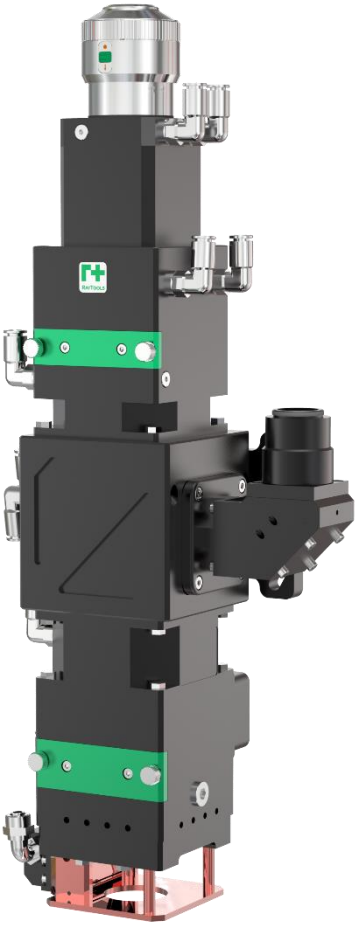
BW12K

12KW High Power Fiber Laser Welding Head

User manual (version number: 1.1)



Shanghai Jiaqiang automation

technology co., ltd

Preface

Thank you for purchasing our products!

This manual for laser welding joint installation debugging made a detailed description, so that you quickly start using this product; If you need to know anything else, you can consult our company directly.
Due to the continuous updating of product functions, the products you receive may differ from the statements in this manual in some aspects. I would like to apologize here!

We reserve all rights to this document, including this document relating to published patents and other registered commercial ownership. It is strictly forbidden to use this document in an improper way, especially to copy and distribute it to third parties.

If you find any errors in this document, please inform us as soon as possible.
The data contained in this manual are intended to describe the product only and should not be considered a declaration of a security interest.
For the benefit of our customers, we are constantly trying to ensure that our products are up to date with the latest technology.

Version description:

Release date of this edition:	August 4, 2023/8

Historical version	Release date	Brief introduction of changes	Editor	Editing date	Peer reviewer	Review date
V1.0	2023/3/30	Establish a user manual	Jiang Weizhi	2023/3/28	Yuan Ling Feng	233/3/29
V1.1	2023/10/19	Update product name and accessory material number, and improve the content	Correction	2023/10/19	Yuan Ling Feng	2023/10/19

Disclaimer

- We reserve the right to change the design for improving the quality or expanding the application mode and based on the production process.
- Our company is not responsible for any loss or accident caused by wrong operation or improper handling of our products.
- Disassembling the product will forfeit all warranty claims, excluding the normal replacement of worn parts and components required for maintenance or commissioning operations.
- Unauthorized alteration of products or use of inappropriate spare parts will directly lead to the invalidation of warranty and liability exemption.
- It is recommended to use only the spare parts provided by our company, or hand them over to our company or a designated professional team for installation.

Usage regulation

- Ensure that the product is used in a dry environment.
- Ensure that products are used in the environment required by EMC standards.
- Products are only allowed to run within the parameters specified by technical data.

Personnel responsibilities

- Familiar with the basic regulations of work safety and accident prevention, and have received equipment operation guidance.
- Read and understand basic safety instructions and operations.
- Must have studied relevant regulations and safety instructions and understand possible hazards.
- Comply with relevant regulations and implement corresponding protective measures.

Safety instructions

- Prevent electric shock

1) Components of the laser head, such as nozzles, sensors, sensor interfaces and attached fasteners, may not be fully protected by ground wires due to limited functions. These parts may carry low voltage. When installing electrical equipment, please pay attention to taking electric shock prevention measures for relevant personnel.

2) Note that the equipment should be grounded as required.

- Prevent danger

1) Never place your hands or other body parts under the laser head.
2) Repair and maintenance work can only be carried out after the power is turned off.
3) Do not exceed the specified maximum pressure.
4) It must be ensured that the laser head is in normal condition at all times.
5) All fasteners such as bolts and nuts must be tightened.

- Laser protection

1) Avoid direct or scattered radiation to eyes or skin.
2) Do not look at the laser beam, even in the condition of wearing optical equipment is not feasible.
3) Use special laser protective eyepieces that meet the requirements of relevant standards.

- Prevent waterway corrosion

To avoid corrosion, use the prescribed coolant and observe the relevant requirements and specified maintenance intervals.

- Noise prevention

When the cutting pressure is high, in order to prevent people from being harmed by noise, the corresponding measures should be stipulated or explained, and observed.

