

## AL50 Laser Series

\*Image of AL50-WC\*



**ACCESS LASER**  
Member of the TRUMPF Group



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## Thank you for purchasing an Access Laser product

Access Laser specializes in RF Excited Long-wave Infrared & Mid-wave Infrared lasers for custom applications in scientific experimentation, research and development, medical and high-performance material processing. Our system architecture emphasizes flexibility, and we take pride in ensuring that every product delivers optimal performance and satisfies your precise needs. We view our role as project collaborators, striving to offer transparent information about each product to make integration with your application successful.

Access Laser remains dedicated to your needs long after your initial purchase. Our technical support and service teams are available, regardless of the warranty period, and we welcome you to contact us whenever you have questions, concerns, or additional requirements at:

Email: [sales@accesslaser.com](mailto:sales@accesslaser.com)

Phone: 425-582-8674

## The AL50 Series

The laser industry's highest power, true cylindrical waveguide RF excited sealed CO<sub>2</sub> laser, the AL50 is a no-compromise solution for the most demanding applications. From non-stop 24/7 semiconductor manufacturing to leading edge research and development.

Available technology upgrades:

**Acousto-Optic Modulation:** Mounting an AOM external to the laser cavity can increase the pulse repetition frequency to 200kHz without optically saturating sensitive targets.

<https://www.accesslaser.com/acousto-optic-modulator-aom/>

**Bandpass Filters:** Utilizing a variety of custom optical coatings we can broadly select the wavelength range of produced light without the sacrifice to power that an intra-cavity grating demands.

<https://www.accesslaser.com/bandpass-filters/>

**Dual Drive:** Changing the DC power supply to the RF driver allows for a fluid switch from continuous wave output to Super Pulse, providing flexibility to your end use.

<https://www.accesslaser.com/dual-drive-d/>

**Diffraction Grating:** For many applications producing a single wavelength of light is an absolute requirement. By implementing an intra-cavity grating, ALC provides access to more than 80 discrete lines in the Mid-wave and Long-wave Infrared spectral regions.

<https://www.accesslaser.com/diffraction-grating-g/>

**Stabilized:** By actively monitoring and compensating for temperature fluctuations, our stabilized lasers enable improved power and wavelength control.

<https://www.accesslaser.com/stabilized-s/>

**Isotope Gas Mixtures:** The standard CO<sub>2</sub> laser provides spectral output between 9.2-10.8μm. For applications requiring other wavelengths, Access Laser can extend this spectral reach and power by varying gas mixtures.

<https://www.accesslaser.com/isotope-gas-mixtures/>

**Line Tracker:** Utilizing our unique software-controlled optical feedback loop, Access Laser provides industry leading power stability and wavelength selection.

<https://www.accesslaser.com/line-tracker-t/>

**Polarization:** Augment your beam for polarization dependent performance. We can add specialized coatings to internal optics that greatly improve the polarization extinction ratio.

<https://www.accesslaser.com/enhanced-polarization-l/>

**Piezo Tuning:** Laser performance is highly correlated to maintaining precise control over the resonator length. Command-driven frequency compensation is one way to enable high performance.

<https://www.accesslaser.com/piezo-cavity-modulation-z/>

**Super Pulse:** By driving the laser gain three times harder for a shorter duration than standard pulse width modulation a discrete pulse train can be generated.

<https://www.accesslaser.com/super-pulse-p/>

## Warranty

All Access Laser CO<sub>2</sub> lasers come with a one-year standard warranty. This certifies that your laser is free of any defects in material or workmanship.

Please see <https://www.accesslaser.com/legal/> for detailed warranty information.

Upon final inspection of your order, please complete the information below and email to [service@accesslaser.com](mailto:service@accesslaser.com). If Access Laser Company is not notified within 14 days of delivery, we will assume that the shipment arrived in satisfactory condition.

Date Received: \_\_\_\_\_

Laser Model: \_\_\_\_\_

Laser Serial Number: \_\_\_\_\_

RF Driver Serial Number: \_\_\_\_\_

Received By: \_\_\_\_\_  
(Name and title)

## Returns

If a failure should occur, please contact your Access Laser Company representative or contact Access Laser headquarters directly at 1-425-582-8674 or [service@accesslaser.com](mailto:service@accesslaser.com).

A company representative will determine whether your laser should be returned for repair or maintenance. If the laser needs to be returned, a Return Merchandise Authorization (RMA) will be issued. Any laser returned without an RMA will be at the client's sole expense.

An ALC representative will make a determination regarding shipping costs. Typically, for failures within the first 45 days, ALC pays all shipping costs to and from ALC. For failures after 45 days, but within the first year, the client shall be responsible for shipping costs to ALC; ALC will pay all shipping costs to return the item(s) to the client. Please be sure to verify shipping costs in advance with your ALC representative, as special considerations may apply.

