

INSTRUCTION SHEET (original)

SAFETY RELAY MODULE

HR2S Series (HR2S-301P (Ver.2), HR2S-301N (ver.2))

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.

NOTE

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SAFETY PRECAUTION

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

- For safe operation, be sure to turn off the power supply of the module before wiring or installation.
- Use within the specified voltage. Do not use power supplies that produce high ripple voltage or abnormal voltage.
- Do not use the module with an electrical load that exceeds the switching capacity.
- Do not use the module in places where inflammable or explosive gases exist. Otherwise, fire or explosion may occur due to switching of contacts.
- The module is designed for use in typical machinery manufacturing facilities. This module shall not be used for nuclear controls, train, aeronautics, automobiles, engines, medical, or entertainment devices or facilities.
- This module doesn't have TÜV SÜD certificate for EN/IEC 61496-1: 2013.
- Leave spaces of more than 5 mm from the sides of the module when an electricity of 3 A or more is continuously applied to the relay contact.
- Leave spaces of more than 5 mm from the sides of the module when an electricity of 3 A or more is continuously applied to the relay contact.

CAUTION

- The category of the control system (hereinafter called category) is determined with the entire control system.
- Determination of category and performance level for the control system (design of the safety-related parts of the control system) must be performed by safety experts.
- This module is classified as overvoltage category III. Make sure to take appropriate measures when designing the control system.
- Life of the module depends on conditions such as switching and electrical loads. Before operation, be sure to test under actual conditions and within the switching capacity.
- Use this module in a completely sealed control panel. Also, leave spaces of more than 5 mm from the top and the bottom of the module.
- The performance may be decreased when used in an environment where density of dust, cutting oil, and an organic solvent, are comparatively high. Contact IDEC for details.
- Resettable fuse is installed in the control circuit for prevention of over current. If the switch is activated, turn off the module. When the problem is resolved, turn on the power again.

WARRANTY

- Before using this module, make sure that the sealing sheet is affixed on the main body.
- Modules without a sealing sheet are excluded from the scope of warranty.
- Modules that have been dropped, damaged, or disassembled are excluded from the scope of warranty.

1 Scope

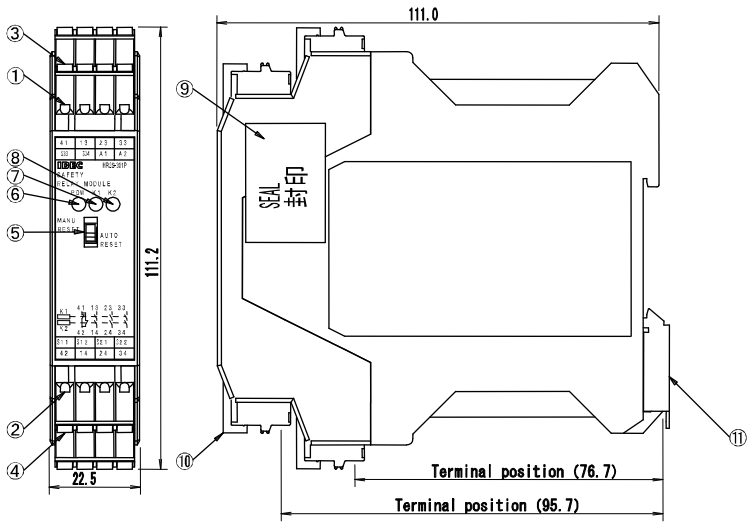
This specification applies to HR2S of the safety relay modules.
Subject model types: HR2S-301P (Ver.2), HR2S-301N (Ver.2)

2 Outline

- This safety relay module satisfies Category 3 or 4, Performance Level e according to EN ISO 13849-1:2008.
- Two types can be selected according to difference of safety input.
- However, in some cases, Category 3 or 4 or Performance Level e cannot be satisfied depending on the circuit where the module is used. See Section 9 for details, and make sure that required safety level is achieved before using of this module.
- Automatic reset (AUTO) and Manual reset (MANU) modes can be selected by switching the AUTO/MANU switch on the front of the module.
- "AUTO" starts immediately when safety input and start / off-check (reset) input are closed. (No monitoring of start switch)
- "MANU" starts when safety input and start / off-check (reset) input are closed and then safety input and start / off-check (reset) input are opened. (With monitoring of start switch)
- Set up the module according to use.
- After the switch is set, affix the supplied protective film to prevent from changing the setting.

