



# BM114 SERIES

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6KW Auto-Focusing Laser Cutting Heads User Manual

**RAYTOOLS**



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Thank you for your choosing our product!

This manual makes a detail introduction about the use of BM114 laser cutting head, including installation, setup, operation and service etc. Please directly contact us if you have other things to know.

Please read these instructions carefully before use the series cutting head and relative equipments. This will help you to use it better.

Because the product keeps renewing, please note the product you receive may differ slightly from the illustrations in this manual in some aspects. We apologize for your inconvenience here.

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## 1 Summary

This manual covers the general description of BM114 series products, including the basic installation, factory settings, operation, use and maintenance services and other aspects. The specific Optical mechanical customization configurations are too much, so only the main unit parts will be introduced in this manual.

The BM114 series is an automatic focusing fiber cutting head released by Swiss RAYTOOLS AG in 2016. The product is equipped with external servo motor and internal driver units, which can drive the focus lamp to change position automatically in the range of about 25mm by linear mechanism. Users can continuously focus through setting program to finish the rapid perforation of thick plates and the automatic cutting of plates of varies thickness and material. The product can be equipped with D37 composite lens group to integrate the beam, a variety of interface settings, so that it can be used with a variety of fiber lasers; optimized optical and water-cooled design allows the laser head work under high power steadily for a long time.

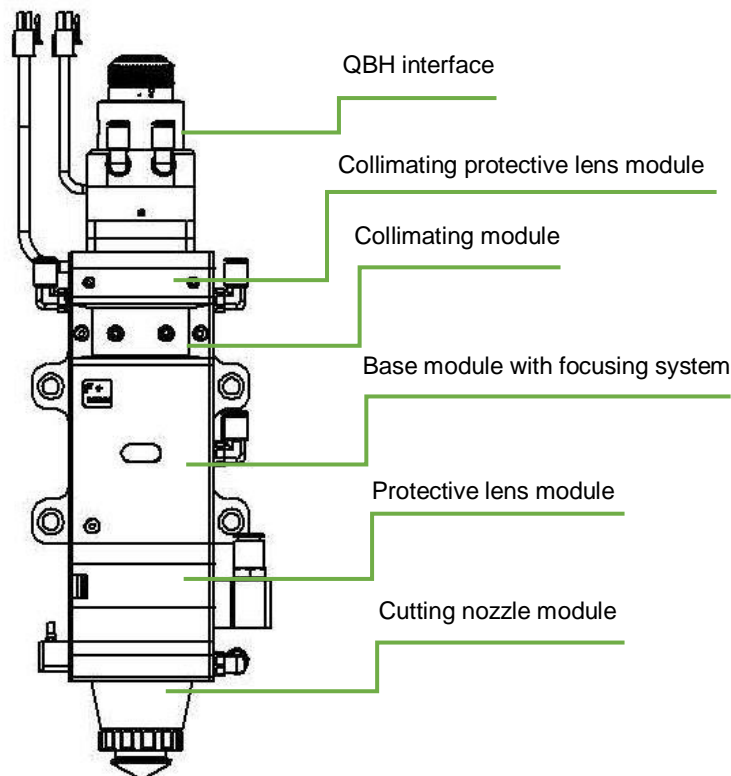


Fig 1 - laser head structure

### 1.1 Product Advantages

- Optimized optical configuration and smooth and efficient airflow design;
- Automatic focusing range + 10 ~ -15mm, adjustment accuracy 0.05mm;
- Equipped with D37 composite lens, the maximum fiber input power can carry 6KW;
- Maximum acceleration of focus lens driver  $10\text{m} / \text{s}^2$ , maximum speed  $10\text{m} / \text{min}$ ;
- The drawer type lens holder make the replacement of protective lens more quickly and easier
- The composite lenses were used for collimation and focusing to obtain the best optical quality and cutting

effect;

- Equipped with QBH, QD and other fiber interfaces can match with various fiber lasers.

## 1.2 Structure & Function

As shown in Figure 1, the laser head consists of four basic units, such as collimating module CM, focusing driving module, protective lens module and nozzle module.

- Collimating module: The collimation function of the optical fiber is collimated after the incident laser is collimated into a parallel beam and the function of tuning;
- Focusing driving module: The collimated beam is focused into a concentrator beam with high power density, and the focus position is automatically adjusted by the driving device;
- Protective lens module: the protective lens protects the focusing lens from damage by returning the slag and prolongs the service life of the focusing lens;
- Nozzle module: Guide the focus beam to the work piece and produce high velocity jet cutting to achieve high quality cutting

## 2 Machinery Installation

### 2.1 Hole site installation installation

BM114 laser machining head and the fixed mounting hole size and position of the machine tool are shown in Figure 3.1. Customers are advised to install the laser head perpendicular to the machined surface as requested and make sure the laser head is locked, which is one of the premises to ensure the follow up sable cutting effect.



**CAUTION:** the Z-axis sliding base for fixing laser processing head should be connected with machine tools and keep a good grounded.

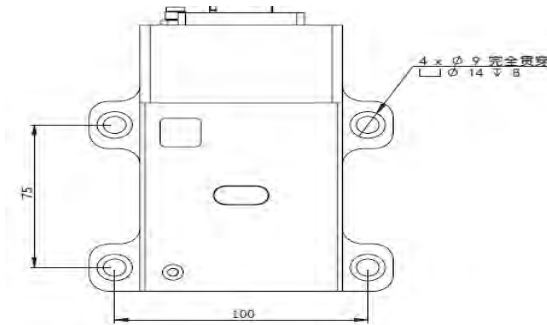


Figure 3.1 — Hole site installation

### 2.2 Connection of Water Pipe and Gas Pipe

#### 2.2.1 Water-cooled interface

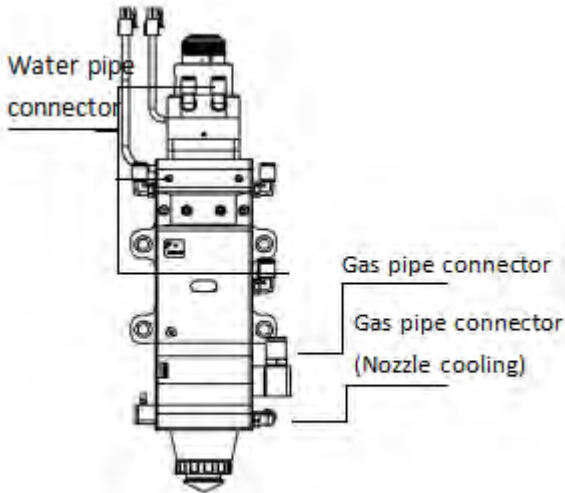
BM114 laser processing head has 3 sets of water-cooled channels which direction of water entry and exit can be arranged arbitrarily. It is important to note that when the laser power is greater than 500 watt hours, it is recommended to use water-cooled.as you can see from Figure 3.2, the position and amount of the water interface, and the right table details the recommended flow velocity.

The design of this water-cooled interface is closed loop water-cooled system, and it also can be used equipped with external water supplied but subjected to the requirements of the list.

Outer diameter of water pipe caliber	6mm
Minimum flow speed	1.8 l/min(0.48gpm)
Entry pressure	170-520kPa(30-60 psi)
Entry temperature	≥room temperture /> dew point
Hardness (relative to CaCO3)	< 250mg/liter
PH range	6 to 8
Particles size available	Diameter less than 200 microns

## 2.2.2 Assist gas interface

The impurity in auxiliary gas such as hydrocarbon and steam will damage the lens and cause cutting power fluctuation as well as inconsistencies between the sections of the work piece. The firm below is the recommended auxiliary gas specification. The higher the purity of the gas, the better the quality of the cutting section.



**Figure 3.2 — Water pipe, Gas pipe**

Impurity can be filtered out in gas supply tube, but Oxygen and water vapor can permeate light path through nonmetal materials, which is the source of the appearance of dust and hydrocarbon. Stainless steel fittings are recommended, at the same time must use filters which can remove a minimum of 0.01 micron particle to purify.

A pressure gauge with a stainless steel diaphragm is recommended. Industrial pressure gauges suck in air. Rubber diaphragm produce hydrocarbon by aging or other factors.

Gas	Purity	Maximum content of water vapor	Maximum content of hydrocarbon
oxygen	99.95%	<5 ppm	<1 ppm
nitrogen	99.99%	<5 ppm	<1 ppm
argon	99.998%	<5 ppm	<1 ppm
helium	99.998%	<5 ppm	<1 ppm
Diameter of auxiliary gas pipe (Outer diameter)		10mm	
Diameter of cooled gas pipe (Outer diameter)		8mm	



**CAUTION:** Gas interface can not be replaced arbitrarily, especially do not use PTFE TAPE, Otherwise, the gas path will be blocked, the normal cutting will not be possible and the laser head parts will be damaged at the same time.

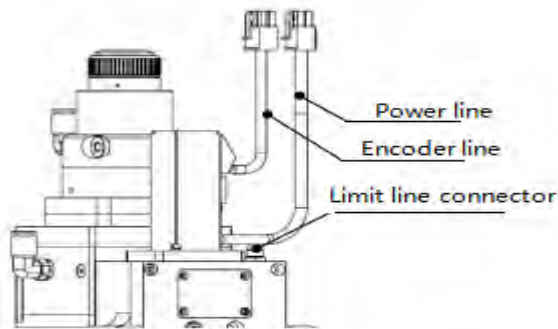


## 2.3 Connection of Cutting Head Cable

This paper mainly introduces the connection between the cable and the cutting head. The control section of the driver and the connection refer to the wiring diagram of each series of system.

