User Manual
LDD Series Laser Diode Drivers

The **LDD Series** is a family of ultra-compact, high-efficiency laser diode drivers engineered for precision high-power applications. Designed to deliver high output current and wide compliance voltage in a minimal footprint, the LDD series offers a cost-effective solution for demanding OEM and laboratory environments.

Key features

- Up to 16 A current with five models
- High compliance voltage (up to 100 V)
- Constant current and power modes
- Adjustable current limit
- Wide input range (11-36 VDC)
- Enable control
- External modulation
- Reverse-polarity protection
- Low current ripple
- Compact footprint for OEM integration

Applications

- Fiber laser pumping
- Direct diode lasers
- Solid-state laser pumping
- Pyrotechnic ignition
- Laser diode test setups
- Materials processing

Standard Package Contents

1 x Driver
1 x 5-pin mating cable assembly
1 x 6-pin mating cable assembly
1 x Inspection Certificate
1 x Datasheet & User Manual (digital format)

Custom laser diode drivers are available to meet specific requirements. For more information, check our services on our website ephotonics.com For orders and to learn more about ephotonics diode drivers, visit our website or contact us at contact@ephotonics.com

Table 1: Specifications of the LDD series laser diode drivers

Feature	Model				
	LDD1030	LDD1630	LDD1060	LDD1660	LDD16100
Maximum output current	10 A	16 A	10 A	16 A	16 A
Output voltage	30 V	30 V	60 V	60 V	100 V
Output power	300 W	480 W	600 W	960 W	1600 W
Maximum power dissipation	35 W	35 W	40 W	45 W	45 W
Control-supply voltage (V_{IN})	11-36 V				
Power efficiency	>94%				
Maximum modulation frequency	50 kHz				
Rise time	2 µs				
Fall time	2.5 µs				
Diode current setpoint	0–5 V				
Long-term current stability	250 ppm				
Enable control	TTL				
Current limit	Yes				
Constant current and power	Yes				
Minimum V_{IN} supply power	2 W				
Operating temperature	0 – 55 °C				
Storage temperature	-40 – 85 °C				
Dimensions	74×63×26 mm				
Weight	140 g				

1. Pin descriptions

This section describes the electrical interface of the LDD series driver. Figure 1 identifies the board terminal callouts, and Table 2 describes their functions and electrical characteristics. These board callout numbers are different from the connector cavity numbers shown in Figure 2.

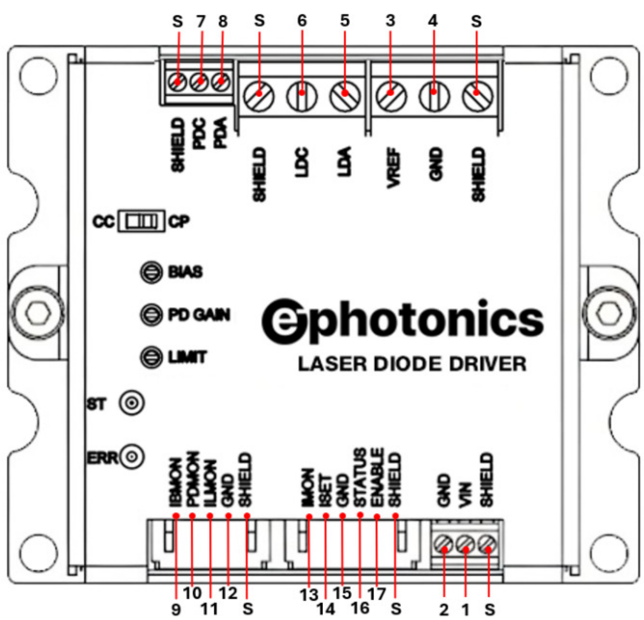

Figure 1: Top-down view of the LDD Driver showing connector locations and callout numbers.

