SHUANG SHOU

ISO9001:2008

CE

LDKS-ⅢH Retro Active Opto-electronic Protective Device

OPERATION MANUAL

◇ LDKS-ⅢH Retro Active Opto-electronic Protective Device is for use where personnel protection is required, please read this manual carefully before installation and utilization.

◇ The operation manual is an important document to guide users to install and use the Active Opto-electronic Protective Device correctly. Agents, dealers and machine tool factories have the obligation to hand over this manual along with the devices to customers.

STRICTLY ADHERE TO ALL INSTRUCTIONS

Jining Keli Photoelectronic Industrial CO., LTD
Laser Research Institute of Shandong Academy of Sciences

PREFACE

Thank you for purchasing "ShuangShou" Active Opto-electronic Protective Device!

LDKS-ⅢH Retro Active Opto-electronic Protective Device (LDKS-ⅢH for short), it is mainly applied in forging industry assorting punching equipment to protect safety of operators.

This device provides protection over the rectangular area between sensor and reflector only. If its installation is not positioned correctly or the operation is not carried on under the instructions or relative security operational provisions, or there is a fault in the actuating mechanism of machine tool, the device will fail to protect well. So, before using this device, please read this manual carefully to fully understand relative items, especially the content marked with "WARNING", "NOTICE" in the manual; in the course of use, please make a correct understanding about the working function of AOPD, operate strictly in accordance with the instructions or relative security operational provisions.

This manual introduces the application of the device on the press only, when LDKS-ⅢH is applied under other occasions, this manual is for reference.

Jining Keli Photo-electronic Industrial Co., Ltd. owns the final right to interpret this manual, if you have any doubt in reading or using this manual, please contact us or access http://www.shuangshou.com.

CONTENT

UNIT 1 BASIC INSTRUCTION

I. APPLICATION SCOPE

I.1. AOPD can be applied to all kinds of press machine, such as punch press, straight press, hydraulic press, forging press, filming press, molding press, injection molding machine, powder metallurgy molding press, plate shearing machine, bending machine, paper cutter and so on, to protect personal security of the operator.

I.2. For presses on which the slider can stop at any point in one stroke, it can achieve the full–trip protection, and it can also achieve the protection from 30° to 180° in one stroke, assorting with the cam switch.

I.3. For presses on which the slider can not stop at any point in one stroke, AOPD can only achieve top stop protection at the end of the last stroke–when the last stroke has already finished, but the next stroke is not activated yet, if the light curtain is on shading state, the next slider stroke will not start.

I.4. Regional protection can be achieved for industrial robot, injection molding machine, packaging equipment, automation equipment, wielding production line etc, which are regarded as dangerous areas.

I.5. AOPD can also be used for detection and prevention of burglary.

II. FEATURES

II.1. Sound self–test function

The AOPD has the self–test function, that is when the device is faulted, it can make sure the OSSD outputs will turn off.

But this device can not detect whether the control signal circuit failure to danger resulted by external physical damage or wrong wring. So designation, installation and wring must be carried out strictly in terms of this manual.

II.2. Start–restart interlock function can be set up

If any light beam of the light curtain is shaded, the AOPD goes to OFF state, press slider stops running at once; even if the light curtain resumes light–passing state, the AOPD still keeps on OFF state and manual reset is necessary to resume the running of press slider.

The start–restart interlock function is not set in the standard configuration.

If the start–restart interlock function is needed, the customer should propose a request when placing the order for AOPD.

Application of interlock function

For presses on which the slider can stop at any point in one stroke, this function is unnecessary.

For presses on which the slider can not stop at any point in one stroke, if the way of feeding material is automatic, the interlock function should be applied to prevent from contingency; if the way of feeding material is manual, it is necessary to apply interlock function.

The AOPD with interlock function, it is commonly fixed with reset button or reset switch down–lead. Please refer to “OPERATION” in chapter “Operation, Check and Maintenance” to see how to use it.

II.3. High capacity of resisting disturbance

The system possesses high capacity of resisting disturbance against electromagnetic signal, strobe light, jointing arc light and surrounding light source etc.

II.4. Easy beam–focusing

Scientific and skillful designed optical system, particular selected components.

II.5. Good vibration resistance

II.6. Convenient and diversified installation

We can provide the regular installation forms such as common side–mounting, common front–mounting, pipe–mounting, double–arm mounting, or magnetic attachment mounting. We can also offer special support to meet the requirement of customer.

II.7. Long performance life

Output Relay is replaceable after reaching the end of its performance life, and high reliability.

III. DESIGNATION

In order to protect the operator from injury, all the presses should be equipped with AOPD.

III.1. For presses on which the slider can stop at any point in one stroke, AOPD can be directly used in conjunction with the press.

III.2. For presses on which the slider can not stop at any point in one stoke, if the coupling union power of clutch is electromagnetic force or gas, fluid power, AOPD can be directly used in conjunction with the press; if the coupling union power of clutch is manpower, AOPD can not be used in conjunction with the press before the dynamic form transformation–namely transform manpower into electromagnetic force or gas, fluid power.

III.3. LDKS–ⅢH is applied to the machine tool of which the protective length is less than 3m;

III.4. ***Protective height ⩾ Length of Slider Stroke + Regulating Variable of Slider Stroke***

III.5. Controller can be selected in accordance with the accessibility requirements, choosing CPS Ⅰ type controller and CQ1 type controller.

If the power & signal cable is exposed outside of the machine tool electrical cabinet, there is a danger that the device will failure to danger resulted by physical damage, so CQ1 type controller should be selected prioritly because it can be installed inside of the electrical cabinet. If CPS Ⅰ type controller has to be selected, it must be installed nearest by the electrical cabinet and protective measurements should be adopted. Meanwhile special person must examine it carefully before each duty.

III.6. Its detection capacity is 70mm and can be applied to the occasions of body protection such as arm.

III.7. When user has no special request, we will supply the power & signal cable and transmission cable with standard length.

IV. PRINCIPLE AND STRUCTURE

IV.1. Schematic illustration of working principle

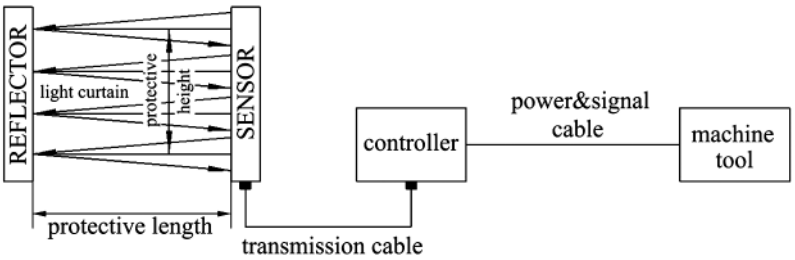


Fig1.1 Schematic illustration of working principle

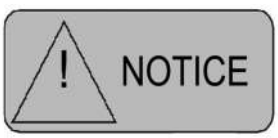
IV.2. Build–up unit

IV.2.1. Control Devices

The controller supplies power for sensor; processes the signals transmitted from it; sends out signal through output signal switching device (OSSD), controlling the forced stroke stop circuit or alarm circuit of machine tool.

In our products, we use relays as the output signal switching device which are assembled in the controller.

Controller is divided into two types, namely CPS Ⅰ type controller and CQ1 type controller.



In this operation manual, "OSSD1" stands for normally open (NO) contacts while "OSSD3" stands for normally closed (NC) contacts. Make sure to distinguish NO contacts from NC contacts clearly before wiring.

IV.2.1.1. CPS Ⅰ type Controller

It is placed outside the external part of machine tool control unit, commonly mounted on the machine bed support, supplying power for sensor, processing signals and sending out stop signal to machine tool control system when the light curtain is on shading state or there is a fault of AOPD.

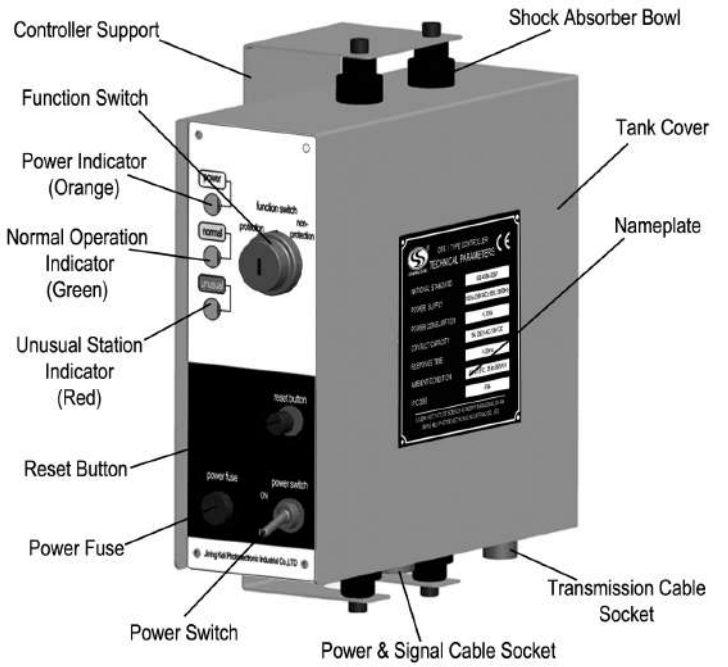


Fig1.2.A CPS Ⅰ type controller–Single–side protection

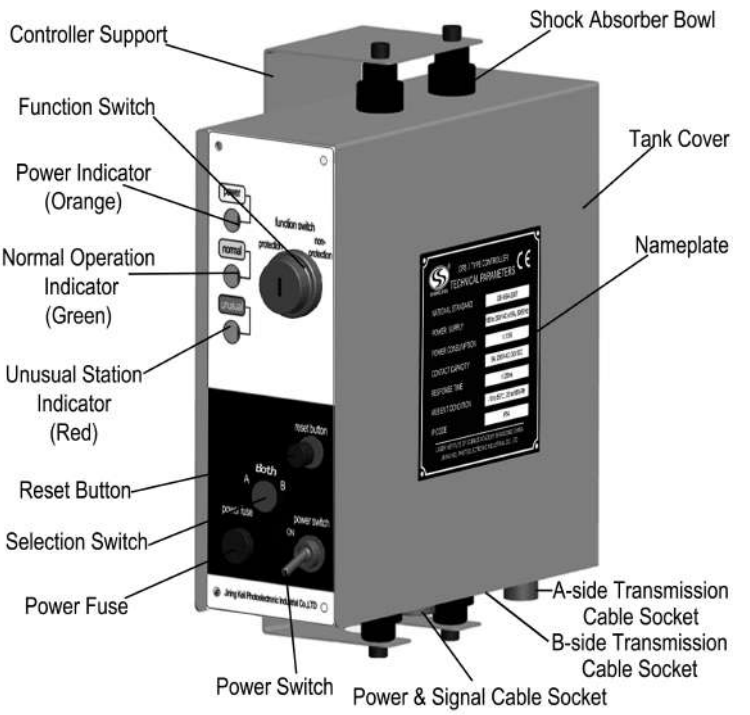


Fig1.2.B CPS Ⅰ type controller–Double–side protection

Sheet1.1 Operating state of CPS Ⅰ type controller

Power switch	Function switch	Power indicator (Orange)	Normal operation indicator(Green)		Unusual station indicator(Red)		Operating state of AOPD
			Light-passing	Shading	Light-passing	Shading	
ON	Protection	ON	ON	OFF	OFF	ON	Protection
	Non-protection	ON	ON	OFF	OFF	ON	Non-protection
OFF	Protection	OFF	OFF	OFF	OFF	OFF	Protection
	Non-protection	OFF	OFF	OFF	OFF	OFF	Non-protection

When the AOPD is on non-effective protection, other safety preventive measures need to be adopted!

Selection switch: A selection switch is set on the panel of double-side protection controller to set detection zone.

When the switch is pointed to "A", the relevant light curtain is activated and "B" side light curtain is bypassed.

When the switch is pointed to "B", the relevant light curtain is activated and "A" side light curtain is bypassed.

When the switch is pointed to "Both", both of light curtains are activated at the same time.

Normal operating state: AOPD works normally, and the light curtain does not detect objects in the detection zone, that is on the light-passing state. For the controller, the normal operation indicator is lit and the unusual station indicator is off, and the control output is in the ON state.

Unusual station state: The light curtain detects objects in the detection zone and turns to the shading state, or detects malfunction and locks on to fault state. For the controller, the normal operation indicator is off and the unusual station indicator is lit, and the control output is in the OFF state.

Note: For the controller with manual reset function, after the system turns to the unusual station state, it always maintains this state until reset is triggered manually.