- Storage and transportation

1) Comply with the storage temperature range allowed by technical data.
2) Take reasonable measures to prevent fire, vibration or impact.
3) Do not store in or near the magnetic field.

Directory

1 Overview

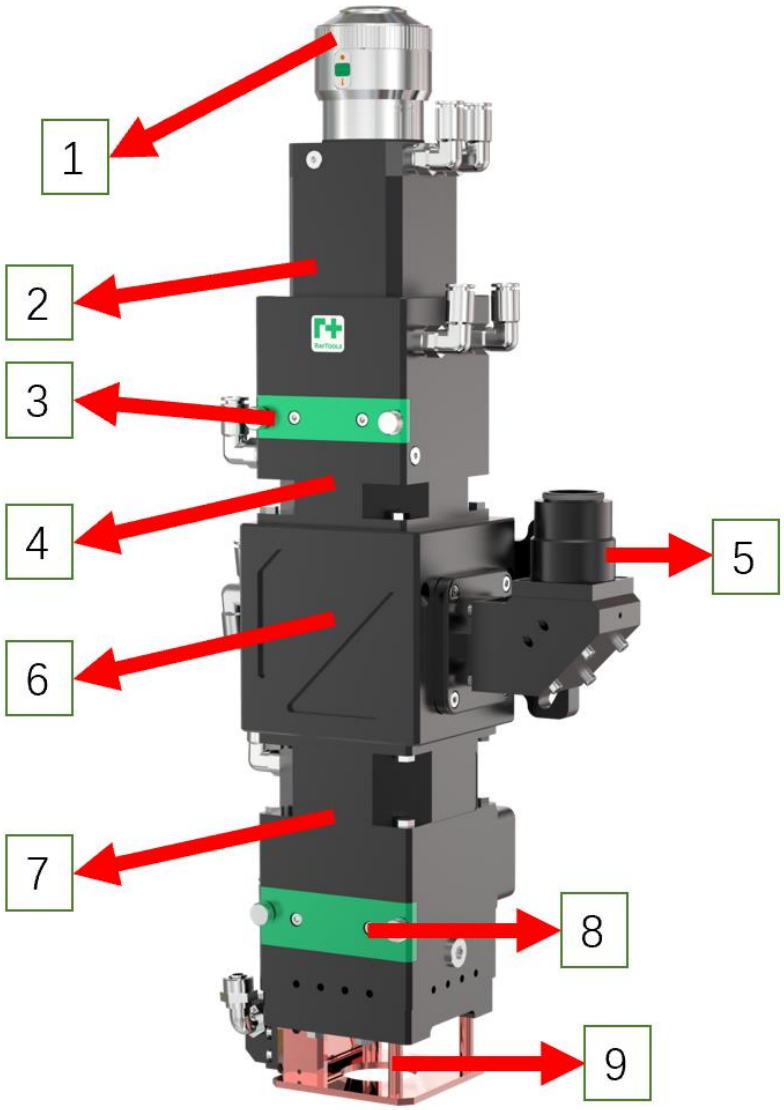
This manual covers the basic installation, factory setup, operation and maintenance services of BW12K series products. There are many specific optical mechanical or custom configurations, and only the main unit components are introduced in this manual.

BW12K Series is a laser processing head suitable for medium and high power industrial laser production applications. Its overall optimized optical focusing system, annular gas path and water cooling unit can completely meet the industrial laser processing environment of material welding and other customized requirements for different applications. A variety of flexible fiber interface options and optical collimation and focusing configurations enable it to adapt to various mainstream fiber lasers in the industry.

1.1 Product characteristics

- Compact structural design;
- Optical lens configuration with different specifications;
- Drawer-type protective mirror seat;
- Efficient water cooling system;
- High quality airflow design;
- A variety of optical fiber interfaces are optional;
- Rich expansion modules;
- Robust sealing design;
- Temperature monitoring design.