Table 2: Pin descriptions

Name	No	Function
VIN	1	Main DC supply input for internal control electronics. Range: 11 – 36 VDC. Requires ≥2 W for operation. Ensure the input voltage is maintained within specified range.
GND	2	Common ground for the internal control supply. This pin must be connected to the negative (-) terminal of the 11–36 VDC power source.
VREF	3	Laser diode compliance-supply input. VREF provides the high-current power for the laser output. Select VREF from the laser diode forward voltage at the intended operating current, the required driver headroom, and the maximum voltage rating of the selected driver model. Refer to **Section 3.**
GND	4	Compliance Supply Ground return. This pin must be connected to the negative (-) terminal of the VREF power supply. For high-current operation, use heavy-gauge, low-resistance wiring and keep the loop area small to minimize inductance and voltage drop.
LDA	5	Laser Diode Anode (+). Positive output terminal for the laser diode. Connect to the laser diode anode lead using high-current rated wiring. Keep cable length as short as possible to minimize inductance. Incorrect wiring can cause permanent damage to the laser diode. 🔑 **IMPORTANT:** Incorrect wiring or polarity reversal can cause permanent damage to the laser diode.
LDC	6	Laser Diode Cathode (-). Negative output terminal. Connect to the laser diode cathode lead using high-current rated wiring. Keep cable length as short as possible to minimize inductance.
PDC	7	Photodiode cathode. Feedback input used in CP mode. Leave this input disconnected when photodiode feedback is not used.
PDA	8	Photodiode anode. Feedback input used in CP mode. Leave this input disconnected when photodiode feedback is not used.
IBMON	9	Provides an analog voltage signal proportional to the laser diode bias current. Monitor this pin while adjusting the BIAS potentiometer to set the desired starting current. The output range is 0–1 VDC, where 1.0 V corresponds to the maximum rated current of the driver model.
PDMON	10	Photodiode monitor. Provides an analog voltage proportional to the monitor-photodiode feedback signal. Use PDMON when calibrating and monitoring CP mode. The output depends on the PDGAIN setting.
ILMON	11	Current Limit Monitor. Provides an analog voltage (0–2 V) representing the current limit set by the LIMIT potentiometer. Used together with IMON to verify that the active current limit is set correctly.
GND	12	Signal Ground. Common return for monitoring signals (IMON, PDMON, ILMON).
IMON	13	Laser diode current monitor. Provides an analog voltage proportional to the current delivered to the laser diode. Use the verified model-specific scaling in Table 3 to convert IMON voltage to current.
ISET	14	Laser Current Setpoint Input. An analog input voltage (0–5 VDC) used to control the laser output current. The output current scales linearly with the input voltage, where 5.0 V represents the maximum rated current. Refer to **Table 3** for the voltage-to-current conversion formula. **Note:** This signal is added to the current set by the BIAS potentiometer. Ensure the combined total does not exceed the laser diode limits. **Modulation:** This pin accepts analog modulation signals (sine, square, ramp) up to 50 kHz. Ensure the signal is within 0–5 V (positive only) and the peak does not exceed the hardware current limit.
GND	15	Signal Ground. Common return for ISET, IMON, and logic inputs.

STATUS	16	Driver Status Output. A digital output indicating the operational state. HIGH indicates the driver is ready/active. LOW indicates a fault condition (e.g., current limit exceeded or internal error).
ENABLE	17	Output Enable Input. Digital input used to turn the laser output ON or OFF. HIGH (+2 V to +Vin) enables the laser output. LOW (GND) disables the output and places the driver in a safe state. For standalone or autonomous operation without an external controller, this pin may be connected directly to the VIN supply (Pin 1). In this configuration, the driver will turn on immediately whenever VIN power is applied. This pin is not intended for modulation. The maximum ON/OFF switching frequency for this pin is 25 Hz.
SHIELD	S	Common Shield / Chassis Ground. All "S" terminals are internally connected and provided for EMI/RFI noise reduction. Connection to the [S] terminals is optional; the driver will function normally without them. For high-precision applications, landing the VREF supply shield near Pin 3 is recommended to ensure maximum signal stability.
MODE SELECT (CC/CP)		Operating Mode Selection Switch. Sets the control logic for the driver. **CC (Constant Current):** The driver regulates the laser diode current at the value commanded by the ISET input and BIAS adjustment, subject to the hardware current limit. The PDA and PDC photodiode inputs are not part of the control loop in CC mode. **CP (Constant Power):** The driver regulates the laser's optical output power using feedback from a monitor photodiode connected to PDA and PDC. The driver automatically adjusts the laser diode current to maintain the commanded optical power, subject to the hardware current limit.
BIAS		Baseline Current Adjustment. Sets a starting current to eliminate turn-on. Rotate 20 turns counter-clockwise (CCW) to set to zero before initial use. Monitor the bias level via the IBMON pin (0–1 V). 🛑 **WARNING:** This current is added to the ISET signal. (Total = Bias + ISET). Ensure the combined total is safe for your laser.
PDGAIN		Photodiode Feedback Gain. Used exclusively in Constant Power (CP) mode. This adjusts the sensitivity of the feedback loop to match the specific photodiode in use. Adjust this until the PDMON voltage matches your desired optical power reference.
LIMIT		Current-limit setpoint. Sets the maximum permitted total output current commanded by BIAS and ISET. Set LIMIT before enabling the laser output. Before initial calibration, rotate the potentiometer 20 turns counter-clockwise to its minimum setting. Monitor ILMON while adjusting the limit and use the verified model-specific scaling. Adjustment: Monitor ILMON while turning the LIMIT potentiometer. Convert voltage to current using the verified model-specific scaling.
ST		Status Indicator. A green LED indicating the operational state of the driver. **ON:** Driver is enabled and operating normally. **OFF:** Driver is disabled or not receiving power.
ERR		Error/Fault Indicator. A red LED that illuminates when a fault is detected. **Note:** If the ERR LED is on, the laser output is disabled. To reset, toggle the ENABLE signal (LOW then HIGH) or cycle the main power.

⚠️ **CAUTION:** Do not toggle the Mode Select switch while the laser is active. Always power down the driver before changing the operating mode to prevent current spikes.

⚠️ **CAUTION**: Hot plugging: Never connect or disconnect the laser diode while any supply connected to VIN or VREF is energized. Set ENABLE LOW, turn off all VIN and VREF supplies, and wait at least 5 seconds before changing the laser-diode wiring. Verify that both supplies are de-energized before proceeding.

🛑 **WARNING:** Current Limits. Before connecting a laser diode for the first time, ensure the LIMIT potentiometer is set to its minimum **(20 turns CCW)**. Gradually increase the limit while monitoring the ILMON pin to ensure the safety of the diode.

🛑 **WARNING:** ESD Sensitivity. Laser diodes are extremely sensitive to Electrostatic Discharge (ESD). Always use grounded wrist straps and anti-static mats when handling the driver and wiring the diode.

