Door Interlock Switches

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- Product training schedule & locations
- Advertising & trade show schedules
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Door Interlock Switches

**Overview**

<table>
<thead>
<tr>
<th>Series Model</th>
<th>HS6B</th>
<th>HS5B</th>
<th>HS2B</th>
<th>HS1B</th>
<th>HS6E</th>
<th>HS5E</th>
<th>HS1E</th>
<th>HS1C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appearance</td>
<td><img src="image" alt="HS6B" /></td>
<td><img src="image" alt="HS5B" /></td>
<td><img src="image" alt="HS2B" /></td>
<td><img src="image" alt="HS1B" /></td>
<td><img src="image" alt="HS6E" /></td>
<td><img src="image" alt="HS5E" /></td>
<td><img src="image" alt="HS1E" /></td>
<td><img src="image" alt="HS1C" /></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Size (mm)</th>
<th>78 x 15 x 30mm</th>
<th>91 x 30 x 30mm</th>
<th>98 x 57 x 40mm</th>
<th>125 x 64 x 40mm</th>
<th>75 x 15 x 75mm</th>
<th>146 x 35 x 40mm</th>
<th>125 x 106 x 39.7mm</th>
</tr>
</thead>
</table>

|---------------|-----------------|--------------------------|----------------|-------------------|----------------|-------------------------------|----------------|-------------------|

<table>
<thead>
<tr>
<th>Solenoid (Yes/No)</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>LED Indicator</th>
<th>No</th>
<th>No</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
<th>Yes</th>
</tr>
</thead>
</table>

**Application Example**

For information on the Teaching Pendant visit www.idec.com/oi/pendant

For more information, visit www.stevenengineering.com
HS6B Series Subminiature Interlock Switch

**HS6B features:**
- Only 78 x 30 x 15mm
- Allows highest level of safety by having 3 contacts: dual load contacts + monitoring contact (ISO13849-1, EN954-1)
- Two actuator entrances provide flexibility for installation options
- Integral molded cable reduces wiring time
- IP67 (IEC60529) watertight sealing (contact is sealed, housing allows drainage)
- Direct Opening Action: Opening the door forces the contacts to disconnect even if the contacts are welded (IEC/EN60947-5-1)
- Actuators comply with ISO14119 and EN1088

**Part Numbers**

<table>
<thead>
<tr>
<th>Contact Configuration</th>
<th>Cable Length</th>
<th>Part Number (Standard Stock in bold)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1NC-1NO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1m</td>
<td>HS6B-11B01</td>
</tr>
<tr>
<td>33</td>
<td>3m</td>
<td>HS6B-11B03</td>
</tr>
<tr>
<td>34</td>
<td>5m</td>
<td>HS6B-11B05</td>
</tr>
<tr>
<td>2NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1m</td>
<td>HS6B-02B01</td>
</tr>
<tr>
<td>31</td>
<td>3m</td>
<td>HS6B-02B03</td>
</tr>
<tr>
<td>32</td>
<td>5m</td>
<td>HS6B-02B05</td>
</tr>
<tr>
<td>2NC-1NO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1m</td>
<td>HS6B-12B01</td>
</tr>
<tr>
<td>21</td>
<td>3m</td>
<td>HS6B-12B03</td>
</tr>
<tr>
<td>31</td>
<td>5m</td>
<td>HS6B-12B05</td>
</tr>
<tr>
<td>3NC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>1m</td>
<td>HS6B-03B01</td>
</tr>
<tr>
<td>21</td>
<td>3m</td>
<td>HS6B-03B03</td>
</tr>
<tr>
<td>31</td>
<td>5m</td>
<td>HS6B-03B05</td>
</tr>
</tbody>
</table>

**Contact Configuration & Operation Chart**

<table>
<thead>
<tr>
<th>Type</th>
<th>Contact Configuration</th>
<th>Contact Operation Chart</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6B-11</td>
<td>1NC-1NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>11-12 33-34 5.5 5.8 28.2</td>
</tr>
<tr>
<td>HS6B-02</td>
<td>2NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>11-12 31-32 5.5 5.8 28.2</td>
</tr>
<tr>
<td>HS6B-12</td>
<td>2NC-1NO</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>11-12 21-22 33-34 5.5 5.8 28.2</td>
</tr>
<tr>
<td>HS6B-03</td>
<td>3NC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>11-12 21-22 31-32 5.5 5.8 28.2</td>
</tr>
</tbody>
</table>

Actuator inserted completely Actuator removed completely
## Actuator Keys

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Part Number</th>
<th>Shape</th>
<th>Appearance</th>
<th>Part Number</th>
<th>Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS9Z-A61</td>
<td>Straight (Mainly for sliding doors)</td>
<td></td>
<td>HS9Z-A65</td>
<td>adjustable actuator 90° angle</td>
</tr>
<tr>
<td></td>
<td>HS9Z-A62</td>
<td>Right-angle (Mainly for hinged doors)</td>
<td></td>
<td>HS9Z-A66</td>
<td>adjustable actuator 180° angle</td>
</tr>
</tbody>
</table>

The actuators are not included, must be ordered separately.

## Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforming to Standards</td>
<td>EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, IEC60664-1, IEC60204-1, EN60204-1, UL508</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>–25 to +70°C (no freezing)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>–40 to +80°C (no freezing)</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>45 to 85% RH (no condensation)</td>
</tr>
<tr>
<td>Storage Humidity</td>
<td>95% RH maximum (no condensation)</td>
</tr>
<tr>
<td>Altitude</td>
<td>2,000m maximum</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>3</td>
</tr>
<tr>
<td>Rated Insulation Voltage (Ui)</td>
<td>300V</td>
</tr>
<tr>
<td>Impulse Withstand Voltage (Uimp)</td>
<td>4kv</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>Between live &amp; dead metal parts: 100MΩ maximum</td>
</tr>
<tr>
<td>Electric Shock Protection Class</td>
<td>Class II</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>Operating Extremes 5 to 55 Hz, half amplitude 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>Damage Limits</td>
</tr>
<tr>
<td>Contact Resistance</td>
<td>300m/s maximum</td>
</tr>
<tr>
<td>Shock Resistance</td>
<td>Operating Extremes 300m/s (30G)</td>
</tr>
<tr>
<td></td>
<td>Damage Limits</td>
</tr>
<tr>
<td>Direct Opening Travel</td>
<td>8 mm minimum</td>
</tr>
<tr>
<td>Direct Opening Force</td>
<td>60N minimum</td>
</tr>
<tr>
<td>Thermal Current (Ith)</td>
<td>2.5A</td>
</tr>
<tr>
<td>Operating Voltage (Ue)</td>
<td>30V, 125V, 250V</td>
</tr>
<tr>
<td>AC Resitive load (AC12)</td>
<td>–, 2.5A, 1.5A</td>
</tr>
<tr>
<td>Inductive load (AC15)</td>
<td>–, 1.5A, 0.75A</td>
</tr>
<tr>
<td>DC Resitive load (DC12)</td>
<td>2.5A, 1.1A, 0.55A</td>
</tr>
<tr>
<td></td>
<td>(2A), (0.4A), (0.2A)</td>
</tr>
<tr>
<td>Inductive load (DC13)</td>
<td>2.3A, 0.55A, 0.27A</td>
</tr>
<tr>
<td></td>
<td>(1A), (0.22A), (0.1A)</td>
</tr>
<tr>
<td>Maximum Actuation Frequency</td>
<td>1200 operations/hour</td>
</tr>
<tr>
<td>Mechanical Life</td>
<td>1,000,000 operations (at full rated load)</td>
</tr>
<tr>
<td>Recommended Actuation Speed</td>
<td>0.05 to 1.0m/s</td>
</tr>
<tr>
<td>Wire Tensile Strength</td>
<td>50N minimum</td>
</tr>
<tr>
<td>Electrical Life</td>
<td>100,000 operations (at full rated load)</td>
</tr>
<tr>
<td>Conditional Short-Circuit Current</td>
<td>50A 250V (IEC60947-5-1, IEC60204-1, -2)</td>
</tr>
<tr>
<td>Weight</td>
<td>120g</td>
</tr>
</tbody>
</table>
Door Interlock Switches

HS6B Series

Installation Notes

Recommended Screw Torque
- Safety switch body installation (M4 screw): 1.0–1.5 N·m
- Actuator installation (M4 screw): 1.0–1.5 N·m

Handling Cables
- Do not tighten or loosen the fastened cable conduit of the safety switch
- Minimum bend radius of installed cable: 40 mm

Wiring Designations

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Color</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6B-12B01</td>
<td>blue-blue/white</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>brown-brown/white</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>orange-orange/white</td>
<td>NO</td>
</tr>
<tr>
<td>HS6B-03B01</td>
<td>blue-blue/white</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>brown-brown/white</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>orange-orange/white</td>
<td>NO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Color</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6B-11B01</td>
<td>blue-blue/white</td>
<td>NC</td>
</tr>
<tr>
<td></td>
<td>orange-orange/white</td>
<td>NO</td>
</tr>
<tr>
<td>HS6B-02B01</td>
<td>blue-blue/white</td>
<td>NC</td>
</tr>
</tbody>
</table>

Dimensions (mm)

Installation

2-M4 Screws
(ø4.3 or M4 tapped)

The interlock switch can be mounted in two directions.

Using straight actuator (HS9Z-A61)

Actuator Stop (supplied)

When mounted (6.6)

When mounted (33.8)

Right-angle actuator (HS9Z-A62)

Actuator Stop (supplied)

When mounted (14)

Angle Adjustable Actuator

2-M4 Screws
(ø4.3 or M4 tapped)

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
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.

Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For doors with small minimum radius, use angle adjustable actuators (HS9Z-A65 or HS9Z-A66).

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

HS9Z-A62 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:

Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment

Vertical Adjustment

Angle Adjustment (M3 Hexagon Socket Head Screw)

Orienting Insert

Horizontal Adjustment

Vertical Adjustment

When using the HS9Z-A65/HS9Z-A66 Angle Adjustable (vertical) Actuator

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

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

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

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).

- 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.
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 the location where a human body may come into contact. Otherwise injury may occur.

Instructions

- Regardless of door types, do not use the interlock switch as a door stop. Install a mechanical door stop at the end of the door to protect the interlock switch against excessive force.
- Do not apply excessive shock to the interlock switch when opening or closing the door. A shock to the interlock switch exceeding 1,000 m/s² may cause damage to the interlock switch.
- Do not disassemble or modify the interlock switch, otherwise a malfunction or an accident may occur.
- Do not install the actuator in the location where a human body may come into contact. Otherwise injury may occur.

Mounting

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

Note: When mounting an actuator key, 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 key (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

<table>
<thead>
<tr>
<th>No.</th>
<th>Insulation Color</th>
<th>No.</th>
<th>Insulation Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Orange/White</td>
<td>4</td>
<td>Brown</td>
</tr>
<tr>
<td>2</td>
<td>Blue/White</td>
<td>5</td>
<td>Blue</td>
</tr>
<tr>
<td>3</td>
<td>Brown/White</td>
<td>6</td>
<td>Orange</td>
</tr>
</tbody>
</table>

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

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.
HS5B Series Miniature Interlock Switch

**HS5B features:**

- 30mm x 30mm x 91mm Compact Housing
- Available with 2 Contact Configurations (1NO + 1NC or 2NC)
- Flexible Installation: By turning the head of the switch to the desired angle, the actuator can be accessed from 8 directions
- Plastic Housing: Light weight
- Direct Opening Action: Opening the door forces the contacts to disconnect even if the contacts are welded (IEC60947-5-1)
- Degree of Protection: IP67 (IEC60529)

---

**Part Numbers**

<table>
<thead>
<tr>
<th>Contact Configuration</th>
<th>Conduit Port Size</th>
<th>Plastic Head Type</th>
<th>Metal Head Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1NC-1NO</td>
<td>G1/2</td>
<td>HS5B-11B</td>
<td>HS5B-11ZB</td>
</tr>
<tr>
<td>3</td>
<td>PG13.5</td>
<td>HS5B-11NP</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>M20</td>
<td>HS5B-11BM</td>
<td>HS5B-11ZBM</td>
</tr>
<tr>
<td>2NC</td>
<td>G1/2</td>
<td>HS5B-02B</td>
<td>HS5B-02ZB</td>
</tr>
<tr>
<td>3</td>
<td>PG13.5</td>
<td>HS5B-02NP</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td>M20</td>
<td>HS5B-02BM</td>
<td>HS5B-02ZBM</td>
</tr>
</tbody>
</table>

The actuators are not included, must be ordered separately.

