

HS1E Interlock Switches with Solenoid (3-circuit)

Dual main circuit + lock monitor circuit provide more safety to your system

- Basic unit and solenoid unit in one housing
- Lightweight plastic housing
- All terminal screws are M3.5, allowing easy wiring.
- Two main circuits 1NC+1NC and a monitor circuit 1NC realizes duplicated main circuit and lock monitor.
- Hostage control can be achieved using the hostage key.
- Guard door can be locked automatically by installing the actuator on the guard and interlock switch on the machine.
- Equipped with two actuator entry slots.
- Double insulation structure
- 5 different numbers are available for key, so that neighboring switches cannot be operated by the same key.

Actuator Retention Force 3000N

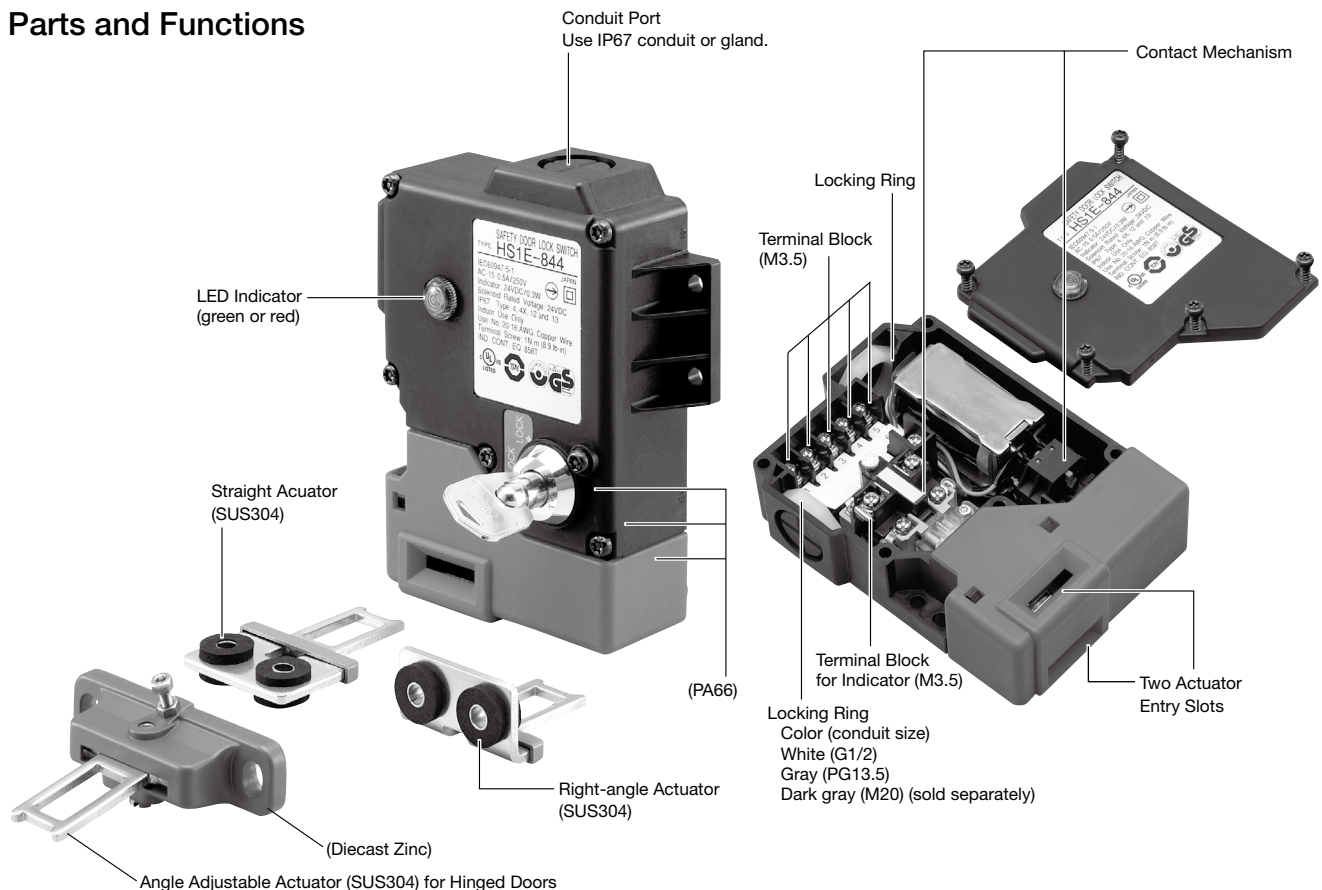
- Ideal locking mechanism and robust actuators for large doors.
- Accommodation of actuator entry slots to rattling doors is enhanced.

