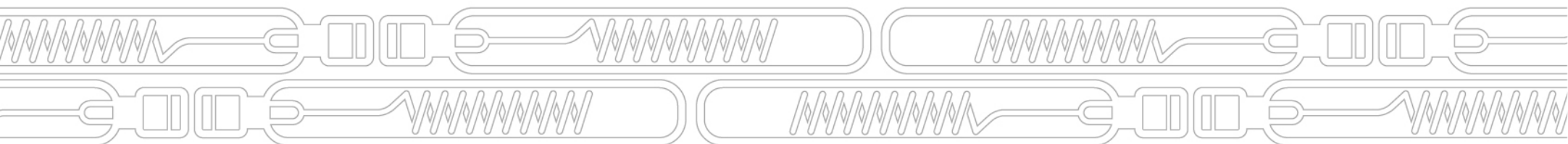




直流二氧化碳激光器 用户手册

DC CO₂ LASER User Manual



北京埃佛尔激光科技有限公司

<http://www.bjefr.com>

简介

北京埃佛尔激光科技有限公司专业从事二氧化碳激光器及系列产品的研制、开发和销售于一体的现代化企业。北京埃佛尔激光科技有限公司致力于二氧化碳激光器的研究和实验长达二十年时间，拥有一支掌握行业领先技术的研究团队，公司具有丰富的实践经验，在北京设有研发中心和生产制造基地。

埃佛尔品牌的生产制造基地，配置一批精湛的技工队伍，超净光学车间，多条常规激光管生产线，拥有强大的制造实力，是国家高新技术企业和国家级专精特新企业，并荣获了中国国内近三十项二氧化碳激光器技术专利证书。



非常感谢您选择了我公司的产品。如果您需要与售后服务人员联系，请准备好以下信息：

- ◆ 激光器的型号；
- ◆ 激光器的序列号；
- ◆ 任何对诊断故障有用的信息。

请认真阅读本手册。本手册包含安装人员以及使用人员所需注意事项的详细信息，为了使本产品保持良好状态而需采取的维护信息。

需注意事项：

警告：在给激光器通电前，需了解本手册中的关于激光器的安全操作和维护方面的注意事项。

警告：请不要对激光器进行调节或改造，否则可能引发危险。

目 录

安 全	1
1.1. 基本信息	1
1.2. 光学安全	1
1.3. 电力安全	1
2. 准备和安装	1
2.1. 冷却液要求	1
2.2. 环境要求	1
2.3. 包装	1
2.4. 激光器的返厂运输	2
2.5. 安装程序	2
3. 操作程序	3
3.1. 工作电流限制	3
4. 技术规格	3
4.1. 激光管	3
4.2. 激光电源	3
5. 图 纸	4-7
6. 气体冷却版	8
6.1. 冷却气体要求	8-9

北京埃佛尔激光科技有限公司

邮箱:bjefrzlc@139.com

传真:+86-10-84572889

网址:www.bjefr.com

地址:北京市通州区永乐经济开发区恒业七街6号及6号院22号楼101

感谢您选用“埃佛尔激光”产品,请使用本产品前详细阅读说明书和产品图解,以便您正确的使用本产品。由于产品不断升级,更新换代最终请以实物为准。

Brief Introduction

Beijing EFR Laser S&T Co., Ltd. is a modern enterprise specializing in the research, development and sales of carbon dioxide lasers and series of products. Beijing EFR Laser S&T Co., Ltd. is committed to the research and experiment of carbon dioxide lasers for 20 years, with a research team that has mastered the industry's leading technology, the company has rich practical experience, and has a research and development center and manufacturing base in Beijing.

The manufacturing base of EFR brand, equipped with a group of exquisite technicians, ultra-clean optical workshop, a number of conventional laser tube production lines, has a strong manufacturing strength, is a national high-tech enterprise and a national specialized special new enterprise, and has obtained nearly 30 carbon dioxide laser technology patent certificates in China.



Please prepare these information before contact our after sales or technical support:

- ◆ CO₂ Laser Model
- ◆ CO₂ Laser Serial Number
- ◆ Any helpful information for trouble shooting.

Please read this manual carefully, it includes installation information for technician and operation information for user, and the maintain information to keep the laser working fine. Attention:

Warning: before power on the laser, please learn safety notes and maintains notes.
Warning: please do not adjust or amend the laser, it could a danger and hurt people.

Contents

1. Safety	10
1.1 Basic Information	10
1.2 Optical Safety	10
1.3 Electrical Safety	10
2. Preparation and Installation	10
2.1 Collant Requirement	10
2.2 Environment Requirement	10
2.3 Package	10
2.4 Return to Us	11
2.5 Installation Procedure	11
3. Operation Procedure	12
3.1 Working Current	12
4. Specifications	12
4.1 Laser Tube	12
4.2 Power Supply	12
5. Diagram	13-16
6. Gas cooling Version	17
6.1 Cooling gas requirements	17-18

Beijing EFR Laser S&T Co., Ltd.

E-mail: bjefrzlc@139.com

Fax: +86-10-84572889

Web: www.bjeifr.com

Address: No.101, Building 22, No.6 Hengye Seven Street, Yongle Industrial
Development Zone, Tongzhou District, Beijing

Thank you for buying EFR Laser product, please read the instructions and product illustrations carefully before using this product, so that you can use this product correctly. Due to the continuous upgrading of products, please refer to the actual product.

