Light the Way to Your Safety
Safety Light Curtains

SFL/SFLA Series

Safety light curtains are installed in potentially dangerous or hazardous areas or machines to safeguard personnel from injury. Operation of potentially dangerous machines are turned off when an object or person is detected between the emitter and receiver. The light curtains feature proven technology from Autonics area sensors and mapping sensors. The light curtains are built to meet international safety standards and regulations. Various detection models and safety functions are available to protect your safety diverse applications.

Safety Standards

IEC/EN 61508 (SIL 3)
IEC/EN 62061 (SIL CL 3)
EN/IEC 61496-1/2 (Type 4, A.O.P.D., E.S.P.E.)
ISO 13849-1/2 (Cat. 4, PL e)

Certifications

CE UKCA TÜV NORD c(UL)us LISTED (S) KCs

K-DESIGN AWARD'19 GOLD
GOOD DESIGN KOREA 2019
PIN UP 2018

Various Models Available for Flexible Applications

The SFL/SFLA series safety light curtains are available in various models for flexible application. The light curtains are available in various product heights, beam pitch size (9 mm/15 mm/25 mm) for installation in diverse environments. The light curtains can be expanded to 4 sets and 400 beams for application in larger scale industrial environments.

1. Various Detection Type Models

Finger detection, hand detection, hand-body detection models are available for application in diverse user environments.

Finger detection type
- Beam pitch : 9 mm
- Minimum detection size : Ø14 mm

Hand detection type
- Beam pitch : 15 mm
- Minimum detection size : Ø20 mm

Body detection type
- Beam pitch : 25 mm
- Minimum detection size : Ø30 mm

SFL Series (Standard Type)

|	Finger	Hand	Body
Sensing distance (Long mode)	0.2 to 10 m	0.2 to 15 m	0.2 to 15 m
Detection capability	Ø 14 mm	Ø 20 mm	Ø 30 mm
Optical axis pitch	9 mm	15 mm	25 mm
Number of beams	15 to 111 ea	12 to 68 ea	42 to 75 ea
Protection height	144 to 1,008 mm	183 to 1,023 mm	1,043 to 1,868 mm

SFLA Series (High Performance Type)

	Finger	Hand	Body
Sensing distance (Long mode)	0.2 to 10 m	0.2 to 15 m	0.2 to 15 m
Detection capability	Ø 14 mm	Ø 20 mm	Ø 30 mm
Optical axis pitch	9 mm	15 mm	25 mm
Number of beams	15 to 199 ea	12 to 124 ea	9 to 75 ea
Protection height	144 to 1,800 mm	183 to 1,863 mm	218 to 1,868 mm

2. Various Protection Height

Various models are available by protection height (144 mm to 1,868 mm), offering options for diverse equipment sizes

