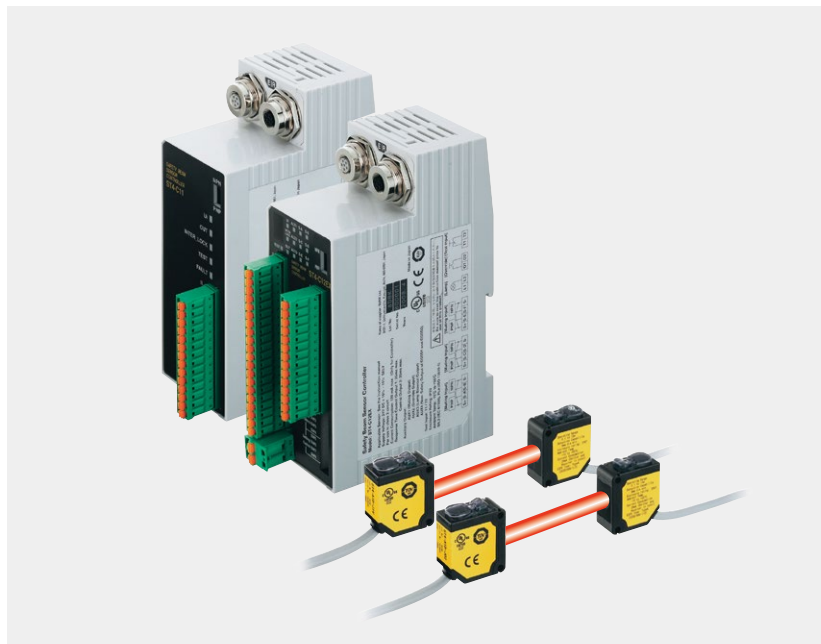
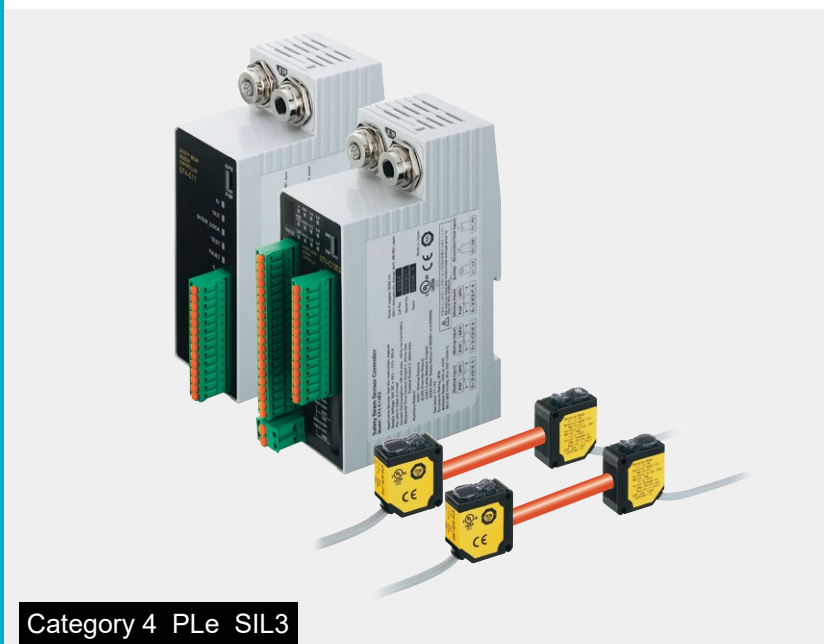


Type 4 Compatible with Up to Control Category 4, PLe and SIL3

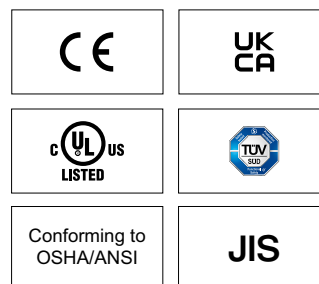
Compact
Safety Beam Sensor
ST4_{SERIES}



ST4 SERIES



Category 4 PLe SIL3

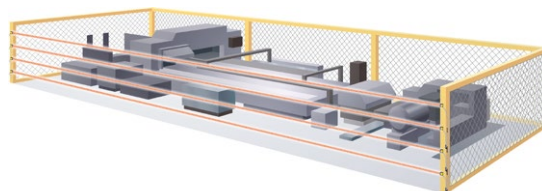


The control category differs depending on the configuration and wiring of the external circuit.

From wide areas to narrow spaces, full support for both safety and productivity

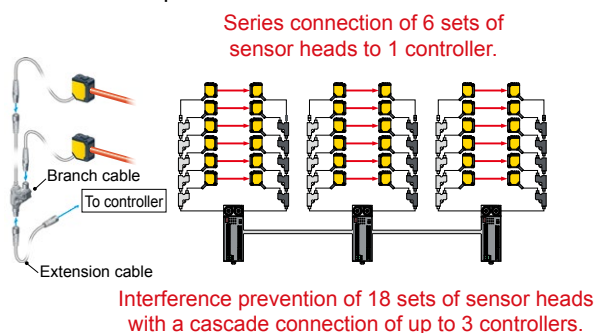
Long sensing range of up to 15 m 49.213 ft

Secures safety of large facilities where installation of guardian fence is difficult.



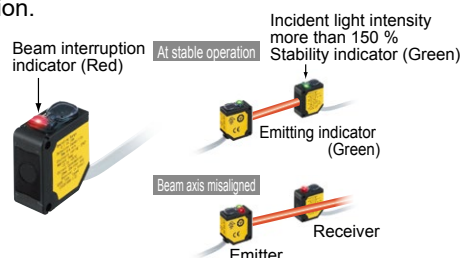
Series connection of sensors and interference prevention

The numbers of sensor heads and controllers can be freely adjusted to meet the heights and the required numbers of the protection area.



Beam axis alignment and operation confirmation

The beam interruption indicator is incorporated in both the emitter and receiver. This indicator can be used not only for operation confirmation but also for beam axis alignment. Moreover, the stability indicator indicates if the incident light intensity exceeds 150 % in stable operation.

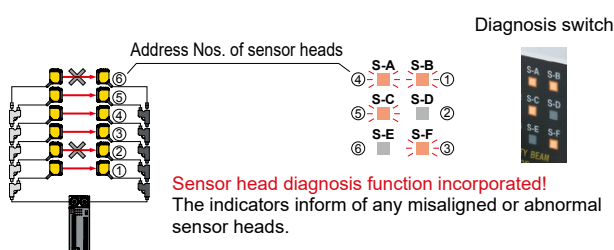


Supports beam axis alignment at startup and quick restoration in case of trouble

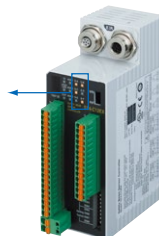
High-functional type ST4-C12EX

Light received condition of the sensor heads in series connection can be confirmed by the high-functional controller ST4-C12EX. In addition, any abnormal sensors during lockout can be identified.

(Ex.) When address No.2 and 6 are misaligned in a series connection of 6 sets.

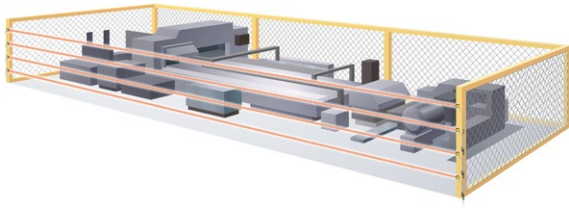


Diagnosis switch

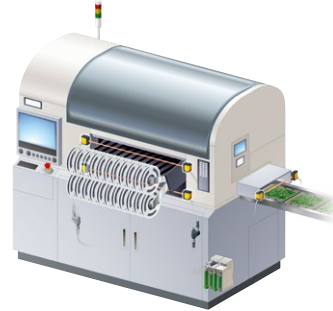


APPLICATIONS

Intrusion detection in hazardous areas

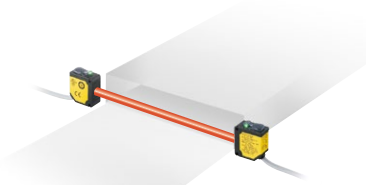
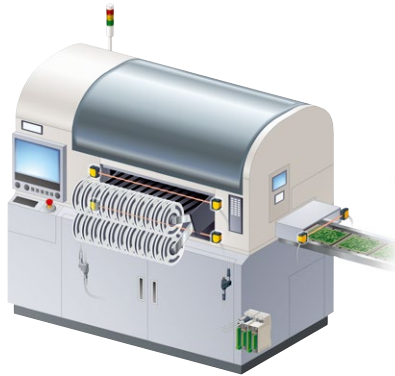


Safety check on the mounting machine



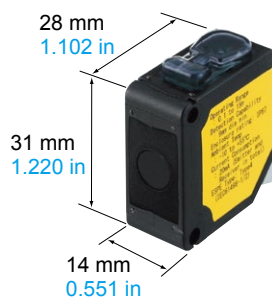
In small openings where safety light curtains cannot be installed

Ensures safety in small openings that are often missed.



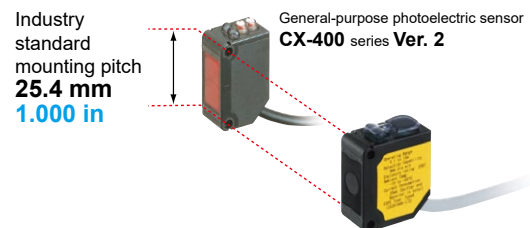
Compact sensor head saves space

The Type 4 long sensing range type has a compact size that is equivalent to those of general-purpose photoelectric sensors.



Industry standard mounting pitch

Having the same mounting pitch as those of general-purpose photoelectric sensors makes model switchovers easy.



Waterproof IP67

Conforming to IP67 rating, the sensor heads can be used safely even at lines where water splashes during washing.



Control of interferences to surrounding sensors

The emission amount adjuster can be used to reduce the emission to control any interference to the surrounding sensors.



Supports both PNP and NPN polarities

A single unit can be used for PNP/NPN output switching, reducing the number of parts that need to be registered.



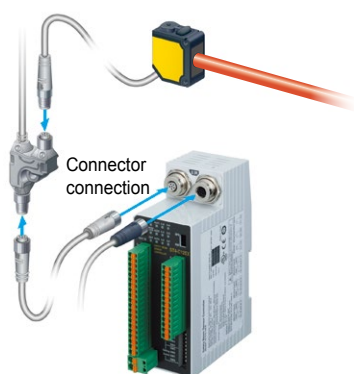
General-purpose type
ST4-C11

High-functional type
ST4-C12EX



Easy connector connection

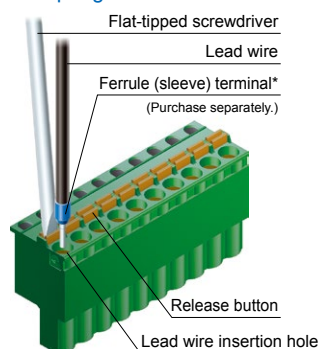
Connecting to the sensor head is done using connector connections, which shortens setup and replacement time.



Easy setup requiring no torque control

A spring method is used for the terminal blocks. There is no need to control tightening torques for these terminal blocks.

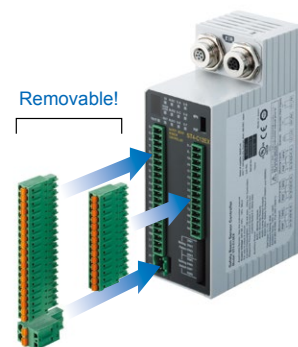
Uses a spring method!