1. 安全

1.1. 基本信息

未经培训、许可、不了解相关安全事项的人员禁止使用此激光器。

未经许可的人员禁止接近此激光器。

在激光器运行区域放置危险标识。

1.2. 光学安全

此激光器是第四级激光器 (Class IV)：即大功率激光器，此类激光不但其直射光束及镜式反射光束对眼和皮肤损伤，而且损伤相当严重，并且其漫反射光也可能给人眼造成损伤。

在激光器运行时，相关人员须佩戴经过认可的激光防护眼镜，且须确认激光防护眼镜与波长相匹配。红外激光束的主波长为 $10.6\mu\text{m}$ 。

即使佩戴激光防护眼镜，也不要直视激光光束。

确保激光光束没有被反射回激光器，否则会导致激光器损坏。

1.3. 电力安全

警告：此激光器电源输入交流电，输出40kV高压直流电，断电后可能仍会有余电。

不要尝试打开激光器电源的外壳。

警告：激光器电源通电时，请不要触摸激光器管体，不要接近激光器的尾端。

2. 准备和安装

2.1. 冷却液要求

系统需要有制冷型冷水机。冷水机要求使用蒸馏水。

建议配套冷水机：

激光器型号 F300/F300-I X300/X300-I 配套冷水机：特域机电CW-6000

激光器型号 F450/F450-I X450/X450-I 配套冷水机：特域机电CW-6100

配套冷水机必须可控制温度在 $15\sim 25^{\circ}\text{C}$ ，配套冷水机流量必须大于13升/分钟，制冷量大于3.0kW。

2.2. 环境要求

应在室温为 $15\sim 30^{\circ}\text{C}$ ，湿度为30~60%的环境中运行此激光器，激光器电源须有足够的通风进行冷却，并避免灰尘对激光器及激光电源的污染。

2.3. 包装

如果激光器在到达时包装已经破损，请在签收时注明损坏程度；然后立即通知北京埃佛尔激光科技有限公司。

为了储存或者运输的需要，请保留此产品的包装。

2.4. 激光器的返厂运输

如果激光器需要返厂处理，必须使用完整的原包装（激光器保护罩严禁开启，一经私自开启我公司不支持质保服务），必须事先与北京埃佛尔激光科技有限公司联系并获得准许后，方可包装运输。

注意：在包装前，须将激光器中的冷却水放空。

2.5. 安装程序

警告：须按规定佩戴安全防护眼镜后，才可对激光器进行安装调试。

2.5.1 将激光器固定在设备上，激光管安装平面度误差应小于2毫米，调整两固定脚高度，使激光管两固定脚保持在同一平面内，误差不大于0.5毫米。

激光电源和冷水机需有足够的安装工作空间，以保证良好的通风。

2.5.2 激光电源和激光器的连接

激光器型号 F300/F300-I X300/X300-I

★ 将激光电源的第一组线，分别于激光器的第一组正负极相连接；激光输出端为负极（管1-），连接激光电源的负极线（V-1）；激光器的另一端为正极（管1+），连接激光电源的正极线（V+1）；

★ 将激光电源的第二组线，分别于激光器的第二组正负极相连接；激光输出端为负极（管2-），连接激光电源的负极线（V-2）；激光器的另一端为正极（管2+），连接激光电源的正极线（V+2）；

★ 注意：两激光电源两组线，应分别连接两支激光管，两激光电源的两组线，不得交叉连接两支激光管；

激光器型号 F450/F450-I X450/X450-I

★ 将激光电源的第一组线，分别于激光器的第一组正负极相连接；激光输出端为负极（管1-），连接激光电源的负极线（V-1）；激光器的另一端为正极（管1+），连接激光电源的正极线（V+1）；

★ 将激光电源的第二组线，分别于激光器的第二组正负极相连接；激光输出端为负极（管2-），连接激光电源的负极线（V-2）；激光器的另一端为正极（管2+），连接激光电源的正极线（V+2）；

★ 将激光电源的第三组线，分别于激光器的第三组正负极相连接；激光输出端为负极（管3-），连接激光电源的负极线（V-3）；激光器的另一端为正极（管3+），连接激光电源的正极线（V+3）；

★ 注意：三台激光电源三组线，应分别连接三支激光管，三台激光电源的三组线，不得交叉连接三支激光管；

2.5.3 冷水机和激光器的连接

★ 连接冷水机与激光器，冷水机进水口（inlet）连接激光器激光输出端的水嘴（出水口），冷水机出水口（outlet）与激光器另一端的水嘴（进水嘴）连接；

2.5.4 打开冷水机，确保冷却水充满激光器水冷管内，气泡完全排出。

警告：在没有冷却水循环或冷却水流量不足的情况下，打开激光器会迅速使其爆裂。由此产生的损失，产品将不能保修。

3. 操作程序

3.1. 工作电流限制

如果工作电流低于10mA，激光管的放电可能会不稳定，会导致输出不稳，光斑模式变差。

此激光器的建议最大电流为35mA。

在建议最大电流以内使用的激光器，仍可输出额定功率；超过建议最大电流使用激光器，将缩短激光管的寿命；超过极限最大电流使用激光器，将严重缩短激光管的寿命。

4. 技术规格

4.1. 激光管

型 号	尺 寸 长×宽×高 (mm)
F300	1740±20×200×116
X300	1760±20×200×116
F300-I	1780×260×160
X300-I	1780×260×160
F450	1760±20×285×116
X450	1760±20×285×116
F450-I	1800×345×160
X450-I	1800×345×160

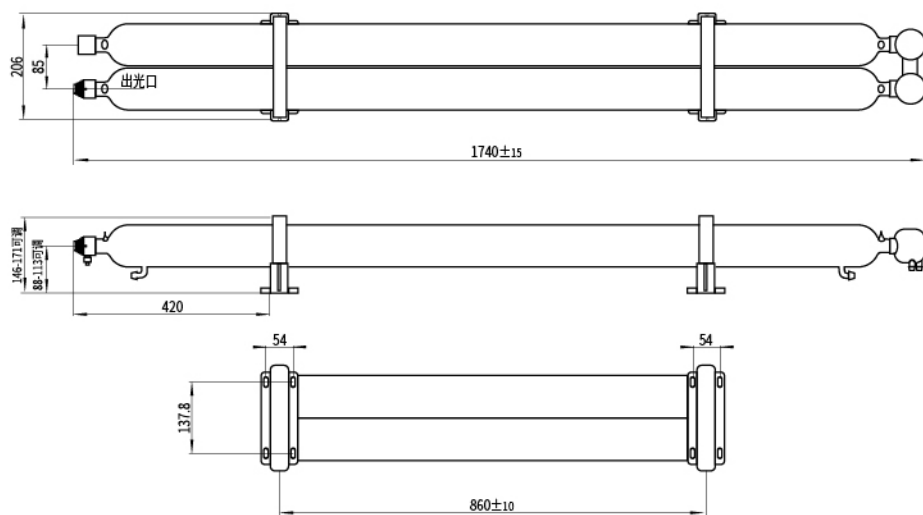
4.2. 激光电源

型 号	最大输出 电流	最大输出 电压	输入-输出	响应速度	长*宽*高 (mm)	重 量 (kg)
PS-100/150A	35mA	55kV	输入-激光管： AC1500V 10mA 60s；输出负极 和激光管相连	≤1mS（从开关 信号给出到输出 电流上升到 设定电流90%的 时间）	325*240*97	4

