

# Safety Controllers

# F3SX

CSM\_F3SX\_DS\_E\_3\_1

## All-in-one safety controller to configure multiple input safety circuits



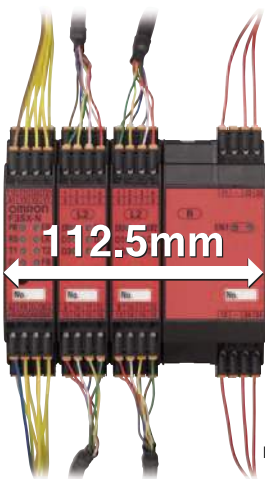
- Semiconductor Output and Relay Connection Output types available.
- Malfunctions can be diagnosed using a detailed LED display.
- Applicable to single beam sensors E3FS/E3ZS.
- IEC/EN 61508 (SIL3) and EN954-1 (Cat.4) certified.



Be sure to read the "Safety Precautions" on page 16

## Features

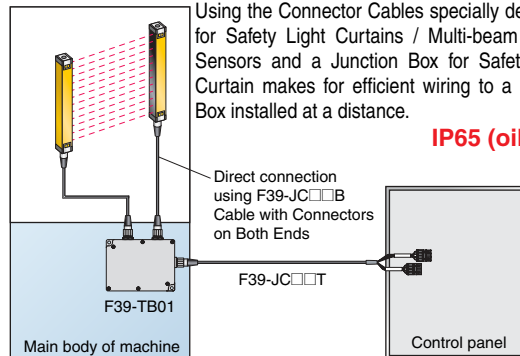
### Simple Connection all in one unit.



- No unnecessary wiring between Units allows considerable cuts in the cost of evaluating design safety.
- Reduced wiring, post terminals, and connector connections enable substantial reductions in the cost of maintenance labor.
- Width has been reduced by approximately 50% from 225 mm to 112.5 mm max. (compared to previous OMRON products; connecting F3SN (4 sets), F3SP-B1P, and G9SB-301).
- Post terminals aid in preventing unintentional neglect to tighten terminal screws.
- Convenient F39-TB01 Junction Box for Safety Light Curtain.



Note: The wire colors are for reference purposes only. Refer to individual international standards for details.



IP65 (oil-resistant)

F39-TB01 Junction Box for Safety Light Curtain



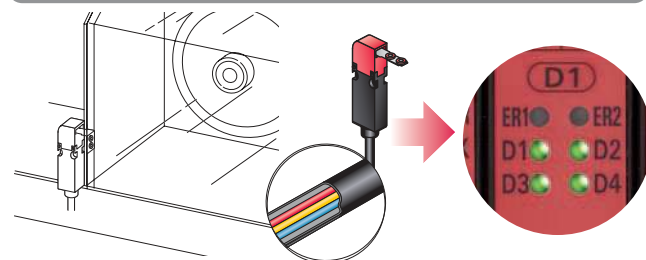
F39-JC□□T Connector Cable for Safety Light Curtains

### Indicator Displays Are Easy to Understand and More Convenient

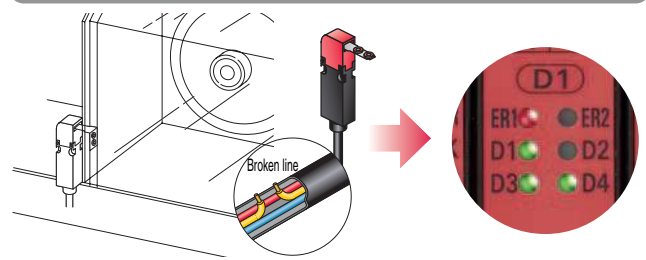
**F3SX** Shorter Downtimes!

The F3SX uses indicators to show the status of each I/O, contributing to less time (downtime) spent investigating the cause.

#### Normal Operation



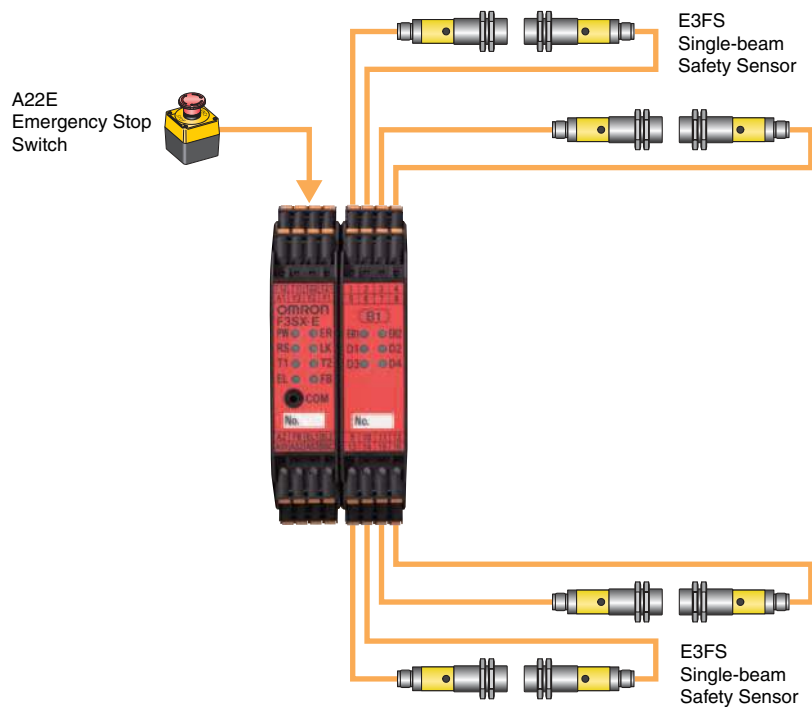
#### Error



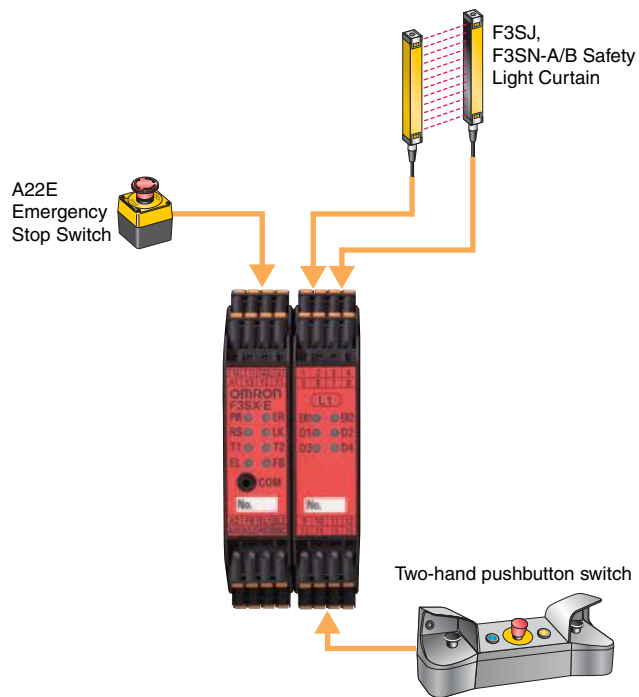
Note: Refer to pages 10 and 11 for details on indicator patterns.

Main models

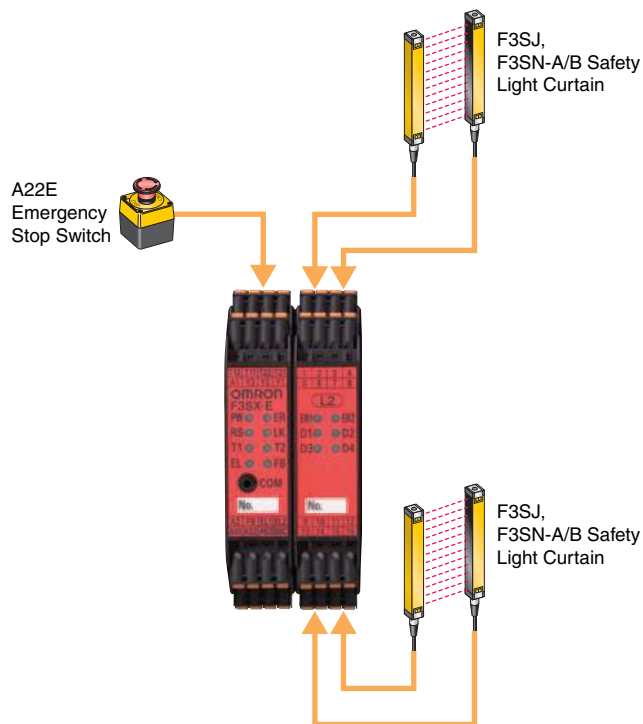
F3SX-EB1



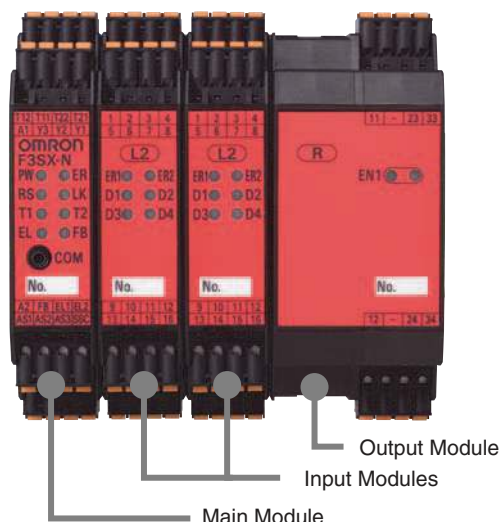
F3SX-EL1



F3SX-EL2



## Product Configuration



The Controller has a modular configuration comprised of a combination of Main Modules, Input Modules, and Output Modules, as shown in the diagram left.

