



ACCESS LASER

where innovation never stops

AL30 Operator Manual



Access Laser Company
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www.accesslaser.com

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Company Statement

Thank you for purchasing an Access Laser product. We remain dedicated to your needs long after your initial purchase. In order to help us meet your needs, please contact us if you have any questions, comments or concerns about your laser, at sales@accesslaser.com or call us at 425-582-8674. Our staff will make every effort to assure that your laser is operating at its peak performance. We look forward to working with you through the life of your project.



Contact Information

Access Laser Company is a multi-national company with its headquarters in Everett, Washington.

| | |
|-----------------|--|
| Mailing Address | Access Laser Company 917 134 th St SW Suite A1 Everett, WA 98204 |
| Phone Number | 425.582.8674 |
| Fax Number | 425.582.8679 |
| Email | sales@accesslaser.com |

Access Laser Company specializes in innovative solutions to meet your application needs. Our Sales Team and Customer Service Team can provide you with the most up-to-date product information. If you need assistance with an order or service, contact Access Laser Company at 425.582.8674, ext.1 or email your questions.

| | |
|---------------------------|--|
| Sales/Technical Questions | sales@accesslaser.com |
|---------------------------|--|

| | |
|--------------------|--|
| Service Department | service@accesslaser.com |
|--------------------|--|



Warranty

All of Access Laser Company's lasers come with a one-year standard warranty, which certifies that your laser is found to be free of any defects in material or workmanship. This warranty applies regardless of your laser application. It does not cover any issues that may arise due to operator negligence, environmental factors, accident, alterations, or improper maintenance.

Access Laser Company requests that you inspect your shipment within 14 days of arrival. If there appears to be any damage or defect you must notify Access Laser Company, in writing, at service@accesslaser.com. If Access Laser Company is not notified within 14 days, we will assume that the shipment arrived in satisfactory condition.

Please complete the information below upon final inspection of your order.

Date Received:

Laser Model:

Laser Serial Number:

RF Driver Serial Number:

Received By:

Access Laser Company and its Authorized Distributors maintain the sole authority to make any claims or statements regarding warranty on Access Laser Company products. Access Laser Company reserves the right to make changes or improvements to product design without notice, and without expectation of equivalent changes in products previously manufactured or shipped.



The AL30 Series

The AL30 Series lasers have an operating power of 30 Watts in Continuous Wave mode. The AL30 is the standard model in the series. The AL30P offers a Super Pulse option, with a peak power of 60 Watts. The AL30D provides the functionality of either the AL30 or the AL30P, by simply changing the power supply voltage.

The AL30S models provide higher power stability than the AL30 standard model, with the option of Super Pulse found in the AL30SP. The AL30SD provides the functionality of either the AL30S or the AL30SP, by simply changing the power supply voltage. Operations of the AL30, AL30P, AL30D, AL30S, AL30SP, and AL30SD are covered in this Operator Manual.

Accessories are available in the AL30 series. Operation instructions for these accessories are included in the Appendices of the Operator Manual, or in a separate manual, included with your shipment.

Because Access Laser Company provides innovative solutions to meet your needs, many specialty features are possible with the AL30 series. Many of these specialty features may alter the appearance of your laser from what is pictured in the Operator Manual, but they do not alter the basic specifications or operation instructions for your laser. If you have any questions about the specifications or operation of your laser, please feel free to contact us at 425-582-8674, ext 1.



Laser Shipment Contents

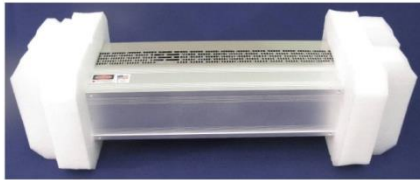
The following items are included with each standard laser shipment:

- AL30 Series Laser
- RF Driver
- BNC to TNC Coax Cables (2)
- D-sub 15 Dongle
- AL30 Series Laser Product Manual
- Laser Test Documents
 - Final Test Document
 - Pulse Power Document
 - Power Plot

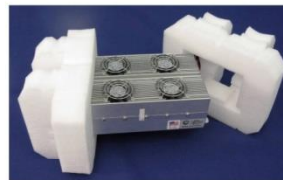
If you have questions about the contents of your shipment, please contact us.



AL30 Laser & RF Driver



AL30 Laser



RF Driver



BNC to TNC Coax Cables (2)



D-sub 15 Dongle



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, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation in which, if not avoided, could result in minor or moderate injury.

CAUTION: Indicates an unsafe practice that can result in property damage.

Note: Additional information provided for optimal product performance.



Safety Information

FDA and Federal Regulations

Access Laser Company has designed our lasers to comply with CDRH requirements set forth by United States Radiation Control Health Act of 1968. Therefore the AL30 series lasers meet all standards for laser products under 21CFR 1040.10 and 21CFR 1040.11. These standards have been set forth to protect the end user from harmful radiation. It is the responsibility of the end user to assure compliance with any and all regulations related to final use or when used outside the United States.



Never Open the Laser

To prevent direct exposure from the laser beam and injury to the user, do not try to open the laser. Opening the laser may result in burns or eye damage or misalignment of the laser or other damage to the laser. The end user will never need to open the laser for maintenance or any other reason. All laser parts are serviceable only by authorized Access Laser personnel. Disassembling the laser voids any warranty.



Eye Protection Required

The AL30 series lasers are Class IV lasers. Class IV Lasers have power outputs of greater than 500 mW. This laser can cause mild to severe burns if skin or eyes are exposed to the beam or scattered radiation. Protective eyewear should be worn at all times.

▲CAUTION Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure.

▲CAUTION Use Appropriate Beam Blocks

The AL30 series lasers produce laser radiation around 10.6 μ m. This wavelength is invisible and requires special equipment to detect or view. Some materials may cause the laser beam to reflect and scatter, causing injury or damage. Take precautions to block the beam from unintentional reflection. Avoid using materials such as copper, aluminum, or gold as beam blocks which are highly reflective and may cause the beam to scatter. Organic materials may be flammable when exposed to the laser beam. Never use organic materials such as plastic or wood as a beam block. Use a beam block designed for the wavelength and power of your laser, or use a laser power meter.



Safety Information

FDA and Federal Regulations

CAUTION Water Cooled Lasers

For water cooled lasers, do not leave the chiller running while the laser is powered off. This may cause condensation in the electrical circuits and optical components, which will lead to damage.

CAUTION Super-Pulse Lasers

For Super Pulse lasers (-P model), running the laser above a 30% duty cycle or 400 μ s pulse length may damage the RF driver. The internal protection program will interrupt the user signal beyond these parameters, making the output inconsistent.



