

HS1C-P Interlock Plug Unit with Door Lock

Interlock plugs with door lock mechanism for high level safety management.

- Installing the actuator on the guard door and the interlock switch on the machine, the guard door can be auto-locked mechanically.
- Removing the interlock plug maintains the interrupted status of load circuit and control circuit.
- Solenoid type and non-solenoid type available
- Solenoid type has a lock mechanism. Lock mechanism prevents removal of interlock plug during machine operation, and allows for removal after the machine has stopped, with solenoid energization signal.
- Flexible installation: The actuator can be inserted into two direction.
- Rugged die-cast aluminum housing
- UL listed, c-UL listed.



Interlock Plug Unit

Solenoid	Part No.
With solenoid (24V DC)	HS1C-P44Z-②
Without solenoid	HS1C-P04Z-②

- Specify an indicator color code in place of ② in the Part No.
G: green, R: red
- Key wrench for TORX screws (HS9Z-T1) is supplied.
- Actuator is not supplied and must be ordered separately.

Actuators

Description	Part No.
Straight Actuator	HS9Z-A1
Right-angle Actuator	HS9Z-A2
Angle Adjustable Actuator (for hinged doors)	HS9Z-A3
Key wrench for TORX screws	HA9Z-T1

Ratings Circuit

Model		HS1C-P44Z	HS1C-P04Z
Main Circuit	Rated Insulation Voltage (Ui)	250V (100% duty cycle)	
	Rated Thermal Current (Ith)	10A	
Monitor Circuit	Rated Insulation Voltage (Ui)	250V	
	Rated Thermal Current (Ith)	3A	
	Rated Operating Voltage (Ue)	250V AC	
	Rated Operating Current (Ie)	0.1A 250V AC/ 30V DC (resistive load)	3A (250V AC/ 30V DC) (resistive load)

Solenoid Unit

Rated Voltage	24V DC
Rated Current	260 mA
Coil Resistance	95Ω (at 20°C)
Pickup Voltage	Rated voltage × 90% 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
Power Consumption	6.3W

Indicator

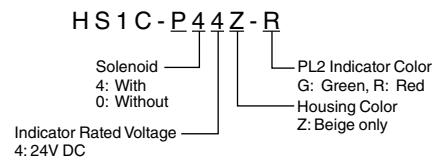
Rated Voltage	24V DC
Rated Current	10 mA
Light Source	LED
Lens Color	G (green), R (red)

- The lens cannot be replaced.

Specifications

Applicable Standards	Main Circuit	UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed) UL498 CSA C22.2 No. 182.1
	Auxiliary Circuit	UL508 (UL listed) CSA C22.2, No. 14 (c-UL listed)
	Applicable Standards for Use	EN 1088
Operating Temperature	-20 to +50°C (no freezing)	
Relative Humidity	45 to 85% (no condensation)	
Storage Temperature	-40 to +80°C (no freezing)	
Pollution Degree	3	
Insulation Resistance	100 MΩ minimum (500V DC megger)	
Contact Resistance	100 mΩ maximum (initial value)	
Dielectric Strength	Between live and dead metal parts: 2000V, 1 minute Between terminals of the same poles: 1000V, 1 minute	
Shock Resistance	Damage limits: 1000 m/s ²	
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum	
Operating Frequency	900 operations per hour (actuator, plug)	
Mechanical Life	30,000 operations minimum (actuator, plug)	
Actuator Retention Force	1500N minimum	
Interlock Plug Strength	Rotational strength when locked: 5 N·m	
Mounting Screw	M5 × 4	
Weight (approx.)	720g (HS1C-P44Z-②)	

Part No. Development



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Circuit Diagrams and Operating Characteristics

With Solenoid

	Status 1	Status 2	Status 3	Status 4	Status 5
Interlock Switch Status	<ul style="list-style-type: none"> Door closed Interlock plug is installed Solenoid de-energized 	<ul style="list-style-type: none"> Door closed Interlock plug is installed Solenoid energized 	<ul style="list-style-type: none"> Door closed Interlock plug is removed Solenoid energized 	<ul style="list-style-type: none"> Door closed Interlock plug is removed Solenoid de-energized 	<ul style="list-style-type: none"> Door open Interlock plug is removed Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Closed	3-4: Open	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Closed	1-2: Closed	1-2: Closed	1-2: Closed
Solenoid Power	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF
Remarks	<ul style="list-style-type: none"> Door locked Interlock plug is retained (cannot turn) Machine can operate 	<ul style="list-style-type: none"> Door locked Interlock plug can be removed by turning Machine can operate 	<ul style="list-style-type: none"> Door can be opened Interlock plug is removed Machine cannot operate 	<ul style="list-style-type: none"> Door can be opened Interlock plug is removed Machine cannot operate 	<ul style="list-style-type: none"> Machine cannot operate

