remarks		 Door locked Key retained Machine ready to operate 	 Door locked Key removable Machine cannot operate 	 Door can be opened Machine cannot operate 	Machine cannot operate	Machine cannot operate	 Door can be opened Machine cannot operate

• Main circuit: Connected to the machine drive control circuit, sending interlock signals to the protective door.

• Monitor circuit: Sends ON/OFF signals of the main circuit and monitoring signals of open/closed status of the protective door.

Operation Characteristics (reference)



	e operation	c a	racteri	stics	s	0	t	e co	ntact	status	е	n t	е
act	uator enters	into	t e ce	enter	o 1	t	е	entr	slot.				
	e circuit No.	12	41 an	d 22		1 a	ıre	inter	conn	ected.	Use	circ	ui
11	42 and 21	2	or sa	et	cir	cui	ts.						

Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and establish a safety circuit which satisfies the requirement of the safety category.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- For HS1E-K, do not apply excessive force to the locked key. Applying force to the key may interfere with solenoid operation, resulting in a failure to unlock. Also, applying a torque larger than 1.8 N·m to the key results in damage.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switch in a dusty, humid, or organicgas atmosphere.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the interlock switch temperature rises to approximately 115°C. Do not touch to prevent burns. If cables come into contact with the interlock switch, use heat-resistant cables.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.
- Actuator retention force is 3000N (static load). When larger force is expected, add a system using interlock switch without lock (ex. HS5D) and sensor in order to detect door opening and to stop the machine.

Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown on the right. For the doors with small minimum radius, use angle adjustable actuators (HS9Z-A3S).
- Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where the human body may come into contact. Otherwise injury may occur.

HS9Z-A2S Actuator (w/rubber cushions)

• 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-A3S Actuator

- When the door hinge is on the extension line of the interlock switch surface: 50mm
- When the door hinge is on the extension line of the actuator mounting surface: 80mm
 HS97-A3S



Actuator Angle Adjustment

- \bullet Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- Recommended tightening torque of angle adjustable screw: 0.8 $N{\cdot}m$
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not move.

Instructions

Mounting Examples

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



Manual Unlocking by Hostage Key (HS1E-K)

Interlock Switch

The HS1E-K has a hostage key for manual unlocking of the actuator to precheck proper entry of the actuator into the slot as well as for emergency use such as a power failure.

• Remove the screw located on the front of the interlock switch using the special wrench supplied with the interlock switch. Insert a small screwdriver into the hole to push the lever inside the interlock switch away from the hostage key until the key is unlocked.



-IS9Z-A1S Actuator

- Turn the hostage key to UNLOCK side to unlock the actuator as shown on the right.
- Note: Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch is lost. After unlocking, install the screw.

Opening/Closing the Cover (HS1E-K)



For safety, make sure that the power is turned off before opening or closing the cover.

- When opening the interlock switch cover, remove the screws of the cover only. Do not remove other screws, otherwise failure of interlock switch will be caused.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.
- When wiring, make sure that any liquid such as water and oil does not enter the interlock switch.
- Close the cover in the following method.
- 1. Turn the key to LOCK position.
- 2. Close the door (actuator is inserted).
- Turn the white plastic part in the interlock switch clockwise until the plastic part comes to the position shown in the figure below.
- 4. Close the cover and tighten the screws to the appropriate torque.



Instructions

Applicable Crimping Terminal



- Use an insulation tube on the crimping terminal.
- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

Applicable Wire Size

• 0.5 to 1.25 mm²

Applicable Cable Glands

• Use IP67 cable gland. When using M20-size cable gland, use locking ring HW9Z-NM20.



When Using Flexible Conduits (Example)

• Flexible conduit example: VF-03 (Nihon Flex)

Conduit Port Size	Plastic Cable Gland	Metal Cable Gland
G1/2	_	RLC-103 (Nihon Flex)
PG13.5	—	RBC-103PG13.5 (Nihon Flex)
M20 (Note 1)	—	RLC-103EC20 (Nihon Flex)

When Using Multi-core Cables (Example)

Conduit Port Size	Plastic Cable Gland	Metal Cable Gland
G1/2	SCS-10* (Seiwa Electric)	ALS-16** (Nihon Flex)
PG13.5	ST13.5 (K-MECS)	ABS-**PG13.5 (Nihon Flex)
M20 (Note 1)	ST-M20X1.5 (K-MECS) (Note 2)	ALS-**EC20 (Nihon Flex)

• Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

- Note 1: When using M20 cable gland, order HW9Z-NM20 locking ring and replace with the locking ring installed in the HS1E interlock switch.
- Note 2: When using ST-M20X1.5 cable gland, use together with a gasket (Part No.: GPM20, K-MECS).

Recommended Tightening Torque of Mounting Screws

- Interlock switch: 3.2 to 3.8 N·m (three M5 screws)
- Lid mounting screw: 0.9 to 1.1 N·m (M4 screw)
- Terminal screw: 0.9 to 1.1 N·m (M3.5 screw)
- Connector: 2.7 to 3.3 N·m
- Actuators
 HS9Z-A3S: 4.5 to 5.5 N⋅m (two M6 screws)
 HS9Z-A1S/A2S: 2.7 to 3.3 N⋅m (two M5 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- Mounting bolts must be provided by the users.
- 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.

Conduit Port Opening

- Make an opening for wire connection by breaking one of the conduit-port knockouts on the interlock switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block or other parts inside the interlock switch.
- Cracks or burrs on the conduit entry may deteriorate the housing protection against water.
- When changing to another conduit port, close the unused opening with an optional plug (Part No.: HS9Z-P1).



HS1B/HS2B Interlock Switches

Machine stops when the door is opened.

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





Parts and Functions



Interlock Switch

Model	Contact Configuration	Indicator	Part No.
	1NC-1NO	—	HS1B-11R
	3 - 4 + 2 1 - 2	With	HS1B-114R-*
	$2NC$ $3 \xrightarrow{Zb} 4 \bigoplus $ $1 \xrightarrow{Zb} 2 \bigoplus$	—	HS1B-02R
		With	HS1B-024R-*
Цеор	1NC-1NO	_	HS2B-11NB
HS2B	$3 \xrightarrow{4} 4 \xrightarrow{3} 1 \xrightarrow{2} 2$	With	HS2B-114NB-*

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

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

Contact Ratings

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

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

Specifications

-	
Applicable Standards	ISO14119 EN1088 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-15 (TÜV approved) UL508 (UL listed) CSA (22.2 No.14 (c-UL listed) IEC 60204-1/EN 60204-1 (applicable standards for use)
Applicable Directive	2006/95/EC (Low Voltage Directive) and 2006/42/EC (Machinery Directive)
Operating Temperature	–20 to 70°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Impulse Withstand Voltage	4 kV
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 M Ω minimum Between live metal part and ground: 100 M Ω minimum Between live metal parts: 100 M Ω minimum Petween compared the same pale: 100 M Ω minimum
	between terminals of the same pole. Too M2 minimum
Electric Shock Protection	HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140)
Electric Shock Protection Degree of Protection	HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) HS2B: Class II (IEC 61140)
Electric Shock Protection Degree of Protection Shock Resistance	HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ²
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance	HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed	HS1B: Class I (IEC 61140) HS2B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel	HS1B: Class I (IEC 61140) HS2B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel Direct Opening Force	HS1B: Class I (IEC 61140) HS2B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum HS1B, HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel Direct Opening Force Operating Frequency	Between terminals of the same pole. 100 Mt2 minimum HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum HS1B, HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum 900 operations per hour
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel Direct Opening Force Operating Frequency Mechanical Life	HS1B: Class I (IEC 61140) HS2B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 H2, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum HS1B, HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum 900 operations per hour 1,000,000 operations minimum (GS-ET-15)
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel Direct Opening Force Operating Frequency Mechanical Life Electrical Life	Between terminates of the same pole. 100 Ms2 minimum HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s ² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum 900 operations per hour 1,000,000 operations minimum (GS-ET-15) 100,000 operations minimum (operating frequency 900 operations per hour, load AC-12, 250V, 6A)
Electric Shock Protection Degree of Protection Shock Resistance Vibration Resistance Actuator Operating Speed Direct Opening Travel Direct Opening Force Operating Frequency Mechanical Life Electrical Life Conditional Short-circuit Current	Between terminals of the same pole. 100 Ms2 minimum HS1B: Class I (IEC 61140) HS2B: Class II (IEC 61140) IP67 (IEC 60529) Damage limits: 1000 m/s² Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm 0.05 to 1.0 m/s 11 mm minimum HS1B, HS2B (without actuator retaining mechanism): 20N minimum HS2B (with actuator retaining mechanism): 36N minimum 900 operations per hour 1,000,000 operations minimum (GS-ET-15) 100A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)

