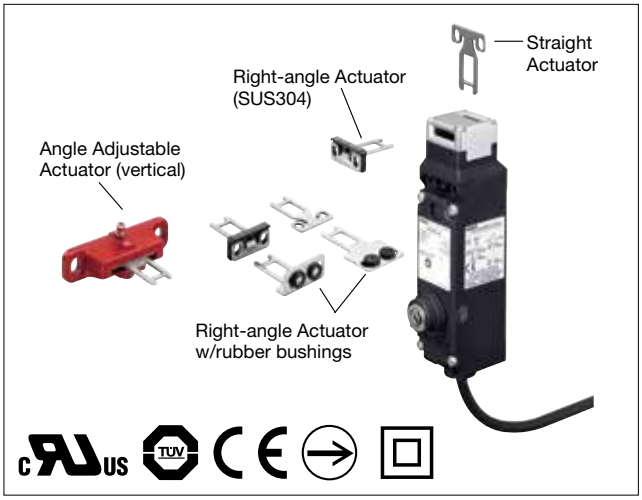
HS5E-K Interlock Switches with Key

New interlock switches that can be locked and unlocked with a key.

- Head removal detection circuitry.
- High-security pin tumbler key is used. Sixteen types of key numbers are available.
- Available with rear unlocking button for emergency escape.
- Accessory available for aluminum frame mounting.
- The locking strength is 1400N minimum. (GS-ET-19)
- The head orientation can be rotated, allowing 8 different actuator entries.
- Metal actuator entry slot ensures high durability.
- Actuator with rubber bushings alleviates the impact of the actuator entry slot.
- Environmentally-friendly. RoHs directive compliant.
- Compact body: 35 × 40 × 146 mm



Ratings

Contact Rating

Rated Insulation Voltage (Ui) (Note 1)			250V		
Rated Thermal Current (Ith)			Operating temperature: –25°C to 60°C: 2.5A max. 60°C to 65°C: 1.5A max. 65°C to 70°C: 1.0A max.		
Rated Voltage (Ue)			30V	125V	250V
Rated Current (Ie) (Note 2)	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-15)	2.3A	0.55A	0.27A

Minimum applicable load (reference value) = 3V AC/DC, 5 mA
(Applicable range may vary with operating conditions and load types.)

Approved ratings

TÜV	AC-15 250V/0.75A DC-13 125V/0.22A DC-13 30V/2.3A
UL/c-UL	AC 125V/1.5A Pilot Duty DC 125V/0.22A Pilot Duty

Key Specifications

Operating Method	2-position maintained
Mechanical Durability	100,000 operations minimum
Insertion/Removal Durability	10,000 operations minimum
Operator Strength	1.0 N·m minimum
Direct Opening Force	0.6 N·m minimum
Direct Opening Angle	60° minimum

Part No. Development

HS5E-KVA0L03-2A501

Circuit Code

	Main Circuit	Door Monitor Circuit	Lock Monitor Circuit
VA:	—	1NC, 1NO	1NC, 1NO
VD:	—	2NC	2NC

Pilot Light
0: None

Rear Unlocking Button
L: With
Blank: Without

Cable Length
03: 3m
05: 5m

Key number
Blank: Standard Key number (500)
or
501 to 515

Key removal specifications
A: Removable in all positions
B: Removable at UNLOCK
C: Removable at LOCK

Operator position
2: 2-position

General Specifications

Applicable Standards	ISO14119, IEC60947-5-1 EN60947-5-1 (TÜV approved) GS-ET-19 (TÜV approved) UL508 (UL recognized) CSA C22.2 No. 14 (c-UL recognized)
	IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	-25 to +70°C (No freezing)
Relative Humidity	45 to 85% (No condensation)
Storage Temperature	-40 to +80°C (No freezing)
Pollution Degree	3
Impulse Withstand Voltage	2.5 kV
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum (500V DC megger) Between live metal part and ground: 100 MΩ minimum (500V DC megger) Between live metal parts: 100 MΩ minimum (500V DC megger) Between terminals of the same pole: 100 MΩ minimum
Electric Shock Class	Class II (IEC61140)
Degree of Protection	IP65 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s² Damage limits: 1,000 m/s²
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	Actuator HS9Z-A51: 11 mm minimum Actuator HS9Z-A51A/A52/A52A/A53/A55: 12 mm minimum
Direct Opening Force	80N minimum
Actuator Retention Force (Note 1)	1,400N minimum (GS-ET-19)
Operating Frequency	900 operations per hour
Rear Unlocking Button Mechanical Durability	3,000 operations minimum (HS5E-K□L)
Mechanical Durability	1,000,000 operations minimum (GS-ET-19)
Electrical Durability	100,000 operations minimum (AC-12, 250V, 1A) 1,000,000 operations minimum (24V AC/DC, 100 mA) (Operating frequency: 900 operations per hour)
Performance between 41 and 42 when head is removed	Mechanical durability: 10 operations minimum Insulation resistance: 100 MΩ (initial value) Withstand voltage: 1,000V for 1 minute (initial value)
Conditional Short-circuit Current	50A (250V) (Note 2)
Cable	UL2464, No. 22 AWG (12-core, 0.3 mm2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	510g (3m cable), 680g (5m cable)

Note 1: See page 54 for actuator retention force.
Note 2: Use 250V/10A fast-blow fuse for short-circuit protection.

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HS5E-K Interlock Switches with Key

Head Removal Detection Circuitry (patented)

Head removal detection circuitry is employed in the HS5E-K. With this innovative function, the monitor circuit (41-42) turns off when the head is removed from the switch, such as when removing the head to change the head direction (applicable with all models of HS5E-K).
With the head installed on the switch, monitor circuits 41-42 and 51-52 operate in synchronization while the key locks/unlocks the actuator. When the head is removed, 41-42 turns off and 51-52 turns on. This disagreement is detected by the head removal detection function.

Actuator unlocked | Actuator locked | Head removed

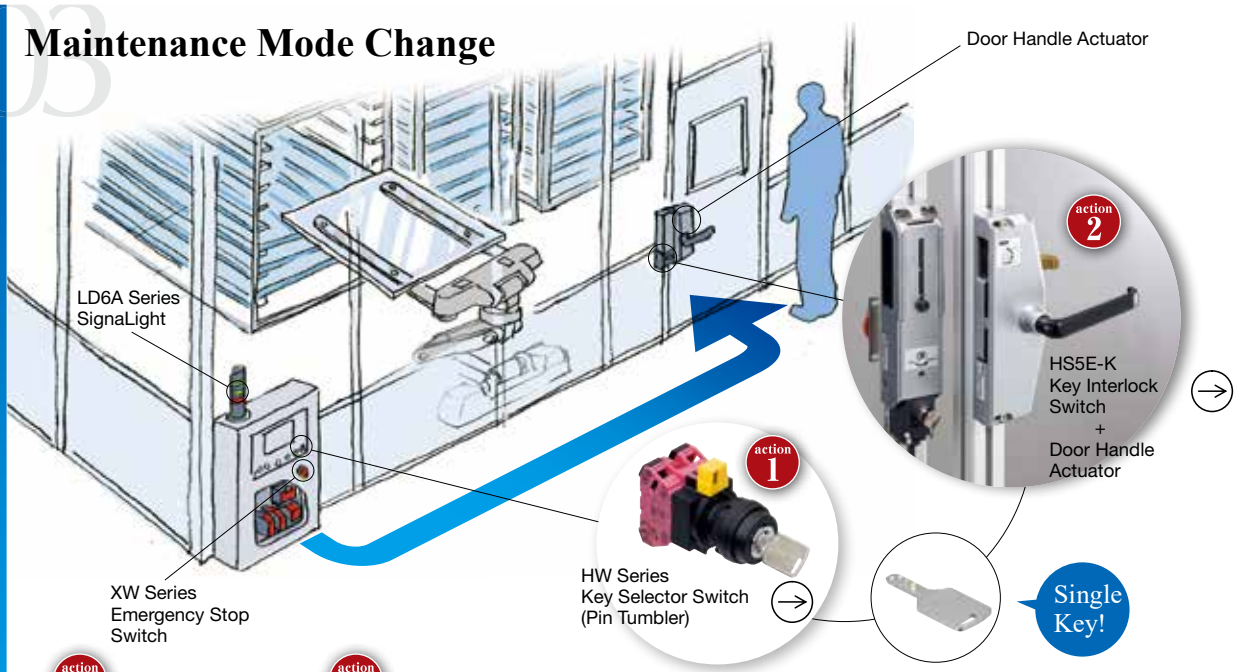
	Actuator unlocked	Actuator locked	Head removed
LOCK / UNLOCK Monitor Circuit (NC) Pink 41 / 42 Pink/White	OFF	ON	OFF
Monitor Circuit (NC) Brown 51 / 52 Brown/White	OFF	ON	ON

Disagreement

Note: Head removal detection function is not direct opening.

