Beijing Dawei Laser Technology Co., Ltd.

Content

Company Introduction

Beijing Dawei Laser Technology Co., Ltd. is professional high-tech enterprise in the laser industry with elites from laser area, optics area, electrics and mechanical field, and computing industry. Our company has been engaged in R&D and production for RF CO2 laser tube for more than 10 years.

Our products are widely used in medical, cosmetic, electronic components, machinery parts, laser engraving, laser marking, packaging, printing and other industries. We have supplied our core products to more than 100 customers all around domestic market and overseas market has been to provide many relevant enterprises core components.

The company has an excellent R & D team to strive for excellence of high technology in laser area, we dedicate to produce and provide high quality products for the domestic and international customers with the best technical support and after-sales maintenance services.

Since the establishment of the company, it keeps "professional, honest, trustworthy" as business philosophy, and approaches "the most reasonable prices, the most complete services, providing the best products," as service goal, and sets "provide first-class products and services " as business goal. Our company is one of best laser related products maker with professional technical personnel, modern management system, diligent dedication of the marketing team by hard work and excellent governance.

In order to maintain the leading technology, build long-lasting business, our company continues to increase investment in scientific research, adhering to the people-oriented and service-oriented, is committed to wide spread our brand to all over the world to create the greatest value of development for our company.

Hazard Information

Hazard information includes terms, symbols, and instructions used in this manual, or on the equipment, to alert both operating and service personnel to the recommended precautions in the care, use, and handling of Class 4 laser equipment.

Terms

Certain terms are used throughout the manual or on the equipment labels. Please familiarize yourself with their definitions and significance.

 Danger — Imminent hazards which, if not avoided, will result in death or serious injury.

 Warning — Potential hazards which, if not avoided, could result in death or serious injury.

 Caution — Potential hazards or unsafe practices which, if not avoided, may result in minor or moderate injury.

General Hazards

 Danger – Serious Personal Injury

This Class 4 laser product emits invisible infrared laser radiation at 10.6μm.

Do not allow laser radiation to enter the eye by viewing direct or reflected laser energy. CO_2 laser radiation can be reflected from metallic objects even though the surface is darkened. Direct or diffuse laser radiation can inflict severe corneal injuries leading to permanent eye damage or blindness. All personnel must wear eye protection suitable for 10.6μm CO_2 radiation when in the same area as an exposed laser beam. Eyewear protects against scattered energy but is not intended to protect against direct viewing of the beam. Never look directly into the laser output aperture or view scattered laser reflections from metallic surfaces.

Enclose the beam path whenever possible. Exposure to direct or diffuse CO_2 laser radiation can seriously burn human or animal tissue, which may cause permanent damage.

This product is not intended for use in explosive, or potentially explosive, atmospheres.

 Warning – Serious Personal Injury

U.S. customers should refer to and follow the laser safety precaution described in the American Nation Standards Institute (ANSI) Z136.1-2007 document, Safe Use of Lasers. Procedures listed in this Standard include the appointment of a Laser Safety Officer (LSO), operation of the product in an area of limited access by trained personnel, servicing of equipment only by trained and authorized personnel, and posting of signs warning of the potential hazards.

European customers should appoint a Laser Safety Officer (LSO) who should refer to and follow the laser safety precautions described in EN60825.1-2007, Safety of Laser Products.

 Warning – Serious Personal Injury

Materials processing with a laser can generate air contaminates such as vapors, fumes, and/or particles that may be noxious, toxic, or even fatal. Material Safety Data Sheets (MSDS) for materials being processed should be thoroughly evaluated and the adequacy of provisions for fume extraction,

filtering, and venting should be carefully considered. Review the following reference for further information: ANSI Z136.1-2007, Safe Use of Lasers.

 Warning – Serious Personal Injury

The use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.

Laser Safety

To prevent exposure to direct or scattered laser radiation, follow all safety precautions specified throughout this manual and exercise safe operating practices per ANSI Z136.1-2007 always when actively lasing.

Always wear approved Laser Safety Glasses with a minimum OD (Optical Density) 4.27 for a wavelength of 10.6μm.

A CO_2 laser can ignite most materials under the proper conditions. Never operate the laser in the presence of flammable or explosive materials, gases, liquids, or vapors.

Other Hazards

The following hazards are typical for this product family when incorporated for intended use: (A) risk of injury when lifting or moving the unit; (B) risk of exposure to hazardous laser energy through unauthorized removal of access panels, doors, or protective barriers; (C) risk of exposure to hazardous laser energy and injury due to failure of personnel to use proper eye protection and/or failure to adhere to applicable laser safety procedures; (D) risk of exposure to hazardous or lethal voltages through unauthorized removal of covers, doors, or access panels; (E) risk of exposure and/or interference from radio-frequency (RF) electro-magnetic energy through unauthorized removal of covers, doors, or access panels; (F) generation of hazardous air contaminants that may be noxious, toxic, or even fatal.

Introduction

This guide provides the basic information needed to operate an Iradion Laser. This laser is designed for use while integrated within a system and is not designed to meet CDRH requirements as a stand-alone product. As such, the user must be aware of certain requirements before use.

CDRH

This is an OEM laser component that has been designed for integration into a functioning laser system. As a stand-alone device, it cannot be turned on and therefore does not incorporate all the safety features required by the Center for Devices and Radiological Health (CDRH). Provisions for the incorporation of these safety features are available, and it is expected that the user will apply them and fully comply with all CDRH requirements.