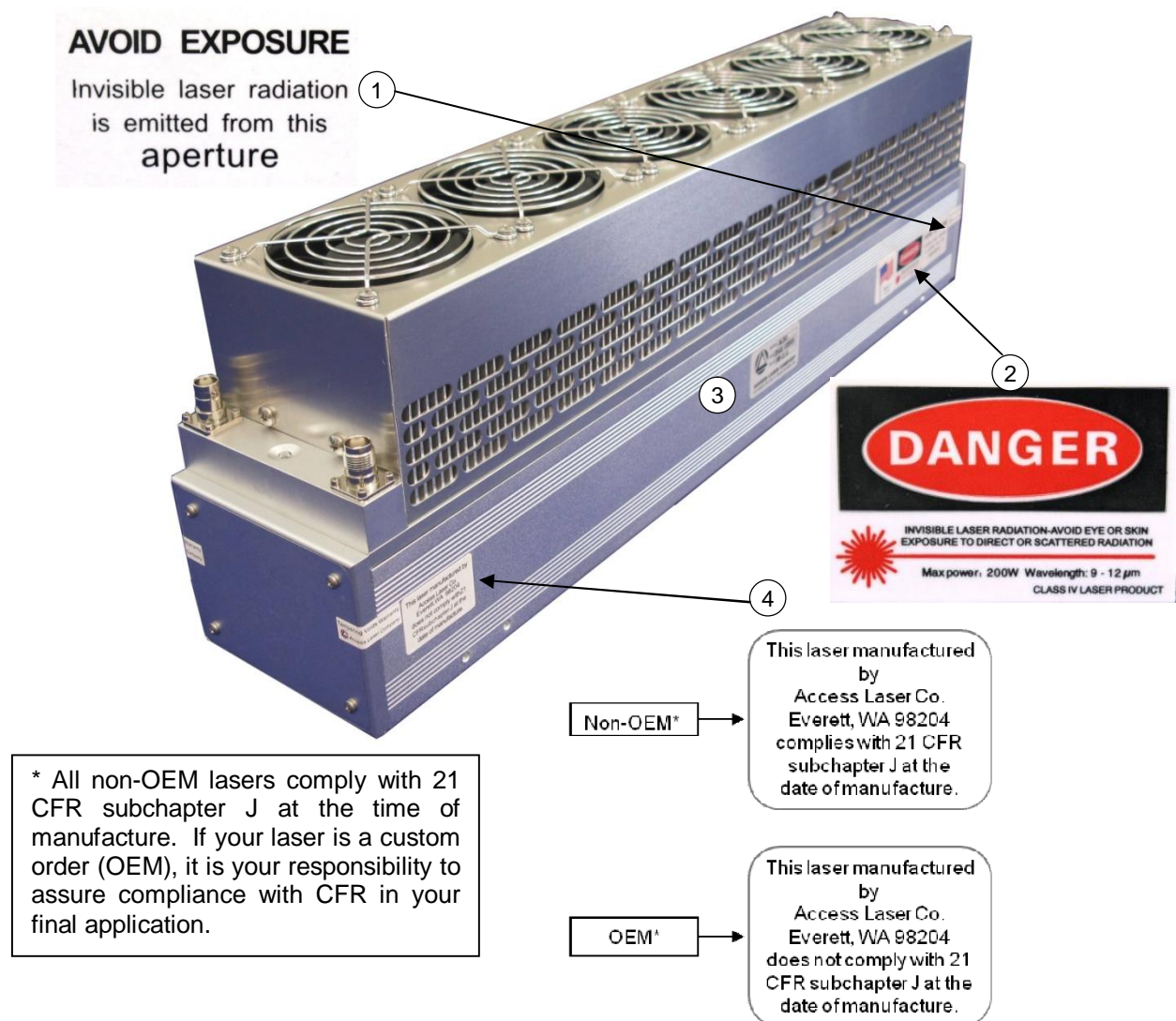
Safety Information

Safety Label Locations

Safety labels identify some potential risks while operating the laser. Please familiarize yourself with the labels.

Safety Label Definitions

1. Aperture label . Indicates location of laser beam exit (aperture) (Manual shutters are not included on non-OEM lasers.)
2. Laser Danger label . Indicates laser class and associated warnings
3. Product Identification label . Indicates Model, Series and date of manufacture
4. CDRH Compliance label . Indicates whether the laser was manufactured in compliance with United States Code of Federal Regulations



Laser Operation Instructions

Operating the Laser

NOTE: If using the LC3 controller, follow the instructions under “Appendix B”.

1. Close the laser shutter (if present).
2. Direct the laser toward an appropriate target, such as a power meter or a beam-blocking device. (See Safety Information regarding appropriate beam blocking devices.)
3. Secure the laser to a bench top.

⚠ CAUTION

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.

4. Connect the Cooling System
 - a. Air Cooled Lasers (where cooling is provided by the end user)
 - i. If no cooling is built in to your laser, you are responsible for providing sufficient cooling to maintain the laser specifications. (See Air Cooling Section for specifications.)
 - ii. Connect your air cooling system to the laser.
 - b. Built-in Fan Cooled Lasers

Connect the 12V DC supply to the fan power connector.
 - c. Built-in Water Cooled Lasers
 - i. Connect the tubing to the PISCO fitting as described in the Water Cooling Connection Instructions.
 - ii. 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.
5. Connect the RF Driver to the laser with the two coax cables, using the TNC and BNC connectors, as shown in the Connection Diagrams.
6. Connect your 5V TTL source to the RF Driver via the TTL gate (BNC connector).
7. Set the TTL input to 0V (0V = OFF; 5V = ON).



Laser Operation Instructions

Operating the Laser

8. Install the gate enabling D-sub 15 dongle onto the D-sub 15 connector on the RF Driver.
9. Connect the appropriate DC Power Supply to the RF Driver
 - a. AL30: 36V DC
 - b. AL30P: 48V DC
 - c. AL30D: 36V DC for Continuous Wave operation. 48V DC for Super Pulse operation.

NOTE Red wire is positive. Black wire is negative.

NOTE The RF driver can be modulated at frequencies from 0 Hz to 100 kHz. Optimal laser performance can be expected at a frequency range of 1-15 kHz.

10. Verify the beam path is pointed at an appropriate beam blocking device.



Eye Protection Required

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

11. Remove the protective tab from the aperture.
12. Open the laser shutter (if present).



Operate the shutter using the lever closest to your body. Never pass your hand in front of the laser beam to operate the shutter.

13. Plug in or apply the DC power supply to the RF Driver. The RF Driver is enabled after a 5 second delay, as indicated by the LED on the D-sub 15 dongle. The LED is red during the safety delay and turns amber when the RF Driver is enabled.



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

Laser Operation Instructions

Operating the Laser

14. To activate the laser beam, apply 5V through the TTL gate (0V = OFF; 5V = ON).

Note: For Super Pulse operation, using the 48V DC power supply, the laser is designed to be run up to 30% duty cycle and pulse length up to 400 μ s.

CAUTION

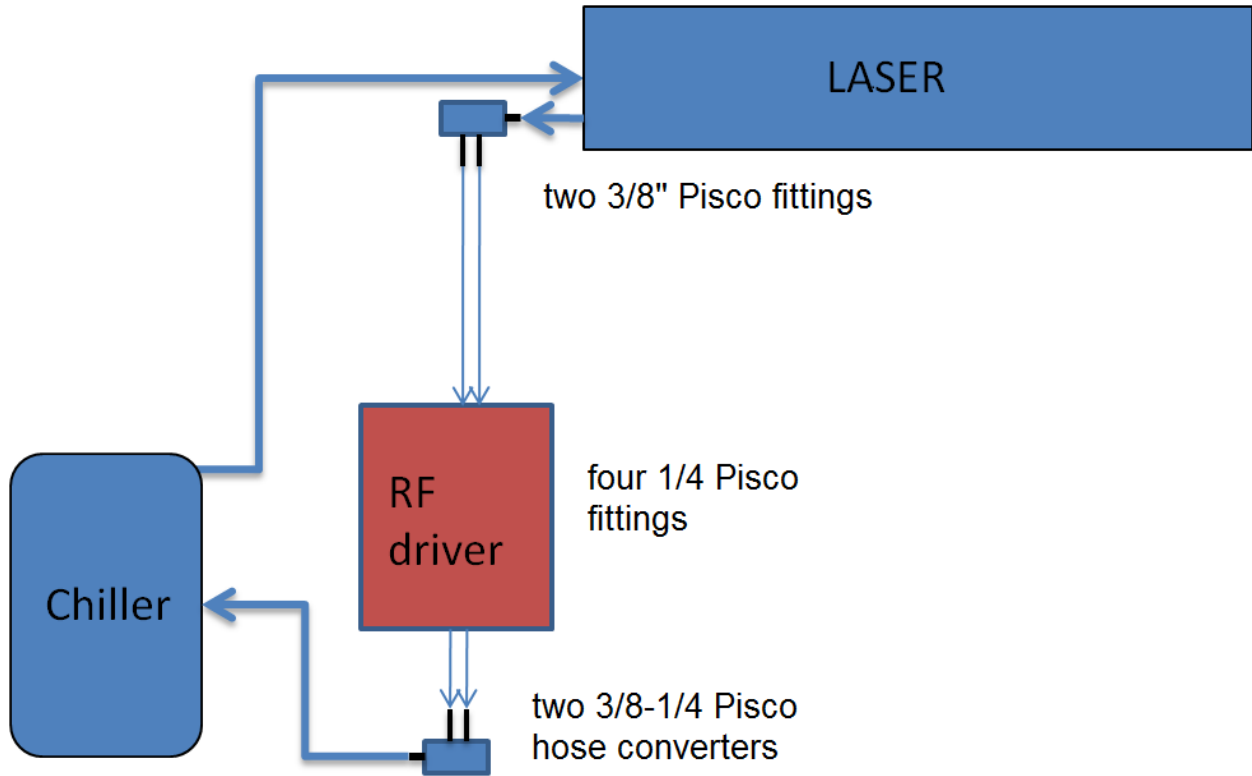
- For Super Pulse operation running above 30% duty cycle or 400 μ s pulse length can damage the RF driver. The internal protection program will interrupt user signal beyond these parameters, making the output inconsistent.
- 5V input to TTL gate should not exceed 20ma or damage may occur
- When powering down the system, remove or disable the 5V input to the TTL Gate before turning off the RF voltage to the laser





Connection Diagrams

Water Cooling Connections



Connection Diagrams

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, Access Laser Company would be happy to answer your questions.

