



Single-Mode Continuous-Wave  
Fiber Laser User Guide  
FSC 2000

Beijing Reci Laser Technology Co., Ltd.

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## **Preface**

Thank you for using the FSC series continuous-wave fiber laser from Beijing Reci laser. We compile this document for you in order that the fiber 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.

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.

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 the information to prevent the unnecessary damages.

## **Company Profile**

Beijing Reci Laser Technology Co., Ltd. is an integrated optical enterprise specializing in the R&D as well as production of lasers. The main products include CO<sub>2</sub> laser tube, radio frequency laser, fiber laser, fiber coupled diode laser and accessories for laser application. Headquarter of the company lies in Zhongguancun technical zone in Jiuxianqiao East Road, Chaoyang District, Beijing. We have 3,500 m<sup>2</sup> office area for R&D and employs more than 100 experts and engineers, who are professional in optics, mechanics, structure design, and software etc. Reci laser possesses lots of patents in China and abroad, which focuses on the long-term development in lasers.

In 2014, the company built the CO<sub>2</sub> laser tube production factory in Yanjiao high-tech park. Reci invested 20 million USD for this 10,000 m<sup>2</sup> plant. Its annual production capacity can reach up to 200,000 units. The total production line uses high precise machines instead of manual operation. With glass-metal joint technology, we have thoroughly solved the problem of output model variation caused by adjusting screws. This brings manufacturing process of CO<sub>2</sub> laser tube to a new period.

Reci radio frequency laser uses planar-waveguide discharge technology. The product models are 300, 450 and 670, which deliver power from 300 W and 600 W. It is high reliable and has good output model. This

kind of laser is very popular for metal and non-metal materials cutting and engraving.

The main products of our high-power CW fiber laser, high-power fiber combiners, and fiber coupled diode laser. Fiber lasers are designed with anti-high-reflection, so that it can be used for long time cutting of cooper, aluminum, gold etc. The output average power range is from 600 W to 3000 W with single-mode CW and 4000-15000 W with multi-mode CW. In 2017, Reci has invested 28 million USD to build the new 12,000 m<sup>2</sup> factory. All equipments are world-class for laser chip package and laser production.

Reci laser is R&D oriented and masters the key technologies of laser. We are a comprehensive laser sources manufacture company with the lead in China. Reci is your reliable partner for long term cooperation.

More information, please visit our website:

<http://www.recilaser.com>

## **Chapter 1 Characteristic Explain**

FSC series fiber laser products provide a wide range of wavelength from 1070 nm to 1090 nm. The lasers are water-cooling and maintenance-free and with a wall plug efficiency of more than 25% and deliver high efficiency, high reliability and high performance.

FSC series fiber lasers 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.

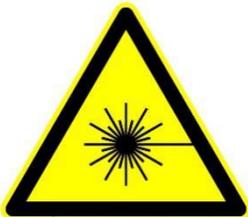
Fiber laser exhibits unique characteristics that may pose safety hazards. Therefore, the laser can't be normally associated with other light sources, and all operators and people near the laser must be aware of these special hazards.

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 Safety Information

### 2.1 Safety Conventions

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

SYMBOLS	DESCRIPTION
	<p><b>WARNING :</b></p> <p>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.</p>
	<p><b>CAUTION :</b></p> <p>Refers to a potential hazard on product. It requires a procedure, 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.</p>
	<p><b>WARNING :</b></p> <p>Refers to a potential laser hazard.</p> <p>The symbol represents laser radiation. The symbol is pasted on laser output end.</p>
<p><b>NO SYMBOL</b></p>	<p><b>IMPORTANT :</b></p> <p>Refers to any information regarding the operation of the product. Please do not overlook this information.</p>



***NOTE:** This device is classified as a high power Class IV laser instrument, and the center wavelength is 1080 nm. This level of laser 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. Use appropriate laser safety eyewear when operating this device. The manufacturer of the laser system is responsible for the safety compliance according to the applicable standards and regulations.*

## **2.2 Laser Protection**

You must wear the safety protective glasses while operating the fiber laser, and rationally select the safety protective glasses according to the lasing wavelength of the fiber laser.

## **2.3 General Safety Instructions**

### **2.3.1 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.

	<p><b>WARNING:</b></p> <p><i>You must exercise caution to avoid/minimize specular reflections as these laser radiations are invisible!</i></p>
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### 2.3.2 Safety Instructions of Accessories

Optical accessories relevant to the laser, such as light-sensitive elements that may be damaged from exposure to the laser light, video cameras, photomultipliers and photodiodes, need related protections.

	<p><b>WARNING:</b></p> <p><i>The Reci FSC laser is strong enough to cut or weld metal, burn skin, clothing and paint. In addition, this laser can ignite volatile substances such as alcohol, gasoline, ether and other solvents.</i></p> <p><i>During the operating process, the flammable materials around the laser must be isolated.</i></p>
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### 2.3.3 Optical Operating Instructions

We strongly recommend that you read the following procedures before operating the fiber 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) Remove the end-cover before switch ON laser. Or else the output head will be damaged irreversibly.

(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 laser in darkened environments.

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

(9) Do not install or detach cutting heads or collimators when laser is active.

(10) 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.

(11) 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.

	<p><b>CAUTION:</b></p> <p><i>(1) The output of the fiber 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.</i></p> <p><i>(2) For cleaning instructions of the lens, please refer to the "Optical Fiber Connector Inspection and Cleaning Guide".</i></p> <p><i>(3) Hot or molten pieces of metal may be produced when the laser is under operation. Exercise caution if debris is produced in operation.</i></p> <p><i>(4) When implement commissioning and calibration of laser output, it's necessary to set the quality of the spot emitted from the laser at low power levels via an infrared viewer, and then gradually increase the output power.</i></p>
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	<p><b>WARNING:</b></p> <p><i>(1) Make sure that the individual protective equipment meets the output power and wavelength range of the laser.</i></p> <p><i>(2) Never look directly into the optical fiber or the collimator, and make sure you wear the safety protective glasses in each operation.</i></p>
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### **2.3.4 Electrical Operating Instructions**

We strongly recommend that you read the following procedures before operating the fiber 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) Make sure that the input AC voltage of the laser is the voltage of the normal AC mains, and wires are connected accurately. Any incorrect wiring method may cause damage to people or instrument.

