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A. Diode Laser Drivers for Single Emitters Operating CW

Some key specifications when considering a driver are:

- Drive current (max and setpoint resolution)
- Noise (p-p, rms, and frequency range)
- Turn-on and switching noise, surges, overcurrent
- Diode/overcurrent/overvoltage protection circuitry (present or not)
- Input voltage
- Interface type
- Power dissipation and heatsinking

Generally speaking, all single emitter devices require no more than 2.0V forward voltage. Operating current level is device-specific, typically from 1 to 8A.

We recommend that great care is taken when enabling/disabling the output of a power supply operating in constant current mode, especially power supplies that are not specifically designed for laser diodes. During on/off or enable/disable of the output, we have noted that several commercially-available benchtop test equipment has been shown to have current spikes in excess of 1A during turn-on/turn-off, which can be damaging to the laser diodes.

Constant-current supply operation recommendations

The best way to avoid damage with a constant-current power supply with unknown on/off output characteristics (meaning that you have not characterized it yourself with an oscilloscope and dummy load) are to:

- (a) Ensure the output is disabled and the output voltage and current are dialed to zero (0) output before turning on the ON/OFF power.
- (b) Set the forward voltage to a maximum of 2V
- (c) Enable the output
- (d) Turn up the current slowly, using a maximum of 0.1A increments if it is a digital adjustment (this prevents current spiking).
- (e) When you arrive at the desired current drive level, turn the forward voltage down so that it is ~0.05V above the operating voltage (this limits forward voltage and is sometimes called the 'compliance voltage').
- (f) When you decide to turn off the laser, turn down the current slowly.
- (g) Disable the output.

If you have determined that enable/disable output does not produce current spikes, once you have set the compliance voltage – you can leave the current knob set and simply disable and enable the output.

Vendors

Agilent (General-purpose bench supplies)
Elgar/Sorenson (General-purpose bench supplies)
Keithley (Very high quality and diode-safe, but limited current)
Newport (Diode-specific power supplies)
Wavelength Electronics (Diode-specific power supplies)
Thorlabs (Diode-specific power supplies)
Vuematrix (Diode-specific, highly integrated solutions)
Laser Drive, Inc. (Specialty diode supplies)
Galaxy Power (Pisces II is high-efficiency DC-DC converter)

Laser Diode-Specific Power Supplies

Thorlabs LDC220 (up to 2A)
Thorlabs LDC340 (up to 4A)
ILX LDC-3744B (up to 4A)
Keithley 2440 (up to 5A)
Wavelength Electronics PLD5000 (up to 5A)
ILX LDX-3565 (up to 6A)
Newport 5060 (up to 6A)
Newport 560B (up to 6A)
Vuematrix VUE-MV (up to 10A)
Newport 5600 (10A and up)
Laser Drive LDI-820/2 (10/15A)

General Benchtop Power Supplies

Agilent 3634A (7A, 25V)
Sorensen HPD 15-20 (15A, 20V)

B. Diode Laser Drivers for Combined Power Modules (CPM, CW)

Generally speaking, CPMs require no more than 14V forward voltage. Operating current level is device-specific but typically is approximately 5A. We recommend care be taken and output on/off spikes examined from individual power supplies. Some commercially-available benchtop test equipment has been shown to have current spikes in excess of 1A during turn-on/turn-off, which can be damaging to the laser diodes.

Vendors

Agilent, BK Precision.

General Benchtop Power Supplies

Agilent 3634A (7A, 25V)



Sorensen HPD 15-20 (15A, 20V)

C. Pulsed Diode Laser Drivers (SE and CPM)

Vendors

Directed Energy <http://www.directedenergy.com/>

They have a range of OEM and benchtop drivers appropriate both for single emitters and CPMs.

Avtech <http://www.avtechpulse.com/>

Benchtop, mostly pulsers.

Laselec <http://www.laselec.com/english/lydya.php>

Mostly benchtop drivers.

Analog Modules <http://www.analogmodules.com>

Very high-current drivers

If you are building your own drivers, a variety of FETs and high-current opamps are available from:

IXYS (<http://www.ixysrf.com/>)

Powerex (www.pwr.com)

International Rectifier (<http://www.irf.com/product-info/hexfet/>)

Apex Microtech (<http://www.apexmicrotech.com/>)

D. Thermoelectric Cooler Controllers

The key specifications when selecting a TEC controller are

Max drive current

Sensor input type (Pt100 vs 10k thermistor vs RTD)

Bipolar vs unipolar drive (can it heat as well as cool)

Temperature stability (not critical for your application)

Startup time (how long to reach temp, does it have feed-forward control, etc)

Form factor, power supply

Interface (how to program the PID loop, self controlling)

Type of drive method: Class A PID or PWM

Single emitters

To run our laser devices at high output power, you should get a TEC driver capable of 5A drive current minimum. For a factory environment with laser diode operating (on), you can probably live with just unipolar drive, as you are unlikely to need heating. In cold environments, or one where you expect to turn the laser off or pulsing it while keeping the TEC running, then a bipolar driver is the correct choice.

All of our devices have a built-in 10k ohm thermistor. Startup time depends on your application and overall system/user requirements.