Lockout state: For the controller with manual reset function, the lockout state is maintained after the system turns to OFF state due to the shaded light curtain or the fault is detected by itself. Even the detected object or the fault is removed, the state can not be changed until reset is triggered manually.

Reset button: For the controller with manual reset function, it is set on the panel, while for the controller with automatic reset function, there is no reset button.

IV.2.1.2. CQ1 type Controller

It is placed inside the internal part of machine tool control unit, supplies power for sensor, processes the signals, sending out stop signal to machine tool control system when the light curtain is on shading state or there is a fault of AOPD.

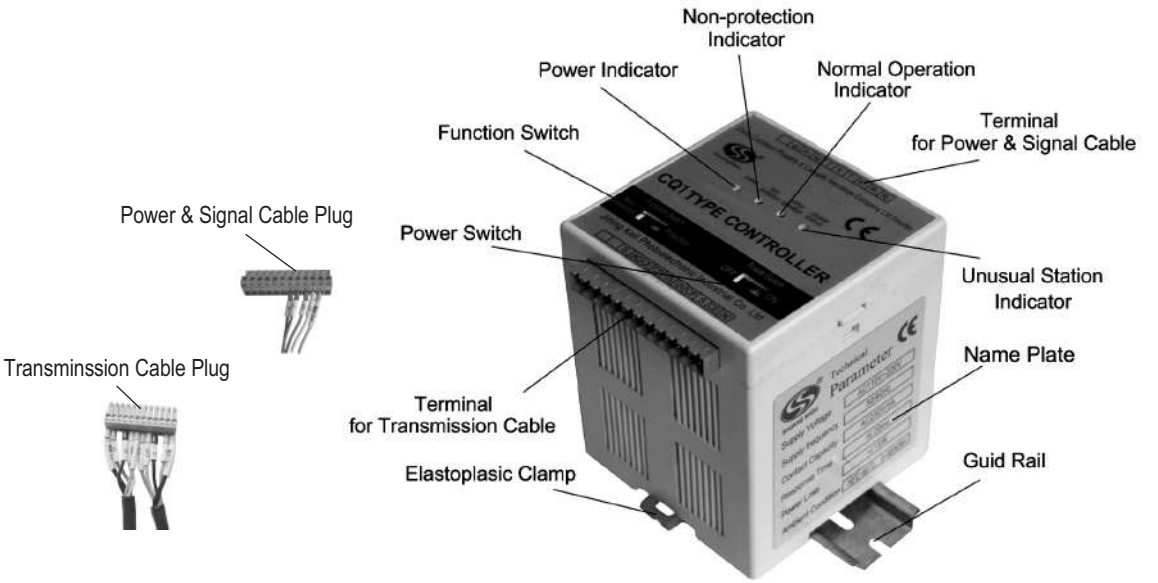


Fig1.3 CQ1 type controller

Sheet1.2 Operating state of CQ1 type controller

Power switch	Function switch	Power indicator (Orange)	Non–protection indicator (Red)	Normal operation indicator(Green)		Unusual station indicator(Red)		Operating state of AOPD
				Light–passing	Shading	Light–passing	Shading	
ON	Protection	ON	OFF	ON	OFF	OFF	ON	Protection
	Non–protection	ON	ON	OFF	OFF	OFF	OFF	Non–protection
OFF	Protection	OFF	OFF	OFF	OFF	OFF	OFF	Protection
	Non–protection	OFF	OFF	OFF	OFF	OFF	OFF	Protection

IV.2.2. Sensor

Sensor is a complex of luminous and light–receiving units, its function is to emit optical signal and to receive optical signal reflected by the reflector.

If any light beam of the rectangle light curtain is intercepting, sensor will send anomalous signal called unusual state signal to controller through the transmission cable.

IV.2.3. Reflector

Reflector is the part to reflect the light from sensor.

IV.2.4. Transmission cable

The transmission cable is utilized for transmitting signals between sensor and controller. The connection points are shown in Fig1.4.

For single–side protection, the standard length of transmission cable is 2.5m; for double–side protection, the standard length of transmission cable is 2.5m and 5m.

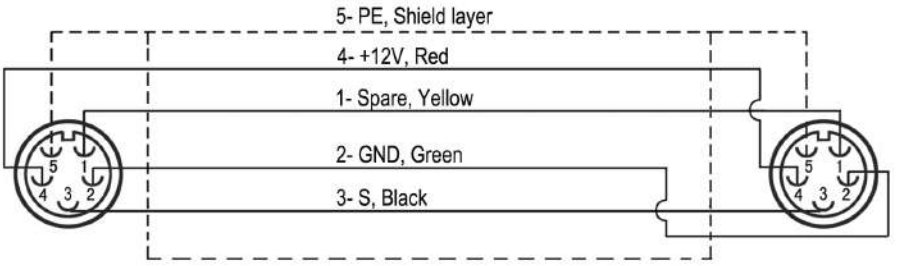


Fig1.4.A Transmission cable for CPS I type controller

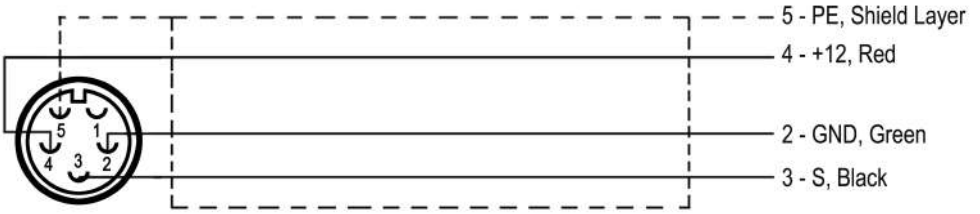


Fig1.4.B Transmission cable for CQ1 type controller

IV.2.5. Power & signal cable

The power & signal cable connects AOPD with power supply, transmitting signal sent from controller to electric equipment of machine tool and other controlled systems. The connection points are shown in Fig1.5.

The standard length of power & signal cable is 2.5m for CPS I type controller and 1.5m for CQ1 type controller。

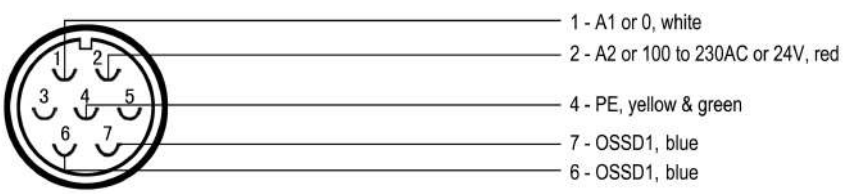


Fig1.5.A Power & signal cable for CPS I type controller

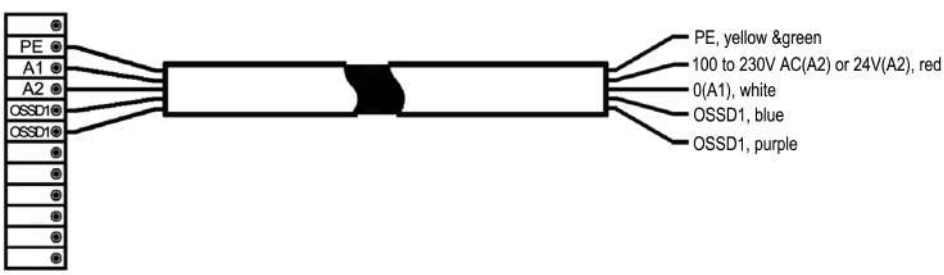


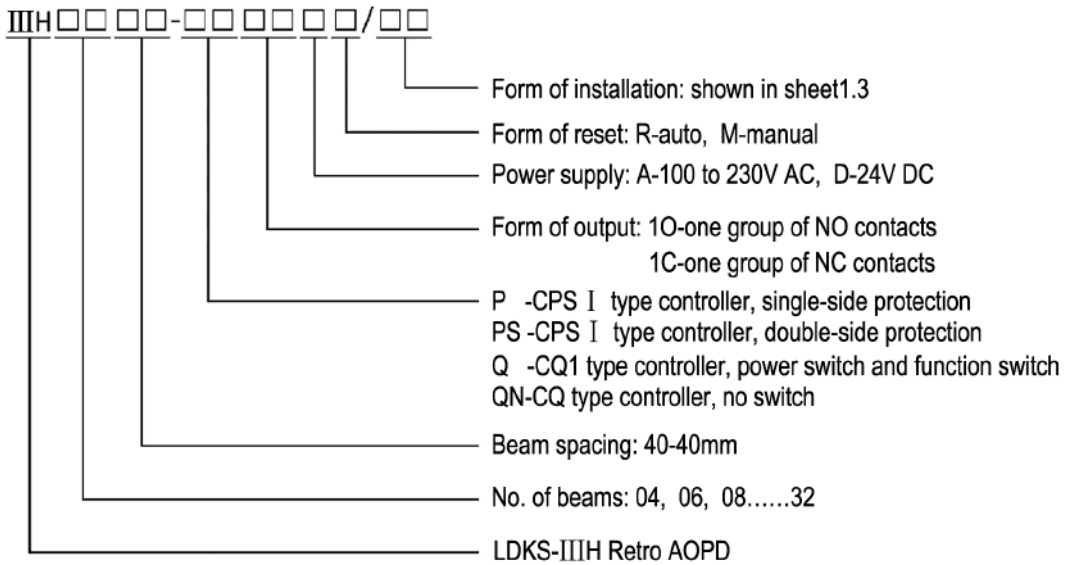
Fig1.5.B Power & signal cable for CQ1 type controller

The customer should make special order if the standard transmission cable does not meet the actual requirements.

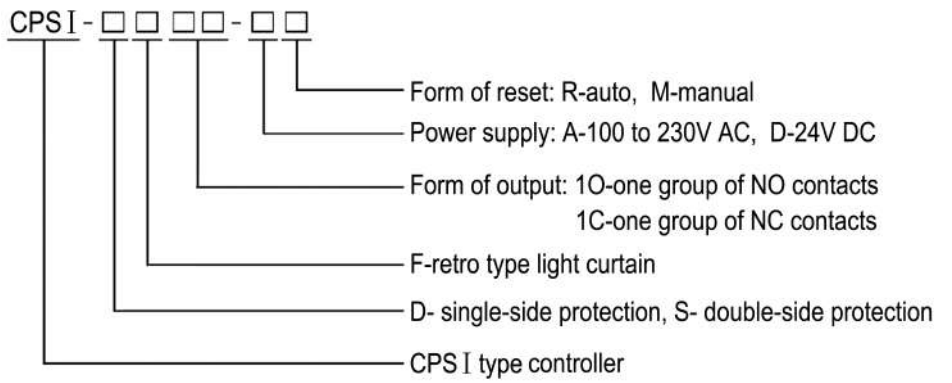
V. INSTRUCTION OF SPECIFICATION

V.1. Specification illustration

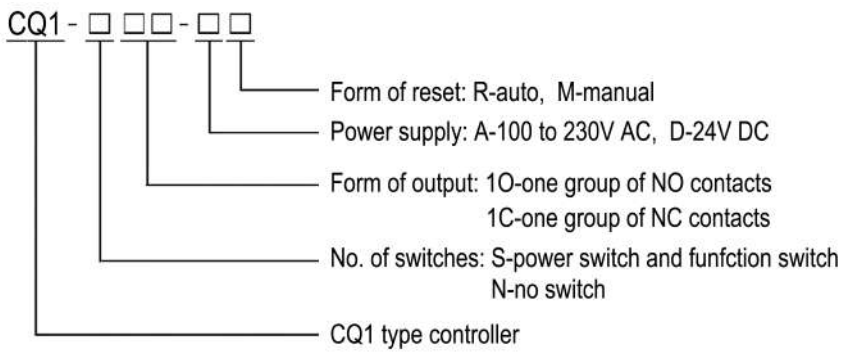
The entire machine specification of AOPD is indicated by 16 characters, the indication is as follows:



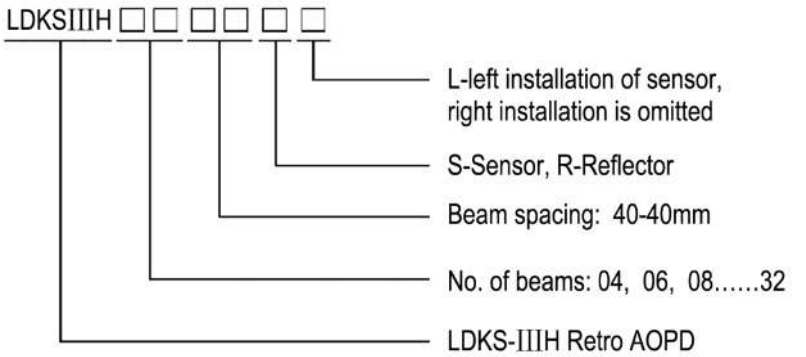
The specification of CPS Ⅰ type controller is indicated by 12 characters, the indication is as follows:



The specification of CQ1 type controller is indicated by 10 characters, the indication is as follows:



The specification of light curtain is indicated by 12 characters, the indication is as follows:



Sheet 1.3 Code of bracket installation

NO.	Form	Code	Remark
1	Common side mounting	PC	See Page18
2	Common front mounting	PZ	See Page20
3	Pipe mounting	GC	See Page22
4	Double–arm mounting	SC	See Page24
5	Magnatic attachment mounting	CX	See Page26
6	Double–bracket arm mounting	SX	These four installations are not included in this operation manual, plesase contact us for their dimensions before ordering.
7	Plate support with magnet mounting	BC	
8	Plate support with bolt mounting	BL	
9	Floor support mounting	DZ	
10	Others forms of bracket	XX	The form of bracket should be rasied in the contact by customer and the code of it will be made by us.

