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# **Intelligent Cutting Head BLT310T Product Manual**

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### Foreword

Thank you for choosing the BLT intelligent cutting head. This manual provides you with important information such as product parameters, installation, and maintenance. Please read this manual carefully before using the product. At the same time, to ensure both operational safety and optimal product performance, please carefully adhere to the precautions outlined in this manual.

BOCHU is constantly updating/upgrading products, so our company reserves the right to modify the product models and descriptions in this manual without prior declaration.

If you have any questions or suggestions during use, please contact us using the information provided in this manual.

#### **Symbol Definitions**

Notice: Provides supplementary explanations or clarifications for the product.

Caution: Indicates that non-compliance with the instructions may result in minor injuries or equipment damage.

Warning: Indicates that non-compliance with the instructions may result in severe injuries or death.

Danger: Indicates that non-compliance with the instructions will result in severe injuries or death.

#### Declaration

Disassembly of the product is strictly prohibited without the technical authorization from BOCHU, otherwise the warranty will be invalid!



## **Revision History**

Version No.	Date	Description
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## Chapter 1 Product Specification

The Intelligent Laser Cutting Head BLT310T is specifically designed for laser beams with wavelengths of 1030 to 1090 nm and a maximum power of 4 kW. It utilizes a bus control system for data transmission between the cutting head and the host machine, enabling intelligent control of the cutting head. The cutting head is equipped with gas interfaces, which are used to connect to cutting gases, which are essential for supporting cutting operations and other functionalities.

Carefully take out the cutting head from its packaging upon receiving the product. The nameplate on the right side of the cutting head provides detailed information, including the product model, serial number, power rating, and interface specifications. Verify that the nameplate information matches your purchase. If any discrepancies are found, contact BOCHU personnel immediately.



Figure 1-1 Nameplate example

#### Caution:

1. The packaging box is specifically designed to protect the product during transportation. Retain the original packaging for later use when returning the cutting head for maintenance.

2. New cutting heads are typically shipped with an accessory box containing a list of included items. These items may be needed for operation or basic maintenance. Store the accessory box carefully to avoid losing any components.

3. Handle the cutting head with care during unpacking and transportation. Uncontrolled impacts or collisions may damage the product.



### 1.2 **Product View**



Figure 1-2 Product view

- 1. Fiber optic interface;
- 2. Upper protective window;
- 3. Collimating module;
- 4. Focusing module
- 5. 2nd lower protective window;
- 6. 1st lower protective window;

- 7. LED work indicator light;
- 8. Cutting gas interface;
- 9. Anti-collision screws;
- 10. Ceramic body locking ring;
- 11. Ceramic body;
- 12. Nozzle.



### **1.3 Technical Parameters**

Table 1-1	BLT 310T Cu	tting Head	Technical	Parameters
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Cutting Head Parameters	Values
Laser Wavelength	1030 ~ 1090 nm
Laser Power	$\leq 4  \mathrm{kW}$
Fiber Interface	QBH/EOC
Spot Magnification	M = 1.5/2.0/2.5  (100:150/100:200/100:250)
Max Focus Adjustment Range	$\pm 50 \text{ mm} (\pm 1.97 \text{ inches})$
NA	Max.0.13 at Fc100
Centering Adjustment Range	$\pm 1.5 \text{ mm} (\pm 0.059 \text{ inches})$
Focusing Acceleration	7.5 m/s <sup>2</sup> (24.6 ft/s <sup>2</sup> )
Cutting Gas Interface	ø10, max 25 bar (2.5 MPa)
Working Temperature	5 ~ 55°C (41 ~ 131°F)
Storage Temperature	-25 ~ +55°C (-13 ~ +131°F)
Dimension	405 x 119 mm (QBH version)
Weight	About 4.3 kg.(QBH version)

To avoid the damage of cutting head during storage or transportation, the following shall be taken into consideration:

### **A** Caution:

1. The cutting head should be stored in the environment within the allowed temperature and humidity range.

2. Avoid storing in magnetic fields (such as permanent magnets or strong alternating fields) and their vicinity.

3. Avoid collisions during transportation or usage.



### 1.4 LED Indicators

Icon	Status	Indication	
POWER	Green	The power is normal.	
	Red	Under-voltage alarm due to insufficient electrical power.	
<b>I</b> I	Light off	Power off. The cause might be that no power is on, the connecting wires are damaged or malfunctioning, or the interface is loose.	
RUN	Green	The system is normal.	
₽	Red	Motor exception. The motor current consumption is too high, and the mechanical components cannot operate smoothly.	
TT	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.	
LINK	Green	The communication is normal.	
	Red	Communication exception.	
<b>!!</b>	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.	
SENSOR	Green	The readings of each sensor are normal.	
	Red	There are exceptions in the readings of the sensors.	
Ĩ	Light off	The connecting wires are damaged or malfunctioning, or the interface is loose.	

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## Chapter 2 Gas Interfaces

As shown in the figure below, the gas interface of the cutting head mainly includes the cutting gas interface.



### Caution:

1. The maximum pressure of the cutting gas is 25 bar (2.5 Mpa).

2. The quality of cutting gas should meet the requirements of ISO 8573-1:2010: solid particles - class 2, water - class 4, oil - class 3. The purer the cutting gas, the longer the service life of the protective window.

3. The diameter of the cutting gas interface is 10 mm.

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## Chapter 3 Electrical Interfaces

### 3.1 **PWE Interface**

The PWE interface supports 100 Mbps network communication and delivers power and data to the BLT series cutting heads via the PWE cable.



Figure 3-1 PWE interface

### **A** Caution:

1. The PWE interface of the cutting head must be connected using the high-flexibility PWE towline cable provided by BOCHU, linking it to BCS210E or BCL4568E.

2. For users of BCL4568E, select an appropriate 24 V power supply based on the power requirements of the cutting head and other devices on the board.

3. During installation, the PWE cable must not be twisted in enclosed spaces. Separate strong and weak electrical cables during wiring. And it is recommended to use isolators to the cables apart, ensuring at least a gap of 10% of the cable diameter between adjacent cables.

### 3.2 Grounding

When the cutting head is installed on the Z-axis of the machine tool, it must be properly grounded. Improper grounding may introduce electromagnetic interference, affecting the normal functionality of the cutting head.

Caution: The cutting head is grounded primarily through the mounting screw holes that connect it to the machine's back plate. Therefore, ensure that both the machine and the screw holes on the cutting head's back plate are properly grounded.



#### 3.3 Wiring

There are two wiring set for BLT310T. The single PWE interface is for Bus system, while the PWE interface combined with aviation plug combination is for non-Bus system.

### Waterproof Cautions:

1. The PWE interface and the aviation interface come with dust plugs from the factory, which can achieve a protection level of IP64 with the dust cap securely in place. Meanwhile, with the PWE cable and aviation plug connected properly, the protection level of IP64 can also be achieved.

2. Once the dust plug is removed, the IP64 protection rating cannot be guaranteed. If exposed to spraying or water splashes, water may enter the product, affecting its functionality.

3. When adjusting the machine wiring, remove the dust plug for wiring, and it is recommended to keep the removed dust plug. Install the dust plug immediately after removing the wire to prevent accidental water ingress during transportation, water piping connections, and other processes.

#### 3.4 **Bus System**



Figure 3-2 Bus system



### **A** Caution:

1. Only the personnel who has received the training and has the professional knowledge can perform the operations above.

2. BCS210E shall be powered off when connecting the cutting head.

### 3.5 Non-Bus System



### **A** Caution:

1. Only the personnel who has received the training and has the professional knowledge can perform the operations above.

2.BCL4500A shall be powered off when connecting the cutting head.

## Chapter 4 Safety Instructions

The installation and use of the cutting head involve certain risks. Only trained personnel familiar with proper procedures should handle it. Ensure necessary protective gear, such as safety goggles, heat-resistant gloves, and masks, is available near the machine to protect workers.

