

# **EXPERT II 355 系列激光器**

安装和操作手册

-- 用于水冷激光器

## **EXPERT II 355 SERIES LASER**

**INSTALLATION AND OPERATION MANUAL**

——For Water-cooled Laser

(Rev. 20170217A)

深圳 RFH 激光技术有限公司

(Rev. 20170217A )

Shenzhen RFH Laser Technology Co., Ltd.

## 前言 PREFACE

### 感谢使用 EXPERT II 355 系列激光器

基于我们的高质量、高可靠性和性价比高的激光器，  
在我们完美的售后服务和及时及时的技术上。  
支持，我们能够帮助您建立自己的激光系统。

### Thanks for using EXPERT II 355 Series Lasers

Based on our high quality, high reliability and great price-quality ratio lasers,  
on top of our immaculate after sales service and prompt on time technical  
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- Website: <http://www.rfhlasertech.com>

### 本手册的用法

本手册旨在帮助用户了解的基本结构  
EXCELLENT355 激光和正确使用激光，包括如何设置  
功率控制系统，如何完成一些基本的操作程序  
激光系统等。

### Usage of this manual

This manual is to help users understand the basic structure of  
EXCELLENT355 Lasers and to properly use the laser, including how to setup the

power control system, how to accomplish some basic operation procedures of the laser system, etc.

## 本手册的目标读者

本手册适用于具备基本知识的工程师  
激光领域的相关硬件和软件。

## Target readers of this manual

This manual is suitable for engineers who have basic knowledge of the related hardware and software in laser field.

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## 第一章摘要 Chapter 1 Summary

### 1.1 概述

该手册包含 EXPERT II 355 Laser 的一般用户信息和它的电源 (驱动器)。它指导用户如何将激光头连接到其电源, 还提供相关激光参数的描述和激光安全问题的注意事项。

专家 II 355 系列激光器的所有特点和规格是如有变更, 恕不另行通知。

### 1.2 个符号

以下符号在整个手册中使用。请注意并阅读小心地使用它们的所有地方。



此符号旨在提醒操作员注意可能在一定条件下操作不当的危险。



此符号旨在提醒操作员可能激光可能造成的伤害。

### 1.3 拆包和零件识别



小心! 小心打开激光包装。激光包含极其脆弱的光学元件。



小心! 避免对激光脐带进行急剧弯曲。电缆防止损坏光纤电缆。



小心! 避免使用窄/弱包装带/皮带而传输激光。

## Chapter 1 Summary

### 1.1 Overview

The manual contains general user information for the EXPERT II 355 Laser and its Power Supply (Driver). It directs the users how to connect laser head to its power supply, and also provides descriptions of the related laser parameters and precautions on laser safety issues.

All of the features and specifications of the EXPERT II 355 Series Lasers are subject to change without notice.

### 1.2 Symbols

Symbols below are used throughout the manual. Please note and read carefully all of the places that they are used.



This symbol is intended to alert the operator to the possible danger of improper operation under certain condition.



This symbol is intended to alert the operator the possible injuries that can be caused by the laser.

### 1.3 Unpacking and Parts Identification



Caution! Open the laser package carefully. The laser contains extremely fragile optical components.



Avoid making sharp bends to the laser umbilical cable to prevent damaging the fiber optic cable.



Caution! Avoid using narrow/weak packing strip/belt while transporting the laser.



### EXPERT II 355 激光器配件：

- 激光头。
- 电源 (驱动器)。
- 冷却器。
- 连接电缆。
- 冷水机软管。
- 交流连接电缆 220V 10A。
- 软件包。
- 工厂测试报告。

请保留原包装材料。当激光系统需要  
要运回工厂，使用原包装材料避免  
运输过程中损坏。




**注意：**下面的标签位于激光头的上表面，  
表示激光器的一些基本参数，如型号、序列号、  
最大功率等。

### Accessories of EXPERT II 355 Laser:

- Laser head.
- Power Supply (Driver).
- Chiller.
- Connection cable.
- Chiller hose.
- AC connection cable 220V 10A.
- Software package.
- Factory test report.

Please retain the original packaging materials. When the laser system needs  
to be shipped back to the factory, use the original packaging materials to avoid  
damage during shipping.

**Note:** The label below is located on the upper surface of the laser head,  
indicating some basic parameters of the laser, as Model Number, Serial Number,  
Max Power, etc.

MODEL: <input type="text"/>	
S/N: <input type="text"/>	LD TEC OUTPUT: <input type="text"/>
AC INPUT: <input type="text"/>	LD OUTPUT: <input type="text"/>
LBO TEC OUTPUT: <input type="text"/>	RF OUTPUT: <input type="text"/>
SIZE: <input type="text"/>	
 Shenzhen RFH Laser Technology Co., Ltd.	
	
	

## 1.4 激光安全



警告! 请阅读本手册小心  
在安装和使用激光器之前。



此激光器的最大输出为 5Watt  
355nm (一个例子)。这个标签是显示  
在激光头的上侧, 近该  
激光输出孔径。

### 1.4.1 激光安全考虑

专家 II 355 激光具有四级水平的发射。极端护理应该在操作期间使用。输出光束可能存在火灾和安全隐患。仅熟悉本手册中列出的安全预防措施的人员应该尝试操作这个激光系统。



危险! 与输出光束的直接眼睛接触该  
激光会造成严重的损害和可能的失明。

使用激光时最大的危险是眼睛受伤。除了主要的光束, 通常有许多较小的光束存在于各种角度附近激光系统。这些光束是由主光束的镜面反射形成的。在抛光的表面, 如透镜, 镜子和其他光学器件。虽然这些光束比主光束弱, 它们可能仍然足够强造成眼睛损伤。

激光束强大到足以灼伤皮肤、衣服和许多其他对象。即使在一定的距离, 激光束仍然可以点燃挥发性物质如各种溶剂。激光束也会损坏感光。摄像机和光电二极管中的元素。建议用户遵循下面和本手册中的注意事项。

EXPERT II 355 激光有一根 3 米长的电源线连接激光激光头的控制器 (电源/驱动器)。由于所有控制操作都是在激光控制器, 操作人员可以有 3 米米之遥操作驱动程序时使用激光头。

## 1.4 Laser Safety



Warning! Please read this manual carefully before installation and use of the laser.



This laser has a maximum output of 5W at 355nm (an example). This label is displayed on the upper side of the laser head, near the laser output aperture.

### 1.4.1 Laser Safety consideration

EXPERT II 355 Laser has Emission at a level of Class IV. Extreme care should be used during operation. The output beam could be a fire and safety hazard. Only personnel who are familiar with the safety precautions listed in this manual should attempt to operate this laser system.



**DANGER!** Direct eye contact with the output beam from the laser will cause serious damage and possible blindness.

The greatest danger when using a laser is eye injury. In addition to the main beam, there are often many smaller beams present at various angles near the laser system. These beams are formed by specular reflections of the main beam at polished surfaces such as lens, mirrors and other optics. Though these beams are weaker than the main beam, they may still be sufficiently intense enough to cause eye damage.

Laser beams are powerful enough to burn skin, clothing, and many other objects. Even at some distance, the laser beam can still ignite volatile substances such as various kinds of solvents. The laser beam can also damage light sensitive elements in video cameras and photo-diodes. The user is advised to follow the precautions below and in this manual.

EXPERT II 355 laser has a 3meter long power cable to connect the laser controller (power supply/driver) to the laser head. Since all control operations are performed on the laser controller, the operator can be 3 meters away from the laser head while operating the driver.

## 1.4.2 激光安全注意事项

为确保操作安全，请采取以下步骤：

- 1.在激光束区域张贴激光警告标志，以提醒那些礼物。在激光工作区周围张贴 **IV** 级警告标志。
- 2.确保激光束不在眼睛水平，以避免看到输出梁。调试时将激光置于低中心高度，以防意外眼睛受伤。
- 3.不要直视激光光源或看散射激光来自任何反射表面的光。
- 4.使用激光束加工材料时，在激光工作区域可能变形和重定向光束路径，极端小心应该使用。
- 5.使用激光时避免佩戴首饰。
- 6.使用时使用合适波长范围的防护眼镜  
激光在任何时候。操作人员应穿着防辐射服。
- 7.请勿移除激光束块。保持激光盖在适当的位置时间。
- 8.避免无经验人员进入激光工作区。
- 9.在激光器内部和周围设置互锁电路。例如，设置一个实验室门上的联锁中断，因此门的打开将激活联锁电路并关闭激光，以避免意外伤害到没有经验的人。  
进入实验室的人员。
- 10.在封闭的房间或密闭区域操作激光是很好的做法以避免光束泄漏。使用红外检测卡检查和防止激光束从泄漏出来。

## **1.4.2 Laser Safety precautions**

To ensure safe operation, please take the following steps:

1. Post laser warning signs in the area of the laser beam to alert those present. Post Class IV Warning signs around laser working area.

2. Make sure the laser beam is not at eye level to avoid looking at the output beam. Place the laser at low center height when debugging, to prevent accidental eye injury.

3. Never look directly into the laser light source or look at scattered laser light from any reflective surface.

4. When the laser beam is used to process materials, certain surfaces in the laser working area may deform and redirect the beam path, extreme caution should be used.

5. Avoid wearing jewelry when using the laser.

6. Use protective eyewear of the right wavelength range when using the laser at all times. Operators should wear radiation protection suit.

7. Do not remove the laser beam block. Keep the laser cover in place at all times.

8. Avoid inexperienced personnel entering the laser working area.

9. Setup Interlock circuits in and around the laser. For example to setup an interlock break on the lab door, so door opening will activate the interlock circuit and shut down laser in order to avoid accidental injury to the inexperienced personnel who entered the lab.

10. It is good practice to operate the laser in a closed room or confined area to avoid beam leaking. Use an IR detector card to check and prevent laser beams from leaking out.

## 第 2 章硬件安装



**警告!** 交流电源的规格是 **5A/50Hz (60Hz)/220 伏**。电源必须正确连接到**地球**地面。

1. 将激光头正确连接到电源/驱动器和冷却器。  
(参见第 2.2 章连接图)
2. 将电源安装在两者都方便的位置，易于操作和无限制的气流。特别是**不要**阻挡激光的底部驱动程序，否则会导致控制 LD 温度的问题。
3. 确保有足够长的电缆/光缆到达激光头。避免电气/光纤脐带电缆急剧弯曲，以避免损坏光纤电缆。保持与实际一样大的折弯半径在安装过程中；**70 毫米**是允许的最小弯曲半径。
4. 正确连接交流电源线。
5. 该驾驶员输入交流电压应确认在  $\pm 10\%$  以上标称值。
6. 验证交流电源开关是否设置为“关”位置。
7. 外部控制计算机上的地面必须与地球隔离地面。

### 2.1 后面板

电源的后面板有多个用于电源线的连接器连接到激光头。详情请参见图 2.1 和表 2.1。

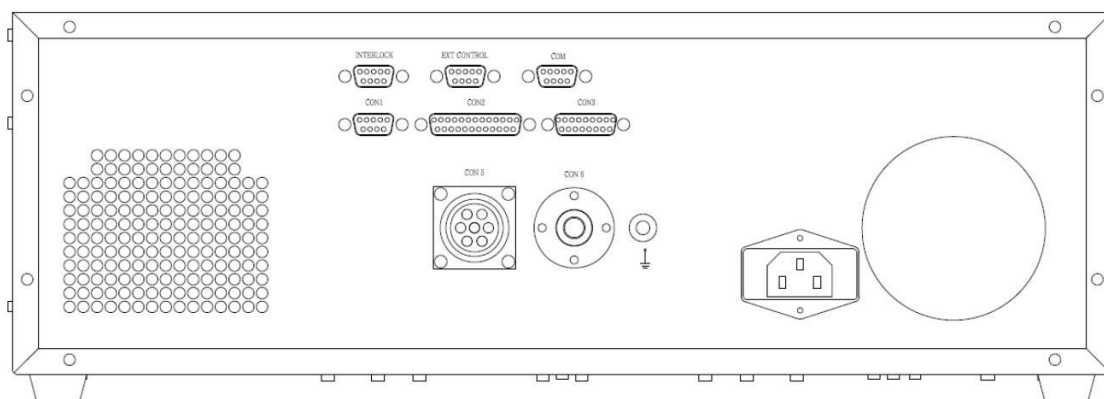


图 2.1 电源背板

## Chapter 2 Hardware Installation



Warning! The specification of the AC power is 5A/50Hz (60HZ)/220Volt. The power must be properly connected to Earth ground.

1. Connect the laser head to the power supply/driver and the chiller properly. (Refer to Chapter 2.2 Connection Diagram)
2. Install the power supply in a convenient location for both, ease of operation and unrestricted airflow. Especially DON'T block the bottom of the laser driver, or it will cause problems to control the LD temperature.
3. Make sure that there is sufficient length for the electrical/optical cable to reach the laser head. Avoid sharp bends to the electrical/optical umbilical cable to avoid damage to the fiber optic cable. Maintain as large a bend radius as practical during installation; 70mm is the minimum bend radius permitted.
4. Connect the AC power line properly.
5. The driver's incoming AC voltage should be confirmed within  $\pm 10\%$  above nominal value.
6. Verify the AC power switch is set to "OFF" position.
7. The ground on external control computer must be isolated from Earth ground.

### 2.1 Back Panel

The back panel of the Power Supply has multiple connectors for power cable to connect to the laser head. For details please refer to Fig 2.1 and Table 2.1.