When requesting an RMA, please have the following information ready:

- Date of purchase
- Laser model
- Serial number for the laser
- Serial number for the RF driver
- Brief description of the issue
- Date the issue was first discovered

Fill out the RMA as completely as possible and include a copy of the RMA with the shipment. Include the laser and ALL accessories when returning the laser. This allows ALC to test each component and determine the source of the issue.

SHIP TO:

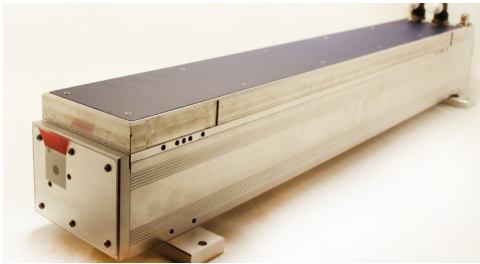
Access Laser Company  
Attn: Service Department  
2211 W. Casino RD Suite A  
Everett, WA 98204

## Laser Shipment Contents

The following items are included with each standard laser shipment:

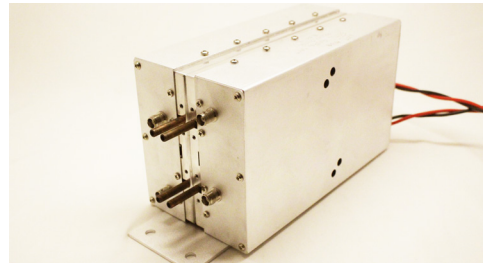
- AL50 Series Laser
- RF Driver
- BNC to TNC Coax Cables (4)
- D-sub 15 Dongle (2)
- Laser Test Documents
  - Final Test Document
  - Power Plot

**If you have questions about the contents of your shipment, please contact us.**



AL50 Series Laser

*Figure. A1*



RF Driver

*Figure. A2*



BNC to TNC Coax Cables (4)

*Figure. A3*



D-Sub 15 Dongle (2)

*Figure. A4*



BNC T Connector and Cable

*Figure. A5*



RA BNC to BNC

*Figure. A6*



RF-50 TTL input connection

*Figure. A7*

## FDA and International Regulations

Access Laser Company (ALC) lasers are designed, tested, and certified to comply with United States (US) and European Union (EU) regulations. For commerce within the US, laser safety requirements are governed by the Center for Devices and Radiological Health (CDRH) as set forth by United States Radiation Control for Health and Safety Act of 1968. For International commerce outside the US, laser safety is commonly governed by IEC Standards.

If you are an OEM that manufactures a laser product that is sold in the US or imported into the US, you are required to file a Product Report with the CDRH, prior to entering commerce in the US, that demonstrates compliance to 21 CFR 1040.10. If you are an OEM that operates and sells outside of the US, use IEC 60825-1 for laser safety compliance. It is the responsibility of the OEM or system integrator to assure complete compliance with any and all applicable regulations when an AL50 series laser is integrated into their system.

Since ALC is a US-based company with international sales, ALC has filed an OEM Product Report with the CDRH for all lasers in the AL50 series; the Product Report shows that our warning labels comply with IEC 60825-1. The AL50 laser complies with 21 CFR 1040.10 and 1040.11 except for conformance with IEC 60825-1 Ed. 3., as described in Laser Notice No. 56, dated May 8, 2019.

Both 21 CFR 1040 and IEC 60825-1 require OEM lasers to be incapable of lasing when removed from the OEM system. In such cases the laser must comply with all applicable requirements of 21 CFR 1040 or IEC 60825-1. When wired compliant to laser safety regulations the AL50 does not operate when removed from the OEM system.

## Safety Information

### Safety Symbols and Terms

Commonly used safety symbols and terms are used throughout this manual and on our products. Please familiarize yourself with the definitions and use of the terms and symbols.



Indicates a hazardous situation which will result in **DEATH** or **SERIOUS INJURY**.



Indicates a hazardous situation which could result in **DEATH** or **SERIOUS INJURY**.



Indicates a hazardous situation in which could result in **MINOR** or **MODERATE INJURY**.



Indicates an unsafe practice that can result in **PROPERTY DAMAGE**.



## Safety Information (continued)

### Safety Label Definitions and Locations

1. Product Identification label – Indicates model, serial number and date of manufacture.
2. Yellow Compliance label – Calls out the edition of IEC 60825-1 used for compliance and the maximum power output and possible wavelengths.
3. Yellow Danger label – Indicates laser class.
4. Safety Compliance label – Indicates whether the laser was manufactured in compliance with United States Code of Federal Regulations and/or International standards. (For OEM lasers, the laser component does not comply with all standards for complete laser products as specified by 21 CFR 1040.10 or IEC 60825-1: 2014-05.)
5. Aperture label – Indicates location of laser beam exit (aperture).

