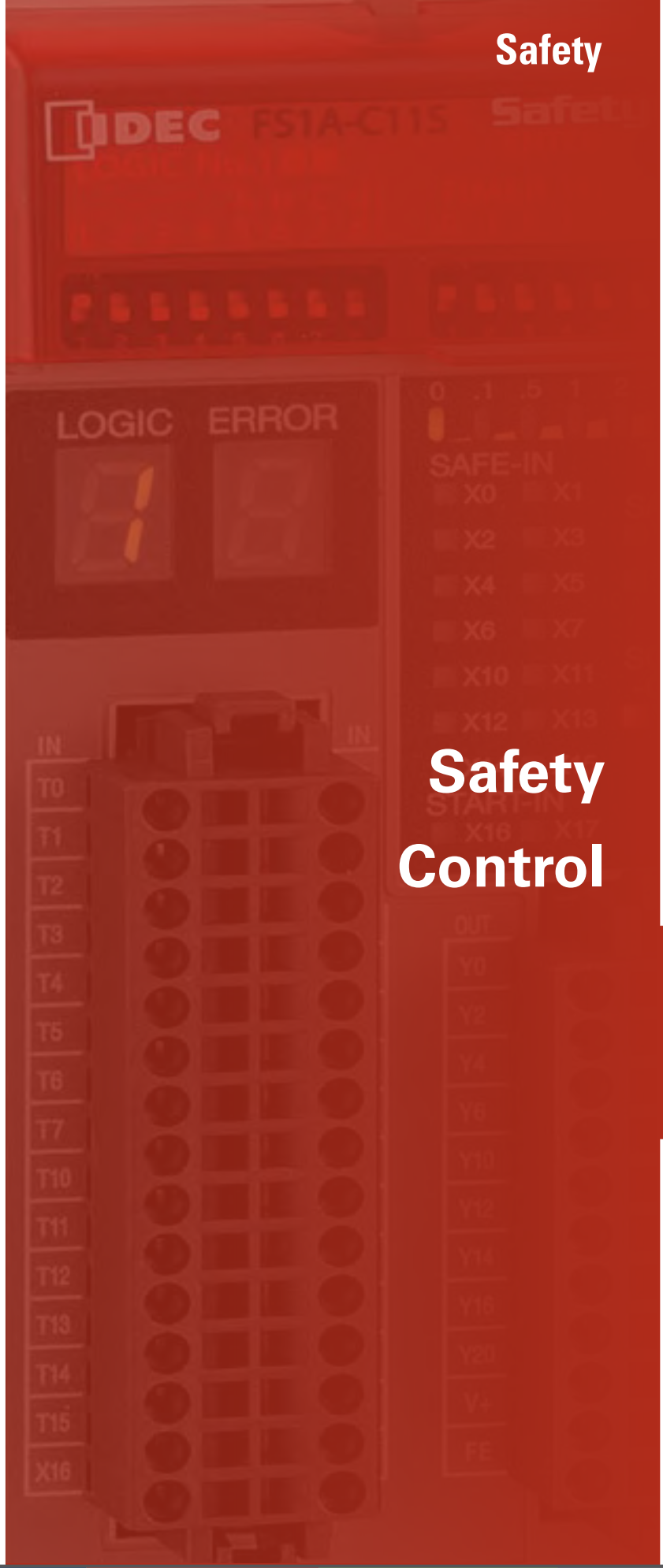


Safety Control

IDEC

www.IDEC.com/safety

Selection Guide

Series	Single Function Safety Relay	Single Function Safety Relay	Multi-function Safety Relay
	HR1S	HR2S	FS1A
Appearance			
Page	421	432	443
Performance Level	PLe	PLe	PLe
Safety Category	3/4	3/4	4
Contact Configuration	1NO/1NC, 2NC, 2NO/3NO (time delay)	3NO/1NC, 3NO/3NO (time delay) /2NC (Aux.)	4NO

Safety Relay HR1S-AC

Key features:

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

Part Numbers

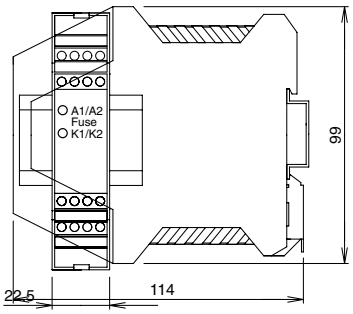
Part Number	Terminal Style
HR1S-AC5121	Integrated Terminal Block
HR1S-AC5121P	Removable Terminal Block

Specifications

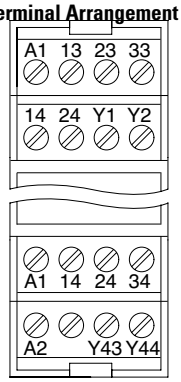
Operating Temperature			–10 to 55°C (no freezing)
Degree of Protection			Terminal: IP20, Housing: IP40
Rated Power Voltage			24V AC (–20 to +10%) 50/60 Hz 24V DC (±20%)
Power Consumption			AC: 2.2 VA (24V AC) maximum DC: 1.2W (24V DC) maximum
Overcurrent Protection			Electronic
Control Circuit Voltage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

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

Dimensions (mm)

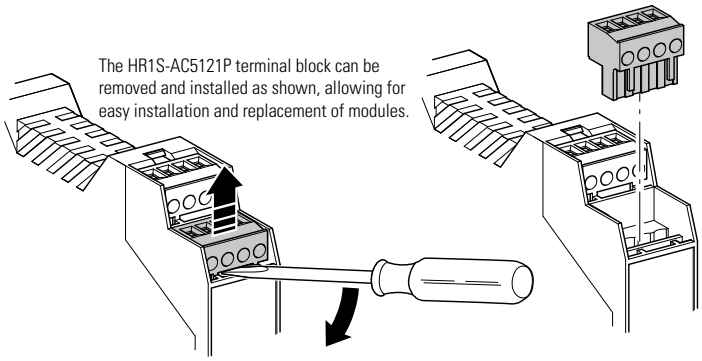


Terminal Arrangement



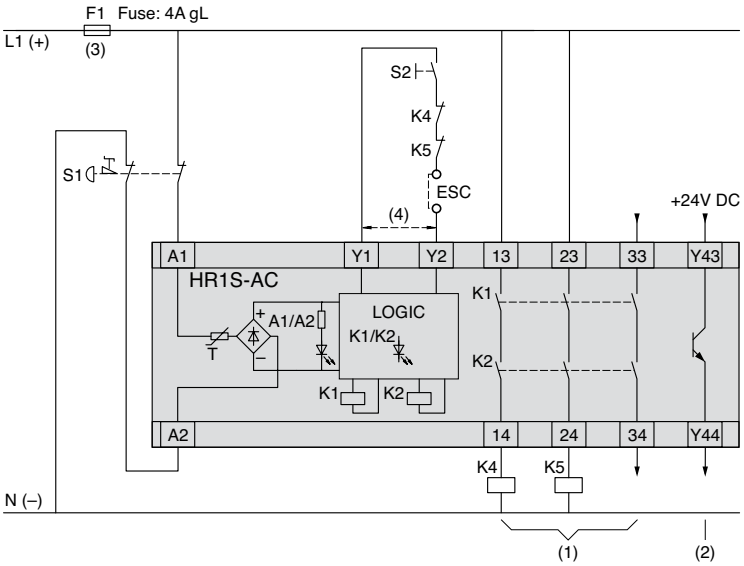
LED Indicator

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

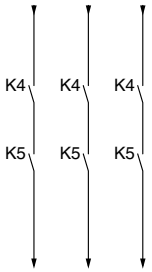


HR1S-AC Wiring Diagram

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



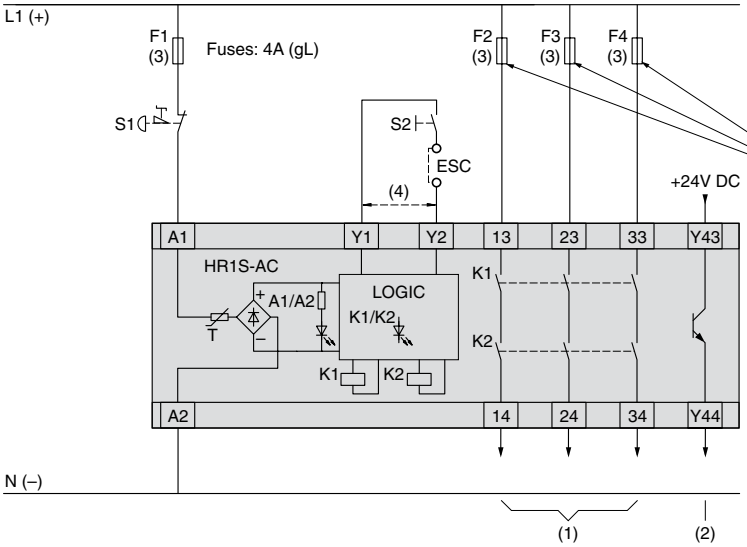
ESC: External Start Condition
S1: Emergency Stop Switch
S2: Start Switch
F1: Protection fuse for the power of safety relay module
K4, 5: Safety contactor



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

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

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

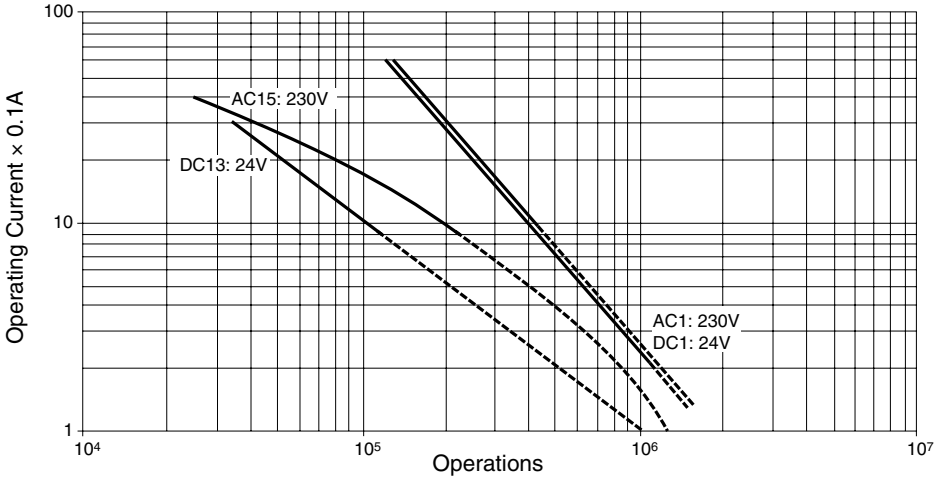


ESC: Exernal Start Condition
S1: Emergency Stop Switch
S2: Start Switch
F1: Protection fuse for the power of safety relay module
F2 to F4: Protection fuse for the output of safety relay module