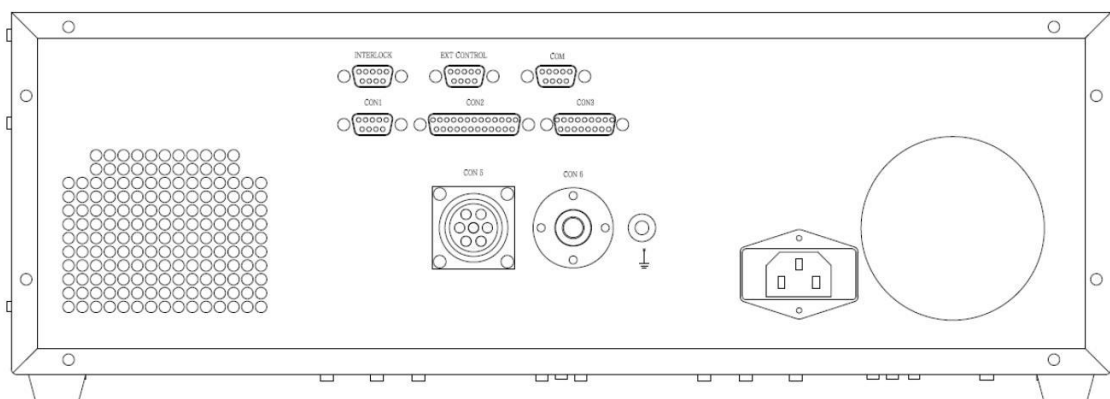


Fig.2.1 Back Panel of the Power Supply

数字名称函数		
1	联锁	
2	分机控制外部激光控制端口	
3	COM COM	
4	CON1 LBO 驱动接口	
5	CON2 检查接口	
6	CON3 运动控制接口	
7	CON4 LD/TEC 驱动接口	
8	风扇出口风扇	
9	射频输出接口	
1	0 接地端口接地	
1	1 电源开关风扇插座电源开关风扇	
1	2 AC50HZ/220V 交流电源接口	

表 2.1 接线端子说明

Number	Name	Function
1	INTERLOCK	INTERLOCK
2	EXT control	外部激光控制端口
3	COM	COM
4	CON1	LBO Driving Interface
5	CON2	Inspection Interface
6	CON3	Motion Control Interface
7	CON4	LD/TEC Driving Interface
8	Fan Outlet	Fan
9	RF Output Interface	RF
10	Ground Port	Grounding
11	Power Switch Fan Outlet	Power Switch Fan
12	AC50HZ/220V	AC Power Interface

TABLE 2.1 Terminal Block Description



## 2.2 连接图 2.2 Connection Diagram

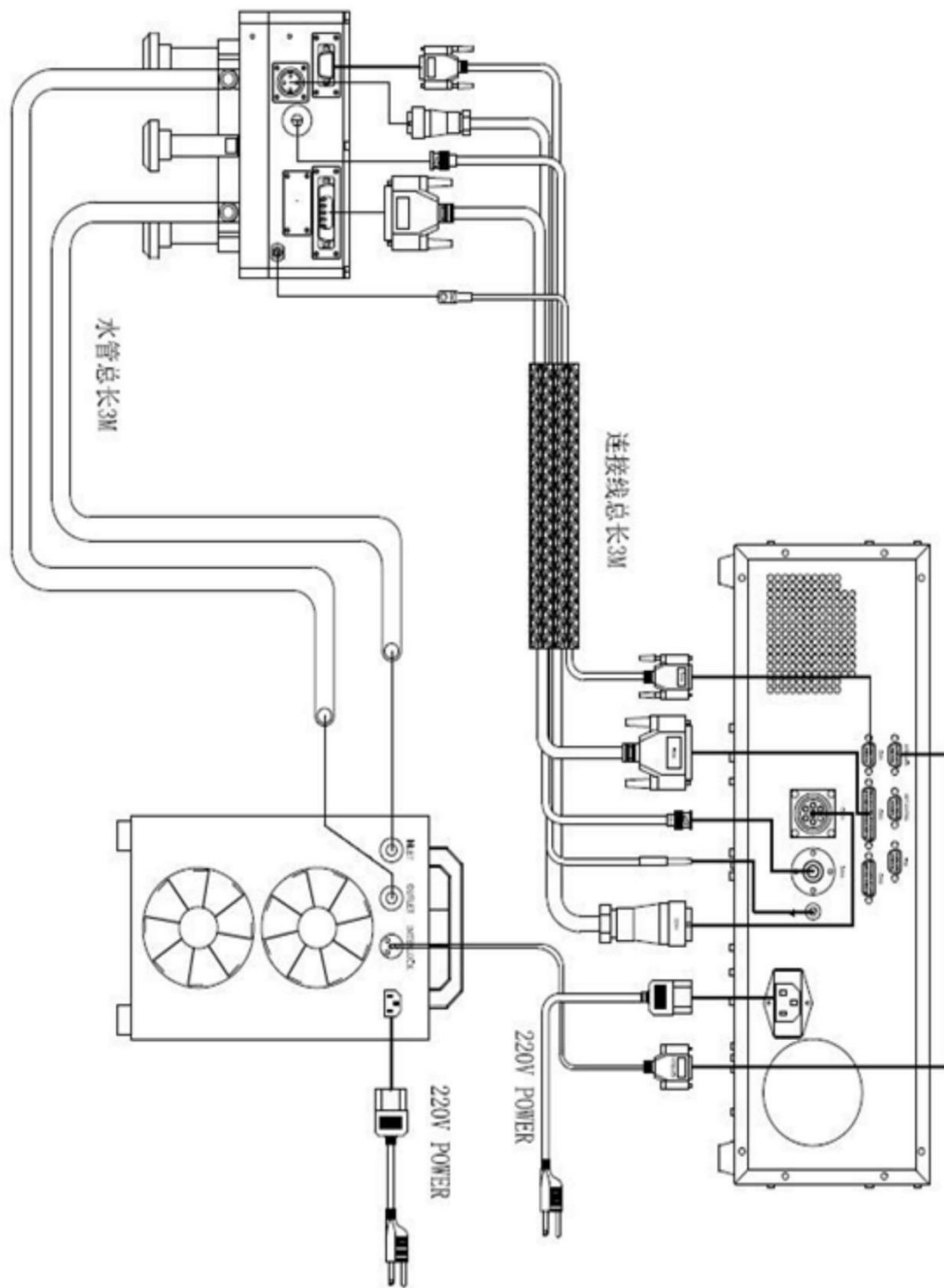


图 2.2 硬件连接示意图 Fig.2.2 Hardware Connection Diagram

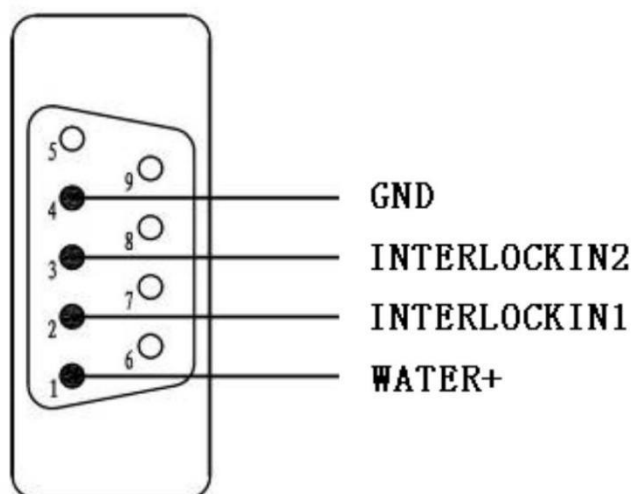


图 2.3 联锁 RS232 接口引脚配置

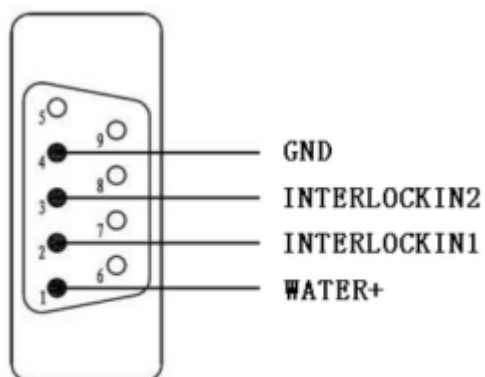


Fig.2.3 Interlock RS232 Interface Pins Configuration

## 第 3 章控制面板介绍

### 3.1 控制面板布局

操作面板包括 LCD 显示屏、按键开关、电源开关，调节旋钮，led 和功能按钮。按钮发出哔哔声时被压。

的布局驾驶员前面板如图 3.1 所示。每个的描述部分面板如表 3.1 所示。

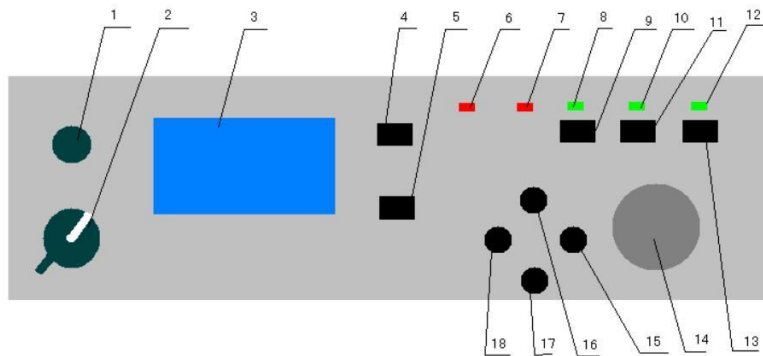


图 3.1 控制面板

数函数	
1	按键开关
2	电源开关
3	显示屏 (192X128, 字符类型) 4 主
页按钮	
5	主菜单显示按钮
6 故障状态	LED (红色)
7	LBO 状态 LED (红色)
8 LD 当前状态	LED(绿色)
9 LD 电流启用按钮	
10Q-SW 启用	LED(绿色)
11Q-SW 启用按钮	
1	2 快门状态
LED(绿色)	
13 快门启用	(在当前版本中不适用)
14 调节旋钮	15 输入按钮
1	6 上一个 (▲) 按钮 (光标移动 Up)
17	下一步 (▼) 按钮 (光标移动向下)
18	取消按钮

表 3.1 前面面板的组件

## Chapter 3 Control Panel Introduction

### 3.1 Control Panel Layout

The operation panel includes LCD display screen, key switch, power switch, adjusting knob, LEDs and functional buttons. The Button beeps when being pressed.

Layout of the Driver's front panel is shown in Fig.3.1. Descriptions of each part of the panel are shown in TABLE 3.1.

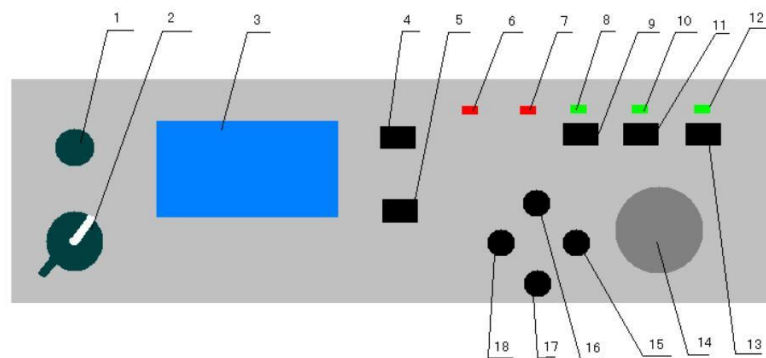


Fig.3.1 Control Panel

Fig.3.1 Control Panel

Number	Function
1	Key Switch
2	Power Switch
3	Display Screen ( 192X128, character type )
4	HOME Page Button
5	Main Menu Display Button
6	FAULT Status LED (red)
7	LBO Status LED (red)
8	LD Current Status LED (green)
9	LD Current Enable Button
10	Q-SW Enable LED (green)
11	Q-SW Enable Button
12	SHUTTER Status LED (green)
13	SHUTTER Enable ( Not applicable in Current Version )
14	Adjusting Knob
15	Enter Button
16	Previous (▲) Button (Cursor moving up)
17	Next (▼) Button (Cursor moving down)
18	Cancel Button

TABLE 3.1 Front Panel's Components

## 3.2 按钮操作说明

电源开关可以打开或关闭整个激光电源的交流电源供应。 钥匙开关可以锁定前面板上的所有按钮。 当按键开关在关闭位置，前面板上的所有按钮都被锁定，无法操作，调节旋钮也不能操作，但电源开关可以仍然被关闭。

**故障状态 LED----** 表示内部检测到保护模式该电源，如过流、过压、过温或冷却器发生保护条件。 然后，系统将关闭电流自动供应。 之前必须删除和重置保护模式该系统可以重新开始正常工作。

**LBO 状态 LED----** 显示了 LBO 控制的工作情况系统。 当 LBO 的温度不在 1 °C 时，LED 将被点亮。 该工作温度范围；当温度在该工作温度范围。

**LDD 按钮及其状态 LED----** 按 LDD 按钮和该相应的状态 LED 点亮，泵二极管驱动器提供电流到该泵浦二极管。 LD 电流在设定速度下达到设定值。 按下按钮再次和状态 LED 熄灭，LD 电流被切断。 然后电流意志减少以设定的速度，直到达到零。

**Q-SW 按钮及其状态 LED----** 转 Q 开关 R.F.驱动器 ON (激光操作脉冲/q 开关) 或关闭 (激光操作连续波或在保持模式-无激光)，状态 LED 灯亮或熄灭因此。

**关闭按钮及其状态 LED----** 系统工作时，压力机关闭按钮，快门 (在激光头的前侧，通过激光器出来) 打开，快门状态 LED 灯亮。 按关闭按钮再次，快门将关闭，状态指示灯熄灭。 此功能仅在所有产品中的某些 OEM 版本激光器中可用。

**上一个(▲) 按钮/下一步(▼) 按钮----** 移动不闪烁光标选择上一个或下一个可更改参数。 移动后该非闪烁光标到所需的项目位置，用户应按输入按钮以显示此项的子菜单或将光标更改为闪烁所需参数的下划线。 当下划线在闪烁时期望参数位置，需要使用调节旋钮来增加或分别减小该特定参数的值。

## 3.2 Button Operation Description

Power Switch can turn on or shut off AC power to the whole laser power supply. Key Switch can lock all buttons on the front panel. When Key Switch is at OFF position, all the buttons on the front panel are locked and cannot be operated, the Adjusting Knob cannot be operated also, but the Power Switch can still be turned off.

**FAULT Status LED**----Indicates that protection mode is detected inside the power supply, such as over-current, over-voltage, over temperature or chiller protection conditions occurred. The system will then shut down the current supply automatically. The protection mode must be removed and reset before the system can start working normally again.

**LBO Status LED**----It shows the working condition of LBO control system. The LED will be illuminated when the temperature of LBO is not within the working temperature range; the LED goes off when the temperature is within the working temperature range.

**LDD Button and Its Status LED**----Press LDD button and the corresponding status LED lit up, the pump diode driver provides current to the pump diode. LD current reaches the setting value at set speed. Press the button again and status LED black out, LD current is cut off. Then current will decrease at a set speed until it reaches zero.

**Q-SW Button and Its Status LED**----Turns the Q-Switch R.F. Driver ON (laser operates pulsed/Q-switched) or OFF (laser operates in continuous wave or in Hold Mode—no lasing), the status LED lights on or goes off accordingly.

**SHUT Button and Its Status LED**----When the system is working, press SHUT button, SHUTTER (in the front side of laser head through which laser comes out) opens and the SHUTTER Status LED lights on. Press SHUT button again, the SHUTTER will be closed and the status LED goes off. This Function is available only in some OEM version lasers among all the products.

**Previous (▲) Button / Next (▼) Button**----Moves the non-blinking cursor to select the Previous or Next changeable parameter. After moving the non-blinking cursor to the desired item location, the user should press Enter button to display the submenu of this item or to change the cursor into a blinking underline of the desired parameter. When the underline is blinking at the desired parameter location, the Adjusting Knob is required to be used to increase or decrease the value of that particular parameter respectively.

