LNTECH®

SLA-3 Bending Machine Protection Device

Instruction Manual

SHANDONG LAIEN OPTIC-ELECTRONIC TECHNOLOGY CO.,LTD.

Contents

Contents

1 Important Information

1.1 Summary

This manual is composed of the SLA-3 device's instruction, operation, installation, wiring, maintenance and troubleshooting etc. excludes the operation instruction for the machine protected(installed with SLA-3), please refer to the manual from the machine protected manufacturer

1.2 Composition

This manual contains chapters:

- Important information contains emphasis information,the makeup of this manual,control dependability information,certificate,directive and so on.
- Basic introduction contains the usage,features, working schematic drawing and terminology,technical parameter data and specification of the SLA-3 device
- Cautions for installation of the SLA-3 device contains calculating determination of placement position and attentions for neighboring placement.
- The device's function and external size.
- NPN/PNP output wiring,the wiring with safety relay and so on.
- Debugging
- Checkout and Maintenance
- Troubleshooting

1.3 Applicable Standards

Standards	Title
EN 61496-1-2013	Machinery safety-Electro-sensitive protective equipment-Part 1:General requirements and tests
EN 61496-2-2013	Machinery safety-Electro-sensitive protective equipment-Part 2:Active opto-electronic protective devices
EN ISO 13849-1-2008	Safety of machinery -- Safety-related parts of control systems -- Part 1: General principles for design

GB 28240-2012	Shears—Safety requirements
GB 28243-2012	Hydraulic press brakes—Safety requirements
GB 7247.1-2001	Safety of laser products--Part 1:Equipment classification,requirements and users guide
GB 4208-2008	Degrees of protection provided by enclosure(IP code)

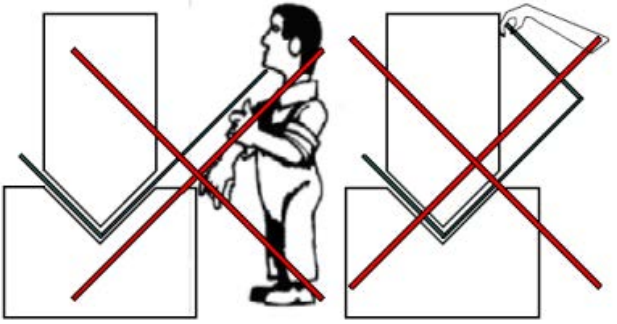
1.4 Safety Signs

! Warning Failure to follow the instruction may result in a serious injury or death

! Caution Failure to follow the instruction may lead to minor or moderate injury

1.5 Notes

1. Read manual
   Please take note of the contents marked **! Caution** includes the peroper operation instructions, taken as the important components for SLA-3 device, ensure of the manual placed at right place.
2. Operator Ability
   To carry out the installtion,adjustment and maintenance by the qualified person
3. Warning
   SLA-3 can't be used with any machine that ejects materials or components parts through the defined area, and can't prevent the materials ejected leading to the injury.
   Also can't provide the protection for below situation:



● SLA-3 offers complete protection (finger and hands) from rapid intervention shortly before the press closes completely, during the very short time before complete closing with non protection, at the same time SLA-3 function is muted(muting indicator ON)

● The switch keys should be kept by the designated person, and to select the working modes according to the application requirements

● The protection function can't be performed to the bending machine with press closing only at working speed, or too long overrun distance

● Prevent the SLA-3 device falling down

1.6 Application Cautions

1. All the upper tools come with the same height and bending middle center, the falling prevention equipment need to be mounted on the worktable or upper tools

2. The SLA-3 is not used to monitor two bending machines placed in a horizontal plane

3. If the workpiece block the light beams, SLA-3 stop immediately the press closing, meanwhile any wavy material maybe cause the unexpected lockout, so need mute the SLA-3 before materail interrupt the beams. i.e. when the upper tool approaching the materail at 6-15mm (as per bending machine overstroke) , control system should send out the muting signal to SLA-3 receiver, and ensure the closing speed <10mm/s according to the type 4 standards.

4. SLA-3 special mode enables the bending or wavy material or even edge bending within a closed box. If the bending machine only closes at work speed,or too big excess of stroke, SLA-3 won't provide protection, i.e. won't prevent access to the hazardous area.
5. The bending machine control system must meet type 4 standards requirements.
6. The protected machine must detect the danger status, and stop it
7. The laser beam maybe intervened by airflow, cause the unexpected lockout, so guarantee the workplace without airflow or little.

! Caution

1. Must keep a certain distance between the SLA-3 beams and upper tool, the distance referring to overrun distance measuring value and distance of SLA-3 beam to upper tool
2. After installtion, only allowed to change the mould which has the same overrun distance, otherwise need re-adjust SLA-3 installation position
3. SLA-3 used with PLC, PLC monitors related short circuited and bypass state, provides closing signal and return signal, also process the SLA-3 output OSSD1 and OSSD2
4. Installation and connection follow the instruction manual, complte the safety regulations to ensure safety operation, not any change allowed to circuit which will cause protection failure.

2.Basic Instruction

2.1 Terminology

Electro-sensitive protective equipment (ESPE)

Assembly of devices and components working together for protective tripping or presence-sensing purposes and comprising as a minimum.

Detection Capability

Sensing function parameter limit specified by the supplier that will cause actuation of the electro-sensitive protective equipment(ESPE).

EDM:

Means by which the electro-sensitive protective equipment(ESPE) monitors the state of control devices which are external to the ESPE.

Lockout Condition:

Condition, initiated by a fault, preventing normal operation of the electro-sensitive protective equipment(ESPE). All output signal switching devices(OSSDs) and, where applicable, all secondary switching devices(SSDs) are signalled to go to the OFF-state.