3 Dimensions and Parts Description

3.1 Dimensions [mm]



3.2 Parts Description

Part No.	Parts Names and Functions
1	CN1: Power supply input, start / off-check input
2	CN2: Safety input (in 2 systems)
3	CN3: Safety output contact
4	CN4: Safety output contact
5	Switch: Select AUTO or MANU start mode
6	POW: Power supply LED
7	K1: ON-LED for safety output system 1
8	K2: ON-LED for safety output system 2
9	Sealing Sheet: 1 piece of sealing sheet is affixed on the side of the main body. Modules without sealing sheet are excluded from the scope of warranty.
10	Terminal Cover: To prevent falling off of terminals CN1 to CN4 and to make sure that the terminals are properly installed.
11	DIN Rail mounting bracket

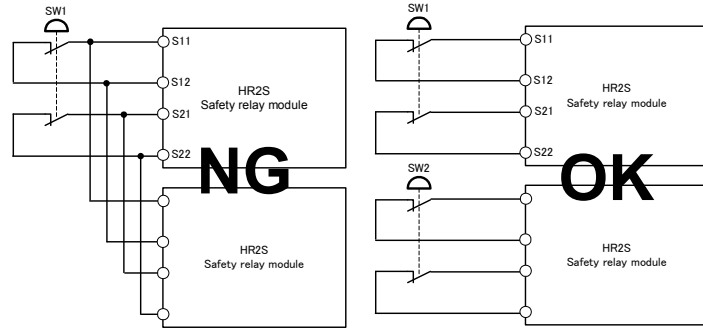
4 Installation and Wiring

4.1 Installation

Mount the module to the panel using DIN rail (35 mm wide). This module can be mounted in any direction. Install the module in a control panel with a protection degree of IP54 or more. For DIN rails, use a mounting clip to prevent the module from falling off. IDEC's mounting clip (BNL6) can be used

4.2 Wiring

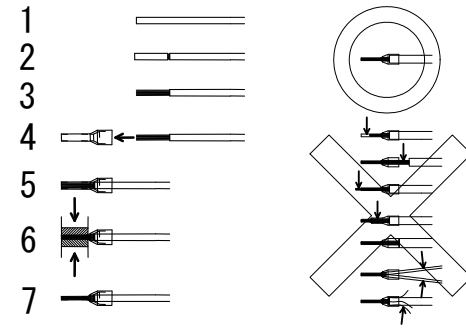
- Use wire size as specified as follows.
 - Stranded wire (flexible wire): 0.2 to 1.5 mm², AWG 24 to 16
 - Solid wire (steel wire): 0.2 to 1.5 mm², AWG 24 to 16
- Connect after terminating the stranded wire with ferrule (sleeve type). Use cables conforming to the applicable standards.
- Close the terminal cover after the wiring is complete.
- If the terminal cover does not close the connector may not be fully inserted. (*Before wiring, check that the electrical wires can be used without problems. Connect no voltage contacts to inputs S11 - S12 (S21 - S22).
- Precautions when using multiple HR2S modules. A single switch (see SW1 in the diagram below) cannot be connected to multiple inputs. Use switches with independent contacts. (Do not connect one safety device to multiple HR2S safety inputs in a parallel connection)



Note) Same for start / off-check input

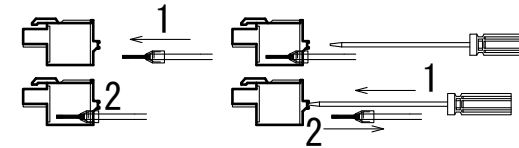
- Power supply terminal
Be sure to use a switching power supply that complies with EMC Directive and IEC 60950, and NEC CLASS2 for an external power supply. Inverse connection of the power supply may result in breakage.
- Sleeve type ferrule
Use crimping metal terminals with length of 8-10 mm.
Ref. MFR: Widemular
Type No.: H0.5/14, H0.5/16, H0.75/14, H0.75/16, H1/14, H1/16, H1.5/14, H1.5/16
MFR: PHOENIX CONTACT
Type No.: AIO.5-8, AIO.5-10, AIO.75-8, AIO.75-10, A11-8, A11-10, A11.5-8, A11.5-10

Wiring termination



Termination process/good example and bad example

Connecting the wiring with the terminal

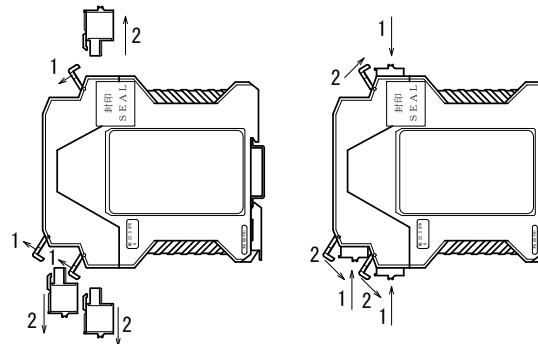


Connecting the wiring

Removing the wiring

Connecting the module and terminal

Close the terminal cover after the wiring is complete. If the terminal cover does not close, the terminal may not be fully inserted.



