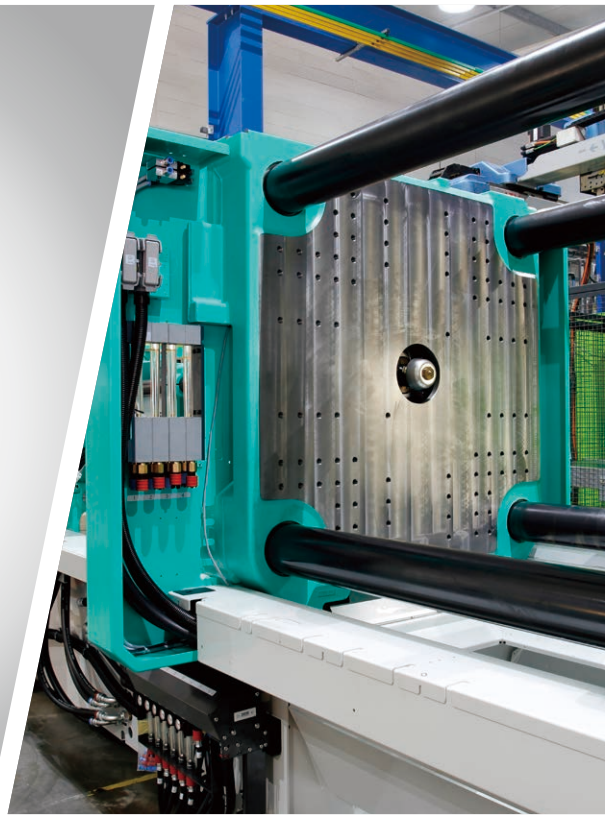
IDEC

S3 CONNECT

Safety Controller
FS1B



SafetyOne®

The Safety Controller that requires no programming

SAVE ALL eco

IDEC CORPORATION

FS1B Safety Controller

A solution designed to prioritize safety, without the need for complex programming.

Establishing a safety system with multiple devices is challenging as it requires deep knowledge of safety protocols, programming, and third-party certification. However, our safety controller simplifies this with 24 pre-loaded safety control logics. It's intuitive and easy to use, eliminating the need for extensive technical expertise. The FS1B safety controller stands out with its certified control logic, reducing design risks and ensuring a smoother certification process for your machinery. Elevate your safety standards effortlessly with the FS1B safety controller – where simplicity meets certified excellence.

Easy setup and use

- Built-in safety control logics that meet international safety standards
- No software required
- Input functions compatible with various devices*
- Easy logic setting with DIP switches

* As part of input device settings

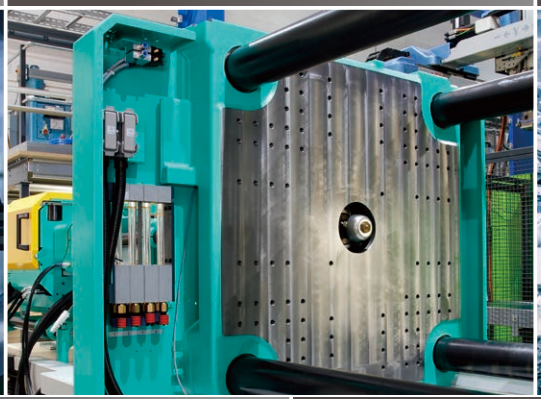
Multi-functional

- Partial stop control
- Mode switching control
- Switch and sensor combined control
- OR control
- Two-hand control logic

Applications

Semiconductor manufacturing equipment

Plastic molding machinery



Robotics for manufacturing

Metalworking machinery

Food processing machinery

Pre-certified safety control logics

The FS1B safety controller and its built-in control logics have been certified by a trusted independent body, ensuring that they operate safely and reliably.

This pre-certification not only enhances the safety of your equipment and system, but also streamlines the overall approval process for machinery certification.

Others Software, hardware, and maintenance costs users money and time

- Programmable safety controller
- Configuration software and programs
- Software driver
- Third-party program certification

Safety PLC or safety controller

Software (program, function block)

IDEC Simply choose a logic number and get started

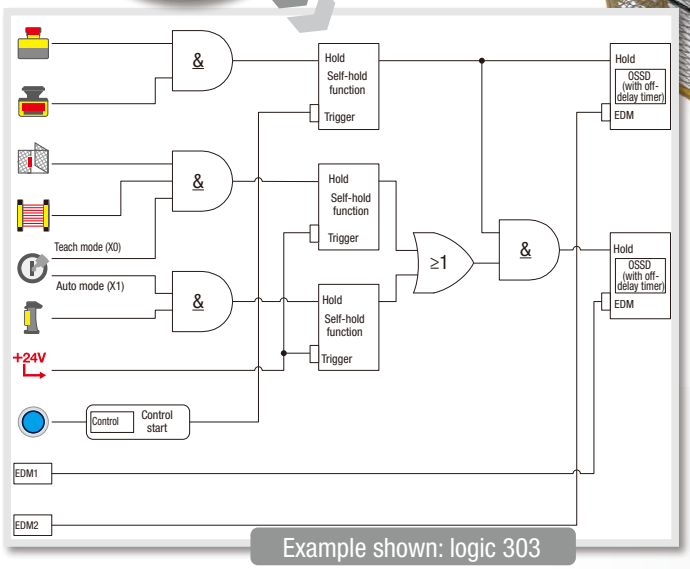
- Setting switches keep the design simple
- No configuration files or version updates required
- No program certification required
- Suitable for maintenance at overseas factories

Certified pre-set logics

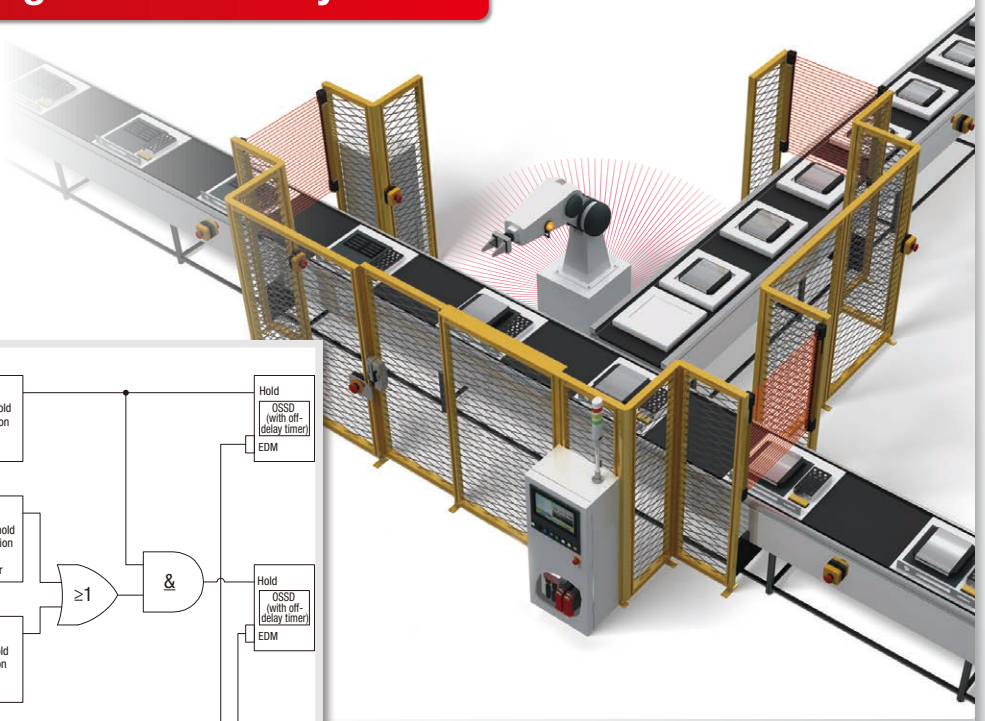
Easy to operate

Use the DIP switches to quickly select logics and adjust the power off delay timer. Colored LEDs make the device status clear at a glance.

Ideal for controlling small-scale systems



Example shown: logic 303



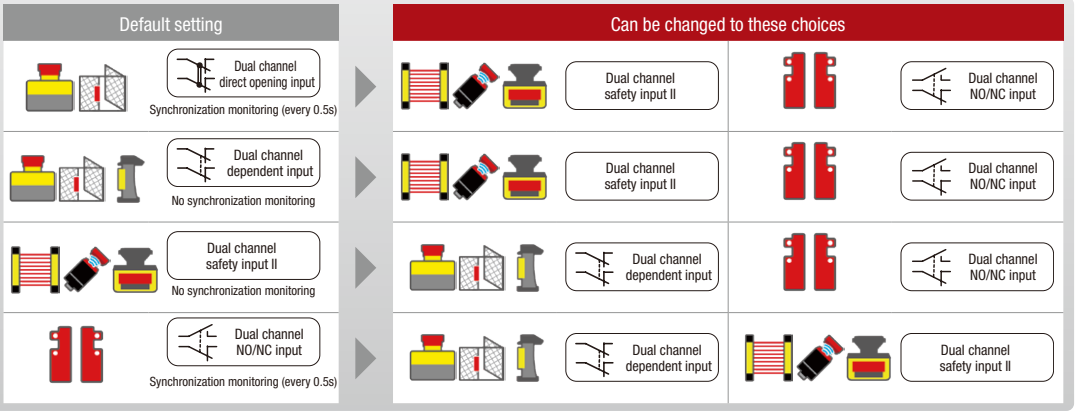
Monitor up to 6 input devices and up to 4 output devices in a single system.

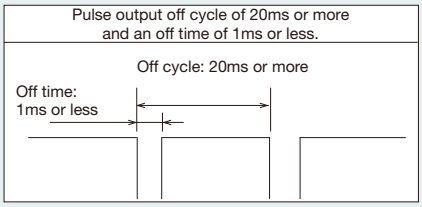
Universal input device compatibility

NEW

The FS1B safety controller allows for quick and simple changes to input functions compared to the previous FS1A.

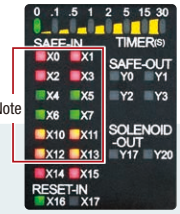
Each control logic's safety input is pre-configured for safety input devices suited to general applications. Each logic also offers the flexibility to adjust the inputs for other safety devices.





1. The FS1B treats a short circuit as a fault. Devices that turn off by detecting short circuits, such as Tape Switches, Edge Switches, and Bumper Switches, cannot be used as input devices in the FS1B.
2. The FS1B reads input signals at regular intervals. Therefore, when connecting semiconductor output (OSSD) components such as Safety Light Curtains or Safety Laser Scanners, use the component that sends output signals of the waveforms shown in the left.

Note



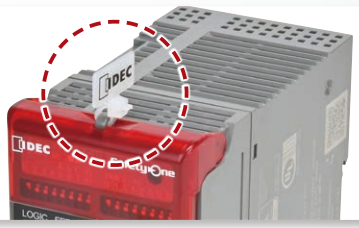
Connect the device you want to monitor, then press and hold the Enter button to complete the configuration.

Note: The corresponding LED is red when a switch (contact) is connected, green when a sensor (OSSD) or other signal is connected, and orange when a non-contact safety switch (1NO-1NC) is connected.

Settings can be locked in

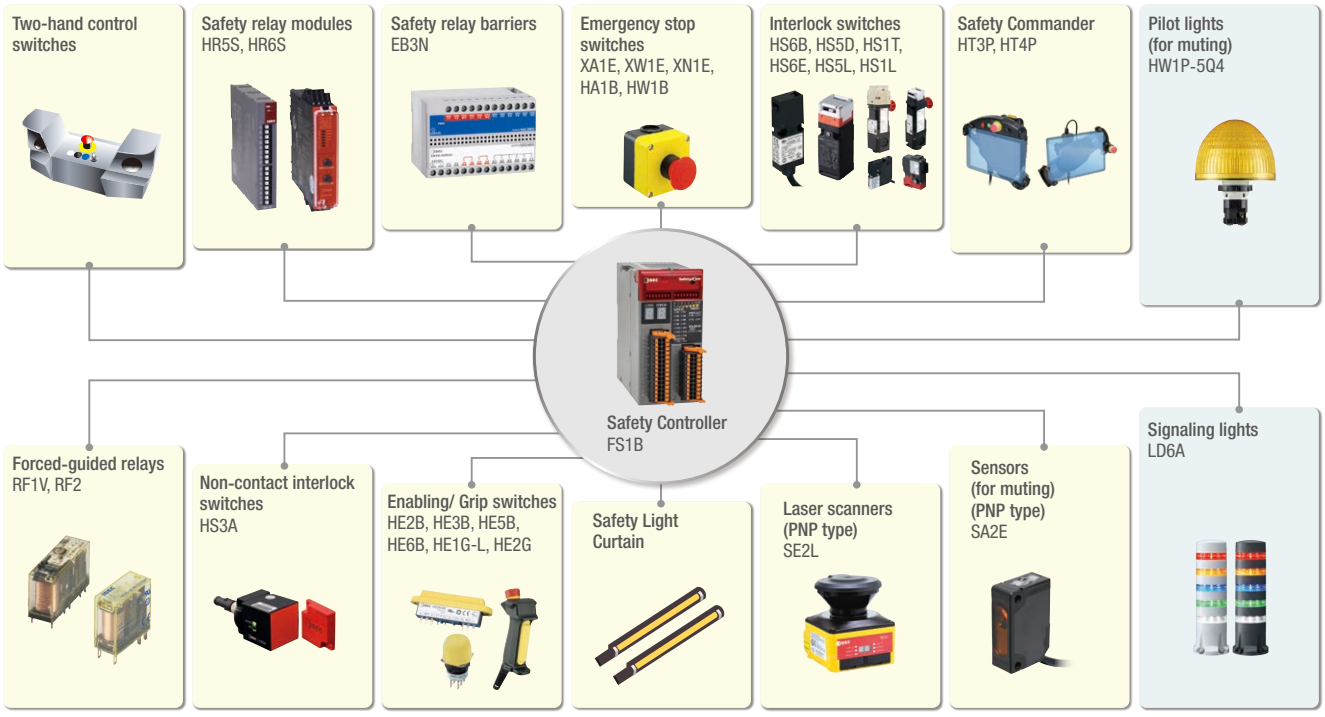
The controller's protective cover can be secured with a marked cable tie*. This prevents any accidental changes to the DIP switches and settings.

*Included with the product.



Comprehensive solutions

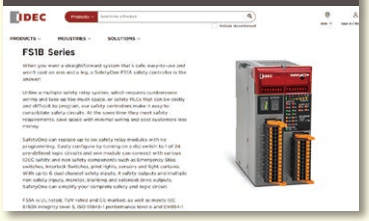
IDEC offers complete safety solutions for a variety of user needs. These include a wide range of safety and display devices that are compatible with the FS1B safety controller.



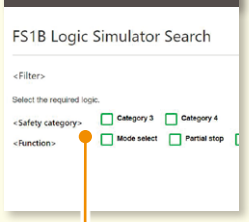
Logic simulation software

Before using the 24 pre-set safety control logics, you can view a simulation of how they work.

1. Visit the FS1B product page

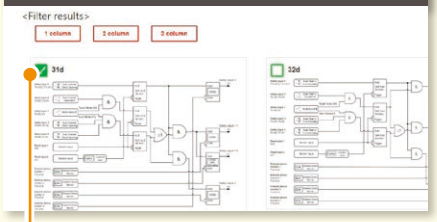


2. Search for a logic



A simulation is provided for every logic option.

