



INSTRUCTION SHEET
Original Instructions
Safety Switch
HS5D Series



Confirm that the delivered product is what you have ordered.
Read this instruction sheet to make sure of correct operation.

* In order to verify if the product you are interested in is certified with the S mark, please check the following section on our website: "List of type numbers certified with the S mark"

SAFETY PRECAUTIONS

In this operation instruction sheet, safety precautions are categorized in order of importance to Warning and Caution :

WARNING

Warning notices are used to emphasize that improper operation may cause severe personal injury or death.

CAUTION

Caution notices are used where inattention might cause personal injury or damage to equipment.

1 Type

Table with 2 columns: Specification Name and Value. Rows include Contact configuration (11: 1NO-1NC, 02: 2NC, 12: 1NO-2NC, 03: 3NC), Material of Head (Blank: Plastic, Z: Metal), Gland Port Size (Blank: G1/2, M: M20, P: PG13.5), and HS5D-11ZRNM model reference.

2 Specifications and Ratings

Table with 2 main columns: Specification Name and Value. Rows include Applicable Standards (EN ISO / ISO14119, IEC60947-5-1, etc.), Standards for Use (IEC60204-1), Interlocking device Type (Type 2), Operating Condition (Temperature, Humidity, etc.), Impulse with voltage (4kV), Rated Insulation voltage (300V), Thermal Current (10A), Class of Protection (Class II), Operating Frequency (900 operations/hour), Operating Speed (0.05 to 1.0 m/s), Mechanical Durability (1,000,000 operations), Electrical Durability (100,000 operations min.), Shock Resistance (1000m/s²), Vibration Resistance (10 to 55 Hz), Direct Opening Travel (10 mm), Direct Opening Force (50 N), Contact Resistance (50mΩ), Degree of Protection (IP67), Conditional short circuit current (100A/250V), and Short-Circuit Protective Device (250V AC, 10A).

Ratings approved by safety agencies

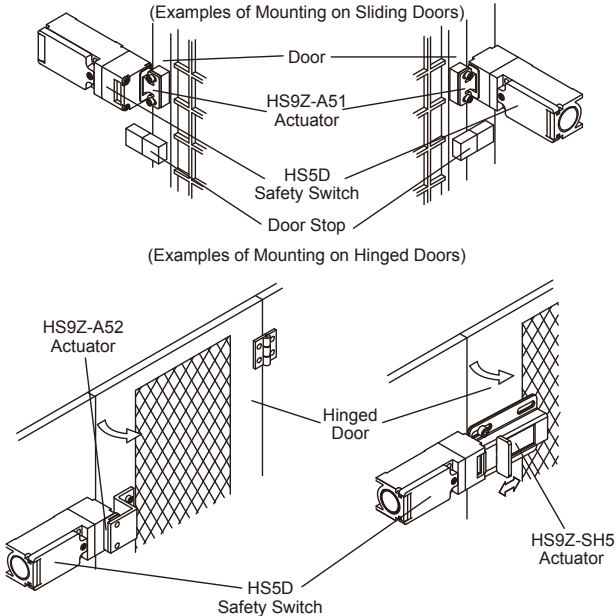
- (1) TÜV rating / CCC rating / KOSHA rating: AC-15 250V, 3A; DC-13 30V, 4A
- (2) UL, c-UL rating: A300 3A, 250V ac, Pilot Duty 4A, 30V dc

HS5D Head Removal Detection Function (Screw Terminal No.11-12)

Table with 2 columns: Property and Value. Rows include Mechanical durability (10 operations min.), Insulation resistance (100M Ω), and Dielectric strength (1,000V 1minute).

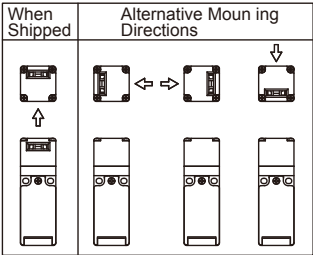
3 Mounting Examples

- Install the interlock switch on the immovable machine or guard, and install the actuator on the movable door. Do not install both interlock switch and actuator on the movable door, otherwise the angle of insertion of the actuator to the safety switch may become inappropriate, and failure will occur.