Removing the terminal

Connecting the terminal

4.3 Wiring length

The external wiring length of a safety input and start / off-check input is specified as follows. IDEC does not guarantee normal operation if wiring length other than specified is used. Safety input: Up to 50 m in total (wiring resistance: 5 ohm maximum) Start / off-check input: Up to 50 m in total (wiring resistance: 5 ohm maximum)

4.4 Maintenance

Replace with a new module when damaged.

5 Input / Output

Terminals	Markings	I/O Signals	Notes
CN1	A1	Power supply +24V DC input	
	A2	Power supply 0V input	
	S33	Start / off-check input	Use no voltage contact.
	S34		
CN2	S11	Safety input 1	Common side
	S12		
	S21	Safety input 2	Common side
	S22		
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 (Resistive load)
	23-24		
	33-34		

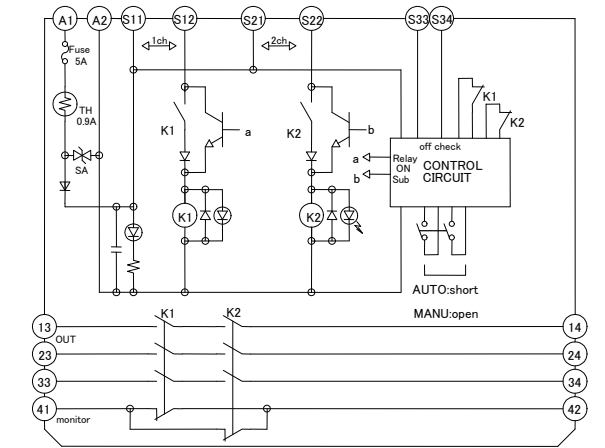
*NOTES

- Leave spaces of more than 5 mm from the side of the module when an electricity of 3A or more is continuously applied to relay contact.
- For CN1 and CN2 terminals, be careful of surges applied by other wiring. Damage may be caused.
- Safety output contact is limited according to standards. See Sub-clause 9.1 for details and Section 8 about the fuse.

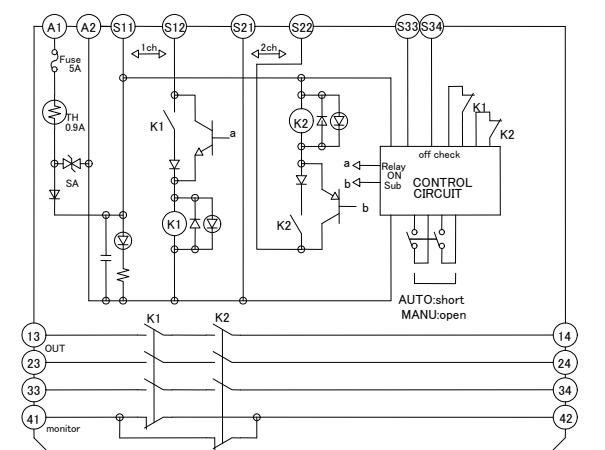
6 Wiring Diagram

6.1 Internal Circuit

HR2S-301P (Ver.2)

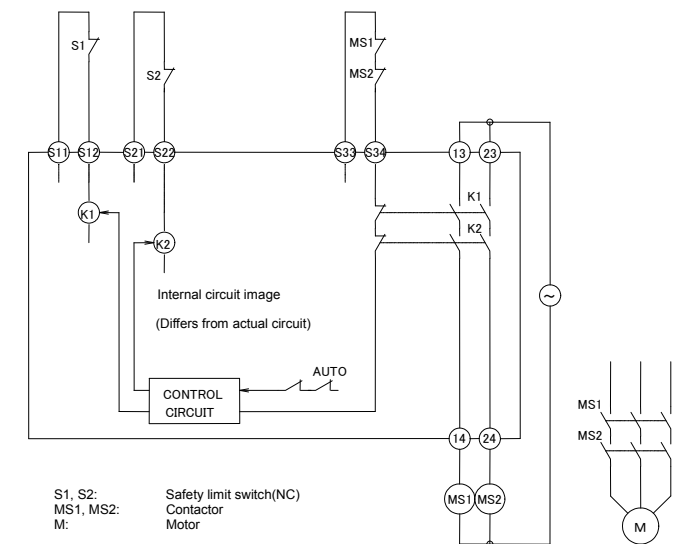


HR2S-301N (Ver.2)

