



A230E 3000W Electric Fiber Laser Cutting Head User Manual

Version V1.0

WUHAN AU3TECH TRADING CO., LTD
www.au3laser.com

Tel: 027-82726630
Fax: : 027-82726630

Daijiashan Technology Park,
No.888 Hanhuang Road.
info@au3tech.com

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Abstract

Key points

This user manual contains basic installation, factory settings, operation, maintenance instructions and other descriptions of A230E fiber laser cutting head. Since mechanical parts are too many, this manual will only introduce the main units.

A230E electric fiber laser cutting head, German brand A-cutter series, is designed for laser power within 3000W, which is a wonderful solution for medium power of laser flat auto focus cutting when working with motion control card MCC series and cutting software SC series.

Reader Objects

This document mainly is applicable to the following personnel:

- Installation engineers
- Maintenance engineers
- Operators

Modification Records

Modification records accumulate the descriptions of the updating of the document. The latest version includes the updating contents of previous versions.

Version V1.0 of Document (May, 2022)

Initial release.

Introduction

This user manual contains basic installation, factory settings, operation, maintenance instructions and other descriptions of A230E fiber laser cutting head. Since mechanical parts are too many, this manual will only introduce the main units.

A230E electric fiber laser cutting head was designed for flat cutting within 3000W by German brand A-cutter in 2022. With motor driver unit inside, the position of focus lens unit in z axis can be adjust automatically in the range of 24mm, so user can set “continues focus adjustment” in the cutting software to accelerate the thick metal plate cutting speed and cut different metal plat with different thickness and kind. With optical lens group in D30 and multi-interfaces design, A230E fiber laser cutting head can be matched with different types of fiber laser sources. It's much more stable during longtime working in high laser power with its optimized optical system and water cooling system.

Product highlights

- A230E electric fiber laser cutting head has been integrated with the controlling unit for adjusting the focus lens unit's position in z axis. By interacting and controlling marshalling with laser cutting controlling system, it largely reduced the system's complexity and the difficulty of installation and debugging.
- Adapting with light alloy materials and compact structure design, A230E electric fiber laser cutting head has only 68mm in length and 3.5KG in weight, which has largely reduced the load-bearing demands on the transom of the laser cutting machine so it can be used more widespread.
- By working with SC series fiber laser cutting system, A230E can realize high speed drilling and auto adjust different types of cutting parameters that have been set in the cutting software in advance. Cutting software can monitor the focus position in real time. It also supports manual adjustment to achieve the perfect cutting performance.

Structure

From figure 1, we can see that A230E fiber laser cutting head contains six basic units: QBH interface, collimate unit, focus unit, protection unit, nozzle tips unit and motor driver unit.

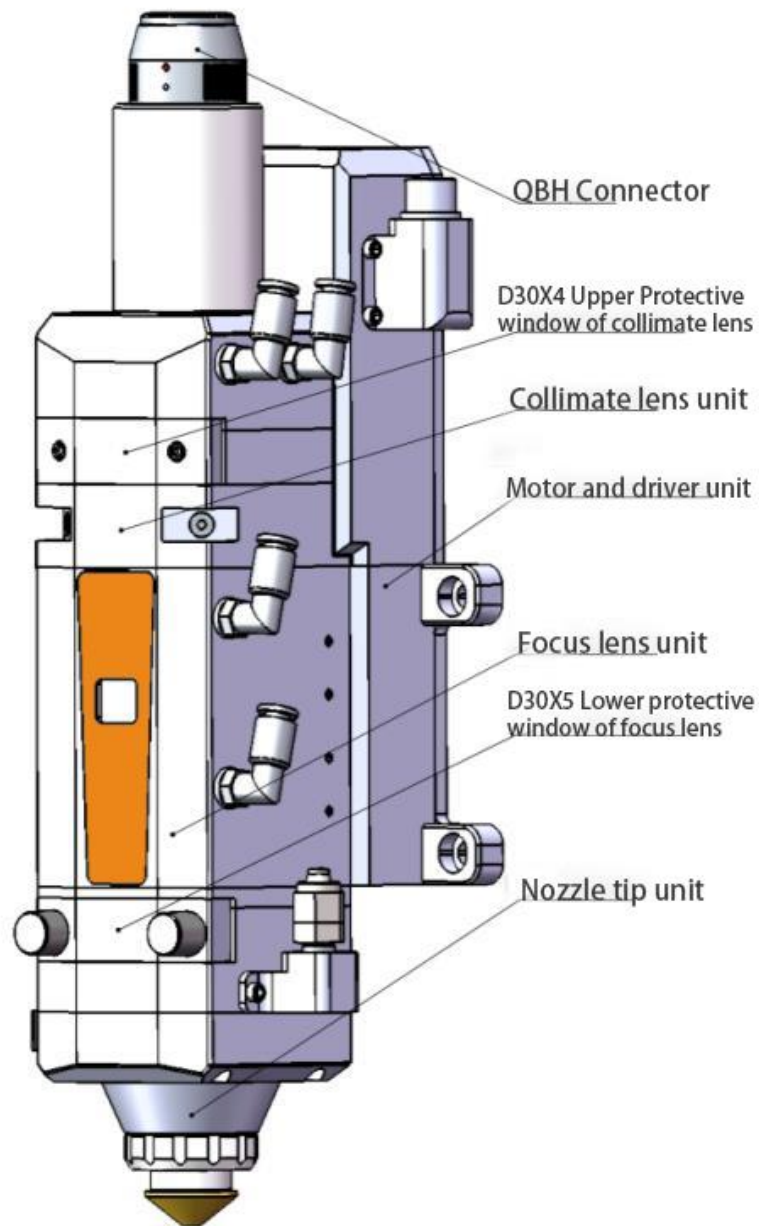


Figure 1. The structure of A230E electric fiber laser cutting head.

