RAYTOOLS

3.3KW Auto Focus Laser Cutting Head -User Manual

2020/11/16	V1.0	First edition
2023/11/28	V2.0	Configuration update

- We reserve the right to change the design in order to improve the quality or expand the application or comply to manufacturing workmanship.
- We will not bear any responsibility for losses and accidents caused by wrong operation or improper handling of our products.
- Dismantling of product will lose all warranty claims excluding the normal replacement of worn parts and

-  Parts of the laser head such as nozzle, sensor, sensor interface and attached fasteners may not be fully protected by the ground wire due to function fault. These parts may have low voltage. When installing electrical equipment, please pay attention to taking anti electric shock measures for relevant personnel.
-  Note that the equipment shall be grounded as specified.

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

- Avoid direct laser radiation or scattering to the skin.
- Do not stare at the laser beam even when wearing optical equipment.
- Use special laser protective eyeglasses that meet the requirements of safety standards IEC 60825-1.

- In order to avoid corrosion, use the specified coolant and comply with relevant requirements and specified maintenance intervals.

- The corresponding measures shall be specified or explained and observed in order to prevent personnel from being harmed by noise when the cutting air pressure is high.

- Observe the storage temperature range allowed by the technical data.
- Take reasonable measures to prevent fire, vibration or impact.
- Do not store in or near the magnetic field.

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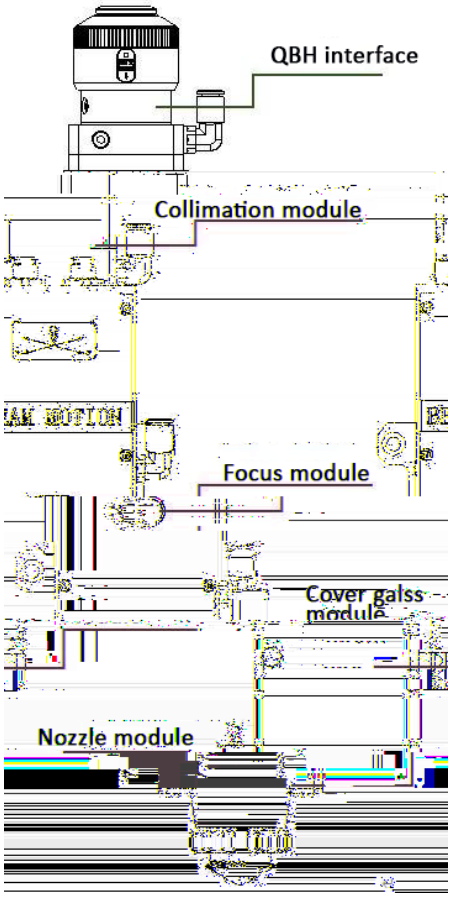
This manual includes basic installation, factory settings, operation and maintenance services and other details about BM110 SERIES products. But only the main parts will be introduced here, as there are too many types of optical and mechanical customization configurations.

Released by RAYTOOLS in 2018, BM110 SERIES auto focus laser cutting heads are equipped with servo motor outside and drive units inside, supporting to move focus lens within 22mm automatically through the linear mechanism. And users can set program to do continuous adjustment of the focus position, so as to perforate thick sheets and auto cut sheets with different thickness and material.

BM110 SERIES products adopt D30 compound lens assembly for beam integration while applying QBH interface with fiber laser. Based on optimized optical and water-cooled design, laser heads can run stably with lower and middle power for a long time.



- Optimized optical configuration & smooth and efficient flow design.
- Auto focus range: +10 ~ -12mm; adjustment accuracy: 0.05mm.
- D30 compo[redacted]lens; max fiber input power: 3.3KW.
- Max. accel[redacted]on of

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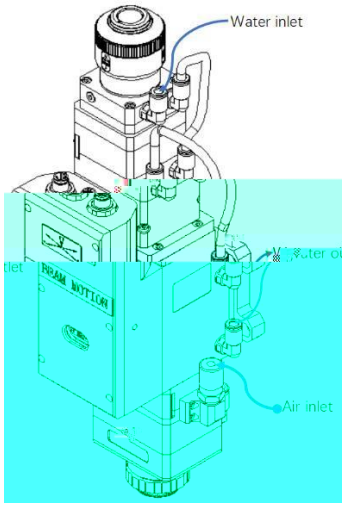


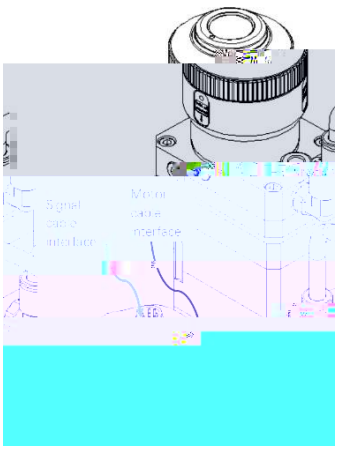
When the laser power is greater than 500W, it is recommended to use water cooling.