Muting:

Temporary automatic suspension of a safety function(s) by safety-related parts of the control system.

On-state

State in which the output circuit is complete and permits the flow of current.

Response Time:

Maximum time between the occurrence of the event leading to the actuation of the sensing device and the output signal switching devices(OSSD) achieving the OFF-state.

Fault:

State of an item characterized by inability to perform a required function, excluding the inability during preventive maintenance or other planned actions, or due to lack of external resources.

Performance Level(PL e):

SLA-3 device comply with EN ISO 13849 PL e requirements,i.e. EN954 cat.4 requirements.

Failure:

Termination of the ability of an item to perform a required function

Note 1: After failure the item has a fault

Note 2: "Failure" is an event, as distinguished from"fault", which is a state.

Note 3: This concept, as defined, does not apply to items consisting of software only.

Note 4: In practice,the term fault and failure are often used synonymously

Self-checking:

The device switches automatically into the "safe state" when it is faulty.

Standard Mounting Range:

Maximum distance between transmitter and receiver is 5 m, if exceed the distance may lead to hazardous motion. For longer range please get in contact with us.

Overrun Distance:

The distance covered during the overrun (e.g. by the ram of a press).

Start Interlock:

After initial operation or after a power supply interruption a renewed "enabling" is blocked by the start interlock.The renewed release of the switching unit is only possible by closing and opening of the start entry.

Box Bending Mode:

The E3 is muted during during bending process.

2.2 Usage

SLA-3 is the safety device specially applied to bending machine for operator's protection which adpoted class 1 laser, A three-dimension laser protective field between the emitter and receiver to form the guarding area underneath the clamped upper tool, any intervention into the area shuts down the closing movement of the press.

2.3 Technical Parameters

Performance Characteristics;	
Protection distance	0～20000mm
Laser source	Class I，635nm
Angle of divergence	≤1.5mrad
Output	PNP×2，cross check,short protection
Switch capability	≤200mA
Response time	<5ms
Safety level	Cat4. PL e
Anti-vibration EN 60068-2-6	Frequency：10 ～ 55Hz Amplitude：0.35mm
Protection level	IP65
Protection category	III
Electrical Characteristics	
Power supply	DC24V
Volt tolerance	±10%
Power consumption	<10W
Environmental/Physical Characteristics	
Operation temperature	-10～50℃
Storage temperature	-40 ～ 85℃

2.4 Characterisitcs

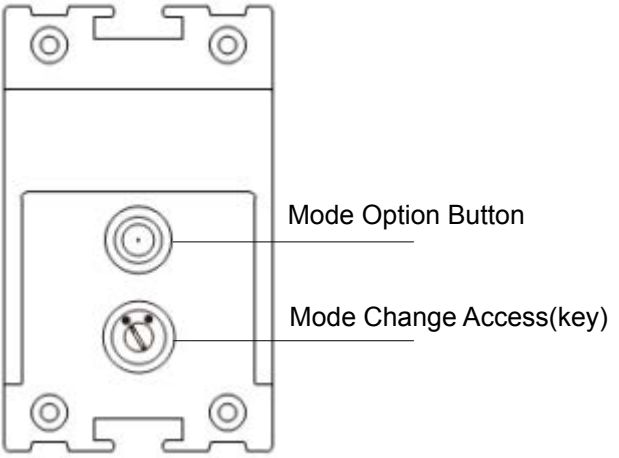
- Floating mount to provide protection without dead zone
- Class 1 laser can detect 4mm and vibration deviation allowed
- Redundancy design,double outputs
- EDM function, monitor dual valves
- Adustment mode, aligment with ease
- Flat bending mode, Box bending mold, Special mode, suitable for different shape process
- Operate at high speed, max. safety at maximum productivity
- Samll size, simple&easy adjustment
- Comply with EN 61496-1/-2, EN ISO13849

2.5 Working Modes

When power up the protector, keep the foot pedal in releasing condition, press the "Mode" button to change the operation modes:"adjustment mode","normal mode","box bending mode","special mode" which will be indicated in receiver panel by LEDs ON.

! Caution

Note: To switch the working mode is prohibited during operating the bending machine, must remove the key after changing the mode.



back of receiver

【Adjustment Mode】

This mode applied to the condition that initially install the SLA-3 or move the emitter/receiver in operation, all laser beams turn ON, output OSSD1,OSSD2 turn OFF, when the beams are not aimed at the receiver properly, E1,E2,E3 indicators "ON", otherwise the indicators are "OFF" and no flashing means promper alignment.

【Flat Bending Mode】

Process the flat material in the mode, E1,E2,E3 beams all work normally, when any beam is blocked the output OSSD1,OSSD2 "OFF" during the high speed closing.

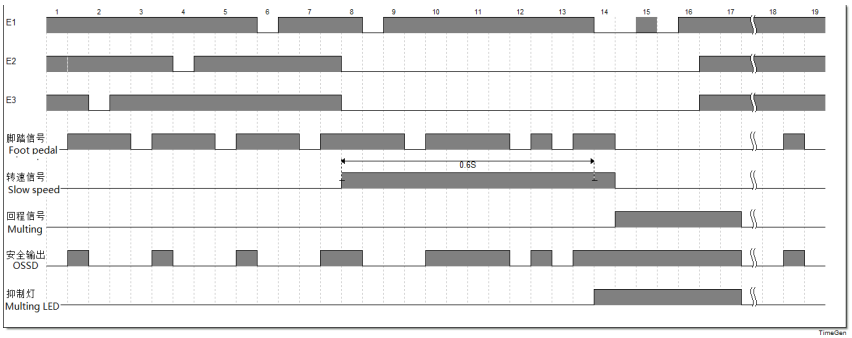


Fig.2-1 Time Diagram of Flat Bending Mode

【Box Bending Mode】

Under the mode,E1,E2 beams work normally, E3 beam is muted(no protection), E1,E2 any beam is blocked during high speed closing, output OSSD1,OSSD2 "OFF" (stop signal)

