## Miniature Interlock Switches

## HS5D



Head removal detection for safer performance.


Note: Contact IDEC for KOSHA approved model.

- See website for details on approvals and standards.


## Head Removal Detection Function

All HS5D models are equipped with "Head Removal Detection Function." When the head is removed, such as when the head is rotated, the main circuit (11-12) turns OFF.
HS5D-12 (example)
When the actuator is removed or inserted, the operation of the main circuits (11-12, 21-22) are the same. However, when the head is removed, disparity is detected (11-12: OFF, 21-22: ON). The disparity of the contacts detects the removal of the head.


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

|  | When actuator is <br> removed | When actuator is <br> inserted | When head is <br> removed |
| :--- | :---: | :---: | :---: |
| Main circuit $(\mathrm{NC}) \quad \Theta^{3}$ | OFF | ON | ON |
| Monitor circuit $(\mathrm{NC}) \Theta^{2}$ | OFF | ON | ON |

## Small size with 3 contacts

- 3 contact types with dual enabling contacts and a monitor contact are available.
- Compact size. Can be installed in narrow spaces.


The head orientation can be rotated, allowing 8 different actuator entries.
Double insulation structure eliminates the need for grounding.
Degree of protection (contacts): IP67 (IEC60529)
NC contacts with direct opening action (IEC/EN60947-5-1)

## HS5D Miniature Interlock Switches



## Specifications

| Applicable Standards | EN IS014119 <br> IEC60947-5-1 <br> EN60947-5-1 (TÜV approved) <br> GS-ET-15 (TÜV approved) <br> UL508 (UL listed) <br> CSA C22.2 No. 14 (c-UL listed) <br> GB14048.5 (CCC approved) <br> KS C IEC60947-5-1/S1-G-1/S2-E-4 (KOSHA approved) |
| :---: | :---: |
|  | IEC60204-1/EN60204-1 (applicable standards for use) |
| Type and Coded Level | Type 2 low level coded interlocking device (ISO 14119) |
| Operating Temperature | -30 to $+70^{\circ} \mathrm{C}$ (no freezing) |
| Relative Humidity | 45 to 85\% (no condensation) |
| Storage Temperature | -40 to $+80^{\circ} \mathrm{C}$ (no freezing) |
| Pollution Degree | 3 |
| Impulse Withstand Voltage | 4 kV |
| Contact Resistance | $50 \mathrm{~m} \Omega$ maximum (initial value) |
| Insulation Resistance (500V DC megger) | Between live and dead metal parts: $100 \mathrm{M} \Omega$ minimum Between terminals of different poles: $100 \mathrm{M} \Omega$ minimum |
| Electric Shock Protection Class | Class II (IEC61140) |
| Degree of Protection | IP67 (IEC60529) |
| Shock Resistance | Damage limits: $1000 \mathrm{~m} / \mathrm{s}^{2}$ |
| Vibration Resistance | Operating extremes: 10 to 55 Hz , amplitude 0.5 mm Damage limits: 30 Hz , amplitude 1.5 mm |
| Actuator Operating Speed | 0.05 to $1.0 \mathrm{~m} / \mathrm{s}$ |
| 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 ( 24 V AC/DC, 100 mA ) (operation frequency: 900 operations per hour) |
| Performance of Terminals 11-12 of Removed Head Unit | Mechanical damage limits: 10 operations min. <br> Insulation resistance: $\quad 100 \mathrm{M} \Omega$ (initial value) <br> Dielectric strength: $\quad 1000 \mathrm{~V}, 1$ minute (initial value) |
| Conditional <br> Short-circuit Current | 100A (250V) (note) |
| Weight (approx.) | Plastic head: 80 g (HS5D- $\square \square$ ) <br> Metal head: 110 g (HS5D- $\square \square Z)$ |

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

## Contact Ratings

| Rated Insulation Voltage (Ui) |  |  | 300 V |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Thermal Current (Ith) |  |  | 10A |  |  |
| Rated Voltage (Ue) |  |  | 30 V | 125 V | 250 V |
| Rated Current (le) * |  | Resistive load (AC-12) | 10A | 10A | 6A |
|  | AC | Inductive Load (AC-15) | 10A | 5A | 3A |
|  | DC | Resistive load (DC-12) | 8A | 2.2A | 1.1A |
|  | DC | Inductive Load (DC-13) | 4A | 1.1A | 0.6A |