The recommended water flow is suggested below.

Outer diameter of water hose	6mm
Minimum flow speed	1.8 l/min 0.48gpm
Entry pressure	170-520kPa
Entry temperature	≥room temperature / dew point
Hardness (relative to CaCO3)	250mg/liter
PH range	6 to 8
Particle size allowed	Diameter less than 200 microns

The water cooling interface, with closed loop system design, can work in external free water supply if meeting above requirements of water flow.

Connect the 8-pin power limit cable and the 12-pin encoding cable to the corresponding connectors on the cutting head, as shown below. Then thread the cables into the machine's cable track grooves and fix cables after reserving a proper length.



Connect the 8-pin power limit cable and the 12-pin encoding cable to the corresponding connectors on the driver. For detailed wiring of driver and limit sensor, please refer to attachment.

: The output mode of limit sensor is NPN- NC (outputs NPN signal when don't trigger the sensor); Please install a relay for conversion according to actual need.

: The wiring must be done when the power is off.

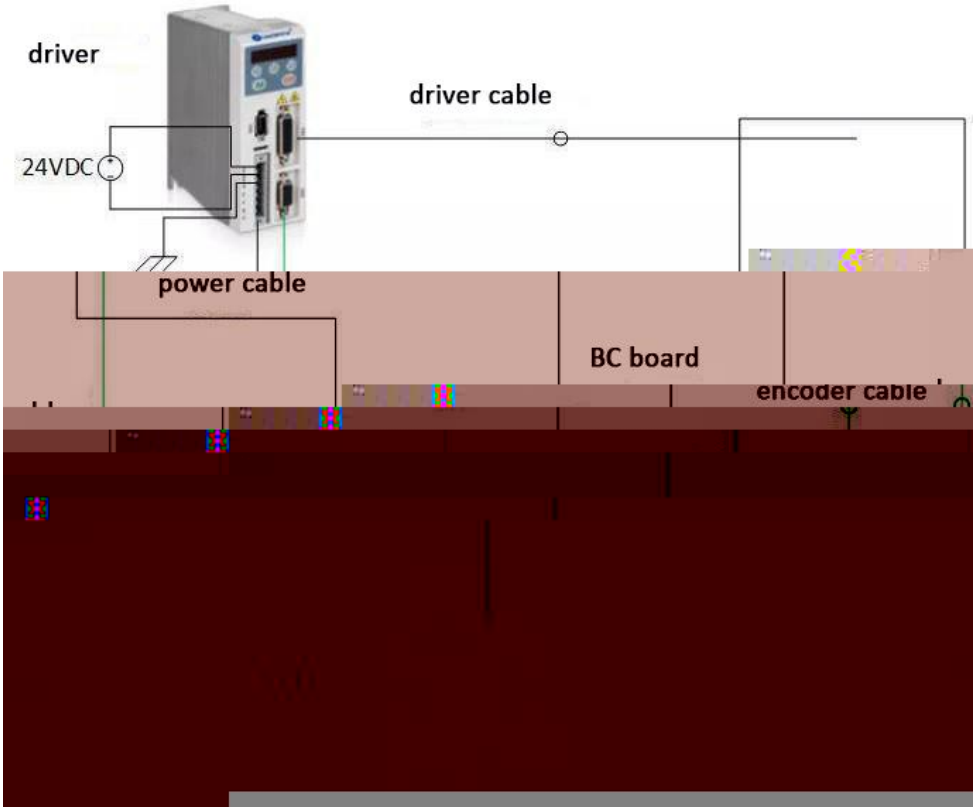
BM110 SERIES products, with collimating lens assembly, can work with most of fiber lasers in the market.

Fiber interface means the connection between the tip of the fiber and the cutting head. Common fiber interface includes QBH type, and every fiber interface is different to fix. Please refer to corresponding instruction of fiber interface.

