Foreword

Thank you for choosing KS06M safety light curtain!

KS06M safety light curtain is suitable for automation and machining field.

The device only protects the rectangular light curtain area between the emitter and the receiver. If its installation position is incorrect, or the operation does not follow the instructions and related safety rules, or the equipment actuator breaks down, the device may not be able to play the protective role. Therefore, before installing this device, please read the instructions carefully and fully understand the relevant items, especially the "warning", "attention" and other contents; in use, please correctly understand the performance of the safety light curtain and operate in strict accordance with the instructions and related safety rules for safety light curtain.

The instructions only introduce the application of KS06M safety light curtain in the pressure machine. The instructions are only used for reference when the safety light curtain is used in other occasions.

As a result of the technical update of the product, when the product is inconsistent with the relevant contents provided in the instructions, the material object shall prevail. We will release the change notice on the company's website in time. Please log in http://www.sdkeli.com for verification.

The instructions are interpreted by Shandong Keli Opto-electronic Technology Co., Ltd.. When reading or using the instructions, please contact us if there are any uncertainties.

Contents

Danger Category and Special Symbol

Before the installation, operation or maintenance of KS06M safety light curtain, please read the instructions carefully and familiarize yourself with the equipment through appearance. The following special information may appear anywhere in the instructions to warn the potential dangers or provide tips for information used to clarify or simplify certain procedure.

 **Warning**
This is a safety warning label. The content of the label is very important. Operators must strictly implement the safety information in the label to avoid possible personal injury.

 **Notice**
This is the prompt label of key information. The content of the label is very important. The operator must understand and strictly enforce the information according to the information requirements to avoid possible legal disputes and product damages.

Please pay attention to the followings: Electrical equipment must be installed, operated, serviced and maintained by qualified professionals.

Part 1 Safety Needs

 Warning

KS06M safety light curtain must be installed and maintained by a professional.

Before the installation and use of KS06M safety light curtain, please carefully read and accurately understand the instructions and operate in strict accordance with the relevant requirements in the instructions.

The inconformity with the instructions may lead to the personnel injury or equipment damages.

1.1 Preventive Measures

Correct use, installation, maintenance and operation are the basis for the safety functions of KS06M safety light curtain. This is the common responsibility of the purchaser, the installer and the person in charge of the enterprise. The person in charge of the enterprise shall be responsible for the necessary training of the employees. Training contents include: Installation, adjustment, use and maintenance of equipment and related safety systems.

KS06M safety light curtain must be installed, repaired and maintained by a professional.

In this case, a professional means "a person who has been professionally trained and accredited, or who has a wealth of knowledge and experience and has proven to be capable of solving such problems" (ANSI B30.2-1983).

1.2 Safety Requirements

To use KS06M safety light curtain, you must comply with the following requirements:

- The controlled equipment should be able to respond reliably after KS06M safety light curtain gives the disconnected signal, otherwise the safety function cannot be realized.
- The person in charge of enterprise and the users are responsible for compliance with any applicable national and local laws, regulations and norms.

- The controlled equipment and safety - related parts should be properly set up to ensure that the control logic error or control loop failure does not result in a risk of failure of KS06M safety light curtain.

1.3 Product Support

Please operate KS06M safety light curtain according to the requirements of the instructions. For more product and service information, please log in: www.shuangshou.com or call at 400-666-0416.

Part 2 Product Introduction

2.1 General

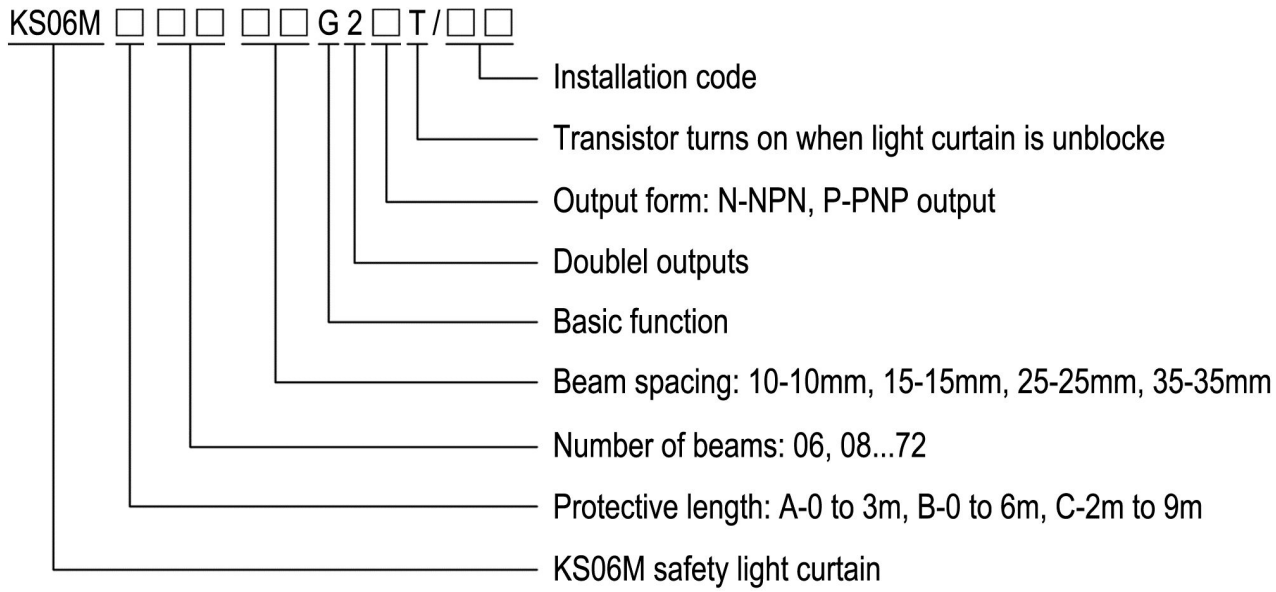
KS06M safety light curtain conforms to the requirements of GB/T 19436.1 Safety Level 4, GB/T 19436.2 Safety Level 4 and GB4584 2007. It is characterized by high safety, tiny appearance, small invalid detection area and high detection accuracy (the maximum accuracy is 14mm; it may be used to protect the fingers). It is applicable to the automation field and machining field.