The common safety risks during the installation and use of the cutting head are listed in the table below:

Туре	Indicator	Description	
Caution		Before replacement or installation, ensure that all components of the laser cutting system (such as the laser, water cooler, controller, power supply, computer, etc.) are turned off. Verify that the laser wavelength range, power level, and fiber interface are compatible with the cutting head. If the cutting head is subjected to impact, inspect the affected area. Replace any damaged components promptly to ensure proper operation. When the machine is shut down or under maintenance, ensure the laser is disabled via the host computer. Implement safety measures and place warning signs to prevent accidental operation, which could	
Laser Radiation		cause injury or equipment damage. The cutting head itself does not generate laser radiation; however, it only guides the laser radiation generated by the laser source. Improper operation, such as a collision, may cause the laser beam to escape uncontrollably, posing a risk to nearby personnel or equipment. Users are prohibited from modifying or disassembling the cutting	
Do Not Disassemble		head without the authorization from qualified personnel. Any consequences arising from unauthorized modifications or disassembly will be the sole responsibility of the user.	

#### Table 4-1 Safety Instructions



Туре	Indicator	Description
Do Not Look Directly at Laser lights		Do not stare directly at the laser beam during debugging or cutting operations. If necessary, wear appropriate protective goggles and maintain a safe distance to avoid health hazards caused by laser radiation. After the cutting head is powered off, the nozzle may remain hot.
Do Not Touch		Avoid touching it directly to prevent burns.
Must Wear Dust Mask		During operation, the cutting head generates a significant amount of smoke and dust. Wear a mask promptly to protect users from potential harm caused by cutting fumes.



### Chapter 5 Cutting Head Installation

During the installation of the cutting head, dust or dirt may accidentally enter the cutting head and contaminate the optical window, affecting its normal use. Please refer to the following installation instructions to avoid contamination.

#### 5.1 **Preparations before Installation**

Prepare the items listed below:

- Cutting head.
- Clean workbench (Type of clean workbench: vertical purification; Cleanliness level: ISO 5, 100; Average airspeed > 0.4 m/s).
- Clean kit: high-intensity flashlight, anhydrous ethanol (or IPA), lint-free purification swabs, cleanroom wiper, compressed air dust removal can (or air blower).



Figure 5-1 Preparation tools for the cutting head installation



**A** Caution:

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1. Only the personnel who have received the training and possess the necessary expertise are permitted to perform the operations mentioned above.

2. To ensure the proper function of the laser equipment and the safety of the operators, please adhere to the relevant operating instructions.

### 5.2 Specified Procedures

### 5.2.1 Prepare the Clean Workbench

Prepare the clean workbench, and start it to work properly.





- Step 1 Check the cleanliness of the equipment (use a particle counter to check cleanliness) and confirm that the FFU (Fan Filter Unit) is within its validity period (measure the average airflow speed in the work area; if the airflow speed is below 0.3 m/s, the FFU must be replaced).
- **Step 2** Check that all switches are functioning properly and verify that the fan is operating normally.
- Step 3 No unnecessary items should be installed in the clean workbench to prevent the clean airflow from being obstructed.
- Step 4 For newly installed or long-unused clean workbenches, clean the surface with a cleanroom wiper and anhydrous ethanol before use.



Startup Procedures:

- Step 1 Connect the power supply and slide the glass door of the clean workbench down to the lowest position, leaving a gap of approximately 10 cm.
- **Step 2** Start the fan, and it is recommended to allow the workbench to purify for about 30 minutes before use.
- Step 3 After normal operation, turn on the clean workbench's lighting.

#### 5.2.2 Put the Cutting Head inside the Clean Workbench

Put the cutting head horizontally inside the clean workbench.



Figure 5-3 Put the cutting head inside the workbench

Caution: To prevent dust from falling inside the chamber, please check the integrity of the specified protection film/cap for the fiber interface before inserting or removing the fiber optic cable.

### 5.2.3 Clean and Wipe the Fiber Optic Interface of the Cutting Head

Clean the fiber interface with a dust-free cloth soaked in anhydrous ethanol.



Figure 5-4 Clean the interface

### 5.2.4 Check the Laser Fiber Optic Connector End Face

Remove the protective cap from the laser fiber optic connector. Use the high-intensity flashlight to inspect the fiber end face for contamination. If clean, the fiber can be directly inserted; if not clean, clean it with a swab dipped in anhydrous ethanol or IPA.

### 5.2.5 Remove the Protective Film / Remove the Protective Cap

Remove the dedicated protective cap or protective plug from the fiber optic connector on the cutting head.

