WAVELENGTH ELECTRONICS


# PLD Series Laser Diode Drivers - Chassis Mount Version

## General Description

The **PLD** series of Laser Diode Drivers combines 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. For applications that require a higher forward voltage, 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.

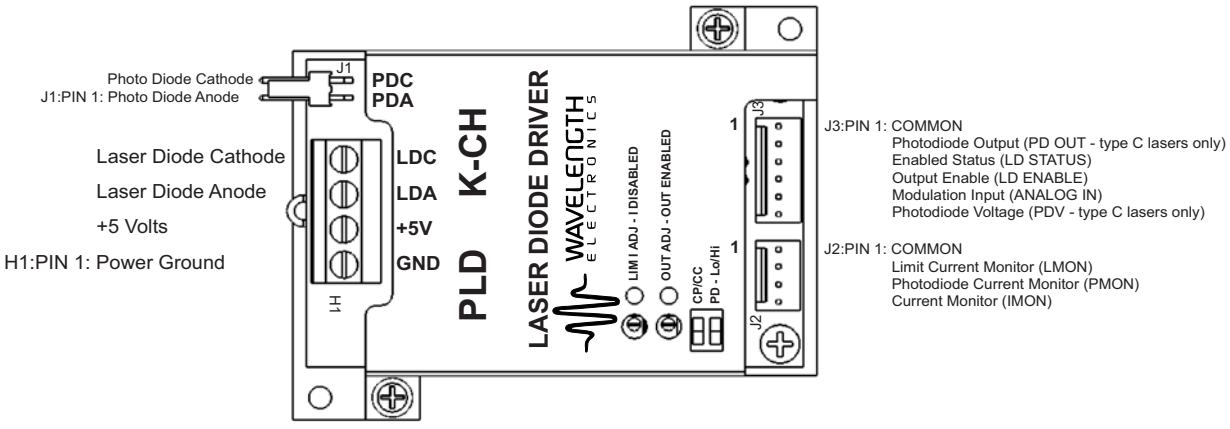
## Ordering Information

| | |
|---|---|
| **PLD-5KCH** | 5 A Laser Diode Driver |
| | |
| **PLD-10KCH** | 10 A Laser Diode Driver |

## Features

- 5 Amp and 10 Amp models
- Single supply operation: +5 VDC
- Separate Laser Diode Supply input allows for flexible compliance voltages up to +28 VDC typical (Consult the online Safe Operating Area (SOA) calculator for supply voltages exceeding +5 VDC: http://www.teamwavelength.com/tools/tools.asp)
- 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

## Pin Descriptions



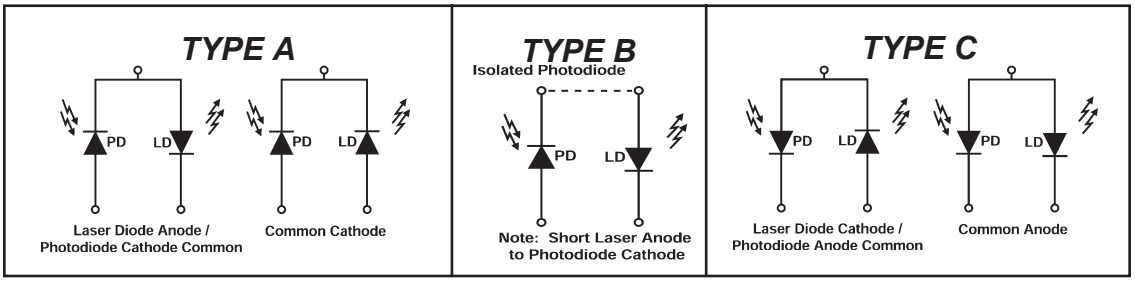

**Call 1-406-587-4910 for technical support.**

## *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 12.**

**Operating instructions for Type C Lasers are detailed on page 14.**




## *Pin Descriptions*

| CONNECTOR | PIN | NAME | DESCRIPTION |
|---|---|---|---|
| H1 | 1 | **GND** | Power supply ground. Used with **+5V** input for high current return. |
| | 2 | **+5V** | Supply voltage to control electronics. Min +4.5 V Max +5.5 V |
| | 3 | **LDA** | Laser Diode Anode and laser diode supply connection.<br>Recommended +LD Supply for single laser is +5 V. Maximum +30 V.<br>In the default configuration a purple jumper wire is connected between pins 2 and 3 for +5 Volt operation.<br>**CAUTION: Too high a voltage may damage the PLD.** |
| | 4 | **LDC** | Laser Diode Cathode |
| J1 | 1 | **PDA** | Photodiode Anode - For Type A or B laser diodes.<br>See page 13 for use with Type C laser diode packages. |
| | 2 | **PDC** | Photodiode Cathode **- For TYPE C laser diodes only.** See page 13. |
| J2 | 1 | **COMMON** | Measurement ground. Low current return used only with **MONITOR** pins and **ANALOG INPUT**. Shorted to **GND** pin internally. |
| | 2 | **LMON** | Current Limit Setpoint Monitor. Impedance = 1 kΩ Output 0 to 2.5 V<br>**NOTE:** Current limit needs to be set 0.2 V above desired limit level. See additional notes on page 9 for fine tuning the current limit. |
| | 3 | **PMON** | Power Monitor (PD Current Monitor). Impedance = 1 kΩ<br>Output 0 to 2.5 V |
| | 4 | **IMON** | Laser Diode Current Monitor. Impedance is 1 kΩ Output 0 to 2.5 V |
| J3 | 1 | **COMMON** | Measurement ground. Low current return used only with **MONITOR** pins and **ANALOG INPUT**. Shorted to **GND** pin internally. |
| | 2 | **PD OUT** | Photodiode Output **- For TYPE C laser diode packages only.** See page 13. |
| | 3 | **LD STATUS** | LIMIT status. LIMIT < 0.3 Volts Normal Operation = High Impedance<br>If Limit is detected, laser diode current will turn off, Limit I LED will light.<br>Toggle LD ENABLE to restart laser diode current. |
| | 4 | **LD ENABLE** | Enable Output Current = +3 to +5 V<br>Disable Output Current = Ground or Floating |
| | 5 | **ANALOG IN** | Remote setpoint or modulation input. Input impedance = 1 MΩ<br>Input 0 to 5 V. Connect **ANALOG INPUT** to **COMMON** when not in use. |
| | 6 | **PDV** | Photodiode Voltage **- For TYPE C laser diode packages only.** See page 13. |

## 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. The PLD series can be purchased with the PWRPAK-5V +5V table top regulated switching power supply for easy configuration and operation. PWRPAK-5V has an 8 Amp maximum output.

## CABLING

Standard lengths for high current wires are 24 inches. Longer leads will result in larger voltage drop, wire heating and decreased modulation bandwidth. Wires are twisted to optimize performance.

Strain relief of high current cables is strongly recommended to keep wires firmly attached to terminal block.

