

Safety Relay Modules

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Flush
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Control
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Blocks

Comm.
Terminals

AS-Interface

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Control
Stations

Explosion
Protection

References

Safety Relay Module Selection Guide

Types

Type		HR1S-AC	HR1S-AF	HR1S-AK
Appearance				
Application		Emergency stop switch Limit switch for guard open/close Interlock switch (automatic start available)		Emergency stop switch Limit switch for guard open/ close Interlock switch Light curtain Safety sensor (automatic start available)
Applicable Standards		UL 508 CSA C22.2 No. 14 EN 954-1, Category 3 (safety circuit) (Note)	UL 508 CSA C22.2 No. 14 EN 954-1, Category 4 (safety circuit) (Note)	
Applicable Standards for Use		EN 418 EN 1088		
Standard Approval		UL, CSA, BG		
Power Supply		24V AC (–20 to +10%) 50/60 Hz 24V DC (±20%)	24V AC (–15 to +10%) 50/60 Hz 24V DC (–15 to +10%)	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
Output Circuit	Safety Circuit	3NO		
	Time-delay Circuit	—	—	—
Signal Circuit	Auxiliary Output	—	—	1NC
	Transistor Output	1NO	—	4NO
Operation Indicator		2 LEDs	3 LEDs	4 LEDs
Page		799	803	806

Note: Safety category (EN 954-1) is achieved by an entire control system, and cannot be achieved by individual components.

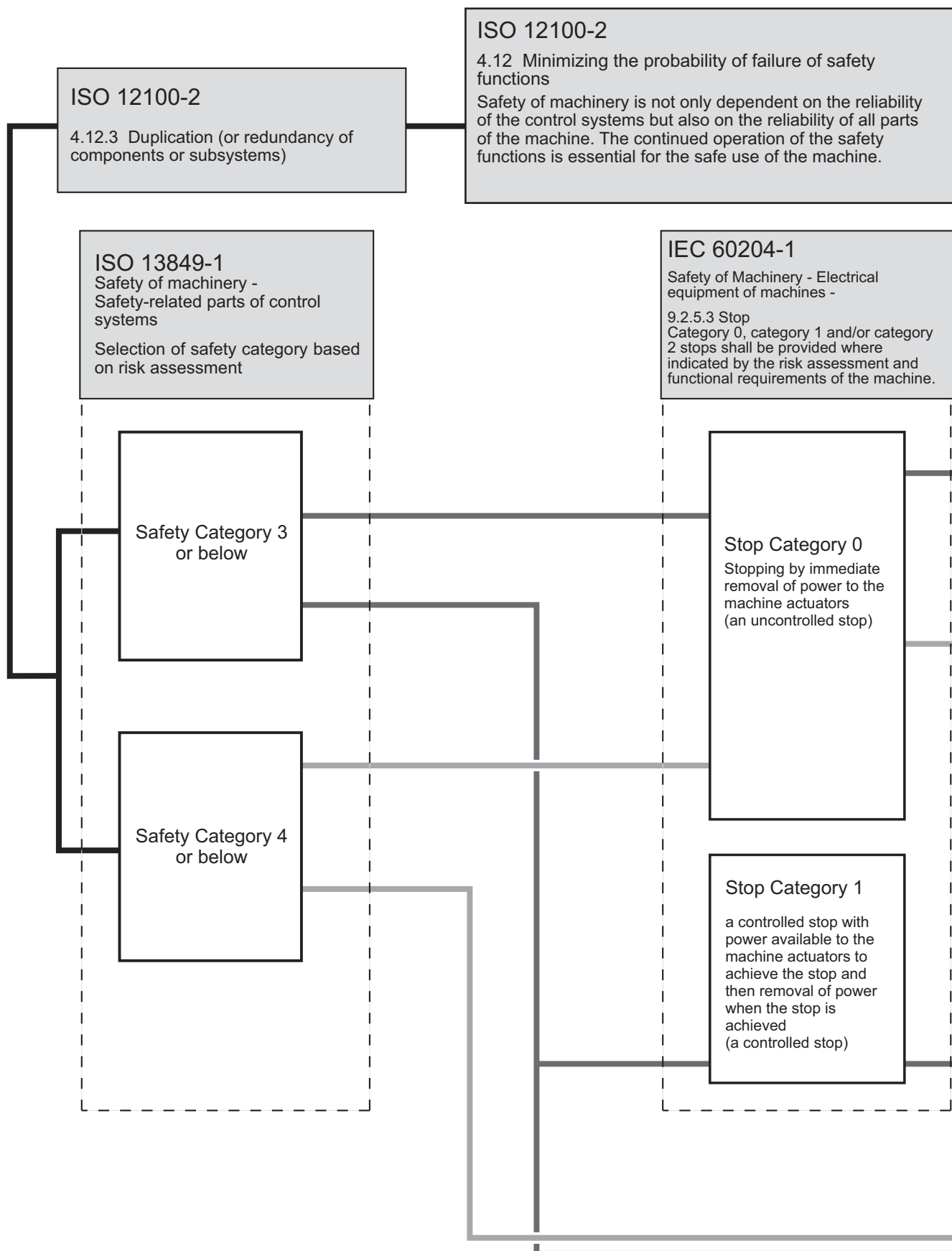
Safety Relay Module Selection Guide

Type	HR1S-AT	HR1S-ECM	HR1S-DMB/DME
Appearance			
Application	Emergency stop switch Limit switch for guard open/close Interlock switch System requiring time-delay (automatic start available)	Safety output circuit expansion	Non-contact interlock switch
Applicable Standards	UL 508 CSA C22.2 No. 14 EN 954-1, Category 4 (safety circuit) (Note) EN 954-1, Category 3 (time-delay circuit) (Note)	UL 508 CSA C22.2 No. 14	UL 508 CSA C22.2 No. 14 EN 954-1, Category 4 (safety circuit) (Note)
Applicable Standards for Use	EN 418 EN 1088	EN 418 EN 1088	EN 1088
Standard Approval	UL, CSA, BG		
Power Supply	HR1S-AT5110: 24V AC (−20 to +10%) 50/60 Hz 24V DC (±20%) HR1S-AT3410: 115V AC (±15%) 50/60 Hz	HR1S-ECM5131: 24V AC (−20 to +10%) 50/60 Hz 24V DC (±20%) HR1S-ECM3431: 115V AC (±15%) 50/60 Hz	24V DC (−20 to +20%)
Output Circuit	Safety Circuit	3NO	4NO
	Time-delay Circuit	2NO (0 to 30 sec adjustable)	—
Signal Circuit	Auxiliary Output	1NC	1NC
	Transistor Output	—	1NO
Operation Indicator	4 LEDs	3 LEDs	3 LEDs (DMB) 15 LEDs (DME)
Page	811	814	692

Note: Safety category (EN 954-1) is achieved by an entire control system, and cannot be achieved by individual components.

Safety Relay Module Selection Chart

ISO / IEC Standards and Safety Relay Modules



Safety Relay Module Selection Chart

ISO 12100-2

4.11.6
Use of automatic monitoring

ISO 12100-2

4.11.4
Restart after power interruption

ISO 12100-2

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

For Safety Output Expansion

Type No. & Appearance	Applicable Standards	Markings
HR1S-AC  Output: 3NO Tr 1NO Width: 22.5 mm Automatic Start	UL 508 CSA C22.2 No.14 EN 60947-1 EN 60947-5-1 EN 60204-1 EN 954-1 category 3 (safety circuit)	
HR1S-AF  Output: 3NO Width: 22.5 mm Automatic Start	UL 508 CSA C22.2 No.14 EN 60947-5-1 EN 50082-2 EN 60204-1 EN 954-1 category 4 (safety circuit)	
HR1S-AK  Output: 3NO+1NC Tr 4NO Width: 45.0 mm Automatic Start	UL 508 CSA C22.2 No.14 EN 60947-1 EN 60947-5-1 EN 60204-1 EN 954-1 category 4 (safety circuit)	
HR1S-DMB/DME  Output: 2NO Tr 2NO Width: 22.5 mm (DMB) 45.0 mm (DME) Automatic Start	EN 60204-1 EN 60947-5-1 EN 60947-5-3 EN 954-1 Category 4 (safety circuit)	
HR1S-AT  Output: 3NO+1NC Off-delay 2NC Width: 90.0mm Automatic Start	UL 508 CSA C22.2 No.14 EN 60947-5-1 EN 50082-2 EN 60204-1 EN 954-1 Category 4 (safety circuit) EN 954-1 Category 3 (time delay circuit)	
HR1S-ECM  Output: 4NO+1NC Tr 1NO Width: 90.0 mm	UL 508 CSA C22.2 No.14 EN 60947-5-1 EN 50082-2 EN 60204-1 EN 954-1 Category 4 (safety circuit)	

HR1S Series Safety Relay Modules

Ideal for using on the safety circuits of CE-marked interlock switches and emergency stop switches.

- 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
- Standard type and off-delay type
- Safety circuit expansion unit available
- UL listed, CSA approved.
- GB approved
- EN, IEC compliant



Types

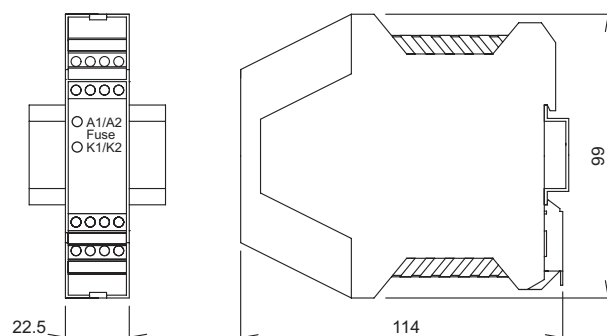
Ordering Type No.	Coformable Safety Category	Output	Features
HR1S-AC5121	3	3NO 1NO (transistor output)	• Small size • Transistor output • Removable terminal block (HR1S-AC5121P)
HR1S-AC5121P			
HR1S-AF5130B	4	3NO	• Small size • High function (welding detection of start switch) • Removable terminal block (HR1S-AC5130P)
HR1S-AF5130PB			
HR1S-AK311144	4	3NO 1NC 4NO (transistor output)	• Light curtain connectable • 4 transistor outputs
HR1S-AK311144P			
HR1S-AK351144			
HR1S-AK351144P			
HR1S-AT5110	4 (3)	3NO 1NC 2NO (off-delay output)	• Off-delay output 2NO • Preset time adjustable (0 to 30 seconds)
HR1S-AT3410			
HR1S-ECM5131	4	4NO 1NC 1NO (transistor output)	• Safety expansion modules for HR1S series • Transistor output • Easy module expansion
HR1S-ECM3431			

HR1S-AC5121/-AC5121P

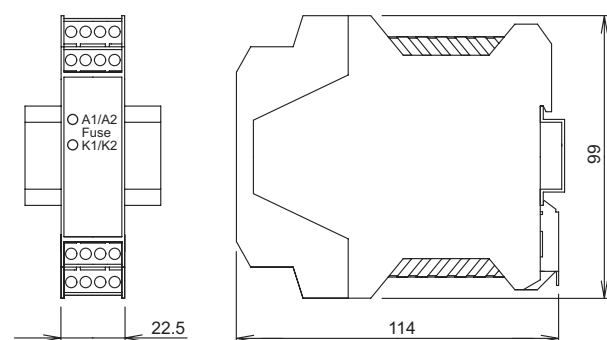


Dimensions

• HR1S-AC5121



• HR1S-AC5121P Removable Terminal Type



All dimensions in mm.

