



Orbital Mekatronik Systems Pvt. Ltd.

IEC SERIES

Safety Light Curtains



INSTRUCTION MANUAL

INDEX

1.	GENERAL.....	1
	1.1 General Description.....	2
	1.2 Features	2
	1.3 Applications.....	3
2.	MECHANICAL MOUNTING.....	3
	2.1 Mounting Procedure.....	3
	2.2 Detection Zone Calculation.....	4
	2.3 Dimensional Details.....	7
	2.4 Mounting Options.....	9
3.	ELECTRICAL CONNECTIONS.....	8
	3.1 Emitter Connection Diagram.....	10
	3.2 Receiver Connection Diagram.....	11
	3.3 Output Connection Diagram.....	12
4.	INSTALLATION AND POSITIONING.....	13
	4.1 Interferences Between the Emitter & Receiver.....	13
	4.2 General Information On Device Positioning.....	14
5.	ALIGNMENT PROCEDURE.....	15
	5.1 Alignment Steps for Type 2.....	15
	5.2 Alignment Steps for Type 4.....	16
6.	FAULT AND DIAGNOSTIC MESSAGES.....	17
	6.1 For RECEIVER Module.....	17
	6.2 For EMITTER Module.....	18
7.	TECHNICAL DETAILS.....	19
8.	SAFETY NOTES.....	20
9.	PERIODIC MAINTENANCE/CHECKS.....	21
10.	CONNECTING CABLES.....	21
11.	WARRANTY.....	21
13.	DISPOSAL.....	21

1. GENERAL INFORMATION

Abbreviations:

AOPD	= Active Opto-electronic Protective Device
ESPE	= Electro-Sensitive Protective Equipment
OSSD	= Output Signal Switching Device
EM	= Emitter
RX	= Receiver
Safety Light Curtain = Safety Guard, ESPE, AOPD	

1.1. General Description of Safety Light Curtains:

The Safety Light Curtains of Type 2 (18.25mm) CE-3-B-1-C-4-M To CE-3-N-1-C-4-M and 36.75mm CE-3-B-1-D-4-M To CE-3-N-1-D-4-M & Type 4 (18.375mm) AC-3-B-1-C-4-C to AC-3-N-1-C-4-C, AC-3-B-1-D-4-C to AC-3-N-1-D-4-C and (10mm) AC-3-B-1-B-4-C to AC-3-N-1-B-4-C are opto-electronic multichannel devices that are designed as Type 2 And Type 4 Safety systems for prevention of accidents in hazardous areas. These comply with international Standards of safety, in particular:

IEC 61496-1 Ed 3.0: 2012 Safety of machinery:
Electro-sensitive protective equipment.
Part 1: General requirements and tests.

IEC 61496-1 Ed 3.0: 2013 Safety of machinery:
Electro-sensitive protective equipment.
Part 2 : Particular requirement for equipment using
active optoelectronics protective devices.

Each device consisting of one emitting and one receiving module, housed inside strong metal extrusions, generates infra red beams, that travel from emitter to receiver. It detects any opaque object placed between emitter and receiver detection area.

M18 connectors, 2 pin and 4 pin are used to connect external power supply and control outputs for IP65.

M12 connectors, 3 pin and 5 pin are used to connect external power supply and control outputs for IT67.

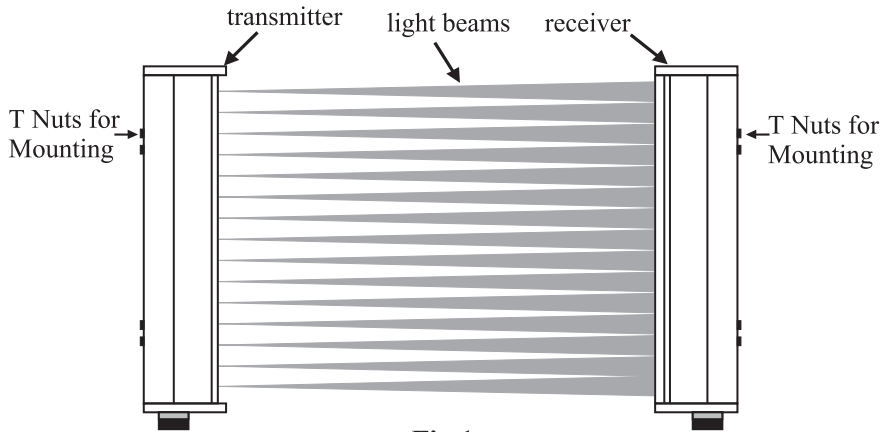


Fig.1

The synchronization between emitter and receiver channels are controlled by their respective microcontrollers, optically. Indicator LEDs provided on the emitter and receiver modules give indication about a) Internal working b) energized condition c) obstruction status of light curtain. In addition, these LEDs help in alignment during installation. The user is advised to consult the manufacturer when in doubt.

1.2. Features:

These models of safety light curtains provide the following features:

- Introduction to Multilayer PCB
- Category 4 safety
- Category 2 Safety
- Dual parallel processing technology
- Fast response time
- Fast scan time
- Ground Pin protection

1.3. Applications:

Safety light curtains are commonly used on all types of automation based machines like weld lines, filter machines, roll-formers, powdered metal compactors, surface finishing machinery, robots, injection molders, woodworking machines, automatic assembly equipment, food processing equipment, and other types of machines and equipment.

In particular they are used to stop the moving mechanical parts of:

- Automation machines
- Automatic and semi- Automatic assembly lines
- Presses, punching machines
- Packaging machines, Auto wood working machines

2. MECHANICAL MOUNTING

2.1 Mounting Procedure:

The emitter (EM) and receiver (RX) modules must be installed facing each other. The connectors must be positioned on the same side and the distance must be within the operating range of the model used.

The Extrusion of the module must be aligned and parallel as much as possible. And after that take reference of the Section 5, for fine alignment.

T nuts provided at the back side slots of each module for mounting. These can be used to mount the device modules at the required protected area.