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

The quick connect tubing fittings are made by PISCO (www.pisco.com). These fittings are easy to use.

Assemble the PISCO fittings

1. Cut the end of the tubing clean and flat.
2. Assure that the outer surface of the tubing is free of defects for the first ½+(13mm)
3. Assure that the tubing is round (not distorted).
4. Verify that the tubing is the correct diameter for the fitting.
5. Insert the tubing into the fitting and push it on 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.
7. The fitting is ready to be used.

To Remove

1. Push the tubing gently into the fitting.
2. Push 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 many 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.

To Operate

1. Always turn on/off the water chiller and the laser power at the same time.
2. If the coolant is running while the laser power is off, condensation can occur. This will damage the laser electronics.



AL30 Series Information

AL30, AL30P, AL30D Specifications

| Model | AL30 | AL30P | AL30D |
|---------------------------------------|--|--|---|
| Wavelength (μm) | 10.5-10.7 | 10.5-10.7 | AL30D has features of both AL30 and AL30P when the appropriate DC power supply is used. |
| CW Power (W) | 30 | 14 (average) | |
| Peak Power (W) | 30 | 60 | <p>¹ Power Stability is based on $\pm (P_{max}-P_{min})/(2*P_{max})$ at constant duty cycle after thermal equilibrium</p> <p>² <u>Air Cooling</u>: Fans are included as standard. 240 CFM</p> <p><u>Water Cooling</u>: Min Flow Rate: 3.8 lpm (1 gpm) Recommended Flow Rate: 9.5 lpm (2.5 gpm) Max Pressure: 10 bar (150 psi) Temperature Range: 15-30° C (59-86° F)</p> <p>³Laser weight is for fan cooled model</p> <p>⁴Water Cooling Height: 4.2"</p> |
| Power Stability ¹ | ±5% | ±5% | |
| Mode Quality (M ²) | <1.1 | <1.1 | |
| Beam Waist Diameter | 2.4 mm | 2.4mm | |
| Waist Location | Output Coupler | Output Coupler | |
| Full Div. Angle | 5.5 mrad | 5.5 mrad | |
| Polarization | >20:1 fixed linear vertical | >20:1 fixed linear vertical | |
| Rise Time (μs) | 100 | 100 | |
| Fall Time (μs) | 100 | 100 | |
| Supply Voltage | 36VDC 600W Regulated | 48V DC 600W Regulated | |
| Electronic PWM Parameters | Frequency up to 100 kHz, duty cycle 0-100% | Frequency up to 100 kHz, duty cycle 0-30%, pulse length up to 0.4 ms | |
| Heat Dissipation | < 600W | <600W | |
| Cooling Requirement ² | Fan Cooled | Fan Cooled | |
| Working Temperature | 5-40° C | 5-40° C | |
| Laser Weight ³ | 19 lbs. | 19 lbs. | |
| RF Driver Weight | 7 lbs. | 7 lbs. | |
| Dimensions (LxWxH, inch) ⁴ | 20.8x3.9x6.5 | 20.8x3.9x6.5 | |

Options Available

- Water cooling
- Real time power monitoring
- Stabilization to ±1% with Line Tracker
- Optimized for 9.3μm or 10.2μm
- Isotope gas fills



AL30 Series Information

AL30S, AL30SP, and AL30SD Specifications

| Model | AL30S | AL30SP | AL30SD |
|---------------------------------------|--|--|--|
| Wavelength (μm) | 10.5-10.7 | 10.5-10.7 | AL30SD has features of both AL30S and AL30SP when the appropriate DC power supply is used. |
| CW Power (W) | 30 | 14 (average) | |
| Peak Power (W) | 30 | 60 | <p>¹ Power Stability is based on $\pm (P_{max}-P_{min})/(2*P_{max})$ at constant duty cycle after thermal equilibrium</p> <p>² <u>Air Cooling</u>: Fans are included as standard. 240 CFM <u>Water Cooling</u>: Min Flow Rate: 3.8 lpm (1 gpm) Recommended flow rate: 9.5 lpm (2.5 gpm) Max Pressure: 10 bar (150 psi) Temperature Range: 15-30° C (59-86° F)</p> |
| Power Stability ¹ | ±2% | ±2% | |
| Mode Quality (M ²) | <1.1 | <1.1 | |
| Beam Waist Diameter | 2.4 mm | 2.4mm | |
| Waist Location | Output Coupler | Output Coupler | |
| Full Div. Angle | 5.5 mrad | 5.5 mrad | |
| Polarization | >20:1 fixed linear vertical | >20:1 fixed linear vertical | |
| Rise Time (μs) | 100 | 100 | |
| Fall Time (μs) | 100 | 100 | |
| Supply Voltage | 36VDC 600W Regulated | 48V DC 600W Regulated | |
| Electronic PWM Parameters | Frequency up to 100 kHz, duty cycle 0-100% | Frequency up to 100 kHz, duty cycle 0-30%, pulse length up to 0.4 ms | |
| Heat Dissipation | < 600W | <600W | |
| Cooling Requirement ² | Fan Cooled Closed Loop | Fan Cooled Closed Loop | |
| Working Temperature | 5-40° C | 5-40° C | |
| Laser Weight ³ | 19 lbs. | 19 lbs. | ³ Laser weight is for fan cooled model only |
| RF Driver Weight | 7 lbs. | 7 lbs. | |
| Dimensions (LxWxH, inch) ⁴ | 20.8x3.9x6.5 | 20.8x3.9x6.5 | ⁴ Water Cooling Height: 4.2" |

Options Available

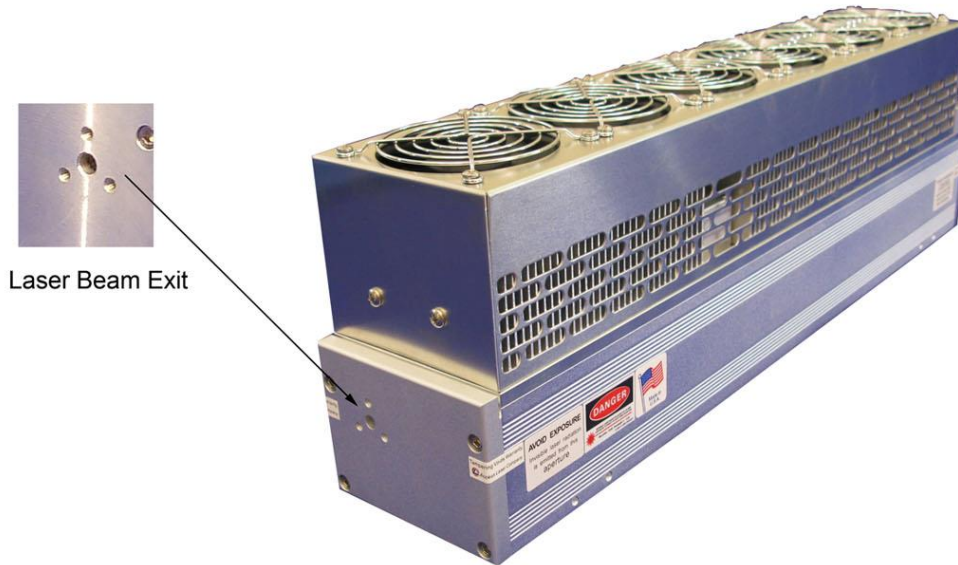
- Water cooling
- Real time power monitoring
- Stabilization to ±1% with Line Tracker
- Optimized for 9.3μm or 10.2μm
- Isotope gas fills



