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ION LASER TECHNOLOGY

I L T 5000

OPERATIONS MANUAL

REVISION B

45-052





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CAUTION

The use of controls or adjustments or the performance of procedures other than those specified herein may result in hazardous radiation exposure.

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UNPACKING AND INSPECTION

Upon receipt of your laser system, have a courier present for inspection of damages incurred during shipping. If damage is found notify courier and 1LT immediately.

The laser head assembly is contained in a double enclosure. Mechanical shock insulation foam should be kept around the inside box. The board attachment to the head serves to isolate the unit from vibration and impact. The interface cables should be kept with the laser head. The power supply is shipped in its own container. All packing materials should be saved in the event the laser must be returned. Packing via other methods is not recommended and in some cases voids warranty.

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SAFETY

The instruction manual must be read thoroughly before the laser system is operated.

Extreme caution must be taken to insure the safety of everyone within the lasers operating region. The Argon lasers short wavelengths POSE EXTREME HAZARDS **for the eyes and it is recommended that laser safety goggles be worn while operating any laser unit. The beam is dangerous even when reflected or scattered from diffuse objects.**

Avoid physical contact with the laser beam. The high spectral intensity and short wavelength may cause tissue damage not immediately apparent.

The laser system comes equipped with CDRH recommended interlocks and warning labels; however, common sense is the most important safety device.

The internal voltage of both the laser head and power supply attains lethal proportions during use and when the unit is shut down, but plugged in.

The I L T 5000 laser systems are designed to be maintenance free and should not be opened by anyone other than Ion Laser Technology certified technicians. Opening of units by anyone else, in most cases, voids warranty.

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GENERAL INFORMATION

1.1 Description

The 1 L T 5000 series lasers are state-of-the-art coherent light source. These units are capable of generating laser radiation in the 457 nm to 514.5 nm regime. This is made possible through the incorporation of BeO in the plasma bore matrix, metal shrouds, and unique optical couplers. This engineering produces a tube that will be simple and inexpensive to reprocess when the time comes.

The I L T series plasma tubes harness the additional gas volume of its enlarged shrouds providing the user with a stable, long lived, high duty cycle tube.

The plasma tube is housed in an all metal resonator which utilizes a four INVAR rad design providing the laser unit with unparalleled stability. Laser head cooling is accomplished by using two high volume fans located at each end of the plasma tube combined with automatic thermostatic control to provide maximum cooling after shut down.

All the off-the-shelf I L T lasers are designed to operate in the TEMoo mode, and provide a polarized output beam. The I L T series laser comes in a full range of output powers and wavelengths to suit different applications. Powers range from 10mW to 100mW and each standard unit has a light feed back mechanism which monitors the lasers output and provides you with amplitude stability (<1% RMS) over extended periods of operation.

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The I L T 5000 laser heads utilize the model 5400 power supply. This power supply mates high tech ingenuity with simplicity to provide you with a small, reliable, solid state, switching power supply. These supplies are available for either 115 VAC or 220 VAC operation. The model 5400 incorporates a voltage doubling front end to boost the 115 VAC line input to 340 VDC and switches at 30 KHZ into a fully isolated step-down transformer. This unique design provides stable output even at low line voltages.

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WARNING!!

HIGH VOLTAGE IS PRESENT

AT THE HEAD AND CONTROL

BOX INTERFACE PINS WHEN

THE UNIT IS PLUGGED IN!!!

INSURE THAT INTERFACE

CONNECTING CORDS OR SAFETY

CAP IS ATTACHED BEFORE

POWER SUPPLY ACTIVATION.

DO NOT ATTACH OR DETACH

UMBILICLES UNLESS POWER

SUPPLY IS UNPLUGGED FROM

LINE!

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INITIAL SET-UP AND OPERATION

CARE must be taken to follow the start up procedures closely. This will insure proper operation and performance of the system.

NOTICE: It is important to fill in the required information on the warranty card and return it immediately. Failure to do so within 14 days of receipt of the system may void warranty.

START UP:

1. **CONNECT INTERFACE CABLE TO LASER HEAD AND POWER SUPPLY. (Double check to insure proper alignment of pins.**

2. **(OPTIONAL) On systems with remote cooling, connect the remote cooling air duct and power cord to the laser head.**

3. **PLUG POWER CORD INTO PROPERLY RATED VOLTAGE OUTLET. (Note, plug incorporates a ground. Do not by-pass!)**

4. **TURN ON KEY SWITCH, POWER LIGHT WILL COME ON. (The laser is equipped with a 45-75 second time delay before laser radiation is emitted from unit.)**

5. **INSURE ALL COOLING FANS ARE OPERATIONAL. (The fans are designed to come on once a critical temperature in the laser tube is reached. They are also designed to stay on after deactivation while the plasma tube cools to a safe point. NOTE: the cooling fans may intermittently cycle on off as heat is dissipated through the laser head, after deactivation.)**

6. **ADJUST LIGHT CONTROL POTENTIOMETER FULLY CLOCKWISE. (This allows maximum current to be supplied across the tube insuring easy and reliable start up.)**

7. **USING A VOLT METER, CHECK AND RECORD THE FOLLOWING:**

   A. LASER POWER - laser light output power is measured by using test jacks on laser head (item # 3 Fig. 7 pg 8). Output power is determined in volts DC. 1 milliwatt = .1 to .5 volts DC, depending the on model.

   B. CATHODE VOLTAGE - measured by using test jacks on laser head (item # 2 Fig. 7 pg 8). Cathode heater voltage is determined in volts AC and, depending on model, will be between 2.1 VAC and 2.6 VAC.

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C. ANODE CURRENT - anode current to the plasma tube is measured at the head (item # 1 Fig. 7 pg 8). Tube current is determined in millivolts DC. 10 millivolts =1 Amp DC, typical current is 6 to 10 Amps DC, in light control, with a current limit of 10 to 12 Amps, depending on the laser model.

D. TUBE VOLTAGE - This is measured by using the left test jacks of both the cathode voltage and anode current terminals (item # 4 Fig. 7 pg 8). Proper operating voltage is between 100 VDC and 110 VDC depending on the current.

The laser should now be fully operational. Check the operations check list to insure all voltages and currents are within operational specifications.

Severe handling may cause these numbers to vary due to a loss of fine tuning. If currents are higher than recommended for safe operation the mirrors may need adjustment. Please refer to pgs 11 thru 14, mirror adjustment and walking the laser or contact a Technical Representative from ILT.

During laser operation observe caution. Do not obstruct air flow to the laser head or power supply. Serious damage to both may result.

Both power supply and laser head are equipped with thermal sensing devices to insure termination of operation if temperatures exceed a critical point. However, running the tube at slightly enhanced temperatures may shorten the tubes effective life. Therefore always insure that your laser head and power supply are receiving optimal free air flow.

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LASER HEAD CONTROLS

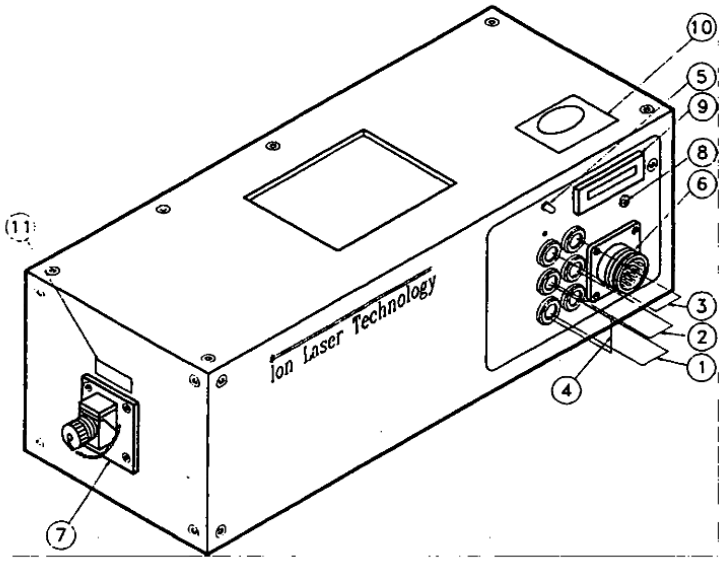
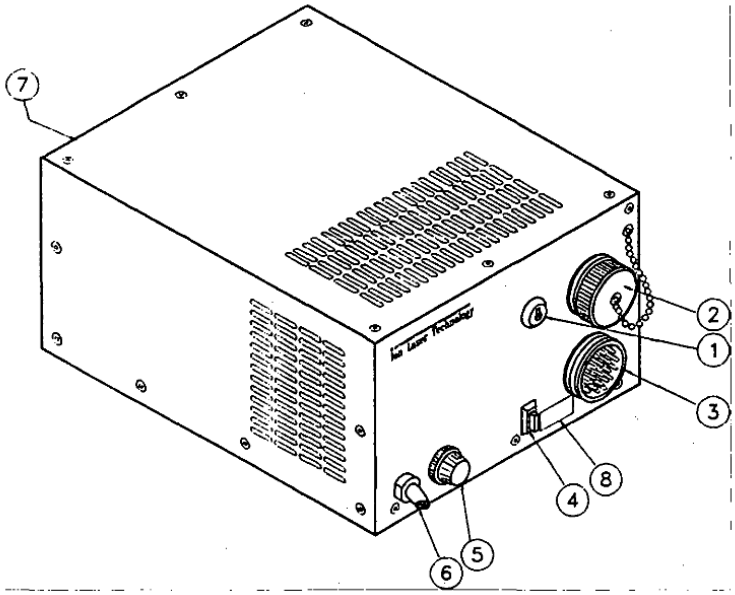


FIG. #7

1. ANODE CURRENT JACKS - these read .01V/Amp in DCV directly.
2. CATHODE VOLTAGE JACKS - these read ACV directly.
3. LASER OUTPUT POWER JACKS - these read DCV in V/mW.
4. TUBE VOLTAGE JACKS - these DCV directly.
5. EMISSION INDICATOR - signifies that laser head is on.
6. HEAD INTERFACE CABLE CONNECTOR.
7. BEAM ATTENUATOR.
8. LIGHT CONTROL ADJUSTMENT SCREW - turning clockwise increases power.
9. HOUR METER - (Check to insure meter is not damaged. Upon receipt of unit, bubble should be at zero).
10. WARNING: logotype label.
11. APERTURE LABEL.