### 5.2.6 Insert the Laser Fiber Connector into the Cutting Head

Align the positioning pin on the fiber optic plug with the notch on the connector, and then insert it into the unlocked fiber optic connector, ensuring it is fully inserted. Rotate the locking cap until it is tightly secured.



Figure 5-5 Insert the QBH fiber connector

### 5.2.7 Wrap and Seal

After inserting the fiber, use tape to wrap and seal the connection between the fiber and the interface of the cutting head.



Caution: To ensure a proper seal, it is recommended to wrap at least three layers of tape for sealing.



### 5.2.8 Install the Cutting Head on the Back Plate

The cutting head can be mounted onto the machine's Z-axis back plate using four screws: A, B, C, and D. When securing the cutting head to the machine, it is essential to ensure that the cutting head is properly tightened and free from any wobbling.



Figure 5-7 Screw A, B, C, D

### 5.2.9 Install Nozzle and Ceramic Body

The nozzle is often damaged due to laser burning or collision, so it is essential to check and replace the nozzle regularly. For the replacement of the nozzle, twist it off by hand in the direction shown in the diagram, then replace it with a new one and tighten it.



Figure 5-8 Ceramic body and nozzle

If the ceramic body is damaged due to collision or other reasons, replace it with the procedures below:

- Step 1 Unscrew the nozzle by hand.
- **Step 2** Use a wrench to remove the ceramic locking ring, and then take out the damaged ceramic body.
- Step 3 Align the new ceramic body with the locating pin hole, press it up by hand, and then tighten the ceramic locking ring.
- **Step 4** Reinstall the nozzle.



### 5.2.10 Laser Beam Centering

Adjust the X-Y alignment knobs using low-power pinpointing to ensure the focus is at the center of the nozzle.



Figure 5-9 Laser beam centering

Manual Operations for Laser Centering:

- **Step 1** Confirm that the laser beam is turned off.
- **Step 2** Place the tape below the nozzle.
- Step 3 Click to trigger a low-power laser pulse and assess the position of the laser beam relative to the nozzle by observing the tape's penetration.
- **Step 4** Adjust the X/Y alignment screws to position the laser beam at the center of the nozzle.

## Chapter 6 Appendix A Maintenance

### A.1 Product Structure Diagram



Figure 6-1 Product diagram



### A.2 Change the Upper Protective Window



Figure 6-2 Change protective window

Follow the procedures below to change the upper protective window:

- Step 1 Loosen the screws to open the upper protective window cartridge shield.
- Step 1 Pull out the upper protective window cartridge.
- Step 2 Cover the chamber with masking tape to prevent dust from entering.
- **Step 3** Remove the pressing ring from the protective window.
- Step 4 Replace the upper protective window.
- Step 5 Open the upper protective window cartridge shield.
- Step 6 Insert the upper protective window cartridge with the window into the cutting head.



Figure 6-3 Insert window cartridge



### A.3 Change the Lower Protective Window



Figure 6-4 Change the lower protective window

Follow the procedures below to change the lower protective window:

- Step 1 Loosen the screws to open the lower protective window cartridge shield.
- Step 2 Pull out the lower protective window cartridge.
- Step 3 Close the lower protective window cartridge shield to prevent dust from entering.
- **Step 4** Remove the pressing ring from the protective window.
- Step 5 Replace the lower protective window.
- Step 6 Open the lower protective window cartridge shield.
- Step 7 Insert the lower protective window cartridge with the window into the cutting head.
- Step 8 Close the protective shield.

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## Chapter 7 Appendix B Mechanical Size

### **B.1 Installation Size for Cutting Head**



Figure 7-1 BLT310T-QBH-150





Figure 7-2 BLT310T -QBH-200



Figure 7-3 BLT310T-QBH-250

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Figure 7-4 BLT 310T-EOC-150











Figure 7-6 BLT310T-EOC-250

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### **B.2 Interface Types**

General Type	Image	Other Compatible Interface Types
QBH	QBH	<ul><li>Trumpf LLK-Q</li><li>IPG HLC-8/LC-8</li></ul>
EOC		• Maxphotonics G5

### Table 7-1 Interface Types of BLT 310T

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