

# INSTRUCTION SHEET

## Original Instructions Safety Relay Module HR5S Series

Confirm that the delivered product is what you have ordered. Read this instruction sheet to make sure of correct operation. Make sure that the instruction sheet is kept by the end user.

### SAFETY NOTE

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

#### WARNING

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

#### CAUTION

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

#### WARNING

- Do not disassemble, repair, or modify this module. This may cause impairment of the safe operability of the module.
- Turn off the power to this module before starting installation, removing, wiring, maintenance, or inspection of the module. Failure to turn power off may cause electric shocks or fire hazard.
- Installation of this module must be performed according to the instruction found in this instruction sheet. Improper installation may cause the module to fail.
- Make sure prevention of electric shocks due to breakdown between output 1 and output 2.
- Use within the specified voltage. Do not use a power supply that produce high ripple voltage or abnormal voltage.
- Use a power supply that meets following required specifications ;
  - Complies with the SELV or PELV circuit specified by IEC 60364-4-41.
  - Has the functionality of the control voltage and current of class 2 circuit, as defined in UL508.
- Check the safety function of this module periodically, turn OFF the signal to the safety input (e.g. at least once a year) and make sure the safety outputs go OFF.

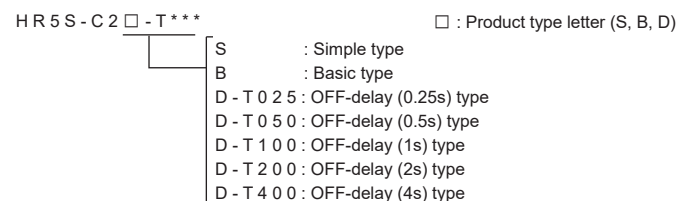
#### CAUTION

- This module is designed for installation within an enclosure. Do not install this module outside an enclosure. Install the module in enclosure rated IP54 or higher.
- Install this module in environments described in this instruction sheet. If the module is used in places where the module is subjected to high temperature, high humidity, condensation, corrosive gases, excessive vibrations, and excessive shocks then electric shocks, fire hazard, or malfunction may result.
- Environment for using this module is "Pollution degree 2". Use the module in environments of pollution degree 2.
- When disposing of this module, handle it under the laws and regulations of the country in which it is disposed.
- Due to a power supply failure, the voltage of S11 (Input driver) may be risen to 34VDC at maximum.

### NOTICE

This module has been designed for environment A. Use of this module in environment B may cause unwanted electromagnetic disturbances in which case the user may be required to take adequate mitigation measures.

## 1 Type



## 2 Overview

The HR5S series safety relay modules are intended for monitoring of emergency stop circuits and/or monitoring of guards. The safety function of HR5S series is to monitor the outputs of safety devices (e.g. emergency stop switches, interlock switches etc.). If the safety device is actuated, the stop condition is relayed via the safety contacts of the module to the machine control circuit to stop the hazard and to remove power.

## 3 Specifications

Applicable standards	
EN ISO13849-1:2023, EN ISO13849-2:2012, EN 60947-5-1:2017+AC:2020	
UL 508, CSA C22.2 No.14	
GB/T 14048.5	

Type No.	HR5S-C2S	HR5S-C2B	HR5S-C2D-T***
<b>Power</b>			
Rated operating voltage	24V DC (Tolerance -15% to +10%), Class 2 Only (For North America)		
Current consumption	100mA maximum at 24V DC (Without load)		
<b>Input (*1)</b>			
Input resistance	30Ω maximum (Between S11 to S##) (## :12, 13, 14, 34, 35, 36) - 30Ω max.(Between Y1 of the previous module to S15)		
<b>Safety output / Auxiliary output (*1)</b>			
Configuration	2NO (Without OFF-delay) :Safety output 1NO (Without OFF-delay):Auxiliary output + 1NO (With OFF-delay):Safety output		
Initial contact resistance	200mΩ maximum each output contact (*2)		
Rated load (resistive load)	250V AC 3A / contact 30V DC 3A / contact		
Maximum operational voltage	250V AC 30V DC		
Minimum applicable load	5V DC, 1mA (reference value) [Failure rate level P (reference value)]		

\*1) The external wiring length for inputs and outputs must be less than 30m or less.