V.2. Specifications list of the light curtain

Sheet1.4 Specification of the light curtain

Sensor	Reflector	No. of beams	Protective height	Size
LDKSⅢH0440S□	LDKSⅢH0440R□	4	120	80×50×218
LDKSⅢH0640S□	LDKSⅢH0640R□	6	200	80×50×298
LDKSⅢH0840S□	LDKSⅢH0840R□	8	280	80×50×378
LDKSⅢH1040S□	LDKSⅢH1040R□	10	360	80×50×458
LDKSⅢH1240S□	LDKSⅢH1240R□	12	440	80×50×538
LDKSⅢH1440S□	LDKSⅢH1440R□	14	520	80×50×618
LDKSⅢH1640S□	LDKSⅢH1640R□	16	600	80×50×698
LDKSⅢH1840S□	LDKSⅢH1840R□	18	680	80×50×778
LDKSⅢH2040S□	LDKSⅢH2040R□	20	760	80×50×858
LDKSⅢH2240S□	LDKSⅢH2240R□	22	840	80×50×938
LDKSⅢH2440S□	LDKSⅢH2440R□	24	920	80×50×1018
LDKSⅢH2640S□	LDKSⅢH2640R□	26	1000	80×50×1098
LDKSⅢH2840S□	LDKSⅢH2840R□	28	1080	80×50×1178
LDKSⅢH3040S□	LDKSⅢH3040R□	30	1160	80×50×1258
LDKSⅢH3240S□	LDKSⅢH3240R□	32	1240	80×50×1338

VI. TECHNICAL PARAMETERS

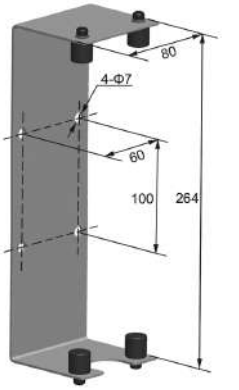
Sheet 1.5 Technical parameters of LDKS–ⅢH

Power supply	100 to 230V AC±15%, 50/60Hz		24V DC±10%
Contact capacity	5A , 250V AC/30V DC		
Power consumption	<15W		
Suitable temperature	–10 to 55℃		
Ambient humidity	0 to 95%RH		
Response time	≤20ms		
Insulating resistance	≥100MΩ		
Dielectric strength	1500V AC, no arcing and flashover in 60s		
Resistance to light interference	10000Lux (angle of incidence≥5°)		
Performance life of relay	$\geqslant 10^6$ times		
Detection capability	70mm		
Protective length	400 to 3000mm		
Dead zone	<400mm		
IP code	Sensor: IP65	CPS Ⅰ : IP54	CQ1: IP20

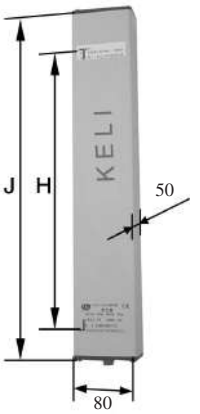
Ⅶ. DIMENSIONS OF MAJOR PARTS

CPS Ⅰ type controller

CQ1 type controller

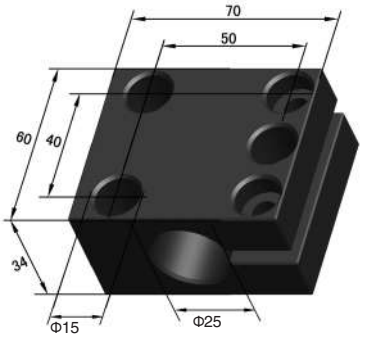


Controller support

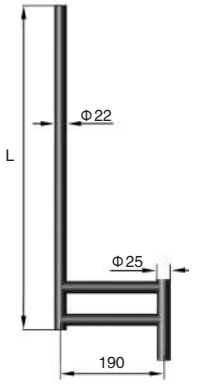


Sensor

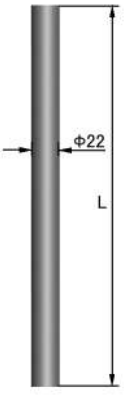
Reflector



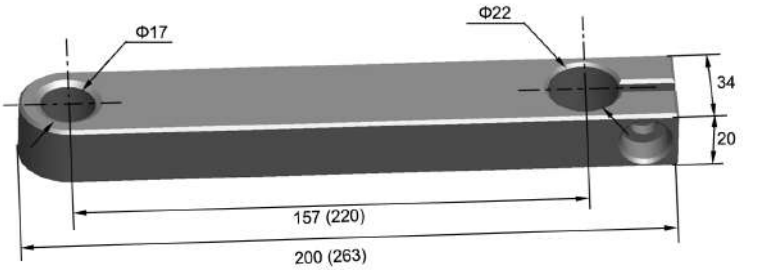
Support seat



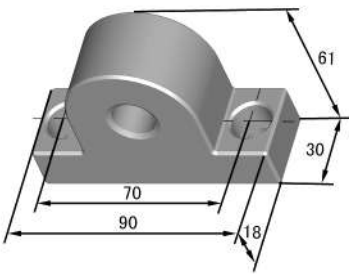
Double–arm pipe



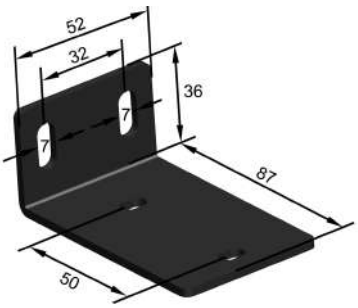
Steel pipe



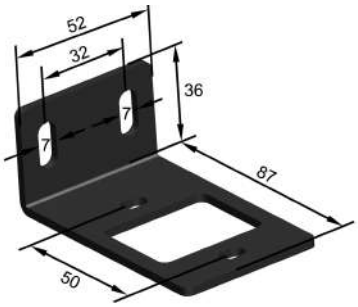
Bracket arm



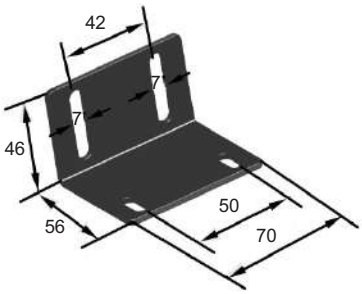
Bracket seat



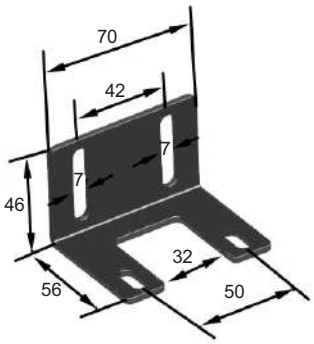
LDKS front–mounting upper bracket



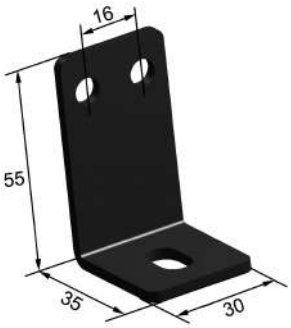
LDKS front–mounting lower bracket



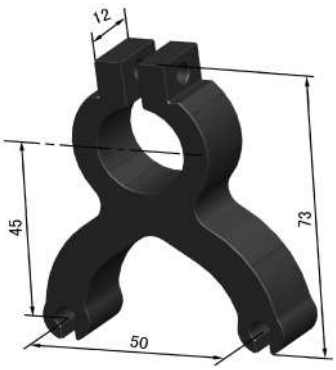
LDKS side–mounting upper bracket



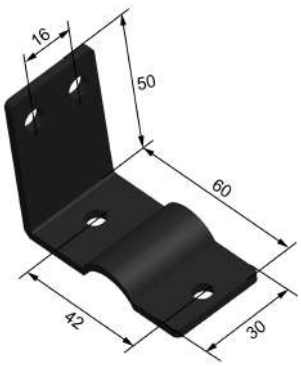
LDKS side–mounting lower bracket



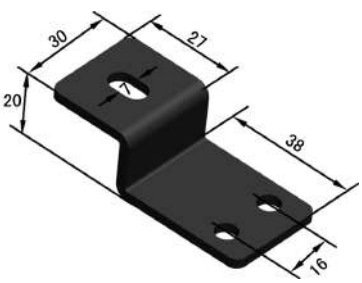
Reflector side–mounting bracket



LDKS pipe–mounting fixing clamp



Reflector pipe–mounting bracket



Reflector front–mounting bracket

Fig1.6 Detail drawing of major parts

UNIT 2 INSTALLATION

NOTICE

As soon as you receive our goods, check the items inside the box according to packing list.
Before installation, shut down the power supply to avoid possible danger.

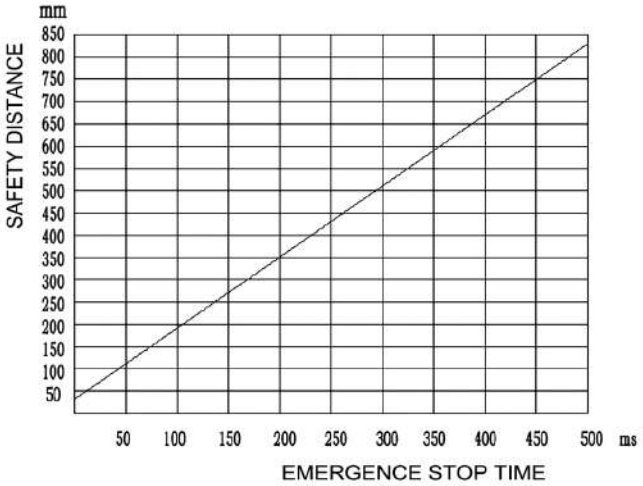
I. INSTALLATION SITE

The installation site contains two factors, that is safety distance and relative altitude height.

To ensure personal safety, the installation site of AOPD must meet the requirement for safety distance and relative altitude position. Otherwise, the accident may occur.

I.1. Safety distance

The safety distance is the minimum distance that must be set between the light curtain of AOPD and the margin of mould orifice to stop the hazardous part before a person or object reaches it. Its algorithmic method should be defined according to the brake mode of the machine tool or reference sheet2.1.



Sheet2.1 Calculation sheet for safety distance

- For presses on which the slider can stop at any point in one stroke, the safety distance can be worked out according to formula (1).

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

Where:

S — Safety distance(in mm)from the light curtain sensing field to the danger zone

K — Velocity (in mm/s) of movement into the danger zone

T — Total response time (in s) of the system, including the response time of the AOPD (informed by the supplier) and the braking time of the press (should be measured by actual time)

C — Additional safety distance (in mm)

- For presses on which the slider can not stop at any point in one stroke, the safety distance can be worked out according to formula (2).

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

Where:

S — Safety distance(in mm)from the light curtain sensing field to the danger zone

K — Velocity (in mm/s) of movement into the danger zone

C — Additional safety distance (in mm)

Ts — Time (in s) from the press slider starts from the upper dead point to the press slider arrives at the lower dead point, name the stroke down time of press slider. Ts can be calculated according to formula (3) or measured by actual time

$$Ts = (1/2 + 1/N)Tn \qquad (3)$$

Where:

N — Number of stoats of clutch

Tn — Time (in s) needed for crankshaft to make a cycle

The value of K:

- To adopt parallel approach of installation, the value of K uses 1600.
- To adopt vertical approach of installation, the value of K uses 2000 if S≤500mm, the value of K uses 1600 if S>500mm.

