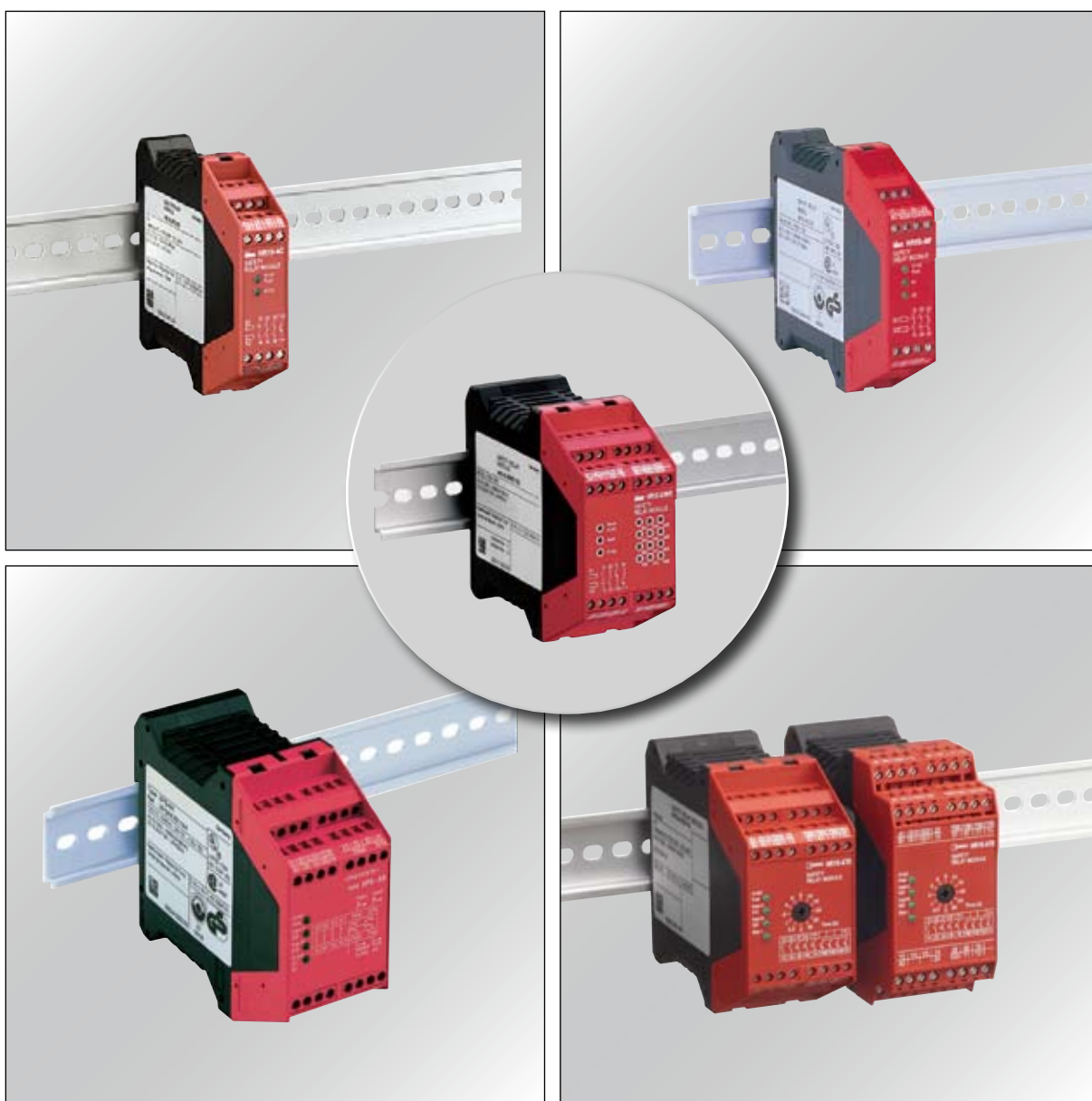


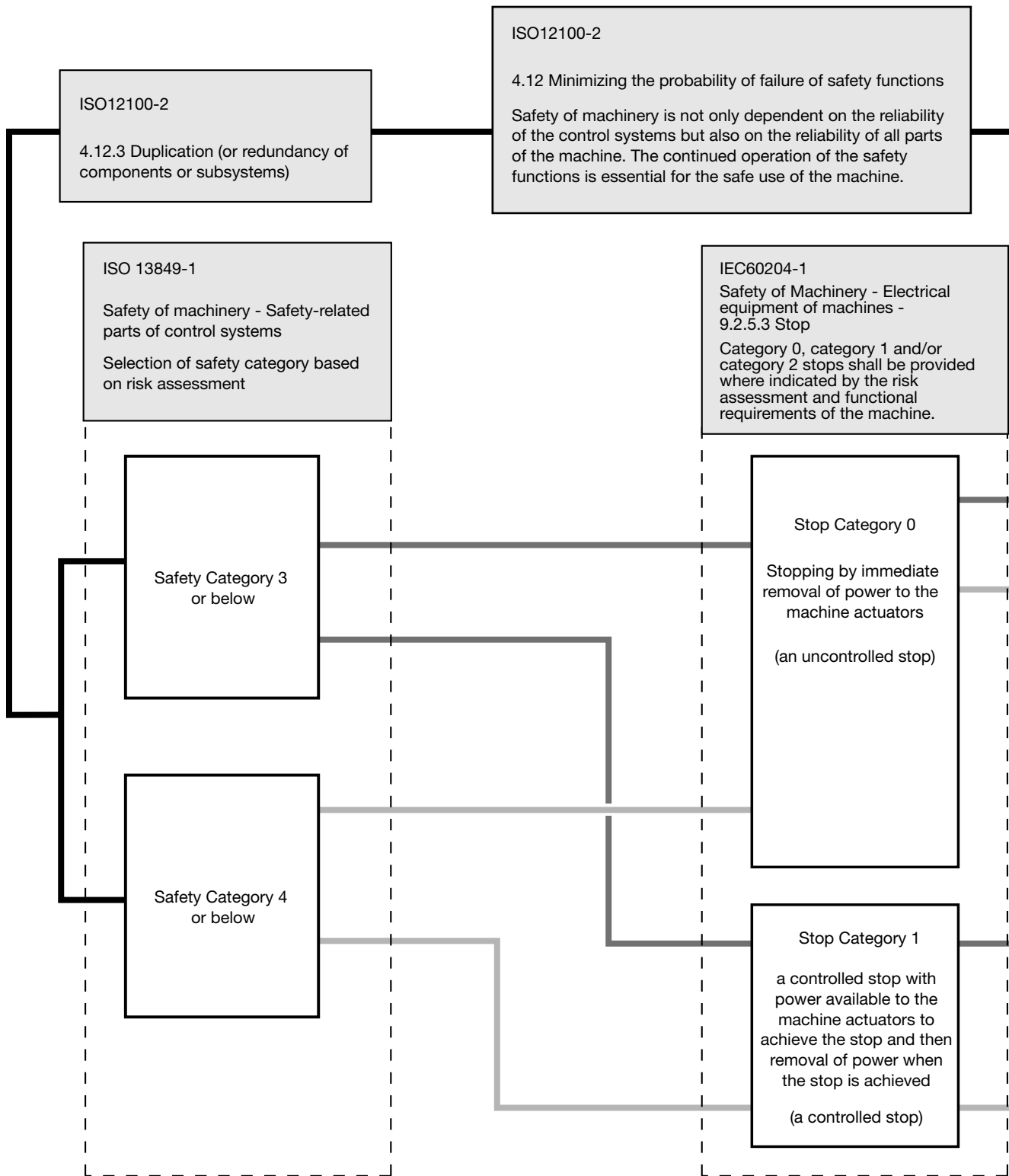
# HR1S

## Safety Relay Modules



# Safety Relay Module Selection Chart

## ISO / IEC Standards and Safety Relay Modules



# Safety Relay Module Selection Chart

ISO12100-2

4.11.6 Use of automatic monitoring

ISO12100-2

4.11.4 Restart after power interruption

ISO12100-2

Safety of machinery — Basic concepts, general principles for design —

4.11 Applying inherently safe design measures to control system

In order to prevent hazardous machine behaviour and to achieve safety functions, the design of control systems shall comply with the principles and methods presented in this subclause 4.11 and in 4.12. (see ISO 13849-1 and IEC 60204-1:1997)

## Safety Equipment for Use

- Emergency Stop Switch
- Interlock Switch
- Interlock Switch with Solenoid
- Enabling Switch

- Emergency Stop Switch
- Interlock Switch
- Interlock Switch with Solenoid

- Enabling Switch











- Light Curtain

- Non-contact Interlock Switch







- Emergency Stop Switch
- Interlock Switch
- Interlock Switch with Solenoid

- Emergency Stop Switch
- Interlock Switch
- Interlock Switch with Solenoid

## HR1S series

Model & Shape	Applicable Standards	Mark	Page
<b>HR1S-AC</b>  Output: 3NO Tr 1NO Width: 22.5 mm	EN ISO 13849-1:2008 EN 62061:2005 EN 60204-1:2006 EN ISO 13850:2008 UL508 CSA C22.2 No.14		4
<b>HR1S-AF</b>  Output: 3NO Width: 22.5 mm	EN ISO 13849-1:2008 EN 62061:2005 EN 60204-1:2006 EN ISO 13850:2008 UL508 CSA C22.2 No.14		8
<b>HR1S-AK</b>  Output: 3NO+1NC Tr 4NO Width: 45.0 mm	EN ISO 13849-1:2008 EN 62061:2005 EN 60204-1:2006 EN ISO 13850:2008 UL508 CSA C22.2 No.14		11
<b>HR1S-DMB/DME</b>  Output: 2NO Tr 2NO Width: 22.5 mm (DMB) 45.0 mm (DME)	EN ISO 13849-1:2008 EN 62061:2005 UL 508 CSA C22.2 No.14		16
<b>HR1S-ATE</b>  Output: safety output 2NO off-delay 3NO Tr 4NO Width: 45.0 mm (DME)	EN ISO 13849-1:2008 EN 62061:2005 EN 60204-1:2006 EN ISO 13850:2007 UL 508 CSA C22.2 No.14		20

## HR2S series

<b>HR2S-301P</b>  Output: 3NO+1NC Width: 22.5 mm	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		Cat No. EP-1319
<b>HR2S-301N</b>  Output: 3NO+1NC Width: 22.5 mm	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		Cat No. EP-1319
<b>HR2S-332N-T</b>  Output: safety output 3NO time-delay output 3NO auxiliary contact 2NC Width: 45.0 mm	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		Cat No. EP-1319

# HR1S-AC Safety Relay Modules

## Transistor output provided.

- Removable terminal block (HR1S-AC5121P) allows for easy module replacement.
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED indicator.
- Finger-safe protection
- 35-mm-wide DIN rail mounting
- EN, IEC compliant.
- TÜV NORD approved.
- UL listed, CSA approved.

Part No.	Voltage	Terminal Style
HR1S-AC5121	24V AC, -20 to +10% 50/60 Hz	Integrated Terminal Block
HR1S-AC5121P	24V DC, ±20%	Removable Terminal Block

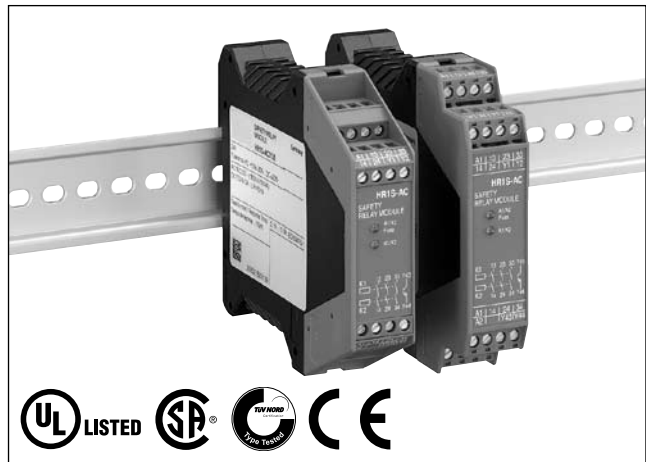
## Specifications

Operating Temperature	-10 to +55°C (no freezing)	
Degree of Protection	Terminal: IP20, Housing: IP40	
Rated 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	
Applicable Performance Level (PL)	e (EN ISO 13849-1)	
Safety Category	3 (EN 954-1)	
Safety Integrity Level (SIL)	3 (EN 62061)	
Response Time	100 ms maximum	
Input Synchronization Time	Unlimited	
Overvoltage Category	III	
Pollution Degree	2	
Rated Insulation Voltage	300V	
No. of Outputs	Safety Circuit	3NO
	Time-delay Circuit	—
	Auxiliary Circuit	Contact Transistor 1NO (transistor)
Output Contact Ratings	Safety Circuit	AC-15 C300: $U_e = 230V AC / I_e = 0.75A$ DC-13 24V/2A: $U_e = 24V DC / I_e = 2A$
	Time-delay Circuit	AC-15 — DC-13 —
	Auxiliary Circuit	AC-15 — DC-13 —
	Transistor Circuit	24V/20mA
	Minimum Applicable Load	17V/10 mA (initial value)
	Operating Frequency	1200 operations/h maximum
Mechanical Durability	10,000,000 operations minimum	
Rated Current	Safety circuit output total: 10.5A maximum	
Wire Size	HR1S-AC5121: 1 × 2.5mm <sup>2</sup> , 2 × 0.75mm <sup>2</sup> maximum HR1S-AC5121P: 1 × 2.5mm <sup>2</sup> , 2 × 1.5mm <sup>2</sup> maximum	
Weight (approx.)	160g	

- 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.