Actuators, Special Key Wrench, and Plug

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

HS1B/HS2B Interlock Switches

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

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

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

• The lens cannot be replaced.

Part No. Development HS1B



HS2B



HS1B/HS2B Interlock Switches

		Status 1	Status 2	
Interlock Switch Status		 Door closed Machine ready to operate 	 Door open Machine cannot be started 	
Door				
HS1B-11 HS2B-11 (1NC-1NO)	Circuit Diagram	⊖ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕ ⊕	Aain Circuit Monitor Circuit	
Main Circuit		3-4: Closed	3-4: Open	
	Monitor Circuit	1-2: Open	1-2: Closed	
HS1B-02 (2NC)	Circuit Diagram	The LED indicator termina status, and thus can be we	al is independent of door irred as necessary.	
	Main Circuit	3-4: Closed	3-4: Open	
	Monitor Circuit	1-2: Closed	1-2: Open	

Circuit Diagram and Operating Characteristics

Dimensions

HS1B using the Straight Actuator (HS9Z-A1)



Mounting Hole Layout

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





Mounting Hole Layout

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

* Actuator center position

Conduit

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Port G1/2

HS1B/HS2B Interlock Switches

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HS2B using the Straight Actuator (HS9Z-A1)



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

(Horizontal Mounting)



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



Right-angle Actuator HS9Z-A2





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



Mounting Hole Layout

(Vertical Mounting)

(Vertical Mounting)

54.3

13.8

RP

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Interlock Switch

Mounting Hole Layout





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Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and establish a safety circuit which satisfies the requirement of the safety category.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The HS1B cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.

Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use the angle adjustable actuator (HS9Z-A3).
- Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where the human body may come into contact. Otherwise injury may occur.

When using the HS9Z-A2 Right-angle Actuator

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



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



When using the Angle-adjustable HS9Z-A3 Actuator

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



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



HS1B/HS2B Interlock Switches

Instructions

Mounting Examples

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



Applicable Crimping Terminal

HS1B

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

Use Crimping Terminal 2 for the ground terminal. HS2B

Use Crimping Terminal 1 for all terminals.



• Use an insulation tube on the crimping terminal.



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

Applicable Cable Glands

• Use IP67 cable gland.



When Using Flexible Conduits (Example)

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

When Using Multi-core Cables (Example)

- Plastic cable gland:
 - (G1/2) SCS-10* (Seiwa Electric)
- Metal cable gland: (G1/2) ALS-16 (Nihon Flex)
- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

Applicable Wire Size

• 0.5 to 1.25 mm² (AWG20 to AWG16)

Recommended Tightening Torque of Mounting Screws

- Interlock Switches HS1B: 4.5 to 5.5 N·m (two M5 screws) HS2B: 3.2 to 3.8 N·m (two M6 screws)
- Terminal screw: 0.9 to 1.1 N·m (M3.5 screws)
- Actuators (HS9Z-A1/A2/A3)
- 4.5 to 5.5 N·m (two M6 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.

Conduit Port Opening (HS2B)

- The HS2B has three conduit ports, which are molded without opening.
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the interlock switch housing using a screwdriver.



- When breaking the conduit port, take care not to damage the contact block and other parts inside the housing.
- Cracks or burrs on the conduit entry may deteriorate the housing protection against water.
- When changing to another conduit port, close the unused opening with an optional plug (Part No.: HS9Z-P1).

HS1C Interlock Switches with Solenoid

The guard door remains locked until the machine stops completely.

- With the actuator mounted on the guard door and the interlock switch on the machine, the door is mechanically locked when closed.
- The door is unlocked by a solenoid lock-release signal from a PLC or another source after the machine has stopped, ensuring higher safety.
- In the event of power failure or for machine maintenance, the door can be unlocked using a special tool.
- Flexible installation: The actuator can be inserted into two directions.
- Select from four different circuit configurations.
- IP67 rated rugged die-cast aluminum housing.





Parts and Functions



HS1C Interlock Switches with Solenoid

Interlock Switch

		1
Contact Configuration	Solenoid Unit Location	Part No.
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NO/1NO	Right	HS1C-R44R-@
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NO	Right	HS1C-R144R-@
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NC+1NC	Right	HS1C-R244R-@
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NC	Right	HS1C-R344R-@

- The contact configurations show the contact status when the actuator is inserted and locked.
- The HS9Z-T1 special key wrench for removing the cover and manual unlocking is supplied with the interlock switch.
- Specify an indicator color in place of (2) in the Part No.
- G: green, R: red
- The solenoid unit installed on the left can be made upon request.
- Actuators are not supplied with the interlock switch, and must be ordered separately.

Actuators/Key Wrench/Screwdriver for TORX Screws

Description	Part No.
Straight Actuator	HS9Z-A1
Right-angle Actuator	HS9Z-A2
Angle Adjustable Actuator (mainly for hinged doors)	HS9Z-A3
Special Key Wrench for TORX	HS9Z-T1

Part No. Development



Contact Ratings

Rated Insulation Voltage (Ui)			300V (between LED or solenoid and ground: 60V)			
Rated Thermal Current (Ith)		Main circuit: 10A Auxiliary circuit: 3A				
Rated Volta	Rated Voltage (Ue)		30V	125V	250V	
		AC	Resistive load (AC-12)	10A	10A	6A
Main Circuit	Main		Inductive Load (AC-15)	10A	5A	ЗA
	D 0	Resistive load (DC-12)	6A	_	_	
Rated	Rated Current (Ie) (Note)	DC	Inductive Load (DC-13)	ЗA	0.9A	_
(le) (Note)		AC	Resistive load (AC-12)	—	ЗA	ЗA
Auxiliar	Auxiliary		Inductive Load (AC-15)	—	—	ЗA
	Circuit	Circuit DC	Resistive load (DC-12)	ЗA	_	_
			Inductive Load (DC-13)	—	0.9A	_

 Minimum applicable load (reference value): 3V AC/DC, 5 mA Note: Ratings approved by safety agencies: A300: AC-15 3A/250V

Solenoid Unit

Rated Voltage	24V DC (100% duty cycle)
Rated Current	415 mA
Coil Resistance	58Ω (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 B

Indicator

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

• The lens cannot be replaced.

