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# BT240 Series Product Manual

## BT240 Product Manual

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## BT240 Product Manual

Thank you for your choosing our product!

This manual introduces the use of BT230 in detail, going through the specification of installation, setup, operation and service. If you have any other questions, you may contact us for further consultation.

Before using this series of cutting heads and other related devices, please read this manual carefully, which will help you use them 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.

### Index

1	Introduction.....	3
1.1	Product Features.....	3
1.2	The functions of the modules.....	3
2	Installation-Mechanicals.....	5
2.1	Installation Of The Hole Site .....	5
2.2	Plumbing .....	5
2.2.1	Water cooling.....	5
2.2.2	Assist Gas .....	6
2.3	Fiber Connectors .....	6
2.4	Fiber Orientation Adjustment.....	6
3	Operation-Mechanicals.....	8
3.1	Beam Centering .....	8
3.1.1	QCS Beam Centering .....	8
3.1.2	QBH Beam Centering .....	8
3.2	Setting Focus Position .....	8
4	Service .....	10
4.1	Cleaning Optics.....	10
4.2	Changing Lens .....	10
4.2.1	Changing 2D Laser Head Cover Slide .....	10
4.2.2	Changing 3D Laser Head Cover Slide .....	11
4.2.3	Changing Collimating Lens Assembly .....	11
4.2.4	Changing Focusing Lens.....	12
4.3	Removing Tip Assembly.....	13
4.3.1	Replacing the ceramic head.....	13
4.3.2	Replacing 3D Module Tm .....	13
4.3.3	Replacing Gas Jet Tip .....	14

## BT240 Product Manual

### 1 Introduction

The manual goes through the brief introduction of installation, setup, factory settings, operation and maintenance service of the BT230 series. While BT230 is available in many optical mechanics and customized configurations, this manual is genetic to the core products.

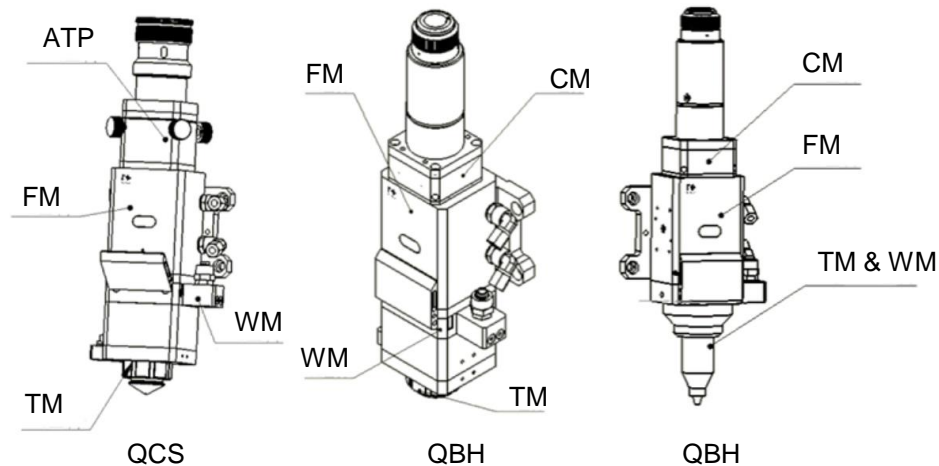


Figure 1 the structure of laser heads

BT230 is a cutting head applied to low-power industrial laser production of RAYTOOLS AG company. The wholly optimized optical focus quality, the design of gas channel inner chamber, breathing gas flow and cooling nozzle, the built-in water-cooling unit as well as the delicate focus sets can completely meet different thin, mediate and thick steel-cutting applications and other customized industrial laser processing environment. A variety of flexible optical fiber connectors and optical collimating and re-focusing equipments adapt it to most optical fiber laser devices in mainstream industry.

#### 1.1 Product Features

- Compact modular design
- Different optic lens options
- 0.05 mm of lens movement to set focus
- Quick and easy access to the cover slide
- High-efficiency water-cooling system
- Built-in annular and lateral gas flow, easy to cut high-reflective materials and preventing thick plate from blasting and sputtering
- guiding adjustments of optical input
- A variety of flexible optical fiber connectors
- Reliable sealing design

#### 1.2 The functions of the modules

See Figure 1, a laser head contains 1) a collimation module CM, 2) a centering module ATP, 3) a focusing module FM, 4) a protection window module WM and 5) a nozzle module TM.

