



# HS5D

## Miniature Interlock Switches



**Head Removal Detection Function for Safer Performance**



# New Generation Miniature Interlock Switches

IDEC's new unique "Head Removal Detection Function" is a new generation technology that assures safety and satisfies international safety standards.

## **New** 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

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 |
|-----------------------------------|--------------------------|---------------------------|----------------------|
| Main circuit (NC) $\ominus$ 11-12 | OFF                      | ON                        | OFF                  |
| Main circuit (NC) $\ominus$ 21-22 | OFF                      | ON                        | ON                   |

Disparity

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) $\ominus$ 1-2 | OFF                      | ON                        | ON                   |

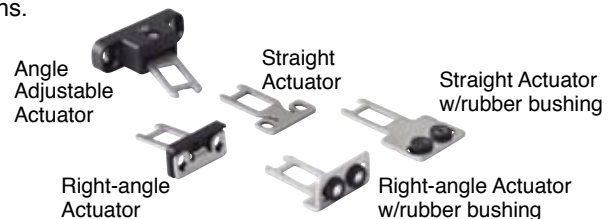
### Small size with 3 contacts

- The HS5D is the same size (dimensions/mounting dimensions) as 2 contact types (HS5B). 3 contact types with dual enabling contacts and a monitor contact are available.
- Compact size. Can be installed in narrow spaces.
- M3 terminal screws make wiring easy.
- Gold-plated contact suitable for small loads.



### Actuators interchangeable with HS5B/HS5E

Actuators can be selected to suit door shapes and applications.



### Various Safety Product Accessories



# 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 type interlock switches (HS5B). 3 contact types with dual enabling contacts and a monitor contact are available. Can be installed in narrow spaces. (30W × 30D × 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                                | ISO14119<br>EN1088<br>IEC60947-5-1<br>EN60947-5-1 (TÜV approval)<br>GS-ET-15 (TÜV approval)<br>UL508<br>CSA C22.2 No. 14<br>IEC60204-1/EN60204-1<br>(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:<br>100 MΩ minimum<br>Between terminals of different poles:<br>100 MΩ minimum                                                                    |
| Electric Shock Protection Class                     | Class II (IEC61140)                                                                                                                                                                |
| Degree of Protection                                | IP67 (IEC60529)                                                                                                                                                                    |
| Shock Resistance                                    | Damage limits: 1000 m/s <sup>2</sup>                                                                                                                                               |
| Vibration Resistance                                | Operating extremes:<br>10 to 55 Hz, amplitude 0.5 mm<br>Damage limits:<br>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)<br>1,000,000 operations minimum (24V AC/DC, 100 mA)<br>(operation frequency: 900 operations per hour)                                  |
| Performance of Terminals 11-12 of Removed Head Unit | Mechanical damage limits: 10 operations min.<br>Insulation resistance: 100 MΩ (initial value)<br>Dielectric strength: 1000V, 1 minute (initial value)                              |
| Conditional Short-circuit Current                   | 100A (250V) (note)                                                                                                                                                                 |
| Weight (approx.)                                    | Plastic head: 80g<br>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 |
| Rated Current (Ie) *          | AC | Resistive load (AC-12) | 10A  | 10A  | 6A   |
|                               |    | Inductive Load (AC-15) | 10A  | 5A   | 3A   |
|                               | DC | Resistive load (DC-12) | 8A   | 2.2A | 1.1A |
|                               |    | Inductive Load (DC-13) | 4A   | 1.1A | 0.6A |

