

Think Automation and beyond...



# HS6E

Subminiature Interlock Switches with Solenoid

# HS6B

Subminiature Interlock Switches



IDEC CORPORATION

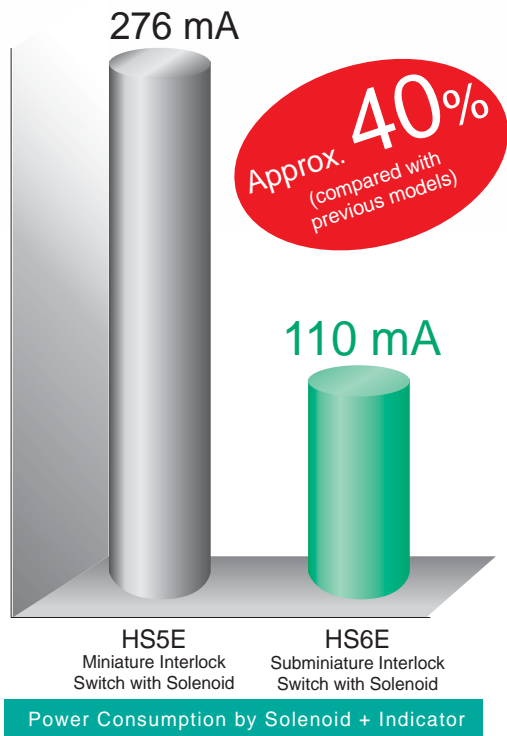
(07/03/12)

# 5-pole Subminiature Interlock Switches Thinnest Body in Its Class

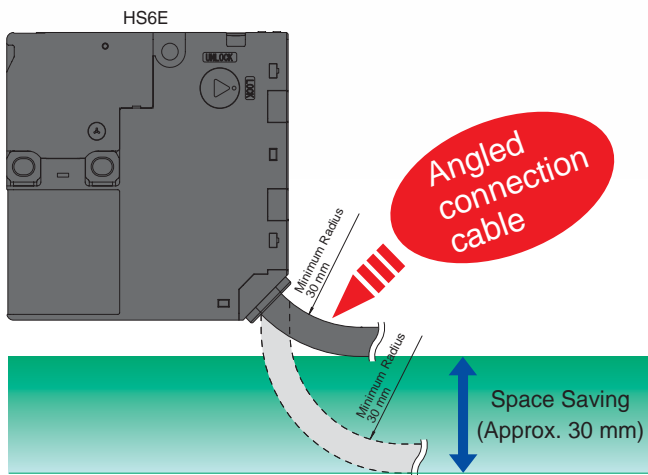


Actual Size (mm)

## Energy saving



## Space saving design with angled connection cable

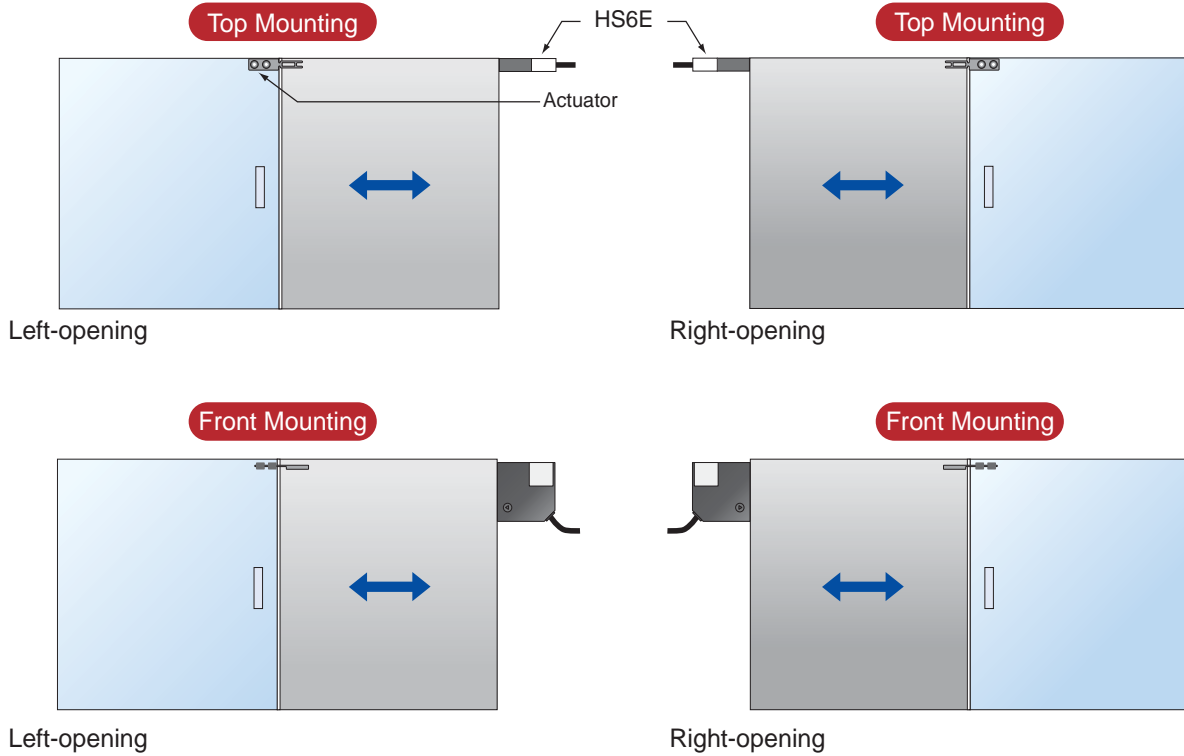


## RoHS directive compliant (2002/95/EC)

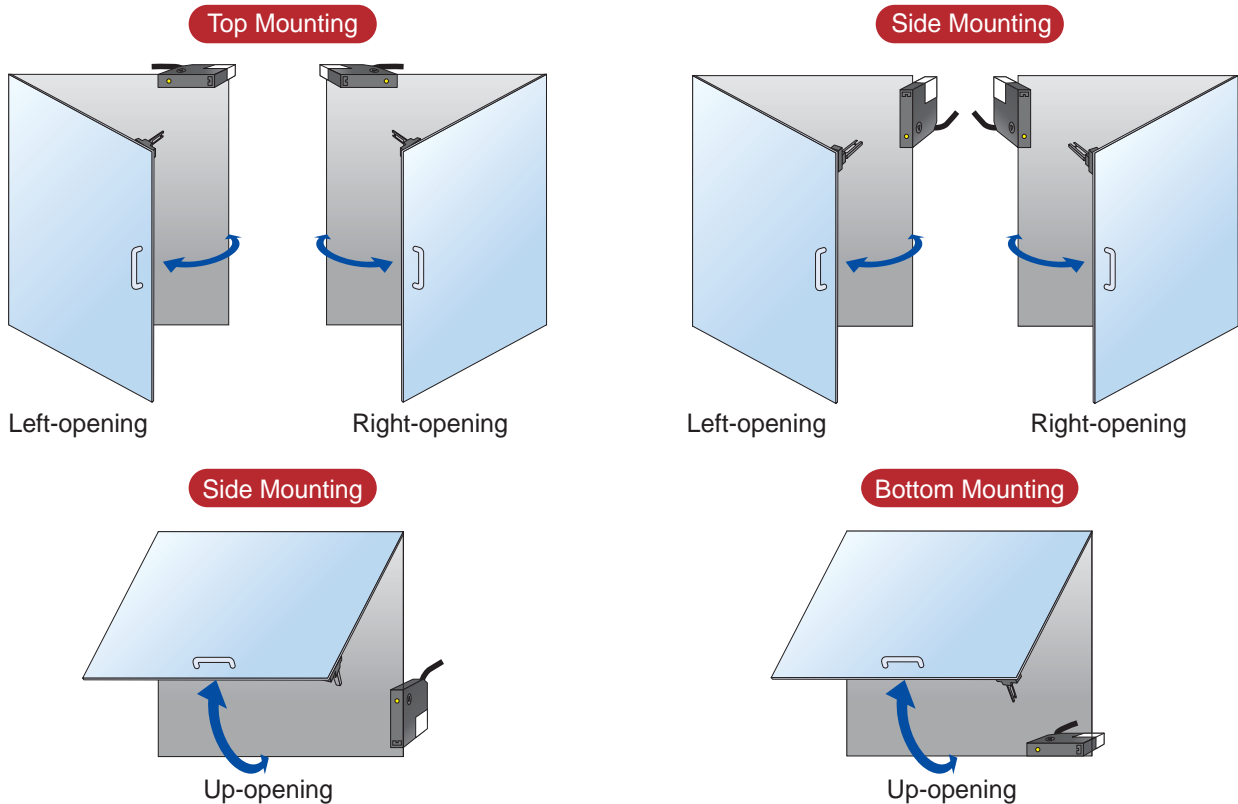
The HS6E series subminiature interlock switches with solenoid do not contain lead, cadmium, mercury, hexavalent chromium, PBB, or PBDE.