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POWER SUPPLY CONTROLS



1. ON-OFF SWITCH (Note: It is recommended that the key be removed when the laser system is shut off).
2. INTERFACE PORT - use with RPC-50 remote control box.
3. LASER HEAD INTERFACE PORT - periodically check positioning and tension of pins to ensure adequate electrical contact.
4. REMOTE PLUG (CDRH remote interface).
5. POWER SUPPLY FUSE - check periodically, 20 Amp Fast Blow.
6. POWER CORD - avoid sharp bends, with time, this may induce electrical shorts.
7. IDENTIFICATION LABEL (Rear panel).
8. CERTIFICATION LABELS

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SUGGESTIONS TO EXTEND THE LIFE OF YOUR LASER

I. FREE AIR FLOW

Maintain at least 6 inches of free space around all air vents. Insure that heated **air from the power supply is not directed into the laser head vice or versa.**

THE LASER HEAD MAY DISSIPATE AS MUCH AS 1500 WATTS OF HEAT DURING OPERATION.

II. AVOID MECHANICAL SHOCK

Your laser system, although of rugged design and construction, may be shifted out of alignment due to mechanical shock or vibration.

WHEN CARRYING THIS INSTRUMENT ALWAYS CARRY IT VIA THE BASE-PLATE NEVER CARRY IT VIA END PLATES OR MIRROR MOUNTS.

111.. RUN AT LOWEST REQUIRED POWER

It is always a goad idea to adjust the light feedback potentiometer on the head to a minimum. When full power is not required.

IV. PERIODIC MAINTENANCE CHECKS

It is a good idea to periodically check the Anode current of your plasma tube. This reading will slowly start to increase over time signifying normal loss of tube life. If any sudden or drastic increases occur notify an ILT service representative. Internal contamination, or loss of alignment may have occurred.

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LASER MIRROR ADJUSTMENT

During operation the laser head may sustain mechanical shock. Although the laser head has been designed to withstand such stresses, movement of the optical components may result.

In order to realign and fine tune the system some understanding of the construction and theory of the operation of the laser system is required.

LASER END PLATE ASSEMBLIES

Laser mirror alignment is maintained by two END PLATE assemblies (see Fig. 12 a, b pg 15). These end plates are held in alignment with the plasma tube by four solid invar rods. These are located at each corner of the end plates for maximum support and stability.

Mirror adjustment is accomplished by the use of mirror gimbals attached to each end plate (see Fig. 12 a, b pg 15).
The mirror gimbal is fabricated out of hardened steel and "pre-stressed" to allow elastic distortion in the X-Y planes with the use of small set screws.
The location and function of each set screw is found on page 13 Fig. 13.

MIRROR ADJUSTMENT

All I L T model lasers are in continuous light control (unless otherwise specified). Therefore, mirror adjustment must be done while monitoring Anode current. Refer to page 8 Fig. 7 item # 1. Peak alignment of mirrors is determined by lowest Anode current and is accomplished by performing the following steps. Refer to Fig. 13, pg 13.

1. Insert Hex Key alignment tool (1.5mm) into hole "B" on high reflector END PLATE. Rotate until lowest current is achieved.
2. Insert Hex Key alignment tool (1.5mm) into hole "A" rotate until lowest current is achieved.

Note: Never rotate more than 90 degrees.

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LOCATION OF MIRROR ADJUSTMENT SCREWS

A This screw is a M3 set screw and is used for horizontal angular adjustment.

B- This screw is a M3 set screw and is used for vertical angular adjustment.

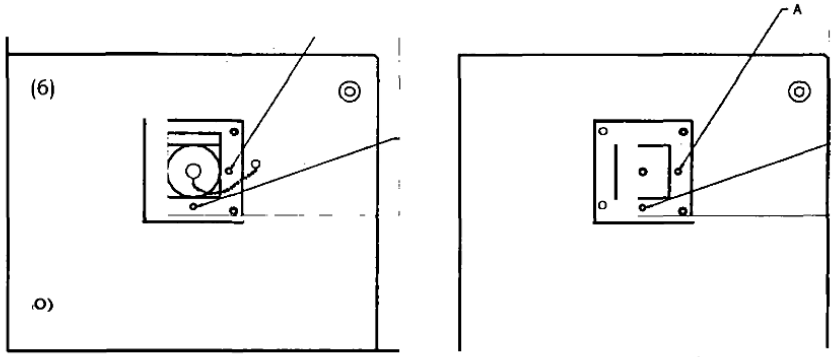


FIG. #13

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WALKING THE LASER BEAM

The mirrors at each end of the tube define a beam path through the tube. Although the mirrors maybe aligned with respect to one another, they may not be aligned with respect to the tube. "Walking" rotates the horizontal and vertical beam path passing through the tube, thus achieving maximum laser power and beam quality. To insure proper alignment, use a short focal length lens to expand the output beam. Check to insure that a clean, round mode pattern appears.

VERTICAL LASER BEAM "WALKING"

a. Peak mirror alignment on the rear resonator plate using both vertical and horizontal adjustments. Observe Anode current.
b. Rotate vertical adjustment screw ("A" Fig. 13) on the output END PLATE clockwise to increase Anode current by 10%.
c. Rotate vertical adjustment screw ("A" Fig. 13) on the high reflector END PLATE to restore laser power.
d. If anode current is less than before adjustment, continue clockwise adjustments until minimum Anode current is reached.
e. If anode current is greater than before begin counterclockwise adjustments.
f. Continue this procedure until you have obtained minimum anode current or maximum power.

HORIZONTAL BEAM "WALKING"

Repeat steps A through F above using the horizontal resonator adjustment screws ("B") Fig. 13.

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OUTPUT MIRROR GIMBAL ASSY..

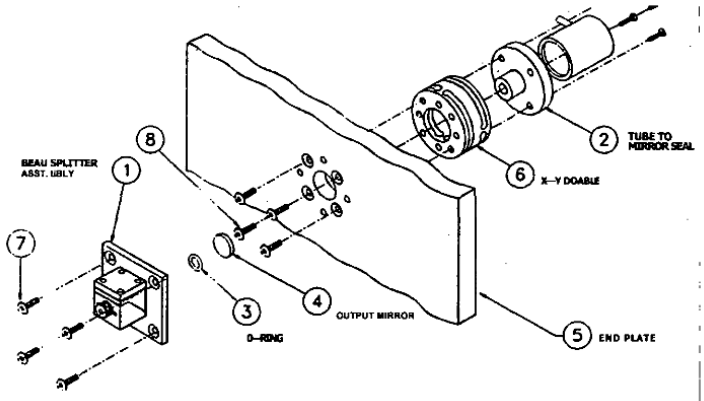


Fig. 12o

HIGH REFLECTOR MIRROR GIMBAL ASSY.

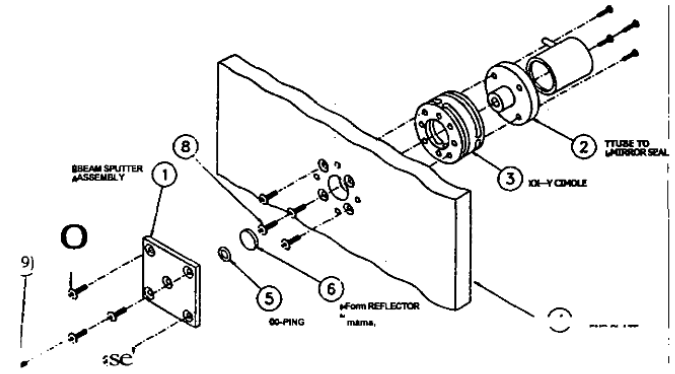


Fig. 12b

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LITTROW PRISM OPTION

Lasers ordered with the single line operation option incorporate a littrow prism. The use of a littrow prism allows the user to tune through all the visible argon wavelengths and provides 100% spectral purity.

The littrow prism is oriented vertically on the high reflector end plates of the laser head. Changing wavelengths is accomplished using screw B (see Fig. 13), rotating clockwise will produce longer wavelengths and rotating counterclockwise will produce shorter wavelengths.

When changing wavelengths it may be necessary to "walk" the beam for the new wavelength, achieving the best beam quality and maximum power. Beam walking and peaking is accomplished by the same procedure described for the multi line models on pages 11 through 14.

CLEANING OF OPTICS

The optics are installed and the cavity is sealed in a clean room environment. Cleaning should not be required during normal use.

However, if the seal is broken and cleaning is required contact the nearest 1LT service representative (page 21). The service representative will determine whether to service the laser at your facility or ship the unit to the nearest ILT service facility. Optical cleaning is accomplished on a 24 hour turn around basis.

Under no circumstances should the user attempt to disassemble the laser head or remove its protective housing. Doing so could damage the laser and subject the user to high voltage and hazardous laser radiation.

Unauthorized service will void user warranty.

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TURN ON TIME

(SPECIFICATIONS)

-Time delay for standby mode ..... < 1ms

-Time delay for operate mode ..... 45-75 seconds

-Laser power stabilization time ..... < 1ms

-Current stabilization time ..... 15 minutes

-Voltage stabilization time ..... 15 minutes

-Time delay for system deactivation ..... < 1ms

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PERFORMANCE SPECIFICATIONS*

	Model	5425	5450	5490
1.	Beam Diameter lie²	.65	.65	.65
2.	Beam Divergence Full Angle	.95mrad	.95mrad	.95mrad
3.	Polarization E-Vector Vertical	> 100:1	>100:1	> 100:1
4.	A.R. Spot	> 25%	> 25%	> .25%
5.	Transverse Mode (Higher order modes available on multi line models with increased power output)	TEMoo	TEMoo	TEMoo
6.	Warm-up time (Cold start) Multi line models From Standby	< 15 min. Immediate		
7.	Beam Pointing Stability After warm-up Periodic	<30 micro radians <10 micro radians		
8.	Beam Amplitude Noise DC to 2MHZ Current Light Control	< 3% RMS < 1% RMS		
9.	Long Term Power Stability 2 hours at constant ambient conditions	1%	1%	1%
10.	Rated Output (mv)	25	50	100

*Specifications subject to change without notice.

