



# GS03C-H01

## Product Manual



# Foreword

Dear Users:

Welcome to use GS03C fiber laser autofocus cutting head produced by Shenzhen Ospri Intelligent Technology Co., LTD. We are honored to have your confidence in our products.

In order to make you have an overall view of the product, convenient for your use, we specifically provide the user manual for you, including product characteristics, structural feature, technical feature, direction for use, maintenance, etc. It's an essential guide when you use this product.

Please read the user manual carefully before use. I'm sure it will be helpful for you to use this product. In addition, if you have any questions during use, please contact us, and we will serve you wholeheartedly.

Declaration:

The contents of User Manual are protected by the Copyright Law. Without the approval of Shenzhen Ospri Intelligent Technology Co., Ltd, any organization or individual shall not copy or tamper it by any means and forms.

In order to ensure your safety and the product works normally, please read the guide book carefully before using.

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# Chapter 1 Overview

## 1.1 Product Parameter

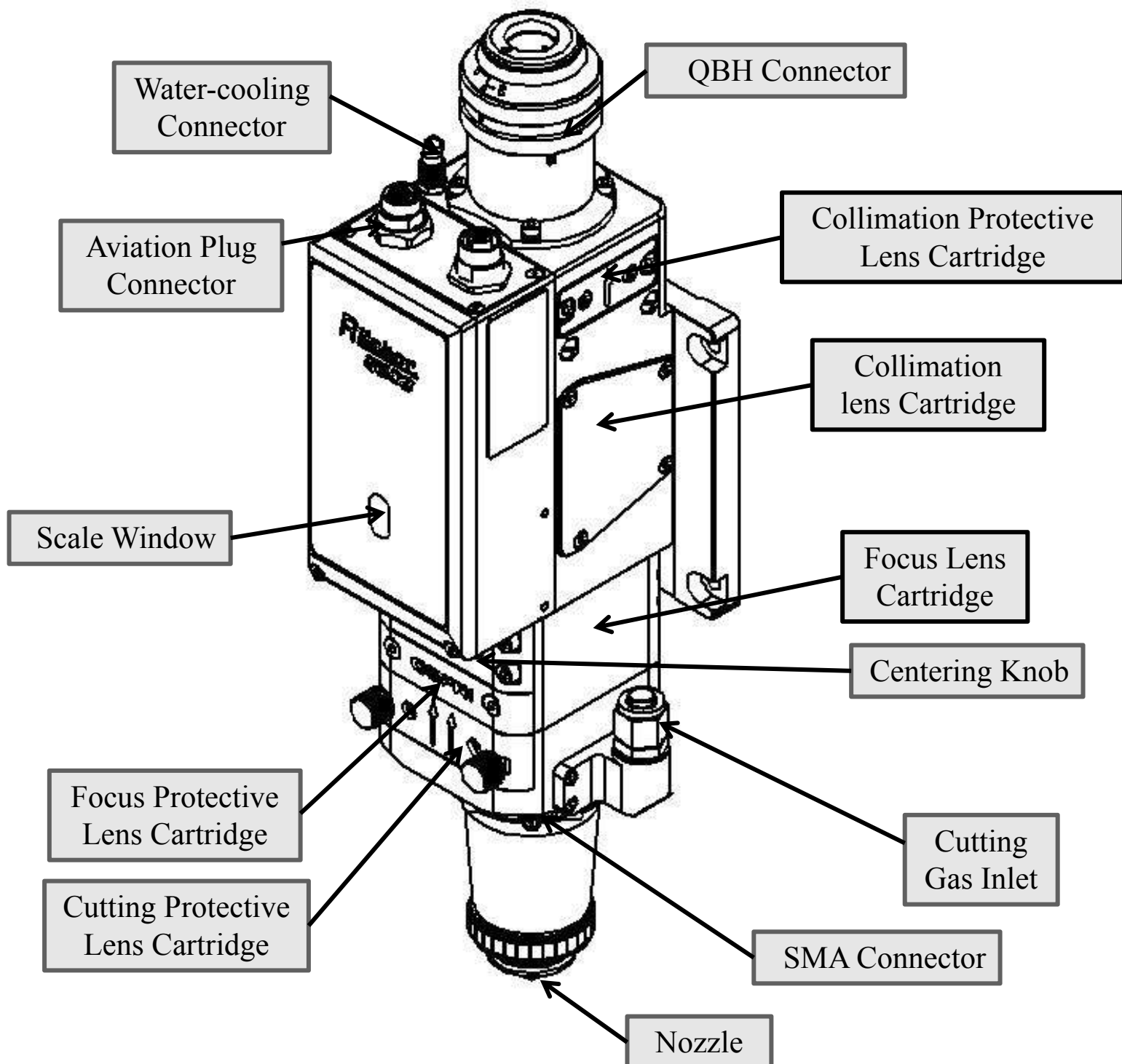
|                    |   |
|--------------------|---|
| Name               | Fiber Laser Cutting Head                          |
| Model              | GS03C-H01   |
| Interface Type     | QBH   |
| Wavelength         | 1080±10nm   |
| Rated Power        | ≤3KW  |
| Focus Length       | 125mm/150mm/200mm                                 |
| Collimation Length | 100mm   |
| Nozzle             | Flat-head FSN02 series; Pointed-head FSN07 series |
| Focusing range     | -18mm~+15mm (150mm)                               |
| Centering range    | ±1.5mm  |
| Focusing speed     | 100mm/s   |
| Gas Pressure       | ≤3Mpa   |
| Weight             | 3.2KG   |

## 1.2 Cautions

- ① Please wear specialized laser safety goggles to ensure human safety when the cutting head is used in coordination with laser cutting machine
- ② Precautions and standard operations should be taken to prevent burning of cutting head and laser nozzle due to the deviation of laser beam from central axis.
- ③ Keep the cutting head clean to prevent coolant, condensate or other foreign matter from entering sensor parts; otherwise, it may cause sensor failure.
- ④ When processing products with laser, use protective devices to prevent the laser beam from causing injury to human body

# Chapter 2 Structural Features

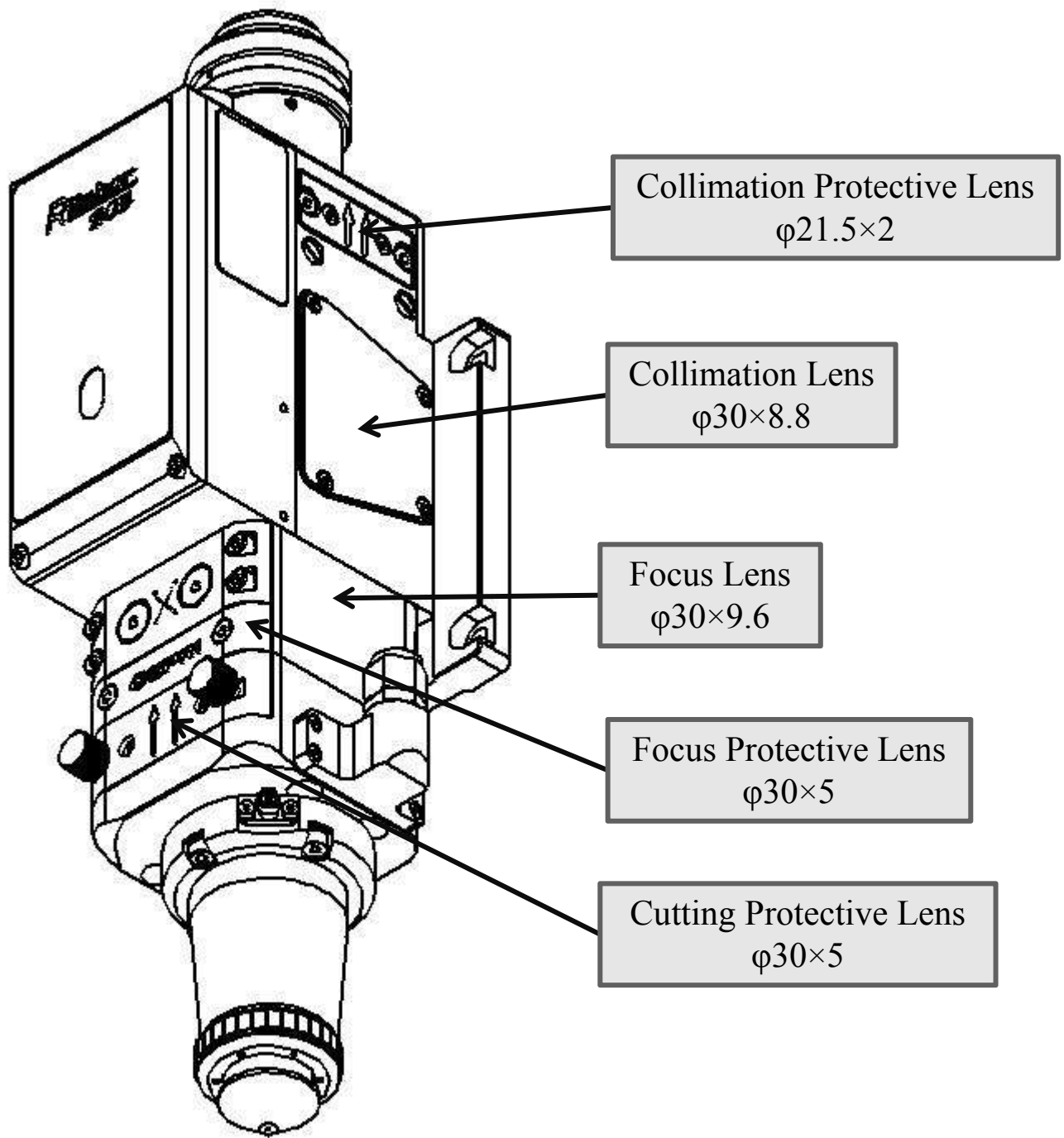
## 2.1 Brief Description of Product Structure



## 2.2 Brief Description of Product Parts

1. Water cooling connector: Mainly cool QBH and cutting head.
2. Aviation plug connector: Power lines for motors, encoder lines, and outputs for limit signals.
2. Collimation protective lens module: When inserting and removing the fiber head, prevent dust from entering the cutting head to protect the collimator fiber laser tip.
4. Scale window: Observation window for the cutting focus, for reference.
5. Focusing protective lens cartridge: Protect the focus lens to avoid contamination during the replacement of cutting protective lens.
6. Cutting protective lens cartridge: Seal the cutting gas and prevent external contaminants from polluting the focus protective lens.
7. Cutting gas inlet:  $\phi 10\text{mm}$  gas connector for inputting cutting gas.
8. Centering knob: Adjust the center of the light path so that the light beam passes through the center of the nozzle.
9. SMA connector: Connect to amplifier.

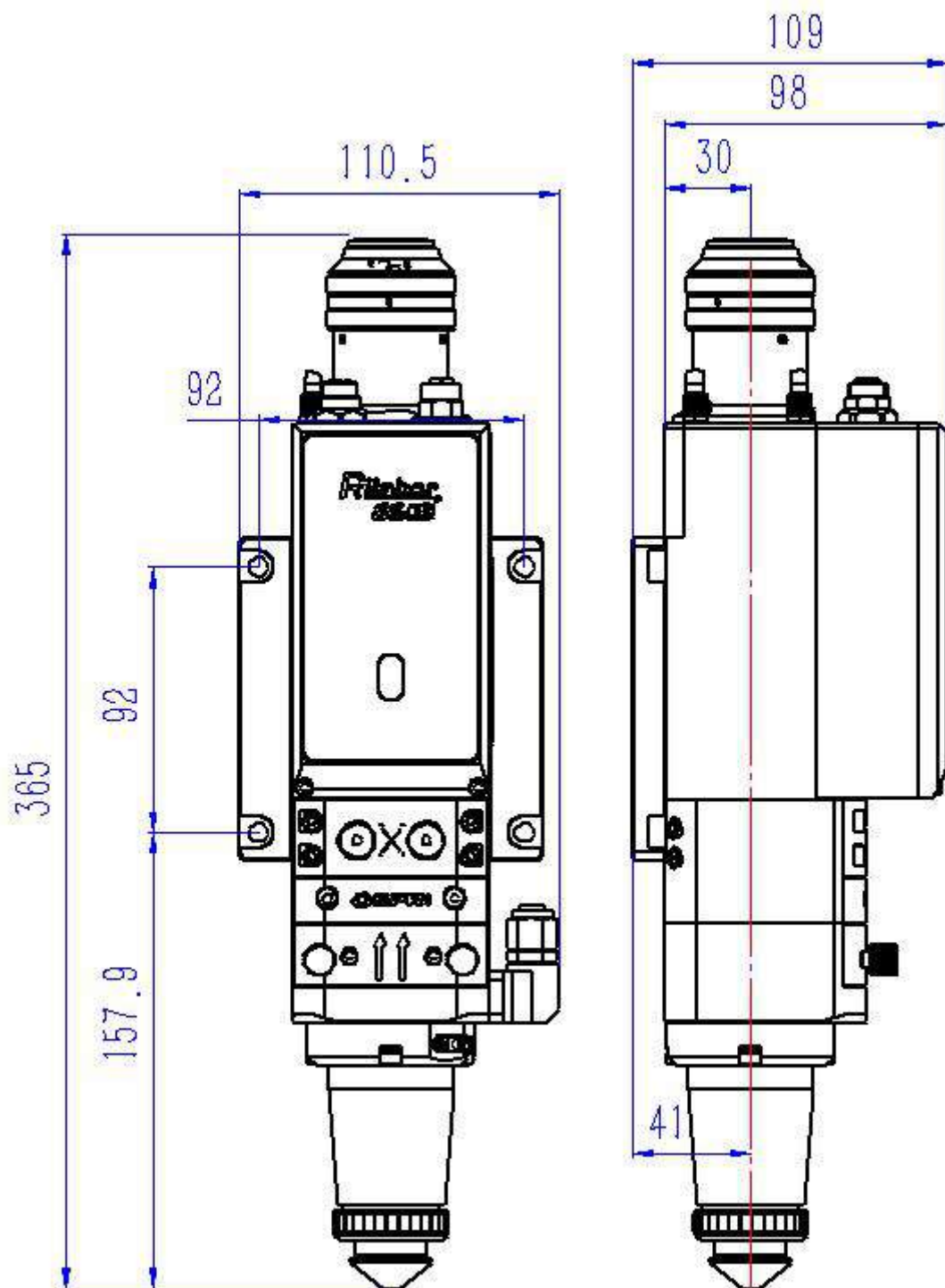
## 2.2.1 Brief Description of Product Parts (Lens Size)





# Chapter 3 Product Installation

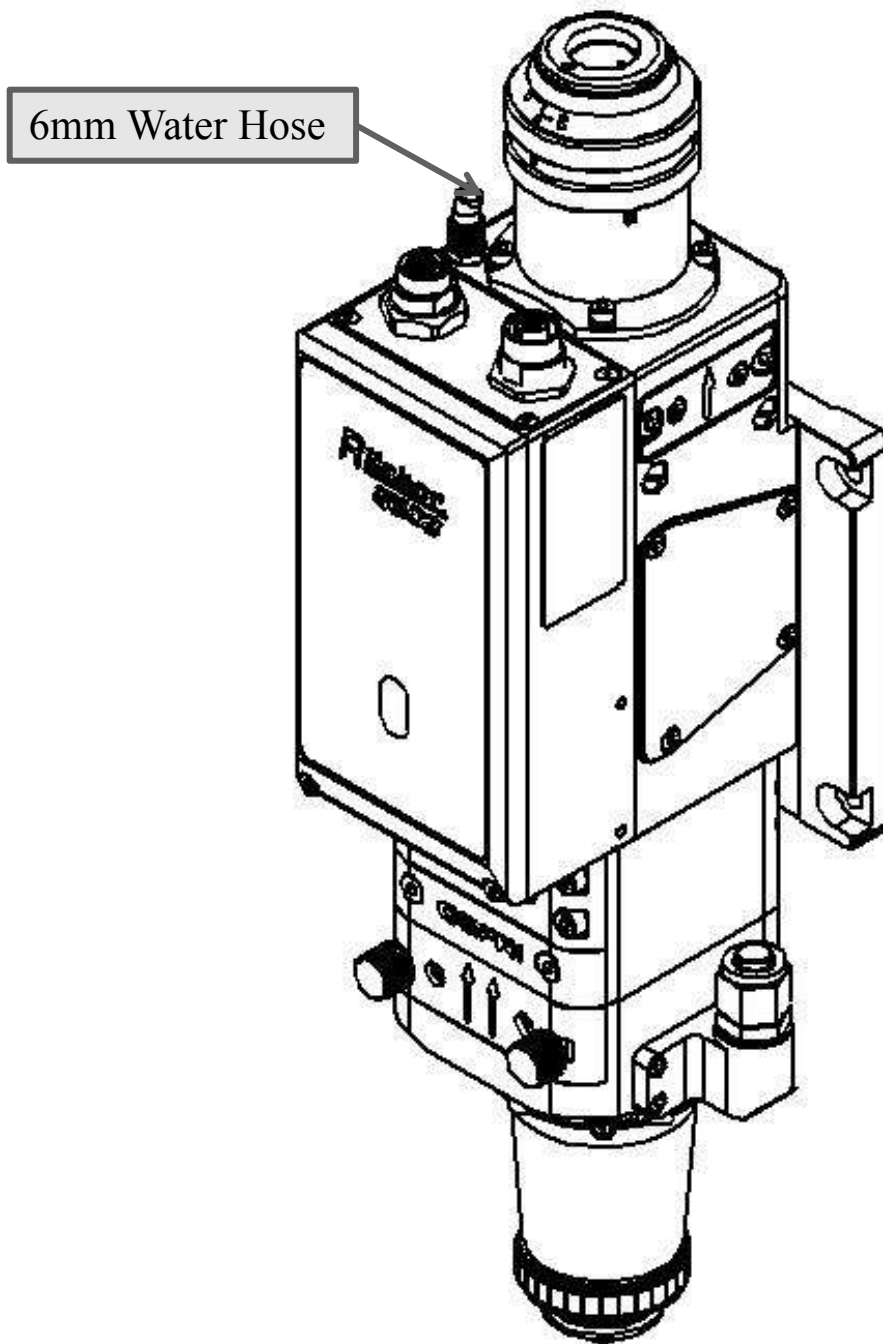
## 3.1 Cutting Head Installation



Dimension drawing of cutting head (collimation F100/focus F150)

## 3.2 Cutting Head Connection

### 3.2.1 Cooling Pipeline



It is used to cool down the cutting head with 1-inlet and 1-outlet cooling connection

### 3.2.2 Cutting Gas Pipeline

The inlet is connected to 10 mm gas hose, used to connect with the cutting had, with the input pressure  $<3.0$  Mpa.

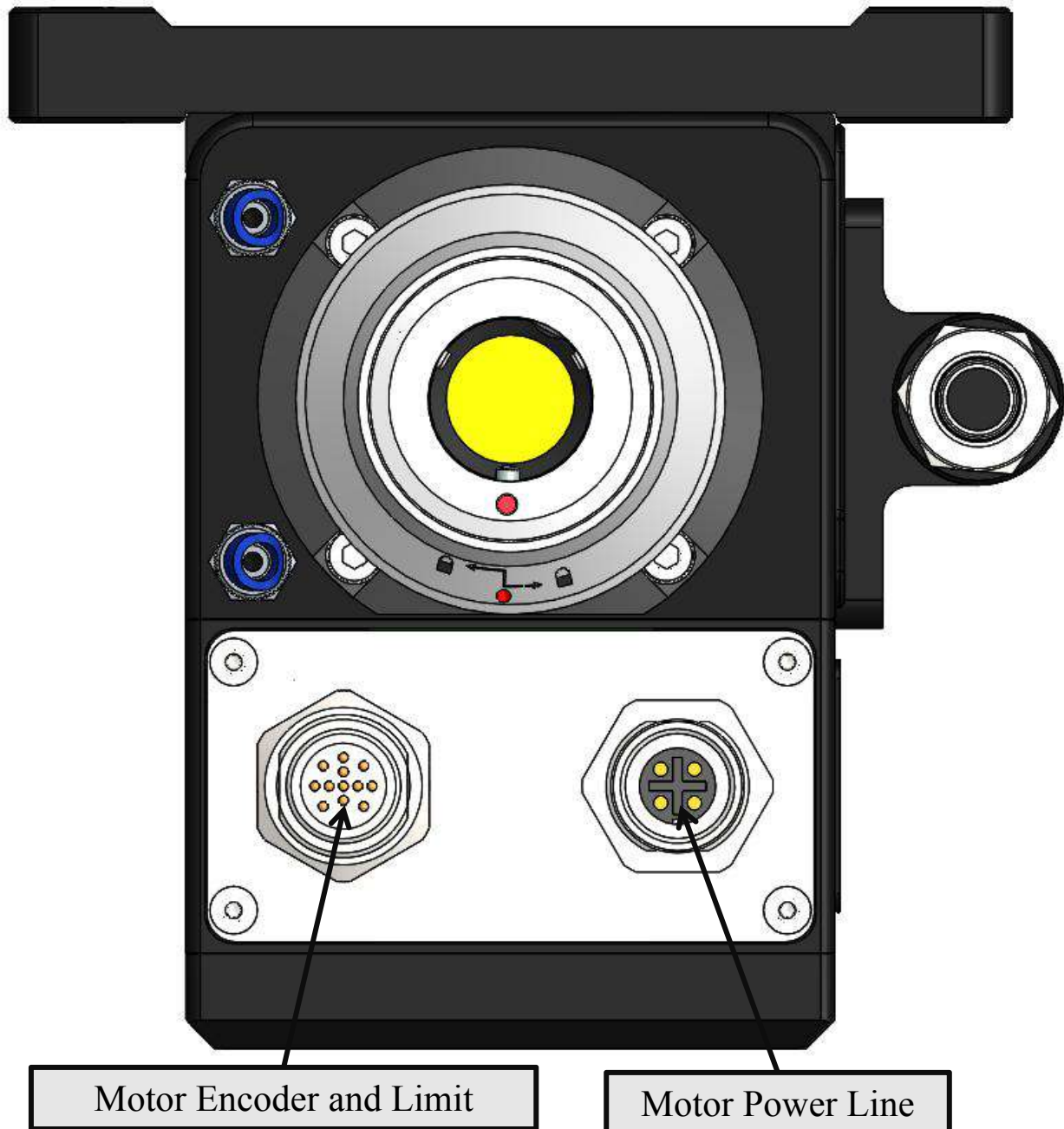
Common gas: Oxygen, nitrogen and compressed air.



**Note:** The gas entering the cutting pipeline must be filtered and dried to prevent contamination of the protective lenses, which could lead to damage.