## 第 4 章应用指南

### 特别说明：

当激光运转时，不要关闭激光通过关闭交流电源。保持激光驱动器处于工作状态。若要打开或关闭激光输出，只需通过激光驱动器启用 LDD 或禁用 LDD。

### 4.1 激光器的初始启动

正确连接所有硬件后，操作员可能会打开激光器司机。下面列出了这些步骤：

1. 打开冷水机交流电源开关，水冷系统启动开机。
2. 打开激光驾驶员交流电源 (转动旋钮位于前面板的左下角到 ON 位置); 激光系统开始靴子。
3. 把按键开关转到开的位置，菜单和按钮的功能已启用。
4. 激光温度稳定约 10 分钟后，按下 LDD 按钮为泵浦二极管提供电流。
5. 检查以验证 LD 的上显示的电流和温度值该液晶屏在正常范围内 (参考出厂检验报告)。当该数字在正常范围内，按 LDD 按钮启用 LD 电流。如果不是，重置 LD 的温度和电流，然后启用 LDD 又来了。
6. 启用 LDD 后，当前将上升到集值。
7. 启用 Q-SW 开关。

当系统处于稳定状态时，操作员可以将按键开关到关闭位置以锁定前面板上的所有按钮司机。

长途运输后，操作员应等到激光器空腔开机前温度达到环境温度该激光。将交流电源开关转到 ON 位置，驾驶员开始工作。然后 LCD 显示屏将被初始化。之后，主页菜单显示在该液晶屏。

一旦电源接通，电流开始提供给 LBO 和 LD。

因为 LBO 预热到设定值需要时间，所以 LBO 状态 LED On 前面板将被照亮一段时间。需要 10 到 15 分钟有系统达到并保持在设定温度。

## Chapter 4 Application Guide

### Special Note:

When the laser is in operation, do not shut down the laser by turning off the AC power source. Keep the laser driver in working status. To turn on or to turn off the laser output, just enable LDD or disable LDD through the laser driver.

### 4.1 Initial Start Up of the Laser

After properly connected all the hardware, operator may turn on the laser driver. The steps are listed below:

1. Turn on the Chiller's AC power switch, and the water-cooling system starts to boot.
2. Turn on the laser driver's AC power source (turn the knob located in the left lower corner of the front panel to the ON position); the laser system starts to boot.
3. Turn the key-switch to the ON position, function of menus and buttons enabled.
4. After about 10 minute temperature stabilization of the laser, press the LDD button to provide current to the pump diode.
5. Check to verify the LD's current and temperature value displayed on the LCD screen are within normal range (refer to factory inspection report). When the numbers are within normal range, press LDD button to enable LD current. If not, reset the temperature and current of LD, and then enable LDD again.
6. After LDD is enabled, the current will ramp up to the set value.
7. Enable Q-SW switch.

When the system is in a stable condition, operator may turn the key-switch to the OFF position to lock all the buttons on the front panel of the driver.

After long-distance transportation, the operator should wait until the laser cavity's temperature reaches the ambient temperature before switching on the laser. Turn AC power switch to ON position and the driver begins to work. Then the LCD display will get initialized. After that, the HOME menu is displayed on the LCD screen.

Once the power is switched on, current start to be provided to LBO and LD. Because it takes time for LBO to warm up to the set value, the LBO status LED on the front panel will be illuminated for a while. It takes 10 to 15 minutes to have the system reached and stay at the set temperature.



一旦打开，故障状态 LED 将短暂点亮并关闭。这个意味着系统工作正常。如果故障 LED 在操作，它显示存在系统警报。必须检查问题并消除之前的激光可以设置回工作状态。

如果发生警报，尝试关闭系统 (等到 LD 电流达到 0 级)，几秒钟内重启激光。如果警报消失，系统可以再次正常工作。

## 4.2 激光关闭程序

1-按下 Q-SW 按钮关闭 Q-SW 开关。上方的绿色 LED 按下按钮将熄灭。

2-禁用 LDD (按 LDD 按钮) 关闭激光二极管驱动器并观察实际 LDD 电流反馈 (通过读取二极管中的第三行设置菜单)。

3-在 LD 电流下降到 0 电平后，关闭驱动器的交流电源。

4-关闭 C希勒的交流电源。

## 4.3 湿度报警

激光器中的光学元件对湿度非常敏感。因此，它是控制激光腔中的湿度水平非常重要。在正常情况下，激光腔内的湿度水平应保持在低于 20%。激光驱动器将触发警报 (可听“哔”应该听到) 当湿度超过上述水平时，警告用户更改激光头内部的干燥剂袋 (在上侧的圆形凹槽中)。当激光腔内的湿度超过 60%，激光驱动器将进入湿度保护模式，自动关闭 LD 电流。

## 4.5 外部控制

外部控制接口如图 4.5 所示。

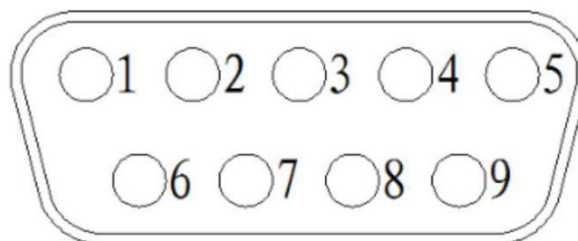


图 4.5 外部控制接口

Once turned on, the FAULT status LED will briefly light up and turns off. This means the system is working properly. If the FAULT LED lights up during operation, it shows there exists a system alarm. The problem must be check out and eliminated before the laser can be set back to the working status.

If an alarm occurs, try to shut down the system (wait until the LD current reaches 0 level), restart laser in a few seconds. If the alarm disappears, the system can work properly again.

## 4.2 Procedure for Laser Shutdown

1- Turn off Q-SW Switch by pressing Q-SW button. The green LED above the pressed button will black out.

2- Disable LDD (press the LDD button) to shutdown the laser diode driver and observe the actual LDD current feedback (by reading the third line in Diode Setting Menu).

3- After LD current drops down to 0 level, turn off AC power of the Driver.

4- Turn off Chiller's AC power.

## 4.3 Moisture Alarm

The optical components in the laser are very sensitive to humidity. Therefore, it's very important to control the humidity level in the laser cavity. In normal condition, the humidity level in the laser cavity should be kept under lower than 20%. The laser driver will trigger alarm alert (audible "BEEP" should be heard) when the humidity exceeds the above level, warning the user to change the desiccant bag inside the laser head (in a circular groove in the upper side). When the humidity inside the laser cavity exceeds 60%, the laser driver will enter humidity protection mode, shutting down LD current automatically.

## 4.5 External Control

External Control Interface is shown in Fig.4.5

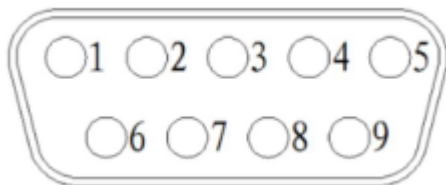


Fig.4.5 External Control Interface

Pin 号	定义备注	
PIN1	NC"NC"-不连接	
PIN2	NC	
PIN3	GATE 外部门 (有源高)	
PIN4	FPS 第一脉冲抑制信号 (输入, 有源高)	
PIN5	GND 接地 (连接到外部板)	
PIN6	脉冲调 Q 脉冲 (输入, R.F.关闭时间)	
PIN7	NC	PIN8 NC
PIN9	NC	
表 4.1 引脚的定义		

第五章马努行动

操作菜单包括以下部分:

- 主要信息显示 (主页)
- 主菜单
- 子菜单

5.1 主显示界面

按 HOME 键进入主信息显示页面。 这就是系统启动后的默认页面。

显示器如图 5.1 所示

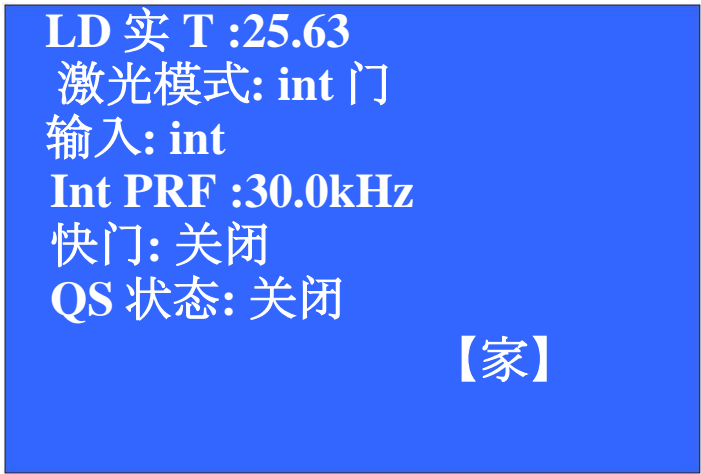


图 5.1 主页

**LD Real I----** 表示 LD 当前值。 一个是设定的电流; 另一个

Pin No.	Definition	Remark
PIN1	NC	"NC"-No Connection
PIN2	NC	
PIN3	GATE	External GATE ( active high)
PIN4	FPS	First Pulse Suppress
Signal(Input, active high)		
PIN5	GND	Ground (connect to external
board)		
PIN6	PULSE	Q-switched pulse (Input, R.F.
off-time)		
PIN7	NC	PIN8
		NC
		PIN9
		NC

ABLE 4.1 Definitions of Pins

## Chapter 5 Operation Manu

The operation menu involves following parts:

- Main Information Display (HOME Page)
- Main Menu
- Submenus

### 5.1 Main Display Interface

Press HOME button to enter the Main Information Display page. This is the default page after the system started.

The display is shown as Fig.5.1

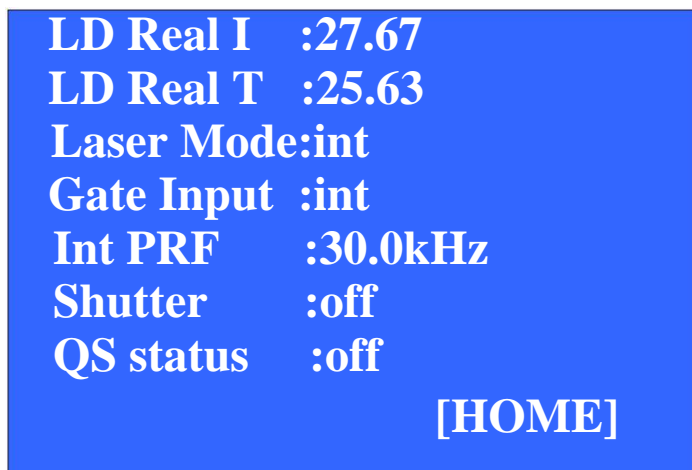


Fig.5.1 HOME Page

**LD Real I**----Indicates LD current value. One is the set current; the other

(右侧编号) 是实际电流。 实时显示实际电流。

**LD 真实 T---** 表示 LD 温度值。 第一个是套装温度， 另一个是实际温度。 显示实际温度实时。

**激光模式----** 用于选择外部触发脉冲或内部触发脉冲。 整定“Int”表示使用内部触发的脉冲。 整定“Ext”表示外部触发的脉冲。

**门输入----** 表示门信号的输入源。 “Int” 表示来自电源内部的门信号。 “Ext” 表示门信号是从外部板的软件。

**Int PRF----** 表示内部脉冲重复率。

**快门----** 表示快门的打开或关闭状态。

**QS 状态 ----**指示状态或 Q 开关， 打开或关闭。

## 5.2 主菜单

按菜单按钮进入菜单界面。 显示器显示为

图 5.2.

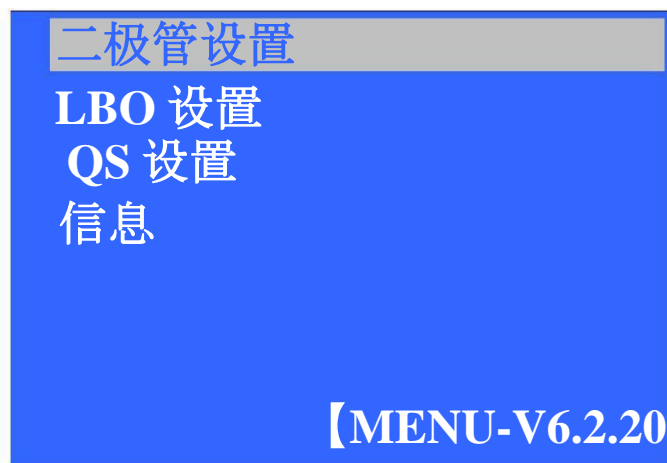


图 5.2 主菜单页

“二极管设置”-----设置 LD 参数。

“LBO 设置”-----设置 LBO 参数。

“QS 设置”-----设置 Q-switch 参数。

“信息”-----显示系统信息。

在菜单页中， 可以通过按向上和向下按钮来移动光标。  
当光标高亮显示某一行时， 按 ENTER 按钮显示

(right side number) is actual current. Actual current is displayed real time.

**LD Real T**---Indicates LD temperature value. The first one is the set temperature, the other is actual temperature. Actual temperature is displayed real time.

**Laser Mode**----Used to select externally-triggered pulse or internally triggered pulse. Setting "Int" indicates using internally triggered pulse. Setting "Ext" indicates externally-triggered pulse.

**Gate Input**----Indicates the input source of GATE signal. "Int" indicates the GATE signal from inside of the power supply. "Ext" indicates the GATE signal is from software of external boards.

**Int PRF**----Indicates the internal pulse repetition rate.

**Shutter**----Indicates the opened or closed state of the Shutter.

**QS Status**----Indicate status or Q-switch, opened or closed.

## 5.2 Main Menu

Enter Menu interface by pressing MENU button. The display is shown as Fig.5.2.