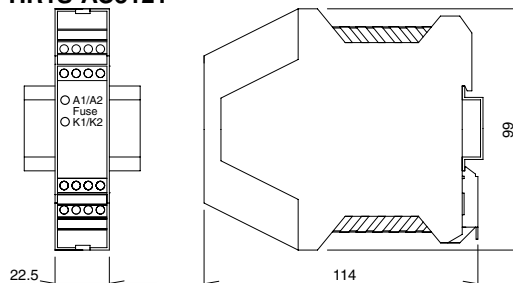
## LED Indicator

- 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.

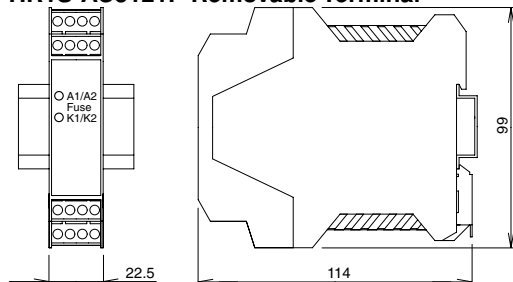


## Dimensions

### HR1S-AC5121

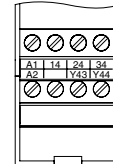
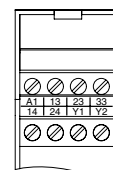


### HR1S-AC5121P Removable Terminal

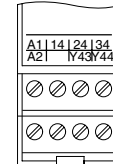
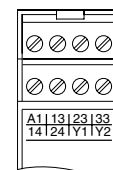


All dimensions in mm.

## Terminal Arrangement

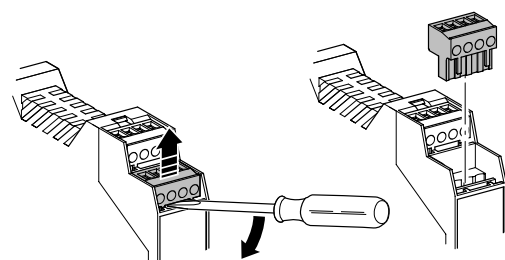


HR1S-AC5121



HR1S-AC5121P

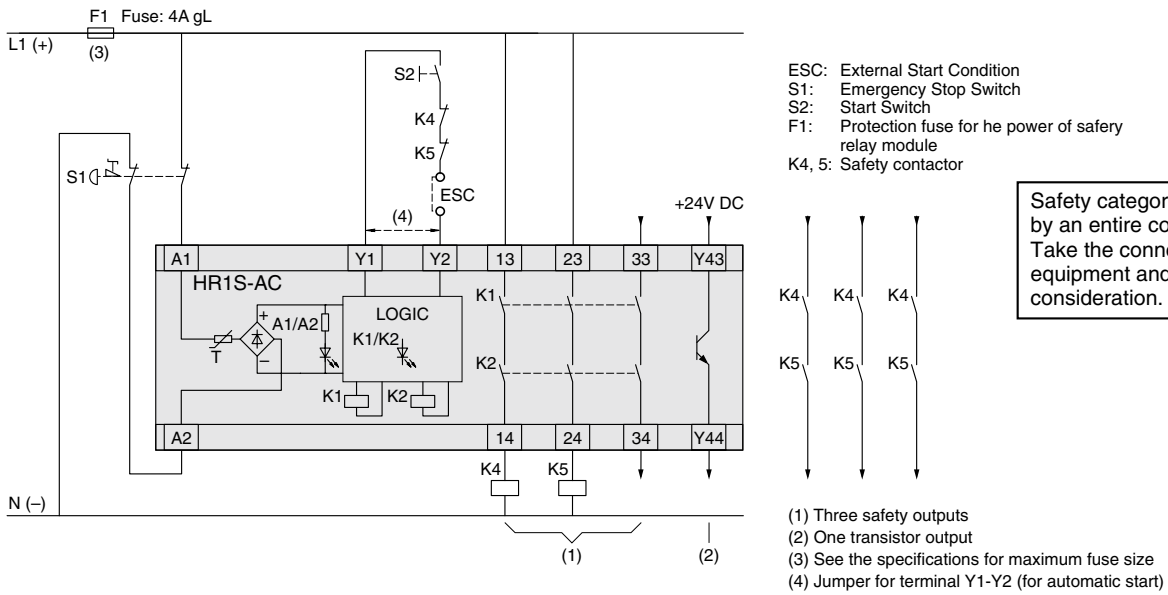
- The terminal block of the HR1S-AC5121P can be removed and installed as shown below, allowing for easy installation and replacement of modules.



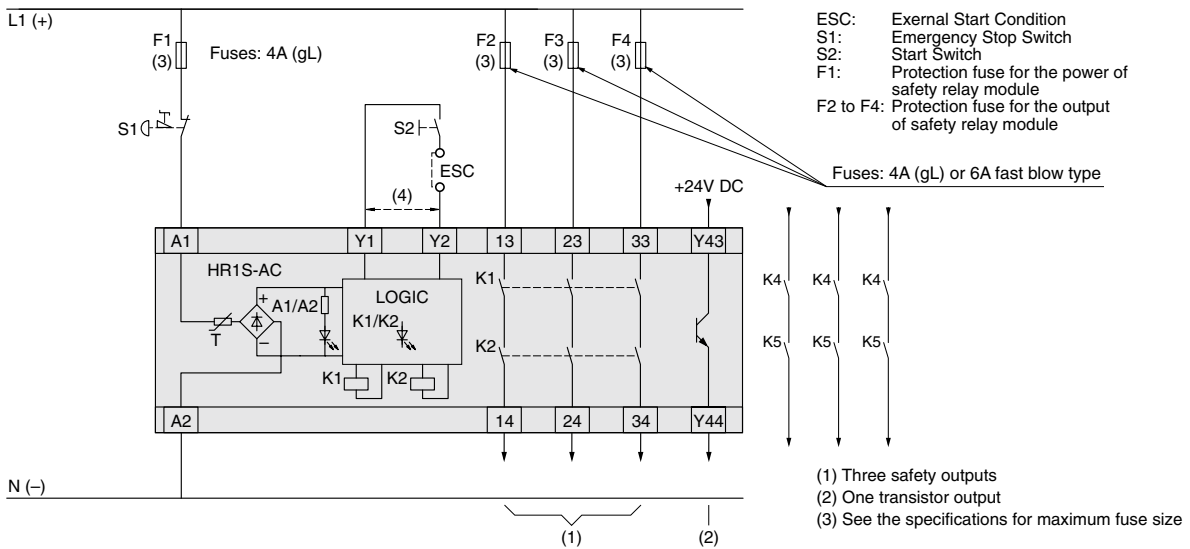
# HR1S-AC Safety Relay Modules

## Wiring Diagram

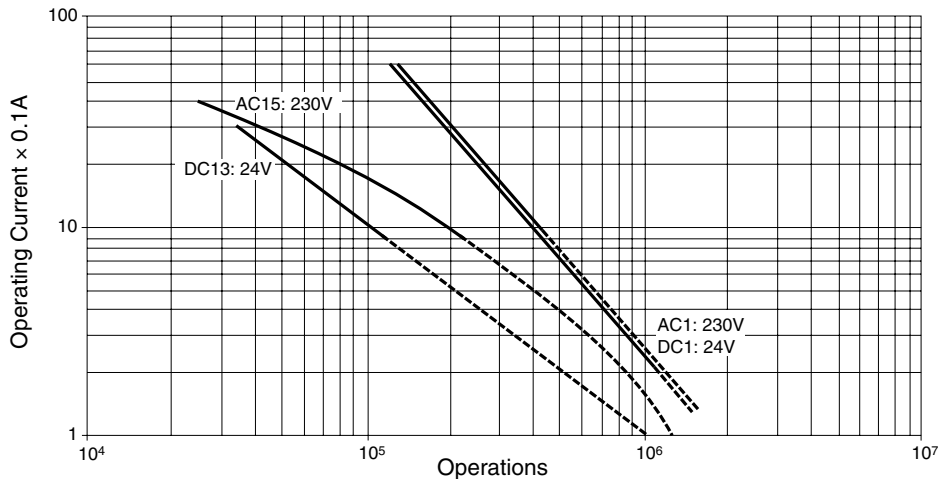
### Safety Category 3 Circuit (using an emergency stop switch with 2NC contacts)