3. Choose a logic



All of the 24 available logics can be selected.

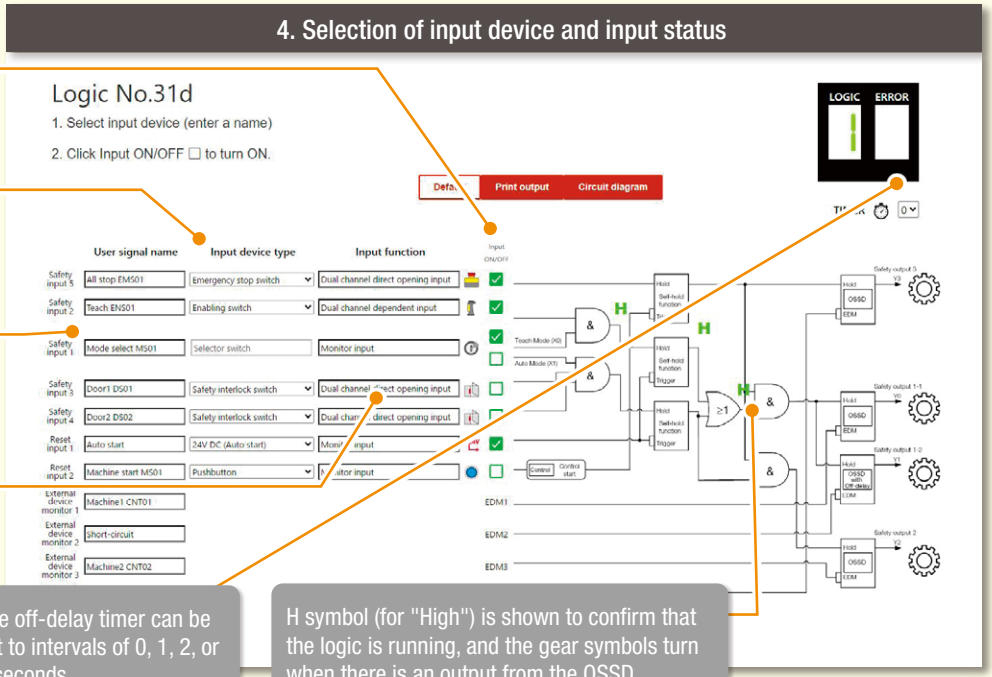
4. Selection of input device and input status

Choose input devices and their status.

Select the input devices that you plan to connect from the drop-down lists.

Give each device a name.

The input function for each device will be displayed automatically.

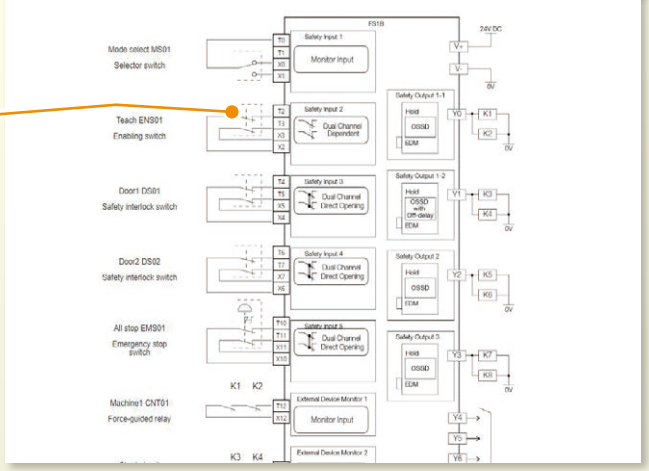


The off-delay timer can be set to intervals of 0, 1, 2, or 5 seconds

H symbol (for "High") is shown to confirm that the logic is running, and the gear symbols turn when there is an output from the OSSD.

5. See example wiring for the control logic

The logic simulation can display wiring examples for each input device. You can use these examples to manage your system, and present them to a third party for certification.



Logics

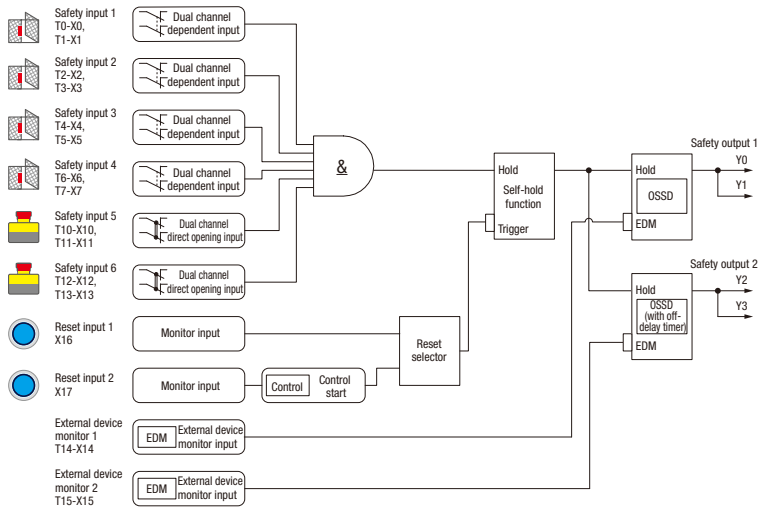
FS1B safety controller (FS1B-C31S) with 24 pre-set logics

Logic no.	Logic	Muting input	Mode select input	Safety output			
				Y0	Y1	Y2	Y3
301	AND circuit			Dual channel safety output		Dual channel safety output (with off-delay timer)	
31A	Circuit including OR function			Dual channel safety output		Dual channel safety output (with off-delay timer)	
31b	Circuit including OR function			Dual channel safety output		Dual channel safety output (with off-delay timer)	
31C	Circuit including muting function	Yes		Dual channel safety output		Dual channel safety output (with off-delay timer)	
31d	Circuit including mode select function		Yes	Safety output	Safety output (with off-delay timer)	Safety output	Safety output
302	Partial stop circuit			Dual channel safety output (with off-delay timer)		Dual channel safety output (with off-delay timer)	
32A	Circuit including muting function and two-hand control input	Yes		Dual channel safety output		Dual channel safety output	
32b	Circuit including OR and XOR function			Dual channel safety output		Dual channel safety output (with off-delay timer)	
32C	Circuit including OR and XOR function			Dual channel safety output		Dual channel safety output (with off-delay timer)	
32d	Partial stop circuit including mode select function		Yes	Safety output	Safety output	Safety output (with off-delay timer)	Safety output
303	Circuit including mode select function		Yes	Dual channel safety output (with off-delay timer)		Dual channel safety output (with off-delay timer)	
33A	Circuit including mode select function		Yes	Dual channel safety output		Dual channel safety output (with off-delay timer)	
33b	Circuit including mode select function and OR function		Yes	Dual channel safety output		Dual channel safety output (with off-delay timer)	
33C	Partial stop circuit including mode select function		Yes	Safety output	Safety output (with off-delay timer)	Safety output	Safety output
33d	Circuit including two of mode select functions		Yes	Dual channel safety output		Dual channel safety output (with off-delay timer)	
304	Partial stop circuit including mode select function		Yes	Safety output	Safety output (with off-delay timer)	Safety output	Safety output
34A	Partial stop circuit including muting function	Yes		Safety output	Safety output (with off-delay timer)	Safety output	Safety output (with off-delay timer)
34b	Partial stop circuit including muting function	Yes		Safety output	Safety output (with off-delay timer)	Safety output	Safety output (with off-delay timer)
34C	Partial stop circuit including mode select function and OR function		Yes	Safety output	Safety output	Safety output	Safety output (with off-delay timer)
34d	Partial stop circuit including OR function			Safety output	Safety output (with off-delay timer)	Safety output	Safety output (with off-delay timer)
305	Partial stop circuit			Safety output	Safety output	Safety output	Safety output (with off-delay timer)
306	Partial stop circuit			Safety output	Safety output	Safety output	Safety output (with off-delay timer)
307	Partial stop circuit			Safety output	Safety output (with off-delay timer)	Safety output	Safety output (with off-delay timer)
308	Partial stop circuit including mode select function		Yes	Safety output	Safety output (with off-delay timer)	Safety output	Safety output (with off-delay timer)

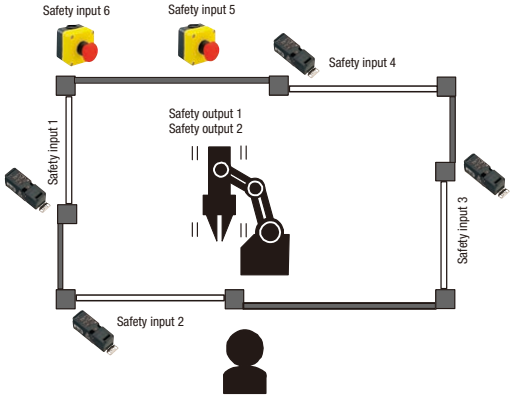
Logic 301

Logic 301 is a control logic with multiple emergency stop devices and access points. The machine can only be activated when all safety conditions are met*. Various input signals, such as contacts and OSSDs, can be input to a single controller. Automatic or manual reset modes can be selected.

Logic circuit



Safety system configuration example

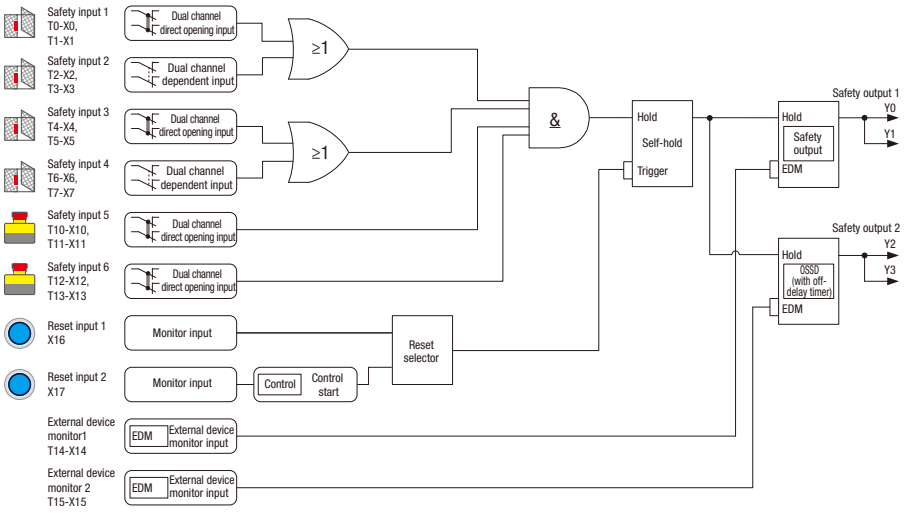


*Please refer to the relevant section of the manual for safety conditions.

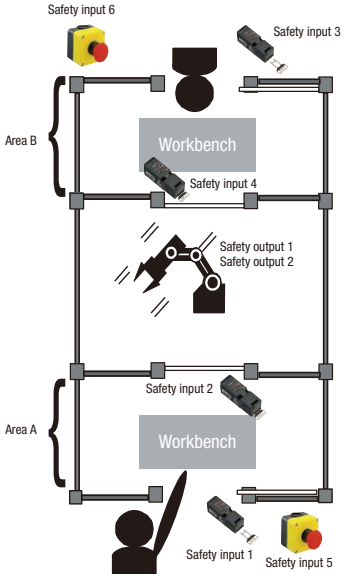
Logic 31A

Logic 31A for is a control logic for use when robots and humans share the working space. The robot stops when a human and a robot exist in the workbench area at the same time.The workbench can be monitored from up to two different locations. Automatic or manual reset modes can be selected.

Logic circuit



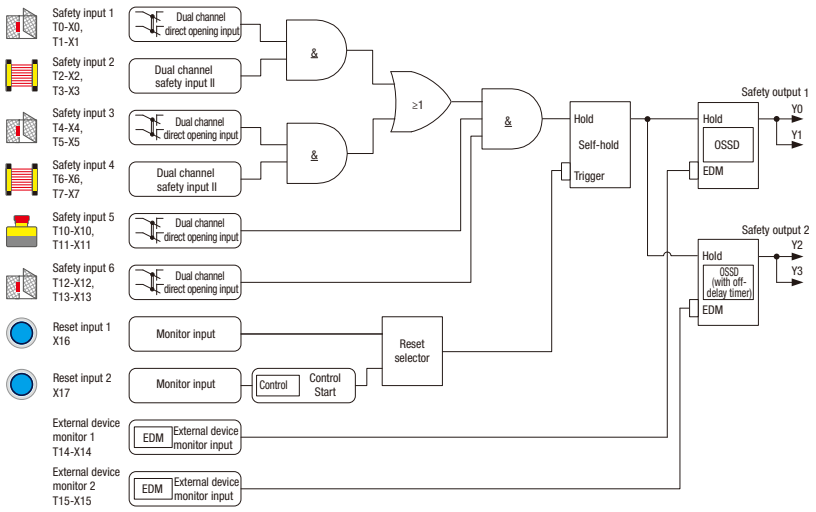
Safety system configuration example



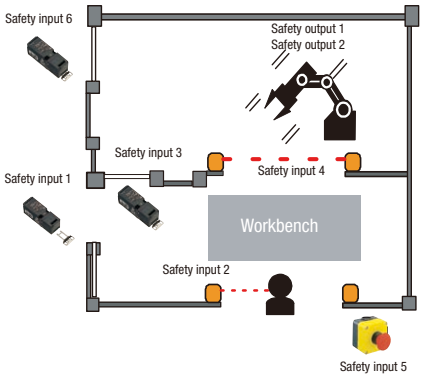
Logic 31b

Logic 31b is a control logic for use when robots and humans share the working space. The robot stops when both exist in the workbench area or when a human enters the area where the robot is located. Automatic or manual reset modes can be selected.

Logic circuit



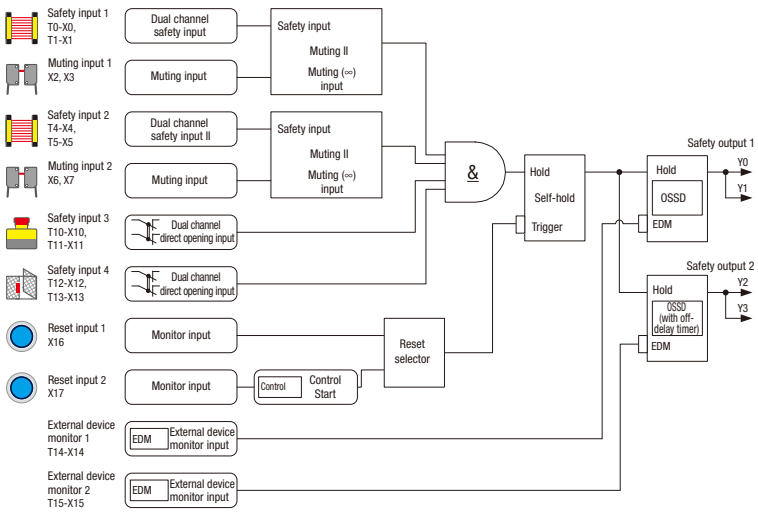
Safety system configuration example



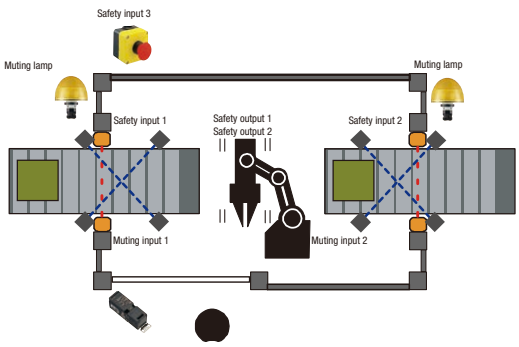
Logic 31C

Logic 31C is a control logic with a muting function that allows workpieces to be conveyed to a hazardous area protected by light curtains. The FS1B can be used for muting if the light curtain does not have a muting function. Automatic or manual reset modes can be selected.