* Connection is possible with a single wire or coil wires.

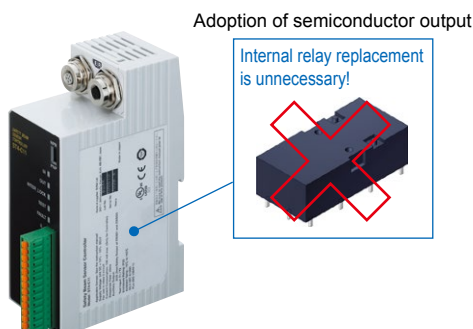
Removal terminal blocks reduce maintenance time

The work required for reconnecting wiring during maintenance is reduced.



Semiconductor output reduces running costs!

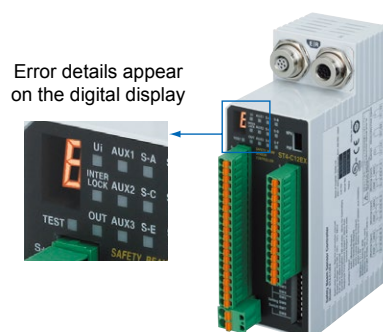
Semiconductor output is used for control output. This means there is no need to periodically replace safety relays.



Error details can be understood at a glance!

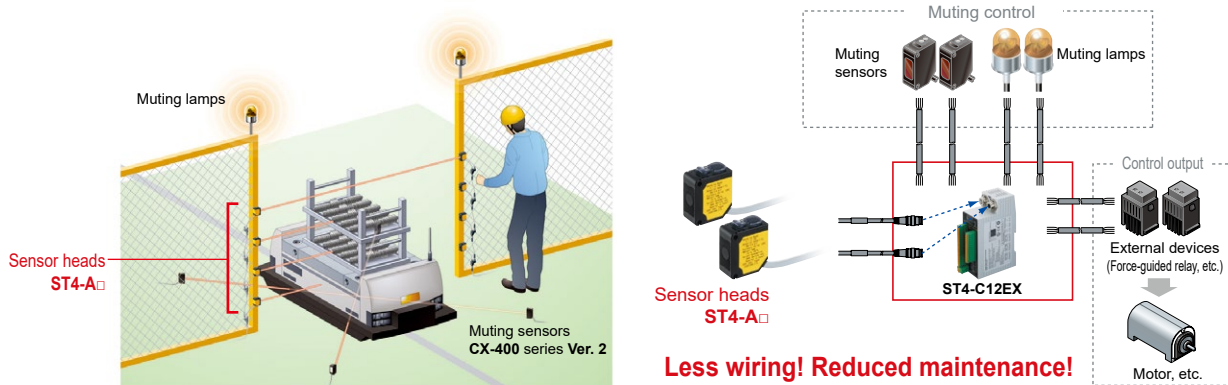
High-functional type
ST4-C12EX

If a problem should occur, the control output is switched OFF, and the details of the error appear on the digital display.



Three patterns of muting control function for greater safety with no loss in productivity High-functional type ST4-C12EX

Sensor heads, muting sensors, and muting lamps connect directly to the controller, so that muting control circuits can be built easily.

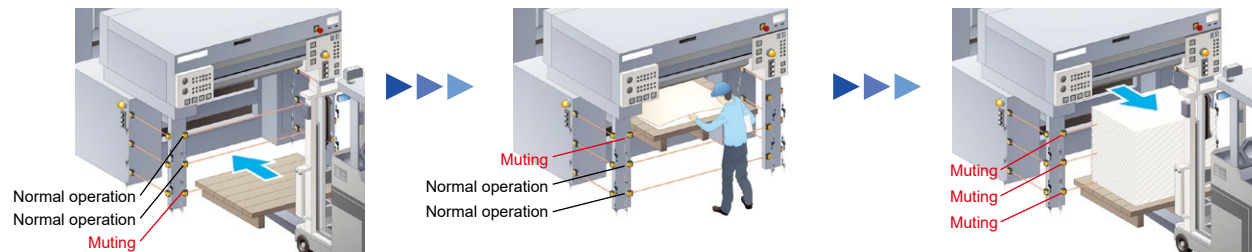


Muting pattern No.1

Compliant to international safety standard ISO 12643 for printing industry

Muting area can be changed to suit the printing process. This is the optimal muting control for printing machines.

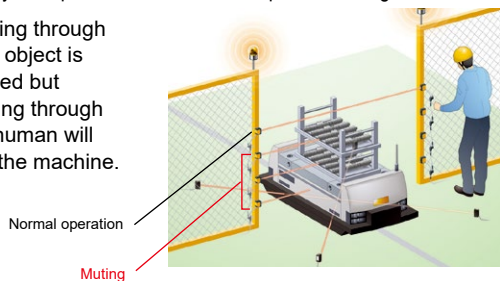
- ① Put in an unfilled palette (Bottom-most muting) ② Sample inspect the printing paper (Top-most muting) ③ Take out the printed material (All muting)



Muting pattern No.2

Set apart only the top-most sensor heads and perform muting control.

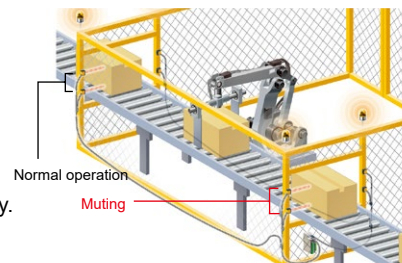
(Ex.) Passing through of an object is allowed but passing through of a human will stop the machine.



Muting pattern No.3

Divide the muting area into two.

(Ex.) Allocate sensor heads at the entrance and exit of objects separately, so that muting is done individually.

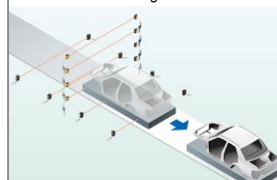


Line restarts smoothly after being stopped while muting control was active <Override function> High-functional type ST4-C12EX

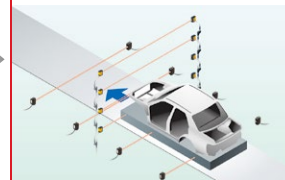
In case the sensor head has been interrupted by an object or in case there is an emergency stop before the muting conditions have been established, all the sensor heads will be temporarily deactivated following by a smooth restart.

(Ex.) When the power turns off while the sensor head has been interrupted by an object.

Previous models Removal of object required
In order to restart, object must be removed to establish the muting conditions.



ST4 Removal of object unnecessary
Temporarily deactivate all the sensor heads and then restart.



Informs all kinds of operation conditions

High-functional type ST4-C12EX

In case the muting lamp that is connected to the controller breaks, an alarm will go off. Also, auxiliary outputs that link to the muting function, override function, and control outputs (OSSD) are incorporated.

Auxiliary outputs	Function	Operation
Auxiliary output 1	Muting output	ON when muting function is invalid
Auxiliary output 2	Override output	ON when override function is invalid
Auxiliary output 3	Blown lamp output	ON when muting lamp is in normal condition
Auxiliary output 4	Monitor output	ON when control output is OFF

ORDER GUIDE

Sensor heads Always use the sensor head and the controller together as a set.

Type	Appearance	Operating range (Note 1)	Model No. (Note 2)
Cable length 0.2 m 0.656 ft			ST4-A1-J02
With emission amount adjuster			ST4-A1-J02V
Cable length 1 m 3.281 ft			ST4-A1-J1
With emission amount adjuster			ST4-A1-J1V

Notes: 1) The "operating range" is the possible setting distance between the emitter and the receiver.

2) The model No. with suffix "E" shown on the label affixed to the product is the emitter, "D" shown on the label is the receiver.

Controllers Always use the sensor head and the controller together as a set.

Type	Appearance	Model No.	Control output
Controller		ST4-C11	Dual PNP transistor open-collector output × 1 system or Dual NPN transistor open-collector output × 1 system (Set using output polarity selection switch)
High-functional type		ST4-C12EX	

OPTIONS

Designation	Model No.	Description		
Extension cable	ST4-CCJ1E	Cable length: 1 m 3.281 ft	For emitter	Use as an extension for the ST4-A□ . 5-wire shielded cable. One each for emitter and receiver Cable color: Gray (for emitter), Gray with black line (for receiver)
	ST4-CCJ1D	Net weight 55 g approx. (1 cable)	For receiver	
	ST4-CCJ3E	Cable length: 3 m 9.843 ft	For emitter	Connector color: Gray (for emitter), Black (for receiver)
	ST4-CCJ3D	Net weight 130 g approx. (1 cable)	For receiver	
	ST4-CCJ5E	Cable length: 5 m 16.404 ft	For emitter	Min. bending radius: R5 mm R0.197 in
	ST4-CCJ5D	Net weight 200 g approx. (1 cable)	For receiver	
	ST4-CCJ7E	Cable length: 7 m 22.966 ft	For emitter	
	ST4-CCJ7D	Net weight 270 g approx. (1 cable)	For receiver	
	ST4-CCJ15E	Cable length: 15 m 49.213 ft	For emitter	
	ST4-CCJ15D	Net weight 540 g approx. (1 cable)	For receiver	
Branch cable	ST4-CCJ05-WY	Cable length: 0.5 m 1.640 ft Net weight 80 g approx. (2 cables)	Use to connect ST4-A□ in series. 5-wire shielded cable. Two cables per set for emitter and receiver Cable color: Gray (for emitter), Gray with black line (for receiver) Connector color: Gray (for emitter), Black (for receiver) Min. bending radius: R5 mm R0.197 in	
Sensor head mounting bracket	MS-CX-1	Foot angled mounting bracket. 2 different types for emitter and receiver required.		
	MS-ST4-3	Back angled mounting bracket. 2 different types for emitter and receiver required.		
	MS-ST4-6	Foot biangled mounting bracket. 2 different types for emitter and receiver required.		
Round slit mask (Note)	OS-ST4-2 (Slit size ø2 mm) ø0.079 in	Dampens the light to suppress interference with neighboring sensors.	Operating range • Slit on one side: 3 m 9.843 ft • Slit on both sides: 0.75 m 2.461 ft	
	OS-ST4-3 (Slit size ø3 mm) ø0.118 in		Operating range • Slit on one side: 4.5 m 14.764 ft • Slit on both sides: 1.5 m 4.921 ft	

Note: When the slit mask is installed, applicable sensing objects are opaque objects with a diameter of ø9 mm **ø0.354 in** or more.

Extension cable

• ST4-CCJ□



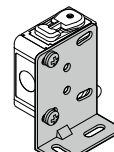
Branch cable

• ST4-CCJ05-WY



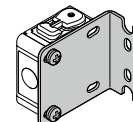
Sensor head mounting bracket

• MS-CX-1



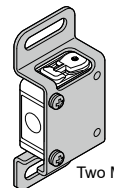
Two M3 (length 12 mm **0.472 in**) screws with washers are attached.

• MS-ST4-3



Two M3 (length 12 mm **0.472 in**) screws with washers are attached.

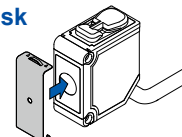
• MS-ST4-6



Two M3 (length 12 mm **0.472 in**) screws with washers are attached.