Note: if the E3 beam blocked can't be detected during high-speed press closing twice, SLA-3 will be automatically switched into the mode

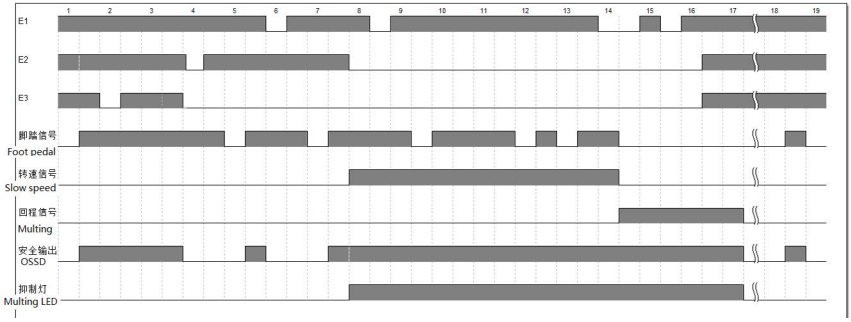


Fig.2-2 Time Diagram of Box Bending Mode

【Special Mode】

Select the mode to process wavy material, E1,E2,E3 beams work normally, when the beam is blocked by material during fast speed closing, output OSSD1,OSSD2 "OFF", release and step the pedal again, if the beam is still interrupted, output OSSD1,OSSD2 keep "OFF", the sensor outputs the complusory slow speed signal(PNP), control the bending machine press close at low speed <10mm/s. At the same time SLA-3 on longer provides the protection to operator, even though the bending machine closes at slow speed, may result in a potential dangerous condition, so must carefully and thoughtfully use the mode, In no event shall SHANDONG LAIEN OPTIC-ELECTRONIC TECHNOLOGY CO.,LTD. be liable to any incidental or special damages under the mode.

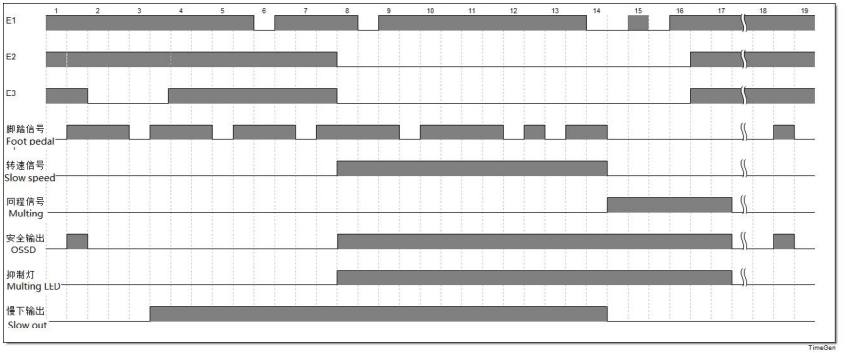


Fig.2-3 Time Diagram of Special Mode

3.Components

3.1 External Size

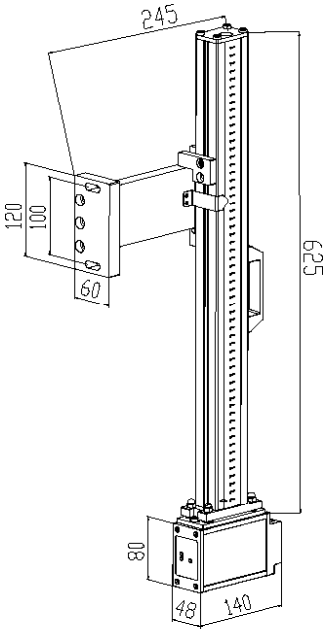


Fig.3-1 External Size

Note: Emitter external size is same as the receiver

3.2 Parts Instruction

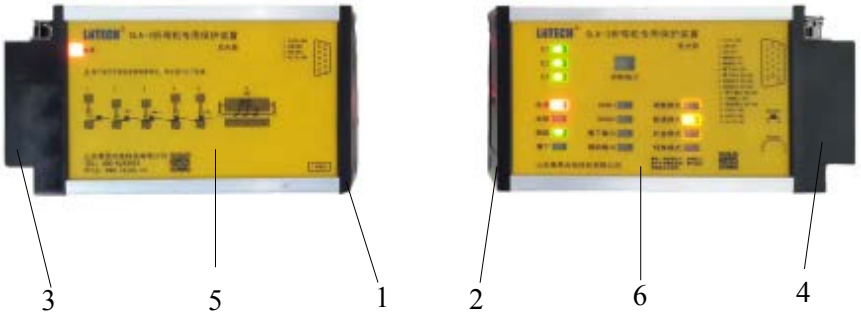
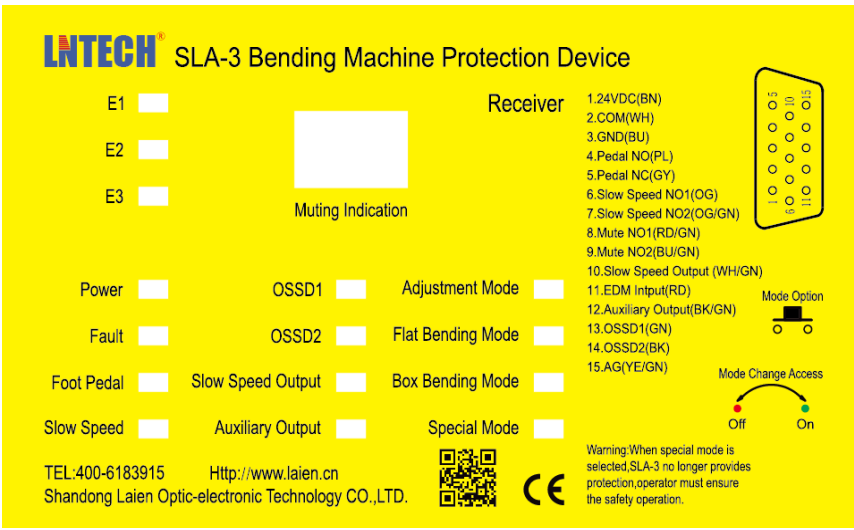


