



ACCESS LASER

where innovation never stops

Merit Series Operator Manual



(Merit S pictured above)

Access Laser Company
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Everett, WA 98204
425.582.8674

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
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Service Department	service@accesslaser.com
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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.



Laser Shipment Contents

The following items are typically enclosed with each laser shipment:

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



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 L4 series lasers meet all standards for laser products under 21CFR 10.40.10 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. Use of controls, adjustments or performance procedures other than those specified herein may result in hazardous exposure.



Eye Protection Required

The L4 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.



Use Appropriate Beam Blocks

The L4 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.

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.



Safety Information

Safety Label Locations



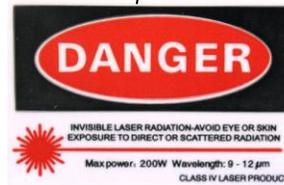
**CAUTION: DO NOT LIFT
BY MICROMETER**

Non-OEM*

This laser manufactured by Access Laser Co. Everett, WA 98204 complies with 21 CFR subchapter J at the date of manufacture.

OEM*

This laser manufactured by Access Laser Co. Everett, WA 98204 does not comply with 21 CFR sub-chapter J at the date of manufacture.



AVOID EXPOSURE

Invisible laser radiation is emitted from this aperture

* All non-OEM lasers comply with 21 CFR subchapter J at the time of manufacture. If your laser is a custom order (OEM), it is your responsibility to assure compliance with CFR in your final application.

(Merit G-LT pictured above)

Laser Information

Merit G Laser Specifications



MeritG with Water Cooling and Line Tracker¹

Model	MeritG	MeritGP	MeritGD
Wavelength (μm)	9.2 to 10.8 μm	9.2 to 10.8 μm	
No. of Lines	50	55	
CW Power	2 watt	-	
Peak power	2 watt	6 watt	
Power stability	±5%	±5%	
Mode Quality (M ²)	< 1.2	< 1.2	
Beam waist diameter	2.4 mm	2.4 mm	
Full Div. Angle	5.5 mrad	5.5 mrad	
Polarization	Vertical	Vertical	
Supply Voltage	28 VDC, 240 W	48 VDC, 240 W	

Electronic PWM parameters	Any frequency up to 100kHz, duty cycle 0-100%	1 kHz to 100kHz, duty cycle 0-25%, pulse length to 0.2 ms
Cooling Requirement	Forced air / Water 0.5 GPM	Forced air / Water 0.5 GPM
Working Temp	5 to 40°C	5 to 40°C
Dimensions (LxWxH)	16" x 2.8" x 4.1"	16" x 2.8" x 4.1"

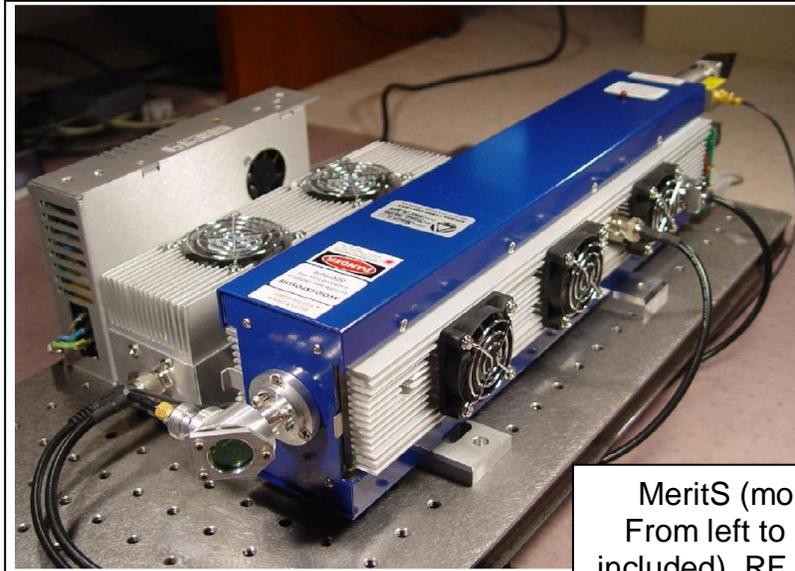
Options available:

- Single fixed wavelength (factory preset)
- Power stabilization with closed loop temperature control ±3%
- Power stabilization with Line Tracker ±1%
- Water cooling
- Cold plate cooling
- Isotope gas fill for different wavelength range



Laser Information

Merit S Laser Specifications



MeritS (mounted with options).
From left to right: DC supply (not included), RF driver (included), Merit

Model	MeritS	MeritSP	MeritSD
CW power	8	5 (average)	
Peak power	8	24	
M ²	< 1.1	< 1.1	
Beam waist diameter	2.4 mm	2.4 mm	
Waist location	Output coupler	Output coupler	
Full Div. Angle	5.5 mrad	5.5 mrad	
Power stability	±2%	±2%	
Wavelength (µm)	Around 10.6	Around 10.6	
Rise time (µs)	200	100	
Fall time (µs)	200	100	
Electronic PWM parameters	Frequency up to 100 kHz, duty cycle 0-100%	Frequency up to 100 kHz, duty cycle 0-25%, pulse length up to 0.4 ms	
Supply Voltage	28 VDC	48 VDC	
Supply Current	7 Amp	5 Amp	
Cooling Requirement	Forced air / Water 0.5 GPM	Forced air / Water 0.5 GPM	
Working Temp	5-40 C	5-40 C	
Dimensions(inch)	14x4x3 (5.0 with fans mounted)	14x4x3 (5.0 with fans mounted)	



Laser Information

Merit S Laser Specifications

Options Available:

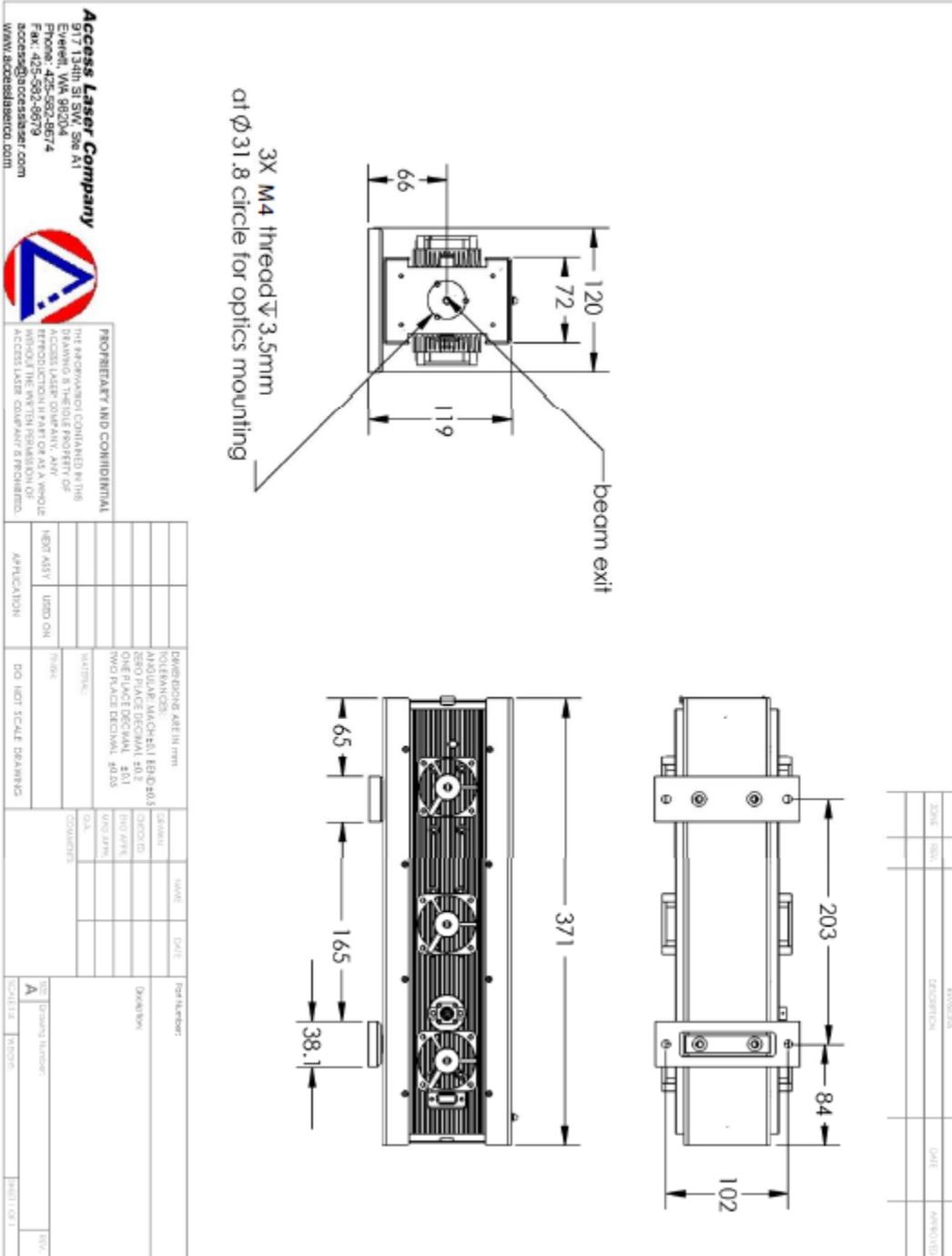
- Water cooling
- Real time power monitor
- Optimized for 9.3 μm
- Power stabilization with Line Tracker $\pm 1\%$
- Isotope gas fill for different wavelength range



