IDEC

INSTRUCTION SHEET
Original Instructions
Solenoid Type Safety Switch
HS5L Series

*In order to verify if the product you are interested in is certified with the S mark, please check the following section on our website: "List of type numbers certified with the S mark"

Thank you for purchasing this IDEC product. Confirm that the delivered product is what you have ordered. Read this instruction sheet to make sure of correct operation.

SAFETY PRECAUTIONS

In this operation instruction sheet, safety precautions are categorized in order of importance to Warning and Caution :
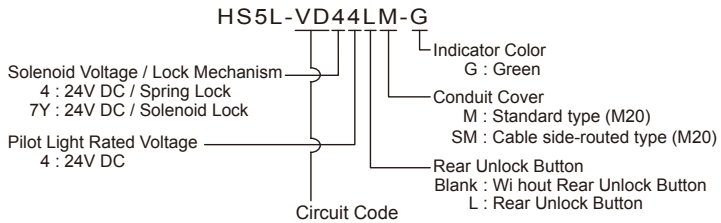
⚠ WARNING

Warning notices are used to emphasize that improper operation may cause severe personal injury or death.

⚠ CAUTION

Caution notices are used where inattention might cause personal injury or damage to equipment.

1 Type

HS5L-VD44LM-G

Solenoid Voltage / Lock Mechanism
4 : 24V DC / Spring Lock
7Y : 24V DC / Solenoid Lock

Pilot Light Rated Voltage
4 : 24V DC

Circuit Code

Indicator Color
G : Green

Conduit Cover
M : Standard type (M20)
SM : Cable side-routed type (M20)

Rear Unlock Button
Blank : Wi hout Rear Unlock Button
L : Rear Unlock Button

Contact Congifuration

Main circuit	Door monitor circuit	Lock monitor circuit		HS5L-□ 44M-G	HS5L-□ 44LM-G	HS5L-□ 7Y4M-G
-	1NC	1NC	XD	√	-	√
-	2NC	-	XF	-	-	√
-	1NC,1NO	-	XG	-	-	√
-	-	2NC	XH	√	√	√
-	1NC,1NO	1NC,1NO	VA	√	√	√
-	1NC,1NO	2NC	VB	√	√	√
-	2NC	1NC,1NO	VC	√	√	√
-	2NC	2NC	VD	√	√	√
-	3NC	1NC	VF	√	√	√
-	2NC,1NO	1NC	VG	√	√	√
-	1NC	2NC,1NO	VJ	√	-	-
1NC+1NC 1NC+1NC	-	-	DD	√	√	-
-	1NO	1NC	XB	-	-	-
-	-	1NC,1NO	XJ	-	-	-
1NC+1NC	1NO	1NO	A	-	-	-
1NC+1NC	1NO	1NC	B	-	-	-
1NC+1NC	1NC	1NO	C	-	-	-
1NC+1NC	1NC	1NC	D	-	-	-
1NC+1NC	2NC	-	F	-	-	-
1NC+1NC	1NC,1NO	-	G	-	-	-
1NC+1NC	-	1NC,1NO	J	-	-	-
-	1NO	1NC,1NO	TA	-	-	-
-	1NO	2NC	TB	-	-	-
-	1NC	1NC,1NO	TC	-	-	-
-	1NC	2NC	TD	-	-	-
-	2NC	1NC	TF	-	-	-
-	1NC,1NO	1NC	TG	-	-	-
-	-	2NC,1NO	TJ	-	-	-

Spring Lock Type / Solenoid Lock Type
Rear Unlock Button

*1 Only type No. on √ mark are supplied as standard.
Contact IDEC for the other if required.

⚠ CAUTION

Solenoid lock type
- This safety switch is designed to lock the actuator while the solenoid is energized and to release it when deenergized.
- When the power to the solenoid is interrupted by accident, such as disconnection, the lock is released before a machine stops ompletely. Then, the worker may be exposed to hazards.
- This safety switch can be used only for limited applications which do not especially need to be locked for safety.

2 Specifications and Ratings

Applicable Standards		EN ISO / ISO14119, IEC60947-5-1, EN60947-5-1, GS-ET-19,UL508, CSA C22 2 No.14, GB 14048. 5
	Standards for Use	IEC60204-1/EN60204-1
Interlocking device Type / the level of coded		Type 2 Interlocking device / low level coded actuator (EN ISO / ISO14119)
Applicable Directives		Low Voltage Directive, Machinery Directive
Operating Condition	Operating Temperature	-25 to +55°C (no freezing)
	Operating Humidity	20 to 95%RH (no condensation)
	Pollution Degree	3 (Inside 2)
	Altitude	2000m maximum
Inpulse withstand voltage ‹Uimp›		2.5kV (Between ground and LED, solenoid circuit : 0.5kV)
Raed Insulation voltage‹Ui›		250V (Between ground and LED, solenoid circuit : 30V)

Thermal Current ‹th›				30V	125V	250V
				2.5A		
Contact Ratings (Reference Values) ‹Ue, Ie›*2	AC	Resistive load (AC12)		-	2.5A	1.5A
		Inductive load (AC15)		-	1.5A	0.75A
	DC	Resistive load (DC12)		2.5A	1.1A	0.55A
		Inductive load (DC13)		2.3A	0.55A	0.27A

Class of Protection	Class II (IEC61140) *3
Operating Frequency	900 operations/hour
Operating Speed	0.05 to 1.0 m/s
B10d	2,000,000 (ISO 13849-1 Annex C Table C.1)
Mechanical durability	2,000,000 operations minimum (GS-ET-19) The Rear Unlock Button: 3000 operations minimum (Type HS5L-□L)
Electrical Durability	100,000 operations min. (AC-12 250V/1.5A) 2,000,000 operations min. (AC/DC 24V 100mA) (900 operations / hour)
Shock Resistance	Operating Extremes: 100m/s², Damage Limits: 1000m/s²
Vibration Resistance	Operating Extremes:10 to 55 Hz, half amplitude 0.35mm Damage Limits: 30 Hz, half amplitude 1.5mm
Actuator Tensile Strength when Locked	Fzh=1,400N minimum F1max=1820N minimum (GS-ET-19) *4, *5 (Fzh=500N minimum: HS9Z-A55 actuator)
Direct Opening Travel	11 mm minimum (actuator: HS9Z-A51,A5P) 12 mm minimum (for other actuators)
Direct Opening Force	120N minimum
Contact Resistance	50 mΩ maximum (initial value)
Degree of Protection	IP67 (IEC60529) , Type 4X Indoor Use Only
Conditional short circuit current	50A(250V)
Short-circuit Protective Device	Use 250V / 10A fast acting type fuse *6

Solenoid	Rated Operating Voltage	DC24V 100% duty cycle
	Rated Current	200 mA (initial value)
	Turn ON Voltage	Rated voltage x 85% maximum (at 20°C)
	Turn OFF Voltage	Rated voltage x 10% minimum (at 20°C)
	Rated Power Consumption	Approx. 5W
Indicator	Rated Operating Voltage	DC24V 100% duty cycle
	Rated Current	10 mA
	Light Source	LED
	Ilumination Color	Green

*2 Ratings approved by safety agencies
  (1)TÜV/CCC rating AC-15 250V/0.75A
                  DC-13 30V/2.3A
  (2)UL , c-UL rating AC-15 250V/0.75A : Pilot Duty
                  DC-13 30V/1A : Pilot Duty
    The M20 threaded opening must be filled by a Listed or Recognized Component Liquid-Tight Flexible Cord Fitting in order to maintain the Tye 4X Indoor use only rating.
  (3)KOSHA rating AC-15 250V/0.75A
                  DC-13 30V/1A

*3 Basic insulation of 2.5kV impuise withstand circuits and between contact circuit SELV(safety extra low voltage) or circuits (such as 230V AC circuits) at the same time, the SELV or PELV arequirements are met any more.

*4 The actuator locking strength is rated at 1400N of static load. Do not apply a load higher than the rated value. When a higher load is expected to work on the actuator, provide an additional system consisting of another safety switch without lock (such as the HS5D safety switch) or a sensor to detect door opening and stop the machine.