ℹ️ **ATTENTION:** Thermal management: The driver generates heat at high output current. Mount it to an appropriate heatsink before applying power. Operation with the baseplate temperature above 55 °C may cause internal damage.

🔑 **IMPORTANT:** Before disconnecting the laser diode, set ENABLE LOW, turn off the VIN and VREF supplies, and wait at least 5 seconds.

2. Supply Voltage Configuration (VIN & VREF)

2.1. Common Supply Operation

VIN and VREF may be powered from the same DC supply only when the required VREF is within the permitted VIN range of 11–36 VDC and does not exceed the maximum voltage rating of the selected driver model. The supply must provide enough power for the control electronics and the laser's maximum operating current, including transient current.

2.2. Separate Supply Operation

Separate VIN and VREF supplies are required when the required VREF is above 36 VDC. They are also recommended for noise-sensitive applications. Connect an 11–36 VDC supply to VIN. Connect a separate high-current supply to VREF, set according to Section 3 and within the maximum voltage rating of the selected driver model. Keep ENABLE LOW while applying or removing either supply.

2.3. Automatic Enable Configuration

If an external enable signal is not required, the ENABLE pin may be connected directly to the VIN pin (e.g., via a jumper wire). This configures the driver to automatically enable its output stage as soon as the control electronics are powered.

Grounding: Use Pin 2 as the VIN return, Pin 4 as the VREF return, and Pins 12 and 15 as signal grounds. Do not substitute one return for another unless the grounding diagram explicitly permits it.

2.4. Supply Separation and Filtering

The VIN input includes reverse-polarity protection and input filtering. Separate VIN and VREF supplies can reduce coupling from high-current laser-load transients into the control supply.

Note: While the control electronics remain stable, any significant voltage drop on the shared supply line may still directly affect the laser diode output compliance. Users must ensure their power supply and cabling are sufficient to minimize these fluctuations.

3. VREF Determination (Compliance Supply)

VREF must exceed the laser diode forward voltage by the driver headroom required at the intended operating current, without exceeding the maximum voltage rating of the selected driver model.

3.1. Standard Procedure (Calculation)

For most applications, simply calculating VREF based on your laser diode's datasheet is sufficient:

1. Identify the target operating current I_{LD} (e.g., 3 A/5 A/10 A) and find the corresponding laser diode forward voltage V_F from the diode datasheet (or measure it).
2. Compute the initial compliance setting:
   VREF (Start) = V_F (at I_{LD}) + 2.0 V (use +2.5 V for extra margin or longer cables).
3. If using multiple laser diodes in series, use the sum of the forward voltages, then add 2.0–2.5 V.

If you do not have the laser diode datasheet, or if you need to optimize VREF to minimize heat generation in critical thermal environments, use one of the advanced methods below (3.2 or 3.3).

3.2. Advanced Method A: Verify Forward Voltage with a Current-Limited Test Source

1. Use the laser diode datasheet value for forward voltage at the intended operating current. If measurement is required, use a current-limited laser diode test source designed for diode characterization. Do not connect the diode directly to an unrestricted voltage source.
2. Increase the test current gradually without exceeding the laser manufacturer's rating, and record the measured forward voltage VF at the intended current.
3. Set the driver's initial VREF to the measured VF plus the verified driver-headroom requirement, without exceeding the selected model's maximum VREF rating.

3.3. Advanced Method B: In-System Optimization

This method can generate significant heat in the driver; mount the driver to an appropriate heat sink and keep the base/heat-sink temperature within the specified limits.

1. ⚠️ Selecting a VREF significantly higher than required increases power dissipation in the driver and may lead to overheating. To minimize thermal stress, use the lowest VREF that still provides the required output current.
2. Set the current limit (LIMIT) to minimum and set BIAS to 0 before enabling.
3. Keep BIAS at zero during initial setup. Apply a small ISET signal and observe whether the laser current increases smoothly.
4. If current/power stops increasing as you raise ISET/BIAS, VREF is insufficient for that operating point; increase VREF gradually until current/power follows the command again.
5. For final optimization, reduce VREF slightly until you are near the minimum value that still supports the required current with stable operation.

⚠️ **CAUTION:** The VREF power supply must be rated for the maximum peak current you intend to drive (e.g., if driving 10 A pulses, the supply must handle 10 A transients without sagging).

⚠️ **CAUTION:** Keep VREF and laser diode wiring short and low-inductance; cable losses and inductance can affect stability and required headroom. Tip: Ensure you use the same cable length and gauge during this test as you will in the final system, so that cable voltage drops are accurately accounted for.

🛑 **WARNING:** Choosing VREF much higher than necessary increases driver dissipation and can cause overheating, so use the minimum VREF that meets the required current.

4. Power Supply Selection Guide

To ensure stable operation and protect both the driver and laser diode, select a power supply that meets the following criteria:

Voltage Requirements:

- **For VIN (Control):** Any regulated DC supply between 11–36 VDC capable of delivering at least 2 W (approx. 200mA @ 12V).
- For VREF (laser load): VREF must exceed the laser diode forward voltage by the required driver headroom and must remain within the maximum voltage rating of the selected model. See Section 3.
- **Current Capability**: For pulsed applications, ensure the power supply has good transient response or add external capacitance near the VREF pins to support peak current demands.
- **Noise & Ripple**: Use a low-noise DC power supply (linear or high-quality switching). Excessive power supply ripple can couple into the laser output, causing optical instability.