	Actuator unlocked	Actuator locked	Head removed
Monitor Circuit (NC) Pink 41 / 42 Pink/White	OFF	ON	ON
Monitor Circuit (NC) Brown 51 / 52 Brown/White	OFF	ON	ON

03 Maintenance Mode Change



action 1 Mode Change → action 2 Door Unlocked (safety output OFF)

Hazards of the system and robot are isolated by the safety guard. When a worker needs to work inside the hazardous area for maintenance, the worker stops the machine using the key to change modes (1), unlock the guard using the key, then remove the key to bring inside the safety guard (2). The worker can switch operation modes and unlock the safety guard using a single key. Furthermore, when the key is taken inside the hazardous area, the guard cannot be locked and the system cannot be turned on. This enables the worker to work safely in the hazardous area.

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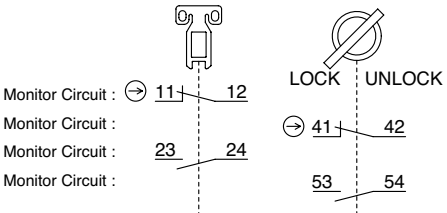
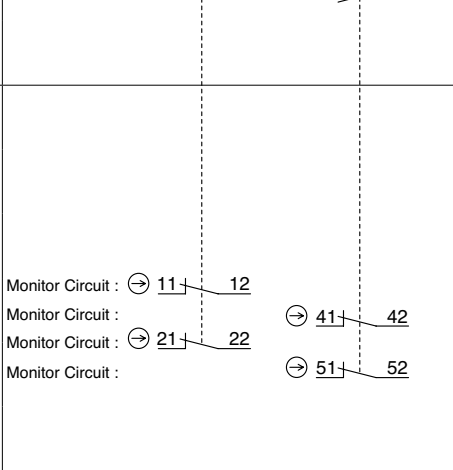
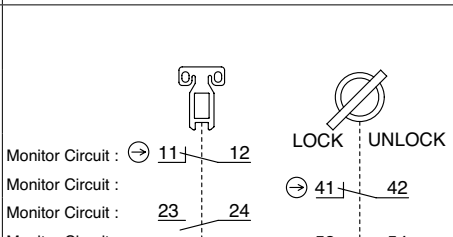
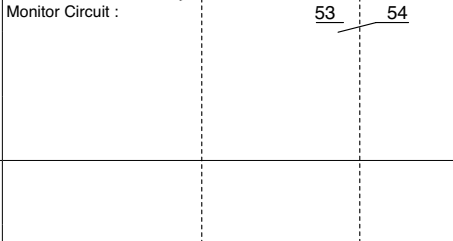
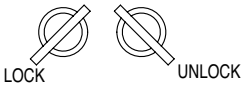
HS5E-K Interlock Switches with Key

Interlock Switch

Package Quantity: 1

Rear Unlocking Button	Circuit Code	Contact Configuration	Key Removal Position	Cable Length	Part No.
Without	VA		A (removable in all positions)	3m	HS5E-KVA003-2A
				5m	HS5E-KVA005-2A
			B (removal in UNLOCK position)	3m	HS5E-KVA003-2B
				5m	HS5E-KVA005-2B
			C (removable in LOCK position)	3m	HS5E-KVA003-2C
				5m	HS5E-KVA005-2C
	VD		A (removable in all positions)	3m	HS5E-KVD003-2A
				5m	HS5E-KVD005-2A
			B (removal in UNLOCK position)	3m	HS5E-KVD003-2B
				5m	HS5E-KVD005-2B
			C (removable in LOCK position)	3m	HS5E-KVD003-2C
				5m	HS5E-KVD005-2C
With	VA		A (removable in all positions)	3m	HS5E-KVA0L03-2A
				5m	HS5E-KVA0L05-2A
			B (removal in UNLOCK position)	3m	HS5E-KVA0L03-2B
				5m	HS5E-KVA0L05-2B
			C (removable in LOCK position)	3m	HS5E-KVA0L03-2C
				5m	HS5E-KVA0L05-2C
	VD		A (removable in all positions)	3m	HS5E-KVD0L03-2A
				5m	HS5E-KVD0L05-2A
			B (removal in UNLOCK position)	3m	HS5E-KVD0L03-2B
				5m	HS5E-KVD0L05-2B
			C (removable in LOCK position)	3m	HS5E-KVD0L03-2C
				5m	HS5E-KVD0L05-2C

- The contact configuration shows the status when the actuator is inserted and the switch is locked.
- Key LOCK and UNLOCK positions are as shown on the right.
- Actuators are not supplied with interlock switches and must be ordered separately.
- To select key numbers, specify numbers 501 to 515 after the Part No.
- When a key number is not specified, key number 500 is supplied as the default key.
  Example: HS5E-KVA003-2A501
  500 (default key) to 515



Note: The key number is engraved on the cylinder.

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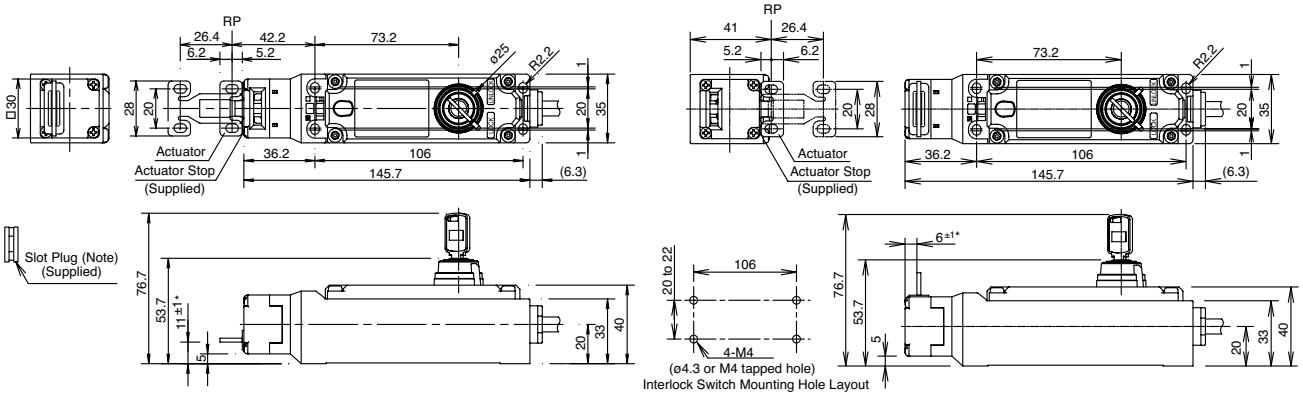
HS5E-K Interlock Switches with Key

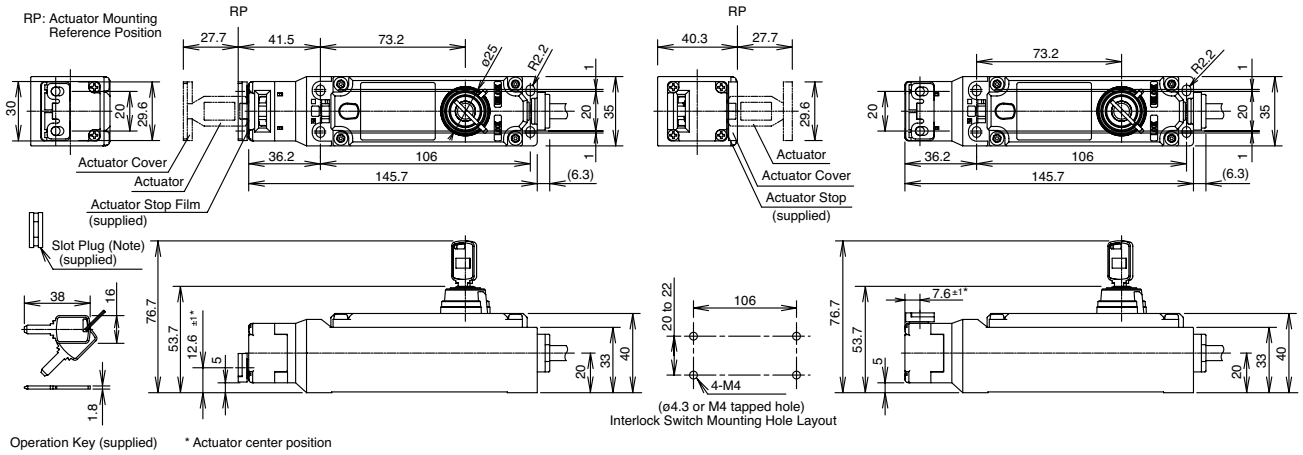
Dimensions and Mounting Layouts

All dimensions in mm.

