LDM9LP
Pigtailed Laser Mount

Operating Manual

Table of Contents

Chapter 1 Warning Symbol Definitions

Below is a list of warning symbols you may encounter in this manual or on your device.

Symbol	Description
	Direct Current
	Alternating Current
	Both Direct and Alternating Current
	Earth Ground Terminal
	Protective Conductor Terminal
	Frame or Chassis Terminal
	Equipotentiality
	On (Supply)
	Off (Supply)
	In Position of a Bi-Stable Push Control
	Out Position of a Bi-Stable Push Control
	Caution: Risk of Electric Shock
	Caution: Hot Surface
	Caution: Risk of Danger
	Warning: Laser Radiation
	Caution: Spinning Blades May Cause Harm

Chapter 2 Safety

Chapter 3 Description

- Designed for Thorlabs' Ø5.6 mm (TO-56) and Ø9 mm (TO-9) Pigtailed Laser Diodes, Single Mode, Polarization Maintaining, or Multimode
- TEC Element Prolongs LD Life and Stabilizes Output Power and Wavelength
- Clamshell Design Eliminates Thermal Gradients Across Diode
- Bias-T Adapter for RF Modulation of Laser Current >200 kHz

Thorlabs' LDM9LP is an LD and TEC mount designed for use with all of our 3- and 4-pin pigtailed diodes[1]. The compact housing protects the pigtail from physical damage, while also offering excellent thermal characteristics. Two 1/4" through holes can be used for securing the mount to an optical table with 1/4"-20 or M6 cap screws.

When operating a pigtailed laser diode, temperature control is highly recommended to stabilize the laser's power and wavelength, while also prolonging the life of the laser. Typical laser diode mounts rely on contact between the diode and the mount's cold plate for heat transfer. Pigtailed laser diodes are often recessed in the pigtail's housing, offering poor contact with the cold plate of standard laser diode mounts. The LDM9LP, however, is specifically designed for operating pigtailed laser diodes. Its clamshell design reduces thermal gradients across the diode, while its cold block cradles the pigtail housing for excellent contact and heat transfer.

DB9 connections interface with all of Thorlabs' LD Current Controllers and TEC Controllers. An SMA connector allows access to a Bias-T circuit for RF modulation of the laser's drive current (200 kHz to >1 GHz). For modulation below 200 kHz, current should be modulated through the laser diode controller. A remote interlock jack is provided for the connection of safety devices such as shutters and warning signs.

1 Due to the variety of fiber pigtailed laser diode packages offered by other companies, this mount is only designed for use with Thorlabs products. Thorlabs offers a laser diode pigtailing service; please contact Tech Support for details.

LDM9LP Contents:

- Pigtail Mount
- 1.5mm Hex Key
- Operating Manual

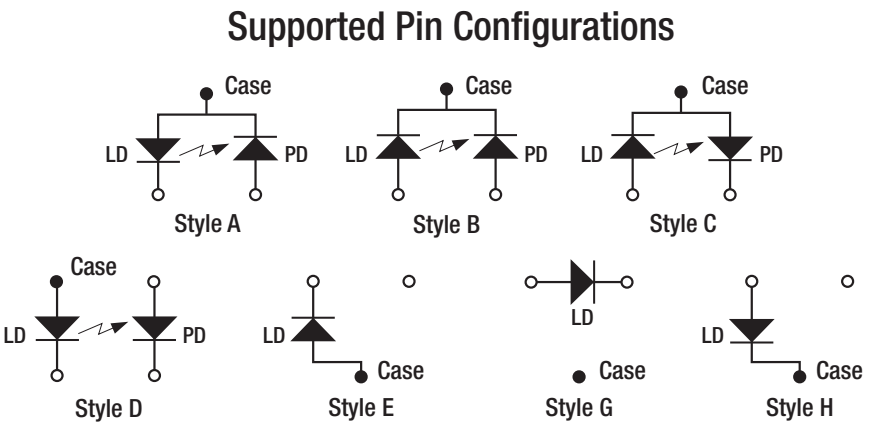


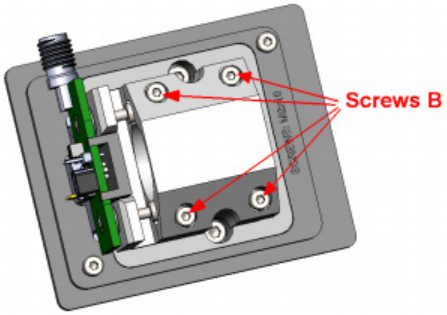
Figure 1 ***Supported Pin Style***

Chapter 4 Setup

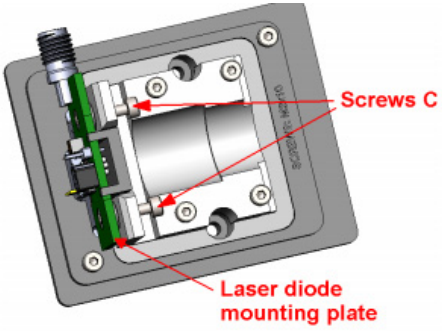
4.1. General

1. Remove the two M2 screws, from the protection cover and remove the cover.

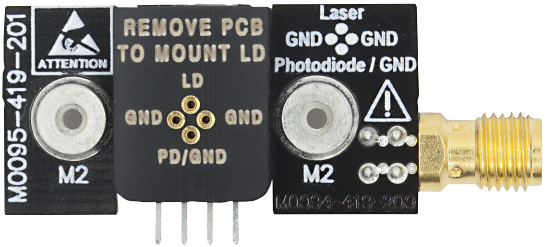
2. Remove the four M2 screws, that fix the upper cooler shell, and remove the upper shell.