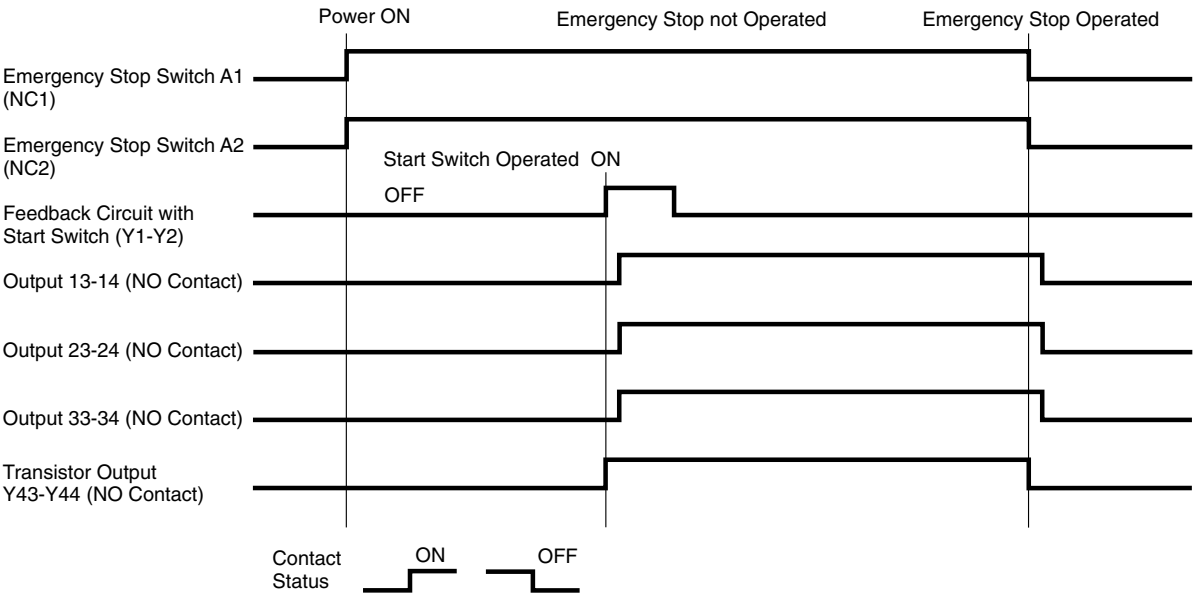
Fuses: 4A (gL) or 6A fast blow type

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

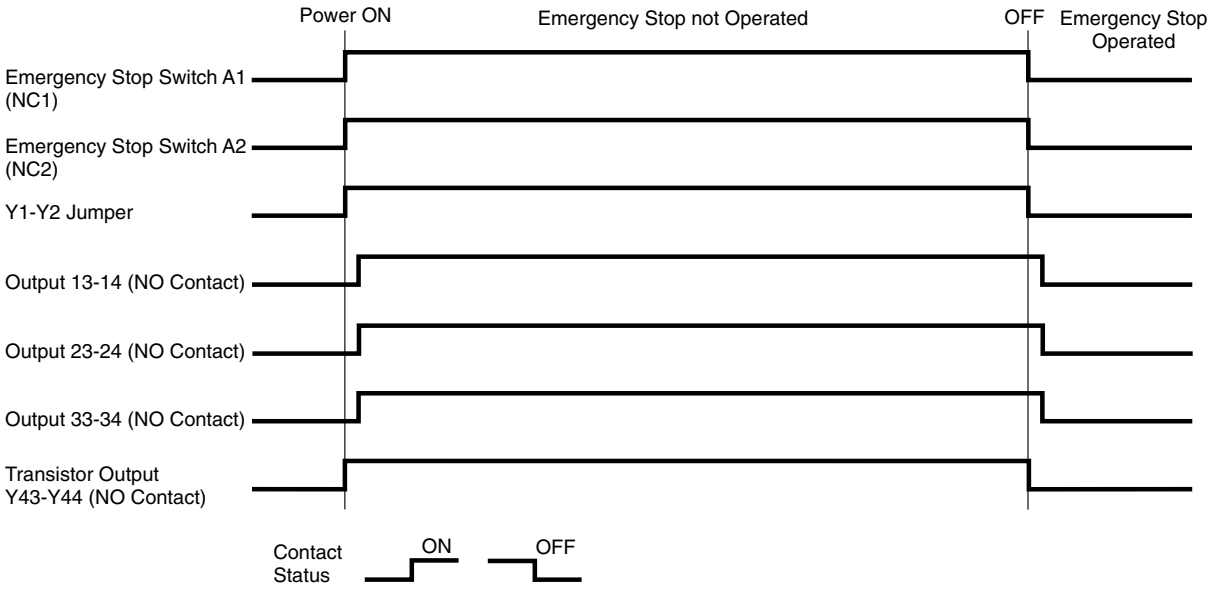
Output Contact Electrical Life



HR1S-AC Safety Relay Module Operation Chart
When Using a Start Switch



When Not Using a Start Switch



Safety Relay HR1S-AF

Key features:

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

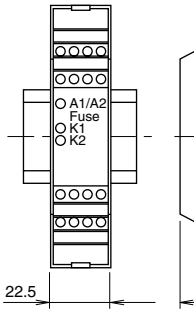
Part Numbers

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

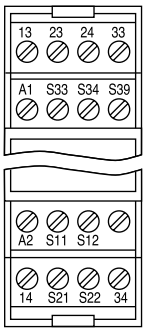
Specifications

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

Dimensions (mm)

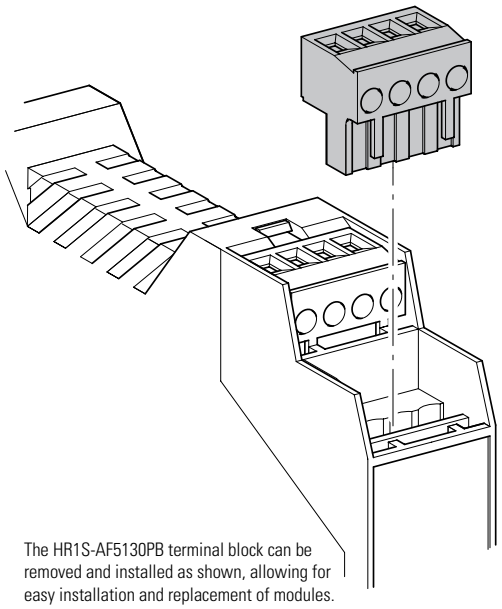


Terminal Arrangement



LED Indicator

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



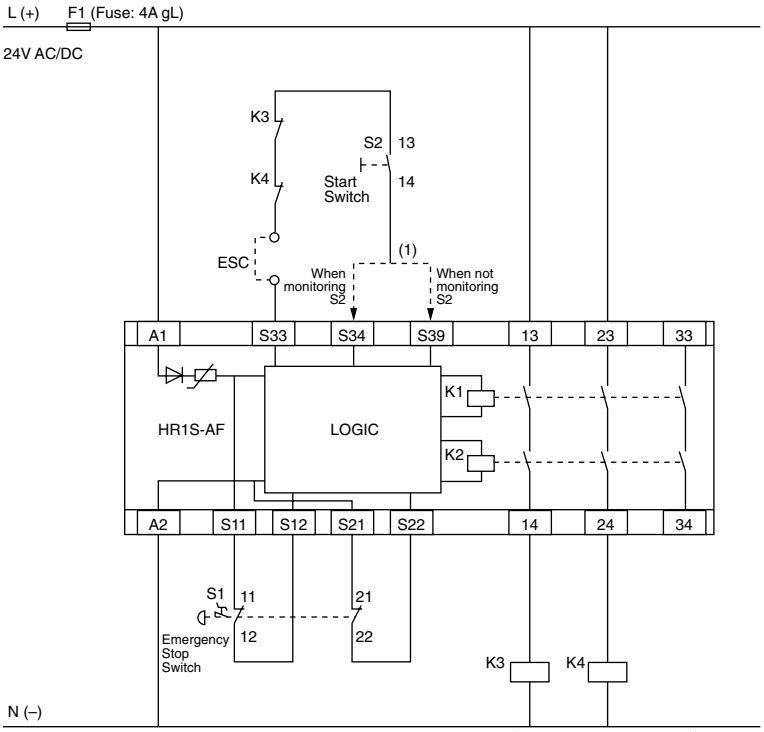
The HR1S-AF5130PB terminal block can be removed and installed as shown, allowing for easy installation and replacement of modules.

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

HR1S-AF Wiring Diagram

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

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

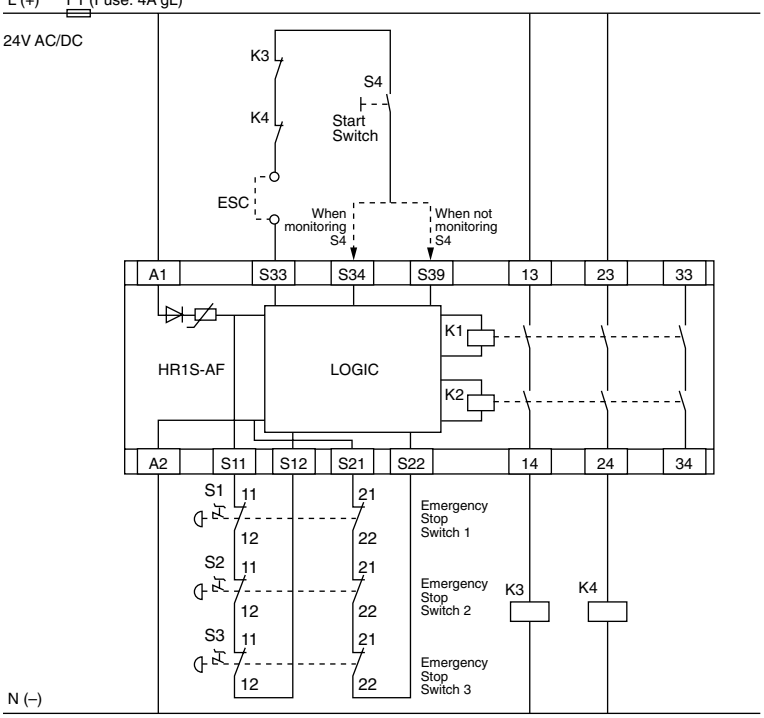


(1) = Start Switch Monitor

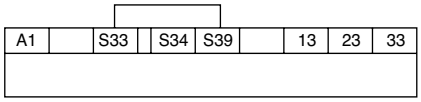
ESC: External Start Condition
F1: Protection fuse for the power of safety relay module
K3, 4: Safety contactor

Safety Output 3 Circuits

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

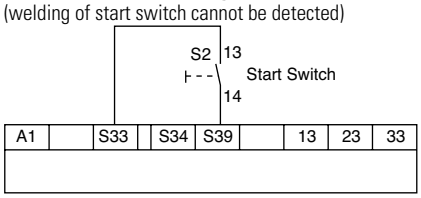


When not using a start switch (automatic start)



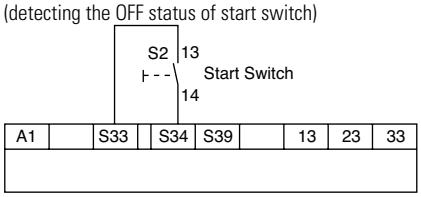
When not monitoring the start switch

(welding of start switch cannot be detected)



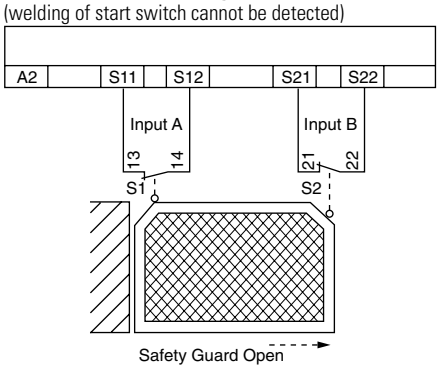
When monitoring the start switch

(detecting the OFF status of start switch)



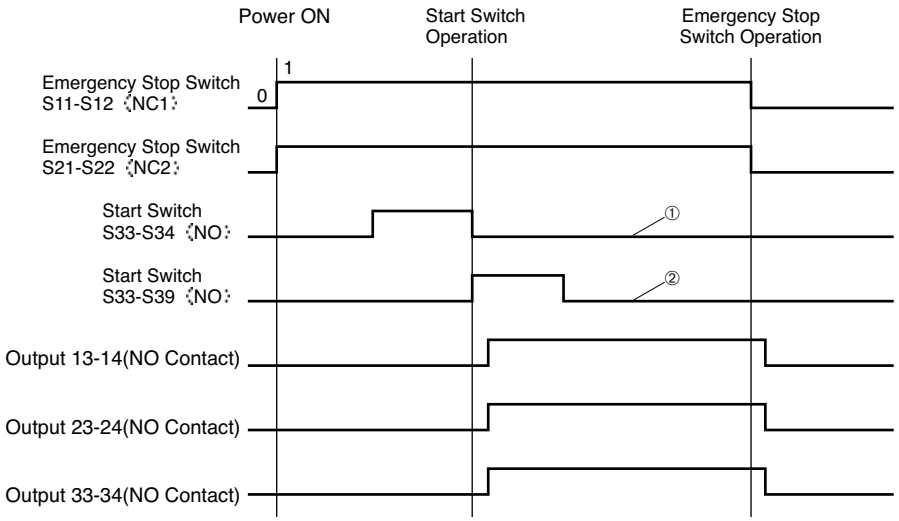
When not monitoring the start switch

(welding of start switch cannot be detected)