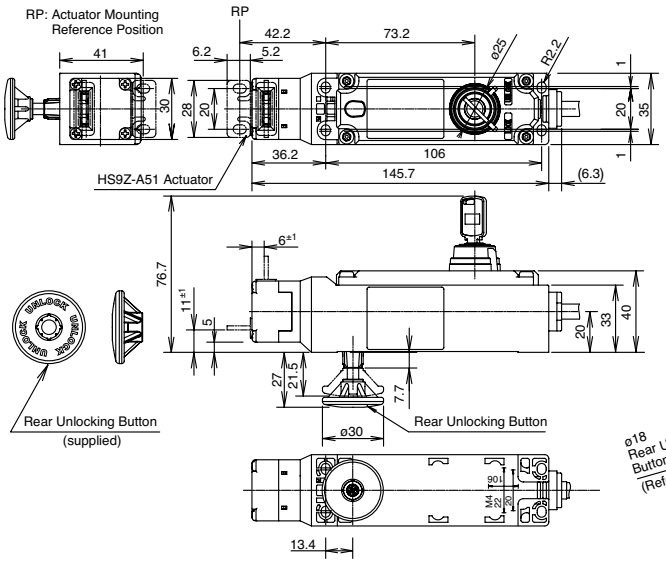
HS5E-K☐
When using Horizontal Mounting / Straight Actuator (HS9Z-A51)



When using Vertical Mounting / Right-angle Actuator (HS9Z-A52)



HS5E-K☐L (Rear Unlocking Button)
When using Horizontal Mounting / Straight Actuator (HS9Z-A51)

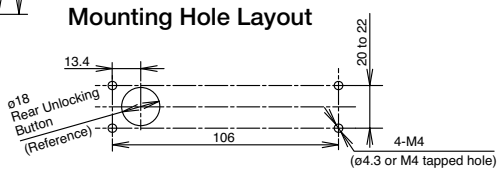


Rear unlocking button mounting

X ≤ 6:	Panel mounting
6 < X < 23:	Not mountable
23 ≤ X ≤ 53 mm:	Use a rear unlocking button kit.

X = Panel thickness
(including panel, mounting frame, and mounting plate)

Mounting Hole Layout



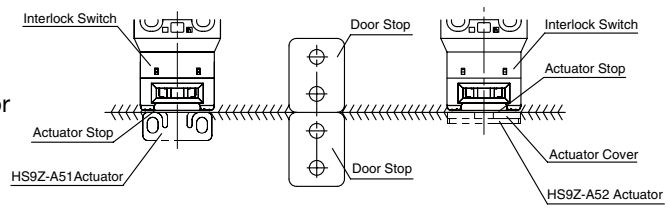
Note: With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

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

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 position where the actuator stop placed on the actuator lightly touches the side surface of the interlock switch.

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



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Actuators

Description	Part No.	Actuator Retention Force
Straight	**HS9Z-A51**	1,400N minimum
Straight with rubber bushings	**HS9Z-A51A**	
Right-angle	**HS9Z-A52**	
Right-angle with rubber bushings	**HS9Z-A52A**	
Angle Adjustable (vertical)	**HS9Z-A53**	
Angle Adjustable (vertical/horizontal)	**HS9Z-A55**	500N minimum When a retention force of 500N or more is required, use HS9Z-A53.

- For actuator dimensions, see page 55.
- See “Minimum Radius of Hinged Door” on page 59 and 60 when using the HS5E-K on hinged doors.

Accessories

Package Quantity: 1

Description		Part No.	Remarks
Sliding Actuator		**HS9Z-SH5**	See page 76 for details.
Door Handle Actuator	Handle Unit (for right-hand door)	**HS9Z-DH5RH**	Choose according to the required opening direction. See page 68 for details.
	Handle Unit (for left-hand door)	**HS9Z-DH5LH**	
	Switch Cover Unit	**HS9Z-DH5C**	Used for installing the interlock switch inside.
Plug Actuator		**HS9Z-A5P**	
Padlock Hasp		**HS9Z-PH5**	
Mounting Plate (Note 1)		**HS9Z-SP51**	Can be used for mounting on aluminum frames.
Rear Unlocking Button Kit		**HS9Z-FL53**	Used when the total thickness of mounting frame, panel, and mounting plate ∗ is: 23 < X ≤ 33 (20 < X ≤ 30 when switch cover unit HS9Z-DH5C is used)
		HS9Z-FL54	Used when the total thickness of mounting frame, panel, and mounting plate ∗ is: 33 < X ≤ 43 (30 < X ≤ 40 when switch cover unit HS9Z-DH5C is used)
		HS9Z-FL55	Used when the total thickness of mounting frame, panel, and mounting plate ∗ is: 43 < X ≤ 53 (40 < X ≤ 50 when switch cover unit HS9Z-DH5C is used)

∗ The mounting part is a frame or a panel that the product is mounted on.

Note 1: When mounting HS5E-KVA0L (rear unlocking button) on an aluminum frame using the mounting plate, provide a mounting hole (see page 57) on the mounting plate and use the manual rear unlocking kit (HS9Z-FL5□).

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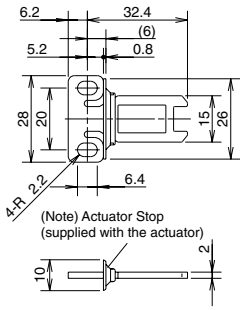
HS5E-K Interlock Switches with Key

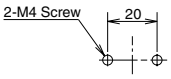
Actuator Dimensions and Mounting Hole Layouts

All dimensions in mm.

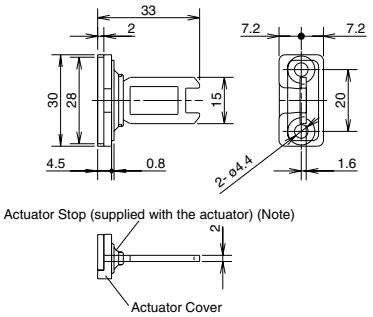
Straight Actuator (HS9Z-A51)



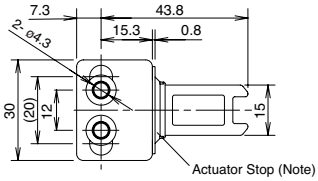
Actuator Mounting Hole Layout
(Straight, Right-angle)



Right-angle Actuator (HS9Z-A52)

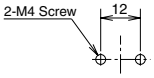


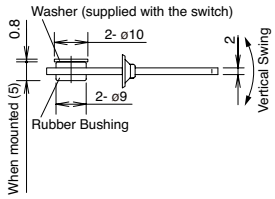
Straight Actuator (with Rubber Bushings) (HS9Z-A51A)



· The mounting center distance is set to 12 mm at the factory. When a distance of 20 mm distance is required, adjust the distance by moving the rubber bushing sideways.
· The actuator has flexibility to the direction indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

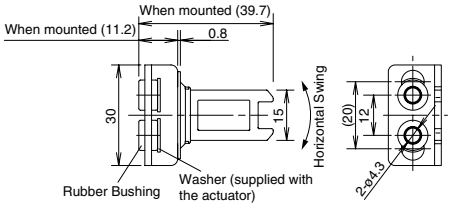
Actuator Mounting Hole Layout
Straight actuator (with rubber bushing)
Right-angle actuator (with rubber bushing)

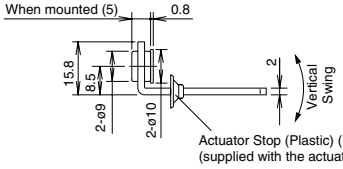




* Mounting centers can be widened to 20 mm by moving the rubber bushings.

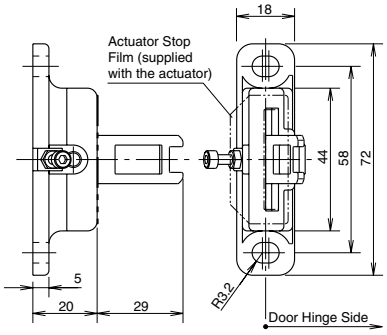
Right-angle Actuator (with Rubber Bushings) (HS9Z-A52A)

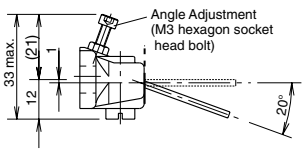




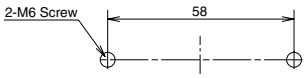
· When the mounting center distance is set to 12 mm the actuator has flexibility both vertically and horizontally.
· When the mounting center distance is set to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber bushings.