### 2.3.1 Connection of Cutting Head and Cable

Connect the corresponding connector of cutting head with motor power cable, encoder cable, sensor cable respectively (as shown in figure 3.3). After the proper length is reserved, the cable is inserted into the track groove of the machine tool and fixed.



**Figure 3.3 — Cable interface of laser cutting head**

### 2.3.2 Cable Connection and Driver Connection

Connect motor power wire and encoder wire with the corresponding interface of driver according to the definition in cable sleeve. The wiring of the drive and limit sensor cables is shown in the wiring diagram of the various wiring systems attached. **Caution: The limiting sensor is divided into high level output and low level output, and the two are normally closed output mode (high level and low level signal are output by the sensor when not triggered); electric relay should be self installed when necessary to carry on the high-low level or the normally open and normally closed conversion.**



**CAUTION:** All wiring is in the state of power failure, and the power can be debugged after inspection.

## 2.4 Fiber Input Interface

BM114 is suitable for most industrial laser generators. It is equipped with collimating mirror assembly

The connection between the end of the fiber and the cutting head is called fiber interface. Commonly used fiber connectors include QBH, QD, etc, and every fiber interface has its unique fixation method. Please refer to corresponding instruction of fiber interface. Figure 5 shows the installation interface of QBH connector.

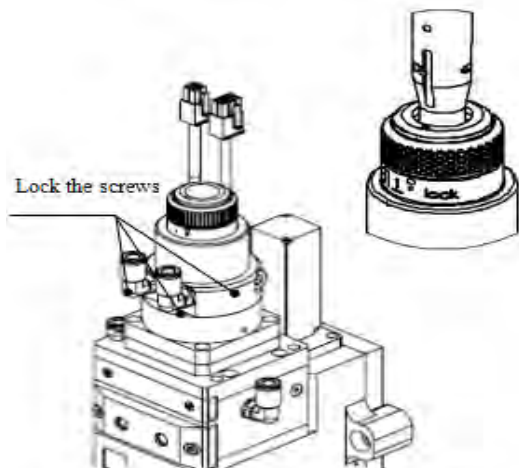
**WARNING:** The optical devices must be kept clean and all dust must be removed before use. If the laser head is vertically inserted in the optical fiber, the laser head must be rotated 90 degrees to the horizontal level and then inserted into the optical fiber to prevent dust from entering the interface and falling on the surface of the lens. Upper limiting in the fiber before fixing the laser head.



## 2.5 Fiber Insertion and Interface Direction Adjustment

In this paper, an optical fiber insertion method is described in conjunction with a QBH joint.

First, align the red point at the end of the QBH interface with the red point of the handwheel; then remove QBH dust proof cover and the red mark of fiber output end is aligned QBH red mark and insert straight to bottom; Then turn the QBH handwheel clockwise. It is in place when you hear the "Da" sound, then pull the handwheel up and turn clockwise again. (see Figure 3.4)



**Figure 3.4 — Diagram of inserting fiber at the QBH interface**

If when the fiber connector insert into the interface, the red dot on fiber is too far away from the red dot on laser head interface, causing an out of alignment insertion, when can refer to steps below to adjust the position of fiber interface on laser head for solving the problem. As shown in Fig. 3.4, unscrew the 4 locking screws of the position of the part icon with a wrench, rotate the QBH interface and screw the locking screws after the red mark is in place.

### 3 System Installation Commissioning

#### 3.1 EtherCAT Installation

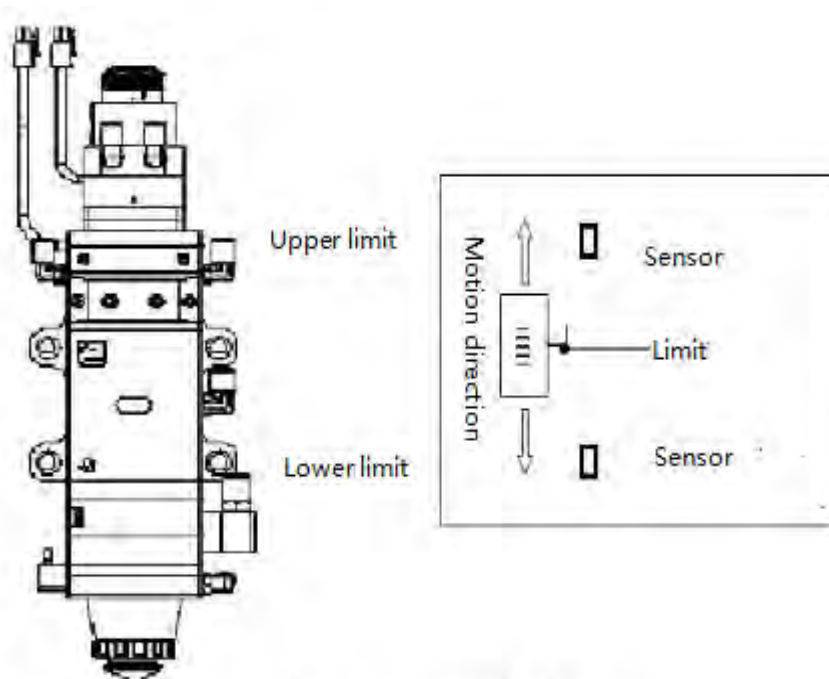
##### 3.1.1 Distribution

- AheadTechs driver + 30W DC motor:  
 The motor is DC servo motor, which should connect the end of the drive L1, L2 respectively with+24V and 0V, and the driver power supply L1C and L2C should connect to 220V exchange L and N.(24V power supply is customer-owned)  
 When EtherCAT is in bus model, the driver in TSM must be placed before 150P device, C5 interface is CAN IN, C6 interface is CAN OUT
- Limit signal:

Black	White	Brown	Blue
Lower limit	Upper limit	+24V	0V

**Note:** the limit sensor is active low, and the signal is often closed, and it continuously outputs 0V signal when it is not triggered. When the configuration bus scheme is used, it needs to connect the relay and be switched to active-high output.

The limit diagram is shown in Figure 4-1.

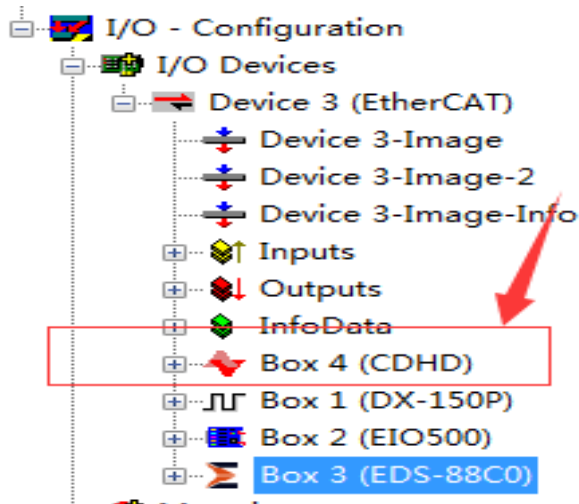


**Figure 4.1 — Limit diagram**

##### 3.1.2 Configure the Hardware

Hardware: bus model driver must be connected before DX-150P. As per: Host - F axis drive - 150P - EIO500 - EDS88C0 (Figure 4.2), connect the F-axis limit and power cord to the I/O, remember the corresponding pin end

number of upper and lower limit. This pin is defined according to field redundant inputs, or expanded cards) The lower limit is in the biFNegLimit, and the upper limit is on the biFPosLimit.