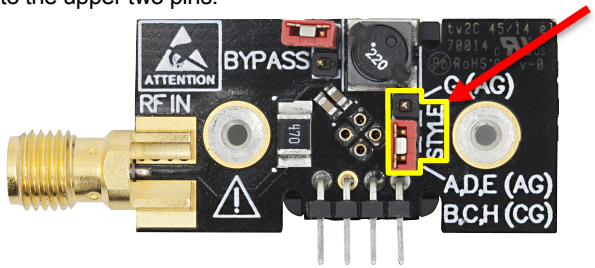
3. Remove the two M2 screws fixing the laser mounting plate to the cooler and pull out the plate from the connector.



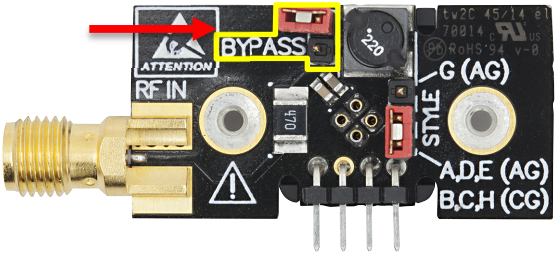
4. Determine the laser pin config-uration from the laser diode data sheets and install the Laser Diode into the socket as shown, according to the corresponding Pin Code. Refer to Figure 4 on page 9.



5. The STYLE jumper on the back of the laser mounting PCB should be placed according to the particular LD pin configuration being used. For pin codes A, B, C, D, E, or H, set the STYLE jumper to the lower two pins. For pin code G, set the jumper to the upper two pins.



6. The BYPASS jumper should be set only if the laser is modulated via the LD DRIVER input on the LDM9LP. Please refer to the table below.



Operation Mode	Bypass Jumper
Low noise, no modulation	No (Removed)
RF Modulation via RF IN (BIAS-T)	No (Removed)
Modulation via LD DRIVER input[2]	Yes (Set)

[2] *If the LD driver being used has a noise reduction filter feature, the jumper may need to be removed to ensure good performance.*

7. Based on the pin configuration used, set the LD and PD switches on the side of the LDM9LP according to the diagram below.

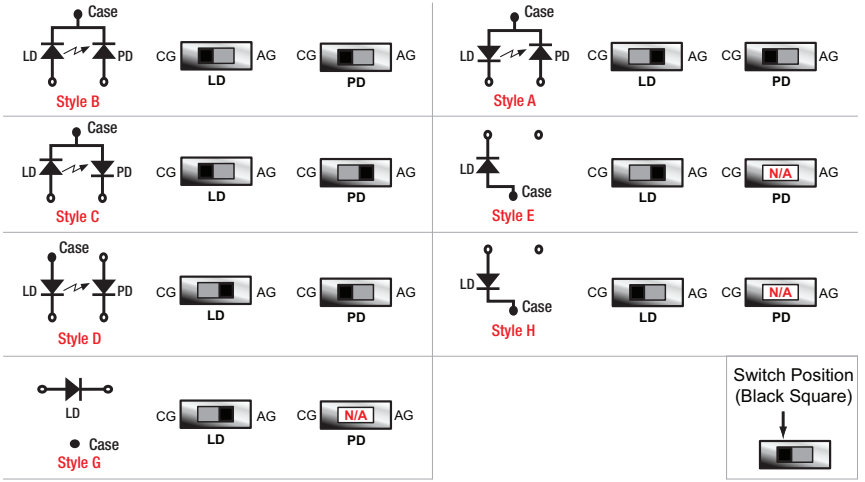


Figure 2 ***Polarity Switch Settings***

8. Thread the two M2 socket head screws into the pigtail flange, securing it to the mounting flange. Next, replace the upper cooler shell and tighten the four M2 socket head screws. Lastly, reattach the protective cover using two M2 socket head screws.

Figure 3 ***Laser Diode Socket***

Socket Diagram

Note: Most laser diodes are three pins with the case tied to one of the laser pins and also to one of the photodiode pins. The other laser and photodiode pin will be isolated from the case. The LDM9LP was designed to operate the laser case at ground potential, therefore this common pin will be inserted into either of the holes marked 'G' below. Insert the isolated laser pin in the position marked LD. The isolated photodiode should now be in the position marked PD.