Angle Adjustable Actuator (Vertical) (HS9Z-A53)



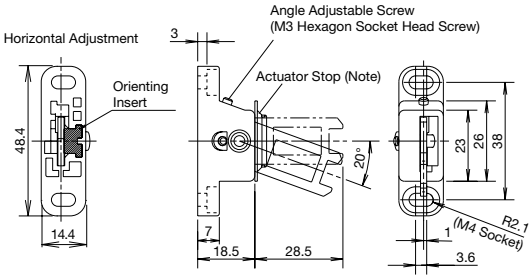


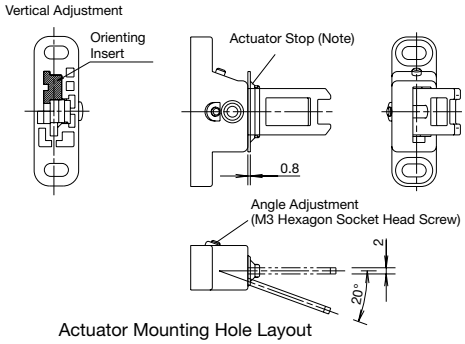
Actuator Mounting Hole Layout
(Vertical Swing)



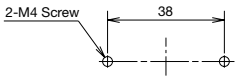
Note: The actuator stop film and actuator stop are supplied with the actuator and used when adjusting the actuator position. Remove after the actuator position is determined.

Angle Adjustable Actuator (Horizontal/Vertical) (HS9Z-A55)





Actuator Mounting Hole Layout
(Horizontal/Vertical)



Actuator Orientation

The orientation of actuator swing (horizontal/vertical) 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.

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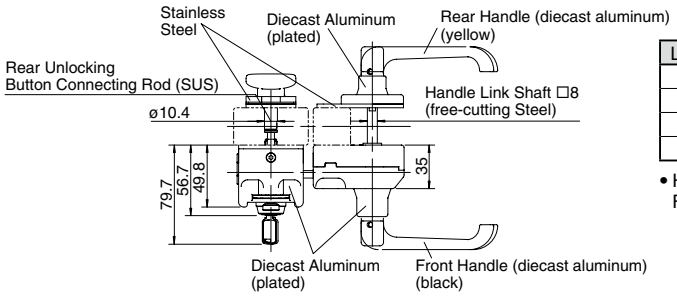
Accessory Dimensions

All dimensions in mm.

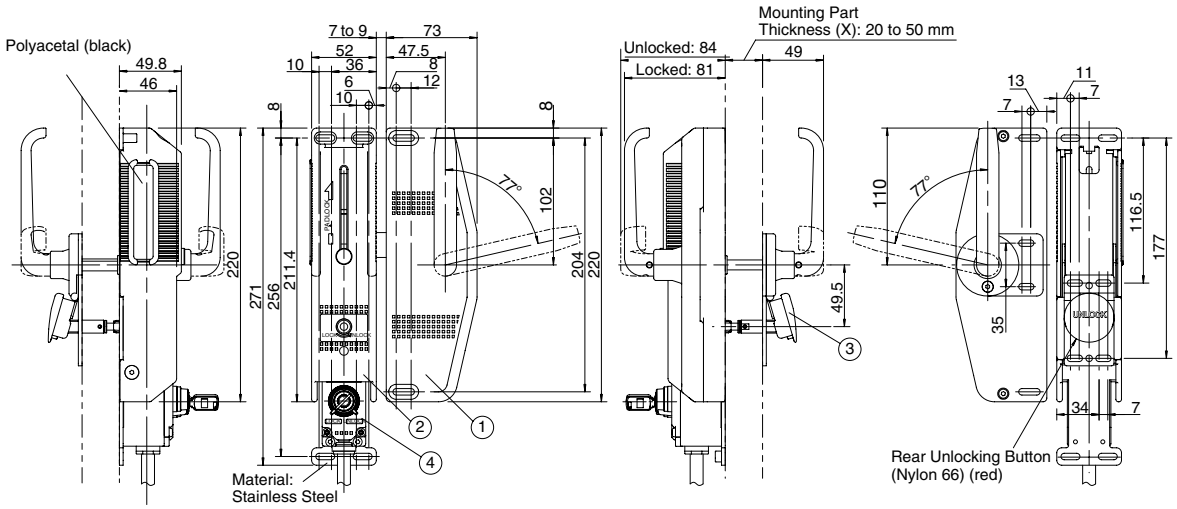
Door Handle Actuator

HS9Z-DH5RH (for right-hand door) / Actuator with Key HS5E-K Interlock Switch



Legend	Description
①	Handle Unit for Right-hand Door (HS9Z-DH5RH)
②	Switch Cover Unit (HS9Z-DH5C)
③	Rear Unlocking Button Kit (HS9Z-FL5□)
④	Interlock switch (HS5E-K) (sold separately)

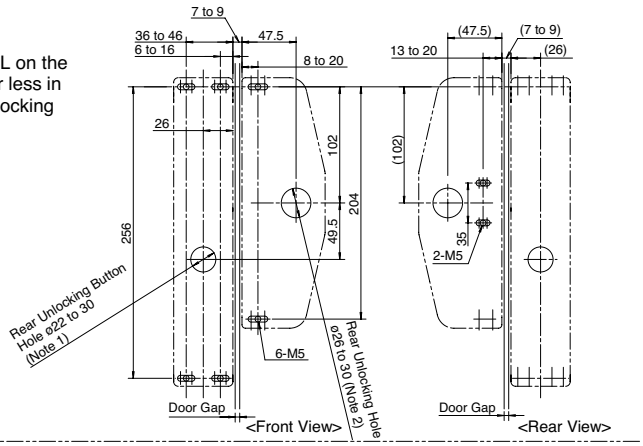
- Handle unit for left-hand door (HS9Z-DH5LH) is available. For details, see page 68.



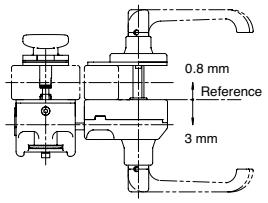
Panel Cut-out

Right-hand Door Handle Unit (HS9Z-DH5RH)

When using the HS5E-K□L on the mounting panel of 3 mm or less in thickness (use the rear unlocking button).

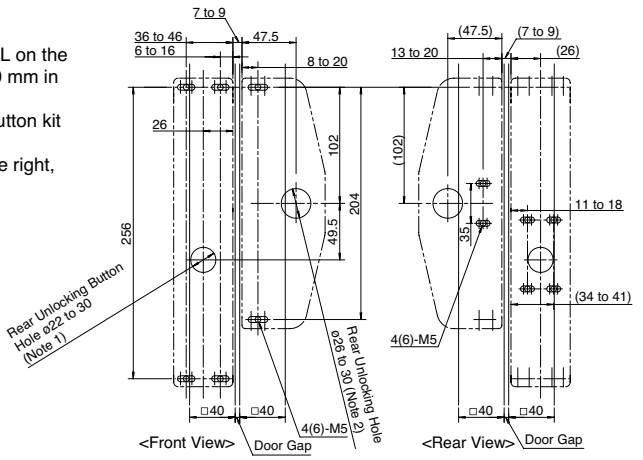


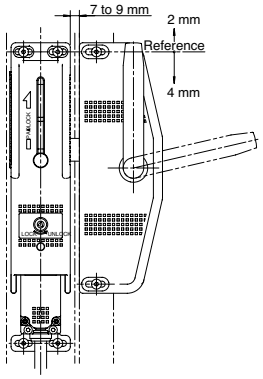
Mounting Position Tolerance



When using the HS5E-K□L on the mounting panel of 20 to 50 mm in thickness.

- Use the rear unlocking button kit (HS9Z-FL5□)
- In the figure shown on the right, □40 mm frame is used.





Note 1: Required when using the HS5E-K□L.

Note 2: Ensure that the hole in the mounting panel does not interfere with the rear handle shaft.