### Safety Category 1 Circuit (using an emergency stop switch with 1NC contact)



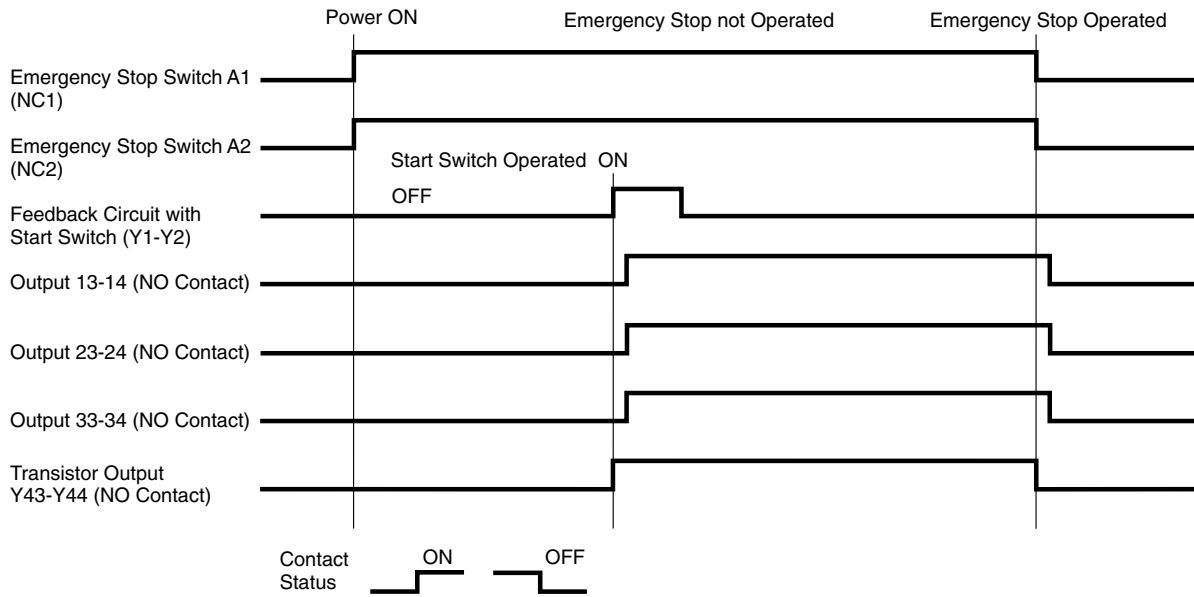
## Output Contact Electrical Life



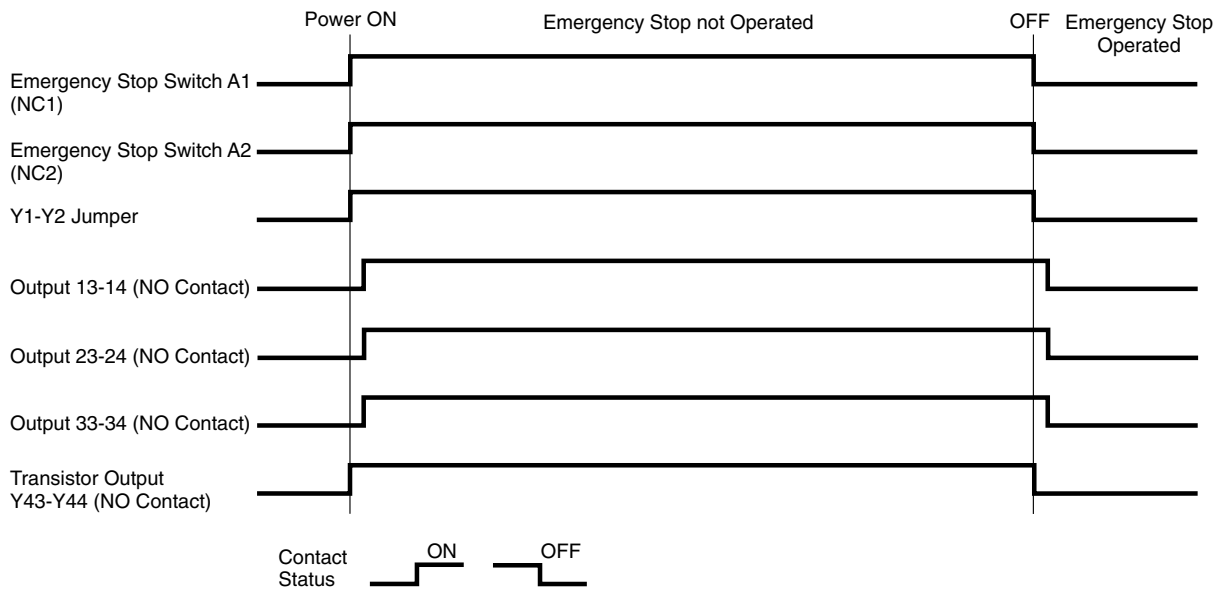
# HR1S-AC Safety Relay Modules

## Operation Chart

### When Using a Start Switch



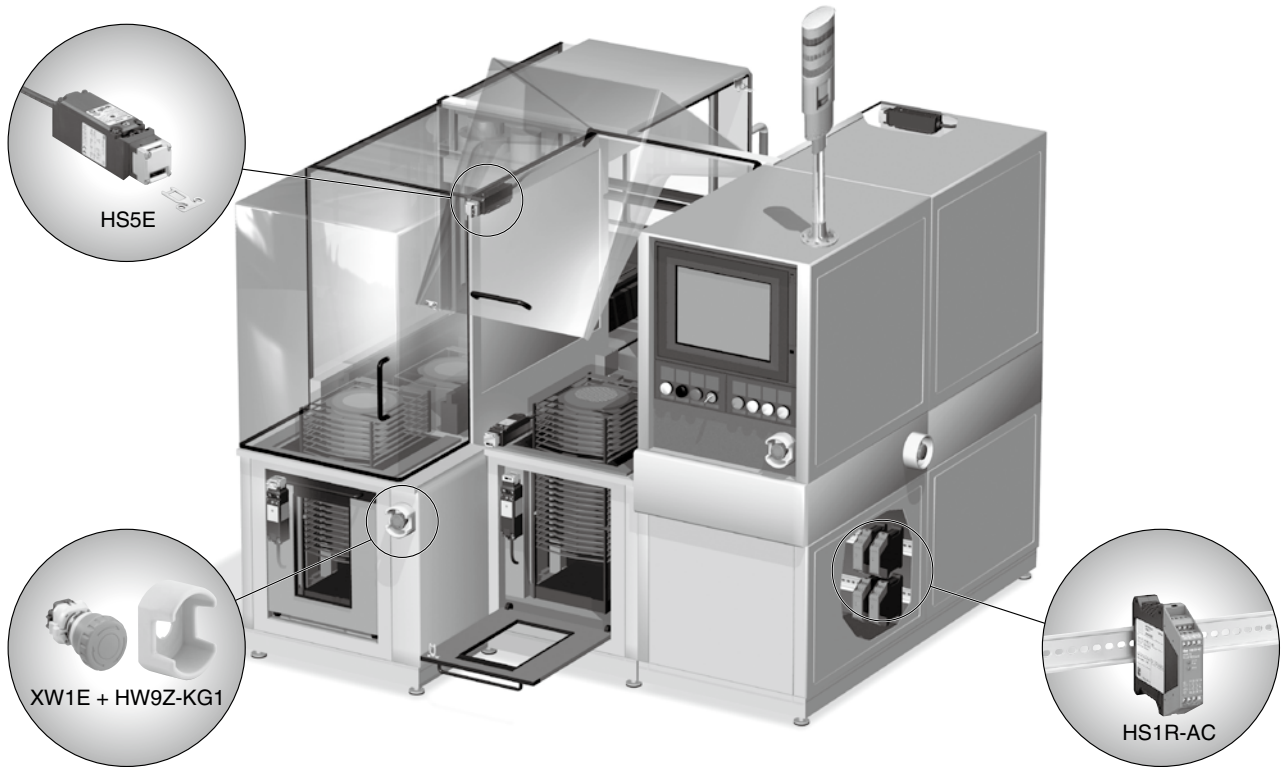
### When not Using the Start Switch



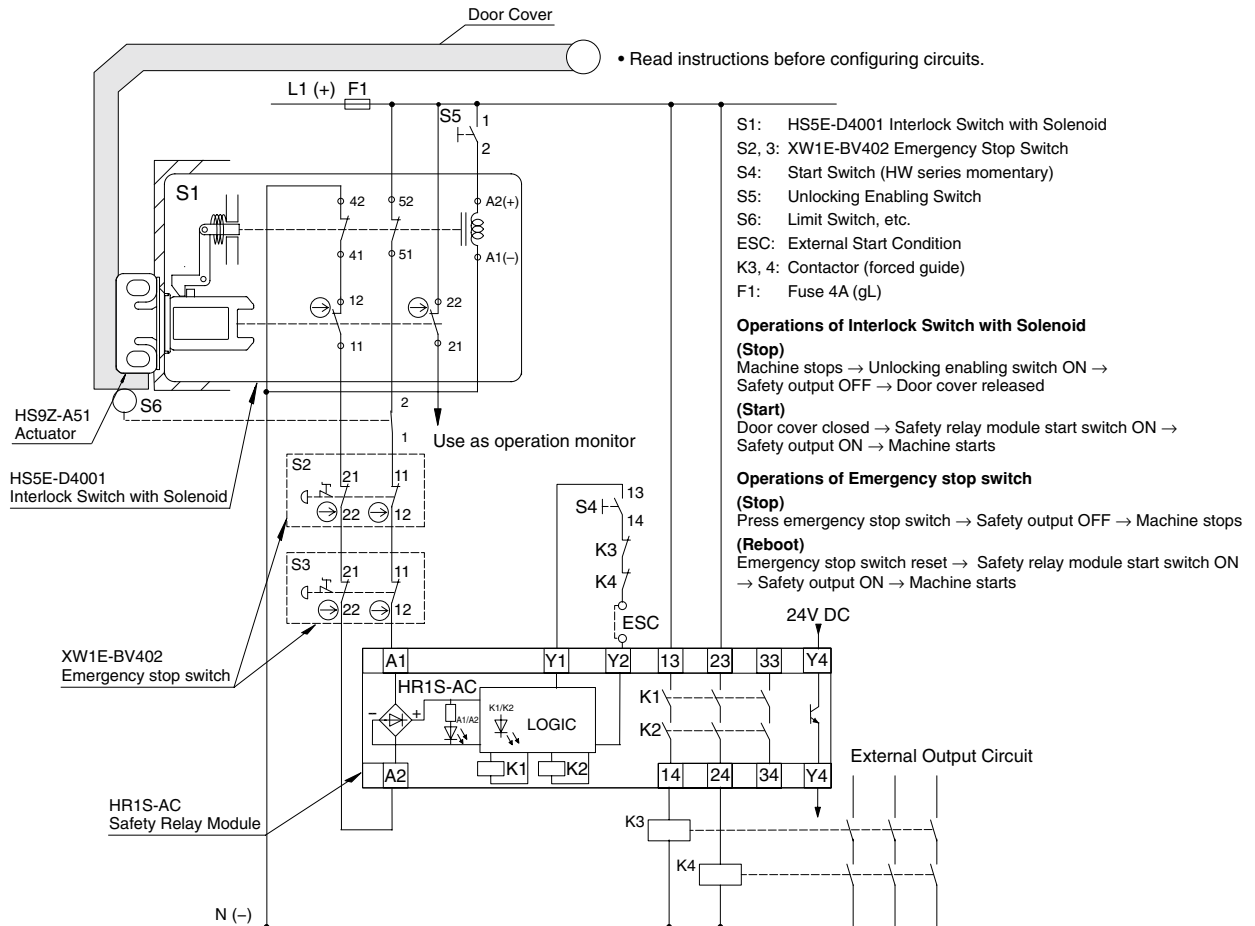
# HR1S-AC Safety Relay Modules

## Semiconductor Manufacturing Equipment Example

When using HR1S-AC (safety relay module) and HS5E (solenoid type interlock switch) + XW1E (emergency stop switch)



## Circuit Example (Safety Category 3)



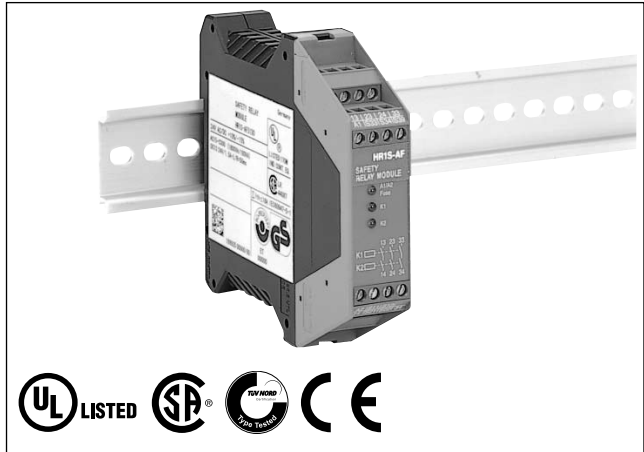
Note: Safety category is determined for the entire system. Take safety equipment and wiring into consideration.

# HR1S-AF Safety Relay Modules

## Small and high function (welding detection of start switch)

- Removable terminal block (HR1S-AC5121P) allows for easy module replacement.
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED indicator.
- Finger-safe protection
- 35-mm-wide DIN rail mounting
- EN, IEC compliant.
- TÜV NORD approved.
- UL listed, CSA approved.

Part No.	Voltage	Terminal Style
HR1S-AF5130B	24V AC, -15 to +10%, 50/60 Hz	Integrated Terminal Block
HR1S-AF5130PB	24V DC, -15 to +10%	Removable Terminal Block



## Specifications

Operating Temperature	-25 to +55°C (no freezing)		
Degree of Protection	Terminal: IP20, Housing: IP40		
Rated Voltage	24V AC (-15 to +10%) 50/60 Hz 24V DC (-15 to +10%)		
Power Consumption	5 VA maximum		
Overcurrent Protection	Electronic (Note)		
Control Circuit Voltage	24V		
Applicable 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		
Maximum Input Resistance	90Ω		
No. of Outputs	Safety Circuit	3NO	
	Time-delay Circuit	—	
	Auxiliary Contact	Contact Transistor	
Output Contact Ratings	Safety Circuit	AC-15	C300 U <sub>e</sub> = 240V AC / I <sub>e</sub> = 0.75A
		DC-13	24V/1.5A, U <sub>e</sub> = 24V DC / I <sub>e</sub> = 1.5A
	Time-delay Circuit	AC-15	—
		DC-13	—
	Auxiliary Circuit	AC-15	—
		DC-13	—
Transistor Circuit	—	—	
Minimum Applicable Load	17V/10 mA (initial value)		
Operating Frequency	1200 operations/h maximum		
Mechanical Durability	10,000,000 operations minimum		
Rated Current	Safety circuit output total: 18A maximum Each safety circuit output: 6A maximum		
Wire Size	HR1S-AF5130B: 1 × 2.5 mm <sup>2</sup> , 2 × 0.75 mm <sup>2</sup> maximum HR1S-AF5130PB: 1 × 2.5 mm <sup>2</sup> , 2 × 1.5 mm <sup>2</sup> maximum		
Weight (approx.)	250g		

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.

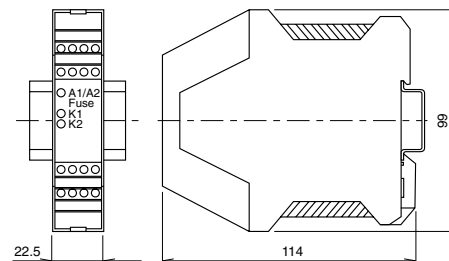
- Use a 4A fuse (Type gL) for power line protection.
- Use a 4A fuse (Type gL) or a 6A fast blow fuse for output line protection.

## LED Indicators

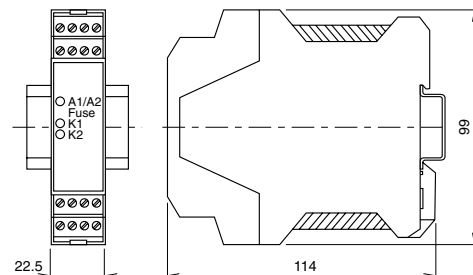
- A1/A2 Fuse: Turns on when power circuit is normal. Turns off when power is interrupted or the electronic fuse blows.
- K1: Turns on when K1 relay operates.
- K2: Turns on when K2 relay operates.

## Dimensions

### HR1S-AF5130B

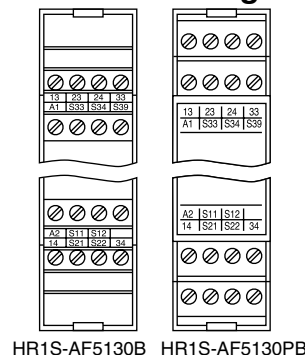


### HR1S-AF5130PB Removable Terminal

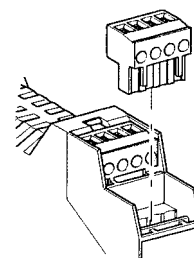


All dimensions in mm.