Laser Information

Merit S Mounting Dimensions

Air Cooled



Laser Information

RF Driver Specifications

Model	RF10b	RF10bP	RB10bD
	Standard	Superpulse driver	Smart driver that can be operated as standard or superpulse
	External TTL Control Input up to 100 KHz Built in plasma ignition signal at 2.5kHz		
	Built in plasma conditioning signal		
Frequency	40.68 MHz		
Supply Voltage	28V DC, 7A	48 V DC, 4A	28 VDC 7 A or 48 VDC, 7A or 4A
Supply Current	14 Amps	8 Amps	14 Amps
Output Power	120 W up to CW	300 W up to 30% or 400 μ S	120 W up to CW or 300 W up to 30% and 400 μ S
Dimensions (inches)	9.6 inch x 3.4 inch x 2.7 inch		
Weight	4 lb		

Caution:

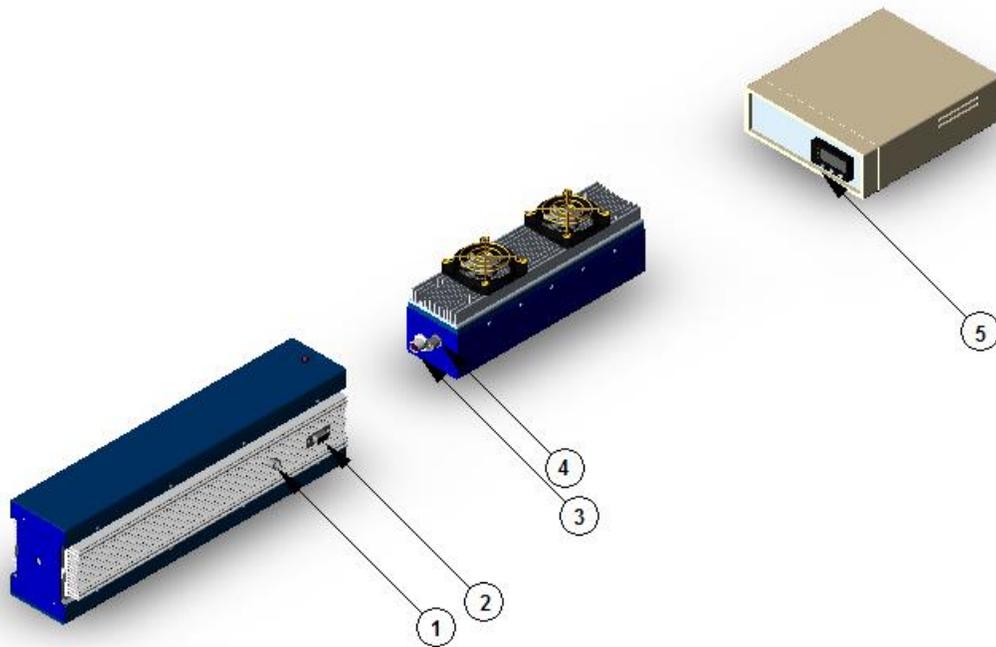
1. Do not connect the DC to the RF driver with the wrong polarity, or the RF driver will be damaged, and void the Warranty.
2. Do not operate the RF driver without its output properly connected to the laser.
3. Do not block the air flow to and from the heat sink, or the RF driver will be damaged.
4. If the fans fail, the RF driver will stop immediately.