Types

Ordering Type No.	Terminal Style
HR1S-AC5121	Integrated Terminal Block
HR1S-AC5121P	Removable Terminal Block

Specifications

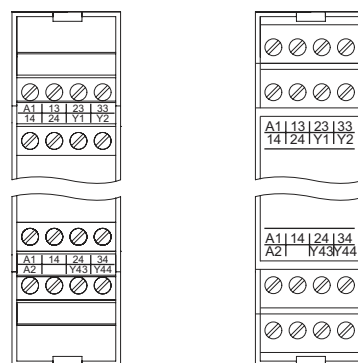
Operating Temperature			-10 to 55°C (no freezing)
Degree of Protection			Terminal: IP20, Housing: IP40
Rated Voltage			24V AC (-20 to +10%) 50/60 Hz 24V DC (±20%)
Power Consumption			AC: 2.2 VA (24V AC) maximum DC: 1.2W (24V DC) maximum
Overcurrent Protection			Electronic
Control Circuit Voltage			24V
Safety Category			3 (EN 954-1)
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
	Auxiliary Circuit		1NO (transistor)
Output Contact Ratings	Safety Circuit	AC-15	C300 (1800VA/180VA)
		DC-13	24V/2A, L/R = 50 ms
	Transistor Circuit		24V/20mA
	Minimum Applicable Load		17V/10 mA (initial value)
Operating Frequency			1200 operations/h maximum
Rated Current			Safety circuit output total: 10.5A maximum
Wire Size			HR1S-AC5121: 1 × 2.5mm ² , 2 × 0.75mm ² maximum HR1S-AC5121P: 1 × 2.5mm ² , 2 × 1.5mm ² 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.

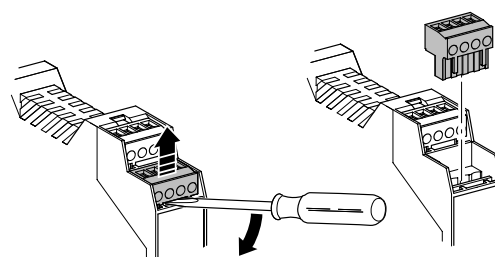
Terminal Arrangement



HR1S-AC5121

HR1S-AC5121P

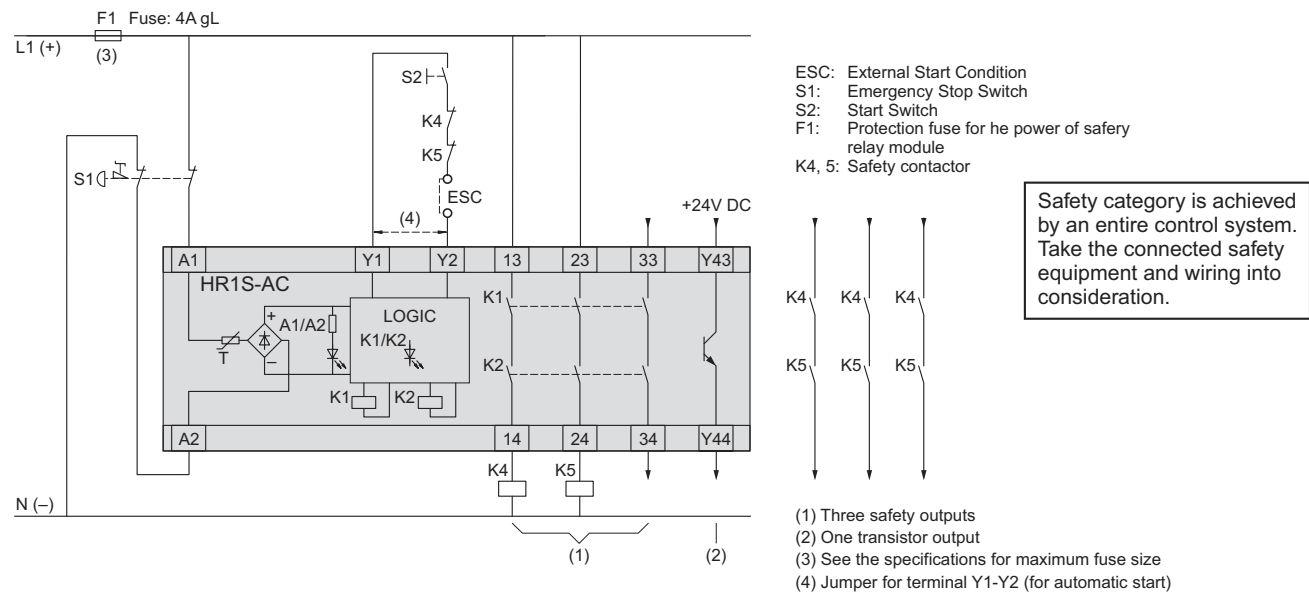
- The terminal block of the HR1S-AC5121P can be removed and installed as shown below, allowing for easy installation and replacement of modules.



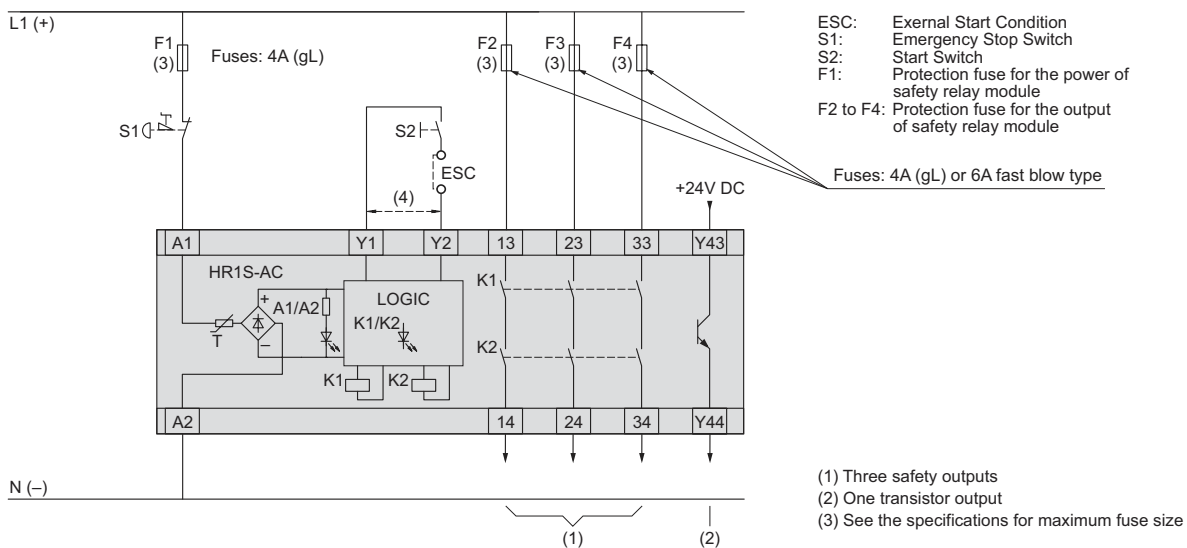
HR1S-AC Safety Relay Modules

HR1S-AC Wiring Diagram

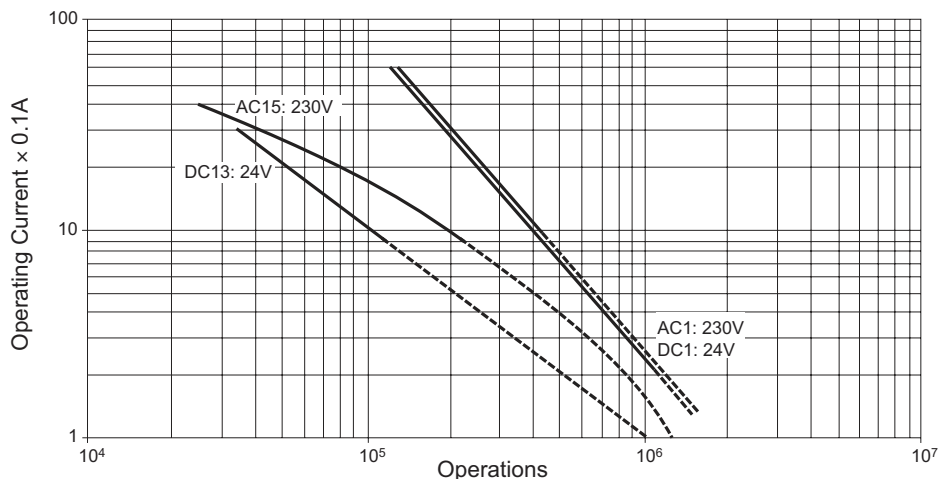
• Safety Category 3 Circuit (using an emergency stop switch with 2NC contacts)



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



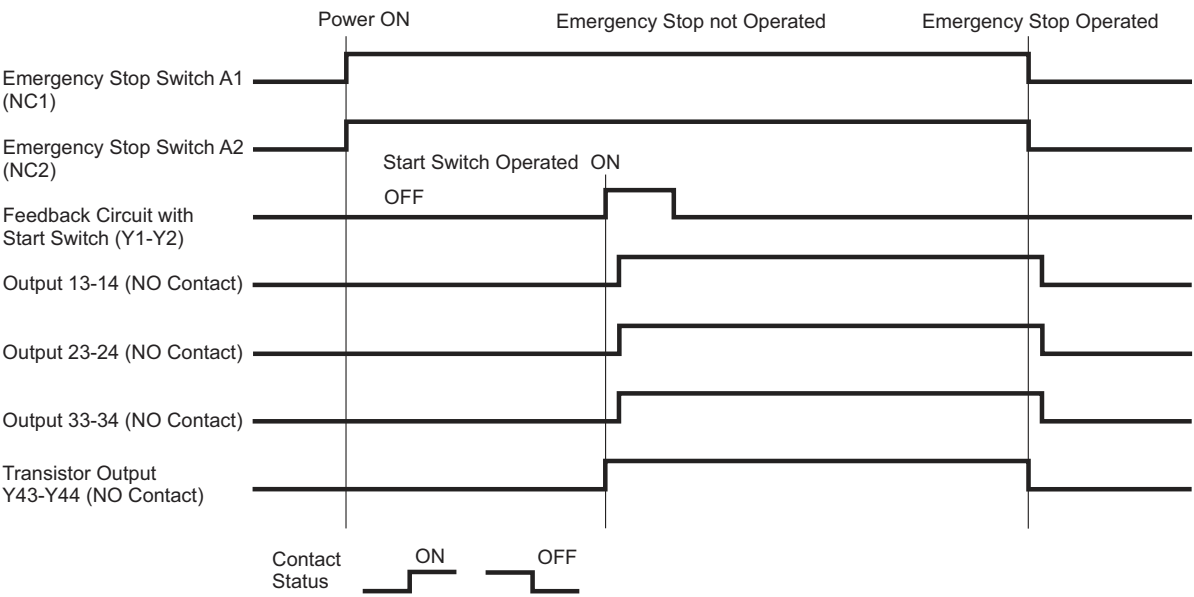
Output Contact Electrical Life



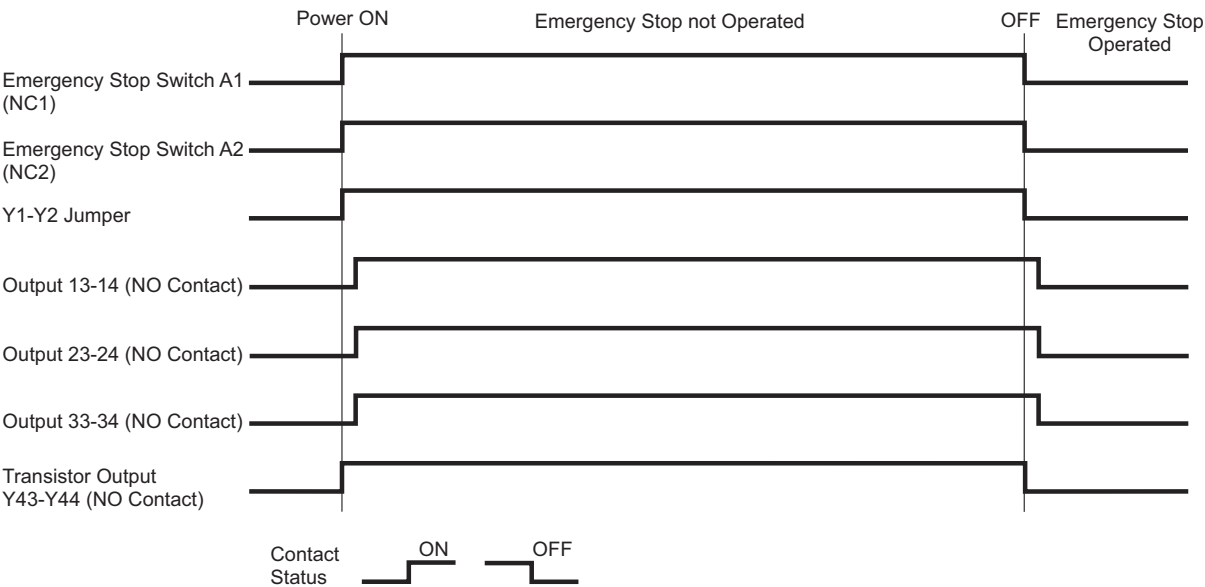
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Display Units
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Terminal Blocks
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Operator Interfaces
Sensors
Control Stations
Explosion Protection
References

