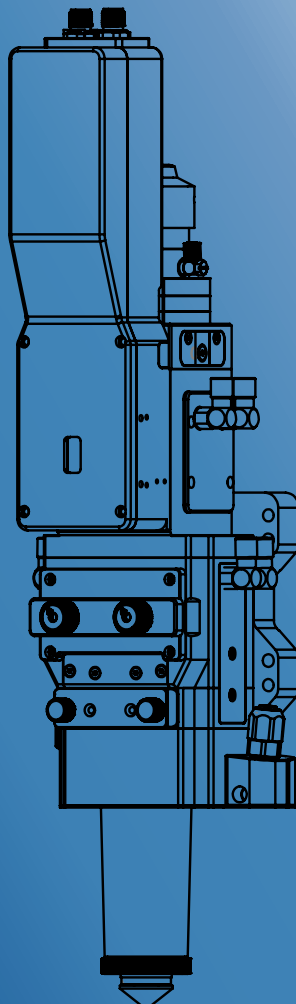




User Manual NC63A



Shenzhen Worthing Technology Co., Ltd.



Please read this manual carefully and make sure you understand its contents before using the laser head.

Please keep this manual for future operation and maintenance.



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1. Technical parameters and installation & debugging

1.1 Technical parameters

Model number: NC63A

Laser wavelength: 1030~1090nm

Working power: $\leq 8000\text{W}$

Fiber connector: QBH/QD/G5

Lens configuration:

collimation F100, focus F150/F200

Focus adjustment range:

Adjustment range of focus lens F150 is $\pm 18\text{mm}$; Adjustment range of focus lens F200 is $\pm 35\text{mm}$

Beam center adjustment range: $\pm 1.5\text{mm}$

Cutting gas connector:

Standard $\phi 10$ (optional $\phi 12$), Gas pressure $\leq 2.5\text{MPa}$

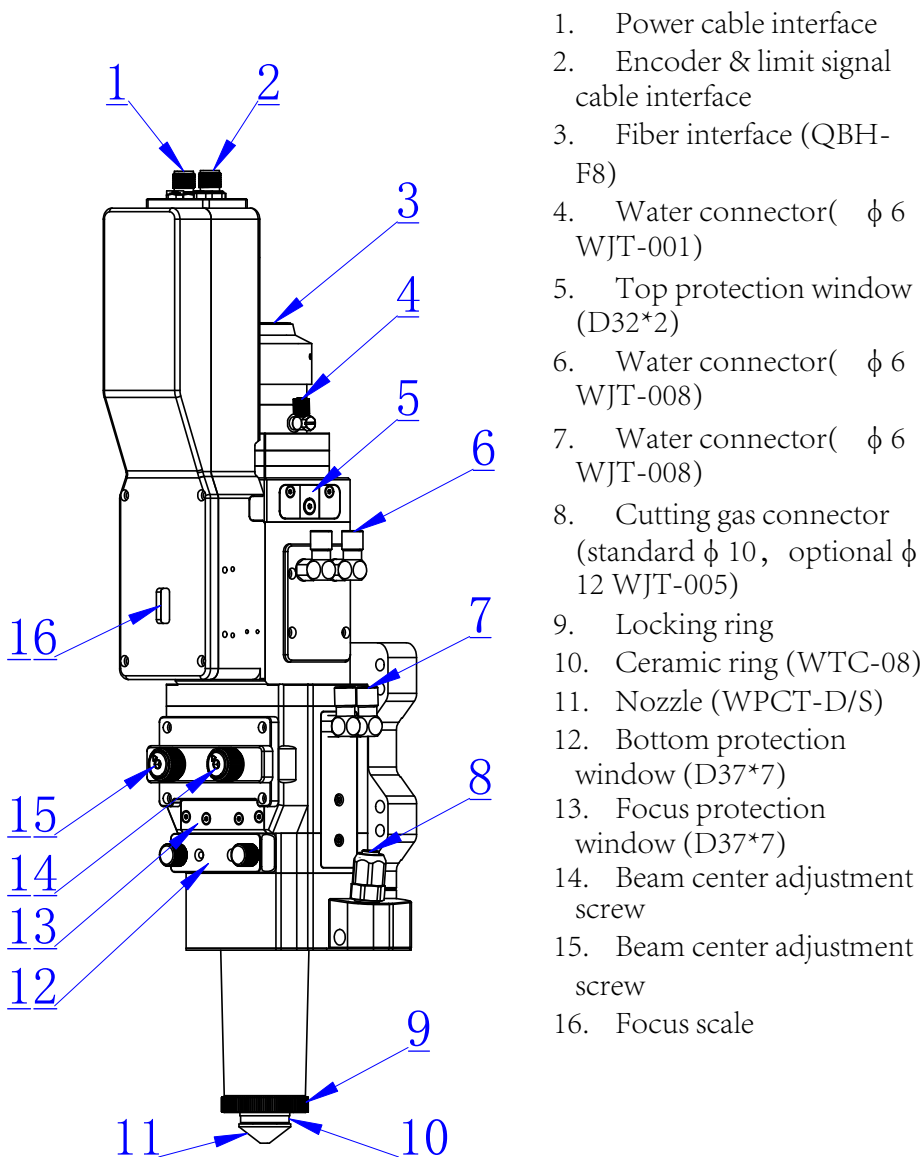
Cooling gas connector: $\phi 6$, Gas pressure $\leq 0.6\text{MPa}$

