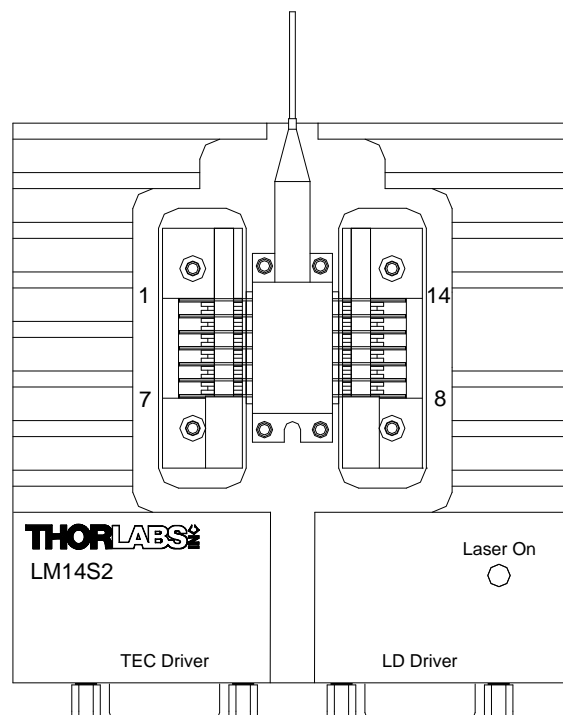

LM14S2

Butterfly Laser Diode Mount

Operating Manual



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Description:

The LM14S2 is a universal laser diode mount specifically designed for 14 pin Butterfly laser diodes that have integrated Thermal Electric Coolers (TECs) and Thermistor sensors. When used with Thorlabs LDC Series Laser Controllers and TED Series TEC Controllers, a laser diode can be operated with precise temperature control for wavelength stability and temperature tuning. A zero insertion force (ZIF) socket accepts all standard 14 pin butterfly laser diode packages. Easy to use configuration cards allow the laser mount to be configured for all possible laser pin assignments.

Designed primarily for Laser Diodes, the LM14S2 can also be used with many two port Electro-optic devices that are in 14-pin butterfly packages.

A Bias T adapter is also included allowing the laser to be directly modulated up to 500MHz. This adapter is intended for use only with butterfly lasers that have integrated RF modulation components (i.e. blocking inductor and 25 Ohm input Impedance).

Additional safety and protection features include an on board reverse bias protection diode, remote safety interlock connection, and the TEC Lockout circuit that prevents enabling of the laser diode unless the temperature controller is also enabled. Designed to work with our LDC and TED controllers the TEC Lockout can easily be bypassed by setting a switch.