Specifications

Applicable Standards	ISO14119, EN1088, IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL listed) GSA C22.2 No.14 (c-UL listed) GB14048.5 (CCC approved)		
	IEC 60204-1/EN 60204-1 (applicable standards for use)		
Operating Temperature	-20 to 50°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 (between LED, solenoid and ground: 2.5 kV)		
Insulation Resistance (500V DC megger)	$\begin{array}{llllllllllllllllllllllllllllllllllll$		
Electric Shock Protection	Class I (IEC 61140)		
Degree of Protection	IP67 (IEC 60529)		
Shock Resistance	Damage limits: 1000 m/s ²		
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum		
Actuator Operating Speed	0.05 to 1.0 m/s		
Direct Opening Travel	11 mm minimum		
Direct Opening Force	20N minimum		
Actuator Retention Force	1500N 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, load AC-12, 250V, 6A) 1,000,000 operations minimum (operating frequency 900 operations per hour, load 24V AC/DC, 100mA)		
Conditional Short-circuit Current	100A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)		
Weight (approx.)	660g		

Dimensions

HS1C-R44-R when using the Straight Actuator (HS9Z-A1)



Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch. • Use four mounting screws to mount the interlock switch according to the mounting hole layout.

HS1C-R44-R when using the Right-angle Actuator (HS9Z-A2)





* Actuator center position

* Actuator center position

Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch. • Use four mounting screws to mount the interlock switch according to the mounting hole layout.

Actuator Dimensions Straight Actuator HS9Z-A1



Right-angle Actuator HS9Z-A2



Angle-adjustable Actuator HS9Z-A3



and used when adjusting the actuator position. Remove the actuator cover and actuator stop film after the actuator position is determined.
Circuit Diagrams and Operating Characteristics HS1C-U4UUR-* (Main Circuit: 1NC+1NC, Monitor Circuit: 1NO/1NO)

	Status 1	Status 2	Status 3	Status 4
Interlock Switch Status	 Door closed Machine ready to operate Solenoid de-energized Solenoid energized Solenoid energized 		 Door open Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid de-energized
Door				
Circuit Diagram	$\begin{array}{c} & & \\$	$\begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \begin{array}{c} & \end{array} \\ \\ & \end{array} \\ & \end{array} \\ & \end{array} \\ & \begin{array}{c} & \end{array} \\ & \end{array} \\ & \end{array} \\ & \end{array} \\ \\ & \end{array} \\ \\ & \end{array} \\ & \end{array} \\ & \end{array} \\ \\ & \end{array} \\ \\ \\ & \end{array} \\ \\ & \end{array} \\ \\ \\ & \end{array} \\ \\ & \end{array} \\ \\ \\ \\$	$\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ & & & & \\ &$	Contacts are linked to the solenoid mechanically.
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Closed	1-2: Closed	1-2: Closed
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF

HS1C-□14□□R-* (Main Circuit: 1NC+1NC, 1NC+1NC, Monitor Circuit: 1NO)

	Status 1	Status 2	Status 3	Status 4
Interlock Switch Status	 Door closed Machine ready to operate Solenoid de-energized 	 Door closed Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid de-energized
Door				
Circuit Diagram	$\begin{array}{c} & 1 \\ & 1 \\ & 2 \\ & 0 \\$	$\begin{array}{c} \hline 1 \\ \hline 2 \\ \hline 9 \\$	$\begin{array}{c} \hline \\ 1 \\ 2 \\ 2 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0$	Contacts are linked to the solenoid mechanically.
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Open	1-2: Closed	1-2: Closed
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF

Main circuit: Connected to the machine drive control circuit, sending interlock signals to the protective door.
Monitor circuit: Sends ON/OFF signals of the main circuit and monitoring signals of open/closed status of the protective door.

	Status 1	Status 2	Status 3	Status 4
Interlock Switch Status	 Door closed Machine ready to operate Solenoid de-energized 	 Door closed Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid de-energized
Door				
Circuit Diagram	$\begin{array}{c} & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & &$	$\begin{array}{c} & & & \\$	$\begin{array}{c c} & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & & \\ & & & \\ &$	$\begin{array}{c} \hline \\ 1 \\ 2 \\ 2 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1 \\ 1$
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Closed	1-2: Open	1-2: Open	1-2: Open
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF

HS1C-02400R-* (Main Circuit: 1NC+1NC, Monitor Circuit: 1NC/1NC)

HS1C-D34DDR-* (Main Circuit: 1NC+1NC, Monitor Circuit: 1NC)

	Status 1	Status 2	Status 3	Status 4
Interlock Switch Status	Switch• Door closed• Door closed• Door closed• Machine ready to operate • Solenoid de-energized• Door closed• Machine cannot be started• Mach started• Solenoid de-energized• Solenoid energized• Solenoid energized		 Door open Machine cannot be started Solenoid energized 	 Door open Machine cannot be started Solenoid de-energized
Door				
Circuit Diagram	$\begin{array}{c} & & & \\$	Contacts are linked to the solenoid mechanically.	Contacts are linked to the solenoid mechanically.	$\begin{array}{c} & & & \\$
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Closed	1-2: Closed	1-2: Open	1-2: Open
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF

Main circuit: Connected to the machine drive control circuit, sending interlock signals to the protective door.
Monitor circuit: Sends ON/OFF signals of the main circuit and monitoring signals of open/closed status of the protective door.

Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and establish a safety circuit which satisfies the requirement of the safety category.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere, or in an area subjected to direct sunlight.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch (HS1B).
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.

Actuator Angle Adjustment

- \bullet Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- \bullet Recommended tightening torque of angle adjustment screw: 0.8 N $\cdot m$
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.
- Actuator retention force is 1500N (static load). Make sure larger force is not applied. When larger force is expected, add a system using interlock switch without lock (ex. HS1B) and sensor in order to detect door opening and to stop the machine.

- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where the human body may come into contact. Otherwise injury may occur.

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 actuators (HS9Z-A3).
- 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:



HS9Z-A3 Actuator

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



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



Instructions

Mounting Examples



Manual Unlocking

The HS1C allows manual unlocking of the actuator to precheck proper entry of the actuator into the slot as well as for emergency use such as a power failure.

• Remove the screw located on the side of the interlock switch using the special wrench supplied with the interlock switch. Insert a small screwdriver into the screw hole to push the lever inside of the interlock switch toward the indicator until the actuator is unlocked.



Note: Before manually unlocking the

interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch with solenoid is lost. After unlocking, ensure to install the screw.

Applicable Crimping Terminal



• Use an insulation tube on the crimping terminal.



Terminal No. 1 to 6

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

When using Ferrules

Ferrules (Phoenix Contact)

Part No.	Applicable Wire
AI 0.75-8 GY	0.5 to 0.75 mm ²
AI 1.0-8 RD	0.75 to 1.0 mm ²
AI 1.5-8 BK	1.0 to 1.5 mm ²

Crimping Tool: CRIMPFOX UD6

Applicable Wire Size

- Terminal Nos. 1, 2, 5, 6, 7, 8: 0.5 to 0.75 mm²
- Terminal Nos. 3, 4, E: 1.0 to 1.25 mm²

Applicable Cable Glands

• Use IP67 cable gland.



When Using Flexible Conduits (Example)

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

When Using Multi-core Cables (Example)

- Plastic cable gland:
- (G1/2) SCS-10* (Seiwa Electric)
- Metal cable gland:
- (G1/2) ALS-16 (Nihon Flex)
- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

Recommended Tightening Torque of Mounting Screws

- Interlock switch: 4.5 to 5.5 N·m (four M5 screws)
- Terminal screws for terminal No. 1 to 6: 0.4 to 0.6 N·m (M3)
- \bullet Terminal screws for terminal No. 7 and 8: 0.9 to 1.1 N·m (M3.5)
- Actuator (HS9Z-A1/A2/A3): 4.5 to 5.5 N·m (two M6 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator are installed in an unremovable manner, for example using special screws, rivets, or welding the screws.

