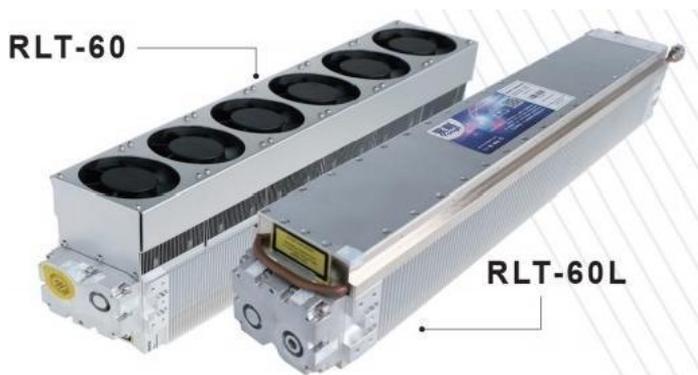




RLT-60系列
射频CO₂激光器使用说明书
RF CO₂ Laser User Manual



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1. 激光安全

1.1 安全标准

使用RLT-60系列射频CO₂激光器(以下简称激光器)的设备应符合中华人民共和国GB/T10320-2011《激光设备和设施的电气安全》和GB7247.1-2012《激光产品的安全第1部分：设备分类、要求》国家标准。

1.2 危险警示

激光器输出9.3 μm-10.6 μm 人眼不可见的远红外波长激光，其直接的或散射的激光辐射能够引起严重的角膜损伤和皮肤损伤，因此，在激光器使用过程中，必须佩戴激光防护镜等保护用品。必须绝对避免激光照射到酒精、乙醚、丙酮以及木板、棉花等可燃物上，以免发生爆炸和火灾。此外还需注意不要将激光束照射到金属、镜子等光滑表面上，避免这些光滑表面反射激光而带来不可预知的危险。

1.3 特别提示

在激光器首次启动输出激光之前，必须取下前面板输出端圆孔上的防尘保护贴，否则，输出的激光束将会烧毁保护贴造成激光器输出镜的污染，严重的污染有可能使得激光器无法输出激光从而导致整机报废。

2. 准备工作

2.1 检查包装

2.1.1 检查包装箱封箱胶条是否完整。

2.1.2 检查包装箱外观是否有损坏、变形以及受潮等现象。

2.2 装箱清单

2.2.1 使用合适的工具打开包装箱，开箱时注意请勿伤及箱内物品。开箱后检查激光器(包括随机配件)及其所在的塑料泡沫包裹是否完好无损，若有意外的情况，请及时与公司销售服务部门联系进行沟通说明。

2.2.2 检查包装箱内物品：激光器1台，激光器检测报告1份，激光器使用说明书1份，激光器输出控制BNC接头(公)1个。

2.2.3 可选择的配件：48V直流电源。

3. 安装与使用

3.1 安装要求

3.1.1 激光器前后端安装有激光器谐振腔的输出镜和反射镜镜座，这是激光器的精密部分，不得与其他任何物件进行硬接触，否则会造成激光器的损坏；但可以使用软性材料与端板进行软接触，用于密封光路保护激光器的输出窗口镜。

3.1.2 安装激光器的固定底板必须具有良好的平面度和足够的刚度，确保安装后激光器不致发生形变。倘若激光器的工作环境有震动的情况，则固定底板最好施加防震措施，以免对于激光器的光路产生影响。

3.1.3 如果因工作环境要求需要把激光器安装在某一个封闭机箱内，则该机箱外必须装有排风装置，保证机箱内外空气可以顺畅循环，使激光器始终处在一个良好的散热状态中。

3.2 激光器前后端板说明

3.2.1 激光器前端板：带有圆形通孔的孔内安装有激光器的输出镜，激光从这个圆孔中输出。

3.2.2 激光器后端板：主要有激光器的供电电源接口(两个48VDC+ 和一个48VDC-) 和控制信号BNC 接口。

3.3 控制信号的连接

3.3.1 供电电源接口：用于连接激光器的48V直流电源供电。连接时，一种办法是将48V直流电源正极输出的导线分成两路与后面板的两个48VDC+ 接口分别连接(设置两个接口的原因主要是为了平衡激光器内部电路的载荷要求)；另一种办法是将48V直流电源正极输出的一根导线与后端板中任意一个48VDC+ 接口连接，同时将这两个接口使用合适的导线短接在一起。48V 直流电源负极输出的导线则应该连接到后端板的48VDC- 接口(即与激光器机壳地连接)。电源和激光器之间的连接导线大于4mm²，正负极不得接反，否则会损坏激光器。