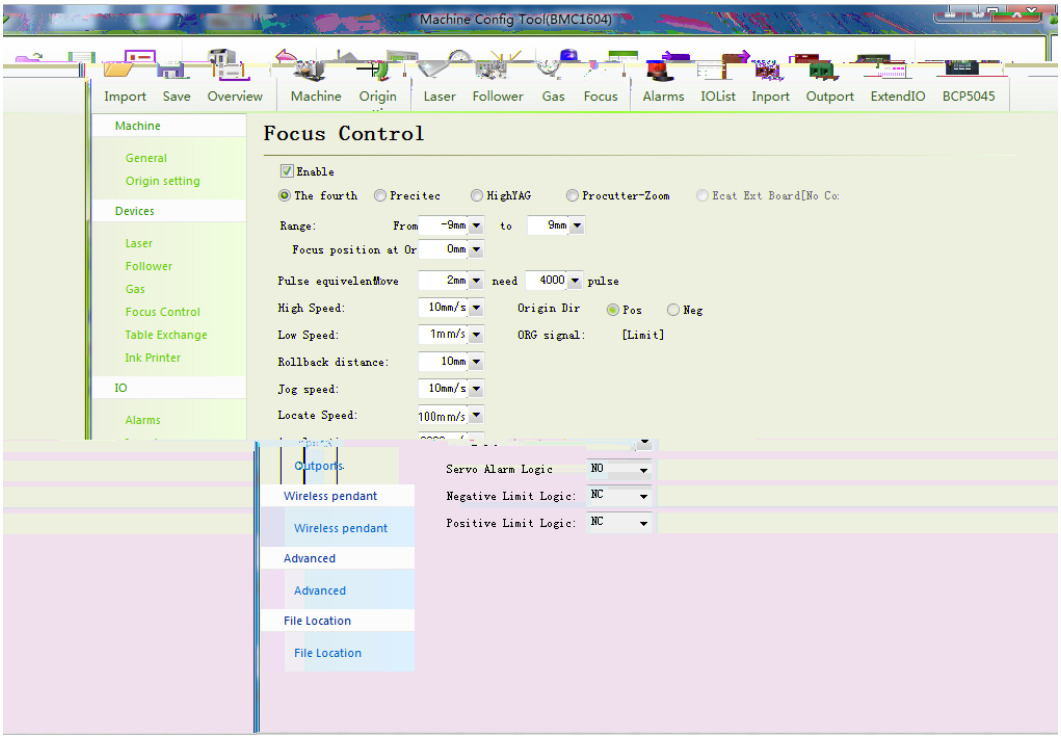
The optical components must be dust free and all dusts must be cleaned before use. The fiber shall be horizontally inserted into fiber interface to prevent dust from entering the interface and falling on the surface of the lens. Upper limit in the fiber before fixing the laser head.

- Use hybrid step motor.
- The Vdc, GND and PE shall be connected to 24V, 0V and earthing respectively.
- A+, A-, B+ and B- are power cables of step motor, and should be wired as below:
- 24V power supply should be customer-provided.

White	Red	Pink	Blue
+24V	0V	Upper limit	Lower limit

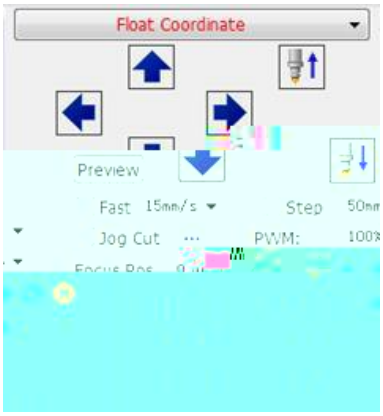


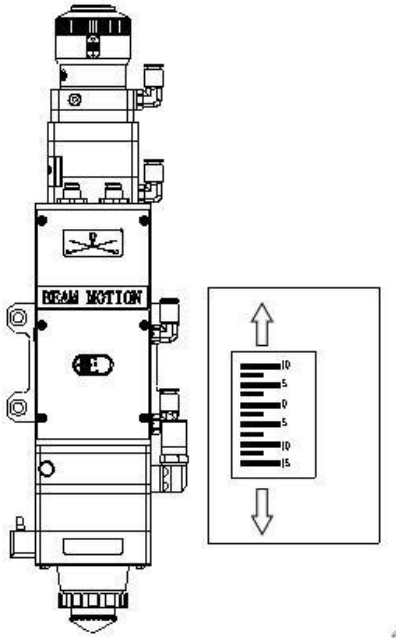
Open Machine Config. Tool and set parameters as below:



If the driver is EtherCAT, please set Pulse No. as 10000.