Instructions

Cable Lead-in Length and Wiring Examples

	Terminal No.	Condu	it Port
	Terminar No.	1	2
	1	30±2	45±2
	2	30±2	50±2
	3	25±2	55±2
	4	25±2	60±2
Cable Length	5	30±2	65±2
	6	30±2	70±2
	7	65±2	35±2
	8	65±2	110±2
	E	85±2	45±2
Wire Stripping Length L2 (mm)		7:	£1

Note: Wire the interlock switches according to the following examples.





When using Conduit Port 2



Note: When wiring the ground (E) terminal, connect in the solid line direction only. Do not connect in the dotted line direction.

HS1C-K Interlock Switches with Solenoid and Hostage Key

Operator's safety inside the hazardous area is ensured with the portable key. Hostage control for large system or machine applications is achieved.

- The door and key are locked during machine operation.
- The door is unlocked by removing the key, and the interruption of load circuit and control circuit are maintained.
- Ideal as a portable key for bringing into the hazardous area.
- 30 different numbers are available for key, so that neighboring switches cannot be operated by the same key.
- Flexible installation: The actuator can be inserted into two directions.
- IP67 rated rugged die-cast aluminum housing.





Interlock Switch

Contact Configuration	Solenoid Unit Location	Part No.
Main Circuit: 1NC+1NC Auxiliary Circuit: 1NC+1NC	Right	HS1C-K244R-②-□

• The contact configurations show the contact status when the actuator is inserted and locked.

- The HS9Z-T1 special key wrench for removing the cover and manual unlocking is supplied with the interlock switch.
- Specify an indicator color in place of ⁽²⁾ in the Part No. G: green, R: red
- Specify a key number in place of □.
- Actuators are not supplied with the interlock switch, and must be ordered separately.

Actuators/Key Wrench/Screwdriver for TORX Screws

Description	Part No.
Straight Actuator	HS9Z-A1
Right-angle Actuator	HS9Z-A2
Angle Adjustable Actuator (mainly for hinged doors)	HS9Z-A3
Special Key Wrench for TORX	HS9Z-T1

Part No. Development



Contact Ratings

Rated Insulation Voltage (Ui)			300V (between LED or solenoid and ground: 60V)			
Rated Thermal Current (Ith)			Main circuit: 10A Auxiliary circuit: 3A			
Rated Vo	tage (Ue)			30V	125V	250V
		Main Circuit DC	Resistive load (AC-12)	10A	10A	6A
	Main		Inductive Load (AC-15)	10A	5A	ЗA
Rated C	Circuit		Resistive load (DC-12)	6A	—	—
Current	rent		Inductive Load (DC-13)	ЗA	0.9A	—
(le)		10	Resistive load (AC-12)	—	ЗA	ЗA
(Note)	Auxiliary	AC	Inductive Load (AC-15)	—	—	ЗA
	Circuit		Resistive load (DC-12)	ЗA	—	—
	DC		Inductive Load (DC-13)	—	0.9A	_

 Minimum applicable load (reference value): 3V AC/DC, 5 mA Note: Ratings approved by safety agencies: A300: AC-15 3A/250V

Solenoid Unit

Rated Voltage	24V DC (100% duty cycle)
Rated Current	305 mA
Coil Resistance	79Ω (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 B

Indicator

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

• The lens cannot be replaced.

HS1C-K Interlock Switches with Solenoid and Hostage Key

Specifications

-	
Applicable Standards	ISO14119 EN1088 IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved)
Applicable Stalluarus	UL508 (UL listed)
	CSA C22.2 No.14 (c-UL listed)
	GB14048.5 (CCC approved)
	IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature	–20 to 40°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 (between LED, solenoid and ground: 2.5 kV)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 M Ω minimum Between live metal part and ground: 100 M Ω minimum Between live metal parts: 100 M Ω minimum Between terminals of the same pole: 100 M Ω minimum
Electric Shock Protection	Class I (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Damage limits: 1000 m/s ²
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	11 mm minimum
Direct Opening Force	20N minimum
Actuator Retention Force	1500N 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, load AC-12, 250V, 6A) 1,000,000 operations minimum (operating frequency 900 operations per hour, load 24V AC/DC, 100mA)
Conditional Short-circuit Current	100A (250V) (Use 250V/10A fast-blow fuse for short-cir- cuit protection.)
Weight (approx.)	660g

Dimensions

HS1C-K when using the Straight Actuator (HS9Z-A1)





Slot Plug

(Note)







* Actuator center position

- Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Use four mounting screws to mount the interlock switch according to the mounting hole layout.



Actuator Dimensions

Straight Actuator HS9Z-A1





Angle-adjustable Actuator HS9Z-A3



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

	Status 1	Status 2	Status 3	Status 4	Status 5	Status 6
Interlock	Door closed	Door closed	 Door closed 	Door open	Door open	Door closed
Switch	 Key is installed 	 Key is installed 	 Key is removed 	Key is removed	Key is removed	Key is removed
Status	Solenoid	Solenoid	Solenoid	Solenoid	Solenoid	Solenoid
	de-energized	eneraized	eneraized	eneraized	de-energized	de-energized
Door						
Circuit Diagram	Contact Block 1 Contact Block 1 Contact Block 2 Contact 2	Contact Block 1	Contact Block 1 2 2 4 4 4 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0	Contact Block 1 2 2 2 2 4 5 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0	Contact Block 1 vignation vigna	Contact Block 1 vyong trau von the transformed to the transformed to
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Closed	1-2: Open	1-2: Open	1-2: Open	1-2: Open	1-2: Open
Solenoid Power	5-6: Power OFF	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF
Remarks	 Door locked Key is retained (does not turn) Machine can operate 	 Door locked Key can be removed by turning Machine cannot operate 	 Door can be opened by hand Machine cannot operate 	Machine cannot operate	Machine cannot operate	 Door can be opened by hand Machine cannot operate

Circuit Diagrams and Operating Characteristics

• Main circuit: Connected to the machine drive control circuit, sending interlock signals to the protective door.

Monitor circuit: Sends ON/OFF signals of the main circuit and monitoring signals of open/closed status of the protective door.

Safety Precautions

 In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.

• If relays are used in the circuit between the interlock switch and

or sticking contacts of standard relays may invalidate the func-

tions of the interlock switch. Perform risk assessment and estab-

lish a safety circuit which satisfies the requirement of the safety

the load, consider the danger and use safety relays, since welded

category.

- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where the human body may come into contact. Otherwise injury may occur.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive force to the locked key. Applying force to the key may interfere with solenoid operation, resulting in a failure to unlock. Also, applying a torque larger than 1.8 N·m to the key results in damage.
- Regardless of the door status, the key is locked when the key is operated while the solenoid is de-energized.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- Actuator retention force is 1500N (static load). When larger force is expected, add a system using interlock switch without lock (ex. HS1B) and sensor in order to detect door opening and to stop the machine.
- If the operating atmosphere is contaminated, use a protective

cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.

- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switches in a dusty, humid, or organicgas atmosphere.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.

HS1C-K Interlock Switches with Solenoid and Hostage Key

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-A3).
- 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:
 HS97-A2 Actuator



HS9Z-A3 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



Actuator Angle Adjustment

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- Recommended tightening torque of angle adjustment screw: 0.8 N·m
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.