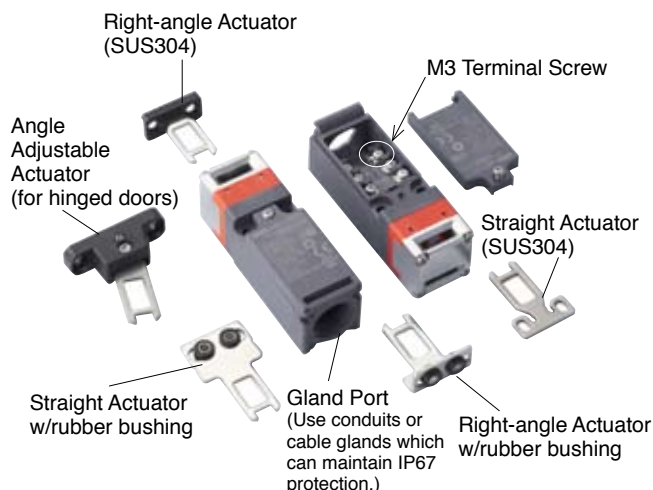
\* Minimum applicable load (reference): 5V AC/DC, 1 mA  
(Applicable range may vary with operating conditions and load types.)

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

## Type No. Development

| HS5D-11 Z RN M      |                      |                           |
|---------------------|----------------------|---------------------------|
| <b>Circuit Code</b> |                      | <b>Gland Port</b>         |
| 11: 1NO-1NC         |                      | blank: G1/2               |
| 02: 2NC             |                      | P: PG13.5                 |
| 12: 1NO-2NC         |                      | M: M20                    |
| 03: 3NC             |                      |                           |
|                     | <b>Head Material</b> | <b>Head/Housing Color</b> |
|                     | blank: Plastic       | RN: Red/Gray              |
|                     | Z: Metal             |                           |

## Parts Description



# HS5D Miniature Interlock Switches

## Miniature Safety Interlock Switch

Package Quantity: 1

| Contact Configuration | Gland Port Size | Type No. (Ordering Type No.) |                 |
|-----------------------|-----------------|------------------------------|-----------------|
|                       |                 | Plastic Head Type            | Metal Head Type |
| <b>1NC-1NO</b><br>    | G1/2            | HS5D-11RN                    | HS5D-11ZRN      |
|                       | PG13.5          | HS5D-11RNP                   | HS5D-11ZRNP     |
|                       | M20             | HS5D-11RNM                   | HS5D-11ZRNM     |
| <b>2NC</b><br>        | G1/2            | HS5D-02RN                    | HS5D-02ZRN      |
|                       | PG13.5          | HS5D-02RNP                   | HS5D-02ZRNP     |
|                       | M20             | HS5D-02RNM                   | HS5D-02ZRNM     |
| <b>2NC-1NO</b><br>    | G1/2            | HS5D-12RN                    | HS5D-12ZRN      |
|                       | PG13.5          | HS5D-12RNP                   | HS5D-12ZRNP     |
|                       | M20             | HS5D-12RNM                   | HS5D-12ZRNM     |
| <b>3NC</b><br>        | G1/2            | HS5D-03RN                    | HS5D-03ZRN      |
|                       | PG13.5          | HS5D-03RNP                   | HS5D-03ZRNP     |
|                       | M20             | HS5D-03RNM                   | HS5D-03ZRNM     |

## Actuator

Package Quantity: 1

| Name                                        | Type No. (Ordering Type 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) Type | HS9Z-A55                     |

## Accessories

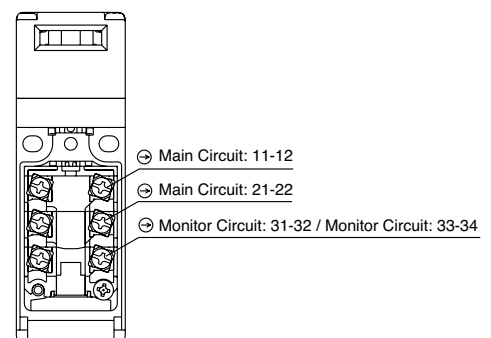
Package Quantity: 1

| Name                 |                            | Type No. (Ordering Type No.) | Remarks                                                                                |
|----------------------|----------------------------|------------------------------|----------------------------------------------------------------------------------------|
| Plug Actuator        |                            | HS9Z-A5P                     | Can also be used for HS5B and HS5E                                                     |
| Door Handle Actuator | Handle Unit                | HS9Z-DH5RH                   | Can also be used for HS5B and HS5E. For right-hand door.                               |
|                      |                            | HS9Z-DH5LH                   | Can also be used for HS5B and HS5E. For left-hand door.                                |
|                      | Switch Cover Unit          | HS9Z-DH5C                    | Used for installing the interlock switch inside.<br>Can also be used for HS5B and HS5E |
|                      | HS5B/HS5D Installation Kit | HS9Z-DH5B                    | Used for mounting HS5B and HS5D                                                        |
| Sliding Actuator     |                            | HS9Z-SH5                     | Can also be used for HS5B and HS5E                                                     |
| Padlock Hasp         |                            | HS9Z-PH5                     | Can also be used for HS5B and HS5E                                                     |