(5) 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 Reci Co., Ltd.

(6) To prevent electrical shock, do not remove enclosure, detach the laser without permission and damage the relevant signs.

(7) Any product with unauthorized dismounting shall not be subject to warranty.

	<p><b>WARNING:</b></p> <p><i>The input voltage of the fiber laser is three-phase AC current (380V AC), which may cause risk of electric shock. All the relevant cables and connection wires have potential hazards.</i></p>
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### 2.3.5 Environment Conditions and Precautions

For ensuring the safety of the fiber 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 fiber 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 fiber laser:

(1) Do not expose the laser to a high moisture/high temperature environment. Install the fiber laser in the cabinet with the function of temperature-humidity control and dust-free.

(2) Operation at higher temperature will accelerate aging, increase threshold current and lower slope efficiency. If the device is overheated, stop operation and contact Reci Co., Ltd.

## **Chapter 3 Product Description**

### **3.1 Property Introductions**

As high power fiber lasers developed for industrial application, FSC Series fiber lasers are compact and efficient. The lasers are mainly applied to the fields of welding, cutting, brazing, etc.

#### **Main Features:**

- (1) High power, high efficiency
- (2) Multiple anti-high-reflection
- (3) High reliability, long service life
- (4) Compact, rugged package
- (5) Extension programming interface

#### **Applications:**

- (1) Industrial applications
- (2) Scientific research

### **3.2 Certification**

Reci 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 Reci immediately.

### 3.3 Front Panel Description



Figure 3.1 the Front Panel of the FSC series fiber laser

Table 3.1 Function of the button/switch on the Front Panel

ITEMS	FUNCTION DESCRIPTION
1-Key Switch	Power switch of laser. Insert the key, rotating to REM, means the laser is operating in the far end mode; rotating to ON, means the laser is operating in local mode; rotating to OFF, means the laser power is off.
2-Start	Start laser. Local mode power-on button, after the laser source power supply air switch opened, need press the button again, then the laser source power supply can power-on.
3-ALARM	Abnormal situation light of laser. Indicator light, green means that the laser power supply is normally powered on; red means that the laser is faulty.
4-Emergency Stop	Emergency stop. Press to turn the laser off and lock immediately, and turn it clockwise to release the button.

### 3.4 Back Panel Description



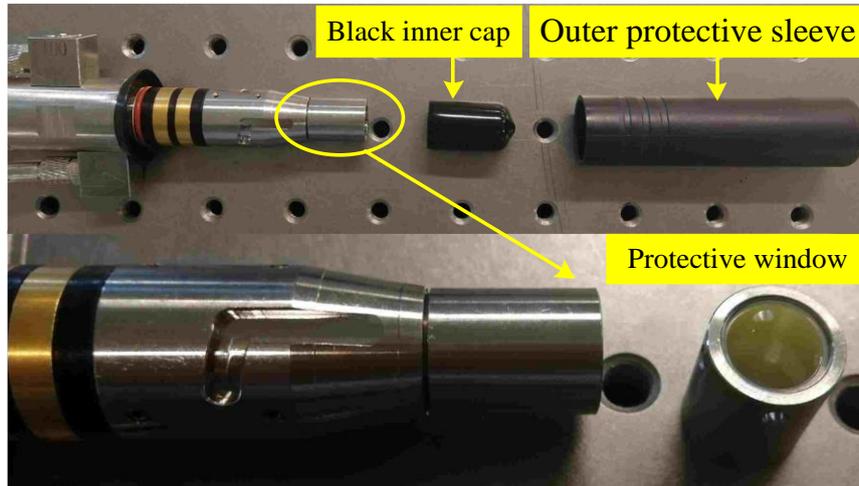
Figure 3.2 the Rear Panel of the FSC series fiber laser

Table 3.2 Function of the button/switch on the rear Panel

ITEMS	FUNCTION DESCRIPTION
1-Air Switch	Power switch of 380V AC power Push on, open 380V AC power; push down, close the 380V AC power
2-AC INPUT	380VAC power input
3-RS232	RS232 connector Can be used for device program modification, providing a matching RS-232 communication line when delivery
4-WM IN	Water flow meter signal input port. Must use the water flow meter configured from the factory.
5-ANG-IN	AD analog control signal input port AD mode 0~10V Analog control signal input, 2-pin aviation plug, 1 pin is negative, 2 feet are positive, and the matching cable is provided at the time of delivery.
6-CTRL-INTERFACE	External control connector
7-WATER (IN/OUT)	The input and output port of cooling water

### 3.5 Optical Output Terminal

The optical output head come with a protective window that can be replaced if damaged. Make sure that the black inner cap of the QBH head is



removed prior to use and is usually arranged with the fiber laser.

Figure3.3 The optical output head and its accessories

#### 3.5.1 Tools for Cleaning

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, pure >99.7% )
- (4) Compressed air (oil free, water free)
- (5) Microscope
- (6) Light source

	<p><b>CAUTION:</b></p> <p><i>(1) It is imperative that the protective lens are checked for dirt, dust, or damage before you use the fiber connector. It will lead to heavy damage if the laser equipped with dirty or damaged fiber connector.</i></p> <p><i>(2) The use of dirty fiber connectors can result in laser damage, which is not covered by the Reci' warranty.</i></p> <p><i>(3) The laser will not be covered by the Reci' warranty if change the laser personally.</i></p>
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	<p><b>WARNING:</b></p> <p><i>(1) 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 Reci' warranty.</i></p> <p><i>(2) Ethanol concentration should be above 99.7% during cleaning.</i></p>
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### 3.5.2 Operating Procedures

Cleaning and maintaining according to the following procedures:

- (1) Switch off the laser power, and place the key switch on position of “OFF”;

(2) Remove the black outer protective sleeve and leave the black inner cap on and clean the fiber connector exterior with optical cleaner, wipe it with a clean optical wipe and dry it with compressed air.

(3) Place fiber connector in the holder of the microscope, remove the black inner cap from the connector.