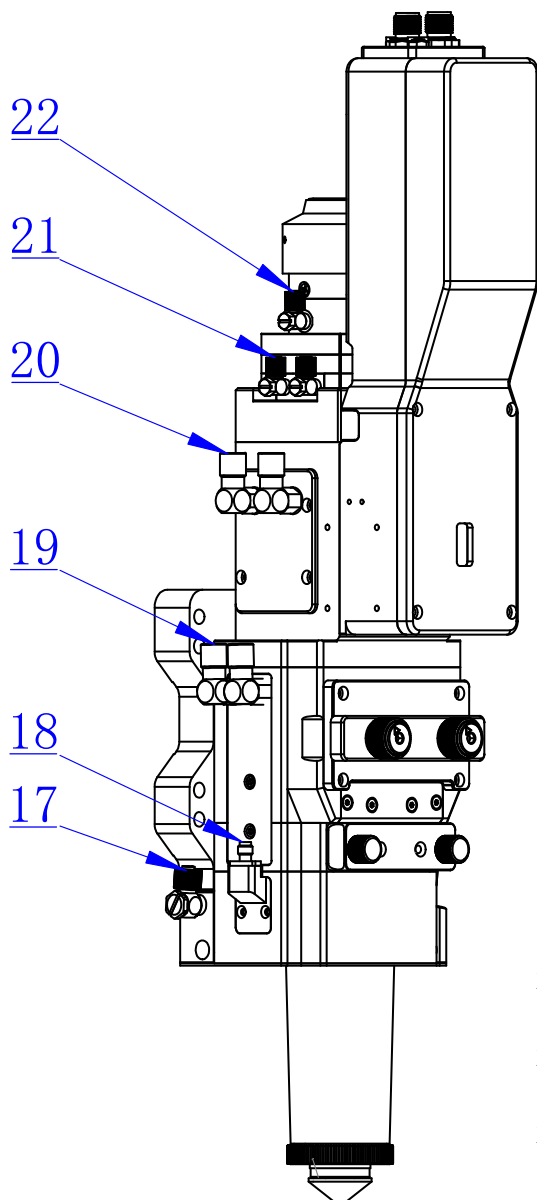
Water connector: $\phi 6$, water

pressure $\leq 0.5\text{MPa}$

Weight: about 7.8kg

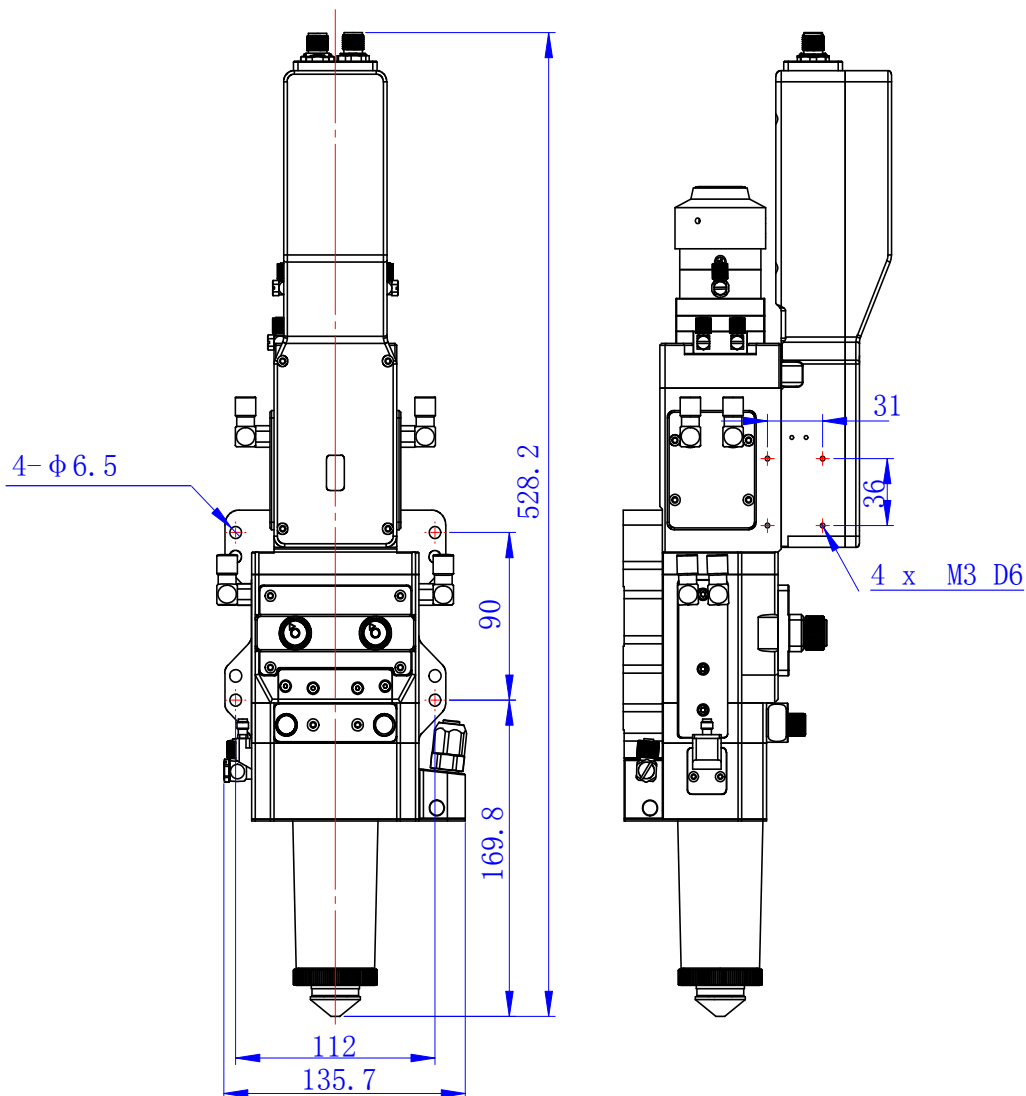
1.2 Interfaces



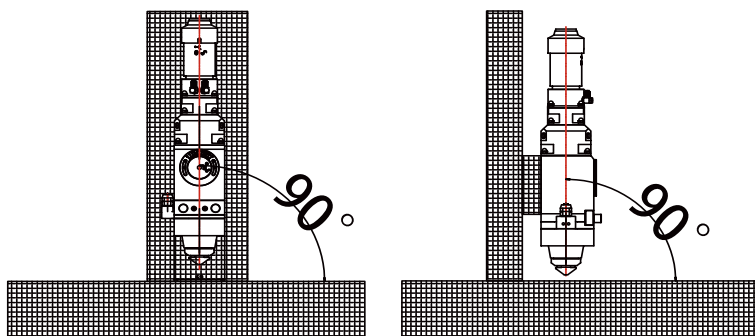


- 17.Cooling gas connector(ϕ 6)
- 18.Sensor signal interface
- 19.Water connector(ϕ 6 WJT-008)
- 20.Water connector(ϕ 6 WJT-008)
- 21.Water connector(ϕ 6 WJT-008)
- 22.Water connector(ϕ 6 WJT-008)

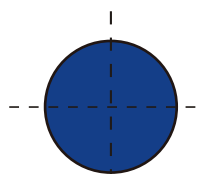
1.3 Installation size



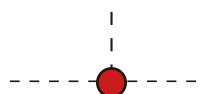
1.4 Installation debugging



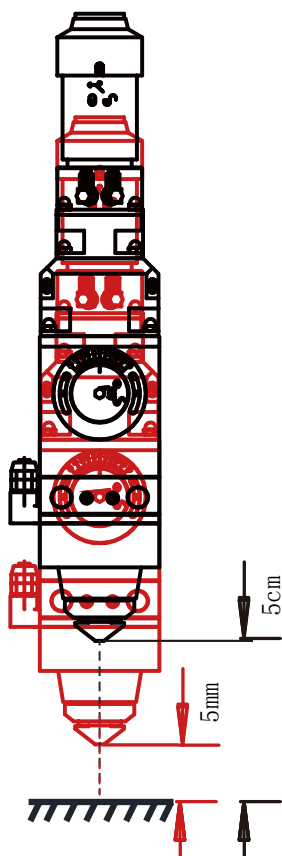
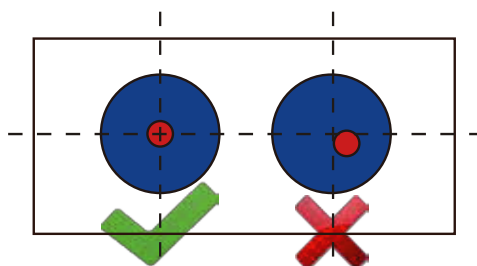
Step 1: set the laser power to 500W, make a short burst at the height of 5cm from the plate, burn around scorch on the plate;



Step 2: set the laser power to 100W, make a short burst at the height of 1~5 cm from the plate, burn a round scorched spot on the plate;

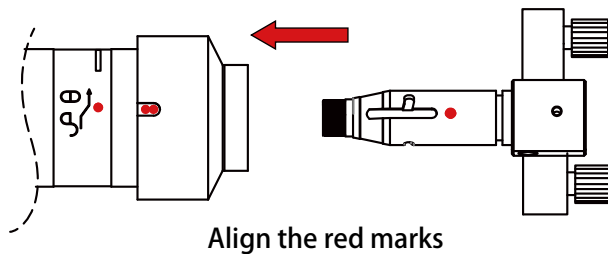


Step 3: compare the concentricity;

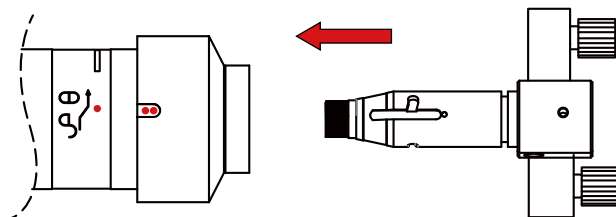


1.5 Fiber connection

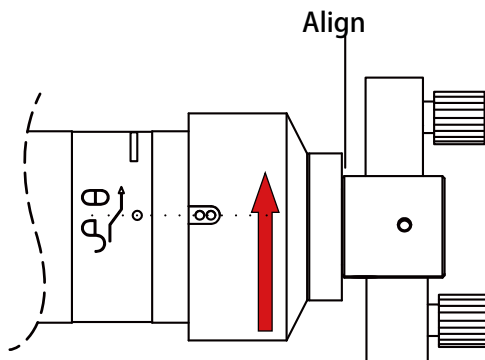
- (1) Place the laser head and optical fiber connector in a horizontal state;
- (2) Clean the QBH and fiber connector with clean rod and ethyl alcohol.