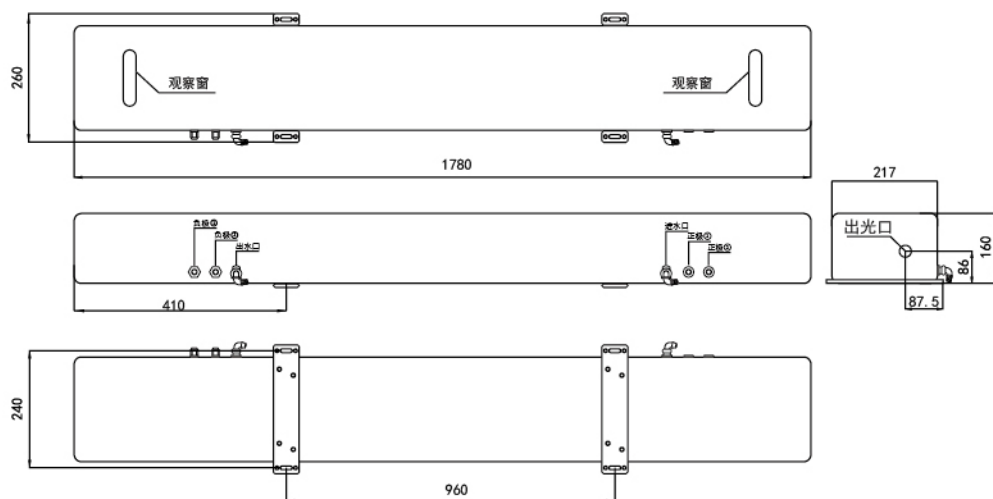
环境要求	使 用	环境要求
温 度	15-30°C	-10-35°C
湿 度	30-60% RH	20-80% RH