## Contact Configuration and Operation Chart

| Type     | Contact Configuration                                         | Contact Operation Chart (reference) |
|----------|---------------------------------------------------------------|-------------------------------------|
| HS5D-11* |                                                               |                                     |
|          | <b>Main Circuit</b> ⊕ 11-12<br><b>Monitor Circuit</b> ⊕ 23-24 |                                     |
| HS5D-02* |                                                               |                                     |
|          | <b>Main Circuit</b> ⊕ 11-12<br><b>Main Circuit</b> ⊕ 21-22    |                                     |
| HS5D-12* |                                                               |                                     |
|          | <b>Main Circuit</b> ⊕ 11-12<br><b>Main Circuit</b> ⊕ 21-22    |                                     |
|          | <b>Monitor Circuit</b> ⊕ 33-34                                |                                     |
| HS5D-03* |                                                               |                                     |
|          | <b>Main Circuit</b> ⊕ 11-12<br><b>Main Circuit</b> ⊕ 21-22    |                                     |
|          | <b>Monitor Circuit</b> ⊕ 31-32                                |                                     |

## Terminal Arrangement



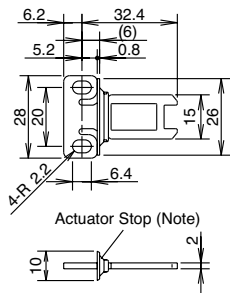
- The operation characteristics shown in the chart above are for the HS9Z-A51. For other actuator types, add 1.3 mm.
- The operation characteristics show the contact status when the actuator enters the entry slot of an interlock switch.



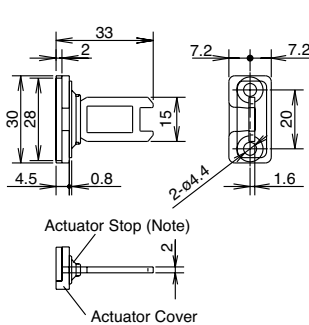
# HS5D Miniature Interlock Switches

## Actuator Dimensions

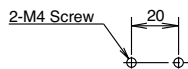
### • Straight (HS9Z-A51)



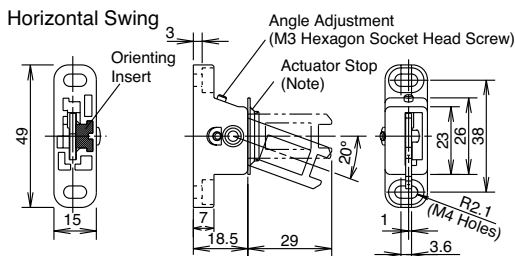
### • Right-angle (HS9Z-A52)



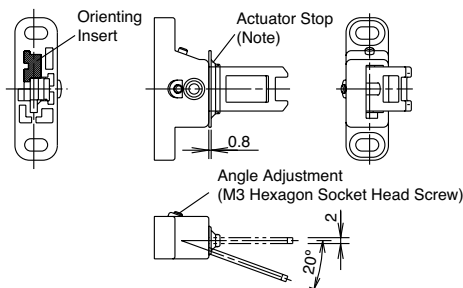
### Actuator Mounting Hole Layout (Straight, Right-angle)



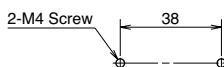
### • Angle Adjustable (HS9Z-A55)



#### Vertical Swing



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

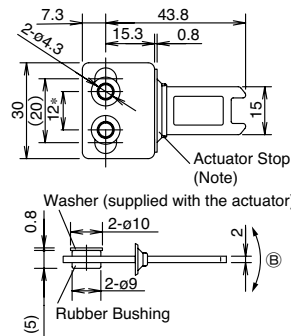


Note: The actuator stop is supplied with the actuator and used when adjusting the actuator position. Remove the actuator stop after the actuator position is determined.