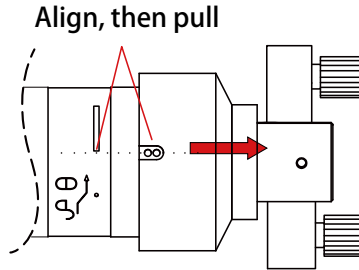
- (3) Insert the fiber connector into QBH gently;



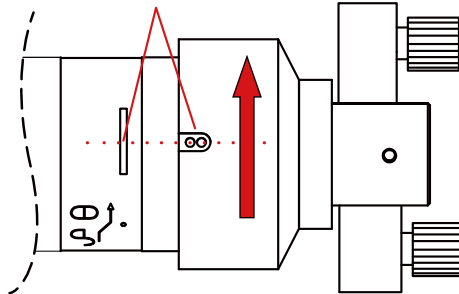
- (4) After inserting, turn the turning rim in the arrow direction until the two red marks are aligned to the white mark;



(5) Then pull the turning rim as the picture below;



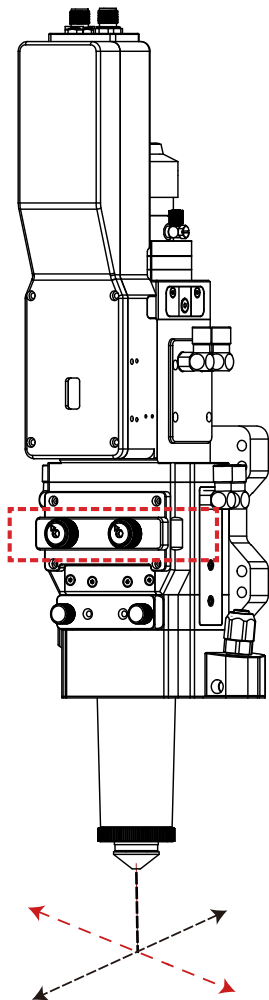
(6) Turn the rim in the direction as picture below at moderate intensity to make it tight (Use thumb and index finger). The red marks can be aligned to or over the middle of the white bar, but do not twist any more when it is in the right position.



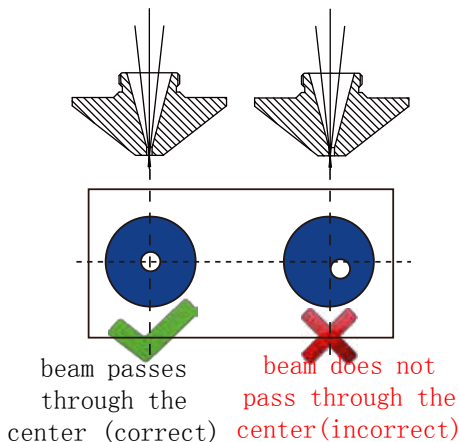
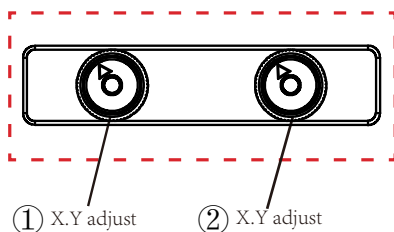
Note: Do not twist vigorously, it may cause damage to precision machinery.

To avoid dust or dirt entering into the fiber optic connector by accident, please clean the fiber rod first. Insert the fiber plug with the laser head in a horizontal position.

1.6 Optical Center Adjustment



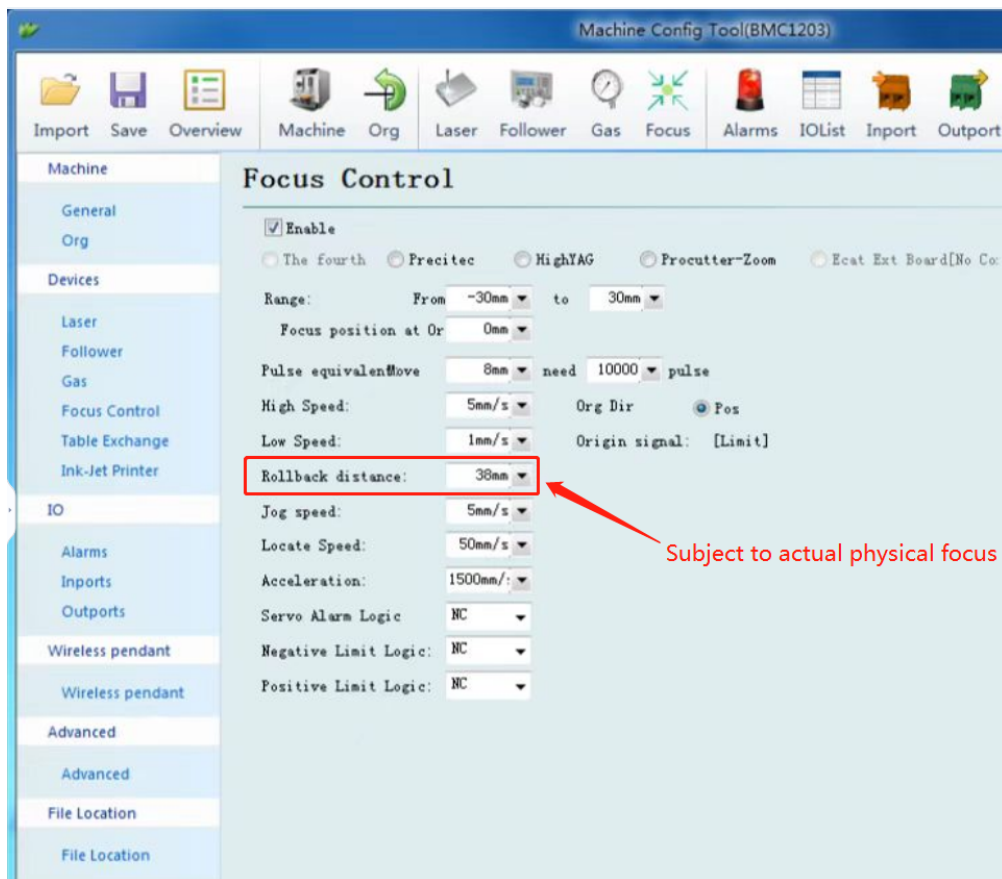
1. Adjust the X/Y screw by allen wrench and make the beam pass through the center of nozzle;
2. The cutting effect is best when the beam pass through the center of nozzle;
3. If the beam does not pass through the center of nozzle, it may cause the beam could not be emitted out or bad cutting effect and so on.



Methods of testing whether the beam pass through the center of nozzle:

1. Paste the transparent tape on the outlet of the nozzle (prefer to a new or undeformed nozzle);
2. Set the power of laser machine to 50W (take 500W for example, adjust the short burst power for 10%);
3. Take off the transparent tape after the beam has been emitted for 1 - 2 seconds;
4. Face the tape to light source and observe the round mark of nozzle on the tape and burned spot of laser passing through the tape.
5. If they are concentric, the testing result is good, but if not, please keep adjusting.
6. When adjustment is finished, tighten the center locking ring (red part) immediately.

1.7 Configuration & focus measurement



Note: 1.This parameter is default value; when user changes it, please avoid hard ware damage;
2.Please contact technician to get specific parameters of different lens combinations.

Kerf method to find zero focus and focus

Purpose:

Correct the "rollback distance" to make the actual physical focus coincide with the software zero focus, and use it as a benchmark for subsequent process debugging.

Method:

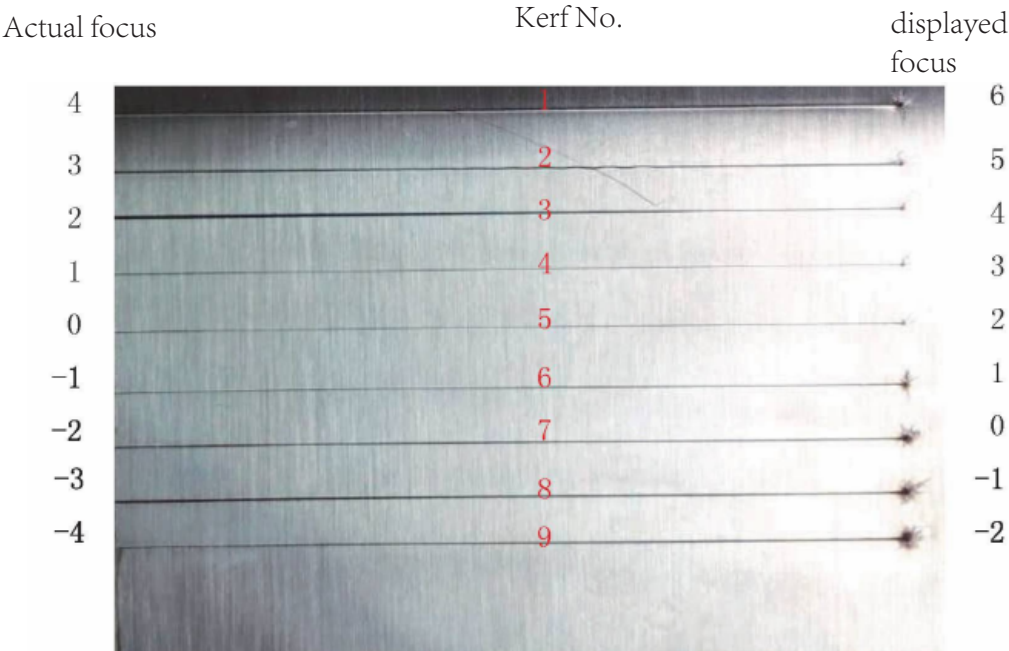
1. Using the cutting kerf method, see the size of the cutting seam to determine the focus position. The kerf at the focus position is the smallest.
2. Correct the "rollback distance" to make the actual physical focus coincide with the software zero focus, and use it as the benchmark for subsequent process debugging.