*5 F1max is maximum force. The actuator's guard-locking force Fzh is calculated in accodance with GS-ET-19:

$$Fzh = \frac{\text{maximum force (F1max)}}{\text{Safety coefficient (=1 3)}}$$

*6 Make sure that a fast acting fuse for short-circuit protection trips before overhea ing of he wires.

3 Mounting Examples

- Install the interlock switch on the immovable machine or guard, and install the actuator on the movable door. Do not install both interlock switch and actuator on the movable door, otherwise the angle of insertion of the actuator to the safety switch may become inappropriate, and failure will occur.

(Examples of Mounting on Sliding Doors)   (Examples of Mounting on Hinged Doors)
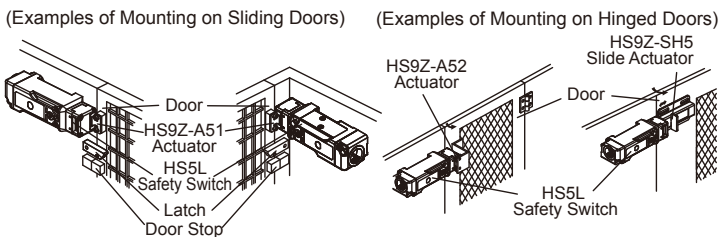
The HS5L Head

- Changing the Mounting Directions of the HS5L Head

  The head of the HS5L can be mounted in four directions by removing the four screws from the corners of the HS5L head.

| When Shipped | Alternative Mounting Directions |
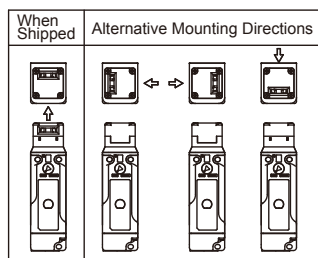
⚠ WARNING

Mounting Directions of the HS5L Head

- Before changing he mounting direction of the HS5L head, turn the manual unlock to UNLOCK using the attached manual unlock key or disconnect wiring from the HS5L.
- If the head position is changed after wiring without taking the above action, the machine may start to operate and the worker may face danger.
- When replacing the HS5L head, make sure that no foreign object enters into the safety switch. Tighten the screws tightly, without leaving space between the head and body, otherwise the safety switch may malfunction.
- Don't remove the screws of head except when the mounting directions of head is changed.

Mounting the Head

- Do not use the metallic or plastic head for the HS5D (without lock type). Be sure to use the head for the HS5L and mount he correct head.

  Take care particularly when using with the HS5D (without lock type).

HS5L — Metallic Color : Silver
HS5D — Metallic Color : Silver / Plastic Color : Red

Metallic Head / Metallic Head / Plastic Head
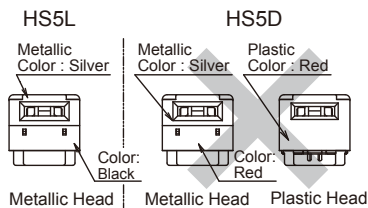
HS5L Head Removal Detection Function (Only Spring Lock Type)

- When the actuator is operated, the operation of the monitor circuit (11-42) and (51-52) are the same.However, when the head is removed, disparity is detected (11-42: OFF, 51-52: ON). The disparity of the contacts detects the removal of the head.

|		ACTUATOR UNLOCK	ACTUATOR LOCK	HEAD REMOVE
Lock Monitor Circuit (NC)	41 — 42			■
Lock Monitor Circuit (NC)	51 — 52			■

■:Contact Closed   □:Contact Open

⚠ CAUTION

- The Head Removal Detection Function cannot be used with HS5L solenoid lock type products.
- When the head is removed from the device (e.g. when changing the mounting position of the head), the 41-42 lock monitor circuit opens (OFF position) and 51-52 monitor circuits close (ON position); so please make sure you connect the 41-42 lock monitor circuit to a safety circuit if you want to use the Head Removal Detection Function.
- The Head Removal Detection Function can only be used with the following spring-lock circuits: A,B,C,D,F,G, J, DD, VB, VD, VJ, TB, TD and TJ type circuits (lock monitor circuit NC: 2 circuits or more, excluding XH). This function cannot be used with other spring-lock type circuits and solenoid circuits.

Installing the Rear Unlock Button
(Type HS5L-□L)

- After installing the interlock switch on the panel, put the rear unlock button (supplied) on the rod on the back of the interlock switch, and fasten using the mounting screw. When installing on the aluminum frame of the thickness of 6mm or more, use the rear unlock button for frame kit (HS9Z-FL5□) sold separately.
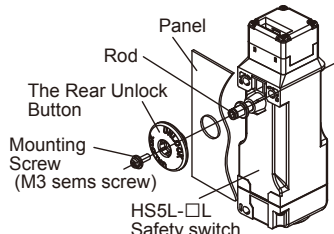

⚠ CAUTION

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

Minimum Radius of Hinged Door

- When using the safety switch for a hinged door, the minimum radius of the applicable door is shown in the following figures.

When the center of the hinged door is on the extension line of the actuator mounting surfase.

When the center of he hinged door is on the extension line of the contact surface of actuator and safety switch.
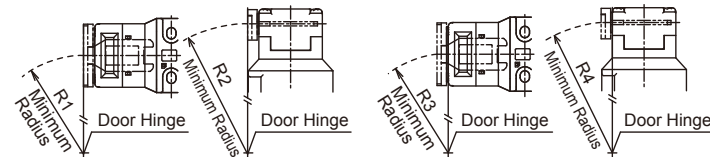
		Minimum Radius			
		R1	R2	R3	R4
HS9Z-A52		230 mm	260 mm	170 mm	190 mm
HS9Z-A52	Mounting centers:12 mm	230 mm	260 mm	120 mm	140 mm
	Mounting centers:20 mm	310 mm		170 mm	
HS9Z-A53			80 mm (Vertical Swing)		50 mm (Vertical Swing)
HS9Z-A55		70 mm (Horizontal Swing)	70 mm (Vertical Swing)	50 mm (Horizontal Swing)	50 mm (Vertical Swing)

⚠ CAUTION

- The values shown above are based on the condition that the actuator enters and exits the actuator entry slot smoothly when the door is closed or opened. Since there may be deviation or dislocation of the hinged door, make sure of correct operation in the actual application before installation.

Adjusting the Angle Adjustable (vertical/horizontal) Actuator
(Type HS9Z-A53/A55)

- Using the angle adjustment screw (M3 hexagon socket set screw), the actuator angle can be adjusted up to 20°(refer to dimensions).
- The larger the actuator angle, the smaller the applicable radius of the door swing. After installing the actuator, open the door. Then adjust the actuator angle so that the actuator enters the entry slot of the safety switch properly.
- After adjusting the actuator angle, apply loctite or the like on the adjustment screw to prevent loosening.

  (Type HS9Z-A53)

  Tightening torque of angle adjustment screw : 0.8 N•m.

  (Type HS9Z-A55)

  Use screw locking agent hat is compatible with the base material.

  Base : PA66 (66 nylon) of glass reinforced grade

  Angle adjustment screws : stainless steel

Actuator Mounting Reference Position

As shown below, the mounting reference position of the actuator inserted into the safety switch is:

  (Type HS9Z-A53)

  The actuator stop film placed on the actuator touches the safety switch lightly.

  (Except Type HS9Z-A53)

  The actuator and actuator cover touches the actuator stop placed on the safety switch lightly.