- Fiber socket: Connect with fiber laser source.
- Collimate unit: turn the incident laser beam into parallel beam, which can be adjust for centering the laser beam.
- Focus unit: turn the parallel beam into gathered beam with high energy, and adjust the focus position in real time by regulating the focus unit.
- Protective unit: avoid the focus lens being polluted by the dust from the surface of the metal sheet and by the metal dregs produced during cutting which can increase the service life of focus lens.
- Nozzle tips unit: lead the gathered beam into the meal sheet and at the same time jet out high-speed gas flow to make sure the perfect cutting quality.
- Motor driver unit: adjust the position of focus lens unit in z axis.

Product configuration

A230E electric fiber laser cutting head was designed for flat cutting within 3000W, its standard configuration is: A230E-Z100-F125/ A230E-Z100-F150.

Technical parameters

Parameter name	Parameter
Max Power	3000W
Fiber Socket	QBH
Focus Lens	Dia=30mm, F=125mm/150mm
Collimate Lens	Dia=30mm, F=100mm
CA	27mm
Laser Wavelength	1064nm
Head Weight	≤3.5kg
Head Max Dia.	77mm
Nozzle Tip Diameter	1mm-4mm
X-Y Adjust	±1mm
Z Adjust	-12mm~+12mm

Configuration list

Name	Quantity
A230E Cutting head	1 pcs
Nozzle tip(Backup)	2 pcs
Protective windows(Backup)	1 pcs

PS: The list is our standard configuration.

The appearance of A230E electric fiber laser cutting head.



Figure 2. The appearance of A230E electric fiber laser cutting head.

Installation of mechanical parts

Installation of main parts

The size of installation hole of A230E showed as figure 3. Please make sure the fiber laser cutting head is perpendicular to the metal sheet when installing and at the same time to make sure the cutting head has been locked stably on the cutting machine for getting a stable cutting quality.

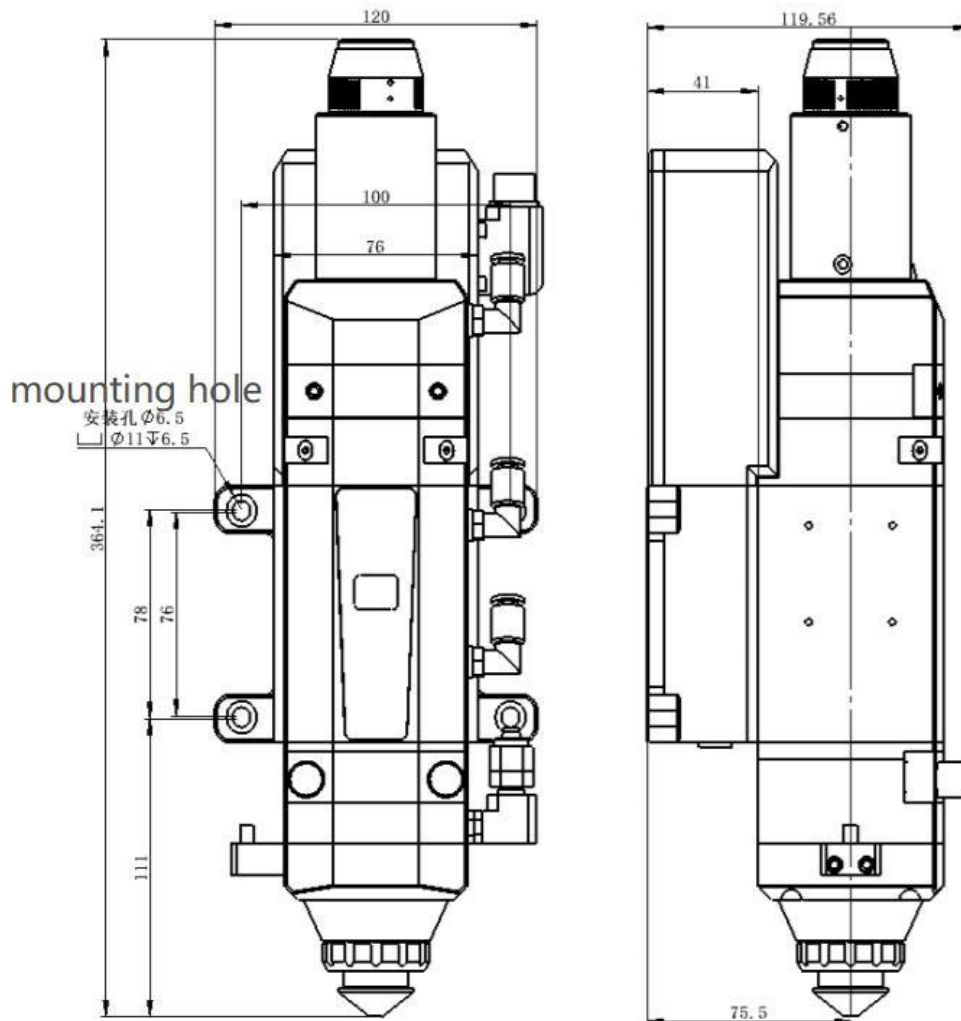


Figure 3. The size and position of installation hole of A230E fiber laser cutting head.



PS: The Z axis motor's slide table for fixing the cutting head must be conducted with the cutting machine and must be in ground connection properly.