Fig.3-2 SLA-3 Parts

1.Emitter Front Cover
2.Receiver Front Cover
3.Emitter Back Cover
4.Receiver Back Cover
5.Emitter Panel
6.Receiver Panel

3.3 Receiver Indicators



3.1 Receiver Indicators

Mark	Function Instruction	Remark
E1/E2/E3	Woring status: proper alignment, indicators (green LED) ONAdjustmen mode: proper alignment, indicators (green LED) OFF	
Muting indication	Receiver is muted,indicator(yellow) flasing	
Power	Power on, indicator(red) ON	
Fault indicator	Wrong wiring or receiver fault, indicator (yellow) flashing	refer to troubleshooting
Pedal switch	Pedal connection,indicatro(green) ON	
Slow speed close	Low speed signal connection, indicator (green) ON	
OSSD1	Receiver output signal connection, indicator (greeen) ON	Safety output
OSSD2	Receiver output signal connection, indicator (greeen) ON	Safety output
Slow speed clos output	Compulsory low speed output(special mode PNP output), indicator(green) ON	
Auxiliary output	Auxiliary indication and EDM off,indicator(green) ON	not used for protection
Adjustment mode	Sensors adjustment,proper alignment indicator(green) ON	
Flat bending mode	Proper alignment indicator(green) ON	
Box bending mode	Proper alignment indicator(green) ON	
Special mode	Proper alignment，indicator(green) ON	
Mode change access	Switch to green point ON, allow to change mode	
Mode option	select mode change access at ON, then push down the option button,can select working mode	

4 Installation（mm）

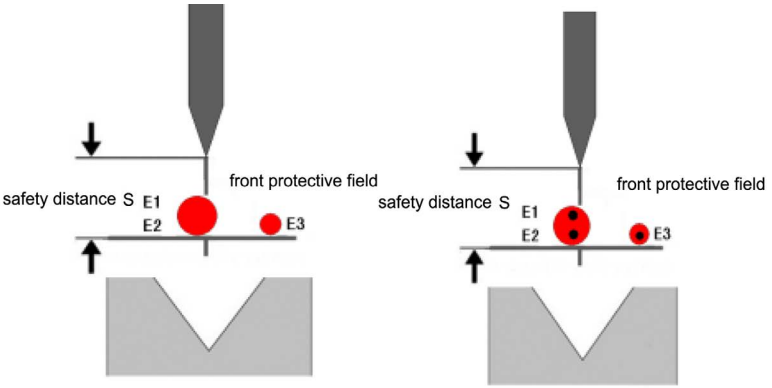
Caution

- To carry out the installation, connection, commissioning and maintenance of SLA-3 device by qulified person
- This warranty does not cover damage or liability for misuse, abuse, or the improper application or installation

4.1 Safety Distance

The safety distance is the vertical line distance (S) from upper tool tip to the bottom beam(E2), which is the min. distance allowed between protection device and the dangerous area

The mounting position must be in line with the safety distance requirements,otherwise may lead to serious injury



Emitter　　Receiver

safety distance(S)calculations：

- S>(t1+t2)×V+6 mm

  t1: SLA-3 response time(max.5ms)；

  t2： bending machine stop time；

  V： bending machine fast closing speed

- Determine bending machine braking distance by grating-rule, then add 6mm

Note: If different value from the calculations,take the bigger one as the safety distance.

4.2 Light Beam Position

All beams position as following fig. when SLA-3 device work's normally, E1 beam should be positioned at 2-3mm behind the top tool tip

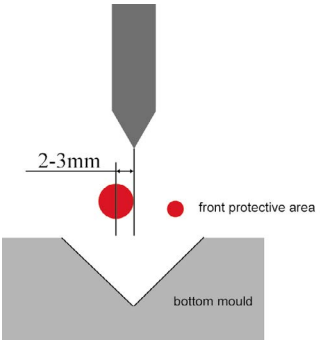


Fig.4-2 Light Beams Position

4.3 Speed Switching Point

The point is the position from fast speed press changed to working speed, which is calculated as per the distance from the point to the workpiece, generally the value is set as per the machine protected overrun distance at 6mm-15mm.

The SLA-3 device bottom beam should be positioned at least 6mm on top of the workpiece when the bending machine close at slow speed

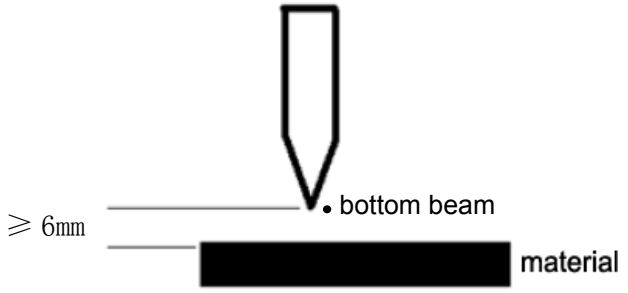


Fig.4-3 Speed Switching Point Setting

4.4 Installation Position

Initially mount or adjust the SLA-3 position, please select the "adjustment mode": Open the mode change access "ON", then press the mode option button to select the "adjustment mode"

Please install the device in full compliance with the manual, otherwise may lead to serious injury