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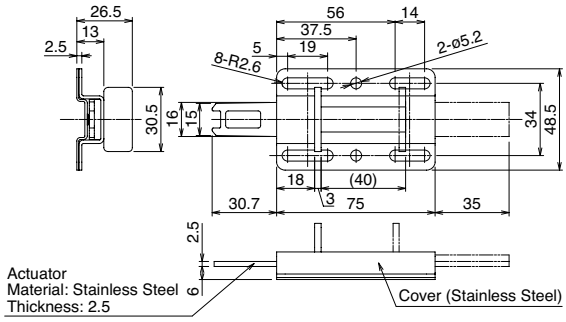
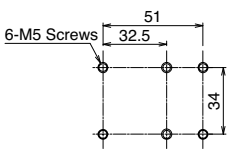
HS5E-K Interlock Switches with Key

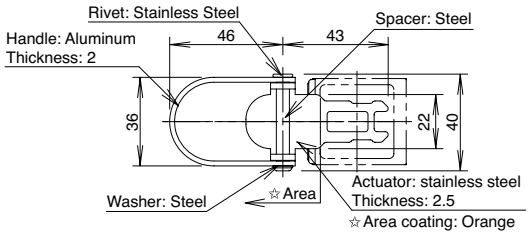
Sliding Actuator (HS9Z-SH5)



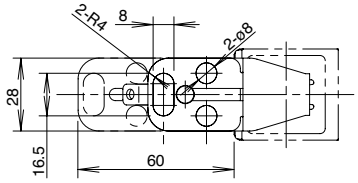
Panel Cut-out



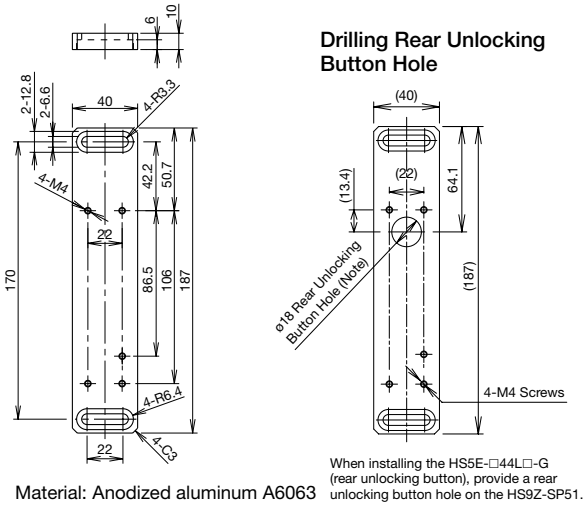
Plug Actuator (HS9Z-A5P)



Padlock Hasp (HS9Z-PH5)

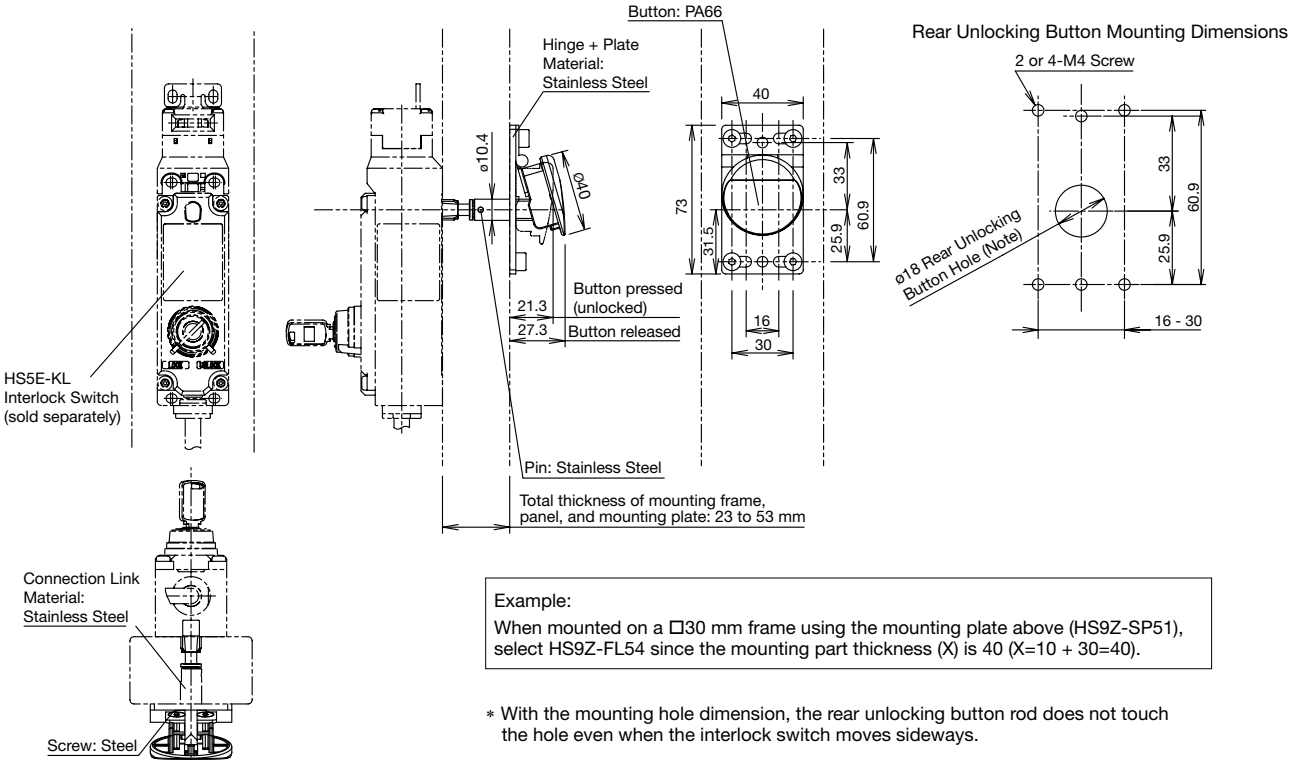


Mounting Plate (HS9Z-SP51)



Material: Anodized aluminum A6063
Weight: Approx. 180g

Rear Unlocking Button Kit (HS9Z-FL5□)



Example:
When mounted on a □30 mm frame using the mounting plate above (HS9Z-SP51), select HS9Z-FL54 since the mounting part thickness (X) is 40 (X=10 + 30=40).

∗ With the mounting hole dimension, the rear unlocking button rod does not touch the hole even when the interlock switch moves sideways.

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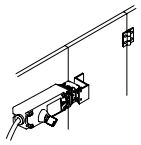
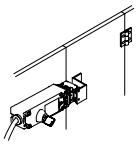
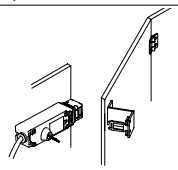
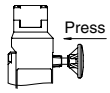
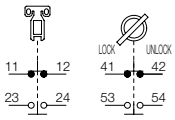
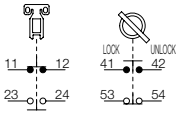
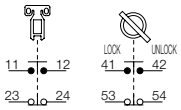
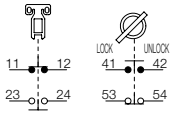
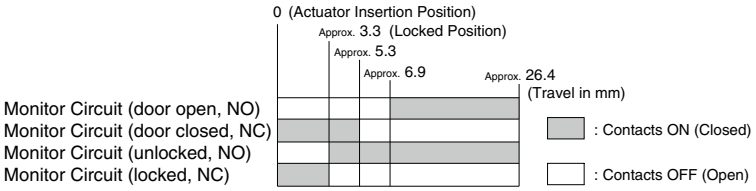
Circuit Diagrams and Operating Characteristics

			Status 1	Status 2	Status 3	Rear Manual Unlock
Interlock Switch Status			• Door closed • Machine ready to operate	• Door closed • Machine cannot be operated	• Door opened • Machine cannot be operated	• Door closed • Machine cannot be operated
Door Status						 Press rear unlocking button. (Note)
Circuit Diagram (Example: HS5E-KVA)						
Door			Closed (locked)	Closed (unlocked)	Opened	Closed (unlocked)
Model and Contact Configuration	HS5E-KVA	Monitor Circuit (door closed) 11-12				
		Monitor Circuit (door open) 23-24				
		Monitor Circuit (locked) 41-42				
		Monitor Circuit (unlocked) 53-54				
	HS5E-KVD	Monitor Circuit (door closed) 11-12				
		Monitor Circuit (door closed) 21-22				
		Monitor Circuit (locked) 41-42				
		Monitor Circuit (locked) 51-52				

Note: When the operator is confined in a hazardous area, the actuator can be unlocked manually by pressing the rear unlocking button, which should be accessed easily by the operator.

- The above contact configuration shows the status when the actuator is inserted and the switch is locked.
- Monitor circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

Operation Characteristics (Reference)



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

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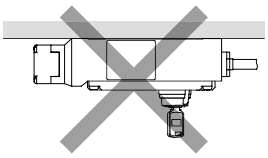
HS5E-K Interlock Switches with Key

Safety Precautions

- In order to avoid electric shock or fire, turn the power off before installation, removal, wire connection, maintenance, or inspection of the interlock switch.
- If relays are used in the circuit between the interlock switch and the load, consider the danger and use safety relays, since welding or sticking contacts of standard relays may invalidate the functions of the interlock switch. Perform a risk assessment and establish a safety circuit that satisfies the requirement of the safety category.
- Do not place a PLC in the circuit between the interlock switch and the load. Safety and security can be endangered in the event of a malfunction of the PLC.
- Do not disassemble or modify the interlock switch, otherwise a breakdown or an accident may occur.
- Do not install the actuator in a location where the human body may come in 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/s^2 may cause damage to the interlock switch.
- 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 foreign objects into the interlock switch may affect the mechanism of the interlock switch and cause a breakdown.
- Using the slot plugs supplied with the interlock switch, plug the unused actuator entry slots.
- Do not store the interlock switches in a dusty, humid, or organic-gas atmosphere.
- Use proprietary actuators only. Using other actuators may damage the interlock switch.
- Do not modify the actuator, otherwise it will damage the interlock switch.
- Do not open the lid of the interlock switch. Loosening the screws may damage the interlock switch.
- The actuator retention force is 1,400N. Do not apply a load higher than the rated value. When a higher load is expected, provide an additional system consisting of another interlock switch without lock (such as the HS5D/HS5B interlock switch) or a sensor to detect the door opening and stop the machine.
- Regardless of door types, do not use the interlock switch as a door lock. Install a separate lock using a latch or take other measures.
- Although the HS9Z-A51A and HS9Z-A52A actuators (w/ rubber bushings) alleviate the shock when the actuator enters the slot on the interlock switch, make sure that excessive shock is not applied. If the rubber bushings become deformed or cracked, replace with new ones.
- Do not mount the interlock switch facing down as shown in the figure below. Otherwise, the key may fall off due to shock.