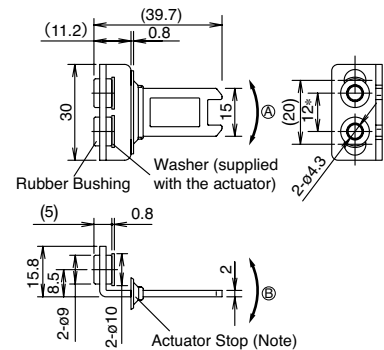
### • Actuator Orientation (Angle Adjustable)

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.

### • Straight w/rubber bushing (HS9Z-A51A)



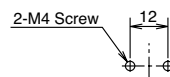
### • Right-angle w/rubber bushing (HS9Z-A52A)



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

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

### Actuator Mounting Hole Layout (Straight w/rubber bushing) (Right-angle w/rubber bushing)

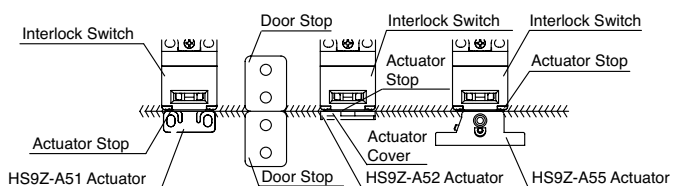


\*Mounting centers can be widened to 20 mm by moving the rubber cushions.

### • 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.



## 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

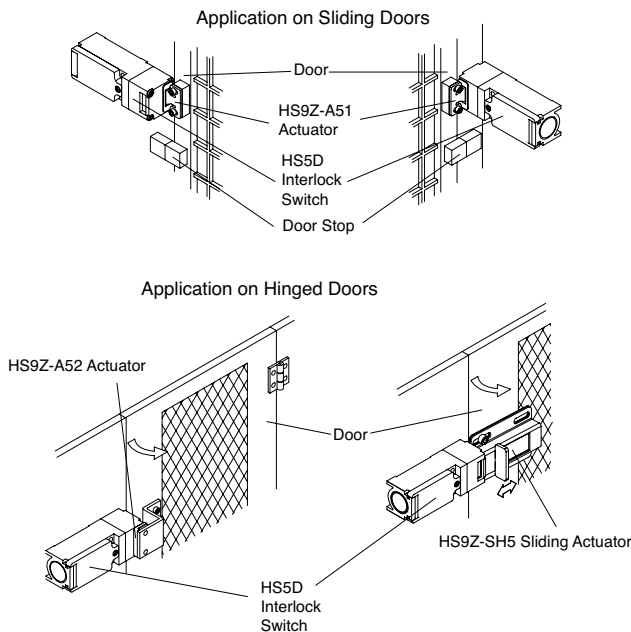
a recommended torque of 0.6 to 0.8 N·m. Improper soldering or failure to tighten the terminal screw may cause overheating and fire.

- 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.

## 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  $1,000 \text{ m/s}^2$  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.

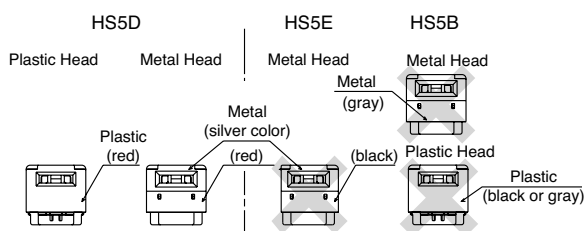
## Mounting Examples



## 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.



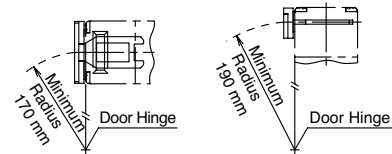
## Minimum Radius of Hinged Door

- 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).