1.2 Product introduction

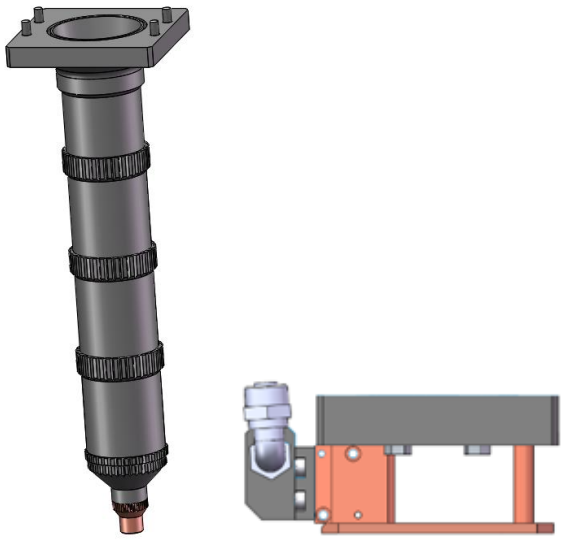


1	Optical fiber interface
2	Aperture
3	Collimating protective mirror
4	Collimating mirror
5	CCD module
6	Beam-combining mirror
7	Focusing mirror
8	Focus protective mirror
9	End assembly

2 Installation and use

2.1 Preparation before installation

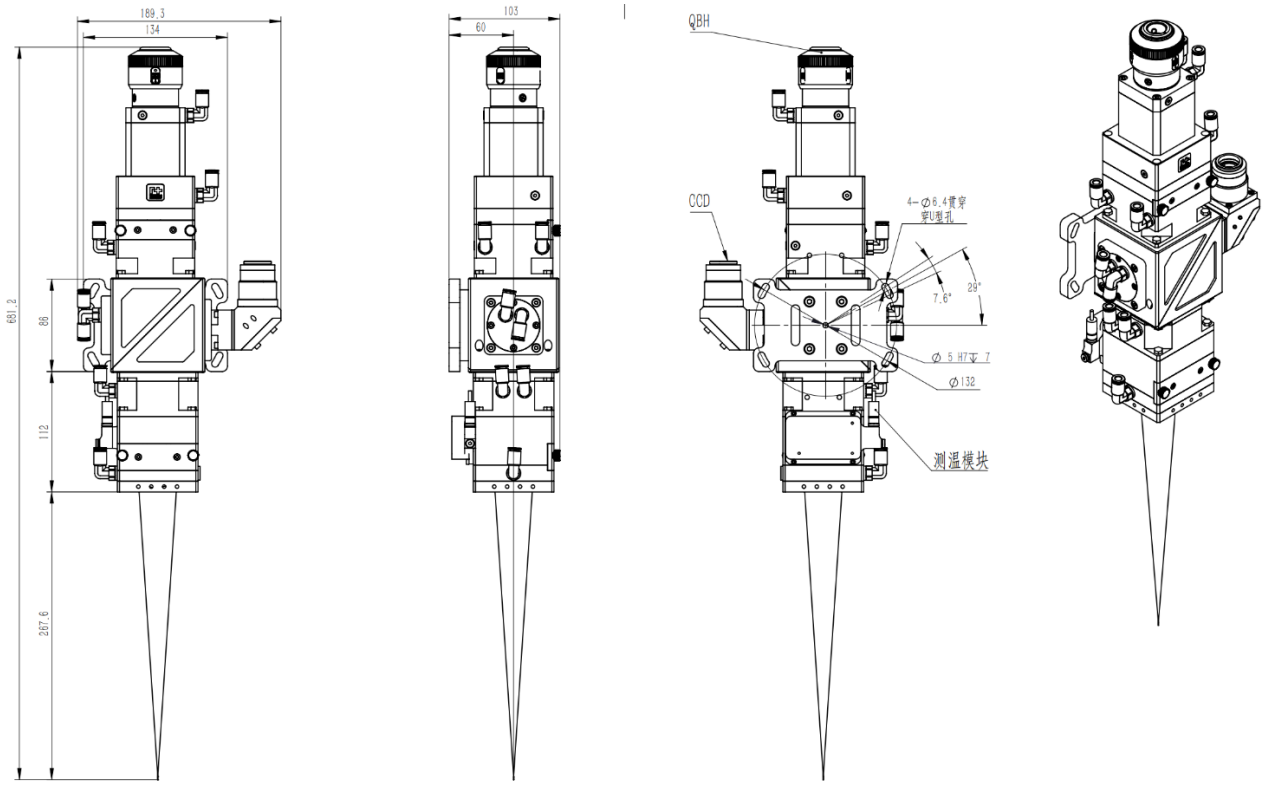
Because BW12K series end components need to be selected according to customer's selection, please confirm whether the end coaxial/air knife + side blowing components are complete before installation; Please install the laser head and the end assembly (use 4 inner hexagon cylindrical head bolts M4 × 45 to install coaxial fittings or use 4 stainless steel outer hexagon bolts M4 × 20 to install air knife assembly); As shown in the following figure:



2.2 Installation hole position

BW12K laser welding joint is fixed with the machine tool through the mounting back plate. See the following figure for the size and position of the mounting back plate hole.