【Installation】

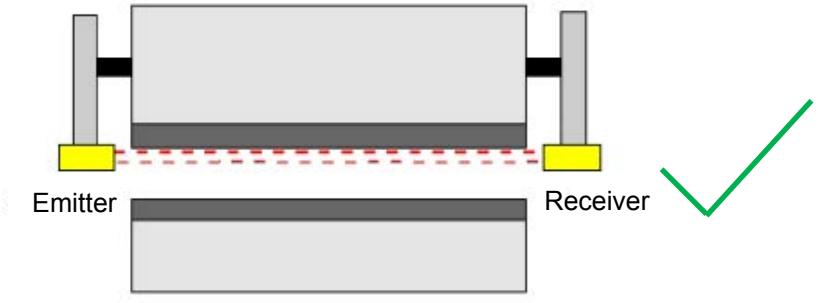


Fig.4-4 Proper Mounting

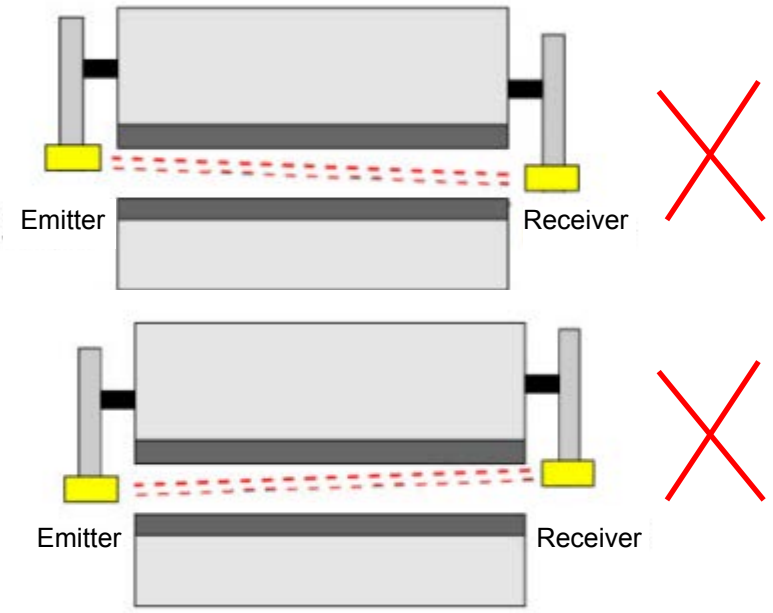


Fig.4-5 Improper Mounting

【Adjustment】

After mounting the SLA-3, slightly adjust the receiver bracket to align properly

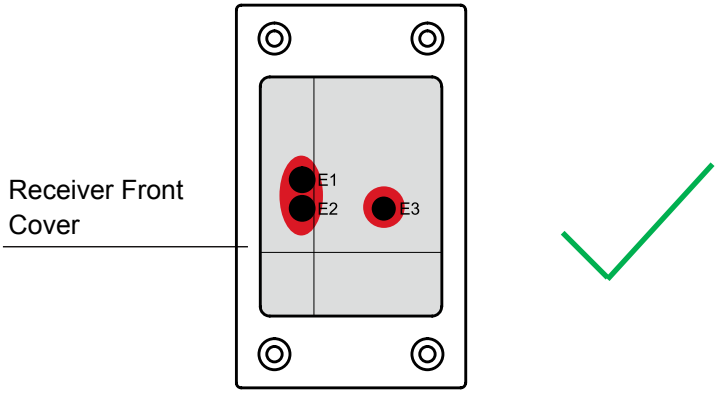


Fig.4-6 Properly Aligned Beams On Receiver Front Cover

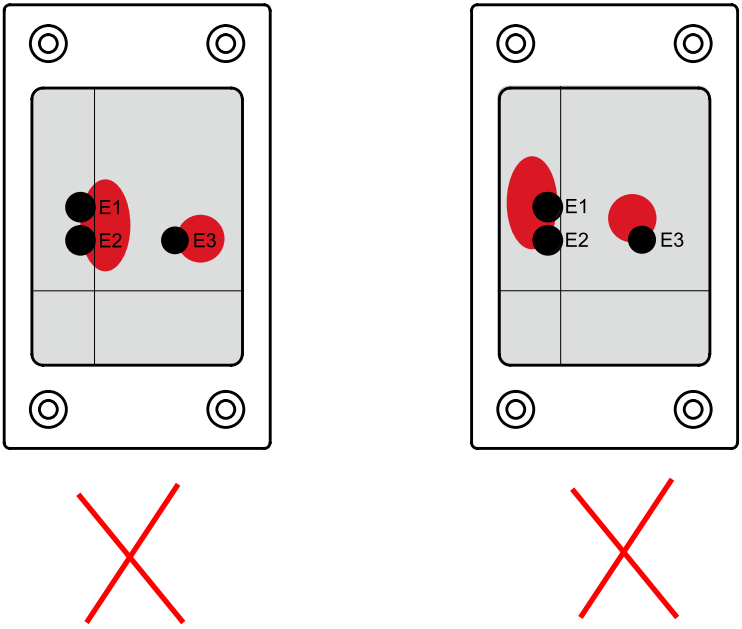
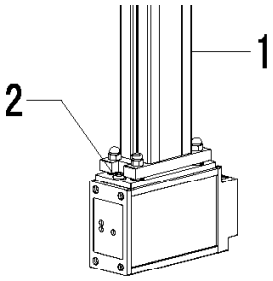


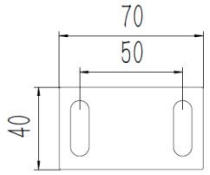
Fig.4-7 Improper Alignment Seen on Receiver Front Cover