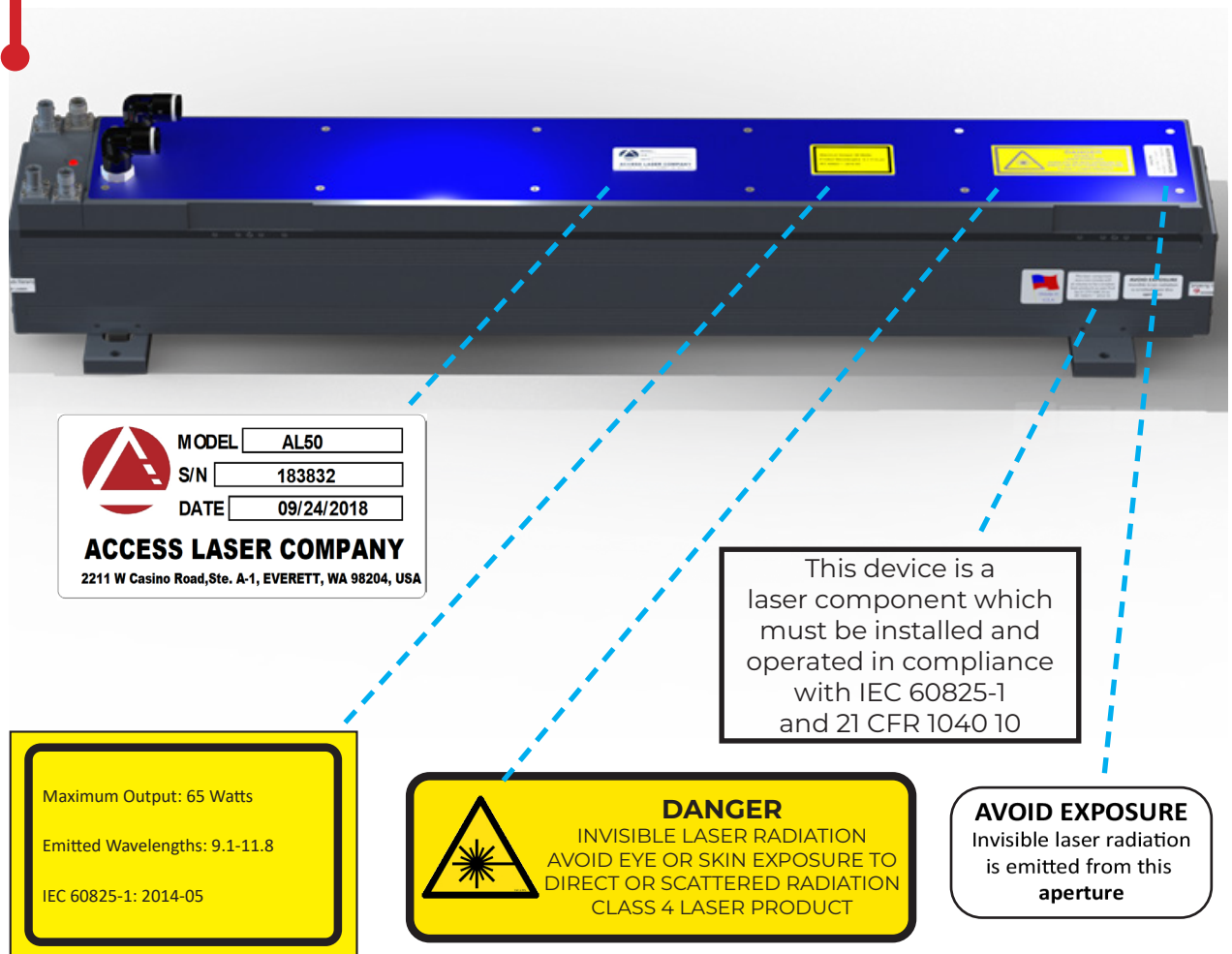


Figure. A8

## Safety Information

### Class 4 Safety Requirements and Features

| Feature                     | Use case   | Required by: |             | Available on the AL50 System?  |
|-----------------------------|--|--------------|-------------|--|
|                             |  | CDRH         | IEC 60825-1 |  |
| Keyswitch                   | On/Off keyswitch controls power to laser electronics. The key cannot be removed when it is in the "ON" position. | Yes          | Yes         | <b>No</b><br>Remote Keyswitch control is available via DB15 connector on the RFAL50, and on the LC4 controller available for purchase. |
| Remote interlock            | Disables the RF Driver when protective equipment or panel door is open.  | Yes          | Yes         | <b>No</b><br>Remote Interlock control is available via DB15 connector on the RFAL50.   |
| Over temperature protection | Shuts down RF driver when the temperature of the RF driver heatsink exceeds 65°C.                                | No           | No          | <b>Yes</b><br>Thermal switch in the RFAL50 driver is monitored by the control board. Disables RF if overtemp occurs.                   |
| Laser shutter               | User can close shutter when servicing unit.  | Yes          | Yes         | <b>No</b><br>Suitable shutters can be purchased from Access Laser or other suppliers of laser optical accessories.                     |
| Laser ready indicator       | Indicates power is applied and laser is ready to operate.  | Yes          | Yes         | <b>Yes</b><br>An LED can be powered by Pin 2 of the DB15 connector (on the RFAL50) to indicate laser ready.                            |
| Delay at power up           | Laser is not enabled when powered up or keyswitch is cycled for about 5 seconds.                                 | Yes          | Yes         | <b>Yes</b><br>When enabled (Pin 8 is pulled high), a 5 second delay is enforced every time the power is cycled.                        |