# Virtually Limitless Mounting Options

## Sliding Doors



## Hinged Doors

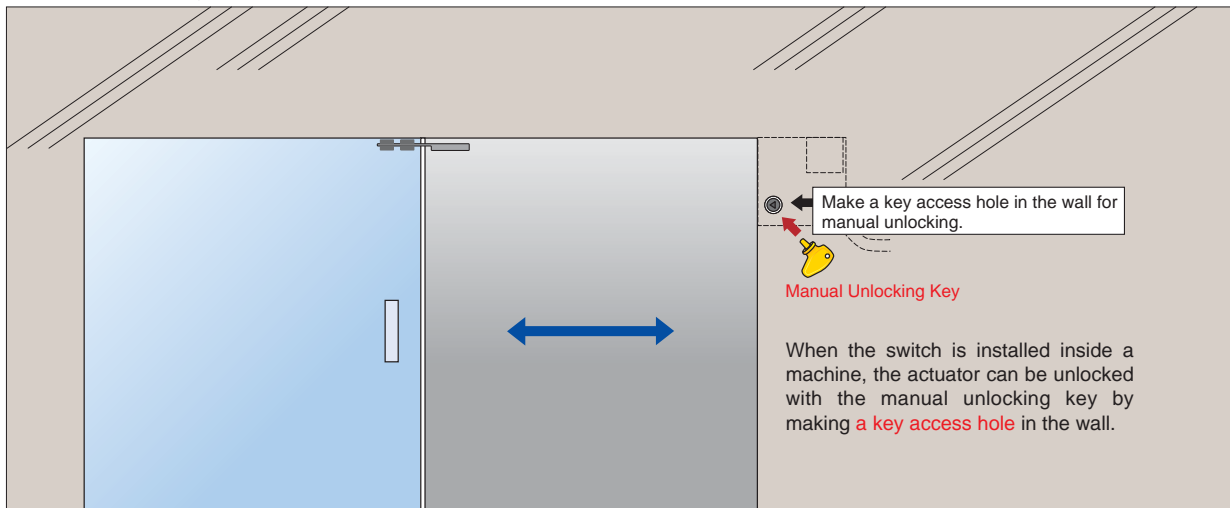


## Manual Unlocking Possible from Three Directions

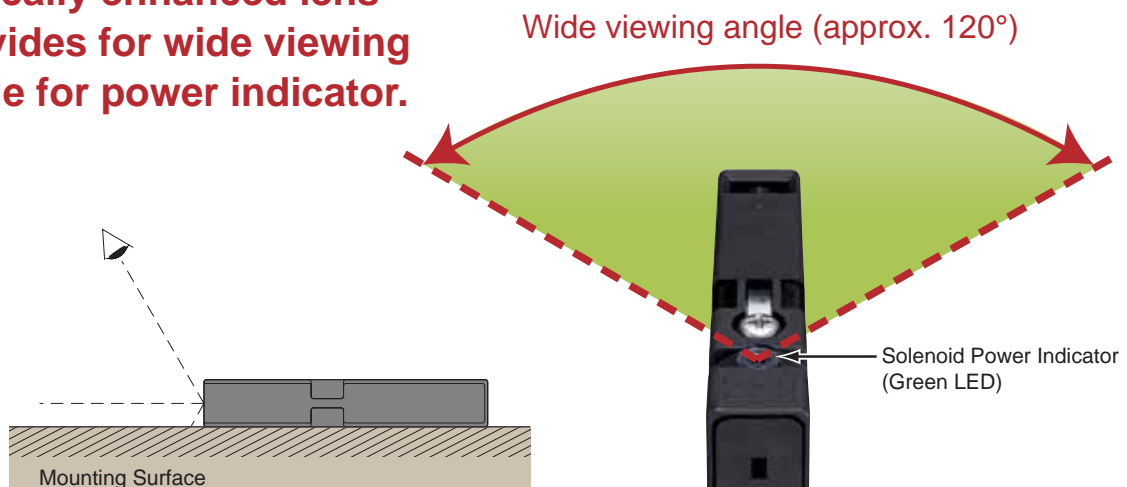
The actuator can be unlocked manually with manual unlocks on either sides of the switch body, or by depressing a plate. For details, see page 14.



When unlocking with manual unlocks



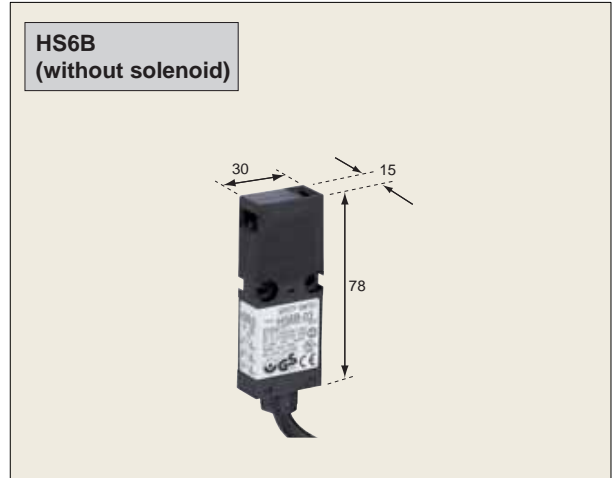
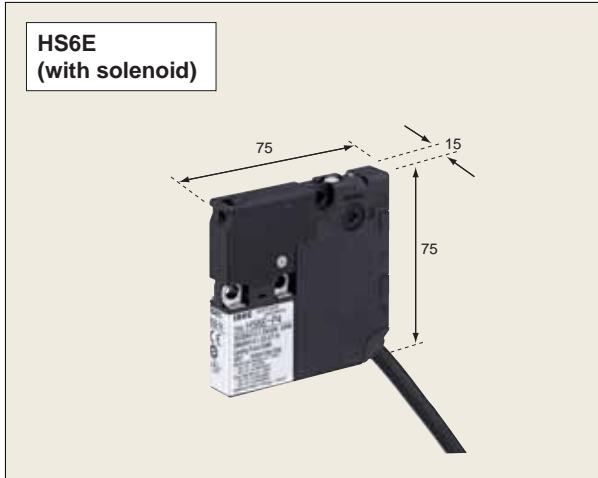
## Optically enhanced lens provides for wide viewing angle for power indicator.