Available Safety Features

The following safety features are available as electronic signals on the rear panel interface:

Interlock

Upon contact closure, allows the system to operate. An open connection will prohibit the laser from firing.

Key switch

Upon contact closure, allows the laser to fire after imposing a 5-second delay. (Key switch function is program version dependent.)

Power up in Fault

Requires the key switch to be cycled. (Program version dependent.)

Lase signal

Output signal indicating the laser is firing.

Fault signal

Output signal indicating the malfunction of an internal component or the electronics.

Indicator lights

DC Power, Temp Warning, Interlock, Fault, Ready, Lase.

Caution

The lasers are waveguide lasers with a “slab” unstable optical resonator. The resulting elliptical beam is corrected by a cylindrical lens in the black extension tube mounted to the faceplate. This assembly is exactly positioned so that the beam direction is close to the original elliptical beam. Removal of the cylindrical lens assembly will result in the loss of this original alignment and will require a procedure for replacement.

Caution

The optical intensity at the cylindrical lens is VERY high (>6000W/cm^2). Any contamination to the optical surface could cause runaway destruction of the

lens. Do NOT burn materials close to the lens or leave fingerprints on the lens.

Caution

The cylindrical lens comes with a pink plastic cap that covers the lens for protection. Remove this cap before applying DC power. Firing the laser through the cap WILL cause permanent damage to the lens.

Model D35L Laser Specification working condition

Model	D35L
Wavelength	10.6μm
CW Output Power	≥35W
Power Stability	
Mode	
Beam Size	1.8mm
Beam Divergence	7.5±0.5mrad
Mode Quality	＜1.3:1
Polarization	(＞100:1） fixed linear
Operating frequency and the duty cycle	0～25KHZ，0～100%DC
weight	6.6kg（14.5lbs）
size	357×92.5×142mm
Input voltage	48VDC±2%，
Input DC current	≤12A
thermal load	＜600W
Ambient Air Temperature	5℃~40℃(41℉~104℉)
Altitude	＜2000m(6，500ft.)
Humidity	Non-condensing
Shipping and storage environments	-10℃~60℃(14℉~140℉)

Attention:

1. Laser power is tested according to the temperature of laser which is 25, everytime the laser temperature rises 1℃, the output power will reduce 1%.
2. Definition of stabilization: ±（Pmax－Pmin）/（2Pmax）.
3. Testing condition of stabilization: Warming up about 10mins, controlling duty cycle constantly, under the normal operating environment.

D35L Laser signal wiring method & Note

Connector	Wiring instruction	Signal instruction
8	Correspond marking or cutting card of PWM positive signal	RF Enabled
6	2 and 6 short circuit	Laser status output TTL Logical output:0=Laser ok,1=Laser fault
2		Control enabled TTL Logical input:0=laser control enabled,1=Laser control off
1、3、4	Correspond marking or cutting card of PWM signal ground	GND

Notice:

1) 48V 30A power supply required grounding
2) Note the dust protection of the laser output window. Prevent the lens from burning due to dust particles. Especially the way laser output window faces up.
3) Be careful to prevent backward reflection, any backward reflection can cause laser damage.
4) We suggest that the front and back end of the laser shouldn't be all fixed at the same time, avoid the deformation of the cavity of the laser cavity due to the stress caused by the heat expansion and shrinkage of the material
5) The fan is inhaled, there must be enough space (greater than 3CM) around the radiator to heat the air, clean the fan in time to ensure good ventilation.

If there are any problems during the usage of the laser, please contact us for your timely solution.

Utility Requirements and System Installation

Unpacking and Inspection

Before unpacking the laser components, inspect the shipping carton for evidence of rough handling, and note any damage. If damage to the shipping carton is evident, request the carrier's agent be present when the unit is unpacked. Inform the Shipping carrier and DAVI of any evidence of damage in shipment. The Buyer and shipping carrier are responsible for any damage which occurs during shipment.

Verifying Delivery

The shipping container contains the following:

- Laser head and integral RF power supply
- Final Test Sheet
- This Operating Manual

If any of these items are missing, report this to DAVI Immediately.

Checking Delivered Items

Verify that the delivered laser head model is that same as the one ordered. If there is any discrepancy noted, contact DAVI immediately.

DAVI recommends that the shipping box and packing materials be saved, as these will be useful should the laser need to be shipped back to DAVI.

Safety Issues in Laser Installation

Installation of the D35L laser must comply with all applicable electrical safety and laser safety laws and regulations. Review Laser Safety for important information relating to Safety.

The negative (return) side of the DC input connection to the D35L RF power supply is connected internally to the chassis. The user must assure that the system into which the D35L is built protects against the possibility that the D35L laser head or RF power supply chassis could be at a hazardous voltage and
that personnel could be exposed to these voltages.

The laser must be secured properly to avoid the possibility of the laser shifting unexpectedly during operation, creating a hazardous condition. The location of the output beam of the D35L laser head is shown in Figure 3. The laser output is emitted from the aperture shown in the referenced figures and propagates within a full cone angle up to 5°. The acceptance angle of the system aperture must intercept all the output of the output of the laser.

DAVI recommends that all beam propagation paths be enclosed and that personnel operating the laser be qualified optical technicians who are familiar with this type of hardware.