*Test documentation available upon request.

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ELECTRICAL SPECIFICATIONS*

	Model	5425A	5450A	5490A
1.	Voltage Optional	115 VAC + 10 VAC 220 VAC + 10 VAC 240 VAC + 10 VAC		
2.	Current	20 Amp	20 Amp	20 Amp
3.	Frequency Optional	60Hz 47 to 63Hz	60Hz	60Hz
4.	Phase	Single	Single	Single
5.	Interface Connector for use with RPC-50	Amp 206150		
6.	Power Supply Switching Frequency	35KHz	35KHz	35KHz

PHYSICAL SPECIFICATIONS *

7.	Power Supply Weight Shipping Weight	20 Lbs. 2 oz. 22 Lbs. 6 oz.
8.	Laser Head Weight Shipping Weight	20 Lbs. 13 oz. 22 Lbs. 14 oz.

* Specifications subject to change without notice.

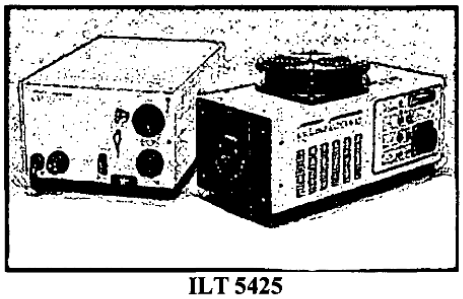
* Test documentation available upon request.

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Remanufactured Ion Laser Technology lasers.

Model 5425A argon laser



ILT 5425

Features:
- New tube
- Air-cooled
- Power up to 200 milliwatts
- Light controlled output
- Linear polarization >100:1
- C.D.R.H. certified
- One year / 2,000 hour warranty

	ILT 5425A
Output Power*	200 milliwatt
Wavelength	457nm to 514nm
Spatial Mode	Multimode**
Beam Divergence	0.95 mRad.
Polarization	Linear >100:1
Power Required	120VAC
Item #	ILT5425A
Price	**$4,895.00**

Steve Garrett 7/13/09
Midwest Laser

- 10 khr tube life typical
- $3500 to refurbish, exchg : 1 week turnaround
- 30 mW single mode typical
  scrolls with normally split mode
- Power monitor 25-35V
- tube current top
- 4g tube heavier 1/3 488 nm
  1/3 514 nm
  < 1% rms DC - 2Hz!
- minor adjust

* Output power is specified as minimum power at end of warranty.

**Single-mode operation is also available. Overall output power will be 50% lower. Multimode beam is typically the "doughnut" mode.

Coherence length: 5 cm typical.

Single frequency etalon tunable 40mW 488/514, TEM00 model 5490ASF available.

Tunable Littrow Prism (457nm to 514nm) available.

Every laser is completely remanufactured to meet or exceed original OEM specifications. Each laser is backed by our ***100% performance guarantee*** for 1 year or 2,000 hours, whichever occurs first.

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Sat 7/11/09

Specs on ILT 5400 Ar ion laser
http://www.midwest-laser.com/ilt5490.pdf

Sam Goldwasser discussion
http://www.repairfaq.org/sam/laserarg.htm

* Argon ion lasers are not of the 'set it and forget it' variety. At least, not those even a financially independent hobbyist can afford. They require a certain amount of maintenance and fiddling to achieve optimal output power and maximize tube life (though this is much less of an issue with internal mirror tubes).

* The basic tubes are costly - even reconditioned ones with many hours already on them. Expect to spend several hundred dollars for one that is not even anywhere near to new or in tip-top condition. A new tube may go for $5,000 or more - just for the tube!

* The power supply will be even more costly (possibly $1,000 or more used) unless you build it yourself since while refurb tubes are available, power supplies don't really wear out so they are in much shorter supply.

A small air-cooled ion laser is probably a more reasonable toy especially if you have to share the single 3-prong outlet in your place with the family microwave! :-) And, some of these lasers still have outputs that can approach 500 mW (though most are much lower).

Some DNA sequencers apparently also contain argon ion and other medium power visible lasers. [ask Terry Hwa if we can salvage the Ar laser in Shumo's old sequencer !!]

The design limitations are as follows. The 60X was originally designed for 7 to 9 A tube running 488 nm TEM00. This equates to a maximum of 20 mW for 8,000 hours. However, all the 60X systems currently out there are usually old tubes running at a MUCH higher current. To get a higher output of 50 to 100 mw, tube life is very limited. The 909 systems deliver about 5 to 6 watts multimode/multiline. Not the best divergence but not bad either. No fill system on the tube, so life is about 1,000 to 2,500 hours. We have regassed plenty of these and kept them running. As a krypton or mixed gas, life around 600 hours is normal. We usually leave a valve on the tube for regassing. The 68B tubes are usually cracked and cannot be repaired, or run at a low pressure and carbon tracked the bypass. The 920 made a lot of power when running, but it was designed to pump into a Dye laser or a fiber. It is a big bore tube to operate on three-phase 208 VAC at 45 amps, good for about 1,000 hours. You would have better divergence with a flashlight. Changing the optics to reduce the divergence makes a 6 watt, 45 amp laser instead of a 14 watt high divergence laser. Better off with a 909, same output, less power consumed.

Argon/Krypton Ion Laser Safety
It is not possible to over-emphasize the hazards involved in working with argon ion lasers.

* The laser itself emits at 10s to 100s of mW or more in a collimated beam instantly damaging to vision. These probably will not start a fire (at least not from the beam itself) but can scorch wood or other materials if even moderately focused. They are all at least Class IIIb and some are Class IV lasers.

* The power supply is very often line-connected and operates at around 100 V with many AMPs of current available for the laser tube or for a nice path through you unsuspecting body. The igniter (starting circuit - aptly named) isn't something you want to come in contact with either. This isn't like a little HeNe power supply.

* The current in the filament and anode wiring and connectors is quite high - up to 25 AMPs or more even for a small air-cooled ion laser. Therefore, the wiring must be of adequate capacity and the male and female pins of the umbilical connectors must be clean and snug or else there will be

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a meltdown or worse. I've heard of these things catching fire due to heating at high resistance connections. Periodically inspect the pins for discoloring (from overheating) and fatigue, and replace any that are suspect. (Squeezing the female pin to make better contact may work temporarily but once overheating has occurred, the springiness is gone and this is risky as a long term cure.) For home-built systems, I would recommend using multiple pins for the high current signals even if the connector manufacturer's spec sheet suggests that a single pin should be adequate.

Having said that, argon ion lasers represent the Holy Grail for laser enthusiasts who will likely turn up their collective noses at HeNe lasers once they have become hooked.

The basic design of the argon/krypton laser is conceptually similar to that of the HeNe (or other gas) laser - plasma tube containing the active medium (argon and/or krypton gas) mirrors forming a Fabry-Perot resonator. However, unlike HeNe lasers, the energy level transitions that contribute to laser action come from ions of argon or krypton - atoms that have had 1 or 2 electrons stripped from their outer shells. Spectral lines at wavelengths less than 400 nm come from atoms that have had 2 electrons removed. Longer wavelengths come from singly ionized atoms. There are many possible transitions in the UV, visible, and IR portions of the spectrum. With suitable optics coherent light from a single spectral line or many lines may be produced simultaneously. An adjustable intra-cavity prism can even be included to permit the desired wavelength to be selected via a thumb-screw adjustment.

Beam characteristics in terms of diameter and divergence are similar to those of HeNe lasers. However, the coherence length (without additional optics) tends to be smaller than that of a HeNe laser of similar cavity length. This is because the gain curve for the ion laser transitions is wider than the one for the HeNe laser - around 2.5 GHz compared to 1.5 GHz. So, a larger number of longitudinal modes will be present and the coherence length will therefore be reduced. Coherence lengths quoted by various sources range from 2.5 to 10 cm for typical air-cooled ion lasers.

To excite the ionic transitions and achieve a population inversion, much more current is needed than for a HeNe laser. A 'small' argon laser may use 10 AMPs of current (rather than the 3 to 8 mA typical of a HeNe laser tube). Even at a tube voltage of 100 VDC, this represents about 1000 W of power dissipation. (Think of a typical space heater inside a small box!) High flow rate forced air cooling is absolutely essential - the tube would melt down in short order without it. Larger ion laser tubes may pass more than 100 AMPs of current at up to 400 VDC or more - and require three-phase power and water cooling - figure on utility substation just for your laser!

Thus, while Ar/Kr ion lasers and HeNe lasers are conceptually similar, the approximately 3 orders of magnitude greater tube current and two orders of magnitude greater power dissipation compared to a HeNe laser mean that the construction details are vastly different. You won't find one of these in a laser pointer!

Compact Low Power Ion Laser?
We all are impressed by HUGE argon ion lasers putting out 20 W or more that are 6 feet long and require 480 VAC three-phase 50 A service.

However, what about a really compact air-cooled argon ion laser only capable of a few mW but made as small as possible?

The problem no matter how you slice it is power dissipation and the bore length required to achieve adequate gain. The smallest commercial argon ion tubes have bore lengths of a little over 75 mm with a diameter of about .5 mm. These may have a lasing threshold as low as 2 A at perhaps 85 V across the tube. Assuming that such a tube could produce 2 mW at a current of 3 A and that amount of power is most that will be needed, the power dissipation of the discharge is reduced to just over 250 W max. For such a tube:

About Small Air-Cooled Ion Lasers with Huge Power Ratings
Sometimes, ion lasers turn up that are about the size of a typical small air-cooled unit but have

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CDRH power ratings of multiple WATTs. In most cases, these are lasers designed for low duty cycle applications. Both the power supply and cooling will be way underrated for CW operation.