Without Solenoid

	Status 1	Status 2	Status 3
Interlock Switch Status	<ul style="list-style-type: none"> Door closed Interlock plug is installed 	<ul style="list-style-type: none"> Door closed Interlock plug is removed 	<ul style="list-style-type: none"> Door open Interlock plug is removed
Door			
Circuit Diagram			
Main Circuit	3-4: Closed	3-4: Open	3-4: Open
Monitor Circuit	1-2: Open	1-2: Open	1-2: Closed
Remarks	<ul style="list-style-type: none"> Door locked Interlock plug can be turned to remove Machine can operate 	<ul style="list-style-type: none"> Door can be opened Interlock plug is removed Machine cannot operate 	<ul style="list-style-type: none"> Interlock plug is removed Machine cannot operate

HS1C-P Interlock Plug Unit with Door Lock

Safety Precautions

- Do not install the interlock plug unit with door lock in the place subject to oil or water. Electric shocks or fire hazard may be caused if the interlock plug is operated when the plug part is contaminated with oil or water.
- Interlock plug units with door lock are used to ensure the safety of operators who carry the plugs. Provide only one plug to a guard. Otherwise the hostage control function is lost, endangering the operators. Ensure complete safety management so that the function is maintained.
- In order to avoid electric shocks or fire, turn power off before installation, removal, wire connection, maintenance, or inspection of the interlock plug unit.
- Do not disassemble or modify the interlock plug unit with door lock. Also do not disable the function of interlock plug unit intentionally. Otherwise a malfunction or an accident may occur.
- Do not install the actuator in a location where a human body may come into contact. Otherwise injury may occur.

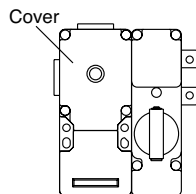
Instructions

- The plug of HS1P interlock plug units resemble the HS2P plug, however, these plugs are not interchangeable. Do not use the plugs of other types, otherwise the interlock plug units will be damaged. The plugs can be distinguished with the handle color.

HS1P: black (same as HS1C-P)

HS2P: aluminum color

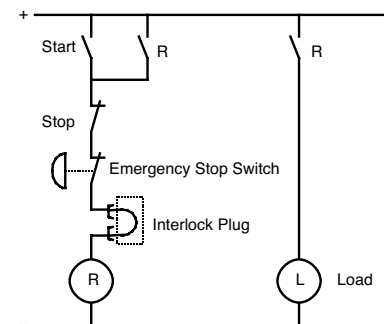
- Regardless of door types, do not use the interlock plug unit as a door stop. Install a mechanical door stop at the end of the door to protect the interlock plug unit against excessive force. If excessive force is applied to the plug, especially to the direction of removing the plug, solenoid operation failure may occur even though the solenoid is energized, resulting in unlocking failure.
- Do not apply excessive shock to the interlock plug unit when opening or closing the door. A shock to the interlock plug unit exceeding 1,000 m/s² may cause damage to the interlock plug unit.
- Regardless of door types, do not use the interlock plug unit as a door lock. Install a separate lock using a latch or other measures.
- The solenoid has polarity. Make sure of the correct polarity when wiring. Do not apply overvoltage, otherwise the solenoid will be burnt.
- When wiring, unscrew the cover only. Unnecessary loosening of other screws may cause a malfunction of the interlock plug unit.