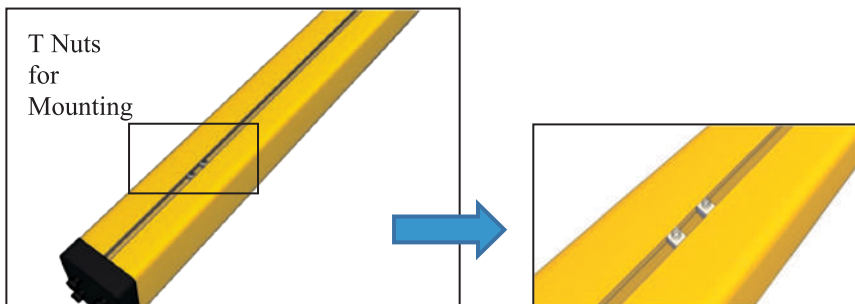


Fig.2

2.2 Detection Zone Calculation:

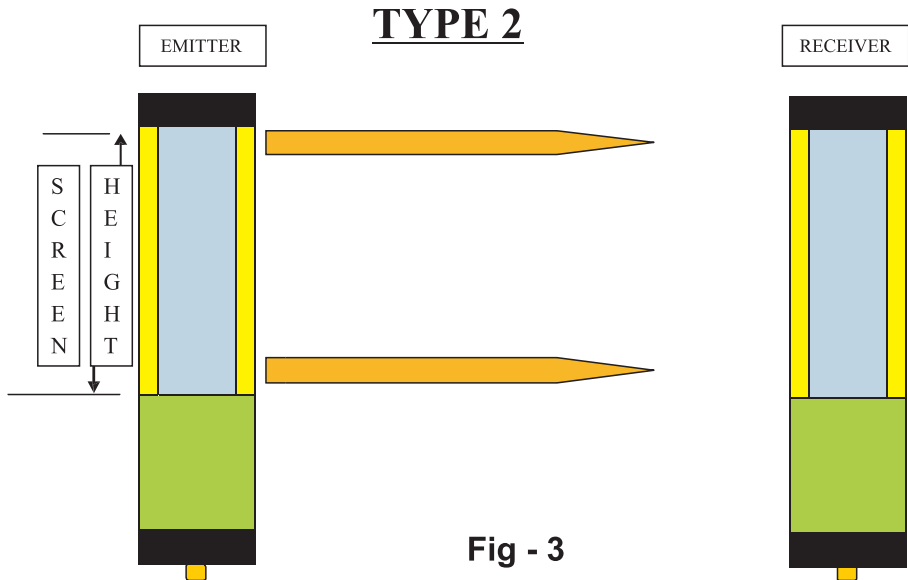


Fig - 3

Pitch : 18.25mm

Screen Height mm	No. of Channels	Pitch mm	Total Height mm	Product Code
145	8	18.25	220	CE-3-B-1-C-4-M
220	12	18.25	295	CE-3-C-1-C-4-M
290	16	18.25	365	CE-3-D-1-C-4-M
365	20	18.25	440	CE-3-I-1-C-4-M
440	24	18.25	515	CE-3-E-1-C-4-M
585	32	18.25	665	CE-3-F-1-C-4-M
660	36	18.25	7354	CE-3-H-1-C-4-M
880	48	18.25	955	CE-3-G-1-C-4-M
1020	56	18.25	1095	CE-3-J-1-C-4-M
1095	60	18.25	1170	CE-3-K-1-C-4-M
1315	72	18.25	1390	CE-3-L-1-C-4-M
1535	84	18.25	1610	CE-3-M-1-C-4-M
1750	96	18.25	1825	CE-3-N-1-C-4-M

Chart No.1 (A)

TYPE 4

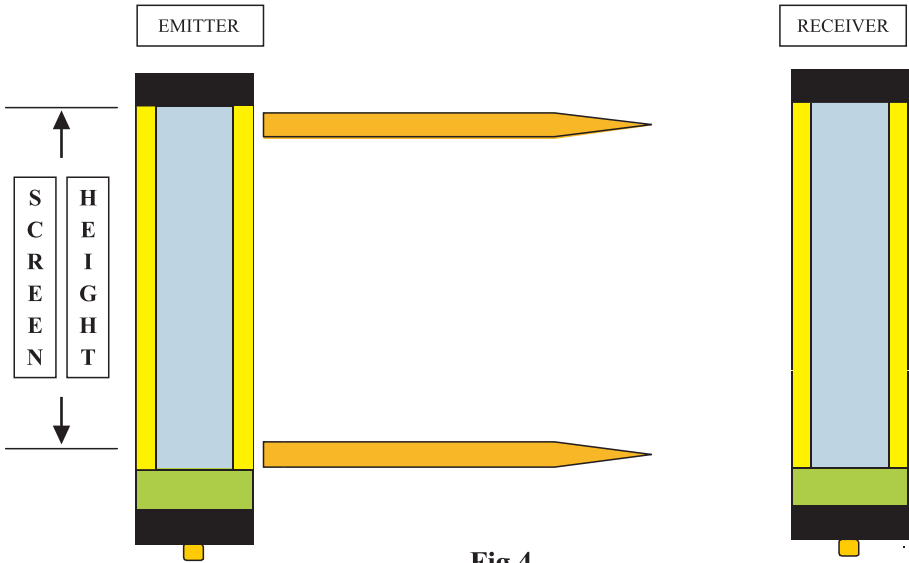


Fig.4

Pitch = 18.375mm

No. of	Pitch	Screen Height	Total Height	Product Code
Channels	(mm)	(mm)	(mm)	
8	18.375	147	177	AC-3-B-1-C-4-C
12	18.375	220	250	AC-3-C-1-C-4-C
16	18.375	294	324	AC-3-D-1-C-4-C
20	18.375	367	397	AC-3-I-1-C-4-C
24	18.375	441	471	AC-3-E-1-C-4-C
32	18.375	588	618	AC-3-F-1-C-4-C
36	18.375	661	691	AC-3-H-1-C-4-C
40	18.375	735	765	AC-3-O-1-C-4-C
48	18.375	882	912	AC-3-G-1-C-4-C
56	18.375	1029	1059	AC-3-J-1-C-4-C
60	18.375	1102	1132	AC-3-K-1-C-4-C
72	18.375	1323	1353	AC-3-L-1-C-4-C
84	18.375	1543	1573	AC-3-M-1-C-4-C
96	18.375	1764	1794	AC-3-N-1-C-4-C

Chart No. 2 (A)