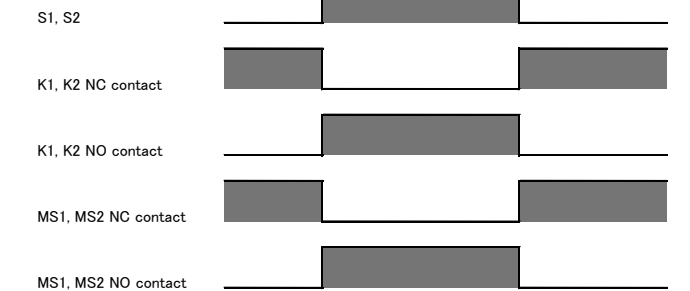


6.2 Wiring Diagram

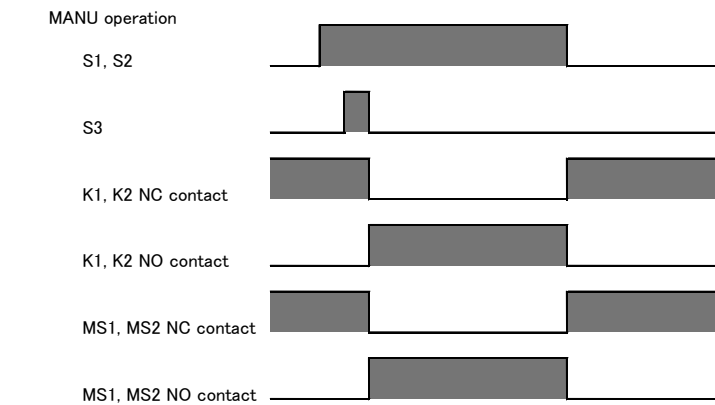
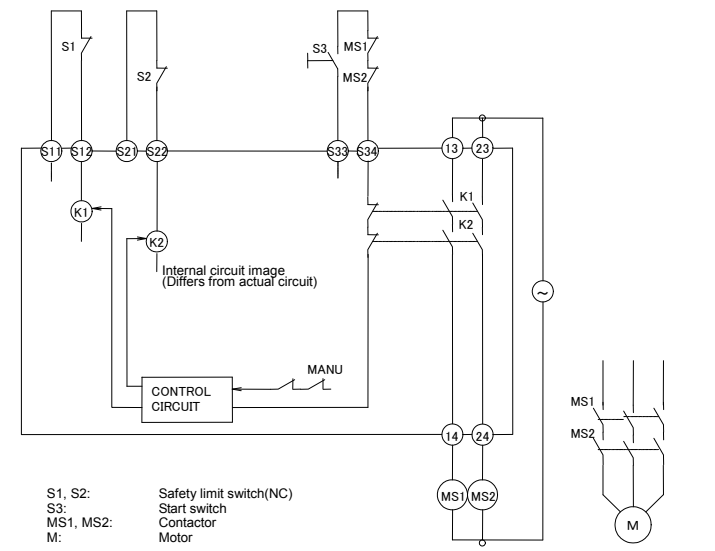
AUTO start mode



AUTO operation



MANU start mode



7 Connecting Control Devices

- Emergency stop switches: Use emergency stop switches that comply with EN/IEC 60947-5-1 or EN/IEC 60947-5-5 and have direct opening action mechanism.
- Interlock switches: Use interlock switches that comply with EN/IEC 60947-5-1 and have direct opening action mechanism.
- Electromagnetic switch: Use reliable electromagnetic switches that are force guided types. If a NC contact of electromagnetic switches without force guided contact is connected to start / off-check input, failure of electromagnetic switch contacts cannot be detected.
- Protection of contact output: For inductive load, it is recommended that users should provide a surge absorber to output contacts to prevent the contacts from welding.
- When an overvoltage larger than the value rated for output contact is expected, provide a fuse with output contact.
- When connecting other control devices: Use the device after verifying that it complies with the required category.