For information on non-standard I/O combinations, contact your OMRON sales representative.

## Model Number Structure

### Model Number Legend

F3SX-□-□●●□□  
 1      2      3

#### 1. Main Modules

E: DC solid-state safety outputs model

N: External indicator outputs model

#### 2. Input Modules

L1: Safety Light Curtain 1 input + Two-hand Control Switch 1 Input

L2: Safety Light Curtain 2 input

D1: Door Switch 2 input

B1: Single-beam Safety Sensor 4 input

#### 3. Output Modules

None: No output module

R: Relay Output Module (DPST-NO, SPST-NC) Non-delay (instant breaking) outputs

R2: Relay Output Module (DPST-NO, SPST-NC) OFF-delay outputs

## Ordering Information

### Main Modules

#### Non-delay (Instant Breaking) Models

Output type	Non-delay (instant breaking) outputs		Model
	Solid-state outputs	Contact outputs	
Indicator output + contact output	None	Main contact (DPST-NO) Auxiliary contact (SPST-NC)	F3SX-N-□□□R
Solid-state output	2 safety outputs 1 auxiliary output	None	F3SX-E-□□□□

**Note:** Models with multiple contact outputs are also available (RR/RRR).

#### OFF-delay Time Setting Models

Output type	Non-delay (instant breaking) outputs		OFF-delay outputs	Model
	Solid-state outputs	Contact outputs	Contact outputs	
Indicator output + contact output	None	Main contact (DPST-NO) Auxiliary contact (SPST-NC)	Main contact (DPST-NO) Auxiliary contact (SPST-NC)	F3SX-N-□□RR2
Solid-state output + contact output	2 safety outputs 1 auxiliary output	None	Main contact (DPST-NO) Auxiliary contact (SPST-NC)	F3SX-E-□□□R2

**Note:** The OFF-delay time for R2 models is factory-set to 0.0 s (non-delay (instant breaking)).

## List of Models

### Non-delay (Instant Breaking) Models

F3SX-NR, F3SX-N-□□□R (with External Indicator Output)

Input type					Model	Width *	Weight (Main Module only)
Emergency Stop	F3SN/F3SH/F3SJ Safety Light Curtain/ Multi-beam Safety Sensor	Single-beam Safety Sensor E3ZS/E3FS	Two-hand Control Switch	Door Switch			
1 set	---	---	---	2 sets	F3SX-N-D1R	90.0 mm	Approx. 0.5 kg
1 set	---	---	---	4 sets	F3SX-N-D1D1R	112.5 mm	Approx. 0.6 kg
1 set	---	---	---	6 sets	F3SX-N-D1D1D1R	135.0 mm	Approx. 0.7 kg
1 set	2 sets	---	---	---	F3SX-N-L2R	90.0 mm	Approx. 0.5 kg
1 set	4 sets	---	---	---	F3SX-N-L2L2R	112.5 mm	Approx. 0.6 kg
1 set	1 set	---	1 set	---	F3SX-N-L1R	90.0 mm	Approx. 0.5 kg
1 set	---	4 sets	---	---	F3SX-N-B1R	90.0 mm	Approx. 0.5 kg

\* For details on the width, refer to "Dimensions" on page 14.

### F3SX-E□/F3SX-E-□□□□ (with DC Solid-state Safety Output)

Input type					Model	Width *	Weight (Main Module only)
Emergency Stop	F3SN/F3SH/F3SJ Safety Light Curtain/ Multi-beam Safety Sensor	Single-beam Safety Sensor E3ZS/E3FS	Two-hand Control Switch	Door Switch			
1 set	---	---	---	2 sets	F3SX-ED1	45.0 mm	Approx. 0.3 kg
1 set	---	---	---	4 sets	F3SX-E-D1D1	67.5 mm	Approx. 0.4 kg
1 set	---	---	---	6 sets	F3SX-E-D1D1D1	90.0 mm	Approx. 0.5 kg
1 set	2 sets	---	---	---	F3SX-EL2	45.0 mm	Approx. 0.3 kg
1 set	4 sets	---	---	---	F3SX-E-L2L2	67.5 mm	Approx. 0.4 kg
1 set	1 set	---	1 set	---	F3SX-EL1	45.0 mm	Approx. 0.3 kg
1 set	---	4 sets	---	---	F3SX-EB1	45.0 mm	Approx. 0.3 kg

\* For details on the width, refer to "Dimensions" on page 14.

### OFF-delay Time Setting Models (Using Function Setup Software for the F3SX)

F3SX-N-□□RR2

Input type				Model	Width *	Weight (Main Module only)
Emergency Stop	F3SN/F3SH/F3SJ Safety Light Curtain/ Multi-beam Safety Sensor	Two-hand Control Switch	Door Switch			
1 set	---	---	2 sets	F3SX-N-D1RR2	135.0 mm	Approx. 0.6 kg
1 set	---	---	4 sets	F3SX-N-D1D1RR2	157.5 mm	Approx. 0.7 kg
1 set	2 sets	---	---	F3SX-N-L2RR2	135.0 mm	Approx. 0.6 kg
1 set	4 sets	---	---	F3SX-N-L2L2RR2	157.5 mm	Approx. 0.7 kg
1 set	1 set	1 set	---	F3SX-N-L1RR2	135.0 mm	Approx. 0.6 kg

**Note: 1.** The factory setting for the OFF-delay time is 0 s (non-delay (instant breaking)).

**2.** By using the Function Setup Software for the F3SX (F3SX-CD100-E, sold separately), the time can be set in 0.1-second units.

\* For details on the width, refer to "Dimensions" on page 14.

F3SX-ER2/F3SX-E-□□□R2


Input type				Model	Width *	Weight (Main Module only)
Emergency Stop	F3SN/F3SH/F3SJ Safety Light Curtain/ Multi-beam Safety Sensor	Two-hand Control Switch	Door Switch			
1 set	---	---	2 sets	F3SX-E-D1R2	90.0 mm	Approx. 0.5 kg
1 set	---	---	4 sets	F3SX-E-D1D1R2	112.5 mm	Approx. 0.6 kg
1 set	2 sets	---	---	F3SX-E-L2R2	90.0 mm	Approx. 0.5 kg
1 set	4 sets	---	---	F3SX-E-L2L2R2	112.5 mm	Approx. 0.6 kg
1 set	1 set	1 set	---	F3SX-E-L1R2	90.0 mm	Approx. 0.5 kg

**Note: 1.** The factory setting for the OFF-delay time is 0 s (non-delay (instant breaking)).

**2.** By using the Function Setup Software for the F3SX (F3SX-CD100-E, sold separately), the time can be set in 0.1-second units.

\* For details on the width, refer to "Dimensions" on page 14.

## Function Setup Software for the F3SX (English Version)


Appearance	Supported OS	Model
	Windows 98SE or higher *, Windows 2000 SP4 or higher, or Windows XP SP1 or higher	F3SX-CD100-E

**Note:** The F3SX-CD100-E Function Setup Software is not included and must be purchased separately. Contact your OMRON representative for details.


\* IE4.0 or higher must be installed.