5. Control Signal Scaling (ISET & IMON)

The driver output current is linearly controlled via the ISET pin (0–5 V) and monitored via the IMON pin (0–2 V)

- **Control (ISET):** Applying 0–5 V sets the current from 0 A to the driver's full scale.
- Feedback (IMON): The driver outputs an analog voltage proportional to the actual laser current. Use Table 3 to determine the scaling factors and sense resistor values for your specific model.

Table 3: Simplified scaling table for IMON reading

Model Number	Max Current	Max Voltage	Rsense	ISET Scaling (Set)	IMON Scaling (Read)
LDD1030	10 A	30 V	0.2 Ω	2.0 A / V	5.0 A / V
LDD1630	16 A*	30 V	0.12 Ω	3.2 A / V	8.33 A / V
LDD1060	10 A	60 V	0.2 Ω	2.0 A / V	5.0 A / V
LDD1660	16 A*	60 V	0.12 Ω	3.2 A / V	8.33 A / V
LDD16100	16 A*	100 V	0.12 Ω	3.2 A / V*	8.33 A / V

Note: 16 A is the rated max but 16.6 A is the theoretical electrical max based on Rsense.

5.1. IMON Calculation Formula:

The actual laser current can be estimated using the internal sense resistor value

$$\text{Laser diode current} = \frac{V_{IMON}}{R_{sense}}$$

Model	R_{sense}
LDD1030	0.2 Ω
LDD1630	0.12 Ω
LDD1060	0.2 Ω
LDD1660	0.12 Ω
LDD16100	0.12 Ω

Example: For the LDD1060 model, the internal sense resistor is 0.2 Ω. If you measure 1.2 V on the IMON pin, the actual current flowing through the laser is: $\frac{V_{IMON}}{R_{sense}} = \frac{1.2\,V}{0.2\,\Omega}$ =6A

5.2. Analog modulation Guidelines

The ISET (Pin 14) input acts as a high-speed analog modulation port, allowing the driver to reproduce complex waveforms (Sine, Square, Ramp) at frequencies up to 50 kHz.

- **Operating Voltage Range:** Modulation signals must remain within the **0 to 5 VDC** range. The driver is DC-coupled; any input signal must be entirely positive.

  ⚠️ **CAUTION:** Applying negative voltages or signals exceeding 5.0 V may result in erratic behavior or internal damage.
- **Modulation Bandwidth:** The driver supports a bandwidth up to **50 kHz** (see Specifications for details). Note that at higher frequencies, the output amplitude may "roll off" or decrease slightly.
- **Additive Logic:** The modulation signal applied to ISET is **added** to the current level set by the **BIAS** potentiometer. Total Command = Bias Setting + ISET Signal.
- **Grounding:** When connecting a function generator, ensure the generator's ground is connected to the driver's Signal Ground (Pin 15) to prevent ground loops that can cause noise in your laser output.

🛑 **WARNING: Peak Current**

Laser diodes are extremely sensitive to peak current. Even very short duration pulses can cause permanent damage to the diode if the current exceeds its maximum rating. Always ensure that you have configured the driver’s maximum output current via the hardware LIMIT potentiometer before applying modulation signals to the ISET pin.

6. Current Limit Configuration

The LIMIT potentiometer sets a hardware ceiling for the total output current commanded by ISET and BIAS. Configure LIMIT before enabling the laser.

1. **Zero the Limit:** Before applying power, ensure the LIMIT potentiometer is turned 20 turns counter-clockwise (CCW) to the minimum setting.
2. **Monitor ILMON:** Apply power to VIN (keep ENABLE low/off). Measure the voltage on the ILMON pin (Pin 11) relative to GND.
3. **Set the Limit:** Slowly turn the LIMIT potentiometer clockwise (CW) until the voltage on ILMON corresponds to your desired maximum current limit.
4. **Scaling:** The ILMON pin uses the same scaling factor as IMON (See **Table 3**).
5. **Example (LDD1060):** To set a 6 A limit, adjust until ILMON reads 1.2 V (since 6 A / 5 A/V = 1.2 V).
6. **Verify:** The driver is now protected. If the output current attempts to exceed this setting, the ERR LED will light up and the STATUS pin will go LOW.

6.1. Resetting a Limit Fault:

If the limit is triggered (ERR LED on):

1. Set the ISET signal to 0 V.
2. Toggle the ENABLE pin LOW then HIGH to reset the driver.

Note: If ENABLE is tied to VIN, remove the automatic-enable connection before troubleshooting. If the connection cannot be removed, turn off both the VIN and VREF supplies, wait for the required discharge time, and then restore power.

7. Constant Power (CP) Mode Configuration

Constant Power (CP) mode is designed to regulate the optical output power of the laser diode using photodiode feedback. Constant-power mode is activated by setting the mode select switch to the CP position on the laser diode driver.

In this mode, the driver dynamically adjusts the laser drive current to maintain a constant optical output power, compensating for temperature variations, laser diode aging and supply voltage fluctuations.

CP mode is intended for applications where optical output power, rather than drive current, must be precisely controlled.

7.1. CP Mode Operating Principle

In CP mode, the driver continuously compares the photodiode feedback signal to a user-defined reference level.

