WAVELENGTH ELECTRONICS

PLD Series Laser Diode Drivers

General Description

The **PLD** Series Laser Diode Drivers combine the high performance you expect from a Wavelength component with two distinct improvements: low voltage operation from +5 V DC, and an **Active Current Limit**.

Operating from a single +5 V supply minimizes heat dissipation. Modular packaging makes it easy to integrate the PLD into your system. A separate laser diode power supply input lets you provide a higher compliance voltage. The **Active Current Limit** not only protects your laser diode, but ensures that you are operating with maximum stability. When the laser current reaches the level set by the Limit I Trimpot, the output disables and the Limit LED and Limit Status indicate the current limit has been reached.

Two photodiode ranges provide variable sensitivities for optimum operation. You can maintain excellent stability when operating in both constant current and constant power mode. All trimpots and switches are easily accessible and offer precision control. A slow start circuit, mechanical shorting relay, and Active Current Limit offer maximum protection for your laser diode even when power is removed.

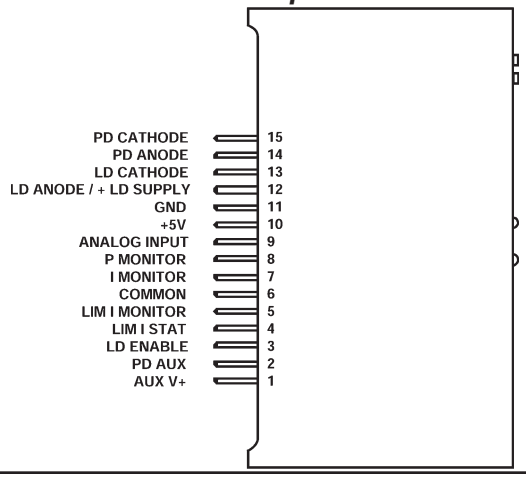
Features

- 200 mA, 500 mA,1.25 A, 5 A and 10 Amp models
- Single supply operation: +5 VDC
- Separate Laser Diode Supply input allows for flexible compliance voltages up to +28 VDC typical
- Manually adjust:
  - Setpoint & Current Limit
  - Constant Current or Constant Power Operation
  - Photodiode Sensitivity
- Remotely:
  - Adjust Setpoint Current with Analog Input
  - Enable or Disable Output
  - Monitor Laser Diode Current, Photodiode Current, and Laser Diode Limit Current
  - Monitor Limit Status
- Supports all laser diode / photodiode pin configurations
- Safety is maximized:
  - Slow start circuitry
  - Mechanical relay protects even when power is removed
  - Active Current Limit
- Integral Heatsink (Fan Assembly included with PLD -5000 and PLD-10000)

Ordering Information

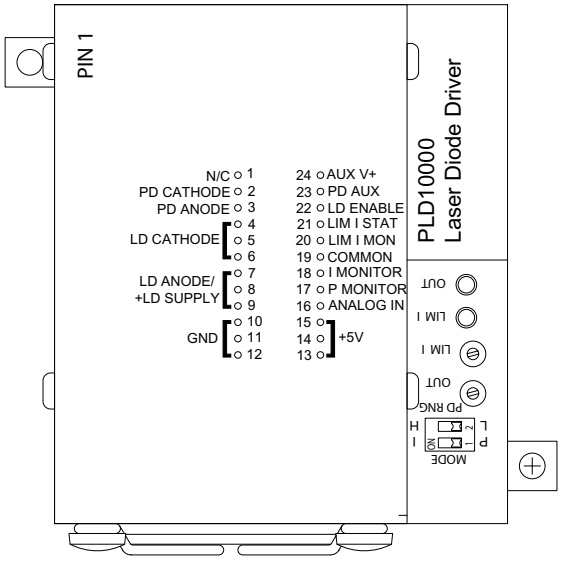
PLD-200	200 mA Laser Diode Driver
PLD-500	500 mA Laser Diode Driver
PLD-1250	1.25 A Laser Diode Driver
PLD-5000	5 A Laser Diode Driver
PLDEVAL	Evaluation PCB for PLD 200, 500, 1250 and 5000
PLD-10000	10 A Laser Diode Driver
PLD10EV	Evaluation PCB for PLD-10000

Pin Descriptions - All Models Except PLD10000*



***Note that the pin layout for the PLD-10000 is different from all other models.**

*Pin Descriptions for PLD-10000**

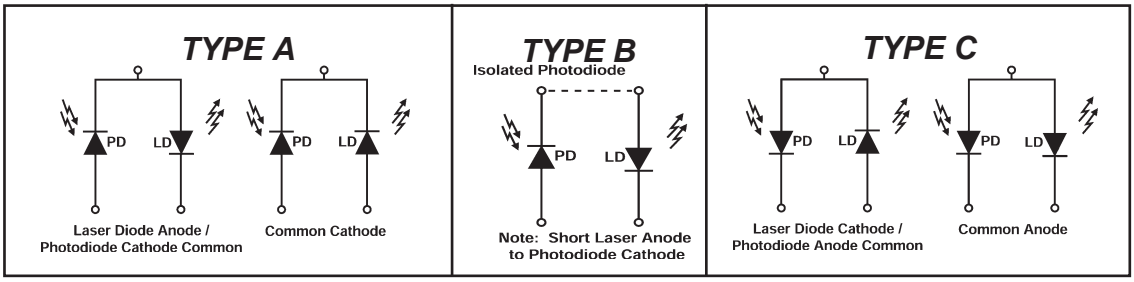


Laser Diode Types

The following laser diode / photodiode configurations are currently manufactured - Type A, Type B, and Type C. Setup and operation vary according to your type of laser diode. **Please identify which laser diode you will be using with the PLD and follow the appropriate operating instructions.**

Operating instructions for lasers of Type A or B are detailed on page 14.

Operating instructions for Type C Lasers are detailed on page 19.



Pin Descriptions

PLD-10000	ALL OTHER MODELS	NAME	DESCRIPTION
24	1		**For TYPE C laser diodes only.** See page 18.
23	2	**AUX V+**	**For TYPE C laser diodes only.** See page 18.
22	3	**PD AUX LD ENABLE**	Enable Output Current = +3 to +5 V Disable Output Current = Ground or Floating
21	4	**LIM I STAT**	LIMIT status. LIMIT $\leq$ 0.3 V. Normal Operation = High Impedance If Limit is detected, laser diode current will turn off, Limit I LED will light. Toggle LD ENABLE to restart laser diode current.
20	5	**LIM I MONITOR**	Current Limit Setpoint Monitor. Impedance = 1 kΩ Output 0 to 2.5 V **NOTE:** Current limit needs to be set 0.2 V above desired limit level. Additional notes for fine-tuning the current limit can be found on page 11.
19	6	**COMMON**	Measurement ground. Low current return used only with **MONITOR** pins and **ANALOG INPUT**. Shorted to **GND** pin internally.
18	7	**I MONITOR**	Laser Diode Current Monitor. Impedance is 1 kΩ Output 0 to 2.5 V
17	8	**P MONITOR**	Power Monitor (PD Current Monitor). Impedance = 1 kΩ Output 0 to 2.5 V
16	9	**ANALOG INPUT**	Remote Setpoint or modulation input. Input impedance = 1 MΩ Input 0 to 5 V. Connect **ANALOG INPUT** to **COMMON** when not in use.
13,14,15	10	**+5V**	Supply voltage to control electronics. Min +4.5 V Max +5.5 V
10,11,12	11	**GND**	Power supply ground. Used with **+5V** input for high current return.
7,8,9	12	**LD ANODE/ +LD SUPPLY**	Laser Diode Anode and Laser Diode Supply connection. Recommended +LD Supply for single laser is +5 V. Maximum +30 V. **CAUTION: Too high a voltage may damage the PLD.**
4,5,6	13	**LD CATHODE**	Laser Diode Cathode
3	14	**PD ANODE**	For Type A or B laser diodes, Photodiode Anode. See page 18 for use with Type C laser diodes.
2	15	**PD CATHODE**	**For TYPE C laser diodes only.** See page 18.
1		**NO CONNECT**	

POWER SUPPLY AND NOISE

The PLD Series Laser Diode Drivers are designed for stable, low noise operation. The power supply you select will directly affect the noise performance of the driver. We recommend using a regulated, linear supply for optimum performance. Depending on your requirements, you may be able to use a switching power supply. Each case must be evaluated independently because a switching power supply will affect noise, transient, and stability performance. Wavelength Electronics offers an evaluation kit and power supplies for easy configuration and operation.

LASER SAFETY ISSUES

WARNING: The PLD laser diode drivers can power up to Class IV laser diodes. Precautions should be taken to avoid exposure to the laser radiation. Do not look directly into the beam or expose hands or other body parts to the beam. Before powering the laser diode, mount it securely and have beam dumps set up to catch both front and back facet outputs.

CAUTION: If you plan to operate the PLD with any Wavelength temperature controller, you **may** need to use separate power supplies. If the TE cooler or thermistor is connected to the laser diode, you must either use two separate power supplies and let each float independent of the other or use a bipolar power supply.

WARNING: Exceeding the maximum specified operating current ($I_{OP\ MAX}$) will damage your laser diode. Become familiar with the PLD series module operation and the exact specifications of your laser diode before attaching it to the PLD module. Seek assistance from someone with experience working with laser diodes if you have not operated one before.

FAN ELECTRICAL NOISE

PLD-5000 and 10000

The PLD-5000 and 10000 models are equipped with a +5 V fan that cools the heatsink. The fan in some cases may create electrical noise. To reduce the electrical noise level you must connect the heatsink to earth/chassis ground or the system ground (power supply common). To ground the heatsink you need to connect ground to the tapped hole in the bottom of the heatsink.

WARNING: The following instruments may cause momentary opens, shorts, or impedance changes that will damage a laser diode if attached to the output of a laser diode driver while in operation.

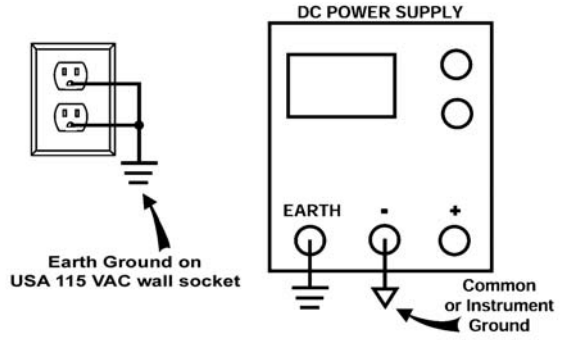
1. A **volt meter** across the laser diode.
2. An **oscilloscope** across the laser diode.
3. A **current meter** in series with the laser diode.

All measurements made with these instruments on the output should be made with a simulated load attached and not a laser diode.

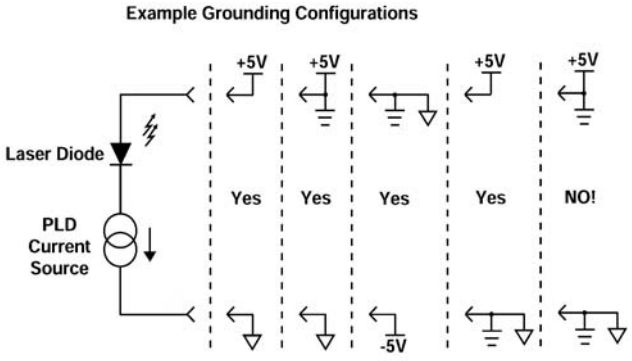
CAUTION: IF LASER DIODE AND PHOTODIODE ARE ISOLATED (TYPE B LASER DIODE) Short the laser diode anode to the photodiode cathode. The PLD series laser diode drivers require the photodiode be connected to the laser diode. If no connection is made between the laser diode and the photodiode, then the PLD will not operate properly in constant power mode, and the power monitor will not read the proper photodiode current.

