BT210 SERIES

800W Laser Cutting Heads User Manual

RAYTOOLS

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Version：	V1.6
Date：	2018/5/2

Historical Versions：

History Edition	Date	Description of change	Editor	Reviewer	Date of Review
V1.0	2016/10/25	Establish	Titian	Eric	
V1.6	2018/5/2	Version Change/Translation	Walter	Alex	2018/5/2

Thank you for your choosing our product!

This manual introduces the use of BT210 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.

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1 Introduction

The manual goes through the brief introduction of installation, setup, factory settings, operation and maintenance service of the BT210 series. While BT210 is available in many optical mechanics and customized configurations, this manual is genetic to the core products.

BT210 is a processing 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, as well as the delicate focus sets can completely meet different 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
- 100mm focal length option , effectively improves the cutting speed of thin plate
- Quick and easy access to the cover slide
- 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

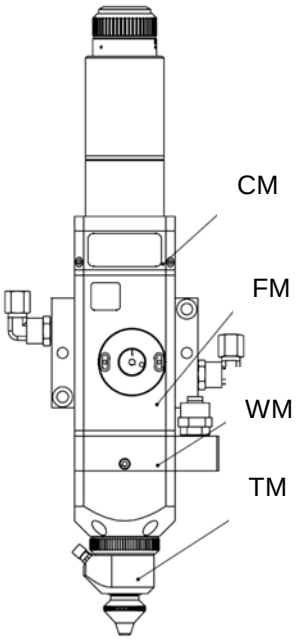


Figure 1 Cutting Laser Head Shown

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

1) Module CM: collimate the optical fiber, collimate the input laser beam to paralleled laser beam
2) Module FM: focus the collimated light beam to high-power-density focused light beam, and move ups and downs to set focus
3) Module WM: protect the optic window, protect the focusing lens from being damaged by residues, lengthen the life span of optics
4) Module TM: guide the focused light beam to the processing workpiece and spray high-speed gas flow to get high-quality cutting and weld.

2 Product Configuration

2.1 Installation of the Hole Site

BT210 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 perpendicular to the processing plate according to the drawings and make sure the laser heads are fixed tightly, without waggling in process. It is one of the preconditions of steady subsequent cuttings.

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

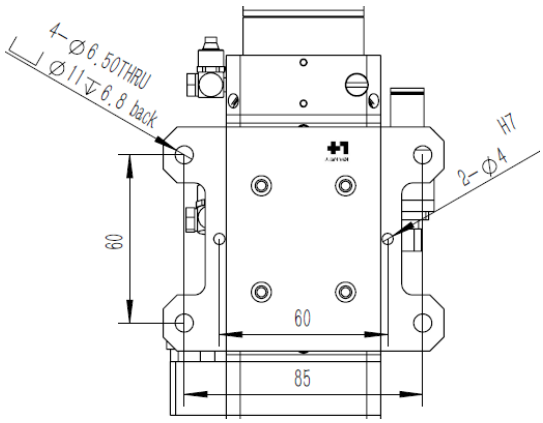


Figure 2. Hole Locations

2.2 Plumbing

2.2.1 Water Cooling

BT210 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 below 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.

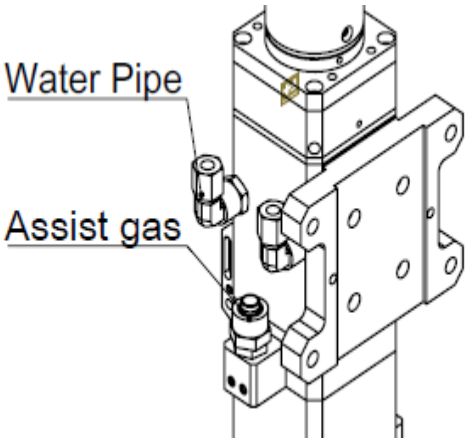


Figure 3. Water and Gas Pipe Connector Position

2.2.2 Assist Gas

Impurities in the assist gas such as hydrocarbons (THC) and moisture (H_2O) can damage optics, cause power fluctuations and result in inconsistent cuts. See the table below for recommended assist gas specifications.

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_2O (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 aspire air and the neoprene diaphragm can be a source of hydrocarbons.

Notice： 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 Input

The fiber input is the interface between the laser and the cutting head. BT210 will adapt to most industrial fibers. It is equipped with collimators.

Common fiber connectors include QBH, QD. Other connections are available too, such as 14, 24, 25, 30 mm grip rings (See figure 5). Each fiber connectors 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

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 reoriented the connector, you may do as follows:

(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.

(3) 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 reoriented the connector, you may do as follows. See Figure 4. Loosen the 4 clamping bolts in Figure 4 with a wrench. Rotate the QBH connector. Once the fiber connector is oriented correctly tighten the clamping bolts and the set screw.

