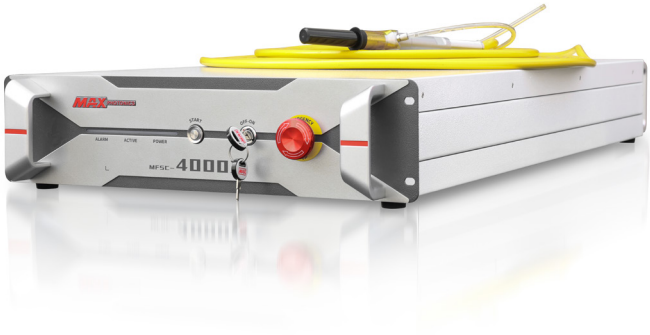
MAX PHOTONICS



MFSC 4000X(G6.1) CW Fiber Laser Series

USER GUIDE

Maxphotonics Co.,Ltd.

Copyright Notation

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Preface

Thank you for using the MFSC 4000X(G6.1) CW Fiber Laser Series from Maxphotonics. We compile this document for you in order that the laser is used and maintained properly. Due to the limited level of the writers, coupled with time constraints, there are some careless mistakes in this document, your understanding and suggestion to help us make an improvement will be much appreciated . Thank you again for using Maxphotonics' products.

Please take time to read and understand this User's Guide and familiarize yourself with the operating and maintenance instructions before you use the product. We strongly recommend that the operator read the Section 2 titled “Safety Information” prior to operating the product.

This User's Guide should stay with the product to provide you and all future users and owners of the product with important operating, safety and other information.

We identify the parts to which you need to pay special attention in the document with underscore. Please notice those information to prevent the unnecessary damages.

MAX PHOTONICS

Company Profile

Found in 2004, Maxphotonics is one of the first fiber laser manufacturers in China. It is also the first in China to realize independent intellectual property rights and vertical integration in the core technologies of fiber lasers and optical devices. One of the national high-tech enterprises. Maxphotonics has developed into an internationally renowned laser manufacturer that develops, manufactures and sells fiber lasers and core optical components. It is the second largest domestic fiber laser manufacturer in the domestic market.

Maxphotonics specializes in the research, development, production and sales of fiber lasers, including pulsed fiber lasers, continuous fiber lasers and direct diode lasers. It also implements pump sources, combiners, fiber gratings, isolators, laser output heads, and stripping. Optical devices such as molds, acousto-optic modulators, and pattern matchers are produced autonomously. Products are widely used in marking, engraving, cutting, drilling, cladding, welding, surface treatment, rapid prototyping and additive manufacturing processes.

More informations，please visit our website：

http://en.maxphotonics.com

Chapter 1
Characteristic Explain

MFSC Series CW Fiber Laser products provide a wide range of wavelength from 1060nm to 1100nm.The lasers are water-cooled and maintenance-free and with a wall plug efficiency of more than 33% and deliver high efficiency, high reliability and high performance.

Maxphotonics' MFSC Series CW Fiber Laser Series are Class 4 laser products and are designed and tested with safety. By following this User Guide and applying sound laser safety practices, it will be a safe and reliable device.

Laser light exhibits unique characteristics that may pose safety hazards. Therefore, the laser light can’t be normally associated with other light sources, and all operators and people near the laser must be aware of these special hazards.

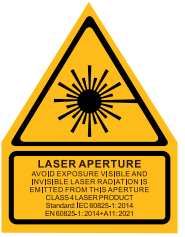
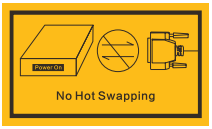
In order to ensure the safe operation and optimal performance of the product, please follow all warnings and safety instructions in this guide during process of operation, maintenance and service.

For ensuring the safety of operators, operators are urged not to open the equipment privately at all times. There are no user serviceable parts, equipment or assemblies associated with this product. Lasers of unauthorized disassembly shall not be subject to warranty.

Chapter 2
General Safety Information

1-Safety Conventions

All safety warning symbols during operating process of the laser include:

SYMBOLS	DESCRIPTION
	WARNING: Refers to a potential Electrical Hazard to human body. It requires a procedure that, if not correctly followed, may result in bodily harm to you and/or others. Do not proceed beyond the WARNING sign until you completely understand and meet the required conditions.
	CAUTION： Refers to a potential hazard on product. It requires a procedure that, if not correctly followed, may result in damage to the product or components. In order to ensure normal use of equipment, do not violate the requirement of the CAUTION sign.
	WARNING:Refers to a potential Laser Hazard.The symbol represents laser radiation. The symbol is pasted on laser output end.
	CAUTION: The symbol contains details on laser power output and wavelength; reminds users to avoid direct or scattered radiation exposure to eyes or skin.
	When connecting or disconnecting external cables, internal cables, boards or other electronic components, the laser must be operated by professional maintenance personnel after turning off the power of the whole machine for 5 seconds; otherwise, it may cause electric shocks or damages to the electronic components of the laser.

NO SYMBOL	IMPORTANT：Refers to any information regarding the operation of the product. Please do not overlook this information.

NOTE :

◎ This device is classified as a high power Class IV laser instrument. It may emit up to 12KW average power from 1060nm to 1100nm. This level of light may cause damage to the eye and skin. Despite the radiation being invisible, the beam may cause irreversible damage to the retina. Laser safety eyewear is not provided with this instrument, but must be worn at all times while the laser is operational.

FCC ID: 2BG364000XG61

The module in this product is labeled with its own FCC ID. The FCC ID is not visible when the module is installed inside another device. Therefore, the outside of the device into which the module is installed must also display a label referring to the module. The final end device must be labeled in a visible area with the following.

CAUTION: The user is cautioned that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

NOTE:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates,

uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FCC Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

2-Laser Protection

1、Laser Protection Requirements

You must wear the safety protective glasses while operating the laser, and rationally select the safety protective glasses according to the lasing wavelength of the laser. If the device is a tunable laser or Raman product, it emits light over a range of wavelengths and the end user should confirm the laser safety eyewear used protects against light emitted by the device over its entire range of wavelength.

2、Laser Protective Equipment Suppliers

Maxphotonics recommends material or equipments provided by following laser protective equipment suppliers for you, including LaserVision USA, Kentek Corporation, Rochwell Laser Industries, etc. All the supplier information is provided by Maxphotonics only for the convenience to use, so Maxphotonics assumes no responsibility for any problem caused by using the products of abovementioned suppliers.

3-Reference Standard

Electromagnetic Compatibility Emission:

EN IEC 61000-6-4:2019

CISPR 16-2-1

CISPR 16-2-3

Anti-interference Performance on Electromagnetic Compatibility:

EN IEC 61000-6-2:2019

EN 61000-4-2:2009

EN 61000-4-3:2020

EN 61000-4-4:2012

EN 61000-4-5:2014+A1:2017

EN 61000-4-6:2014

EN 61000-4-11:2020

4-General Safety Instructions

1、Specular Reflection

There are often numerous secondary laser beams produced at various angles in the output port of the laser. These divergent beams are produced when the primary beam of laser reflects off a smooth surface, and they are called specular reflections. Although these secondary beams may be less powerful than the total power emitted from the primary beam, the intensity may be great enough to cause damage to the eyes and skin as well as surface of materials.

WARNING:

◎ You must exercise caution to avoid/minimize specular reflections as these laser radiations are invisible!

2、Safety Instructions of Accessories

The photosensitive elements integrated in laser-related optical accessories may be damaged by laser exposure, such as video cameras, photomultiplier tubes, and photodiodes. Attention should be paid to related device protection.