(After mounting the actuator, remove the actuator stop from the safety switch.)
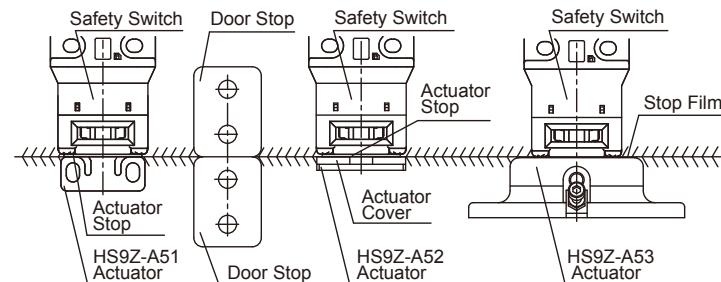
Actuator Mounting Tolerance

- Mounting tolerance of the actuator is 1.0 mm in the four lateral directions.
- Make sure the actuator can be inserted into the entry slot wi hout any issue.
- When closing the door, the actuator is inserted and locked within a certain distance from the reference position. After the actuator has been locked, the contact operation is not affected by the actuator movement in the locked state.

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HS9Z-A51   HS9Z-A52   Center / Safety Switch

3.3mm   4.6mm   ±1.0mm   ±1.0mm
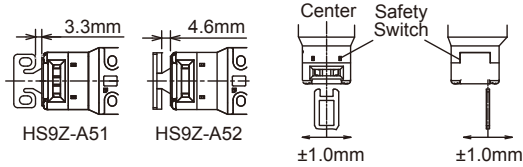
	(Actuator deviation) + (Door movement)
HS9Z-A51	≤ 3.3mm
HS9Z-A52 HS9Z-A51A HS9Z-A52A	≤ 4.6mm
HS9Z-A53	≤ 5.6mm
HS9Z-A55	≤ 4.6mm

For Type HS9Z-A51A/A52A actuator

- When there is a displacement of safety switch and actuator, the actuator may hit the entry slot of safety switch hardly, thus damaging the entry slot and acutuator. The rubber cushions on the HS9Z actuator prevent the actuator from damaging the entry slot by absorbing the shock with movement flexibility. Do not, however, exert excessive shocks, otherwise the failure of safety switch may be caused.
- The rubber cushions may deteriorate depending on the operating enviroment and conditions. Immediately replace the deformed or cracked rubber cushions with new ones.

Recommended Screw Tightening Torque

Name or Use	Screw Tightening Torque
For mounting the safety switch (M4 screw) *7	1.8 to 2.2 N•m
For mounting the cover(M3screw)	0.5 to 0.7N•m
For mounting the HS5L head (M3)	0.9 to 1.1 N•m
For mounting the rear unlock button (M3 sems screw)	0.5 to 0.7 N•m
For mounting the actuator (HS9Z-A51: two M4 screws) *7	1.8 to 2.2 N•m
(HS9Z-A52: two M4 Phillips screws)	0.8 to 1.2 N•m
(HS9Z-A51A/A52A: two M4 screws) *7,8	1.0 to 1.5 N•m
(HS9Z-A53: two M6 screws) *7	4.5 to 5.5 N•m
(HS9Z-A55: two M4 screws) *7	1.0 to 1.5 N•m

⚠ CAUTION

- *7 When the torque is not enough to recommended screw tightening torque, make sure that the screw do not become loose by using adhesive sealants etc. to keep right operation and mounting positioning.
- *8 In the case of HS9Z-A51A and HS9Z-A52A, using two M4 screws and two attached washers, fasten the actuator securely on the door.

M4 Screw / Washer / Rubber Cushion / Door / M4 Mounting Hole
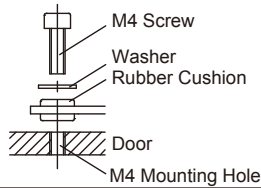
4 Precautions for Operation

For Mounting

- Do not apply an excessive shock to the safety switch when opening or closing the door. A shock to the safety switch exceeding 1,000 m/s^2 may cause failure.
- Provide a door guide, and ensure that force is applied on the safety switch only in the actuator insertion direction.
- Do not pull the actuator while it is locked. Also, regardless of door types, do not use the safety switch as a door lock. Install a separate lock as shown in section 3.
- Entry of foreign objects in the actuator entry slot may affect the mechanism of the switch and cause a breakdown. If the operating atmosphere is contaminated, use a protective cover to prevent the entry of foreign objects into the switch through the actuator entry slots.
- Make sure to install the product in a place where it cannot be damaged. Make sure to conduct a proper risk assessment evaluation before using the product, and use a shield or a cover to protect the product if need be.
- While the solenoid is energized, the switch temperature rises approximately 40°C above the ambient temperature (to approximately 95°C while the ambient temperature is 55°C). Keep hands off to prevent burns. If cables come into contact with the switch, use heat-resistant cables.
- Solenoid has polarity. Be sure to wire correctly. Do not apply voltage that exceed the rated voltage, otherwise the solenoid will be burnt out.
- Do not fasten and loosen the conduit at the bottom of the safety switch.
- Use the dedicated actuators only. Other actuators will cause damage to the switch.
- Be careful not to injure yourself with the screwdriver tip when wiring the terminals.
- Be careful not to damage the square-shaped screwdriver port when inserting the driver into it in order to wire the terminals. Inserting the screwdriver with too much strength may damage the product.
- Before using the following accessories, be sure to refer to the instruction manual for the respective accessory and follow the instructions in the manual to ensure correct use.
 HS9Z-DH5 / HS9Z-EH5 / HS9Z-SP51 / HS9Z-SH5 / HS9Z-BA5 / HS9Z-FL5

⚠ WARNING

- Turn off the power to the safety switch before starting installation, removal, wiring, maintenance, and inspection on the safety switch. Failure to turn power off may cause electrical shocks or fire hazard.
- Do not disassemble or modify the switch. Also do not attempt to disable the interlock switch function, otherwise a breakdown or an accident will result.

⚠ CAUTION

- HS5L Series Safety Switches are Type 2 low-level coded interlocking devices (EN ISO / ISO14119). The following system installation & mounting instructions are EN ISO / ISO14119 requirements to prevent function failure from the interlock switch.
  1. Using permanent fixing methods (e.g. welding, rivets, special screws...etc) to prevent dismantling or de-positioning of the interlock device. However, permanent fixing methods are not an adequate solution if you expect the interlock device to fail during the machinery lifetime, or if you need to replace the product in quick manner. In these situations, other measures (see 2.) should be put in place to reduce the risks of function failure.
  2. At least one of the following measures should be applied to prevent function failure.
     (1) Mounting the interlock device in a place out of reach from workers
     (2) Using shielding protection to prevent physical obstruction of the device
     (3) Mounting the interlock device in a hidden position
     (4) Integrate status monitoring & cycling testing of the device to the control system to prevent product failure.
- Regardless of door types, do not use the safety switch as a door stop. Install a mechanical door stop to the end of the door to protect the safety switch against excessive force.
- Mount the actuator so that it will not hit the operator when the door is open, otherwise injury may be caused.
- Pay attention to the management of spare actuator. Safety function of door interlock switch will be lost in case the spare actuator is inserted in the interlock switch. Ensure that the actuator is firmly fastened to the door (welding, rivet, special screw) in the appropriate location, so that the actuator cannot be removed easily.
- Do not cut or remodel the actuator, otherwise failure will occur.
- If multiple safety components are wired in series, the Performance Level to ISO13849-1 will be reduced due to the restricted error detection under certain circumstance.
- The insulation of the cable has to withstand environmental influences.
- The entire concept of the control system, in which the safety component is integrated, must be validated to ISO13849-2.

For Manual Unlocking

- To change the normal position to the manual unlocking position as shown above, turn the key fully (90 degrees) using the special key included with the switch.
- Using the switch with the key being not fully turned(less than 90 degrees) may cause damage to the switch or errors.
- When manually unlocked, the switch will keep the main and lock monitor circuit disconnected and the door unlocked.
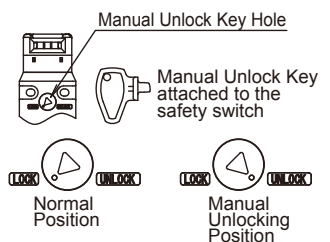
  (Type HS5L-□4)

  The HS5L allows manual unlocking of the actuator to precheck proper door operation before wiring or turning power on, as well as for emergency use such as a power failure.