Mechanical Mounting

The dimensions for the D35L laser head are shown in Figure 3. Mechanical mounting of the D35L laser head must result in on distortion or stress the laser head in any way. Otherwise, optical alignment and power stability could be adversely affected

Mounting Considerations for D35L

Certain aspects of specific customer applications may preclude absolute interchangeability of laser heads. For example, for certain applications, the sensitivity of the application to optical beam pointing errors may require optical realignment after the laser head is replaced in the customer's integrated system.

Depending on the method of mounting and the sensitivity of the integrated customer system to beam pointing errors, even removing a laser head from the customer's system, then replacing the same laser head back into the customer's system may require optical realignment. Consult issues.

DAVI recommends use of the optional brackets that are designed for mounting the laser safely without inducing any stress onto the laser. In any case, take care not to induce stress onto the laser head, as optical misalignment can occur, which would require the laser to be returned to DAVI for service. A mechanical drawing for this bracket is provided in the Appendix A. DAVI strongly encourages use of this bracket or a similar design in order to accommodate temperature changes in operation while providing secure mounting.

Ambient Air Cleanliness

D35L laser heads are designed for use in a dust-free or nearly dust-free environment. They should be installed in a protective. Housing that prevents dust or debris from contaminating the optical output window. Do not turn the laser on if there is water, dust, or dirt on the output element; otherwise, damage to the coating on this optical element may occur. To prevent such optical
damage, never allow the output window to become contaminated.

Do not allow the fins on the heat-sinking elements to become clogged with dirt, dust, or debris. They must be cleaned periodically as indicated in Section Five: Maintenance and Troubleshooting. The DAVI warranty covers defects in material and workmanship relating to the output optical element, but this warrant does not cover damage to the external output surface which is the result of contamination of the surface, or abrasion of the surface.

Air Cooling

The D35L air-cooled laser incorporates heat sinks cooled by forced air (blown by fans). The four fans draw 1 A of current when supplied with the required 48 VDC electrical power. Running the fans at higher voltages will reduce the operating life and is strongly discouraged. The user must provide the correct voltage polarity to the fans for the airflow. Direction to be enough to cool the laser adequately.

Air Flow

For the D series of air-cooled lasers, open-air flow for the laser system is critical. Therefore, DAVI requires clear access to free air within 60 mm of the cooling fans and fins for the laser system. The air used to cool the D35L must be clean and free of contaminates. This requirement be fulfilled by filtering the air at the input to the laser cavity or system equipment.

Signal Interface

The signal interface in the laser interlock system shuts the laser off when the fans fail to operate. With this approach, the laser is commanded through the signal interface to shut down if the airflow interlock system detects excessive heat. DAVI recommends that both RF Enable and Control Enable be commanded to the OFF state when the airflow interlock system detects an over-temperature fault. These signals are listed in Table 1 and further discussed in subsections of Section Four: Laser Operation.

Electrical Power Connection

The D35L laser requires 48 VDC input DC power. This power is carried from the power source to the system through the terminal block on the D35L. The
maximum current required is 12 A.

The negative (return) side of the DC input connection to the D35L RF power

supply is connected internally to the chassis.

The user must assure that the system into which the D35L is built protects against the possibility that the D35L chassis Could be at a hazardous voltage and that personnel could be exposed to these voltages. DAVI strongly recommends that the user review the precautions described in Section Two: Laser Safety regarding electrical safety before using the D35L laser. It is the user's Responsibility to provide circuit breakers and/or fusing of the AC power source, in accordance with all applicable laws and regulations.

DC Power Supply Requirements

The following are the requirements for the customer-supplied DC power supplies.

Control Signal Connection

Electrical control of the D35L laser is achieved via a RJ-45 connector built into the system. The signals carried on each of the pins are indicated in Table 1. Details about controlling the laser through the signal interface are discussed in Laser Operation.

DAVI highly recommends use of shielded interface cables. The interface cable shield must connect to the chassis ground of the controller. In addition to proper shielding, this shield provides a secondary connection for the signal ground (Pin #8).

A floating ground connection (use of un-shielded interface cable or no return path between the host control electronics and the laser) can present an unsafe condition and result in unstable or unexpected operation of the laser. This condition can arise when the control signal ground connection (Pin #8) is lost and the Control Enable (Pin #7) and RF Enable (Pin #1) remain high. Therefore, DAWEI strongly recommends that a second safety ground be provided either via a shielded control cable or common potential chassis mounting between the laser head and the control electronics.

Laser Operation

Signal Interface Connectors

For all D35L laser, the signal interface between the D35L laser and the customer's equipment is through a RJ-45 connector that is built into the RF power supply. The pin assignments for the interface are indicated in Table 1. The signal interface and its use are discussed in detail in this section.

Table 1. Signal Interface Description and Connector Pinout

PIN NO.	
1	RF Enable TTL logic input; 1=RF ON, 0=RF OFF; 1 kΩ impedance This input turns on the laser. See also Pin 7, Control Enable, below
2	+15 VDC ±.5 VDC, .25 Amps Max output for customer use
3	LASER OK TTL logic output; 1=LASER OK, 0=LASER Fault; I =-0.4 mA, I =8 mA Output is asserted when no faults (SWR, Temp. Or Volt.) are detected
4	Temperature OK TTL logic output; 1=Temp OK, 0=Temp Fault; I =-0.4 mA, I =8 mA Output is asserted when temperature is below maximum value
5	Voltage OK TTL logic output; 1=Voltage OK, 0=Voltage Fault; I =-0.4 mA, I =8 mA Output is asserted when DC supply voltage (V) is below max. value
6	Must be connected to GND
7	Control Enable TTL logic input; 1=Laser Control Enabled, 0=Laser Control Disabled This input must be asserted before RF enable can used to turn on laser
8	GND
Notes: 1) Connector used is RJ-45 type. 2) These specifications are subject to change.	