- 1) Module CM: collimate the optical fiber, collimate the input laser beam to paralleled laser beam and

## BT240 Product Manual

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center the beam.

- 2 ) Module ATP : aiming at laser heads with paralleled beam(not need to be collimated), adjust the angles of the beam (beam centering).
- 3 ) Module FM: focus the collimated light beam to high-power-density focused light beam, and move ups and downs to set the focal point.
- 4 ) Module WM: protect the optics, protect the focusing lens from being damaged by residues and lengthen the life span of the optics.
- 5 ) Module TM: guide the focused light beam to the processing workpiece and spray high-speed gas flow to achieve high-quality cutting.

# BT240 Product Manual

## 2 Installation-Mechanicals

### 2.1 Installation Of The Hole Site

BT240 laser heads are fixed on the machine tool by a mount plate attached to FM module. See Figure 2 for hole sizes and locations. Clients are recommend to install the laser heads vertically to the processing plate according to the drawings and make sure the laser heads are fixed tightly, without wagging in process. It is one of the preconditions of steady subsequent cuttings.

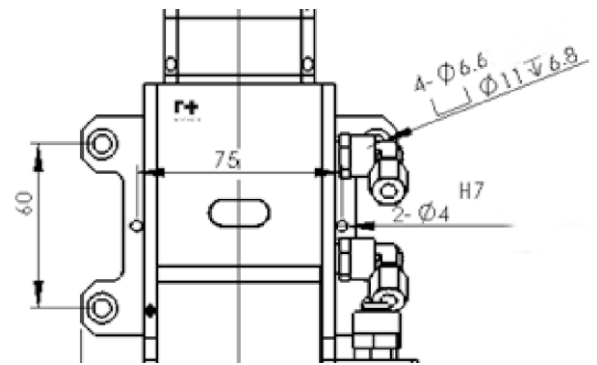


Figure 2 Hole Locations



**Attention :** Z-axis motor plate using to fix the laser head plate should be conducted to the machine tool and the ground.

### 2.2 Plumbing

#### 2.2.1 Water cooling

BT240 processing heads are equipped with a water-cooling circuit, the direction of water moving in and out can be changed at will. It is recommended that power levels greater than 500 watts use water cooling. See Figure 3 for hose locations and numbers and the table on the right for recommended flow rates.

Minimum Flow Rate	1.8 liters/minute ( 0.48gpm )
Inlet Pressure	170-520kPa(30-60 psi)
Inlet Temperature	≥room temperature / > dew point
Hardness ( Equivalent to CaCO3 )	< 250mg/liter
PH	6 to 8
Particulate Size	<200 microns in diameter

The cooling circuit is designed to be operated on either a closed-looped cooling system or facility tap water--as long as the requirements in the table above are met.