Installation of Water cooling

A230E electric fiber laser cutting head has two water cooling circuits, you could self-configure the direction of water in and out. Kindly suggest you to use water cooling once the laser power is above 500w. The position and quantity of water cooling interface showed as below (Figure 4). The water cooling interface is a closed-loop design, but the cooling water can also be provided from the external and must be following the instructions showed as below:

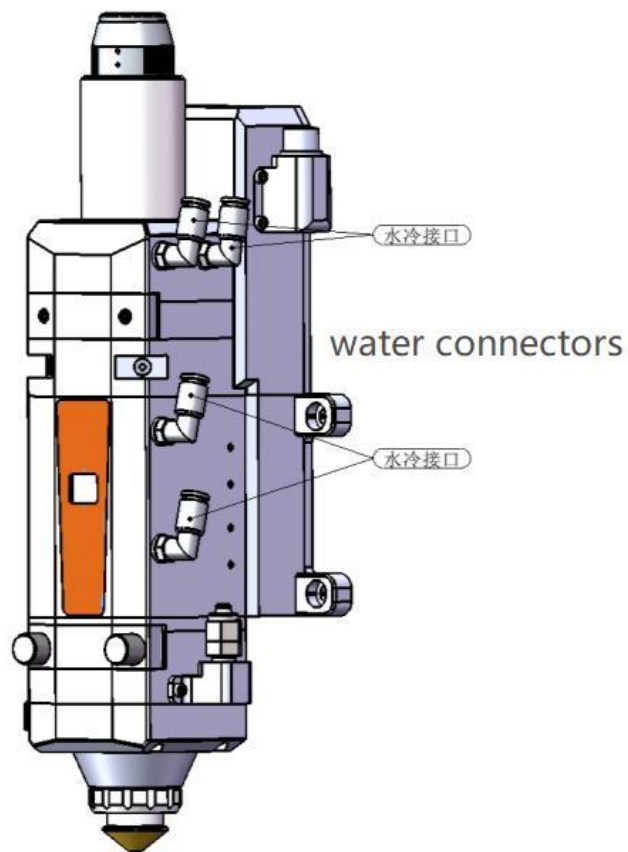


Figure 4. The interface of water cooling of A230E electric fiber laser cutting head.

Parameters	Value
The outside diameters of water-cooling tube	6mm±0.1mm
The minimum water velocity	1.8L/min (0.48gpm)
The water pressure of inlet	170-520kPa(30-60 psi)
The temperature of inlet	≥room temperature/ > dew point
Hardness (compare with CaCO3)	< 250mg/liter
PH range	6 to 8
The size of particulate that allowed passing	Dia<200 μm

Installation of gas circuit

The dregs like hydrocarbon and vapor contained in the cutting gas will damage the optical lens, and fluctuate the power of gathered laser beam which will result in the differences of the cutting section from the up to the bottom. Here are the suggested cutting gas and its purity (Figure 5). The higher the gas purity is, the better the cutting quality of section will be.

The dregs can be filtered in the gas providing pipes while O₂ and vapor can easily enter into the optical system by permeating nonmetal parts, which is the reason why dust and hydrocarbon appear inside the cutting head. So we kindly suggest you to use accessories in stainless steel and to use purifier that can filter particulate minimum in 0.01 μm. And suggest you to use diaphragm pressure gage in stainless steel, if you use diaphragm pressure gage in rubber, once the rubber aged, it can easily react with the air inhaled by the industrial pressure gage and generate hydrocarbon. A230E fiber laser cutting head has 1 cutting gas circuit, the outside diameter of gas pipe is 10mm. (Figure 5)

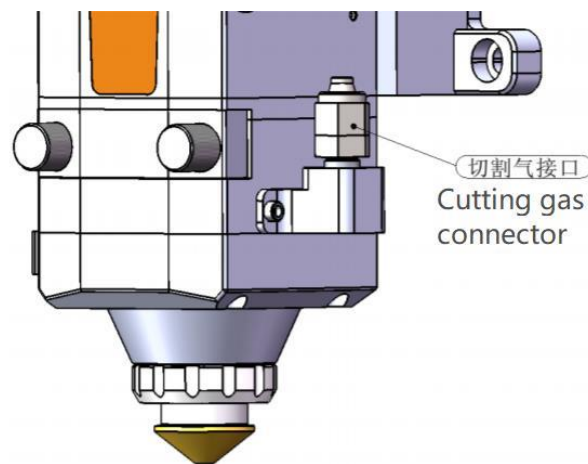


Figure 5. The interface of cutting gas of A230E electric fiber laser cutting head.

Type of gas	Purity
O ₂	99.95%
N ₂	99.99%
Air	99.998%
He	99.998%



PS: Please don't change the gas connector randomly, especially don't use PTFE tape to seal the gas connector or it may block the gas circuit thus affect the cutting quality and damage the cutting head.

Fiber socket

A230E electric fiber laser cutting head can be matched with multi types of industrial laser source, it has collimate unit. The connected part between the end of optical fiber and cutting head was called QBH connector. The standard fiber socket of A230E electric fiber laser cutting head is QBH connector. (Figure 6)

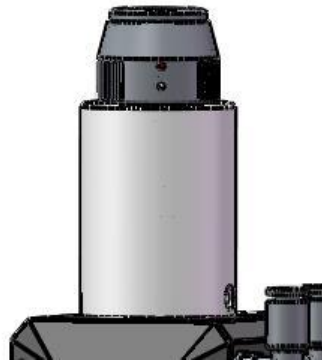


Figure 6. QBH connector of A230E electric fiber laser cutting head.



PS: All optical parts must be kept absolutely clean before using the cutting head. Please make sure the cutting head has been placed in horizon before installing the fiber in order to avoid the dust entering inside. Once all has been done, then start to fix the cutting head.