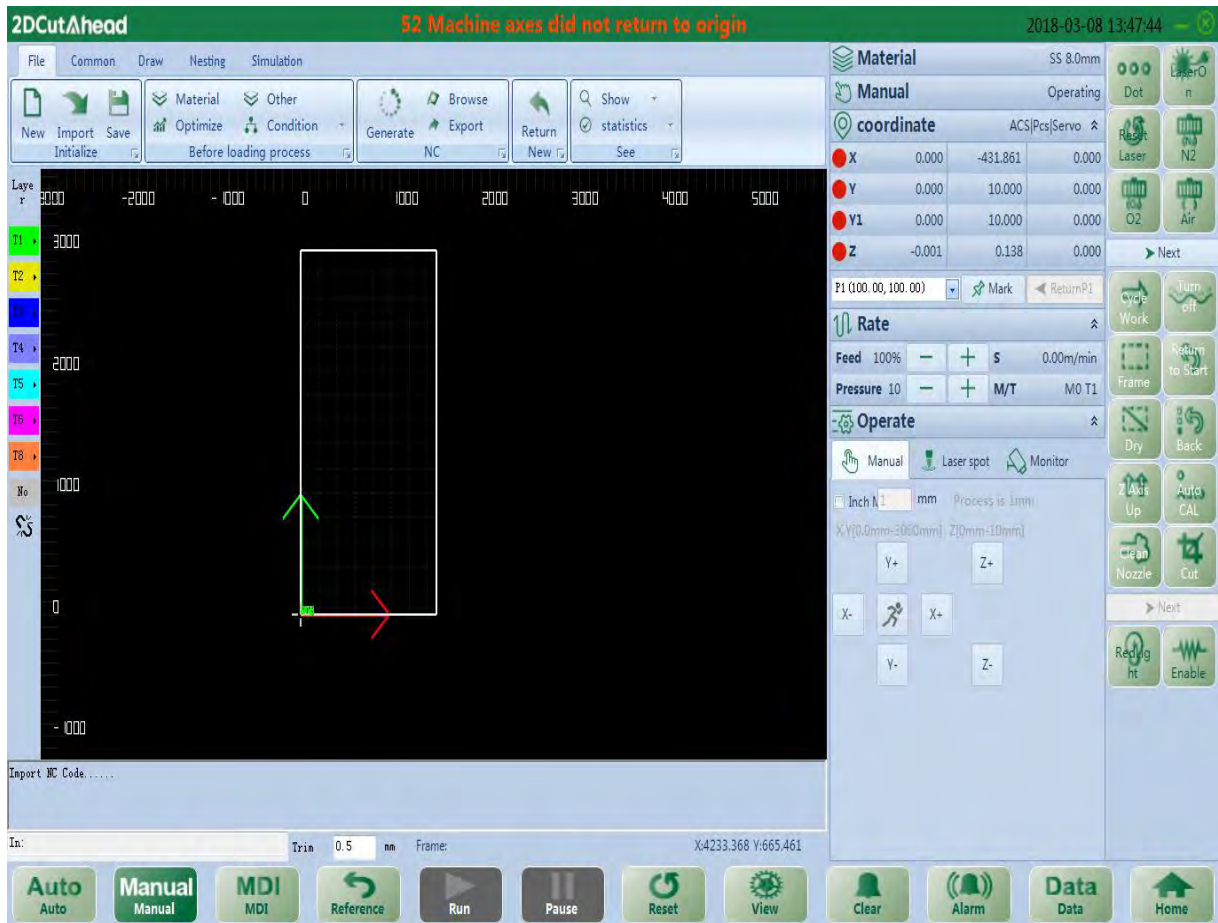


**Figure 4.2 — TSM configuration diagram**

Software: first copy xml files in the driver to C:\TwinCAT\Io\EtherCAT (it's necessary when it's EtherCAT bus model driver, if not and use 150P it need not to), run the HMI interface to change the path to the HMI, and in TSM first let TSM become config mode, and then scan the device. In the pop-up dialog box, select the new add drive, and the 150P on the right, Select before, add the drive, select the F axis in the NC axis, and drive the link to the F axis; In the corresponding card and the corresponding pin, link to PLC in the F axis positive and negative limit field (lower limit biFNegLimit, upper limit biFPosLimit). Activate TSM, run HMI.

### 3.1.3 eInterface Settings and Adjustments

After the configuration is completed, enter the home / settings / super administrator login / factory / function switch / auto focus /F axis, enter the axis parameter /F axis, in the axis parameter, open debugging "TRUE", after setting up, the CNC interface is shown in Figure 4.3.



**Figure 4.3 — CNC Interface**

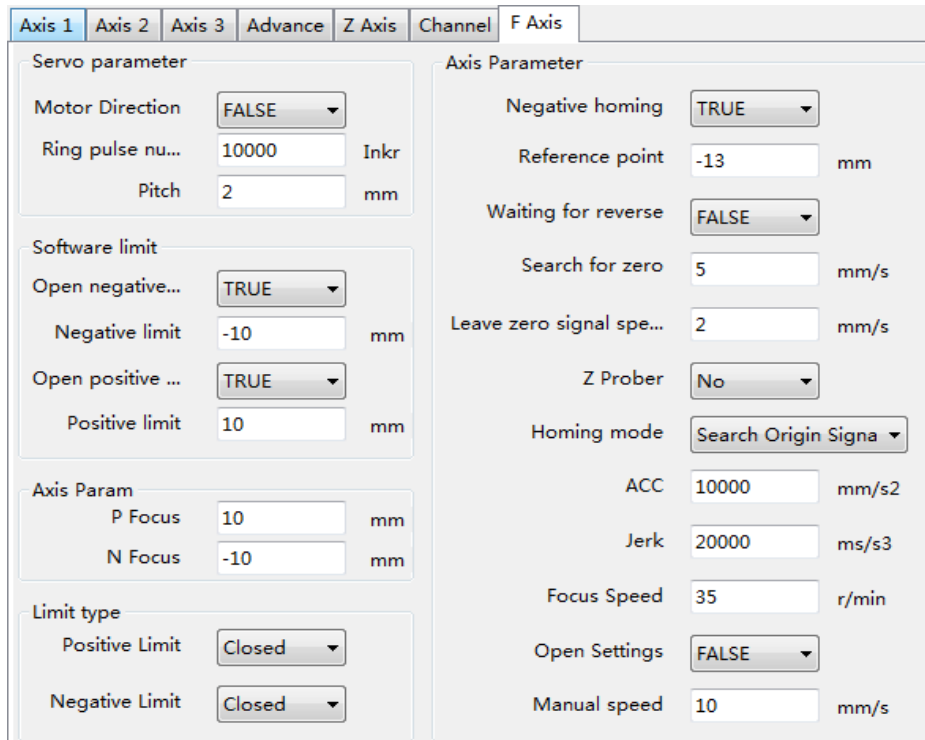
1. Verify the servo parameters (the number of pulses per turn, the number of pulses per turn)
2. Inch F axis, check whether the action is normal (from the pitch and direction), 0 scale upward movement of F+.
3. Slow moving the F axis so that it meets the positive and negative limit, check the signal, the direction is right (positive and negative limit wiring has pipe sleeve mark)
4. Axis parameter (default parameter, shown in Figure 4.4)
  - AheadTechs drive bus pulse 10000 pulse / loop
  - Zoom speed is recommended to set the value to 50-100mm/s
5. F axis zero return, zero focus coke (zero focus position and zero position coincides with the same point) steps:
  - 1) The parameter point position is set to 0.
  - 2) F axis zero return with barrel moving downward and touches lower limit scale at about -13 (note: Upper limit at about +10)
  - 3) View the position on the cutting head. For example, -10.
  - 4) Reset the parameter point position to -10.
  - 5) Return to zero again.
  - 6) Laser dotting confirms whether coke is zero.
  - 7) By manually move the F tuning, find focus position. Record the coordinates at this time. For

example, -1.

- 8) Change the parameter point position to -9.
- 9) Again back to zero, this zero zero position and focal position overlap, change focus finish.

After the zero return, the F axis is moved up and down, so that it touches the limit, records the machine tool coordinates, and enter coordinates of the upper and lower limits into the positive focus and negative focus of the F axis.

### 7.Setting the corresponding soft limit parameter



**Fig 4.4-Axis parameter interface**

**Note: negative return to zero must be true, reverse wait sync pulse, acceleration, acceleration factor, speed of change need not be modified, according to the default mode!**

### 3.1.4 Cutting Parameter Setting

When cutting different plates, in the process parameters, fill in different cutting, perforation, focus position and other parameters (for example, carbon steel, cutting the focus of 1.5, the focus of the perforation is 2, and other parameters, such as Figure 4.5)

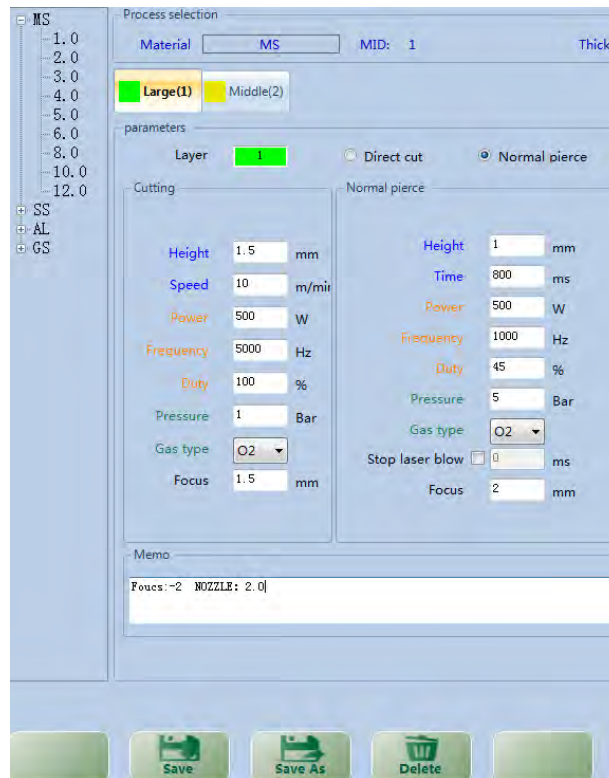


Figure 4.5 — Process interface

## 3.2 BC with position mode

### 3.2.1 Distribution

- AheadTechs driver + 30W DC motor:  
The motor is DC servo motor, which should connect the end of the drive L1, L2 respectively with +24V and 0V, and the driver power supply L1C and L2C should connect to 220V exchange L and N. (24V power supply is customer-owned)
- Limit signal:

Black	White	Brown	Blue
Lower limit	Upper limit	+24V	0V

**Note:** the limit sensor is active low, and the signal is often closed, and it continuously outputs 0V signal when it is not triggered. The limit diagram is shown in Figure 4-1.