(4) Focus the microscope onto the connector surface so that the protective lens can be seen clearly from the microscope.

(5) Check the surface carefully. If some contamination is visible on the surface, cleaning is necessary.

(6) Reinstall the inner cap and the outer sleeve onto the cleaned fiber connector.

(7) Take out the cap and sleeve, then connect the fiber connector with cutting head quickly and fasten them. (Place the cap face down on a clean surface or a lint-free wipe).



***IMPORTANT:***

*(1) Do not reuse a lint-free optical wipe or swab.*

*(2) Do not touch the protective lens of the fiber connector.*

*(3) Do not blow directly, or else new dirty will be brought.*

*(4) Do not touch the tip of the cleaning swab with your fingers and use each swab only once.*

*(5) Cleaning is necessary before place the protect cover and sleeve.*

	<p>(6) <i>Never blow air directly at the surface, because you could imbed contaminants into the surface. Always blow across the surface!</i></p> <p>(7) <i>If the fiber connector could not be installed in optical system immediately, please cover it with the protective cap cleaned with compressed air.</i></p>
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## Chapter 4 Specification

### 4.1 Characteristic Parameters

The characteristic parameters of the FSC series fiber laser which the power is ranged from 2000W to 2500W is demonstrated in the table.

Table4.1 Parameters of the FSC2000&FSC2500 laser

	MODEL	FSC2000	FSC2500
Optical Specification	Output Power (W)	2000	2500
	Central Wavelength (nm)	1080±3	
	Operating Mode	CW/Modulate	
	Polarization	Random	
	Power Range (%)	10~100	
	Max. Modulation Frequency (kHz)	20	
	Power Instability (%)	<3	
	Red Laser	Yes	
	Beam Delivery Optics	QBH	
	Output Fiber Diameter (μm)	30/100 (Customizable)	
	Beam Quality M <sup>2</sup>	<1.5	
Delivery Fiber Length (m)	15 (Customizable)		
Electric	Operating Voltage (VAC)	380	

	MODEL	FSC2000	FSC2500
Specification	Power Consumption (W)	<8000	<10000
	Control Mode	Ext. RS 232/Ext. AD/Hyper terminal	
Other Specification	Ambient Temperature (°C)	5~40	
	Ambient Humidity (%)	<70	
	Cooling Water Temperature (°C)	25	
	Cooling Water Flow (L/min)	>30	>35
	QBH Cooling Water Temperature (°C)	Room temperature	
	QBH Cooling Water Flow (L/min)	1.5 ~4.5	
	Storage temperature (°C)	-10~60	
	Dimensions W×H×D (mm <sup>3</sup> )	483×214×850	
	Weight (kg)	<80	

## 4.2 Structural Layout

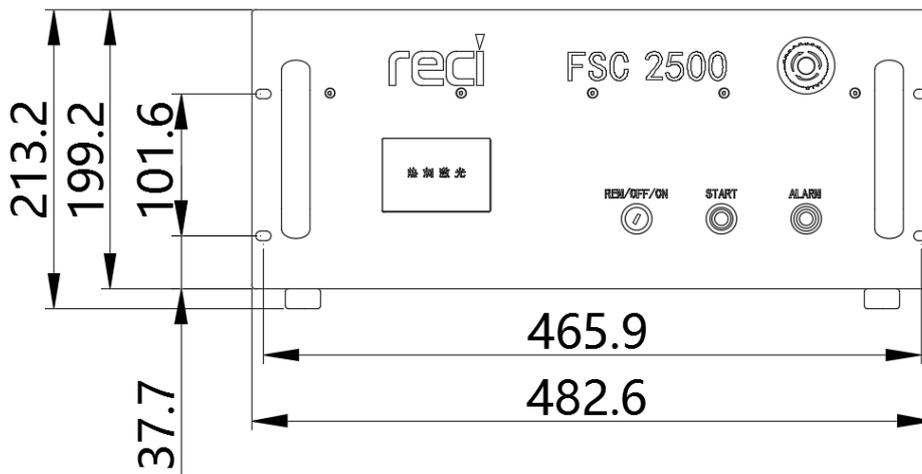


Figure 4.1 the measurement of the front panel structural layout

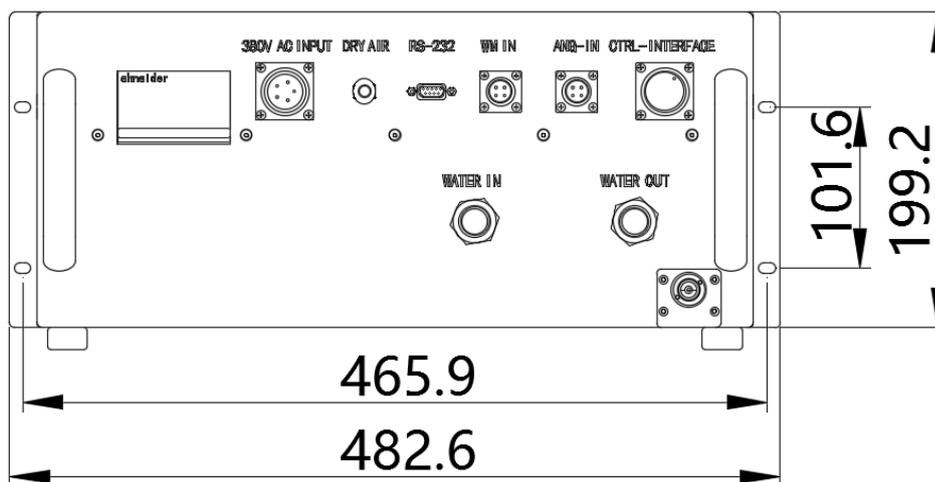


Figure 4.2 the measurement of the rear panel structural layout

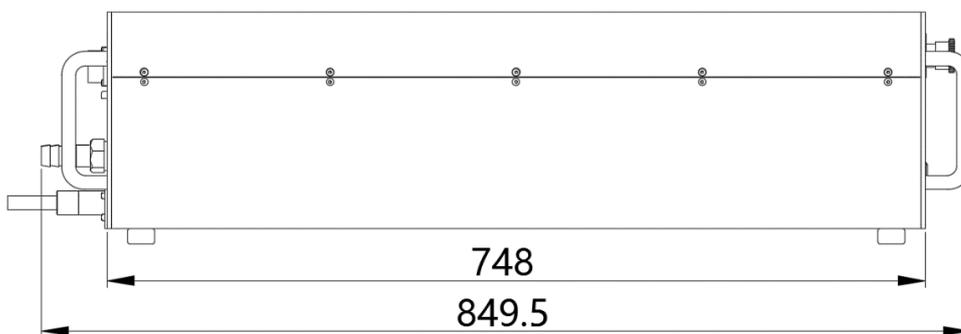


Figure 4.3 the measurement of the profile structural layout

### 4.3 The Optical Output Terminal Structural Layout

The output terminal of FSC2000 is just like the figure. The outside measurement is marked.