- The cover uses special screws which cannot be removed or tightened by general drivers. Use the special wrench supplied with the interlock plug unit.
- While connecting to the conduit port, prevent foreign objects from entering the interlock plug unit, such as dust and liquids.
- If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the interlock plug unit through the actuator entry slots.
- Entry of a considerable amount of foreign objects into the interlock plug unit may affect the mechanism of the interlock plug unit and cause a malfunction.
- Actuator retention force is 1500N (static load). When larger force is expected, add a system using interlock switch without lock (ex. HS1B) and sensor in order to detect door opening and to stop the machine.
- Plug the unused actuator entry slot using the slot plug supplied with the interlock plug unit.
- Do not store the interlock plug unit in a dusty, humid, or organic-gas atmosphere.

- Make sure that the interlock plug unit is not energized when removing or installing the plug (after operating the emergency stop button shown in the circuit example shown below). Do not start or stop the machine by plug removal/installation, otherwise the interlock plug unit may fail.

Interlock Plug Circuit Example



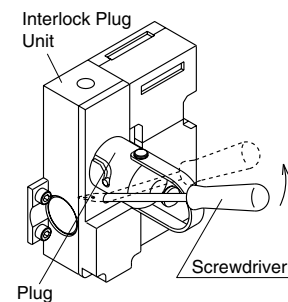
Note 1: When using the main circuit on AC, connect emergency stop switch to Line, and interlock plug unit to Neutral.

Note 2: When using the main circuit on DC, connect to the + line with emergency stop switch first followed by the interlock plug unit.

Manual Unlocking

The HS1C-P allows manual unlocking of the actuator to pre-check 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 plug unit using the special wrench supplied with the interlock plug unit. Insert a small screwdriver into the screw hole and push the lever inside as shown below until the key is unlocked.
- Turn and remove the plug.
- After unlocking, ensure to install the screw.



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Instructions

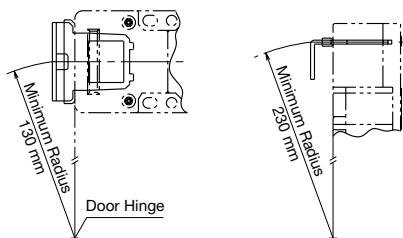
Minimum Radius of Hinged Door

- When using the interlock plug unit for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use angle adjustable actuators (HS9Z-A3).

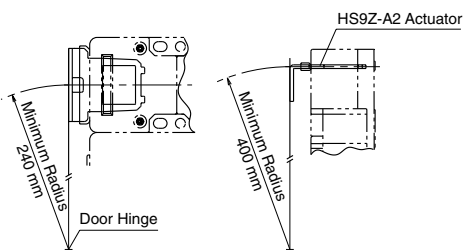
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A2 Actuator

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

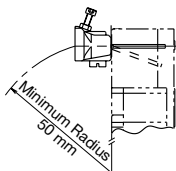


- When the door hinge is on the extension line of the actuator mounting surface:

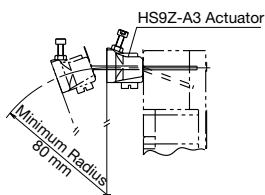


HS9Z-A3 Actuator

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



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



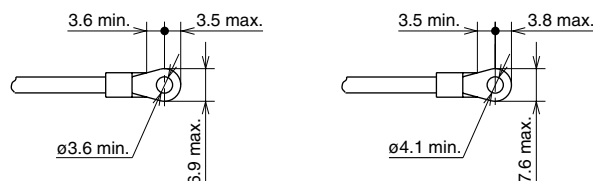
Actuator Angle Adjustment

- 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 adjustment screw: 0.8 N·m
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not loosen.

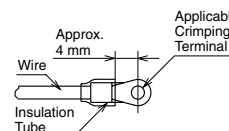
Applicable Crimping Terminal

Terminal Nos. 7, 8

Ground Terminal: E



- Use an insulation tube on the crimping terminal



Terminal No. 1 to 6

- Direct wiring using either solid or stranded wires.
- When using stranded wires, make sure that loose wires do not cause short circuit. Also, do not solder the terminal to prevent loose wires.