### 3.2.2 Software Settings

Open the platform configuration tool, enter the value shown in Figure 4.6

1. Set parameter as the figure.



2. Select J axis for detection, open loop point movement control. Move or detect the encoder in the (-14mm~+9mm) stroke to determine the encoder direction.
3. Save the parameters and enter the interface

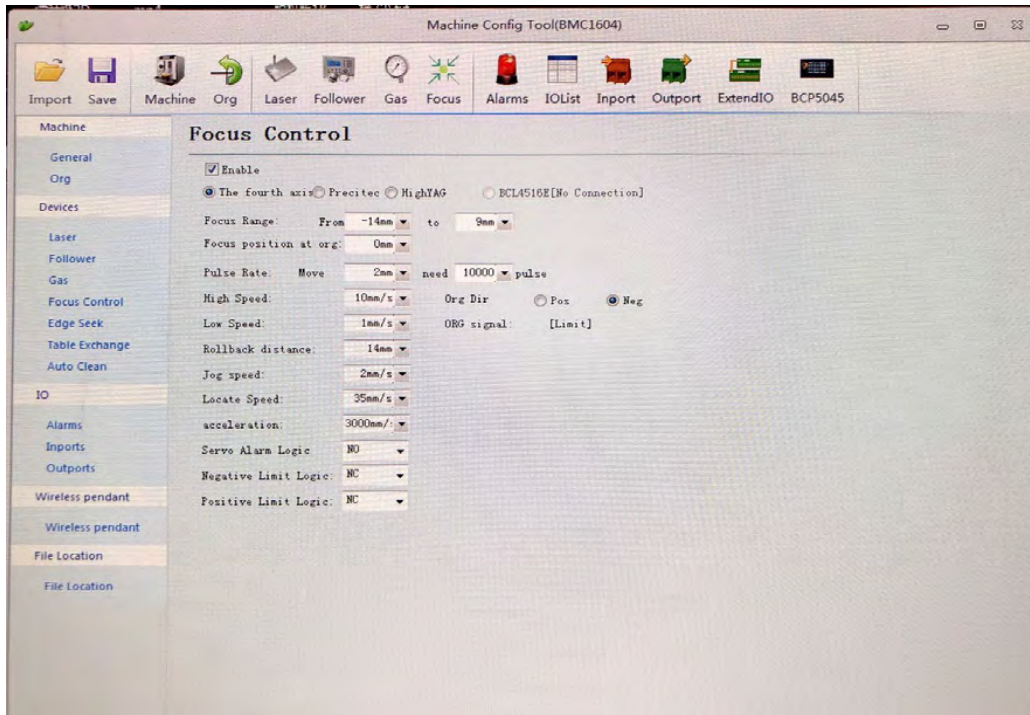


Figure 4.6 — Platform configuration tools

### 3.2.3 Interface Operation

1. Inch J axi, check up if the action is normal(distance to “pitch” and direction), 0 scale moves up to J+.
2. Slow moving the J axis so that it meets the positive and negative limit, check whether the direction, the signal is normal or not.
3. Click zero returning icon, J axis move to negative direction and return zero again when touches negative limit, at the same time ,the position of zero point coincides with zero foal position and the zero returning is finished.

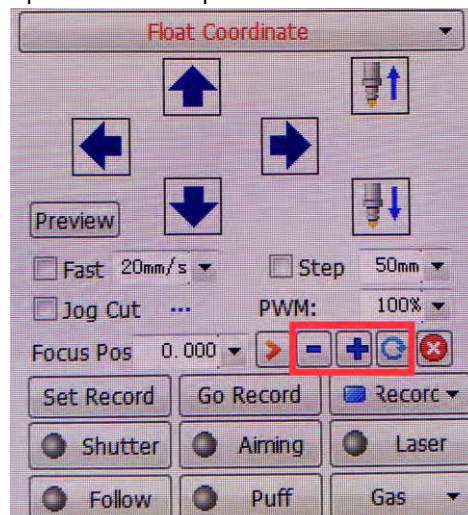


Figure 4.7— Operation interface



**Note:**

1. Click+, the barrel move upward. When it touches positive limit, click -, then barrel move downward to the negative limit.
2. The direction of origin is negative, and take lower limit as a sampling signal.
3. Pitch 2mm, 10000 pulses one turn
4. Positioning speed recommended setting 50-100mm/s.

### 3.3 BC with velocity mode

#### 3.3.1 Distribution

1. AheadTechs driver + DC motor :

The motor is DC servo motor, which should connect the end of the drive L1, L2 respectively with +24V and 0V , and the driver power supply L1C and L2C should connect to 220V exchange L and N.(24V power supply is customer-owned)

2. Limit Signal:

Black	White	Brown	Blue
Lower limit	Upper limit	+24V	0V

**Note: the limit sensor is active low, and the signal is often closed, and it continuously outputs 0V signal when it is not triggered. The limit diagram is shown in Figure 4-1.**

#### 3.3.2 Software settings

The axis parameter settings are shown in Figure 4.8.

Entry J axis detection, "closed loop movement control", inch J axis, detect whether the action is normal, 0 scale moving upward is J+, encoder and speed detection.

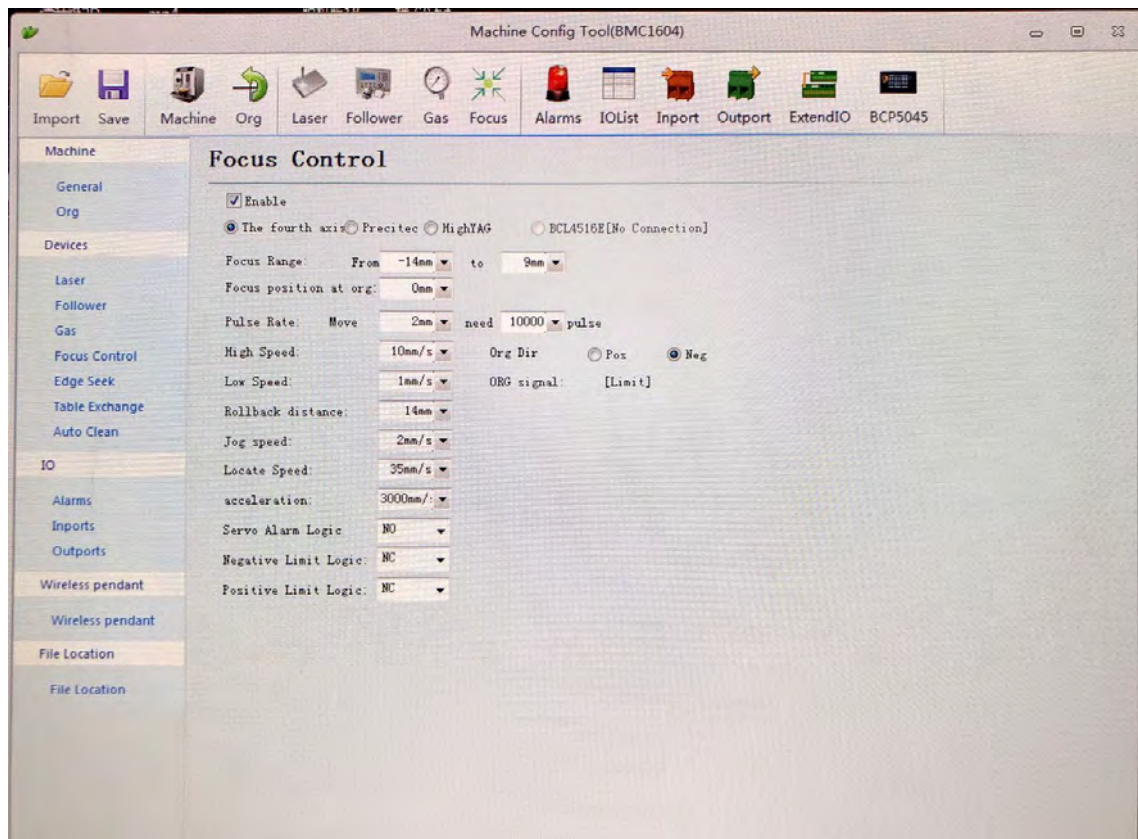


Figure 4.8— Platform configuration tools

### 3.3.3 Interface Operation

1. Close to upper limit. Inch J axis after ensure there's no warning and detect whether the action is normal(distance to "pitch" and direction), 0 scale moving upward is J+
2. Slow moving J axis so that it touches the positive and negative limit, detect whether the signal and direction is right.(The positive and negative limit wiring has the pipe sleeve mark)
3. Click zero returning icon, J axis move to negative direction and turn to zero again after touching the negative limit. At the moment zero point position coincides with zero focus position, the zero returning is finished.

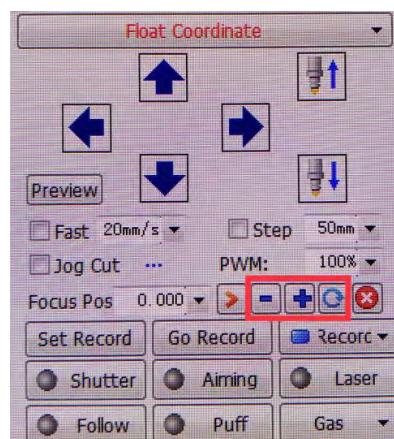


Figure 4.9— Operation interface

**Note:**

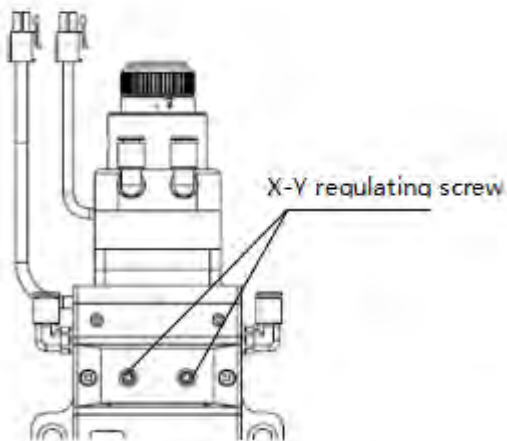
1. Click +, the barrel move upward, click - when it touches negative limit. The barrel move downward and arrive negative limit.
2. The direction of origin is negative, and take lower limit as a sampling signal.
3. Pitch 2mm, 10000 pulses one turn.
4. Positioning speed recommended setting 50-100mm/s.