| Power fail lockout          | The RF Driver is disabled when the power comes back on after an intermittent failure.                            | Yes          | Yes         | <b>Yes</b><br>When Pin 8 is pulled high, the remote keyswitch has to be cycled (off to on) to restore operation after a power failure. |
| Warning Labels              | Labels attached to various locations on laser housing to warn users of potential dangers.                        | Yes          | Yes         | <b>Yes</b><br>Compliant to IEC 60825-1.  |
| RF Power indicator          | When RF power is applied to the laser, the red LED on the laser is turned on                                     | No           | No          | <b>Yes</b><br>This LED is shown in the laser rendering.  |

As can be seen in the table above, if you are integrating an AL50 into an OEM system, you must add an external keyswitch and an interlock switch using the built-in keyswitch and interlock monitoring functions of the RFAL50 provided by the DB15 connector. Alternatively, the LC4 controller is an available accessory which adds keyswitch functionality.

When using the laser in a laboratory or bench top environment, the end user should implement an external shutter system at the front (Beam Exit) of the laser.

## Operating Instructions

### Operating the laser

1. Direct the laser toward an appropriate beam dump.

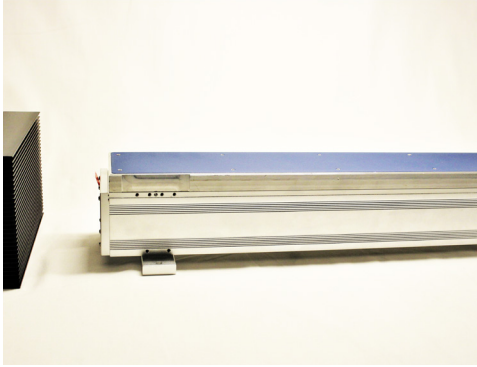


Figure. 1

2. If using on an optical bench, secure the laser down with the mounting holes in the base plate.



*Do not torque, twist or bend the laser body during the mounting process.*

*Applying uneven pressure to the laser body may distort the laser body, causing poor performance and possible damage.*

3. Connect the Cooling System

- a) Connect tubing to the PISCO fitting as described in the Water Cooling Connection Instructions.
- b) Connect the tubing to the laser and the chiller, as shown in the Water Cooling Connection Diagrams. Be sure that the tubing input and output are the same on both sides of the laser.

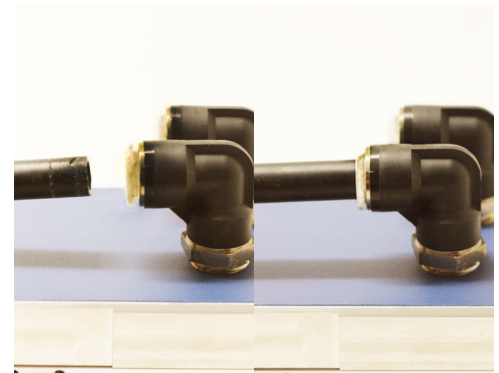


Figure. 2

4. Connect the RF Driver to the laser with the coax cables using the TNC and BNC connectors, as shown in the Connection Diagrams.