To avoid damage to the RF power supply, make sure your electronic controller is compatible with the interface described in Table 1.

As noted in Section Two: Laser Safety, the signal interface is designed to provide a high degree of reliability in the control of laser on any use of the signal interface in safety interlock subsystems, or in any other subsystem which affects personnel safety.

Operating Modes

All D35L lasers can be operated in continuous wave (CW) mode or Gated CW mode. Each mode is described in the following sections; details about how to operate the laser in each mode is also discussed.

In the following sections, the assumption is that the laser has been initially started so the laser is now ready for operation.

Typical Waveform

Figure 1 illustrates a typical periodic pulsed laser waveform. The RF input to the laser will generally follow the "RF Enable" signal (Table 1). The laser output will generally follow the RF input, but will be distorted.

The pulse repetition frequency is PRF = $\frac{1}{T}$ T = period of the waveform

The duty cycle is DC = $(\frac{\tau}{T})$ 100 τ = the pulse width

CW Mode

To command any D35L laser to operate in CW mode, "RF Enable" must be set continuously to Logic Level 1 (high).

Pre-Ionization

Pre-ionization is a feature of the D35L laser that provides ease of start-up and improved pulse timing. Upon 48 VDC Power-up the D35L will automatically begin
a pre-ionization pulse sequence.

During the first approximately 40seconds the Laser OK fault Condition will be assured (Laser OK=false). It is not possible to operate the D35L during this period. Under normal conditions, after 40 seconds the Laser OK will automatically return to Laser OK = true and the laser is ready to operate.

Gated CM Mode

The D35L laser can produce a wide range of pulse repetition frequencies (PRFs), pulse widths, and duty cycles in Gated CW mode. RF Enable pulse widths of less than 1 μs and/or PRFs greater than 25 kHz are not advisable. Except for these restrictions on pulse widths and PRFs, the RF power support any duty
cycle from zero to 100% in Gated CW mode.

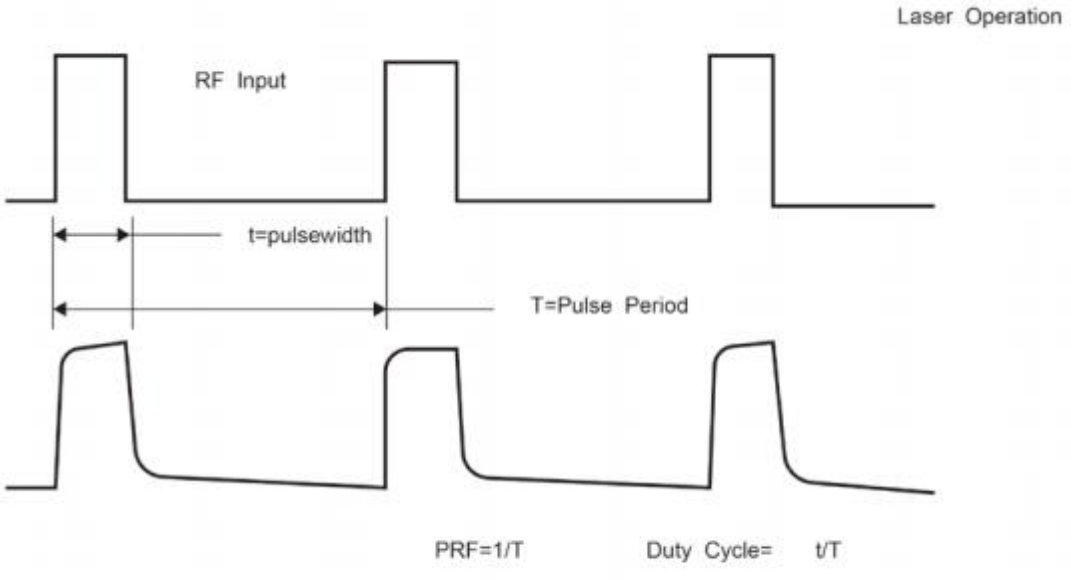


Figure 1

Variable Output Power Capability; Pulse width Variation

All D35L lasers provide the capability to vary the average laser output continuously from near zero to least the CW output power specified in Table 1- 1. The user implements this capability by adjusting the pulse width of the input command "RF Enable Select".

Optical Pulse Shape

When the pulse width of the input digital signal "RF Enable" Is varied, the Pulse width of the RF input to the laser's electric discharge is also varied. Because of

the complex dynamics of the electric discharge and the laser resonator, the optical output from the laser will be a distorted version of the RF input waveform. To vary the laser output power, adjust the RF pulse width in Gated CW mode, with the recommended lower limit on pulse width at 1 μs.

Complex Modulation Waveforms

There are a variety of potentially useful Modulation waveforms in addition to simple periodic waveforms with a single pulse per period of the waveform

Varying the Pulse width

Some users may require pulsed output with fixed pulse width but variable pulse energy. It is possible to approximate the desired optical output by pulsing the laser at a relatively high PRF (e.g.,25 kHz), then envelope-modulating at a lower PRF (e. g., 1 kHz). Variation of the pulse width of the 25 kHz modulation would provide the ability to vary the pulse energy of the 1 kHz pulses continuously.