Changing the Mounting Directions of the HS5D Head

- The head of HS5D can be mounted in four directions by removing the four screws on the corners of the HS5D head.



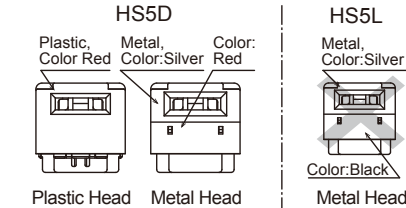
WARNING

Mounting Directions of the HS5D Head

- When replacing the HS5D head, make sure that no foreign object enters into the safety switch.
- Tighten the screws tightly, otherwise the safety switch may malfunction.
- Don't remove the screws of head except when the mounting directions of head is changed.
- When tightening the screw in the head section with an electric screwdriver or similar tool, temporarily tighten the first part of the screw by hand first, and then tighten with the electric screwdriver.

Mounting the HS5D Head

- Do not use the metal head for the HS5L with lock type. Be sure to use the plastic head or metal head for the HS5D. Be sure to use the correct head.



HS5D Head Removal Detection Function

- The the NC contacts of the two main circuits (11-12, 21-22) are operated similarly by the actuator. But, when the HS5D head is removed, the NC contact of the main circuit (11-12) is opened, and other NC contact (21-22) remains closed.

	Actuator pulled	Actuator inserted	When the HS5D head is removed
Main Circuit (11-12)			
Main Circuit (21-22)			
Monitor Circuit (33-34)			
(31-32)			
Main Circuit: 11 12			
Main Circuit: 21 22			

:Contact Closed :Contact Open

CAUTION

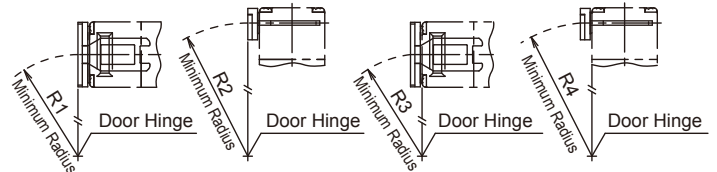
- When the HS5D head is removed, the NC contact of the main circuit (11-12) is opened, and other NC contact(s) remain closed. Use the NC contact of the main circuit (11-12) for the safety circuit.
- Turn off the power when using this function.

Minimum Radius of Hinged Door

- When using the safety switch for a hinged door, the minimum radius of the applicable door is shown in the following figures.

When the center of the hinged door is on the extension line of the actuator mounting surfade.

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



	Minimum Radius			
	R1	R2	R3	R4
HS9Z-A52	230 mm	260 mm	170 mm	190 mm
HS9Z-A52A	230 mm	260 mm	120 mm	140 mm
HS9Z-A55	70 mm	70 mm	50 mm	50 mm
	(Horizontal Swing)	(Vertical Swing)	(Horizontal Swing)	(Vertical Swing)

CAUTION

The above example are based on the condition that the actuator enters and exits the actuator entry slot smoothly when the door is closed or opened. Since there may be deviation or dislocation of the hinged door, make sure of correct operation in the actual application before installation.

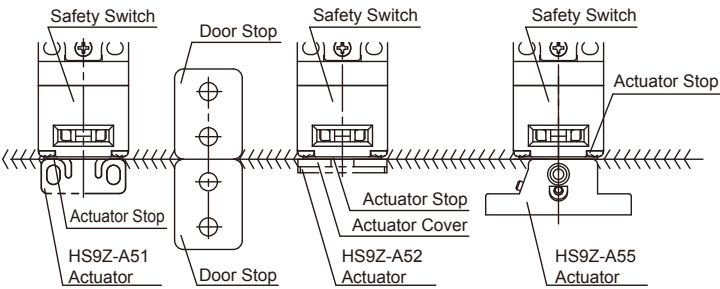
Adjusting the Angle Adjustable (vertical/horizontal) Actuator (Type HS9Z-A53/A55)