Logic circuit



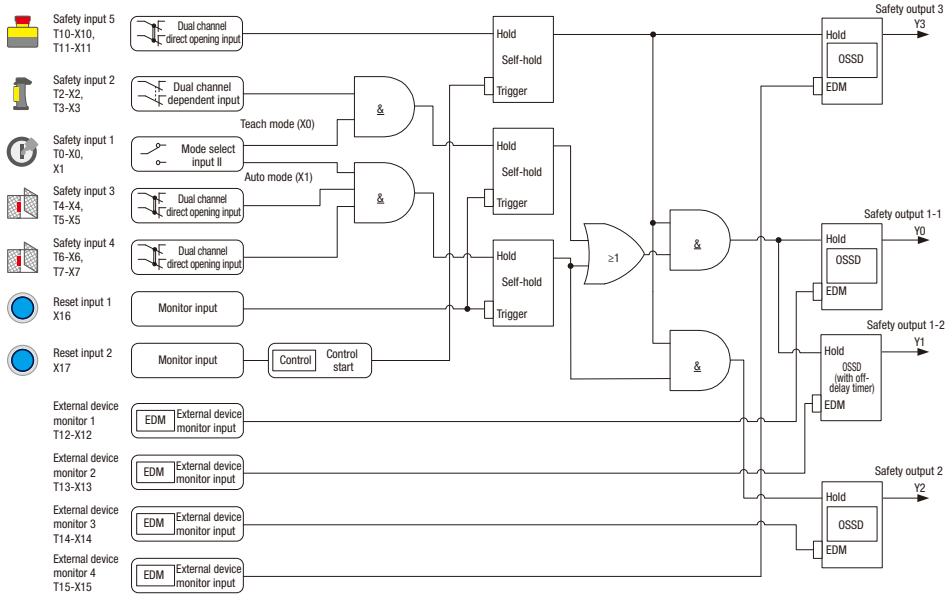
Safety system configuration example



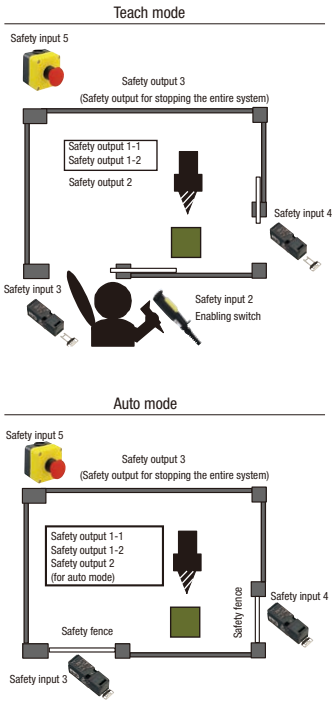
Logic 31d

Logic 31d is a control logic for machine tools with two access points. It allows switching between manual and auto modes while the equipment operates in the hazardous area during maintenance. Partial stop control is possible.

Logic circuit



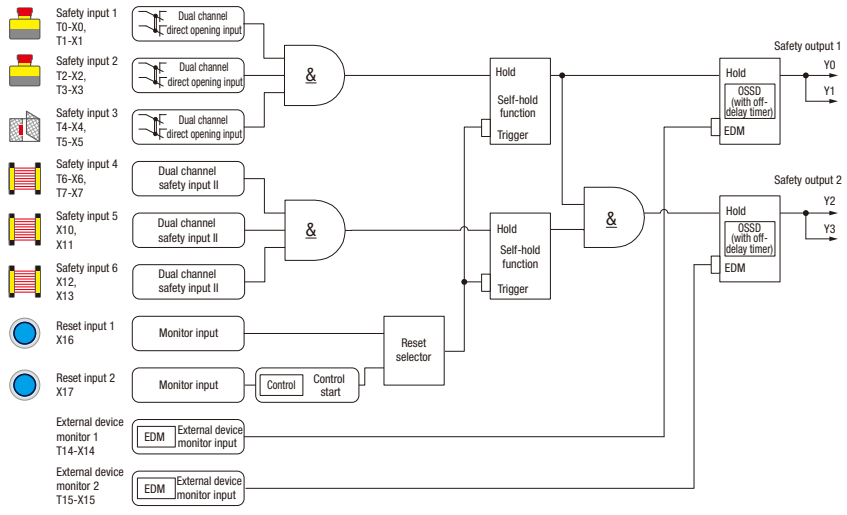
Safety system configuration example



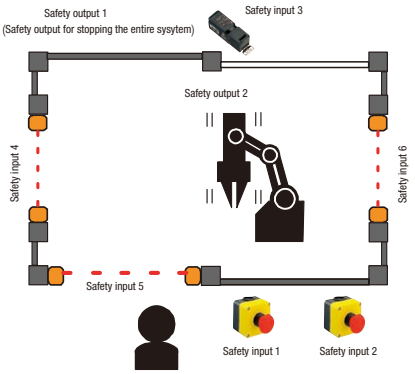
Logic 302

Logic 302 is a control logic for production facilities with multiple emergency stop devices and access points requiring partial stop control. Automatic or manual reset modes can be selected.

Logic circuit



Safety system configuration example

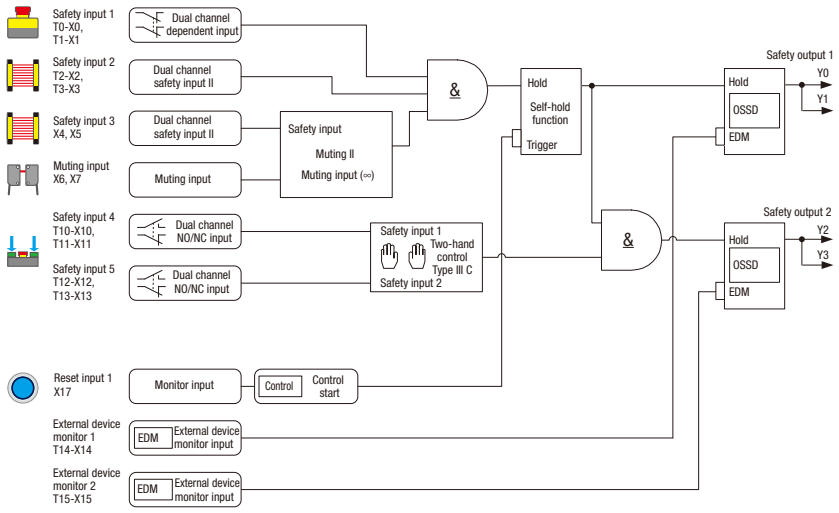


Logic 32A

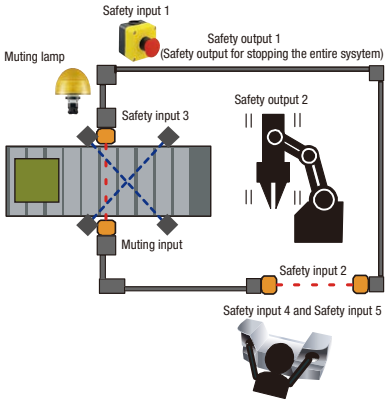
Logic 32A is a control logic for machines that require two-handed operation to activate. The machine can be activated by two-handed operation when safety conditions, such as the presence of emergency stop devices and light curtains, are met. Light curtains support muting functions, and monitoring of two-handed operation meets type IIIC requirements.

- The example shows safety input 2 (after configuration) with input functions that differ from the default value.

Logic circuit



Safety system configuration example

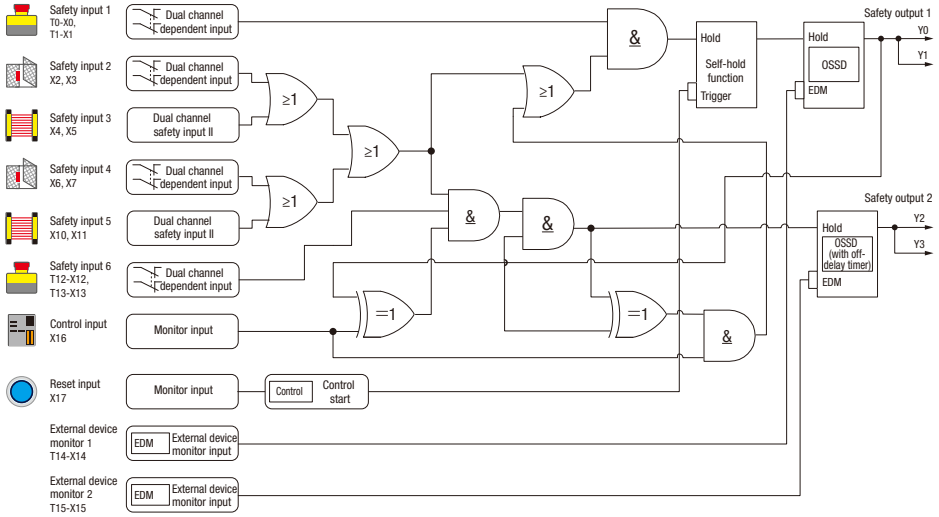


Logic 32b

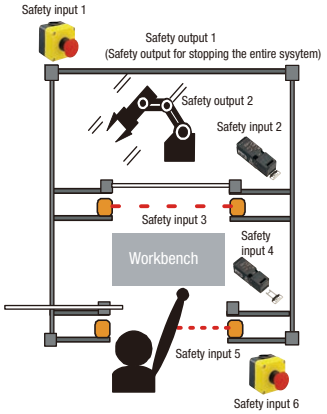
Logic 32b is a control logic that uses two sets of dual channel interlocks. Robots and humans share the same working space but the robot stops when both exist in the workbench area at the same time.

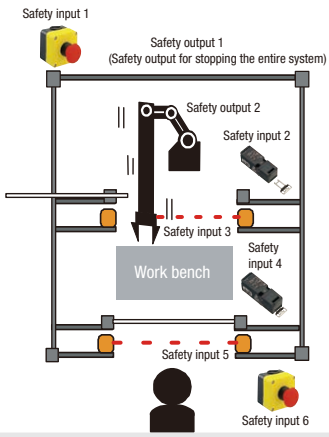
- The example shows safety inputs 2 and 4 (after configuration) with input functions that differ from the default settings.

Logic circuit



Safety system configuration example

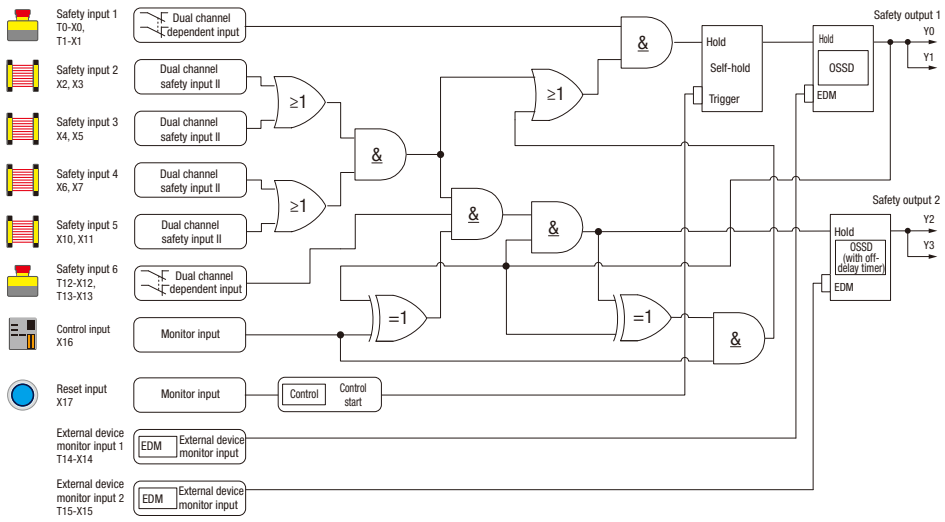




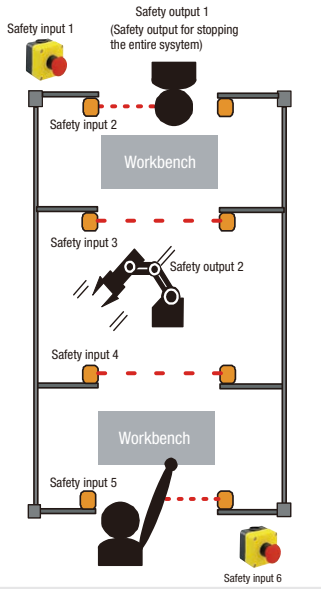
Logic 32C

Logic 32C is a control logic for use when robots and humans share the working space. The robot stops when a human and a robot exist in the workbench area at the same time. The workbench can be monitored from up to two different locations.

Logic circuit



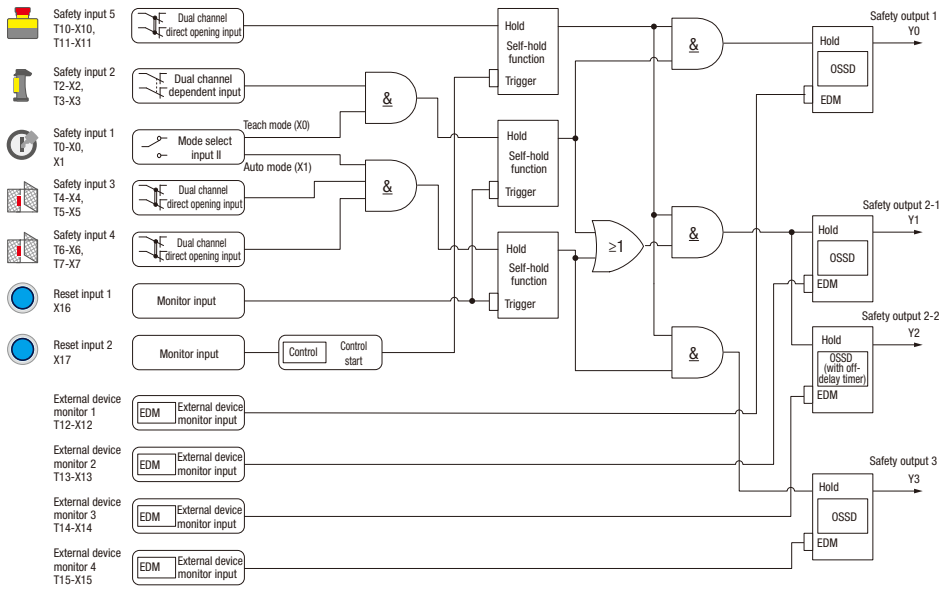
Safety system configuration example



Logic 32d

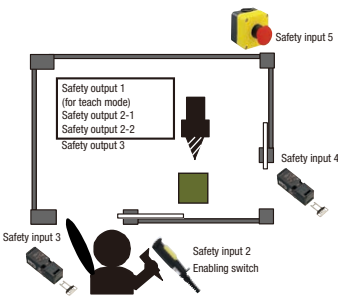
Logic 32 is a control logic for a machine tool with two access points. It allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. It controls machines that operate only either in teach mode or auto mode.