WARNING :

◎ The Maxphotonics MFSC laser light is strong enough to cut or weld metal, burn skin, clothing and paint. In addition, this light can ignite volatile substances such as alcohol, gasoline, ether and other solvents. During the operating process, the flammable materials around the laser must be isolated.

3、Optical Operating Instructions

We strongly recommend that you read the following procedures before operating the laser:

1、Never look directly into the laser output port when the power is turned on.

2、Avoid positioning the laser and all optical output components at eye level.

3、Equip with laser beam casing.

4、Make sure to remove the tail cover of the laser output head before the laser is turned on, otherwise it will cause irreversible damage to the laser fiber output head.

5、Ensure that all personal protective equipment is suitable for the output power and wavelength range of the laser.

6、Use the laser in a room with access controlled by door interlocks. Post warning signs. Limit the safety areas to operate the laser.

7、Please do not operate the laser in darkened environments.

8、Do not turn on the laser without an optical coupling fiber or an optical output connector.

9、Carry out commissioning, calibration and focusing at low output power and then increase the output power gradually when the calibrating and focusing work is done.

10、Do not install or detach cutting heads or collimators when the laser is active

11、Make sure that the laser is shut down and the power is off before you install or detach cutting heads or collimators.

12、If the equipment is operated in a manner not specified in this document, the protection devices and performance of the equipment may be impaired and the warranty will be voided.

CAUTION:

◎ The output of the laser is delivered through a lens with an anti-reflection coating. If the backward-stage light path of your laser has the optical lens, please strictly inspect the lens of the output head and the backward-stage lens

of the laser, and ensure that there is no dust and any other impurity on the lens. Please note that any macroscopic attachment may cause extreme damage to lens or burn the laser or any backward-stage light path equipment.

◎ For cleaning instructions of the lens, please refer to the "Optical Fiber Connector Inspection and Cleaning Guide".

◎ Hot or molten pieces of metal may be produced when the laser is under operation. Exercise caution if debris is produced in operation.

◎ When you carry out commissioning and calibration of the laser output, you must set the laser output at low power level and then gradually increase the output power during checking the quality of the light spot emitted from the laser via an infrared viewer.

WARNING:

◎ Make sure that the individual protective equipment meets the output power and wavelength range of the laser.

◎ Never look directly into the optical fiber or the collimator, and make sure you wear the safety protective glasses in each operation.

4、Electrical Operating Instructions

We strongly recommend that you read the following procedures before operating the laser:

1、Make sure the shell of this equipment is properly grounded. Any interruption of the ground loop may result in personal injury.

2、Make sure the power source connecting equipment is properly grounded.

3、In order to further reduce fire hazard, replace the line fuses (if applicable) with the same types and ratings. The use of other fuses or material is prohibited.

4、In order to prevent the risk of personal injury, it is necessary to install a leakage protection power switch with a load current of not less than 63A outside the laser.

5、Make sure that the input AC voltage of the laser is the voltage of the normal AC mains (Three-phase four-wire 360-440VAC), and wires are connected accurately. Any incorrect wiring method may cause damage to people or instrument.

6、The equipment does not have any part which can be maintained by operators, and all the maintenance operations must be finished by the professionals of Maxphotonics Co., Ltd.

7、To prevent electrical shock, do not remove enclosure, detach the laser without permission and damage the relevant signs. Any product with unauthorized dismounting shall not be subject to warranty.

WARNING:

◎ The input voltage of the laser is triple-phase AC current (360-440VAC), which may cause risk of electric shock. All the relevant cables and connection wires have potential hazards.

5.Environment Conditions and Precautions

For ensuring the safety of the laser working area, suitable enclosures shall be applied, including but not limited the laser safety signs and the interlocking devices. Corresponding operators must be trained and examined and know the normal safety specifications for operating the laser.

Meanwhile, it is important that the output components shall not be installed at eye level. Because of interaction of the laser and the metal material, the radiation of high-level ultraviolet light or visible light may be produced. Make sure that the laser is provided with the protective cover to prevent the eyes or other parts of human bodies from damage by radiation.

We recommend that you comply with the following operating measures to prolong the service life of the laser:

(1) Please ensure that the working area is properly ventilated and the laser is placed in a cabinet with temperature and humidity control and dustproof function. Do not expose the laser to high temperature and high humidity.

(2) Operating the equipment at high temperatures accelerates aging, increases current thresholds, and reduces laser sensitivity and conversion efficiency. If the device is overheated, please stop using it and ask for help from Chuangxin Laser.

Caution:

◎ Please operate the equipment carefully to avoid accidental damage to the equipment.

◎ If the laser is placed in an environment below 0 °C, be sure to add the corresponding antifreeze to the water cooler. If the machine is not used for a long time, be sure to drain the water in the water inlet and outlet (high-pressure air gun is recommended) to prevent the residual water from freezing and damaging the water-passing device.If the ice causes the water pipe to break, there will be a risk of leakage during the re-transmission of water and electricity, or even more serious personal injury.

5-Additional Safety Information

For additional information regarding Laser Safety, please refer to the list below:

Laser Institute of America(LIA)

13501 Ingenuity Drive, Suite 128

Orlando,Florida 32826

Phone:407 380 1553,Fax: 407 380 5588

Toll Free:1 800 34 LASER

American National Standards Institute

ANSI Z136.1, American National Standard for the Safe Use of Lasers

(Available through LIA)

International Electro-technical Commission

IEC 60825-1,Edition 1.2

Center for Devices and Radiological Health

21 CFR 1040.10 - Performance Standards for Light-Emitting Products

US Department of Labor - OSHA

Publication 8-1.7 - Guidelines for Laser Safety and Hazard Assessment.

Laser Safety Equipment

Laurin Publishing

Laser safety equipment and Buyer’s Guides

Chapter 3
Product Description

1-Features

MFSC Series CW fiber lasers are compact and efficient and high-quality laser output lasers developed for industrial application. They are mainly applied to the fields of puching, welding, cutting, etc.

Main Features:

1、High-quality laser output

2、High power, high efficiency

3、High reliability, long service life

4、Compact, rugged package

5、Extension programming interface

Applications:

1、Industrial applications

2、Scientific research

2-Module Configuration

Maxphotonics offers many configurable modes. This manual will give complete instructions for all modes, please refer to section 6.3-6.6.

3-Laser Model Designation Codes

M - F - S - C - XXX - XX 1 - 2 - 3 - 4 - 5 - 6		
1	Manufacturer's code	M means Maxphotonics
2	Gain media of the laser	F means Fiber Laser
3	Laser mode	S means Single Mode
4	Laser state	C means Continue Wave
5	Maximum output power	XXXX W means the maximum output power of the laser
6	Additional message	Can be null

4 - Certification

Maxphotonics certifies that this equipment has been thoroughly tested and inspected and meets published specifications prior to shipping. Upon receiving your equipment, check whether the packaging and accessories have been damaged in transit. If damage is apparent, please contact Maxphotonics immediately.

5- Front Panel Description

ITEMS	FUNCTION DESCRIPTION
ALARM	Laser Abnormal Status Alarm Indicator
ACTIVE	Laser Normal Status Indicator
POWER	Laser power indicator
START	Laser on button for external control
OFF-ON	Laser start switch
EMERGENCY	Emergency stop switch

6-Back Panel Description

ITEMS	FUNCTION DESCRIPTION
CTRL	Laser External Control Interface
ECAT IN	Bus Input
ECAT OUT	Bus Output
ETHERNET	RJ45 Network Interface
BLUETOOTH	Bluetooth communication
AC380V	360-440VAC AC power input
WATER OUT	Laser Water Cooled Outlet (1 inch)
WATER IN	Laser water-cooled inlet (1 in.)
PE	Grounding

7-Optical Output Terminal

1、Optical Output Head

The optical output head come with a protective window that can be replaced if damaged. Make sure that the end cap of the QBH head is removed prior to use and is usually arranged with the laser.