Pitch = 36.75mm

No. of Channels	Pitch (mm)	Screen Height (mm)	Total Height (mm)	Product Code
8	36.75	294	324	AC-3-B-1-D-4-C
12	36.75	441	471	AC-3-C-1-D-4-C
16	36.75	588	618	AC-3-D-1-D-4-C
20	36.75	735	765	AC-3-I-1-D-4-C
24	36.75	882	912	AC-3-E-1-D-4-C
32	36.75	1176	1206	AC-3-F-1-D-4-C
36	36.75	1323	1353	AC-3-H-1-D-4-C
40	36.75	1470	1500	AC-3-O-1-D-4-C
48	36.75	1764	1794	AC-3-G-1-D-4-C
56	36.75	2058	2088	AC-3-J-1-D-4-C
60	36.75	2205	2235	AC-3-K-1-D-4-C
72	36.75	2646	2676	AC-3-L-1-D-4-C
84	36.75	3087	3117	AC-3-M-1-D-4-C
96	36.75	3528	3558	AC-3-N-1-D-4-C

Chart No. 2 (B)

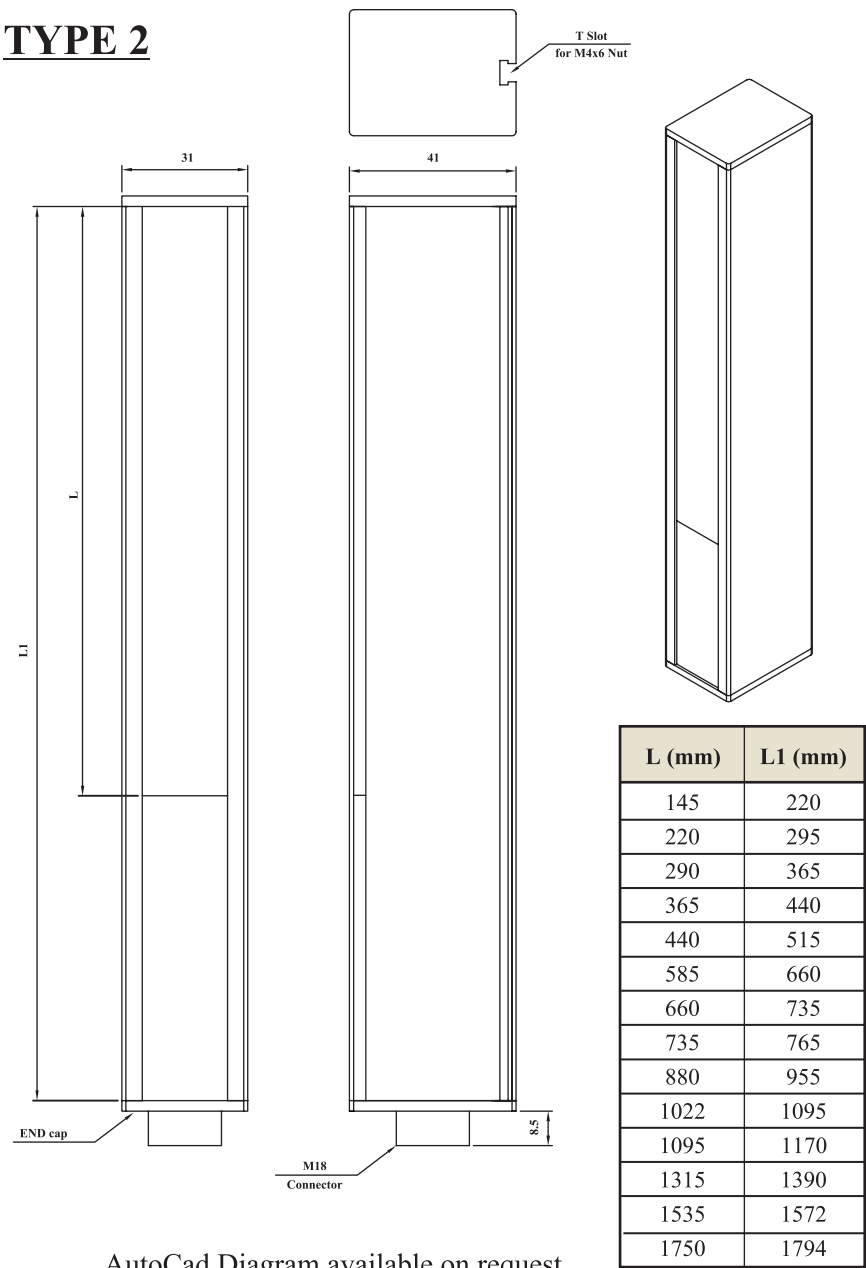
Pitch = 10mm

No. of Channels	Pitch (mm)	Screen Height (mm)	Total Height (mm)	Product Code
12	10	120	150	AC-3-C-1-B-4-C
20	10	200	398	AC-3-I-1-B-4-C
24	10	240	270	AC-3-E-1-B-4-C
32	10	320	350	AC-3-F-1-B-4-C
36	10	360	691	AC-3-H-1-B-4-C
48	10	480	510	AC-3-G-1-B-4-C
56	10	560	590	AC-3-J-1-B-4-C
60	10	600	1132	AC-3-K-1-B-4-C
72	10	720	750	AC-3-L-1-B-4-C
84	10	840	1573	AC-3-M-1-B-4-C
96	10	960	990	AC-3-N-1-B-4-C

Chart No. 2 (C)