Electrical life	250V AC 3A resistive load: 100,000 operations minimum (*3) 30V DC 3A resistive load: 100,000 operations minimum (*3) 250V AC 1A resistive load: 500,000 operations minimum (*4) 30V DC 1A resistive load: 500,000 operations minimum (*4) [AC-15] 240V AC 2A inductive load: 100,000 operations minimum (operating frequency 1200 per hour, cosφ = 0.3) [DC-13] 24V DC 1A inductive load: 100,000 operations minimum (operating frequency 1200 per hour, L/R = 48ms)		
Mechanical life	10 million operations minimum (operating frequency 10,800 per hour)		
Conditional short-circuit current	1,000A External fuse: 5A FH (IEC 60127-2)		
Fault Output (*1)	Semiconductor output, Rated 24V DC 100mA maximum		
Fault monitor output	Semiconductor output, Rated 24V DC 100mA max.		
<b>Time</b>			
Reaction time (*5) (*6)	0.02s maximum	Output with OFF-delay D - T025 (0.25s): 0.25s ± 0.05s D - T050 (0.5s): 0.50s ± 0.07s D - T100 (1s): 1.00s ± 0.10s D - T200 (2s): 2.00s ± 0.15s D - T400 (4s): 4.00s ± 0.20s Output without OFF-delay: 0.02s max.	
Response time by failure diagnosis function (*7)	Detection by EDM	0.25s maximum	D - T025 (0.25s): 0.5s maximum D - T050 (0.5s): 0.8s maximum D - T100 (1s): 1.3s maximum D - T200 (2s): 2.4s maximum D - T400 (4s): 4.5s maximum
	Detection by SW monitor	- 0.6s maximum	
Turn ON time (*6)	0.05s maximum		

\*2) Measured using 6V DC, 1A voltage drop method.

\*3) Operating frequency 1200 per hour

\*4) Operating frequency 1800 per hour

\*5) The interval between when the safety input (S12) turns OFF and safety output contacts and/or the auxiliary output contact turn OFF.

\*6) When measured at the rated voltage (at 20°C). Excluding contact bounce time.

\*7) The interval between when the module detects a fault and the fault monitor output (Y1) turns ON, and the fault detection output (Y2) turns OFF at the same time.

Type No.	HR5S-C2S	HR5S-C2B	HR5S-C2D-T***
<b>Environmental Characteristics</b>			
Surrounding air temperature in operation	-10 °C to +55 °C (no freezing, no condensation)		
UL maximum ambient temperature (*8)	40 °C		
Operating humidity	5 % RH to 85% RH (no condensation)		
Storage temperature	-25 °C to +85 °C (no freezing, no condensation)		
Storage humidity	5 % RH to 85% RH (no condensation)		
Altitude	Operation: 0 to 2,000m		
Operating atmosphere	Indoor use only (atmosphere free from corrosive gases)		
IP (protective structure specification)	Enclosure: IP40 Terminals: IP20		
Pollution degree	2		
Over voltage category	II		
Insulation	Basic insulation (Reinforced insulation: Between contact output circuits and other circuits)		
Rated insulation voltage	250V (contact outputs)		
Rated impulse withstand voltage	2,500V (Between different terminal contact outputs) (4,000V: Between contact output circuits and other circuits)		
Dielectric strength (1 minute)	3,750V AC (Between enclosure and internal circuit) 2,500V AC (Between different terminal contact outputs) (Between contact output circuits and other circuits)		
Vibration resistance	5 Hz to 8.4 Hz: 3.5 mm <sub>peak</sub> , 8.4 Hz to 150 Hz: 10 m/s <sup>2</sup> peak 1 octave/min, 10 cycles for 3 axes		
Shock resistance	150 m/s <sup>2</sup> , pulse width: 11 msec, 3 times for 6 directions		

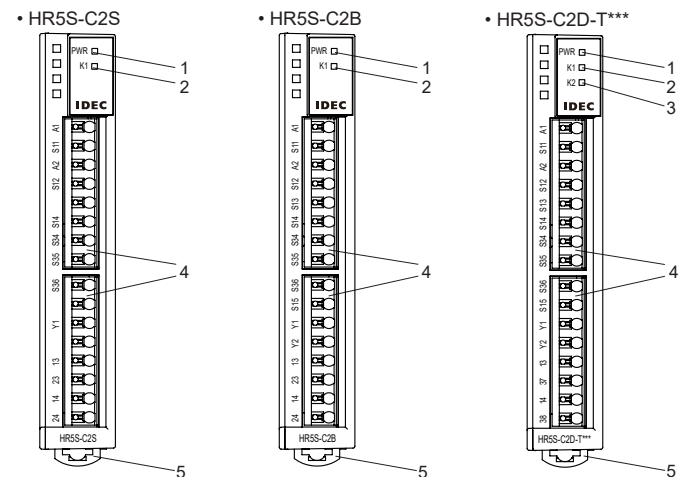
\*8) UL approved surrounding air temperature of enclosure. (For North America)