Protection from Unacceptable Inputs

The D35L laser easily accommodates complex modulation waveforms. The laser system will protect itself from damage due to inappropriate inputs, even for such complex input waveforms.

Turning the Laser On and Checking Output Power

The following steps detail the method to turn a D35L laser on and to perform an output power check.

1. Ensure that the laser output aperture is clear and free of packing material.
2. Place a laser power meter head in a position to intercept the output beam, and turn on the power meter.
3. Verify that the system does not have condensation on its outer surfaces.
4. If the D35L laser is built into a system with safety interlocks, verify that all required laser safety interlocks are positioned for laser operation.
5. Verify that other safety features, such as equipment covers, shutters, and warning lights are functional and operating properly.
6. Verify the solid electrical connection between the negative DC input terminal on the system and earth ground.
7. Ensure that all safety procedures, such as use of laser safety goggles as detailed in Section Two: Laser Safety are observed.
8. Turn AC power to the DC power supply on.
9. Turn DC power to the system on.
10. Set the user-supplied control equipment to activate the laser in CW mode, in accordance with the instructions below.
11. After a few seconds of laser operation, read and verify the power level. The laser output should meet or exceed the laser output power specification given in Table 1.
12. Set the user-supplied control equipment to deactivate the laser.
13. Turn DC power off.
14. Turn AC power off.

Electronic Control

Your D35L laser is controlled through the electronic interface described by Table 1. In this section, additional information is provided about the use of this control interface.

Use of the control interface in any strategy for assuring personnel safety must comply with the design guidelines discussed in：Laser Safety.

Electronic Signals Required to Turn the Laser On

The laser can be commanded electronically to turn on any time during which

DC power is applied to the RF power supply and the RF power supply is connected to the laser head properly. DAVI recommends that all the control signals be set to their "off" condition until DC power is applier to the RF power supply.

Start-up Sequence

The following steps detail how to turn the laser on in CW mode.

1. Apply DC power to the laser. Note that this will initiate the pre-ionization pulse stream and laser will be locked out of operation for approximately 30 seconds. During this time the "LaserOK" fault signal will indicate a fault condition.
2. Set "Control Enable" (Pin 7) to "TTL high" (logic 1). This enables the RF power supply by enabling DC power to an internal control board.
3. After the "LaserOK" pulse how returned to a true condition, activate "RM enable".
4. Set "RF Enable" to login 1 (pin 1. This activates the RF output of the FR power supply.

Response Times of Laser to RF Enable and Control Enable

The response time of the RF power supply to "Control Enable" (Pin 7), and to "RF Enable" (Pin 1) are quite different. The response to "RF Enable" is on a microsecond time scale, whereas the response to "Control Enable" is on a time scale of milliseconds.

This difference is not significant if the objective is to use the power supply only in CW mode. However, if it is desired to use the power supply in Gated CW mode, it is important to consider the response time of the power supply.

In general, it is best to turn the DC power supply on with "Control Enable" and leave it on while modulating "RF Enable" as required.

Signals Used for Fault Detection

Several of the signals listed in Table 1 may be used at the customer's discretion for diagnosing faults the laser system.

The approach that provides the easiest access to these signals is to provide indicators, such as light-emitting diodes (LEDs), on the customer's system control console for three of these signals. One way to use these signals is to sink the current for one LED on the operator's control panel with each of the following three Signal leads:

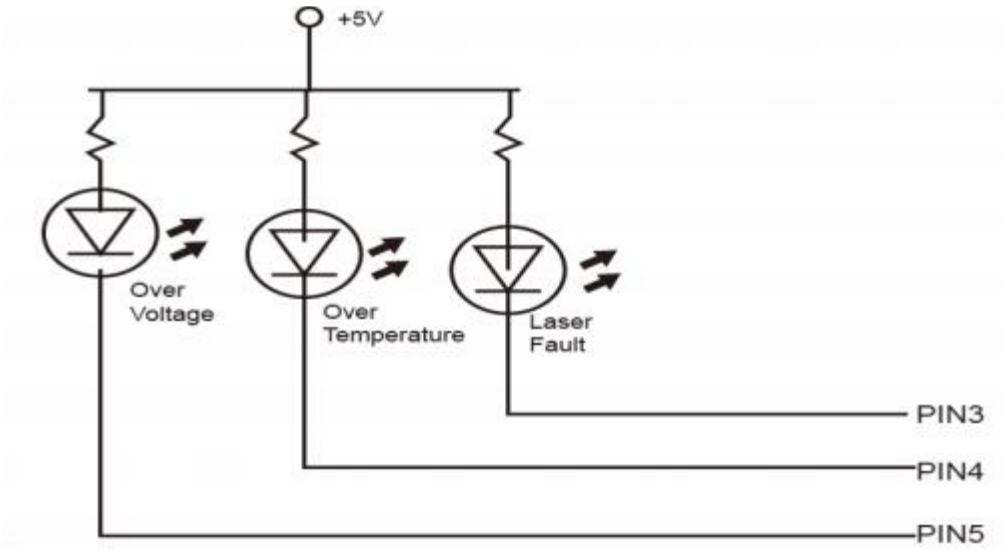


Figure 2. Fault Detection Circuit

Laser OK (pin 3): This signal indicates a composites fault if either over temperature, or voltage are at fault. The LaserOK will indicate a fault condition on power up of the 48VDC supply for a period of approximately 30 seconds.
Temperature OK(pin 4): This signal indicates an over temperature fault, This will trip at a laser head temperature Of approximately 65℃.