1,868 mm
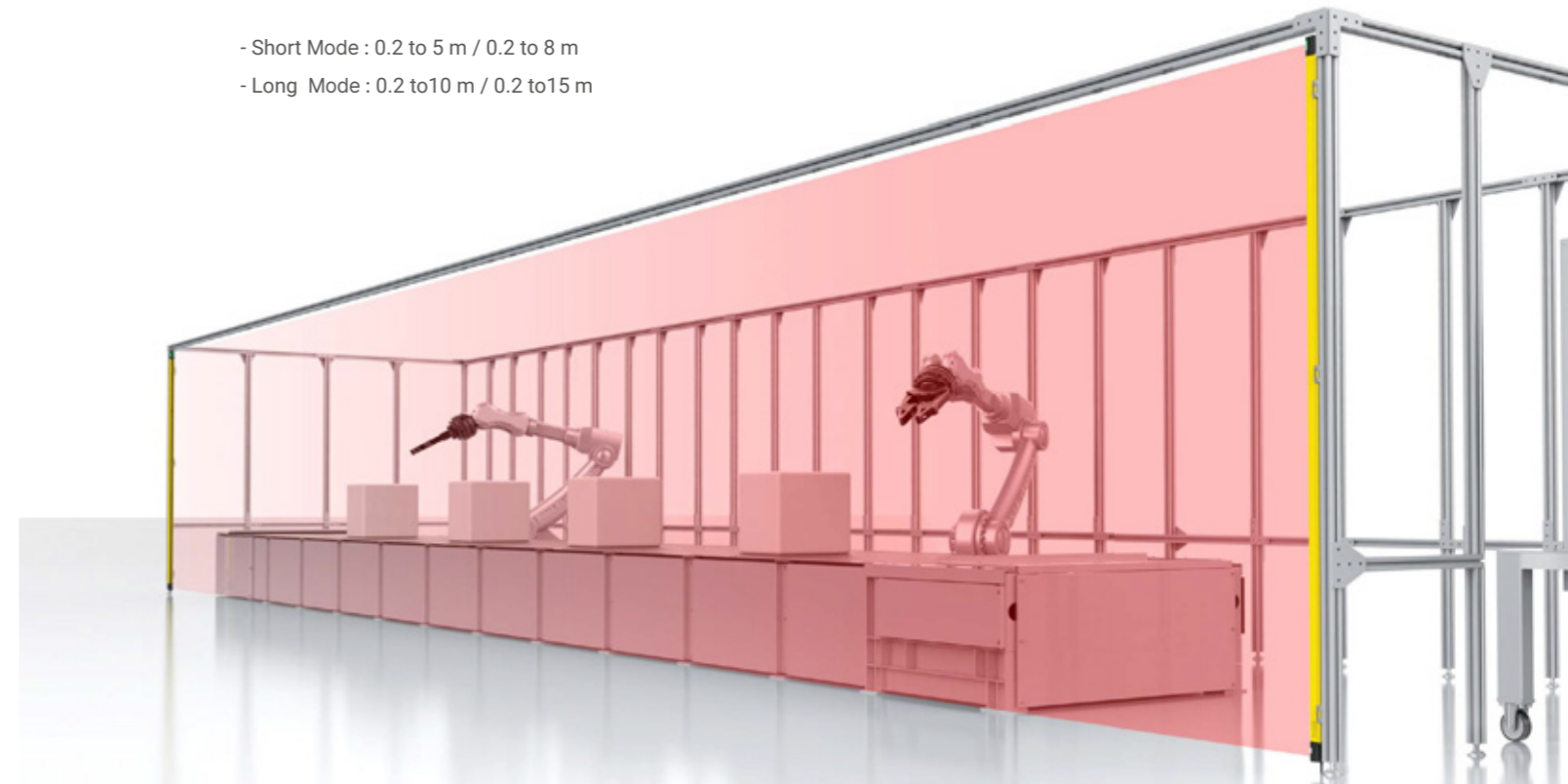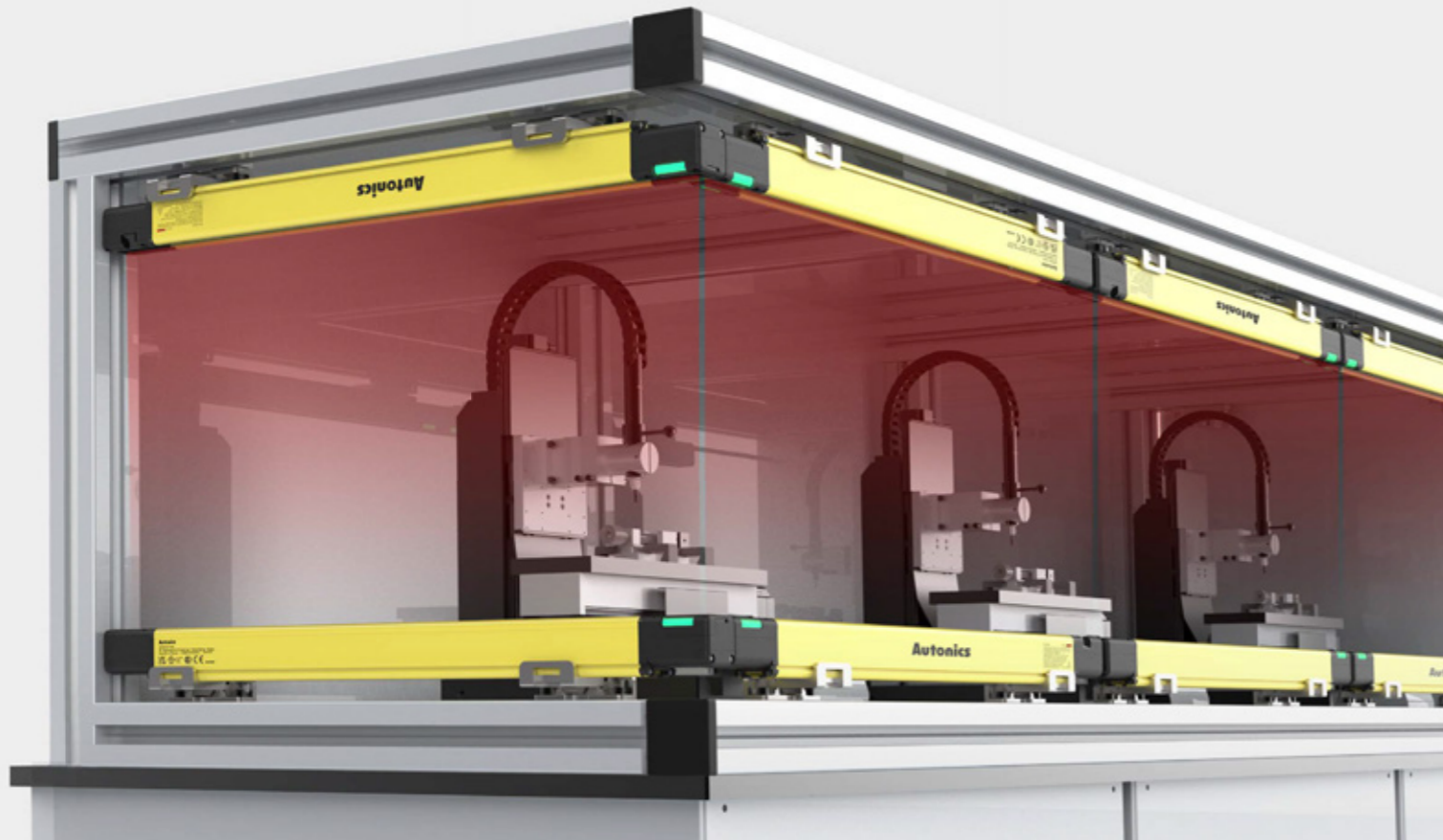
144 mm
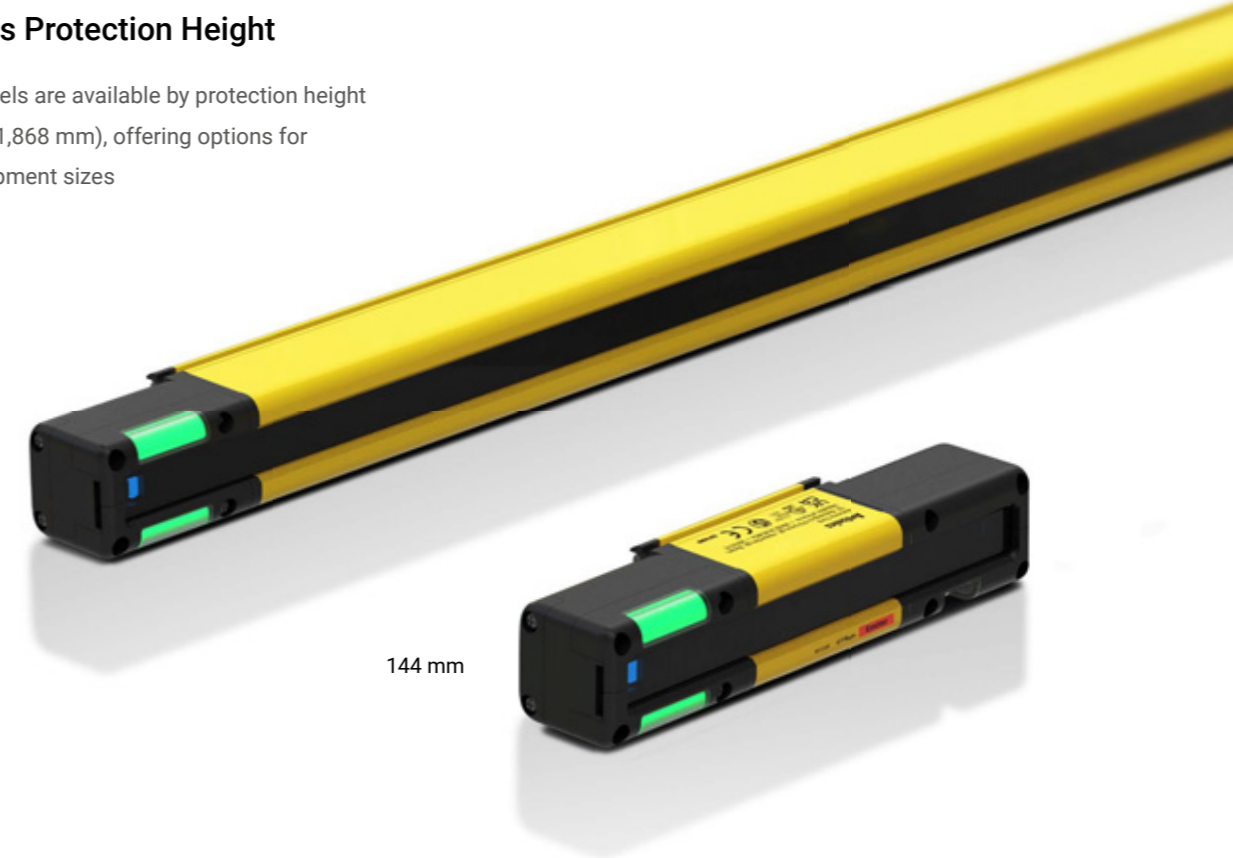
3. Long Sensing Distance

Long sensing distance (15 m) allows wider area of detection. The sensors can be set to short/long mode depending on user needs.