Connection Diagrams

Laser to RF Driver

Front View

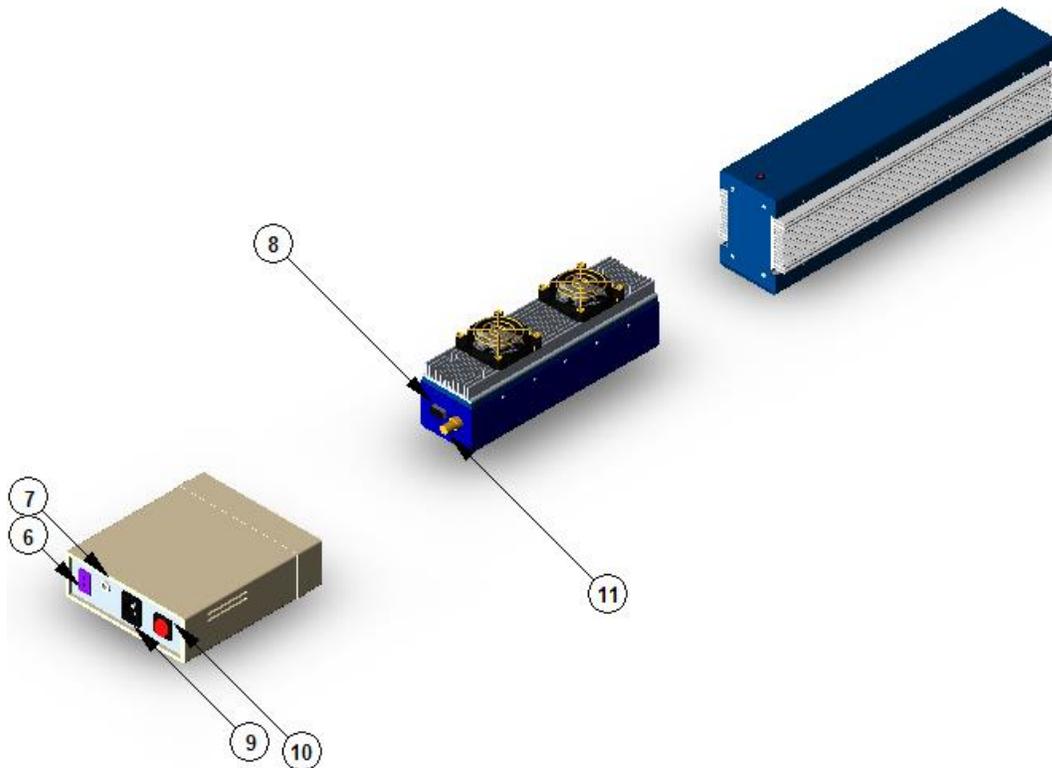


1. TNC RF Power Input, connect to 4
2. D-sub 9 Laser Interlock Input on Laser, connect to 3
3. 6 pin Mini-DUN Laser Interlock on RF Driver, connect to 2
4. TNC RF Output on RF Driver, connect to 1
5. TC2 Controller (*Note: This is an optional feature for air-cooled systems only, and is not included with every system*)

Connection Diagrams

Laser to RF Driver

Rear View



6. Type E Thermocouple for TC2(plug in sensor lead from laser)
7. 5mm x 2.1mm, 12 VDC, connect to fans(not shown)
8. D-sub HD15, plug in LC3 Laser Controller or OEM Dongle.
9. AC Input for TC2
10. Power Switch for TC2
11. BNC TTL Input for Laser Modulation when OEM dongle is plugged in 8.

Connection Diagrams

Water Cooling (optional feature)

Water Cooling 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 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). These fittings are easy to use.