Note：The emitter indicator will be off when the SLA-3 device is muted

4.5 Installation Instruction

1st step: determin the installation position, then drill holes at the position
2nd step: tighten the bracket as per fig.4-8



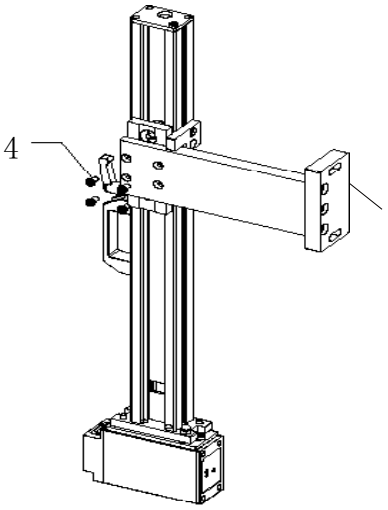


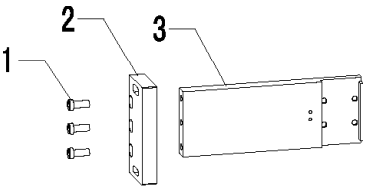
vertical view

1. Adjustment bracket
2. Screw M6*12

Fig.4-8 Installation Bracket

3rd step: receiver mounting bracket

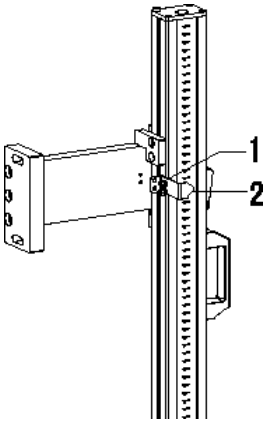




1.Screw M8*20
2.Fixed bracket 1
3.Fixed bracket 2
4.Screw M6*12

Fig.4-9 Receiver Mounting Bracket

4th step: use M6*16 screw to fix the block



1.Screw M4*12
2.Pointer

5th step: use M8*30 screw to fix the bracket into the drilled holes in the machine protected

Note: can rotate the SLA-3 by adjusting the M6*12 screw connected adjustment bracket with SLA-3 device

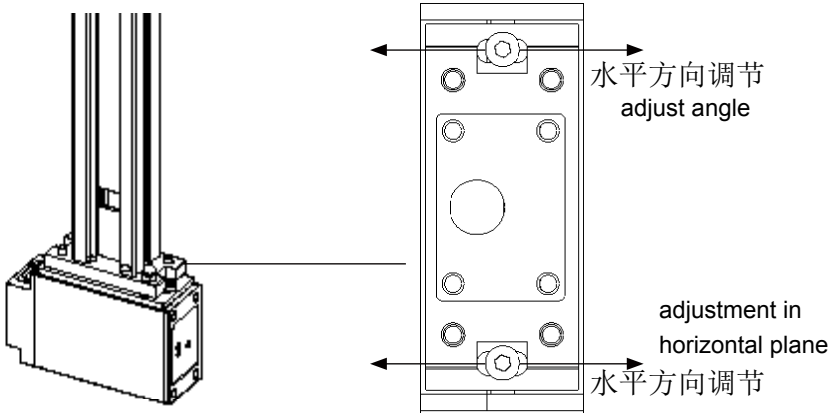


Fig.4-10 Ajustment Diagram

Warning

Ensure the bending machine be powered off when mount the SLA-3 protection device, otherwise may lead to serious injury. Verify the emitter and receiver in the same horizotal and vertical plane,E3 beam set at front of upper tool tip, the distance from receiver and emitter to machine slider >10cm.

4.6 Installation Tools

1. electrodrill, bore bit(φ6.8)
2. screw tap(M8)
3. screwdriver
4. Allen key(6mm)
5. pointed-nose pliers

5 Wiring

5.1 Cautions

Warning

- Must switch off the SLA-3 device before wiring and completely connect in compliance with the drawing
- Any change is not allowed to the device circuit
- Connect with power supply device complying with local law or standards, otherwise may lead to damage or misoperation

Remark: the wiring implemented by qualified persons, in accordance with this manual and applicable safety regulations.

The power supply device meets below requirements:

1) local verified power device

2) comply with EMS directs(for CE certification)

3) comply with low-volt directives,output power below 100VA

4) output holding time >20ms

5) when electric surge occur,need usd SPD

6) In line with CLASS 2 (comply with UL/cUL)<SUPPLYMENTARY> As IEC 60536 regulation that the power device with double insulation or reinforced insulation distance.Comply with low-volt directives and output power<100VA