Please refer to “Fiber Connector Inspection and Cleaning Guide” about the cleaning method.

Optical Output Head (G4.3 QBH head)

Chapter 4
Specification

1-Optical Characteristic Parameters

No.	Characteristics	Test Conditions	Min.	Nom.	Max.	Unit
1	Operation Mode	CW/Modulated				
2	Polarization	Random				
3	Output Power of MFSC-4000X(G6.1)	100% CW	3900	4000	4100	W
4	Tuning Range of Output Power		10		100	%
5	Emission Wavelength	100% CW	1070	1080	1090	nm
6	Spectrum Width(3dB)	100% CW		4	7	nm
7	Short-term Power Instability	100% CW >1h		±1	±2	%
8	Long-term Power Instability	100% CW >24h		±3	±5	%
9	Beam Quality （BPP）	100% Output 100um QBH	1.2		1.8	mm x mrad
10	Laser Switching ON Time	10%→90% Output		50	100	μs
11	Laser Switching OFF Time	90%→10% Output		50	100	μs
12	Modulation Rate	100% Output			5	KHz
13	Red Guide Laser Power	100% Output	500		1000	μW
14	Feeding Fiber Cable Length			20		m
15	Feeding Fiber Core Size	50				μm
16	Feeding Fiber Cable Bending Radius		200			mm
17	Output Connector	QBH Output				

2-General Characteristic Parameters

No.	Characteristics	Test Conditions	Min.	Nom.	Max.	Unit
1	Operating Voltage		360	400	440	VAC
2	Input PowerMFSC-4000X(G6.1)	100% Output			18	KW
3	Operating Ambient Temperature		10		40	℃
4	Operating Ambient Relative Humidity		10		85	%
5	Cooling Method	Water-cooling				
6	Storage Temperature		-10		60	℃
7	Dimensions	445*895.5*115(W*D*H)				mm
8	Weight	55±5				kg

3-Water Cooling Condition

No.	Characteristics	Min.		Unit
1	Cooling Method	Water Cooling		
2	Chiller Set Temperature	Summer 24	Winter 20	℃
		Add antifreeze condition, water cooling temperature 18		
3	Hydraulic pressure	≥ 4.5		bar
4	MFSC-4000X(G6.1) water flow requirements	≥ 32		L/min
5	MFSC-4000X(G6.1) Chiller rated cooling capacity requirements	10		kw

CAUTION :

◎ The cooling capacity of the chiller shall meet the requirements in the table above under the working conditions of ring temperature of 40°C and outlet temperature of 22(18°C when antifreeze is added).

◎ The above recommended water pressure requires the pressure drop of the main line Δp ≤ 0.5bar. If this value is exceeded, the main circuit water pressure should be increased accordingly.

◎ Cooling water and filter element, need to be replaced once a month; Winter (refers to the low temperature environment of 0 ° C and below) before the coming of the cooling water should be replaced with a volume ratio of 20% glycol solution (recommended brand Klein), and every two months, it is strictly prohibited to add excessive, low thermal conductivity of antifreeze, excessive addition is easy to cause poor heat dissipation. After the end of winter, it is necessary to replace the antifreeze back to distilled water and replace the filter element, and restore the maintenance frequency of once a month.

◎ When the ambient temperature of the equipment is lower than -15C, the water cooler with double system function must be used, and the cooling system must run uninterrupted.

4-QBH Water Cooling Condition

Cooling Method	Water pipe size requirement	Water Flow Rate (L/min)	Hydraulic pressure (bar)	Cooling Temperature (°C)
Water cooling	Φ6	≥4	≥4	28-30

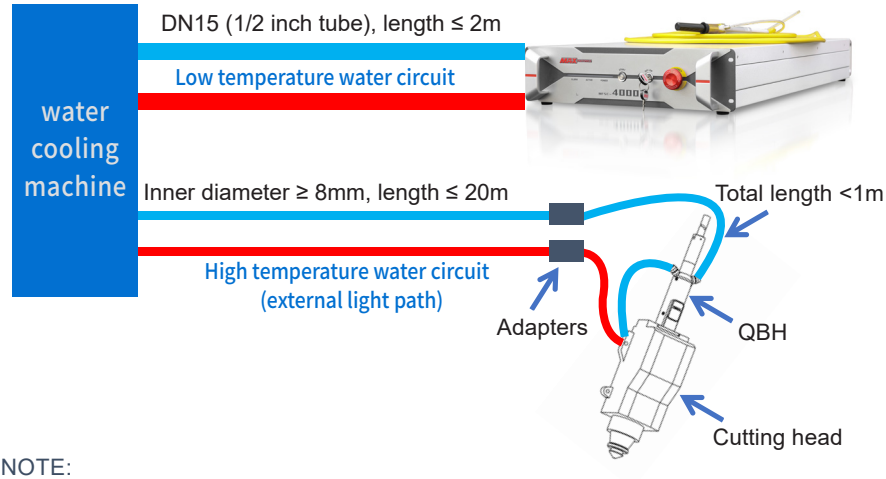
NOTE:

◎ External light path tube inner diameter ≥ 8mm, length ≤ 20m;

◎ The length of the Φ6 pipe connected to the LOE after switching from the external light path is ≤ 1m;

◎ QBH is connected in series with the cutting head;

◎ The above recommended external light path water pressure requires the pressure drop of the cutting head Δp ≤ 3bar. If this value is exceeded, the external light path water pressure should be increased accordingly.



NOTE:

◎ Water pipe color: blue input water, red return water.

5-Installation Environment Requirements

1.The ambient air cleanliness grade requirement for optical fiber output head installation: 1000 or more stringent grade. Suggestions for Configuration of Standard Purification Workbench;

2.laser working environment temperature:10°C–40°C;

3.laser working environment humidity:10%-85%;

4.Avoid the condensation environment,the specific control standards are as follows:

Ambient Temperature, Relative Humidity, Dew Point Comparison Table

Relative Humidity%	30	35	40	45	50	55	60	65	70	75	80	85	90	95
Ambient Temperature (℃)	Dew point Td(℃)													
10	-7.0	-5.0	-3.0	-1.3	00	1.5	2.5	3.6	4.8	5.8	6.7	7.6	8.4	9.2
11	-6.5	-4.0	-2.0	-0.5	1.0	2.5	3.5	4.8	5.8	6.7	7.7	8.6	9.4	10.2
12	-5.0	-3.0	-1.0	0.5	2.0	3.3	4.4	5.5	6.7	7.7	8.7	9.5	10.9	11.2
13	-4.5	-2.0	-0.2	1.4	2.8	4.1	5.3	6.6	7.7	8.7	9.6	10.5	11.4	12.2
14	-3.2	-1.0	0.7	2.2	3.5	5.1	6.4	7.5	8.6	9.6	10.6	11.5	12.4	13.2
15	-2.3	-0.3	1.5	3.1	4.6	6.0	7.3	8.4	9.6	10.6	11.6	12.5	13.4	14.2
16	-1.3	0.5	2.4	4.0	5.6	7.0	8.3	9.5	10.6	11.6	12.6	13.4	14.3	15.2
17	-0.5	1.5	3.2	5.0	6.5	8.0	9.2	10.2	11.5	12.5	13.5	14.5	15.3	16.2
18	0.2	2.3	4.0	5.8	7.4	9.0	10.2	11.3	12.5	13.5	14.5	15.4	16.4	17.2
19	1.0	3.2	5.0	7.2	8.4	9.8	11.0	12.2	13.4	14.5	15.4	16.5	17.3	18.2
20	2.0	4.0	6.0	7.8	9.4	10.7	12.0	13.2	14.4	15.4	16.5	17.4	18.3	19.2
21	2.8	5.0	7.0	8.6	10.2	11.0	12.9	14.2	15.3	16.4	17.4	18.4	19.3	20.2
22	3.5	5.8	7.8	9.5	11.0	12.5	13.8	15.2	16.3	17.3	18.4	19.4	20.3	21.2
23	4.4	6.8	8.7	10.4	12.0	13.5	14.8	16.2	17.3	18.4	19.4	20.4	21.3	22.2
24	5.3	7.7	9.7	11.4	13.0	14.5	15.8	17.0	18.2	19.3	20.4	21.4	22.3	23.1
25	6.2	8.6	10.5	12.3	14.0	15.4	16.8	18.0	19.1	20.3	21.3	22.3	23.2	23.9
26	7.0	9.4	11.4	13.2	14.8	16.3	17.7	19.0	20.1	21.2	22.3	23.3	24.2	25.1
27	8.0	10.3	12.2	14.0	15.8	17.3	18.7	19.9	21.1	22.2	23.2	24.3	25.2	26.1
28	8.8	11.2	13.2	15.0	16.7	18.0	19.6	20.9	22.0	23.0	24.2	25.2	26.2	27.1
29	9.7	12.0	14.0	15.9	17.6	19.2	20.5	21.3	23.0	24.1	25.2	26.2	27.2	28.1
30	10.5	12.9	14.9	16.8	18.5	20.0	21.4	22.8	23.9	25.1	26.2	27.2	28.2	29.1
31	11.4	13.8	15.9	17.8	19.4	20.9	22.4	23.0	24.8	26.0	26.9	28.2	29.2	30.1
32	12.2	14.7	16.8	18.6	20.3	21.9	23.3	24.6	25.8	27.0	28.1	29.2	30.1	31.1
33	13.0	15.6	17.6	19.6	21.3	22.9	24.2	25.6	26.8	28.0	29.0	30.1	32.1	32.1
34	13.9	16.5	18.6	20.5	22.2	23.8	25.2	26.5	27.7	29.0	29.5	31.1	32.1	33.1
35	14.9	17.4	19.5	21.4	23.0	24.6	26.2	27.5	28.7	29.9	31.0	32.1	33.1	34.1
36	15.7	18.1	20.3	22.2	24.0	25.0	27.0	28.4	29.0	30.9	32.0	33.1	34.1	35.2
37	16.6	19.2	21.2	23.2	24.9	26.5	27.9	29.5	30.7	31.8	33.0	34.1	35.2	36.2
38	17.5	19.9	22.0	23.9	25.8	27.4	28.9	30.3	31.5	32.0	33.9	35.1	36.0	37.0
39	18.1	20.8	23.0	24.9	26.6	28.3	29.8	31.2	32.5	33.8	34.9	36.2	36.8	38.1
40	19.2	21.6	23.8	25.8	27.6	29.2	30.7	32.1	33.5	34.7	35.8	36.8	38.1	39.1

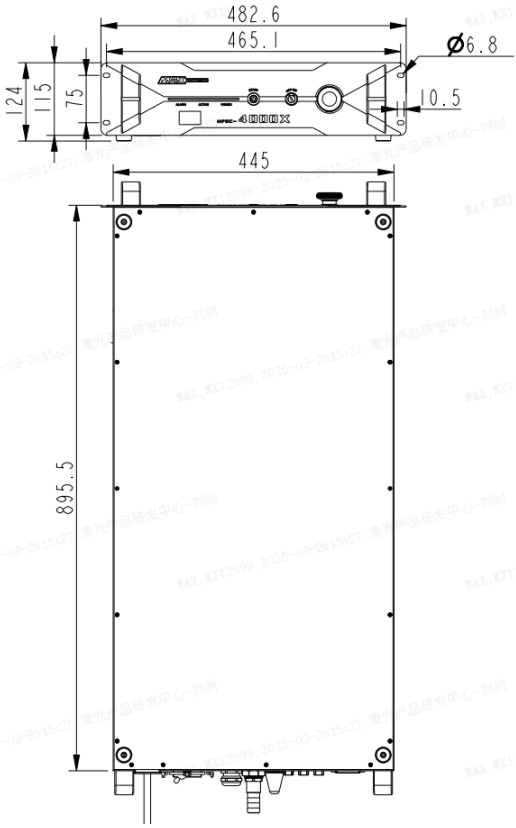
NOTE :

◎ In order to ensure a good operating environment of the laser, to reduce the probability of failure due to condensation. We recommende to prepare an air-conditioned room for the laser, so that the temperature in the air-conditioned room is ≤ 28 ° C, and the relative humidity is ≤ 50%. The water cooler should be placed in a different space from the laser. It is forbidden to place the water cooler in the air-conditioned room;

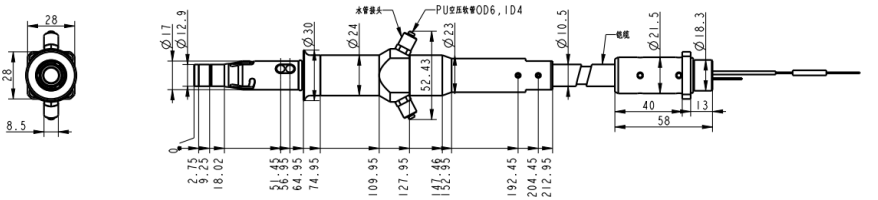
◎ The laser head works at circulating temperature. In order to avoid condensation on the laser head, it is necessary to adjust the temperature of the cooling water of the external light path to room temperature. It is forbidden to cool the laser head with low-temperature cooling water.

6-Structural Layout

Laser size chart (unit: mm)



G4.3 QBH Outline dimension drawing of laser output terminal (unit: mm)



Chapter 5
Unpacking Guide

1-Unpacking Steps

The laser is precise valuables, so Maxphotonics recommends that you unpack the packing box according to the following steps:

1. Place the package containing the laser equipment on a horizontal surface, such as a concrete floor or a hard floor;

2. Open the packaging wooden box, remove the foam upper cover, and take out the accessories;

3. Check the “packing list” to check the accessories;

4. QBH and cable are placed on the top plate of the laser. Please take care carefully to ensure that the minimum bending radius of the fiber cable is >200mm.

5. After the accessories are taken out and counted, the laser is moved out of the box by a motorized forklift, the laser is placed on the flat ground, and the caster brake pads are pressed to prevent the laser from rolling by itself;

6. Please ensure that the laser is in a dry, ventilated, no dust; the 1 meter space around the laser is unobstructed, the front of the laser and the operator's location are unobstructed, the visual is unobstructed, there is no dripping above the laser, and the laser is located. The position is drained smoothly, and no water accumulation occurs.

7. Please purchase the same water pipe according to the water pipe sample attached to the package; the water pipe is connected to the laser inlet and outlet pipe pagoda joint, and is fastened with the attached hose clamp;

8. Save all items after unpacking to prevent future transportation or storage.

NOTES:

◎ If any damage of the external package and internal parts has been found upon receipt of product, please contact Maxphotonics Co., Ltd. or designated agent immediately.

◎ The air conditioner behind the laser has a drain port, connect the drain pipe, ensure that the drain pipe is level, and the height of any position of the drain pipe should not be higher than the outlet height of the drain pipe (if the laser matches the air conditioner).