GROUNDING VARIATIONS

Some laser diode packages short either pin of the laser diode to the case, which may connect the pin to earth ground through system hardware. Special attention to the details of grounding will ensure safe operation. We offer the following definitions and options:



Unless Earth and Instrument Ground are connected via the power supply, Instrument Ground is floating with respect to Earth Ground



See page 11 for higher voltage operation (page 12 for PLD-10000)

Electrical Specifications

Model Number	*PLD-200*	*PLD-500*	*PLD-1250*	*PLD-5000*	*PLD-10000*
Drive Current Output					
Output Current Range	**0 - 200 mA**	**0 - 500 mA**	**0 - 1250 mA**	**0 - 5 Amps**	**0 - 10 Amps**
Compliance Voltage with +5V input	< 3 V	< 3 V	< 3 V	< 3 V	< 3 V
Compliance Voltage ❶	< 28 V	< 28 V	< 28 V	< 28 V	< 28 V
Temperature Coefficient	< 100 ppm/°C	< 100 ppm/°C	< 100 ppm/°C	< 100 ppm/°C	< 100 ppm/°C
Short Term Stability (1 hr)	< 10 ppm	< 10 ppm	< 10 ppm	< 10 ppm	< 50 ppm
Long Term Stability (24 hrs.)	< 20 ppm	< 20 ppm	< 20 ppm	< 20 ppm	< 100 ppm
Noise and Ripple (rms) ❷	< 10 μA	< 15 μA	< 20 μA	< 30 μA	< 50 μA
Current Limit Range	0 - 200 mA	0 - 500 mA	0 - 1250 mA	0 - 5 Amps	0 - 10 Amps
Photodiode Feedback					
High Range ❸	50 - 5000 μA	50 - 5000 μA	50 - 5000 μA	50 - 5000 μA	50 - 5000 μA
Low Range (TYPE A & B ONLY) ❸	15 - 500 μA	15 - 500 μA	15 - 500 μA	15 - 500 μA	15 - 500 μA
Const. Power Output Stability	< 0.02 %	< 0.02 %	< 0.02 %	< 0.02 %	< 0.05 %
External Modulation (Constant Current)					
Input Impedance	1 MΩ	1 MΩ	1 MΩ	1 MΩ	1 MΩ
Transfer Function (0 to +5 V Max)	40 mA/V	100 mA/V	250 mA/V	1 A/V	2.3 A/V
Bandwidth (3 dB) ❸	65 kHz	100 kHz	100 kHz	100 kHz	70 kHz
Depth of Modulation at 20kHz ❻	90%	90%	90%	90%	90%
Power Supply					
Power Up Trip Point ❹	4.5 V	4.5 V	4.5 V	4.5 V	4.5 V
Power Down Trip Point ❹	3.5 V	3.5 V	3.5 V	3.5 V	3.5 V
Max. Internal Power Dissipation	3 Watts	9 Watts	12 Watts	15 Watts	40 Watts
Monitor Accuracy					
Monitor voltage versus expected output current based on transfer function (percent of full scale)	2%	2%	2%	2%	2%

General Specifications

Power Supply Requirements: ❺
STD +5 V Operation, TYPE A or B lasers:
+5 V supply pin: +5 VDC (+5.5 V MAX)
Add for High Compliance Voltage:
+LD Supply: +3 VDC to +30 VDC MAX
Add for TYPE C lasers:
Aux V+: +8 VDC to +12 VDC (+12.5 V MAX)

Supply Current
PLD-200 & PLD-500: 50 mA plus max. LD current
PLD-1250: 150 mA plus max LD current
PLD-5000: 150 mA plus max LD current
PLD-10000: 250 mA plus max LD current

Operating Temperature
0 to +50°C (guaranteed)

Warm-up
1 hour to rated accuracy

Weight
< 1.0 lb. (PLD-10000)
< 0.3 lbs. (All other PLD models)

Size (H x W x D)
1.52" x 2.65" x 0.81" (PLD-200)
1.52" x 2.65" x 1.10" (PLD-500)
1.52" x 2.65" x 1.82" (PLD-1250)
1.52" x 2.65" x 1.82" (PLD-5000)
3.34" x 3.35" x 3.20" (PLD-10000)

❶ Compliance Voltage will vary depending on power supply voltages. A maximum compliance voltage of +28 volts will be obtained with +30 volts input. A maximum compliance voltage of +3 volts will be obtained with +5 volts input. See pages 12 & 13 for more detail.

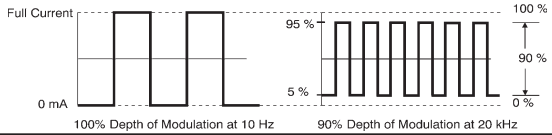
❷ With **ANALOG INPUT** shorted to **COMMON**.

❸ Modulation bandwidth in Constant Power mode will depend on photodiode response. It is typically 10% of Constant Current Bandwidth. NOTE: Photodiode manufacturer's current specifications vary by a large percentage.

❹ The PLD Series drivers have internal control circuitry which turns the output on and off depending on the voltage at the **+5V** pin. When the voltage reaches the power up trip point (+4.5 V), and the **LD ENABLE** pin is greater than 3 V, the module soft starts the laser diode. When the voltage reaches the power down trip point (+3.5 V), the module shunts current around the laser diode, powering it down in a controlled fashion.

❺ If a thermistor or TE module are case common with the laser diode, the PLD and temperature controller power supplies may need to be isolated from each other or a bipolar supply may be required.

❻ As pulse frequency increases on the analog input, the peak-to-peak output amplitude diminishes. For example, these graphs show the waveform shape at 10 Hz and 20 kHz. Depth of modulation continues to decrease after 20 kHz.



TYPICAL PERFORMANCE GRAPHS

Caution:

Do not exceed the Safe Operating Area (SOA). Exceeding the SOA voids the warranty.

To determine if the operating parameters fall within the SOA of the device, the maximum voltage drop across the driver and the maximum current must be plotted on the SOA curves. An online SOA calculator is available at http://www.teamwavelength.com/tools/tools.asp .

These values are used for the example SOA determination:

Device: PLD 5000

V_S = 10 volts

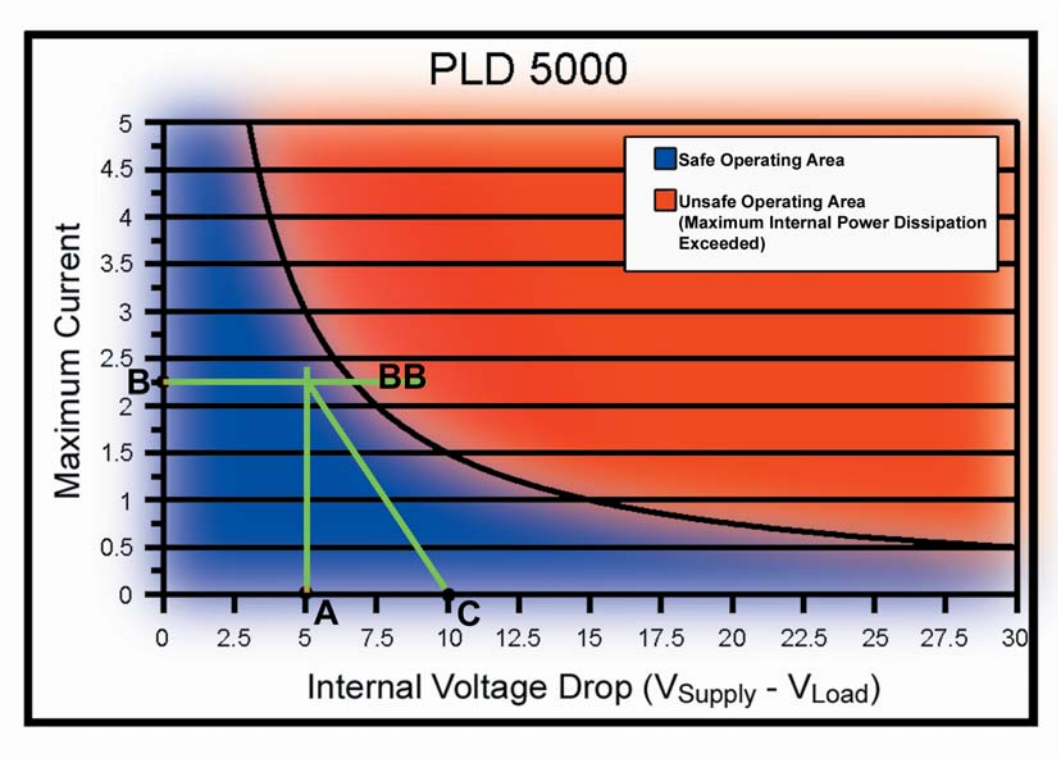
V_{Load} = 5 volts

I_{Load} = 2.25 amps } These values are determined from the specifications of the laser diode.

Follow these steps:

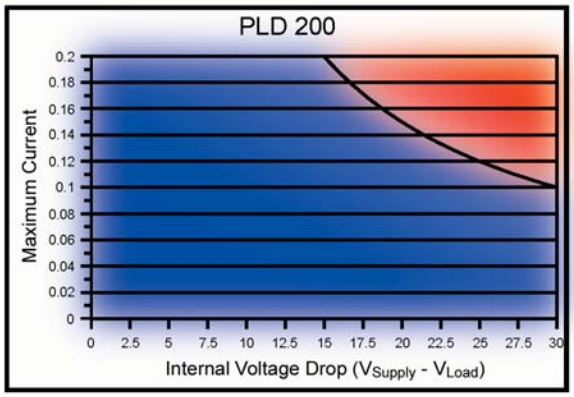
1. Determine the maximum voltage drop across the driver, V_S-V_{Load}, and mark on the X axis. Example: 10 volts - 5 volts = 5 volts, Point A
2. Determine the maximum current, I_{Load}, through the driver and mark on the Y axis: (2.25 amps, Point B)
3. Draw a horizontal line through Point B across the chart. (Line BB)
4. Draw a vertical line from Point A to the maximum current line indicated by Line BB.
5. Mark V_S on the X axis. (Point C)
6. Draw the Load Line from where the vertical line from point A intersects Line BB down to Point C.

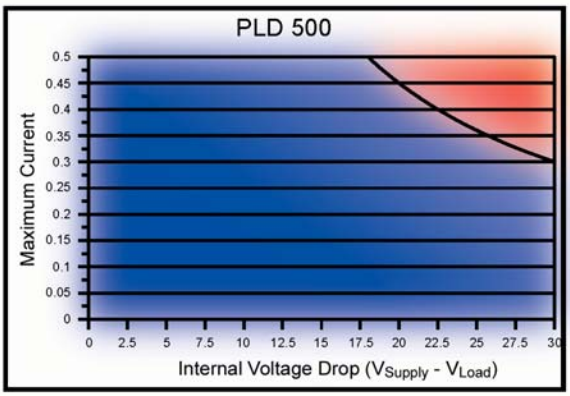
Refer to the chart shown below and note that the Load Line is within the Safe Operating Area for this device.

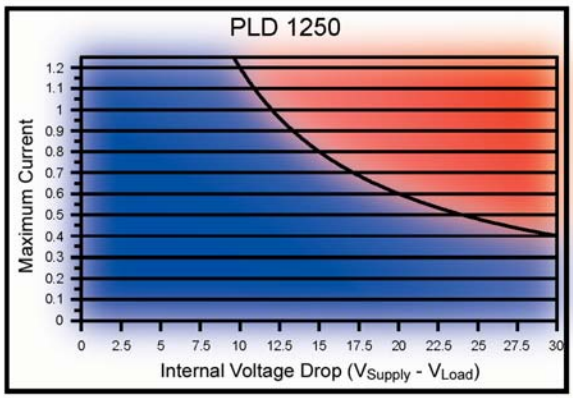


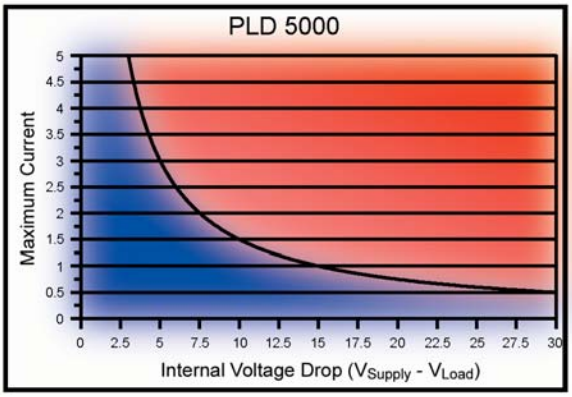
Safe Operating Charts

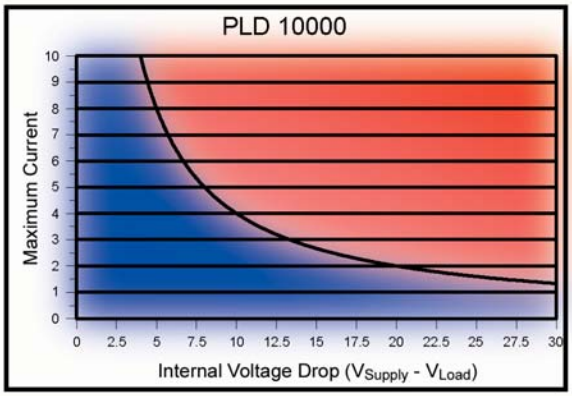
The charts on this page can be used to determine if your design falls within the **Safe Operating Area** (SOA) for the PLD series driver that you are using. For an example of how to use these charts, reference the previous page. There is also an online Safe Operating Area calculator available at http://www.teamwavelength.com/tools/tools.asp .