KS06M safety light curtain provides protection against dangerous areas at different distances, such as 3m, 6m, 9m, etc. Users can choose the appropriate screen model according to the actual width of the table-board.

KS06M safety light curtain provides two-channel PNP or NPN output control signal.

2.2 Specification

The specification of KS06M safety light curtain is shown as follows:



2.3 Selection Instruction

KS06M safety light curtain should be preferred for places with restricted installation space. The appearance of this series of safety light curtain is tiny that the thickness is 25mm and the width is 30mm. The invalid detection area at both ends of the sensor is less than 7.5 mm. It basically can realize the whole area coverage of the light curtain installation area.

➢ Choose a reasonable length of protection: KS06M safety light curtain is divided into type A, type B and type C according to the protection length. The protection length is respectively 0-3m, 0-6m, 2-9m. In order to ensure the stable operation of the system, the protection length of the selected light curtain should be greater than the width of the table-board needs to be protected.

Notice
When the actual protection table-board width is larger than the rated protection length, it may lead to unstable system work or shorten service life.

➢ Select reasonable detection accuracy: There are four kinds of detection accuracy for KS06M safety light curtain: 14mm,20mm,30mm,40mm. The light curtain with the detection accuracy of 14mm can be used for finger protection; the light curtain with detection accuracy of 20mm and 30mm can be used for palm protection; the light curtain with detection accuracy of 40mm can be used for arm protection and other occasions with lower requirements for the detection accuracy.

Warning
The size of the object that needs to be protected should not be less than the value of detection accuracy of the light curtain. The company does not take any responsibility for any personal injury caused by the lack of detection accuracy.

➢ Choose a reasonable height of protection: The protection height of KS06M safety light curtain is 150mm-2485mm; The protection height of light curtain should not be lower than that required by relevant safety standards.

Warning

The company does not take any responsibility for any personal injury caused by the lack of protection height.

➢ Select the appropriate form of output: KS06M safety light curtain provides two output forms, namely PNP output and NPN output.

Warning

Because the contact with the machine tool shell may cause danger and invalidity after the output cable is opened, we do not recommend the use of NPN output form. We shall not be liable for any personal injury caused by the short circuit between the output cable and other circuits

2.4 Function and Appearance

- **Safety light curtain**

KS06M safety light curtain consists of emitter, receiver and transmission cable. Emitter is the combination of the light emitting unit, which is used to transmit the light signal; receiver is the combination of the light receiving unit, which is used to receive and process the light signal from the emitter, and transmit the On-off state signal of light curtain to the controlled equipment; The transmission cable provides power supply and communication channel to emitter and receiver, and transmits the detection results of light curtain to the controlled equipment at the same time.

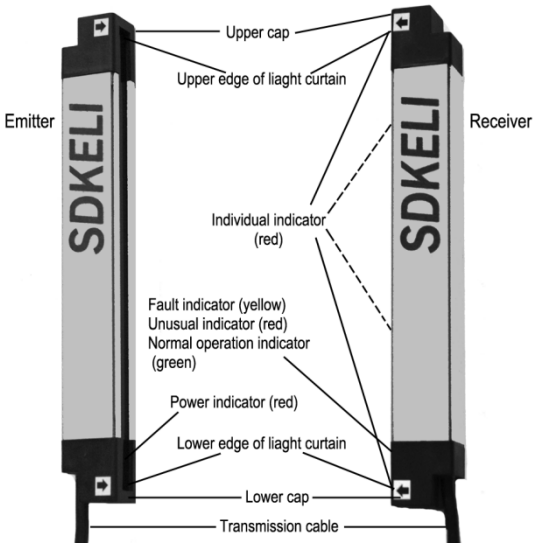


Fig.2.4.1 Schematic diagram of light curtain

- **Transmission cable**

Standard length of transmission cable:

The standard cable length of KS06M safety light curtain is type A: 1.5m, 3.5m; Type B: 1.5m, 6.5m; Type C 1.5m, 9.5m.

When the configuration of the standard cable length cannot meet the requirements, it should be customized when ordering.

The connection of each connection point of the transmission cable is shown in Fig.2.4.2.

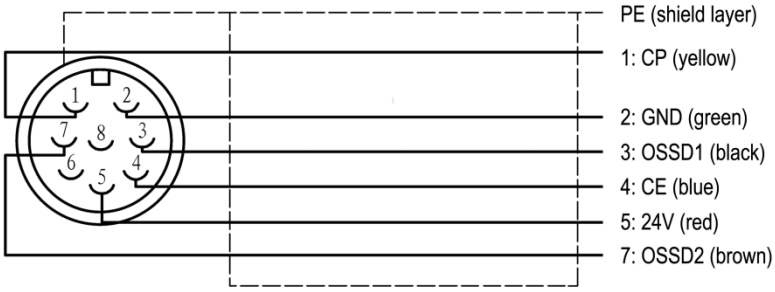
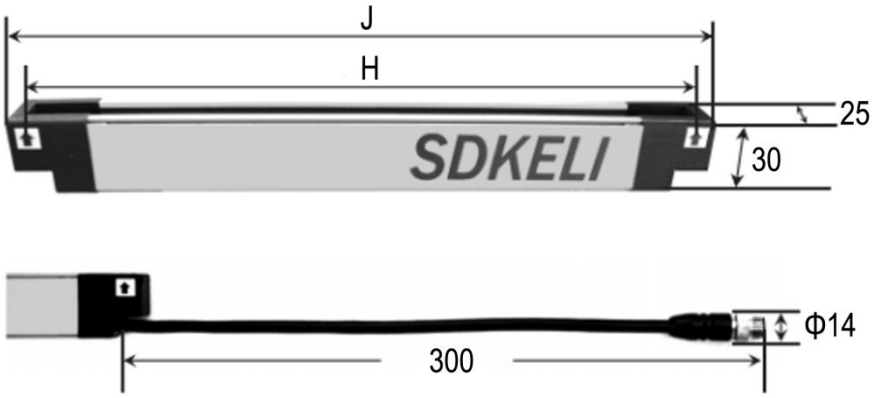
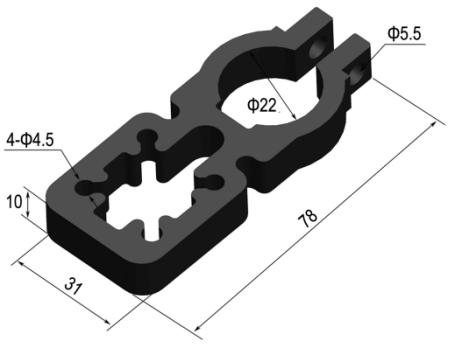