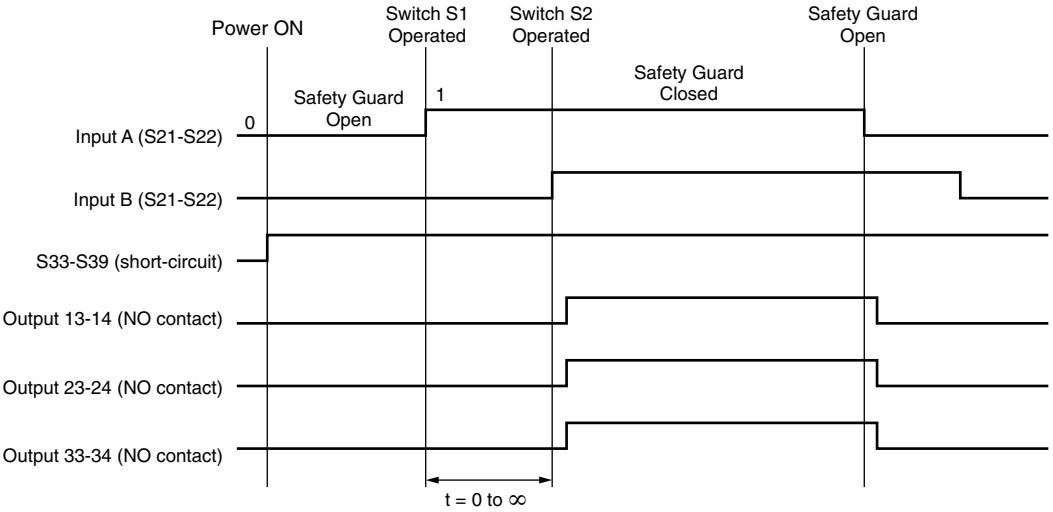
ESC: External Start Condition
F1: Protection fuse for the power of safety relay module
K3, 4: Safety contactor

HR1S-AF Operation Chart
When Using the Emergency Stop Switch

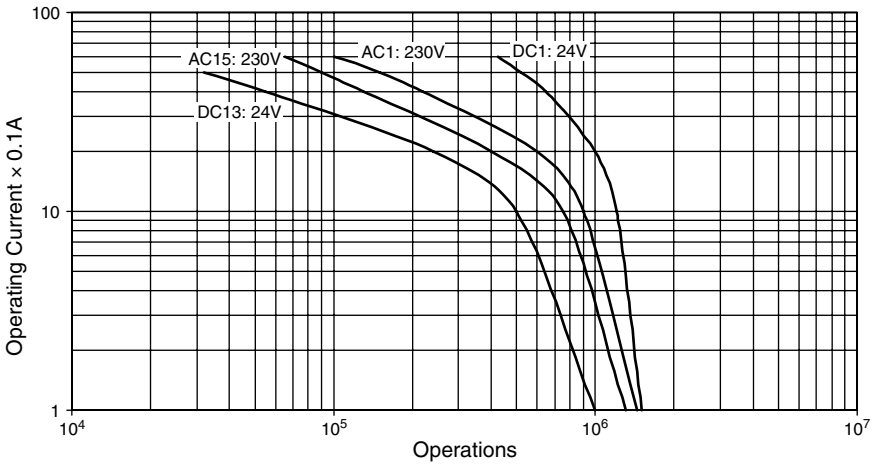


① When monitoring the start switch (detecting the OFF status of start switch)
② When not monitoring the start switch (contact welding of start switch cannot be detected)

When not Using the Safety Guard (Automatic Start)



Output Contact Electrical Life



Safety Relay HR1S-DM

Key features:

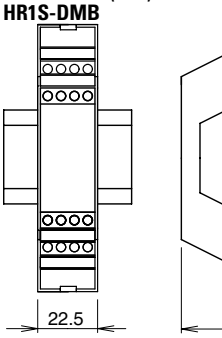
- 1NO-1NC safety input type, such as magnetic coded safety switches
- Fault diagnosis function with dual safety circuits.
- Internal relay operations can be monitored with LED Indicator.
- Finger-safe protection
- 22.5 or 45mm wide, 35mm DIN rail mounting
- EN ISO 13849-1 PLe, Safety Cat 4 compliant,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

HR1S-DMB( )P

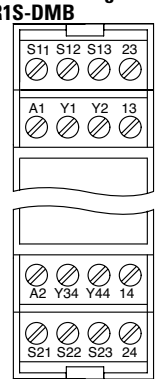
Part Numbers

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

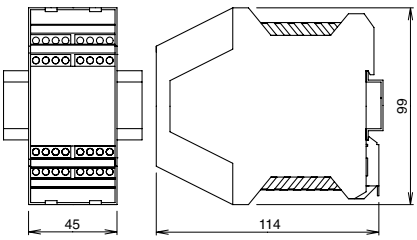
Dimensions (mm)
HR1S-DMB



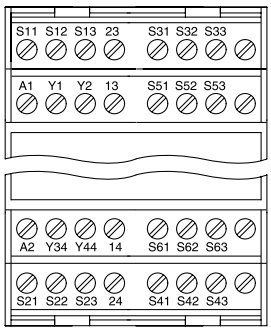
Terminal Arrangement
HR1S-DMB



Dimensions (mm)
HR1S-DME



Terminal Arrangement
HR1S-DME



Specifications

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

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

LED Indicator

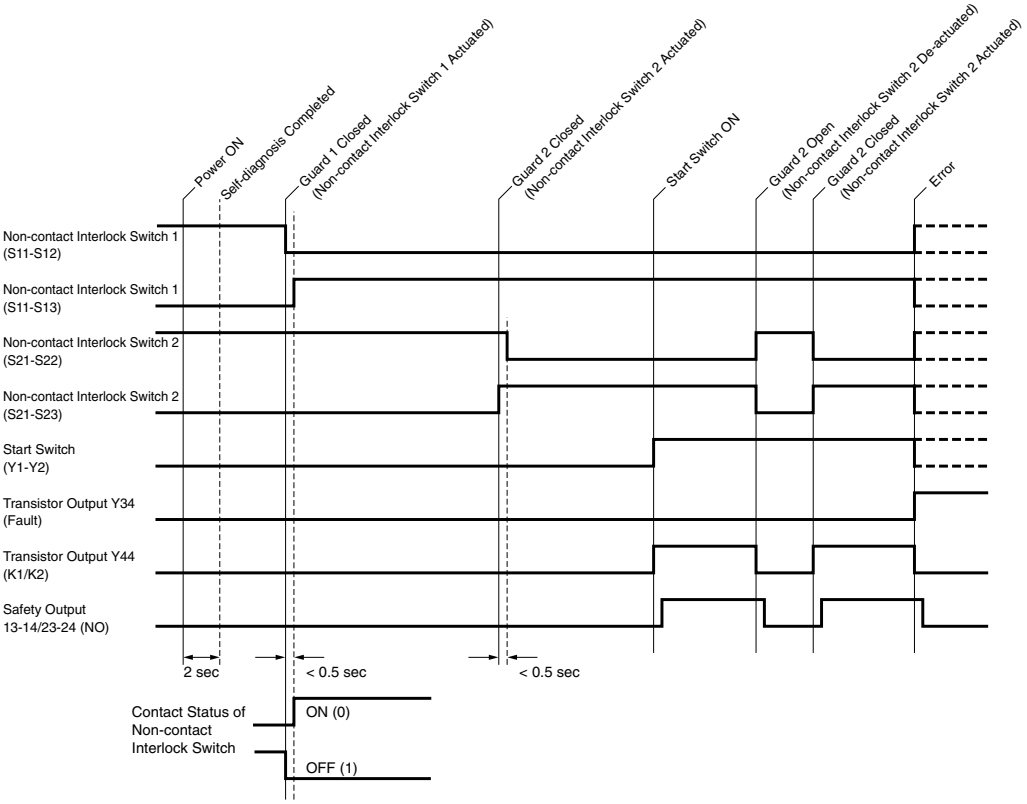
HR1S-DMB

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

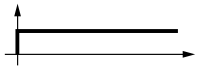
HR1S-DME

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

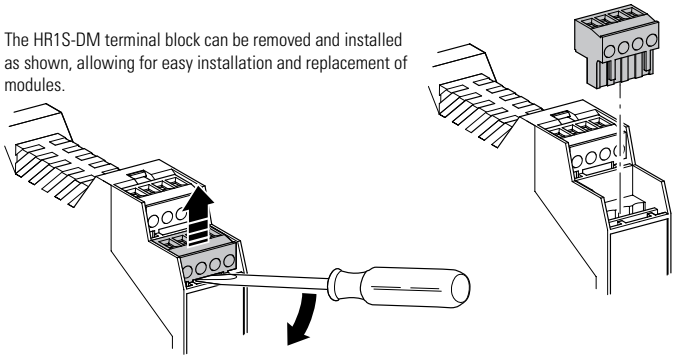
HR1S-DM Operation Chart
When Using the Emergency Stop Switch



Causes of Fault LED Indication

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

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



Safety Relay HR1S-ATE

Key features:

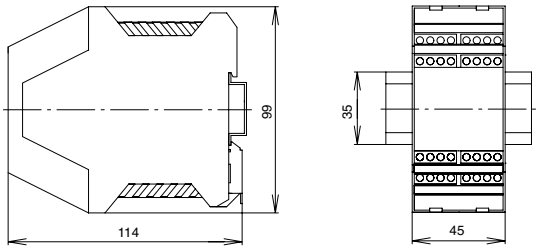
- EN ISO 13849-1 performance level e, safety category 4 compliant, and EN 62061 safety integrity level 3
- Integrated and removable teminal styles available
- Compact design: 45 mm in width
- Time delay outputs: 3NO
- Auxiliary output enables power supply monitoring, inputs (2 channels), and a time delay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

Part Numbers

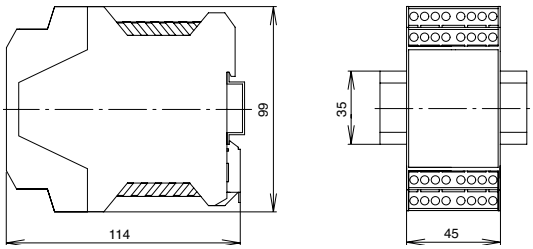
Part Number	Terminal Style
HR1S-ATE5110	Integrated Terminal Block
HR1S-ATE5110P	Removable Terminal Block

Dimensions (mm)

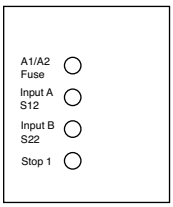
HR1S-ATE5110 Integrated Terminal Type



HR1S-ATE5110P Removable Terminal Type



LED Indicator



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

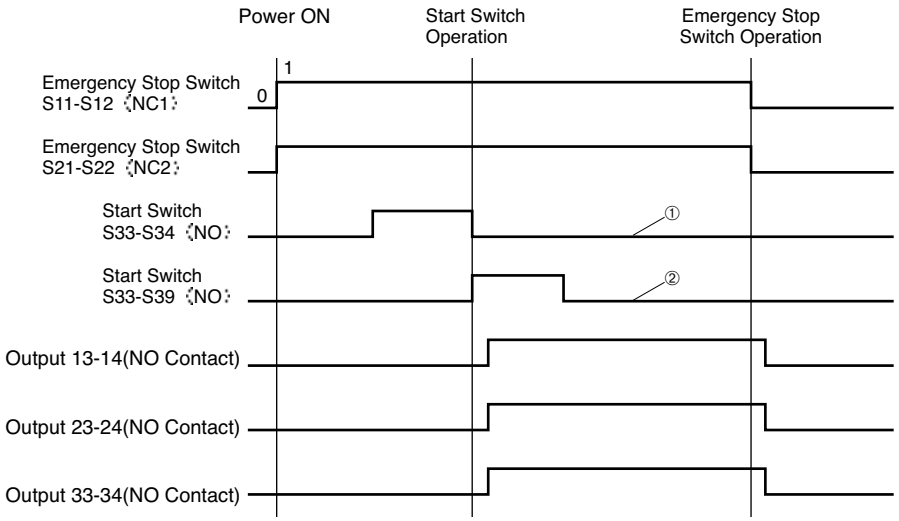
Specifications

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

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

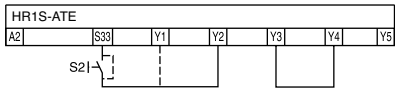
Use a 4A fuse (Type gG) for power protection.Use a 6A fuse (Type gG) for safety output protection.
Use a 4A fuse (Type gG) for time-delay output and auxiliary output protection.

HR1S-ATE Wiring Diagram
Safety Category 4 (3) Circuit (using an emergency stop switch) (Note)

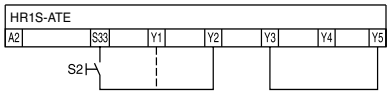


Safety category is achieved by the entire control system. Take the connected safety equipment and wiring into consideration.