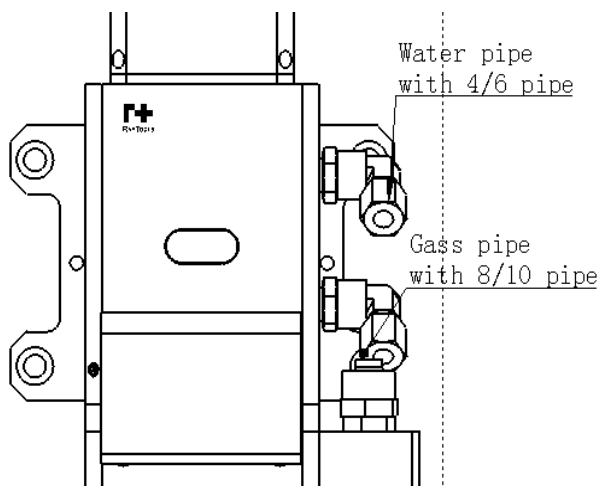


Figure 3-1 Hose Location Of The 2D laser head

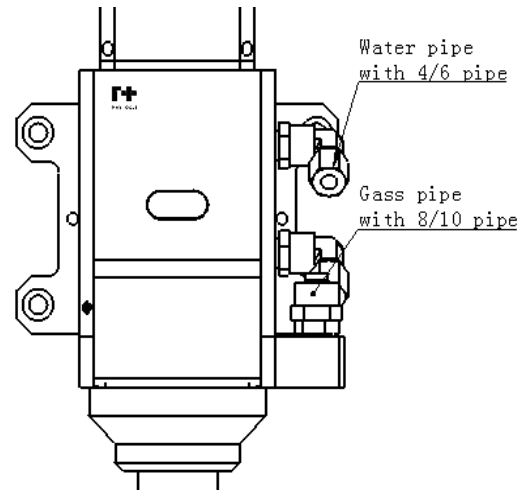


Figure 3-2 Hose Location Of The 2D laser heads

## BT240 Product Manual

### 2.2.2 Assist Gas

Impurities in the assist gas such as hydrocarbons (THC) and moisture (H<sub>2</sub>O) can damage optics, cause power fluctuations and result in inconsistent cuts. See the table below for recommended assist gas specifications. The purer the gas is, the higher quality the cutting will gain.

Impurities can also be picked up in the supply lines. Non-metallic materials can allow oxygen and moisture to permeate the system and can be a source of dust and hydrocarbons. Stainless steel lines and fittings are recommended. Filters and purifiers that remove particles down to 0.01 microns should be used to purify the optical system.

GAS	PURITY	MAX H <sub>2</sub> O ( ppm )	MAX THC ( ppm )
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

Regulators with a stainless steel diaphragm are recommended. Industrial regulators can aspirate air and the neoprene diaphragm can be a source of hydrocarbons.



**Attention :** The air tube should not be changed at will. Especially, raw materials should be avoided to seal the tube. Otherwise, the gas circuit will be jammed, the machine may not work normally and the optic items will be damaged.

### 2.3 Fiber Connectors

BT240 will adapt to most industrial fibers. It is equipped with collimators.

The interface between the laser and the cutting head is called the fiber conductor. Common fiber connectors include QBH, QD, LLK-D and LLK-B. Aiming at conductor QD, BT has 14, 24, 25, 30 grip rings. Other connections are available too. Each fiber connector has its own unique method of securely attaching the fiber. Refer to the fiber type for specific instructions. QBH connector is illustrated in Figure 1.



**Caution :** Great care must be taken to ensure the optics remain clean. Wipe any excess debris from the head before servicing. If the head is oriented with vertical beam input, the head should be rotated to prevent debris from falling onto the optics. Fix the head after the fiber is inserted.

### 2.4 Fiber Orientation Adjustment

We introduce the fiber input method according to QBH connector here.

- 1) The red dot on QBH connector should be in alignment with that on the hand wheel. Connect the fiber with the QBH connector. Make sure the red dot on the connector is in alignment with these two spots.
- 2) Rotate the hand wheel clockwise. When you hear 'da', pull the wheel and rotate towards the right again to the correct orientation.

When the fiber is connected to the head, the red dot on the fiber may be far away from the red dot on the head, which prevent the fiber being input straight. To reorient the connector, you may do as follows. See

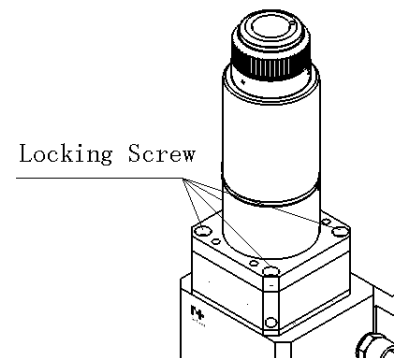


Figure 4-1 Fiber Orientation

## BT240 Product Manual

Figure 4-1. Loosen the 4 clamping bolts in Figure 4-1 with a wrench. Rotate the QBH connector. Once the fiber connector is oriented correctly tighten the clamping bolts and the set screw.

BT240 QCS connector input manual

- (1)loosen locking ring 1 and 2.
- (2)Input the fiber connector horizontally
- (3)Tighten locking ring 1 and 2. Use a wrench if necessary.