### Diode Setting

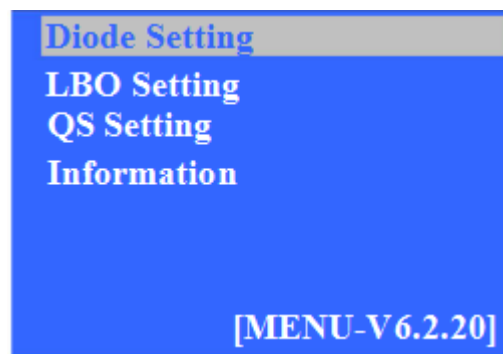


Fig.5.2 Main Menu Page

**"Diode Setting"** ---- Sets LD parameters.

**"LBO Setting"** ---- Sets LBO parameters.

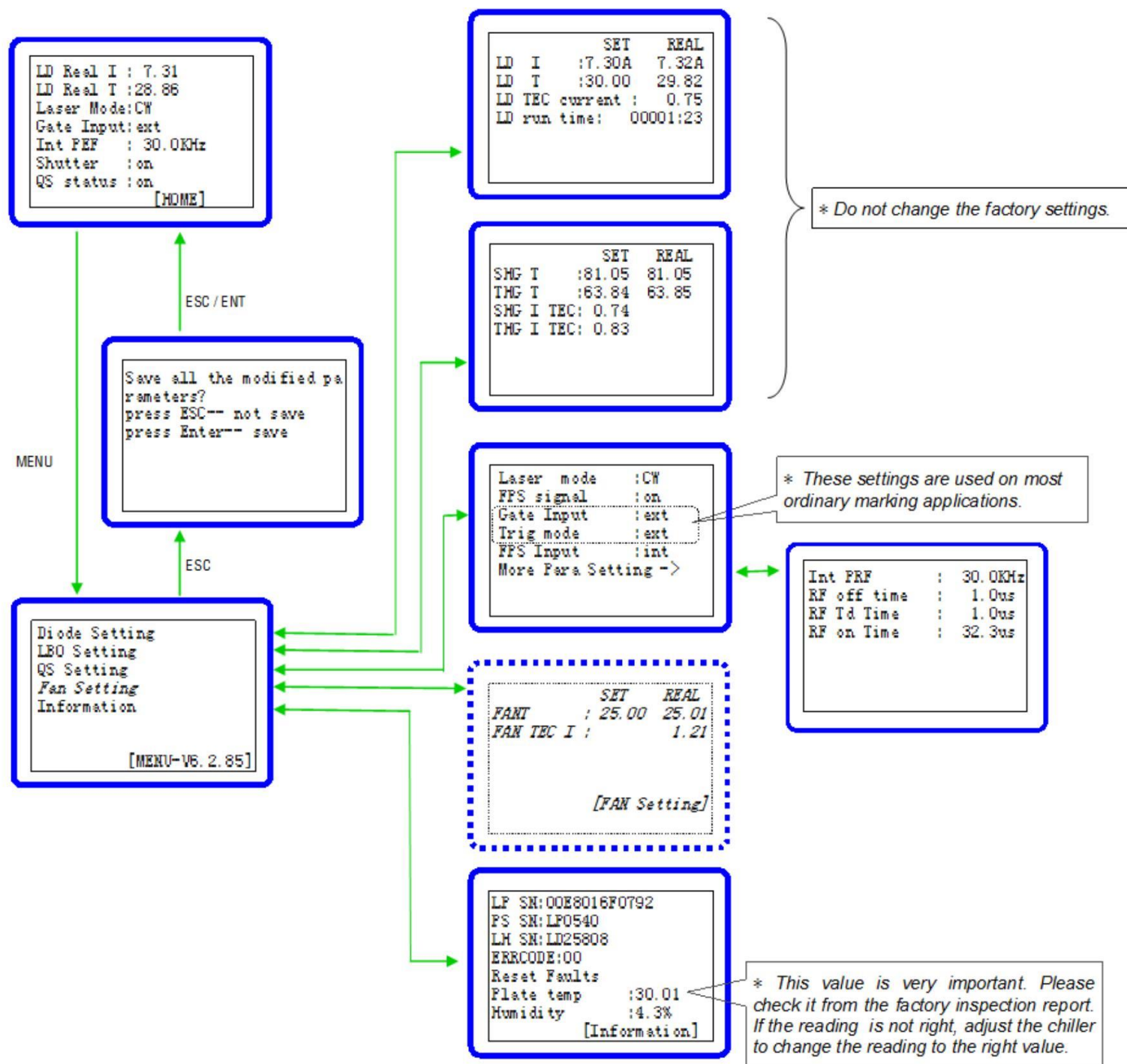
**"QS Setting"** ---- Sets Q-switch parameters.

**"Information"** ---- Displays system information.

In MENU page, the cursor can be moved by pressing Up and Down button. When the cursor is highlighting certain line, press ENTER button to display that

项目的从属菜单。

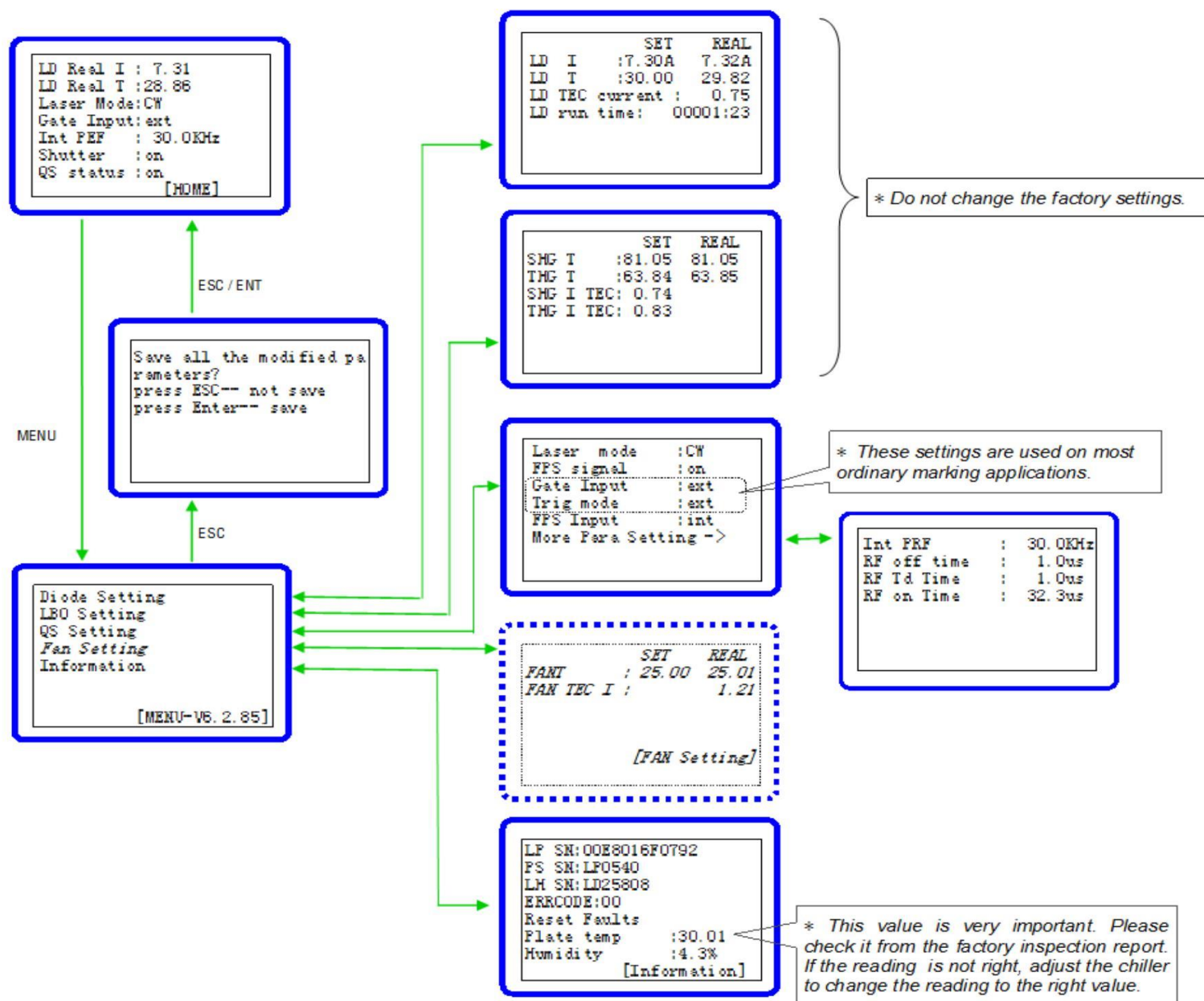
在主菜单页面中，要返回主页，请按 **ESC** 按钮或按主页按钮直接。



主菜单结构:item's subordinate menu.

In Main Menu page, to return to the HOME Page, press ESC button or press HOME button directly.

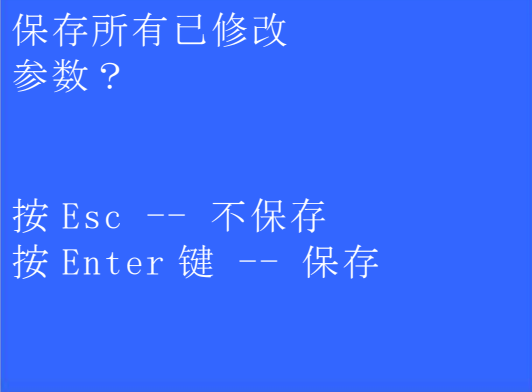
### Main Menu Structure:





## 5.3 保存更改

在主菜单页面中，按下 **ESC** 按钮后，将显示一个指示，如下所示：



保存所有已修改  
参数？  
  
按 Esc -- 不保存  
按 Enter 键 -- 保存

图 5.3 更改保存确认页

**按 ENTER 键：**确认更改；参数的更改将是存储到系统内部的 ROM 中。

**按 ESC 键：**确认不保存更改。参数将是暂时的。系统重启后，参数将是旧参数，不被改变。

**注意：**在主菜单页面或任何特定子菜单页面中，按主页按钮可以直接返回主页。但是此操作不会存储已将参数更改为 ROM。如果需要更改参数，操作员必须永久按下 **ESC** 按钮，直到图 5.3 中的页面出现，然后按 **Enter** 键确认更改。

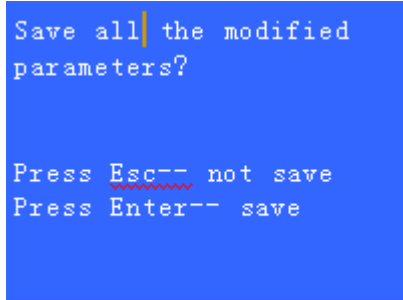
## 5.4 子菜单

可以通过主菜单输入子菜单。每个项目的值为显示。只有在子菜单中输入每个项目后才能设置参数。

### 5.4.1 二极管设置菜单

## 5.3 Saving Changes

In Main Menu page, after pressing ESC button, an indication will be displayed, as showed below:



```
Save all the modified  
parameters?  
  
Press Esc-- not save  
Press Enter-- save
```

Fig.5.3 Changes Saving Confirmation Page

**Press ENTER:** Confirm the change; changes of the parameters will be stored into the ROM inside the system.

**Press ESC:** Confirm not saving the changes. The parameters will be temporary. After the system reboot, the parameters will be the old ones without being changed.

**Note:** In Main Menu page or any certain submenu page, press HOME button can return to the HOME page directly. But this operation will not store the changed parameters into ROM. If the parameters need to be changed permanently, the operator must press ESC button until the page in Fig.5.3 appears, and press Enter to confirm the changes.

## 5.4 Submenu

Submenus can be entered through the Main Menu. Value of each item is displayed. Parameters can be set only after entering each item in the Submenus.

### 5.4.1 Diode Setting Menu

图 5.4 显示如何从进入页面或设置 LD 参数主菜单。

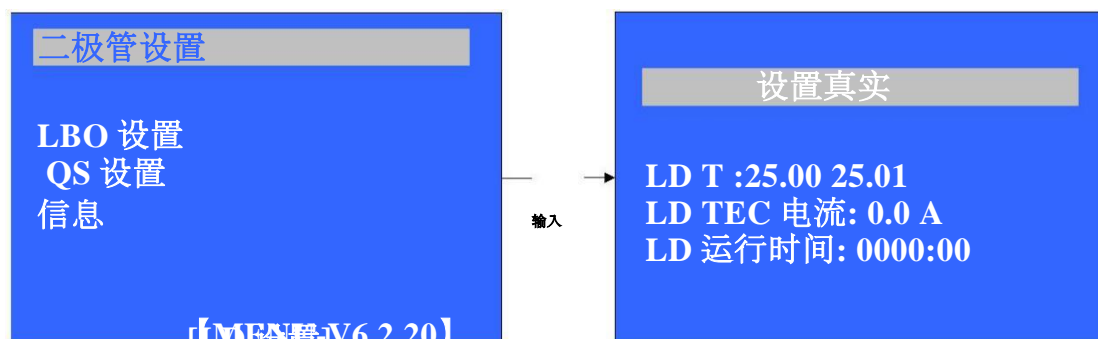


图 5.4 二极管参数设置页面

“LD I Set”---- 显示设置的 LD 当前值。

“LD T Set”---- 显示 LD 的设定温度。

“LD I REAL”---- 显示实际 LD 电流的值。

“LD T 真实”---- 显示 LD 的真实温度。

“LD TEC 电流”---- 显示 LD TEC 的实际工作电流。

“LD 运行时间”---- 显示 LD 累计工作时间。 中的单位前一部分是小时; 在后面的部分是分钟。

进入此页面后, 第一行将自动突出显示。 该只能在第一行和第二行之间进行选择。 仅可以修改这两个项目中的参数。 其他行中的参数都是实际反馈值。

Fig.5.4 Display how to enter the page or setting LD parameters from the Main Menu.

### Diode Setting

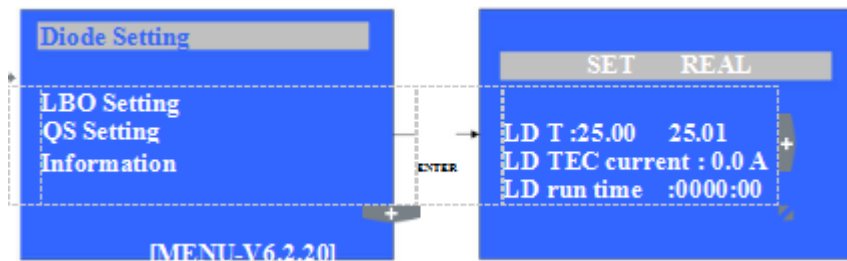


Fig.5.4 Diode

### Parameters Setting Page

**"LD I Set "** ---- Displays the set LD current value.

**"LD T Set "** ---- Displays the set temperature of LD.

**"LD I REAL"** ---- Displays the value of actual LD current.

**"LD T REAL"** ---- Displays the real temperature of LD.

**"LD TEC Current"** ---- Displays the actual working current of LD TEC.

**"LD Run Time"** ---- Displays LD accumulated working hours. The unit in former part is Hour; in the later part is Minute.

After entering this page, the first line will be highlighted automatically. The selection can be made only between the first line and second line. Only parameters in these two items can be modified. Parameters in other lines are all actual feedback values.