For example: 1. Platform settings:

2. Start cutting from focus +6 displayed on the software, with an interval of 1mm, and cut to focus -2. It is observed that the fifth line is the thinnest, then the actual focus 0 is at the current software display focus +2 position.

3. Correction: If the actual focus of the kerf method is higher than the focus displayed by the software, then the rollback distance = rollback - difference value

Rollback distance=9-2=7, otherwise the same principle



2. Maintenance/Disassembly

2.1 Routine inspection and maintenance



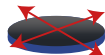
Check



Distance



Replace



Adjust the lens



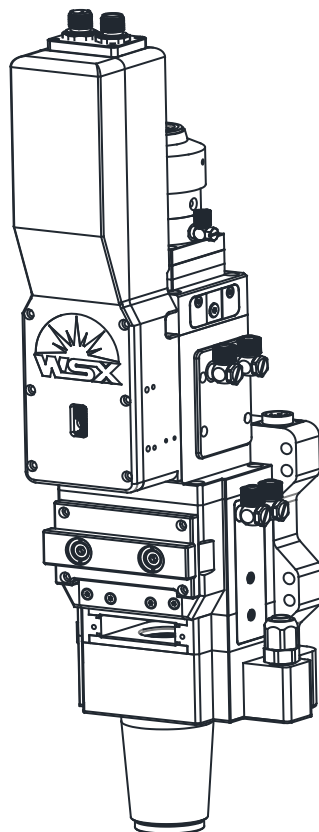
Maintenance



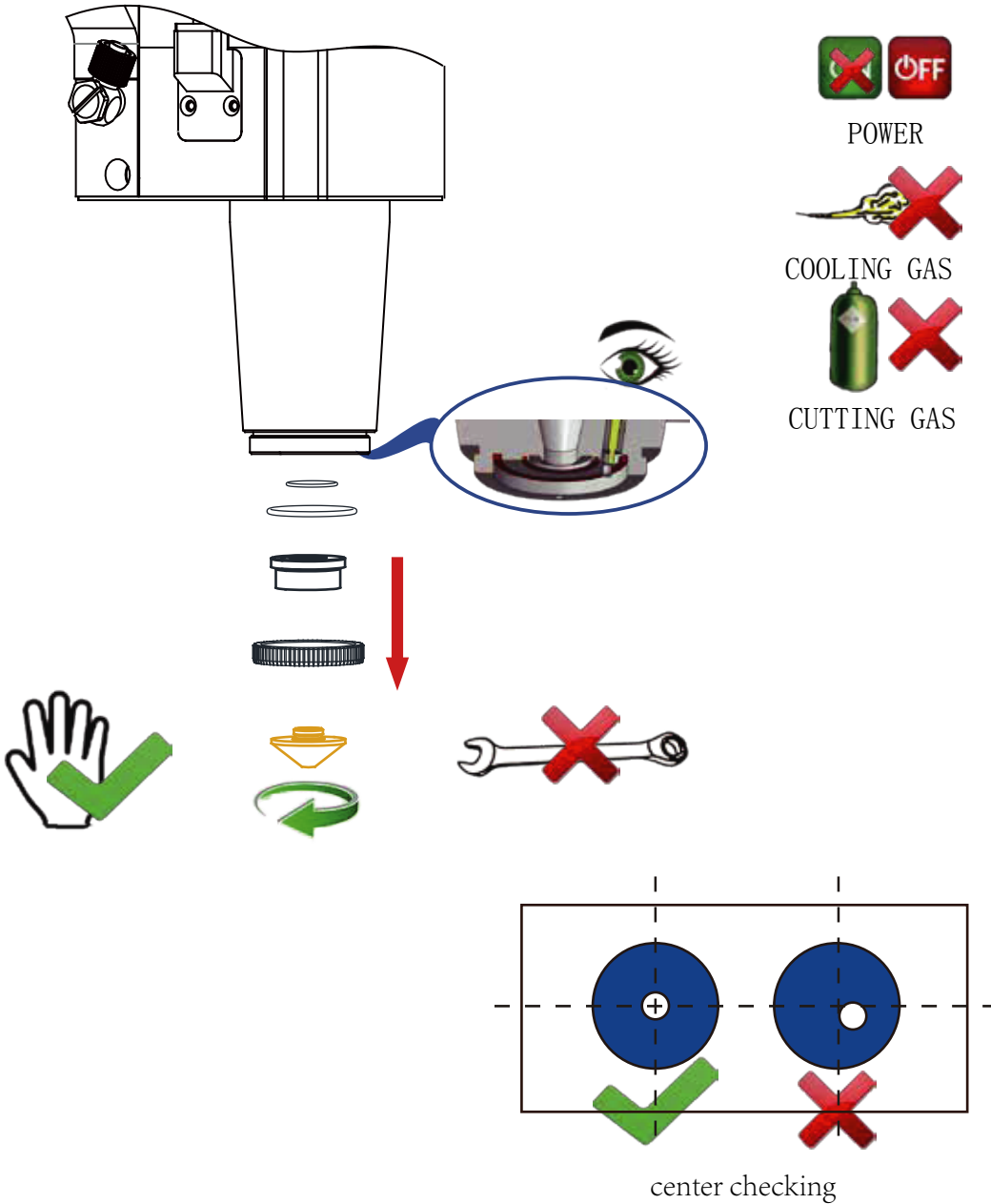
Maintenance Period



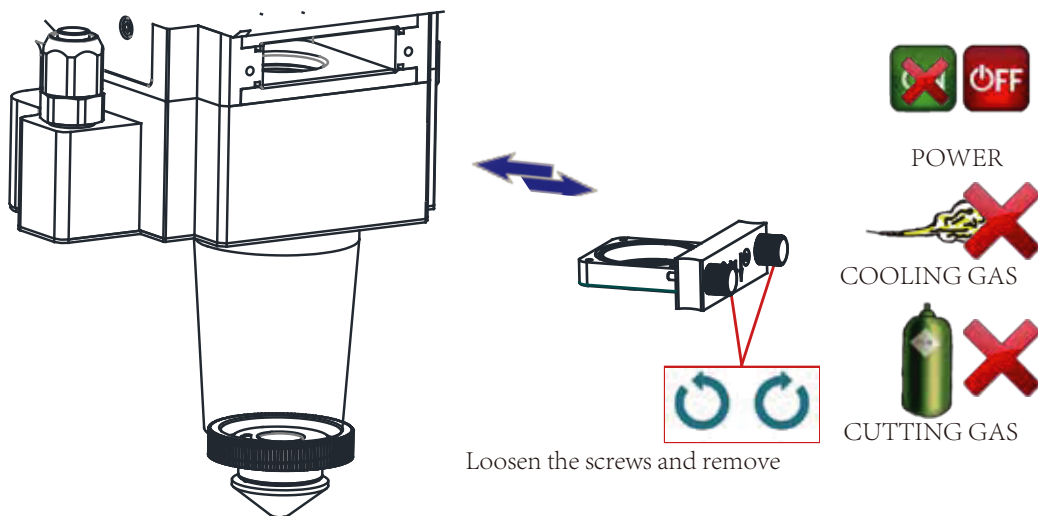
Calibration



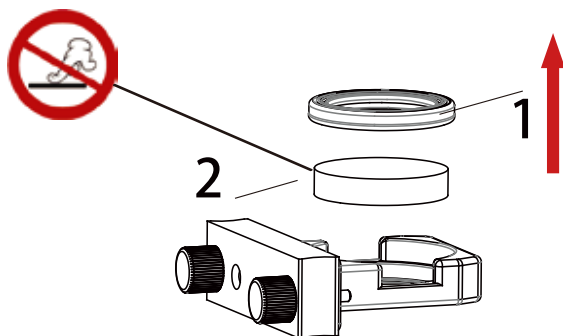
2.2 Replacement of Ceramic Ring & Nozzle



2.3 Replacement of Lower Protection Window



Pay attention to dust: when removing and installing the lens, wear dust gloves and finger covers in a clean place. When changing lens, use adhesive paper to paste sealed window, prevent dust to enter the interior cause pollution.