Spring Lock

- Automatically locks the actuator without power applied to the solenoid.
- After the machine stops, unlocking is completed by the solenoid, providing high safety features.
- Manual unlocking is possible in the event of power failure or maintenance.

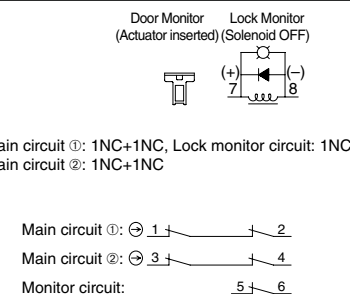


Parts and Functions



HS1E Interlock Switches with Solenoid (3-circuit)

Interlock Switch

Lock Mechanism	Contact Configuration	Conduit Port Size	Style			Part No.
			Indicator	Manual Unlock Key	Hostage Key	
Spring Lock	 <p>Door Monitor (Actuator inserted) Lock Monitor (Solenoid OFF)</p> <p>Main circuit ①: 1NC+1NC, Lock monitor circuit: 1NC Main circuit ②: 1NC+1NC</p> <p>Main circuit ①: ⊕ 1 ——— 2 Main circuit ②: ⊕ 3 ——— 4 Monitor circuit: 5 ——— 6</p>	G1/2	—	—	With	HS1E-K840MSR-□
			With	—	With	HS1E-K844MSR-②-□
		PG13.5	—	—	With	HS1E-K840MSRP-□
			With	—	With	HS1E-K844MSRP-②-□

- Specify a key number in place of □ in the Part No. (T001 to T005)
- Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.
- Specify an indicator color code in place of ② in the Part No.
G: green, R: red
- The contact configuration shows when the actuator is inserted and locked.
- Actuator is not supplied with the interlock switch, and must be ordered separately.

Actuator / Key Wrench for TORX Screws

Name	Specification	Part No.	Ordering No.	Package Quantity
Straight Actuator	—	HS9Z-A1S	HS9Z-A1S	1
Right-angle Actuator		HS9Z-A2S	HS9Z-A2S	
Angle Adjustable Actuator (for hinged door)		HS9Z-A3S	HS9Z-A3S	
Key Wrench for TORX Screws		HS9Z-T1	HS9Z-T1	
Conduit Port Plug		HS9Z-P1	HS9Z-P1	
Locking Ring for Gland	M20 thread	HW9Z-NM20	HW9Z-NM20PN05	5

- When using M20 size gland, order locking ring HW9Z-NM20 separately.

Part No. Development

HS1E-K844MSRP-R-T001

Contact Configuration	Hostage Key No.
Main Circuit	T001 to T005 (5 types)
Monitor Circuit	Indicator Color
8: 1NC+1NC, 1NC+1NC	Blank: Without indicator
1NC	G: green
Solenoid Voltage	R: red
4: 24V DC	Conduit Port
Indicator Rated Voltage	Blank: G1/2
4: 24V DC	P: PG13.5
0: Without indicator	Housing Color
Retention Force	R: red/black
MS: 3000N*	

* Retention force for horizontal direction (parallel to the mounting panel)

HS1E Interlock Switches with Solenoid (3-circuit)

Ratings

Contact Ratings

Rated Insulation Voltage (Ui)		300V (between LED or solenoid and ground: 60V)				
Rated Thermal Current (Ith)		2.5A				
Rated Voltage (Ue)		30V	125V	250V		
Rated Current (Ie) (Note)	Main Circuit	AC	Resistive load (AC-12)	—	2.5A	1.5A
			Inductive Load (AC-15)	—	1.5A	0.75A
		DC	Resistive load (DC-12)	2.5A	1.1A	0.55A
			Inductive Load (DC-13)	2.3A	0.55A	0.27A

- Minimum applicable load (reference value): 3V AC/DC, 5 mA
(Applicable range is subject to operating conditions and load.)

