Safety Overview 256
Safety Components 258

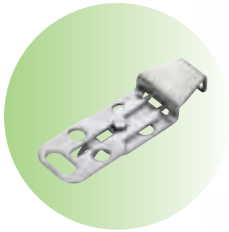
Safety Overview

IDEC

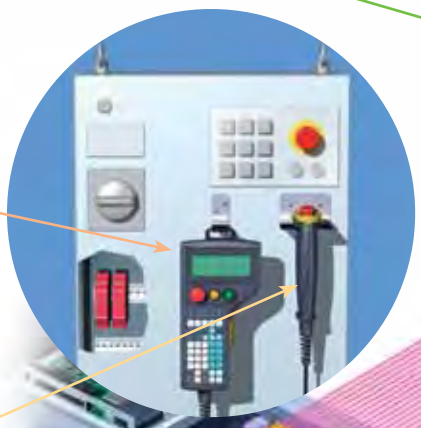
www.IDEC.com/safety

Safety Overview

Solenoid Interlock Switch
This safety switch serves as an interlock that enables the machine to start only when the guard is closed and locked. The guard is unlocked by the solenoid.
page 290



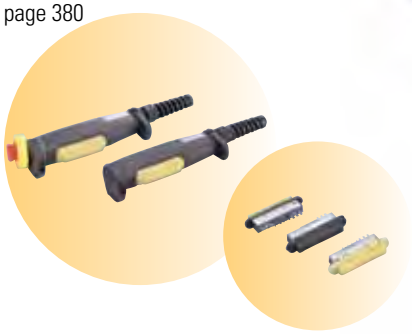
Safety Product Accessories



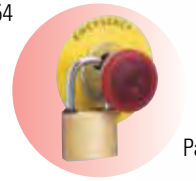
Teaching Pendant

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

Grip Switch / Enabling Switch
Safety devices are intended to help the operator avoid dangers of unexpected machine operation during work within hazardous areas.
page 380



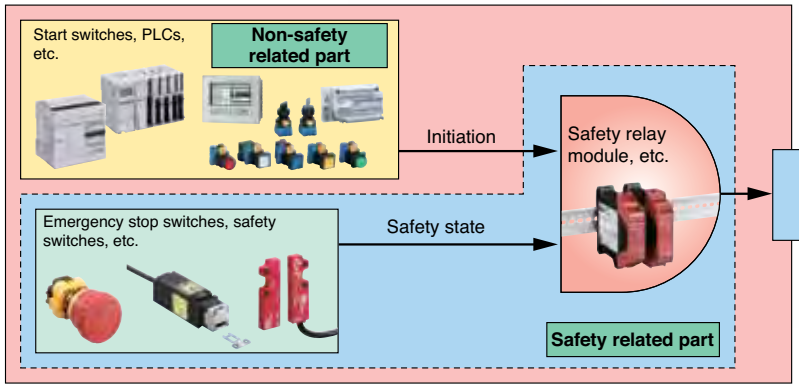
Emergency Stop Switch
page 654



Padlockable type

SignaLight Tower
page 704

Production System



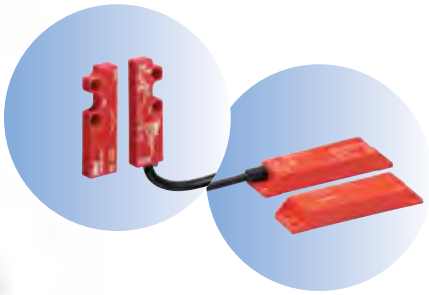
Safety Relay Module
This device is intended to start the machine only when the safety control system is functioning normally and safety information from safety devices (safety switch, emergency stop switch, etc.) is relayed to the machine.
page 393

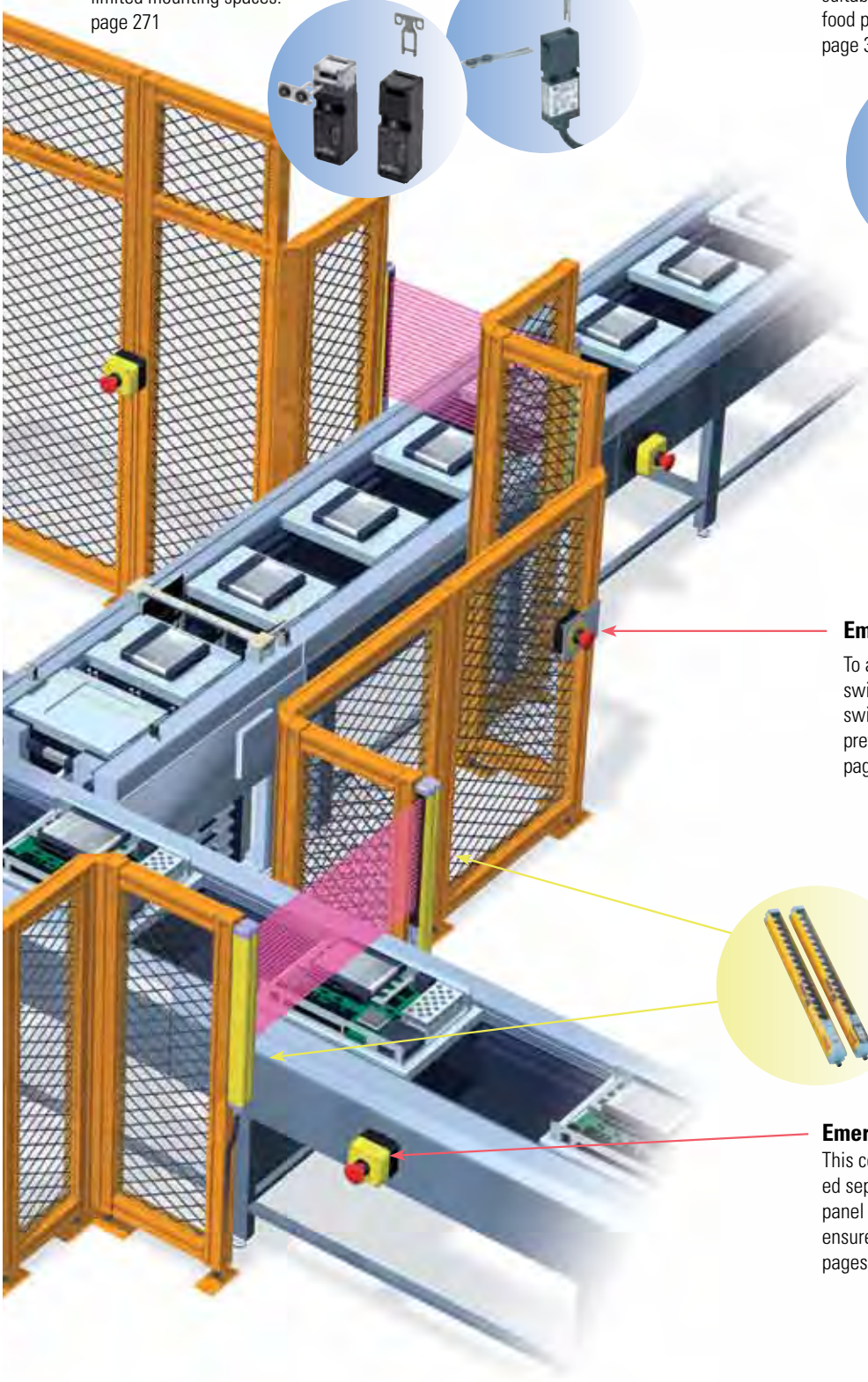
Interlock Switch

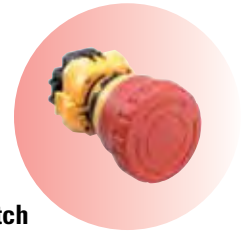
This safety switch serves as an interlock that enables the machine to start only when the guard is closed. Once the guard is opened, the machine stops or cannot be started. This safety switch is suitable for applications in limited mounting spaces.
page 271

Non-contact Safety Interlock Switch

This safety switch is an interlock switch that can detect the open/close status of the door without mechanical contact. Taking advantage of dust-proof and water-proof construction as well as miniature size, the non-contact safety switch is suitable for semiconductor manufacturing systems, food processing systems, and assembly lines.
page 342

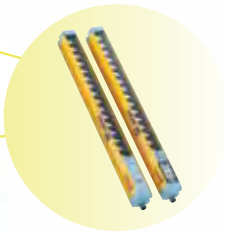






Emergency Stop Switch

To avoid accidents in an emergency, this switch is used to stop the machine. This switch provides a safety lock mechanism to prevent accidental startup of the machine.
page 259



Safety Light Curtain

This device detects the entry of a person or object into the hazardous area by the interruption of light beams.
page 429

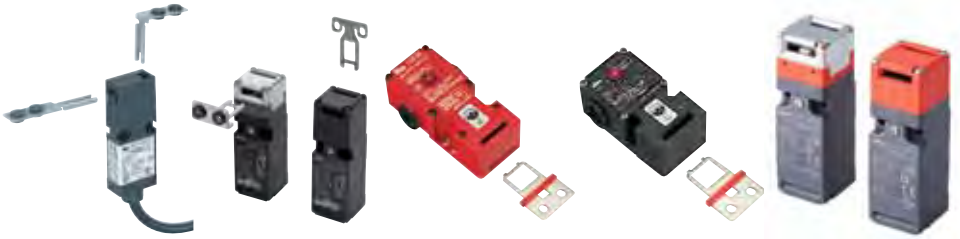
Emergency Stop Control Box

This control box can be mounted separate from the control panel wherever required to ensure safety.
pages 562 & 652

Safety Components

Emergency Stop Switches pages 259, 444, 461, 525, 558, 562, 652 & 654

Safety Interlock Switches page 271



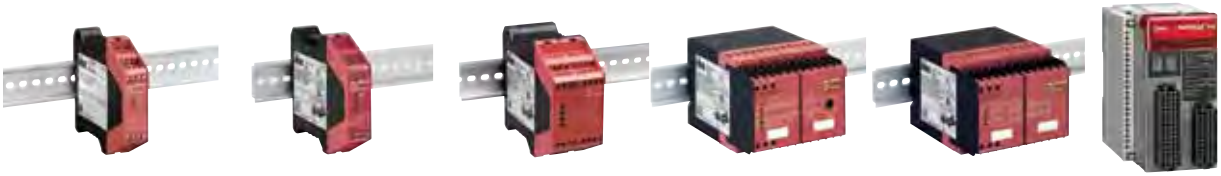
Key Locking Safety Switches page 329

Solenoid Safety Interlock Switches page 290

Door Handle Gate System page 354

Enabling Switches / Grip Switches page 363

Safety Control Modules page 393



Non-contact Safety Switches page 342

Safety Light Curtains page 429

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HS6B Subminiature 271
HS5D Miniature 276
HS2B Full Size 283
HS1B Full Size 287
HS6E Subminiature with Solenoid 290
HS5E Miniature with Solenoid 299
HS1E Full Size Solenoid Locking 315
HS1C Full Size Solenoid Locking 321
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HS7A-DMC Non-Contact Magnetic 342
HS7A-DMP Non-Contact Magnetic 346
HS3A Non-contact RFID 350
HS5B/HS5E Door Handle Actuator 354

Interlock Switches

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Selection Guide

Standard Interlock Safety Switches

Series	Subminiature	Miniature		Full Size	
	HS6B	HS5B	HS5D	HS2B	HS1B
Appearance					
Page	271	www.IDEC.com/safety	276	283	287
Size (mm)	30 x 15 x 78mm	91 x 30 x 30mm	30 x 30 x 90mm	52 x 35 x 98mm	52 x 35 x 125mm
Contacts	2 or 3	2	2 or 3	2	2
Termination	Integrated cable	Screw	Screw	Screw	Screw
Material	Plastic body	Plastic body	Metal or plastic head	Plastic head	Die-cast aluminum body

Solenoid Locking Safety Switches

Series	Subminiature	Miniature	Full Size		
	HS6E	HS5E	HS1E	HS1C	HS1L
Appearance					
Page	290	299	315	321	326
Size (mm)	75 x 15 x 75mm 500N	35 x 40 x 146mm 1400N	104 x 35 x 129mm 1500N	106 x 35 x 125mm 1500N	104 x 35 x 129mm 3000N
Contacts	5	4	3 or 4	3 or 4	6
Termination	Integrated cable	Integrated cable	Screw	Screw	Screw
Material	Plastic body	Metal head, plastic body	Plastic body	Die-cast aluminum body	Plastic body

Key Locking Safety Switch

Series	HS5E-K
Appearance	
Page	329
Size (mm)	35 x 40 x 146
Contacts	4
Termination	Integrated cable
Material	Metal head, plastic body

Non-contact Safety Switch

HS7A-DMC	HS7A-DMP	HS3A
342	346	350
7 x 16 x 51	13 x 25 x 88	40 x 47 x 70mm
2	3	3
Integrated cable	Integrated cable	M12
PBT	PBT	PBT

HS6B Subminiature Interlock Switches

Key features:

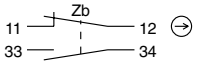
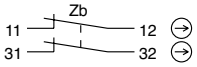
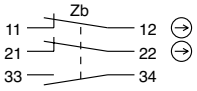
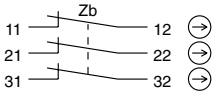
- Only 78 x 30 x 15mm
- Two actuator entrances provide flexibility for installation options
- Integrated molded cable reduces wiring time
- IP67 (IEC60529)
- Direct Opening Action
- Actuators comply with ISO14119 and EN1088

GS-ET-15
BG standard in Germany

Direct Opening Action

Double Insulation

Part Numbers

Contact Configuration	Cable Length	Part Number
1NC-1NO 	1m	HS6B-11B01
	3m	**HS6B-11B03**
	5m	HS6B-11B05
2NC 	1m	HS6B-02B01
	3m	**HS6B-02B03**
	5m	HS6B-02B05
2NC-1NO 	1m	HS6B-12B01
	3m	**HS6B-12B03**
	5m	HS6B-12B05
3NC 	1m	HS6B-03B01
	3m	**HS6B-03B03**
	5m	HS6B-03B05

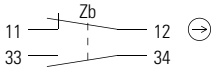
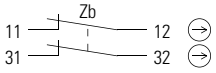
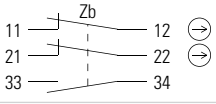
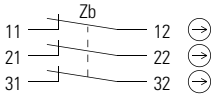
Standard stock items in bold.

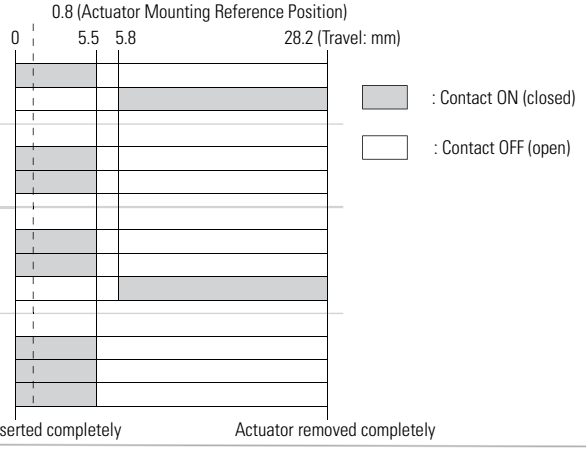
Actuator Keys (order separately)

Appearance	Part Number	Shape
	HS9Z-A61	Straight
	HS9Z-A62	Right-angle
	HS9Z-A65	Adjustable actuator 90° angle
	HS9Z-A66	Adjustable actuator 180° angle

Actuators are not included and must be ordered separately.

Contact Configuration & Operation Chart

Type	Contact Configuration	Contact Operation Chart
HS6B-11	1NC-1NO 	11-12, 33-34
HS6B-02	2NC 	11-12, 31-32
HS6B-12	2NC-1NO 	11-12, 21-22, 33-34
HS6B-03	3NC 	11-12, 21-22, 31-32



Specifications

Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-15, IEC60664-1, IEC60204-1, EN60204-1, UL508, CSA C22.2 No. 14
Operating Temperature		–25 to +70°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Relative Humidity		45 to 85% RH (no condensation)
Storage Humidity		95% maximum (no condensation)
Altitude		2,000m maximum
Pollution Degree		3
Rated Insulation Voltage (U_i)		300V
Impulse Withstand Voltage (U_{imp})		4kv
Insulation Resistance		Between live & dead metal parts: 100MΩ maximum
		Between positive & negative live parts: 100MΩ minimum
Electric Shock Protection Class		Class II
Degree of Protection		IP67 (IEC60529)
Vibration Resistance	Operating Extremes	5 to 55 Hz, half amplitude 0.5 mm
	Damage Limits	30Hz, half amplitude 1.5mm
Contact Resistance		300mΩ maximum
Shock Resistance	Operating Extremes	300m/s² (30G)
	Damage Limits	1000m/s² (100G)
Direct Opening Travel		8mm minimum
Direct Opening Force		60N minimum
Thermal Current (I_{th})		2.5A
Operating Frequency		1200 operations/hour
Mechanical Life		1,000,000 operations (GS-ET-15)
Recommended Actuation Speed		0.05 to 1.0m/s
Wire Tensile Strength		50N minimum
Electrical Life		100,000 operations (at full rated load)
Conditional Short-Circuit Current		50A 250V (IEC60947-5-1, IEC60269-1, -2)
Weight		120g

Contact Ratings

Rated Operating Current (I_e)	Operating Voltage (U_e)		30V	125V	250V
	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
			(2A)	(0.4)A	(0.2A)
		Inductive load (DC-13)	2.3A	0.55A	0.27A
			(1A)	(0.22A)	(0.1A)

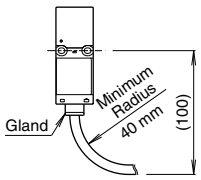
Installation Notes

Recommended Screw Torque

- Safety switch body installation (M4 screw): 1.0~1.5N-m
- Actuator installation (M4 screw): 1.0~1.5N-m

Handling Cables

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

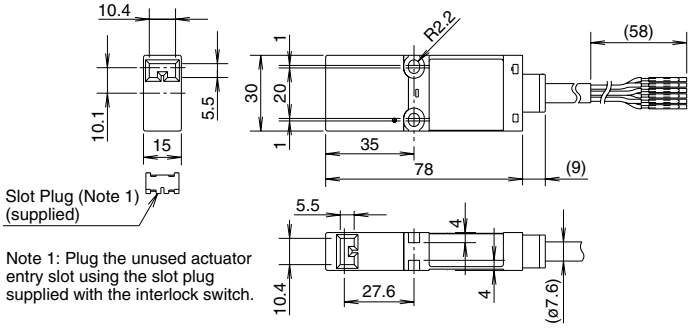


Wiring Designations

Part Number	Contact	Terminal #	Color
HS6B-12B01 (2NC-1NO)	NC	11-12	blue-blue/white
	NC	21-22	brown-brown/white
	NO	33-34	orange-orange/white
HS6B-03B01 (3NC)	NC	11-12	blue-blue/white
	NC	21-22	brown-brown/white
	NC	31-32	orange-orange/white
HS6B-11B01 (1NC-1NO)	NC	11-12	blue-blue/white
	NO	33-34	orange-orange/white
HS6B-02B01 (2NC)	NC	11-12	blue-blue/white
	NC	31-32	orange-orange/white

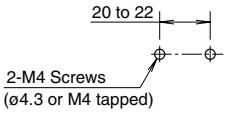
Dimensions (mm)

HS6B



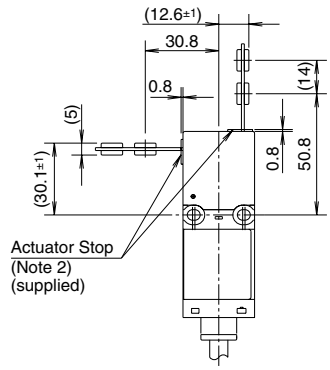
Note 1: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.

Installation

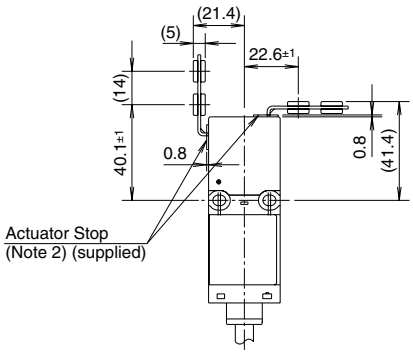


The interlock switch can be mounted in two directions.

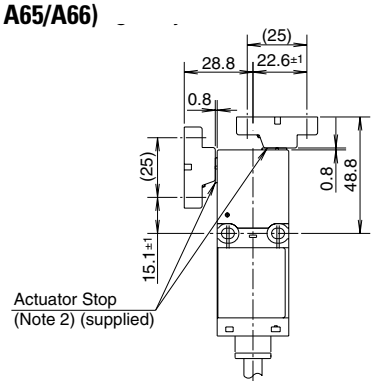
Using straight actuator (HS9Z-A61)



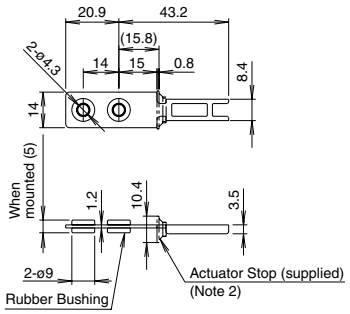
Using Right-angle actuator (HS9Z-A62)



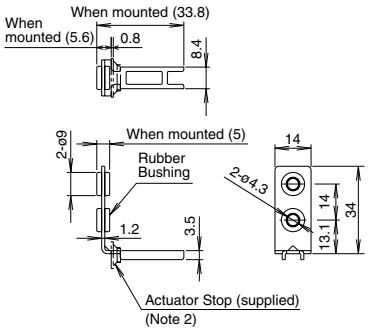
Using Angle Adjustable Actuator (HS9Z-A65/A66)



Straight actuator (HS9Z-A61)

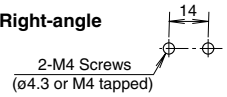


Right-angle actuator (HS9Z-A62)

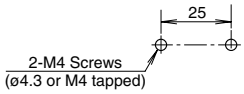


Actuator Installation

Straight/Right-angle Actuator

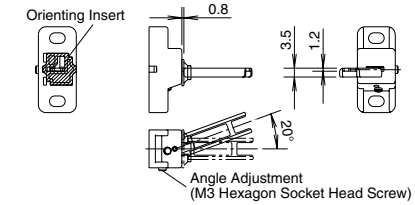


Angle Adjustable Actuator

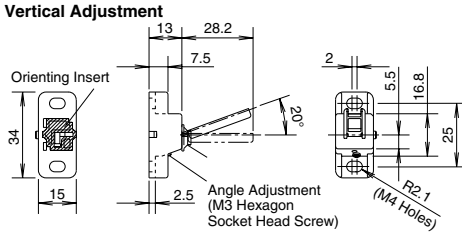


Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment



Vertical Adjustment



The orientation of actuator adjustment (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator.

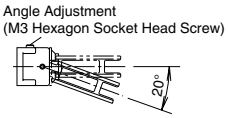
The base is made of glass-reinforced PA66 (66 nylon). Angle adjustment screws are stainless steel. When using adhesive on screws, take material compatibility into consideration.

Note 2: After mounting the actuator, remove the actuator stop from the interlock switch.

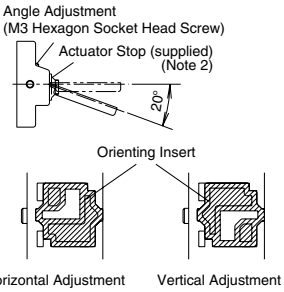
Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment



Vertical Adjustment



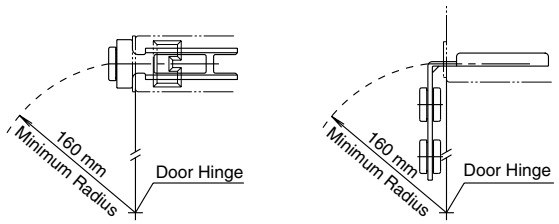
Minimum Radius of Hinged Door

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

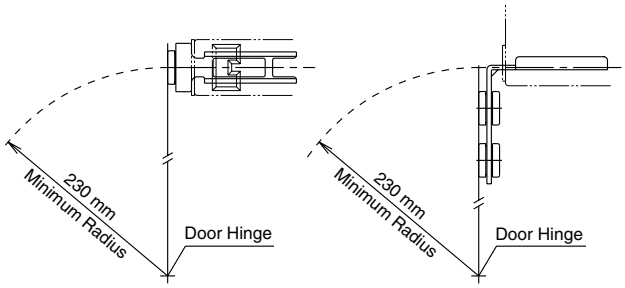
  Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A62 Actuator

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



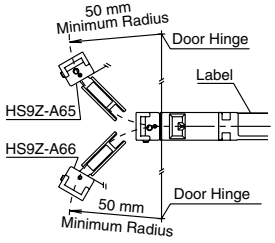
- When the door hinge is on the extension line of the actuator mounting surface:



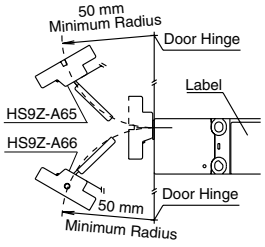
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable (vertical) Actuator

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

Horizontal Swing

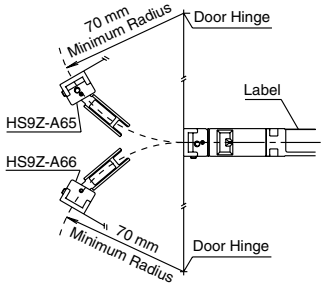


Vertical Swing

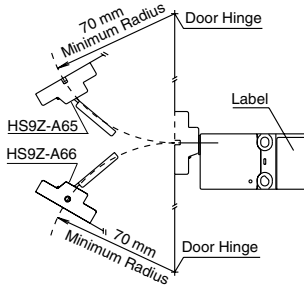


- When the door hinge is on extension line of the actuator mounting surface:

Horizontal Swing



Vertical Swing



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

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).
- Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can enter properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not become loose.

HS5D Miniature Interlock Switches

Key features:

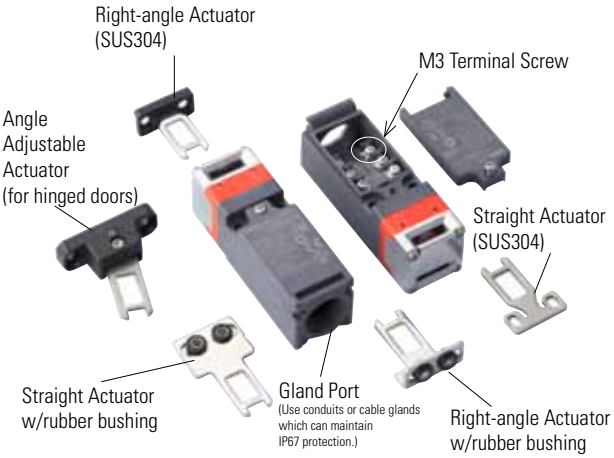
- Detects detachment of head for enhanced safety
- Compact dimensions with up to three contacts
- The head orientation can be rotated, allowing 8 different actuator entries
- NC contacts with direct opening action (IEC/EN60947-5-1)
- M3 terminal screws for easy wiring
- Gold-plated contacts suitable for small loads

Part Numbers

Contact Configuration	Gland Port Size	Plastic Head Type	Metal Head Type
1NC-1NO Zb Main Circuit 11 12 Monitor Circuit 23 24	G1/2	HS5D-11RN	HS5D-11ZRN
	PG13.5	HS5D-11RNP	HS5D-11ZRNP
	M20	HS5D-11RNM	HS5D-11ZRNM
2NC Zb Main Circuit 11 12 Monitor Circuit 21 22	G1/2	**HS5D-02RN**	**HS5D-02ZRN**
	PG13.5	HS5D-02RNP	HS5D-02ZRNP
	M20	HS5D-02RNM	HS5D-02ZRNM
2NC-1NO Zb Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 33 34	G1/2	**HS5D-12RN**	**HS5D-12ZRN**
	PG13.5	HS5D-12RNP	HS5D-12ZRNP
	M20	HS5D-12RNM	HS5D-12ZRNM
3NC Zb Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 31 32	G1/2	**HS5D-03RN**	**HS5D-03ZRN**
	PG13.5	HS5D-03RNP	HS5D-03ZRNP
	M20	HS5D-03RNM	HS5D-03ZRNM

Standard stock items in bold.

Parts Description



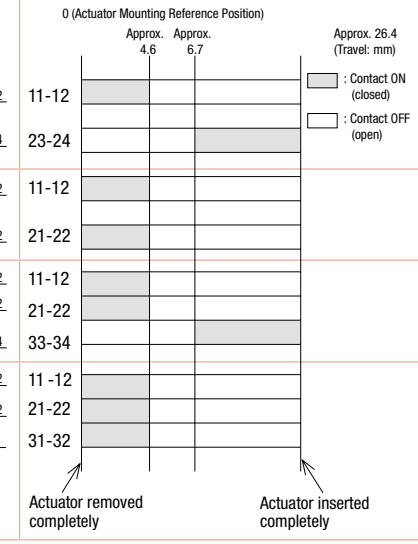
Actuator Keys (order separately)

Item	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A51A	Straight w/rubber bushings
	HS9Z-A52	Right-angle
	HS9Z-A52A	Right-angle w/rubber bushings
	HS9Z-A55	Angle Adjustable (vertical/horizontal)
	HS9Z-A5P	Plug Actuator
	HS9Z-SH5	Sliding Actuator
	HS9Z-PH5	Padlock Hasp

Actuators are not included and must be ordered separately.

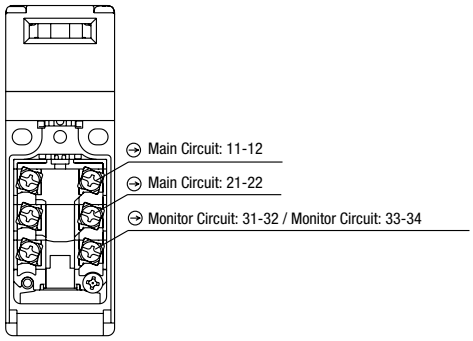
Contact Configuration & Operation Chart

Type	Contact Configuration	Contact Operation Chart (reference)
HS5D-11*	Main Circuit 11 12 Monitor Circuit 23 24	11-12 23-24
HS5D-02*	Main Circuit 11 12 Main Circuit 21 22	11-12 21-22
HS5D-12*	Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit 33 34	11-12 21-22 33-34
HS5D-03*	Main Circuit 11 12 Main Circuit 21 22 Monitor Circuit	11 -12 21-22 31-32



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

Terminal Arrangement



Specifications

Applicable Standards	ISO14119, EN1088, IEC60947-5-1, EN60947-5-1 (TÜV approval), GS-ET-15 (TÜV approval), UL508, CSA C22.2 No. 14, GB14048.5 (CCC approval), IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature	–30 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	4 kV
Contact Resistance	50 mΩ maximum (initial value)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum
Electric Shock Protection Class	Class II (IEC61140)
Degree of Protection	IP67 (IEC60529)
Shock Resistance	Damage limits: 1000 m/s^2
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.5 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	10 mm minimum
Direct Opening Force	50N minimum
Operating Frequency	900 operations per hour
Mechanical Durability	1,000,000 operations minimum (GS-ET-15)
Electrical Durability	100,000 operations minimum (AC-12 250V, 6A) 1,000,000 operations minimum (24V AC/DC,100 mA) (operation frequency: 900 operations per hour)
Performance of Terminals 11-12 of Removed Head Unit	Mechanical damage limits: 10 operations min. Insulation resistance: 100 MΩ (initial value) Dielectric strength: 1000V, 1 minute (initial value)
Conditional Short-circuit Current	100A (250V) (note)
Weight (approx.)	Plastic head: 80g Metal head: 110g

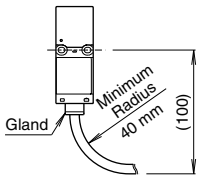
Contact Ratings

			30V	125V	250V
Rated Operating Current (I_e)	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
			(1A)	(0.22A)	(0.1A)

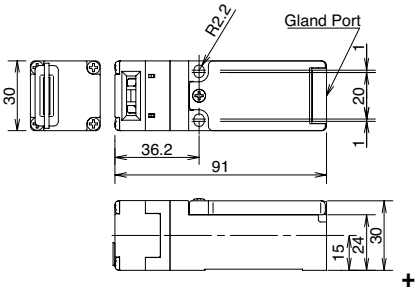
Installation Notes

Recommended Screw Torque

- Safety switch body installation (M4 screw): 1.0~1.5N-m
- Actuator installation (M4 screw): 1.0~1.5N-m

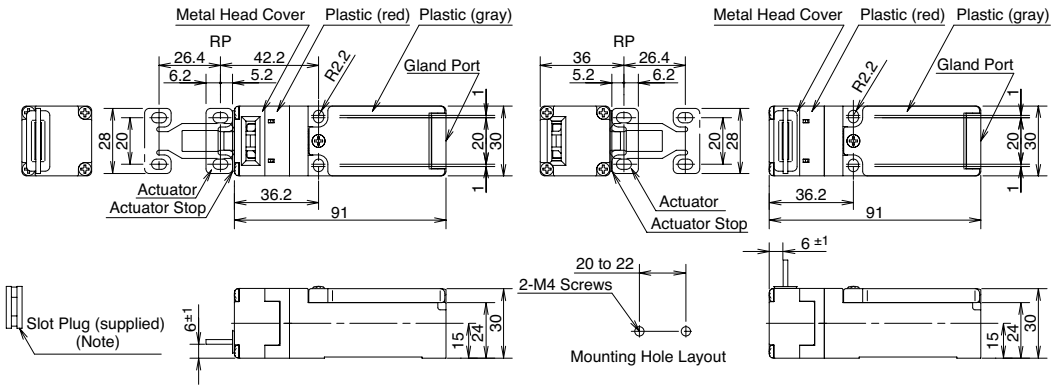


Dimensions and Mounting Hole Layouts

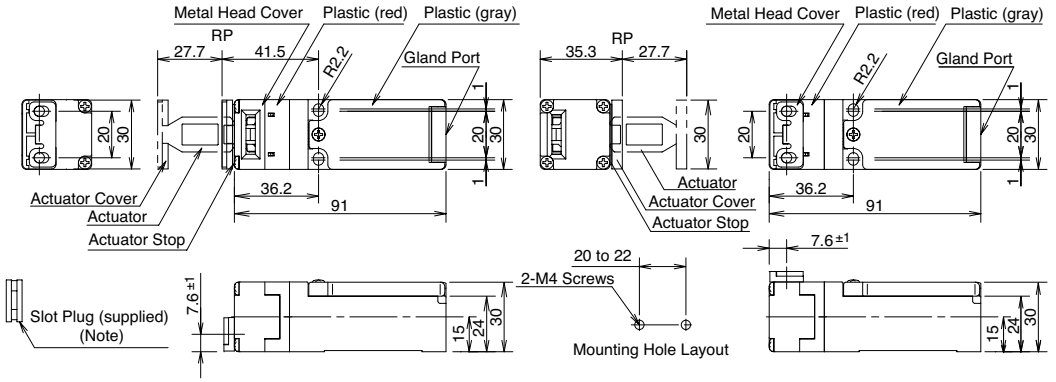


HS5D-□□ZRN□ (Metal Head)
With HS9Z-A51 Straight Actuator

RP: Reference mounting position.

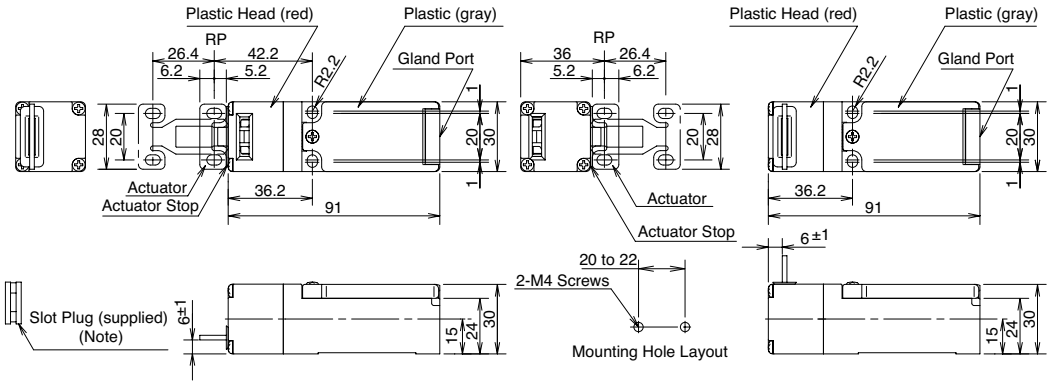


With HS9Z-A52 Right-angle Actuator

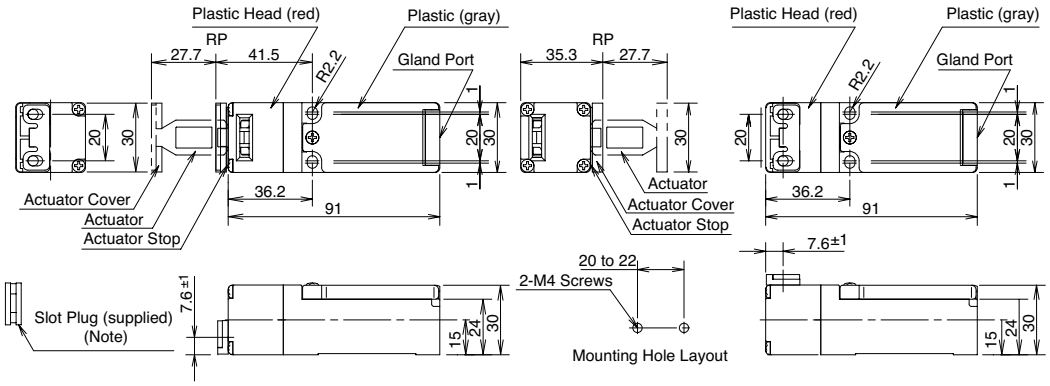


All dimensions in mm.

HS5D-□□RN□ (Plastic Head)
With HS9Z-A51 Straight Actuator



With HS9Z-A52 Right-angle Actuator

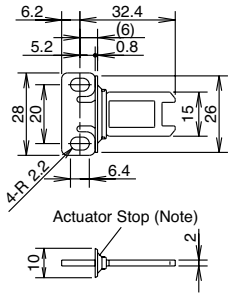


All dimensions in mm.

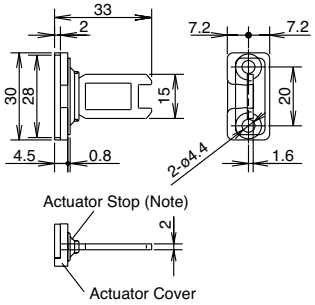
Note: Plug the unused actuator insertion slot using the slot plug supplied with the safety interlock switch.

Actuator Dimensions

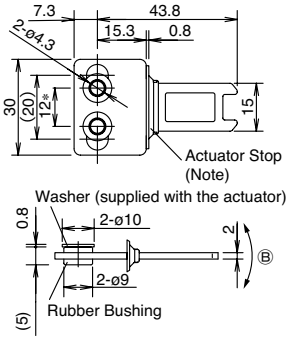
Straight (HS9Z-A51)



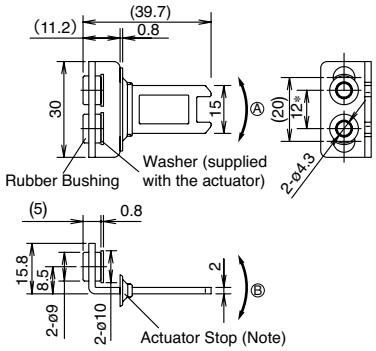
Right-angle (HS9Z-A52)



Straight w/rubber bushing (HS9Z-A51A)

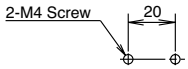


Right-angle w/rubber bushing (HS9Z-A52A)

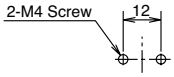


The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
ⒶⒷ The actuator has flexibility to the directions indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

Actuator Mounting Hole Layout (Straight, Right-angle)

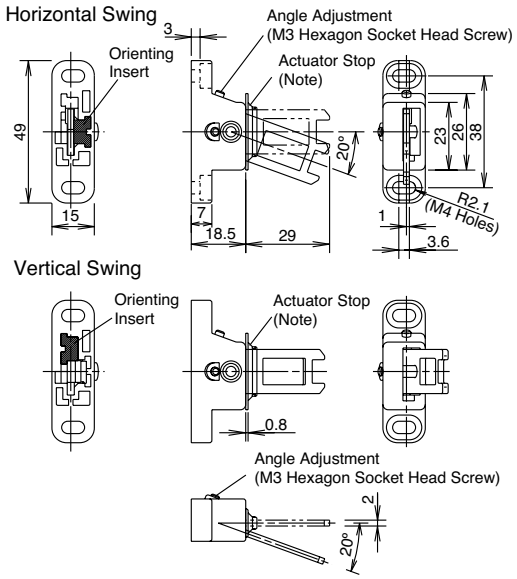


Actuator Mounting Hole Layout (Straight w/rubber bushing) (Right-angle w/rubber bushing)



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

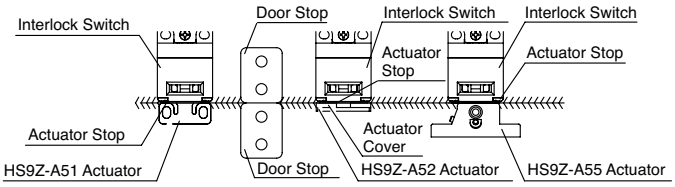
Angle Adjustable (HS9Z-A55)



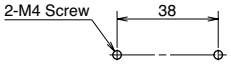
Actuator Mounting Reference Position

As shown in the figure below, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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



Actuator Mounting Hole Layout (Straight, Right-angle)



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

Actuator Orientation (Angle Adjustable)

The angle of actuator swing can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the orienting insert, otherwise the actuator will not operate properly.

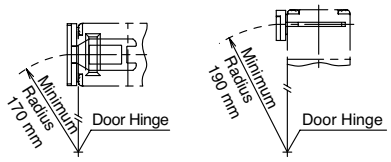
Minimum Radius of Hinged Door

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

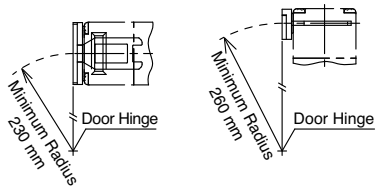
  Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

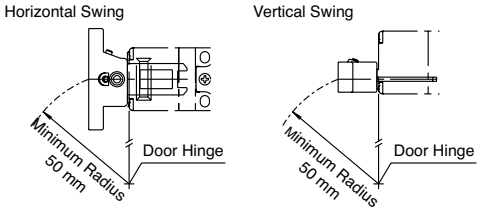


- When the door hinge is on the extension line of the actuator mounting surface:

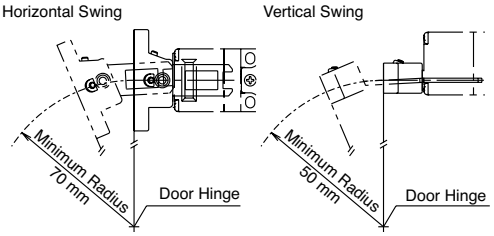


When using the HS9Z-A55 Angle Adjustable Actuator

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



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



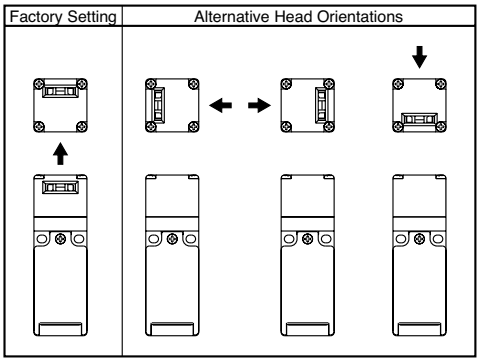
Actuator Angle Adjustment for the HS9Z-A55

- Using the angle adjustment screw, the actuator angle can be adjusted (see figures "Actuator Dimensions" on page 13). 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 loosen.

Instructions

Rotating the Head

- The head of the HS5D can be rotated by removing the four screws from the corners of the HS5D head and reinstalling the head in the desired orientation. When reinstalling the head, make sure that no foreign object enters the interlock switch. Tighten the screws tightly, because loose tightening may cause malfunction.
- Recommended screw tightening torque: 0.9 to 1.1 N·m



Head Removal Detection Function

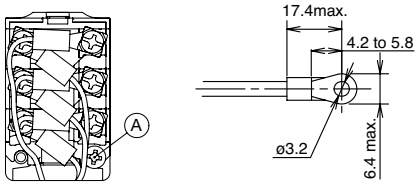
Only the NC contact of the main circuit (11-12) turns OFF (open) when the head is removed, such as when rotating the head. Because NC contacts of other than the main circuit (11-12) turn ON (closed), be sure to connect the main circuit (11-12) to the safety circuit.

Recommended Tightening Torque

- Interlock Switch Mounting Screw: 1.8 ± 2.2 N·m (two M4 screws)
- Housing Lid Screw: 0.2 to 0.4 N·m (M3 screw)
- Terminal Screw: 0.6 to 0.8 N·m (M3 screw)
- Connector: 2.7 to 3.3 N·m
- Actuators
  HS9Z-A51: 1.8 ± 2.2 N·m (two M4 screws)
  HS9Z-A52: 0.8 ± 1.2 N·m (two M4 Phillips screws)
  HS9Z-A51A/A52A: 1.0 to 1.5 N·m (two M4 screws)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)
- The above recommended tightening torques of the mounting screws are the values confirmed with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not come loose after mounting.
- Mounting bolts must be provided by the user.
- To avoid unauthorized or unintended removal of the interlock switch and the actuator, it is recommended that the interlock switch and the actuator be installed in an unremovable manner, for example using special screws or welding the screws.

Applicable Crimping Terminal

When using crimping terminals, be sure to install insulation tubes on the crimping terminals to prevent electric shocks. When using stranded wires, make sure that loose wires do not cause short circuit. Also do not solder the terminal to prevent loose wires.



Applicable wire size (with insulation tube): 0.2 to 0.5 mm^2 (20 ~ 24 AWG)

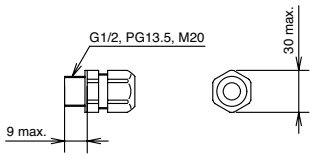
Note: Do not remove screw A during wiring. Removing the screw may cause malfunction or damage.

Applicable Wire Size

0.5 to 1.5 mm^2 (16 ~ 20 AWG)

Applicable Cable Glands

Use a cable gland with a degree of protection IP67.



HS2B Full Size Interlock Switches

Key features:

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

EN1088
EN60947-5-1
IEC60947-5-1

GS-ET-15
BG standard in Germany

Direct Opening Action

Double Insulation

Part Numbers
Body

Model		Contact Configuration	Pilot Light	Part Number
	HS2B (plastic housing)	1NC-1NO	Without	HS2B-11NB
			With red LED	HS2B-114NB-R
			With green LED	HS2B-114NB-G

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

Actuator Keys & Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator
	HS9Z-P1	Conduit Opening Plug

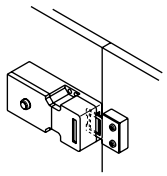
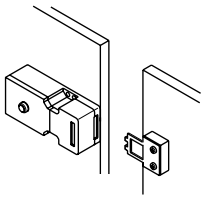
Specifications

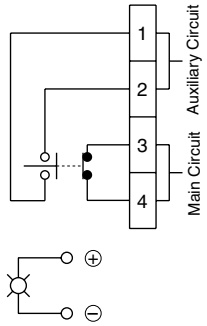
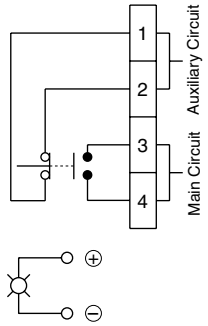
Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508
Operating Temperature		–25 to +70°C (no freezing)
Storage Temperature		–40 to +80°C
Operating Humidity		85% RH maximum (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (Ui)		300V (between LED and ground: 60V)
Impulse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

Contact Ratings

Rated Operating Current (Ie)	Operating Voltage (Ue)		30V	125V	250V
	AC	Resistive load (AC12)	10A	10A	6A
		Inductive load (AC15)	10A	5A	3A
	DC	Resistive load (DC12)	8A	2.2A	1.1A
		Inductive load (DC13)	4A	1.1A	0.6A

Application Examples and Circuit Diagrams

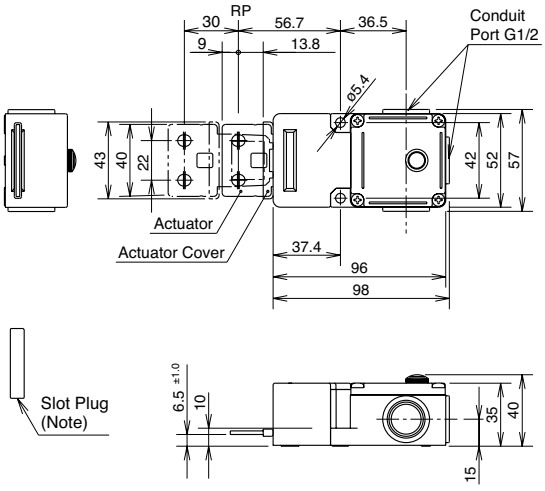
	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
Door		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
HS2B-11 (1NO-1NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

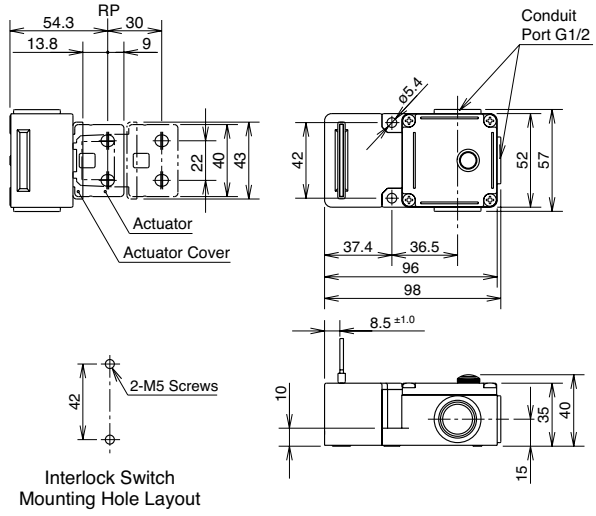
1. Main Circuit: used to enable the machine to start only when the main circuit is closed. Auxiliary Circuit: used to indicate whether the main circuit or door is open or closed.
2. Terminals + and - are used for the LED indicator, and are isolated from door status.

Dimensions (mm)
Using the straight actuator (HS9Z-A1)

(Horizontal Mounting)



(Vertical Mounting)

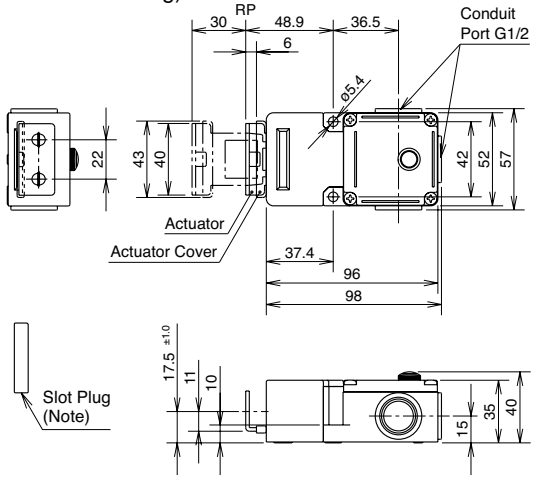


Interlock Switch Mounting Hole Layout

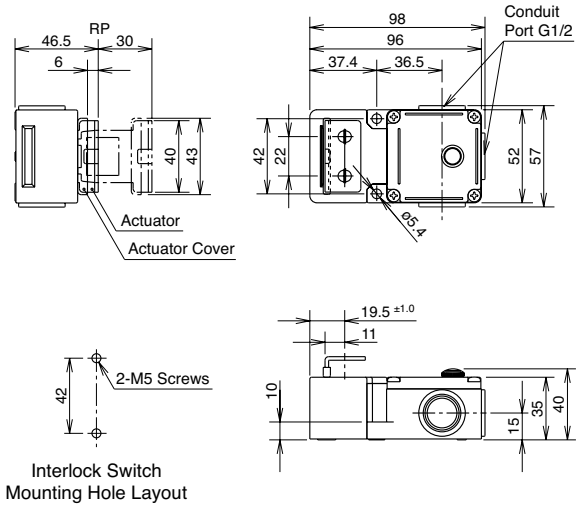
Dimensions (mm), continued

Using the Right-angle actuator (HS9Z-A2)

(Horizontal Mounting)



(Vertical Mounting)

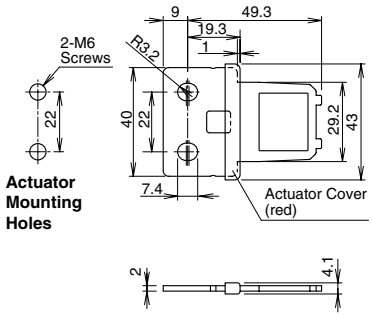


Interlock Switch Mounting Hole Layout

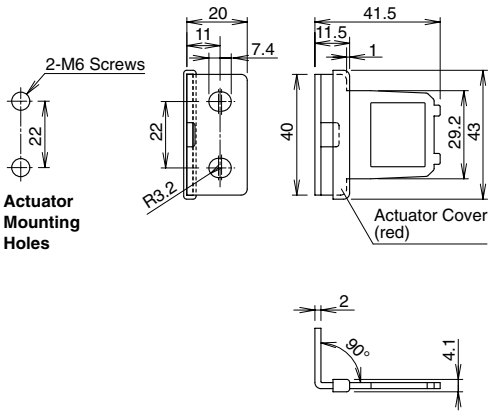
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

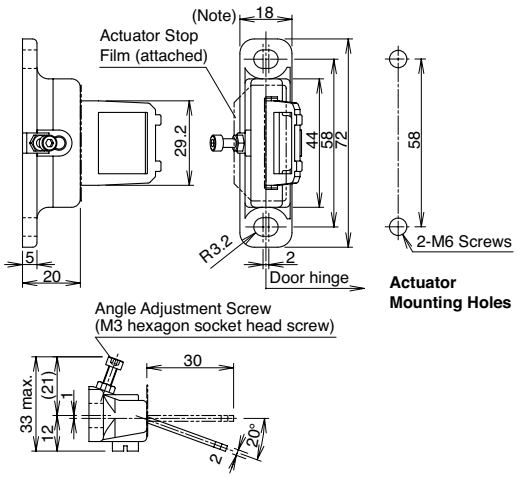
Straight Actuator HS9Z-A1



Right-angle Actuator HS9Z-A2



Angle-adjustable Actuator HS9Z-A3



Adjustable Actuator

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

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

Actuator Angle Adjustment

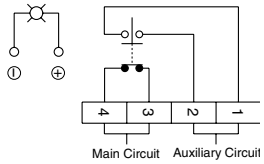
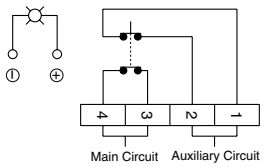
- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0˚) to 20˚
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.
- Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)
- After adjusting the actuator angle, apply loctite or the like to the adjustment screw to prevent it from loosening.

HS1B Full Size Interlock Switches

Key features:

- Rugged aluminum die-cast housing
- Direct Opening Action
- Available with or without an indicator (red or green)
- Flexible Installation: Two actuator entries and three conduit ports are provided
- Select from two circuit configurations (1NO-1NC or 2NC).
- IP67

Part Numbers
Body

Model	Contact Configuration	Pilot Light	Part Number
	1NC-1NO	Without	**HS1B-11R**
		Red LED	HS1B-114R-R
		Green LED	HS1B-114R-G
	2NC	Without	**HS1B-02R**
		Red LED	HS1B-024R-R
		Green LED	**HS1B-024R-G**

Standard stock items in bold.

Actuator Keys and Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator (Mainly for sliding doors)
	HS9Z-A2	Right-angle Actuator (Mainly for rotating doors)
	HS9Z-A3	Adjustable Actuator
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug

Actuators are not included and must be ordered separately.

Specifications

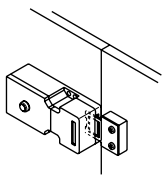
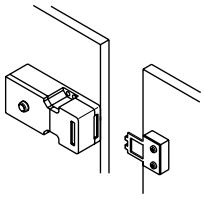
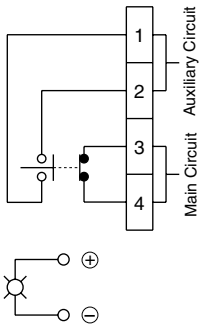
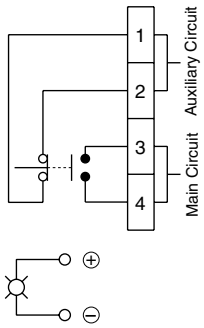
Conforming to Standards		IEC60947-5-1, EN60947-5-1, GS-ET-15, UL508, CSA C22.2 No. 14
Operating Temperature		–20 to +70°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		45 to 85% (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (U_i)		300V (between LED and ground: 60V)
Impulse Withstand Voltage (U_{imp})		4 kV (between LED and ground: 2.5 kV)
Insulation Resistance		Between live and dead metal parts: 100 MΩ minimum Between live metal part and ground: 100 MΩ minimum Between live metal parts: 100 MΩ minimum Between terminals of the same pole: 100 MΩ minimum
Electric Shock Protection Class		Class I (IEC61140)
Pollution Degree		3 (IEC60947-5-1)
Degree of Protection		IP67 (IEC60529)
Vibration Resistance	Operating Extremes	10 to 55 Hz, amplitude 0.5mm p-p
	Damage Limits	60 m/sec^2 (approx. 6G)

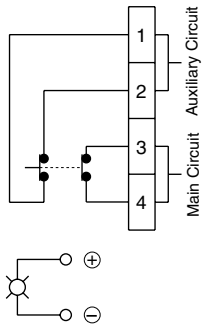
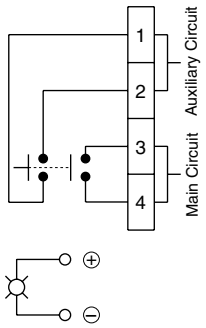
Shock Resistance		1,000 m/sec^2 (approx. 100G)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11 mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		10A
Operating Frequency		900 operations/hour
Mechanical Life		1,000,000 operations
Electrical Life		100,000 operations (rated load)
Conditional Short-circuit Current		100A (IEC60947-5-1)
Recommended Short Circuit Protection		250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)
Indicator	Operating Voltage	24V DC
	Current	10 mA
	Light Source	LED lamp
	Lens Color	Red or Green (12 mm dia. Lens)
Weight		Approx. 280g

Contact Ratings

Rated Operating Current (I_e)	Operating Voltage (U_e)		30V	125V	250V
	AC	Resistive load (AC12)	10A	10A	6A
		Inductive load (AC15)	10A	5A	3A
	DC	Resistive load (DC12)	8A	2.2A	1.1A
		Inductive load (DC13)	4A	1.1A	0.6A

Application Examples and Circuit Diagrams

	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
Door		
HS1B-11 (1NO-1NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed

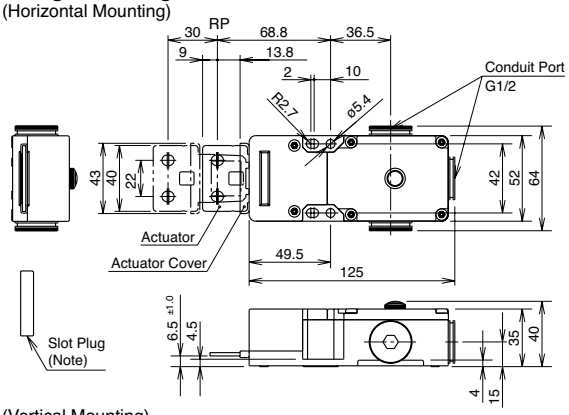
	Status 1	Status 2
Door/ Switch Status	Door Closed Machine ready to operate	Door opened Machine cannot be started
HS1B-02 (2NC) Circuit Diagram		
Main Circuit	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Open

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

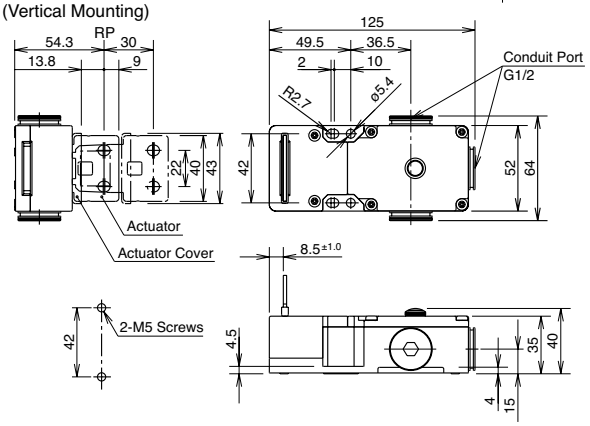
Dimensions (mm)

Using the straight actuator (HS9Z-A1)

(Horizontal Mounting)

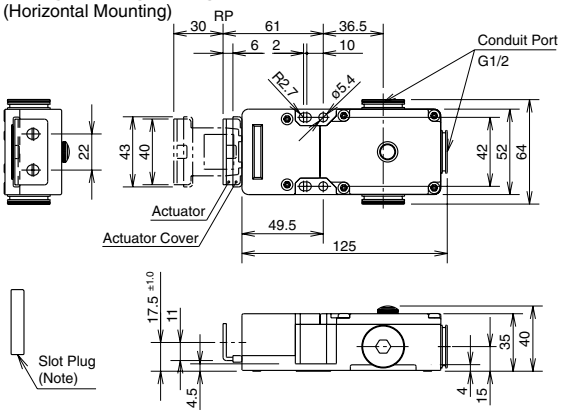


(Vertical Mounting)

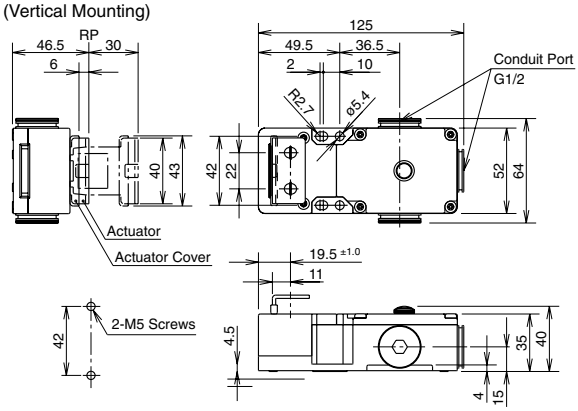


Using the Right-angle actuator (HS9Z-A2)

(Horizontal Mounting)



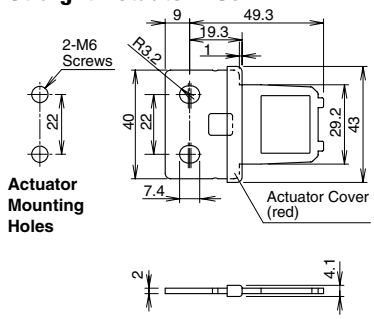
(Vertical Mounting)



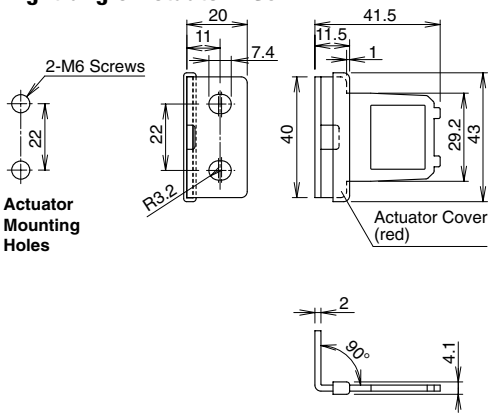
Plug the unused actuator insertion slot using the slot plug supplied with the interlock switch.

Actuator Dimensions

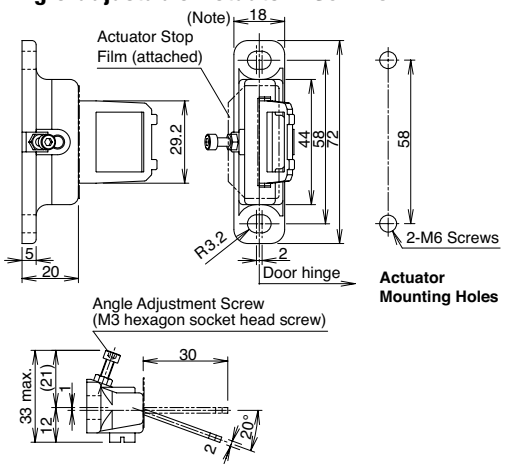
Straight Actuator HS9Z-A1



Right-angle Actuator HS9Z-A2



Angle-adjustable Actuator HS9Z-A3



Adjustable Actuator

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

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

Actuator Angle Adjustment

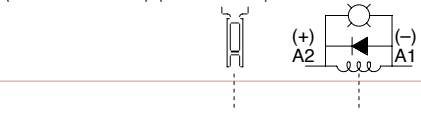
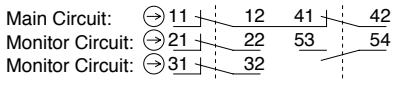
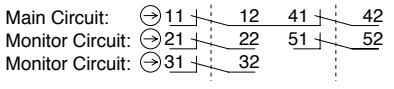
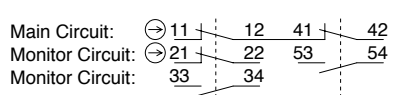
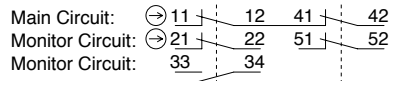
- Using the screw (M3 hex socket head screw), the actuator angle can be adjusted (refer to the dimensional drawing). Adjustable angle: (0˚) to 20˚
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can be inserted properly into the entry slot of the safety switch.
- Recommended tightening torque: 0.8 N-m (approx. 8.0 kgf-cm)
- After adjusting the actuator angle, apply loctite or the like to the adjustment screw to prevent it from loosening.

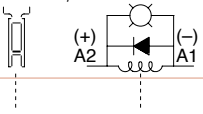
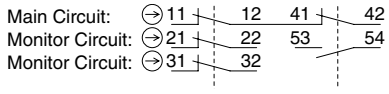
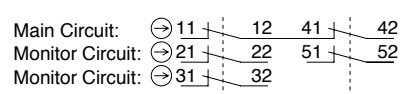
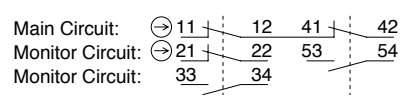
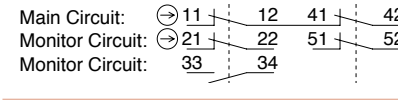
HS6E Subminiature Interlock Switches with Solenoid

Key features:

- Compact body: 75 × 15 × 75mm
  15mm wide, thinnest solenoid interlock switch in the world
- Reversible mounting and angled cable allow four actuator insertion directions
- Energy saving: 24V DC, 110mA (solenoid: 100mA, LED: 10mA)
- Manual unlocking possible on three sides
- LED indicator shows solenoid operation
- 500N locking retention force

Part Numbers

Mechanical Spring Lock (power solenoid to unlock)		
Contact Configuration	Cable Length	Part Number
(Actuator inserted) (Solenoid OFF) 		
	1m 3m 5m	HS6E-L44B01-G **HS6E-L44B03-G** HS6E-L44B05-G
	1m 3m 5m	HS6E-M44B01-G **HS6E-M44B03-G** HS6E-M44B05-G
	1m 3m 5m	HS6E-N44B01-G **HS6E-N44B03-G** HS6E-N44B05-G
	1m 3m 5m	HS6E-P44B01-G **HS6E-P44B03-G** HS6E-P44B05-G

Solenoid Lock (remove power to solenoid to unlock)		
Contact Configuration	Cable Length	Part Number
(Actuator inserted) (Solenoid ON) 		
	1m 3m 5m	HS6E-L7Y4B01-G **HS6E-L7Y4B03-G** HS6E-L7Y4B05-G
	1m 3m 5m	HS6E-M7Y4B01-G **HS6E-M7Y4B03-G** HS6E-M7Y4B05-G
	1m 3m 5m	HS6E-N7Y4B01-G **HS6E-N7Y4B03-G** HS6E-N7Y4B05-G
	1m 3m 5m	HS6E-P7Y4B01-G **HS6E-P7Y4B03-G** HS6E-P7Y4B05-G

1. Contact configuration shows the contact status when actuator is inserted and solenoid off for spring lock.
2. Contact configuration shows the contact status when actuator is inserted and solenoid on for solenoid lock.
3. Indicator LED color is green.
4. Actuator keys are not supplied with the interlock switch and must be ordered separately.
5. Standard stock items in bold.