# Features - HS6E and HS6B Subminiature Interlock Switches

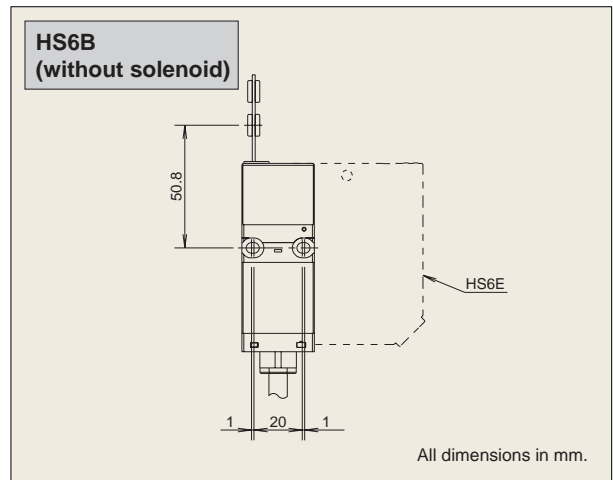
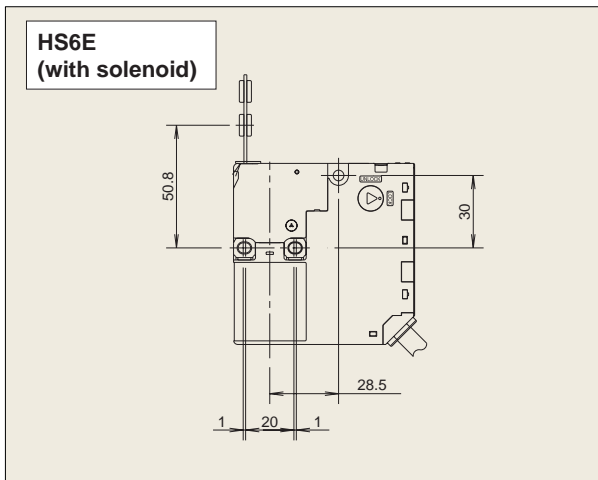
- HS6E: with solenoid, HS6B: without solenoid
- Common mounting holes - HS6E and HS6B
- Common actuators - HS6E and HS6B

## Dimensions



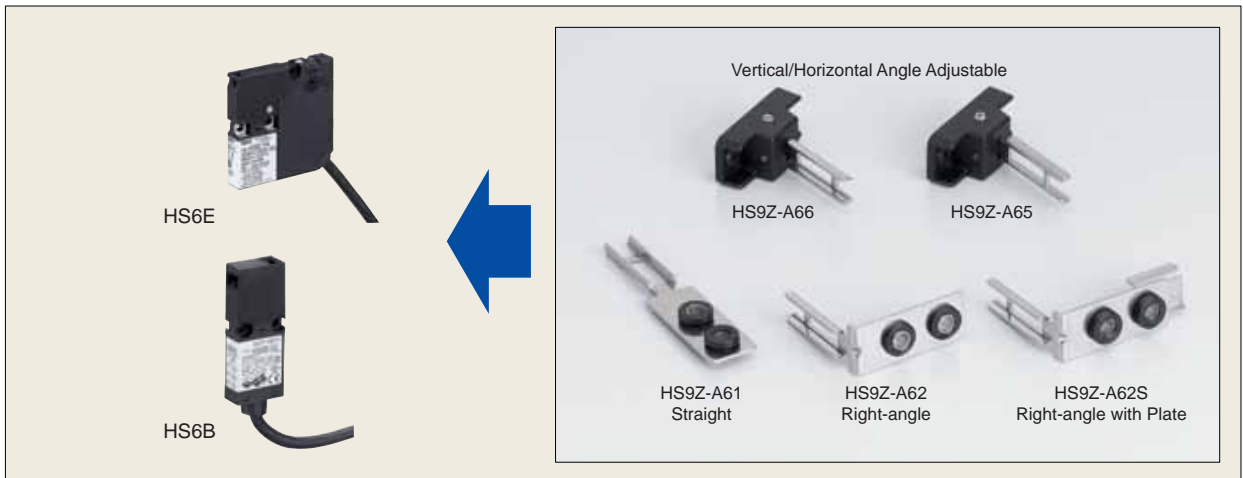
## Mounting Hole Layout

- Add one additional hole in the mounting panel for the HS6B, then the HS6E can be installed on the same panel.



## Common Actuators

- The same actuators can be used on the HS6E and HS6B.



# HS6E Subminiature Interlock Switches with Solenoid

Small interlock switch with five poles and solenoid.

Ideal for applications in tight spaces.

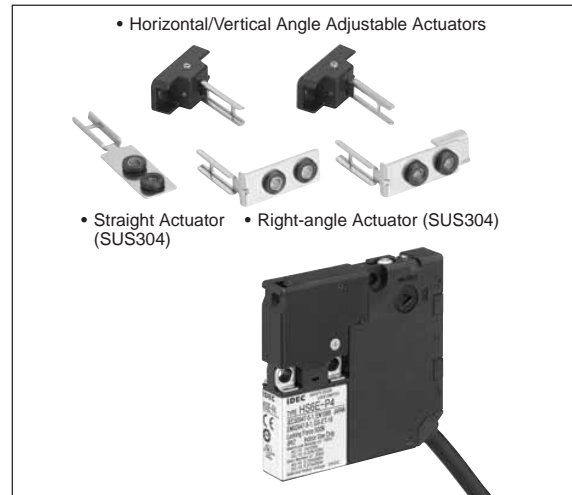
- Compact body: 75 × 15 × 75 mm  
15-mm-wide, thinnest solenoid type interlock switch in the world.
- Reversible mounting and angled cable allow four actuator insertion directions.
- Energy saving. 24V DC, 110 mA (solenoid: 100 mA, LED: 10 mA)
- Manual unlocking possible on three sides.
- RoHS compliant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

### Spring Lock Type

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

### Solenoid Lock Type

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



## Ratings

### • Contact Ratings

Rated Insulation Voltage (Ui) (Note 1)		300V (door monitor contact) 150V (lock monitor contact) 30V (between LED or solenoid and ground)				
Rated Thermal Current (Ith)		Operating temperature -25 to 35°C 2.5A (up to 2 circuits) 1.0A (3 or more circuits) Operating temperature 35 to 50°C 1.0A (1 circuit) 0.5A (2 or more circuits)				
Rated Voltage (Ue)		30V	125V	250V		
Rated Current (Ie) *	Main & Lock Monitor Circuits	AC	Resistive load (AC-12)	—	2A	—
			Inductive Load (AC-15)	—	1A	—
	DC	Resistive load (DC-12)	2A	0.4A	—	
			Inductive Load (DC-13)	1A	0.22A	—
	Door Monitor Circuit	AC	Resistive load (AC-12)	—	2.5A	1.5A
			Inductive Load (AC-15)	—	1.5A	0.75A
DC		Resistive load (DC-12)	2.5A	1.1A	0.55A	
		Inductive Load (DC-13)	2.3A	0.55A	0.27A	

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

### • Solenoid/Indicator

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



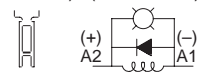
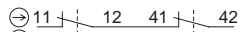
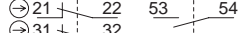
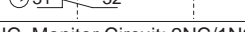
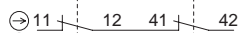
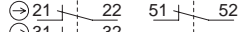
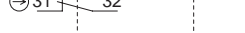

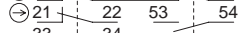
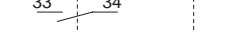

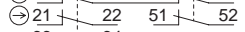
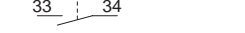
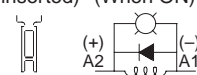
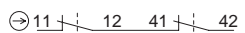
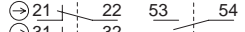
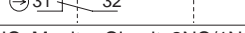

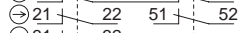
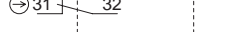
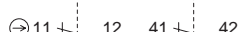
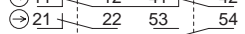


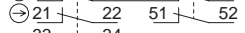
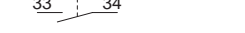
## Specifications

Applicable Standards	UL 508 (UL listed) CSA C22.2, No. 14 (c-UL listed) ISO 14119 IEC 60947-5-1 EN 60947-5-1 (TÜV approval) EN 1088 (TÜV approval) GS-ET-19 IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature	-25 to +50°C (no freezing)
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 MΩ minimum Between terminals of different poles: 100 MΩ minimum
Contact Resistance	300 mΩ maximum (initial value, 1m cable) 500 mΩ maximum (initial value, 3m cable) 700 mΩ maximum (initial value, 5m cable)
Electric Shock Protection	Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Operating extremes: 100 m/s <sup>2</sup> (10G) Damage limits: 1000 m/s <sup>2</sup> (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 <sup>2</sup> or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	200g (HS6E-***01)