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.
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.

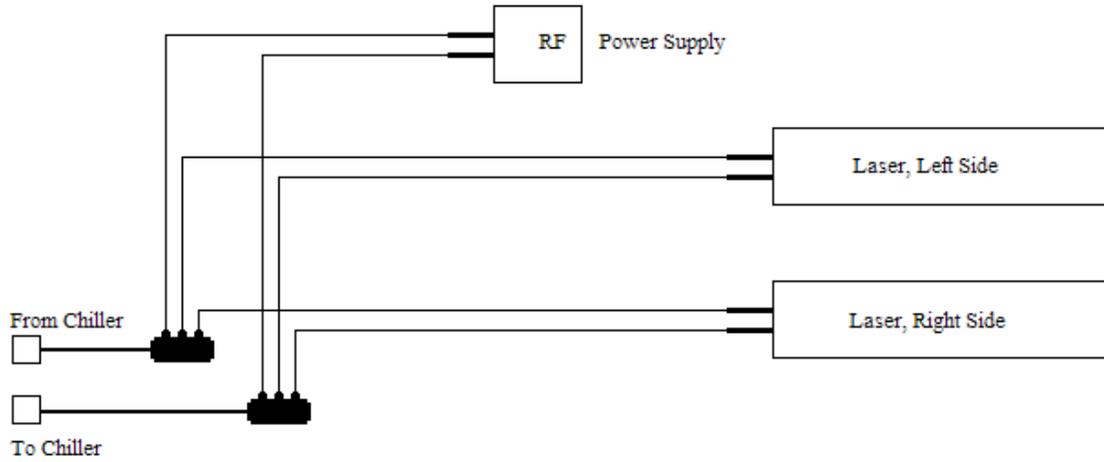
To Operate

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.



Connection Diagrams

Water Cooling (optional feature)



Laser Operation Instructions

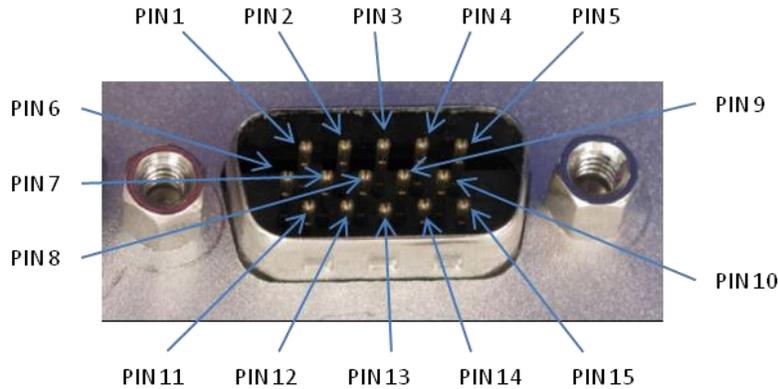
1. Direct the laser toward a target, such as a power meter or a beam-blocking device.
2. Connect the components of the laser system with the cables provided as shown in the Connections Diagram.
3. Open the laser shutter (if present).
4. The laser is controlled by applying 5V DC (20 mA) to the TTL Gate on the RF Driver (0V=off, 5V=on). The RF driver can be modulated at frequencies from 0 Hz to 100 kHz, but optimal grating frequency is 1-15 kHz. Standard for Merit lasers, too?
5. Verify the enabling plug on the D-sub 15 connector is installed on the RF driver.
6. Connect the appropriate DC Power Supply to the RF Driver
 - a. Merit-S or -G: 28V DC for CW operation
 - b. Merit-SP or -GP: 48V DC for Super Pulse operation
 - c. Merit-SD or -GD: Correct power supply for desired mode
7. 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.
8. **WARNING: For super pulse (48 volt) running above 30% duty cycle or 400 μ s pulse length may damage the RF driver. The internal protection program will interrupt user signal beyond these parameters, making the output inconsistent.**
9. **Do not externally gate this power supply above 100kHz.**