Logic circuit

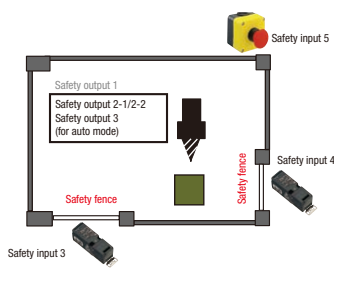


Safety system configuration example

Teach mode



Auto mode

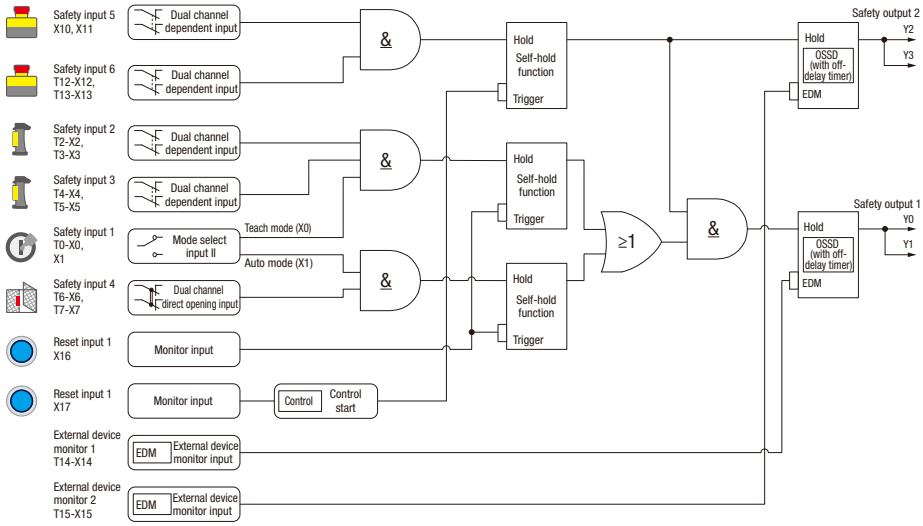


Logic 303

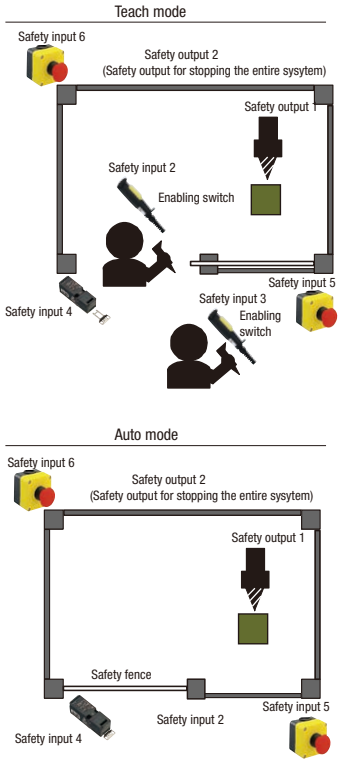
Logic 303 is a control logic for machine tools with an access point. It allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. Two people with enabling devices can work simultaneously. Partial stop control is possible.

- The example shows safety input 5 (after configuration) with input functions that differ from the default settings.

Logic circuit



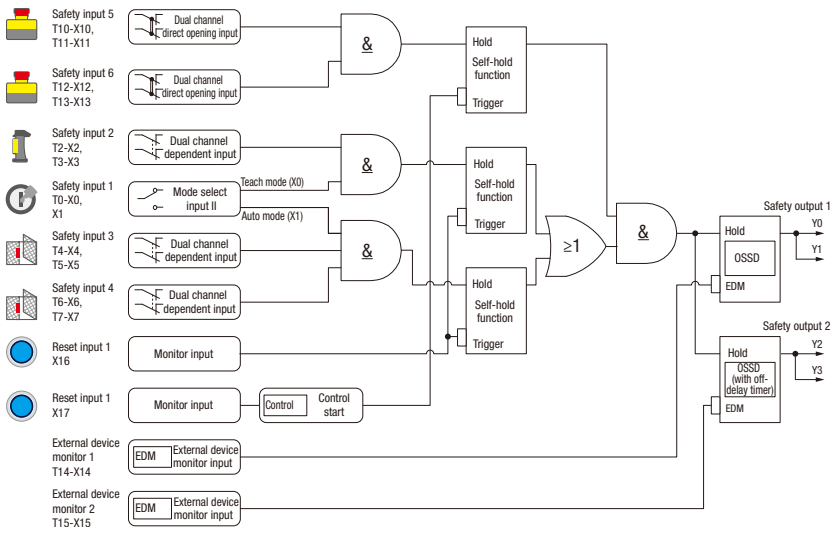
Safety system configuration example



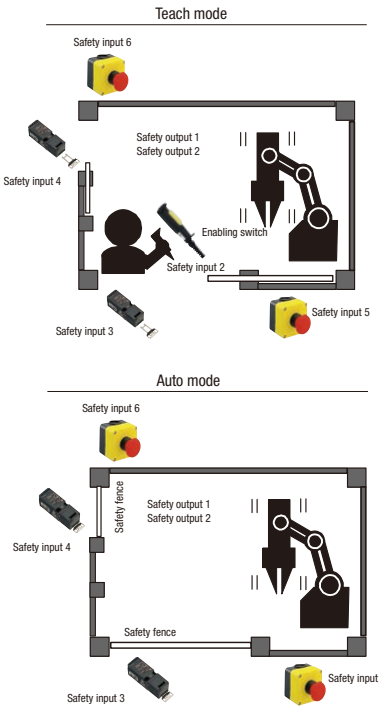
Logic 33A

Logic 33A is a control logic for robot equipment with two access points. It allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance.

Logic circuit



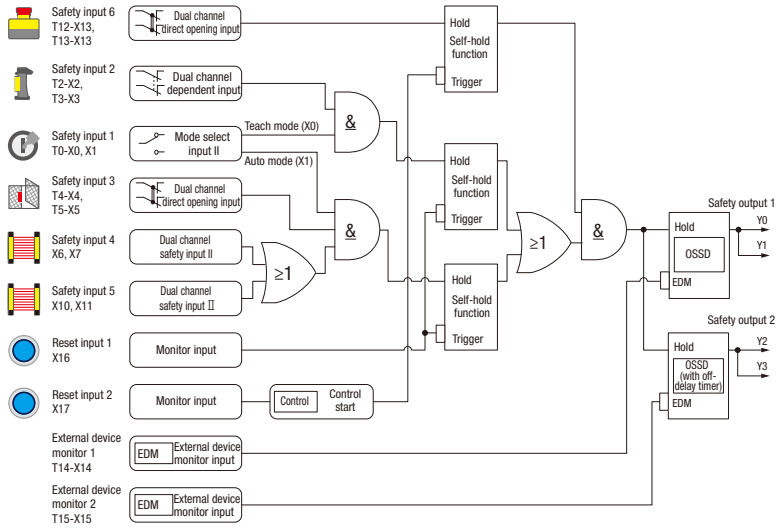
Safety system configuration example



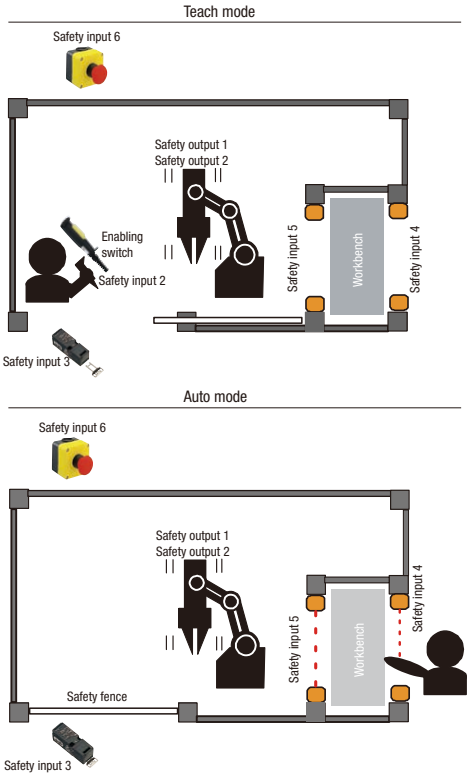
Logic 33b

Logic 33b is a control logic for robot equipment with two access points. It allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. In auto mode, the robot and the operator share the same working space, and the robot stops when the robot and the operator exist at the same time.

Logic circuit



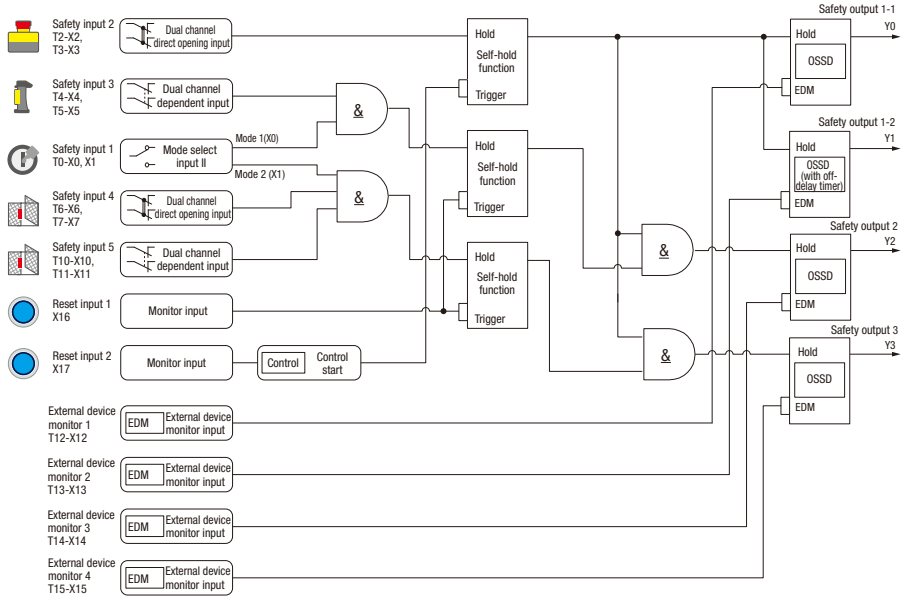
Safety system configuration example



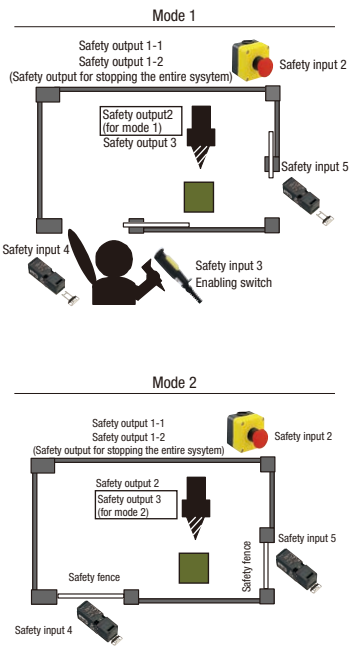
Logic 33C

Logic 33C is a control logic for machine tools with two access points. It allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. Machines can operate in both modes or only in each mode. Partial stop control is possible.

Logic circuit



Safety system configuration example

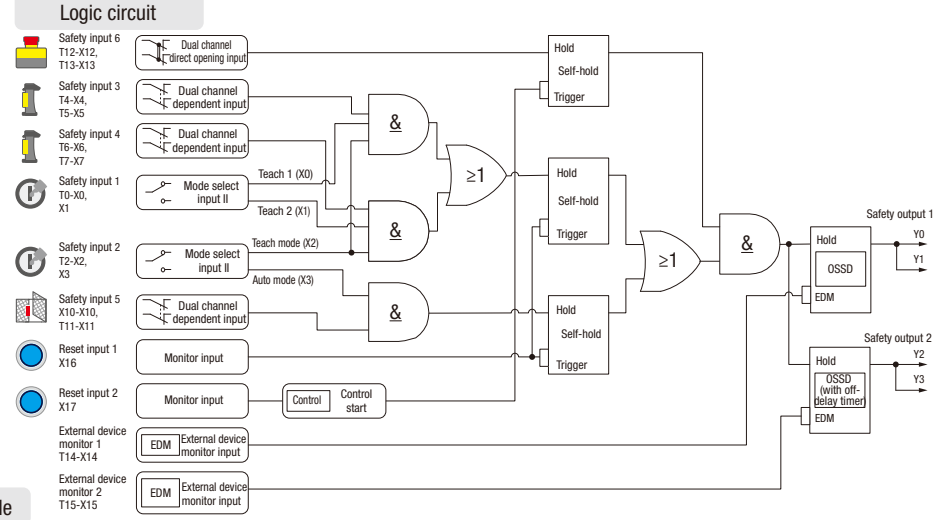


Logic 33d

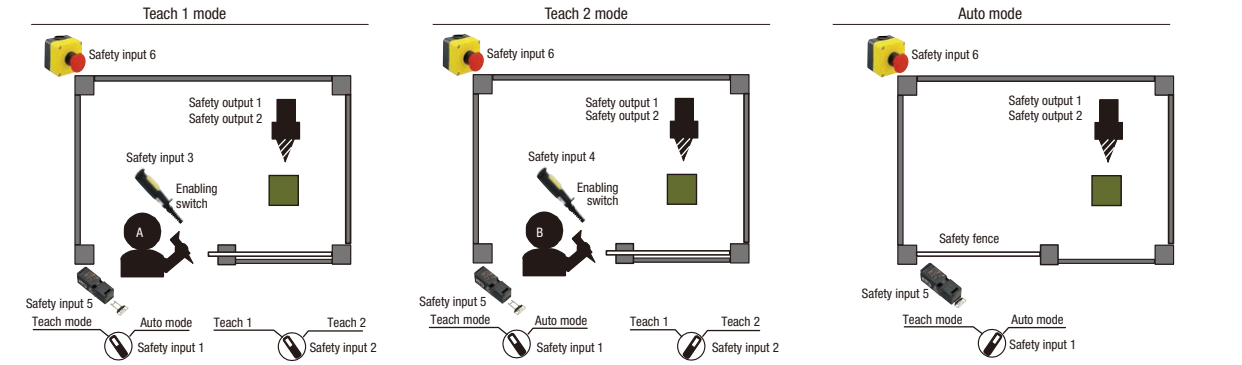
Logic 33d is a control logic that allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. Two types of teach modes are available.

- The example shows safety input 5 (after configuration) with input functions that differ from the default settings.