- Using the angle adjustment screw (M3 hexagon socket set screw), the actuator angle can be adjusted up to 20°(refer to dimensions).
 - The larger the actuator angle, the smaller the applicable radius of the door swing. After installing the actuator, open the door. Then adjust the actuator angle so that the actuator enters the entry slot of the safety switch properly.
 - After adjusting the actuator angle, apply loctite or the like on the adjustment screw to prevent loosening.
- (Type HS9Z-A53)
Tightening torque of angle adjustment screw : 0.8 N·m.
- (Type HS9Z-A55)
Use screw locking agent that is compatible with the base material.
Base : PA66 (66 nylon) of glass reinforced grade
Angle adjustment screws : stainless steel

Actuator Mounting Reference Position

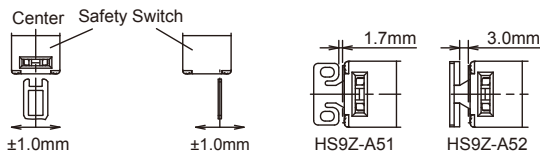
As shown below, the mounting reference position of the actuator inserted into the safety switch is:

- (Type HS9Z-A53)
The actuator stop film placed on the actuator touches the safety switch lightly.
(Except Type HS9Z-A53)
The actuator and actuator cover touches the actuator stop placed on the safety switch lightly.
- (After mounting the actuator, remove the actuator stop from the safety switch.)



Actuator Mounting Tolerance

- Mounting tolerance of the actuator is 1.0mm in the four lateral directions.
- Make sure the actuator can be inserted into the entry slot without any issue.
- When closing the door, the actuator is inserted within a certain distance from the reference position. The contact operation is not affected by the actuator movement.



	(Actuator deviation) + (Door movement)
HS9Z-A51	≤ 1.7 mm
HS9Z-A52	≤ 3.0 mm
HS9Z-A51A	≤ 3.0 mm
HS9Z-A52A	≤ 3.0 mm
HS9Z-A55	≤ 2.5 mm

HS9Z-A51A/HS9Z-A52A

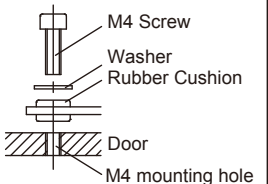
- When there is a displacement of safety switch and actuator, the actuator may hit the entry slot of safety switch hardly, thus damaging the entry slot and actuator. The rubber cushions on the HS9Z actuator prevent the actuator from damaging the entry slit by absorbing the shock with movement flexibility. Do not, however, exert excessive shocks, otherwise the failure of safety switch may be caused.
- The rubber cushions may deteriorate depending on the operating environment and conditions. Immediately replace the deformed or cracked rubber cushions with new ones.

Recommended Screw Tightening Torque

Name or Use	Screw Tightening Torque
For mounting the safety switch (M4 screw) *1	1.8 to 2.2 N·m
For mounting the HS5D lid (M3)	0.2 to 0.4 N·m
Terminal screw (M3)	0.6 to 0.8 N·m
Cable gland	2.7 to 3.3 N·m
For mounting the HS5D head (M3)	0.9 to 1.1 N·m
For mounting the actuator (HS9Z-A51: M4 screw) *1	1.8 to 2.2 N·m
(HS9Z-A52: M4 Phillips screw)	0.8 to 1.2 N·m
(HS9Z-A51A/A52A/A55: two M4 screws) *1, 2	1.0 to 1.5 N·m

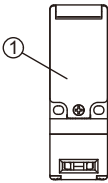
CAUTION

- *1 When the torque is not enough to recommended screw tightening torque, make sure that the screw do not become loose by using adhesive sealants etc. to keep right operation and mounting positioning.
- *2 In the case of HS9Z-A51A and HS9Z-A52A, using two M4 screws and two attached washers, fasten the actuator securely on the door.



4 Precautions for Operation

- Do not apply an excessive shock to the safety switch when opening or closing the door. A shock to the safety switch exceeding 1000 m/s² may cause failure.
- Provide a door guide, and ensure that force is applied on the safety switch only in the actuator insertion direction.
- When opening the safety switch lid to wire, open the lid①only. (See the figure on the right.) Never remove other screws, otherwise the safety switch may be damaged.
- Entry of foreign objects in the actuator entry slot may affect the mechanism of the switch and cause a breakdown. If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the switch through the actuator entry slots.
- When wiring or installing a gland, make sure that no foreign objects, dust, and water enter into the safety switch.
- Make sure to install the product in a place where it cannot be damaged. Make sure to conduct a proper risk assessment evaluation before using the product, and use a shield or a cover to protect the product if need be.
- Use only the designated actuator for the HS5D. Other actuators will cause a breakdown of the switch.