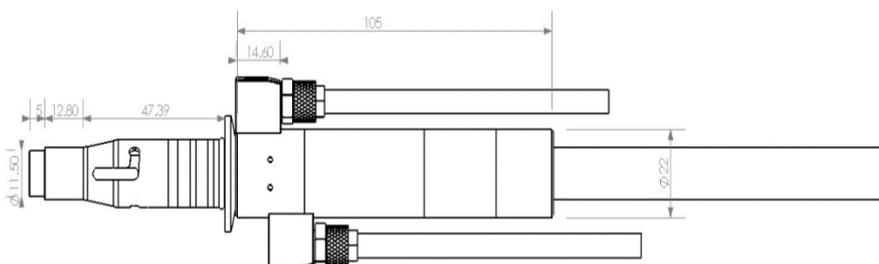


Figure 4.4 the measurement of the QBH structural layout (overlook)

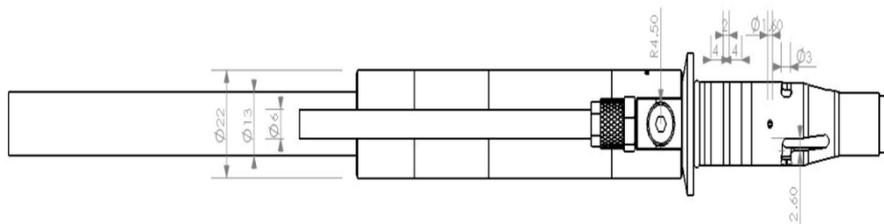


Figure 4.5 the measurement of the QBH structural layout (side-looking)

## 4.4 Installation and Tips for Cooling System

### 4.4.1 Connection of the cooling system

We connect the laser and the cooling-water machine with the  $\Phi 19$ mm PU water pipe. The “WATER IN” connects with the supplied water, and the “WATER OUT” connects with the returned water.

For the QBH, a  $\Phi 6$ mm polyurethane pipe is used to connect to the cooling water。 We recommend that you comply with the following operating measures in the figure4.6:

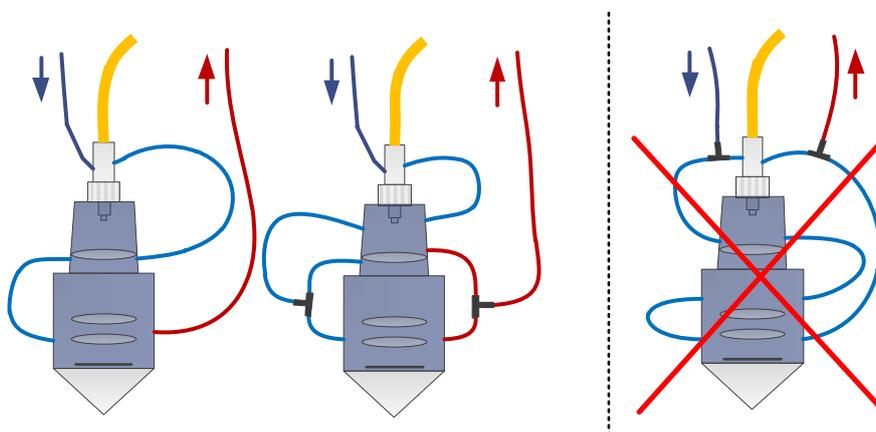


Figure4.6 The connection of the QBH with the cooling water

### 4.4.2 Tips for the cooling system

We strongly recommend that you can follow the tips for a reliable status of the laser for its life:

#### 1) Requirement for cooling fluid

a) Make sure the water is pure enough-- the de-ionized water is the best choice, or you can also use purified water which is for drinking;

b) Please pour some ethanol into the water in order to avoid the waterway stopped by the putrefaction, which is suggested about 10% of all.

c) When the surrounding temperature is between  $-10^{\circ}\text{C}$ ~  $0^{\circ}\text{C}$ , gain the ethanol proportion to 30%, and replace once three months .

d) When the surrounding temperature is below  $-10^{\circ}\text{C}$ , the cooling machine with a heating system should never lay off all the time .

## 2) The other requirement of the cooling system

a) When the cooling machine works the first time, please make sure the waterway is unclogged and watertight, at the same time the water supply is connected to the “WATER IN”, and return water is connected to the “WATER OUT”;

b) If the laser is away from work for a long time, please empty the water in it.



### **CAUTION:**

*Set temperature for the cooling machine according to the surrounding temperature. Unsuitable temperature will lead bad results—too high temperature can lead the laser exceptional, even damaged, and the low temperature may cause badly condensation trouble both on the laser device and the QBH.*

	<p><b>WARNING:</b></p> <p><i>Make sure the cooling system works before the laser device does, and the temperature is required being 25°C, when you decide to turn on the laser device.</i></p>
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## Chapter 5 Operation Guide

### 5.1 Electric Power Connect

The power cord 5-pin aviation plug is inserted into the rear panel with the "AC INPUT" socket and the other end connected to the 380VAC power supply.