It is recommended that the customer install the laser head perpendicular to the machining plate surface, and ensure that the laser head is locked and there is no shaking during machining, which is one of the prerequisites to ensure the subsequent stable welding effect.



Schematic diagram of installation hole position take 150: 350 as an example (with CCD interface and temperature monitoring). If you need other specifications, please contact our company

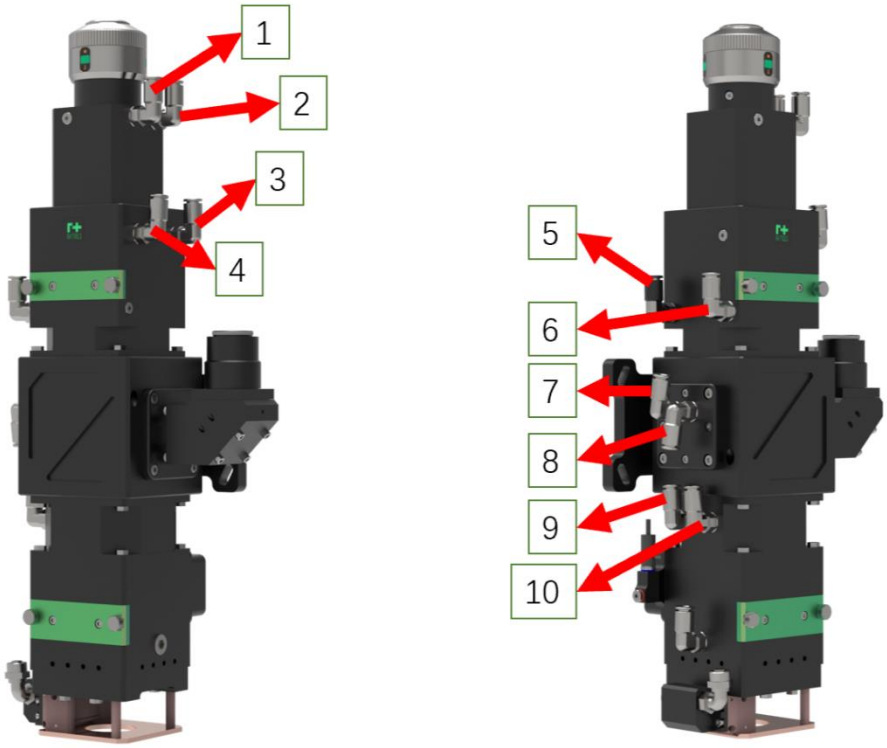
2.3 The technical parameters of this product are shown in the following table

Laser wavelength	1064nm
Optical fiber interface	QBH (standard), QD, LLK-B, LLK-D, LOE, Q +
Optical aperture	48mm
Collimating focal length	100mm, 150mm
Focal length of focus	300mm, 350mm, 400mm
Specifications for protective mirrors	φ 50mm*8mm (lower protective drawer)
CCD Connection Module	Standard C/CS interface

2.4 Waterway and gas way connection

2.4.1 Waterway connection

Figure 2-1 shows the recommended connection method of BW12K laser processing head waterway.



Connect 2-3, 4-5, 6-7, 8-9 with a water pipe with a diameter of 6mm to form a loop

Connector 1 is connected to the water inlet of chiller

Joint 10 is connected to the water return port of chiller

Fig. 2-1 BW12K Laser Welding Joint Waterway Connection

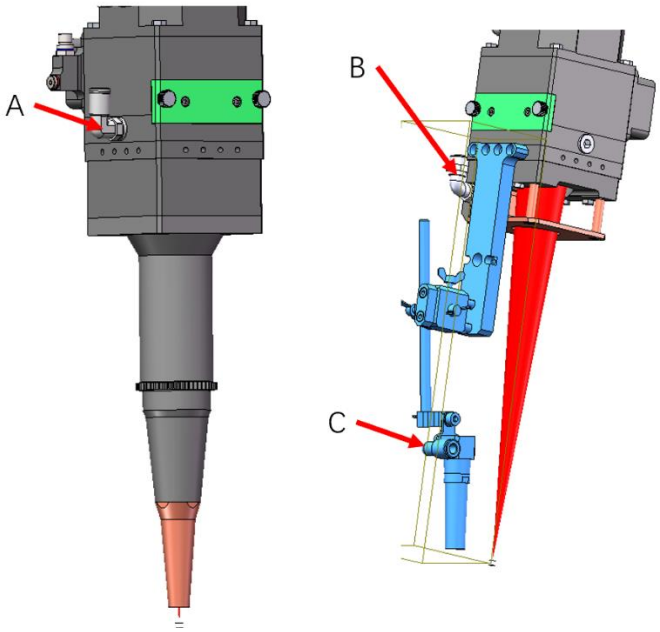
Specific requirements for cooling water are shown in the following table:

Minimum velocity	2.3 L/min (0.6 gpm)
Water pressure requirement	Approximately 0.4 Mpa

Inlet temperature	Room temperature > cooling temperature > dew point
Hardness	< 250mg/liter (relative to CaCO3)
PH range	6 to 8 (deionized or distilled water)
The size of particles can be passed	Less than 200 microns in diameter

2.4.2 Pneumatic connection

The air circuit connection of BW12K air knife and coaxial protection is shown in the following figure respectively



Coaxial gas path: Joint A is connected with inert protective gas

Paraxial air path: 1. Joint B is an air knife interface, which is connected with 4 ~ 6bar clean compressed air.

2. Connector C is a protective gas interface, which is connected with

inert protective gas.

Fig. 2-2 BW12K Laser Welding Joint Gas Path Connection

The requirements of the connected gas are shown in the following table. The pressure of compressed air is generally 0.4 ~ 0.6 MPa, and the pressure of protective gas is about 0.1 MPa when connecting nitrogen, argon or helium, which is specifically adjusted according to the welding requirements.

Gas	Maximum water vapor content (ppm)	Maximum content of hydrocarbons (ppm)
Nitrogen	< 5 ppm	< 1 ppm
Argon gas	< 5 ppm	< 1 ppm
Helium gas	< 5 ppm	< 1 ppm
Air	< 5 ppm	< 1 ppm

2.5 Optical fiber connection

Optical fiber interface refers to the connection between the optical fiber end of laser and the welding joint. BW12K is suitable for most industrial laser generators.

Commonly used optical fiber interfaces include QBH and QD, and other optical fiber interfaces can also be adapted. Each laser interface has its own unique method of fixing optical fibers. Please refer to the corresponding introduction to the use of optical fiber interface.

Warning: Optics must be kept clean and all dust must be removed before use. If the laser head is fixed vertically with optical fiber, then the laser head must be rotated 90 degrees to be placed horizontally, and then inserted with optical fiber to prevent dust from falling on the lens surface, and then fixed with optical fiber.

The connection method between QBH and optical fiber is shown in Figure 2-3:

1) Rotating the outer sleeve so that the red dot on the side surface of the outer sleeve and the red dot on the inner sleeve are in one line;
2) Take off the optical fiber protective cap and check whether the crystal head glass of the optical fiber rod is clean. If there is pollution, it must be cleaned first;
3) The clean optical fiber head is coaxial with QBH, and the red dot on QBH is guaranteed to be in the same straight line with the longest groove on the optical fiber head;
4) Insert the optical fiber head into QBH, lift and rotate the outer sleeve until the two contact surfaces are attached.

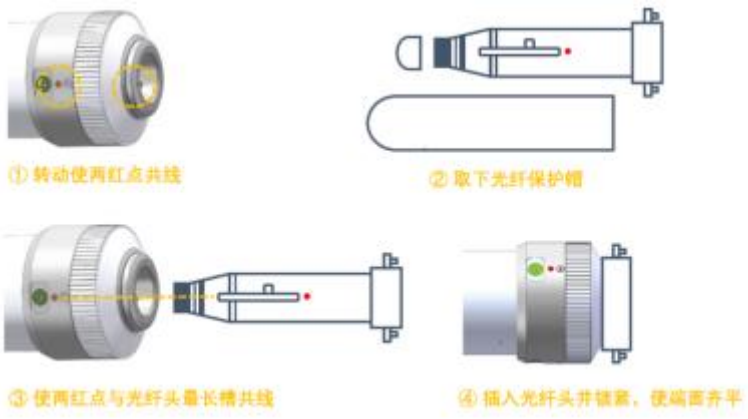


Fig. 2-3 QBH and optical fiber connection method

2.6 CCD regulation

2.6.1 Brightness adjustment

The brightness level can be realized by adjusting the knurled rotation structure in the right picture.

2.6.2 Clarity adjustment

The clarity can be adjusted by adjusting the convex cylindrical structure at the upper end of the square on the right.

2.6.3 Field of view centering

By tightening/loosening the two M4 adjusting screws in front of the large triangle block, the field of view can be adjusted.