Voltage OK (pin5): This signal will indicate a fault if V_{DD} Exceeds 55 VDC.

Maintenance and Troubleshooting

The D35L laser requires no routine maintenance. However, the air-cooling system may require maintenance, as described below.

Air Cooling system maintenance

Ambient air cleanliness must be maintained for fans and heat sinks to operate properly. Cooling efficiency will degrade if the fans and heat sinks accumulate dust and dirt particles. The user must clean and vacuum any dust and dirt particles from the heat sinks and fans approximately every six months, or as needs.

Cleanliness of Output Optical Element

The laser head must never be activated if the output optical element is contaminated by water, dust, or any contaminant. Operation of the laser head with any contaminant on the surface of that optical element may result in damage to the coating. If any contamination is present, the laser must be returned to DAVI so the problem can be corrected. The customer's system design should also be reviewed to prevent a recurrence of the contamination problem.

Troubleshooting

DAVI recommends that the following checks be performed before calling for service.

DC power and voltage

Verify that DC power is available to the RF power supply. Verify that the voltage on Pin 2 of the signal interface connector is (+15±0.5) VDC, as shown in Table 1.

If the voltage is not within the specified range, the RF power supply is faulty and the laser must be returned to DAVI.

Over Temperature shutdown

If the fault detection signal named "Temperature OK" (Pin 4 in Table 1," signal Interface Description and Connector Pinout") is active, troubleshoot the cooling system to determine why the RF power supply appears to be overheating.

Control Inputs

Verify that the control inputs at the interface connector are set to appropriate values in accordance with Table 1, "Signal Interface Description and Connector pinout," on page 15.

The fault detection signals form the RF power supply are discussed in the section titled "Signals Used for Fault Detection" on page 4-6.

CW Mode

If the laser output is non-zero, measure the laser output power in CW mode and compare it to the output power specified for your laser model in Table 1-2 on page 5.

The signal inputs required to place the laser in CW mode are discussed in the section titled "CW Mode" on page 16.

Control Inputs

Verify that the control inputs at the interface connector are set to appropriate values in accordance with Table 1, "Signal Interface Description and Connector Pinout," on page 15.

The fault detection signals from the RF power supply are discussed in the

section “Signals Used Fault Detection” on page 4-6.

Over-Temperature Shutdown

The D35L comes equipped with a temperature fault sensor. This sensor is located inside the RF supply module in the vicinity of the RF power amplifier. This sensor detects an over-temperature condition when this RF amplifier is approximately 100℃. Under normal conditions (fans operating with free air
flow), this corresponds to a case temperature of approximately 85℃.

Determine why the over-temperature fault is activating and correct this problem. The laser will not be damaged by an over-temperature.

If the fault detection signal “Temperature OK” (Pin 4 in Table 1 on page 4-1) is active, the temperature of the laser has exceeded 90℃. Troubleshoot the cooling system to determine why the laser appears to be overheating.

CW Mode

If the laser output is non-zero, measure the laser output power in CW Mode and compare it to the output power specified for your laser model in Table 1-2 on page 5.

The signal inputs required to place the laser in CW mode are discussed in the section titled “CW Mode” on page 16.

Visualizing

If the laser output is non-zero and you have access to visually inspect the spatial structure of the output beam, perform such a visualization and record the results.