TÜV rating AC-15 250V/0.5A DC-13 125V/0.22A AC-15 240V/0.75A DC-13 30V/2.3A	UL/c-UL rating 250V AC/0.5A Pilot Duty 30V DC/1.0A Pilot Duty 240V AC/0.75A Pilot Duty C300 Q300
CCC rating AC-15 240V/0.75A DC-13 30V/2.3A	

Solenoid

Model	HS1E-K
Rated Voltage	24V DC (100% duty cycle)
Rated Current	206 mA
Coil Resistance	116Ω (at 20°C)
Pickup Voltage	Rated voltage × 85% maximum (at 20°C)
Dropout Voltage	Rated voltage × 10% minimum (at 20°C)
Maximum Continuous Applicable Voltage	Rated voltage × 110%
Maximum Continuous Applicable Time	Continuous
Insulation Class	Class F

Indicator

Rated Voltage	24V DC
Rated Current	10 mA
Light Source	LED
Lens Color	G (green), R (red)

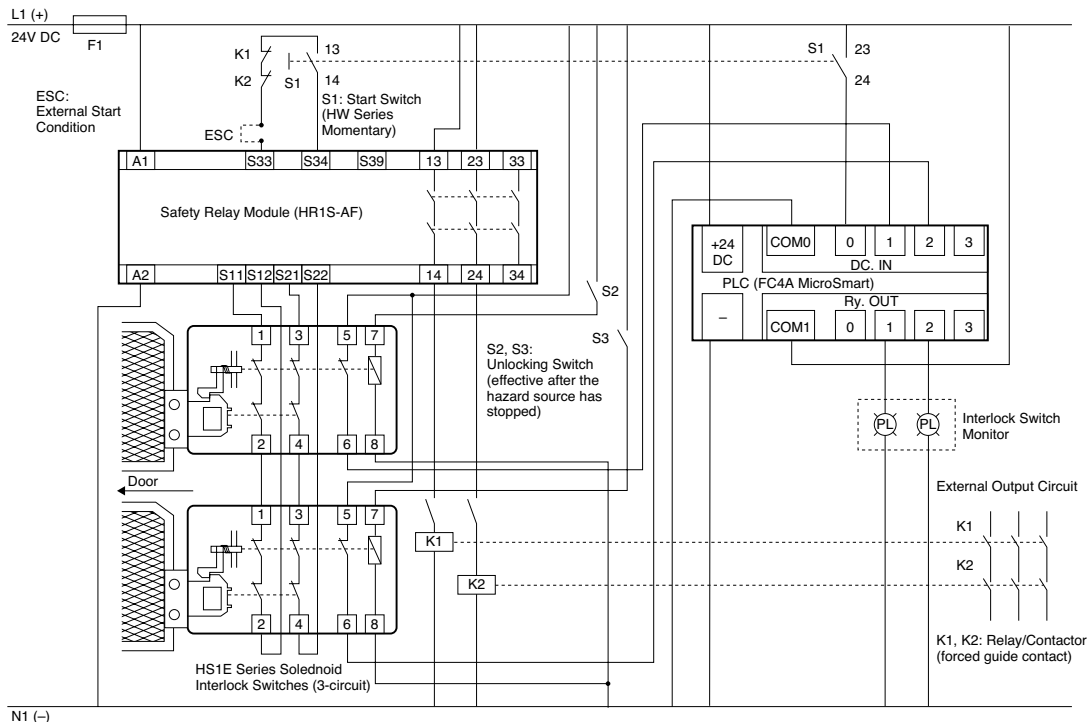
- The lens cannot be replaced.

Specifications

Applicable Standards	ISO14119 IEC60947-5-1, EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved), UL508 (UL listed) CSA C22.2 No.14 (c-UL listed) GB/T14048.5 (CCC approved) IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature	-20 to 40°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	-40 to +80°C (no freezing)
Pollution Degree	3
Impulse Withstand Voltage	4 kV (between LED or solenoid and grounding: 2.5 kV)
Insulation Resistance (500V DC megger)	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 II (IEC 61140)
Degree of Protection	IP67 (IEC 60529)
Shock Resistance	Damage limits: 1000 m/s ²
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.35 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	11 mm minimum
Direct Opening Force	20N minimum
Actuator Retention Force	3000N minimum (GS-ET-19) (2800N in the direction vertical to the mounting panel)
Operating Frequency	900 operations per hour
Mechanical Life	1,000,000 operations minimum (GS-ET-19) 30,000 operations minimum (key operation)
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100mA, operating frequency 900 operations per hour)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)
Weight (approx.)	500g