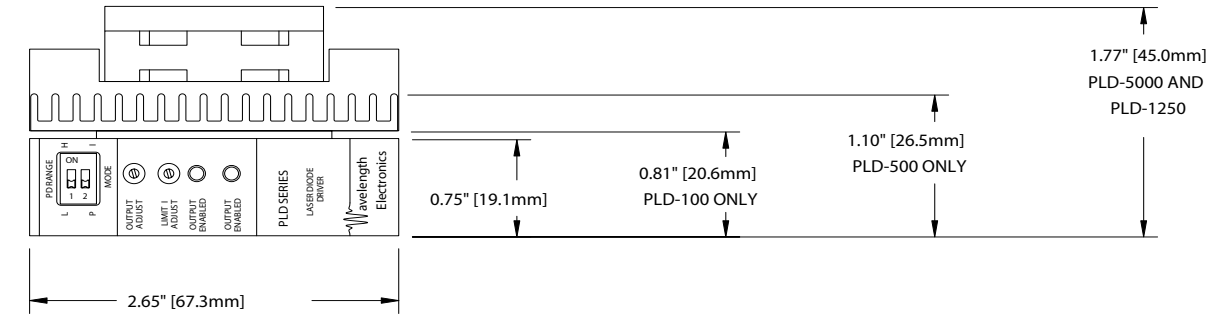


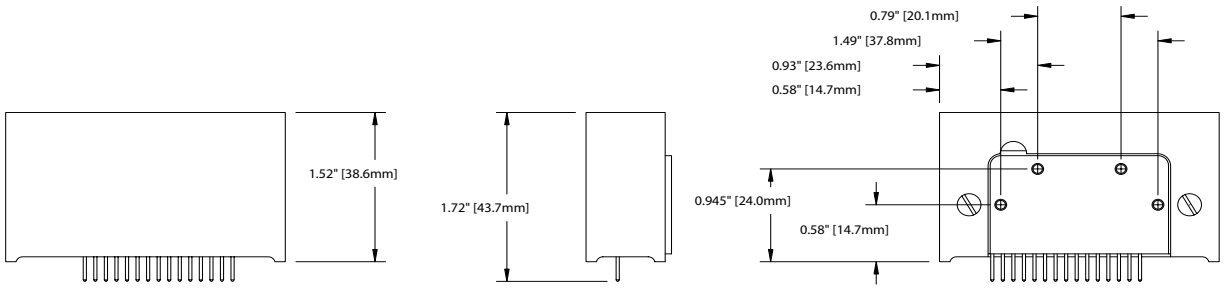


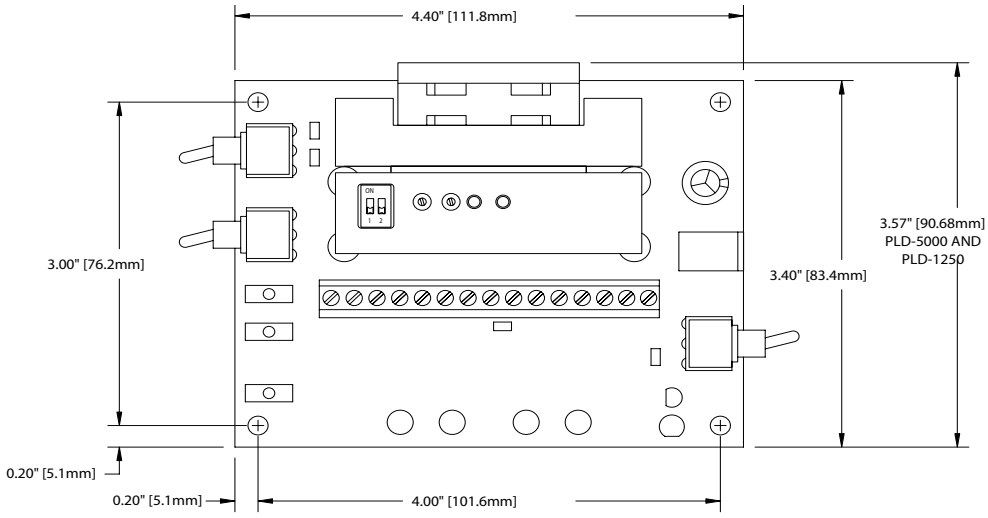




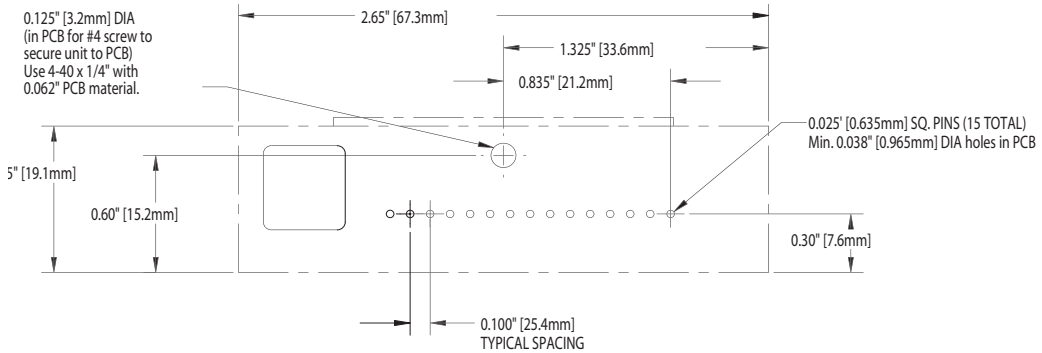
*Mechanical Specifications **
(PLD-10000 Mechanical Specs are Included on the Following Page)





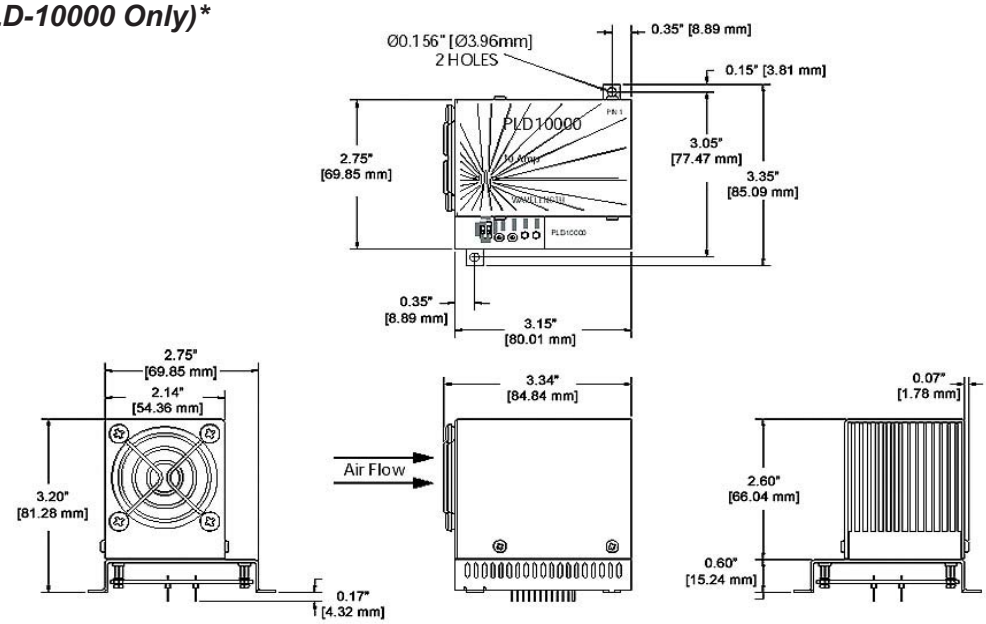


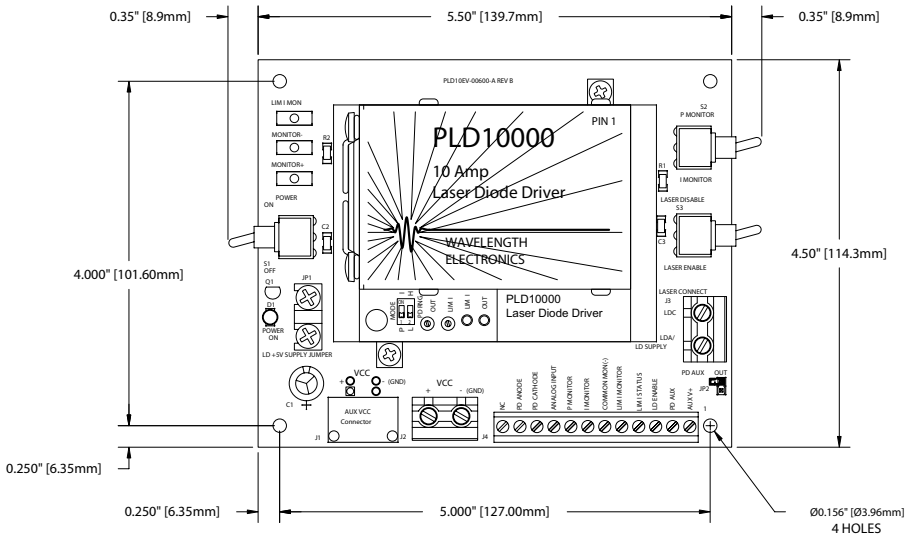
*PCB Layout Pattern - Top View **



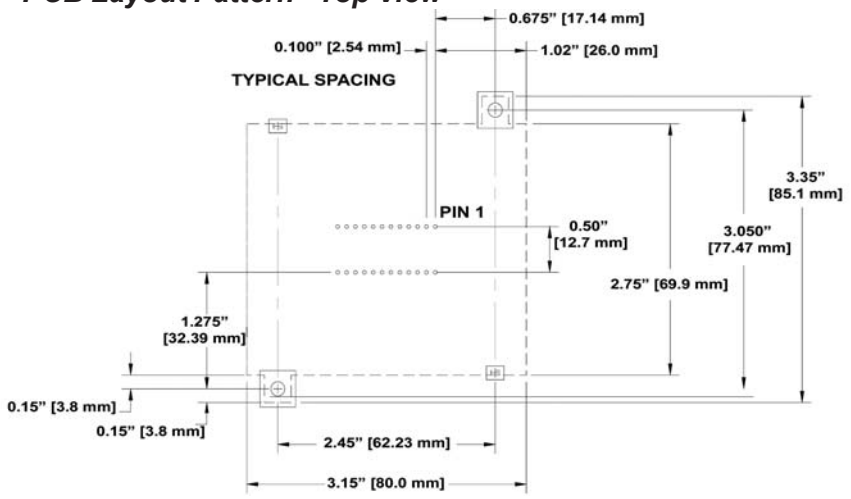
***All tolerances are ±5%**

*Mechanical Specifications (PLD-10000 Only)**





*PCB Layout Pattern - Top View**

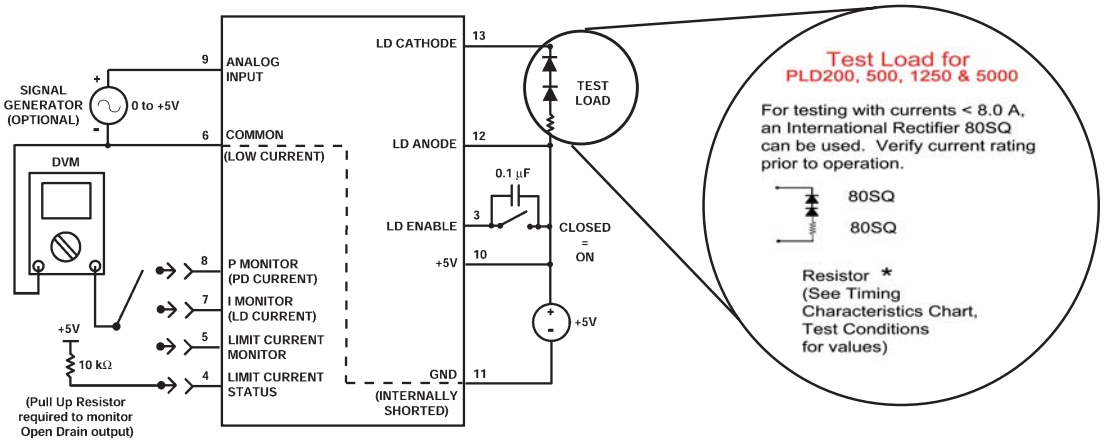


***All Tolerances Are ± 5%**

Timing Characteristics

Symbol	Parameter	Test Points	Test Conditions *	Typ
t_{ON}	On Time	Load	PLD200 - 10 Ω	6.8 µsec
			PLD500 - 1.0 Ω	6.8 µsec
			PLD1250 - 0.1 Ω	6.8 µsec
			PLD5000 - 0.1 Ω	6.8 µsec
			PLD10000 - 0.1 Ω	10 µsec
t_{OFF}	Off Time	Load	PLD200 - 10 Ω	6.8 µsec
			PLD500 - 1.0 Ω	6.8 µsec
			PLD1250 - 0.1 Ω	6.8 µsec
			PLD5000 - 0.1 Ω	6.8 µsec
			PLD10000 - 0.1 Ω	12 µsec
$t_{SLOWSTART}$	Slow Start Time	Load	PLD200 - 10 Ω	1.5 sec
			PLD500 - 1.0 Ω	1.5 sec
			PLD1250 - 0.1 Ω	1.5 sec
			PLD5000 - 0.1 Ω	1.5 sec
			PLD10000 - 0.1 Ω	1.5 sec

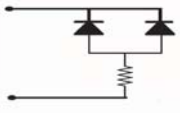
Test Setup for Parameter Measurement



PLD-10000 Test Setup

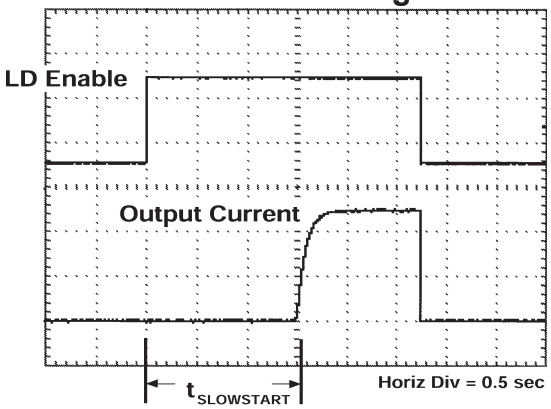
Test Load for
PLD10000

For testing with currents up to 10A, two International Rectifier 80SQ diodes can be used in parallel. Verify current rating prior to operation.