## Accessories (Sold Separately)


### Junction Box for Safety Light Curtain

Appearance	Connecting devices	Model
	F3SN-A/-B, F3SJ ↕ F3SX Series	F39-TB01


### Junction Connector for F3SX

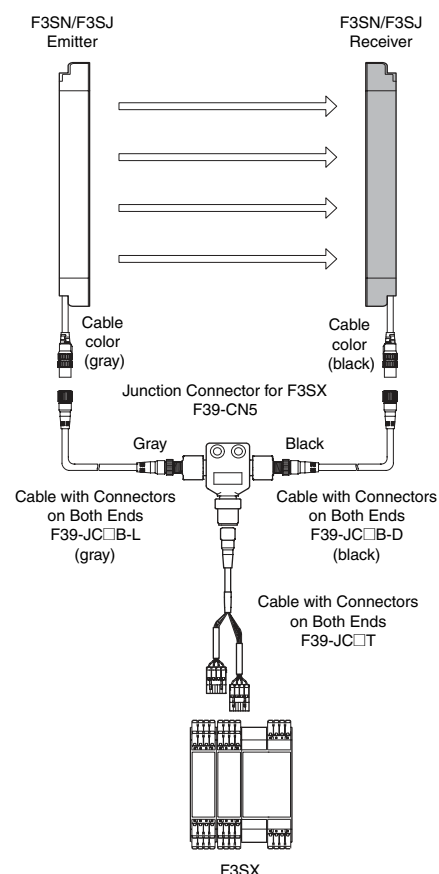
Appearance	Connecting devices	Model
	F3SN-A/-B, F3SJ ↕ F3SX Series	F39-CN5

### Cable with Connectors on Both Ends

Appearance	Connecting devices	Model	Cable length
	F39-TB01, F39-CN5 ↕ F3SX Series	F39-JC1T	1 m
		F39-JC3T	3 m
		F39-JC5T	5 m
		F39-JC10T	10 m

### RS-232C Cable (9-pin D-Sub Connector)

Appearance	Connecting devices	Model	Cable length
	RS-232C cable for connecting F3SX to personal computer	F39-JC2X1	2 m
	RS-232C cable for connecting F3SX to OMRON PLC	F39-JC2X2	



## Specifications

### General Specifications

#### Common Specifications

Item	Ratings and Specifications
Safety category (EN954-1)	Category 4
Safety standards (IEC61508)	SIL3
Rated supply voltage	24 VDC $\pm$ 10% (ripple p-p 10% max.)
Startup time	5 s max.
Control circuit protection	Output short-circuit protection, power supply reverse polarity protection *
Overvoltage category (IEC60664-1)	II
Insulation resistance	100 M $\Omega$ (500 VDC) between all lead wires and outer case
Dielectric strength	2,200 VAC, 50/60 Hz for 1 min between all lead wires and outer case
Ambient temperature	Operating: $-10$ to $50^{\circ}\text{C}$ (with no icing or condensation) Storage: $-30$ to $70^{\circ}\text{C}$ (with no icing or condensation)
Ambient humidity	Operating and storage: 35% to 85% (with no icing or condensation)
Vibration resistance	10 to 55 Hz, double amplitude: 0.7 mm, X, Y and Z directions, 20 sweeps (power ON)
Shock resistance	100 m/s <sup>2</sup> , X, Y and Z directions, 1,000 times (power ON)
Case material	Glass fiber-reinforced polyamide 66 (PA-66-FR)
Degree of protection	Terminal block: IP20 Main body: IP40 (IEC60529)

\* If the protective function operates, turn ON the power again to recover.

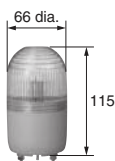
#### Main Modules with External Indicator Output (N Modules)

I/O		Ratings and Specifications
Input	Emergency stop input	ON: 15 to 24 VDC $\pm$ 10% OFF: Open or 0 to 5 VDC max. Internal impedance: Approx. 5 k $\Omega$
	Reset input	
	Feedback input	
	Auxiliary input	
DC solid-state output	External indicator output *1 *2	Connectable indicators: Filament types (incandescent lamp) 24 VDC, 3 to 7 W
	Auxiliary solid-state output	PNP transistor output Load current: 25 mA max. Residual voltage: 2 V max. *3

\*1. When external indicators are not connected, connect resistance (1/4 W, 4.7 k $\Omega$ ) between the EL1 terminal and EL2 terminal. The lead wire resistance (without polarity) shown in the following diagram is included with the product.



\*2. OMRON recommends the following indicators (Power consumption: 5 W).



ASSC-24  
(by ARROW ELECTRONICS  
IND. CO., LTD.)

\*3. Except for voltage drop due to cable extension.

## Main Modules with DC Solid-state Safety Output (E Modules)

Item		Ratings and Specifications
Input	Emergency stop input	ON: DC15 to 24 V $\pm$ 10% OFF: Open or 0 to 5 VDC max. Internal impedance: Approx. 5 k $\Omega$
	Reset input	
	Feedback input	
	Auxiliary input	
DC solid-state output	DC solid-state safety output	PNP transistor output Load current: 300 mA max. (resistance load/inductive load) *1 Residual voltage (when ON): 2 V max. *2 Residual voltage (when OFF): 0.1 V max. Leakage current (when OFF): 0.1 mA max. Allowable capacitive load: 1 $\mu$ F max. Allowable wire resistance between output terminals and load: 4 $\Omega$ max.
	Auxiliary solid-state output	PNP transistor output Load current: 25 mA max; Residual voltage: 2 V max. *2

**Note: 1.** With an inductive load, connect a diode or other surge absorber parallel to the load.  
**2.** Except for voltage drop due to cable extension.

## Relay Output Modules

**R Modules: Delay time cannot be set.**

**R2 Modules: OFF-delay can be set.**

Item			Ratings and Specifications	
Relay contact outputs	Number of main contacts (safety outputs)		DPST-NO	
	Number of auxiliary contacts (auxiliary outputs)		SPST-NC	
	Rated load	Resistive load	Terminals 11/12 (Auxiliary contact: Auxiliary output)	250 VAC, 50/60Hz, 30 VDC at 5A
			Terminals 23/24 Terminals 33/34 (Main contacts: Safety outputs)	250 VAC, 50/60Hz, 30 VDC at 3.15 A (5 A) *1
	Inductive load	AC15: 240 VAC at 2 A $\cos\phi = 0.3$ DC13: 24 VDC at 1 A L/R = 48 ms		
		Minimum permissible load *2		24 VDC at 5 mA (reference value) *3
	Electrical durability *2		100,000 operations min. (switching frequency: 1,800 times/hr)	
Mechanical durability *2		10,000,000 operations min. (switching frequency: 36,000 times/hr)		

\*1. An external fuse must be connected to the safety relay output. The safety category depends on the fuse rating:

1) Safety Category 4 (EN954-1)

A fuse rated at 3.15 A max. must be connected externally to protect the safety relay output from contact welding. The current that can be applied to the relay contacts is limited by the fuse rating to 3.15 A max. (resistive load).

2) Safety Category 3 (EN954-1) or lower

A fuse rated at 5 A max. must be connected externally to protect the safety relay output from contact welding. The current that can be applied to the relay contacts is limited by the fuse rating to 5 A max. (resistive load). For details, refer to section 10.4.3.4 of prEN50156-1.

\*2. This rating is for Modules with built-in relays. The durability conditions are an ambient temperature of 15 to 35°C and an ambient humidity of 25% to 75%.

\*3. This value is a reference value. The Modules are not designed to be used below this value. If a large load is applied even once, switching may not be possible for microloads.

## Rated Current

The rated current depends on the type and number of Modules used, as shown below.

Module type	Rated current
Main Module (E, N)	150 mA
Input Module (L1, L2, B1, D1)	150 mA
Relay Output Module (R, R2)	100 mA

**Example:**

F3SX-N-L2L2R: 150 (N Module) + 150 (L2 Module) + 150 (L2 Module) + 100 (R Module) = 550 mA

## Response Time

### Non-delay (Instant Breaking) Models

Model (N Modules)	Relay outputs		Auxiliary output (AS1)	
	ON → OFF	OFF → ON	ON → OFF	OFF → ON
F3SX-NR(-S)	35 ms	135 ms	25 ms	105 ms
F3SX-N□R(-S)	35 ms	135 ms	25 ms	105 ms
F3SX-N□□R(-S)	40 ms	156 ms	30 ms	126 ms
F3SX-N□□□R(-S)	45 ms	177 ms	35 ms	147 ms

### OFF-delay Time Setting Models

Model (N Modules)	Relay outputs		Auxiliary output (AS1)	
	ON → OFF *	OFF → ON	ON → OFF	OFF → ON
F3SX-NRR2 *	35 ms	135 ms	25 ms	105 ms
F3SX-N□RR2 *	40 ms	156 ms	30 ms	126 ms
F3SX-N□□RR2 *	45 ms	177 ms	35 ms	147 ms

**Note:** The actual OFF-delay time (time from when input turns OFF until output turns OFF) is calculated by adding the applicable times shown in the above table to the user-set time.