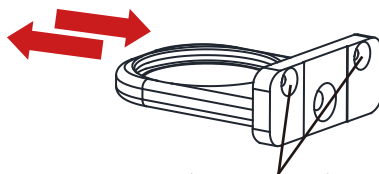
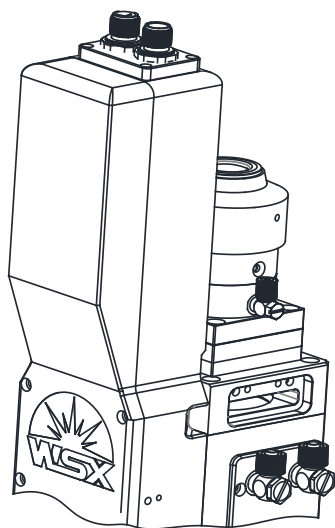
1、 Pressing ring 2、 Protective glass

Note : Remove in the direction of the arrow, otherwise it may cause damages.

DO NOT operate with wrench or iron plier.



2.4 Replacement of Upper Protection Window



Loosen the screws and remove



POWER

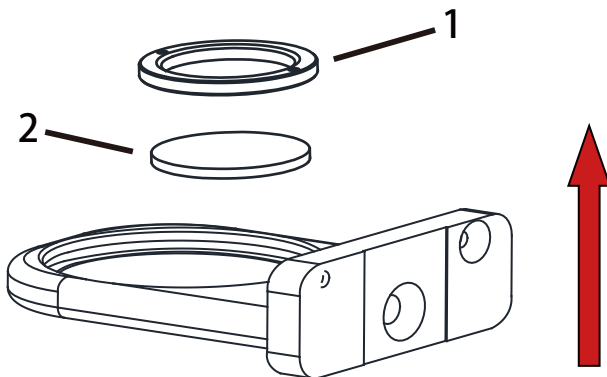
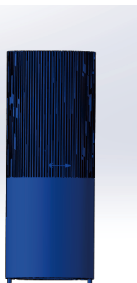


COOLING GAS



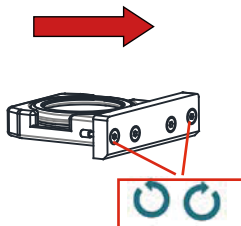
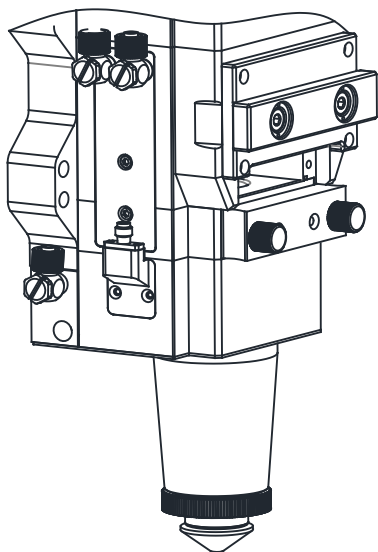
CUTTING GAS

Pay attention to dust: when removing and installing the lens, wear dust gloves and finger covers in a clean place . When changing lens, use adhesive paper to paste sealed window, prevent dust to enter the interior cause pollution.



- 3** 1、Pressing ring 2、Protective glass 3、 Fixture tools
 Note : Remove in the direction of the arrow with fixture tools, otherwise it may cause damages.
 DO NOT operate with wrench or iron plier.

2.5 Replacement of Focus Protection Window



Loosen the screws and remove



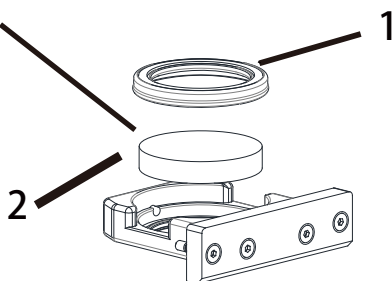
POWER



COOLING GAS



CUTTING GAS

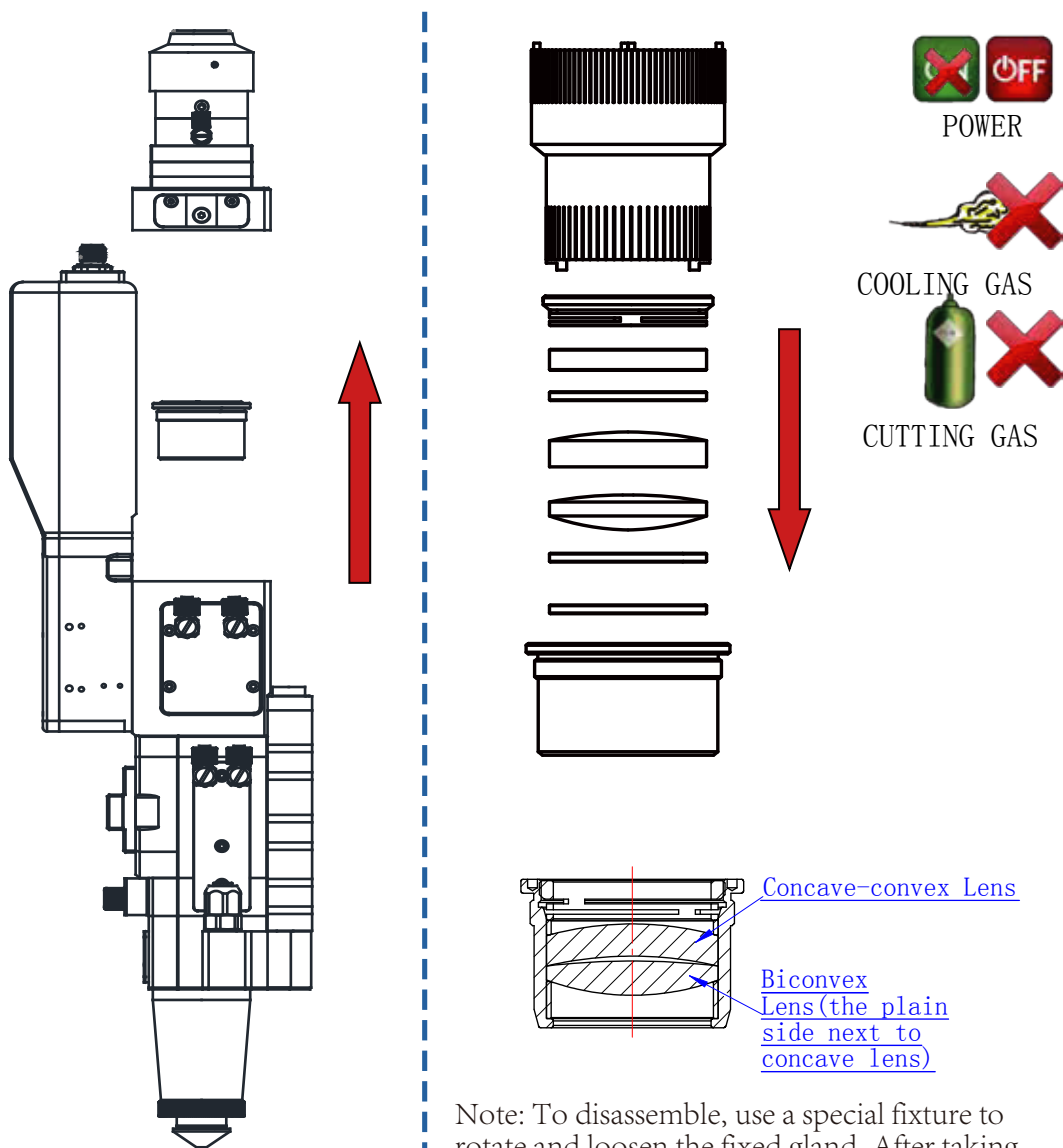


1、 Pressing ring 2、 Protective glass

Note : Remove in the direction of the arrow, otherwise it may cause damages.

