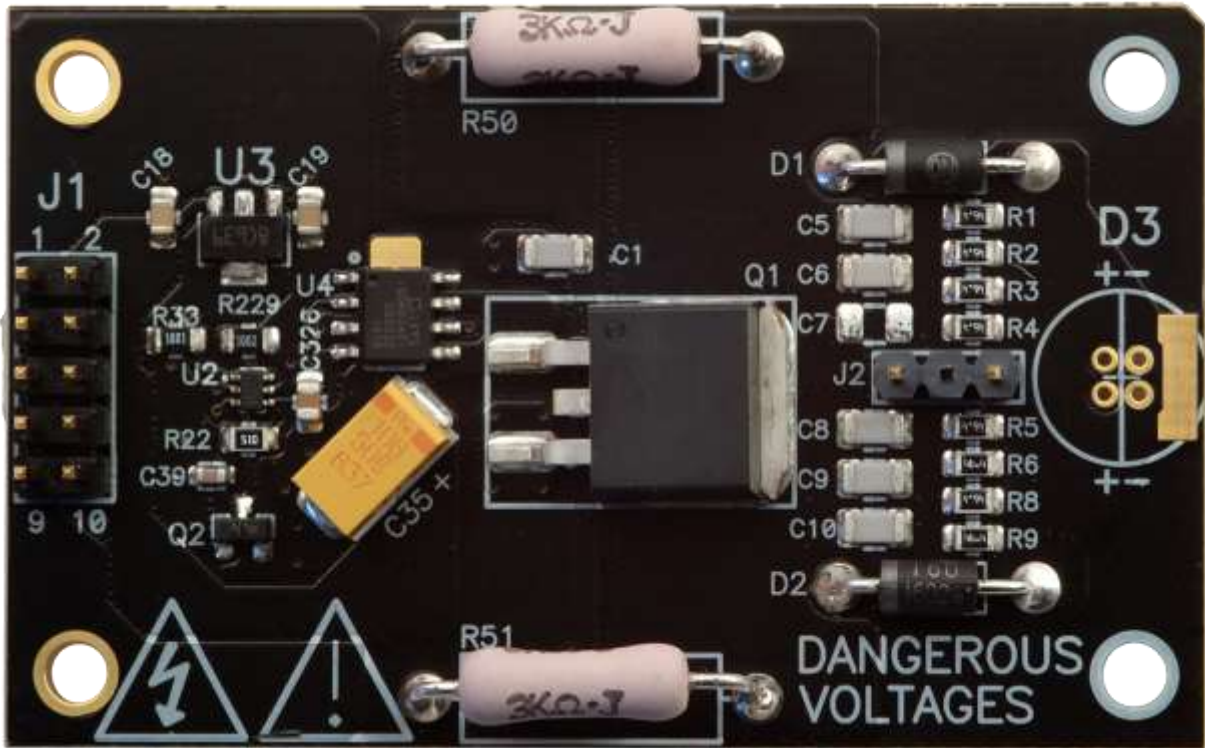


# PCO-7114

## Laser Diode Driver Module

### Operation Manual



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# Safety

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- Do not install, handle, or remove the PCO-7114 while it is operating.
- Do not use this device in a manner not specified by the manufacturer.
- Allow sufficient space around this device for air circulation.
- Do not use where liquids are present or in corrosive environments.

## **WARNING**

**Risk of lethal electric shock. Do not touch the output or laser diode while it is operating. This device produces LETHAL levels of electric current at its output.**

DO NOT OPERATE THIS DEVICE UNLESS ANOTHER PERSON, CAPABLE OF RENDERING FIRST AID OR RESUSCITATION, IS PRESENT.

SAFE AND PROPER OPERATION OF THIS DEVICE IS THE RESPONSIBILITY OF THE USER.

Directed Energy, Inc. (DEI) provides information on its products and associated hazards, but it assumes no responsibility for the after-sale operation and safety practices.

# Introduction

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## ❖ Description

The PCO-7114 is an economical pulsed laser diode driver in a compact OEM module. It is designed to provide extremely fast, high-current pulses to drive laser diodes in rangefinder, LIDAR, atmospheric communication, and other applications requiring high-current nanosecond pulses.

The PCO-7114 delivers up to 50 A with a fixed pulse width of  $\leq 4$  ns with a maximum frequency of 45 kHz.

Mounting pads are provided to mount the laser diode directly to the driver. The four-hole mounting pattern accepts TO-18, TO-5, TO-52, 5.6 mm, and 9 mm packages.

There are two solder pads at the end of the board that facilitate mounting laser diode packages on-axis to the driver. Alternately, the diode can be connected remotely from the driver using low-impedance strip line cable between the mounting pads and the leads of the laser diode.

The PCO-7114 output current is set by the amplitude of the voltage at the high voltage input. The frequency is set by trigger pulses applied to the gate input.