The insertion and locking of QBH fiber

Firstly, please let the red point of QBH fiber align with the marking red point of QBH socket; secondly, take out of the dust cover, and once the red point of QBH fiber aligned the marking red point of QBH socket, please insert the fiber into the bottom; thirdly, rotate the QBH hand wheel in clockwise until a “Tack” sound came out, then pull the hand wheel up; at last, rotate the QBH hand wheel in clockwise again until the end. (Figure 7)

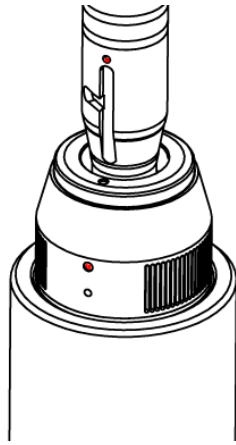


Figure 7. The insertion and locking of QBH fiber.

Installation of Electricity and gas

A230E electric fiber laser cutting head has already been integrated with motor, driver and controller, while its power supply and controlling signal have been integrated in the five-pin aerospace plug of M16 showed as figure 8.

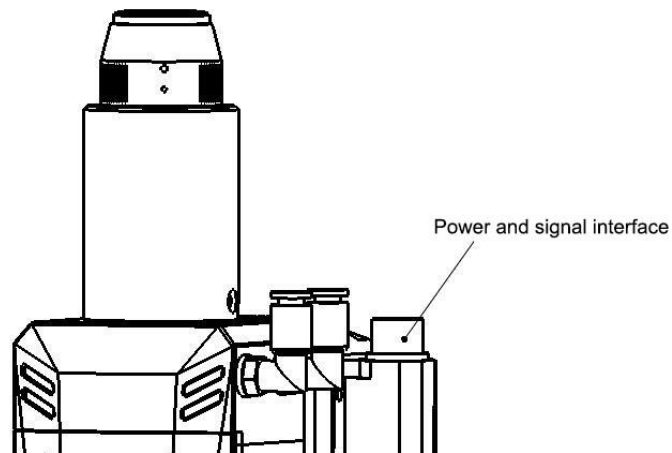


Figure 8. Interface of power supply and signal cable.

Pin number	Definition
pin1	B (RS485)
pin2	A (RS485)
pin3	24V DC (power input)
pin4	GND
pin5	none



PS: When working with SC series fiber laser cutting system, there will be a signal cable in 15m especially for electric fiber laser cutting head with M16 in one end and cables in the other end. One is connected with electric fiber laser cutting head and the other end is connected with the motion control card. When used with other controlling system, this port needs to be redefined and we do not provide more details in the user's manual.



The centering and adjusting of laser beam

The centering of laser beam

The cutting quality mainly depends on whether the optical lens is in the center or not. If the optical lens is not in the center, the laser beam will reach to the inside parts of the cutting head thus the inside parts can be easily out of shape because of high temperature. Thus, whenever the cutting quality is getting worse, please try to adjust the position of optical lens or the nozzle tips and try again.

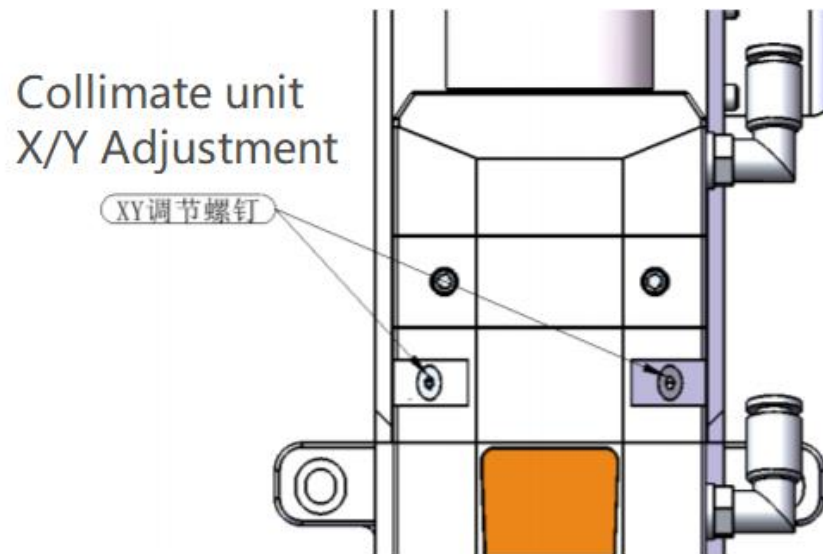


Figure 9. The centering of laser beam of A230E electric fiber laser cutting head.

The centering of A230E electric fiber laser cutting head can be done by adjusting the X-Y direction of collimate lens. Collimator Unit X/Y Adjustment showed as Figure 9. The adjustment can be done by using hexagonal screw driver until the laser beam is in the center of nozzle tips. Please make sure the laser beam is in the center of the nozzle tips before start cutting. Normally you could try to use this way to check if the laser beam is in the center of nozzle tips or not:

- (1) Take one piece of scotch tape and then horizontally stick on the bottom of nozzle tips;
- (2) Open the red light inside the laser source and then take out the scotch tape you stick on the nozzle tips to check if the red light is in the middle of the nozzle tip's center hole. If not, please adjust the X-Y direction of collimate lens and repeat the first two steps until it does;
- (3) Open the laser source and adjust the power in the range of 80w to 100w, then manually enable the laser power in order to receive a spot on the tap;

(4) Take out of the scotch tape to check if the cutting hole is exactly in the center of the nozzle tip's hole;

(5) Repeat all the steps above to find the best center position relative to the nozzle tips' hole;

This is the basic method to find the best center position of laser beam.

Focus adjustment

The focus adjustment in Z axis of A230E electric fiber laser cutting head needs to be done in the SC series cutting software showed as figure 10. User can adjust the position of focus lens unit in Z axis step by step until to its settled position. SC series cutting software supports focus position calibration, stepping piercing and other complicated parameters setting, which can meet different cutting demands when cutting different metal sheet.