WARNING

- Turn off the power to the safety switch before starting installation, removal, wiring, maintenance, and inspection on the safety switch. Failure to turn power off may cause electrical shocks or fire hazard.
- Do not disassemble or modify the switch. Also do not attempt to disable the safety switch function, otherwise a breakdown or an accident will result.
- Use wires of a proper size to meet voltage and current requirements. Tighten the terminal screws to a recommended tightening torque of 1.0N·m. Loose terminal screws will cause unexpected heating and fire hazard during operation.

CAUTION

- HS5D Series Safety Switches are Type 2 low-level coded interlocking devices (EN ISO / ISO14119). The following system installation & mounting instructions are EN ISO / ISO14119 requirements to prevent function failure from the interlock switch.
 - Using permanent fixing methods (e.g. welding, rivets, special screws...etc) to prevent dismantling or de-positioning of the interlock device. However, permanent fixing methods are not an adequate solution if you expect the interlock device to fail during the machinery lifetime, or if you need to replace the product in quick manner. In these situations, other measures (see 2.) should be put in place to reduce the risks of function failure.
 - At least one of the following measures should be applied to prevent function failure.
 - Mounting the interlock device in a place out of reach from workers
 - Using shielding protection to prevent physical obstruction of the device
 - Mounting the interlock device in a hidden position
 - Integrate status monitoring & cycling testing of the device to the control system to prevent product failure.
- Do not use the safety switch as a door stop on any type of doors. Install mechanical door stops on the door ends to protect the safety switch from excessive force.
- Mount the actuator so that it will not hit the operator when the door is open, otherwise injury may be caused.
- Pay attention to the management of spare actuator. Safety function of door safety switch will be lost in case the spare actuator is inserted into the safety switch.
- Ensure that the actuator is firmly fastened to the door (welding, rivet, special screw) in the appropriate location, so that the actuator cannot be removed easily.
- Do not cut or remodel the actuator, otherwise failure will occur.
- If multiple safety components are wired in series, the Performance Level to EN ISO 13849-1 will be reduced due to the restricted error detection under certain circumstance.
- The entire concept of the control system, in which the safety component is integrated, must be validated to EN ISO 13849-2.

5 Contact Operation

Contact Configuration and Operation

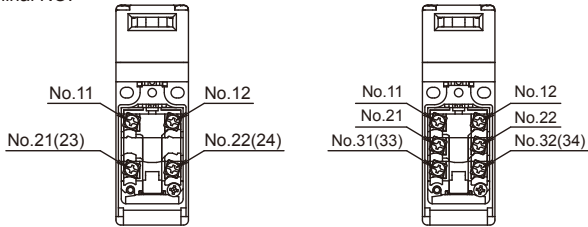
Type	Contact Configuration	Contact Operation(reference)		
		0 (Actuator Mounting Reference Position) Approx. 4.6 Approx. 6.7 Approx. 26.4 (Travel: mm)		
HS5D-11	Main Circuit: 11 12	11-12		
	Monitor Circuit: 23 24	23-24		
HS5D-02	Main Circuit: 11 12	11-12		
	Monitor Circuit: 21 22	21-22		
HS5D-12	Main Circuit: 11 12	11-12		
	Main Circuit: 21 22	21-22		
	Monitor Circuit: 33 34	33-34		
HS5D-03	Main Circuit: 11 12	11-12		
	Main Circuit: 21 22	21-22		
	Monitor Circuit: 31 32	31-32		
These are the image of locking position with actuator inserted.		(Actuator Completely Inserted) (Actuator Pulled Out)		

- Contact operation is based on the condition that the actuator is inserted into the center of the safety switch slot.
- Contact operation shows the HS9Z-A51 actuator.
(For other actuators, add 1.3mm to contact operation.)