Figure 5.1 the wire for the AC source

Table 5.1 definition of the AC wire

PIN	PHASE LINE
1	PE
2	A
3	B
4	C
5	N

## 5.2 Interface Definition

### 5.2.1 Analog Connecting Wire



Figure 5.2 the wire for the analog connecting

Table5.2 definition of the Analog wire

PIN	DESCRIPTION	REMARK
1	Analog voltage signal ground	
2	Analog voltage signal, AD mode power control signal	0~10V

### 5.2.2 RS 232 Connecting Wire



Figure 5.3 the wire for the RS232 connecting

Table5.3 definition of the RS232 wire

PIN	DESCRIPTION	REMARK
2	RX	Receive
3	TX	Send
5	GND	GND

### 5.2.3 CTRL\_INTERFACE Connecting Wire



Figure 5.4 the wire for the control connecting

Table5.4 definition of the control wire

PIN	DESCRIPTION	REMARK
1	RS485-A。	485 for the parameter setting
2	RS485-B	
3	REM_START-	24V High Level Effective, Used for remote power on ( same function as the button in the surface )
4	REM_START+	
5	LASER_EN+	24V High Level Effective, Laser Enable for AD Mode
6	LASER_EN-	
7	KEY_LOCK+	External Safety Lock-in Signal. KEY_LOCK fault will be reported after disconnection. (This function is enabled by background software settings)
8	KEY_LOCK-	
9	EX_ALARM_OUT+	fault signal output normal open+
10	EX_ALARM_OUT-	fault signal output normal open -
11	Not Use	Not Use
12	MOD_SW-	External modulation signal input, 24V High Level Effective.
13	MOD_SW+	
14	Not Use	Not Use
15	Not Use	Not Use
16	Not Use	Not Use

### 5.2.4 485 connecting wire



Figure 5.5 the wire for the 485 connecting

Table5.3 definition of the 485 wire

PIN	DESCRIPTION	REMARK
1	R/T+	Connect to 485A of CTRL_INTERFACE
2	R/T-	Connect to 485B of CTRL_INTERFACE

## 5.3 Laser Control

The power supply of the fiber laser is powered by local and remote methods. The local mode is controlled by the front panel START button, and the remote mode is controlled by the REM\_START signal line in the rear panel CTRL\_INTERFACE.

The laser power setting and the light-emission enable control: the laser power setting is controlled by the 0~10V analog signal on the rear panel, the light-emission enable control is controlled by the LASER\_EN signal line of CTRL\_INTERFACE in the rear panel. In addition, the output is controlled by the MOD\_SW signal of CTRL\_INTERFACE in the rear panel

### 5.3.1 Local AD Mode

#### Settings and Connections

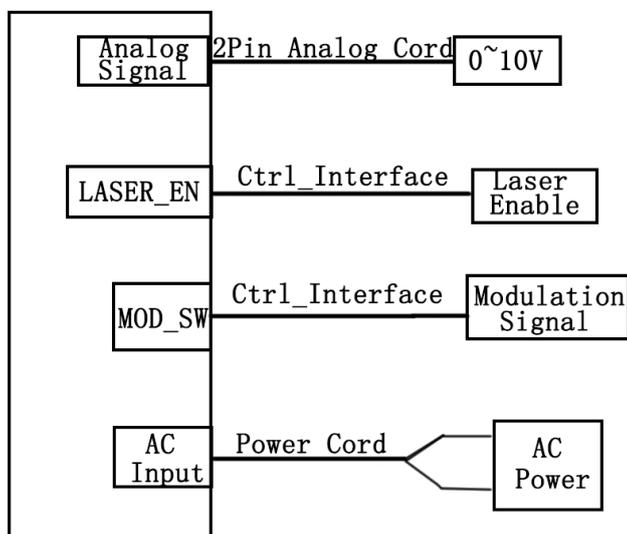


Figure 5.6 the connection for local AD model

- (1) Set the AD mode with the control software.
- (2) The 24V Laser enable signal is connected to pins 5 and 6 of the rear panel 16PIN CTRL\_INTERFACE.
- (3) The 24V modulated signal is connected to pins 12 and 13 in the rear panel 16 PIN CTRL\_INTERFACE.
- (4) 0~10 analog signal to the rear panel 2 PIN analog interface.

#### Sequence of operations

- (1) Turn the front panel key switch to the ON side.
- (2) Turn on the power switch at Rear panel of device. Wait for 30S to initialize the device (It can also be closed and opened, controlled by an external switch)

(3) Press the POWER button on the front panel, the laser power module is powered up and the red light indicator is turned on.

(4) Set the laser power through the 0~10 analog signal.

(5) Turn on the 24V laser enable signal (the light output power can also be changed after the light is enabled).

(6) Fast switching optical modulation output by modulation signal.  
 (The red light indicator automatically turns off when laser is emitted, and turns on when laser is off)

### 5.3.2 Remote AD Model

#### Settings and Connections

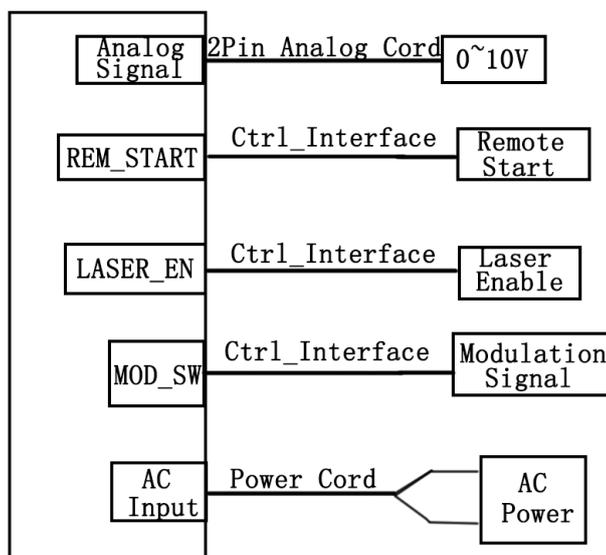


Figure 5.6 the connecting for remote AD model

(1) Set the AD mode with the control software.

(2) The 24V laser enable signal is connected to pins 5 and 6 of the rear panel 16 PIN CTRL\_INTERFACE.

(3) The 24V modulated signal is connected to pins 12 and 13 in the rear panel 16 PIN CTRL\_INTERFACE.