5. 图纸

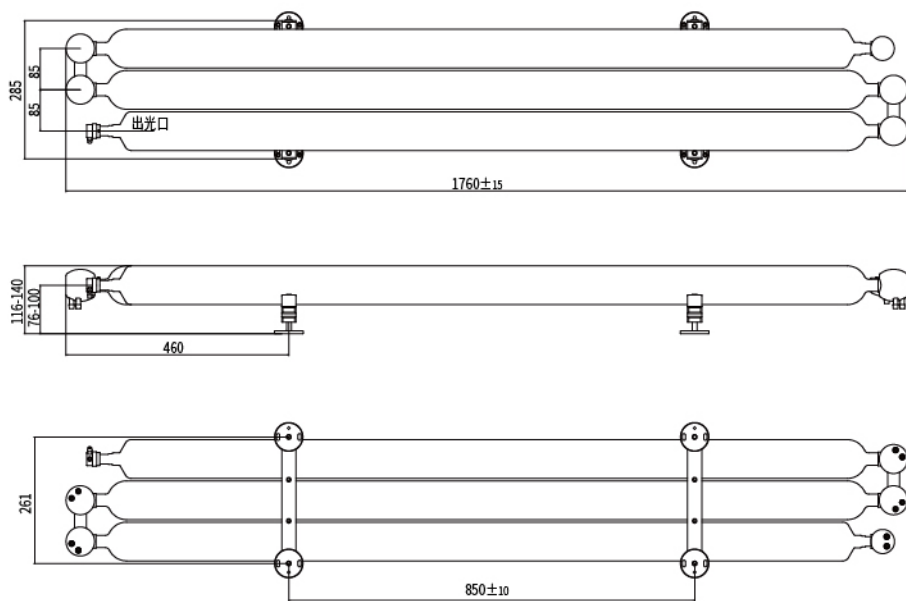
F300/X300安装尺寸图



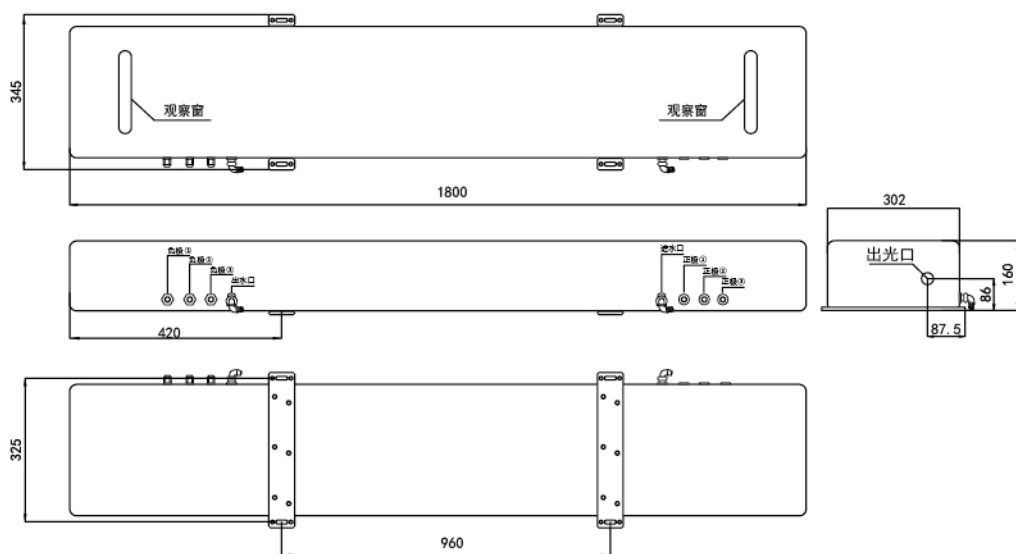
F300-I/X300-I 安装尺寸图



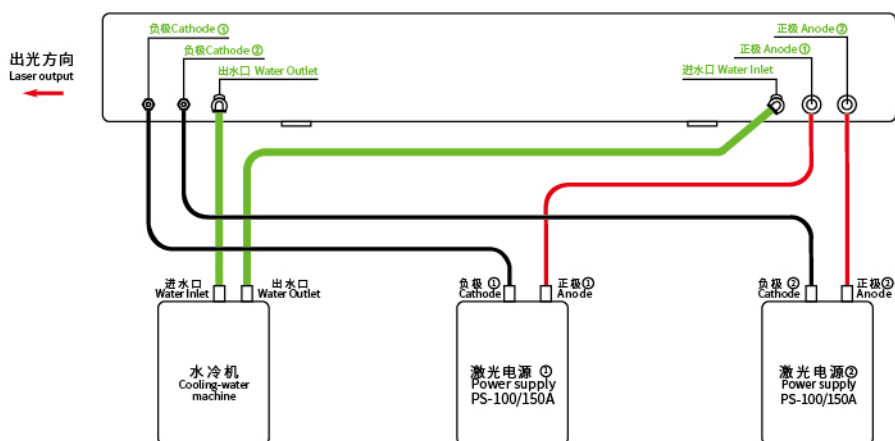
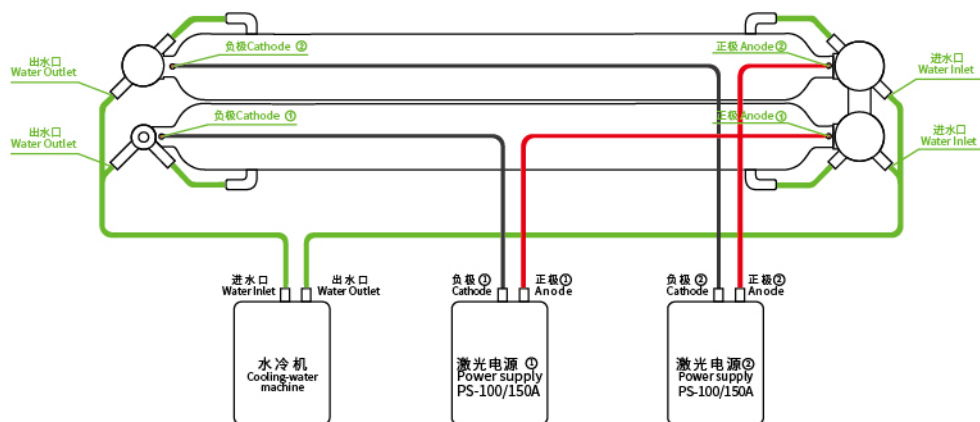
F450/X450安装尺寸图



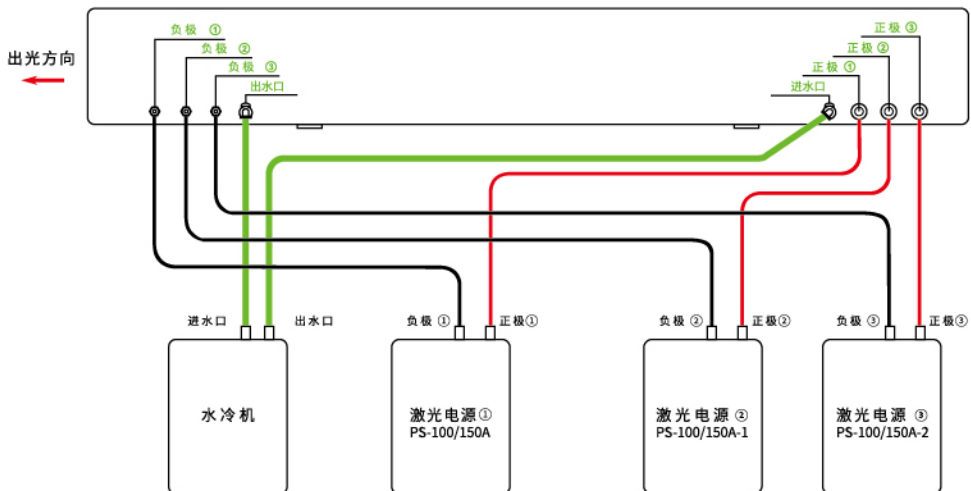
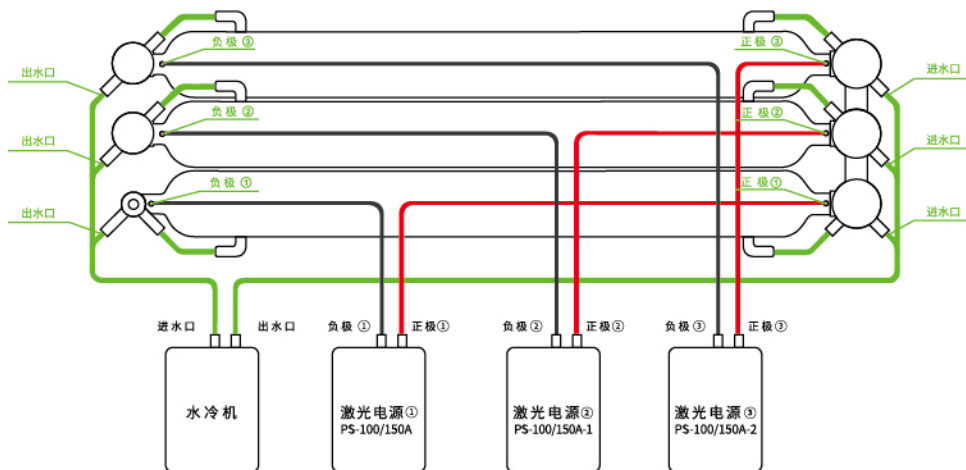
F450-I/X450-I 安装尺寸图