如果需要修改参数，请参考下面的流程：

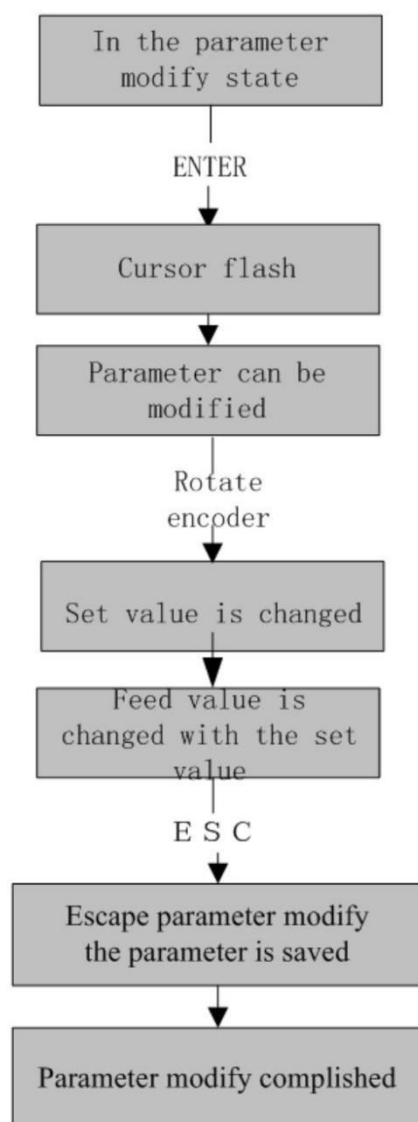
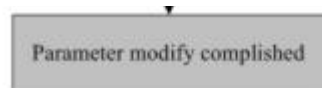


图 5.5 参数设置流程

当参数处于编辑模式时，向上和向下按钮不激活。退出编辑模式，向上和向下按钮将再次激活。当在编辑模式下，可以切换旋钮来更改参数，这将更新到控制系统。当按 **ESC** 按钮退出编辑模式，修改的参数将存储在系统内部的 **ROM** 中。

修改完第一行的参数后，上下移动按钮修改 **LD** 温度。只有这两行中的参数可以是修改后，显示的其他参数为实际参数和不能 **Be** 已修改。



neters, refer to the flow below:

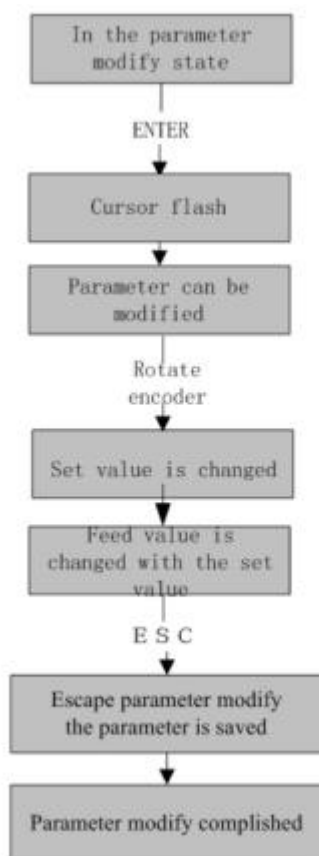


Fig.5.5 Parameter Setting Flow

When the parameters are in editing mode, Up and Down button are not activated. Exit editing mode, Up and Down button will be activated again. When in editing mode, the knob can be switched to change the parameters which will be updated to the control system. When ESC button is pressed to exit editing mode, the parameters modified will be stored in the ROM inside the system.

After the parameters in the first line have been modified, move Up and Down button to modify LD temperature. Only parameters in these two lines can be modified, other parameters displayed are actual parameters and can't be modified.

### 5.4.2 LBO 设置菜单

图 5.6 显示如何从主菜单页进入 LBO 设置页。

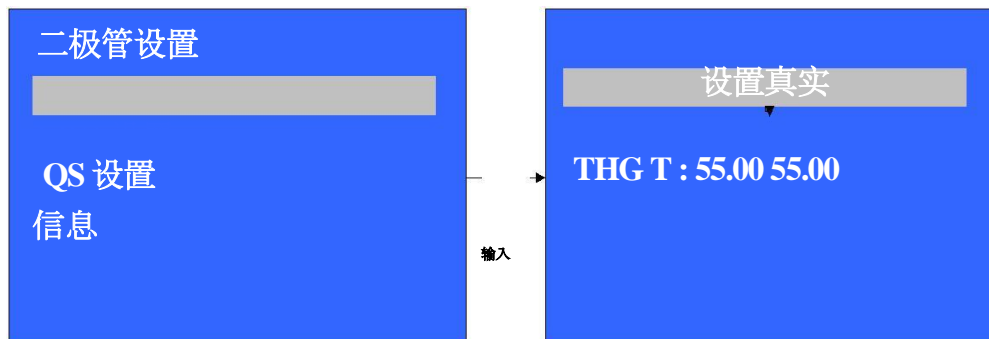


图 5.6 LBO 设置页面

“**SHG T设置**”---- 显示 SHG 的设定温度。

“**THG T设置**”---- 显示 THG 的设定温度。

“**SHG T REAL**”---- 显示 SHG 的实际温度。

“**THG T 真实**”---- 显示 THG 的实际温度。

SHG 和 THG 的设定温度可以修改。修改流程如图 5.4 所示。其他参数为实际值和不能被修改。

向上和向下移动按钮来移动光标并选择一个项目。压力以确认所选项目。光标开始闪烁。旋转旋钮进行修改值。修改一次有效。光标可以在两者之间移动第一行和第二行。按 **ESC** 键退出编辑模式，然后修改的参数将被临时存储（更改可以是可用的系统重新启动后）。如果操作员需要保存内部的更改系统 ROM，按 **ESC** 退出编辑模式，再次按 **ESC** 返回到主菜单，再次按 **ESC** 键进入数据保存确认页（见图 5.3）。

在非编辑模式下，按 **ESC** 键并返回主菜单。按菜单按钮可以直接指向主菜单。

### 5.4.3 QS 设置菜单

图 5.7 显示了从主菜单进入 QS 设置页面的流程。

## 5.4.2 LBO Setting Menu

Fig.5.6 shows how to enter LBO Setting page from Main Menu page.



Fig. 5.6 LBO Setting Page

**"SHG T Set"** ---- Displays the set temperature of SHG.

**"THG T Set"** ---- Displays the set temperature of THG.

**"SHG T REAL"** ---- Displays actual temperature of SHG.

**"THG T REAL"** ---- Displays actual temperature of THG.

The set temperature of SHG and THG can be modified. The modification flow is like Fig.5.4. Other parameters are actual value and can't be modified.

Move Up and Down button to move the cursor and select an item. Press ENT to confirm the selected item. The cursor starts to blink. Rotate the knob to modify the value. The modification is valid at once. The cursor can be moved between the first line and second line. Press ESC to quit the editing mode and the parameters modified will be stored temporarily (the changes can be available after system rebooted). If the operator needs to save the changes inside the system ROM, press ESC to quit the editing mode, press ESC again to return to the Main Menu, and press ESC once more to enter the data saving confirmation page (see Fig. 5.3).

In non-editing mode press ESC and get back to the Main Menu. Press MENU button can lead to the Main Menu directly.

## 5.4.3 QS Setting Menu

Fig.5.7 shows the flow of entering QS Setting page from the Main Menu.



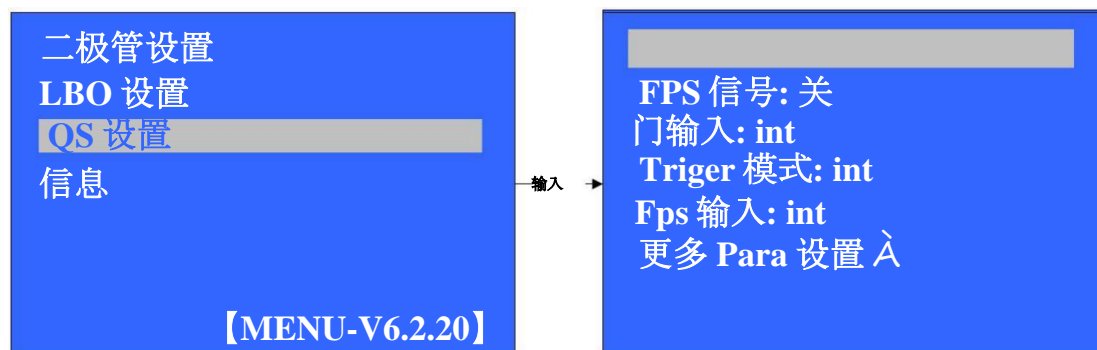


图 5.7 QS 设置页面

**“激光器模式”**----- 表示 Q-SW 的工作模式。CW 意味着连续输出模式。OFF 用于保持模式。此模式意味着输出未启用 Q-SW 功能按钮时的 Q-SW 状态。在 CW 模式下，Q-SW 不是启用和激光输出在平均功率为连续波。In OFF 模式，Q-SW 未启用，Q-SW 保持，无激光。一旦启用 Q-SW 按钮，当前 CW 状态将更改为脉冲输出状态。

**“FPS信号”**----- 套第一脉冲抑制信号。可以设置为 OFF (禁用) 或开启 (启用)。默认设置为“启用”。

**“门输入”**----- 选择门信号源。“Int”表示内部门信号，TTL 电平，有源高。“分机”指示外部门信号，TTL 电平，活性高。

**“Trig模式”**----- 表示可以内部触发 Q-SW 的模式或外部触发。默认设置是内部触发的。

**“FPS输入”**----- 选择 FPS 信号源。“Int”表示内部门信号，TTL 电平，有效高。“ext”表示外部 FPS 信号，TTL 电平，活性高。

按向上或向下按钮移动光标并选择项目。然后按 ENT 以确认所选项目并进入编辑模式。光标开始到眨眼。旋转旋钮修改选定的项目，在“Cw”和“保持”，“int”和“Ext”、“on”和“关”。修改将是有效的实时。按 ESC 键退出编辑模式。修改的参数将存储在系统自动。再次按 ESC 键返回主菜单。

在编辑模式下，将禁用光标移动。离开编辑后模式，光标移动将再次启用。

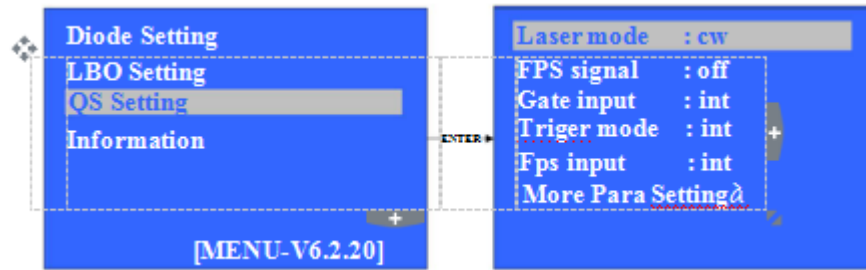


Fig.5.7 QS Setting Page

**“Laser Mode”** ---- Indicates the working mode of Q-SW. CW means continuous output mode. OFF is for HOLD mode. This mode means the output status of Q-SW when Q-SW function button is not enabled. In CW mode, Q-SW isn't enabled and the laser outputs at average power as continuous wave. In OFF mode, Q-SW is not enabled, Q-SW hold, no lasing. Once Q-SW button is enabled, the current CW status will be changed to pulse output status.

**“FPS Signal”** ---- Sets first pulse suppress signal. It can be set to OFF (disable) or ON (enable) . Default set is “enable”.

**“Gate Input”** ---- Selects the GATE signal source. “int” indicates internal GATE signal, TTL level, active high. “ext” indicates external GATE signal, TTL level, active high.

**“Trig Mode”** ---- Indicates that mode of Q-SW can be internally triggered or externally triggered. Default set is internally triggered.

**“FPS Input”** ---- Selects the FPS signal source. “int” indicates internal GATE signal, TTL level, active high. “ext” indicates external FPS signal, TTL level, active high.

Press Up or Down button to move the cursor and select the item. Then press ENT to confirm the selected item and enter the editing mode. The cursor starts to blink. Rotate the knob to modify the selected item, switch between “cw” and “hold”, “int” and “ext”, “on” and “off”. The modification will be effective real time. Press ESC to quit the editing mode. The parameters modified will be stored in the system automatically. Press ESC again to get back to the Main Menu.

In editing mode, the cursor movement is disabled. After leaving the editing mode, the cursor movement will be enabled again.

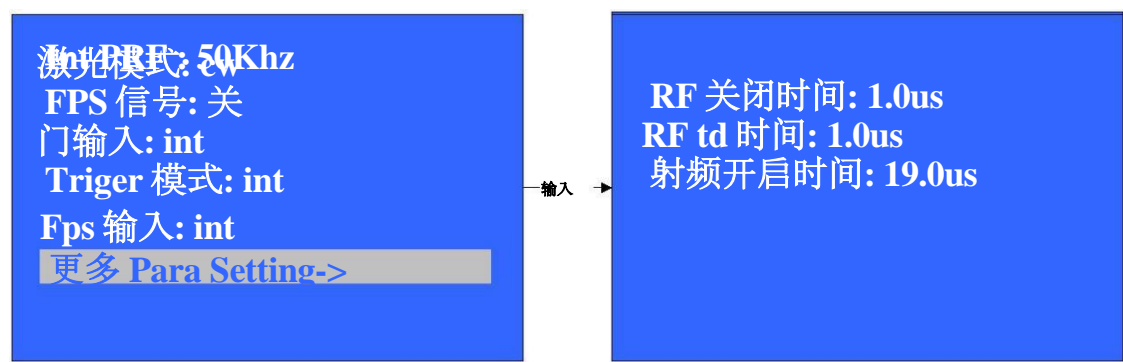


图 5.8 更多 Para 设置

**“IntRPF”**---- 设置 Q-SW 脉冲的重复率，默认设置为 30 KHz。

**“R.F.关闭时间”**---- 设定循环中激光的功率释放时间  
在当前设定频率下。 默认设置为 1 微秒。

当未启用 Q-SW 按钮时，可以将激光模式设置为 cw 或等等。  
当启用 Q-SW 按钮时，它会更改为 RF 脉冲输出状态。 FPS 信号是设置 FPS 信号的状态。 当它打开时，FPS 信号有效。 当它关闭时，FPS 信号无效。

通过设置门输入可实现八种功能模型、Triger 模式和 FPS 输入选项。

FPS 信号门输入触发模式 FPS 输入 RF 脉冲信号 1 在 ext int 正常输出 2 在 ext int 正常输出 3 在 ext int 正常输出 4 On ext ext 普通输出 5 on int 普通输出 6 on int int ext 普通输出 7 on int ext int No 输出 8 on int ext No 输出


5.4.4 信息菜单

图 5.9 显示从主菜单输入信息菜单的流程。

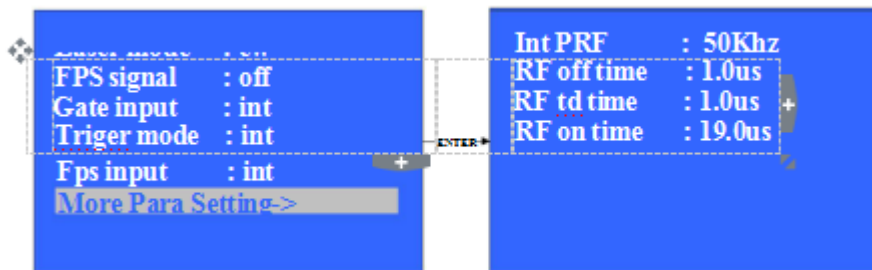


Fig.5.8 More Para Setting

**"Int RPF"** ---- Sets the repetition rate of Q-SW pulse, default set is 30 KHz.

**"R.F. Off Time"** ---- Sets power releasing time of the laser in a circulation under current set frequency. Default set is 1micro second.

