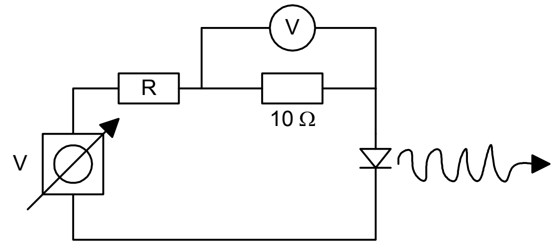
Laser diode lab

1. Check that the laser driver (blue-green box with transparent lid) is off and on DC. The power should at no time exceed **2 mW** – keep in mind!

2. The laser diode is mounted at the end of the bench. Observe that some of the electrical cables are loose and the laser can be destroyed if you pull the thin cables.

3. The laser of this year is slightly different from the one in the data sheet. Typical currents are between 28 and 45 mA. They vary from laser to laser.

4. The laser is arranged according to the figure, i.e. with two series resistances. Over one (10Ω) we measure the voltage drop with the yellow voltmeter. From that we calculate the laser current.



5. Switch on the voltmeter. Use the 2V DC range.
   How large voltage would you expect if you operate in the current range mentioned above?...............

6. Switch on the laser diode (ON).

7. Calculate the current that the laser takes. …………………………………………….

8. If the laser does not emit radiation, or if only very weak light is seen, increase the current with the adjustable resistor marked P_{ut} under the lid. Use the beige plastic screwdriver to avoid shortcuts. Adjust carefully. The resistor is sensitive and can break!!! Do not increase the current above than the maximum current given on the paper on the bench.

9. Hold the cardboard in front of the laser and draw conclusions about the beam propagation. Why is it looking as it does?

10. Measure the divergence of the laser beam, horizontally and vertically.
    ....

11. Assume that that the laser light is appearing as light from a slit. Which dimensions would then the emitting aperture have?
    ......………………...

12. Use the microscope objective that is mounted in a xyz-translator to focus the beam on the photo detector. Connect it to oscilloscope via a 50 Ω adapter.

13. Calculate the output power of the laser. ....………………………

14. Measure the output power vs. current. (Approximately 7- 10 points is enough) Stop before you have exceeded the maximum current allowed. Plot the data in a diagram. Does the curve have laser character? …….. Determine the threshold from the diagram ....

15. Try to c*ollimate* the beam with the microscope objective mounted in the xyz-translator and try to get the beam straight and *parallel with the optical bench.* <u>Avoid hitting other students with the beam!</u> (If the beam is collimated, at what distance is then the diode placed relative to the microscope objective? Obs! No numerical answer is needed.)

16. Determine the polarization of the laser with the reference polaroid that the assistant has. Why did you get this result?………………

17. Measure the transmitted power vs. angle (0-360º) with the polarizer in the rotation stage. Normalize to zero degrees for light parallel with the horizontal plane.

18. Plot the graph. How is the measured intensity (power) changing with angle? How should it be theoretically?

19. Use the diffraction grating and the ruler to determine the laser wavelength. The grating has 1200 lines/mm. Estimate the accuracy in your measurement!

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DET110 - HIGH-SPEED SILICON DETECTOR

DESCRIPTION:

Thorlabs' DET110 is a ready-to-use high-speed photo detector. The unit comes complete with a photodiode and internal 12V bias battery enclosed in a ruggedized aluminum housing. The head includes a removable 1" optical coupler (SM1T1), providing easy mounting of ND filters, spectral filters and other Thorlabs 1" stackable lens mount accessories. Also available are fiber adapters (SMA, FC and ST style). An #8-32 tapped hole is provided on the base of the housing to mount the detector directly to a Thorlabs' positioning device (1/2" post holder, mounting plates, etc.).

SPECIFICATIONS:

Detector:	Silicon PIN	**Housing:**	Black Anodized Aluminum
Spectral Response:	320-1100nm	**Size:**	ϕ1.43" x 1.67"
Peak Wavelength:	960nm+/-50nm	**Output:**	BNC, DC-Coupled
Rise/Fall Time[1]:	20ns	**Bias:**	12V Battery (Type A23)
Diode Capacitance:	20pF	**Mounting:**	8-32 (M4) Tapped Hole
NEP:	1.2×10^{-14} W/√HZ	**Diode Socket:**	TO-5, Anode Marked
Dark Current:	10nA	**Damage Threshold:**	100mW CW
Active Area:	$13mm^2$ 3.6mm x 3.6mm square		$0.5\ J/cm^2$ (10ns pulse)
Linearity Limit:	1mW		