Fig.2.4.2 Signal definition of transmission cable

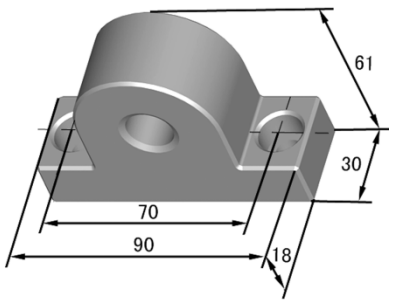
2.5 Part Dimensions



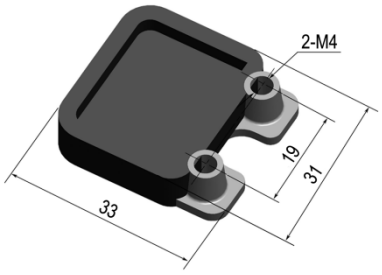
Connector



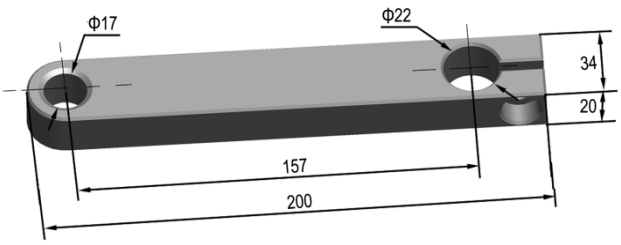
LCS pipe-mounting fixing clamp



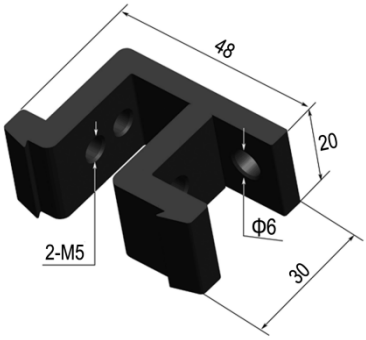
Bracket seat



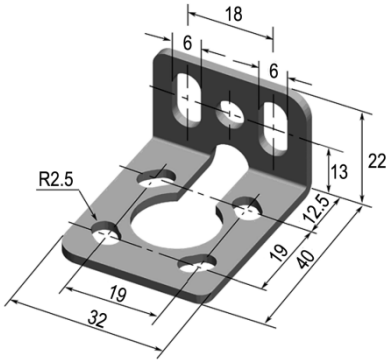
LCS vibration-reducer



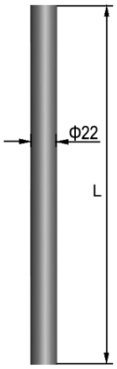
Bracket arm



LCS JZ mounting bracket



LCS vibration-mounting bracket



Steel pipe

Fig.2.5.1 Detail drawing of major parts

Table 2.5.1 List of protective height H, sensor length J and steel pipe L

Number of beams	Detection capability 14mm			Detection capability 20mm			Detection capability 30mm			Detection capability 40mm		
	Beam spacing 10mm			Beam spacing 15mm			Beam spacing 25mm			Beam spacing 35mm		
	H	J	L	H	J	L	H	J	L	H	J	L
6										175	190	500
8							175	190	500	245	260	500
10							225	240	500	315	330	500
12				165	180	500	275	290	500	385	400	750
14				195	210	500	325	340	750	455	470	750
16	150	165	500	225	240	500	375	390	750	525	540	750
18				255	270	500	425	440	750	595	610	1000
20	190	205	500	285	300	500	475	490	750	665	680	1000
22				315	330	500	525	540	750	735	750	1000
24	230	245	500	345	360	750	575	590	1000	805	820	1000
26				375	390	750	625	640	1000	875	890	1200
28	270	285	500	405	420	750	675	690	1000	945	960	1200
30				435	450	750	725	740	1000	1015	1030	1200
32	310	325	500	465	480	750	775	790	1000	1085	1100	1500
34				495	510	750	825	840	1200	1155	1170	1500
36	350	365	750	525	540	750	875	890	1200	1225	1240	1500
38				555	570	750	925	940	1200	1295	1310	1500
40	390	405	750	585	600	1000	975	990	1200	1365	1380	1750
42				615	630	1000	1025	1040	1500	1435	1450	1750
44	430	445	750	645	660	1000	1075	1090	1500	1505	1520	1750
46				675	690	1000	1125	1140	1500	1575	1590	2000
48	470	485	750	705	720	1000	1175	1190	1500	1645	1660	2000
50				735	750	1000	1225	1240	1500	1715	1730	2000
52	510	525	750	765	780	1000	1275	1290	1500	1785	1800	2000
54				795	810	1000	1325	1340	1750	1855	1870	
56	550	565	750	825	840	1200	1375	1390	1750	1925	1940	
58				855	870	1200	1425	1440	1750	1995	2010	
60	590	605	1000	885	900	1200	1475	1490	1750	2065	2080	
62				915	930	1200	1525	1540	1750	2135	2150	
64	630	645	1000	945	960	1200	1575	1590	2000	2205	2220	
66				975	990	1200	1625	1640	2000	2275	2290	
68	670	685	1000	1005	1020	1200	1675	1690	2000	2345	2360	
70				1035	1050	1500	1725	1740	2000	2415	2430	
72	710	725	1000	1065	1080	1500	1775	1790	2000	2485	2500	