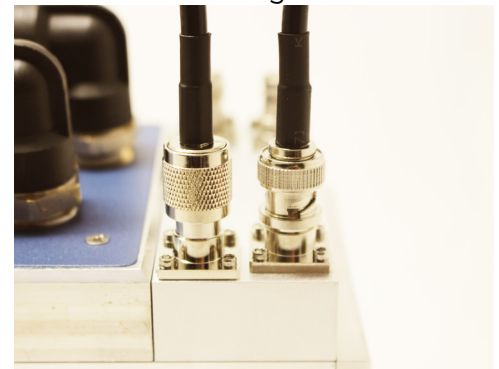


Figure. 3

## Operating the laser (Continued)

5. Connect the RF cable to the TNC connector on the RF Driver.

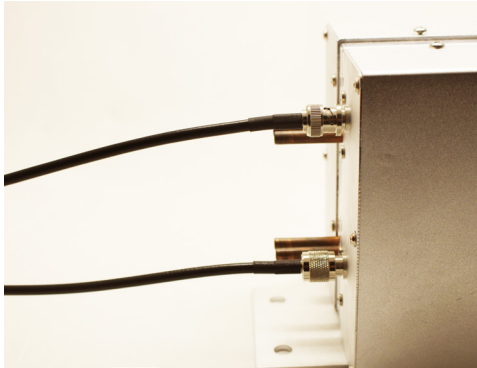


Figure. 4

6. Connect the RF Driver to the DC power supply.

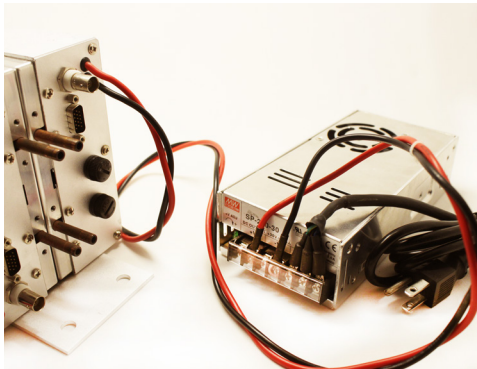


Figure. 5

7. Verify the beam path is pointed at an appropriate beam dump.

**DANGER**

*Eye Protection Required.*

*This laser can cause mild to severe burns if skin or eyes are exposed to the beam or scattered radiation. Protective eye wear should be worn at all times.*

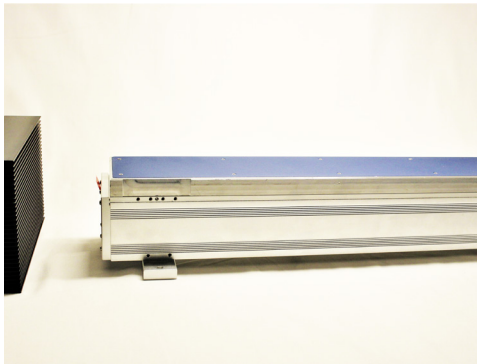


Figure. 6

8. Remove the protective tab from the aperture.

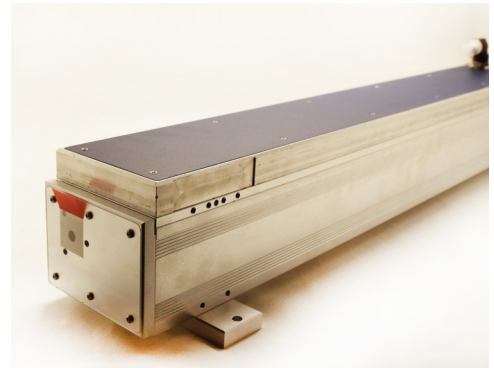


Figure. 7

9. Verify the enabling plug on the D-sub 15 connector is installed on the RF driver.

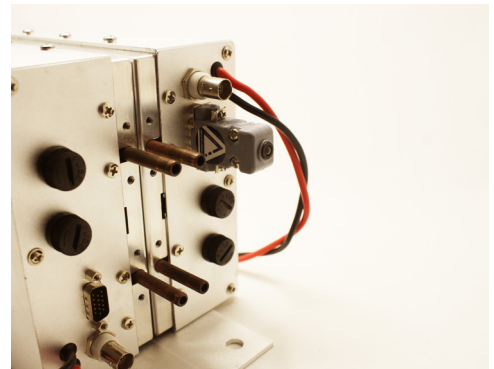


Figure. 8

10. Plug in the DC power supply to enable RF Driver.

**DANGER**

*The red LED on the laser indicates the laser is powered. When the laser is powered it is able to lase upon application of a control signal.*