Round slit mask

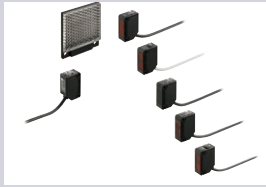
• OS-ST4-2 • OS-ST4-3



OPTIONS

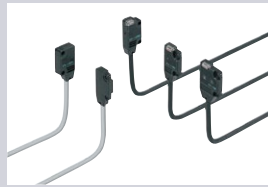
Introduction to Panasonic Industry's sensors that can be used as muting sensors

Compact Photoelectric Sensor **CX-400 SERIES Ver.2**



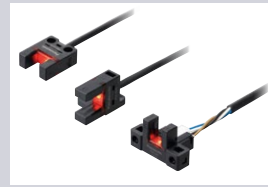
- World standard size
- Wide variation

Ultra-slim Photoelectric Sensor **EX-10 SERIES Ver.2**



- 3.5 mm **0.138 in** thickness
- Long sensing range: 1 m **3.281 ft** (thru-beam type: **EX-19**)
- * The **EX-20** series that is compatible with M3 mounting screws is also available.

U-shaped Micro Photoelectric Sensor **PM-25/45/65 SERIES**



- Three protection circuits standard on all models
- Ample beam emitting / receiving distance of 6 mm **0.236 in**
- Easy to mount with M3 screws

Rectangular-shaped Inductive Proximity Sensor **GX-F/H SERIES**



- Industry longest in stable sensing range
- 10 times the durability (Compared to previous models)
- IP68G rating

* Please check the specifications of each muting sensor before making a selection.

Recommended safety relay

Model No.: SF series (Safety Relay)

Note: Contact our sales office for details on the recommended products.

SPECIFICATIONS

Sensor heads

Type		Cable length 0.2 m 0.656 ft		Cable length 1 m 3.281 ft	
		With emission amount adjuster		With emission amount adjuster	
Item	Model No.	ST4-A1-J02	ST4-A1-J02V	ST4-A1-J1	ST4-A1-J1V
Applicable standard (Note 2)		IEC 61496-1/2 (JIS B 9704-1/2 / ANSI/UL 61496-1/2) (Type 4), ISO 13849-1: 2015 (Category 4, PLe), JIS B 9705-1 (Category 4), IEC 61508-1 to 3 (SIL3), IEC 62061 (SIL3), JIS C 0508-1 to 3 (SIL3), UL 1998, OSHA 1910.212, OSHA 1910.217 (C), ANSI B11.1 to B11.19, ANSI/RIA R15.06, ANSI/ISA S84.01 (SIL3)			
Applicable regulations and certifications (Note 2)		CE Marking (Machinery Directive, EMC Directive, RoHS Directive) , UKCA Marking [Supply of Machinery (Safety) Regulations, EMC Regulations, RoHS Regulations], UL/c-UL Listing certification, TÜV SÜD certification			
Operating range		0.1 to 15 m 0.328 to 49.213 ft (Note 3)			
Sensing object		ø9 mm ø0.354 in or more opaque object			
Effective aperture angle (EAA)		±2.5° or less for operating range exceeding 3 m 9.843 ft (required by IEC 61496-2 / UL 61496-2)			
Supply voltage		Supplied from controller			
Current consumption		Emitter: 11 mA or less, Receiver: 9 mA or less			
Beam interruption indicator (Note 4)		Red LED (lights up when the beam is interrupted or lock out, lights off during reception)			
Beam emission indicator		Green LED (lights up during beam emission, lights off during emission halt)			
Stable incident beam indicator		Green LED (lights up under stable light received condition, lights off under unstable light received condition)			
Environmental resistance	Degree of protection	IP67 (IEC)			
	Ambient temperature	-10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: -25 to +70 °C -13 to +158 °F			
	Ambient humidity	30 to 85 % RH, Storage: 30 to 95 % RH			
	Ambient illuminance	Incandescent lamp: 3,500 lx or less at the light-receiving face			
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure			
	Insulation resistance	20 MΩ or more with 500V DC megger between all supply terminals connected together and enclosure			
	Vibration resistance	10 to 55 Hz frequency, 0.75 mm 0.030 in double amplitude or maximum acceleration 90 m/s ² in X, Y and Z directions for two hours each			
	Shock resistance	300 m/s ² acceleration in X, Y and Z directions three times each			
Emitting element		Infrared LED (Peak emission wavelength: 870 nm 0.034 mil)			
Material		Enclosure: PBT (Polybutylene terephthalate), Lens: Acrylic, Indicator cover: Acrylic			
Cable		Shielded cable with connector, 0.2 m 0.656 ft long		Shielded cable with connector, 1 m 3.281 ft long	
Cable extension		Extention up to total 50 m 164.042 ft is possible for both emitter and receiver with exclusive cable.			
Weight (Total of emitter and receiver)		Net weight: 45 g approx., Gross weight: 60 g approx.		Net weight: 100 g approx., Gross weight: 140 g approx.	

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C **+68 °F**.
 2) Complies with those standards and regulations only when the sensor head is used in combination with the controller **ST4-C11 / ST4-C12EX**.
 3) The operating range is the possible setting distance between the emitter and the receiver. It can detect sensing object of less than 0.1 m **0.328 ft** away.
 4) Shows light interruption information between the emitter and the receiver with the same address. It does not show OSSD output.
 For details on addresses, refer to "Address allocations of sensor head ST4-A□" (p.12).

SPECIFICATIONS

Controllers

Type	Controller	High-functional controller
Model No.	ST4-C11	ST4-C12EX
Applicable sensor head		ST4-A□
No. of series connections	Interference prevention possible when up to a maximum of 6 sets are connected (When the maximum of 3 controllers are connected together, interference prevention is possible for up to 18 sets)	
Applicable standards (Note 2)	IEC 61496-1/2 (JIS B 9704-1/2 / ANSI/UL 61496-1/2) (Type 4), ISO 13849-1: 2015 (Category 4, PLe), JIS B 9705-1 (Category 4), IEC 61508-1 to 3 (SIL3), IEC 62061 (SILCL3), JIS C 0508-1 to 3 (SIL3), UL 1998, OSHA 1910.212, OSHA 1910.217 (C), ANSI B11.1 to B11.19, ANSI/RIA R15.06, ANSI/ISA S84.01 (SIL3)	
Applicable regulations and certifications (Note 2)	CE Marking (Machinery Directive, EMC Directive, RoHS Directive) , UKCA Marking [Supply of Machinery (Safety) Regulations, EMC Regulations, RoHS Regulations], UL/c-UL Listing certification, TÜV SÜD certification	
Supply voltage	24 V DC ⁺¹⁰ ₋₁₅ % Ripple P-P 10 % or less	
Current consumption	100 mA or less (excluding sensor head ST4-A□)	120 mA or less (excluding sensor head ST4-A□)
Control outputs (OSSD1, OSSD2) (Note 3)	PNP open-collector transistor / NPN open-collector transistor, Dual output × 1 system (Set using output polarity selection switch) <PNP output> • Maximum source current: 200 mA • Applied voltage: same as the supply voltage (between control output and +V) • Residual voltage: 2.5 V or less (at 200 mA source current) • Leakage current: 200 μA or less (including power OFF condition) • Maximum load capacity: 1 μF (from no-load to max. source current) • Load wiring resistance: 3 Ω or less (between control output and load)	
	<NPN output> • Maximum sink current: 200 mA • Applied voltage: same as the supply voltage (between control output and 0 V) • Residual voltage: 2.0 V or less (at 200 mA sink current) • Leakage current: 200 μA or less (including power OFF condition) • Maximum load capacity: 1 μF (from no-load to max. sink current) • Load wiring resistance: 3 Ω or less (between control output and load)	
	Operation mode	ON when all beams of the connected ST4-A□ s are received OFF when one or more beams of the connected ST4-A□ s are interrupted (except during muting / override when ST4-C12EX is used) OFF during lockout
Protection circuit	Incorporated	
Response time	OFF response: 25 ms or less, ON response: 90 ms or less (auto reset) / 140 ms or less (manual reset)	
Auxiliary outputs (Note 3)	PNP open-collector transistor / NPN open-collector transistor (Set using output polarity selection switch) ST4-C11 : one output, ST4-C12EX : four outputs <PNP output> • Maximum source current: 100 mA • Applied voltage: same as the supply voltage(between auxiliary output and +V) • Residual voltage: 2.5 V or less (at 100 mA source current)	
	<NPN output> • Maximum sink current: 100 mA • Applied voltage: same as the supply voltage(between auxiliary output and 0 V) • Residual voltage: 2.0 V or less (at 100 mA sink current)	
	Operation mode	<Auxiliary output 1> ON when muting function is invalid, OFF when muting function is valid <Auxiliary output 2> ON when override function is invalid, OFF when override function is valid <Auxiliary output 3> ON when muting lamp is in normal condition, OFF when muting lamp is in abnormal condition <Auxiliary output 4> Negative logic of the control outputs (OSSD1, OSSD2)
Protection circuit	Incorporated	
Muting lamp output (Note 3)	—————	Available muting lamp: 24 V DC, 1 to 10 W
Protection circuit	Incorporated	
PFH _D (Note 4) / MTTF _D (Note 5)	Refer to the following table / More than 100 years	
Environmental resistance	Degree of protection	Enclosure: IP40 (IEC), Terminal: IP20 (IEC)
	Ambient temperature / Ambient humidity	-10 to +55 °C +14 to +131 °F (No dew condensation or icing allowed), Storage: -25 to +70°C -13 to +158 °F / 30 to 85 % RH, Storage: 30 to 95 % RH
	Voltage withstandability	1,000 V AC for one min. between all supply terminals connected together and enclosure
	Insulation resistance	20 MΩ or more with 500 V DC mega between all supply terminals connected together and enclosure
	Vibration resistance	10 to 55 Hz frequency, 0.75 mm 0.030 in double amplitude or maximum acceleration 90 m/s ² in X, Y and Z directions for two hours each
	Shock resistance	300 m/s ² acceleration in X, Y and Z directions three times each
Connection terminal	Detachable spring-cage terminal	
Wiring cable	Terminal block connector: 0.2 to 1.5 mm ² , Power supply connector (A1, A2): 0.2 to 2.5 mm ² (only for ST4-C12EX)	
Material	Enclosure: ABS	
Weight	Net weight: 180 g approx., Gross weight: 390 g approx.	Net weight: 240 g approx., Gross weight: 450 g approx.

Notes: 1) Where measurement conditions have not been specified precisely, the conditions used were an ambient temperature of +20 °C **+68 °F**.

2) Complies with those standards and regulations only when the controller is used in combination with the sensor head **ST4-A□**.

3) If the total current of the control outputs (OSSD1, OSSD2), auxiliary outputs, and muting lamp output exceeds 400 mA, the wiring resistance between the controller and the power supply should be 1 Ω or less. In addition, if the total current is 400 mA or less, the wiring resistance between the controller and the power supply should be 2 Ω or less.

4) PFH_D (Probability of dangerous failure per hour) depends on number of single beam sensor **ST4-A□** connected to controller.

