

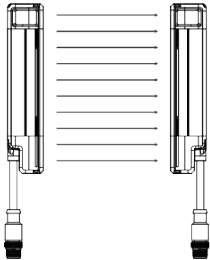


Type 4 Blind-Zone-Free Safety Light Curtain

Model E-LV4SLC Series

INSTRUCTION MANUAL

Thank you for choosing MiSUMi products. The matters needing attention during the installation and use of this product are mainly described below. Please read the manual carefully to fully understand the product before use. For your convenience, please keep the manual in a safe place for reference at any time.



1. Safety Precautions

- ◆ Installation, maintenance and servicing shall be performed by qualified personnel only.
- ◆ Thoroughly read this manual prior to use to understand proper installation, operation and maintenance procedures. Users must establish and strictly enforce safety protocols.
- ◆ OSSD safety outputs must comply with: No short-circuit to power supply; No exceeding rated values; Interconnection between two or more OSSDs is strictly prohibited.
- ◆ Do not modify cable length without authorization. Use shielded cables for extensions with proper grounding. Incorrect wiring may cause malfunction.
- ◆ Use only provided accessory kit. Undersized screws cause insecure mounting; oversized screws may damage housing leading to failure. Refer to warning labels and installation diagrams in the kit.
- ◆ Install away from reflective surfaces or implement countermeasures: Cover reflective objects, reduce surface gloss (e.g. apply frosted films) to eliminate interference.
- ◆ Impact or dropping is strictly prohibited. Handle with extreme care.



- ▲ Do not plug/unplug cables while power is connected.
- ▲ Unauthorized repositioning after calibration is prohibited.
- ▲ Ensure machinery is in a safe state during installation.
- ▲ Prohibited in flammable or corrosive environments.

2. Product Overview

This safety grating adopts a blind-zone-free design, compliant with IEC61508 SIL3 Safety Integrity Level 4. The internal MCU features redundant design with dual-loop outputs, periodic self-testing, and mutual-testing functions to provide comprehensive safety protection. Advanced self-diagnostic capabilities ensure optimal performance and eliminate potential hazards. Compatible with both light synchronization and line synchronization, it offers a compact size, elegant appearance, and superior performance for diverse applications. Supports additional functions such as EDM (External Device Monitoring) and interlock reset to meet complex safety requirements. PC-based configuration allows flexible customization of grating parameters. Multiple mounting options adapt to various environments, ensuring easy installation and maintenance.

- ◆ No Blind Zone: Blind-zone-free technology ensures complete protection.
- ◆ SIL3 Compliance: Meets IEC61508 Safety Integrity Level 4 standards.
- ◆ Enhanced Safety: Periodic dual self-testing and mutual-testing circuits.
- ◆ Dual Synchronization Modes: Light sync/line sync selectable.
- ◆ Dual-Channel Redundant Outputs: Self-diagnostic pulses detect overcurrent, short circuits, or mutual shorts in real time.
- ◆ External EDM Function: Monitors connected devices (relays, contactors) to prevent safety failures.
- ◆ Interlock Reset: Supports manual/auto reset modes.
- ◆ PC Configuration: Customize sync mode, EDM, and reset functions via software.
- ◆ Versatile Mounting: Suitable for diverse installation environments.

3. Technical Parameters

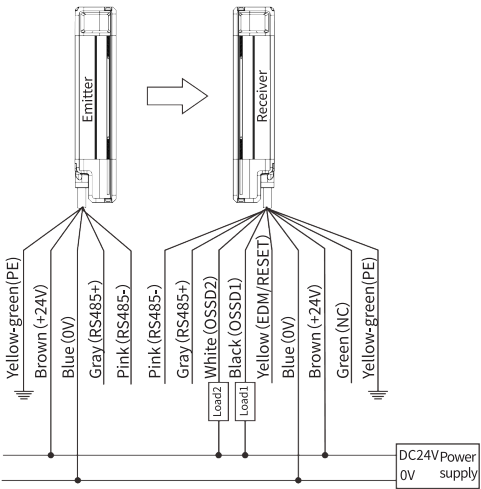
Compliance Standards	IEC61508 SIL3		
Power Supply	DC24V±20%		
Power Consumption	<5W		
Optical axis pitch	10mm	20mm	40mm
Minimum detectable object size	15mm	25mm	45mm
Number of Optical Axes	16、20、.....、160	8、10、.....、80	4、6、.....、40
Protection Height	$S=N \times \text{Optical axis pitch} + \text{Resolution}$, N: Number of Axes		
Emitter Light Source	940nm Infrared		
Response Time	$\leq 2 \times (N \times 0.1 + 3)$ ms (N: Number of Axes)		
Safety Output (OSSD)	PNP Transistor Output: Load Current $\leq 200\text{mA}$, Residual Voltage $\leq 1\text{V}$ (excluding voltage drop from cable length), Leakage Current $\leq 0.1\text{mA}$; NPN Transistor Output: Load Current $\leq 200\text{mA}$, Residual Voltage $\leq 1\text{V}$ (excluding voltage drop from cable length), Leakage Current $\leq 0.1\text{mA}$		
Circuit Protection	Overvoltage Protection, Reverse Polarity Protection, Output Overcurrent Protection, Output Short-Circuit Protection		
Detection Range	0.1 – 5m		
Anti-Light Interference	10,000Lux (Incident Angle $\theta > 2.5^\circ$)		
Grating Type	Through-Beam		
Synchronization Mode	Light/Line Sync (Default: Light Sync [No EDM, Auto Reset]; Line Sync requires software configuration. See [7. Software Configuration])		
Material	Aluminum Alloy		
Accessories	Cables: Emitter Line 4-core $\times 1 \times 3.5\text{m}$, Receiver Line 8-core $\times 1 \times 3.5\text{m}$, On-Body Cable: 300mm Mounting Bracket: Side-Mount, Free-Rotation Combination Set		
Cross-Section Dimensions	30*28mm		
Vibration Resistance	Frequency 10Hz~55Hz, Amplitude $0.35 \pm 0.05\text{mm}$, 20 cycles each in X/Y/Z directions		
Shock Resistance	100 m/s ² (approx. 10 G) 16 ms pulse 1000 cycles each in X/Y/Z directions		
Operating Environment Temperature	-10°C~55°C (non-condensing)		
Storage Environment Temperature	-30°C~70°C (non-condensing)		
Operating Environment Humidity	<85% RH at 20°C		
TM(Continuous Operation Time)	20 years (ISO 13849-1)		

Table 3-1 Optical Grating Technical Specifications

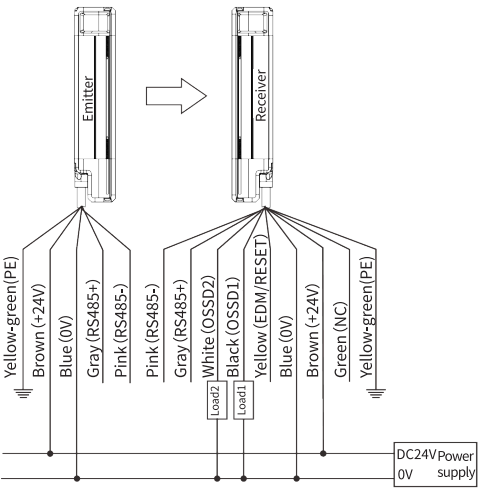
4. Electrical Connections

4.1 Optical Grating Wiring Diagram [Light Synchronization]

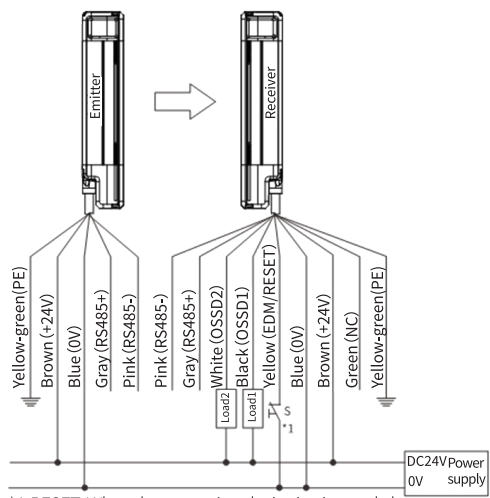
1. Light Synchronization: NPN Output Wiring Diagram (NO EDM, Automatic Reset).