- Move J axis to check if the action is normal (“thread pitch” and direction), J+ indicates scale 0 up.
- Move J axis slowly to touch the positive and negative limit, and check if the direction and limit signal are normal.
- Click  , J axis moves to negative direction and do 2nd homing when touching negative limit. Then the position of zero point coincides with zero focal position and homing is finished.



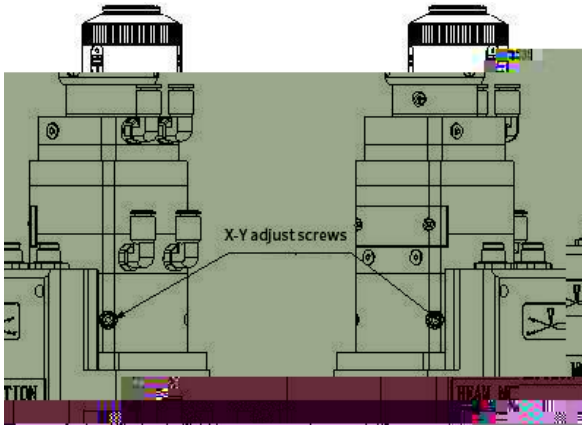


- Click +, lens holder moves upward to positive limit; click -, lens holder moves downward to negative limit.
- The homing direction is negative, and take lower limit as a sampling signal.
- Pitch 2mm; pulse/circle: 4000
- Recommended positioning speed: 50-100mm/s.

Cutting quality in a great extent depends on whether the beam spot is in the center of nozzle or not. If the beam spot is not in the center, the laser beam may hit the nozzle or inner wall of the laser head, that leads to produce high temperature deformation. Beam center position adjustment should be considered when nozzle is replaced or the cutting quality is decreased.

Beam center position adjustment of the laser cutting head can be finished by adjusting Collimating lens, X-Y direction. The adjusting screws are located on the top of the cutting head as shown below. By using inner hexagon spanner users can loosen or tighten the adjusting screw until the beam spot is located in the center of nozzle. Make sure the laser beam output from the center of nozzle. A method commonly used, tape dotting method as below:

- Pick a scotch tape, flatten it and stick it to the nozzle tip.
- Open the red light of the laser. Find and observe the position of red light in the scotch tape.
- Adjust the 2 X/Y adjusting knobs to get beam aligned.
- Open laser and adjust laser power within 80W-100W and dot manually.
- Tear off the tape and check the shooting hole position in tape.
- Repeat the above steps to find out relatively centered position.

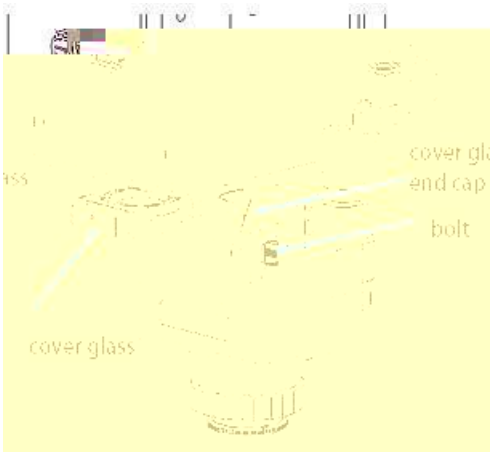


Laser cutting head is equipped with automated focusing system. But it is required to dot manually to redefine the zero focus position when it is initially set or lenses and lasers are replaced. For details about operating system parameters, please refer to the system instructions. Manual dot can refer to the following steps:

1. Attach one textured tape on nozzle tip. Set laser power to 80-100W.
2. While moving each 0.5mm focus (as small as possible), shot a hole on the textured tape.
3. Dotting several times to find out the focus corresponding to the smallest hole which is supposed to be real zero focus. The zero focus is just at the tip of the nozzle.

It's necessary to maintain lenses regularly because of the characteristic of laser cutting process. Cleaning to the cover glass once a week is recommended. The collimating lenses and focusing lenses are recommended to be cleaned once every 2~3 months. In order to facilitate the maintenance of the cover glass, the cover glass holder adopts a drawer type structure.

- To put fingertip onto left thumb and index finger.
- Spray absolute ethanol onto the polyester swab.
- Hold the edge of the lens with left thumb and index finger gently. (note: avoid touching the surface of the lens by fingertip in case of trace)
- Hold the lens to face eyes by left hand and hold the polyester swab by right hand. Wipe the lens gently in single direction, from bottom to top or from left to right (Should not wipe back and forth in case of secondary pollution to lens) and use rubber blow (purely compressed air) to blow the surface of the lens. Both surfaces should be cleaned. After cleaning, make sure that there is no residual like detergent, floating ash, foreign matters and impurities.