		Number of single beam sensor ST4-A□					
		1 unit	2 units	3 units	4 units	5 units	6 units
PFH _D	ST4-C11	4.79×10^{-10}	6.53×10^{-10}	8.27×10^{-10}	1.00×10^{-9}	1.18×10^{-9}	1.35×10^{-9}
	ST4-C12EX	4.96×10^{-10}	6.70×10^{-10}	8.45×10^{-10}	1.02×10^{-9}	1.19×10^{-9}	1.37×10^{-9}

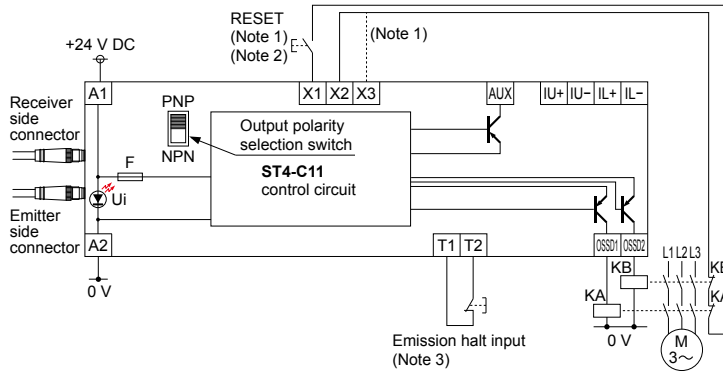
5) MTTFD_D: Mean time to dangerous failure (in years)

I/O CIRCUIT AND WIRING DIAGRAMS

ST4-C11

In case of PNP output

- Set the output polarity selection switch to the PNP side.

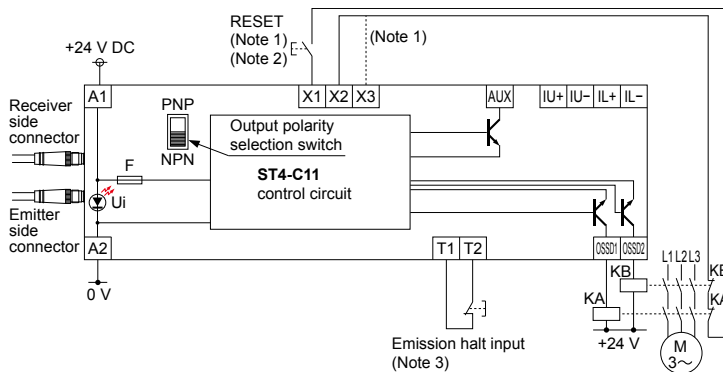


- Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.
- 2) Use a momentary-type switch as the reset (RESET) button.
- 3) Emission halt input is for stopping emission when open, and emitting when short-circuited. If not using the test button, short-circuit T1 and T2.

KA, KB: Force-guided relay or magnetic contactor

In case of NPN output

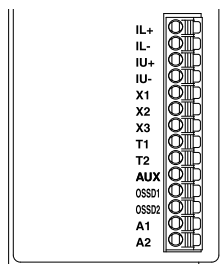
- Set the output polarity selection switch to the NPN side.



- Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.
- 2) Use a momentary-type switch as the reset (RESET) button.
- 3) Emission halt input is for stopping emission when open, and emitting when short-circuited. If not using the test button, short-circuit T1 and T2.

KA, KB: Force-guided relay or magnetic contactor

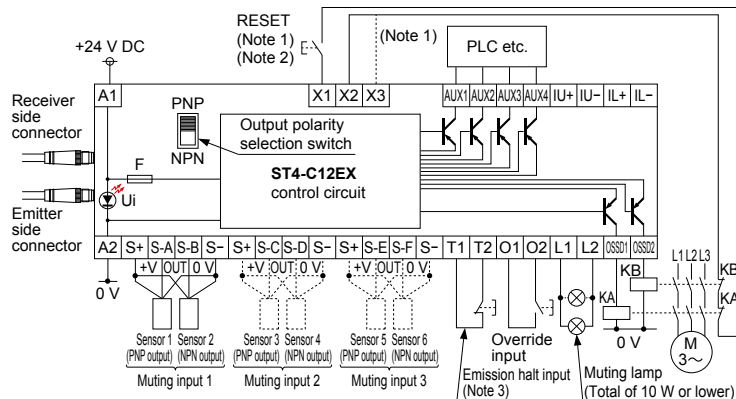
Terminal arrangement diagram



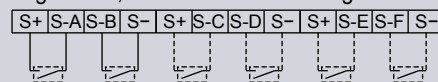
Terminal	Description
IL+	Interference prevention terminals
IL-	For details, refer to "Interference prevention function" (p.12).
IU+	Interference prevention terminals
IU-	For details, refer to "Interference prevention function" (p.12).
X1	Reset input terminals
X2	(When X1 and X2 are connected: manual reset, and when X1 and X3 are connected: auto reset)
X3	
T1	Emission halt input terminals
T2	(Open: emission halt, Short-circuit: emission)
AUX	Negative logic of the control outputs (OSSD1, OSSD2)
OSSD1	Control outputs (OSSD1, OSSD2)
OSSD2	
A1	24 V DC
A2	0 V

I/O CIRCUIT AND WIRING DIAGRAMS**ST4-C12EX****In case of PNP output**

- Set the output polarity selection switch to the PNP side.



When using the normally open (NO) contact switch as a muting sensor, wire as shown in the figure below.

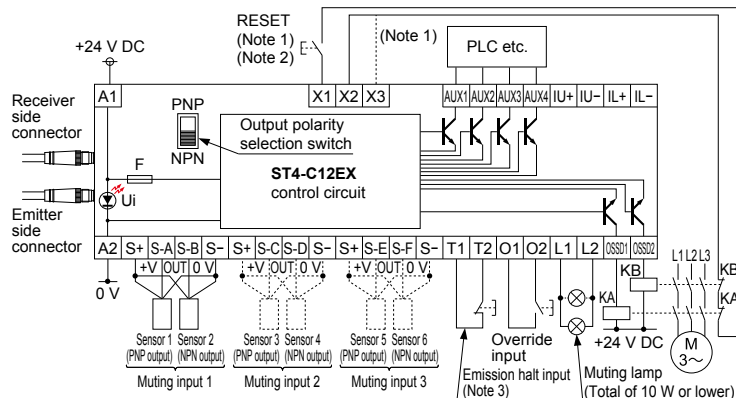


- Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.
 2) Use a momentary-type switch as the reset (RESET) button.
 3) Emission halt input is for stopping emission when open, and emitting when short-circuited. If not using the test button, short-circuit T1 and T2.

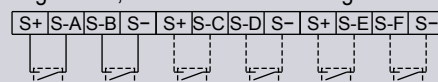
KA, KB: Force-guided relay or magnetic contactor

In case of NPN output

- Set the output polarity selection switch to the NPN side.

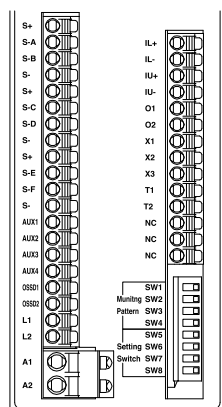


When using the normally open (NO) contact switch as a muting sensor, wire as shown in the figure below.



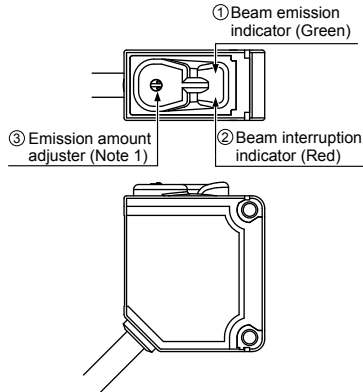
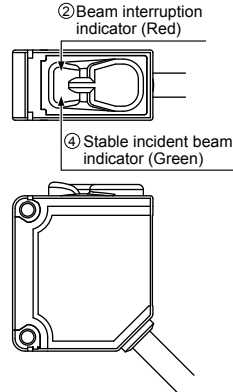
- Notes: 1) The left diagram is when using manual reset. If automatic reset is used, disconnect the lead from X2 and connect it to X3. In this case, a reset (RESET) button is not needed.
 2) Use a momentary-type switch as the reset (RESET) button.
 3) Emission halt input is for stopping emission when open, and emitting when short-circuited. If not using the test button, short-circuit T1 and T2.

KA, KB: Force-guided relay or magnetic contactor

Terminal arrangement diagram

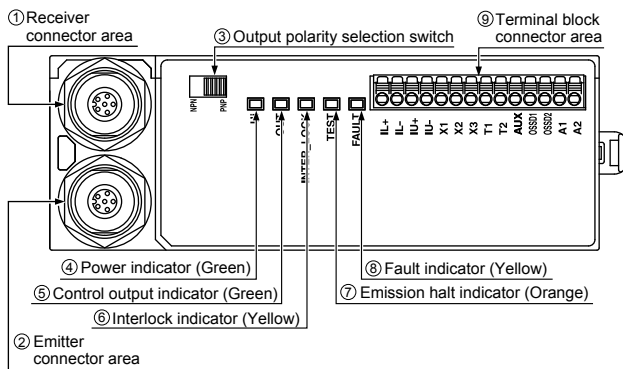
Terminal	Description
S+	Muting input power supply (24 V)
S-A	Muting input S-A [For NO (normally open) contact or PNP output type sensor]
S-B	Muting input S-B [For NO (normally open) contact or NPN output type sensor]
S-	Muting input power supply (0 V)
S+	Muting input power supply (24 V)
S-C	Muting input S-C [For NO (normally open) contact or PNP output type sensor]
S-D	Muting input S-D [For NO (normally open) contact or NPN output type sensor]
S-	Muting input power supply (0 V)
S+	Muting input power supply (24 V)
S-E	Muting input S-E [For NO (normally open) contact or PNP output type sensor]
S-F	Muting input S-F [For NO (normally open) contact or NPN output type sensor]
S-	Muting input power supply (0 V)
AUX1	Auxiliary output 1 (muting function)
AUX2	Auxiliary output 2 (override function)
AUX3	Auxiliary output 3 (muting lamp shutoff)
AUX4	Negative logic of the control outputs (OSSD1, OSSD2)
OSSD1	Control outputs (OSSD1, OSSD2)
OSSD2	Control outputs (OSSD1, OSSD2)
L1	Muting lamp connecting terminal
L2	Muting lamp connecting terminal
A1	24 V DC
A2	0 V

Terminal	Description
IL+	Interference prevention terminals
IL-	For details, refer to "Interference prevention function" (p.12).
IU+	Interference prevention terminals
IU-	For details, refer to "Interference prevention function" (p.12).
O1	Override input terminals
O2	Override input terminals
X1	Reset input terminals
X2	(When X1 and X2 are connected: manual reset, and when X1 and X3 are connected: auto reset)
X3	
T1	Emission halt input terminals
T2	(Open: emission halt, Short-circuit: emission)

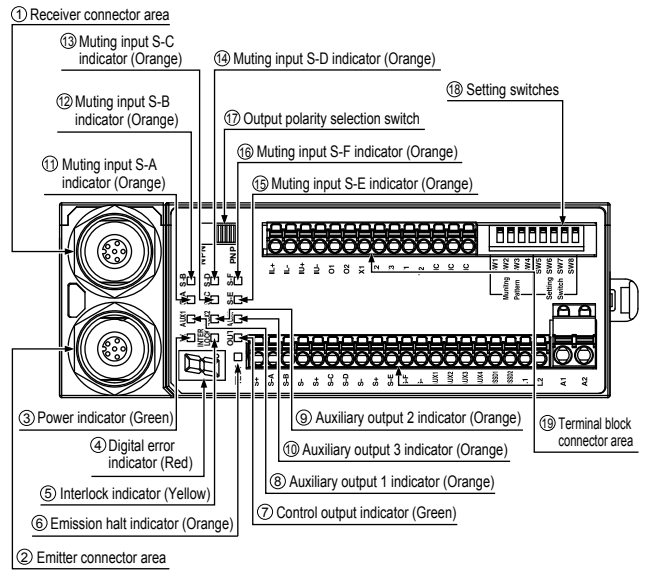
PRECAUTIONS FOR PROPER USE**Part description and function****Sensor head ST4-A□****<Emitter>****<Receiver>**

	Designation	Function
①	Beam emission indicator (Green)	Lights up during beam emission of the sensor. Lights off during emission halt of the sensor.
②	Beam interruption indicator (Red)	Lights up during beam interruption of the sensor. Lights up during lock out. Lights off during beam reception of the sensor.
③	Emission amount adjuster (Note 1)	The emission amount adjuster of ST4-A□V is used to reduce the beam emission from ST4-A□V , and prevent the influence against other sensors. Do not use the emission amount adjuster of ST4-A□V in order to prevent the reflective surfaces.
④	Stable incident beam indicator (Green)	Lights up when incident beam intensity is over 150 %. (Note 2) Lights off when incident beam intensity is 150 % or less. (Note 2)

Notes: 1) It is only equipped with the emission amount adjuster equipped type **ST4-A□V**.
 2) The incident beam intensity that makes the control outputs (OSSD1, OSSD2) to turn ON is regarded as 100 %.