---

**Actuator Keys**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Part Number (Package Qty 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>HS9Z-A51</td>
<td></td>
</tr>
<tr>
<td>Straight w/rubber bushings</td>
<td>HS9Z-A51A</td>
<td></td>
</tr>
<tr>
<td>Right-angle</td>
<td>HS9Z-A52</td>
<td></td>
</tr>
<tr>
<td>Right-angle w/rubber bushings</td>
<td>HS9Z-A52A</td>
<td></td>
</tr>
<tr>
<td>Angle Adjustable (for hinged doors)</td>
<td>HS9Z-A55</td>
<td></td>
</tr>
</tbody>
</table>

---

**Parts Description**

- M3.5 Terminal Screws
- Right-angle Actuator
- Angle Adjustable Actuator (for hinged doors)
- Right-angle Actuator w/rubber bushing
- Conduit Port (suitable conduits or cable glands which can maintain IP67 protection)
- Straight Actuator w/rubber bushing
## Accessories

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Part Number</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS5B/HS5E Plug Actuator (allows switch to be used as interlock plug unit)</td>
<td>HS92-A5P</td>
<td>35g</td>
</tr>
<tr>
<td></td>
<td>HS5B/HS5E Padlock Hasp (prevents unauthorized insertion of actuator)</td>
<td>HS92-PH5</td>
<td>35g</td>
</tr>
</tbody>
</table>

## Contact Configuration & Operation Chart

<table>
<thead>
<tr>
<th>Model</th>
<th>Contact Configuration</th>
<th>Contact Operation Chart</th>
<th>Contact Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS5B-11</td>
<td>1NC-1NO</td>
<td>Actuator inserted completely</td>
<td>ON (closed)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Actuator removed completely</td>
<td>OFF (open)</td>
</tr>
<tr>
<td>HS5B-02</td>
<td>2NC</td>
<td>3–4 1–2</td>
<td></td>
</tr>
</tbody>
</table>

## Specifications

<table>
<thead>
<tr>
<th>Conforming to Standards</th>
<th>EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Temperature</td>
<td>–20 to +70°C (no freezing)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>–40 to +80°C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>85% RH maximum (no condensation)</td>
</tr>
<tr>
<td>Altitude</td>
<td>2,000m maximum</td>
</tr>
<tr>
<td>Rated Insulation Voltage (Ui)</td>
<td>300V</td>
</tr>
<tr>
<td>Impulse Withstand Voltage (Uimp)</td>
<td>4 kV</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>100MΩ minimum (500V DC megger)</td>
</tr>
<tr>
<td>Electric Shock Protection Class</td>
<td>Class II (IEC61140)</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>3 (IEC60664-1)</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>Operating Extremes: 10 to 55 Hz, amplitude 0.5 mm</td>
</tr>
<tr>
<td></td>
<td>Damage Limits: 60 m/sec² (approx. 6G)</td>
</tr>
<tr>
<td>Shock Resistance</td>
<td>1,000 m/sec² (approx. 100G)</td>
</tr>
<tr>
<td>Actuator Operating Speed</td>
<td>1 m/sec maximum</td>
</tr>
<tr>
<td>Positive Opening Travel</td>
<td>8 mm minimum</td>
</tr>
<tr>
<td>Positive Opening Force</td>
<td>60N minimum</td>
</tr>
<tr>
<td>Thermal Current (Ith)</td>
<td>10A</td>
</tr>
<tr>
<td>Rated Operating Current (Ie)</td>
<td>Operating Voltage (Ue)</td>
</tr>
<tr>
<td></td>
<td>30V</td>
</tr>
<tr>
<td>AC Resistive load (AC12)</td>
<td>10A</td>
</tr>
<tr>
<td>Inductive load (AC15)</td>
<td>10A</td>
</tr>
<tr>
<td>DC Resistive load (DC12)</td>
<td>8A</td>
</tr>
<tr>
<td>Inductive load (DC13)</td>
<td>4A</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>900 operations/hour</td>
</tr>
<tr>
<td>Mechanical Life</td>
<td>1,000,000 operations</td>
</tr>
<tr>
<td>Electrical Life</td>
<td>100,000 operations (rated load)</td>
</tr>
<tr>
<td>Conditional Short-circuit Current</td>
<td>100A (IEC60947-5-1)</td>
</tr>
<tr>
<td>Recommended Short Circuit Protection</td>
<td>250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 80g</td>
</tr>
</tbody>
</table>
HS5B Series

Door Interlock Switches

Overview

X Series E-Stop

Enabling Switches

AS-Interface Safety at Work

Application Examples and Circuit Diagrams

HS5B-11 (1NO-1NC)

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door/Switch Status</td>
<td>Door Closed</td>
</tr>
<tr>
<td></td>
<td>Machine ready to operate</td>
</tr>
</tbody>
</table>

Door

Circuit Diagram

Main Circuit 3-4: Closed 3-4: Open
Aux. Circuit 1-2: Open 1-2: Closed

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.

HS5B-02 (2NC)

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door/Switch Status</td>
<td>Door Closed</td>
</tr>
<tr>
<td></td>
<td>Machine ready to operate</td>
</tr>
</tbody>
</table>

Door

Circuit Diagram

Main Circuit 3-4: Closed 3-4: Open
Aux. Circuit 1-2: Closed 1-2: Open

Dimensions (mm)

Plastic Head - using the straight actuator (HS9Z-A51)

Plastic Head (black or gray)

Conduit Port

Actuator Actuator Stop

Actuator Mounting Reference Position

Slot Plug (supplied) (Note)

2-M4 Screws

Mounting Hole Layout

Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.
**Dimensions (mm), continued**

**Plastic Head – using the Right-angle actuator (HS9Z-A52)**

![Diagram of Plastic Head - using the Right-angle actuator (HS9Z-A52)]

Actuator
Actuator Stop
Actuator Cover

20 to 22
2-M4 Screws
Mounting Hole Layout

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

**Metal Head - using the straight actuator (HS9Z-A51A)**

![Diagram of Metal Head - using the straight actuator (HS9Z-A51A)]

Actuator
Actuator Stop
Actuator Cover

RP: Actuator Mounting Reference Position

Slot Plug (supplied) (Note)

20 to 22
2-M4 Screws
Mounting Hole Layout

**Metal Head – using the Right-angle actuator (HS9Z-A52A)**

![Diagram of Metal Head - using the Right-angle actuator (HS9Z-A52A)]

Actuator
Actuator Stop
Actuator Cover

Slot Plug (supplied) (Note)

20 to 22
2-M4 Screws
Mounting Hole Layout

Note: Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.
### Overview
- **Actuator Mounting Hole Layout (Straight, Right-angle)**

  - **Straight Actuator - HS9Z-A51** (mainly for sliding doors)
  - **Right-angle Actuator - HS9Z-A52** (mainly for hinged doors)

### Actuator Key Dimensions (mm)

<table>
<thead>
<tr>
<th>Actuator Type</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight</td>
<td>7.3 x 43.8</td>
</tr>
<tr>
<td>Right-angle</td>
<td>15.3 x 39.7</td>
</tr>
</tbody>
</table>

### Adjustable Actuator - HS9Z-A55

- **Horizontal Swing**
- **Vertical Swing**

### 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.

### Actuator Stop (Note)

- 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 with rubber bushing, right-angle with rubber bushing)

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

### Accessory Dimensions (mm)

<table>
<thead>
<tr>
<th>Accessory</th>
<th>Dimensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS9Z-A5P</td>
<td>36.2 x 43</td>
</tr>
<tr>
<td>HS9Z-PH5</td>
<td>30 x 48</td>
</tr>
</tbody>
</table>
Door Interlock Switches

HS5B Series

Mounting Examples
Mount the interlock switch as shown in the examples below.

Mounting on Sliding Doors

Mounting on Hinged Doors

Mounting the HS5B Head
The metal head for the HS5E interlock switch cannot be used on the HS5B. Be sure to use the plastic head or metal head for the HS5B. Take care particularly when using both HS5B and HS5E together.

Rotating the Head
The head of the HS5B can be rotated by removing the four screws from the corners of the HS5B 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. If the screws are loose it may cause the switch to malfunction.

Recommended screw tightening torque: 1.0 ±0.1 N·m

<table>
<thead>
<tr>
<th>Factory Setting</th>
<th>Alternative Head Orientations</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>

Applicable Crimping Terminal
When using crimping terminals, be sure to install insulation tubes on the crimping terminals to prevent electric shocks.

Applicable Wire Size
- 0.5 to 1.25 mm² (AWG20 to AWG16)

Recommended Tightening Torque of Mounting Screws
- Interlock Switch: 2.0 ± 0.2 N·m (two M4 screws) *
- Actuator Keys
  - HS9Z-A51: 2.0 ± 0.2 N·m (two M4 screws) *
  - HS9Z-A52: 1.0 ± 0.2 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 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.
- When installing HS9Z-A51A or HS9Z-A52A actuator keys, use the washer (supplied with the actuator) on the hinged door, and mount tightly using two M4 screws.

Mounting Centers
12 mm (factory setting), adjustable to 20 mm

Conduit Port Size Identification
Conduit port size is identified by the arrow on the back of the HS5B interlock switch. The following example shows the identification of the M20 conduit port size.

Marking | Conduit Port Size |
---------|------------------|
E        | Ø1/2             |
P5        | Ø13.5            |
M30      | M20              |

Note: Choose mounting centers either 12 mm or 20 mm.
**Actuator Angle Adjustment**
- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0° to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.

**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-A55).
  
  **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-A52 Actuator**
- When the door hinge is on the extension line of the interlock switch surface:
  - Minimum radius: 170 mm
  - When the door hinge is on the extension line of the actuator mounting surface:
    - Minimum radius: 230 mm

**When using the HS9Z-A55 Angle Adjustable Actuator**
- When the door hinge is on the extension line of the interlock switch surface:
  - Minimum radius: 50 mm
- When the door hinge is on the extension line of the actuator mounting surface:
  - Minimum radius: 70 mm

**Actuator Angle Adjustment for the HS9Z-A55**
- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 354). 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 entry slot of the safety switch.
- Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)
- After adjusting the actuator angle, apply loctite or the like to the adjustment screw to prevent it from loosening.

**Applicable Cable Glands**

**When Using Multi-core Cables (Example)**

<table>
<thead>
<tr>
<th>Conduit Port Size</th>
<th>Plastic Cable Gland</th>
<th>Metal Cable Gland</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1/2</td>
<td>SCS-10* (Seiwa Electric)</td>
<td>ALS-16** (Nihon Flex)</td>
</tr>
<tr>
<td>G13.5</td>
<td>ST13.5 (K-MECS)</td>
<td>ABS-**PG13.5 (Nihon Flex)</td>
</tr>
<tr>
<td>M20</td>
<td>STA-M20X1.5 (K-MECS)</td>
<td>ALS-**EC20 (Nihon Flex)</td>
</tr>
</tbody>
</table>

- Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.
- When using a 1/2-14NPT cable gland, use the HS5B interlock switch with M20 conduit port (Part No.: HS5B-***BM) together with an adapter (Part No.: MA-M/NPT 20X1.5 5402-0110, K-MECS) and a gasket (Part No.: GP M20, K-MECS). Install a gasket between the interlock switch and the adapter. Apply sealing tape between the cable gland and the adapter to make sure of IP67 protection for the enclosure.
HS2B Series Full Size Interlock Switch

**HS2B features:**
- Direct Opening Action: If the door is forced open, the contacts are disconnected even if they are welded or stuck
- Available with or without an indicator (red or green)
- Flexible Installation: Two actuator entries and three conduit ports are provided
- 1NC-1NO contacts
- Compact and lightweight plastic housing
- Degree of Contact Protection: IP67

### Part Numbers

**Body**

<table>
<thead>
<tr>
<th>Model</th>
<th>Contact Configuration</th>
<th>Pilot Light</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS2B (plastic housing)</td>
<td>1NC-1NO</td>
<td>Without</td>
<td>HS2B-11NB</td>
</tr>
</tbody>
</table>

**Part Number Key**

**HS2B - 11 4 N B - R**

- **Indicator Color**
  - R (Red), G (Green)
- **Indicator Rated Voltage**
  - 4 (24V DC)
  - Blank (without indicator)

**Actuator Keys & Accessories**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS9Z-A1</td>
<td>Straight Actuator (Mainly for sliding doors)</td>
</tr>
<tr>
<td></td>
<td>HS9Z-A2</td>
<td>Right-angle Actuator (Mainly for rotating doors)</td>
</tr>
<tr>
<td></td>
<td>HS9Z-A3</td>
<td>Adjustable Actuator</td>
</tr>
<tr>
<td></td>
<td>HS9Z-P1</td>
<td>Conduit Opening Plug</td>
</tr>
</tbody>
</table>

Order the actuators separately (not supplied with the switch).