2.6 Technical Parameters

Project	Parameters		Project	Parameters
Working voltage	DC21.6V-26.4V		Response time	≤10ms
Power consumption	<10W		Insulation resistance	>100MΩ
Ambient temperature	-10℃-55℃		IP code	IP65
Ambient humidity	35-95%RH		Anti-light interference	10000Lux (angle of incidence ≥5)
Dielectric strength	No breakdown or flashover phenomenon under AC1500V in 60s			
Beam spacing	10mm	15mm	25mm	35mm
Detection capability	14mm	20mm	30mm	40mm
Protection length	Series A: 0-3m	Series B: 0-6m	Series C: 2-9m	
Output characteristics	NPN type: When transmitting light, the transistor is ON, ≤200mA and the output voltage is ≤4V. When shading light, the transistor is OFF, the output voltage is ≤VCC-1V and the leakage current is <2mA. PNP type: When transmitting light, the transistor is ON, ≤200mA and the output voltage is ≤VCC-4V. When shading light, the transistor is OFF, the output voltage is ≤1V and the leakage current is <2mA.			

Part 3 Installation, Wiring and Commissioning

Notice

Before installing, please open the packing box and check the packing device according to the packing list; When installing, turn off the power of the machine to avoid danger.

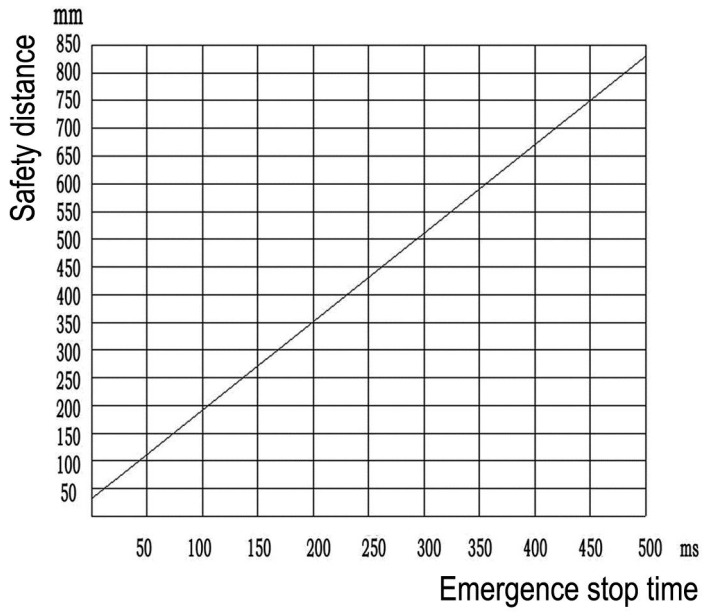
3.1 Determination of Installation Position

The installation position contains two elements of safety distance and high position.

In order to ensure the safety of the operator, the installation position of the safety light curtain must conform to the requirements of safety distance and height, otherwise, there is still the possibility of accidents.

3.1.1 Calculation of safety distance

- Safety distance is the minimum distance between the light curtain plane of a safety light curtain and the cutting edge of a mold. The calculation method shall be determined according to the braking mode of the pressure machine or with reference to the table below.



- For a pressure machine in which the slider can stop at any position of the stroke, the safety distance is calculated by formula (1).

$$S = KT + C \qquad (1)$$

Therein: ***S***--Safety distance (mm);

K - The speed of a person's body or part near a dangerous area (mm /s);

T - Total braking time of the system (s);

C--Additional distance (mm);

- For a pressure machine in which the slider can stop at any position of the stroke, the safety distance is calculated by formula (2).

$$S = KT_s + C \qquad (2)$$

Therein: ***S***--Safety distance (mm);

K - The speed of a person's body or part near a dangerous area (mm /s);

C--Additional distance (mm);

T_s- The time from the hand away from the light curtain to the slider of the pressure machine reaching the bottom dead center (s). It can be calculated according to formula (3) or measured in practice.

Determination of K value

- When the light curtain of safety light curtain is installed horizontally, the speed should be 1600 mm/s.
- When the light curtain of the safety light curtain is installed vertically, if the safety distance is not more than 500 mm, the speed should be 2000 mm/s; If the safety distance is larger than 500 mm, the speed should be 1600 mm/s.

The determination of *T* and T_s

- Total braking time of the system T includes the response time of safety light curtain and braking time of pressure machine.
- Response time of safety light curtain is given by the supplier of safety light curtain.

- The braking time of pressure machine should be measured according to the situations.
- The calculation method of Ts is given in the following formula.

$$T_s = (1/2 + 1/N) T_n \qquad (3)$$

Therein: ***N*** - Number of engagement slots of clutch;

T_n - Time that the crankshaft rotates one cycle (S).

Determination of C value

- The additional distance C is determined on the basis of the entry of hand into the light curtain of safety light curtain (response area) without causing the response of safety light curtain.
- According to the detection accuracy of the safety light curtain, C value is selected according to the rules of the following table when calculating the safety distance.

Detection accuracy (mm)	Additional distance C(mm)	Stroke start of safety light curtain
≤14	0	Allowed
>14-20	80	
>20-30	130	
>30-40	240	Not allowed
>40	850	

Warning
The safety distance is one of the necessary conditions to ensure the protection function of the safety light curtain. The safety distance must be calculated correctly and must be ensured when installing!!

3.1.2 Determination of height position

Height position refers to the protection height of the safety light curtain relative to the upper and lower position of the die of the machine tool. Namely under the premise of guaranteeing the safety distance, the undermost light beam of safety light curtain should not be higher than the lower edge of lower die and the uppermost light beam should not be lower than the upper edge of upper die, as

shown in Figure 3.1.1. This relates to the selection of protection height of safety light curtain.