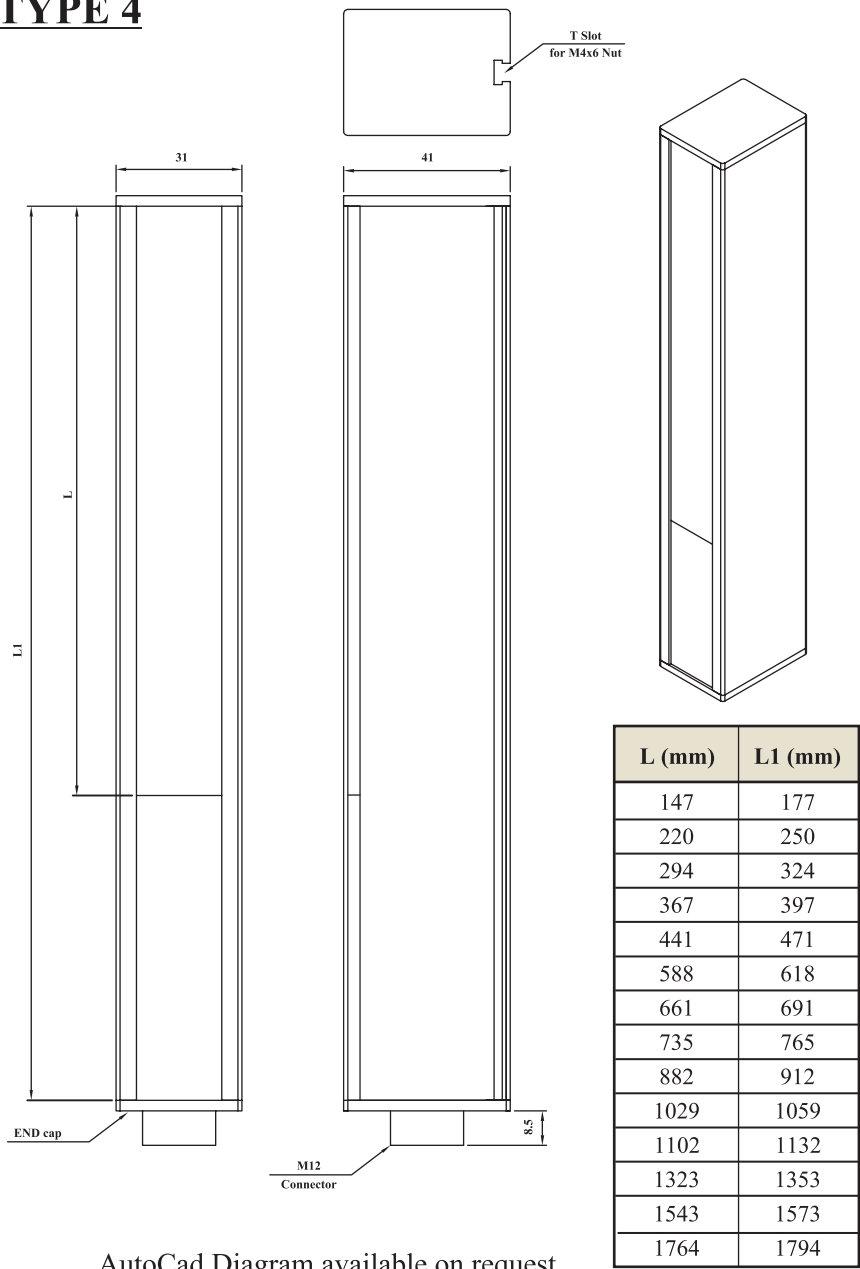
2.3 Dimensional Details

TYPE 2



AutoCad Diagram available on request.

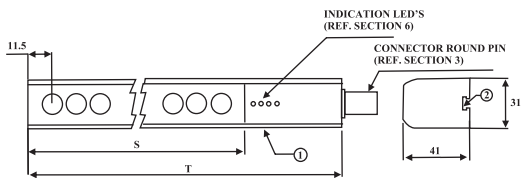
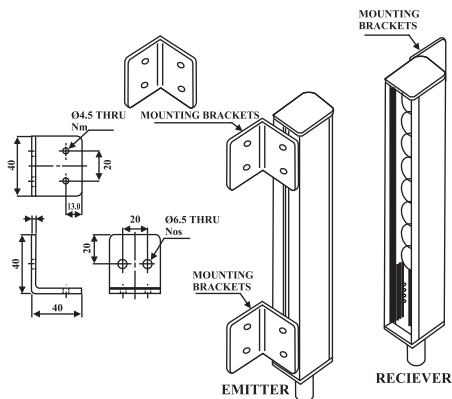
TYPE 4



AutoCad Diagram available on request.

2.4 Mounting Options:

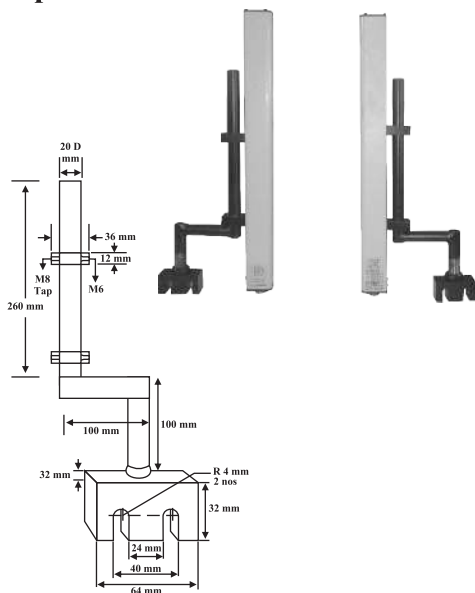
Option 1



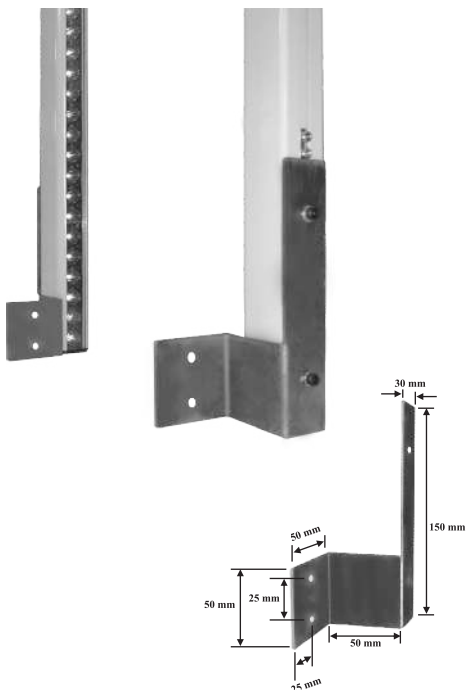
S = SCREEN HEIGHT [REF. CHART (1A & 1B)]
T = TOTAL HEIGHT [REF. CHART (1A & 1B)]

1. Extruded Aluminium section
2. T Slot for M4x6 Nuts

Option 2



Option 3



3. ELECTRICAL CONNECTIONS

3.1 CONNECTION for IP65

Emitter:

M18 2-pole connector

1	:	Black	:	Ground
2	:	Red	:	+24VD
3	:	Silver	:	Shield Earth

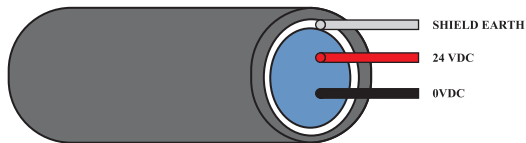


Fig.5

Receiver :

M18 4-pole connector

1	:	Black	:	Ground
2	:	Red	:	+24VDC
3	:	Yellow	:	OSSD 1
4	:	Green	:	OSSD 2
5	:	Silver	:	Shield Earth

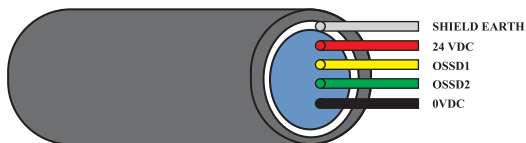


Fig.6

3.2 CONNECTION for IP67

Emitter:

M12 3-pole connector

1	:	Brown/Red	:	24VDC
2	:	Blue	:	Ground
3	:	Black	:	Not Connected

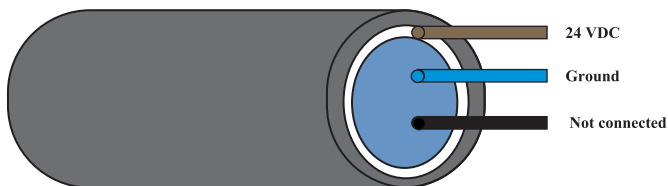


Fig.7

Receiver :

M12 5-pole connector

1	:	Blue	:	Ground
2	:	Red/Brown	:	+24VDC
3	:	White	:	OSSD 1
4	:	Black	:	OSSD 2
5	:	Grey	:	Not Connected

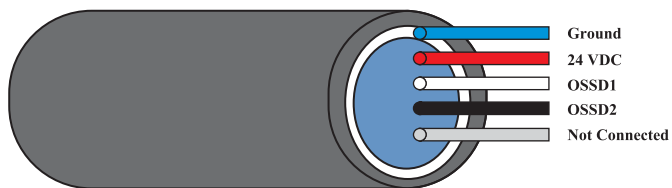


Fig.8

3.3 Output Connection Diagram:

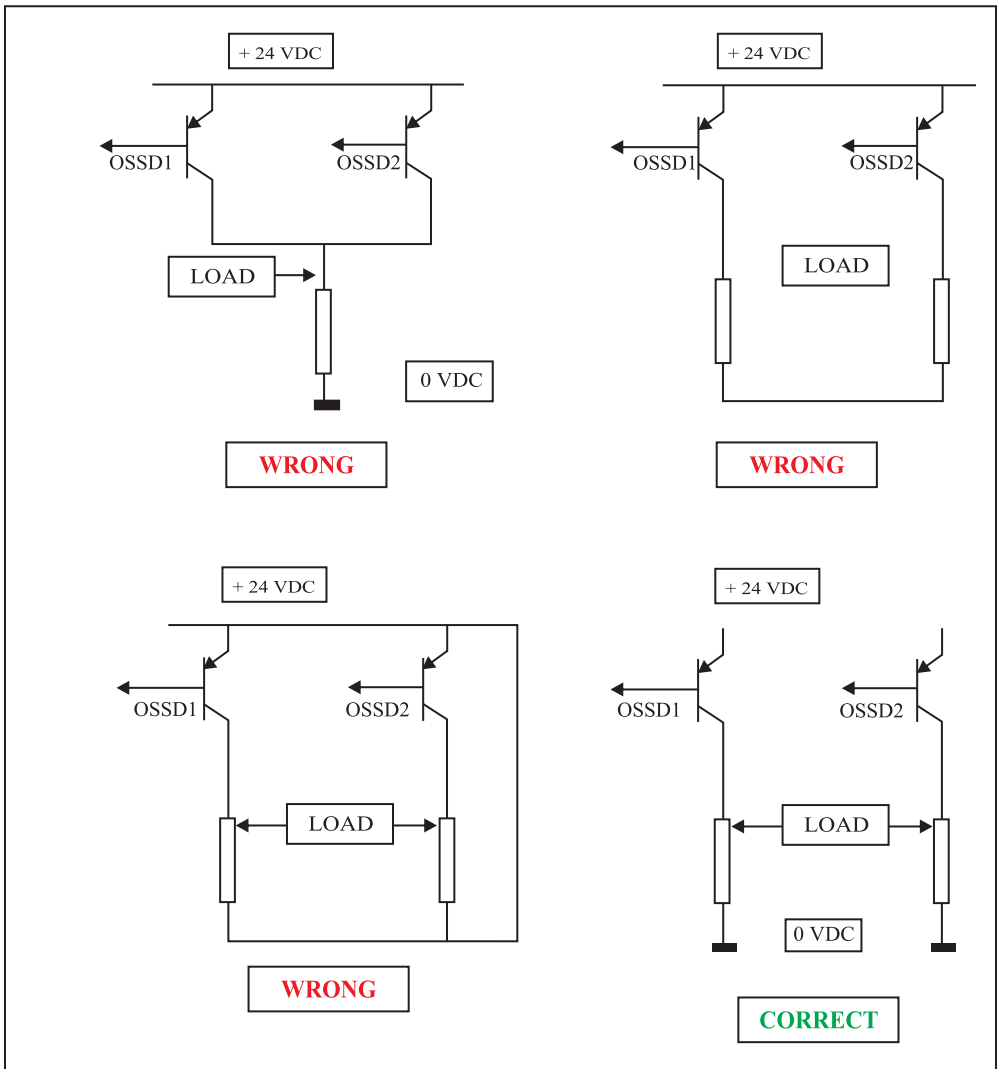


Fig.9

4. INSTALLATION AND POSITIONING

4.1 Interferences Between The Emitter and Receiver:

When several safety devices must be installed in adjacent areas, interferences between the emitter of one device and the receiver of the other must be avoided.

Fig.10 provides an example of possible interferences between different devices and two pertinent solutions.