Not necessary to specify color if indicator option not chosen.
### Specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conforming to Standards</td>
<td>IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508</td>
</tr>
<tr>
<td>Operating Temperature</td>
<td>–25 to +70°C (no freezing)</td>
</tr>
<tr>
<td>Storage Temperature</td>
<td>–40 to +80°C</td>
</tr>
<tr>
<td>Operating Humidity</td>
<td>85% RH maximum (no condensation)</td>
</tr>
<tr>
<td>Altitude</td>
<td>2,000m maximum</td>
</tr>
<tr>
<td>Rated Insulation Voltage (Ui)</td>
<td>300V (between LED and ground: 60V)</td>
</tr>
<tr>
<td>Impulse Withstand Voltage (Uimp)</td>
<td>4 kV (between LED and ground: 2.5 kV)</td>
</tr>
<tr>
<td>Insulation Resistance</td>
<td>Between live and dead metal parts: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between live metal part and ground: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between live metal parts: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between terminals of the same pole: 100 MΩ minimum</td>
</tr>
<tr>
<td>Electric Shock Protection Class</td>
<td>Class II (IEC61140)</td>
</tr>
<tr>
<td>Pollution Degree</td>
<td>3 (IEC60947-5-1)</td>
</tr>
<tr>
<td>Degree of Protection</td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td>Vibration Resistance</td>
<td>Operating Extremes: 10 to 55 Hz, amplitude 0.5mm</td>
</tr>
<tr>
<td></td>
<td>Damage Limits: 60 m/sec² (approx. 6G)</td>
</tr>
<tr>
<td>Shock Resistance</td>
<td>1,000 m/sec² (approx. 100G)</td>
</tr>
<tr>
<td>Actuator Operating Speed</td>
<td>1 m/sec maximum</td>
</tr>
<tr>
<td>Positive Opening Travel</td>
<td>11 mm minimum</td>
</tr>
<tr>
<td>Positive Opening Force</td>
<td>36N minimum</td>
</tr>
<tr>
<td>Thermal Current (Ith)</td>
<td>10A</td>
</tr>
<tr>
<td>Rated Operating Current (Ie)</td>
<td>Operating Voltage (Ue) 30V</td>
</tr>
<tr>
<td></td>
<td>AC Resisitive load (AC12)</td>
</tr>
<tr>
<td></td>
<td>Inductive load (AC15)</td>
</tr>
<tr>
<td></td>
<td>DC Resitive load (DC12)</td>
</tr>
<tr>
<td></td>
<td>Inductive load (DC13)</td>
</tr>
<tr>
<td>Operating Frequency</td>
<td>900 operations/hour</td>
</tr>
<tr>
<td>Mechanical Life</td>
<td>1,000,000 operations</td>
</tr>
<tr>
<td>Electrical Life</td>
<td>100,000 operations (rated load)</td>
</tr>
<tr>
<td>Conditional Short-circuit Current</td>
<td>100A (IEC60947-5-1)</td>
</tr>
<tr>
<td>Recommended Short Circuit Protection</td>
<td>250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)</td>
</tr>
<tr>
<td>Indicator</td>
<td>Operating Voltage 24V DC</td>
</tr>
<tr>
<td></td>
<td>Current 10 mA</td>
</tr>
<tr>
<td></td>
<td>Light Source LED lamp</td>
</tr>
<tr>
<td></td>
<td>Lens Color Red or Green (12 mm dia. Lens)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 130g</td>
</tr>
</tbody>
</table>

---

**Overview**

- **Door Interlock Switches**
- **Enabling Switches**
- **Barriers**
- **AS-Interface Safety at Work**

---

**Door Interlock Switches**

- **X Series E-Stops**
- **358  **
- **www.idec.com**
**HS2B Series Door Interlock Switches**

**Application Examples and Circuit Diagrams**

<table>
<thead>
<tr>
<th>HS2B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Status 1</strong></td>
</tr>
<tr>
<td>Door/</td>
</tr>
<tr>
<td>Switch</td>
</tr>
</tbody>
</table>

**Door Interlock Switches**

**Overview** X Series E-Stops  
Door Interlock Switches  
Enabling Switches  
Barriers  
AS-Interface  
Safety at Work

**Application Examples and Circuit Diagrams**

**HS2B**

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
</tr>
</thead>
</table>
| Door/ Switch Status | Door Closed  
- Machine ready to operate |
| Door opened  
- Machine cannot be started |

**Circuit Diagram**

**HS2B-11 (1NO-1NC)**

**Main Circuit**

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
3. Terminals + and - are used for the LED indicator, and are isolated from door status.

**Dimensions (mm)**

**HS2B - using the straight actuator (HS9Z-A1)**

(Horizontal Mounting)

(VERTICAL MOUNTING)
Dimensions (mm), continued

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

(Horizontal Mounting) (Vertical Mounting)

Plugging the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

Straight Actuator HS9Z-A1

Right-angle Actuator HS9Z-A2

Angle-adjustable Actuator HS9Z-A3

Adjustable Actuator

The actuator angle is adjustable (0° to 20°) for hinged doors. The minimum radius of the door opening can be as small as 100mm.

Actuator Angle Adjustment

- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0°) to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.

- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.
- Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)
- After adjusting the actuator angle, apply loctite or the like to the adjustment screw to prevent it from loosening.
HS1B Series Full Size Interlock Switch

**HS1B features:**
- Rugged aluminum die-cast housing
- Direct Opening Action: If the door is forced open, the contacts are disconnected even if they are welded or stuck
- Available with or without an indicator (red or green)
- Flexible Installation: Two actuator entries and three conduit ports are provided
- Select from two circuit configurations (1NO-1NC or 2NC).
- Degree of Contact Protection: IP67

**Part Numbers**

<table>
<thead>
<tr>
<th>Body</th>
<th>Contact Configuration</th>
<th>Pilot Light</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS1B (alum. die-cast housing)</td>
<td>1NC-1NO</td>
<td>Without red LED</td>
<td>HS1B-114R-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With green LED</td>
<td>HS1B-114R-G</td>
</tr>
<tr>
<td></td>
<td>2NC</td>
<td>Without red LED</td>
<td>HS1B-024R-R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With green LED</td>
<td>HS1B-024R-G</td>
</tr>
</tbody>
</table>

1. The special key wrench (HS9Z-T1) for removing the cover and manual unlocking is included with the switch.
2. Order the actuators separately (not supplied with the switch).

**Actuator Keys and Accessories**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="HS9Z-A1" alt="Image" /></td>
<td>HS9Z-A1</td>
<td>Straight Actuator (Mainly for sliding doors)</td>
</tr>
<tr>
<td><img src="HS9Z-A2" alt="Image" /></td>
<td>HS9Z-A2</td>
<td>Right-angle Actuator (Mainly for rotating doors)</td>
</tr>
<tr>
<td><img src="HS9Z-A3" alt="Image" /></td>
<td>HS9Z-A3</td>
<td>Adjustable Actuator</td>
</tr>
<tr>
<td><img src="HS9Z-T1" alt="Image" /></td>
<td>HS9Z-T1</td>
<td>Key Wrench (included with switch)</td>
</tr>
<tr>
<td><img src="HS9Z-P1" alt="Image" /></td>
<td>HS9Z-P1</td>
<td>Conduit Opening Plug</td>
</tr>
</tbody>
</table>

*Torx is a registered trademark of Camcar Textron.*
### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conforming to Standards</strong></td>
<td>IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>–25 to +70°C (no freezing)</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>–40 to +80°C</td>
</tr>
<tr>
<td><strong>Operating Humidity</strong></td>
<td>85% RH maximum (no condensation)</td>
</tr>
<tr>
<td><strong>Altitude</strong></td>
<td>2,000m maximum</td>
</tr>
<tr>
<td><strong>Rated Insulation Voltage (Ui)</strong></td>
<td>300V (between LED and ground: 60V)</td>
</tr>
<tr>
<td><strong>Impulse Withstand Voltage (Uimp)</strong></td>
<td>4 kV (between LED and ground: 2.5 kV)</td>
</tr>
<tr>
<td><strong>Insulation Resistance</strong></td>
<td>Between live and dead metal parts: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between live metal part and ground: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between live metal parts: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between terminals of the same pole: 100 MΩ minimum</td>
</tr>
<tr>
<td><strong>Electric Shock Protection Class</strong></td>
<td>Class I (IEC61140)</td>
</tr>
<tr>
<td><strong>Pollution Degree</strong></td>
<td>3 (IEC60947-5-1)</td>
</tr>
<tr>
<td><strong>Degree of Protection</strong></td>
<td>IP67 (IEC60529)</td>
</tr>
<tr>
<td><strong>Vibration Resistance</strong></td>
<td>10 to 55 Hz, amplitude 0.5mm p-p</td>
</tr>
<tr>
<td><strong>Operating Extremes</strong></td>
<td>60 m/sec² (approx. 6G)</td>
</tr>
<tr>
<td><strong>Damage Limits</strong></td>
<td>1,000 m/sec² (approx. 100G)</td>
</tr>
<tr>
<td><strong>Actuator Operating Speed</strong></td>
<td>1 m/sec maximum</td>
</tr>
<tr>
<td><strong>Positive Opening Travel</strong></td>
<td>11 mm minimum</td>
</tr>
<tr>
<td><strong>Positive Opening Force</strong></td>
<td>20N minimum</td>
</tr>
<tr>
<td><strong>Thermal Current (Ith)</strong></td>
<td>10A</td>
</tr>
<tr>
<td><strong>Rated Operating Current (Ie)</strong></td>
<td>AC Resitive load (AC12): 10A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (AC15): 10A</td>
</tr>
<tr>
<td></td>
<td>DC Resitive load (DC12): 8A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (DC13): 4A</td>
</tr>
<tr>
<td></td>
<td>Operating Voltage (Ue): 30V 125V 250V</td>
</tr>
<tr>
<td></td>
<td>Resistive load (AC12): 10A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (AC15): 10A</td>
</tr>
<tr>
<td></td>
<td>Resistive load (DC12): 8A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (DC13): 4A</td>
</tr>
<tr>
<td></td>
<td>Thermal Current (Ith): 10A</td>
</tr>
<tr>
<td><strong>Operating Frequency</strong></td>
<td>900 operations/hour</td>
</tr>
<tr>
<td><strong>Mechanical Life</strong></td>
<td>1,000,000 operations</td>
</tr>
<tr>
<td><strong>Electrical Life</strong></td>
<td>100,000 operations (rated load)</td>
</tr>
<tr>
<td><strong>Conditional Short-circuit Current</strong></td>
<td>100A (IEC60947-5-1)</td>
</tr>
<tr>
<td><strong>Recommended Short Circuit Protection</strong></td>
<td>250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)</td>
</tr>
<tr>
<td><strong>Indicator</strong></td>
<td>Operating Voltage: 24V DC</td>
</tr>
<tr>
<td></td>
<td>Current: 10 mA</td>
</tr>
<tr>
<td></td>
<td>Light Source: LED lamp</td>
</tr>
<tr>
<td></td>
<td>Lens Color: Red or Green (12 mm dia. Lens)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 280g</td>
</tr>
</tbody>
</table>
Application Examples and Circuit Diagrams

**HS1B**

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Door/ Switch Status</strong></td>
<td><strong>Door Closed</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Machine ready to operate</strong></td>
</tr>
</tbody>
</table>

**Door**

**HS1B-11** (1NO-1NC)  
Circuit Diagram

<table>
<thead>
<tr>
<th>Main Circuit</th>
<th>Auxiliary Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4: Closed</td>
<td></td>
</tr>
<tr>
<td>3-4: Open</td>
<td></td>
</tr>
</tbody>
</table>

**HS1B-02** (2NC)  
Circuit Diagram

<table>
<thead>
<tr>
<th>Main Circuit</th>
<th>Auxiliary Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-4: Closed</td>
<td></td>
</tr>
<tr>
<td>3-4: Open</td>
<td></td>
</tr>
</tbody>
</table>

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.  
   Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.  
2. Terminals + and - are used for the LED indicator, and are isolated from door status.  
   Wire the terminals only when needed.

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Overview

Door Interlock Switches

Dimensions (mm)

HS1B - using the straight actuator (HS9Z-A1) (Horizontal Mounting)

HS1B - using the Right-angle actuator (HS9Z-A2) (Horizontal Mounting)

HS1B - using the Right-angle actuator (HS9Z-A2) (Vertical Mounting)

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

Actuator Dimensions

Straight Actuator HS9Z-A1

Right-angle Actuator HS9Z-A2

Angle-adjustable Actuator HS9Z-A3

Adjustable Actuator

The actuator angle is adjustable (0˚ to 20˚) for hinged doors.

The minimum radius of the door opening can be as small as 100mm.

 Actuator Angle Adjustment

• Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0˚) to 20˚

• The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.

• After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.

• Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)

• After adjusting the actuator angle, apply loctite or the like to the adjustment screw to prevent it from loosening.

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HS6E Subminiature Interlock Switches with Solenoid

HS6E features:
- 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

Part Numbers

<table>
<thead>
<tr>
<th>Lock Mechanism</th>
<th>Circuit Number</th>
<th>Contact Configuration</th>
<th>Cable Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>1m</td>
<td>(Actuator inserted) (Solenoid OFF)</td>
<td></td>
<td>HS6E-L44B01-G</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td></td>
<td></td>
<td>HS6E-L44B03-G</td>
</tr>
<tr>
<td></td>
<td>5m</td>
<td></td>
<td></td>
<td>HS6E-L44B05-G</td>
</tr>
<tr>
<td>M</td>
<td>1m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NO</td>
<td></td>
<td>HS6E-M44B01-G</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NC</td>
<td></td>
<td>HS6E-M44B03-G</td>
</tr>
<tr>
<td></td>
<td>5m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NO</td>
<td></td>
<td>HS6E-M44B05-G</td>
</tr>
<tr>
<td>N</td>
<td>1m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO</td>
<td></td>
<td>HS6E-N44B01-G</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO</td>
<td></td>
<td>HS6E-N44B03-G</td>
</tr>
<tr>
<td></td>
<td>5m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO</td>
<td></td>
<td>HS6E-N44B05-G</td>
</tr>
<tr>
<td>P</td>
<td>1m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NC</td>
<td></td>
<td>HS6E-P44B01-G</td>
</tr>
<tr>
<td></td>
<td>3m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NC</td>
<td></td>
<td>HS6E-P44B03-G</td>
</tr>
<tr>
<td></td>
<td>5m</td>
<td>Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NC</td>
<td></td>
<td>HS6E-P44B05-G</td>
</tr>
</tbody>
</table>

Part Number Key

- Indicator Color: G (Green)
- Cable Length: 01: 1m, 03: 3m, 05: 5m
- Housing Color: B (Black)
- Indicator Rated Voltage: 24V DC
- Blank (without indicator)
- Solenoid Unit Voltage/Lock Mechanism: 4: Spring Lock, 7Y: Solenoid Lock

Circuit Code

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

LED color is G (green) only.