The screenshot displays the SC series cutting software interface. On the left, there are control buttons: 'Go Origin' (yellow), 'Go Origin Done', 'Step Up', 'Stop', 'Step Down', and 'Step Len' (1.0 mm). Below these are 'Run Speed' (15 mm/s) and 'Origin Adj' (0.1) with minus and plus buttons. A checkbox for 'Enable Gas Pressure Wa...' is also present. The 'Run Status' panel in the center shows a table of system parameters. The 'ECH Property' panel on the right shows 'Auto Focus Parameters' with a table of alarm and temperature settings, and an 'Enable Software ...' checkbox. At the bottom, there are buttons for 'System R...', 'Adv Mode', 'Refresh P...', 'Write Par...', and 'Return'.

Run Status	
Product Model	14209
Software Version	80132
DI State	0x30002
DO State	0x0
Alarm State	0x0
Run Status	0x80000002
Run Command	0
Axis Position	4.50
Current Speed	0.00
Gas Pressure	0.0
Temperature(°C)	19.5
Target Gas Pres...	0.00
LED RGB	0xff

ECH Property	
Auto Focus Parameters	
Low Gas Pressure Al...	19
High Gas Pressure Al...	20
Gas Pressure Alarm ...	1
High Temperature Al...	300.00
High Temperature Al...	1
Enable Software ...	

Figure 10. Focus adjustment of A230E on SC series cutting software.

The adjustment range of focus lens unit of A230E in Z axis can be "+12mm~-12mm". Since the focus position of the lens itself can have error, user can manual adjust it by jogging and check its real position through the "focus visual window" showed as figure 11. Then user can do micro adjustment on the cutting software to revise.

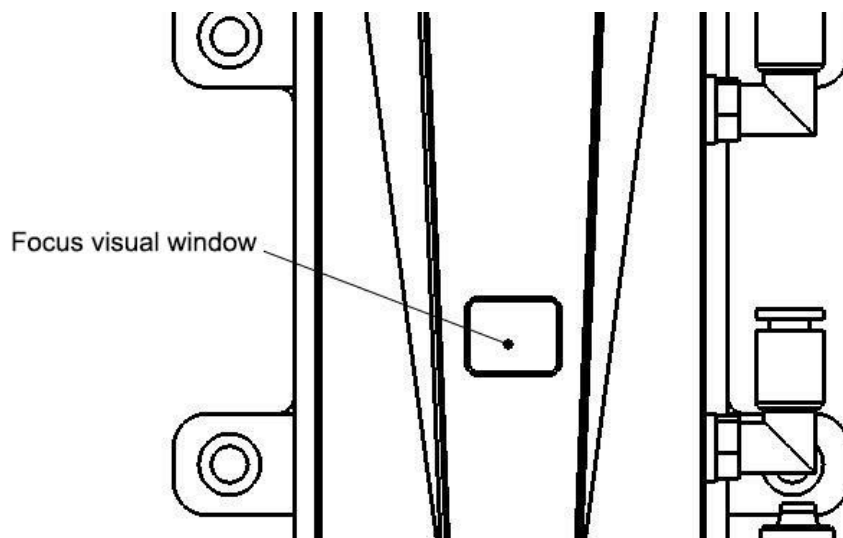


Figure11. Focus scale window of A230E electric fiber laser cutting head.

Care and maintenance

Optical lens cleaning

A230E electric fiber laser cutting head has 2 types of protective windows: the one in the top is protective windows of collimate lens, the other one at the bottom is protective windows of focus lens. When there are dust or dregs on optical lens, the dust or dregs will absorb heat of the laser beam which can increase the temperature of the optical lens, then the optical lens can easily be out of shape and result in bad cutting quality. Thus, the optical lens clearing in regular is necessary. Kindly suggest you do the cleaning once a week. The components of each protective windows showed as Figure 12.

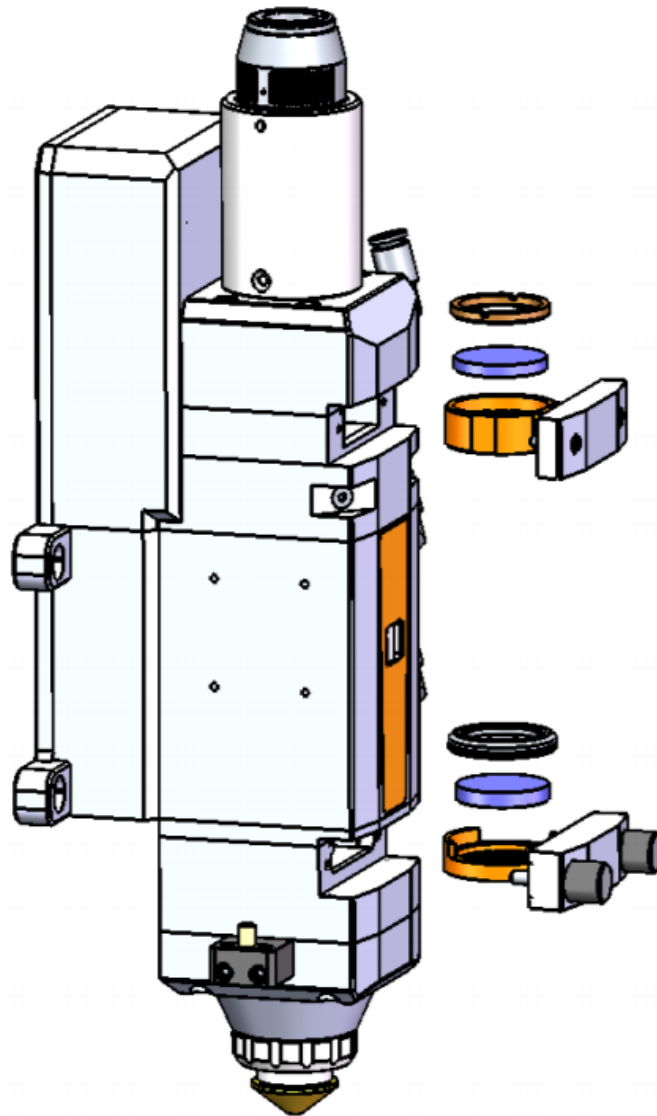


Figure 12. The components of each protective windows of A230E electric fiber laser cutting head.