Figure. 9

## Water Cooling Diagram



\*AL50 Water Cooled Laser shown above

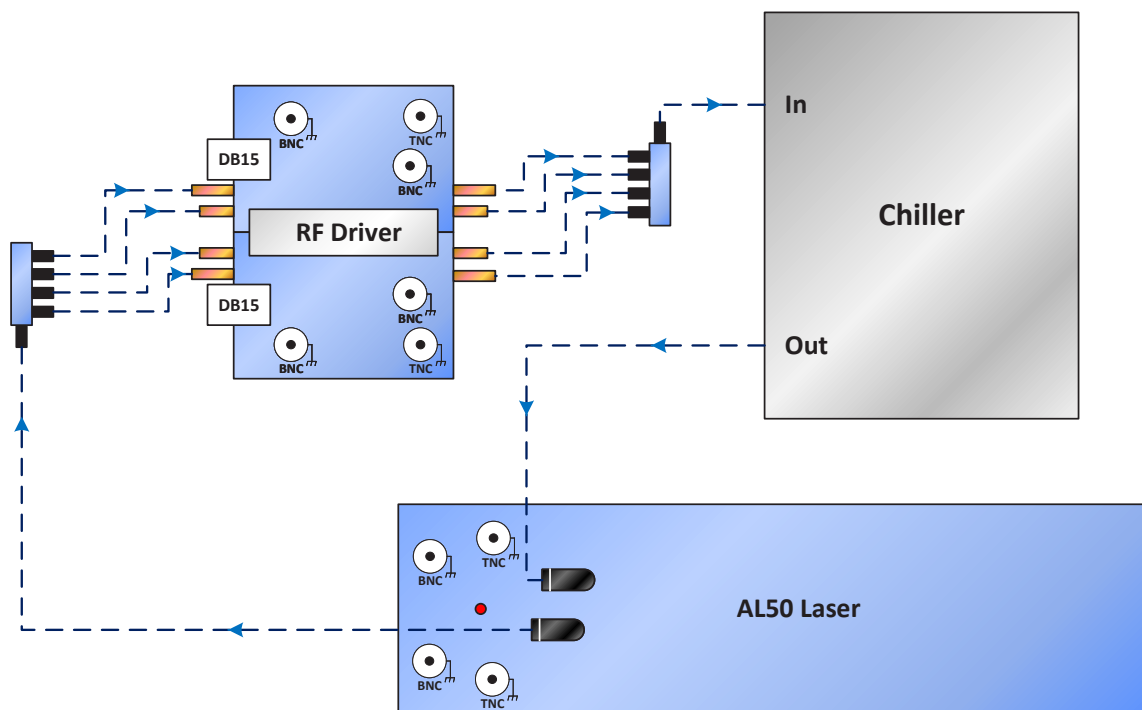


Figure. A9



## Water Cooling Connection Instructions

If your laser is water-cooled, your laser comes with a kit containing the parts required to connect your laser to your chiller (chiller not provided). If assistance is required, please contact Access Laser.

For optimal performance with your water cooling system, keep the laser balanced, cool the left and right sides of the laser equally, and keep the laser stable.

The quick connect tubing fittings are made by PISCO ([www.pisco.com](http://www.pisco.com)).

### To Install

1. The end of the tubing must be cut off clean and flat.
2. The outer surface of the tubing must be free of defects for the first ½" (13mm)
3. The tubing must be round (not distorted).
4. The tubing must be the correct diameter for the fitting.
5. Insert the tubing into the fitting and push it as far as possible. It should go in approximately 0.7" (18mm)
6. Pull gently on the tubing to verify that the small Stainless Steel teeth in the fitting are grabbing the tubing securely. The fitting is ready to be used.

### To Remove

1. Push the tubing gently into the fitting.
2. Pull back on the ring into the fitting. This will release the small Stainless Steel teeth from the tubing.
3. While holding the ring close to the fitting, gently pull the tubing out of the fitting.
4. The fitting can be removed and replaced on the tubing multiple times, until the end of the tubing becomes scratched. If the end of the tubing is scratched, it should be cut back to expose smooth surface.



Always turn on/off the water chiller and the laser power at the same time.