The value of C:

- The value of C should be set by the maximal length of the arm which put into the light curtain sensing field but not cause the AOPD to response.
- The value of C should be set according to the detection capability, shown in the following table.

Detection Capability(mm)	C(mm)
≤14	0
>14 to 20	80
>20 to 30	130
>30 to 40	240
>40	850

The safety distance is one of necessary conditions for achieving the protection function of AOPD. The calculation about safety distance must be correct and accurate. The safety distance must be ensured while installing AOPD.

I.2. Relative altitude height

Relative altitude height refers to the upper and lower position of light curtain relative to the die orifice of machine tool. Namely in the premise of ensuring the safety distance, the lowest light beam of AOPD shall not higher than the lower edge of lower die orifice, and the highest light beam of AOPD shall not be lower than the upper die orifice. See Fig2.1.1, this is related to the selection of the protective height of AOPD.

Relative Altitude Height ⩾ Length of Slider Stroke + Regulating Variable of Slider Stroke

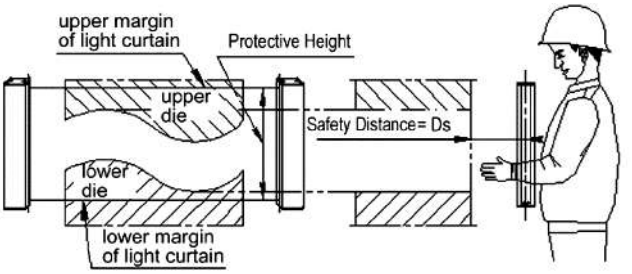


Fig2.1.1 The correct position of installation site

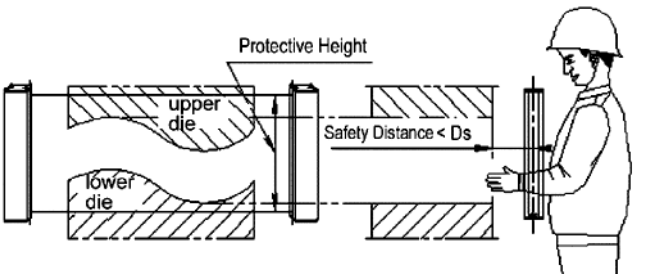


Fig2.1.2 Incorrect position of installation site
—light curtain is too close to die orifice.

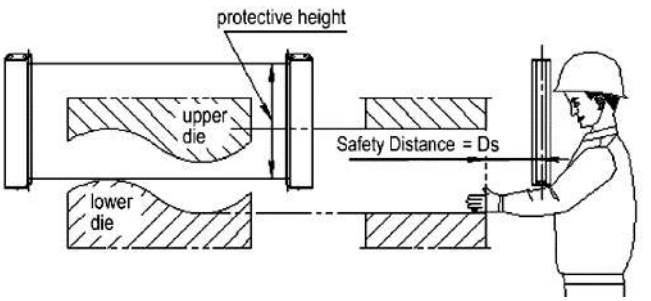


Fig2.1.3 Incorrect position of installation site
—light curtain is a little higher, the hand can stretch into it under the lowest beam.

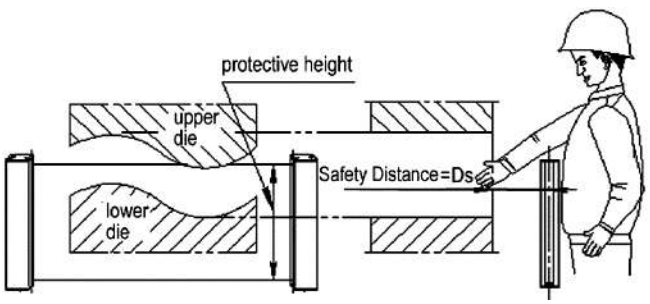


Fig2.1.4 Incorrect position of installation site
—light curtain is a little lower, the hand can stretch into it upside the highest beam.

The relative altitude height is one of necessary conditions for achieving the protection function of AOPD, the relative altitude height must be ensured while installing AOPD.
If the brake staff of press slider is in faults, it must be checked and repaired in time. Otherwise even if the installation site is correct, the risk of accident exists.
If the die is changed in the course of using AOPD, the safety distance and relative altitude height must be readjusted according to the two requirements above.

I.3. Auxiliary protective equipment

If the distance between light curtain and die orifice is over 400mm, auxiliary protective equipment should be installed to prevent operator from entering the danger zone, it is shown in Fig.2.1.5. If this distance is no more than 400mm, auxiliary protective equipment may also be adopted.

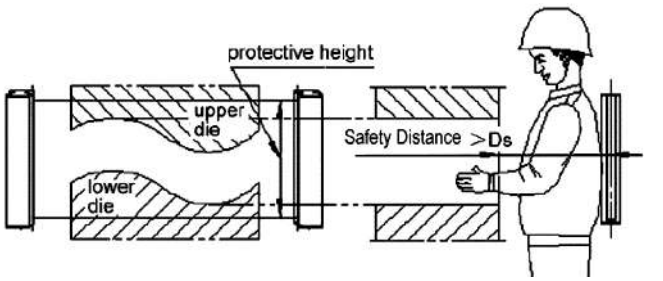


Fig2.1.5 Incorrect position of installation site
—light curtain is too far from die orifice, operators could enter danger zone.

Ⅱ. INSTALLATION TOOL

Electric drill,	Aiguilles (specification: Φ4.2/Φ5.2/Φ6.7/Φ10)
Taps (specification: M6/M8)	Cross–ended screwdriver,
Knife–ended screwdriver,	Inner–hexagon wrench (specification: 4#/5#/6#)
Adjustable wrench,	Long flat nose pliers.

- To install LDKS common front/side–mounting bracket and controller support: Φ5.2 aiguille and M6 tap;
- To install the bracket seat for pipe–mounting installation: Φ6.7 aiguille and M8 tap;
- To install CQ1 controller: Φ4.2 aiguille;
- To drill the cable–passing hole of transmission cables and power & signal cables: Φ10 aiguille.

Ⅲ. INSTALLATION OF CONTROL DEVICE

III.1. Installation of CPS Ⅰ type controller

CPS Ⅰ type controller is installed on the bed support of machine tool through controller support, the procedures are as follows:

1. Select proper position according to the size of CPS Ⅰ type controller (avoiding collision, convenient for operation, easy to maintain).
2. According to the mounting dimensions of CPS Ⅰ type controller support, fix the support well, as shown in Fig2.2.

3. Install CPS Ⅰ type controller on the support through shock absorber and its bowl support, the procedures are as follows:

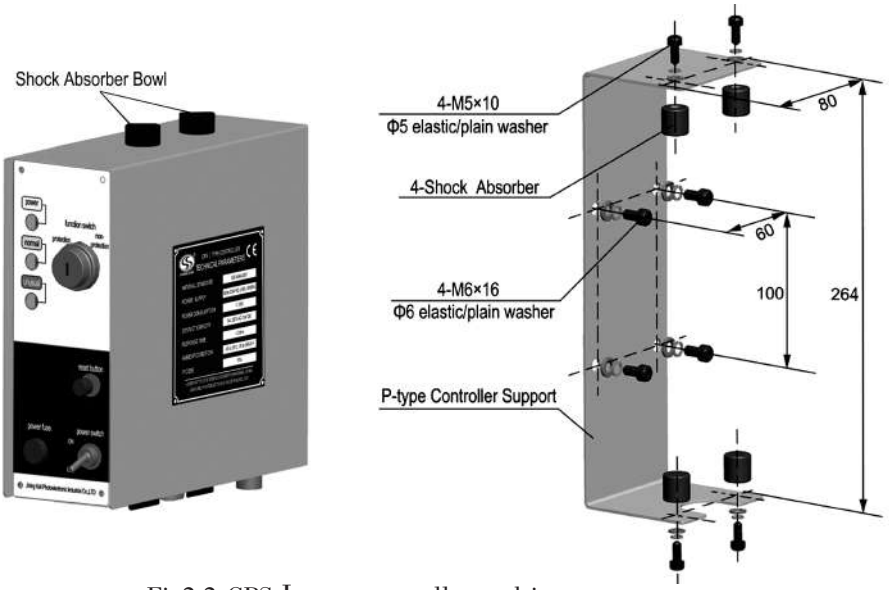


Fig2.2 CPS Ⅰ type controller and its support

- Take off two shock absorbers from the upper part of controller support, and then put them into the shock absorber bowl support of the upper part of controller.
- Aim the shock absorber bowl supports of the lower part of controller at the shock absorbers of the lower part of controller support, and then assemble the shock absorber and its bowl support. Push forward the controller into its support; make the tapped holes of shock absorbers to be aimed at the holes of the upper part of controller support.
- Tighten the two M5×10 Phillips screws to fix firmly the two shock absorbers to the upper part of controller support.

III.2. Installation of CQ1 type controller

CQ1 type controller is directly fixed onto the 35mm guide rail inside the control unit of machine tool, see Fig2.3.

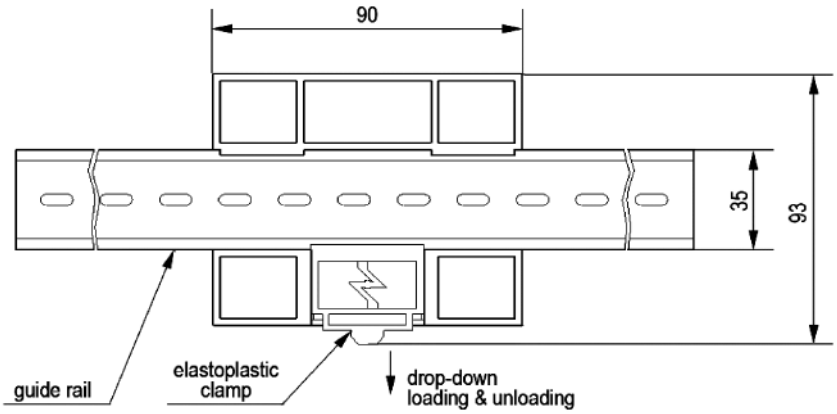


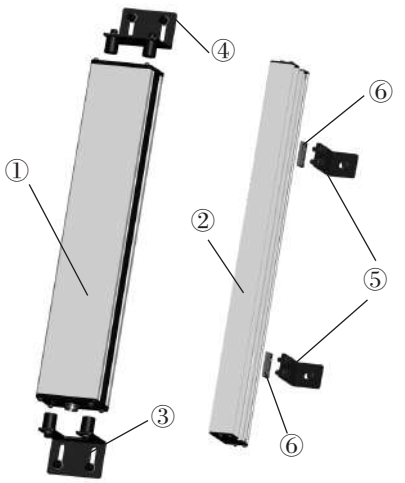
Fig2.3 CQ1 type Controller

IV. INSTALLATION OF LIGHT CURTAIN

WARNING **Before installation, safety distance and relative altitude height must be calculated and defined correctly.**

IV.1. Common side mounting (PC)

The way, to install sensor through LDKS side–mounting bracket on bed piece and to install reflector directly on bed piece, is generally applied to straight side press of support construction. The form of installation is shown in Fig2.4.



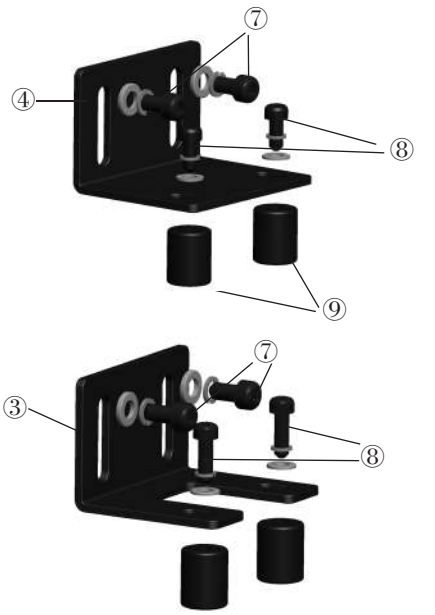
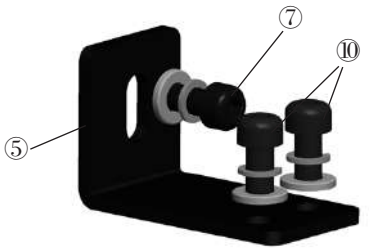


Fig2.4 Common side mounting (PC)



①Sensor ②Reflector ③LDKS side–mounting lower bracket
④LDKS side–mounting upper bracket
⑤Reflector side–mounting bracket ⑥ Double–hole T–nut
⑦M6×16 inner hexagon screw, Φ6 elastic/plain washer
⑧M5×10inner hexagon screw, Φ5 elastic/plain washer
⑨Shock absorber
⑩M6×12 inner hexagon screw, Φ6 elastic/plain washer

1. Installation of sensor

- In the premise of ensuring the safety distance, select proper installation position on the machine bed piece, drill and tap according to dimensions shown in Fig2.4.C. The drilling hole must be located to ensure that the sensor and reflector are parallel and aligned after being installed.
- Fix LDKS side–mounting lower bracket on to the machine bed piece through two M6×16 inner hexagon screws. Fix the sensor on to the lower bracket by inserting its installed holes on the bottom into the shock absorber.
- Insert two shock absorbers of the LDKS side–mounting upper bracket into the installed holes on the top of sensor; fix the upper bracket on to the machine bed piece through two M6×16 inner

hexagon screws.