HR1S-AC Safety Relay Module Operation Chart

• When Using a Start Switch



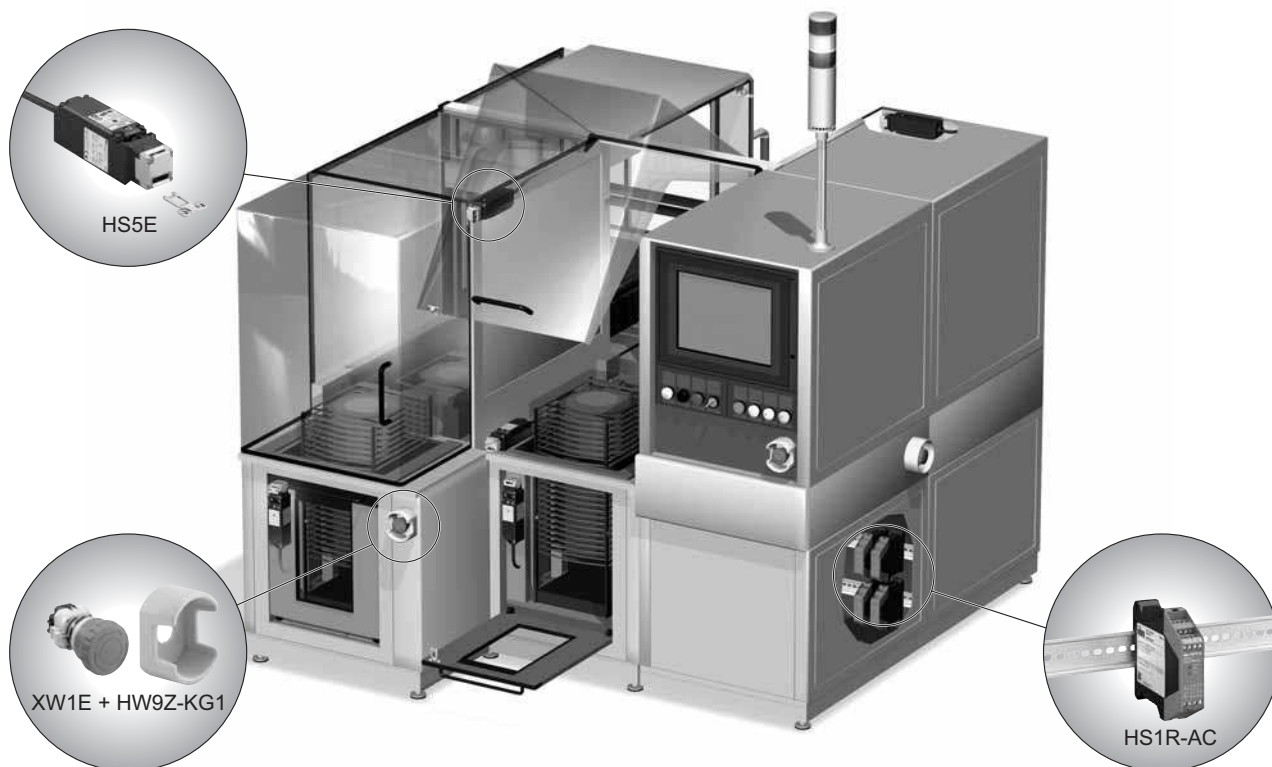
• When not Using the Start Switch



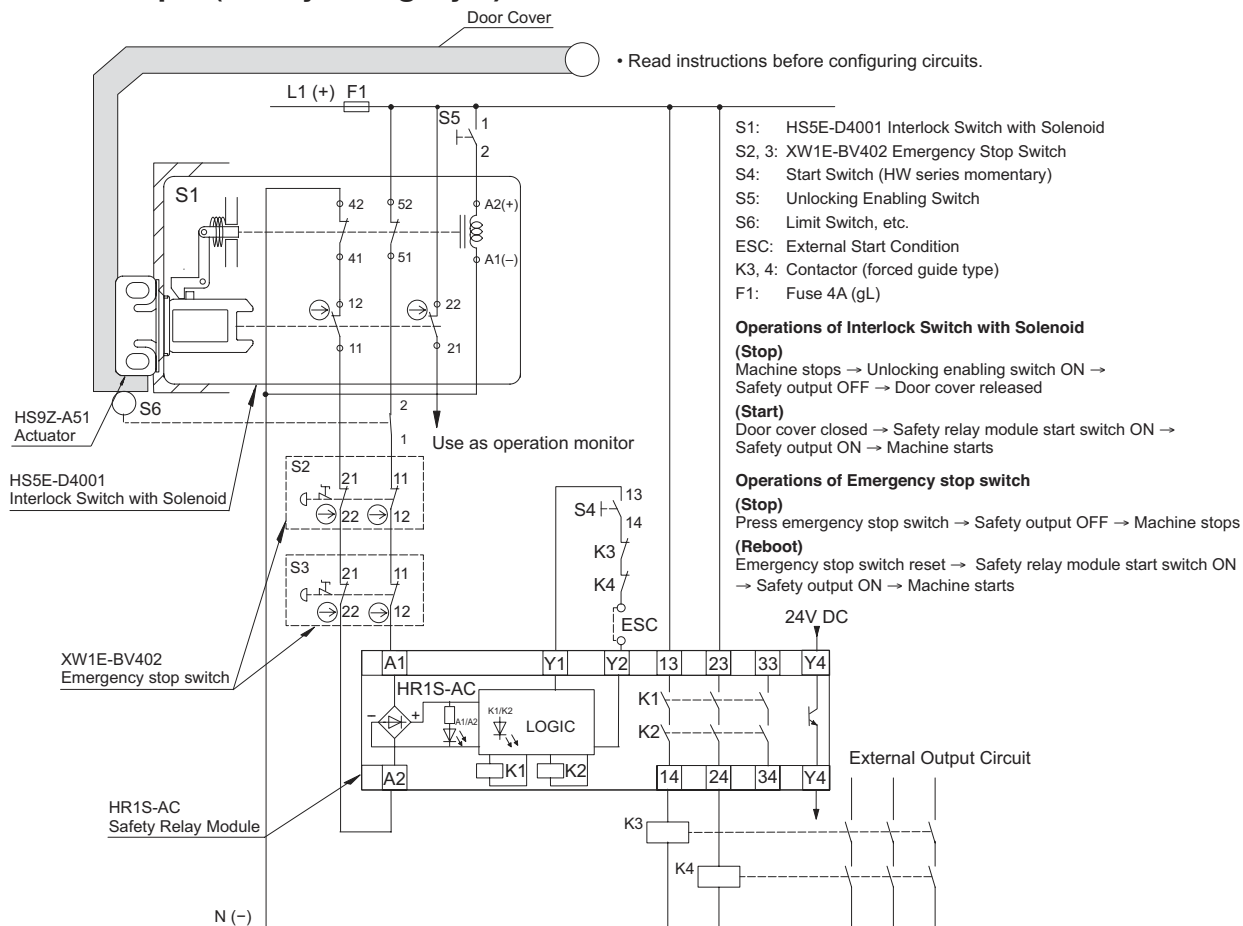
HR1S-AC Safety Relay Modules

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)

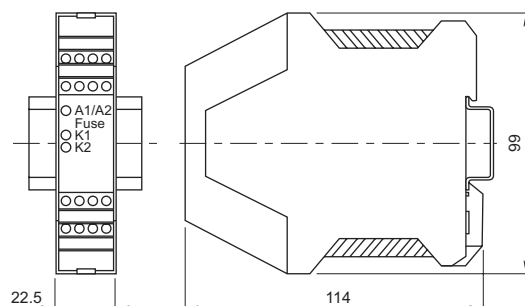


HR1S-AF5130B/-AF5130PB

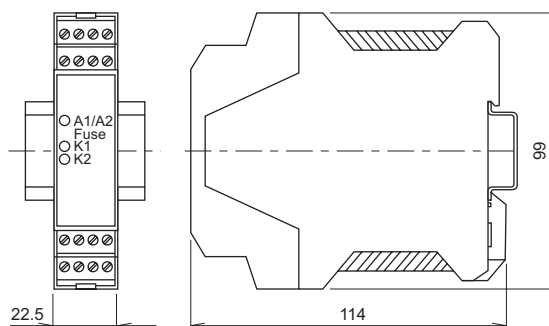


Dimensions

• HR1S-AF5130B



• HR1S-AF5130PB Removable Terminal Type



All dimensions in mm.

Types

Ordering Type No.	Terminal Style
HR1S-AF5130B	Integrated Terminal Block
HR1S-AF5130PB	Removable Terminal Block

Specifications

Operating Temperature		-25 to +55°C (no freezing)
Degree of Protection		Terminal: IP20, Housing: IP40
Rated Voltage		24V AC (-15 to +10%) 50/60 Hz 24V DC (-15 to +10%)
Power Consumption		5 VA maximum (24V AC) 2.5W maximum (24V DC)
Overcurrent Protection		Electronic (Note)
Control Circuit Voltage		24V
Safety Category		4
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	
Output Contact Ratings	Safety Circuit	AC-15
		DC-13
	Minimum Applicable Load	
Operating Frequency		1200 operations/h maximum
Rated Current		Safety circuit output total: 18A maximum Each safety circuit output: 6A maximum
Wire Size		HR1S-AF5130B: 1 × 2.5 mm ² , 2 × 0.75 mm ² maximum HR1S-AF5130PB: 1 × 2.5 mm ² , 2 × 1.5 mm ² maximum
Weight (approx.)		250g

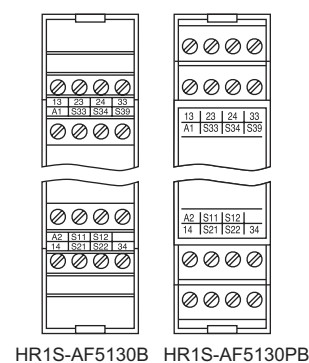
Note: Short-circuit of S11 and S21 activates the overcurrent protection circuit, interrupting the power supply. The safety output turns off. Normal status is restored when the short-circuit is removed.

- 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.

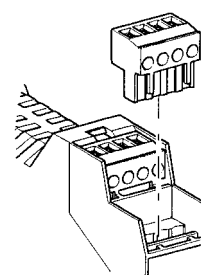
LED Indicator

- 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.