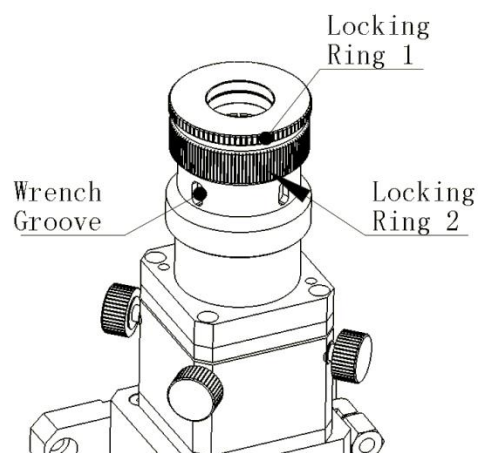


Figure 4-2 Fiber Orientation



## BT240 Product Manual

### 3 Operation-Mechanicals

#### 3.1 Beam Centering

##### 3.1.1 QCS Beam Centering

There are four set screws in the four corners. Divide them into two groups and each group has two screws. Set the screws in pair: tighten one and loosen the other.

Centering method :

1. Loosen the adjuster screw in the opposite direction you want the beam to move. Then tighten the adjuster screw that is opposite of the screw that is opposite of the screw that was just loosened.
2. Use two groups of screws until the beam is centered in the tip.
3. Once the beam is centered, double-check to ensure that the all adjuster screws are snug finger tight.

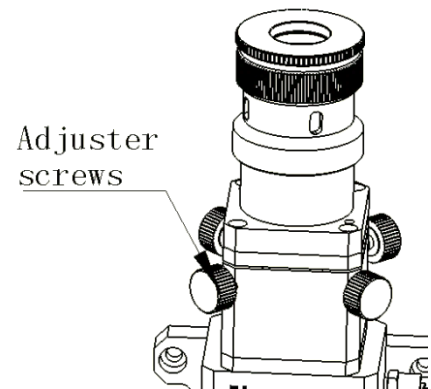


Figure 5-1 Centering

##### 3.1.2 QBH Beam Centering

The best cutting quality to a great extent relies on the centering lens. If the lens is not in the middle, the beam may touch the tip or the inner wall and lead to deformation because of high temperature.

When the gas jet tip is changed or the cutting quality is not good, the lenses should be centered.

Tip centering of BT240 is accomplished by adjusting the X-Y position of the collimating lenses. See Figure 5 for locations of adjuster screws on cutting heads. Loosen or tighten the screws with a 2.5mm hex wrench until the beam is centered in the tip.

One common method to make sure the beam is centered in the tip is to use a piece of translucent tape

- (1) Put a piece of translucent tape on the end of the Gas Jet Tip.
- (2) Turn on the laser's internal red aiming beam and observe the position of the beam on the tape relative to the nozzle orifice. Use the adjuster screws to center the red dot on the nozzle orifice.
- (3) Next power up the laser at a power setting of 80W-100W and take a shot.
- (4) Tear down the tape and check whether the hole is centered in the nozzle orifice.
- (5) A series of adjustments and shots may be needed until the beam is centered in the Gas Jet Tip.

This method needs a series of adjustments and is the basic operation of any laser centering.

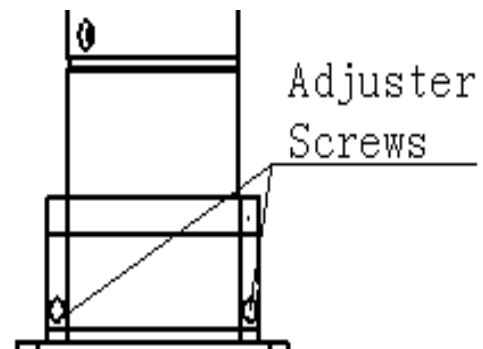


Figure 5-2 Centering

#### 3.2 Setting Focus Position

BT240 is equipped with an adjustable lens holder that allows you to move the laser focal point to optimize the laser processing. The lens has a total of 20mm of movement. You should find the focal point before cutting. There are a lot of ways to find the focal point. One of them is to paste crepe paper at the end of the tip:

1. Adjust the Focus Dial Knob to the largest scale and power up the laser at a power setting of 80-100W
2. Take a laser shot on the crepe paper each movement of less than 0.55mm (the nearer the movement is, the better)

## BT240 Product Manual

3. Take shots several times. Find the smallest shot and its relevant scale is the best focus. (The focal point is just on the nozzle orifice.)

The relationship between the Focal Dial Knob and the focal point:

The adjusting range of the focal point is '8~12'.

For example: when the Focal Dial Knob is at 0, the position of the focal point will be at the end of the tip.

When the Focal Dial Knob is at +8, the position of the focal point will be 8mm in the tip.