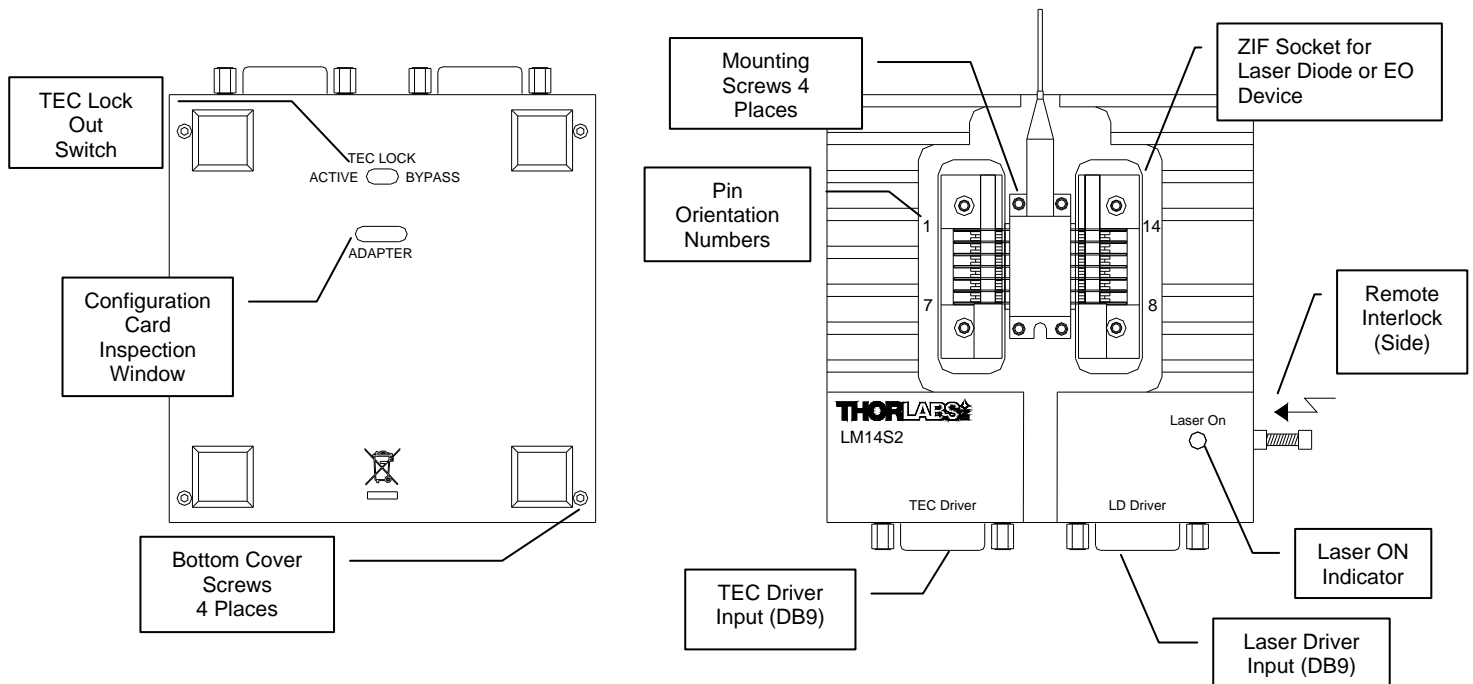


Figure 1 - Location of Features

Table 1 - LM14S2 Specifications

Laser Specs	
Lasers Supported:	14 Pin Butterfly
Max. Laser Current:	5 Amps
Laser Pin Configurations:	User Configurable
RF Modulation Frequency:	100kHz to 500MHz
RF Input Connection:	SMA
RF Input Impedance:	25 Ω (on Bias T adapter)
Max. RF Power:	200mW or Limit of LD
Laser Polarity:	Anode Grounded – See “Grounding” below

TEC Specs	
Max TEC Current:	5 A
Max TEC Voltage :	Laser Specific
TEC Heating / Cooling Capacity:	Laser Specific
Typical Temperature Range (LD dependent)	0 to 70°C
Temp Sensors	Laser Specific
General	
Size:	3.5” x 3.5” x 1.25”
Weight:	0.6 lb.

Setup:

Caution! Always observe proper Laser safety when operating this unit.

Note: The following procedure applies to installing and using a butterfly laser diode with the LM14S2. For information regarding Electro-optic devices other than laser diodes please refer to Appendix B AFTER reviewing these instructions for configuration card and device installation.