The protection height should not be lower than that required light curtain protection height by relevant safety standards.

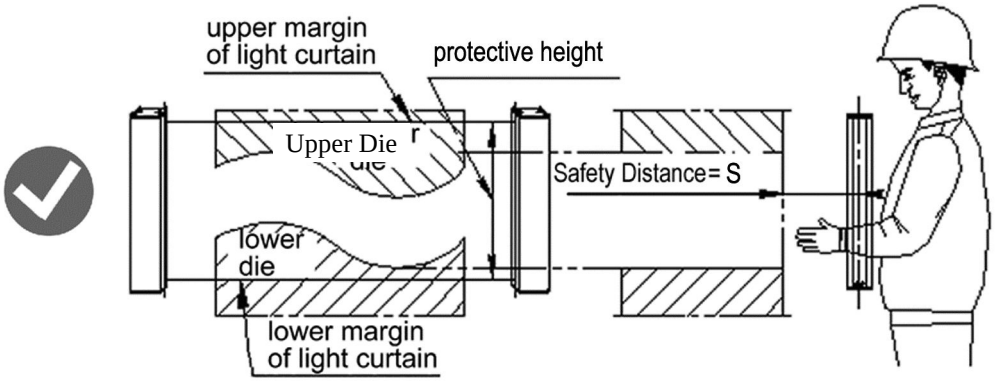


Fig.3.1.1 Correct installation position

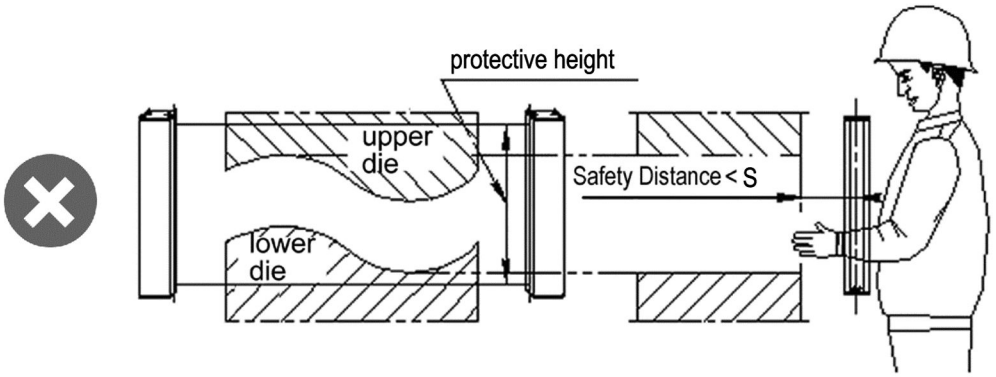


Fig.3.1.2 Incorrect installation position

(light curtain is too close to the die orifice)

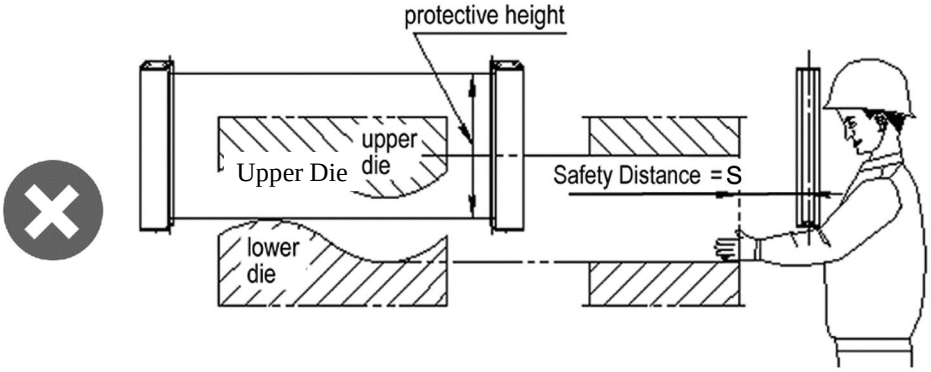


Fig.3.1.3 Incorrect installation position

(light curtain is a little higher, the hand can stretch into it under the lowest beam)

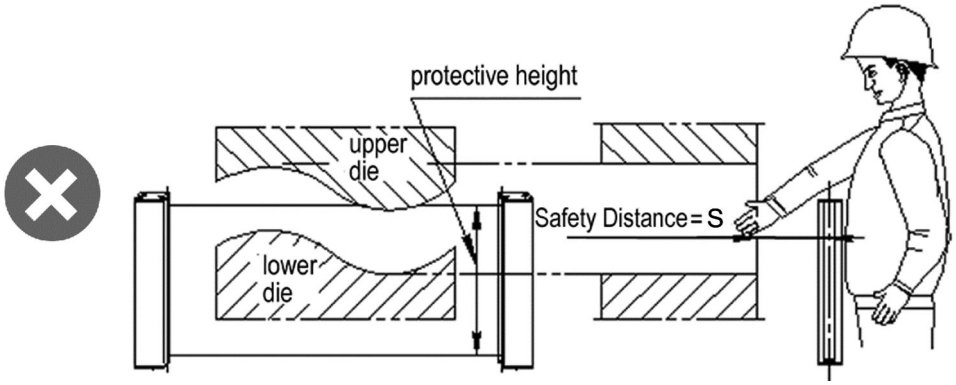


Fig.3.1.4 Incorrect installation position

(light curtain is a little lower, the hand can stretch into it upside the highest beam)

3.1.3 Settings for auxiliary protection measures

When the horizontal distance between the safety light curtain plane of the safety light curtain and the front end of the die exceeds 400 mm, additional auxiliary photoelectric or protective bars should be installed to prevent the operator from entering the inside of the light curtain plane, as shown in Figure 3.1.5. When the distance is less than 400mm, Auxiliary photoelectric or protective fence and other safety measures may be taken.