5.2 SLA-3 Wiring with safety relay

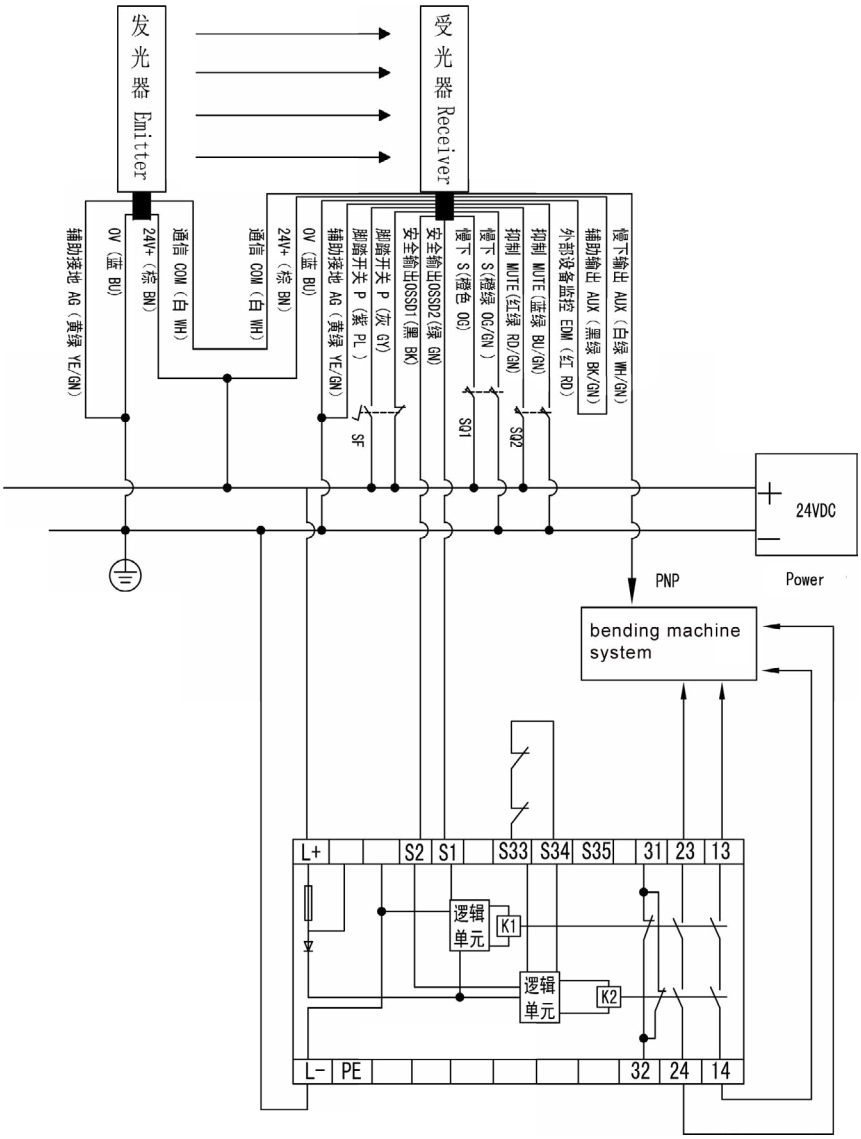


Fig.5-1 SLA-3 Wiring With Safety Relay

5.3 SLA-3 I/O Wiring

Note: K1,K2 is the electromagnetic valve with feedback monitoring or safety relay in the bending machine system Fig.5-1.

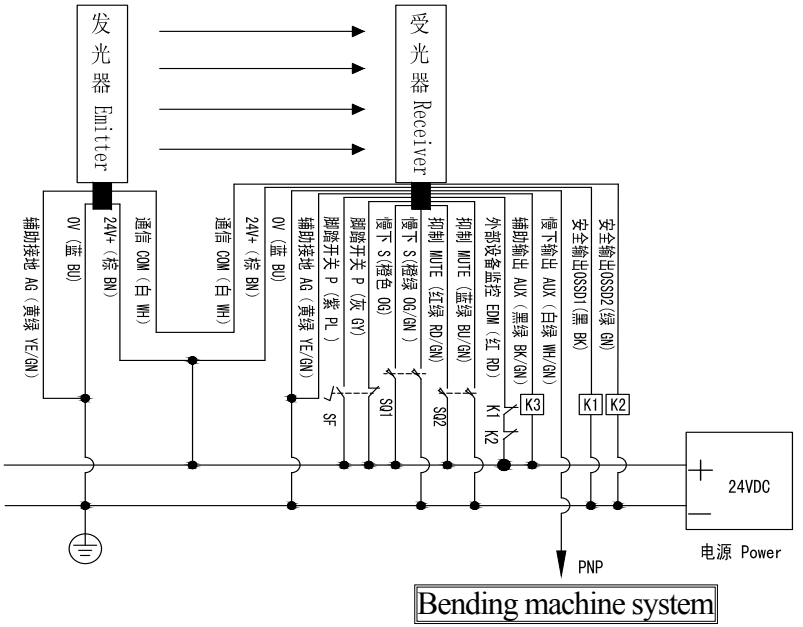


Fig.5-2 I/O Wiring

Wiring Procedure：

1. connect with power 24VDC
2. short EDM cable with auxiliary output if no need
3. check the pedal, low speed closing,muting signal
4. connect with the pedal signal,i.e. purple,grey cable, check and confirm the wiring correct.

5.check the slow speed closing wiring correct,i.e. orange, orange/green cable
6.check the muting wiring correct,i.e. red/green, blue/green cable
7.After the above wiring, operate the bending machine with full stroke to check and confirm the SLA-3 device output and indicators display normally
8. Connect the output1, output2 with bending machine control system, control the machine and check if works normally or not

5.4 Signal Cable

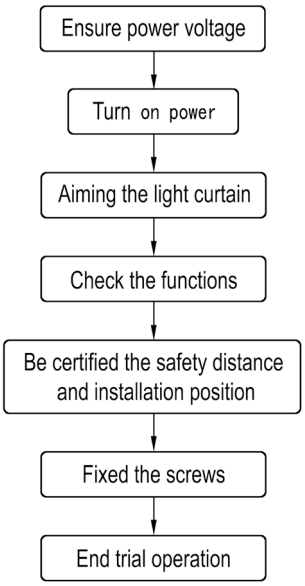
Part	Color	Function	Remark
Emiter	Brown	DC24V	VCC
	White	COM	LOC
	Blue	GND	0V
	Yellow/Green	AG	auxiliary GND
Receiver	Brown	DC24V	VCC
	White	COM	LOC
	Blue	GND	0V
	Purple	Pedal NO	pedal signal
	Grey	Pedal NC	pedal signal
	Orange	Slow speed NO1	slow speed signal
	Orange/Green	Slow speed NO2	slow speed signal
	Red/Green	Mute NO1	muting signal
	Blue/Green	Mute NO2	muting signal
	White/Green	Slow speed output	PNP
	Red	EDM input	EDM
	Black/Green	Auxiliary output	not a safety output
	Green	OSSD1	safety output
	Black	OSSD2	safety output
	Yellow/Green	AG	auxiliary GND

6 Debugging

6.1 debug

Caution

Need check thoroughly and confirm all connection correct, then power on the device to debug



① Check power voltage

Ensure the power voltage conforming to that listed in technical label, the range is ±10%.