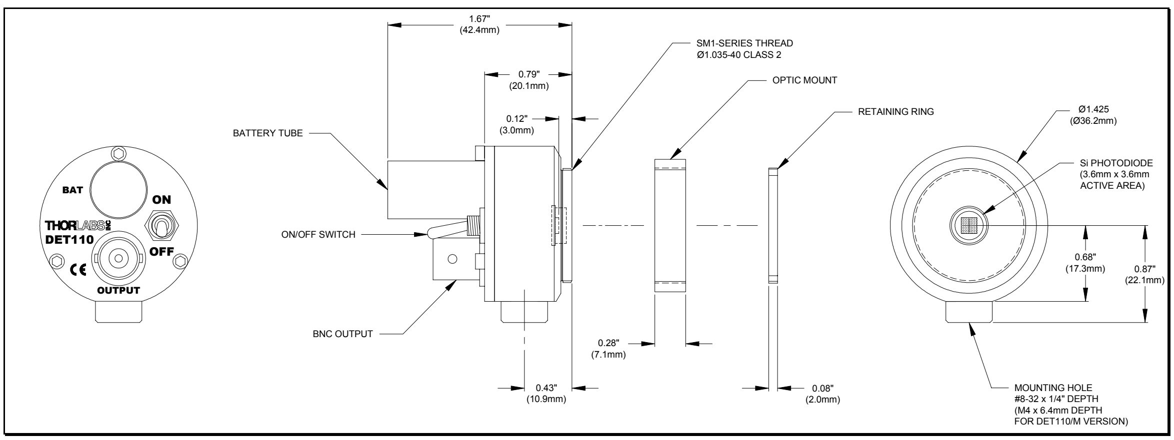


Figure 1. - Mechanical Dimensions

OPERATION:

Thorlabs DET series are ideal for measuring both pulsed and CW light sources. The DET110 includes a reversed-biased PIN photo diode, bias battery, and ON/OFF switch packaged in a ruggedized housing. The BNC output signal is the direct photocurrent out of the photo diode anode and is a function of the incident light power and wavelength. The Spectral Responsivity, $\Re(\lambda)$, can be obtained from Figure 2 to estimate the amount of photocurrent to expect. Most users will wish to convert this photocurrent to a voltage for viewing on an oscilloscope or DVM. This is accomplished by adding an external load resistance, R_{LOAD}. The output voltage is derived as:

$$V_O = P * \Re(\lambda) * R_{LOAD}$$

The bandwidth, f_{BW}, and the rise-time response, t_R, are determined from the diode capacitance, C_J, and the load resistance, R_{LOAD} as shown below:

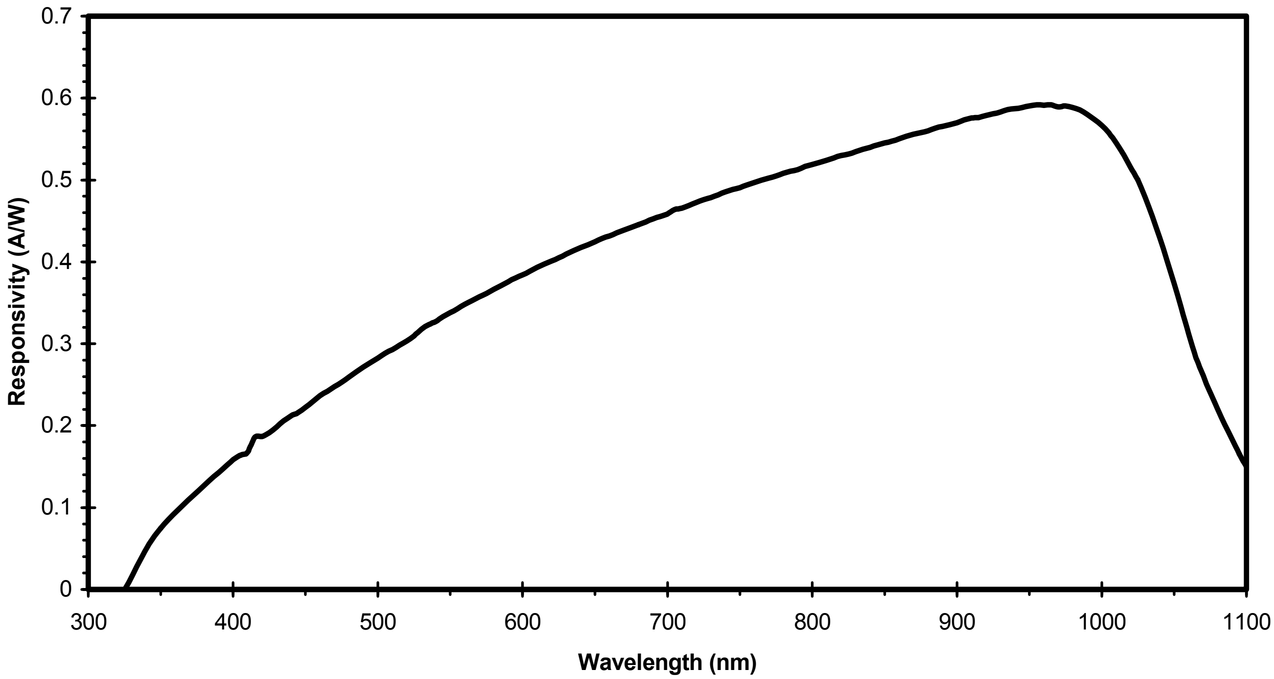
$$f_{BW} = 1 / (2 * \pi * R_{LOAD} * C_J)$$