Actuator keys are not supplied with the interlock switch and must be ordered separately.
### Lock Mechanism | Circuit Number | Contact Configuration | Cable Length | Part Number (Standard Stock in bold)
--- | --- | --- | --- | ---
L | Main Circuit: 1NC + 1NC, Monitor Circuit: 2NC/1NO | 1m | HS6E-L7Y4B01-G | HS6E-L7Y4B03-G | HS6E-L7Y4B05-G
| Main Circuit: | 3m | HS6E-M7Y4B01-G | HS6E-M7Y4B03-G | HS6E-M7Y4B05-G
| Monitor Circuit: | 5m | HS6E-N7Y4B01-G | HS6E-N7Y4B03-G | HS6E-N7Y4B05-G
| N | Main Circuit: 1NC + 1NC, Monitor Circuit: 1NC, 1NO/1NO | 1m | HS6E-P7Y4B01-G | HS6E-P7Y4B03-G | HS6E-P7Y4B05-G
| Main Circuit: | 3m | HS6E-N7Y4B01-G | HS6E-N7Y4B03-G | HS6E-N7Y4B05-G
| Monitor Circuit: | 5m | HS6E-P7Y4B01-G | HS6E-P7Y4B03-G | HS6E-P7Y4B05-G

The contact configurations show the contact status when the actuator is inserted and locked. LED color is G (green) only.

Actuator keys are not supplied with the interlock switch and must be ordered separately.

### Actuator Keys

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Item</th>
<th>Ordering Part Number</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Actuator</td>
<td>HS9Z-A61</td>
<td>The retention force of HS9Z-A61 actuator is 500N maximum. Do not apply excessive load.</td>
<td></td>
</tr>
<tr>
<td>Right-angle Actuator</td>
<td>HS9Z-A62</td>
<td>The retention force of HS9Z-A62 actuator is 100N maximum. Do not apply excessive load. When retention force of 100N or more is required, use the HS9Z-A62S actuator.</td>
<td></td>
</tr>
<tr>
<td>Right-angle Actuator with Mounting Plate</td>
<td>HS9Z-A62S</td>
<td>The retention force of HS9Z-A62S actuator is 500N maximum. Do not apply excessive load.</td>
<td></td>
</tr>
<tr>
<td>Horizontal/Vertical Angle Adjustable Actuator</td>
<td>HS9Z-A65</td>
<td>The HS9Z-A65 and HS9Z-A66 have their metal actuator installed in opposite directions. Select actuator by determining the required moving direction in consideration of the door and interlock switch. See pages 370 and 373 for more information. The retention force of HS9Z-A65 and HS9Z-A66 500N maximum.</td>
<td></td>
</tr>
<tr>
<td>Horizontal/Vertical Angle Adjustable Actuator</td>
<td>HS9Z-A66</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Accessory

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Unlock Key (long type)</td>
<td>HS9Z-T3</td>
</tr>
</tbody>
</table>
### Specifications

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Conforming to Standards</strong></td>
<td>UL 508 (UL listed), CSA C22.2, No. 14 (c-UL listed), ISO 14119</td>
</tr>
<tr>
<td></td>
<td>IEC 60947-5-1, EN 60947-5-1 (TÜV approval), EN 1088 (TÜV approval),</td>
</tr>
<tr>
<td></td>
<td>GS-ET-19</td>
</tr>
<tr>
<td></td>
<td>IEC 60204-1/EN 60204-1 (applicable standards for use)</td>
</tr>
<tr>
<td><strong>Operating Temperature</strong></td>
<td>–25 to +50°C (no freezing)</td>
</tr>
<tr>
<td><strong>Storage Temperature</strong></td>
<td>–40 to +80°C (no freezing)</td>
</tr>
<tr>
<td><strong>Operating Humidity</strong></td>
<td>45 to 85% (no condensation)</td>
</tr>
<tr>
<td><strong>Rated Insulation Voltage (Ui)</strong></td>
<td>300V (between LED and ground: 60V)</td>
</tr>
<tr>
<td><strong>Impulse Withstand Voltage (Uimp)</strong></td>
<td>Main &amp; lock monitor circuits: 1.5 kV</td>
</tr>
<tr>
<td></td>
<td>Door monitor circuit: 2.5 kV</td>
</tr>
<tr>
<td></td>
<td>Between solenoid/LED and ground: 0.5 kV</td>
</tr>
<tr>
<td><strong>Insulation Resistance (500V DC megger)</strong></td>
<td>Between live and dead metal parts: 100 MΩ minimum</td>
</tr>
<tr>
<td></td>
<td>Between terminals of different poles: 100 MΩ minimum.</td>
</tr>
<tr>
<td><strong>Contact Resistance</strong></td>
<td>300 mΩ maximum (initial value, 1m cable)</td>
</tr>
<tr>
<td></td>
<td>500 mΩ maximum (initial value, 3m cable)</td>
</tr>
<tr>
<td></td>
<td>700 mΩ maximum (initial value, 5m cable)</td>
</tr>
<tr>
<td><strong>Electric Shock Protection Class</strong></td>
<td>Class II (IEC 61140)</td>
</tr>
<tr>
<td><strong>Pollution Degree</strong></td>
<td>3</td>
</tr>
<tr>
<td><strong>Degree of Protection</strong></td>
<td>IP67 (IEC 60529)</td>
</tr>
<tr>
<td><strong>Vibration Resistance</strong></td>
<td><strong>Operating Extremes</strong> 10 to 55 Hz, amplitude 0.35mm</td>
</tr>
<tr>
<td></td>
<td><strong>Damage Limits</strong> 30 Hz, amplitude 1.5 mm</td>
</tr>
<tr>
<td><strong>Shock Resistance</strong></td>
<td><strong>Operating Extremes</strong> 100 m/s² (10G)</td>
</tr>
<tr>
<td></td>
<td><strong>Damage Limits</strong> 1000 m/s² (100G)</td>
</tr>
<tr>
<td><strong>Actuator Operating Speed</strong></td>
<td>0.05 to 1.0 m/s</td>
</tr>
<tr>
<td><strong>Direct Opening Travel</strong></td>
<td>8.0 mm minimum</td>
</tr>
<tr>
<td><strong>Direct Opening Force</strong></td>
<td>60N minimum</td>
</tr>
<tr>
<td><strong>Actuator Retention Force</strong></td>
<td>500N maximum (GS-ET-19)</td>
</tr>
<tr>
<td><strong>Operating Frequency</strong></td>
<td>900 operations/hour</td>
</tr>
<tr>
<td><strong>Mechanical Life</strong></td>
<td>1,000,000 operations minimum (GS-ET-19)</td>
</tr>
<tr>
<td><strong>Electrical Life</strong></td>
<td>100,000 operations minimum (rated load)</td>
</tr>
<tr>
<td></td>
<td>100,000 operations minimum (24V AC/DC, 100 mA)</td>
</tr>
<tr>
<td></td>
<td>(operating frequency 900 operations/hr)</td>
</tr>
<tr>
<td><strong>Conditional Short-circuit Current</strong></td>
<td>50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)</td>
</tr>
<tr>
<td><strong>Cable</strong></td>
<td>UL2464, No. 22 AWG (12-core: 0.3 mm² or equivalent/core)</td>
</tr>
<tr>
<td><strong>Cable Diameter</strong></td>
<td>ø7.6 mm</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>Approx. 200g</td>
</tr>
</tbody>
</table>
# HS6E Series
## Door Interlock Switches

### Overview
- **X Series E-Stops**
- **Enabling Switches**
- **Barriers**
- **AS-Interface Safety at Work**

### Door Interlock Switches
- **Solenoid/Indicator**
  - **Locking Mechanism**: Spring Lock Type or Solenoid Lock Type
  - **Rated Voltage**: 24V DC
  - **Current**
    - **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
- **Contact Ratings**
  - **Light Source**: LED
  - **Illumination Color**: Green
  - **Rated Insulation Voltage (Ui)**
    - 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)
      - Operating temperature (35 to 50°C)
      - 2.5A (up to 2 circuits)
      - 1.0A (3 or more circuits)
    - Operating voltage (Ue)
      - Main and Lock Monitor Circuits
        - AC: Resitive load (AC12)
          - 30V: 2A
          - 125V: 1A
          - 250V: –
        - DC: Inductive load (AC15)
          - –
        - AC: Resitive load (DC12)
          - 30V: 2A
          - 125V: 0.4A
          - 250V: –
        - DC: Inductive load (DC13)
          - 2A
          - 0.22A
          - –
      - Door Monitor Circuit
        - AC: Resitive load (AC12)
          - 30V: 2.5A
          - 125V: 1.1A
          - 250V: 0.55A
        - DC: Inductive load (DC13)
          - –
          - 1.1A
          - 0.55A
          - 0.27A

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

- UL, c-UL rating
  - Main/Lock monitor circuit: 125V AC, 1A Pilot duty
  - 125V DC, 0.22A Pilot duty
  - Door monitor circuit: 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
Dimensions

**Interlock Switch**

**Mounting Hole Layout**

- Hole for Manual Unlocking ø12 (reference)
- 3-M4 Screw (ø4.3 or M4 tapped hole)

**Dimensions**

- Interlock Switch
  - 30
  - 20 to 22
  - 20.5
  - 28.5
  - 41.8

- Manual Unlocking Key
  - 3-M4 Screw
  - ø12 (reference)

- Mounting Hole Layout
  - When using straight actuator (HS9Z-A61)
  - (12.6±1)
  - Hole for Manual Unlocking ø12 (reference)
  - 3-M4 Screw (ø4.3 or M4 tapped hole)

  - When using right-angle actuator (HS9Z-A62)
    - 22.6±1
    - Actuator Stop (supplied)

  - When using horizontal/vertical angle adjustable actuator (HS9Z-A65/A66)
    - 22.6±1
    - Actuator Stop (supplied)

**Actuator Mounting Reference Position**

As shown in the figure on the right, the mounting reference position of the actuator key when inserted in the interlock switch is:

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

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

---

USA: 800-262-IDEC  Canada: 888-317-IDEC
### Door Interlock Switches

#### Overview

**X Series E-Stops**

- **Door Interlock Switches**
- **Enabling Switches**
- **Barriers**

#### HS6E Series

**370**

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#### Door Interlock Switches

**Actuator Key Dimensions (mm)**

- **Straight Actuator (HS9Z-A61)**
- **Straight Actuator (HS9Z-A61) Right-angle Actuator (HS9Z-A62)**
- **Right-angle Actuator with Mounting Plate (HS9Z-A62S)**

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

**Note:** See page 373 for actuator installation.

**Angle Adjustable Actuator (HS9Z-A65)**

- **Horizontal Adjustment**
- **Vertical Adjustment**

**Angle Adjustable Actuator (HS9Z-A66)**

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

**Actuator Adjustment Orientation**

- **Horizontal Adjustment**
- **Vertical Adjustment**

**Manual Unlock Key (plastic)**

(supplied with switch, not replaceable)

**Manual Unlock Key, HS9Z-T3 (metal)**

---

**Accessory**

<table>
<thead>
<tr>
<th>Description</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual Unlock Key (long type)</td>
<td>HS9Z-T3</td>
</tr>
</tbody>
</table>

---

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

---

**Orienting Insert**

- 2-M4 Screw (ø4.3 or M4 tapping screw)

---

**Note:** See page 373 for actuator installation.
### Circuit Diagrams and Operating Characteristics

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
<th>Status 4</th>
<th>Unlocking Using Manual Unlock Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interlock Switch Status</td>
<td>• Door closed</td>
<td>• Door opened</td>
<td>• Door open</td>
<td>• Door open</td>
</tr>
<tr>
<td>• Machine ready to operate</td>
<td>• Machine cannot be operated</td>
<td>• Machine cannot be operated</td>
<td>Solenoid energized</td>
<td>Solenoid energized</td>
</tr>
<tr>
<td>• Solenoid de-energized</td>
<td>• Solenoid energized</td>
<td>• Solenoid energized</td>
<td>• Solenoid energized</td>
<td>• Solenoid de-energized</td>
</tr>
</tbody>
</table>

#### Operation Characteristics (reference)

**Main Circuit**
- Door Monitor Circuit (door open, NO)
- Door Monitor Circuit (door closed, NC)
- Lock Monitor Circuit (locked, NC)
- Lock Monitor Circuit (unlocked, NO)

**Solenoid Power A1-A2 (all types)**
- OFF (de-energized)
- ON (energized)
- ON (energized)
- OFF (de-energized)

---

**Operation Characteristics**

- **Main Circuit**
  - Door Monitor Circuit (door open, NO)
  - Door Monitor Circuit (door closed, NC)
  - Lock Monitor Circuit (locked, NC)
  - Lock Monitor Circuit (unlocked, NO)

**Actuator Insertion Position**
- 0 (Actuator Insertion Position)
- 1 (Locked Position)
- 4.7 mm
- 5.0 mm
- 27.4 mm (stroke in mm)

- Contacts ON (closed)
- Contacts OFF (open)

---

The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.

---

The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.

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The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.

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The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.