(From: Steve Roberts (osteven@akrobiz.com).)

For CW work, 4 units of 350 cfm Patriot fans for a model 68B, the HGM5 is an ALC-68B with shortened Brewster stems, a bigger gas ballast, and a slightly wider bore, it can be 3 watt CW laser, but is usually ran duty cycled. I have seen ALC-68s do 7 watts on the bench when freshly made. The HGM does run about 500 mW CW and can be pulsed up to 3 watts max for up to say 15 seconds with the existing HGM fan, which is a big squirrel cage type.

The warning label is 5 watts on the HGM5, the medical circuitry clips the power at 3 W.

If you could cool it enough, an ALC-60X size tube can do 2 to 3 watts easily, in fact there is a medical unit that uses a small internal mirror tube at 3 watts using a closed loop water-to-air-cooler in a power-on-demand application at a 5% or so duty cycle. What limits you on an ALC-60X is the glowing red undercooled anode that will open up when you try it - spoken from experience, not conjecture. :-)

Argon lines:

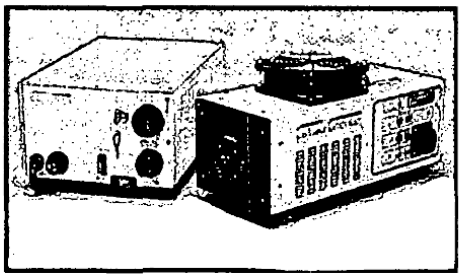
Wavelength	Relative Power	Absolute Power
454.6 nm	.03	.8 W
457.9 nm	.06	1.5 W
465.8 nm	.03	.8 W
472.7 nm	.05	1.3 W
476.5 nm	.12	3.0 W
488.0 nm	.32	8.0 W
496.5 nm	.12	3.0 W
501.7 nm	.07	1.8 W
514.5 nm	.40	10.0 W
528.7 nm	.07	1.8 W

Argon laser RIN noise :

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Remanufactured Ion Laser Technology lasers.

Model 5425A argon laser



ILT 5425

Features:
- New tube
- Air-cooled
- Power up to 200 milliwatts
- Light controlled output
- Linear polarization >100:1
- C.D.R.H. certified
- One year / 2,000 hour warranty

	ILT 5425A
Output Power*	200 milliwatt
Wavelength	457nm to 514nm
Spatial Mode	Multimode**
Beam Divergence	0.95 mRad.
Polarization	Linear >100:1
Power Required	120VAC
Item #	ILT5425A
Price	**$4,895.00**

* Output power is specified as minimum power at end of warranty.

**Single-mode operation is also available. Overall output power will be 50% lower. Multimode beam is typically the "doughnut" mode.

Coherence length: 5 cm typical.

Single frequency etalon tunable 40mW 488/514, TEM00 model 5490ASF available.

Tunable Littrow Prism (457nm to 514nm) available.

Every laser is completely remanufactured to meet or exceed original OEM specifications. Each laser is backed by our ***100% performance guarantee*** for 1 year or 2,000 hours, whichever occurs first.

Back- ILT Laser Main Page

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Phone (815) 462-9500 FAX (815) 462-8955 email

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Steve Garratt
Michael Laser Tech als @ physics.
allan.schweitzer @ gmail.com

30 mW
Tube life: slow leak. 10,000 Hrs

Out of alignment.

5425 $3500 new tube

Rent Ar laser
→ DC – 2 M
< 1% RMS
to 24 hrs
1%

power meter
Voltage output: Volume 2.5–3.5 V

Tube current: mV: 1 mV = 1 A
10 A max
Heed
adjust rear mirror
Hour meter

most likely Style Model
mirror
Single tube 435 ($14) 1/3 1/3
minimal. Kr max doubled

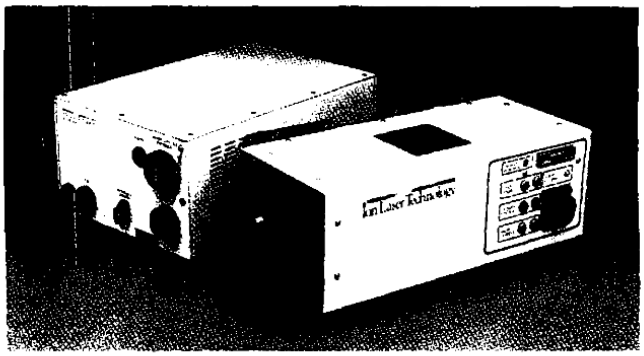
~~Grant~~
back mirror 1 spiral + 1 flat Lithium

Steve Garratt

Leak is

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ILT Model 5490A
Air-Cooled Argon Ion Laser



STANDARD FEATURES
- 100mW Multiline Output
- TEMoo/Polarized Beam
- Metal/Ceramic Plasma Tube
- Double Size Gas Reservoir for Extended Life
- Hands Off Operation
- Thermostat Controlled Air Cooling Switching Regulator Power Supply
- Excellent Power and Pointing Stability
- Invar Rod Resonator
- Light Feedback Regulation
- CDRH Certified

OPTIONAL FEATURES
- Tuneable/Singleline-Littrow Prism 457nm to 514nm
- Multimode Optics up to 300mW Output
- 19" Rackmount Power Supply Model 5401
- Remote Control (RPC-50) W/Standby Interlock
- Remote Cooling for Systems Requiring Cooling Fans to be Located Away from Laser Head
- WC Option Compatible - Allows User to Quick Change From Singleline to Multiline Operation

SYSTEM

The ILT Model 5490A Argon Ion Laser is an advanced, stat of the art coherent light source, designed with reliability in mind. The 5490A is our most versatile laser offered, and is compatible with all of ILT's available options. This in combination with a rugged ceramic/ metal plasma tube, invar resonator, switching power supply and light feedback regulation, the 5490A offers a wealth of advantages for

PLASMA TUBE

The ILT plasma tube is constructed of BeO ceramic with enlarged metal end shrouds. This provides high thermal conductivity and large gas volume for extended tube lifetime. This tube is designed with brewster windows sealed on each end and external mirrors, providing high polarization and high spectral purity when used with our littrow prism option. This design also gives the end user a simple and less expensive, typically half the cost, tube to refurbish when the time comes.

RESONATOR

The plasma tube is housed in a lightweight aluminum resonator structure which utilizes a four invar rod design. This design provides excellent mechanical and beam pointing stability. The mirror mounts are held in place with a one piece, solid spring steel adjustment gimble. This unique combination provides field proven, hands free operation. The resonator also incorporates a molecular sieve dryer system attached to teflon tube to mirror seals which provides guaranteed maintenance free operation, even in humid environments.

Laser head cooling is accomplished by using two high volume fans located at each end of the resonator. Air moves across the anode and cathode shrouds and exits through a fully brazed pure copper heat sink.

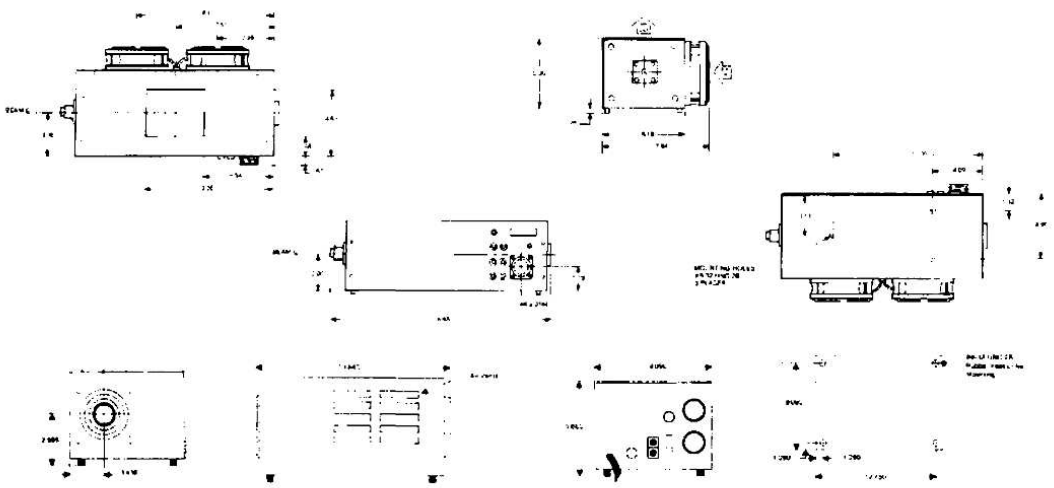
A fan thermostat controls cooling fans and monitors tube temperature. Fans turn on when tube is up to operating temperature and turn off only after tube is completely cooled down. As a result, the tube can warm up and cool down faster.

POWER SUPPLY

The laser head is powered by the Model 5400 or optional 5401, high efficiency, switching regulator power supply. These power supplies incorporate a MOSFET switching bridge and high frequency isolation transformer. This exclusive design permits a wide range of operating voltages (100VAC, 120VAC, or 240VAC) and adds total line isolation. Both supplies come standard with light feedback regulation which gives the user excellent amplitude and long term power stability. The 5400 is supplied with interlock remote connection, key switch, and remote control interface. The system can be controlled manually via power control on laser head or remotely by a host system or the Model RPC-50 remote control. The RPC-50 has a 4 inch high resolution LED bar graph display. This display reads out laser power and tube current. The RPC-50 also has run/standby switch, and display of system interlocks that provide diagnostic information in the event of system failure.

Ion Laser Technology has united high technological ingenuity with no nonsense design to provide our customers with the most reliable laser systems available today. This commitment combined with quick turnaround by ILT service technicians, demonstrates Ion Laser Technology's standard of performance plus support.