The reference level is determined by:

- ISET input: the primary control signal that defines the target optical power
- BIAS adjustment: the preset baseline current for laser operation

The system monitors the optical output through the monitor photodiode and dynamically adjusts the laser drive current to minimize the error between the feedback signal, and the reference level.

Through this closed-loop control scheme, the optical output power is maintained at the desired level.

This architecture provides stable and reliable operation despite environmental changes and device-to-device variations.

7.2. Photodiode Feedback Processing Structure

In CP mode, the photodiode signal is processed through an analog feedback chain before entering the control loop. The photodiode feedback:

- is proportional to the optical output power,
- is compared with the ISET-derived reference through the PDMON path, and
- generates an error signal used to adjust the laser drive current.

7.3. PDGAIN Adjustment and Optical Power Calibration

For CP mode to operate correctly, stably, and predictably, the photodiode feedback chain (PDMON + PDGAIN) must be calibrated to a defined reference operating point. This calibration procedure is performed in **CC mode**. In CC mode, the photodiode signal is not part of the control loop and is used for monitoring only. This makes it possible to independently evaluate:

- the relationship between **ISET voltage** and **drive current**,
- the resulting **optical output power** for that current, and
- the portion of that optical power incident on the photodiode according to the coupler ratio.

7.3.1 Defining the Reference Operating Point (CC Mode)

1. Set the driver to **CC mode**.
2. Determine the **ISET voltage** corresponding to the target optical power or target drive current.
3. At the target operating point, verify that the monitor-photodiode signal remains within its specified linear input range for the selected optical coupler ratio.

The objective of this step is to physically verify the following chain:

ISET → Laser Current → Optical Power → Photodiode Current

7.3.2 Calculating PDMON Reference Voltage

The PDMON reference voltage corresponding to the selected ISET voltage is calculated as follows:

$$V_{PDMON,target} = \left(\frac{V_{ISET}}{2.5}\right) \times 0.818$$

where, 2.5 is the reference conversion factor for ISET and 0.818 is the fixed conversion coefficient for PDMON.This calculated value is the target voltage that must be set at the PDMON pin using the PDGAIN potentiometer.

7.3.3 PDGAIN Adjustment

1. In **CC mode**, apply the selected **ISET** voltage.
2. Measure the **PDMON** pin voltage.
3. Adjust the **PDGAIN** potentiometer until the **PDMON** voltage matches the calculated target value.

Note: If the calculated **PDMON** target value cannot be achieved within the adjustment range, the **coupler ratio** may need to be changed, or the optical power incident on the photodiode may need to be increased or decreased. Because these changes will alter the **PDMON** level, the target value must be recalculated and the **PDGAIN** adjustment repeated.

7.3.4 Photodiode Linearity Verification (Critical step)

After the **PDMON** reference value has been adjusted, the system must **not** be switched to **CP mode** immediately. First, it must be confirmed that the photodiode is operating within its linear region.

To verify this:

1. Keep the driver in CC mode, set BIAS to zero, and confirm that LIMIT is set no higher than the laser diode's maximum safe current.
2. Begin with ISET at 0 V and increase it gradually in small steps. Stop at the voltage corresponding to the intended maximum test current; do not automatically increase ISET to 5 V.
3. At each step, record ISET, IMON, and PDMON. Confirm that PDMON increases proportionally with IMON throughout the intended operating range.
4. Stop immediately if the current limit activates, the output becomes unstable, or PDMON stops increasing.

Maximum ISET test voltage = maximum test current ÷ model-specific ISET scaling from Table 3.

WARNING : Maximum laser current: Never allow the laser current to exceed the laser diode manufacturer's maximum rating. Configure the hardware current limit before this test. Begin with ISET at 0 V and increase it gradually while monitoring IMON.

Detection of linearity problems: If IMON continues to increase while PDMON begins to level off, the photodiode or PDMON amplifier may be approaching saturation. Reduce the optical signal reaching the photodiode, verify the coupler ratio, and repeat the calibration. Do not enable CP mode until linear operation has been confirmed over the intended operating range.

7.3.5 Switching to CP Mode

After it has been confirmed that the photodiode operates linearly over the full operating range, the driver should be turned off, the mode switch should be set to the **CP** position, and the driver should then be turned on again. From this point onward, the system regulates the optical power corresponding to the **ISET** input in closed-loop operation and provides stable constant-power performance.

8. Control Interface and Connector Pinout

The unit features two input connector bases (5-pin and 6-pin). The following diagram details the pinout and the recommended external circuitry. Mating cable assemblies A05KR05KR26E305B and A06KR06KR26E305B are supplied for integration.