Example: If the OFF-delay for an F3SX-N-RR2 is set to 0.5 s (500 ms), the actual OFF-delay is  $500 + 35 = 535$  ms.

\* R2 Modules (terminals 23/24, 33/34) support an OFF-delay time setting using the Function Setup Software for the F3SX (F3SX-CD100-E). The OFF-delay time is factory-set to 0 s (non-delay (instant breaking)).

### Non-delay (Instant Breaking) Models

Model (E Modules)	Relay outputs		DC solid-state safety output, auxiliary output	
	ON → OFF	OFF → ON	ON → OFF	OFF → ON
F3SX-E(-S)	---	---	25 ms	105 ms
F3SX-E□(-S)	35 ms	135 ms	25 ms	105 ms
F3SX-E□□(-S)	35 ms	135 ms	25 ms	105 ms
F3SX-E□□□(-S)	40 ms	156 ms	30 ms	126 ms
F3SX-E□□□□(-S)	45 ms	177 ms	35 ms	147 ms

### OFF-delay Time Setting Models

Model (E Modules)	Relay outputs		DC solid-state safety output, auxiliary output	
	ON → OFF *	OFF → ON	ON → OFF	OFF → ON
F3SX-ER2 *	35 ms	135 ms	25 ms	105 ms
F3SX-E□R2 *	35 ms	135 ms	25 ms	105 ms
F3SX-E□□R2 *	40 ms	156 ms	30 ms	126 ms
F3SX-E□□□R2 *	45 ms	177 ms	35 ms	147 ms

**Note:** The actual OFF-delay time (time from when input turns OFF until output turns OFF) is calculated by adding the applicable times shown in the above table to the user-set time.

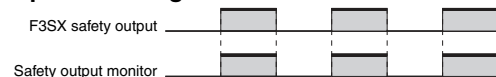
Example: If the OFF-delay for an F3SX-E-D1D1D1R2 is set to 1 s (1,000 ms), the actual OFF-delay is  $1,000 + 45 = 1,045$  ms.

\* R2 Modules (terminals 23/24, 33/34) support an OFF-delay time setting using the Function Setup Software for the F3SX (F3SX-CD100-E). The OFF-delay time is factory-set to 0 s (non-delay (instant breaking)).

## Safety Output Monitor (AS1 Terminal: N/E Modules)

The safety output monitor outputs synchronously with the safety outputs (non-delay (instant breaking)).

### Operation Diagram



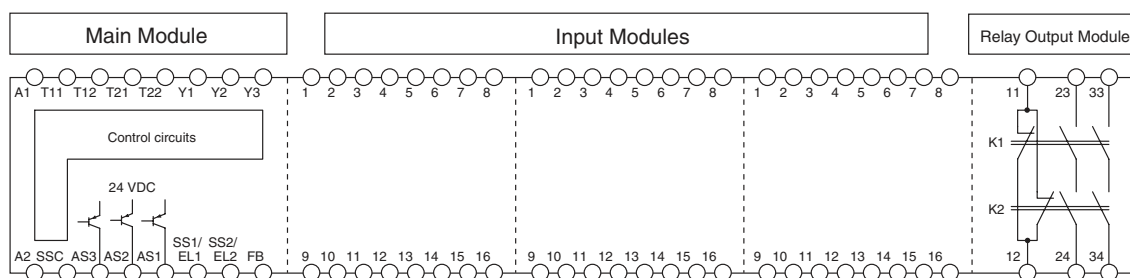
### WARNING

AS1, AS2, and AS3 are not safety outputs and cannot be used to configure a safety system. Doing so may result in serious injury if the F3SX or peripheral devices malfunction.



# Connections

## Terminal Arrangement



## Main Modules

Item	Terminal No.	Function	
		F3SX-N	F3SX-E
Power supply inputs	A1	24-VDC input	
	A2	GND (0 V) input	
Emergency stop inputs *1	T11	Emergency Stop Switch inputs	
	T12		
	T21		
	T22		
Reset inputs	Y1	Reset inputs: Auto/manual reset selection, system reset	
	Y2		
	Y3		
Feedback input	FB	Feedback time monitor (500 ms max.)	
Auxiliary solid-state outputs *2	AS1	Safety output monitor (standard setting: Outputs synchronously with the safety output)	
	AS2	Information trigger (Standard setting: Outputs error information, information on excessive output switching, and information on excessive ON time)	Ready output (Standard setting: Outputs when safety inputs are all ON.)
	AS3	Standby output (Standard setting: Outputs after power is turned ON, the F3SX has been initialization, and I/O can be normally controlled.)	
Auxiliary input *3	SSC	Start command input (soft-start circuit)	
External indicator outputs *4	EL1	Indicator input with diagnostic functions (+: sourcing)	---
	EL2	Indicator input with diagnostic functions (-: sinking)	---
DC solid-state safety outputs	SS1	---	DC solid-state safety output 1
	SS2	---	DC solid-state safety output 2
RS-232C port	COM	RS-232C port for connecting communications cable	

\*1. If the emergency stop switch is not necessary, directly connect terminal T11 to T12, and terminal T21 to T22.

\*2. The Function Setup Software for the F3SX (F3SX-CD100-E, sold separately) can be used to change function settings for the auxiliary solid-state output terminals (AS1, AS2, and AS3), and the external indicator output. For details refer to the *Help* menu in the F3SX-CD100-E.

\*3. When the start command input (SSC) is not necessary, directly connect the SSC terminal to the 24 VDC input terminal (A1 terminal).

\*4. When an external indicator is not necessary, connect resistance (1/4 W, 4.7 kΩ) between the terminals EL1 and EL2.

## Indicator Display, Lighting Patterns, and Meanings

ER indicator	Meaning	Cause	Remedy
● Lit	Emergency stop switch input sync error	Emergency stop switch contact is faulty or emergency stop switch wiring is incorrect.	Check the wiring to the emergency stop switch.
☀ 1-time flashing	Short-circuit/wiring error between emergency stop switch inputs	The wiring to the emergency stop switch has short-circuited.	Check the emergency stop switch and wiring.
☀ 2-time flashing	Emergency stop switch input terminal circuit error	The emergency stop switch input terminal is faulty.	Replace the F3SX.
		Excessive noise is affecting the F3SX.	Check the noise conditions around the F3SX.
☀ 3-time flashing	Reset input terminal error	The wiring to the reset input terminal is incorrect.	Check the wiring to the reset input terminal.
		The wiring to the reset input terminal is broken or short-circuited.	Check the wiring to the reset input terminal.
		The reset input terminal circuit is faulty.	Replace the F3SX.
☀ 4-time flashing	External indicator output terminal error (F3SX-N)	The external indicator output circuit is faulty.	Replace the external indicator.
		The wiring to the external indicator output circuit is incorrect	Check the wiring to the external indicator.
		An error has occurred in the external indicator output circuit.	Replace the F3SX.
	DC solid-state safety output terminal error (F3SX-E)	The load (external device) is faulty.	Replace the load (external device).
		The wiring to the load (external device) is incorrect.	Check the wiring to the load (external device).
		An error has occurred in the DC solid-state safety output circuit.	Replace the F3SX.
☀ 5-time flashing	Relay output terminal error *	The relay output is faulty.	Replace the F3SX.
		Excessive noise is affecting the F3SX.	Check the noise conditions around the F3SX.
☀ 6-time flashing	Feedback input terminal error	The wiring to the contactor or other external device is incorrect.	Check the wiring to the contactor or other external devices.
		The contactor or other external device is faulty.	Replace the contactor or other external device.
☀ Continuously flashing	Noise or F3SX malfunction	Excessive noise is affecting the F3SX.	Check the noise conditions around the F3SX.
		The F3SX's internal circuits are faulty.	Replace the F3SX.

\* This error does not occur in F3SX Safety Controllers configured without a Relay Output Module.