(4) 0~10 analog signal to the rear panel 2 PIN analog interface.

(5) The 24V remote start signal is connected to pins 3 and 4 in the rear panel 16 PIN CTRL\_INTERFACE.

### **Sequence of operations**

(1) Turn the front panel key switch to the REM side.

(2) Turn on the power switch at Rear panel of device. Wait for 30S to initialize the device (It can also be closed and opened, controlled by an external switch)

(3) Turn on the 24V remote start signal, power on the laser power module, and the red light indicator turns on.

(4) Set the optical power through the 0~10 analog signal.

(5) Turn on the 24V laser enable signal. (After 5 seconds, the remote start signal can be set to enable the laser output power to be changed after the laser is enabled.)

(6) Fast switching optical modulation output by modulation signal. (The red light indicator automatically turns off when laser is emitted, and turns on when laser is off)

## **Chapter 6 Use of monitoring software**

### **6.1 Connect**

Connect 485 connecting wire to 1&2 pin of Rear panel's 16 pin CTRL\_INTERFACE. 1 pin connects to T/R+ of 485 connecting wire, 2 pin connects to T/R- of 485connecting wire. Then connect the other side of 485 connecting wire to a computer which is installed the software.

Open the software. Click to Setting page (as the figure 6.2), Select the corresponding serial Num, Click “open port” button. After choosing the right one, Click “set default ”button, The next time the software starts, it will automatically open the serial port.

### **6.2 Monitor Page**

Click “Monitor ” to cut over the interface to “Monitor Page”, just as the following figure 6.1:

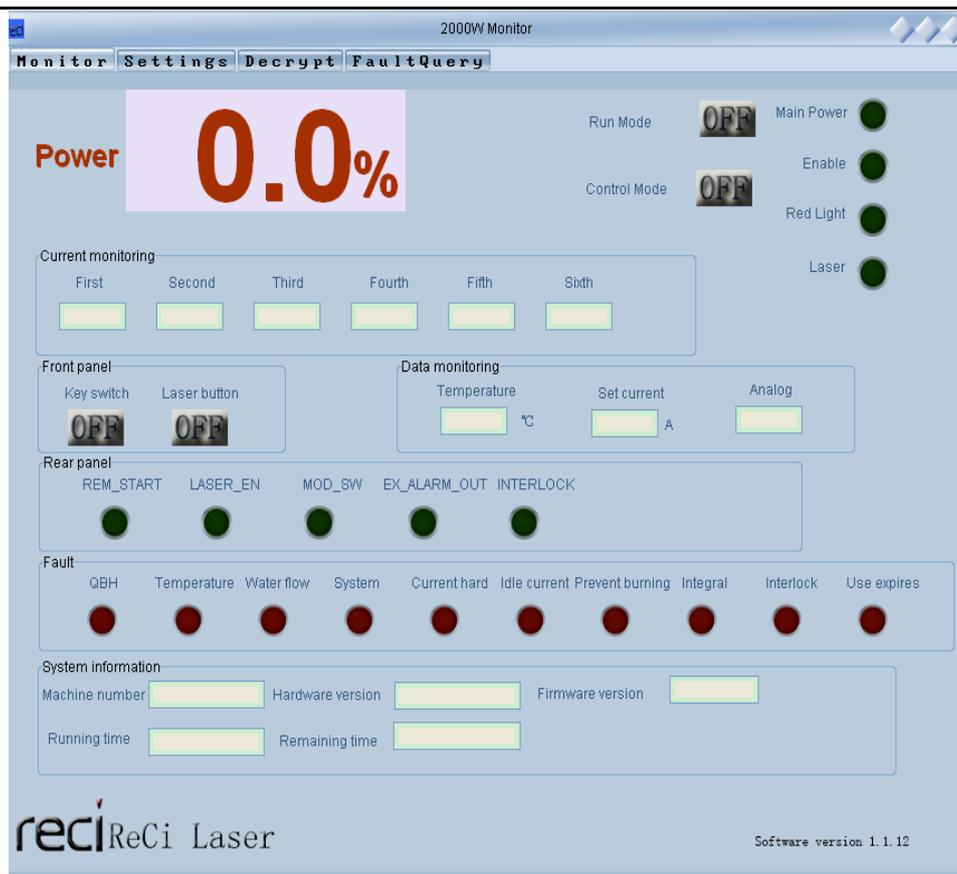


Figure 6.1 Monitor Page

Table 6.1 The function of the buttons on Monitor Page

MODULE	DESCRIPTION	FUNCTION
Operation instructions	Run mode	1) AD mode is the normal run mode; 2) 232 mode only use in Production debugging
	Control mode	1) REM represents remote mode 2) ON represents local mode
	Main power	Green lamp on means the main power turn on
	Enable	Green lamp on means the laser is enabled
	Red light	Green lamp on means the red light turn on
	Laser	Green lamp on means laser is being emitted
Current monitoring	“First” to “Sixth”	Display 6-channel sampled data values
Front panel	Key switch	Position of key switch

<b>MODULE</b>	<b>DESCRIPTION</b>	<b>FUNCTION</b>
	Laser button	Position of laser button
Data monitoring	Temperature	Temperature of Pump Source
	Set current	Current value set to device
	Analog	Sampling value of power supply added to back-end analog data line
Rear panel	As the figure 6.1	Green lamp on means the corresponding signal is valid
Fault	As the figure 6.1	Red lamp on means the corresponding fault is valid
System information	Machine number	The number of the laser device
	Hardware version	Hardware version of the device
	Firmware version	Firmware version of the device
	Running time	Display the device has been running, The unit is minutes
	Remaining time	Display the remaining time of the device can be used

### 6.3 Setting Page

The Page is just as the figure 6.2. The function of the different button is as the following table6.2.