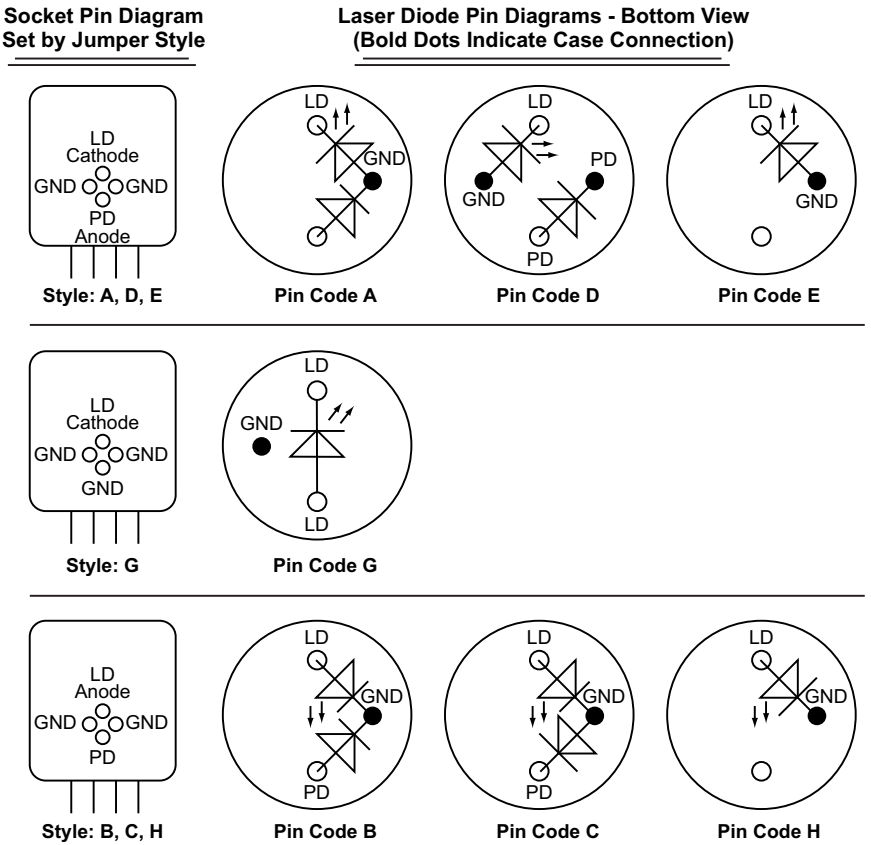


Figure 4 ***Socket Pin Diagram***

4.2. Special Note for 4-pin Laser Diodes

The LDM9LP also supports 4-pin laser diodes. Insert the laser into the 4-pin socket and note which laser pin is in the 12 o'clock position (laser anode or cathode). Also, note which photodiode pin is in the 6 o'clock position (anode or cathode). The mount will tie the laser and photodiode pins located at 9 o'clock and 3 o'clock together and also to ground. By noting which polarity pins are inserted in the socket, you can convert the 4-pin layout to one of the 3-pin layouts in Figure 2 above. Set the LD and PD polarity switches accordingly.

Laser diodes with pin style F are not compatible with this mount. The pins are oriented across from each other and will not align properly in the mount.

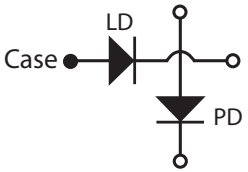


Figure 5 ***Pin Style F***

4.3. Special Note for Laser Diodes without a Monitor Photodiode

Laser diodes without a monitor photodiode will also work with the LDM9LP. The laser diode pins must be positioned between the LD and G positions. Some 2 pin packages will not align with the laser diode socket, but 3 pin versions can be mounted similar to typical laser diodes with photodiodes.

4.4. Laser Diode Current Controller Connection

Using the Thorlabs LDC/ITC Series Laser Controllers:

- The LDM9LP is compatible with all Thorlabs LDC LD controllers and ITC series combination controllers (LD and TEC). Appropriate cables with DB9 connectors are included with Thorlabs controllers and ensure that the controllers cannot be connected incorrectly. Additionally, these controllers have built-in protection circuitry that protects the laser when not in use.
- The nomenclature for the Laser Diode polarity switch on the LDC40xx and ITC40xx drivers and the LDM9LP are consistent with each other. For example, if the laser polarity on the driver is set to “AG” (anode grounded), then the LD polarity switch on the LDM9LP should also be set to AG, and so on.
- The nomenclature for the Photo Diode polarity switch on the LDC40xx/80xx and ITC series drivers and the LDM9LP is as follows: The photodiode polarity switch on the LDM9LP must always be set to “CG”. The photodiode polarity should be set with the internal Laser controller switch only. For more information on how to set Polarity settings on the Laser controller, please refer to the appropriate Laser Controller manual.

4.5. Using a Third-Party Laser Controller

When using a third-party controller, a custom cable will have to be made to properly interface to the laser mount. Please refer to the table below for laser connections.