### 3.3 Wiring Definitions and Requirements

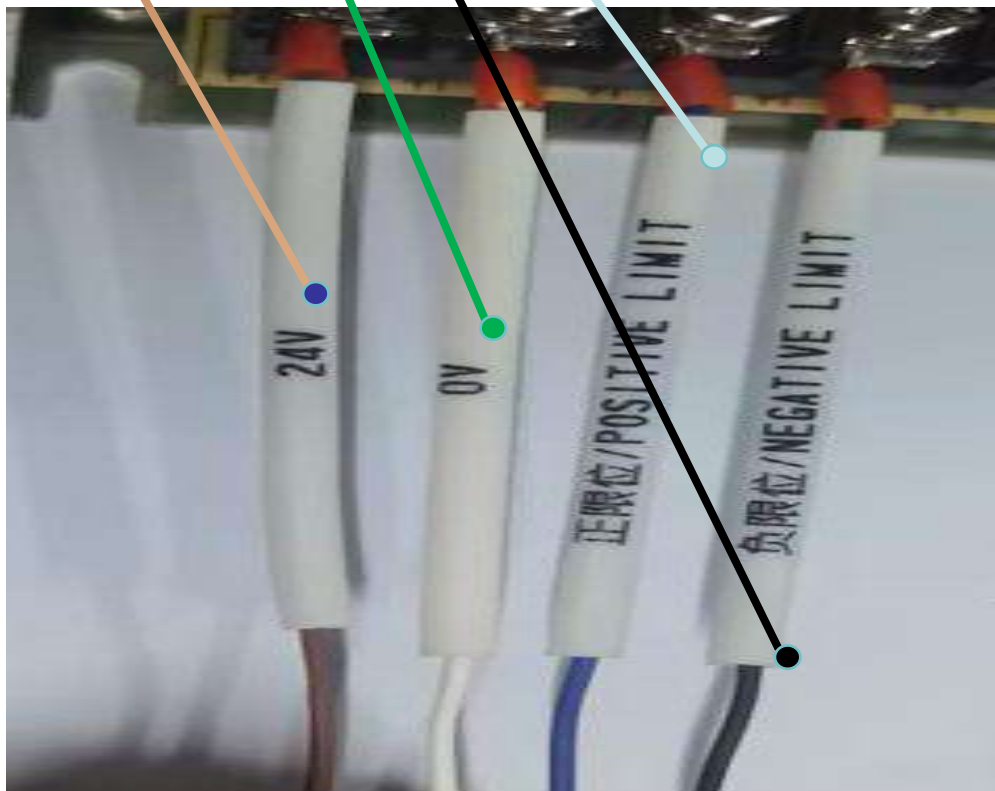
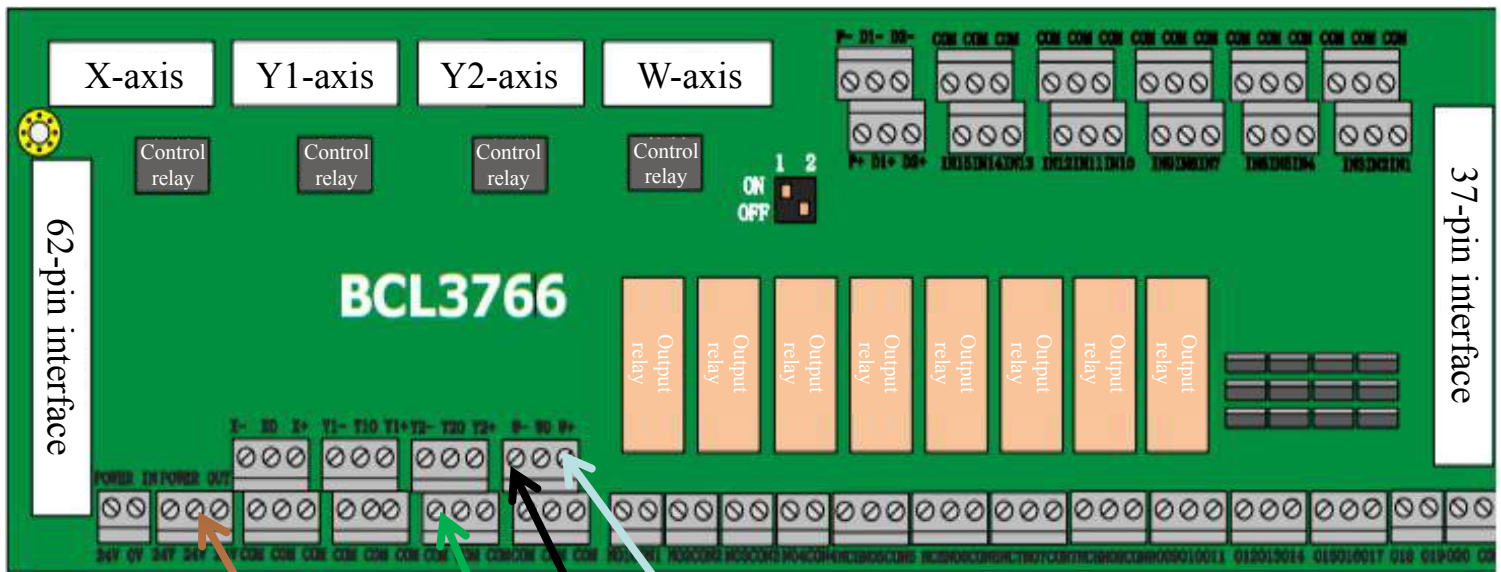
#### 3.3.1 Aviation Plug Connector



**Note:** Power off when plugging or unplugging the aviation plugs, otherwise the servo motor will be burned inside.

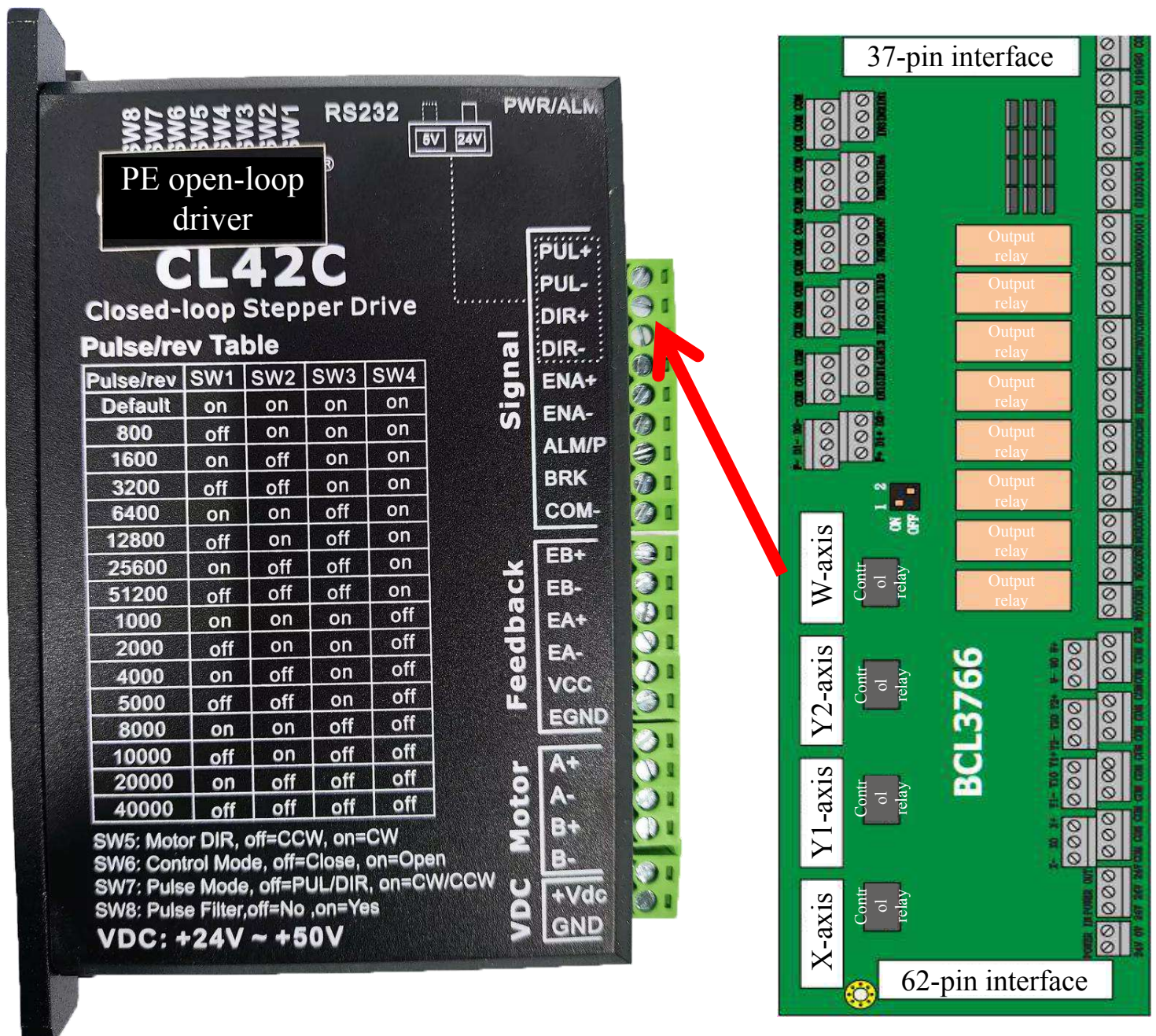
### 3.3.2: FSCUT2000C System Wiring (Example: BCL3766)

#### 3.3.2.1: Board IO Wiring



Limit switches and alarm signals are both NPN outputs; the alarm signal must be connected to the system. If damage to the cutting head occurs due to an unconnected alarm signal, the customer is fully responsible.

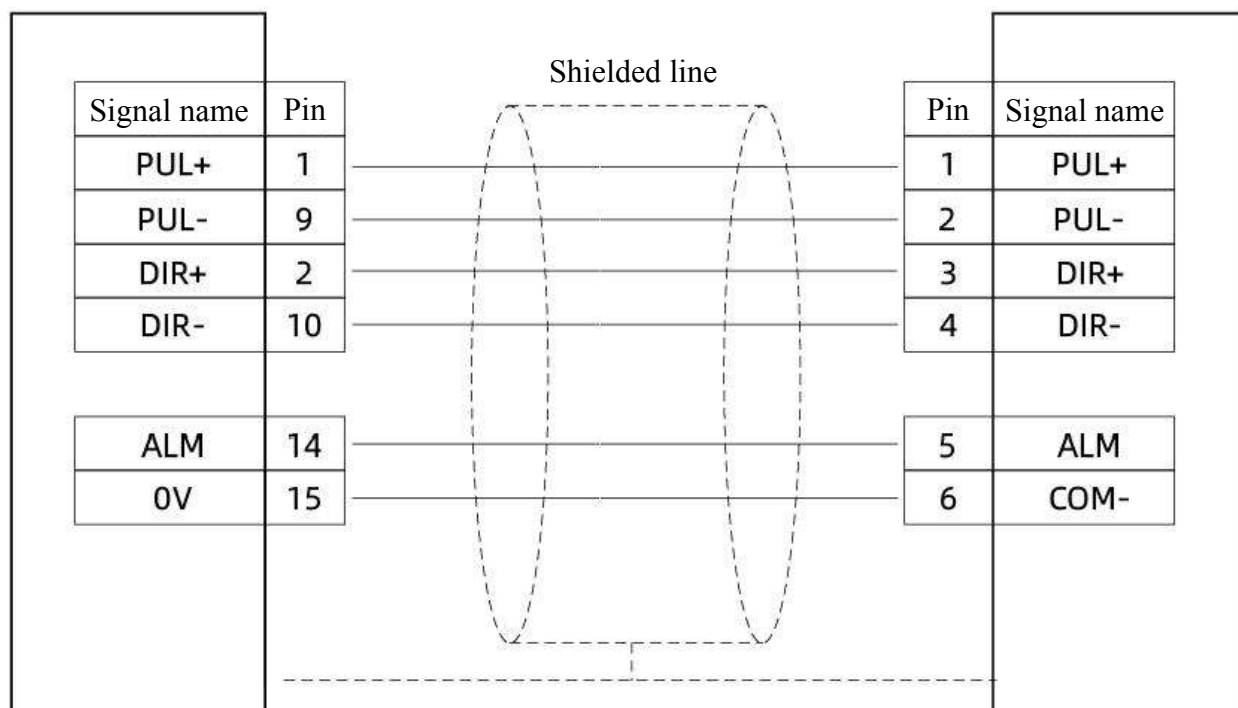




### 3.3.2.3: Board Axis Port Definition Wiring

Cypcut DB15 Male Control Interface

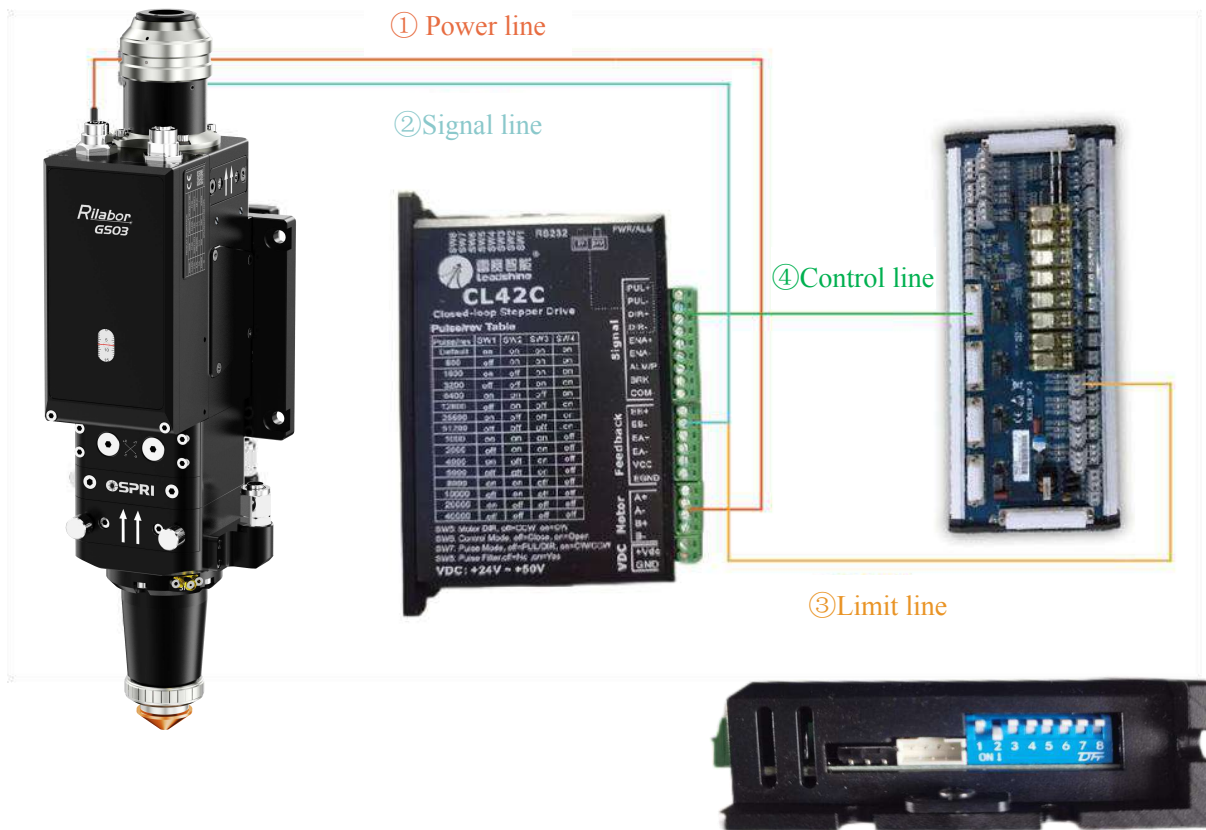
Driver end



### 3.3.2.4: Drive Parameters

| Parameter Index | Parameter Value | Parameter Content               |
|-----------------|-----------------|---------------------------------|
| PR0.00          | 10000           | Pulses per command revolution   |
| PR0.01          | 2               | Open/Closed loop mode selection |
| PR0.03          | 1               | Motor direction                 |
| PR0.42          | 6               | Motor type                      |
| PR4.31          | 0               | Fault output level              |
| PR5.00          | 10              | Motor peak current              |
| PR7.01          | 4000            | Encoder resolution              |

### 3.3.2.5: Cutting Head and Pulse System Wiring



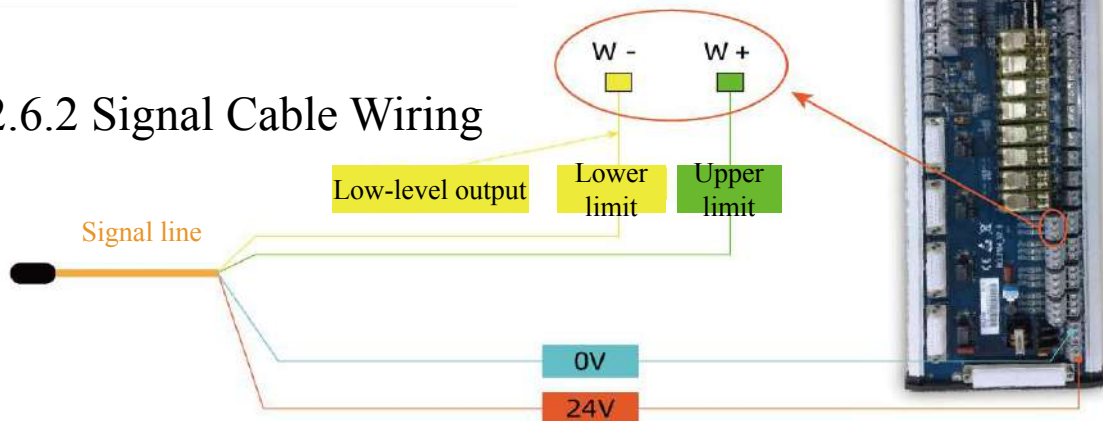
### 3.3.2.6: Cutting Head and System Wiring

Toggle switch position

#### 3.3.2.6.1: Servo Driver Power Wiring (DC24V)



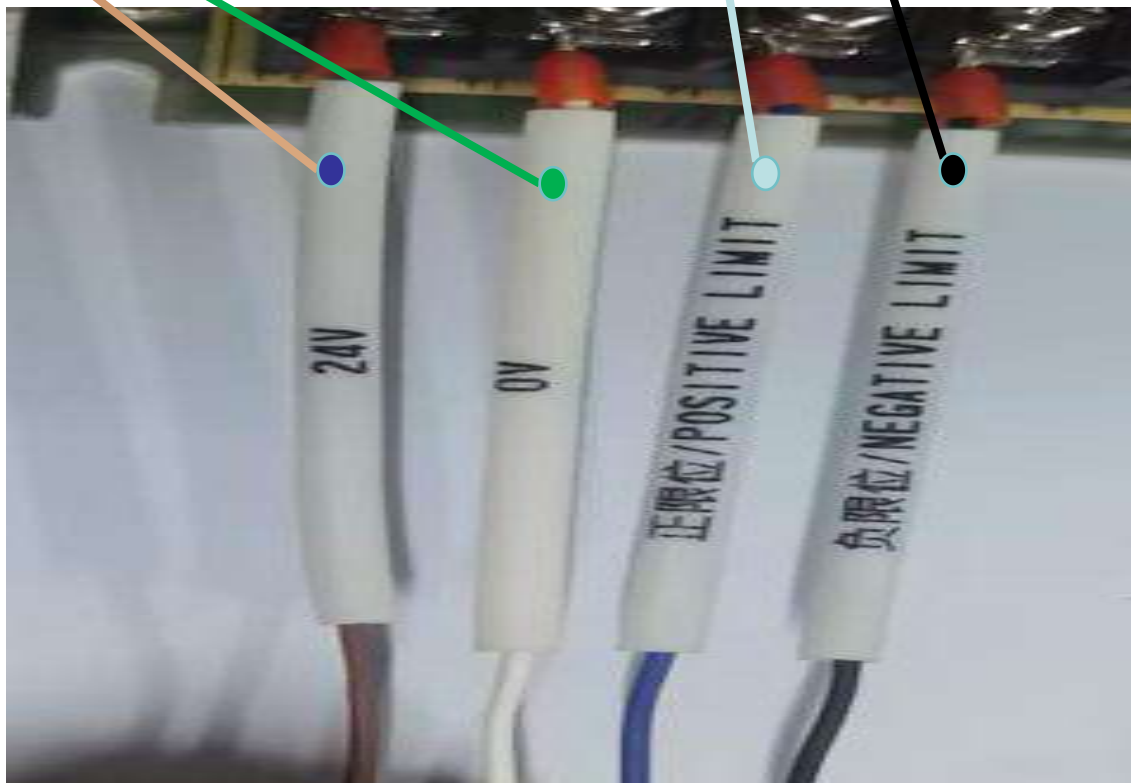
#### 3.3.2.6.2 Signal Cable Wiring





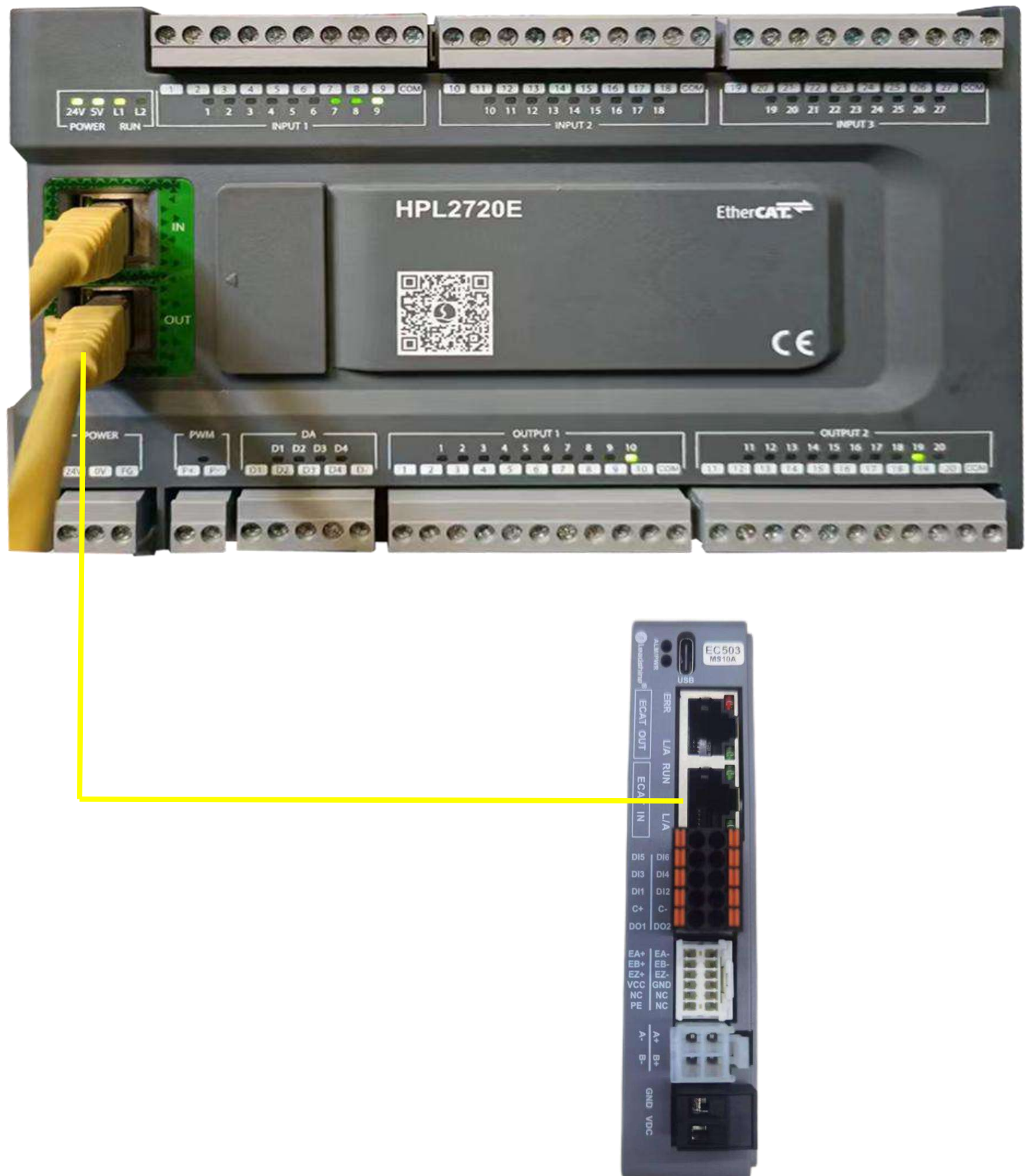
### 3.3.3: FSCUT8000 System Wiring (Example: HPL2720E)