◎ If the ambient temperature and relative humidity are high enough the laser will run a process of dehumidification for about 30 minutes. It is normal and the laser should be reboot again after the Condense Warning is released.

◎ The chiller should be closed when the laser is turned off in case that the moisture in the air condense on cool parts within the laser. When an air-conditioner is available it is suggested that you run the air-conditioner for half an hour before turning on the chiller and the laser power switch.

Recommendation：Change the environmental temperature and relative humidity and make the laser work away from the dew point (for example keeping the laser in a room with air-condition).

2-Packing List

No.	Names of fittings	Description	Unit	Quantity
1	Fiber Laser	MFSC-4000X-BKW6.1	pc	1
2	External Controls (External)	3m	pc	1
3	Ultra Category 5 Double Shielded Network Cable	10m	pc	1
4	Key	/	pc	2
5	QBH Water Tube Sample Tube	Φ6x4mm	pc	1
6	Laser Water Tube Sample Tube	Φ29*Φ19.1mm	pc	1
7	Hose Bands	Zinc-plated throat clamp, tightening range 26-38mm	pc	2
8	Round tip swabs	/	pc	1
9	Pointed cotton swabs	/	pc	1
10	Ultra-fine dust free cloth (2*2)		pc	6
11	Lens protection film	Φ12*28.5mm	pc	6

Chapter 6
Operation Guide

1-Notice

CAUTION:

◎ Please refer to Chapter 4 "Specification" for proper electrical power.

◎ Please refer to Chapter 2 "General Safety Information" for inspecting whether the configuration environment of peripheral work of the laser meets the requirements.

2-Electrical Power Connection

The laser power input line needs to be connected to three-phase four-wire AC. It is important to ensure that the zero-fire wire is correctly connected according to the line mark and the ground wire is well connected. Poor contact of the ground wire may cause potential damage to the laser.

For ensuring the safety feature, Maxphotonics recommends you connect a 63A circuit breaker (air switch) in series between the power supply unit and the laser. This electric power shall be in close proximity to the power supply unit of the equipment and can be easily disconnected.

Refer to Chapter 4 "Specification" to determine your electrical specification if you have any problem about wiring.

3-Extension Interface

Laser The CTRL interface is a high quality DB44 interface that provides a variety of signals for functional control of the laser, as described below:

4000X(G6.1) CTRL Interface definition Table

CTRL Interface Pin	Wire Colo	English Label	中文标签	Notes
33	Orange and black	EXLOCK_CH1B	互锁 1B	1B/1A shorted: laser normal, control light out (dry contact) 1B/1A disconnected: laser locked, no light output (dry contact)
34	Orange	EXLOCK_CH1A	互锁 1A	
8	yellow-black	CONTROL-	外部出光 -	± Short: Controls the laser out (dry contact) ± Disconnect: Controls the laser off (dry contact)
23	Yellow	CONTROL+	外部出光 +	
39	Brown White	ERROR/ ALARM_B	故障输出 B	Dry contact output, on - fault, off - normal, (contact voltage V ⩽ 30VDC, contact current I ⩽ 100mA)
40	Brown	ERROR/ ALARM_A	故障输出 A	
29	Green White	AN1_PWR_ PEAK_10V-	0-10V 输入 -	Control laser output power (1V-10%, 10V-100%I ⩾ 1mA)
14	Green	AN1_PWR_ PEAK_10V+	0-10V 输入 +	
2	Black and White	PWM1-	调制输入 1-	High Level：20VDC ⩽ V ⩽ 30VDC Low Level：0VDC ⩽ V ⩽ 5VDC I ⩾ 5mA
17	Black	PWM1+	调制输入 1+	

4	red and white	ENABLE1-	使能输入 1-	High Level：20VDC ⩽ V ⩽ 30VDC Low Level：0VDC ⩽ V ⩽ 5VDC I ⩾ 5mA
19	Red	ENABLE1+	使能输入 1+	
37	Light Blue Black	EMERGENCY1_ INPUT-	急停输入 1 -	± Short: Controls the laser out (dry contact) ± Disconnect: Controls the laser off (dry contact)
38	Light Blue	EMERGENCY1_ INPUT+	急停输入 1 +	
6	Light Green Black	EX_REST-	错误复位 -	High level: 20-30V Low level: 0-12V I>=5mA
21	Light Green	EX_REST+	错误复位 +	
25	Blue White	GND_ISO_24V-	数字地 -	24V+-5%,50mA, output high level out of light, output low level out of light
10	Blue	LASER_ EMISSION	激光器 出光状态	
28	purple-black	ISO_REF_VSS	模拟地	Laser Output Power Feedback 0-8V. 0.8V-10%, 8V-100%.
13	purple	AN_OUT_PWR	功率 检测输出	

4-Start Steps

WARNING:

◎ Make sure that all the electrical connections (including cooling water connections) are connected prior to use. All the connectors must be held steady with screws if possible.

◎ NEVER look directly into the output fiber and make sure that you wear the laser safety eyewear while operating the product.Make sure all power is removed from the laser when wiring.

Start steps are as follows:

(1) Start the water cooler;

(2) Remove the collimator end cap;

(3) Check that the collimator end face is clean and free of debris;

(4) Ensure that the emergency stop and interlock of the external control line are in the short-circuit state;

(5) Turn on the laser power supply.

5-Mode Description

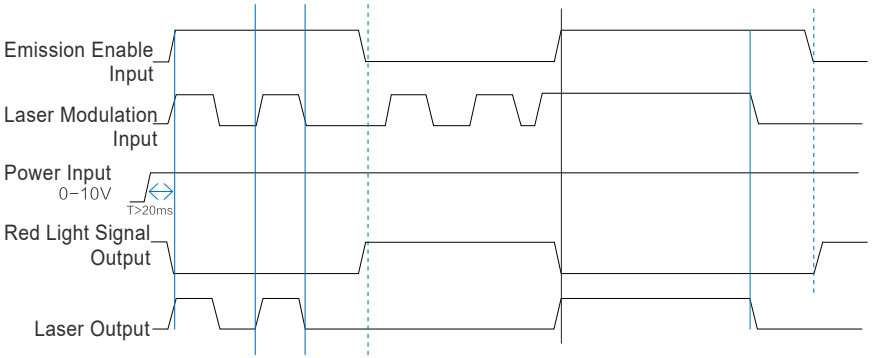
The working modes of the laser are as follows:

1.CW Mode：The light emitted is continuous and this mode is used for cutting.

2.Modulated Mode：The light emitted is pulsed and this mode is used for controlling the output average power of the laser.

3.External Control: Control the output of the laser via external control software.

External Control Signal Timing:



4. Indicator status indication:

◎ Power-on preheating state: the POWER light traffic light flashes at 1HZ alternately;

◎ Standby state: POWER light green on, ALARM light green on;

◎ Light output status: ACTIVE light green on;

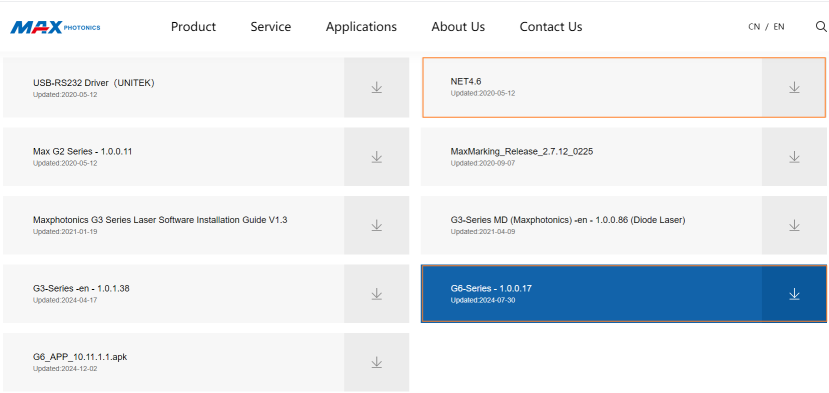
◎ ALARM status: ALARM light is steady red;

6-Software Description

(1) Enter “Chuangxin Laser official website” - “Download Center” - “Software”, download “NET4.6”, “G6-Series-n.n.n.n”. NET4.6”, ‘G6-Series-n.n.n.n’. (Versions may be upgraded from time to time.