Logic circuit



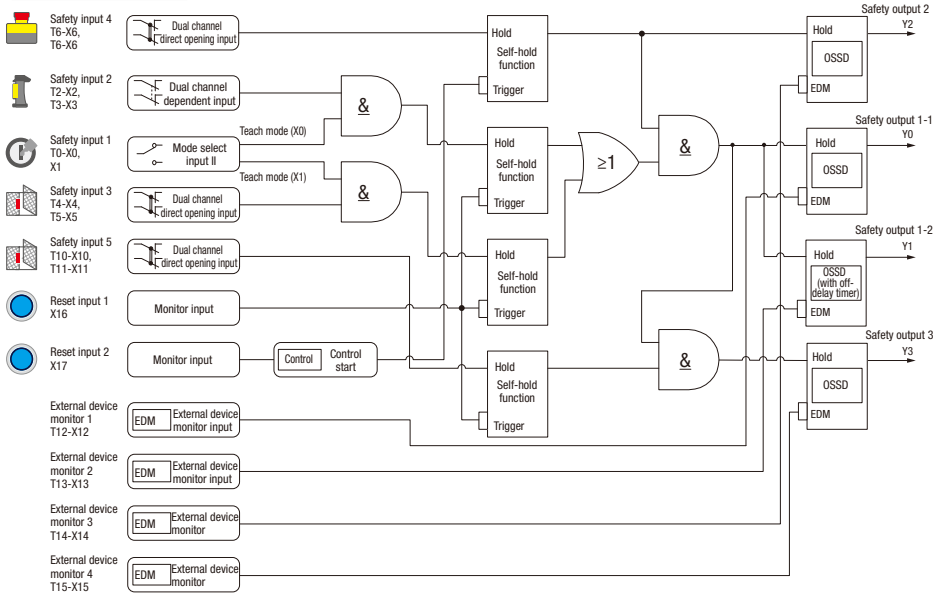
Safety system configuration example



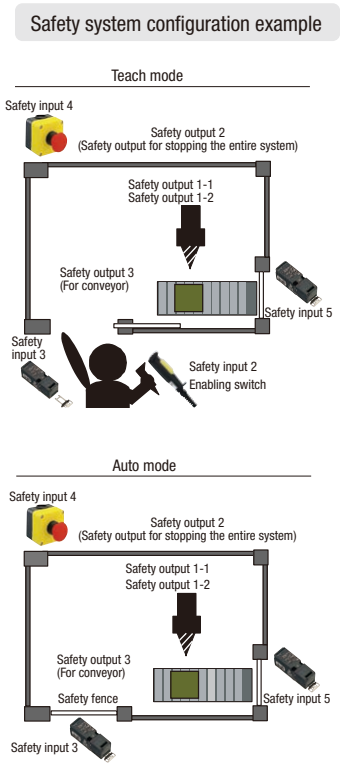
Logic 304

Logic 304 is a control logic that allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. In addition, it can control machines with protective covers that operate in both modes. Partial stop control is possible.

Logic circuit



Safety system configuration example

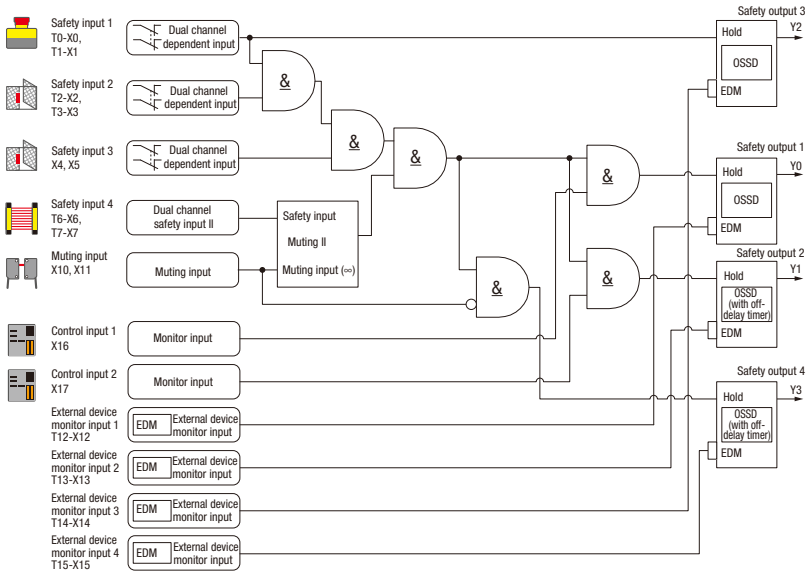


Logic 34A

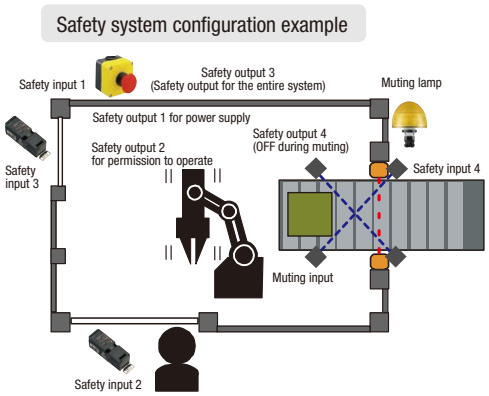
Logic 34A is a control logic with a muting function that allows workpieces to be conveyed to a hazardous area protected by devices such as light curtains. The FS1B can be used for muting if the light curtain does not have a muting function. Machines may stop operating during muting.

• The example shows safety inputs 3 and 4 (after configuration) with input functions that differ from the default values.

Logic circuit



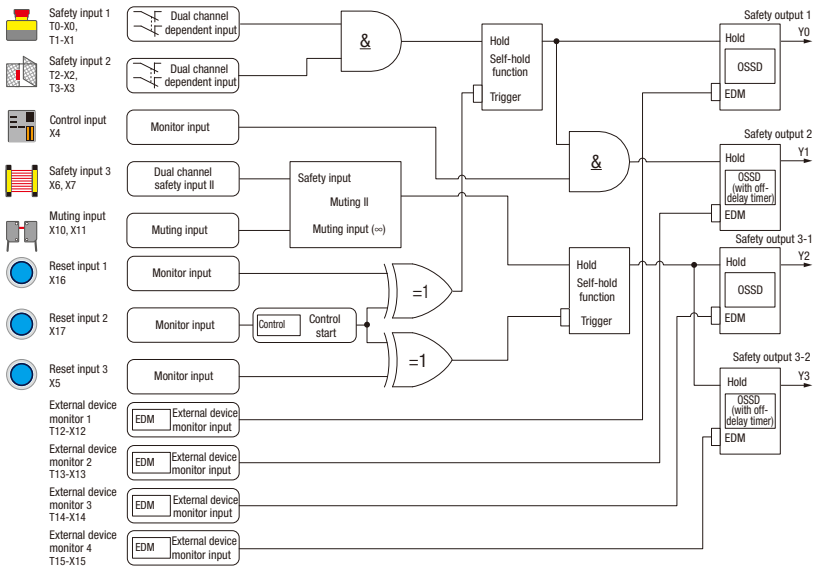
Safety system configuration example



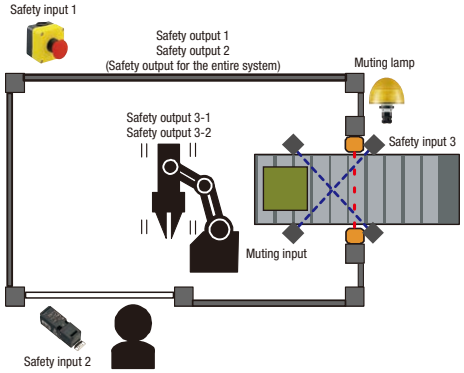
Logic 34b

Logic 34b is a control logic with a muting function that allows workpieces to be conveyed to a hazardous area protected by devices such as light curtains. The FS1B can be used for muting if the light curtain does not have a muting function. The robot can be controlled so that it does not activate depending on the location of the workpiece or machine.

Logic circuit



Safety system configuration example

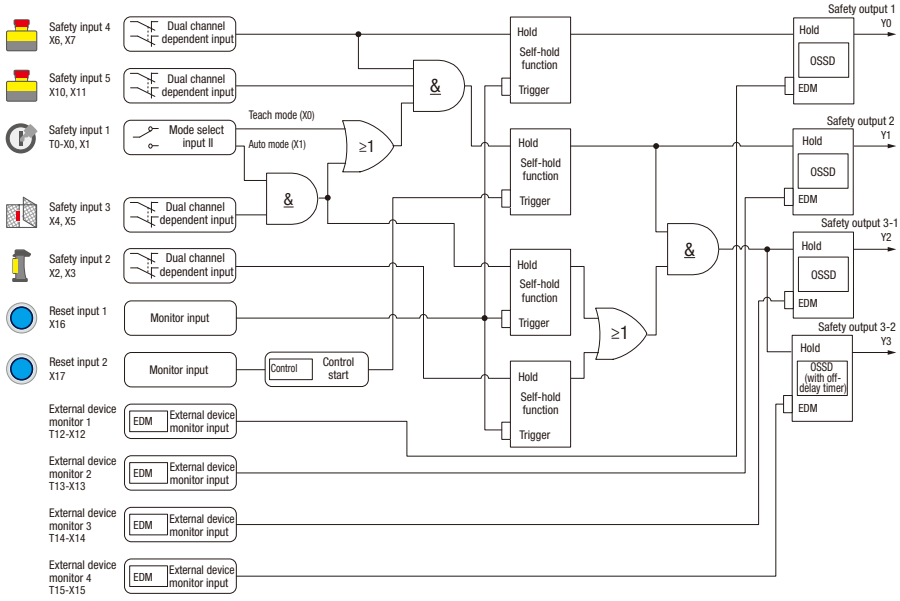


Logic 34C

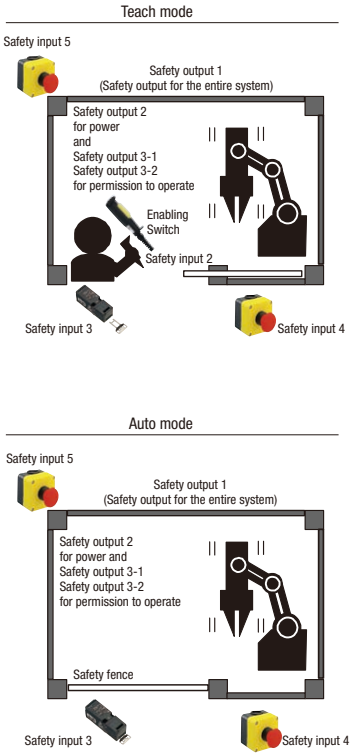
Logic 34C is a control logic that allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. It is possible to allow machines in auto mode to switch to teach mode on a limited basis.

- The example shows safety input 2,3, 4, and 5 (after configuration) with input functions that differ from the default settings.

Logic circuit



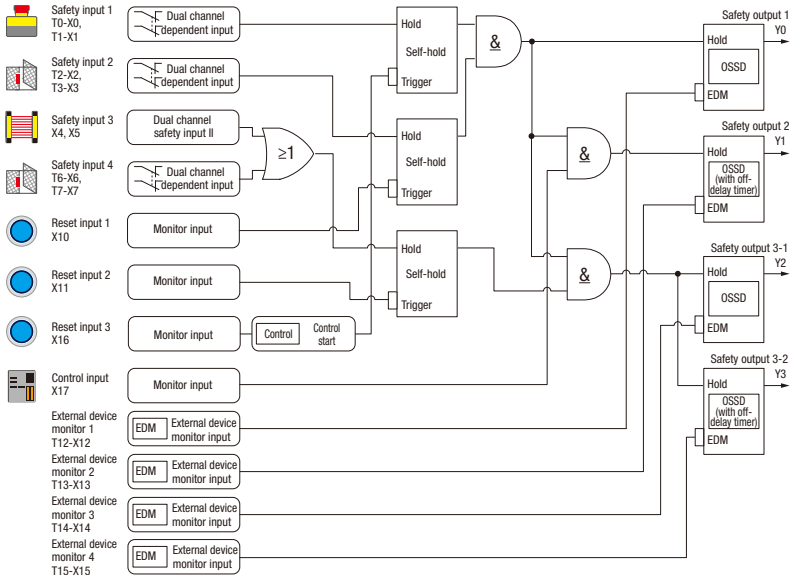
Safety system configuration example



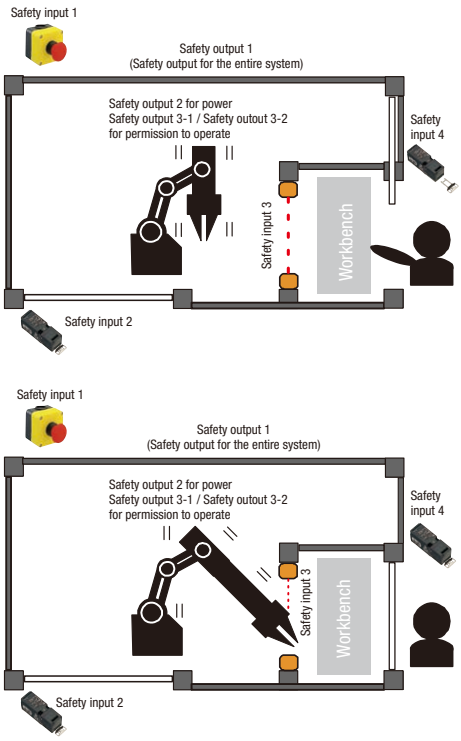
Logic 34d

Logic 34d is a control logic for use when robots and humans share the working space. The robot partially stops when a human and a robot exist in the workbench area at the same time.

Logic circuit



Safety system configuration example

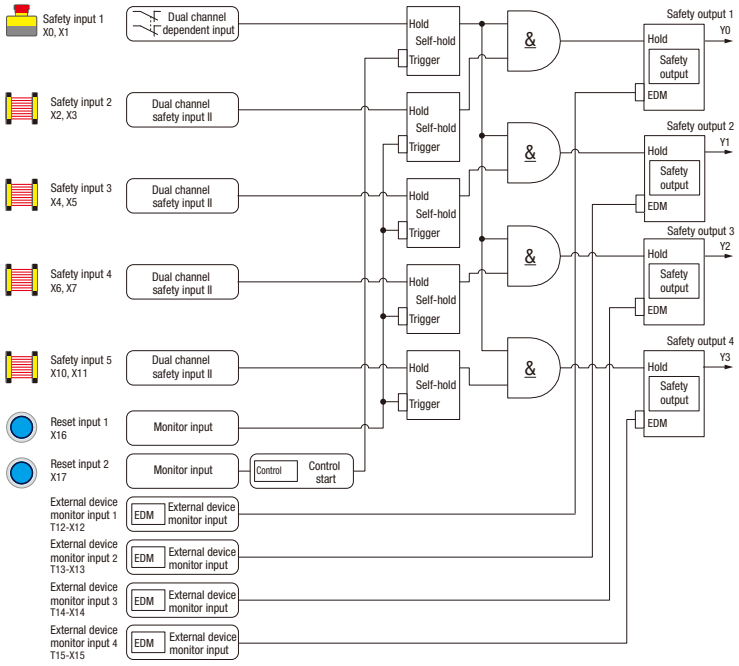


Logic 305

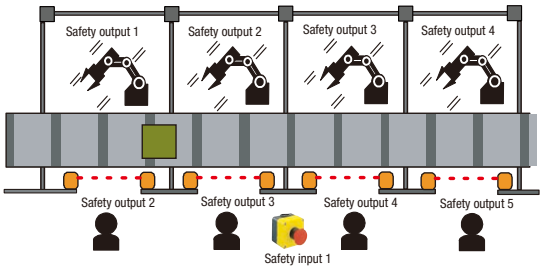
Logic 305 is a control logic for multiple independent hazard sources, each with its own access point, which partially stops individual machines when accessible (such as light curtain protection). When the emergency stop device is operated, it stops the entire system.

- The example shows safety input 1 (after configuration) with input functions that differ from the default settings.