When Q-SW button is not enabled, Laser mode can be set to cw or hold. When Q-SW button is enabled, it changes to RF pulse output status. FPS signal is to set FPS signal's status. When it is on, FPS Signal effective. When it is off, FPS Signal is invalid.

Eight function models can be achieved by setting Gate input、Triger mode and FPS input options.

	FPS signal	Gate input	Triger mode	FPS input	RF Pulse Signal
1	on	ext	int	int	Normal Output
2	on	ext	int	ext	Normal Output
3	on	ext	ext	int	Normal Output
4	on	ext	ext	ext	Normal Output
5	on	int	int	int	Normal Output
6	on	int	int	ext	Normal Output
7	on	int	ext	int	No Output 8
on	int	ext	ext		No Output

TABLE 5.1: Function Model List

#### 5.4.4 Information Menu

Fig.5.9 displays the flow of entering Information menu from the Main Menu.

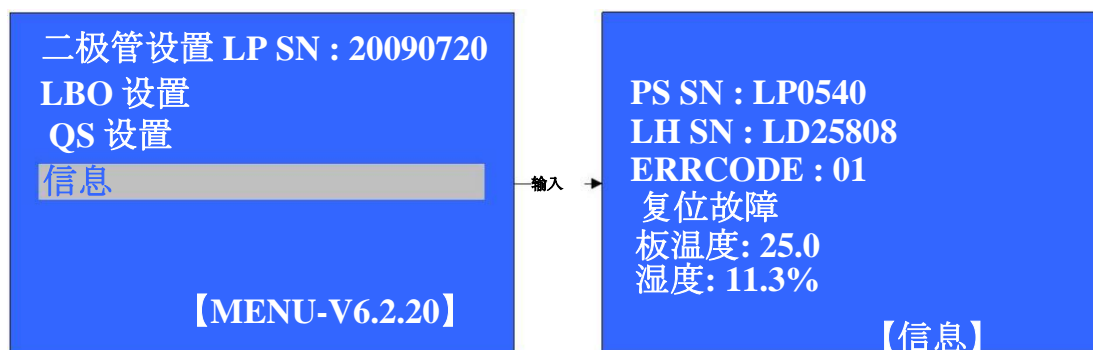


图 5.9 信息显示页面

此页中显示的参数不能被修改。只有行“重置故障”在此页面中突出显示。

“LPSN”---- 表示激光头的序列号。

“PSSN”---- 显示电源的硬件序列号。

“LHSN”---- 显示电源中软件的版本。

“ERRCODE”---- 显示当前错误代码。请参阅表 7.1

在第 7 章中查看代码描述。

“复位故障”---- 执行故障重置。按 “Enter” 按钮，然后按 “fault” 重置立即执行。之后，项目 ERRORCODE 值更改为 “00”，这表明故障复位完成，目前没有错误发生。

“板 Temp”-显示温度的底板底部激光腔。

“湿度”---- 表示激光腔内的湿度水平。

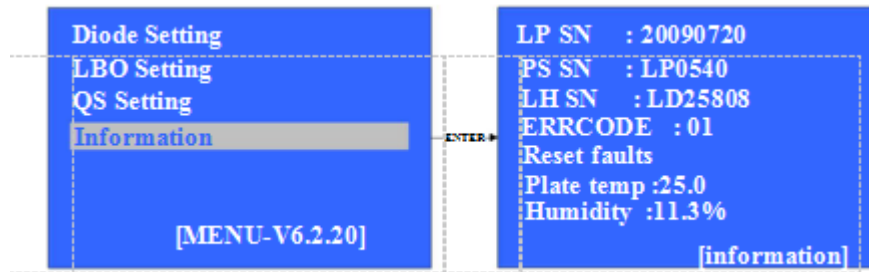


Fig.5.9 Information Display Page

The parameters displayed in this page can't be modified. Only the line of "Reset Faults" is highlighted in this page.

**"LP SN"** ---- Indicates the serial number of the laser head.

**"PS SN"** ---- Displays the hardware serial number of power supply.

**"LH SN"** ---- Displays the version of the software in the power supply.

**"ERROCODE"** ---- Displays the current error code. Please refer to TABLE 7.1 in Chapter 7 to see the codes description.

**"Reset Faults"** ---- Executes Fault reset. Press Enter button, then fault reset is executed at once. After this, item ERRORCODE value changed to "00", which indicates completion of Faults Reset and no error occurs at present.

**"Plate Temp"** ---- Displays the temperature of the base plate in the bottom of laser cavity.

**"Humidity"** ---- Indicates the humidity level in the laser cavity.

## 第 6 章串行通信

### 6.1 功能描述

操作员可以使用串行端口来设置电源的参数  
供应，工作参数和状态将实时显示。

串行通信采用 RS232 标准。

### 6.2 硬件互连

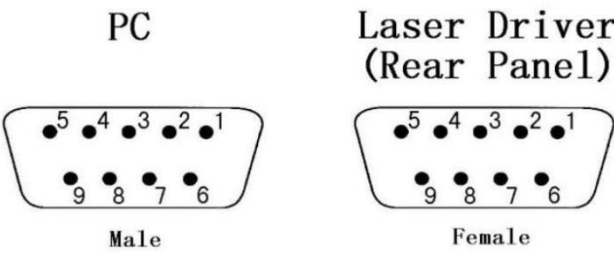


图 6.1 串口图

针数 个人计算机	描述	针数 激光器 驱动器	描述
1	无连接 1 无连接		
2	RX (来自 LDD 上的 Pin3 交叉侧)	2	收到的数据 (从 Pin3 交叉在 PC 端)
3	TX (交叉到 LDD 侧的 Pin2)	3	传输的数据 (交叉到 Pin2 在 PC 端)
4	用引脚 6 短路 (在 PC 侧)	4	用引脚 6 短路 (在 LDD 侧)
5	信号地 5 信号地		
6	用引脚 4 短路 (在 PC 侧)	6	用引脚 4 短路 (在 LDD 侧)
7	用引脚 8 短路 (在 PC 侧)	7	用引脚 8 短路 (在 LDD 侧)
8	用引脚 7 短路 (在 PC 侧)	8	用引脚 7 短路 (在 LDD 侧)
9	无连接 9 无连接		

表 6.1 引脚说明

# Chapter 6 Serial Communication

## 6.1 Function Description

The operator can use the serial port to set up the parameters of the power supply, the working parameters and status will be displayed in real time.

RS232 standard is adopted in the serial communication.

## 6.2 Hardware Interconnection

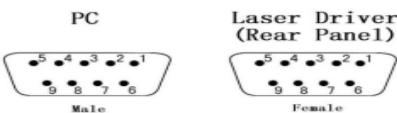


Fig.6.1 Fig.6.1 Serial Port Diagram

Pin Num PC	Description	Pin Num Laser Driver	Description
1	No connection	1	No connection
2	RX(Cross from Pin3 on LDD Side)	2	Received Data(Cross from Pin3 on PC Side)
3	TX(Cross to Pin2 on LDD Side)	3	Transmitted Data(Cross to Pin2 on PC Side)
4	Shorted with pin 6(On PC side)	4	Shorted with pin 6(On LDD side)
5	Signal Ground	5	Signal Ground
6	Shorted with pin 4(On PC side)	6	Shorted with pin 4(On LDD side)
7	Shorted with pin 8(On PC side)	7	Shorted with pin 8(On LDD side)
8	Shorted with pin 7(On PC side)	8	Shorted with pin 7(On LDD side)
9	No connection	9	No connection

TABLE 6.1 Pins Description



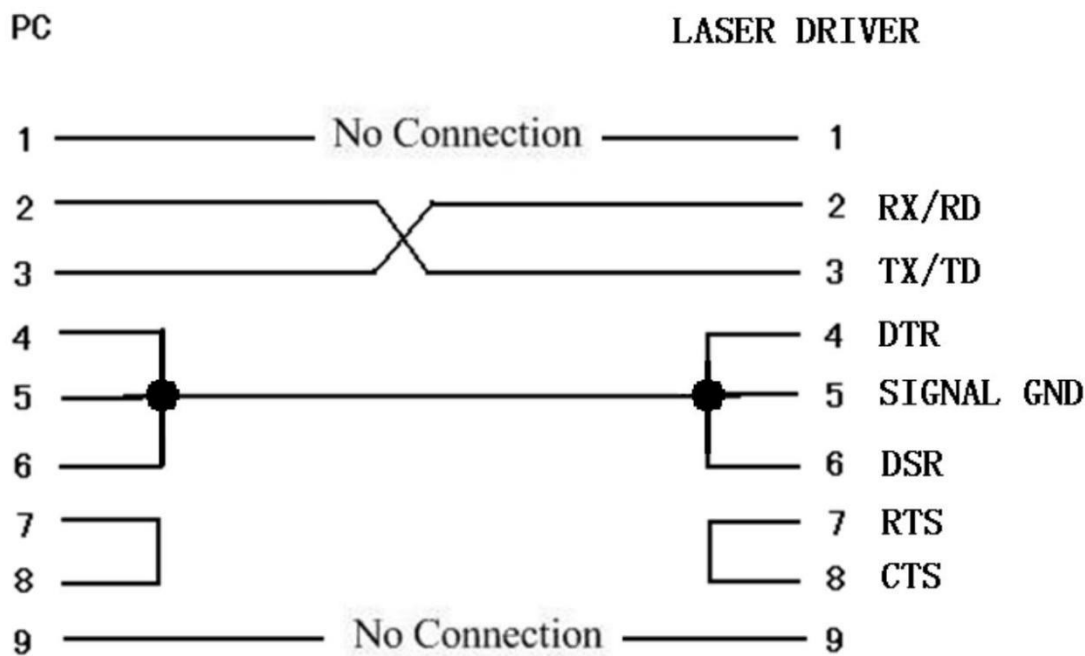


图 6.2 互连电气图

### 6.3 RS232 控制指令集

名称 <b>LP_Open</b>	
原型 Unsigned short LP _ Open (unsigned shortCom)	
Com 参数: 串行端口号	
描述	打开通信接口并执行这个功能时，已启用串行通信。 示例

名称 <b>LP_Close</b>	
原型无符号短 LP _ 关闭(无效)	
参数	
描述	关闭通信接口并执行此操作功能， 串行端口关闭。
程序示例	

名称 <b>LP_RemoteEn</b>	
原型 Unsigned short LP _ RemoteEn (unsigned short远程)	
Remote: 0 禁用串行端口操作， 启用电源操作按钮面板。	
参数	1 启用串行端口操作， 禁用按钮在电源操作面板上。

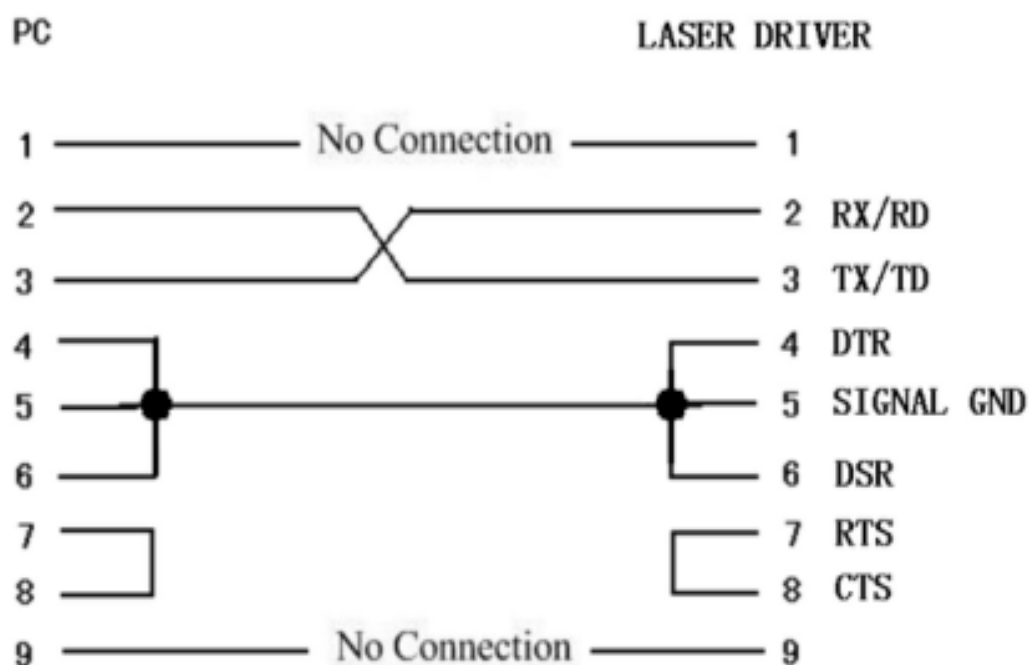


Fig.6.2 Interconnection Electrical Diagram

### 6.3 RS232 Control Instruction Set

Name	LP_Open
Prototype	Unsigned short LP_Open (unsigned short com)
Parameter	com : Serial Port number
Description	After turn on communication interface and performing this function, the serial communication is enabled.
Example	

Name	LP_Close
Prototype	Unsigned short LP_Close (void)
Parameter	
Description	Close the communication interface and perform this function, serial port is closed.
Program Example	

Name	LP_RemoteEn
Prototype	Unsigned short LP_RemoteEn (unsigned short remote)
Parameter	Remote: 0 Disable Serial Port operation, enable the buttons on power operation panel. 1 Enable Serial Port operation, disable buttons on power operation panel.