## AL50 Laser Wiring Diagrams

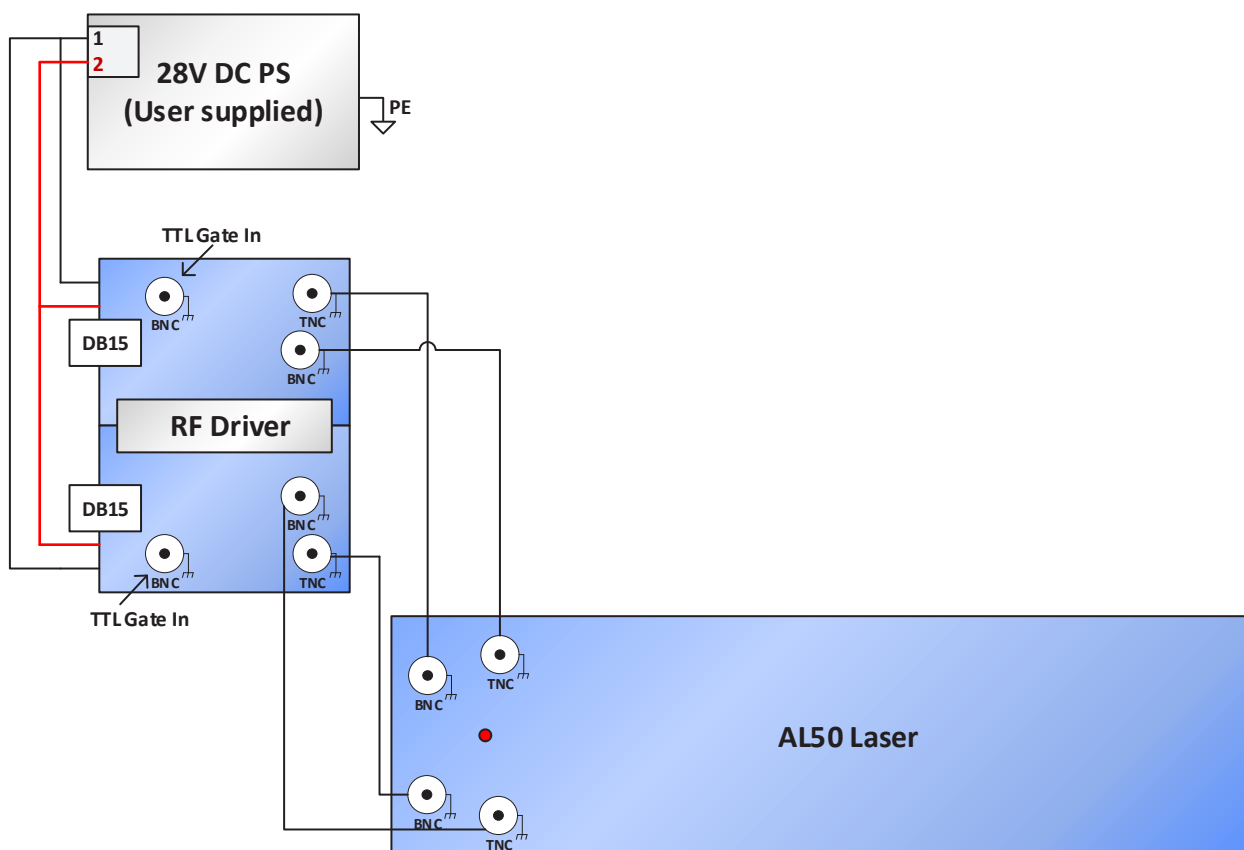
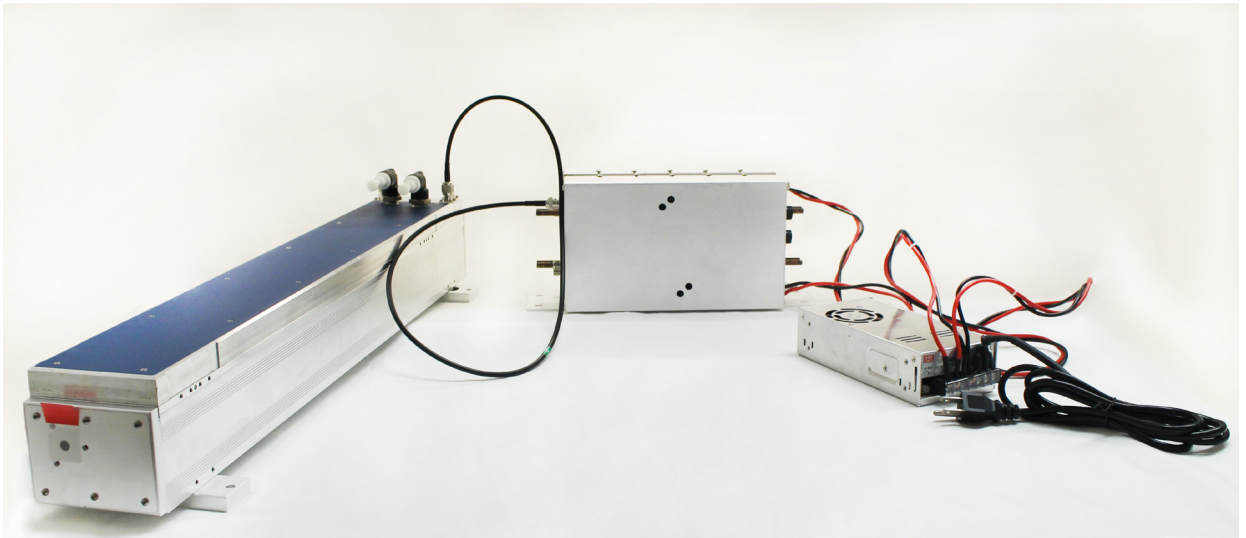


Figure. A10

## AL50 Laser Connection Diagrams



From left to right : AL50 Laser, BNC to TNC cable, RFAL50 Driver, DC Power Supply.

*Figure. A11*



## RFAL50 Driver Specifications

|                      |   |
|----------------------|---|
| Model:               | RFAL50                                      |
| Supply Voltage:      | 28 V DC                                     |
| Supply Current:      | 28 A  |
| Output Power:        | 130 W per Channel                           |
| Frequency:           | 40.68 MHz                                   |
| Plasma Conditioning: | Built-in 1.8 KHz Plasma Conditioning signal |
| Repetition Rate:     | External TTL Control Input up to 100 kHz    |