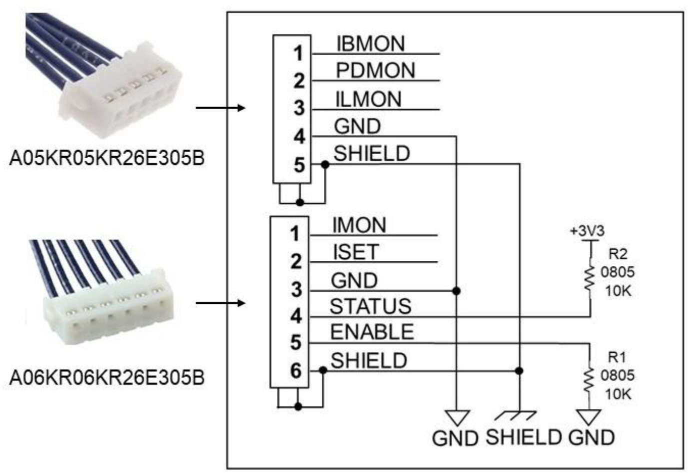

Figure 2: Control Interface Pinout and Recommended External Connections (5-Pin & 6-Pin Connectors)

9. Thermal management

The LDD module's safe operating area is determined by the amount of power that can be transferred from the output stage to the heatsink. Exceeding this power limit may cause permanent damage to the driver.

$$P_{diss} \approx (V_{REF} - V_{DIODE}) \times I_{DIODE}$$

The driver has an aluminum baseplate that must conduct heat to an external heatsink. Maximum permitted dissipation is model-dependent: 35 W for LDD1030 and LDD1630; 40 W for LDD1060; and 45 W for LDD1660 and LDD16100. Do not exceed the applicable model limit.

- **Fan Cooling:** Fan cooling with a standard heatsink is typically sufficient as long as the operating point remains within the "Safe Zone" shown in Figure 3.
- Water cooling: Operation near the applicable model-specific dissipation limit may require a water-cooled plate.
- **Recommendation:** Maintain the baseplate surface temperature below 50°C (ideally <30°C for best stability).

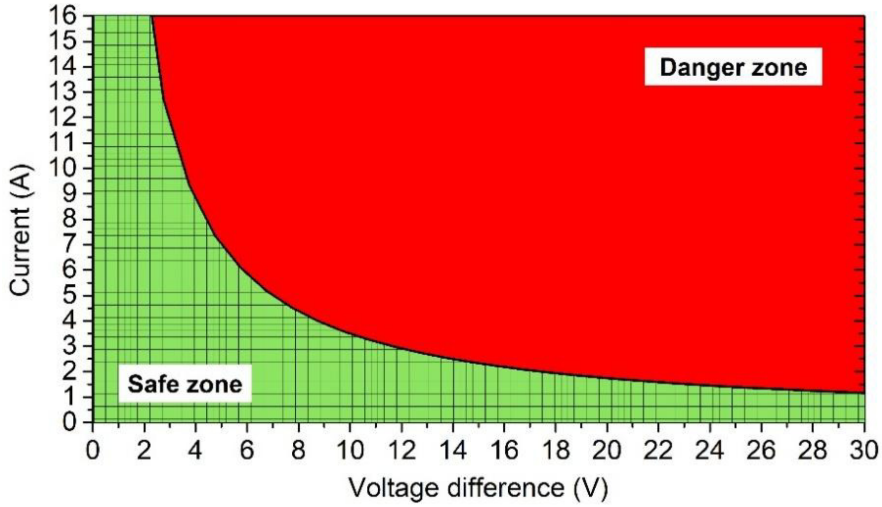

Figure 3: Safe Operating Zone - Current vs. Voltage Difference

10. Quick Start and Wiring Guide

10.1. PHASE 1: Mandatory Safety Preparation

Before making electrical connections, set ENABLE LOW and ensure that all VIN and VREF supplies are off. Do not install the automatic-enable jumper during initial commissioning. Perform Phase 1 without the laser diode connected to establish a safe zero-current starting point.

1. **Zero the Potentiometers:** Using a small flathead screwdriver, rotate the BIAS and LIMIT potentiometers 20 full turns counter-clockwise (CCW). This sets both the Safety Limit and the Baseline Current to zero.
2. **Verify Thermal Setup:** Ensure the driver is mounted to an adequate heat-sink (aluminum plate or chassis). Confirm there is sufficient airflow around the unit.
3. **Select Operating Mode:** Set the onboard slide switch to CC (Constant Current). This is the safest mode for initial setup.
4. **Configure Reference Voltage (VREF):** Set your high-power supply to the required Compliance Voltage. (See Section 3 for more information).

10.2. PHASE 2: System Architecture Decisions

Review the two boxes below and select the wiring strategy for your application:

Power Selection	Enable Control
Option A: Separate Supplies - Use two independent DC supplies. - Supply 1 (11-36V): Connect to VIN (Pin 1) and GND (Pin 2). - Supply 2 (Reference): Connect to VREF (Pin 3) and GND (Pin 4) for the laser diode. Benefit: Isolates control logic from high-current laser transients. **Option B: Shared Source** - Wiring: Bridge Pins 1 & 3 (+) and 2 & 4 (–). *Limit: Total supply must be between 11V and 36V.*	**Option A: Standalone (Automatic-ON)** The driver starts immediately when VIN is applied. Do not use automatic enable during initial commissioning. - Action: Install a jumper between board callouts 17 and 1 only after VREF, LIMIT, and the wiring have been verified with all supplies off. **Option B: External Control (PLC/PC)** -Current is toggled by an external logic signal. -Action: Connect Pin 17 to your controller. -Logic: HIGH (+5V) = ON / LOW (0V) = OFF.

💡 **TIP: Use a Dummy Load for Initial Testing**

For first-time setup or when testing complex modulation signals, it is highly recommended to use a Dummy Load (e.g., a high-power resistor or a string of high-current rectifier diodes) instead of the laser diode. This allows you to safely verify your VREF, LIMIT, and ISET settings without the risk of accidental laser damage.