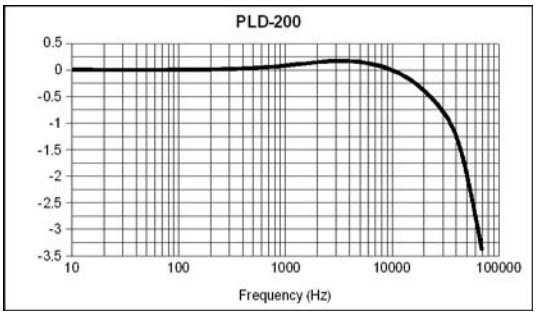


Resistor *
(See Timing Characteristics Chart Test Conditions)

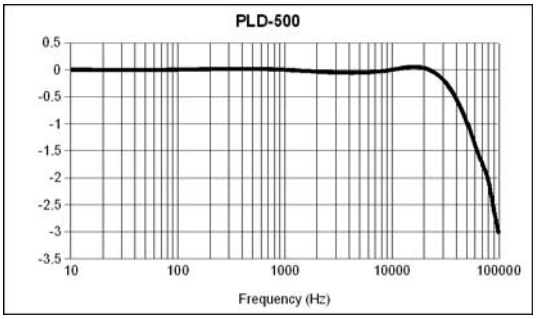
Slow Start Timing



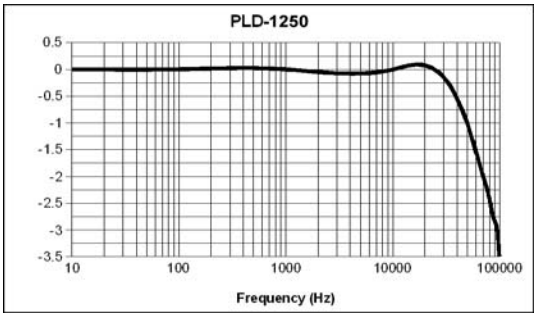
Large signal frequency response



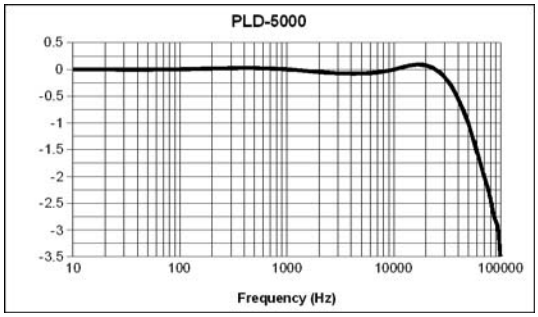
Large signal frequency response



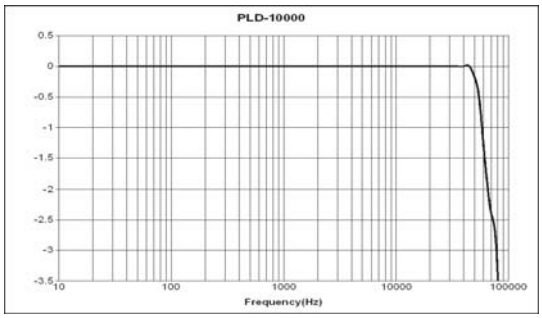
Large signal frequency response



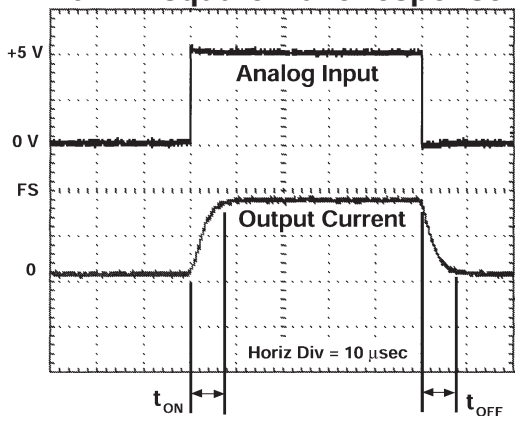
Large signal frequency response



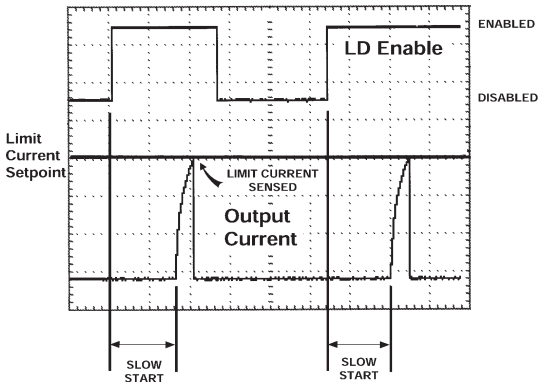
Large signal frequency response



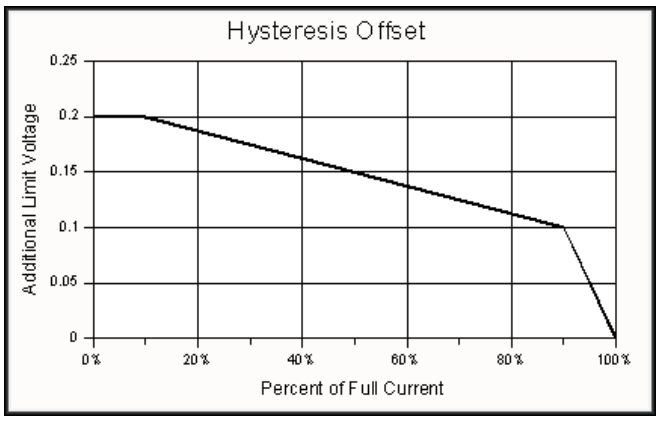
10 kHz square wave response



Current Limit Operation



Fine Tuning Your Limit Current Setting



The limit current circuit contains a small amount of hysteresis, which causes the limit current to trip slightly before expected. If the PLD current is close to the limit setpoint this hysteresis may affect operation. To compensate, a small offset voltage can be added to the limit current setting based on the Hysteresis offset chart above.

Example:

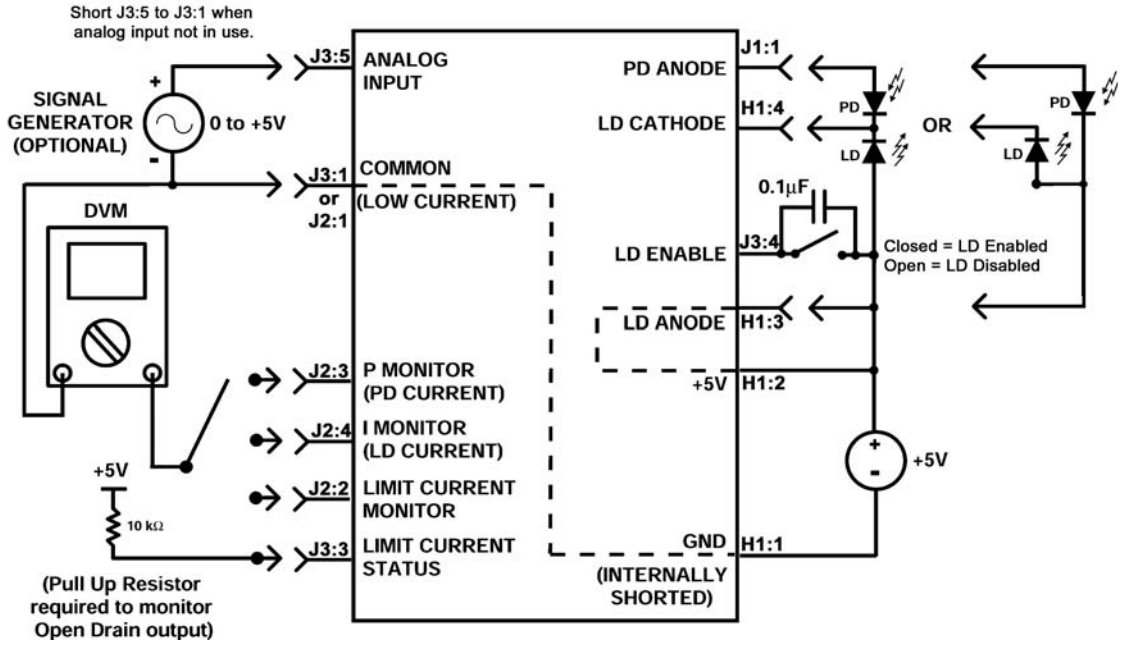
PLD5000 with a current limit of 2.5 Amps = 50% of maximum current

HO = Hysteresis Offset = 0.15V at 50%

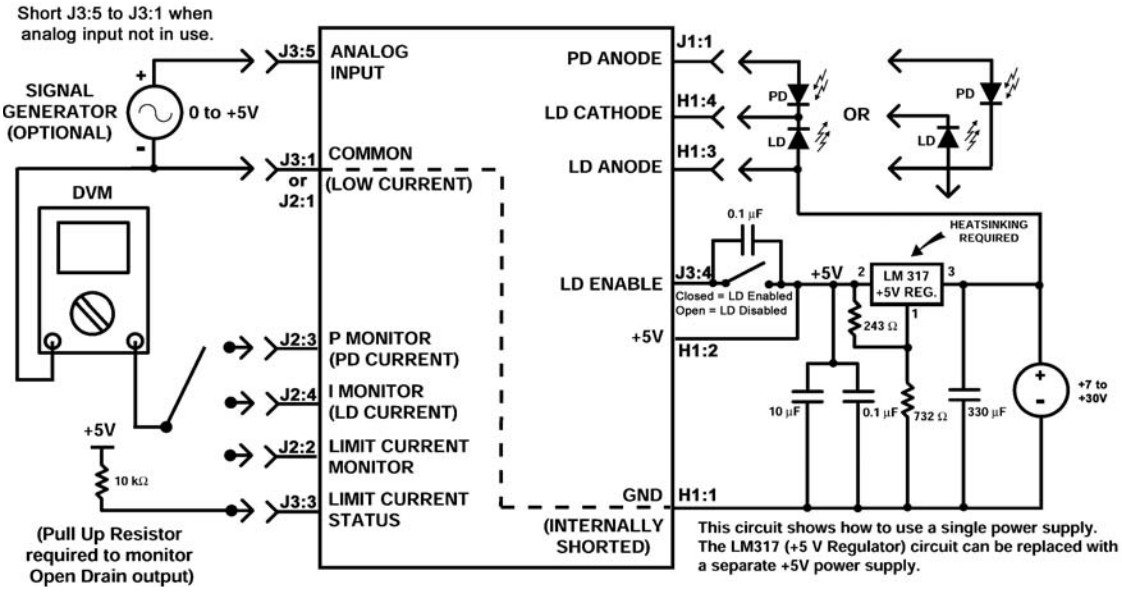
The transfer function for PLD5000 limit current monitor is 2 A/V as given on pages 12 and 14.*

$$V_{LIM} = \frac{I_{LIM}}{2\ A/V} + HO = 1.25\ V + .15\ V = 1.4\ V$$

*Typical Setup for Type A or B laser diode +5V operation**



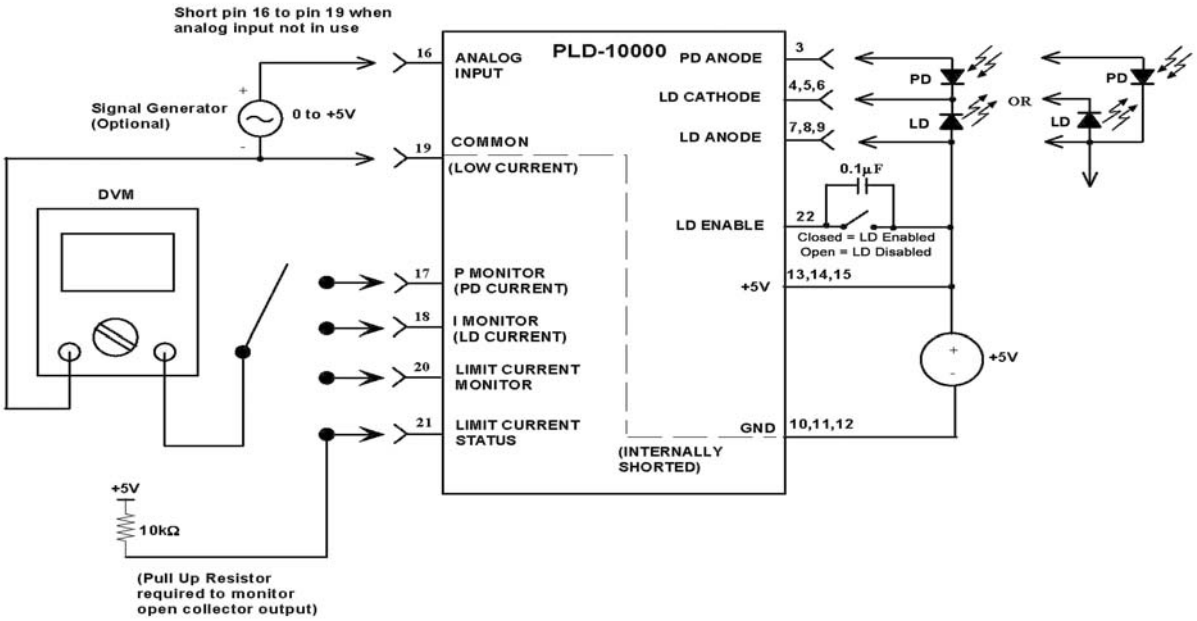
*Typical Setup for Type A or B laser diode - High Compliance Voltage operation**