Appendix A: Available Accessories

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

Appendix A: Available Accessories

RF Driver D-sub 15 Connector

6	CDRH Safety Mode. Controls key switch on PIN 3 and Safety Interlock of PIN 4.	Short to PIN 15 / Enables key switch	<i>Open / Disables key switch</i>
7	Gate for Laser Enable	Not connected or connected to 0V / Laser disabled	<i>Connected to 5V or to PIN 1 / Laser enabled</i>
8	Time delay control: 5 seconds between initial power on and lasing	Short to PIN 15 / No delay	<i>Open / Delay True</i>
9	Discharge conditioning	Short to PIN 15 / Conditioning off (NOT recommended)	<i>Open / Conditioning on</i>
10	Gate 2, connected to BNC input, signal is provided by the customer to turn the laser on/off electronically.	<i>Not connected or connected to 0V / Laser off</i>	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

Bold, italicized text indicates OEM factory configuration with D-sub plug provided

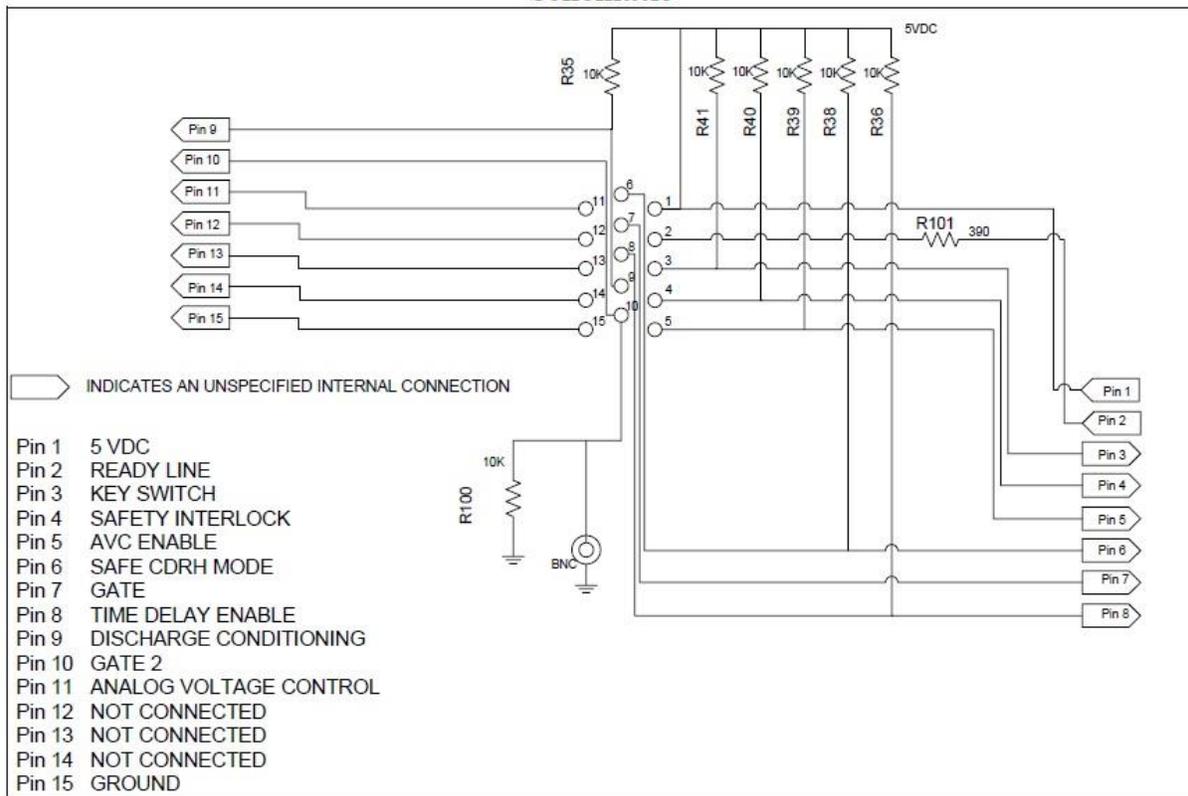


Appendix A: Available Accessories

RF Driver D-sub 15 Connector

Engineer's Notes

Schematic



Appendix A: Available Accessories

RF Driver D-sub 15 Connector

Engineer's Notes

- 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: Available Accessories

RF Driver D-sub 15 Connector

Engineer's Notes

- 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 (not recommended).
- 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 A: Available Accessories