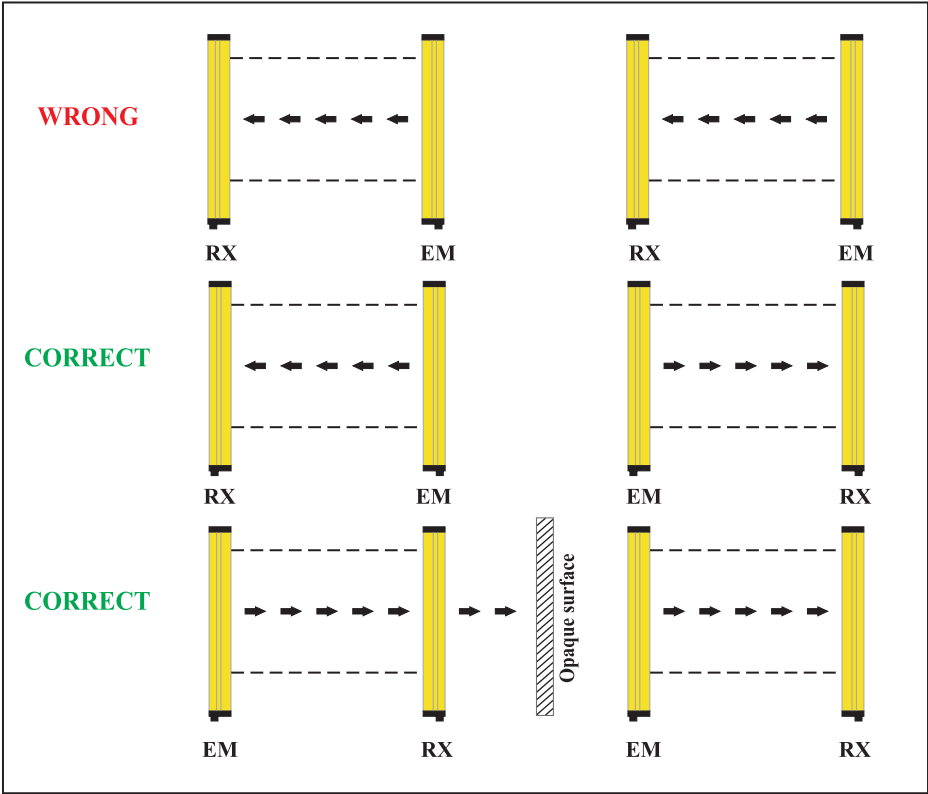


Fig.10

4.2 General Information On Device Positioning:

The device must be carefully positioned, such that, the access to the hazardous area must only be possible through the protection safety light beams.

The below images a) and b) shows installations, where light curtains of insufficient length have been installed. These allow the operator to reach work area without cutting light beams, and are therefore unsafe. Diagram c) shows corrected situation which is safe.

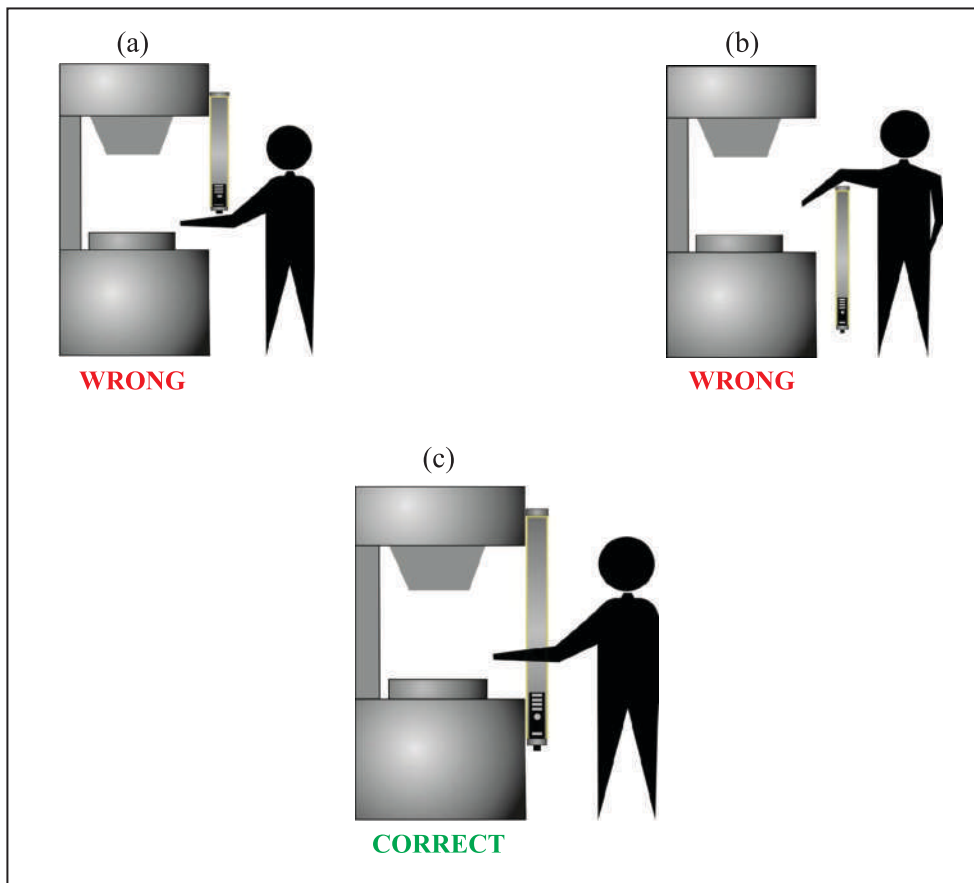


Fig.11

5. ALIGNMENT PROCEDURE

5.1 FOR TYPE 2

The alignment of the emitter and receiver modules are necessary to achieve proper functioning of the safety light curtain.

For the proper operation, the Emitter and Receiver must be made parallel to and facing each other. To align them, there are two YELLOW LED indicators, in Receiver and Transmitter units.