## 4 Safety Performance

Type No.	HR5S-C2S	HR5S-C2B	HR5S-C2D-T***
Performance level (PL) (EN ISO 13849-1)	PLc	PLd	
Category (Cat.)	2 (EN ISO 13849-1)		
Mean time to dangerous failure (MTTF <sub>D</sub> )	330 years or more (100 years: Applying the limit value from EN ISO 13849-1) (MTTF <sub>D</sub> of the fault outputs is 210 years or more)		
Diagnostic coverage (DC <sub>avg</sub> )	Medium (90% or more) (EN ISO 13849-1)		
Mission time (T <sub>M</sub> )	20 years (EN ISO 13849-1)		
Stop category (EN 60204-1:2018)	0	1 (Safety output2 with OFF-delay) (*1) 0 (Auxiliary output1 without OFF-delay)	

- \*1) "Stop category 1" of EN 60204-1:2018 is corresponding to "SS1-I" of EN 61800-5-2:2017.
- The performance level and the category in accordance with EN ISO 13849-1 depends on the external wiring, the application case, the choice of control station and how this is physically arranged on the machine.
  - The user must perform a risk assessment in accordance with ISO 12100.
  - The entire system/machine must undergo validation in accordance with the applicable standards on the basis of this.
  - The module contains electro-mechanical relays. Therefore this indicated performance level and this MTTF<sub>D</sub> value depend on the load and on the operating cycles in the application. The above mentioned performance level and MTTF<sub>D</sub> values are suitable for nominal load and maximum 8,760 switching cycles per year or for small load and maximum 525,600 switching cycles per year.

## 5 Parts Description and Definition of Terminals



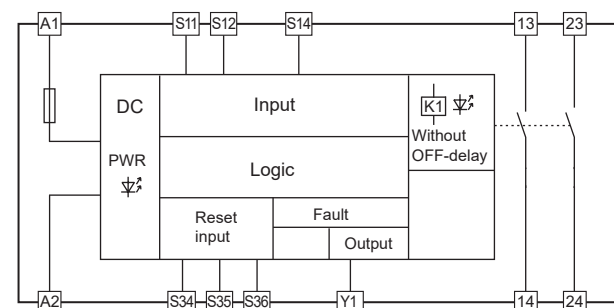
Parts No.	Parts Name and Functions
1	PWR LED: Power supply indicator
2	K1 LED: Indicator of Safety output(s) (or Auxiliary output) without OFF-delay
3	K2 LED: Indicator of Safety output with OFF-delay
4	Push-in terminal
5	DIN Rail mounting hook

Product Type letter	Number of Terminal	Name of Terminal	Function
S B D	A1, A2	Power supply	24V DC for power supply (A1: 24V DC, A2: 0V)
✓ ✓ ✓	S11	Input driver	24V DC output for Safety input, Reset inputs, Switch monitor input, and EDM input
✓ ✓ ✓	S12	Safety input	NC contacts of switches with a direct opening action mechanism (e.g. emergency stop switches or interlock switches) or other interlock switches (e.g. coded magnetic switches) shall be connected between S11 and S12.
✓ ✓	S13	Switch monitor input	NO contacts of interlock switches (e.g. coded magnetic switches) shall be connected between S11 and S13. In case of no use, S13 shall be opened.
✓ ✓ ✓	S14	EDM input	NC contacts of external contactors shall be connected between S11 and S14.
✓ ✓	S15	Fault monitor input	Fault monitor output (Y1) of a previous module shall be connected. In case of no use, S15 shall be opened.
✓ ✓ ✓	S34	Manual reset input	A switch shall be connected between S11 and S34. Only a rising edge followed by a falling edge triggers the reset event.
✓ ✓ ✓	S35	Auto reset input	A switch shall be connected between S11 and S35, or S11 and S35 shall be bridged. A rising edge triggers the reset event.
✓ ✓ ✓	S36	Fault reset input	A switch shall be connected between S11 and S36. Only a rising edge followed by a falling edge triggers the fault reset event. When the fault reset event is triggered after a failure is cleared, the fault detection output (Y2) comes ON from OFF and the fault monitor output (Y1) comes OFF from ON.
✓ ✓	13 - 14	Safety output 1 Without OFF-delay Auxiliary output 1 Without OFF-delay	The contact configuration is NO. The contact is a part of the force guided relay (K1) contained in HR5S.
✓ ✓	23 - 24	Safety output 2 Without OFF-delay	The contact configuration is NO. The contact is a part of the force guided relay (K1) contained in HR5S.
✓ ✓	37 - 38	Safety output 2 With OFF-delay	The contact configuration is NO. The contact is a part of the force guided relay (K2) contained in HR5S.
✓ ✓ ✓	Y1	Fault monitor output	The output is kept on high level (Typ. 24VDC) when the module detects a fault. (Semiconductor output)
✓ ✓	Y2	Fault detection output	The output is kept on low level (Typ. 0V) when the module detects a fault. (Semiconductor output)