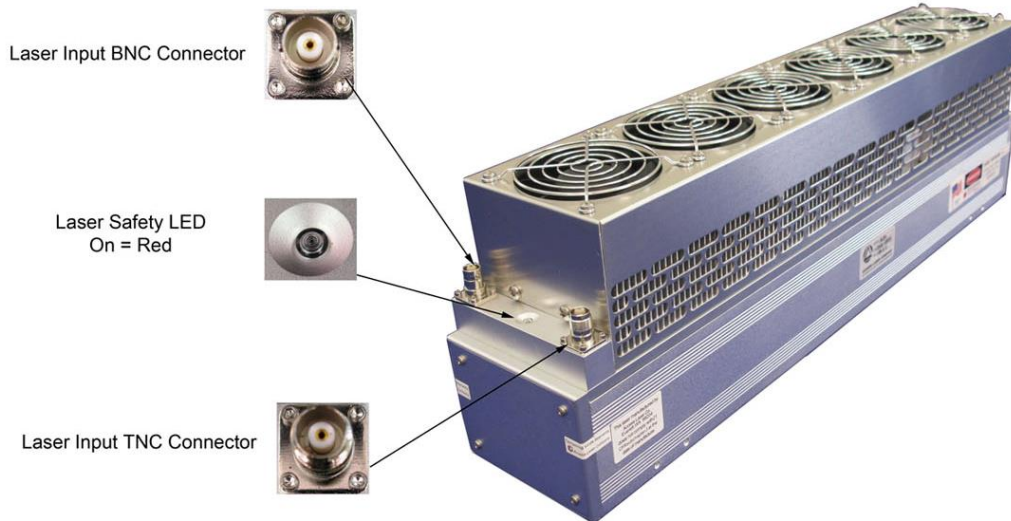
AL30 Series Information

AL30 Photos

Laser Front

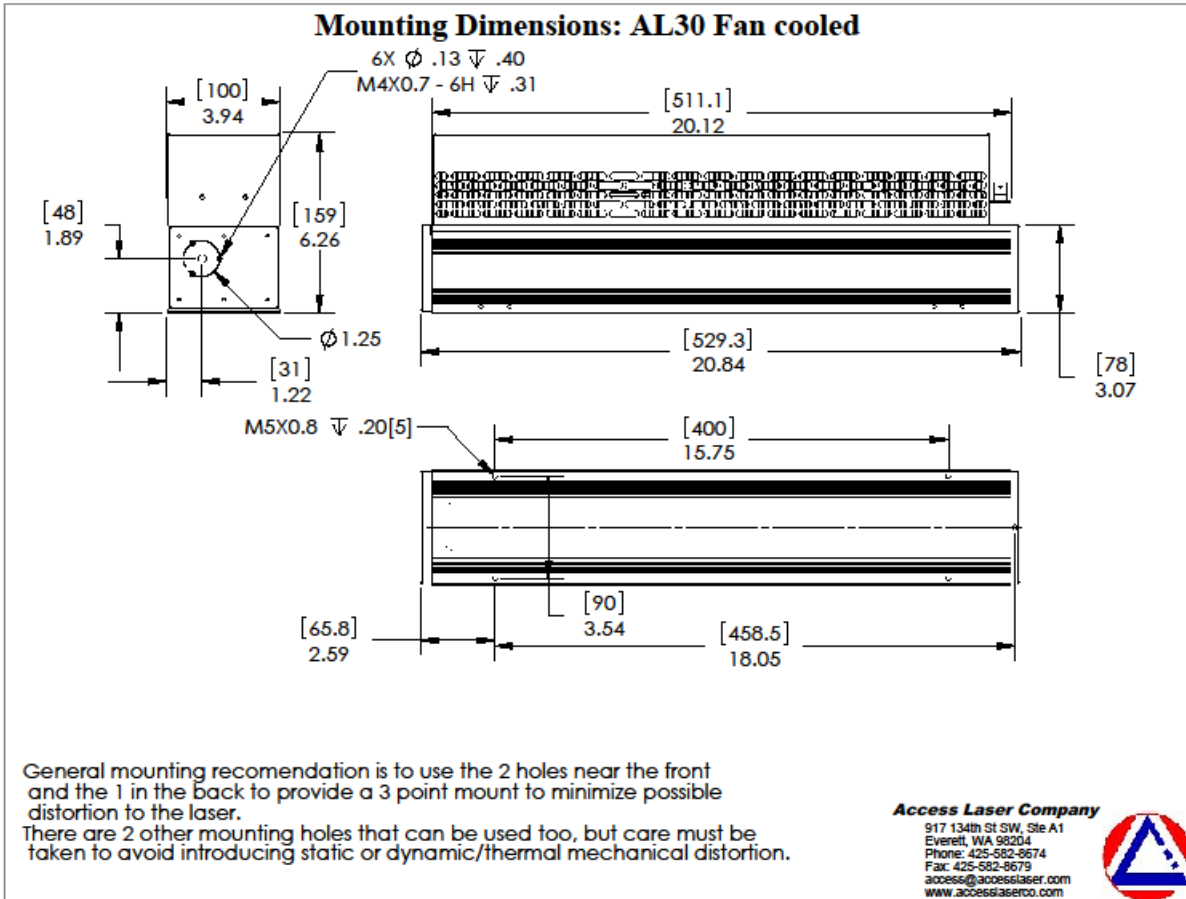


Laser Back



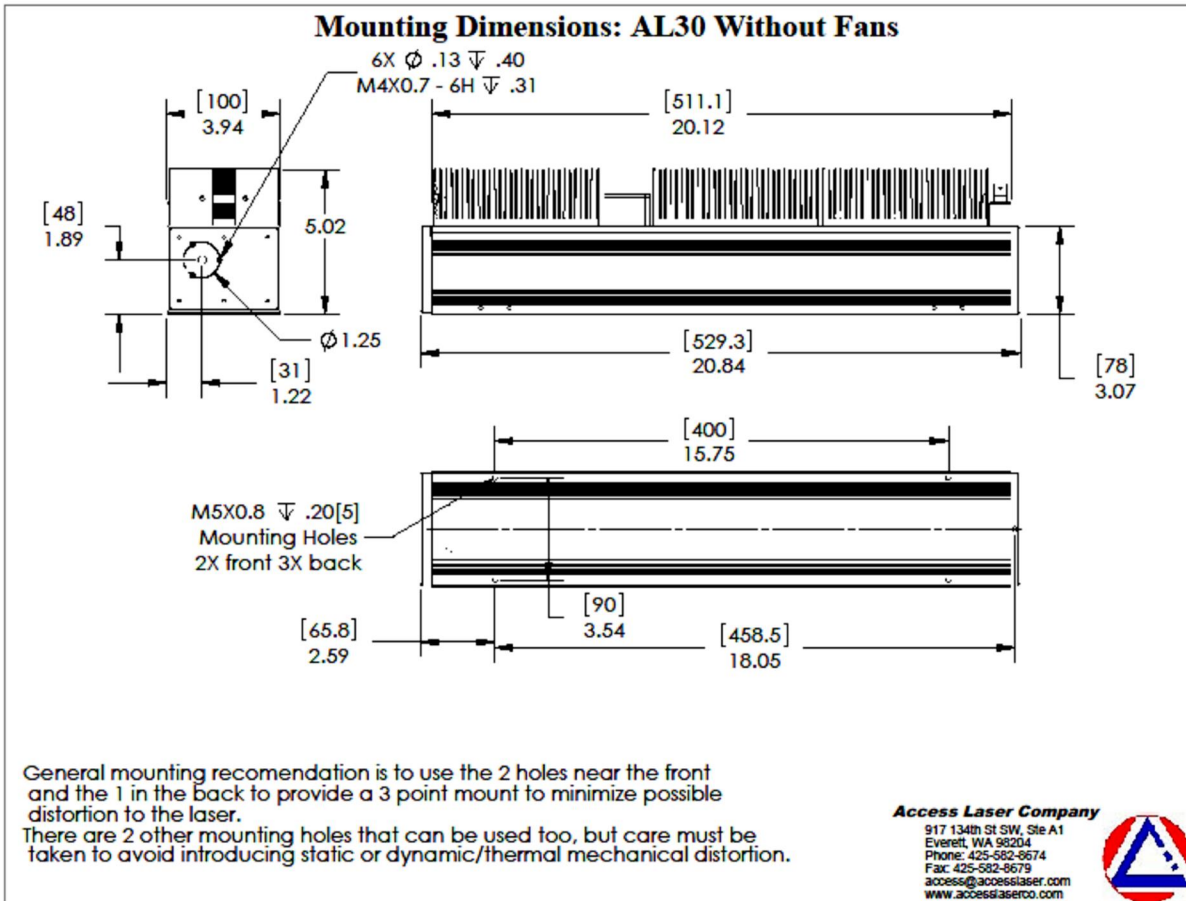
AL30 Series Information

Air Cooled Dimensions-with fans



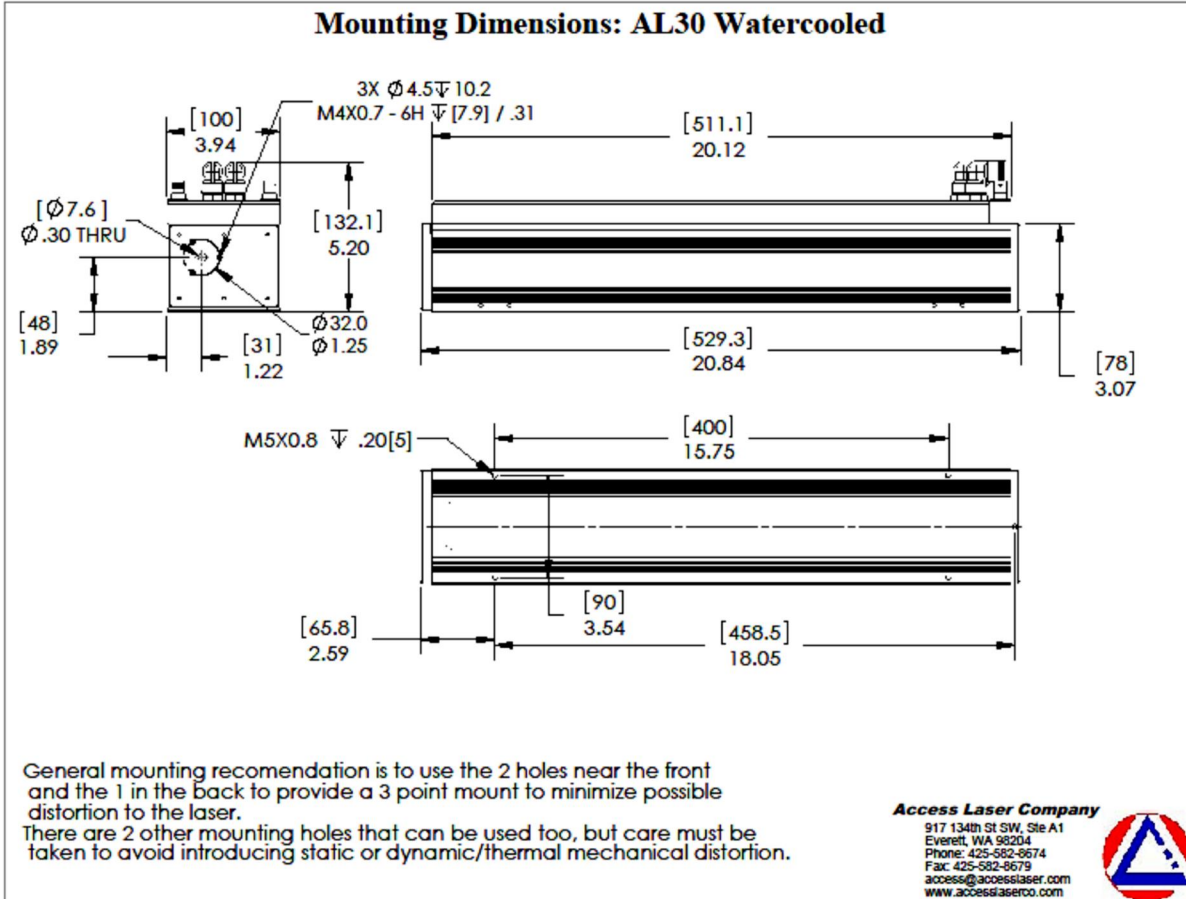
AL30 Series Information

Air Cooled Dimensions-without fans



AL30 Series Information

Water Cooled Dimensions



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AL30 Series Information

RF30 Driver Specifications

| Model | RF30 | RF30-P | RF30-D |
|-------------------|--|----------------------------------|---|
| Features | Standard | Super Pulse | Smart Driver that can be either Standard or Super Pulse |
| | External TTL Control Input up to 100kHz | | |
| | Built-in Plasma Ignition Signal at 2.5kHz | | |
| Frequency | 40.68 MHz | | |
| Supply Voltage | 36V DC Regulated | 48V DC Regulated | 36V DC / 48V DC Regulated |
| Supply Current | 16.5 Amps | 10.5 Amps | 16.5A / 10.5A |
| Output Power | 2 X 150W at CW | 2 X 250W Limited at 25% or 400us | 2 x 150 W at 36VDC CW 2 X 250W at 48VDC Limited at 25% duty cycle or 400µs |
| Dimensions/Weight | 5.7 x 10.8 x 3.7 inches (144 x 274 x 93 mm) / 7 lbs (3.2 Kg) | | |

CAUTION

Never connect the DC to the RF driver with the wrong polarity, or the RF driver will be damaged.

CAUTION

Never operate the RF driver without its output properly connected to the laser.

CAUTION

Do not block the air flow to and from the heat sink, or the RF driver will be damaged.

CAUTION

On air cooled versions, if the fans fail, the RF driver will stop immediately.

CAUTION

Do not gate the RF driver at frequencies above 100 kHz.