Actuator Keys

Appearance	Item	Ordering Part Number	Remarks
	Straight Actuator	HS9Z-A61	The retention force of HS9Z-A61 actuator is 500N maximum. Do not apply excessive load.
	Right-angle Actuator	HS9Z-A62	The retention force of HS9Z-A62 actuator is 100N maximum. Do not apply excessive load. When retention force of 100N or more is required, use the HS9Z-A62S actuator.
	Right-angle Actuator with Mounting Plate	HS9Z-A62S	The retention force of HS9Z-A62S actuator is 500N maximum. Do not apply excessive load.
	Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A65	The HS9Z-A65 and HS9Z-A66 have their metal actuator installed in opposite directions. Select actuator by determining the required moving direction in consideration of the door and interlock switch. See page 294 for more information. The retention force of HS9Z-A65 and HS9Z-A66 500N maximum.
	Horizontal/Vertical Angle Adjustable Actuator	HS9Z-A66	

Accessory

Description	Part Number
Manual Unlock Key (long type)	HS9Z-T3

Specifications

Conforming to Standards		UL 508 (UL listed), CSA C22.2, No. 14 (c-UL listed), ISO 14119 IEC 60947-5-1, EN 60947-5-1 (TÜV approval), EN 1088 (TÜV approval), GS-ET-19 IEC 60204-1/EN 60204-1 (applicable standards for use)
Operating Temperature		–25 to +50°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Operating Humidity		45 to 85% (no condensation)
Rated Insulation Voltage (U_i)		300V (between LED and ground: 60V)
Impulse Withstand Voltage (U_{imp})		Main & lock monitor circuits: 1.5 KV Door monitor circuit: 2.5 kV Between solenoid/LED and ground: 0.5 kV
Insulation Resistance (500V DC megger)		Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum.
Contact Resistance		300 mΩ maximum (initial value, 1m cable) 500 mΩ maximum (initial value, 3m cable) 700 mΩ maximum (initial value, 5m cable)
Electric Shock Protection Class		Class II (IEC 61140)
Pollution Degree		3
Degree of Protection		IP67 (IEC 60529)
Vibration Resistance	Operating Extremes	10 to 55 Hz, amplitude 0.35mm
	Damage Limits	30 Hz, amplitude 1.5 mm
Shock Resistance	Operating Extremes	100 m/s^2 (10G)
	Damage Limits	1000 m/s^2 (100G)
Actuator Operating Speed		0.05 to 1.0 m/s
Direct Opening Travel		8.0 mm minimum

Direct Opening Force	60N minimum
Actuator Retention Force	500N maximum (GS-ET-19)
Operating Frequency	900 operations/hour
Mechanical Life	1,000,000 operations minimum (GS-ET-19)
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA) (operating frequency 900 operations/hr)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short-circuit protection.)
Cable	22 AWG (12-core: 0.3 mm^2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight	Approx. 200g

1. UL, c-UL rating: Main/Lock monitor circuit: 125V AC, 1A Pilot duty, 125V DC, 0.22A Pilot duty
   Door monitor circuit:240V AC, 0.75A Pilot duty250V DC, 0.27A Pilot duty
2. TÜV rating: Main/Lock monitor circuit: AC-15 125V/1A, DC-13 125V/0.22A
   Door monitor circuit: AC-15 240V/0.75A, DC-13 250V/0.27A

Solenoid/Indicator

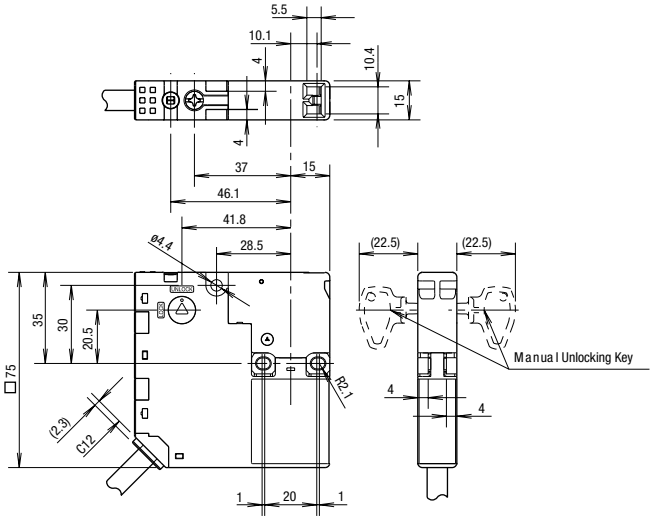
Locking Mechanism		Spring Lock Type or Solenoid Lock Type
Rated Voltage		24V DC
Current		110 mA (solenoid 100 mA, LED 10 mA)
Solenoid	Coil Resistance	240Ω (at 20°C)
	Pickup Voltage	Rated voltage × 85% maximum (at 20°C)
	Dropout Voltage	Rated voltage × 10% minimum (at 20°C)
	Maximum Continuous Applicable Voltage	Rated voltage × 110%
	Maximum Continuous Applicable Time	Continuous
	Insulation Class	Class F
Indicator	Light Source	LED
	Illumination Color	Green

Contact Ratings

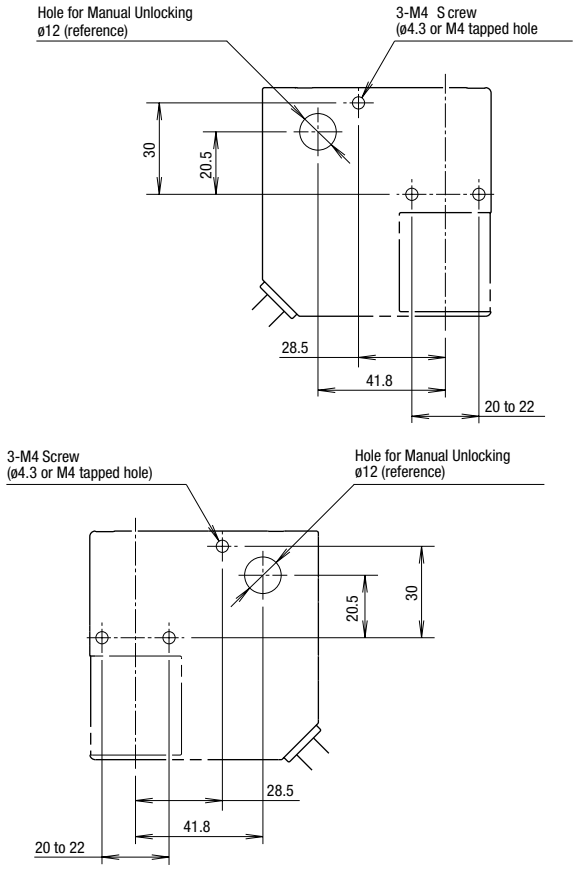
	Operating Voltage (U_e)			**30V**	**125V**	**250V**
Rated Operating Current (I_e)	Main and Lock Monitor Circuits	AC	Resistive load (AC-12) Inductive load (AC-15)	–	2A 1A	–
		DC	Resistive load (DC-12) Inductive load (DC-13)	2A 1A	0.4A 0.22A	–
	Door Monitor Circuit	AC	Resistive load (AC-12) Inductive load (AC-15)	–	2.5A 1.5A	1.5A 0.75A
		DC	Resistive load (DC-12) Inductive load (DC-13)	2.5A 2.3A	1.1A 0.55A	0.55A 0.27A

1. UL, c-UL rating: Main/Lock monitor circuit: 125V AC, 1A Pilot duty, 125V DC, 0.22A Pilot duty
   Door monitor circuit:240V AC, 0.75A Pilot duty250V DC, 0.27A Pilot duty
2. TÜV rating: Main/Lock monitor circuit: AC-15 125V/1A, DC-13 125V/0.22A
   Door monitor circuit: AC-15 240V/0.75A, DC-13 250V/0.27A

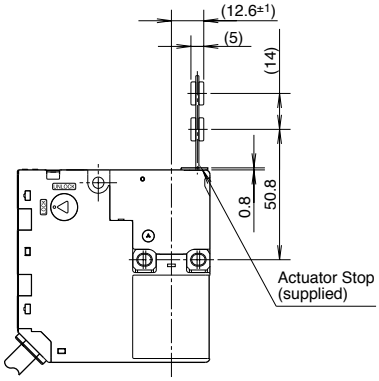
Dimensions (mm)
Interlock Switch



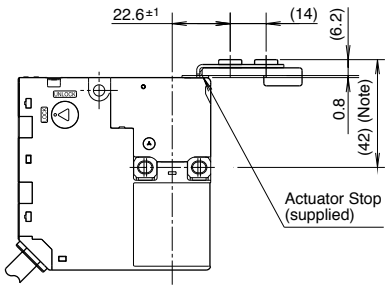
Mounting Hole Layout



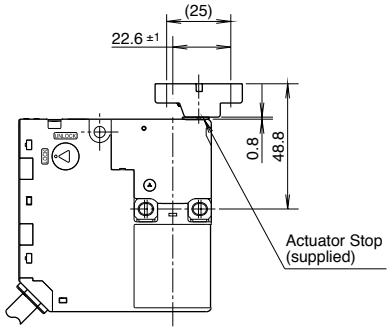
When using straight actuator (HS9Z-A61)



When using right-angle actuator (HS9Z-A62)



When using horizontal/vertical angle adjustable actuator (HS9Z-A65/A66)

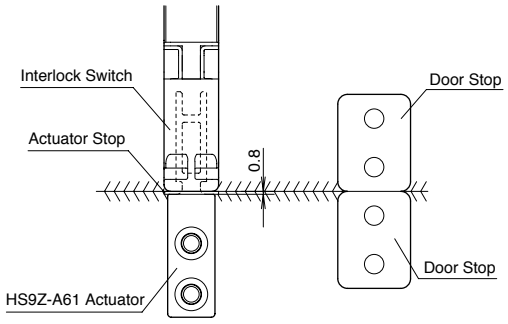


Actuator Mounting Reference Position

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

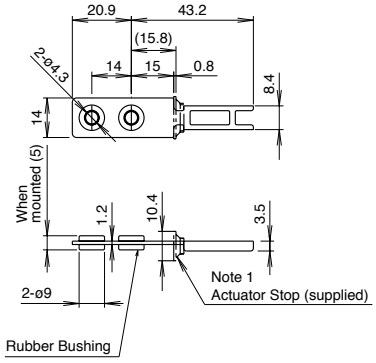
The actuator stop on the actuator lightly touches the interlock switch.

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



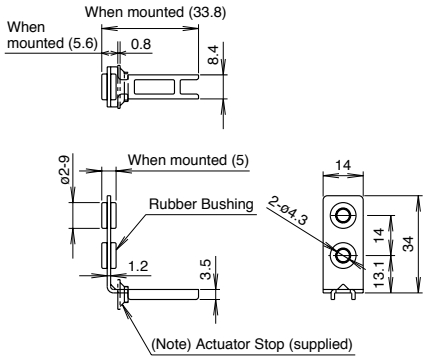
Actuator Key Dimensions (mm)

Straight Actuator (HS9Z-A61)



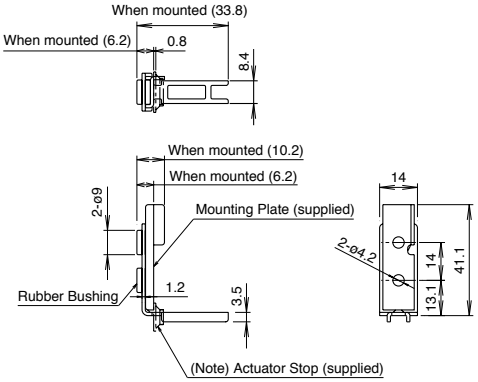
Straight Actuator (HS9Z-A61) Right-angle Actuator (HS9Z-A62)

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



Right-angle Actuator with Mounting Plate (HS9Z-A62S)

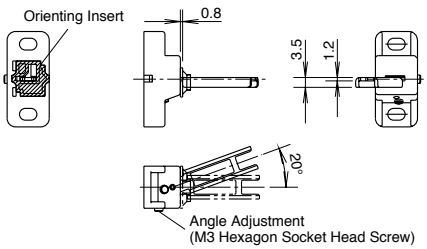
Note: See page 297 for actuator installation.



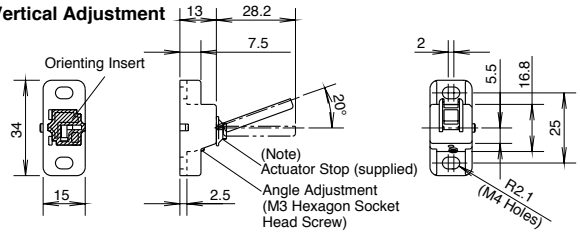
The actuator stop is used to adjust the actuator position. Remove after the actuator position is mounted.

Angle Adjustable Actuator (HS9Z-A65)

Horizontal Adjustment



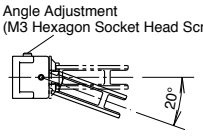
Vertical Adjustment



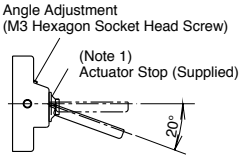
Angle Adjustable Actuator (HS9Z-A66)

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

Horizontal Adjustment

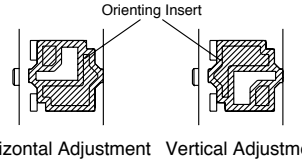


Vertical Adjustment



Actuator Adjustment Orientation

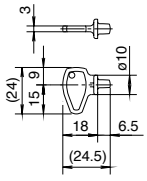
The orientation of actuator adjustment (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator.



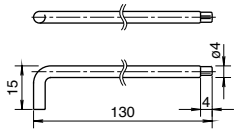
Angle Adjustable Actuator (HS9Z-A65)

Manual Unlock Key (plastic)

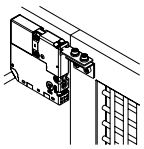
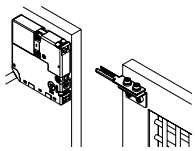
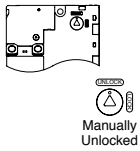
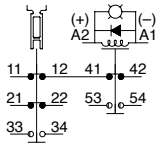
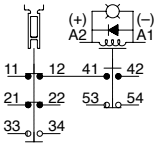
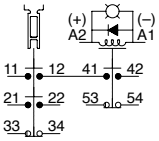
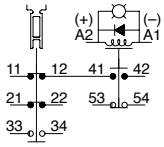
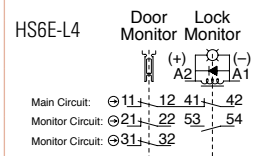
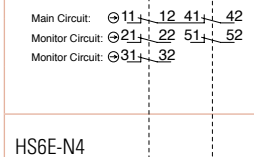
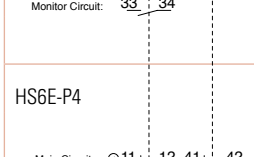
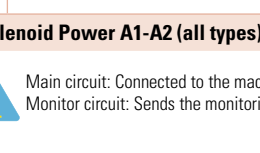
(supplied with switch, not replaceable)



Manual Unlock Key, HS9Z-T3 (metal)

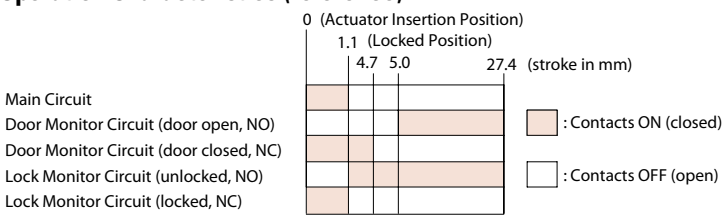


Circuit Diagrams and Operating Characteristics

Spring Lock Type	Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status	Door closed **Machine ready to operate** Solenoid de-energized	Door opened Machine cannot be operated Solenoid energized	Door open Machine cannot be operated Solenoid energized	Door open Machine cannot be operated Solenoid de-energized	Door closed Machine cannot be operated Solenoid de-energized
Door Status					
Circuit Diagram (Example: HS6E-N4)					
Door	**Closed (locked)**	**Closed (unlocked)**	**Open**	**Open**	**Closed (unlocked)**
Part Number and Circuit Diagram: HS6E-L4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-M4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS6E-N4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (unlocked) 53-54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-P4 	Main Circuit 11-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (locked) 51-52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)		**OFF (de-energized)**	**ON (energized)**	**ON (energized)**	**OFF (de-energized)**	**OFF (de-energized)**

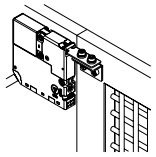
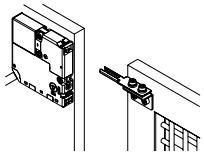
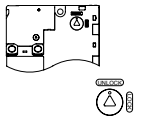
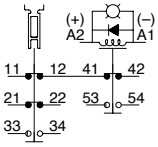
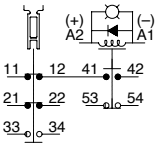
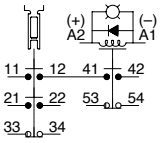
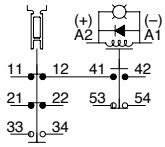
Main circuit: Connected to the machine drive control circuit, sending the interlock signals of the protective door.
Monitor circuit: Sends the monitoring signals of open/closed and lock/unlocked statuses of the protective door.

Operation Characteristics (reference)



The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

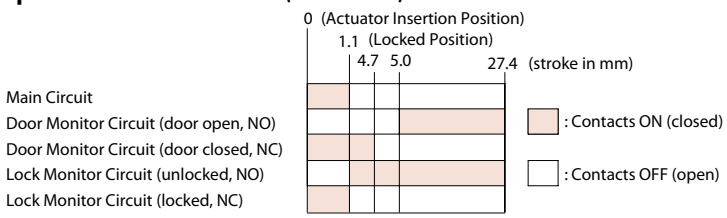
Solenoid Lock Type

	Status 1	Status 2	Status 3	Status 4	Unlocking Using Manual Unlock Key
Interlock Switch Status	Door closed **Machine ready to operate** Solenoid energized	Door closed Machine cannot be operated Solenoid de-energized	Door open Machine cannot be operated Solenoid de-energized	Door open Machine cannot be operated Solenoid de-energized	Door open Machine cannot be operated Solenoid de-energized
Door Status					
Circuit Diagram (Example: HS6E-N7Y)					
Door	**Closed (locked)**	**Closed (unlocked)**	**Open**	**Open**	**Closed (unlocked)**
Part Number and Circuit Diagram — HS6E-L7Y	Main Circuit 11-42: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (unlocked) 53-54: OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-M7Y	Main Circuit 11-42: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door closed) 31-32: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Lock Monitor Circuit (locked) 51-52: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS6E-N7Y	Main Circuit 11-42: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34: OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (unlocked) 53-54: OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS6E-P7Y	Main Circuit 11-42: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
	Door Monitor Circuit (door closed) 21-22: ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
	Door Monitor Circuit (door open) 33-34: OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
	Lock Monitor Circuit (locked) 51-52: ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	**ON (energized)**	**OFF (de-energized)**	**OFF (de-energized)**	**ON (energized) (Note 2)**	OFF (de-energized) to ON (re-energized) (Note 1) (Note 2)

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

Note 1: Do not attempt manual unlocking while the solenoid is energized.
Note 2: Do not energize the solenoid for a long period of time while the door is open or while the door is unlocked manually using the manual unlock key.

Operation Characteristics (reference)



The characteristics shown in the chart above are of the HS9Z-A61, -A62, -A65, and -A66 actuators. For the HS9Z-A62S actuator, subtract 0.6 mm.
The characteristics show the contact status when the actuator enters an entry slot of an interlock switch.

Operating Instructions

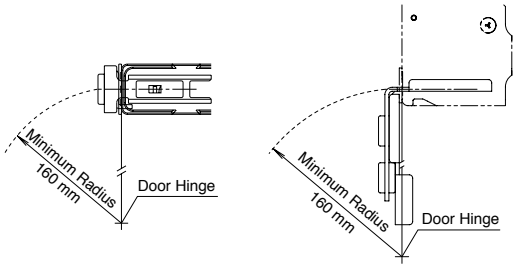
Minimum Radius of Hinged Door

- When using the interlock switch on hinged doors, refer to the minimum radius of doors shown below. When using on doors with small minimum radius, use the angle adjustable actuator (HS9Z-A65 and HS9Z-A66).

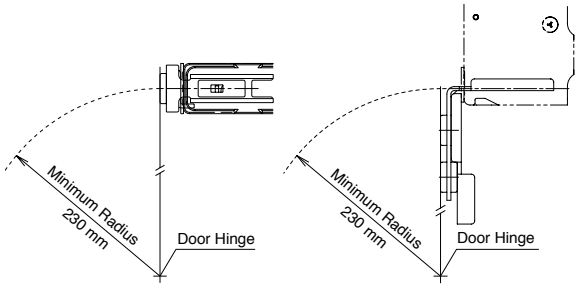
Note: Because deviation or dislocation of hinged doors may occur in actual applications, make sure of the correct operation before installation.

When Using the HS9Z-A62/A62S Right-angle Actuator

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



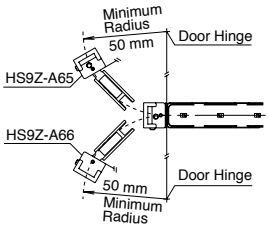
- When door hinge is on the extension line of the actuator mounting surface:



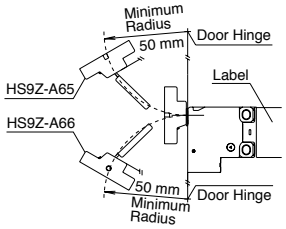
When using the HS9Z-A65/HS9Z-A66 Angle Adjustable Actuator

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

Horizontal Adjustment

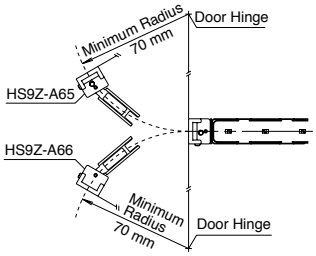


Vertical Adjustment

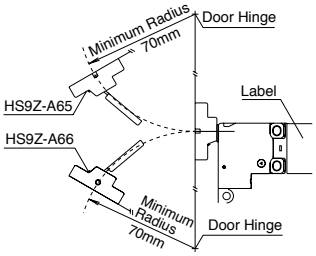


- When door hinge is on the extension line of the actuator mounting surface

Horizontal Adjustment



Vertical Adjustment

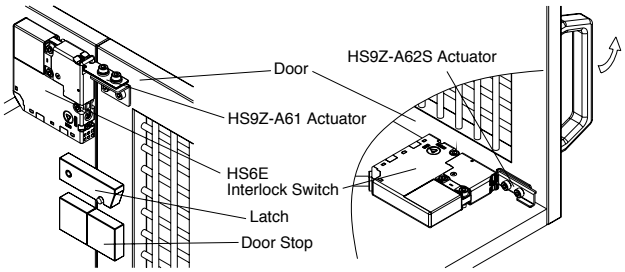


Actuator Angle Adjustment for the HS9Z-A65/HS9Z-A66

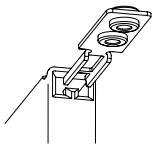
- Using the angle adjustment screw, the actuator angle can be adjusted (see figures on page 370).
  Adjustable angle: 0 to 20°
- The larger the adjusted angle of the actuator, the smaller the applicable radius of the door opening.
- After installing the actuator, open the door. Then adjust the actuator so that its edge can enter properly into the actuator entry slot of the interlock switch.
- After adjusting the actuator angle, apply Loctite to the adjustment screw so that the screw will not become loose.

Mounting Examples

Application on Sliding Doors **Application on Hinged Doors**

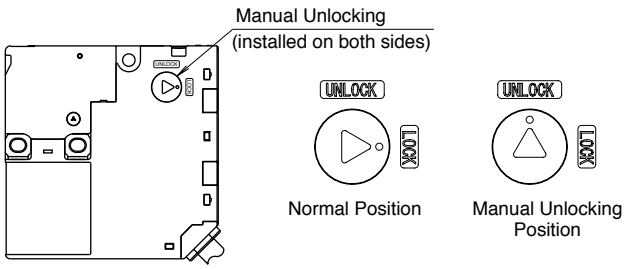


Note: When mounting the actuator, make sure that the actuator enters the slot in the correct direction, as shown on the right.



For Manual Unlocking

When using the manual unlock key



- Using the interlock switch with the actuator not fully turned (less than 90°) may cause damage to the interlock switch or operation failures (when manually unlocked, the switch will keep the main circuit disconnected and the door unlocked).
- Do not apply excessive force (0.45 N·m or more) to the manual unlock part, otherwise the manual unlock part will become damaged.

Manual Unlock Key
(supplied with the interlock switch)

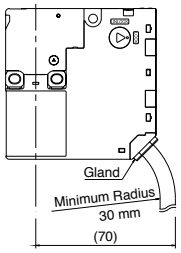
See instruction manual for full details.

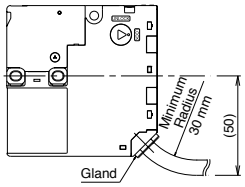
Recommended Tightening Torque of Mounting Screws

- Interlock switch: 1.0 to 1.5 N·m (three M4 screws)
- Actuators: 1.0 to 1.5 N·m (two M4 screws)

Cables

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





Wire Identification

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

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

Terminal Number Identification

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

Type	Contact Arrangement
HS6E-L	Door Monitor / Lock Monitor (+) White A2 (–) A1 Black Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 53 54 Pink/White Monitor circuit: Orange 31 32 Orange/White
HS6E-M	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 51 52 Pink/White Monitor circuit: Orange 31 32 Orange/White
HS6E-N	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 53 54 Pink/White Monitor circuit: Orange 33 34 Orange/White
HS6E-P	Main circuit: Blue 11 12 41 42 Blue/White Monitor circuit: Brown 21 22 Brown/White Pink 51 52 Pink/White Monitor circuit: Orange 33 34 Orange/White

Note: The contact arrangements show the contact status when the actuator is inserted and locked.

HS5E Miniature Interlock Switches with Solenoid

Spring Lock Type Features:

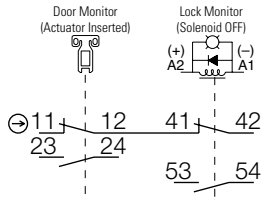
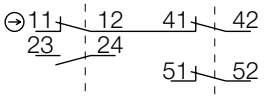
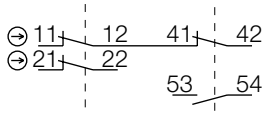
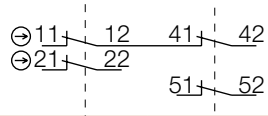
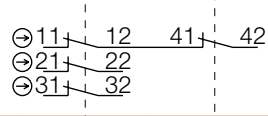
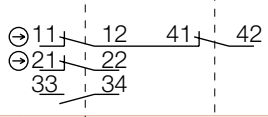
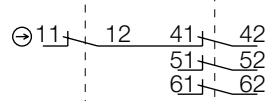
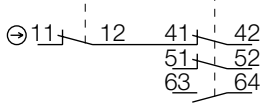
- Automatically locks the actuator without power applied to the solenoid
- After the machine stops, unlocking is completed by the solenoid, providing high safety features
- Manual unlocking is possible in the event of power failure or maintenance
- Gold-plated contacts

Solenoid Lock Type Features:

- The actuator is locked when energized
- The actuator is unlocked when de-energized
- Flexible locking function can be achieved for an application where locking is not required and sudden stopping of machine must be prevented
- Gold-plated contacts

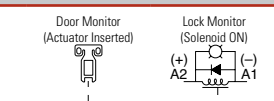
Part Numbers

Spring Lock Type (Power Solenoid to VA Lock)

Circuit Code	Contact Configuration	Cable Length	Part Number		
			Without LED	With LED	With LED and Rear Unlock Button
A **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NO**		1m	HS5E-A4001	HS5E-A4401-G	HS5E-A44L01-G
		3m	HS5E-A4003	HS5E-A4403-G	HS5E-A44L03-G
		5m	HS5E-A4005	HS5E-A4405-G	HS5E-A44L05-G
B **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NC**		1m	HS5E-B4001	HS5E-B4401-G	
		3m	HS5E-B4003	HS5E-B4403-G	
		5m	HS5E-B4005	HS5E-B4405-G	
C **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NO**		1m	HS5E-C4001	HS5E-C4401-G	HS5E-C44L01-G
		3m	HS5E-C4003	HS5E-C4403-G	HS5E-C44L03-G
		5m	HS5E-C4005	HS5E-C4405-G	HS5E-C44L05-G
D **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NC**		1m	HS5E-D4001	HS5E-D4401-G	HS5E-D44L01-G
		3m	HS5E-D4003	HS5E-D4403-G	HS5E-D44L03-G
		5m	HS5E-D4005	HS5E-D4405-G	HS5E-D44L05-G
F **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-F4001	HS5E-F4401-G	HS5E-F44L01-G
		3m	HS5E-F4003	HS5E-F4403-G	HS5E-F44L03-G
		5m	HS5E-F4005	HS5E-F4405-G	HS5E-F44L05-G
G **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-G4001	HS5E-G4401-G	HS5E-G44L01-G
		3m	HS5E-G4003	HS5E-G4403-G	HS5E-G44L03-G
		5m	HS5E-G4005	HS5E-G4405-G	HS5E-G44L05-G
H **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-H4001	HS5E-H4401-G	
		3m	HS5E-H4003	HS5E-H4403-G	
		5m	HS5E-H4005	HS5E-H4405-G	
J **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-J4001	HS5E-J4401-G	
		3m	HS5E-J4003	HS5E-J4403-G	
		5m	HS5E-J4005	HS5E-J4405-G	

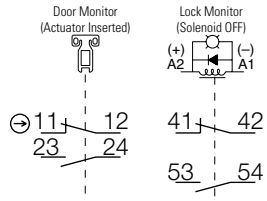
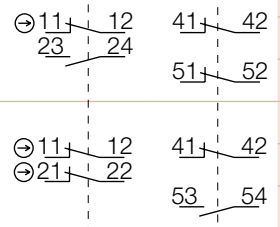
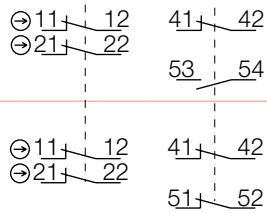
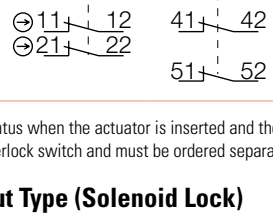
The contact configuration shows the status when the actuator is inserted and the switch is locked.
The contact configuration shows the status when the indicator is installed.
Actuators are not supplied with the interlock switch and must be ordered separately.

Dual Safety Circuit type

Circuit Code	Contact Configuration	Cable Length	Part Number
DD **Main Circuit: 1NC+1NC** **1NC+1NC**		1m	HS5E-DD4401-G
		3m	HS5E-DD4403-G
		5m	HS5E-DD4405-G

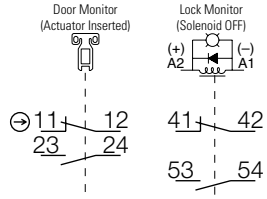
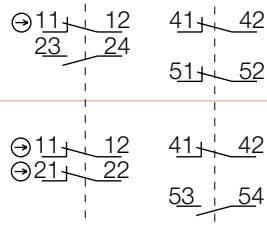
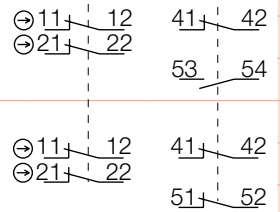
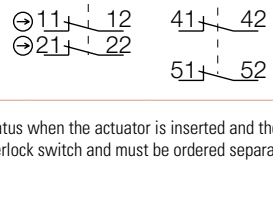
The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with the interlock switch and must be ordered separately.

Four-circuit Independent Output Type (Spring Lock)

Circuit Code	Contact Configuration	Cable Length	Part Number
VA **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 1NC, 1NO**		1m	HS5E-VA4401-G
		3m	HS5E-VA4403-G
		5m	HS5E-VA4405-G
VB **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 2NC**		1m	HS5E-VB4401-G
		3m	HS5E-VB4403-G
		5m	HS5E-VB4405-G
VC **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 1NC, 1NO**		1m	HS5E-VC4401-G
		3m	HS5E-VC4403-G
		5m	HS5E-VC4405-G
VD **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 2NC**		1m	HS5E-VD4401-G
		3m	HS5E-VD4403-G
		5m	HS5E-VD4405-G

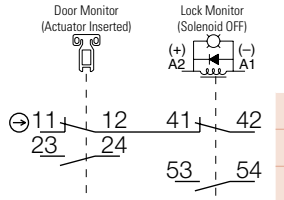
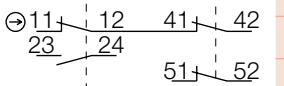
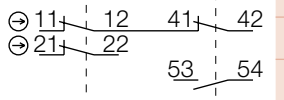
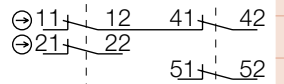
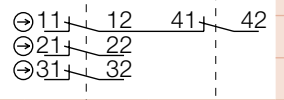
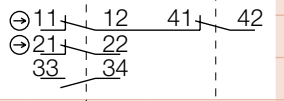
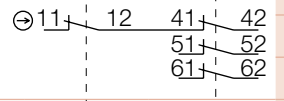
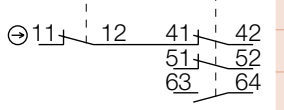
The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with the interlock switch and must be ordered separately.

Four-circuit Independent Output Type (Solenoid Lock)

Circuit Code	Contact Configuration	Cable Length	Part Number
VA **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 1NC, 1NO**		1m	HS5E-VA7Y401-G
		3m	HS5E-VA7Y403-G
		5m	HS5E-VA7Y405-G
VB **Door Monitor Circuit: 1NC, 1NO** **Lock Monitor Circuit: 2NC**		1m	HS5E-VB7Y401-G
		3m	HS5E-VB7Y403-G
		5m	HS5E-VB7Y405-G
VC **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 1NC, 1NO**		1m	HS5E-VC7Y401-G
		3m	HS5E-VC7Y403-G
		5m	HS5E-VC7Y405-G
VD **Door Monitor Circuit: 2NC** **Lock Monitor Circuit: 2NC**		1m	HS5E-VD7Y401-G
		3m	HS5E-VD7Y403-G
		5m	HS5E-VD7Y405-G

The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with the interlock switch and must be ordered separately.

Solenoid Lock Type (Remove Power to Unlock)

Circuit Code	Contact Configuration	Cable Length	Part Number	
			Without LED	With LED
A **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NO**		1m	HS5E-A7Y001	HS5E-A7Y401-G
		3m	HS5E-A7Y003	HS5E-A7Y403-G
		5m	HS5E-A7Y005	HS5E-A7Y405-G
B **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NO** **Lock Monitor Circuit: 1NC**		1m	HS5E-B7Y001	HS5E-B7Y401-G
		3m	HS5E-B7Y003	HS5E-B7Y403-G
		5m	HS5E-B7Y005	HS5E-B7Y405-G
C **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NO**		1m	HS5E-C7Y001	HS5E-C7Y401-G
		3m	HS5E-C7Y003	HS5E-C7Y403-G
		5m	HS5E-C7Y005	HS5E-C7Y405-G
D **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC** **Lock Monitor Circuit: 1NC**		1m	HS5E-D7Y001	HS5E-D7Y401-G
		3m	HS5E-D7Y003	HS5E-D7Y403-G
		5m	HS5E-D7Y005	HS5E-D7Y405-G
F **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-F7Y001	HS5E-F7Y401-G
		3m	HS5E-F7Y003	HS5E-F7Y403-G
		5m	HS5E-F7Y005	HS5E-F7Y405-G
G **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-G7Y001	HS5E-G7Y401-G
		3m	HS5E-G7Y003	HS5E-G7Y403-G
		5m	HS5E-G7Y005	HS5E-G7Y405-G
H **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 2NC**		1m	HS5E-H7Y001	HS5E-H7Y401-G
		3m	HS5E-H7Y003	HS5E-H7Y403-G
		5m	HS5E-H7Y005	HS5E-H7Y405-G
J **Main Circuit: 1NC+1NC** **Door Monitor Circuit: 1NC, 1NO**		1m	HS5E-J7Y001	HS5E-J7Y401-G
		3m	HS5E-J7Y003	HS5E-J7Y403-G
		5m	HS5E-J7Y005	HS5E-J7Y405-G

The contact configuration shows the status when the actuator is inserted and the switch is locked.
The contact configuration shows the status when the indicator is installed.
Actuators are not supplied with the interlock switch and must be ordered separately.

Actuator Keys & Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A52	Right-angle
	HS9Z-A53	Angle adjustable vertical operation
	HS9Z-A55	Angle adjustable horizontal/vertical operation [1]
	HS9Z-A5P	Plug Actuator (allows switch to be used as interlock plug unit)

Item	Part Number	Description
	HS9Z-PH5	Padlock Hasp (prevents unauthorized insertion of actuator)
	HS9Z-SP51	Mounting Plate (allows easy mounting to aluminum frames)
	HS9Z-T3	Manual unlock key (long type - metal)
	HS9Z-SH5	Sliding Actuator

1. The actuator tensile strength is 500N minimum.
2. Actuators are not included and must be included separately.

Specifications

Conforming Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (BG approval), UL508, CSA C22.2, No. 14, GB 140485.5 (CCC approval) IEC60204-1/EN60204-1
Application Standards	IEC60204-1/EN60204-1
Operating Temperature	–25 to 50°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Operating Environment	Degree of pollution: 3
Impulse Withstand Voltage	2.5 kV (between LED, solenoid and grounding: 0.5 kV)
Insulation Resistance (DC megger)	Between live and dead metal parts: 100 MΩ minimum Between live metal part and ground: 100 MΩ minimum Between live metal parts: 100 MΩ minimum Between Terminals of the same pole: 100 MΩ minimum
Electric Shock Protection Class	Class II (IEC61140)
Degree of Protection	IP67 (IEC60529)
Shock Resistance	Operating extremes: 100 m/s^2 (10 G) Damage limits: 1000 m/s^2 (100 G)
Vibration Resistance	Operating extremes: 10 to 55 H, amplitude 0.35 mm minimum Damage limits: 30 Hz, amplitude 1.5 mm minimum
Actuator Operating Speed	0.05 to 1.0m/s
Direct Opening Travel	Actuator HS9Z-A51: 11mm minimum Actuator HS9Z-A52/A53/A55: 12mm minimum
Direct Opening Force	80N minimum
Actuator Retention Force	1400N minimum (GS-ET-19)
Operating Frequency	900 operations per hour
Mechanical Life	1,000,000 operations minimum (GS-ET-19)
Electrical Life	100,000 operations minimum (operating frequency 900 operations per hour, rated load AC-12, 250V, 1A)
Conditional Short-circuit Current	50A (250V) (Note: Use 250V/10A fast acting type fuse for short circuit protection.)
Cable	21AWG - 8-core: 0.5mm^2 or equivalent/core (HS5E-V types: No. 22AWG - 12-core :0.3mm^2 on equivalent/ core)
Cable Diameter	ø7.6 mm
Weight (approx.)	400g - 1m cable type, 580g - 3m cable type, 760g - 5m cable type

Specifications

Rated Voltage	24V DC
Current	266 mA
Coil Resistance	90Ω (at 20°C)
Operating Voltage	Rated voltage x 85% or less (at 20°C)
Return Voltage	Rated voltage x 10% or more (at 20°C)
Maximum Continuous Applying Voltage	Rated voltage x 110%
Insulation Class	Class F

Pilot Light

Rated Voltage	24V DC
Current	10mA
Light Source	LED
Light Color	Green

Current Ratings

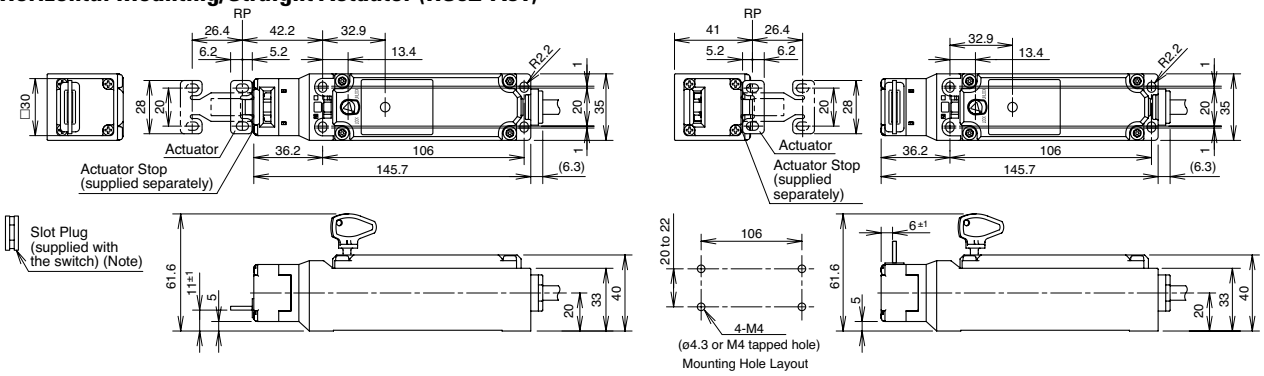
Rated Insulation Voltage (U_i) [2]			250V (between LED, solenoid and grounding: 30V)		
Thermal Current (I_{th})			2.5A		
Rated Voltage (U_e)			30V	125V	250V
Rated Current (Ie) [3]	AC	Resistive load (AC12)	—	2.5A	1.5A
		Inductive Load (AC15)	—	1.5A	0.75A
	DC	Resistive load (DC12)	2.5A	1.1A	0.55A
		Inductive Load (DC13)	2.3A	0.55A	0.27A

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

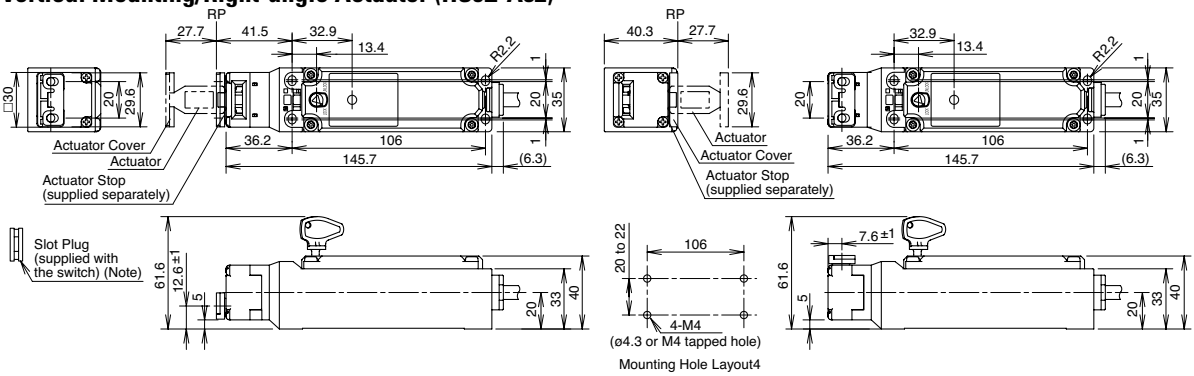
Dimensions (mm) and Mounting Hole Layouts

HS5E-□□4□-G (with indicator)

Horizontal Mounting/Straight Actuator (HS9Z-A51)

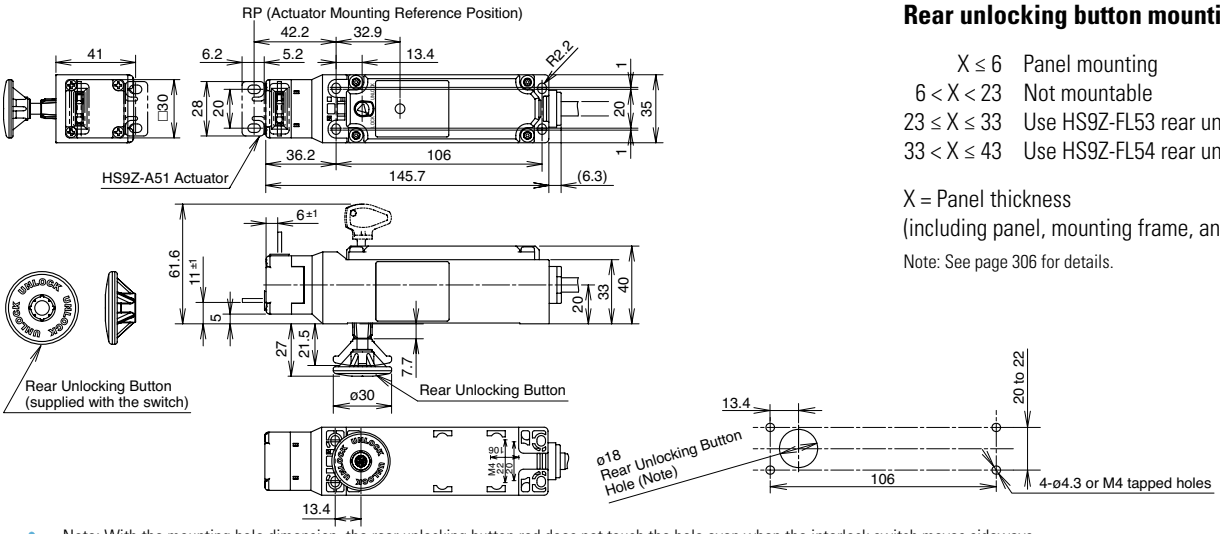


Vertical Mounting/Right-angle Actuator (HS9Z-A52)



HS5E-□44L□-G (rear unlocking button type)

Horizontal Mounting/Straight Actuator (HS9Z-A51)



Rear unlocking button mounting

X ≤ 6	Panel mounting
6 < X < 23	Not mountable
23 ≤ X ≤ 33	Use HS9Z-FL53 rear unlocking button kit (Note)
33 < X ≤ 43	Use HS9Z-FL54 rear unlocking button kit (Note)

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

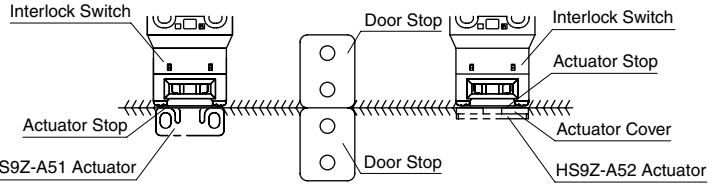
Note: See page 306 for details.

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

Actuator Mounting Reference Position

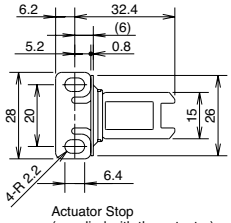
As shown in the figure on the right, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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

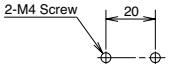


Dimensions and Mounting Hole Layouts, continued

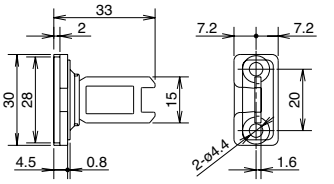
Straight Actuator (HS9Z-A51)

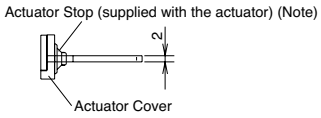


• Actuator Mounting Hole Layout
(Straight, L-shaped)

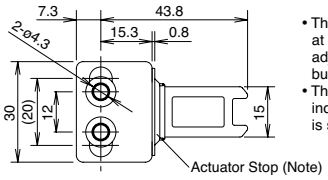


Right-angle Actuator (HS9Z-A52)

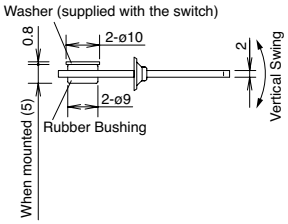




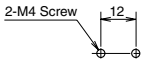
Straight Actuator w/Rubber Bushings (HS9Z-A51A)



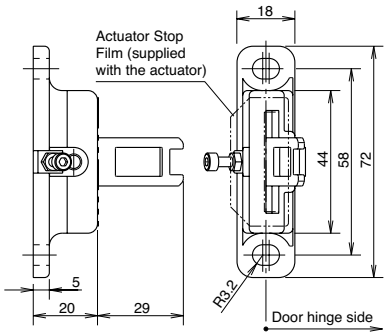
• The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
• The actuator has flexiblity to the direction indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.

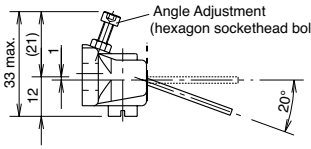


• Actuator Mounting Hole Layout
Straight type (with rubber bushings)
Right-angle type (with rubber bushings)

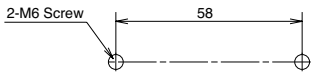


Note: Mounting centers can be widened to 20 mm by moving the rubber bushings.

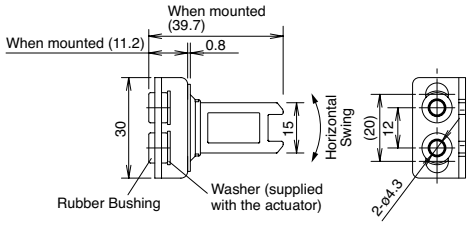


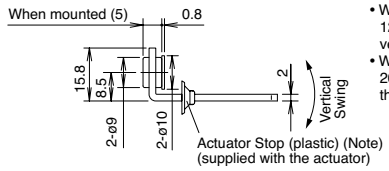


• Actuator Mounting Hole Layout
(vertical swing)

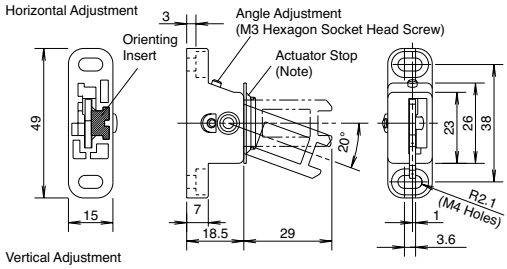


Right-angle Actuator w/Rubber Bushings (HS9Z-A52A)

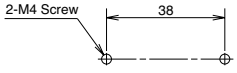




• When the mounting center distance is set to 12 mm, the actuator has flexibility both vertically and horizontally.
• When the mounting center distance is set to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber bushings.



• Actuator Mounting Hole Layout
(horizontal/vertical swing)

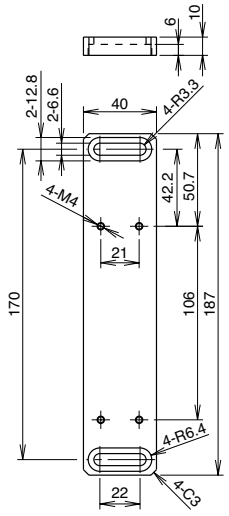


Actuator Orientation

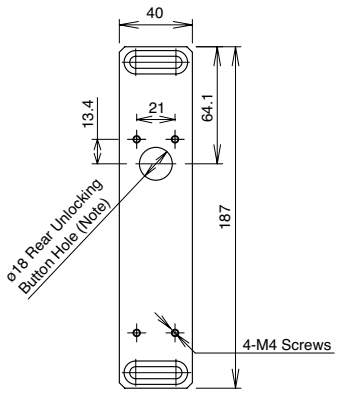
The orientation of actuator swing (horizontal/vertical) can be changed using the orienting insert (white plastic) installed on the back of the actuator. Do not lose the orientating insert, otherwise the actuator will not swing properly.

Dimensions and Mounting Hole Layouts, continued

Mounting Plate (HS9Z-SP51)

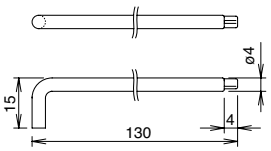


Drilling Rear Unlocking Button Hole

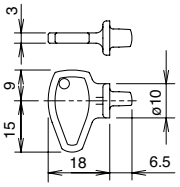


When installing the HS5E-□44L□-G (rear unlocking button type), provide a rear unlocking button hole on the HS9Z-SP51.

Manual Unlocking Key (Metal) (HS9Z-T3)

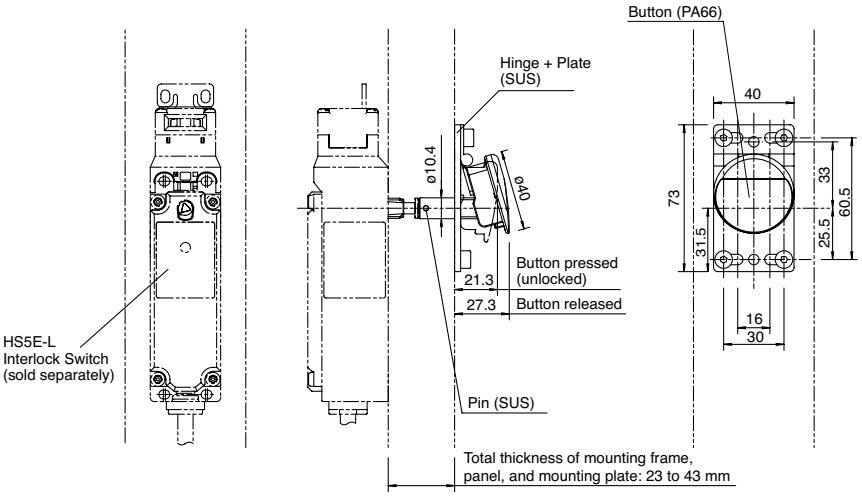


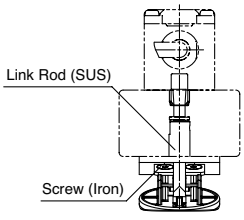
Manual Unlocking Key (plastic)



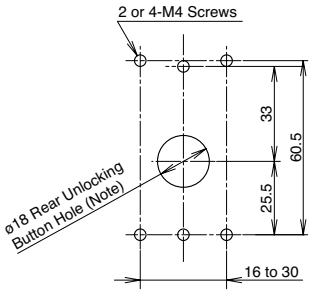
Material: Anodized aluminum A6063
Weight: Approx. 180g

Rear Unlocking Button Kit (HS9Z-FL5□)





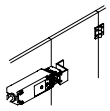
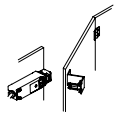
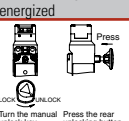
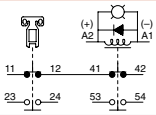
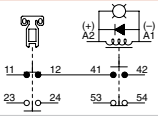
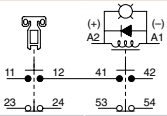
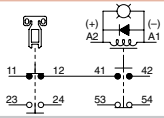
Rear Unlocking Button Kit Mounting Hole Layout



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

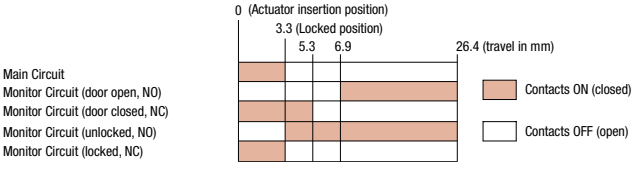
Circuit Diagrams and Operating Characteristics

Standard and Rear Unlocking Type - Spring Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-A4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration: HS5E-A4 (Door Monitor (Actuator Inserted), Lock Monitor (Solenoid OFF))					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door open): 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
Monitor Circuit (unlocked): 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-B4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door open): 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
Monitor Circuit (locked): 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-C4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door closed): 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (unlocked): 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-D4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door closed): 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (locked): 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-F4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door closed): 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door closed): 31–32	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-G4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (door closed): 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door open): 33–34	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-H4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (locked): 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (locked): 61–62	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-J4					
Main Circuit: 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (locked): 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (unlocked): 63–64	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

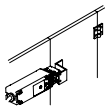
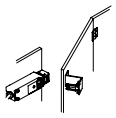
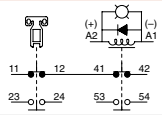
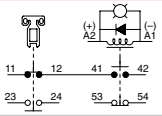
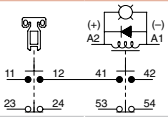
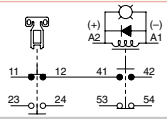
Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-A7Y)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Solenoid Power A1-A2 (all types)	ON (energized)	OFF (de-energized)	OFF (de-energized)	ON (energized)[2]	OFF to ON [1, 2]

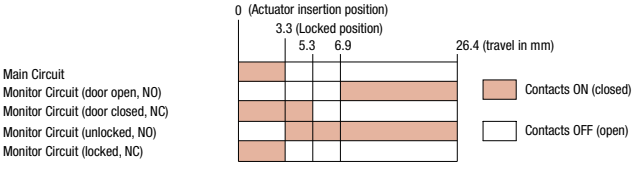
Contact Configuration

	Main Circuit 11–42	Monitor Circuit (door open) 23–24	Monitor Circuit (unlocked) 53–54	Monitor Circuit (locked) 51–52	Monitor Circuit (door closed) 21–22	Monitor Circuit (door closed) 31–32	Monitor Circuit (door open) 33–34	Monitor Circuit (locked) 61–62	Monitor Circuit (unlocked) 63–64
HS5E-A7Y	ON (closed)	OFF (open)	OFF (open)						
	OFF (open)	OFF (open)	ON (closed)	ON (closed)					
	OFF (open)	ON (closed)	ON (closed)	ON (closed)					
HS5E-B7Y	ON (closed)	OFF (open)	OFF (open)						
	OFF (open)	OFF (open)	ON (closed)	ON (closed)					
	ON (closed)	OFF (open)	OFF (open)	OFF (open)					
HS5E-C7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)				
	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)				
HS5E-D7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)				
	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)				
HS5E-F7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)				
	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)				
HS5E-G7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)				
	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)				
HS5E-H7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)				
	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)				
HS5E-J7Y	ON (closed)	OFF (open)	OFF (open)						
	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)				
	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)				

The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.
Monitor Circuit: Sends monitoring signals of protective door open/closed status or protective door lock/unlock status.

1: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.
2: When the operator is confined in a hazardous zone, the actuator can be unlocked manually by pressing the rear unlocking button.

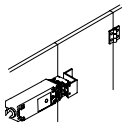
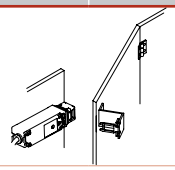
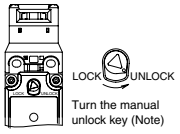
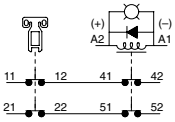
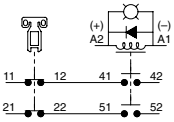
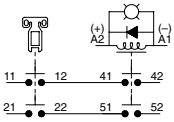
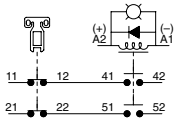
Operation Characteristics (reference)

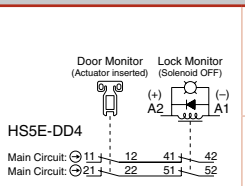


The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

Dual Safety Circuit Type

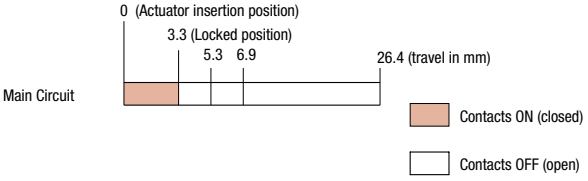
Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized
Door Status					
Circuit Diagram (HS5E-A7Y)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration — Main Circuit 11–42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Contact Configuration — Main Circuit 21–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)



The above contact configuration shows the status when the actuator is inserted and locked.
Main Circuit: Connected to the control circuit of machine drive part, sending interlock signals of the protective door.

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

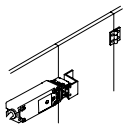
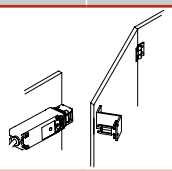
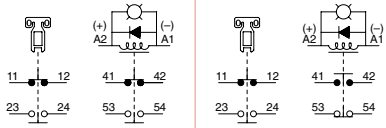
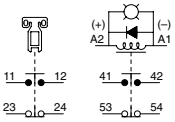
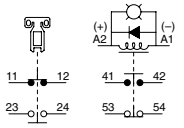
Operation Characteristics (reference)

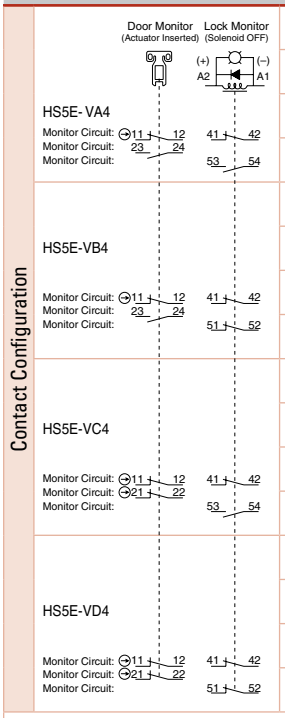


The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

Standard Type - Solenoid Lock Type

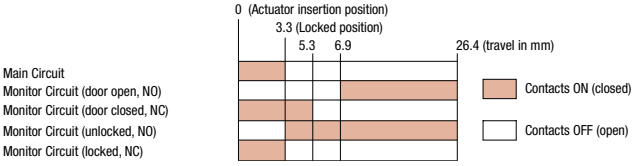
Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized
Door Status					
Circuit Diagram (HS5E-VA4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration – HS5E- VA4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E- VA4 – Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E- VA4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E- VA4 – Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VB4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VB4 – Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
HS5E-VB4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VB4 – Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC4 – Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VC4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC4 – Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VD4 – Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD4 – Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
HS5E-VD4 – Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VD4 – Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)



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

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

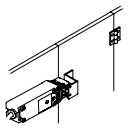
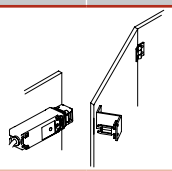
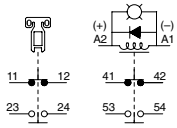
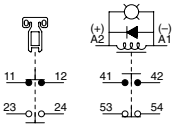
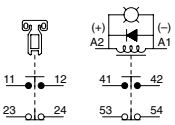
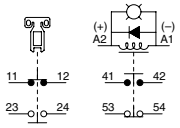
Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

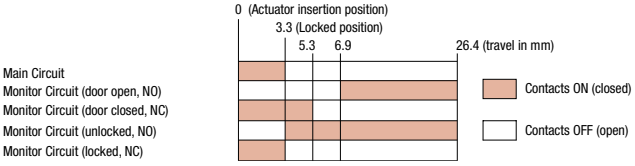
Standard Type - Solenoid Lock Type

Interlock Switch Status	Status 1	Status 2	Status 3	Status 4	Manual Unlock
	• Door Closed • Machine ready to operate • Solenoid energized	• Door Closed • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid energized	• Door Closed • Machine cannot be operated • Solenoid de-energized → energized
Door Status					
Circuit Diagram (HS5E-VA4)					
Door	Closed (locked)	Closed (unlocked)	Open	Open	Closed (unlocked)
Contact Configuration: HS5E-VA7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VB7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door open) 23–24	OFF (open)	OFF (open)	ON (closed)	ON (closed)	OFF (open)
Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
HS5E-VC7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)	ON (closed)
HS5E-VD7Y — Main Circuit 11–42	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door closed) 21–22	ON (closed)	ON (closed)	OFF (open)	OFF (open)	ON (closed)
Monitor Circuit (door open) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Monitor Circuit (locked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)	OFF (open)
Solenoid Power A1-A2 (all types)	OFF (de-energized)	ON (energized)	ON (energized)	OFF (de-energized)	OFF (de-energized)

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

Note: Actuator can be unlocked manually for confirming the door movement before wiring and energizing, and also for emergency situation such as power failure.

Operation Characteristics (reference)



The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

Operating Instructions

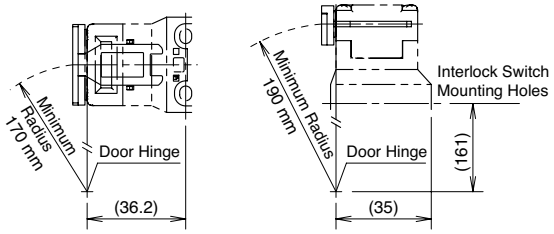
Minimum Radius of Hinged Door

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

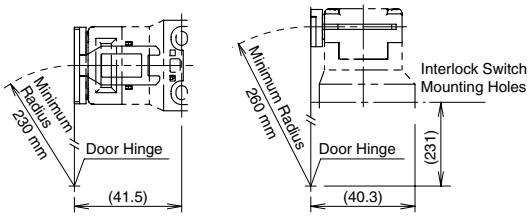
Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

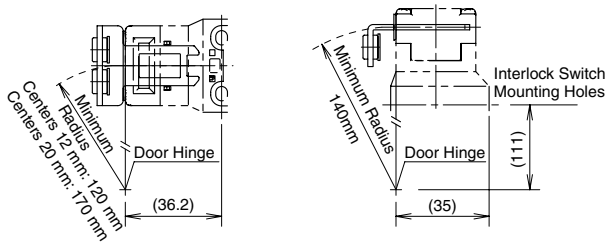


When the door hinge is on the extension line of the actuator mounting surface:

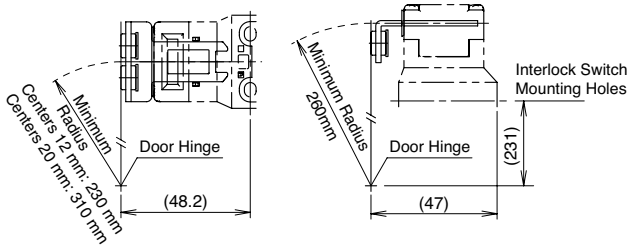


HS9Z-A52 Actuator (w/rubber bushings)

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:



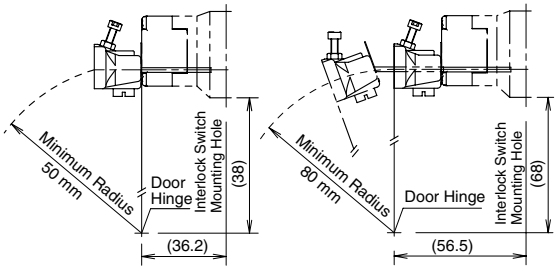
Actuator Angle Adjustment

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on pagepage 304).
  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

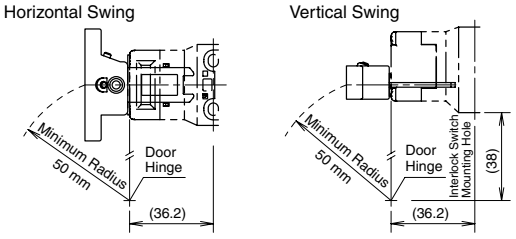
When the door hinge is on the extension line of the interlock switch surface: 50 mm

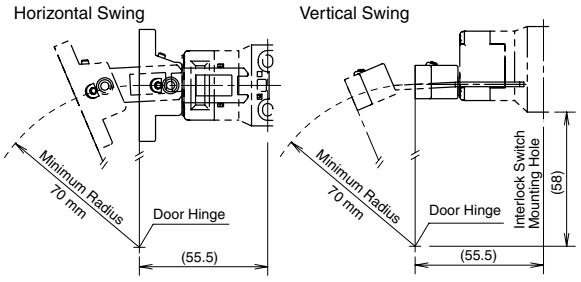
When the door hinge is on the extension line of the actuator mounting surface: 80 mm



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

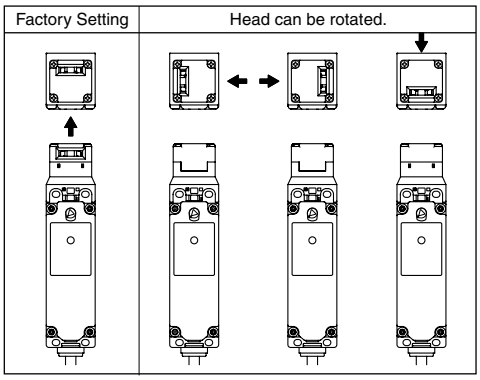




When the door hinge is on the extension line of the actuator mounting surface: 70 mm

Rotating the Head

The head of the HS5E can be rotated by removing the four screws from the corners of the HS5E head and reinstalling the head in the desired orientation. Before wiring the HS5E, replace the head if necessary. 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 space between the head and body, otherwise the interlock switch may malfunction.
Recommended tightening torque: 0.9 to 1.1 N·m.



Instructions, continued

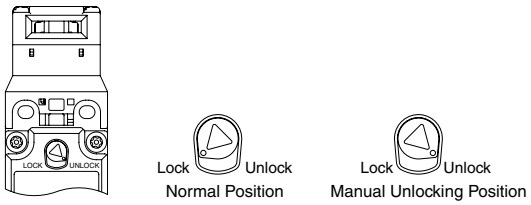
For Manual Unlocking

Spring lock type

The HS5E allows manual unlocking of the actuator to pre-check proper door movement before wiring or turning power on, as well as for emergency use such as a power failure.