Logic circuit



Safety system configuration example

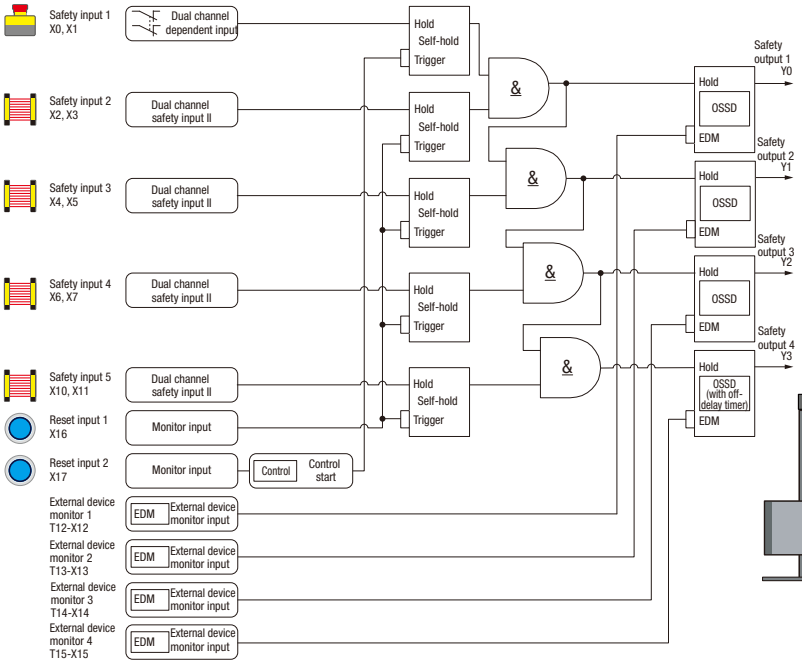


Logic 306

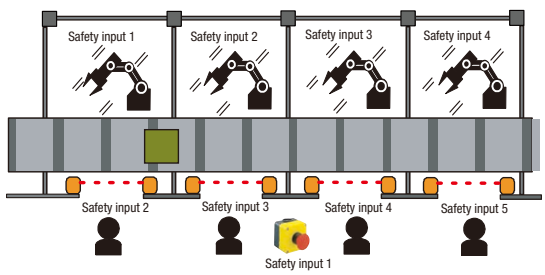
Logic 306 is a control logic for multiple dependent hazard sources, each with its own access point, which depending on the machine, stops other related machines. When the emergency stop device is operated, it stops the entire system.

- The example shows safety input 1 (after configuration) with input functions that differ from the default settings.

Logic circuit



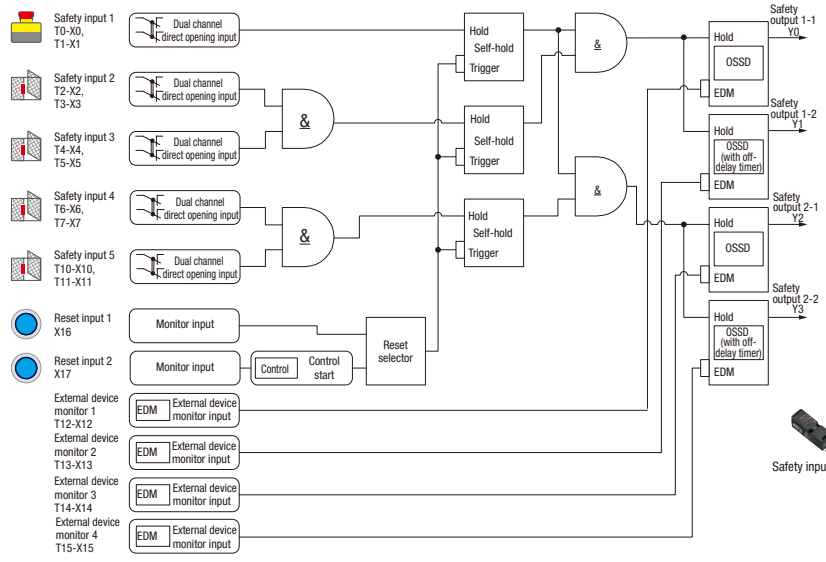
Safety system configuration example



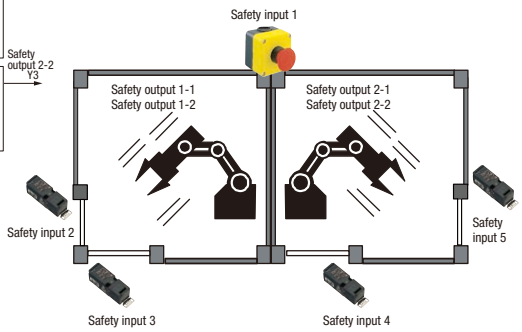
Logic 307

Logic 307 is a control logic for two sets of robot equipment with two access points, allowing partial stops.
When the emergency stop device is operated, it stops both robots.

Logic circuit



Safety system configuration example

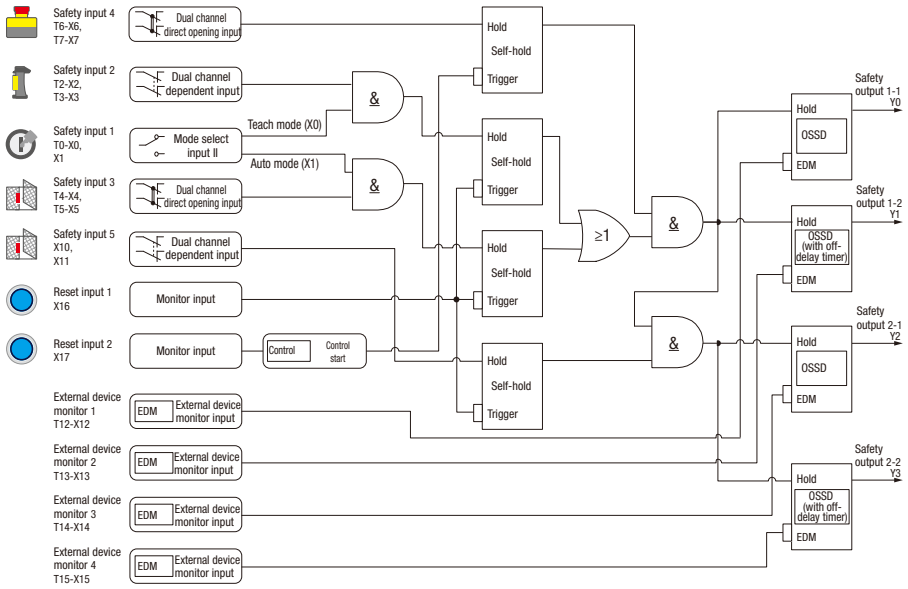


Logic 308

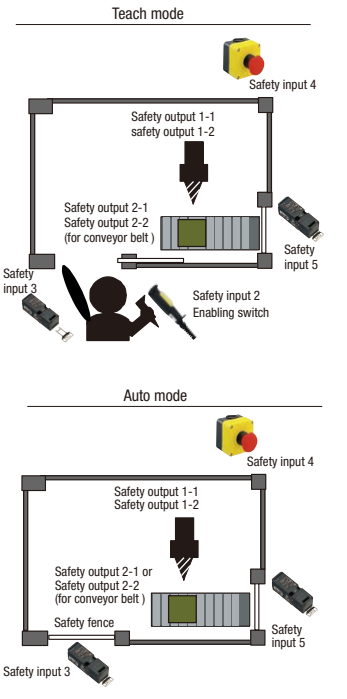
Logic 308 is a control logic that allows switching between teach and auto modes so that the equipment can operate in hazardous areas during maintenance. In addition, it can control machines with protective covers that operate in both modes.

- The example shows safety input 5 (after configuration) with input functions that differ from the default settings.

Logic circuit



Safety system configuration example



FS1B Safety Controller

No programming required

- Safety controller with 24 pre-programmed logics, certified to international safety standards
- Ready-to-use logics such as partial stop control and mode switching logics.
- The universal input feature enables connection with contacts and sensors.

See website for details on approvals and standards.

FS1B Safety Controller

Quantity: 1

Name	Part No.
FS1B Safety Controller	FS1B-C31S

Standard accessories

- Connector for input (FS9Z-CN03).....1 pc
- Connector for output (FS9Z-CN04) .....1 pc
- Marking tie.....1 pc

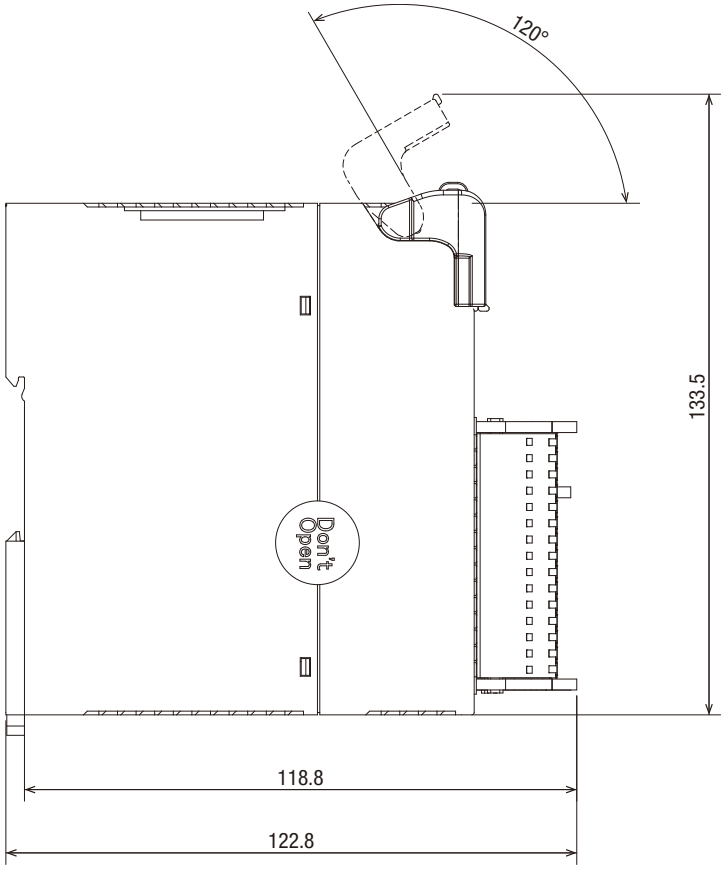
Accessories

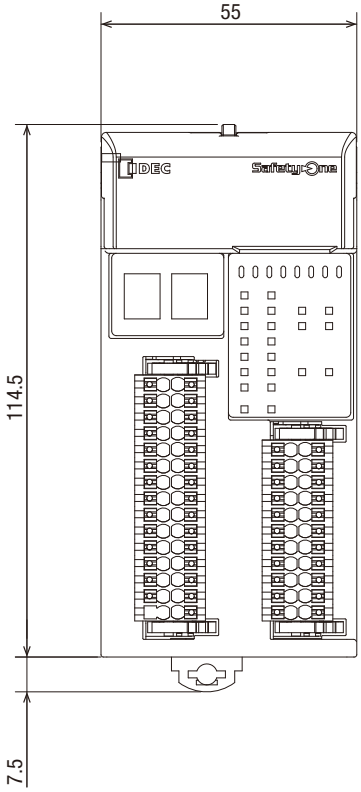
When ordering, specfiy the Ordering No.

Name	Shape	Part No.	Quantity
Input connector		FS9Z-CN03	1
Output connector		FS9Z-CN04	1
Marking tie (*1)		FS9Z-MT01	10 pcs

*1) The marking tie is used to lock the protective cover of the main unit.

All dimensions in mm.





General Specifications

Operating environment

Operating temperature	-10 to +55°C (no freezing)
Storage temperature	-40 to +70°C (no freezing)
Operating humidity	5 to 95% (with no condensation)
Storage humidity	5 to 95% (with no condensation)
Pollution degree	2 (IEC60664-1)
Degree of protection	IP20 (IEC60529)
Corrosion immunity	Free from corrosive gases
Atmospheric pressure (Altitude)	Operation: 1,013 to 795hPa (0 to 2,000m) Transport: 1,013 to 701hPa (0 to 2,000m)
Installation location	Inside IP54 or above rated enclosure
Apparatus class	Open type apparatus
Overvoltage category	II
Vibration resistance	5 to 8.4Hz: 3.5mm (peak) 8.4 to 150 Hz: 10 m/s^2 (peak) 1 octave/minute, 10 sweeps, each X, Y, Z axes (IEC61131-2)
Shock resistance	150m/s^2, 11ms (3 shocks each on three axes in 6 directions) (IEC61131-2)
EMC resistance	IEC61131-2 Zone B
Connector insertion/ removal durability	25 operations maximum
Configuration switch durability	100 operations maximum per pole
Enter button durability	1,000 operations maximum
Weight (approx.)	280g
Product life	10 years (at 40°C operating temperature)

Power supply specifications

Rated power voltage	24V DC
Allowable voltage range	20.4 to 28.8V DC (including ripple)
Power consumption	Stand alone: 6W approx. (24V DC) Maximum connect load: 48W maximum (24V DC)
Allowable momentary power interruption	1ms minimum (at the rated power voltage)
Dielectric strength	Between internal circuit and housing: 1,000V AC, 1 minute
Effect of incorrect wiring	Reverse polarity: No operation, no damage Improper voltage: Permanent damage may occur Improper wiring: Permanent damage may occur

Time specifications

Response time	ON - > OFF	40ms maximum (*1) (*5) Logic 32b and 32C: 50ms maximum (*1) (*5)
	OFF - > ON	100ms maximum (*2)
	Mode select	3s maximum (*3) (*5)
Start-up time		3s maximum (*4)

*1) When the setting of the off-delay time is instantaneous (0 sec.):
The time it takes from when the safety input turns off until the safety output turns off.

*2) When set to auto reset:
The time is takes from when the safety output turns on until the safety input turns on.
When set to manual reset:
The time it takes from when the safety output turns on until the reset input turns on. (The time until reset input turns on is 0.1 sec. minimum.)
When set to control reset:
The time it takes from when the safety output turns off→on→off until the safety input turns on. (The time until reset input turns on is 0.1sec. to 0.5 sec.)

*3) When the setting of the off-delay timer is instantaneous (0 sec):
The time it takes from when the mode select is requested (such as the operation of selector switches) until the safety output turns off.

*4) The time it takes from power on to run state

*5) When the setting of the off-delay timer is other than instantaneous (0 sec.), add off-delay time to the response time.
The maximum off-delay time is "the set off-delay time" x 1.05 + 0.01 sec.

Approvals

TÜV Rheinland

Applicable standard: EN IEC 61508 Part1-7, EN ISO 13849-1, EN ISO 13849-2, EN 61000-6-7, EN 61131-2 (clause6.1-6.3, 8)
Applicable standard for use: IEC 62061

UL

UL508, CSA C22.2 No.142

Safety performance

Safety performance based on IEC 61508 requirements

Safety output	PFDavg (*6)	PFH (*6)	Maximum achievable SIL
Dual channel safety output	$\leq 9.8 \times 10^{-6}$	$\leq 1.3 \times 10^{-10}$	3
Redundant safe output	$\leq 4.0 \times 10^{-5}$	$\leq 6.7 \times 10^{-10}$	2

*6) Proof test interval is 10 years. After this time, the FS1B must be replaced.

Safety performance based on ISO 13849-1 requirements

Safety output	$MTTF_D$	DC_{avg}	Maximum achievable category	Maximum achievable PL
Dual channel safety output	≥206 years	High	3 or 4	e
Redundant safe output	≥176 years (*7)	Medium	3	d

• Mission time is 10 years.