- Short Mode : 0.2 to 5 m / 0.2 to 8 m
- Long Mode : 0.2 to10 m / 0.2 to15 m

High Durability and Environmental Performance

The SFL/SFLA series is designed with hardened casing and screen protection for application in harsh conditions. The light curtains can be installed in environments with impact, dust, or moisture.

1. Robust Body Housing

The robust body housing allows stable operation in harsh conditions with sudden impact.

2. Window Screen Protection

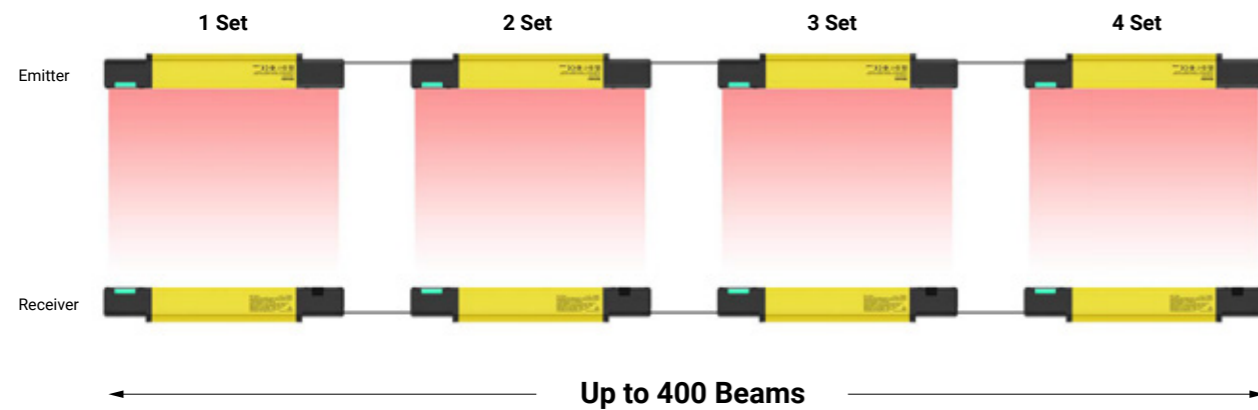The narrow window screen with protection minimizes the chance of impact to the sensing areas.

4. Expand up to 400 Beams

The SFLA series light curtains can be expanded up to 4 sets and 400 beams with serial expansion cables. Multiple light curtains can be controlled using a single connection line, offering easier wiring, installation, and design planning.

Also, the mutual interference protection ensures that there is no signal interference between the connected units. If an error is detected in a single unit, all connected units will enter into lockout state.
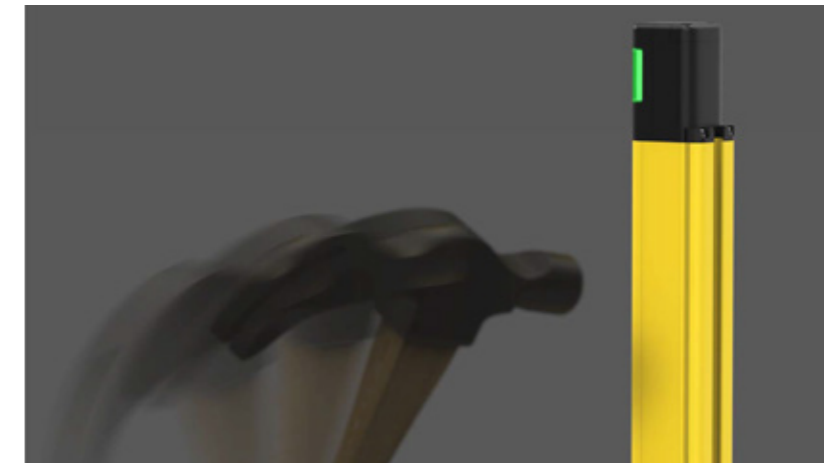
⁕ SFL series: expand up to 3 sets and 300 beams

3. IP65/IP67/IP67G/IP69K Protection Rating

IP65/IP67/IP67G/IP69K protection structure allows the units to be safely applied in environments with dust or water.

Serial Expansion Connection (SFLA Series)

1 Set   2 Set   3 Set   4 Set

Emitter

Receiver

Up to 400 Beams

Easy Status Check with Indicators

The SFL/SFLA series is designed to provide a sense of safety to users. The large operation indicators offer minimal blind spots, and operators can easily check the status of the light curtains in real-time, ensuring safety of both personnel and machines.

1. Top Control Output Indicator

The top control output indicator shows various output status including output ON/OFF, muting/override status, lockout status etc. The indicator is located on the top corner of the unit, which make it highly visible from any angle.

2. Status Display

The 7-segment status display shows various operation status of the unit using alphabet or numbers. Users can check various status including error status, communication status, warning conditions, etc.

Status Display Description

Location	Operation	Display		Description
Emitter / Receiver	PC connection (download)	P	Flashing	Flashes when downloading the setting information.
	Communication error	C	Flashing	Flashes when RS485 communication error occurs.
	Error condition	E	Flashing	Flashes when entering the lockout condition.
	Warning condition	A	Flashing	Flashes when in a warning condition.
Emitter	Default condition	0	ON	Displays when function is deactivated.
	Blanking	b	ON	Displays when the blanking function is activated.
	Muting	n̄	ON	Displays when in the muting state.
	Override	o	ON	Displays when in the override state.
	Reset-hold	H	ON	Displays when waiting for reset-hold input.
	Reduced resolution	r	ON	Displays when the reduced resolution function is activated.
Receiver	Light incident	0~9	ON	Displays the sensitivity level of beams with the lowest light incident (0 to 9).