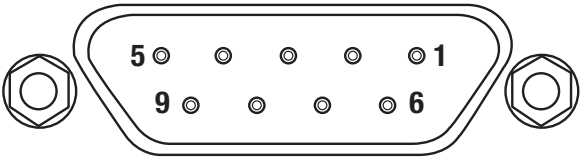


Figure 6 ***LD Controller DB9 Female Connection***

LD Pin	Signal	Description
1	Interlock and Status Pin (LDC Specific)	This pin is the input to the LD Status indicator and interlock circuits. When using Thorlabs' LDC controllers, no external circuitry is required. To use these features with third-party controllers, please refer to page 16.
2	Photodiode Cathode	This pin is connected to the 6 o'clock pin on the laser socket when the PD polarity switch is set to AG (anode grounded). It is attached to ground and the 9 o'clock and 3 o'clock pins on the laser socket when the PD polarity switch is set to CG (cathode grounded).
3	Laser Ground (Case)	This pin is connected to the 9 o'clock and 3 o'clock pins on the laser socket and corresponds to the settings of the LD and PD polarity switches. i.e., If the LD and PD switches are set to AG, then this pin grounds the anode of the laser diode and photodiode.
4	Photodiode Anode	This pin is connected to the 6 o'clock pin on the laser socket when the PD polarity switch is set to CG (cathode grounded). It is attached to ground and the 9 o'clock and 3 o'clock pins on the laser socket when the PD polarity switch is set to AG (anode grounded).
5	Interlock and Status Return	This pin is the return side of the Status and Interlock circuitry.
6	Laser Diode Voltage (Cathode)	This pin is connected to LD interface pin 7, through a 499 Ω resistor, when the LD polarity switch is set to AG (anode grounded). It is attached directly to LD interface pin 3 when the LD polarity switch is set to CG (cathode grounded).
7	Laser Diode Cathode	This pin is connected to the 12 o'clock pin on the laser socket when the LD polarity switch is set to AG (anode grounded). Otherwise it is floating.
8	Laser Diode Anode	This pin is connected to the 12 o'clock pin on the laser socket when the LD polarity switch is set to CG (cathode grounded). Otherwise it is floating.
9	Laser Diode Voltage (Anode)	This pin is connected to LD interface pin 8, through a 499 Ω resistor, when the LD polarity switch is set to CG (cathode grounded). It is attached directly to LD interface pin 3 when the LD polarity switch is set to AG (anode grounded).

4.6. TEC Controller Connection

Using Thorlabs' TED Series TEC Controllers:

- The LDM9LP is compatible with all Thorlabs TED series temperature controllers and ITC series combination controllers (LD and TEC). The TED series is shipped with a mating DB9 cable that plugs directly into the controller and laser mount. Using the cable supplied with the TED, the controller cannot be connected incorrectly. Simply connect the cable included with the TED to the laser mount and to the controller.

Using a Third-Party TEC Controller:

- When using a third-party controller, a custom cable will have to be made to properly interface to the laser mount. Please refer to the table below for connections.

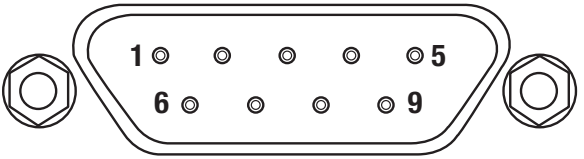


Figure 7 ***TEC Controller DB9 Male Connection***

TEC Pin	Signal	Description
1	TEC Lockout (+)	This pin is connected to the anode of the photo-relay side of the TEC lockout circuit. When using Thorlabs' TED Series, no external circuitry is required. To use these features with third-party controllers, please refer to the Status and Interlock section of this manual.
2	+Thermistor	The 10 kΩ @ 25 °C NTC thermistor (provided for temperature feedback).
3	-Thermistor	The thermistor return pin.
4	+TEC	This pin is connected to the positive terminal of the TEC.
5	-TEC and TEC Lockout (-)	This pin is connected to the negative terminal of the TEC element, and also is common to the cathode of the photo-relay of the TEC lockout circuit – refer to the Status and Interlock section of this manual.
6	NC	Unused
7	NC	Unused
8	NC	Unused
9	NC	Unused

4.7. TEC Lockout and Ground Jumpers

Two jumpers, JMP1 and JMP2, are located under the cover on the main PCB assembly. Remove the cover plate by removing the four M2 screws securing the cover plate.

Locate the jumper “JMP1” on left side of the PCB. Setting or Removal the jumper will allow you to bypass or enable the TEC Lockout feature. This feature, when enabled, will prevent the laser diode from being turned on unless the TEC controller is enabled. The unit is shipped from the factory with the TEC Lockout feature bypassed.

To enable the TEC Lockout, simply remove the cover of the unit and remove the blue jumper from the JMP1 header. The jumper can be placed on one of the other header pins for safe keeping.

An optional ground jumper is also provided to allow connecting the system ground node (common to the “G” pins of the laser diode connector) to the metal housing of the unit, which is also connected to the shields of the LD and TEC input cables. Care should be taken when using this connection as unwanted ground loops may be formed. The unit is shipped from the factory with JMP2 disconnected. To close this connection, remove the cover of the unit and place the blue jumper onto both pins of the JMP2 header.