Example of Safety Circuit + Monitoring using 3-circuit Interlock Switches (safety category 3)

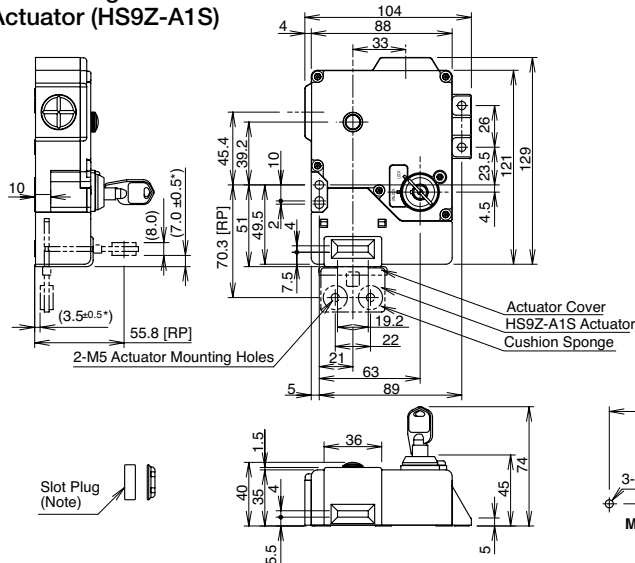
Before operation of the following circuit, it is recommended for the entire safety-related system to undergo a third party evaluation.



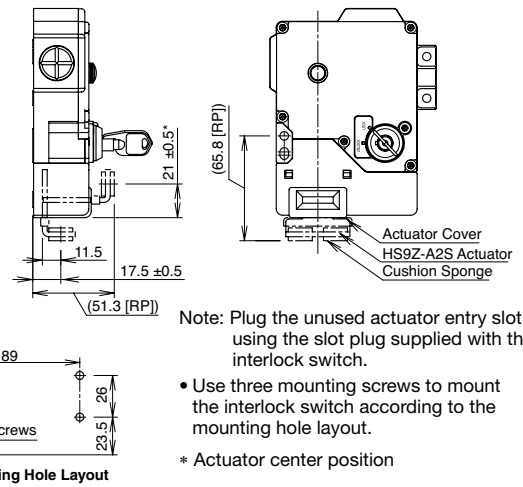
HS1E Interlock Switches with Solenoid (3-circuit)

Dimensions

HS1E-K
Horizontal Mounting
Straight Actuator (HS9Z-A1S)

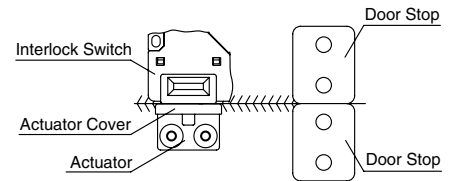


Horizontal Mounting
Straight Actuator (HS9Z-A2S)



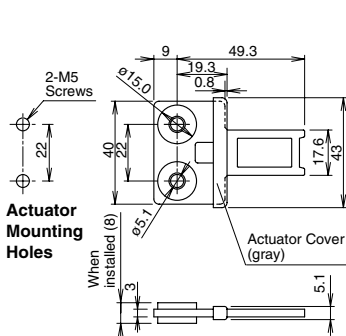
Actuator Mounting Reference Position

As shown in the figure on the right, the mounting reference position of the actuator when inserted in the interlock switch is:
The actuator cover lightly touches the interlock switch.
After mounting the actuator, remove the actuator cover from the actuator.

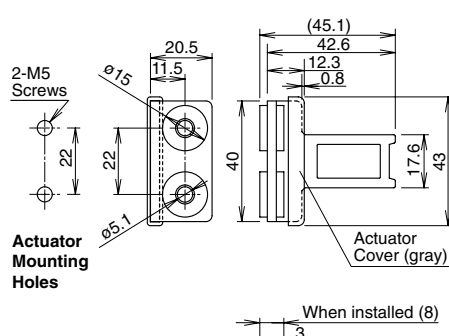


Actuator Dimensions

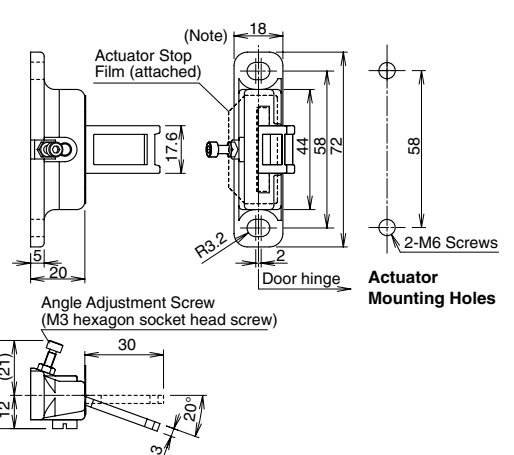
Straight Actuator (HS9Z-A1S)