Terminal Arrangement



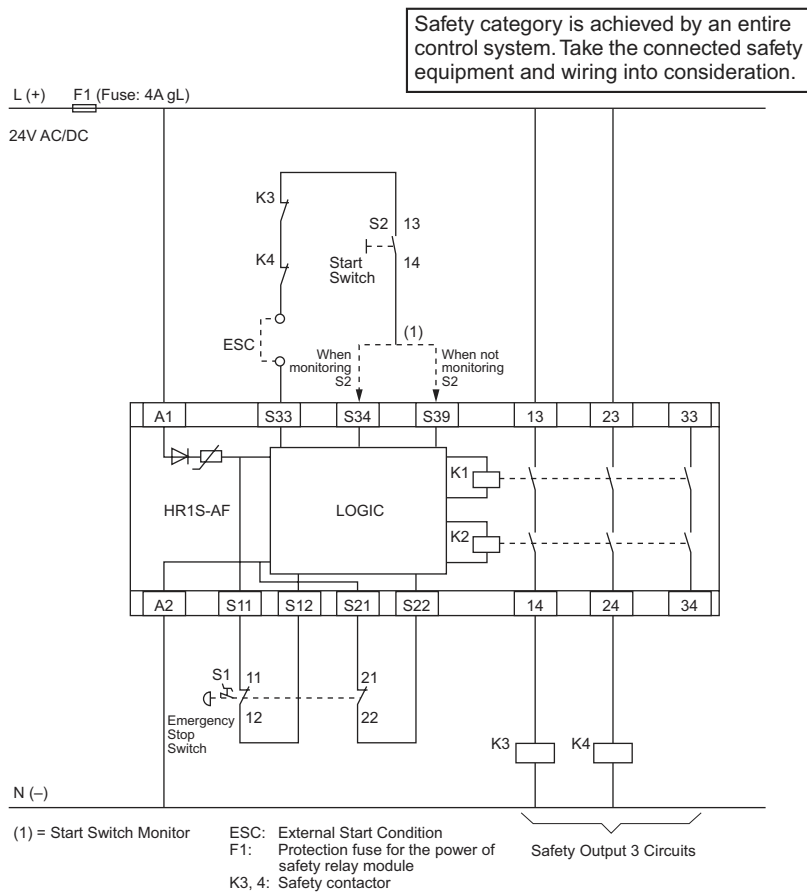
- The terminal block of the HR1S-AF5130PB can be removed and installed as shown below, allowing for easy installation and replacement of modules.



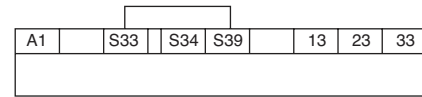
HR1S-AF Safety Relay Modules

HR1S-AF Wiring Diagram

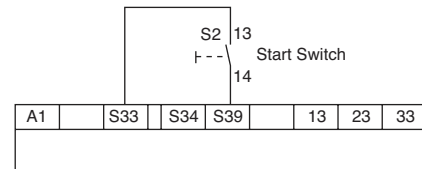
• Safety Category 4 Circuit (using an emergency stop switch)



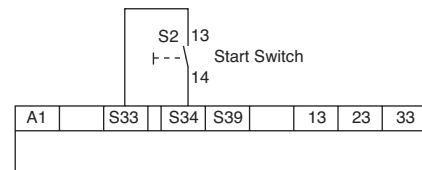
• When not using a start switch (automatic start)



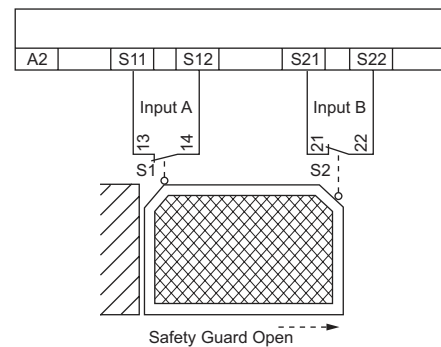
• When not monitoring the start switch (welding of start switch cannot be detected)



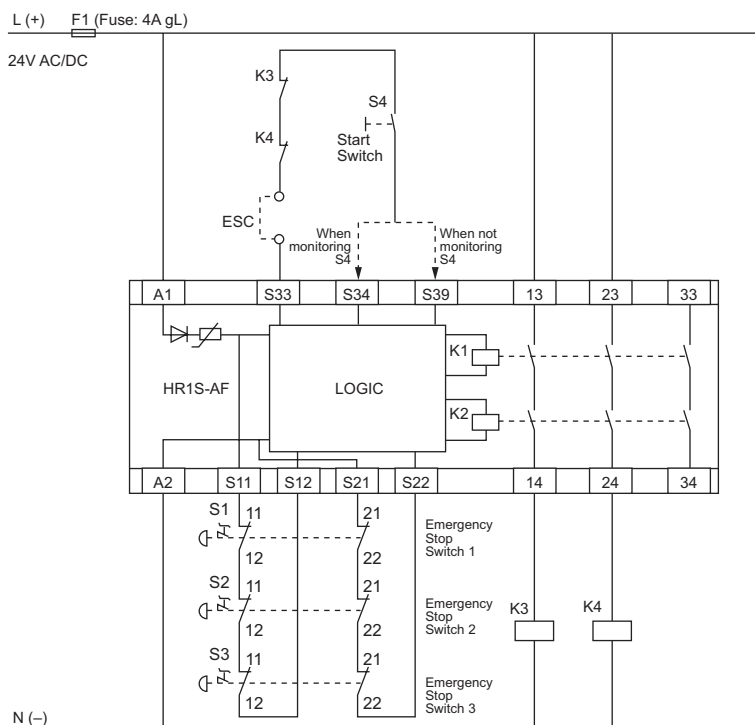
• When monitoring the start switch (detecting the OFF status of start switch)



• Limit switch or interlock switch for guard opening/closing



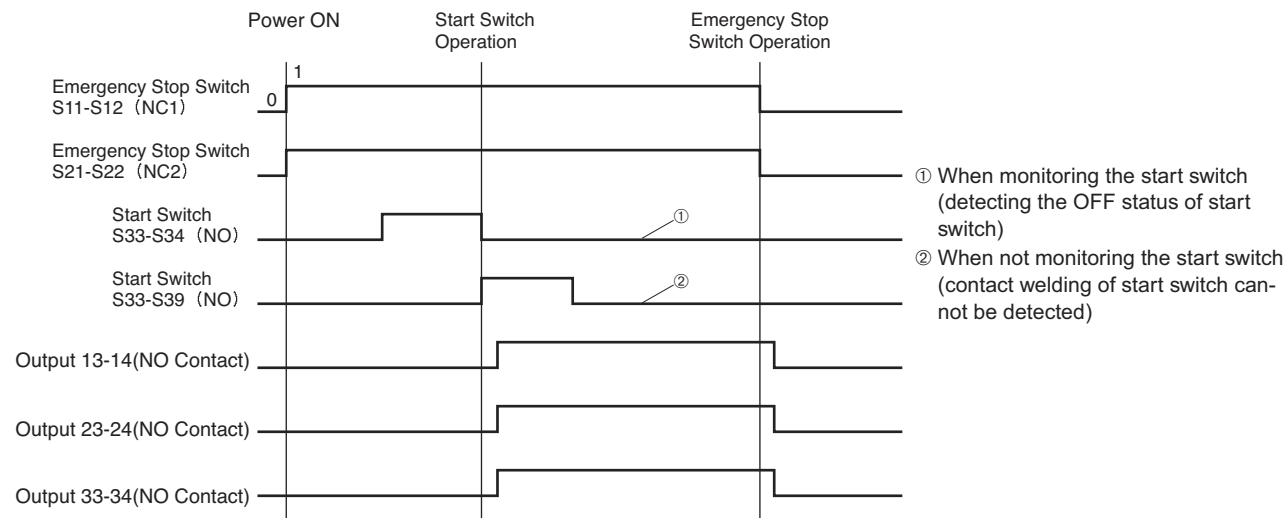
• Safety Category 3 Circuit (using multiple emergency stop switches)



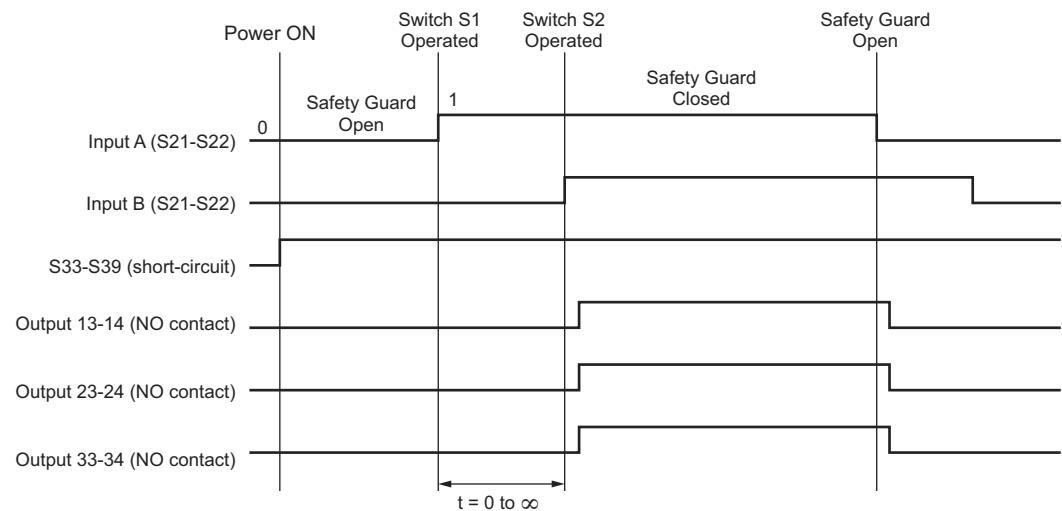
Flush Silhouette
Control Units
Display Lights
Display Units
Safety Products
Terminal Blocks
Comm. Terminals
AS-Interface
Relays & Timers
Sockets
Circuit Protectors
Power Supplies
PLCs & SmartRelay
Operator Interfaces
Sensors
Control Stations
Explosion Protection
References

HR1S-AF Operation Chart

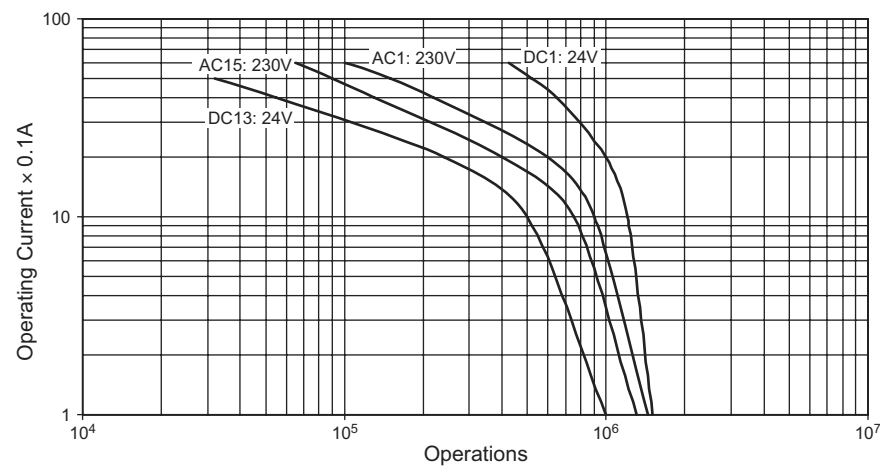
• When Using the Emergency Stop Switch



• When not Using the Safety Guard (Automatic Start)



Output Contact Electrical Life



HR1S-AK Safety Relay Modules

HR1S-AK311144/-AK311144P/-AK351144/-AK351144P



Types

Ordering Type No.	Terminal Style	Rated Voltage
HR1S-AK311144	Integrated Terminal Block	24V AC
HR1S-AK311144P	Removable Terminal Block	24V DC
HR1S-AK351144	Integrated Terminal Block	120V AC
HR1S-AK351144P	Removable Terminal Block	24V DC