2. Installation of reflector

- According to the position of installed sensor, select proper installation position on the machine bed piece, drill and tap according to dimensions shown in Fig2.4.F. The drilling hole must be located to ensure that the sensor and reflector are parallel and aligned after being installed.
- Fix reflector side–mounting brackets on to the machine bed piece through M6×16 inner hexagon screws and fix the reflector on brackets through two double–hole T–nuts.

3. Adjust the position of sensor and reflector, make them parallel, corresponding, aligned.
4. Fasten all installed screws after start–up test.
5. Dimension A, B, C, F and H is as shown on sheet 2.2.

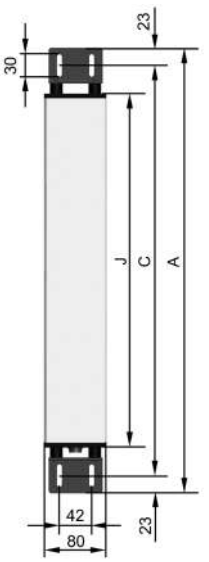


Fig2.4.A

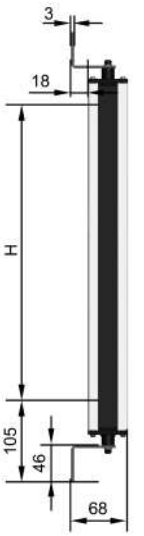


Fig2.4.B

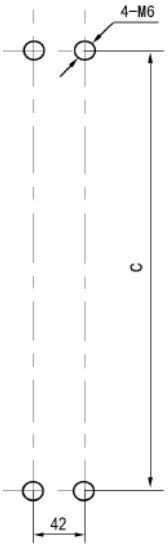


Fig2.4.C

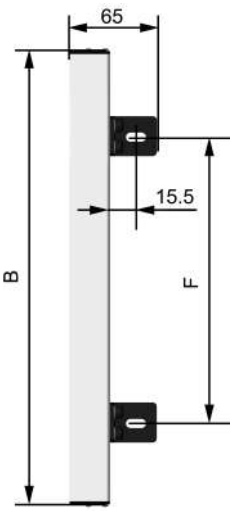


Fig2.4.D

Fig2.4.E

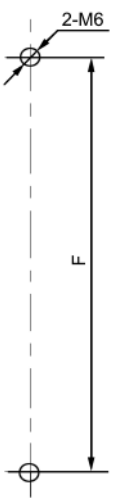


Fig2.4.F

IV.2. Common front mounting (PZ)

The way, to install sensor through LDKS front-mounting bracket on bed piece and to install reflector directly on bed piece, is generally applied to straight side press of support construction. The form of installation is shown in Fig2.5.

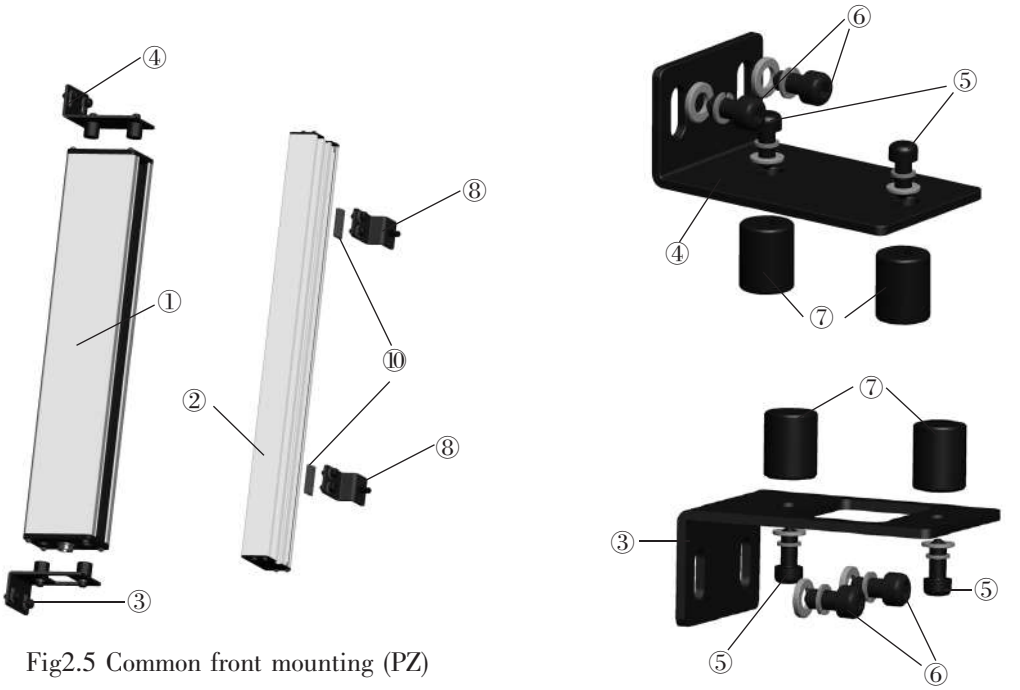
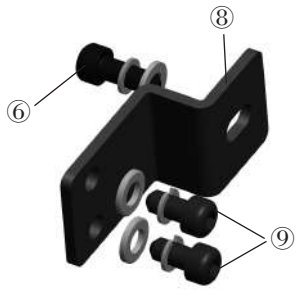


Fig2.5 Common front mounting (PZ)



①Sensor ②Reflector ③LDKS front-mounting lower bracket
④LDKS front-mounting upper bracket
⑤M5×10inner hexagon screw, Φ5 elastic/plain washer
⑥M6×16 inner hexagon screw, Φ6 elastic/plain washer
⑦Shock absorber ⑧Reflector front-mounting bracket
⑨M6×12 inner hexagon screw, Φ6 elastic/plain washer
⑩Double-hole T-nut

1. Installation of sensor

- In the premise of ensuring the safety distance, select proper installation position on the machine bed piece, drill and tap according to dimensions shown in Fig2.5.C. The drilling hole must be located to ensure that the sensor and reflector are parallel and aligned after being installed.
- Fix LDKS front-mounting lower bracket on to the machine bed piece through two M6×16 inner hexagon screws. Fix the sensor on to the lower bracket by inserting its installed holes on the bottom into the shock absorber.
- Insert two shock absorbers of the LDKS front-mounting upper bracket into the installed holes on the top of sensor; fix the upper bracket on to the machine bed piece through two M6×16 inner hexagon screws.

2. Installation of reflector

- According to the position of installed sensor, select proper installation position on the machine bed piece, drill and tap according to dimensions shown in Fig2.4.F. The drilling hole must be located to ensure that the sensor and reflector are parallel and aligned after being installed.
- Fix reflector front–mounting brackets on to the machine bed piece through M6×16 inner hexagon screws and fix the reflector on brackets through two double–hole T–nuts.

3. Adjust the position of sensor and reflector, make them parallel, corresponding, aligned.
4. Fasten all installed screws after start–up test.
5. Dimension A, B, C, F and H is as shown on sheet 2.2.

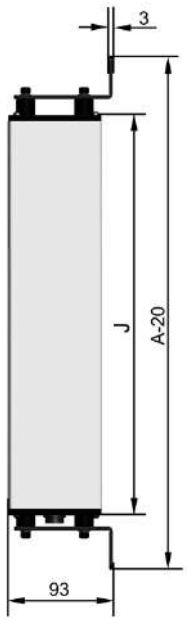


Fig2.5.A

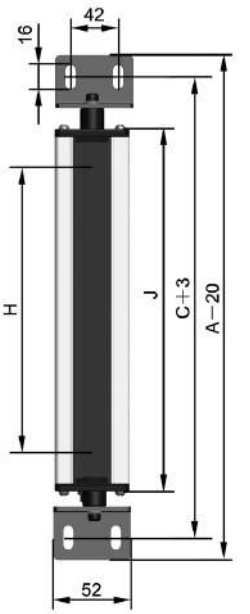


Fig2.5.B

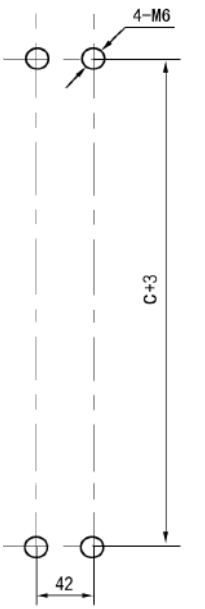


Fig2.5.C

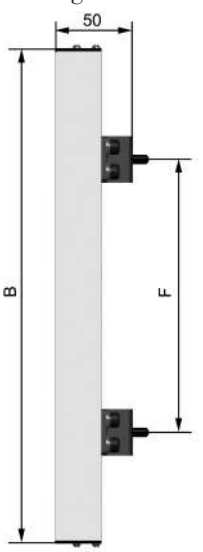


Fig2.5.D

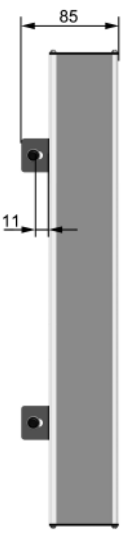


Fig2.5.E

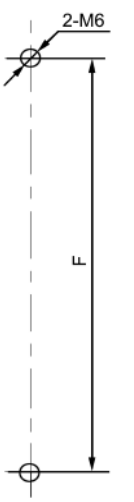


Fig2.5.F

IV.3. Pipe mounting (GC)

Sensor and reflector are fixed on the machine tool through an adjustable pipe-mounting support. This way is generally applied to open press and four column hydraulic press. The form of installation is as shown in Fig2.6.

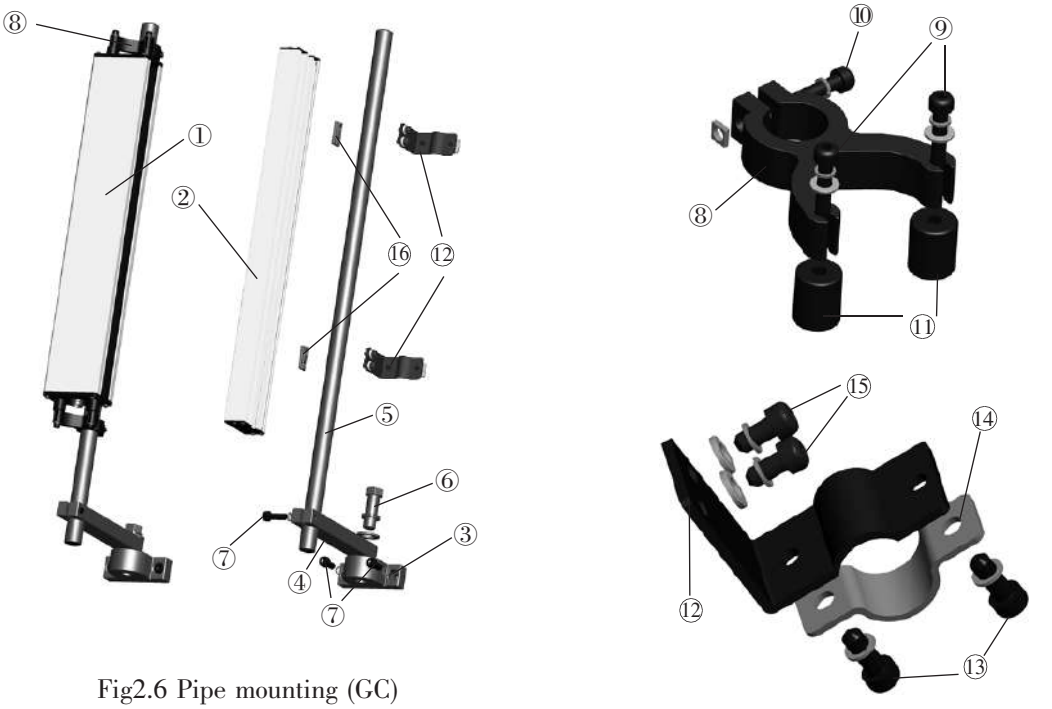


Fig2.6 Pipe mounting (GC)

①Sensor ②Reflector ③Bracket seat ④Bracket arm ⑤Steel pipe
⑥M16×45 hexagon screw, Φ16 elastic/plain washer
⑦M8×20 inner hexagon screw, Φ8 elastic washer
⑧LDKS pipe-mounting fixing clamp
⑨M5×25 inner hexagon screw, Φ5 elastic/plain washer
⑩M5×25 inner hexagon screw, Φ5 elastic washer, M5 square nut
⑪Shock absorber
⑫Reflector pipe-mounting bracket
⑬M6×20 inner hexagon screw, Φ6 elastic washer
⑭Ω-clamp
⑮M6×12 inner hexagon screw, Φ5 elastic/plain washer
⑯Double-hole T-nut

1. Install adjustable pipe-mounting support

- Select proper position from two sides of machine tool, drill and tap according to dimensions shown in Fig2.6.A. Fix the bracket seat onto the machine bed piece by two M8×20 inner hexagon screws. Fix the bracket arm on the bracket seat by one M16×45 hexagon screw.