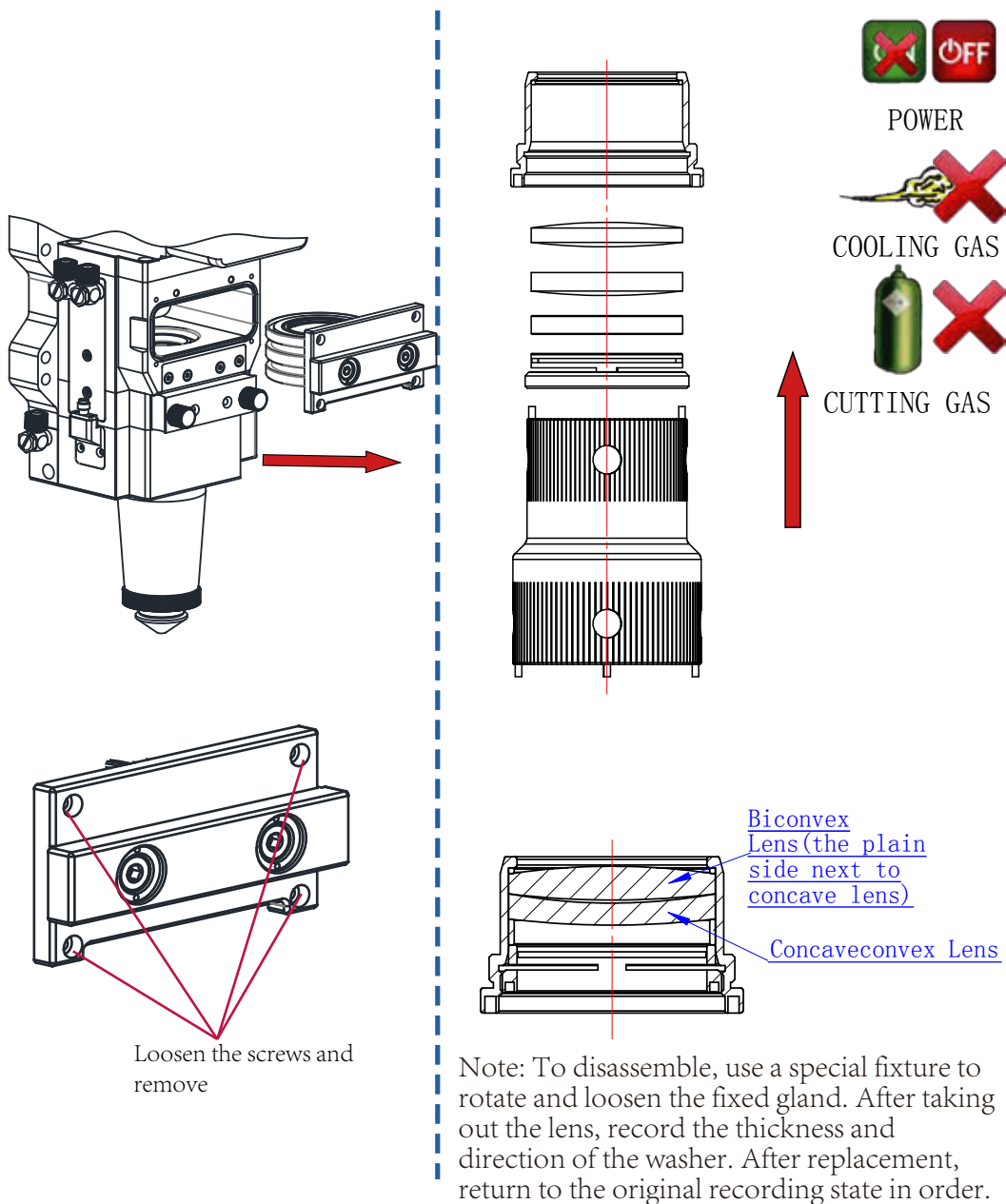
DO NOT operate with wrench or iron plier.

2.6 Replacement of Collimation Lens



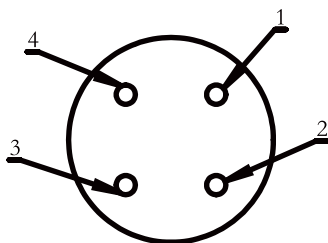
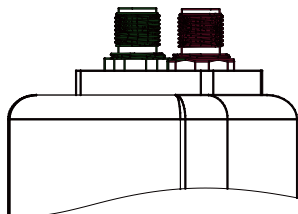
Note: To disassemble, use a special fixture to rotate and loosen the fixed gland. After taking out the lens, record the thickness and direction of the washer. After replacement, return to the original recording state in order.

2.7 Replacement of Focus Lens



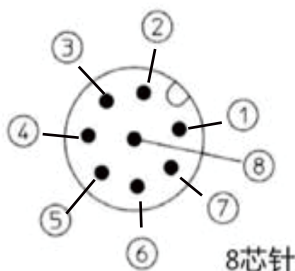
3. Electrical interface and definition

3.1 Electrical interface



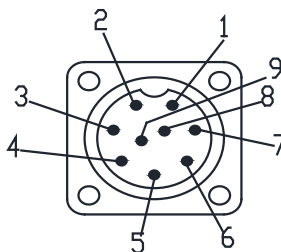
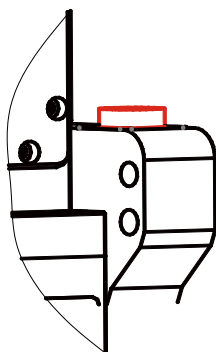
1	W
2	U
3	V
4	FG (Ground)

Servo Motor Power Supply Interface (Red)



pin	definition
shell	shielded wire
1	-D (Encoder Signal Data-)
2	+D (Encoder Signal Data+)
3	SG (Signal Ground)
4	VCC ((Encoder Power+5V)
5	+24V (Approach Switch Power)
6	0V (Approach Switch Power)
7	W+ (Approach Switch Signal)
8	W- (Approach Switch Signal)

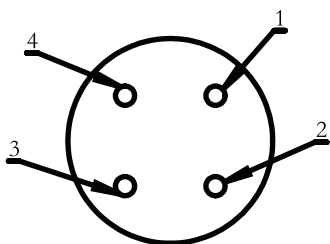
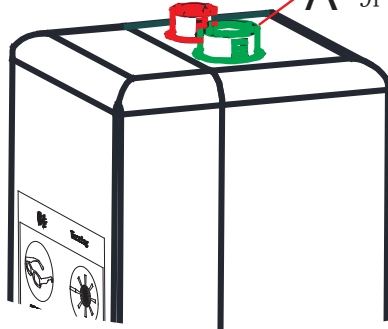
Servo Motor Encoder & Approach Switch Interface (Green)



pin	definition
1	24V ground
2	24+ power
3	232 ground
4	alarm reset
5	ALM - OUT
6	232 TX
7	232 RS
8	null
9	null

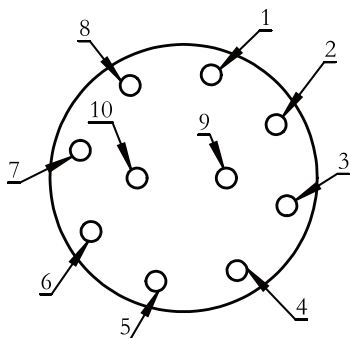
Lens Monitoring Signal Interface (Red)