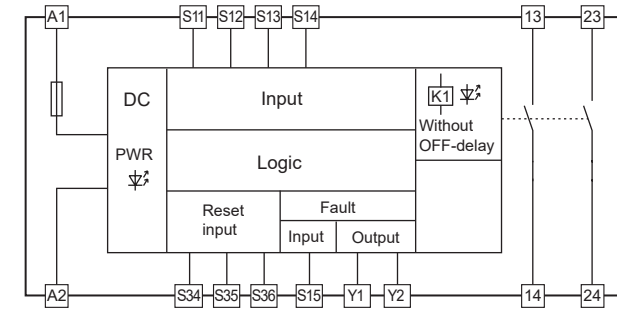
## 6 Block Diagram

\* K1 and K2 are the force guided relays contained in the module.

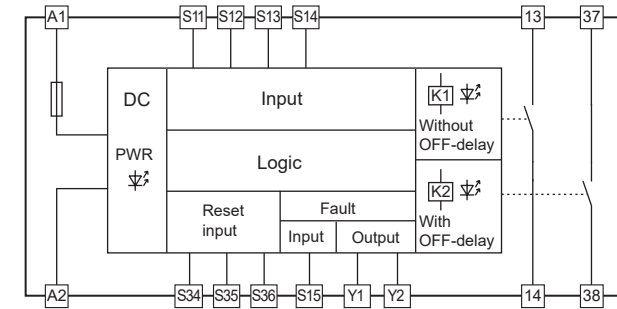
• HR5S-C2S



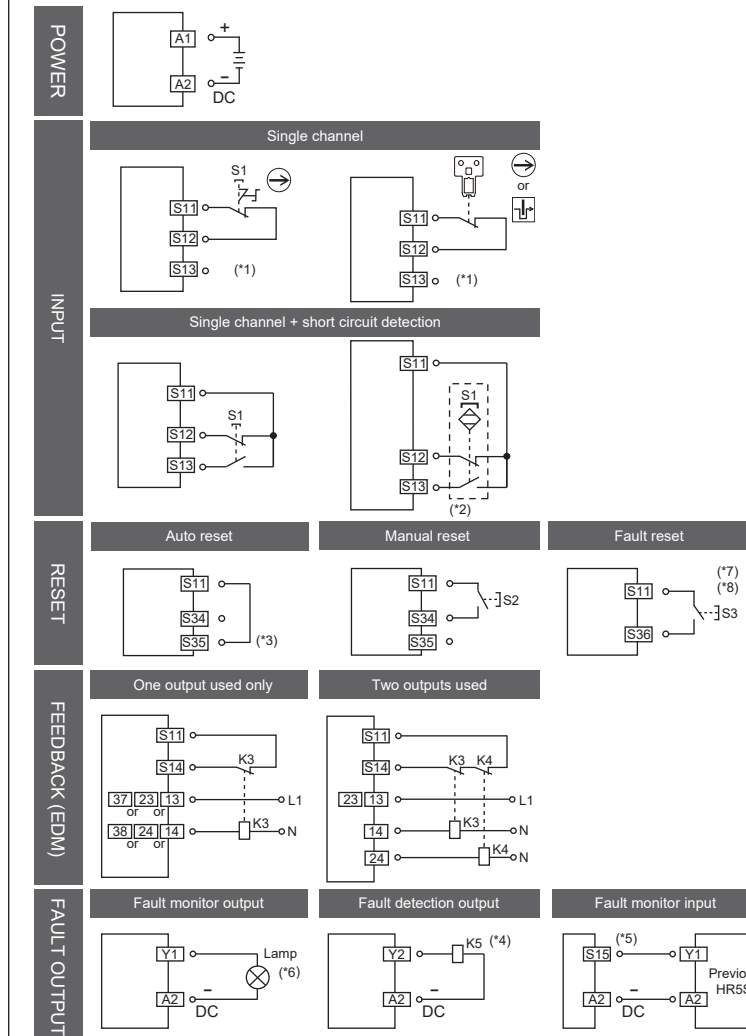
• HR5S-C2B



• HR5S-C2D-T\*\*\*



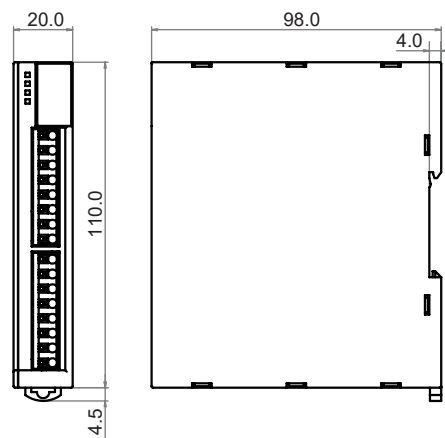
## 7 Wiring Examples



- \*1) When the switch monitor input (S13) is not used, it is necessary to exclude a short circuit between the cable of safety input (S12) and other cables (e.g. to protect the cables and/or to shield the cables).
- \*2) Illustrates contact status when actuator exists.
- \*3) When the auto reset input (S35) is used, it is necessary to perform risk assessment to prevent an unexpected activation and the manual reset input (S34) must not be used.
- \*4) The fault detection output (Y2) goes OFF when a fault is detected, i.e. it is possible for K5 (e.g. a contactor) to stop the hazard source (e.g. a motor).
- \*5) The fault monitor input (S15) can be connected to the fault monitor output (Y1) of previous module (HR5S), i.e. it is possible to combine their fault outputs.
- \*6) The fault monitor output (Y1) goes ON when a fault is detected, i.e. it is possible to provide a warning (e.g. a lamp). Leakage currents of the fault output may cause the LED lamp to illuminate dimly even when the output is off. In this case, insert a shunt resistor with the LED lamp.
- \*7) S36 does not require wiring when fault reset is performed by turning on the power again.