- 1) Locate unit on a solid, dry working surface.
- 2) Remove the bottom cover from the unit by removing the four 4-40 screws from the bottom cover.
- 3) Determine the type of laser you are using (Type 1 Pump, Type 2 Telcom, or Other) Refer to "Configuration Card Pin-outs". Install the appropriate configuration card into the 24 pin header located on the now exposed bottom side of the main pcb:
 - If you are using a Type 1 laser install the Type 1 / Type 2 configuration card into the 24 pin header with the text "TYPE 1" facing towards the connector side of the unit.
 - If you are using a Type 2 laser install the Type 1 / Type 2 configuration card into the 24 pin header with the text "TYPE 2" facing towards the connector side of the unit.
 - If your laser does not match either a Type 1 or Type 2 pin-out then you must use the custom configuration card. See "Configuration Cards" for information on wiring this card.
- MAKE SURE** the socket on the configuration card is properly aligned with the 24 pin header!
- 4) Replace the bottom cover to the unit and secure with the four 4-40 screws removed above. The cover must be oriented to allow the TEC LOCK switch to pass through it. When installed properly the configuration card can be identified through the inspection window in the bottom cover.
- 5) Connect the laser driver to the DB9 female connector labeled LD Driver. This connector is pin for pin compatible with all Thorlab's LDC series Laser Diode Controllers. If using other drivers refer to Table 2 for the pin outs for the LD Driver connector.
- 6) Connect the TEC controller to the DB9 male connector labeled TEC Driver. This connector is pin for pin compatible with the Thorlab's TEC Controllers. If using other controllers refer to Table 3 for the pin outs for the TEC Driver connector.
- 7) Install the butterfly laser diode into the Zero Insertion Force (ZIF) sockets as follows:
(ATTENTION! Always observe proper ESD protection when handling laser diode)
 - a) Press the latching mechanisms on each ZIF socket away from the pin clamps to release the clamps.
 - b) Swing the pin clamps forward to expose the contacts on each socket.
 - c) Remove the four 2-56 cap head screws mounted between the two ZIF sockets using a 5/64" ball driver or suitable tool.
 - d) Apply a thin layer of thermal grease to the bottom of the butterfly laser diode. (Optional but recommended)
 - e) Carefully lay the butterfly laser diode onto the ZIF sockets. The output fiber of the laser must exit towards the front of the mount – OPPOSITE the DB9 connectors. The pin orientation of the socket is marked on the sides of the ZIF sockets. Align the pins into the slots for each contact.
 - f) Install the four 2-56 cap head screws into the four mounting holes on the butterfly package, securing the laser to the mount.
 - g) Swing the pin clamps back onto the ZIF socket, taking care that all of the laser diode pins are still aligned onto the correct contacts.
 - h) Press the latching mechanism forward onto the pin clamps until they snap into place, latching the pin clamps onto the pins and contacts.
- 8) Using the TEC / Laser Lockout feature:

The "TEC / Laser Lockout" feature provides an added level of protection for your butterfly laser diode. By monitoring a status signal from the TEC controller, the Laser Driver can only be enabled if the TEC controller is also enabled. This feature is activated by setting the TEC LOCK switch located on the bottom of the unit to the proper position. Set to "Active" to use this feature, or set it to "Bypass" to disable the feature. Designed for direct compatibility with the Thorlab's LDC and TEC controllers, no additional wiring is required when used in conjunction with these drivers.
- 9) Operating the Butterfly Laser Diode

Once the butterfly laser diode is properly mounted in the LM14S2, set the operating temperature using the TEC controller. Once the set temperature has been reached enable the laser diode, set the drive current or power level and control as you normally would.

Laser Controller Connection:

Using the Thorlabs LDC Series Laser Controllers:

- The LM14S2 is best used with Thorlabs LDC Series Laser Controllers. The LDC series drivers are shipped with a mating DB9 cable that plugs directly into the controller and laser head. Using the cable supplied with the LDC, the controller cannot be connected incorrectly. Also, the LDC has built-in protection circuitry that protects the laser when not in use. Simply connect the DB9 cable included with the LDC to the Laser Mount and to the controller.

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:

Table 2 - Laser Diode Connector Pin Functions

LD Interface 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 LDCs no external circuitry is required. To use these features with third-party controllers please refer to the Status and Interlock section of this manual.
5	Interlock and Status Return	This pin is the return side of the Status and Interlock circuitry.
7	Laser Diode Cathode LDC	Use this pin for the Laser Diode Cathode connection. This pin must always be driven more negative than Pin 3 (Laser Anode), otherwise a reverse bias protection diode will clamp this pin to Pin 3.
8	Not Used	
3	Laser Diode Anode LDA	Use this pin for the Laser Diode Anode connection. This pin must always be driven more positive than Pin 7 (Laser Cathode), otherwise a reverse bias protection diode will clamp this pin to Pin 7.
2	Photodiode Cathode PDC	Use this pin to connect to the integral monitor photodiode Cathode of your laser diode.
4	Photodiode Anode PDA	Use this pin to connect to the integral monitor photodiode Anode of your laser diode.
6	Laser Diode Voltage (-) VLD(-)	This pin can be used to measure the voltage at the laser diode cathode. There is a 499 Ohm resistor between this pin and the LD cathode.
9	Laser Diode Voltage (+) VLD(+)	This pin can be used to measure the voltage at the laser diode anode. There is a 499 Ohm resistor between this pin and the LD anode.