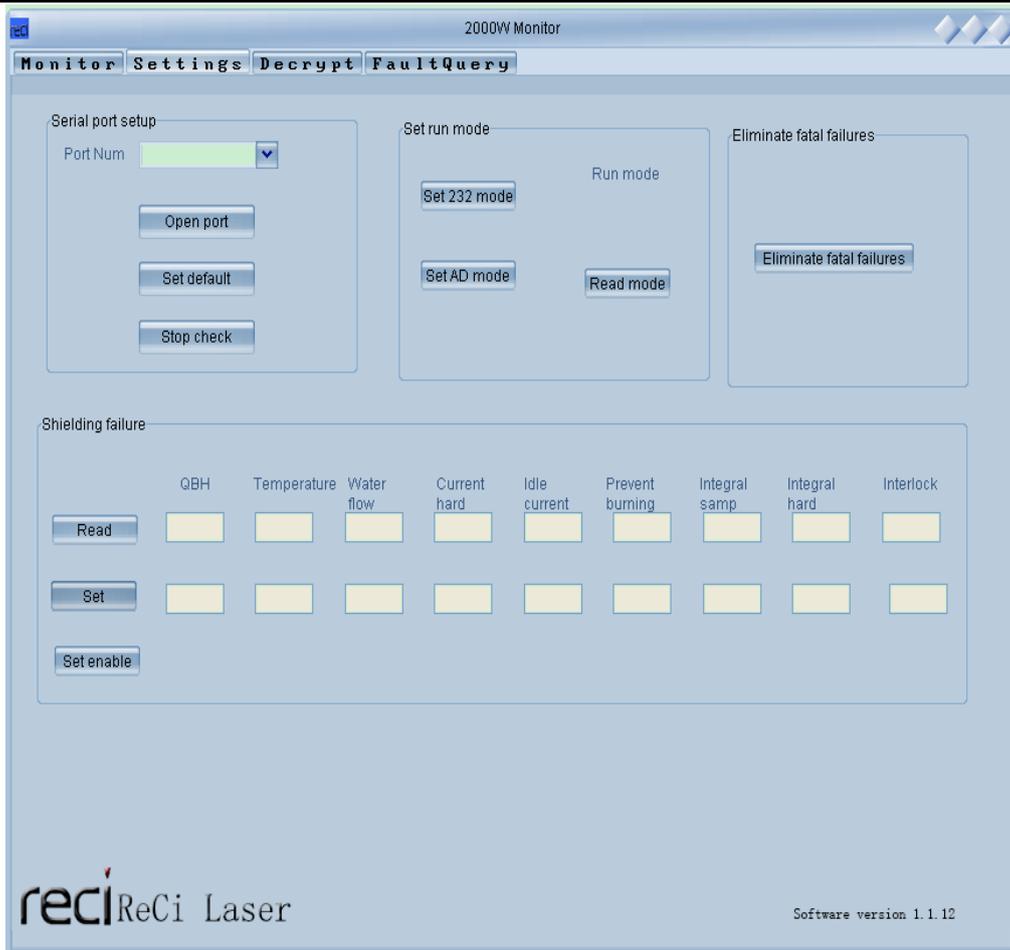


Figure 6.2 Setting Page

Table6.2 The function of the buttons on Setting Page

MODULE	DESCRIPTION	FUNTION
Serial port setup	Port Num	Drop-down box to select the corresponding serial port
	Open port button	Open the corresponding serial port
	Set default	Set the corresponding serial port to the default serial port. The next software restart will automatically open the serial port
Set run mode	Set 232 mode button	Set the device to 232 mode operation, needs to be restarted to be effective.
	Set AD mode button	Set the device to 232 mode operation, needs to be restarted to be effective
	Read mode button	Read operation mode of the device is now set up

MODULE	DESCRIPTION	FUNTION
Eliminate fatal failures	Eliminate fatal	Eliminate fatal failures of the current device
Shielding failure	Read button	Read the current fault shielding of the device
	Set button	It is necessary to put the fault shielding file provided by the manufacturer under the installation folder of the software, and then click the set enable button to enable it

## 6.4 Decrypt Page

There are two kinds of settings: “Proxy settings” and “user settings”. Among them, the agent is the password set by the manufacturer to the distributor to limit the use time. User is the password set by the distributor to limit the use time of the end user.

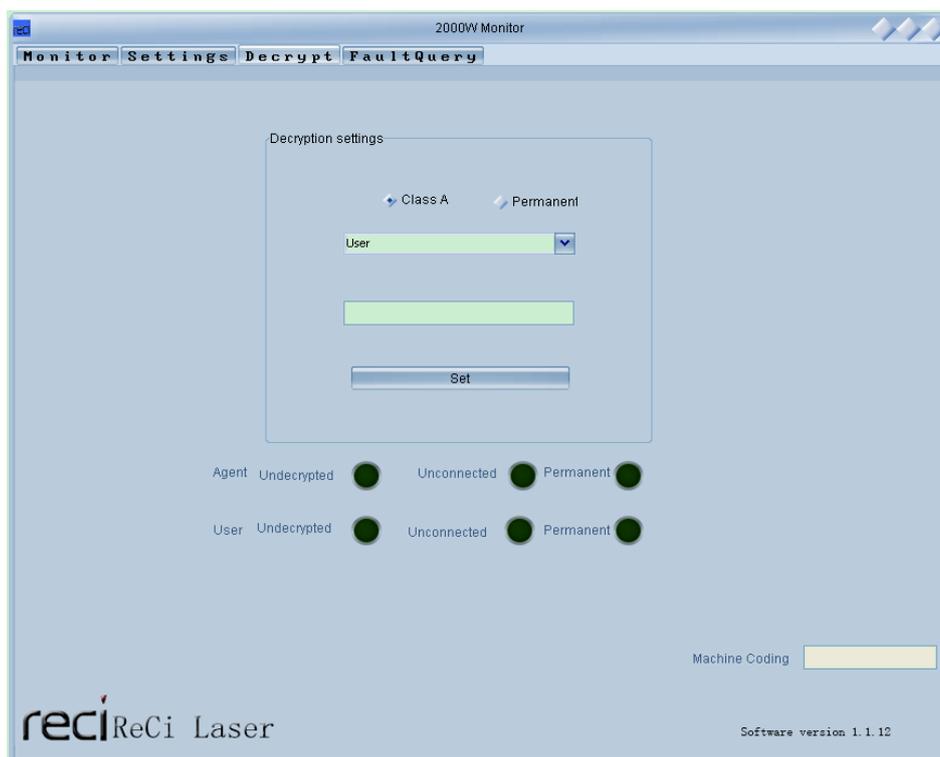


Figure 6.3 Decrypt Page

Level A decryption is a set time for each password input. Permanent decryption denotes unlimited lifetime. The following indicator lights and

text display the decryption status of the device after the connection between the software and the device.