1 **Top beam indicator** lights up top beam is received
2 **Top control output indicator** lights up or flashes depending on control output
3 **Power/lockout indicator** lights up when powered on or normal operation
4 **Bottom beam indicator** lights up when bottom beam is received
5 **Frequency indicator** lights up with frequency B setting / turned off with frequency A setting
6 **External test indicator** lights up when external test signal is applied
7 **Interlock indicator** lights up when during interlock state
8 **EDM indicator** lights up with EDM input
9 **NPN/PNP indicator** lights up with NPN setting/turned off with PNP setting
10 **Control output indicator** green light when output ON, red light when output OFF
**11** **Status display** indicates operation status

3. Beam Indicator

The LED beam indicator turns blue when the beam is received normally, and turns off when the light is blocked.
The LED turns red when ambient light is received. The indicator allows easy installation and setting, and also provides users with visual indication of errors.

1) Check Installation

The indicator can detect misalignment of emitter and receiver in real-time, allowing easier installation and setting.
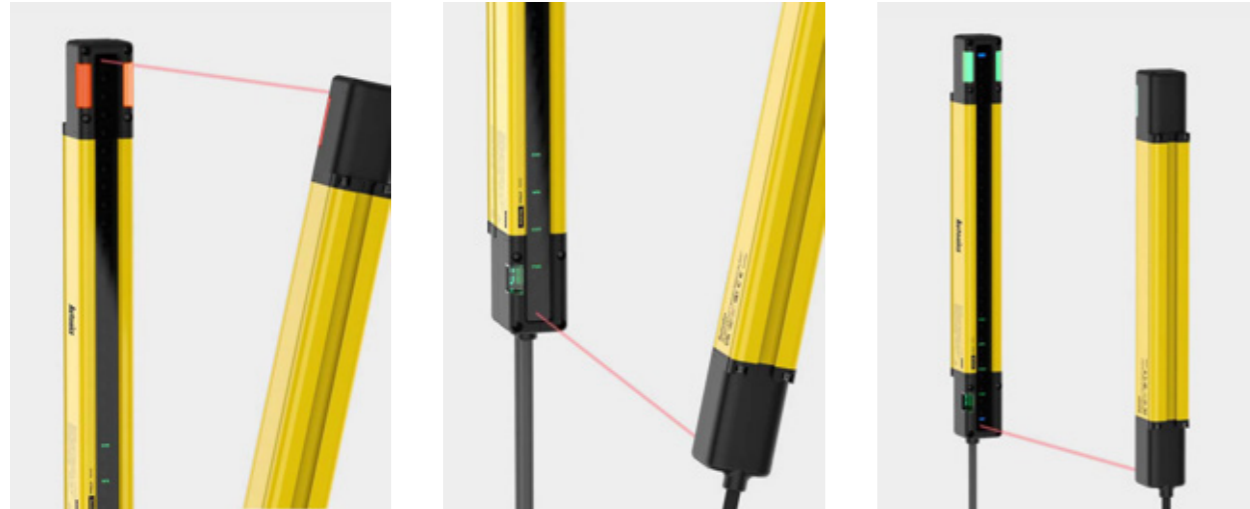
❶ Align the top beam

❷ Align the bottom beam

❸ If the LED indicator turns blue, the beams have been aligned normally.

2) Check Light Sensitivity

The sensitivity reduction alarm is activated if the amount of light received changes due to vibration, heating, distortion, or other factors preventing problems in advance.
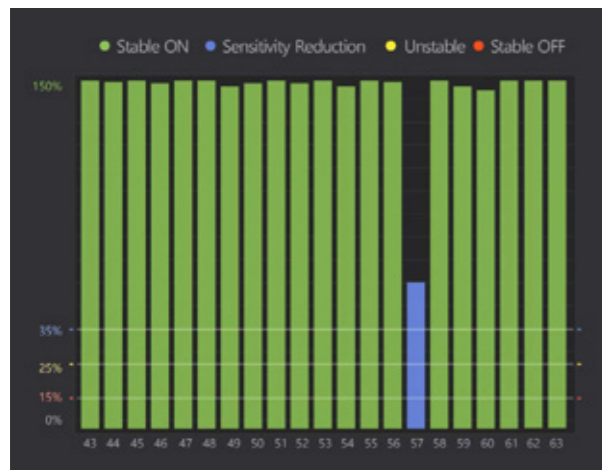
※ Light level over 30%: blue LED ON / light level over 15%: blue LED flashing / light level under 15%: blue LED OFF

3) Check Ambient Light

Ambient light alarm is activated if external ambient light is detected or if emitter/receiver operation timing is affected. (Ambient light algorithm)

Easy Installation

The SFL/SFLA series features easy installation. Standard and adjustable brackets are available and can be installed on top, bottom, or middle of the units. The adjustable brackets can be adjusted by 15 degrees to right or left for easier installation.

One-Touch Bracket

The push-to-install one-touch method allows easier installation.
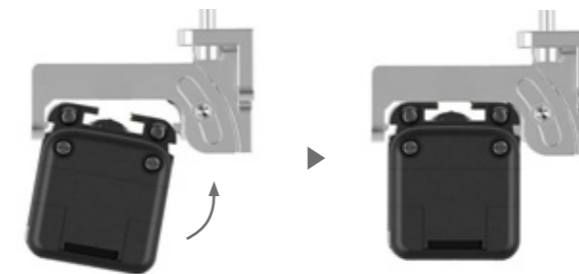
Adjustable Brackets

The adjustable brackets can be adjusted by 15 degrees to right or left after installation for easier setting.
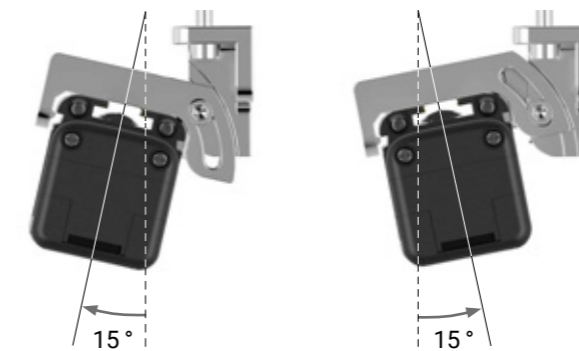
Brackets by Light Curtain Length

Brackets \ Length	Max. 1 m	Min. 1 m
Top/Bottom adjustable bracket (BK-SFL-TBA)	Requires 2 brackets	Unavailable
Top/Bottom bracket (BK-SFL-TBF)		
Side adjustable bracket (BK-SFL-SA)	Requires 2 brackets	Requires 3 brackets
Side bracket (BK-SFL-SF)		

Safety Light Curtain Software, atLightCurtain

atLightCurtain is a dedicated software for SFL/SFLA series safety light curtains to monitor operation status and set functions Users can set various safety-related functions including muting, blanking from the parameter menu and monitor various operation status including light amount, connection, and errors.