CPM-20 (no TEC)

Please see our separate application notes, which discuss in detail both fan cooling and external TEC-based cooling.



CPM II (integrated TEC and controller circuitry)

Please see the operating manual for the CPM II for details of this information. The CPM-II contains a TEC controller and therefore does NOT need a TEC controller. It requires only a fixed-voltage power supply is required, such as the:

- Astrodyne SP-200-5 (120Vac input; 5V, 40A output)
- Galaxy Power Pisces II G2PW5V030 or G2PC5V030 (48 or 24Vdc input; 5V, 30A output)
- Any bench supply capable of 5V and ~20-40A

Some relevant model numbers

(sorted by manufacturer name)

ILX LDT-5525 (24W)

ILX LDT-5948 (60W)

ILX LDT-5980 (120W)

Keithley 2510 (50W)

Newport 325B (15W)

Newport 3040 (32W)

Newport 350B (55W)

Thorlabs TED350 (40W)

Wavelength Electronics LFI3751 (5A max)

Wavelength Electronics MPT5000 (5A max)

Wavelength Electronics MPT10000 (10A max)

E. Resource List: Power Supply Manufacturers

General-Purpose

Agilent Test & Measurement
(800) 829-4444

www.agilent.com

Wide range of benchtop power supplies, but not aimed especially at laser diodes. Be careful of constant current mode performance..

Astrodyne

300 Myles Standish Blvd.
Taunton, MA 02780

(508) 823-8080

www.astrodyne.com

Line of OEM-style AC-DC and DC-DC power supplies. We recommend a model for the TEC controller in the Compound Photonics CPM-II product.

Deltron, Inc.

290 Wissahickon Avenue
North Wales, PA 19454
215-699-9261

www.deltroninc.com

Compact OEM power supplies.

Elgar Electronics Corporation
(Sorenson)

9250 Brown Deer Road
San Diego, CA 92121
858-450-0085

www.elgar.com

Wide range of benchtop power supplies, but not aimed especially at laser diodes. Be careful of constant current mode performance..

Galaxy Power

155 Flanders Road
Westborough, MA 01581
508-870-9775

www.galaxypwr.com

Very compact, high-efficiency DC-DC power supplies.

Keithley Instruments, Inc.

28775 Aurora Road
Cleveland, Ohio 44139
(440) 248-0400

www.keithley.com

Mostly low-current drive (up to 10A). Excellent sourcemeter modules and matrix controllers.

(Please note that the inclusion or exclusion of vendors or model numbers in this application note does not constitute a recommendation or advocacy from Compound Photonics, Inc. If you are a vendor and wish to be added to this application note, please contact Dr. Robert S. Williamson III, rswiii@CompoundPhotonics.com).

Specialty

Analog Modules, Inc.

126 Baywood Avenue
Longwood, FL 32750-3426
407-339-4355

www.analogmodules.com

Wide range of specialty power supplies, including diode lasers.

Arroyo Instruments

373 Front Street, Suite B
Grover Beach, CA 93433
(805) 481-6684

www.arroyoinstruments.com

Benchtop laser diode and TEC drivers, mounts. Limited current drive capability.

Directed Energy, Inc. (IXYS)

2401 Research Blvd., Suite 108
Fort Collins, CO 80526
(970) 493-1901

www.directedenergy.com

Specializes in fast pulsed power supplies, for laser diode and other applications. Offer custom design expertise.

ILX Lightwave

31950 East Frontage Road
Bozeman, MT 59715
800-459-9459

www.ilxlightwave.com

Wide range of benchtop laser diode power supplies up to 40A, CW and QCW.

Laselec SA

105, Avenue du Général Eisenhower
BP 23 705
31037 Toulouse Cedex
FRANCE

www.laselec.com

Benchtop CW & QCW laser diode supplies from 5 to 200A,

Laser Drive, Inc.

5318 Ranalli Drive
Gibsonia, PA 15044
(724) 443-7688

www.laserdrive.com

Specializes in power supplies for laser diodes and other laser types. Repairs many legacy power supplies, does some specialty power supply design. Offer custom design expertise.

Lumina Power, Inc.

240 Jubilee Dr
Peabody, MA 01960
(978) 532 4666

www.luminapower.com/

High current OEM-style power supplies specifically for laser diodes, CW and QCW up to 100A.

Thorlabs, Inc.

435 Route 206 North
Newton, NJ 07860
973-579-7227

www.thorlabs.com

Benchtop laser diode power supplies, CW, up to 8A. Also carries multi-channel drivers (up to 8 channels). Also carries OEM power supplies up to 2.5A. Carries a line of laser diode mounts and TEC controllers.

Vuemetrix

960 Hamlin Court
Sunnyvale, CA 94089-1401
408-734-9974

www.vuemetrix.com

Specialty diode laser drivers, especially for arrays of single emitters and for lifetest. High-level controller interface is their specialty (e.g., to PDAs). Offer custom design expertise.

Wavelength Electronics, Inc.

51 Evergreen Drive
Suite B Bozeman, MT 59715
(406) 587-4910

www.teamwavelength.com

Specializes in power supplies for laser diodes and TEC controllers. Have a nice line of PCB-mounted supply bricks, and moderate to low-noise performance.