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OUTPUT SPECIFICATIONS

Multiline	100mw (all lines)						
SingleLine Tuneable	457.9nm 6.0mw	465.8nm 5.5mw	476/472.7nm 10.0mw	488nm 40.0mw	496.5nm 10.0mw	501nm 7.0mw	514nm 40.0mw

PERFORMANCE SPECIFICATIONS

Beam Diameter $1/e^2$	.65mm
Beam Divergence	.95mrad
Full angle	
Polarization	> 100:1
E-Vector Vertical	
A.R. Spot	< 25%
Transverse Mode	TEM_{00}
(Higher order modes available on multiline models with increase output power)	
Warm-up time (cold start)	
Multiline models	< 5 mins.
Littrow Prism models	< 15 mins
From standby	Immediate
Beam Pointing Stability	
After warm-up	< 30 microradians
Periodic	10 microradians
Beam Amplitude Noise	
DC to 2MHZ	< 1% RMS
Long Term Power Stability	
2 hours at constant ambient conditions	1%

ELECTRICAL SPECIFICATIONS

Voltage	115VAC ± 10%
Optional	220VAC ± 10%
Current	20 Amp
Frequency	60 hz
Optional	47 to 63 Hz
Phase	Single
Power Supply	30 KHz
Switching Frequency	

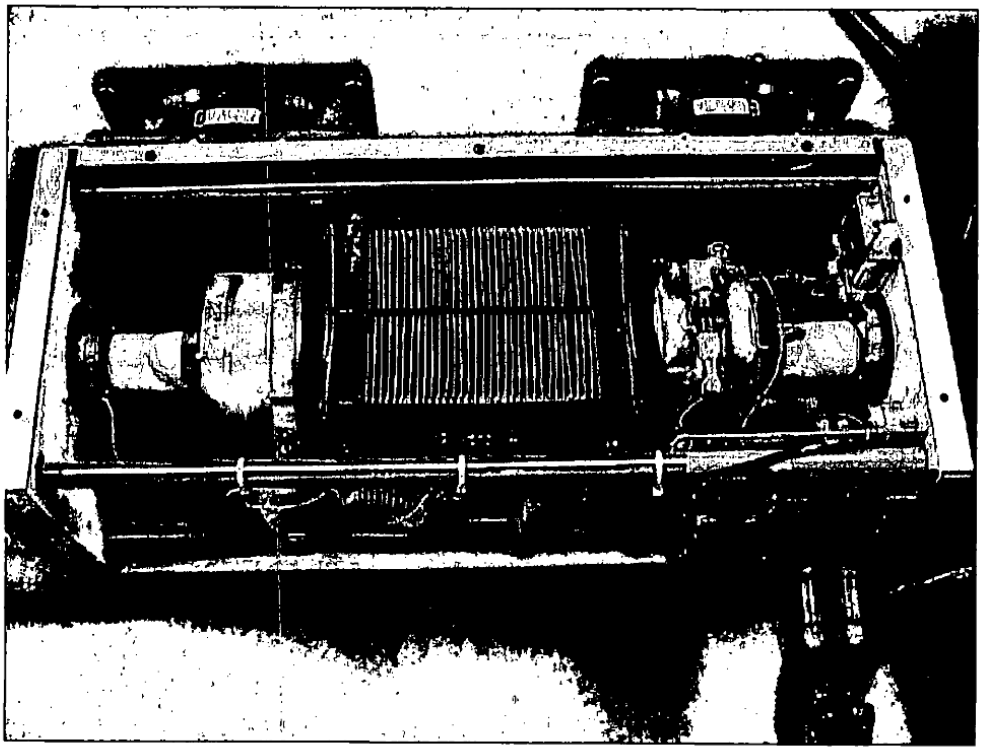
SHIPPING SPECIFICATIONS

Power Supply Weight	20 lbs.
Shipping Weight	23 lbs.
Laser Head Weight	20 lbs.
Shipping Weight	31 lbs.

Specifications subject to change without notice.

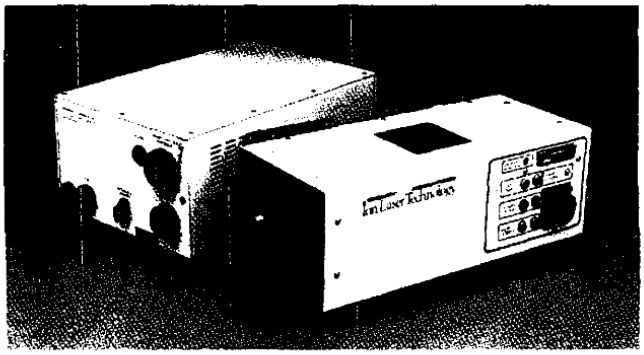


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ILT Model 5490A
Air-Cooled Argon Ion Laser



STANDARD FEATURES
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- TEMoo/Polarized Beam
- Metal/Ceramic Plasma Tube
- Double Size Gas Reservoir for Extended Life
- Hands Off Operation
- Thermostat Controlled Air Cooling
- Switching Regulator Power Supply
- Excellent Power and Pointing Stability
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- CDRH Certified

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- Multimode Optics up to 300mW Output
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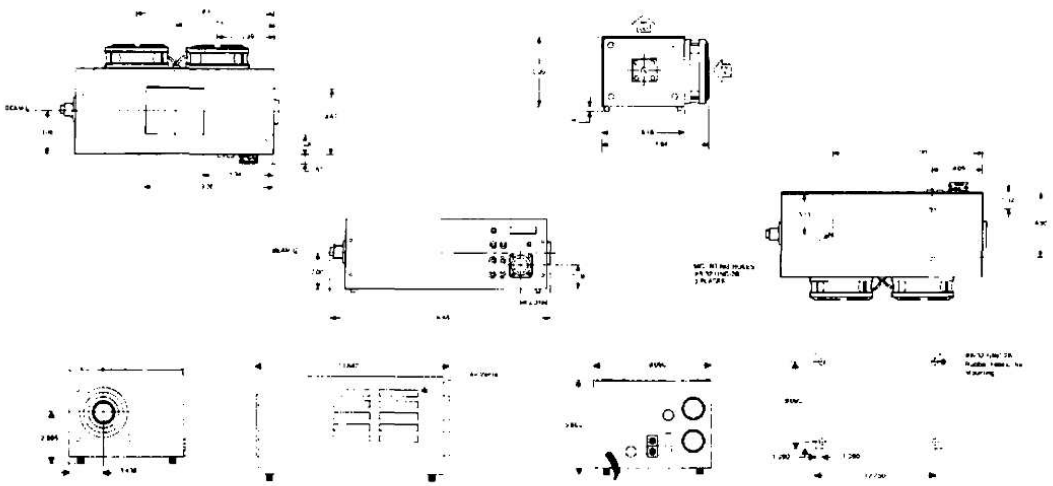
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SingleLine	457.9nm	465.8nm	476/472.7nm	488nm	496.5nm	501nm	514nm
Tuneable	6.0mw	5.5mw	10.0mw	40.0mw	10.0mw	7.0mw	40.0mw

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Beam Diameter $1/e^2$	.65mm
Beam Divergence	.95mrad
Full angle	
Polarization	> 100:1
E-Vector Vertical	
A.R. Spot	< .25%
Transverse Mode	TEM_{00}
(Higher order modes available on multiline models with increase output power)	
Warm-up time (cold start)	
Multiline models	< 5 mins.
Littrow Prism models	< 15 mins.
From standby	Immediate
Beam Pointing Stability	
After warm-up	< 30 microradians
Periodic	10 microradians
Beam Amplitude Noise	
DC to 2MHZ	< 1% RMS
Long Term Power Stability	
2 hours at constant ambient conditions	1%

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Voltage	115VAC ± 10%
Optional	220VAC ± 10%
Current	20 Amp
Frequency	60 hz
Optional	47 to 63 Hz
Phase	Single
Power Supply	30 KHz
Switching Frequency	

SHIPPING SPECIFICATIONS

Power Supply Weight	20 lbs.
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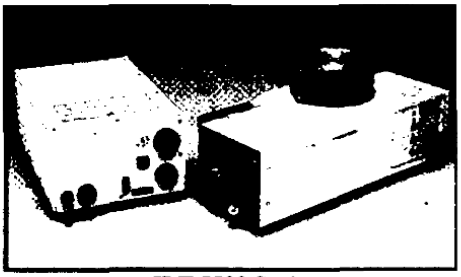


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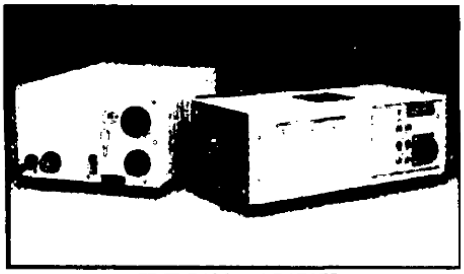


Remanufactured Air-Cooled Argon & Krypton Lasers.

Originally manufactured by Ion Laser Technolgy Inc.

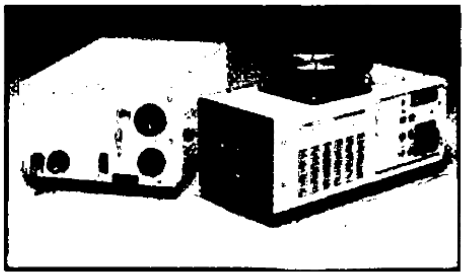


ILT 5500 Series



ILT 5490A / 5470K

Features:
- New tube
- Air-cooled
- Power up to 1/2 Watt
- Light contolled output
- Linear polarization >100:1
- C.D.R.H. certified
- One year / 2,000 hour warranty



ILT 5425

Argon Lasers

Model	Output Power*	Base Price
ILT5500A	1/2 Watt	$6,595.00
ILT5490A	200 milliwatt	$4,895.00
ILT5425A	200 milliwatt	$4,895.00

Ion Laser Technology
General Product Information:
(7Mbytes)
ILT5000 Series

Argon/Krypton mixed-gas Lasers

Model	Output Power*	Base Price
ILT5470K	50 milliwatt	$5,985.00

* Output power is specified as minimum power at end of warranty with multiline, multimode optics.

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Tunable Littrow Prism (457nm to 514nm) available for argon lasers.
Single line and single mode optics also available.