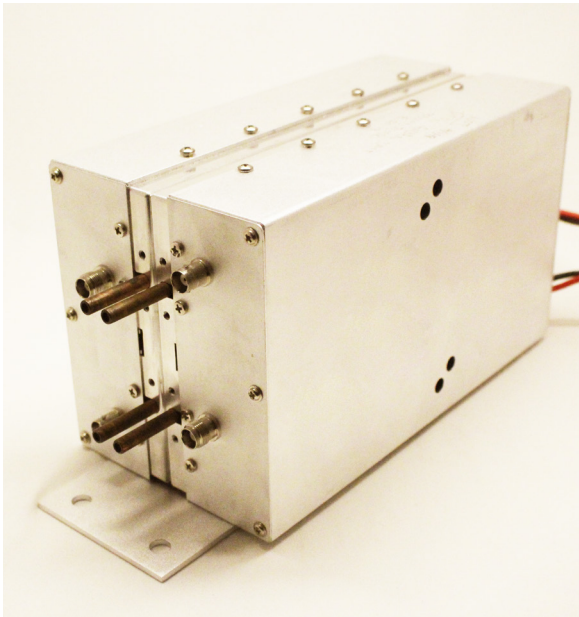


Figure. A12

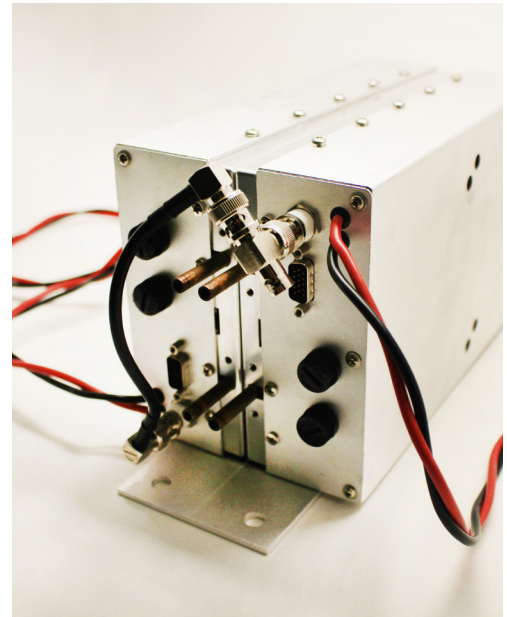


Figure. A13

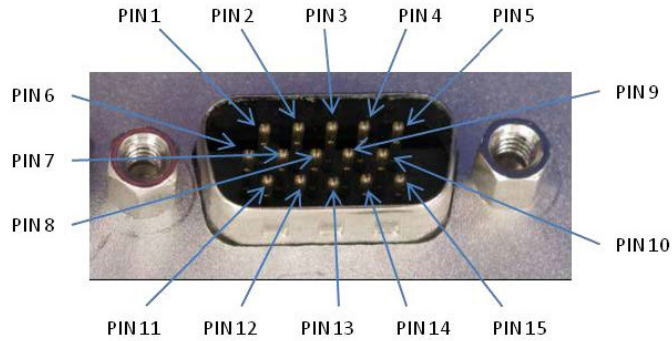


### Caution:

1. Never connect the DC to the RF driver with the wrong polarity, or the RF driver will be damaged.
2. Never operate the RF driver without its output properly connected to the laser.
3. Do not block the air flow to and from the heat sink, or the RF driver will be damaged.
4. If the fans fail the RF driver will stop immediately.

## RFAL50 Driver Operation

The laser is controlled by applying 5V DC (20 mA) to the TTL Gate on the RF Driver (0V=off, 5V=on) to PIN 7 and PIN 10. The RF driver can be modulated at frequencies from 0 Hz to 100 kHz, but optimal grating frequency is 1-15 kHz using Analog Voltage Control. AVC is implemented by enabling PIN 5 and applying 0-5V DC on PIN 11. 0V to 5V results in a proportional 0% to 100% Pulse Width Modulated laser output.



| Pin # | Function  |
|-------|---|
| 1     | 5 VDC, 20 mA capacity, for power ready indicator.<br>(Can be used to drive an external red LED if current limiting resistor is used.)   |
| 2     | Laser ready signal; can be connected to an external green LED to indicate laser ready status; no current limiting resistor required.  |
| 3     | Safety Key Switch Connection. When this pin is enabled by PIN 6 and there is a power outage or opening interlock (PIN 4), this pin needs to be pulled high and then low again to restore laser operation. |
| 4     | Safety Interlock. Connect to pin 15 to close interlock circuit. (This function also needs to be enabled by PIN 6.)  |
| 5     | AVC (Pin 11) Enable.  |
| 6     | CDRH Safety Mode. Enables keyswitch on PIN 3 and Safety Interlock of PIN 4.   |
| 7     | Input gate for Laser Enable   |
| 8     | Time delay control: 5 seconds<br>between initial power on and lasing  |
| 9     | Plasma conditioning   |
| 10    | Input for Gate 2. (Connected to BNC input.) A 5 V signal is provided by the customer to turn the laser on/off electronically.   |
| 11    | Input for Analog Voltage Control (AVC)  |
| 12-14 | Do not use  |
| 15    | Ground  |