  (Type HS5L-□7Y)

  If the actuator is not unlocked althoug the solenoid is deenergized, the actuator can be unlocked manually.

Manual Unlock Key Hole / Manual Unlock Key attached to the safety switch / Normal Position / Manual Unlocking Position

⚠ CAUTION

- Before manually unlocking the safety switch, make sure the machine has come to a complete stop. Manual unlocking during operation may unlock the switch before the machine stops, and the function of safety switch with solenoid is lost.
- While the solenoid is energized, do not unlock the actuator manually (solenoid lock type).
- Do not apply excessive force (0.45 N•m or more) to the manual unlock key. Otherwise the manual unlock switch will be damaged. Do not attach the key to the switch intentionally (he key is designed to fall off when the operator's hand is off the key).
- Do not leave the manual unlock key attached to the switch during operation. This is dangerous because the switch can always be unlocked while the machine is in operation.

For the Rear Unlock Button
(Type HS5L-□L)

- The rear unlock button is used for an emergency escape when the orker is confined in the safety hedge (the dangerous area).
  (The rear unlock button is according to EN ISO / ISO14119, GS-ET-19)
- The lock is released when he rear unlock button is pressed, and the door can be opened.
- To return to locked status, pull back the button. While the rear unlock button is depressed, the main circuit remains open and the door is unlocked.

Lock Release / The Rear Unlock Button
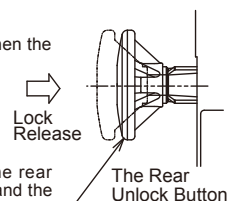
⚠ CAUTION

- Install the HS5L to ensure that a worker can operate the rear unlock button from inside the safety hedge (the dangerous area). It is dangerous to install the HS5L in the position where the rear unlock button can be operated from outside the the safety hedge (the dangerous area), because it is possible to unlock while the machine is operating.
- Use hand to press the button, and do not use a tool. Do not apply excessive force to he rear unlock button.

5 Contact Operation

Contact Configuration and Operation

Type *10	Contact Congifuration *11	Contact Operation (reference)
HS5L-XD□	Monitor Circuit: ⊖ 11—12 / Monitor Circuit: 41—42	11-12 / 41-42
HS5L-XF□	Monitor Circuit: ⊖ 11—12 / Monitor Circuit: 21—22	11-12 / 21-22
HS5L-XG□	Monitor Circuit: ⊖ 11—12 / 23—24	11-12 / 23-24
HS5L-XH□	Monitor Circuit: 41—42 / Monitor Circuit: 51—52	41-42 / 51-52
HS5L-VA□	Monitor Circuit: ⊖ 11—12 / 23—24 / 41—42 / 53—54	11-12 / 23-24 / 41-42 / 53-54
HS5L-VB□	Monitor Circuit: ⊖ 11—12 / 23—24 / 41—42 / 51—52	11-12 / 23-24 / 41-42 / 51-52
HS5L-VC□	Monitor Circuit: ⊖ 11—12 / ⊖ 21—22 / 41—42 / 53—54	11-12 / 41-42 / 53-54
HS5L-VD□	Monitor Circuit: ⊖ 11—12 / ⊖ 21—22 / 41—42 / 51—52	11-12 / 21-22 / 41-42 / 51-52
HS5L-VF□	Monitor Circuit: ⊖ 11—12 / ⊖ 21—22 / ⊖ 31—32 / 41—42	11-12 / 21-22 / 31-32 / 41-42
HS5L-VG□	Monitor Circuit: ⊖ 11—12 / ⊖ 21—22 / 33—34 / 41—42	11-12 / 21-22 / 33-34 / 41-42
HS5L-VJ□	Monitor Circuit: ⊖ 11—12 / 41—42 / 51—52 / 63—64	11-12 / 41-42 / 51-52 / 63-64
HS5L-DD□	Main Circuit: ⊖ 11—42 / Main Circuit: ⊖ 21—52	11-42 / 21-52
[HS5L-XB□]	Monitor Circuit: 13—14 / Monitor Circuit: 41—42	13-14 / 41-42
[HS5L-XJ□]	Monitor Circuit: 41—42 / 53—54	41-42 / 53-54
[HS5L-A□]	Main Circuit: 11—42 / Monitor Circuit: 23—24 / Monitor Circuit: 53—54	11-42 / 23-24 / 53-54
[HS5L-B□]	Main Circuit: 11—42 / Monitor Circuit: 23—24 / Monitor Circuit: 51—52	11-42 / 23-24 / 51-52
[HS5L-C□]	Main Circuit: ⊖ 11—42 / Monitor Circuit: ⊖ 21—22 / Monitor Circuit: 53—54	11-42 / 21-22 / 53-54
[HS5L-D□]	Main Circuit: ⊖ 11—42 / Monitor Circuit: ⊖ 21—22 / Monitor Circuit: 51—52	11-42 / 21-22 / 51-52
[HS5L-F□]	Main Circuit: ⊖ 11—42 / Monitor Circuit: ⊖ 21—22 / Monitor Circuit: ⊖ 31—32	11-42 / 21-22 / 31-32
[HS5L-G□]	Main Circuit: ⊖ 11—42 / Monitor Circuit: ⊖ 21—22 / Monitor Circuit: 33—34	11-42 / 21-22 / 33-34
[HS5L-J□]	Main Circuit: ⊖ 11—42 / Monitor Circuit: 51—52 / Monitor Circuit: 63—64	11-42 / 51-52 / 63-64
[HS5L-TA□]	Monitor Circuit: 41—42 / Monitor Circuit: 13—14 / Monitor Circuit: 53—54	41-42 / 13-14 / 53-54
[HS5L-TB□]	Monitor Circuit: 41—42 / Monitor Circuit: 13—14 / Monitor Circuit: 51—52	41-42 / 13-14 / 51-52
[HS5L-TC□]	Monitor Circuit: 41—42 / Monitor Circuit: ⊖ 11—12 / Monitor Circuit: 53—54	41-42 / 11-12 / 53-54
[HS5L-TD□]	Monitor Circuit: 41—42 / Monitor Circuit: ⊖ 11—12 / Monitor Circuit: 51—52	41-42 / 11-12 / 51-52
[HS5L-TF□]	Monitor Circuit: 41—42 / Monitor Circuit: ⊖ 11—12 / Monitor Circuit: ⊖ 21—22	41-42 / 11-12 / 21-22
[HS5L-TG□]	Monitor Circuit: 41—42 / Monitor Circuit: ⊖ 11—12 / Monitor Circuit: 23—24	41-42 / 11-12 / 23-24
[HS5L-TJ□]	Monitor Circuit: 41—42 / Monitor Circuit: 51—52 / Monitor Circuit: 63—64	41-42 / 51-52 / 63-64

(Travel: mm)
0 (Actuator Mounting Reference Position)
Approx. 3 3 (Lock) — Approx. 5 3 — Approx. 6.9 — Approx. 26.4

(Actuator Completely Inserted) — (Actuator Pulled Out)

■ :Contact Closed □ :Contact Open

- Contact operation is based on the condition that the actuator is inserted into the center of the safety switch slot.

- Contact operation shows the HS9Z-A51 actuator. (For other actuators, add 1.3 mm to contact operation.)
- Use main circuit or monitor circuit with ⊞ for the input to safety circuit.
- Indicator turns on when solenoid is energized.

⚠ CAUTION

*9 This locking monitoring marking has been newly described in section 9.2.1 of EN ISO / ISO14119. It indicates that any devices with this marking meet the following EN ISO / ISO 14119 requirements:
  - General (- General requirements for guard locking devices) (Section 5.7.1) *
  - Locking monitoring (- Locking monitoring for guard locking devices) (Section 5.7.2.2)

  When a lock monitor circuit (contact) has the locking monitoring marking, it means that one circuit (contact) can monitor the position and the locking function of the protective door. (The locking monitoring circuit (contact) turns ON only when the protective door is closed and locked.)