Incorrect Orientation

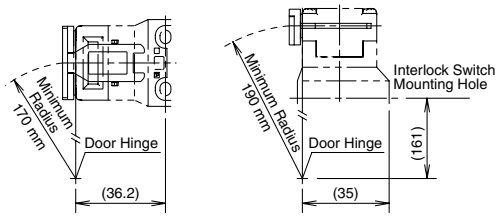
Minimum Radius of Hinged Door

When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For doors with a small minimum radius, use angle adjustable actuators (HS9Z-A53 or HS9Z-A55) .

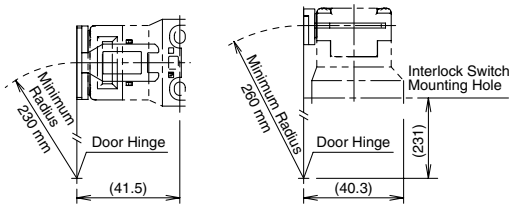
Note: Because deviation or dislocation of a hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

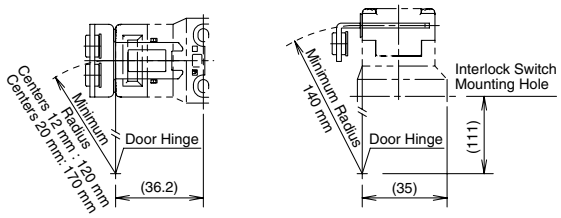


When the door hinge is on the extension line of the actuator mounting surface:

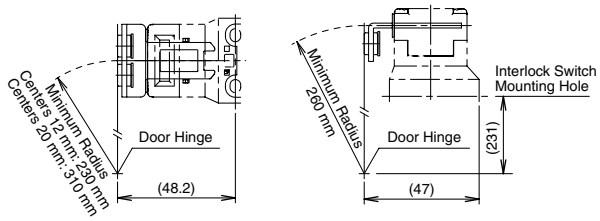


HS9Z-A52A Actuator (with rubber bushings)

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:



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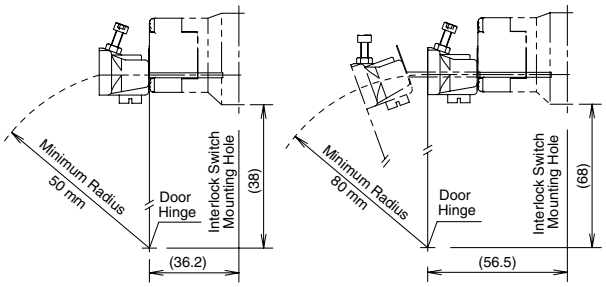
Instructions

Actuator Angle Adjustment (vertical/horizontal)

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on page 55). Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening. After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not move.

When using the HS9Z-A53 Angle Adjustable (vertical) Actuator

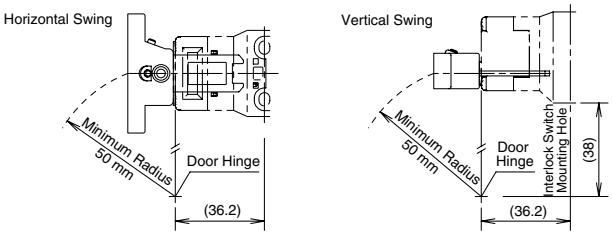
- When the door hinge is on the extension line of the interlock switch surface: 50 mm
- When the door hinge is on the extension line of the actuator mounting surface: 80 mm



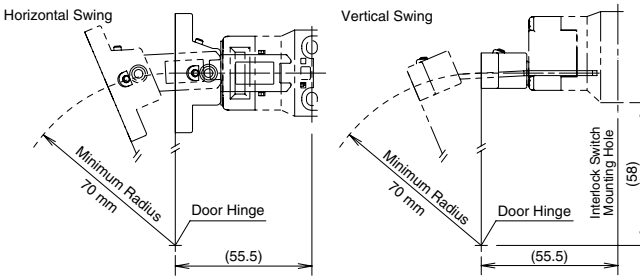
When using the HS9Z-A55 Angle Adjustable (vertical/horizontal) Actuator

- When the door hinge is on the extension line of the interlock switch surface: 50 mm
- When the door hinge is on the extension line of the actuator mounting surface: 70 mm

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

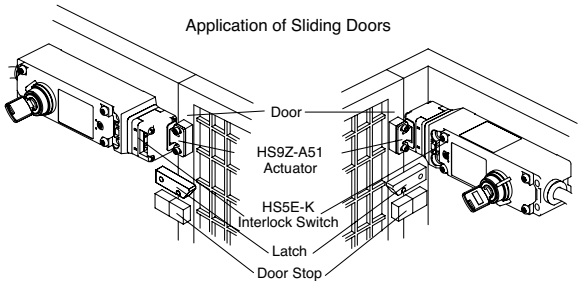


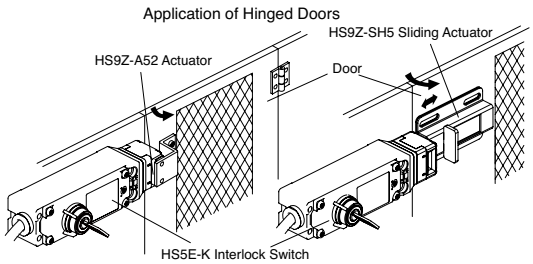
When the door hinge is on the extension line of the actuator mounting surface



Mounting Examples

- Mount the interlocks switch to 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.

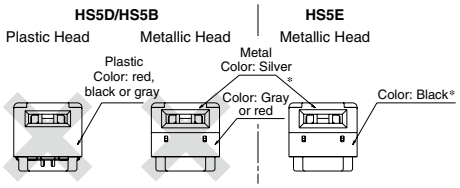




Install the interlock switch on the immovable part of the door.
Install the actuator on the movable part of the door.

Installing the Head

Do not use plastic and metallic heads of HS5D/HS5B interlock switches on the HS5E-K. Be sure to use HS5E metallic heads. The metal heads of the HS5E, HS5D, and HS5B look similar. When using these interlock switches adjacently, ensure that the heads are not interchanged.

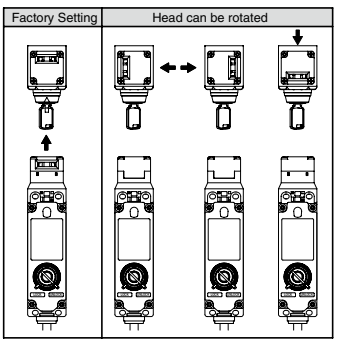


* The metal head can be distinguished easily by the color of the plastic.

Rotating the head

The head can be rotated by removing the four screws from the corners of the head and reinstalling the head in the desired orientation. Before wiring the HS5E-K, replace the head. Before replacing the head, turn the manual unlock to the UNLOCK position using the manual unlock key. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws tightly, without leaving a space between the head and body, otherwise the interlock switch may malfunction.

(Recommended tightening torque: 0.9 to 1.1 N·m)



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HS5E-K Interlock Switches with Key

Instructions

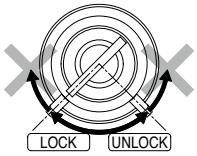
Head Removal Detection Circuitry

- Only the lock monitor circuit 41-42 turns off (open) when the head is removed, such as when the head is rotated. The other monitor circuit 51-52 turns ON (close). Be sure to connect the lock monitor circuit (41-42) to a safety circuit.
- When connecting the HS5E-K to a safety circuit, connect the door monitor circuits (11-12)⊖ and the lock monitor circuits (41- 42)⊖ in series. (GS-ET-19)
- When rotating the head, make sure that the interlock switch is not wired or that the key position is in the UN-LOCK position.