- Minimum applicable load (reference): 5V AC/DC, 1 mA
(Applicable range may vary with operating conditions and load types.)
* TÜV rating: AC-15 3A/250V, DC-13 4A/30V

Part No. Development


## Parts Description

Right-angle Actuator
(SUS304)

Switches \& Pilot Lights

Control Boxes
Emergency
Stop Switches
Enabling
Switches
Safety Products
Explosion Proof
Terminal Blocks
Relays \& Sockets
Circuit
Protectors
Power Supplies
LED Illumination
Controllers
Operator
Interfaces
Sensors
AUTO-ID

Interlock
Switches
Non-contact
Interlock Switches
Safety Laser
Scanners
Safety Light
Curtains
Safety Modules

HS6B
HS6E
HS5D
HS5L
HS1L
Actuators for
HS1/HS5/HS6
Actuators/
Padlock Hasp

HS5D Miniature Interlock Switches

Miniature Safety Interlock Switch Package Quantity: 1

| Contact Configuration |  | Gland Port Size | Part No. |  |
| :---: | :---: | :---: | :---: | :---: |
|  |  | Plastic Head | Metal Head |
| 1NC-1N0 | Main Circuit $\oplus$   12 <br> Monitor Circuit $\underline{23}$ 24   |  | G1/2 | HS5D-11RN | HS5D-11ZRN |
|  |  | PG13.5 | HS5D-11RNP | HS5D-11ZRNP |
|  |  | M20 | HS5D-11RNM | HS5D-11ZRNM |
| 2NC |  | G1/2 | HS5D-02RN | HS5D-02ZRN |
|  |  | PG13.5 | HS5D-02RNP | HS5D-02ZRNP |
|  |  | M20 | HS5D-02RNM | HS5D-02ZRNM |
| 2NC-1NO |  | G1/2 | HS5D-12RN | HS5D-12ZRN |
|  |  | PG13.5 | HS5D-12RNP | HS5D-12ZRNP |
|  |  | M20 | HS5D-12RNM | HS5D-12ZRNM |
| 3NC |   Zb  <br> Main Circuit $\Theta$ 11 12 <br> Main Circuit $\Theta$ $21+$ 22 <br> Monitor Circuit $\Theta$ 31 32 | G1/2 | HS5D-03RN | HS5D-03ZRN |
|  |  | PG13.5 | HS5D-03RNP | HS5D-03ZRNP |
|  |  | M20 | HS5D-03RNM | HS5D-03ZRNM |

Actuator Package Quantity: 1

| Name | Part No. |
| :--- | :--- |
| Straight | HS9Z-A51 |
| Straight w/rubber bushings | HS9Z-A51A |
| Right-angle | HS9Z-A52 |
| Right-angle w/rubber bushings | HS9Z-A52A |
| Angle Adjustable (vertical/horizontal) | HS9Z-A55 |

- See E-064 for details on actuators.


## Accessories

Package Quantity: 1

| Name |  | Part No. | Remarks |
| :---: | :---: | :---: | :---: |
| Plug Actuator |  | HS9Z-A5P |  |
| Door Handle Actuator | Handle Unit | HS9Z-DH5RH | For right-hand door. |
|  |  | HS9Z-DH5LH | For left-hand door. |
|  | Switch Cover Unit | HS9Z-DH5C | Used for installing the interlock switch inside. |
|  | HS5D Installation Kit | HS9Z-DH5B | Used for mounting HS5D. |
| Sliding Actuator |  | HS9Z-SH5 |  |
| Slide Handle Actuator |  | HS9Z-EH5L |  |
| Padlock Hasp |  | HS9Z-PH5 |  |

Safety Light Curtains

## Contact Configuration and Operation Chart



- The operation characteristics shown in the chart above are for the HS9Z-A51.

For other actuator types, add 1.3 mm .