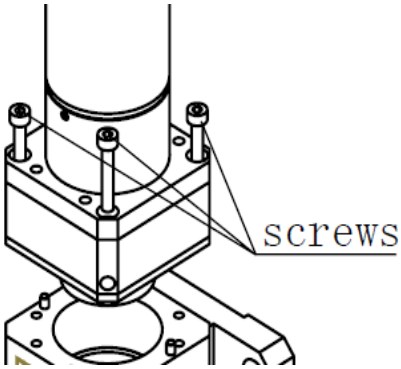


Figure 4. Fiber Orientation

BT210 QCS connector input manual

(1) See Figure 5, loosen locking ring 1 and 2.

(2) Input the fiber connector horizontally

(3) Tighten locking ring 1 and 2. Use a wrench if necessary.

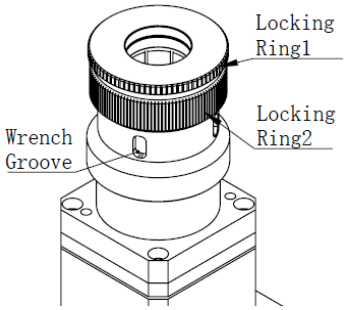


Figure 5. Fiber Orientation

2.5 Gas Jet Tip 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 BT210 is accomplished by adjusting the X-Y position of the collimating lenses.

2.5.1 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：

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.

Use two groups of screws until the beam is centered in the tip.

Once the beam is centered, double-check to ensure that the all adjuster screws are snug finger tight.

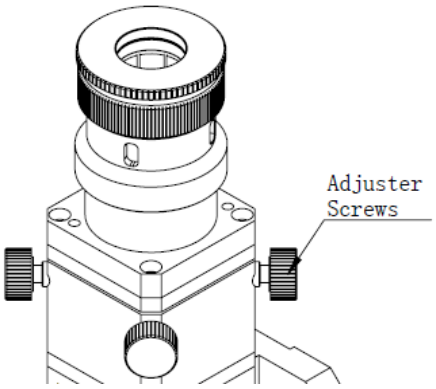


Figure 6. QCS Beam Centering

2.5.2 QBH Beam Centering

See Figure 7 for locations of adjuster screws on cutting heads. Loosen or tighten the screws with a 2.55mm hex wrench until the beam is center in the tip.

Make sure the beam is centered in the tip. One common method 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.

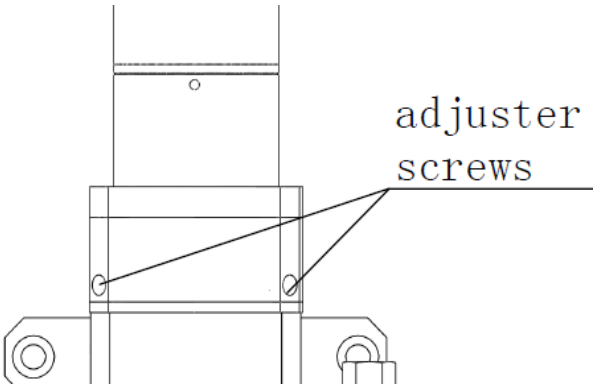


Figure 7. QBH Beam Centering

2.6 Setting Focus Position

BT210 is equipped with a adjustable lens holder that allows you to move the laser focal point to optimize the laser processing. The lens has a total of 14mm 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 0.1mm (the nearer the movement is, the better)

(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.)

To adjust the focus position, follow this procedure:

- Uncover the lid
- Loosen the lock nut by rotating it counterclockwise
- Adjust the focal distance by changing the indicated scale with the wrench rotating knob
- Once the focus position is properly set, tighten the Lock Nut by rotating it clockwise.

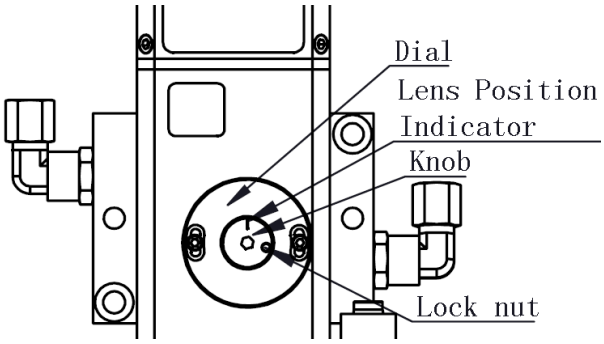


Figure 8. Setting Focus Position

3 Mechanical Installation

3.1 Cleaning optics

Because of the feature 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, powder free 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 of 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.

3.2 Changing Lens

3.2.1 Changing Cover Slide

You may do as follows to change cover slide:

- Remove the lid of Module FM
- Loosen the locking screw with a 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)
- Install the cover slide by placing it into the Cover Slide Drawer.
- Press the seal ring into the drawer to retain the cover slide. 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 and cover the lid.