(Subject to the announcement on the official website without prior notice.)

Website: http://en.maxphotonics.com/En/Software.html



(2) Install the runtime environment (NET4.6). (You do not need to install NET4.6 on Win10 systems or systems that already have .NET 4.6 installed).

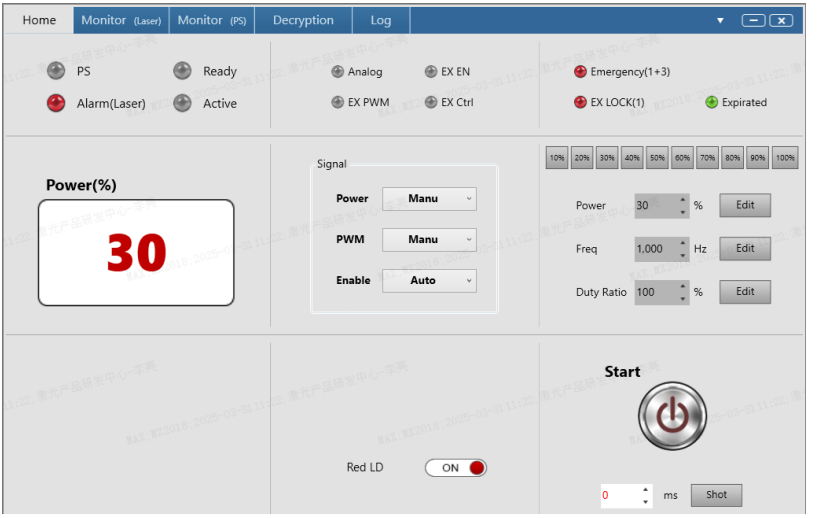
(3) Install the monitoring software (G6-Series-n.n.n.n) and a shortcut to “G6-Series” will appear on your desktop.

(4) Locate the EtherNet communication interface on the back panel of the laser, use a network cable to connect it to the computer, and power up the laser.

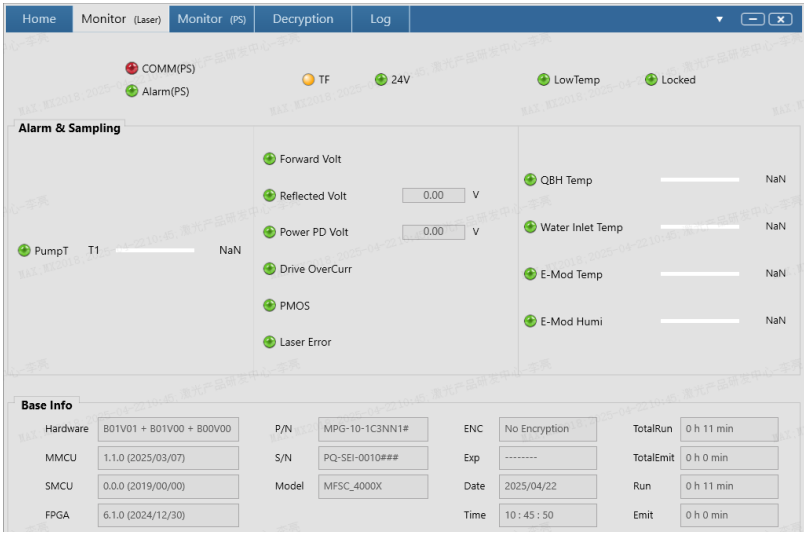
(5) Set the IP of the computer to the same network segment as the IP of the laser, but not the same as the IP of the laser (the default IP of the laser is 192.168.0.178).

(6) Double-click the desktop “G6-Series” shortcut to open the monitoring software and enter the following connection interface. Input the IP address of the laser (default is 192.168.0.178), click “Login” button and try to connect with the laser.

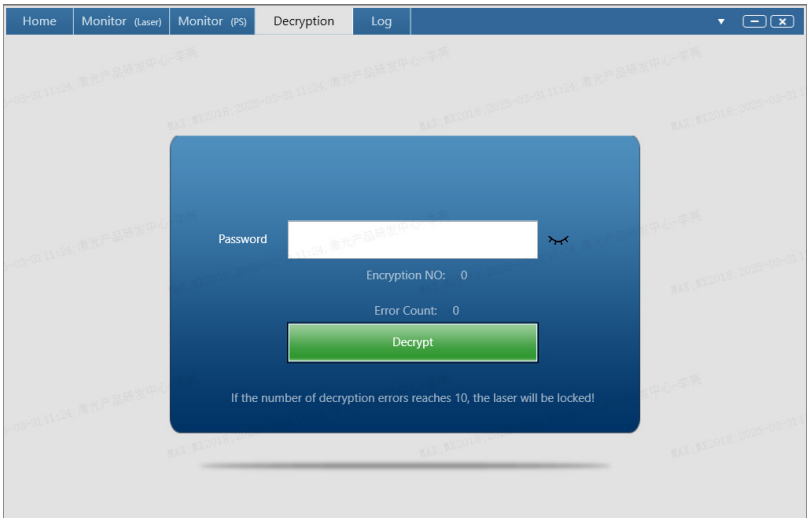
(7) If the laser has been powered up and the model can be matched with the monitoring software, it will enter the following main interface.



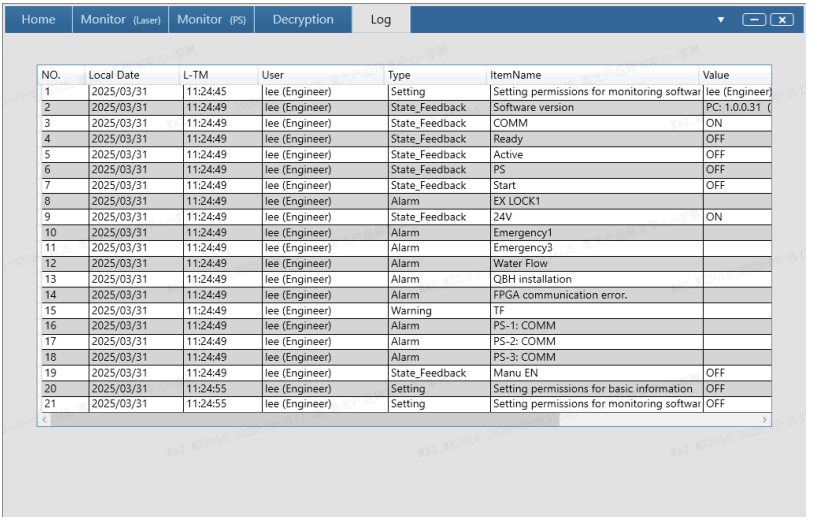
(7) Monitor page.



(8) Decryption page.



(9) Log page.