描述	启用远程控制。 执行此函数后， 电源操作面板上的按钮会出现功能障碍
示例	

<b>名称 LP_LdEn</b>	
原型无符号短 LP _ LdEn (无符号短 en)	
参数	En: 0 禁用 LD 当前 1 启用 LD 电流
说明禁用或启用 LD 电流。	
示例	

<b>名称 LP_QswtEn</b>	
原型无符号短 LP _ QswtEn (无符号短 en)	
参数	En: 0 禁用 Q 输出 1 启用 Q 输出说
明禁用或启用 Q 信号	
示例	

<b>名称 LP_SetLdI</b>	
原型无符号短 LP_SetLdI (双电流)	
参数电流: 电流阀, 单位为安培。	
描述设置 LD 工作电流	
示例	

<b>名称 LP_SetLdTemp</b>	
Prototype Unsigned short LP _ SetLdTemp (doubleTemp)	
参数 temp: 温度值, 单位为摄氏。	
设置 LD 工作温度。 温度是有效 最大值和最大值之间的描述设置值, 如果不 那么它是无效的。	
示例	

<b>名称 LP_SetQFre</b>	
原型无符号短 LP_SetQFre (无符号短频率)	
参数频率: 调 Q 脉冲的频率, 单位为千赫	
描述集 q 开关脉冲频率	
示例	

<b>名称 LP_SetQWidth</b>	
原型无符号短 LP_SetQWidth (无符号短宽度) 参数宽度: 调 Q 脉冲的 脉冲宽度, 单位为 us。	

Description	Enable remote control. After performing this function, the buttons on power operation panel will be dysfunction
Example	

<b>Name</b>	<b>LP_LdEn</b>
Prototype	Unsigned short LP_LdEn (unsigned short en)
Parameter	en: 0    Disable LD current 1    Enable LD current
Description	Disable or enable LD current.
Example	

<b>Name</b>	<b>LP_QswtEn</b>
Prototype	Unsigned short LP_QswtEn (unsigned short en)
Parameter	en: 0    Disable Q output 1    Enable Q output
Description	Disable or enable Q signal
Example	

<b>Name</b>	<b>LP_SetLdI</b>
Prototype	Unsigned short LP_SetLdI(double current)
Parameter	Current: current valve, unit is ampere.
Description	Set LD working current
Example	

<b>Name</b>	<b>LP_SetLdTemp</b>
Prototype	Unsigned short LP_SetLdTemp (double temp)
Parameter	temp: Temperature value, unit is centigrade.
Description	Set LD working temperature. The temperature is valid between the minimum and maximum setting value, if not then it is invalid.
Example	

<b>Name</b>	<b>LP_SetQFre</b>
Prototype	Unsigned short LP_SetQFre (unsigned short frequency)
Parameter	frequency: Frequency of Q-switched pulse, unit is KHz
Description	Set Q-switched pulse frequency
Example	

<b>Name</b>	<b>LP_SetQWidth</b>
Prototype	Unsigned short LP_SetQWidth (unsigned short width)
Parameter	width: Pulse width of Q-switched pulse, unit is us.

Q 开关设置脉冲宽度描述脉搏。	
示例	

<b>名称 LP_SetSHGTemp</b>	
原型无符号短 LP_SetSHGTemp (倍增器 Temp)	
Temp 参数: 设定 LBO 的工作温度 SHG.	
设置 LBO 的说明 SHG的工作温度。	
示例	

<b>名称 LP_SetTHGTemp</b>	
原型无符号短 LP_SetTHGTemp (triplerTemp)	
Temp 参数: 设定 LBO 的工作温度 THG.	
设置 LBO 的说明 THG的工作温度。	
示例	

<b>名称 LP_GateSel</b>	
原型无符号短 LP_GateSel (无符号短源)	
源: 门信号源 参数 0: 内部门 1: 外门	
描述 用于选择栅极信号源。 它可以设置为内部 信号或外部信号。 很高。 示例	

<b>名称 LP_PulseSel</b>	
原型无符号短 LP_PulseSel (无符号短源)	
来源: 调 Q 脉冲信号资源。	
参数 0: 内部脉冲 1: 外部脉冲	
描述 用于选择 q 开关脉冲信号资源。 用户 可以设置内部信号或外部信号。 很高。	
示例	

<b>名称 LP_SetLasMode</b>	
原型无符号短 LP_SetLasMode (无符号短模式)	
模式: Q 输出模式	
参数 0: Q 开关平均功率输出模式 1: Q 开关关闭模式	
设置 Q 的描述驾驶员输出方式	
示例	

Description	Set pulse width of Q-switched pulse.
Example	

<b>Name</b>	<b><u>LP_SetSHGTemp</u></b>
Prototype	Unsigned short <u>LP_SetSHGTemp</u> (doubler temp)
Parameter	temp: Set working temperature of LBO SHG.
Description	For setting LBO <u>SHG's</u> working temperature.
Example	

<b>Name</b>	<b><u>LP_SetTHGTemp</u></b>
Prototype	Unsigned short <u>LP_SetTHGTemp</u> (tripler temp)
Parameter	temp: Set working temperature of LBO THG.
Description	For setting LBO <u>THG's</u> working temperature.
Example	

<b>Name</b>	<b><u>LP_GateSel</u></b>
Prototype	Unsigned short <u>LP_GateSel</u> (unsigned short source)
Parameter	source: GATE signal source 0: Internal GATE 1: External GATE
Description	For choosing GATE signal source. It can set to internal signal or external signal. High on.
Example	

<b>Name</b>	<b><u>LP_PulseSel</u></b>
Prototype	Unsigned short <u>LP_PulseSel</u> (unsigned short source)
Parameter	source: Q-switched pulse signal resource. 0: Internal pulse 1: External pulse
Description	For choosing Q-switched pulse signal resource. The user can set internal signal or external signal. High on.
Example	

<b>Name</b>	<b><u>LP_SetLasMode</u></b>
Prototype	Unsigned short <u>LP_SetLasMode</u> (unsigned short mode)
Parameter	mode: Q output mode 0: Q switch average power output mode 1: Q switch turn off mode
Description	To set Q driver's output mode
Example	

名称	<b>LP_SetLDRamp</b>
原型	无符号短 LP _ SetLDRamp (双斜坡)
参数渐变:	当前坡度
描述	设置 LD 电流上升率, 单位为安培/S
示例	

名称	<b>LP_GetPointInfo</b>
原型	Unsigned short LP _ GetPointInfo (unsigned 短的 Pointnum, unsigned short * sts, unsigned short * life)
参数	Sts: 当前 LBO 点的状态。 1 表示健康, 0 表示伤害。  生活: 工作时间。 Pointnum: 工作点。
描述	已经阅读了 LBO 工作地点的状态和时间工作。
示例	

名称	<b>LP_GetSts</b>
原型	Unsigned short LP _ GetSts (unsigned short* Sts)
参数	Sts: 激光工作状态。 STS:  Bit0-LDD 开/关 Bit1-快门开/关 Bit2-Q-SW 开/关 Bit3-键盘编辑启用/禁用 Bit4-* 保留 * Bit5-* 保留 * Bit6-* 保留 *
Bit7-电源键	SWON
要获取的描述	激光工作状态。
示例	

名称	<b>LP_GetLDIs</b>
原型	无符号短 LP _ GetLDIs (双* 当前)
当前参数:	设置工作电流。
描述	以获得 LD 工作电流。
示例	

<b>Name</b>	<b><u>LP_SetLDRamp</u></b>
Prototype	Unsigned short LP_SetLDRamp (double ramp)
Parameter	ramp: slope current
Description	To set LD current rising rate, unit is amperes /S
Example	

<b>Name</b>	<b><u>LP_GetPointInfo</u></b>
Prototype	Unsigned short LP_GetPointInfo (unsigned short pointnum, unsigned short *sts, unsigned short *life)
Parameter	Sts: State of current LBO spot. 1 means healthy, 0 means damage. Life: Worked time. Pointnum: Working spot.
Description	Read the state of LBO working spot and the time already worked.
Example	

<b>Name</b>	<b><u>LP_GetSts</u></b>
Prototype	Unsigned short LP_GetSts (unsigned short *sts) Sts: Laser's working state. STS:
Parameter	<div> bit0 - LDD ON/OFF  bit1 - SHUTTER ON/OFF  bit2 - Q-SW ON/OFF  bit3 - KEYPAD EDIT ENABLE/DISABLE  bit4 - ***RESERVED***  bit5 - ***RESERVED***  bit6 - ***RESERVED***  bit7 - POWER KEY SW ON </div>
Description	To obtain laser's working state.
Example	

<b>Name</b>	<b><u>LP_GetLDIs</u></b>
Prototype	Unsigned short LP_GetLDIs (double *current)
Parameter	Current: Setting working current.
Description	To obtain LD working current.
Example	



姓名 <b>LP_GetLDIa</b>	
原型无符号短 LP_GetLDIa (双* 当前)	
参数电流: 实际工作电流	
描述以获得实际 LD 工作电流。	
示例	

名称 <b>LP_GetQPara</b>	
原型	Unsigned short LP_GetQPara (unsigned short
	* 频率, 无符号短 * 宽度)
参数	Para: 调 Q 的设定频率和脉冲宽度
脉冲。	
	获取调 Q 的设定频率和脉冲宽度

描述

脉冲。

示例

名称 <b>LP_GetQSts</b>	
原型 Unsigned short LP_GetQPara (unsigned short* Sts)	
Sts:Q的工作状态	
	Bit0: * 预留 *
	Bit1: * RESERVED *
	bit2: * RESERVED *
参数 bit3:* 保留 *	
Bit4: QSW 密钥禁用开/关	
Bit5: * 保留 *	
	Bit6: 外部频率开/关
	Bit7: 外部门开/关
	获得调 Q 的设定频率和脉冲宽度

描述

脉冲

示例

名称 <b>LP_GetErrCode</b>	
原型 Unsigned short LP_GetErrCode (unsigned short* 代码)	
代码: 错误保护代码	
	Bit15: * RESERVED *
	bit14: * RESERVED *
	bit13: * RESERVED *
参数 bit12: 控制电缆断开报警	
Bit11: THG 过流报警	
	Bit10: SHG 过流报警 bit9: LD TEC

过流报警

Bit08: 联锁

<b>Name</b>	<b>LP_GetLDIa</b>
Prototype	Unsigned short LP_GetLDIa (double *current)
Parameter	Current: Actual working current
Description	To obtain actual LD working current.
Example	

<b>Name</b>	<b>LP_GetQPara</b>
Prototype	Unsigned short LP_GetQPara (unsigned short *frequency, unsigned short *width)
Parameter	Para: Setting frequency and pulse width of Q-switched pulse. Obtain the setting frequency and pulse width of Q-switched pulse.
Description	
Example	

<b>Name</b>	<b>LP_GetQSts</b>
Prototype	Unsigned short LP_GetQSts (unsigned short *sts) sts: Q's working status
Parameter	bit0: ***RESERVED*** bit1: ***RESERVED*** bit2: ***RESERVED*** bit3: ***RESERVED*** bit4: QSW KEY DISABLE ON/OFF bit5: ***RESERVED*** bit6: EXTERNAL FREQUENCY ON/OFF bit7: EXTERNAL GATE ON/OFF
Description	Obtain setting frequency and pulse width of Q-switched pulse
Example	

<b>Name</b>	<b>LP_GetErrCode</b>
Prototype	Unsigned short LP_GetErrCode (unsigned short *code) code: error protection code
Parameter	bit15: ***RESERVED*** bit14: ***RESERVED*** bit13: ***RESERVED*** bit12: Control cable disConnection alarm bit11: THG over-current alarm bit10: SHG over-current alarm bit9: LD TEC over-current alarm bit08: INTERLOCK

	<p>Bit07: 水保护</p> <p>Bit06: 湿度警报</p> <p>Bit05: 钒酸盐温度报警</p> <p>Bit04: 底板温度和湿度报警</p> <p>Bit03: THG 温度警报 bit02: SHG 温度警报 bit01: 激光二极管温度</p> <p>Bit00: 激光二极管过流</p>
描述以获取错误代码。	
示例	

### 名称 **LP\_GetTemp**

原型	<p>Unsigned shortLP_GetTemps(double * shgtemp, double * Thgtemp, double * ldtemp)</p>
Shgtemp:SHG的工作温度	
参数 Thgtemp:THG的工作温度	
LDtemp:LD的工作温度	
描述以获得 THG, SHG, LD 的设定温度。	
示例	

### 名称 **LP\_GetTempa**

原型	<p>Unsigned shortLP_GetTempa(double * shgtemp, double * Thgtemp, double * ldtemp)</p>
Shgtemp:Shg的工作温度	
参数 Thgtemp:Thg的工作温度	
LDtemp:LD的工作温度	
描述以获得 THG, SHG, LD 的实际温度。	
示例	

### 名称 **LP\_GetLDTime**

原型	<p>UnsignedshortLP_GetLDTime (unsigned short * hours, unsigned short * minute) 小时: 小时</p>
参数	<p>分钟: f 分钟</p>

描述以获得实际的 LD 工作几个小时。

示例

	bit07: water protection bit06: humidity alarm bit05: VANADATE temperature alarm bit04: baseplate temperature and humidity alarm bit03: THG temperature alarm bit02: SHG temperature alarm bit01: laser diode over temperature bit00 :laser diode over-current
Description	To obtain error code.
Example	

<b>Name</b>	<b><u>LP_GetTemp</u></b>
Prototype	unsigned short <u>LP_GetTemps</u> (double *shgtemp, double* thgtemp, double *ldtemp)
Parameter	Shgtemp: SHG's working temperature Thgtemp: THG's working temperature LDtemp: LD's working temperature
Description	To obtain the setting temperature of THG, SHG, LD.
Example	

<b>Name</b>	<b><u>LP_GetTempa</u></b>
Prototype	unsigned short <u>LP_GetTempa</u> (double* shgtemp, double* thgtemp, double *ldtemp)
Parameter	Shgtemp: shg's working temperature Thgtemp: thg's working temperature LDtemp: LD's working temperature
Description	To obtain actual temperature of THG, SHG, LD.
Example	

<b>Name</b>	<b><u>LP_GetLDTime</u></b>
Prototype	unsigned short <u>LP_GetLDTime</u> (unsigned short *hours, unsigned short *minute)
Parameter	Hours: hour
	Minutes :f minutes
Description	To obtain the actual LD working hours.
Example	

名称	<b>LP_GetHWVrsn</b>
原型	unsignedshortLP_GetHWVrsn(char* Vrsn)
参数	Vrsn: 版本号
描述	获取硬件版本的说明号码。
示例	

名称	<b>LP_GetSWVrsn</b>
原型	unsignedshortLP_GetSWVrsn(char* Vrsn)
参数	Vrsn: 版本号。
描述	描述以获取软件版本号。
示例	

<b>Name</b>	<b>LP_GetHWVrsn</b>
Prototype	unsignedshortLP_GetHWVrsn(char *vrsn)
Parameter	Vrsn: version number
Description	To obtain hardware version number.
Example	

<b>Name</b>	<b>LP_GetSWVrsn</b>
Prototype	unsignedshortLP_GetSWVrsn(char *vrsn)
Parameter	Vrsn: version number.
Description	To obtain software version number.
Example	

## 第 7 章故障排除

电源在正常情况下工作时，故障 LED 不是照明。出现错误时，故障指示灯亮起。当这种情况发生时，激光电源保护功能通过切断 LD 立即发生电流，因此激光停止。

当发生故障保护时，操作员需要定位原因的错误，修复问题，并重新启动激光。

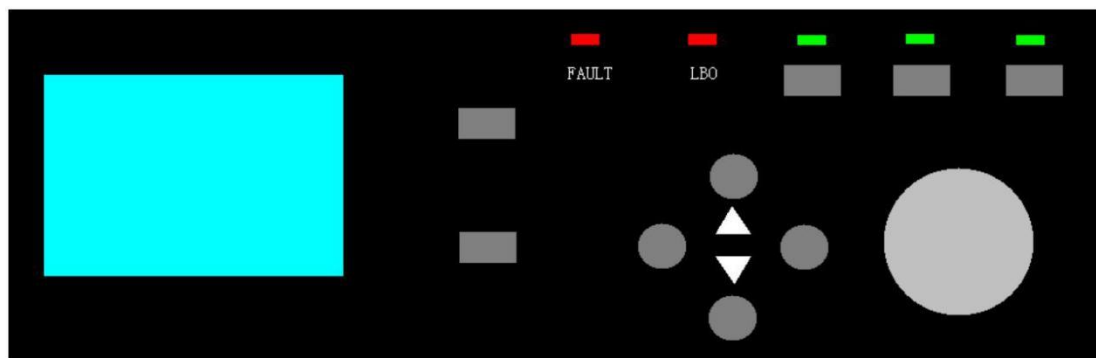


图 7.1 故障 LED 状态

如图 7.1 所示，故障指示灯指示出现错误。这个 LED 点亮当电源内部发生保护时向上。任何保护从内部将点亮故障 LED。

故障的主要原因如下：

- LD 过流
- LD 过温
- LD TEC 过流
- SHG 超温
- THG 过温
- SHG 驱动器过流
- THG 驱动器过流
- 湿度保护
- 底板温度保护
- 水保护
- 联锁

## Chapter 7 Troubleshooting

When power supply works under normal condition, the FAULT LED is not illuminated. The FAULT LED lit up when error occurs. When that happens, the laser power supply protection function takes place immediately by cutting off LD current, thus lasing stops.