All of these lasers are completely remanufactured to meet or exceed original OEM specifications. Each laser is backed by our ***100% performance guarantee*** for 1 year or 2,000 hours.

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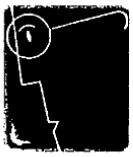
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Company Overview

Midwest Laser Products, LLC is a leading source for new, used, and surplus laser equipment. Our customers include domestic and international corporations, educational institutions, and individuals. We have a diverse line of products ranging from new laser diode modules to used research, medical, and industrial lasers. See our `Products' section for a list of items available, or go to `Purchasing' if you have items you would like to sell. We guarantee every piece of equipment we sell. See our terms for further information.



Sales / Customer Service

For help with sales or to reach customer service please call **815-462-9500** Monday through Friday 8:30am to 5:00pm (CST).

Mission Statement

Midwest Laser Products is dedicated to providing its customers quality new and used laser equipment. We place extremely high regard on the practice of business in a professional and ethical manner and strive to maintain confidence and satisfaction in all of our customers.

Company Background

Since 1988 Midwest Laser Products has been providing its customers quality new and surplus lasers. In the beginning our emphasis was on helium-neon, and argon lasers. These were the most affordable lasers that met the needs of many hobbyists, holographers, educators, and others. With the advent of commercially available visible (red) laser diodes, we began distributing laser diodes and collimating lenses in 1990, and complete laser diode modules shortly thereafter. We are now an independent manufacturer/distributor of: laser diode modules, diode-pumped green lasers, and laser scanners . We also carry a variety of laser systems which are new, surplus, and previously owned, including: argon, helium-neon, Nd:YAG, Helium-Cadmium, and others.

Locations:

Mailing Address:
P.O. Box 262
Frankfort, IL 60423

Returns / Shipments:
342 N LaGrange Rd Ste 102
Frankfort, IL 60423

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We Would Like to Hear from You

If you have any comments or suggestions about our web site please fill out our feedback form. We appreciate your input.

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Newton, NJ 07860-0366
www.thorlabs.com

PH. 973-579-7227
FAX 973-300-3600
technicalsupport@thorlabs.com

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:	350-1100nm	**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 x 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		

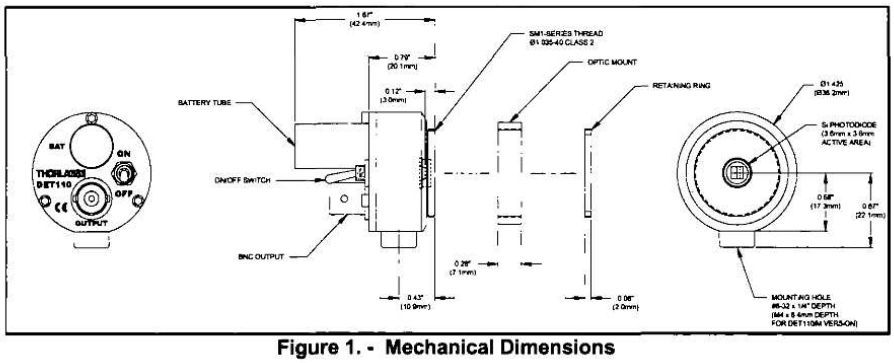


Figure 1. - Mechanical Dimensions

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:

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

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

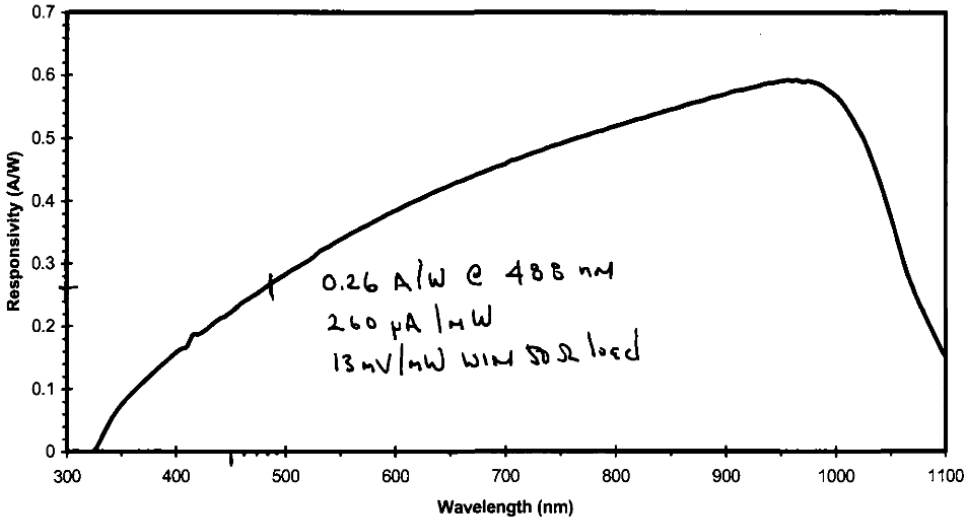
2199-S01 Rev D 8/15/2005

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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



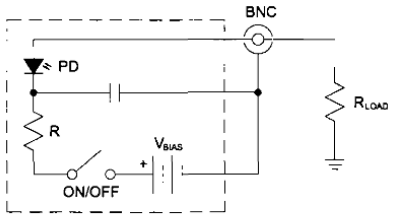


Figure 3 – Circuit Block Diagram

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.

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WEEE

As required by the WEEE (Waste Electrical and Electronic Equipment Directive) of the European Community and the corresponding national laws, Thorlabs offers all end users in the EC the possibility to return "end of life" units without incurring disposal charges.

This offer is valid for Thorlabs electrical and electronic equipment

- sold after August 13th 2005
- marked correspondingly with the crossed out "wheelie bin" logo (see fig. 1)
- sold to a company or institute within the EC
- currently owned by a company or institute within the EC
- still complete, not disassembled and not contaminated

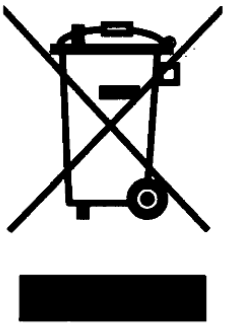
As the WEEE directive applies to self contained operational electrical and electronic products, this "end of life" take back service does not refer to other Thorlabs products, such as

- pure OEM products, that means assemblies to be built into a unit by the user (e. g. OEM laser driver cards)
- components
- mechanics and optics
- left over parts of units disassembled by the user (PCB's, housings etc.).

If you wish to return a Thorlabs unit for waste recovery, please contact Thorlabs or your nearest dealer for further information.

Waste treatment on your own responsibility
If you do not return an "end of life" unit to Thorlabs, you must hand it to a company specialized in waste recovery. Do not dispose of the unit in a litter bin or at a public waste disposal site.

Ecological background
It is well known that WEEE pollutes the environment by releasing toxic products during decomposition. The aim of the European RoHS directive is to reduce the content of toxic substances in electronic products in the future.
The intent of the WEEE directive is to enforce the recycling of WEEE. A controlled recycling of end of live products will thereby avoid negative impacts on the environment.



Crossed out "wheelie bin" symbol

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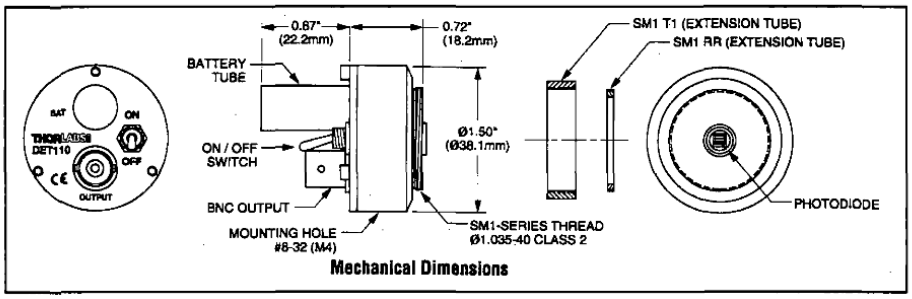
HIGH-SPEED SILICON DETECTOR - DET110

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) which provides 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:**	1.50" RD x 1.60"
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 x 10^{-14}W/?HZ	**Diode Socket:**	TO-5, Anode Marked
Dark Current:	10nA	**Damage Threshold:**	100mW CW
Active Area:	13mm^2		0.5 J/cm^2 (10ns pulse)
	3.6mm x 3.6mm square		
Linearity Limit:	1mW		



Mechanical Dimensions

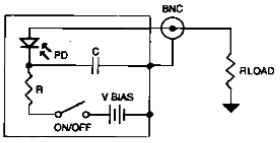
Thorlab's DET series are ideal for measuring both pulsed and CW light sources. The DET110 includes a reverse-biased PIN photo diode, bias battery, and an ON/OFF switch packaged in a ruggedized housing. The BNC output signal is the direct photocurrent out of the photo diode anode and is a function of the incident light power and wavelength. The responsivity, $\Re(\lambda)$, can be read from Figure 1 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}:

$$f_{BW} = 1/(2\pi^*R_{LOAD}^*C_J),\ T_R = 0.35/f_{BW}$$

Notes:
1. Measuring with a 50Ω Terminating Resistor.

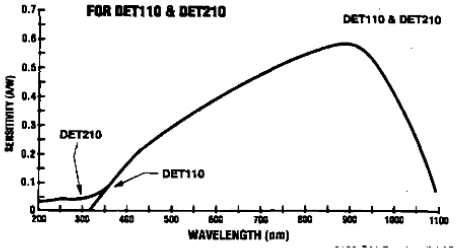


For maximum bandwidth, we recommend using a 50Ω coax cable with a 50Ω terminating resistor at the end of the coax. This will also minimize ringing by matching the coax with its characteristic impedance. If bandwidth is not important, you can increase the amount of voltage for a given input light by increasing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

Also Available: 1ns Silicon, Germanium Detectors (800-1800nm), InGaAs and amplified detectors.

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.