## Input Modules

### L1

Terminal No.	Connection	
1	Not used.	
2	2hand-SW S32 NC contact	
3	Not used.	
4	2hand-SW S31 NC contact	
5	2hand-SW S32 NO contact	
6	2hand-SW S32 COMMON	
7	2hand-SW S31 NO contact	
8	2hand-SW S31 COMMON	
9	Test input	
10	Control output 2	
11	Reset input	
12	Control output 1	
13	RS-485 (B)	
14	RS-485 (A)	
15	0 V	
16	+24 V	

**Note:** For details on the signals and wiring of Two-hand Control Switches, refer to “F3SX-N-L1R (Auto reset) Circuit Example” on page 13.

### D1

Terminal No.	Connection	
1	Not used.	
2		
3		
4		
5	Contact such as Safety Limit Switch or Safety Door Switch	First set
6		
7	Contact such as Safety Limit Switch or Safety Door Switch	Second set
8		
9	Contact such as Safety Limit Switch or Safety Door Switch	Second set
10		
11	Contact such as Safety Limit Switch or Safety Door Switch	Second set
12		
13	Not used.	
14		
15		
16		

### L2

Terminal No.	Connection	
1	+24 V	
2	0 V	
3	RS-485 (A)	
4	RS-485 (B)	
5	Control output 1	
6	Reset input	
7	Control output 2	
8	Test input	
9	Test input	
10	Control output 2	
11	Reset input	
12	Control output 1	
13	RS-485 (B)	
14	RS-485 (A)	
15	0 V	
16	+24 V	

### B1

Terminal No.	Connection	
1	+24 V	
2	0 V	
3	Control output	
4	Test input	
5	+24 V	
6	0 V	
7	Control output	
8	Test input	
9	Test input	
10	Control output	
11	0 V	
12	+24 V	
13	Test input	
14	Control output	
15	0 V	
16	+24 V	

## Relay Output Modules

Terminal No.	Function
11/12	Auxiliary relay output (N.C.)
23/24	Safety relay output (N.O.)
33/34	Safety relay output (N.O.)

## Indicator Display, Lighting Patterns, and Meaning for L1/L2/D1 Modules

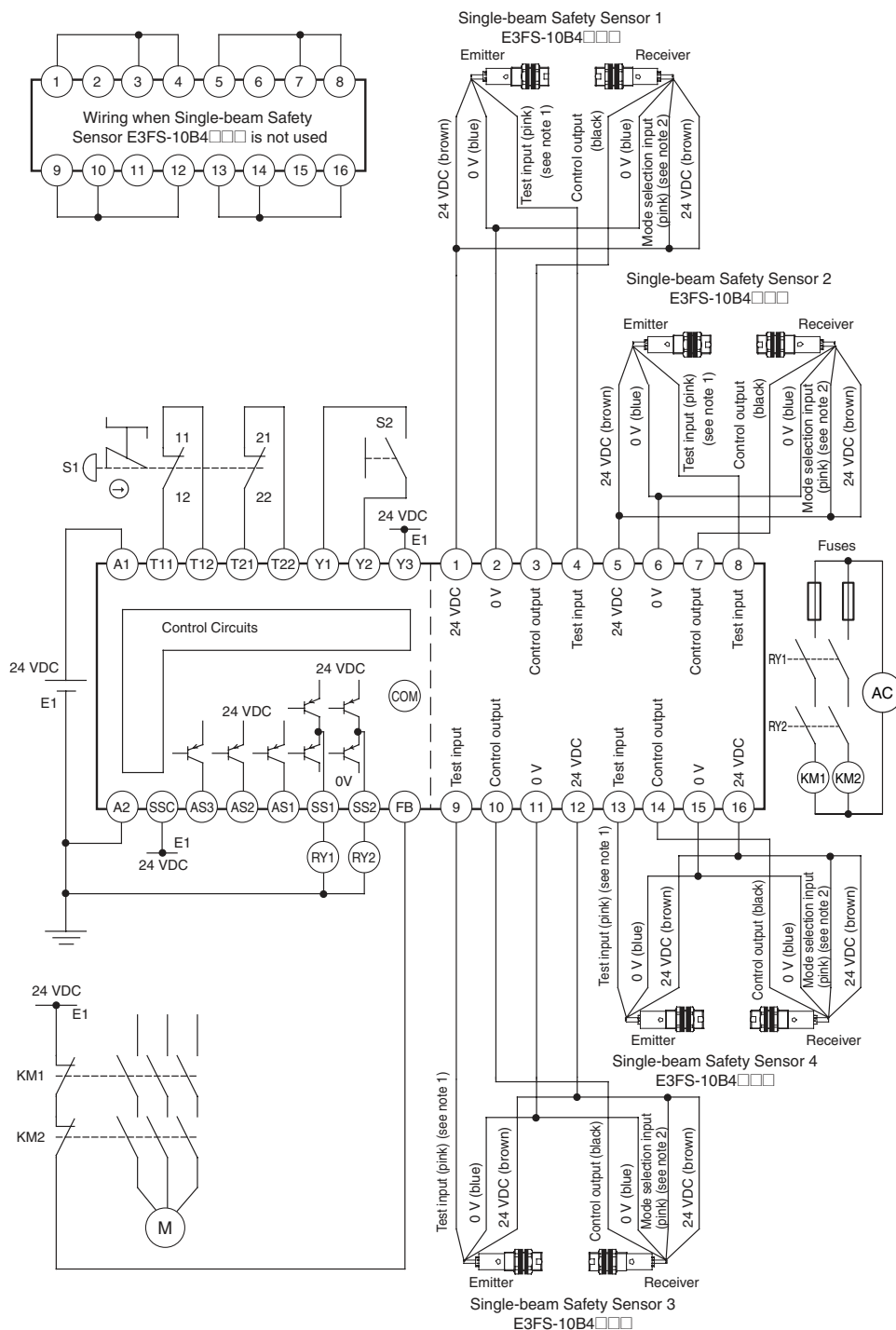
The ER1 indicator display indicates errors in Modules in the first set, and the ER2 indicator display indicates errors in Modules in the second set.

ER1/ER2 indicator	Meaning	Cause	Remedy
● Lit	Input sync error in input device	The input device contacts are faulty or the input device wiring is incorrect.	Check the input device and wiring.
☀ 1-time flashing	Short-circuit or wiring error between inputs of input device.	The input device wiring is short-circuited.	Check the wiring to the input device.
☀ 2-time flashing	Error in input terminal circuit of input device.	Excessive noise is affecting the F3SX.	Check the noise environment around the F3SX.
		The input device input circuits are faulty.	Replace the F3SX.

**Note:** Refer to the *F3SX User's Manual* for LED lighting patterns on B1 Models.

# Application Examples

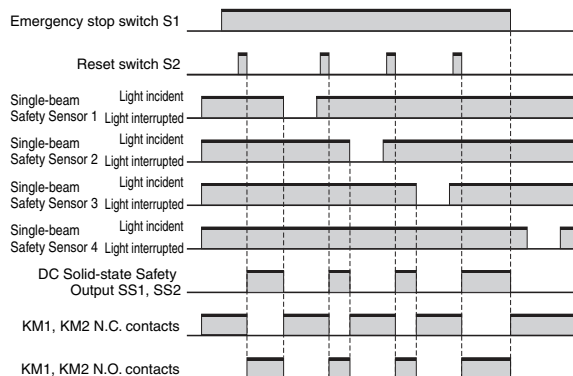
## F3SX-EB1 (Manual reset) Circuit Example