---

The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
## Solenoid Lock Type

<table>
<thead>
<tr>
<th>Interlock Switch Status</th>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
<th>Status 4</th>
<th>Unlocking Using Manual Unlock Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door closed</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Machine ready to operate</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
<tr>
<td>Solenoid energized</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
<td>•</td>
</tr>
</tbody>
</table>

### Door Status

- **Solenoid energized**
  - Operate
  - Machine ready to operate
  - Door closed

- **Solenoid de-energized**
  - Operated

### Circuit Diagram (Example: HS6E-N7Y)

#### Part Number and Circuit Diagram
- **HS6E-L7Y**
- **HS6E-M7Y**
- **HS6E-N7Y**
- **HS6E-P7Y**

#### Operation Characteristics (reference)

**Main Circuit**
- Door Monitor and Lock Monitor
- Door Monitor Circuit (open, NO)
- Door Monitor Circuit (closed, NC)
- Lock Monitor Circuit (locked, NO)
- Lock Monitor Circuit (locked, NC)

**Solenoid Power A1-A2 (all types)**
- ON (energized)
- OFF (de-energized)
- ON (energized) (Note 2)

**Stroke in mm**
- 0 (Actuator Insertion Position)
- 1.1 (Locked Position)
- 4.7, 5.0

- Contacts ON (closed)
- Contacts OFF (open)

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.

---

**Main Circuit:** Connected to the machine drive control circuit, sending the interlock signals of the protective door. Monitor circuit: Sends the monitoring signals of open/closed and lock/unlocked statuses of the protective door.

**Warning:**
- 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.

---

**Door Interlock Switches**

- **Door Closed (locked)**
  - ON (closed)
  - OFF (open)

- **Door Open (unlocked)**
  - OFF (open)
  - ON (closed)

**Circuit Diagram**

**Symbol Key**
- (+) A2
- (–) A1
- On (closed)
- Off (open)

**Contact Status**
- Contacts ON (closed)
- Contacts OFF (open)

**Actuator Insertion Position**

**Stroke in mm**
- 0 (Actuator Insertion Position)
- 1.1 (Locked Position)
- 4.7, 5.0

**Diagram Example:**

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

---

**HS6E Series**

- **Overview**
- **X Series E-Stops**
- **AS-Interface Safety at Work**

---

**www.idec.com**

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**372**

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Operating Instructions

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

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

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

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

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370). 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 the 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 an emergency.

When using the manual unlock key

- When locking or unlocking the interlock switch manually, turn the actuator fully using the manual unlock key supplied with the switch.
- Using the interlock switch with the actuator not fully turned (less than 90°) may cause damage to the interlock switch or operation failures (when manually unlocked, the switch will keep the main circuit disconnected and the door unlocked).
- Do not apply excessive force (0.45 N·m or more) to the manual unlock part, otherwise the manual unlock part will become damaged.
- Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can always be unlocked while the machine is in operation.

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 a 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).

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 an 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 color and or a white line printed on the wire.

<table>
<thead>
<tr>
<th>No.</th>
<th>Insulation Color</th>
<th>No.</th>
<th>Insulation Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Blue/White</td>
<td>7</td>
<td>White</td>
</tr>
<tr>
<td>2</td>
<td>Gray</td>
<td>8</td>
<td>Black</td>
</tr>
<tr>
<td>3</td>
<td>Pink</td>
<td>9</td>
<td>Pink/White</td>
</tr>
<tr>
<td>4</td>
<td>Orange</td>
<td>10</td>
<td>Brown/White</td>
</tr>
<tr>
<td>5</td>
<td>Orange/White</td>
<td>11</td>
<td>Brown</td>
</tr>
<tr>
<td>6</td>
<td>Gray/White</td>
<td>12</td>
<td>Blue</td>
</tr>
</tbody>
</table>

Terminal Number Identification

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

<table>
<thead>
<tr>
<th>Type</th>
<th>Contact Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS6E-L</td>
<td><img src="HS6E-L-diagram" alt="Diagram" /></td>
</tr>
<tr>
<td>HS6E-M</td>
<td><img src="HS6E-M-diagram" alt="Diagram" /></td>
</tr>
<tr>
<td>HS6E-N</td>
<td><img src="HS6E-N-diagram" alt="Diagram" /></td>
</tr>
<tr>
<td>HS6E-P</td>
<td><img src="HS6E-P-diagram" alt="Diagram" /></td>
</tr>
</tbody>
</table>

Note: The contact arrangements show the contact status when the actuator is inserted and locked.
HS5E Series Miniature Solenoid Locking Switches

HS5E features:
- World’s smallest 4 contact solenoid interlock switch. (35 x 40 x 146 mm)
- Four contacts
- Gold-plated contacts
- Spring lock type (unlocks when the solenoid is energized) and solenoid lock type (locks when solenoid is energized) are available
- Flexible installation - the head can rotate, allowing 8 different actuator entries
- Metal actuator entry slot ensures long life
- Actuator locking strength is 1000N minimum (GS-ET-19)
- Integral molded cable reduces wiring time
- LED pilot light indicates the solenoid status
- RoHS Directive Compliant
- Contacts are IP67 (IEC60529)
- NC contacts are direct opening (IEC/EN60947-5-1)
- Only proprietary actuators can be used, preventing unauthorized access (ISO14119, EN1088)
- Double insulation structure - no grounding required

Spring Lock Type
- Automatically locks the actuator without power to the solenoid
- After the machine stops, unlocking is accomplished by energizing the solenoid, providing a high level of safety
- Manual unlocking is possible in the event of power failure or maintenance

Solenoid Lock Type
- The actuator is locked when energized
- The actuator is unlocked when de-energized

Embedded Image:
- Green LED Indicator
- Metallic Head
- Adjustable Actuator (mainly for hinged doors)
- L-shaped Actuator (mainly for hinged doors)
- Integrated Cable
- Right-angle Actuator
- Manual Unlocking Actuator Slot
- 2 Actuator Entry Slots
- Straight Actuator (mainly for sliding doors)
# Door Interlock Switches

## HS5E Series

### Body

<table>
<thead>
<tr>
<th>Lock Mechanism</th>
<th>Circuit Number</th>
<th>Contact Arrangement</th>
<th>Pilot Light</th>
<th>Cable Length</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spring Lock A</td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-A4001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-A4401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-A4403-G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-B4001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-B4401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-B4403-G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-D4001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-D4401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-D4403-G</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Solenoid Lock A</td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-A7Y001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-A7Y401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-A7Y403-G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-B7Y001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-B7Y401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-B7Y403-G</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>Without</td>
<td>1 m</td>
<td>HS5E-D7Y001</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>With</td>
<td>3 m</td>
<td>HS5E-D7Y401-G</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Main Circuit: 1NC+1NC, Monitor Circuit: 1NO, 1NO</td>
<td>5 m</td>
<td>HS5E-D7Y403-G</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Contact configuration shows the contact status when actuator is inserted and solenoid off for spring lock or solenoid on for solenoid lock.

### Actuator Keys

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS9Z-A51</td>
<td>Straight</td>
<td></td>
</tr>
<tr>
<td>HS9Z-A52</td>
<td>Right-angle</td>
<td></td>
</tr>
<tr>
<td>HS9Z-A55</td>
<td>Horizontal/vertical operation (for hinged doors) (see note below)</td>
<td></td>
</tr>
</tbody>
</table>

The actuator tensile strength is 500N minimum.

### Accessories

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Description</th>
<th>Part Number</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSS8/HS5E Plug Actuator (allows switch to be used as interlock plug unit)</td>
<td>HSS8Z-AS5P</td>
<td>35g</td>
<td></td>
</tr>
<tr>
<td>HSS8/HS5E Padlock Hasp (prevents unauthorized insertion of actuator)</td>
<td>HSS8Z-PH5</td>
<td>35g</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS9Z-SP51</td>
<td>Mounting Plate</td>
</tr>
<tr>
<td>HS9Z-T3</td>
<td>Manual unlock key (long type)</td>
</tr>
</tbody>
</table>

---

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# Interlock Switch Status

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
<th>Status 4</th>
<th>Unlocking Using Manual Unlock Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>Door closed</td>
<td>Door opened</td>
<td>Door open</td>
<td>Door open</td>
<td>Door closed</td>
</tr>
<tr>
<td>Machine ready to operate</td>
<td>Machine cannot be operated</td>
<td>Machine cannot be operated</td>
<td>Machine cannot be operated</td>
<td>Machine cannot be operated</td>
</tr>
<tr>
<td>Solenoid de-energized</td>
<td>Solenoid energized</td>
<td>Solenoid energized</td>
<td>Solenoid de-energized</td>
<td>Solenoid de-energized</td>
</tr>
</tbody>
</table>

## Door Status

<table>
<thead>
<tr>
<th>Solenoid Power A1-A2 (all types)</th>
<th>Closed (locked)</th>
<th>Closed (unlocked)</th>
<th>Open</th>
<th>Open</th>
<th>Closed (unlocked)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HSSE-A4</td>
<td>ON (closed)</td>
<td>OFF (open)</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF (open)</td>
</tr>
<tr>
<td>HSSE-B4</td>
<td>OFF (open)</td>
<td>OFF (open)</td>
<td>ON (closed)</td>
<td>ON (closed)</td>
<td>OFF (open)</td>
</tr>
<tr>
<td>HSSE-D4</td>
<td>ON (closed)</td>
<td>OFF (open)</td>
<td>OFF</td>
<td>OFF</td>
<td>OFF (open)</td>
</tr>
</tbody>
</table>

## Circuit Diagrams

### Door Interlock Switches

**HSSE-A4**
- Main Circuit: ON (closed)
- Monitor Circuit: OFF (open)
- Door Status: Open
- Solenoid Power: OFF (open)

**HSSE-B4**
- Main Circuit: OFF (open)
- Monitor Circuit: ON (closed)
- Door Status: Closed (unlocked)
- Solenoid Power: OFF (open)

**HSSE-D4**
- Main Circuit: ON (closed)
- Monitor Circuit: OFF (open)
- Door Status: Open
- Solenoid Power: OFF (open)

### Solenoid Power A1-A2 (all types)
- Closed (locked): OFF (de-energized)
- Closed (unlocked): ON (energized)
- Open: ON (energized)
- Open: OFF (de-energized)
- Closed (unlocked): OFF (de-energized)

#### Operating Characteristics

<table>
<thead>
<tr>
<th>Operating Characteristics (reference)</th>
<th>26.4 (stroke in mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Key Insertion Position</td>
<td>3.3 - 6.5</td>
</tr>
<tr>
<td>Contacts ON (closed)</td>
<td></td>
</tr>
<tr>
<td>Contacts OFF (open)</td>
<td></td>
</tr>
</tbody>
</table>

### Manual Unlocking

1. Main circuit: Connected to the control circuit of machine drive part, sending the interlock signals to the protective door.
3. Do not attempt manual unlock when energized.
4. Do not energize the solenoid for a prolonged period of time when the door is open and when unlocking the door manually.

The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.

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

**Conforming Standards**
- ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (BG approval), UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized)

**Application Standards**
- IEC60204-1/EN60204-1

**Operating Temperature**
- –25 to 50°C (no freezing)

**Relative Humidity**
- 45 to 85% (no condensation)

**Storage Temperature**
- –40 to +80°C (no freezing)

**Impulse Withstand Voltage**
- 2.5 kV (between LED, solenoid and grounding: 0.5 kV)

**Insulation Resistance**
- Between live and dead metal parts: 100 MΩ minimum
- Between live metal part and ground: 100 MΩ minimum
- Between live metal parts: 100 MΩ minimum
- Between Terminals of the same pole: 100 MΩ minimum

**Electric Shock Protection Class**
- Class II (IEC61140)

**Degree of Protection**
- IP67 (IEC60529)

**Shock Resistance**
- Operating extremes: 100 m/s² (10 G)
- Damage limits: 1000 m/s² (100 G)

**Vibration Resistance**
- Operating extremes: 10 to 55 Hz, amplitude 0.35 mm minimum
- Damage limits: 30 Hz, amplitude 1.5 mm minimum

**Actuator Operating Speed**
- 0.05 to 1.0 m/s

**Positive Opening Travel**
- Actuator HS9Z-A51: 11 mm minimum
- Actuator HS9Z-A52/A55: 12 mm minimum

**Positive Opening Force**
- 80N minimum

**Tensile Strength when Locked**
- 1000 N minimum (GS-ET-19)

**Operating Frequency**
- 900 operations per hour

**Mechanical Life**
- 1,000,000 operations minimum (GS-ET-19)

**Electrical Life**
- 100,000 operations minimum (operating frequency 900 operations per hour, rated load AC-12, 250V, 1A)

**Conditional Short-circuit Current**
- 50A (250V) (Note: Use 250V/10A fast acting type fuse for short circuit protection.)