LC3 Laser Controller (Optional)

Specifications & Operation

Model: LC3

Features: Safety Key Switch
Safety Interlock/ Phono plug
Stand-by, CW or Pulse/ Toggle Switch
Power Adjustment/ Knob
External Gate/ BNC Connector



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 supply DC voltage is 28V switch into CW (0-100%) mode, the Red “MODE” LED should light up. The knob will adjust pulse width 0-100% as it is turned Clockwise. The frequency of this pulse-width modulation is 2.5 kHz.
- If supply DC voltage is 48V switch into Pulse (0-30%) mode, the Blue “MODE” LED should light up. The knob will adjust pulse width 0-30%) as it is turned Clockwise. The frequency of this pulse-width modulation is 2.5 kHz.
- A ground voltage supplied through the BNC connector turns off the laser. When the ground is removed or 5V is applied the laser will turn on at the duty cycle setting determined by the knob position. This TTL level gate signal can be 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 the interlock is 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.

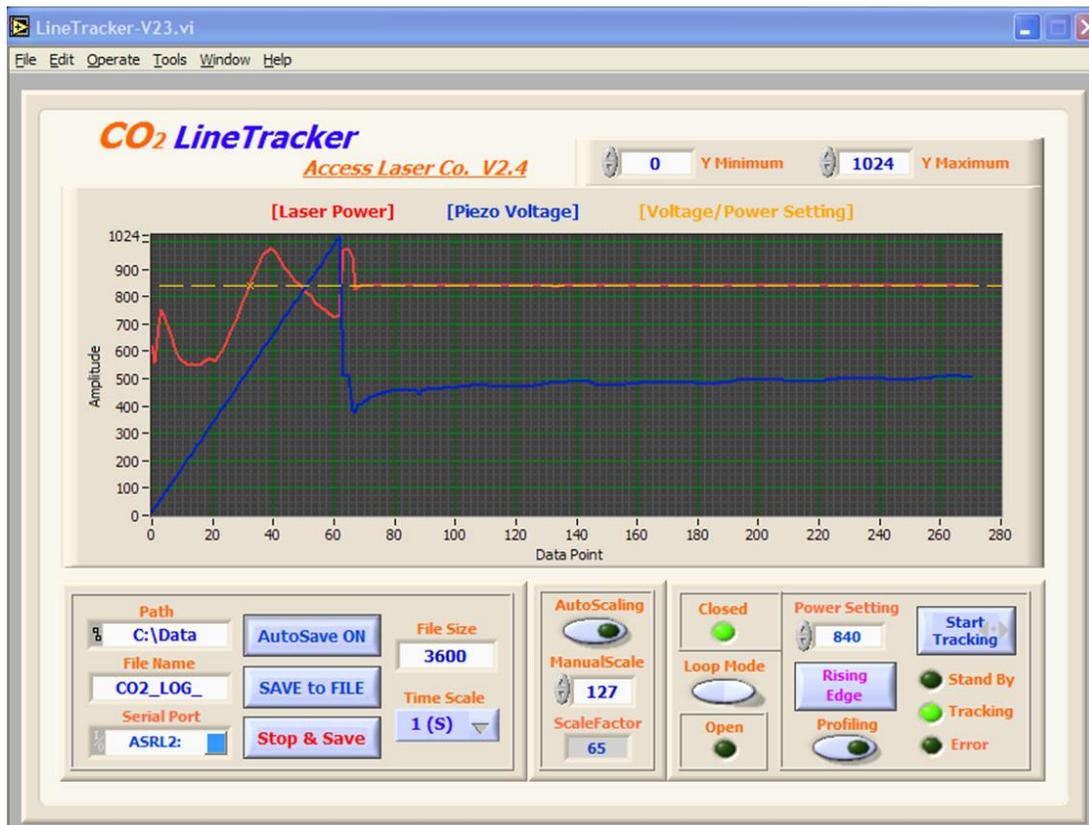


Appendix A: Available Accessories

Line Tracker (Optional)

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 an L4S laser.



Appendix B: 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.