TEC Controller Connection:

Using the Thorlabs TED Series TEC Controllers:

- The LM14S2 is best used with Thorlabs TED200 or related TEC Controllers. The TED series are 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 laser connections:

Table 3 - TEC Connector Pin Functions

TEC Interface Pin	Signal	Description
4	TEC(+)	This pin is connected to the positive terminal of the TEC element integrated in the laser diode.
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.
1	TEC Lockout (+)	This pin is connected to the anode of the photo-relay side of the TEC Lockout circuit. When using Thorlabs TEDs 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 TH+	This pin is connected to the Thermistor integrated in the laser diode.
3	-Thermistor TH_GND	The Thermistor return pin. See Grounding Jumpers below.
7	Not Used	
9	Not Used	
6	Not Used	
8	Not Used	

Grounding:

Two jumpers, JMP1 and JMP2, are located on the main PCB, accessible by removing the bottom cover.

JMP1 allows you to connect the Anode circuit on the main PCB to the shield connection of the LD Driver DB9 cable, in most cases making it common to the chassis of the Laser Diode Driver and Earth. To completely float the circuit simply disconnect this jumper. The jumper can be placed on one or the other header pins for safe keeping. **IMPORTANT NOTE:** If your laser driver has a grounded anode drive signal, removing JMP1 will not float the circuit, it will simply disconnect it from the cable shield. In fact, when using a driver that does have a grounded anode connection, it may be beneficial to remove JMP1 to prevent a ground loop from forming.

The unit is shipped with JMP1 NOT installed.

JMP2 allows you to connect the -Thermistor (TH_GND) signal to the Laser Diode Anode on the main pcb. In some cases certain butterfly packages make this connection at the laser itself.

The unit is shipped with JMP2 NOT installed.

Note: The Type 2 Configuration Card ties the laser diode Pin 8, Pin 9, Pin 11, and Pin 13 together, making the Anode of the Laser Diode common to the case of the device. Refer to Fig. 6 below.

Making the Safety Interlock Connections:

The LM14S2 is equipped with a Remote Interlock connector located on the side panel. In order to enable the laser driver, 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 shutdown.

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 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 **2.5mm mono phono jack**. This connector is readily available at most electronics stores (Radio Shack, Digikey, Mouser, Allied to name a few).

The electrical specifications for the Interlock input are as follows:

Type of Mating Connector: 2.5mm mono phono jack

Open Circuit Voltage: +5VDC with respect to system ground (when used in conjunction with Thorlabs drivers)

Short Circuit Current: 10mADC Typical

Connector Polarity: Tip is positive, 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)

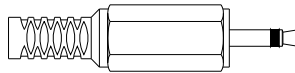


Figure 2 - Remote Interlock Connector

RF Modulation:

The LM14S2 has a Bias-T adapter to provide an RF input for modulating the laser with an external RF source up to 500 MHz. The adapter has a 25Ω input that is AC-coupled directly to the laser through a Bias-T network. This adapter will only work with butterfly lasers specifically designed with an integrated blocking inductor and an additional 25 Ohms of input impedance (See Fig 7 below) . The adapter makes its RF connection to Pin 12 of the laser diode (Typically an Anode connection) and the return connection is made at Pin 13. This is a Type 2 Laser and therefore the TYPE 2 configuration option should be installed (see SETUP Step 3 above). The DC input to this type of laser is applied to Pin 3 of the laser diode.

Install the Bias-T adapter as follows:

- 1) Install the Laser Diode as described in SETUP Step 7 above. Do not clamp the right side ZIF socket.
- 2) Remove the two black cap head screws on the right side ZIF socket. The socket will stay in place as it is soldered to the main PCB below.
- 3) Orient the Bias-T adapter over the right side of the mount with the component side facing down.
- 4) Carefully place the adapter into the opening in the heat sink fins on the right side, orienting the two pins of the adapter onto pins 12 and 13 of the laser diode.
- 5) Install the two stainless steel cap head screws provided in the Bias-T kit. Do not over tighten.
- 6) Clamp the ZIF socket down onto the remaining laser diode pins.
- 7) If the Bias-T adapter is removed, re-install the black cap head screws removed in Step 2 above, do not install the stainless steel screws as they will interfere with the Configuration Card.