10.3. PHASE 3: Physical Wiring & Integration

Control Wiring: Connect the 5-pin and 6-pin cables according to your Phase 2 choices.
Laser Connection: Connect the Laser Anode to LDA (Pin 5) and Cathode to LDC (Pin 6). Ensure screws are tight.
Shielding (Optional): land optional cable shields on the "S" terminal nearest to Pin 3 (VREF).

10.4. PHASE 4: Calibration and First Fire

Perform these steps in order to safely transition from a "Zero State" to an active laser.

1. Apply logic power: Confirm that ENABLE is LOW and that no automatic-enable jumper is installed. Turn on the 11–36 VDC VIN supply.
   - Confirm that the green ST LED is lit.
   - Check: The Red ERR LED must be OFF.
2. **SET SAFETY LIMIT**
   - Connect the multimeter positive lead to board callout 11 (ILMON) and the negative lead to board callout 12 (signal ground).
   - Check: The Red ERR LED must be OFF. Slowly rotate the LIMIT potentiometer clockwise (CW) until the multimeter shows the voltage corresponding to your laser's maximum safe current.

Reference: Use the verified model-specific scaling in Table 3.

3. **Apply Laser Power** by turning on your VREF power supply**.**
4. **Activate the driver:** After the current limit, VREF, wiring, and ISET signal have been verified, set ENABLE HIGH. Do not use automatic enable during initial commissioning.
5. **Modulation Check:** If using an external signal generator for ISET, view the signal on an oscilloscope before enabling the driver. Confirm that the peaks are within safety limits.
6. Ramp current: Connect the multimeter positive lead to board callout 13 (IMON) and the negative lead to board callout 15 (signal ground). Keep BIAS at zero and increase ISET gradually until the intended operating current is reached.
7. **Verify:** Confirm that IMON (pin 13) never exceeds the limit just set in Step 2.

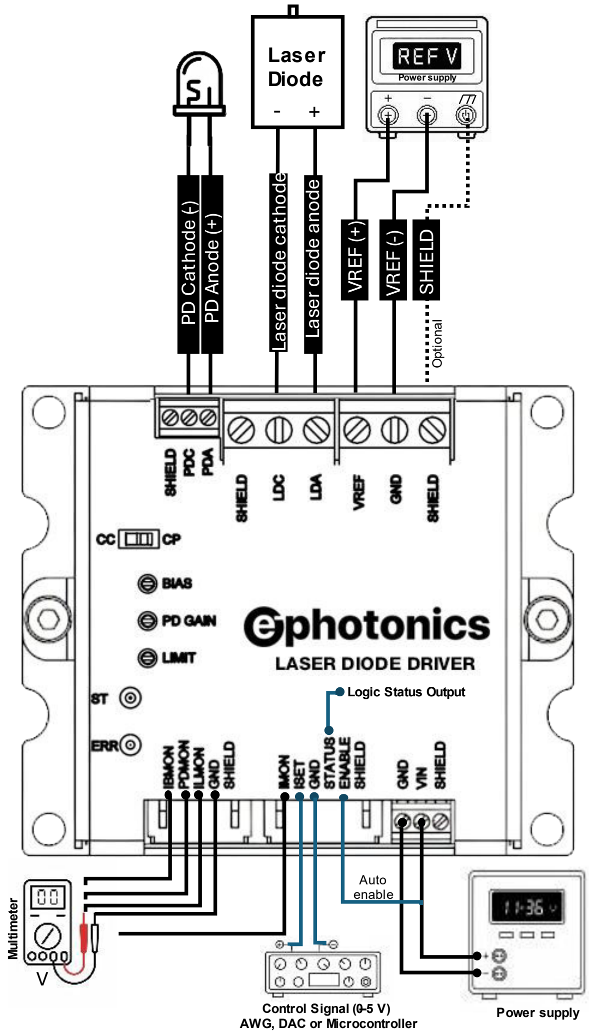

Figure 4: Quick start wiring schematic

Table 4: Analog Monitor Scaling and Calibration Reference

Calibration Goal	Multimeter (+)	Multimeter (–)	Expected Reading (Target)
Check Safety Limit	Pin 11 (ILMON)	Pin 12 (GND)	~ 0.2 V/1A for 10 A models ~0.125V/A for 16A models
Check Laser Current	Pin 13 (IMON)	Pin 15 (GND)	2.0 V = Max
Check Starting Current	Pin 9 (IBMON)	Pin 12 (GND)	(0-1.0 V)

11. Mechanical dimensions

All dimensions are in millimeters; a 3D model is available on request.