When using Ferrules

Ferrules (Phoenix Contact)

Part No.	Applicable Wire
AI 0.75-8 GY	0.5 to 0.75 mm ²
AI 1.0-8 RD	0.75 to 1.0 mm ²
AI 1.5-8 BK	1.0 to 1.5 mm ²

Crimping Tool: CRIMPFOX UD6

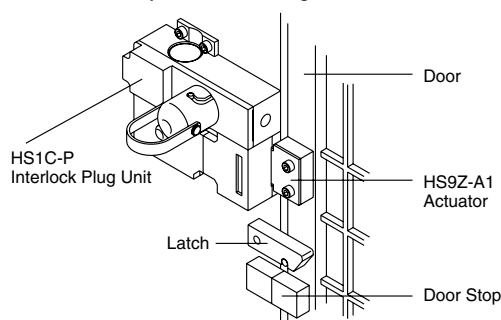
Applicable Wire Size

- Terminal Nos. 1, 2, 5, 6, 7, 8: 0.5 to 0.75 mm²
- Terminal Nos. 3, 4, E: 1.0 to 1.25 mm²

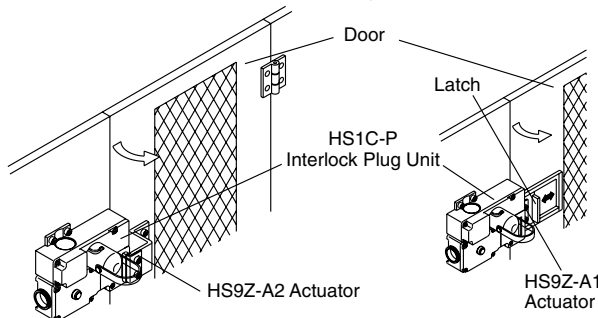
Installing the Interlock Plug Unit

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

Application on Sliding Doors



Application on Hinged Doors

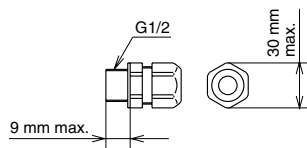


HS1C-P Interlock Plug Unit with Door Lock

Instructions

Applicable Cable Glands

- Use IP67 cable gland.



When Using Flexible Conduits (Example)

- Flexible conduit example: VF-03 (Nihon Flex)
- Metal gland example:
(G1/2) RLC-103 (Nihon Flex)

When Using Multi-core Cables (Example)

- Plastic cable gland:
(G1/2) SCS-10* (Seiwa Electric)
- Metal cable gland:
(G1/2) ALS-16 (Nihon Flex)
- 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.

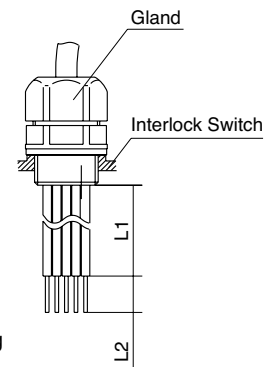
Recommended Tightening Torque of Mounting Screws

- Interlock switch: 4.5 to 5.5 N·m (four M5 screws)
- Actuator (HS9Z-A1/A2/A3): 4.5 to 5.5 N·m (two M6 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.

Cable Lead-in Length and Wiring Examples

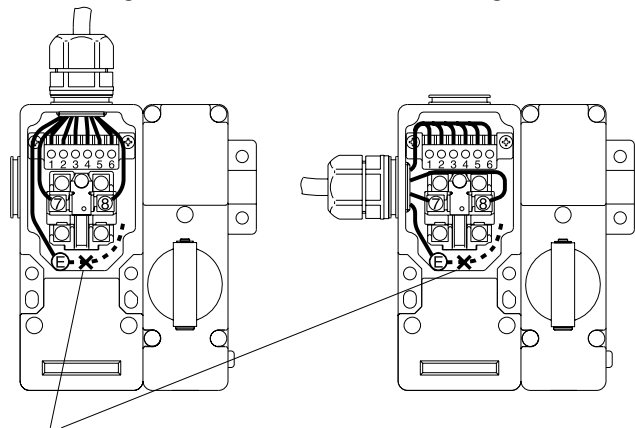
	Terminal No.	Conduit Port	
		①	②
Cable Length L1 (mm)	1	30±2	45±2
	2	30±2	50±2
	3	25±2	55±2
	4	25±2	60±2
	5	30±2	65±2
	6	30±2	70±2
	7	65±2	35±2
	8	65±2	110±2
Wire Stripping Length L2 (mm)	E	85±2	45±2
		7±1	

Note: Wire the interlock switches according to the following examples.



When using Conduit Port ①

When using Conduit Port ②



Note: When wiring the ground (E) terminal, connect in the solid line direction only. Do not connect in the dotted line direction.