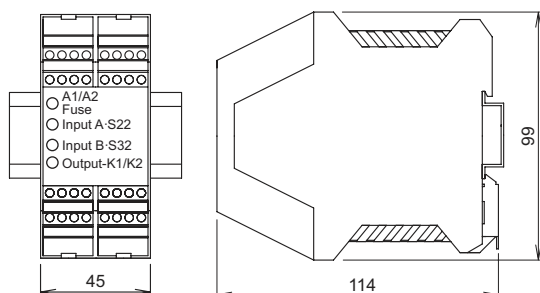
Specifications

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		
Safety Category	4		
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
	Auxiliary Contacts	Contact	1NC
		Transistor	4NO
Output Contact Ratings	Safety Circuit	AC-15	C300 (1800VA/180VA)
		DC-13	24V/1.5A, L/R = 50 ms
	Auxiliary Circuits	AC-15	C300 (1800VA/180VA)
		DC-13	24V/1.5A, L/R = 50 ms
	Transistor Circuit	24V/20 mA	
Minimum Applicable Load	17V/10 mA (initial value)		
Operating Frequency	1200 operations/h maximum		
Rated Current	Safety circuit output total: 18A maximum Each safety circuit output: 6A maximum		
Wire Size	HR1S-AK311144: 1 × 2.5 mm ² , 2 × 0.75 mm ² maximum HR1S-AK311144P: 1 × 2.5 mm ² , 2 × 1.5 mm ² maximum HR1S-AK351144: 1 × 2.5 mm ² , 2 × 0.75 mm ² maximum HR1S-AK351144P: 1 × 2.5 mm ² , 2 × 1.5 mm ² maximum		
Weight (approx.)	HR1S-AK311144(P): 300g HR1S-AK351144(P): 400g		

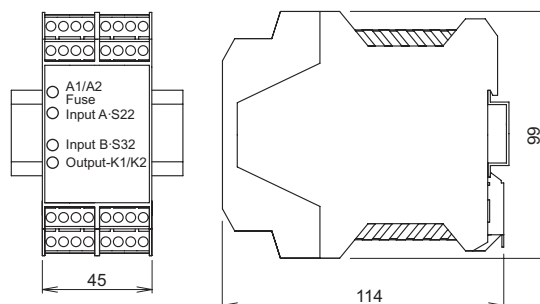
• Use a 4A fuse (Type gL) or a 6A fast blow fuse for power line and output line protection.

Dimensions

• HR1S-AK311144/-AK351144



• HR1S-AK311144P/-AK351144P Removable Terminal Type



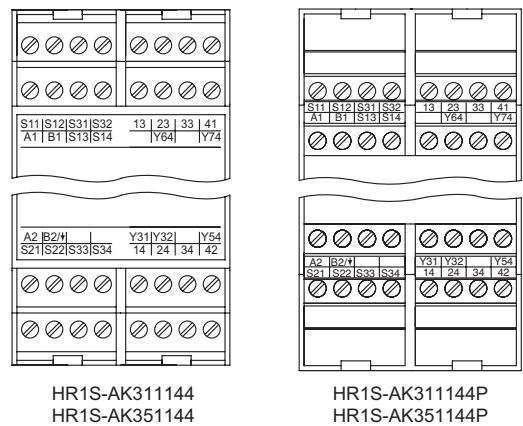
All dimensions in mm.

Flush Silhouette
Control Units
Display Lights
Display Units
Safety Products
Terminal Blocks
Comm. Terminals
AS-Interface
Relays & Timers
Sockets
Circuit Protectors
Power Supplies
PLCs & SmartRelay
Operator Interfaces
Sensors
Control Stations
Explosion Protection
References

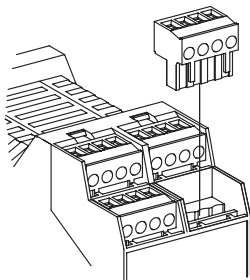
LED Indicator

- 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.

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

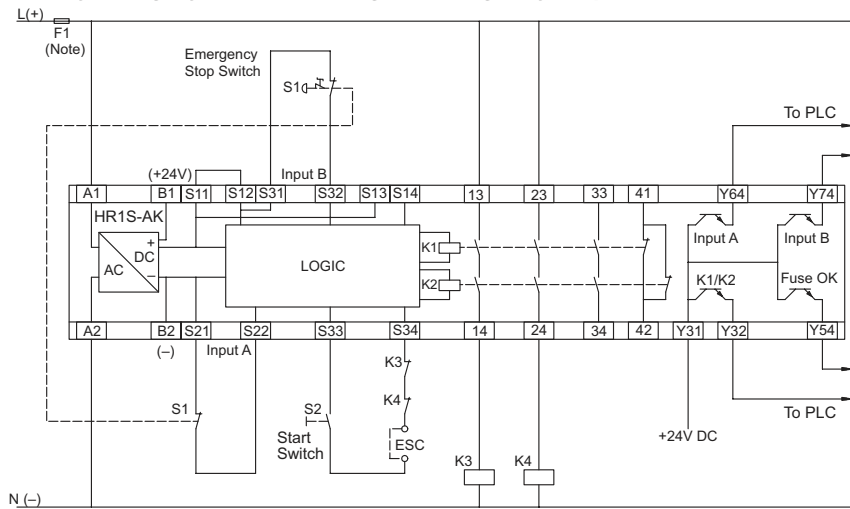
HR1S-AK Wiring Diagram

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

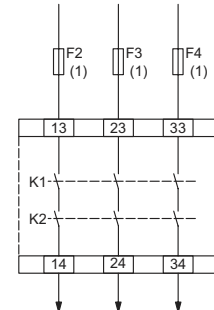
AC power: A1-A2

DC power: B1-B2

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



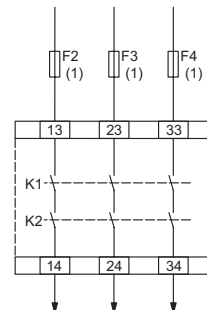
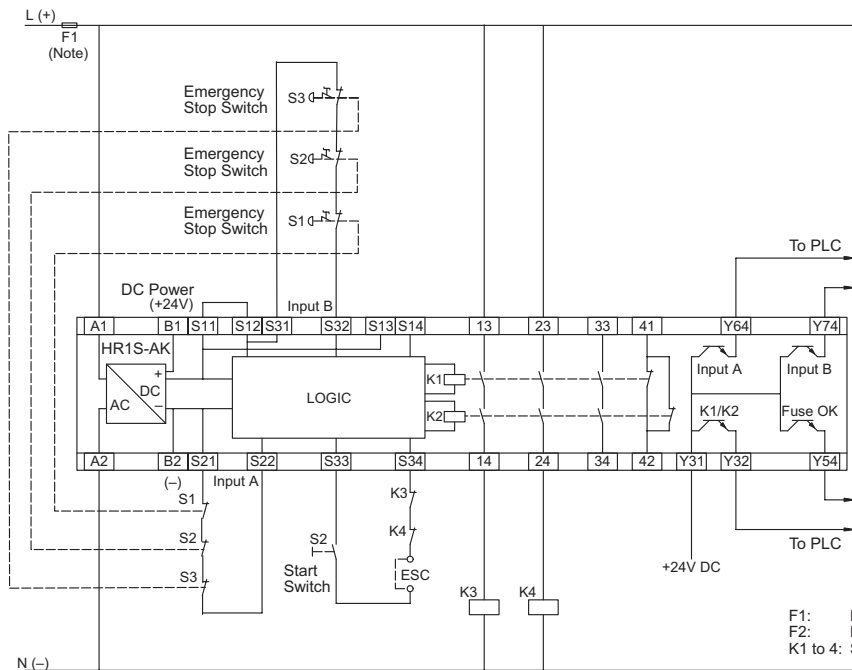
Safety category is achieved by an entire control system. Take the connected safety equipment and wiring into consideration.



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

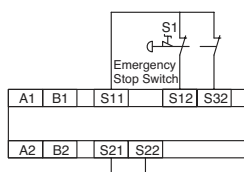
• Safety Category 3 Circuit (using multiple emergency stop switches)



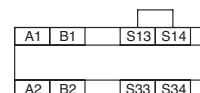
Note: Use a 4A fuse (Type gL) or a 6A fast blow fuse for power and output line protection.

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

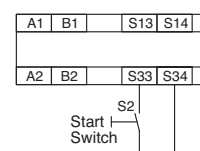
• Although two input channels are used, short-circuit cannot be detected in the wiring shown below. Safety category becomes 3.



• When not using a start switch (automatic start)



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

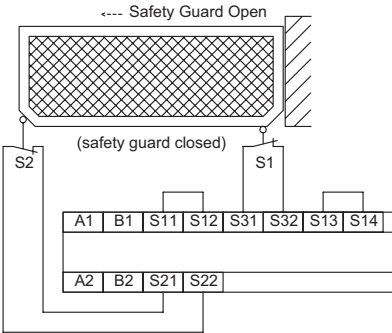


HR1S-AK Wiring Diagram with Safety Equipment

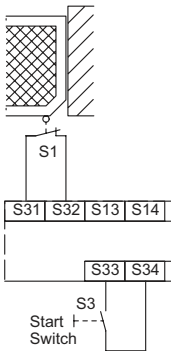
Applicable safety category depends on the function of connected safety equipment. Confirm the function of safety equipment before use.