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

Terminal Arrangement


Dimensions and Mounting Hole Layouts
HS5D-DपZRND (Metal Head)
With HS9Z-A51 Straight Actuator
RP: Reference mounting position


Control Boxes

Emergency
Stop Switches
Enabling
Switches

Explosion Proof

Terminal Blocks
Relays \& Sockets

Protectors
Power Supplies
LED Illumination

Controllers
Operator Interfaces

Sensors

AUTO-ID

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. Improper soldering or failure to tighten the terminal screw may cause overheating and fire.
- Do not install the actuator in the location where a human body may come in contact. Otherwise injury may occur.
- 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.
- HS5D interlock switches are Type 2 low level coded interlocking devices (IS014119). According to ISO14119, the following is required to minimize defeat when installing and constructing systems:

1. Prevent dismantling or de-positioning of the elements of the interlocking device by use of non-detachable fixing (e.g. welding, gluing, one-way screws, riveting). However, use of non-detachable fixing can be an inappropriate solution in cases where a failure of the interlocking device during lifetime of the machinery can be expected and a fast change is necessary. In this case measures mentioned below, should be used to provide the required level of risk reduction.
2. Apply at least one out of the four measures below.
(1) Mounting out of reach.
(2) Physical obstruction or shielding.
(3) Mounting in hidden position.
(4) Integration of defeat monitoring by means of status monitoring/cyclic testing.

## 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 $1,000 \mathrm{~m} / \mathrm{s}^{2}$ 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.
- Safety function of the door interlock switch will be lost if a spare key is inserted into the interlock switch. Make sure that a spare key is not used on the interlock switch.
- Ensure that the actuator is firmly fastened to the door (by welding, rivet, or special screws) in the appropriate location, so that the actuator cannot be removed.
- Do not cut the actuator. Modification of the actuator may cause damage.
- Although the HS9Z-A51A/A52A 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.


## Mounting Examples



## Installing the Head

Do not use the metal head of the HS5E-K/5L interlock switch on the HS5D.
When using these HS5D and HS5E-K/5L interlock switches adjacently, ensure that the heads are not interchanged.

| HS5D |  |
| :--- | :--- |
| Plastic Head | Hetal Head | | Hetal Head |
| :--- |



## Instructions

## Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use angle adjustable actuators (HS9Z-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:

Horizontal Swing


Vertical Swing


- 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 E-065). Adjustable angle: 0 to $20^{\circ}$
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening. After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.


## Rotating the Head

- The head of the HS5D can be rotated by removing the four screws from the corners of the HS5D head and reinstalling the head in the desired orientation. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws tightly, because loose tightening may cause malfunction.
- Recommended screw tightening torque: 0.9 to $1.1 \mathrm{~N} \cdot \mathrm{~m}$



## 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: $1.8 \pm 2.2 \mathrm{~N} \cdot \mathrm{~m}$ (two M4 screws)
- Housing Lid Screw: 0.2 to $0.4 \mathrm{~N} \cdot \mathrm{~m}$ (M3 screw)
- Terminal Screw: $\quad 0.6$ to $0.8 \mathrm{~N} \cdot \mathrm{~m}$ (M3 screw)
- Connector: $\quad 2.7$ to $3.3 \mathrm{~N} \cdot \mathrm{~m}$
- Actuators

HS9Z-A51: $\quad 1.8 \pm 2.2 \mathrm{~N} \cdot \mathrm{~m}$ (two M4 screws)
HS9Z-A52: $\quad 0.8 \pm 1.2 \mathrm{~N} \cdot \mathrm{~m}$ (two M4 Phillips screws)
HS9Z-A51A/A52A: 1.0 to $1.5 \mathrm{~N} \cdot \mathrm{~m}$ (two M4 screws)
HS9Z-A55: $\quad 1.0$ to $1.5 \mathrm{~N} \cdot \mathrm{~m}$ (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.

Protectors
Power Supplies
LED Illumination
Controllers
Operator
Interfaces
Sensors
AUTO-ID

## HS5D Miniature Interlock Switches

Instructions

## Applicable Crimping Terminal

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


## Applicable 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 $1 / 2-14$ NPT cable gland, use the HS5D interlock switch with M20 gland port (Part No.: HS5D-***BM) together with an adaptor (Part No.: MA-M/NPT 20X1.5 5402-0110, LAPP) and a gasket (Part No.: GP M20, LAPP). Install a gasket between the interlock switch and the adaptor. Apply sealing tape between the cable gland and the adaptor to make sure of IP67 protection for the enclosure.