2. Light Synchronization: PNP Output Wiring Diagram (NO EDM, Automatic Reset).

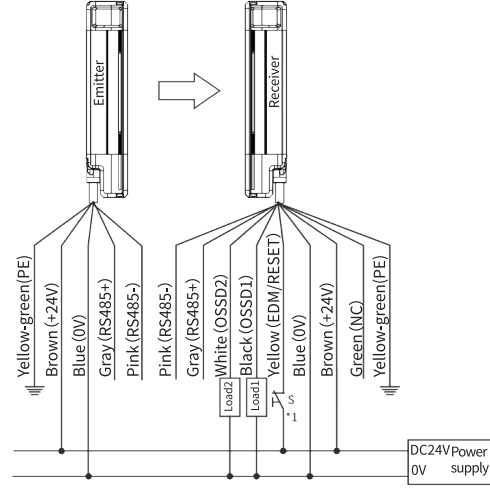


3. Light Synchronization: NPN Output Wiring Diagram (No EDM , Manual Reset).



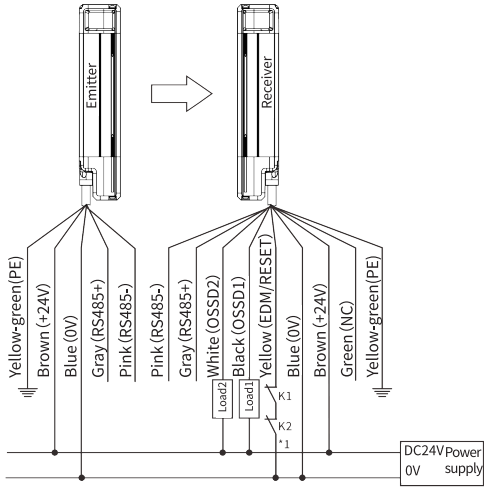
*1 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

4. Light Synchronization: PNP Output Wiring Diagram (NO EDM , Manual Reset).



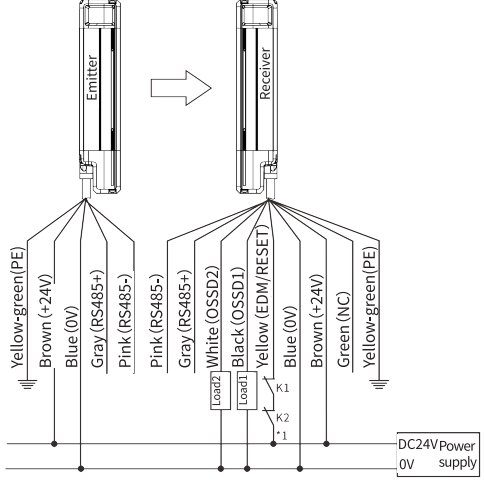
*1 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

5. Light Synchronization: NPN Output Wiring Diagram (with EDM and Automatic Reset).



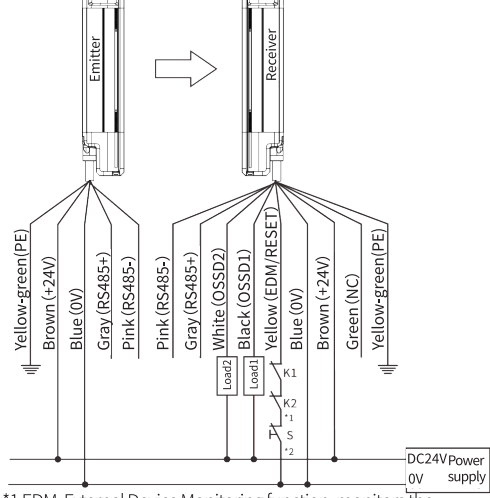
*1 EDM: External Device Monitoring function, monitors the status of external devices.

6. Light Synchronization: PNP Output Wiring Diagram (with EDM and Automatic Reset).



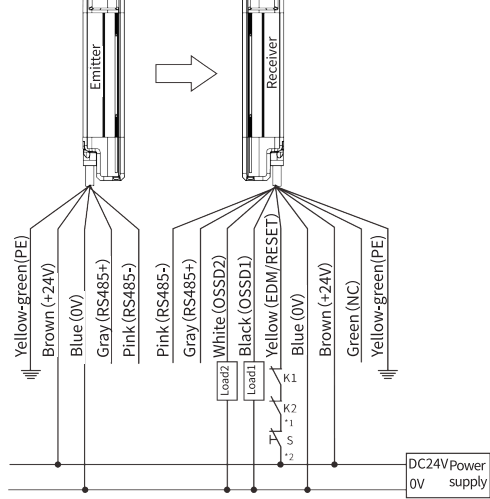
*1 EDM: External Device Monitoring function, monitors the status of external devices.

7. Light Synchronization: NPN Output Wiring Diagram (with EDM and Manual Reset).



*1 EDM: External Device Monitoring function, monitors the status of external devices.
*2 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

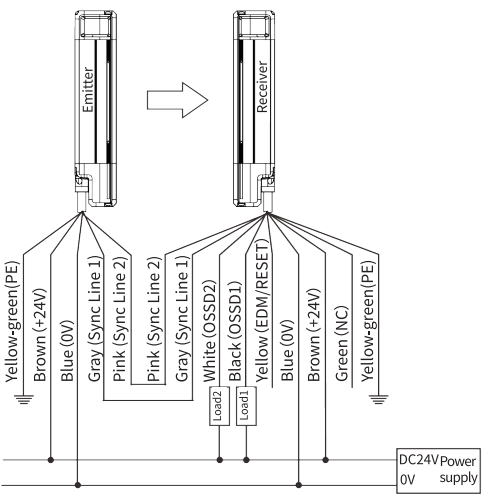
8. Light Synchronization: PNP Output Wiring Diagram (with EDM and Manual Reset).



*1 EDM: External Device Monitoring function, monitors the status of external devices.
*2 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

4.2 Optical Grating Wiring Diagram [Line Synchronization]

1. Line Synchronization: NPN Output Wiring Diagram (NO EDM , Automatic Reset).



2. Line Synchronization: PNP Output Wiring Diagram (NO EDM , Automatic Reset).

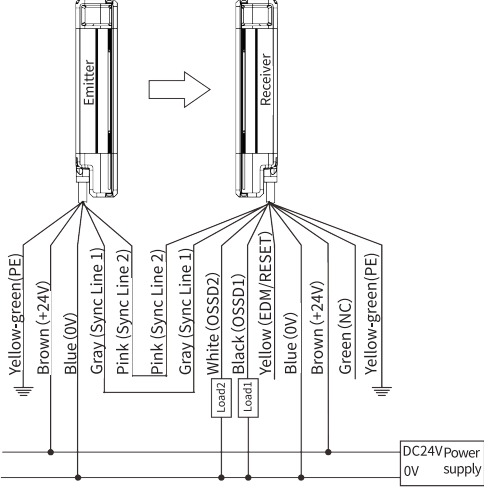
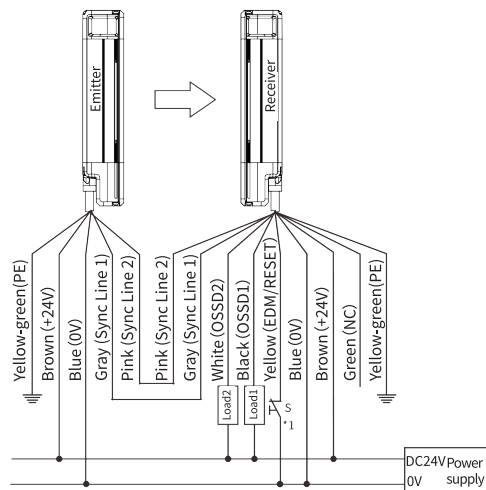