TYPICAL SPECTRAL RESPONSE FOR DET110 & DET210



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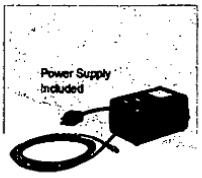
Click here to visit the Amplified Photodetectors page with pricing and availability information on Thorlabs.com

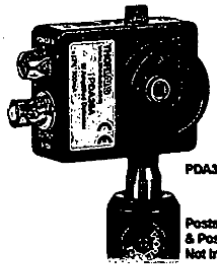
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FAX: (973) 300-3600
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Amplified Photodetectors

- ▷ InGaAs, Si, GaP, PbS and PbSe Versions Available
- ▷ DC-150MHz or Switchable Gain Detectors
- ▷ Spectral Range: 150 - 4800nm







NEW DETECTOR DESIGN
For Details Click
New/Old Design Tab Below

Overview

PDA Series Features

- Low-Noise, Wide Band Amplifiers
- Detector Types: GaP, Si, Ge, InGaAs, PbS, and PbSe
- Wavelength Ranges from 150 to 4800 nm
- Bandwidth up to 150 MHz
- High-Speed PIN Photodiodes
- 0 to 10 V Output
- Compatible with SM1 Series and SM05 Series Products
- **Threaded Mount for Ø1" (Ø25 mm) Optics Included**
- **Power Supply Included**

The PDA series of Amplified Photodetectors integrates a wide range of photodiodes with an amplifier into compact packages. The modules possess a thin profile to allow access to light paths with the minimum amount of interference. All connections and controls are located perpendicular to the light path, providing increased accessibility. The low noise transimpedance or voltage amplifiers are capable of driving 50 Ω loads. All units include a removable threaded coupler that is compatible with many Thorlabs SM1 and SM05 threaded accessories. This allows convenient mounting of external optics, optical fibers, and apertures, as well as providing an easy mounting mechanism when using Thorlabs cage assembly accessories. Each housing provides two 8-32 tapped mounting holes (M4 for - EC versions) centered on the detector surface. A 120 VAC AC/DC power supply is included (230 VAC for - EC versions).

Switchable Gain Modules
The following modules feature gain adjustment over a 70 dB range to take full advantage of the photodiode response. Gains are adjustable from 1.5 kV/A to 4.7 MV/A in eight steps of 10 dB each. Choose from the following switchable gain units:

Item #	Type	Wavelength Range
PDA25K	GaP	UV (150 - 550 nm)
PDA36A	Si	VIS-NIR (350 - 1100 nm)
PDA100A	Si	VIS-NIR (400 - 1100 nm) *
PDA10CS	InGaAs	NIR (700 - 1800 nm)
PDA50B	Ge	NIR (800 - 1800 nm) *
* Large area detector		

Ultra Low Noise Detectors
The PDA8A Series feature an exceptionally low noise with a high fixed gain:

Item #	Type	Wavelength Range
PDA8A	Si	VIS-NIR (320 - 1000 nm)

Please view the *Specs* tab for complete specifications of all models.

Wideband Detectors
Some models in this series feature large bandwidth (DC - 150 MHz) while still maintaining low noise. These include:

Item #	Type	Wavelength Range
PDA10A	Si	VIS-NIR (200 - 1100 nm)
PDA10CF	InGaAs	NIR (700 - 1800 nm)

IR Detectors
Thorlabs has introduced three new IR Amplified Detectors. Two models feature lead salt detectors with fixed gain AC coupled amplifiers. The third model is an extended range InGaAs detector with a fixed gain transimpedance amplifier with an operating bandwidth from DC -15 MHz.

Item #	Type	Wavelength Range
PDA10D	InGaAs	IR (1.2 - 2.6 µm)
PDA30G	PbS*	IR (1.0 - 2.9 µm)
PDA20H	PbSe*	IR (1.5 - 4.8 µm)
* The PbS and PbSe detectors have AC coupled amplifiers		

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Specs

Performance Specifications

Sensor	Item #	Replaces	Active Area	Wavelength	Peak Response	Bandwidth	NEP ($W/Hz^{1/2}$)	Rise Time[b] (ns)
Si (VIS-NIR)	**PDA8A**	*NEW*	0.5 mm² (Ø0.8 mm)	320 - 1000 nm	0.56 A/W @ 820 nm	DC - 50 MHz	6.5×10^{-12}	7
	PDA10A	PDA155	0.8 mm² (Ø1.0 mm)	200 - 1100 nm	0.45 A/W @ 750 nm	DC - 150 MHz	3.5 x 10-11	2.3
	PDA36A	PDA55	13 mm² (3.6 mm x 3.6 mm)	350 - 1100 nm	0.65 A/W @ 970 nm	DC - 17 MHz	2x10-12	20.6
	PDA100A	PDA520	75.4 mm² (Ø9.8 mm)	400 - 1100 nm	0.65 A/W @ 970 nm	DC - 1.5 MHz	2x10-12	233.3
Ge (NIR)	**PDA50B**	*NEW*	19.6 mm² (Ø5.0 mm)	800 - 1800 nm	0.85 A/W @ 1550 nm	DC - 400 kHz	6×10^{-12}	875.0
GaP (UV-VIS)	**PDA25K**	*NEW*	4.8 mm² (2.54 mm x 2.54 mm)	150 - 550 nm	0.12 A/W @ 440 nm	DC - 7.5 MHz	7×10^{-12}	46.6
InGaAs (NIR-IR)	**PDA10CF**	PDA255	0.2 mm² (Ø0.5 mm)	700 - 1800 nm	0.95 A/W @ 1550 nm	DC - 150 MHz	5.5×10^{-11}	2.3
	PDA10CS	PDA400	0.8 mm² (Ø1.0 mm)	700 - 1800 nm	0.95 A/W @ 1550 nm	DC - 17 MHz	$2x10^{-12}$	20.6
	PDA10D	*NEW*	0.8 mm² (Ø1.0 mm)	1.2 - 2.6 µm	1.1 V/W @ 2.3 µm	DC - 15 MHz	$3.5x10^{-11}$	20.6
PbS (IR)[a]	**PDA30G**	*NEW*	3 mm x 3 mm	1.0 µm - 2.9 µm	1.5 x 106 V/W @ 2.2 µm	0.2 - 1 kHz	1.5×10^{-11}	350
PbSe (IR)[a]	**PDA20H**	*NEW*	2 mm x 2 mm	1.5 µm - 4.8 µm	2 x 105 V/W @ 4 µm	0.2 - 10 kHz	1.5×10^{-10}	35

a) *This detector has an AC coupled amplifer.*
b) *Please note that rise times depend on the chosen gain level. As one increases the gain of a given optical amplifier, the bandwidth is reduced, and hence, the rise time increases.*

Gain Specifications

Fixed Gain Photo Detector	Gain Type	Gain w/ HiZ Load	Gain w/ 50 Ω Load	Output Voltage w/ HiZ Load	Output Voltage w/ 50 Ω Load
PDA8A	Fixed	100 kV/A	50 kV/A	0 - 3.6 V	0 - 1.8 V
PDA10A	Fixed	10 kV/A	5 kV/A	0 - 10 V	0 - 5 V
PDA10CF	Fixed	10 kV/A	5 kV/A	0 - 10 V	0 - 5 V
PDA10D	Fixed	10 kV/A	5 kV/A	0 - 10 V	0 - 5 V
PDA30G	Fixed	100x	50x	± 10 V	± 5 V
PDA20H	Fixed	100x	50x	± 10 V	± 5 V

Switchable Gain Photo Detector	Gain Step (dB)	Gain w/ HiZ Load	Gain w/ 50 Ω Load	Output Voltage w/ HiZ Load	Output Voltage w/ 50 Ω Load
PDA36A **PDA100A** **PDA50B** **PDA25K** **PDA10CS**	0	1.5 kV/A	0.75 kV/A	0 - 10 V	0 - 5 V
	10	4.75 kV/A	2.38 kV/A	0 - 10 V	0 - 5 V
	20	15 kV/A	7.5 kV/A	0 - 10 V	0 - 5 V
	30	47.5 kV/A	23.8 kV/A	0 - 10 V	0 - 5 V
	40	150 kV/A	75 kV/A	0 - 10 V	0 - 5 V
	50	475 kV/A	238 kV/A	0 - 10 V	0 - 5 V
	60	1.5 MV/A	750 kV/A	0 - 10 V	0 - 5 V
	70	4.75 MV/A	2.38 MV/A	0 - 10 V	0 - 5 V

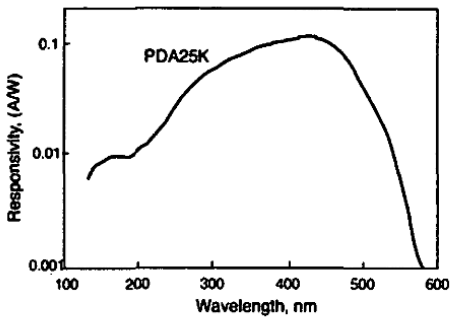
Note: Gain figures can also be expressed in units of Ω.