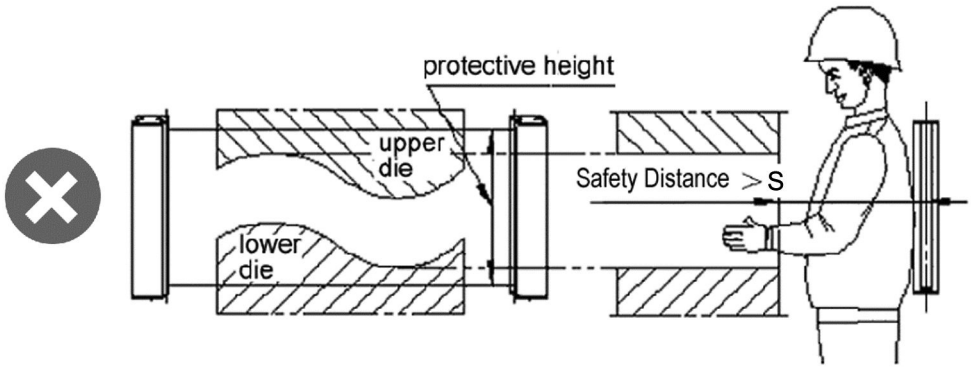


Fig.3.1.5 Incorrect installation position

(light curtain is too far from the die orifice, operators could enter danger zone)

Warning

A. The height position is one of the necessary conditions to ensure the protection function of the safety light curtain. The installation must ensure that the height is in the correct position.

B. When the machine tool slides, we must overhaul the machine tool timely. Otherwise, even if the safety light curtain is installed in the right position, it will not ensure safety.

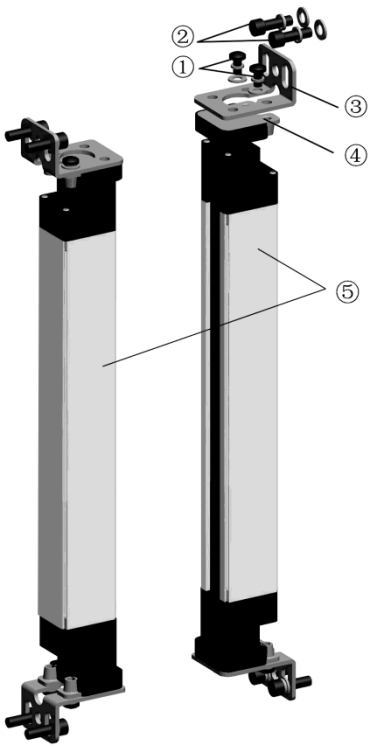
C. If it is necessary to replace the mold in the use process, we must adjust the position of safety light curtain according to the above two items of requirements.

D. The company is not liable for any personal injury caused by the wrong location of the installation.

3.2 Installation of Light Curtain

3.2.1 Common front mounting (PZ)

It refers to the installation mode that the emitter and receiver are directly installed on the machine body with common mounting bracket. It is generally applicable to the closed pressure machine with framed structure. Installing form as shown in Fig.3.2.1. The installation steps are as follows:



① M4×8 cross recessed screw, Φ4 elastic/plain washer
② M5×16 inner hexagon screw, Φ5 elastic/plain washer
③ LCS vibration-mounting bracket
④ LCS vibration-reducer
⑤ Emitter/ Receiver

Fig.3.2.1 Common front mounting (PZ)

A. The installation position of emitter and receiver should be determined according to the calculated safety distance and height. Care should be taken to ensure that the emitter can be installed parallel to the receiver.

B. Connector plug-in of sensor should be penetrated the middle hole of LCS vibration-mounting bracket. Pay attention to the bracket installation hole down when entering.

C. As shown in the graphical direction, connect LCS vibration-mounting bracket and LCS vibration-reducer with M4x8 cross recessed screws.

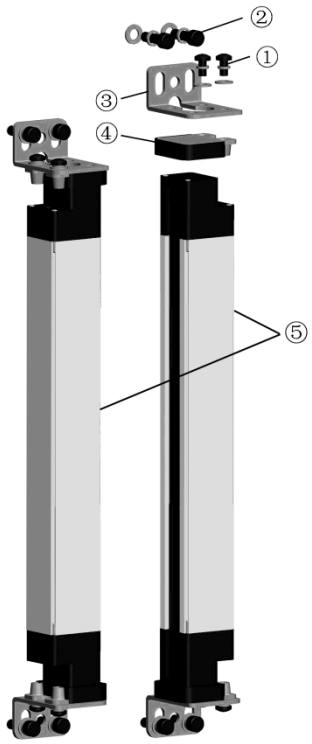
D. Fasten LCS vibration-mounting bracket on the bed piece with M5x16 inner hexagon screws.

E. Adjust the position of emitter and receiver to make them parallel and aligned and tighten the installation screws properly.

F. After commissioning, fasten all mounting screws.

3.2.2 Common side mounting (PC)

It refers to the installation mode that the emitter and receiver are directly installed on the machine body with the ordinary mounting bracket. It is generally applicable to the closed pressure machine with framed structure. Installing form as shown in Fig.3.2.2 The installation steps are as follows:



① M4×8 cross recessed screw, Φ4 elastic/plain washer
② M5×16 inner hexagon screw, Φ5 elastic/plain washer
③ LCS vibration-mounting bracket
④ LCS vibration-reducer
⑤ Emitter/ Receiver

Fig.3.2.2 Common mounting (PC)

A. The installation position of emitter and receiver should be determined according to the calculated safety distance and height. Care should be taken to ensure that the emitter can be installed parallel to the receiver.

B. As shown in the graphical direction, connect LCS vibration-mounting bracket and LCS vibration-reducer with M4x8 cross recessed screws.