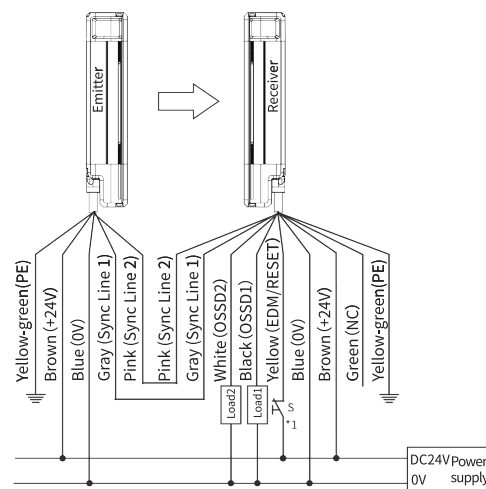
Fig. 4-1 Wiring Diagram [Light Synchronization]

3. Line Synchronization: NPN Output Wiring Diagram (No EDM , Manual Reset).



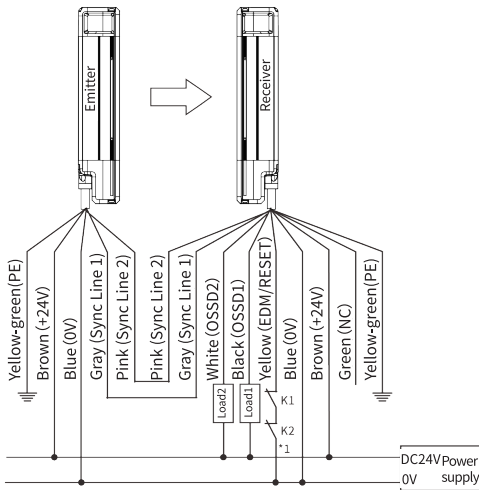
*1 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

4. Line Synchronization: PNP Output Wiring Diagram (NO EDM , Manual Reset).



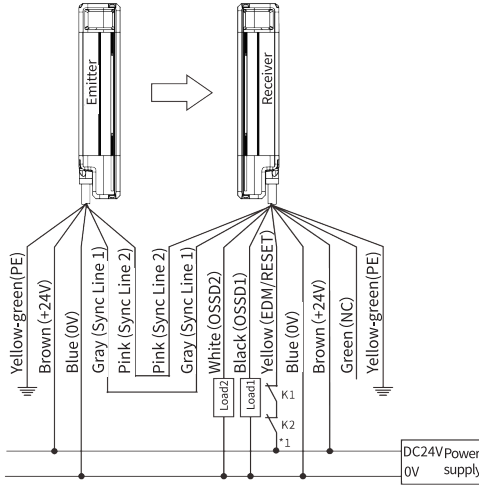
*1 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

5. Line Synchronization: NPN Output Wiring Diagram (with EDM and Automatic Reset).



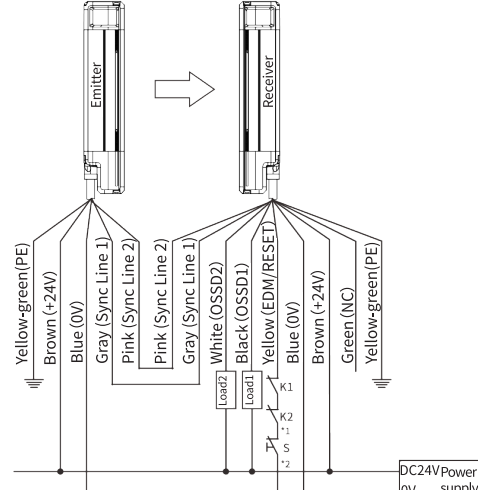
*1 EDM: External Device Monitoring function, monitors the status of external devices.

6. Line Synchronization: PNP Output Wiring Diagram (with EDM and Automatic Reset).



*1 EDM: External Device Monitoring function, monitors the status of external devices.

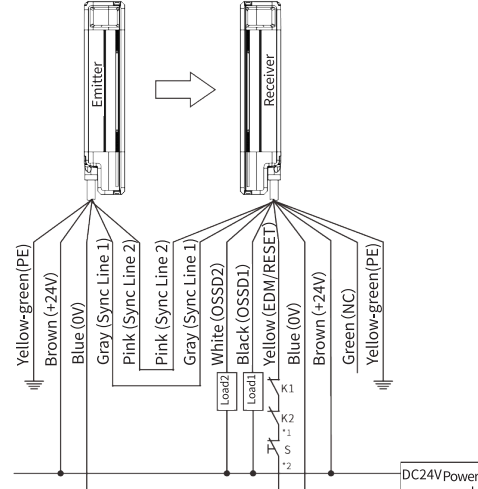
7. Line Synchronization: NPN Output Wiring Diagram (with EDM and Manual Reset).



*1 EDM: External Device Monitoring function, monitors the status of external devices.

*2 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

8. Line Synchronization: PNP Output Wiring Diagram (with EDM and Manual Reset).



*1 EDM: External Device Monitoring function, monitors the status of external devices.

*2 RESET: When the protection device is triggered, the restart interlock prevents the machine from restarting. The operator must first press the reset button to restore the monitoring function of the protection device. Then, the operator can restart the machine.

Fig. 4-2 Wiring Diagram【Line Synchronization】

Note

When using the line synchronization function with this product, please ensure that the RS485 communication lines between the emitter and receiver sides of the same optical grating are properly connected (connect gray wires together and pink wires together) before turning on the power to the optical grating. If the RS485 communication lines are connected after the power is turned on, the optical grating will not be able to align the light. In this case, the issue can be resolved by turning the power to the optical grating off and on again.

Warnings

- ▲ Users must wire the device with the power turned off. Unauthorized cable replacement by users is strictly prohibited.
- ▲ Short circuits between signal lines, output terminals, and the power supply are strictly prohibited. This may damage the optical grating.
- ▲ Connecting two or more OSSDs together is prohibited. Ensure that the controller processes the two signals separately. Otherwise, the optical grating may fail or not function properly.
- ▲ Users must correctly wire the device after fully understanding the signal meanings of all wires.
- ▲ Keep the safety grating cables away from high-voltage and power lines.
- ▲ Do not connect any wires of the safety grating to a DC power supply exceeding 30V or to an AC power supply. This may cause electric shock or damage to the optical grating.

4.3 OSSD Cross-Scan Timing

The OSSD cross-scan timing diagram is as follows.

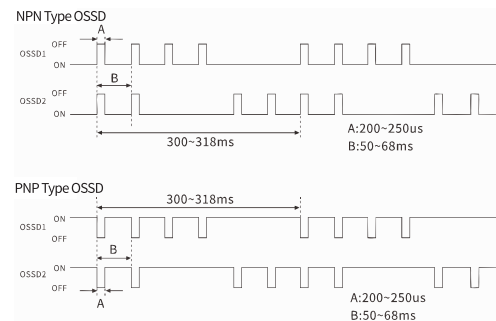


Fig. 4-3 Timing Diagram

4.4 Transmission Lines

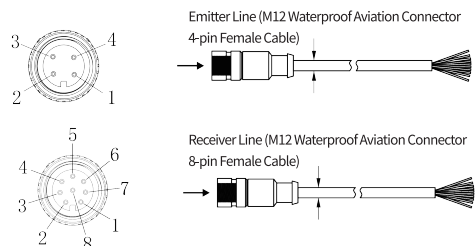
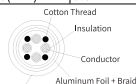



Fig. 4-4 Transmission Line Wiring Diagram

The colors and functions of the transmission lines connected to the optical grating are as follows:

Cable	Pin	Wire Color	Function	Wiring Instructions
Emitter Line	1	Brown	24V Power Positive	Connect to DC Power 24V Positive
	3	Blue	0V Power Negative	Connect to DC Power 0V Negative
	2	Gray	Configuration RS485+/Synchronization RS485+	Refer to Wiring Diagram
	4	Pink	Configuration RS485-/Synchronization RS485-	
	*PE	Yellow-Green	PE Shield Wire	Ground/Connect to GND
Receiver Line	2	Brown	24V Power Positive	Connect to DC Power 24V Positive
	7	Blue	0V Power Negative	Connect to DC Power 0V Negative
	5	Gray	Configuration RS485+/Synchronization RS485+	Refer to Wiring Diagram
	6	Pink	Configuration RS485-/Synchronization RS485-	
	*PE	Yellow-Green	PE Shield Wire	Ground/Connect to GND
	8	Black	OSSD1 Switching Output Terminal	Connect to Switching Signal Input Port 1
	1	White	OSSD2 Switching Output Terminal	Connect to Switching Signal Input Port 2
	4	Yellow	EDM Detection and RESET Input	Refer to Wiring Diagram
	3	Green	-	Unused Wire

*The PE pin is the soldering point where the shield mesh of the transmission line is soldered to the metal shell of the M12 waterproof aviation connector.