Right-angle Actuator (HS9Z-A2S)



Angle Adjustable Actuator (HS9Z-A3S)



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

HS1E Interlock Switches with Solenoid (3-circuit)

Circuit Diagrams and Operating Characteristics

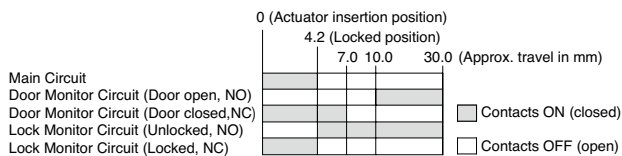
Spring Lock

HS1E-K84□□MSR-* (Main Circuit: 1NC+1NC, 1NC+1NC, Monitor Circuit: 1NC)

Interlock Switch Status		Status 1	Status 2	Status 3	Status 4	Status 5	Status 6
		<ul style="list-style-type: none"> Door closed Key is installed Solenoid de-energized 	<ul style="list-style-type: none"> Door closed Key is installed Solenoid energized 	<ul style="list-style-type: none"> Door closed Key is removed Solenoid energized 	<ul style="list-style-type: none"> Door open Key is removed Solenoid de-energized 	<ul style="list-style-type: none"> Door open Key is removed Solenoid de-energized 	<ul style="list-style-type: none"> Door closed Key is removed Solenoid de-energized
Door							
Circuit Diagram							
Contact Configuration							
<p>Main Circuit: ① 1 ② 2 Main Circuit: ③ 3 ④ 4 Monitor Circuit: ⑤ 5 ⑥ 6</p>	Main Circuit	1-2, 3-4: Closed	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open	1-2, 3-4: Open
	Monitor Circuit	5-6: Closed	5-6: Open	5-6: Open	5-6: Open	5-6: Open	5-6: Open
Solenoid Power		7-8: Power OFF	7-8: Power ON	7-8: Power ON	7-8: Power OFF	7-8: Power OFF	7-8: Power OFF
Remarks		<ul style="list-style-type: none"> Door locked Key retained Machine ready to operate 	<ul style="list-style-type: none"> Door locked Key removable Machine cannot operate 	<ul style="list-style-type: none"> Door can be opened Machine cannot operate 	<ul style="list-style-type: none"> Machine cannot operate 	<ul style="list-style-type: none"> Machine cannot operate 	<ul style="list-style-type: none"> Door can be opened Machine cannot operate

- Main circuit: Connected to the machine drive control circuit, sending interlock signals to the protective door.
- Monitor circuit: Sends ON/OFF signals of the main circuit and monitoring signals of open/closed status of the protective door.

Operation Characteristics (reference)



operation characteristics so the contact status in the actuator enters into the center of the entry slot. The circuit No. 12 41 and 22 1 are interconnected. Use circuit 11 42 and 21 2 or set circuits.

HS1E Interlock Switches with Solenoid (3-circuit)

Safety Precautions

- In order to avoid electric shock or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welded or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform risk assessment and establish a safety circuit which satisfies the requirement 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 the 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.
- For HS1E-K, do not apply excessive force to the locked key. Applying force to the key may interfere with solenoid operation, resulting in a failure to unlock. Also, applying a torque larger than 1.8 N·m to the key results in damage.
- 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.
- When wiring, unscrew the cover with part number label only. Unnecessary loosening of other screws may cause a malfunction of the interlock switch.
- Prevent foreign objects such as dust and liquids from entering the interlock switch while connecting a conduit or wiring.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock switch through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a malfunction.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
- Do not store the interlock switch in a dusty, humid, or organic-gas atmosphere.
- Use dedicated actuators only. When other actuators are used, the interlock switch may be damaged.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or other measures.
- While the solenoid is energized, the interlock switch temperature rises to approximately 115°C. Do not touch to prevent burns. If cables come into contact with the interlock switch, use heat-resistant cables.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.
- Actuator retention force is 3000N (static load). When larger force is expected, add a system using interlock switch without lock (ex. HS5D) and sensor in order to detect door opening and to stop the machine.