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



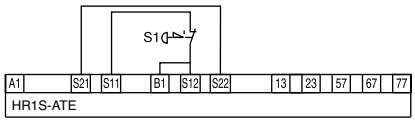
When monitoring the start switch
(Y3-Y5 short-circuited)



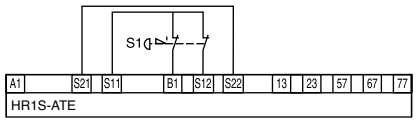
1. When monitoring the start switch, starts when switched off (default setting/recommended)
2. When monitoring the start switch, starts when switched on
3. Outputs must be fused (see the instruction manual for maximum fuse size)
4. To PLC, etc.
Note: When using off-delay output, safety category becomes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

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

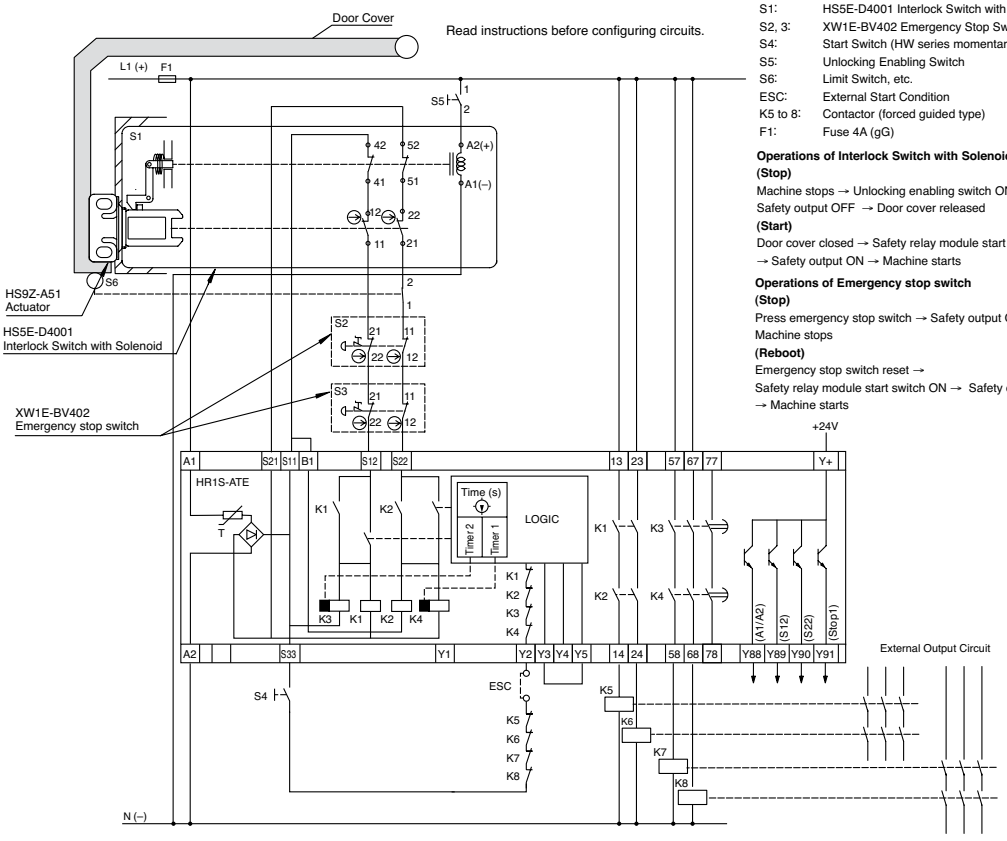
Emergency stop switch - Input 1 channel
When not detecting short-circuit (All failures such as short-circuit of emergency stop switch wiring not detected)



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



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

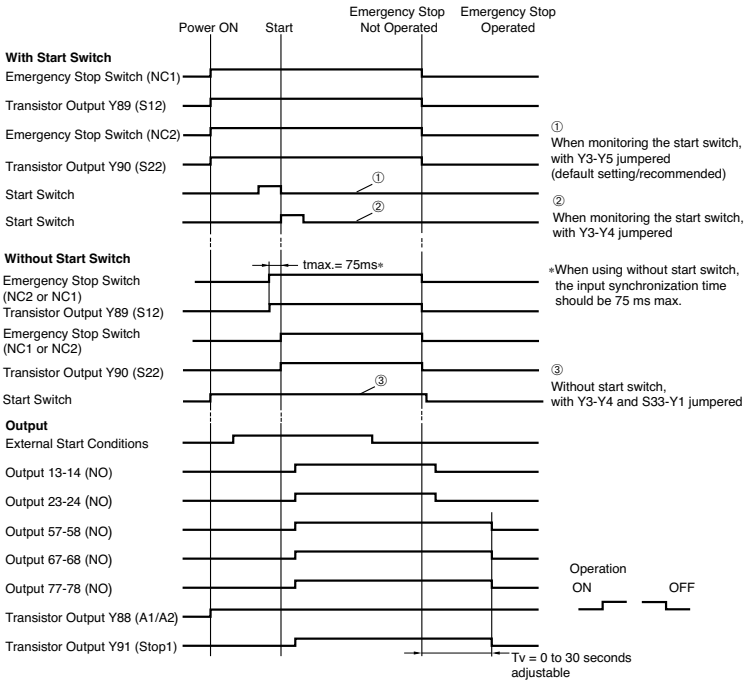


S1: HS5E-D4001 Interlock Switch with Solenoid
S2, 3: XW1E-BV402 Emergency Stop Switch
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.
ESC: External Start Condition
K5 to 8: Contactor (forced guided type)
F1: Fuse 4A (gG)

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

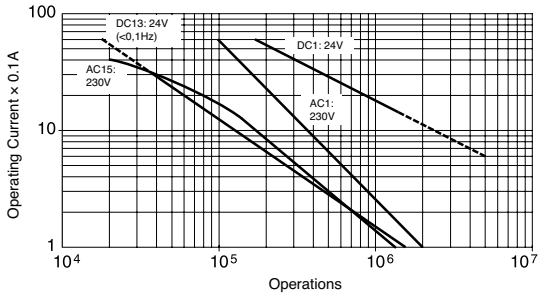
Operations of Emergency stop switch
(Stop)
Press emergency stop switch → Safety output OFF → Machine stops
(Reboot)
Emergency stop switch reset → Safety relay module start switch ON → Safety output ON → Machine starts

HR1S-ATE Operation Chart



Output Contact Electrical Life

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



Residual Risk (En ISO/ISO12100-1)

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

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

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

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

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

Key features:

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

Part Numbers

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

Specifications

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

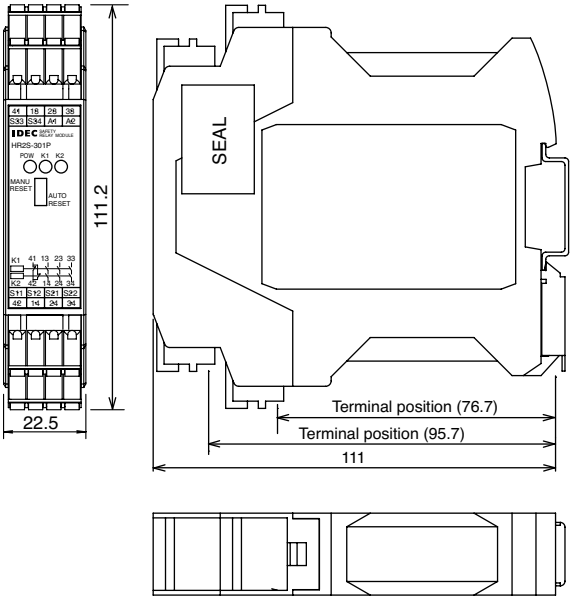
Minimum Applicable Load				24V DC / 5 mA (Reference value)
Response Time				20 ms maximum [3 4]
Overvoltage Category				III (IEC60664-1)
Pollution Degree				2 (IEC60664-1)
Rated Insulation Voltage (output contact)				250V (IEC60664-1)
Output Contact Ratings	Terminals 13-14 23-24 33-34	Rated Load [5 6]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

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

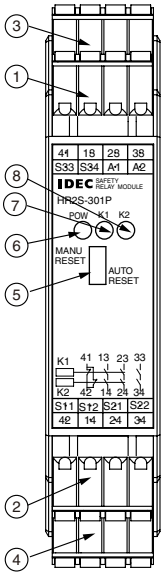
Category 4	HR2S-301N, HR2S-301P + Type 4 OSSD's	3.6A
Category 3	HR2S-301P	5.0A

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

Dimensions (mm)



Terminal Arrangement



Part Description

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

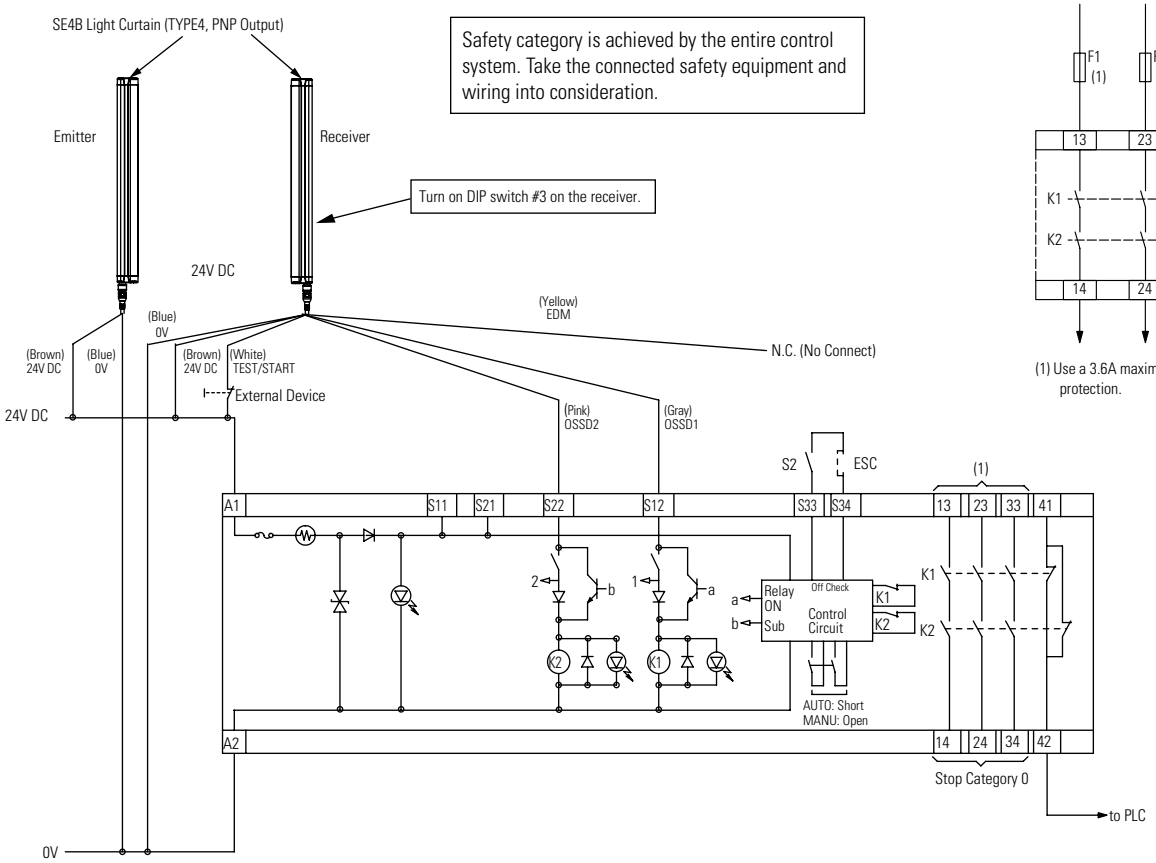
Terminal Arrangement

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

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

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

*EDM function disabled

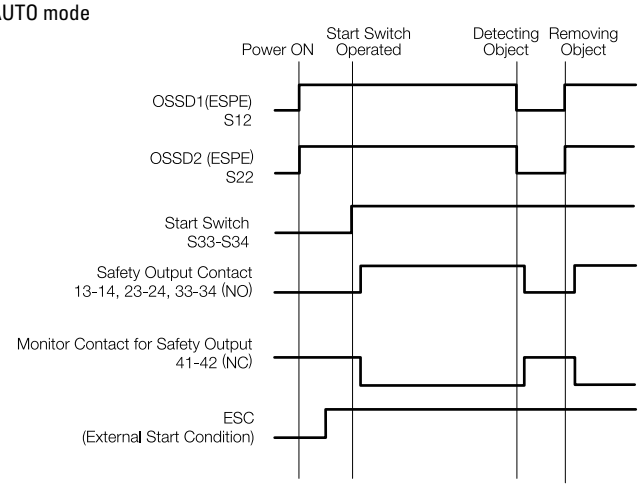


The SE4B light curtains are used in the above system.