Solenoid lock type

The solenoid lock type interlock switch normally does not need the manual unlock. However, only when the interlock switch would not release the actuator even though the solenoid is de-energized, the interlock switch can be unlocked manually. Unlock the interlock switch manually only when the solenoid is de-energized. Do not unlock the interlock switch manually when the solenoid is energized.



When locking or unlocking the interlock switch manually, turn the key fully using the manual unlock key supplied with the interlock switch.

Using the interlock switch with the key not fully turned (less than 90°) may cause damage to the interlock switch or operation failures (when manually unlocked, the interlock switch will keep the main circuit disconnected and the door unlocked).

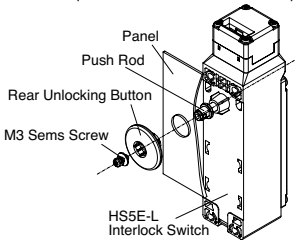
Do not apply excessive force to the manual unlock, otherwise the manual unlock will become damaged.

Do not leave the manual unlock key attached to the interlock switch during operation. This is dangerous because the interlock switch can always be unlocked while the machine is in operation.

Manual Unlocking Key
(supplied with the switch)

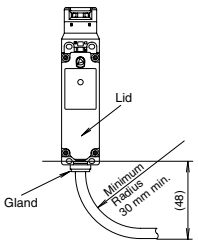
Installing the Rear Unlocking Button

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 M3 sems screw. Rear unlocking button 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 43 mm, use the rear unlocking button kit (HS9Z-FL53 or HS9Z-FL54) sold separately.



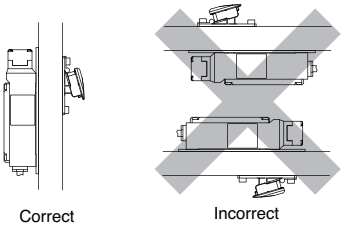
Cables

- When bending the cable during wiring, make sure that the cable radius is kept at 30 mm minimum.
- Solenoid has polarity. Be sure of the correct polarity when wiring.



Safety Precautions

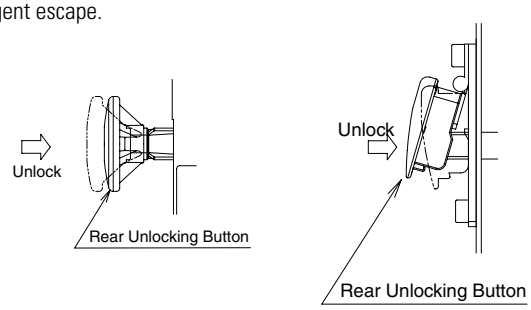
Install the rear unlocking button kit in the correct direction as shown below. Do not install the kit in incorrect directions, otherwise malfunction will be caused.



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

Manual Unlocking using the Rear Unlocking Button

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

Recommended Tightening Torque

- HS5E 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)
  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)
  HS9Z-A53: 4.5 to 5.5 N·m (two M6 screws)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)

Note: The above recommended tightening torque of the mounting screws are the values with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.

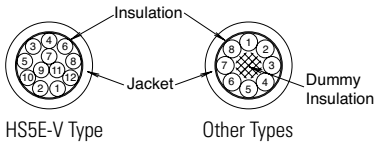
Instructions, continued

Wire Identification

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

- HS5E-V: Wires of gray and gray/white insulation cannot be used.
- HS5E-DD: Wires of brown and brown/white insulation 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



Terminal Number Identification

- When wiring, the terminal number of each contact can be identified by wire color.
- The following table shows the identification of terminal numbers.

Type	Circuit Diagram
HS5E-A	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-B	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-C	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-D	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-F	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 31 32 Brown/White
HS5E-G	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 33 34 Brown/White
HS5E-H	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Brown 51 52 Brown/White Monitor Circuit: Orange 61 62 Orange/White
HS5E-J	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Monitor Circuit: Brown 51 52 Brown/White Monitor Circuit: Orange 63 64 Orange/White
HS5E-DD	White (+) A2 (–) A1 Black Main Circuit: Blue 11 12 41 42 Blue/White Main Circuit: Orange 21 22 51 52 Orange/White

When wiring, cut unnecessary wires such as the dummy insulation (white) and any unused wires.

Type	Circuit Diagram
HS5E-VA	White (+) A2 (–) A1 Black Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-VB	White (+) A2 (–) A1 Black Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 23 24 Orange/White Monitor Circuit: Brown 51 52 Brown/White
HS5E-VC	White (+) A2 (–) A1 Black Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 53 54 Brown/White
HS5E-VD	White (+) A2 (–) A1 Black Monitor Circuit: Blue 11 12 Blue/White Pink 41 42 Pink/White Monitor Circuit: Orange 21 22 Orange/White Monitor Circuit: Brown 51 52 Brown/White

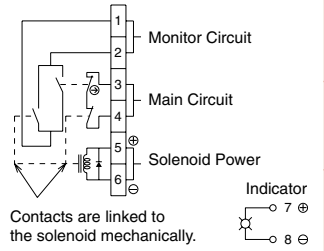
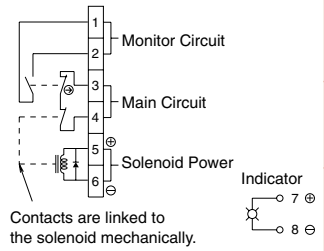
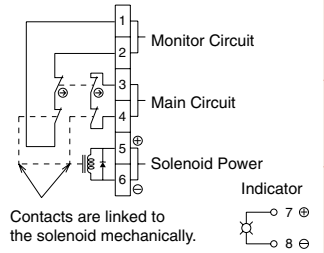
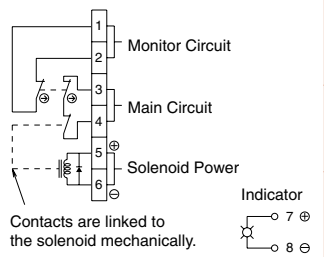
The above contact configuration shows the status when the actuator is inserted and locked.

HS1E Full Size Solenoid Locking Switches

Key features:

- Plastic Housing: Lightweight
- 1500N locking retention force
- Available with a red or green indicator
- Choose from 4 circuit configurations
- Flexible Installation: The actuator can be accessed from two directions
- Ease of Wiring: M3.5 termination screws

Part Numbers (Mechanical Spring Lock Only)

Contact Configuration		LED	Standard	Manual Unlock Key
Main circuit: 1NC + 1NC Monitor circuit: 1NO/1NO		None	HS1E-40R	HS1E-40KR
		Green	HS1E-44R-G	HS1E-44KR-G
		Red	HS1E-44R-R	HS1E-44KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NO		None	HS1E-140R	HS1E-140KR
		Green	HS1E-144R-G	HS1E-144KR-G
		Red	HS1E-144R-R	HS1E-144KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NC + 1NC		None	HS1E-240R	HS1E-240KR
		Green	HS1E-244R-G	HS1E-244KR-G
		Red	HS1E-244R-R	HS1E-244KR-R
Main circuit: 1NC + 1NC Monitor circuit: 1NC		None	HS1E-340R	HS1E-340KR
		Green	HS1E-344R-G	HS1E-344KR-G
		Red	HS1E-344R-R	HS1E-344KR-R

1. Key wrench for TORX screws (HS9Z-T1) is supplied with the interlock switch.
2. Actuator is not supplied with the interlock switch, and must be ordered separately.
3. TORX is a registered trademark of Camcar Textron.

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator
	HS9Z-A2	Right-angle Actuator
	HS9Z-A3	Adjustable Actuator
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

Specifications

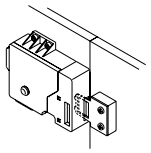
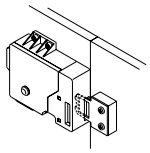
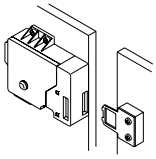
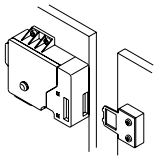
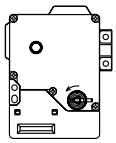
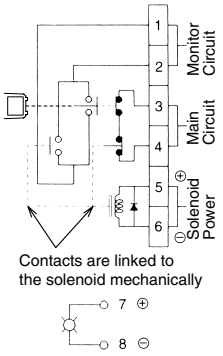
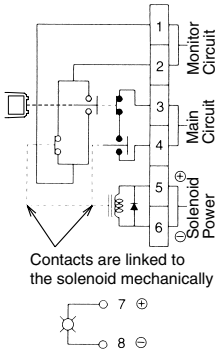
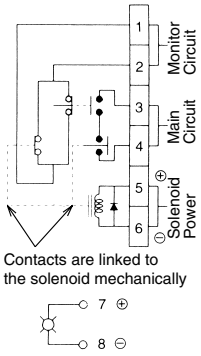
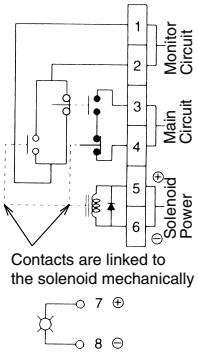
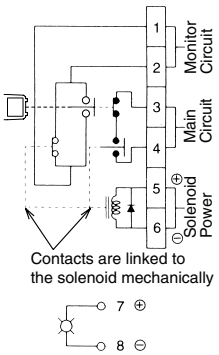
Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1(TUV), ISO14119, GS-ET-19 (BG), UL508, CSA C22.2 No. 14, GB14048.5 (CCC approval), IEC60204-1, EN60204-1 (applicable standards for use)
Operating Temperature		–20 to +40°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		40 - 85% RH (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (Ui)		300V (between LED or solenoid and ground: 60V)
Impulse Withstand Voltage (Uimp)		4 kV (between LED or solenoid and ground: 2.5 kV)
Insulation Resistance (measured with 500V DC megger)		Between live and dead metal parts: 100 MΩ minimum Between live metal part and ground: 100 MΩ minimum Between live metal parts: 100 MΩ minimum Between terminals of the same pole: 100 MΩ minimum
Electric Shock Protection		Class II (according to IEC61140)
Pollution Degree		3 (IEC60947-5-1)
Degree of Protection		IP67 (IEC60529)
Vibration Resistance	Operating Extremes	10 to 55 Hz, minimum (amplitude 0.35 mm)
	Damage Limits	50 m/sec^2 (approx. 5G)
Shock Resistance		1,000 m/sec^2 (approx. 100G)
Actuator Retention Force		1,500N minimum (per GS-ET-19)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		Main circuit: 10A, Auxiliary circuit: 3A
Contact Gap		Main circuit: 1.7 mm min., Auxiliary circuit: 1.2 mm min.
Operating Frequency		900 operations/hour max.
Mechanical Life		1,000,000 operations min. (at full rated load) 900 ops/hr (AC-12/250V, 6A)
Electrical Life		100,000 operations (rated load)
Conditional Short-circuit Current		100A (per IEC60947-5-1)
Recommended Short Circuit Protection		250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)
Solenoid Unit	Operating Voltage	24V DC
	Current	292mA (initial value)
	Coil Resistance	102Ω (at 20°C)
	Pickup Voltage	20.4V maximum (at 20°C)
	Drop Out Voltage	2.4V minimum (at 20°C)
	Allowable Voltage	26.4V max (continuous)
	Insulation Class	Class F
Indicator	Operating Voltage	24V DC
	Current	10mA
	Light Source	LED lamp
	Lens Color	Red or Green
Weight (approx.)		500g

Contact Ratings

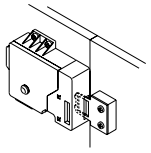
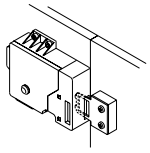
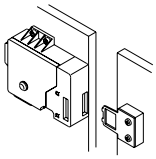
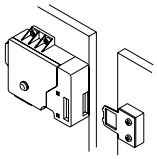
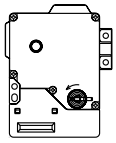
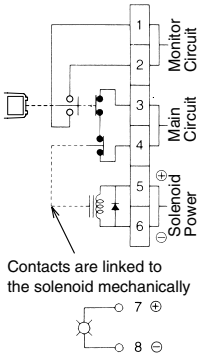
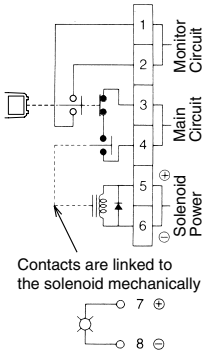
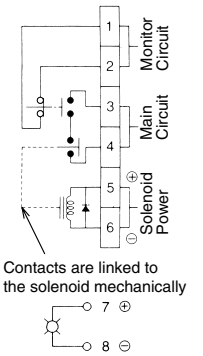
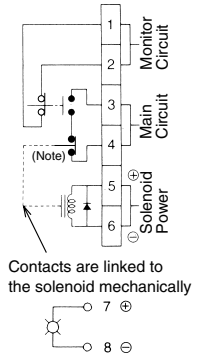
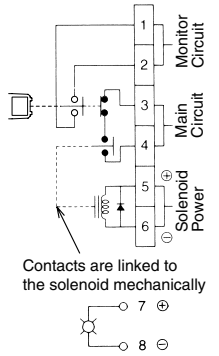
				Operating Voltage (Ue)	30V	125V	250V
Rated Operating Current (Ie)	Main Circuit	AC	Resistive load (AC12)		10A	10A	6A
			Inductive load (AC15)		10A	5A	3A
		DC	Resistive load (DC12)		6A	–	–
			Inductive load (DC13)		3A	0.9A	–
	Auxiliary Circuit	AC	Resistive load (AC12)		–	3A	3A
			Inductive load (AC15)		–	–	3A
		DC	Resistive load (DC12)		3A	–	–
			Inductive load (DC13)		–	0.9A	–

Application Examples and Circuit Diagrams

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

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	Door Closed Machine ready to operate Solenoid de-energized	Door Closed Machine cannot be started Solenoid de-energized	Door Opened Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid de-energized	Door Closed Machine cannot be started Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Closed	3-4: Open
Aux. Circuit	1-2: Open	1-2: Closed	1-2: Closed	1-2: Closed	1-2: Closed
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

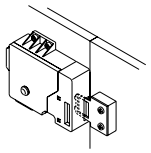
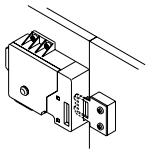
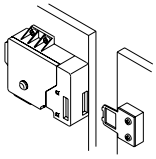
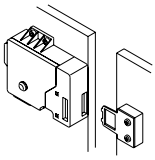
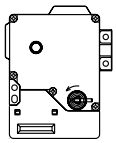
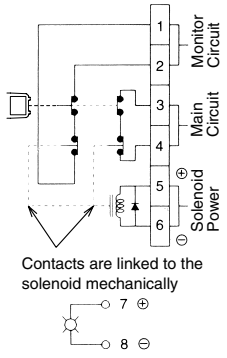
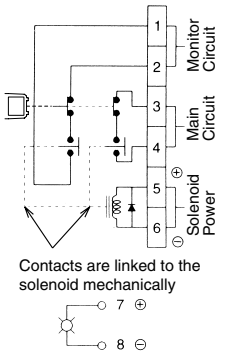
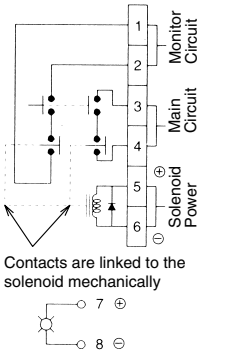
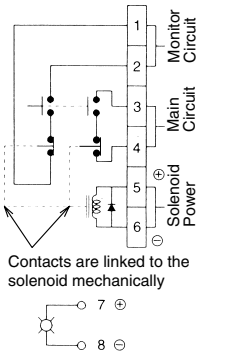
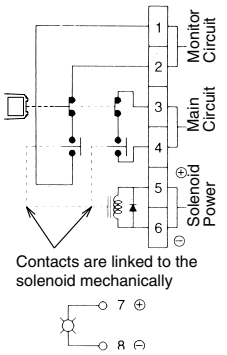
HS1E-14 (Main Circuit: 1NC-1NC, Auxiliary Circuit: 1NO)

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	Door Closed Machine ready to operate Solenoid de-energized	Door Closed Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid de-energized	Door Closed Machine cannot be started Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Open	1-2: Open	1-2: Closed	1-2: Closed	1-2: Open
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

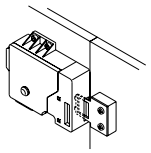
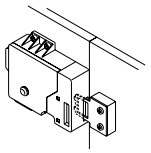
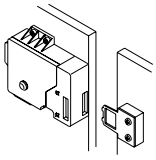
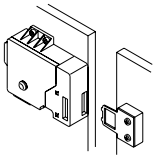
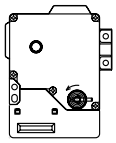
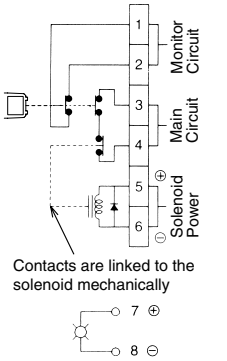
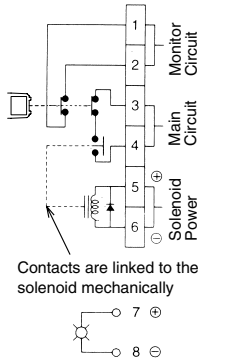
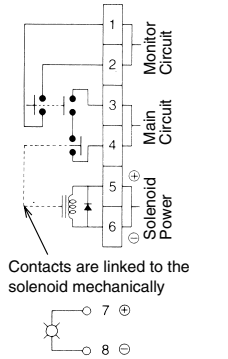
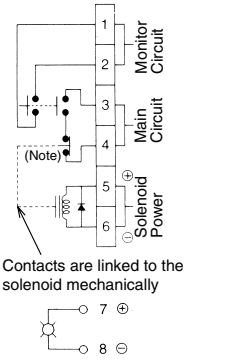
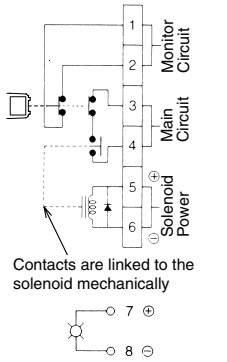
1. Main Circuit: used to enable the machine to start only when the main circuit is closed.
2. Auxiliary Circuit: used to indicate whether the machine circuit or door is open or closed.
3. Terminals 7 and 8 are used for the LED indicator, and are isolated from solenoid and door status.

Application Examples and Circuit Diagrams, continued

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

	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	Door Closed Machine ready to operate Solenoid de-energized	Door Closed Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid de-energized	Door Closed Machine cannot be started Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Open	1-2: Open	1-2: Open	1-2: Open
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

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

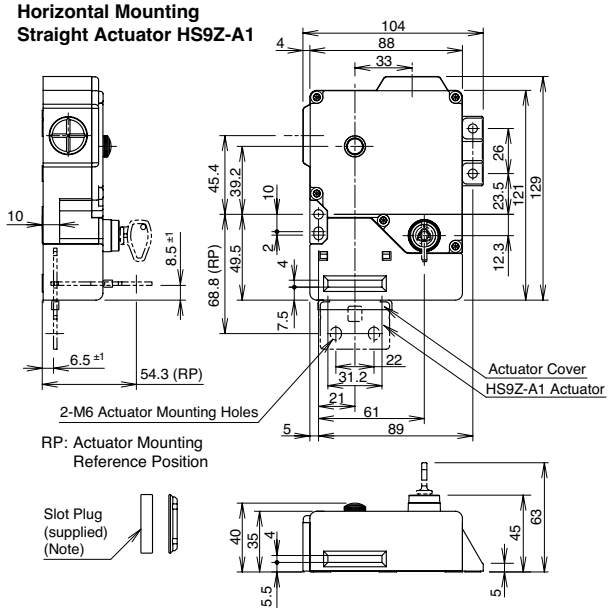
	Status 1	Status 2	Status 3	Status 4	Unlocked Manually
Switch/Door Status	Door Closed Machine ready to operate Solenoid de-energized	Door Closed Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid energized	Door Opened Machine cannot be started Solenoid de-energized	Door Closed Machine cannot be started Solenoid de-energized
Door					
Circuit Diagram					
Main Circuit	3-4: Closed	3-4: Open	3-4: Open	3-4: Open	3-4: Open
Aux. Circuit	1-2: Closed	1-2: Closed	1-2: Open	1-2: Open	1-2: Closed
Solenoid	5-6: Power OFF	5-6: Power ON	5-6: Power ON	5-6: Power OFF	5-6: Power OFF

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

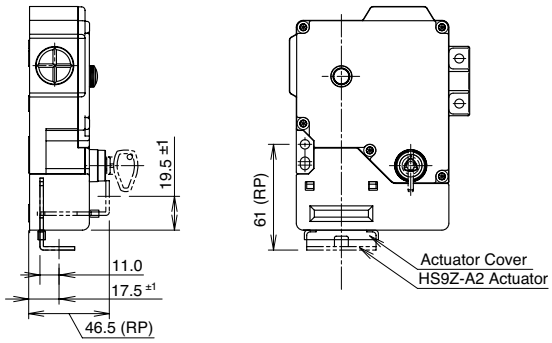
Dimensions (mm)

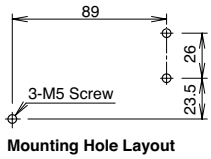
HS1E with indicator - using 1500N operating force

Horizontal Mounting
Straight Actuator HS9Z-A1



Vertical Mounting
Right-angle Actuator HS9Z-A2



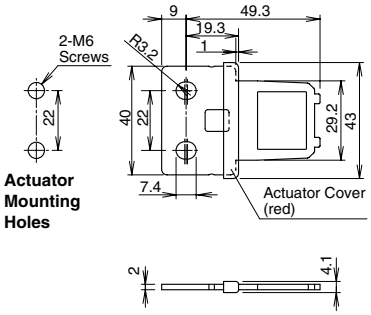


Mounting Hole Layout

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

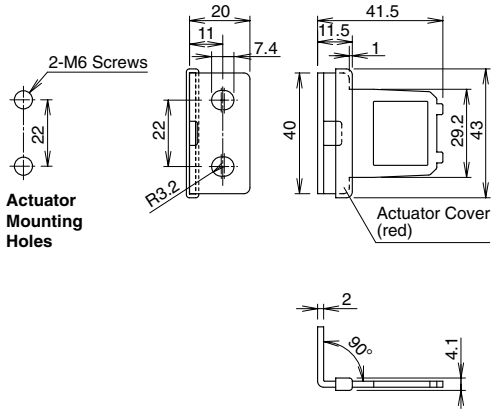
Accessories

Straight Actuator (mainly for sliding doors) HS9Z-A1



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

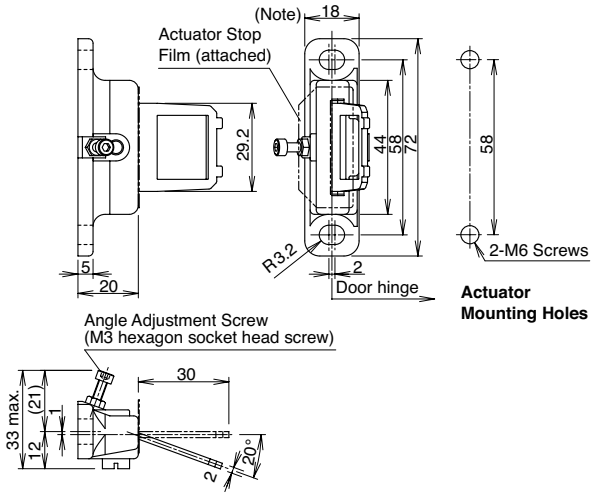
*After installing the actuator, remove the actuator cover.



Adjustable Actuator

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

For HS1/HS2 Series (HS9Z-A3)



All dimensions in mm.

Accessories, continued

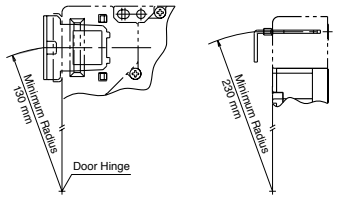
Minimum Radius of Hinged Door

- When using the interlock switch for a hinged door, refer to the minimum radius of doors shown below. For the doors with small minimum radius, use angle adjustable actuators (HS9ZA3 or HS9Z-A3S).

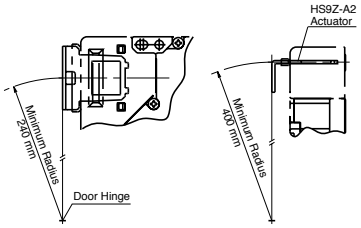
Note: Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A2 Actuator

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

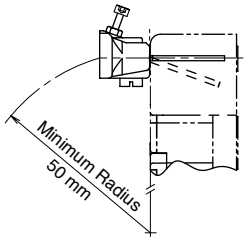


- When the door hinge is on the extension line of the actuator mounting surface:

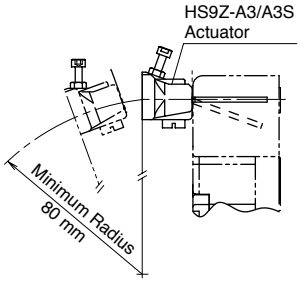


When using the HS9Z-A3 Angle Adjustable (vertical) Actuator

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



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

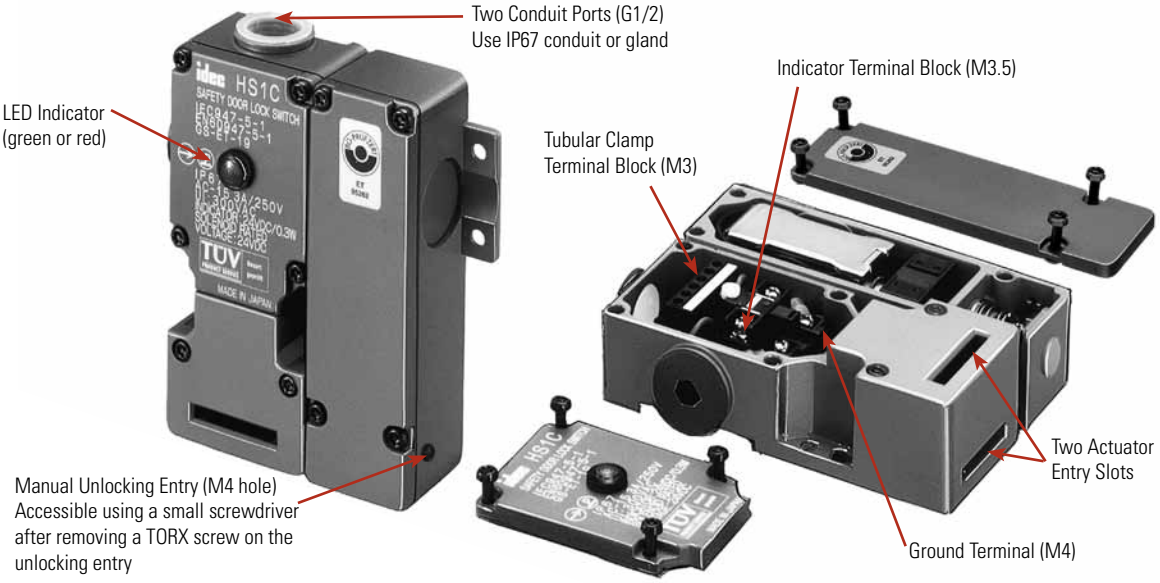


HS1C Full Size Solenoid Locking Switches

Key features:

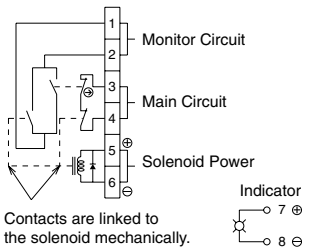
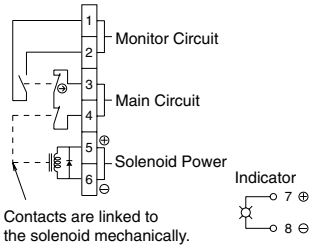
- Rugged aluminum die-cast housing
- 1500N locking retention force
- Flexible Installation: The actuator can be accessed from two directions
- Select from four different circuit configurations
- IP67

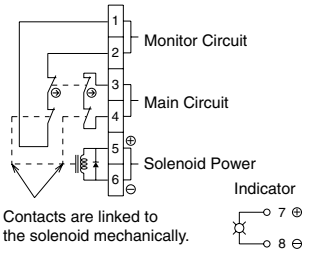
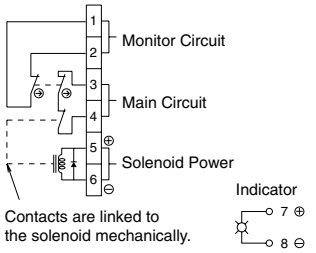
HS1C Series Functionality



TORX is a registered trademark of Camcar Textron.

Part Numbers (Mechanical Spring Lock Only)

Contact Configuration	Indicator LED	Part Number
	Green	HS1C-R44R-G
	Red	HS1C-R44R-R
	Green	HS1C-R144R-G
	Red	HS1C-R144R-R

Contact Configuration	Indicator LED	Part Number
	Green	HS1C-R244R-G
	Red	HS1C-R244R-R
	Green	HS1C-R344R-G
	Red	HS1C-R344R-R

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A1	Straight Actuator
	HS9Z-A2	Right-angle Actuator
	HS9Z-A3	Adjustable Actuator

Appearance	Part Number	Description
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

Specifications

Conforming to Standards		EN1088, IEC60947-5-1, EN60947-5-1, GS-ET-19, UL508, GB 140485.5 (CCC approval), CSA C22.2 No. 14
Operating Temperature		–20 to +40°C (no freezing)
Storage Temperature		–40 to +80°C
Relative Humidity		40 to 85% (no condensation)
Altitude		2,000m maximum
Rated Insulation Voltage (U_i)		300V (between LED or solenoid and ground: 60V)
Impulse Withstand Voltage (U_{imp})		4 kV (between LED or solenoid and ground: 2.5 kV)
Insulation Resistance		Between live and dead metal parts: 100 MΩ minimum Between live metal part and ground: 100 MΩ minimum Between live metal parts: 100 MΩ minimum Between terminals of the same pole: 100 MΩ minimum
Electric Shock Protection Class		Class 1 (IEC61140)
Pollution Degree		3 (IEC60947-5-1)
Degree of Protection		IP67 (IEC60529)
Vibration Resistance	Operating Extremes	10 to 55 Hz, amplitude 0.5 mm
	Damage Limits	60 m/sec^2 (approx. 6G)
Shock Resistance		1,000 m/s^2 (approx. 100G)
Actuator Retention Force		1,500N minimum
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		20N minimum
Thermal Current (I_{th})		Main circuit: 10A, Auxiliary circuit: 3A
Contact Opening Distance		Main circuit: 1.7 mm max., Auxiliary circuit: 1.2 mm min.
Operating Frequency		900 operations/hour max.
Mechanical Life		1,000,000 operations
Electrical Life		100,000 operations (rated load)
Conditional Short-circuit Current		100A (IEC60947-5-1)
Recommended Short Circuit Protection		250V, 10A fuse (Type D01 based on IEC60269-1, 60269-2)

Specifications, con't

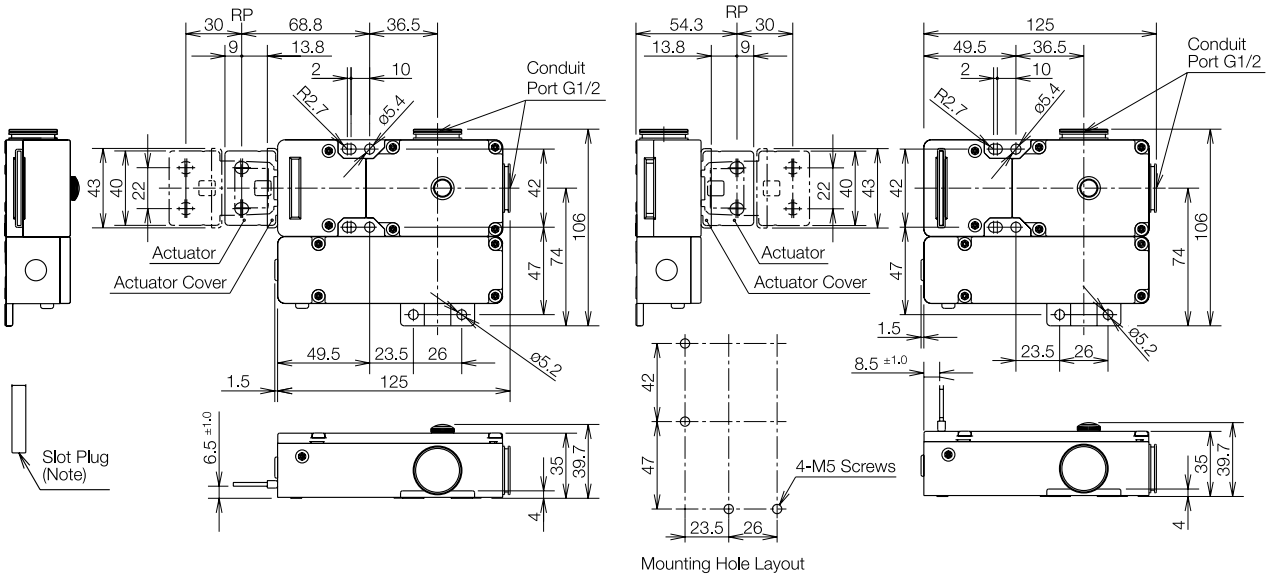
Solenoid Unit	Operating Voltage	24V DC (100% duty cycle)
	Current	415mA (initial value)
	Coil Resistance	58Ω (at 20°C)
	Energizing Voltage	Rated voltage x 85% maximum (at 20°C)
	De-energizing Voltage	Rated voltage x 10% minimum (at 20°C)
	Continuous Applicable Voltage	Rated voltage x 110%
	Insulation Class	Class B
Indicator	Operating Voltage	24V DC
	Current	10 mA
	Light Source	LED lamp
	Lens Color	Red or Green
Weight (approx.)		660g

Contact Ratings

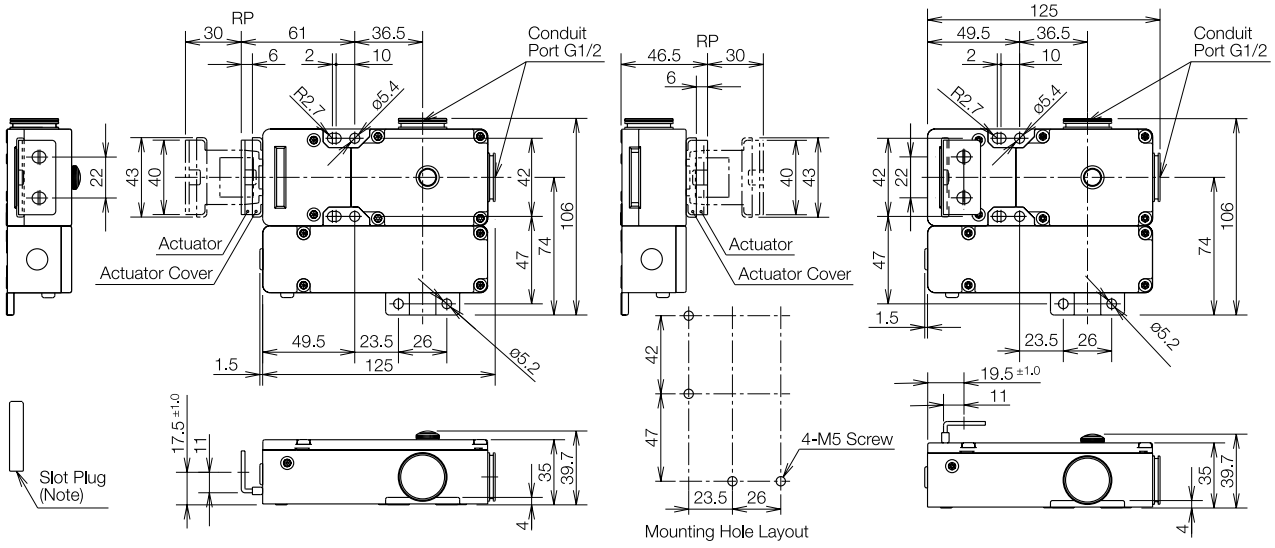
Rated Operating Current (Ie)	Operating Voltage (Ue)			30V	125V	250V
	Main Circuit	AC	Resistive load (AC12)	10A	10A	6A
			Inductive load (AC15)	10A	5A	3A
		DC	Resistive load (DC12)	6A	–	–
			Inductive load (DC13)	3A	0.9A	–
	Auxiliary Circuit	AC	Resistive load (AC12)	–	3A	3A
			Inductive load (AC15)	–	–	3A
		DC	Resistive load (DC12)	3A	–	–
			Inductive load (DC13)	–	0.9A	–

Dimensions (mm)

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

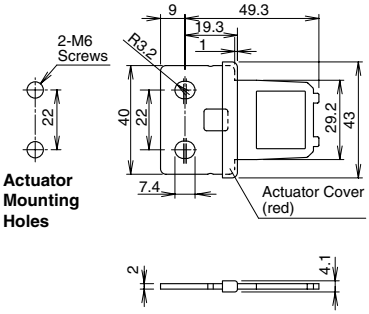


HS1C-R44R-* - using the Right-angle actuator (HS9Z-A2)



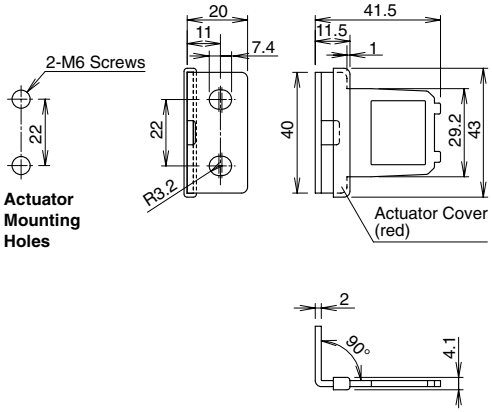
Accessories

Straight Actuator (mainly for sliding doors)
HS9Z-A1



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

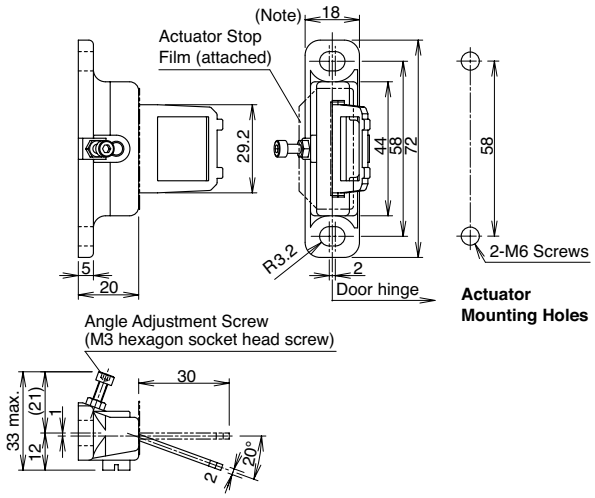
*After installing the actuator, remove the actuator cover.



Adjustable Actuator

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

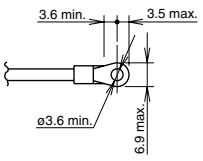
For HS1/HS2 Series (HS9Z-A3)



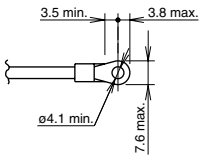
All dimensions in mm.

Applicable Crimping Terminals

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

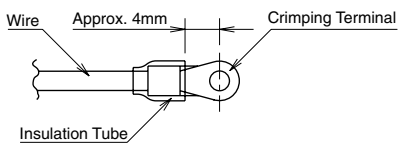


Crimping Terminal 1



Crimping Terminal 2

Use an insulation tube on the crimping terminal.



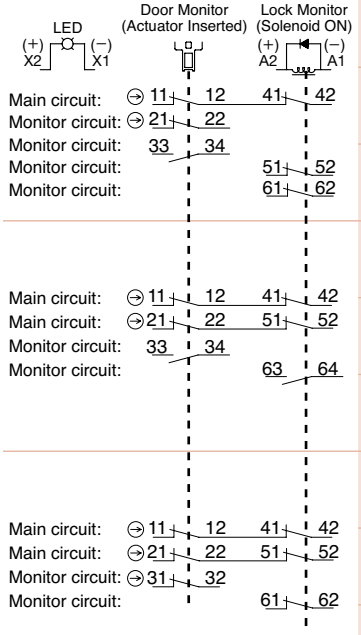
HS1L Interlock Switches with Solenoid

Key features:

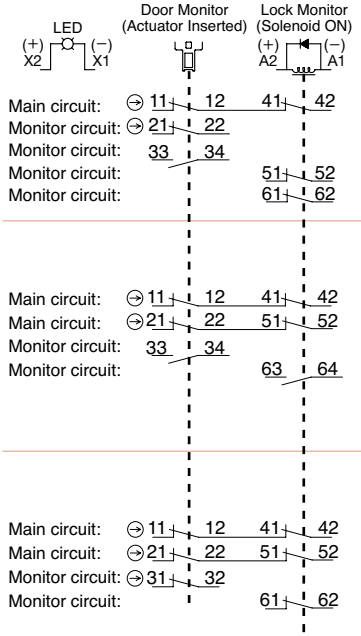
- 3,000N locking retention force
- LED indicator
- Energy-efficient solenoid
- 6 contacts with easy-to-wire terminations
- M3 terminal screws for easy wiring

Part Numbers

Mechanical Spring Lock (power solenoid to unlock)

Contact Configuration	Conduit Size	LED	Part Number
	G1/2	Red	HS1L-R44KMSR-R
		Green	**HS1L-R44KMSR-G**
	PG13.5	Red	HS1L-R44KMSRP-R
		Green	HS1L-R44KMSRP-G
	M20	Red	HS1L-R44KMSRM-R
		Green	HS1L-R44KMSRM-G
	G1/2	Red	HS1L-DQ44KMSR-R
		Green	**HS1L-DQ44KMSR-G**
	PG13.5	Red	HS1L-DQ44KMSRP-R
		Green	HS1L-DQ44KMSRP-G
	M20	Red	HS1L-DQ44KMSRM-R
		Green	HS1L-DQ44KMSRM-G
	G1/2	Red	HS1L-DT44KMSR-R
		Green	**HS1L-DT44KMSR-G**
	PG13.5	Red	HS1L-DT44KMSRP-R
		Green	HS1L-DT44KMSRP-G
	M20	Red	HS1L-DT44KMSRM-R
		Green	HS1L-DT44KMSRM-G

Solenoid Lock (Remove Power to Unlock)

Contact Configuration	Conduit Size	LED	Part Number
	G1/2	Red	HS1L-R7Y4KMSR-R
		Green	**HS1L-R7Y4KMSR-G**
	PG13.5	Red	HS1L-R7Y4KMSRP-R
		Green	HS1L-R7Y4KMSRP-G
	M20	Red	HS1L-R7Y4KMSRM-R
		Green	HS1L-R7Y4KMSRM-G
	G1/2	Red	HS1L-DQ7Y4KMSR-R
		Green	**HS1L-DQ7Y4KMSR-G**
	PG13.5	Red	HS1L-DQ7Y4KMSRP-R
		Green	HS1L-DQ7Y4KMSRP-G
	M20	Red	HS1L-DQ7Y4KMSRM-R
		Green	HS1L-DQ7Y4KMSRM-G
	G1/2	Red	HS1L-DT7Y4KMSR-R
		Green	**HS1L-DT7Y4KMSR-G**
	PG13.5	Red	HS1L-DT7Y4KMSRP-R
		Green	HS1L-DT7Y4KMSRP-G
	M20	Red	HS1L-DT7Y4KMSRM-R
		Green	HS1L-DT7Y4KMSRM-G

1. Contact configuration shows the contact status when actuator is inserted and solenoid off for spring lock.
2. Contact configuration shows the contact status when actuator is inserted and solenoid on for solenoid lock.
3. Actuators are not supplied with the interlock switch and must be ordered separately.
4. Standard stock items in bold.

Actuator Keys & Accessories (order separately)

Appearance	Part Number	Description
	HS9Z-A1S	Straight Actuator
	HS9Z-A2S	L-shaped Actuator
	HS9Z-A3S	Angle Adjustable Actuator (vertical operation only)

Appearance	Part Number	Description
	HS9Z-T1	Key Wrench (included with switch)
	HS9Z-P1	Conduit Opening Plug (G1/2)

Specifications

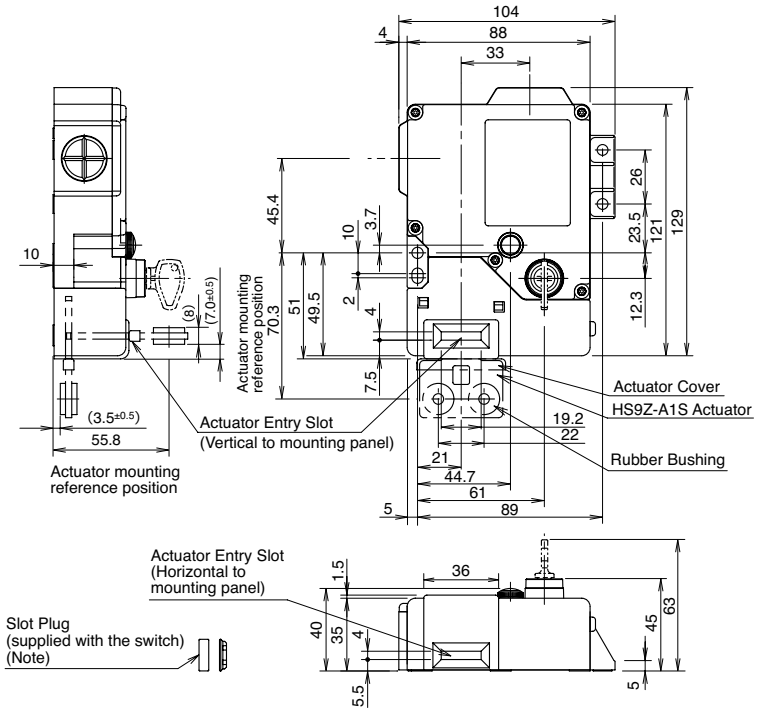
Conforming to Standards		ISO14119, IEC60947-5-1. EN60947-5-1 (TÜV approval), GS-ET-19 (TÜV approval). UL508, CSA C22.2 No. 14 IEC60204-1/EN60204-1 (applicable standards for use)
Operating Temperature		–20 to +55°C (no freezing)
Storage Temperature		–40 to +80°C (no freezing)
Relative Humidity		45 to 85% (no condensation)
Rated Insulation Voltage (Ui)		300V
Overvoltage Category		III
Electric Shock Protection		Class II (IEC 61140)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		Damage limits: 1000m/s^2
Actuator Retention Force		3000N minimum (GS-ET-19)
Actuator Operating Speed		0.05 to 1.0m/s
Direct Opening Travel		11mm minimum
Direct Opening Force		50N minimum
Thermal Current (Ith)		10A
Operating Frequency		900 operations per hour
Mechanical Life		1,000,000 operations minimum (GS-ET-19)
Electrical Life		100,000 operations minimum (AC-15 3A/250V) 1,000,000 operations minimum (24V AC/DC, 100mA) (operating frequency 900 operations per hour)
Solenoid Unit	Rated Operating Voltage	24V DC (100% duty cycle)
	Rated Current	200mA (initial value)
Indicator	Rated Operating Voltage	24V DC
	Rated Current	10mA
	Light Source	LED
	Illumination Color	Green (G), Red (R)
Weight (approx.)		450g (HS1L-DQ44)

Contact Ratings

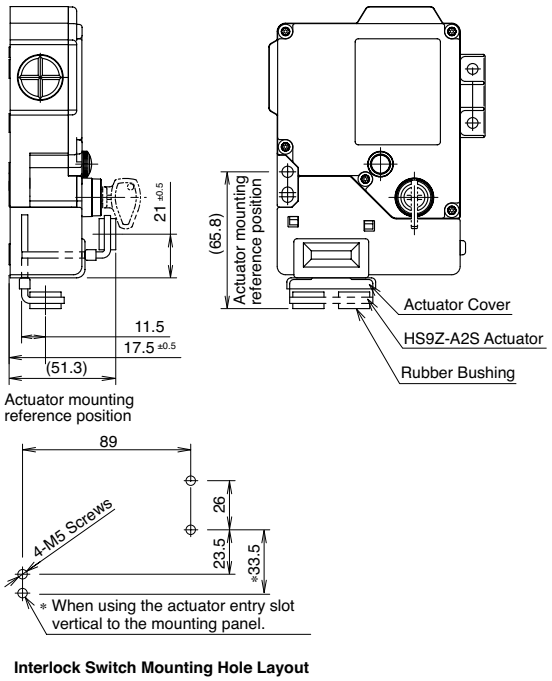
Rated Operating Current (I_e)	Rated Voltage (U_e)		30V	125V	250V
	AC	Resistive load (AC12)	10A	10A	6A
		Inductive load (AC15)	10A	5A	3A
	DC	Resistive load (DC12)	8A	2.2A	1.1A
		Inductive load (DC13)	4A	0.9A	0.6A

Dimensions (mm) and Mounting Hole Layouts

Interlock switch when using straight actuator (HS9Z-A1S)



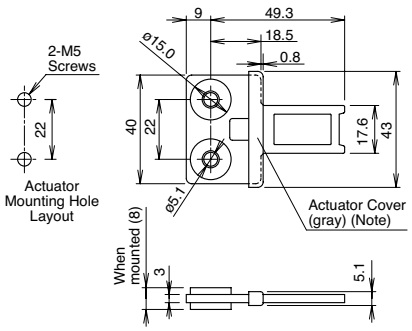
Interlock switch when using L-shaped actuator (HS9Z-A2S)



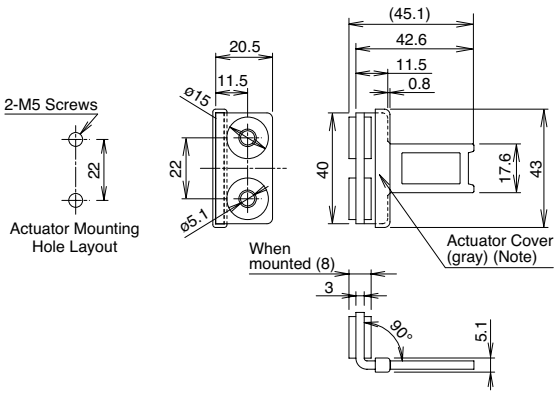
Interlock Switch Mounting Hole Layout

Note: Plug the unused actuator entry slot using the slot plug supplied with the interlock switch.
* Install the interlock switch using four mounting screws when using the actuator entry slot vertical to the mounting panel, and three mounting screws when using the actuator entry slot horizontal to the mounting panel.

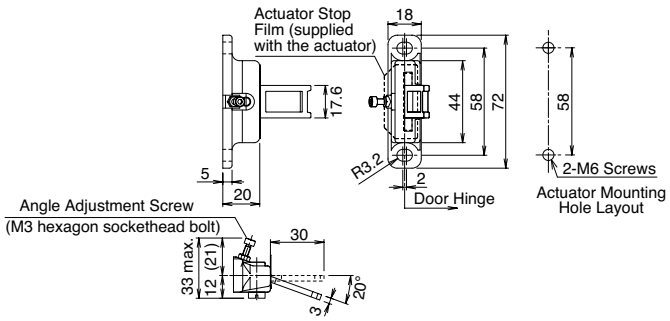
Straight Actuator (HS9Z-A1S)



L-shaped Actuator (HS9Z-A2S)



Angle Adjustable (vertical) Actuator (HS9Z-A3S)



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

HS5E-K Key Locking Safety Interlock Switches

Key features:

- Head removal detection circuitry.
- High-security pin tumbler key types are used. Sixteen types of key numbers are available, see page 330.
- Available with rear unlocking button for emergency escape.
- Accessory available for aluminum frame mounting.
- Gold-plated contacts.
- 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.
- Double insulation structure. No need for grounding.
- Compact body: 35 × 40 × 146 mm

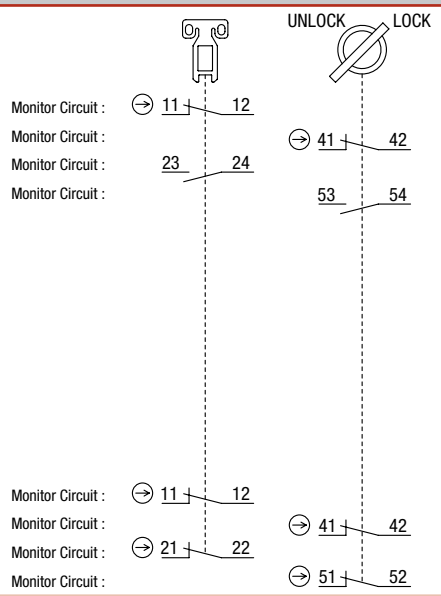
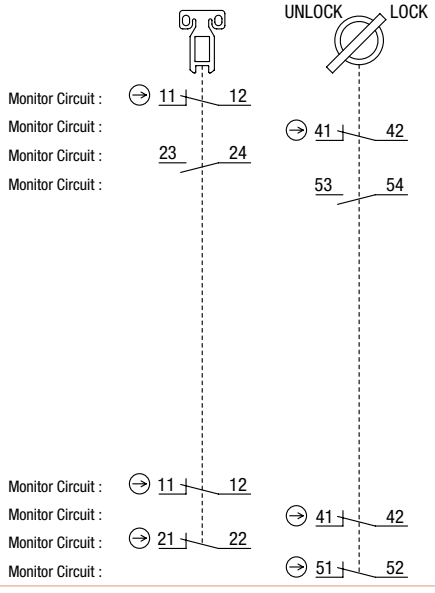
A single key used for interlock switch and selector switch prevents itself from being left in the lock.

Hostage key ensures that the person holding the key is not locked inside the hazardous area.

Hostage key prevents the machine from starting unexpectedly.

HS5E-K key interlock switches use a key to lock and unlock a door of safeguard. When the key is taken into a dangerous area, the interlock switch cannot be locked and the machine does not operate. Therefore, workers can be prevented from being locked in a dangerous area, and the system is prevented from restarting unexpectedly. Furthermore, because the key used for HS5E-K key interlock switches can also be used for HW series key selector switches (pin tumbler type), switching operation modes of systems and door unlocking can be performed using a single key. 16 types of key numbers are available, so that each system can have its own key, and a higher level of safety can be achieved.

Spring Lock Type (Power Solenoid to VA Lock)

Circuit Code	Contact Configuration	Key Removal Position	Cable Length	Part Number	
				Standard	With Rear Unlock Button
VA		A (removable in all positions)	3m	HS5E-KVA003-2A	HS5E-KVA0L03-2A
			5m	HS5E-KVA005-2A	HS5E-KVA0L05-2A
		B (removal in UNLOCK position)	3m	HS5E-KVA003-2B	HS5E-KVA0L03-2B
			5m	HS5E-KVA005-2B	HS5E-KVA0L05-2B
		C (removable in LOCK position)	3m	HS5E-KVA003-2C	HS5E-KVA0L03-2C
			5m	HS5E-KVA005-2C	HS5E-KVA0L05-2C
VD		A (removable in all positions)	3m	HS5E-KVD003-2A	HS5E-KVD0L03-2A
			5m	HS5E-KVD005-2A	HS5E-KVD0L05-2A
		B (removal in UNLOCK position)	3m	HS5E-KVD003-2B	HS5E-KVD0L03-2B
			5m	HS5E-KVD005-2B	HS5E-KVD0L05-2B
		C (removable in LOCK position)	3m	HS5E-KVD003-2C	HS5E-KVD0L03-2C
			5m	HS5E-KVD005-2C	HS5E-KVD0L05-2C

The contact configuration shows the status when the actuator is inserted and the switch is locked.
Actuators are not supplied with interlock switches and must be ordered separately.
Key number 500 is supplied as the default key in table above (500 not added to part number).

To order additional key types, specify key number at end of part number (special order).
Example: HS5E-KVA003-2A501
501 to 515
Note: The key number is engraved on the cylinder.

Actuator Keys & Accessories

Appearance	Part Number	Description
	HS9Z-A51	Straight
	HS9Z-A52	Right-angle
	HS9Z-A53	Angle adjustable vertical operation

Appearance	Part Number	Description
	HS9Z-A55	Angle adjustable horizontal/vertical operation [1]
	HS9Z-A5P	Plug Actuator (allows switch to be used as interlock plug unit)
	HS9Z-PH5	Padlock Hasp (prevents unauthorized insertion of actuator)

Appearance	Part Number	Description
	HS9Z-SP51	Mounting Plate (allows easy mounting to aluminum frames)
	HS9Z-T3	Manual unlock key (long type - metal)
	HS9Z-SH5	Sliding Actuator

1. The actuator tensile strength is 500N minimum.
2. Actuators are not included and must be included separately.

Specifications

Applicable Standards	ISO14119, IEC60947-5-1, EN60947-5-1 (TÜV approval), EN1088, GS-ET-19 (TÜV approval), UL508 (UL recognition), 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/s^2 Damage limits: 1,000 m/s^2
Vibration Resistance	Operating extremes: 10 to 55 Hz, amplitude 0.35 mm Damage limits: 30 Hz, amplitude 1.5 mm
Actuator Operating Speed	0.05 to 1.0 m/s
Direct Opening Travel	Actuator HS9Z-A51: 11 mm minimum Actuator HS9Z-A51A/A52/A52A/A53/A55: 12 mm minimum
Direct Opening Force	80N minimum
Actuator Retention Force [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) [2]
Cable	22 AWG (12-core, 0.3 mm^2 or equivalent/core)
Cable Diameter	ø7.6 mm
Weight (approx.)	400g (HS5E-KVA003)

1. See page 330 for actuator retention force.
2. Use 250V/10A fast-blow fuse for short-circuit protection.

Key Cylinder 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

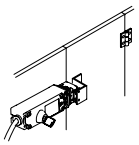
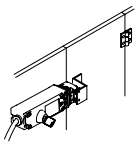
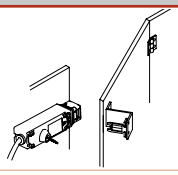
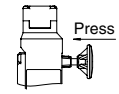
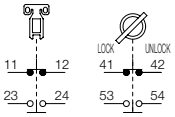
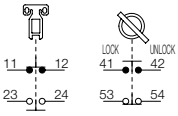
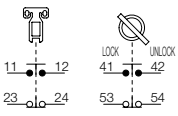
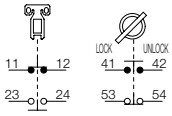
Contact Rating

Rated Insulation Voltage (U_i) [1]			250V		
Rated Thermal Current (I_{th})			Operating temperature: –25°C to 60°C: 2.5A max. 60° to 65°C: 1.5A max. 65°C to 70°C: 1.0A max.		
Rated Voltage (U_e)			30V	125V	250V
Rated Current (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

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

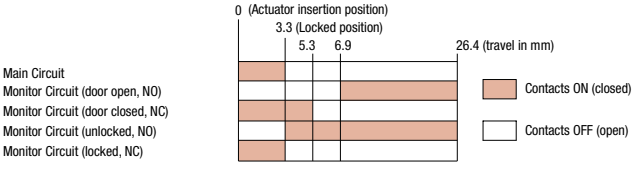
1: UL rating: 125V
2: TÜV rating: AC-15, 0.5A/250V, DC-13, 0.22A/125V
UL, c-UL rating: Pilot Duty AC 0.5A/125V, Pilot Duty DC 0.22A/125V

Standard Type - Solenoid Lock Type

Interlock Switch Status			Status 1	Status 2	Status 3	Manual Unlock
			• Door Closed • Machine ready to operate • Solenoid energized	• Door Closed • Machine cannot be operated • Solenoid de-energized	• Door Open • Machine cannot be operated • Solenoid de-energized	• Door Closed • Machine cannot be operated • Solenoid de-energized energized
Door Status						 Press rear unlocking button. (Note)
Circuit Diagram (HS5E-KVA)						
Door			Closed (locked)	Closed (unlocked)	Open	Closed (unlocked)
Type No. and Contact Configuration	HS5E-KVA	Main Circuit (door closed) 11–12	ON (closed)	ON (closed)	OFF (open)	ON (closed)
		Monitor Circuit (door open) 23-24	OFF (open)	OFF (open)	ON (closed)	OFF (open)
		Monitor Circuit (locked) 41-42	ON (closed)	OFF (open)	OFF (open)	ON (closed)
		Monitor Circuit (unlocked) 53–54	OFF (open)	ON (closed)	ON (closed)	ON (closed)
	HS5E-KVD	Main Circuit (door closed) 11–12	ON (closed)	ON (closed)	OFF (open)	ON (closed)
		Monitor Circuit (door open) 21-22	ON (closed)	ON (closed)	OFF (open)	OFF (open)
		Monitor Circuit (locked) 41-42	ON (closed)	OFF (open)	OFF (open)	OFF (open)
		Monitor Circuit (unlocked) 51–52	ON (closed)	OFF (open)	OFF (open)	OFF (open)

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)



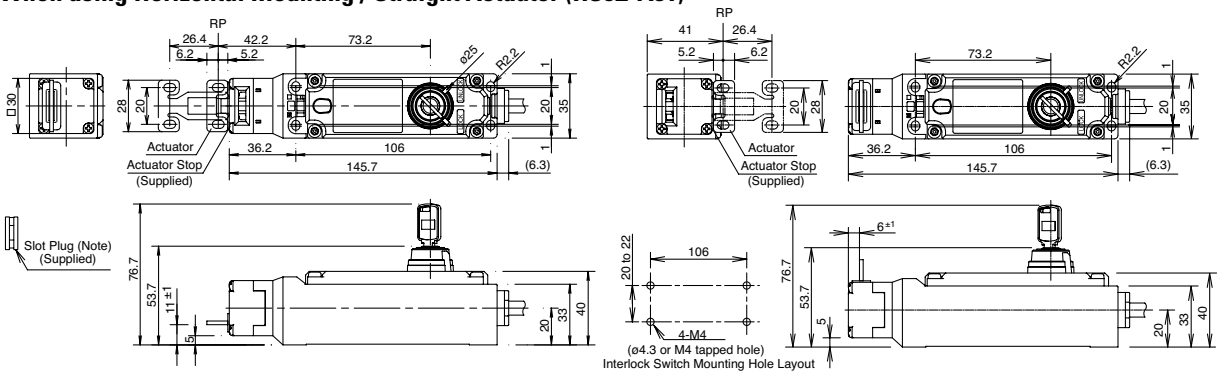
The operation characteristics shown in the chart above are of the HS9Z-A51. For other actuator types, add 1.3 mm.

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

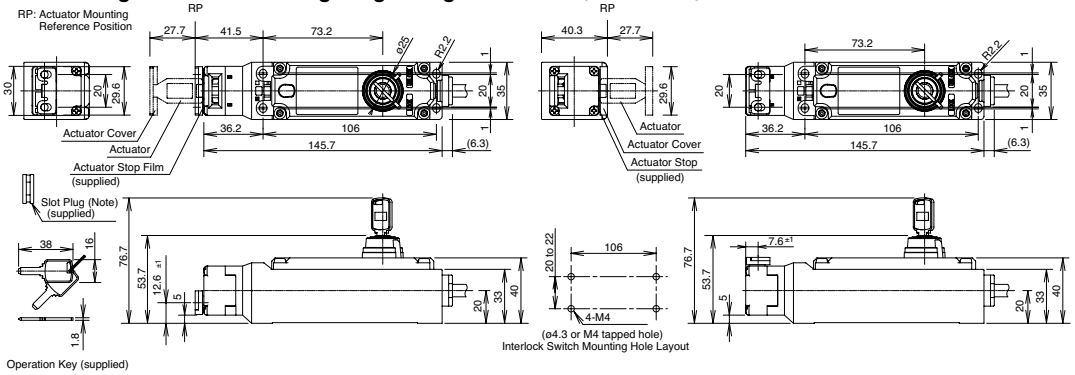
Dimensions (mm) and Mounting Hole Layouts

HS5E-K□

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

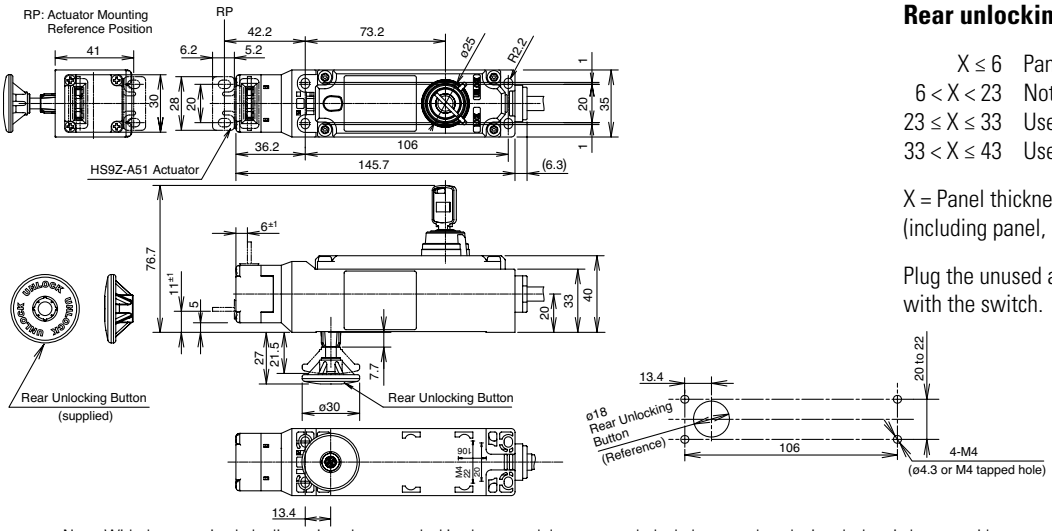


When using Vertical Mounting / Right-angle Actuator (HS9Z-A52)



HS5E-K□L (Rear Unlocking Button Type)

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



Rear unlocking button mounting

X ≤ 6	Panel mounting
6 < X < 23	Not mountable
23 ≤ X ≤ 33	Use HS9Z-FL53 rear unlocking button kit (Note)
33 < X ≤ 43	Use HS9Z-FL54 rear unlocking button kit (Note)

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

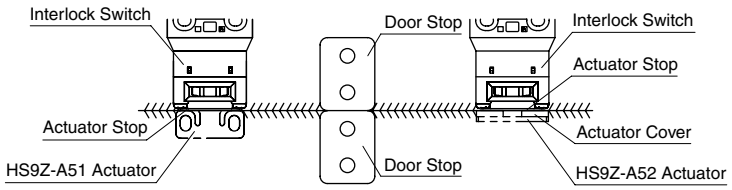
Plug the unused actuator entry slot using the plug supplied with the switch.

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

Actuator Mounting Reference Position

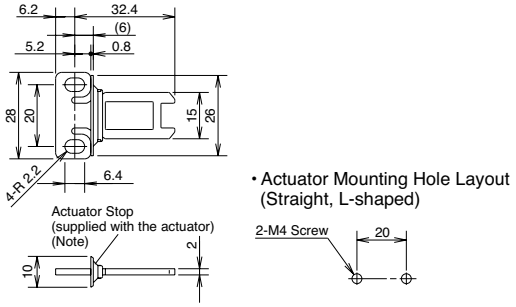
As shown in the figure on the right, the mounting reference position of the actuator when inserted in the interlock switch is where the actuator stop placed on the actuator lightly touches the interlock switch.

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

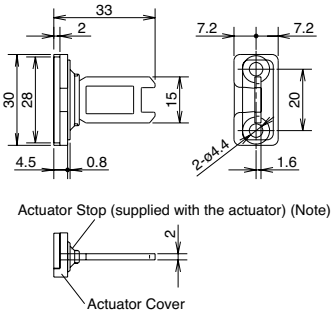


Dimensions and Mounting Hole Layouts, continued

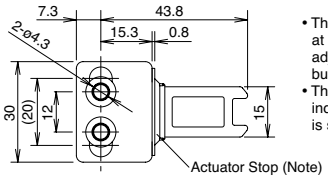
Straight Actuator (HS9Z-A51)



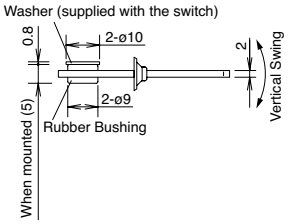
Right-angle Actuator (HS9Z-A52)



Straight Actuator w/Rubber Bushings (HS9Z-A51A)

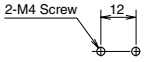


- The mounting center distance is set to 12 mm at factory. When 20-mm distance is required, adjust the distance by moving the rubber bushings.
- The actuator has flexiblity to the direction indicated by the arrows. When 20-mm distance is selected, the actuator swings vertically.