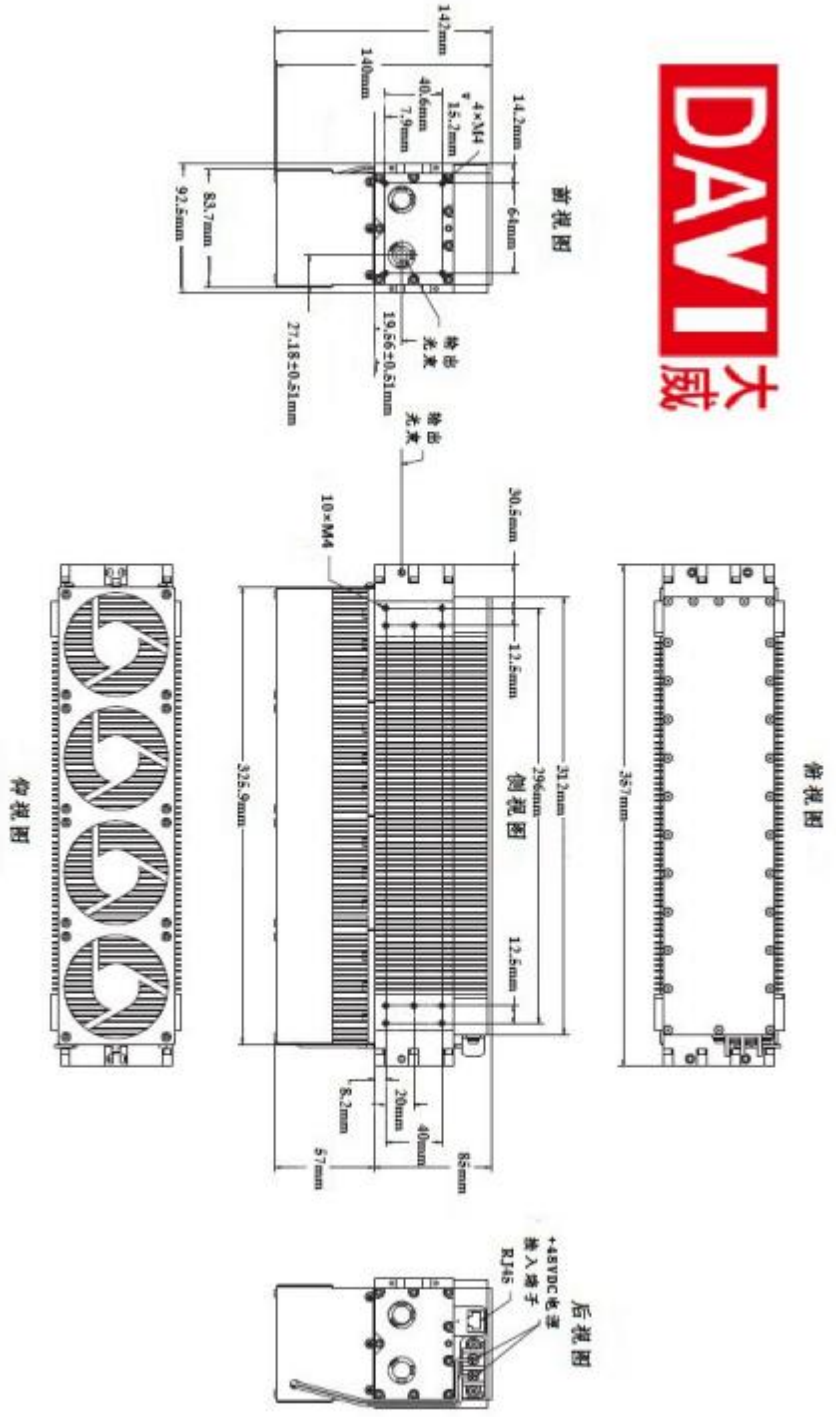
If there is evidence that the spatial quality (Transverse Mode quality) of the output beam is degraded, examine the output optical element of the laser head, looking for evidence of damage to the optical coating. (This examination must be performed with AC power to the laser system disconnected.)

If any coating damage is present, the laser must be returned to DAVI to be corrected by DAVI technicians.

The customer's system design should also be reviewed to determine if contamination to the optical element could have Contributed to the coating damage. If, after performing the above checks, there is a problem with the laser, proceed to Section B, “D” Series Laser Warranty.