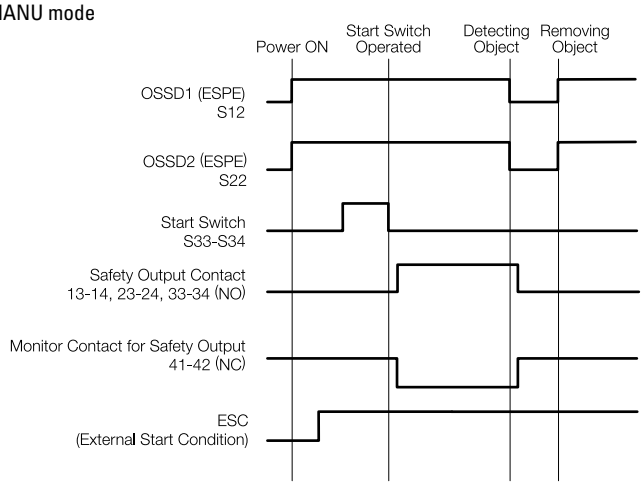
ESC: External Start Condition
F1 to 3: Protective fuse for the output of safety relay module
K1 to 2: Safety Contactor
S2: Start Switch
S33-S34: Feedback loop

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

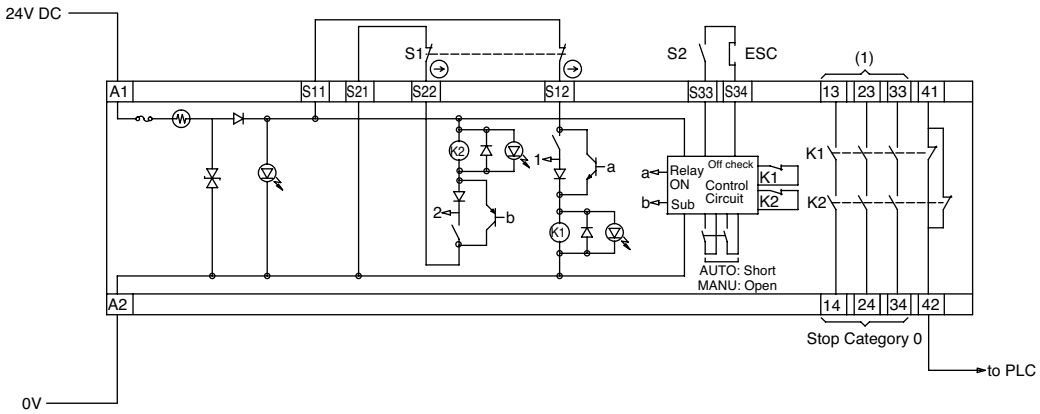
AUTO mode



MANU mode

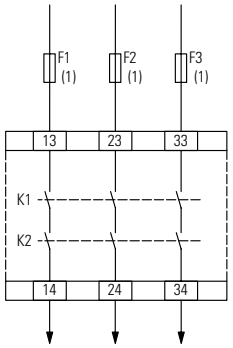


HR2S-301N Wiring Diagram
Safety Category 4 (3) Circuit Example (using an emergency stop switch)



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

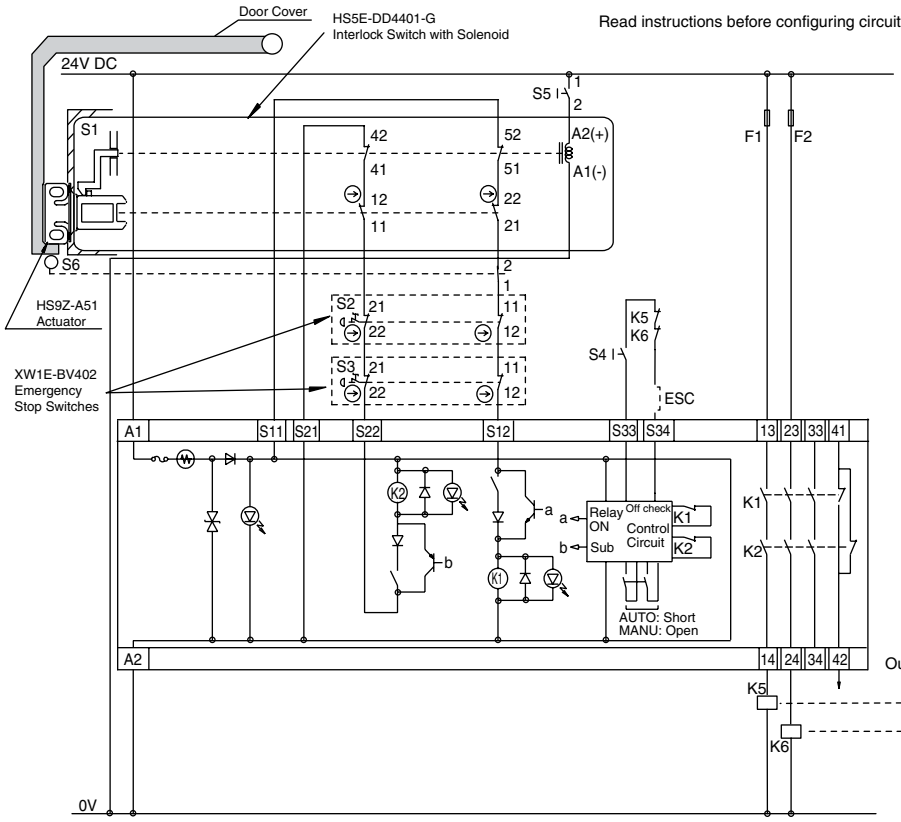
ESC: External start condition
F1 to 3: Protective fuse for the output of safety relay module
S1: Emergency stop switch with 2NC contacts, safety switch (recommended)
S2: Start Switch
S33-S34: Feedback loop



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

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

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



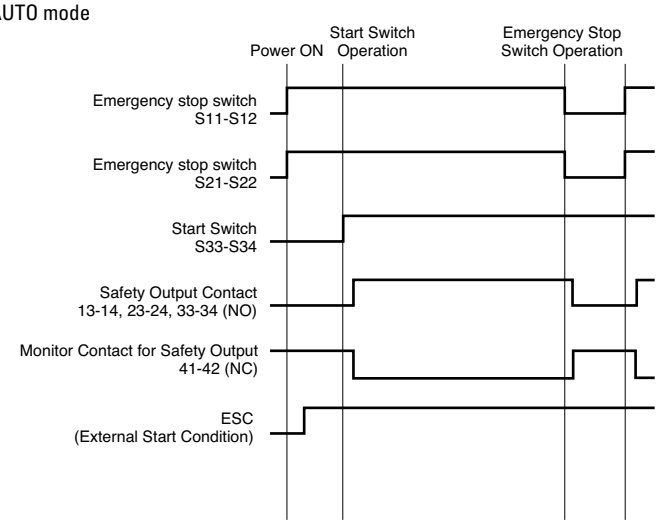
ESC: External Start Condition
F1, F2: Fuse 3.6A
K5, 6: Safety Contactor (force guided)
S1: HS5E-DD4401-G Interlock Switch with Solenoid
S2, 3: XW1E-BV402 Emergency Stop Switches
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.

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

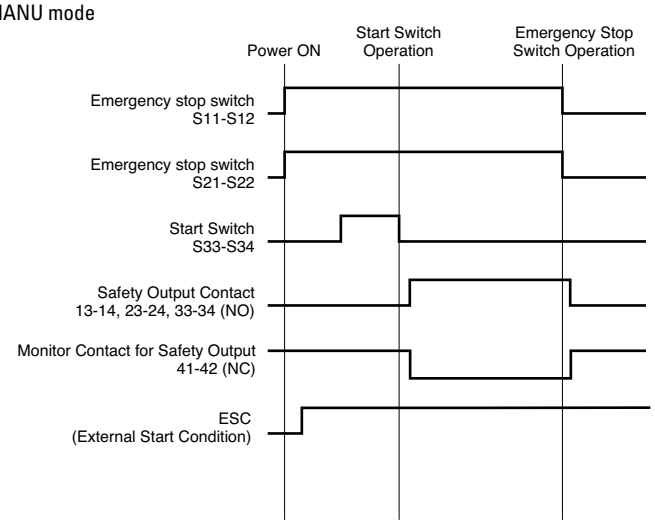
Operations of Emergency Stop Switch
(Stop)
Press emergency stop switch → Safety output OFF → Machine stops
(Start)
Emergency stop switch reset → Safety relay module start switch ON → Safety output ON → Machine starts

HR2S-301N Operation Chart
Using an emergency stop switch

AUTO mode



MANU mode



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

Key features:

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

Part Numbers

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

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

Specifcations

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

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

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

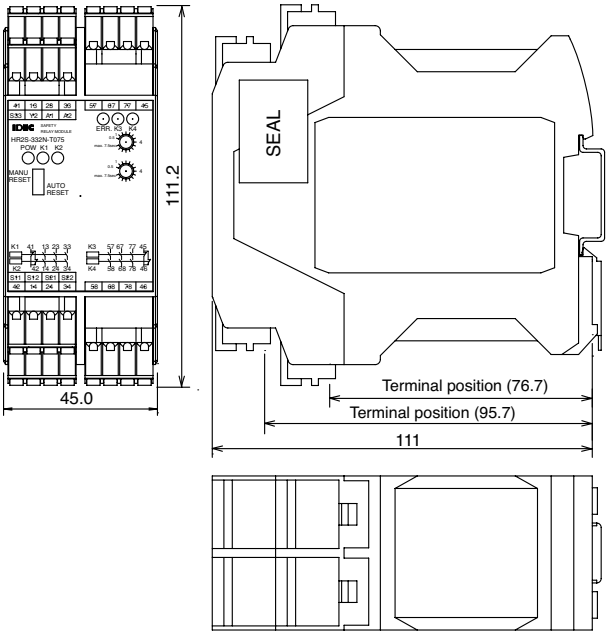
Specifications, con't

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

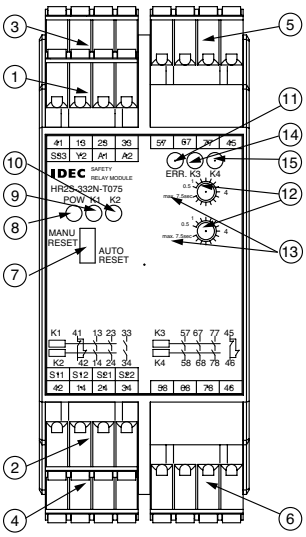
Time-delay Output Contact	Terminals 57-58 67-68 77-78	Rated Load [5][6]		250V AC / 30V DC (resistive load) [7] Category 3 or lower: 5.0A maximum Category 4 or lower: 3.6A maximum
		Safety Circuit	AC15	240V AC / 2A cosø=0.3
			DC13	24V DC / 1A L/R=48 ms
		No. of Outputs		3 (NO contact output)
	Terminals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

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

Dimensions (mm)



Terminal Arrangement



Part Description

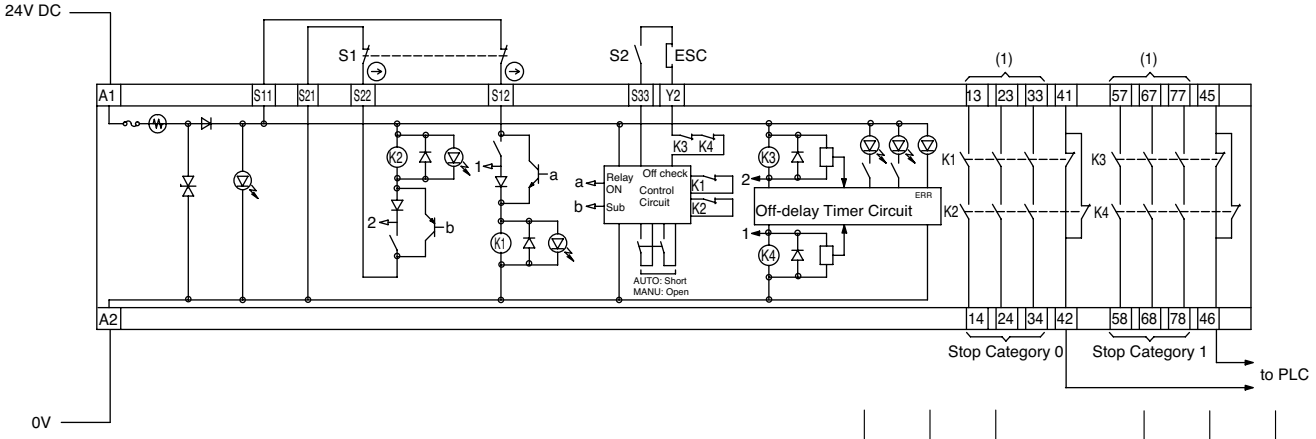
Part No.	Part Names and Functions
1	CN1: Power supply input, start/off-check input
2	CN2: Safety input (dual channel)
3	CN3: Safety output contact
4	CN4: Safety output contact
5	CN5: Time-delay safety output contact
6	CN6: Time-delay safety output contact
7	Switch: Select AUTO or MANU mode
8	POW: Power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