#### 3.3.3.1: Board IO Wiring (Example: HPL2720E)

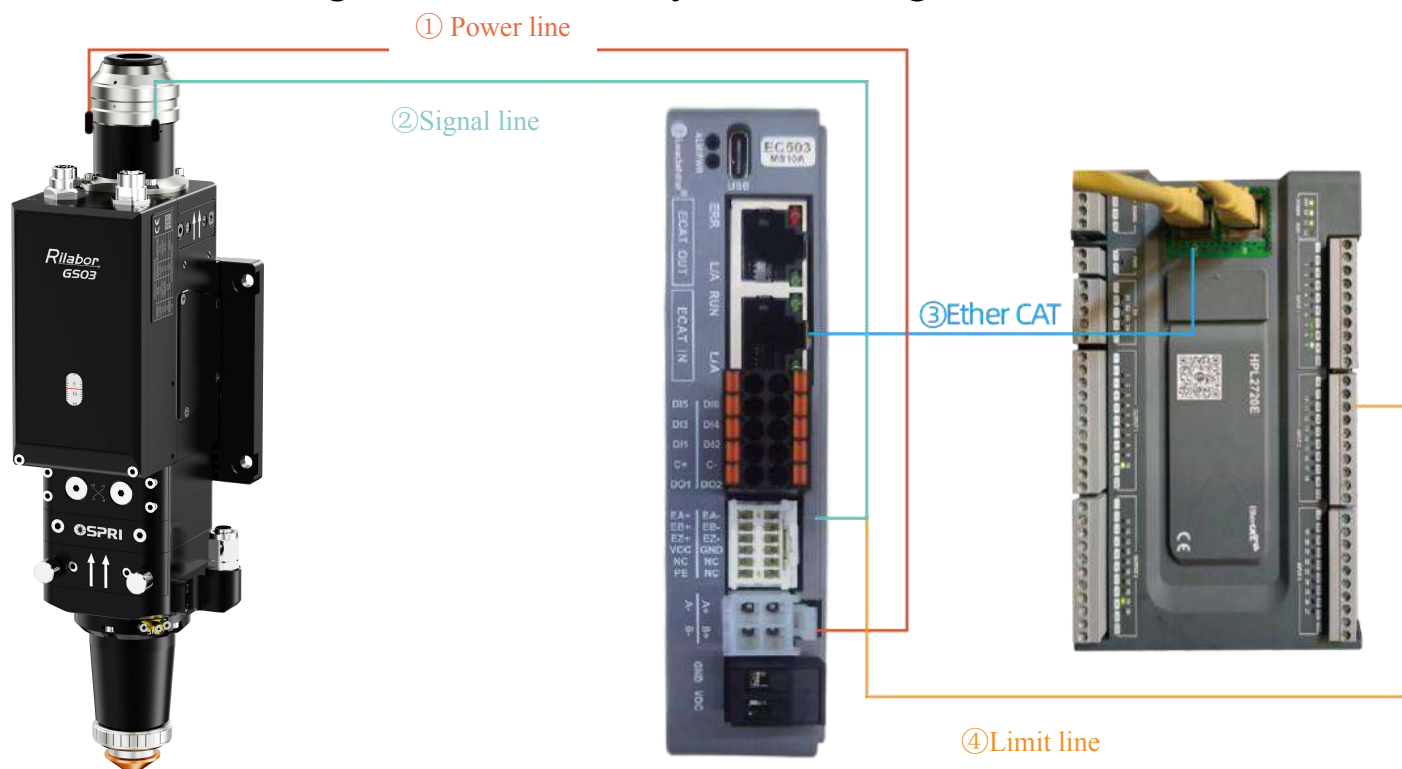


Limit switch with NPN output

### 3.3.3.2: Board and Driver Wiring (Example: HPL2720E)

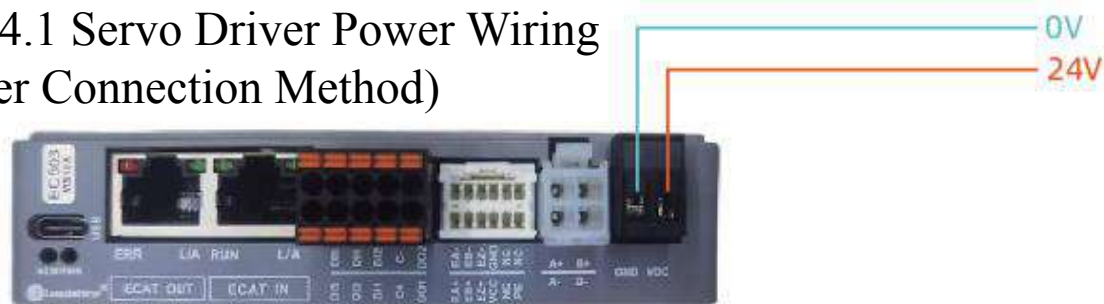


### 3.3.3.3 Cutting Head and Bus System Wiring



### 3.3.3.4 Cutting Head and System Wiring

#### 3.3.3.4.1 Servo Driver Power Wiring (Power Connection Method)

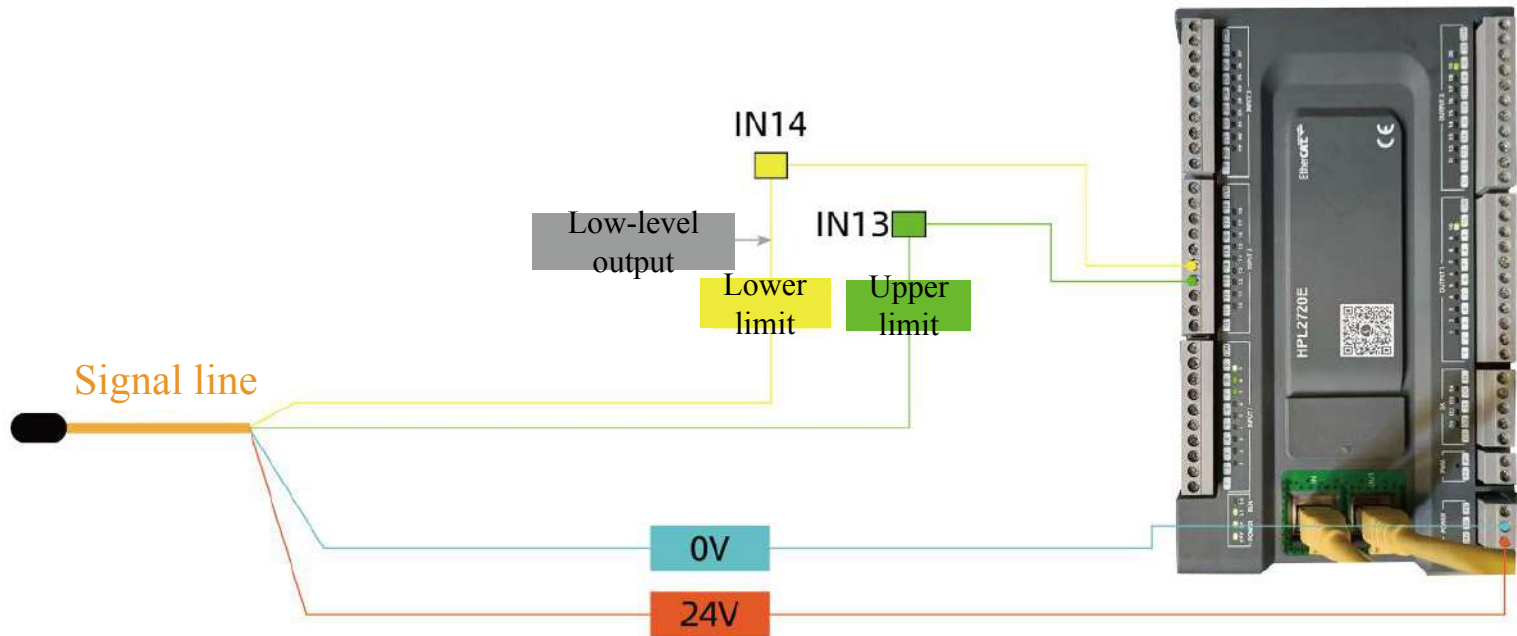


#### 3.3.3.4.2 Driver Parameters

| Parameter Index | Parameter Value | Parameter Content                   |
|-----------------|-----------------|-------------------------------------|
| PA000           | 10000           | Pulses per revolution               |
| PA003           | 0               | Rotation direction                  |
| PA411           | 81              | Servo alarm logic (normally closed) |
| PR438           | 0               | Slave source                        |

Note: Electronic gear ratio numerator: 8192;  
Electronic gear ratio denominator: 10000;  
Encoder resolution: 13 bits;

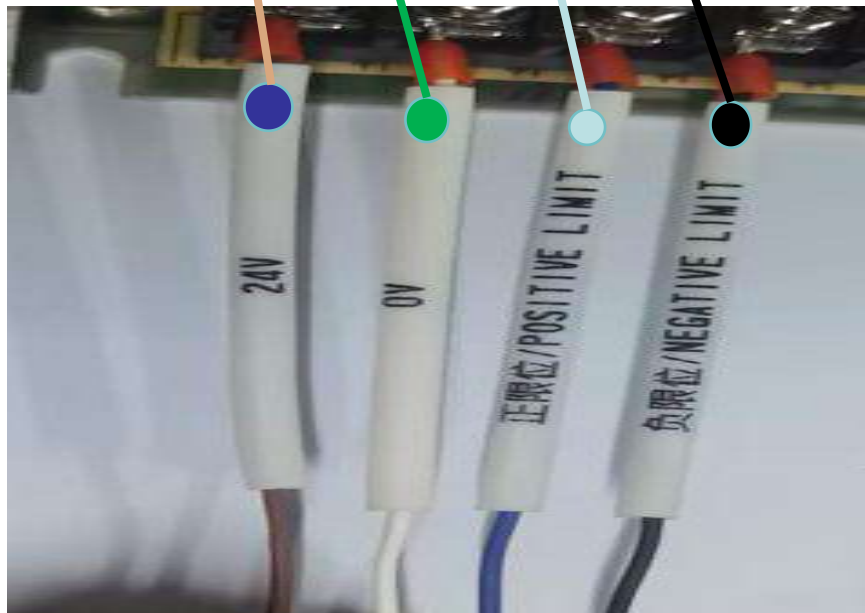
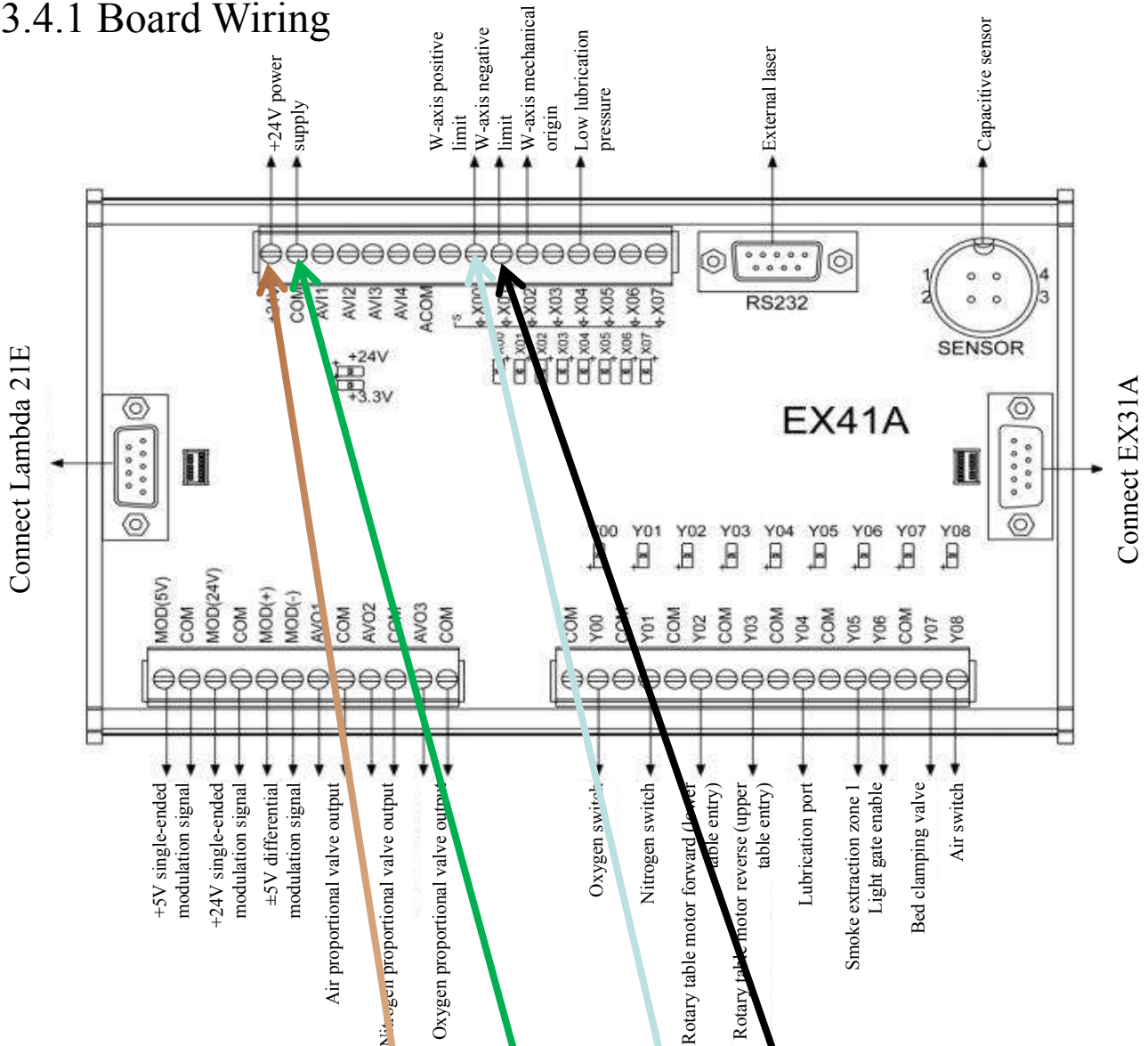
### 3.3.3.4.3 Signal Cable Wiring





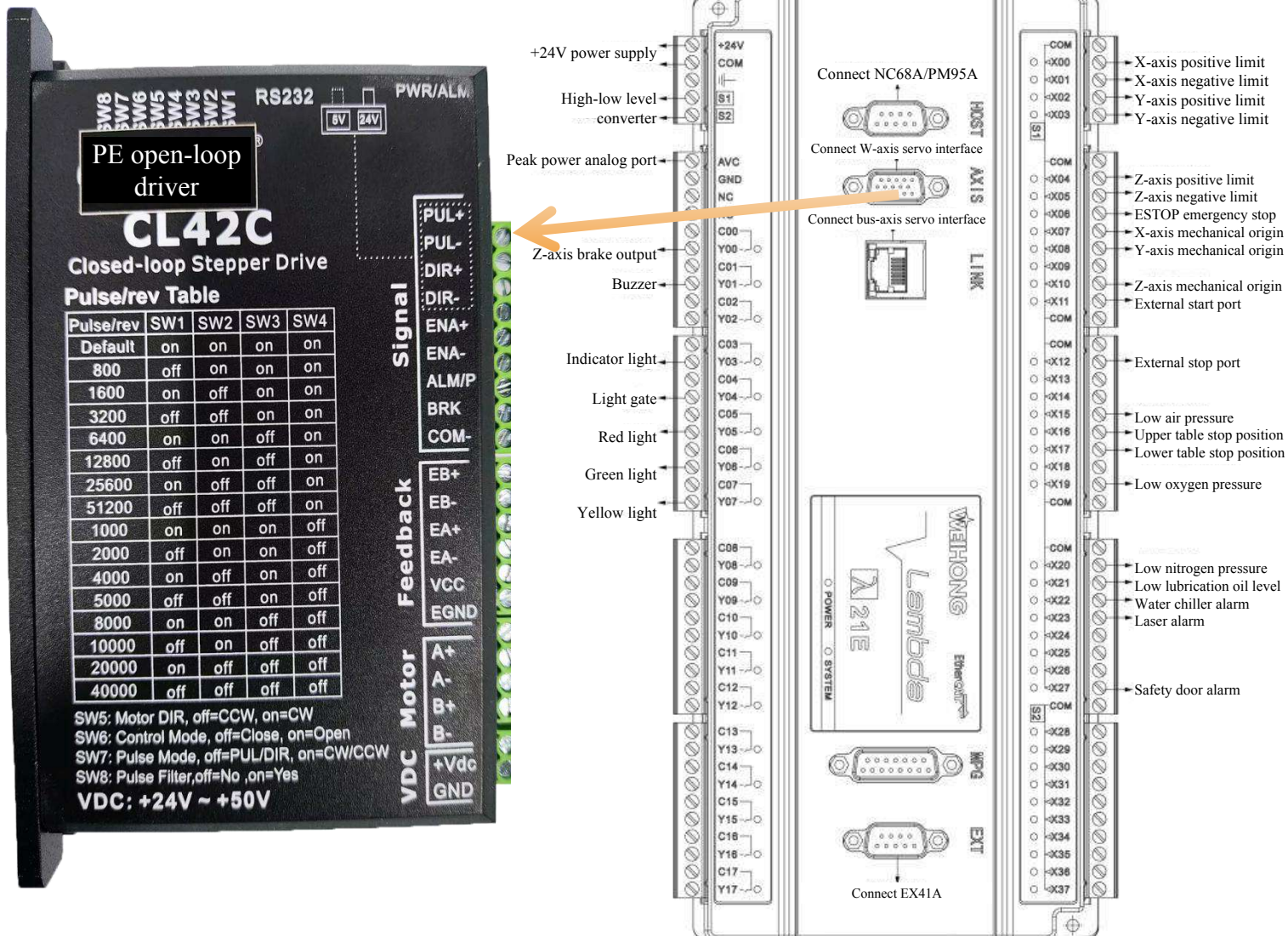
### 3.3.4: LS6000M Non-Bus System Wiring (Example: EX41A)

#### 3.3.4.1 Board Wiring



Limit switch with NPN output

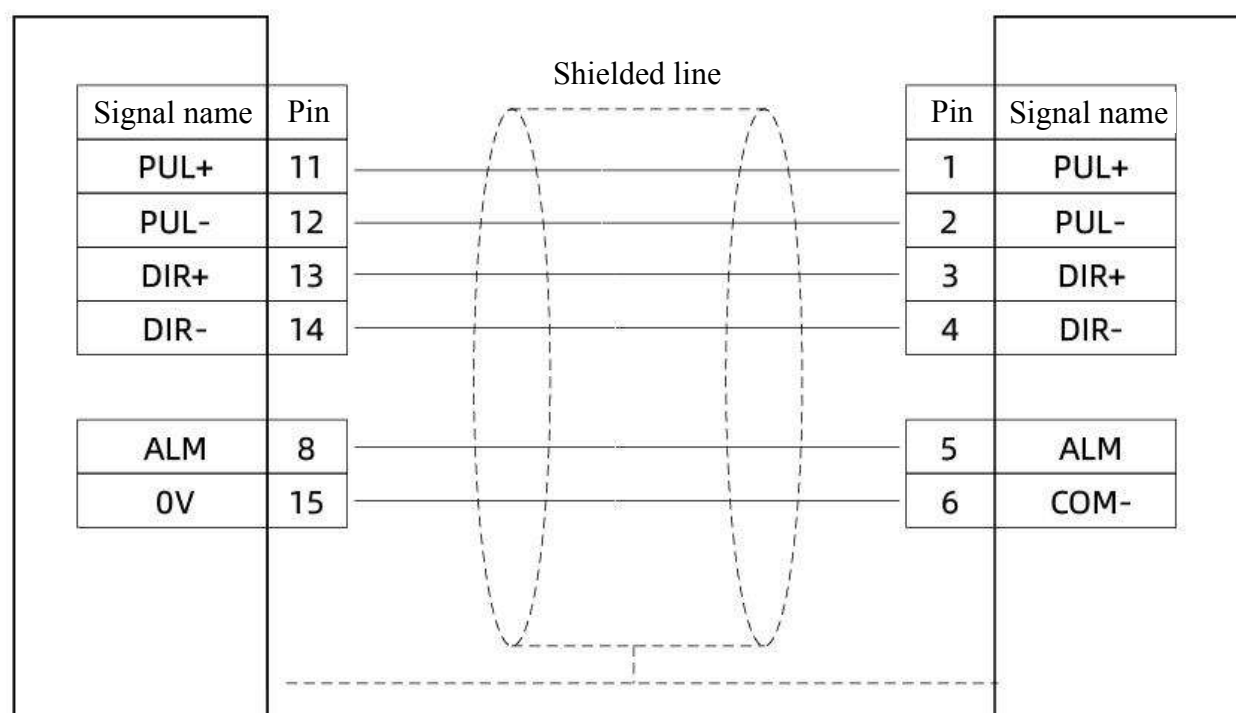
### 3.3.4.2: LS6000M Board and Driver Wiring (Example: 21E)