2.6.4 Field of view rotation

1) Loosen the 4 M3x6 socket screws 1-2 turns as shown in the left figure.

2) Loosen the top wire of M3x3 for 1-2 turns.

3) Grasp the cylindrical part above the convex cylindrical structure (clarity adjustment) and rotate it clockwise (thread tightening direction) by a certain angle to achieve the desired field of view direction.

4) After adjusting the direction of the field of view, keep the cylindrical part still and lock the four M3x6 hexagon screws.

5) Tighten the top wire of M3x3, that is, adjust the direction of the field of view.

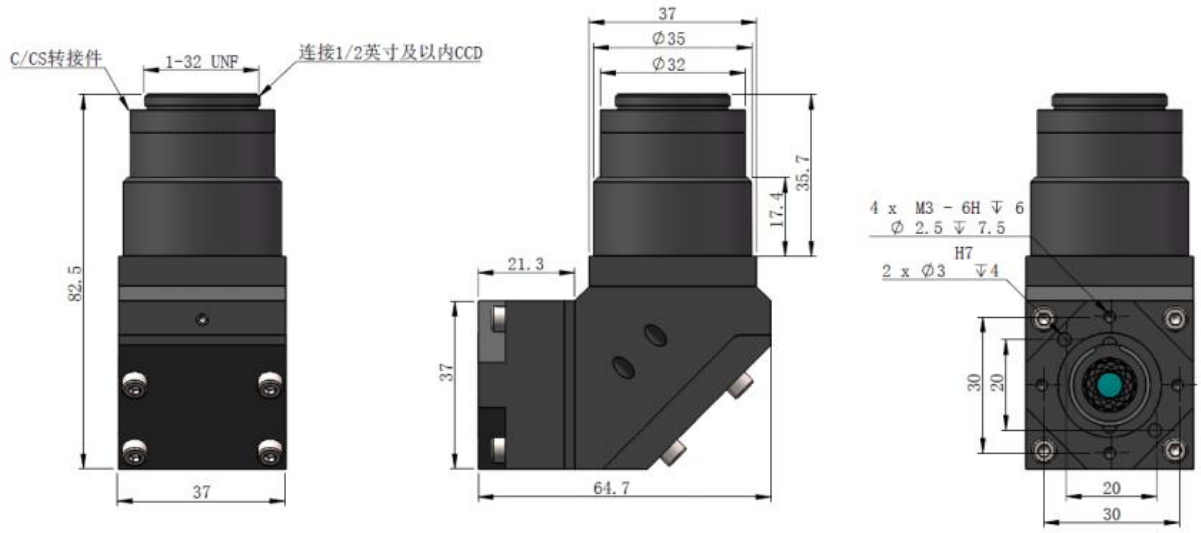


Fig. 2-4 Adjustment Method of BW12K CCD

2.6.5 Matching table between different defocus and lens imaging

When it is used with the focusing mirror of laser head, the defocus range can be clearly seen by the lens according to the focal length of the focusing mirror

See the table below for details.

Focal length of common focusing lens/mm	Positive defocus/mm	Negative defocus/mm
125	5.5	8.5
150	8	12
200	17	19
250	28	28
300	42	38
400	82	63
500	136	92