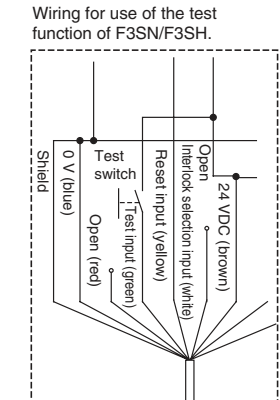
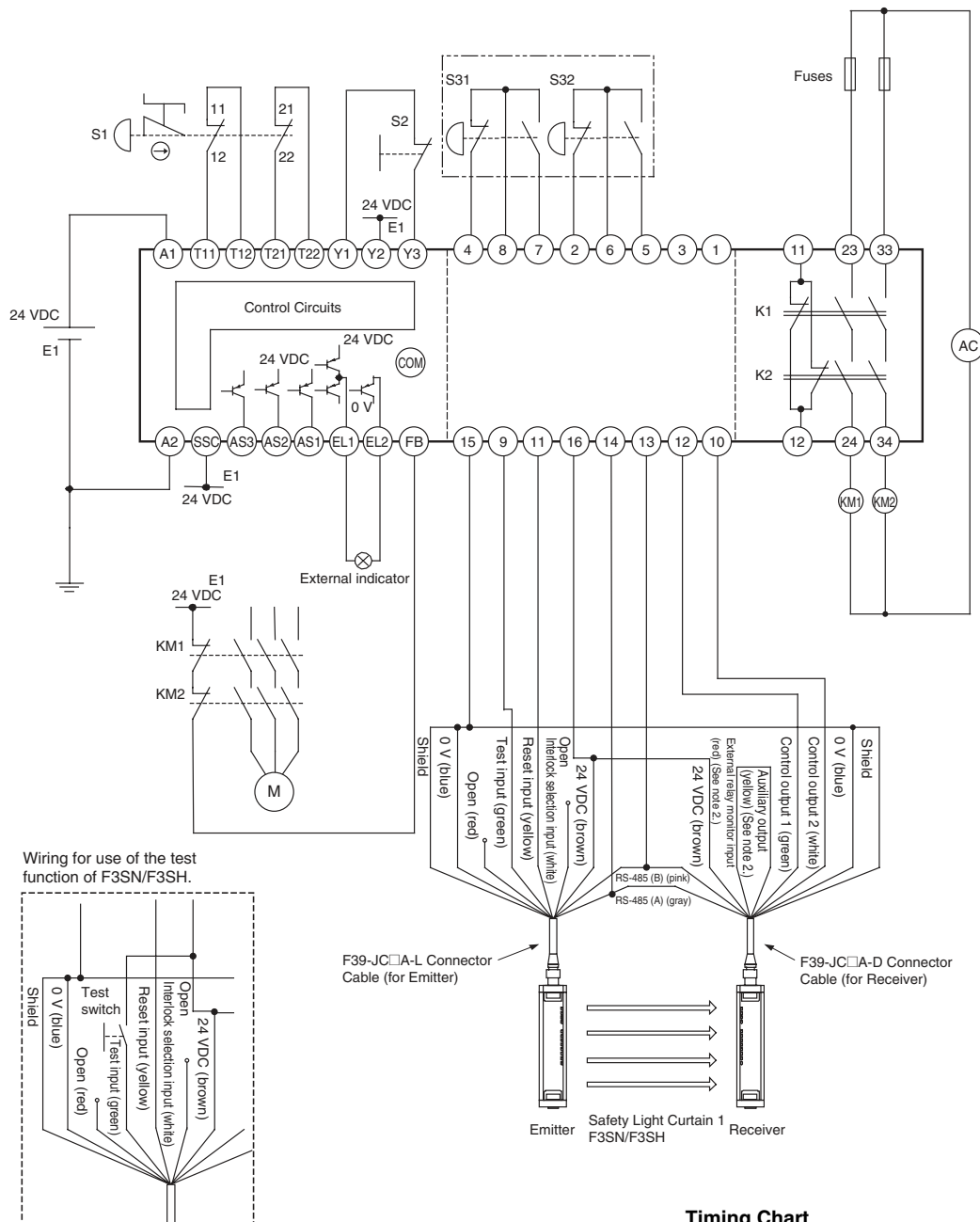
- S1: Emergency stop switch with positive opening mechanism A165E or A22E(⊖)
- S2: Reset switch
- KM1, KM2: Magnetic contactor
- RY1, RY2: Relay
- M: Three-phase motor
- E1: 24-VDC power supply (S82K)

- Note:**
1. The black wire is used when the Cable with Connector (Socket) on One End (XS2F-D42□-□80-□) is connected to an E3FS-10B4-M1-M Connector.
  2. The white wire is used when the Cable with Connector (Socket) on One End (XS2F-D42□-□80-□) is connected to an E3FS-10B4-M1-M Connector.
  3. The above circuit diagram example conforms to Category 2.
  4. The EN60204-1 stop function category is 0 (zero) for the example in the above circuit diagram.

### Timing Chart



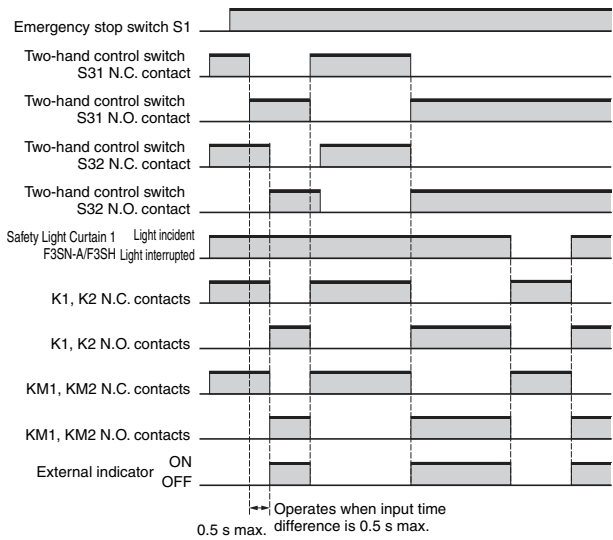
F3SX-N-L1R (Auto reset) Circuit Example



- S1: Emergency stop switch with positive opening mechanism A165E or A22E) ⊕
- S2: Reset switch
- S31, S32: Two-hand control switch
- KM1, KM2: Magnetic contactor
- M: Three-phase motor
- E1: 24-VDC power supply (S82K)
- External indicator: Filament-type indicator  
(When an external indicator is not necessary, connect resistance of 1/4 W, 4.7 kΩ.)

- Note:**
1. The above circuit diagram example conforms to Category 4. (Applicable safety category 2 when connecting an F3SN-B.)
  2. In this connection example, the auxiliary output is set to the standard setting (Dark-ON operation). To operate using non-standard settings, refer to each catalog for the F3SN-A/F3SH or Instruction Manual.
  3. The EN60204-1 stop function category is 0 (zero) for the example in the above circuit diagram.

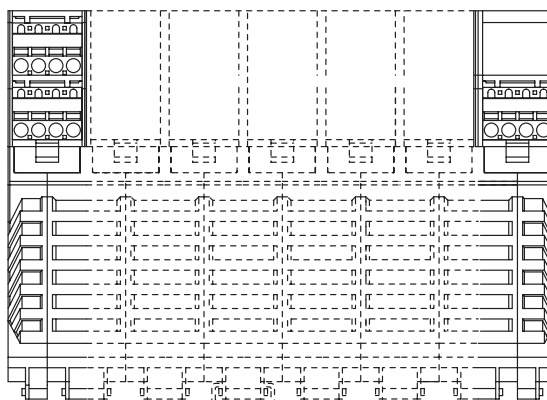
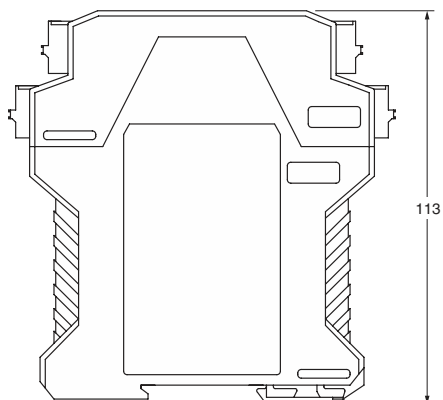
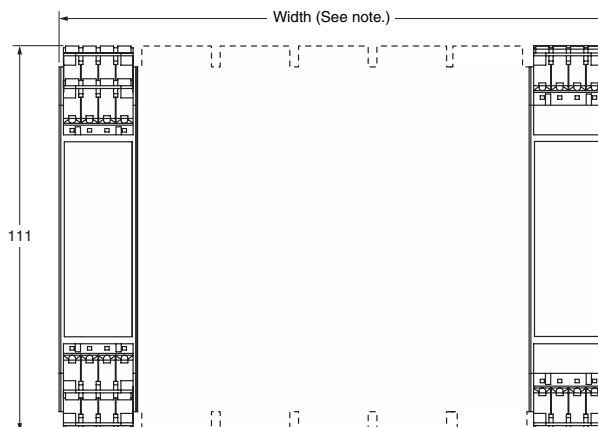
Timing Chart



# Dimensions

## Safety Controller

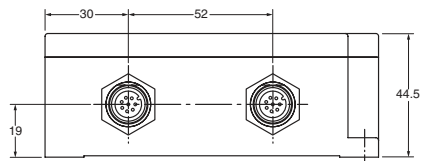
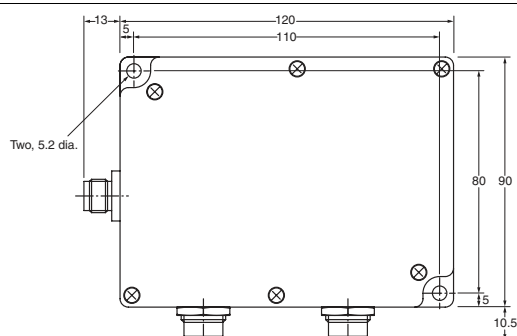
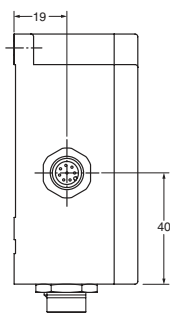
### F3SX



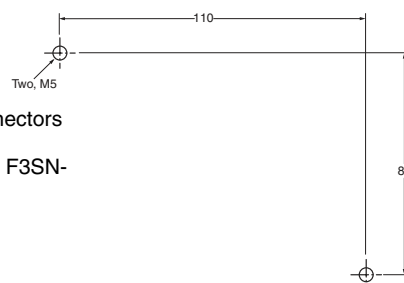
**Note:** For details on the width, refer to “List of Models” on page 4 to 5.