接线示意图 Wiring diagram



接线示意图 Wiring diagram



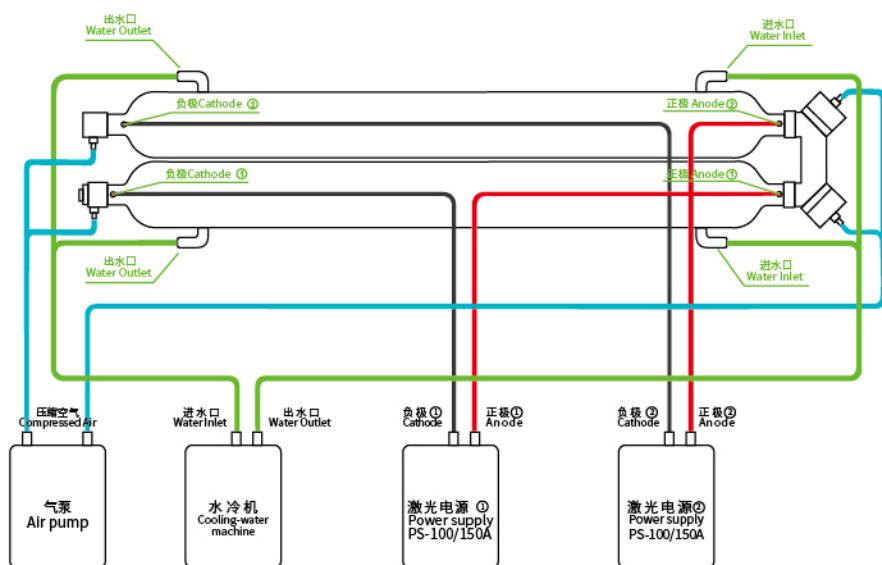
6. 气体冷却版

6.1. 冷却气体要求

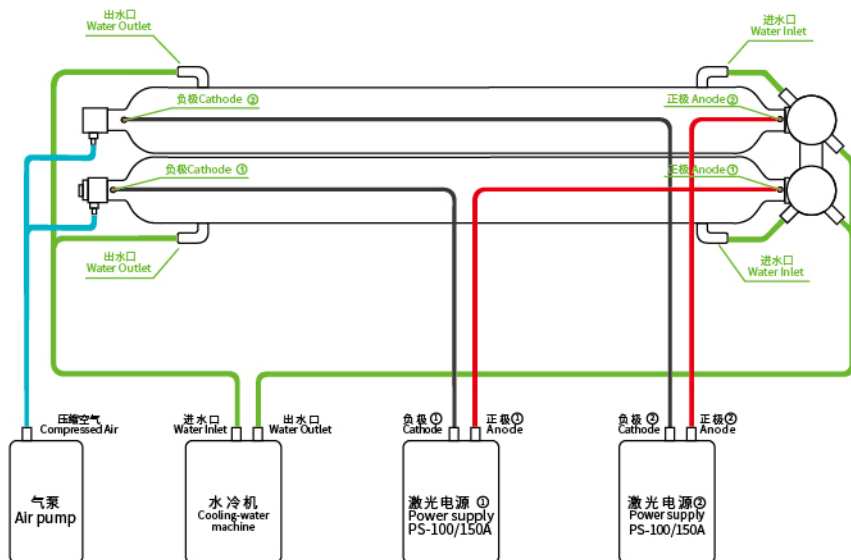
系统需要有压缩空气对镜片进行冷却。建议压缩空气气量不大于60L/min，且不小于30L/min。压缩空气的温度应保持在15~30℃。压缩空气应使用除油、除水装置，确保镜片冷却系统不被污染，否则有可能会造成激光管的严重损坏。

连接压缩空气与激光器，将直径6毫米的压缩空气气管插入激光器激光输出端的进气口，确保插入到位，不漏气，打开压缩空气阀门，确保压缩空气畅通过激光器的前后四片镜片气冷管内，并在激光器输出端排出。（请您在连接前确保压缩空气气量不大于60L/min，且不小于30L/min。）

接线示意图 Wiring diagram



接线示意图 Wiring diagram



1. Safety

1.1. Basic Information

It's totally prohibited to use this laser without training, permission, or learning safety notes.

It's totally prohibited to approaching the laser without permission. There must be DANGER signs in the laser working area.

1.2. Optical Safety

This CO₂ laser grade is Class IV: high power laser. Both the laser direct beam & mirror-reflected beam could injure eye and skin HEAVILY. Even if the diffuse laser could injure eye.

During laser working, the operator or any body around should wear certificated protection glasses that the wave length is same as the CO₂ laser: 10.6μm. Do not expose the eyes onto the laser beam even if wearing protection glasses.

Make sure the laser beam is not reflected back to the CO₂ laser, or it will damage the CO₂ laser itself.

1.3. Electrical Safety

Warning: the power supply of the laser inputs AC and outputs 40KV high voltage DC, there could be electricity remained even if powered off.

Do not open the power supply shell.

Warning: when the power supply is powered on, please do not touch the laser tube body, do not approaching the end of the laser tube (the high voltage side).

2. Preparation & Installation

2.1. Coolant Requirement

The CO₂ laser requires for chiller with cooling function. The chiller should use pure water. Recommended Model: Model:F300/F300-I X300/X300-I S&A:CW-6000
Model:F450/F450-I X450/X450-I S&A:CW-6100

The chiller should be able to control temperature between 15-25℃, and the flow should be more than 13L/min, refrigeration capacity should be more than 3.0KW.

2.2. Environment Requirement

The laser working environment should be temperature 15-30℃, humidity 30-60%. For power supply cooling, there should be enough air flow. And the environment should be clean, no dust which pollutes the laser and the power supply.

2.3. Package

If the CO₂ laser package was damaged when you got it, please do note down the extent of damage on the waybill;

For stock or transportation requirement, please keep the original package carefully.

2.4. Return to Us

If the CO₂ laser has to be sent back to us, please contact us for permission before sending back, and use the original good package.

Note: before packing, please empty the water inside the laser tube.

2.5. Installation Procedure

Warning: before install the laser tube and , please wear the protection glasses first.

There should be enough space for power supply and chiller for air flow cooling purpose.