Emitter Cable Specifications		
configuration	5,8 Black 4-core shielded cable (Brown/Gray/Blue/Pink) 40/0.08BS+250D*1.05*4C+4 cotton threads+AL+B96/0.10TC OD:5.8 Gray	
COMPNRRNR	A	
Conductor	Constitution AWG/mm	40/0.08BS+250D
	Material	Bare copper
	Cabling OD mm	0.08±0.005
Insulation	NO of wire	4
	Core Material	PVC 35P Temperature Resistance 105°C
	Core Diameter (OD) mm	1.1 _{±0.1}
	Average Thickness	0.2
Shield	Color	1.Brown 2.Gray 3.Blue 4.Pink
	Aluminum/polyester	AL.FACE OUTSIDE
	Constitution N/mm	Braid:96/0.10±3
	Material	Tinned Copper Wire(TS)
Jacket	coversge %	80%
	Outer Sheath Diameter (OD)mm	5.8±0.1 mm
	Material	110P PVC semi-matte
	Color	Gray
Diagram	Average Thickness(MM)	0.5
	 <p>Cotton Thread Insulation Conductor Aluminum Foil + Braid Outer Sheath</p>	

Receiver Cable Specifications		
configuration	5.8 Black 8-core shielded cable (White/Yellow/Green/Blue/Gray/Brown/Pink/Black) 40/0.08BS+250D*1.05*8C+4 cotton threads+AL+B96/0.10TC OD:5.8 Black	
COMPNRRNR	A	
Conductor	Constitution AWG/mm	40/0.08BS+250D
	Material	Bare copper
	Cabling OD mm	0.08±0.005
Insulation	NO of wire	8
	Core Material	PVC 35P Temperature Resistance 105°
	Core Diameter (OD) mm	1.05 ⁺⁰ _{-0.1}
	Average Thickness	0.2
Shield	Color	1.White 2.Yellow 3.Green 4.Blue 5.Gray 6.Brown 7.Pink 8.Black
	Aluminum/polyester	AL.FACE OUTSIDE
	Constitution N/mm	Braid:96/0.10±3
	Material	Tinned Copper Wire(TS)
Jacket	coversge %	80%
	Outer Sheath Diameter (OD)mm	5.8+0.1 mm
	Material	110P PVC
	Color	Black
Diagram	Average Thickness(MM)	0.5
		
	Outer Sheath Cotton Thread Aluminum Insulation Aluminum Foil + Braid Conductor	

5. Product Dimensions

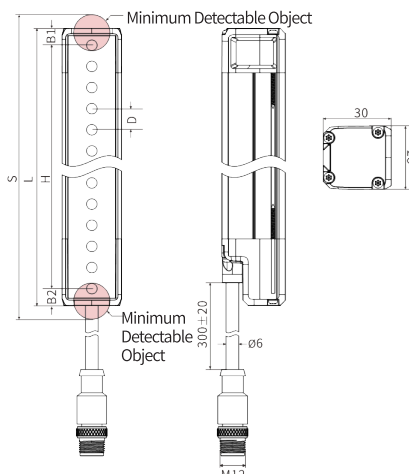


Fig. 5-1 Optical Grating Structural Dimensions Diagram

Detection Height $H = (N-1) \times \text{Optical axis pitch}$, N is the number of optical axes

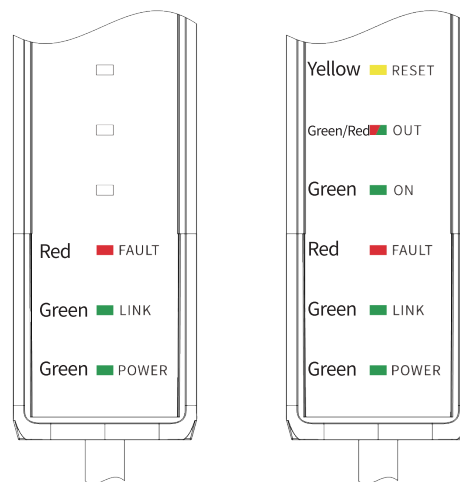
Protection Height $S = N \times \text{Optical axis pitch} + \text{Resolution}$, N is the number of optical axes

Total Grating Height $L = B1 + H + B2$

Correspondence Table of Optical axis pitch and Structural Dimensions			
Optical axis pitch D	B1	B2	Minimum detectable object size
10mm	8mm	8mm	15mm
20mm	8mm	8mm	25mm
40mm	18mm	18mm	45mm

Table 5-1 Optical Grating Size Correspondence Table

6. Display Instructions



Emitter

Receiver

Figure 6-1 Indicator Display Schematic Diagram

Emitter Side Operation Instructions			
POWER	LINK	FAULT	Status Description
Green light on	Green light on	light off	Normal operation status
Green light on	Green(1Hz)	light off	Initializing
Green light on	Green(2Hz)	light off	Line synchronization not synchronized
Green(1Hz)	light off	Red	Undervoltage, please check power supply
Green(2Hz)	light off	Red	Overvoltage, please check power supply
Green light on	light off	Red	Internal fault, return for repair
light off	light off	light off	Power not on/internal fault

Receiver Side Operation Instructions						
POWER	LINK	FAULT	ON	OUT	RESET	Status Description
Green light on	Green light on	light off	Green light on	Green light on	light off	Normal status (light passing)
Green light on	Green light on	light off	light off	Red light on	light off	Normal status (light blocking)
Green light on	Green(1Hz)	light off	light off	Red light on	light off	Initializing
Green light on	Green(2Hz)	light off	light off	Red light on	light off	Light synchronization or line synchronization not synchronized
Green light on	Green light on	light off	Green light on	Red light on	Yellow light on	Manually open RESET
Green(1Hz)	light off	Red	light off	Red light on	light off	Undervoltage, please check power supply
Green(2Hz)	light off	Red	light off	Red light on	light off	Overvoltage, please check power supply
Green light on	light off	Red(1Hz)	light off	Red light on	light off	EDM fault
Green light on	light off	Red(2Hz)	light off	Red light on	light off	Two outputs shorted
Green light on	light off	Red(4Hz)	light off	Red light on	light off	Output overload
Green light on	light off	Red	light off	Red light on	light off	Internal fault, return for repair
light off	light off	light off	light off	Red light on	light off	Internal fault, return for repair
Green light on	light off	light off	light off	light off	light off	Internal fault, return for repair
light off	light off	light off	light off	light off	light off	Power not on/internal fault

Table 6-2 Indicator light status table

7. Software Configuration

7.1 Debugging Tools

Software Tools	Configuration Software
Tools	USB to RS485 Converter (Driver can be downloaded by consulting sales or technical personnel)
Computer	System Requirements: Windows XP or above, resolution 1280*720 or higher

7.2 Software Installation (Standard Installation Version, Portable Version)

Download link location:

<https://www.misumi.com.cn/vona2/detail/110311204649/>

1.Select portable version (no installation required);E-LV4SLC Configuration

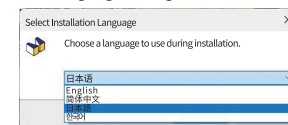
Double-click the EXE file to use directly



2.Select standard installation file: E-LV4SLC Configuration



Select language during installation

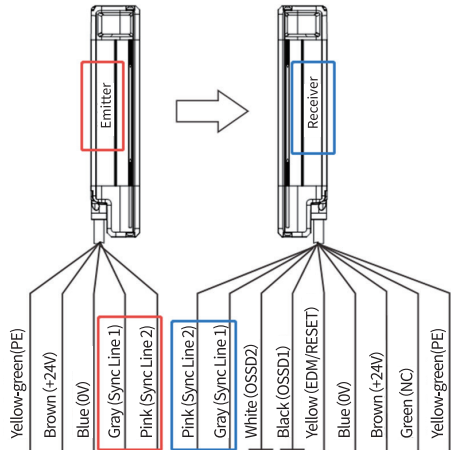


Display shortcut icon on desktop

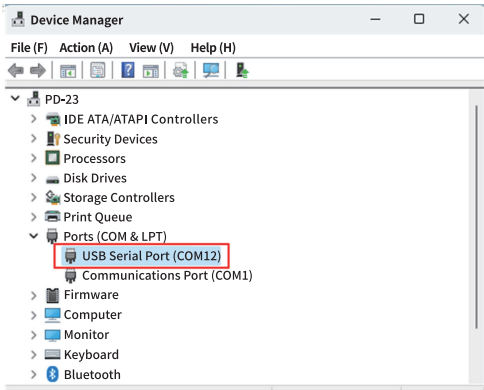


7.3 Software Usage Instructions

1. Communication Connection:
To prevent misoperation, the grating can only communicate with the computer within 3 seconds after power-on. Correctly connect the emitter or receiver side of the grating to the power supply and the USB-to-RS485 converter (brown: DC24V, blue: DC 0V, gray: RS485+, pink: RS485-). For a single configuration, only one side of the grating can be connected. Do not connect both the emitter and receiver side RS485 ports to the converter simultaneously. (Refer to Chapter 4: Electrical Connections)



The connection steps are as follows:
① First, correctly connect the power supply part of the receiver or emitter side (brown: DC24V, blue: DC 0V). At the same time, connect the RS485 communication cable of the receiver or emitter side (gray: RS485+, pink: RS485-).
② Ensure that the USB-to-RS485 converter is effectively connected to the computer and confirm the driver's serial port number (e.g., COM12).



2. Communication Connection Steps and Precautions:
1. ① The grating is in a power-off state -----> ② Open the software and select the language to use -----> ③ Select the correct serial port number -----> ④ Click the 【Open Serial Port】 button -----> ⑤ Power on the grating quickly within 3 seconds -----> The software will automatically jump to the working mode page
If the connection is not successful after more than 3 seconds, check whether the serial port number is correct, and whether the power supply and RS485 communication cable are effectively connected, and then repeat the steps ①~⑤.

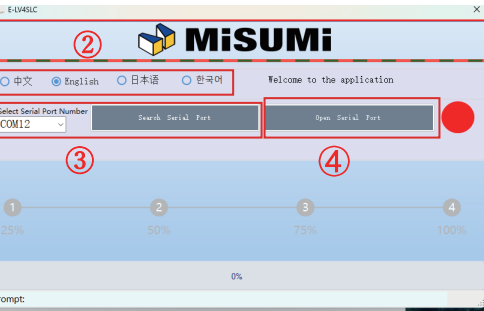


Fig. 7-1 Main Parameter Configuration Interface

3. Parameter Configuration Interface: (Light/Line Synchronization Switching requires simultaneous modification on both the emitter and receiver sides)
1. Emitter Side Parameter Configuration Interface:
Configure the emitter side as needed. ① Select the option parameter to be modified -----> ② Click the 【Modify】 button box -----> ③ Display 【✓】 to indicate that the item has been successfully modified.

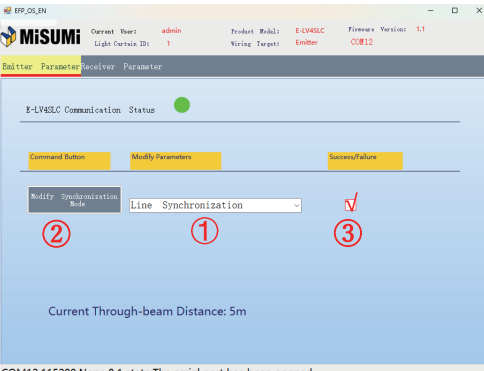


Fig. 7-2 Emitter Side Parameter Configuration Interface

2. Receiver Side Parameter Configuration Interface:
Configure the receiver side as needed. ① Select the option parameter to be modified -----> ② Click the 【Modify】 button box -----> ③ Display 【✓】 to indicate that the item has been successfully modified.

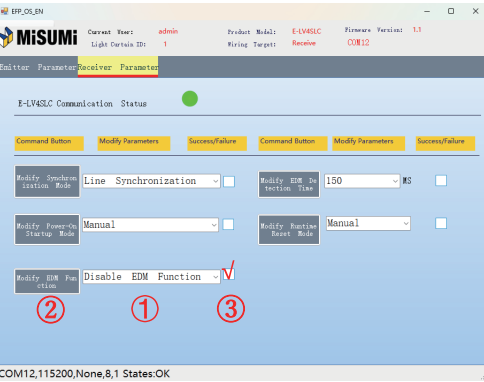


Fig. 7-3 Receiver Side Parameter Configuration Interface

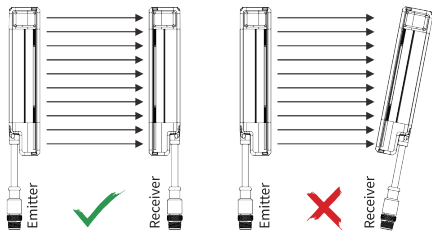
4. Communication Disconnection
After completing the configuration on the emitter or receiver side, the user can disconnect the communication between the grating and the computer by first turning off the DC24V power supply of the grating and then disconnecting the RS485 communication cable. This completes the software configuration of the grating, and it can be installed and used normally thereafter.

8. Light Curtain Installation

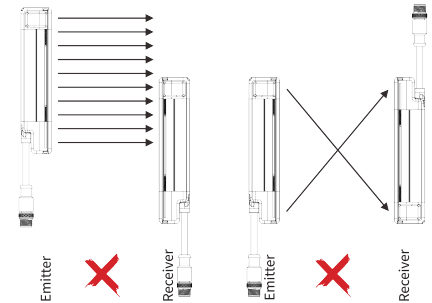
Safety distance and installation height are two critical factors for ensuring the protective function of the safety light curtain. The safety distance must be calculated correctly, and the light curtain's installation position must meet the requirements for safety distance and installation height. Otherwise, accidents may still occur.

8.1 Installation Orientation

The Emitter and Receiver transmission line interfaces must face the same direction. The Receiver cannot be installed 180° relative to the Emitter. The Emitter and Receiver must be on the same plane, with their optical surfaces parallel and aligned.



1. Correct installation: Light curtain parallel and aligned, cables facing the same direction.
2. Incorrect installation: Light curtain misaligned.



3. Incorrect installation: Light curtain tilted.
4. Incorrect installation: Light curtain reversed, cables not facing the same direction.

Fig. 8-1: Schematic Diagram of Installation Orientation

8.2 Calculation of Safety Distance

The safety distance refers to the minimum distance between the safety light curtain and the hazard point. To ensure the equipment stops immediately when a person or object enters the hazard zone, a safety distance S must be established between the hazard zone and the safety light curtain (as shown in Figure 8-2). The safety distance varies depending on national standards and equipment characteristics. It must be set according to relevant standards during installation; otherwise, accidents may still occur.