To adjust the focus position, follow this procedure:

- Loosen the lock nut by rotating it counterclockwise
- Turn the Focus Dial Knob and adjust the focal distance according to the scale
- Once the focus position is properly set, tighten the Lock Nut by rotating it clockwise

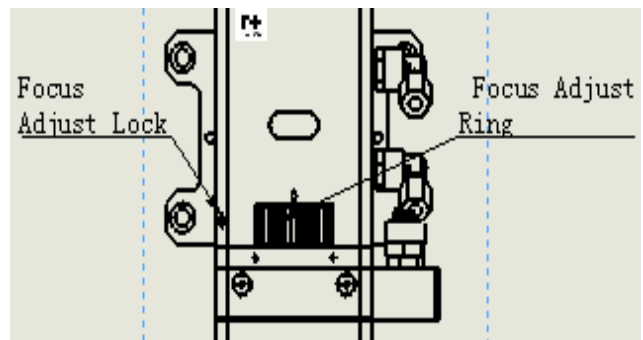


Figure 6 Setting Focus Position

## BT240 Product Manual

### 4 Service

#### 4.1 Cleaning Optics

Because of the feature of laser cutting, the optics should be maintained at regular intervals. The cover slides are recommended to be cleaned once a week and the collimating and focusing lens should be cleaned every 2-3 months.

Slide cleaning:

- I. Tools: powder free gloves, powderfree finger cots, long-fiber absorbent cotton swabs, alcohol, rubber air-blowing machine
- II. Cleaning method:
  1. Wear finger cops for the thumb and the index finger of the left hand
  2. Spray alcohol to the absorbent cotton swabs
  3. Pinch the edge of the slides with the thumb and the index finger(Attention: Finger cops should not touch the surface of the lens to avoid leaving marks )
  4. Look straightly at the lens. Take the absorbent cotton swabs with your right hand. Scrub the lens in one direction(from bottom to top or from left to right). Do not scrub the lens back and forth to avoid secondary pollution. Blow the surface of the lens with the air-blowing machine. Both sides should be cleaned. Double-check the lens after cleaning to make sure no cleansers, absorbent cottons and impurities are left.

#### 4.2 Changing Lens

The process should be finished in a clean environment. Wear powderfree gloves and finger tops when taking out the lens.

##### 4.2.1 Changing 2D Laser Head Cover Slide

The cover slide is a vulnerable part and should be change once it is damaged.

- Loosen the locking screw with a hex wrench.
- Remove the cover slide by depressing the buttons on either sides of the Cover Slide Drawer.
- Remove the cover side from the drawer by applying pressure with your fingers to the surface of the cover slide, opposite the seal ring. The seal ring and cover slide will pop out (save the seal ring).
- Clean or change the cover slide

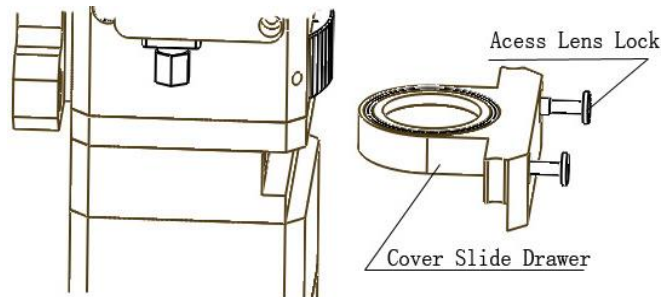


Figure 7 Changing Cover Slide

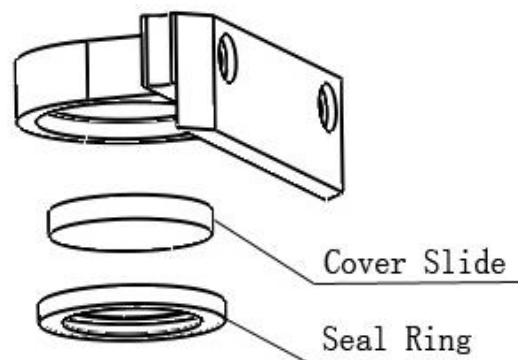


Figure 8 The Structure Of The Cover Drawer

## BT240 Product Manual

- Install the cover slide (with no front and back) by placing it into the Cover Slide Drawer.
- Retain the seal ring into the drawer. Replace with a new seal ring if it appears to be damaged.
- Reinstall the cover drawer into the head by depressing the buttons on either side of the unit.
- Tighten the locking screw.