WARNING

Be sure to turn off the power before when switching between AUTO/MANU. Below are cautions for the start / off-check input. For the start / off-check input, use devices with back check functions (mirror contact). When using other than those specified, it may cause a hazardous situation by failure of combination with other failures.

AUTO mode:
It is forbidden to use the start switch. Otherwise, the contacts of the start switch may weld and may cause unexpected operation that could lead to hazards.

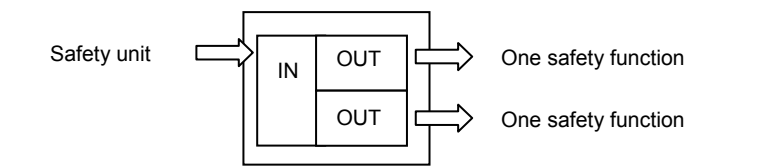
MANU mode:
When using the start switch, be sure to use NO (normally open) momentary type. Use reliable device for start switch. This safety relay module has internal circuit to block the start when start switch has malfunction. When this safety relay module is not started, remove the cause of short malfunction and replace the start switch.

8 Fuse

To satisfy category 4, use a fuse which limits the current to 3.6 A maximum. This fuse is not required if the short circuit current is less than 5 A. These measures prevent the contacts from welding. See EN 50156 and Sub-clause 9.1 for details.

9 Category, Stop Category and Performance Level

When applying EN ISO 13849-1:2008 to machinery, perform risk assessment of the machinery and make sure to achieve the Performance Level (PL) greater than the required Performance Level (PLr) for each safety function. (PLr ≤ PL)
Also, Stop Category is required for machinery, and its system must be arranged as to satisfy the required Stop Category.
The following section describes Category, Stop Category, Performance Level and notes.
Notes:
The following figures show the concept of this module.



9.1 Category
HR2S series can be used under environments Category 3 or 4 required by EN ISO 13849-1:2008. However, Category 3 or 4 may not be satisfied depending on conditions of use. The following table shows Category of each safety function according to safety input, safety contact output, and safety devices to be connected.

Type No.	Output type of the safety device connected to the safety input	Rating of safety output contact (A) Note 1	Available Category
HR2S-301P (Ver.2)	Contact output (safety output)	5 or less	3
HR2S-301N (Ver.2)	Contact output (safety output)	5 or less	3
		3.6 or less	4

Note 1) Protection by fuse according to EN 60159 is required.

9.2 Stop Category
HR2S-301P (Ver.2), HR2S-301N (Ver.2): Stop category 0
Emergency stop control according to Stop Category 0 defined in EN / IEC 60204-1 is feasible. However, Stop Category 0 may not be satisfied depending on conditions of use. Because the stop category is determined by control system take the connected safety equipment and wiring into consideration.

9.3 Performance Level
HR2S series satisfies Performance Level e according to EN ISO 13849-1: 2008. However Performance Level e may not be satisfied depending on conditions of use. Calculate the Performance Level of each safety function based on device used for safety input, device connected to output contacts, and HR2S (factors as shown below), and make sure that the satisfied Performance Level equals to or be better than the required Performance Level.

Calculation Data of Performance Level for the entire control system (machine)

Type No.	MTTFd	DCavg	CCF
HR2S-301P (Ver.2)/301N (Ver.2)	100 years min.	99%	88 points

Calculate the Performance Level per each safety function.

10 Specifications

10.1 Module Type

Type No.	Product type	Safety output contact	Monitor contact for safety output
HR2S-301P (Ver.2)	Safety relay module (Positive type)	3NO	1NC
HR2S-301N (Ver.2)	Safety relay module (Negative type)	3NO	1NC

NOTE:
Products fall into two categories depending on the wiring method. See Sub-clause 9.1 for details.