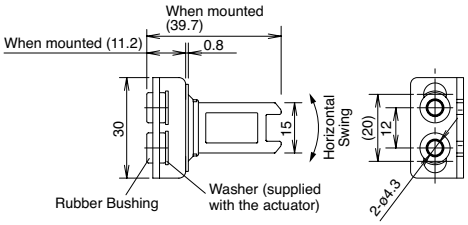
• Actuator Mounting Hole Layout

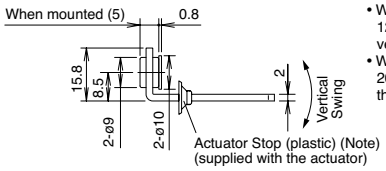
Straight type (with rubber bushings)
Right-angle type (with rubber bushings)



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

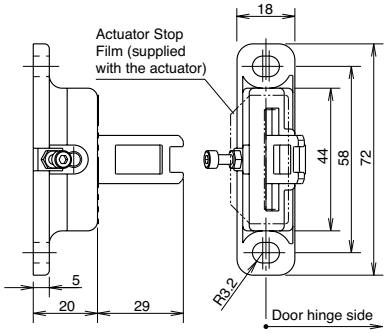
Right-angle Actuator w/Rubber Bushings (HS9Z-A52A)

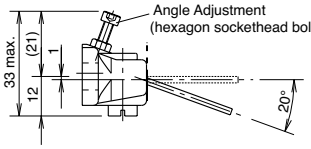




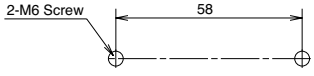
- When the mounting center distance is set to 12 mm, the actuator has flexibility both vertically and horizontally.
- When the mounting center distance is set to 20 mm, the actuator swings vertically. Adjust the distance by moving the rubber bushings.

Angle Adjustable Actuator (Vertical) (HS9Z-A53)

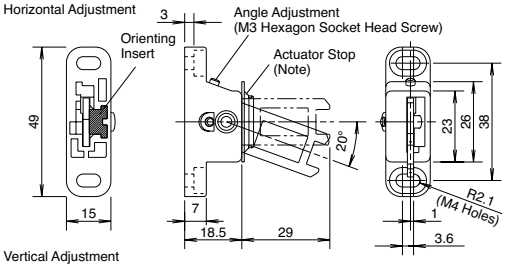


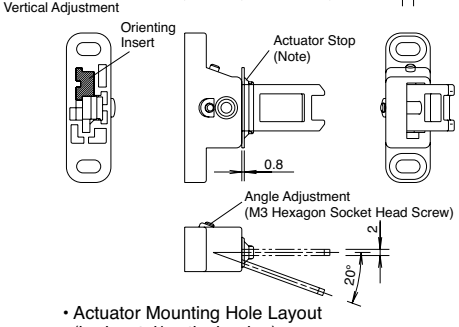


• Actuator Mounting Hole Layout
(vertical swing)

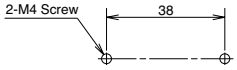


Angle Adjustable Actuator (Horizontal/Vertical) (HS9Z-A55)





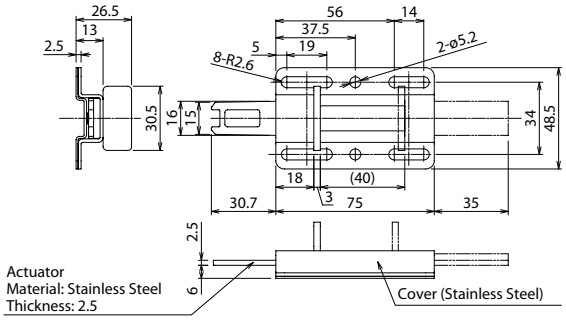
• Actuator Mounting Hole Layout
(horizontal/vertical swing)



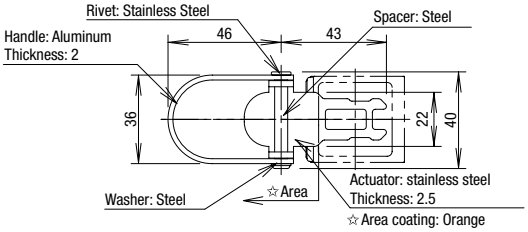
Actuator Orientation

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 orientating insert, otherwise the actuator will not swing properly.

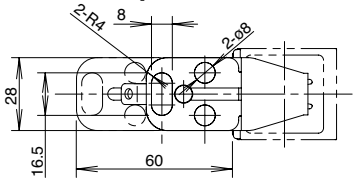
Sliding Actuator (HS9Z-SH5)



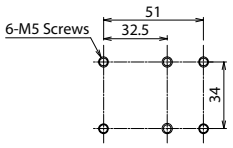
Plug Actuator (HS9Z-A5P)



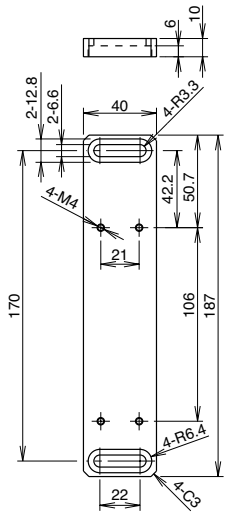
Padlock Hasp (HS9Z-PH5)



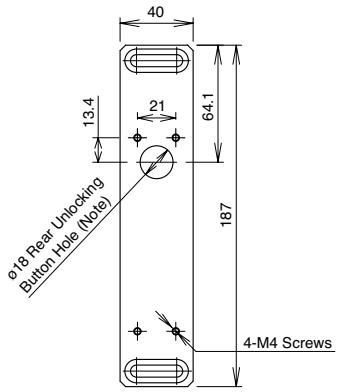
Panel Cut-out



Mounting Plate (HS9Z-SP51)

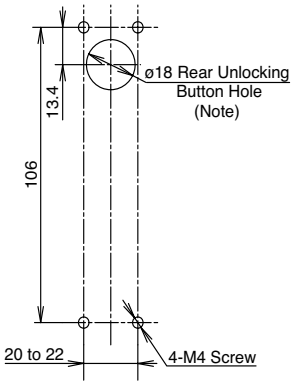


Drilling Rear Unlocking Button Hole



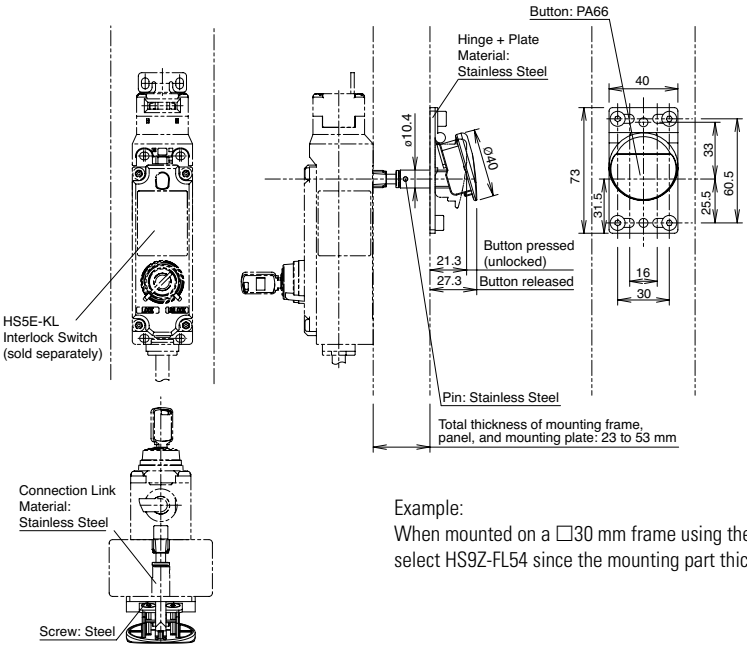
When installing the HS5E-□44L□-G (rear unlocking button type), provide a rear unlocking button hole on the HS9Z-SP51.

Manual Unlocking Key (Metal) (HS9Z-T3)

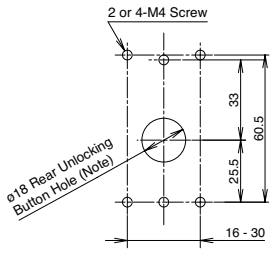


Material: Anodized aluminum A6063
Weight: Approx. 180g

Rear Unlocking Button Kit (HS9Z-FL5□)



Rear Unlocking Button Mounting Dimensions



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

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).

Operating Instructions

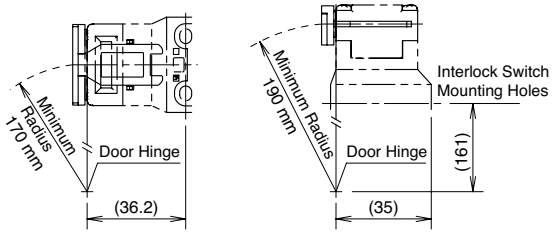
Minimum Radius of Hinged Door

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

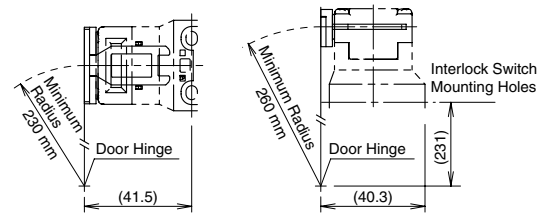
Because deviation or dislocation of hinged door may occur in actual applications, make sure of the correct operation before installation.

HS9Z-A52 Actuator

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

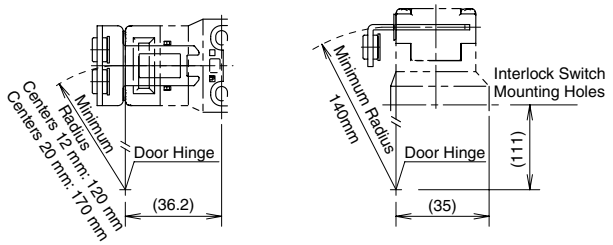


When the door hinge is on the extension line of the actuator mounting surface:

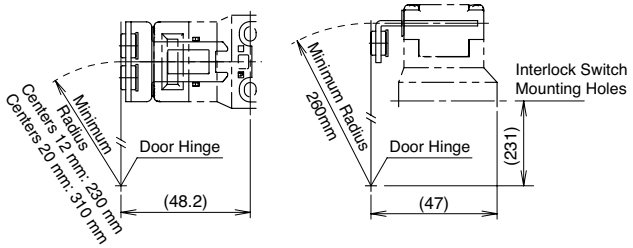


HS9Z-A52 Actuator (w/rubber bushings)

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:



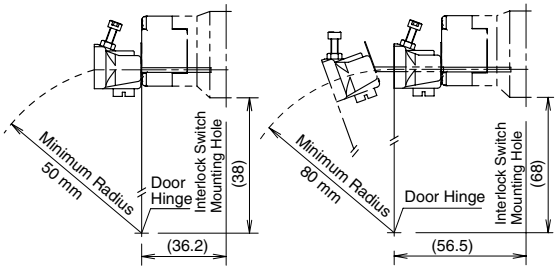
Actuator Angle Adjustment (vertical/horizontal)

- Using the angle adjustment screw, the actuator angle can be adjusted (refer to the dimensional drawing on page 333).
  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

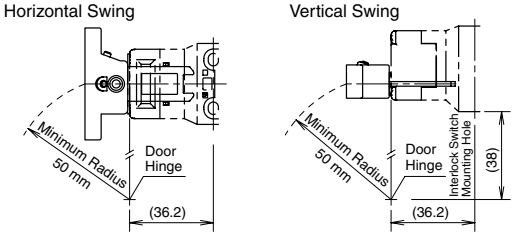
When the door hinge is on the extension line of the interlock switch surface: 50 mm

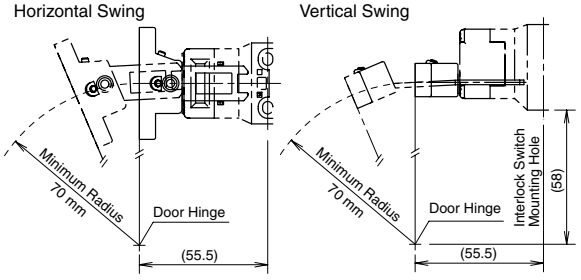
When the door hinge is on the extension line of the actuator mounting surface: 80 mm



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

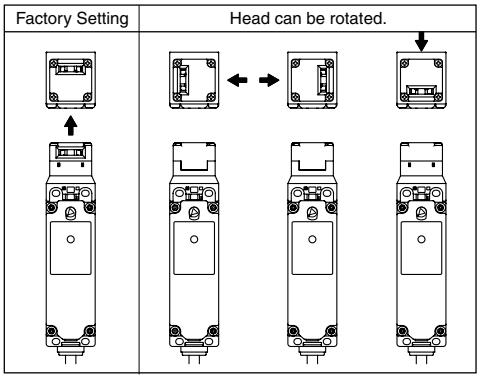




When the door hinge is on the extension line of the actuator mounting surface: 70 mm

Rotating the Head

The head of the HS5E can be rotated by removing the four screws from the corners of the HS5E head and reinstalling the head in the desired orientation. Before wiring the HS5E, replace the head if necessary. 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 space between the head and body, otherwise the interlock switch may malfunction.
Recommended tightening torque: 0.9 to 1.1 N·m.



Instructions, continued

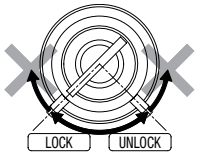
Head Removal Detection Circuitry

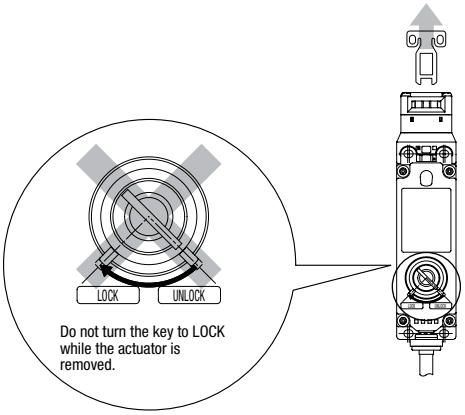
- Only the lock monitor circuit 41-42 turns off (open) when the head is removed, such as when the head is rotated. The other monitor circuit 51-52 turns ON (close). Be sure to connect the lock monitor circuit (41-42) to a safety circuit.
- When connecting the HS5E-K to a safety circuit, connect the door 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 UNLOCK position.

Key

Follow the instructions below to avoid operating failures and damage.

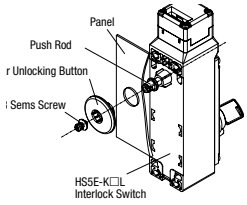
- Insert the key completely.
- Do not remove or insert the key while turning the key.
- Other than the standard key number (500), 15 types of key numbers are available. Use a key with the same number as the number on the cylinder.
- Do not apply excessive force when turning the key. Otherwise operating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



Recommended Tightening Torque for Mounting Screws

- HS5E 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)
  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)
  HS9Z-A53: 4.5 to 5.5 N·m (two M6 screws)
  HS9Z-A55: 1.0 to 1.5 N·m (two M4 screws)

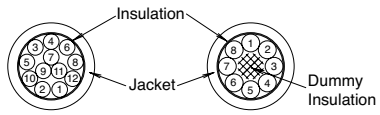
Note: The above recommended tightening torque of the mounting screws are the values with hex socket head bolts. When other screws are used and tightened to a smaller torque, make sure that the screws do not become loose after mounting.

Wire Identification

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

- HS5E-V: Wires of gray and gray/white insulation cannot be used.
- HS5E-DD: Wires of brown and brown/white insulation 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.

Type	Circuit Diagram
HS5E-KVA	UNLOCK LOCK Monitor Circuit: Blue ⊖11 — 12 Blue/White Monitor Circuit: Pink ⊖41 — 42 Pink/White Monitor Circuit: Orange 23 — 24 Orange/White Monitor Circuit: Brown 53 — 54 Brown/White
HS5E-KVD	Monitor Circuit: Blue ⊖11 — 12 Blue/White Monitor Circuit: Pink ⊖41 — 42 Pink/White Monitor Circuit: Orange ⊖21 — 22 Orange/White Monitor Circuit: Brown ⊖51 — 52 Brown/White

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

ø22 HW Key Switch

Key features:

- Key Selector Switches with Direct Opening Action Mechanism
- High-security Pin Tumbler Key
- The NC contact is opened by direct opening action mechanism ⊖. Mode selection enables easy construction of safety systems.
- The single key enables the hostage control of combining HW series key selector switch (pin tumbler type) and HS5E-K interlock key switch. High-security pin tumbler key is used. Sixteen types of key numbers are available.
- Selection of 2-position and 3-position, maintained, spring-return types and key retained variety is available.
- Degree of Protection: IP65 (IEC60529)

Applicable Standards	Mark	File No. or Organization
UL508	UL LISTED	UL Listing File No. E68961
CSA C22.2 No.14	SP	CSA166730 (LR92374)
EN60947-5-1	TÜV	TÜV Rheinland R50054316
	CE	Self-declaration Low Voltage Directive of Europe

Two-position Key Switch (90°)

Contact Code	Contact Block		Standard Logic			Inverse Logic		
			Logic Table		Maintained 1 2	Logic Table		Maintained 2 1
	Mounting Position	Contact	1	2		1	2	
1NO (10)	①	NO		●	HW1K-2PA10	●		HW1K-2JPA10
	②	–	Dummy Block			Dummy Block		
1NC (01)	①	NC	●		HW1K-2PA01		●	HW1K-2JPA01
	②	–	Dummy Block			Dummy Block		
2NO (20)	①	NO		●	HW1K-2PA20	●		HW1K-2JPA20
	②	NO		●		●		
2NC (02)	①	NC	●		HW1K-2PA02		●	HW1K-2JPA02
	②	NC	●				●	
1NO-1NC (11)	①	NO		●	HW1K-2PA11	●		HW1K-2JPA11
	②	NC	●				●	
2NO-2NC (22)	①	NO		●	HW1K-2PA22	●		HW1K-2JPA22
	②	NC	●				●	
	③	NO		●		●		
	④	NC	●				●	

Contact Block Mounting Position

For contact block mounting position, see the figure to the right of the table.
Each key selector switch is supplied with two keys.
Key number 500 is supplied as the default key in table above (500 not added to part number).
To order additional key types, specify key number at end of part number (special order).
Example: HS5E-KVA003-2A501
501 to 515
Note: The key number is engraved on the cylinder.

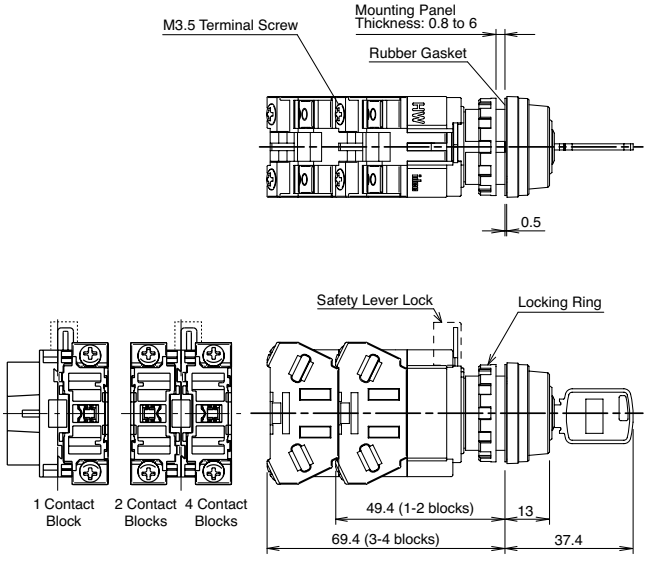
Three-position Key Switch (45°)

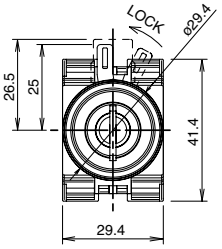
Contact Code	Contact Block No.	Contact Block Contact	Logic Table 1	Logic Table 0	Logic Table 2	Cam Code	Maintained (1 0 2)
2NC (02)	①	NC		●		–	HW1K-3PA02
	②	NC	●				
2NO-2NC (22N1)	①	NO	●			–	HW1K-3PA22N1
	②	NO			●		
	③	NC		●			
	④	NC	●				
2NO (02)	①	NO	●			–	HW1K-3PA20
	②	NO			●		
2NO-1NC (21N1)	①	NO	●			J	HW1K-3JPA21N1
	②	NO			●		
	③	NC		●			
☆	④	–	Dummy Block				
2NO-2NC (22N9)	①	NC			●	S	HW1K-3SPA22N9
	②	NC	●				
	③	NO	●				
☆	④	NO			●		
4NC (04)	①	NC			●	S	HW1K-3SPA04
	②	NC	●				
	③	NC			●		
☆	④	NC	●				

Contact Block Mounting Position

On the contact arrangement marked with ☆ in the table above, the rated current (load switching current) is reduced to a half of the rated current of the contact block. The rated insulation voltage and the rated thermal current remain unchanged.
For models with ☆, contacts may overlap when the operator position is changed.
For contact block mounting position, see the figure on the right.
Each key selector switch is supplied with two keys.
15 types of key numbers are available in addition to standard (500) key.
Key number 500 is supplied as the default key in table above (500 not added to part number).
To order additional key types, specify key number at end of part number (special order).
Example: HS5E-KVA003-2A501
501 to 515
Note: The key number is engraved on the cylinder.

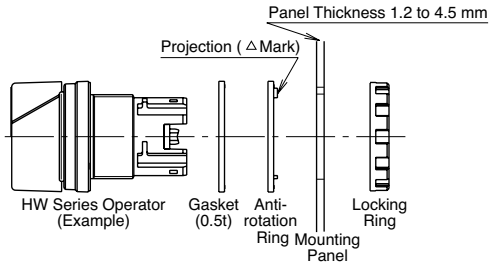
Dimensions (mm)



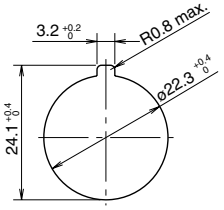


Anti-rotation Ring and Panel cut-out

Align the TOP marking on the operator and the TOP mark on the anti-rotation ring with the recess in the mounting panel.



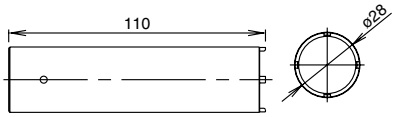
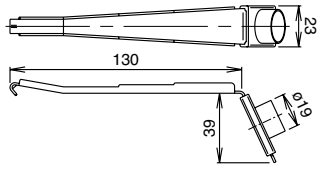
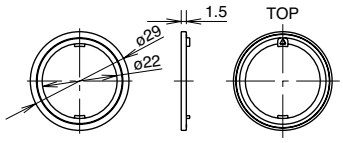
Panel-cut
(Complies with IEC 60947-5-1)

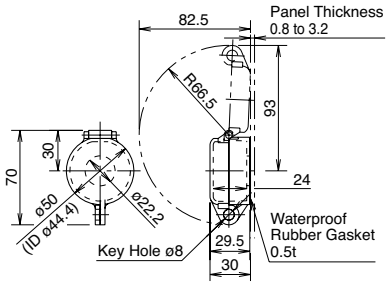
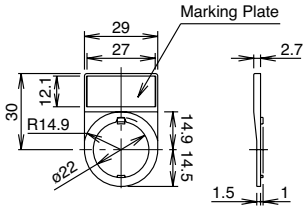
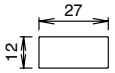


Replacement Parts

Item	Material	Part No.	Remarks
Contact Block	1NO contact	HW-G10	Housing color: blue Push rod: green
	1NC contact	HW-G01	Housing color: purple Push rod: red
Dummy Block	Nylon	TW-DB	Used when using contact blocks in odd numbers.
Spare Key	Metal (nickel-plated brass)	LW9Z-SK-500	Standard key number
		LW9Z-SK-□	Key number 501 to 515
Locking Ring	Polyamide	HW9Z-LN	Black
Safety Lever Lock	Polyacetal	HW9Z-LS	Yellow One safety lever lock is supplied as standard.
Gasket	Polyacetal	HW9Z-WM	Black

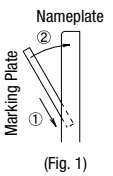
Accessories

Item	Material	Part No.	Dimensions
Locking Ring Wrench	Metal (brass) Weight: approx. 150g	MW9Z-T1	Used to tighten the locking ring when installing the HW switch onto a panel. Tighten the locking ring to a torque of 2.0 N·m. 
Contact Block Removal Tool	Metal (copper-zinc plating) / Nitrile Rubber	TW-KC1	Used to remove the contact block and the transformer, and also to install or remove the pilot light lens. Also used to adjust the panel thickness (1, 1.6, 2, 2.3, 3.2, and 5 mm). 
Anti-rotation Ring	Ring: Nylon Gasket: Nitrile Rubber	HW9Z-RL	Used to prevent the operator from turning. 

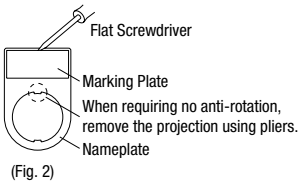
Item	Material	Part No.	Dimensions
Padlock Cover	Body: Polyarylate Gasket: Nitrile Rubber	HW9Z-KL1	
Nameplate	Plastic (black) 1.5 mm thick	HWAM	Order marking plate (HWNP-☐) separately. 
Marking Plate	Aluminum (black) 1.0 mm thick	HWNP-☐	White letters on black background  Specify a legend code in place of ☐ in the Type No.

Code	Legend
31	OFF-ON
35	HAND-AUTO
53	HAND-OFF-AUTO

To install the marking plate on a nameplate, see Fig. 1.
To remove the marking plate, insert a flat screwdriver between the marking plate and nameplate as shown in Fig. 2.
When using a nameplate, mounting panel thickness is decreased by 1.5 mm.
When an anti-rotation ring on the nameplate is not required, remove the projection using pliers as shown in Fig. 2.



(Fig. 1)



(Fig. 2)

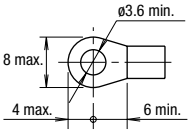
Operating Instructions

Applicable Wiring

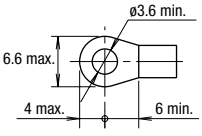
1. The applicable wire size is 14 AWG maximum (Solid wire 16 AWG max.). One or two wires can be connected.

Applicable Crimping Terminal

Crimping Terminal for Ⓐ

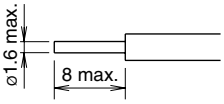


Crimping Terminal for Ⓑ



Be sure to use an insulation tube or cover on the crimping part of the crimping terminal to prevent electrical shocks.

Solid Wire



2. Tighten the M3.5 terminal screw to a recommended tightening torque of 1.0 to 1.3 N·m.

HS7A-DMC Magnetic Safety Switches

Key features:

- Compact size and easy positioning.
- Combination with proprietary relay modules achieves safety category 4 (EN954-1).
- Compact size (7 × 16 × 51mm)
- Positioning for installation is easy.
- Up to 36 sets can be connected.
  (safety relay module: HR1S-DME)
- Degree of protection: IP67

Part Numbers

HS7A Non-contact Magnetic Interlock Switches

Contact Configuration	Cable Length	LED	Part Number	Applicable Safety Relay Module
1NO + 1NC	2m	Without	HS7A-DMC5902	HR1S-D☐
		With	HS7A-DMC5912	
	5m	Without	HS7A-DMC5905	
		With	HS7A-DMC5915	
	10m	Without	HS7A-DMC59010	
		With	HS7A-DMC59110	
2NO	2m	Without	HS7A-DMC7902	HR1S-AF☐
		With	HS7A-DMC7912	
	5m	Without	HS7A-DMC7905	
		With	HS7A-DMC7915	
	10m	Without	HS7A-DMC79010	
		With	HS7A-DMC79110	

The HS7A-DMC non-contact interlock switch is supplied with an HS9Z-ZC1 actuator.
The contact configuration in the table above shows the contact status when the non-contact interlock switch is not activated.

HR1S Safety Relay Modules for Non-contact Interlock Switches

Safety Relay Module	Voltage	Number of Inputs	Max. Number of Connectable Non-contact Interlock Switches
HR1S-DMB☐32	24V DC –20 to +20%	2	12
HR1S-DME☐32		6	36
HR1S-AF☐30B	24V AC –15 to +10% 50/60 Hz 24V DC –15 to +10%	1	6

Safety category 3 can be achieved when connecting two or more non-contact interlock switches per one input.
When connecting multiple non-contact interlock switches (HS7A-DMC790☐), use HR1S-AF51☐.
(HS7A-DMC791☐ cannot be connected in multiple numbers.)

Accessory

Name	Part Number
Actuator	HS9Z-ZC1

One HS9Z-ZC1 is supplied with each HS7A-DMC non-contact interlock switch.

Maximum Number of Connectable Non-contact Interlock Switches per Input of Safety Relay Module

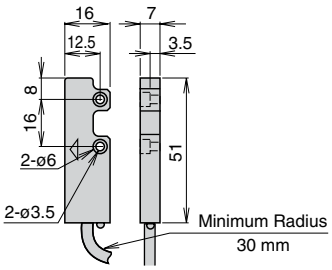
Non-contact Interlock Switch	HS7A-DMC59☐☐		HS7A-DMC79☐☐	
	Without LED	With LED	Without LED	With LED
HR1S-D☐	6	3	–	–
HR1S-AF☐	–	–	6	1

Specifications

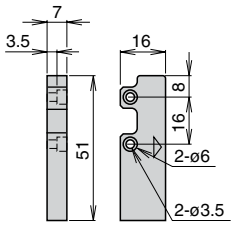
Applicable Standards		IEC/EN 60947-5-1 UL508 (UL listed) CSA C22.2, No. 14
Operating Temperature		–25 to 85°C (no freezing)
Relative Humidity		30 to 85% RH (no condensation)
Storage Temperature		–40 to +85°C (no freezing)
Pollution Degree		3
Electric Shock Protection		Class II (IEC 60536)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		300 m/s^2 (11 ms) (IEC 60068-2-7)
Vibration Resistance		100 m/s^2 (10 to 150 Hz) (IEC 60068-2-6)
Rated Voltage (Ue)		24V DC
Rated Current (Ie)		100 mA
Repeat Accuracy		10% maximum
Maximum Operating Frequency		150 Hz
Voltage Drop	I = 10 mA	0.1V (without LED) / 2.4V (with LED)
	I = 100 mA	1V (without LED) / 4.2V (with LED)
Housing Material		PBT
Housing Color		Red
Cable		AWG23 × 4 Cable length: 2m, 5m, 10m
Weight (approx.)		HS7A-DMC: 100g (cable length: 2m) HS9Z-ZC1: 9g

Dimensions (mm)

HS7A-DMC (Non-contact Interlock Switch)



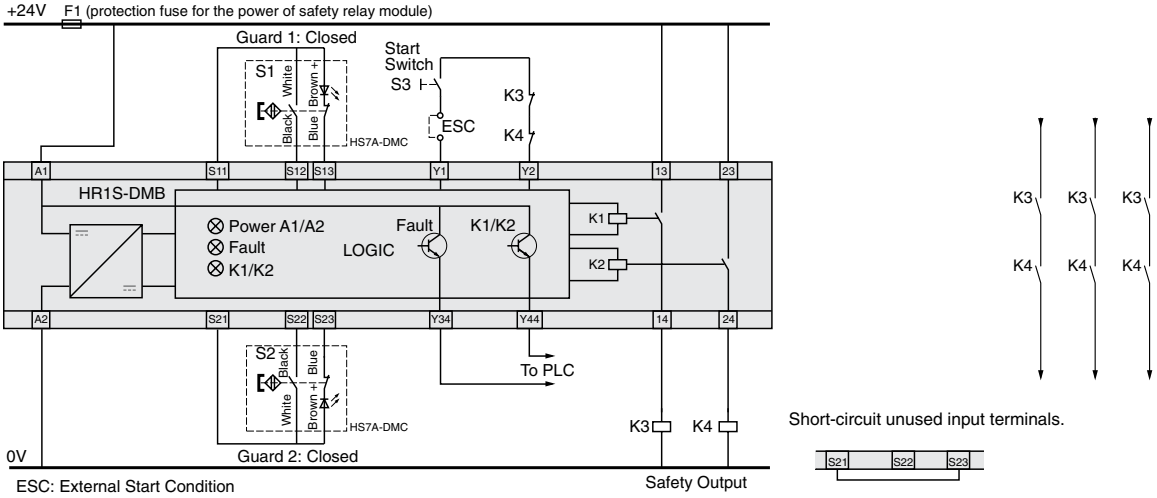
HS9Z-ZC1 (Actuator)



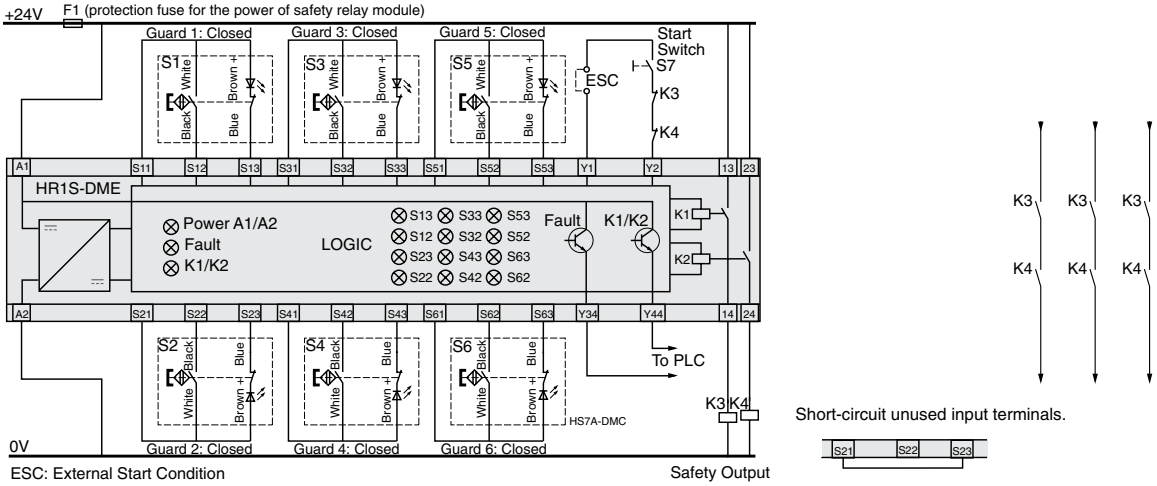
Example Wiring Diagram

The following diagrams show the contact statuses when the non-contact interlock switches are activated by the actuators.

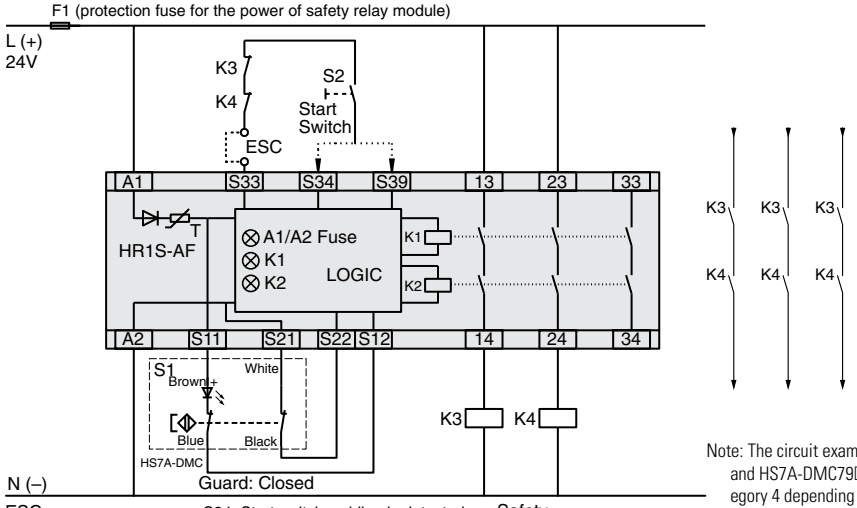
Example: Safety Category 4 (ISO 13849-1) Circuit, HR1S-DMB + HS7A-DMC591☐ (1NO+1NC) + HS9Z-ZC1



Example: Safety Category 4 (EN 13849-1) Circuit, HR1S-DME + HS7A-DMC591☐ (1NO+1NC) + HS9Z-ZC1



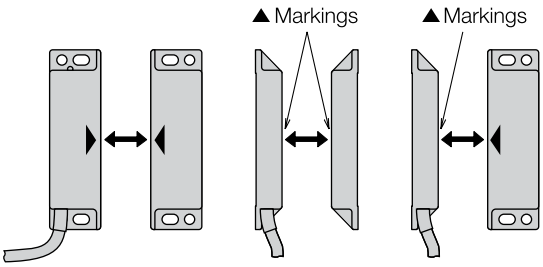
Example: Safety Category 4 (EN 13849-1) Circuit, HR1S-DME + HS7A-DMC591☐ (1NO+1NC) + HS9Z-ZC1



Note: The circuit example shown on the left (HR1S-AF and HS7A-DMC79☐☐ may not conform to safety category 4 depending on the operating conditions, such as the frequency of safety function check. Perform risk assessment of your system before operation.

Operating Instructions

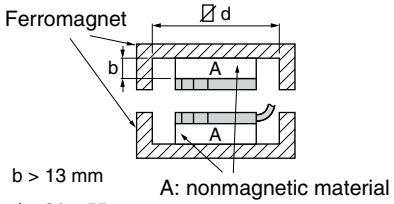
Operating Direction



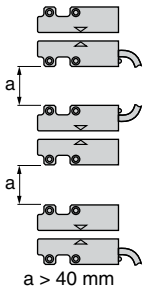
Safety output ON distance (SAO): 3mm.

Precautions for Installation

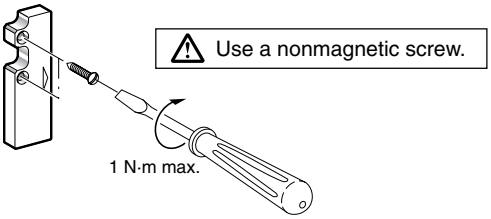
When installing on a ferromagnet



Close mounting

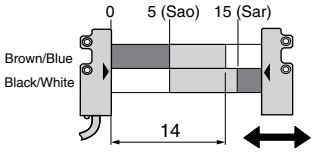


Tightening Torque

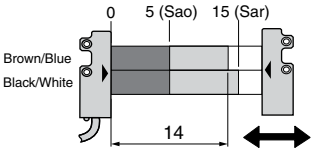


Operation Chart

HS7A-DMC59□□(1NO+1NC)



HS7A-DMC79□□(2NO)



Dimensions: mm

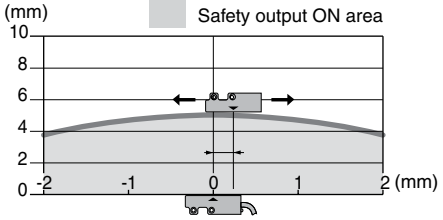
Contact Status

	Contact Closed (1)
	Contact Open (0)
	Transient State

Sao: Assured operating distance where the safety output is sure to turn on.
Sar: Assured release distance where the safety output is sure to turn off.

Note: When the transfer time between the actuator's Sao-Sar is 500 ms or longer, the time lag is detected as an error.

Operation Area



HS7A-DMP Magnetic Safety Switches

Key features:

- Three-contact models.
  Auxiliary contacts enable PLCs to monitor the door status.
- Operation signals from auxiliary contacts can be read directly by controllers such as PLCs, allowing for monitoring HS7A-DMP non-contact interlock switches.
- Ideal for installation on guard doors where positioning is difficult.
- Conformable up to safety category 4 (EN ISO 13849-1)
  (Combining with proprietary safety relay module achieves safety category 4.)
- A maximum of 36 sets can be connected (safety relay module: HR1S-DME)
- Degree of protection: IP67

The HS7A-DMP non-contact interlock switches can be used as interlock switches when used in combination with safety relay modules specified by IDEC.

Part Numbers

HS7A Non-contact Interlock Switches

Contact Configuration	Cable Length	LED	Ordering Type No.	Applicable Safety Relay Module
1NO+2NC	2m	Without	HS7A-DMP5002	HR1S-D☐
		With	HS7A-DMP5012	
	5m	Without	HS7A-DMP5005	
		With	HS7A-DMP5015	
2NO+1NC	2m	Without	HS7A-DMP7002	HR1S-AF☐
		With	HS7A-DMP7012	
	5m	Without	HS7A-DMP7005	
		With	HS7A-DMP7015	

The HS7A-DMP non-contact interlock switch is supplied with an HS9Z-ZP1 actuator.
The contact configuration in the table above shows the contact status when the non-contact interlock switch is not activated.

HR1S Safety Relay Modules for Non-contact Interlock Switches

Safety Relay Module	Number of Inputs	Max. Number of Connectable Non-contact Interlock Switches
HR1S-DMB☐	2	12
HR1S-DME☐	6	36
HR1S-AF☐	1	6

When connecting multiple non-contact interlock switches (HS7A-DMP700☐), use HR1S-AF☐.
(HS7A-DMP701☐ cannot be connected in multiple numbers.)

Accessory

Name	Part Number
Actuator	HS9Z-ZP1

One HS9Z-ZP1 is supplied with each HS7A-DMP non-contact interlock switch.

Maximum Number of Connectable Non-contact Interlock Switches per Input of Safety Relay Module

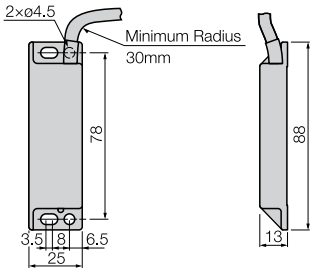
Non-contact Interlock Switch	HS7A-DMP50☐☐		HS7A-DMP70☐☐	
	Without LED	With LED	Without LED	With LED
HR1S-DM☐	6	3	–	–
HR1S-AF☐	–	–	6	1

Specifications

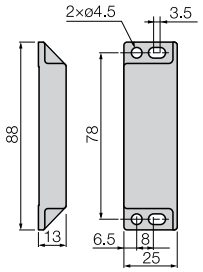
Applicable Standards		IEC/EN 60947-5-1 UL508 (UL listed) CSA C22.2, No. 14
Operating Temperature		–25 to 85°C (no freezing)
Relative Humidity		35 to 85% RH (no condensation)
Storage Temperature		–40 to +85°C (no freezing)
Pollution Degree		3
Electric Shock Protection		Class II (IEC 60536)
Degree of Protection		IP67 (IEC 60529)
Shock Resistance		300 m/s^2 (11 ms) (IEC 60068-2-7)
Vibration Resistance		100 m/s^2 (10 to 150 Hz) (IEC 60068-2-6)
Rated Voltage (Ue)		24V DC
Rated Current (Ie)		100 mA
Repeat Accuracy		10% maximum
Maximum Operating Frequency		150 Hz
Voltage Drop	I = 10 mA	0.1V (without LED) / 2.4V (with LED)
	I = 100 mA	1V (without LED) / 4.2V (with LED)
Electrical Durability		1,200,000 operations minimum
Housing Material		PBT
Housing Color		Red
Cable		AWG23 × 6 Cable length: 2m, 5m
Weight (approx.)		HS7A-DMP: 180g (cable length: 2 m) HS9Z-ZP1: 50g

Dimensions (mm)

HS7A-DMP□□□□ (Non-contact Interlock Switch)



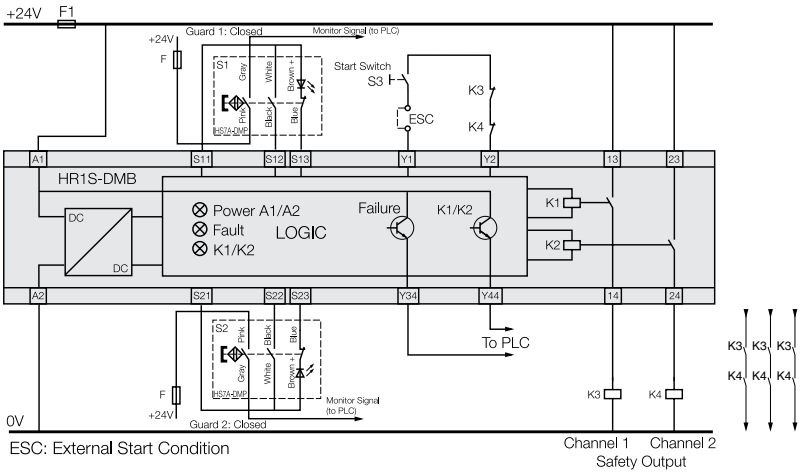
HS7A-ZP1 (Actuator)



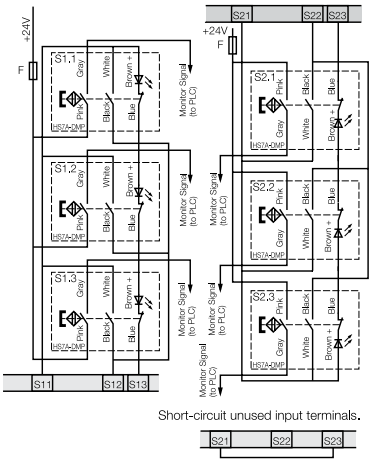
Example Wiring Diagram

The following diagrams show the contact statuses when the non-contact interlock switches are activated by the actuators.

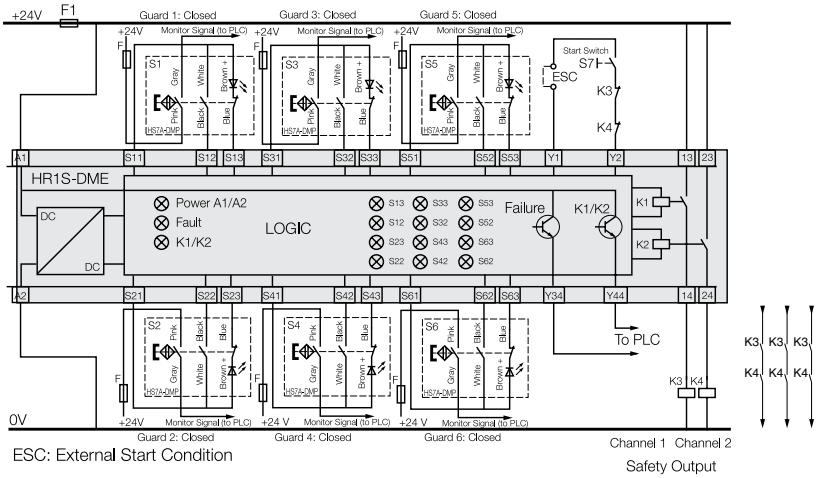
Example: Safety Category 4 (ISO 13849-1) Circuit HR1S-DMB + HS7A-DMP50□□ (1NO+2NC) + HS9Z-ZP1



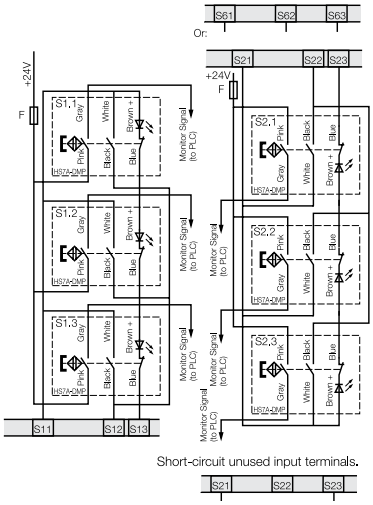
Example: Safety Category 3 (EN ISO 13849-1) Circuit HR1S-DMB



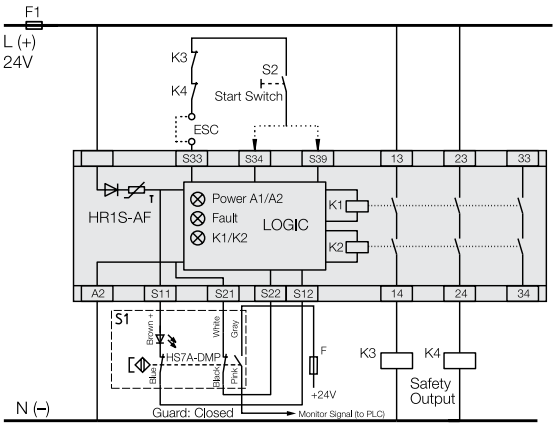
Example: Safety Category 4 (ISO 13849-1) Circuit HR1S-DME + HS7A-DMP50□□ (1NO+2NC) + HS9Z-ZP1



Example: Safety Category 3 (ISO 13849-1) Circuit HR1S-DME



Example: Safety Category 4 (ISO 13849-1) Circuit HR1S-AF + HS7A-DMP70□□ (2NO+1NC) + HS9Z-ZP1



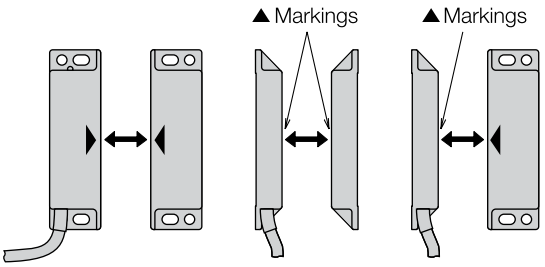
F1: Protection fuse for the power of safety relay module

F: Protection fuse for monitor signal contacts (max. 500mA gG (gL))

Note: The circuit example shown on the left (HR1S-AF and HS7A-DMP70□□) may not conform to safety category 4 depending on the operating conditions, such as the frequency of safety function check. Perform risk assessment of your system before operation.

Operating Instructions

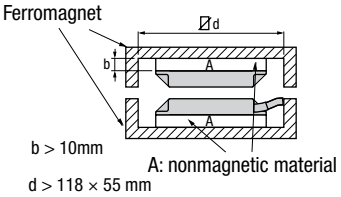
Operating Direction



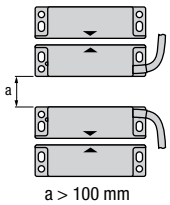
Safety output ON distance (SAO): 3mm.

Precautions for Installation

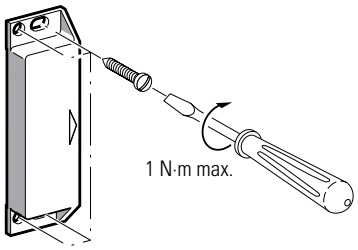
When installing on a ferromagnet



Close mounting



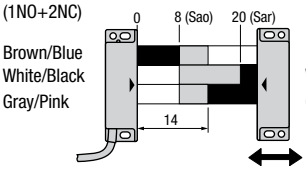
Tightening Torque



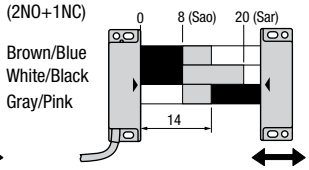
⚠ Use a nonmagnetic screw.

Operation Chart

HS7A-DMP50□□ (1NO+2NC)



HS7A-DMP70□□ (2NO+1NC)



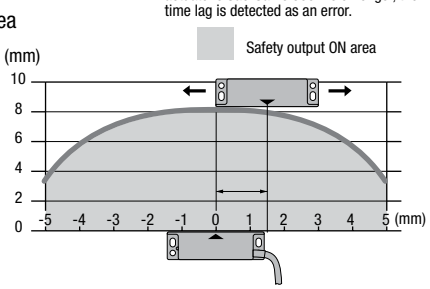
Contact Status

■	Contact closed (1)
□	Contact open (0)
▒	Transient area

Sao: Assured operating distance where the safety output is sure to turn on.
Sar: Assured release distance when the safety output is sure to turn off.

Note: When the transfer time between the actuator's Sao-Sar is 500 ms or longer, the time lag is detected as an error.

Operation Area



HS3A Non-contact RFID Safety Switches

Key features:

- RFID non-contact interlock switch, Category 4 and PLe (EN/ISO 13849-1) compliant.
- The sensor head with built-in safety function (redundant solid state output with internal monitoring) eliminates the need for a designated safety module.
- RFID ensures detection of slow-moving, open, sliding, and rattling doors.
- Multicode and unicode sensor heads are available. Unicode sensor head (one sensor head corresponds to one actuator) prevents tampering with the use of an unassigned spare actuator.
- Sensor head can be installed in 5 directions.
- Degree of protection IP67. Actuator IP67, IP69K (Note)

Note: IP69K is a degree of protection specified by Deutsches Institüt für Normung (DIN), DW 40050 Part 9 for hot and high-pressure water.

Interlock Switch
(Sensor Head)

Actuator

Part Numbers

HS3A Non-contact RFID Safety Switches

Outputs	Type	Part Number
Safety output: 2 Monitor output: 1	Multicode	HS3A-H21M4
	Unicode	HS3A-H21U4

Accessories

Name			Part Number	Remarks
Actuator			HS9Z-ZH31	Actuator for both multicode and unicode sensor heads. Supplied with two M5 × 10 mounting screws (stainless steel)
Terminal Plug (For serial connection)			HS9Z-H3TP	Used on Y-branch connector when connecting two or more switches in series.
Y-branch Connector (For serial connection)			HS9Z-H3YD	Used when connecting two or more switches in series. Plug connector: 8-pin (switch side), 5-pin (cable side)
M12 Plug Connection Cable	For connecting two or more switches in series	5-pin, 5m	HS9Z-H3F505	Used when connecting two or more switches in series. 5-pin plug connector is provided at one end.
		5-pin, 10m	HS9Z-H3F510	
	For connecting a single switch	8-pin, 5m	HS9Z-H3F805	Used when connecting a single switch. 8-pin plug connector is provided at one end.
		8-pin, 10m	HS9Z-H3F810	
M12 Plug Connection Cable (For serial connection)		5-pin, 5m	HS9Z-H3F5M05	Used when connecting two or more switches in series. 5-pin plug connectors are provided at both ends.
		5-pin, 10m	HS9Z-H3F5M10	

See below for an example of accessories required when connecting N number of HS3A switches in series.

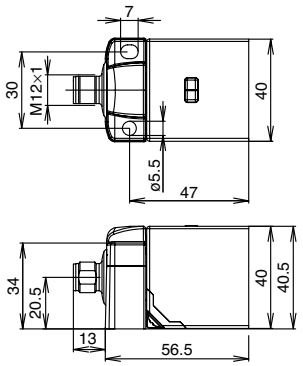
HS3A non-contact interlock switch (HS3Z-H21☐4): N pcs.
Actuator (HS9Z-ZH31): N pcs.
Terminal plug (HS9Z-H3TP): 1 pc.
Y-branch connector (HS9Z-H3YD): N pcs.
M12 plug connection cable, open end (HS9Z-H3F5☐☐): 1 pc.
M12 plug connection cable, plug connectors at both ends (HS9Z-H3F5M☐☐): N–1 pcs.

Specifications

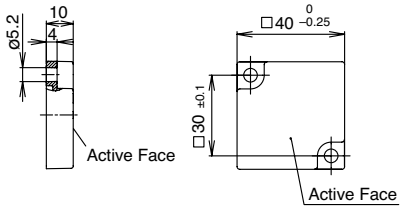
Applicable Standards		EN60947-5-3 (IFA approval) EN954-1 EN ISO13849-1 EN62061 GS-ET-14 (IFA approval) UL508 (UL listed) CSA C22.2 No.14 (c-UL listed)
Operating Temperature		–20 to +55°C (no freezing)
Relative Humidity		5 to 80% (no condensation)
Storage Temperature		–25 to +70°C
Pollution Degree		3
Sensor Classification		PDF-M (EN60947-5-3)
Performance Level (PL)		e (EN ISO 13849-1)
Safety Category		4 (EN ISO 13849-1)
Safety Integrity Level (SIL)		3 (EN 62061)
Degree of Protection	Interlock Switch (sensor head)	IP67
	Actuator	IP67, IP69K (Note)
Rated Voltage (UB)		24V DC ±15%
Current Consumption		80mA (at no load)
Dielectric Strength		500V AC
Output Specifications	Safety Output	Semiconductor output, P-channel Output voltage: Max: UB [V], Min.: UB-1.5 [V] Maximum output current per safety output: 400 mA
	Monitor Output	Semiconductor output, P-channel Output voltage: Max: UB [V], Min.: 0.8×UB [V] Maximum output current: 200 mA
Operation Distance	Turn-on Distance	15mm (typ.)
	Assured Turn-on Distance (Sao)	13mm
	Maximum Turn-off Distance (Sar)	58mm
Response Time	When using a single switch	260 ms (actuator removed)
		150 ms (non-identical input signal at IA/IB)
		150 ms (non-identical enabling input state at IA/IB)
		300 ms (short-circuit or cross-circuit at OA/OB, or internal error)
	When using two or more switches (max.)	360 ms (actuator removed)
		250 ms (non-identical input signal at IA/IB)
		400 ms (non-identical enabling input state at IA/IB)
		400 ms (short-circuit or cross-circuit at OA/OB, or internal error)
Shock Resistance		Operating extremes: 300 m/s^2 (11 ms)
Vibration Resistance		10 to 55 Hz, amplitude 0.5 mm
Material		PBT
Cable		M12 plug connection cable, 8-pin
Weight (approx.)		400g (HS3A-H21☐☐)
Attachment		System Manual (CD-ROM)

Dimensions (mm)

Sensor Head

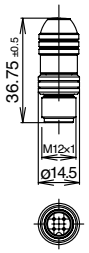


Actuator

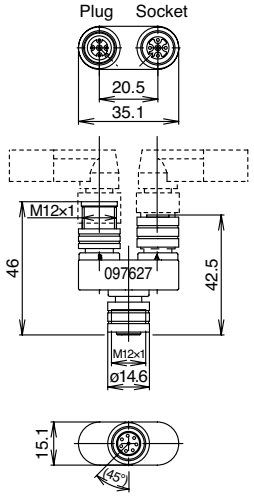


Supplied with two mounting screws (M5 × 10).

Terminal Plug HS9Z-H3TP

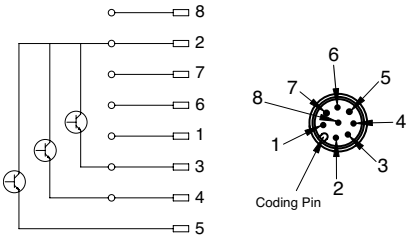


Y-branch Connector HS9Z-H3YD



Specifications

Non-contact Interlock Switch



Plug Connection Cable

HS9Z-H3FB

Pin	Wire	Legend	Description
1	White	IB	Enabling input (channel 2)
2	Brown	UB	Power supply (24V DC)
3	Green	OA	Safety output (channel 1)
4	Yellow	OB	Safety output (channel 2)
5	Gray	OUT	Monitoring output
6	Pink	IA	Enabling input (channel 1)
7	Blue	0V	0V
8	Red	RST	Reset input for hardware

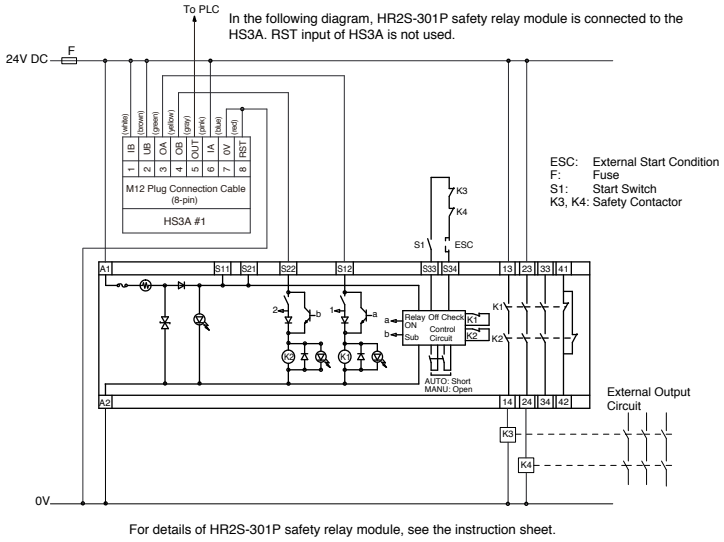
HS9Z-H3FS

Pin	Wire	Legend
1	Brown	UB
2	White	OA
3	Blue	0V
4	Black	OB
5	Gray	RST

Wiring Diagram

When using a single HS3A

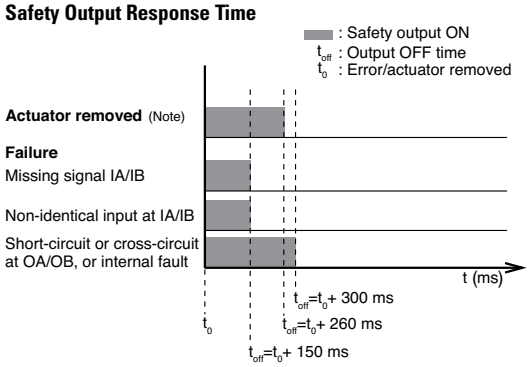
When using a single HS3A, connect as shown in the figure below (Note). The OUT output can be connected to a control system, to a PLC for example, as a monitoring output.
The HS3A can be reset via the RST input. To reset, apply 24V DC for at least 3 seconds. When not using the RST input, connect the RST input to 0V.



For details of HR2S-301P safety relay module, see the instruction sheet.

Note: Safety performance of the actual system is determined by performing a risk assessment on the entire system. Depending on the risk level the system may entail, K1 and K2 need to be monitored to prevent serious accidents.

Safety Output Response Time



Note: The time required for the safety output to turn off after the actuator moves outside the operating distance of the HS3A switch.

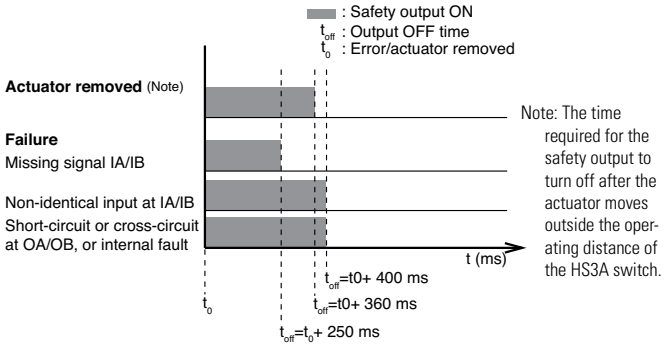
When using two or more HS3A in series

A maximum of 20 can be connected in series.
Pay attention to the contact resistance at the connection points.

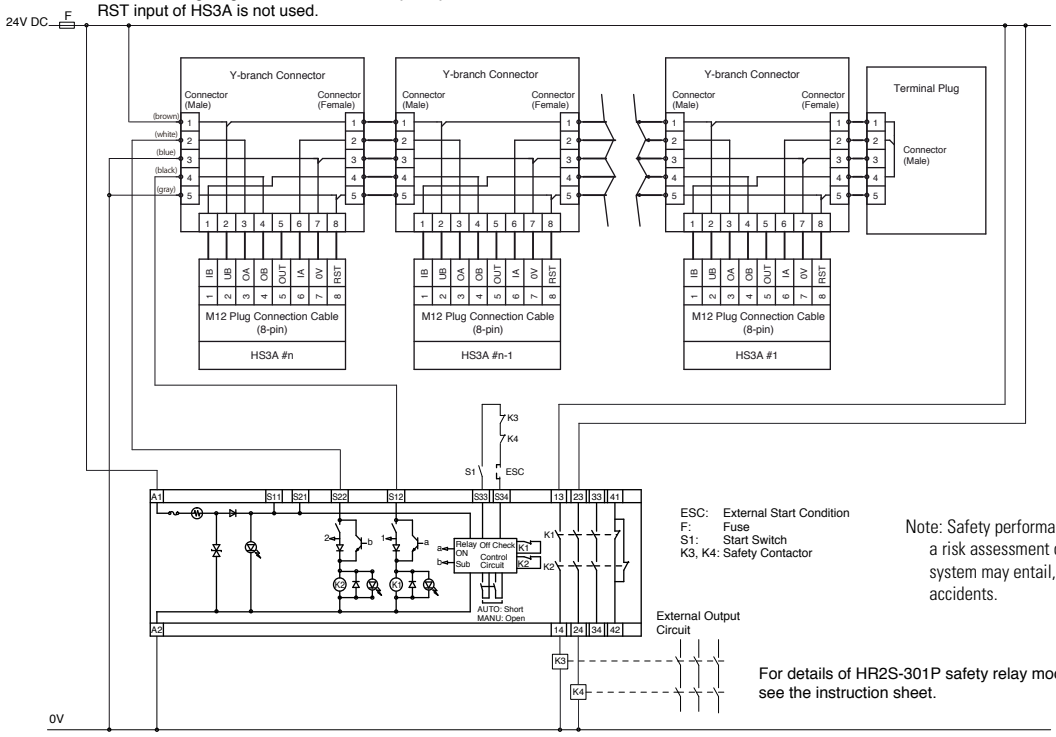
The HS3A switches can be connected in series using plug connection cables and Y-branch connectors as shown in the figure below (Note). When any of the HS3A switches detects that the safety guard is open, or when a failure has occurred on any of the switches, the system tuns off the machine. However, the external control system cannot detect which safety guard is open or where a failure has occurred.

The HS3A can be reset via the RST input. To reset, apply 24V DC for at least 3 seconds. When not using the RST input, connect the RST input to 0V.

Safety Output Response Time



In the following diagram, HR2S-301P safety relay module is connected to the HS3A.
RST input of HS3A is not used.



ESC: External Start Condition
F: Fuse
S1: Start Switch
K3, K4: Safety Contactor

Note: Safety performance of the actual system is determined by performing a risk assessment on the entire system. Depending on the risk level the system may entail, K1 and K2 need to be monitored to prevent serious accidents.

For details of HR2S-301P safety relay module, see the instruction sheet.

Operation Distance and Response Time

When installing the HS3A, ensure the safety of the door opening area by paying attention to the operation distance (Table 1) and response time (Table 2) shown below.

Table 1: Operation Distance [1]

Distance	Value (mm)		
	Min.	Typ.	Max.
Turn-on distance	—	15 [2]	—
Assured turn-on distance Sa0	13	—	—
Switching hysteresis	1.5	2.5	—
Assured turn-off distance Sar	—	—	58

1. When the off-center displacement of the interlock switch (sensor head) and actuator is 0 mm.
2. When surface-mounted on aluminum. When using by embedding in metal, pay attention to the operation distance affected by the metal. In non-metallic environment, the typical turn-on distance increases to 30mm.

Table 2: Response Time

Response Time	When connecting a single switch (max.)	260 ms (actuator removed)
		150 ms (missing enabling input IA/IB)
		150 ms (non-identical enabling input state at IA/IB)
		300 ms (short-circuit or cross-circuit at OA/OB, or internal fault)
	When connecting two or more switches (max.)	360 ms (actuator removed)
		250 ms (missing signal enabling input IA/IB)
		400 ms (non-identical enabling input state at IA/IB)
		400 ms (short-circuit or cross circuit at OA/OB or internal fault)

Note: To ensure safety, both safety outputs (OA and OB) must always be evaluated. Single-channel use of the safety outputs as shown below leads to a reduction of safety category stipulated in EN954-1.

HS5B/HS5E Door Handle Actuator

Key features:

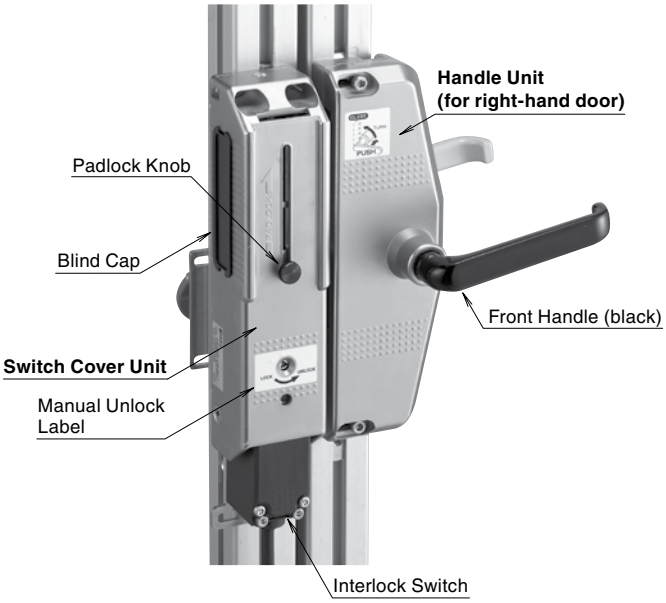
- Easy and secure operation
- Rattling doors can be locked smoothly and securely.
- A door can be locked with an actuator by pushing and turning the handle.
- Padlock tab is provided to ensure operator safety.
- Interlock switch with or without solenoid lock can be installed.
- LED shows solenoid status (when using HS5E-☐44L☐☐-G).