A current monitor is provided as a straightforward means to observe the diode current waveform in real time with an oscilloscope.

## ❖ Design Considerations

Many stray elements and components can affect PCO-7114 performance. One of the most important is stray inductance, which includes the output current loop's circuit elements and the physical inductance of that loop. The magnitude of this inductance has a great effect on pulse width and peak output current. The PCO-7114 design minimizes the stray inductance of the circuit components to approximately 2 nH. However, the laser diode that it drives, and the means by which the diode is connected to the PCO-7114, also contribute to stray inductance. The user can minimize this additional inductance by choosing appropriate diode packages and interconnections between the diode and driver.

**The diode must be electrically isolated from earth (chassis) ground.**

## J1 Control Connector

Connector J1 is a two-row header on 0.1" centers. The header mates with a rectangular 10 position housing connector such as Amphenol part # 65043-032LF or equivalent.

Connector J1 has the following pin connections for controlling the PCO-7114:

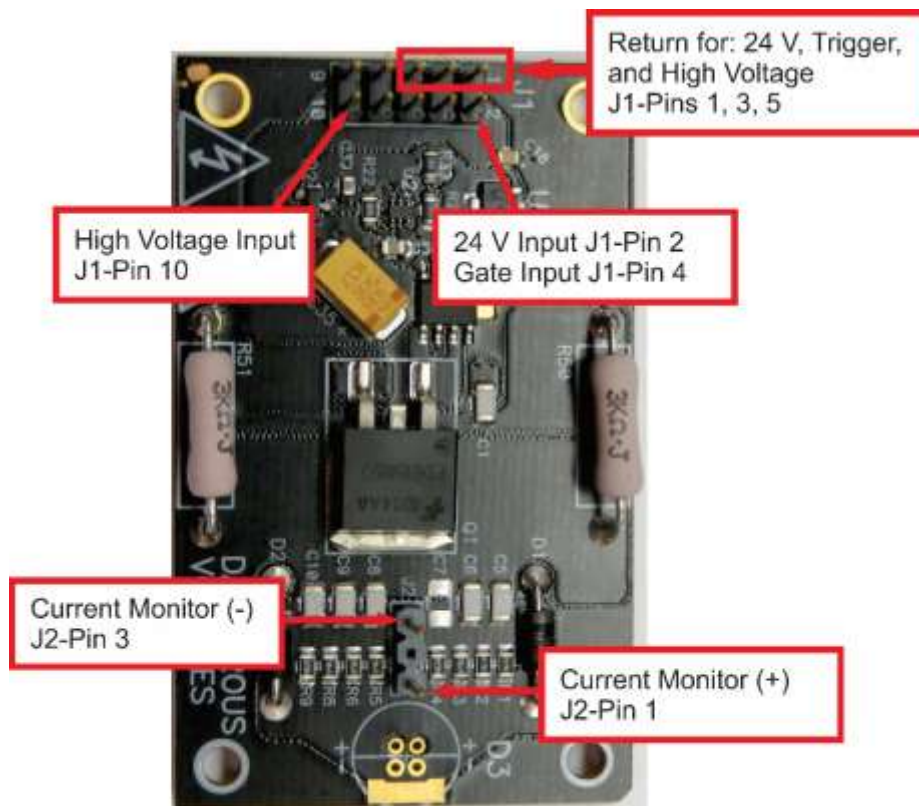
- Pin 1, 3, and 5: Return for: 24 V, Trigger, and High Voltage
- Pin 2: 24 V DC Input
- Pin 4: Trigger (Gate) input, 50  $\Omega$  impedance
- Pin 10: High Voltage input

## J2 Current Monitor

Connector J2 (Current Monitor) is a one-row header on 0.1" centers. The header mates with a rectangular 3 position Housing, Amphenol part # 65039-034LF or equivalent.

These are the pin connections for the current monitor:

- Pin 1: Current Monitor (+) output
- Pin 3: Current Monitor (-) output



The gate signal should be connected to pin 4 of J1. The shield of the coaxial cable should be connected to any one of the Return pins (1, 3, or 5) of connector J1. To improve pulse fidelity, all connections should be as short as possible. The gate signal should be TTL (+3V to +5V) into 50Ω. The voltage level of the pulse generator should be set while terminated into a 50Ω termination (such as the 50Ω input of an oscilloscope) prior to connection to the PCO-7114.

The output frequency follows the input gate frequency. The output pulse width is determined by the output current amplitude. Less than 5 A has a pulse width of less than 6 ns. Between 5 A and less than 20 A has a pulse width of less than 5 ns. And between 20 A to 50 A the pulse width is less than 4 ns.

The PCO-7114 output current is set by the amplitude of the voltage at the high voltage input. The DC high voltage power supply charges the PCO-7114's on-board energy storage capacitors. The high voltage DC power supply needs to provide the maximum AVERAGE current drawn by the driver and diode, not the PEAK current.