Laser power supply and laser connection

Model:F300/F300-I X300/X300-I

Connect the first group of wires of the laser power supply to the first group of positive and negative poles of the laser, respectively; the laser output terminal is the negative pole (tube 1-), connected to the negative pole line (V-1) of the laser power supply; the other end of the laser is Positive pole (tube 1+), connected to the positive pole line (V+ 1) of the laser power supply;

tive and negative poles of the laser, respectively; the laser output terminal is the negative pole (tube 2-), connected to the negative pole line (V-2) of the laser power supply; the other end of the laser is Positive pole (tube 2+), connected to the positive pole line (V+2) of the laser power supply;

Note: The two sets of lines of the two laser power supplies should be connected to the two laser tubes respectively, and the two sets of lines of the two laser power supplies must not be cross-connected to the two laser tubes;

Model:F450/F450-I X450/X450-I

Connect the first group of wires of the laser power supply to the first group of positive and negative poles of the laser, respectively; the laser output terminal is the negative pole (tube 1-), connected to the negative pole line (V-1) of the laser power supply; the other end of the laser is Positive pole (tube 1+), connected to the positive pole line (V+1) of the laser power supply;

Connect the second group of wires of the laser power supply to the second group of positive and negative poles of the laser, respectively; the laser output terminal is the negative pole (tube 2-), connected to the negative pole line (V-2) of the laser power supply; the other end of the laser is Positive pole (tube 2+), connected to the positive pole line (V+2) of the laser power supply;

Connect the third set of wires of the laser power supply to the third set of positive and negative poles of the laser, respectively; the laser output end is the negative pole (tube 3-), connecting the negative pole wire (V-3) of the laser power supply; the other end of the laser is the positive pole (tube 3+), connecting the positive pole wire (V+3) of the laser power supply;

Note: The separate three sets of wires for the three power supplies shall be connected to the three laser tubes separately, and the separate three sets of wires for the three power supplies shall not be cross-connected to the three laser tubes;

3. Operation Procedure

3.1. Working Current

If the working current is less than 10mA, the electrical-discharge will be unstable, and the laser output will be also unstable, the beam spot mode will be poor.

The recommended working current is 35mA.

Under recommended working current, the laser will output the rated power; over the recommended working current, the laser tube working life will be reduced; over the max current, the laser tube working life will be very short.

4. Specification

4.1. Laser Tube

Model	Size L*W*H (mm)
F300	1740±20×200×116
X300	1760±20×200×116
F300-I	1780×260×160
X300-I	1780×260×160
F450	1760±20×285×116
X450	1760±20×285×116
F450-I	1800×345×160
X450-I	1800×345×160

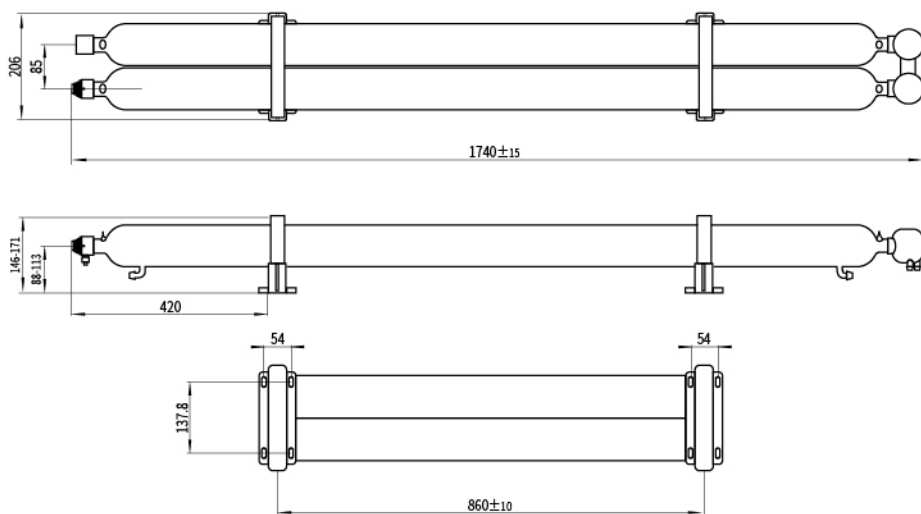
4.2. Power Supply

Model	Maximum output current	Maximum input current	Input-Output	responding speed	L*W*H (mm)	weight Kilogram (kg)
PS-100/150A	35mA	55kV	Input: laser tube AC1500V 10mA 60s; output negative electrode is connected to the laser tube	≤1mS (the time from when the switch signal is given to when the output current rises to 90% of the set current)	325*240*97	4

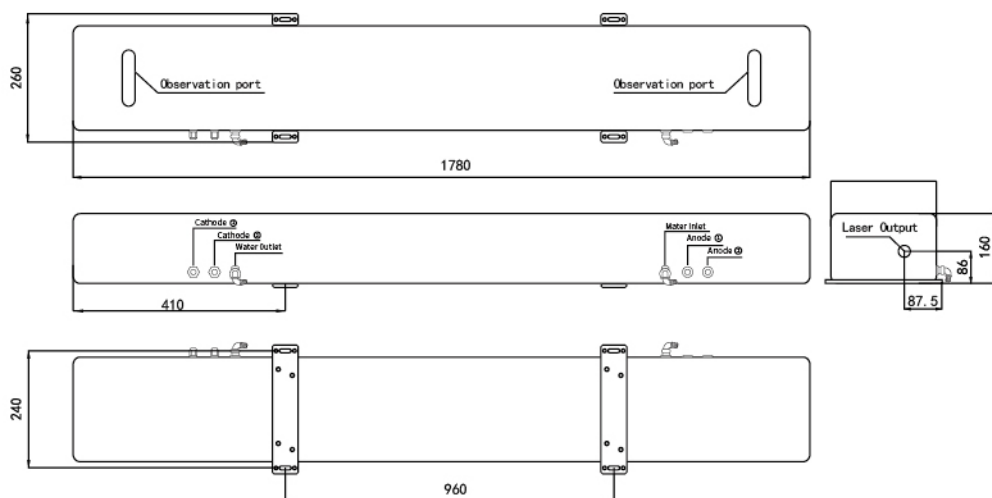
Environment	Using	Storage
Temperature	15-30°C	-10-35°C
Humidity	30-60% RH	20-80% RH