### 3.3.4.3: Board Axis Port Definition Wiring

Weihong three-row DB15 (dense)  
male connector

Driver end

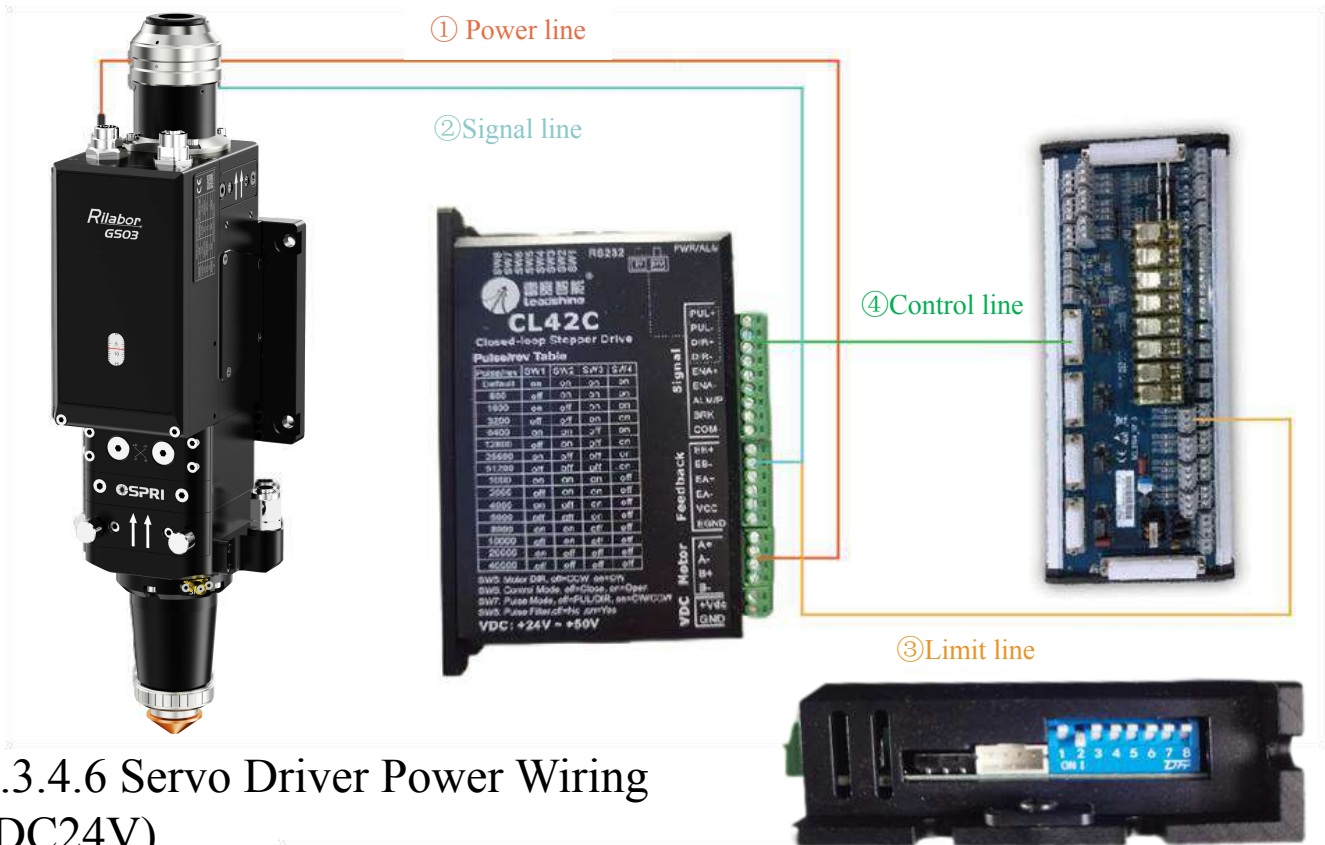


### 3.3.4.4: Driver Parameters

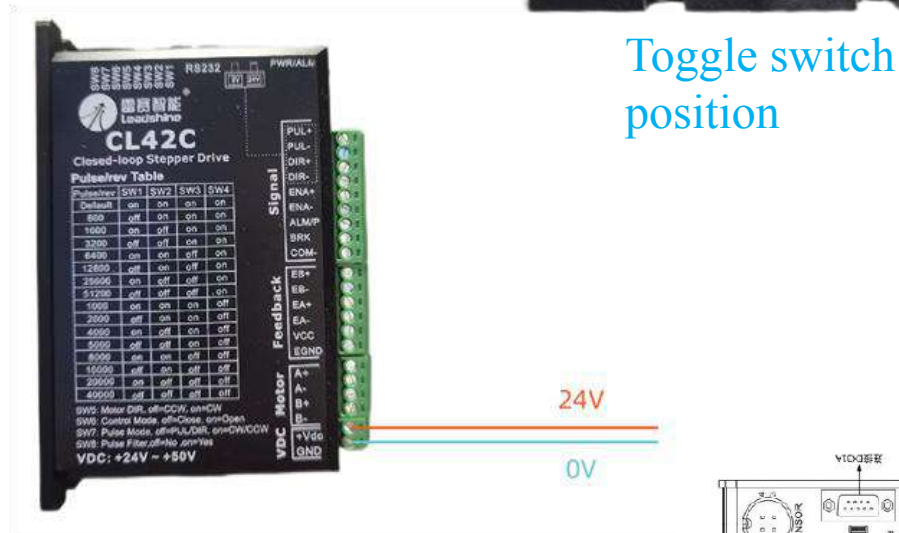
| Parameter Index | Parameter Value | Parameter Content               |
|-----------------|-----------------|---------------------------------|
| PR0.00          | 10000           | Pulses per command revolution   |
| PR0.01          | 2               | Open/Closed loop mode selection |
| PR0.03          | 1               | Motor direction                 |
| PR0.42          | 6               | Motor type                      |
| PR4.31          | 0               | Fault output level              |
| PR5.00          | 10              | Motor peak current              |
| PR7.01          | 4000            | Encoder resolution              |



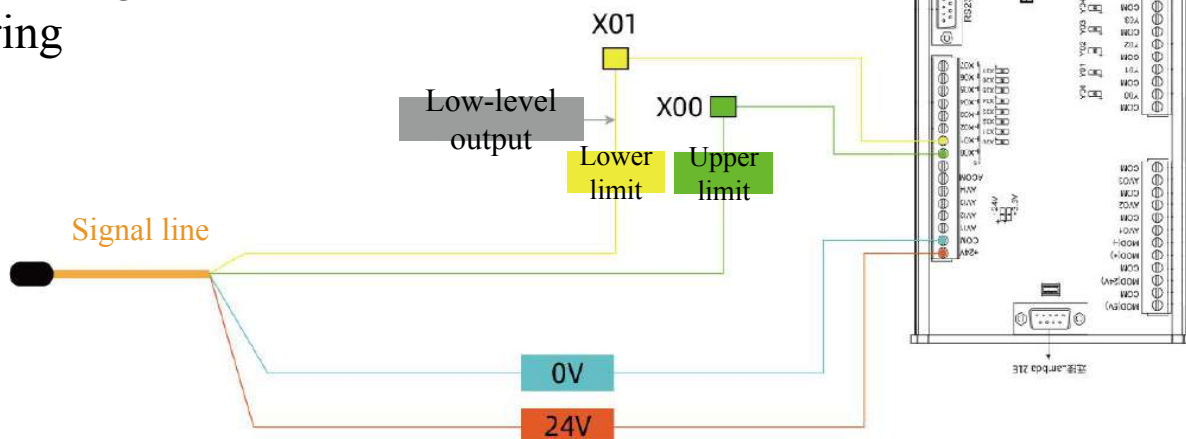
### 3.3.4.5 Cutting Head and Non-Bus System Wiring



### 3.3.4.6 Servo Driver Power Wiring (DC24V)



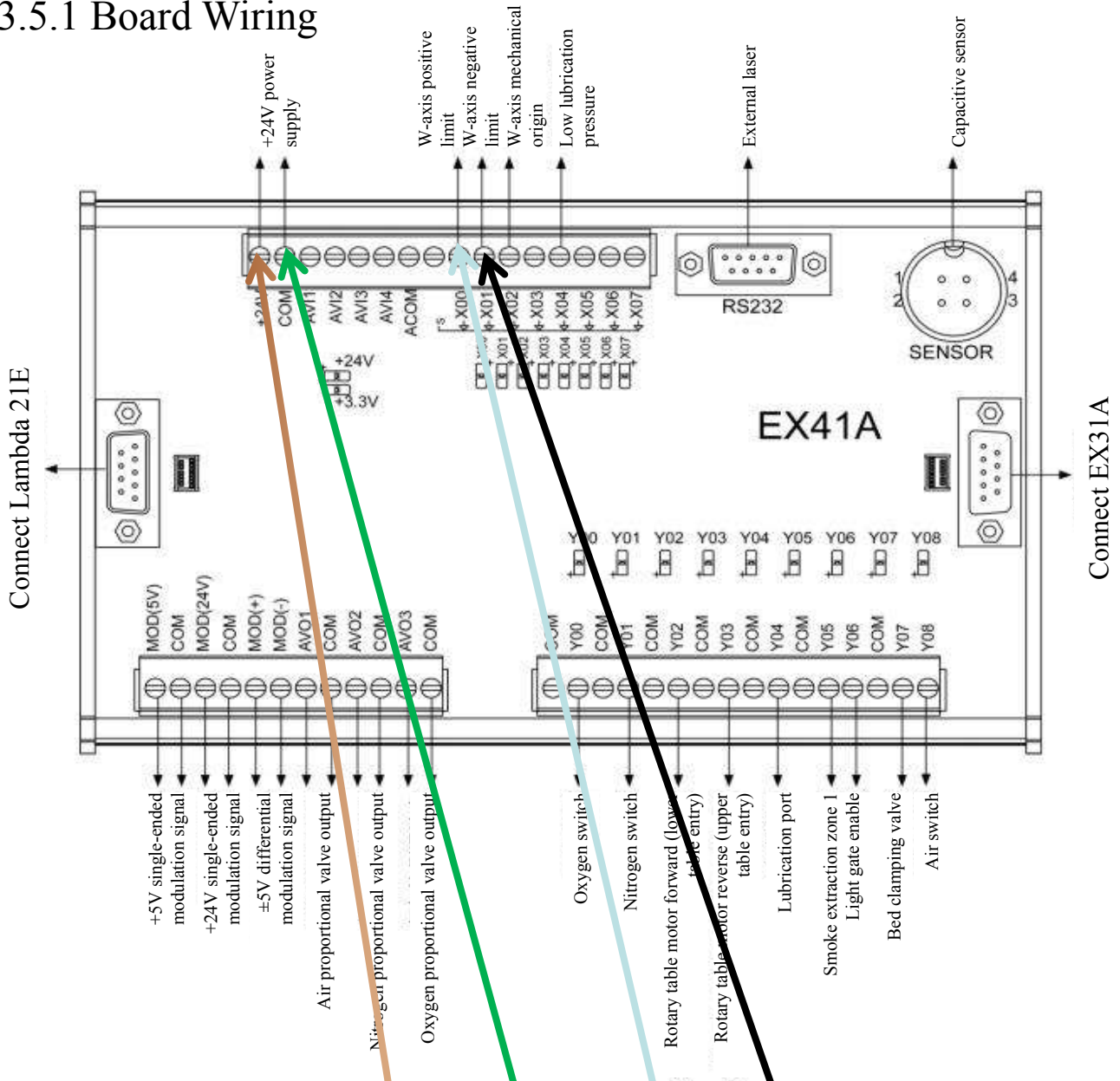
### 3.3.4.7 Signal Line Wiring





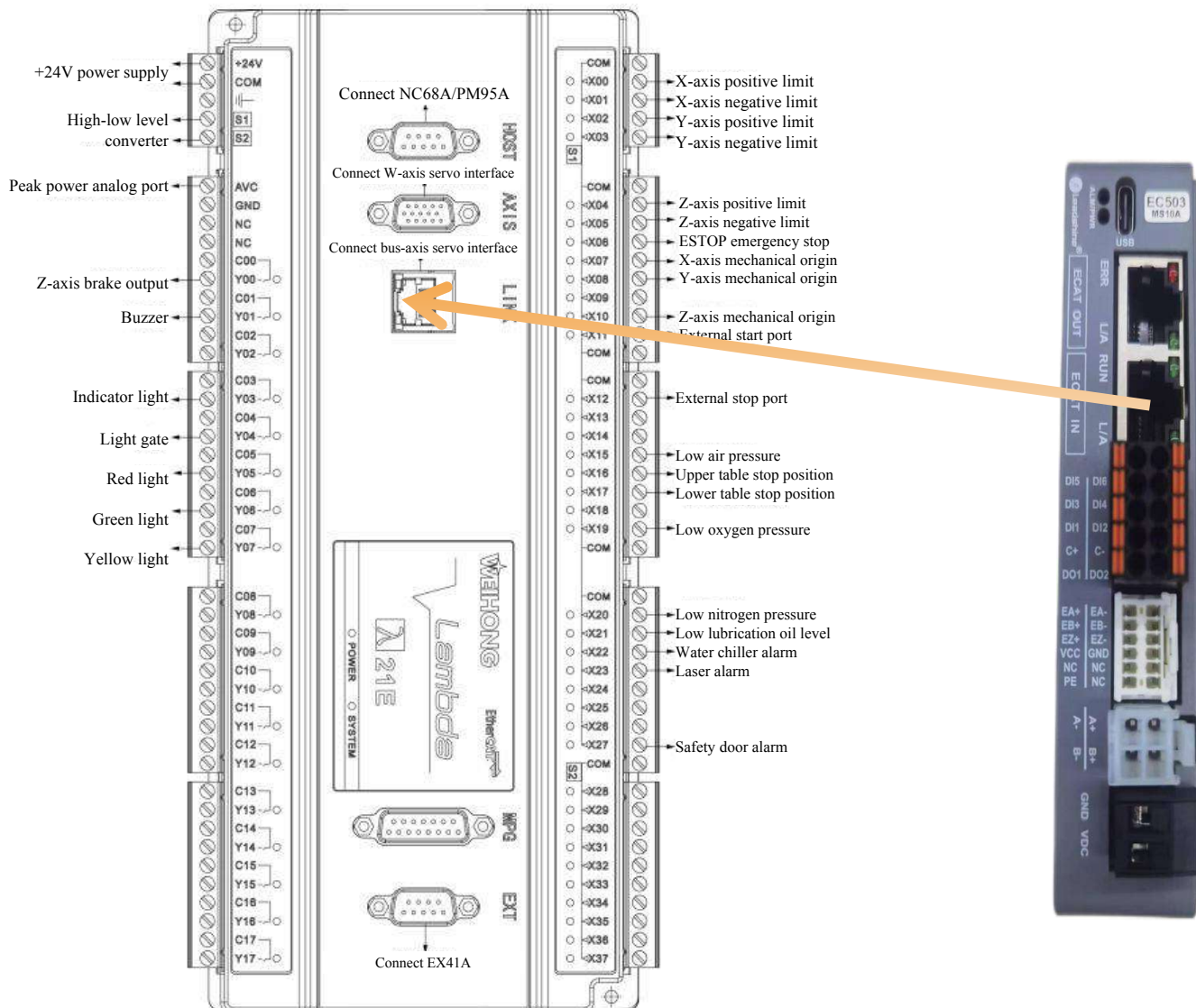
### 3.3.5: LS6000M Bus System Wiring (Example: EX41A)

#### 3.3.5.1 Board Wiring

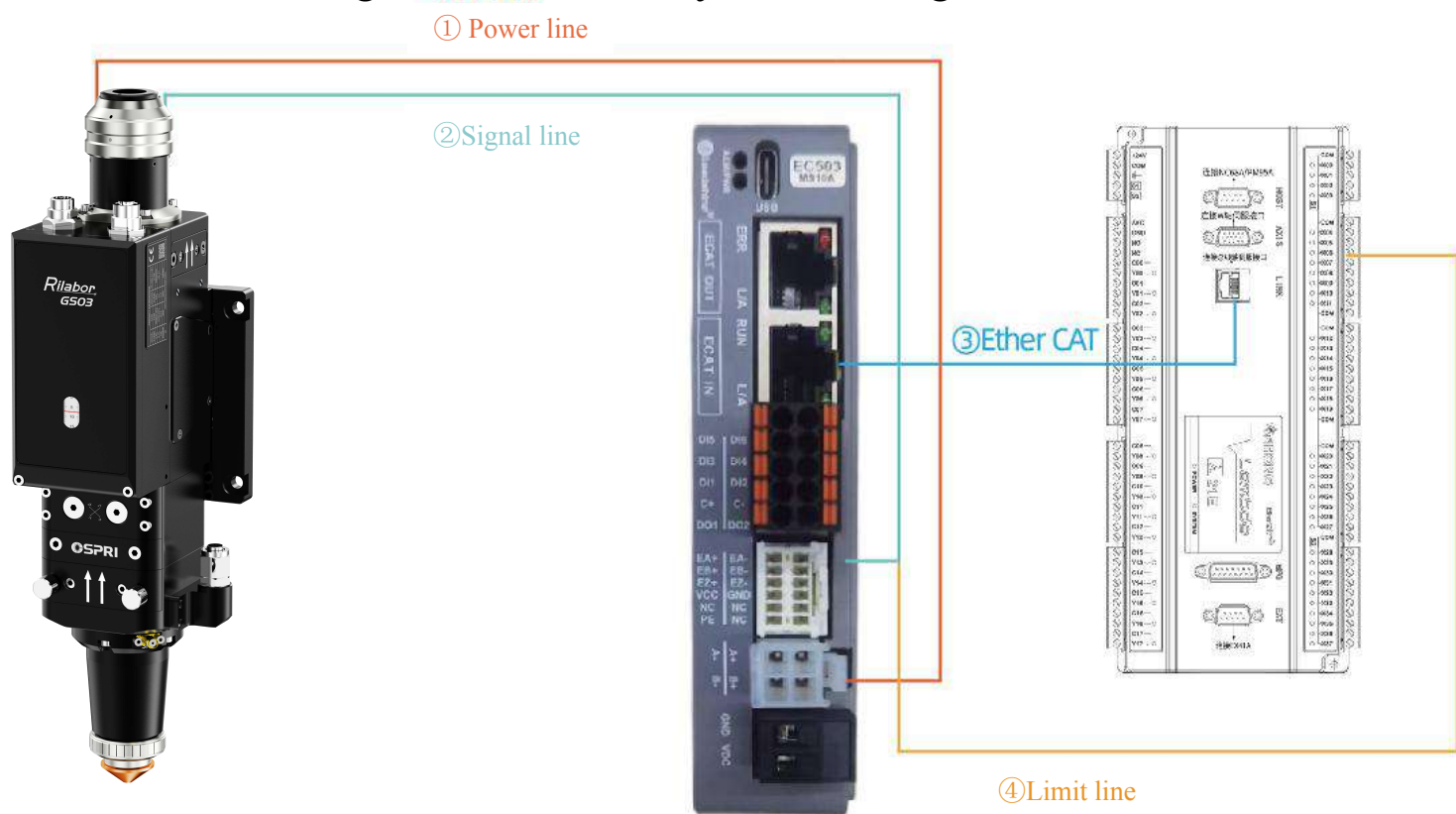


Limit switch  
with NPN  
output

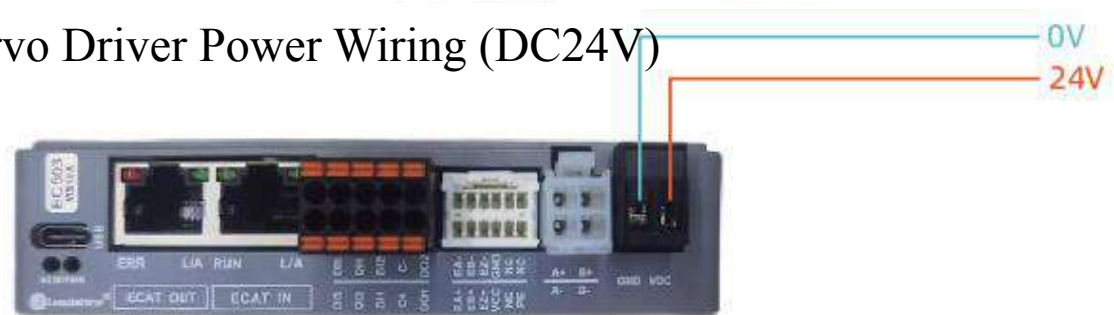
### 3.3.5.2: LS6000M Board and Driver Wiring (Example: 21E)



### 3.3.5.3 Cutting Head and Bus System Wiring



### 3.3.5.4 Servo Driver Power Wiring (DC24V)

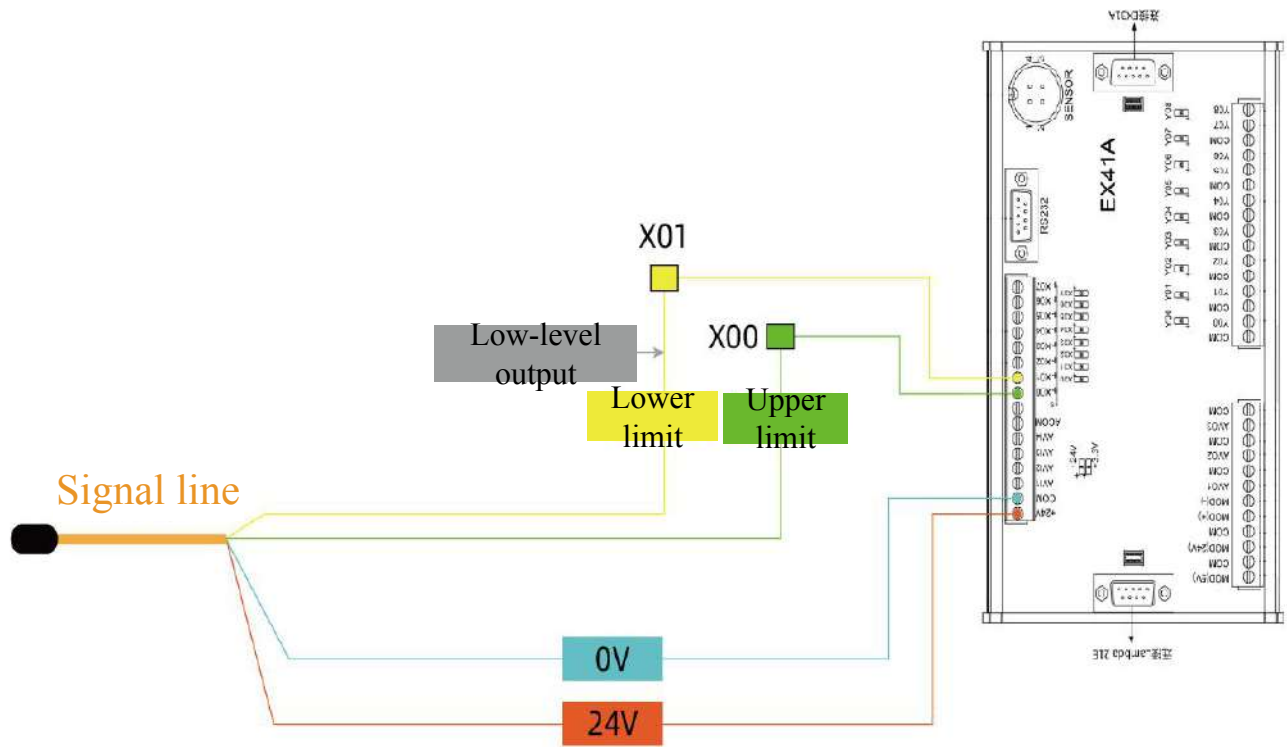


### 3.3.5.5 Driver Parameters

| Parameter Index | Parameter Value | Parameter Content                   |
|-----------------|-----------------|-------------------------------------|
| PA000           | 10000           | Pulses per revolution               |
| PA003           | 0               | Rotation direction                  |
| PA411           | 81              | Servo alarm logic (normally closed) |
| PR438           | 0               | Slave source                        |