Terminal Arrangement

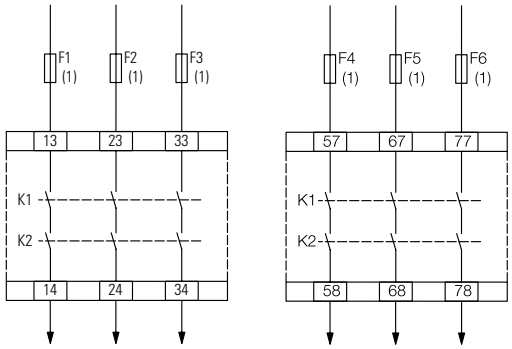
Terminals	Markings	I/O Signals		Remarks
CN1	A1	Power supply +24V DC input		
	A2	Power supply 0V input		
	S33	Start/off-check input		Use a dry contact.
	Y2			
CN2	S11	Safety input 1	Common	Use a dry contact.
	S12		Function	
	S21	Safety input 2	Common	
	S22		Function	
CN3 CN4	41–42	Monitor contact for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

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

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



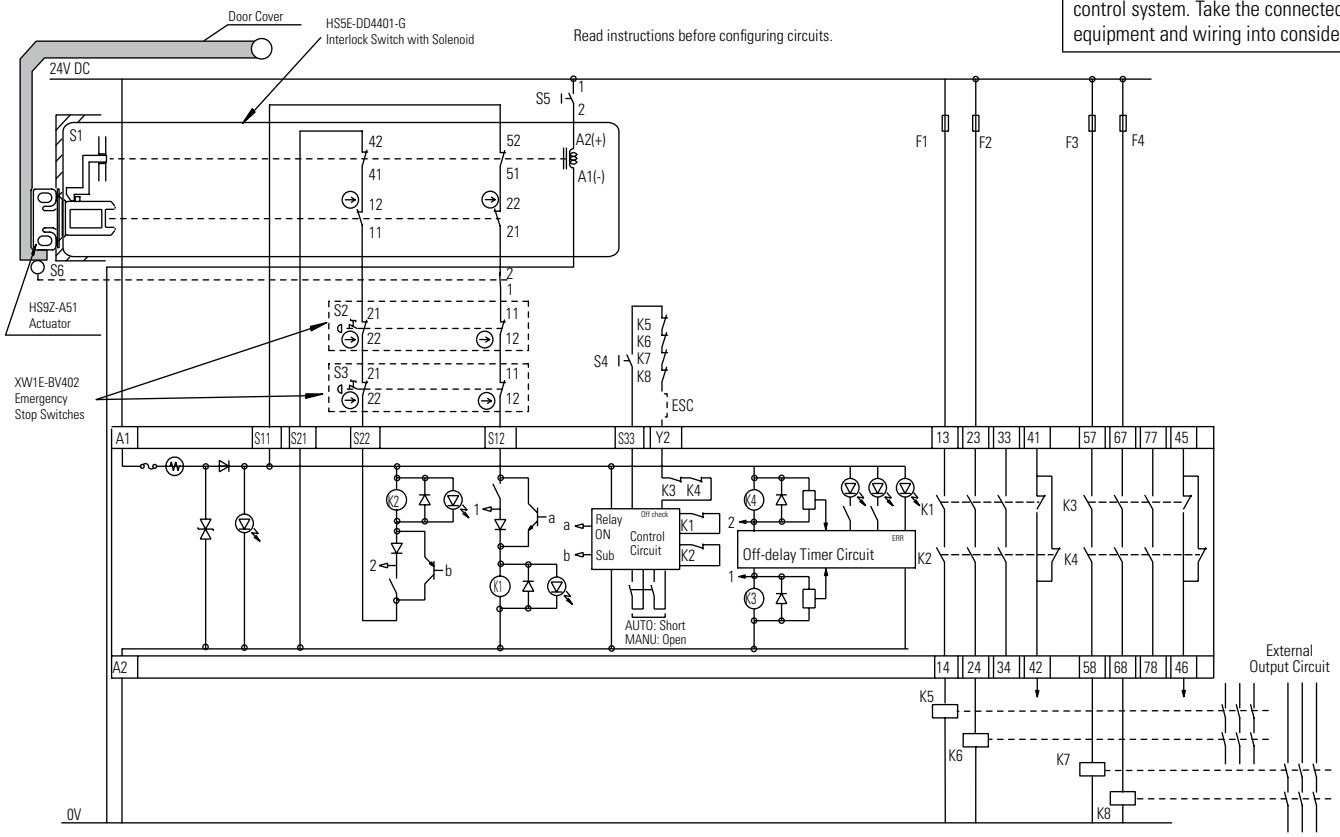
ESC: External Start Condition
F1 to 6: Protective fuse for the output of safety relay module
S1: Emergency stop switch with 2NC contacts, safety switch (recommended)
S2: Start Switch
S33-Y2: Feedback loop



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

Safety Category 3 Circuit (using multiple emergency stop switches)

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



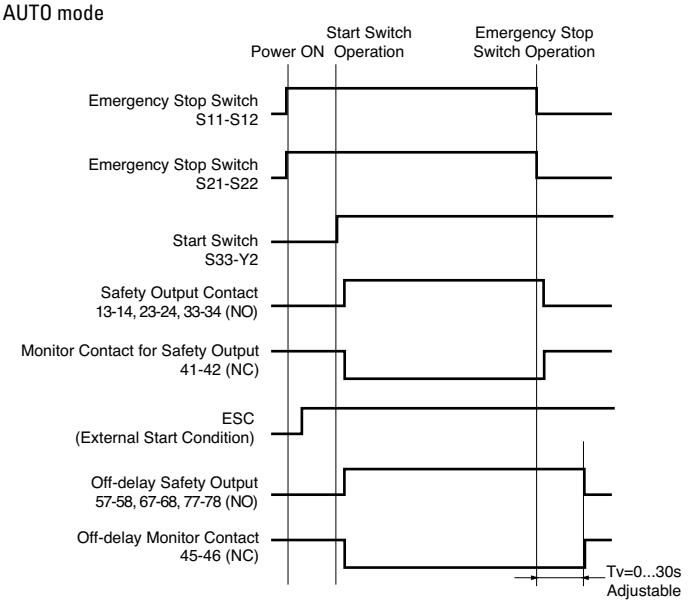
ESC: External Start Condition
F1 to F4: Fuse 3.6A
K5 to 8: Safety Contactor
S1: HS5E-DD4401-G Interlock Switch with Solenoid
S2,3: XW1E-BV402 Emergency Stop Switches
S4: Start Switch (HW series momentary)
S5: Unlocking Enabling Switch
S6: Limit Switch, etc.

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

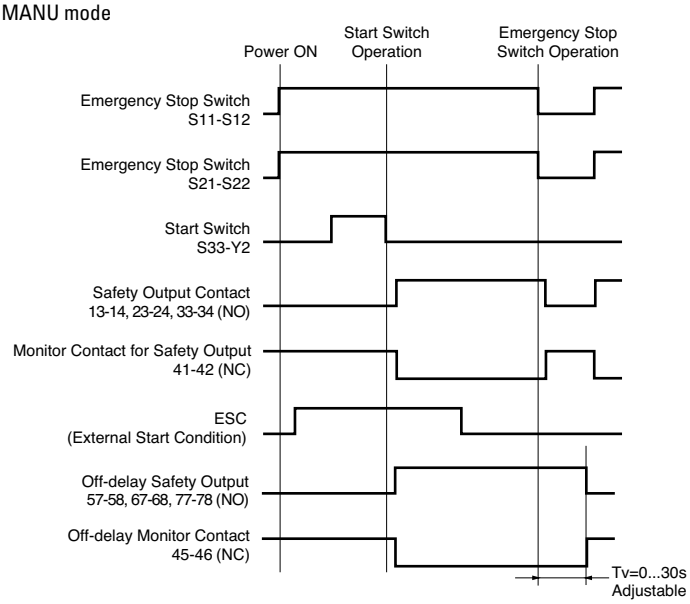
Operations of Emergency Stop Switch
(Stop)
Press emergency stop switch Safety output OFF Machine stops
(Start)
Emergency stop switch reset Safety relay module start switch ON Safety output ON Machine starts

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

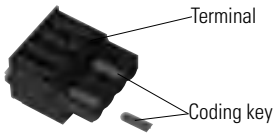
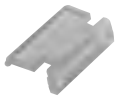
AUTO mode



MANU mode



Maintenance Parts

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

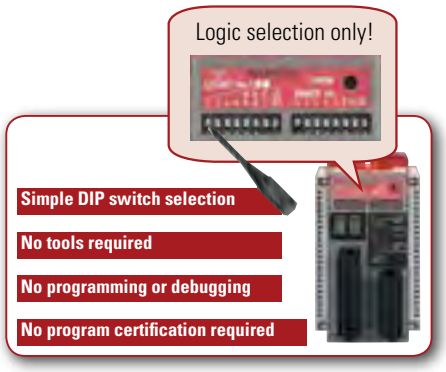
FS1A Multi-function Safety Relay

Key features:

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

Part Numbers

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



Optional Parts

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

Complies with key safety standards!

International Standards Compliant

ISO13849-1 PLe

The **SafetyOne** satisfies:

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

ISO IEC EN ANSI/RIA ANSI SEMI NFPA

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

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

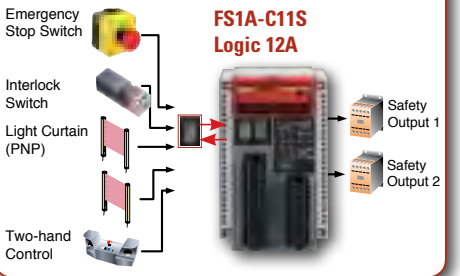
Large functionality in a compact housing!