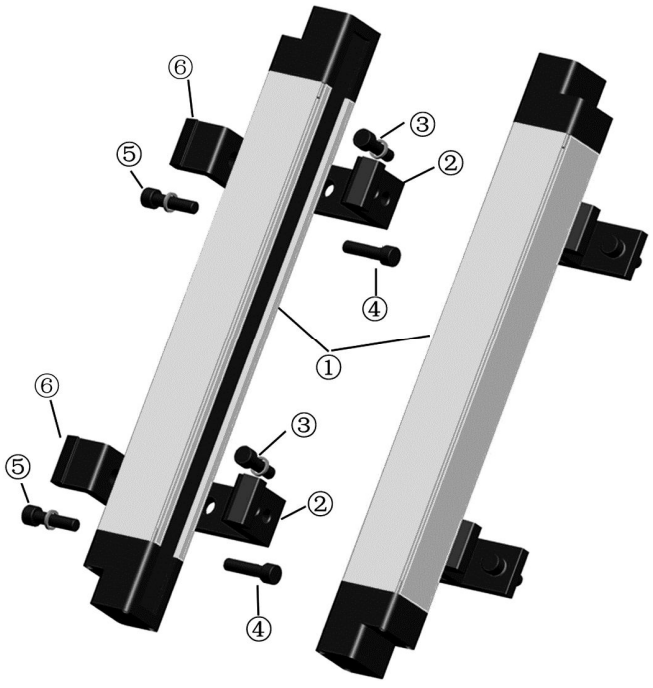
C. Fasten LCS vibration-mounting bracket on the bed piece with M5x16 inner hexagon screws.

D. Adjust the position of emitter and receiver to make them parallel and aligned and tighten the installations crews properly.

E. After commissioning, fasten all mounting screws.

3.2.3 Clamping mounting (JZ) (select back clamping or side clamping)

It refers to the installation mode that the emitter and receiver are directly installed on the machine body with the clamping mounting bracket. It is generally applicable to the occasions where it is not convenient to adopt the upper and lower mounting bracket in the framed structure. Installing form as shown in Fig.3.2.3 The installation steps are as follows:



① Emitter/ Receiver

② LCS mounting bracket

③ M5×16 inner hexagon screw, Φ5 elastic/plain washer

④ M5×16 inner hexagon screw

⑤ M5×20 inner hexagon screw, Φ5 elastic/plain washer

⑥ LCS clamping bracket

Fig.3.2.3 Clamping mounting (JZ)

A. The installation position of emitter and receiver should be determined according to the calculated safety distance and height. Care should be taken to ensure that the emitter can be

installed parallel to the receiver.

B. Pre-fasten LCS mounting bracket and LCS clamping bracket with inner hexagon screw.

C. Fasten LCS mounting bracket on the bed piece with M5×16 inner hexagon screw.

D. Insert the buckle of LCS mounting bracket and LCS clamping bracket into the mounting slot of emitter and receiver, pre-fasten M5×20 inner hexagon screw.

E. Adjust the height position of emitter and receiver. The height position should be consistent. The installation bolts should be tightened properly.

F. Adjust M5×16 inner hexagon screw ④ to make the emitter and receiver parallel and aligned, and properly tighten the bolts.

G. After commissioning, fasten all mounting screws and adjusting screws.

3.2.4 Pipe mounting mode (GZ)

Install the emitter and receiver on the machine tool through the pipe mounting bracket. It is generally applicable to the open pressure machine and four-column hydraulic press. Installing form as shown in Fig.3.2.4 The installation steps are as follows:

A. Install pipe mounting bracket

- According to the safety distance and height position, determine the installation position on both sides of machine tool, drill holes and tap wire, bracket seat to the bed piece of machine tool with M8x20 inner hexagon screws;
- Mount the bracket arm on bracket seat with M16x45 hexagon screw;
- Insert steel pipe in the hole of bracket arm, adjust it to the proper height. Tighten inner hexagon screw on the arm.

B. When front-mount mode is used, before the implementation of step C, firstly penetrate the lower transmission cable of emitter and receiver to the internal hole of LCS pipe-mounting fixing clamp. When the side-mount mode is used, the step may be omitted.

C. Respectively fasten LCS vibration-reducer of emitter and reciver to LCS pipe-mounting fixing clamp with M4x20 cross recessed screws according to the graphical directions.

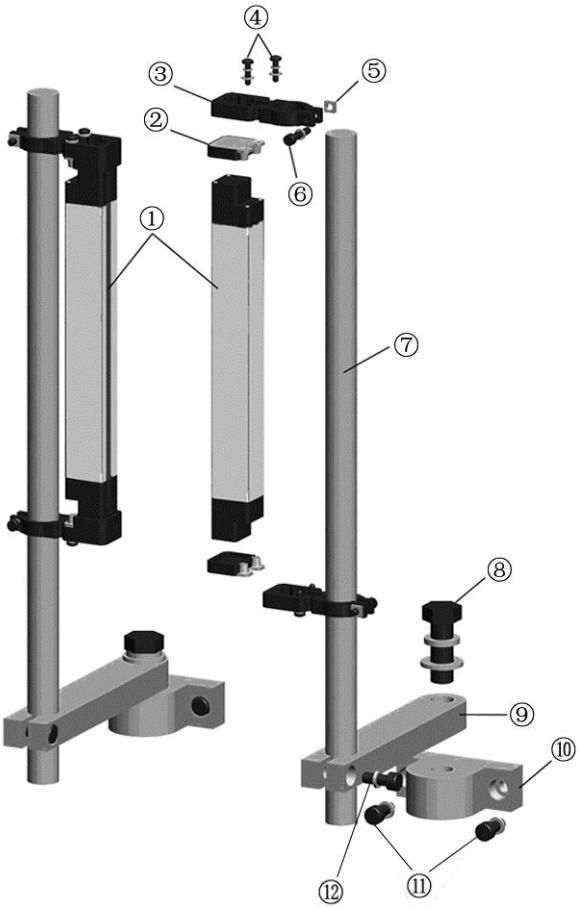
D. Mount LCS pipe-mounting fixing clamp on each steel pipe, tighten M5×25 inner hexagon

screw.

E. Mount emitter and receiver in the assembling slot of upper and lower vibration-reducer of steel pipe, properly tighten the M5×25 inner hexagon screw on LCS pipe-mounting fixing clamp.