# HS6E Subminiature Interlock Switches with Solenoid

## Types






### • Subminiature Interlock Switch

Lock Mechanism	Circuit Number	Contact Arrangement	Cable Length	Type No.
Spring Lock	L	(When inserted) (When OFF)  Main Circuit: 1NC+1NC, Monitor Circuit: 2NC/1NO Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-L44B01-G
		3m	HS6E-L44B03-G	
		5m	HS6E-L44B05-G	
	M	Main Circuit: 1NC+1NC, Monitor Circuit: 2NC/1NC Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-M44B01-G
			3m	HS6E-M44B03-G
			5m	HS6E-M44B05-G
	N	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NO/1NO Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-N44B01-G
			3m	HS6E-N44B03-G
			5m	HS6E-N44B05-G
	P	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NO/1NC Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-P44B01-G
			3m	HS6E-P44B03-G
			5m	HS6E-P44B05-G
Solenoid Lock	L	(When inserted) (When ON)  Main Circuit: 1NC+1NC, Monitor Circuit: 2NC/1NO Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-L7Y4B01-G
		3m	HS6E-L7Y4B03-G	
		5m	HS6E-L7Y4B05-G	
	M	Main Circuit: 1NC+1NC, Monitor Circuit: 2NC/1NC Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-M7Y4B01-G
			3m	HS6E-M7Y4B03-G
			5m	HS6E-M7Y4B05-G
	N	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NO/1NO Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-N7Y4B01-G
			3m	HS6E-N7Y4B03-G
			5m	HS6E-N7Y4B05-G
	P	Main Circuit: 1NC+1NC, Monitor Circuit: 1NC, 1NO/1NC Main Circuit:  Monitor Circuit:  Monitor Circuit: 	1m	HS6E-P7Y4B01-G
			3m	HS6E-P7Y4B03-G
			5m	HS6E-P7Y4B05-G

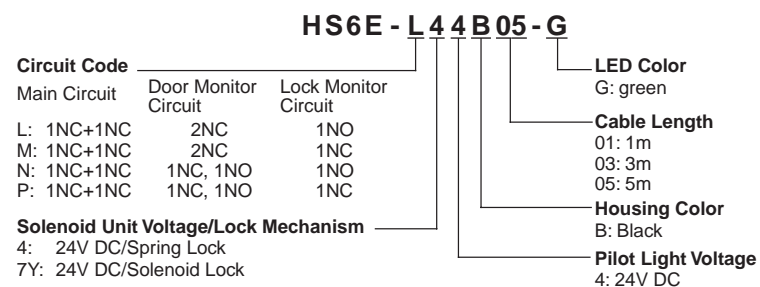
- The contact arrangements show the contact status when the actuator is inserted and locked.
- LED color is G (green) only.
- Actuators are not supplied with the interlock switch and must be ordered separately.

# HS6E Subminiature Interlock Switches with Solenoid

## • Actuator

Appearance	Ordering Type No.	Remarks
Straight Actuator 	HS9Z-A61	The tensile strength 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 tensile strength of HS9Z-A62 actuator is 100N maximum. Do no apply excessive load, otherwise the actuator may fall off the door. When tensile strength of 100N or more is required, use the HS9Z-A62S actuator.
Right-angle Actuator with Mounting Plate 	HS9Z-A62S	The tensile strength of HS9Z-A62S actuator is 500N maximum. Do no apply excessive load, otherwise the actuator may fall off the door.
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. See pages 10, 13, and 14. The tensile strength of HS9Z-A65 and HS9Z-A66 actuators is 500N maximum.
Angle Adjustable Actuator 	HS9Z-A66	

## Type No. Development



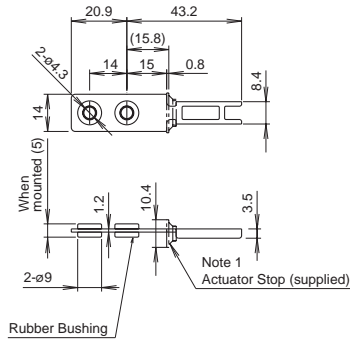




# HS6E Subminiature Interlock Switches with Solenoid

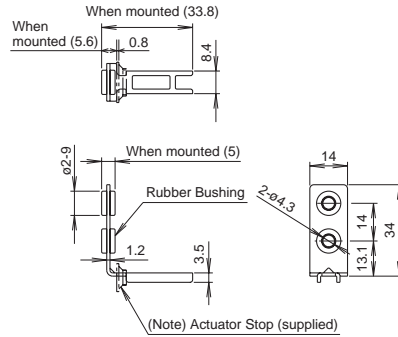
## Actuator Dimensions

### Straight Actuator (HS9Z-A61)



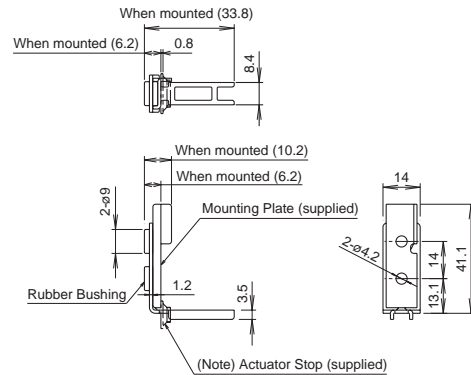
### Right-angle Actuator (HS9Z-A62)

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



### Right-angle Actuator (HS9Z-A62S)

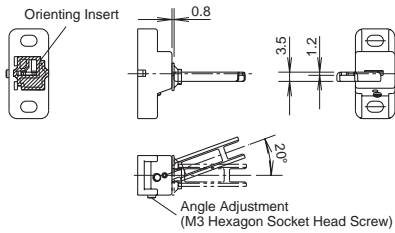
Note: See page 15 for actuator installation.



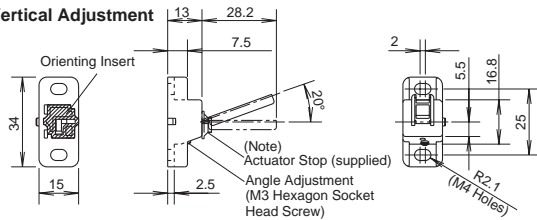
Note: The actuator stop is used to adjust the actuator position. Remove the actuator stop after the actuator position is mounted.

### Angle Adjustable Actuator (HS9Z-A65)

#### Horizontal Adjustment



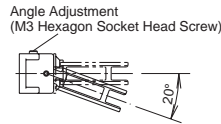
#### Vertical Adjustment



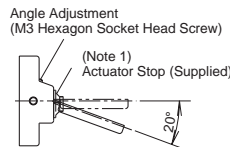
### Angle Adjustable Actuator (HS9Z-A66)

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

#### Horizontal Adjustment

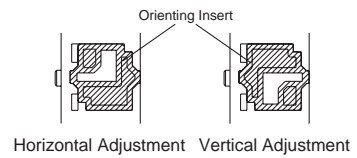


#### Vertical Adjustment



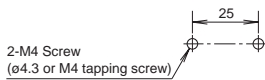
### Actuator Adjustment Orientation

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



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

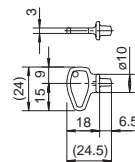
### Actuator Mounting Hole Layout (horizontal/vertical swing)



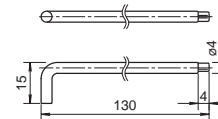
## Accessory

Description	Ordering Type No.
Manual Unlock Key (long type)	HS9Z-T3

### Manual Unlock Key (supplied) (plastic)



### Manual Unlock Key (long type) (metal)



All dimensions in mm.