Controller ST4-C11

	Designation	Function
①	Receiver connector area	Connects the receiver of ST4-A□ .
②	Emitter connector area	Connects the emitter of ST4-A□ .
③	Output polarity selection switch	Switches the control output to PNP output or NPN output.
④	Power indicator (Green)	Lights up when the power is ON.
⑤	Control output indicator (Green)	Lights up when the control outputs (OSSD1, OSSD2) are ON.
⑥	Interlock indicator (Yellow)	Lights up when the interlock is ON. Lights off when an error occurs or the control outputs (OSSD1, OSSD2) are ON.
⑦	Emission halt indicator (Orange)	Lights up when the emission halt function is valid.
⑧	Fault indicator (Yellow)	Lights up or blinks when an error occurs.
⑨	Terminal block connector area	For details, refer to " Terminal arrangement diagram " (p.9).

High-functional controller ST4-C12EX

	Designation	Function
①	Receiver connector area	Connects the receiver of ST4-A□ .
②	Emitter connector area	Connects the emitter of ST4-A□ .
③	Power indicator (Green)	Lights up when the power is ON.
④	Digital error indicator (Red)	Lights up in 7-segment when an error occurs. For details, refer to the instruction manual of the product.
⑤	Interlock indicator (Yellow)	Lights up when the interlock is ON. Lights off when an error occurs or the control outputs (OSSD1, OSSD2) are ON.
⑥	Emission halt indicator (Orange)	Lights up when the emission halt function is valid.
⑦	Control output indicator (Green)	Lights up when the control outputs (OSSD1, OSSD2) are ON.
⑧	Auxiliary output 1 indicator (Orange)	Lights off when the muting function is valid. Lights up when the muting function is invalid.
⑨	Auxiliary output 2 indicator (Orange)	Lights off when the override function is valid. Lights up when the override function is invalid.
⑩	Auxiliary output 3 indicator (Orange)	Lights up when the muting lamp is in normal operation. Lights off when the muting lamp is in error.
⑪	Muting input S-A indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-A) is input ON.
⑫	Muting input S-B indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-B) is input ON.
⑬	Muting input S-C indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-C) is input ON.
⑭	Muting input S-D indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-D) is input ON.
⑮	Muting input S-E indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-E) is input ON.
⑯	Muting input S-F indicator (Orange)	Lights up when the sensor connected to the muting input terminal (S-F) is input ON.
⑰	Output polarity selection switch	Switches the control output to PNP output or NPN output.
⑱	Setting switches	For details, refer to the " Muting pattern selection function, Sensor head diagnosis function and Muting lamp diagnosis function " (p.15~).
⑲	Terminal block connector area	For details, refer to " Terminal arrangement diagram " (p.10).

PRECAUTION FOR PROPER USE



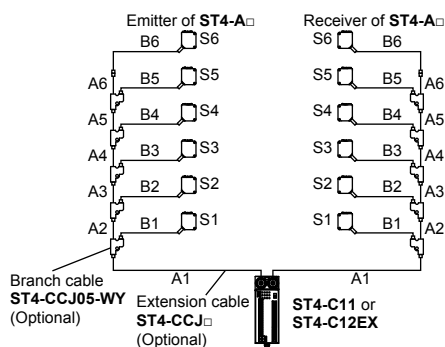
- When this device is used in the "PSDI Mode," an appropriate control circuit must be configured between this device and the machinery. For details, be sure to refer to the standards or regulations applicable in each region or country.
- To use this product in the U.S.A., refer to OSHA 1910.212 and OSHA 1910.217 for installation, and in Europe, refer to EN 999 as well. Observe your national and local requirements before installing this product.

- This catalog is a guide to select a suitable product. Be sure to read instruction manual of the product prior to its use.
- Make sure to use the sensor head and the controller together as a set.

- Make sure to carry out the test run before regular operation.
- This safety system is for use only on machinery in which the dangerous parts can be stopped immediately, either by an emergency stop unit or by disconnecting the power supply. Do not use this system with machinery which cannot be stopped at any point in its operation cycle.

When connecting multiple units of sensor head ST4-A□

- ST4-A□** can be connected up to six units per controller. Total cable length of **ST4-A□** should be 50 m **164.042 ft** or less (emitter and receiver, respectively).
Total cable length 50 m **164.042 ft** or less (emitter and receiver, respectively)
= A1 + A2 + A3 + A4 + A5 + A6 + B1 + B2 + B3 + B4 + B5 + B6



Address allocations of sensor head ST4-A□

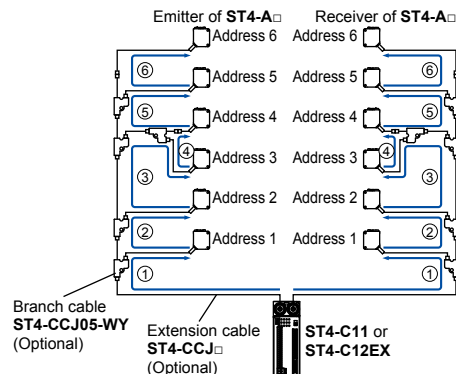
- In case of connecting multiple units of **ST4-A□**, addresses are automatically allocated to the newly connected units of **ST4-A□** in order starting from the unit closest to the controller (in the directions of the arrows in the following diagram).
- The corresponding emitter and receiver have the same address as shown in the following diagram.
- Automatic interference prevention function also operates on each address of the sensors, which prevents mutual interference among them.



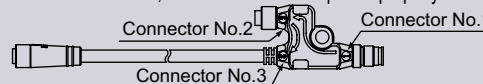
Take care that the emitter and the receiver of **ST4-A□** operate only in the combination of the same address.

<Connecting example>

- In case of branching between **ST4-A□** and **ST4-CCJ05-WY** when six units of **ST4-A□** are connected.



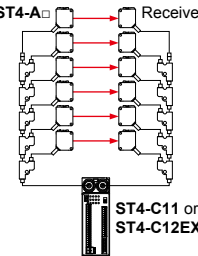
- Addresses of **ST4-A□** are allocated in order of the numbers that are marked on the main body of **ST4-CCJ05-WY** (optional).
- Make sure to connect **ST4-A□**s to the connector 2 and 3 of the **ST4-CCJ05-WY** (optional). If **ST4-A□**s are not connected to the connector 2 and 3, the device does not operate properly.



Interference prevention function

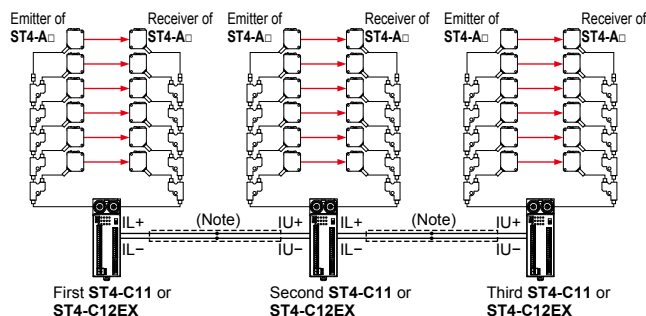
Interference prevention function when using one controller

- Up to six units of **ST4-A□** can be connected per controller, and mutual interference between **ST4-A□**s can be prevented by the automatic interference prevention function incorporated in the controller.



Interference prevention function when using two or more controllers

- Mutual interference between **ST4-A□**s (total of 18 units) can be prevented up to three units of controllers.
- Even if **ST4-C11** and **ST4-C12EX** are mixed, the interference prevention system can be constructed.



Note: Length of the cable that connects to the interference prevention terminal should be 1 m **3.281 ft** or less.

Self-diagnosis function

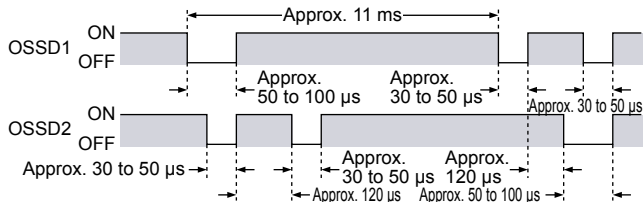
- The controller incorporates the self-diagnosis function.
- The self-diagnosis is carried out when the power is turned ON and during operation periodically.
- In case an abnormality is detected during self-diagnosis, the device will be in the lockout condition at that instant, and the control outputs (OSSD1, OSSD2) is fixed at the OFF condition.

PRECAUTION FOR PROPER USE

Output waveform [control outputs (OSSD1, OSSD2) ON]

- Since the controller performs the self-diagnosis of the output circuit when the sensor head is in light receiving status (ON status), the control outputs (OSSD1, OSSD2) become OFF status periodically.

<Time chart>



- When the OFF signal is fed back, the controller judges the output circuit as normal. When the OFF signal is not fed back, the controller judges either the output circuit or wiring as error, and the control outputs (OSSD1, OSSD2) maintain OFF status.



Since the OFF signal of this device might cause malfunction, perform the connection while paying attention to the input response time of the machine to be connected to this device.

Reset operation

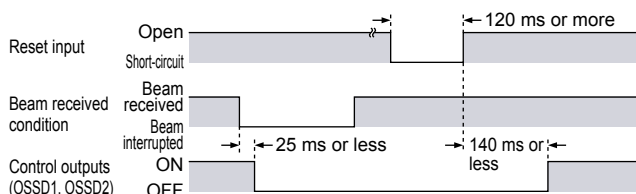
- The selection of manual / auto reset at interlock is available for the control outputs (OSSD1, OSSD2).

Terminal	Operation
X1-X2	Manual reset
X1-X3	Auto reset

Manual reset

- The control outputs (OSSD1, OSSD2) are not turned ON automatically even **ST4-A** receives the light beam.

<Time chart>



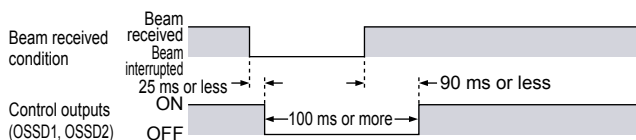
Auto reset

- The control outputs (OSSD1, OSSD2) turn ON automatically when **ST4-A** receives the light beam.