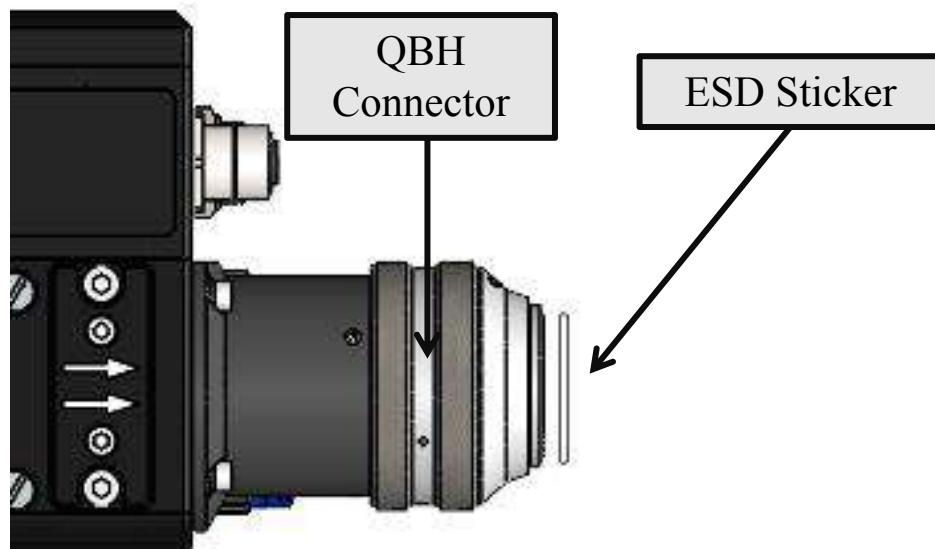
Note: Electronic gear ratio numerator: 8192;  
 Electronic gear ratio denominator: 10000;  
 Encoder resolution: 13 bits;

### 3.3.5.6 Signal Line Wiring

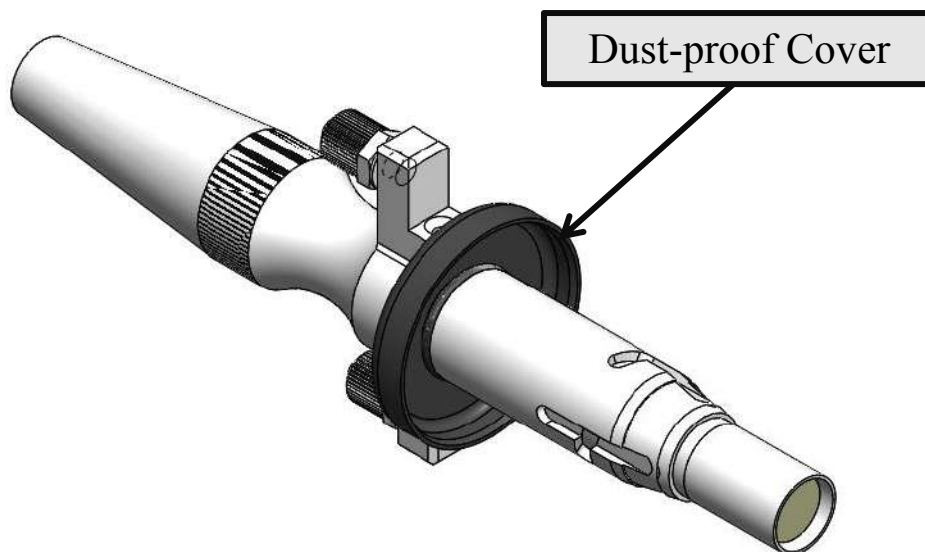


### 3.4 Installation of QBH Fiber Laser Head

3.4.1 Put the cutting head horizontally, remove the white cover and static sticker:

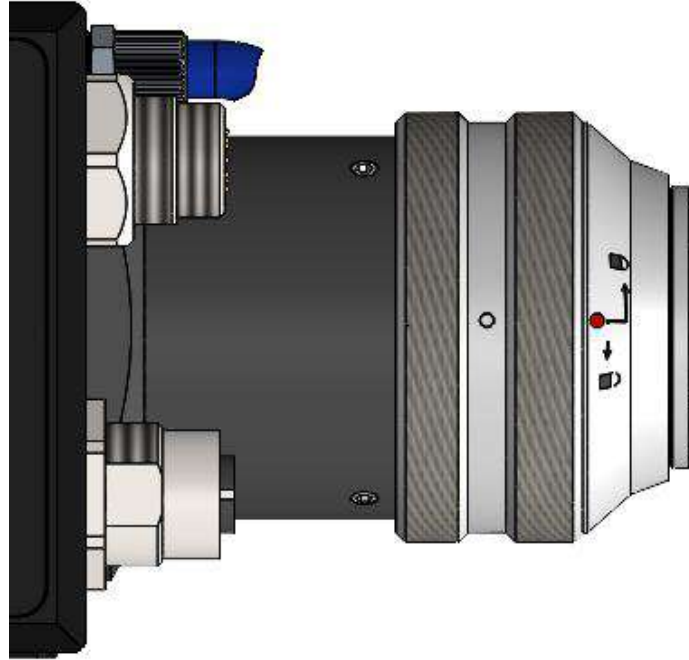


3.4.2 Cover the dust-proof cover which is in the white accessory box, onto the fiber laser tip. as shown in the figure below:

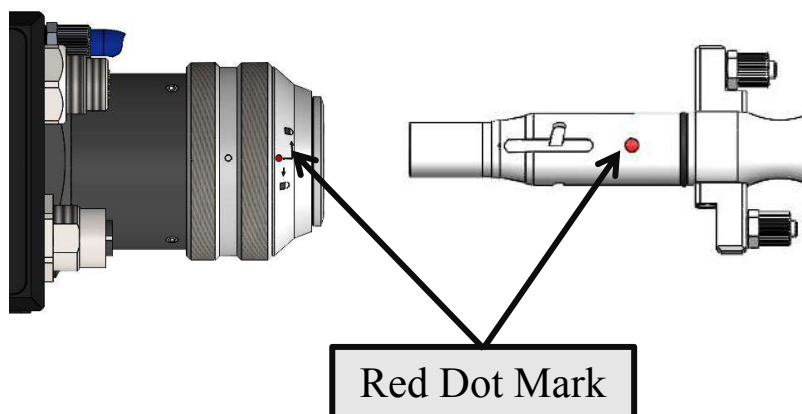


**Attention:** In case the fiber head is with original dust-proof gasket, users can choose whether install dust-proof cover or not according to the actual condition.

3.4.3 Turn the QBH connector into the open state, that is, screw it to the limit position counterclockwise (a "thud" sound can be heard). Do not twist with great force, otherwise the internal structure of the QBH may be damaged.

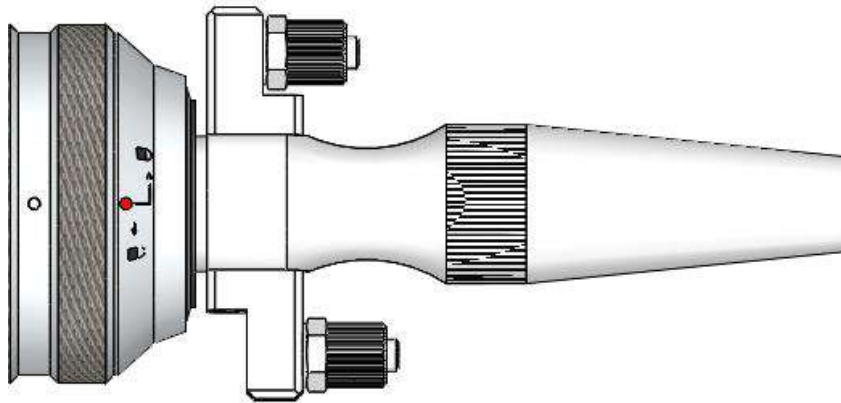


3.4.4 Align the red dot on the fiber head with the red dot on the QBH connector, and slowly insert the fiber head into the QBH connector, as shown in the figure below:





3.4.5 Turn the QBH connector to the locked state, that is, screw it toward the limit position clockwise (a "thud" sound can be heard). Then lift the swivel nut up and screw the nut clockwise again until the fiber tip is compressed tightly. (Do not twist with great force, otherwise the internal structure of the QBH internal structure)



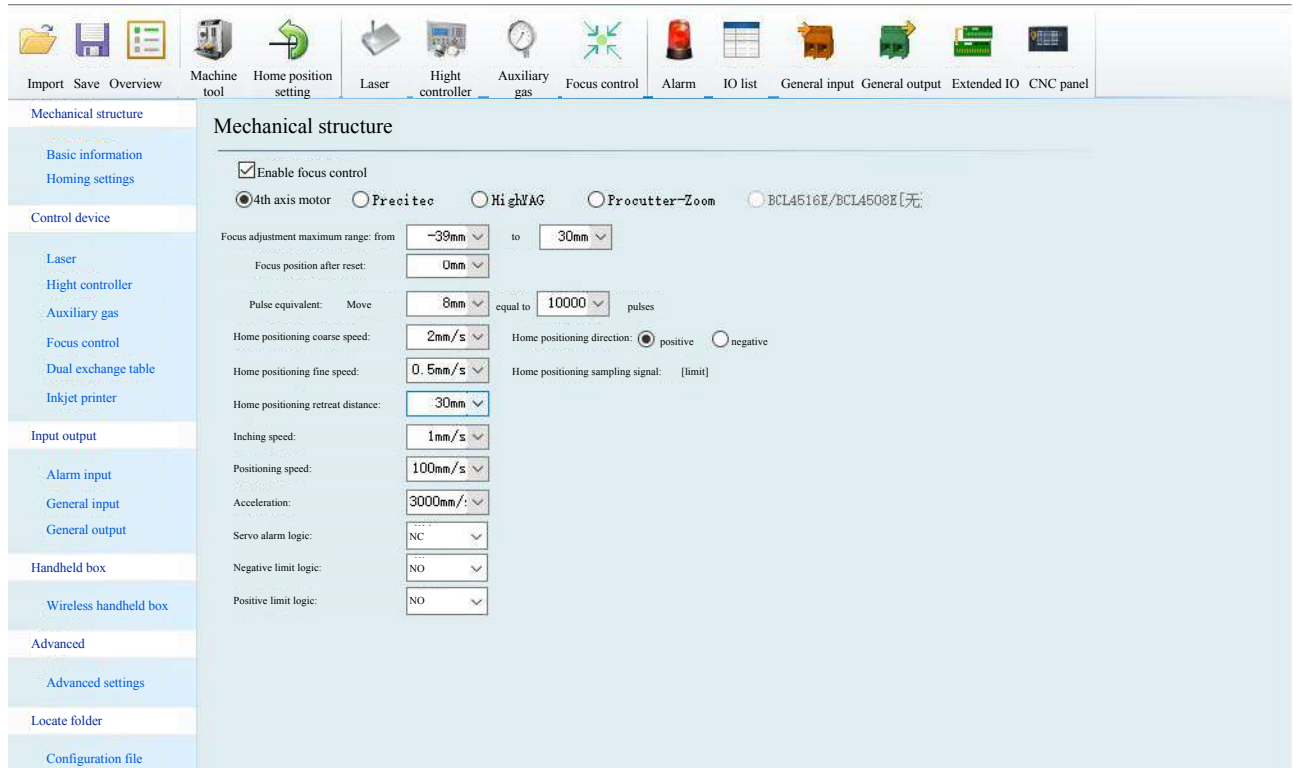
Attention: Wrap with masking tape after plugging fiber tip.

# Chapter 4 Product Debugging

## 4.1: System Configuration

### 4.1.1: FSCUT2000C System Configuration (Pulse System)

#### 4.1.1.1: Focus Control Configuration



### LCS03 Platform Configuration

100 collimation, 200 focus:

Focus maximum adjustment range: -32mm to 26mm;

Pulse equivalent: every 8mm movement corresponds to 10,000 pulses;

Return to home direction: Forward;

Retraction distance: 26mm;

Limit logic: Normally open;

100 collimation 125 focus, 100 collimation 150 focus:

Focus maximum adjustment range: -18mm to 15mm;

Pulse equivalent: 10,000 pulses per 4.5mm of movement;

Return to home direction: Forward;

Retraction distance: 15mm;

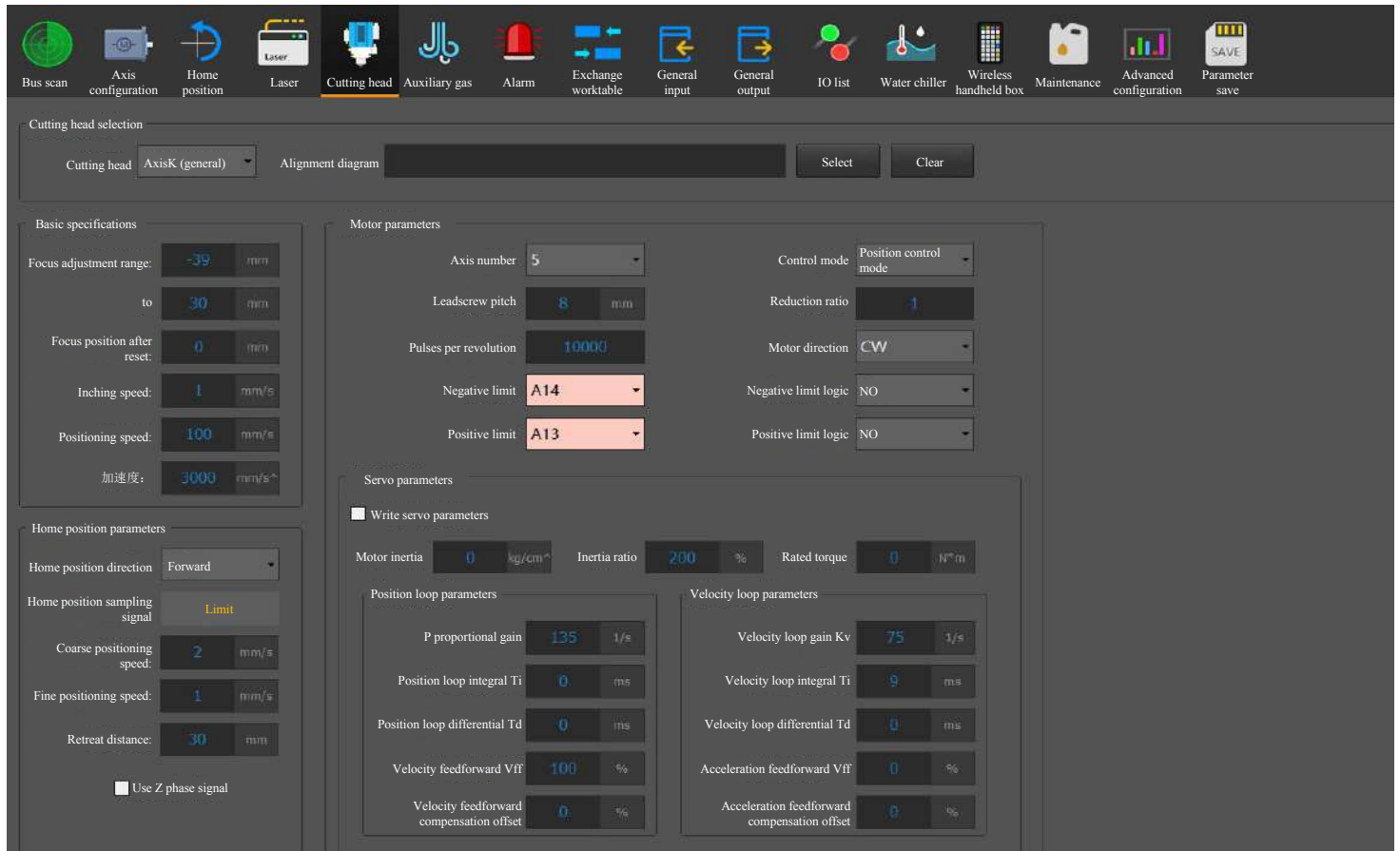
Limit logic: Normally open;

**Attention: The retraction distance can be slightly adjusted according to the actual cutting focus.**



## 4.1.2: FSCUT8000 System Configuration (Bus System)

### 4.1.2.1: Focus Control Configuration and Limit Configuration



### LCS03 Platform Configuration

100 collimation, 200 focus:

Focus maximum adjustment range: -32mm to 26mm;

Pulse equivalent: every 8mm movement corresponds to 10,000 pulses;

Return to home direction: Forward;

Retraction distance: 26mm;

Limit logic: Normally open;

100 collimation 125 focus, 100 collimation 150 focus:

Focus maximum adjustment range: -18mm to 15mm;

Pulse equivalent: 10,000 pulses per 4.5mm of movement;









Return to home direction: Forward;

Retraction distance: 15mm;

Limit logic: Normally open;

## 4.1.3: LS6000M Non-Bus System Configuration

### 4.1.3.1: W Axis Parameter Configuration

| Common parameters   |        |        |  |                       |
|---|--------|--------|--|-----------------------|
| System parameters   |        |        |  |                       |
| Follower control  |        |        |  |                       |
| Laser settings  |        |        |  |                       |
| Regular maintenance reminder for machine tools  |        |        |  |                       |
| Search  |        |        |  |                       |
| Name  |        |        |  |                       |
| Value   |        |        |  |                       |
| Unit  |        |        |  |                       |
| Effective time  |        |        |  |                       |
| 1.0.3 W-axis parameters   |        |        |  |                       |
| Encoder direction (W)   | 1      |        |  | Effective immediately |
| Axis direction (W)  | 1      |        |  | Effective immediately |
| Pulse equivalent (W)  | 0.0008 | mm/p   |  | Effective immediately |
| Command pulse count per revolution (W)  | 10000  |        |  | Effective immediately |
| Feedback pulse count per revolution (W)   | 4000   |        |  | Effective immediately |
| Soft limit upper value (W)  | 30     | mm     |  | Effective immediately |
| Soft limit lower value (W)  | -39    | mm     |  | Effective immediately |
| Enable soft limit protection (W)  | Yes    |        |  | Effective immediately |
| Maximum axis speed (W)  | 6000   | mm/min |  | Effective immediately |
| Parameter name: Maximum axis speed (W)<br>Value: 6000mm/min<br>Description: Maximum speed of W axis   |        |        |  |                       |
| <div>  Drawing            Machining            Process            Monitoring            Operation report            Settings            Maintenance            Advanced         </div> |        |        |  |                       |

## LCS03 Platform Configuration

100 collimation, 200 focus:

Encoder direction: 1;

Pulse equivalent: 0.0008;

Feedback pulses per revolution: 4,000;

Lower soft limit: -32;

Maximum axis speed: 6000 mm/s;

axis direction: 1;

pulses per revolution: 10,000;

upper soft limit: 26;

soft limit protection enabled: Yes;

100 collimation 125 focus, 100 collimation 150 focus:

Encoder direction: 1;

Pulse equivalent: 0.00045;

Feedback pulses per revolution: 4,000;

Lower soft limit: -18;

Maximum axis speed: 6000 mm/s;

axis direction: 1;

pulses per revolution: 10,000;

upper soft limit: 15;

soft limit protection enabled: Yes;

### 4.1.3.2: W Axis Home Position Configuration

Common parameters
System parameters
Follower control
Laser settings
Regular maintenance reminder for machine tools

Parameter overview

Basic machine tool parameters

1.0 Axis parameter settings
1.1 Home position setting
1.1.0 Common parameters
1.1.1 X-axis origin setting
1.1.2 Y-axis origin setting
1.1.3 Z-axis origin setting
1.1.4 W-axis origin setting
1.2 Error compensation settings
Speed and precision control
External device control
Advanced function parameters

Manufacturer

Search

| Name   | Value | Unit   | Effective time        |
|--|-------|--------|-----------------------|
| <b>1.1.4 W-axis origin setting</b>                           |       |        |                       |
| Use Z phase signal (W)                                       | No    |        | Effective immediately |
| Coarse positioning stage direction (W)                       | 1     |        | Effective immediately |
| Coarse positioning stage speed (W)                           | 120   | mm/min | Effective immediately |
| Fine positioning stage speed (W)                             | 3     | mm/min | Effective immediately |
| Retreat distance (W)   | 30    | mm     | Effective immediately |
| Retreat speed (W)  | 3     | mm/min | Effective immediately |
| Minimum distance for coarse and fine positioning signals (W) | 0.5   | mm     | Effective immediately |

Parameter name: Fine positioning stage speed (W)  
Value: 3mm/min  
Description: Feed speed during the fine positioning stage of returning to the mechanical origin.

Drawing
Machining
Process
Monitoring
Operation report
Settings
Maintenance
Advanced

### LCS03 Platform Configuration

100 collimation, 200 focus:

|                                      |                                  |
|--------------------------------------|----------------------------------|
| Use Z-phase signal: No;              | coarse positioning direction: 1; |
| Coarse positioning speed: 120mm/min; | fine positioning speed: 3mm/s;   |
| Coarse positioning direction: 1;     | retraction distance: 26;         |
| Retraction speed: 1mm/min;           |                                  |

100 collimation 125 focus, 100 collimation 150 focus:

|                                      |                                  |
|--------------------------------------|----------------------------------|
| Use Z-phase signal: No;              | coarse positioning direction: 1; |
| Coarse positioning speed: 120mm/min; | fine positioning speed: 3mm/s;   |
| Coarse positioning direction: 1;     | retraction distance: 15;         |
| Retraction speed: 1mm/min;           |                                  |

### 4.1.3.3: Focus Control Configuration

Common parameters

System parameters

Follower control

Laser settings

Regular maintenance reminder for machine tools

Search

Parameter overview

Basic machine tool parameters

1.0 Axis parameter settings

1.1 Home position setting

1.1.0 Common parameters

1.1.1 X-axis origin setting

1.1.2 Y-axis origin setting

1.1.3 Z-axis origin setting

1.1.4 W-axis origin setting

1.2 Error compensation settings

Speed and precision control

External device control

3.0 Monitoring

3.1 Lubrication

3.2 Gas control

3.3 Smoke extraction

3.4 Exchange worktable

3.5 Focus control

3.6 Nozzle cleaning

3.7 Buzzer

Advanced function parameters

| Name                           | Value | Unit | Effective time        |
|--------------------------------|-------|------|-----------------------|
| 3.5 Focus control              |       |      |                       |
| Enable focus control           | Yes   |      | Effective on restart  |
| Focus control mode             | 0     |      | Effective on restart  |
| Focus position detection delay | 1000  | ms   | Effective immediately |
| Home position detection delay  | 20    | s    | Effective immediately |
| Pulei focus confirmation delay | 100   | ms   | Effective immediately |

Manufacturer

Parameter name: Focus control mode

Value: 0

Description: Focus control mode. 0: Axis control; 1: Pulei auto-focus.