# HS6E Subminiature Interlock Switches with Solenoid

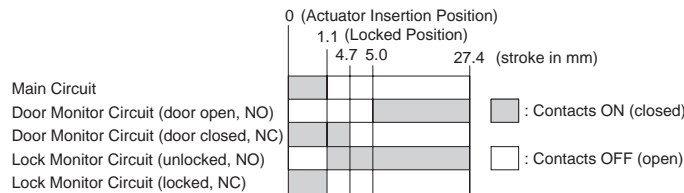
## Circuit Diagrams and Operating Characteristics

### • Spring Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Unlocking using Manual Unlock Key		
	<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine ready to operate</li> <li>Solenoid de-energized</li> </ul>	<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine cannot be operated</li> <li>Solenoid energized</li> </ul>	<ul style="list-style-type: none"> <li>Door open</li> <li>Machine cannot be operated</li> <li>Solenoid energized</li> </ul>	<ul style="list-style-type: none"> <li>Door open</li> <li>Machine cannot be operated</li> <li>Solenoid de-energized</li> </ul>		<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine cannot be operated</li> <li>Solenoid de-energized</li> </ul>	
Door Status							
Circuit Diagram (Example: HS6E-N4)							
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)		
Type No. and Circuit Diagram	<b>HS6E-L4</b>  Main Circuit: 11-12, 41-42 Door Monitor Circuit: 21-22, 53-54 Lock Monitor Circuit: 31-32, 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	<b>HS6E-M4</b>  Main Circuit: 11-12, 41-42 Door Monitor Circuit: 21-22, 51-52 Lock Monitor Circuit: 31-32, 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	<b>HS6E-N4</b>  Main Circuit: 11-12, 41-42 Door Monitor Circuit: 21-22, 53-54 Lock Monitor Circuit: 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	<b>HS6E-P4</b>  Main Circuit: 11-12, 41-42 Door Monitor Circuit: 21-22, 51-52 Lock Monitor Circuit: 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)		

Main circuit: Connected to the control circuit of machine drive part, 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 HS9Z-A62S actuator, subtract 0.6 mm.
- The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

# HS6E Subminiature Interlock Switches with Solenoid

## • Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Unlocking using Manual Unlock Key		
	<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine ready to operate</li> <li>Solenoid energized</li> </ul>	<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine cannot be operated</li> <li>Solenoid de-energized</li> </ul>	<ul style="list-style-type: none"> <li>Door open</li> <li>Machine cannot be operated</li> <li>Solenoid de-energized</li> </ul>	<ul style="list-style-type: none"> <li>Door open</li> <li>Machine cannot be operated</li> <li>Solenoid energized</li> </ul>		<ul style="list-style-type: none"> <li>Door closed</li> <li>Machine cannot be operated</li> <li>Solenoid de-energized</li> </ul>	
Door Status							
Circuit Diagram (Example: HS6E-N7Y)							
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)		
Type No. and Circuit Diagram	<b>HS6E-L7Y</b>  Main Circuit: 11-12 41-42 Door Monitor Circuit: 21-22 53-54 Monitor Circuit: 31-32	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	<b>HS6E-M7Y</b>  Main Circuit: 11-12 41-42 Monitor Circuit: 21-22 51-52 Monitor Circuit: 31-32	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	<b>HS6E-N7Y</b>  Main Circuit: 11-12 41-42 Monitor Circuit: 21-22 53-54 Monitor Circuit: 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
	<b>HS6E-P7Y</b>  Main Circuit: 11-12 41-42 Monitor Circuit: 21-22 51-52 Monitor Circuit: 33-34	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
		Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
		Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized) (Note 2)	OFF (de-energized) to ON (re-energized) (Note 1) (Note 2)		

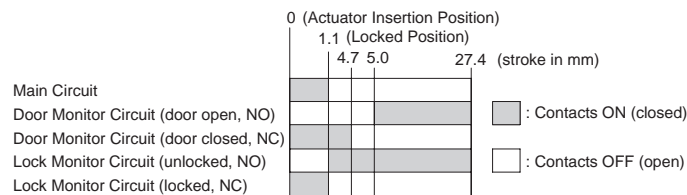
Main circuit: Connected to the control circuit of machine drive part, sending the interlock signals of the protective door.

Monitor circuit: Sends the monitoring signals of open/closed and lock/unlocked statuses of the protective door.

Note 1: Do not attempt manual unlocking while the solenoid is energized.

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

## Operation Characteristics (reference)



• The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators.

For HS9Z-A62S actuator, subtract 0.6 mm.

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

## Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wiring, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, use only safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and make a safety circuit which satisfies the requirements of the safety category.
- Do not place a PLC in the circuit between the interlock switch and the load. Safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in a location where a human body may come in contact. Otherwise injury may occur.
- Solenoid lock type 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 type must not be used in applications where locking is strictly required for safety. Perform a risk assessment and determine whether solenoid lock type is appropriate.

## 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 external force on the actuator while unlocking, otherwise the actuator may not be unlocked.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding  $1,000 \text{ m/s}^2$  may cause damage to the interlock switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere, or in an area subjected to direct sunlight.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- 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  $35^\circ\text{C}$  above the ambient temperature (to approximately  $85^\circ\text{C}$  while the ambient temperature is  $50^\circ\text{C}$ ). Do not touch to prevent burns. If cables come into contact with the switch, use heat-resistant cables.
- Bouncing will occur on the lock monitor contact during locking and unlocking (reference value: 20 ms).
- 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.

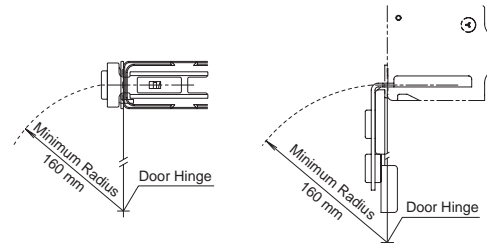
## Minimum Radius of Hinged Door

- 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).

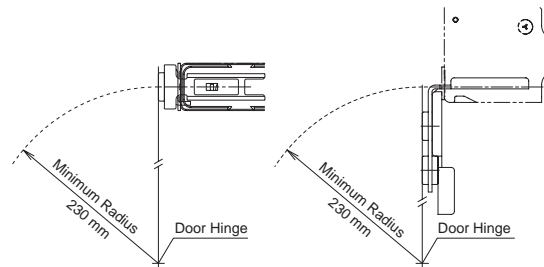
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

## 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 interlock switch surface:

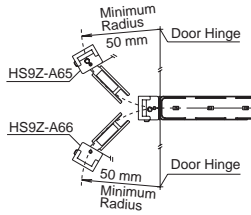


# HS6E Subminiature Interlock Switches with Solenoid

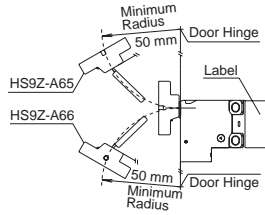
## When using the HS9Z-A65/HS9Z-A66 Angle Adjustable Actuator

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

### Horizontal Adjustment

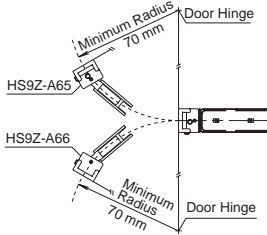


### Vertical Adjustment

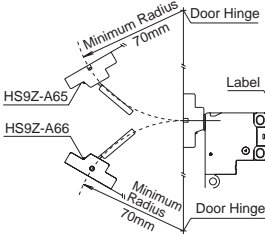


- When the door hinge is on the extension line of the actuator mounting surface

### Horizontal Adjustment



### Vertical Adjustment

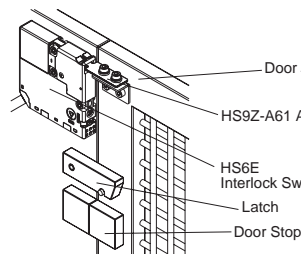


## Actuator Angle Adjustment for the HS9Z-A65/HS9Z-A66

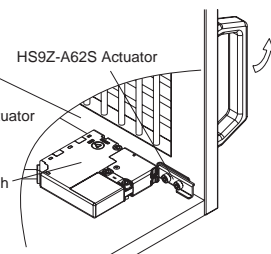
- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 10).  
Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can enter properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not become loose.