## Terminal Arrangement



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

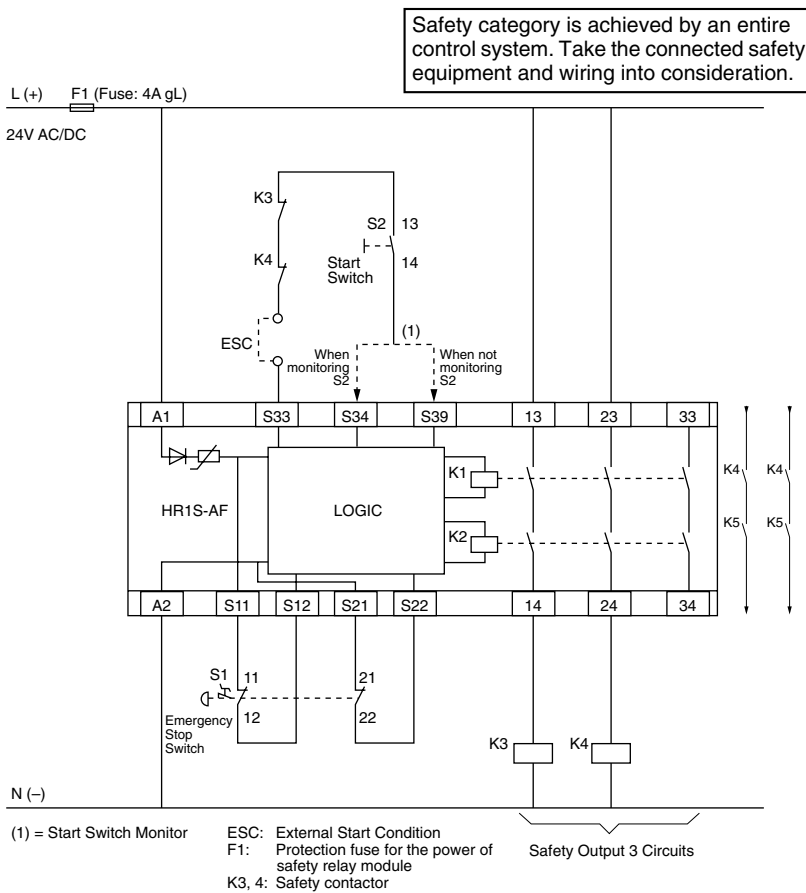




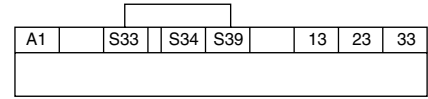
# HR1S-AF Safety Relay Modules

## Wiring Diagram

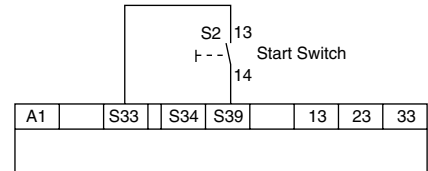
### Safety Category 4 Circuit (using an emergency stop switch)



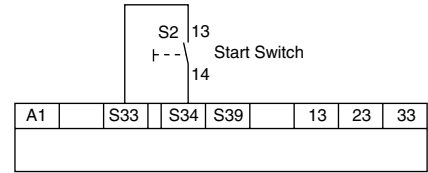
### When not using a start switch (automatic start)



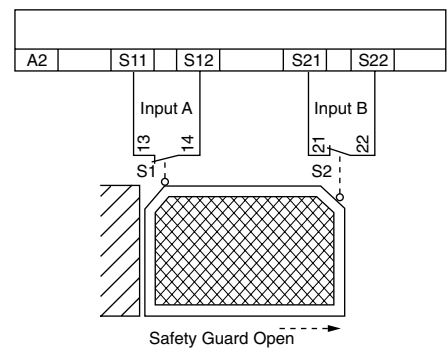
### When not monitoring the start switch (welding of start switch cannot be detected)



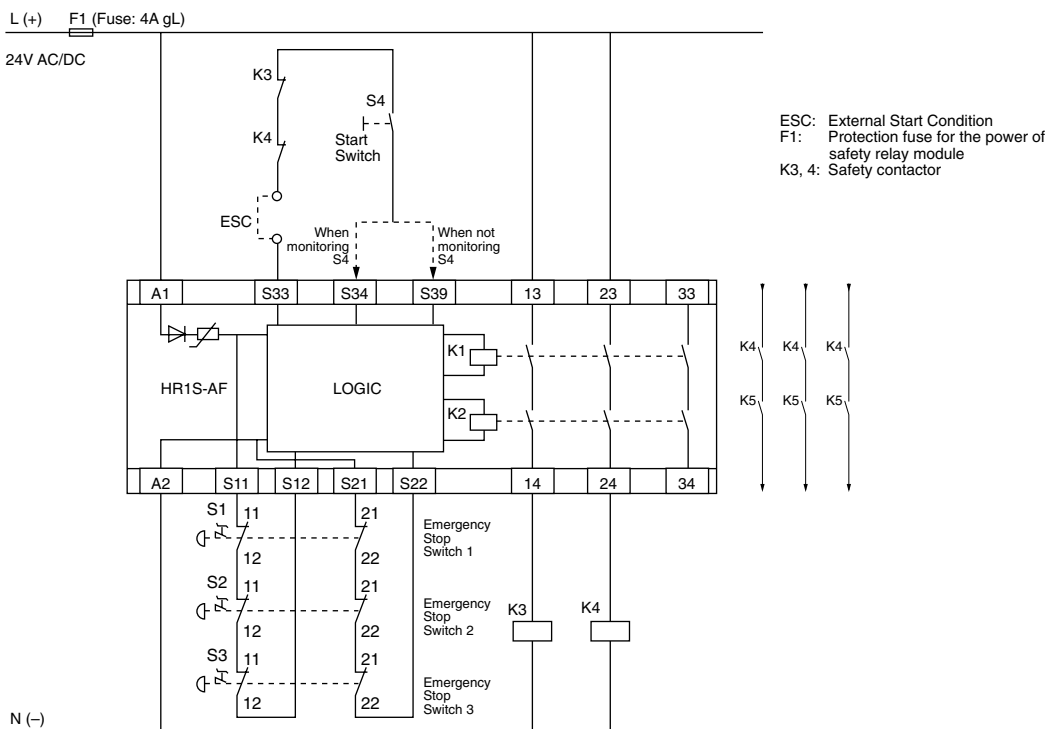
### When monitoring the start switch (detecting the OFF status of start switch)



### Limit switch or interlock switch for guard opening/closing



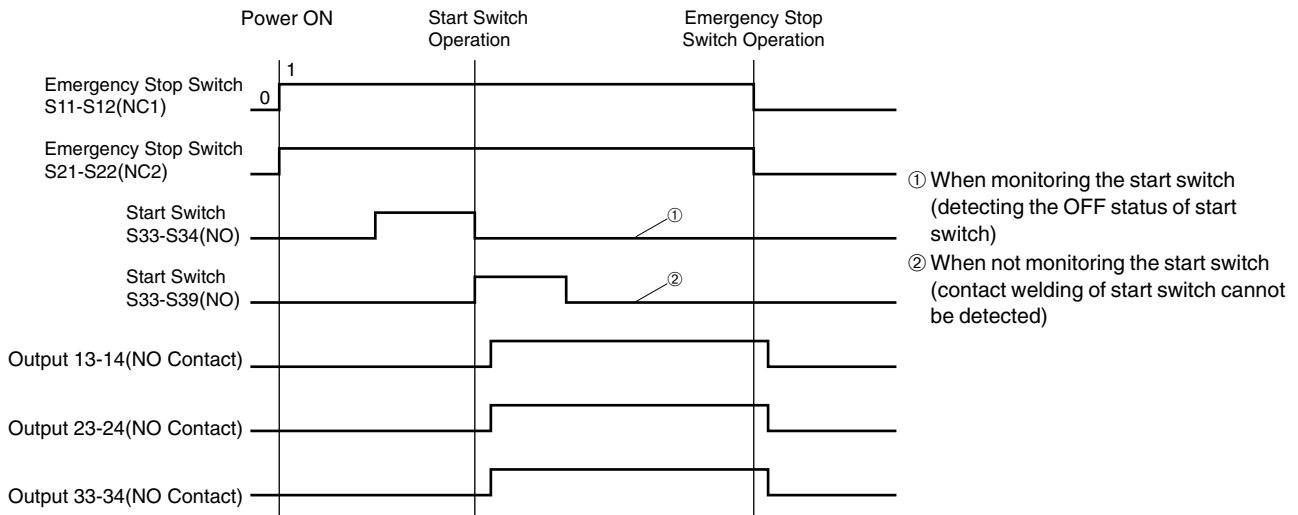
### Safety Category 3 Circuit (using multiple emergency stop switches)



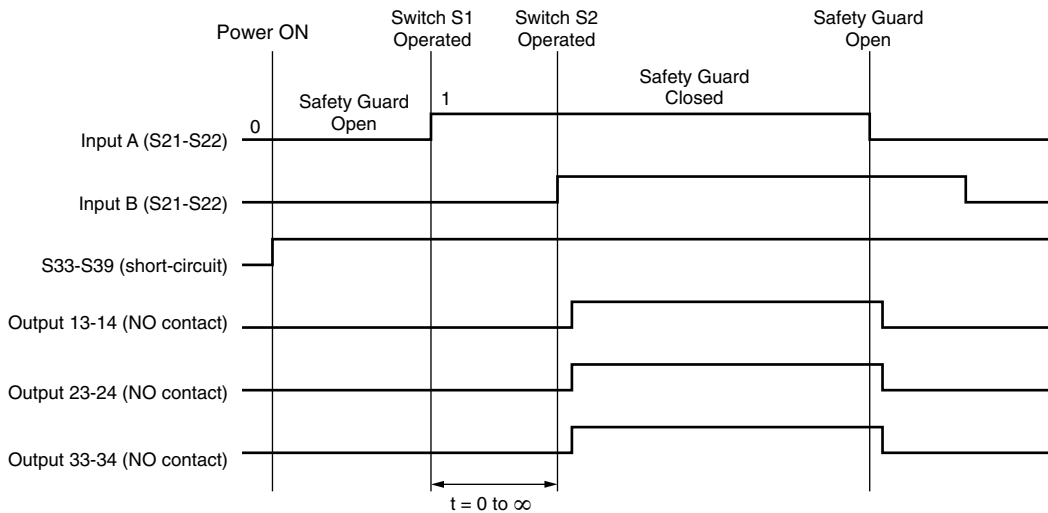
# HR1S-AF Safety Relay Modules

## Operation Chart

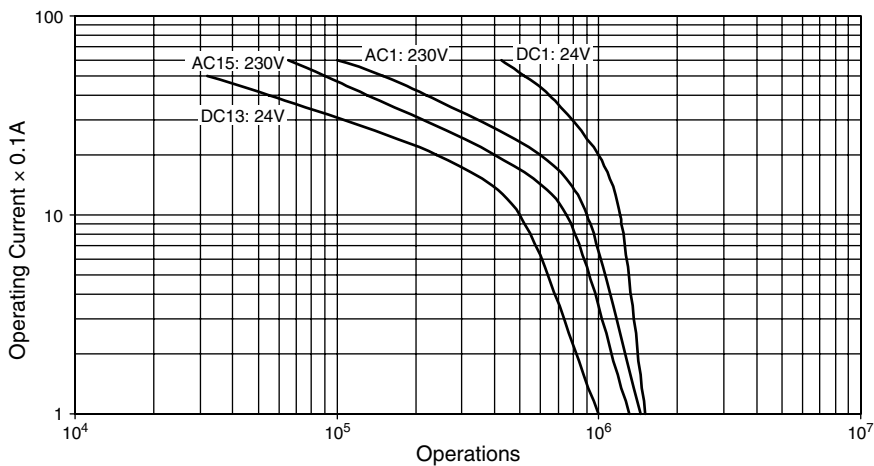
### When Using the Emergency Stop Switch



### When not Using the Safety Guard (Automatic Start)



## Output Contact Electrical Life



# HR1S-AK Safety Relay Modules

## Four transistor outputs

- Removable terminal block (HR1S-AC5121P) allows for easy module replacement.
- Can be connected to light curtain.
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED indicator.
- Finger-safe protection
- 35-mm-wide DIN rail mounting
- EN, IEC compliant.
- TÜV NORD approved.
- UL listed, CSA approved.

Part No.	Voltage	Terminal Style
HR1S-AK311144	24V AC, -15 to +10%, 50/60 Hz	Integrated Terminal Block
HR1S-AK351144		
HR1S-AK311144P	24V DC, -15 to +10%	Removable Terminal Block
HR1S-AK351144P		

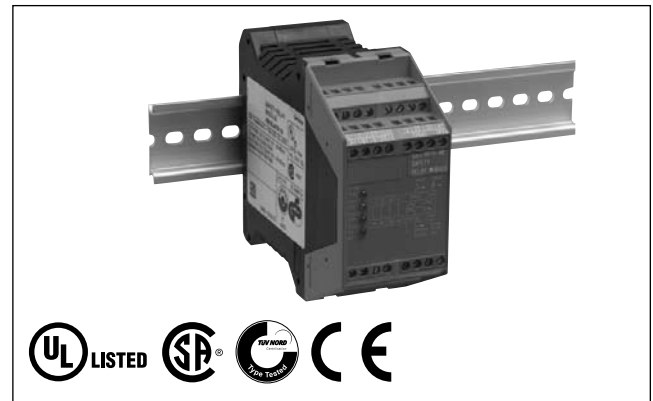
## Specifications

Operating Temperature	-10 to 55°C (no freezing)		
Degree of Protection	Terminal: IP20, Housing: IP40		
Rated Voltage	HR1S-AK311144(P): 24V AC (-15 to +10%) 50/60 Hz 24V DC (-15 to +10%) HR1S-AK351144(P): 120V AC (-15 to +10%) 50/60 Hz 24V DC (-15 to +10%)		
Power Consumption	120V AC: 6 VA maximum 24V AC: 5 VA maximum 24V DC: 3W maximum		
Overcurrent Protection	Electronic		
Control Circuit Voltage	24V		
Applicable Performance Level (PL)	e (EN ISO 13849-1)		
Safety Category	4 (EN ISO 13849-1)		
Safety Integrity Level (SIL)	3 (EN 62061)		
Response Time	40 ms maximum		
Input Synchronization Time	S1 → S2: 2 sec S2 → S1: 4 sec Automatic start: unlimited		
Overvoltage Category	III		
Pollution Degree	2		
Rated Insulation Voltage	300V		
Maximum Input Resistance	28Ω		
No. of Output Circuits	Safety Circuit	3NO	
	Time-delay Circuit	—	
Output Contact Ratings	Auxiliary Contacts	Contact	1NC
		Transistor	4NO
	Safety Circuit	AC-15	C300 Ue = 230V AC / Ie = 0.75A
		DC-13	24V/1.5A, 24V DC / Ie = 1.5A
	Time-delay Circuit	AC-15	—
		DC-13	—
Auxiliary Circuits	AC-15	C300 Ue = 230V AC / Ie = 0.75A	
	DC-13	24V/1.5A, 24V DC / Ie = 1.5A	
Transistor Circuit	24V/20 mA		
Minimum Applicable Load	17V/10 mA (initial value)		
Operating Frequency	1200 operations/h maximum		
Mechanical Durability	10,000,000 operations minimum		
Rated Current	Safety circuit output total: 18A maximum Each safety circuit output: 6A maximum		
Wire Size	HR1S-AK311144: 1 × 2.5 mm <sup>2</sup> , 2 × 0.75 mm <sup>2</sup> maximum HR1S-AK311144P: 1 × 2.5 mm <sup>2</sup> , 2 × 1.5 mm <sup>2</sup> maximum HR1S-AK351144: 1 × 2.5 mm <sup>2</sup> , 2 × 0.75 mm <sup>2</sup> maximum HR1S-AK351144P: 1 × 2.5 mm <sup>2</sup> , 2 × 1.5 mm <sup>2</sup> maximum		
Weight (approx.)	HR1S-AK311144(P): 300g HR1S-AK351144(P): 400g		

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

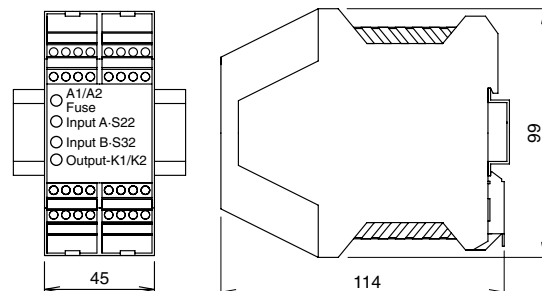
## LED Indicator

- A1/A2 Fuse:  
Turns on when power voltage is normal.  
Turns off when power is interrupted or the electronic fuse blows.
- Input A-S22: Turns on when S21-S22 is closed.
- Input B-S32: Turns on when S31-S32 is closed.
- Output K1/K2: Turns on when the safety outputs of 13-14, 23-24, and 33-34 are closed.