Drawing

Machining

Process

Monitoring

Operation report

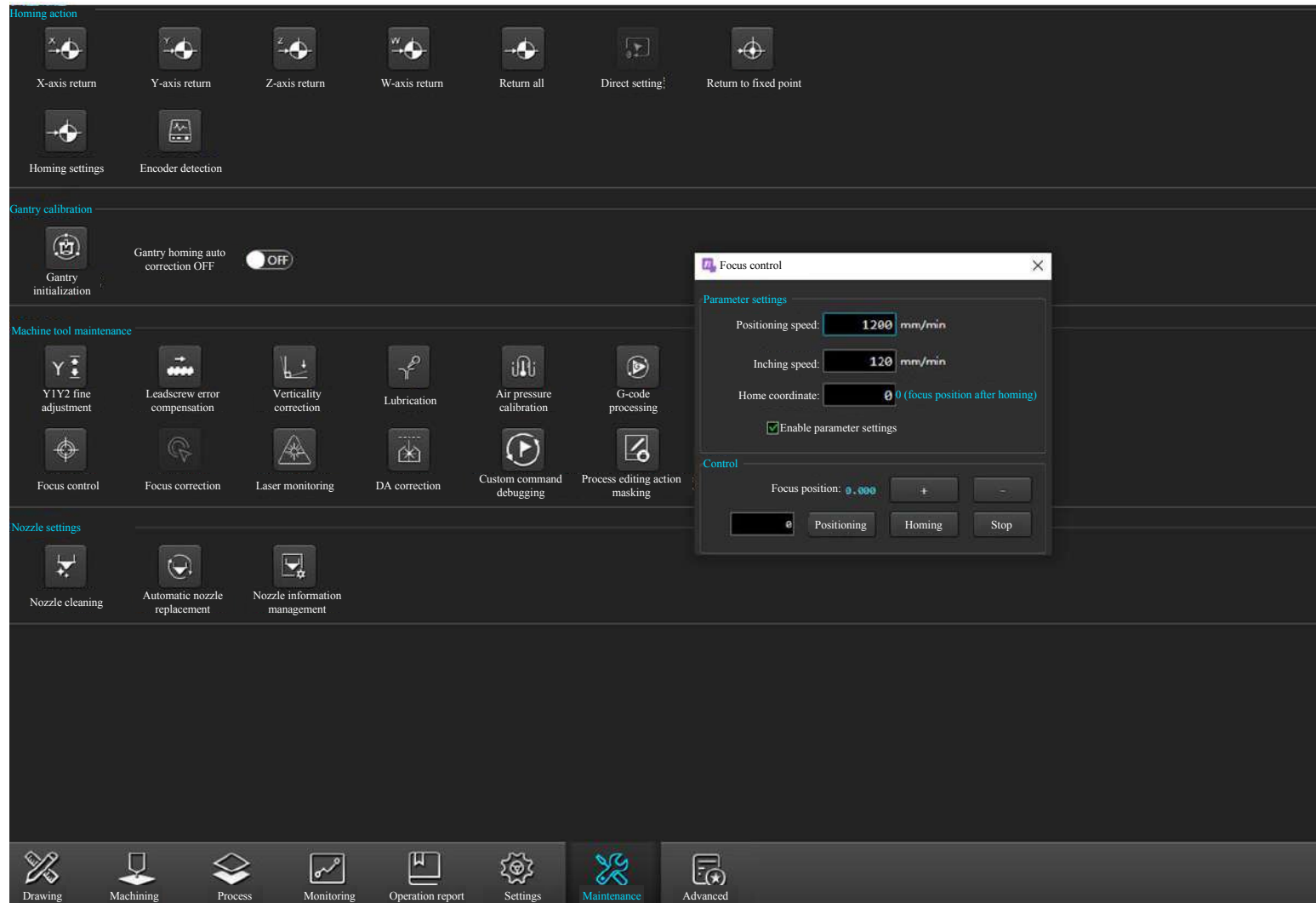
Settings

Maintenance

Advanced

Focus control enabled: Yes;  
Focus control mode: Axis port control;

### 4.1.3.4: Focus Control Configuration



The screenshot displays the SPRI software interface with the 'Focus control' window open. The interface is organized into several sections:

- Homing action:** Includes buttons for X-axis return, Y-axis return, Z-axis return, W-axis return, Return all, Direct setting, and Return to fixed point. Below these are 'Homing settings' and 'Encoder detection'.
- Gantry calibration:** Features a 'Gantry initialization' button and a 'Gantry homing auto correction OFF' toggle switch.
- Machine tool maintenance:** Contains buttons for Y1Y2 fine adjustment, Leadscrew error compensation, Verticality correction, Lubrication, Air pressure calibration, G-code processing, Focus control, Focus correction, Laser monitoring, DA correction, Custom command debugging, and Process editing action masking.
- Nozzle settings:** Includes buttons for Nozzle cleaning, Automatic nozzle replacement, and Nozzle information management.

The 'Focus control' window is open, showing the following settings:

- Parameter settings:**
  - Positioning speed: 1200 mm/min
  - Inching speed: 120 mm/min
  - Home coordinate: 0 (focus position after homing)
  - ☒ Enable parameter settings
- Control:**
  - Focus position: 0.000
  - Buttons: +, -, Positioning, Homing, Stop

The bottom of the interface features a navigation bar with icons for Drawing, Machining, Process, Monitoring, Operation report, Settings, Maintenance (highlighted), and Advanced.

Positioning speed: 1200mm/min;  
Jogging speed: 120mm/min;  
Home coordinate: 0;  
Parameter setting enabled: Checked;

#### 4.1.3.5: W Axis No-Load Speed Setting

| Common parameters   | System parameters | Follower control  | Laser settings | Regular maintenance reminder for machine tools |
|---|-------------------|---|----------------|--|
| Parameter overview<br>▶ Basic machine tool parameters<br>▶ Speed and precision control<br>▶ External device control<br>▶ Advanced function parameters | Search            | Name  | Value          | UnitEffective time                             |
|   |                   | Manual acceleration change time (X)   | 50             | msEffective immediately                        |
|   |                   | Manual acceleration change time (Y)   | 50             | msEffective immediately                        |
|   |                   | Manual acceleration change time (Z)   | 50             | msEffective immediately                        |
|   |                   | Manual acceleration change time (W)   | 250            | msEffective immediately                        |
|   |                   | <b>2.1.0 Machining speed control</b>  |                |  |
|   |                   | Perimeter traversal speed   | 30000          | mm/minEffective immediately                    |
|   |                   | Machining acceleration  | 5000           | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Maximum speed for reference circle  | 5000           | mm/minEffective immediately                    |
|   |                   | Maximum turning acceleration  | 5000           | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Machine tool rigidity coefficient   | 1              | Effective immediately                          |
|   |                   | <b>2.1.1 No-load speed control</b>  |                |  |
|   |                   | Single-axis no-load speed (X)   | 30000          | mm/minEffective immediately                    |
|   |                   | Single-axis no-load speed (Y)   | 30000          | mm/minEffective immediately                    |
|   |                   | Single-axis no-load speed (W)   | 6000           | mm/minEffective immediately                    |
|   |                   | Single-axis no-load acceleration (X)  | 10000          | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Single-axis no-load acceleration (Y)  | 10000          | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Single-axis no-load acceleration (W)  | 2000           | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Single-axis no-load acceleration change time (X)  | 50             | msEffective immediately                        |
|   |                   | Single-axis no-load acceleration change time (Y)  | 50             | msEffective immediately                        |
|   |                   | Single-axis no-load acceleration change time (W)  | 50             | msEffective immediately                        |
|   |                   | <b>2.2.0 Machining precision control</b>  |                |  |
|   |                   | Magnification smoothing time  | 0              | sEffective immediately                         |
|   |                   | Deceleration acceleration on stop   | 15000          | mm/s <sup>2</sup> Effective immediately        |
|   |                   | Corner error  | 0.05           | m/mEffective immediately                       |
|   |                   | Stop when connection speed is 0   | Yes            | Effective immediately                          |
| Manufacturer  |                   | Parameter name: Single-axis no-load acceleration (W)<br>Value: 2000mm/s <sup>2</sup><br>Description: Maximum no-load acceleration of the W-axis during machining. |                |  |

Single axis no-load speed (W): 6000mm/min;  
Single axis no-load acceleration (W): 2000mm/s<sup>2</sup>;  
Single axis no-load acceleration Time (W): 50ms;

### 4.1.3.6: W Axis Signal Association

External devices

Port settings

Log list

| Address           | Polarity | Sampling | Description                           |
|-------------------|----------|----------|---------------------------------------|
| LD21E-04.Fln6     | NO       | S:1ms    | Follower error occurring              |
| LD21E-04.Fln7     | NO       | S:1ms    | Floating head calibration in progress |
| LD21E-04.Fln8     | NO       | S:1ms    | Follower not calibrated               |
| LD21E-04.Fln9     | NO       | S:1ms    | Frog jumping                          |
| LD21E-04.Fln10    | NO       | S:1ms    | Frog jump command error               |
| LD21E-04.Fln11    | NO       | S:1ms    | Touching plate                        |
| LD21E-04.Fln12    | NO       | S:1ms    | Follower in position                  |
| LD21E-04.Fln13    | NO       | S:1ms    | Follower lower limit                  |
| LD21E-04.Fln14    | NO       | S:1ms    | Capacitance surge                     |
| LD21E-04.Fln15    | NO       | S:1ms    | Excessive penetration at edge         |
| LD21E-04.Fln16    | NO       | S:1ms    | Follower upper limit                  |
| LD21E-04.Fln18    | NO       | S:1ms    | Reached plate surface position        |
| LD21E-04.Fln19    | NO       | S:1ms    | Nozzle bottom or side close to plate  |
| EX41A.X00         | NO       | S:4ms    | W-axis positive limit                 |
| EX41A.X01         | NO       | S:4ms    | W-axis negative limit                 |
| EX41A.X02         | NO       | S:4ms    | W-axis mechanical origin              |
| EX41A.X03         | NO       | S:4ms    | Cutting head alarm                    |
| EX41A.X04         | NO       | S:4ms    | Low lubrication pressure              |
| EX41A.X07         | NO       | S:1ms    | Time reversal anomaly                 |
| EX31A.X00         | NO       | S:4ms    | Exchange worktable                    |
| EX31A.X01         | NO       | S:4ms    | Release bed                           |
| EX31A.X02         | NO       | S:4ms    | Bed released                          |
| EX31A.X05         | NO       | S:4ms    | Exchange table locked                 |
| EX31A.X06         | NC       | S:4ms    | Safety door in position               |
| EX31A.X07         | NO       | S:4ms    | Z-axis negative limit (upper)         |
| EX31A.X08         | NO       | S:4ms    | Lower table entry                     |
| EX31A.X09         | NO       | S:4ms    | Upper table entry                     |
| Output port       |          |          |                                       |
| LD21E-04.Axis0_On |          |          | X-axis servo enabled                  |
| LD21E-04.Axis1_On |          |          | Y-axis servo enabled                  |
| LD21E-04.Axis2_On |          |          | Z-axis servo enabled                  |
| LD21E-04.Axis3_On |          |          | Y2-axis servo enabled                 |

Test on

Test off

Cancel test

Cancel all

Filtering

Change polarity

Machining

Process

Monitoring

Operation report

Settings

Maintenance

Advanced

EX41A.X00 NO (normally open) W-Axis Positive Limit  
EX41A.X01 NO (normally open) W-Axis Negative Limit

## 4.1.4: LS6000M Bus System Configuration

### 4.1.4.1: W Axis Parameter Configuration

Common parameters
System parameters
Driver settings
Follower control
Laser settings
Regular maintenance reminder for machine tools

Parameter overview

- Basic machine tool parameters
  - 1.0 Axis parameter settings
    - 1.0.0 X-axis parameters
    - 1.0.1 Y-axis parameters
    - 1.0.2 Z-axis parameters
    - 1.0.3 W-axis parameters
  - 1.1 Home position setting
  - 1.2 Error compensation settings
- Speed and precision control
- External device control
- Advanced function parameters

| Name   | Value | Unit   | Effective time        |
|--|-------|--------|-----------------------|
| 1.0.3 W-axis parameters                        |       |        |                       |
| Driver station address 1 (W)                   | 5     |        | Effective on restart  |
| Driver station address 2 (W)                   | 15    |        | Effective on restart  |
| Slave address internal axis offset address (W) | 0     |        | Effective on restart  |
| Axis direction (W)                             | 1     |        | Effective immediately |
| Lead screw pitch (W)                           | 8     | mm     | Effective immediately |
| Encoder resolution (W)                         | 13    |        | Effective immediately |
| Encoder type (W)                               | 0     |        | Effective on restart  |
| Electronic gear ratio numerator (W)            | 8192  |        | Effective immediately |
| Electronic gear ratio denominator (W)          | 10000 |        | Effective immediately |
| Soft limit upper value (W)                     | 30    | mm     | Effective immediately |
| Soft limit lower value (W)                     | -39   | mm     | Effective immediately |
| Enable soft limit protection (W)               | Yes   |        | Effective immediately |
| Maximum axis speed (W)                         | 6000  | mm/min | Effective immediately |
| Check axis encoder error (W)                   | No    |        | Effective immediately |
| Encoder steady state tolerance (W)             | 0.1   | mm     | Effective immediately |
| Encoder dynamic tolerance (W)                  | 40    | mm     | Effective immediately |

Manufacturer

Parameter name: Maximum axis speed (W)  
Value: 6000mm/min  
Description: Maximum speed of W axis

Machining
Process
Monitoring
Operation report
Settings
Maintenance
Advanced



## LCS03 Platform Configuration

100 collimation, 200 focus:

Driver slave address 1 (W): 5;  
Driver slave address 2 (W): 15;  
Axis direction: 1;  
Lead screw pitch: 8;  
Encoder resolution: 13 bits;  
Encoder type: 0;  
Electronic gear ratio numerator (W): 8192;  
Electronic gear ratio denominator (W): 10,000;;  
Upper soft limit (W): 26;  
Lower soft limit (W): -32;  
Soft limit protection enabled (W): Yes;  
Maximum axis speed (W): 6000mm/min;

100 collimation 125 focus, 100 collimation 150 focus:

Driver slave address 1 (W): 5;  
Driver slave address 2 (W): 15;  
Axis direction: 1;  
Screw pitch: 4.5;  
Encoder resolution: 13 bits;  
Encoder type: 0;  
Electronic gear ratio numerator (W): 8192;  
Electronic gear ratio denominator (W): 10,000;;  
Upper soft limit (W): 15;  
Lower soft limit (W): -18;  
Soft limit protection enabled (W): Yes;  
Maximum axis speed (W): 6000mm/min;

**Parameter overview**

- Basic machine tool parameters
  - 1.0 Axis parameter settings
    - 1.0.0 X-axis parameters
    - 1.0.1 Y-axis parameters
    - 1.0.2 Z-axis parameters
    - 1.0.3 W-axis parameters
  - 1.1 Home position setting
    - 1.1.0 Common parameters
    - 1.1.1 X-axis origin setting
    - 1.1.2 Y-axis origin setting
    - 1.1.3 Z-axis origin setting
    - 1.1.4 W-axis origin setting
  - 1.2 Error compensation settings
- ▶ Speed and precision control
- ▶ External device control
- ▶ Advanced function parameters

| Name                           | Value    | Unit   | Effective time        |
|--------------------------------|----------|--------|-----------------------|
| <b>1.0.3 W-axis parameters</b> |          |        |                       |
| Driver station address 1 (W)   | No       |        | Effective immediately |
| Driver station address 1 (W)   | <b>1</b> |        | Effective immediately |
| Driver station address 1 (W)   | 120      | mm/min | Effective immediately |
| Driver station address 2 (W)   | 3        | mm/min | Effective immediately |
| Driver station address 1 (W)   | 30       | mm     | Effective immediately |
| Driver station address 2 (W)   | 3        | mm/min | Effective immediately |
| Driver station address 1 (W)   | 0.5      | mm     | Effective immediately |
| Driver station address 2 (W)   | Yes      |        | Effective immediately |
| Driver station address 1 (W)   | 1        |        | Effective immediately |

Manufacturer:  

Parameter name: Coarse positioning phase direction (W)  
 Value: 1  
 Description: During the mechanical origin return process, the direction of movement in the coarse positioning phase. 1: Positive direction; -1: Negative direction.

Machining

Process

Monitoring

Operation

**Settings**

Maintenance

Advanced

retraction distance: 15;

#### 4.1.4.3: Focus Control Configuration

Common parameters

System parameters

Driver settings

Follower control

Laser settings

Regular maintenance reminder for machine tools

Search

Parameter overview

Basic machine tool parameters

▶ 1.0 Axis parameter settings

▶ 1.1 Home position setting

▶ 1.2 Error compensation settings

▶ Speed and precision control

External device control

3.0 Monitoring

3.1 Lubrication

3.2 Gas control

▶ 3.3 Smoke extraction

▶ 3.4 Exchange worktable

▶ 3.5 Focus control

3.5.1 Common parameters

3.5.2 Cutting head

3.5.3 General focusing parameters

3.5.4 Focusing parameters

3.6 Nozzle cleaning

▶ 3.7 Buzzer

3.9 Safety door

▶ Advanced function parameters

| Name                              | Value | Unit | Effective time        |
|-----------------------------------|-------|------|-----------------------|
| 3.5.1 Common parameters           |       |      |                       |
| Enable focus control              | Yes   |      | Effective on restart  |
| Focus control mode                | 2     |      | Effective on restart  |
| 3.5.2 Cutting head                |       |      |                       |
| Cutting head type                 | 0     |      | Effective on restart  |
| COM port name                     |       |      | Effective on restart  |
| 3.5.3 General focusing parameters |       |      |                       |
| Focus compensation type           | 1     |      | Effective on restart  |
| 3.5.4 Focusing parameters         |       |      |                       |
| Focus position detection delay    | 1000  | ms   | Effective immediately |
| Home position detection delay     | 20    | s    | Effective immediately |
| Pulei focus confirmation delay    | 100   | ms   | Effective immediately |
| Preleigh focusing delay           | 15    | ms   | Effective immediately |
| Preleigh cutting head type        | 0     |      | Effective immediately |

Manufacturer

Parameter name: Enable focus control

Value: Yes

Description: Whether to enable the focus control feature. Yes: Enabled; No: Disabled.

Machining

Process

Monitoring

Operation report

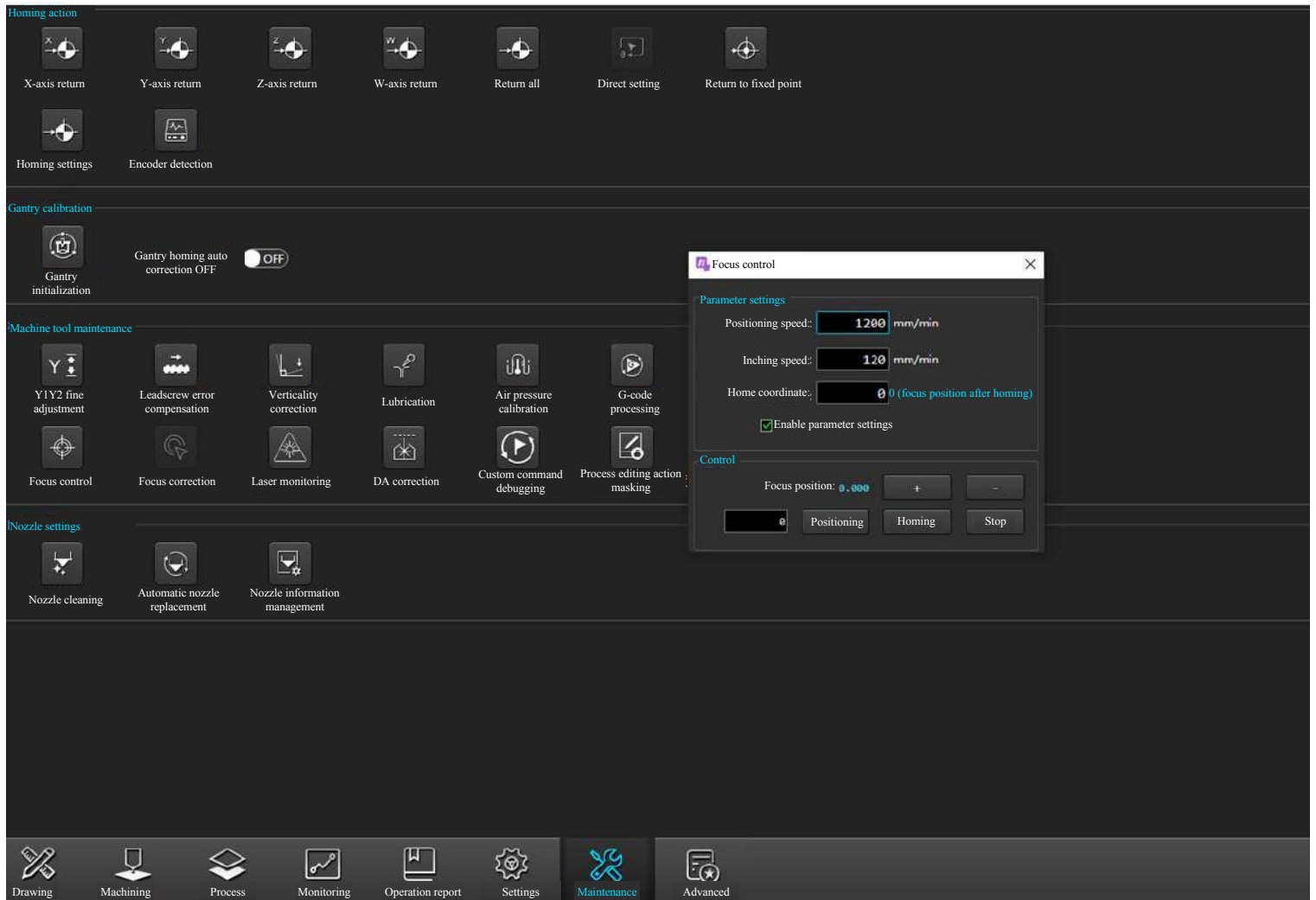
Settings

Maintenance

Advanced

Focus control enabled: Yes;  
Focus control mode: EtherCAT Bus

#### 4.1.4.4: Focus Control Configuration



Positioning speed: 1200mm/min;  
Jogging speed: 120mm/min;  
Home coordinate: 0;  
Parameter setting enabled: Checked;