  *note Both types of HS5L safety switches - spring lock type switches and solenoid lock type switches - have obtained the locking monitoring cer ification marking. Based on risk assessment results, solenoid lock type switches can be used only for limited applications which do not especially need to be locked for safety.

*10 Type No. in [ ] are not supplied as standard. See 1. Type for standard.

*11 These are the image of locking position with actuator inserted.

Operation Cycle

- Spring Lock Type (HS5L-□4)

Door States	Closed	Closed	Open	Closed
Solenoid Power A1-A2	OFF	ON	ON/OFF	OFF
Manual Unlock Key	Turn the key to lock position	Turn he key to lock position	Turn the key to lock posi ion	Turn the key to unlock position
Rear Unlock Button	Returned status	Returned status	Returned status	When opera ing he Button
Main Circuit 11-42 21-52	Closed	Open	Open	Open
Monitor Circuit 11-12 21-22 31-32	Closed	Closed	Open	Closed
Monitor Circuit 23-24 33-34	Open	Open	Closed	Open
Monitor Circuit 41-42 51-52	Closed	Open	Open	Open
Monitor Circuit 53-54 63-64	Open	Closed	Closed	Closed
	Door is locked. The machine can be operated.	Door is unlocked. The machine can not be operated.	The machine can not be operated.	Door is unlocked. The machine can not be operated.

- Solenoid Lock Type (HS5L-□7Y)

Door States	Closed	Closed	Open	Closed
Solenoid Power A1-A2	ON	OFF	OFF/ON *13	OFF *12 *13
Manual Unlock Key	Turn the key to lock position	Turn he key to lock position	Turn the key to lock posi ion	Turn the key to unlock position
Rear Unlock Button	Returned status	Returned status	Returned status	When opera ing he Button
Main Circuit 11-42 21-52	Closed	Open	Open	Open
Monitor Circuit 11-12 21-22 31-32	Closed	Closed	Open	Closed
Monitor Circuit 23-24 33-34	Open	Open	Closed	Open
Monitor Circuit 41-42 51-52	Closed	Open	Open	Open
Monitor Circuit 53-54 63-64	Open	Closed	Closed	Closed
	Door is locked. The machine can be operated.	Door is unlocked. The machine can not be operated.	The machine can not be operated.	Door is unlocked. The machine can not be operated.

⚠ CAUTION

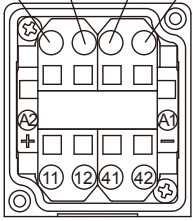*12 Do not attempt manual unlocking when the solenoid is energized.

*13 Do not energize the solenoid for a long time while the door is open or when the door is unlocked manually.
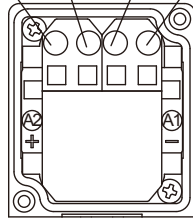
IDEC

6 Wiring

Terminal wiring method

- Terminal NO.

‹4 contact type›

21/23/ 22/24/ 31/33/ 32/34/
63   64   51/53   52/54

11 12 41 42

‹2 contact type›

11/13/ 12/14/ 21/23/ 22/24/
51/53   52/54   41/43   42/44

Note :

- The following type circuits are shipped with jumpers connecting the indicated terminals.
  A,B,C,D,F,G,J type circuits: Jumper connecting 12-41
  DD type circuit: Jumpers connecting 12-41 and 22-51

- When the NC contacts (11-12)/(21-22) of the door monitor circuit and NC contacts (41-42)/(51-52) of the lock monitor circuit are connected in series as inputs to the safety circuit, connect 12-41 or 22-51 before use.

- Recommended Wire Core Size : 0.3 to 1.5 mm² (AWG22 to 16)

- Wire length and example of layout

Type	Routing direction	Wire Length: L1
HS5L-□△*4M-G HS5L-□△*4LM-G	Straight orientation	30 to 35mm
HS5L-□△*4SM-G	Straight orientation	50 to 55mm
HS5L-□△*4LSM-G	Horizontal orientation	40 to 45mm

8 to 9mm   L1
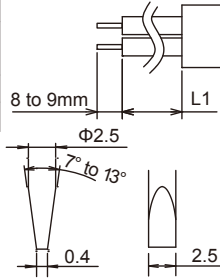
- For wiring, use the following applicable screwdriver.
  (Tip shape of the driver is according to the standard of DIN5264)

Φ2.5
7° to 13°
0.4   2.5

- In applications using ferrules for stranded wires, choose the ferrule listed in the table.

Applicable wire (stranded) mm²	AWG	Part No.	Manufacturer
0.34	22	AI0.34-6TQ	Phoenix Contact
0.5	20	AI0.5-6WH	Phoenix Contact
0.75	18	AI0.75-6GY	Phoenix Contact
1	18	AI1-6RD	Phoenix Contact
0.5	20	TE0.5-8	Nichifu
0.75	18	TE0.75-8	Nichifu
1	18	TE1.0-8	Nichifu

- Wire insertion positions, screwdriver insertion positions, and the directions of screwdriver tip are shown below.

Screwdriver Tip
The square-shaped Screwdriver Port Direction of Screwdriver Tip
The round-shaped Wire Port
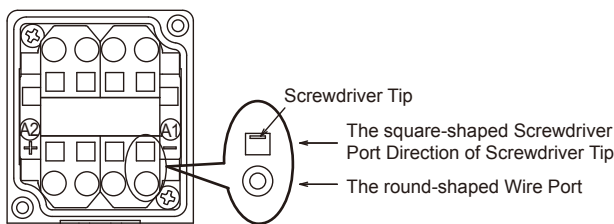
- Wiring Instructions

1. Insert the applicable screwdriver into the square-shaped port as shown,until the screwdriver tip touches the bottom of the spring.

2. Push in the screwdriver until it touches the bottom of the port. The wire port is now open, and the screwdriver is held in place. The screwdriver will not come off even if you release your hand.

Bottom of the Port
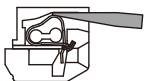
3. While the screwdriver is retained in the port, insert the wire or ferrule into the round-shaped wire port. Each wire port can accommodate one wire or ferrule.
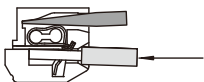
4. Pull out the screwdriver. The connection is now complete.
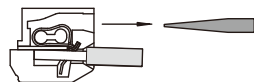
- When using wire with insulation diameter of Φ2.0mm or less, do not insert the wire too deep where the insulation inserts into the spring clamp opening. Otherwise conductive failure will be caused. Make sure that the wire insulation is stripped 8 to 9 mm and the wire is inserted to the bottom.

- Please connect one wire per terminal port (according to the general requirements section (13.1.1) of IEC60204).

Incorrect ✕   Correct ○

The wire insulation sheath is in contact with the clamps

The wire is inserted deep enough between the clamps
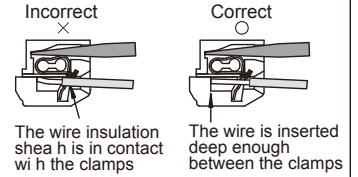
How to change the cable routing direction (cable side-routed type)

When using a cable side-routed type (HS5L-□△*SM-G), you can select from three orientations (straight, left and right) as the wiring direction. When the unit is shipped, the cover is installed so that wiring can be routed straight or in the left orientation. When using the unit with the wiring in the right orientation, refit the cover by the procedure below.

① Remove the cover mounting screws (M3 screws x 2), and remove the cover from the HS5L Safety Switch main unit.

② Rotate the terminal cover 180 degrees as shown in the figure.

③ Install the cover on the Safety Switch, and secure it in place with the cover mounting screws (M3 screws x 2).

* Before tightening the cover mounting screws, slide the spacer in the direction opposite the screw positions to prevent it from coming into contact with the screwdriver.