The whole process needs to be completed in a dust free room. Wear dust-proof gloves or fingertips when removing or installing the lenses.

The cover glass is wearing part which needs to be replaced once it is damaged.

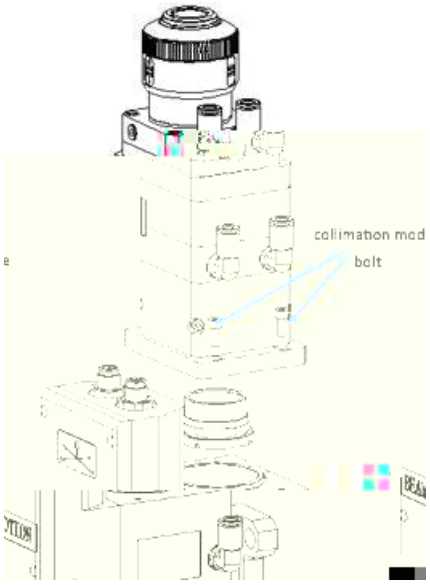
- Loose the 2 bolts to pull out cover glass holder by pinching 2 edges of drawer type holder.
- Seal the mounting openings by textured tape immediately.
- Remove the pressing ring and cover glass after wearing fingertips.
-

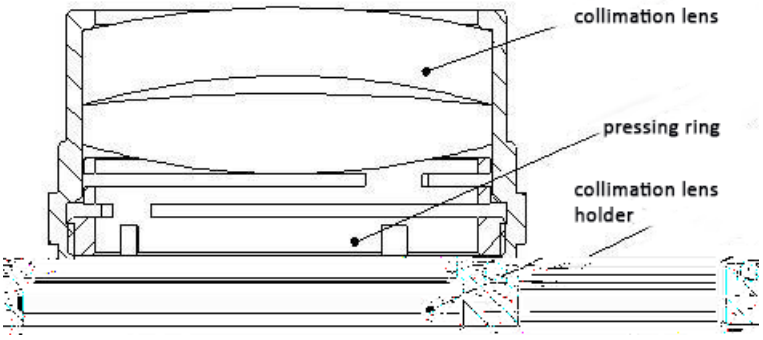
The cover glass is wearing part which needs to be replaced once it is damaged.

As shown above, loose the 2 bolts to pull out cover glass holder by pinching 2 edges of drawer type holder.

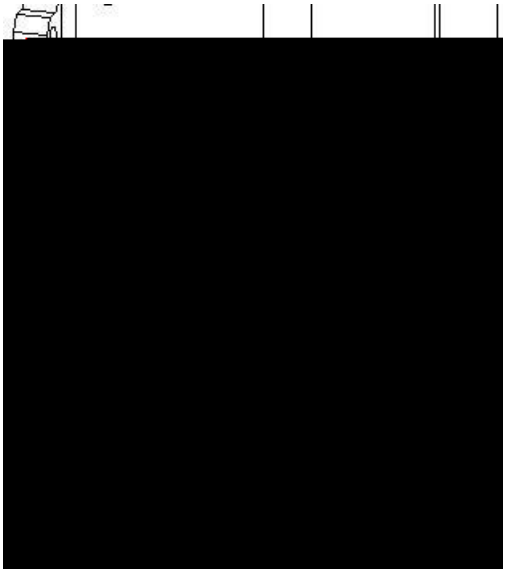
- Seal the mounting openings by textured tape immediately.
- Remove the pressing ring and cover glass after wearing fingertips.
- Clean the cover glass holder and seal ring. The elastic seal ring should be replaced if it is damaged.
- Install the cleaned or new cover glass (regardless of the front or back surface) into the holder of cover glass.
- Install the pressing ring.
- Insert the cover glass holder back to the laser head and tighten the bolts.

It is not allowed to pull out the edge of seal ring directly as it is very easy to damage the seal ring. Please wear the clean gloves or fingertips.





- Remove the laser head and move to a dust free room.
- Clean all dusts on the laser head surface.
- Loose the bolts to pull out whole assembly.
- Seal the mounting openings by textured tape immediately.
- Move the assembly. Remove the pressing ring and collimation lenses with lens tool.
- Replace or clean the collimation lenses.
- Mount the assembly back to the cutting head and tighten the bolts.