## Mounting Examples

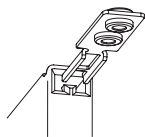
### Application on Sliding Doors



### Application on Hinged Doors



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



## For Manual Unlocking

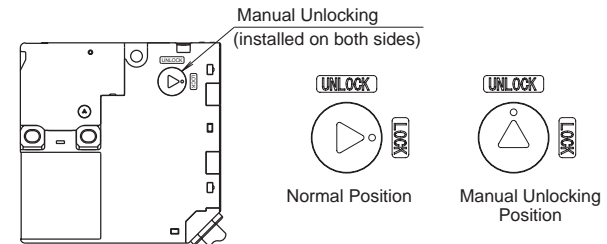
### Spring lock type

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

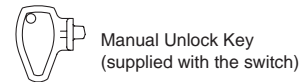
### Solenoid lock type

The HS6E can be unlocked manually in emergency.

## When using the manual unlock key

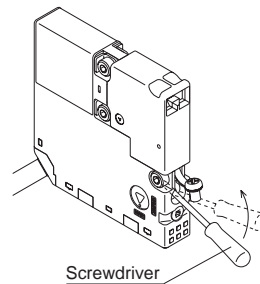


- When locking or unlocking the interlock switch manually, turn the key fully using the manual unlocking key supplied with the switch.
- Using the interlock switch with the key not fully turned (less than 90°) may cause damage to the switch or operation failures (when manually unlocked, the switch will 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 unlocking key attached to the switch during operation. This is dangerous because the switch can always be unlocked while the machine is in operation.



## 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.



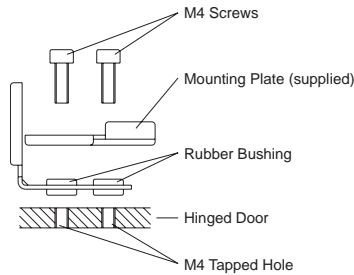
## Caution

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 type).

# HS6E Subminiature Interlock Switches with Solenoid

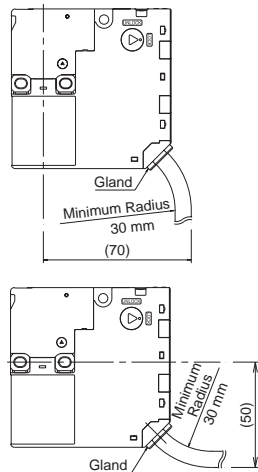
## Recommended Tightening Torque of Mounting Screws

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



## Cables

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

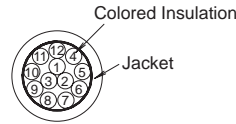


## Wire Identification

- Wires can be identified by 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.



## 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.

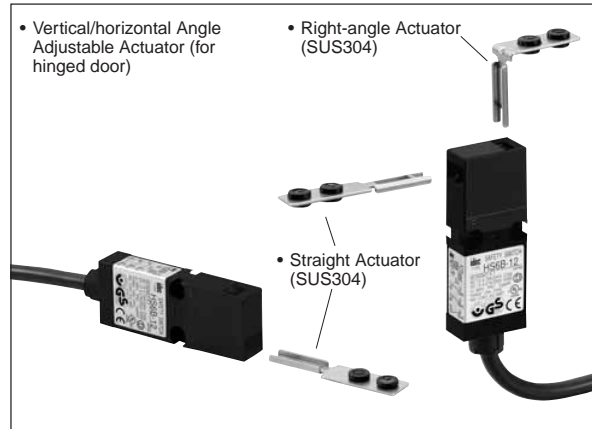
Type	Contact Arrangement	
	Door Monitor	Lock Monitor
HS6E-L		
	Main circuit: Blue → 11	12 → 41 → 42 Blue/White
	Monitor circuit: Brown → 21	22 Brown/White Pink 53 → 54 Pink/White
	Monitor circuit: Orange → 31	32 Orange/White
HS6E-M	Main circuit: Blue → 11	12 → 41 → 42 Blue/White
	Monitor circuit: Brown → 21	22 Brown/White Pink 51 → 52 Pink/White
	Monitor circuit: Orange → 31	32 Orange/White
HS6E-N	Main circuit: Blue → 11	12 → 41 → 42 Blue/White
	Monitor circuit: Brown → 21	22 Brown/White Pink 53 → 54 Pink/White
	Monitor circuit: Orange → 33	34 Orange/White
HS6E-P	Main circuit: Blue → 11	12 → 41 → 42 Blue/White
	Monitor circuit: Brown → 21	22 Brown/White Pink 51 → 52 Pink/White
	Monitor circuit: Orange → 33	34 Orange/White

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

# HS6B Subminiature Interlock Switches

## World-class compactness with three poles of contacts.

- World's smallest switch: 30 × 30 × 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)
- Housing allows drainage.
- NC contacts are direct opening action (IEC/EN 60947-5-1).
- Proprietary actuators prevent unauthorized opening of the contacts (ISO14119, EN1088).



## Types

Contact Configuration	Cable Length	Type No. (Package quantity: 1)
1NC-1NO 	1m	HS6B-11B01
	3m	HS6B-11B03
	5m	HS6B-11B05
2NC 	1m	HS6B-02B01
	3m	HS6B-02B03
	5m	HS6B-02B05
2NC-1NO 	1m	HS6B-12B01
	3m	HS6B-12B03
	5m	HS6B-12B05
3NC 	1m	HS6B-03B01
	3m	HS6B-03B03
	5m	HS6B-03B05

## Actuators

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

Note: Select an actuator that moves in the direction required by the hinged door and interlock switch (see pages 17 and 18).

## Contact Ratings

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

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

\* Ratings approved by safety agencies

C300: AC-15, 0.75A/240V  
Q300: DC-13, 0.27A/250V

## Specifications

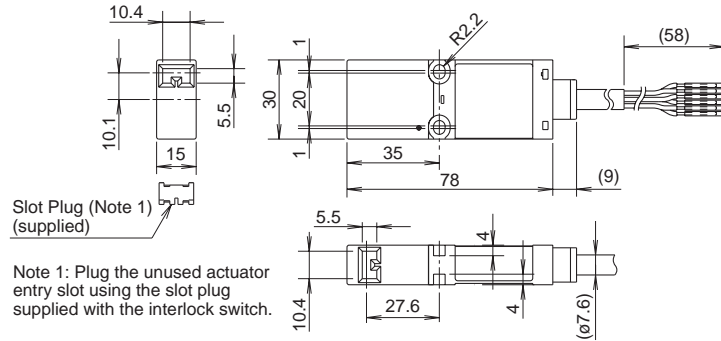
Applicable Standards	UL508 (UL listed)
	CSA C22.2, No. 14 (c-UL listed)
	ISO 14119
	EN 1088
Applicable Directives	IEC 60947-5-1
	EN 60947-5-1 (DEMKO approval)
	GS-ET-15 (BG approval)
Applicable Directive	IEC 60204-1/ EN 60204-1 (applicable standards for use)
	73/23/EEC (Low Voltage Directive)
Operating Temperature	-25 to +70°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Impulse Withstand Voltage	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 mΩ maximum (initial value, 1m cable)
	500 mΩ maximum (initial value, 3m cable)
	700 mΩ maximum (initial value, 5m cable)
Electric Shock Protection Class	Class II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Operating extremes: 300 m/s <sup>2</sup> (30G)
	Damage limits: 1000 m/s <sup>2</sup> (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)
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-03B01)



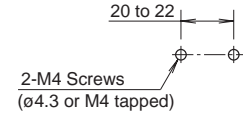
# HS6B Subminiature Interlock Switches

## Dimensions

### • Interlock Switch

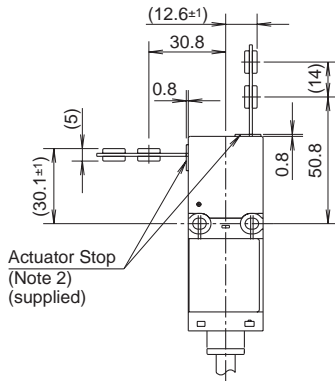


### • Mounting Hole Layout

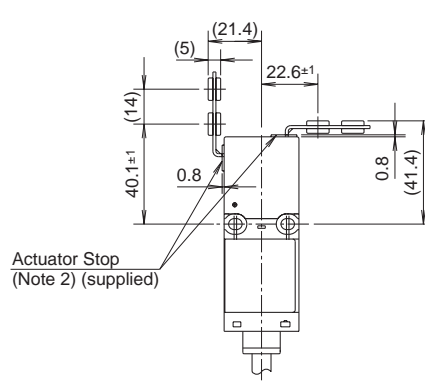


The interlock switch can be mounted in two directions.