### 4.1.4.5: W Axis No-Load Speed Setting

| Common parameters  |  | System parameters  |  | Follower control                    |  | Laser settings |  | Regular maintenance reminder for machine tools |  |                       |  |  |  |
|--|--|--|--|-------------------------------------|--|----------------|--|--|--|-----------------------|--|--|--|
| <div>▼</div>   |  | Search   |  | Name                                |  | Value          |  | Unit   |  | Effective time        |  |  |  |
| <div>Parameter overview</div> <div>▶ Basic machine tool parameters</div> <div>▶ Speed and precision control</div> <div>▶ External device control</div> <div>▶ Advanced function parameters</div> |  |  |  | Manual acceleration change time (X) |  | 50             |  | ms   |  | Effective immediately |  |  |  |
|  |  |  |  | Manual acceleration change time (Y) |  | 50             |  | ms   |  | Effective immediately |  |  |  |
|  |  |  |  | Manual acceleration change time (Z) |  | 50             |  | ms   |  | Effective immediately |  |  |  |
|  |  |  |  | Manual acceleration change time (W) |  | 250            |  | ms   |  | Effective immediately |  |  |  |
|  |  |  |  | 2.1.0 Machining speed control       |  |                |  |  |  |                       |  |  |  |
|  |  |  |  | Perimeter traversal speed           |  | 30000          |  | mm/min   |  | Effective immediately |  |  |  |
|  |  |  |  | Machining acceleration              |  | 5000           |  | mm/s^2   |  | Effective immediately |  |  |  |
|  |  |  |  | Maximum speed for reference circle  |  | 5000           |  | mm/min   |  | Effective immediately |  |  |  |
|  |  |  |  | Maximum turning acceleration        |  | 5000           |  | mm/s^2   |  | Effective immediately |  |  |  |
|  |  |  |  | Machine tool rigidity coefficient   |  | 1              |  |  |  | Effective immediately |  |  |  |
|  |  | 2.1.1 No-load speed control  |  |                                     |  |                |  |  |  |                       |  |  |  |
|  |  | Single-axis no-load speed (X)  |  | 30000                               |  | mm/min         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load speed (Y)  |  | 30000                               |  | mm/min         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load speed (W)  |  | 6000                                |  | mm/min         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration (X)   |  | 10000                               |  | mm/s^2         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration (Y)   |  | 10000                               |  | mm/s^2         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration (W)   |  | 2000                                |  | mm/s^2         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration change time (X)   |  | 50                                  |  | ms             |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration change time (Y)   |  | 50                                  |  | ms             |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Single-axis no-load acceleration change time (W)   |  | 50                                  |  | ms             |  | Effective immediately                          |  |                       |  |  |  |
|  |  | 2.2.0 Machining precision control  |  |                                     |  |                |  |  |  |                       |  |  |  |
|  |  | Magnification smoothing time   |  | 0                                   |  | s              |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Deceleration acceleration on stop  |  | 15000                               |  | mm/s^2         |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Corner error   |  | 0.05                                |  | mm             |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Stop when connection speed is 0  |  | Yes                                 |  |                |  | Effective immediately                          |  |                       |  |  |  |
|  |  | Parameter name: Single-axis no-load acceleration (W)<br>Value: 2000mm/s^2<br>Description: Maximum no-load acceleration of the W-axis during machining. |  |                                     |  |                |  |  |  |                       |  |  |  |
| Manufacturer   |  |  |  |                                     |  |                |  |  |  |                       |  |  |  |

Single axis no-load speed (W): 6000mm/min;  
Single axis no-load acceleration (W): 2000mm/s<sup>2</sup>;  
Single axis no-load acceleration Time (W): 50ms;

## 4.1.4.6: W Axis Signal Association

External devices

Port settings

Log list

| Address           | Polarity | Sampling | Description                           |
|-------------------|----------|----------|---------------------------------------|
| LD21E-04.Fln6     | NO       | S:1ms    | Follower error occurring              |
| LD21E-04.Fln7     | NO       | S:1ms    | Floating head calibration in progress |
| LD21E-04.Fln8     | NO       | S:1ms    | Follower not calibrated               |
| LD21E-04.Fln9     | NO       | S:1ms    | Frog jumping                          |
| LD21E-04.Fln10    | NO       | S:1ms    | Frog jump command error               |
| LD21E-04.Fln11    | NO       | S:1ms    | Touching plate                        |
| LD21E-04.Fln12    | NO       | S:1ms    | Follower in position                  |
| LD21E-04.Fln13    | NO       | S:1ms    | Follower lower limit                  |
| LD21E-04.Fln14    | NO       | S:1ms    | Capacitance surge                     |
| LD21E-04.Fln15    | NO       | S:1ms    | Excessive penetration at edge         |
| LD21E-04.Fln16    | NO       | S:1ms    | Follower upper limit                  |
| LD21E-04.Fln18    | NO       | S:1ms    | Reached plate surface position        |
| LD21E-04.Fln19    | NO       | S:1ms    | Nozzle bottom or side close to plate  |
| EX41A.X00         | NO       | S:4ms    | W-axis positive limit                 |
| EX41A.X01         | NO       | S:4ms    | W-axis negative limit                 |
| EX41A.X02         | NO       | S:4ms    | W-axis mechanical origin              |
| EX41A.X03         | NO       | S:4ms    | Cutting head alarm                    |
| EX41A.X04         | NO       | S:4ms    | Low lubrication pressure              |
| EX41A.X07         | NO       | S:1ms    | Time reversal anomaly                 |
| EX31A.X00         | NO       | S:4ms    | Exchange worktable                    |
| EX31A.X01         | NO       | S:4ms    | Release bed                           |
| EX31A.X02         | NO       | S:4ms    | Bed released                          |
| EX31A.X05         | NO       | S:4ms    | Exchange table locked                 |
| EX31A.X06         | NC       | S:4ms    | Safety door in position               |
| EX31A.X07         | NO       | S:4ms    | Z-axis negative limit (upper)         |
| EX31A.X08         | NO       | S:4ms    | Lower table entry                     |
| EX31A.X09         | NO       | S:4ms    | Upper table entry                     |
| Output port       |          |          |                                       |
| LD21E-04.Axis0_On |          |          | X-axis servo enabled                  |
| LD21E-04.Axis1_On |          |          | Y-axis servo enabled                  |
| LD21E-04.Axis2_On |          |          | Z-axis servo enabled                  |
| LD21E-04.Axis3_On |          |          | Y2-axis servo enabled                 |

Test on

Test off

Cancel test

Cancel all

Filtering

Change polarity

Machining

Process

Monitoring

Operation report

Settings

Maintenance

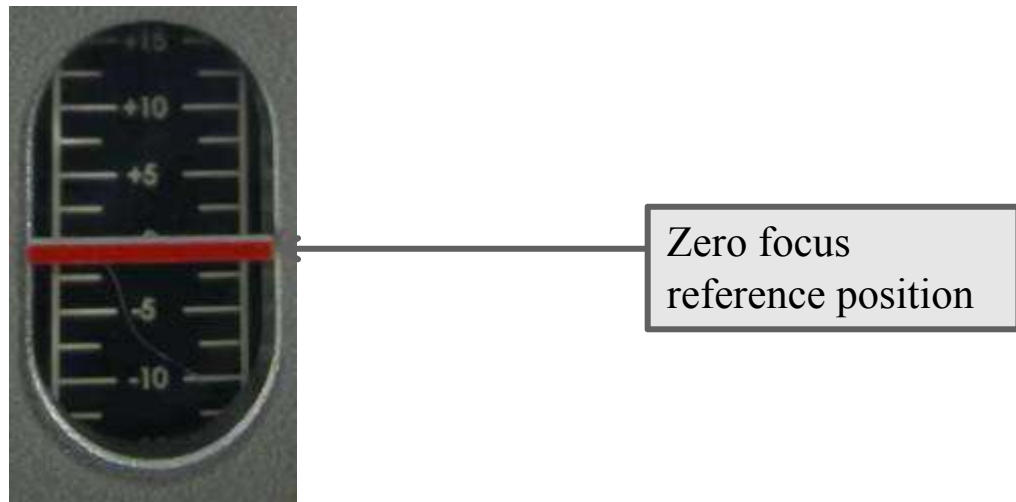
Advanced

EX41A.X00 NO (normally open) W-Axis Positive Limit  
EX41A.X01 NO (normally open) W-Axis Negative Limit



## 4.2 Observing Scales

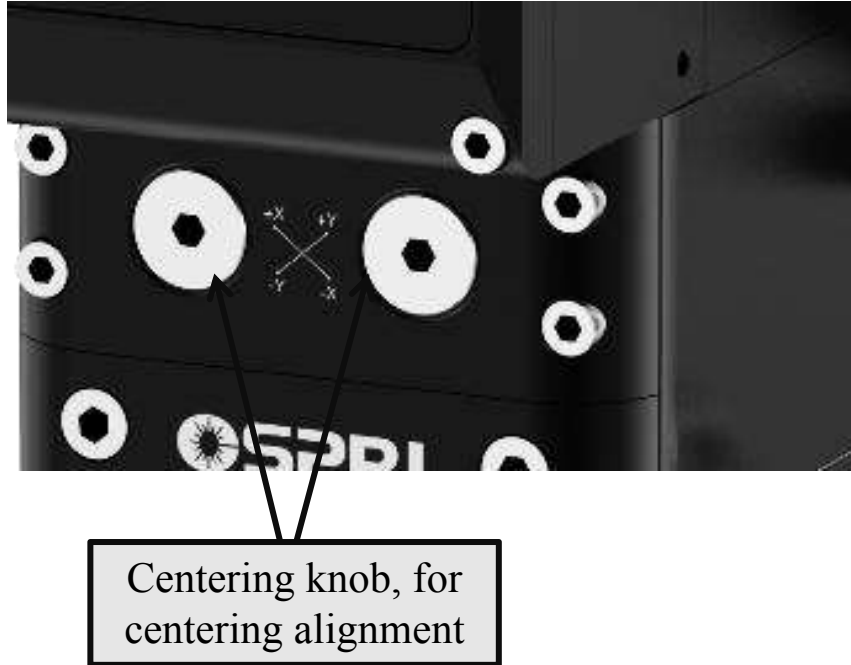
After setting, open the cutting software and reset the focus to observe whether the focus moves, as shown in the figure below:



Note: The scale numbers are for reference only, and the actual zero point shall be subject to the actual focus. Different lasers may vary.

## 4.2 Collimation Adjustment Instructions

The laser beam must be kept in the center of the nozzle to achieve good joint-cutting effect. When it deviates from the center of the nozzle, it needs to be adjusted through the beam centering module.

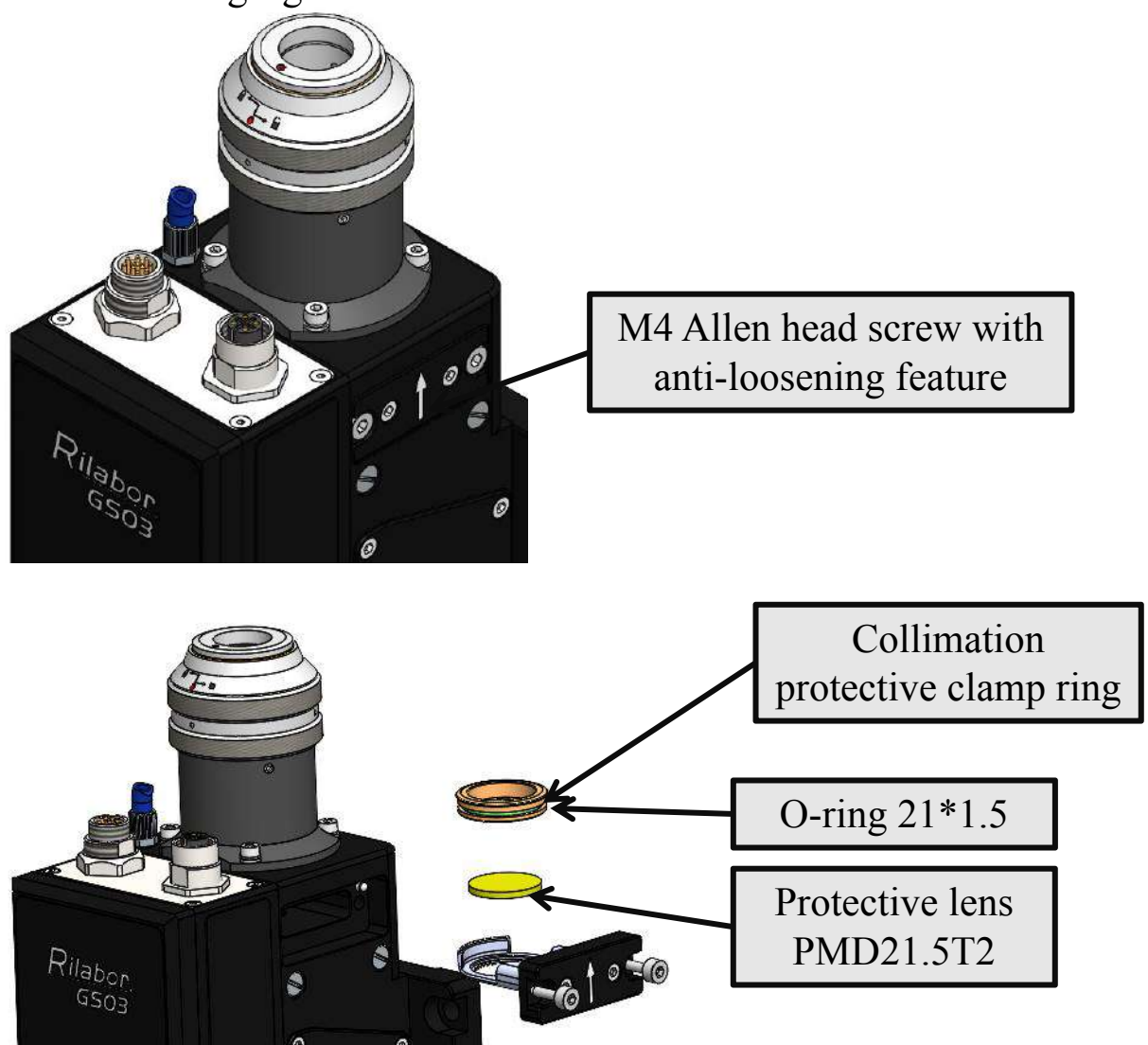


# Chapter 5 Product Maintenance

## 5.1 Maintenance and Replacement of Protective Lens

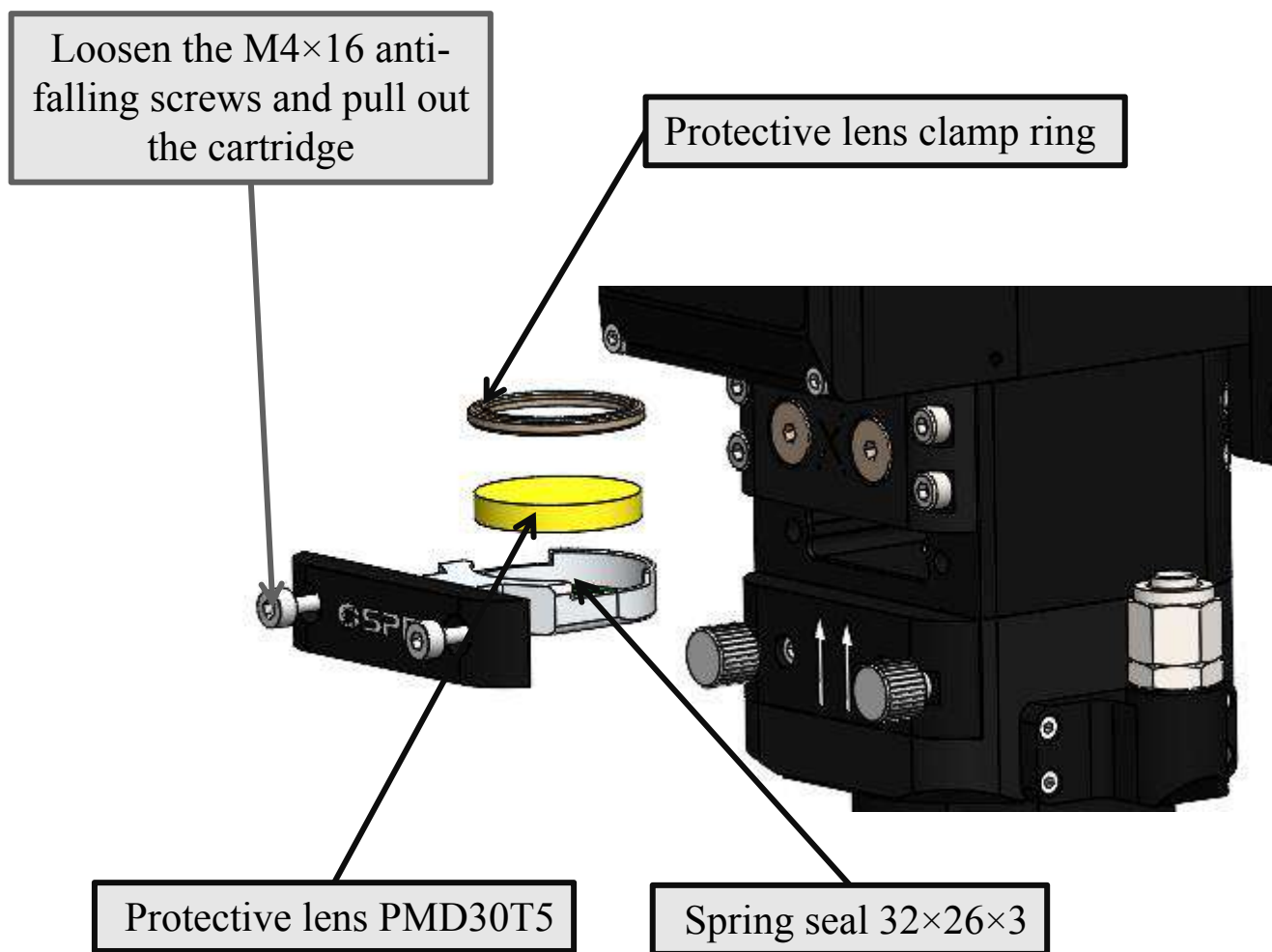
In case poor cutting performance occurs while cutting protective lens is normal, but burning points on the ceramic piece, the collimation protective lens or focus protective lens possibly is polluted or damaged. In this condition, please pull out the protective lens cartridge to check the lens. Before checking, use a clean cloth dampened with alcohol to wipe the exterior clean.

5.1.1 Disassembly of Collimation Protective Lens The disassembly method is as shown in the following figure:



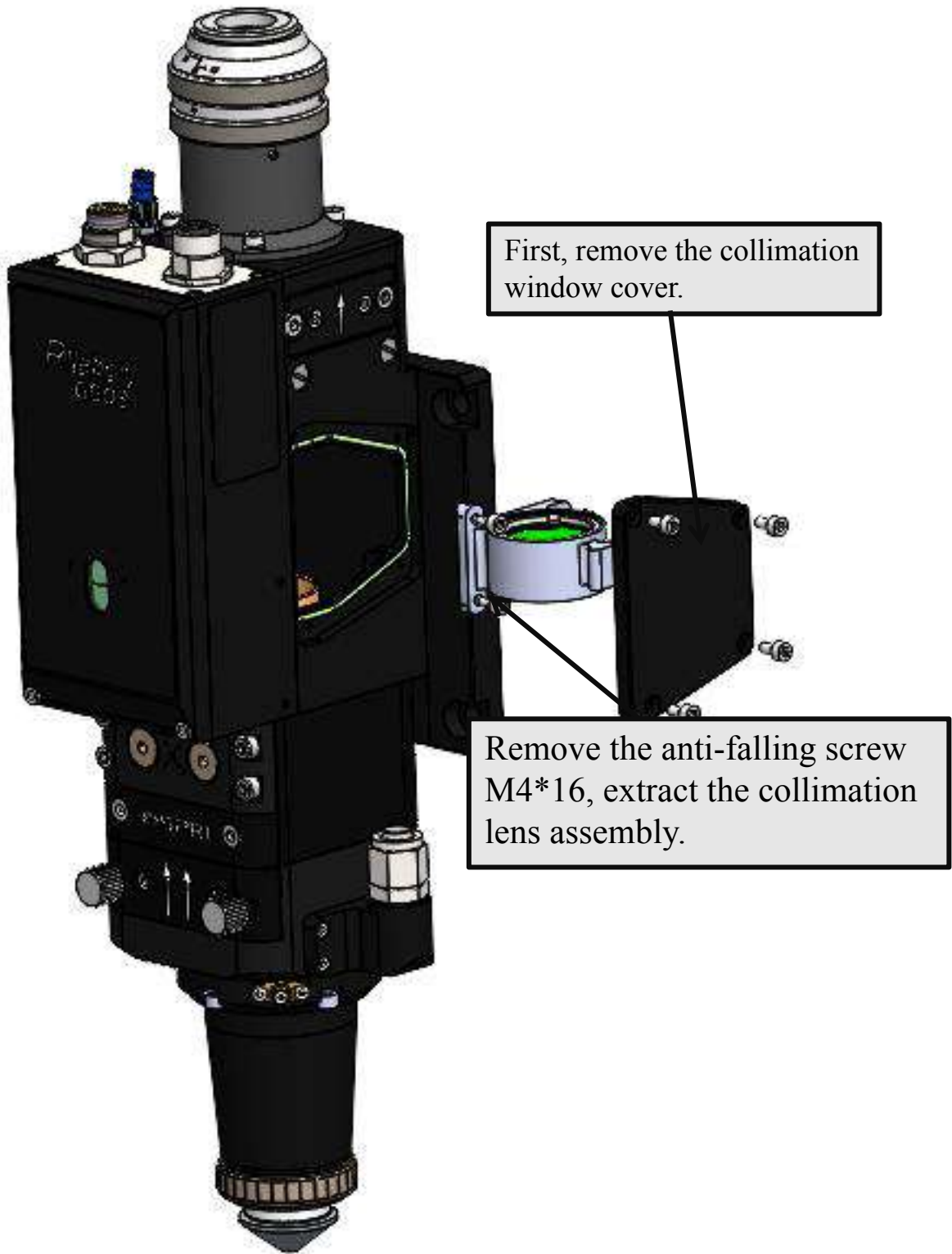
### 5.1.2 Disassembly and Assembly of Focus Protective Lens

Loosen the two M4×16 hexagon socket anti-falling screws, pull out the protective lens cartridge, and replace the protective lens (PMD30T5).