Two limit switches/without synchronization monitor

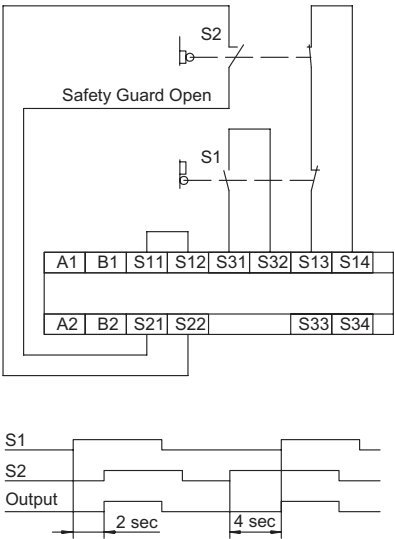
Automatic Start



Using a Start Switch

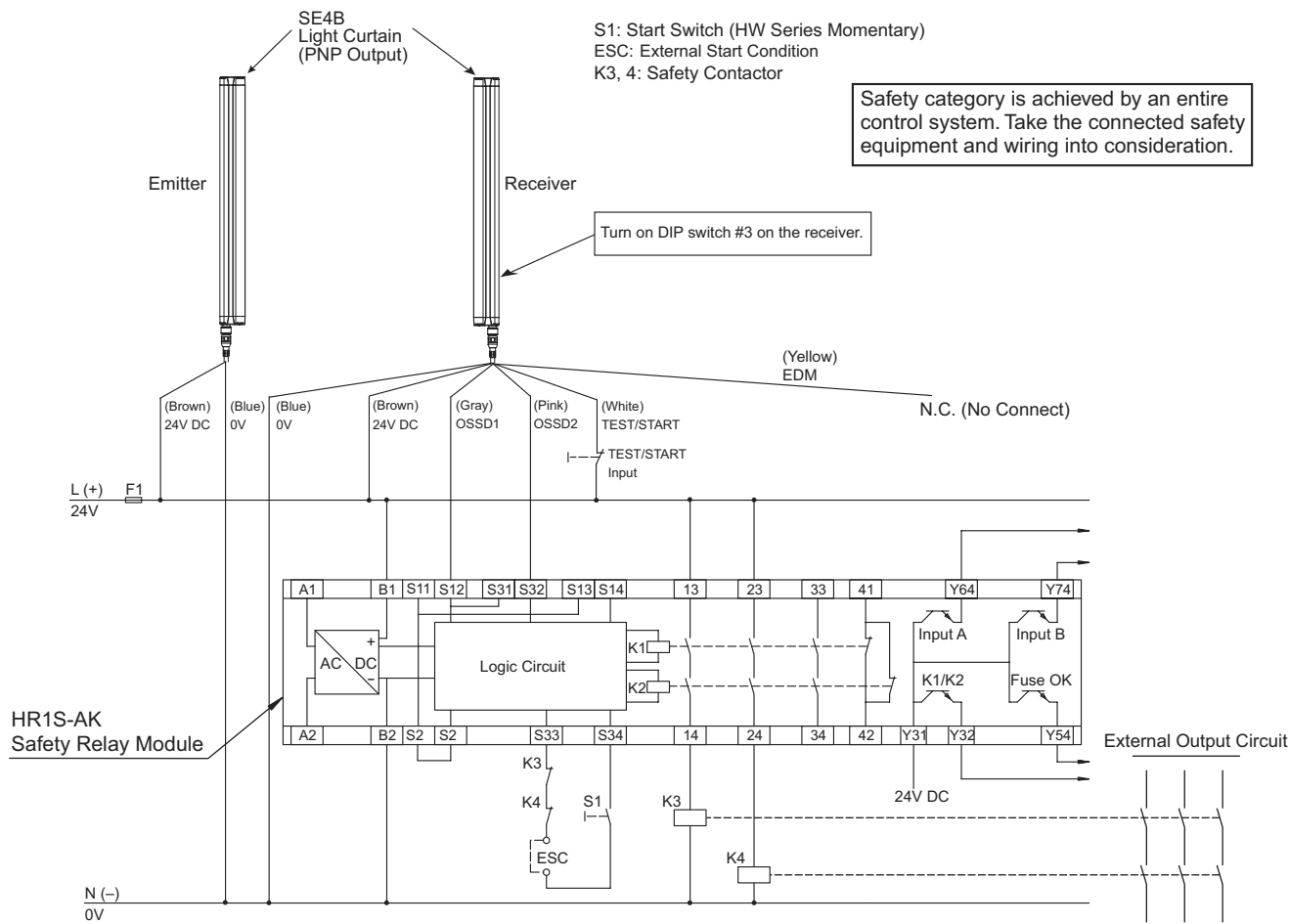


Two limit switches with synchronization monitor
(Synchronization monitor is effective for automatic start only.)



When connecting with light a curtain

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



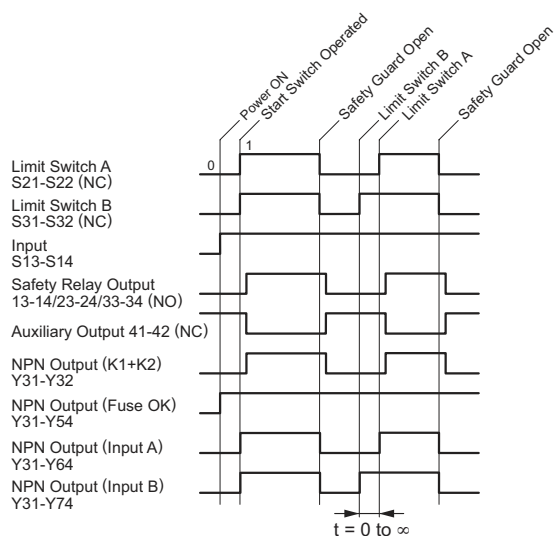
The SE4B light curtains are used in the above system.

Flush Silhouette
Control Units
Display Lights
Display Units
Safety Products
Terminal Blocks
Comm. Terminals
AS-Interface
Relays & Timers
Sockets
Circuit Protectors
Power Supplies
PLCs & SmartRelay
Operator Interfaces
Sensors
Control Stations
Explosion Protection
References

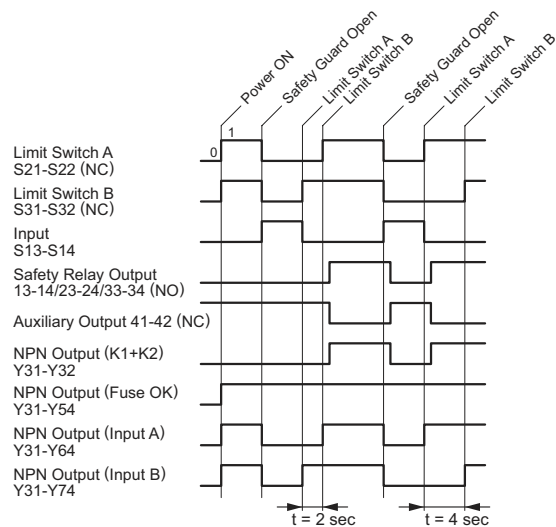
HR1S-AK Safety Relay Modules

HR1S-AK Operation Chart

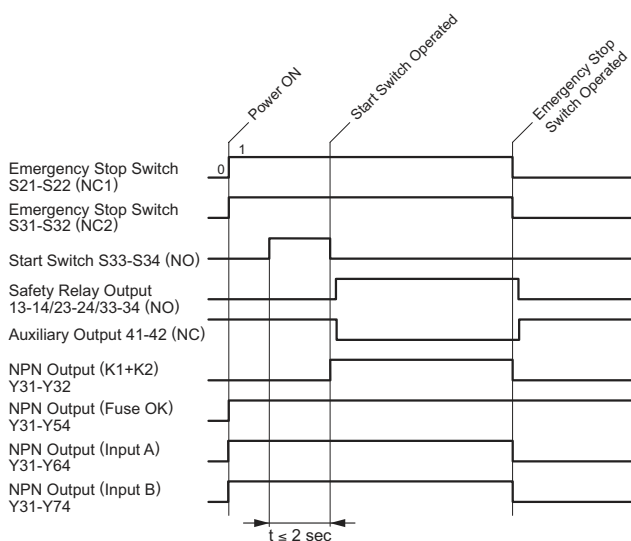
• Safety guard application using two limit switches (automatic start mode)



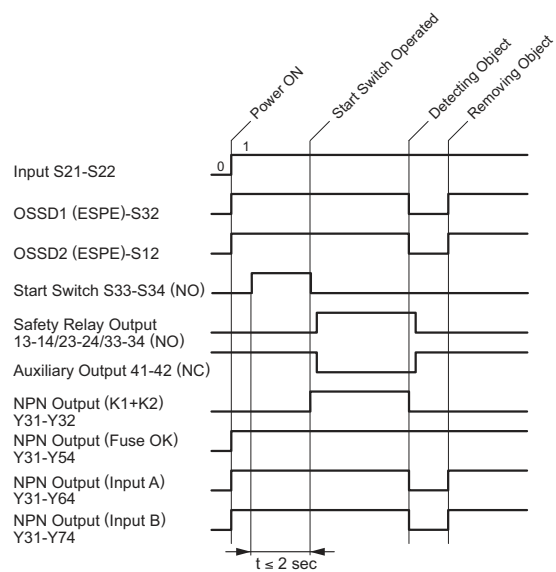
• Safety guard application using two limit switches (automatic start mode, synchronization monitor mode)



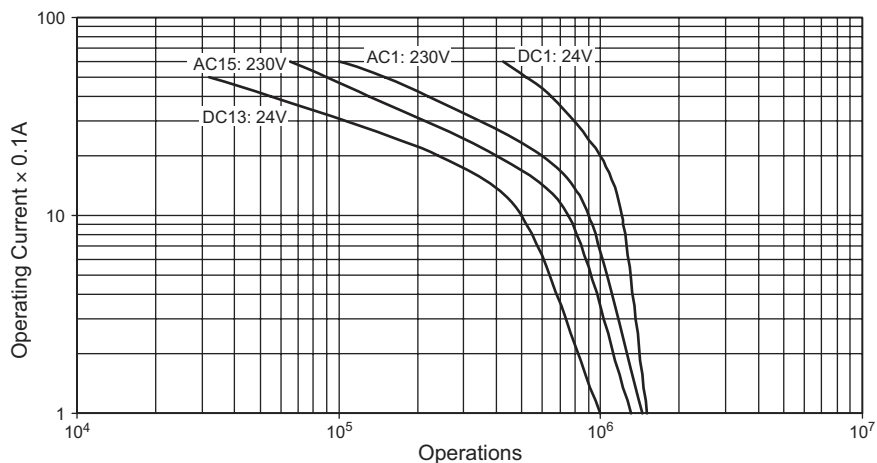
• Using emergency stop switches (start switch monitor mode)



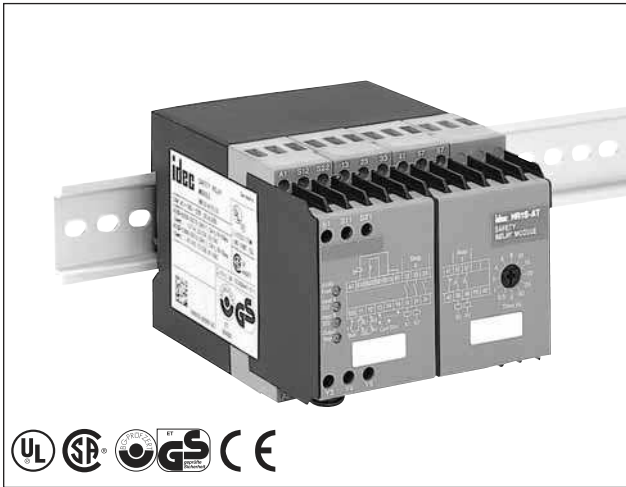
• Using OSSD output of light curtain (ESPE)



Output Contact Electrical Life



HR1S-AT5110/-AT3410



Types

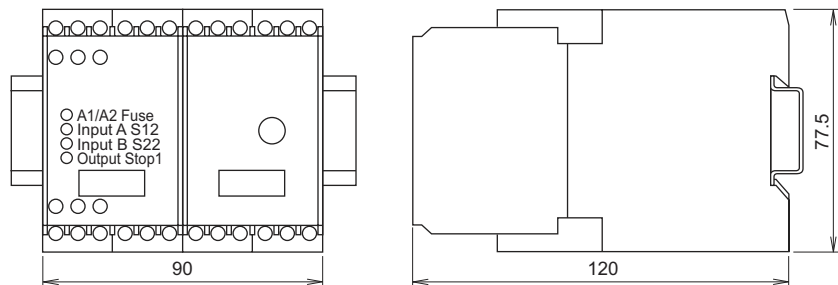
Ordering Type No.	Rated Voltage
HR1S-AT5110	24V AC (–20 to +10%) 50/60 Hz 24V DC (–20 to +20%)
HR1S-AT3410	115V AC (±15%) 50/60 Hz

Specifications

Operating Temperature	-10 to +55°C (no freezing)		
Degree of Protection	Terminal: IP20, Housing: IP40		
Rated Voltage	HR1S-AT5110: 24V AC (-20 to +10%) 50/60 Hz 24V DC (-20 to +20%) HR1S-AT3410: 115V AC (±15%) 50/60 Hz		
Power Consumption	HR1S-AT5110: 8VA maximum (24V AC) 4.4W maximum (24V DC) HR1S-AT3410: 10VA maximum		
Overcurrent Protection	Electronic		
Control Circuit Voltage	HR1S-AT5110: 24V HR1S-AT3410: 48V		
Safety Category	4		
Response Time	20 ms maximum		
Input Synchronization Time	Within 75 ms (at automatic start)		
Overvoltage Category	III		
Pollution Degree	2		
Rated Insulation Voltage	300V		
No. of Output Circuits	Safety Circuit		3NO
	Time-delay Circuit		2NO
	Auxiliary Contacts	Contact	1NC
Output Contact Ratings	Safety Circuit	AC-15	B300 (3600VA/360VA)
		DC-13	24V/1.5A, L/R = 50 ms
	Time-delay Circuit	AC-15	C300 (1800VA/180VA)
		DC-13	24V/1.5A, L/R = 50 ms
		Preset Time	0, 0.5, 1, 2, 4, 6, 8, 10, 15, 20, 25, 30 sec
	Auxiliary Circuits	AC-15	C300 (1800VA/180VA)
		DC-13	24V/1.5A, L/R = 50 ms
Minimum Applicable Load		17V/10 mA (initial value)	
Operating Frequency	1200 operations/h maximum		
Rated Current	Output total: 8A maximum		
Wire Size	2 × 2.5 mm ² maximum		
Weight (approx.)	HR1S-AT5110: 650g HR1S-AT3410: 850g		

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

Dimensions



All dimensions in mm.