Mounting Examples

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



Manual Unlocking

The HS1C-K allows manual unlocking of the actuator to precheck proper entry of the actuator into the slot as well as for emergency use such as a power failure.

- Remove the screw located on the front of the interlock switch using the special wrench supplied with the interlock switch. Insert a small screwdriver into the screw hole and push the lever inside of the interlock switch away from the key until the key is unlocked (see the figure below).
- Turn the key to unlock the actuator.



Note: Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch with solenoid is lost. After unlocking, ensure to install the screw.

Applicable Crimping Terminal

• See page 112.

Applicable Wire Size

- Terminal Nos. 1, 2, 5, 6, 7, 8: 0.5 to 0.75 mm²
- Terminal Nos. 3, 4, E: 1.0 to 1.25 mm²

Applicable Cable Glands

• Use IP67 cable gland.



When Using Flexible Conduits (Example)

- Flexible conduit example: VF-03 (Nihon Flex)
- Metal gland example: (G1/2) RLC-103 (Nihon Flex)
- When Using Multi-core Cables (Example)
- Plastic cable gland:
- (G1/2) SCS-10* (Seiwa Electric)
- Metal cable gland:
- (G1/2) ALS-16 (Nihon Flex)
- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

Recommended Tightening Torque of Mounting Screws

- Interlock switch: 4.5 to 5.5 N·m (four M5 screws)
- Terminal screws for terminal No. 1 to 6: 0.4 to 0.6 N·m (M3)
- Terminal screws for terminal No. 7 and 8: 0.9 to 1.1 N·m (M3.5)
- Actuator (HS9Z-A1/A2/A3): 4.5 to 5.5 N·m (two M6 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator are installed in an unremovable manner, for example using special screws, rivets, or welding the screws.

Instructions

Cable Lead-in Length and Wiring Examples

	Terminal No.	Condu	uit Port
	Terminal No.	1	2
	1	30±2	45±2
	2	30±2	50±2
	3	25±2	55±2
	4	25±2	60±2
Cable Length	5	30±2	65±2
	6	30±2	70±2
	7	65±2	35±2
	8	65±2	110±2
	E	85±2	45±2
Wire Stripping Length L2 (mm)		7:	±1

Note: Wire the interlock switches according to the following examples.

When using Conduit Port ①



When using Conduit Port 2



Note: When wiring the ground (E) terminal, connect in the solid line direction only. Do not connect in the dotted line direction.

HS1P Interlock Plug Unit

Interlock plugs for controlling the safety in production areas.

- Ideal as a portable key for bringing into the hazardous area, or for detecting open/closed door status by chaining with a guarded door (chain must be provided by the user).
- · Removing the interlock plug maintains the interrupted status of load circuit and control circuit.
- Bayonet-style plug removal/installation ensures stability.
- Prevents intentional short-circuit with a wire on metal chip. (Double-break internal contacts achieve high safety.)
- · Solenoid type and non-solenoid type available.
- Solenoid type has a lock mechanism. Lock mechanism prevents removal of interlock plug during machine operation, and allows for removal after the machine has stopped, with solenoid energization signal.
- Manual unlocking is possible in the event of power failure or maintenance using a special tool (solenoid type only).
- Rugged die-cast aluminum housing
- UL listed, c-UL listed.



Interlock Plug Unit

Solenoid	No. of Indicators	Part No.
With colonoid (24)(DC)	2	HS1P-441-@@
With Solehold (24V DC)	1	HS1P-341-2
Without colonoid	1	HS1P-241-2
Without solehold	—	HS1P-11

• Specify an indicator color code in place of 2 in the Part No. G: green, R: red

Plug alone cannot be sold.

· Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.

· Cable length is 1m. 3m is also available upon request.

Ratings

Main Circuit

Model		HS1P-441	HS1P-341	HS1P-241	HS1P-11
Plug	Rated Insulation Voltage (Ui)	30V	250V	30V	250V
Contact	Rated Thermal Current (Ith)	5A (at 24V DC)	5A	10A (at 24V DC)	10A
	Rated Insulation Voltage (Ui)	30V	250V	_	_
Mioro	Rated Thermal Current (Ith)	5A	5A	_	_
Switch	Rated Operating Voltage (Ue)	24V DC	250V	_	_
	Rated Operating Current (Ie)	5A (resistive load)	5A (240V AC, 30V DC) (resistive load)	_	_

Solenoid Unit

Rated Voltage	24V DC (100% duty cycle)
Rated Current	260 mA
Coil Resistance	95Ω (at 20°C)
Pickup Voltage	Rated voltage × 90% 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
Power Consumption	6.3W

Indicator

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

Specifications

-	
Applicable Standards	UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed) UL498 CSA C22.2 No. 182.1 EN 1088 (applicable standards for use)
Operating Temperature	-20 to +50°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Insulation Resistance	100 MΩ minimum 500V DC megger
Contact Resistance	300 m Ω maximum (initial value at cable length 1m)
Dielectric Strength	Between live and dead metal parts: 2000V, 1 minute Between terminals of the same pole: 1000V, 1 minute
Shock Resistance	Damage limits: 1000 m/s ²
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
Operating Frequency	900 operations per hour
Mechanical Life	30,000 operations minimum
Interlock Plug Strength	Rotational strength when locked: 5 N·m
Mounting Screw	M5 × 4
Weight (approx.)	560g (HS1P-441-22) 800g (HS1P-443-22)

Part No. Development



PL2 Indicator Color G: Green, R: Red PL1 Indicator Color G: Green, R: Red Cable Length 1:1m 3:3m

4: 24V DC Blank: Without indicator

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· The lens cannot be replaced.

Dimensions

HS1P



Cable Size

• HS1P-4: VCTF 0.75 mm² (6-pin), Sheath outside diameter ø8.9 mm

- HS1P-3: VCTF 0.75mm² (5-pin), Sheath outside diameter ø8.9 mm
- HS1P-2: VCTF 1.25mm² (4-pin), Sheath outside diameter ø8.5 mm
- HS1P-1: VCTF 1.25mm² (3-pin), Sheath outside diameter ø7.8 mm

Mounting Hole Layout



Circuit Diagrams and Operating Characteristics

	With Solenoid (HS1P-4)			Without Solenoid (HS1P-2)		
Interlock Plug Unit	Interlock plug is installed	Interlock plug is installed	Interlock plug is removed	Interlock plug is removed	Interlock plug is installed	Interlock plug is installed
Status	Solenoid is de-energized	Solenoid is energized	Solenoid is energized	Solenoid is de-energized	_	_
Door						
Circuit Diagram	Interlock Plug Interlock Plug	Interlock Plug Interlock Plug	Interlock Plug To power@- PL1 PL2 Micro switch turns off when solenoid is energized.	Interlock Plug	HS1P-1 does not ha	Interlock Plug
• • •					Ground: White	
Main Circuit	White - Yellow: Closed	White - Yellow: Open	White - Yellow: Open	White - Yellow: Open	White - Red: Closed	White - Red: Open
Indicator (Note)	PL1: ON PL2: OFF	PL1: OFF PL2: ON	PL1: OFF PL2: ON	PL1: OFF PL2: OFF	ON	OFF
Solenoid Power	Red - Black: Power OFF	Red - Black: Power ON	Red - Black: Power ON	Red - Black: Power OFF	—	_
Remarks	 Interlock plug is retained (cannot turn) Machine can operate 	 Interlock plug can be removed by turning Machine cannot operate 	 Interlock plug is removed Machine cannot operate 	 Interlock plug is removed Machine cannot operate 	 Interlock plug can be removed by turning Machine can operate 	 Interlock plug is removed Machine cannot operate

Safety Precautions

- Do not install the interlock plug unit in places subject to oil or water. Electric shocks or fire hazard may be caused if the interlock plug is operated when the plug part is contaminated with oil or water.
- Interlock plug units are used to ensure the safety of operators who carry the plugs. Provide only one plug to a guard. Otherwise the hostage control function is lost, endangering the operators. Ensure complete safety management so that the function is maintained.