Alignment Steps:

After the mechanical installation and the electrical connections, follow these steps to align both the modules:

- Connect the power supply of +24 VDC to Safety light curtain.
- Check the Red POWER-ON LED of both modules, they must be ON.
- Now check the YELLOW READY LED of Transmitter module. If it is blinking it indicates the light curtain is not aligned. Then adjust the alignment until the Yellow LED starts glowing & remains steady. Check the green OUTPUT LED of Receiver module & Yellow READY LED of Receiver module. If it is not glowing it indicates that some channels are not aligned, or obstruction between TX & RX. Check & aligned until the Green LED of OUTPUT starts glowing & remains steady.

Follow the table to align the both modules:

LED STATUS	DIAGNOSTICS
<div><div>● WAIT</div><div>● READY</div><div>● OUTPUT</div><div>● POWER ON</div></div>	<div>Power supply is not connected properly.</div> <div>Refer Page No.11, Electrical Connections</div>
<div><div>● WAIT</div><div>● READY</div><div>● OUTPUT</div><div>● POWER ON</div></div>	<div>GREEN and YELLOW LED are OFF</div> <div>Safety light curtain is not properly aligned.</div>
<div><div>● WAIT</div><div>○ READY</div><div>● OUTPUT</div><div>● POWER ON</div></div>	<div>Output GREEN LED is OFF .</div> <div>Check for the obstruction between TX and RX.</div>
<div><div>● WAIT</div><div>○ READY</div><div>○ OUTPUT</div><div>● POWER ON</div></div>	<div>Ready LED is YELLOW.</div> <div>Output LED is GREEN.</div> <div>Power LED is RED.</div> <div>All optical beams are correctly aligned.</div>

5.2 FOR TYPE 4

The alignment of the emitter and receiver modules is necessary to achieve proper functioning of the safety light curtain.

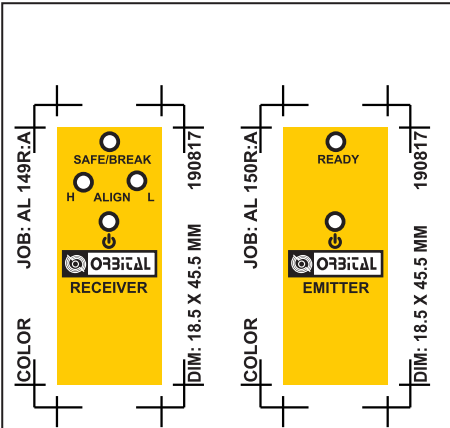
For the proper operation, the emitter and receiver must be made parallel to and facing each other. To align them, there are two LED indicators. Yellow for HIGH ALIGN and Green for LOW ALIGN on the receiver unit.

Alignment Steps:

After the mechanical installation and the electrical connections, follow these steps to align both the modules:

- Connect the power supply of +24 VDC to Safety light curtain.
- Check the Red POWER-ON LED of both modules, they must be ON.
- Check the Green LOW ALIGN LED of the receiver module, if it is not ON it indicates that the lowest beam is not aligned. Adjust the lower end of the pair until Green LED becomes ON.
- Now check the Yellow HIGH ALIGN LED of the Receiver module. If not ON it indicates the Highest beam is not aligned. Adjust the upper end of the pair until Yellow LED becomes ON.
- If there is no obstruction in the light path, Receiver’s SAFE/BREAK indicator must be Green.
- Emitter’s SAFE indicator must also be Green. It indicates proper functioning of Emitter
- Finally if Emitter’s SAFE LED is Green, Receiver’s HIGH ALIGN and LOW ALIGN both are ON and SAFE/BREAK Indicator is Green, then it indicates all optics are correctly aligned, and that the light curtain is not obstructed.





















Follow the table to align the both modules:

Diagnostics	
	<i>Power supply is not connected properly. Refer Page No.11, Electrical Connections</i>
	<i>GREEN and YELLOW LEDs are blinking or OFF Top and Lowest optical beams are not aligned.</i>
	<i>GREEN LED of low align is ON, but YELLOW LED of high align is OFF Lowest optical beam is aligned but Highest optical beam is not aligned</i>
	<i>Lowest and Top optical beams are aligned, but some opaque object is obstructing one or more of the remaining beams.</i>
	<i>AOPD is fully aligned, there is no obstruction in the detection Zone</i>

6. FAULT AND DIAGNOSTIC MESSAGES

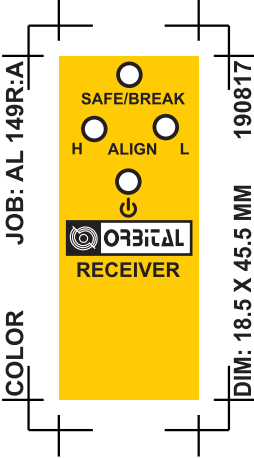
The operator is able to check the main causes of the response of the safety light curtain, using the indication LEDs.

6.1 FOR TYPE 2

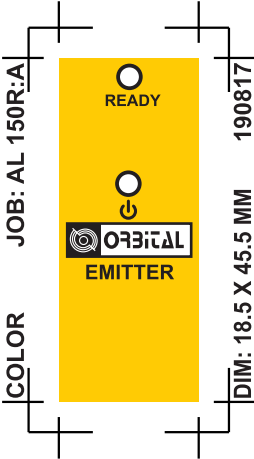
LED Status	Diagnostics, Check and Repair
 WAIT  READY  OUTPUT  POWER ON	Electrical connection fault <i>Refer Page No. 10, Electrical Connections And connect it properly.</i>
 WAIT  READY  OUTPUT  POWER ON	Alignment fault <i>Adjust the alignment of both modules by Mounting them paralely.</i>
 WAIT  READY  OUTPUT  POWER ON	Output LED is not ON <i>Adjust both modules to align and check for Obstruction between TX and RX.</i>
 WAIT  READY  OUTPUT  POWER ON	Microcontroller fault <i>All indicator LEDs are Blinking, Power On LED is ON, Need to repair, Contact to ORBITAL SYSTEMS.</i>
 WAIT  READY  OUTPUT  POWER ON	<i>WAIT LED is OFF (BLACK) , OUTPUT LED is ON (GREEN) , READY LED is ON (YELLOW) , All optical beams are correctly aligned.</i>

6.2 FOR TYPE 4

For Receiver Module:

LED Status	Diagnostics, Check and repair
	<p>Electrical connection fault Refer Page No. 8, Electrical Connections. And connect it properly.</p>
	<p>Alignment fault Adjust both modules and align.</p>
	<p>Alignment fault, Top LED is not aligned Adjust the top part of the modules.</p>
	<p>Microcontroller fault All indicator LEDs are Blinking, Power On LED is ON, Need to repair, Contact to ORBITAL SYSTEM.</p>
	<p>Safe/Break LED is GREEN, Low Align LED is ON, High Align LED is ON, All optical beams are correctly aligned.</p>

For Emitter Module:

LED Status	Diagnostics, Check and Repair
	<p>SAFE and POWER ON LEDs are OFF Electrical connections fault Refer Page No. 11, Electrical Connections. And connect it properly.</p>
	<p>Microcontroller failure Contact to ORBITAL SYSTEMS</p>
	<p>Emitter is working properly</p>

7. TECHNICAL SPECIFICATIONS

Power supply(VDD):	24VDC \pm 20%
Emissiontype:	Infrared(880nm)
Resolution:	14mm/30mm/48mm
OperatingRange:	Standard: 5meters; upto 15meters on request
SafetyCategory:	Type 2 / Type4
Nominalscreenheight:	Refer Chart No. 1 / 2
Outputtype:	2PNPoutputs(withshortcircuitprotection)
OutputCurrent:	0.1Amax/eachoutput
Output ON Voltage:	Type 2 - VDC-1VDC / Type 4-VDD-1.3VDC
Output OFF voltage:	Type 2 - 0.3VDC / Type 4- 0.7 VDC
Capacitive LoadPure:	100nF
ResistiveLoadPure:	240Ohms
MechanicalProtection:	IP65 / IP67
Ambientlightrejection:	IEC61496-2
Referencestandard:	IEC61496-1, IEC61496-2
Housing material:	Painted aluminum
Lensmaterial:	Polymethyl methacrylate(PMMA)
Connections:	IP 65-M18 2 Pole TX, M18 4 Pole RX IP 67-M12 3 Pole TX, M12 5 Pole RX
Operatingtemperature:	0...+ 55°C
Maximum Lengthof ConnectionCables:	50meters.
Humidity:	15...95 %(no condensation)
Vibrations:	Frequency10...55 Hz

9. SAFETY NOTES

The installation and connection of Safety Light Curtain must be entrusted to only qualified Personnel. The operators working in dangerous area must be trained and knowledgeable about the Safety Light Curtains.

- Machine under control must be able to respond to OSSDs of safety light curtain with fast response.
- The safety light curtains must be installed at a safe distance from danger zone. A calculation for the same is given below.
- The 30 mm resolution for Type 2 & Type 4 this guard protects operators hand 14mm resolution for 10mm pitch this guard protects (detects) operator fingers. The 48mm resolution is for area guarding.
- The operator hands must not be able to reach danger zone without passing through the detection zone of the Safety Guard.
- A stable and reliable Power supply of 24 VDC with 1Amp rating minimum is recommended with CE Mark.
- Keep reflecting surfaces at least 131mm away from detection zone for operating distances upto 3meters. For longer operating distances use formula:
 $R=0.044XD$, where R=distance of reflecting surface, D=operating distance
- **Only shielded cables must be used to connect to Safety Light Curtain.**
- Strong Electromagnetic interference can affect functioning. Outputs of 2 or more Safety Light Curtains must not be passed through same wire harness. High Voltage AC wires such as motor supply cables, drivers, Inverter cables must be routed separately
- Distance between Safety Light Curtain and Danger zone for vertically mounted Safety Light Curtain:
Procedure for calculating minimum distance of safety light curtain form danger zone.

For Vertically mounted Guards of 30mm resolution:

$$D = 1600 \times (T + t) + 128\text{mm}$$

If above equation results in $D < 500$, then recalculate as below:

$$D = 2000 \times (T + t) + 128\text{mm}$$

For guards with 36.75mm pitch, add 144mm to above results.

For Horizontally mounted Guards of 30mm resolution:

$$D = 1600 \times (T + t) + 1200\text{mm} - Z$$

$$Z = 0.4 \times \text{Vertical Distance of the Guard from the Ground}$$

- The user, customer is not allowed to open or repair this safety guard.
- The shield wire of Emitter and receiver must be connected to Earth connection at the 24VDC power supply.

10. CONNECTING CABLES

There are two types of shielded cables

For **IP65:- 2 Core and 4 Core**

The emitter receives its +24 VDC supply through Red and Black wires of 2 core shielded cable.

The Receiver receives its +24 VDC supply from Red and Black cores of the 4 core shielded cable.

It delivers controlled output from its 2 OSSDs from other two cores i.e. OSSD1 output through Yellow Core and OSSD2 output through Green core.

For **IP67:- 3 Core and 5 Core**

The emitter receives its +24 VDC supply through Brown and Blue wires of 3 core shielded cable.

The Receiver receives its +24 VDC supply from Red and Blue cores of the 5 core shielded cable.

It delivers controlled output from its 2 OSSDs from other two cores i.e. OSSD1 output through White Core and OSSD2 output through Black core.

11. PERIODIC MAINTENANCE/CHECKS

- Check to see if there is buildup of dust layer on the transparent acrylic surface of Emitter and Receiver. Use soft dry cotton cloth to gently wipe the surface. In case thick/ greasy deposits, take help from manufacturer representative.
- Check the alignment.
- Check with the help of a test piece:
 - a) Protection height
 - b) Protected area
 - c) Time taken to stop machine when obstructed with test piece
 - d) Chances of approaching the hazardous part of machine without being detected.

12. WARRANTY

The product is covered by 1 year warranty from the date of manufacture.

Warranty does not apply under following conditions:

- a) Damages due to incorrect handling
- b) Bumps
- c) Accidents, damages caused by incorrect installation
- d) Opening of the emitter, receiver units

13. DISPOSAL

This product is made up from standard engineering materials & is non-hazardous.

Disposal of this product should follow procedures applicable for disposal of light engineering goods.



Orbital Mekatronik Systems Pvt. Ltd.

**C - 7, Unit No. 134, 1st Floor, "Bhumi World",
Mumbai Nasik Highway, Pimplas,
Bhiwandi - 421 302, Thane (Dist)
Website : www.orbitalmekatronik.com**