$$t_R = 0.35 / f_{BW}$$

For maximum bandwidth, we recommend using a 50Ω coax cable with a 50Ω terminating resistor at the end of the coax. This will also minimize ringing by matching the coax with its characteristic impedance. If bandwidth is not important, you may increase the amount of voltage for a given input light by increasing the R_{LOAD} up to a maximum of 10KΩ.

Note: The detector has an AC path to ground even with the switch in the OFF position. It is normal to see an output response to an AC signal with the switch in this state. However, because the detector is unbiased, operation in this mode is not recommended.

Figure 2 - Typical DET110 Spectral Responsivity Curve



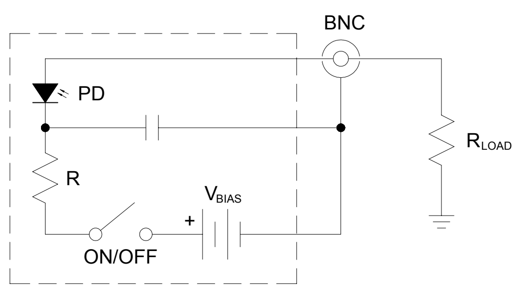


Figure 3 – Circuit Block Diagram

FIBER ADAPTERS AND OTHER ACCESSORIES

Thorlabs sells a number of accessories that are compatible with the 1" thread on the DET housing including FC, SMA, and ST fiber adapters, stackable lens tubes for mounting optics, and cage assemblies that allow the DET to be incorporated into elaborate 3-D optical assemblies.

Caution: The DET110 was designed to allow maximum accessibility to the photo detector by having the front surface of the diode extend outside of the DET housing. When using fiber adapters, make sure that the fiber ferrule does not crash into the detector. Failure to do so may cause damage to the diode and / or the fiber. An easy way to accomplish this is to install a SM1RR retaining ring (included with the DET110) inside the 1" threaded coupler *before* installing the fiber adapter.

Also available are 1ns Si detectors, InGaAs detectors, and a complete line of amplified detectors.

MAINTAINING THE DET110

There are no serviceable parts in the DET110 optical head or power supply. The housing may be cleaned by wiping with a soft, damp cloth. The window of the detector should only be cleaned using optical grade wipes. If you suspect a problem with your DET110 please call Thorlabs and technical support will be happy to assist you.

ELFA artikelnr 75-706-17 SDL3038-011 Laserdiod 5mW

The SDL3038 Series is index guided AlGaInP laser diode.
The low threshold current and short wavelength are achieved by a strained multiple quantum well active layer. The lasing wavelength is the same as that of He-Ne gas laser. The SDL3038 Series serves applications such as bar-code scanner, laser pointer, and other optical information systems.

FEATURES

- Short wavelength : 635nm
- Output power : 5 mW CW
- High operaing temperature : 40°C 5mW MTTF >20000h
- PIN photodiode built-in for light output monitor

Absolute Maximum Ratings

parameter		Symbol	Rating	Unit
Light Output		Po	5	mW
Reverse Voltage	Laser	VR	2	V
	PIN		30	
Operating Temperature		Topr	-10 ~ +40	°C
Storage Temperature		Tstg	-40 ~ +85	°C

Electrical and Optical Characteristics

(Tc=25°C)

Parameter		Symbol	Condition	Min.	Typ.	Max.	Unit
Threshold Current		Ith		—	60	85	mA
Operating Current		Iop	Po=5mW	—	75	100	mA
Lasing Wavelength		λp	Po=5mW	—	635	640	nm
Beam Divergence 1)	Perpendicular	θ⊥	Po=5mW	25	35	40	deg.
	Parallel	θ//	Po=5mW	6	8	10	deg.
Off Axis Angle	Perpendicular	Δθ⊥		—	—	±3	deg.
	Parallel	Δθ//		—		±3	deg.
Differential Efficiency		dPo/dIop		0.1	0.3	—	mW/mA
Monitoring Output Current		Im	Po=5mW	0.05	0.2	—	mA
Astigmatism		As	Po=5mW	—	8	—	μm

1) Full angle at half maximum