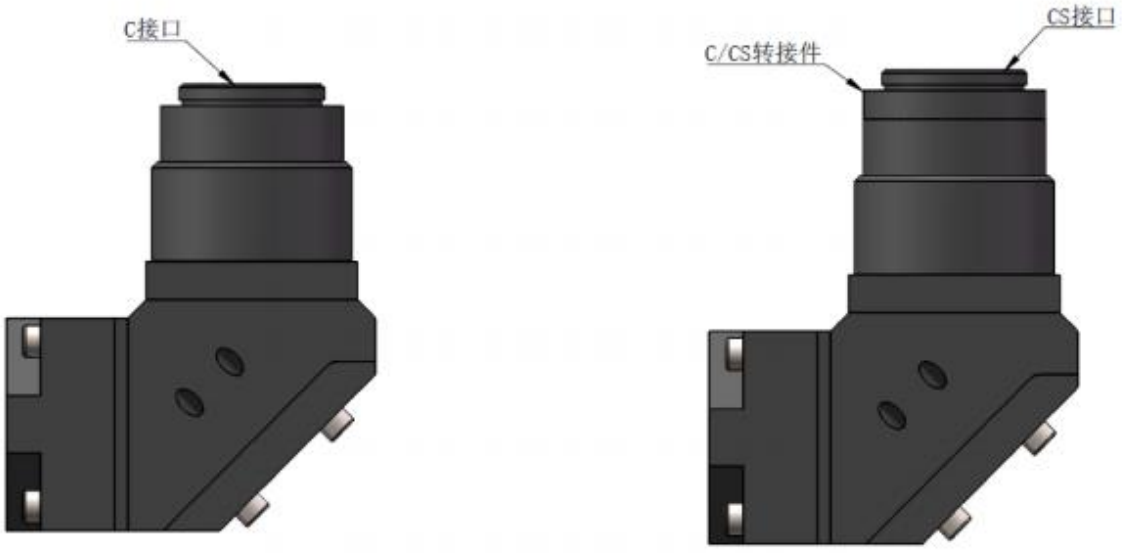
2.6.6 Matters needing attention

1. When the lens is connected with the C interface industrial camera, the C/CS adapter of the connection port needs to be removed; It can be directly interfaced with CS

Industrial camera connection

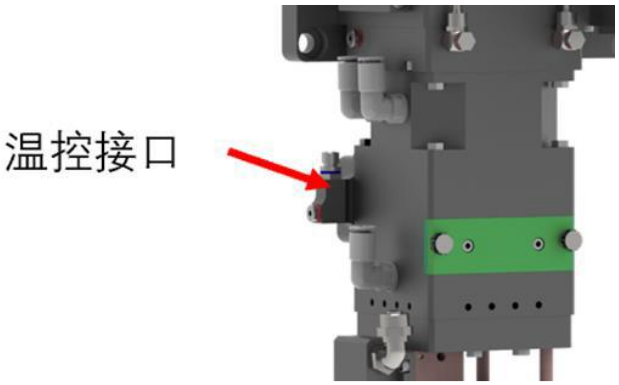
2. When adjusting brightness and clarity, it is not advisable to exert too much force to ensure that the adjustment does not exceed the internal stroke

3. All anti-detachable labels cannot be detached without permission



2.7 Temperature control module

BW12K provides a temperature monitoring module that uses an alarm signal output line to synchronize the alarm signal to the processing equipment.



2.7.1 Power supply & signal output

BW12K temperature control version uses M8 aerial plug on the side of laser head for module power supply and alarm signal output. The factory has provided 15m connecting wire, and the wiring definition is as follows:

Corresponding navigation pin position	Line color	Definition
1	red/red	24V
2	green/green	Empty foot position
3	blue/blue	GND
4	black/black	Signal output

3 Maintenance.

3.1 Disassembly and installation of protective lenses

Installation and removal of protective lenses are shown in Figure 3-1:

Loosen the screw;

Pull out the drawer-type mirror base;

Press the lens with your fingers, and push the lens out of the lens base from the side without flooding;

Installing the protective lens in the mirror base;

Press the protective mirror with a floodplug seal;

Inserting the mirror base back into the laser processing head;

Locking screw.

Note: It is forbidden to directly dig out or pick out the floodplug on the protective mirror with nails or hard objects, which will seriously cause damage to the floodplug, air leakage and even damage to the protective mirror and focusing mirror; The floodplug seal should be properly stored after being taken out, so as not to affect the welding quality.

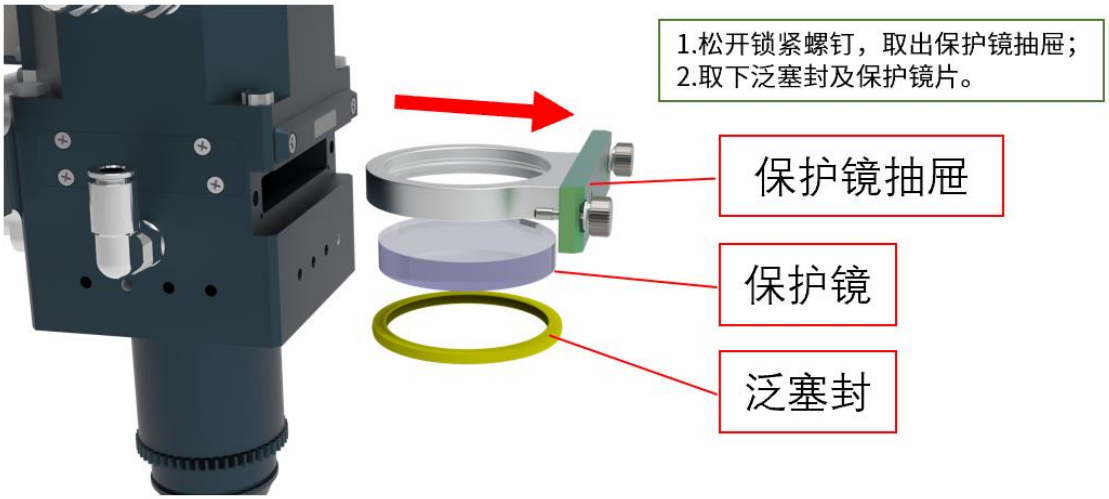


Figure 3-1 BW12K Protective Lens Removal and Installation

3.2 Protect the cleanliness of lenses

According to the processing characteristics of laser welding, it is necessary to clean the protective lenses regularly.