Insert steel pipe into the round hole of bracket arm, adjust it to a proper height, tight properly the M8×20 inner hexagon screw by 6# inner hexagon wrench.

2. Install sensor

- Install the two LDKS pipe–mounting fixing clamps on the steel pipe, adjust the lower clamp to a proper position, tight properly the M5×25 inner hexagon screw by 4# inner hexagon wrench.
- Fix the sensor on to the lower clamp by inserting its installed holes on the bottom into the shock absorber.
- Adjust the upper LDKS pipe–mounting fixing clamp until the two shock absorbers of it can be inserted into the installed holes on the top of sensor totally.

3. Install reflector

- Assemble the ref;ector and reflector pipe–mounting brackets through two double–hole T–nuts.and Ω–clamp through M6×20 inner hexagon screws well.
- Fix assembled parts to the steel pipe by assemble Ω–clamps and reflector pipe–mounting brackets, tightening M6×20 inner hexagon screws properly.

4. Adjust the position of sensor and reflector, make them parallel, corresponding, aligned.
5. Fasten all installed screws after start–up test.
6. Dimension A, B, C, F and H is as shown on sheet 2.2.

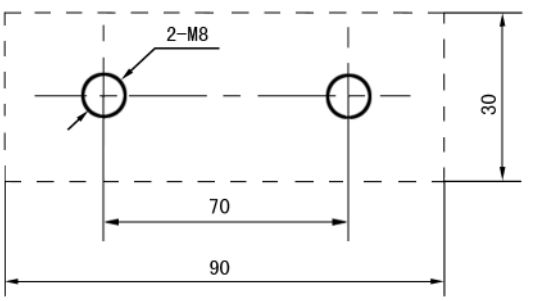


Fig2.6.A

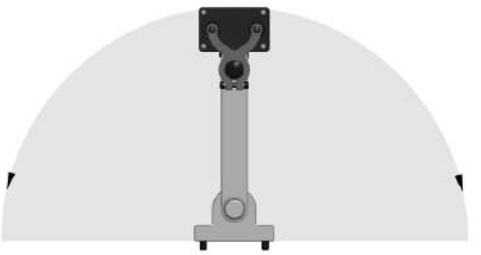


Fig2.6.B Adjustable in the range of 180°

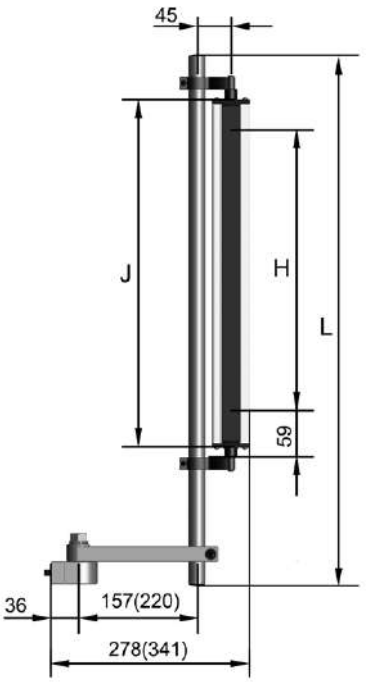


Fig2.6.C

Fig2.6.D

IV.4. Double–arm mounting (SC)

Sensor and reflector are fixed on the machine tool through an adjustable double–arm mounting support. This way is generally applied to open press and four column hydraulic press. The form of installation is as shown in Fig2.7.

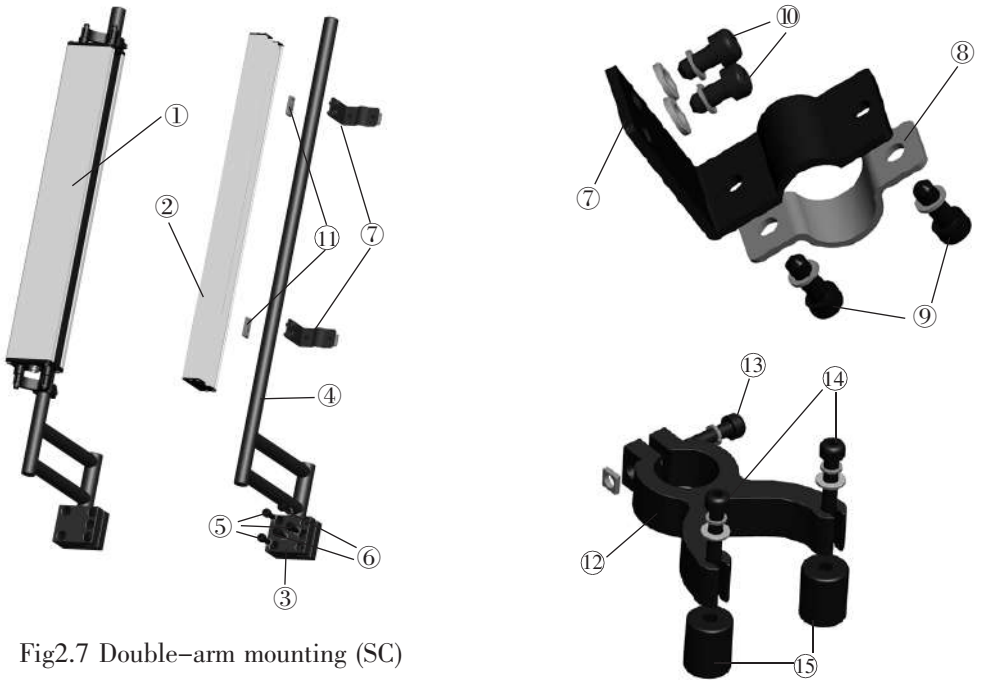


Fig2.7 Double–arm mounting (SC)

①Sensor ②Reflector ③Support seat ④Double–arm pipe
⑤ ⑥M8×25 inner hexagon screw, Φ8 elastic washer
⑦Reflector pipe–mounting bracket
⑧Ω–clamp
⑨M6×20 inner hexagon screw, Φ6 elastic washer
⑩M6×12 inner hexagon screw, Φ6 elastic washer
⑪Double–hole T–nut
⑫LDKS pipe–mounting fixing clamp
⑬M5×25 inner hexagon screw, Φ5 elastic washer, M5 square nut
⑭M5×25 inner hexagon screw, Φ5 elastic/plain washer
⑮Shock absorber

1. Install adjustable double–arm mounting support

- Select proper position from two sides of machine tool, drill and tap according to dimensions shown in Fig2.7.A. Fix the support seat onto the machine bed piece by three M8×20 inner hexagon screws. Insert double–arm pipe into the round hole of support seat, adjust it to a proper height, tight properly
- the M8×25 inner hexagon screws by 6# inner hexagon wrench.

2. Install sensor

Install the two LDKS pipe–mounting fixing clamps on the double–aarm pipe, adjust the lower
- clamp to a proper position, tight properly the M5×25 inner hexagon screw by 4# inner hexagon wrench.

Fix the sensor on to the lower clamp by inserting its installed holes on the bottom into the shock
- absorber.

Adjust the upper LDKS pipe–mounting fixing clamp until the two shock absorbers of it can be in-
- serted into the installed holes on the top of sensor totally.

3. Install reflector

Assemble the reflector and reflector pipe–mounting brackets through two double–hole T–nuts.
- Fix assembled parts to the double–arm pipe by assemble Ω–clamps and reflector pipe–mounting brackets, tightening M6×20 inner hexagon screws properly.

4. Adjust the position of sensor and reflector, make them parallel, corresponding, aligned.
5. Fasten all installed screws after start–up test.
6. Dimension A, B, C, F and H is as shown on sheet 2.2.

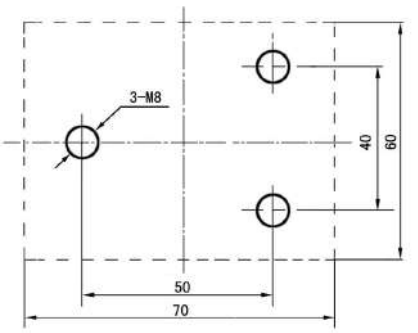


Fig2.7.A

Fig2.7.B Adjustable in the range of 180°

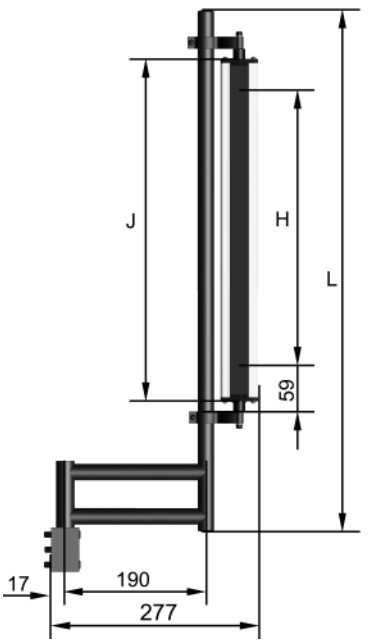


Fig2.7.C

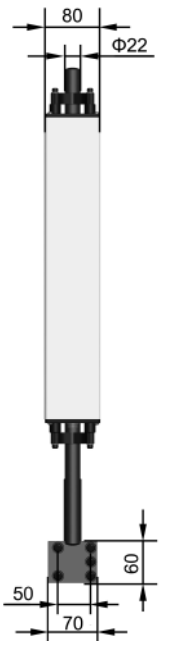


Fig2.7.D

Sheet2.2 Installation dimensions of LDKS–ⅢH (Unit: mm)

No. of beams	A	B	C	F	H	J	L
4	330	265	284	120	120	218	500
6	410	355	364	180	200	298	500
8	490	445	444	240	280	378	750
10	570	535	524	300	360	458	750
12	650	625	604	360	440	538	1000
14	730	715	684	420	520	618	1000
16	810	805	764	480	600	698	1000
18	890	895	844	540	680	778	1200
20	970	985	924	600	760	858	1200
22	1050	1075	1004	660	840	938	1500
24	1130	1165	1084	720	920	1018	1500
26	1210	1255	1164	780	1000	1098	1500
28	1290	1345	1244	840	1080	1178	1500
30	1370	1435	1324	900	1160	1258	1750
32	1450	1525	1404	960	1240	1338	1750

IV.5. Magnetic attachment mounting (CX)

This way is generally applied to side straight press of bracket construction, the installation is convenient. The form of installation is shown in Fig2.8.

Refer to Fig2.7, select proper position on the bed piece, and absorb sensor and refletor onto the bed piece.

Sensor and reflector should be parallel, corresponding, aligned. If the bed piece of machine tool is not flat, a steel of 6 to 10mm width could be attached to the bed piece of machine tool.

Dimension B, F, H and J is as shown on sheet 2.2.

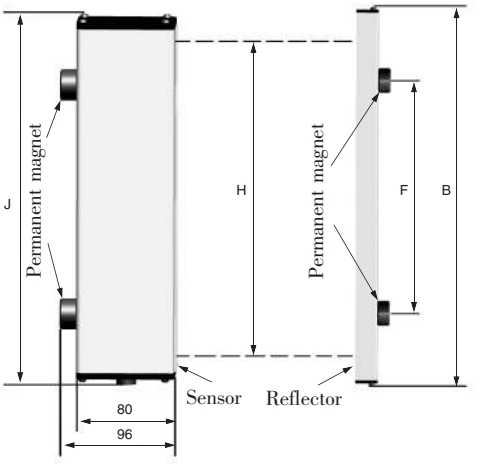


Fig2.8 Magnetic attachment mounting (CX)

To adopt this form of installation, it is necessary to have dedicated staff responsible for the safety management; the installation positions of AOPD must meet the requirements for safety distance and relative altitude height.