Junction Box for Safety Light Curtain

F39-TB01



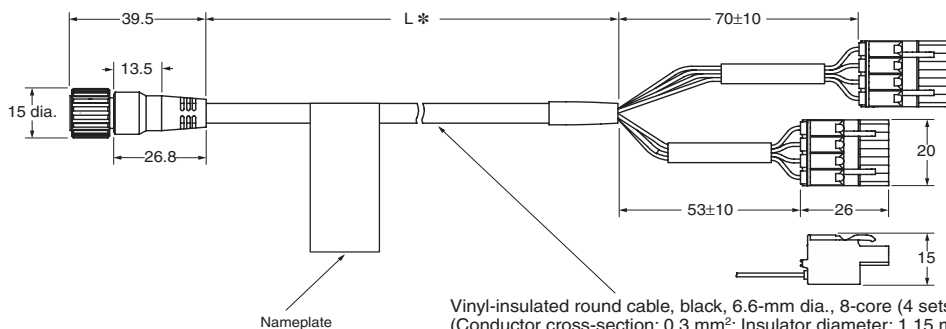
Mounting Hole Dimensions



**Note:** Use F39-JC□B or F39-JC□T Cable with Connectors on Both Ends to connect the Junction Box. For details on F39-JC□B, refer to F3SJ Ver.2, F3SN-A/F3SN-B/F3SH-A, and F3SN-A□SS.

Cable with Connectors on Both Ends

F39-JC□□T



Vinyl-insulated round cable, black, 6.6-mm dia., 8-core (4 sets)  
(Conductor cross-section: 0.3 mm<sup>2</sup>; Insulator diameter: 1.15 mm)  
Standard length: L \*

\* The length depends on the model number, as shown below.

Model	L (mm)
F39-JC1T	1,000 <sup>+150</sup> <sub>0</sub>
F39-JC3T	3,000 <sup>+150</sup> <sub>0</sub>
F39-JC5T	5,000 <sup>+300</sup> <sub>0</sub>
F39-JC10T	10,000 <sup>+300</sup> <sub>0</sub>

Wire color	Signal name	F3SX terminal No.
Brown	+24 V	1 or 16
Blue/shield	0 V	2 or 15
Gray	RS-485 (A)	3 or 14
Pink	RS-485 (B)	4 or 13
Green	Control output 1	5 or 12
Yellow	Reset output	6 or 11
White	Control output 2	7 or 10
Red	Test input	8 or 9

## Safety Precautions

The following information is intended as a guide for selecting the F3SX Safety Controller. Be sure to read the User's Manual for the product (SCHG-705) before use.

### Overview

- The F3SX is designed for use by authorized personnel who thoroughly understand the installed machinery.
- The use of "authorized personnel" in the User's Manual (SCHG-705) refers to personnel qualified and authorized to secure safety across all phases of the safety life cycle from machinery design through, installation, operation, maintenance, and disposal.
- The specified installation environment and machinery performance characteristics of the F3SX are applicable under correct usage conditions. Have a related organization perform risk assessment before selecting, installing, or setting the F3SX.
- Be sure to thoroughly read and understand the User's Manual for the product (SCHG-705) before use and always use the product correctly according to the manual.

### Regulations and Standards

- "Type Approval" specified in Chapter 44.2 of the Industrial Safety and Health Law in Japan does not apply to independent Controllers. This law applies to systems incorporated with the F3SX Controllers. Therefore, when using the F3SX Controllers in Japan as "safety devices for presses or shearing machines" as specified in Chapter 42 of the same law, apply for approval as a system.

- The F3SX is electro-sensitive protective equipment (ESPE) in accordance with European Union (EU) Machinery Directive Annex IV, B, Safety Components, Item 1 and Item 2.
- The F3SX received the following approvals from TÜV-Product Service.
  1. EU Regulations
    - Machinery Directive: Directive 98/37/EC
    - Low Voltage Directive: Directive 73/23/EEC
    - EMC Directive: Directive 89/336/EEC
  2. European Standards
    - EN61508 (SIL1-3), EN954-1 (Category 4, 3, 2, 1, B), EN61496-1 (TYPE 4 ESPE), EN50178, EN55011, EN60204-1, EN61000-6-2, EN61000-6-4, EN1760, EN574 (Type III C), EN1088
  3. International Standards
    - IEC61508 (SIL1-3), IEC61496-1 (Type 4 ESPE), IEC60204-1
    - The F3SX received the following approvals from the Third Party Assessment Body UL:
    - Certificate of UL listing for US and Canadian safety standards: UL508, UL1998, UL61496-1 (Type 4 ESPE), CSA C22.2 No. 14, CSA C22.2 No.0.8

### WARNING

- Install the reset switch in a location from which the entire hazardous area is visible and where the switch cannot be operated from within the hazardous area.
- Connect control devices that are suitable for the required safety functions. Using unsuitable external devices may result in the F3SX not being capable of performing safety functions fully.
- The DC Power Supply Unit must satisfy all of the following conditions for the F3SX to meet EN60204-1, IEC61496-1, and UL508 standards.
  - The power supply voltage is within the rating (24 VDC  $\pm$  10%).
  - The power supply is used to supply the F3SX and its connected Sensors only, and is not connected to any other devices or equipment. When connecting multiple devices, make sure the total rated current is not exceeded.
  - The power supply conforms to the EMC Directive (industrial environment).
  - The power supply uses double or reinforced insulation between the primary and secondary circuits.
  - The power supply automatically resets overcurrent protection characteristics (voltage drop).
  - The power supply maintains an output holding time of at least 20 ms.
  - The power supply must have output characteristics of Class 2 Circuit or Limited Voltage-Current Circuit as defined in UL508.
  - The power supply must conform to regulatory requirements and standards regarding EMC and electrical equipment safety of the country where the F3SX is installed.  
Example: The EMC Directive (industrial environment) and the Low Voltage Directive in EU.
- When using a commercially available switching regulator, make sure FG (frame ground terminal) is connected. Faulty operation caused by switching noise may result if the terminal is not connected.
- Do not connect a DC or AC power supply output that exceeds the rated value to the power supply input of the F3SX.
- Connect a fuse serially to the output contact of the relay output.
- Do not use a load that exceeds the switching capacity. Doing so may result in damage to the output circuits and the F3SX may not be capable of turning OFF.
- Take measures to prevent common malfunctions that would disable all redundant safety circuits at the same time.
- Do not use the F3SX's PLC communications functions to configure a safety system. Doing so may result in serious injury due to faulty wiring or PLC malfunction.
- Do not attempt to disassemble, repair, or modify the F3SX. Otherwise, the F3SX may not be capable of performing its safety functions.
- Wire the I/O terminals correctly. Incorrect wiring may result in electric shock or the safety functions may be damaged.
- Do not use the auxiliary outputs to configure a safety system. Using the auxiliary outputs as safety outputs may result in serious injury if the F3SX or peripheral devices malfunction.
- Do not connect input devices to the auxiliary input terminal (start command input) to configure a safety system. Doing so may result in serious injury if the F3SX or peripheral devices malfunction.