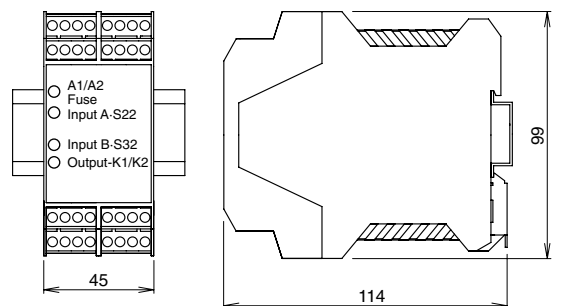


## Dimensions

### HR1S-AK311144/-AK351144

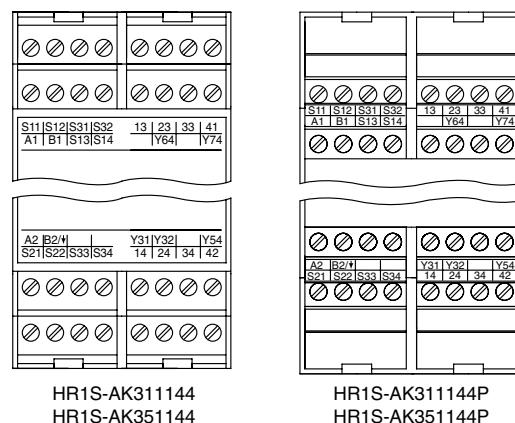


### HR1S-AK311144P/-AK351144P Removable Terminal

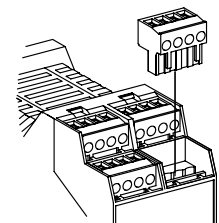


All dimensions in mm.

## Terminal Arrangement



- The terminal blocks of the HR1S-AK311144P/-AK351144P can be removed and installed as shown below, allowing for easy installation and replacement of modules.



# HR1S-AK Safety Relay Modules

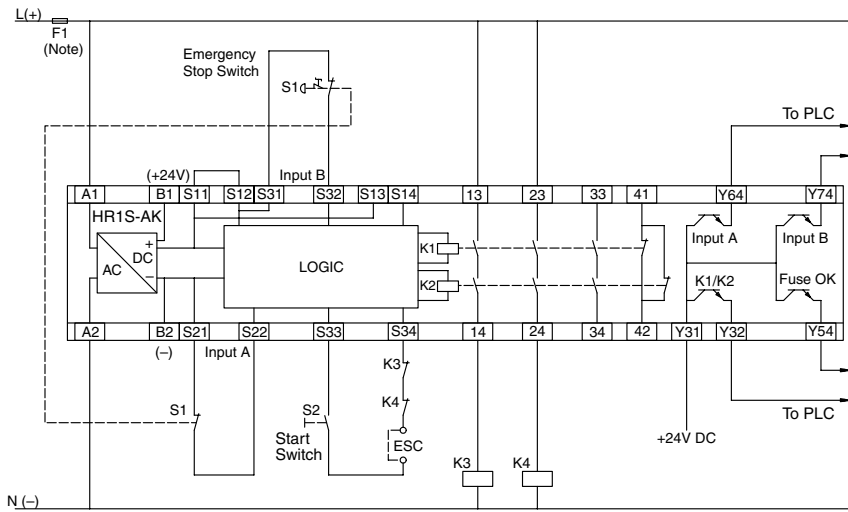
## Wiring Diagram

Note: Be sure to connect terminals to correct power supply.

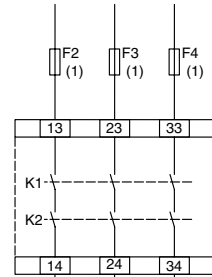
AC power: A1-A2

DC power: B1-B2

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



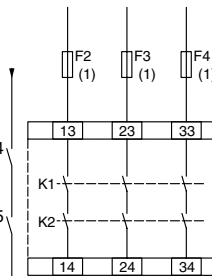
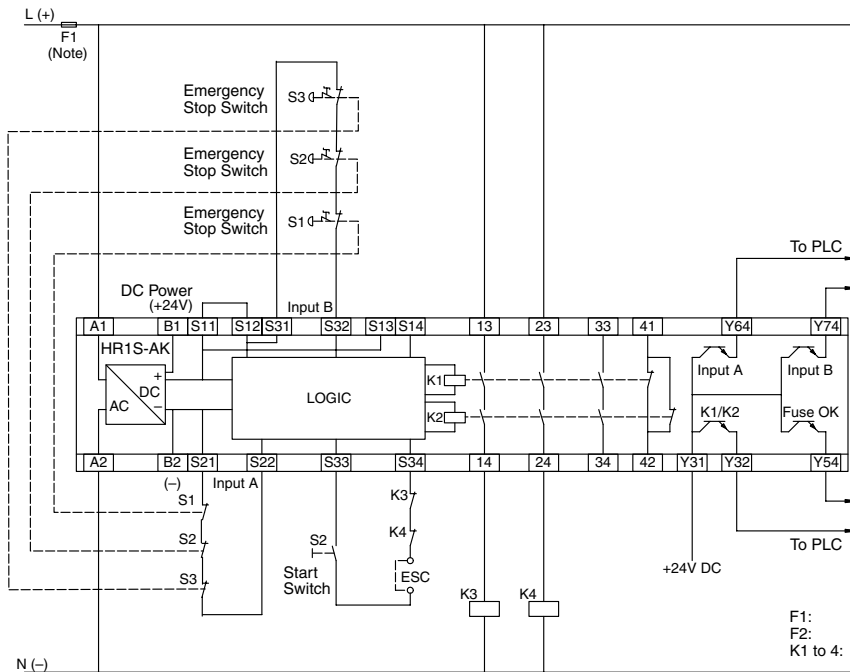
Safety category is achieved by an entire control system. Take the connected safety equipment and wiring into consideration.



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

F1: Protection fuse for the power of safety relay module  
F2: Protection fuse for the output of safety relay module  
K1 to 4: Safety contactor

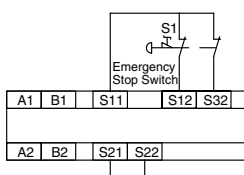
### Safety Category 3 Circuit (using multiple emergency stop switches)



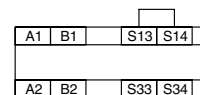
Note: Use a 4A fuse (Type gL) or a 6A fast blow fuse for power and output line protection.

F1: Protection fuse for the power of safety relay module  
F2: Protection fuse for the output of safety relay module  
K1 to 4: Safety contactor

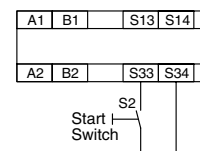
Although two input channels are used, short-circuit cannot be detected in the wiring shown below. Safety category becomes 3.



### When not using a start switch (automatic start)



### When monitoring the start switch (detecting the OFF status of start switch)



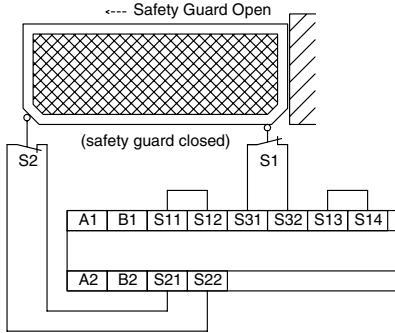
## Wiring Diagram with Safety Equipment

Applicable safety category depends on the function of connected safety equipment. Confirm the function of safety equipment before use.

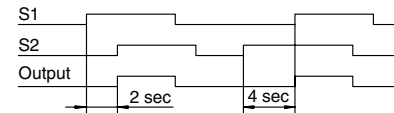
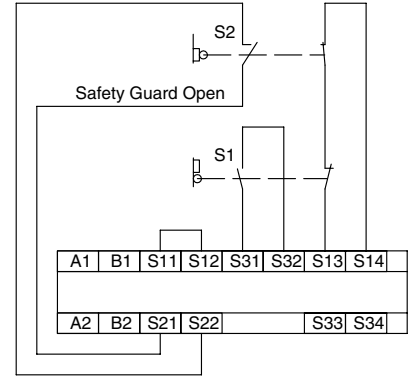
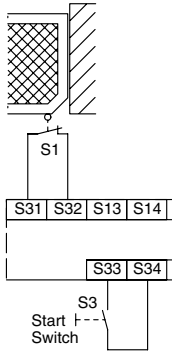
**Two limit switches with synchronization monitor (Synchronization monitor is effective for automatic start only.)**

### Two limit switches/without synchronization monitor

#### Automatic Start

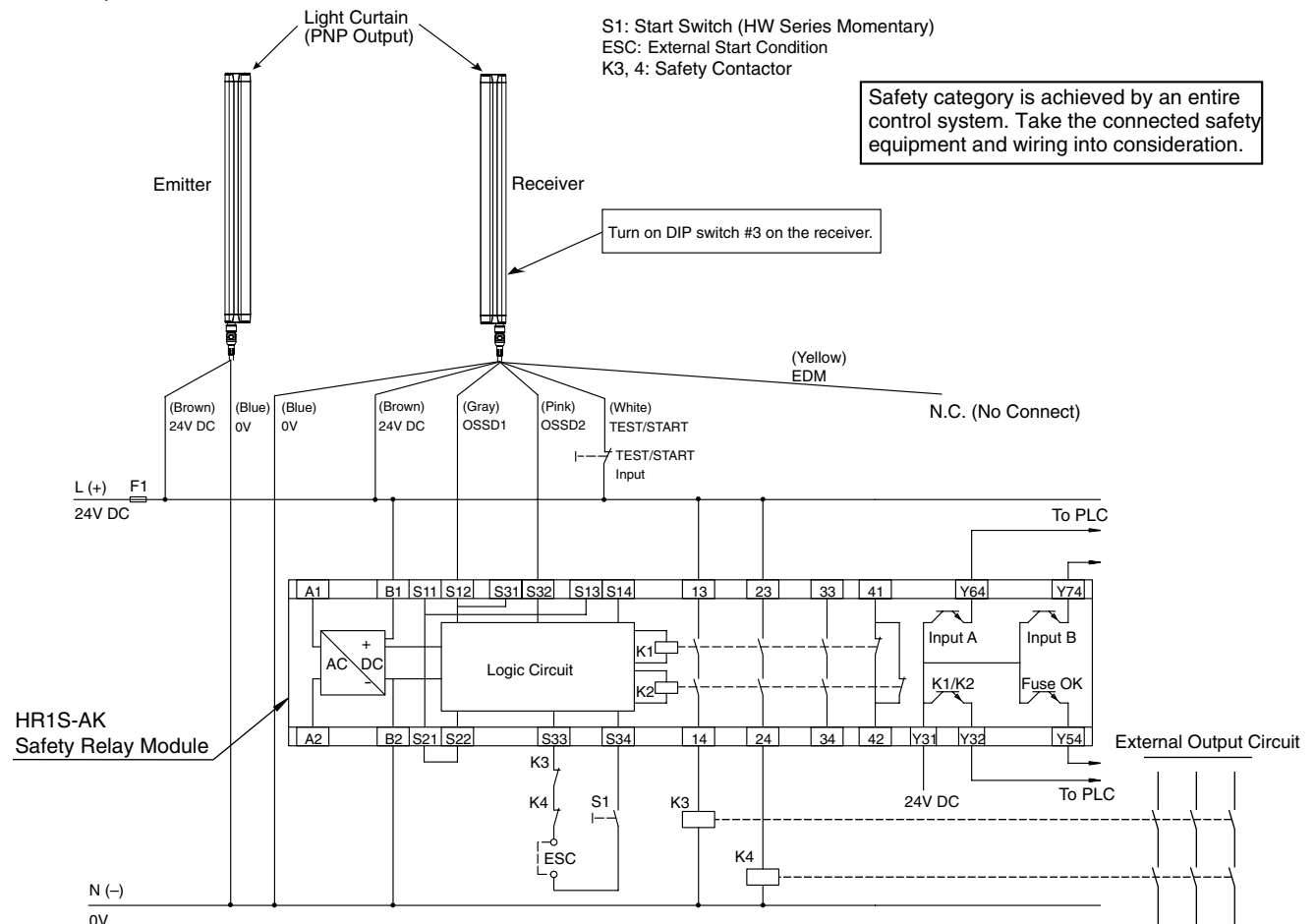


#### Using a Start Switch



### When connecting with a light curtain

Note: Note the terminals with different input voltages when wiring.  
AC power: Connect to A1-A2.  
DC power: Connect to B1-B2.