Instructions

- The plug of HS1P interlock plug units resemble the plug of HS2P interlock plug units, however, these plugs are not interchangeable. Do not use the plugs of other types, otherwise the interlock plug units will be damaged. The plugs can be distinguished with the handlet color.
 - HS1P: black
 - HS2P: aluminum color
- When chaining a interlock plug unit with the door, give a proper slack to the chain and do not apply excessive force to the plug. PL2 shows solenoid power ON. If excessive force is applied to the plug, especially to the direction of removing the plug, solenoid operation failure may occur even though the solenoid is energized, resulting in unlocking failure.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.
- Do not store the interlock plug units in a dusty, humid, or organic-gas atmosphere. Also avoid direct sunlight.
- The HS1P allows manual unlocking of the plug to precheck proper installation as well as for emergency use such as a power failure.
- Remove the screw located on the front of the interlock plug unit using the special wrench supplied with the unit. Insert a small screwdriver into the screw hole and push the lever inside as shown below until the key is unlocked.
- 2. Turn and remove the plug.
- 3. After unlocking, ensure to install the screw.

Interlock Plug Unit

 Make sure that the interlock plug unit is not energized when removing or installing the plug (after operating the emergency stop button shown in the circuit example shown below). Do not start or stop the machine by plug removal/installation, otherwise the interlock plug unit may fail.

[Interlock Plug Circuit Example]



Note: When using the main circuit on AC (HS1P-1, HS1P-34), connect the emergency stop switch to Line, and the interlock plug unit to Neutral.

- In order to avoid electric shocks or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock plug unit.
- Do not disassemble or modify the interlock plug unit. Also do not disable the function of interlock plug unit intentionally. Otherwise a malfunction or an accident may occur.

Installing the Interlock Plug Units

Secure the interlock plug unit using four M5 hex socket head bolts.

[Example] When installing the door using a chain

- 1. Secure the interlock plug unit on the machine using four M5 hex socket head bolts.
- 2. Secure the chain on the plug handle and the door.
- 3. Do not use a chain which is unnecessarily long, so that the door does not open wide with the plug installed.



Recommended Tightening Torque of Mounting Screws

- Interlock plug unit: 4.5 to 5.5 N·m (four M5 screws)
- Mounting bolts must be supplied by the user.
- The above recommended tightening torques of the mounting screws are the values with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.
- To avoid unauthorized or unintended removal of the interlock plug unit and the actuator, it is recommended that the interlock switch and the actuator are installed in an unremovable manner, for example using special screws, rivets, or welding the screws.

HS1C-P Interlock Plug Unit with Door Lock

Interlock plugs with door lock mechanism for high level safety management.

- Installing the actuator on the guard door and the interlock switch on the machine, the guard door can be auto-locked mechanically.
- Removing the interlock plug maintains the interrupted status of load circuit and control circuit.
- Solenoid type and non-solenoid type available
- Solenoid type has a lock mechanism. Lock mechanism prevents removal of interlock plug during machine operation, and allows for removal after the machine has stopped, with solenoid energization signal.
- Flexible installation: The actuator can be inserted into two direction.
- Rugged die-cast aluminum housing
- UL listed, c-UL listed.



Interlock Plug Unit

Solenoid	Part No.
With solenoid (24V DC)	HS1C-P44Z-2
Without solenoid	HS1C-P04Z-2

- Specify an indicator color code in place of 2 in the Part No. G: green, R: red
- Key wrench for TORX screws (HS9Z-T1) is supplied.
- Actuator is not supplied and must be ordered separately.

Actuators

Description	Part No.
Straight Actuator	HS9Z-A1
Right-angle Actuator	HS9Z-A2
Angle Adjustable Actuator (for hinged doors)	HS9Z-A3
Key wrench for TORX screws	HA9Z-T1

Ratings

Circuit `

	Model	HS1C-P44Z	HS1C-P04Z	
Main	Rated Insulation Voltage (Ui)	250V (100% duty cycle)		
Circuit	Rated Thermal Current (Ith)	10A		
	Rated Insulation Voltage (Ui)	250V		
	Rated Thermal Current (Ith)	3A		
Monitor	Rated Operating Voltage (Ue)	250V AC		
Circuit	Rated Operating Current (Ie)	0.1A 250V AC/ 30V DC (resistive load)	3A (250V AC/ 30V DC) (resistive load)	

Solenoid Unit

Rated Voltage	24V DC
Rated Current	260 mA
Coil Resistance	95Ω (at 20°C)
Pickup Voltage	Rated voltage × 90% 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
Power Consumption	6.3W

Indicator

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

• The lens cannot be replaced.



Specifications

Main Circuit		UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed) UL498 CSA C22.2 No. 182.1	
Applicable Standards	Auxiliary Circuit	UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed)	
	Applicable Standards for Use	EN 1088	
Operating T	emperature	-20 to +50°C (no freezing)	
Relative Hu	midity	45 to 85% (no condensation)	
Storage Ter	nperature	-40 to +80°C (no freezing)	
Pollution De	gree	3	
Insulation F	lesistance	100 MΩ minimum (500V DC megger)	
Contact Resistance		100 m Ω maximum (initial value)	
Dielectric Strength		Between live and dead metal parts: 2000V, 1 minute Between terminals of the same poles: 1000V, 1 minute	
Shock Resi	stance	Damage limits: 1000 m/s ²	
Vibration Resistance		Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum	
Operating F	requency	900 operations per hour (actuator, plug)	
Mechanical Life		30,000 operations minimum (actuator, plug)	
Actuator Retention Force		1500N minimum	
Interlock Plu	ug Strength	Rotational strength when locked: 5 N·m	
Mounting S	crew	M5 × 4	
Weight (app	prox.)	720g (HS1C-P44Z-2)	

Part No. Development



HS1C-P Interlock Plug Unit with Door Lock

Dimensions



Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch. • Use four mounting screws to mount the interlock switch according to the mounting hole layout.