## 4 Beam Adjustments and Focusing

### 4.1 Beam Adjustments (QBH interface)

Cutting quality in a great extent depend on whether the lens is in the middle. If the lens is not in the middle, the laser beam may contact with nozzle or inner wall to produce high temperature deformation. Lens centering operation should be considered when nozzle is replaced or the cutting quality is decreased.

Lens centering of laser cutting head can be finished by adjusting Collimating mirror, X-Y direction. The adjusting screw is located on the top of the cutting head as shown in Figure 5.1. By using inner hexagon spanner can loosen or screw the adjusting screw until the beam is located in the middle of nozzle. Make sure the laser beam output from the center of nozzle. A method commonly used tape dotting method:



**Figure 5.1 — Beam center-regulation**

Pick a scotch tape, flatten it, and attach it to the center of nozzle which directly below the hole end face;  
 Open the inner guiding red light of the laser. Find and observe the position of nozzle center that the red light in the scotch tape relative to;

Next open and adjust laser generator at the range of 80W-100W and dot manually.

Tear off the tape and check the hole in the center of the nozzle;

Repeat the above steps to find the optimum relative nozzle center position of the beam;

This adjustment requires a series of adjustments, which is the basic operation of general laser tuning.

## 4.2 The Focus Position Adjustment

BM114 is equipped with automated focusing system. But it still need dot manually to redecide the focus position when it reset of replacement of lenses, lasers. For details about operating system parameters, please refer to the system instructions.

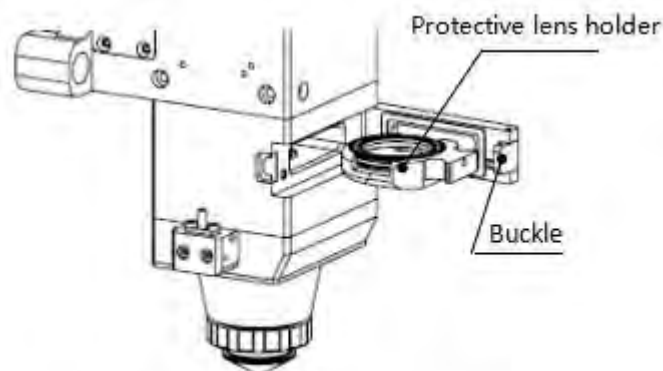
Manual focus can refer to the following steps:

1. The laser head scale is displayed to the maximum, and the laser power range is set to 80-100w;
2. Then, within each moving 0.5mm (as small as possible), open a laser hole on the textured paper;
3. Drilling several times, finally compare and find out the scale corresponding to the smallest hole is zero coke, that is, the focus is just at the end of the nozzle section.

## 5 Maintenance

### 5.1 Cleaning Lens

It's necessary to maintain lenses regularly because of the characteristic of laser cutting process. Once a weak cleaning the protective lenses is recommended. The collimating lenses and focusing lenses are recommended to clean once every 2~3 months. In order to facilitate the maintenance of the protective lens, the protective lens holder adopts a drawer type structure. (Figure 6.1)



**Figure 6.1 — Take out protective lens**

Lens cleaning

- a. Tools: Dust-proof gloves or finger stall, long fiber cotton stick, ethanol, rubber gas blowing.
- b. Cleaning instruction:
  1. The left thumb and index finger with fingertip;
  2. Spray ethanol onto the absorbent cotton stick
  3. Hold the slide edge of the lens with left thumb and index finger gently.(note: avoid the fingertip touching

the surface of the lens)

- Put the lens facing to eyes, hold the absorbent cotton stick with the left hand. Wipe the lens gently in single direction, from bottom to top or from left to right, ( Should not be able to wipe back and forth, so as not to secondary pollution of the lens)and use rubber blowing to sway the surface of the lens. Both sides should be cleaned. After cleaning, make sure that there is no residual: detergent, absorbent cotton, foreign matter and impurities.

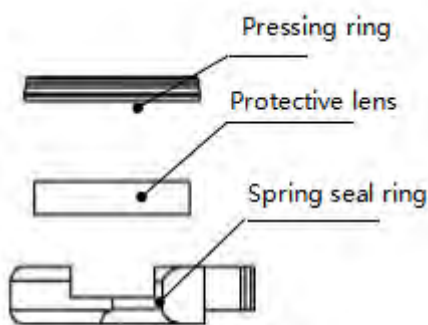
## 5.2 Removal and Installation of Lenses

The whole process needs to be completed in a clean place. Wear dust-proof gloves or fingertips when removing or installing the lenses.

### 5.2.1 Removal and Installation of Collimating Protective Lenses

The protective lens are a fragile part and need to be replaced after damage.

- As shown in Figure 6.1, open the buckle, open the cover of protective lens, pinch the two sides of the drawer-type lens holder and pull out the base of protective lens;
- Remove the pressure washer of the protective lens , remove the lens after wearing fingertips
- Clean the lens, lens holder and seal ring. The elastic seal ring should be replaced if damaged.
- Install the new cleaned lens (Regardless of the positive or negative side) into the drawer type lens holder.
- Put the pressure washer of the protective lens back.
- Insert the protective lens holder back to the laser processing head, cover the lid of the protective lens and fasten the buckle.

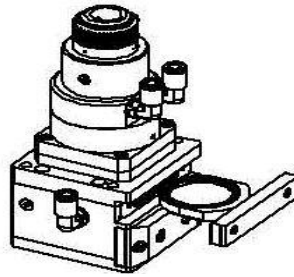


**Figure 6.2 — Structure of protective lens**

### 5.2.2 Removal and Installation of Collimating Lenses

The collimating protective lenses are a fragile part and need to be replaced after damage.

- Use a 2.5mm inner hexagon spanner to unscrew the screw of collimating protective lens (as shown in figure 6.3);

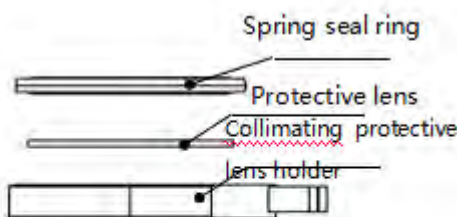


**Figure 6.3 — Take out collimating protective lens**

- Remove the gland of collimating protective lens, pinch the two sides of the drawer-type lens holder and pull out the base of protective lens;
- Seal the part connected with the components of collimating protective lens with textured paper so as to prevent the entry of dust;
- Wear the fingerstall and take out the lens;
- Clean the lenses, lens holder and seal rings, for example, replace a new one for the damaged elastic seal ring;
- Install the new lens (regardless of the front and back sides) wiped clean into the drawer-type lens holder;
- Re-install the seal ring;
- Re-insert the collimating protective lens holder to the laser processing head, cover the lid of collimating protective lens and tighten the locking screw.



**Note:** It is not allowed to directly pull out of the edge of the elastic seal ring, which will damage the elastic seal ring very easily.



**Figure 6.4 — Structure of collimating protective lens**

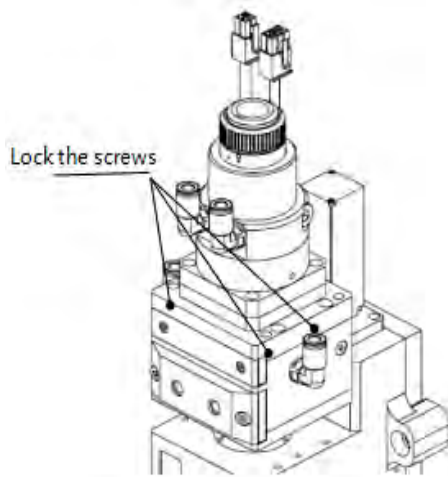
### 5.2.3 Removal and Installation of Collimating Lenses

- Removal and installation of collimating lenses refer to the following steps:
- Remove the laser head and move to a clean place. Clean all dust on the laser head surface;
- Use a 3mm internal hexagonal wrench to unscrew the locking screws of the collimating components (as shown in Figure 6.5), seal the part connected with the components of collimating components with

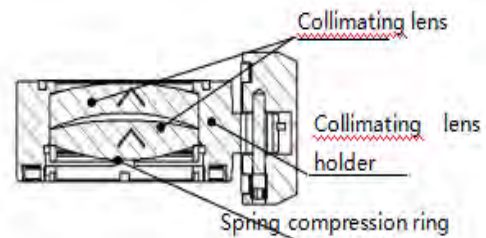


textured paper so as to prevent the entry of dust;

- Screw out the collimating lens holder, and remove the spring compression ring and collimator lens with the lens-removing tools;
- Replace or clean the collimating lenses.
- As shown in Figure 6.6, reassemble the components of collimating lens in order, pay attention to screw the spring compression ring appropriately with force, and re-screw it into the collimating components;
- Lock the screws of the collimating components;
- Check whether the focus position is in the center of the nozzle hole before use, if it is not in the center, it is necessary to carry out center-regulating operation again.