Part Numbers

Description		Ordering Type No.	Remarks	
Handle Unit	For right-hand door	HS9Z-DH5RH	Choose according to the required opening side.	
	For left-hand door	HS9Z-DH5LH		
Switch Cover Unit		HS9Z-DH5C	Used for installing the interlock switch inside.	
HS5B Installation Kit		HS9Z-DH5B	Contains a mounting plate and two spacers.	
Rear Unlocking Button Kit [1]		HS9Z-FL53	Contains a button with base plate and a connecting rod	Mounting panel thickness (X): 20 ≤ X ≤ 30mm [2]
		HS9Z-FL54		Mounting panel thickness (X): 30 ≤ X ≤ 40mm [2]

1. Use the kit in combination with the HS5E-☐44L☐☐-G rear unlocking button type interlock switch.
2. Mounting panel is a frame or a panel.

Parts Description



Front View

Rear View

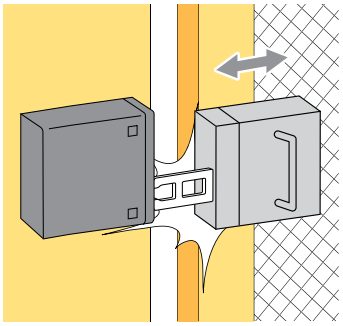
Specifications

Applicable Interlock Switch	HS5B Metal Head Interlock Switch [1] HS5E Rear Unlocking Button Type Interlock Switch with Solenoid [2]
Operating Temperature	–25 to +70°C (no freezing)
Mechanical Durability	100,000 operations minimum
Applicable Shackle Diameter of Padlock	ø6 to 7.5 mm
Withstand Load of Padlock Tab	30N maximum
Handle Operation Angle	77° (removed position ⟷ inserted position)
Insulation Resistance (500V DC megger)	Between live and dead metal parts: 100 MΩ minimum Between terminals of different poles: 100 MΩ minimum.

1. HS5B-□□ZB, HS5B-□□ZBM
2. HS5E-□44L□□-G
Interlock switch is not supplied with the actuator and must be ordered separately.
For the specifications of interlock switches, see pages XX, XX, and XX.

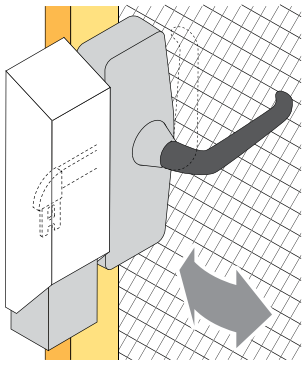
Rotational handle actuator can be inserted/removed smoothly on rattling doors.

Conventional Sliding Actuator



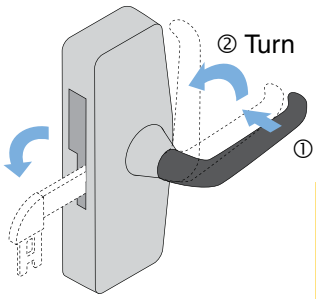
IDEC's Door Handle Actuator

Rattling doors can be locked smoothly and securely.

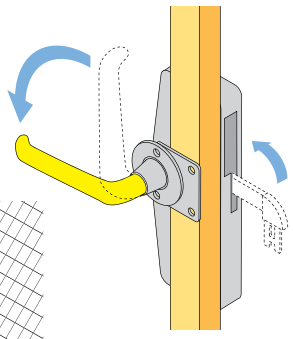


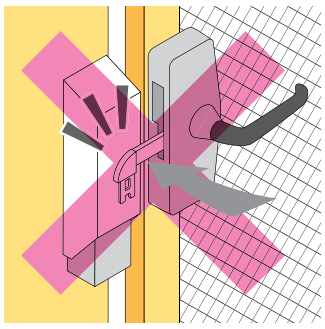
The door can be locked and unlocked by pushing and turning the handle.

The actuator can be inserted into the interlock switch by pushing and turning the front handle. The actuator can be removed from the interlock switch by turning the front handle.

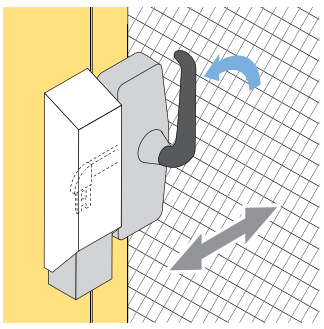


The rear handle can remove the actuator, but cannot insert the actuator.





Because the handle can be turned only while it is pushed, the actuator is prevented from hitting the switch cover unit.



Sliding doors can also be locked securely.

Padlockable tab ensures operator's safety.

When padlocks are installed on the padlock tab, the machine cannot be started because the actuator entry slot is blocked and the actuator cannot enter the interlock switch. By requiring all operators to have their own padlock and installing them on the door handle actuator before entering the hazardous area, the door will not be closed unless all padlocks are removed—i.e. all operators have left the hazardous area.

Note: Operators must observe rules in the workplace in order to ensure safety. Residual risk such as failure to install padlocks must be taken into consideration.

Interlock switch with/without solenoid locking can be selected.

HS5E

(HS5E-□44L□□-G)

HS5B

(HS5B-□□Z)

Door Handle Actuator Configuration

Interlock Switches

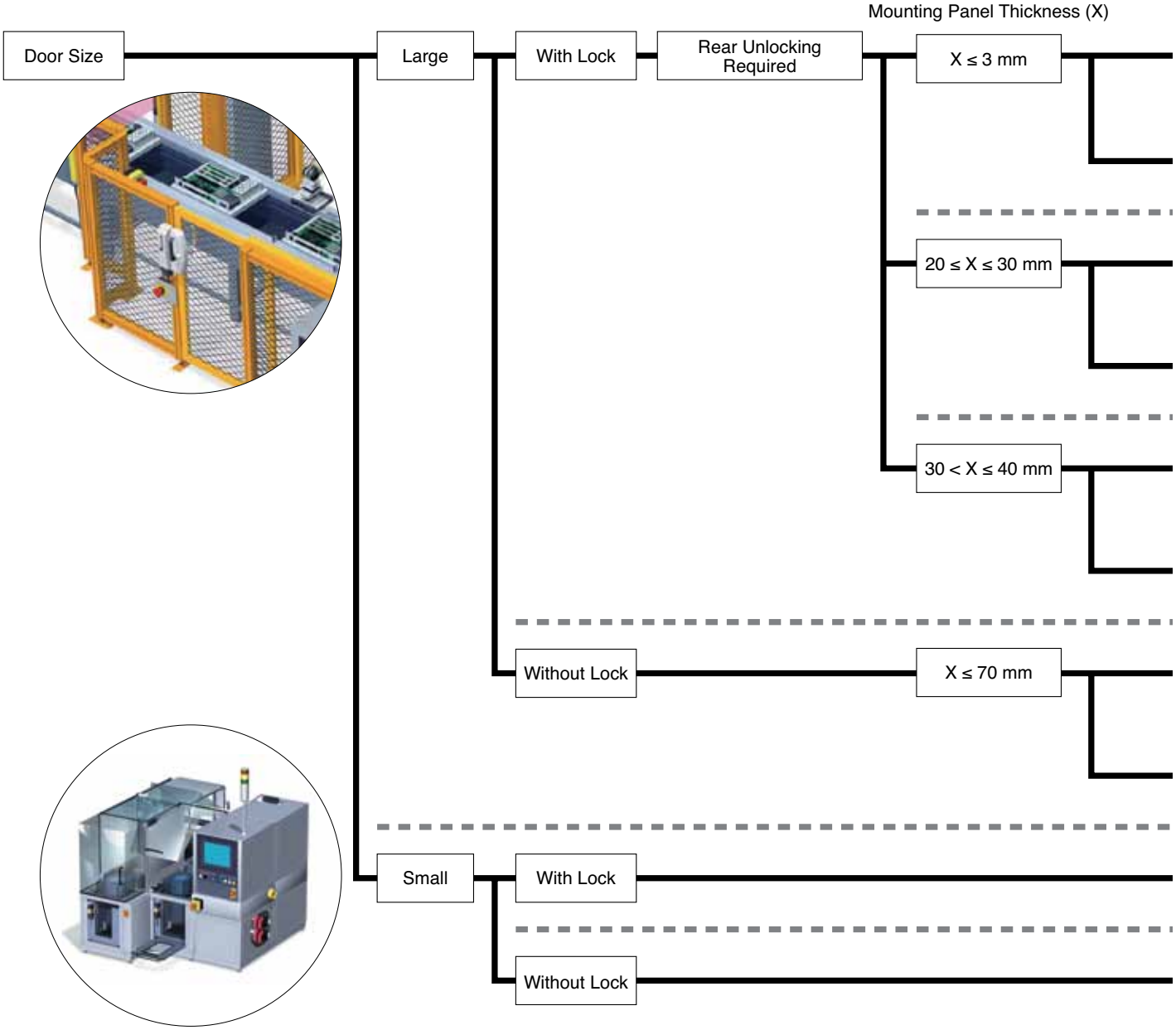
HS5E-☐44L☐☐-G
Rear Unlocking
Button Type

HS5B-☐☐Z
Metal Head Type

Switch Cover Unit

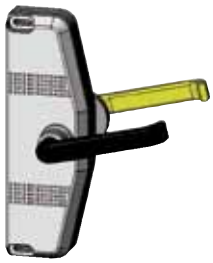
HS9Z-DH5C

Selection Chart



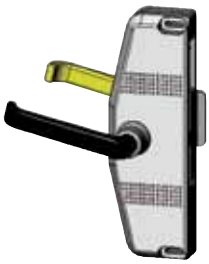
Handle Unit

Right-hand Door



HS9Z-DH5RH

Left-hand Door



HS9Z-DH5LH

Accessories
Rear Unlocking Button Kit

HS9Z-FL53
HS9Z-FL54

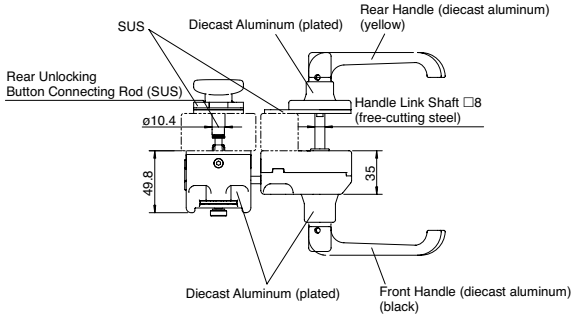
HS5B Installation Kit

HS9Z-DH5B

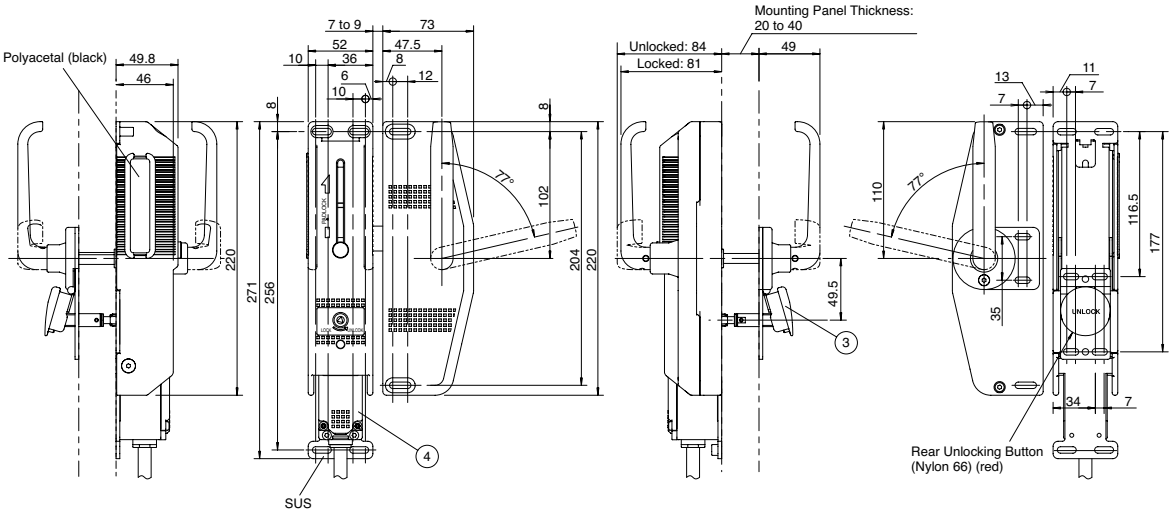
Handle Unit			Switch Cover Unit	Accessories	Interlock Switch
Right-hand Door	HS9Z-DH5RH	+	HS9Z-DH5C		HS5E-∗44L∗∗-G (Rear Unlocking Button Type)
Left-hand Door	HS9Z-DH5LH	+			
Right-hand Door	HS9Z-DH5RH	+		Rear Unlocking Button Kit HS9Z-FL53	
Left-hand Door	HS9Z-DH5LH	+			
Right-hand Door	HS9Z-DH5RH	+		Rear Unlocking Button Kit HS9Z-FL54	
Left-hand Door	HS9Z-DH5LH	+			
Right-hand Door	HS9Z-DH5RH	+		HS5B Installation Kit HS9Z-DH5B	HS5B-∗∗Z (Metal Head Type)
Left-hand Door	HS9Z-DH5LH	+			
Sliding Actuator HS9Z-SH5		+			HS5E (All types)
		+			HS5B-∗∗Z (Metal Head Type)

Dimensions (mm)

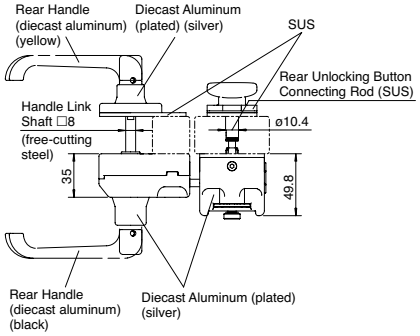
HS9Z-DH5RH (right-hand door) and HS5E-□44L□□-G Interlock Switch with Solenoid



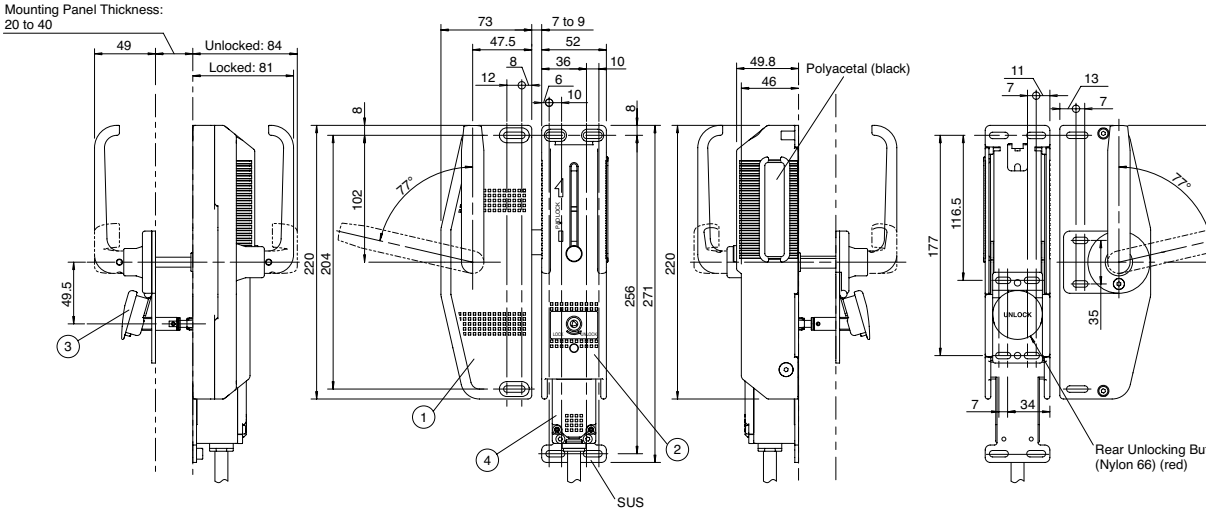
Legend	Description
1	Right-hand Door Handle Unit HS9Z-DH5RH
2	Switch Cover Unit HS9Z-DH5C
3	Rear Unlocking Button Kit HS9Z-FL5□
4	Interlock Switch HS5E-□44L□□-G



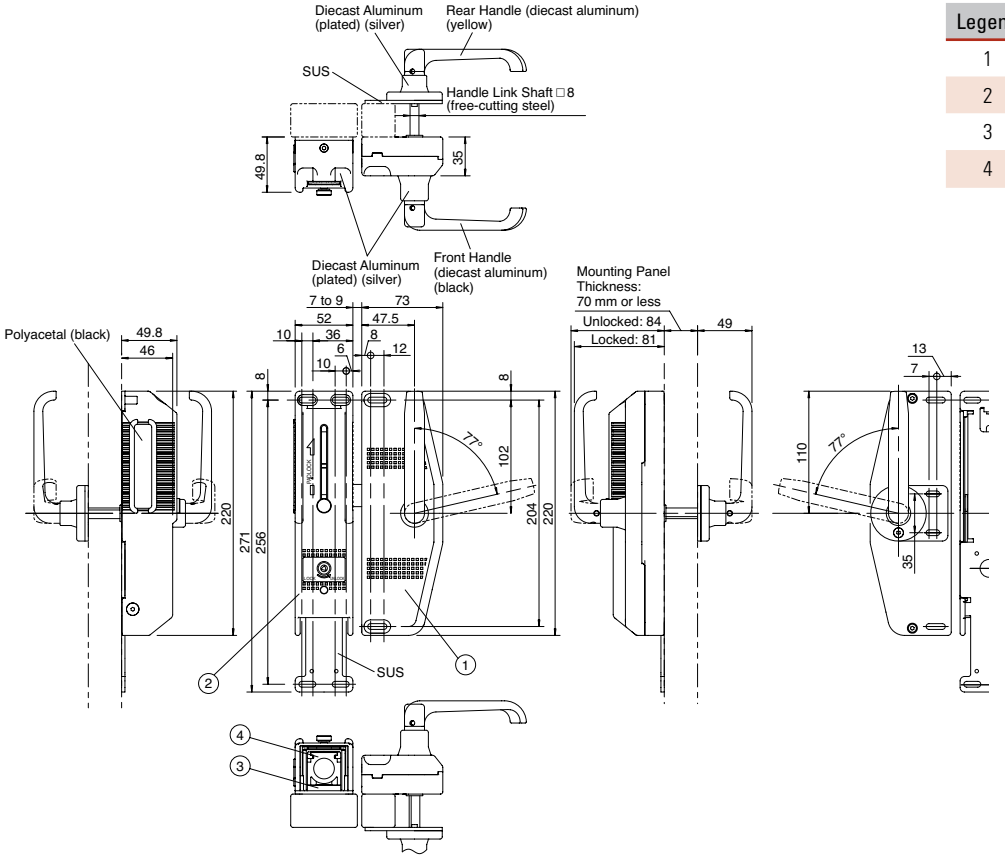
HS9Z-DH5LH (left-hand door) and HS5E-□44L□□-G Interlock Switch with Solenoid



Legend	Description
1	Left-hand Door Handle Unit HS9Z-DH5LH
2	Switch Cover Unit HS9Z-DH5C
3	Rear Unlocking Button Kit HS9Z-FL5□
4	Interlock Switch HS5E-□44L□□-G

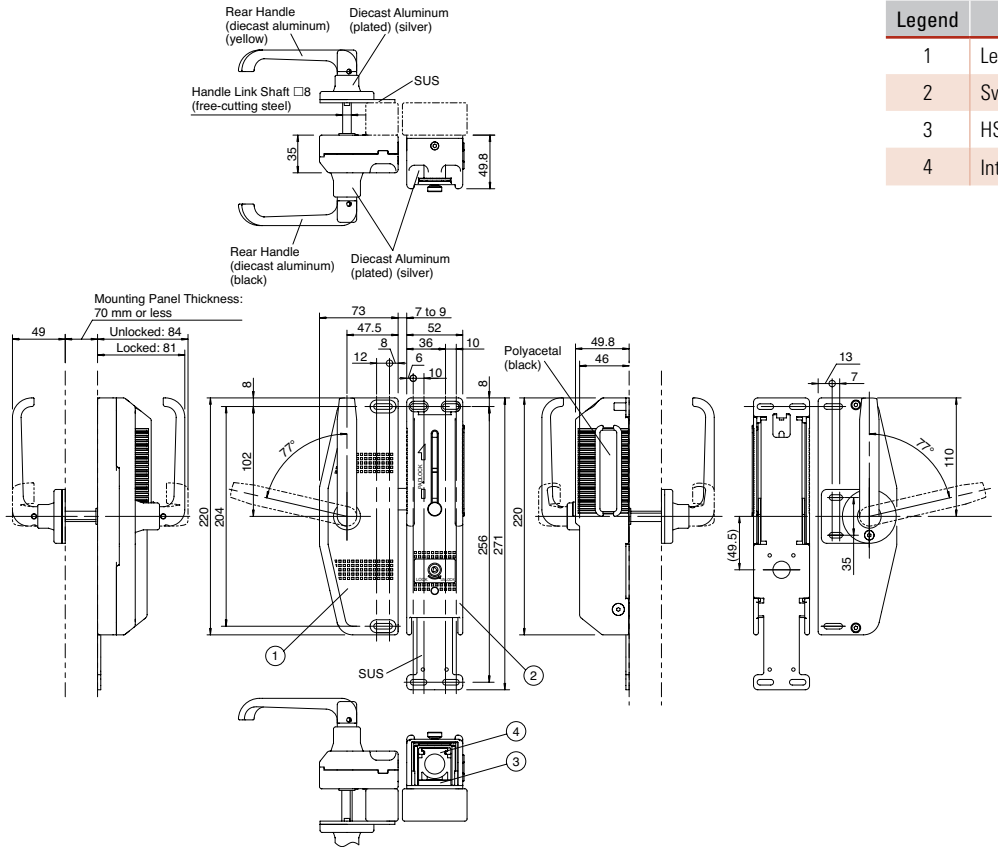


HS9Z-DH5RH (right-hand door) and HS5B-□□Z Interlock Switch



Legend	Description
1	Right-hand Door Handle Unit HS9Z-DH5RH
2	Switch Cover Unit HS9Z-DH5C
3	HS5B Installation Kit HS9Z-DH5B
4	Interlock Switch HS5B-□□Z

HS9Z-DH5LH (left-hand door) and HS5B-□□Z Interlock Switch



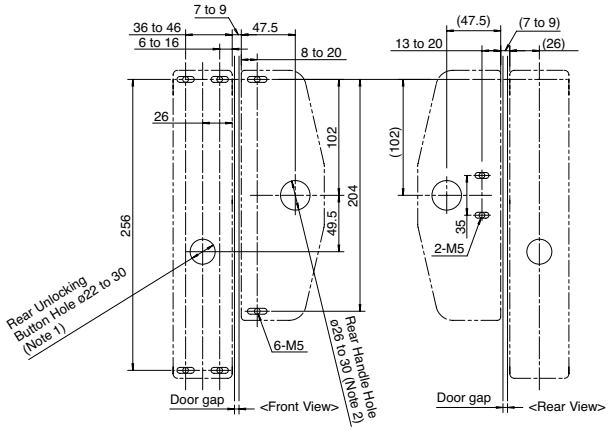
Legend	Description
1	Left-hand Door Handle Unit HS9Z-DH5LH
2	Switch Cover Unit HS9Z-DH5C
3	HS5B Installation Kit HS9Z-DH5B
4	Interlock Switch HS5B-□□Z

Panel Cut-out

HS9Z-DH5RH right-hand door handle unit

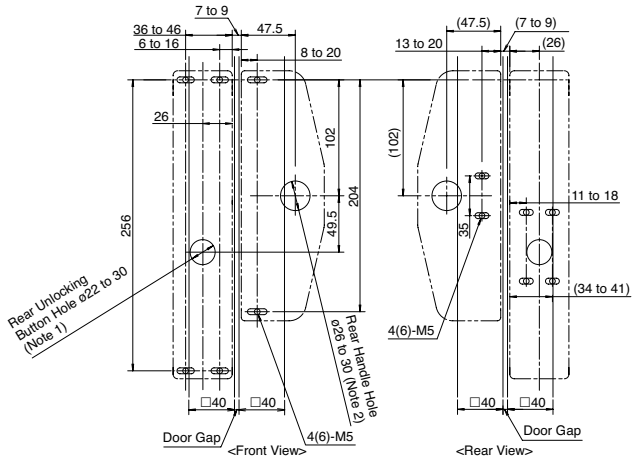
When using the HS5E-☐44L☐☐-G on the mounting panel of 3 mm or less in thickness (use the rear unlocking button).

When using the HS5B-☐Z (mounting panel thickness X ≤70mm).



When using the HS5E-☐44L☐☐-G on the mounting panel of 20 to 40 mm in thickness.

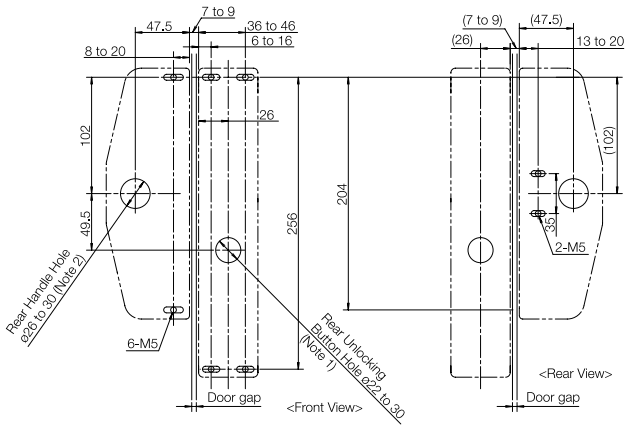
- Use the rear unlocking button kit (HS9Z-FL5☐).
- In the figure shown on the right, ☐40mm frame is used.



HS9Z-DH5LH left-hand door handle unit

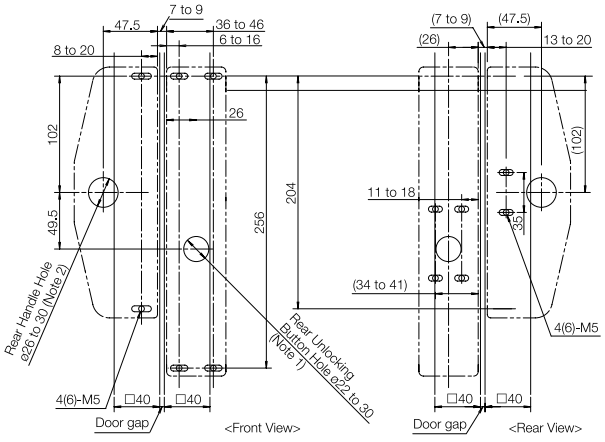
When using the HS5E-☐44L☐☐-G on the mounting panel of 3 mm or less in thickness (use the rear unlocking button).

When using the HS5B-☐Z (mounting panel thickness X ≤ 70mm).

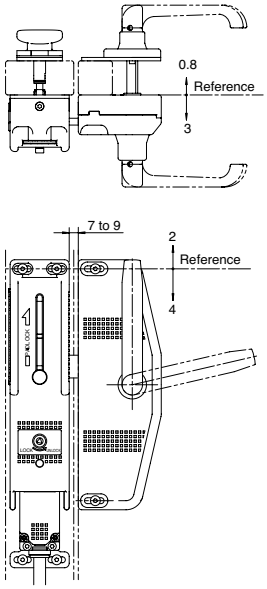


When using the HS5E-☐44L☐☐-G on the mounting panel of 20 to 40 mm in thickness.

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

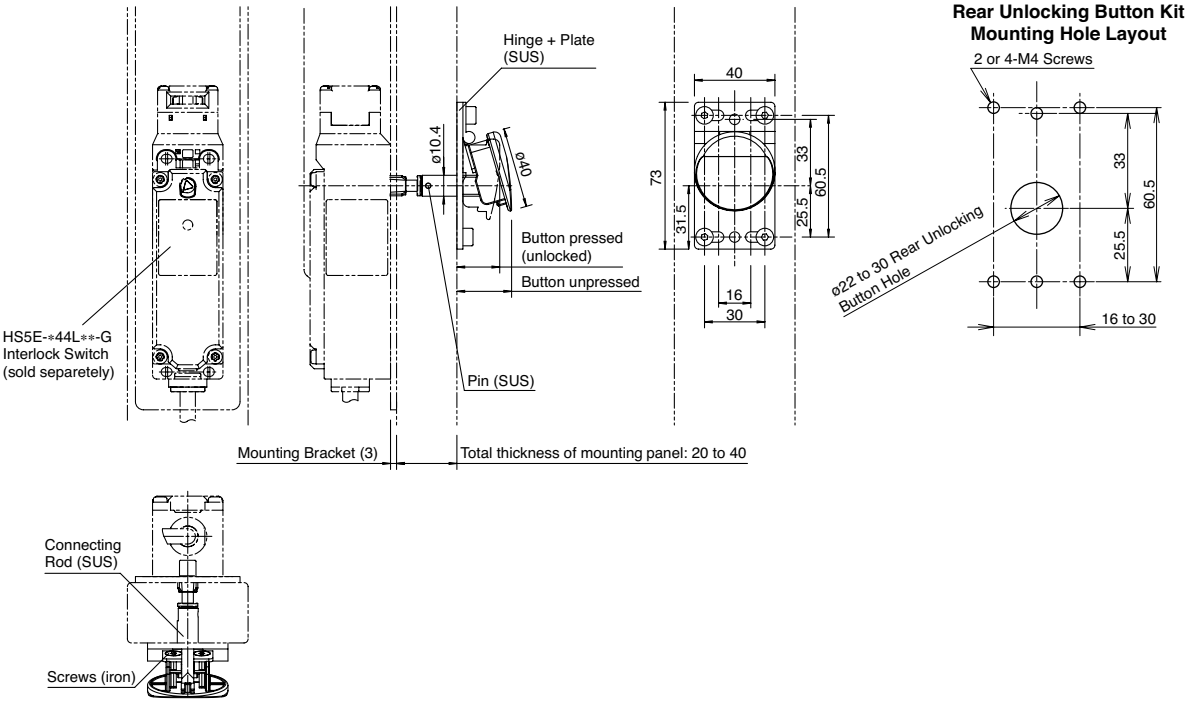


Mounting Position Tolerance

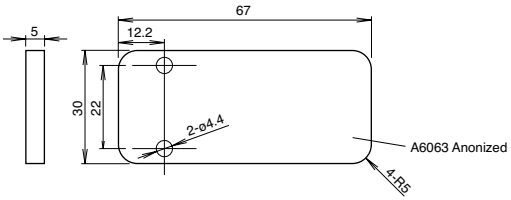


Note 1: Required when using the HS5E-☐44L-☐☐-G.
Not required when using the HS5B-☐☐Z (without locking function).
Note 2: Ensure that the hole in the mounting panel does not interfere with the rear handle shaft.

Rear Unlocking Button Kit (HS9Z-FL53/HS9Z-FL54) (Use with the HS5E-*44L**-G Interlock Switch)



HS5B Installation Kit (HS9Z-DH5B)



Note: The illustration kit contains the aluminum mounting plate shown above and two spacers.

For more information, download instruction sheet from web.

Selection Guide 365

Panel Mount Enabling Switches 366
- HE1B Series 366
- HE2B Series 368
- HE3B Series 371
- HE5B Series 374
- HE6B Series 377

Grip Enabling Switches 380
- HE1G Series 380
- HE1G-L Series 384
- HE2G Series 387
- HE5B Housing 391

Enabling Switches

IDEC

www.IDEC.com/safety

Enabling "Dead Man" Switches

What is an enabling switch?

An enabling switch is a 3-position (OFF-ON-OFF) switch to allow a machine operation only when the switch is lightly pressed and held in the middle position (position 2). Because it disables machine operation when released (position 1) or further depressed (position 3) by a panicked operator, the safety of operators is ensured.

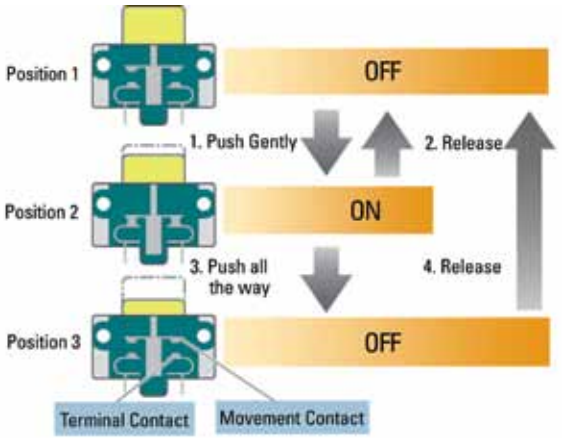
IDEC was a pioneer in developing these type of switches and championed the additional IEC60947-5-8 requirements for enabling switches to be used in automated manufacturing cells.

Because operators use pendants in dangerous environments performing teaching, system changeover, and maintenance of robots, they must have protection against unpredictable motion of robots, and therefore teach pendants are equipped with 3-position enabling switches.

IEC symbol designating a 3-position enabling switch as specified in IEC60947-5-8

HE1B Enabling Switch Movement

3 Position Enabling Switch
Position 1 - Normal position - Contact Open
Position 2 - Push half way - Contact Closed
Position 3 - Push all the way - Contact Open



When releasing switch from position 3 back to position 1, the switch will not enter the ON state.

Selection Guide

Enabling Switches

Series	HE1B	HE2B	HE3B	HE5B	HE6B
Appearance					
Page	366	368	371	374	377
Description	Basic Switch	Full Size Contacts	16mm Panel Mount	16mm Panel Mount	Compact Size
Main Contacts	1NO	DPDT/DPDT, 2NC/DPDT, 4NC	DPDT	DPDT	DPDT
Monitor Contacts	–	2NC, 4NC	–	–	2NC

Grip Switches

Series	HE1G	HE1G-L	HE2G	HE5B Housing
Appearance				
Page	380	384	387	391
Description	Grip Switch	Light Force Grip Switch	Compact, Ergonomic Grip Switch	Grip switch housing for HE5B
Maximum Contacts	DPDT, 1NC/DPDT, 2NC		DPDT	DPDT
Options	E Stop or Push Button	E Stop or Push Button	E Stop, Push Button, Key Switch, Pilot Light	–

Application Example

Teaching Pendant

Back of Teaching Pendant

HE1B Basic Enabling Switch

Key features:

- 3-position functionality (OFF – ON –OFF) as required for manual robotic control
- Ideally suited for use as enabling (aka "deadman") switch on teach pendants
- Provides a high level of safety based on human behavioral studies that determine personnel may squeeze OR let go when presented with a panic situation
- Positive action contacts "On" (pos. 2) to "Off" (pos. 3) ensure no contact welding (per EN60947-5-1 / IEC60947-5-1)
- Contacts will not close when released from "Off" (pos. 3) to "Off" (pos. 1) (per IEC60204-1; 9.2.5.8)
- Small and lightweight

Part Numbers

Item	Installation	Part Number
	Side	HE1B-M1
	Front	HE1B-M1N

Specifications

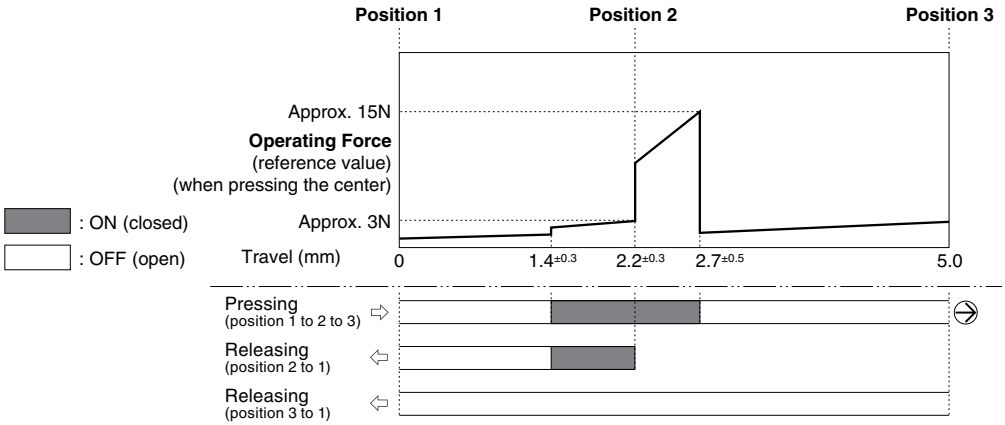
Conforming to Standards		UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized), IEC/EN 60947-5-1, IEC/EN 60947-5-8 (TÜV approval)
Operating Temperature		–25 to +60°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Storage Temperature		–40 to +80°C (no freezing)
Pollution Degree		2
Initial Contact Resistance		50mΩ maximum
Insulation Resistance		100MΩ minimum
Impulse Withstand Voltage		2.5kV
Operating Frequency		1200 operations/hour
Mechanical Life		Position 1→2→1: 1,000,000 operations minimum
		Position 1→2→3→1: 100,000 operations minimum
Electrical Life		100,000 operations minimum at rated load
Shock Resistance	Operating Extremes	150m/s^2 (15G)
	Damage Limits	1000m/s^2 (100G)
Vibration Resistance	Operating Extremes	5 to 55Hz, amplitude 0.5mm minimum
	Damage Limits	16.7Hz, amplitude 1.5mm minimum
Terminal		Solder Terminal
Recommended Wire Size		0.5mm^2 maximum / 1 line (20AWG)
Solder Heat Resistance		260°C / 3 seconds maximum
Terminal Pulling Strength		20N minimum
Recommended Screw Torque		HE1B-M1: M3 screw / 0.5 to 0.8Nm
Degree of Protection		IP40 (IEC 60529) excluding terminal part
Conditional Short-Circuit Current		50A (250V)
Recommended Short Circuit Protection		250V, 10A fast blow fuse (IEC 60127-1)
Circuit Opening Force		30N minimum (position 2→3)
Control Resistance (Operating)		250N minimum
Weight		Approx. 6g

Current Ratings

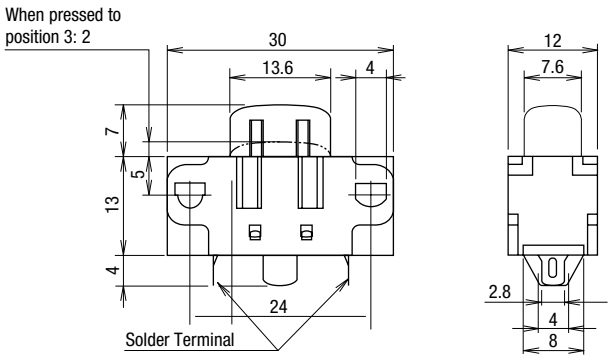
Rated Insulation Voltage (Ui)			AC / DC250V		
Thermal Current (Ith)			5A		
Rated Operating Voltage (Ue)			30V	125V	250V
Rated Operating Current (Ie)	AC 50/60Hz	Resistive Load (AC-12)	–	3A	1.5A
		Inductive Load (AC-15)	–	1.5A	0.75A
	DC	Resistive Load (DC-12)	2A	0.4A	0.2A
		Inductive Load (DC-13)	1A	0.22A	0.1A
Contact Configuration			SPST-NO three position (OFF-ON-OFF)		

Minimum applicable load: AC/DC3V • 5mA (For reference only).

Operating Characteristics

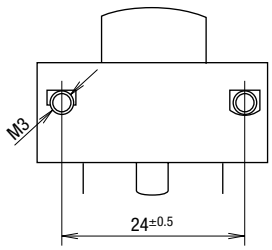


Dimensions (mm)



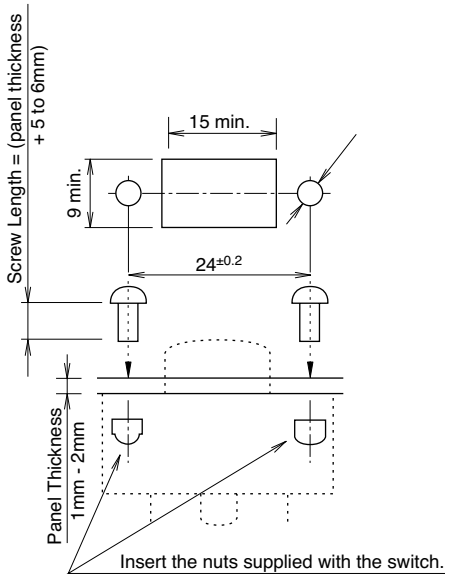
HE1B-M1 (Side Mounting)

1. M3 Screw (not provided)
2. Thread built in



HE1B-M1N (Front Mounting)

1. M3 Screw (not provided)
2. Locking nut (2 pcs) included



When using a panel thicker than 2mm, the button will be lower than the surface of the panel

HE2B Redundant (Double) Basic Enabling Switch

Key features:

- 3-position functionality (OFF – ON –OFF) as required for manual robotic control
- Ideally suited for use as enabling (aka "deadman") switch on teach pendants
- Provides a high level of safety based on human behavioral studies that determine personnel may squeeze OR let go when presented with a panic situation
- Snap acting contacts from Off→On (1→ 2)
- Positive action contacts from On→Off (2→ 3) ensure no contact welding (per EN60947-5-1 / IEC60947-5-1)
- Contacts will not re-close when released from Off→On (3→1) (per IEC60204-1; 9.2.5.8)
- Multiple contacts for enhanced reliability
- Monitoring contacts in addition to main load contacts
- Available with or without rubber cover (cover provides IP65 watertight seal)

(Monitor Switch)

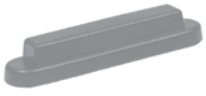
IEC60947-5-8 3-POSITION ENABLING SWITCH INSIDE

Part Numbers

Style			Number of Contacts			Part Number
			3 Position Switch	Push Monitor Switch	Return Monitor Switch	
	Without Rubber Cover		2	0	0	HE2B-M200
			2	1	1	HE2B-M211
			2	2	2	HE2B-M222
	With Rubber Cover	Yellow	2	0	0	HE2B-M200PY
			2	1	1	HE2B-M211PY
			2	2	2	HE2B-M222PY
		Black	2	0	0	HE2B-M200PB
			2	1	1	HE2B-M211PB
			2	2	2	HE2B-M222PB
		Gray	2	0	0	HE2B-M200PN1
			2	1	1	HE2B-M211PN1
			2	2	2	HE2B-M222PN1

Accessories

Replacement Rubber Cover

Apperance	Color	Part Number	Material
	Yellow	HE9Z-D2Y	Silicon Rubber
	Black	HE9Z-D2B	
	Gray	HE9Z-D2N1	NBR/PVC Polyblend

Specifications

Conforming to Standards		UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized), IEC/EN 60947-5-1, IEC/EN 60947-5-8 (TÜV approval)
Application Standards		ISO 12100-1, -2, EN 12100-1, 2 / EN 292, IEC 60204-1 / EN 60204-1 ISO11161 / prEN 11161, ISO10218 / EN 775, ANSI / RIA R15.06, ANSI B11.19
Operating Temperature		–25 to +60°C (no freezing)
Operating Humidity		45 to 85% RH (no condensation)
Storage Temperature		–40 to +80°C (no freezing)
Pollution Degree		2 (inside of panel/contact side)
		3 (outside of panel/operating side)
Contact Resistance		50mΩ maximum
Insulation Resistance		Between live and dead metal parts: 100MΩ maximum
		Between positive and negative live parts: 100MΩ minimum
Impulse Withstand Voltage		2.5kV
Operating Frequency		1200 operations/hour
Mechanical Life		Position 1→2: 1,000,000 operations minimum Position 1→2→3→1: 100,000 operations minimum
Electrical Life		100,000 (at full rated load)
Shock Resistance	Operating Extremes	150m/s^2 (15 G)
	Damage Limits	1000m/s^2 (100 G)
Vibration Resistance	Operating Extremes	5 to 55Hz, amplitude 0.5mm minimum
	Damage Limits	16.7Hz, amplitude 1.5mm minimum
Terminal		0.110" quick connect / solder terminal
Recommended Wire Size		0.5mm^2 maximum / 1 line (20AWG)
Solder Heat Resistance		310 ~ 350°C / 3 seconds maximum
Terminal Pulling Strength		20N minimum
Recommended Screw Torque		0.5 to 0.8Nm
Degree of Protection		with rubber cover: IP65, without rubber cover: IP40 (IEC 60529),
Conditional Short-Circuit Current		50A (250V)
Recommended Short Circuit Protection		250V/10A fast blow fuse (IEC 60127-1)
Circuit Opening Force		60N minimum (button return monitor & button push monitor)
Actuating Force (Operating)		500N minimum
Weight		Approx. 26g (without cover), 30g (with cover)

Contact Ratings

Rated Insulation Voltage (Ui)				250V		
Thermal Current (Ith)				3A		
Rated Operating Voltage (Ue)				30V	125V	250V
Rated Operating Current (Ie)	3 Position Switch	AC	Resistive Load (AC-12)	–	1A	0.5A
			Inductive Load (AC-15)	–	0.7A	0.5A
		DC	Resistive Load (DC-12)	1A	0.2A	–
			Inductive Load (DC-13)	0.7A	0.1A	–
	Push/return Monitor Switch (NC Contacts)	AC	Resistive Load (AC-12)	–	2.5A	1.5A
			Inductive Load (AC-15)	–	1.5A	0.75A
		DC	Resistive Load (DC-12)	2.5A	1.1A	0.55A
			Inductive Load (DC-13)	2.3A	0.55A	0.27A
Contact Configuration	3 Position Switch			2 contacts (DPDT)		
	Return Monitor Switch			0 ~ 2 contacts (NC)		
	Push Monitor Switch			0 ~ 2 contacts (NC)		

Minimum applicable load (reference) = AC/DC3V • 5mA (for reference only)

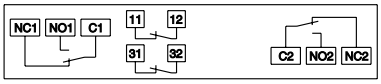
Circuit Diagrams

Terminal Circuit Diagrams (bottom view)

Label Side

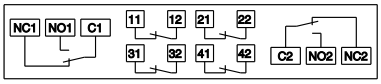
HE2B-M200

Label Side



HE2B-M211

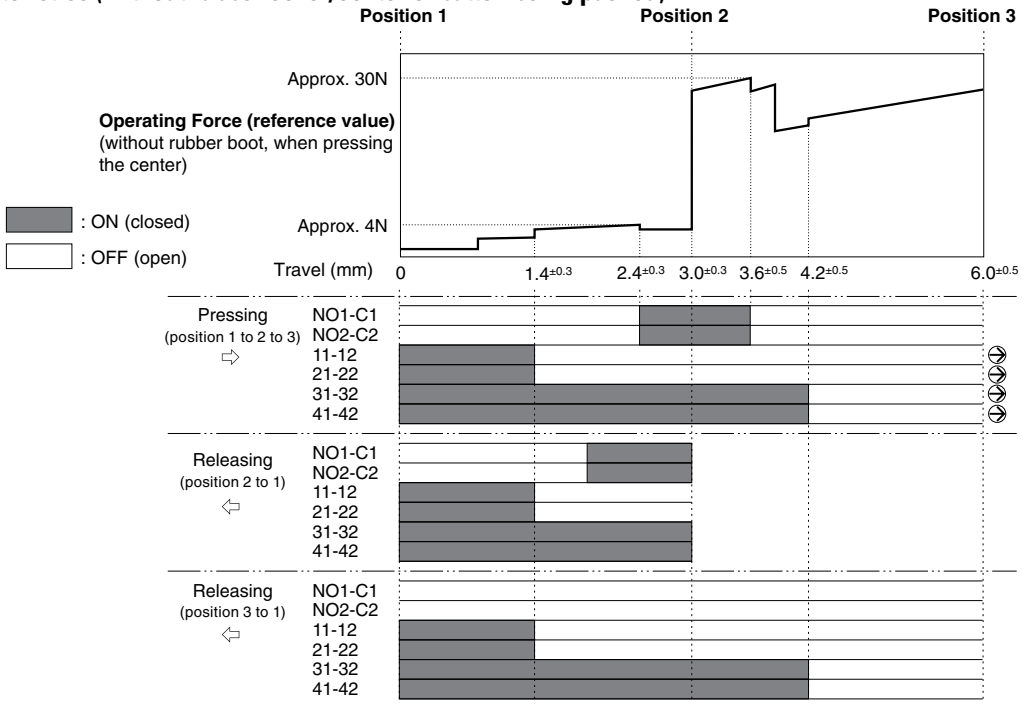
Label Side



HE2B-M222

Operating Characteristics

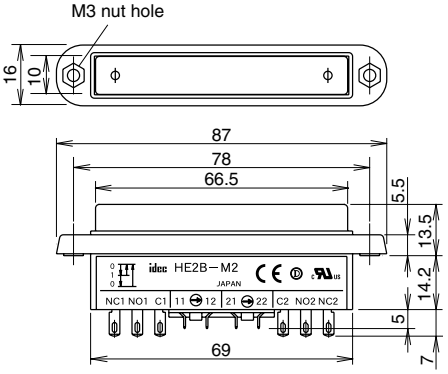
Operating Characteristics (without rubber cover/center of button being pushed)



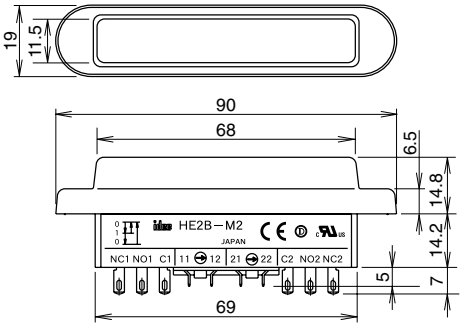
Using rubber boot will change the operating force depending on the operating temperature.

Dimensions (mm)

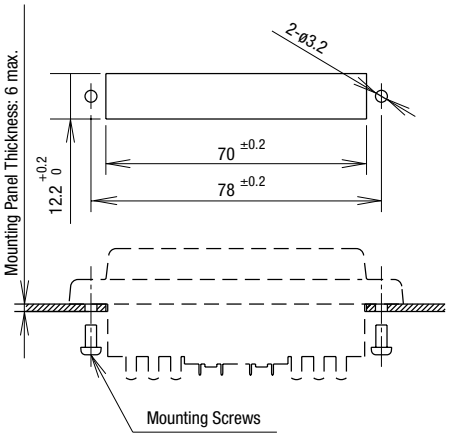
Without Rubber Cover



With Rubber Cover



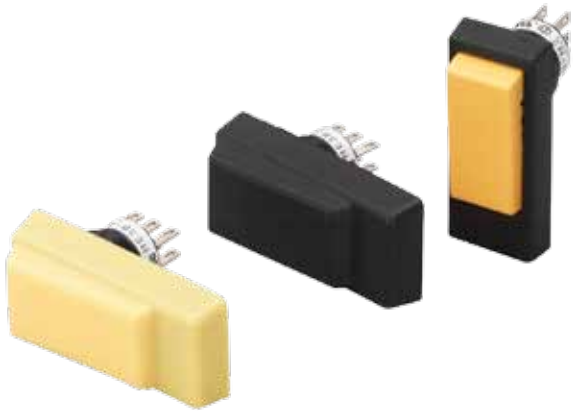
Mounting Hole Layout



HE3B ø16mm Redundant Contact Switch

Key features:

- 3-position functionality (OFF – ON – OFF) as required for manual robotic control
- Provides a high level of safety based on human behavioral studies that determine personnel may squeeze OR let go when presented with a panic situation
- Contacts will not re-close when released from Off→On (3→1) (per IEC60204-1; 9.2.5.8)
- Multiple contacts for enhanced reliability
- Snap acting contacts from position 1 to 2
- Available with or without rubber cover



Part Numbers

Style			Part Numbers
	Without Rubber Cover		HE3B-M2
	With Rubber Cover	Yellow	HE3B-M2PY
		Black	HE3B-M2PB
		Gray	HE3B-M2PN1

Accessories

Replacement Rubber Cover

Appearance	Color	Part Number	Material
	Yellow	HE9Z-D3Y	Silicon Rubber
	Black	HE9Z-D3B	
	Gray	HE9Z-D3N1	NBR/PVC polyblend

Lock Nut Tool

Appearance	Part Number	Material
	MT-001	Metal

Specifications

Conforming to Standards	UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized) IEC/EN 60947-5-1, IEC/EN 60947-5-8 (TÜV approval)
Application Standards	ISO 12100-1, -2, EN 12100-1, 2, IEC 60204-1 / EN 60204-1 ISO 11161 / prEN 11161, ISO 10218 / EN 775 ANSI/RIA R15.06, ANSI B11.19
Operating Temperature	–25 to +60°C (no freezing)
Operating Humidity	45 to 85% RH maximum (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	2 (inside panel, terminal side) 3 (outside panel, operator side)
Contact Resistance	50mΩ maximum
Insulation Resistance	Between live & dead metal parts: 100MΩ maximum
	Between positive & negative live parts: 100MΩ minimum
Impulse Withstand Voltage	1.5kV
Operating Frequency	1200 operations/hour
Mechanical Life	Position 1→2→1: 1,000,000 operations minimum
	Position 1→2→3→1: 100,000 operations minimum

Specifications con't

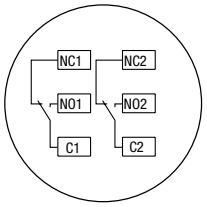
Electrical Life		100,000 operations minimum at rated load
Shock Resistance	Operating Extremes	150m/s² (15 G)
	Damage Limits	500m/s² (50 G)
Vibration Resistance	Operating Extremes	5 to 55Hz, applitude 0.5mm minimum
	Damage Limits	16.7Hz, applitude 1.5mm minimum
Terminal		0.110" quick connect / solder terminal
Recommended Wire Size		0.5mm² maximum / 1 line (20AWG)
Solder Heat Resistance		310 ~ 350°C / 3 seconds maximum
Terminal Pulling Strength		20N minimum
Recommended Screw Torque		0.68 to 0.88Nm
Degree of Protection		with rubber cover: IP65, without rubber cover: IP40 (IEC 60529)
Conditional Short-Circuit Current		50A (125V)
Recommended Short Circuit Protection		125V/10A fast blow fuse (IEC 60127-1)
Circuit Opening Force		500N minimum
Weight		without rubber cover - Approx. 14g with rubber cover - Approx. 18g

Contact Ratings

Rated Insulation Voltage (Ui)			125V	
Thermal Current (Ith)			3A	
Rated Operating Voltage (Ue)			30V	125V
Rated Operating Current (Ie)	AC	Resistive Load (AC-12)	–	1A
		Inductive Load (AC-15)	–	0.7A
	DC	Resistive Load (DC-12)	1A	0.2A
		Inductive Load (DC-13)	0.7A	0.1A
Contact Configuration			2 contacts (DPDT)	
Minimum Applicable Load			AC/DC5V 1mA reference	

Circuit Diagrams

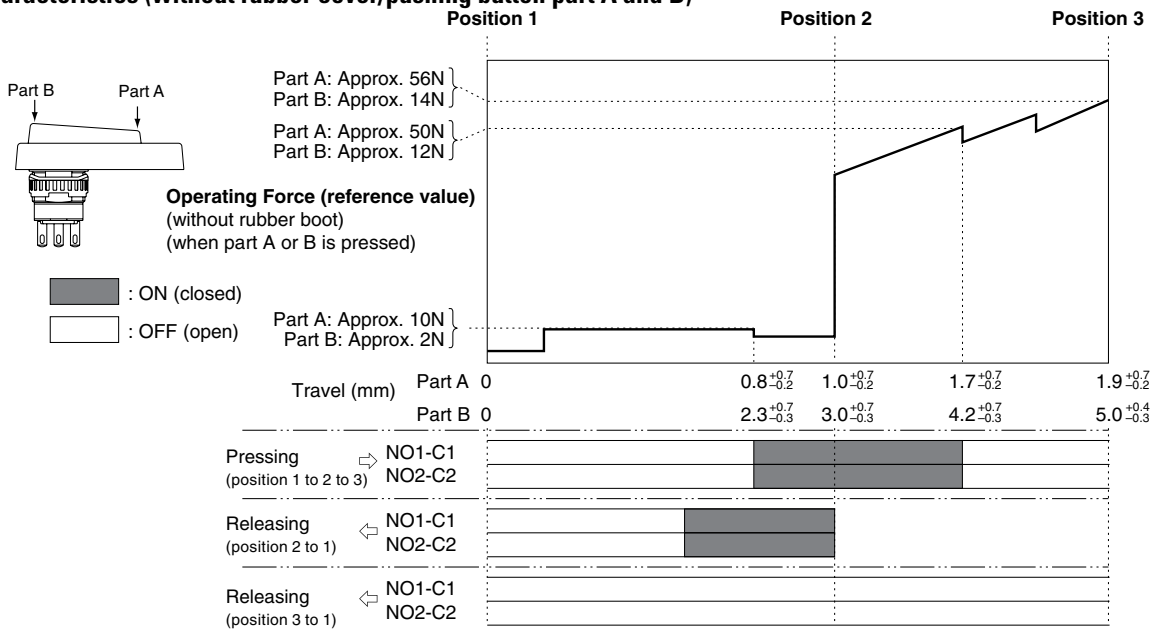
Terminal Circuit Diagrams (bottom view)



1. 3 position switch: 2 contacts, terminal no. = between NO1-C1, between NO2-C2
2. Use between NO-C for OFF→ On→ OFF 3 position switch (NC is not used).

Operating Characteristics

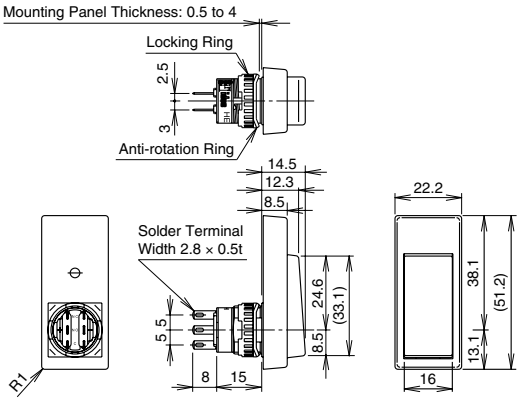
Operating Characteristics (without rubber cover/pushing button part A and B)



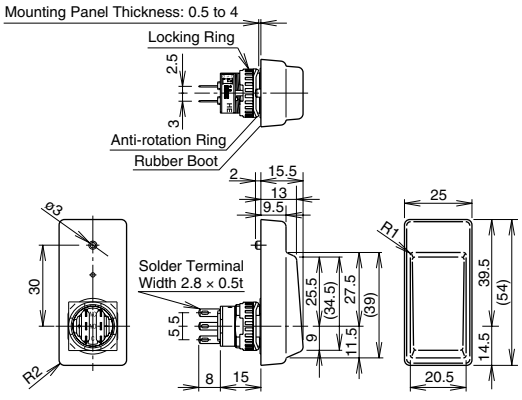
Using rubber boot will change the operating force depending on the operating temperature.

Dimensions (mm)

Without Rubber Cover

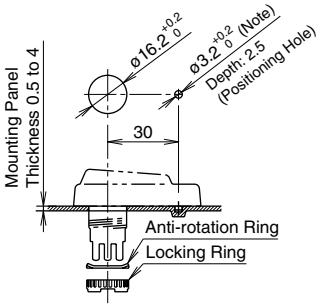


With Rubber Cover



All dimensions in mm.

Mounting Hole Layout



1. Recommended Lock Nut Torque: 0.68 to 0.88Nm.
2. Use a lock nut tool to screw on the lock nut (see page 371).
3. To retain the switches waterproof performance, do not penetrate the rubber cover.
4. Remove the rubber cover projection if you do not want a positioning hole. (Do not penetrate the rubber cover).

HE5B ø16mm Redundant Contact Pushbutton Enabling Switch

Key features:

- Ergonomically-designed OFF-ON-OFF 3-position operation
- Easy recognition of position 1 → 2 transition, made possible by snap action switch
- Sufficient load difference is provided for shifting from position 2 → 3
- Light force needed to maintain position 2, so that operators can easily use the enabling switch
- The switch does not turn ON when being released from position 3 (OFF when pressed) to position 1 (OFF when released) (IEC60204-1, 9.2.5.8)
- Two contacts are provided for safety
- IP65 (using the waterproof rubber cover)
- Mounts in a 16mm (5/8") round hole

Part Numbers

Style		Color	Part Number
	Silicon Rubber	Yellow	HE5B-M2PY
		Black	HE5B-M2PB
	NBR/PVC	Gray	HE5B-M2PN1

NBR/PVC cover comes in gray only.

Accessories

Replacement Rubber Cover

Appearance	Part Number	Material	
	Silicon Rubber	Yellow	HE9Z-D5Y
		Black	HE9Z-D5B
	NBR/PVC Polyblend	Gray	HE9Z-D5N1

Lock Nut Tool

Appearance	Part Number	Material
	MT-001	Metal

Grip Housing

Appearance	Part Number
	HE9Z-GSH51

See page 391 for more information.

Specifications

Conforming to Standards	UL508 (UL recognized), CSA C22.2, No. 14 (c-UL recognized) IEC/EN 60947-5-1, IEC/EN 60947-5-8 (TÜV approval)
Application Standards	ISO 12100-1, -2, EN 12100-1, 2 / EN292, IEC 60204-1 / EN 60204-1, ISO 11161 / prEN 11161, ISO 10218 / EN 775, ANSI/RIA R15.06, ANSI B11.19
Operating Temperature	Silicon rubber boot: –25 to 60°C (no freezing) NBR/PVC Polyblend rubber boot: –10 to 60°C (no freezing)
Relative Humidity	45 to 85% RH (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Operating Environment	Degree of pollution: 2 (panel inside/terminal side) Degree of pollution: 3 (panel outside/operator side)
Contact Resistance	50 mΩ maximum (initial value)
Insulation Resistance (DC megger)	Between live and dead metal parts: 100 MΩ minimum Between terminals of different pole: 100 MΩ minimum
Impulse Withstand Voltage	1.5 kV

Specifications con't

Operating Frequency	1200 operations per hour
Mechanical Life	Position 1→ 2→ 1: 1,000,000 operations minimum Position 1→ 2→ 3→ 1: 100,000 operations minimum
Electrical Life	100,000 operations minimum
Shock Resistance	Operating extremes: 150 m/s² (15 G) Damage limits: 500 m/s² (50 G)
Vibration Resistance	Operating extremes: 5 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 5 to 55 Hz, amplitude 0.5 mm minimum
Terminal Style	Solder Terminal
Recommended Wire Size	0.5 mm² maximum per line (20AWG)
Solder Heat Resistance	310 ~ 350°C, 3 seconds maximum
Terminal Pulling Strength	20 N minimum
Recommended Tightening Torque of Locking Ring	0.29 to 0.49 N·m
Degree of Protection	IP65
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast acting type fuse for short circuit protection.)
Operator Strength	250N minimum (when pressing the entire surface of the operator)
Weight (approx.)	9 g

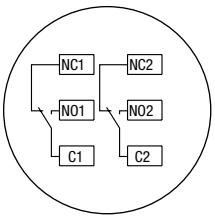
Current Ratings

Rated Insulation Voltage (Ui)			125V	
Thermal Current (Ith)			3A	
Rated Operating Voltage (Ue)			30V	125V
Rated Operating Current (Ie)	AC	Resistive Load (AC-12)	–	0.5A
		Inductive Load (AC-15)	–	0.3A
	DC	Resistive Load (DC-12)	1A	–
		Inductive Load (DC-13)	0.7A	–
Contact Configuration			2 contacts (DPDT)	

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

Circuit Diagrams

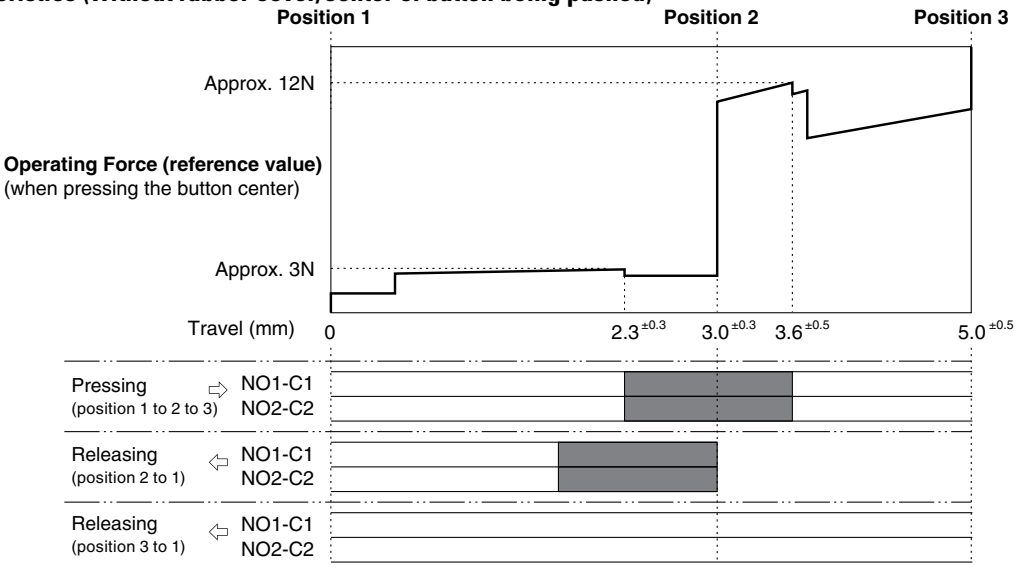
Terminal Arrangement (Bottom View)



1. 3 position switch: 2 contacts, terminal no. = between NO1-C1, between NO2-C2
2. Use between NO-C for OFF→ On→ OFF 3 position switch (NC is not used).

Operating Characteristics

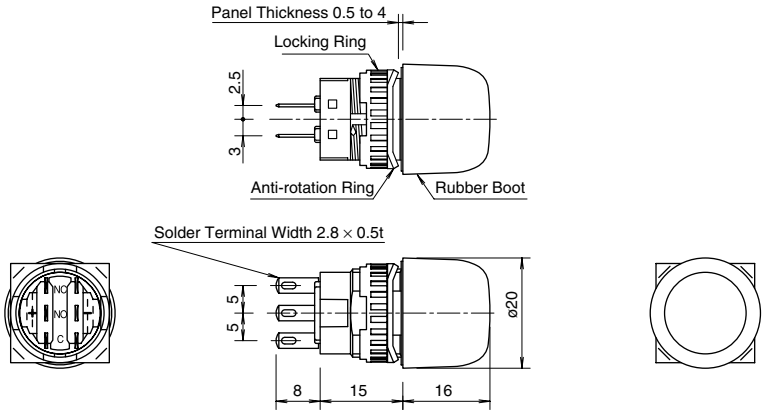
Operating Characteristics (without rubber cover/center of button being pushed)



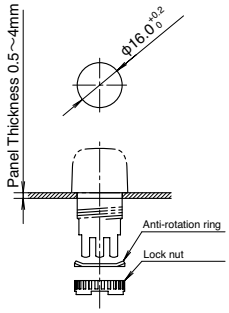
Operating load depends on ambient temperature.

Dimensions (mm)

With Rubber Cover



Mounting Hole Layout



1. Recommended tightening torque for Locking Ring: 0.29 to 0.49 N·mm.
2. Use a lock nut tool to screw on the lock nut (see page 374).

HE6B Enabling Switch

Key features:

- Ergonomically-designed OFF-ON-OFF operation.
- The switch does not turn ON while returning from position 3 (OFF) to position 1 (OFF)
- IEC 60204-1 (2005), 10.9
- IEC 60947-5-8 (2006), 7.1.9*
- Some teach pendants are equipped with two 3-position enabling switches, and when one switch is pressed to position 3 (OFF), the other switch must not enable machine operation even when pressed to position 2. Machine operation can resume after both switches are released. The monitoring switches monitor the OFF status of the 3-position enabling switch, whether the button is returned to position 1 or the button is pressed to position 3 (monitor switches have direct opening action mechanism.)
- Two contacts are provided in a 3-position enabling switch so that even if one contact fails, the other contact will still disable machine operation.
- The waterproof rubber boot provides IP65 protection.