① Safety switch
Terminal cover
Spacer
M3 screws

② 180°

③
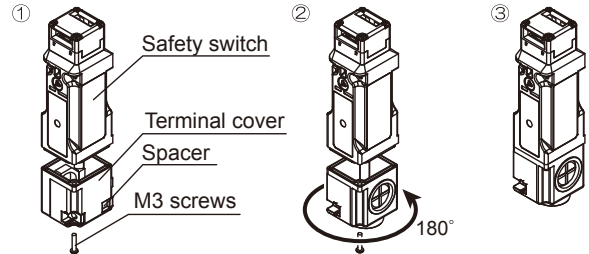
How to open conduit port (cable side-routed type)

- Before use, knock in the conduit port where the connector is to be connected, using a tool such as screwdriver as shown in the figures.

- Before opening the conduit port, remove the terminal cover from the HS5L Safety Switch main unit, and remove the locking ring for the cable gland installed in the terminal cover.

- Be sure to remove any crack or burrs on the conduit port, as it will impair waterproof performance.

Safety switch
Locking ring for cable gland
Terminal cover

Straight orientation   Horizontal orientation
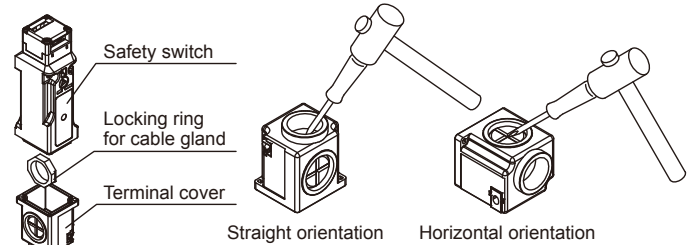
Applicable Connectors

Use a connector with a degree of protection IP67.

Applicable connector dimensions : See the figure on the right.

- When using flexible conduit and metal connector
  Applicable Flexible Conduit Example:
  Type VF-03 (made by Nihon Flex)
  (M20) Applicable Metal Connector Example:
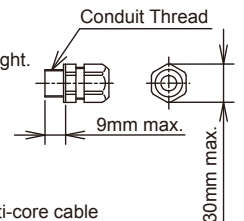 Type RLC-103EC20 (made by Nihon Flex)

- When using plastic connector, metal connector and multi-core cable
  (M20) Applicable Plastic Connector Example:
  Type ST-M20×1.5 (made by LAPP)
  Applicable Metal Connector Example:
  Type ALS-□□EC20 (made by Nihon Flex)

Conduit Thread
9mm max.
30mm max.

Note : Confirm the outside diameter of the multi-core cable, the connector type depends on the outside diameter of multi-core cable.

Note : When using ST-M20×1.5, use with gasket GP-M (Type No: GPM20, made by LAPP).

Note : If you use HS5L as Type 4X, please use M20 connectors that are certified the following.
Plastic connector: Type 4,4X, 6 or 6P
Metal connector: Type 4X or 6P

Connecters' mounting method

1. Loosen connecter A and connecter B, and insert the cable into these pieces in the following order :

   connecter B → waterproof gasket → connecter A.

   Do not tighten the connecters yet.
2. Remove the terminal cover from the switch and insert the cable into the cover.
3. Wire the terminals.
4. Tighten connecter A into the terminal cover. Fix the terminal cover back into its original position. Tighten connector B.
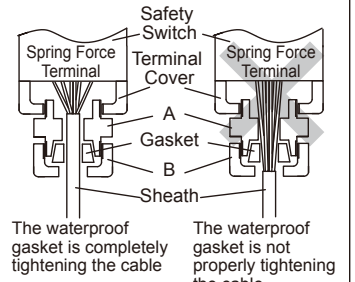
Connecter (To buy separately)

A   Gasket   B

Connecter
(To buy separately)

Safety Switch   Terminal Cover
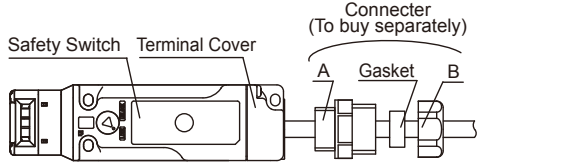
A   Gasket   B

Note : To unwire the terminals, disassemble the product in the following order:

turn off the power → loosen connecter B → remove the terminal cover → remove the waterproof gasket from connecter A* → loosen connecter A

* Please remove the water-proof gasket carefully with tools such as tweezers. Be careful when removing the gasket as damages may affect its waterproof properties. Also, loosening connecter A without removing the gasket first may damage the cable and provoke connection issues. Please make sure you re-insert the waterproof gasket properly into connector A when re-assembling the product.

⚠ CAUTION

- Make sure not to lose any screw when removing the terminal cover from the switch.
- Please make sure the cable is insterted deep enough into the terminal cover so that the waterproof gasket can tighten he cable sheath completely and ensure its waterproof functions.
- Make sure you always tighten connecter A before connecter B, otherwise the wires which connect the terminals might get twisted or might break, and this might also damage the terminal ports.
- When tightening the connecters, only use a tightening torque that is approved by the connecters' manufacturer to ensure waterproof properties of the product.
- Do not pull or twist the cable with excessive force, otherwise you might damage he wires inside of it.

Safety Switch
Spring Force Terminal   Terminal Cover   Spring Force Terminal
A
Gasket
B
Sheath

The waterproof gasket is completely tightening the cable

The waterproof gasket is not properly tightening the cable

7 Example of wiring Diagram realizing Safety Category

Example of a circuit diagram for Safety Category 3 (attainable PL = d)

(Condi ion 1: To apply he fault exclusion of mechanical structural parts including he actuator → Make sure to use the product within the product specification range described in this manual and the version of the manual provided with the product.)

(Condi ion 2: Documentation of he reason for he machine/equipment manufacturer to have applied the fault exclusion based on ISO13849-1, ISO13849-2 or IEC62061)
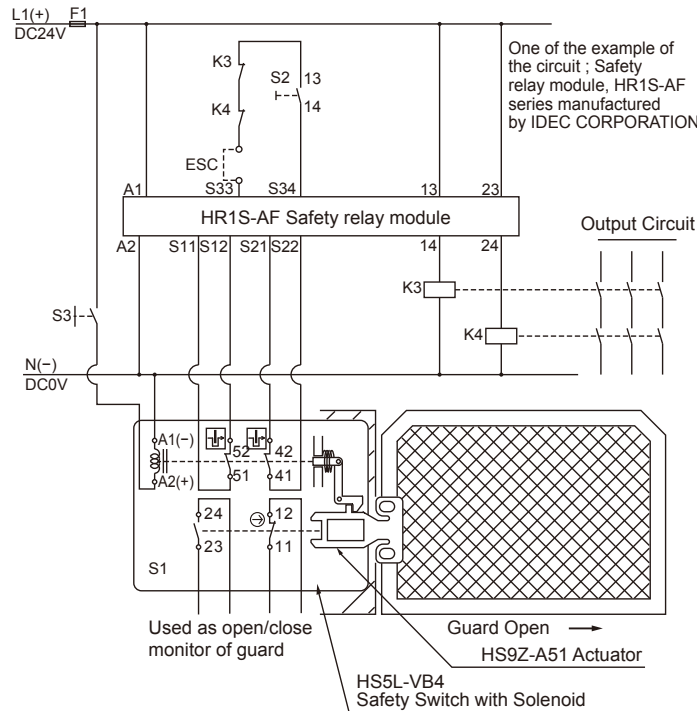
S1:   HS5L-VB4 Safety Switch with Solenoid
S2:   Starting Switch (HW Series Momentary)
S3:   Unlocking Enabling Switch
S4:   Safety limit Switch
ESC: Outside start condition
K3, 4: Safety Contactor
F1:   Outside fuse of safety relay module at power supply line