## 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.

***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:

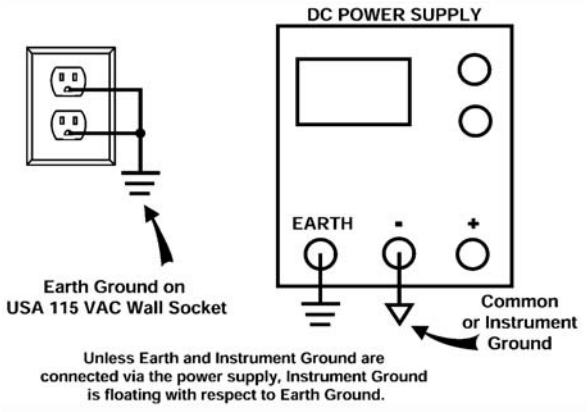
1. A **volt meter** across the laser diode.
2. An **oscilloscope** across the laser diode.
3. A **current meter** in series with the laser diode.

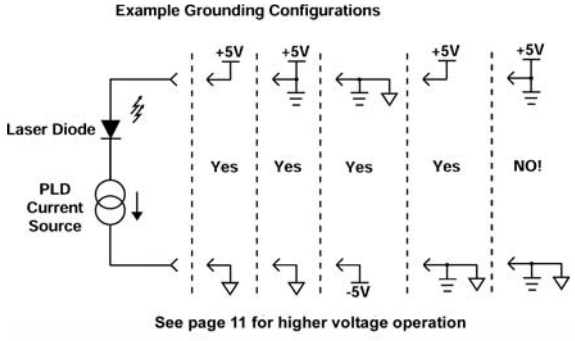
All measurements made with these instruments on the output should be made with a simulated load attached and not a laser diode.

***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:



## *Electrical Specifications*

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

## *General Specifications*

**Power Supply Requirements: ❺**

**Supply Voltage**

**STD +5 V Operation, TYPE A or B lasers:**
+5V (H1:2): +5 VDC (+5.5 V MAX)

**Laser Diode Anode Supply:**
LDA (H1:3): +4.5 VDC to +5 VDC - Standard Operation
>+5 VDC to 30 VDC - High Compliance

**TYPE C lasers:**
PDV (J3:6): +8 VDC to +12 VDC (+12.5 V MAX)

**Supply Current**
PLD-5KCH: 150 mA plus max LD current
PLD-10KCH: 250 mA plus max LD current

**Operating Temperature**
0 to +50°C (guaranteed)

**Warm-up**
1 hour to rated accuracy

**Weight**
< 3.2 oz

**Size (H x W x D)**
1.14" x 2.35" x 2.90"

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 page 11 for more detail.

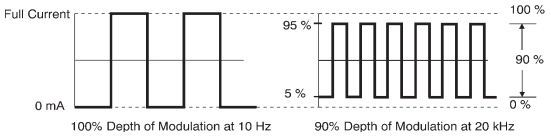
❷ With **ANALOG INPUT** shorted to **COMMON**.

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 5KCH

$V_{LDA}$ (H1:2) = 10 volts

$V_{LD}$ = 5 volts

$I_{LD}$ = 2.25 amps

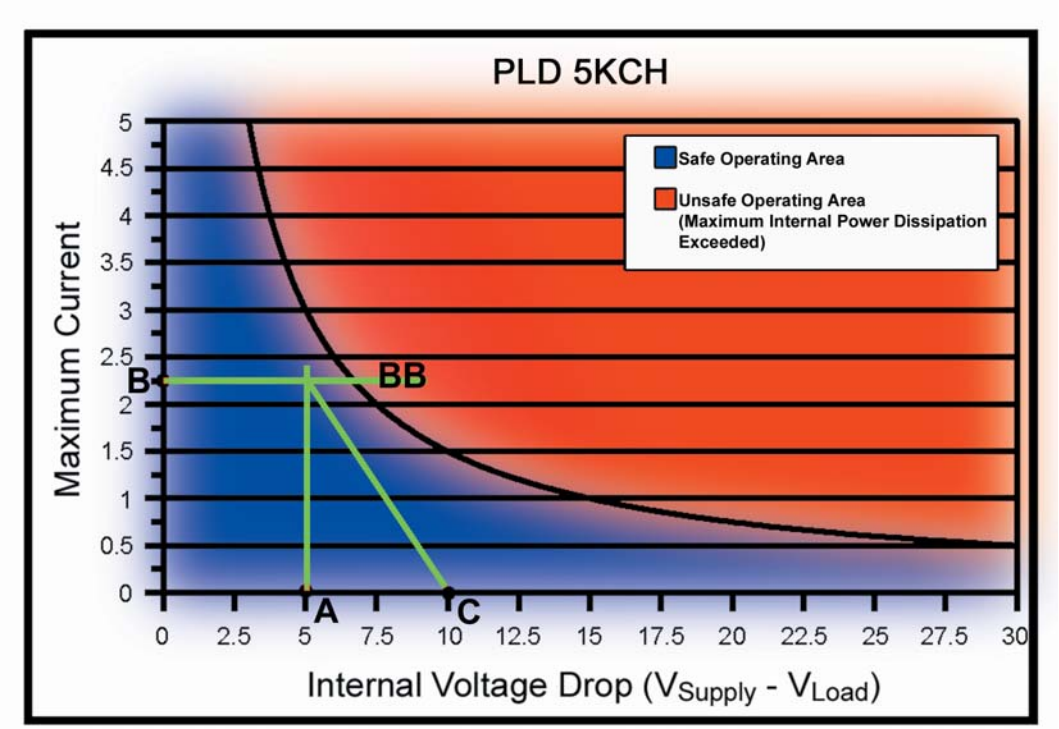
} These values are determined from the specifications of the laser diode.

Follow these steps:

1. Determine the maximum voltage drop across the driver, $V_{LDA}$-$V_{LD}$, and mark on the X axis.
   Example: 10 volts - 5 volts = 5 volts (Point A)
2. Determine the maximum current, $I_{LD}$, through the laser diode 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 $V_{LDA}$ 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.