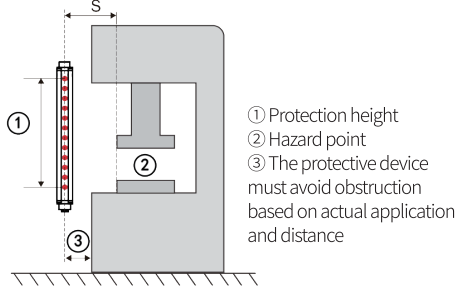


Fig. 8-2: Schematic Diagram of Safety Distance for Vertical Protection Zones

◆ For Presses Where the Slide Can Stop at Any Point During the Stroke, The safety distance is calculated using Formula (1)

$$S = K \times T_s + 8 \times (d - 14 \text{ mm}) \quad \dots \dots \text{Formula (1)}$$

◆ For presses where the slide cannot stop at any point during the stroke, the safety distance is calculated using Formula (2):

$$S = K \times T_s + 8 \times (d - 14 \text{ mm}) \quad \dots \dots \text{Formula (2)}$$

Where:

S : Safety distance, in millimeters (mm);

K : Speed of intrusion of a person or body part into the light curtain's effective area, in millimeters per second (mm/s);

T_s : Total braking time of the equipment system, in seconds (s);

T_s : Time from when the hand leaves the light curtain (i.e., allowing the slide to start) until the press slide reaches the bottom dead center (i.e., the slide's downward stroke time), in seconds (s); The T_s value must be calculated using Formula (3) below or measured empirically.

d : Resolution of the safety light curtain, in millimeters (mm).

Determination of K Value

◆ When the safety light curtain is horizontally installed, use 1600 mm/s.

◆ When the safety light curtain is vertically installed: If the safety distance is ≤ 500 mm, use 2000 mm/s; If the safety distance is > 500 mm, use 1600 mm/s.

Determination of T Value

◆ The total system braking time T = Response time of the safety light curtain + Machine stopping time.

◆ The response time of the safety light curtain is provided by the supplier.

◆ The machine stopping time must be measured empirically.

Determination of T_s Value

◆ The calculation of T_s is given by the following formula:

$$T_s = (1/2 + 1/N) \times T_n \quad \dots \dots \text{Formula (3)}$$

Where:

N : Number of engagement slots in the clutch;

T_n : Time for one revolution of the crankshaft, in seconds (s).

◆ Calculation Steps

1. First, calculate S using the following formula: Start with $K = 2000$ mm/s, $S = 2000$ mm/s $\times T + 8 \times (d - 14$ mm)

2. If the result $S \leq 500$ mm, use this value as the minimum safety distance.

3. If the result $S > 500$ mm, recalculate S : Use $K = 1600$ mm/s, $S = 1600$ mm/s $\times T + 8 \times (d - 14$ mm)

4. If the recalculated result $S > 500$ mm, use this value as the minimum safety distance.

5. If the recalculated result $S \leq 500$ mm, the minimum safety distance is 500 mm.

◆ Calculation Example

Assumptions: Machine stopping time = 290 ms ; Light curtain response time = 30 ms ; Light curtain resolution = 20 mm ;

Calculations:

$$T = 290 \text{ ms} + 30 \text{ ms} = 320 \text{ ms} = 0.32 \text{ s} ;$$

$$S = 2000 \text{ mm/s} \times 0.32 \text{ s} + 8 \times (20 \text{ mm} - 14 \text{ mm}) = 688 \text{ mm} ;$$

$$S > 500 \text{ mm, proceed to the next step} ;$$

$$S = 1600 \text{ mm/s} \times 0.32 \text{ s} + 8 \times (20 \text{ mm} - 14 \text{ mm}) = 560 \text{ mm} ;$$

Therefore, the minimum safety distance for this example is $S = 560$ mm.



▲ Safety distance is a mandatory requirement for ensuring the protective function of safety light curtains. The safety distance must be correctly calculated and strictly maintained during installation.

▲ During installation, the minimum distance from the light curtain plane to the hazard point must exceed the safety distance. If the selected safety distance is insufficient, the machine's hazardous state cannot be terminated in time.

▲ When the safety distance exceeds 400mm, additional auxiliary protective measures must be implemented.

8.3 Considerations for Overhead Reach

Per ISO 13855, any possibility of bypassing the electro-sensitive protective equipment (ESPE) must be eliminated. If reaching into the hazard zone through the vertical protective area from above is possible, both the protection height and minimum distance of the ESPE must be determined. This shall be verified by comparing calculated values based on detectable limb/body parts with values obtained through reach testing, adopting the larger value.

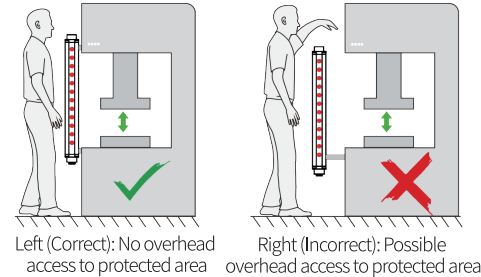


Fig.8-3 Schematic Diagram of Overhead Access to Electro-Sensitive Protective Equipment

8.4 Determination of Installation Height

Installation Height refers to the position of the safety light curtain relative to the upper and lower die openings of the equipment. Under the premise of ensuring the safety distance, the lowest beam of the light curtain must not be higher than the lower edge of the lower die opening, and the highest beam must not be lower than the upper edge of the upper die opening. In practical applications where no relevant safety standards apply, the isolation between operators and hazardous areas must be ensured. When the horizontal distance between the light curtain plane and the front edge of the die opening exceeds 400mm, auxiliary light curtains or protective barriers must be installed to prevent operators from entering the inner side of the light curtain plane, as shown in Figure 8-4. Even when the distance is less than 400mm, safety measures such as auxiliary light curtains or protective barriers may still be implemented.

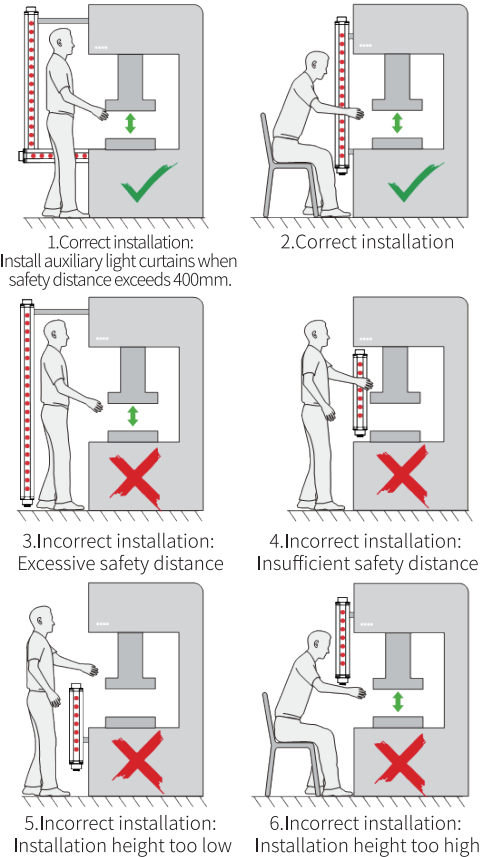


Fig.8-4 Schematic diagram of light curtain installation positions



- ▲ If molds are replaced during operation, the safety distance and installation position must be re-adjusted according to the requirements in Sections 8.2 and 8.4.
- ▲ If the machine exhibits runaway movement (e.g., unintended sliding), repair and adjust the machine immediately. Even with a correctly installed photoelectric protective device, safety cannot be guaranteed (the device only controls electrical components and cannot prevent mechanical failures like runaway movement or fractures).
- ▲ When the safety distance exceeds 400 mm, additional protective measures are necessary.
- ▲ The installation height is critical for ensuring the protective function of the safety light curtain. Verify the height is correct during installation.
- ▲ During installation, eliminate risks of bypassing the light curtain from below, above, or behind, and ensure the light curtain cannot shift position.
- ▲ Install the safety light curtain only on compliant equipment where the protected zone width remains constant during operation.