4P aviation plug **B** 9P aviation plug **A**



1	W
2	U
3	V
4	FG (Ground)

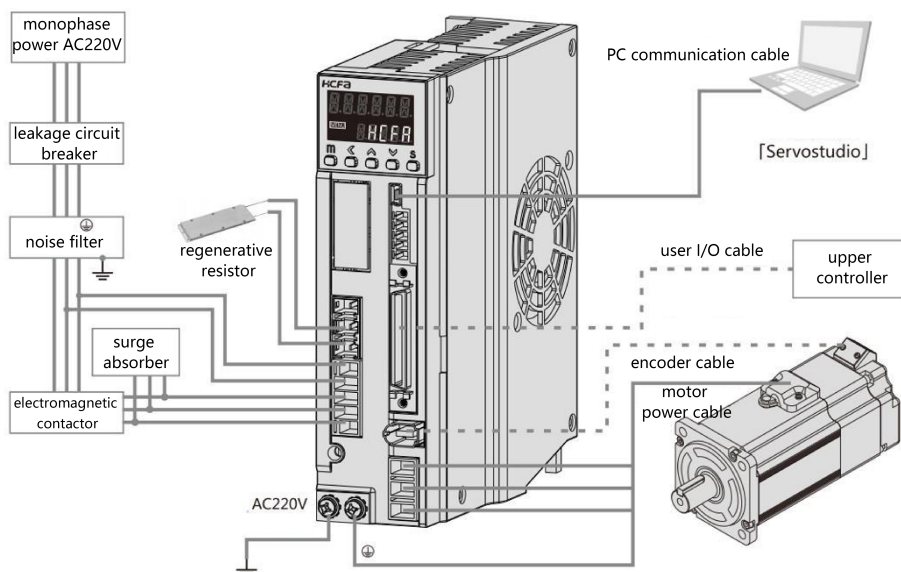
Servo Motor Power Supply Interface (Red)



1	FG (Shielded wire)
2	-D (Encoder Signal Data-)
3	+D (Encoder Signal Data+)
4	SG (Signal Ground)
5	VCC (Encoder Power +5V)
6	+24V (Approach Switch Power)
7	0V (Approach Switch Power)
8	W+ (Approach Switch Power)
9	W- (Approach Switch Power)

Servo Motor Encoder & Approach Switch Interface (Green)

3.2 HCFA servo connection



Wiring points

The control circuit power supply and the main circuit power supply should be wired from the same AC220V main power supply;

For user I/O cables, please use shielded twisted pair cables

The length of the encoder cable should be less than 20M.

Note: For the debugging of the servo drive, please refer to the HCFA manual

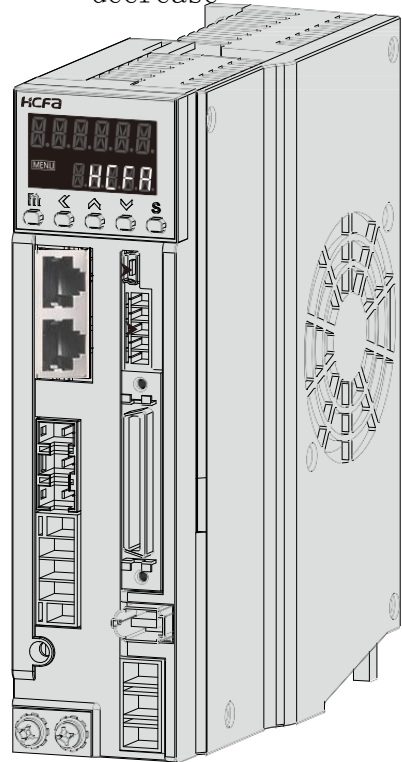
图15

3.3 Servo Panels and Ports

Menu
Left
increase
decrease
setting

EtherCAT communication port

- CN4:485 communication port
- CN1:user control port
- B1/B2 : regenerative resistor port
- Below 750W: L1C/L2C and /L/ N are control power input and main circuit power input Above 1KW: L1C/L2C and /L1/L2/L3 are control power input and main circuit power input
- CN2:encoder interface
- UVW motor power output interface



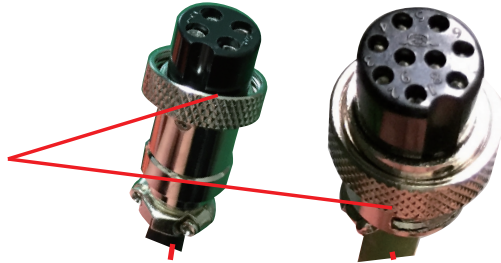
Parameter setting:

parameter	value	parameter	value	parameter	value
P0.00	0	P00.01	7	P00.03	14

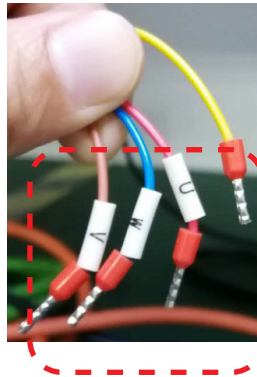
3.4 Servo wiring and checking



Lock to prevent loosening



U, V, W order
cannot be
reversed



3.5 Checking of wiring between laser head and driver

(1) Check the mark of the UVW cable, which should correspond one-to-one with the UVW on the plug.

(2) The UVW cannot be connected to the ground wire and the casing, and the resistance between the UVW and the casing is greater than $5M\Omega$.

Test conditions: one end of the cutting head is connected, and one end of the driver is not connected.

(3) The resistance between UVW electrodes is about 20Ω . If the resistance is 0 (short circuit) or the multimeter shows infinity (open circuit), it is regarded as abnormal.

Test conditions: one end of the cutting head is connected, and one end of the driver is not connected.

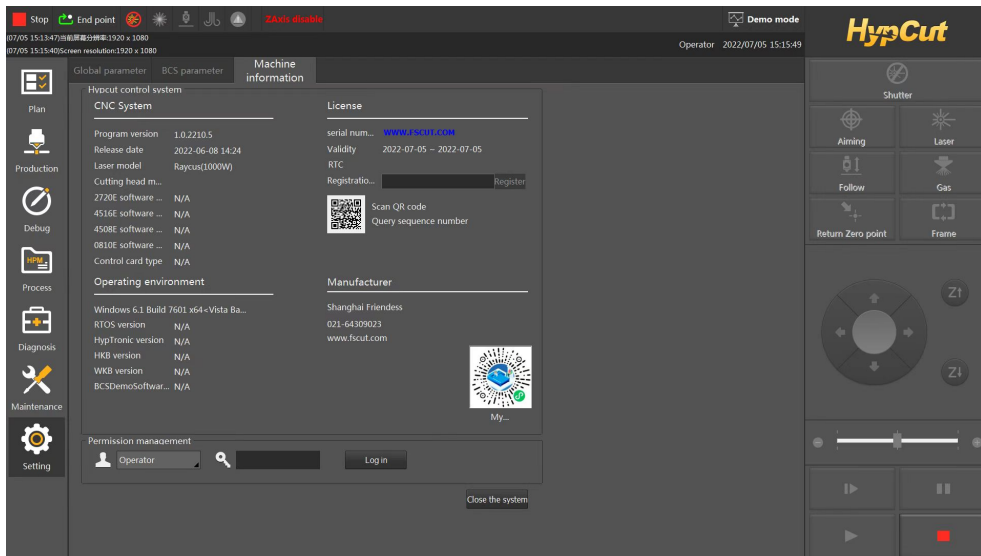
(4) Ground (very important).

(5) When connecting the aviation plug, be sure to follow the steps below:

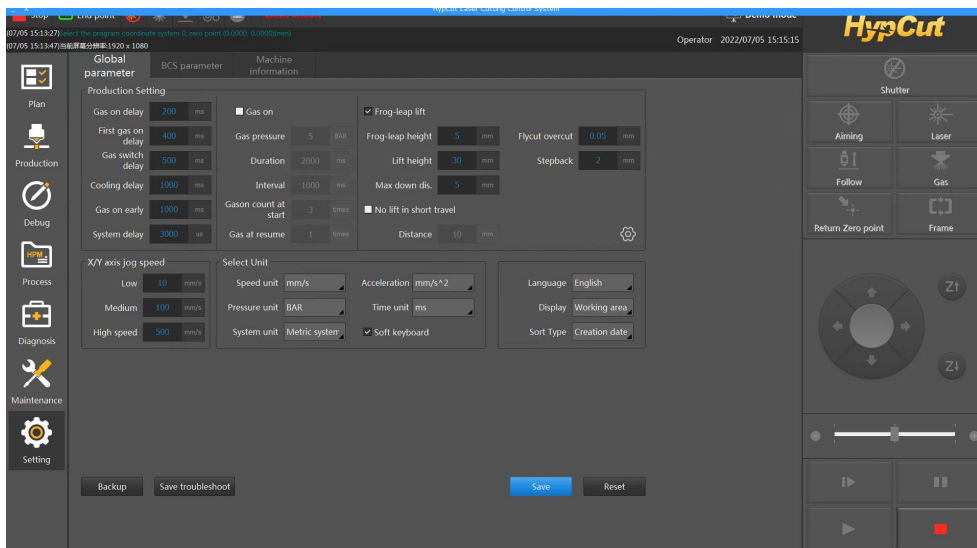
Step 1: Use an air gun to blow off the water, oil, dust and other debris in the air port. Step 2: Tighten the male and female headers of the aerial plug.