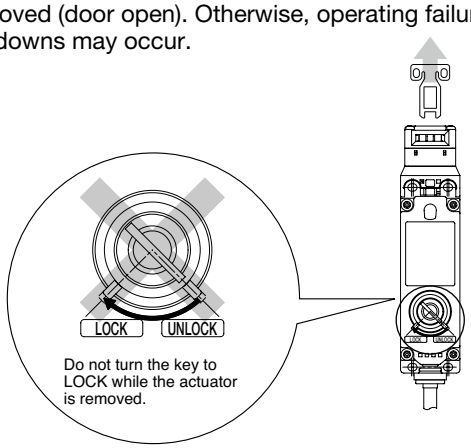
Key

Follow the instructions below to avoid operating failures and damage.

- Insert the key completely.
- Do not remove or insert the key while turning the key.
- Other than the standard key number (500), 15 types of key numbers are available. Use a key with the same number as the number on the cylinder.
- Do not apply excessive force when turning the key. Otherwise operating failures and damage may occur.

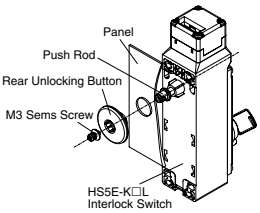


- Do not turn the key to the LOCK side while the actuator is removed (door open). Otherwise, operating failures and breakdowns may occur.



Installing the Rear Unlocking Button (HS5E-K□L)

After installing the interlock switch on the panel, place the rear unlocking button (supplied with the switch) on the push rod on the back of the interlock switch, and fasten the button using the screw supplied with the switch. Rear unlocking buttons can be installed alone when the total thickness of mounting frame and panel is 6 mm or less. When the total thickness of mounting frame, panel, and mounting plate is 23 to 53 mm, use the rear unlocking button kit (HS9Z-FL53, HS9Z-FL54, or HS9Z-FL55) sold separately.

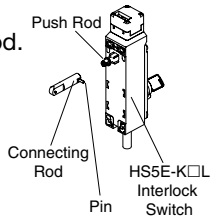


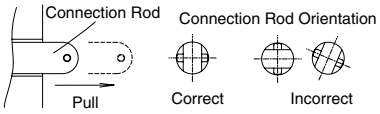
Safety Precautions

After installing the rear unlocking button, apply Loctite to the screw so that the screw dose not become loose. The button is made of glass-reinforced PA66 (66 nylon). The screw is made of iron. Take the compatibility of the plastic material and Loctite into consideration.

Mounting the Rear Unlocking Button Kit

1. Install a connecting rod onto the push rod on the HS5E-K rear unlocking button interlock switch (HS5E-K□L, sold separately).
2. A pin is attached to the connecting rod. Insert the pin into the hole in the push rod, using pliers.
3. Pull the connection rod from the hole in the mounting frame, and turn the button operating pin to the horizontal position.

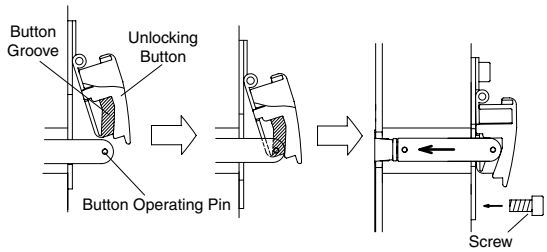




Safety Precautions

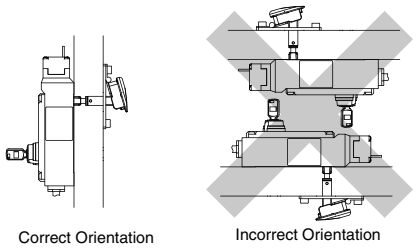
Ensure that the connecting rod is pulled out completely and it is horizontal to the interlock switch, otherwise the unlocking button cannot be installed.
Note: Frame or panel must be supplied by the user.
For the mounting hole layout of interlock switches, see page 57.
When using the mounting plate HS9Z-SP51, provide a hole for the connecting rod in the plate according to the mounting plate mounting hole layout shown on page 57.

4. Install the unlocking button on the connecting rod by fitting the pin to the grooves on the back of the button, and fasten the base plate on the mounting frame using the screws.
5. After fastening the screws, check if locking and unlocking operations can be performed.



Safety Precautions

Install the rear unlocking button kit in the correct direction as shown below. Do not install the kit in incorrect directions, otherwise a malfunction may occur.



Do not apply strong force, exceeding 100 m/s², to the interlock switch while the rear unlocking button is not pressed, otherwise a malfunction may occur.

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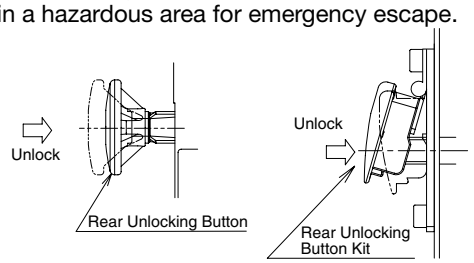
Instructions

Manual Unlocking using the Rear Unlocking Button

- The rear unlocking button is used by the operator confined in a hazardous area for emergency escape.



How to operate

- When the rear unlocking button is pressed, the interlock switch is unlocked and the door can be opened.
- To lock the interlock switch, pull back the button.
- When the button remains pressed, the interlock switch cannot be locked even if the door is closed, and the main circuit remains open.

Safety Precautions

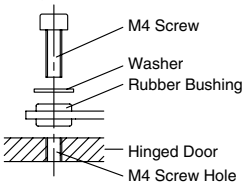
- Install the rear unlocking button in a place where only the operator inside the hazardous area can use it. Do not install the button in a place where an operator outside the hazardous area can use it, otherwise the interlock switch may be unlocked during usual machine operation, causing danger.
- Operate the rear unlocking button by hand only. Do not operate using a tool or with excessive force. Do not apply force to the button from the direction other than the proper direction, otherwise the button will be damaged.

Recommended Tightening Torque for Mounting Screws

- HS5E-K interlock switch: 1.8 to 2.2 N·m (four M4 screws) (Note)
- Rear unlocking button: 0.5 to 0.7 N·m
- Rear unlocking button kit: 4.8 to 5.2 N·m (M5 Screw)
- Actuators
  HS9Z-A51: 1.8 to 2.2 N·m (two M4 screws) (Note)
  HS9Z-A52: 0.8 to 1.2 N·m (two M4 Phillips screws)
  HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws) (Note)
  HS9Z-A53: 4.5 to 5.5 N·m (two M6 screws) (Note)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws) (Note)

Note: 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 the interlock switch and the actuator, it is recommended that the interlock switch and actuator are installed in a secure manner, for example using special screws or welding the screws.
- When installing the HS9Z-A51A and HS9Z-A52A actuators, use the washer (supplied with the actuator) on the hinged door, and mount tightly using two M4 screws.



Note: Choose mounting centers of either 12 mm or 20 mm.

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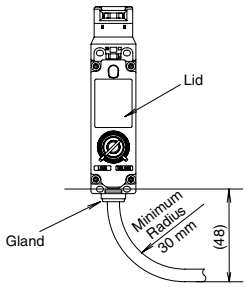
HS5E-K Interlock Switches with Key

Instructions

Cables

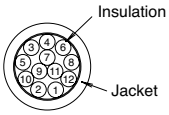
- Do not fasten or loosen the gland at the bottom of the interlock switch.
- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm minimum.
- When wiring, make sure that water or oil does not enter the cable.
- Do not open the lid of the interlock switch. Otherwise the interlock switch will be damaged.



Wire Identification

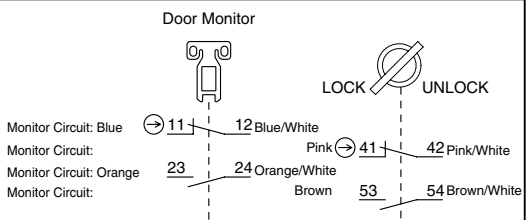
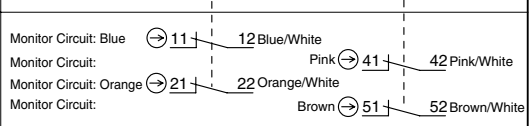
- Wires can be identified by color and white line printed on the wire.
- Wires whose colors are white, black, gray and gray/white cannot be used.

No.	Insulation	No.	Insulation	No.	Insulation	No.	Insulation
1	White	4	Blue	7	Blue/White	10	Pink/White
2	Black	5	Brown/White	8	Orange/White	11	Gray
3	Brown	6	Orange	9	Pink	12	Gray/White



Circuit Code Identification

- Circuit codes can be identified by the insulation color in each contact configuration.
- The following table shows the identification of circuit numbers.
- When wiring, cut unnecessary wires such as the dummy insulation (white) and any unused wires.