The nozzle is required to be replaced if it gets crash or damaged by laser beam. The dirt on ceramic body is required to be cleaned or to replace the ceramic body if it gets crash.

- Unscrew the nozzle.
- Press the ceramic body upward by hand to make it fixed without deflection and then unscrew the retaining ring.
- Align the pin hole of the new ceramic body with the locating pin. Press the ceramic body upward by hand and tighten the retaining ring.
- Screw the new nozzle and get it properly tightened.
- Do the capacitance calibration once again after replacing the nozzle or ceramic body.

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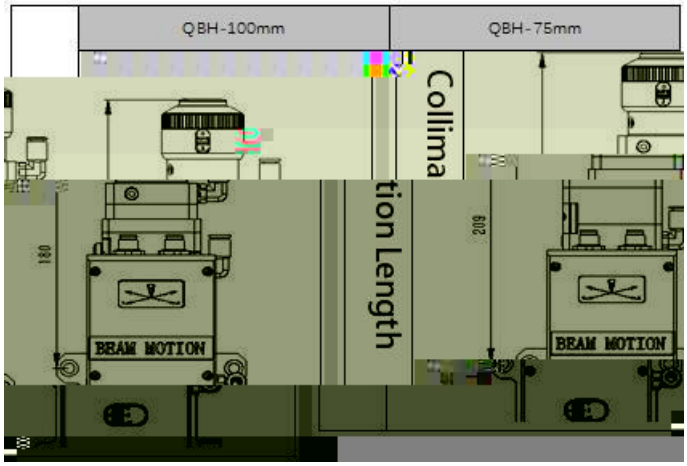
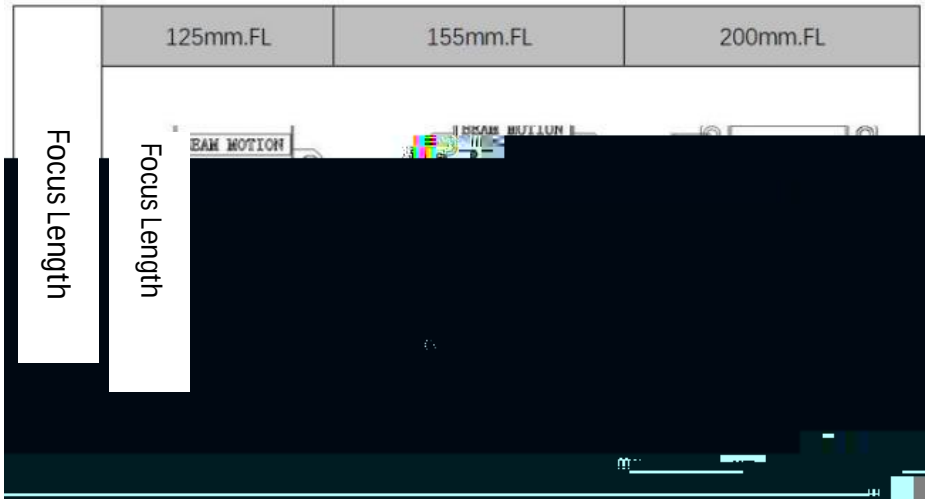

QBH-100mm
QBH-75mm
Collima
tion Length
BEAM MOTION
BEAM MOTION


125mm.FL
155mm.FL
200mm.FL
Focus Length
Focus Length

Fiber Interface	
QBH	211FIA3003

Item		Product ID
F100	meniscus lens	110255AAFBHE0089
F100	biconvex lens	110255AACBHE0090
F125	biconvex lens	110255AACBHE0092
F125	meniscus lens	110255AAFBHE0091
F150	meniscus lens	110255AAEBHE0094
F150	biconvex lens	110255AACBHE0093
F200	meniscus lens	110255AAFBHE0127
F200	biconvex lens	110255AACBHE0126

Laser head config.	Lens assembly	Product ID
75	collimation lens assembly	120AG0610A
100	collimation lens assembly	120AG0600A
125	focus lens assembly	120AG0700A
150	focus lens assembly	120AG0800A
200	focus lens assembly	120AG1400A
Universal	focus lens assembly	120AG2000A

Cover Glass		Seal Ring	
Specification	Product ID	Specification	Product ID
D24.9 x 1.5 top	211LCG0020	φ29.4 top cover glass	11021M2110007
D27.9 x 4.1 middle	211LCG0037	/	
D27.9 x 4.1 bottom	211LCG0037	φ32.2 bottom cover glass	11021M2110007

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