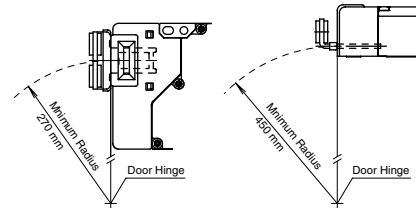
Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown on the right. For the doors with small minimum radius, use angle adjustable actuators (HS9Z-A3S).

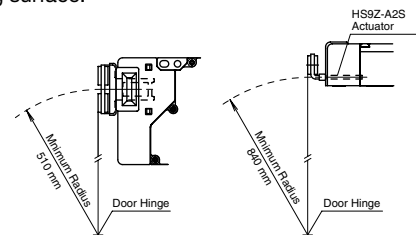
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A2S Actuator (w/rubber cushions)

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

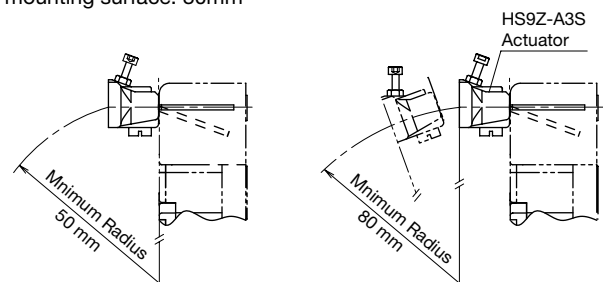


- When the door hinge is on the extension line of the actuator mounting surface:



HS9Z-A3S Actuator

- When the door hinge is on the extension line of the interlock switch surface: 50mm
- When the door hinge is on the extension line of the actuator mounting surface: 80mm



Actuator Angle Adjustment

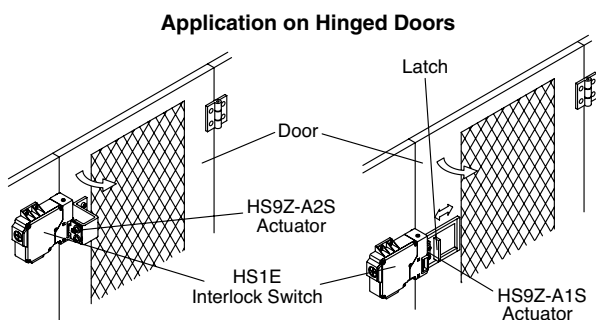
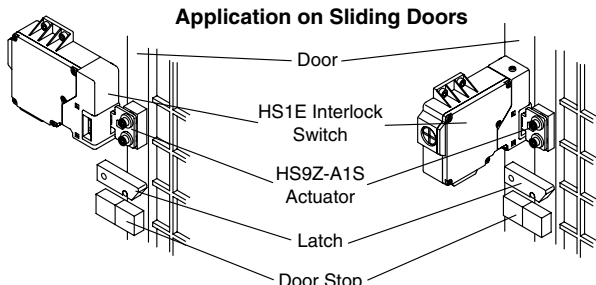
- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- Recommended tightening torque of angle adjustable screw: 0.8 N·m
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not move.

HS1E Interlock Switches with Solenoid (3-circuit)

Instructions

Mounting Examples

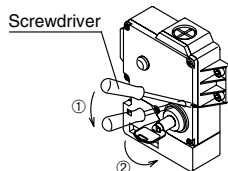
Mount the interlock switch on a fixed machine or guard, and mount the actuator on the hinged door. Do not mount both interlock switch and actuator on the hinged doors, otherwise malfunction will occur.



Manual Unlocking by Hostage Key (HS1E-K)

The HS1E-K has a hostage key for manual unlocking of the actuator to precheck proper entry of the actuator into the slot as well as for emergency use such as a power failure.

- Remove the screw located on the front of the interlock switch using the special wrench supplied with the interlock switch. Insert a small screwdriver into the hole to push the lever inside the interlock switch away from the hostage key until the key is unlocked.



- Turn the hostage key to UNLOCK side to unlock the actuator as shown on the right.