* IEC 60947-5-8 Control circuit devices and switching elements – Three-position enabling switches

(Monitor Switch)

Part Numbers

Model	Contact Configuration/No. of Contacts			Color	Part Number
	3-position Switch	Button Return Monitor Switch ⊖	Button Depress Monitor Switch ⊖		
	2	0	0	Yellow	HE6B-M200Y
				Black	HE6B-M200B
	2	1	1	Yellow	HE6B-M211Y
				Black	HE6B-M211B

Accessories

Replacement Rubber Cover

Appearance	Color	Part Number	Material
	Yellow	HE9Z-D6Y	Silicon Rubber
	Black	HE9Z-D6B	

Specifications

Conforming to Standards	IEC 60947-5-1/EN60947-5-1 IEC 60947-5-8/EN60947-5-8 (TÜV approved) GS-ET-22 (TÜV approved) UL508 (UL recognized) CSA C22.2 No.14 (c-UL recognized)
Application Standards for Use	ISO 12100/EN ISO 12100, IEC 60204-1/EN 60204-1, ISO 11161/EN ISO 11161, ISO 10218-1/EN ISO 10218-1, ANSI/RIA/ISO 10218-1, ANSI/RIA/R15.06, ANSI B 11.19 ISO 13849-1/EN ISO 13849-1
Operating Temperature	–25 to +60°C (no freezing)
Relative Humidity	45 to 85% RH (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	2 (inside panel, terminal side) 3 (outside panel, operator side)
Contact Resistance	50mΩ maximum (initial value)
Insulation Resistance	Between live and dead metal parts: 100MΩ minimum (500V DC megger) Between terminals of different poles: 10 MΩ minimum (500V DC megger)
Impulse Withstand Voltage	1.5kV (3 position switch) 2.5kV (monitor switch)
Operating Frequency	1200 operations per hour
Mechanical Life	Position 1→2→1: 1,000,000 operations minimum Position 1→2→3→1: 100,000 operations minimum
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA)
Shock Resistance	Operating extremes: 150m/s^2 (15G) Damage limits: 500m/s^2 (50G)
Vibration Resistance	Operating extremes: 5 to 55 Hz, amplitude 0.5mm Damage limits: 16.7Hz, amplitude 1.5mm
Terminal Style	Solder terminal
Applicable Wire Size	1 cable, 0.5mm^2 maximum (20AWG wire)
Solder Terminal Heat Resistance	310 to 350°C, 3 seconds maximum
Terminal Tensile Strength	20N minimum
Locking Ring Recommended Tightening Torque	0.5 to 0.8N·m
Degree of Protection	IP65 (IEC 60529)
Conditional Short-circuit Current	50A (125V): 3-position switch (Use 120V/10A fast acting type fuse for short circuit protection.) (IEC 60127-1) 50A (250V): monitor switch (Use 250V/10A fast acting type fuse for short circuit protection.) (IEC 60127-1)
Direct Opening Force	40N minimum (button release monitor and button depress monitor switches)
Direct Opening Stroke (when pressing the entire button surface)	0.9mm minimum (button return monitor switch) 4.0mm minimum (button depress monitor switch)
Operator Strength	250N minimum (when pressing the entire button surface)
Weight (approx.)	17g

Current Ratings

Rated Insulation Voltage (Ui)				125V (monitor switch: 250V)		
Rated Thermal Current (Ith)				3A		
Rated Voltage (Ue)				30V	125V	250V
Rated Current (Ie)	3-position switch	AC	Resistive Load (AC-12)	–	0.5A	–
			Inductive Load (AC-15)	–	0.3A	–
		DC	Resistive Load (DC-12)	1A	–	–
			Inductive Load (DC-13)	0.7A	–	–
	Button return monitor switch Button depress monitor switch (NC)	AC	Resistive Load (AC-12)	–	2.5A	1.5A
			Inductive Load (AC-15)	–	1.5A	0.75A
		DC	Resistive Load (DC-12)	2.5A	1.1A	0.55A
			Inductive Load (DC-13)	2.3A	0.55A	0.27A
Contact Configuration		3-position switch		2 contacts		
		Button return monitor switch		0 or 1 contact		
		Button depress monitor switch		0 or 1 contact		

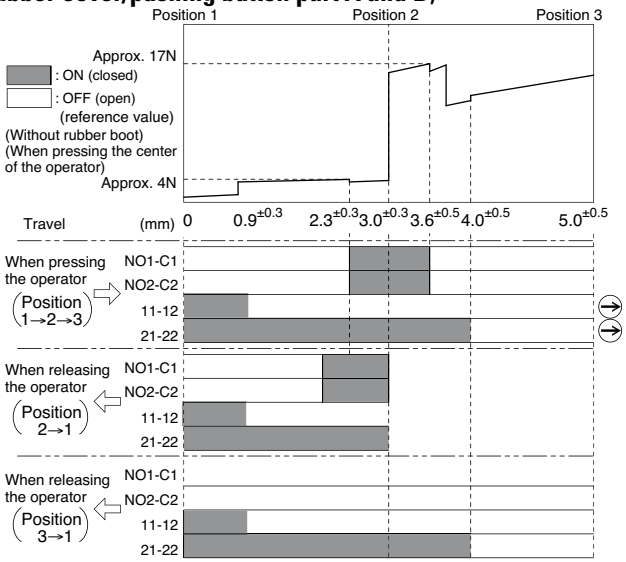
TÜV ratings:
3 position switch:
AC-12 125V/0.5A
DC-12 30V/1A
DC-13 30V/0.7A
Monitor Switch:
AC-15 250V/0.5A
DC-13 125V/0.22A
DC-13 30V/1A

UL ratings:
3-position switch:
125V AC/0.5A (Resistive)
30V DC/1A (Resistive)
Monitor switch:
250V AC/0.5A (General use)
30V DC/1A (General use)

Minimum applicable load (reference value): 3V AC/DC, 5mA (Applicable operation area depends on the operating conditions and load.)

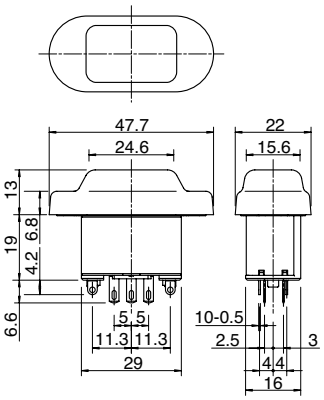
Operating Characteristics

Operating Characteristics (without rubber cover/pushing button part A and B)

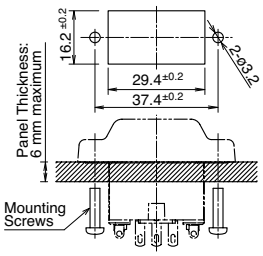


Notes: When a rubber boot is used, the operating force depends on the operating temperature.

Dimensions (mm)



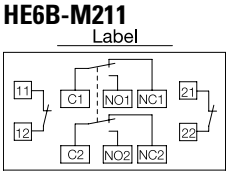
Mounting Hole Layout



Mounting screws: M3 screw × 2
(not attached and must be supplied by the user)
Mounting screw length: 5 to 6 mm (panel thickness + gasket)

Terminal Arrangement (bottom view)

HE6B-M211



3-position switch 2 contacts [1]
Button return monitor switch: 1 contact, terminals 11-12
Button depress monitor switch: 1 contact, terminals 21-22
There are no terminals 11-22 and 21-22 for HE6B-M200 type.
[1]Use NO and C terminals for OFF → ON → OFF 3-position switch (NC terminal is not used.)

HE1G Basic Grip Enabling Switch

Key features:

- 3 position functionality (Off – On – Off) as required for manual robotic control
- Ideally suited for use as an enabling (aka "deadman") switch for robotic cells
- Provides a high level of safety based on human behavioral studies that determine personnel may squeeze OR let go when presented with a panic situation
- Contacts will not re-close when released from Off → On (3 → 1) (per IEC60204-1; 9.2.5.8)
- Optional E-Stop switch built in
- Connection for conduit and cable strain relief built in
- IP66 waterproof sealing
- Meets ANSI RIA 15.06 robotics standards
- Optional momentary pushbutton or E-Stop built in

(HE1B installed)

Part Numbers

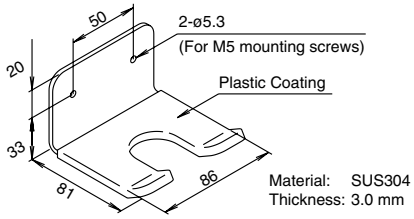
Contact Configuration			Rubber Boot	Part No.
3-position Switch	Monitor Switch	Pushbutton		
2 contacts	With (1NC)	–	Silicon Rubber / yellow	HE1G-21SM
			NBR/PVC Polyblend / gray	HE1G-21SM-1N
		Momentary Pushbutton (1NO) (1NO: AB6M-M1PB)	Silicon Rubber / yellow	HE1G-21SMB
			NBR/PVC Polyblend / gray	HE1G-21SMB-1N
	Without	Emergency Stop Switch (2NC) (2NC: HA1E-V2S2R)	Silicon Rubber / yellow	HE1G-20ME
			NBR/PVC Polyblend / gray	HE1G-20ME-1N
		Momentary Pushbutton (2NO) (2NO: AB6M-M2PB)	Silicon Rubber / yellow	HE1G-20MB
			NBR/PVC Polyblend / gray	HE1G-20MB-1N

Accessories

Replacement Rubber Cover

Appearance	Part Number	Material	Color
	HE9Z-GBK1	Silicon Rubber	Yellow
	HE9Z-GBK1-1N	NBR/PVC	Gray

Mounting Plate (secures grip switch)

Appearance	Part Number	Material
	HE9Z-GH1	Metal

Specifications

Conforming to Standards	UL508 (UL listed), CSA C22.2, No. 14 (c-UL listed), IEC/EN 60947-5-1 (TÜV/BG approval), GS-ET-22 (TÜV/BG approval)
Applicable Standards	ISO 12100-1, -2, EN12100-1, -2, IEC 60204-1 / EN 60204-1, ISO11161 / prEN11161, ISO 10218 / EN 775, ANSI/RIA R15.06, ANSI B11.19
Operating Temperature	–25 to +60°C (no freezing)
Operating Humidity	45 to 85% RH maximum (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	3
Contact Resistance	100mΩ maximum
Insulation Resistance	Between live & dead metal parts: 100MΩ maximum Between positive & negative live parts: 100MΩ minimum

Specifications con't

Impulse Withstand Voltage		2.5kV
Operating Frequency		1200 operations/hour
Mechanical Life		Position 1→ 2→ 1: 1,000,000 operations minimum
		Position 1→ 2→ 3→ 1: 100,000 operations minimum
Electrical Life		100,000 minimum at rated load
Shock Resistance	Operating Extremes	150m/s² (15 G)
	Damage Limits	1000m/s² (100 G)
Vibration Resistance	Operating Extremes	5 to 55Hz, amplitude 0.5mm minimum
	Damage Limits	16.7Hz, amplitude 1.5mm minimum
Recommend Wire Size		0.14 to 1.5mm² (24AWG - 16AWG)
Recommend Cable Size		ø7 to 13mm
Conduit Size		M20
Terminal Pulling Strength		20N minimum
Terminal Screw Torque		0.5 to 0.6Nm
Degree of Protection		HE1G-21SM: IP66, HE1G-20MB: IP65 HE1G-20ME: IP65, HE1G-21SMB: IP65
Conditional Short Circuit Current		50A (250V)
Recommended Short Circuit Protection		250V/10A fast blow fuse (IEC 60127-1)
Weight (approx.)		HE1G-21SM: 210g HE1G-20ME: 250g HE1G-20MB/HE1G-21SMB: 220g

Contact Ratings

Rated Insulation Voltage (Ui)				250V		
Thermal Current (Ith)				3A		
Rated Operating Voltage (Ue)				30V	125V	250V
Rated Operating Current (Ie)	3 Position Switch (Terminal No.1-2, 3-4)	AC	Resistive Load (AC-12)	–	3A	1.5A
			Inductive Load (AC-15)	–	1.5A	0.75A
		DC	Resistive Load (DC-12)	2A	0.4A	0.2A
			Inductive Load (DC-13)	1A	0.22A	0.1A
	Monitor Switch (Terminal No. 5-6 of HE1G-21SM)	AC	Resistive Load (AC-12)	–	2A	1A
			Inductive Load (AC-15)	–	1A	0.5A
		DC	Resistive Load (DC-12)	2A	0.4A	0.2A
			Inductive Load (DC-13)	1A	0.22A	0.1A
	Emergency Stop Pushbutton (Terminal No. 5-6, 7-8 of HE1G-20ME)	AC	Resistive Load (AC-12)	–	–	–
			Inductive Load (AC-15)	–	–	0.5A
		DC	Resistive Load (DC-12)	–	–	–
			Inductive Load (DC-13)	–	–	0.1A

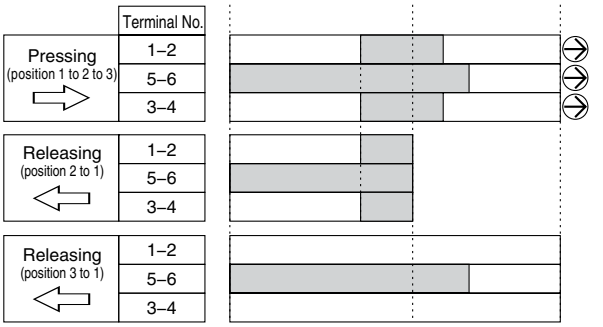
Contact Configuration	3 Position Switch	2 Contacts
	Monitor Switch	0 or 1 Contact
	Emergency Stop Pushbutton	0 or 2 Contacts
	Momentary Pushbutton	0 to 2 contacts

The minimum load (reference) = AC/DC3V • 5mA (for reference only.

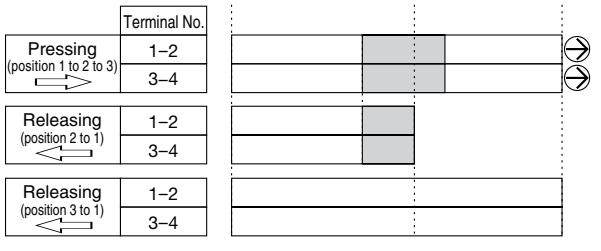
Operating Characteristics

Contact Movement

HE1G-21SM



HE1G-20ME



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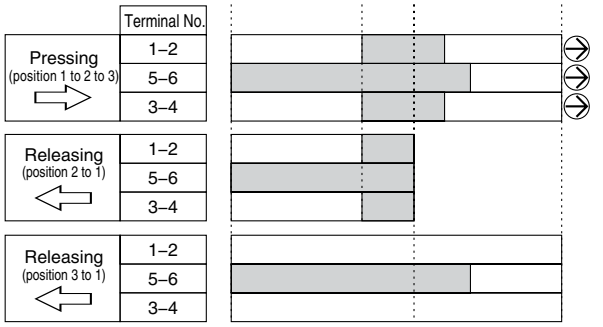
Emergency Stop Switch: 2NC contact (terminal no. 5-6, 7-8)

HE1G-21SMB



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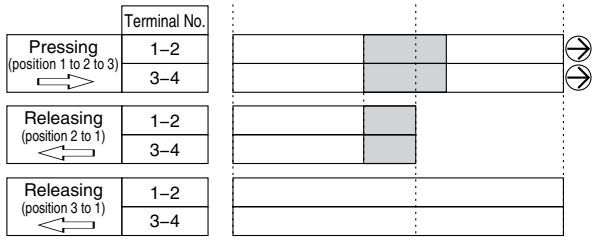
Momentary Pushbutton: 1NO contact (terminal no. 7-8)

HE1G-20MB



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Momentary Pushbutton: 2NO contact (terminal no. 5-6, 7-8)

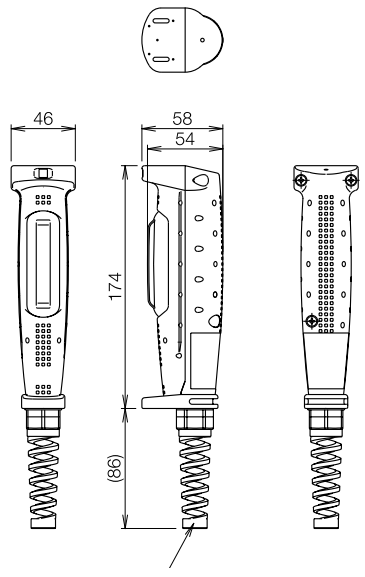
: contact ON (closed) : contact OFF (open)

Notes:

1. 3-position switches operate with direct opening action ⊖ when shifting from position 2 to position 3.
2. For the output of the enabling device, use terminals 1-2 and 3-4.
3. The above operation characteristics show when the center of the button is pressed. Pressing the edge of a button turns on one contact earlier than the other contact, causing a delay in operation.

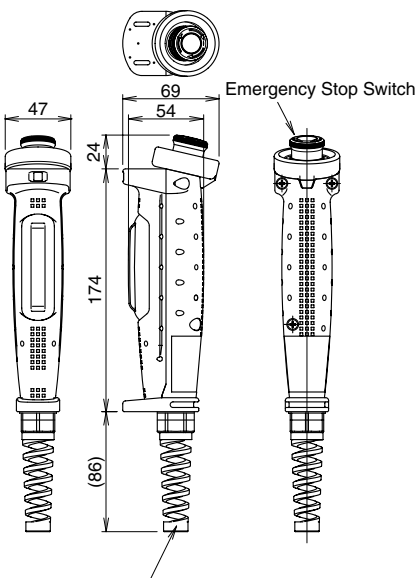
Dimensions (mm)

HE1G-21SM



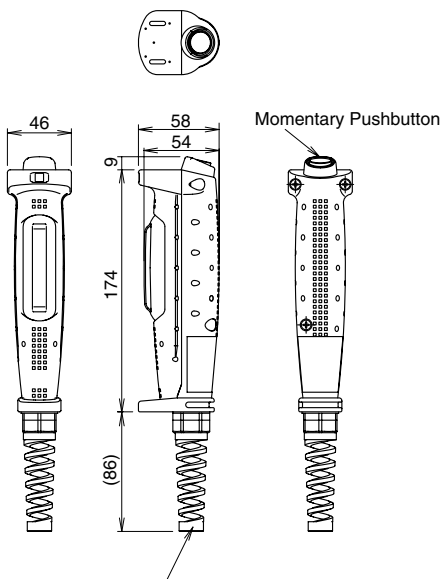
Connector (supplied with grip switch)
Part No. SKINTOP BS-M20x1.5 (LAPP)

HE1G-20ME



Connector (supplied with grip switch)
Part No. SKINTOP BS-M20x1.5 (LAPP)

HE1G-20MB/21SMB

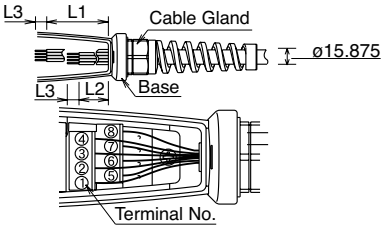


Connector (supplied with grip switch)
Part No. SKINTOP BS-M20x1.5 (LAPP)

Wiring Precautions
HE1G

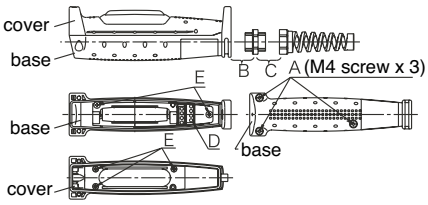
- Wire Stripping Information

Wire Length	Terminal Number 1-4	Terminal Number 5-8
L1, L2 (mm)	L1=40mm	L2=27mm
L3 (mm)	L3=6mm	



- Applicable Wire Size:0.14 to 1.5mm^2 (24 - 16AWG, one wire per terminal)

- Recommended Torque



	See Drawing Above	Recommended Torque
Rubber Boot & Base	A	1.2±0.1Nm
Connector & Grip Switch	B	4.0±0.3Nm
Connector	C	4.0±0.3Nm
Terminal Screw	D	0.5±0.6Nm
Do Not Remove	E	

HE1G-L Light Force Grip Enabling Switch

Key features:

- 3 position functionality (Off – On – Off) as required for manual robotic control
- Ideally suited for use as an enabling (aka "deadman") switch for robotic cells
- Provides a high level of safety based on human behavioral studies that determine personnel may squeeze OR let go when presented with a panic situation
- Contacts will not re-close when released from Off → On (3 → 1) (per IEC60204-1; 9.2.5.8)
- Optional E-Stop switch built in
- Connection for conduit and cable strain relief built in
- IP66 waterproof sealing
- Meets ANSI RIA 15.06 robotics standards
- Optional momentary pushbutton
- Distinctive tactile feedback when shifting to position 2 (enabling position)
- Lighter operating force to on position

c UL us LISTED (screw terminal)

(Monitor Switch)

Variation

In addition to a monitoring switch, the HE1G grip switch is also available with an emergency stop switch or a momentary pushbutton. Screw terminal and wire-saving internal connector models can be selected.

Part Numbers

Contact Configuration			Rubber Boot	Part Numbers	
3-position Switch	Monitor Switch	Additional Pushbutton Switch		Screw Terminals	Internal Connector
2 contacts	With (1NC)	Without	Yellow[1]	HE1G-L21SM	HE1G-L21SMC
			Gray[2]	HE1G-L21SM-1N	HE1G-L21SMC-1N
		Momentary Pushbutton Switch (1NO: AB6M-M1PB)	Yellow[1]	HE1G-L21SMB	HE1G-L21SMCB
			Gray[2]	HE1G-L21SMB-1N	HE1G-L21SMCB-1N
	Without	Emergency Stop Switch (2NC: HA1E-V2S2R)	Yellow[1]	HE1G-L20ME	HE1G-L20MCE
			Gray[2]	HE1G-L20ME-1N	HE1G-L20MCE-1N
		Momentary Pushbutton Switch (2NO: AB6M-M2PB)	Yellow[1]	HE1G-L20MB	HE1G-L20MCB
			Gray[2]	HE1G-L20MB-1N	HE1G-L20MCB-1N

1: Yellow silicon rubber: Can be used in general factories. Remains flexible at cold temperatures. Suitable to applications in a wide operating temperature range.
2: Gray NBR/PVC polyblend: Oil-proof. Suitable for environments subjected to machine oil and painting robot where silicon rubber cannot be used.

Specifications

Applicable Standards	UL508 (UL listed, screw terminal only) CSA C22.2, No. 14 (c-UL listed, screw terminal only) IEC/EN 60947-5-1 (TÜV/BG approval) GS-ET-22 (TÜV/BG approval)
Applicable Standards for Use	ISO 12100-1, -2, IEC 60204-1/EN 60204-1, ISO11161 / prEN11161, ISO 10218 / EN 775, ANSI/RIA R15.06, ANSI B11.19
Operating Temperature	Silicon rubber boot: –25 to 60°C (no freezing) NBR/PVC Polyblend rubber boot: –10 to 60°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	3
Contact Resistance	100 mΩ maximum (initial value)
Insulation Resistance	Between live and dead metal parts: 100 MΩ minimum (500V DC megger) Between terminals of different pole: 100 MΩ minimum (500V DC megger)
Impulse Withstand Voltage	Screw terminal: 2.5 kV (momentary pushbuttons: 1.5 kV) Internal connector: 1.5 kV
Electric Shock Protection Class	Class II (IEC 61140)
Operating Frequency	1,200 operations per hour
Mechanical Life	Position 1→2→1: 1,000,000 operations minimum Position 1→2→3→1: 100,000 operations minimum
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA)
Shock Resistance	Operating extremes: 150 m/s^2 Damage limits: 1,000 m/s^2
Vibration Resistance	Operating extremes: 5 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 16.7 Hz, amplitude 1.5 mm minimum
Applicable Wire Size	Screw terminal: 0.14 to 1.5 mm2 (AWG16 to 24) Internal connector: 0.05 to 0.86 mm2 (AWG18 to 30)
Applicable Cable	Outside diameter ø7 to 13 mm
Conduit Port Size	M20 (cable gland is supplied with the grip style enabling switch)
Terminal Tensile Strength	20N minimum
Terminal Screw Tightening Torque	0.5 to 0.6 N·m
Degree of Protection	HE1G-L21SM: IP66 (IEC 60529) HE1G-L20ME: IP65 (IEC 60529) HE1G-L20MB: IP65 (IEC 60529) HE1G-L21SMB: IP65 (IEC 60529)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short circuit protection.)
Direct Opening Force	70N minimum (monitor switch)
Operator Strength	500N minimum (when pressing the entire button surface)
Weight (approx.)	HE1G-L21SMC: 190g HE1G-L21SM/L21SMCB/L20MCB: 200g HE1G-L21SMB/L20MB: 210g HE1G-L20MCE: 230g HE1G-L20ME: 240g

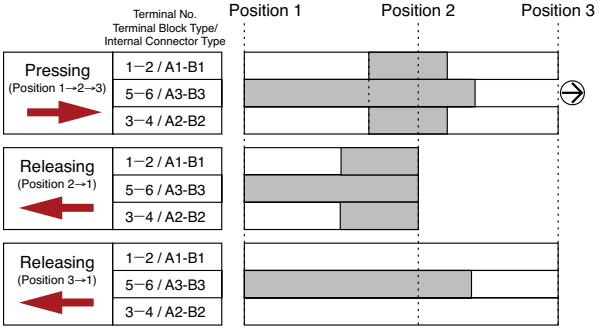
See grip switch catalog for complete list of specifications.

Contact Ratings

Rated Insulation Voltage (Ui)					250V (momentary pushbutton: 125V)		
Rated Thermal Current (Ith)					2.5A (Note)		
Rated Voltage (Ue)					30V	125V	250V
Rated Current (Ie)	Grip Style Enabling Switch	3-position Switch (Terminal No.1-2/A1-B1,3-4/A2-B2)	AC	Resistive Load (AC-12)	—	1A	0.5A
				Inductive Load (AC-15)	—	0.7A	0.5A
			DC	Resistive Load (DC-12)	1A	0.2A	—
				Inductive Load (DC-13)	0.7A	0.1A	—
		Monitor Switch (HE1G-L21SM/ HE1G-L21SMB, Terminal No.5-6/A3-B3)	AC	Resistive Load (AC-12)	—	2A	1A
				Inductive Load (AC-15)	—	1A	0.5A
			DC	Resistive Load (DC-12)	2.5A	1.1A	055A
				Inductive Load (DC-13)	2.3A	0.55A	0.27A
	Pushbutton	Emergency Sop Switch (HE1G-L20M, Terminal No. 5-6/A3-B3, 7-8/A4-B4)	AC	Resistive Load (AC-12)	—	—	—
				Inductive Load (AC-15)	—	—	0.5A
			DC	Resistive Load (DC-12)	—	—	—
				Inductive Load (DC-13)	—	—	0.1A
		Momentary Puhsbutton (HE1G-L20M, Terminal No.5-6/A3-B3,7-8/A4-B4) (HE1G-L21SM, Terminal No.7-8/A4-B4)	AC	Resistive Load (AC-12)	—	0.5A	—
				Inductive Load (AC-15)	—	0.3A	—
			DC	Resistive Load (DC-12)	1A	0.2A	—
				Inductive Load (DC-13)	0.7A	0.1A	—

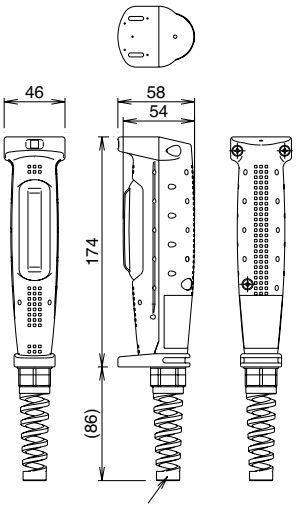
Minimum applicable load (reference value): 3V AC/DC, 5 mA (Applicable range is subject to the operating conditions and load.)
Note: Operating temp. 40 to up to +50°C (not included): 2A (4 circuits) 50 to +60°C: 1.5A (3 or 4 circuits)

Operating Characteristics
HE1G-L21SM, HE1G-L21SMC, HE1G-L21SM-1N, HE1G-L21SMC-1N



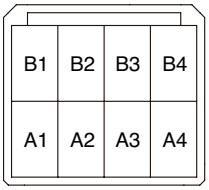
Terminals 1-2/A1-B1 and 3-4/A2-B2 are outputs of the 3-position enabling switch.
Terminals 5-6/A3-B3 are outputs of the monitor switch.
The above operation characteristics show when the center of the grip switch button is pressed. Because two contacts are designed to operate independently, pressing the edge of the button turns on one contact earlier than the other contact, causing a delay in operation. To avoid this, always press the center of the button.

Dimensions (mm)
HE1G-L21SM, HE1G-L21SMC, HE1G-L21SM-1N, HE1G-L21SMC-1N



Cable Gland (supplied with grip switch)
Type No.: SKINTOP BS-M20 × 1.5 (LAPP)

Internal Connector Terminal No.

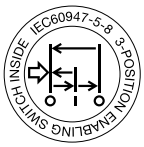


Connector
Tyco Electronics D-1200D series
Receptacle housing: 1-1827864-4
Receptacle contact
1827586-2: AWG28 to 30
(Hand tool: 1762952-1)
1827587-2: AWG22 to 28
(Hand tool: 1762846-1)
1827588-2: AWG22 to 28
(Hand tool: 1762950-1)
1827589-2: AWG18 to 22
(Hand tool: 1762625-1)

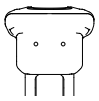
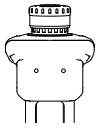
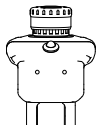
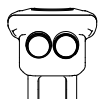
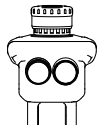
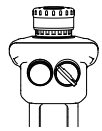
HE2G Compact Grip Enabling Switch

Key features:

- New compact, light-weight grip switch provides a comfortable hold
- Compact design fits comfortably in the hand
- Light operating force ensures worry-free operation
- 3-position switch with distinctive tactile feedback
- Dual enabling contacts ensure a high level of safety



Part Numbers

Additional Control Units		Rubber Boot Color	Solder Terminal	Internal Connector
None		Yellow	HE2G-21SH	HE2G-21SC
		Gray	HE2G-21SH-1N	HE2G-21SC-1N
Estop		Yellow	HE2G-21SHE	–
Estop and Green Pilot Light			HE2G-21SHE-P-0	
Two Momentary Pushbuttons			HE2G-21SH-L-L	
E-Stop and Two Momentary Pushbuttons			HE2G-21SHE-L-L	HE2G-21SCE-L-L
E-Stop, Momentary Pushbutton and Key Switch			HE2G-21SHE-L-K	HE2G-21SCE-L-K

1. Additional control units installed on the HE2G are as follows:
   Emergency Stop Switch: XA1E-BV3U02R
   Momentary Pushbutton: AB6M-M2PLW
   Key Selector Switch: AS6M-2KT2PA Pilot Light: UP9P-2498G
2. Silicon rubber: Can be used in general factories. Remains flexible in cold temperatures. Suitable in applications with a wide operating temperature range.
3. NBR/PVC polyblend: Oil-proof. Suitable for environments subjected to machine oil and painting robots where silicon rubber cannot be used.

Specifications

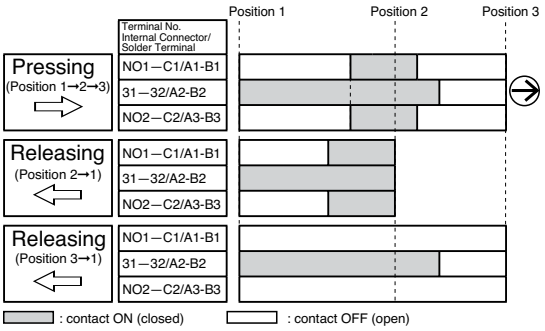
Applicable Standards	UL508 (UL recognition) CSA C22.2, No. 14 (c-UL recognition) IEC/EN 60947-5-1 (TÜV) GS-ET-22 (TÜV approval)
Applicable Standards for Use	ISO 12100-1, -2 IEC 60204-1/EN 60204-1 ISO11161 / prEN11161 ISO 10218 / EN 775 ANSI/RIA R15.06 ANSI B11.19
Operating Temperature	Silicon rubber boot: –25 to 60°C (no freezing) NBR/PVC Polyblend rubber boot: –10 to 60°C (no freezing)
Relative Humidity	45 to 85% (no condensation)
Storage Temperature	–40 to +80°C (no freezing)
Pollution Degree	3
Contact Resistance	50 mΩ maximum (initial value)
Insulation Resistance	Between live and dead metal parts: 100 MΩ minimum (500V DC megger) Between terminals of different pole: 100 MΩ minimum (500V DC megger)
Impulse Withstand Voltage	(Solder terminal) Grip style enabling switch/emergency stop switch: 2.5 kV Momentary pushbutton/key selector switch: 1.5 kV Pilot light: 500V AC, 1 minute (between live and dead parts) (Internal connector) Grip style enabling switch/emergency stop switch/momentary pushbutton/key selector switch: 1.5 kV
Electric Shock Protection Class	Class II (IEC 61140) (With pilot light: class III)
Operating Frequency	1,200 operations per hour
Mechanical Life	Position 1 → 2 → 1: 1,000,000 operations minimum Position 1 → 2 → 3 → 1: 100,000 operations minimum
Electrical Life	100,000 operations minimum (rated load) 1,000,000 operations minimum (24V AC/DC, 100 mA)
Shock Resistance	Operating extremes: 150 m/s^2 (15G) Damage limits: 1,000 m/s^2 (100G)
Vibration Resistance	Operating extremes: 5 to 55 Hz, amplitude 0.5 mm minimum Damage limits: 16.7 Hz, amplitude 1.5 mm minimum
Applicable Wire	Solder terminal: 0.5 mm^2 maximum (20 AWG) Internal connector: 0.05 to 0.86 mm^2 (AWG18 to 30)
Applicable Wire Size	Solder terminal: 0.5 mm^2 (20 AWG) Internal connector: 0.05 to 0.86 mm^2 (AWG18 to 30) (AWG22 between switch and connector)
Applicable Cable	Outside diameter: ø4.5 to 10 mm
Conduit Port Size	M16 (cable gland is supplied)
Terminal Tensile Strength	20N minimum
Degree of Protection	With control unit: IP67/IP66 (IEC 60529) Without control unit: IP65 (IEC 60529)
Conditional Short-circuit Current	50A (250V) (Use 250V/10A fast-blow fuse for short circuit protection.)
Direct Opening Force	60N minimum (monitor switch)
Operator Strength	500N minimum (when pressing the entire button surface)
Weight (approx.)	HE2G-21SH: 140g HE2G-21SH-P-0/-21SC: 145g HE2G-21SHE/-21SC-P-0: 150g HE2G-21SH-L-L/-21SHE-P-0/-21SCE: 155g HE2G-21SH-L-K/-21SCE-P-0: 160g HE2G-21SHE-L-L/-21SC-L-L: 165g HE2G-21SHE-L-K/-21SC-L-K: 170g HE2G-21SCE-L-L: 175g HE2G-21SCE-L-K: 180g

Contact Ratings

Rated Insulation Voltage (Ui)					250V (momentary pushbutton and key selector: 125V) / 30V (with pilot light)		
Rated Thermal Current (Ith)					3A (emergency stop switch: 5A)		
Rated Voltage (Ue)					30V	125V	250V
Rated Current	Grip Style Enabling Switch	3-position switch (Terminal No. NO1-C1/A1-B1, NO2-C2/A3-B3)	AC	Resistive Load (AC-12)	—	1A	0.5A
				Inductive Load (AC-15)	—	0.7A	0.5A
			DC	Resistive Load (DC-12)	1A	0.2A	—
				Inductive Load (DC-13)	0.7A	0.1A	—
		Monitor Switch (NC contact) (Terminal No. 31-32/A2-B2)	AC	Resistive Load (AC-12)	—	2.5A	1.5A
				Inductive Load (AC-15)	—	1.5A	0.75A
			DC	Resistive Load (DC-12)	2.5A	1.1A	0.55A
				Inductive Load (DC-13)	2.3A	0.55A	0.27A
	Control Unit	Emergency Stop Switch XA1E-BV3U02R (Terminal No.1-2/A1-B1, 1-2/A2-B2)	AC	Resistive Load (AC-12)	—	5A	3A
				Inductive Load (AC-15)	—	3A	1.5A
			DC	Resistive Load (DC-12)	2A	0.4A	0.2A
				Inductive Load (DC-13)	1A	0.22A	0.1A
		Momentary Pushbutton Key Selector Switch AB6M-M2PLW, AS6M-2KT2PA (Terminal No.C1/B1, NO1/B2, NC1/B3, C2/A1, NO2/A2, NC2/A3)	AC	Resistive Load (AC-12)	—	0.5A	—
				Inductive Load (AC-15)	—	0.3A	—
			DC	Resistive Load (DC-12)	1A	0.2A	—
				Inductive Load (DC-13)	0.7A	0.1A	—
		UP9 Pilot Light UP9P-2498G (Terminal No. +, –)			Rated operating voltage: 24V DC ±10% Rated current: 15mA		

Note: Minimum applicable load (reference value): 3V AC/DC, 5 mA
(Applicable range is subject to the operating conditions and load.)
*Operating temperature for internal connectors:
–25°C min., 40°C max. 2.5A (12 to 19 poles), 2A (20 to 22 poles)
40°C min., 50°C max. 2.5A (8 to12 poles), 2A (13 to 22 poles)
50°C min., 60°C max. 2.5A (6, 7 poles), 2A (8 to13 poles), 1.5A (14 to 22 poles)

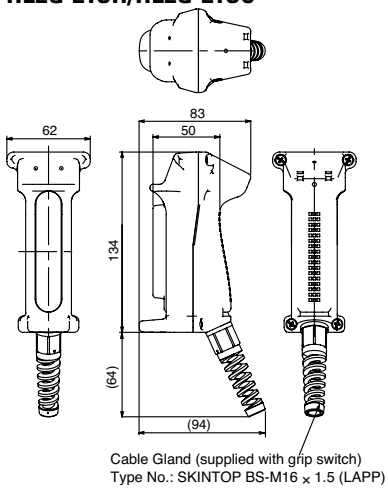
Operation Characteristics



Terminals NO1-C1/A1-B1, NO2-C2/A3-B3 are outputs of the 3-position enabling switch.
The above operation characteristics show when the center of the grip switch button is pressed. Because two contacts are designed to operate independently, pressing the edge of the button turns on one contact earlier than the other contact, causing a delay in operation To avoid this, always press the center of the button.

Dimensions (mm)

HE2G-21SH/HE2G-21SC



All dimensions in mm.

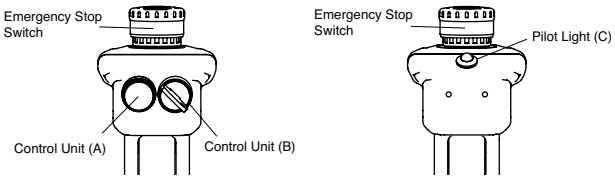
Internal Connector

Cable side connector:
Tyco Electronics D-1200D Series

- Receptacle: 1-1827864-☐
- Receptacle contact
  - 1827586-2: AWG28 to 30 (Hand tool: 1762952-1)
  - 1827587-2: AWG22 to 28 (Hand tool: 1762846-1)
  - 1827588-2: AWG22 to 28 (Hand tool: 1762950-1)
  - 1827589-2: AWG18 to 22 (Hand tool: 1762625-1)

Specify 2 or 3 in place of ☐.
2: 4-pin connector
3: 6-pin connector
The customer needs to purchase the connector separately.

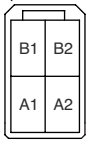
Additional Control Unit Layout



Contact Arrangement (Internal Connector)

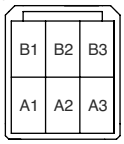
Internal Connector Pin No.

4-pin



Emergency stop switch

6-pin

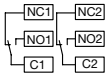


3-position switch
Momentary pushbutton
Key selector switch

3-position switch /control unit side connector:
Tyco Electronics D-1200D Series
Tab housing: 1-1903130-2 (4-pin connector)
1-1903130-3 (6-pin connector)
Tab contact: 19303116-2

Terminal Arrangement (TOP VIEW)

Emergency stop switch



Momentary pushbutton
Key selector switch

6-Pin Connector Allotment Table

Internal Connector Pin No.	Momentary pushbutton Key selector switch
A1	C2
A2	NO2
A3	NC2
B1	C1
B2	NO1
B3	NC1

Grip Switch Housing for HE5B Enabling Switch

Grip Style Enabling Switch Housing

- HE5B enabling switches can be installed in the HE9Z-GSH51 grip style enabling switch housing to be used as 3-position grip style enabling switches.

Part Numbers

Part Number	Description
HE9Z-GSH51	Grip Switch Housing for HE5B Enabling Switch

Specifications

Applicable Standards	IEC/EN 60529, UL50
Operating Temperature	–25 to 60°C (no freezing)
Relative Humidity	45 to 85% RH (no condensation)
Storage Temperature	–40 to 80°C (no freezing)
Pollution Degree	3
Shock Resistance	Damage limits: 500 m/s^2 (50G)
Vibration Resistance	Damage limits: 5 to 55 Hz, amplitude 0.5 mm
Electric Shock Protection Class	Class II (when using HE5B-M2P*)
Applicable Cable	Outside diameter ø4.5 to 10 mm
Conduit Port Size	M16 (cable gland is supplied with the grip style enabling switch housing)
Degree of Protection	IP65 (with HE5B-M2P*) Type 4X (with HE5B-M2P*)
Weight (approx.)	65g (grip style enabling switch housing only)

The specifications are for the grip style enabilng switch housing only. For enabling switch, see the HE5B specifications on page 374.

The following switches can be installed on the grip style enabling switch housing to be used as hand-held switches.

AB6M pushbuttons (IP65, except for AB6M-V)
AS6M selector switches (IP65)
AS6M key selector switches (IP65)

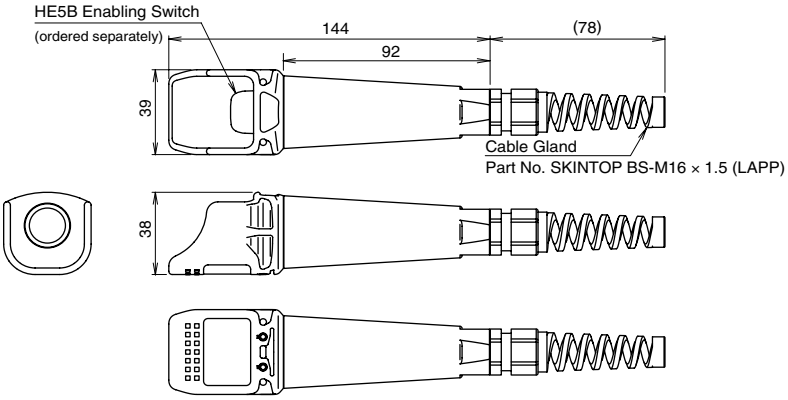
Notes:

The HE9Z-GSH51 grip style enabling switch housing does not include the HE5B enabling switch. The enabling switch must be ordered separately.

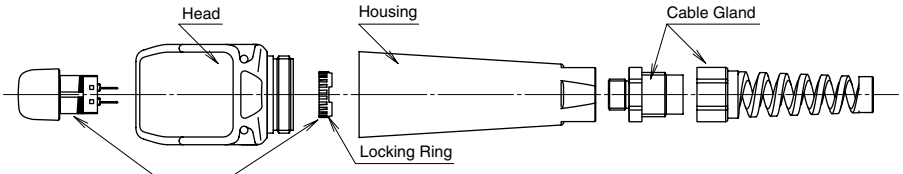
The HE5B enabling switch must be installed and wired to the HE9Z-GSH51 grip style enabling switch housing by the user. For information on wiring, see the instruction sheet supplied with the HE9Z-GSH51.

Dimensions (mm)

HE9Z-GSH51

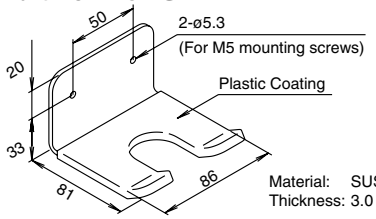


HE9Z-GSH51 + HE5B Construction



Anti-rotation ring is not required when installing the HE5B enabling switch on the HE9Z-GSH51 grip style enabling switch housing. Use the locking ring only.

Mounting Bracket
Part No. HE9Z-GH1



Material: SUS304
Thickness: 3.0 mm

All dimensions in mm.

Selection Guide..... 410
Safety Relay HR1S-AC 411
Safety Relay HR1S-AF..... 414
Safety Relay HR1S-DM..... 417
Safety Relay HR1S-ATE..... 419
Safety Relay HR2S-301..... 422
Safety Relay HR2S-332N..... 427
FS1A Multi-function Safety Relay 433

Safety Control

IDEC

www.IDEC.com/safety

Selection Guide

Series	Single Function Safety Relay	Single Function Safety Relay	Multi-function Safety Relay
	HR1S	HR2S	FS1A
Appearance			
Page	412	423	434
Performance Level	PLe	PLe	PLe
Safety Category	3/4	3/4	4
Contact Configuration	1NO/1NC, 2NC, 2NO/3NO (time delay)	3NO/1NC, 3NO/3NO (time delay) /2NC (Aux.)	4NO

Safety Relay HR1S-AC

Key features:

- 1NC or 2NC safety input type, such as E-Stops or Interlock Switches
- EN ISO 13849-1 PLe, Safety Cat 3 compliant, and EN 62061 SIL 3
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED Indicator.
- Finger-safe protection
- 22.5mm wide, 35mm DIN rail mounting
- UL listed, CSA certified, TÜV NORD approved

Part Numbers

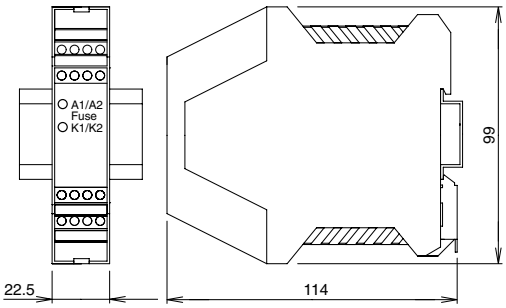
Part Number	Terminal Style
HR1S-AC5121	Integrated Terminal Block
HR1S-AC5121P	Removable Terminal Block

Specifications

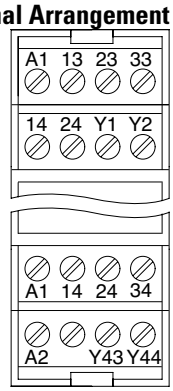
Operating Temperature			–10 to 55°C (no freezing)
Degree of Protection			Terminal: IP20, Housing: IP40
Rated Power Voltage			24V AC (–20 to +10%) 50/60 Hz 24V DC (±20%)
Power Consumption			AC: 2.2 VA (24V AC) maximum DC: 1.2W (24V DC) maximum
Overcurrent Protection			Electronic
Control Circuit Voltage			24V
Performance Level (PL)			e (EN ISO 13849-1)
Safety Category			3 (EN 954-1)
Safety Integrity Level (SIL)			3 (EN 62061)
Response Time			100ms maximum
Input Synchronization Time			Unlimited
Overvoltage Category			III
Pollution Degree			2
Rated Insulation Voltage			300V
Safety Outputs	Instantaneous (Stop Cat 0)		3NO
	Auxiliary Contact		1NO (transistor, PNP)
Output Contact Ratings	Safety Circuit	AC-15	C300: Ue= 240VAC, Ie=0.75A
		DC-13	Ue=24VDC, Ie=2A
	Transistor Circuit		24V/20mA
	Minimum Applicable Load		17V/10mA (initial value)
Operation Frequency			1200 operations/h maximum
Rated Current			Safety circuit output total: 10.5A maximum
Wire Size			HR1S-AC5121: 1 × 2.5mm², 2 × 0.75mm² maximum HR1S-AC5121P: 1 × 2.5mm², 2 × 1.5mm² maximum
Weight			160g

Use a 4A fuse (Type gL) for power fuse protection.
Use a 4A (Type gL) or a 6A fast blow fuse for output fuse protection

Dimensions (mm)

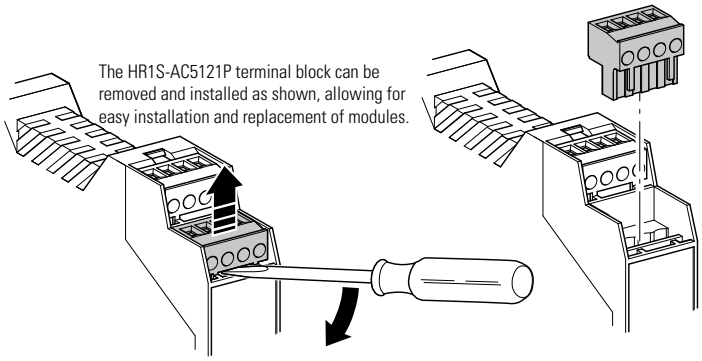


Terminal Arrangement



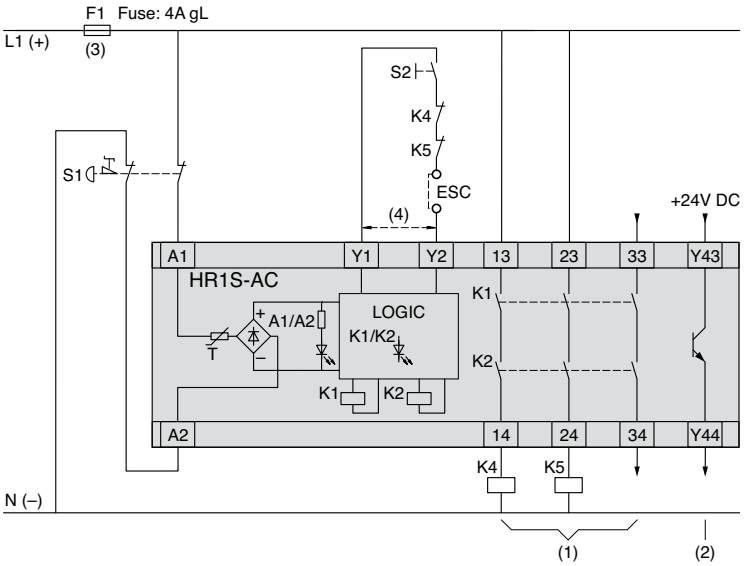
LED Indicator

- A1/A2 Fuse:
  Turns on when power circuit is normal.
  Turns off when power is interrupted or the electronic fuse blows.
- K1: Turns on when K1 relay operates.
- K2: Turns on when K2 relay operates.

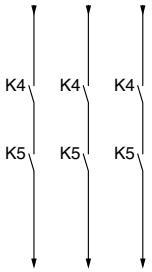


HR1S-AC Wiring Diagram

Safety Category 3 Example Circuit (using an emergency stop switch with 2NC contacts)



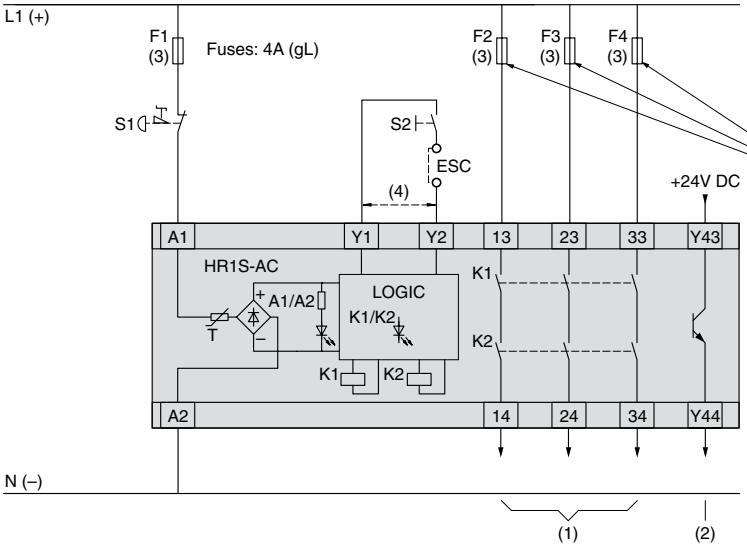
ESC: External Start Condition
S1: Emergency Stop Switch
S2: Start Switch
F1: Protection fuse for the power of safety relay module
K4, 5: Safety contactor



The Safety Category is achieved by the entire control system. Take any connected safety equipment and wiring into consideration.

(1) Three safety outputs
(2) One transistor output
(3) See the specifications for maximum fuse size
(4) Jumper for terminal Y1-Y2 (for automatic start)

Safety Category 3 Example Circuit (using an emergency stop switch with 2NC contacts)

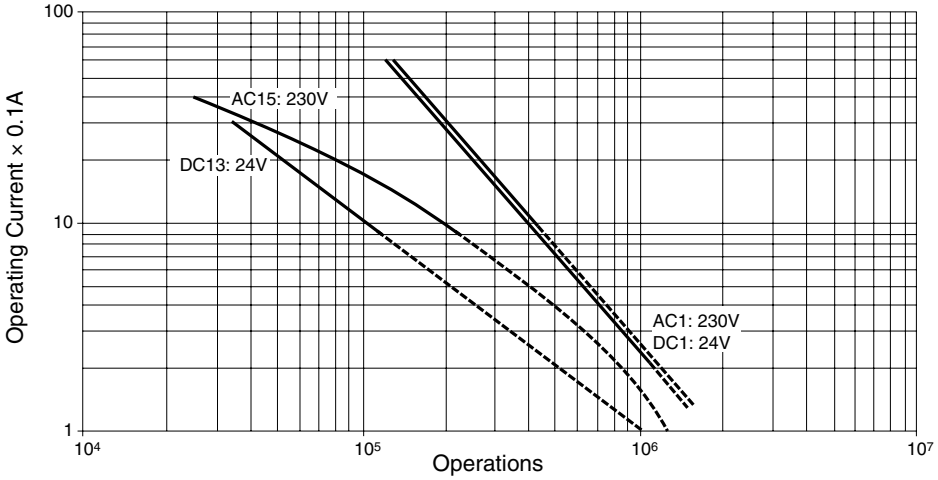


ESC: Exernal Start Condition
S1: Emergency Stop Switch
S2: Start Switch
F1: Protection fuse for the power of safety relay module
F2 to F4: Protection fuse for the output of safety relay module

Fuses: 4A (gL) or 6A fast blow type

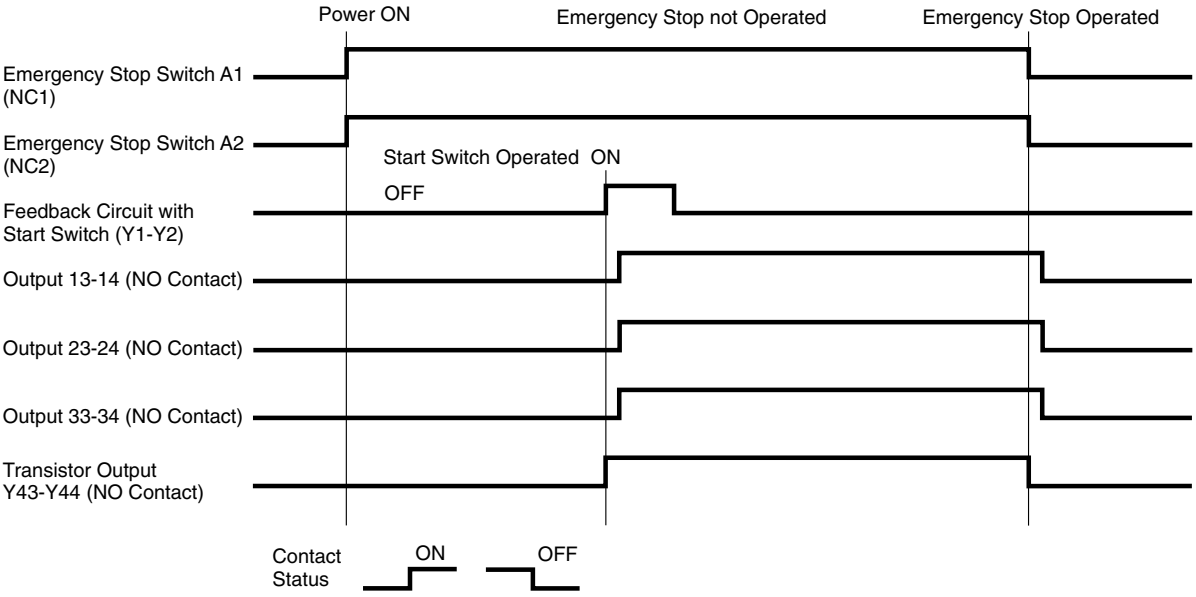
(1) Three safety outputs
(2) One transistor output
(3) See the specifications for maximum fuse size

Output Contact Electrical Life

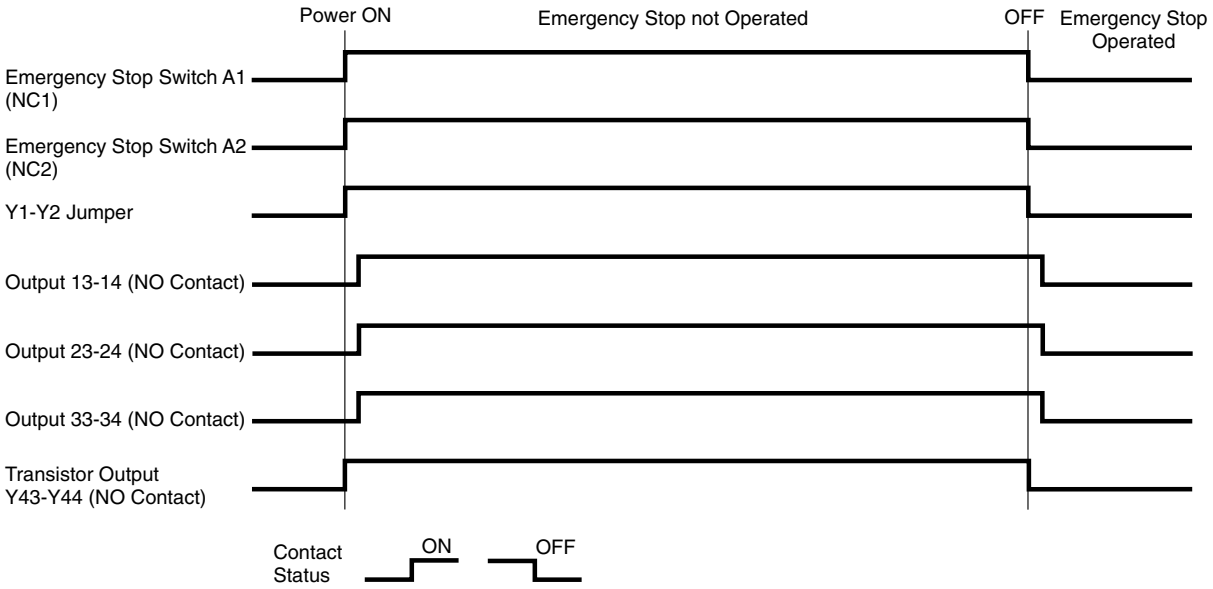


HR1S-AC Safety Relay Module Operation Chart

When Using a Start Switch



When Not Using a Start Switch



Safety Relay HR1S-AF

Key features:

- 2NC safety input type, such as E-Stops or Interlock Switches
- EN ISO 13849-1 PLe, Safety Cat 4 compliant, and EN 62061 SIL 3
- Welding detection of start switch
- Fault diagnosis function with dual safety circuits
- Internal relay operations can be monitored with LED Indicator.
- Finger-safe protection
- 22.5mm wide, 35mm DIN rail mounting
- UL listed, CSA certified, TÜV NORD approved

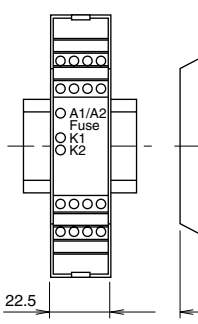
Part Numbers

Part Number	Terminal Style
HR1S-AF5130B	Integrated Terminal Block
HR1S-AF5130PB	Removable Terminal Block

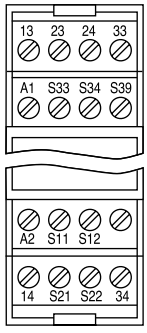
Specifications

Operating Temperature			–25 to +55°C (no freezing)
Degree of Protection			Terminal: IP20, Housing: IP40
Rated Power Voltage			24V AC (–15 to +10%) 50/60 Hz 24V DC (–15 to +10%)
Power Consumption			5 VA maximum (24V AC) 2.5W maximum (24V DC)
Overcurrent Protection			Electronic (Note)
Control Circuit Voltage			24V
Performance Level (PL)			e (EN ISO 13849-1)
Safety Category			4 (EN ISO 13849-1)
Safety Integrity Level (SIL)			3 (EN 62061)
Response Time			When S11-S12, S21-S22 are interrupted: 20 ms maximum When power is interrupted: 60 ms maximum
Input Synchronization Time			Unlimited
Overvoltage Category			III
Pollution Degree			2
Rated Insulation Voltage			300V
Safety Outputs	Instantaneous (Stop Cat 0)		3NO
Output Contact Ratings	Safety Circuit	AC-15	C300: Ue= 240VAC, Ie=0.75A
		DC-13	Ue=24VDC, Ie=2A
	Minimum Applicable Load		17V/10mA (initial value)
Operation Frequency			1200 operations/h maximum
Rated Current			Safety circuit output total: 18A maximum Each safety circuit output: 6A maximum
Wire Size			HR1S-AF5130B: 1 × 2.5 mm², 2 × 0.75 mm² maximum HR1S-AF5130PB: 1 × 2.5 mm², 2 × 1.5 mm² maximum
Weight			250g

Dimensions (mm)

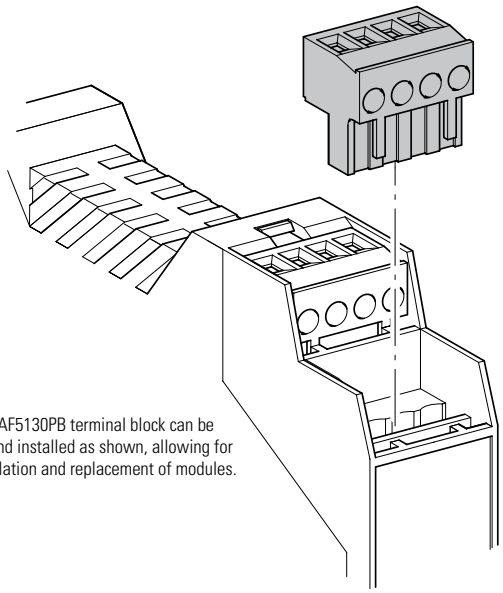


Terminal Arrangement



LED Indicator

- A1/A2 Fuse:
  Turns on when power circuit is normal.
  Turns off when power is interrupted or the electronic fuse blows.
- K1: Turns on when K1 relay operates.
- K2: Turns on when K2 relay operates.



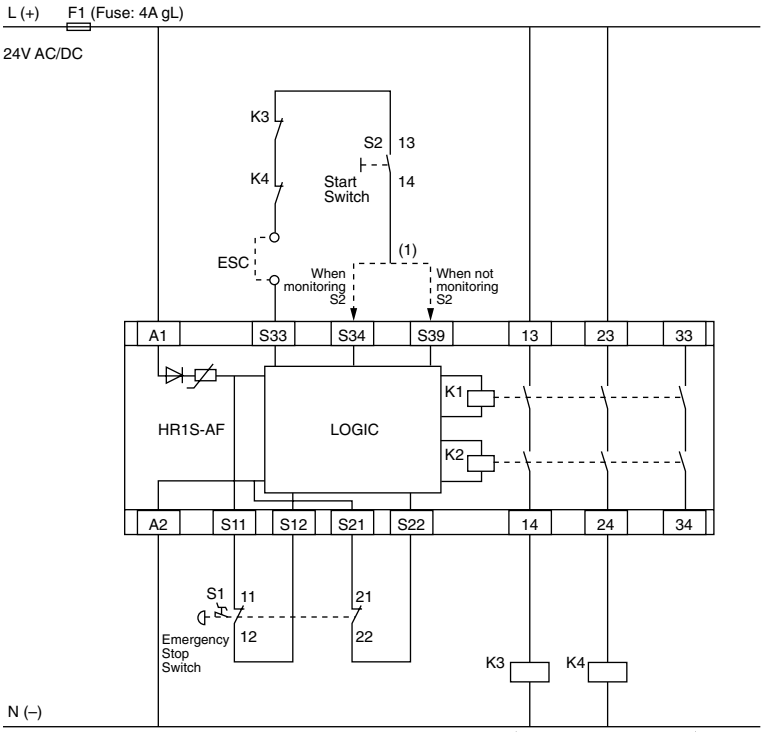
The HR1S-AF5130PB terminal block can be removed and installed as shown, allowing for easy installation and replacement of modules.

Note: Short-circuit of S11 and S21 activates the overcurrent protection circuit, interrupting the power supply. The safety output turns off. Normal status is restored when the short-circuit is removed. Use a 4A fuse (Type gL) for power line protection. Use a 4A fuse (Type gL) or a 6A fast blow fuse for output line protection.

HR1S-AF Wiring Diagram

Safety Category 4 Example Circuit (using an emergency stop switch)

The Safety Category is achieved by the entire control system. Take any connected safety equipment and wiring into consideration.