**Cable**
- UL2464, No. 21 AWG (8-core: 0.5 mm² or equivalent/core)
- Cable Diameter: ø7.6 mm
- Weight (approx.): 400 g (HS5E-***01)

### Pilot Light

**Rated Voltage**
- 24V DC

**Current**
- 10 mA

**Light Source**
- LED

**Light Color**
- Green

<table>
<thead>
<tr>
<th>Part Number Key</th>
<th>HS5E - A 4 4 01 - G</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Pilot Light Color</strong></td>
<td>G (Green)</td>
</tr>
<tr>
<td><strong>Cable Length</strong></td>
<td>01: 1m</td>
</tr>
<tr>
<td></td>
<td>03: 3m</td>
</tr>
<tr>
<td></td>
<td>05: 5m</td>
</tr>
</tbody>
</table>

### Pilot Light Voltage

- 4: 24V DC
- 0: without pilot light

<table>
<thead>
<tr>
<th>Solenoid Unit Voltage/Lock Mechanism</th>
</tr>
</thead>
<tbody>
<tr>
<td>4: 24V DC/Spring Lock</td>
</tr>
<tr>
<td>7Y: 24V DC/Solenoid Lock</td>
</tr>
</tbody>
</table>

### Electric Shock Protection Class

- Class II (IEC61140)

### Degree of Protection

- IP67 (IEC60529)

### Shock Resistance

- Operating extremes: 100 m/s² (10 G)
- Damage limits: 1000 m/s² (100 G)

### Vibration Resistance

- Operating extremes: 10 to 55 Hz, amplitude 0.35 mm minimum
- Damage limits: 30 Hz, amplitude 1.5 mm minimum

### Actuator Operating Speed

- 0.05 to 1.0 m/s

### Positive Opening Travel

- Actuator HS9Z-A51: 11 mm minimum
- Actuator HS9Z-A52/A55: 12 mm minimum

### Positive Opening Force

- 80N minimum

### Tensile Strength when Locked

- 1000 N minimum (GS-ET-19)

### Operating Frequency

- 900 operations per hour

### Mechanical Life

- 1,000,000 operations minimum (GS-ET-19)

### Electrical Life

- 100,000 operations minimum (operating frequency 900 operations per hour, rated load AC-12, 250V, 1A)

### Conditional Short-circuit Current

- 50A (250V) (Note: Use 250V/10A fast acting type fuse for short circuit protection.)

### Cable

- UL2464, No. 21 AWG (8-core: 0.5 mm² or equivalent/core)
- Cable Diameter: ø7.6 mm
- Weight (approx.): 400 g (HS5E-***01)

### Current Ratings

**Rated Insulation Voltage (Ui) (see note 2)**
- 250V (between LED, solenoid and grounding: 30V)

**Current (Ith)**
- 2.5A

<table>
<thead>
<tr>
<th>Rated Voltage (Ui)</th>
<th>250V (between LED, solenoid and grounding: 30V)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AC</strong></td>
<td></td>
</tr>
<tr>
<td>Resistive load (AC12)</td>
<td>—         2A         1A</td>
</tr>
<tr>
<td>Inductive Load (AC15)</td>
<td>—     1A          0.5A</td>
</tr>
<tr>
<td><strong>DC</strong></td>
<td></td>
</tr>
<tr>
<td>Resistive load (DC12)</td>
<td>2A        0.4A       0.2A</td>
</tr>
<tr>
<td>Inductive Load (DC13)</td>
<td>1A        0.22A      0.1A</td>
</tr>
</tbody>
</table>

1. Minimum applicable load (reference value): 3V AC/DC, 5 mA
2. UL rating: 125V
3. TUV, BG rating: AC-15, 0.5A/250V, DC-13, 0.22A/125V
   UL, c-UL rating: Pilot duty AC 0.5A/125V, Pilot duty DC 0.22A/125V
Dimensions (mm) and Mounting Hole Layouts

Actuator Keys

**HS5E-**4*G (w/pilot light)**

**Horizontal Mounting/Straight Actuator (HS9Z-A51)**

**Vertical Mounting/Right-angle Actuator (HS9Z-A52)**

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

**Actuator Key Mounting Reference Position**

As shown in the figure on the right, the mounting reference position of the actuator when inserted in the safety switch is:

**HS9Z-A51**: The actuator lightly touches the actuator stop placed on the safety switch.

**HS9Z-A52**: The actuator cover lightly touches the actuator stop placed on the safety switch.

After mounting the actuator, remove the actuator stop from the safety switch.
Dimensions and Mounting Hole Layouts, continued

Vertically/Horizontally Movable Actuator (HS9Z-A55)

**Horizontal Swing**

- Orienting Insert
- Actuator Stop (Note)
- Angle Adjustment (M3 Hexagon Socket Head Screw)

**Vertical Swing**

- Orienting Insert
- Actuator Stop (Note)
- Angle Adjustment (M3 Hexagon Socket Head Screw)

**Actuator Orientation**

The orientation of the actuator operation (horizontal/vertical) can be changed with the orientation part (white plastic part) installed on the back of the actuator.

Do not lose the orientation part, otherwise the actuator will not operate properly.

The actuator stop film and actuator stop are used when adjusting the actuator position, and must be removed after adjustment.

**Accessory Dimensions (mm)**

<table>
<thead>
<tr>
<th>Actuator Type</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting Plate</td>
<td>HS9Z-SP51</td>
</tr>
<tr>
<td>Manual Unlocking Key (long)</td>
<td>HS9Z-T3</td>
</tr>
</tbody>
</table>

- **Manual Unlocking Key** (plastic, supplied with the switch, non-replaceable)
- **HS9Z-T3 Manual Unlocking Key** (metal, long-shaped)
Minimum Radius of Hinged Door
- When using the safety switch for a hinged door, refer to the minimum radius of doors as shown below. For doors with small minimum radius, use adjustable actuators (HS9Z-A55).

Because deviation or dislocation of a hinged door may occur, make sure of correct operation of the actual application before installation.

HS9Z-A52 Actuator
(When the center of the hinged door is on the extension line of the actuator mounting surface.)

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

Changing the Orientation of the Head
- The head of the HS5E can be mounted in four ways by removing the four screws from the corners of the HS5E head and reinstalling the head in the desired orientation. Before wiring the HS5E, replace the head. Before replacing the head, turn the manual unlock part to the UNLOCK position using the manual unlock key. When reinstalling the head, make sure that no foreign objects enter the safety switch. Tighten the screws, without leaving space between the head and body, otherwise the safety switch may malfunction.
- Recommended tightening torque: 1.0 ±0.1 N·m

Actuator Angle Adjustment
- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing).
  Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.
- After adjusting the actuator angle, apply loctite to the adjustment screw so that the screw will not loosen.

When using the HS9Z-A55 horizontally-movable actuator
- When the center of the hinged door is on the extension line of the contact surface of actuator and safety switch: 50 mm
- When the center of the hinged door is on the extension line of the actuator mounting surface: 70 mm

Mounting Examples

Safety Precautions
- Before manually unlocking the safety switch, make sure the machine has come to a complete stop. Manual unlocking during operation may unlock the switch before the machine stops, and the protection of the safety switch with solenoid is lost. While the solenoid is energized, do not unlock the actuator manually (solenoid lock type).
Instructions, continued

For Manual Unlocking

- **Spring lock type**
  The HS5E allows manual unlocking of the actuator to pre-check proper door operation before wiring or turning power on, as well as for an emergency or a power failure.

- **Solenoid lock type**
  If the actuator is not unlocked although the solenoid is de-energized, the actuator can be unlocked manually.

  ![Locked and Unlocked Positions](image)

  Manual Unlocking Key (supplied with the switch)

  To change from the locked to the manual unlocked position as shown above, turn the actuator fully 90° using the proprietary actuator supplied with the switch.

  Using the safety switch with the actuator not fully turned (less than 90°) may cause damage to the switch or errors (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 be damaged. Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can be unlocked while the machine is in operation.

  Recommended Tightening Torque of Mounting Screws

  - **Safety Switch:** 2.0 ± 0.2 N·m (two M4 screws)
  - **Actuators**
    - HS92-A51: 2.0 ± 0.2 N·m (two M4 screws)
    - HS92-A52: 1.0 ± 0.2 N·m (two M4 Phillips screws)
    - HS92-A55: 1.0 ± 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 become loose after mounting.

  Mounting bolts must be provided by the users.

  To avoid unauthorized or unintended removal of safety switch and the actuator, it is recommended that the safety switch and the actuator are installed in an unremovable manner, for example using special screws or welding the screws.

Cables

- Do not fasten or loosen the gland at the bottom of the safety switch.
- When bending the cable during wiring, make sure that the cable radius is kept at least 30mm.
- When wiring, make sure that water or oil does not enter the cable.
- Do not open the lid of the safety switch. Otherwise the switch may become damaged.
- Solenoid has polarity. Observe the correct polarity when wiring.

Wire Identification

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

<table>
<thead>
<tr>
<th>No.</th>
<th>Insulator Color</th>
<th>No.</th>
<th>Insulator Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>white</td>
<td>5</td>
<td>brown/white</td>
</tr>
<tr>
<td>2</td>
<td>black</td>
<td>6</td>
<td>orange</td>
</tr>
<tr>
<td>3</td>
<td>brown</td>
<td>7</td>
<td>blue/white</td>
</tr>
<tr>
<td>4</td>
<td>blue</td>
<td>8</td>
<td>orange/white</td>
</tr>
</tbody>
</table>

Terminal Number Identification

- When wiring, identify the terminal number of each contact with the color of insulator.
- The following table shows the identification of terminal numbers.
- When wiring, cut unnecessary wires such as dummy insulator (white) and/or unused wires to avoid incorrect wiring.

<table>
<thead>
<tr>
<th>Type</th>
<th>Circuit Diagram</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS5E-A</td>
<td><img src="image" alt="Circuit Diagram" /></td>
</tr>
<tr>
<td>HS5E-B</td>
<td><img src="image" alt="Circuit Diagram" /></td>
</tr>
<tr>
<td>HS5E-D</td>
<td><img src="image" alt="Circuit Diagram" /></td>
</tr>
</tbody>
</table>
HS1E Series Full Size Solenoid Locking Switches

HS1E features:
- Basic unit and solenoid unit in one housing
- Plastic Housing: Light weight
- Ease of Wiring: All the terminal screws are M3.5
- Available with a red or green indicator
- Choose from 4 circuit configurations
- When mounting the actuator on a movable door, and the switch on a machine body, the door can be mechanically locked when closed
- Greater Safety: The door is unlocked by a solenoid lock-release signal from a PLC or other source after the machine has stopped
- In the event of power failure or for machine maintenance, the door can be unlocked using a special tool
- Flexible Installation: The actuator can be accessed from two directions

HS1E Series Functionality

- Conduit Port
  Use IP67 conduit or gland.

- LED Indicator
  (green or red)

- Straight Actuator
  (Zinc Diecast)

- Angle Adjustable Actuator
  (for hinged doors)

- Right-angle Actuator

- Terminal Block for Pilot Light (M3.5)

- Two Actuator Entry Slots

- Contact Mechanism
## Part Numbers

<table>
<thead>
<tr>
<th>Actuator Retention Force</th>
<th>Lock Mechanism</th>
<th>Contact Configuration</th>
<th>Conduit Port Size</th>
<th>Model</th>
<th>Indicator</th>
<th>Manual Unlock Key</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500N (when locked)</td>
<td>Spring Lock</td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NO/1NO</td>
<td>G1/2</td>
<td>—</td>
<td>—</td>
<td>With</td>
<td>HS1E-40R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-44R-Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NO</td>
<td>G1/2</td>
<td>—</td>
<td>—</td>
<td>With</td>
<td>HS1E-40KR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-44KR-Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NO + 1NC</td>
<td>G1/2</td>
<td>—</td>
<td>—</td>
<td>With</td>
<td>HS1E-240R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-244R-Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NC</td>
<td>G1/2</td>
<td>—</td>
<td>—</td>
<td>With</td>
<td>HS1E-240KR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-244KR-Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NC</td>
<td>G1/2</td>
<td>—</td>
<td>—</td>
<td>With</td>
<td>HS1E-340R</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-344R-Ø</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Main circuit: 1NC + 1NC Monitor circuit: 1NC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-340KR</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contacts are linked to the solenoid mechanically.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>HS1E-344KR-Ø</td>
</tr>
</tbody>
</table>

1. Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.
2. Specify color code in place of Ø in the part number. G: green, R: red
3. Actuator is not supplied with the interlock switch, and must be ordered separately.
4. TORX is a registered trademark of Camcar Textron.