Step 3: Use masking tape or electrical tape to wrap the air plug to prevent moisture, oil and dust from entering the air plug.

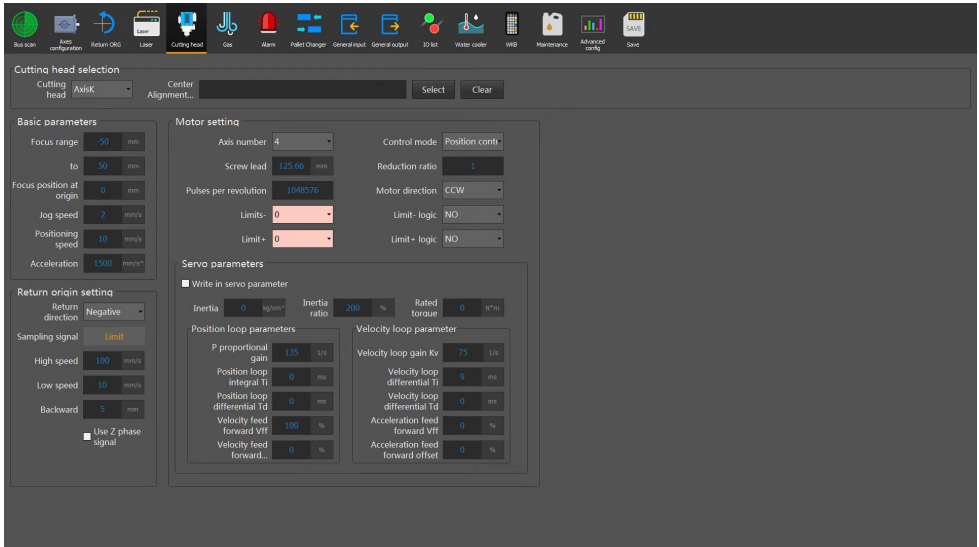
1. Settings > Device Information Interface > Enter Password 64309023 > Enter Expert Mode



2. Settings>Overall Parameters>Click Platform Configuration>



Axis configuration



Axis configuration

Basic parameters

Focus range: -50 mm to 50 mm

Focus position at origin: 0 mm

Jog speed: 2 mm/s

Positioning speed: 10 mm/s

Acceleration: 1500 mm/s²

Return origin setting

Return direction: Negative

Sampling signal: Limit

High speed: 100 mm/s

Low speed: 10 mm/s

Backward: 5 mm

☒ Use Z phase signal

Motor setting

Axis number: 4

Screw lead: 125.66 mm

Pulses per revolution: 1048376

Limits: 0

Limit+: 0

Control mode: Position control

Reduction ratio: 1

Motor direction: CCW

Limit- logic: NO

Limit+ logic: NO

Servo parameters

☒ Write in servo parameter

Inertia: 0 kg/cm²

Inertia ratio: 200 %

Rated torque: 0 N·m

Position loop parameters

P proportional gain: 1.35 1/s

Position loop integral Ti: 0 ms

Position loop differential Td: 0 ms

Velocity feed forward Vff: 100 %

Velocity feed forward offset: 0 %

Velocity loop parameters

Velocity loop gain Kv: 75 1/s

Velocity loop differential Ti: 9 ms

Velocity loop differential Td: 0 ms

Acceleration feed forward Vff: 0 %

Acceleration feed forward offset: 0 %

Common problems and faults

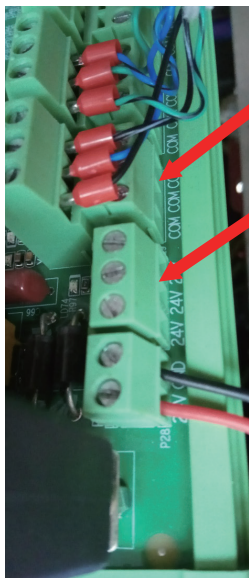
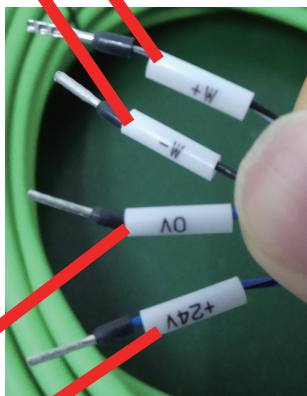
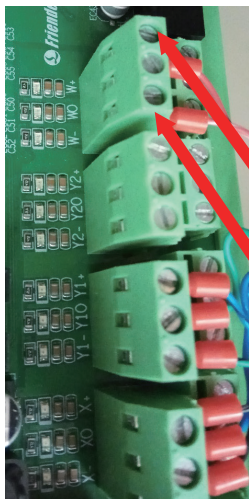
Fault code	Fault cause	Troubleshooting and handling methods
Err.007	Encoder initialization failed	Check the encoder wiring, or replace the encoder cable
Err.013	Encoder communication exception	1. Check the encoder wiring, or replace the encoder cable 2. Check that the encoder is well grounded
Err.017	Torque saturation timeout	Check that the UVW is disconnected
Err.018	Control power underpressure	1. Check the input power supply and wiring 2. Replace the drive
Err.019	Speed failure	1. Check the UVW and the encoder wiring 2. Check the drive & motor
Err.020	Overvoltage	Check the input power supply voltage
Err.043	The position deviation is too large	Check whether the motor line is disconnected

W

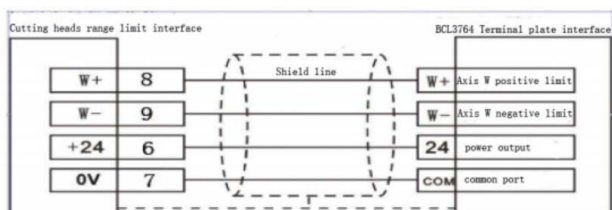
Y2

Y1

X



Definition of laser focusing adjustment range limitation switch connector



Limit signal inspection method:

Test condition

- (1) Connect the DC24 power supply.
- (2) Do not connect W+ W- first.
- (3) The laser head scale 0 is in the middle of the window.

Steps

- (1) Select the "DC voltage" gear for the multimeter, 200V or above.
- (2) The red test lead is connected to the DC24V end, and the black test lead is connected to the W+ end (the side of the laser head line).
- (3) If the displayed voltage value is greater than 18V, it is normal (theoretical value is 24V), and if it is less than 14V, it is abnormal (theoretical value is 0V).
- (4) Jog in the positive direction, observe that the voltage changes, and the voltage difference is more than 12V, which is normal.
- (5) The red test lead is connected to the DC24V end, and the black test lead is connected to the W- end (the side of the laser head line).
- (6) If the displayed voltage value is greater than 18V, it is normal (theoretical value is 24V), and if it is less than 14V, it is abnormal (theoretical value is 0V).
- (7) Jog in the positive and negative directions in turn, observe that the voltage has changed, and the voltage difference is greater than 12V, which is normal.
- (8) Connect W+ W- to the corresponding port of the system expansion card.
- (9) Open the control software, the limit logic high is normally closed. Jog the movement to the positive and negative limit and observe whether the system can detect the limit.
- (10) The above is the detection method of the normally closed limit switch, and the opposite is true for the normally open type.

Note: Before use, jog the servo motor to confirm that the positive and negative limits are valid, and then enable the automatic mode. Before enabling automatic mode, let the servo motor home.



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