The maximum average power that the high voltage supply must provide is determined by the peak output current and duty cycle required for the user's application. This power can be approximated by the formula:

$$V_{\text{POWER}} = V_{\text{SUPPLY}} \times I_{\text{PULSE}} \times \text{Duty Cycle}$$

- $V_{\text{SUPPLY}}$  is the voltage required of the high voltage DC power supply for a given pulse output current.
- $I_{\text{PULSE}}$  is the output pulse current.
- Duty Cycle is calculated using the formula: pulse width x frequency.

## ❖ Accessories Available

### **Current Monitor Cable Assembly (PCA-9140)**

An optional Current Monitor Cable allows the user to monitor the output current pulses with an oscilloscope. The current-to-voltage ratio is 20:1 (20 A to 1 V).

### **Output Cable Assembly (1820-0030)**

An optional micro-strip line Output Cable allows the user to connect the PCO-7114 to a remote laser diode with minimum added inductance.

# Operation

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## ❖ Safety

Follow the safety guidelines. DO NOT PROCEED WITHOUT UNDERSTANDING AND OBSERVING THESE GUIDELINES.

## ❖ Requirements

Verify that the PCO-7114:

- Is connected with the proper cables and the correct impedance set.
- Has its output connected to a load or output device of the proper polarity.
- **The load must be electrically isolated from earth (chassis) ground.**

## ❖ Setup

1. Verify the PCO-7114 is OFF when connecting or disconnecting the laser diode or load.
2. Make the laser diode connection with the correct polarity. If necessary, review the output connector silkscreen for polarity specifications.
3. Connect J1 input as follows:
  - a. 24 V power supply to J1 pin 2
  - b. Gate source to J1 pin 4
    - i. Set the external trigger source to 50  $\Omega$  impedance and a frequency below the maximum specified for the PCO-7114 Safe Operating Area.
  - c. High-voltage power supply to J1 pin 10
    - i. Set the high voltage to the required amount. Do not exceed the maximum high voltage input value of 180 VDC.
  - d. 24 Volt, Trigger, and High Voltage return to J1 pin 1, 3, 5
4. Connect an oscilloscope to the current monitor if desired.
  - a. Current monitor (+) to J2 pin 1
  - b. Current monitor (–) to J2 pin 3
  - c. 50  $\Omega$  termination impedance when using the optional Current Monitor Cable Assembly (PCA-9140).
  - d. 20 A/V typical ratio

## ❖ Power Up

1. Verify the external trigger is disabled.
2. Verify the high voltage is disabled.
3. Power on the 24 DC power source.
4. Set the output current by varying the high voltage input at J1 pin10.
5. Enable the external high voltage power supply source.
6. Set the external trigger for the desired frequency, being careful to not exceed the maximum frequency specified in the Safe Operating Area graph (found in the datasheet).
7. Enable the external trigger source.
8. Verify the output is correct with the current monitor and an oscilloscope, adjust the high voltage power supply to obtain the desired output current.
9. Allow the system to operate for 5 minutes and verify the output current is stable, adjust the high voltage power supply if necessary.

## ❖ Power Down

1. Disable the external trigger source.
2. Disable the high voltage source.
3. Turn the 24 V DC power source OFF.



# Warranty and Service

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## ❖ Warranty

Directed Energy, Inc. (DEI) warrants equipment it manufactures to be free from defects in materials and factory workmanship under conditions of normal use, and agrees to repair or replace any standard product that fails to perform as specified within one year after date of shipment to the original owner. OEM, modified, and custom products are warranted, as stated above, for ninety (90) days from date of shipment to original owner. This Warranty shall not apply to any product that has been:

- I. Repaired, worked on, or altered by persons unauthorized by DEI in such a manner as to injure, in DEI's sole judgment, the performance, stability, or reliability of the product;
- II. Subjected the product to misuse, neglect, or accident; or
- III. Connected, installed, adjusted, or used otherwise than in accordance with instructions furnished by DEI.

DEI reserves the right to make any changes in the design or construction of its products at any time, without incurring any obligation to make any change whatever in units previously delivered.

DEI's sole obligation, and buyer's sole remedies, under this agreement shall be limited to a refund of the purchase price, or at DEI's sole discretion, to the repair or replacement of products in kind that prove, to DEI's satisfaction, to be defective, when returned to the DEI factory, transportation prepaid by the buyer, within the warranty period. DEI shall in no way be liable for damages consequential or incidental to defects in its products, for failure of delivery in whole or in part, for injuries resulting from its use, or for any other cause.

Returns must be preauthorized and accompanied by a DEI return authorization number.

The foregoing states the entire warranty extended by DEI, and is given and accepted in lieu of 1) any and all other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and fitness for any particular purpose and 2) any obligation, liability, right, claim or remedy in contract or tort.

## ❖ **Factory Service and Support**

For more information about your instrument or for an operation problem, please contact the factory:

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# Notes

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