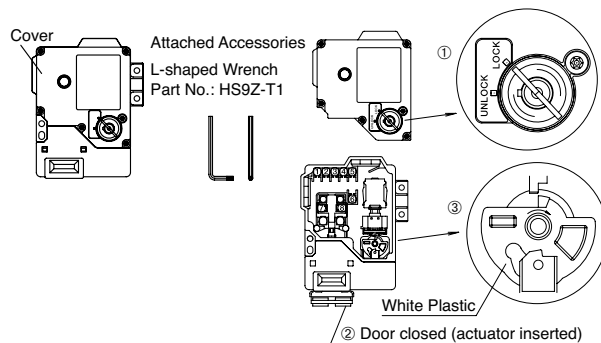
Note: Before manually unlocking the interlock switch, make sure that the machine has come to a complete stop. Manual unlocking during operation may unlock the interlock switch before the machine stops, and the function of interlock switch is lost. After unlocking, install the screw.

Opening/Closing the Cover (HS1E-K)



For safety, make sure that the power is turned off before opening or closing the cover.

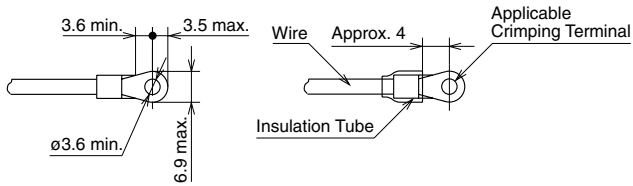
- When opening the interlock switch cover, remove the screws of the cover only. Do not remove other screws, otherwise failure of interlock switch will be caused.
- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock switch.
- When wiring, make sure that any liquid such as water and oil does not enter the interlock switch.
- Close the cover in the following method.
 1. Turn the key to LOCK position.
 2. Close the door (actuator is inserted).
 3. Turn the white plastic part in the interlock switch clockwise until the plastic part comes to the position shown in the figure below.
 4. Close the cover and tighten the screws to the appropriate torque.



HS1E Interlock Switches with Solenoid (3-circuit)

Instructions

Applicable Crimping Terminal



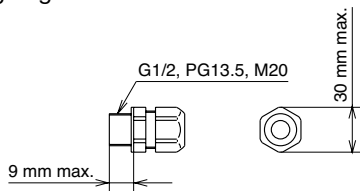
- Use an insulation tube on the crimping terminal.
- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

Applicable Wire Size

- 0.5 to 1.25 mm²

Applicable Cable Glands

- Use IP67 cable gland. When using M20-size cable gland, use locking ring HW9Z-NM20.



Refer to the instruction sheet from the URL below for recommended cable glands.

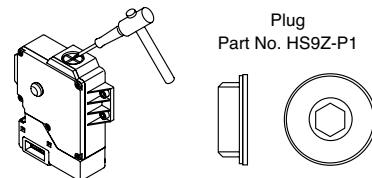
https://apac.idec.com/idec-apac/en/SGD/c/HS1E_Series

Recommended Tightening Torque of Mounting Screws

- Interlock switch: 3.2 to 3.8 N·m (three M5 screws)
- Lid mounting screw: 0.9 to 1.1 N·m (M4 screw)
- Terminal screw: 0.9 to 1.1 N·m (M3.5 screw)
- Connector: 2.7 to 3.3 N·m
- Actuators
HS9Z-A3S: 4.5 to 5.5 N·m (two M6 screws)
HS9Z-A1S/A2S: 2.7 to 3.3 N·m (two M5 screws)
- Mounting bolts must be provided by users.
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- Mounting bolts must be provided by the users.
- 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.

Conduit Port Opening

- Make an opening for wire connection by breaking one of the conduit-port knockouts on the interlock switch housing using a screwdriver.
- When breaking the conduit port, take care not to damage the contact block or other parts inside the interlock 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).



Ordering Terms and Conditions

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By purchasing products listed in our catalogs, datasheets, and the like (hereinafter referred to as "Catalogs") you agree to be bound by these terms and conditions. Please read and agree to the terms and conditions before placing your order.

1. Notes on contents of Catalogs

- (1) Rated values, performance values, and specification values of IDEC products listed in this Catalog are values acquired under respective conditions in independent testing, and do not guarantee values gained in combined conditions.
Also, durability varies depending on the usage environment and usage conditions.
- (2) Reference data and reference values listed in Catalogs are for reference purposes only, and do not guarantee that the product will always operate appropriately in that range.
- (3) The specifications / appearance and accessories of IDEC products listed in Catalogs are subject to change or termination of sales without notice, for improvement or other reasons.
- (4) The content of Catalogs is subject to change without notice.