If this device is used with the auto-reset, avoid an auto-restart of the system after the control outputs (OSSD1, OSSD2) are stopped by using a safety relay unit, etc. (EN 60204-1)

<Time chart>

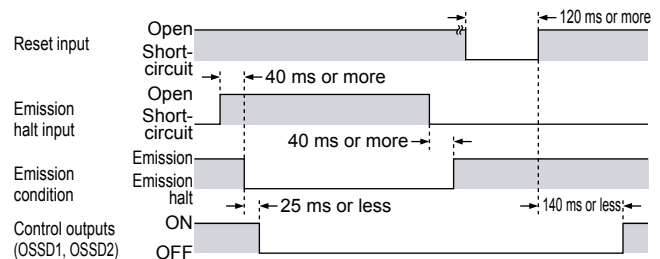


Emission halt function

- This function stops the emission process of the emitter of **ST4-A**.
- During emission halt, the control outputs (OSSD1, OSSD2) are OFF and the emission halt indicator (orange) lights up.
- By using this function, malfunction due to extraneous noise or abnormality in the control outputs (OSSD1, OSSD2) and the auxiliary outputs can be determined even from the equipment side.

Between T1 and T2	Operation
Open	Emission halt
Short-circuit	Emission

Time chart for manual reset



Do not use the emission halt function for the purpose of stopping the device. Failure to do so could result in death or serious injury.

Auxiliary outputs (Non-safety output)

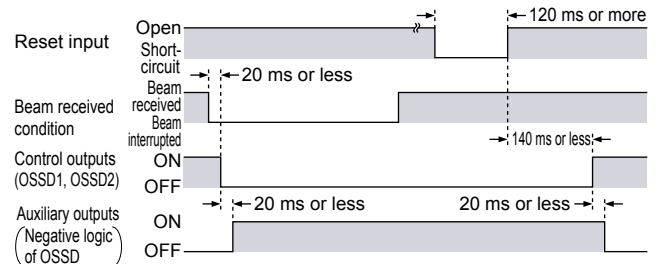
Auxiliary output operation of controller ST4-C11

Terminal	Auxiliary output operation
AUX	Negative logic of the control outputs (OSSD1, OSSD2)

Auxiliary output operation of multiple function controller

Terminal	Auxiliary output operation
AUX1	ON when muting function is invalid / OFF when muting function is valid
AUX2	ON when override function is invalid / OFF when override function is valid
AUX3	ON when muting lamp is in normal condition / OFF when muting lamp is in abnormal condition
AUX4	Negative logic of the control outputs (OSSD1, OSSD2)

<Time chart for manual reset>



Do not use the auxiliary outputs for the purpose of stopping the device. Failure to do so could result in death or serious injury.

PRECAUTION FOR PROPER USE

Muting function (Only for ST4-C12EX)



- Incorrect using of the muting control may cause accidents. Please understand the muting control fully, and use it. As for the muting control, the following international standards define the requirements.
ISO 13849-1: 2015 (EN 954-1: 2015 / JIS B 9705-1)
IEC 61496-1 (ANSI/UL 61496 / JIS B 9704-1)
IEC 60204-1 (JIS B 9960-1)
EN 415-4
ANSI B11.19-1990
ANSI/RIA R15.06-1999
- Use the muting control while the machine cycle is not in danger mode. Maintain safety with the other measure while the muting control is activated.
- For the application that the muting control is activated when an object passes through the sensor, place the muting sensor so that the conditions for the muting control cannot be satisfied by intrusion of personnel when the object is passing through the sensor or the object is not passing through it.
- The muting lamp should be installed in a position where it can always be seen by operators who set or adjust the machine.
- Be sure to check the operation of the muting function before its use. Furthermore, check the condition of the muting lamp (cleanliness or brightness, etc.).

- This function turns the safety function of **ST4-C12EX** into invalid temporarily.
- When the control outputs (OSSD1, OSSD2) are ON, this function is available for passing the object through the sensing area of the device without stopping the device.
- The muting function becomes valid when all the conditions listed below are satisfied:
 - The control outputs (OSSD1, OSSD2) shall be ON.
 - The incandescent lamp with 1 to 10 W shall be connected to the muting lamp output.
 - The muting inputs between S-A and S-B (between S-C and S-D, or between S-E and S-F) shall be changed from OFF (open) to ON. The time difference from OFF to ON shall be 0 to 3 sec.
- However, if exceeding 180 sec. time limit, the muting function will be invalid. In addition, the muting valid time can also be changed to unlimited. For details on the setting method, refer to the "**Muting pattern selection function**" (p.15).
- The following devices, photoelectric sensor with semiconductor output, inductive proximity sensor, position switch on NO (Normally Open) contacting point, etc. are available for applying to the muting sensor.

Specification for muting sensor

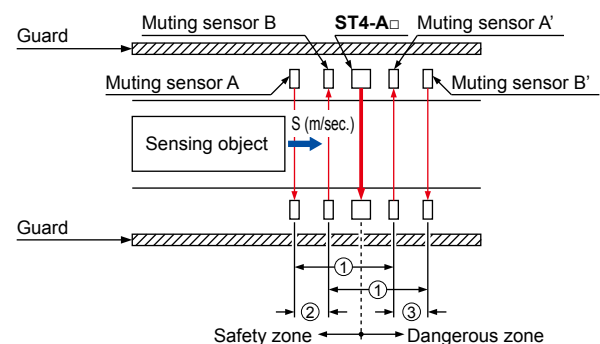
	Muting input terminals S-A, S-C, S-E		Muting input terminals S-B, S-D, S-F	
	When ON	When OFF	When ON	When OFF
Dark-ON condition (photoelectric sensor, etc.) Normally open (inductive proximity sensor, etc.) ON with object contacted condition (position switch, etc.)	+V (S+ terminals)	Open	0 V (S- terminals)	Open



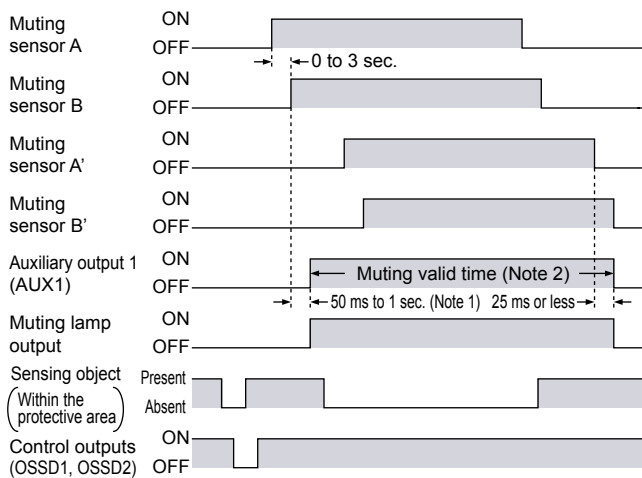
- Be sure to use the muting sensor that satisfies the "**Specification for muting sensor**" above. If using the other muting sensor not satisfying the specification above, the muting function might become valid with the timing that the machine designer cannot expect and could result in death or serious injury.
- Make sure to connect the muting lamp and activate the muting lamp diagnosis function. For the muting lamp diagnosis function, refer to "**Muting lamp diagnosis function**" (p.16).
- It is recommended that two muting lamps should be connected in parallel. In this case, take care not to exceed 10 W.

- The muting function can be used continuously even if after making the muting lamp diagnosis function invalid. However, in case of not activating the muting lamp diagnosis function, perform the risk assessment and confirm the standards or regulations applicable in each region or country before using the muting function. For details, refer to "**Muting lamp diagnosis function**" (p.16).

Installation condition example of muting sensor



- ① Shorten the distances between muting sensors A to A' and between B to B' than the whole length of the sensing object.
- ② The moving speed [S (m/sec.)] of the sensing object to be passed through the muting sensors A to B shall be under 3 sec.
Distance between A and B < S × 3 (sec.)
- ③ The moving speed [S (m/sec.)] of the sensing object to be passed through the muting sensors A' to B' shall be under 3 sec.
Distance between A' and B' < S × 3 (sec.)
- ④ The muting sensors A and A' are the PNP output type sensors.
The muting sensors B and B' are the NPN output type sensors.

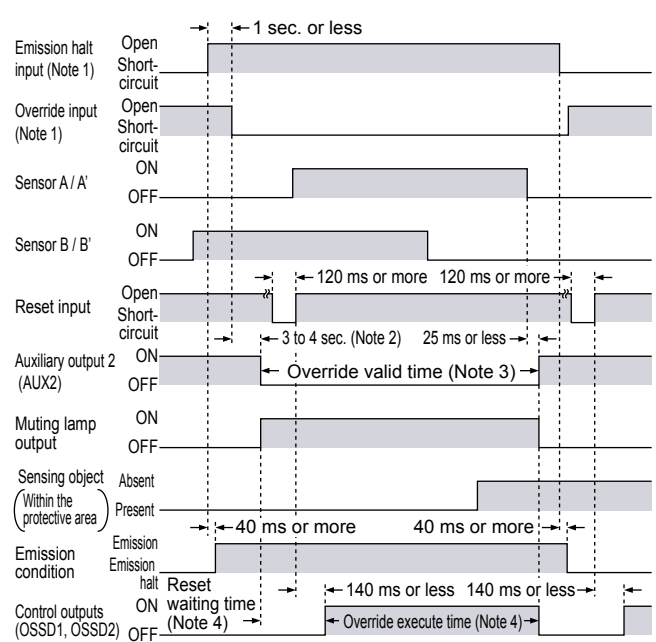
PRECAUTION FOR PROPER USE**<Time chart>**

- Notes: 1) This is when the muting lamp diagnosis function is valid. If the muting lamp does not light up even if 1 sec. is passed, the muting function becomes invalid. When the muting lamp diagnosis function is invalid, the muting function becomes valid 50 ms after the input conditions of the muting sensor A (A') and B (B') were satisfied.
For setting the muting lamp diagnosis function, refer to "**Muting lamp diagnosis function**" (p.16).
- 2) The muting time can be set to 180 sec. or no time restriction.
For the setting method, refer to "**Muting pattern selection function**" (p.15).

Override function (Only for ST4-C12EX)

- The override function forcibly turns the safety function of **ST4-C12EX** into invalid.
- This function is used for the following cases: when the customer who uses the muting function needs to start the device with the control outputs (OSSD1, OSSD2) be OFF status, when the device is required to continue operating even though the muting sensor becomes valid after the muting sensor is turned ON at the starting of line.
- The override function becomes valid when all the conditions listed below are satisfied:
 - The incandescent lamp with 1 to 10 W shall be connected to the muting lamp output.
 - The signal shall be input to either or both of the muting inputs between S-A and S-B (between S-C and S-D, or S-E and S-F).
- The emission halt input shall be opened and the override input shall be short-circuited within 1 sec. (3 sec. continuously).
- If one of the three conditions above becomes invalid or exceeds the override valid time 60 sec. or 600 sec. (Note), the override function becomes invalid.
- The override function is disabled for all sensor heads which are connected to the **ST4-C12EX**. If the muting area is divided into two areas, be sure to design the installation to maintain safety for both areas.

Note: For setting the valid time of override, refer to "**Muting pattern selection function**" (p.15).