AL30 Series Information

RF30 Driver Photos

RF Output BNC Connector



RF Output TNC Connector



D-sub 15 Connector
The Dongle or
LC3 Controller
plug-in here

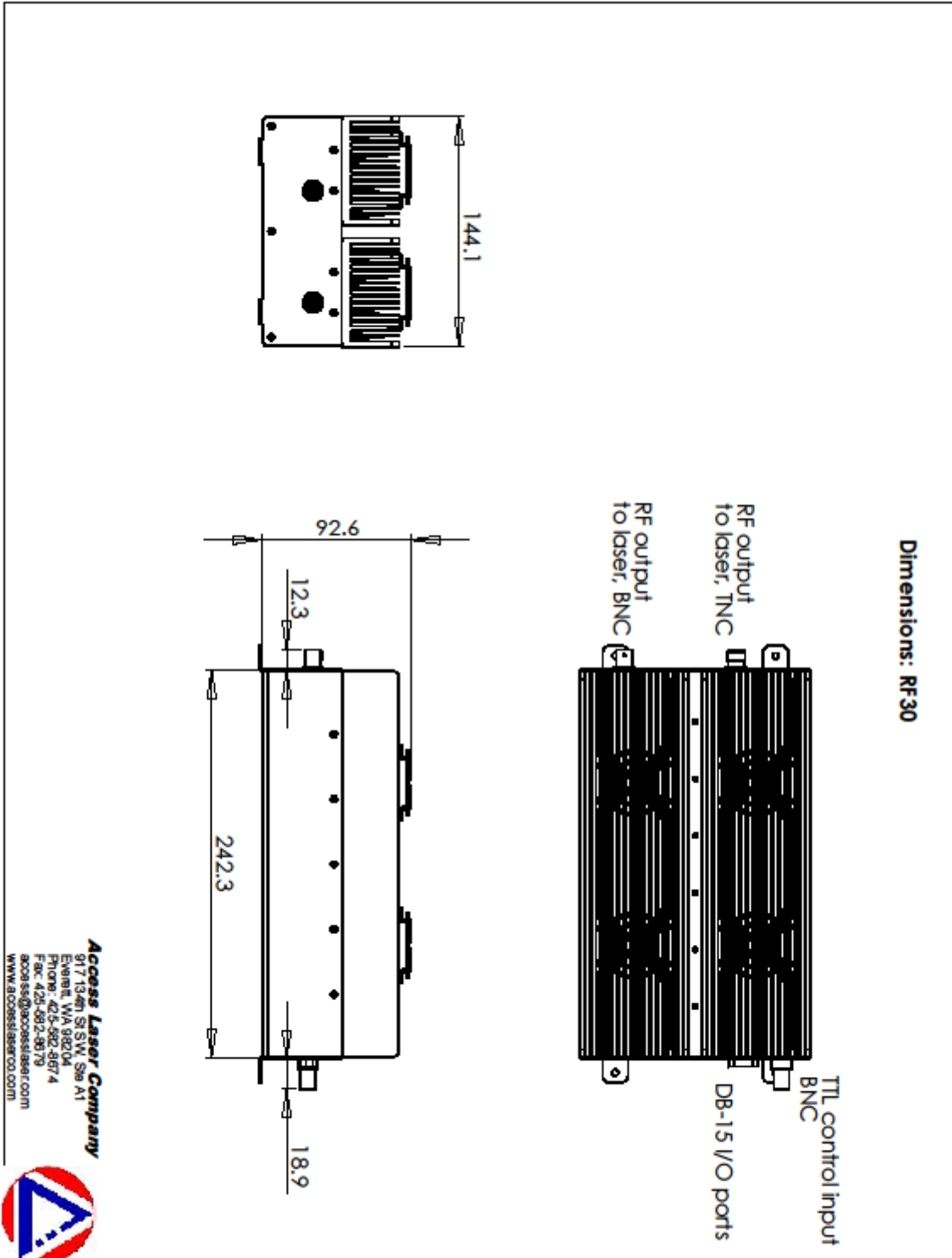


BNC Connector
TTL Input Gate
0V = Laser Off
5V = Laser On

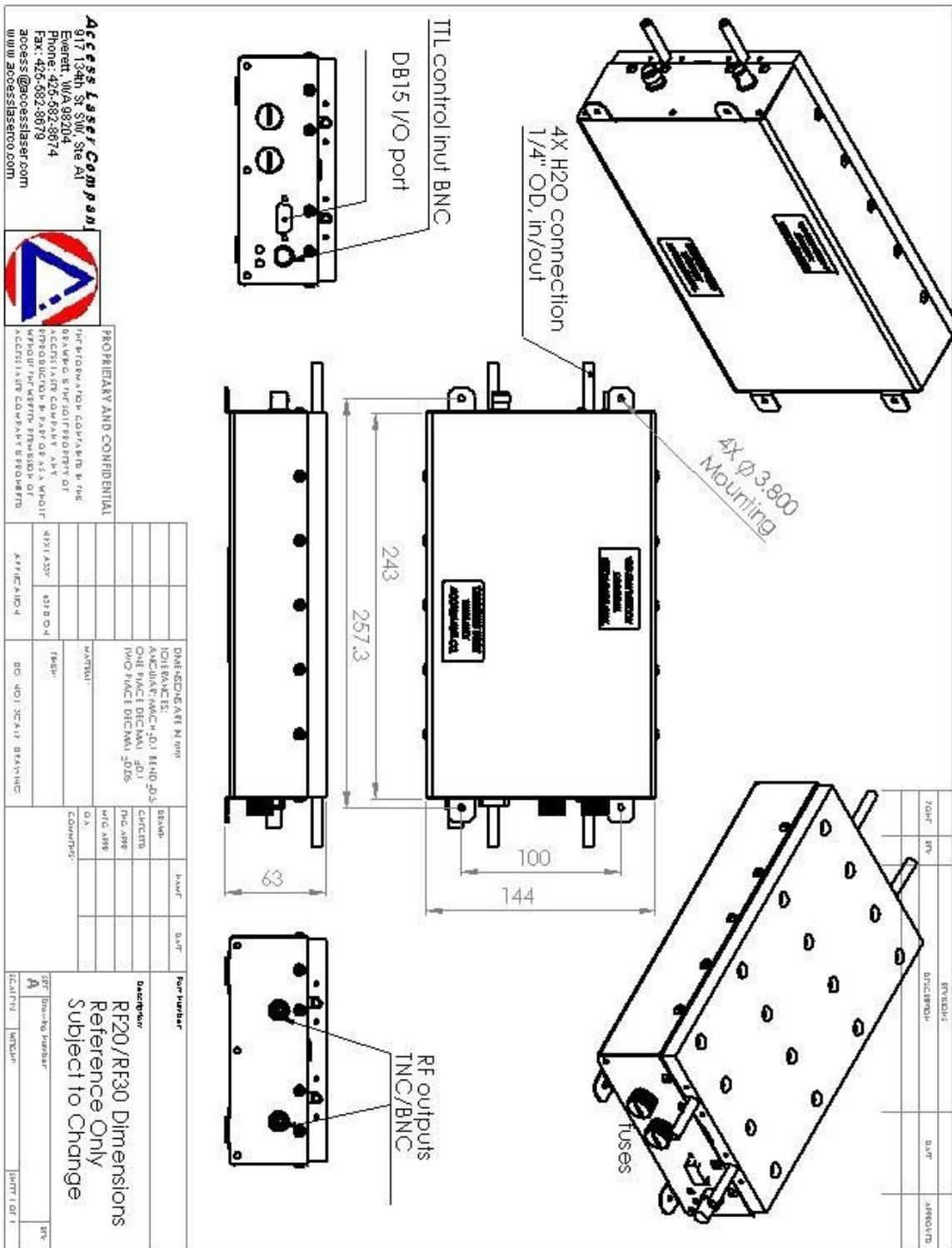


AL30 Series Information

RF30 Driver Dimensions

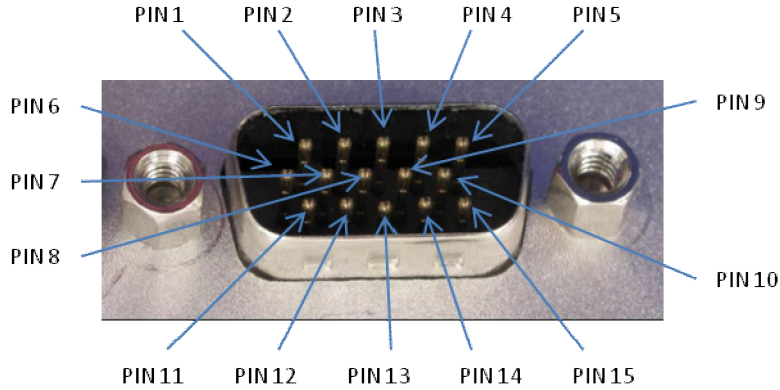






Appendix A: RF Driver D-sub 15 Connector

RF Driver D-Sub 15 Connection Port
Pin Number Diagram



Custom Controls and Signals at the D-sub 15 Connector

| Pin # | FUNCTION | MODE 0 Action / Result | MODE 1 Action / Result |
|-------|---|---|--|
| 1 | 5 VDC, 20 mA capacity, power ready. Connection to an external red LED. | Red LED off / No power. | Red LED on / Powered |
| 2 | Connected to an external green LED to indicate laser ready status, up to 10 mA supplied. | Green LED off / Laser not ready. Fault due to RF overtemp, interlock opened, or key switch fault. | Green LED on / Laser is ready to fire |
| 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. | Short to PIN 15 / DC power supply is connected to laser | Open / No DC power to laser |
| 4 | Safety Interlock = top level laser enable. This pin also needs to be enabled by PIN 6. | Short to PIN 15 / Laser enabled at the top level | Open / Laser not operational |
| 5 | AVC (Pin 11) Enable | Short to PIN 15 / Enables AVC together with PIN 10 | Open / Disables AVC |
| 6 | CDRH Safety Mode. Controls key switch on PIN 3 and Safety Interlock of PIN 4. | Short to PIN 15 / Enables key switch | Open / Disables key switch |
| 7 | Gate for Laser Enable | Not connected or connected to 0V / Laser disabled | Connected to 5V or to PIN 1 / Laser enabled |