■ Tools for cleaning optical lens:

Dust free gloves or fingerstall, cotton swab in polyester fiber, absolute ethyl alcohol, air blowing device in rubber (clean compressed air) etc.

■ Optical lens cleaning method and Notes:

(1) Please put on the fingerstall in the thumb and index finger of your left hand;

(2) Spray some absolute ethyl alcohol on the cotton swab;

(3) Hold the lens at its **side edge** by your thumb and index finger of your left hand (PS: Never hold the lens directly by your fingers without fingerstall, since the lens can easily be polluted)

(4) Hold the lens up to the same horizon of your eyes and use the cotton fiber to wipe the lens gently from the bottom to the top or from the left to the right by your right hand (PS: The cleaning process can only be down in one certain direction, or the lens can easily be in repeated pollution.)

(5) Use the air blowing device to sway the surface of the lens. Please clean the lens in both sides, and once the cleaning has been done, please double check if there are still any absolute ethyl alcohol/dust/dregs or other things are left on the lens.

Disassembly and installation of optical lens:

The whole process needs to be done in a clean place, and please take on the dust free gloves or fingerstall before disassembly.

■ Disassembly and installation of protective windows of collimate lens:

Collimate lens can be easily damaged if the dust falls inside the head when connecting the cutting head with the laser source.

(1) Loose the two screws showed in figure 13, and carefully take out of the lens with cover slide drawer;

(2) Take out of the **screw ring** by tools properly and take out of the lens using your fingers after putting on fingerstall;

(3) Cleaning the lens, cover slide drawer and **screw ring**;

- (4) Put the cleaned lens back into the cover slide drawer; (No difference in pros and cons)
- (5) Put the **screw ring** back to the cover slide drawer;
- (6) Put the protective windows unit back into the cutting head and then tighten the two screws.

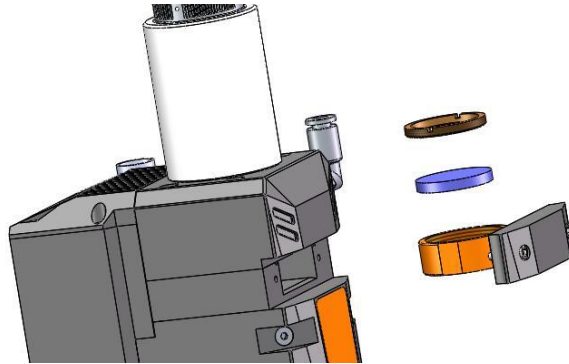


Figure 13. Protective windows of collimate lens.



PS: There is a seal ring inside the cover slide drawer (under the lens), please don't lose it when you clean or change the protective windows. If the seal ring is missing or being damaged, please change with a new one.

■ Disassembly and installation of protective windows of focus lens:

Protective windows is vulnerable parts, please change with a new one once it has been damaged.

- (1) Loose the two screws showed in figure 14, and carefully take out of the lens with cover slide drawer;
- (2) Take out of the **protective window upper seal ring** by tools properly and take out of the lens using your fingers after putting on fingerstall;
- (3) Cleaning the lens, cover slide drawer and **protective window upper seal ring**, if the seal ring has been damaged, please change with a new one;
- (4) Put the cleaned lens back into the cover slide drawer; (No difference in pros and cons)
- (5) Put the **protective window upper seal ring** back to the cover slide drawer;
- (6) Put the protective windows unit back into the cutting head and then tighten the two screws.

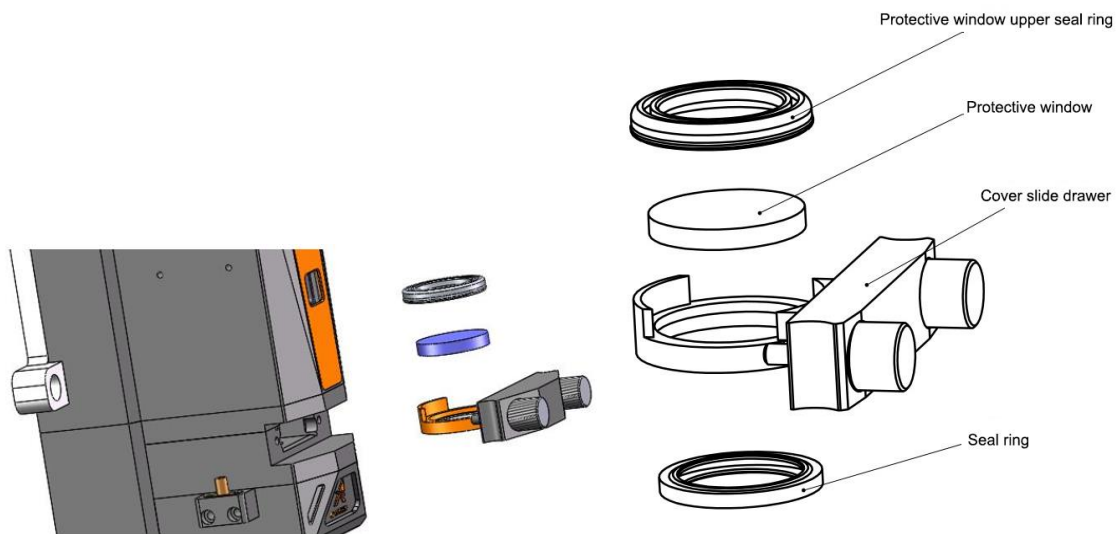


Figure 14. Protective windows of focus lens.