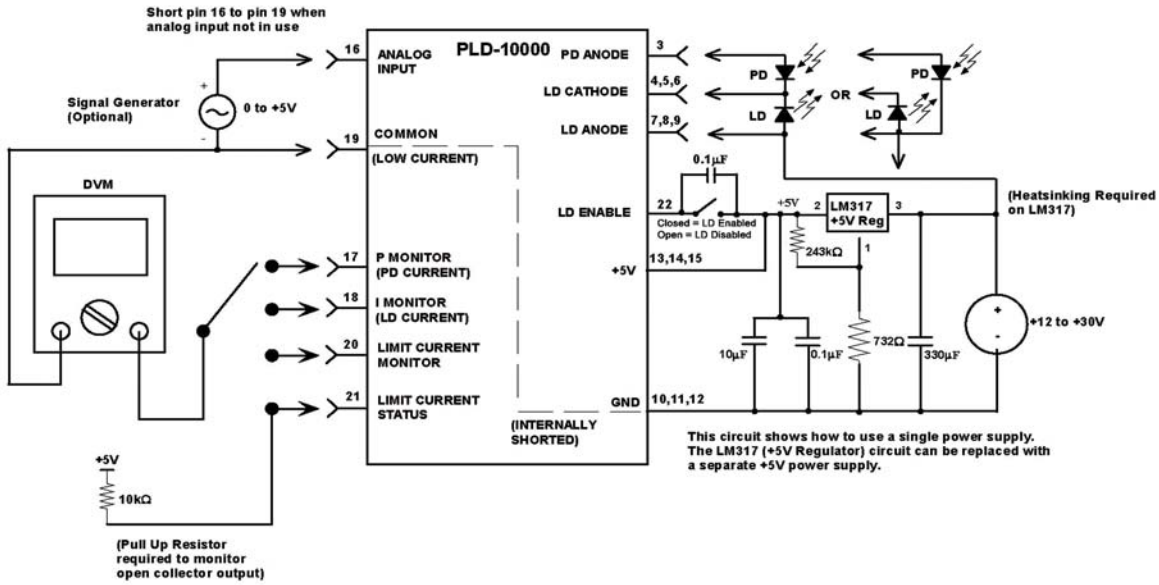
***Note that the pin connections for the PLD-10000 are different from all other PLD models. Please see the following page for PLD-10000 connection diagrams.**

***The connection diagrams on this page apply only to the PLD-10000. Please see the previous page for connection of other PLD models.**

*Typical Setup for Type A or B laser diode +5V operation**



*Typical Setup for Type A or B laser diode - High Compliance Voltage operation**



Operating Procedures for Type A or B laser diodes +5V operation

Constant Current Mode

With the Output Disabled:

(1) Configure Mode Switch to I. [switch on top of PLD]

(2) Set Limit Current: Monitor the **Lim I Monitor** voltage and adjust the **Current Limit** trimpot clockwise (CW) until the voltage on the **Lim I Monitor** corresponds to the desired level.

NOTE: The current limit circuit triggers slightly before the expected limit level. To fine tune the limit, add an offset voltage to the setting per the graph on page 11.

Limit Current and I Monitor Transfer Functions	
PLD-200	80 mA/Volt
PLD-500	200 mA/Volt
PLD-1250	500 mA/Volt
PLD-5000	2 Amps/Volt
PLD-10000	4.6 Amps/Volt

Once Current Limit is detected, the output will turn off and the LIM I led will illuminate red. The LIM I Status voltage and LIM I LED will stay on until the LD Enable is toggled off then on, and the error no longer exists.

(3) Set Operating Current. Use the transfer function from step 2 to calculate the desired current. Monitor the voltage on the **I Monitor** pin. With the **Output Adjust** trimpot fully counterclockwise (CCW), enable the output. Slowly adjust the OUTPUT ADJUST trimpot CW until the desired voltage is measured on the **I Monitor** pin.

(4) Monitor the Photodiode (optional). If the Photodiode is connected to the laser diode, check the voltage on the **P Monitor** pin. The PD switch on top of the PLD will determine the output transfer voltage by the position of the switch:

L = 200 μA / V **H = 2 mA / V**
(15 - 500 μA range) **(50 - 5000 μA range)**

(5) Analog Input: This input is designed for analog signals only and is not recommended for use with TTL signals. You can either input a DC voltage for remote current setpoint control or use this input to modulate the laser diode. The total setpoint voltage is the sum of the Analog Input voltage and the voltage introduced by the onboard trimpot. The input transfer function will depend on the PLD model in use.

Model	Transfer Function
PLD-200	40 mA / Volt
PLD-500	100 mA / Volt
PLD-1250	250 mA/Volt
PLD-5000	1 Amp/Volt
PLD-10000	2.3 Amps/Volt

Constant Power Mode

With the Output Disabled:

(1) Configure Mode Switch to P. [switch on top of PLD]

(2) Set Limit Current: Monitor the **Lim I Monitor** voltage and adjust the **Current Limit** trimpot clockwise until the voltage on the **Lim I Monitor** corresponds to the desired level.

NOTE: The current limit circuit triggers slightly before the expected limit level. To fine tune the limit, add an offset voltage to the setting per the graph on page 11.

Limit Current and I Monitor Transfer Functions	
PLD-200	80 mA/Volt
PLD-500	200 mA/Volt
PLD-1250	500 mA/Volt
PLD-5000	2 Amp/Volt
PLD10000	4.6 Amp/Volt

Once Current Limit is detected, the output will turn off and the LIM I led will illuminate red. The LIM I Status voltage and LIM I LED will stay on until the LD Enable is toggled off then on and the error no longer exists.

(3) Set the output power.

Determine the photodiode current from data provided with your laser diode. Monitor the voltage on the **P Monitor** pin. Set the **PD Range Switch** for the appropriate photodiode current

L = 15 - 500 μA **H = 50 - 5000 μA**

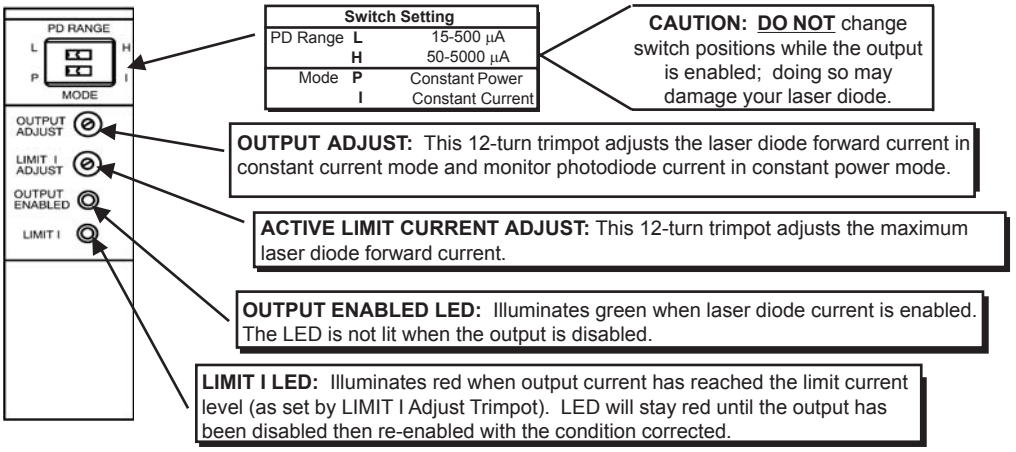
With the **Output Adjust** trimpot fully CCW, enable the output. When the laser reaches threshold, the photodiode current changes abruptly and rises quickly. Adjust the **OUTPUT ADJUST** trimpot slowly until the voltage on the **P Monitor** pin corresponds to the desired photodiode current. Transfer functions for Low and High Photodiode mode are:

L = 200 μA / V **H = 2 mA / V**

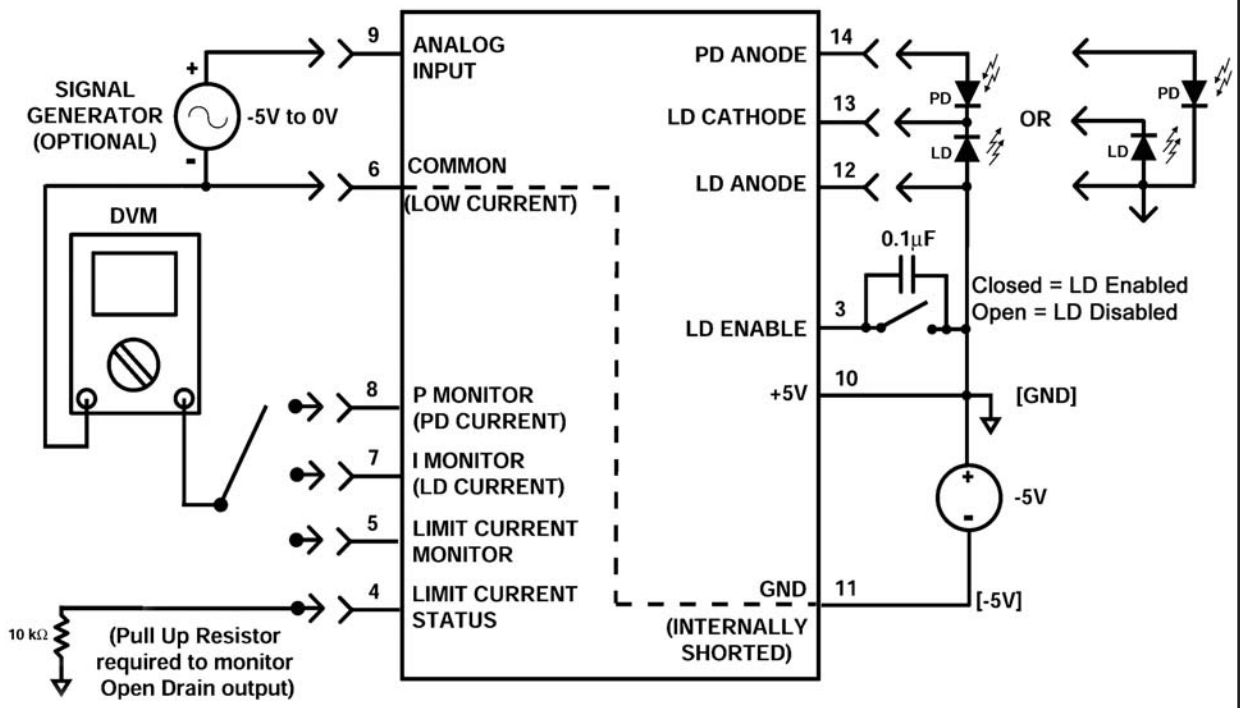
(4) Analog Input: This input is designed for analog signals only and is not recommended for use with TTL signals. You can either input a DC voltage for remote current setpoint control or use this input to modulate the laser diode. The total setpoint voltage is the sum of the Analog Input voltage and the voltage introduced by the onboard trimpot. The input transfer function is the same for all models and depends on the **PD RANGE** switch setting.