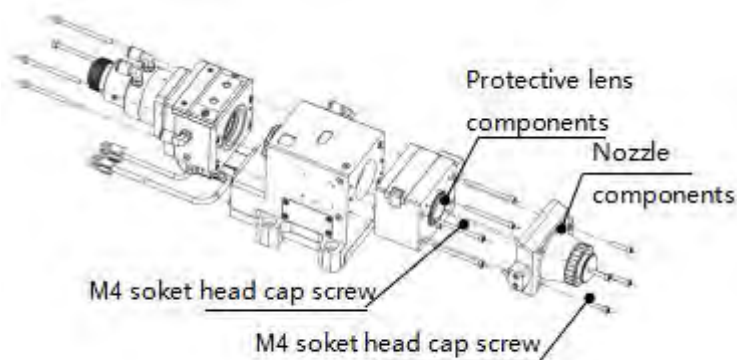
**Figure 6.5 — Dismantle components**



**Figure 6.6 — Installation diagram of collimating lens**

## 5.2.4 Removal and Installation of Focus Lenses

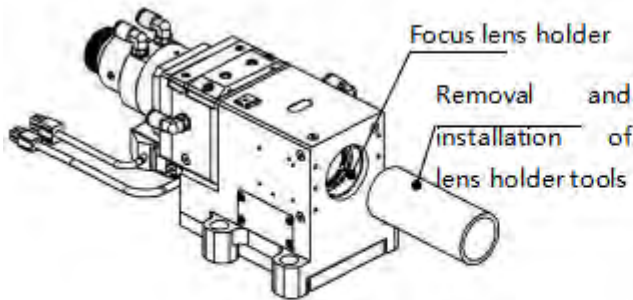
- Removal and installation of focus lenses refer to the following steps:
- Remove the laser head and move to a clean place. Clean all dust on the laser head surface;
- Place the laser head horizontally. As shown in Figure 6.7, remove the locking screws from bottom to top;



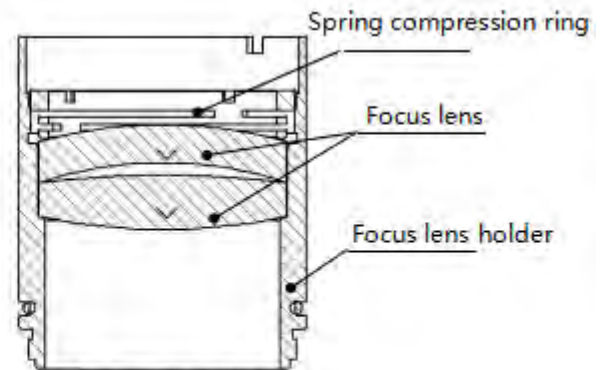
**Figure 6.7 — Framing**

- As shown in figure 6.8, use a lens-taking tool to remove the focus lens holder;

- Remove the spring pressure washer and lens with a lens taking tool;
- Replace or clean the focus lens.
- As the direction (arrow) shown in figure 6.9, put the focusing lens and the spring pressure washer in the lens holder carefully and tighten the pressure washer properly;
- Spin the focus lens holder back to focus lens barrel and tighten it;
- As the sequence shown in figure 6.7, reassemble and lock the screw.
- Check if the focus position is at the center of nozzle. If not, you need to refer to the 3.1 step to reset the operation.



**Figure 6.8 — Removal and installation of focus lens**



**Figure 6.9 — Installation diagram of focus lens**

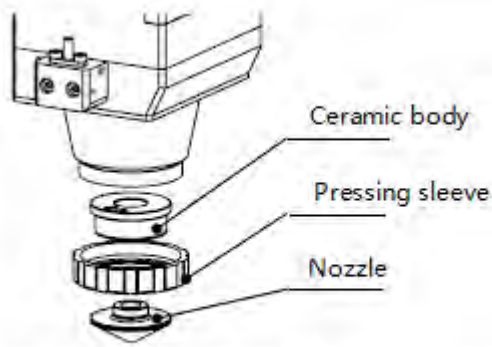
## 5.3 Replace Nozzle Connector

In the laser cutting process, the laser head will inevitably be hit, so it is necessary to replace the nozzle connectors.

### 5.3.1 Replace Ceramic Body

- Unscrew the nozzle;
- Press the ceramic body with hands, make it fixed and not oblique, and then screw off the pressing sleeve;
- Align the pin hole of the new ceramic body with 2 locating pins, press the ceramic body with the hand and screw on the pressuring sleeve;
- Screw on the nozzle and tighten it with appropriate strength.





**Figure 7.0 — Replace the nozzle connector**

### 5.3.2 Replace Nozzle

- Unscrew the nozzle
- Replace with a new nozzle, and re-tighten it with appropriate force.
- Do the capacitance calibration once again after replacing the nozzle or ceramic body.

## 5.4 Troubleshooting of Driver

### 5.4.1 Fault Analysis of AheadTechs Driver

FB3

Definition	Communication failure
Failure description	The connection between the driver and the host computer is disconnected
Measures to be taken	Insert and extract the network cable between the driver and the host computer again

J1

Definition	Position error is out of range
Failure description	Motor locked-rotor or the motor is out of range
Measures to be taken	Power on the driver again and move in the opposite direction; or increase the tolerance range of the position error.

r6

Definition	Hall signal is illegal
Failure description	The driver cannot detect the Hall signal
Measures to be taken	Check whether Hall signal lines are connected correctly, rotate the motor, read the Hall state code to see which Hall signal is not connected; check whether the encoder is poorly contacted, if the contact is perfect, add the anti-interference magnet ring.

r20

Definition	Feedback communication failure
Failure description	The driver cannot detect the encoder feedback
Measures to be taken	Check whether the encoder lines are connected correctly; Check whether the selected encoding type (MENCTYPE) is correct; Detect whether the encode line is interfered

r25

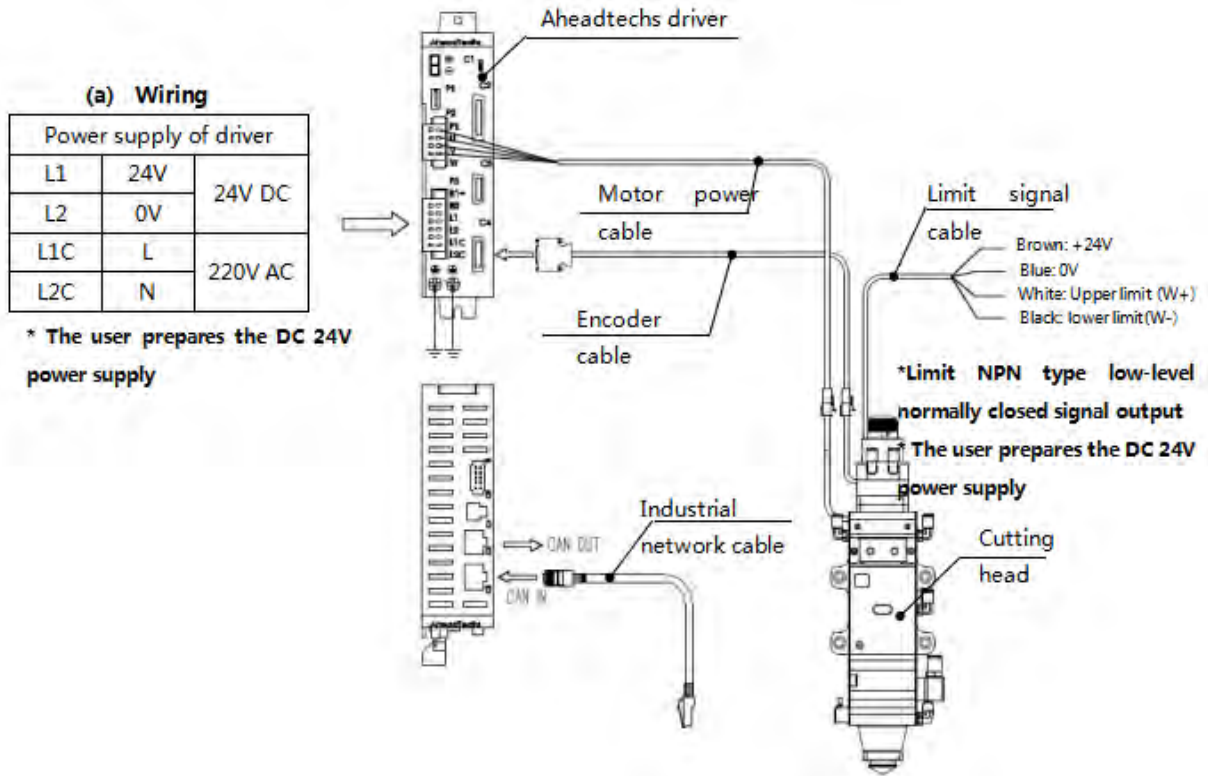
Definition	Pulse & direction input line (signal) is interrupted
Failure description	A pulse & direction signal is not connected
Measures to be taken	Check whether all pulse & direction signals are connected correctly with the driver; check whether the control lines are connected correctly