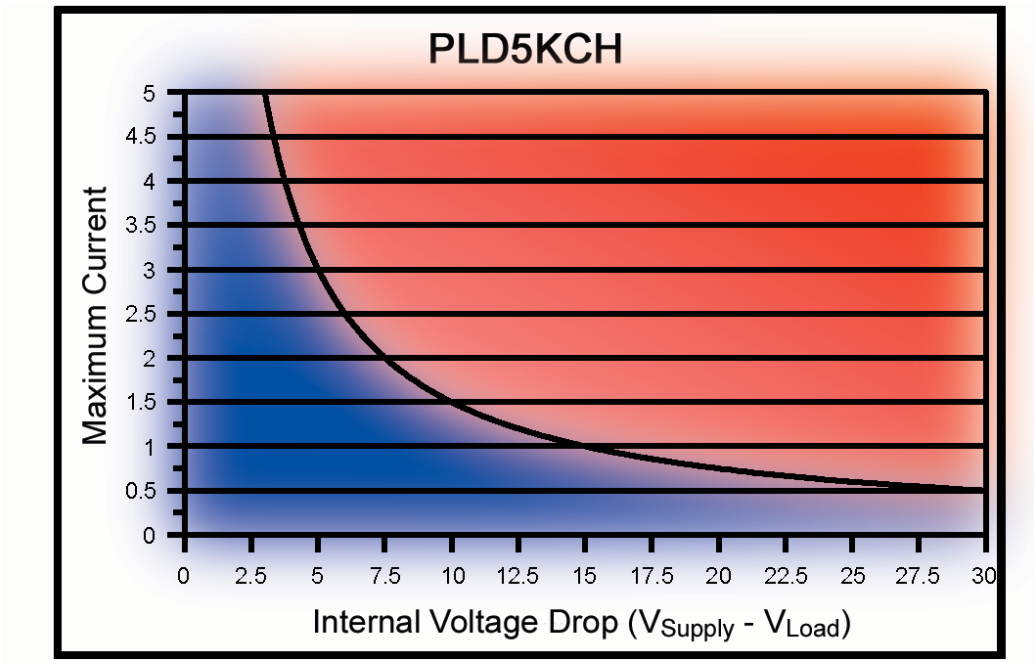
Better thermal performance can be achieved at higher currents by providing airflow across the the electronics as well as the chassis. The cover deliberately leaves the connector ends exposed for airflow

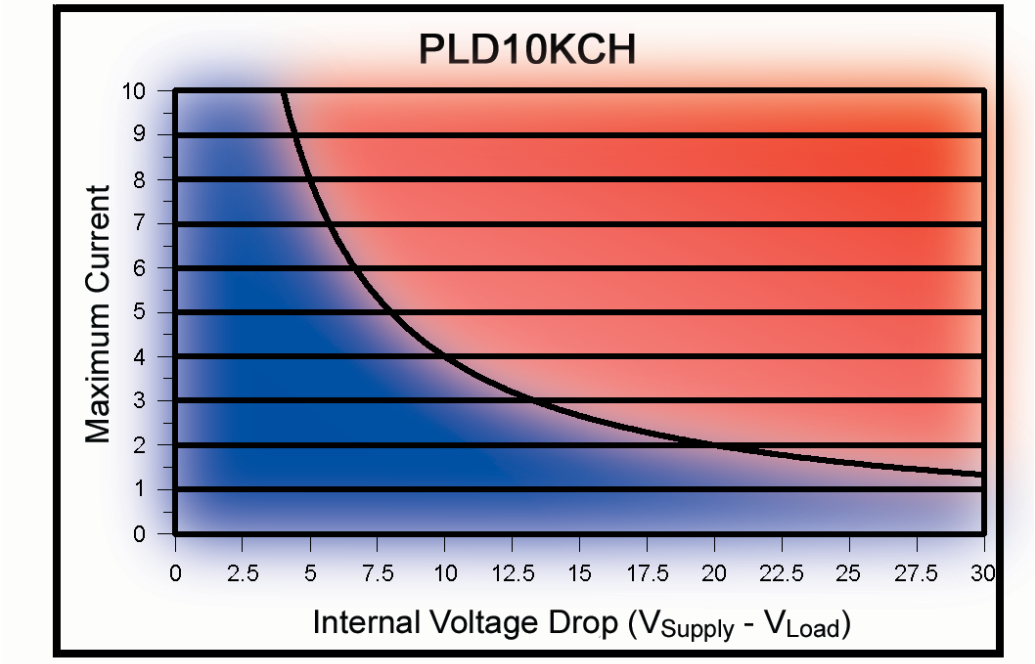



***Derate maximum power dissipation 1.3 Watts / °C for chassis temperatures above 55 °C**

***Safe Operating Area 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 .

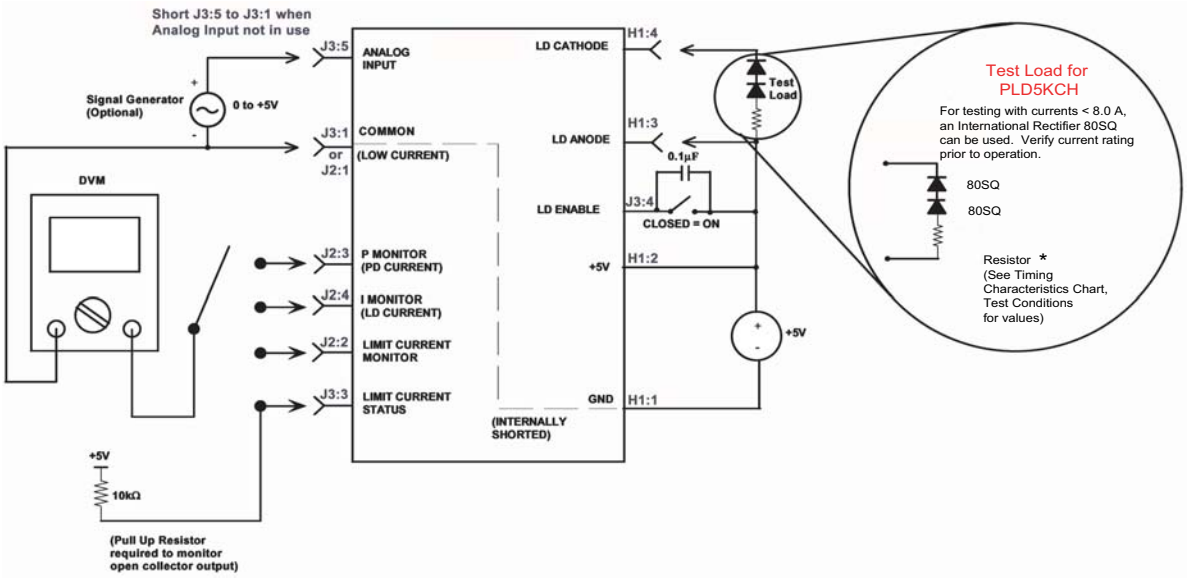


## *Timing Characteristics*

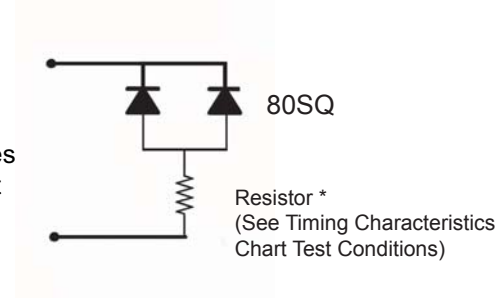
| Symbol | Parameter | Test Points | Test Conditions * | Typ |
|---|---|---|---|---|
| $t_{ON}$ | On Time | Load | PLD5KCH - 0.1 Ω | 6.8 µsec |
| | | | PLD10KCH - 0.1 Ω | 10 µsec |
| $t_{OFF}$ | Off Time | Load | PLD5KCH - 0.1 Ω | 6.8 µsec |
| | | | PLD10KCH - 0.1 Ω | 12 µsec |
| $t_{SLOWSTART}$ | Slow Start Time | Load | PLD5KCH - 0.1 Ω | 1.5 sec |
| | | | PLD10KCH - 0.1 Ω | 1.5 sec |