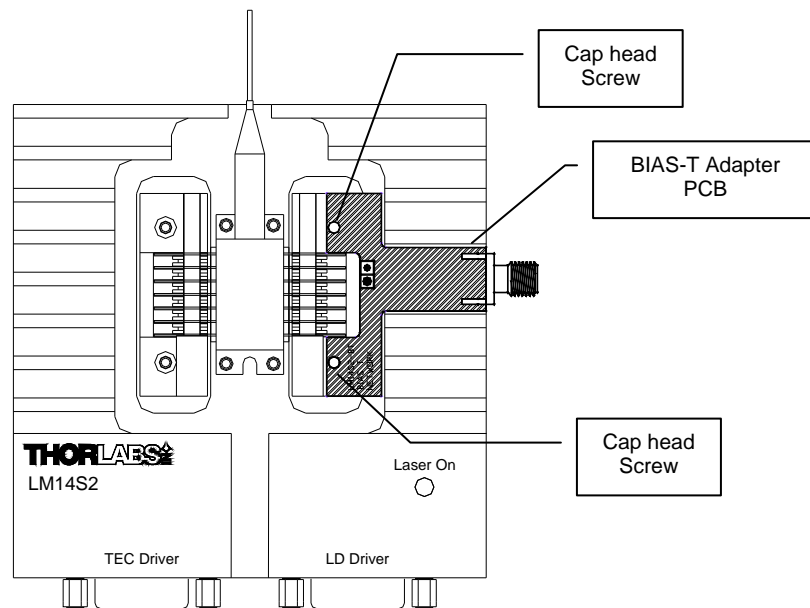


Figure 3 - Installing Bias-T Adapter

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:

$$\text{RF Voltage} = (\text{Laser Diode Modulating Current}) * 50\Omega$$

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.

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 Thorlab's 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 LM14S2.
- Set the TEC Lock switch on the bottom of the unit to “Bypass”.
- Connect a resistor to LD Interface DB9 Pin 1 appropriately sized to limit the current into Pin 1 to between 5 – 10mA.
- The “driver” side of this resistor should be connected to a DC signal that, when high, indicates that the laser diode is being driven.
- 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 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.

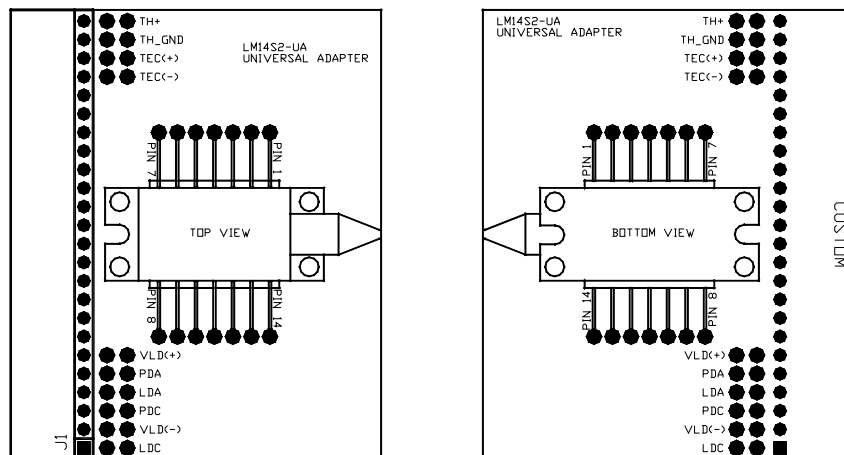
Configuration Cards:

The LM14S2 is shipped with two Configuration Cards needed to program the unit for the proper pin-outs for the type of laser being installed in the mount. In most cases the dual Type 1 / Type 2 Configuration Card can be used to route the DB9 input signals to the mounted laser diode. Refer to the next page **Configuration Card Pin-outs** for specifics on which side of the configuration card to use.

For non-standard devices that do not use the pin-out conventions described on the next page we have include a Custom Configuration Card. This card is designed to allow you to easily configure the mount to any pin configuration by soldering wires between the appropriate points on the card. For convenience the outline of the butterfly package is shown on both sides of the card, in it's proper top and bottom views. In addition an extra set of holes is provided to allow multiple connections to one node.

Ideally a solid 26 – 30 AWG insulated wire can be used for the various connections, but any suitable wire can be used.

Refer to Table 1 and Table 2 for signal nomenclatures shown in bold type.



Configuration Card Pin-outs:

Refer to the following diagrams to determine which type of configuration card to use with your laser diode.