3.3.2 控制信号 BNC 接口：PWM信号通过激光器后面板上BNC接入，BNC连接线的芯线极性为正，另一根线极性为负。

3.4 激光器控制和操作

3.4.1 激光器控制过程：RLT-60系列型激光器通过脉冲宽度调制信号(PWM) 来控制激光功率输出。PWM信号的低电平电压范围应在0-0.5V(激光关)；高电平电

压范围应在3.5-5V（激光开），通过 PWM信号占空比可对激光功率进行控制， PWM信号由外部控制卡提供，PWM信号调制频率为 0-25KHz， 占空比0-100%。

下图所示的波形就是一个典型的0-5V 的 PWM 信号，占空比(或脉宽)可调，频率也可调：

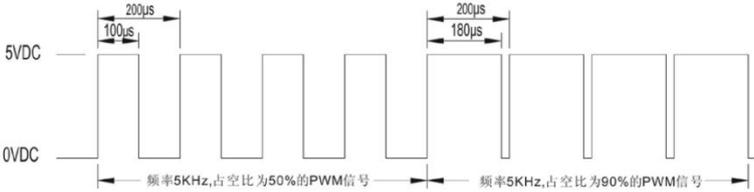


图1 . TTL 控制信号实现的 PWM调制功能示意图

3.4.2 激光器开机操作：开启48V 直流供电电源，激光器处于准备输出的待机状态；此时，通过 BNC 连接线输入TTL 信号，则激光器开始输出激光。在激光器输出过程中，用户可以通过改变TTL 信号参数可以改变 PWM 的调制功能，获得所需要的激光脉冲宽度、重复频率和平均功率等输出指标。

3.4.3 激光器关机步骤：停止TTL 控制信号输入，激光输出停止；关闭48V 直流供电电源。

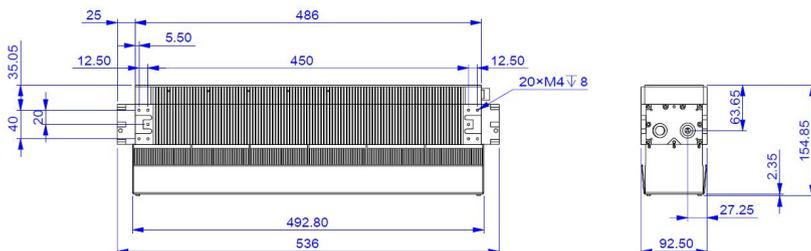
4. RLT-60系列射频CO₂激光器参数表

型号	RLT-60i	RLT-60h	RLT-60	RLT-60iL	RLT-60hL	RLT-60L
波长	9.3 μm	10.2 μm	10.6 μm	9.3 μm	10.2 μm	10.6 μm
激光功率	45W	55W	60W	45W	55W	60W
功率稳定性	≤±5%					
光束质量 M ²	<1.2					
光束直径 (1/ e ²)	2.2±0.2mm					
光束发散角 (全角)	<8.0mrad					
偏振性	水平线偏振, >100:1					
调制频率	0-25kHz					
占空比范围	0-100%					
电输入	DC 48V/21A					

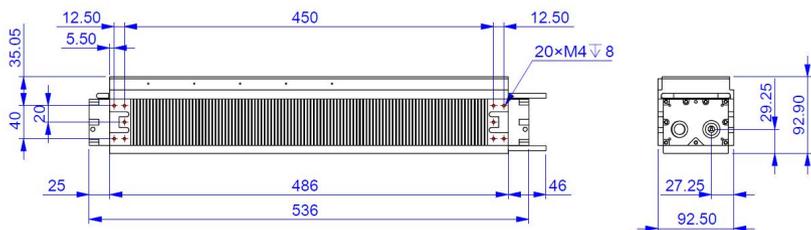
冷却方式	风冷	水冷
尺寸	536mmx92.5mmx155mm	557mmx92.5mmx93mm
重量	10.00kg	8.80kg
工作外壳温度	<60℃ (140°F)	<50℃ (122°F)
工作环境温度	<15~40℃ (59~104°F)	
湿度	非冷凝	
运输和存储环境温度	-10~40℃ (14~104°F)	
<p>1) 激光功率在激光器温度25℃下测得，高于25℃每上升1℃输出功率约降低1%</p> <p>2) 稳定度计算公式：稳定度=±(Pmax-Pmin)/(2Pmax) 稳定度测试条件：正常运行环境下，开机预热5分钟，恒定控制占空比。</p>		