### Test Setup for Parameter Measurement

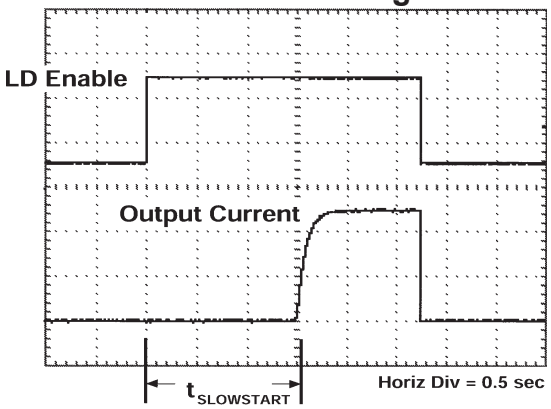



## Test Load for PLD10KCH

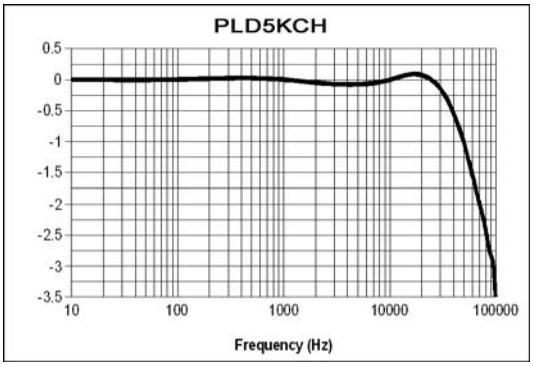
For testing with currents up to 10A, two International Rectifier 80SQ diodes can be used in parallel. Verify current rating prior to operation.



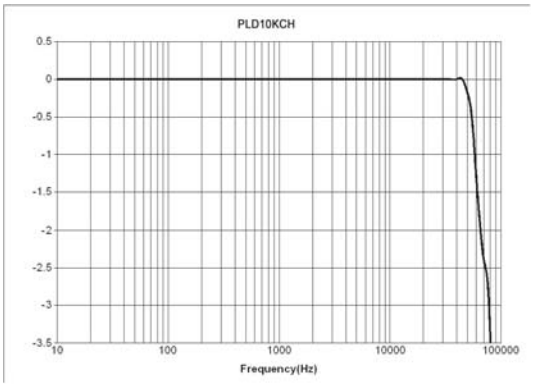
## Slow Start Timing



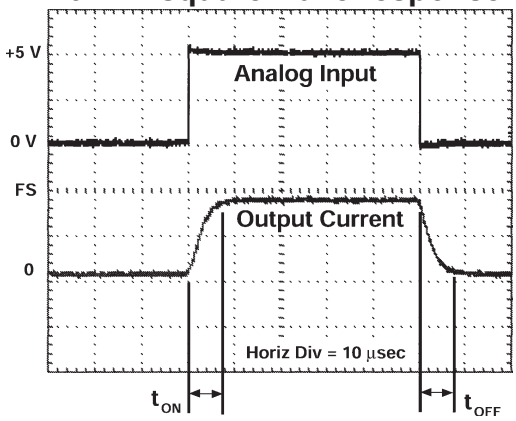

## Large signal frequency response



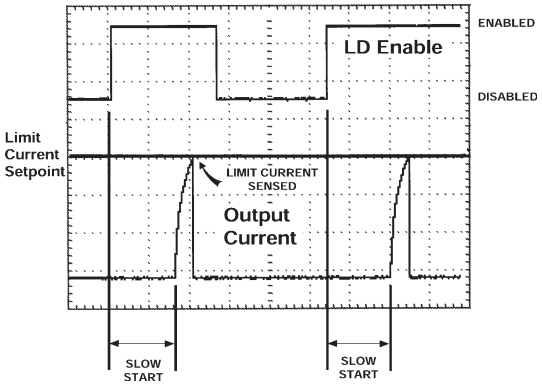

## Large signal frequency response



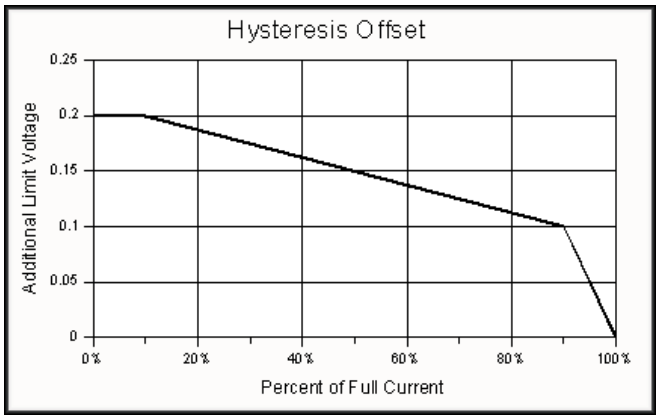

## 10 kHz square wave response




## 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:

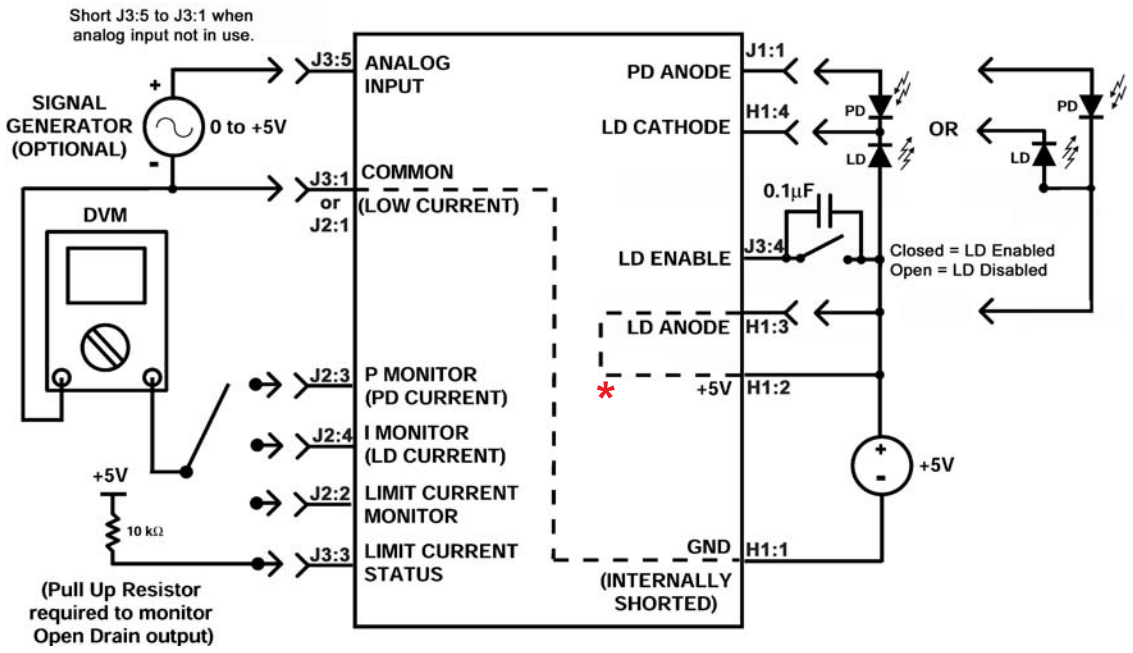
PLD5KCH with a current limit of 2.5 Amps = 50% of maximum current