※ Detailed settings and features may not be available on standard type SFL series.

1. User-Oriented Graphic Interface

The atLightCurtain software screen features ribbon menus with status display, monitoring, and setting screens.
The intuitive icons and user-oriented interface allows even novice users to easily operate the software. The setting and monitoring screens can be expanded to show diverse range of information.

1 **Ribbon menu**   main software functions
2 **Status display screen**   product information and operation status
3 **Monitoring and setting screen**   product connection and monitoring information, safety functions
4 **Monitoring**   light level by beam, connection, errors/alarms, etc.
5 **Safety-related functions**   model settings, muting, blanking, and other settings

2. Various Safety-Related Functions

Industrial settings vary greatly by size and type, and potential dangers can occur from various environmental factors. Users can set muting, blanking, and other safety-related functions on the SFLA series with the atLightCurtain software.
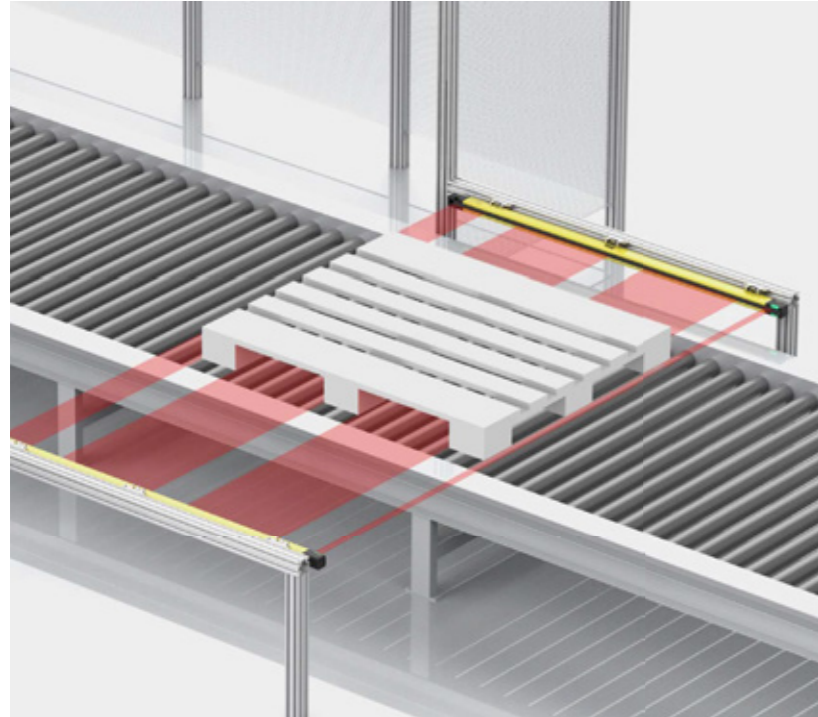
1) Reduced Resolution

Reduced resolution is a function for changing the detection capability of the light curtain. It prevents the control output from turning OFF when an object moving through the light curtain is smaller than the designated size. Reduced resolution can be set for all areas within the detection area, and up to 3 beams can be set to be ignored.

2) Muting

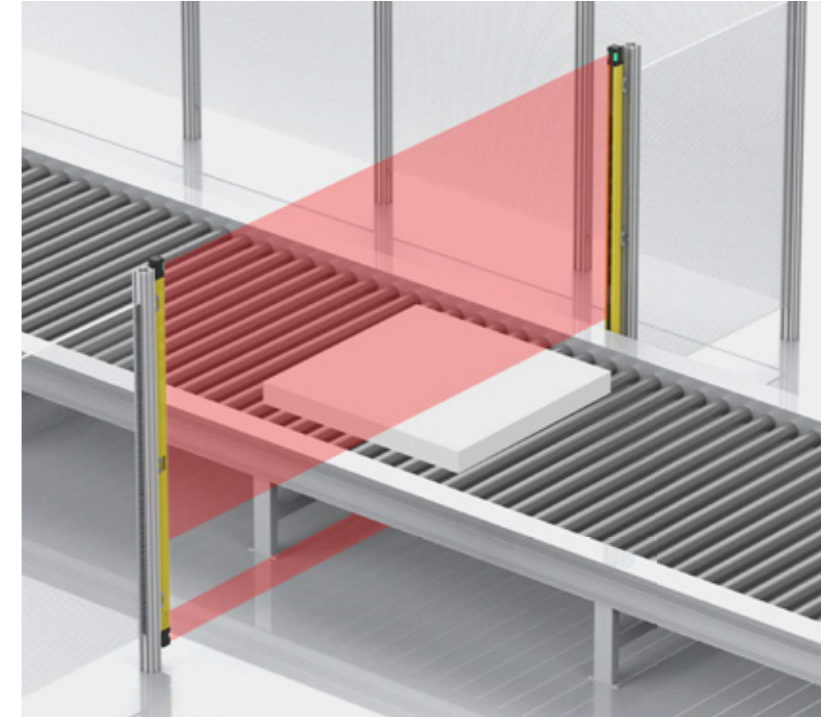Muting function is a function to prevent the control output from turning OFF when an object is detected moving through the curtain. The light curtains can be set so that machines will stop operation only when a person is detected by muting the beams where objects may pass. The muting area can be set for the entire detection area or only for selected areas.

Muting Function Types

Standard Mode	Default muting function that starts and ends muting status by the set conditions.
Exit-Only Mode	Maintains muting status until object has completely cleared the area.

3) Blanking

Blanking function allows users to set selected beams blanking zones, preventing detection of objects in the blanking zone. This function can be used if an object or machine is located within the detection area, partially blocking some beams.

Blanking Function Types

Fixed Blanking	Used when an object or machine is continuously blocking certain beams.
Floating Blanking	Used when an fixed-sized object is moving. The blanking area changes with the moving object.

4) Override

Override function is used when the muting function ends and operation resumes, but the object is still within the detection area. The override function can be used to turn output ON to remove the object in the moving direction.

Light Curtain Selection Guide

Choose the correct light curtain model by following the directions below.

Step 1. Select model by purpose of use.