■ Disassembly and installation of collimate lens:

(1) Disassembly the cutting head and clean up all the dust on the surface of the head in a clean place;

(2) Loosen all the screws of the collimate lens unit showed in figure 15 by hexagonal screw driver in 3mm, and kindly suggest you use masking tape to cover the part connecting with collimate lens for preventing dust coming inside;

(3) Take out of the collimate lens with lens' holder by optics resemble tools and then take out of the screw ring and collimate lens by the same tool;

(4) Clean or change the collimate lens;

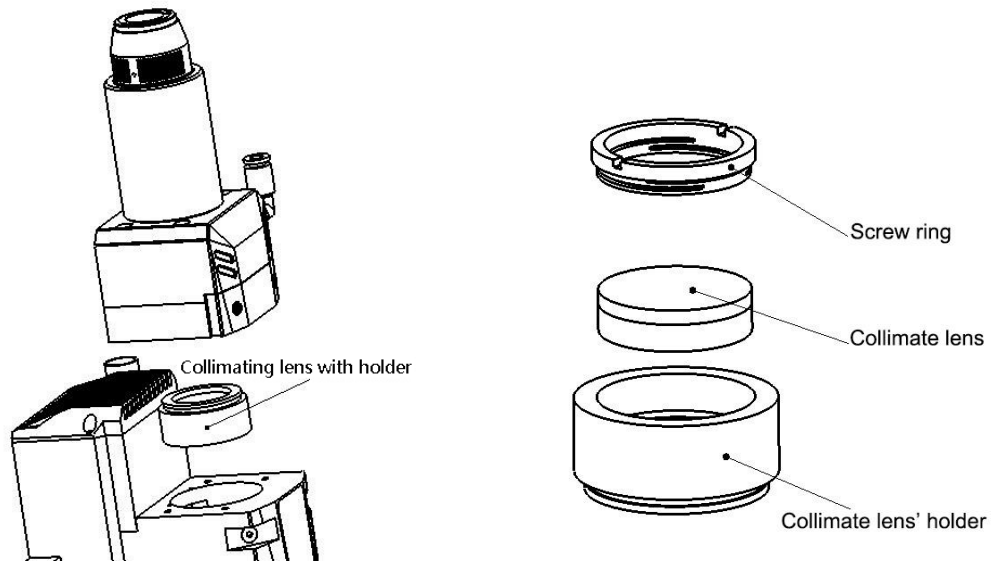


Figure 15. Collimate lens with lens' holder.

■ Disassembly and installation of focus lens:

(1) Disassembly the cutting head and clean up all the dust on the surface of the head in a clean place;

(2) Loosen all the screws of the focus lens unit showed in figure 16 by hexagonal screw driver in 4mm, and kindly suggest you use masking tape to cover the part connecting with focus lens for preventing dust coming inside;

(3) Take out of the focus lens with lens' holder by optics resemble tools and then take out of the screw ring and focus lens by the same tool;

(4) Clean or change the focus lens;

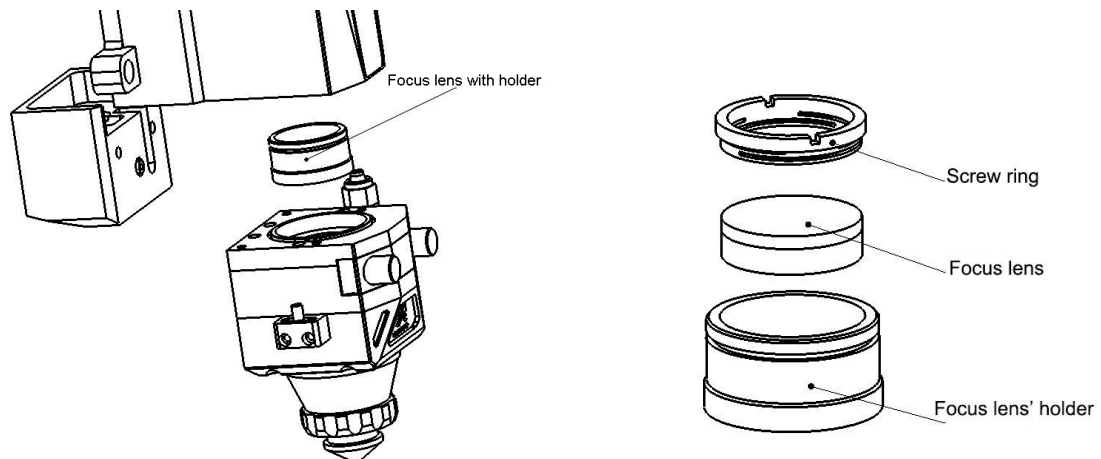


Figure 16. Focus lens with lens' holder.

Replacement of capacitive nozzle body

Laser cutting head sometimes would be hit during its working, and in that case, if unlucky, the capacitive nozzle body will need to be replaced. (Figure 17)

■ Replacement of ceramic ring:

- (1) Screw off the nozzle tips;
- (2) Hold the ceramic ring straight and then screw off the lock ring;
- (3) Alignment the pin hole of the new ceramic ring with the 2 locating pin, and hold straight the ceramic ring, then screw on the lock ring;
- (4) Screw on nozzle tips and tighten it with proper strength.

■ Replacement of nozzle tips:

- (1) Screw off the nozzle tips;
- (2) Screw on a new nozzle tips and tighten it with proper strength;
- (3) Head calibration must be done again after the replacement of nozzle tips or ceramic rings.