6 Wiring

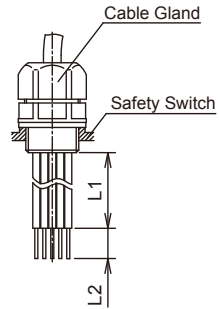
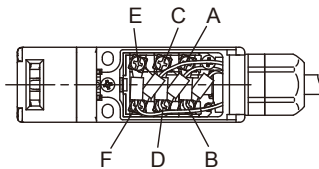
Terminal wiring method

- Terminal NO.



Wire Length inside the Safety Switch

	Screw Terminal No.	When using crimping terminal	When using without crimping terminal
Wire Length: L1 (mm)	A	25±2	30±2
	B	25±2	30±2
	C	40±2	45±2
	D	40±2	45±2
	E	50±2	55±2
	F	50±2	55±2
Wire Stripping Length:L2(mm)		7±1	

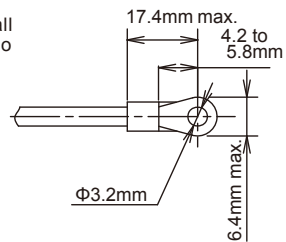


Recommended Wire Core Size: 0.5 to 1.5 mm²

Applicable Crimping Terminal

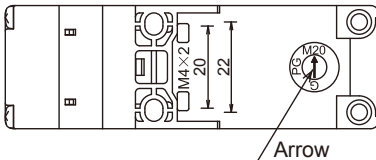
Manufacture	Type	Recommended Wire Core Size
JST	NO.5-3	0.2 to 0.5mm ²

- Use an insulation tube on the crimping terminal.
- When using crimping terminals, be sure to install insulation tubes on the crimping terminals to prevent electric shocks.



Gland Port Size Identification

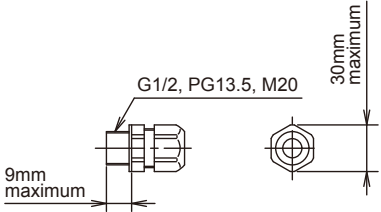
Gland port size is identified by the arrow on the back of the HS5D safety switch. The following example shows the identification of the M20 gland port size.



Mark	Gland port size
G	G1/2
PG	PG13.5
M20	M20

Applicable Cable Glands

- Use a cable gland with a degree of protection IP67.
- Applicable cable gland dimensions



- When using flexible conduit and metal cable gland
Applicable Flexible Conduit Example: Type VF-03 (made by Nihon Flex)

Gland port size	Plastic cable gland	Metal cable gland
G1/2		RLC-103 (made by Nihon Flex)
PG13.5		RBC-103PG13.5 (made by Nihon Flex)
M20		RLC-103EC20 (made by Nihon Flex)

- When using plastic cable gland, metal cable gland and multi-core cable

Gland port size	Plastic cable gland	Metal cable gland
G1/2	SCS-10□ (made by Seiwa Electric)	ALS-16□□ (made by Nihon Flex)
PG13.5	ST13.5 (made by K-MECS)	ABS-□□PG13.5 (made by Nihon Flex)
M20	ST-M20X1.5 (made by K-MECS)	ALS-□□EC20 (made by Nihon Flex)

- When using a 1/2-14NPT cable gland, use HS5D safety switch with M20 gland port size (Type: HS5D-□□□BM) together with adaptor (Type: MA-M/NPT 20X1.5 5402-0110, made by K-MECS) and gasket (Type: GP M20, made by K-MECS) which are sold separately. Install the gasket between the safety switch and the adaptor. Apply a sealing tape between the cable gland and the adaptor so that the enclosure will conform to IP67.