8.5 Precautions for Adjacent Installations

When two or more sets of grating devices are installed adjacent to each other, mutual interference between the grating devices is likely to occur. As shown in Figure 8-5, the infrared light emitted by the Emitter unit of System ① may affect the receiver unit of System ②, which could interfere with the protective function of System ②. This means that the operator is at risk, so installation should be carried out with reference to Figure 8-6. That is, without a light-blocking partition, adjacent gratings should not be installed on the same side. Otherwise, the light emitted from the Emitter may easily reach the receiver of the adjacent system.

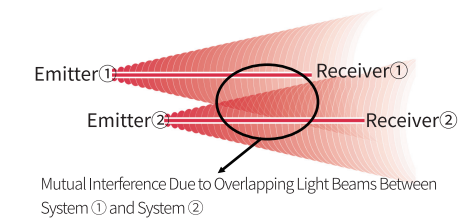


Fig. 8-5: Schematic Diagram for Avoiding Mutual Interference Between System ① and System ②

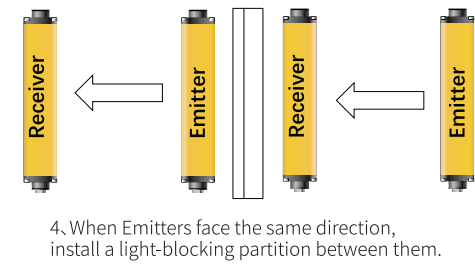
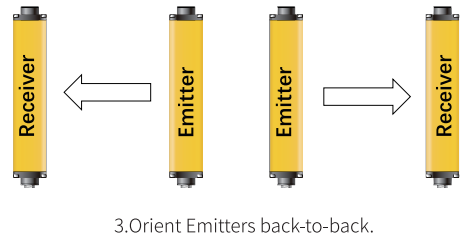
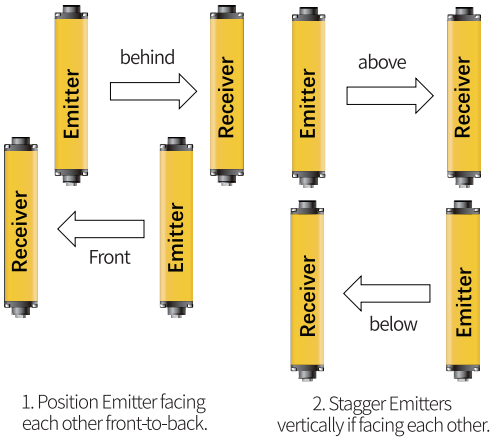


Fig.8-6 Installation Layout to Prevent Mutual Interference Between Light Curtains

▲ Mutual interference between light curtains can disable their protective functions.

▲ Adopt the correct installation method based on specific conditions to eliminate interference and ensure safety.

8.6 Installation Position with Reflective Surfaces

If there are objects with smooth reflective surfaces (e.g., metal plates, floors, ceilings, workpieces, covers, partitions, glass panels) near the light curtain device, the installation position of the light curtain must maintain a distance greater than A (m) from such reflective surfaces. The value of A can be calculated using the formula provided in the table or obtained from the coordinate graph. As shown in Fig. 8-7, the cone has an aperture angle α , which is formed between the optical axis and the light beam at the edge of the cone. Here, α = aperture angle of the beam, L = distance between the Emitter and receiver, and $L < \text{maximum effective range of the light curtain}$.

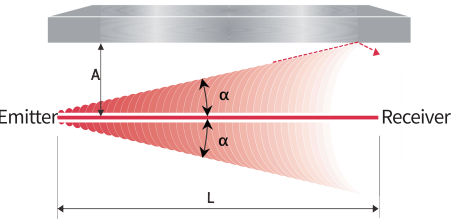


Fig.8-7 Reflective Surface Interference Diagram

Protection Length L (m)	Allowable Distance A (m)
$\leq 3\text{m}$	0.131m
$>3\text{m}$	$L \times \tan\alpha = L \times 0.04366$ ($\alpha=2.5^\circ$)

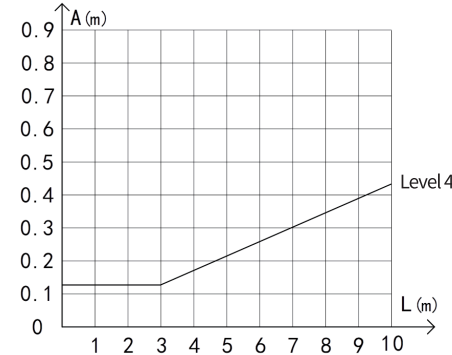


Fig. 8-8: Coordinate Diagram for Installation Position Affected by Reflective Objects

▲ Smooth reflective surfaces or scattering media (e.g., dust, fog, smoke) from surrounding reflective objects may alter the propagation direction of light beams emitted by the light curtain. This can bypass the detection of personnel or body parts, causing the safety light curtain to malfunction and fail to provide protection.

▲ During installation, keep the light curtain as far away from reflective objects as possible, or eliminate interference by covering/blocking reflective surfaces (e.g., reducing surface smoothness or applying frosted materials) to ensure safety.

8.7 Side Mounting Bracket Installation

Install the light curtain onto the equipment bed wall or aluminum profile using a side-mounted bracket, as shown in the figure below. Installation steps are as follows:

A. Determine the installation position of the light curtain on the equipment based on the calculated safe distance and height (when installing on the equipment bed wall, drill and tap holes. Ensure the Emitter and receiver are parallel and aligned after installation during hole positioning).

B. Attach the light curtain to the side-mounted bracket using M5x6 hex socket screws combined with an M5 slider.

C. Install the side-mounted bracket onto the equipment bed wall or bracket profile using M6x16 hex socket screws, M6 flat washers, and spring washers.

D. Adjust the light curtain position to ensure it is parallel, aligned, and properly positioned, then tighten the screws appropriately.

E. After connecting the cables to the light curtain and completing power-on debugging, securely fasten all installation screws.

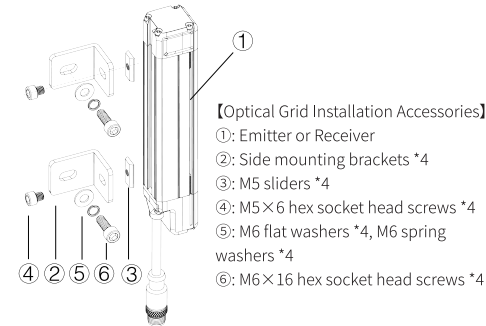


Fig.8-9 Side Bracket Installation Diagram

8.8 Top/Bottom Rotating Bracket Installation Instructions

- Install the light curtain on equipment walls or aluminum profiles using top/bottom brackets as follows:
- A. Determine the installation position of the light curtain on the equipment based on the calculated safe distance and height (when installing on the equipment bed wall, drill and tap holes. Ensure the Emitter and receiver are parallel and aligned after installation during hole positioning).
- B. Assemble the upper/lower rotating bracket-1 and upper/lower rotating bracket-2 together using M5x6 hex socket screws.
- C. Attach the light curtain to the bracket assembly from Step B using M5x6 hex socket screws combined with an M5 slider.
- D. Install the upper/lower rotating brackets onto the equipment bed wall or bracket profile using M6x16 hex socket screws, M6 flat washers, and spring washers.
- E. Adjust the light curtain position to ensure it is parallel, aligned, and properly positioned, then tighten the screws appropriately.
- F. After connecting the cables to the light curtain and completing power-on debugging, securely fasten all installation screws.