5. 尺寸图

5.1 RLT-60i、RLT-60h、RLT-60尺寸图



5.2 RLT-60iL、RLT-60hL、RLT-60L尺寸图



1.Operation Safety

1.1 Safety Regulations

The equipment utilizing RLT-60 series RF CO₂ laser (hereinafter referred to as laser) shall comply with The National Standards of The People's Republic of China GB/T10320-2011 "Electrical Safety of Laser Equipment and Facilities" and GB7247.1-2012 "Safety of Laser Products -Part1:Equipment Classification and Requirements"

1.2 Warnings

The laser emits invisible infrared laser beam with wavelengths of 9.3 μm / 10.6 μm, direct or scattered laser radiation can cause severe corneal injury and skin damage. Therefore, during the use of the laser, it is necessary to wear protective glasses or other protective devices is essential. It is absolutely necessary to avoid laser irradiation on alcohol, ether, acetone, wood, cotton and other combustible materials to avoid explosion and fire. In addition, care should be taken not to irradiate the laser beam on smooth surfaces such as metals and mirrors, to avoid unpredictable dangers caused by the reflection of laser light on these smooth surfaces.

1.3 Reminder

Before the laser starts to output the laser for the first time, the dust-proof protective sticker on the round hole at the output end of the front panel must be removed. Otherwise, the output laser beam will burn the protective sticker and cause pollution of the laser output mirror. Serious pollution may make the laser unable to output laser and cause the whole machine to be scrapped.

2.Preparations

2.1 Check the packaging

2.1.1 Check if the sealing tape is complete.

2.1.2 Check if the packaging is damaged or serious deformation,damp and so on.

2.2 Unpacking and packing list

2.2.1 Use suitable tools to open the box,and be careful not to damage the contents when unpacking.After unpacking,check the laser (including random accessories)and the plastic foam is intact.If there is an accident,please contact the company's sales and service department for communication and explanation.

2.2.2 Check the contents of the packing box:1 RF laser,1 laser inspection report, 1 laser instruction,and 1 connector (male)of BNC control.

2.2.3 Optional accessories:48V DC power supply.

3.Installation and Operation

3.1Installation Requirements

3.1.1 The precision parts of RLT-60 series,Output Lens and Full Reflector holders of the resonator,are mounted at the front and rear ends of the laser.Hard Contact to these two parts are prohibited.Otherwise,it will cause a serious damage to the laser.The soft types of materials can be applied to contact the plate of output end,in order to seal the beam path so to protect the output lens.

3.1.2 The flatness and sufficient rigidity of the laser holder is essential to avoid the deformation of the laser,after installation.If the laser is to be operated under a vibrating working environment,it is better to equip the anti-vibration measures to the laser holder to avoid any negative effect on the laser beam path.

3.1.3 If the working environment requires the laser to be installed in an enclosed enclosure, the enclosure must be equipped with a ventilation device to ensure that the air inside and outside the enclosure is circulated smoothly so that the laser is always in a good thermal condition.

3.2 Front and Rear End Plates of RLT-60 series

3.2.1 Laser front end plate:the hole with the circular through-hole,which contains the output mirror of the laser,from which the laser emits.

3.2.2 Laser rear end plate:Majorly,the power supply interface for the laser (two 48VDC+and one 48VDC-)and the control signal BNC interface.

3.3 Electrical Connection of Rear Panel

3.3.1 Power supply interface:48V DC power supply for the laser.When connecting,one method is to divide the positive output wire of the 48V DC power supply into two channels and connect them to the two 48V DC+interfaces on the rear panel respectively(the reason for setting the two interfaces is mainly to balance the load requirements of the internal circuit of the laser);Another method is to connect a wire of the positive output of the 48V DC power supply to any 48V DC interface on the rear panel,and at the same time short-circuit the two interfaces together with a suitable wire.The wire of the negative output of the 48V DC power supply should be connected to the 48V DC interface of the rear panel (ie,connected to the ground of the laser chassis).The connection wire between the power supply and the laser should be larger than 4mm²,and the positive and negative poles should not be reversed, otherwise the laser will be damaged.

3.3.2 Control signal BNC interface:The PWM signal is connected via BNC on the rear panel of the laser,the polarity of the core wire of the BNC connection is positive and the polarity of the other wire is negative.

3.4 Laser Control and Operation

3.4.1 Laser control process:RLT-60 series laser controls laser power output through pulse width modulation signal (PWM).The low-level voltage range of the PWM signal should be 0-0.5V (laser off);the high-level voltage range should be 3.5-5V(laser on).The laser power can be controlled by the PWM signal duty cycle.External control card provide the PWM signal.