Appendix A: RF Driver D-sub 15 Connector

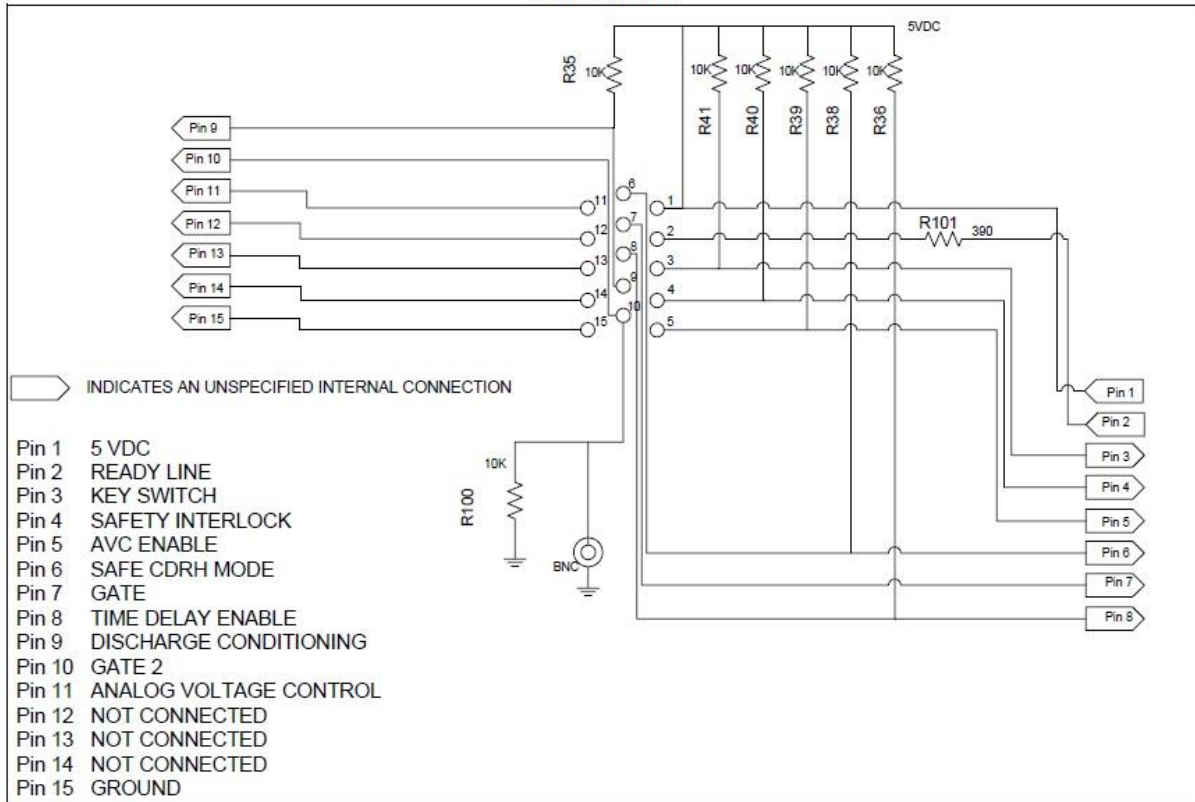
| Pin # | FUNCTION | MODE 0 Action / Result | MODE 1 Action / Result |
|-------|---|--|--|
| 8 | Time delay control: 5 seconds between initial power on and lasing | Short to PIN 15 / No delay | Open / Delay True |
| 9 | Discharge conditioning | Open / Conditioning on (Recommended for surgical applications) | Open / Conditioning on (Recommended for marking applications) |
| 10 | Gate 2, connected to BNC input, signal is provided by the customer to turn the laser on/off electronically. | Not connected or connected to 0V / Laser off | Connected to 5V / Laser on |
| 11 | Input, AVC ¹ | This is an analog function therefore there are more than two modes. ² | |
| 12-14 | Do not use | | |
| 15 | Ground | N/A | N/A |



Appendix A: RF Driver D-sub 15 Connector

ENGINEER'S NOTES

Schematic



Appendix A: RF Driver D-sub 15 Connector

ENGINEER'S NOTES (cont.)

- PIN 1 5V DC regulated supply output line. 20 mA source capacity. Intended to light remote Power On+LED. (**Important:** no internal series current limiting resistor provided on this line.)
- PIN 2 This output line is a Laser Ready+indicator in both the Safe CDRH mode and the OEM mode. When LOW, it indicates a fault has occurred and the laser is shut down: RF amplifier over heated, DIN cable not connected or RF cable not connected or damaged. The Amplifier will operate for approximately one minute on start-up before the processor checks for faults. This allows some troubleshooting before a Fault Shutdown. In the Safe CDRH mode two additional faults are indicated by PIN 2. The Key Switch fault status (see description of PIN 3) and the Interlock Fault Status (see description of PIN 4). This is an un-buffered output of 3.8V DC with internal 390 ohm current limiting resistor R101. If remoting this signal, we recommend buffering.
- PIN 3 Key Switch is an active LOW input line. The Key Switch is a safety requirement for many laser systems. PIN 3 is internally pulled HIGH with a 10k resistor R41. The Key Switch is only functional in the Safe CDRH mode (PIN 6 LOW). To implement a Key Switch use the normally open contacts. (Key Switch on+ is PIN 3 pulled LOW). The Key Switch has to be turned on before the laser can operate. When there is a power outage the Key Switch has to be recycled to restore laser operation. The key should not be removable when the Key Switch is turned on.
- PIN 4 Safety Interlock is an active HIGH input line. The Safety Interlock is a safety requirement for some laser systems. When PIN 4 is functional any logic HIGH transition on PIN 4 halts lasing. PIN 4 is internally pulled HIGH with a 10k resistor R40. The Safety Interlock is only functional in the Safe CDRH mode (PIN 6 LOW).
- PIN 5 Analog Voltage Control (AVC) input enable line. The AVC input is a LOW enable. PIN 11 becomes active as a 0V DC to 5V DC analog PWM control line. See definition of PIN 11 for AVC mode of operation. When PIN 5 is pulled HIGH (internal 10k pull up resistor R39), lasing is controlled exclusively by the logical result of Gate (PIN 7) AND Gate-2 (PIN 10).
- PIN 6 Safe CDRH mode LOW enable input line. The Key Switch (PIN 3) and the Safety Interlock (PIN 4) becomes active. When PIN 6 is pulled HIGH (internal 10k pull up resistor R38) these two safety devices are disabled. Operation with PIN 6 disable (HIGH) is generally referred to as the OEM mode+.



Appendix A: RF Driver D-sub 15 Connector

- PIN 7 Gate is an active HIGH lasing enable input. Gate is pulled LOW internally (processor controlled 10k pull down resistor). To initiate lasing, both the Gate (PIN 7) and Gate-2 (PIN 10) input lines must be pulled HIGH externally by user.
- PIN 8 Delay Enable is an active HIGH input. When active, while operating in the OEM mode (PIN 6 HIGH), a 5 second delay is enforced every time the DC supply electrical power is cycled. PIN 8 must be enabled to operate in the Safe CDRH mode. When active, while operating in the safe CDRH mode, a 5 second lasing safety delay is enforced every time the Key Switch is cycled. The Delay Enable line is internally pulled HIGH by a 10k resistor R36. User must pull PIN 8 LOW to suppress the safety delay (not recommended).
- PIN 9 Discharge Conditioning active HIGH enable input line. PIN 9 is internally pulled HIGH by a 10k resistor R35. User must pull PIN 9 LOW to suppress Discharge Conditioning.
- PIN 10 Gate-2 is an active HIGH lasing enable input. Gate-2 is pulled LOW by an internal 10k pull down resistor R100. To initiate lasing, both the Gate-2 (PIN 10) and Gate (PIN 7) input lines must be pulled HIGH externally by the user. Additionally, Gate-2 is wired directly to the external BNC connector.
- PIN 11 AVC (Analog Voltage Control) input. See definition of PIN 5. A 0V DC to 5V DC analog voltage on PIN 11 results in a proportional 0% to 100% Pulse Width Modulated (PWM) laser output. The PWM frequency is 2.5 kHz. To enable the internal PWM drive signal in the AVC mode: PIN 5 must be held LOW by user, Gate-2 (PIN 10) must be pulled HIGH by user, Gate (PIN 7) can be left open (NC) or pulled HIGH by user and a non-zero voltage between 0V DC and 5V DC must be present on PIN 11 for lasing to occur. By the way of Example 1, 1V at this pin will cause the PWM to operate at a 20% duty cycle, 3V at 60%, etc. (Note: Gate (PIN 7) is pulled HIGH internally by the processor. PIN 7 is functional as a lasing sizable when pulled LOW by the user.)
- PIN 12 Disabled
- PIN 13 Disabled
- PIN 14 Disabled
- PIN 15 Ground



Appendix B: Available Accessories

LC3 Laser Controller

SPECIFICATIONS & OPERATION

| | |
|-----------|--|
| Model: | LC3 |
| Features: | Safety Key Switch Safety Interlock Power Adjustment External Gate |



Operation Procedure

- Make certain the D-sub15 Connector on the RF Driver is available to accept the connector on the end of the controller.
- Make certain that the 3 position switch is in the middle, placing the laser in standby %STBY+mode.
- Install the LC3 D-sub15 Connector; the Red %POWER+LED should light.
- Turn the key switch from the %OFF+ position to the %ON+ position, the Green %READY+LED should light after ~5 seconds.
- If running the DC voltage at 28V switch into %0-100% mode, the Red %MODE+LED should light up. The knob will adjust from off to CW (0-100%) as it is turned Clockwise.
- The TTL Gate on the controller can be used to turn off the laser by applying ground. When the ground is removed or 5V is applied the laser will turn on at the duty cycle setting determined by the knob position. The gate can be modulated as necessary up to 100kHz.
- The interlock connector on the LC3 can be connected to a user provided safety switch or door switch, to have the laser turn off. It is a 1/8+stereo jack; the two wires must remain shorted together for the laser to operate. The connector is self-shorting, so if not using the interlock there is no need to plug anything into it.
- If any of the interlocks are triggered or the DC power is interrupted the Key Switch will need to be cycled OFF and back ON to turn the laser back on.