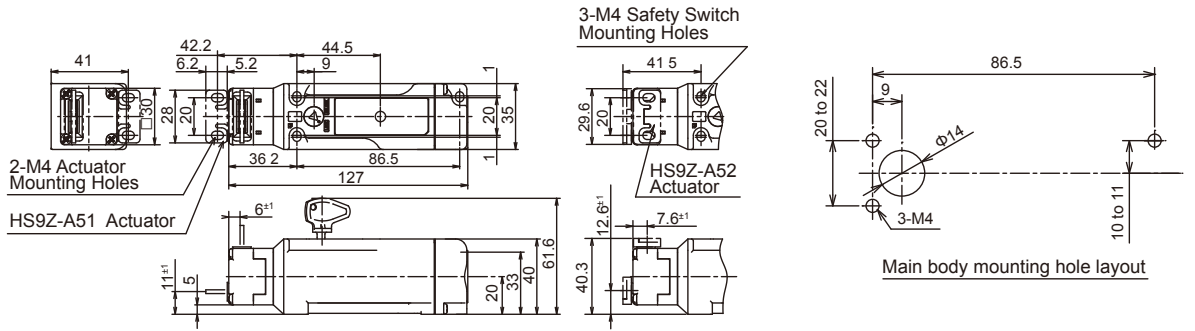### Example of a circuit diagram for Safety Category 4 (attainable PL = e)
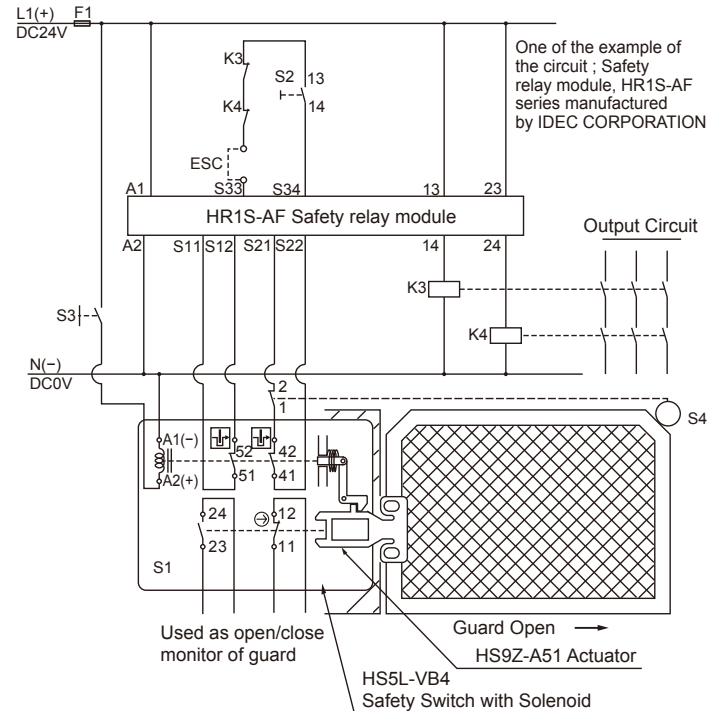
Note: Use he monitoring device(Safety relay module) provided he capavility to detect a cross short circuit. The insulation of the cable has to withstand environmental influences. If a control device other than he one shown in the draft is used, the used control device has to be equipped with a cross short circuit monitor.
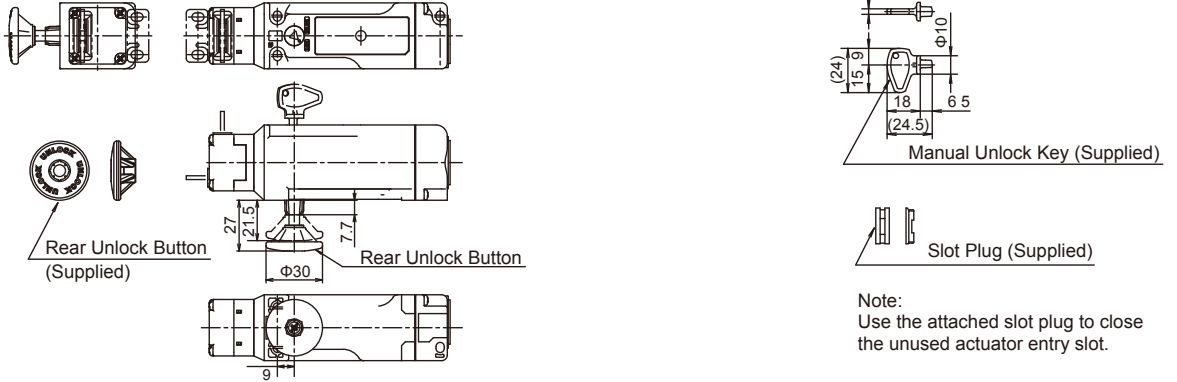
IDEC

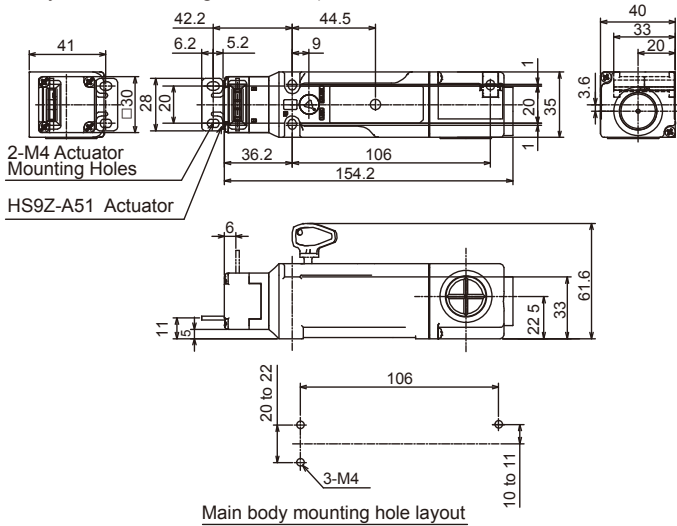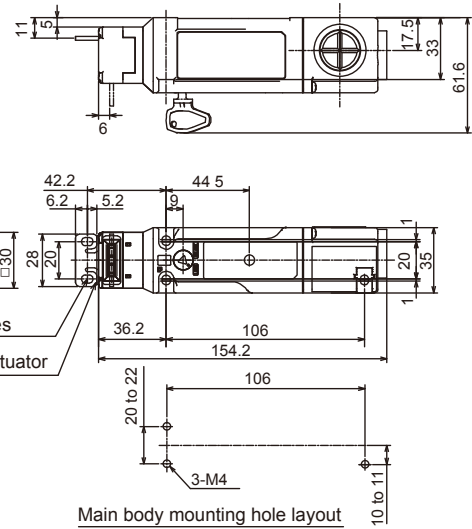## 8 Dimensions (mm)

Safety Switch dimensions

Type : HS5L-□4M

Main body mounting hole layout

Type : HS5L-□4LM

Rear Unlock Button (Supplied)

Rear Unlock Button

Manual Unlock Key (Supplied)

Slot Plug (Supplied)

Note:
Use the attached slot plug to close the unused actuator entry slot.

Type : HS5L-□4SM
(Factory defalut, Routing to left side)   (Routing to right side)

Main body mounting hole layout

Type : HS5L-□4LSM
(Factory defalut, Routing to left side)   (Routing to right side)

Rear Unlock Button (Supplied)