SF L 1 2 – 3

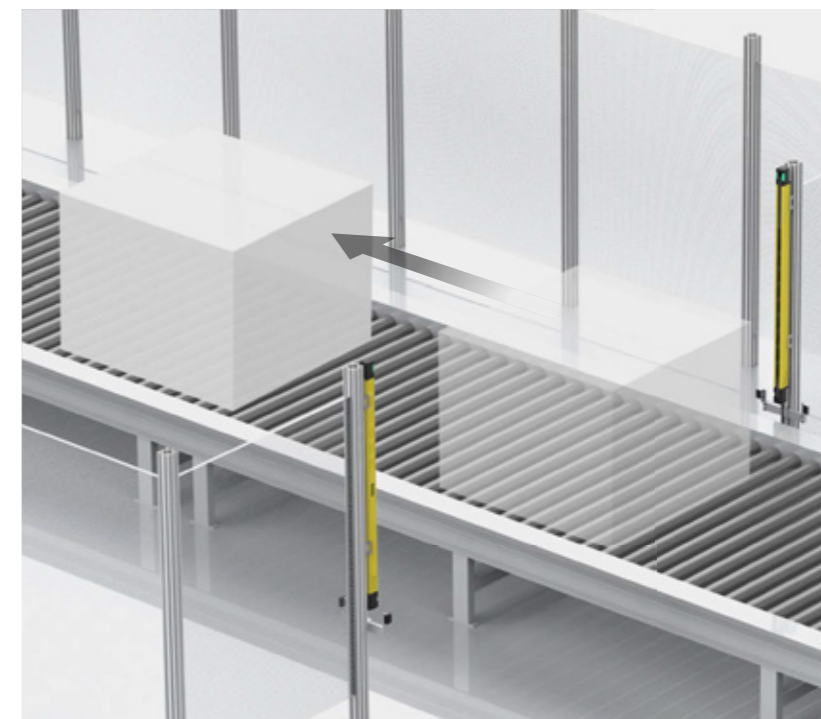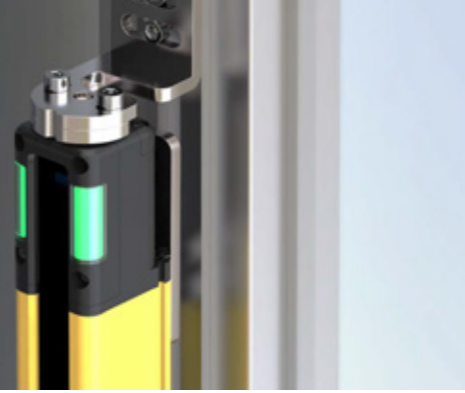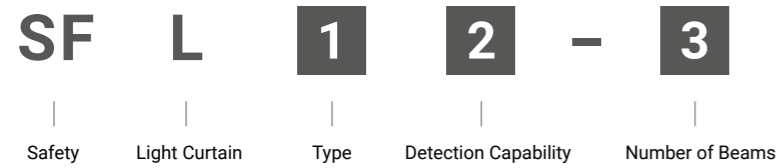|				
Safety	Light Curtain	Type	Detection Capability	Number of Beams

1 Select type

Select standard or high performance type depending on required needs.

Classifi-cation	Function	SFL Series (Standard type)	SFLA Series (High performance type)
General functions	Mode and status	○	○
	Self-test		
	RS485 communication (between emitter and receiver)		
	Monitor light incident level		
	OSSD output		
	Mutual interference prevention		
Safety-related functions	Interlock	○	●
	Lockout reset	○	○
	External device monitoring (EDM)	○	●
	Muting	○	●
	Override	○	●
	Blanking (Fixed blanking and floating blanking)	X	●
	Reduced resolution	X	●
Other functions	Series connection	○	○
	Select sensing distance		
	Select NPN or PNP		
	External test (light emission stops)		
	Auxiliary output (AUX)	○	●
	Lamp output (Lamp)	○	●
	PC connection	○	●
Type		**No-mark**	**A**

※ ● : Supported (detailed settings available) / ○ : Supported (detailed settings unavailable) /
  X : Not supported

2 Select detection capability

Select the detection capability type. (finger, hand, body)

Detection type	Detection object size		Tag
Finger	ø14mm		□□□(□)14
Hand	ø20mm		□□□(□)20
Body	ø30mm		□□□(□)30

3 Select number of beams

Select the number of beams by detection capability.

Finger detection type

No. of beams	Protection height (mm)	Tag
15	144	□□□(□)14-15
23	216	□□□(□)14-23
31	288	□□□(□)14-31
39	360	□□□(□)14-39
47	432	□□□(□)14-47
55	504	□□□(□)14-55
63	576	□□□(□)14-63
71	648	□□□(□)14-71
79	720	□□□(□)14-79
87	792	□□□(□)14-87
95	864	□□□(□)14-95
103	936	□□□(□)14-103
111	1,008	□□□(□)14-111
119	1,080	□□□14-119
127	1,152	□□□14-127
135	1,224	□□□14-135
143	1,296	□□□14-143
151	1,368	□□□14-151
159	1,440	□□□14-159
167	1,512	□□□14-167
175	1,584	□□□14-175
183	1,656	□□□14-183
191	1,728	□□□14-191
199	1,800	□□□14-199

Hand detection type

No. of beams	Protection height (mm)	Tag
12	183	□□□(□)20-12
16	243	□□□(□)20-16
20	303	□□□(□)20-20
24	363	□□□(□)20-24
28	423	□□□(□)20-28
32	483	□□□(□)20-32
36	543	□□□(□)20-36
40	603	□□□(□)20-40
44	663	□□□(□)20-44
48	723	□□□(□)20-48
52	783	□□□(□)20-52
56	843	□□□(□)20-56
60	903	□□□(□)20-60
64	963	□□□(□)20-64
68	1,023	□□□(□)20-68
72	1,083	□□□□20-72
76	1,143	□□□□20-76
80	1,203	□□□□20-80
84	1,263	□□□□20-84
88	1,323	□□□□20-88
92	1,383	□□□□20-92
96	1,443	□□□□20-96
100	1,503	□□□□20-100
104	1,563	□□□□20-104
108	1,623	□□□□20-108
112	1,683	□□□□20-112
116	1,743	□□□□20-116
120	1,803	□□□□20-120
124	1,863	□□□□20-124

Body detection type

No. of beams	Protection height (mm)	Tag
9	218	□□□□30-9
12	293	□□□□30-12
15	368	□□□□30-15
18	443	□□□□30-18
21	518	□□□□30-21
24	593	□□□□30-24
27	668	□□□□30-27
30	743	□□□□30-30
33	818	□□□□30-33
36	893	□□□□30-36
39	968	□□□□30-39
42	1,043	□□□(□)30-42
45	1,118	□□□(□)30-45
48	1,193	□□□(□)30-48
51	1,268	□□□(□)30-51
54	1,343	□□□(□)30-54
57	1,418	□□□(□)30-57
60	1,493	□□□(□)30-60
63	1,586	□□□(□)30-63
66	1,643	□□□(□)30-66
69	1,718	□□□(□)30-69
72	1,793	□□□(□)30-72
75	1,868	□□□(□)30-75

Step 2. Select cables by condition.