- \*8) Manual reset switch S2 can be used as a fault reset switch S3. When doing so, be sure to perform risk assessment.

## 8 Dimensions

98.0mm x 110.0mm x 20.0mm (Weight : Approx. 150g (OFF-delay type))



## 9 Installation and Wirings

### Installation to DIN rail

Mount this module on 35mm DIN rails. This module is designed for installation within an enclosure. Do not install this module outside an enclosure. Install the module in enclosure rated IP54 or higher. For DIN rails, use a mounting clip to prevent the module from falling off. IDEC's mounting clip (BNL6) can be used.

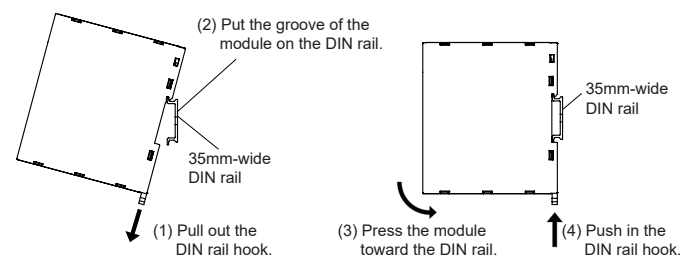


Fig. Mounting

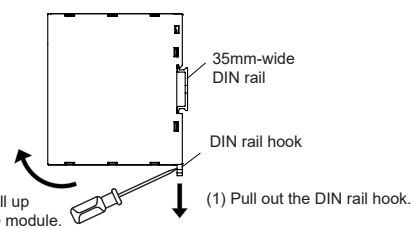


Fig. Removing

### Direct Mounting on Panel Surface

Pull out the DIN rail hook on the back of the module and insert the direct mounting hook (HR5S-PSP) into the slot. Attach the module to the mounting plate using the screw holes. Attach the module to the mounting plate using M4 screws, as shown below, or make 5 to 6mm mounting holes and secure the module using M4 pan head screws. Always give sufficient consideration to operability, ease-of-maintenance, and environmental resistance when deciding on the mounting position.

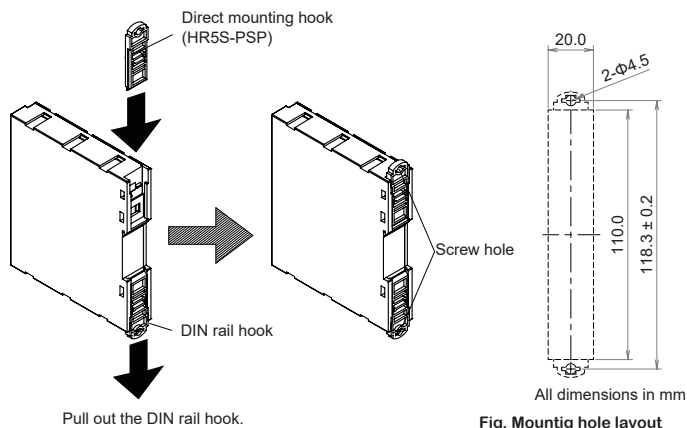


Fig. Mounting hole layout

### Wiring

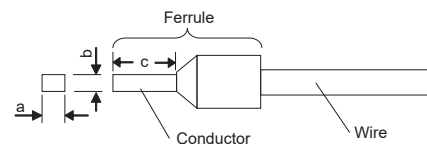
Use the following to wire to HR5S

- Solid wire : 24 AWG to 16 AWG (0.2 to 1.5 mm<sup>2</sup>)
- Stranded wire / Flexible wire : 24 AWG to 18 AWG (0.25 to 0.75 mm<sup>2</sup>)
- Strip the cover of wire : 7 to 9 mm

Use cables conforming to the applicable standards.