NO.	Local Date	L-TM	User	Type	ItemName	Value
1	2025/03/31	11:24:45	lee (Engineer)	Setting	Setting permissions for monitoring softwar	lee (Engineer)
2	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	Software version	PC: 1.0.0.31 (
3	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	COMM	ON
4	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	Ready	OFF
5	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	Active	OFF
6	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	PS	OFF
7	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	Start	OFF
8	2025/03/31	11:24:49	lee (Engineer)	Alarm	EX LOCK1	
9	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	24V	ON
10	2025/03/31	11:24:49	lee (Engineer)	Alarm	Emergency1	
11	2025/03/31	11:24:49	lee (Engineer)	Alarm	Emergency3	
12	2025/03/31	11:24:49	lee (Engineer)	Alarm	Water Flow	
13	2025/03/31	11:24:49	lee (Engineer)	Alarm	QBH installation	
14	2025/03/31	11:24:49	lee (Engineer)	Alarm	FPGA communication error.	
15	2025/03/31	11:24:49	lee (Engineer)	Warning	TF	
16	2025/03/31	11:24:49	lee (Engineer)	Alarm	PS-1: COMM	
17	2025/03/31	11:24:49	lee (Engineer)	Alarm	PS-2: COMM	
18	2025/03/31	11:24:49	lee (Engineer)	Alarm	PS-3: COMM	
19	2025/03/31	11:24:49	lee (Engineer)	State_Feedback	Manu EN	OFF
20	2025/03/31	11:24:55	lee (Engineer)	Setting	Setting permissions for basic information	OFF
21	2025/03/31	11:24:55	lee (Engineer)	Setting	Setting permissions for monitoring softwar	OFF

7-Error List

The fault alarm points set by the laser include:

NO.	Fault name	Cause of Failure	Note
1	Forward Light Alarm	Laser Internal Optical Path Detection Faults	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** Laser is not detected by the PD inside the laser. **Solution:** 1. Restart the laser, do not turn on the laser, check whether there is red light. If there is no red light, please contact Chuangxin customer service; 2.If there is red light, please check whether the relevant module can turn on the laser. Check whether the module power supply DC switching power supply voltage output is normal.
2	Back light alarm	Laser Internal Optical Circuit Detection Faults	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** The laser detects an excessive return light. **Solution:** 1. check the laser focus position; 2. check whether the material is placed horizontally; 3.Check whether the material is ultra-high anti-material; 4.Check whether the thickness of the material is over the standard, can not cut through the alarm; 5.Turn off the laser, suspend the use of 3-5 minutes, laser restart, turn on the laser

3	Inlet temperature alarm	Inlet temperature fault	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** Laser module water cooling plate temperature is too high, temperature alarm. **Solution:** Turn off the laser, check whether the chiller flow rate and water temperature are normal, and whether the water pipe is blocked. After checking, restart the laser, the laser returns to normal. If you can not return to normal contact Chuangxin customer service personnel.
4	Pump source temperature alarm	Chiller or laser internal piping fault	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** Laser module pump source temperature is too high, temperature alarm. **Solution:** Turn off the laser, check whether the chiller flow rate and water temperature are normal, and whether the water pipe is blocked. After the check is completed, restart the laser, the laser returns to normal. If it can not be restored, normal contact Chuangxin customer service personnel.
5	Overcurrent Alarm	Laser overcurrent fault	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** Single module block pump source operating current exceeds maximum limit. **Solution:** 1. Reboot after the laser is turned off, check whether it is normal; if normal, normal use; 2.If there is still a maximum current alarm, the driving MOS tube in the whole machine may be broken, you need to turn off the laser immediately, contact Chuangxin customer service personnel.

6	QBH installation alarm	QBH not in place	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** Poor contact between laser QBH output head contact and cutting head contact. **Solution:** Turn off the laser, check the laser QBH output head and cutting head, and reinstall.
7	Abnormal communication alarm	Laser communication failure	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** There is no signal transmission between the communication cable and the whole machine. **Solution:** 1. Check whether the signal line connected with the whole machine is loose; 2.Check whether it can be powered up and start normally, whether there is red light, and whether the power supply voltage output works normally.
8	Emergency stop alarm	Laser emergency stop alarm fault	**Protective measures:** The main power supply stops supplying power and turns off the laser. **Possible cause:** The emergency stop switch is pressed. **Solution:** The emergency stop switch is returned to its normal state and the laser is restarted.
9	Encryption alarm	Laser encryption expired	Front panel ALARM indicator and ACTIVE indicator, alternately flashing red and green, continue normal use please contact Chuangxin customer service personnel.

NOTE:

◎ All the alarm message will be displayed on the Monitor Software. Please pay attention and contact our service personnel if you need.

Chapter 7
Service and Maintenance

1-Maintenance Instructions

Before connect the laser fiber connector, it is necessary to check the dust, dirt adhesion and damage of the end face. Using dirty or unclean fibre optic connectors can cause serious damage to the laser. Maxphotonics does not take any responsibility for laser damage caused by using unclean optical fiber connectors. If the optical fiber connector is tampered with privately, the equipment will no longer in guarantee.

For cleaning a fiber connector you need the following materials:

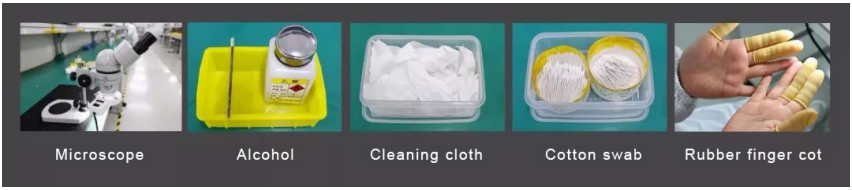
1.Powder-free rubber gloves or fingerstall;

2.Lint free optical cleaning wipes and/or swabs;

3.Ahydrous ethanol (Optical level, purity >99.5%);

4.Compressed air (no oil, no water), or a wooden rod rolled with a double-layer adhesive tape;

5.Scale microscope (can be enlarged by 20 times and above).



IMPORTANT:

◎ It is imperative that you wear powder-free rubber gloves during this cleaning procedure! It is hereby stated that damage to the fiber connector can occur due to mishandling, the use of incorrect cleaning procedures, or chemicals for cleaning. This is not covered by the Maxphotonics' warranty.

2-Appearance Inspection

1.Environmental requirements

LOE cleaning and installing cutting head shall be carried out in the clean room purification workbench,the dust-free grade requires 1000 grades, and the reference cleansing workbench as follow:

2.Operating Procedures

1.Switch off the laser power, and place the key switch on position of "OFF";

2.Rotate the black protective sleeve of the connector clockwise, place it under

a 20x microscope and make the surface to be inspected clear, and check whether the appearance of the quartz rod meets the appearance standard. (referrence2.2.5);

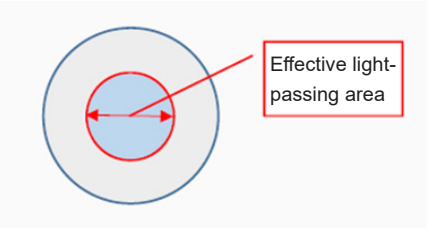
3.If there is no dust particles, or the dust particles meet the appearance standards, put the black protective sleeve to return the connector;

4.If it is found that the dust particles exceed the appearance standard requirements, then clean them according to the requirements of step 3;

5.Appearance standards are shown in the table below:

Power	Quartz rod	
	Effective light-passing area (within φ3mm)	Non-effective light-passing area (outside φ3mm)
4000W-20KW	Pitting diameter: Not allowed Scratch width: Not allowed	Pitting diameter：≤ 0.1 Scratch width：≤ 0.005
2000W-4000W	Pitting diameter：≤ 0.05 Scratch width：≤ 0.002	Pitting diameter：≤ 0.1 Scratch width：≤ 0.005
Below 2000W (single Module)	Pitting diameter：≤ 0.1 Scratch width：≤ 0.005	Pitting diameter：≤ 0.1 Scratch width：≤ 0.01