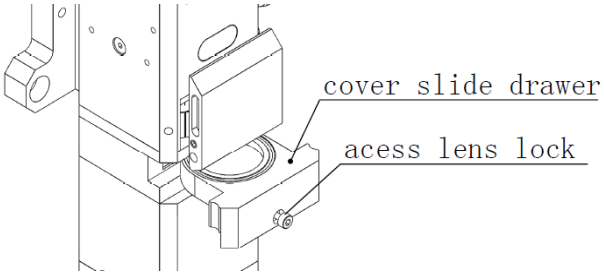


Figure 9. Changing Cover

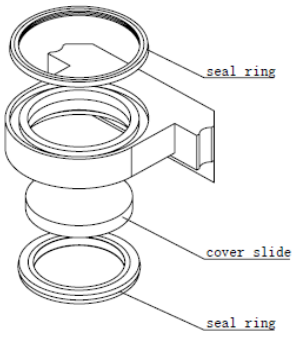


Figure 10. Inside Structure of The Cover Drawer

3.2.2 Changing Collimator 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 BT210
- 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 set screw and take out the collimator holder and the collimator.
- Install the new collimator in the new collimator holder. Thread them onto Module CM and tightening the screws.
- Reinstall components in reverse order.
- Check the tip centering, laser focus and image focus and adjust as needed.

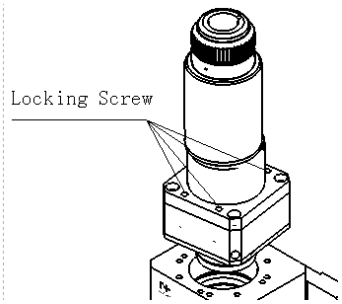
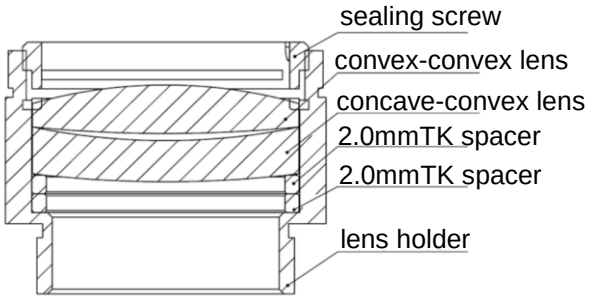


Figure 11. Collimating Module CM



D28mm CX-CX/CC-CX CM Lens Holder

Figure 12. CM Lens Holder Installation

3.2.3 Changing Focusing Lens

The focusing lens can be changed while the head is mounted to the machine. Always wear powder free gloves or finger cots when handling optics.

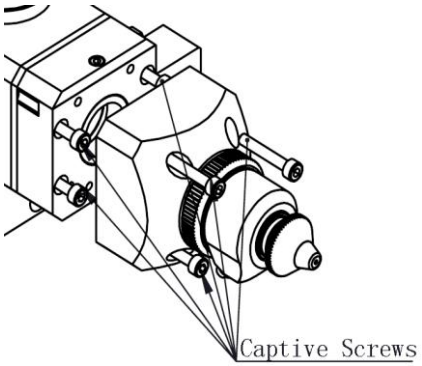


Figure13（2D）Remove Module WM and

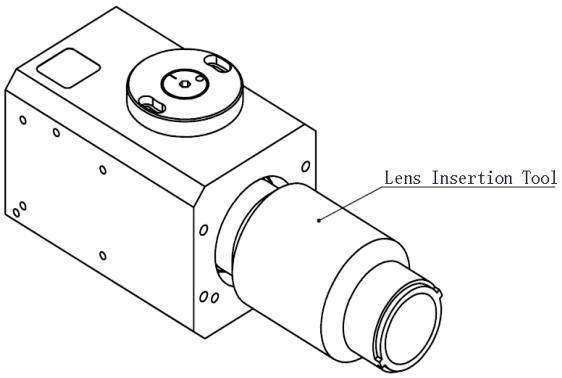


Figure14 Remove The Focusing Lens

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

- 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.
- 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.

  Be careful not to over tighten the lens holder as this may cause the lens to distort.
- Reassemble components in reverse order.
- Check the tip centering, laser focus and image and adjust as needed.

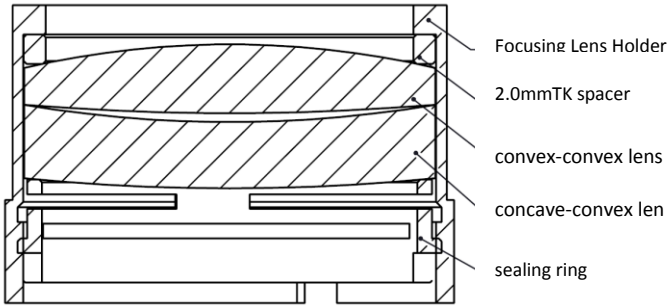


Figure 15. D28mm FM Lens Holder Installation Instruction

3.3 Replacing Gas Jet Tip

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

- Unscrew gas jet tip connector and remove gas jet tip connector and gas jet tip.
- Insert the new gas jet tip and gas jet tip connectors on TM components.
- A calibration capacitor is needed after replacement.