When using stranded wire, insulated ferrule should be used. Use below insulated ferrule.

- Insulated ferrule : 24 AWG to 18 AWG (0.25 to 0.75mm<sup>2</sup>)
- Crimp Width (a) : 2.1 mm max.
- Height (b) : 1.48 mm max.
- Conductor length (c) : 7 to 9 mm

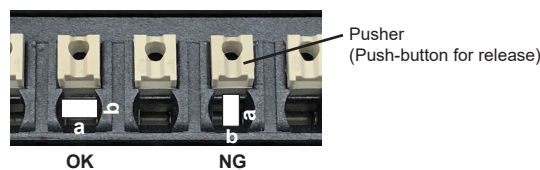


## Recommended ferrules

Applicable cable	Model number (order number)			
mm <sup>2</sup>	AWG	IEEC	PHOENIX CONTACT	
0.25	24	S3TL-H025-12WJ	H0,25/12 HBL (9025760000)	AI 0,25-8YE
0.34	22	S3TL-H034-12WT	H0,34/12 TK (9025770000)	AI 0,34-8TQ
0.5	20	S3TL-H05-14WA	H0,5/14 OR (0690700000)	AI 0,5-8WH
0.75	18	S3TL-H075-14WW	H0,75/14 W (0462900000)	AI 0,75-8GY

### How to insert solid wire and insulated ferrule

The stripped solid wire or stranded wire with insulated ferrule is simply plugged into the contact point. So no tools are required for the wire connection. After inserting, make sure wire is fastened on to push-in terminal.



### How to release wire

Use a screwdriver (e.g. a slotted head screwdriver) to release wire from Push-in terminal. And when releasing wire, the power source should be disconnected.

- Push the push-button with a force of about 20 N by a driver.
- Pull out the wire straight while the push-button is pushed.

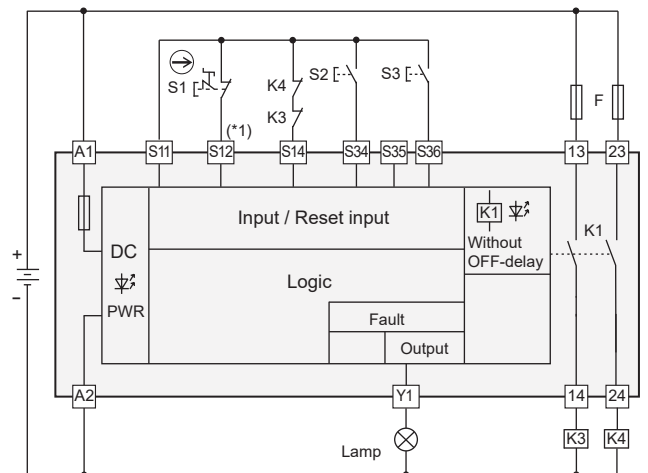
Push-in terminal may be damaged.

- Not push the push-button by a force of 40 N and over.
- Not Pull out the wire without pushing the push-button.

## 10 Wiring Diagram (Typical application)

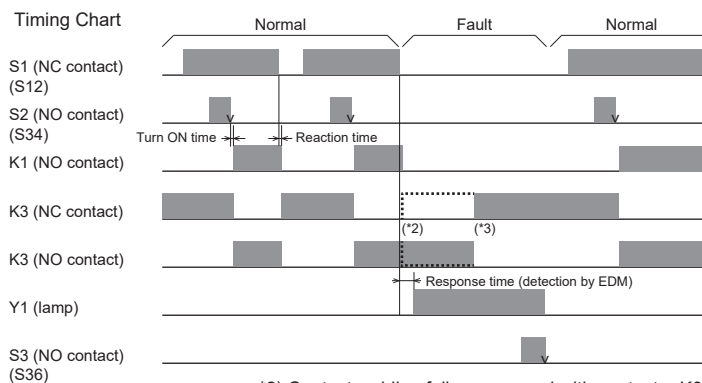
HR5S-C2S : The maximum achievable PL is "c".

(In the figure below, the manual reset input (S34) is used.)