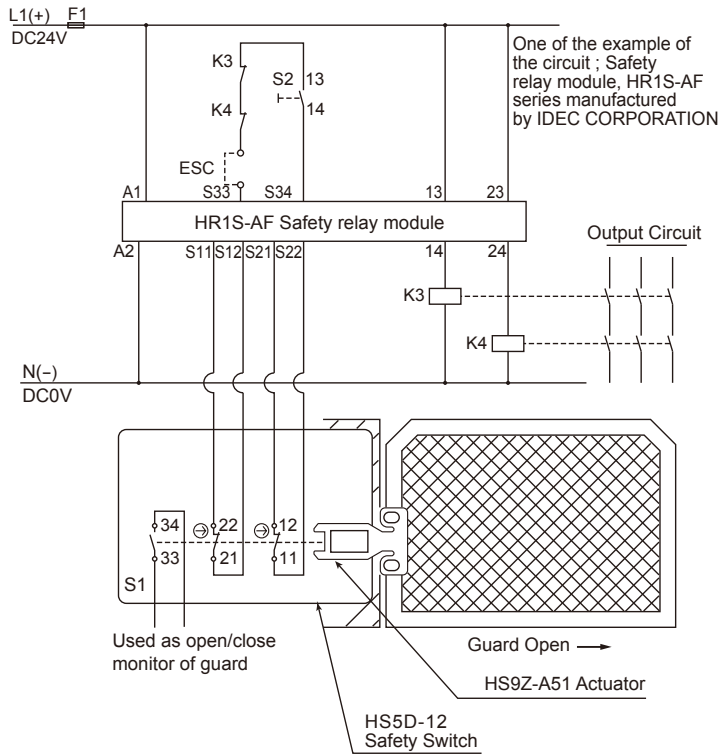
CAUTION

Confirm the outside diameter of the multi-core cable because the cable gland type depends on the outside diameter of the multi-core cable.

7 Example of wiring Diagram realizing Safety Category

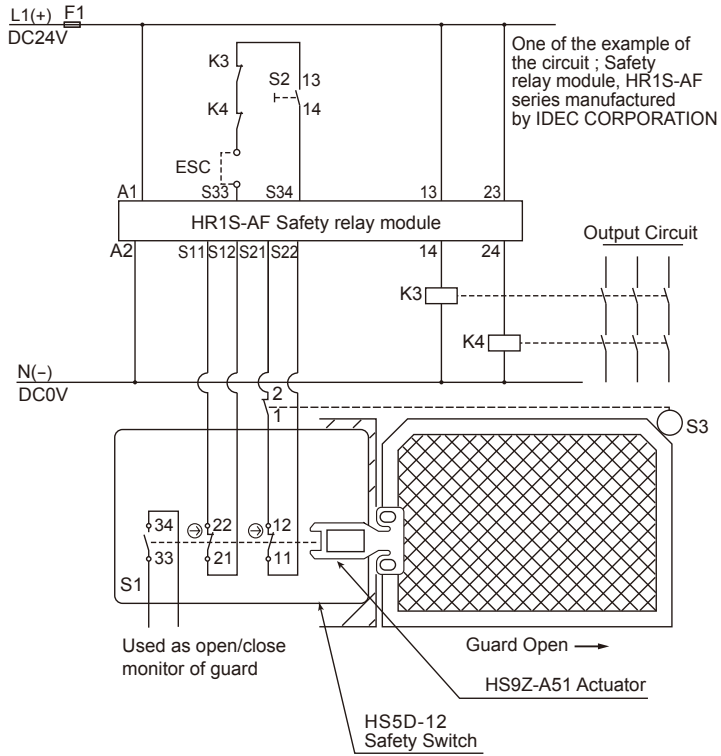
Example of a circuit diagram for Safety Category 3
(attainable PL = d)

(Condition 1: To apply the fault exclusion of mechanical structural parts including the actuator
→ Make sure to use the product within the product specification range described in this manual and the version of the manual provided with the product.)
(Condition 2: Documentation of the reason for the machine/equipment manufacturer to have applied the fault exclusion based on ISO13849-1, ISO13849-2 or IEC62061.)



- S1: HS5D-12 Safety Switch
- S2: Starting Switch (HW Series Momentary)
- S3: Safety limit Switch
- ESC: Outside start condition
- K3, 4: Safety Contactor
- F1: Outside fuse of safety relay module at power supply line

Example of a circuit diagram for Safety Category 4
(attainable PL = e)



Note: Use the monitoring device(Safety relay module) provided the capability to detect a cross short circuit. The insulation of the cable has to withstand environmental influences. If a control device other than the one shown in the draft is used, the used control device has to be equipped with a cross short circuit monitor.