Unit：mm



Schematic diagram of effective light passing area

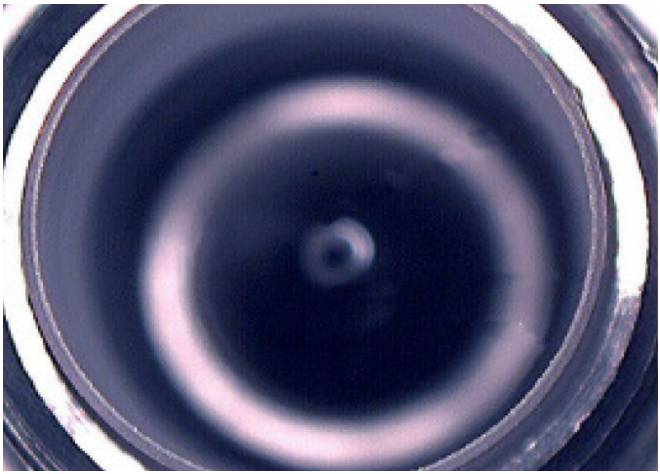
3-Cleaning Procedures

1.Switch off the laser power, and place the key switch on position of "OFF"

2.Cleaning protective lens with swabs

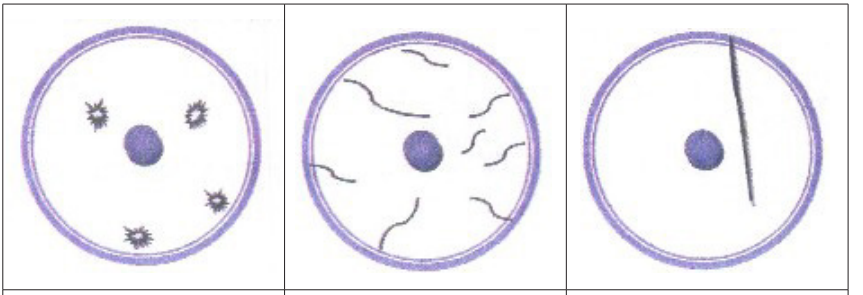
1.Rotate the black protective sleeve of the connector clockwise, place the inner or outer surface under a microscope of 20 times and make it clear. After careful observation, determine the specific position of the dust particles, open the alcohol bottle cap and gently press the alcohol bottle mouth makes a small amount of alcohol ooze out, completely immerse the round cotton swab in alcohol, and then lightly swab the cotton swab to remove excess alcohol. Use a cotton swab to wipe the dust particles straight in the direction of the operator's body. The force should be light. After each wiping, the cotton swab can be rotated 180° and then wiped with the other side. After wiping for 2 times, the cotton swab is scrapped. Note that it is not allowed to circle. Or wipe back and forth to prevent dust particles from contaminating other areas or cotton swabs directly scratching the surface.After all cleaning, it is necessary to observe under the microscope again whether the surface is clean.

Actual image of the fiber



Quartz rod

Endface may be damaged



Surface damaged	Coating damage	Scratch

2.Check the inner wall of the protective guide tube if there is obvious foreign matter with the microscope. If the foreign matter can be cleaned with a double-sided glue stick, then use a cotton swab to wash the alcohol for further cleaning. After the protective guide tube is dried, directly put on the connector.

3.Cleaning method for quartz rods

If find that the internal quartz rod is dusty or dirty, you can open the lens to clean it. The specific steps are as follows:

1.Rotate the black protective sleeve, dust cap and protective lens at clockwise, first wipe the circumference and thread surface of the entire connector lens piece with an optical cleaning cloth and alcohol;

Remove the fiber protection sleeve and inner protective cover

2.Put the quartz rod under a 20x microscope and make it clear. After careful observation, determine the specific location of the dust particles and clean according to the method of 3.2.1. For dust particles on the side of the fused quartz rod, use a pointed cotton swab to clean along the circumferential surface. After all cleaning, confirm under the microscope whether it is clean, including the chamfered area. Finally, wrap it on the table with a non-woven fabric, and then continue other work to prevent the dust from contaminating the end face and side of the fused silica rod again;

Cotton swab to wipe quartz rod

3.Along the grain of the surface of the metal part, gently rotate the lens piece back to the metal part and confirm that it is in place. Place the black protective sleeve on the connector.

IMPROTANT:

◎ Do not reuse a lint-free optical wipe or swab;

◎ Do not touch the protective lens of the fiber connector;

◎ Do not blow directly, or else new dirty will be brought;

◎ Do not touch the tip of the cleaning swab with your fingers;

◎ Cleaning is necessary before place the protective cover and s leeve;

◎ Never blow air directly at the surface, because you could imbed contaminants into the surface. Always blow across the surface;

◎ If the fiber connector could not be installed in optical system immediately, please cover it with the protective cap cleaned with compressed air;

◎ Be sure to operate in a Class 1000 clean environment.

Chapter 8
Service and Maintenance

1-Maintenance Notes

CAUTION :

◎ No operator serviceable parts inside. Refer all servicing to qualified Maxphotonics personnel.

◎ For ensuring that the repairs or replacement within the warranty scope can be carried out, and perfectly maintaining your interests, please submit application to the Maxphotonics or the local representative after finding the faults. Upon receiving our authorization, you need to pack the product in a suitable package and return it.

◎ You should keep the proof when finding any damage after receiving the product, so as to claim the rights to shippers.

IMPORTANT :

◎ Do not send any product to Maxphotonics without RMA.

◎ If the product is beyond the warranty period or the warranty scope, customers shall be responsible for the repairing cost.

CHANGE :

◎ We have the rights to change any design or structure of our product, and the information is subject to change without notice.

2-Service Statements

More problems regarding the safety, set-up, operation or maintenance please reading this "User Guide" carefully and flowing the operation steps stictly. Please call the Customer Service Department for other questions.

Please call the Customer Service Department for other questions: 400-900-9588.

Your problems will be follow-up by our technical support group after verified. If the problems cannot be solved , you may need to return the product to Maxphotonics for further troubleshooting.

Chapter 9
Warranty Statements

1-General Clauses

Maxphotonics Co.,Ltd. carries out warranty for any defect of the product caused by its material and production technology within the warranty period agreed in contract, and ensures that its product meet the relevant quality and specification requirements specified in the document under normal use condition.

Maxphotonics Co.,Ltd. rationally determines to repair or replace the products with faults caused by its material or production technology within the warranty period, and repairs or replacement of all the products within the warranty scope are carried out according to the rest of the warranty period of primary products.

2-Warranty Limitations

Under the following circumstances, the products, parts (including the fiber connectors) or equipment are not within the warranty scope:

（1）Tampered, opened, detached or reconstructed by personnel outside Maxphotonics;

（2）Damaged from misuse, neglect or accident;

（3）Used beyond the specification and technical requirements of the product;

（4）Indirectly damaged from users' software or interfaces;

（5）Improper installation or maintenance, or operating under conditions not included in this manual;

（6）The fittings and the fiber connectors are not included in the warranty scope.

Customers are obligated to understand the information above and operate according to the User Guide and specification, or the faults arising therefrom are not included in the warranty scope.

IMPORTANT:

◎ Within the warranty scope, purchasers must feed back within 31 days after finding the product defect.

◎ Maxphotonics does not grant any Third Party rights to repair or replace the parts, the equipment or other Maxphotonics products.