L = 100 μA / V **Hi = 1 mA / V**

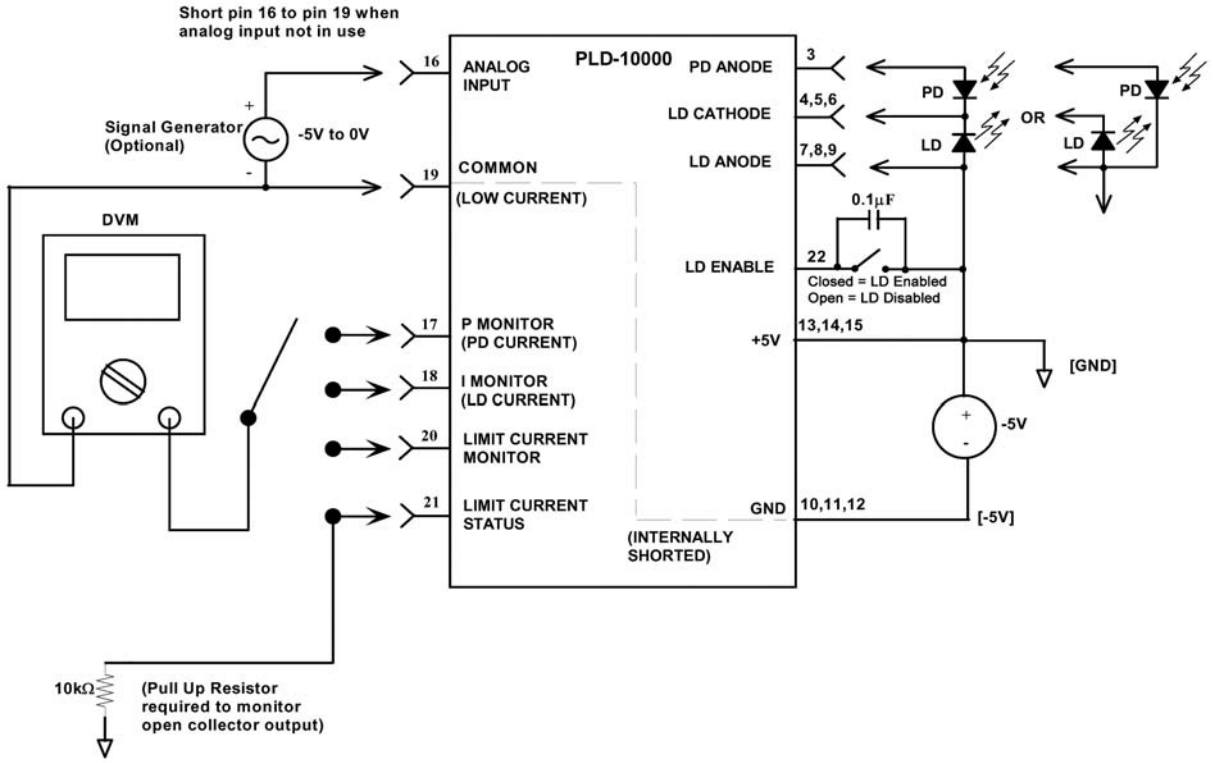
External Adjustments



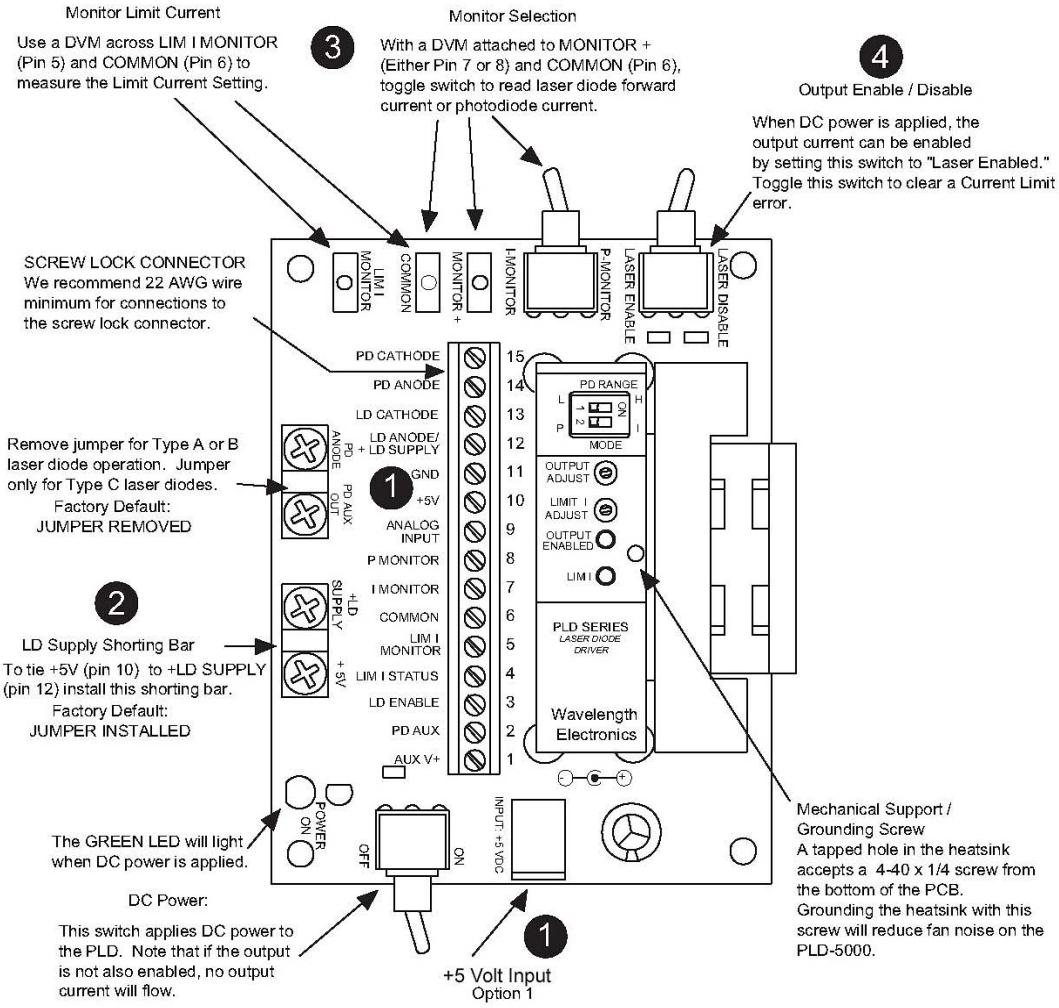
Typical Setup for Type A or B laser diode Negative Supply operation (Does not Include PLD-10000. See below for PLD-10000 Setup.)



Typical Setup for PLD-10000 with Type A or B laser diode Negative Supply Operation



Operating the PLDEVAL PCB with Type A & B Laser Diodes (Does Not Include PLD-10000)



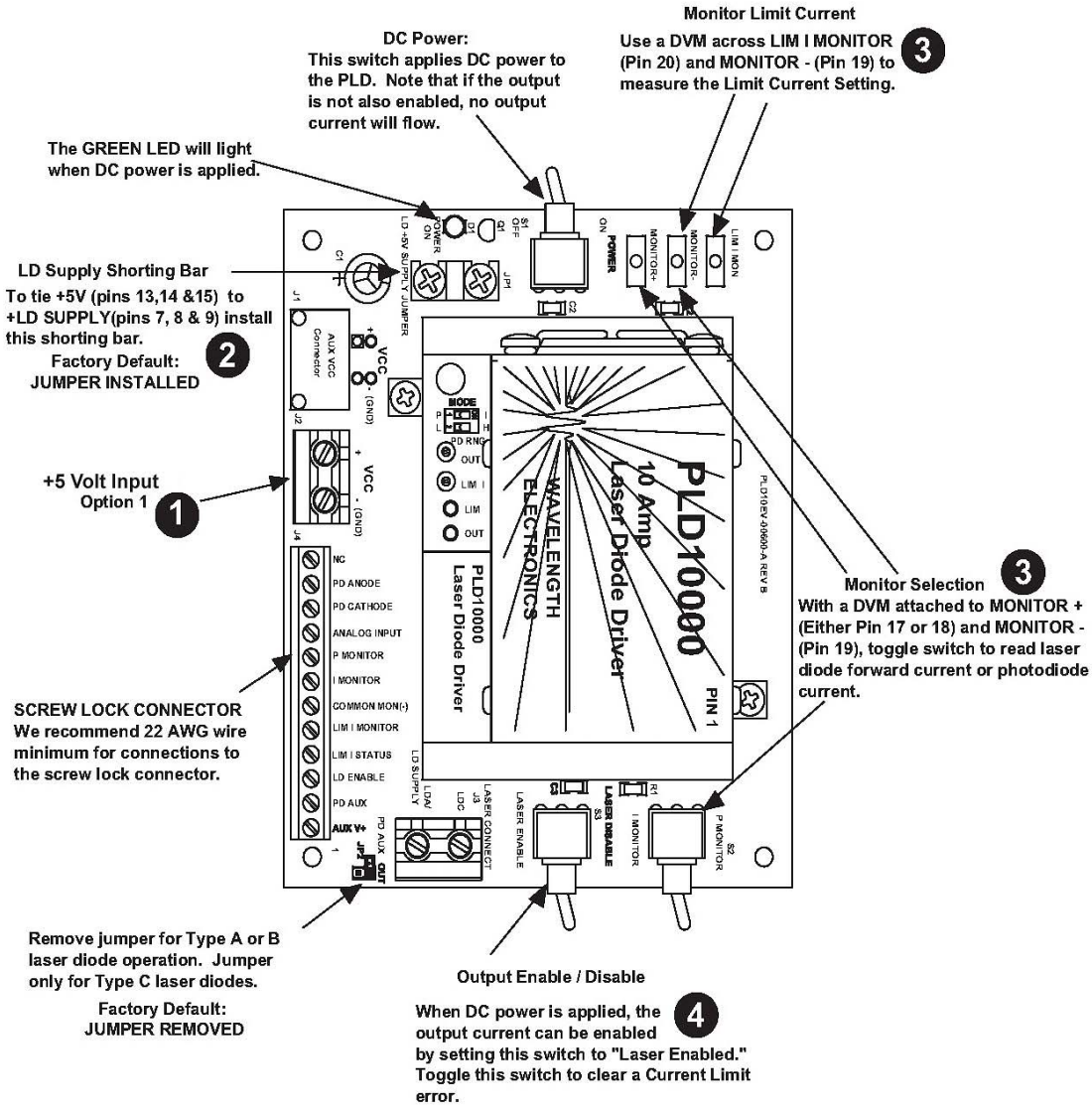
1 +5 Volt Input
Two inputs are available. If using a 2.5 mm circular connector (such as provided with the POWERPAK-5V) use the DC input next to the power switch. Otherwise, use the screw-lock connector, pins 10 & 11.

2 Compliance Voltage
If a single laser diode is being used, install the jumper on the bar to short +LD SUPPLY with +5V. For higher compliance voltage, remove the jumper and provide voltage to pin 12 via the screw lock connector. See High Compliance Voltage Operation on page 12.

3 Monitors
To monitor Limit Current, Laser Diode or Photodiode Current, use COMMON for the negative input of the DVM and either LIM I MONITOR or MONITOR + for the positive input. The switch set to P-MONITOR measures photodiode current. I-MONITOR measures laser diode current.

4 LD ENABLE
The switch enables and disables output current to the laser diode. Toggle this switch to clear a Current Limit error.

Operating the PLD10EV PCB with Type A & B Laser Diodes (PLD-10000 Only)



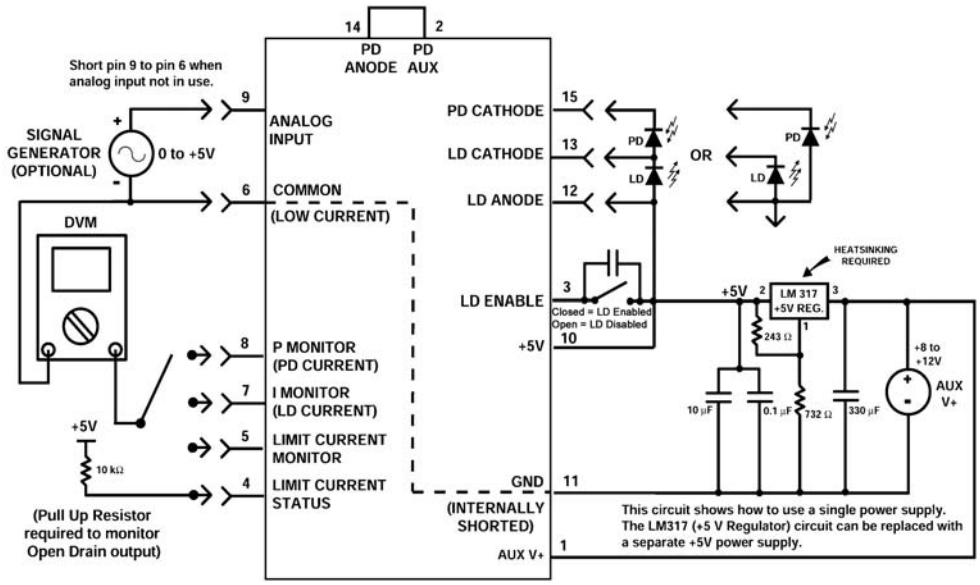
1 +5 Volt Input
Two inputs are available. The screw lock connector shown here comes factory installed on the board in the J4 position. J2 allows the user to install custom connectors.
NOTE: This input is for use with +5 Volt only.