**Caution : Don't take out the seal ring by digging its edge. This may damage the seal ring.**

### 4.2.2 Changing 3D Laser Head Cover Slide

- Open the outside cover of the jet tip
- Remove the cover slide by depressing the buttons on either sides of the Cover Slide Drawer
- Remove the cover side from the drawer by applying pressure with your fingers to the surface of the cover slide, opposite the seal ring. The seal ring and cover slide will pop out. (save the seal ring)
- Clean or change the cover slide
- Install the cover slide by placing it into the Cover Slide Drawer.
- Retain the seal ring into the drawer. Replace with a new seal ring if it appears to be damaged.
- Reinstall the cover drawer into the head by depressing the buttons on either side of the unit.
- Rotate and close the jet tip

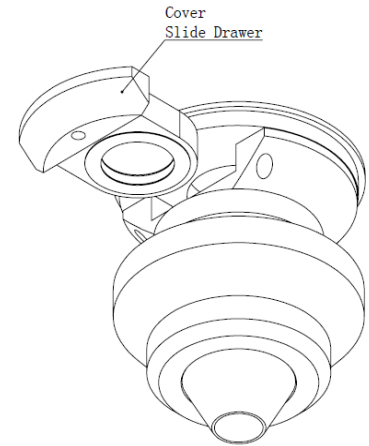


Figure 9 Changing Cover Slide

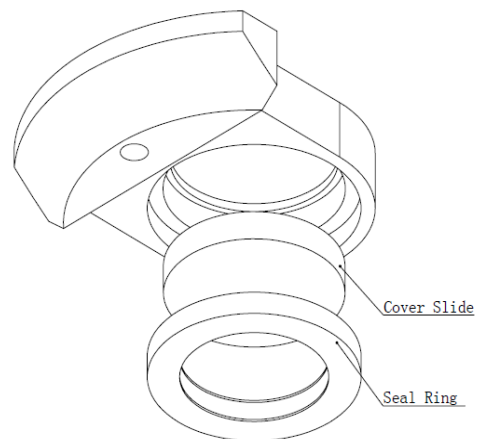


Figure 10 Inside Structure Of The Cover Drawer

### 4.2.3 Changing Collimating Lens Assembly

Changing the collimating lens assembly can be performed while the head is mounted to the machine. This menu only covers the servicing of a Raytools' collimator. Refer to third-party collimator's instructions for its servicing.



**Caution : Remove fiber with great care. Damaging fiber end may result in fiber replacement. Store fiber in such a manner to protect the end of the fiber from being damaged.**

- Wipe away loose debris from BT240
- Using a 3 mm hex wrench, remove screws holding the fiber collimating assembly as shown in Figure 11. Take assembly to a clean area.
- Loosen the collimator holder and take out the seal ring and the collimator.
- Change or clean the collimator
- Install the collimator in order. Tighten the seal ring and thread them onto Module FRA.
- Reinstall components in reverse order.
- Check the tip centering, laser focus and image focus and adjust as needed.