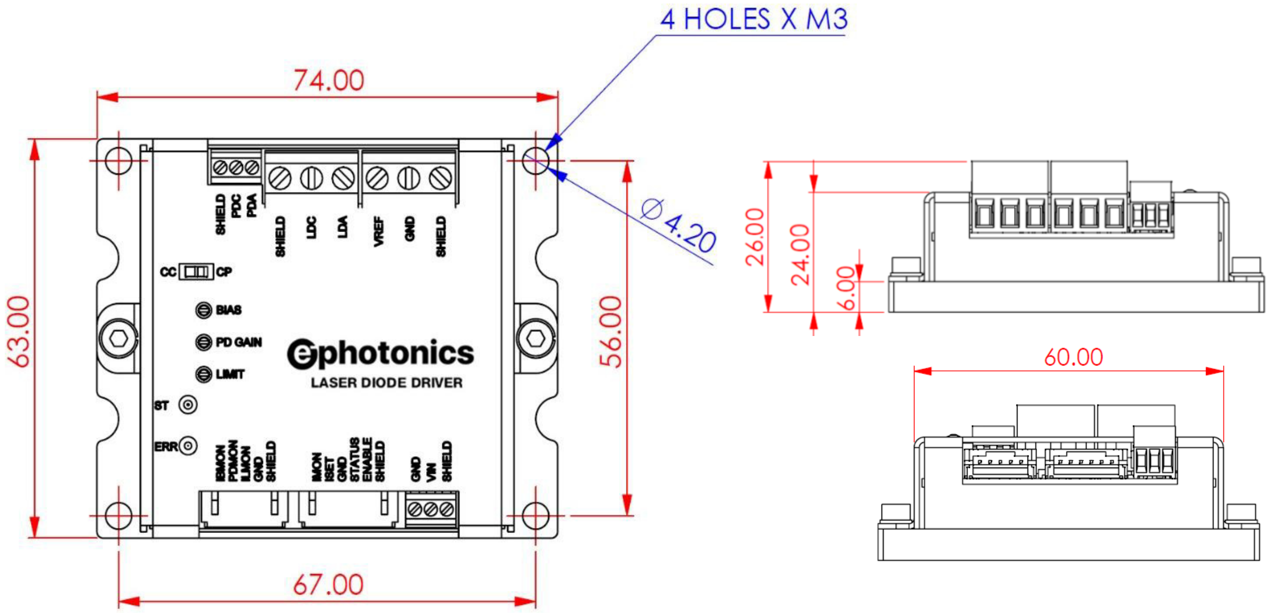

Figure 5: Mechanical drawing with dimensions

12. Warranty

Products in the LDD series are covered by a one-year limited warranty from the date of shipment.

13. Frequently asked questions (FAQ) and troubleshooting

1. **Can I connect VIN ground (2) to any ground on connector pins (12,15)?**
Use the ground assigned to each interface: Pin 2 for VIN, Pin 4 for VREF, and Pins 12 and 15 for signals. Do not substitute grounds unless the verified grounding diagram explicitly permits it.

2. **My laser isn't turning on. The ERR LED is off.**
Check VREF against the laser diode forward voltage and the driver-headroom requirement in Section 3. Confirm that VREF remains within the selected model's maximum rating. Also confirm that LIMIT has been set gradually to the laser's safe current.

3. **The driver gets very hot even at low current.**
VREF may be higher than required. Estimate dissipation from the VREF-to-diode voltage difference and laser current, then reduce VREF to the lowest value that maintains stable current with the verified driver headroom.

4. **Can I use a PWM signal on the ISET pin?**
Use a filtered PWM signal only when the resulting ISET voltage remains within 0–5 V and the peak laser current stays below the configured limit. An unfiltered PWM signal commands pulsed laser current and must not be used unless the complete pulsed-current operating conditions have been validated.

5. **If I use VIN to provide the ENABLE signal, can I connect the source ground to the logic ground pins (12 or 15)?**
Connect the VIN and ENABLE return to the designated VIN or signal ground. Treat Pin 4 as the VREF power return.

6. **Can I use a single 12V battery for the whole setup?**
A single 12 V battery may be used only when the laser diode forward voltage plus required driver headroom is below the available battery voltage and the battery, wiring, fuse, and connectors can safely supply the maximum continuous and transient current. Follow Section 2.1.

7. **Do I need to connect the SHIELD pins?**

No. Connecting the SHIELD terminals is **optional**. They are provided for terminating cable shields in high-noise environments; follow the verified system grounding and EMC plan.

8. Can I drive LEDs with this driver instead of a laser diode?
Yes, the LDD series can drive high-power LEDs in Constant Current (CC) mode. Ensure the VREF voltage is set correctly for the LED string's forward voltage.

9. What happens if I reverse the VIN power supply polarity?
VIN includes reverse-polarity protection. VREF does not. Verify VREF polarity before applying power; reversed VREF polarity can damage the output stage.

10. The output current seems unstable or noisy.
Check your cabling. Long or coiled cables add inductance which can cause ringing. Use short, twisted-pair wires for the LDA/LDC connection. Also, verify that your VREF power supply is stable and has sufficient current capacity.

11. Can I use the 5V output from a USB port to control ISET?
A USB-powered DAC or controller may drive ISET only if it provides a controlled 0–5 V analog output referenced to the designated signal ground. Do not connect an uncontrolled USB 5 V power rail directly to ISET, and do not power VIN from USB.

12. My laser diode has a built-in photodiode. How do I use it?
Connect the monitor-photodiode anode to PDA and cathode to PDC only after verifying the photodiode polarity and permitted input range. Complete the CC-mode calibration and linearity checks in **Section 7** before switching to CP mode and adjusting PDGAIN.

13. Why are there five separate Shield (S) terminals?
All terminals marked S are connected to a common shield plane. Use the terminal nearest the relevant cable to keep the shield connection short and reduce loop area. Connect the shield according to the verified system grounding and EMC plan.

14. Can I run this driver without a heatsink for just 1 minute of testing?
Not recommended. Even at low currents, the driver can heat up rapidly. Always mount the driver to a metal surface before applying power to ensure the longevity of the electronics.

For technical assistance or application inquiries, please contact our support team at
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