10.2 Specification

Type No.	HR2S-301P (Ver.2) /301N (Ver.2)			
Overvoltage Category	III (IEC 60664-1)			
Pollution Degree	2 (IEC 60664-1)			
Insulation	Basic insulation (Output contact circuits and an internal circuit have reinforced insulation)			
Rated Voltage	24V DC (Tolerance: -15% to +10%)			
Rated Current Consumption	80mA			
Rated Power Consumption	2.2W			
Category and Performance Level (According to EN ISO 13849-1:2008) (NOTE1)	Category 3 or 4, PL e			
Stop Category (According to EN / IEC 60204-1)	0			
Safety Output Contact	Configuration	3NO 1NC		
	Terminals: 13 to 14, 23 to 24, 33 to 34 (NO-Contact Output)	Rated Load (NOTE 2, 3, 9)	250V AC/30V DC (NOTE 10) (Resistive load)	
			EN60947-5-1 Table 4	AC15 240V AC, 2A, cosφ=0.3 DC13 24V DC, 1A, L/R=48ms
		Number of outputs	3 (NO-Contact Output)	
			Terminals: 41 to 42 (NC-Contact Output)	Rated load (NOTE 3)
	EN60947-5-1 Table 4	AC15 240V AC, 2A, cosφ=0.3 DC13 24V DC, 1A, L/R=48ms		
	Number of outputs	1 (NC-Contact Output)		
		Contact Resistance (initial value) (NOTE 4)		200mohm max.
	Turn On Time (NOTE 5)	50ms max.		
	Response Time (NOTE 5, 6)	20ms max.		
Insulation Resistance (NOTE 7)	100Mohm min.			
Dielectric Voltage	Outer case to internal circuit	3,750V AC, 1mA max., for 1 min		
	Between output electrodes	2,500V AC, 1mA max., for 1min		
	Between input-output			
	Between power supply output			
Overcurrent protection for control circuit	Resettable fuse installed (approx.0.9A) (NOTE 8)			
Overcurrent protection for output circuit	External installation (NOTE 9)			

Vibration resistance	10 to 55 Hz, 1 octave/min, 0.7 mmp-p X, Y and Z directions, 20 sweep 5 to 55 Hz, 30 m/s ² , 2h for each X, Y and Z direction
Bump	100 m/s ² , Pulse width 16 msec, 1,000 times for each X, Y and Z direction
Shock resistance	300 m/s ² , Pulse width 11 msec, 3 times for each X, Y and Z direction
Electrical Life	100,000 operations min.
Mechanical Life	5,000,000 operations min.
Durability Time for Connector Insertion/Pull out	10 times max.
Operating Temperature	-10 to 55°C, no freezing, non-condensing
Storage Temperature	-25 to 70°C, no freezing, non-condensing
Operating Humidity	30 to 85%RH, non-condensing
Storage Humidity	30 to 85%RH, non-condensing
Corrosion Immunity	Atmosphere free from corrosive gases
Altitude	Operation 0 to 2000m
Housing Material	PA 66-FR(UL94 V0)
Degree of Protection	IP20 for terminal block, IP40 for main body
Weight	200g max.

- NOTE1:** Use HR2S-301N (Ver.2) when using in Category 4. See Sub-clause 9.1.
NOTE2: Leave spaces of 5 mm at the sides of the module when an electricity of 3 A or more is continuously applied to relay contact.
NOTE3: Minimum applicable load is 24 V DC, 5mA (ref. value). Do not apply load that exceeds the specified load. Once a large load is applied, it may disable switching of contacts at small loads.
NOTE4: With voltage drop method at 5 or 6 V DC, 1A.
NOTE5: When measured at the rated voltage (at 20 °C). Excluding contact bounce time.
NOTE6: The interval between when safety input turns off and safety output contact turns off.
NOTE7: 500V DC megger, same measurement positions as the dielectric strength.
NOTE8: At operating temperature of 20 °C.
NOTE9: To prevent the safety output contact from overcurrent, use a fuse. See Section 8.
NOTE10: The maximum current at safety output contact is specified by standards for which certification was granted. See Sub-clause 9.1.

10.3 Applicable Standards and Declaration of Conformity

EC Declaration of Conformity

We hereby declare that the following our component conform with the essential health and safety requirement.

Product : HR2S Series Safety Relay Module
Model : HR2S-301P (Ver.2), HR2S-301N (Ver.2)
HR2S-332N-T075 (Ver.2), HR2S-332N-T15 (Ver.2), HR2S-332N-T30 (Ver.2)

The above product has been evaluated for conformity with Low Voltage Directive (2006/95/EC) and EMC directive (2004/108/EC) and Machinery Directive (2006/42/EC) by the following European standard.

Low Voltage Directive: EN 50178: 1997
EN 60204-1:2006/A1:2009
Machinery Directive: EN ISO 13849-1: 2008
EMC Directive: EN 61000-6-2: 2005
EN 55011:2009/A1:2010
EN 61326-3-1:2008

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October 2015

If you need the original EC declaration of conformity, please offer to our sales person or agency.

	Applicable Standards	Approval
UL Standard	UL508 Industrial Control Equipment	TÜV SÜD NRTL
CSA Standard	CAN/CSA C22.2 No.14 Industrial Control Equipment	

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