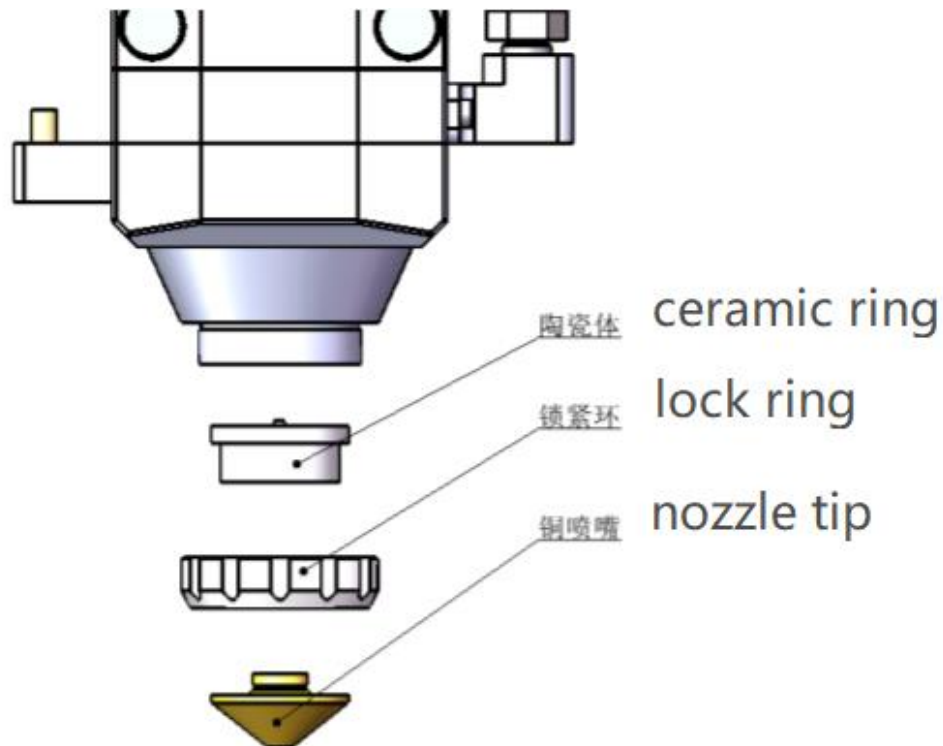


Figure 17. Ceramic rings and nozzle tips of A230E electric fiber laser cutting head.

Collimate lens unit and focus lens unit of A230E electric fiber laser cutting head.

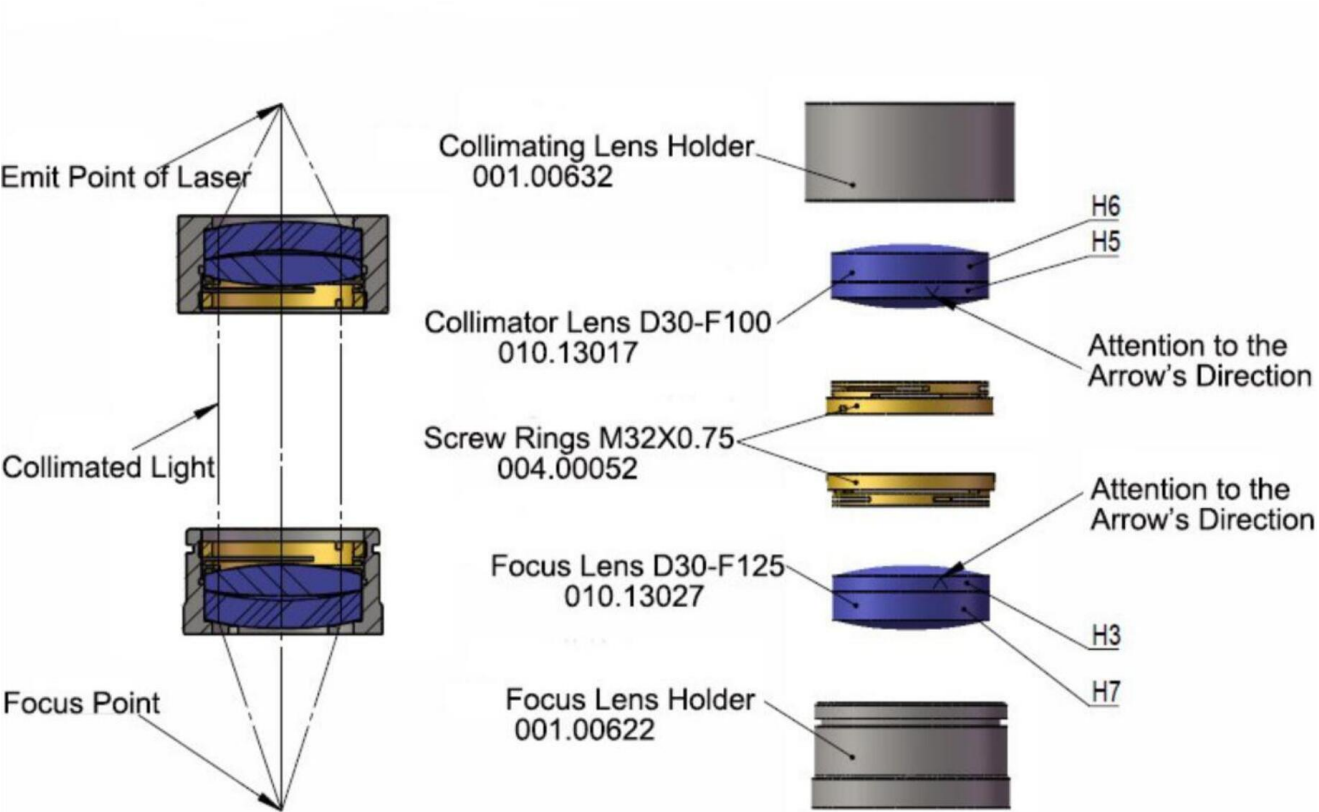


Figure 18. Collimate and focus lens' assembly process of A230E electric fiber laser cutting head.