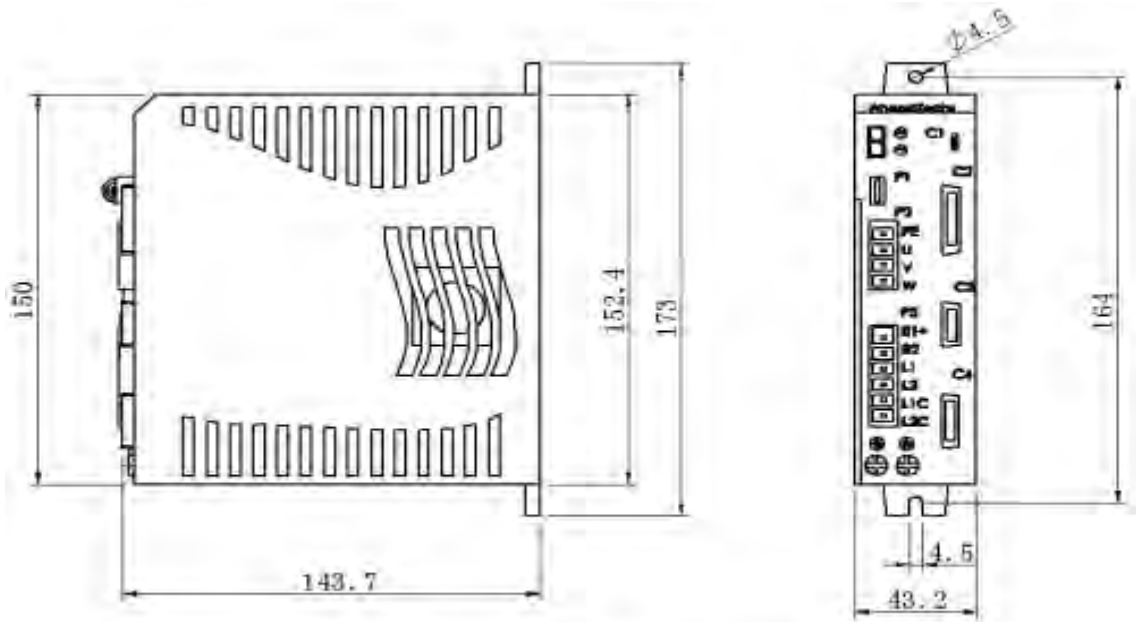
u

Definition	Undervoltage
Failure description	The bus voltage is lower than the minimum value
Measures to be taken	Check whether the wiring of drivers L1 and L2 is correct; check whether the driver parameters are correct; check whether the undervoltage detection value is reasonable; check whether the servo motor type is wrong.

## 6 BM114 System Constitution

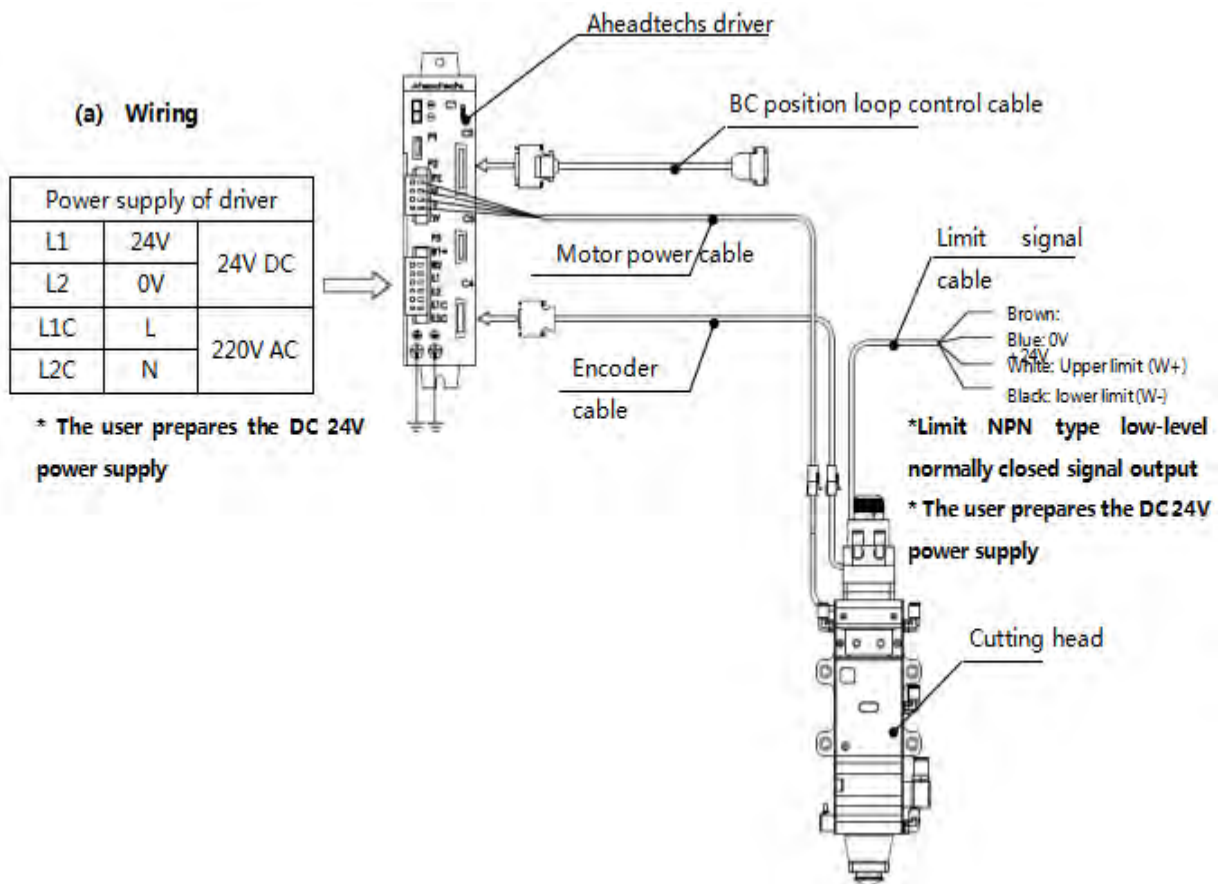
### 6.1 System Constitution (Bus)

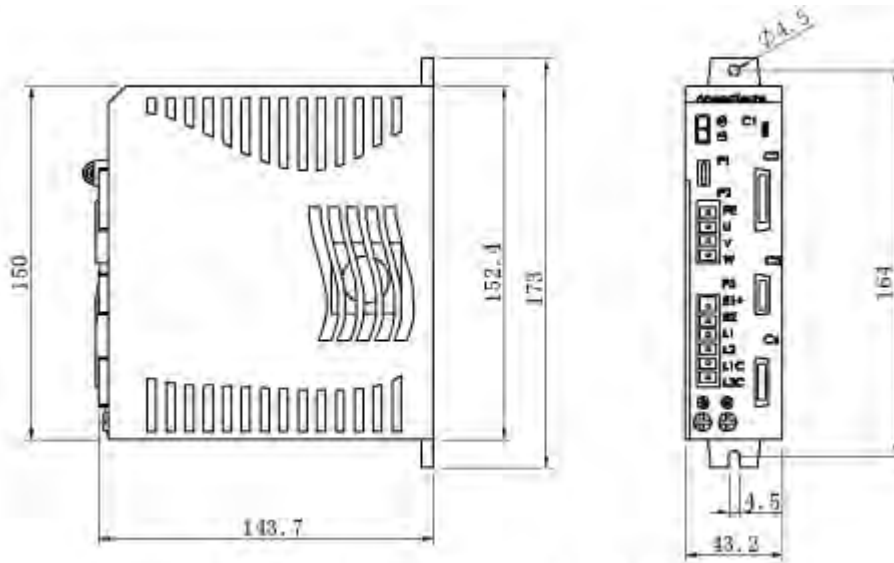




(b) Boundary dimension of Aheadtechs driver

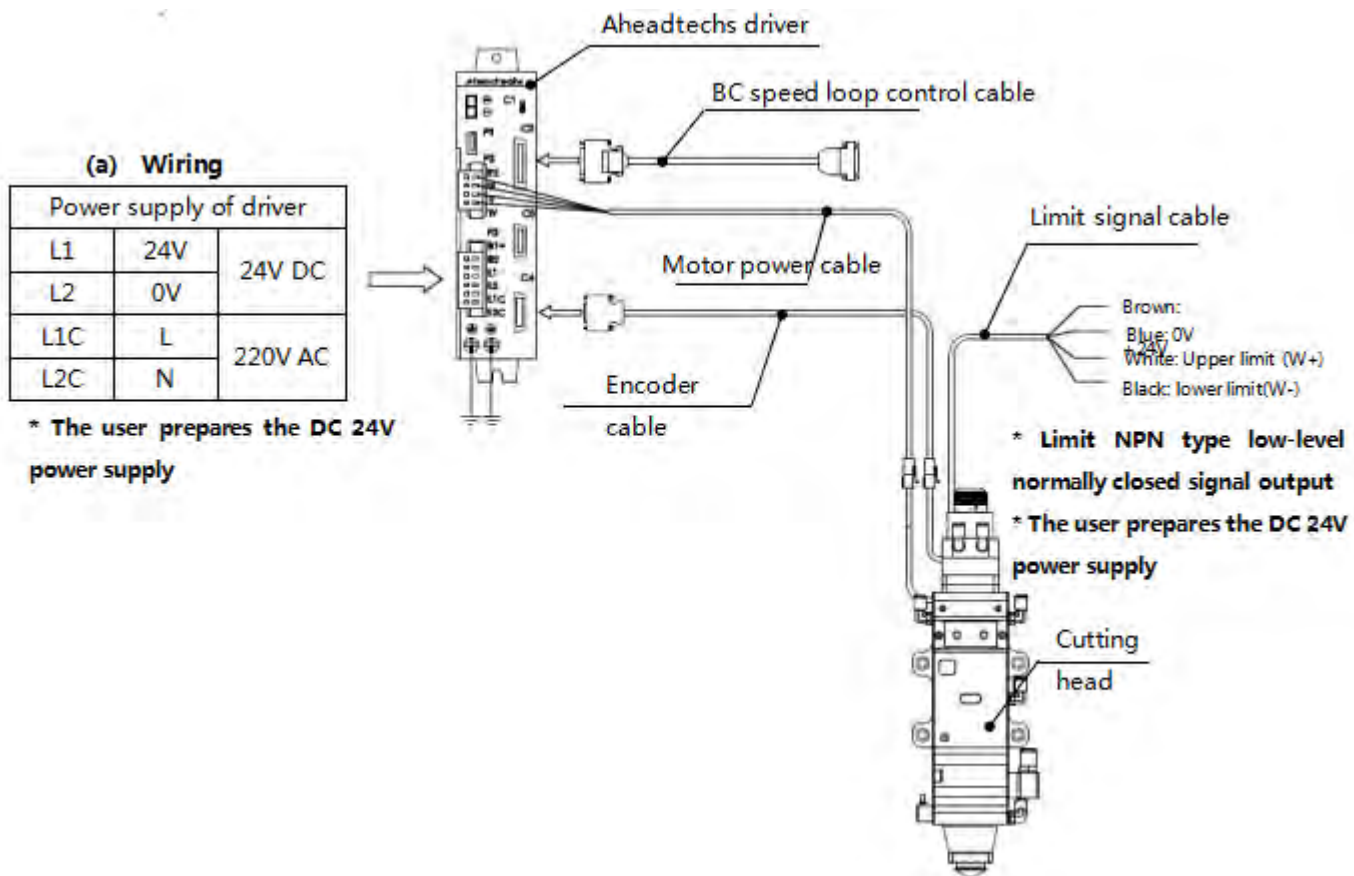
## 6.2 System Constitution (Non-bus position loop -BC)