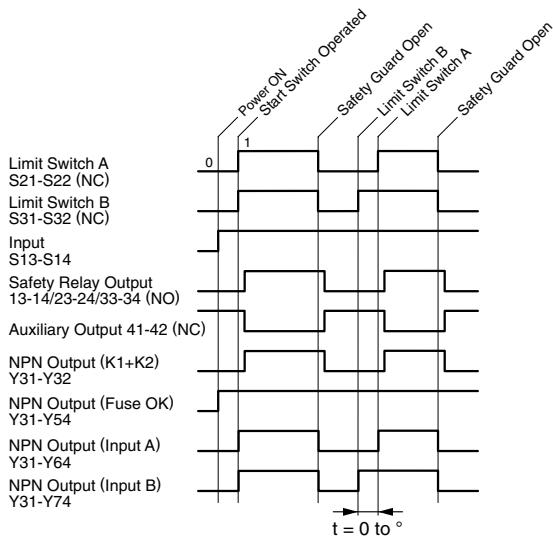


The light curtains are used in the above system.

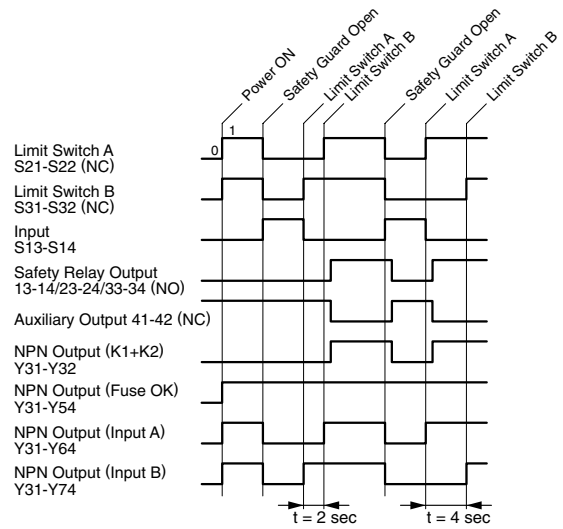
# HR1S-AK Safety Relay Modules

## Operation Chart

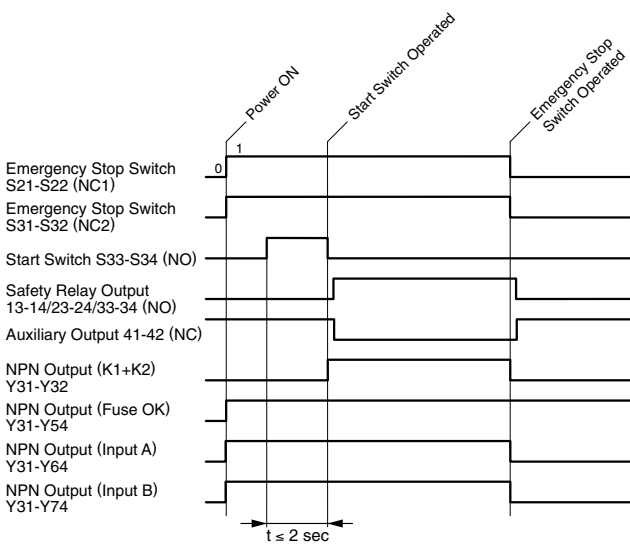
**Safety guard application using two limit switches (automatic start mode)**



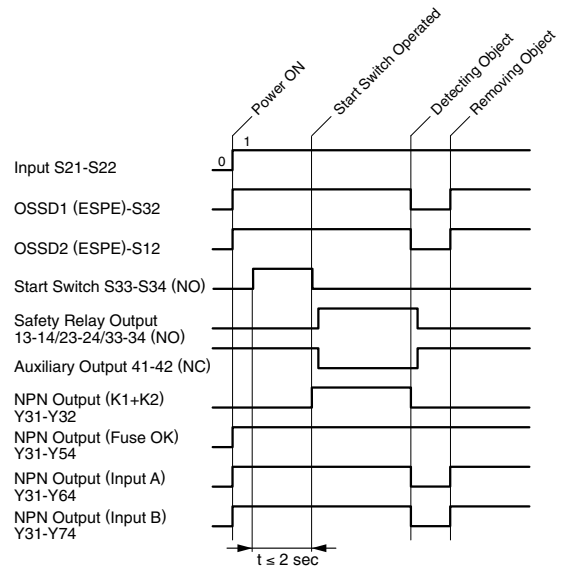
**Safety guard application using two limit switches (automatic start mode, synchronization monitor mode)**



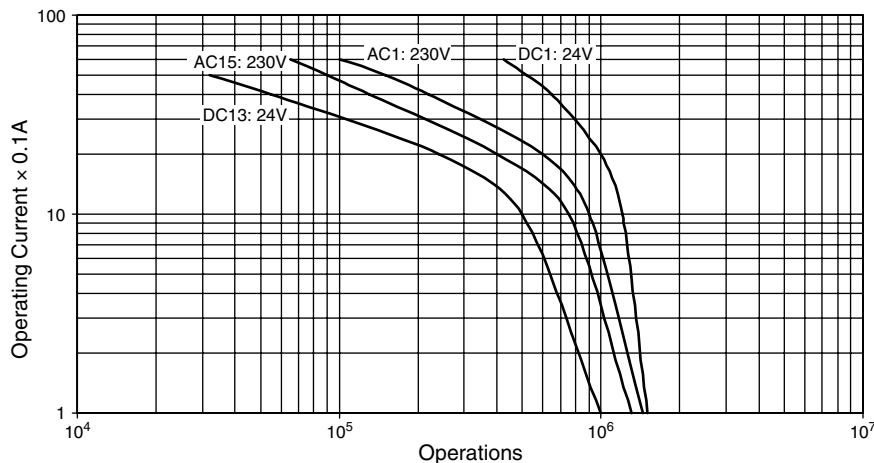
**Using emergency stop switches (start switch monitor mode)**



**Using OSSD output of light curtain (ESPE)**



## Output Contact Electrical Life



## Residual Risk (EN292-1, 5.5)

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

1. When circuits other than described in this catalog are used.

2. When the applicable standards of machine operation are not observed, or when the machine is not adjusted or maintained properly (observe the maintenance schedule strictly).

3. When the contacts of relays and contactors for connecting with safety outputs are not forced guide compliant with EN 50205.

## Instructions

### HR1S Safety Relay Modules

- Do not disassemble the safety relay modules. Do not damage the seal.
- Negligence to observe the following instructions may cause accidents that result in death or serious injuries.
  - **Connect the wires according to the wiring diagrams shown in this catalog.**
  - **Connect the wires according to the applicable standards.**
  - **The contacts of relays and contactors to connect with safety outputs must be forced guided compliant with EN 50205.**
  - **When maintaining or adjusting the machines, observe the maintenance schedule.**
- Turn the power off before installation, removal, wire connection, maintenance, or inspection of the safety relay module in order to avoid electric shock or fire. Otherwise death or serious injury may be caused.
- When installing and wiring, provide sufficient distance from inverter or power line.

### HR1S-AC

- Use 13-14, 23-24, and 33-34 outputs for stop category 0 compliant with EN 60204-1/EN 418.
- Do not use Y43-Y44 outputs for safety-related circuits.

### HR1S-AF

- Use 13-14, 23-24, and 33-34 outputs for stop category 0 compliant with EN 60204-1/EN 418.
- In order to detect the failure of start switch such as contact welding, connect start switch to S33-S34. Contact welding cannot be detected when the start switch is connected to S33-S39, because the output circuit closes when the start switch closes.

### HR1S-AK

- Use 13-14, 23-24, and 33-34 outputs for stop category 0 compliant with EN 60204-1/EN 418.
- Do not use 41-42, Y31-Y32, Y31-Y54, Y31-Y64, or Y31-Y74 outputs for safety-related circuits.

# HR1S-DMB/DME Safety Relay Modules



## 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		
Applicable 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	500 ms (between two non-contact interlock switches)		
Overvoltage Category	III		
Pollution Degree	2		
Rated Insulation Voltage	300V		
Maximum Input Resistance	100Ω (per input point)		
No. of Outputs	Safety Circuit		
	Time Delay Circuit		
Auxiliary Circuit	Contact	—	
	Transistor	2NO	
Output Contact Ratings	Safety Circuit	AC-15	C300 (Ue = 230V AC / Ie = 0.75A)
		DC-13	Ue = 24V DC / Ie = 1.5A
	Time Delay Circuit	AC-15	—
		DC-13	—
	Auxiliary Circuit	AC-15	—
		DC-13	—
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	HR1S-DMB1132: 0.14 to 2.5 mm <sup>2</sup>		
	HR1S-DME1132: 0.2 to 2.5mm <sup>2</sup>		
	HR1S-DMB1132P: 0.2 to 2.5mm <sup>2</sup>		
	HR1S-DME1132P: 0.2 to 2.5mm <sup>2</sup>		
Weight	HR1S-DMB: 180g		
	HR1S-DME: 250g		

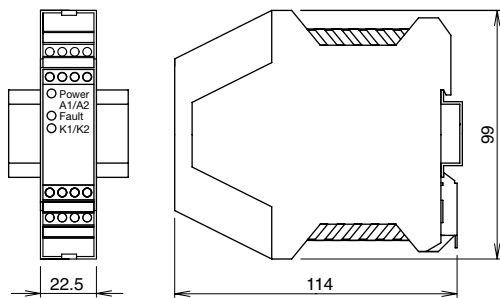
Part No.	Voltage	Terminal Style	Input
HR1S-DMB1132	24V DC -20 to +20%	Integrated terminal block	2
HR1S-DMB1132P		Removable terminal block	
HR1S-DME1132		Integrated terminal block	6
HR1S-DME1132P		Removable terminal block	

- Package quantity: 1
- For the maximum number of connectable non-contact interlock switches, see Cat No. EP1453-0.

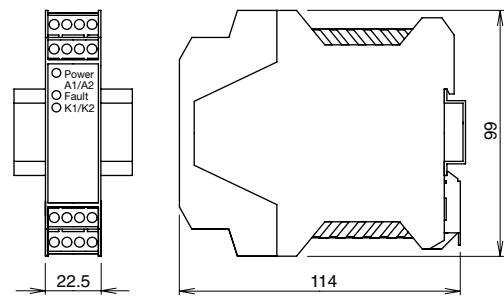
- Use a 4A fuse (Type gL) for power fuse protection.
- Use a 4A (Type gL) or a 6A fast blow fuse for output fuse protection.

## Dimensions

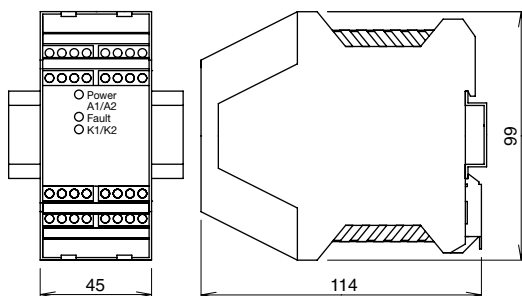
### HR1S-DMB1132



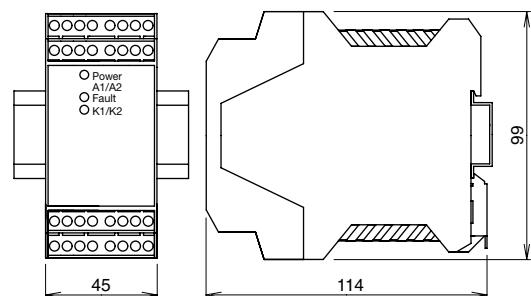
### HR1S-DMB1132P



### HR1S-DME1132



### HR1S-DME1132P



All dimensions in mm.



# HR1S-DMB/HR1S-DME Safety Relay Modules

## LED Indication

### HR1S-DMB

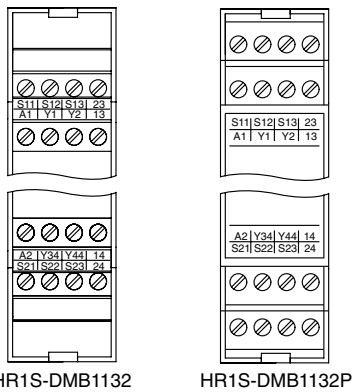
- Power A1/A2:  
Turns on when power circuit is normal.  
Turns off when power is interrupted or the electronic fuse blows.
- Fault:  
Turns on when the HR1S fails (see failure causes on page 18).
- K1/K2:  
Turns on when K1/K2 relays operate.