S1 : Emergency stop switch  
 S2 : Reset switch for start  
 S3 : Reset switch for a fault  
 K1 : Force guided relay contained in the module  
 K3, K4 : Contactor  
 M1, M2 : Motor  
 F : External fuse

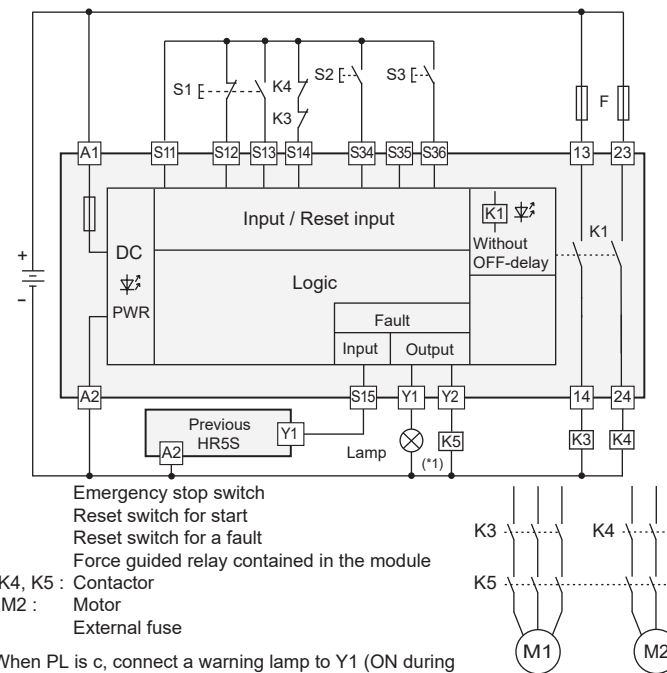
\*1) It is necessary to exclude a short circuit between the cable of safety input (S12) and other cables (e.g. to protect the cables and/or to shield the cables).



\*2) Contact welding failure occurred with contactor K3.  
 \*3) Failure removed.

HR5S-C2B : The maximum achievable PL is "d".

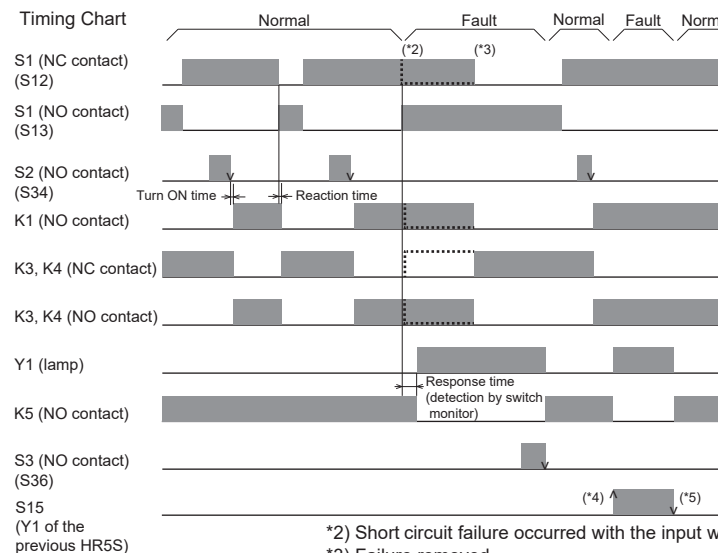
(In the figure below, the manual reset input (S34) is used.)



S1 : Emergency stop switch  
 S2 : Reset switch for start  
 S3 : Reset switch for a fault  
 K1 : Force guided relay contained in the module  
 K3, K4, K5 : Contactor  
 M1, M2 : Motor  
 F : External fuse

\*1) When PL is c, connect a warning lamp to Y1 (ON during fault detection).

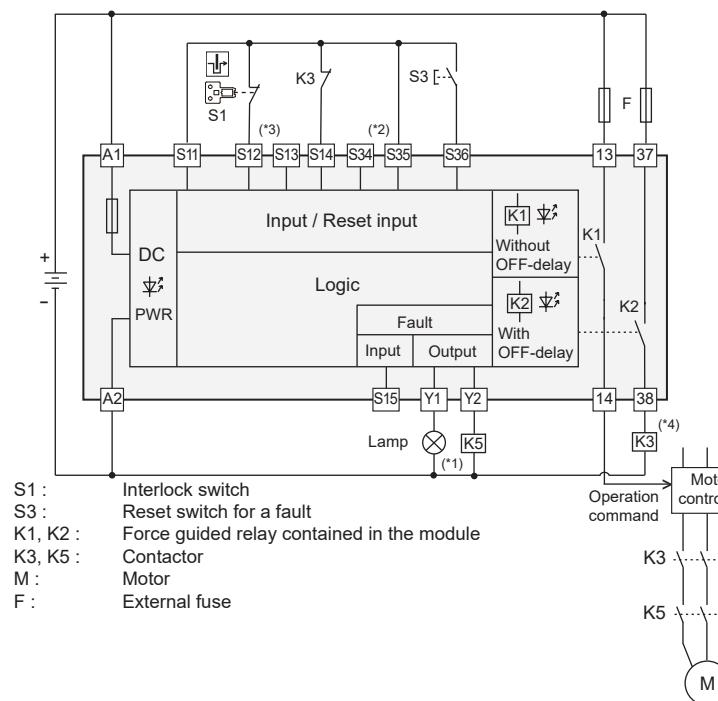
When PL is d, connect a contactor K5 to shut power of the hazardous source to Y2 (OFF during fault detection).