② Power on

As per P22 fig.5-1/5-2，check carefully then switch on

③Alignment

Adjust SLA-3 position and angle to keep at the same height

④Test

In adjustment mode,block each beam to ensure the device works normally

light passing, E1,E2,E3 indicators OFF

light blocked, E1,E2,E3 indicators ON

⑤Determin Installation Position

⑥Tighten screw

⑦Debugging over

6.2 Safety Test

Carry out the safety performance test before operation,i.e. use the test rod or overrun distance measuring equipment.Overrun distance test should be finished during the 1st working stroke, if the test is not passed, the machine must not be used until the problem is removed, if consecutive 10 measuring values exceeds 10mm, to decrease slider's fast speed, which can be finished by SLA-3 with limit switch.

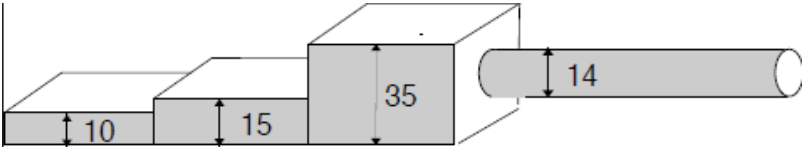


Fig.6-1 Step-wedge Test Rod

a. place the "10" part at the bottom mould then start the bending machine

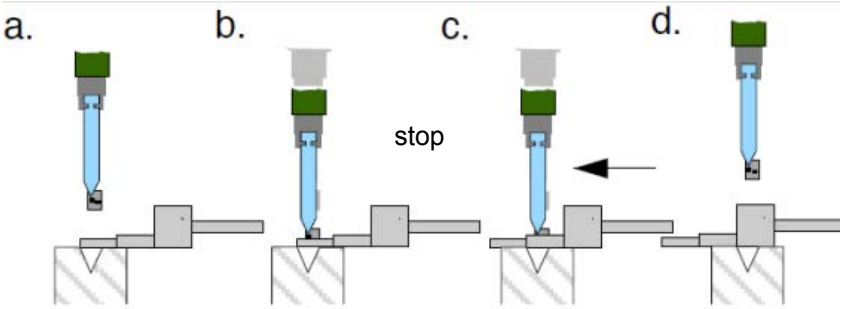
b. bending machine stops closing

c. remove test rod and place "15" part at bottom mould, bending machine is still out of working and tool tip may not touch the rod

d. return the slider, place "35" part at the bottom mould,then start closing

e. upper tool movement should be stopped before touching the test rod at "35" part

f. E1,E2,E3 indicators are still OFF when moving the test rod



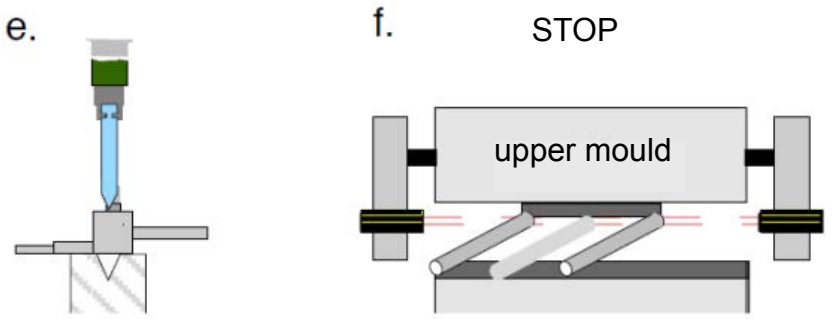


Fig.6-2 Test Procedure Diagram

7 Checkout and Maintenance

7.1 Cautions

- Before operation, check to ensure the SLA-3 device work normally.
- Do not change the device position at random.
- When a malfunction happened, need the professional technicians to check and repair.
- Should switch off power before dismounting the light curtain by the professional technicians
- Allow to change mould with the same overrun distance, otherwise need adjust the SLA-3 position by professional technicians

7.2 Checkout and Maintenance

Item	Content	Method	Check Period
Checkout	Interception test(check every light beam)	To block each beam to confirm indicators work normally and normal output	Before operation
	Check the fastener	Check and ensure of all fasteners fixed	Every 6 months
Maintenance	Clean the housing	Clean with soft cotton yarn soaked water or detergent, prohibit cleaning with organic solvent	according to the situation
	Tighten fastener	Fix loosen screws tightly, replace the damaged ones	according to the situation
	Need check the device before operation apart from the periodic checkout		

8 Troubleshooting

Fig.8.1 The SLA-3 device and press brakes faults analysis

Fault Phenomenon	Reason	Solution
fault indicator flashing once per second	safety output short	output overload or short
fault indicator flashing twice per second	abnormal muting signal or switch	muting switch fault
fault indicator flashing 5 times per second	EDM fault	EDM disconnection
step pedal but indicator is off	double pedal signal is ineffective	pedal switch wiring fault
slow speed indicator is off when press closing	slow speed signal is ineffective	slow speed switch fault
press brakes returned trip,muting indicator is flashing	muting signal is ineffective	muting switch fault
stop work when press closing, safety output disconnected,can't recover from the condition	the workpiece is too thick or wavy material, E1 beam interrupted when closing	Set higher RPM
no laser sent out from emitter when press brakes upper mould at the top dead center	press brakes is muted,muting switch is not disconnected	step the pedal, press brakes closes and emitter sends out laser normally,otherwise check the muting signal

Note: refer to the form for other guarded machines

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