**CAUTION**

- The applicable safety category is determined from the whole safety control system. Consultation with a third party assessment body is recommended to make sure that the whole safety control system meets requirements.
- The service life greatly depends on factors such as the switching conditions and load. Be sure to test the F3SX under actual application conditions, and make sure that the number of switching operations is within the permissible range.
- Use the F3SX within a protective structure that complies with IP54 or higher.
- Secure the F3SX to the DIN track using Mounting Brackets if the DIN track is short or if securing is otherwise required. Not doing so may result in the F3SX falling off the DIN track due to vibration.
- Provide a space of at least 5 mm beside and at least 50 mm above and below the F3SX for ventilation.

**Terminology****IEC61508: 1998 (EN61508: 2001)**

This standard specifies detailed provisions for the procedures to be followed (including design and evaluation methods) covering all phases of the safety life cycle from design through installation, maintenance, and disposal when a product has safety functions that use electrical, electronic, or programmable systems.

**DC Solid-state Safety Output Waveform**

In the F3SX, the output periodically turns OFF for a short time to check that the function for turning OFF output is operating normally. If the output signal turns OFF during this time the output circuit is determined to be operating normally. Conversely, if the output does not turn OFF, an output circuit or wiring error is detected, and the Controller is put in lockout status. Set the input response time of connected devices such that the devices connected to terminals SS1 and SS2 do not malfunction due to the OFF pulse signal.

**SIL (Safety Integrity Level)**

SIL refers to a numeric value that indicates the safety integrity requirements of the safety system in the same way as they were previously indicated by EN954-1 Safety Categories B, and 1 through 4. The level is obtained by calculating the ratio of dangerous malfunctions that can occur and assigning a level that corresponds to the frequency of use. This Controller is SIL3, which indicates a safety level equivalent to EN954-1 Safety Category 4.

**Diagnostic Functions****Intersystem Synchronous Monitoring**

The time difference in the rise time of inputs between systems (between channels 1 and 2) is monitored. This prevents safety equipment from being disabled.

**Intersystem Short-circuit Monitoring**

Short-circuits of inputs between systems (between channels 1 and 2) are monitored. This allows detection of damage to safety equipment. If a short-circuit occurs, the Controller is locked out, and the OFF status is maintained. (Fuse replacement is not required.)

**Control Functions****Monitoring Feedback Timing (FB)**

The N.C. contact of the external relay that controls the source of danger in the machine is input to the F3SX as a feedback signal, thereby detecting welding contacts and other operating faults, and can also monitor whether the feedback signal is returned within a fixed time (factory setting: 500 ms).

When this function is not used, perform function settings using the F3SX-CD100-E Function Setup Software for the F3SX.

**Standby Output (AS3 Terminal)**

The standby output is output after the F3SX CPU Unit is initialized and I/O control can be performed normally. Use this output as part of the operation standby signals for the entire system.

The standby output is not a safety output. Do not use the standby output to configure safety systems. Doing so may result in serious injury if a malfunction occurs.

**Ready Output****(AS2 Terminal: E Modules)**

The ready output is output when the F3SX is in a standby state and all the safety inputs are ON.

**Information Trigger****(AS2 Terminal: N Modules)**

The information trigger is output when damage or a timeout occurs during Controller diagnosis or monitoring. The trigger signal can be used as a command request signal to a host (e.g., Programmable Controller or personal computer).

The information trigger output is not a safety output. Do not use the information trigger to configure safety systems. Doing so may result in serious injury if a malfunction occurs.

**Start Command Input (SSC Terminal)**

The start command input is used to operate a safety relay when it receives a start command from the machine in addition to an input condition from the safety device. (If the SSC terminal is not required, connect it to the 24-VDC terminal.)

Do not connect the start command input to an input device, or otherwise use it to configure safety systems. Doing so may result in serious injury if a malfunction occurs.

**Precautions for Correct Use**

1. Do not use the F3SX in atmospheres or environments that exceed product ratings.
2. Safety Application Controller's Relay durability depends greatly on the switching condition. Confirm the actual conditions of operation in which the Relay will be used in order to make sure the permissible number of switching operations. When the accumulated number of operation exceeds its permissible range, it can cause failure of reset of safety control circuit. In such case, please replace the Relay or the Safety Application Controller immediately. If the Relay or the Safety Application Controller is used continuously without replacing, then it can lead to loss of safety function.

## Read and Understand This Catalog

Please read and understand this catalog before purchasing the products. Please consult your OMRON representative if you have any questions or comments.

## Warranty and Limitations of Liability

### WARRANTY

OMRON's exclusive warranty is that the products are free from defects in materials and workmanship for a period of one year (or other period if specified) from date of sale by OMRON.

OMRON MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, REGARDING NON-INFRINGEMENT, MERCHANTABILITY, OR FITNESS FOR PARTICULAR PURPOSE OF THE PRODUCTS. ANY BUYER OR USER ACKNOWLEDGES THAT THE BUYER OR USER ALONE HAS DETERMINED THAT THE PRODUCTS WILL SUITABLY MEET THE REQUIREMENTS OF THEIR INTENDED USE. OMRON DISCLAIMS ALL OTHER WARRANTIES, EXPRESS OR IMPLIED.

### LIMITATIONS OF LIABILITY

OMRON SHALL NOT BE RESPONSIBLE FOR SPECIAL, INDIRECT, OR CONSEQUENTIAL DAMAGES, LOSS OF PROFITS OR COMMERCIAL LOSS IN ANY WAY CONNECTED WITH THE PRODUCTS, WHETHER SUCH CLAIM IS BASED ON CONTRACT, WARRANTY, NEGLIGENCE, OR STRICT LIABILITY.

In no event shall the responsibility of OMRON for any act exceed the individual price of the product on which liability is asserted.

IN NO EVENT SHALL OMRON BE RESPONSIBLE FOR WARRANTY, REPAIR, OR OTHER CLAIMS REGARDING THE PRODUCTS UNLESS OMRON'S ANALYSIS CONFIRMS THAT THE PRODUCTS WERE PROPERLY HANDLED, STORED, INSTALLED, AND MAINTAINED AND NOT SUBJECT TO CONTAMINATION, ABUSE, MISUSE, OR INAPPROPRIATE MODIFICATION OR REPAIR.

## Application Considerations

### SUITABILITY FOR USE

OMRON shall not be responsible for conformity with any standards, codes, or regulations that apply to the combination of products in the customer's application or use of the products.

At the customer's request, OMRON will provide applicable third party certification documents identifying ratings and limitations of use that apply to the products. This information by itself is not sufficient for a complete determination of the suitability of the products in combination with the end product, machine, system, or other application or use.

The following are some examples of applications for which particular attention must be given. This is not intended to be an exhaustive list of all possible uses of the products, nor is it intended to imply that the uses listed may be suitable for the products:

- Outdoor use, uses involving potential chemical contamination or electrical interference, or conditions or uses not described in this catalog.
- Nuclear energy control systems, combustion systems, railroad systems, aviation systems, medical equipment, amusement machines, vehicles, safety equipment, and installations subject to separate industry or government regulations.
- Systems, machines, and equipment that could present a risk to life or property.

Please know and observe all prohibitions of use applicable to the products.

NEVER USE THE PRODUCTS FOR AN APPLICATION INVOLVING SERIOUS RISK TO LIFE OR PROPERTY WITHOUT ENSURING THAT THE SYSTEM AS A WHOLE HAS BEEN DESIGNED TO ADDRESS THE RISKS, AND THAT THE OMRON PRODUCTS ARE PROPERLY RATED AND INSTALLED FOR THE INTENDED USE WITHIN THE OVERALL EQUIPMENT OR SYSTEM.

### PROGRAMMABLE PRODUCTS

OMRON shall not be responsible for the user's programming of a programmable product, or any consequence thereof.

## Disclaimers

### CHANGE IN SPECIFICATIONS

Product specifications and accessories may be changed at any time based on improvements and other reasons.

It is our practice to change model numbers when published ratings or features are changed, or when significant construction changes are made. However, some specifications of the products may be changed without any notice. When in doubt, special model numbers may be assigned to fix or establish key specifications for your application on your request. Please consult with your OMRON representative at any time to confirm actual specifications of purchased products.

### DIMENSIONS AND WEIGHTS

Dimensions and weights are nominal and are not to be used for manufacturing purposes, even when tolerances are shown.

### PERFORMANCE DATA

Performance data given in this catalog is provided as a guide for the user in determining suitability and does not constitute a warranty. It may represent the result of OMRON's test conditions, and the users must correlate it to actual application requirements. Actual performance is subject to the OMRON Warranty and Limitations of Liability.

### ERRORS AND OMISSIONS

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2008.12

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Industrial Automation Company

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