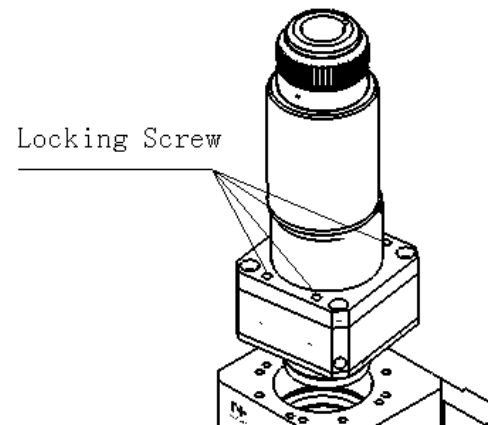


Figure 11 Collimating Module CM

BT240 Product Manual

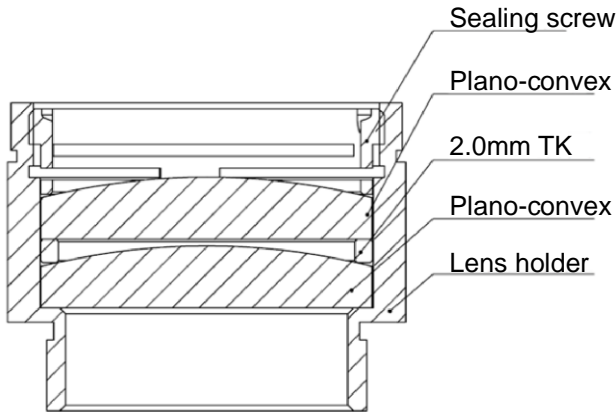


Figure 12-1 Installation Instruction — D28mm PL-CX/PL-CX CM Lens Holder

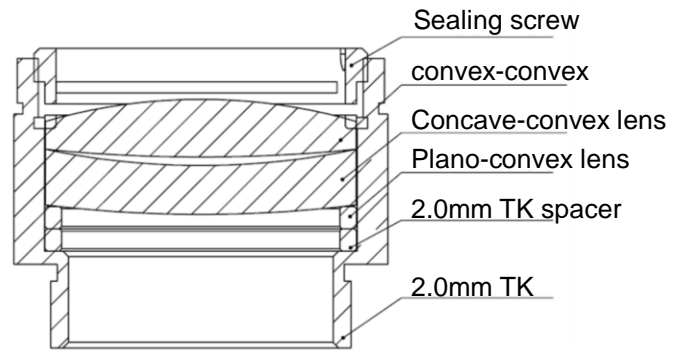


Figure 12-2 Installation Instruction — D28mm CX-CX/CC-CX CM Lens Holder

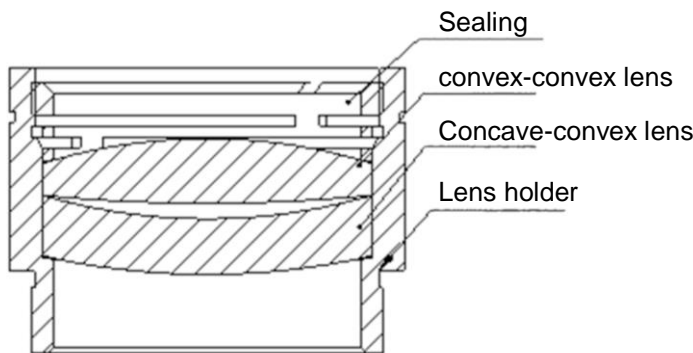


Figure 12-3 Installation Instruction — D30mm CX-CX/CC-CX CM Lens Holder

4.2.4 Changing Focusing Lens

Changing the focusing lens assembly can be performed while the head is mounted to the machine. This menu only covers the servicing of a Raytools' focusing lens. Refer to third-party focusing lens' instructions for its servicing.



**Caution :** As lens holder is removed, be sure to keep it vertical to prevent the lens from falling out.

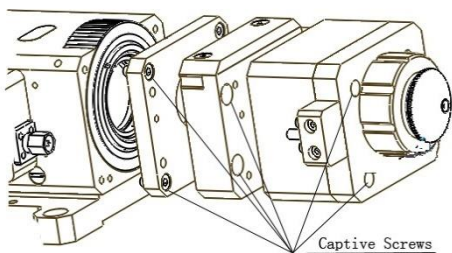


Figure 13 Remove Module WM and TM

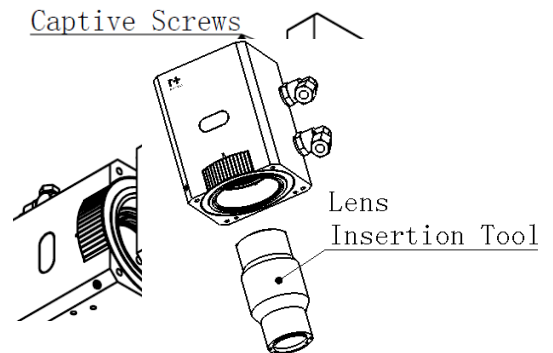


Figure 14 Remove The Focusing Lens

- See Figure 13, take out the locking screw from the bottom to the top.
- See Figure 14, using the lens insertion tool, unthread the lens holder.
- Place the lens holder on a clean place. Invert the lens holder and take out the lens.

## BT240 Product Manual

- Clean or change the focusing lens.
- See Figure 15, put the focusing lens and the spacer rings in the lens holder carefully.
- Place the lens holder onto the lens insertion tool and insert it into the focusing lens tube. Tighten the lens holder until it is snug.
- Reassemble components in order.
- Check the tip centering, laser focus and image and adjust as needed.