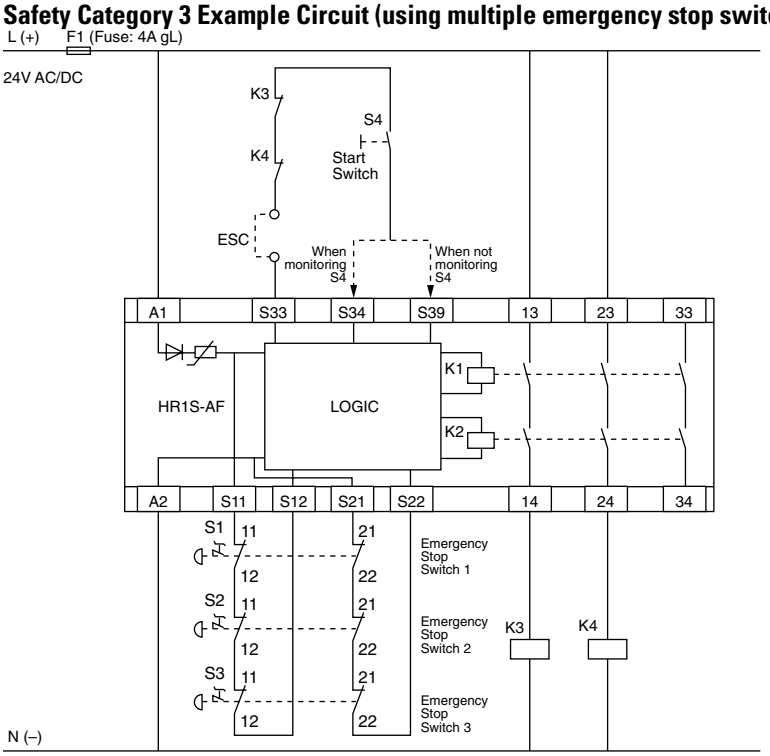


(1) = Start Switch Monitor

ESC: External Start Condition
F1: Protection fuse for the power of safety relay module
K3, 4: Safety contactor

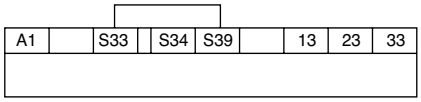
Safety Output 3 Circuits

Safety Category 3 Example Circuit (using multiple emergency stop switches)



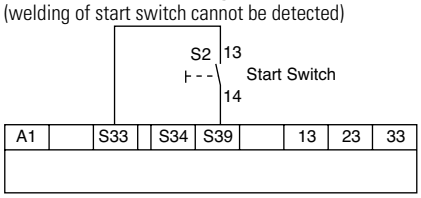
ESC: External Start Condition
F1: Protection fuse for the power of safety relay module
K3, 4: Safety contactor

When not using a start switch (automatic start)



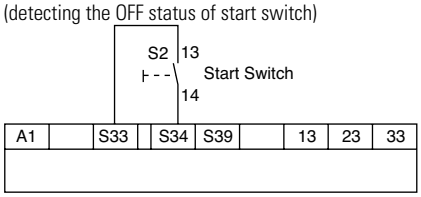
When not monitoring the start switch

(welding of start switch cannot be detected)



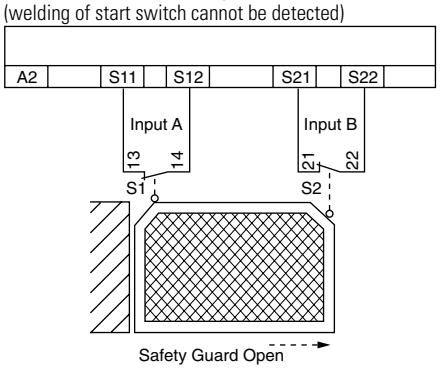
When monitoring the start switch

(detecting the OFF status of start switch)



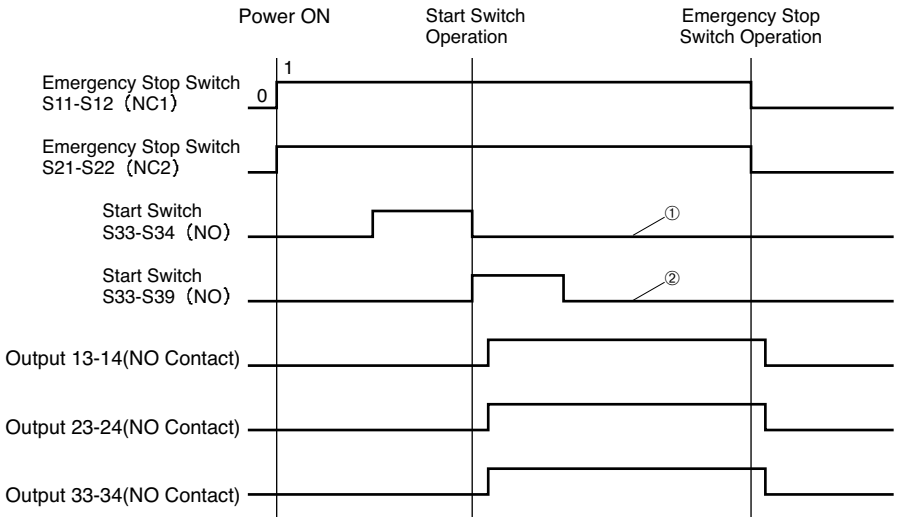
When not monitoring the start switch

(welding of start switch cannot be detected)



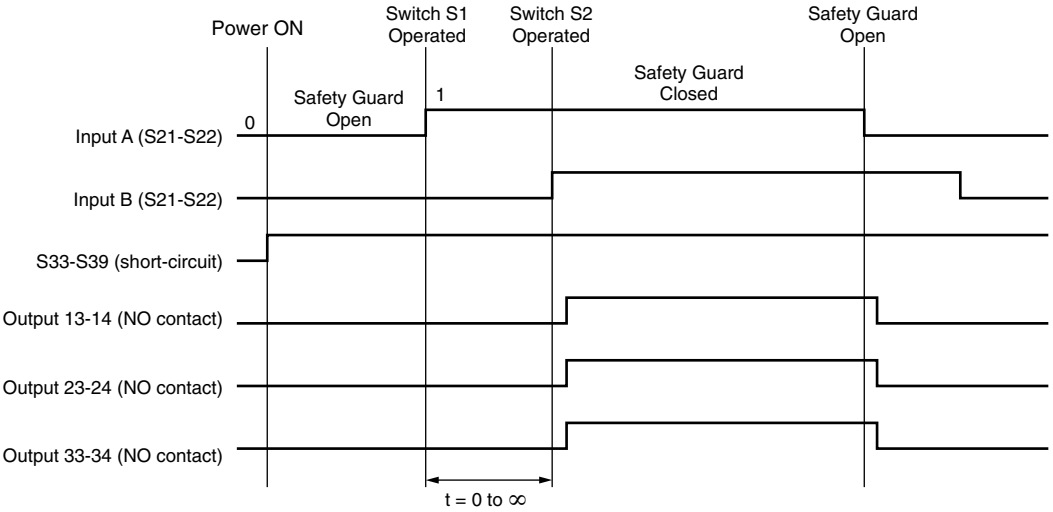
HR1S-AF Operation Chart

When Using the Emergency Stop Switch

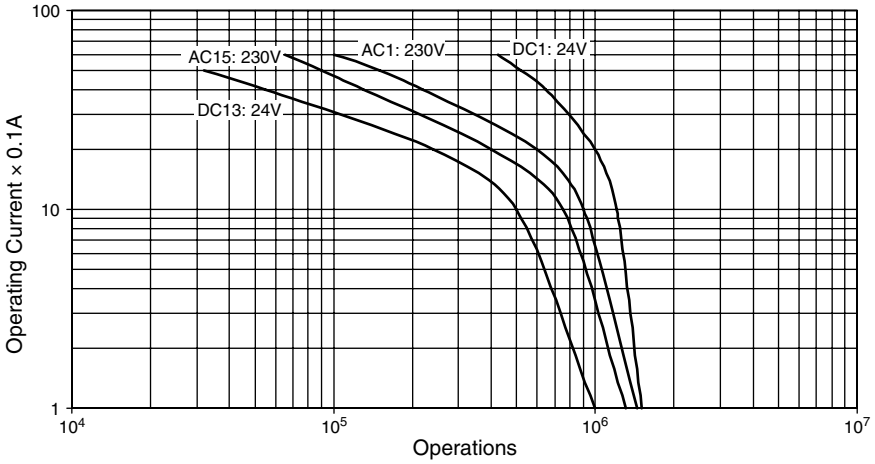


① When monitoring the start switch (detecting the OFF status of start switch)
② When not monitoring the start switch (contact welding of start switch cannot be detected)

When not Using the Safety Guard (Automatic Start)



Output Contact Electrical Life



Safety Relay HR1S-DM

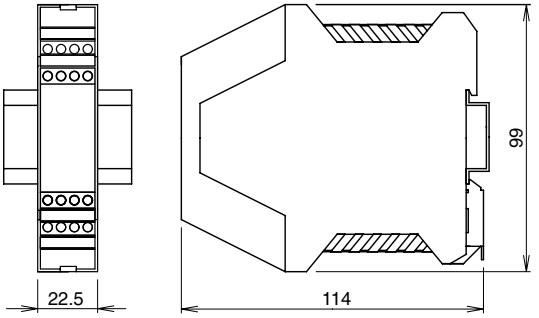
Key features:

- 1NO-1NC safety input type, such as magnetic coded safety switches
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED Indicator.
- Finger-safe protection
- 22.5 or 45mm wide, 35mm DIN rail mounting
- EN ISO 13849-1 PLe, Safety Cat 4 compliant, and EN 62061 SIL 3
- UL listed, CSA certified, TÜV NORD approved

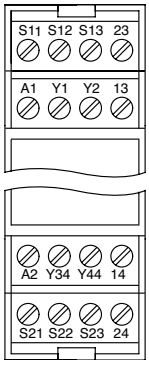
Part Numbers

Part Number	Terminal Style	Input
HR1S-DMB1132	Integrated Terminal Block	2
HR1S-DMB1132P	Removable Terminal Block	
HR1S-DME1132	Integrated Terminal Block	6
HR1S-DME1132P	Removable Terminal Block	

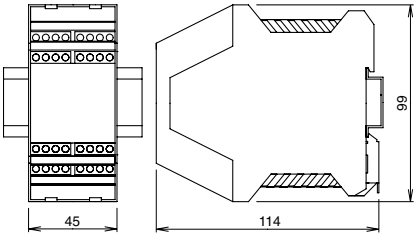
Dimensions (mm) HR1S-DMB



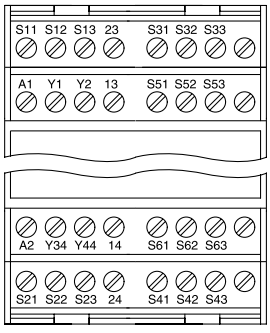
Terminal Arrangement HR1S-DMB



Dimensions (mm) HR1S-DME



Terminal Arrangement HR1S-DME



Specifications

Operating Temperature			–10 to 55°C (no freezing)
Degree of Protection			Terminal: IP20, Housing: IP40
Rated Power Voltage			24V DC (–20 to +20%)
Power Consumption			HR1S-DMB: 2.5W maximum (24V DC) HR1S-DME: 3.5W maximum (24V DC)
Overcurrent Protection			Electronic
Control Circuit Voltage			24V DC
Performance Level (PL)			e (EN ISO 13849-1)
Safety Category			4 (EN ISO 13849-1)
Safety Integrity Level (SIL)			3 (EN 62061)
Response Time			20 ms maximum
Input Synchronization Time			500ms max
Overvoltage Category			III
Pollution Degree			2
Rated Insulation Voltage			300V
Maximum Input Resistance			100Ω (per input point)
No. of Outputs	Safety Circuit		2NO
	Auxilliary Contact		2NO (transistor PNP)
Output Contact Ratings	Safety Circuit	AC-15	C300: Ue= 240VAC, Ie=0.75A
		DC-13	Ue= 24V DC, Ie= 1.5A
	Transistor Circuit		24V/20 mA
	Minimum Applicable Load		17V/10 mA (initial value)
Operation Frequency			1200 operations/hour maximum
Rated Current			Output total 12A maximum
Wire Size			0.14 to 2.5 mm^2
Weight			HR1S-DMB: 180g HR1S-DME: 250g

Use a 4A fuse (Type gL) for power fuse protection.
Use a 4A (Type gL) or a 6A fast blow fuse for output fuse protection.

LED Indicator

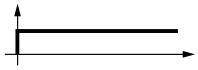
HR1S-DMB

- Power A1/A2:
  Turns on when power circuit is normal.
  Turns off when power is interrupted or the electronic fuse blows.
- Fault:
  Turns on when the HR1S fails (see failure causes on page 694).
- K1/K2:
  Turns on when K1/K2 relays operate.

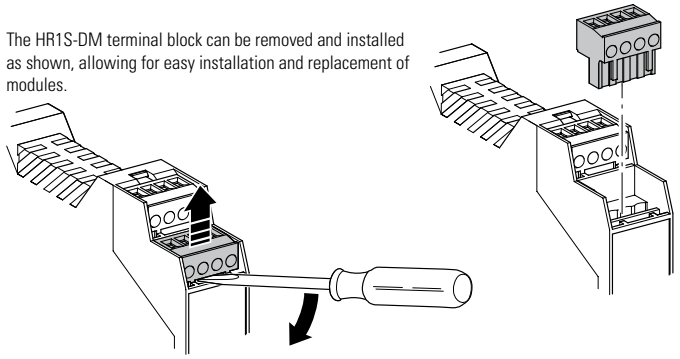
HR1S-DME

- Power A1/A2:
  Turns on when power circuit is normal.
  Turns off when power is interrupted or the electronic fuse blows.
- Fault:
  Turns on when the HR1S fails (see failure causes on page 694)
- K1/K2:
  Turns on when K1/K2 relays operate.
- S13: NO contact of non-contact interlock switch 1
- S12: NC contact of non-contact interlock switch 1
- S23: NO contact of non-contact interlock switch 2
- S22: NC contact of non-contact interlock switch 2
- S33: NO contact of non-contact interlock switch 3
- S32: NC contact of non-contact interlock switch 3
- S43: NO contact of non-contact interlock switch 4
- S42: NC contact of non-contact interlock switch 4
- S53: NO contact of non-contact interlock switch 5
- S52: NC contact of non-contact interlock switch 5
- S63: NO contact of non-contact interlock switch 6
- S62: NC contact of non-contact interlock switch 6

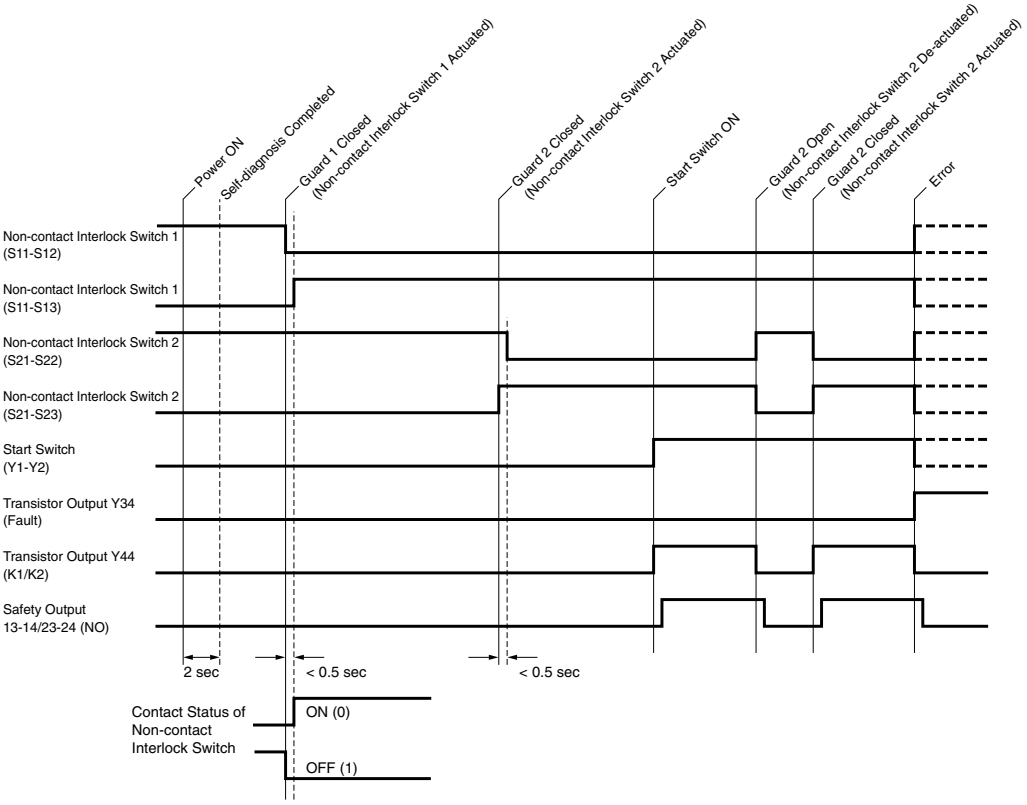
Causes of Fault LED Indication

LED2: Fault	Fault Type	Fault Cause	Measures
	Internal Fault	Fault of the internal circuit	Replace the safety relay module.
	External Fault	Short circuit of the +24V power supply and input terminal	Remove the short circuit and reboot.
	External Fault	Short-circuit of the non-contact interlock switch wiring	Correct the wiring of the non-contact interlock switch and reboot.
	Synchronization time excess of switch contact input	Synchronization for the NO contact and NC contact of the non-contact interlock switch (HS7A) is 0.5 seconds or longer.	Open and close the door again.
		Fault of the non-contact interlock switch (HS7A)	Replace the non-contact interlock switch.

The HR1S-DM terminal block can be removed and installed as shown, allowing for easy installation and replacement of modules.



HR1S-DM Operation Chart
When Using the Emergency Stop Switch



Safety Relay HR1S-ATE

Key features:

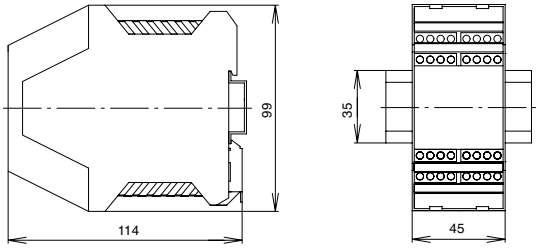
- EN ISO 13849-1 performance level e, safety category 4 compliant, and EN 62061 safety integrity level 3
- Integrated and removable teminal styles available
- Compact design: 45 mm in width
- Time delay outputs: 3NO
- Auxiliary output enables power supply monitoring, inputs (2 channels), and a time delay output
- Environmentally friendly, RoHs directive compliant
- UL Listed, CSA certified, TÜV NORD approved

Part Numbers

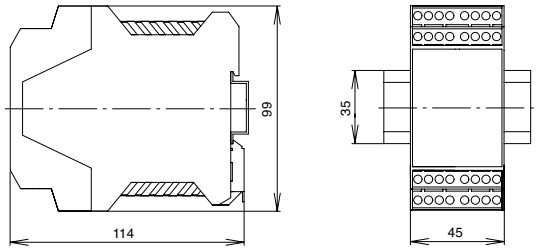
Part Number	Terminal Style
HR1S-ATE5110	Integrated Terminal Block
HR1S-ATE5110P	Removable Terminal Block

Dimensions (mm)

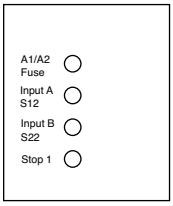
HR1S-ATE5110 Integrated Terminal Type



HR1S-ATE5110P Removable Terminal Type



LED Indicator



A1/A2 Fuse: Turns on when power circuit is normal.
Input A S12: Turns on when S11–S12 is closed.
Input B S22: Turns on when S21–S22 is closed.
Stop1: Turns on when the time-delay output circuits 57-58, 67-68, and 77-78 are closed.

Specifications

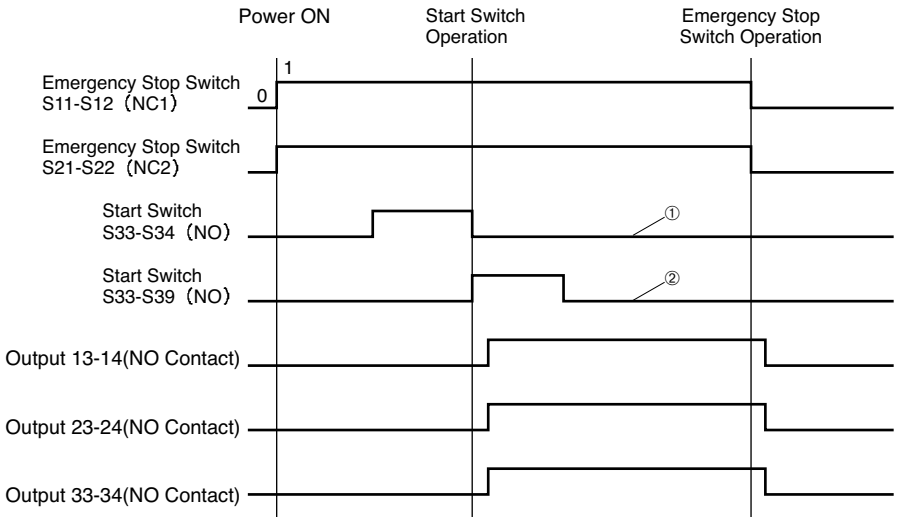
Applicable Standards			EN 60204-1: 2007, EN 60947-1: 2007, EN 60947-5-1:2004, EN 61000-6-2: 2005 EN 61000-6-4: 2007, EN 62061: 2005 EN ISO 13849-1: 2008, EN ISO 13849-2: 2008
Applicable Standards for Use			EN 60204-1: 2006 EN ISO 13850: 2008
Performance level (PL)			e (EN ISO 13849-1)
Safety Category			4 (EN ISO 13849-1)
Safety Integrity Level (SIL)			3 (EN 62061)
Stop Category			0, 1 (EN 60204-1) (Note)
Operating Temperature			–10 to +55°C (no freezing)
Relative Humidity			30 to 85% RH (no condensation)
Impulse Withstand Voltage			4 kV (IEC 60947-5-1)
Shock Resistance			150 m/s², 11m sec, 3 shocks in each 3 axes
Vibration Resistance			10 to 60 Hz, amplitude 0.35 mm 60 to 150 Hz, acceleration 50 m/s²
Degree of Protection			Terminal: IP20 Enclosure: IP40
Rated Voltage			24V AC –20% +10% 24V DC –20% +20%
Power Consumption			24V AC: 8 VA max. 24V DC: 4W max.
Overcurrent Protection			Built-in, electronic
Minimal Applicable Load			17V DC / 10 mA (initial value)
Response Time			ON to OFF: 20 ms max. (instantaneous output)
Overvoltage Category			III
Pollution Degree			2
Rated Insulation Voltage			300V Ac
No of Outputs	Safety Circuit		2NO
	Time-delay Circuit		3NO
	Auxilliary Circuit	Contact	None
		Transistor	4
Output Contact Ratings	Safety Circuit	AC15	C300 (230V AC / Ie=0.75A)
		DC13	24V DC / Ie=1A
	Time-delay Circuit	AC15	C300 (230V AC/ Ie=0.75A)
		DC13	24V DC / Ie=1A
		Preset Time	0, 0.5, 1, 2, 4, 6, 8, 10, 15, 20, 25, 30 sec.
	Auxilliary Circuit		24V DC / 20 mA (PNP)
Mechanical Durability			10,000,000 operations
Electrical Durability			See page XX
Rated Current			Total output: 8A max. 1 output 4A max.
Wire Size		HR1S-ATE5110	Single wire: 0.2 to 2.5 mm² max. (24~14 AWG) Multiple wires: 0.14 to 0.75 mm² max.
		HR1S-ATE5110P	Single wire: 0.2 to 2.5 mm² max.(24~14 AWG) Multiple wires: 0.2 to 1.5 mm² max.
Weight (approx.)			280g

Note: Safety output contact — Stop category 0
Time-delay output contact — Stop category 1

Use a 4A fuse (Type gG) for power protection.Use a 6A fuse (Type gG) for safety output protection.
Use a 4A fuse (Type gG) for time-delay output and auxiliary output protection.

HR1S-ATE Wiring Diagram

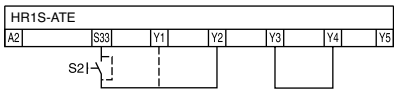
Safety Category 4 (3) Circuit (using an emergency stop switch) (Note)



Safety category is achieved by the entire control system. Take the connected safety equipment and wiring into consideration.

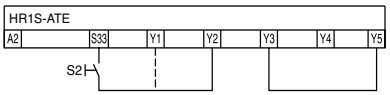
When not monitoring the start switch

(Y3-Y4 short-circuited)
(automatic start when S33-Y2 is short-circuited)



When monitoring the start switch

(Y3-Y5 short-circuited)



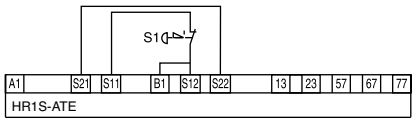
1. When monitoring the start switch, starts when switched off (default setting/recommended)
2. When monitoring the start switch, starts when switched on
3. Outputs must be fused (see the instruction manual for maximum fuse size)
4. To PLC, etc.

Note: When using off-delay output, safety category becomes 3.

S1 = Emergency stop switch with 2 NC contacts (recommended)
S2 = Start switch
ESC = External start conditions
Y1 (S33) – Y2 = Feedback loop

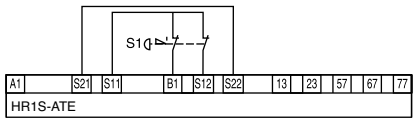
Emergency stop switch - Input 1 channel

When not detecting short-circuit (All failures such as short-circuit of emergency stop switch wiring not detected)

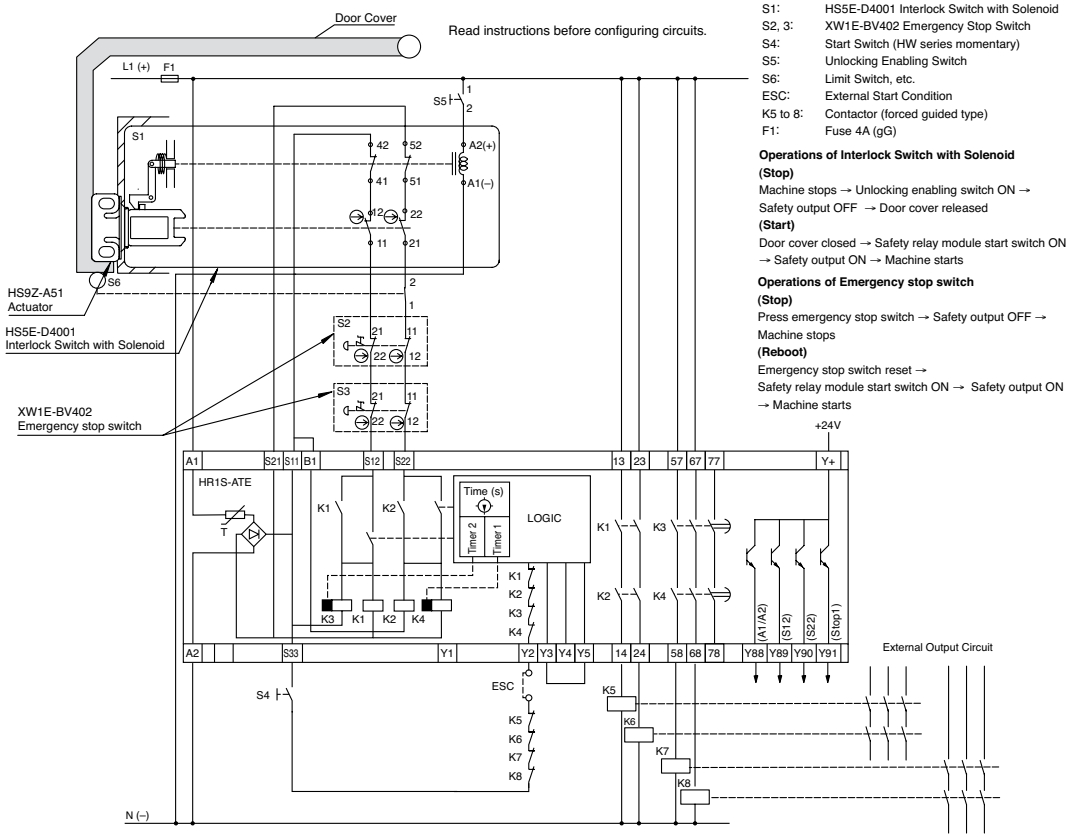


Emergency stop switch - Input 2 channels

When not detecting short-circuit(B1-S12 short-circuit not detected)



Safety Category 3 Example Circuit (using multiple emergency stop switches)

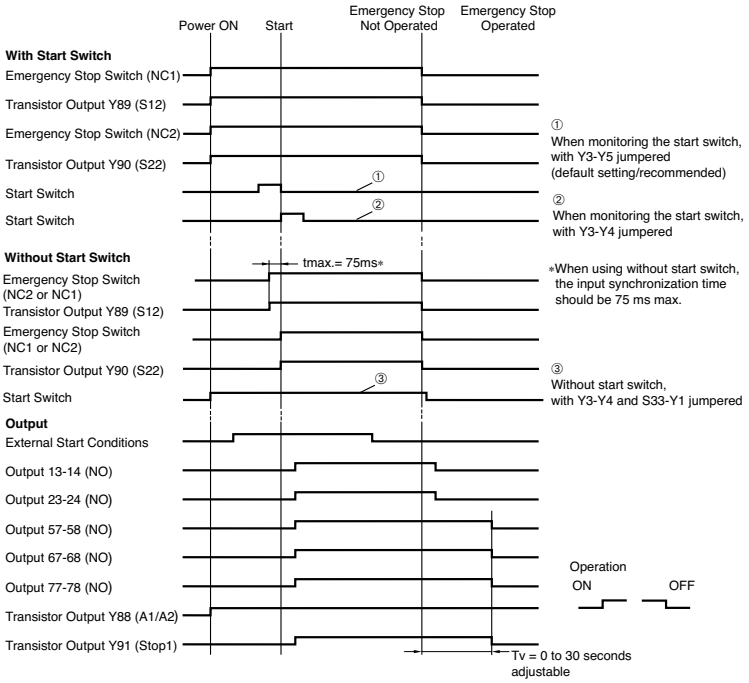


S1: HS5E-D4001 Interlock Switch with Solenoid
S2, 3: XW1E-BV402 Emergency Stop Switch
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.
ESC: External Start Condition
K5 to 8: Contactor (forced guided type)
F1: Fuse 4A (gG)

Operations of Interlock Switch with Solenoid
(Stop)
Machine stops → Unlocking enabling switch ON → Safety output OFF → Door cover released
(Start)
Door cover closed → Safety relay module start switch ON → Safety output ON → Machine starts

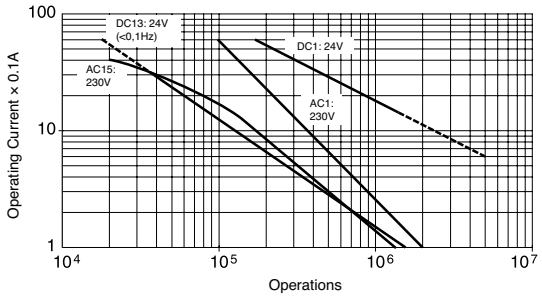
Operations of Emergency stop switch
(Stop)
Press emergency stop switch → Safety output OFF → Machine stops
(Reboot)
Emergency stop switch reset → Safety relay module start switch ON → Safety output ON → Machine starts

HR1S-ATE Operation Chart



Output Contact Electrical Life

(Safety Circuit, Time-delay Circuit, Auxilliary Circuit)



Residual Risk (En ISO/ISO12100-1)

The wiring diagrams on previous page have been tested under actual operating conditions. The HR1S-ATE safety relay module can be used in a safety circuit by connecting to safety equipment compliant to applicable standards. Consider residual risk in the following circumstances:

a) When it is necessary to modify the recommended circuit and if added/modified components are not properly integrated into the control circuit.

b) When applicable standards of machine operation are not observed, or when the machine is not adjusted or maintained properly (adhere to a strict maintenance schedule).

c) When the contacts of relays and contactors for connected with safety outputs are not forced guided (compliant with EN 50205).

HR2S-301P/HR2S-301N Safety Relay Modules

Key features:

- Simple wiring procedure
- Removable terminal block enables easy replacement
- Terminal cover detects improper connection
- Operation modes can be changes with a single action
- Compact design enables installation in a narrow space
- Safety Category 4, Performance Level e according to EN ISO 13849-1: 2008
- TÜV SÜD European and North American (NRTL)

Part Numbers

Contact Configuration		Input	Supply Voltage	Part No.
Safety Output	Auxiliary Contact			
3NO	1NC	Positive	24V DC –15% to +10%	HR2S-301P
		Negative	24V DC –15% to +10%	HR2S-301N

Specifications

Applicable Standards	EN ISO 13849-1: 2008 EN 954-1: 1996 EN 50178: 1997 EN 55011/A2: 2007 EN 61000-6-2: 2005 IEC/EN 61496-1: 2006 UL508/R2005-07 CAN/CSA C22.2 No.14: 2005
Applicable Standards for Use	EN 60204-1: 2006
Performance level (PL)	e (EN ISO 13849-1)
Safety Category [1]	3 or 4 (EN ISO 13849-1)
Stop Category	0 (IEC/EN 60204-1)
Operating Temperature	–10 to +55°C (no freezing)
Relative Humidity	30 to 85% (no condensation)
Altitude	0 to 2000m (operating)
Insulation Resistance	100Ω minimum (500V DC megger, same measurement positions as dielectric strength)
Dielectric Strength	Between outside housing and internal circuit: 3,750V AC,1 minute Between outputs of different poles: 2,500V AC, 1 minute Between input and output terminals: 2,500V AC, 1 minute Between power supply and output terminals: 2,500V AC ,1 minute
Shock Resistance	300 m/s², pulse width 11m sec, 3 shocks in each of 3 axes
Bump	100 m/s², pulse width 16m sec, 1000 times in each of 3 axes
Vibration Resistance	10 to 55 Hz, 1 octave/minute, 0.7 mmp-p in each of 3 axes, 20 sweeps, 5 to 55 Hz, 30 m/s², for 2 hours in each of 3 axes
Degree of Protection	Terminals: IP20 Housing: IP40
Rated Voltage	24V DC –15% +10%
Power Consumption	2.2W (26.4V DC)
Overcurrent Protection	Built-in, electronic (approx. 0.9A)
Contact Resistance	200 mΩ maximum [2]
Turn-On Time	50 ms maximum [3]

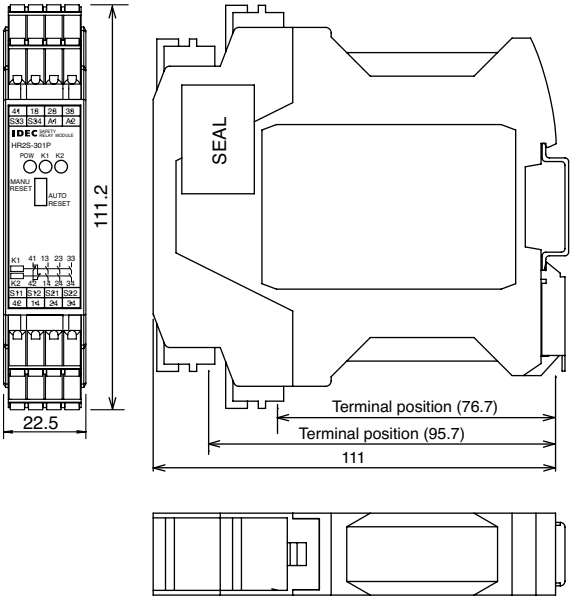
Minimum Applicable Load				24V DC / 5 mA (Reference value)
Response Time				20 ms maximum [3 4]
Overvoltage Category				III (IEC60664-1)
Pollution Degree				2 (IEC60664-1)
Rated Insulation Voltage (output contact)				250V (IEC60664-1)
Output Contact Ratings	Terminals 13-14 23-24 33-34	Rated Load [5 6]		250V AC / 30V DC (resistive load) [7] Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		3 (NO contact output)
	Terminals 41-42	Rated Load [6]		250V AC / 30V DC (resistive load) Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		1 (NC contact output)
Mechanical Durability				5,000,000 operations minimum
Electrical Durability				100,000 operations minimum
Wire Size				0.2 mm² to 1.5 mm² (24 to 16 AWG)
Weight (approx.)				200g

1. HR2S-301N is recommended for use in category 4 safety applications. The requirements of the safety category must be determined according to the safety equipment. We recommend that you consult a third party organization.
   Categories may change depending on the combination of the safety equipment. Categories may also change depending on the output contact ratings.
2. Measured using 5 or 6V DC, 1A voltage drop method.
3. When measured at the rated voltage (at 20°C), excluding contact bounce time.
4. The time from when the safety input turns OFF to when the safety output turns OFF.
5. Leave 5 mm of space between the sides of the module when more than 3A is continuously applied to the relay contact.
6. The module is not suitable for use with a load less than the minimum applicable load. Once a large load is applied, contacts may not operate with a small load.
7. The maximum current of the safety output contact is specified by the approved standard.

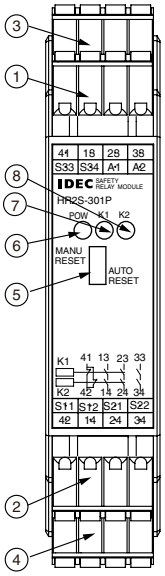
Category 4	HR2S-301N, HR2S-301P + Type 4 OSSD's	3.6A
Category 3	HR2S-301P	5.0A

To prevent the safety output contact from overcurrent, use a fuse. To satisfy Category 4, use a fuse with a maximum current of 3.6A. This fuse is not required if the short circuit current is less than 5A.

Dimensions (mm)



Terminal Arrangement



Part Description

Part No.	Part Names and Functions
1	CN1: Power supply input, start/off-check input
2	CN2: Safety input (dual channel)
3	CN3: Safety output contact
4	CN4: Safety output contact
5	Switch: Select AUTO or MANU mode
6	POW: Power LED
7	K1: ON-LED for safety output
8	K2: ON-LED for safety output

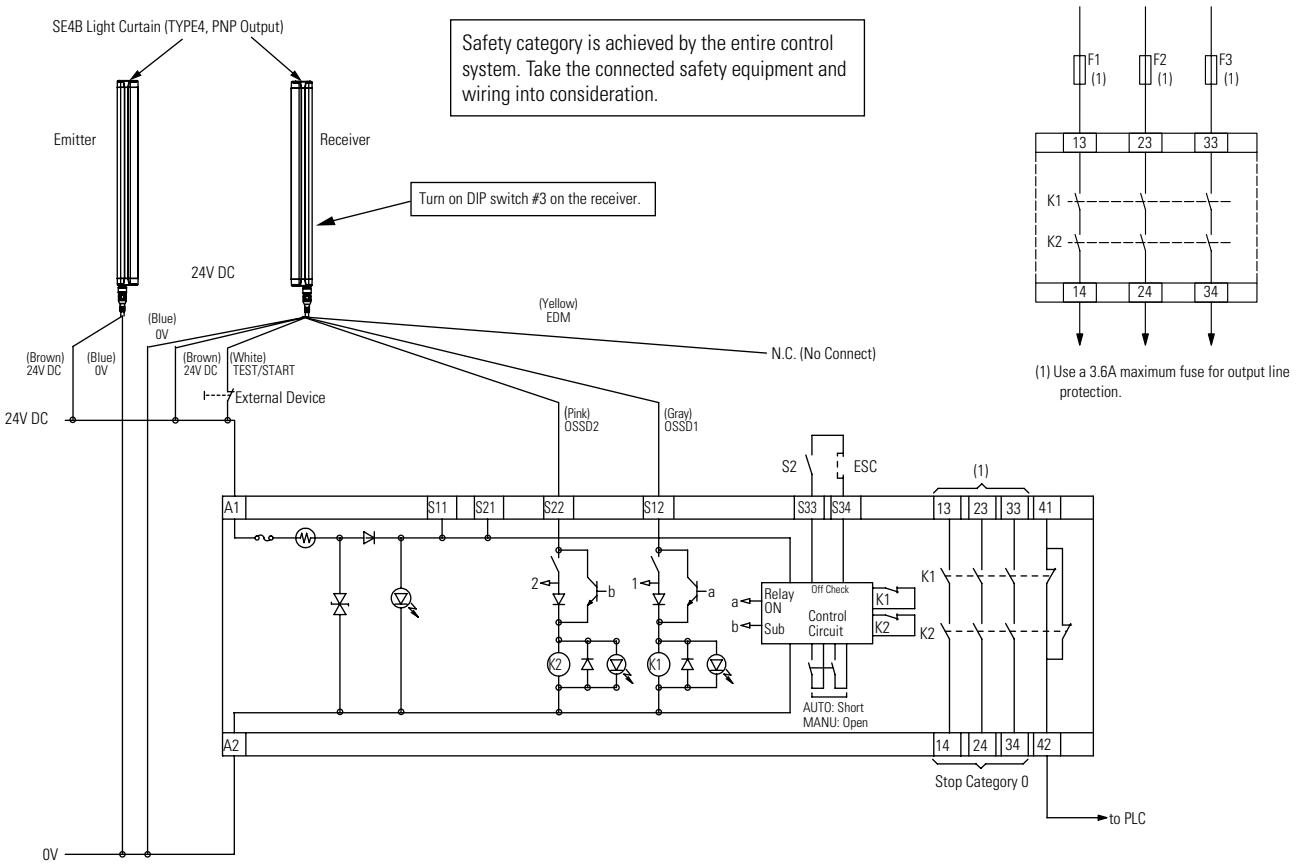
Terminal Arrangement

Terminal	Markings	I/O Signals		Notes
CN1	A1	Power supply +24V DC input		
	A2	Power supply 0V input		
	S33	Start/off-check input		Use a dry contact.
	S34			
CN2	S11	Safety input 1	Common	For HR2S-301N, use a dry contact. When connecting TYPE 4 safety light curtain to HR2S-301P, use only S12 (S22).
	S12		Function	
	S21	Safety input 2	Common	
	S22		Function	
CN3 CN4	41–42	Monitor contact for safety output (NC)		Rated load 250V AC / 30V DC, 1A (Resistive load)
	13–14	Safety output contact (NO)		Rated load 250V AC / 30V DC (Note) (Resistive load)
	23–24			
	33–34			

Note: 5.0A max. Category 3 or lower HR2S-301P
3.6A max. Category 4 HR2S-301N, HR2S-301P + Type 4 OSSD's

HR2S-301P Wiring Diagram
Safety Category 4 Circuit Example (using a safety light curtain)

*EDM function disabled

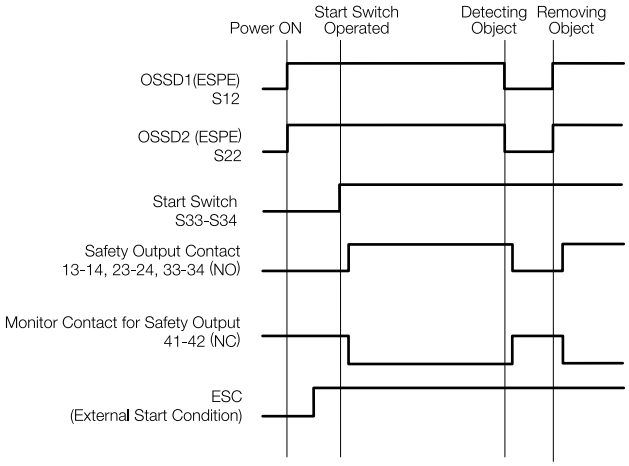


The SE4B light curtains are used in the above system.

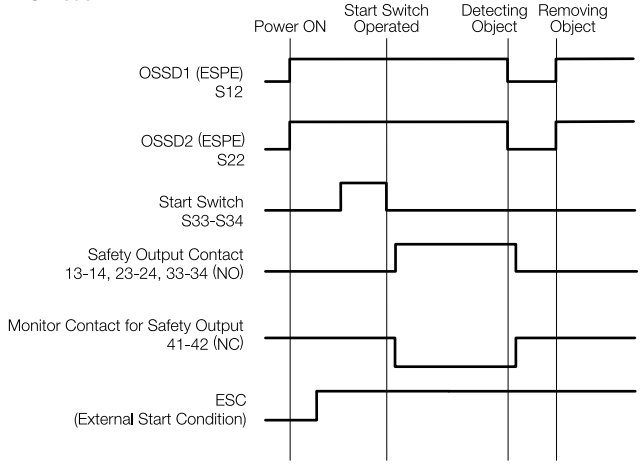
ESC: External Start Condition
F1 to 3: Protective fuse for the output of safety relay module
K1 to 2: Safety Contactor
S2: Start Switch
S33-S34: Feedback loop

HR2S-301P Operation Chart
Using OSSD outputs of a light curtain (EPSE)

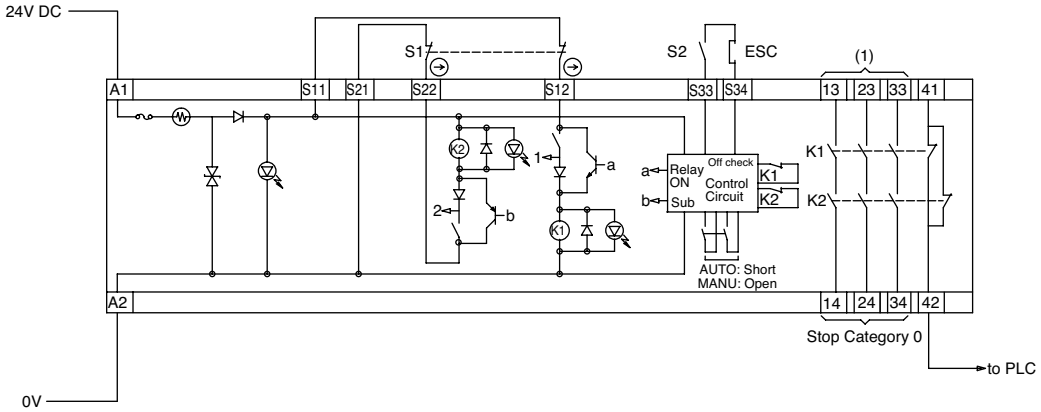
AUTO mode



MANU mode

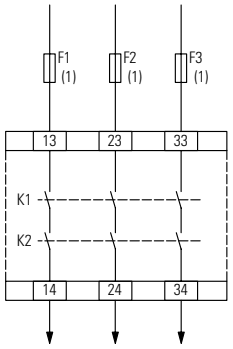


HR2S-301N Wiring Diagram
Safety Category 4 (3) Circuit Example (using an emergency stop switch)



Safety category is achieved by the entire control system. Take the connected safety equipment and wiring into consideration.

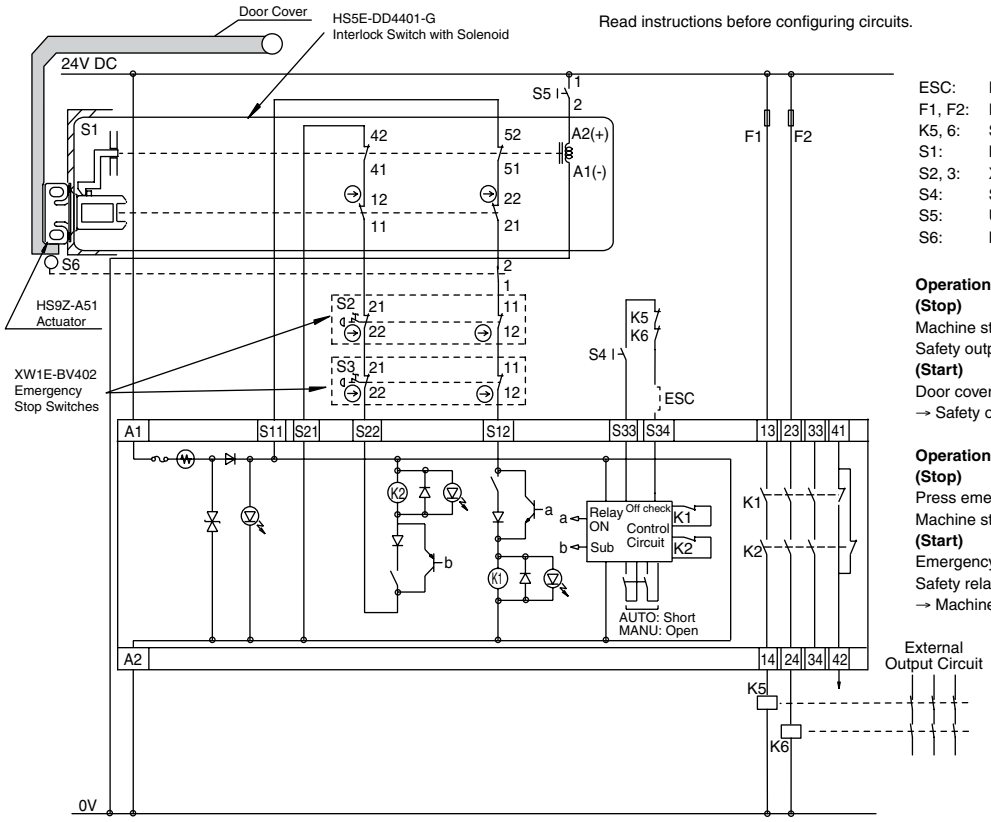
ESC: External start condition
F1 to 3: Protective fuse for the output of safety relay module
S1: Emergency stop switch with 2NC contacts, safety switch (recommended)
S2: Start Switch
S33-S34: Feedback loop



(1) Use a 3.6A maximum fuse for output line protection.

HR2S-301N Wiring Diagram
Safety Category 4 (3) Circuit Example (using an emergency stop switch)

Safety category is achieved by the entire control system. Take the connected safety equipment and wiring into consideration.



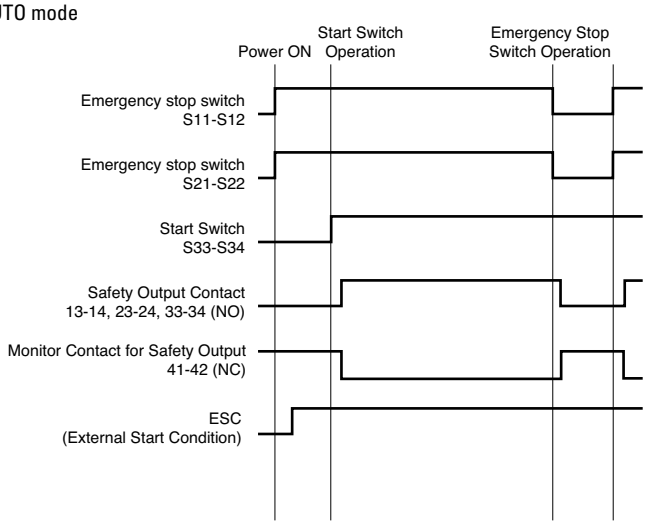
ESC: External Start Condition
F1, F2: Fuse 3.6A
K5, 6: Safety Contactor (force guided)
S1: HS5E-DD4401-G Interlock Switch with Solenoid
S2, 3: XW1E-BV402 Emergency Stop Switches
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.

Operations of Interlock Switch with Solenoid
(Stop)
Machine stops → Unlocking enabling switch ON → Safety output OFF → Door cover released
(Start)
Door cover closed → Safety relay module start switch ON → Safety output ON → Machine starts

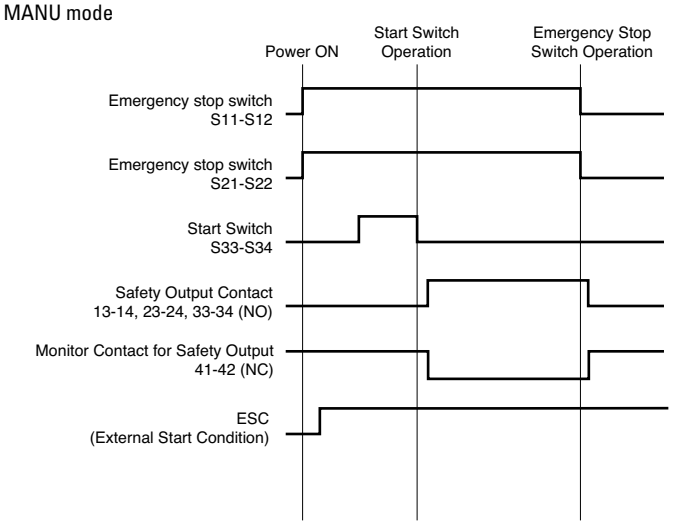
Operations of Emergency Stop Switch
(Stop)
Press emergency stop switch → Safety output OFF → Machine stops
(Start)
Emergency stop switch reset → Safety relay module start switch ON → Safety output ON → Machine starts

HR2S-301N Operation Chart
Using an emergency stop switch

AUTO mode



MANU mode



HR2S-332N-T075/T15/T30 Safety Relay Modules

Key features:

- Simple wiring procedure
- Removable terminal block enables easy replacement
- Terminal cover detects improper connection
- Operation modes can be changes with a single action
- Compact design enables installation in a narrow space
- Safety Category 4, Performance Level e according to EN ISO 13849-1: 2008
- TÜV SÜD European and North American (NRTL)

Part Numbers

Contact Configuration			Input	Supply Voltage	Part No.
Safety Output	Time-delay Safety Output	Auxiliary Contact			
3NO	3NO	2NC	Negative	24V DC –15% to +10%	HR2S-332N-T075
					HR2S-332N-T15
					HR2S-332N-T30

Note: Time-delay duration can be set in 15 steps. 7.5 sec. (0.5, 1.0 … 7.0, 7.5); 15 sec. (1, 2 … 14, 15); 30 sec. (2, 4 … 28, 30)

Specifcations

Applicable Standards	EN ISO 13849-1: 2008 EN 954-1: 1996 EN 50178: 1997 EN 55011/A2: 2007 EN 61000-6-2: 2005 EN 61496-1: 2004 UL508/R2005-07 CAN/CSA C22.2 No.14: 2005
Applicable Standards for Use	EN 60204-1: 2006
Performance level (PL)	e (EN ISO13849-1)
Safety Category	4 (EN ISO13849-1)
Stop Category	0, 1 (IEC/EN 60204-1) [1]
Operating Temperature	–10 to +55°C (no freezing)
Relative Humidity	30 to 85% (no condensation)
Altitude	0 to 2000m (operating)
Insulation Resistance	100 MΩ minimum (500V DC megger, same measurement positions as dielectric strength)
Dielectric Strength	Between outside housing and internal circuit: 3,750V AC,1 minute Between outputs of different poles: 2,500V AC, 1 minute Between input and output terminals: 2,500V AC, 1 minute Between power supply and output terminals: 2,500V AC,1 minute

Shock Resistance	300 m/s^2, pulse width 11m sec, 3 times in each of 3 axes
Bump	100 m/s^2, pulse width 16m sec, 1000 times in each of 3 axes
Vibration Resistance	10 to 55 Hz, 1 octave/minute, 0.7 mmp-p in each of 3 axes, 20 sweeps, 5 to 55 Hz, 30 m/s^2, for 2 hours in each of 3 axes
Degree of Protection	Terminals: IP20 Housing: IP40
Rated Voltage	24V DC –15% to +10%
Power Consumption	4.6W (26.4V DC)
Overcurrent Protection	Built-in, electronic (approx. 0.9A)
Contact Resistance	200 mW maximum (measured using 5 or 6V DC, 1A voltage drop method)
Turn-On Time	50 ms maximum
Minimum Applicable Load	24V DC / 5 mA (reference value)
Response Time	20 ms maximum [2 3]
Overvoltage Category	III (IEC60664-1)
Pollution Degree	2 (IEC60664-1)
Rated Insulation Voltage (output contact)	250V (IEC60664-1)

1. Safety output contact: Stop Category 0
   Time-delay output contact: Stop Category 1
2. When measured at the rated voltage (at 20°C), excluding contact bounce time.
3. The time from when the safety input turns OFF to when the safety output turns OFF.

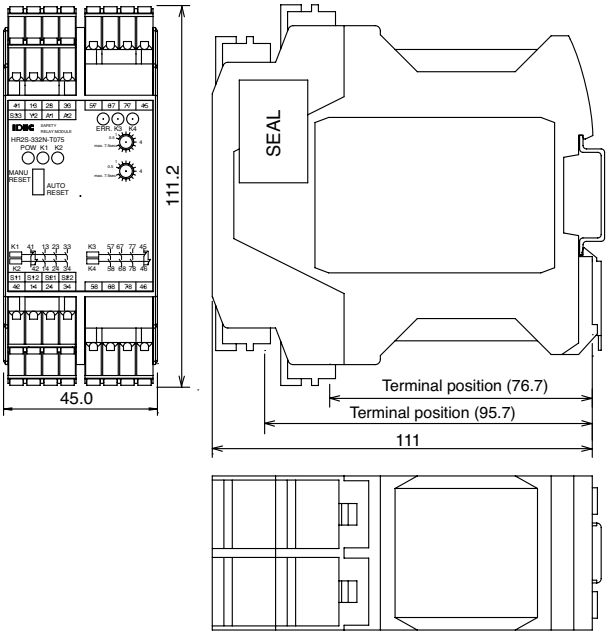
Specifications, con't

Output Contact Ratings	Terminals 13-14 23-24 33-34	Rated Load [5 6]		250V AC / 30V DC (resistive load) [7] Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		3 (NO contact output)
	Terminals 41-42	Rated Load [6]		250V AC / 30V DC (resistive load) Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		1 (NC contact output)

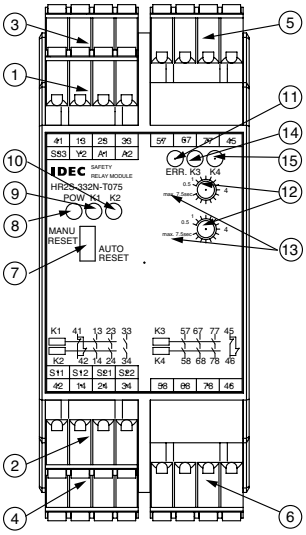
Time-delay Output Contact	Terminals 57-58 67-68 77-78	Rated Load [5 6]		250V AC / 30V DC (resistive load) [7] Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		3 (NO contact output)
	Terminals 45-46	Rated Load [6]		250V AC / 30V DC (resistive load) Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		1 (NC contact output)
Mechanical Durability				5,000,000 operations minimum
Electrical Durability				100,000 operations minimum
Wire Size				0.2 mm^2 to 1.5 mm^2 (24 to 16 AWG)
Weight (approx.)				320g

5. Leave 5 mm of space between the sides of the module when more than 3A is continuously applied to the relay contact.
6. The module is not suitable for use with a load less than the minimum applicable load. Once a large load is applied, contacts may not operate with a small load.
7. The maximum current of the safety output contact is specified by the approved standard.
   Category 4: 3.6A Category 3: 5.0A
   To prevent the safety output contact from overcurrent, use a fuse. To satisfy Category 4, use a fuse with a maximum current of 3.6A. This fuse is not required if the short circuit current is less than 5A.

Dimensions (mm)



Terminal Arrangement



Part Description

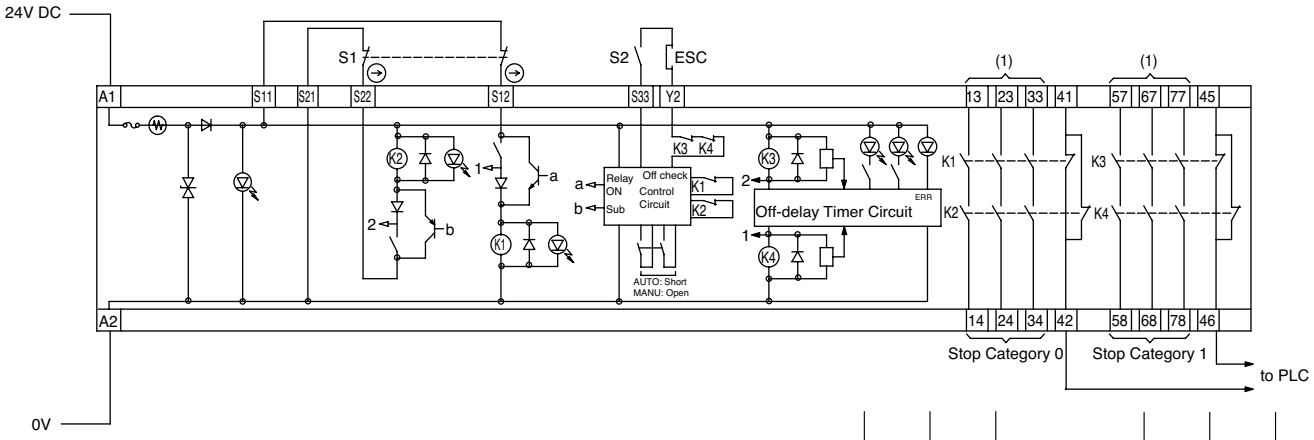
Part No.	Part Names and Functions
1	CN1: Power supply input, start/off-check input
2	CN2: Safety input (dual channel)
3	CN3: Safety output contact
4	CN4: Safety output contact
5	CN5: Time-delay safety output contact
6	CN6: Time-delay safety output contact
7	Switch: Select AUTO or MANU mode
8	POW: Power LED
9	K1: ON-LED for safety output
10	K2: ON-LED for safety output
11	ERR: Error (timer) LED
12	Switches: Time-delay. The same value should be set for both switches. Otherwise, an error occurs.
13	Characters: Maximum time-delay duration is displayed. 0.75: 7.5 sec., 15: 15 sec., 30: 30 sec.
14	K3: ON-LED for safety output
15	K4: ON-LED for safety output

Terminal Arrangement

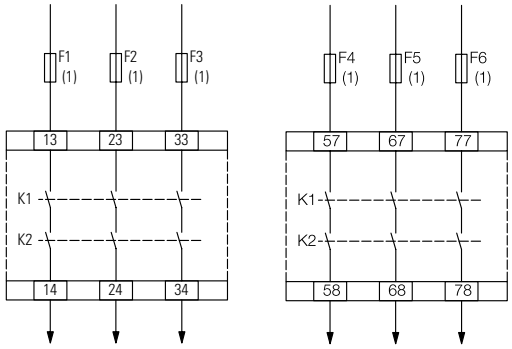
Terminals	Markings	I/O Signals		Remarks
CN1	A1	Power supply +24V DC input		
	A2	Power supply 0V input		
	S33	Start/off-check input		Use a dry contact.
	Y2			
CN2	S11	Safety input 1	Common	Use a dry contact.
	S12		Function	
	S21	Safety input 2	Common	
	S22		Function	
CN3 CN4	41–42	Monitor contact for safety output (NC)		Rated load 250V AC / 30V DC 1A (Resistive load)
	13–14	Safety output contact (NO)		Rated load 250V AC / 30V DC (Note) (Resistive load)
	23–24			
	33–34			
CN5 CN6	45–46	Time-delay safety output contact (NC)		Rated load 250V AC / 30V DC 1A (Resistive load)
	57–58	Time-delay safety output contact (NO)		Rated load 250V AC / 30V DC (Note) (Resistive load)
	67–68			
	77–78			

Note: 5.0A maximum Category 3 or lower
3.6A maximum Category 4

HR2S-332N-T075/T15/T30 Wiring Diagram
Safety Category 4 Circuit Example (using an emergency stop switch)



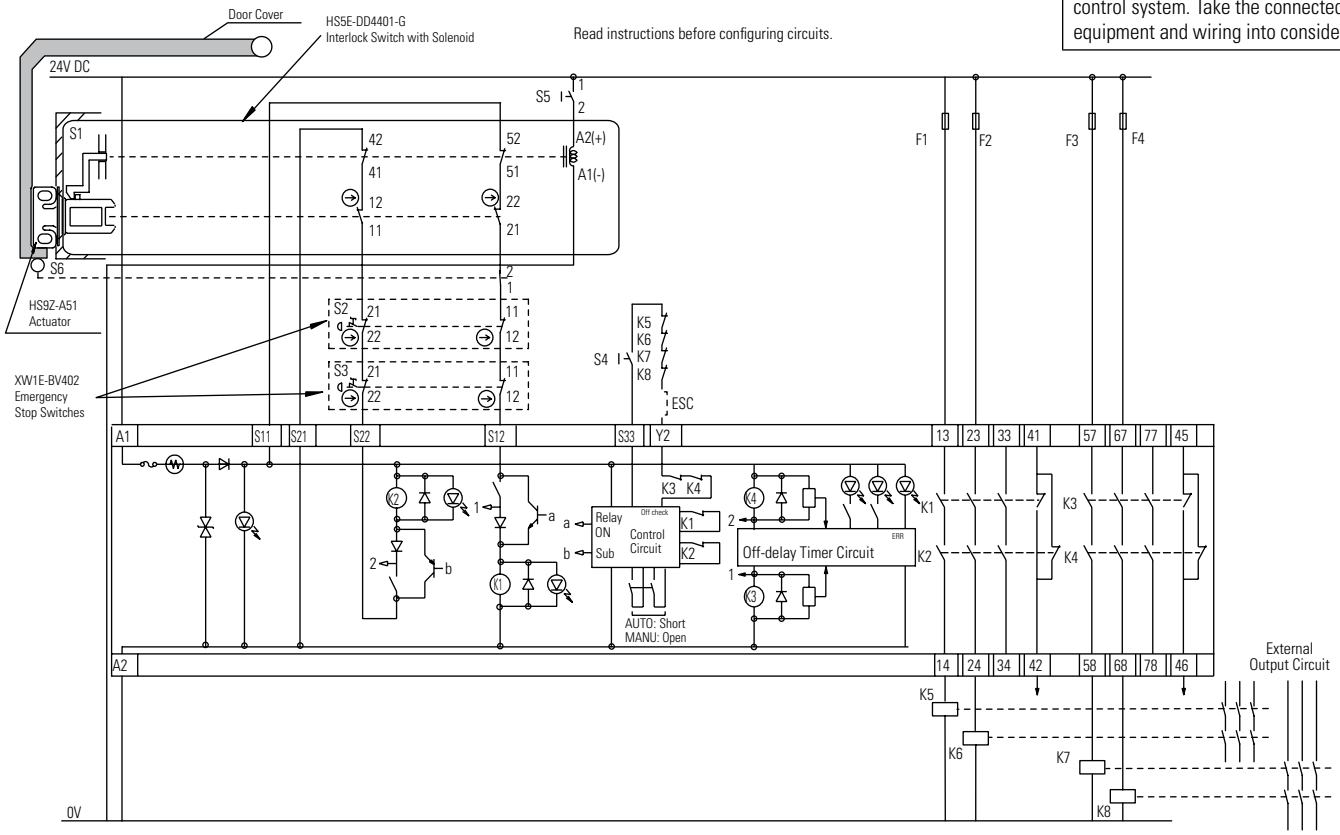
ESC: External Start Condition
F1 to 6: Protective fuse for the output of safety relay module
S1: Emergency stop switch with 2NC contacts, safety switch (recommended)
S2: Start Switch
S33-Y2: Feedback loop



(1) Use a 3.6A maximum fuse for output line protection.

Safety Category 3 Circuit (using multiple emergency stop switches)

Safety category is achieved by the entire control system. Take the connected safety equipment and wiring into consideration.



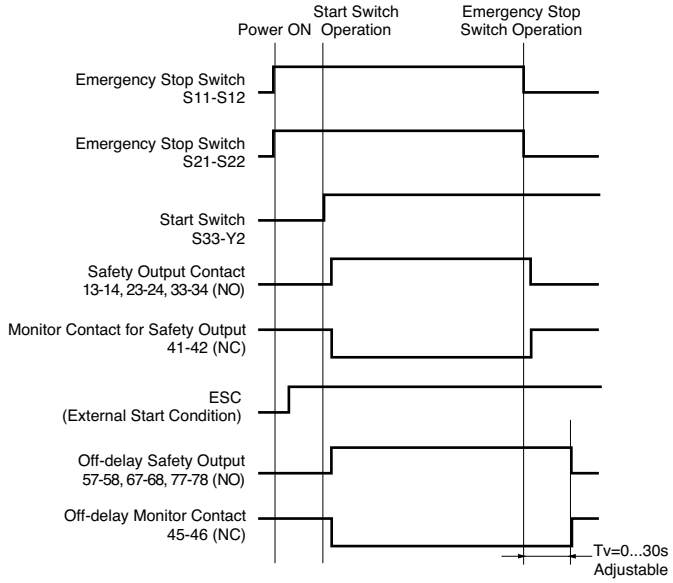
ESC: External Start Condition
F1 to F4: Fuse 3.6A
K5 to 8: Safety Contactor
S1: HS5E-DD4401-G Interlock Switch with Solenoid
S2,3: XW1E-BV402 Emergency Stop Switches
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.

Operations of Interlock Switch with Solenoid
(Stop)
Machine stops Unlocking enabling switch ON Safety output OFF Door cover released
(Start)
Door cover closed Safety relay module start switch ON Safety output ON Machine starts

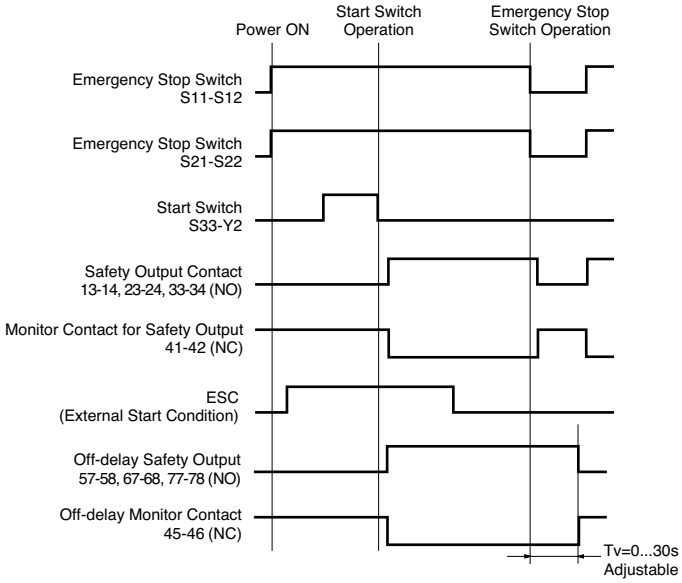
Operations of Emergency Stop Switch
(Stop)
Press emergency stop switch Safety output OFF Machine stops
(Start)
Emergency stop switch reset Safety relay module start switch ON Safety output ON Machine starts

HR2S-332N-T075/T15/T30 Operation Chart
Using emergency stop switches

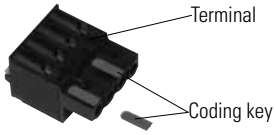
AUTO mode



MANU mode



Maintenance Parts

Item	Part Number	Remarks
Terminal / Coding Key 	HR9Z-PMT1	Coding keys are used to prevent incorrect insertion of terminals.
Terminal Cover	HR9Z-PMC1	Used to make sure that the terminals are fully inserted.
Protective Tape	HR9Z-PE1	Used to protect the AUTO/MANU switch on the front of the module.

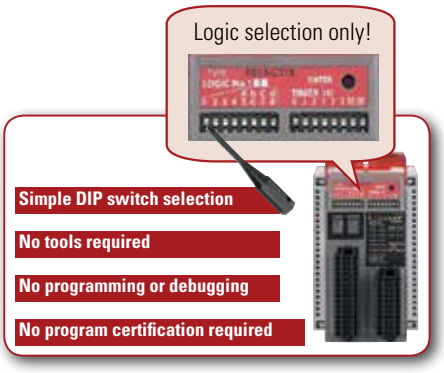
FS1A Multi-function Safety Relay

Key features:

- No programming required. Configuration complete by turning on a logic switch
- A safety circuit can be configured easily just by selecting a logic from eight pre-programmed logics
- Mode selection, partial/entire stop can be achieved just by selecting a logic
- One SafetyOne module can connect with various safety inputs such as emergency stop switches and light curtains
- The status of safety I/Os and the SafetyOne errors can be monitored
- Solenoid drive output is provided, eliminating the need for a PLC
- IEC 61508 safety integrity level 3, ISO 13849-1 performance level e, and EN954-1 control category 4 compliant

Part Numbers

No. of Logic	Part Number
8	FS1A-C01S
24	FS1A-C11S



Optional Parts

Product	Part Number	Note
Input Connector	FS9Z-CN01	
Output Connector	FS9Z-CN02	
Connecting Tool	FS9Z-SD01	
Marked Cable Tie	FS9Z-MT01	Used to lock the protective cover of the FS1A.
DIN Rail	BNDN1000	Aluminum, 1m 35mm wide
End Clip	BNL6	

Complies with key safety standards!

International Standards Compliant

ISO13849-1 PLe

The **SafetyOne** satisfies:

EN 954-1	Category 4
IEC 61508	SIL3
ISO 13849-1	Performance level e

ISO IEC EN ANSI/RIA
ANSI SEMI NFPA

With 8 (FS1A-C01S) or 24 (FS1A-C11S) pre-programmed safety circuit logics in a compact housing, the FS1A SafetyOne safety controller allows you to build a safety circuit by just sliding a DIP switch. Because the programs are tested and approved for compliance with key safety standards, labor, cost, and time for safety system certification can be reduced greatly.