When FAULT protection takes place, the operator needs to locate the cause of the error, fix the problem and reboot the laser.

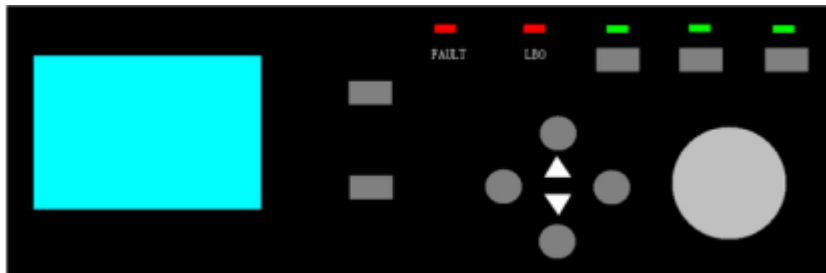


Fig.7.1 FAULT LED Status

As shown in Fig.7.1, the FAULT LED indicates that error occurs. This LED lit up when protection takes place inside the power supply. Any protection from inside will illuminate the FAULT LED.

Main causes of the faults are listed below:

- LD over-current
- LD over-temperature
- LD TEC over-current
- SHG over-temperature
- THG over-temperature
- SHG Driver over-current
- THG Driver over-current
- Humidity protection
- Base plate temperature protection
- Water protection
- Interlock

## 7.1 发现故障

有两种方法可以跟踪故障的来源:

1:在主菜单内, 选择“信息”项目并按 **Enter** 按钮。

通过读取 **ERRCODE** 值来确认错误的来源。

2:检查 **pcb** 板 (激光驱动器内部) 上的 **led** 以定位错误来源。

**ERRCODE** 和特定错误源之间的详细关系是显示在表 7.1 中。

故障源错误码	
LD 过流 01	
LD 过温 02 LD TEC 过流 03	
SHG 超温 04 THG 超温 05	
SHG TEC 驱动器过流 06	
THG 驱动器过流 07	
湿度保护 08	
底板温度	09
保护	
水保护 10	
联锁保护 11	
控制电缆断开	12
误差	
FAN TEC 开路保护 13	
FAN TEC Over Heat Protection 14	
LD2 过流保护 15	
LD2 过热保护 16	
LD2TEC 过流保护 17	
1 级授权已过期	
报警	18
2 级授权已过期	19
报警	
表 7.1 故障源指标	

## 7.2 故障复位

确认并排除故障源后, 对故障进行复位  
LED (使 LED 熄灭), 激光能否恢复正常工作



## 7.1 Finding Fault

There are two methods to trace to sources of FAULT:

- 1: Inside the Main Menu, select "Information" item and press Enter button. Confirm the source of the error by reading ERRCODE value.
- 2: Check the LEDs on PCB board (inside the laser driver) to locate the error source.

Detailed relationships between ERRCODE and specific error source are displayed in TABLE 7.1.

Fault Source	ERRCODE
LD over-current	01
LD over-temperature	02
LD TEC over-current	03
SHG over-temperature	
04 THG over-temperature	
05	
SHG TEC Driver over-current	06
THG Driver over-current	07
Humidity Protection	08
Base Plate Temperature Protection	09
Water Protection	10
Interlock Protection	11
Control cable disconnection error	12
FAN TEC Open Circuit Protection	13
FAN TEC Over Heat Protection	14
LD2 Overcurrent Protection	15
LD2 Over Heat Protection	16
LD2TEC Overcurrent Protection	17
Level 1 Authorization Expired Alarm	18
Level 2 Authorization Expired Alarm	19

TABLE 7.1 Fault Source Index

## 7.2 Fault Reset

Only after confirming and removing the fault source, and resetting the FAULT LED (to make the LED black out), can the laser be set back to normal working

状态。

有两种方法可以重置故障 LED:

1:在主菜单中, 选择“信息”项目。光标将自动移动到“重置故障”项目。按 ENTER 按钮执行故障复位。当故障源是固定的, 故障 LED 熄灭; 如果故障源仍然存在, 故障 LED 仍将点亮, 直到错误完全清除。

2:按下 PCB 上的故障复位按钮 (在驱动器中) 也可能导致一个故障清除。

## 第八章电气规范

### 8.1 交流输入

交流输入为 220V, 50/60hz。交流电源应有效接地。

### 8.2 激光控制端口(输入)

- 脉冲: TTL 电平
- GATE:TTL 电平
- FPS :TTL 级别

### 8.3 COM 端口

标准 RS232 规格。

status.

There are two ways to reset the FAULT LED:

1: In the Main Menu, select "Information" item. The cursor will automatically moves to "Reset Fault" item. Press ENTER button to execute a Fault Reset. When the fault source is fixed, the FAULT LED blacks out; if the fault source still exists, the FAULT LED will still be illuminated until the error completely cleared.

2: Pressing the Fault Reset button on the PCB (in the Driver) can also leads to a fault clearance.

## **Chapter 8 Electrical Specifications**

### **8.1 AC Input**

AC input is 220V, 50/60HZ. AC source should be grounded effectively.

### **8.2 Laser Control Port ( Input )**

- PULSE: TTL level
- GATE: TTL level
- FPS : TTL level

### **8.3 COM Port**

Standard RS232 spec.



## 9.2 电源机械尺寸 9.2 Power Supply Mechanical Dimensions

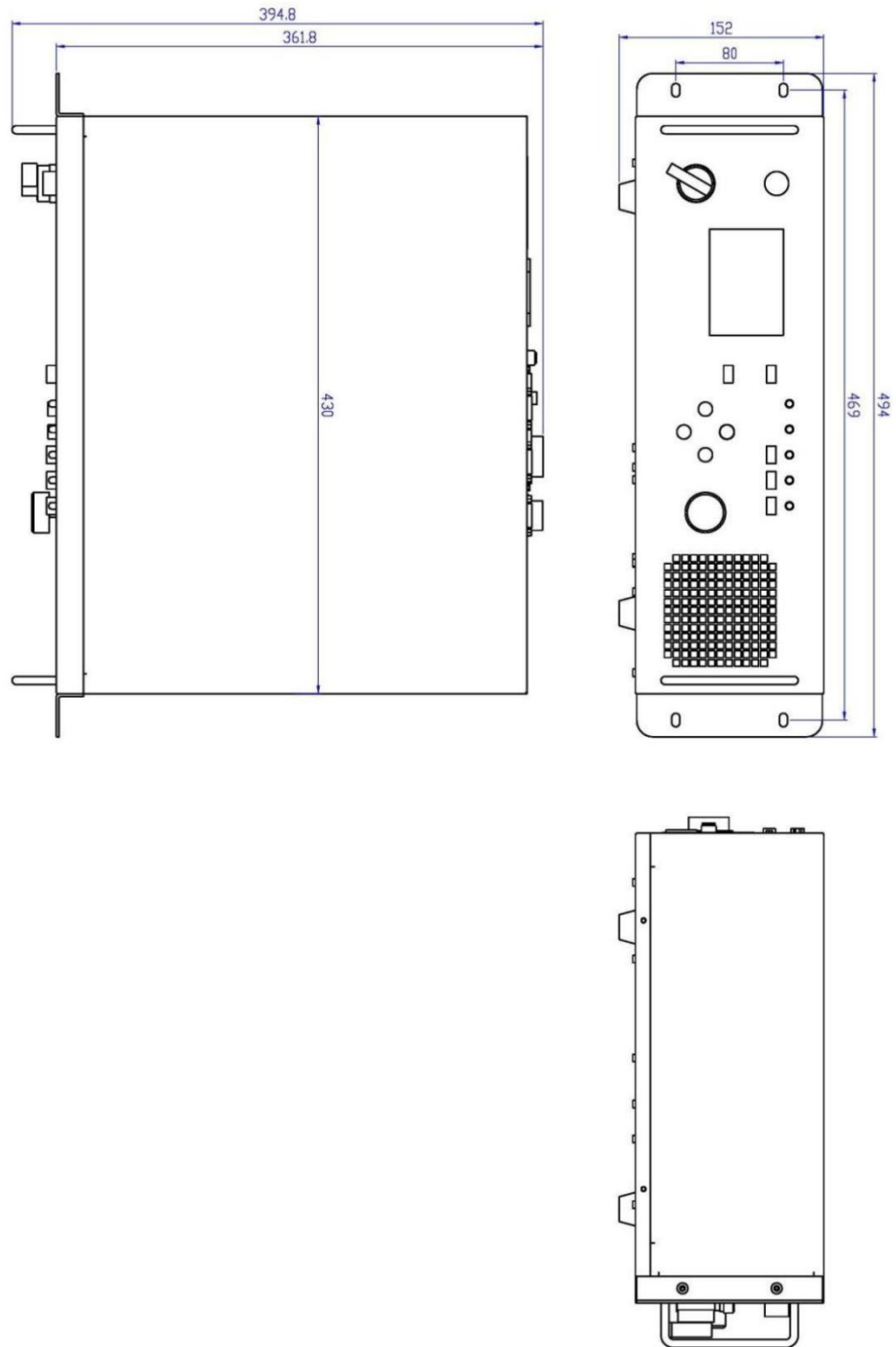


图 9.3 电源尺寸 Fig.9.3 Power Supply Dimensions

## 9.3 冷水机机械尺寸 9.2 Power Supply Mechanical Dimensions

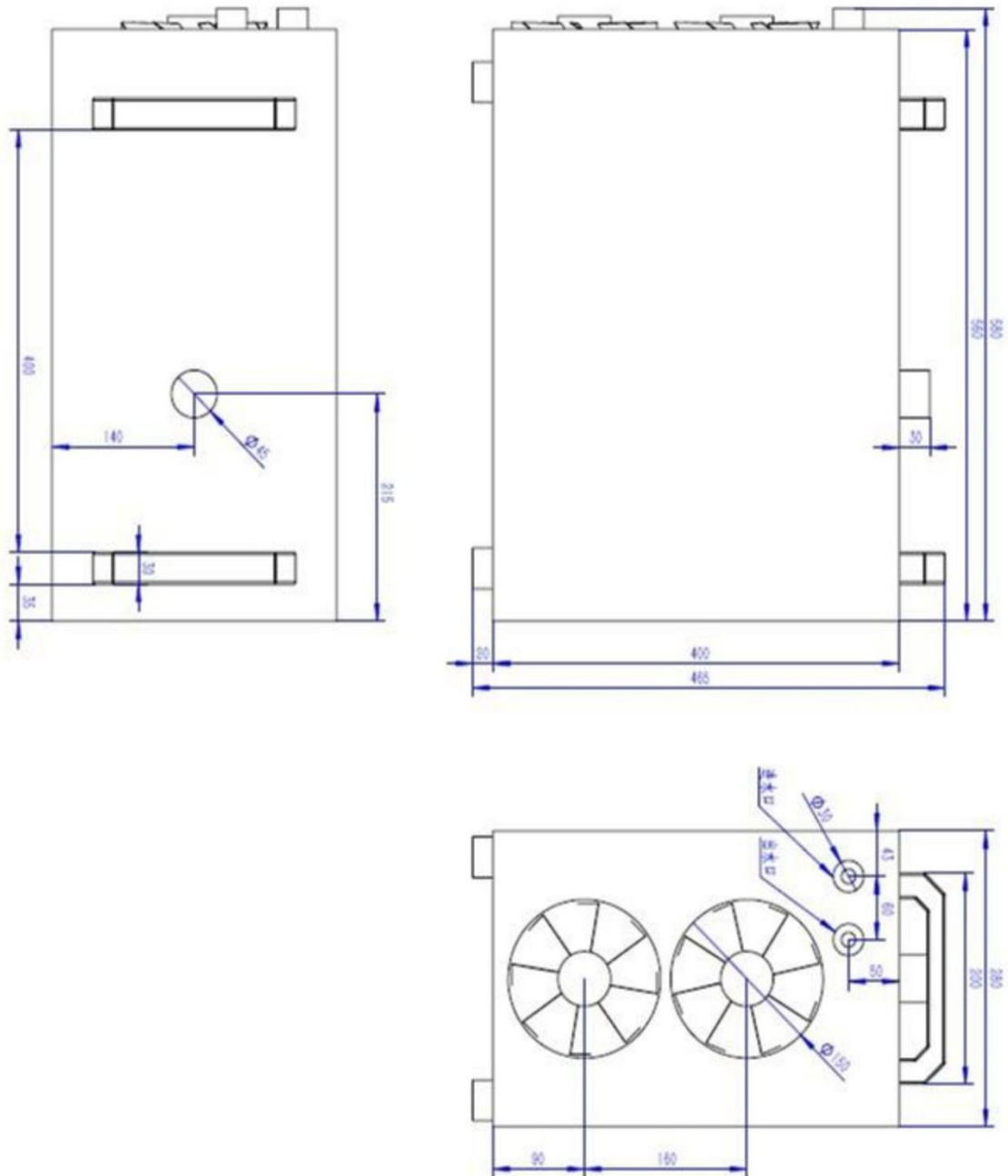


图 9.4 冷水机尺寸.9.4 Chiller Dimensions



深圳 RFH 激光技术有限公司

地址:2 楼, 南山高新技术产业园区中区 M10,  
深圳。 中国

**WEB:** [Http://www.rfhlasertech.com](http://www.rfhlasertech.com)

电话:+ 86-0755- 18928466502、86375012、86375016

传真:+ 86-0755-86028961、86028988

**E-MAIL:** [Sales@rfhlasertech.com](mailto:Sales@rfhlasertech.com)