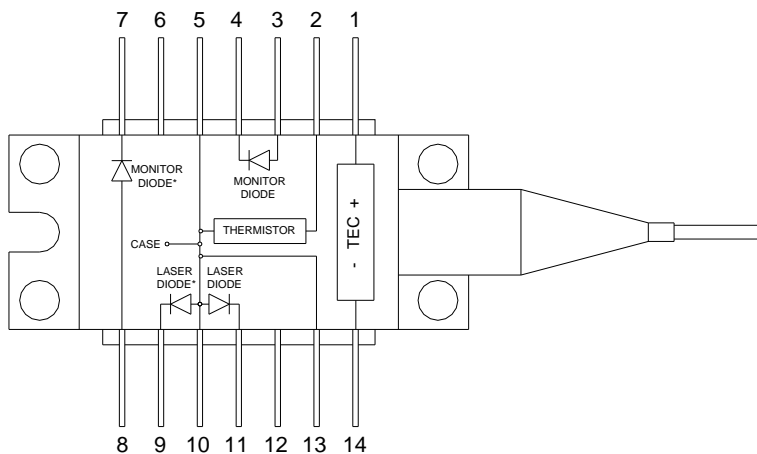


Figure 5 - Type 1 Pump Laser Diode

* View shows alternate locations for monitor and laser diodes.

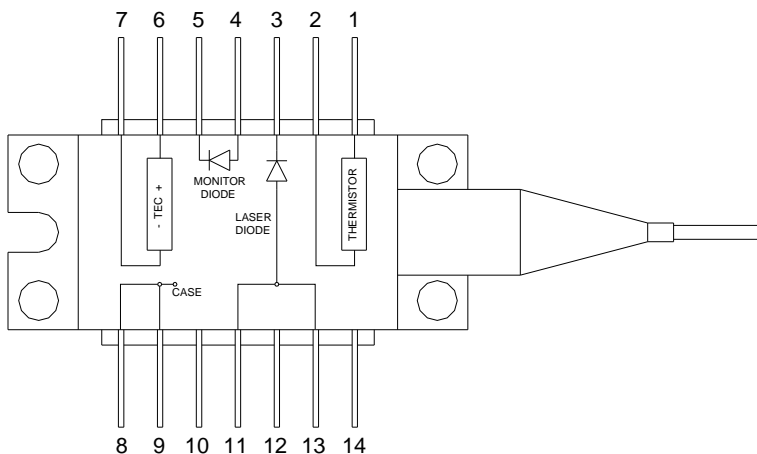


Figure 6 - Type 2 Telcom Laser Diode

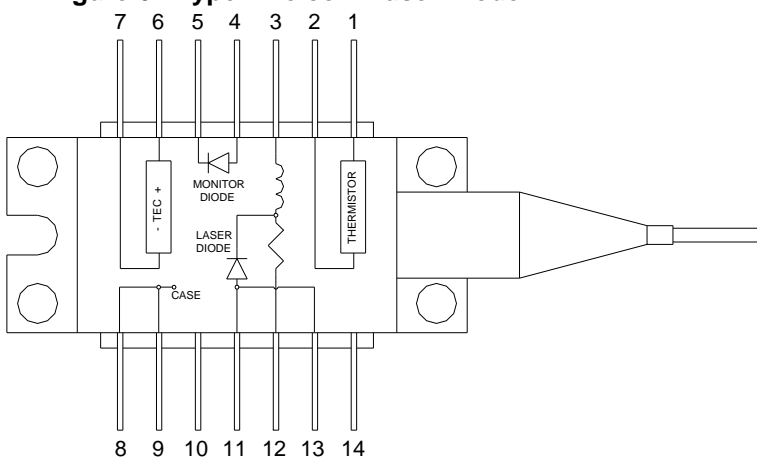


Figure 7 - Type 2 Laser w/ Integrated Bias-T

Maintaining the LM14S2:

There are no serviceable parts in the LM14S2. The housing may be cleaned by wiping with a soft damp cloth. If you suspect a problem with your LM14S2 please call Thorlabs and an engineer will be happy to assist you.