### Actuator Keys & Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS9Z-A1</td>
<td></td>
<td>Straight Actuator (Mainly for sliding doors)</td>
</tr>
<tr>
<td>HS9Z-A2</td>
<td></td>
<td>Right-angle Actuator (Mainly for rotating doors)</td>
</tr>
<tr>
<td>HS9Z-A3</td>
<td></td>
<td>Adjustable Actuator</td>
</tr>
<tr>
<td></td>
<td>HS9Z-T1</td>
<td>Key Wrench (included with switch)</td>
</tr>
<tr>
<td></td>
<td>HS9Z-P1</td>
<td>Conduit Opening Plug</td>
</tr>
<tr>
<td></td>
<td>HS9Z-KEY1</td>
<td>Replacement Manual Unlocking Key</td>
</tr>
</tbody>
</table>
### Specifications

**Conforming to Standards**
- EN1088, IEC60947-5-1, EN60947-5-1(TUV), ISO14119, GS-ET-19 (BG), UL508, CSA C22.2 No. 14 (c-UL)

**Applicable Use**
- IEC60204-1, EN60204-1

**Operating Temperature**
- –20 to +40°C (no freezing)

**Storage Temperature**
- –40 to +80°C

**Operating Humidity**
- 40 - 85% RH (no condensation)

**Altitude**
- 2,000m maximum

**Rated Insulation Voltage (Ui)**
- 300V (between LED or solenoid and ground: 80V)

**Impulse Withstand Voltage (Uimp)**
- 4 kV (between LED or solenoid and ground: 2.5 kV)

**Insulation Resistance**
- Between live and dead metal parts: 100 MΩ minimum
- Between live metal part and ground: 100 MΩ minimum
- Between terminals of the same pole: 100 MΩ minimum

**Electric Shock Protection**
- Class II (according to IEC61140)

**Pollution Degree**
- 3 (IEC60947-5-1)

**Degree of Protection**
- IP67 (IEC60529)

**Vibration**
- Operating Extremes: 10 to 55 Hz, minimum (amplitude 0.35 mm)
- Damage Limits: 50 m/sec² (approx. 5G)

**Shock Resistance**
- 1,000 m/sec² (approx. 100G)

**Actuator Tensile Strength when Locked**
- 1,500N minimum (per GS-ET-19)

**Actuator Operating Speed**
- 1 m/sec maximum

**Positive Opening Travel**
- 11 mm minimum

**Positive Opening Force**
- 20N minimum

**Thermal Current (Ith)**
- Main circuit: 10A, Auxiliary circuit: 3A

**Rated Operating Current (le)**

<table>
<thead>
<tr>
<th>Circuit</th>
<th>Main Circuit</th>
<th>Auxiliary Circuit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Voltage (Ue)</td>
<td>30V</td>
</tr>
<tr>
<td>AC</td>
<td>Resistive load (AC12)</td>
<td>10A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (AC15)</td>
<td>10A</td>
</tr>
<tr>
<td>DC</td>
<td>Resistive load (DC12)</td>
<td>6A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (DC13)</td>
<td>3A</td>
</tr>
<tr>
<td>AC</td>
<td>Resistive load (AC12)</td>
<td>–</td>
</tr>
<tr>
<td></td>
<td>Inductive load (AC15)</td>
<td>–</td>
</tr>
<tr>
<td>DC</td>
<td>Resistive load (DC12)</td>
<td>3A</td>
</tr>
<tr>
<td></td>
<td>Inductive load (DC13)</td>
<td>–</td>
</tr>
</tbody>
</table>

**Contact Gap**
- Main circuit: 1.7 mm min., Auxiliary circuit: 1.2 mm min.

**Operating Frequency**
- 900 operations/hour max.

**Mechanical Life**
- 1,000,000 operations min. (at full rated load)
- 900 ops/hr (AC-12/250V, 6A)

**Electrical Life**
- 100,000 operations (rated load)

**Conditional Short-circuit Current**
- 100A (per IEC60947-5-1)

**Recommended Short Circuit Protection**
- 250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)

**Solenoid Unit**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>24V DC</td>
</tr>
<tr>
<td>Current</td>
<td>292mA</td>
</tr>
<tr>
<td>Coil Resistance</td>
<td>102Ω (at 20°C)</td>
</tr>
<tr>
<td>Pickup Voltage</td>
<td>20.5V maximum (at 20°C)</td>
</tr>
<tr>
<td>DropOut Voltage</td>
<td>2.4 minimum (at 20°C)</td>
</tr>
<tr>
<td>Allowable Voltage</td>
<td>26.4V max (continuous)</td>
</tr>
<tr>
<td>Insulation Class</td>
<td>Class F</td>
</tr>
</tbody>
</table>

**Indicator**

<table>
<thead>
<tr>
<th>Operation</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage</td>
<td>24V DC</td>
</tr>
<tr>
<td>Current</td>
<td>10 mA</td>
</tr>
<tr>
<td>Light Source</td>
<td>LED lamp</td>
</tr>
<tr>
<td>Lens Color</td>
<td>Red or Green (12 mm dia. Lens)</td>
</tr>
<tr>
<td>Weight</td>
<td>Approx. 500g</td>
</tr>
</tbody>
</table>

---

**Part Number Key**

- HS1E - 2 4 4 K R - R

  - Indicator Color:
    - R (Red)
    - G (Green)

  - Manual Unlock Key:
    - K (with actuator)
    - 0 (without actuator)

  - Indicator Rated Voltage:
    - 4 (24V DC)
    - Blank (without indicator)

  - Circuit Code:
    - Main Circuit: 1NC + 1NC 1NO/1NO
    - Auxiliary Circuit: 1NC + 1NC 1NC + 1NC
HS1E Series Door Interlock Switches

Application Examples and Circuit Diagrams

### HS1E-4 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO/1NO)

<table>
<thead>
<tr>
<th>Status</th>
<th>Switch/Door Status</th>
<th>Door Status</th>
<th>Machine Status</th>
<th>Solenoid Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status 1</td>
<td>Door Closed</td>
<td>Machine ready to operate</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Status 2</td>
<td>Door Closed</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Status 3</td>
<td>Door Opened</td>
<td>Machine cannot be started</td>
<td>Solenoid energized</td>
<td></td>
</tr>
<tr>
<td>Status 4</td>
<td>Door Opened</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Unlocked Manually</td>
<td>Door Closed</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
</tbody>
</table>

#### Circuit Diagram

- Main Circuit: 3-4: Closed
- Aux. Circuit: 1-2: Open
- Solenoid: 5-6: Power OFF

---

### HS1E-14 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO)

<table>
<thead>
<tr>
<th>Status</th>
<th>Switch/Door Status</th>
<th>Door Status</th>
<th>Machine Status</th>
<th>Solenoid Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status 1</td>
<td>Door Closed</td>
<td>Machine ready to operate</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Status 2</td>
<td>Door Closed</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Status 3</td>
<td>Door Opened</td>
<td>Machine cannot be started</td>
<td>Solenoid energized</td>
<td></td>
</tr>
<tr>
<td>Status 4</td>
<td>Door Opened</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
<tr>
<td>Unlocked Manually</td>
<td>Door Closed</td>
<td>Machine cannot be started</td>
<td>Solenoid de-energized</td>
<td></td>
</tr>
</tbody>
</table>

#### Circuit Diagram

- Main Circuit: 3-4: Closed
- Aux. Circuit: 1-2: Open
- Solenoid: 5-6: Power OFF

---

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid and door status.
Application Examples and Circuit Diagrams, continued

**HS1E-24 (Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC+NC)**

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
<th>Status 4</th>
<th>Unlocked Manually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch/Door Status</td>
<td>Door Closed</td>
<td>Door Closed</td>
<td>Door Opened</td>
<td>Door Closed</td>
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<tr>
<td></td>
<td>Machine ready to operate</td>
<td>Machine cannot be started</td>
<td>Machine cannot be started</td>
<td>Machine cannot be started</td>
</tr>
<tr>
<td></td>
<td>Solenoid de-energized</td>
<td>Solenoid energized</td>
<td>Solenoid energized</td>
<td>Solenoid de-energized</td>
</tr>
<tr>
<td>Door Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Door Closed</td>
<td>Machine ready to operate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solenoid de-energized</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Circuit Diagram**

Main Circuit | 3-4: Closed | 3-4: Open | 3-4: Open | 3-4: Open |
Solenoid | 5-6: Power OFF | 5-6: Power ON | 5-6: Power OFF | 5-6: Power OFF |

**HS1E-34 (Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC)**

<table>
<thead>
<tr>
<th>Status 1</th>
<th>Status 2</th>
<th>Status 3</th>
<th>Status 4</th>
<th>Unlocked Manually</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch/Door Status</td>
<td>Door Closed</td>
<td>Door Closed</td>
<td>Door Opened</td>
<td>Door Closed</td>
</tr>
<tr>
<td></td>
<td>Machine ready to operate</td>
<td>Machine cannot be started</td>
<td>Machine cannot be started</td>
<td>Machine cannot be started</td>
</tr>
<tr>
<td></td>
<td>Solenoid de-energized</td>
<td>Solenoid energized</td>
<td>Solenoid energized</td>
<td>Solenoid de-energized</td>
</tr>
<tr>
<td>Door Status</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Door Closed</td>
<td>Machine ready to operate</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Solenoid de-energized</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Circuit Diagram**

Main Circuit | 3-4: Closed | 3-4: Open | 3-4: Open | 3-4: Open |
Solenoid | 5-6: Power OFF | 5-6: Power ON | 5-6: Power OFF | 5-6: Power OFF |

1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid or door status.
HS1E Series Door Interlock Switches

Overview X Series E-Stops Door Interlock Switches Enabling Switches Barriers AS-Interface Safety at Work

Dimensions (mm)

**HS1E with indicator - using 1500N operating force**

**Horizontal Mounting**
Straight Actuator HS9Z-A1

**Vertical Mounting**
Right-angle Actuator HS9Z-A2

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

---

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
Accessories

Straight Actuator (mainly for sliding doors) HS9Z-A1

```
2-M6 Screws

Actuator Mounting Holes

Actuator Cover (red)
```

Right-angle Actuator (mainly for hinged doors) HS9Z-A2

```
2-M6 Screws

Actuator Mounting Holes

Actuator Cover (red)
```

*After installing the actuator, remove the actuator cover.

Adjustable Actuator

- The actuator angle is adjustable (0˚ to 20˚) for hinged doors.
- The minimum radius of the door opening can be as small as 100mm.

For HS1/HS2 Series (HS9Z-A3)

```
Angle Adjustment Screw (M3 hexagon socket head screw)

Actuator Stop Film (attached)
```

All dimensions in mm.
Actuator Angle Adjustment

- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0˚) to 20˚
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.

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 (HS9ZA3 or HS9Z-A3S).

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

HS9Z-A2 Actuator

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

When using the HS9Z-A3 Angle Adjustable (vertical) 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:
HS1C Series Full Size Solenoid Locking Switches

**HS1C features:**
- Rugged Aluminum Die-cast Housing
- With the actuator mounted on a movable door, and the switch on a machine, the door can be mechanically locked when closed.
- Greater Safety: The door is unlocked by a solenoid lock-release signal from a PLC or another source after the machine has stopped.
- In the event of power failure or for machine maintenance, the door can be unlocked using a special tool.
- Flexible Installation: The actuator can be accessed from two directions.
- Select from four different circuit configurations.
- IP67 Protection

**HS1C Series Functionality**

- Two Conduit Ports (G1/2)
- Use IP67 conduit or gland
- LED Indicator (green or red)
- Straight Actuator (SUS304)
- Right-angle Actuator (SUS304)
- Angle Adjustable Actuator for hinged doors
- Contact Mechanism (Direct Opening Action)
- Tubular Clamp Terminal Block (M3)
- Manual Unlocking Entry (M4 hole)
- Accessible using a small screwdriver after removing a TORX screw on the unlocking entry
- Two Actuator Entry Slots
- Ground Terminal (M4)
- Indicator Terminal Block (M3.5)

TORX is a registered trademark of Camcar Textron.
### Part Numbers

<table>
<thead>
<tr>
<th>Contact Configuration</th>
<th>Indicator LED</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NO/1NO</td>
<td>Green</td>
<td>HS1C-R44R-G</td>
</tr>
<tr>
<td>Auxiliary Circuit: 1NO</td>
<td>Red</td>
<td>HS1C-R44R-R</td>
</tr>
<tr>
<td>Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC+1NC</td>
<td>Green</td>
<td>HS1C-R144R-G</td>
</tr>
<tr>
<td>Auxiliary Circuit: 1NC</td>
<td>Red</td>
<td>HS1C-R144R-R</td>
</tr>
<tr>
<td>Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC+1NC</td>
<td>Green</td>
<td>HS1C-R244R-G</td>
</tr>
<tr>
<td>Auxiliary Circuit: 1NC</td>
<td>Red</td>
<td>HS1C-R244R-R</td>
</tr>
<tr>
<td>Main Circuit: 1NC+1NC, Auxiliary Circuit: 1NC</td>
<td>Green</td>
<td>HS1C-R344R-G</td>
</tr>
<tr>
<td>Auxiliary Circuit: 1NC</td>
<td>Red</td>
<td>HS1C-R344R-R</td>
</tr>
</tbody>
</table>

### Actuator Keys & Accessories

<table>
<thead>
<tr>
<th>Item</th>
<th>Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS9Z-A1</td>
<td>HS9Z-A1</td>
<td>Straight Actuator (Mainly for sliding doors)</td>
</tr>
<tr>
<td>HS9Z-A2</td>
<td>HS9Z-A1</td>
<td>Right-angle Actuator (Mainly for rotating doors)</td>
</tr>
<tr>
<td>HS9Z-A3</td>
<td>HS9Z-A1</td>
<td>Adjustable Actuator</td>
</tr>
<tr>
<td>HS9Z-T1</td>
<td>HS9Z-A1</td>
<td>Key Wrench (included with switch)</td>
</tr>
</tbody>
</table>
HS1C Series

Overview

Door Interlock Switches

Enabling Switches

Barriers

Overview

X Series E-Stops

Specifications

Conforming to Standards
EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-19, UL508

Operating Temperature
–20 to +40°C (no freezing)

Storage Temperature
–40 to +80°C

Operating Humidity
85% RH maximum (no condensation)

Altitude
2,000m maximum

Rated Insulation Voltage (Ui)
300V (between LED or solenoid and ground: 60V)

Impulse Withstand Voltage (Uimp)
4 kV (between LED or solenoid and ground: 2.5 kV)

Insulation Resistance
Between live and dead metal parts: 100 MΩ minimum
Between live metal part and ground: 100 MΩ minimum
Between live metal parts: 100 MΩ minimum
Between terminals of the same pole: 100 MΩ minimum

Electric Shock Protection Class
Class 1 (IEC61140)

Pollution Degree
3 (IEC60947-5-1)

Degree of Protection
IP67 (IEC60529)

Vibration Resistance
10 to 55 Hz, amplitude 0.5 mm

Operating Extremes
60 m/sec² (approx. 6G)