2 Compliance Voltage
If a single laser diode is being used, install the jumper on the bar to short +LD SUPPLY with +5V. For higher compliance voltage, remove the jumper and provide voltage to the Laser Anode, pins 7, 8 & 9 via the screw lock connector J3. See High Compliance Voltage Operation on page 12.

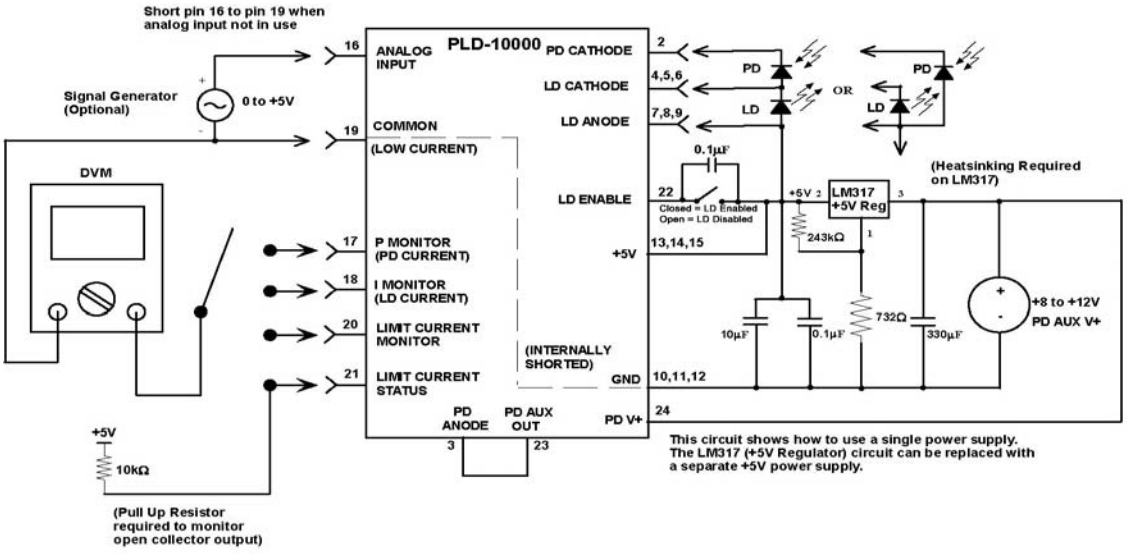
3 Monitors
To monitor Limit Current, Laser Diode or Photodiode Current, use MONITOR - for the negative input of the DVM and either LIM I MONITOR or MONITOR + for the positive input. The switch set to P-MONITOR measures photodiode current. I-MONITOR measures laser diode current.

4 LD ENABLE
The switch enables and disables output current to the laser diode. Toggle this switch to clear a Current Limit error.

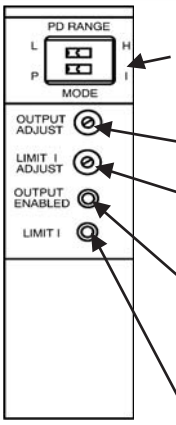
Typical Setup for Type C laser diodes (Does not Include PLD-10000. See below for PLD-10000 Setup.)



Typical Setup for PLD-10000 with Type C laser diodes



External Adjustments



Switch Setting		
PD Range	**L**	This switch must be set in the **L** position for Type C laser diodes. The photodiode range is 15 - 500 µA.
Mode	**P**	Constant Power
	I	Constant Current

CAUTION: DO NOT change switch positions while the output is enabled; doing so may damage your laser diode.

OUTPUT ADJUST: This 12-turn trimpot adjusts the laser diode forward current in constant current mode and monitor photodiode current in constant power mode.

ACTIVE LIMIT CURRENT ADJUST: This 12-turn trimpot adjusts the maximum laser diode forward current.

OUTPUT ENABLED LED: Illuminates green when laser diode current is enabled. The LED is not lit when the output is disabled.

LIMIT I LED: Illuminates red when output current has reached the limit current level (as set by LIMIT I Adjust Trimpot). LED will stay red until the output has been disabled then re-enabled with the condition corrected.

Operating Procedures for Type C laser diodes

Constant Current Mode

With the Output Disabled:

(1) Configure Mode Switch to I. [switch on top of PLD]

(2) Set Limit Current: Monitor the voltage on the **Lim I Monitor** pin and adjust **Current Limit** trimpot clockwise until the voltage on the **Lim I Monitor** pin corresponds to the desired level.

NOTE: The current limit circuit triggers slightly before the expected limit level. To fine tune the limit, add an offset voltage to the setting per the graph on page 11.

Limit Current and I Monitor	Transfer Functions
PLD-200	80 mA/Volt
PLD-500	200 mA/Volt
PLD-1250	500 mA/Volt
PLD-5000	2 Amps/Volt
PLD-10000	4.6 Amps/Volt

Once Current Limit is detected, the output will turn off and the LIM I led will illuminate red. The LIM I Status voltage and LIM I LED will stay on until the LD Enable is toggled off then on, and the error no longer exists.

(3) Set Operating Current. Use the transfer function from step 2 to calculate the desired current. Monitor the voltage on the **I Monitor** pin. With the OUTPUT ADJUST trimpot fully CCW, enable the output. Slowly adjust the OUTPUT ADJUST trimpot CW until the desired voltage is measured on the **I Monitor** pin.

(4) Monitor the Photodiode (optional). If the Photodiode is connected to the laser diode, monitor the **P Monitor** voltage. The PD switch on top of the PLD should be set to **L** (High mode (Hi) is not available for type C configurations.):

L = 200 μA / V

(5) Analog Input: This input is designed for analog signals only and is not recommended for use with TTL signals. You can either input a DC voltage for remote current setpoint control or use this input to modulate the laser diode. The total setpoint voltage is the sum of the Analog Input voltage and the voltage introduced by the onboard trimpot. The input transfer function will depend on the PLD model in use.

Model	Transfer Function
PLD-200	40 mA / Volt
PLD-500	100 mA / Volt
PLD-1250	250 mA/Volt
PLD-5000	1 Amp/Volt
PLD-10000	2.3 Amps/Volt

Constant Power Mode

With the Output Disabled:

(1) Configure Mode Switch to P. [switch on top of PLD]

(2) Set Limit Current: Monitor the voltage on the **Lim I Monitor** pin and adjust **Current Limit** trimpot clockwise until the voltage on the **Lim I Monitor** pin corresponds to the desired level.

NOTE: The current limit circuit triggers slightly before the expected limit level. To fine tune the limit, add an offset voltage to the setting per the graph on page 11.

Limit Current and I Monitor	Transfer Functions
PLD-200	80 mA/Volt
PLD-500	200 mA/Volt
PLD-1250	500 mA/Volt
PLD-5000	2 Amps/Volt
PLD-10000	4.6 Amps/Volt

Once Current Limit is detected, the output will turn off and the LIM I led will illuminate red. The LIM I Status voltage and LIM I LED will stay on until the LD Enable is toggled off then on and the error no longer exists.

(3) Set the output power.

Determine the photodiode current from data provided with your laser diode. Monitor the voltage on **P Monitor**. One photodiode range is available. Set the PD Range Switch to **L**.

L Range = 15 - 500 μA

With the Output Adjust trimpot fully CCW, enable the output. When the laser reaches threshold, the photodiode current changes abruptly and rises quickly. Adjust the **OUTPUT ADJUST** trimpot slowly until the voltage on **P Monitor** corresponds to the desired photodiode current. The transfer function is:

L = 200 μA / V

This can be adjusted with a resistor (R) connected between **PD Cathode** and **AUX V+**. The new range can be calculated with:

$$\text{RANGE} = 2.5\ \text{V} / (R \parallel 5\ \text{k}\Omega) \quad [\text{A}]$$

The new transfer function is:

$$\text{TF} = 1 / (R \parallel 5\ \text{k}\Omega) \quad [\text{A / V}]$$

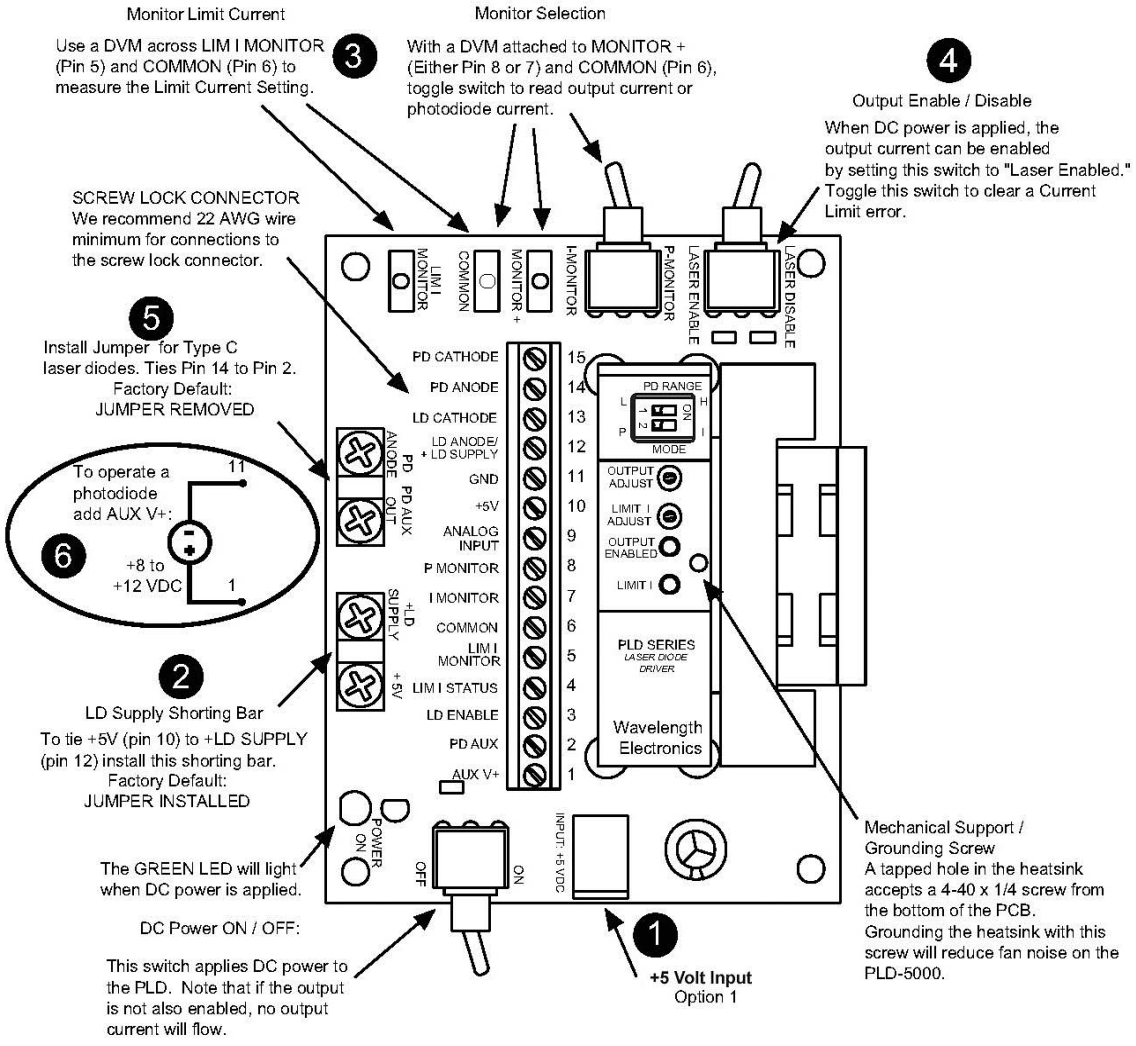
For example, a 500 Ω resistor converts the RANGE to:
2.5 / (500 * 5000 / (500 + 5000)) = 5500 μA max
and the transfer function to:
1 / (500 * 5000 / (500 + 5000)) = 2.2 mA / V

(4) Analog Input: This input is designed for analog signals only and is not recommended for use with TTL signals. You can either input a DC voltage for remote current setpoint control or use this input to modulate the laser diode. The total setpoint voltage is the sum of the Analog Input voltage and the voltage introduced by the onboard trimpot. The input transfer function for all models is:

100 μA/V.

Note that the transfer function will change if you change the photodiode RANGE. The new transfer function is RANGE / 5 V.