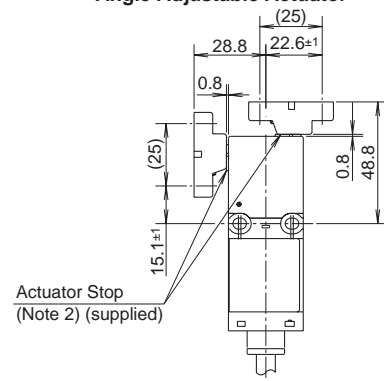
### • Using the HS9Z-A61 Straight Actuator



### • Using the HS9Z-A62 Right-angle Actuator

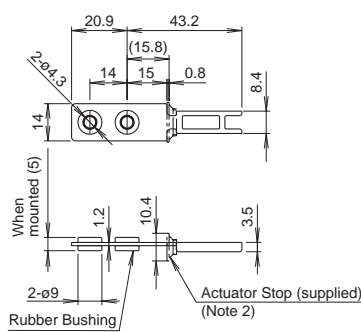


### • Using the HS9Z-A65/A66 Angle Adjustable Actuator

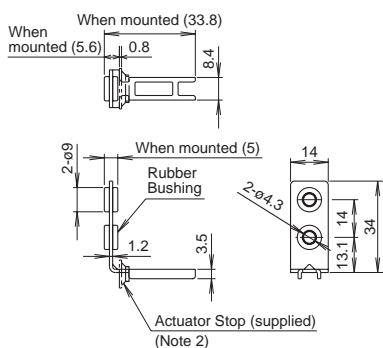


## Actuator Dimensions

### • Straight Actuator (HS9Z-A61)

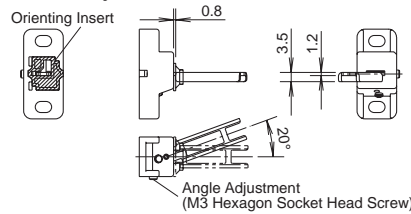


### • Right-angle Actuator (HS9Z-A62)

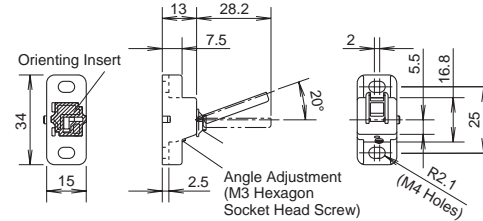


### • Angle Adjustable Actuator (HS9Z-A65)

#### Horizontal Adjustment



#### Vertical Adjustment



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

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

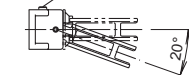
Note 2: After mounting the actuator, remove the actuator stop from the interlock switch.

### • Angle Adjustable Actuator (HS9Z-A66)

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

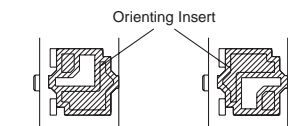
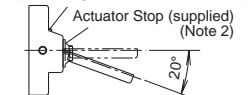
#### Horizontal Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)



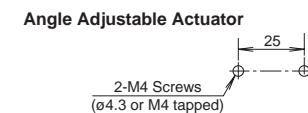
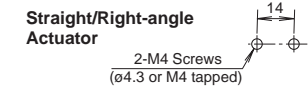
#### Vertical Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)



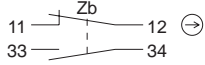
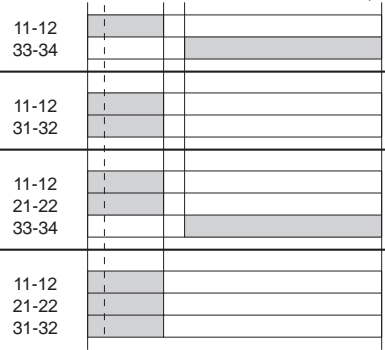


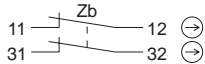
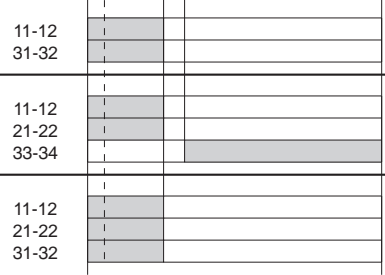
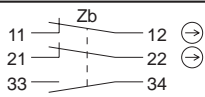
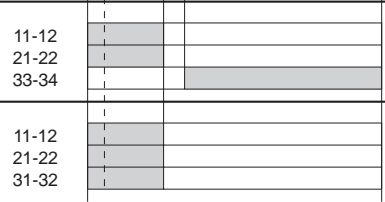
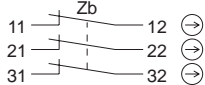
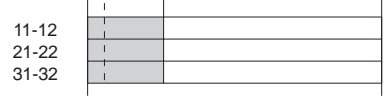
Horizontal Adjustment      Vertical Adjustment

### • Actuator Mounting Hole Layout



# HS6B Subminiature Interlock Switches

## Contact Configuration and Operation Chart

Type	Contact Configuration	Contact Operation Chart
HS6B-11	1NC-1NO 	<p>0.8 (Actuator Mounting Reference Position)</p> <p>0 5.5 5.8 28.2 (Travel: mm)</p>  <p>Legend:   : Contact ON (closed)   : Contact OFF (open)</p>
HS6B-02	2NC 	
HS6B-12	2NC-1NO 	
HS6B-03	3NC 	

Actuator inserted completely      Actuator removed completely

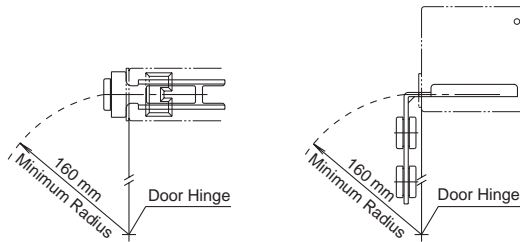
### Minimum Radius of Hinged Door

- 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).