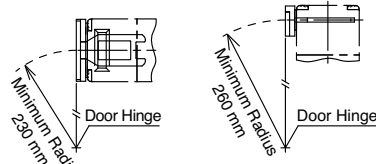
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

### When using the HS9Z-A52 Actuator

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

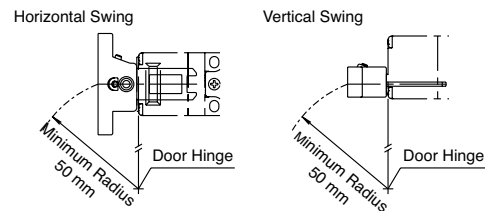


- When the door hinge is on the extension line of the actuator mounting surface:

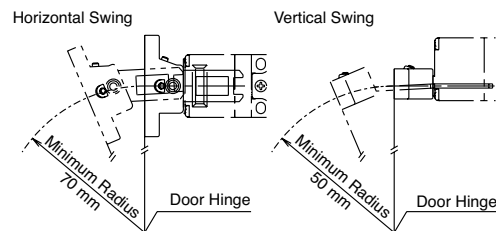


### When using the HS9Z-A55 Angle Adjustable Actuator

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



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



### Actuator Angle Adjustment for the HS9Z-A55

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 6). 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.

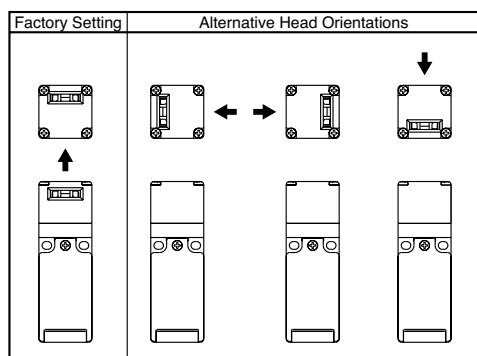


# HS5D Miniature Interlock Switches

## Instructions

### Rotating the Head

- The head of the HS5D can be rotated by removing the four screws from the corners of the HS5D head and re-installing 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

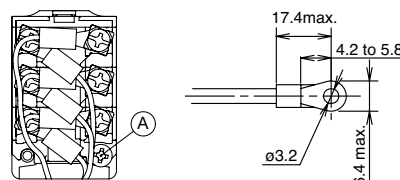
Only the NC contact of the main circuit (11-12) turns OFF (open) when the head is removed, such as when rotating the head. Because NC contacts of other than the main circuit (11-12) turn ON (closed), be sure to connect the main circuit (11-12) to the safety circuit.

### Recommended Tightening Torque

- Interlock Switch Mounting Screw:  $1.8 \pm 2.2$  N·m (two M4 screws)
- Housing Lid Screw: 0.2 to 0.4 N·m (M3 screw)
- Terminal Screw: 0.6 to 0.8 N·m (M3 screw)
- Connector: 2.7 to 3.3 N·m
- Actuators
  - HS9Z-A51:  $1.8 \pm 2.2$  N·m (two M4 screws)
  - HS9Z-A52:  $0.8 \pm 1.2$  N·m (two M4 Phillips screws)
  - HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws)
  - HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- Mounting bolts must be provided by the user.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator be installed in an unremovable manner, for example using special screws or welding the screws.

### Applicable Crimping Terminal

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



Recommended manufacturer: JST

Part No.: N0.5-3

Applicable wire size (with insulation tube): 0.2 to 0.5 mm<sup>2</sup>

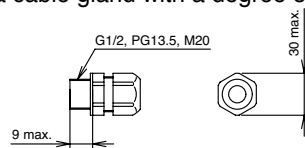
Note: Do not remove screw A during wiring. Removing the screw may cause malfunction or damage.

### Applicable Wire Size

0.5 to 1.5 mm<sup>2</sup>

### 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 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)

| 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 (Type No.: HS5D-\*\*\*BM) together with an adaptor (Type No.: MA-M/NPT 20X1.5 5402-0110, LAPP) and a gasket (Type 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.

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



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