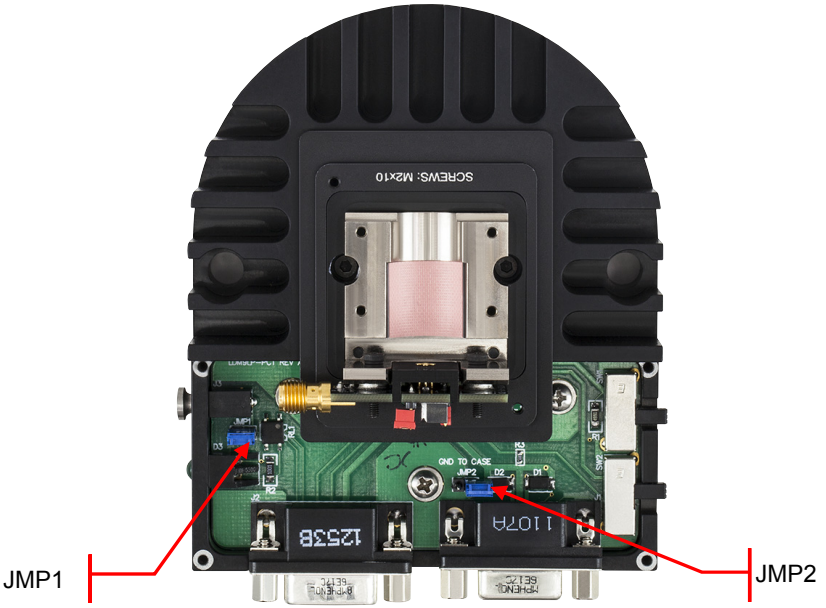


Figure 8 ***Jumpers***

Chapter 5 Operation

5.1. General

Once the laser is mounted in the LDM9LP and a Laser Diode Current Controller and TEC Controller are connected, the device is ready to operate. Please refer to the operating instructions for the laser and temperature controller for specific operating instructions.

When operating at low temperatures in high humidity climates, the laser mount may develop internal condensation. If this occurs, turn the laser off, open the case, and allow the mount to dry off completely before reusing.

5.2. RF Modulation

The LDM9LP has an RF input for modulating the laser with an external RF source from 200 kHz to beyond 1 GHz. This is a 50 Ω input that is AC-coupled directly to the laser through the Bias-T network. To calculate the desired RF power to modulate the laser, determine the amount of modulating current needed from the laser manufacturer's data sheets and use the following calculations:

$$RF\ Voltage = (LD\ Modulating\ Current) \times 50\ \Omega$$

It is strongly recommended that you start off conservatively by a factor of 10 below the calculated modulating voltage and slowly bring the RF power up until the desired depth of modulation is reached.

Use the laser controller to establish the DC operating point of the laser.

WARNING

The RF input is directly coupled to the laser. Any excessive transients or noise will be coupled into the laser and may cause the laser to be overdriven. Also, the laser can be easily overdriven if excessive RF power is applied to this input. Use the RF modulation input with care to avoid damaging your laser.

5.3. Status and Interlocks

This unit is equipped with two interlock circuits and an LED that indicates if the laser diode is enabled. All three circuits are designed to interface with Thorlabs' laser and TEC controllers with no external circuitry.

- If third-party controllers are used to drive the laser diode or TEC elements, then only the LD on indicator can be used. To prevent damage to the Status and Interlock circuits, the following external connections should be followed:
- Install the shorting device into the REMOTE INTRLK connector that was shipped with the LDM9LP.
- Install the TEC LOCKOUT bypass jumper into JMP1 inside the LDM9LP case (see 4.7).
- Connect a resistor to LD Interface DB9 Pin 1 appropriately sized to limit the current into Pin 1 to between 5 and 10 mA.
- The "driver" side of this resistor should be connected to a DC signal that, when high, indicates that the laser diode is being driven (driver dependent).
- If you have any questions regarding these connections, please feel free to contact an engineer at Thorlabs for clarification.

If you wish to make full use of all of the Status and Interlock features with your third-party drivers, please contact Thorlabs and an engineer will help you determine if this is possible and how to implement these features.

5.4. Maintaining the LDM9LP

There are no serviceable parts in the LDM9LP. The housing may be cleaned by wiping with a soft, damp cloth. If you suspect a problem with your LDM9LP, please call Thorlabs and an engineer will be happy to assist you.

Chapter 6 Making Safety Interlock Connections

The LDM9LP is equipped with a Remote Interlock connector located on the side panel. In order to enable the laser source, a short circuit must be applied across the terminals of the Remote Interlock Connector. In practice this connection is made available to allow the user to connect a remote actuated switch to the connector (i.e., an open door indicator). The switch, which must be normally open, has to be closed in order for the unit to be enabled. Once the switch is in an open state, the laser diode must automatically shut down.

All units shipped from Thorlabs are configured with a shorting device installed in the interlock connector. If you are not going to use this feature, then you can leave the shorting device installed and the unit will operate normally as described in the procedures in this manual. If you wish to make use of the interlock feature, you will need to acquire the appropriate connector mate and wire it to your remote interlock switch. Next, remove the shorting device by unscrewing it from the input and install the connector into the interlock input.