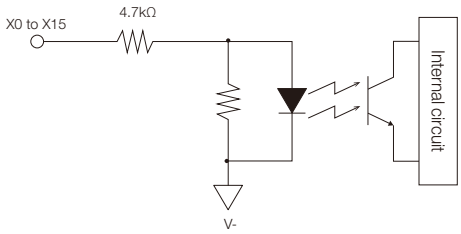
*7) The maximum years per channel is 100 years according to ISO 13849-1 requirement.

Safety input specifications

Drive terminals	Rated drive voltage	Power supply voltage
	Minimum drive voltage	Power supply voltage - 3V DC
	Number of drive terminals	14 (T0, T1, T2, T3, T4, T5, T6, T7, T10, T11, T12, T13, T14, T15)
Receive terminals	Rated input voltage	24V DC
	Input voltage range	0 to 28.8V DC
	Input ON voltage	15 to 28.8V DC
	Input OFF voltage	Open or 0 to 5V DC
	Number of reset inputs	14 (X0, X1, X2, X3, X4, X5, X6, X7, X10, X11, X12, X13, X14, X15)
	Rated input current	6mA/1 point (at 24V DC input voltage)
	Input impedance	4.7kΩ approx.
	Input type	Sink input, Type1 (IEC611311-2)
Wire	Cable length in compliance with electromagnetic immunity	30m maximum (total wire length per input)
	Allowable wire resistance	300Ω maximum

- Drive terminals of safety inputs send safety confirmation signals (pulse signals) for the diagnosis of safety components and input circuits. The operating characteristics of the safety input change depending on the selected logic. For details, see the manual. Basic specifications remain the same.
- When connecting multiple interlock switches, the applicable safety performance depends on the result of risk assessment for entire safety configuration. When evaluating the safety performance of a system using interlock switches, refer to the relevant standards (such as ISO 14119)

Safety input (receive terminal) equivalent circuit

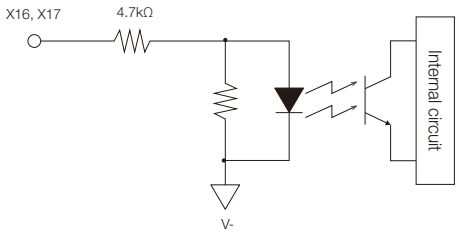


Reset input specifications

Receive terminals	Rated input voltage	24V DC
	Input voltage range	0 to 28.8V DC
	Input ON voltage	15 to 28.8V DC
	Input OFF voltage	Open or 0 to 5V DC
	Rated input current	5mA/1 point (at 24V DC)
	Input impedance	4.7kΩ approx.
	Input type	Sink input, Type1 (EN611311-2)
	Number of reset inputs	2 (X16, X17)
Wire	Cable length in compliance with electromagnetic immunity	30m maximum (total wire length per input)
	Allowable wire resistance	300Ω maximum

- The operating characteristics of the reset input change depending on the selected logic. For details, see the manual. Basic specifications remain the same.

Reset input equivalent circuit



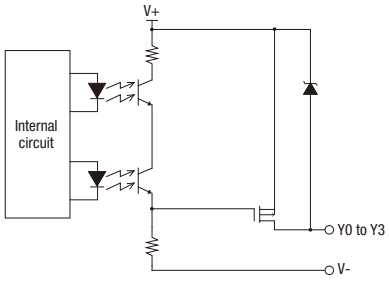
Safety output specifications

Rated output voltage		Power supply voltage
Minimum output ON voltage		Power Supply voltage - 2V DC
Maximum detectable voltage at off (*1)		14.6V DC
Maximum residual voltage at off		2V DC
Number of safety outputs		4 (Y0, Y1, Y2, Y3)
Maximum load current	1 output	500mA maximum
	Total	1A maximum
Leakage current		0.1mA maximum
Output type		Source output
Wire	Cable length in compliance with electromagnetic immunity	30m maximum (total wire length per output)

*1) When the safety output is off, and an abnormal voltage occurs with the safety output if its voltage is the maximum detectable voltage or less; the FS1B may not be able to detect its abnormal state.
Ensure the system does not cause a dangerous state even if the voltage is lower than the maximum detectable voltage. (e.g, by protecting external wiring, using appropriate actuators, etc.)

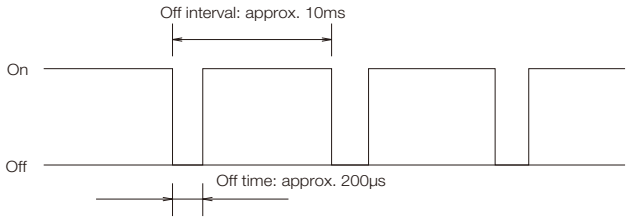
- The operating characteristics of the safety output change depending on the selected logic. For details, see the manual. Basic specifications remain the same.

Safety output equivalent circuit



- The safety outputs of the product are solid state outputs. When the output is on, off-check signals are generated at regular intervals.

Off-check pulse waveform of safety outputs

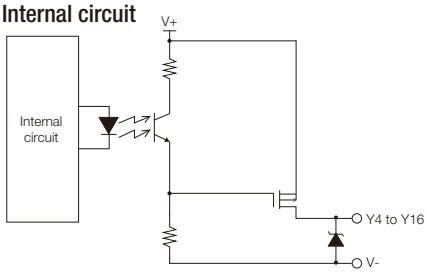


Monitor output specifications

Rated output voltage		Power supply voltage
Minimum output ON voltage		Power Supply voltage - 2V
Leakage current		0.1mA maximum
Maximum load current	1 output	20mA maximum
Output type		Source output
Number of safety outputs		11 (Y4, Y5, Y6, Y7, Y10, Y11, Y12, Y13, Y14, Y15, Y16)
Wire	Cable length in compliance with electromagnetic immunity	30m maximum (total wire length per input)

The operating characteristics of the monitor output change depending on the selected logic.
For details, see instructions. Basic specifications remain the same.

Internal circuit

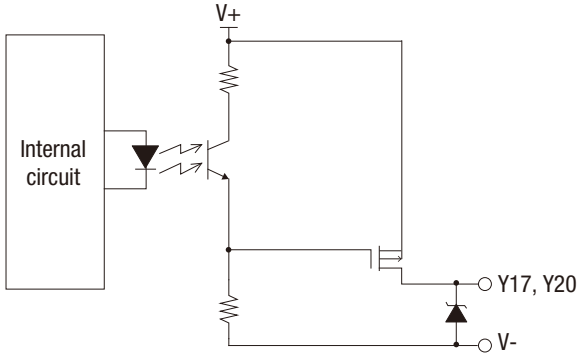


Solenoid/Lamp output specification

Rated output voltage		Power supply voltage
Minimum output ON voltage		Power supply voltage - 2V DC
Leakage current		0.1mA maximum
Maximum load current	1 output	250mA maximum
Output		Source output
Wire	Cable length in compliance with electromagnetic immunity	30m maximum (total wire length per input)

- The selected operating characteristics of solenoid/lamp output change depending on the selected logic. For details, see the User's Manual. Basic specifications remain the same.

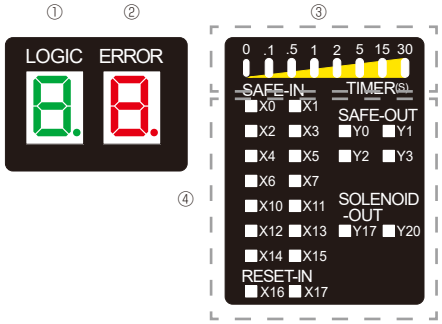
Solenoid/Lamp output internal circuit



Display specifications

(1)	Logic LED (green)
(2)	Error LED (red)
(3)	Timer LED (green)
(4)	Input/Output LED SAFE-IN (red/green/orange) (*1) RESET-IN (green) SAFE-OUT (orange) SOLENOID-OUT (orange)

*1) Differs depending on the selected input specification.



(1) Logic LED

LED	Status	Description	State (*3)
1, 2, 3, 4 5, 6, 7, 8, A, b, C, d (*2)	ON	Selected logic number (Example: logic 34A: 4→A→4→A→4...)	Run state Configuration state Protection State
	Blink	Selected logic number (Example: Logic 34A: 4→A→OFF→4→A→OFF→4...)	Configuration state
E	Blink	Logic configuration error (logic not selected, or multiple logics are selected)	Configuration state
None	OFF	Error	Stop state

*2) When the input function is changed, "." (dot) lights ON/blink in the lower right.
*3) For more details on states, see the user's manual.

(2) Error LED

LED	Status	Description	State (*6)
1 (*1)	ON	Errors that can be removed by turning off the input (Input monitor error)	Protection State
2, 3, 4, 6, 7, 8 (*4)	ON	Error requiring power restart to clear	Stop state
C (*5)	ON	Configuration procedure is in progress	Configuration state
	Blink	Configuration is valid (*7)	Configuration state
None	OFF	Normal operation	Run state

*4) For details on errors and countermeasures, see the user's manual.
*5) When the input function is changed, "." (dot) lights ON/blink in the lower right.
*6) For more details on states, see the user's manual.
*7) The 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.)

(3) Timer LED

LED	Status	Description	State (*1)
0s	ON	No Off-delay (safety outputs shut down immediately)	Run state Protection state
.1s	ON	Off-delay timer 0.1s	Run state Protection state
.5s	ON	Off-delay timer 0.5s	Run state Protection state
1s	ON	Off-delay timer 1s	Run state Protection state
2s	ON	Off-delay timer 2s	Run state Protection state
15s	ON	Off-delay timer 15s	Run state Protection state
30s	ON	Off-delay timer 30s	Run state Protection state
LED (each)	Blink	Selected off-delay timer value	Configuration state
None	OFF	Off-delay timer value is not selected	Configuration state
		Error (*2)	Stop state

*1) For more details on states, see the user's manual.
*2) For details on the errors and countermeasures, see the user's manual.

(4) Input/Output LED

Input LED: SAFE-IN (X0 to X15), RESET-IN (X16, X17)

LED	Status	Description	State (*4)
X0 to X15 (*3)	ON	Input ON	Run state
	OFF	Input OFF	Run state
		Error (*5)	Configuration state Stop state
	Blink	An input error occurred at the flashing point. (*5)	Run state Protection State Stop state
X16, X17	ON	Input ON	Run state
	OFF	Input OFF	Run state
		Error (*5)	Configuration state Stop state
	Blink	An input error occurred at the flashing point. (*5)	Stop state

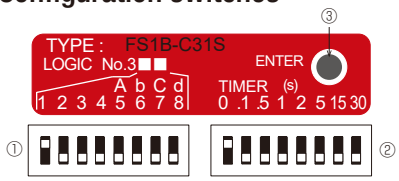
*3) The LED colors change depending on the selected input functions. For details, see the user's manual .
*4) For more details on states, see the user's manual.
*5) For details on errors and countermeasures, see the user's manual.

Output LED: SAFE-OUT (Y0 to Y3), SOLENOID-OUT (Y17, Y20)

LED	Status	Description	State (*6)
Y0 to Y3	ON	Output ON	Run state
	OFF	Output OFF	Run state
		Error (*7)	Configuration state Protection state Stop state
	Blink	Off-delay timer operation,	Run state
		An outputs error occurred at the flashing point. (*7)	Stop state
Y17, Y20	ON	Output ON	Run state
	OFF	Output OFF	Run state
		Error (*7)	Configuration state Protection state Stop state

*6) For more details on states, see the user's manual.
*7) For details on errors and countermeasures, see the user's manual.

Configuration switches



(1) Logic configuration switch

This switch is a slide switch for configurating the logics. When one of 1 to 8, one of 1 to 4, and one of A, b, C, or d (5 to 8) is selected, the corresponding logic in FS1B is activated. For more details on each logic, see the user's manual. It is in an ON state when the switch is pushed up.

(2) Timer configuration switch

This switch for selecting off-delay time value. When one of 8 digits is selected, the delay time at shut-off operation is activated. The upper position of each digit is the ON state.

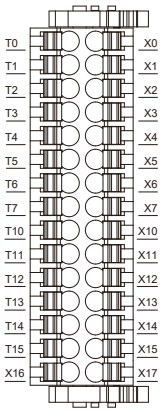
Timer value	Switch No.	Description
0s	1	No Off-delay (safety outputs shut down immediately)
.1s	2	Off-delay timer 0.1s
.5s	3	Off-delay timer 0.5s
1s	4	Off-delay timer 1s
2s	5	Off-delay timer 2s
5s	6	Off-delay timer 5s
15s	7	Off-delay timer 15s
30s	8	Off-delay timer 30s

(3) Enter button

This switch is used to enter the operation specification (logic, timer, input function) settings. When each switch is correctly configured in the configuration state, it can be set by pressing the enter button for 1 to 5 seconds. After pressing the enter button, the error LED will blink from 1 to 5 seconds maximum. When the button is released while the LED is blinking, the setting will be confirmed.

Connector specifications

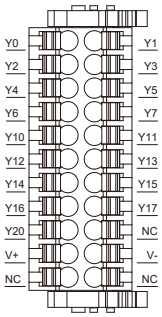
Input connector



Applicable connector: Push-in (30-pin)
- FS9Z-CN03
  (standard accessories and IDEC optional parts)
- B2CF 3.50/30/180LR SN BK BX (Weidmüller)

Terminal	Description	Terminal	Description
T0	Safety input drive terminal 0	X0	Safety input receive terminal 0
T1	Safety input drive terminal 1	X1	Safety input receive terminal 1
T2	Safety input drive terminal 2	X2	Safety input receive terminal 2
T3	Safety input drive terminal 3	X3	Safety input receive terminal 3
T4	Safety input drive terminal 4	X4	Safety input receive terminal 4
T5	Safety input drive terminal 5	X5	Safety input receive terminal 5
T6	Safety input drive terminal 6	X6	Safety input receive terminal 6
T7	Safety input drive terminal 7	X7	Safety input receive terminal 7
T10	Safety input drive terminal 10	X10	Safety input receive terminal 10
T11	Safety input drive terminal 11	X11	Safety input receive terminal 11
T12	Safety input drive terminal 12	X12	Safety input receive terminal 12
T13	Safety input drive terminal 13	X13	Safety input receive terminal 13
T14	Safety input drive terminal 14	X14	Safety input receive terminal 14
T15	Safety input drive terminal 15	X15	Safety input receive terminal 15
X16	Reset input specification 16	X17	Reset input specification 17

Output connector

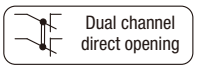
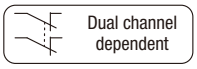
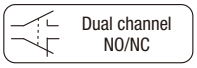
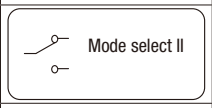
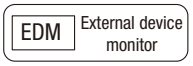


Applicable connector: Push-in (22-pin)
- FS9Z-CN04
  (standard accessories and IDEC optional parts)
- B2CF 3.50/22/180LR SN BK BX (Weidmüller)