### HR1S-DME

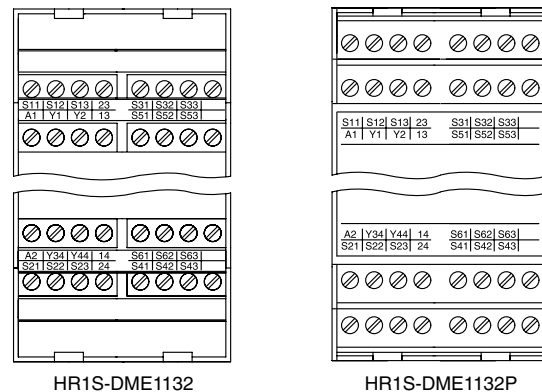
- Power A1/A2:  
Turns on when power circuit is normal.  
Turns off when power is interrupted or the electronic fuse blows.
- Fault:  
Turns on when the HR1S fails (see failure causes on page 18).
- K1/K2:  
Turns on when K1/K2 relays operate.
- S13: NO contact of non-contact interlock switch 1
- S12: 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

## Terminal Arrangement

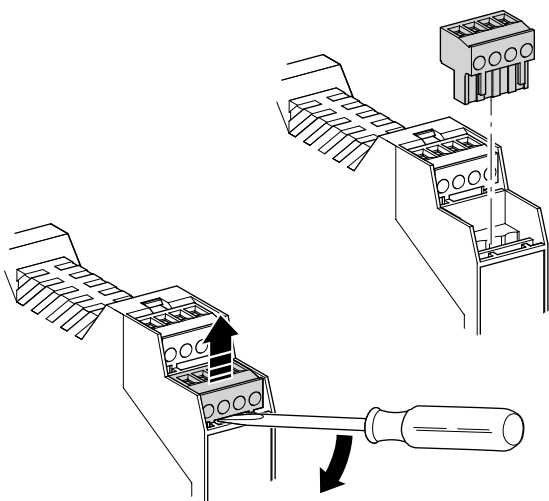
### HR1S-DMB



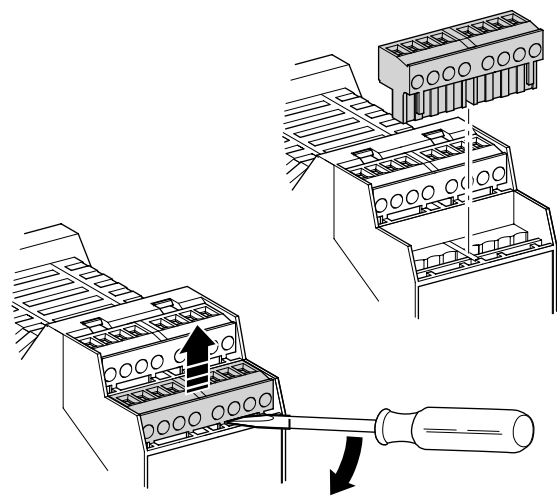
### HR1S-DME



- The terminal block of the HR1S-DMB□□□□P can be removed and installed as shown below, allowing for easy installation and replacement of modules.



- The terminal block of the HR1S-DME□□□□P can be removed and installed as shown below, allowing for easy installation and replacement of modules.



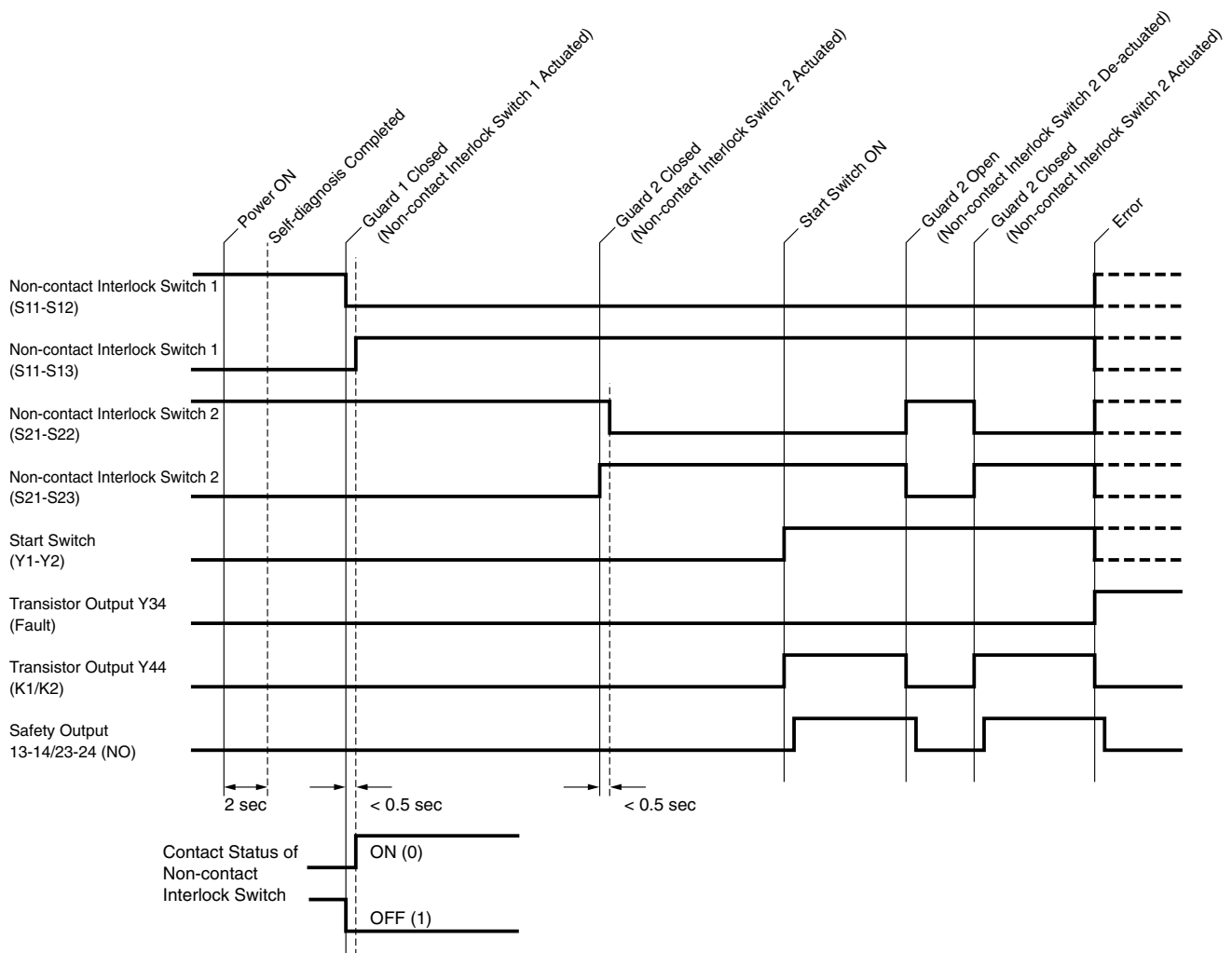
# HR1S-DMB/HR1S-DME Safety Relay Modules

## 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.

- External fault: 1-sec ON, 1-sec OFF
- Synchronization time excess: 30-sec ON, 30-sec OFF

## HR1S-DMB/HR1S-DME Safety Relay Module Operation Chart



# HR1S-DMB/DME Safety Relay Modules

## Residual Risk (EN292-1, 5.5)

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

1. When circuits other than described in this catalog are used.

2. When the applicable standards of machine operation are not observed. Or, when machine is not adjusted or maintained properly (observe the maintenance schedule strictly).

3. When the contacts of relays and contactors for connecting with safety outputs are not of the forced guide type compliant with EN 50205.

## Instructions

### HR1S Safety Relay Modules

- Do not disassemble the safety relay modules. Do not damage the seal.
- Negligence to observe the following instructions may cause accidents that result in death or serious injuries.
  - **Connect the wires according to the wiring diagrams shown in this catalog.**
  - **Connect the wires according to the applicable standards.**
  - **The contacts of relays and contactors to connect with safety outputs must be of the forced guided type compliant with EN 50205.**
  - **When maintaining or adjusting the machines, observe the maintenance schedule.**
- Turn the power off before installation, removal, wire connection, maintenance, or inspection of the safety relay module in order to avoid electric shock or fire. Otherwise death or serious injury may be caused.

### HR1S-DMB/HR1S-DME

- Use 13-14 and 23-24 safety outputs for the safety equipment which constitutes the safety circuit compliant with EN 60204-4/EN418.
- Connect the 13-14 and 23-24 safety outputs in series when turning on/off the hazard source directly in the circuit of safety category 4.
- The safety relay module will perform self diagnosis for two seconds after powering on A1-A2 terminals. During self diagnosis, all LEDs will turn on, and Y34/Y44 outputs turn on.
- Safety outputs turn on when the non-contact interlock switch has been activated and the start input turns on. The safety outputs turn on only when the NO contact of the non-contact interlock switch turns on within 0.5 seconds after the NC contact has turned off.
- Short-circuit the unused inputs according to the wiring diagram.
- Connect a surge absorbing element to the input coil of the relay connected to the safety output.
- Use a 4A fuse (Type gL) or a 6A fast blow fuse for power and output fuse protection.

### HR1S-AF

- For stop category 0 compliant with EN 60204-1/EN418, use the outputs of 13-14, 23-24, and 33-34.
- Connect a start switch to S33-S34 to detect contact welding and other failures. Contact welding cannot be detected if the start switch is connected to S33-S39, because the output circuit closes when the start switch closes.

# HR1S-ATE Safety Relay Modules

**New compact safety relay modules. Size is reduced by 50% from conventional models. Plug-in terminal structure enables simple wiring.**

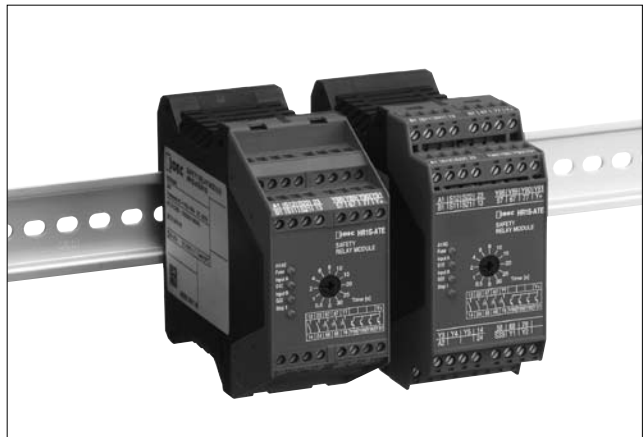
- EN ISO 13849-1 performance level e, safety category 4 compliant, and EN 62061 safety integrity level 3.
- Integrated and removable terminal styles available.
- Compact design: 45 mm in width.
- Time delay outputs: 3NO
- Auxiliary output enables power supply monitoring, inputs (2 channels), and a time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

Package Quantity: 1

Part No.	Terminal Style
HR1S-ATE5110	Integrated Terminal Block
HR1S-ATE5110P	Removable Terminal Block

## Specifications

Applicable Standards	EN 60204-1: 2006 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/s <sup>2</sup> , 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/s <sup>2</sup>	
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→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
Auxiliary Circuit	Contact	—
	Transistor	4
Output Contact Ratings	Safety Circuit	AC15 C300 (Ue = 230V AC / Ie = 0.75A) DC13 24V DC / Ie=1A
	Time-delay Circuit	AC15 C300 (Ue = 230V AC / Ie=0.75A) DC13 Ue = 24V DC / Ie=1A
		Preset Time
	Auxiliary Circuit	24V DC / 20 mA (PNP)
	Mechanical Durability	10,000,000 operations
Electrical Durability	See page 22.	
Rated Current	Total output: 8A max. 1 output 4A max.	



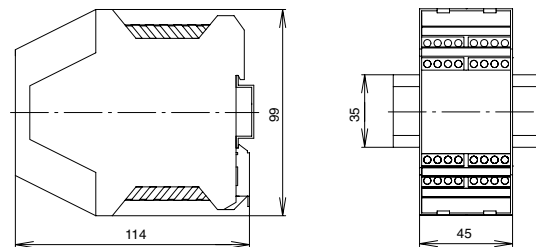
Wire Size	HR1S-ATE5110	Single wire: 0.2 to 2.5 mm <sup>2</sup> max. (24–14 AWG) Multiple wires: 0.14 to 0.75 mm <sup>2</sup> max.
	HR1S-ATE5110P	Single wire: 0.2 to 2.5 mm <sup>2</sup> max. (24–14 AWG) Multiple wires: 0.2 to 1.5 mm <sup>2</sup> max.
Weight (approx.)	280g	

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

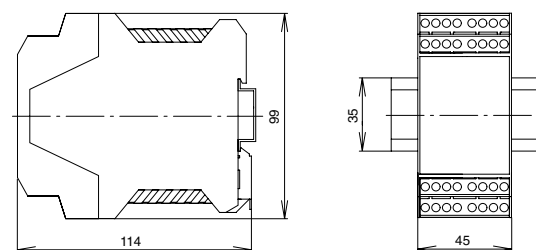
- Use a 4A fuse (Type gG) for power protection. Use a 6A fuse (Type gG) for safety output protection. Use a 4A fuse (Type gG) for time-delay output and auxiliary output protection.

## Dimensions

### HR1S-ATE5110 Integrated Terminal

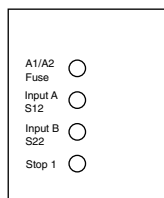


### HR1S-ATE5110P Removable Terminal



All dimensions in mm.

## LED Indicator



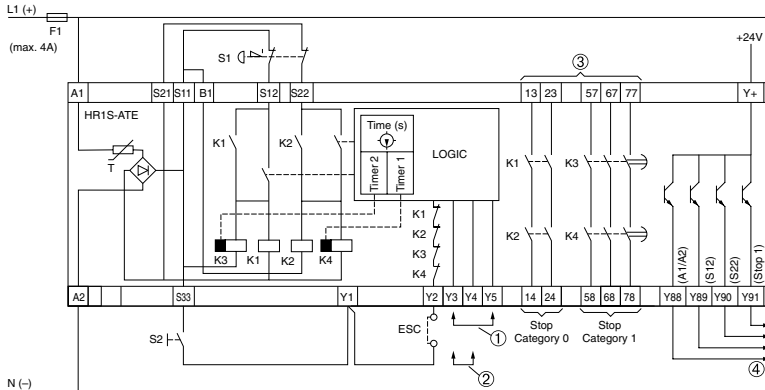
- A1/A2 Fuse: Turns on when power circuit is normal.
- Input A S12: Turns on when S11–S12 is closed.
- Input B S22: Turns on when S21–S22 is closed.
- Stop1: Turns on when the time-delay output circuits 57-58, 67-68, and 77-78 are closed.