The specific cleaning method is shown in Figure 3-2:

(1) Take the side of the lens after wearing gloves, and do not touch the upper and lower surfaces of the lens with your fingers, as shown in Figure A;

(2) Lay dust-free on the optical parts and drop 2 to 3 drops of lens cleaner, as shown in Figure B;

(3) Drag the dust-free cloth horizontally and slowly over the lens to ensure that there are no drag marks. After dragging, the lens becomes clean. This step can be repeated many times until cleaning is completed. Use a new dust-free cloth for each operation, as shown in Figure C;

(4) If the oil pollution is serious, it is necessary to use cotton swabs to clean the mirror surface. Spray the lens cleaner on the clean cotton swab, and then clean the optical elements. When cleaning, move counterclockwise from inside to outside in a circle. Only gentle force can be exerted on the surface of optical components. Gently turn the swab along the longitudinal axis to clean the lenses as effectively as possible, as shown in Figure D.

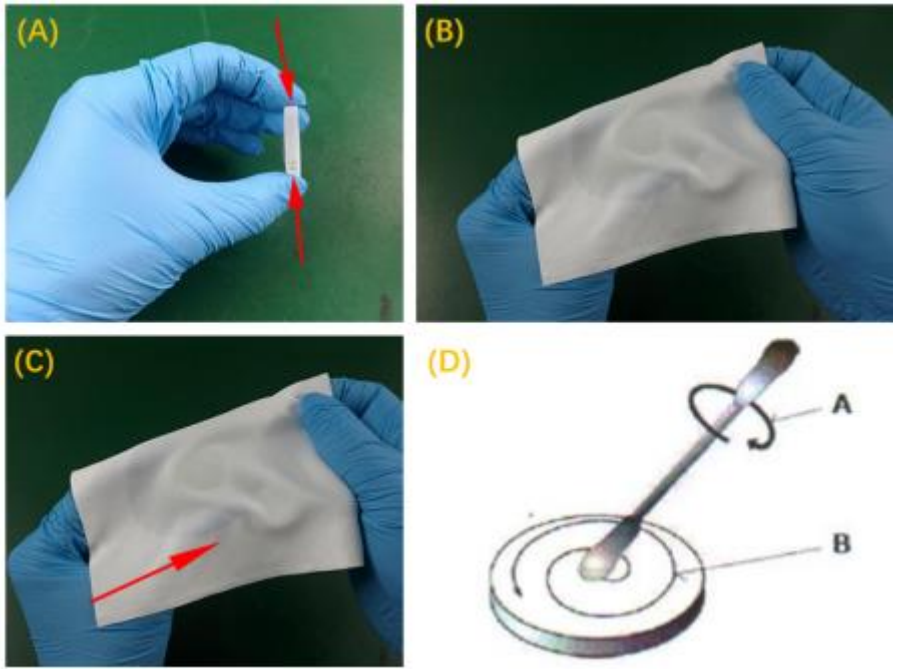


Fig. 3-2 Cleaning Method of Protective Lens

3.3 Material number configuration table of wearing parts

3.3.1 Protective mirror

Dimensions of protective mirrors	Protect mirror material number
D50*8 (protective mirror)	211LCG0122
D37*1. 6 (Collimating Protective Mirror)	211LCG0045

3.3.2 Flooding seal

Type	Flooding sealing material number
Flood plug seal of lower protective drawer	11021M2110008

3.3.3 Coaxial assembly

Coaxial specification	Coaxial material number
300mm	120FC0500A
350mm	120FC0600A

3.3.4 Paraxial

Type	Paraxial material number
Paraxial protection assembly	120AJ1100B

3.3.5 Air knife

Type	Air knife material number
Air knife	120AX7200A

3.3.6 Nozzle

Type	Nozzle material number
Coaxial protection nozzle	120AP6104A

3.3.7 Temperature measuring cable

Type	Cable material number
Four-core 15M signal cable	1103708020010