UNIT 3 WIRING

WARNING

Make sure to perform wiring while the power supply of machine tool is OFF and the wiring is performed according to the wiring diagram strictly.

Properly perform the wiring after confirming the signal names of all terminals.

PE is the earth wire of AOPD, it must be connected well to the earth.

OSSD is forbidden to be connected into 380V circuit.

I. WIRING ABOUT CPS Ⅰ TYPE CONTROLLER

CPS Ⅰ type controller provides switch mode power input.

I.1. Wiring about power & signal cable

Power & signal cable between controller and the electric equipment of machine tool is 5–core cable (RVV5), in which the terminal of controller is connected by 7–core socket connector.

At the time of wiring, connect to the correct power supply according to the numerical values marked on the nameplate, see Fig3.1.A for single–side protecion and Fig3.1.B for double–side protecion.

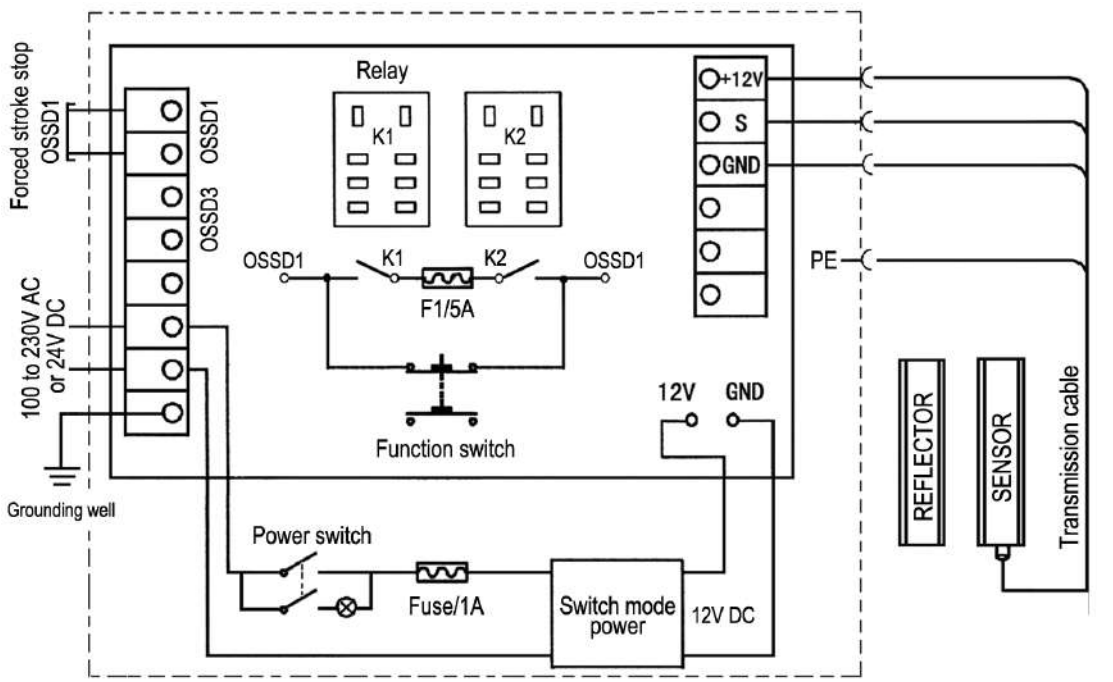


Fig3.1.A CPS Ⅰ type controller wiring – Single–side protection

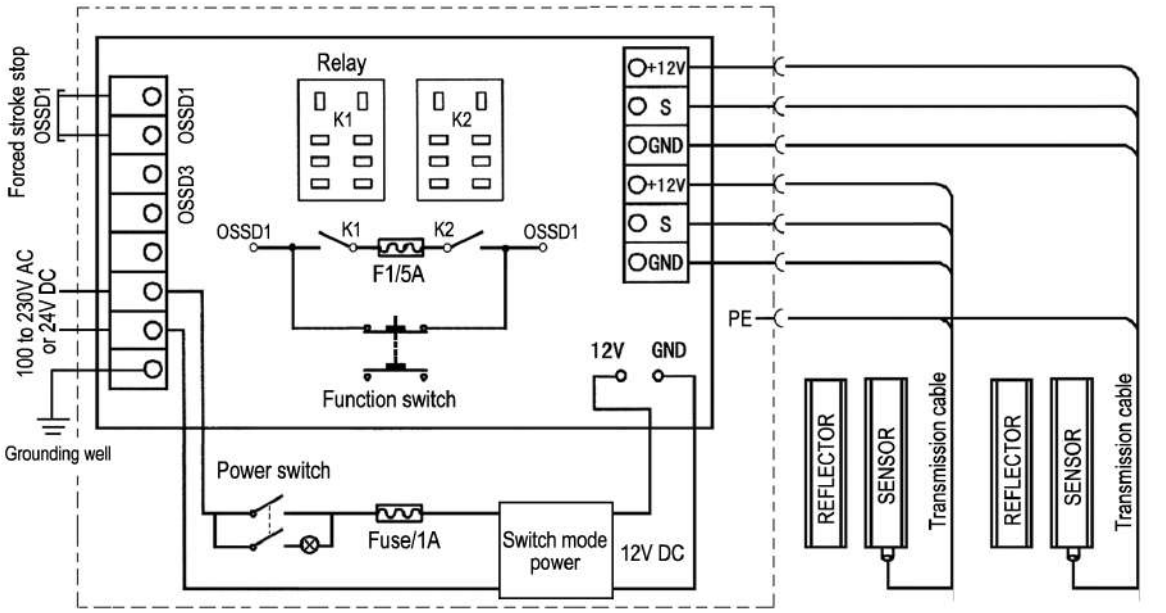


Fig3.1.B CPS Ⅰ type controller wiring – Double-side protection

I.2. Wiring about OSSD1

OSSD1 are control lines. They are the output signal contact of AOPD, commonly normal open contact. They should be connected to the stop control loop of machine stroke. The wire terminals marked with OSSD1 should be connected according to the form of connection shown in Fig3.2.

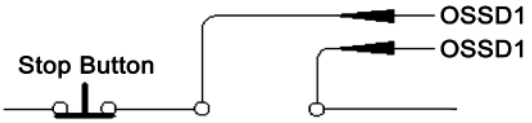


Fig3.2 Wiring for OSSD1

Sheet3.1 Output signal state of OSSD1

Light curtain state	Indicators of sensor		Indicators of CPS Ⅰ type controller		Output signal state of OSSD1
	Green status indicator	Red status indicator	Normal operation indicator	Unusual station indicator	
Light-passing	ON	OFF	ON	OFF	Closing
Shading	OFF	ON	OFF	ON	Opening

The declaration of using normally closed (NC) contacts:

The customer should make special order if they want to use NC contacts as the control connects.

If NC contacts must be used for special purpose, it is ensured that they must be connected reliably with the stop control loop of machine stroke. The maintenance should be carried out besides control function of AOPD being checked routinely by the operators. The condition of all the contact junctions with NC contacts must be checked monthly to ensure that they are connected reliably.Our company will not be responsible for the accident caused by improper wiring of NC contacts.

WARNING

In general, NC contacts should not be used as the control contact for safe purpose!
Our company will not be responsible for control failure resulted by poor contact or disconnection of the circuit.
Other safety measurements must be adopted when NC contacts have to be connected into the circuit.

I.3. Realization of muting function

1. If the muting function is realized by machine tool itself, no additional wiring is needed;
2. If the muting function is realized with the help of AOPD, connect one pair of normal open contact points of cam switch with OSSD1 in parallel, as shown in Fig3.3.

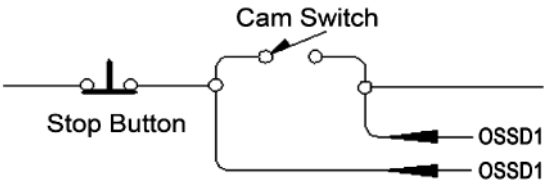


Fig3.3 The muting function is realized by OSSD1

WARNING

To avoid an accident, the cam switch must be adjusted to the right angle!

The transmission cables between CPS Ⅰ type controller and sensor is 5–core cable. The two terminals of transmission cable are all connected by multipin connector with the way of threaded connection.

NOTICE

To avoid strength created by strain and damage of connector, the cable close to the side of connector should be relaxed properly when tightened after the completion of wiring. See Fig3.6.

II. WIRING ABOUT CQ1 TYPE CONTROLLER

CQ1 type controller provides switch mode power input.

II.1. Wiring about power & signal cable

The power & signal cable between controller and the electric equipment of machine tool is 5–core cable, in which the terminal of controller is connected by 12–core connection terminals.

At the time of wiring, connect to the correct power supply according to the numerical values marked on the nameplate, see Fig3.4.

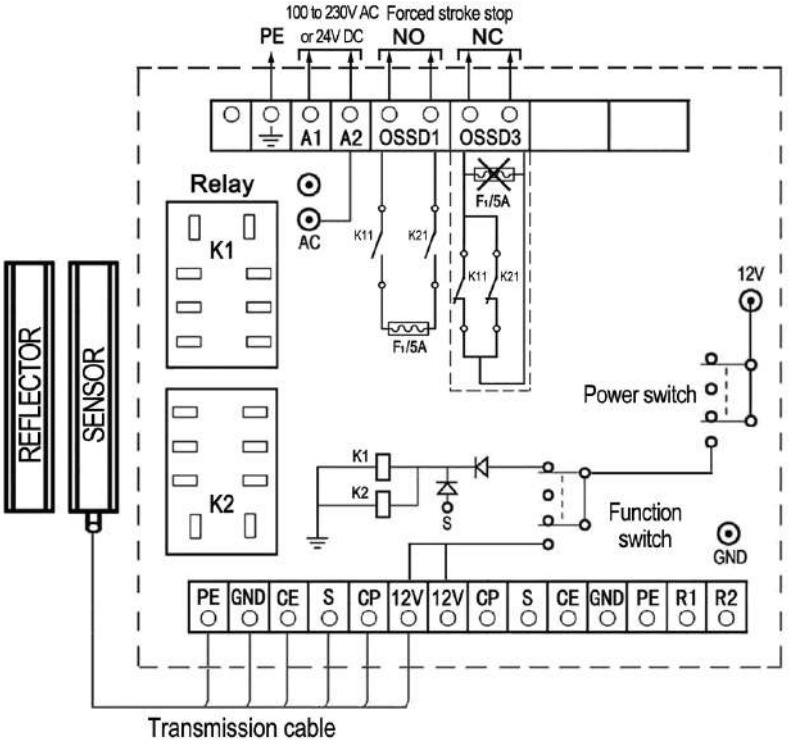


Fig3.4 CQ1 type controller wiring

II.2. Wiring about OSSD1 refers to the connection form of CPS Ⅰ type controller.

II.3. In general, OSSD3 should not be used as the control contact for safe purpose! If OSSD3 are needed, take out the overload fuse F1/5A first.

WARNING

If customer insists using OSSD3 to control operating stroke of machine tool slide, our company will not be responsible for control failure resulted by poor contact or disconnection of the circuit.

II.4. Realization of muting function

The realization of muting function, refer to the connection form of CPS Ⅰ type controller.

II.5. Wiring about CQ1 type controller and sensor

The transmission cable between CQ1 type controller and sensor is 5–core cable. Transmission cable and CQ1 type controller are connected by 12–core terminal; transmission cable and sensor are connected by 5–core multipin connectors.

At the time of wiring, connect the terminals of transmission cable with the correspondingly terminals of the CQ1 type controller according to the wire markings, fasten the compression–joint screw, and then connect the transmission cable with sensor.

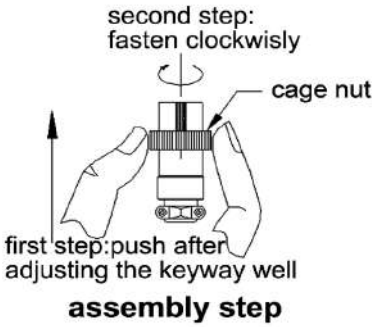
NOTICE

To avoid strength created by strain and damage of connector, the cable close to the side of connector should be relaxed properly when tightened after the completion of wiring. See Fig3.6.

Ⅲ. ASSEMBLY ABOUT CONNECTOR

According to Fig3.5:

- At the time of assembly, use the plug for insertion, the plug key tallies the groove, jogs the end of plug, then fasten the cage nut clockwise.
- At the time of disassembly, loosen the cage nut anticlockwise, and then pull the plug out.