\*2) Short circuit failure occurred with the input wire.  
 \*3) Failure removed.  
 \*4) Failure occurred with the previous HR5S  
 \*5) Failure removed from the previous HR5S

HR5S-C2D-T\*\*\* : The maximum achievable PL is "d".

(In the figure below, the auto reset input (S35) is used.)



S1 : Interlock switch  
 S3 : Reset switch for a fault  
 K1, K2 : Force guided relay contained in the module  
 K3, K5 : Contactor  
 M : Motor  
 F : External fuse

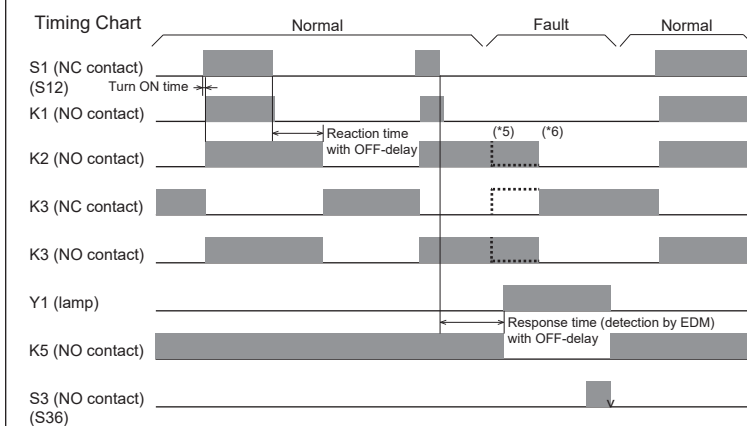
\*1) When PL is c, connect a warning lamp to Y1 (ON during fault detection).

When PL is d, connect a contactor K5 to shut power of the hazardous source to Y2 (OFF during fault detection).

\*2) When the auto reset input (S35) is used, it is necessary to perform risk assessment to prevent an unexpected activation.

\*3) When the switch monitor input (S13) is not used, it is necessary to exclude a short circuit between the cable of safety input (S12) and other cables (e.g. to protect the cables and/or to shield the cables).

\*4) "Stop category 1" of IEC 60204-1 is corresponding to "SS1-1" of IEC 61800-5-2.



\*5) Contact welding failure occurred with the internal relay K2.  
 \*6) Failure removed.

## 11 Troubleshooting

The module has the fault monitor output (and the fault detection output). The fault monitor output (Y1) goes ON (and the fault detection output (Y2) goes OFF) when a fault is detected. In this case, make sure nothing is a short circuit and a contact welding. The module can restart if a failure is cleared, and then check the safety function of this module. If the module is unable to resume the normal operation, contact the distributor or sales representative for support. The year of manufacture can be seen on the module.

## 12 Declaration of conformity

### EU declaration of conformity

Identification of the Product : Safety Relay Module  
 Name and address of Manufacturer : IDEC CORPORATION  
 2-6-64 Nishimiyahara, Yodogawa-ku, Osaka 532-0004 Japan

Name and address of the authorized representative and authorized to compile the technical file : APEM SAS  
 55, Avenue Edouard Herriot BP1,  
 82303 Caussade Cedex, France

This declaration of conformity is issued under the sole responsibility of the manufacturer.

Object of the declaration : Series Name - HR5S Series  
 Model No. - HR5S-C2S, HR5S-C2B, HR5S-C2D-T025, HR5S-C2D-T050, HR5S-C2D-T100,  
 HR5S-C2D-T200, HR5S-C2D-T400

The object of the declaration described above is in conformity with the relevant EU harmonization legislation : 2014/30/EU Electromagnetic Compatibility Directive  
 2006/42/EC Machinery Directive

2011/65/EU and (EU)2015/863 RoHS Directive  
 Applied Union harmonized legislation and references to the relevant harmonization standards used or references the other technical specifications in relation to which conformity is declared.  
 EN 60947-5-1:2017+AC:2020, EN ISO 13849-1:2023, EN ISO 13849-2:2012, EN IEC 63000:2018

Where applicable, the notified body : TÜV Rheinland Industrie Service GmbH (NB No.0035)  
 Am Grauen Stein 51105 Köln Germany  
 Additional Information : TÜV Rheinland Certificate No. 01/205/5739.01/24

**IDEC CORPORATION**

<http://www.idec.com>

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