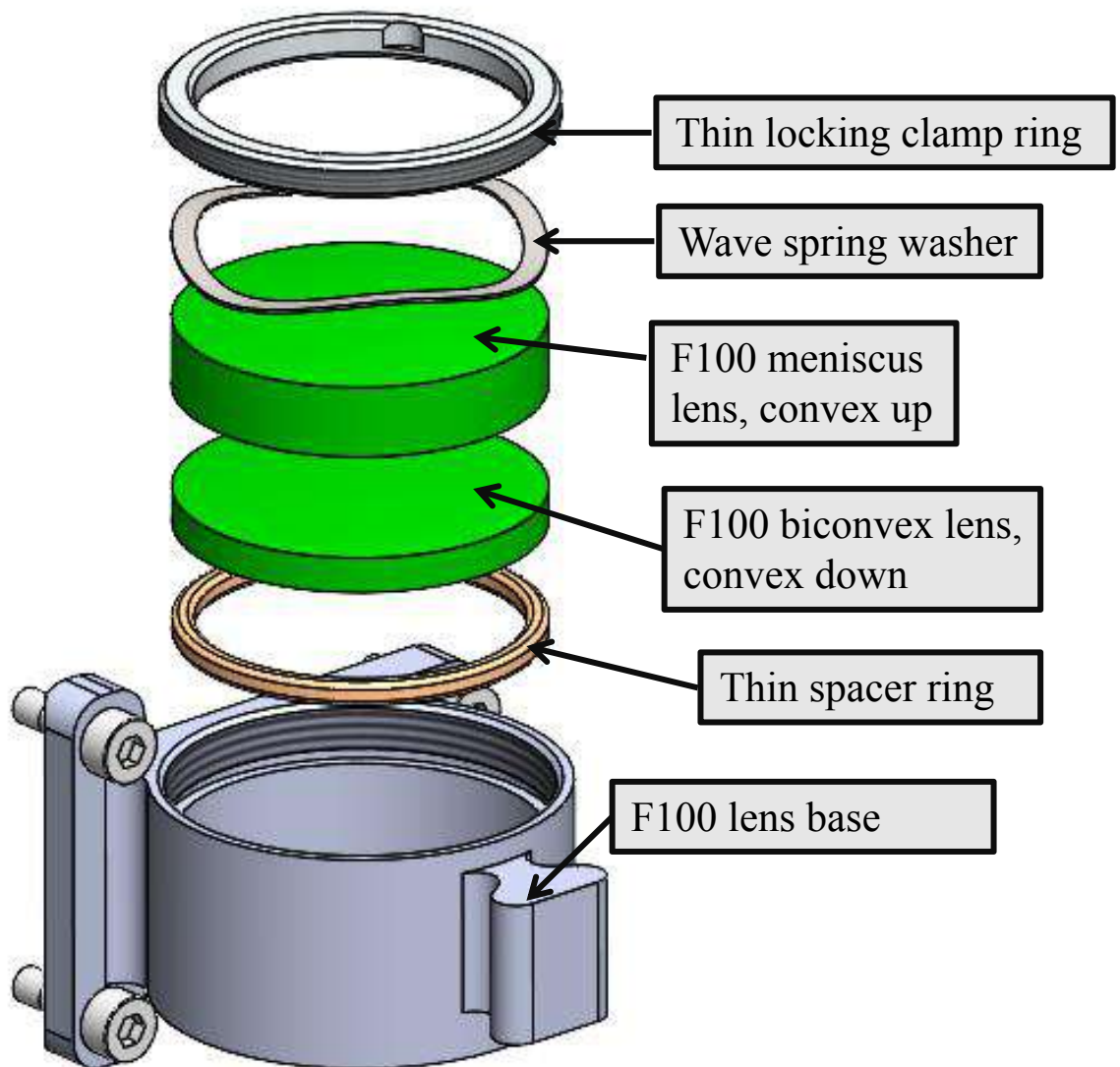
## 5.2 Maintenance and Replacement of Collimation Lens

### 5.2.1 Disassembly of Collimation Lens





### 5.2.1.1 Disassembly and Assembly of Collimation Lens F100



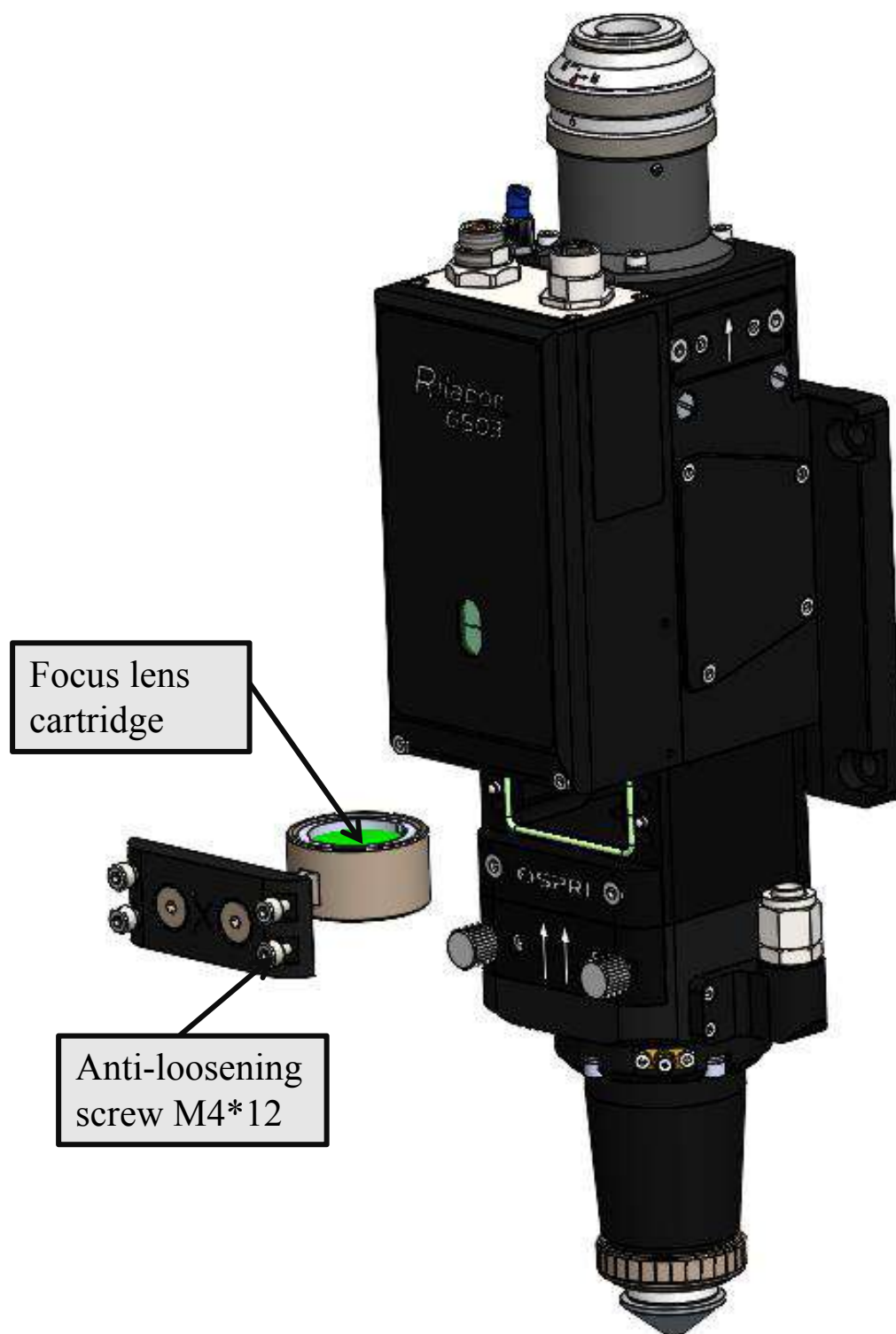
### 5.2.2 Cleaning of Collimation Lens



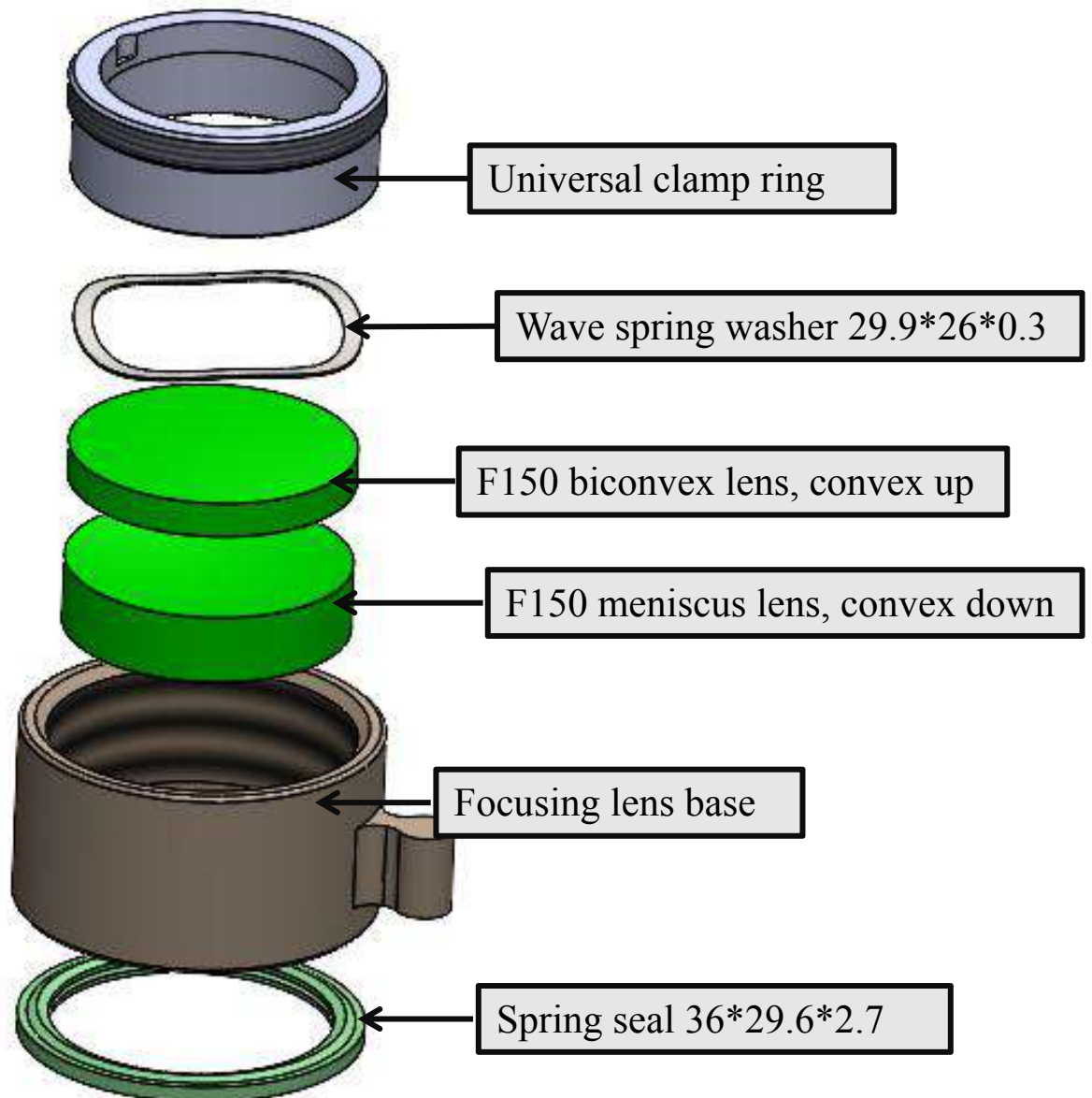
- ①Tools: Dust-free wiping swabs, isopropyl alcohol, dry and pure compressed air.
- ②Spray isopropyl alcohol onto the dust-free wiping swabs.
- ③Gently pinch the both sides of the lens with the left thumb and index finger.
- ④Hold the wiping swabs with right hand to gently wipe both sides of the lens in a single direction from bottom to top or from left to right, and blow the lens surface with the rubber air blower to confirm that there is no foreign matters on the cleansed lens surface.
- ⑤The cleaned collimation lens must be installed into the collimation lens base and inserted into the cutting head as soon as possible.

## 5.3 Maintenance and Replacement of Focus Lens

### 5.3.1 Disassembly and Assembly of Focus Lens



### 5.3.1.1 Disassembly and Assembly of Focus Lens



### 5.3.2 Cleaning of Focus Lens



- ①Tools: Dust-free wiping swabs, isopropyl alcohol, dry and pure compressed air.
- ②Spray isopropyl alcohol onto the dust-free wiping swabs.
- ③Gently pinch the both sides of the lens with the left thumb and index finger.
- ④Hold the wiping swabs with right hand to gently wipe both sides of the lens in a single direction from bottom to top or from left to right, and blow the lens surface with the rubber air blower to confirm that there is no foreign matters on the cleansed lens surface.
- ⑤The cleaned focus lens must be installed into the focus lens base and inserted into the cutting head as soon as possible.

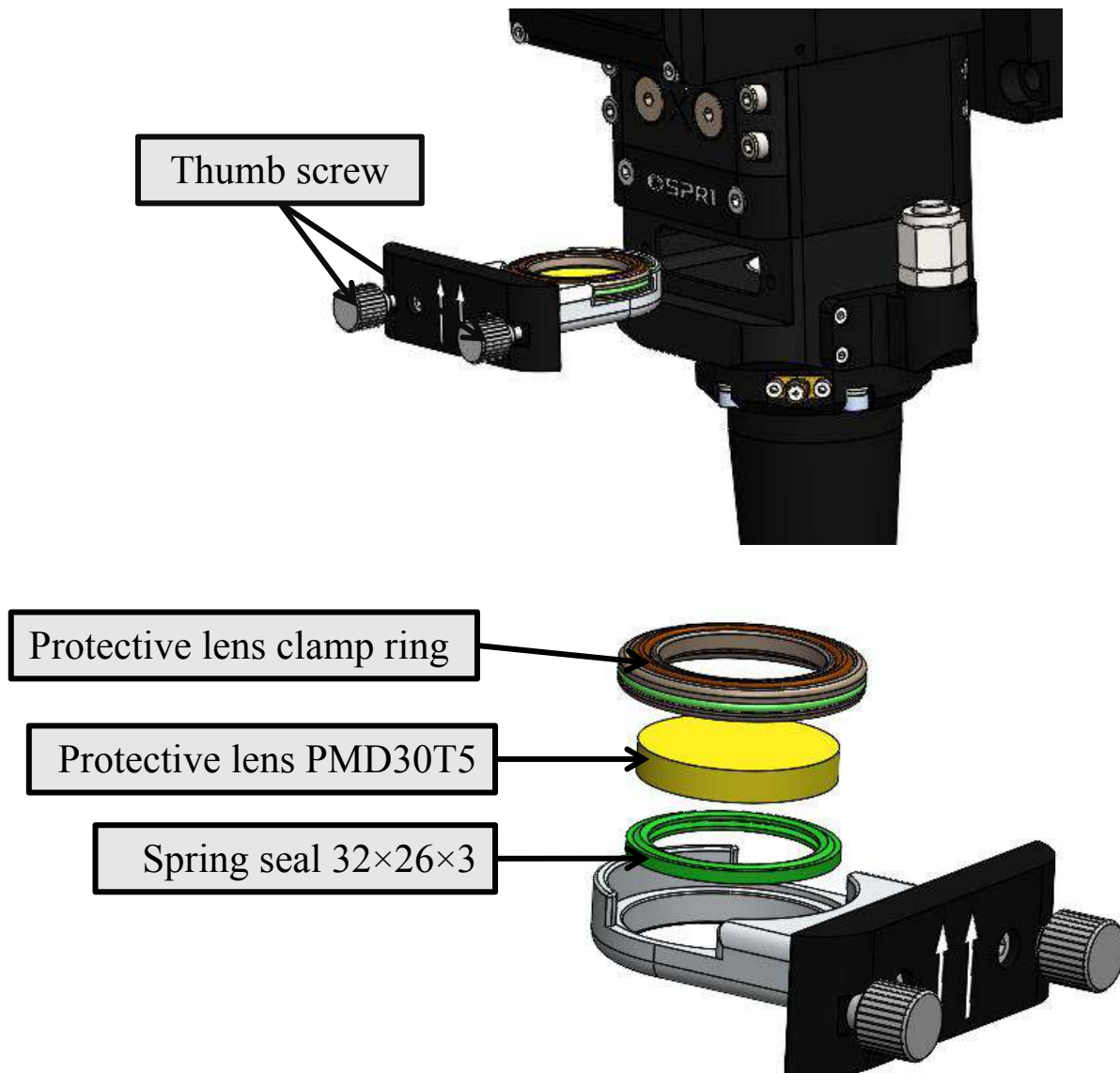


## 5.4 Maintenance of Cutting Protective Lens

When the protective lens has impurities or foreign matters, they will absorb laser and heat up, resulting in damage to protective lens. Therefore, it is recommended to clean the protective lens once a week. Besides, the protective lens is a wearing part and should be replaced in time if damaged.

### 5.4.1 Disassembly of Protective Lens

Loosen the thumb screws with hand, hold the screws and slowly pull out the focus protective lens assembly, and move it to a clean and dust-free environment.



The assembly sequence is as shown in the figure above

### 5.4.2 Cleaning of Protective Lens



- ①Tools: Dust-free wiping swabs, isopropyl alcohol, dry and pure compressed air.
- ②Spray isopropyl alcohol onto the dust-free wiping swabs.
- ③Gently pinch the both sides of the lens with the left thumb and index finger.
- ④Hold the wiping swabs with right hand to gently wipe both sides of the lens in a single direction from bottom to top or from left to right, and blow the lens surface with the rubber air blower to confirm that there is no foreign matters on the cleansed lens surface.
- ⑤The cleansed lens must be installed into the cutting head's body as soon as possible or stored in other clean and sealed container.

**Attention:** When cleaning and replacing the protective lens, avoid the grease on hands or dust in the environment from contaminating the protective lens . In principle, focusing lenses, collimation lenses, and cutting lenses should not be disassembled. If you feel that the lens is contaminated, you can first take the optical lens for testing. If necessary, you can contact the technical staff of our company.

## 5.5 Maintenance of Sensor Parts

Ceramic body is a wearing part but can be replaced after being damaged. The ceramic body should be aligned with the two locating pins of the body in the installation process. Otherwise, the ceramic body cannot be properly installed in place, thus causing operating failure of the sensor component. When locking the ceramic, tighten it with the locking nut. The different degree of tightness on locking nuts would directly affect the operating parameters of the sensor parts.

The laser nozzle is the sensitive element of the sensing component and is connected to the body through the thread. It is a wearing part. After it has worked for a period of time, it is necessary to remove the bonded slag and replace it in time when the burning loss is serious.

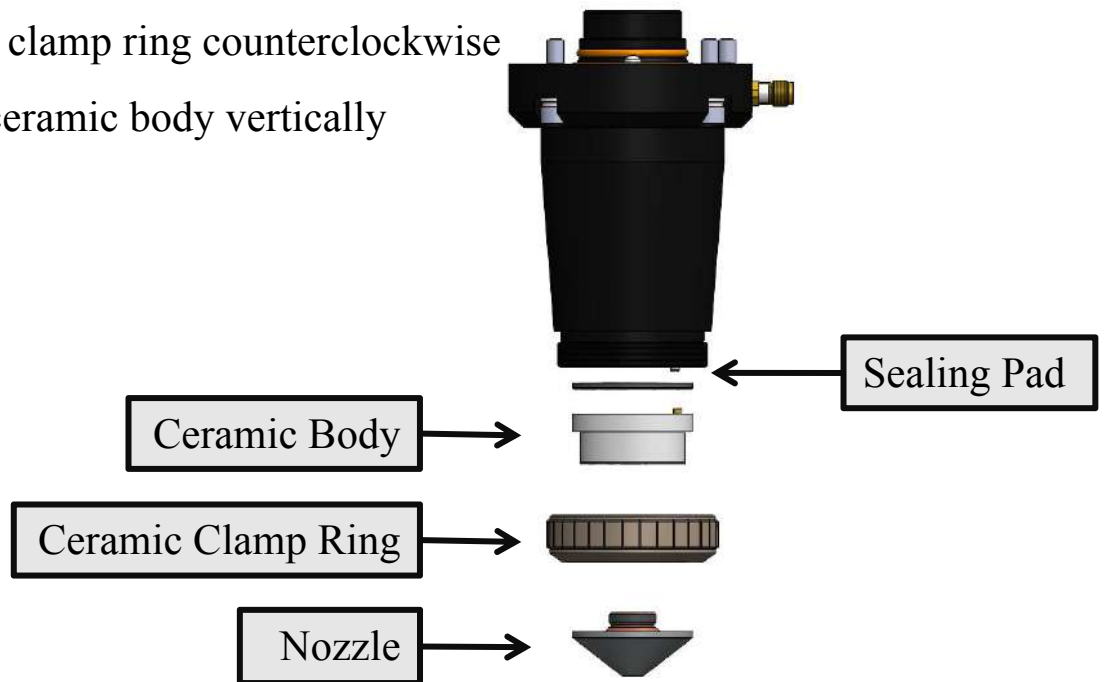
After assembling the ceramics, tighten the locking nut and expose the ceramic evenly about 2-3mm.

### **The following cautions should be taken in use:**

- ① Dry and clean auxiliary gas should be used when cutting. If there is water, oil and other impurities in the gas, mutations may occur at working clearance, and even cause work disorder of the sensor. It is suggested to use high purity oxygen and configure the gas dryer, oil-water separator and other devices.
- ② The sensor after being defaced should be cleaned with clean and dry cotton cloths, etc. Do not use liquid to clean the cutting head and ceramic, and then connect and assemble it properly after cleaning.
- ③ The ceramic body can be replaced after being damaged. After ceramic body is replaced, an initialization of electrical system together with the amplifier should be conducted through a reset operation.
- ④ The shape and size of the cutting nozzle would directly affect the characteristics of the sensor. Therefore, specified cutting nozzle must be used.

### 5.5.1 Replacement of Nozzles and Ceramic Body

- ① Screw off the nozzle counterclockwise
- ② Screw off the clamp ring counterclockwise
- ③ Remove the ceramic body vertically downward



### 5.5.2 Cleaning of Ceramic Rings

- ① Take out the ceramic and clean it with anhydrous alcohol or isopropyl alcohol.
- ② Ensure that the ceramic surface is clean and dry without moisture before installation.



**Note:** Cleanliness of ceramic surface is directly related to the operating performance of the following system. It is necessary to clean timely the dirt on the ceramic surface in order to ensure the working performance of the system.



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