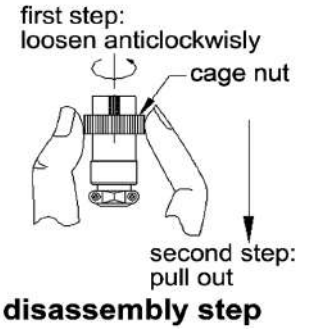


Fig3.5 Schematic illustration of assembly and disassembly department

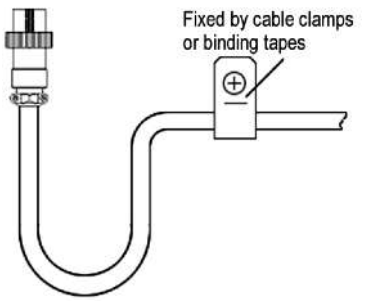


Fig3.6 Method of fixing cables

UNIT 4 DEBUGGING

After wiring, make a detailed check according to nameplate markings and operation manual to ensure that all the connections are correct; the power supply can be switched on for debugging after the verification of wiring.

I. THE DEBUGGING OF AOPD

I.1. Turn off the power switch, and then energize the machine tool(all the indicators are off). Check the power voltage with multimeter, the value must be in line with the voltage marked on the nameplate (voltage fluctuation range must not exceed ±15%).

I.2. For CPS Ⅰ type controller and CQ1 type controller, turn on the power switch, the orange power indicator is on.

I.3. Turn on the power switch and turn the function switch to the protection side.

Adjust the positions of sensor and reflector, make them parallel, corresponding, aligned, until the red status indicator of sensor is off, the green status indicator of sensor is on.

I.4. Shade the light curtain beam by beam. On the sensor, the red status indicator is on, the green status indicator is off and the individual indicator which indicates the state of the corresponding beam is off. On the controller, the green normal operation indicator is off; the red unusual station indicator is on;

When the light curtain is on light-passing state, on the sensor, the red status indicator is off, the green status indicator is on and all the individual indicators are on. On the controller, the green normal operation indicator is on, the red unusual station indicator is off, and AOPD is ON state.

I.5. Ensure that the safety distance and relative altitude height are both correct.

I.6. Fasten firmly all the installed screws on AOPD.

II. ANGLE ADJUSTMENT OF MUTING FUNCTION

If muting function needs to be realized, the angle of cam can be adjusted according to the situation shown in Fig4.1 on the premise of safety. In the case that muting function is realized with the help of AOPD, the state of muting function is shown in Sheet4.1.

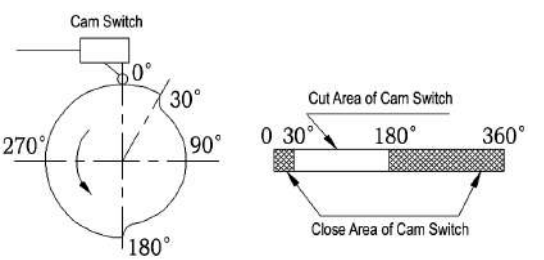


Fig4.1 Structure & Functional mode of cam switch

Sheet 4.1 State of muting function

Method of connection	State of cam switch	State of light curtain	State of Controller		State of stop control loop
			Normal	Unusual	
Connected with OSSD1	Closing	Light–passing	ON	OFF	Closing
		Shading	OFF	ON	Closing
	Opening	Light–passing	ON	OFF	Closing
		Shading	OFF	ON	Opening

The adjustment of cam angle determined the non–protection area of machine tool, it matters the personnel safety, please be cautious!

III. COMMISSIONING

After debugging, commissioning should be carried out to ensure the AOPD is absolutely risk–free in operation.

III.1. Shade the light beams of light curtain, observe indicators of AOPD, and check if the conversion of indicators is in line with status sheet 4.1.

III.2. For presses on which the slider can stop at any point in one stroke, in the protection interval—as for the machine tool with muting function, the cam switch of muting function is in opening status from 30° to 180° of stroke down— shade the light curtain, the machine tool slider will stop at once.

For presses on which the slide stop at any point in one stroke, the braking must not have any failure!
If the braking is at fault, the machine tool must be repaired!
If the braking of machine tool is at fault, the AOPD can not offer personnel protection!

For presses which can only realize upper dead point protection, when the slider is at the upper dead point, shade the light curtain, the next stoke is not able to start up.

As for presses which can only realize upper dead point protection, the machine tool can not have the clutch failure!
If the clutch of machine tool has failure, the machine tool must be repaired!
If the clutch of machine tool has failure, the AOPD is at risk!

III.3. When the slider is at the lower dead point, shade the light curtain, the slider of machine should be able to return.

If Ⅲ.1, Ⅲ.2, Ⅲ.3 above are all met, the debugging of AOPD is successful, and it can be put in use.

UNIT 5 OPERATION, CHECK AND MAINTENANCE

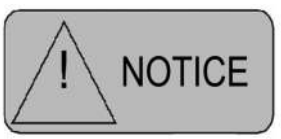
I. OPERATION

- Before operating the machine, check the AOPD control function to the machine tool slider, as shown in III COMMISSIONING, UNIT 4 DEBUGGING.
- For safe purpose, the key of function switch of CPS Ⅰ type controller must be kept by special staff.
- The position of light curtain should not be changed at will.
- The safety distance and relative altitude height of AOPD must be adjusted by special staff after changing the die.
- When failure of AOPD occurred, it should be repaired by professional staff.
- When the AOPD and the transmission cables are being disassembled, at first switch off the power supply, this must be operated by special staff.
- The performance life for relay inside the controller is 10^6 times, it should be changed when reaches performance life.

  If the misty opacity occurred inside the relay, the relay must be changed.
- **When the AOPD is not in use,**

  for CPS Ⅰ type controller, turn the function switch to the non–protection side ;

  for CQ1 type controller, turn off the power switch, turn the function switch to the non–protection side.



At this moment, the AOPD can not protect any more, other safety prevention measures should be adopted.

- During use, prevent the AOPD from collision caused by work piece, tool, scrap.
- If the controller is equipped with reset button, after light shading, the machine slider couldn't run or start up again until the AOPD is reset by pressing the reset button.

When the AOPD is not in use, other safety prevention measures should be adopted.

Hot line wiring for power & signal cable is forbidden!

II. CHECK AND MAINTENANCE

The check and maintenance of AOPD is very important to ensure the protection of punching operation, the AOPD must be checked and maintained regularly to give full play to its function. See sheet5.1 for detailed requirement of check and maintenance.

Sheet5.1

Projects	Details	Methods	Period
Check	Filter plate	Make sure the light–passing and surface is clean and unbroken	Before operating
	Light–shading confirmation beam by beam	Shade each beam of the light curtain; observe the indicators of sensor and controller	
	Effective protection scope	As for the machine tool with the muting function realized by the cam switch, shade the light curtain during 30° to 180° of the cam switch trip, the slider of machine tool will stop at once	
	Fasteners	Fasten all the screws	Six months
	Connection terminals	Make sure the cage nuts are not loosened, the lead contact is all right	
	Relay	Make sure the installation of relay is solid, the contact is all right, the movement is normal; observe the relay to make sure there is no misty opacity phenomena inside it	
Maintenance	Replacement of relay	It must be fixed firmly after the replacement	Misty opacity occurred inside the relay or the performance life has reached 10^6 times
	Cleaning of light–passing surface	Clean it with a clean and soft cotton yarn bedewed with alcohol (organic solvent is banned from using)	Carry on according to the operational situation
	Replacement of the filter surface	If it is broken, it should be replaced at once	
	Tightening and replacement of fasteners	Fasten the loosened fasteners, fasteners with the broken sliding –filament must be replaced at once	
Apart from regular checks, it is necessary to check AOPD before each operation.			

Hot line wiring for power & signal cable is forbidden!

UNIT 6 CHECK AND MAINTENANCE OF SIMPLE FAILURE

I. THE DISTINGUISHING OF AOPD AND MACHINE TOOL FAILURE

Sheet 6.1

Phenomena	Cause	Solution
AOPD could not work , all the indicators are off	No supply voltage	Couple in correct power supply
	Controller failure	Refer to sheet6.2
AOPD works intermittently , the conversion of indicator is abnormal	Low or incorrect supply voltage	Couple in correct power supply
	Bad beam focusing for AOPD or critical beam focusing	Readjust the position of sensor and reflector to make beam focusing all right
The conversion for indicator of AOPD is normal, press is not able to work	The connection between OSSD signal cable of AOPD output terminal and electric part of machine tool cut or incorrect	Check the electric circuit of machine tool connected with NO contacts, if the wiring is correct, replace or restore power & signal cable
	Electric failure of machine tool	Check and repair electric circuit of machine tool
	Controller failure	Refer to sheet6.2
The conversion for indicator of AOPD is normal, shade the light curtain, the press doses not stop	The electric circuit of machine tool connected with NO contacts short circuit	Check and repair the electric circuit of machine tool connected with NO contacts
	The circuit of cam switch for muting function is short circuit.	Check and repair the circuit for muting function
	The braking of machine tool are at fault.	Check the machine tool
The conversion for indicator of AOPD is normal, shade the light curtain, the press doses not stop at once	The adjustment of cam switch for muting function is incorrect	Check the machine tool or adjust the cam switch to the correct angle
	The clutch of machine tool are at fault	Check the machine tool
Turn the function switch to the non–protection side, press is not able to work	The electric circuit of machine tool connected with NO contacts is broken	Check and repair the electric circuit of machine tool connected with NO contacts, if the wiring is correct then replace or restore the power & signal cable
	The loop of electric stroke for machine tool disconnects	Check and repair electric circuit of machine tool
	Controller failure	Refer to sheet6.2
Turn the function switch to the protection side, press is not able to work; turn the function switch to the non–protection side, press work normally	Controller failure	Refer to sheet6.2
	Sensor failure	Refer to sheet6.3

All the phenomenon shown in the above sheet takes place at a time when power switch is turned on.

II. THE CONTROLLER FAILURE, CHECK AND MAINTENANCE

Sheet6.2

Phenomena of failure		Cause	Solution
The AOPD does not work, all the indicators are off		No supply voltage	Couple in correct power supply
		The power fuse fusing	Replace the power fuse with a new one of the same specification, 5×20/1A
		Power & signal cable failure or bad contact for socket connector	Check and repair power & signal cable and socket connector
		Power switch broken or bad contact for connector, or relevant circuits broken	Replace power switch, or check and repair and relevant circuit
		The switch mode power is broken	Check the circuit and switch mode power, replace the switch mode power if the wiring is correct
The conversion for indicator of AOPD is normal, press is not able to work		The fuse F1 fusing	Replace the power fuse with a new one of the same specification, 5×20/5A
		The control output circuit breaks	Check and repair the circuit and wiring between OSSD
		The contact point of relay is ageing or broken	Replace the relay with a new one of the same specification
Turn the function switch to the non – protection side, press is not able to work		For CPS Ⅰ type controller, function switch is broken or related circuit failure	Check the circuit of function switch, if there is no fault, replace the controller
		For CQ1 type controller, function switch or relay failure, the load fuse fusing	Check the load fuse or relay, if there is no fault, replace the controller
The power indicator and unusual station indicator are on; the normal operation indicator is off.	The green status indicator of sensor is off	Sensor failure	Refer to sheet6.3
		Wiring failure of transmission cables or transmission cable fault	Check and repair the transmission cable, if it's broken, replace it
	The green status indicator of sensor is on	S signal line of transmission cable loose contact	Check the connection for S signal line
		The relay failure	Replace the relay with a new one of the same specification
		The controller failure	Replace the controller with a new one of the same specification

All the phenomenon shown in the above sheet takes place at a time when power switch is turned on.

III. THE SENSOR FAILURE, CHECK AND MAINTENANCE

Sheet6.3

Phenomena	Cause	Solution
All the indicators of sensor are off	Transmission cable failure	Check and repair transmission cable and the wiring
	Sensor failure	Replace sensor with a new one of the same specification
The red status indicator of sensor is on, the green status indicator is off	Bad beam focusing	Make the beam focusing well
	The filter plate surface of sensor is dirty.	Wipe it with a clean, soft cotton yarn
	Sensor failure	Replace sensor with a new one of the same specification

TEL: 86-537 2168110 or 2338345 FAX: 86-537 2331667
WEB: www.sdkeli.com Service Tel: 400 666 0416
ADD: A3 building, Industry & Education & Research base of Jining National High-tech Zone, Shandong, China
ZIP: 272000