Troubleshooting:

- 1) Laser Driver will not enable.
 - If you are using Thorlabs Laser and TEC controllers with your LM14S2 mount....
 - o Remote Interlock is open.
Make sure that either the "shorting device" is installed in the REMOTE INTRLK connector on the side of the LM14S2. If you have a remote interlock switch connected to this REMOTE INTRLK connector it must be in a closed position.
 - o 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 **SETUP Step 8** and Fig. 1. If it is selected then the TED series TEC controller must be enabled first before the LDC series laser controller can be enabled.
- 2) Laser wavelength or power is unstable even though the TEC controller shows a stable temperature...
 - Make sure your laser diode is fully seated onto the LM14S2 laser mount, its body is in full contact with the heat sink base, and the four securing screws are tightened.
- 3) The LDC series laser driver indicates an "Open Circuit" alarm when I try to enable the laser....
 - The LD polarity switch setting is incorrect on your LDC series driver. In most cases your butterfly laser will operate with an Anode grounded polarity, therefore set the LD polarity switch on the back of your LDC series driver to AG.
- 4) My laser diode does not turn on at all.
 - Make sure you have the correct Configuration card installed and that it is seated in the 24 pin header properly. This is easily checked by turning the unit over and reading the card type in the adapter inspection window (See Fig.1).

If you still have problems or questions regarding the operation of your LM14S2 please feel free to call ThorLabs, Inc. and ask for TECH SUPPORT.

Appendix A – Non-Standard Laser Diode Configurations

NEL Module Type STB:

The NEL laser diode shown in Figure 8 differs slightly from a standard Type 2 Telcom laser in that the laser diode cathode connection is presented on Pin 12 instead of Pin 3.

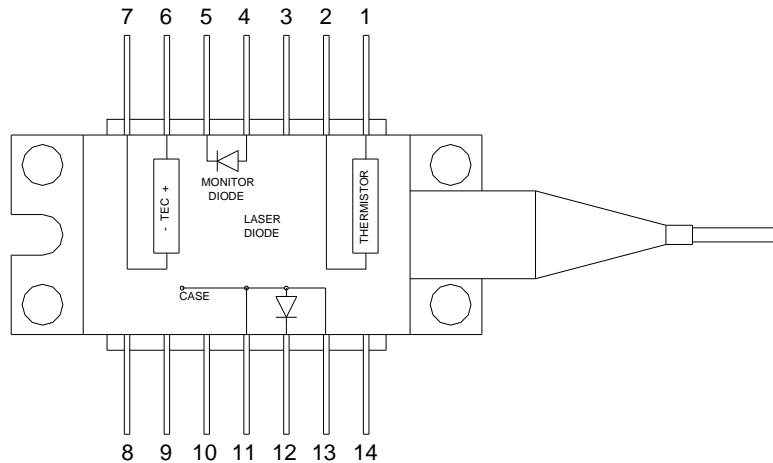
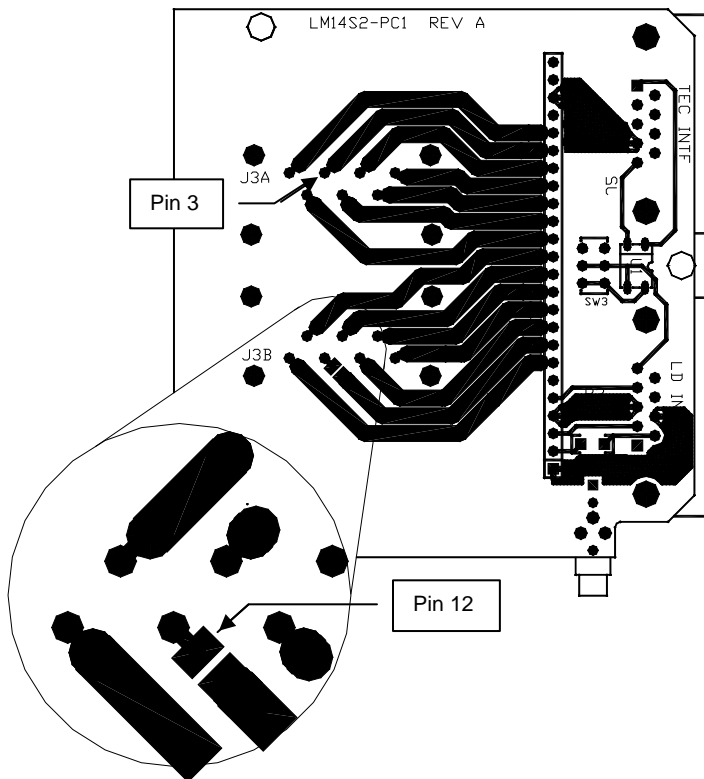


Figure 8 – NEL Type STB Laser

In its normal configuration, the LM14S2 has an open connection to Pin 12 of the laser diode ZIF socket. This is done to prevent conflicts while using the Bias T adapter on Type 2 laser diodes w/ internal Bias T components (see Figure 7).