Small & Compact

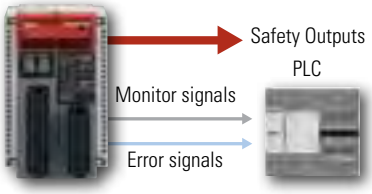
ALL-IN-ONE

Replaces more than seven safety relay modules

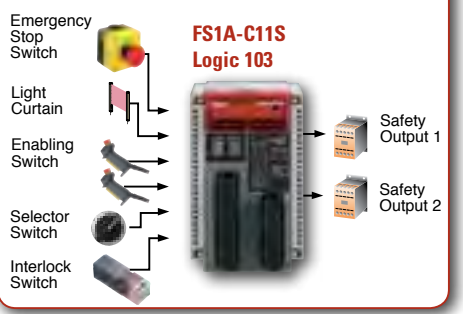
Two-hand Control



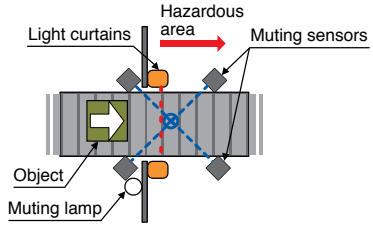
Monitor Output

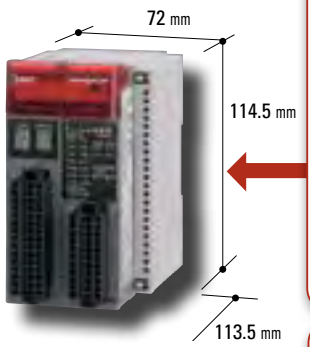


Mode selection

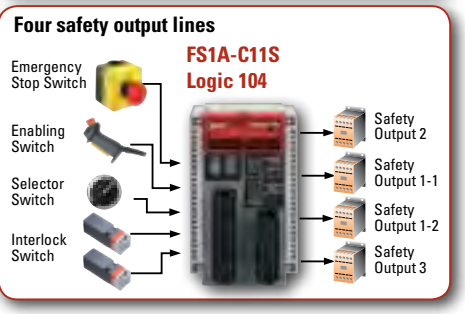


Muting function of light curtains

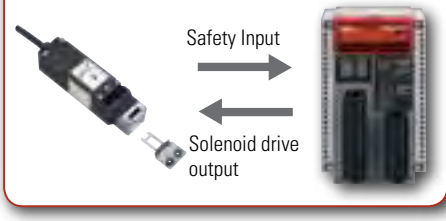


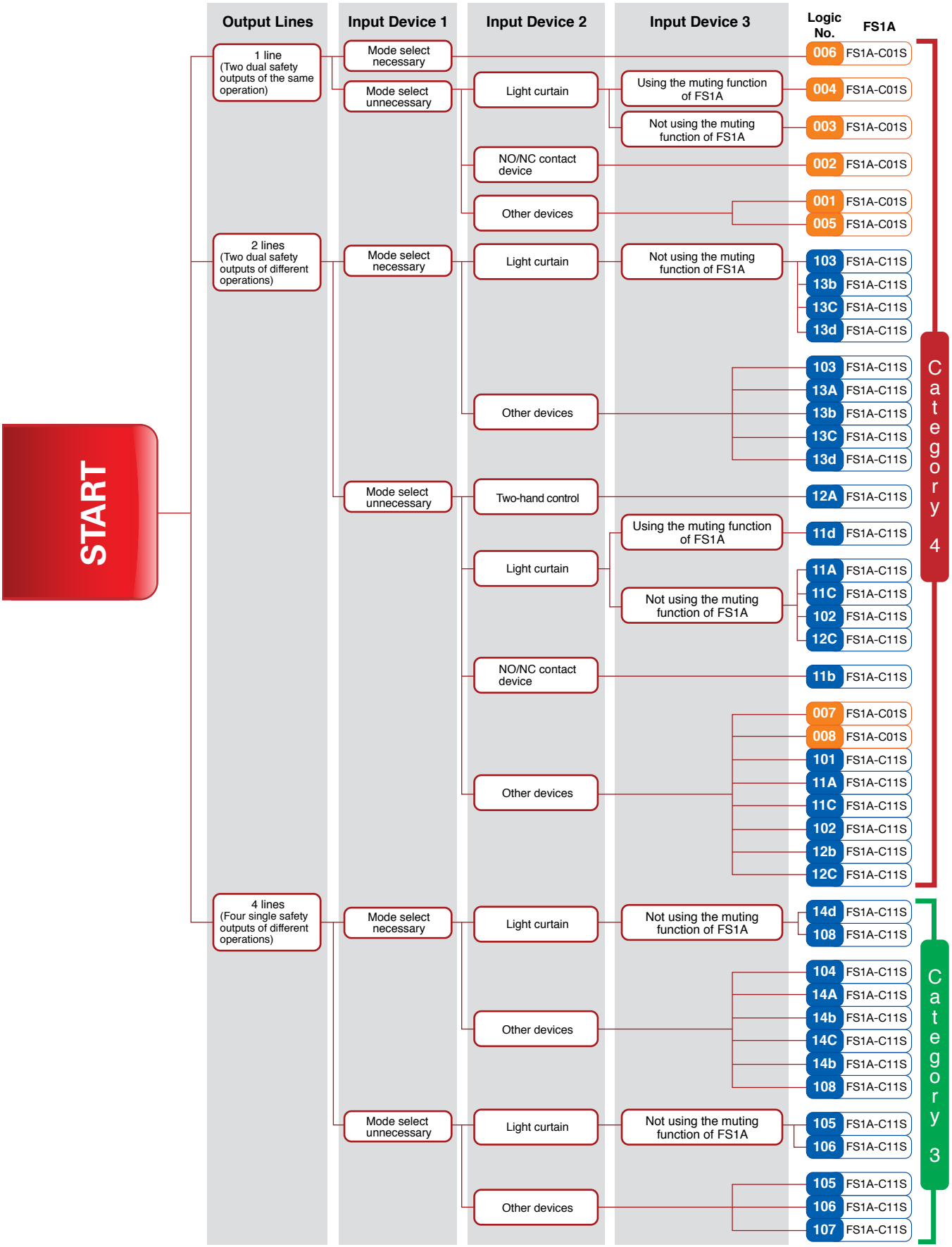


Four safety output lines



Solenoid drive output




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

Specifications

Operating Environment

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

Electric Characteristics

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

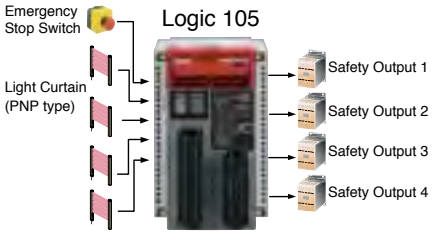
1. The time to shut off safety outputs after inputs are turned off or input monitor error is detected (when off-delay timer is set to 0s)
2. Time to shut off safety outputs after an error (except input monitor error) or a configuration change of logic or timer is detected (not depending on the off-delay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

Examples

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

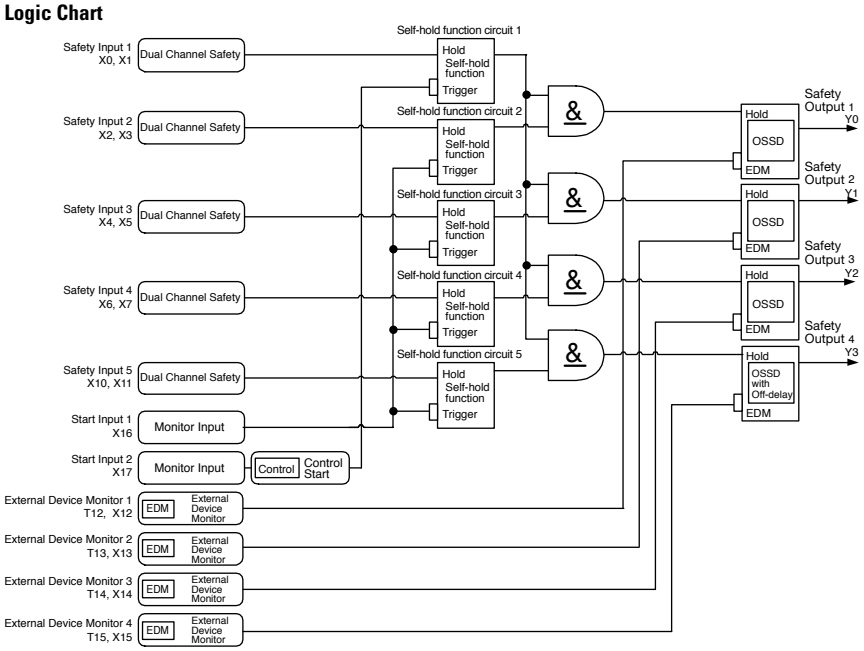
Logic 105 is used for safeguarding measures of machine tools and robots, which use safety equipment such as light curtains with dual solid state outputs. Safety outputs are single output. Five dual channel safety inputs can be connected. Safety output 4 has an off-delay timer.

Wiring Example



DIP Switch and LED Display

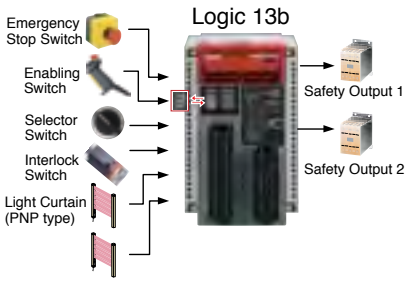
Logic Chart



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

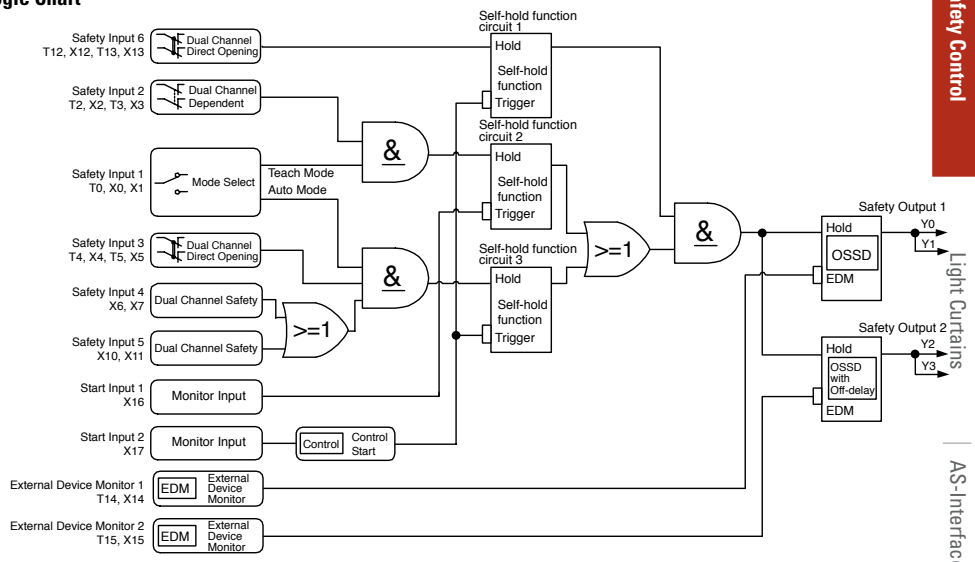
In machine tools and robots, a hazard source is isolated by a guard in automatic operation. In human-attended operation such as teaching and maintenance, the operator has to work inside a hazardous area. Logic 13b is used to configure a system in which teach or auto mode can be selected using a selector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

Wiring Example



DIP Switch and LED Display

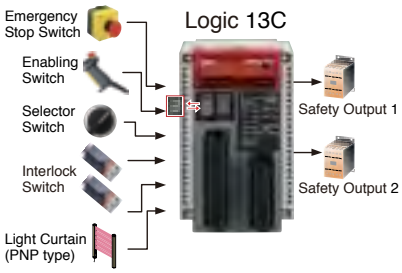
Logic Chart



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

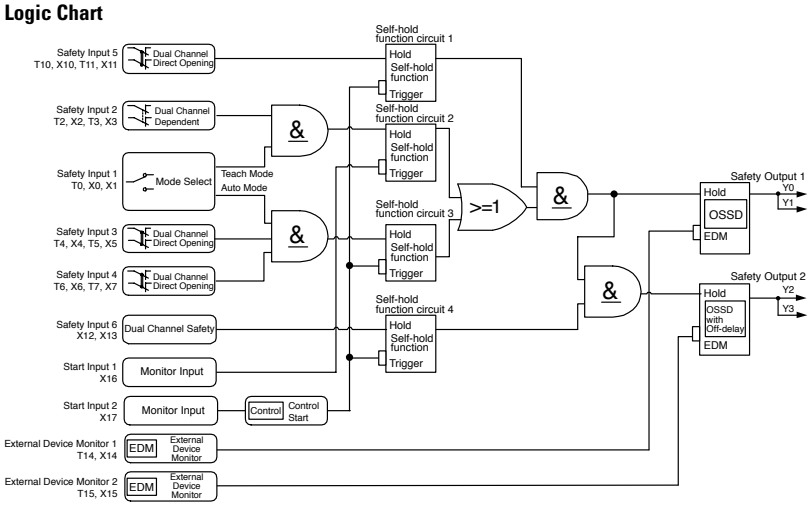
In machine tools and robots, a hazard source is isolated by a guard in automatic operation. In human-attended operation such as teaching and maintenance, the operator has to work inside a hazardous area. Logic 13C is used to configure a system in which teach or auto mode can be selected using a selector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

Wiring Example



DIP Switch and LED Display

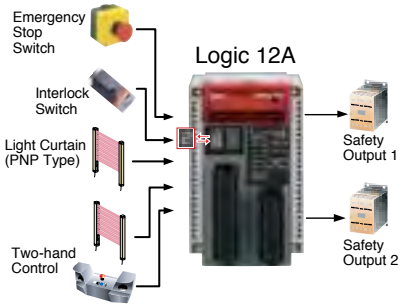
Logic Chart



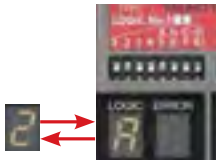
FS1A-C11S Logic 12A	The logic for apparatus with a two-hand control device	Output Line: 2 2 dual safety outputs of different operations	Category 4