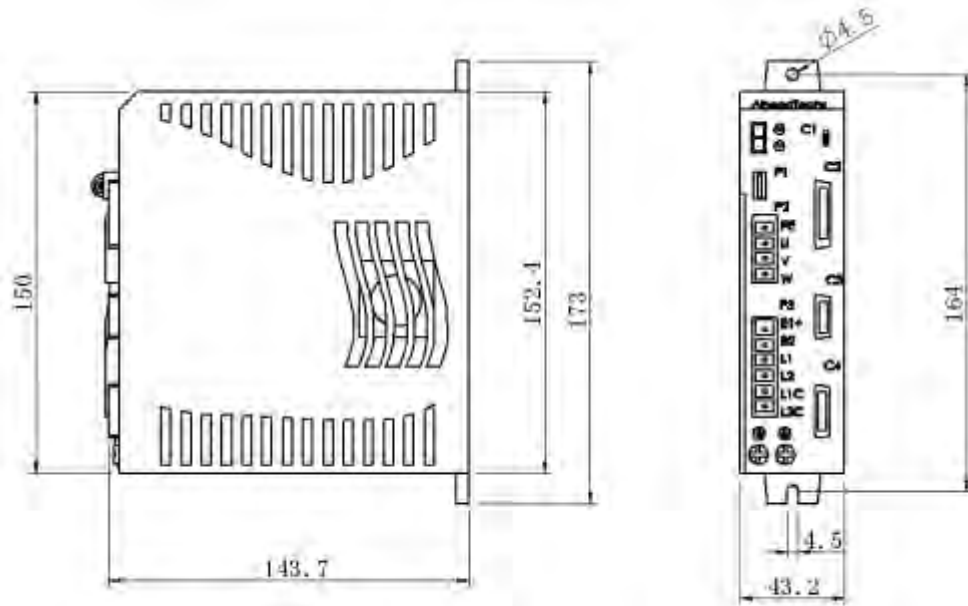




(b) Boundary dimension of Aheadtechs driver

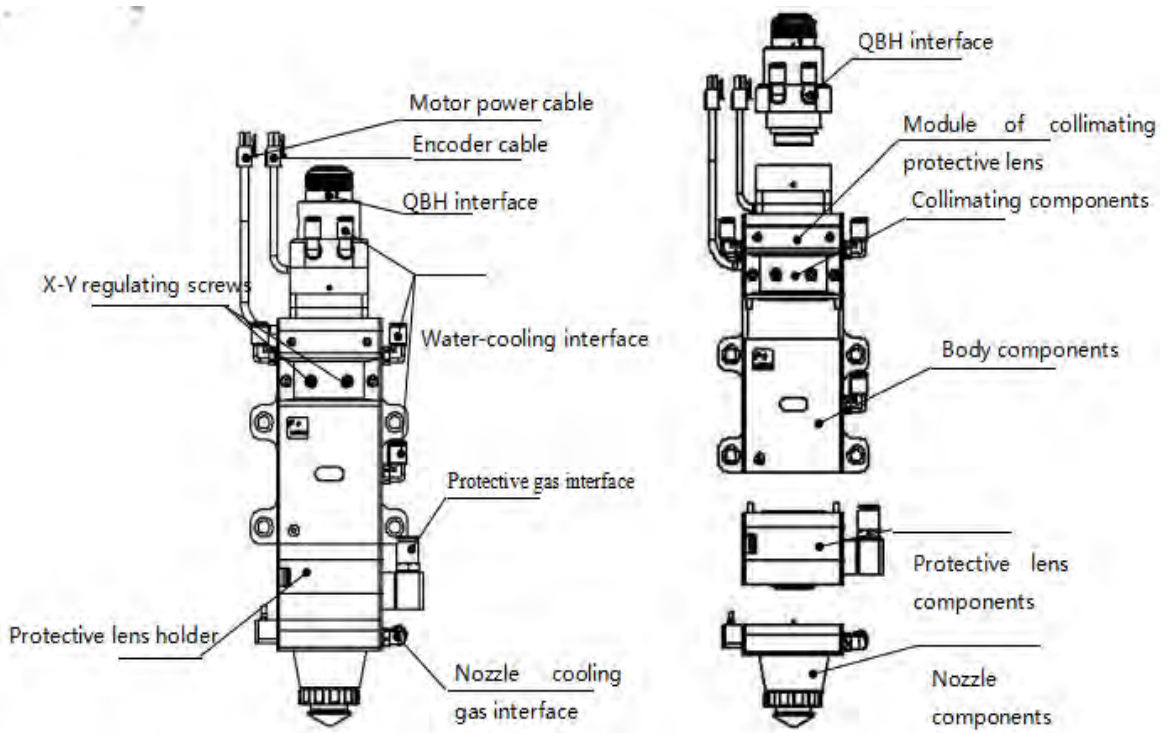
### 6.3 System Constitution (Non-bus position loop -BC)



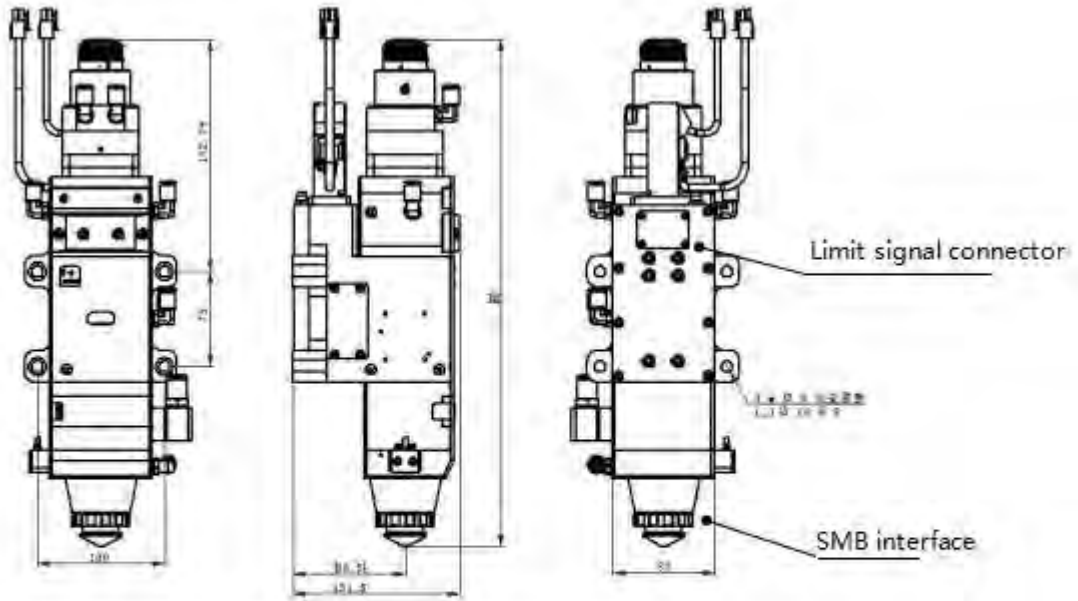


**(b) Boundary dimension of Aheadtechs driver**

## 7 Mechanical and Optical Configurations Diagram

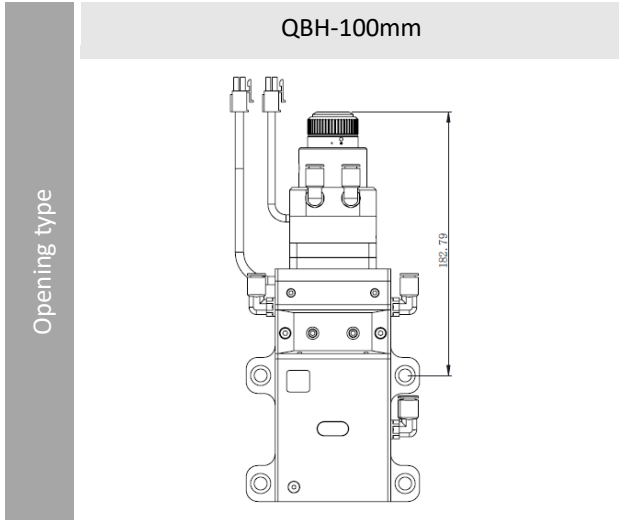


### 7.1 Cutting Head Shape



CL/mm		200	
FL/mm		150	200
H/mm	QBH	399.95	436.95





### 7.1.1 Focus length