Model	Contact Configuration
HS5E-KVA	
HS5E-KVD	

- The contact configuration shows the status where the actuator is inserted and the switch is locked.

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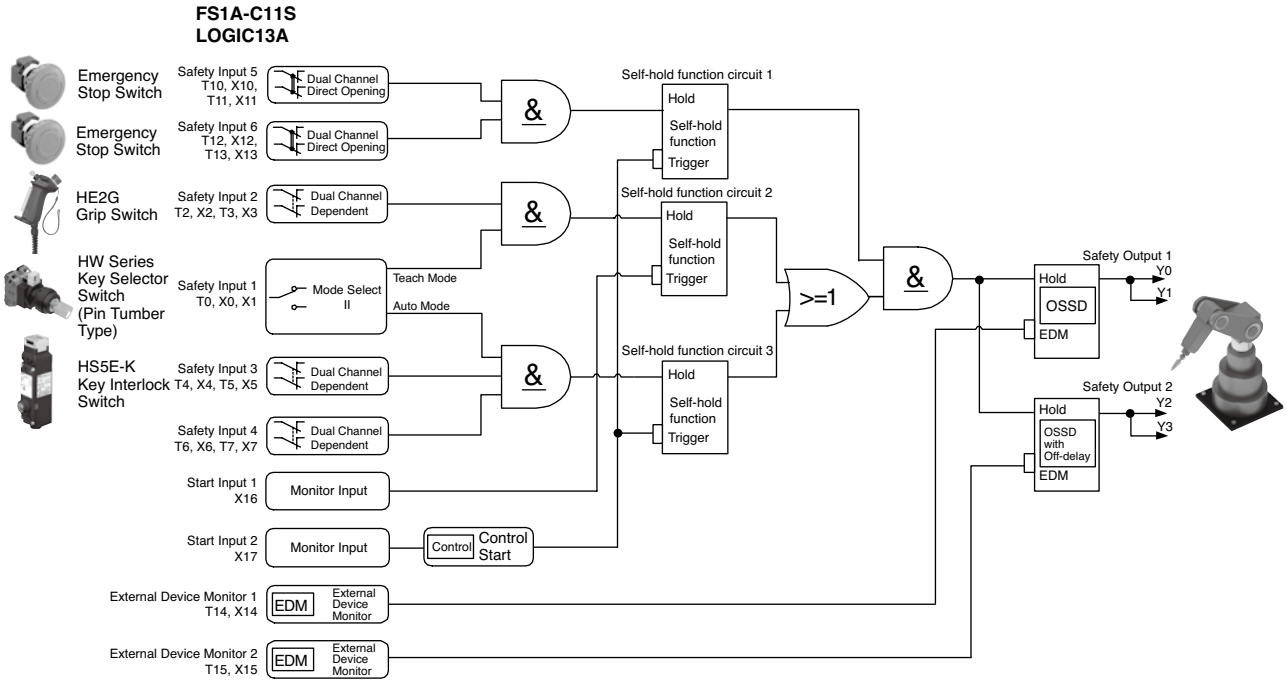
Logic Circuit using FS1A Safety Controller

Example 1: Hostage control (one robot)

Turn the key selector switch to Teach Mode and remove the key. Unlock HS5E-K using the same key, then remove the key and open the door to enter.
Gripping the enabling switch in the enabling position enables the robot to operate.



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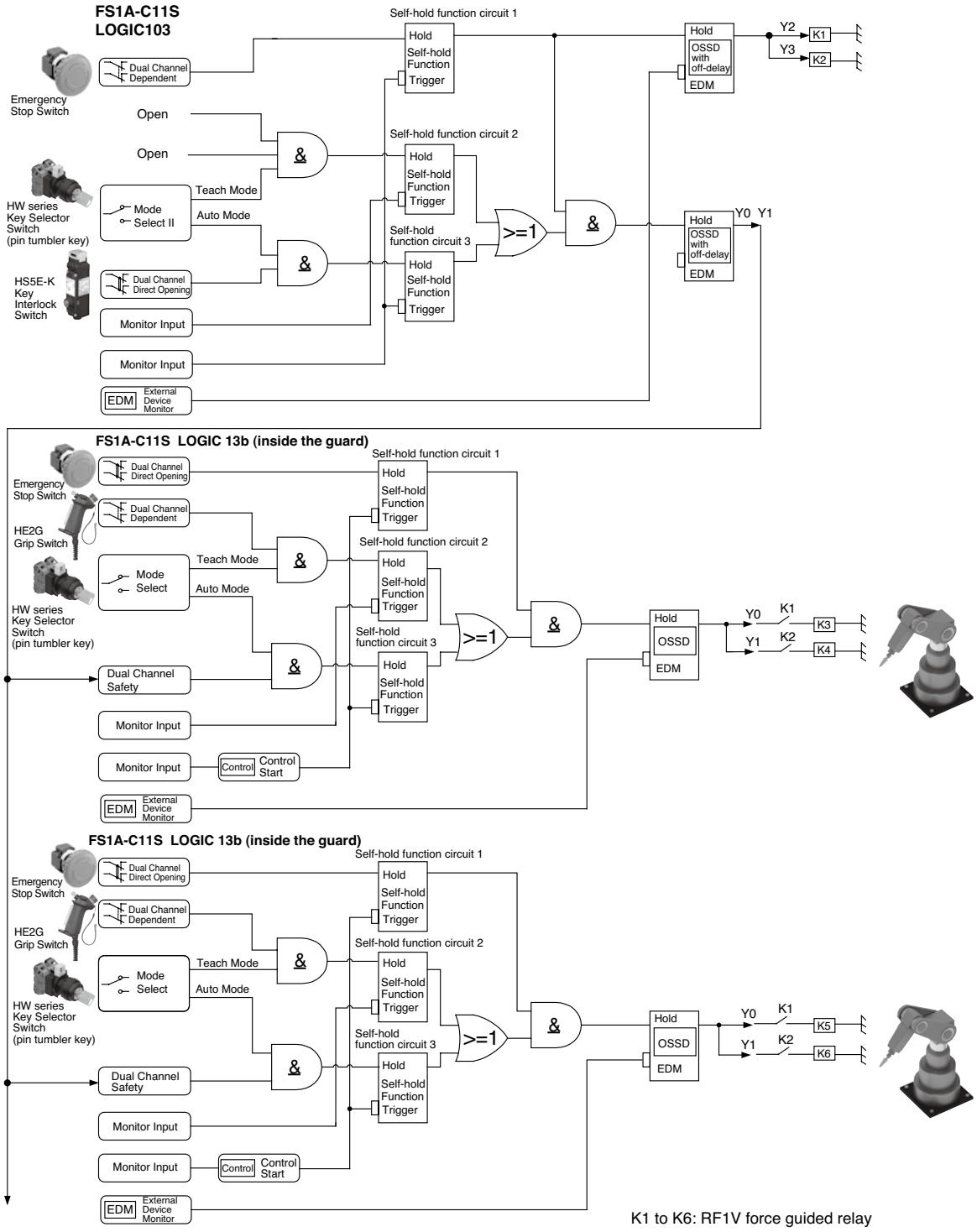
HS5E-K Interlock Switches with Key

Example 2: Partial Mode Change (Multiple Robots)

Three FS1A safety controllers are required for two robots and four FS1A safety controllers for three robots.
Turn the key selector switch of the first robot (logic no. 103) to Teach Mode and remove the key. Unlock the HS5E-K interlock switch using the same key and open the door to enter. Using the same key, Turn the key selector switches of the second (logic No. 13b) or subsequent robots to be operated to Teach Mode. Gripping the enabling switch in the enabling position enables the robot to operate.

Note 1: Teaching is possible with one robot at a time. Teaching multiple robots is not possible at the same time.
Note 2: The emergency stop switch connected to the first FS1A safety controller is effective for all robots.
Note 3: Connect safety outputs Y2 and Y3 (solid state outputs) of the first FS1A safety controller to the RF1V force guided relay (K1, K2), and connect its NO contact to the safety output Y0, Y1 of the second and the subsequent FS1A safety controllers. Connect NC contact to the EDM input of the first FS1A safety controller.
The required number of RF1V (K1, K2):
For two robots: 2NO2NC
For three robots: 3NO1NC
For four robots: 4NO2NC
Note 4: The emergency stop switch connected to the second and subsequent FS1A safety controllers are effective for the robot only.
Note 5: Connect the NC contacts of K3 and K4 to EDM input of the second FS1A safety controller. Connect the NC contacts of K5 and K6 to the EDM input of the third FS1A safety controller. Select force guided relays for K3, K4, K5 and K6 according to the operation control circuits of the robots.



K1 to K6: RF1V force guided relay

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