Note: The eight logic programs of FS1A-C01S are not included in the 24 logic programs of FS1A-C11S.

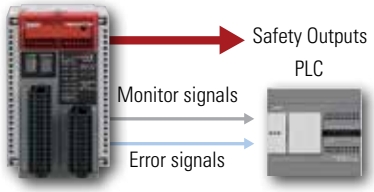
Large functionality in a compact housing!

Small & Compact

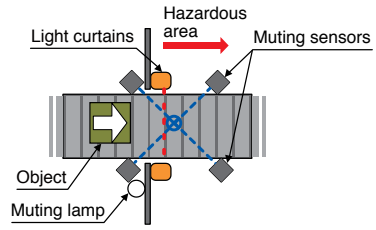
ALL-IN-ONE

Replaces more than seven safety relay modules

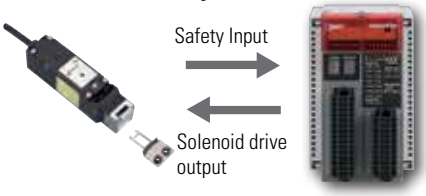
Monitor Output

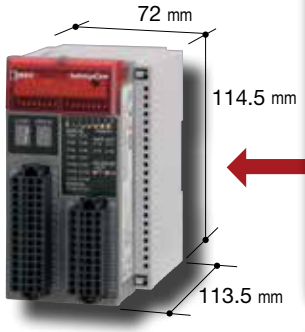


Muting function of light curtains



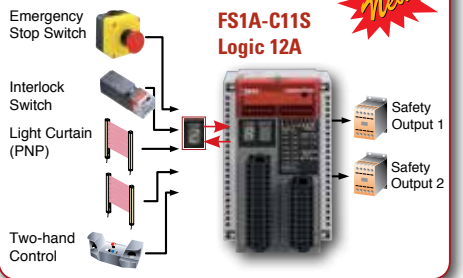
Solenoid drive output





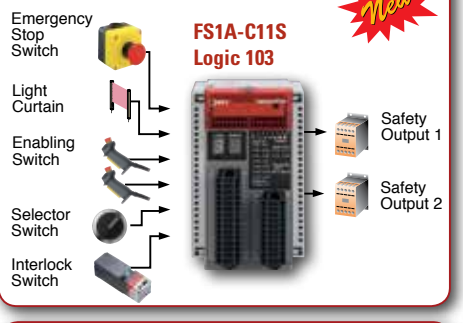
Two-hand Control

New



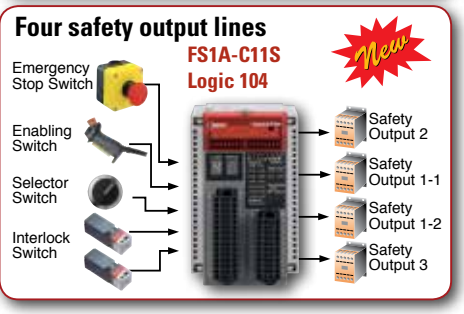
Mode selection

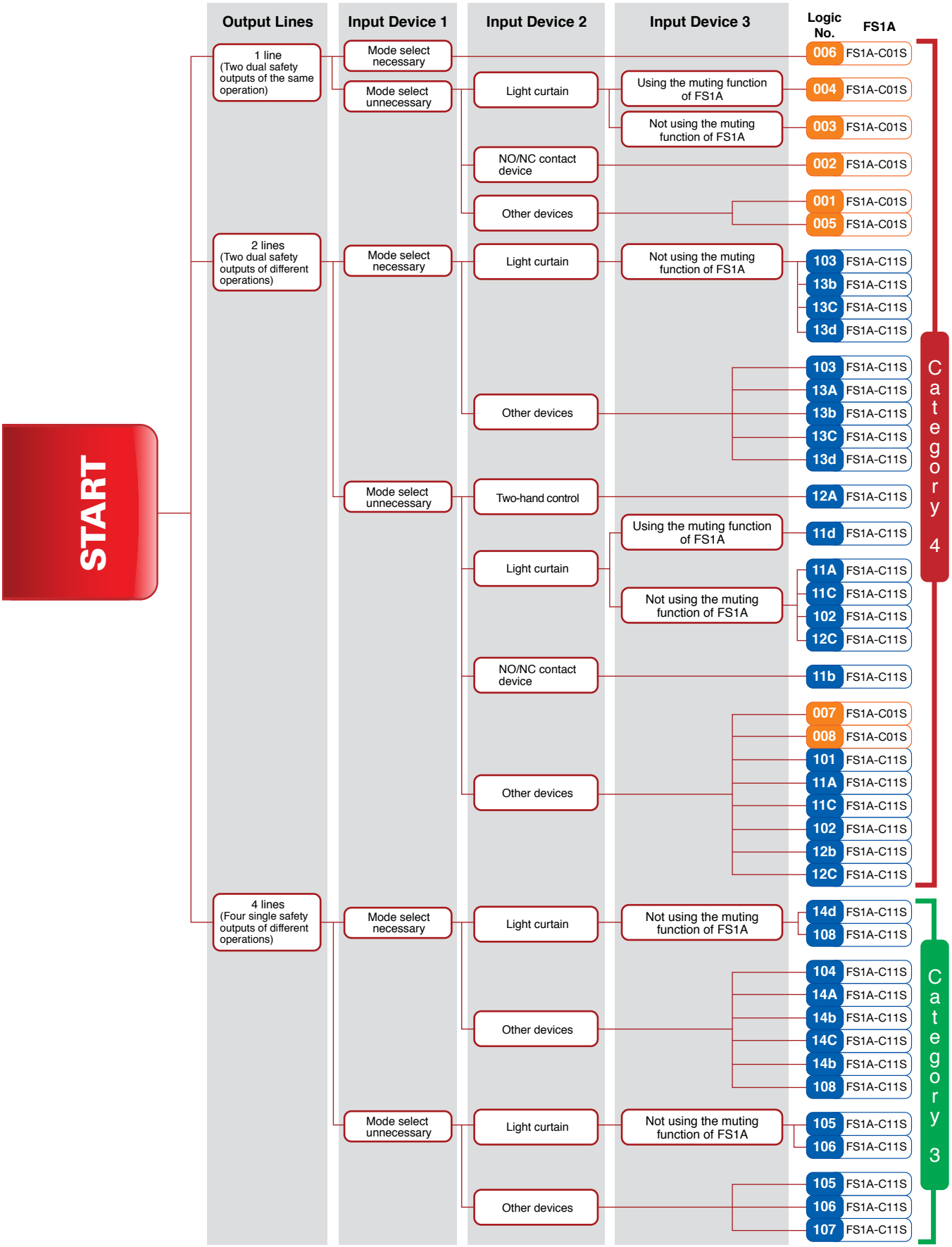
New



Four safety output lines

New




START
Output Lines
Input Device 1
Input Device 2
Input Device 3
Logic No.
FS1A
1 line (Two dual safety outputs of the same operation)
2 lines (Two dual safety outputs of different operations)
4 lines (Four single safety outputs of different operations)
Mode select necessary
Mode select unnecessary
Light curtain
Other devices
NO/NC contact device
Two-hand control
Using the muting function of FS1A
Not using the muting function of FS1A
006 FS1A-C01S
004 FS1A-C01S
003 FS1A-C01S
002 FS1A-C01S
001 FS1A-C01S
005 FS1A-C01S
103 FS1A-C11S
13b FS1A-C11S
13C FS1A-C11S
13d FS1A-C11S
13A FS1A-C11S
12A FS1A-C11S
11d FS1A-C11S
11A FS1A-C11S
11C FS1A-C11S
102 FS1A-C11S
12C FS1A-C11S
11b FS1A-C11S
007 FS1A-C01S
008 FS1A-C01S
101 FS1A-C11S
12b FS1A-C11S
14d FS1A-C11S
108 FS1A-C11S
104 FS1A-C11S
14A FS1A-C11S
14b FS1A-C11S
14C FS1A-C11S
105 FS1A-C11S
106 FS1A-C11S
107 FS1A-C11S
Category 4
Category 3

Specifications

Operating Environment

Applicable Standards	TÜV approval: IEC/EN 61000-6-2, IEC/EN 61000-6-4, IEC/EN 61496-1, IEC 61508 Part 1-7, IEC/EN 62061, ISO 13849-1, ISO 13851 (FS1A-C11S), EN 954-1 UL: UL508, CSA C22.2 No. 142 Applicable standards: IEC/EN 60204-1, IEC/EN 61131-2, ISO 10218-1, ANSI/RIA R15.06, ANSI B11.19, SEMI S2-0706, NFPA79 EN 954-1, 13849-1, 62061, 61496-1, 60204-1, 61131-2, 61000-6-2, 61000-6-4 ANSI/RIA R15.06 ANSI B11.19 SEMI S2 NFPA 79
Safety Circuit	Logic selection
Operating Temperature	–10 to +55°C (no freezing)
Operating Humidity	10 to 95% RH (no condensation)
Storage Temperature	–40 to +70°C (no freezing)
Storage Humidity	10 to 95% RH (no condensation)
Pollution Degree	2 (IEC/EN60664-1)
Degree of Protection	IP20 (IEC/EN60529)
Corrosion Immunity	Free from corrosive gases
Altitude	Operation: 0 to 2000m, Transport: 0 to 3000m
Vibration Resistance	Vibration: 5 to 8.4 Hz, amplitude 3.5 mm 8.4 to 150 Hz Acceleration: 9.8 m/s^2 (2 hours each on three mutually perpendicular axes) (IEC/EN60028-2-6) Bump: Acceleration 98 m/s^2, 16 ms (1000 times each on three mutually perpendicular axes) (IEC/EN60028-2-29)
Shock Resistance	147 m/s^2, 11ms (3 shocks each on three mutually perpendicular axes (IEC/EN 60028-2-27)
Connector Insertion/ Removal Durability	50 times maximum
Configuration Switch Durability	100 operations maximum per pole
Enter Button Durability	1000 operations maximum
Housing Material	Modified-polyphenyleneether (m-PPE)
Weight (approx.)	330g

Electric Characteristics

Rated Voltage	24V DC
Allowable Voltage Range	20.4 to 28.8V DC
Maximum Power Consumption	48W (at the rated power voltage, when all I/Os are ON) (incl. output load)
Allowable Momentary Power Interruption	10 ms minimum (at the rated power voltage)
Response Time	ON–OFF: 40 ms maximum [1] 100 ms maximum [2] OFF–ON: 100 ms maximum [3]
Start-up Time [4]	6 sec maximum
Dielectric Strength	Between live part and FE terminal: 500V AC, 1 minute Between housing and FE terminal: 500V AC, 1 minute
Insulation Resistance	Between live part and FE terminal: 10 MΩ minimum (500V DC megger) Between housing and FE terminal: 10 MΩ minimum (500V DC megger)
Impulse Noise Immunity (noise simulator)	Power terminal: ±1 kV 50 ns, 1μs (direct connection) I/O terminal: ±2kV 50 ns, 1μs (coupling adapter)
Inrush Current	25A maximum
Ground	Ground resistance of 100Ω maximum
Effect of Incorrect Wiring	Reverse polarity: No operation, no damage Improper voltage: Permanent damage may occur

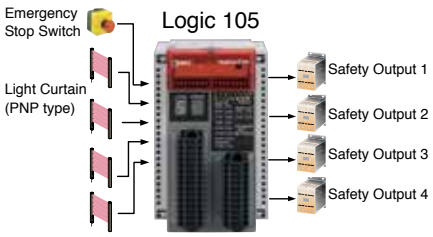
1. The time to shut off safety outputs after inputs are turned off or input monitor error is detected (when off-delay timer is set to 0s)
2. Time to shut off safety outputs after an error (except input monitor error) or a configuration change of logic or timer is detected (not depending on the off-delay timer value)
3. Auto start—Time to turn on safety outputs after safe inputs are turned on
   Manual start—Time to turn on safety outputs after start inputs are turned on
   Control start—Time to turn on safety outputs after the start inputs are turned off-on-off (maintain ON for 0.1 to 5s)
4. Time to change to Run state after power supply is turned on.

Examples

FS1A-C11S Logic 105	Partial stop logic for apparatus with openings	Output Line: 4 4 single safety outputs of different operations	Category 3

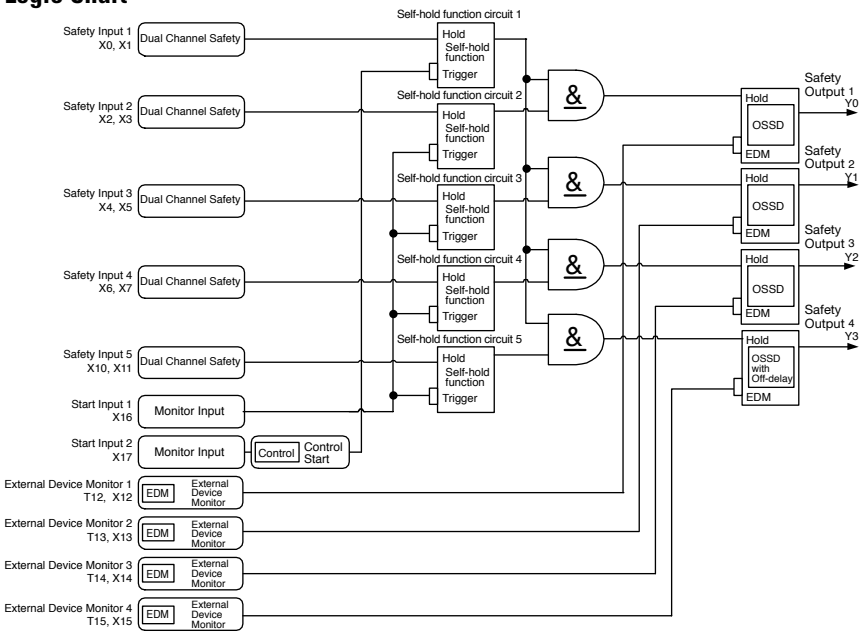
Logic 105 is used for safeguarding measures of machine tools and robots, which use safety equipment such as light curtains with dual solid state outputs. Safety outputs are single output. Five dual channel safety inputs can be connected. Safety output 4 has an off-delay timer.

Wiring Example



DIP Switch and LED Display

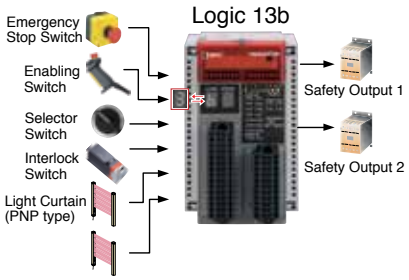
Logic Chart



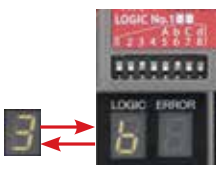
FS1A-C11S Logic 13b	The logic constructing an OR circuit applicable for selection of active safety input devices	Output Line: 2 2 dual safety outputs of different operations	Category 4

In machine tools and robots, a hazard source is isolated by a guard in automatic operation. In human-attended operation such as teaching and maintenance, the operator has to work inside a hazardous area. Logic 13b is used to configure a system in which teach or auto mode can be selected using a selector switch. Safety outputs are dual channel outputs. OR circuit can be configured in auto mode. Two dual channel direct opening input, one mode select input, one dual channel dependent input, and two dual channel safety inputs can be connected. Safety output 2 has an off-delay timer.

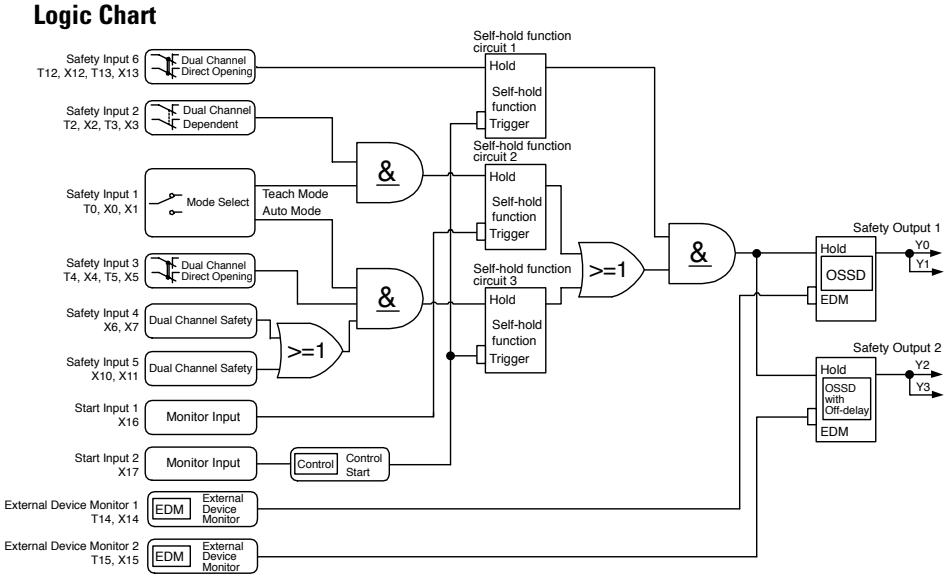
Wiring Example



DIP Switch and LED Display



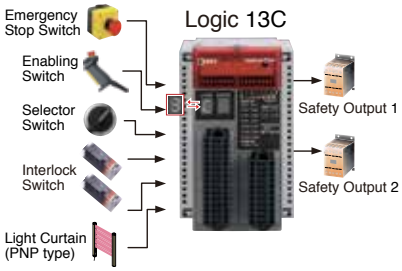
Logic Chart



FS1A-C11S Logic 13C	Partial stop logic applicable for selection of active safety input devices	Output Line: 2 2 dual safety outputs of different operations	Category 4

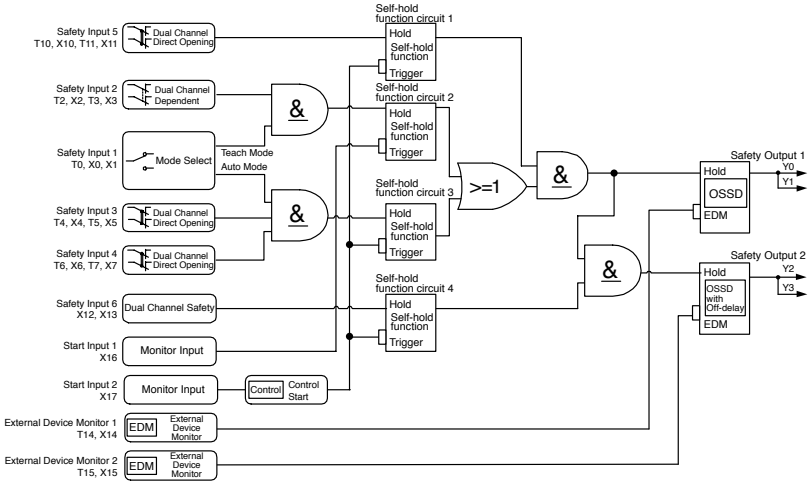
In machine tools and robots, a hazard source is isolated by a guard in automatic operation. In human-attended operation such as teaching and maintenance, the operator has to work inside a hazardous area. Logic 13C is used to configure a system in which teach or auto mode can be selected using a selector switch. Safety outputs are dual channel outputs. Three dual channel direct opening inputs, one mode select input, one dual channel dependent input, one dual channel safety input can be connected. Safety output 2 has an off-delay timer.

Wiring Example



DIP Switch and LED Display

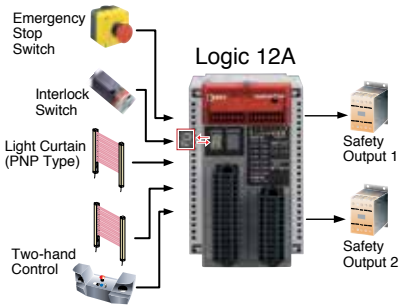
Logic Chart



FS1A-C11S Logic 12A	The logic for apparatus with a two-hand control device	Output Line: 2 2 dual safety outputs of different operations	Category 4

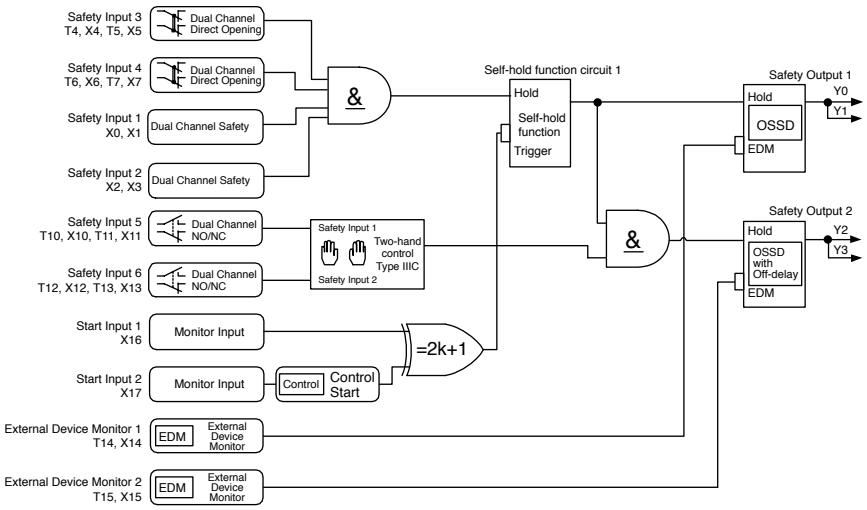
Logic 12A is used for safeguarding measures of machine tools that use two-hand control. Safety outputs are dual channel outputs. Two dual channel direct opening inputs, one two-hand control input (two safety inputs = one point), and two dual channel safety inputs can be connected. Safety output 2 has an off-delay timer.

Wiring Example



DIP Switch and LED Display

Logic Chart



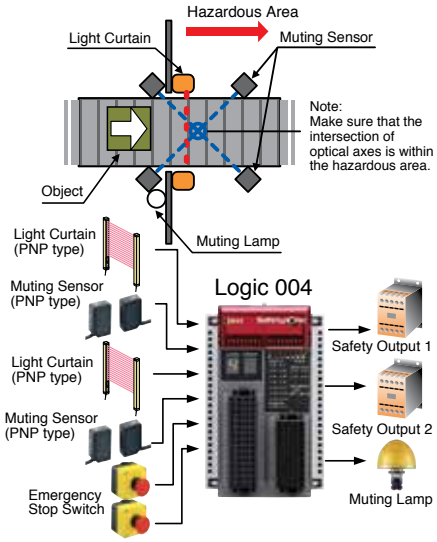
FS1A-C01S Logic 004	Muting function logic for apparatus with openings	Output Line: 1 2 dual safety outputs of the same operation	Category 4

In Logic 004, muting functions are added to the dual solid state output of Logic 003. Dual direct-opening components such as emergency stop switches and interlock switches can be used at the same time.

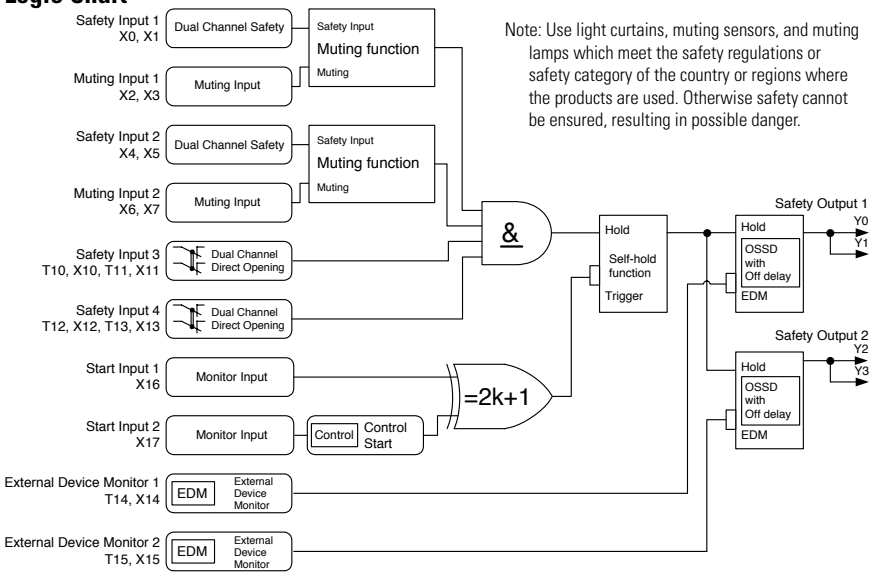
Muting Function Improves Productivity

With a muting function, the system stops when detecting a human and temporarily defeats the light curtain while work objects are being supplied. This improves the system's productivity. Muting functions can be used easily by connecting a light curtain, muting sensor, and muting lamp to the SafetyOne (Note). In muting status, the OFF signals of corresponding safety solid state outputs are defeated.

Wiring Example



Logic Chart



Note: Use light curtains, muting sensors, and muting lamps which meet the safety regulations or safety category of the country or regions where the products are used. Otherwise safety cannot be ensured, resulting in possible danger.

Note: When installing light curtain and muting sensor, ensure safety by referring to IEC TS 62046 technical documents.

DIP Switch and LED Display

Safety Input Specifications

Drive Terminals

(T0, T1, T2, T3, T4, T5, T6, T7, T10, T11, T12, T13, T14, T15)

Rated Drive Voltage	Power supply voltage
Minimum Drive Voltage	Power supply voltage – 2.0V
Number of Drive Terminals	14
Maximum Drive Current	20 mA per terminal (28.8V DC) (Note)

Note: Drive terminals of safety inputs send safety confirmation signals (pulse signals) for the diagnosis of safety components and input circuits.
Wiring and diagnosis function change depending on the selected logic. See user's manual "Chapter 5 Logic." Basic specifications remain the same.

Receive Terminals

(X0, X1, X2, X3, X4, X5, X6, X7, X10, X11, X12, X13, X14, X15)

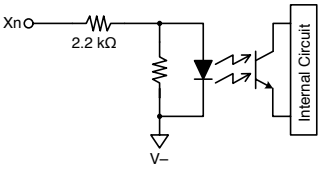
Rated Input Voltage	24V DC
Input ON Voltage	15.0 to 28.8V DC
Input OFF Voltage	Open or 0 to 5.0V DC
Number of Inputs	14
Input Current	10 mA per terminal (at the rated power voltage)
Input Signal	Sink input (for PNP output), Type 1 (IEC61131-2)

Wire

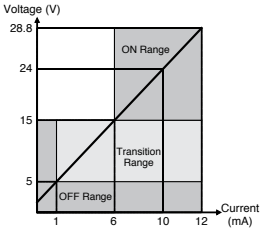
Cable Length (Note)	100m maximum (total wire length per input)
Allowable Wire Resistance	300Ω maximum

Note: When wiring between the SafetyOne and a component is 30m or more, use shielded cable to ensure electromagnetic immunity.

• Receive Terminal Internal Circuit



• Receive Terminal Operating Range

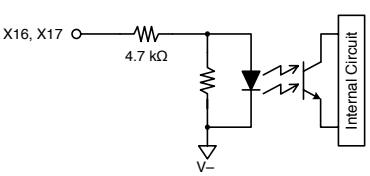


Start Input Specifications

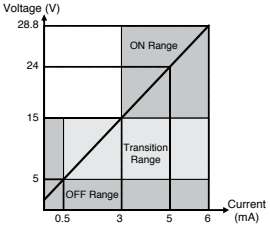
Rated Input Voltage	24V DC
Input ON Voltage	15.0 to 28.8V DC
Input OFF Voltage	Open or 0V to 5.0V DC
Number of Start Inputs	2 (X16, X17)
Input Current	5 mA per terminal (at the rated power voltage)
Input Signal	Sink input (PNP output), Type 1 (IEC61131-2)
Cable Length (Note)	100m maximum (total wire length per input)
Allowable Wire Resistance	300Ω maximum

Note: When wiring between the SafetyOne and a component is 30m or more, use shielded cable to ensure electromagnetic immunity.

• Start Input Internal Circuit



• Start Input Operation Range

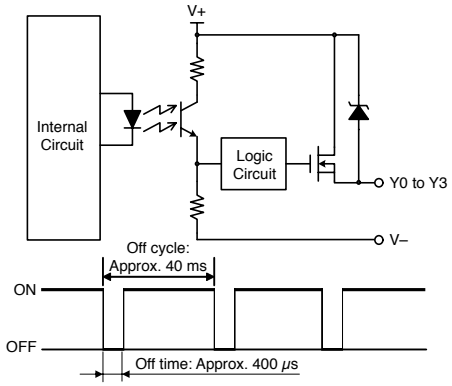


Safety Output Specifications

Output Type		Source output (N channel MOSFET)
Rated Output Voltage		Power supply voltage
Minimum Output Voltage		Power supply voltage – 2.0V
Number of Safety Outputs		4 (Y0, Y1, Y2, Y3)
Maximum Output Current	1 output	500 mA maximum
	Total	1A maximum
Leakage Current		0.1 mA maximum
Allowable Inductive Load [1]		L/R = 25 ms
Allowable Capacitive Load		1 µF maximum
Cable Length [2]		100m maximum (total length per output)

1. When connecting an inductive load, connect a protection element such as a diode.
2. When wiring between the SafetyOne and a component is 30m or more, use shielded cable to ensure electromagnetic immunity.

• Safety Output Internal Circuit



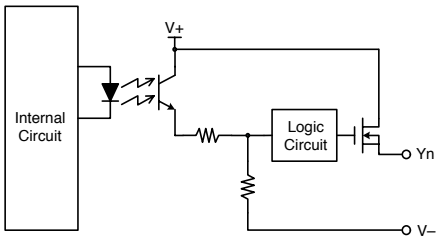
The safety outputs of the SafetyOne are solid state outputs. When the output is on, off-check signals are generated at regular intervals. The operating characteristics of the safety output change depending on the selected logic. For details, see user's manual "Chapter 5 Logic." The basic specifications remain the same.
Note that off-check signals may cause reaction of some safety components depending on their response speed. Monitor output and solenoid/lamp output do not generate outputs of off-check signals.

Monitor Output Specifications

Output Type		Source output (N channel MOSFET)
Rated Output Voltage		Power supply voltage
Minimum Output Voltage		Power supply voltage – 2.0V
Number of Safety Outputs		4 (Y0, Y1, Y2, Y3)
Maximum Output Current	1 output	500 mA maximum
	Total	1A maximum
Leakage Current		0.1 mA maximum
Allowable Inductive Load [1]		L/R = 25 ms
Allowable Capacitive Load		1 µF maximum
Cable Length [2]		100m maximum (total length per output)

Note: When wiring between the SafetyOne and a component is 30m or more, use shielded cable to ensure electromagnetic immunity.

• Monitor Output Internal Circuit



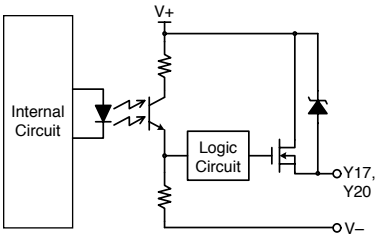
The operating characteristics of the monitor output change depending on the selected logic. For details, see user's manual "Chapter 5 Logic." The basic specifications remain the same.
Do not use monitor output as a safety output, otherwise the system's safety cannot be assured when the SafetyOne or safety components fail.

Solenoid/Lamp Output Specifications

Output Type		Source output (N channel MOSFET)
Rated Output Voltage		Power supply voltage
Minimum Output Voltage		Power supply voltage – 2.0V
No. of Solenoid/Lamp Outputs		2 (Y17, Y20)
Maximum Output Current	1 output	500 mA maximum
	Total	500 mA maximum
Leakage Current		0.1 mA maximum
Allowable Inductive Load [1]		L/R = 25 ms
Cable Length [2]		100m maximum (total length per output)

1. When connecting an inductive load, connect a protection element such as a diode.
2. When wiring between the SafetyOne and a component is 30m or more, use shielded cable to ensure electromagnetic immunity.

Solenoid/Lamp Output Internal Circuit



The selected operating characteristics of solenoid/lamp output change depending on the selected logic. For details, see user's manual "Chapter 5 Logic." The basic specifications remain the same. Do not use solenoid/lamp output as a safety output, otherwise the system's safety cannot be assured when the SafetyOne or safety components fail.

Internal States

State	Description
Initial	Initial processing is performed immediately after power is supplied to the SafetyOne. The internal circuits are checked and the LEDs show operation confirmation (blinking) for 6 seconds (approx).
Run	The SafetyOne is under normal operation. Logic processing continues without failures or wiring errors.
Configuration	A logic or off-delay timer value is being configured. Configuration enables the logic and off-delay timer value. When completed, the SafetyOne changes to the Run state.
Protection	An input monitor error has occurred with dual channel input, EDM input, or muting input. When the problem is removed, the SafetyOne changes to Run state.
Stop	A failure or error has occurred with an external device or internal circuit. When the problem is removed and the power is turned on, Stop state is cleared.

LED and Output States

When safety outputs are dual channel outputs

State	Logic LED	Error LED	Timer LED	Safety Output	Solenoid/ Lamp Output	Monitor Output			
				Y0 to Y3	Y17, Y20	Y4 to Y13	Y14	Y15	Y16
Initial	(Note 1)	(Note 1)	(Note 1)	OFF	OFF	OFF	ON	ON	OFF
Run	Logic #	Blank	Selected Value	(Note 2)	(Note 2)	(Note 2)	OFF	OFF	ON
Configuration	(Note 3)	C	(Note 3)	OFF	OFF	OFF	OFF	ON	OFF
Protection	Logic #	1	Selected Value	Off (Note 6)	OFF	(Note 4)	OFF	ON	OFF
Stop	Blank	(Note 5)	Blank	OFF	OFF	(Note 4)	ON	ON or OFF	OFF

When safety outputs are single channel outputs

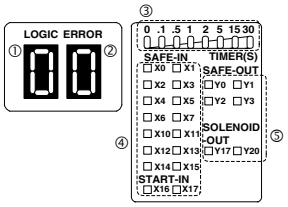
State	Logic LED	Error LED	Timer LED	Safety Output	Monitor Output			
				Y0 to Y3	Y4 to Y13, Y17, Y20	Y14	Y15	Y16
Initial	(Note 1)	(Note 1)	(Note 1)	OFF	OFF	ON	ON	OFF
Run	Logic #	Blank	Selected Value	(Note 2)	(Note 2)	OFF	OFF	ON
Configuration	(Note 3)	C	(Note 3)	OFF	OFF	OFF	ON	OFF
Protection	Logic #	1	Selected Value	Off (Note 6)	(Note 4)	OFF	ON	OFF
Stop	Blank	(Note 5)	Blank	OFF	(Note 4)	ON	ON or OFF	OFF

1. Random display of Initial state.
2. Output and LED display of the selected logic.
3. Blinking LED display of the selected logic number or the selected timer value.
4. Pulsing display of monitor output and output LED corresponding to the input of error. Other LEDs and monitor outputs maintain the display of Run state.
5. Error number is displayed.
6. Safety output with timer is turned OFF after set OFF-delay time.

Caution: Solenoid/lamp outputs (Y17, Y20) turn on for 1 second maximum when the state changes to Run state. Take operation of connected components into consideration.

LEDs

① Logic LED (green)
② Error LED (red)
③ Timer LED (green)
④ Input LED (orange)
⑤ Output LED (orange)



Logic LED ①

Type	LED	Status	Description
FS1A-C01S	1, 2, 3, 4, 5, 6, 7, 8	ON	The selected logic is in Run or Protection state
		Blink	The selected logic is in Configuration state
FS1A-C11S	1, 2, 3, 4, 5, 6, 7, 8, A, b, C, d	ON	The selected logic is in Run or Protection state (Ex. Logic 14A: 4→A→4→A→4→...)
		Blink	The selected logic is in Configuration state (Ex. Logic 14A: 4→A→OFF→A→4→OFF...)
FS1A-C01S/ C11S	E	Blink	The selected logic has Configuration error (logic not selected, or multiple logics are selected)
	Random	ON/Blink	Initializing (Initial state)
	OFF	OFF	Error (Stop state)

FS1A-C01S setting
Correct: Selecting one logic from 1 to 8
Wrong: Selecting two or more logics from 1 to 8

FS1A-C11S setting
Correct: Selecting one logic from 1 to 8
Selecting one from 1 to 4, and one from A, b, C, or d.
Wrong: Selecting three or more logics from 1 to 8
Selecting two or more logics from 1 to 4
Selecting two or more logics from A (5), b (6), C (7), or d (8)

Error LED ②

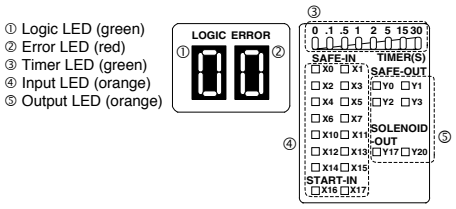
Type	LED	Status	Description
FS1A-C01S/ FS1A-C11S	1	ON	Input monitor error (Protection state)
	2	ON	Wiring error at safety input or an error in safety input circuits
	3	ON	Wiring error at start input or an error in start input circuit
	4	ON	Wiring error at safety output or an error in safety output circuit
	5	ON	Muting lamp error (disconnection) (FS1A-C01S: logic 4 only) (FS1A-C11S: logic 11d only)
	6	ON	Power supply error or internal power supply circuit error
	7	ON	Internal error, power supply error, or internal power supply circuit error
	9	ON	EMC disturbance
	C	ON	Configuration procedure is in progress (Configuration state)
		Blink	Configuration is valid (Note) (Configuration state)
	Random	ON/Blink	Initializing (Initial state)
	OFF	OFF	Normal operation (Run state)

Note: Blinks for 1 to 5 seconds after the enter button is pressed. Releasing the button during blinking activates the setting. The blinking LED becomes ON if the button is pressed for more than 5 seconds, and the setting becomes invalid even after the button is released.

Timer LED ③

Type	LED	Status	Description
FS1A-C01S/ FS1A-C11S	0	ON	No off-delay (safety outputs shut down immediately)
	.1	ON	Off-delay timer 0.1s
	.5	ON	Off-delay timer 0.5s
	1	ON	Off-delay timer 1s
	2	ON	Off-delay timer 2s
	5	ON	Off-delay timer 5s
	15	ON	Off-delay timer 15s
	30	ON	Off-delay timer 30s
	Each LED	Blink	Selected timer value (Configuration state)
	Random	ON/Blink	Initializing (Initial state)
	All LEDs	OFF	Timer value is not selected or the SafetyOne is in Stop state

LEDs, con't



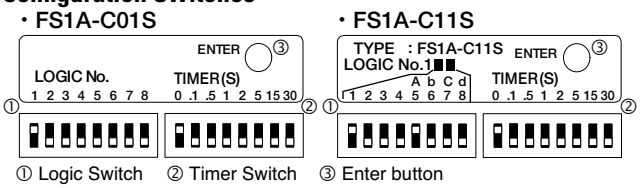
Input LED ④
SAFE-IN (X0 to X15), START-IN (X16, X17)

Type	LED	Status	Description
FS1A-C01S	X0 to X15	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
		Blink	Input monitor error
	X16, X17	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
FS1A-C11S	X0 to X15	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
		Blink	Input error (error displayed on error LED)
	X16, X17	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
		Blink	Input error (error displayed on error LED)

Ourput LED ⑤
SAFE-OUT (Y0 to Y3), SOLENOID-OUT (Y17, Y20)

Type	LED	Status	Description
FS1A-C01S	Y0 to Y3	ON	Output ON
		OFF	Output OFF, Stop/Configuration state
		Blink	Off-delay operating
	Y17, Y20	ON	Output ON
		OFF	Output OFF, Stop/Configuration state
FS1A-C11S	Y0 to Y3	ON	Output ON
		OFF	Output OFF
		Blink	Off-delay operating, or output error (error displayed on error LED)
	Y17, Y20	ON	Output ON
		OFF	Output OFF
		Blink	Off-delay operating, or output error (error displayed on error LED)

Configuration Switches



① Logic Switch ② Timer Switch ③ Enter button

Logic Switch ①

FS1A-C01S

Eight DIP switches are provided for selecting a logic by moving a switch upward. For details, see user's manual "Chapter 5 Logic." Only one logic switch can be selected.

DIP Switch	1	2	3	4	5	6	7	8
Logic	001	002	003	004	005	006	007	008

FS1A-C11S

Eight DIP switches are provided for selecting a logic by moving one or two switch(es) upward. For details, see user's manual "Chapter 5 Logic."

DIP Switch	1	2	3	4	5	6	7	8
Logic	001	002	003	004	005	006	007	008
	1 + A	1 + b	1 + C	1 + d	2 + A	2 + b	2 + C	2 + d
	11A	11b	11C	11d	12A	12b	12C	12d
	3 + A	3 + b	3 + C	3 + d	4 + A	4 + b	4 + C	4 + d
	13A	13b	13C	13d	14A	14b	14C	14d

Timer Switch ②

Eight DIP switches are provided for selecting an off-delay timer value, by moving a switch upward. Only one timer switch can be selected.

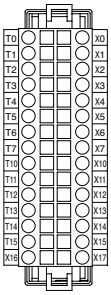
Switch No.	Timer Value	Description
1	0	No off-delay (safety outputs shut down immediately)
2	.1	Off-delay timer 0.1s
3	.5	Off-delay timer 0.5s
4	1	Off-delay timer 1s
5	2	Off-delay timer 2s
6	5	Off-delay timer 5s
7	15	Off-delay timer 15s
8	30	Off-delay timer 30s

Enter Button ③

The enter button is used to activate the configuration of logic and timer switches. Error LED will blink for 1 to 5 seconds after pressing the enter button. Releasing the button during blinking activates the setting. The blinking LED becomes ON if the button is pressed for more than 5 seconds, and the setting becomes invalid even after the button is released. For setting the switches and enter button, use the setting tool supplied with the Safety-One.

Connector Specifications

Input Connector

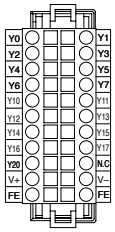


Applicable connector
- Spring clamp (30-pin)
  FS9Z-CN01 (IDEC)
  2-1871940-5
  (Tyco Electronics)
- Crimp (30-pin)
  2-1871946-5
  (Tyco Electronics)

Terminal	No.	Description
T0	A1	Safety input drive terminal 0
T1	A2	Safety input drive terminal 1
T2	A3	Safety input drive terminal 2
T3	A4	Safety input drive terminal 3
T4	A5	Safety input drive terminal 4
T5	A6	Safety input drive terminal 5
T6	A7	Safety input drive terminal 6
T7	A8	Safety input drive terminal 7
T10	A9	Safety input drive terminal 10
T11	A10	Safety input drive terminal 11
T12	A11	Safety input drive terminal 12
T13	A12	Safety input drive terminal 13
T14	A13	Safety input drive terminal 14
T15	A14	Safety input drive terminal 15
T16	A15	Start input terminal 16
X0	B1	Safety input receive terminal 0
X1	B2	Safety input receive terminal 1
X2	B3	Safety input receive terminal 2
X3	B4	Safety input receive terminal 3
X4	B5	Safety input receive terminal 4
X5	B6	Safety input receive terminal 5
X6	B7	Safety input receive terminal 6
X7	B8	Safety input receive terminal 7
X10	B9	Safety input receive terminal 10
X11	B10	Safety input receive terminal 11
X12	B11	Safety input receive terminal 12
X13	B12	Safety input receive terminal 13
X14	B13	Safety input receive terminal 14
X15	B14	Safety input receive terminal 15
X17	B15	Start input terminal 17

Note: For the specifications of crimp connector, contact Tyco Electronics.

Output Connector



Applicable connector
- Spring clamp (22-pin)
  FS9Z-CN02 (IDEC)
  2-1871940-1
  (Tyco Electronics)
- Crimp (22-pin)
  2-1871946-1
  (Tyco Electronics)

Terminal	No.	Description
Y0	A1	Safety output terminal 0
Y2	A2	Safety output terminal 2
Y4	A3	Safety output terminal 4
Y6	A4	Safety output terminal 6
Y10	A5	Safety output terminal 10
Y12	A6	Safety output terminal 12
Y14	A7	Safety output terminal 14
Y16	A8	Safety output terminal 16
Y20	A9	Solenoid/lamp output terminal 20
V+	A10	24V DC power terminal
FE	A11	Functional ground terminal
Y1	B1	Safety output terminal 1
Y3	B2	Safety output terminal 3
Y5	B3	Safety output terminal 5
Y7	B4	Safety output terminal 7
Y11	B5	Safety output terminal 11
Y13	B6	Safety output terminal 13
Y15	B7	Safety output terminal 15
Y17	B8	Solenoid/lamp output terminal 17
NC	B9	Blank terminal
V–	B10	0V DC power terminal
FE	B11	Functional ground terminal

Emergency Stop Switches 467

Operating Instructions..... 471

AS-Interface Safety at Work

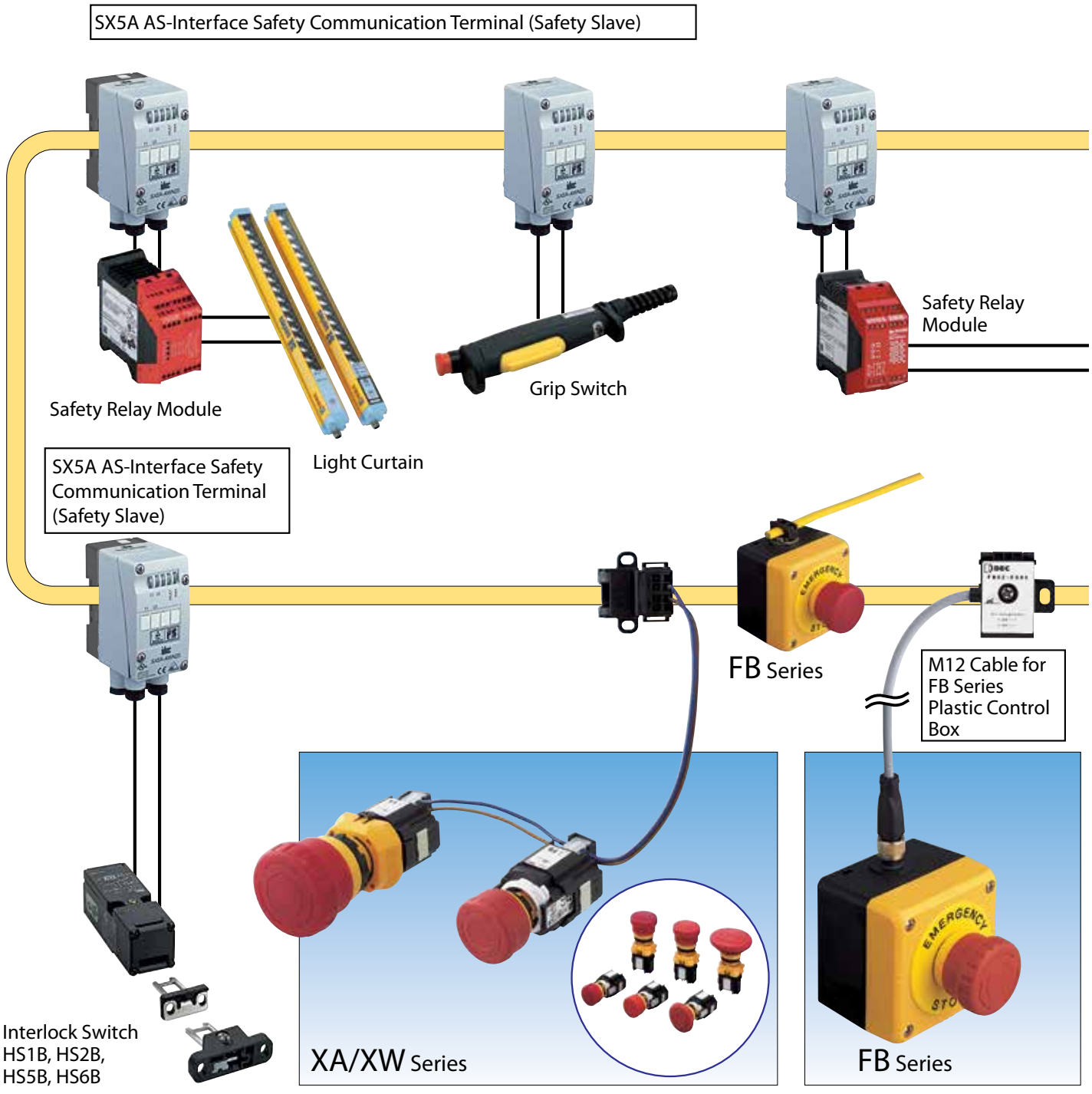
IDEC

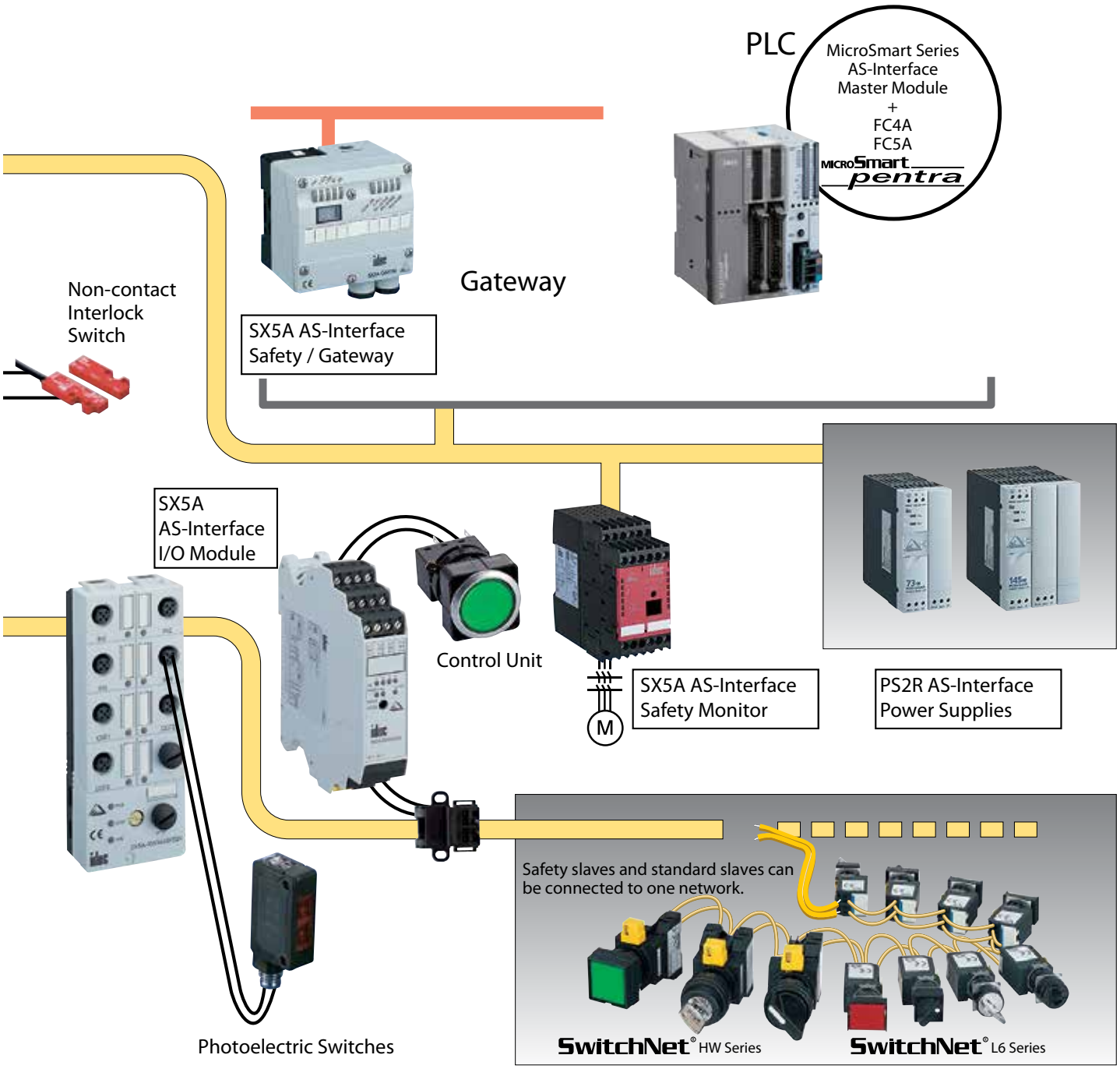
www.IDEC.com/safety

AS-Interface Safety at Work

AS-Interface safety at work integrates a safety network into one wire-saving system.

- Safety slaves and safety monitors can be simply connected to the existing AS-Interface network to establish the AS-Interface Safety at Work.
- Interlock switches, safety relay modules and other safety components can be connected to the safety network via safety slaves.
- Emergency stop switches can be connected directly to AS-Interface Safety at Work, further reducing wiring.
- Safety components can be connected to other networks through gateways.




PLC
MicroSmart Series
AS-Interface
Master Module
+
FC4A
FC5A
MICROSmart pentra
Gateway
SX5A AS-Interface
Safety / Gateway
Non-contact
Interlock
Switch
SX5A
AS-Interface
I/O Module
Control Unit
SX5A AS-Interface
Safety Monitor
PS2R AS-Interface
Power Supplies
M
Safety slaves and standard slaves can
be connected to one network.
SwitchNet® HW Series
SwitchNet® L6 Series
Photoelectric Switches

Emergency Stop Switches

XA Series/XW Series/FB Series (Plastic Enclosures) with Safety Slave Functions for Direct Connection to the AS-Interface Safety at Work

- Emergency stop switches with safety slave functions can be connected to the AS-Interface Safety at Work network.
- Complies with IEC 61508 SIL3 (Functional safety of electrical/electronic/programmable electronic safety-related systems) and EN954-1 safety category 4 (Safety of machinery-Safety related parts of control systems).
- Space, wire, and labor-saving solutions for safety equipment
- Equipped with AS-Interface standard slave functions. Monitored with AS-Interface master devices.
- A wide variety of safety components:
  1) 1-IN (non-illuminated) and 1-IN/1-OUT (illuminated) available.
  2) FB series plastic control stations with ø16mm XA series and ø22mm XW series emergency stop switches available.
  3) XA series available with ø29mm and ø40mm mushroom buttons and XW series available with ø40mm and ø60mm jumbo mushroom buttons.
  4) Terminal connectors are available in insulation displacement, crimping, and M12 connectors which enable effective connection of multiple switches.

Part Numbers

ø16mm XA Series

Button Size	Connector Terminal	I/O Points	Illumination	Part Number	Button/Lens Color
ø29	IDC	1-IN	Non-illuminated	XA1E-BV3Z10C1R	Red
				XA1E-BV3Z10C1N	Gray
		1-IN 1-OUT	Illuminated	XA1E-LV3Z114C1R	Red
ø40		1-IN	Non-illuminated	XA1E-BV4Z10C1R	
		1-IN 1-OUT	Illuminated	XA1E-LV4Z114C1R	

ø22mm XW Series

Button Size	Connector Terminal	I/O Points	Illumination	Part Number	Button/LensColor
ø40	IDC	1-IN	Non-illuminated	XW1E-BV4Z10C1R	Red
	Crimping			XW1E-BV4Z10C2R	
	IDC	1-IN 1-OUT	Illuminated	XW1E-LV4Z114C1R	
	Crimping			XW1E-LV4Z114C2R	
ø60	IDC	1-IN	Non-illuminated	XW1E-BV5Z10C1R	
	Crimping			XW1E-BV5Z10C2R	

E-Stop Enclosure

Button Size	Connector Terminal	I/O Points	Illumination	Nameplate	Part Number	Button/Lens Color
ø40	M12	1-IN	Non-illuminated	Without	FB1W-XW1E-BV4Z10C2R-Y0-1	Red
				With	FB1W-XW1E-BV4Z10C2R-Y1-1	
		1-IN	Illuminated	Without	FB1W-XW1E-LV4Z114C2R-Y0-1	
		1-OUT		With	FB1W-XW1E-LV4Z114C2R-Y1-1	
ø60		1-IN	Non-illuminated	Without	FB1W-XW1E-BV5Z10C2R-Y0-1	
ø40	AS- Interface Piercing	1-IN	Non-illuminated	Without	FB1W-XW1E-BV4Z10C2R-Y0-2	
				With	FB1W-XW1E-BV4Z10C2R-Y1-2	
		1-IN 1-OUT	Illuminated	Without	FB1W-XW1E-LV4Z114C2R-Y0-2	
				With	FB1W-XW1E-LV4Z114C2R-Y1-2	
ø60		1-IN	Non-illuminated	Without	FB1W-XW1E-BV5Z10C2R-Y0-2	

1. Units have been evaluated as emergency stop devices by TÜV.
2. Units with nameplates are engraved "Emergency Stop".

Accessories

Name	Specification	Part Number
XA/XW Series IDC Connector Kit [1]	End connector (with cover)	XW9Z-C100-1
	Through connector (with cover)	XW9Z-C100-2
IDC Connector Termination Tool	Manufactured by ITW Pancon	MMIT-156F
Crimping Type Connector Cable	Length 500 mm, with one connector	XW9Z-C205
	Length 1m, with one connector	XW9Z-C210
FB Series Control Station M12 Connector Cable	Length 300 mm, straight	FB9Z-CS03
	Length 1m, straight	FB9Z-CS10
	Length 2m, straight	FB9Z-CS20
	Length 1m, right-angle	FB9Z-CL10
	Length 2m, right-angle	FB9Z-CL20
Hand-held Programming Device	[2]	SX9Z-ADR1N

1. Minimum order is 5 pieces. IDC connector termination tool MMIT-156F (ITW Pancon) may be required to connect the cable to the connector.
2. *Hand-held programming device accessories:
-Programming device cable (SX9Z-CN1)
-Programming device AC adapter (SX9Z-ADPT)
-SwitchNet addressing port adapter (LA9Z-SNADP)

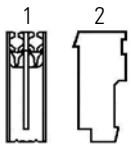
Specifications

General	Operating Voltage		26.5 to 31.6V DC (supplied from AS-Interface)
	Rated Input Current		Illuminated type: 35 mA (XA series), 40 mA (XW, FB series) Non-illuminated type: 25 mA
	Dielectric Strength		500V AC, 1 minute
	Insulation Resistance		100 MΩ (500V DC megger)
	Operating Temperature		XA, XW series: -25 to +55°C (no freezing) FB series: Illuminated type -25 to +50°C (no freezing) Non-illuminated type -25 to +55°C (no freezing)
	Storage Temperature		-40 to +70°C (no freezing)
	Operating Humidity		45 to 85% RH (no condensation)
	Pollution Degree (IEC60664)		XA, XW series - Operator unit: 3, Communication unit: 2, FB series: 3 (2 - per UL)
	Degree of Protection		Operator unit: IP65
	IEC60529		Terminal unit: IP20 (FB series: IP65)
	Corrosion Immunity		Free from corrosive gases
	Vibration Resistance		Damage limits/Operating extremes: 10 to 500 Hz, amplitude 0.35 mm, acceleration 50 m/s^2
	Shock Resistance		Damage limits: 150 m/s^2, Operating extremes: 1000 m/s^2
	Weight (approx.)		XA series ø29: 35g, ø40: 40g XW series ø40: 60g, ø60: 70g FB series M12 connector: 195g (ø40), 205g (ø60) Piercing: 235g (ø40), 245g (ø60)
Communication	Communication		AS-Interface Ver. 3.0
	Slave Type		Safety slave
	Maximum Network Length		100m total
	Maximum No. of Slaves		31 (when only safety slaves are connected)
	Profile (I/O, ID, ID2)		S-7, B, E (illuminated type) S-0, B, E (non-illuminated type)
	Data Bit	Input	Emergency stop switch When pressed: DI0 0, DI1 0, DI2 0, DI3 0
			Emergency stop switch When not pressed: DI0 X, DI1 X, DI2 X, DI3 X (x:0.1 (unspecified))
		Output	DO0 = 1 Pilot light: on DO1 to 3: not used DO0 = 0 Pilot light: off
	Parameter Bit		Not used

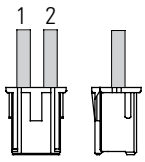
Mechanical/Electrical	Operating Force	Pushlock: 10.5N (XA series), 32N (XW, FB series) Pull reset: 10N (XA series), 21N (XW, FB series) Turn reset: 0.16N·m (XA series), 0.27 N·m (XW, FB series)
	Minimum Force Required for Direct Opening Action	60N (XA series), 80N (XW, FB series)
	Minimum Operator Stroke Required for Direct Opening Action	4.0 mm
	Maximum Operating Stroke	4.5 mm
	Operating Frequency	900 operations/hour
	Mechanical Life	250,000 operations minimum
	Electrical Life	250,000 operations minimum
	Connectors	IDC connector (XA series) IDC connector, crimping connector (XW series) M12 connector/AS-Interface piercing connector (FB series)
	Recommended Tightening Torque for Locking Ring	0.88 N·m (XA series), 2.0 N·m (XW series)

Pin Assignment

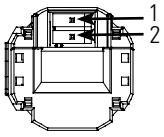
XA/XW Series



IDC: XW9Z-C100-1 (End connector)

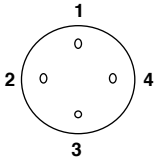


XW9Z-C100-2 (Through connector)

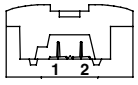


FB Series

(M12 Connector)



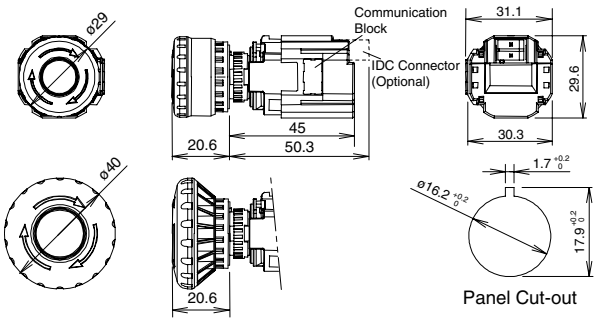
(AS-Interface Piercing Connector)



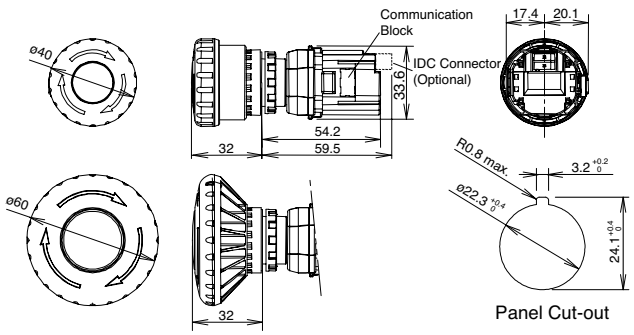
1: AS-i+
2: AS-i-

Dimensions

XA Series

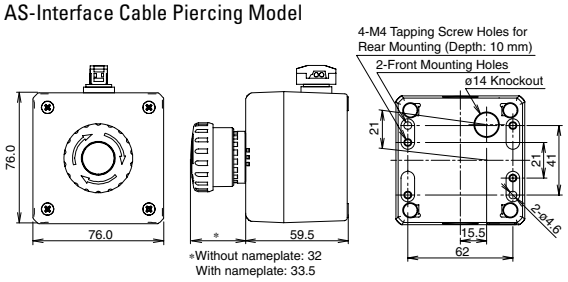


XW Series

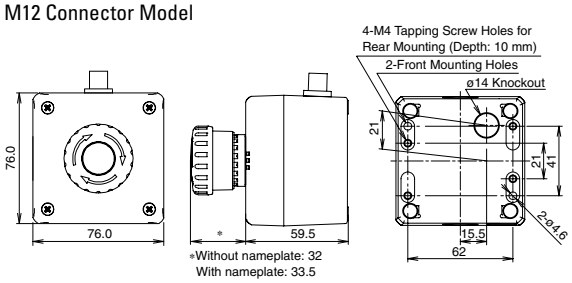


FB Series

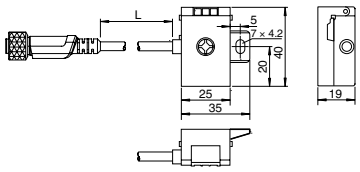
AS-Interface Cable Piercing Model



M12 Connector Model



M12 Connector Cable for FB Series

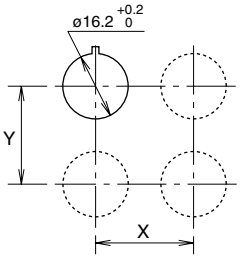


Mounting Centers

XA Series

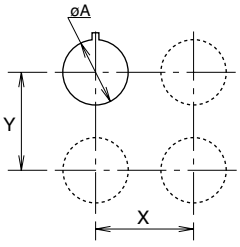
XA Size	X & Y
ø29	40mm minimum
ø40	50mm minimum
ø60	70mm minimum

The above values are for installing with ø16mm pushbutton switches. For using with control units of other size and operator shape, determine the mounting centers in consideration of easy operation and wiring.



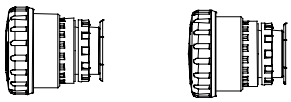
XW Series

XW Size	øA	X & Y
40mm	22.3+0.4	70mm min



Resetting

These emergency stop switches are push-lock, pull/turn reset types. When pressed, the operator is latched, and reset by pulling or turning.



Operating Instructions

AS-Interface Safety Monitor

Wiring and Installation

Before wiring the interface cable, discharge static electricity. Tighten the screws to a torque of 0.8 to 1.2 N·m.

The AS-Interface power supply unit must separate the main power (input) and output safely according to IEC 60742. It must also maintain a stable supply in the event of instantaneous power failure.

Replacing the Safety Slave

Press "Service" button before and after replacing the safety slave. Resetting of safety monitor using the PC is not necessary. After replacement, check whether the new safety slave performs correctly.

Replacing the Safety Monitor

The settings of the safety monitor can be transferred to the new safety monitor using the download cable sold separately, and the new safety monitor does not require resetting using software. After replacement, check whether the new safety monitor performs correctly.

AS-Interface Safety Communication Terminal & Base Module

Wiring

The AS-Interface safety communication terminal will be connected to the AS-Interface network via the base module. When only one AS-i flat cable is used, plug the unused grooves using the gaskets supplied with the base module. Tighten the screws to a torque of 0.7 N·m maximum.

Before wiring, disconnect the safety communication terminal and discharge static electricity with an adequate method. Connect the emergency stop switches and interlock switches in normally-closed status.

The slave has two independent inputs for connecting the products to comply with the required safety category. When complying with safety category 4, limit the cable length between the module and the input device to not longer than 30m. For leading in the cables, use the upper part (1 and 2), and tighten the cable gland to a torque of 0.5 to 0.7 N·m.

Emergency Stop Switches

Panel Mounting

The panel thickness should be within the range from 0.8 to 6.0 mm. Remove the locking ring from the operator and check that the rubber gasket is in place. Insert the operator from panel front into the panel hole. Face the side without thread on the operator with TOP marking upward, and tighten the locking ring using ring wrench MW9Z-T1 to a torque of 2.0 N·m maximum. Do not use pliers. Do not tighten with excessive force, otherwise the locking ring will be damaged.

To prevent the XW emergency stop switches from rotating when resetting from the latched position, use of an anti-rotation ring (HW9Z-RL) or a nameplate is recommended.

Address Setting

The lid of the address setting device on the side of the unit can be removed by prying it out. Take care not to lose the lid, which comes off completely. By removing the lid of the address setting section, you can see the terminals for connecting a programming cable. Connect the programming cable to the terminals.

To set an address while mounting this product on the panel, more than 60mm space is necessary on the left side in terms of the AS-Interface communication unit. Note that adequate space cannot be allocated by the distance specified with minimum mounting centers. If adequate space cannot be allocated, set the address before installing the product on the panel or set the address after removing the AS-Interface communication unit from the operation section.

Wiring

A maximum of 31 units can be connected to a network. Addresses must be assigned to avoid overlaps.

This product allows connecting safety slaves with safety equipment, and normal slaves without safety equipment at the same time. Do not connect safety related signals to a normal slave.

The AS-Interface slaves are divided into two types: A/B slaves with expanded addresses and standard slaves without expanded addresses. If A/B slaves and standard slaves are connected simultaneously, the maximum number of slaves connectable to a network may exceed 31.

The network length is a maximum of 100 meters, including all wires. However, the maximum possible length of the wires may actually be shorter than 100 meters depending on the type of master and composition of slaves. Consider the lengths of cables and wiring topology so that voltage drops in transmission lines are no higher than 3V.

Use applicable two-wire flat cables for wiring.

Do not operate the switch using solid object such as metal or with excessive force, otherwise the switch may be deformed or damaged, causing malfunction or operation failure.