HO = Hysteresis Offset = 0.15V at 50%

The transfer function for PLD5KCH limit current monitor is 2 A/V as given on pages 12 and 14.*

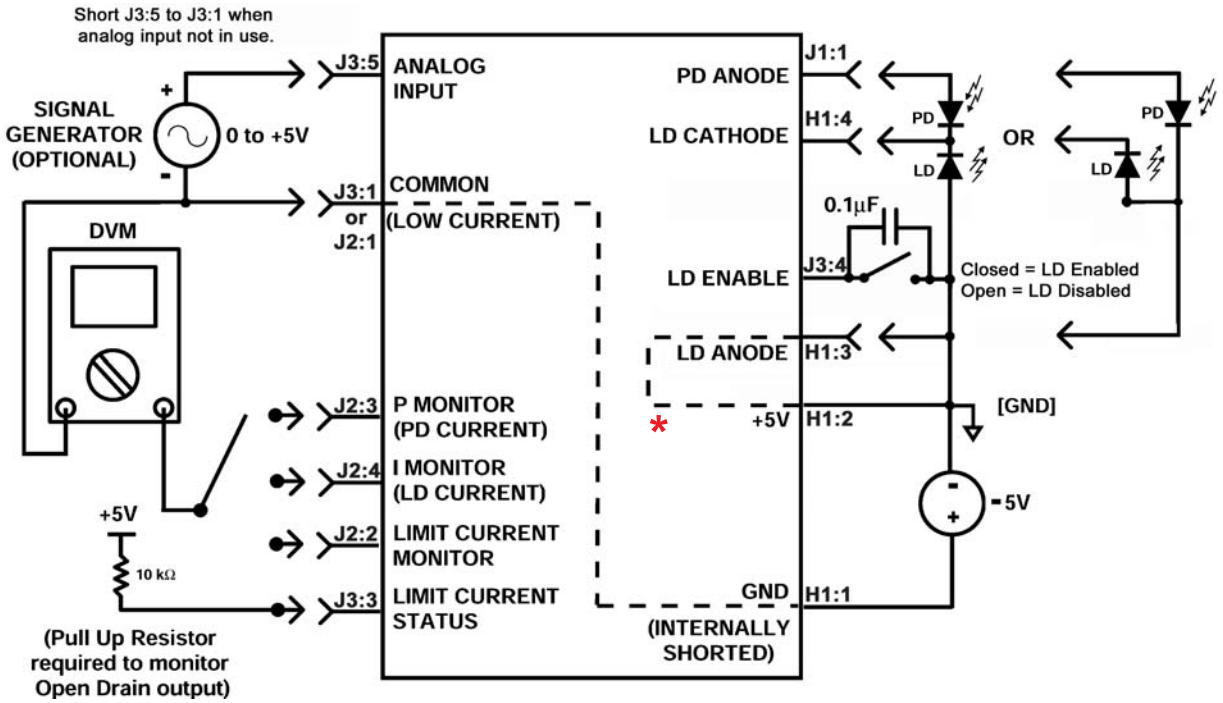
$$V_{LIM} = \frac{I_{LIM}}{2\ A/V} + HO = 1.25\ V + .15\ V = 1.4\ V$$

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

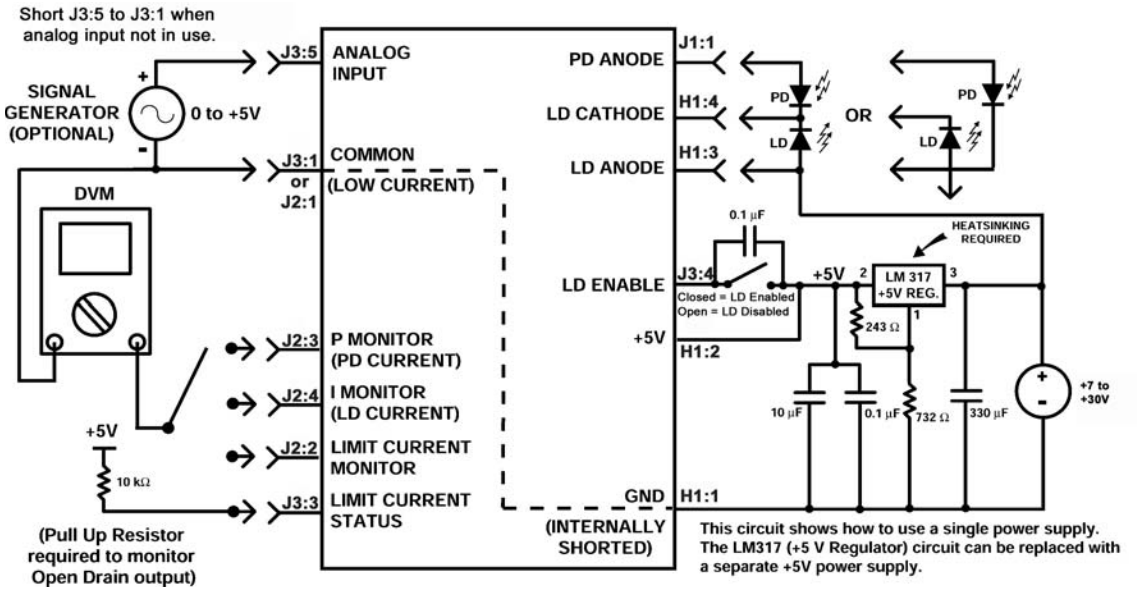



*** Note: In the default configuration, pins 2 and 3 on H1 are jumpered. The PLD10K-CH and PLD5K-CH are shipped in this configuration. Since this jumper makes the connection between these pins, it eliminates the need for the user to connect the pins.**