Appendix B: Optional Accessories

TC2a Temperature Controller (Standard on air-cooled -S models)

Operation Instructions for TC2a when used with RF30 Driver

To find the temperature range for the TC2a:

- Run the laser at full power (no modulation) with the fans constantly on. The laser temperature should rise approximately 30° F above room temperature.
- Run the laser at full power with the fans off. The laser temperature should rise above 130°F, which should be avoided.
- This gives the maximum range above ambient temperature that the controller should be set to.
 - For example, with an ambient room temperature of 68°F, the temperature settings can be between 98°F (68°+30°) and 130°F.
- Different wavelengths may be tuned in and stabilized by setting the temperature controller within the maximum range. A reference table specific to your laser was created when laser is produced. It is part of the final Test Documents included in your laser's shipment. Because lab conditions vary, the reference table provides you with an approximation. A final table can be created in your own lab environment.
- From a cold start, thermal equilibrium and stability are achieved after approximately 30 to 45 minutes.

Notes

- The temperature rise will differ at duty cycles of less than 100%. The set point on the TC2a where the laser is most stable at the desired wavelength will therefore be different.
- If the power is not within the desired stability the laser may switch from one wavelength to another. Try adjusting the set point by $\pm 0.1^\circ$ F to $\pm 0.4^\circ$ F. This will re-center the laser resonator for a particular wavelength.
- The controller has an auto-tune feature for its PID control. A cycle time of approximately 7 seconds is expected, with a proportional band set around 1° F.



Appendix B: Optional Accessories

TC2a Temperature Controller (Standard on air-cooled -S models)

Temperature Controller Default Settings

| | |
|------------|------------|
| P = 1 | P-N2 = 8 |
| I = 125 | P-SL = 32 |
| D = 28.8 | P-SU = 150 |
| CTRL = PID | P-DP = 1 |
| TC = 7 | P-N1 = 3 |

CAUTION

This controller is intended for Continuous Wave (CW) laser operation. If you modulate the laser to achieve different power levels, the laser resonator will have different thermal characteristics and the TC2a may not perform as designed.

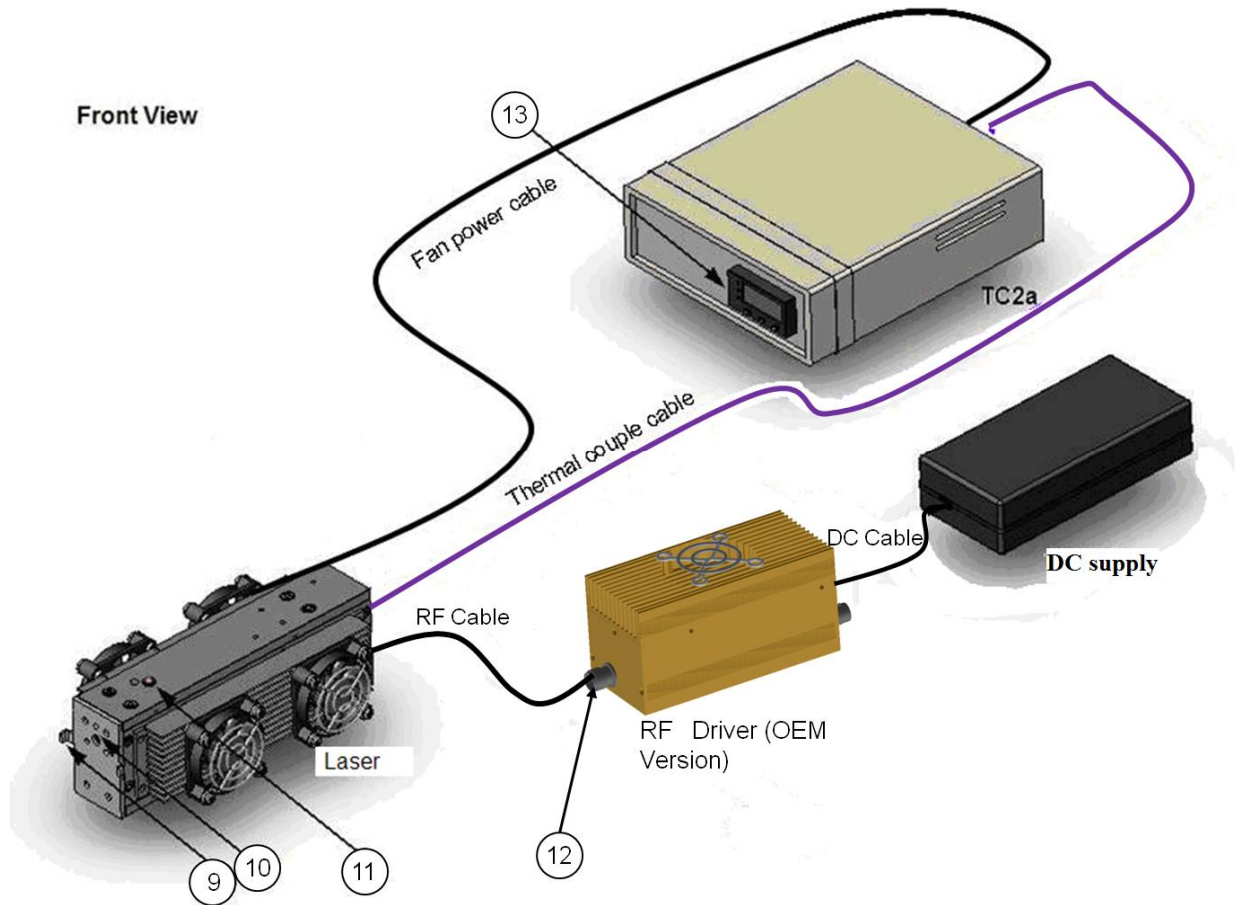
CAUTION

Air from fans may interfere with laser power monitoring.



Appendix B: Available Accessories

Laser System Connection Diagram With TC2 Temperature Controller



1. Manual Shutter
2. Laser Beam Exit
3. Laser Power-on indicating LED
4. RF Output
5. Temperature Display
6. Type E Thermocouple Input
7. Controlled fan power out
8. AC power in (110-240V) for TC2
9. TC2 power switch
10. RF driver control signal input, BNC
11. DC power input for RF driver
12. RF input to laser, TNC
13. Temperature display



Appendix B: Available Accessories

Line Tracker

CLOSED-loop Spectrum/Power Stabilizer

A line tracker is available as an accessory for any . S or . G model laser. A line tracker maintains a fixed wavelength at a high degree of power and frequency stability in a CO₂ laser. The line tracker consists of a beam sampling assembly, a Piezo actuator and a controller. The Line Tracker can be connected to a computer through an RS-232 interface for information and data logging. Any of the Access Laser . S (stabilized) or . G (grating tuned) lasers can be equipped with Line Tracker to achieve more robust, longer term operation of $\pm 1\%$ power stability, even in outdoor applications where the ambient environment fluctuates.



Screen shot of the Line Tracker computer interface. This plot was obtained with a Merit laser.

Appendix C: Returns

If a failure should occur, please contact your Access Laser Company representative, or contact our Headquarters at 1-425-582-8674 or at 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 your 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. Special considerations may apply. Be sure to verify shipping costs with your ALC representative.

When requesting an RMA please have the following information ready:

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

Fill out the RMA as completely as possible. Include a copy of the RMA in the laser package. Also fax a copy to us at 1-425-582-8679, Attention: Service. When faxing the RMA please include the tracking number for the return shipment.

For any returns, please ship the item(s) to:

Access Laser Company
Attn: Service Department
917 134th St SW, Suite A1
Everett, WA 98204

Include the laser and ALL accessories when returning the laser. This allows ALC to test each component and determine the source of the issue.