To operate this type of NEL laser diode in a CW mode, the following modification can be easily made to the LM14S2 that will connect Pin 12 to the Laser Diode Cathode circuit internal to the mount...



- 1) Remove the bottom plate and any Adapter Cards that may be installed, exposing the bottom of the main PCB of the LM14S2.
- 2) Pin 12 is identified by two adjacent pads with a narrow slit between them (See Detail to the right).
- 3) If you have a Revision A Type1/Type2 Adapter Card (Rev marking is located next to the "TYPE 1" text), carefully install a wire connecting Pin 12 of the ZIF socket to Pin 3.
- 4) If you have a Revision B or higher adapter Card, carefully flow a small bead of solder across the slit at Pin 12, bridging the two pads.
- 5) Install the TYPE1/TYPE2 Adapter Card with the TYPE2 connector mating with the main PCB of the LM14S2.

Appendix B – Two Port Electro-optic Devices

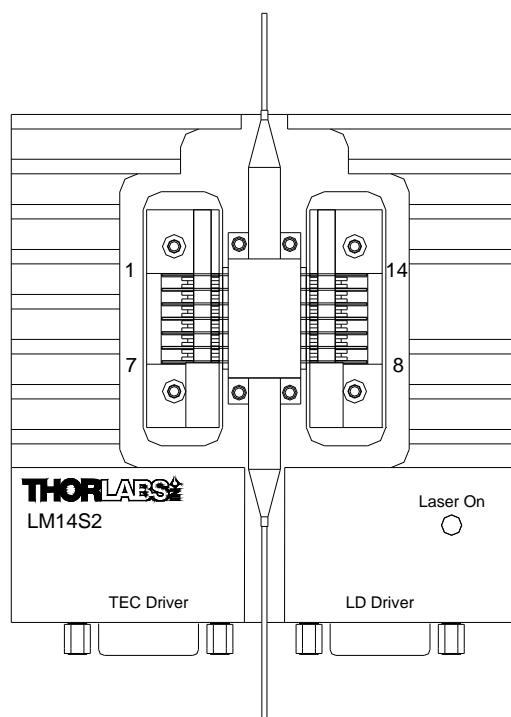
The LM14S2 allows for mounting a two port, fiber coupled Electro-optic device. Typically these devices will have ports on opposite sides of their packages with fiber optic cables extending from each port. In some cases they may contain an integrated thermo-electric cooler, or require some form of current input to operate the device. The LM14S2 can accommodate most devices of this type.

In order to make the necessary connections between the DB9 input connectors and the ZIF socket you will need to use the “Custom Configuration Card” provided with the LM14S2. Please review “Set Up” on page 3 and “Configuration Cards” on page 8.

When installing the EO device please observe proper device polarity by orienting the device’s pins with the pins on the ZIF sockets according to the pin designations printed to the side of each ZIF socket.

The nomenclature for the custom configuration card applies to laser diode functions, but can easily be adapted to most EO device functions. Please refer to Tables 2 and 3 for specifics on the connections. If you have problems working out the configuration, please feel free to contact Thorlabs’ Tech support for assistance.

IMPORTANT NOTE: The LM14S2 is intended for use with negative driven current sources connected to the LDC connection with respect to the LDA input. That is to say, the LDA connection will be grounded and the LDC connection will have a negative potential. The LM14S2 incorporates a diode clamp across the LDA/LDC connections at the DB9 connector. Therefore, if the LDC input is driven positive, the diode will conduct and shunt current directly to the LDA input, bypassing the EO device entirely.



LM14S2 with a Two-Port Electro-Optic Device

WEEE

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 13th 2005
- marked correspondingly with the crossed out “wheelie bin” logo (see fig. 1)
- 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

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 on 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 live products will thereby avoid negative impacts on the environment.



Crossed out “wheelie bin” symbol