Rear Unlock Button
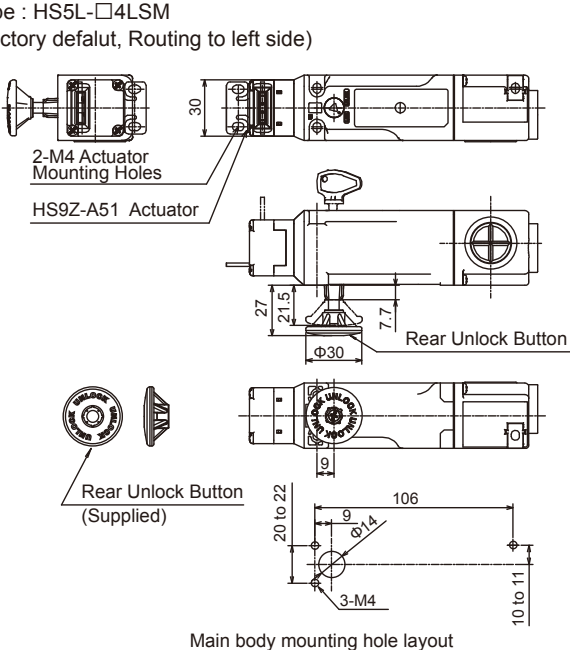
Main body mounting hole layout
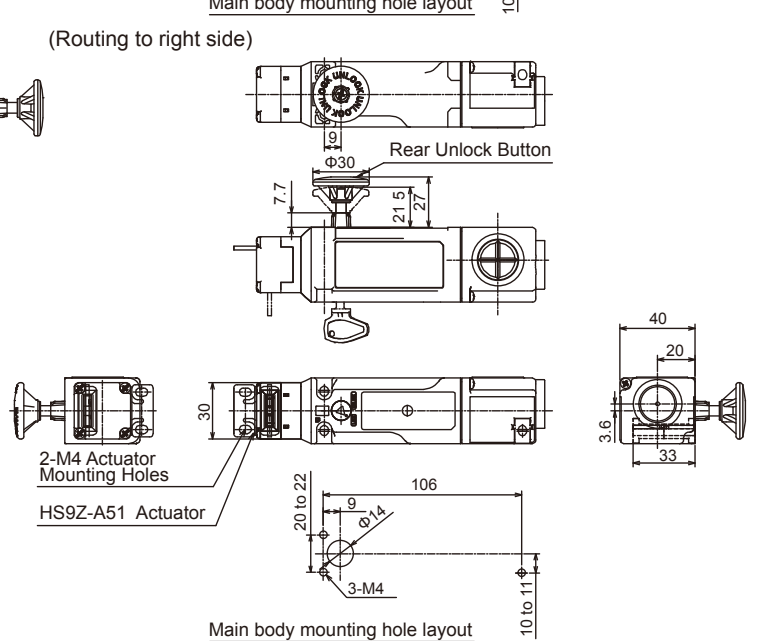
Accessories dimensions

(To be sold by separately)

Type : HS9Z-A51

Actuator Stop *14
(Supplied with actuator)

Type : HS9Z-A52

Actuator Stop *14
(Supplied with actuator)
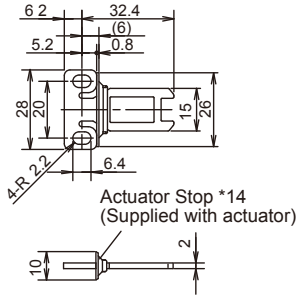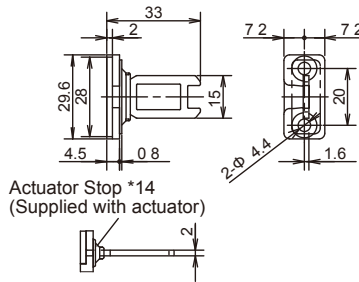
HS9Z-A51/A52 Actuator mounting hole layout

2-M4
(Φ4.3 or M4 tapped)

Type : HS9Z-A51A

Actuator Stop *14
(Supplied with actuator)

Washer(Supplied with actuator)
2-Φ10
2-Φ9
Rubber Cushions

Type : HS9Z-A52A

When installed on the door(11.2)
When installed on the door(39.7)

Rubber Cushions
Washer(Supplied with actuator)
when installed on the door(5)

Actuator Stop *14
(Supplied with actuator)
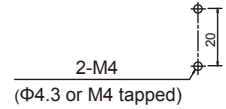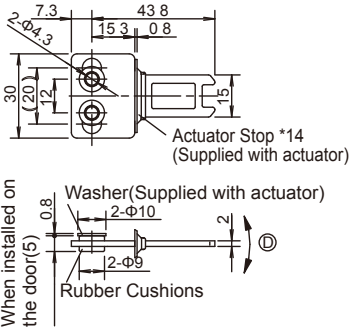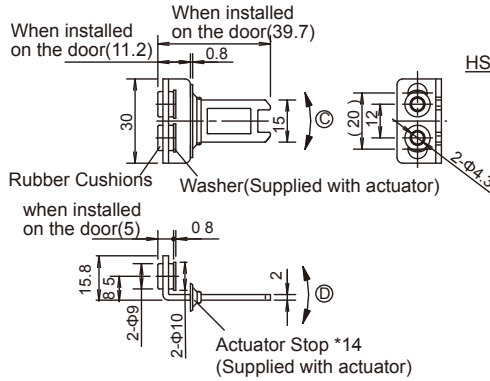
HS9Z-A51A/A52A Actuator mounting hole layout

2-M4
(Φ4.3 or M4 tapped)
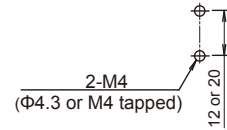
* Make sure to use the product with the moun ing pitch at either 12 mm or 20 mm.

*Mounting pitch is set to 12 mm in factory. When setting the mounting pitch to 20 mm, widen he pitch of rubber cushions to 20 mm.

* The actuator has movement flexibility to the direc ions shown in Ⓓ.

* Make sure to use the product with the moun ing pitch at either 12 mm or 20 mm.

* When the mounting pitch is 12 mm (factory setting), the actuator has movement flexibility to the directions shown in Ⓒ and Ⓓ .
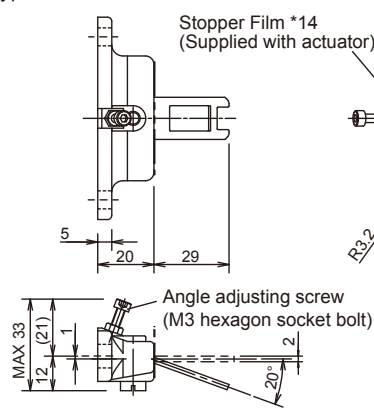
* When the mounting pitch is 20 mm, he actuator has movement flexibility to the directions shown in Ⓓ. Side the rubber cushions together with the screws.
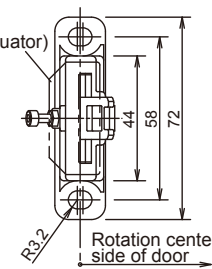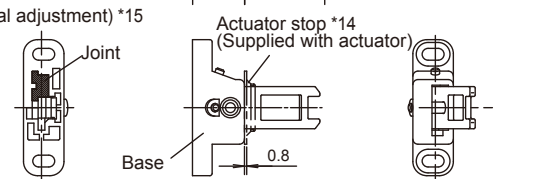
Type : HS9Z-A55

(Horizontal adjustment) *15
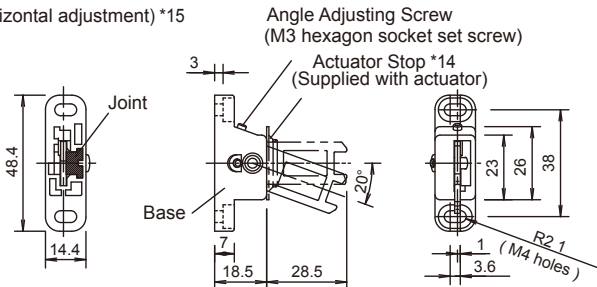
Angle Adjusting Screw
(M3 hexagon socket set screw)
Actuator Stop *14
(Supplied with actuator)

Joint
Base
(M4 holes)

(Vertical adjustment) *15

Actuator stop *14
(Supplied with actuator)

Joint
Base

Angle adjusting screw
(M3 hexagon socket set screw)

Actuator mounting hole layout

2-M4
(Φ4.3 or M4 tapped)

Type : HS9Z-A53

Stopper Film *14
(Supplied with actuator)

Rotation center side of door

Angle adjusting screw
(M3 hexagon socket bolt)

Actuator mounting hole layout

2-M6
(Φ6.3 or M6 tapped)

*14 The actuator stop and The Stopper film are used when adjusting the actuator position. Remove after the actuator position is determined.

*15 The direction of adjustable angle can be changed (vertical or horizontal) by changing the insertion direction of the joint (white plastic part).Do not lose the joints. Actuators do not operatenormally without a joint.

Joint

(horizontal adjustment) (vertical adjustment)

9 Precaution for Disposal

Dispose of the HS5L safety switch as an industrial waste.

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