The interlock input only accepts a 2.5 mm mono phono jack. This connector is readily available at most electronics stores (Radio Shack, Digikey, Mouser, Allied, etc.).

The electrical specifications for the interlock input are as follows:

Specification	Value
Type of Mating Connector	2.5 mm Mono Phono Jack
Open Circuit Voltage	+5 VDC with Respect to Chassis Ground
Short Circuit Current	~8 mA DC
Connector Polarity	Tip is +5 V, Barrel is Ground
Interlock Switch Requirements	Must be N.O. Dry Contacts. Under no circumstances should any external voltages be applied to the Interlock Input

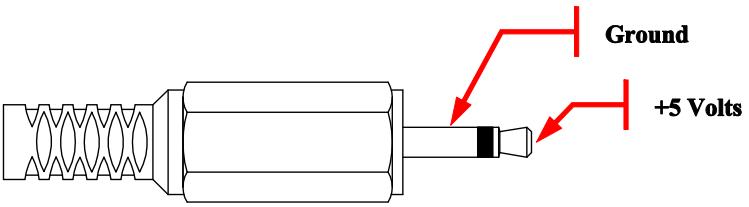


Figure 9 ***Remote Interlock Connector***

Chapter 7 Troubleshooting

If you are using Thorlabs' Laser controller with your LDM9LP:

Possible Solution	Directions
Remote interlock is open	Make sure that either the shorting device is installed in the REMOTE INTRLK connector on the side of the LDM9LP. If you have a remote interlock switch connected to this REMOTE INTRLK connector, it must be in a closed position.
Laser Driver will not Enable	Make sure the Remote Interlock is closed. Check the laser diode polarity and make sure the polarity switches on the mount are set correctly.

Laser Wavelength or Power is Unstable

Possible Solution	Directions
LD is not fully seated	Make sure your laser pigtail is fully inserted into the LDM9LP laser socket and its body is in full contact with the copper cold plate.
LD is mode hopping	The laser pigtail may be operating on a mode transition. Try adjusting the temperature to shift the laser diode to a more stable operating point.

The LDC Series Laser Driver Indicates an "Open Circuit" Alarm When You Try to Enable the Laser

Possible Solution	Directions
LD and PD polarity switch settings are incorrect	Refer to Figure 2 and the data sheet for your specific diode to ensure the proper settings. The LD polarity switch setting on the mount must match the LD polarity switch setting on the rear panel of your LDC series laser diode controller.
LD orientation may be incorrect in the socket	Refer to Figure 1 and the laser pigtail data sheet for you specific diode to ensure proper orientation.
TEC lockout circuit is active and the TED Series TEC controller is not enabled	To determine if you have selected the TEC Lockout circuit to be active, refer to 3.7 and Figure 7. If it is selected, then the TED Series TEC controller must be enabled first before the LDC Series laser controller can be enabled.

If you still have problems or questions regarding the operation of your LDM9LP, please feel free to call Thorlabs and ask for Technical Support.

Chapter 8 Specifications

Performance Specifications	
Lasers Supported	Thorlabs LPS, LPS-PM, and LPM Series
Maximum Laser Current	1 A
Laser Pin Configurations	A, B, C, D, E, G, H (Figure 1)
RF Modulation Frequency (Modulate low frequencies through LD Controller)	>200 kHz
RF Input Impedance	50 Ω
Maximum RF Power	500 mW
Maximum TEC Current	4.5 A
Maximum TEC Voltage	3.0 V
TEC Heating/Cooling Capacity	7 W (Mounted to 12" x 12" Breadboard)
Typical Temperature Range (LD Dependent)	0 to 70 °C -10 to 70 °C (Mounted on 12" x 12" Breadboard)
Temperature Sensor	10 kΩ NTC Thermistor, ±1% at 25°C, β = 3988

Physical Specifications	
Laser Polarity Select	External Slide Switch
Photodiode Polarity Select	External Slide Switch
Laser Interface	DB9 Female
TEC Interface	DB9 Male
RF Input Connector	SMA Jack
Interlock Connector	2.5 mm Phono Jack
Indicators	LD Enabled (Green LED)
Size (L x W x H)	4.48” x 3.5” x 2.1”
Weight	550 grams

8.1. RF Modulation Charts

RF modulation of the LDM9LP can be accomplished in one of two ways. For low frequencies (below ~200 kHz), the RF modulator should be connected to the LD controller. Figure 9 shows the performance of Thorlabs' LDC202C and ITC4005 when used with the LDM9LP and RF modulation. Above 200 kHz, the modulator should be connected to the LDM9LP's SMA connector. The mount has been tested up to 1 GHz, which is shown in Figure 10 below.