5. Installation Diagram

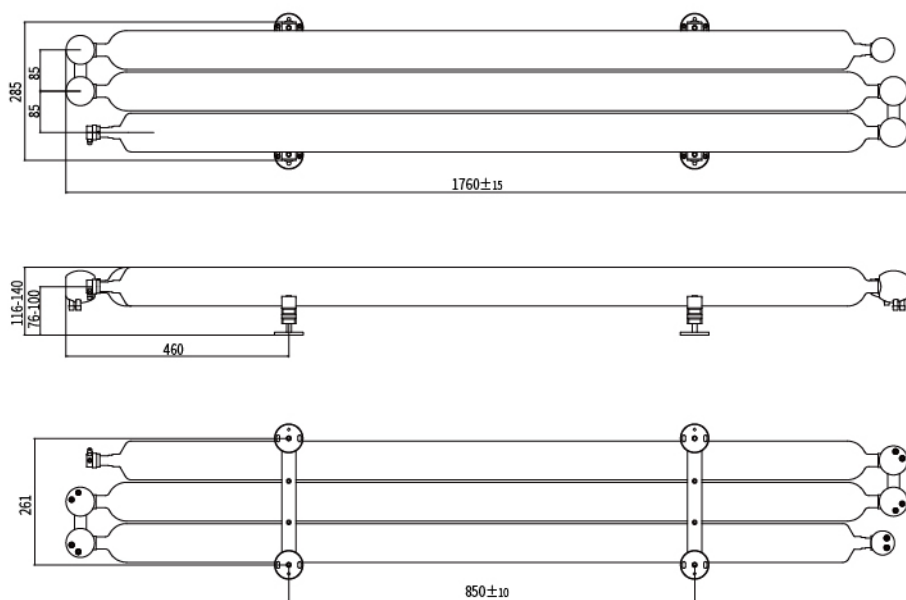
INSTALLATION DIAGRAM OF CO₂ LASER TUBE MODEL F300/X300



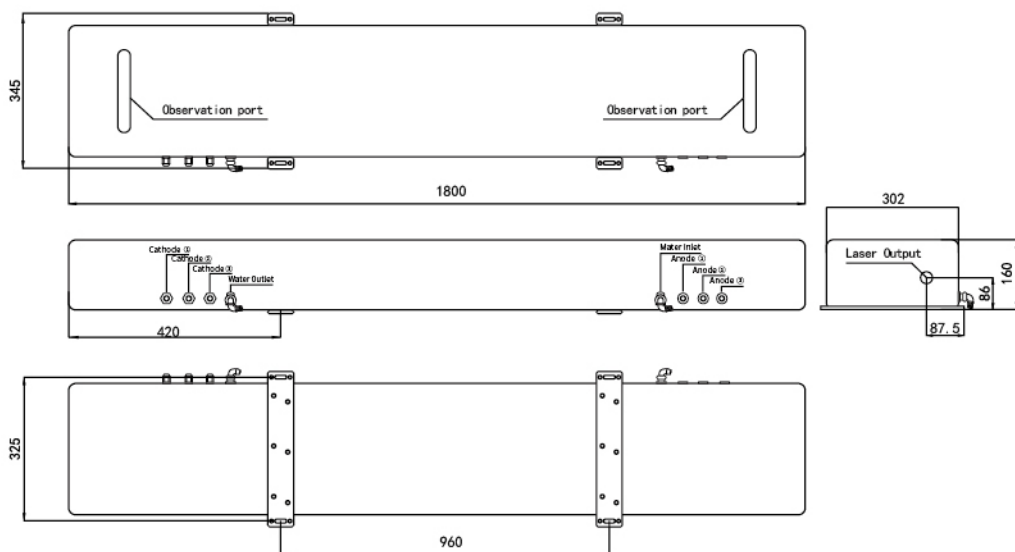
INSTALLATION DIAGRAM OF CO₂ LASER TUBE MODEL F300-I/X300-I



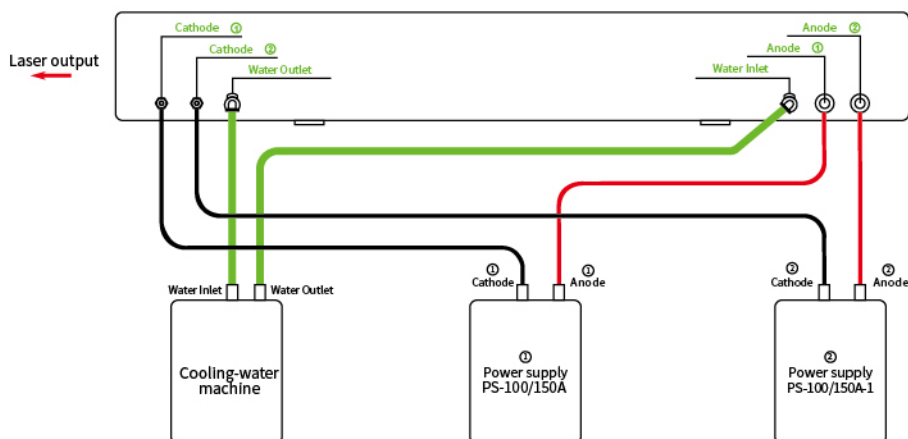
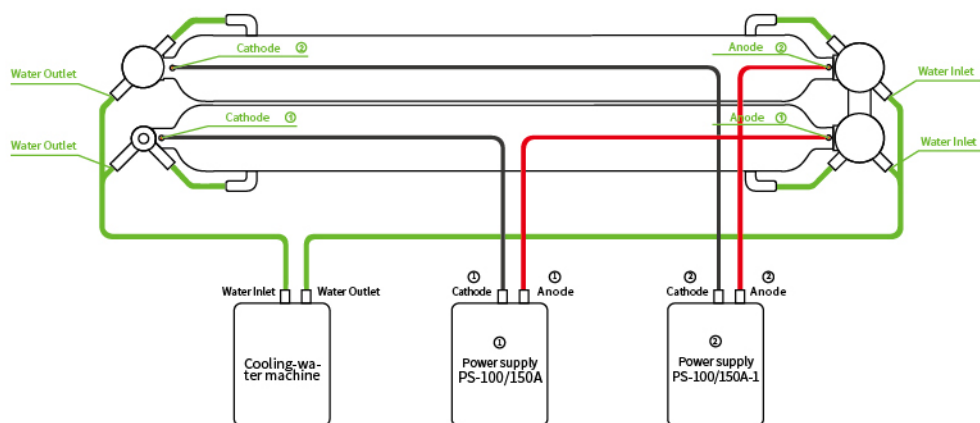
INSTALLATION DIAGRAM OF CO₂ LASER TUBEMODEL F450/X450