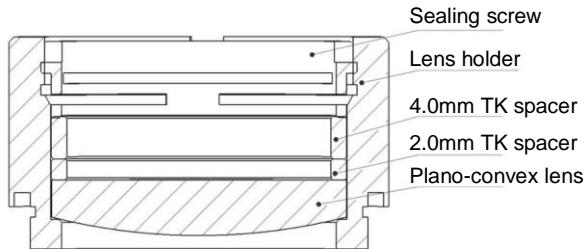


Figure 15-1 Installation Instruction —  
D28mm PL-CX/PL-CX FM Lens Holder

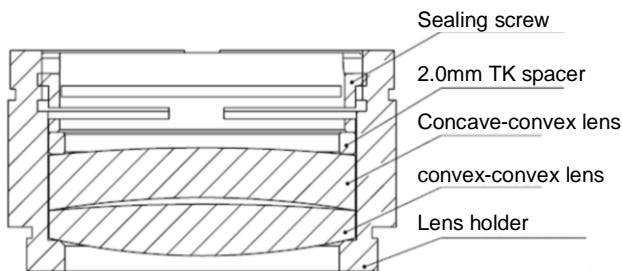


Figure 15-1 Installation Instruction —  
D28mm CX-CX/CC-CX FM Lens Holder

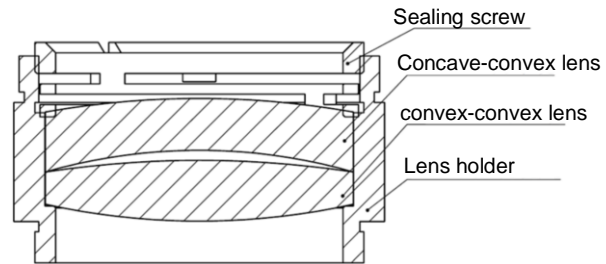


Figure 15-1 Installation Instruction —  
D30mm CX-CX/CC-CX FM Lens Holder

### 4.3 Removing Tip Assembly

In the process of laser cutting, the laser head will be unavoidably stricken. In this circumstance, the tip needs to be changed.

#### 4.3.1 Replacing the ceramic head

- Unscrew the tip
- Press the ceramic head and fix it without deviation. Then rotate the press cover.
- Make two 2 mm location holes on the new ceramic head aligned with two location pins on the gas jet tip. Hold the ceramic head and rotate the press cover.
- Reassemble components in reverse order.

#### 4.3.2 Replacing 3D Module Tm

- Unscrew the outside cover of Module TM
- Unscrew the locking screws with a wrench
- Install the new Module TM on the laser head with screws
- Screw the outside cover

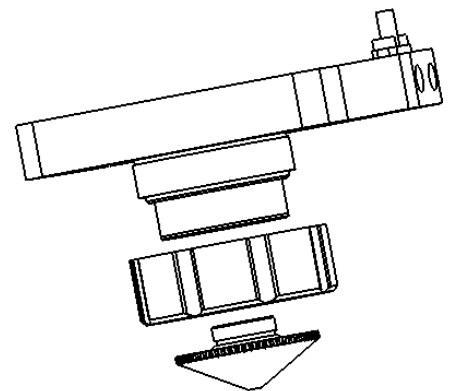


Figure 16 Remove Tip assembly

## BT240 Product Manual

### 4.3.3 Replacing Gas Jet Tip

- Unscrew the gas jet tip
- Insert the new gas jet tip. Tighten with appropriate force.
- A calibration capacitor is needed after replacement.

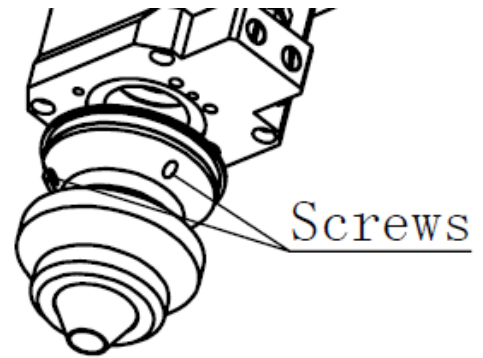


Figure 17. Replace Module TM