LED Indicator

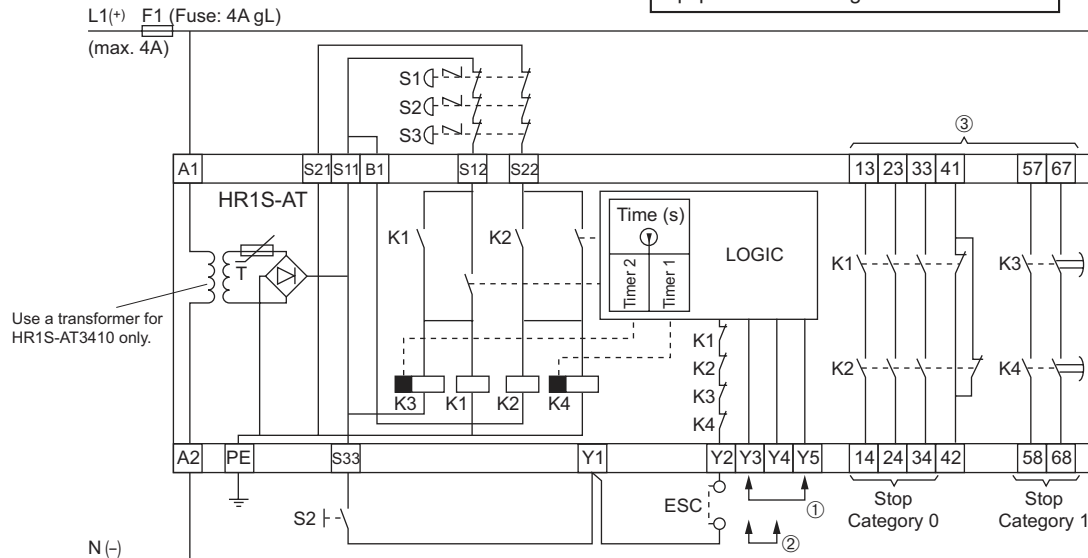
- A1/A2 Fuse: Turns on when power circuit is normal.
- Input A S12: Turns on when S11-S12 is closed.
- Input B S22: Turns on when S21-S22 is closed.
- Output Stop 1: Turns on when the time-delay output circuits 57-58, 67-68 are closed.

HR1S-AT Safety Relay Modules

HR1S-AT Wiring Diagram

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

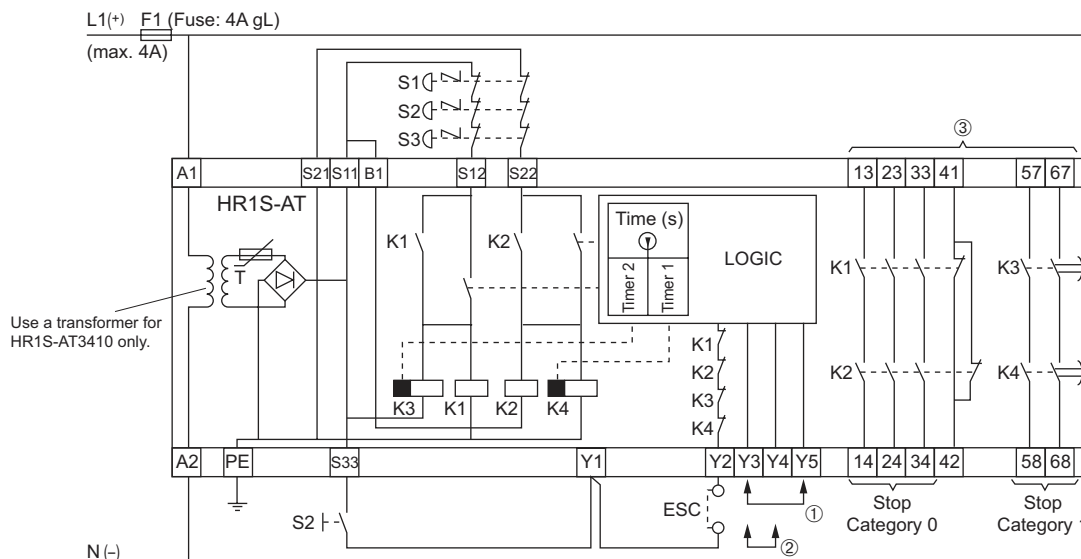
Safety category is achieved by an entire control system. Take the connected safety equipment and wiring into consideration.



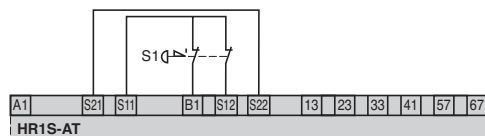
- ① When monitoring the start switch (detecting OFF) (recommended)
 - ② When not monitoring the start switch (start switch welding cannot be detected) (output circuit closes when the start switch is closed)
 - ③ Provide an external fuse for output line protection.
- Note: When using off-delay output, safety category becomes 3.

- S1: Emergency stop switch - 2NC contact, when using with different poles (recommended)
 S2: Start switch
 ESC: External start condition
 Y1 (S33)-Y2: Feedback loop
 F1: Protection fuse

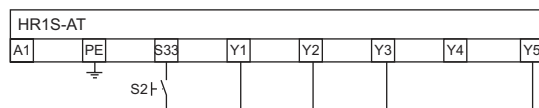
• Safety Category 3 Circuit (using multiple emergency stop switches)



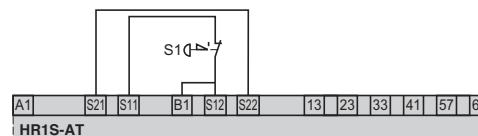
• Emergency stop switch - Input 2 channels When not detecting short-circuit (B1-S12 short-circuit not detected)



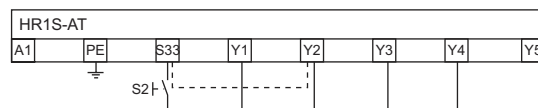
• When monitoring the start switch (Y3-Y5 short-circuited)



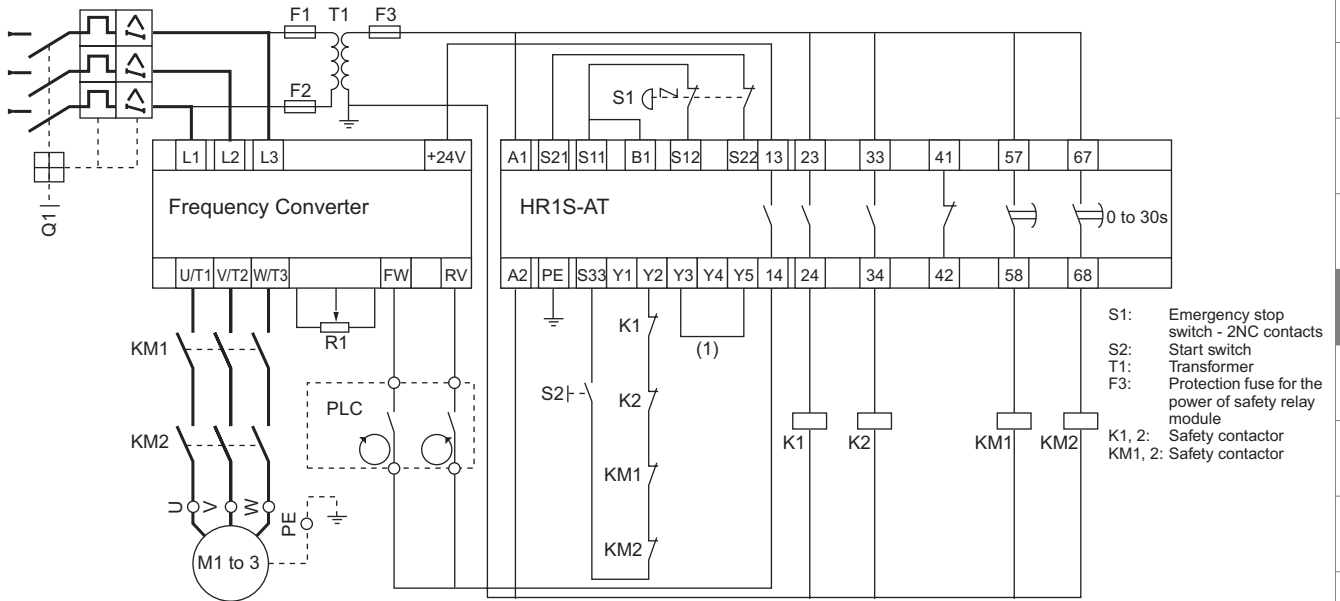
• Emergency stop switch - Input 1 channel When not detecting short-circuit (All failures such as short-circuit of emergency stop switch wiring not detected)



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

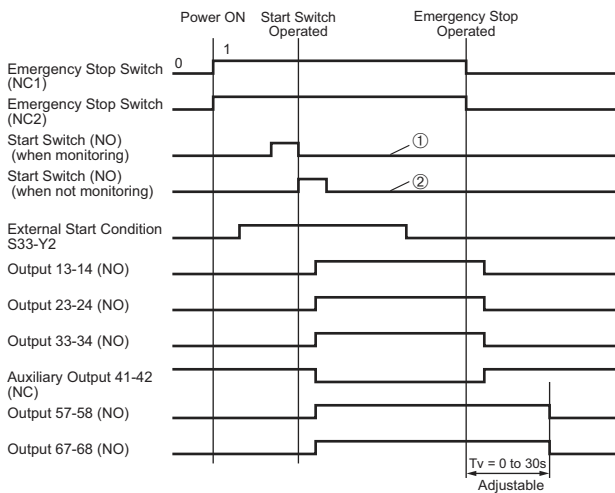


• HR1S-AT with a Variable Speed Drive Wiring Diagram (safety category 3 circuit)

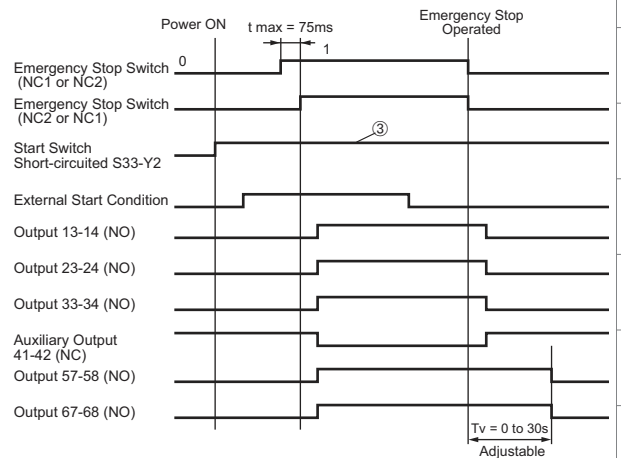


(1): When monitoring the start switch (detecting the OFF status of start switch)
The output circuit closes when the start switch opens after being closed (recommended).