Actuator Dimensions

Straight Actuator HS9Z-A1

Right-angle Actuator HS9Z-A2

Angle-adjustable Actuator HS9Z-A3



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

Circuit Diagrams and Operating Characteristics

With Solenoid

	Status 1	Status 2	Status 3	Status 4	Status 5
Interlock Switch Status	 Door closed Interlock plug is installed Solenoid de- energized 	 Door closed Interlock plug is installed Solenoid energized 	 Door closed Interlock plug is removed Solenoid energized 	 Door closed Interlock plug is removed Solenoid de- energized 	 Door open Interlock plug is removed Solenoid de- energized
Door					
Circuit Diagram	→	$\begin{array}{c} 1\\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	$\begin{array}{c} & & & \\$	$\begin{array}{c} & 1 \\$	Interlock Plug ⊕ picture Wicroswitch maintaines ON status when the plug is removed. 7 ⊕ 8 ⊖
Main Circuit	3-4: Closed	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Closed	1-2: Closed	1-2: Closed	1-2: Closed
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF
Remarks	 Door locked Interlock plug is retained (cannot turn) Machine can operate 	 Door locked Interlock plug can be removed by turning Machine can operate 	 Door can be opened Interlock plug is removed Machine cannot operate 	 Door can be opened Interlock plug is removed Machine cannot operate 	Machine cannot operate

Without Solenoid

	Status 1	Status 2	Status 3
Interlock Switch Status	 Door closed Interlock plug is installed 	 Door closed Interlock plug is removed 	 Door open Interlock plug is removed
Door			
Circuit Diagram	Interlock Plug 5	Interlock Plug 5 6	Interlock Plug 5
	7⊕ 8⊖	, 7⊕ X 8⊖	7⊕
Main Circuit	3-4: Closed	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Open	1-2: Closed
Remarks	 Door locked Interlock plug can be turned to remove Machine can operate 	 Door can be opened Interlock plug is removed Machine cannot operate 	 Interlock plug is removed Machine cannot operate

HS1C-P Interlock Plug Unit with Door Lock

Safety Precautions

- Do not install the interlock plug unit with door lock in the place subject to oil or water. Electric shocks or fire hazard may be caused if the interlock plug is operated when the plug part is contaminated with oil or water.
- Interlock plug units with door lock are used to ensure the safety of operators who carry the plugs. Provide only one plug to a guard. Otherwise the hostage control function is lost, endangering the operators. Ensure complete safety management so that the function is maintained.
- In order to avoid electric shocks or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock plug unit.
- Do not disassemble or modify the interlock plug unit with door lock Also do not disable the function of interlock plug unit intentionally. Otherwise a malfunction or an accident may occur.
- Do not install the actuator in a location where a human body may come into contact. Otherwise injury may occur.

Instructions

• The plug of HS1P interlock plug units resemble the HS2P plug, however, these plugs are not interchangeable. Do not use the plugs of other types, otherwise the interlock plug units will be damaged. The plugs can be distinguished with the handle color.

HS1P: black (sane as HS1C-P)

- HS2P: aluminum color
- Regardless of door types, do not use the interlock plug unit as a door stop. Install a mechanical door stop at the end of the door to protect the interlock plug unit against excessive force. If excessive force is applied to the plug, especially to the direction of removing the plug, solenoid operation failure may occur even though the solenoid is energized, resulting in unlocking failure.
- Do not apply excessive shock to the interlock plug unit when opening or closing the door. A shock to the interlock plug unit exceeding 1,000 m/s2 may cause damage to the interlock plug unit.
- Regardless of door types, do not use the interlock plug unit as a door lock. Install a separate lock using a latch or other measures.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.
- When wiring, unscrew the cover only. Unnecessary loosening of other screws may cause a malfunction of the interlock plug unit.



- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock plug unit.
- While connecting to the conduit port, prevent foreign objects from entering the interlock plug unit, such as dust and liquids.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock plug unit through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock plug unit may affect the mechanism of the interlock plug unit and cause a malfunction.
- Actuator retention force is 1500N (static load). When larger force is expected, add a system using interlock switch without lock (ex. HS1B) and sensor in order to detect door opening and to stop the machine.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock plug unit.
- Do not store the interlock plug unit in a dusty, humid, or organic-gas atmosphere.

• Make sure that the interlock plug unit is not energized when removing or installing the plug (after operating the emergency stop button shown in the circuit example shown below). Do not start or stop the machine by plug removal/installation, otherwise the interlock plug unit may fail.



- Note 1: When using the main circuit on AC, connect emergency stop switch to Line, and interlock plug unit to Neutral.
- Note 2: When using the main circuit on DC, connect to the + line with emergency stop switch first followed by the interlock plug unit.

Manual Unlocking

The HS1C-P allows manual unlocking of the actuator to precheck proper entry of the actuator into the slot as well as for emergency use such as a power failure.

- Remove the screw located on the front of the interlock plug unit using the special wrench supplied with the interlock plug unit. Insert a small screwdriver into the screw hole and push the lever inside as shown below until the key is unlocked.
- Turn and remove the plug.
- After unlocking, ensure to install the screw.



Instructions

Minimum Radius of Hinged Door

- When using the interlock plug unit 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-A3).
- 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 plug unit surface:



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



HS9Z-A3 Actuator

• When the door hinge is on the extension line of the interlock plug unit surface:



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



Actuator Angle Adjustment

- \bullet Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- Recommended tightening torque of angle adjustment screw: 0.8 $\text{N}{\cdot}\text{m}$
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.

Applicable Crimping Terminal

Terminal Nos. 7, 8

Ground Terminal: E



• Use an insulation tube on the crimping terminal



Terminal No. 1 to 6

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

When using Ferrules

Ferrules (Phoenix Contact)

Part No.	Applicable Wire
AI 0.75-8 GY	0.5 to 0.75 mm ²
AI 1.0-8 RD	0.75 to 1.0 mm ²
AI 1.5-8 BK	1.0 to 1.5 mm ²

Crimping Tool: CRIMPFOX UD6

Applicable Wire Size

- Terminal Nos. 1, 2, 5, 6, 7, 8: 0.5 to 0.75 mm²
- Terminal Nos. 3, 4, E: 1.0 to 1.25 mm²

Installing the Interlock Plug Unit

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



HS1C-P Interlock Plug Unit with Door Lock

Instructions

Applicable Cable Glands

• Use IP67 cable gland.



When Using Flexible Conduits (Example)

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

When Using Multi-core Cables (Example)

- Plastic cable gland: (G1/2) SCS-10* (Seiwa Electric)
 - (G1/2) SCS-10* (Seiwa Electric)
- Metal cable gland: (G1/2) ALS-16 (Nihon Flex)
- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.

Recommended Tightening Torque of Mounting Screws

- Interlock switch: 4.5 to 5.5 N·m (four M5 screws)
- Actuator (HS9Z-A1/A2/A3): 4.5 to 5.5 N·m (two M6 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.

Cable Lead-in Length and Wiring Examples

	Terminal	Conduit Port	
	No.	1	2
	1	30±2	45±2
	2	30±2	50±2
	3	25±2	55±2
Cable	4	25±2	60±2
Length	5	30±2	65±2
L1 (mm)	6	30±2	70±2
	7	65±2	35±2
	8		110±2
	E	85±2	45±2
Wire Stripp	ing Length	7:	±1



Note: Wire the interlock switches according to the following examples.

When using Conduit Port ${\scriptstyle \textcircled{0}}$

When using Conduit Port 2



Note: When wiring the ground (E) terminal, connect in the solid line direction only. Do not connect in the dotted line direction.

HS2P Interlock Plug Unit

Interlock plugs for controlling the safety at production sites.

- Ideal as a portable key for bringing into the hazardous area.
- Removing the interlock plug maintains the interrupted status of load circuit and control circuit.
- Bayonet-style plug removal/installation ensures stability.
- Prevents intentional short-circuit with a wire or metal chip. (Double-break internal contacts achieve high safety.)
- •ø30mm mounting hole
- Plastic housing with die-cast aluminum plug
- Terminal cover is provided as standard.
- UL listed, c-UL listed.