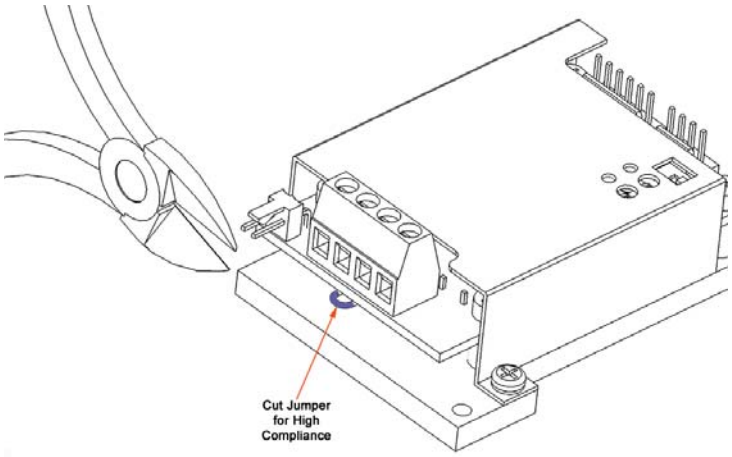
## *Typical Setup for Type A or B laser diode - Negative Supply Operation*



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




***Note: When configuring the PLD10K-CH and PLD5K-CH for High Compliance operation, the jumper must be cut on Terminal Block H1 between pins 2 and 3. This allows the addition of a separate power supply to the laser diode anode (H1, Pin 3). See the diagram below for the location of the jumper.**



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

### *Constant Current Mode*

***With the Output Disabled:***

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

**(2) Set Limit Current:** Monitor the **LMON** (J2:2) voltage and adjust the **LIM I** trimpot clockwise (CW) until the voltage on **LMON** 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 9.

| Limit Current and I Monitor Transfer Functions | |
|---|---|
| PLD-5KCH | 2 Amps/Volt |
| PLD-10KCH | 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 will drop to ground and the LIM I LED will stay on until 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 (J2:4). 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 (J2:3). The PD switch on top of the PLD will determine the output transfer voltage by the position of the switch:

**Lo = 200 μA / V** **Hi = 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-5KCH | 1 Amp/Volt |
| PLD-10KCH | 2.3 Amps/Volt |

### *Constant Power Mode*

***With the Output Disabled:***

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

**(2) Set Limit Current:** Monitor the **LMON** (J2:2) voltage and adjust the **LIM I** trimpot clockwise until the voltage on **LMON** 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 9.

| Limit Current and I Monitor Transfer Functions | |
|---|---|
| PLD-5KCH | 2 Amp/Volt |
| PLD10KCH | 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 will drop to ground and the LIM I LED will stay on until 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 (J2:3). Set the **PD Range Switch** for the appropriate photodiode current

**Lo = 15 - 500 μA** **Hi = 50 - 5000 μA**

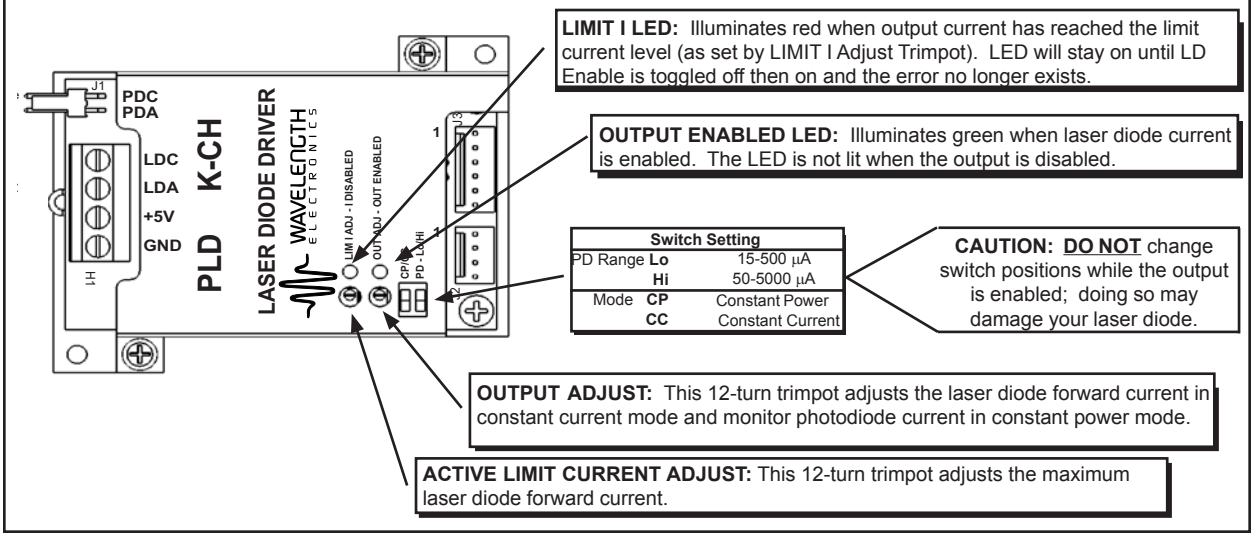
With the **Output Adjust** trimpot fully CCW, enable the output. When the laser reaches threshold, the photodiode current changes abruptly and rises quickly. Adjust the **Output Adjust** trimpot slowly until the voltage on **PMON** (J2:3) corresponds to the desired photodiode current. Transfer functions for Low and High Photodiode mode are:

**Lo = 200 μA / V** **Hi = 2 mA / V**

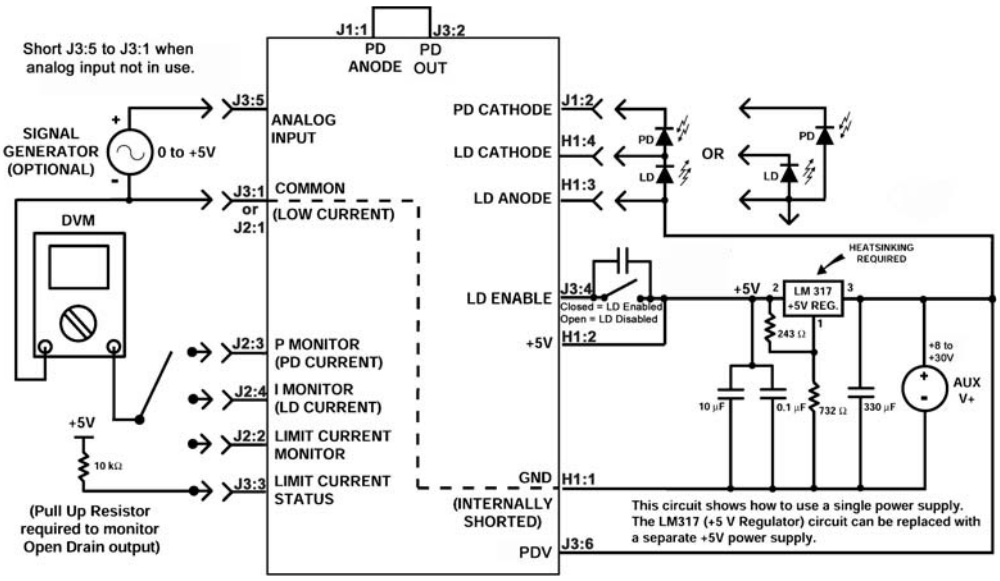
**(4) Analog Input: This input is designed for analog signals only and is not recommended for use with TTL signals**. You can either input a DC voltage for remote current setpoint control or use this input to modulate the laser diode. The total setpoint voltage is the sum of the Analog Input voltage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