HR1S-AT Operation Chart



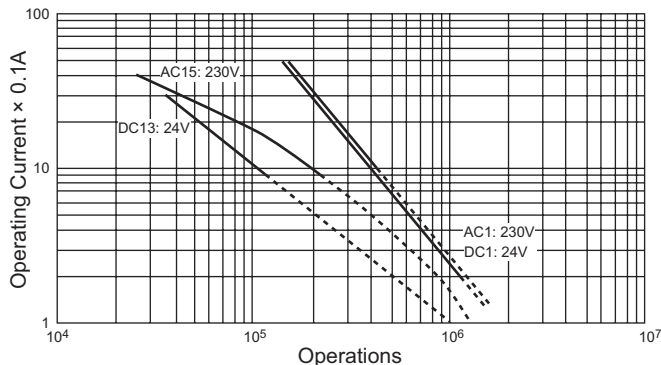
- ① When monitoring the start switch (detecting the OFF status of start switch) (recommended) Y3-Y5 short-circuited
- ② When not monitoring the start switch (contact welding of start switch cannot be detected) Y3-Y4 short-circuited



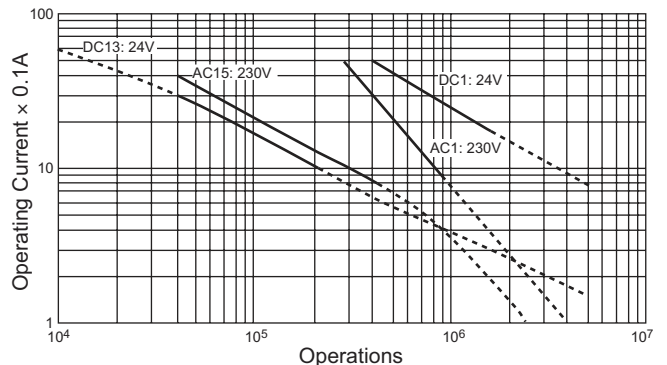
- ③ Without start switch (automatic start) (Y3-Y4 and S33-Y2 short-circuited)

Output Contact Electrical Life

• Time-delay Circuit, Auxiliary Circuit



• Safety Circuit



HR1S-ECM Safety Relay Modules

HR1S-ECM5131/-ECM3431



Types

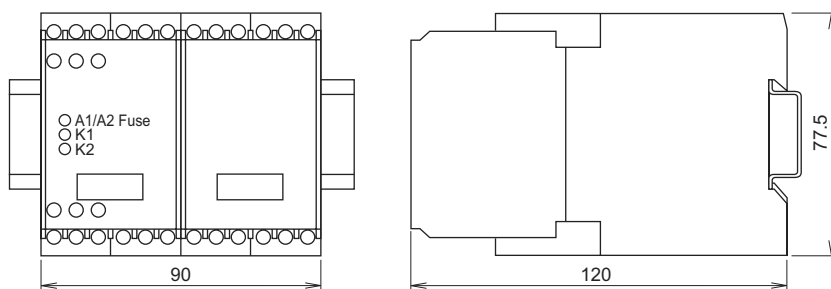
Ordering Type No.	Rated Voltage
HR1S-ECM5131	24V AC (–20 to +10%) 50/60 Hz 24V DC (–20 to +20%)
HR1S-ECM3431	115V AC (±15%) 50/60 Hz

Specifications

Operating Temperature		–10 to +55°C (no freezing)	
Degree of Protection		Terminal: IP20, Housing: IP40	
Rated Voltage		HR1S-ECM5131: 24V AC (–20 to +10%) 50/60 Hz 24V DC (–20 to +20%) HR1S-ECM3431: 115V AC (±15%) 50/60 Hz	
Power Consumption		HR1S-ECM5131: 3VA maximum (24V AC) 1.7W maximum (24V DC) HR1S-ECM3431: 5VA	
Overcurrent Protection		Electronic	
Control Circuit Voltage		HR1S-ECM5131: 24V HR1S-ECM3431: 48V	
Safety Category		4	
Response Time		23 ms maximum	
Overvoltage Category		III	
Pollution Degree		2	
Rated Insulation Voltage		300V	
No. of Output Circuits	Safety Circuit		4NO
	Auxiliary Contacts	Contact	1NC
		Transistor	1NO
Output Contact Ratings	Safety Circuit	AC-15	B300 (3600VA/360VA)
		DC-13	24V/1.5A, L/R = 50 ms
	Auxiliary Circuits	AC-15	C300 (1800VA/180VA)
		DC-13	24V/1.2A, L/R = 50 ms
	Transistor Circuit		24V/20 mA
	Minimum Applicable Load		17V/10 mA (initial value)
Operating Frequency		1200 operations/h maximum	
Rated Current		Output total: 24A maximum	
Wire Size		2 × 2.5 mm ² maximum	
Weight (approx.)		HR1S-ECM5131: 500g HR1S-ECM3431: 650g	

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

Dimensions



All dimensions in mm.

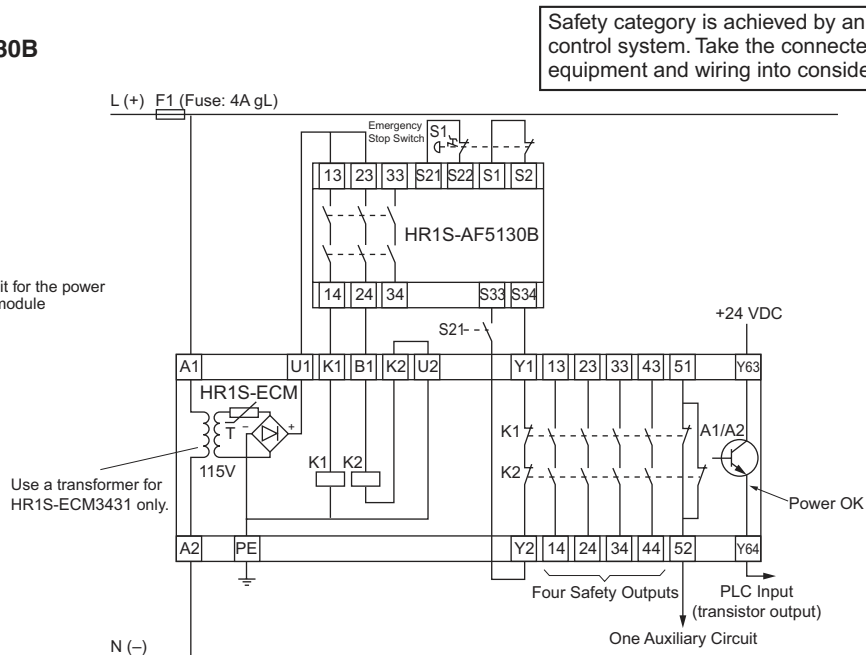
LED Indicator

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

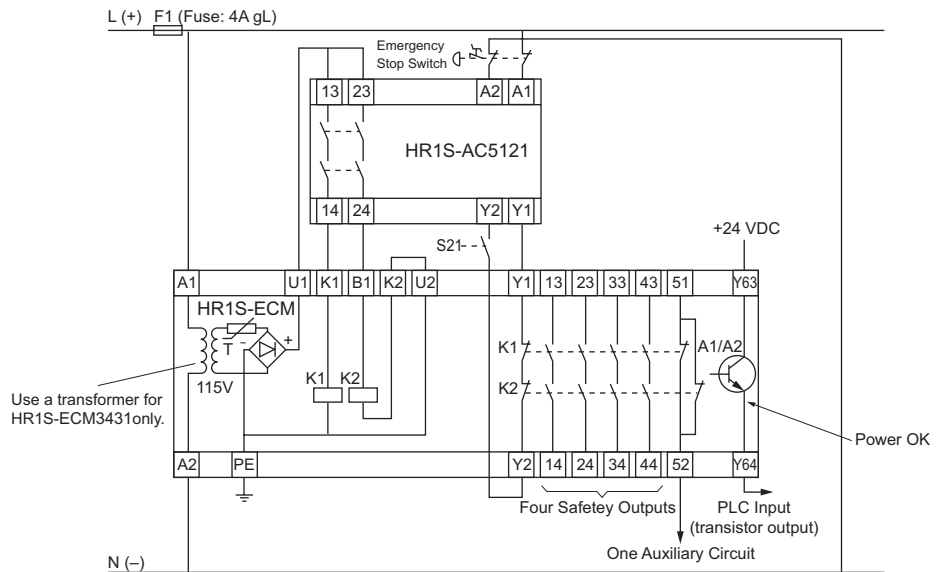
HR1S-ECM Wiring Diagram

- **Safety Category 4 Circuit**
Combination with HR1S-AF5130B

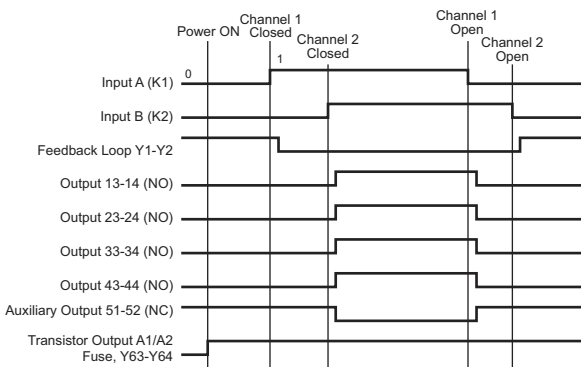
S2: Start switch
F1: Protection circuit for the power of safety relay module



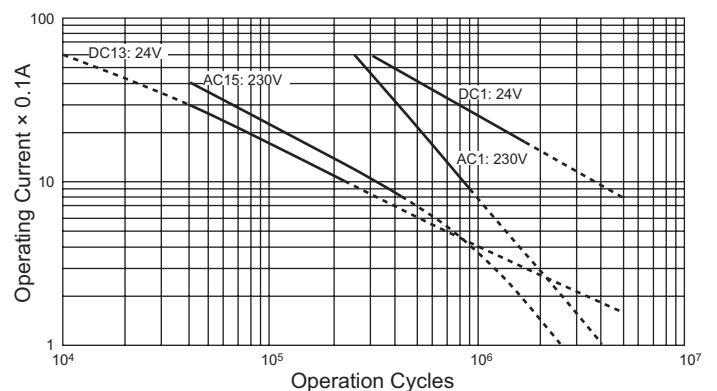
- **Safety Category 3 Circuit**
Combination with HR1S-AC5121



HR1S-ECM Operation Chart



Output Contact Electrical Life



HR1S 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 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 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 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.
- 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-AT

- Use 13-14, 23-24, and 33-34 outputs for stop category 0 compliant with EN 60204-1/EN 418. For stop category 1, use 57-58 and 67-68 outputs.
- Do not use 41-42 outputs for safety-related circuits (such as confirming the signals of open safety output).
- For using the two contacts of emergency stop switch effectively, connect the two contacts to S11-S12 and S21-S22, short-circuiting B1-S11.
Connecting the two emergency switch contacts to S11-S12 and B1-S11 and short-circuiting S21-S22 prevents detection of short-circuit between the two input channels, because of resulting in connection of the same poles (short-circuit caused by tucked cable cannot be detected).
- In order to detect the failure of start switch such as contact welding, short-circuit Y3-Y5.

Short-circuiting Y3-Y4 prevents detection of the start switch contact welding, because the output circuit closes when start switch closes.

HR1S-ECM

- Use 13-14, 23-24, 33-34, and 43-44 outputs for stop category 0 compliant with EN 60204-1/EN 418.
- Do not use 51-52 and Y63-Y64 outputs for safety-related circuits.

HR1S-DMB/HR1S-DME

- Use 13-14 and 23-24 safety outputs for the safety equipment which constitutes the safety circuit compliant with EN 60204-1/EN 418.
- 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 performs self-diagnosis for two seconds after powering up A1-A2 terminals. During self-diagnosis, all LEDs turn on, and Y34/Y44 outputs also turn on.
- Safety outputs turn on when the non-contact interlock switch has been actuated 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) fuse for power line protection.
- Use a 4A fuse (Type gL) or a 6A fast blow fuse for output line protection.