<Time chart for manual reset>

- Notes: 1) The override function turns ON when either opening the emission halt input, or short-circuiting the override input, whichever operates first.
- 2) This is when the muting lamp diagnosis function is valid. If the muting lamp does not light up even if 4 sec. is passed, the override function becomes invalid. When the muting lamp diagnosis function is invalid, the muting function becomes valid 3 sec. after the input conditions of the muting sensor A (A') and B (B') were satisfied. For setting of the muting lamp diagnosis function, refer to "**Muting lamp diagnosis function**" (p.16).
- 3) Override time can be set to either 60 sec. or 600 sec.
For setting, refer to "**Muting pattern selection function**" (p.15).
- 4) Total time of the reset waiting time and the override execute time is the override valid time. The override function will not be performed until the reset waiting time is passed after the override condition is satisfied (after starting the override valid time).

Muting pattern selection function (Only for ST4-C12EX)

- The muting pattern and the valid time of the muting / override can be set with the setting switches "SW1 to SW4".



Make sure to turn OFF the power when setting the muting pattern.

Even if setting the muting pattern while power is ON, it will be invalid.

Muting pattern No.	Valid time			
	Muting	Override	Muting	Override
	180 sec.	60 sec.	No time restriction	600 sec.
1				
2				
3				

Note: If other than the above muting pattern is set, the device will be in lockout condition, and an error will be indicated on the fault display (red).

PRECAUTION FOR PROPER USE

Control condition of muting pattern (Only for ST4-C12EX)

- Muting control can be selected from three patterns. Muting patterns which conform to ISO 12643 (safety requirements for graphic technology equipment and systems) are provided.
- For actual examples of use, refer to p.5.

Number: address (Note), 6 → 5: Muting condition

Pattern No.	Muting input terminals	No. of connected ST4-A□					
		6 sets	5 sets	4 sets	3 sets	2 sets	1 set
Pattern No. 1	ON between S-A and S-B						Invalid
	ON between S-C and S-D						Invalid
	ON between S-E and S-F						Invalid
Pattern No. 2	ON between S-A and S-B						Invalid
	ON between S-C and S-D						Invalid
	ON between S-E and S-F						Invalid
Pattern No. 3	ON between S-A and S-B						Invalid
	ON between S-C and S-D						Invalid
	ON between S-E and S-F						Invalid

Note: For details on addresses, refer to "Address allocations of sensor head **ST4-A□**" (p.12).

Sensor head diagnosis function (Only for ST4-C12EX)

- Beam received / interrupted condition of the connected **ST4-A□**, or sensor fault can be checked by **ST4-C12EX**. When **ST4-A□** is in the beam received condition, the muting input indicator (orange) lights up. However, the muting input indicator (orange) remains OFF if **ST4-A□** is in the beam interrupted condition or **ST4-A□** is not connected. The relation between addresses of **ST4-A□** and the muting input indicator (orange) is as follows.

	Normal operation	When the sensor diagnosis function is valid
Setting switch "SW5"		
Muting input indicator (Orange)	S-A ○ ○ S-B S-C ○ ○ S-D S-E ○ ○ S-F	Address 4 ○ ○ Address 1 Address 5 ○ ○ Address 2 Address 6 ○ ○ Address 3

Note: For details on addresses, refer to "Address allocations of sensor head **ST4-A□**" (p.12).

Muting lamp diagnosis function (Only for ST4-C12EX)

- The status of the indicator is checked while muting is in progress, and if the lamp is blown, auxiliary output 3 (AUX3) is set to OFF.
- If the lamp is blown, the muting status is canceled immediately.
- It is possible to nullify the muting lamp diagnosis in this function.
The muting function is available continuously even when the muting lamp is not connected.
- To nullify the muting lamp diagnosis function, turn OFF the power once, and turn ON the setting switch "SW8", then turn ON the power again.



Make sure to turn OFF the power in order to set the muting lamp diagnosis function.

	Muting lamp diagnosis function	
	Valid	Invalid
Setting switch "SW8"		

Sensing area



- Be sure to install protection structure around the machine so that the operator must pass through the sensing area of this device to reach the dangerous parts of the machine. Failure to do so can result in death or serious injury.
- Do not use any reflective type or retroreflective type arrangement.
- Installing multiple sets of this device produces a non-sensing area or causes mutual interference, which may result in death or serious injury.

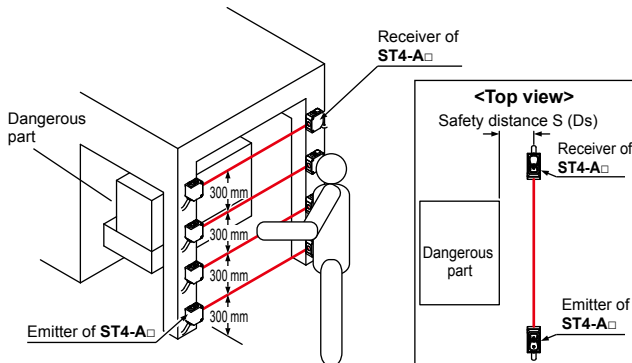


Calculate the safety distance correctly, and always maintain the distance which is equal to or greater than the safety distance, between the sensing area of this device and the dangerous parts of the machine. If the safety distance is miscalculated or if sufficient distance is not maintained, the machine will not stop quickly before reaching to the dangerous parts, which can result in death or serious injury.

PRECAUTION FOR PROPER USE

- The safety distance is the minimum distance that must be maintained between the **ST4-A□** and the dangerous parts of the machine so that the machine can be stopped before a human body or an object can reach the dangerous parts.
- The safety distance is calculated based on the equation described in the next page when a person moves perpendicular to the sensing area of the area sensor.

<When installing four units of ST4-A□>



Before designing the system, refer to the relevant standards of the region where this device is to be used, and then install this device. Furthermore, the equation described in the following is to be used only in case the intrusion direction is perpendicular to the sensing area. In case the intrusion direction is not perpendicular to the sensing area, be sure to refer to the relevant standard (regional standard, specification of the machine, etc.) for details of the calculation.



The max. response time of the machine is from the point that the machine receives the halt signal from this device to the point that the dangerous part of the machine stops. The max. response time of the machine should be timed with the machine to be actually used.

For use in Europe (EU) (as per EN 999) (Also applicable to ISO 13855)

- Equation ① $S = K \times T + C$
S: Safety distance (mm)
Minimum required distance between the sensing area surface and the dangerous parts of the machine
- K: Intrusion velocity of operator's body or object (mm/sec.)
Taken as 1,600 (mm/sec.) for calculation
- T: Response time of total equipment (sec.)
 $T = T_m + T_{ST4}$
T_m: Maximum halting time of device (sec.)
T_{ST4}: Response time of this device (sec.)
- C: Additional distance (mm)
EN 999 recommends the height of beam axis and the additional distance as shown in the table below.

No. of sensor heads	1 set	2 sets	3 sets	4 sets
Height of beam axis (e.g. Height from the floor) [mm]	750	400 900	300 700 1,100	300 600 900 1,200
Setup example				
C [mm]	1,200	850	850	850

<In case four units of ST4-A□ are installed>

- Equation ① $S = K \times T + C$
S: Safety distance (mm)
Minimum required distance between the sensing area surface and the dangerous parts of the machine
- K: Intrusion velocity of operator's body or object (mm/sec.)
Taken as 1,600 (mm/sec.) for calculation
- T: Response time of total equipment (sec.)
 $T = T_m + T_{ST4}$
T_m: Maximum halting time of device (sec.)
T_{ST4}: Response time of this device (sec.)
- C: 850 (mm)

For use in the United States of America (as per ANSI/RIA R15.06)

- Equation ② $D_s = K \times T + D_{pf}$
D_s: Safety distance (mm)
Minimum required distance between the sensing area surface and the dangerous parts of the machine
- K: Intrusion speed {Recommended value in OSHA is 63 (inch/sec.) [≈ 1,600 (mm/sec.)]}
ANSI/RIA R15.06 does not define the intrusion speed "K". When determining K, consider possible factors including physical ability of operators.
- T: Response time of total equipment (sec.) including OFF response time of this device: 25 ms.
- D_{pf}: Additional distance calculated from the size of the minimum sensing object of the sensor (mm)
(ANSI/RIA R15.06 stipulates the installation requirements as follows.)

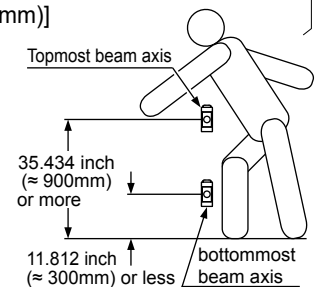
Since the calculation above is performed by taking 1 (inch) = 25.4 (mm), there is a slight difference between the representation in (mm) and that in (inch). Refer to the relevant standard for details.

<In case of an application to "REACH OVER">

- Installation requirements

Detectable minimum sensing object:
2.52 (inch) [≈ 64 (mm)] or more,
and under 23.623 (inch) [≈ 600 (mm)]
Bottommost beam axis: 11.812 (inch) [≈ 300 (mm)] or less
Topmost beam axis: 35.434 (inch) [≈ 900 (mm)] or more
D_{pf}: 47.245 (inch) [≈ 1,200 (mm)]

$$D_s = K \times T + D_{pf} = 63 \times T + 47.245 \text{ (inch)}$$



PRECAUTION FOR PROPER USE

<In case of an application to "REACH THRU">

• Installation requirements

Detectable minimum sensing object:

2.52 (inch) [≈ 64 (mm)] or more,
and under 23.623 (inch) [≈ 600 (mm)]

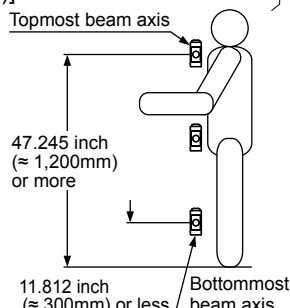
Bottommost beam axis: 11.812 (inch) [≈ 300 (mm)] or less

Topmost beam axis: 47.245 (inch) [≈ 1,200 (mm)] or more

Dpf: 35.434 (inch) [≈ 900 (mm)]

$$D_s = K \times T + D_{pf}$$

$$= 63 \times T + 35.434 \text{ (inch)}$$

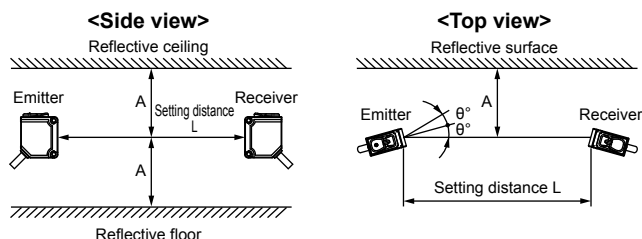


Influence of reflective surfaces



If there exists a reflective surface in the place where this device is to be installed, make sure to install this device so that reflected light from the reflective surface does not enter into the receiver, or take countermeasures such as painting, masking, roughening, or changing the material of the reflective surface, etc. Failure to do so may cause the device not to detect, resulting in death or serious injury.

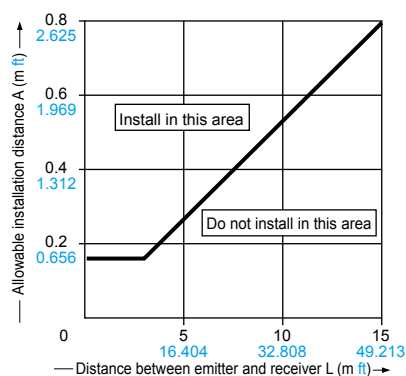
- Install this device at a distance of at least A (m) (given below) away from reflective surfaces such as metal walls, floors, ceilings, objects, covers, panels or glass surfaces.