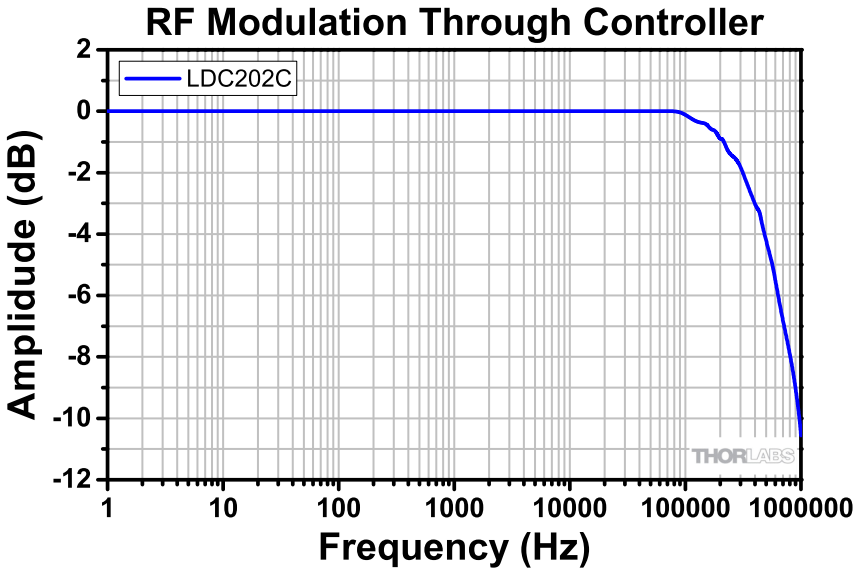


Figure 10 ***Low Frequency Modulation Through LD Controller***

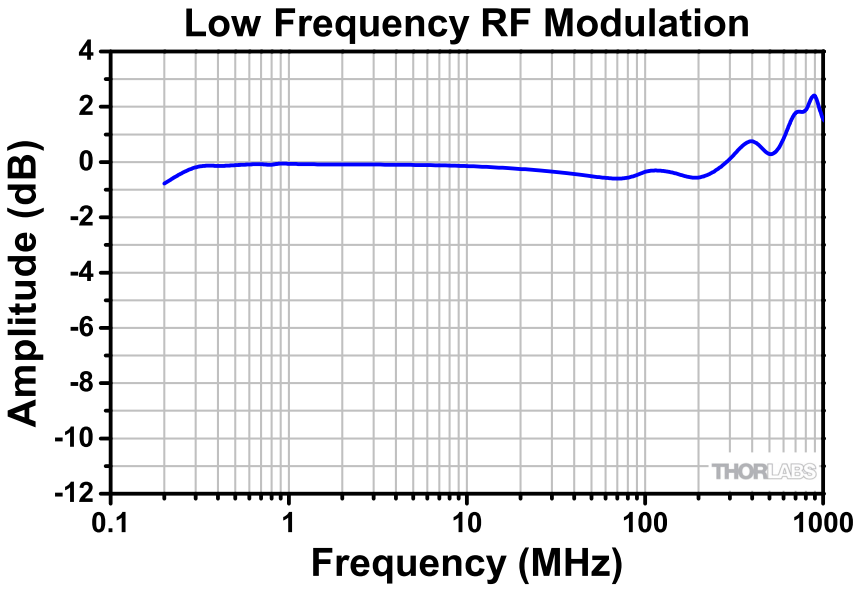


Figure 11 ***RF Modulation Through SMA Connector on LDM9LP***

8.2. Thermistor Data

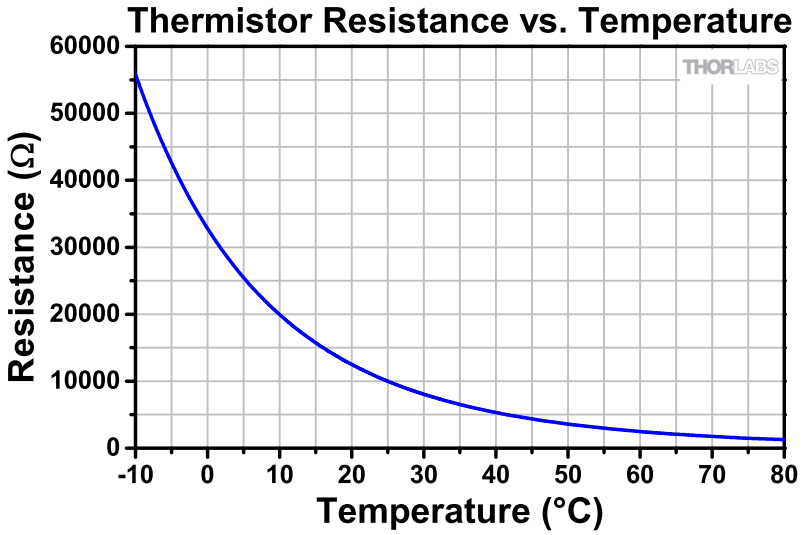


Figure 12 ***Thermistor Plot***

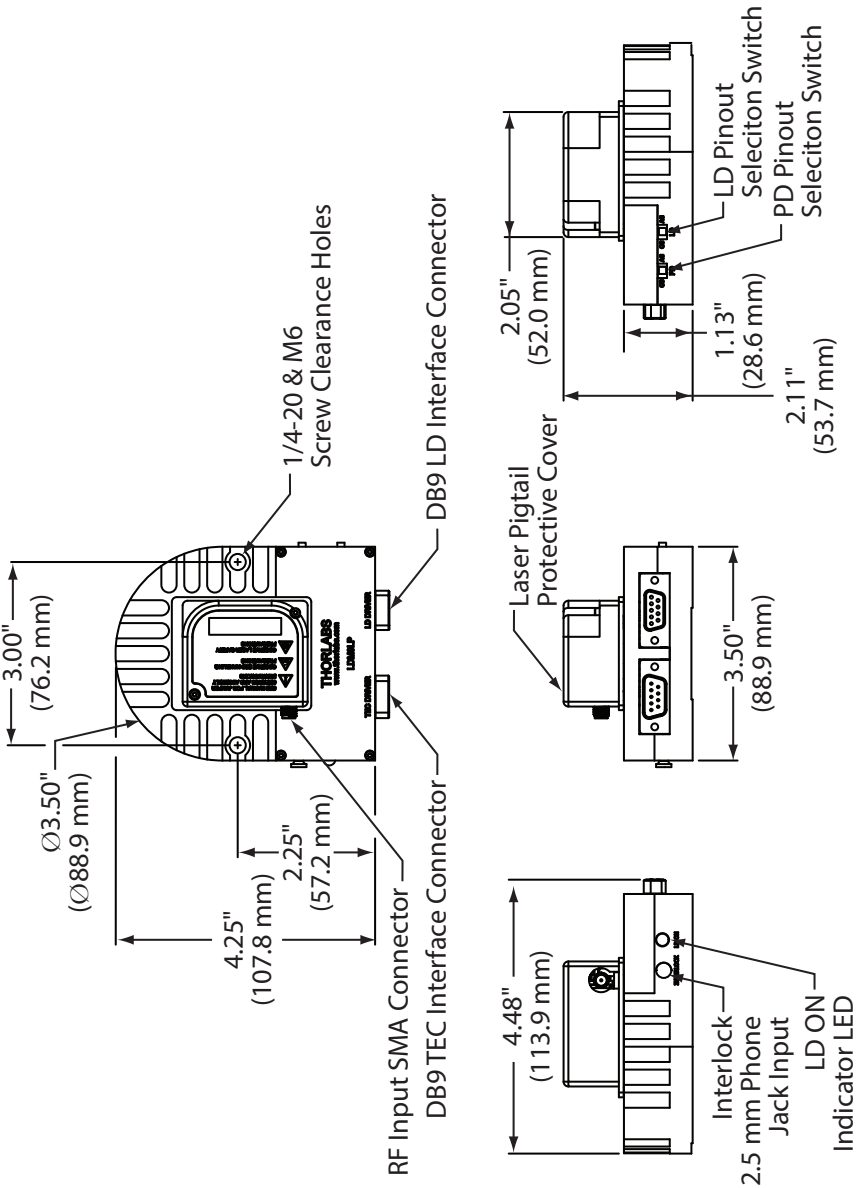
A thermistor is a resistor with a negative temperature coefficient (as for this, also known as NTC). It's resistance decreases exponentially with temperature. The significant change of resistance with temperature predestines a NTC for temperature measurements. The diagram above shows the typical curve for a 10kΩ thermistor. Usually, its nominal resistance is referenced to 25°C. The dependency of resistance vs. Temperature can be described using several methods. Resistance can be calculated with the following equation:

$$R_t = 10\ k\Omega \times \mathrm{e}^{\left(A+\frac{B}{T}+\frac{C}{T^2}+\frac{D}{T^3}\right)}$$

A commonly used alternative to the Stein-Hart equation is the β equation (often called exponential method) which is derived from the Steinhart-Hart model:

$$\frac{1}{T} = \frac{1}{T_0} + \frac{1}{\beta}\ln\left(\frac{R}{R_0}\right)\ ; where\ R = R_0 e^{\beta(}\frac{1}{T} - \frac{1}{T_0})$$

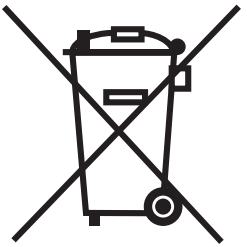
Chapter 9 Mechanical Drawing



Chapter 10 Regulatory

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return “end of life” units without incurring disposal charges.

- This offer is valid for Thorlabs electrical and electronic equipment:
- Sold after August 13, 2005
- Marked correspondingly with the crossed out “wheelie bin” logo (see right)
- Sold to a company or institute within the EC
- Currently owned by a company or institute within the EC
- Still complete, not disassembled and not contaminated



Wheelie Bin Logo

As the WEEE directive applies to self contained operational electrical and electronic products, this end of life take back service does not refer to other Thorlabs products, such as:

- Pure OEM products, that means assemblies to be built into a unit by the user (e.g. OEM laser driver cards)
- Components
- Mechanics and optics
- Left over parts of units disassembled by the user (PCB’s, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste Treatment is Your Own Responsibility

If you do not return an “end of life” unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological Background

It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.

The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of life products will thereby avoid negative impacts on the environment.

Chapter 11 Thorlabs Worldwide Contacts

For technical support or sales inquiries, please visit us at www.thorlabs.com/contact for our most up-to-date contact information.

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