# HR1S-ATE Safety Relay Modules

## Wiring Diagram

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

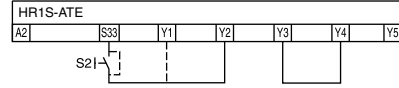
Safety category is achieved by an entire control system. Take the connected safety equipment and wiring into consideration.



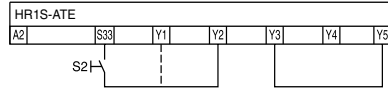
- ① When monitoring the start switch, starts when switched off (default setting/recommended)
  - ② When monitoring the start switch, starts when switched on
  - ③ Outputs must be fused (see the instruction manual for maximum fuse size)
  - ④ To PLC, etc.
- Note: When using off-delay output, safety category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

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

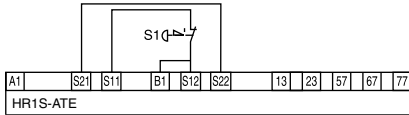
### When not monitoring the start switch (Y3-Y4 short-circuited) (automatic start when S33-Y2 is short-circuited)



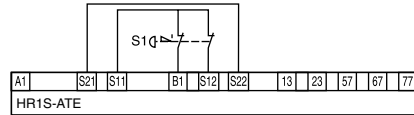
### When monitoring the start switch (Y3-Y5 short-circuited)



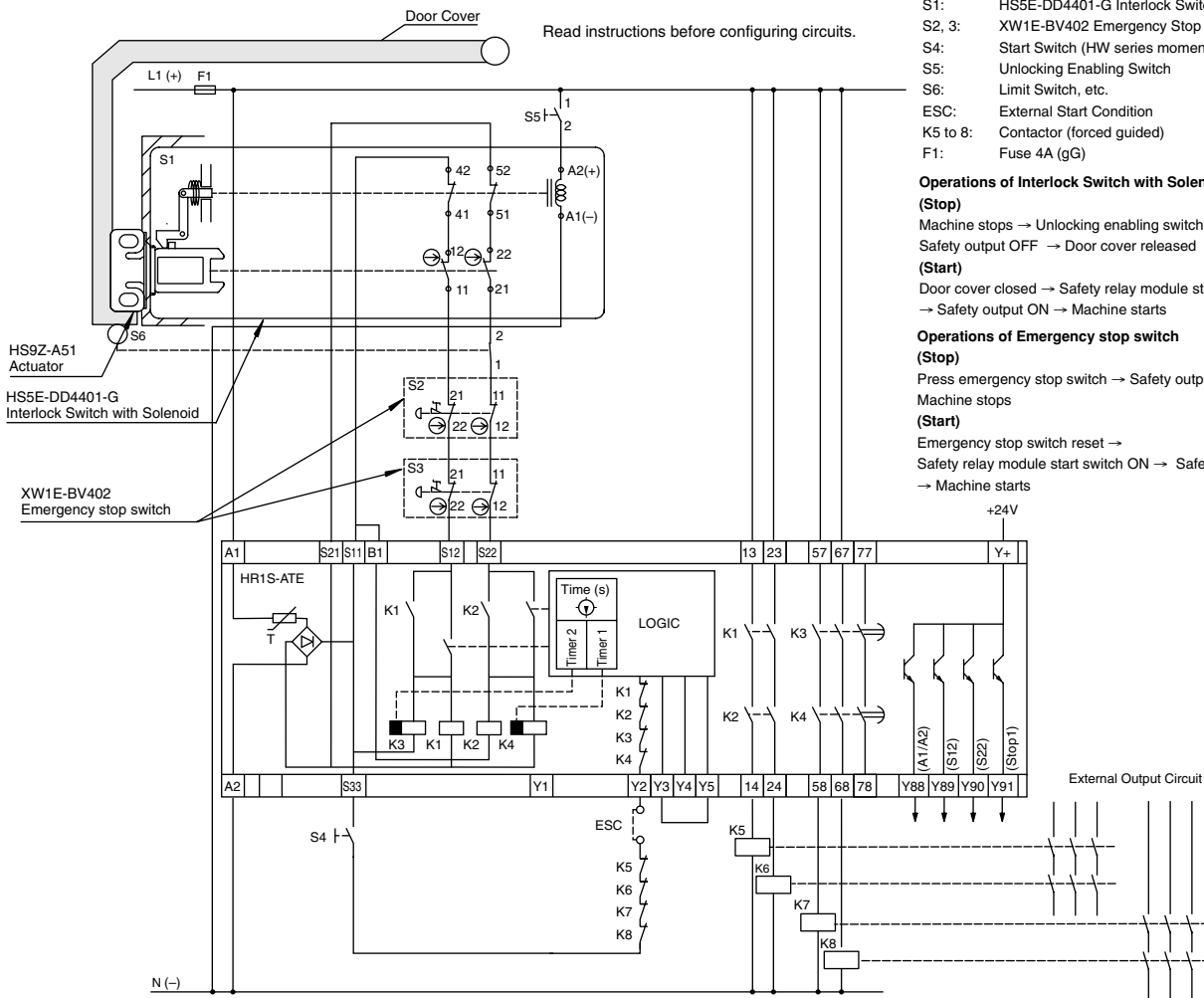
### Emergency stop switch - Input 1 channel When not detecting short-circuit (All failures such as short-circuit of emergency stop switch wiring not detected)



### Emergency stop switch - Input 2 channels When not detecting short-circuit (B1-S12 short-circuit not detected)



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



Read instructions before configuring circuits.

- S1: HS5E-DD4401-G 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)
- 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

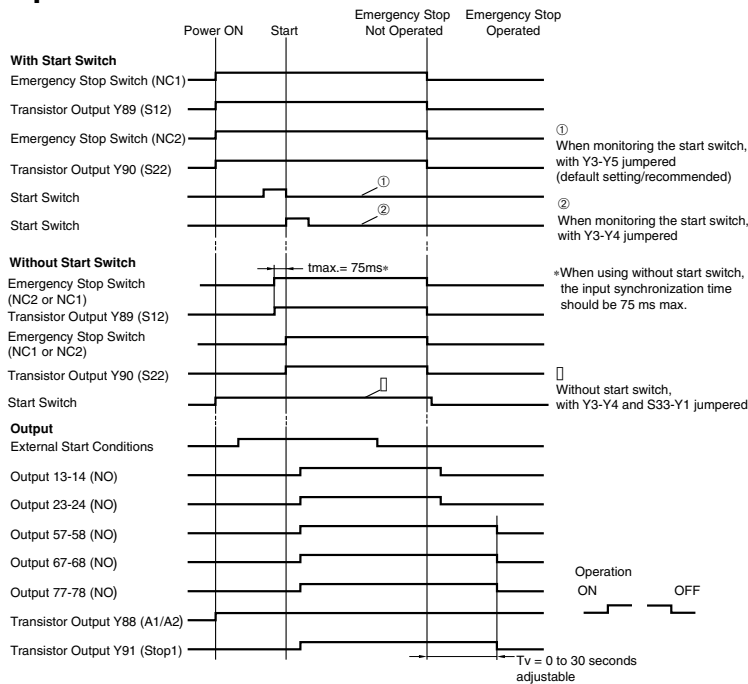
##### (Stop)

Press emergency stop switch → Safety output OFF → Machine stops

##### (Start)

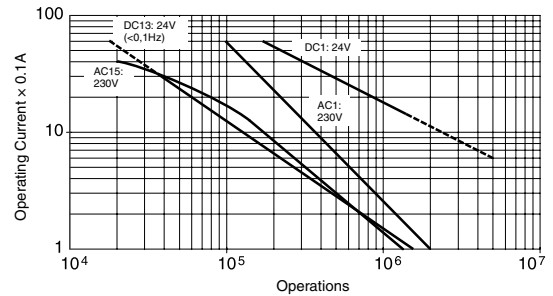
Emergency stop switch reset → Safety relay module start switch ON → Safety output ON → Machine starts

## Operation Chart



## Output Contact Electrical Life

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



## Residual Risk (EN ISO/ISO12100-1)

The wiring diagrams on page 21 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).

## Instructions

- Only persons with technical expertise may install, startup, modify, or retrofit the HR1S-ATE safety relay module.
- Turn the power off before installation, removal, wiring, maintenance, or inspection of the safety relay module. If an error occurs, line voltage may be present at the control circuit in devices without DC isolation.
- Observe all electrical safety regulations issued by appropriate technical authorities or trade association. The safety function can be lost if the device is not used for its intended purpose.
- Do not open the housing or perform invalid operation, otherwise the warranty will become voided.
- Negligence to observe the following instructions may cause accidents that may result in death or serious injuries.
- Connect the wires according to the wiring diagrams shown on page 21.
- Connect the wires according to applicable standards.
- The contacts of relays and contactors to connected with safety outputs must be forced guided (compliant with EN 50205).
- For external fusing, use an appropriate fuse size and connect according to the wiring diagram on page 21.
- When maintaining or adjusting machines, observe the maintenance schedule.
- If the recommended circuit is modified or if components are added/modified, make sure that they are properly integrated into the control circuit.
- Relays must have mechanically-linked contacts.
- Follow required standards applicable to the operation of the machine. When maintaining or adjusting machines, observe a proper maintenance schedule.

- Do not use the module if it has been subjected to improper or incorrect use. In this case, the warranty will be voided.
- Do not use the HR1S-ATE under stressful conditions such as irregular voltage, current, temperature, or humidity.
- Before starting up your equipment for the first time, be sure to check all safety functions according to regulations and observe the specified test cycles for safety equipment.
- Perform the following precautionary steps prior to installation, assembly, or disassembly of the system.
  1. Disconnect the supply voltage to the equipment / system prior to starting work.
  2. To prevent accidental activation of the module or system, perform lock-out or tag-out.
  3. Make sure that no voltage is applied.
  4. Ground N (-) as shown in the wiring diagram on page 21.
  5. Protect against adjacent operating components using guards or barriers.
  6. The devices must be installed in a cabinet with a protection class of at least IP54.
- Contact Protection  
 Type of protection according to EN/IEC 60529  
 Housing / Terminals: IP40 / IP20  
 Finger-safe protection according to EN 50274
- Connect external fuse according to the wiring diagram on page 21.



Specifications and other descriptions in this catalog are subject to change without notice.



## IDEC CORPORATION

7-31, Nishi-Miyahara 1-Chome, Yodogawa-ku, Osaka 532-8550, Japan  
Tel: +81-6-6398-2571, Fax: +81-6-6392-9731  
E-mail: marketing@idec.co.jp

### IDEC CORPORATION (USA)

1175 Elko Drive  
Sunnyvale, CA 94089-2209, USA  
Tel: +1-408-747-0550 / (800) 262-IDEC (4332)  
Fax: +1-408-744-9055 / (800) 635-6246  
E-mail: opencontact@idec.com

### IDEC CANADA LIMITED

3155 Pepper Mill Court, Unit 4  
Mississauga, Ontario, L5L 4X7, Canada  
Tel: +1-905-890-8561  
Toll Free: (800) 262-IDEC (4332)  
Fax: +1-905-890-8562  
E-mail: sales@ca.idec.com

### IDEC AUSTRALIA PTY. LTD.

Unit 17, 104 Ferntree Gully Road,  
Oakleigh, Victoria 3166, Australia  
Tel: +61-3-8523-5900, Toll Free: 1800-68-4332  
Fax: +61-3-8523-5999  
E-mail: sales@au.idec.com

### IDEC ELECTRONICS LIMITED

Unit 2, Beechwood, Chineham Business Park,  
Basingstoke, Hampshire RG24 8WA, UK  
Tel: +44-1256-321000, Fax: +44-1256-327755  
E-mail: sales@uk.idec.com

### IDEC ELEKTROTECHNIK GmbH

Wendenstrasse 331, 20537 Hamburg, Germany  
Tel: +49-40-25 30 54 - 0, Fax: +49-40-25 30 54 - 24  
E-mail: service@idec.de

### IDEC (SHANGHAI) CORPORATION

Room 701-702 Chong Hing Finance Center,  
No. 288 Nanjing Road West, Shanghai 200003, PRC  
Tel: +86-21-6135-1515  
Fax: +86-21-6135-6225 / +86-21-6135-6226  
E-mail: idec@cn.idec.com

### IDEC (BEIJING) CORPORATION

Room 211B, Tower B, The Grand Pacific Building,  
8A Guanghua Road, Chaoyang District,  
Beijing 100026, PRC  
Tel: +86-10-6581-6131, Fax: +86-10-6581-5119

### IDEC (SHENZHEN) CORPORATION

Unit AB-3B2, Tian Xiang Building, Tian'an Cyber Park,  
Fu Tian District, Shenzhen, Guang Dong 518040, PRC  
Tel: +86-755-8356-2977, Fax: +86-755-8356-2944

### IDEC IZUMI (H.K.) CO., LTD.

Units 11-15, Level 27, Tower 1,  
Millennium City 1, 388 Kwun Tong Road,  
Kwun Tong, Kowloon, Hong Kong  
Tel: +852-2803-8989, Fax: +852-2565-0171  
E-mail: info@hk.idec.com

### IDEC TAIWAN CORPORATION

8F-1, No. 79, Hsin Tai Wu Road, Sec. 1,  
Hsi-Chih District, 22101 New Taipei City, Taiwan  
Tel: +886-2-2698-3929, Fax: +886-2-2698-3931  
E-mail: service@tw.idec.com

### IDEC IZUMI ASIA PTE. LTD.

No. 31, Tannery Lane #05-01,  
HB Centre 2, Singapore 347788  
Tel: +65-6746-1155, Fax: +65-6844-5995  
E-mail: info@sg.idec.com