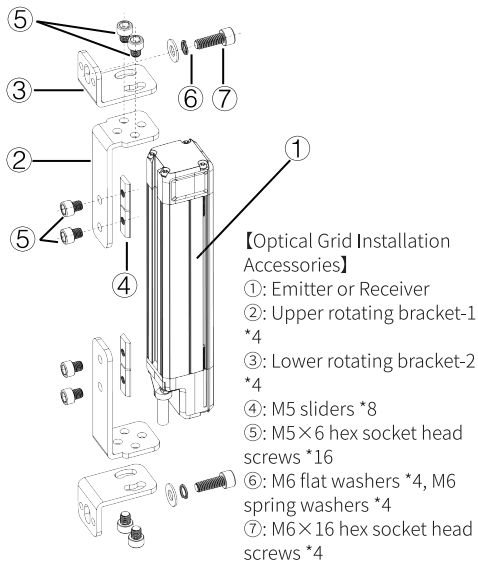


Fig.8-10 Vertical Bracket Installation Diagram

9、Electrical Commissioning

9.1 Safety Light Curtain Commissioning

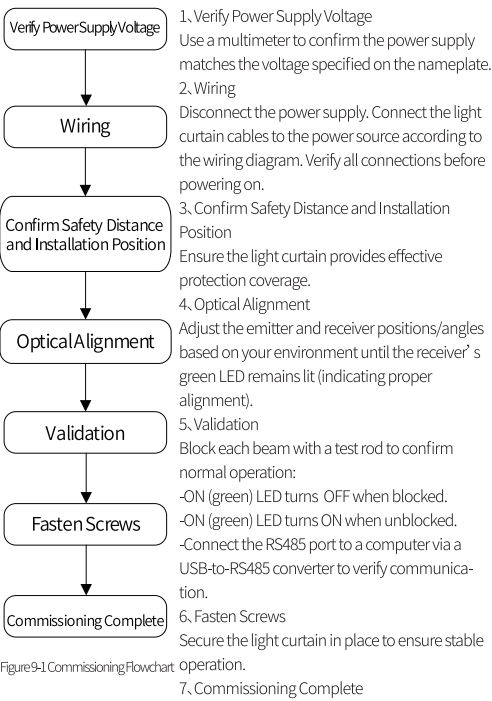


Figure9-1 CommissioningFlowchart

▲ Ensure the installation environment meets product requirements before mounting.

▲ Perform thorough checks after wiring to confirm correctness before powering on.

▲ Tighten the connector nut on the cable plug to the light curtain socket to prevent disconnection (loose plugs disable protection).

▲ Use screws from our accessory kit to avoid damaging the housing or causing short circuits.

10、Usage, Maintenance, and Troubleshooting

10.1 Usage Precautions

- ◆ Always power off the system and have professionals perform disassembly, repairs, or cable handling.
- ◆ Verify the light curtain's control functionality before each use.
- ◆ Do not reposition the light curtain during operation.
- ◆ After replacing molds/jigs, have authorized personnel readjust the safety distance and installation position.
- ◆ Avoid collisions between the light curtain, connectors, or cables and workpieces/tools/debris during operation.

10.2 Inspection and Maintenance

Regular inspection and maintenance of the safety light curtain are crucial to ensure optimal performance. To maximize its effectiveness, periodic checks and upkeep must be performed.

Inspection Item	Method	Inspection Cycle
Visual Integrity Check	Inspect the housing, end caps, light transmission surfaces (filters), cables, and connectors for damage.	1 month
Light Transmission Surface Check	Ensure all light transmission surfaces are clean and undamaged.	Before operation starts
Beam Blocking Test	Block each beam individually and verify indicator light status.	Before operation starts
Control Function Verification	Confirm the light curtain effectively controls equipment (or triggers alarms).	Before operation starts
Fastener Inspection	Check all fasteners for tightness.	1 month
Terminal Connection Check	Ensure terminal screws are secure and wires are properly connected.	1 month
Maintenance Item	Method	Maintenance Cycle
Cleaning Light Transmission Surfaces	Clean surfaces regularly (Do not use organic solvents).	As needed
Fastener Tightening	Tighten any loose screws.	As needed

Table 10-1 Light Curtain Inspection & Maintenance Guide

10.3 Troubleshooting

Symptom	Possible Cause	Solution
Light curtain not working; all indicators off.	No power supply.	Check power connection and wiring.
Intermittent operation: FAULT light off, OUT light flashing red/green.	Misalignment.	Realign the light curtain. Ensure proper grounding or eliminate interference.
	Poor grounding or electrical interference.	grounding or eliminate interference.
	Dirty or damaged transmission surfaces.	Clean surfaces or replace filters.
LINK indicator flashing on emitter/receiver	wire sync mode :RS485 sync cable disconnected.	Reconnect securely and restart.
	Internal failure.	Replace or repair the unit.
LINK flashing on receiver only	optical sync mode : Optical sync failure.	Ensure no obstructions between units and clean transmission surfaces.
	Internal failure.	Replace or repair the unit.
FAULT light off, POWER light flashing.	Overvoltage/undervoltage.	Adjust power supply to DC24V.

Table10-2 Light Curtain Fault Diagnosis Guide

Letter of Commitment on Product Quality

MiSUMi products have undergone strict factory inspection. In case of any fault, contact MiSUMi technical staff and provide details of the fault so that we can solve it for you as soon as possible.

Warranty period

- The warranty period is one year from the date on which the product is delivered to the location specified by the Buyer.

Warranty scope

- (1) If there is a fault caused by MiSUMi within the above warranty period, MiSUMi will repair the product free of charge. However, the following situations are not covered by the warranty.
- Faults caused by incorrect use or improper operation due to failure to comply with the conditions specified in the instruction manual, user manual or technical requirements specifically reached between the Buyer and MiSUMi.
 - Faults caused not by defects in the product but the Buyer's equipment or software design.
 - Faults due to modifications or repairs by personnel not from MiSUMi.
 - Faults that could be completely avoided by correct maintenance or replacement of wearing parts in accordance with the operating instruction or user manual.
 - Faults caused by factors such as unforeseen changes in the level of science and technology after the product is shipped from MiSUMi.
 - MiSUMi is not responsible for any fault due to natural disasters such as fire, earthquake and flood, or external factors such as abnormal voltage.
- (2) The warranty scope is limited to the conditions stipulated in Article (1), and MiSUMi shall not be liable for any indirect loss (equipment damage, loss of opportunity, loss of profit, etc.) or other losses caused to the Buyer by its equipment.

Applicability of the product

MiSUMi products are designed and manufactured for general-purpose products in general industries, thusly MiSUMi products cannot be used in and are not suitable for the following applications. However, the product can be used if the Buyer consults MiSUMi in advance on the use of the product in a responsible manner, understands the technical specifications, grades and performance of the product, and takes necessary safety measures. In this case, the product warranty coverage is the same as above.

Applications where there is potential chemical pollution or electrical damage, or use under

- conditions and environments not specified in the product catalog, instruction manual, etc.
- Atomic force control equipment, incineration equipment, railways, aircrafts,
- vehicle equipment, safety devices and equipment manufactured for administrative agencies and in accordance with the regulations of individual industries.
- Machinery, systems and devices that may endanger life and property.
- Equipment requiring high reliability such as gas, water & electricity supply systems, and 24-hour continuous operation systems.

Precautions for Use

- Please use the product within its specifications. In addition, the function and performance of the product cannot be guaranteed if modified.
- This product is developed and manufactured for use in an industrial environment.
- Do not use the product outdoors.
- When using the product to improve the protection of people from the hazards around the machine to which it is applied, follow the regulations of the relevant safety authorities of the country or region. For details, please consult the appropriate authorities.
- When applying the product to a specific machine, follow the appropriate use method and safety regulations for installation, operation, and maintenance items. The installation personnel and the personnel in charge of the use of the product shall be responsible for applying the product based on these items.
- Be aware that the product may be damaged if subjected to excessive impact caused by events such as a fall.
- Use the product with consideration for the abnormalities that may occur to the product and with the appropriate safety measures in place to prevent loss.
- Before putting the product into operation, check that its functions and performance are normal and consistent with its design. Dispose of the product as industrial waste when it is scrapped.