The PWM signal modulation frequency is 0-25KHz,and the duty cycle is 0-100%.

The Figure 1 shows a typical 0-5V PWM signal with adjustable duty cycle (or pulse width) and adjustable frequency:

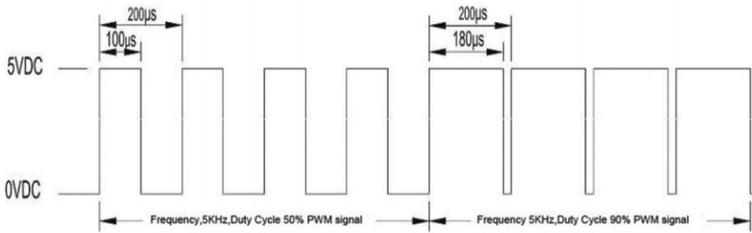


Figure 1. Schematic diagram of PWM modulation function realized by TTL control signal

3.4.2 Laser start-up operation: Turn on the 48V DC power supply, and the laser is in a standby state ready to output; at this time, input the TTL signal through the BNC cable, and the laser starts to output laser. In the laser output process, the user can change the PWM modulation function by changing the TTL signal parameters, and obtain the required output indicators such as laser pulse width, repetition frequency and average power.

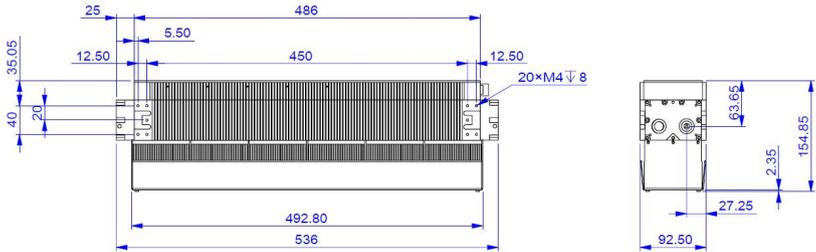
3.4.3 Laser shutdown steps: stop the TTL control signal input, the laser output stops, then turn off the 48V DC power supply.

4.RLT-60 series RF CO₂ lasers Specifications

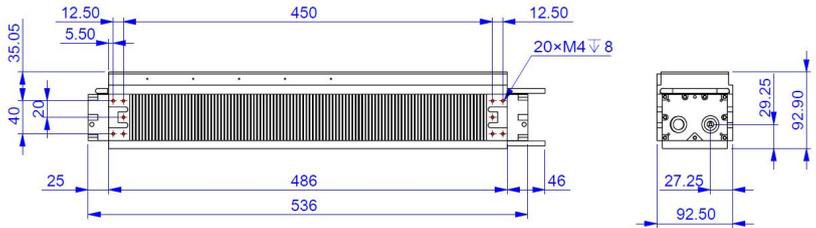
Mode	RLT-60i	RLT-60h	RLT-60	RLT-60iL	RLT-60hL	RLT-60L
Wavelength	9.3μm	10.2μm	10.6μm	9.3μm	10.2μm	10.6μm
Rated Power	45W	55W	60W	45W	55W	60W
Power Instability	≤±5%					
Beam QualityM ²	< 1.2					
Beam Size (1/e ²)	2.2±0.2mm					
Beam Divergence	<8.0mrad					
Polarization	Horizontal Linear Polarization, > 100:1					
Modulation Frequency	0-25kHz					
Duty	0-100%					
Electrical Input	DC 48V/21A					
cooling method	Air Cooling			Water Cooling		
Size(L*W*H)	536mmx92.5mmx155mm			557mmx92.5mmx93mm		
Weight	10.00kg			8.80kg		
Maximum Case Temperature	<60°C (140°F)			<50°C (122°F)		
Ambient Temperature at Work	<15~40°C (59-104°F)					
Humidity	Non-condensing					
Transportation and Storage Environments Temperature	-10~40°C (14~104°F)					
<p>1)Output power measured at a laser temperature of 25°C. Higher than 25°C,1°C increase will cause output power deduction about 1%</p> <p>2)Stability Formular:Stability =±(Pmax-Pmin)/(2Pmax) Stability test conditions:In normal operating environment,preheat the laser for 5 minutes and constant control the duty cycle</p>						

5. Dimensional Drawing

5.1 RLT-60i, RLT-60h, RLT-60 dimensional drawing



5.2 RLT-60iL, RLT-60hL, RLT-60L dimensional drawing





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