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

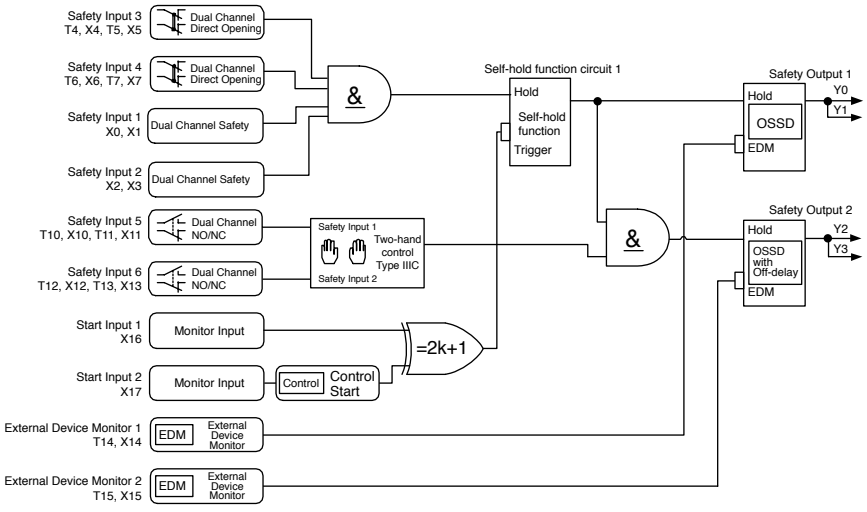
Wiring Example



DIP Switch and LED Display



Logic Chart



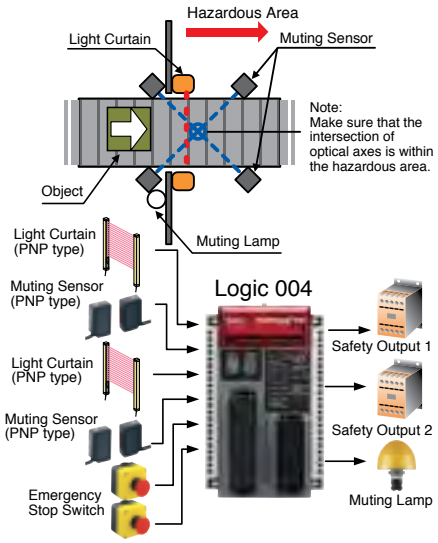
FS1A-C01S Logic 004	Muting function logic for apparatus with openings	Output Line: 1 2 dual safety outputs of the same operation	Category 4

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

Muting Function Improves Productivity

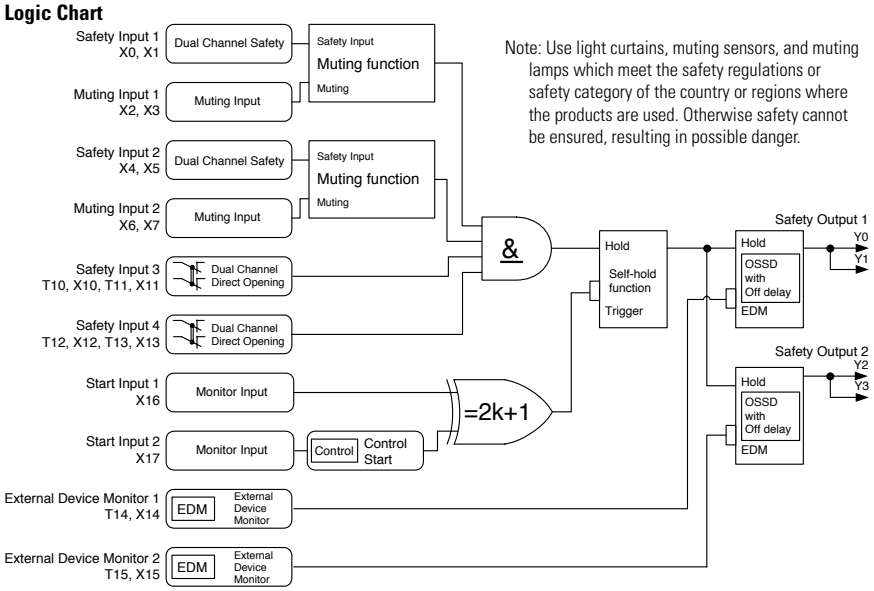
With a muting function, the system stops when detecting a human and temporarily defeats the light curtain while work objects are being supplied. This improves the system's productivity. Muting functions can be used easily by connecting a light curtain, muting sensor, and muting lamp to the SafetyOne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

Wiring Example



DIP Switch and LED Display

Logic Chart



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

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

Safety Input Specifications

Drive Terminals

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

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

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

Receive Terminals

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

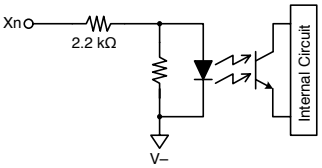
Rated Input Voltage	24V DC
Input ON Voltage	15.0 to 28.8V DC
Input OFF Voltage	Open or 0 to 5.0V DC
Number of Inputs	14
Input Current	10 mA per terminal (at the rated power voltage)
Input Signal	Sink input (for PNP output), Type 1 (IEC61131-2)

Wire

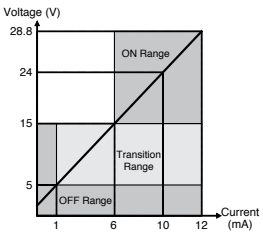
Cable Length (Note)	100m maximum (total wire length per input)
Allowable Wire Resistance	300Ω maximum

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

• Receive Terminal Internal Circuit



• Receive Terminal Operating Range

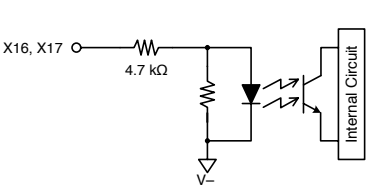


Start Input Specifications

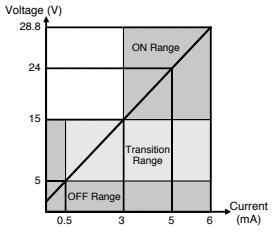
Rated Input Voltage	24V DC
Input ON Voltage	15.0 to 28.8V DC
Input OFF Voltage	Open or 0V to 5.0V DC
Number of Start Inputs	2 (X16, X17)
Input Current	5 mA per terminal (at the rated power voltage)
Input Signal	Sink input (PNP output), Type 1 (IEC61131-2)
Cable Length (Note)	100m maximum (total wire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

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

• Start Input Internal Circuit



• Start Input Operation Range

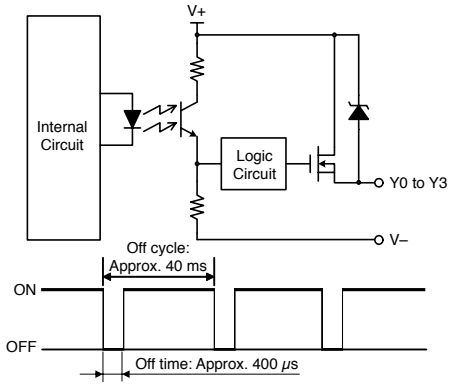


Safety Output Specifications

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

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

• Safety Output Internal Circuit



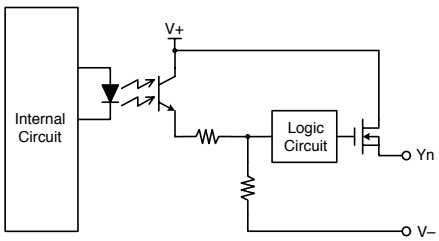
The safety outputs of the SafetyOne are solid state outputs. When the output is on, off-check signals are generated at regular intervals. The operating characteristics of the safety output change depending on the selected logic. For details, see user's manual "Chapter 5 Logic." The basic specifications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

Monitor Output Specifications

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

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

• Monitor Output Internal Circuit



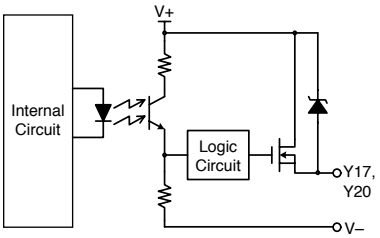
The operating characteristics of the monitor output change depending on the selected logic. For details, see user's manual "Chapter 5 Logic." The basic specifications remain the same.
Do not use monitor output as a safety output, otherwise the system's safety cannot be assured when the SafetyOne or safety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

Solenoid/Lamp Output Specifications

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

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

Solenoid/Lamp Output Internal Circuit



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

Internal States

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

LED and Output States

When safety outputs are dual channel outputs

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

When safety outputs are single channel outputs

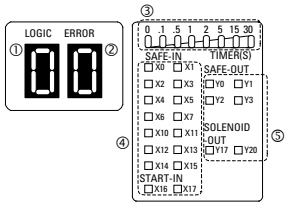
State	Logic LED	Error LED	Timer LED	Safety Output	Monitor Output			
				Y0 to Y3	Y4 to Y13, Y17, Y20	Y14	Y15	Y16
Initial	(Note 1)	(Note 1)	(Note 1)	OFF	OFF	ON	ON	OFF
Run	Logic #	Blank	Selected Value	(Note 2)	(Note 2)	OFF	OFF	ON
Configuration	(Note 3)	C	(Note 3)	OFF	OFF	OFF	ON	OFF
Protection	Logic #	1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

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

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

LEDs

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



Logic LED ①

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

FS1A-C01S setting

Correct: Selecting one logic from 1 to 8
Wrong: Selecting two or more logics from 1 to 8

FS1A-C11S setting

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

Error LED ②

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

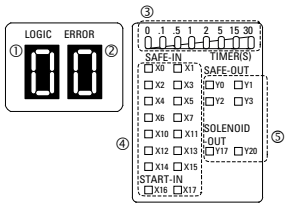
Note: Blinks for 1 to 5 seconds after the enter button is pressed. Releasing the button during blinking activates the setting. The blinking LED becomes ON if the button is pressed for more than 5 seconds, and the setting becomes invalid even after the button is released.

Timer LED ③

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

LEDs, con't

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



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

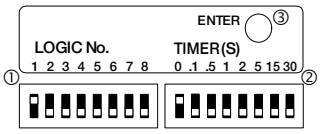
Type	LED	Status	Description
FS1A-C01S	X0 to X15	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
		Blink	Input monitor error
	X16, X17	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
FS1A-C11S	X0 to X15	ON	Input ON
		OFF	Input OFF, Stop/Configuration state
		Blink	Input error (error displayed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

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

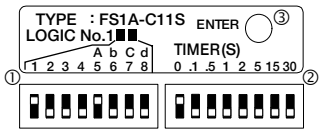
Type	LED	Status	Description
FS1A-C01S	Y0 to Y3	ON	Output ON
		OFF	Output OFF, Stop/Configuration state
		Blink	Off-delay operating
	Y17, Y20	ON	Output ON
		OFF	Output OFF, Stop/Configuration state
FS1A-C11S	Y0 to Y3	ON	Output ON
		OFF	Output OFF
		Blink	Off-delay operating, or output error (error displayed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

Configuration Switches

• FS1A-C01S



• FS1A-C11S



① Logic Switch ② Timer Switch ③ Enter button

Logic Switch ①

FS1A-C01S

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

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

FS1A-C11S

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

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

1 + A	1 + b	1 + C	1 + d	2 + A	2 + b	2 + C	2 + d
11A	11b	11C	11d	12A	12b	12C	12d

3 + A	3 + b	3 + C	3 + d	4 + A	4 + b	4 + C	4 + d
13A	13b	13C	13d	14A	14b	14C	14d

Timer Switch ②

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

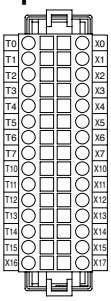
Switch No.	Timer Value	Description
1	0	No off-delay (safety outputs shut down immediately)
2	.1	Off-delay timer 0.1s
3	.5	Off-delay timer 0.5s
4	1	Off-delay timer 1s
5	2	Off-delay timer 2s
6	5	Off-delay timer 5s
7	15	Off-delay timer 15s
8	30	Off-delay timer 30s

Enter Button ③

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

Connector Specifications

Input Connector

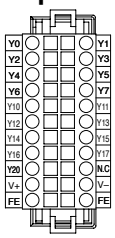


Applicable connector
- Spring clamp (30-pin)
  FS9Z-CN01 (IDEC)
  2-1871940-5
  (Tyco Electronics)
- Crimp (30-pin)
  2-1871946-5
  (Tyco Electronics)

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

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

Output Connector



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

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