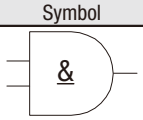
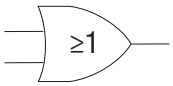
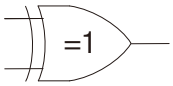
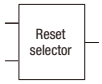
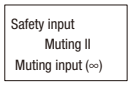
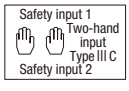
Terminal	Description	Terminal	Description
Y0	Safety output terminal 0	Y1	Safety output terminal 1
Y2	Safety output terminal 2	Y3	Safety output terminal 3
Y4	Monitor output terminal 4	Y5	Monitor output terminal 5
Y6	Monitor output terminal 6	Y7	Monitor output terminal 7
Y10	Monitor output terminal 10	Y11	Monitor output terminal 11
Y12	Monitor output terminal 12	Y13	Monitor output terminal 13
Y14	Monitor output terminal 14	Y15	Monitor output terminal 15
Y16	Monitor output terminal 16	Y17	Solenoid/lamp output terminal 17
Y20	Solenoid/lamp output terminal 20	N.C.	Blank terminal
V+	24V DC power terminal	V-	0V DC power terminal
N.C.	Blank terminal	N.C.	Blank terminal

Function name/symbol/content of logic circuit

Input functions

Function	LED color	Symbol	Description	Input functions that can be changed
Dual channel direct opening input	Red		For connecting safety components with redundant contacts, such as emergency stop switches or interlock switches. If there is a time lag between opening and closing of the contacts, an alert condition occurs. (Monitoring time 0.5 sec)	Dual channel safety input II Dual channel NO/NC input
Dual channel dependent input	Red		For connecting safety components with redundant contacts such as enabling switches. The time difference between opening and closing of contacts does not result in an alert condition.	Dual channel safety input II Dual channel NO/NC input
Dual channel safety input II	Green		For connecting safety components with redundant semiconductor outputs (PNP outputs) such as safety light curtains and safety laser scanners.	Dual channel dependent input Dual channel NO/NC input
Dual channel NO/NC input	Orange		For connecting safety components with redundant NO/NC contacts, such as non-contact safety switches or interlock switches.	Dual channel dependent input Dual channel safety input II
Mode select input II	Orange		For connecting selector switches or other mode select devices.	-
Muting Input	Green		For connecting muting sensors such as photoelectric switches.	-
Monitor input	Green		For connecting devices for control input and reset input such as sensors and switches.	-
External device monitor input	Red		For monitoring external devices that the FS1B controls, such as force guided relays and safety contactors. It connects NC contacts of external devices connected to the safety outputs to diagnose abnormalities in external devices.	-

Other functions

	Function	Symbol	Description
Logic operation faction	AND		Logical multiplication (AND) of multiple inputs.
	OR		Logical addition (OR) of multiple inputs.
	XOR II		Exclusive logical addition (XOR)of multiple inputs.
	Reset selector		Ensures that the connected input (reset input) does not go n state at the same time.
	Self-hold		Self-holding of input.
	Muting II		Adds muting function to the connected safety components.
	Control Start		Checks the operation of the connected device for reset input.
	Two-hand control		Provides two-handed operation input. Type C(ISO 13851)is supported.
Safety output	Safety output (without off-delay timer)		For controlling the safety output. Turns off the safety outputs immediately after the input is turned off.
	Safety output (with off-delay timer)		Controls the safety output. After the input is turned off, the safety output is turned off after the time set by the timer switch has elapsed.

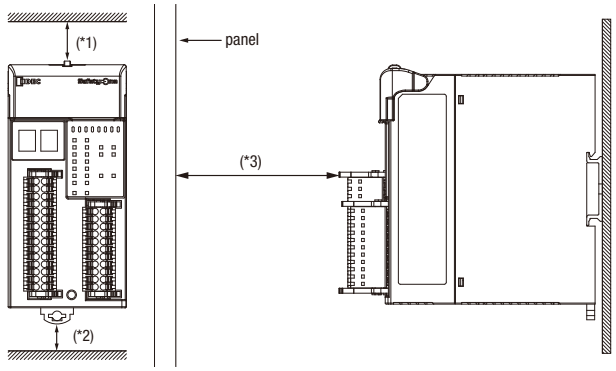
Safety Precautions

- Do not disassemble, repair, or modify the product. Otherwise, the safety performance will be impaired.
- Turn off the power before installation, removal, wiring, maintenance, or inspection. Otherwise, electrical shocks or fire hazards may occur.
- Before operating the product, read the instruction sheet and the user's manual carefully and ensure that the environment conforms to the specification requirements. If the product is operated in an environment that exceeds the specifications, its safety performance will be impaired.
- Installation, wiring, configuration, and operation of the product must be performed by safety experts only. Safety personnel are persons who have the qualifications and authorization for the design, installation, operation, maintenance, and disposal of the product. Persons without technical expertise in safety products must not use the product. Also, the unit should be installed in a locked control panel so that no one other than the safety personnel can perform wiring or change settings.
- Due to the self-diagnostic function of the product, reconnect the power of the product at appropriate intervals to maintain the safety performance. (At least once every 24 hours)
- Install the product according to the instruction sheet and the User's Manual. Improper installation may cause the product to fall or cause damage.
- Do not use the monitor output or solenoid/lamp outputs as safety outputs. Failure of the product or peripheral devices may impair the system's safety performance.
- To prevent unexpected system startup, safety measures should be taken to prevent the hazardous source from operating only with the reset input of product. (For example, install a start switch, etc.)
- Ensure that the reset switch is installed outside the hazardous area, where the operator can confirm that no one is inside when starting the operation of the safety system.
- Do not use the reset input and external device monitor input as safety inputs. Failure of the product or peripheral devices may impair the system's safety performance.
- Use the product in compliance with the laws and regulations of the country or region where the product is used.
- Use safety inputs and outputs in circuit configurations conforming to safety requirements and applications.
- Correctly wire the safety outputs to prevent the hazardous source from operating due to a short circuit with another wiring.
- Calculate the safety distance by taking into consideration the response time of the product and the safety components connected to it.
- The product cannot monitor the speed of hazardous sources or prevent (detect) machining dust from workpieces. If necessary, additional safety measures should be taken in the system to reduce risk.
- When using logic that includes a mode select input, the operating mode set by the system should be displayed so that the operator can verify the operating mode of the system. (For example, the monitor output of the product is taken into the system, information on the system operation mode is processed as a safety parameter, and the result of the setting is displayed on the display.)
- Safety performance is evaluated for the entire system. Check thoroughly before use.
- Use a power supply that meets all the following required specifications.
  - Conforms to the power supply rating of the product.
  - Complies with the SELV/PELV circuit specified by IEC60364-4-41.
  - Has the functionality or the functional equivalent of the control voltage and current of class 2 circuit, as defined in UL508.
  - Complies with laws and regulations relating to electrical safety and EMC under the regulations of the country where it is being used.
- After configuring a new setting or modifying a setting, check each input and output function.
- Separate the products from components and wires which do not satisfy Class 2 circuit requirements.

Instructions

Installation Location

- The product is designed for installation within an enclosure.
- Use the product within the specified value.
- Do not install the product in the following environment. Otherwise, electric shock, fire, or malfunction may occur.
  - Where dust, salt, iron particles, or oil fumes exist.
  - Where the product is subjected to shocks or vibrations.
  - Where corrosive or combustible gas exists.
  - Where condensation occurs.
  - Where the product is directly exposed to water.
  - Where high-voltage lines, high-voltage equipment, power lines, and power equipment exist nearby.
  - Where large switching surges are generated nearby.
  - Where strong magnetic fields or strong electric fields are generated.
- Install the product vertically as shown in the figure on the . For ventilation, provide space around the product, so that sufficient distance is kept from other components, heat source, or panel surface.



- Use the product within the operating temperature range of -10°C to +55°C.

*1) Ensure that the distance for opening/closing the protective cover is maintained. (20mm minimum)
*2) Take into consideration the distance required for installation and removal on the DIN rail, as well as enough ventilation. (Approx.20mm)
*3) Take into consideration the wiring connected to the input/output connectors. (Approx. 80mm)

Instructions

Installation Direction

Install the product vertically as shown in Figure 1.
Do not install the product upward, sideways, or downward, as shown in Figure 2.

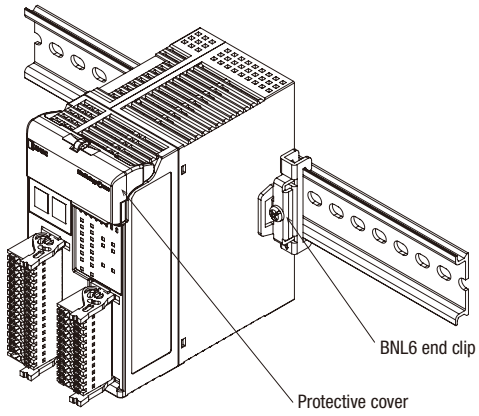


Figure 1: Correct installation direction

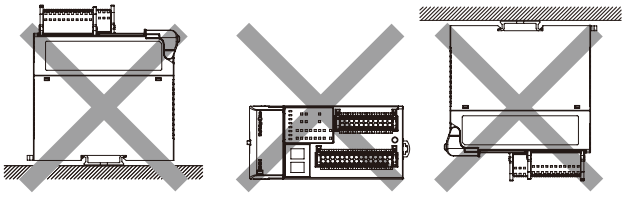


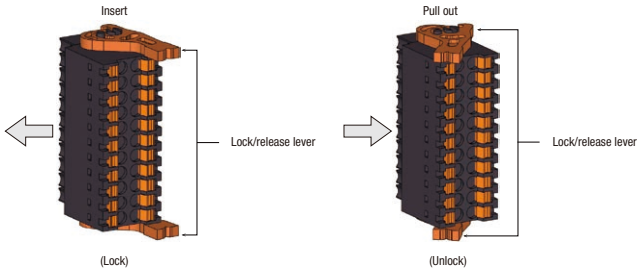
Figure 2: Incorrect mounting direction

Wiring

Connector type and wiring

Type	No. of poles	Part No.	Remarks
Push-in connector with lock and release lever	30	FS9Z-CN03	Accessories Optional parts
		B2CF 3.50/30/180LR SN BK BX	Weidmüller
	22	FS9Z-CN04	Accessories Optional parts
		B2CF 3.50/22/180LR SN BK BX	Weidmüller

Push the connector into the product until the latches click. When inserted fully to the end, click sound or feel is confirmed, and the lock/release lever locks it. To pull out, lift both ends of the lock/release lever in the unlock direction and then pull out. Do not attempt to pull out unless the lever is completely lifted, as this could cause it to jam and damage the product or connector.



Applicable wire / Recommended ferrule

Applicable wire sizes are as mentioned below. Use cables that are compliant to standards.
Single wire: 0.14mm²to 1.5mm² (AWG 26 to AWG16)
Strip length: 10 ± 0.5mm
Stranded wire: 0.14mm²to 1.0mm² (AWG 26 to AWG 17)
Use insulating ferrules when using solid wires. See below for recommended insulating ferrules. (*1)

Applicable wire		Ferrule conductor length	Wire strip length	IDEC	Weidmüller	
(AWG)	²mm			Part No.	Part No.	Ordering No.
26	0.14	8mm	10mm	S3TL-F014-12WC (*2)	H0.14/12 GR SV	9028240000
24	0.25	8mm	10mm	S3TL-H025-12WJ	H0.25/12 HBL	9025760000
22	0.34	8mm	10mm	S3TL-H034-12WT	H0.34/12 TK	9025770000
20	0.5	10mm	12mm	S3TL-H05-16WA	H0.5/16 OR	9025870000
18	0.75	10mm	12mm	S3TL-H075-16WW	H0.75/16 W	9025860000
17	1.0	10mm	12mm	S3TL-H10-16WY	H1.0/16 GE	9025950000

*1) Recommended Crimping tool: S3TL-CR06D (IDEC), PZ6/5 (Weidmüller), PZ 1.5 (Weidmüller)
*2) When using S3TL-F014-12WC (H0.14/12 GR SV), use crimping tool PZ 1.5.

Be sure to read the instruction manual carefully before performing installation, wiring, or maintenance work.

For details on mounting, wiring, and maintenance, see the instruction manual from the URL below.
Please check the user's manual.

URL: https://product.idec.com/?product=FS1B-C31S

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i. Use of IDEC products with sufficient allowance for rating and performance

ii. Safety design, including redundant design and malfunction prevention design that prevents other danger and damage even in the event that an IDEC product fails

iii. Wiring and installation that ensures the IDEC product used in your system, machine, device, or the like can perform and function according to its specifications

(4) Continuing to use an IDEC product even after the performance has deteriorated can result in abnormal heat, smoke, fires, and the like due to insulation deterioration or the like. Perform periodic maintenance for IDEC products and the systems, machines, devices, and the like in which they are used.

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i. Use in applications that require a high degree of safety, including nuclear power control equipment, transportation equipment (railroads / airplanes / ships / vehicles / vehicle instruments, etc.), equipment for use in outer space, elevating equipment, medical instruments, safety devices, or any other equipment, instruments, or the like that could endanger life or human health

ii. Use in applications that require a high degree of reliability, such as provision systems for gas / waterworks / electricity, etc., systems that operate continuously for 24 hours, and settlement systems

iii. Use in applications where the product may be handled or used deviating from the specifications or conditions / environment listed in the Catalogs, such as equipment used outdoors or applications in environments subject to chemical pollution or electromagnetic interference
If you would like to use IDEC products in the above applications, be sure to consult with an IDEC sales representative.

3. Inspections

We ask that you implement inspections for IDEC products you purchase without delay, as well as thoroughly keep in mind management/maintenance regarding handling of the product before and during the inspection.

4. Warranty

(1) Warranty period

The warranty period for IDEC products shall be one (1) year after purchase or delivery to the specified location. However, this shall not apply in cases where there is a different specification in the Catalogs or there is another agreement in place between you and IDEC.

(2) Warranty scope

Should a failure occur in an IDEC product during the above warranty period for reasons attributable to IDEC, then IDEC shall replace or repair that product, free of charge, at the purchase location / delivery location of the product, or an IDEC service base. However, failures caused by the following reasons shall be deemed outside the scope of this warranty.

i. The product was handled or used deviating from the conditions / environment listed in the Catalogs

ii. The failure was caused by reasons other than an IDEC product

iii. Modification or repair was performed by a party other than IDEC

iv. The failure was caused by a software program of a party other than IDEC

v. The product was used outside of its original purpose

vi. Replacement of maintenance parts, installation of accessories, or the like was not performed properly in accordance with the user's manual and Catalogs

vii. The failure could not have been predicted with the scientific and technical standards at the time when the product was shipped from IDEC

viii. The failure was due to other causes not attributable to IDEC (including cases of force majeure such as natural disasters and other disasters)

Furthermore, the warranty described here refers to a warranty on the IDEC product as a unit, and damages induced by the failure of an IDEC product are excluded from this warranty.

5. Limitation of liability

The warranty listed in this Agreement is the full and complete warranty for IDEC products, and IDEC shall bear no liability whatsoever regarding special damages, indirect damages, incidental damages, or passive damages that occurred due to an IDEC product.

6. Service scope

The prices of IDEC products do not include the cost of services, such as dispatching technicians. Therefore, separate fees are required in the following cases.

(1) Instructions for installation / adjustment and accompaniment at test operation (including creating application software and testing operation, etc.)

(2) Maintenance inspections, adjustments, and repairs

(3) Technical instructions and technical training

(4) Product tests or inspections specified by you

The above content assumes transactions and usage within your region. Please consult with an IDEC sales representative regarding transactions and usage outside of your region. Also, IDEC provides no guarantees whatsoever regarding IDEC products sold outside your region.

IDEC CORPORATION

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www.idec.com

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