Operating the PLDPCB with Type C Laser Diodes (Does Not Include PLD-10000)



1 +5 Volt Input
Two inputs are available. If using a 2.5 mm circular connector (such as provided with the POWERPAK-5V) use the DC input next to the power switch. Otherwise, use the screw-lock connector, pins 10 & 11.

2 Compliance Voltage
If a single laser diode is to be operated, install the jumper on the bar to short +LD SUPPLY with +5V. For higher compliance voltage, remove the jumper and provide voltage to pin 12 via the screw lock connector.

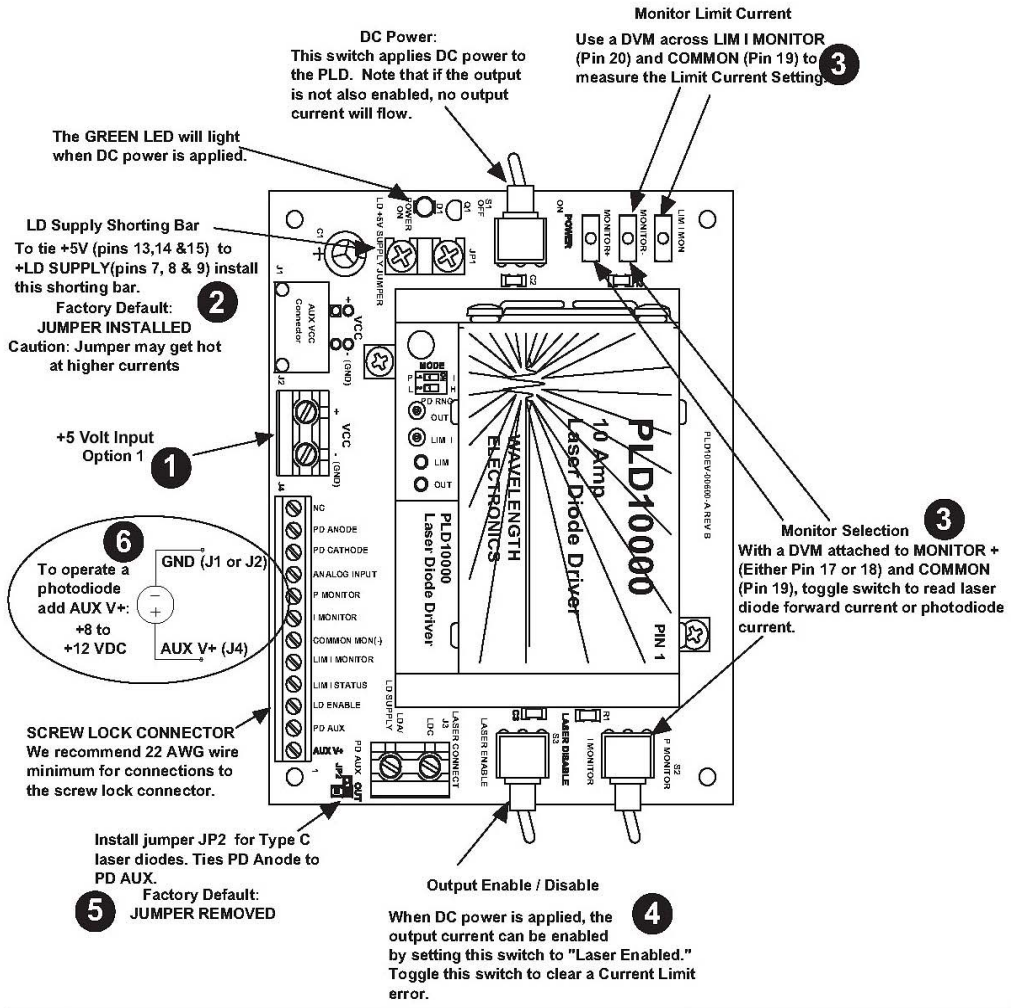
3 Monitors
To monitor Limit Current, Laser Diode or Photodiode Current, use COMMON for the negative input of the DVM and either LIM I MONITOR or MONITOR + for the positive input. The switch set to P-MONITOR measures photodiode current. I-MONITOR measures laser diode current.

4 LD ENABLE
The switch enables and disables output current to the laser diode. Toggle this switch to clear a Current Limit error.

5 Photodiode Feedback
To use photodiode feedback, you must jumper PD AUX to PD ANODE. A jumper is provided.

6 To Operate a Photodiode
To use photodiode feedback, you must provide AUX V+ of +8V to +12V across pins 1 & 11 of the screw lock connector.

Operating the PLD10EV with Type C Laser Diodes (PLD-10000 Only)



1 **+5 Volt Input**
Two inputs are available. The screw lock connector shown here comes factory installed on the board in the J2 position. J1 allows the user to install custom connectors.
NOTE: This input is for use with +5V only.

2 **Compliance Voltage**
If a single laser diode is being used, install the jumper on the bar to short +LD SUPPLY with +5V. For higher compliance voltage, remove the jumper and provide voltage to pins 7, 8 & 9 via the screw lock connector. See High Compliance Voltage Operation on page 12 and Type C operation on page 18.

3 **Monitors**
To monitor Limit Current, Laser Diode or Photodiode Current, use COMMON for the negative input of the DVM and either LIM I MONITOR or MONITOR + for the positive input. The switch set to P-MONITOR measures photodiode current. I-MONITOR measures laser diode current.

4 **LD ENABLE**
The switch enables and disables output current to the laser diode. Toggle this switch to clear a Current Limit error.

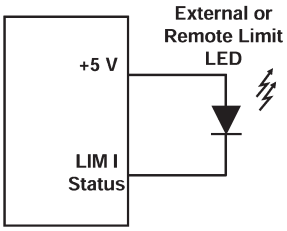
5 **Photodiode Feedback**
To use photodiode feedback, you must jumper PD AUX to PD ANODE. A jumper is provided.

6 **To Operate a Photodiode**
To use photodiode feedback, you must provide AUX V+ of +8V to +12V between the GND pin on the power connector (J1 or J2) and AUX V+ on J4.

APPLICATION NOTES

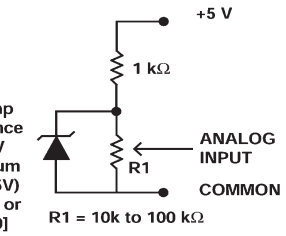
Remote Status LED circuit

A 332 Ω resistor is in series with the open drain output of the LIM I Status pin, so an external LED can be connected directly to the LIM I Status pin as shown.



External Trimpot Circuit

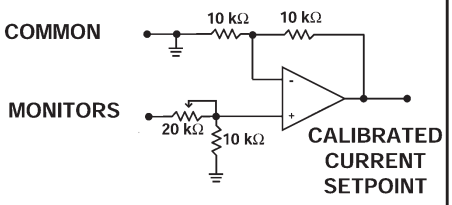
Recommended circuit when an external trimpot is used to control the PLD output current.



R1 = 10k to 100 kΩ

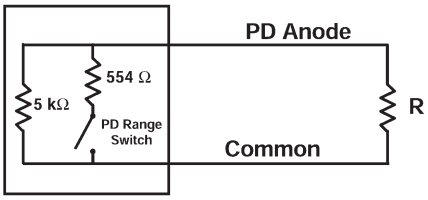
Monitor Calibration Circuit

A small offset may be present when measuring the P Monitor, I Monitor or LIM I Monitor voltage with respect to the actual output. Add this circuit to remove any offset.



Change PD Range for TYPE A or B laser diodes

Put a resistor across the **PD Anode** and **Common** pins to modify the PD range of the PLD.



PD Range = L

$$\text{Range} = \frac{2.5\ V * 10^6}{R \parallel 5\ k\Omega}\ [\mu A]$$

$$\text{Transfer Function} = \frac{10^6}{R \parallel 5\ k\Omega}\ [\mu A / V]$$

$$R \parallel 5\ k\Omega = \frac{R * 5000}{R + 5000}$$

PD Range = H

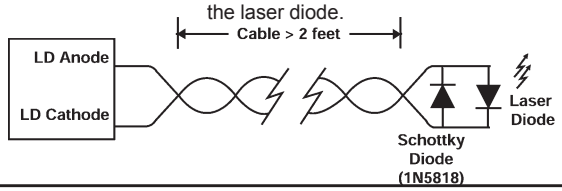
$$\text{Range} = \frac{2.5\ V * 10^6}{R \parallel 500\ \Omega}\ [\mu A]$$

$$\text{Transfer Function} = \frac{10^6}{R \parallel 500\ \Omega}\ [\mu A / V]$$

$$R \parallel 5\ k\Omega = \frac{R * 500}{R + 500}$$

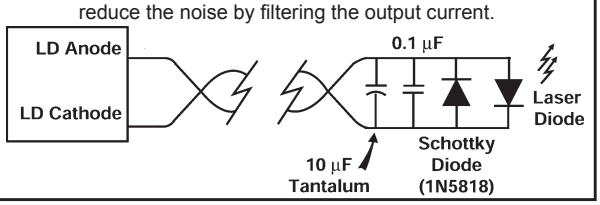
Laser Diode Protection when using a long cable

With a cable longer than two feet, add a Schottky diode across the laser diode.

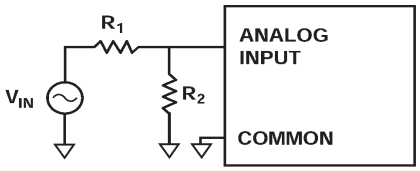


Filter the PLD Output

If you don't need to modulate, you can reduce the noise by filtering the output current.



Change the Modulation Transfer Function



Keep R_1 and R_2 below 100 kΩ for maximum accuracy.

$$\text{New Transfer Function} = \frac{R_2}{R_2 + R_1} * \text{Old Transfer Function}$$

Example: (for PLD-200) $R_1 = 9\ k\Omega$, $R_2 = 1\ k\Omega$

$$\text{New Transfer Function} = \frac{1}{1 + 9} * 40\ mA / V = 4\ mA / V$$

Parallel multiple PLDs for higher current outputs

Contact the Factory for more information on paralleling multiple units for higher current. Or see the following link to Application Note AN-LD06:

ftp://ftp.teamwavelength.com/pub/downloads/notes/an-ld06.pdf

CERTIFICATION AND WARRANTY

CERTIFICATION:

Wavelength Electronics, Inc. (Wavelength) certifies that this product met its published specifications at the time of shipment. Wavelength further certifies that its calibration measurements are traceable to the United States National Institute of Standards and Technology, to the extent allowed by that organization's calibration facilities, and to the calibration facilities of other International Standards Organization members.

WARRANTY:

This Wavelength product is warranted against defects in materials and workmanship for a period of 90 days from date of shipment. During the warranty period, Wavelength will, at its option, either repair or replace products which prove to be defective.

WARRANTY SERVICE:

For warranty service or repair, this product must be returned to the factory. An RMA is required for products returned to Wavelength for warranty service. The Buyer shall prepay shipping charges to Wavelength and Wavelength shall pay shipping charges to return the product to the Buyer upon determination of defective materials or workmanship. However, the Buyer shall pay all shipping charges, duties, and taxes for products returned to Wavelength from another country.

LIMITATIONS OF WARRANTY:

The warranty shall not apply to defects resulting from improper use or misuse of the product or operation outside published specifications.

No other warranty is expressed or implied. Wavelength specifically disclaims the implied warranties of merchantilability and fitness for a particular purpose.

EXCLUSIVE REMEDIES:

The remedies provided herein are the Buyer's sole and exclusive remedies. Wavelength shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory.

NOTICE:

The information contained in this document is subject to change without notice. Wavelength will not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material. No part of this document may be photocopied, reproduced, or translated to another language without the prior written consent of Wavelength.

SAFETY:

There are no user serviceable parts inside this product. Return the product to Wavelength for service and repair to ensure that safety features are maintained.

LIFE SUPPORT POLICY:

As a general policy, Wavelength Electronics, Inc. does not recommend the use of any of its products in life support applications where the failure or malfunction of the Wavelength product can be reasonably expected to cause failure of the life support device or to significantly affect its safety or effectiveness. Wavelength will not knowingly sell its products for use in such applications unless it receives written assurances satisfactory to Wavelength that the risks of injury or damage have been minimized, the customer assumes all such risks, and there is no product liability for Wavelength. Examples of devices considered to be life support devices are neonatal oxygen analyzers, nerve stimulators (for any use), auto transfusion devices, blood pumps, defibrillators, arrhythmia detectors and alarms, pacemakers, hemodialysis systems, peritoneal dialysis systems, ventilators of all types, and infusion pumps as well as other devices designated as "critical" by the FDA. The above are representative examples only and are not intended to be conclusive or exclusive of any other life support device.

REVISION HISTORY

REVISION	DATE	NOTES
REV. F	13-Nov-08	Monitor Accuracy data updated
REV. G	17-Feb-09	Updated Mechanical specifications

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