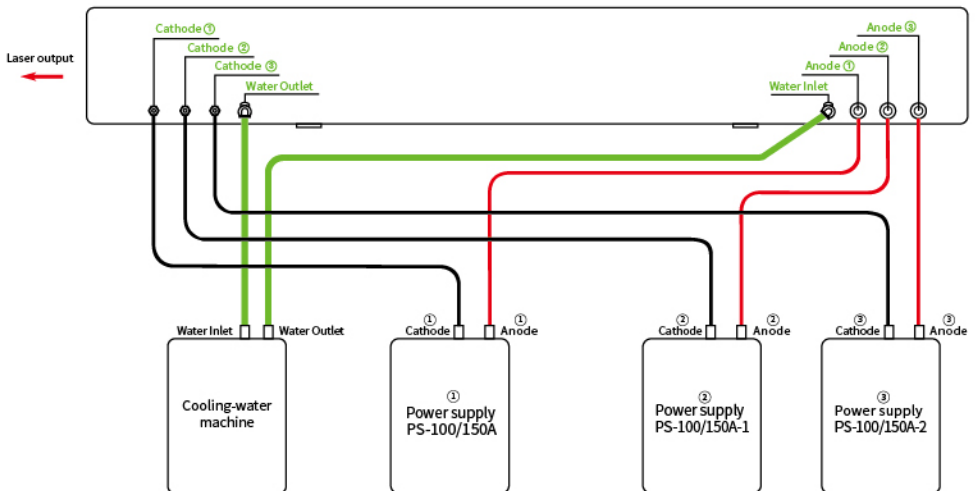
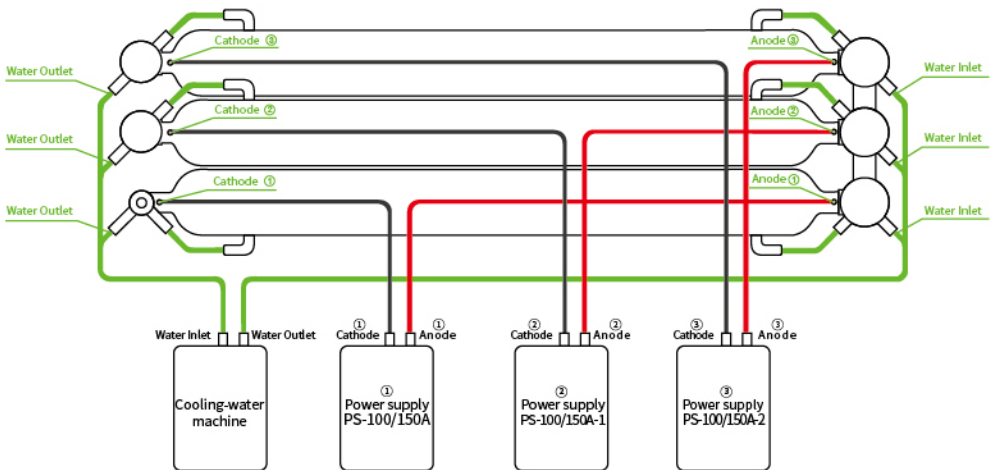
INSTALLATION DIAGRAM OF CO₂ LASER TUBEMODEL F450-I/X450-I



Wiring diagram



Wiring diagram

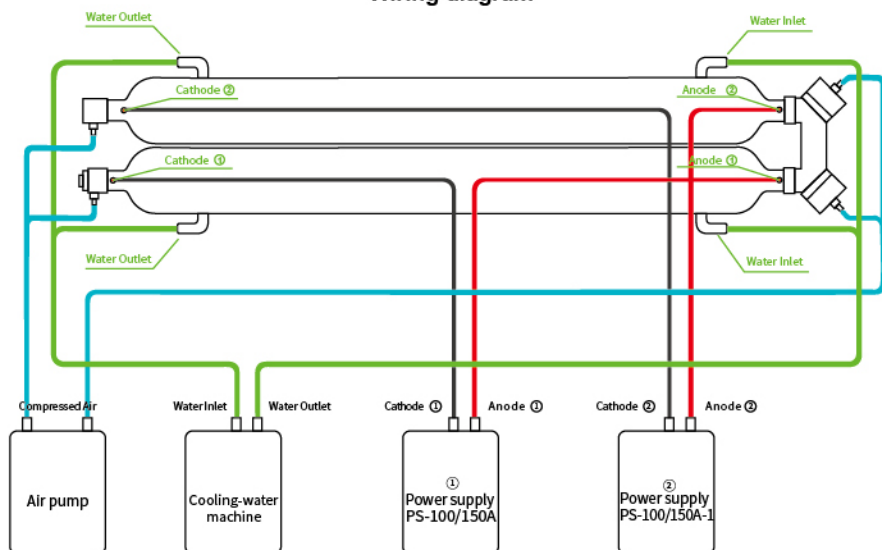


6. Gas cooling Version

6.1. Cooling gas requirements

Connect the compressed air and laser, insert the 6 mm diameter compressed air pipe into the laser output end of the laser, and ensure that the insertion is in place and the air is not leaking. Open the compressed air valve to ensure that the compressed air passes through the laser's front lens air-cooling tubes and is discharged at the output end of the laser. (We recommend the compressed air volume is less than 60L/min and more than 30L/min.)

Wiring diagram



Wiring diagram