Name	Shape	Model		Length (m)
		Emitter (black)	**Receiver** (black)	
Power I/O cables (connector type)		SFL-BCT	SFL-BCR	0.3
Power I/O cables (cable connector type)		SFL-C3T	SFL-C3R	3
		SFL-C7T	SFL-C7R	7
		SFL-C10T	SFL-C10R	10
		SFL-C15T	SFL-C15R	15
M12 Connector cables (socket type)		CID8-3T	CID8-3R	3
		CID8-5T	CID8-5R	5
		CID8-7T	CID8-7R	7
		CID8-10T	CID8-10R	10
M12 Connector cables (socket-plug type)		C1D8-3T	C1D8-3R	3
		C1D8-5T	C1D8-5R	5
		C1D8-7T	C1D8-7R	7
		C1D8-10T	C1D8-10R	10
		C1D8-15T	C1D8-15R	15
		C1D8-20T	C1D8-20R	20
Serial expansion cables		SFL-EC03T	SFL-EC03R	0.3
		SFL-EC3T	SFL-EC3R	3
		SFL-EC7T	SFL-EC7R	7
		SFL-EC10T	SFL-EC10R	10
Lamp output cable		SFL-LC		3
Y type connector cable (connector cable for reducing wires)		SFL-YC		0.5
Y type connector cable (reset switch connector cable)		SFL-YCR		0.5
USB to Serial communication converter		SCM-SFL		1.5

Step 3. Select installation brackets.

Type	Top/bottom brackets	Mid-area brackets
Adjustable type	Top/bottom adjustable brackets BK-SFL-TBA 	Mid-area adjustable brackets BK-SFL-SA
Standard type	Top/bottom brackets BK-SFL-TBF 	Mid-area brackets BK-SFL-SF

❈ **Safety Light Curtains Accessory (Sold Separately)**

LOTO (Lockout-Tagout) Device, SFL-LT / SFL-LT2

SFL-LT protects worker safety through a lockout function that forcibly blocks the optical axis to maintain the interlock condition of the light curtains.

Light Curtains
SFL/SFLA Series
Technical Overview

Ordering Information

This is only for reference. For selecting the specific model, follow the Autonics web site.

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SFL ❶ ❷ - ❸ - ❹
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❶ Type
No-mark: Standard type
A: High performance type

❷ Detection capability
14: Ø 14 mm, finger
20: Ø 20 mm, hand
30: Ø 30 mm, hand-body

❸ Number of optical axes
Number: Number of optical axes

❹ Korea safety certification
No-mark: S-mark
A: KCs (industrial robot protection device)

※ Sold Separately

• Power I / O cable : SFL-BCT(R), SFL-C□T(R)
• M12 connector cable: CID8-□T(R), C1D8-□T(R)
• Y type connector cable: SFL-YC, SFL-YCR
• Series connector cable: SFL-EC□T(R)
• Lamp output cable: SFL-LC
• Bracket: BK-SFL-□
• SFL / SFLA dedicated USB to Serial communication converter: SCM-SFL
• Test piece: SFL-T□
• LOTO (Lockout-Tagout) device: SFL-LT□

Dimensions

Unit: mm, For the detailed dimensions of the product, follow the Autonics web site. This dimension is based on the SFL(A) 14 model. The appearance varies depending on the detection capability.

End cap [01]
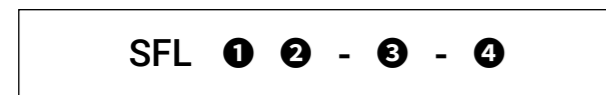
7-segment display
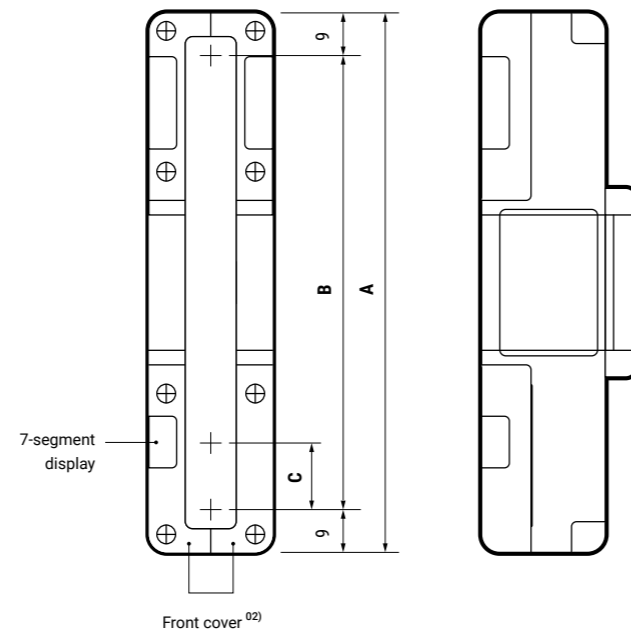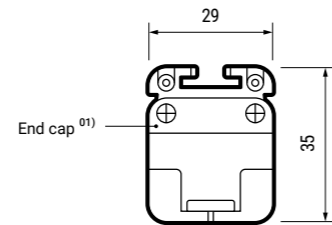
Front cover [02]

01) When removing the end cap, there is the lamp output terminal (top) or the power supply terminal (bottom).
02) When removing the front cover, there is the setting switch (on the emitter and the receiver) or the PC communication port (on the receiver).