2. Note on applications

- (1) If using IDEC products in combination with other products, confirm the applicable laws / regulations and standards.
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- (2) The usage examples and application examples listed in Catalogs are for reference purposes only. Therefore, when introducing a product, confirm the performance and safety of the instruments, devices, and the like before use. Furthermore, regarding these examples, IDEC does not grant license to use IDEC products to you, and IDEC offers no warranties regarding the ownership of intellectual property rights or non-infringement upon the intellectual property rights of third parties.
- (3) When using IDEC products, be cautious when implementing the following.
 - i. Use of IDEC products with sufficient allowance for rating and performance
 - ii. Safety design, including redundant design and malfunction prevention design that prevents other danger and damage even in the event that an IDEC product fails
 - iii. Wiring and installation that ensures the IDEC product used in your system, machine, device, or the like can perform and function according to its specifications
- (4) Continuing to use an IDEC product even after the performance has deteriorated can result in abnormal heat, smoke, fires, and the like due to insulation deterioration or the like. Perform periodic maintenance for IDEC products and the systems, machines, devices, and the like in which they are used.
- (5) IDEC products are developed and manufactured as general-purpose products for general industrial products. They are not intended for use in the following applications, and in the event that you use an IDEC product for these applications, unless otherwise agreed upon between you and IDEC, IDEC shall provide no guarantees whatsoever regarding IDEC products.
 - i. Use in applications that require a high degree of safety, including nuclear power control equipment, transportation equipment (railroads / airplanes / ships / vehicles / vehicle instruments, etc.), equipment for use in outer space, elevating equipment, medical instruments, safety devices, or any other equipment, instruments, or the like that could endanger life or human health
 - ii. Use in applications that require a high degree of reliability, such as provision systems for gas / waterworks / electricity, etc., systems that operate continuously for 24 hours, and settlement systems
 - iii. Use in applications where the product may be handled or used deviating from the specifications or conditions / environment listed in the Catalogs, such as equipment used outdoors or applications in environments subject to chemical pollution or electromagnetic interference
If you would like to use IDEC products in the above applications, be sure to consult with an IDEC sales representative.

3. Inspections

We ask that you implement inspections for IDEC products you purchase without delay, as well as thoroughly keep in mind management/maintenance regarding handling of the product before and during the inspection.

4. Warranty

- (1) Warranty period
The warranty period for IDEC products shall be one (1) year after purchase or delivery to the specified location. However, this shall not apply in cases where there is a different specification in the Catalogs or there is another agreement in place between you and IDEC.
- (2) Warranty scope
Should a failure occur in an IDEC product during the above warranty period for reasons attributable to IDEC, then IDEC shall replace or repair that product, free of charge, at the purchase location / delivery location of the product, or an IDEC service base. However, failures caused by the following reasons shall be deemed outside the scope of this warranty.
 - i. The product was handled or used deviating from the conditions / environment listed in the Catalogs
 - ii. The failure was caused by reasons other than an IDEC product
 - iii. Modification or repair was performed by a party other than IDEC
 - iv. The failure was caused by a software program of a party other than IDEC
 - v. The product was used outside of its original purpose
 - vi. Replacement of maintenance parts, installation of accessories, or the like was not performed properly in accordance with the user's manual and Catalogs
 - vii. The failure could not have been predicted with the scientific and technical standards at the time when the product was shipped from IDEC
 - viii. The failure was due to other causes not attributable to IDEC (including cases of force majeure such as natural disasters and other disasters)Furthermore, the warranty described here refers to a warranty on the IDEC product as a unit, and damages induced by the failure of an IDEC product are excluded from this warranty.

5. Limitation of liability

The warranty listed in this Agreement is the full and complete warranty for IDEC products, and IDEC shall bear no liability whatsoever regarding special damages, indirect damages, incidental damages, or passive damages that occurred due to an IDEC product.

6. Service scope

The prices of IDEC products do not include the cost of services, such as dispatching technicians. Therefore, separate fees are required in the following cases.

- (1) Instructions for installation / adjustment and accompaniment at test operation (including creating application software and testing operation, etc.)
- (2) Maintenance inspections, adjustments, and repairs
- (3) Technical instructions and technical training
- (4) Product tests or inspections specified by you

The above content assumes transactions and usage within your region. Please consult with an IDEC sales representative regarding transactions and usage outside of your region. Also, IDEC provides no guarantees whatsoever regarding IDEC products sold outside your region.

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