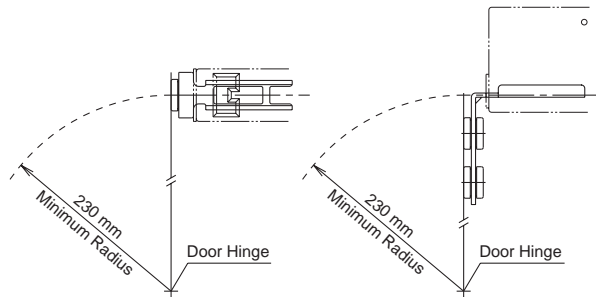
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

#### When using the HS9Z-A62 Right-angle Actuator

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



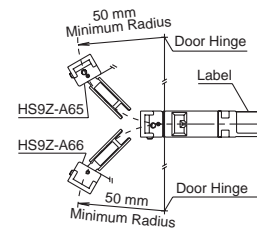
- When the door hinged is on the extension line of the actuator mounting surface:



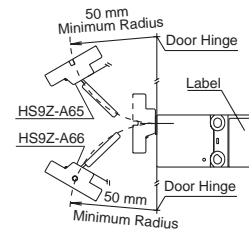
### When using the HS9Z-A65/HS9Z-A66 Angle Adjustable Actuator

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

#### Horizontal Adjustment

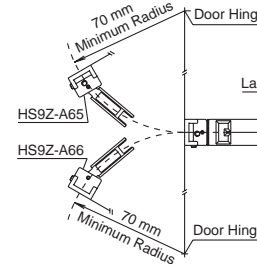


#### Vertical Adjustment

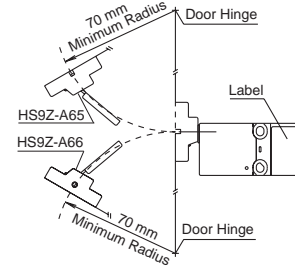


- When the door hinge is on the extension line of the actuator mounting surface:

#### Horizontal Adjustment



#### Vertical Adjustment



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

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

# HS6B Subminiature Interlock Switches

## Safety Precautions

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

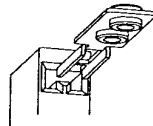
## Instructions

- 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/s<sup>2</sup> may cause damage to the interlock switch.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use proprietary actuators only. When other actuators are used, the interlock switch may be damaged.
- Cover the unused actuator entry slot using the slot plug supplied with the interlock switch.

## Mounting

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



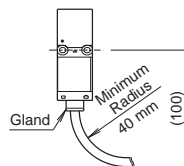
## Recommended Screw Tightening Torque

- 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

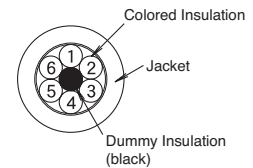
- Do not fasten or loosen the gland at the bottom of the interlock switch.
- When bending cable during wiring, make sure that the cable radius is kept at 40 mm minimum.
- When wiring, make sure that water or oil does not enter from the end of cable.



## Wire Identification

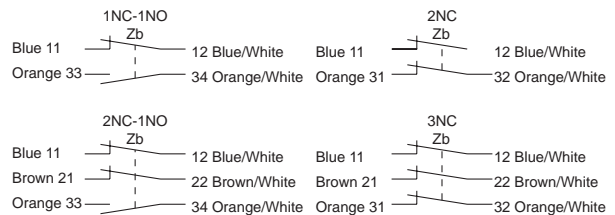
- Wires can be identified by color and/or a white line printed on the wire.

No.	Insulation Color	No.	Insulation Color
1	Orange/White	4	Brown
2	Blue/White	5	Blue
3	Brown/White	6	Orange



## Terminal Number Identification

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

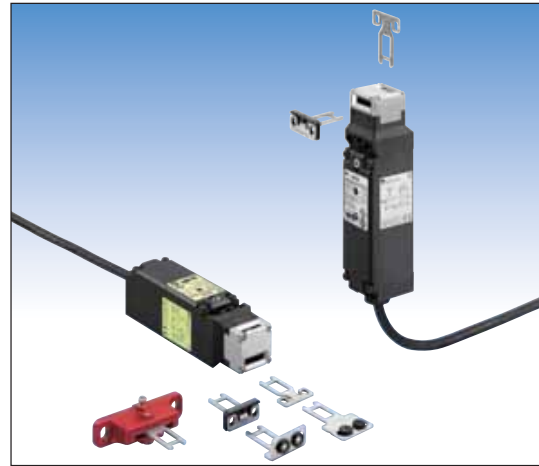


- When wiring, cut any dummy insulation (black) and any unused wires at the end of the jacket to avoid incorrect wiring.

## HS5E Series Miniature Interlock Switches with Solenoid

**Solenoid interlock switch with four contacts in a compact body. Ideal for small or special-shape doors with limited mounting space.**

- Compact body, 35 × 40 × 146 mm.
- Four poles with gold-plated contacts.
- Spring lock and solenoid lock types are available.
- The head orientation can be rotated, allowing for 8 different actuator entries.
- Metal head ensures durability.
- Locking strength 1000N minimum (GS-ET-19)
- Integrated cable design minimizes wiring, preventing incorrect wiring.
- RoHS directive compliant.



## HS5B Series Miniature Interlock Switches

**Metal head type and M20 conduit port newly added.**

- Actuators are interchangeable with the HS5E miniature interlock switches with solenoid.
- Actuators with rubber bushing available.
- RoHS directive compliant.
- The head orientation can be rotated, allowing for 8 different actuator entries.
- Compact body, 30 × 30 × 90 mm.



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



### IDEC CORPORATION

**IDEC CORPORATION (USA)**  
1175 Elko Drive, Sunnyvale, CA 94089-2209, USA  
Tel: +1-408-747-0550 / (800) 262-IDEC (4332)  
Fax: +1-408-744-9055 / (800) 635-6246  
E-mail: opencontact@idec.com

**IDEC CANADA LIMITED**  
Unit 22-151, Brunel Road, Mississauga, Ontario, L4Z 1X3, Canada  
Tel: +1-905-890-8561, Toll Free: (888) 317-4332  
Fax: +1-905-890-8562  
E-mail: sales@ca.idec.com

**IDEC AUSTRALIA PTY. LTD.**  
2/3 Macro Court, Rowville, Victoria 3178, Australia  
Tel: +61-3-9763-3244, Toll Free: 1800-68-4332  
Fax: +61-3-9763-3255  
E-mail: sales@au.idec.com

**IDEC ELECTRONICS LIMITED**  
Unit 2, Beechwood, Chineham Business Park, Basingstoke, Hampshire RG24 8WA, UK  
Tel: +44-1256-321000, Fax: +44-1256-327755  
E-mail: sales@uk.idec.com

7-31, Nishi-Miyahara 1-Chome, Yodogawa-ku, Osaka 532-8550, Japan  
Tel: +81-6-6398-2571, Fax: +81-6-6392-9731  
E-mail: products@idec.co.jp

**IDEC ELEKTROTECHNIK GmbH**  
Wendenstrasse 331, 20537 Hamburg, Germany  
Tel: +49-40-25 30 54 - 0, Fax: +49-40-25 30 54 - 24  
E-mail: service@idec.de

**IDEC (SHANGHAI) CORPORATION**  
Room 608-609, 6F, Gangtai Plaza, No. 700, Yan'an East Road, Shanghai 200001, PRC  
Tel: +86-21-5353-1000, Fax: +86-21-5353-1263  
E-mail: idec@cn.idec.com

**IDEC (BEIJING) CORPORATION**  
Room 211B, Tower B, The Grand Pacific Building, 8A Guanghua Road, Chaoyang District, Beijing 100026, PRC  
Tel: +86-10-6581-6131, Fax: +86-10-6581-5119

**IDEC (SHENZHEN) CORPORATION**  
Unit AB-3B2, Tian Xiang Building, Tian'an Cyber Park, Fu Tian District, Shenzhen, Guang Dong 518040, PRC  
Tel: +86-755-8356-2977, Fax: +86-755-8356-2944

**IDEC IZUMI (H.K.) CO., LTD.**  
Unit 1505-07, DCH Commercial Centre No. 25, Westlands Road, Quarry Bay, Hong Kong  
Tel: +852-2803-8989, Fax: +852-2565-0171  
E-mail: info@hk.idec.com

**IDEC TAIWAN CORPORATION**  
8F-1, No. 79, Hsin Tai Wu Road, Sec. 1, Hsi-Chih, Taipei County, Taiwan  
Tel: +886-2-2698-3929, Fax: +886-2-2698-3931  
E-mail: service@tw.idec.com

**IDEC IZUMI ASIA PTE. LTD.**  
No. 31, Tannery Lane #05-01, Dragon Land Building, Singapore 347788  
Tel: +65-6746-1155, Fax: +65-6844-5995  
E-mail: info@sg.idec.com

www.idec.com

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