Damage Limits
1,000 m/s² (approx. 100G)

Shock Resistance
1,500N minimum

Operating Speed
1 m/sec maximum

Positive Opening Force
20N minimum

Operating Temperature
–20 to +40°C (no freezing)

Storage Temperature
–40 to +80°C

Operating Humidity
85% RH maximum (no condensation)

Altitude
2,000m maximum

Rated Insulation Voltage (Ui)
300V (between LED or solenoid and ground: 60V)

Impulse Withstand Voltage (Uimp)
4 kV (between LED or solenoid and ground: 2.5 kV)

Insulation Resistance
Between live and dead metal parts: 100 MΩ minimum
Between live metal part and ground: 100 MΩ minimum
Between live metal parts: 100 MΩ minimum
Between terminals of the same pole: 100 MΩ minimum

Electric Shock Protection Class
Class 1 (IEC61140)

Pollution Degree
3 (IEC60947-5-1)

Degree of Protection
IP67 (IEC60529)

Vibration Resistance
10 to 55 Hz, amplitude 0.5 mm

Operating Extremes
60 m/sec² (approx. 6G)

Damage Limits
1,000 m/s² (approx. 100G)

Shock Resistance
1,500N minimum

Operating Speed
1 m/sec maximum

Positive Opening Force
20N minimum

Operating Temperature
–20 to +40°C (no freezing)

Storage Temperature
–40 to +80°C

Operating Humidity
85% RH maximum (no condensation)

Altitude
2,000m maximum

Rated Insulation Voltage (Ui)
300V (between LED or solenoid and ground: 60V)

Impulse Withstand Voltage (Uimp)
4 kV (between LED or solenoid and ground: 2.5 kV)

Insulation Resistance
Between live and dead metal parts: 100 MΩ minimum
Between live metal part and ground: 100 MΩ minimum
Between live metal parts: 100 MΩ minimum
Between terminals of the same pole: 100 MΩ minimum

Electric Shock Protection Class
Class 1 (IEC61140)

Pollution Degree
3 (IEC60947-5-1)

Degree of Protection
IP67 (IEC60529)

Vibration Resistance
10 to 55 Hz, amplitude 0.5 mm

Operating Extremes
60 m/sec² (approx. 6G)

Damage Limits
1,000 m/s² (approx. 100G)

Shock Resistance
1,500N minimum

Operating Speed
1 m/sec maximum

Positive Opening Force
20N minimum

Thermal Current (Ith)
Main circuit: 10A, Auxiliary circuit: 3A

Conditional Short-circuit Current
100A (IEC60947-5-1)

Recommended Short Circuit Protection
250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)

Part Number Key
HS1C - R 1 4 4 R - R

Indicator Color
R (Red)

Housing Color
R (Red)

Solenoid and LED Voltage
4 (24V DC)

Circuit Code
Main Circuit
1: 1NC + 1NC
2: 1NC + 1NC
3: 1NC + 1NC

Auxiliary Circuit
1NC + 1NC
1NC + 1NC
1NC + 1NC

Indicators
Operating Voltage
24V DC

Current
415 mA

Coil Resistance
58Ω (at 20°C)

Energizing Voltage
Rated voltage x 85% maximum (at 20°C)

De-energizing Voltage
Rated voltage x 10% minimum (at 20°C)

Continuous Applicable Voltage
Rated voltage x 110%

Continuous Applicable Duration
Not specifically limited

Insulation Class
Class B

Indicator
Operating Voltage
24V DC

Current
10 mA

Light Source
LED lamp

Lens Color
Red or Green (12 mm dia. Lens)

Weight
Approx. 660g
HS1C Series Door Interlock Switches

Overview
X Series E-Stops
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Dimensions (mm)

HS1C-R44R-* - using the straight actuator (HS9Z-A1)

HS1C-R44R-* - using the Right-angle actuator (HS9Z-A2)

Mounting Hole Layout

Slot Plug (Note)

4-M5 Screws

Courtesy of Steven Engineering, Inc.-230 Ryan Way, South San Francisco, CA 94080-6370-Main Office: (650) 588-9200-Outside Local Area: (800) 258-9200-www.stevenengineering.com
### Accessories

**Straight Actuator (mainly for sliding doors)**

**HS9Z-A1**

- 2-M6 Screws
- Actuator Mounting Holes
- Actuator Cover (red)

**Right-angle Actuator (mainly for hinged doors)**

**HS9Z-A2**

- 2-M6 Screws
- Actuator Mounting Holes
- Actuator Cover (red)

- *After installing the actuator, remove the actuator cover.*

**Adjustable Actuator**

- The actuator angle is adjustable (0° to 20°) for hinged doors.
- The minimum radius of the door opening can be as small as 100mm.

**For HS1/HS2 Series (HS9Z-A3)**

- Angle Adjustment Screw (M3 hexagon socket head screw)
- Actuator Stop Film (attached)
- Door hinge
- Actuator Mounting Holes

All dimensions in mm.
**Precautions**

**Door Interlock Switches**

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

- Do not place a PLC in the circuit between the safety switch and the load. The safety security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the switch. It may cause a breakdown or an accident.

**Operation Precautions - for all series**

- Regardless of door types, do not use the safety switch as a door stop. Install a mechanical door stop at the end of the door to protect the safety switch against excessive force.
- Do not apply excessive shock to the switch when opening or closing the door.
- A shock to the door exceeding 1,000 m/sec² (approx. 100G) may cause the contacts of the switch to chatter, and a malfunction of the switch may occur.
- For connection of wires, unscrew the cover. Unnecessary loosening of other screws may cause a malfunction of the switch.

**Safety Precautions**

- Do not apply excessive shock to the switch when opening or closing the door.
- A shock to the door exceeding 1,000 m/sec² (approx. 100G) may cause the contacts of the switch to chatter, and a malfunction of the switch may occur.
- For connection of wires, unscrew the cover. Unnecessary loosening of other screws may cause a malfunction of the switch.

**Operation Precautions - for all series**

- Prevent foreign objects such as dust and liquids from entering the switch while connecting conduit or wiring.
- 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.
- Entry of a considerable amount of foreign objects into the switch may affect the mechanism of the switch and cause a breakdown.
- Do not store the switches in a dusty, humid, or organic-gas atmosphere.

**HS5E/HS5B Precautions**

**For Rotating Head Directions**

- The heads of the HS5E/HS5B can be rotated in 90° increments after removing the 4 screws on the corners of the head. Prevent entry of foreign objects into the switch during removal of the head. Tighten these screws with torque designated in the instruction sheet. Improper torque may cause errors.

- Minimum Radius of Hinged Doors

  - 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-A55).

<table>
<thead>
<tr>
<th></th>
<th>Factory Setting</th>
<th>Head can be rotated</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**HS2B Precautions**

**Wire Connection**

- The HS2B has 3 conduit ports, which are closed as a part of the molded switch housing.
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block or other parts inside the switch.

- Cracks or burrs on the conduit entry may deteriorate the housing protection against water.
- When changing to another conduit port, close the unused opening with an optional plug (Part No. HS9Z-P1).
HS1E Precautions

**Wire Connection**
- Make an opening for wire connection by breaking one of the conduit-port knockouts on the switch housing using a screwdriver.
- Before breaking the knockout, temporarily remove the connector-fixing lock nut from the switch.
- When breaking the knockout, take care not to damage the contact block or other parts inside the switch.
- Cracks or burrs on the conduit entry may deteriorate the housing protection.
- When changing to the other conduit port, close the unused opening with an optional plug (accessory).

**Manual Unlocking**
- Remove the screw located on the unlocking entry at the side of the switch using the key wrench included with the switch. Then insert a small screwdriver into the switch to push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).
- Insert a small screwdriver into the elliptical hole on the back of the switch, then push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).

**HS1C Precautions**
- Regardless of door type, do not use the safety switch as a locking device. Install a locking device independently, for example, using a metal latch (also applicable to HS1E).
- The safety switch cover can be only removed with the special key wrench supplied with the switch or with the optional screwdriver (also applicable to HS1B and HS1E).
- Remove the screw located on the unlocking entry at the side of the switch using the key wrench included with the switch. Then insert a small screwdriver into the switch to push the lever inside of the switch toward the indicator until the actuator is unlocked (refer to the diagram on the right).

Caution: After the unlocking operation, put the screw back into the unlocking entry for safety.
**Precautions**

**Door Interlock Switches**

**Overview**

**X Series E-Stops**

**Enabling Switches**

**Barriers**

**AS-Interface Safety at Work**

---

**Operation Precautions**

**Applicable Crimping Terminals**

- (Refer to the Crimping Terminal 1 or 2 shown in the drawing below.)
  - **HS1C**
    - Terminals No. 1 to 6: Use solid or stranded wires only (crimping terminals not applicable).
    - Terminals No. 7 and 8: Crimping Terminal 1
    - Ground Terminal: Crimping Terminal 2
  - **HS1B**
    - Ground Terminal: Crimping Terminal 2
    - Other Terminals: Crimping Terminal 1
    - HS2B, HS5B, and HS1E
      - Crimping Terminal 1

**Applicable Connectors (As shown below)**

- Use connectors which maintain the IP67 protection.
- Applicable Connector Dimensions
- Flex Conduit: VF03 (Japan Flex) www.nipolex.co.jp
- Steel Connector (G1/2): ALC-103 (PF13.5): RBC-103PG13.5

**Recommended Screw Tightening Torque**

- **HS1C**: 5.0±0.5 N-m (approx. 50±5 kgf·cm) (4 or 6 pcs of M5 hex socket head cap screws)
- **HS1B**: 5.0±0.5 N-m (approx. 50±5 kgf·cm) (2 or 4 pcs. of M5 hex socket head cap screws)
- **HS2B**: 5.0±0.5 N-m (approx. 50±5 kgf·cm) (2 pcs of M5 hex socket head cap screws)
- **HS5B**: 4.0±0.4 N-m (approx. 40±4 kgf·cm) (2 pcs of M4 hex socket head cap screws)
- **HS1E**: 5.0±0.5 N-m (approx. 50±5 kgf·cm) (4 or 6 pcs of M5 hex socket head cap screws)
- Actuator (HS9Z-A1/A2)
  - 5.0±0.5 N-m (approx. 50±5 kgf·cm) (2 pcs. of M6 hex socket head cap screws)
- Actuator (HS9Z-A51/A52)
  - 2.0±0.2 N-m (approx. 20±2 kgf·cm) (2 pcs of M4 hex socket head cap screws)
  - 1.0±0.2 N-m (approx. 10±2 kgf·cm) (2 pcs of M4 Phillips screws)

The screws are supplied by the user.

**Applicable Wire Size**

- **HS1C**: 0.5 to 0.75 mm² (Terminals No.1, 2, 5 to 8)
  - 1.0 to 1.25 mm² (Terminals No.3, 4, and grounding terminal)
- **HS5B**: 0.5 to 1.25 mm²
- **HS1E**: 0.5 to 1.25 mm²

---

**Installation Examples (see the diagrams below)**

**Mounting on Sliding Doors**

- Door Stop
  - HS9Z-A1 Actuator

**Mounting on Hinged Doors**

- Latch
  - HS9Z-A2 Actuator
  - HS9Z-A1 Actuator

---

**Use an insulation tube on the crimping terminal.**

---

**Crimping Terminal 1**

**Crimping Terminal 2**

---

**Recommended Screw Tightening Torque**

---

**Applicable Wire Size**
Actuator Angle Adjustment
• Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0°) to 20°
• The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.

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-A55).
  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-A52 Actuator
• When the door hinge is on the extension line of the interlock switch surface:

When using the HS9Z-A55 Angle Adjustable Actuator
• When door hinge is on the extension line of the interlock switch surface: 50 mm
• When door hinge is on the extension line of the actuator mounting surface: 70 mm

Actuator Angle Adjustment for the HS9Z-A55
• Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370). 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 entry slot of the safety switch.
• Recommended tightening torque: 0.8 N·m (approx. 8.0 kgf-cm)
• After adjusting the actuator angle, apply loctite or the like to the adjustment screw so as to prevent its loosening.

Applicable Cable Glands

When Using Multi-core Cables (Example)

<table>
<thead>
<tr>
<th>Conduit Port Size</th>
<th>Plastic Cable Gland</th>
<th>Metal Cable Gland</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1/2</td>
<td>SCS-10* (Seiwa Electric)</td>
<td>ALS-18** (Nihon Flex)</td>
</tr>
<tr>
<td>PG13.5</td>
<td>ST13.5 (K-MECS)</td>
<td>ABS-**PG13.5 (Nihon Flex)</td>
</tr>
<tr>
<td>M20</td>
<td>ST-M20X1.5 (K-MECS)</td>
<td>ALS-**EC20 (Nihon Flex)</td>
</tr>
</tbody>
</table>

• Different cable glands are used depending on the cable sheath outside diameter. When purchasing a cable gland, confirm that the cable gland is applicable to the cable sheath outside diameter.
• When using a 1/2-14NPT cable gland, use the HS5B interlock switch with M20 conduit port (Part No.: HS5B-***BM) together with an adapter (Part No.: MA-M/NPT 20X1.5 5402-0110, K-MECS) and a gasket (Part No.: GP M20, K-MECS). Install a gasket between the interlock switch and the adapter. Apply sealing tape between the cable gland and the adapter to make sure of IP67 protection for the enclosure.