**Lo = 100 μA / V** **Hi = 1 mA / V**

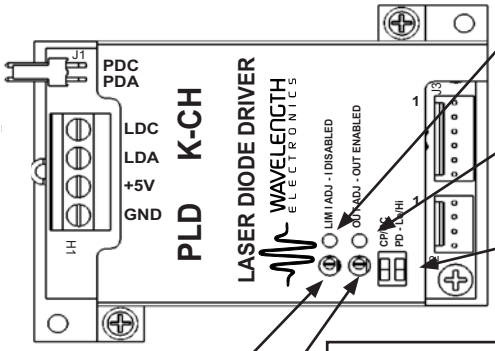
## *External Adjustments*



## *Typical Setup for Type C laser diodes*




## *External Adjustments*




**LIMIT I LED:** Illuminates red when output current has reached the limit current level (as set by LIMIT I Adjust Trimpot). LED will stay on until LD Enable is toggled off then on and the error no longer exists.

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

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

## *Operating Procedures for Type C laser diodes*

### *Constant Current Mode*

***With the Output Disabled:***

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

**(2) Set Limit Current:** Monitor the voltage on the **LMON** pin (J2:2) and adjust **LIM I** trimpot clockwise (CW) until the voltage on the **LMON** 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 9.

| Limit Current and I Monitor Transfer Functions | |
|---|---|
| PLD-5KCH | 2 Amps/Volt |
| PLD-10KCH | 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 will drop to ground and the LIM I LED will stay on until 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 **IMON** pin **(J2:4)** . 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 **IMON** pin.

**(4) Monitor the Photodiode (optional).** If the Photodiode is connected to the laser diode, monitor the **PMON** voltage (J2:3). The PD switch on top of the PLD should be set to **Lo** (High mode (Hi) is not available for type C configurations.):

**Lo = 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-5KCH | 1 Amp/Volt |
| PLD-10KCH | 2.3 Amps/Volt |

### *Constant Power Mode*

***With the Output Disabled:***

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

**(2) Set Limit Current:** Monitor the voltage on the **LMON** pin (J2:2) and adjust **LIM I** trimpot clockwise until the voltage on the **LMON** 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 9.

| Limit Current and I Monitor Transfer Functions | |
|---|---|
| PLD-5KCH | 2 Amps/Volt |
| PLD-10KCH | 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 will drop to ground and the LIM I LED will stay on until LD Enable is toggled off then on, and the error no longer exists.**

**(3) Set the output power.**

Determine the photodiode current ($I_M$ at operating current $I_{OP}$) from data provided with your laser diode. Monitor the voltage on **PMON** (J2:3). One photodiode range is available. Set the PD Range Switch to **Lo**.

**Lo 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:

**Lo = 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:

RANGE = 2.5 V / (R || 5 kΩ) [A]

The new transfer function is:

TF = 1 / (R || 5 kΩ) [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

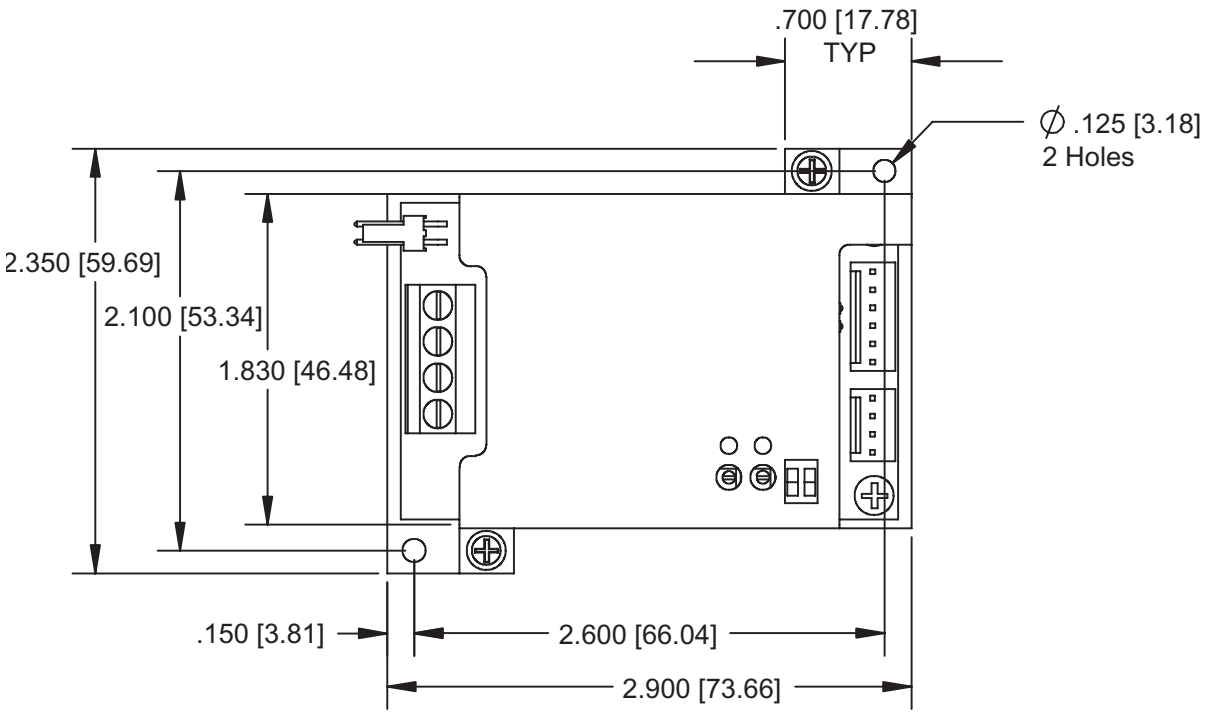
**For details on choosing a custom photodiode range, see page 17.**