D35L Laser Tube Picture

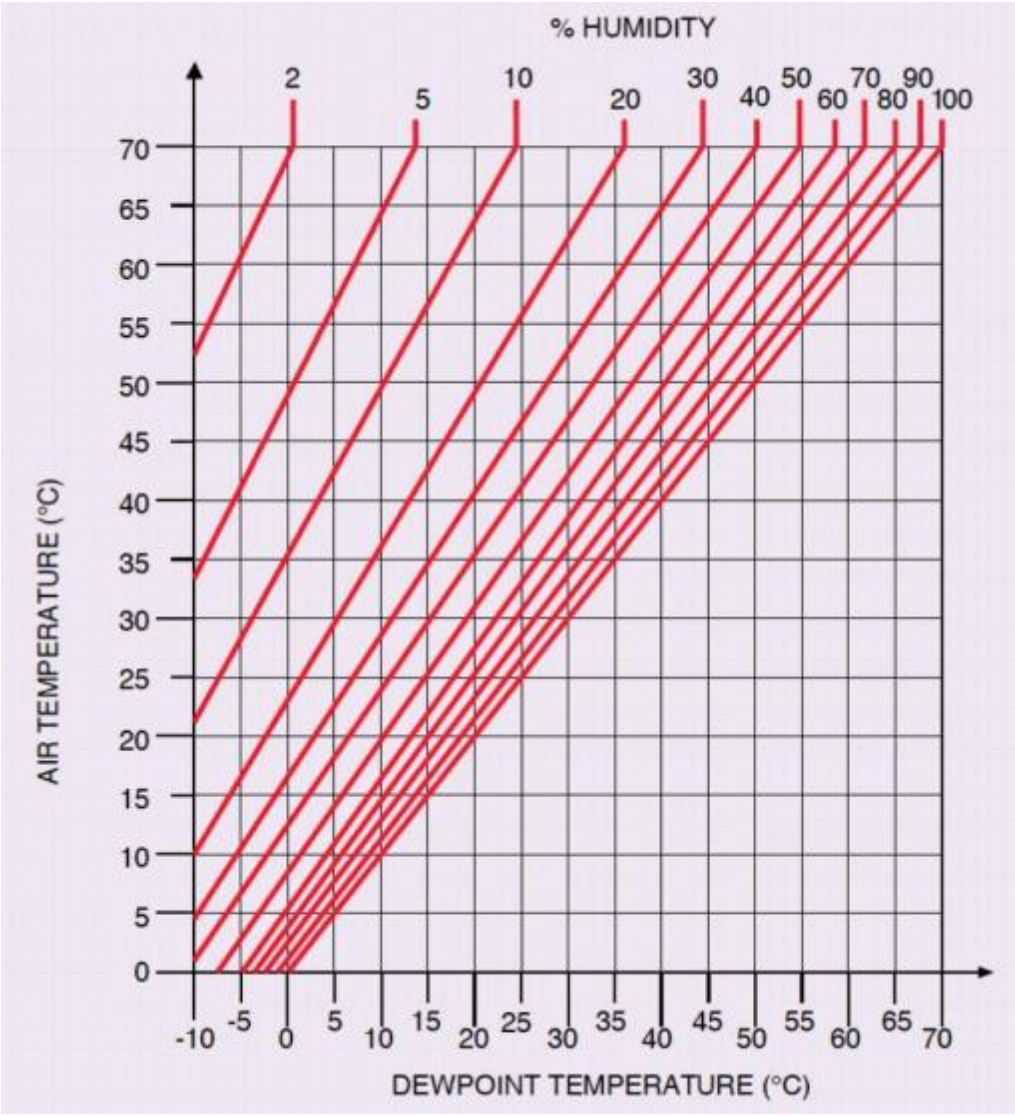
Structure Drawing



Condensation

In some environments, where the temperature and humidity are high, the temperature setting of the cooler may need to be set higher than the specifications indicate. The chart below shows the dew point at various air temperatures and relative humidity.

To determine the dew point temperature, measure the air temperature and relative humidity. Draw a horizontal line from the air temperature (Y-axis) to the relative humidity line. Then draw a vertical line from that intersection down to the dew point temperature (X-axis).



Common questions and answers during Laser use

Question 1: The laser may fail to start properly after being laid aside for a period. Why does this problem arise, how to solve it when it happens?

Answer: If the laser tube was laid aside for a long time, when use it again, the laser module may not be able to start preionization properly. Under this situation, the electronic circuit of the laser module may test a high degree back reflection voltage, which will cause SWR fault (Laser OK Fault) so the laser can't start work normally. When you start to use the laser tube after putting aside for a long time, it is advised to set the duty cycle of Modulation Signal less than 10% frequency less than 25KHz, this operation can avoid trigger SWR Fault. When a SWR fault already occurred can add the Modulation Signal to the laser tube, the electronic circuit will send a Secondary ionization pulse which can help the laser tube heating up.

Question 2: What will happen when the laser module is in overheating protection? How to handle it when it happens?

Answer: If the laser module triggers heat protection, it will stop working. When it happens, the user should do this work: 1. turn off the laser power. 2. For water cooling type laser tubes, inspect if the water-cooling machine is normally working or not. 3.For the air-cooling type laser tubes, inspect if the fans are normally working or not. 4. Inspect if the fans and heat sink of the air-cooling laser should make a cleaning. 5. Check if there is enough ventilation space around the air-cooling laser. 6. When the above problems happen, you should wait and don't turn on the laser tube until the laser tube temperature drops to normal level.

Question 3: What problems must we pay attention to during the storage and transport process?

Answer: First, during the storage and transport process, please make sure the cooling water stored inside the laser tube has been dried up completely. We recommend Purity 99.95% dry nitrogen to blow dry. If not, the remained cooling water may cause irreparable damage to the laser tube. Secondly, the beam output window should be sealed during storage and transport process, in case the beam output window being polluted. Thirdly, in order to prevent the unexpected impact to damage the laser tube, please handle it gently during storage and transport. At the same time, please make sure the water pipe of the laser tube doesn't bear force, in case to prevent the water pipe shape distortion.

Question 4: What are the requirements for the use of the laser?

Answer:1）Environmental temperature should be kept at 5 ℃ to 40 ℃ when necessary to use air conditioner .

2）Environmental cleanliness, in the case of the laser without external dustproof equipment, high dust degree will cause the laser window to burn out.

3) Environment humidity requires the phenomenon of non-condensation of laser.

4) Environmental acid-base degree keeps neutral.

Question 5: If the laser output window lens is polluted, how should we handle it? can we wipe it with a cotton swab?
Answer: No. Wiping with a cotton swab will further damage the lens. If only a small number of particles is attached to the front lens, and the lens coating film has not been burned, you can try to blow the lens with 99.95% pure nitrogen. When testing the lens, it is necessary to pull out the power line.

Question 6: If you know the size of the spot, how do you choose the size of the lens in the light path?
Answer: The size of the lens in the external optical path should be twice as large as the actual spot size.

Question 7: What is the reason for the enough output power of the laser, but the low power of the processing terminal?
Answer: In this case, it is usually caused by high energy loss in the optical path of the laser, Users should check the following points:
1) Whether the size of the external optical path lens and the size of clear aperture are big enough
2) Whether the quality of lens of external optical path is qualified, the loss rate of a single lens must not exceed 3%.
3) Whether the lens of external optical path is contaminated or damaged.
4) Whether the external optical path has been correctly aligned.

Question 8: What should be done when the laser is low or unstable during use?
Answer: In this case, the user should check the following items first:
1) Use the multimeter to measure the voltage of the DC power supply of the laser.
2) Measuring the DC power output of the laser with an oscilloscope has great fluctuation or not.
3) Use an oscilloscope to measure the control signal to the laser is normal or not.
4) Whether the water-cooling machine of water-cooled laser is normal and the flow rate conform to the requirements.
5) Check whether the cooling fan and heat sink of the air-cooled laser are in normal condition or not.

Question 9: The surface of the laser has a lot of sealing labels. What is the function of the label?
Answer: Each laser has a seal label. Please protect the seal label. If the sealing label is damaged, the laser will not receive the proper warranty service.

Question 10: What is the guarantee condition of the laser?
Answer: In the warranty period if the laser output index is lower than the commitment made by Beijing Dawei laser technology Co., Ltd., the user can enjoy free warranty service. But it does not include damage to the laser caused by human reasons or due to improper use, and the seal label needs to be kept intact.

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