Distance between emitter and receiver (Setting distance L)	Allowable installation distance A
0.1 to 3 m 0.328 to 9.843 ft	0.16 m 0.525 ft
3 to 15 m 9.843 to 49.213 ft	$L/2 \times \tan 2\theta = L \times 0.053 \text{ (m)}$ 0.174 (ft) ($\theta = 3^\circ$)

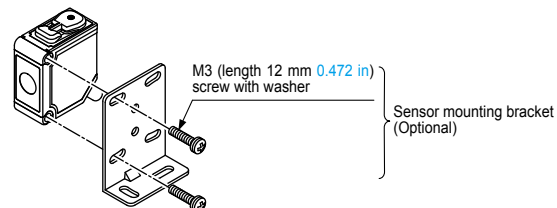
Note: The effective aperture angle for this device is $\pm 2.5^\circ$ (when $L > 3 \text{ m}$ **9.843 ft**) as required by IEC 61496-2 / , ANSI/UL 61496-2. However, install this device away from reflective surfaces considering an effective aperture angle of $\pm 3^\circ$ to take care of beam misalignment, etc. during installation.

<Allowable installation distance between reflective surfaces and beam axis of receiver>

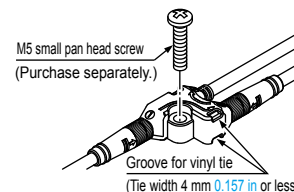


Mounting

- When mounting the sensor head, the tightening torque should be 0.5 N·m or less.



- When mounting **ST4-CCJ05-WY**, the tightening torque should be 0.7 N·m or less. Using a vinyl tie (width 4 mm **0.157 in** or less) to fix the cable is also possible.



Wiring

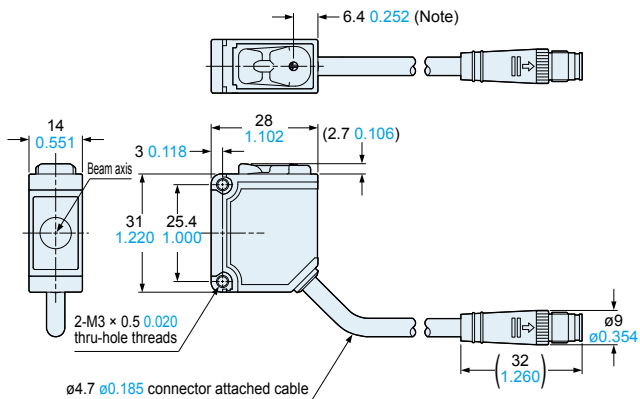


Refer to the applicable regulations for the region where this device is to be used when setting up the device. In addition, make sure that all necessary measures are taken to prevent possible dangerous operating errors resulting from earth faults.

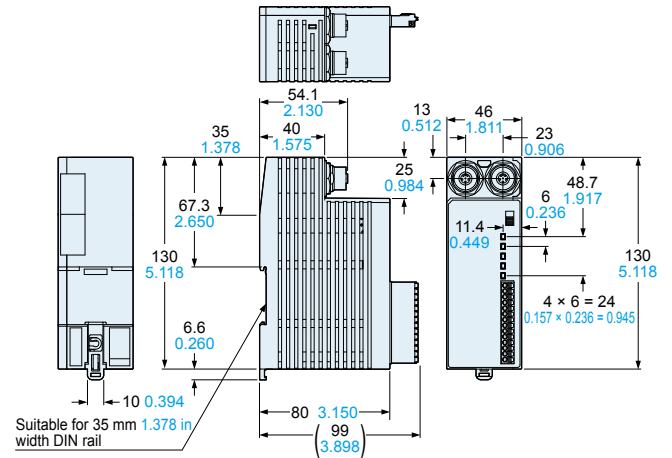
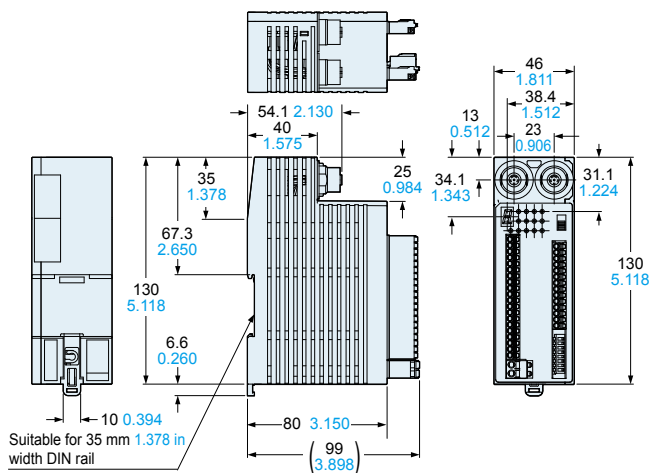
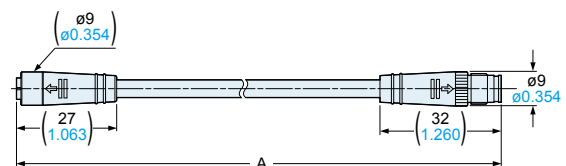
- Make sure to carry out the wiring in the power supply off condition.
- Verify that the supply voltage variation is within the rating.
- If power is supplied from a commercial switching regulator, ensure that the frame ground (F.G.) terminal of the power supply is connected to an actual ground.
- In case noise generating equipment (switching regulator, inverter motor, etc.) is used in the vicinity of this sensor and controller, connect the frame ground (F.G.) terminal of the equipment to an actual ground.
- Do not run the wires together with high-voltage lines or power lines or put them in the same raceway. This can cause malfunction due to induction.
- It is recommended that the following single wires or twisted wires (lead wires) be used to connect to the terminal block of the controller.
 - Terminal block connector: 0.2 to 1.5 mm² (AWG24 to AWG16)
 - Power supply connector (A1, A2) (**ST4-C12EX** only): 0.2 to 2.5 mm² (AWG24 to AWG12)

Others

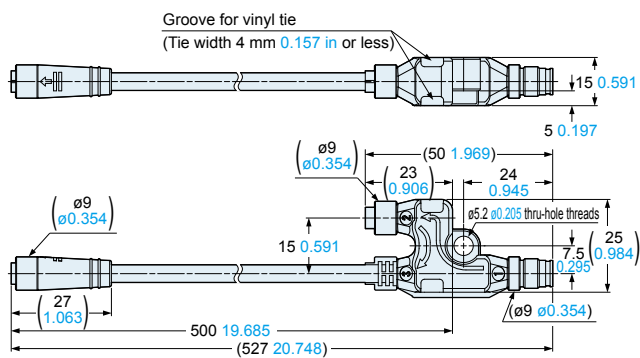
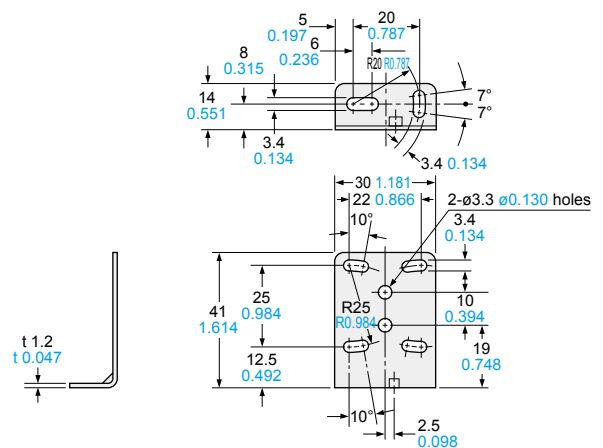
- This device has been developed / produced for industrial use only.
- Do not use this device with mobile equipment such as an automated guided vehicle (AGV).
- Do not use during the initial transient time (2 sec.) after the power supply is switched on.
- Avoid dust, dirt and steam.
- Take care that the sensor does not come in direct contact with water, oil, grease, or organic solvents, such as, thinner, etc.
- Take care that the sensor is not directly exposed to fluorescent lamp from a rapid-starter lamp or a high frequency lighting device, as it may affect the sensing performance.
- This product is suitable for indoor use only.
- The DC power supply unit must satisfy the conditions given below.
 - 1) Power supply unit authorized in the region where this devices is to be used.
 - 2) Power supply unit conforming to EMC Directive and Low-voltage Directive (In case CE marking conformity is required).
 - 3) Power supply unit conforming to EMC Regulations and Low voltage Regulations (In case UKCA marking conformity is required).
 - 4) Power supply unit conforming to the Low-voltage Directive and with an output of 100 VA or less.
 - 5) The frame ground (F.G.) terminal must be connected to ground when using a commercially available switching regulator.
 - 6) Power supply unit with an output holding time of 20 ms or more.
 - 7) If surges are likely to occur, take countermeasures such as connecting a surge absorber to the origin of the surge.
 - 8) Power supply unit corresponding to Class 2 (In case UL / cUL conformity is required).

DIMENSIONS (Unit: mm in)**ST4-A□****Sensor head**

Note: It indicates the position of the emission amount adjuster on **ST4-A□V**.

ST4-C11**Controller****ST4-C12EX****Controller****ST4-CCJ□****Extension cable (Optional)**

Model No.	A
ST4-CCJ1□	1,000 39.370
ST4-CCJ3□	3,000 118.110
ST4-CCJ5□	5,000 196.850
ST4-CCJ7□	7,000 275.590
ST4-CCJ15□	15,000 590.550

ST4-CCJ05-WY**Branch cable (Optional)****MS-CX-1****Sensor head mounting bracket (Optional)**

Material: Stainless steel (SUS304)

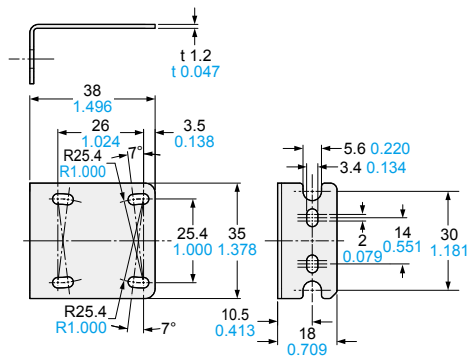
Two M3 (length 12 mm (0.472 in) screws with washers are attached.

DIMENSIONS (Unit: mm in)

The CAD data can be downloaded from our website.

MS-ST4-3

Sensor head mounting bracket (Optional)

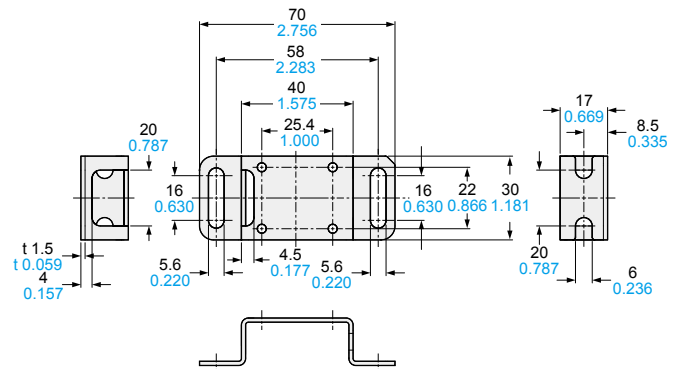


Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.

MS-ST4-6

Sensor head mounting bracket (Optional)



Material: Stainless steel (SUS304)

Two M3 (length 12 mm 0.472 in) screws with washers are attached.

Disclaimer

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