**(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:

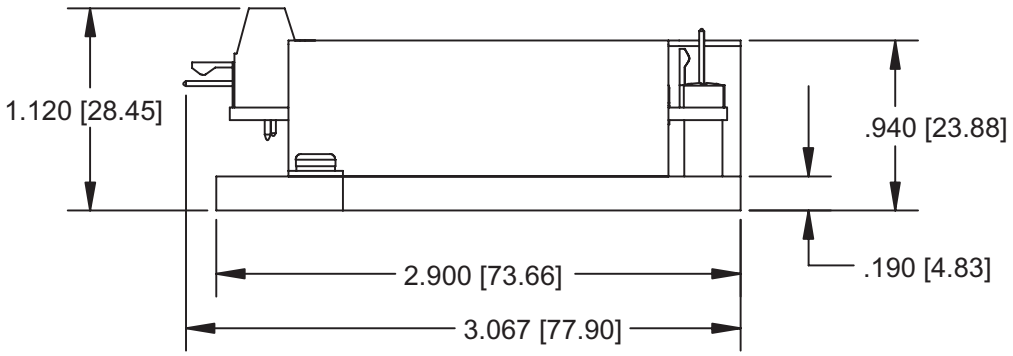
**100 μA/V.**

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

***Mechanical Specifications***




**Direction for Recommended Airflow**




***All Tolerances are ±5%**

**Dimensions are in Inches [mm]**

## *Cable Diagrams*

### Power & Laser Diode Cable (WCB308)

-Connect to H1-

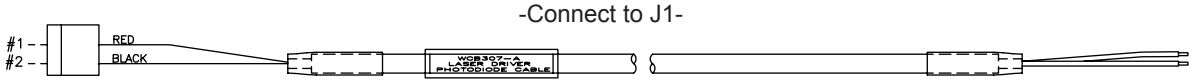

Standard lengths for high current wires are 24 inches. Longer leads will result in larger voltage drop, wire heating and decreased modulation bandwidth. Wires are twisted to optimize performance.

| PIN | WIRE COLOR |
|---|---|
| 1 - GND | Black |
| 2 - +5V | Red |
| 3 - LDA | White |
| 4 - LDC | Blue |

Strain relief of high current cables is strongly recommended to keep wires firmly attached to terminal block.

### Photodiode Cable (WCB307)

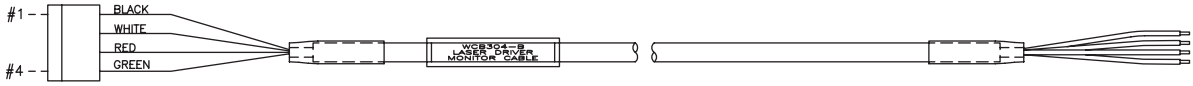
-Connect to J1-




| PIN | WIRE COLOR |
|---|---|
| 1 - PDA | Red |
| 2 - PDC | Black |

### Monitor Cable (WCB304)

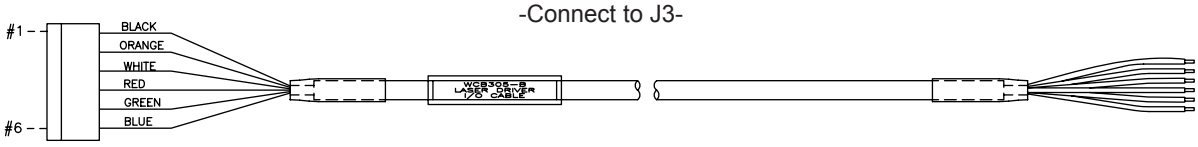
-Connect to J2-




| PIN | WIRE COLOR |
|---|---|
| 1 - Common | Black |
| 2 - LMON | White |
| 3 - PMON | Red |
| 4 - IMON | Green |

### I/O Cable (WCB305)

-Connect to J3-

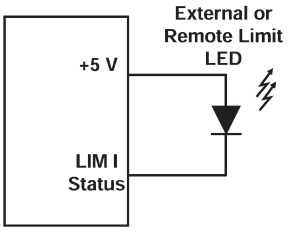



| PIN | WIRE COLOR |
|---|---|
| 1 - Common | Black |
| 2 - PD Out | Orange |
| 3 - LD Status | White |
| 4 - LD Enable | Red |
| 5 - Analog In | Green |
| 6 - PDV | Blue |

# APPLICATION NOTES

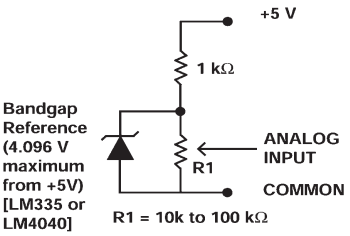
### Remote Status LED circuit

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.



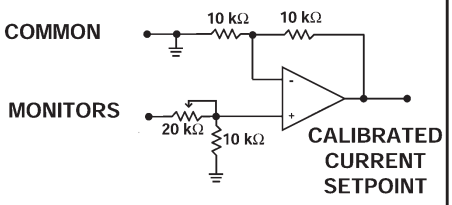

### External Trimpot Circuit

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



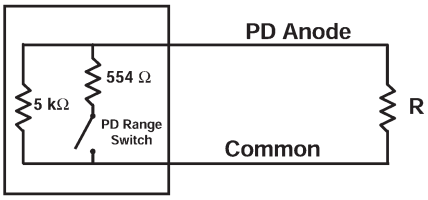

### Monitor Calibration Circuit

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**

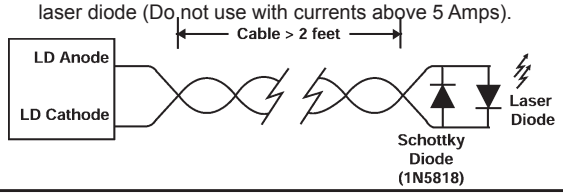
$$\text{Range} = \frac{2.5\ V * 10^6}{R \parallel 500\ \Omega}\ [\mu A]$$

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

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

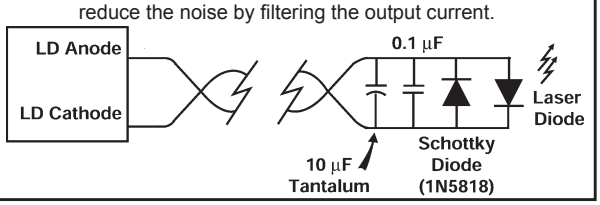
### Laser Diode Protection when using a long cable

With a cable longer than two feet, add a Schottky diode across the laser diode (Do not use with currents above 5 Amps).

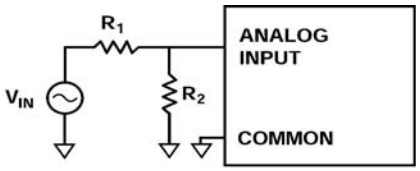



### Filter the PLD Output

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 PLD5KCH) $R_1 = 9\ k\Omega$, $R_2 = 1\ k\Omega$

$$\text{New Transfer Function} = \frac{1}{1 + 9} * 1\ A/V = 100\ mA/V$$

### 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 it's 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 merchantability 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. A | Jan-08 | Initial release |
| REV. B | 11-Nov-08 | Monitor Accuracy data updated |

**WAVELENGTH ELECTRONICS, INC.**
**51 Evergreen Drive**
**Bozeman, Montana, 59715**

**phone: (406) 587-4910 Sales/Tech Support**
**fax: (406) 587-4911**
**e-mail: sales@teamwavelength.com**
**web: www.teamwavelength.com**