Interlock Plug Unit

-	
Part No.	
HS2P-1M	

Specifications

Applicable Standards	UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed) UL498 CSA C22.2 No. 182.1
	EN 1088 (applicable standards for use)
Rated Insulation Voltage (Ui)	250V
Rated Thermal Current (Ith)	10A
Operating Temperature	−20 to +50°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Insulation Resistance	100 MΩ minimum (500V DC megger)
Dielectric Strength	Between live and dead metal parts: 2000V, 1 minute Between terminals of the same poles: 2000V, 1 minute
Contact Resistance	100 m Ω minimum (initial value)
Shock Resistance	Damage limits: 1000 m/s ²
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
Operation Method	With dedicated plug
Mechanical Life	30,000 operations minimum
Operating Characteristics	Operating angle 45° Pull-out stroke 23.0mm minimum
Interlock Plug Strength	Rotation strength when locked: 3.0 N·m minimum
Weight (approx.)	150g

Dimensions



Safety Precautions

- Do not install the interlock plug unit in places subject to oil or water. Electric shock or fire hazard may be caused if the interlock plug is operated when the plug part is contaminated with oil or water.
- Interlock plug units are used to ensure the safety of operators who carry the plugs. Provide only one plug to a guard. Otherwise the hostage control function is lost, endangering the operators. Ensure complete safety management so that the function is maintained.

Instructions

- The plug of HS2P interlock plug units resemble the plug of HS1P interlock plug units, however, these plugs are not interchangeable. Do not use the plugs of other types, otherwise the interlock plug units will be damaged. The plugs can be distinguished with the handle color.
 - HS1P: black HS2P: aluminum color
 - HS2P: aluminum color
- Do not store the interlock plug units in a dusty, humid, or organic-gas atmosphere. Also avoid direct sunlight.
- Make sure that the interlock plug unit is not energized when removing or installing the plug (after operating the emergency stop button shown in the circuit example shown below). Do not start or stop the machine by plug removal/installation, otherwise the interlock plug unit may fail.

[Interlock Plug Circuit Example]



Mounting Panel Thickness and Gaskets

The HS2P interlock plug is supplied with gaskets (1.5-mmthick \times 2 and 0.5-mm-thick \times 1) and an anti-rotation ring. Adjust the number of gaskets depending on the mounting panel thickness as shown in the table below. Do not use other combination of gaskets, otherwise the interlock plug will be damaged and waterproof function will be lost.

Mounting Panel Thickness (mm)	1.5 to 2.7	2.0 to 3.2	3.0 to 4.2
	1.5t × 2	1.5t × 2	1.5t × 1
Gasket	0.51 X 1	2	0.51 × 1
Combination			

- In order to avoid electric shocks or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock plug unit.
- Do not disassemble or modify the interlock plug unit. Also do not disable the function of interlock plug unit intentionally. Otherwise a malfunction or an accident may occur.

Installing the Anti-rotation Ring

When mounting the HS2P interlock plug on a panel, align the recess on the panel and the projection of the anti-rotating ring as shown below.



Installing the Locking Ring

Using locking ring wrench OR-12 sold separately, tighten the locking ring to a torque of 1.8 to 2.2 N·m. Do not tighten with excessive force, otherwise the interlock plug will be damaged.

Applicable Crimping Terminal



- Use an insulation tube on the crimping terminal.
- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

Applicable Wire Size

• ø2.0 mm² maximum (solid wire: ø1.6mm maximum) × 2

Recommended Tightening Torque of Mounting Screws (M3.5)

● 0.9 to 1.1 N·m

Actuator with Plastic Holder

HS5 series interlock switches detect the installation/removal of grip style enabling switches.

- The actuator with plastic holder for the HS5 series interlock switches can be installed onto the HE1G/HE1G-L/ HE2G grip style enabling switches easily using the two mounting screws supplied with the actuator.
- Inserting the actuator on the grip style enabling switch into the entry slot of HS5D/HS5B/HS5E/HS5E-K interlock switch, the grip style enabling switch can be retained firmly in position.
- Using with HS5E/HS5E-K interlock switches prevent unauthorized removal of grip style enabling switches.
- Easy switching by removing/installing the grip style enabling switches can be achieved by designing the circuit to initiate automatic or manual operation when the interlock switch is installed or removed, respectively.

Actuator with Plastic Holder HS5B Interlock Switch
HS5E Interlock Switch

Description	Part No.
Actuator with plastic holder for HE1G/HE1G-L/HE2G	HE9Z-GP15

Note: The HE1G/HE1G-L/HE2G grip style enabling switches and HS5 series interlock switches are ordered separately.

Specifications

Applicable Model	HE1G/HE1G-L/HE2G Grip Style Enabling Switch HS5D/HS5B/HS5E/HS5E-K Interlock Switch
Mechanical Durability	10,000 operations
Weight (approx.)	30g

Note: Refer to the specifications of HE1G/HE1G-L/HE2G grip style enabling switches and HS5D/HS5B/HS5E/HS5E-K interlock switches.

Dimensions

When used with an HE1G/HE1G-L and HS5D/HS5B



When used with an HE1G/HE1G-L and HS5E/HS5E-K



Actuator with Plastic Holder

Instructions

Mounting

① The HE9Z-GP15 and the HE1G/HE1G-L are installed as shown in the following figure.



② Secure the actuator using the attached two screws in the direction of the arrow as shown in the following figure.



 Using the attached screws (M4 self-tapping screw × 2), secure the HE9Z-GP15 to the grip style enabling switch. Recommended tightening torgue: 1.0±0.1 N·m

Do not use excessive force to tighten the HE9Z-GP15 onto the switch, otherwise the mounting holes will become deformed and the HE9Z-GP15 cannot be secured. Prevent the screws from loosening by applying epoxy. (Recommended: LOCTITE 425, ThreeBond 1401)

Precautions for Installation

- When using the HE9Z-GP15 for safety-related equipment in a control system, refer to safety standards and regulations in each country and region to make sure of correct operation. Also, perform a risk assessment to ensure safety before starting operation of the machine.
- Read the instruction sheets for both the grip style enabling switch and interlock switch to be used.
- Insert the HE9Z-GP15 in the direction shown in the following figure only. Do not insert from any other direction. Also, do not use the slot plug attached to the interlock switch.



 See below for vertical installation. Do not install in any other direction. Also, make sure that the mounting surface is provided for the entire area of the grip style enabling switch, so that the switch does not tilt as shown below. Otherwise the HE9Z-GP15 actuator will be deformed.



- Do not install the grip style enabling switch and the interlock switch in an area subjected to vibration. Excessive vibration may cause malfunction of the switch contacts of the grip style enabling switch. Also, exposure to vibration for a long period of time can cause scratching and deformation of plastic parts.
- When installing or removing the grip style enabling switch, do not use excessive force in any direction other than shown in the following figure. Otherwise the HE9Z-GP15 actuator can become deformed or damaged.



 Make sure that the HE9Z-GP15 actuator is inserted completely into the interlock switch. Avoid any foreign objects between the actuator and interlock switch as they may interfere with the plastic spring, resulting in possible damage to the actuator.



Complete Installation

 When manually unlocking the HS5E interlock switch attached to the grip style enabling switch, bend the spiral part of the connector slightly to be able to access the manual unlock key.



- Do not apply excessive shocks to the HE9Z-GP15 when attached to the interlock switch, otherwise the actuator may be removed from the interlock switch. Also excessive shocks may result in damage or failure of the interlock switch.
- When the plastic part of the HE9Z-GP15 or the actuator is damaged or deformed, stop using immediately.
- The HE9Z-GP15 is used for HE1G/HE1G-L/HE2G grip style enabling switch and HS5D/HS5B/HS5E/HS5E-K interlock switches only. Do not use the HE9Z-GP15 for other products.
- Do not modify or disassemble the HE9Z-GP15.

Specifications and other descriptions in this brochure are subject to change without notice.

Die technischen Daten und sonstigen Beschreibungen dieser Druckschrift können ohne vorherige Ankündigung geändert werden.

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