F. Adjust the installation position of emitter and receiver (including the safety distance, protection height and horizontal corner) to make them parallel and aligned.

G. After commissioning, fasten all screws.



① Emitter/ Receiver
② LCS vibration-reducer
③ LCS pipe-mounting fixing clamp
④ M4×20 cross recessed screw, Φ4 elastic/plain washer
⑤ M5 square nut washer
⑥ M5×25 inner hexagon screw, Φ5 elastic washer
⑦ Steel pipe
⑧ M16×45 hexagon screw, Φ16 elastic/plain washer
⑨ Bracket arm
⑩ Bracket seat
⑪ M8×20 inner hexagon screw, Φ8 elastic washer
⑫ M8×20 inner hexagon screw, Φ8 elastic washer

Fig.3.2.4 Pipe mounting installation (GZ)

3.3 Wiring and Commissioning

3.3.1 Wiring

Warning

The working voltage of KS06M safety light curtain is DC21.6V-DC26.4V. It may damage the sensor if the power voltage exceeds DC26.4V or misconnected AC power supply.

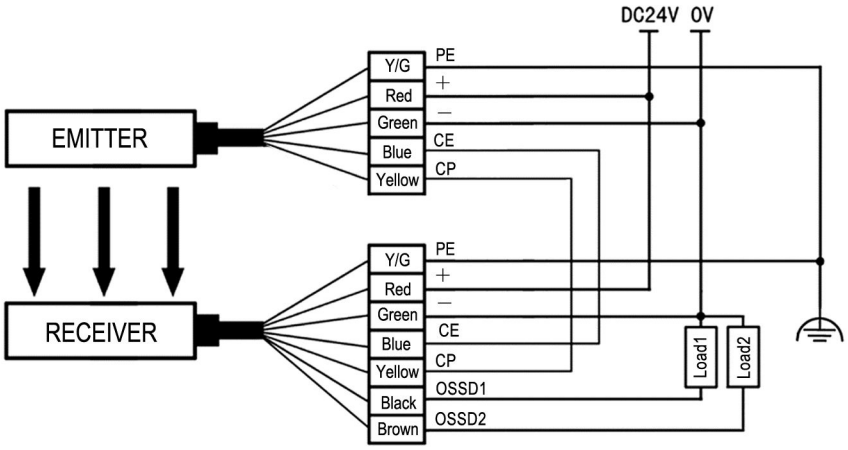


Fig.3.3.1 PNP output

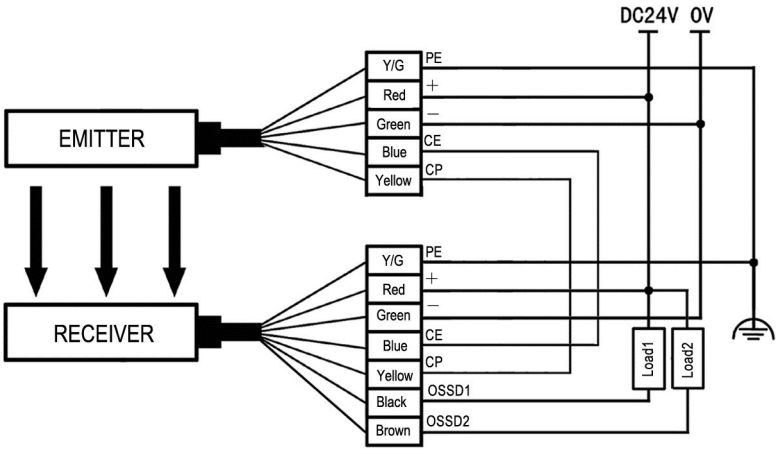


Fig.3.3.2 NPN output

After the installation, connect the cable according to Fig.3.3.1 or Fig.3.3.2. KS06M safety light curtain provides two output forms, namely PNP output or NPN output. The normal indicator (green light) is on when the light curtain transmits light on the light curtain. The output transistor is connected and has the drive capacity; when the light is shielded, the abnormal indicator (red light) is on and the output transistor is disconnected. In case of failure in the light curtain, the receiver fault indicator (yellow) is on and the output transistor is disconnected.

3.3.2 Commissioning

After the installation and wiring, check referring to the wiring diagram and confirm the accurate

wiring. Confirm the wiring is correct before the power-on commissioning.

- **Beam focusing**

Adjust the position of emitter and receiver to make them parallel and aligned until the red indicator on the receiver is off, the green indicator is on and the shunting indicator is off. No red and green lights are allowed to jump repeatedly to the critical state of light.

- **Inspection**

When shading one beam, the corresponding shunting indicator will be on. The red indicator on the receiver is on and the green indicator is off. After removing the shade, the red indicator will be off, the green indicator will be on and the shunting indicator will be off. The above state indicates the safety light curtain is normal.

- **Trial operation**

After the completion of commissioning work and before the formal working, the trial operation should be conducted with the controlled equipment. When it is confirmed that the safety light curtain is shaded, the state of control equipment should be consistent with the forecast to ensure the accuracy.

Part 4 Maintenance

Before the formal working, check the working state of light curtain. The work may be conducted when normal. The abnormal conditions should be reported to the professionals. The check and maintenance of safety light curtain are very important to the operation on site. We should formulate the safety regulations to standardize the use, inspection and maintenance of light curtain. The fault and overhaul of emitter and receiver are shown in the following table.

Fault phenomenon	Failure causes	Solutions
All indicators of emitter or receiver are not on	Power supply fault	Check external power supply
	Fault of transmission cable	Maintain transmission cables and connectors
	Emitter or receiver is damaged	Replace emitter or receiver
The red indicator of receiver is on and the green indicator is off	The beam focusing is not good	Focus the beam
	The surface of filter plate of emitter or receiver is dirty	Wipe with clean and softy cotton yarn
	Fault of emitter or receiver	Replace emitter or receiver
Yellow indicator of receiver is on	Fault of receiver	Replace receiver