Detection capability	Models	Number of beams	A (protective height)	B (sensing height)	C (optical axis pitch)
Ø 14 mm (finger)	Standard	15 to 111	144 to 1,008	126 to 990	9
Ø 14 mm (finger)	Advanced	15 to 199	144 to 1,800	126 to 1,782	9
Ø 20 mm (hand)	Standard	12 to 68	183 to 1,023	165 to 1,005	15
Ø 20 mm (hand)	Advanced	12 to 124	183 to 1,863	165 to 1,845	15
Ø 30 mm (hand-body)	Standard	42 to 75	1,043 to 1,868	1,025 to 1,850	25
Ø 30 mm (hand-body)	Advanced	9 to 75	218 to 1,868	200 to 1,850	25

Specifications

Type	Standard type		
Models	SFL14-□-□	SFL20-□-□	SFL30-□-□
Sensing type	Through-beam		
Light source	Infrared LED (855 nm)		
Effective aperture angle (EAA)	Within ± 2.5 ° when the sensing distance is greater than 3 m for both emitter and receiver.		
Sensing distance	Short - Long mode (setting switch)		
Short mode	0.2 to 5 m	0.2 to 8 m	0.2 to 8 m
Long mode	0.2 to 10 m	0.2 to 15 m	0.2 to 15 m
Detection capability	Ø 14 mm (finger)	Ø 20 mm (hand)	Ø 30 mm (hand-body)
Detection object	Opaque object		
Number of optical axes [01]	15 to 111	12 to 68	42 to 75
Protective height	144 to 1,008 mm	183 to 1,023 mm	1,043 to 1,868 mm
Optical axis pitch	9 mm	15 mm	25 mm
Series connection	Max. 3 SET (≤ 300 optical axes)		

Type	Advanced type		
Models	SFLA14-□-□	SFLA20-□-□	SFLA30-□-□
Sensing type	Through-beam		
Light source	Infrared LED (855 nm)		
Effective aperture angle (EAA)	Within ± 2.5 ° when the sensing distance is greater than 3 m for both emitter and receiver.		
Sensing distance	Short - Long mode (setting switch or atLightCurtain)		
Short mode	0.2 to 5 m	0.2 to 8 m	0.2 to 8 m
Long mode	0.2 to 10 m	0.2 to 15 m	0.2 to 15 m
Detection capability	Ø 14 mm (finger)	Ø 20 mm (hand)	Ø 30 mm (hand-body)
Detection object	Opaque object		
Number of optical axes [01]	15 to 199	12 to 124	9 to 75
Protective height	144 to 1,800 mm	183 to 1,863 mm	218 to 1,868 mm
Optical axis pitch	9 mm	15 mm	25 mm
Series connection	Max. 4 SET (≤ 400 optical axes)		

01) It may differ depending on the models. For more information, see the "SFL/SFLA User Manual."

Power supply	24 VDC⎓± 20 % (Ripple P-P: ≤ 10 %)
Current consumption [01]	Emitter: ≤ 106 mA, receiver: ≤ 181 mA
Response time [01]	T_{OFF} (ON → OFF): ≤ 19.9 ms, T_{ON} (OFF → ON): ≤ 49.7 ms
Safety related output : OSSD output	NPN or PNP open collector Load voltage [02]: ON - 24 VDC⎓ (except for the residual voltage), OFF - 0 VDC⎓, Load current [03]: ≤ 300 mA, Residual voltage [04]: ≤ 2 VDC⎓ (except for voltage drop due to wiring), Load capability: ≤ 2.2 μF, Leakage current: ≤ 2.0 mA, Wire resistance of load: ≤ 2.7 Ω
Auxiliary output (AUX 1/2) [05]	NPN or PNP open collector Load voltage: ≤ 24 VDC⎓, Load current: ≤ 100 mA, Residual voltage: ≤ 2 VDC⎓ (except for voltage drop due to wiring)
Lamp output (LAMP 1/2) [05]	NPN or PNP open collector Load voltage: ≤ 24 VDC⎓, Load current: ≤ 300 mA
External input	Reset input, mute 1/2 input, EDM, external test. When setting NPN output ON: 0 - 3 VDC⎓, OFF: 9 - 24 VDC⎓ or open, short-circuit current: ≤ 3 mA When setting PNP output ON: 9 - 24 VDC⎓, OFF: 0 - 3 VDC⎓ or open, short-circuit current: ≤ 3 mA
Protection circuit	Reverse power polarity, reverse output polarity, output short-circuit over-current protection
Safety-related functions	Interlock (reset hold), external device monitoring (EDM), muting/override, Blanking (fixed blanking, floating blanking), reduced resolution
General functions	Self-test, alarm for reduction of incident light level, mutual interference prevention
Others functions	Change of sensing distance, switching to NPN or PNP, external test (light emission stops), auxiliary output (AUX 1, 2), lamp output (LAMP1, 2)
Synchronization type	Timing method by RS485 synchronous line
Insulation resistance	≥ 20MΩ (at 500 VDC⎓ megger)
Noise immunity	± 240 VDC⎓ the square wave noise (pulse width: 1μs) by the noise simulation
Dielectric strength	1,000 VAC∼ 50/60 Hz for 1 minute
Vibration [06]	10 mm double amplitude at frequency of 5 to 150 Hz, 10 sweeps in each X, Y, Z direction
Shock [06]	250 m/s2 (≈ 25 G), pulse width 6 ms in each X, Y, Z direction for 100 times
Ambient illumination (receiver)	Incandescent lamp: ≤ 3,000 lx, sunlight: ≤ 10,000 lx
Ambient temperature	-30 to 60 °C, storage: -30 to 70 °C (no freezing or condensation)
Ambient humidity	35 to 85 %RH, storage: 35 to 95 %RH (no freezing or condensation)
Protection rating [07]	IP65, IP67 (IEC standard), IP67G (JEM Standard), IP69K (DIN standard)
Material	Case: Aluminum, Front cover and sensing part: Polymethyl methacrylate, End cap: polycarbonate, Power I/O cable and connector cable: polyurethane (PUR) or polyvinyl chloride (PVC), Y type connector cable: polyvinyl chloride (PVC), lamp output cable and series connector cable: polyurethane (PUR), Top / Bottom adjustable bracket and Top / Bottom bracket: SUS304, Side adjustable bracket and Side bracket: nickel plated Zn
Approval	CE UK TÜV NORD ⓤ ⑤ (industrial robot protection device) [08]
International standards	UL 508, CSA C22.2 No. 14, ISO 13849-1 (PL e, Cat. 4), ISO 13849-2 (PL e, Cat. 4), UL 61496-1 (Type 4, ESPE), UL 61496-2 (Type 4, AOPDs), IEC/EN 61496-1 (Type 4, ESPE), IEC/EN 61496-2 (Type 4, AOPDs), IEC/EN 61508-1~-7 (SIL 3), IEC/EN 62061 (SIL CL 3)

01) It may differ depending on the models. For more information, refer to the "SFL/SFLA User Manual."
02) The values of load voltage were drawn with PNP output, and in case of NPN output, apply these in reverse.
03) Be sure that the load current should be greater than 6 mA.
04) The residual voltage was drawn with 300 mA of load current.
05) It is the non-safety output. Do not use it for safety purposes.
06) Testing according to IEC 61496-1 standards.
07) Approved certification protection ratings are IP65 and IP67.
08) The certified models for S-mark and KCs (industrial robot protection device) have the same functional basis.