## 6.5 Fault Query Page

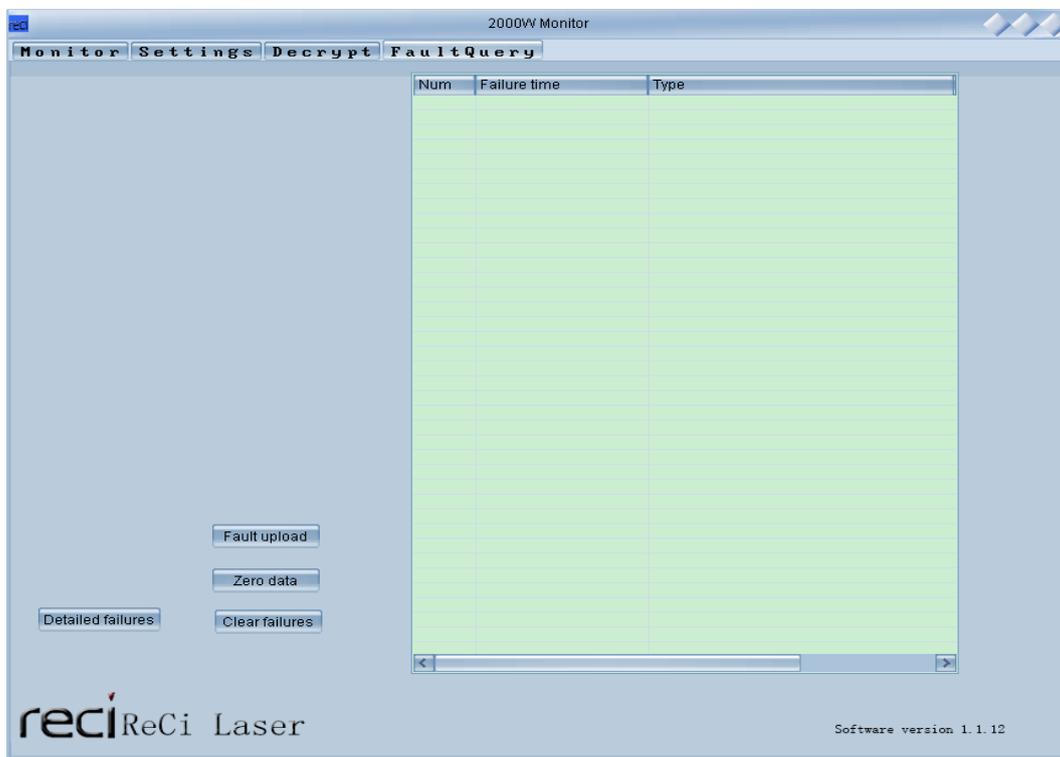


Figure 6.4 Fault Query Page

Table 6.3 The Function of the Button on the Page

DESCRIPTION	FUNCTION
Fault upload button	Upload the Storage failure in device.
Zero data button	Clear the displayed fault data.
Clear failures button	Clear fault data saved in device
Detailed failures button	Data required for the production of after-sales service personnel

## Chapter 7 Common faults treatment

The failure instructions and possible solutions are as follows :

Table7.1 the failure instructions and possible solutions

MESSAGE	DESCRIPTION
Pump temperature fault	<p>Fault description</p> <p>The temperature at the pump Laser source exceeds the temperature limit.</p> <p>Solution</p> <p>Check whether the water cooler is working properly and whether the water temperature is set correctly. When the water cooler works normally and the water temperature drops to the set temperature, restart the laser source. If there is any trouble, please contact our after-sales service staff.</p>
QBH fault	<p>Fault description</p> <p>The contact between the laser QBH and the cutting head is not good.</p> <p>Solution</p> <p>Re-install the cutting head, restart the laser to see if the fault is still happening, if it happens, pull out QBH in the external short contact electrode, restart the laser source to see if the fault is still happening, if there is still a fault, and please contact our after-sales service personnel.</p>
KEY_LOCK fault	<p>Fault description</p> <p>The seventh and eighth pins of the CTRL_INTERFACE interface are not short circuited.</p> <p>Solution</p> <p>Shorting connect the seventh pin and eighth pin of the</p>

MESSAGE	DESCRIPTION
	CTRL_INTERFACE interface or shielding the fault with the software.
High reflective hardware overrun	<p>Fault description</p> <p>The material cut by the laser has a strong high back light.</p> <p>Solution</p> <p>Contact our after-sales service personnel to see if you can continue to use lasers.</p>
Current hardware limit	<p>Fault description</p> <p>The laser module supply current exceeds the hardware threshold.</p> <p>Solution</p> <p>Check if the 220V power supply of the laser is stable. If it is stable, reduce the peak output power of the laser. If it still occurs, please contact our after-sales service personnel.</p>
Water flow fault	<p>Fault description</p> <p>The laser water flow is below the set value.</p> <p>Solution</p> <p>Check that the water flow meter is installed correctly, that the chiller is working properly and that the water flow meets the requirements.</p>
Analog overrun	<p>Fault description</p> <p>The external input analog quantity exceeds 10V.</p> <p>Solution</p> <p>Check if the analog quantity exceeds 10V and the polarity is correct. After normal, restart the laser. If it still occurs, please contact our after-sales service personnel.</p>
Idle current fault	<p>Fault description</p> <p>The current value when the laser is turned off exceeds the</p>

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<b>MESSAGE</b>	<b>DESCRIPTION</b>
	<p>upper limit.</p> <p><b>Solution</b></p> <p>Restart the laser. If it happens frequently, please contact our after-sales service personnel.</p>
Anti-burn fault	<p><b>Fault description</b></p> <p>Laser internal optical path detection failure</p> <p><b>Solution</b></p> <p>Contact our after-sales service personnel to see if you can continue to use lasers.</p>