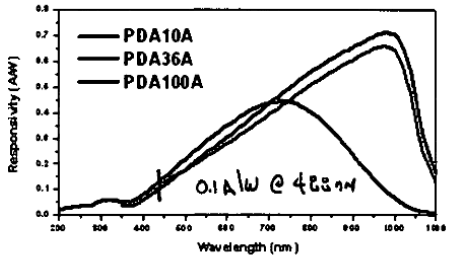
Graphs

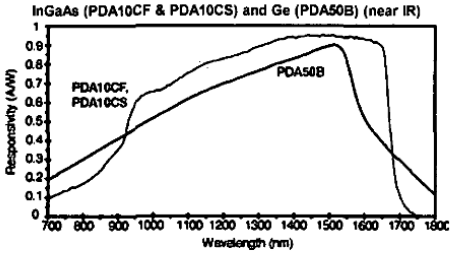
Responsivity Data for PDA Photodiodes

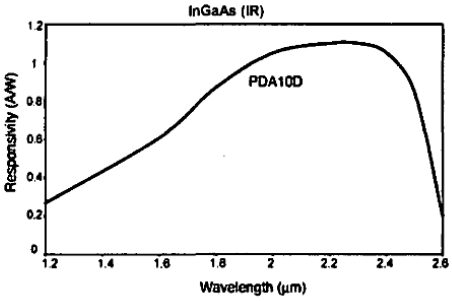
GaP (UV, visible) Si (visible, near IR)

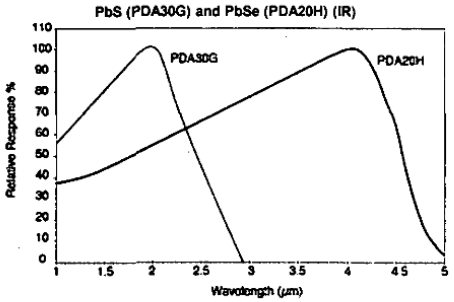
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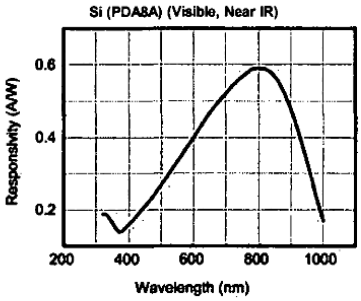












New vs Old Design

Cross Reference

Sensor	Obsolete Part	Replacement Part
Si	PDA155	PDA10A
	PDA55	PDA36A
	PDA520	PDA100A
InGaAs	PDA255	PDA10CF
	PDA400	PDA10CS

Click on Obsolete Part number to view its product page.

Changes to PDA Design

We have made a few changes to the housing of our popular optical detector modules. These changes will not affect the opto-electronic performance of these devices, but will make them easier to use in dense optical systems. The new design is more compact with a significantly reduced body thickness which allows the detector access to the light path even between closely spaced optical elements.

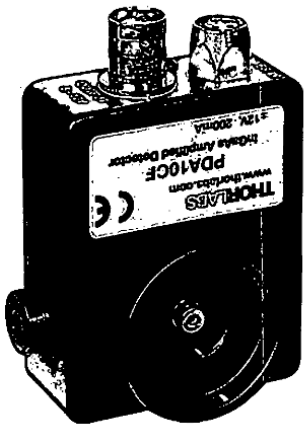
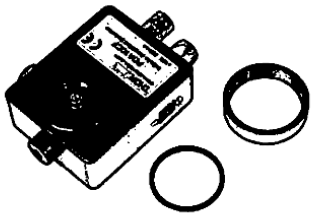
Building on the slimmer package design, we have also moved things around to make the detector packages more flexible and easier to adjust in actual applications. The power supply input and the BNC output are now located on an outer edge of the package. Previously, the cables protruded out the back of the device, greatly adding to the overall thickness of the package. These changes now allow the package to fit into spaces as thin as 1.1" (27.9 mm); the old design, with its thicker body style, and with the electrical connections protruding out the back required a minimum gap of 3" (75 mm). Additionally, the detectors now have two tapped mounting holes perpendicular to each other, so that the unit can be mounted in a horizontal or vertical orientation. This dual mounting feature offsets the fact that the cables protrude out the side of the package thus requiring more free space above or alongside your beam path.

For the amplified detectors, we have also moved the user controls to an outside edge. Please click on the specifications tab to view a cross-reference chart that relates the new part numbers to the older ones. These changes were prompted by customer comments, if you have any thoughts on how we can improve any of our products or services please contact us, either by phone or by sending in a note via the feedback link on our homepage, (see the "**Hungry for Your Thoughts**" link).

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Mounting Options

The PDA series photodetector housing is compatible with our entire line of lens tube, TR series post, and cage mounting systems. Because of the flexibility, the best method for mounting the housing in a given optical setup is not always obvious. The pictures and text in this tab will discuss some of the common mounting solutions. As always, our technical support staff is available for individual consultation.

		
Picture of a PDA series photodetector as it will look when unpackaged.	Picture of a PDA series photodetector with the included SM1T1 and its retaining ring removed from the front of the housing.	A close up picture of the front of a PDA series photodetector with the SM1T1 removed. The external SM1and internal SM05 threading on the photodetector housing can be seen in this image.

Lens Tube System

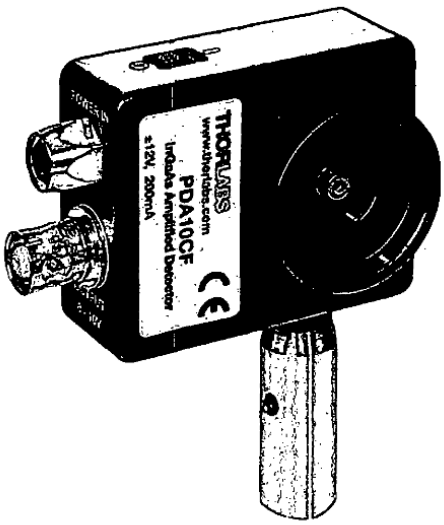
Each PDA housing includes a detachable Ø1" Optic Mount (SM1T1) that allows for Ø1" (Ø25.4 mm) optical components, such as optical filters and lenses, to be mounted along the axis perpendicular to the center of the photosensitive region. The maximum thickness of an optic that can be mounted in the SM1T1 is 0.1" (2.8 mm). For thicker Ø1" (Ø25.4 mm) optics or for any thickness of Ø0.5" (Ø12.7 mm) optics, remove the SM1T1 from the front of the detector and place (must be purchased separately) an SM1 or SM05 series lens tube, respectively, on the front of the detector.

The SM1 and SM05 threading on the PDA photodetector housing make it compatible with our SM lens tube system and accessories. Two particularly useful accessories include the SM threaded irises and the SM compatible IR and visible alignment tools. Also available are fiber optic adapters for use with connectorized fibers; please see the *Accessories tab* above.

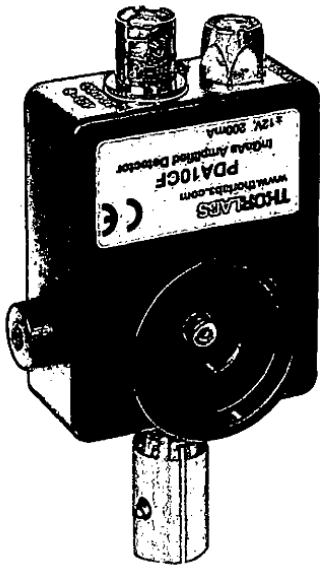
TR Series Post (Ø1/2" Posts) System

The PDA housing can be mounted vertically or horizontally on a TR Series Post using the #8-32 (M4) threaded holes.

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PDA series photodetector mounted horizontally on a TR series post. Notice how the on/off switch is easily accessible from the top and the electrical connection comes in perpendicular to the beam path.



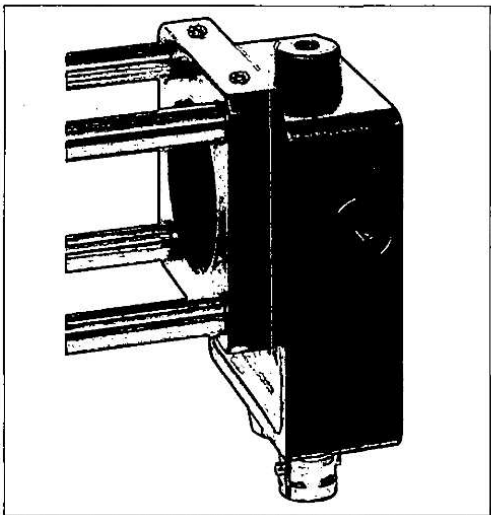
PDA series photodetector mounted vertically on a TR series post.

Cage System

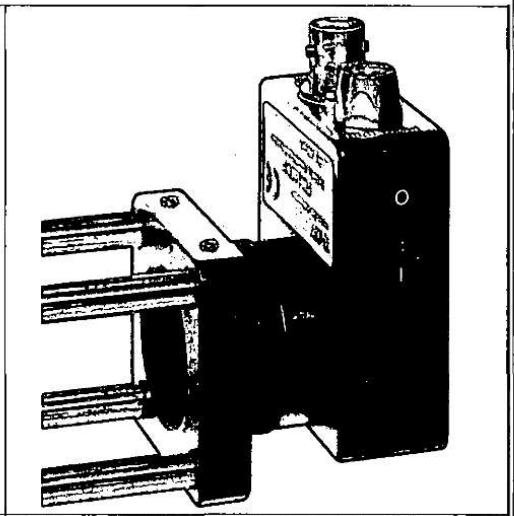
The simplest method for attaching the PDA photodetector housing to a cage plate is to remove the SM1T1 that is attached to the front of the PDA when it is shipped. This will expose external SM1 threading that is deep enough to thread the photodetector directly to a CP02 30 mm cage plate. When the CP02 cage plate is tightened down onto the PDA photodetector housing the cage plate will not necessarily be square with the detector. To fix this, back off the cage plate until it is square with the photodetector and then use the retaining ring included with the SM1T1 to lock the PDA photodetector into the desired location. This method for attaching the PDA photodetector housing to a cage plate does not allow for much freedom in determining the orientation of the photodetector; however, it has the benefit of not needing an adapter piece and it allows the diode to be as close as possible to the cage plate, which can be important in setups where the light is divergent. On a side note, Thorlabs sells the SM05PD and SM1PD series of photodiodes that can be threaded into a cage plate so that the diode is flush with the front surface of the cage plate; however, the photodiode is unbiased.

For more freedom in choosing the orientation of the PDA photodetector housing when attaching it, a SM1T2 lens tube coupler can be purchased. In this configuration the SM1T1 is left on the detector and the SM1T2 is threaded into it. The exposed external SM1 threading is now deep enough to secure the detector to a CP02 cage plate in any orientation and lock it into place using one of the two locking rings on the ST1T2.

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This picture shows a PDA series photodetector attached to a CP02 cage plate after removing the SM1T1. The retaining ring from the SM1T1 was used to make the orientation of the detector square with the cage plate.

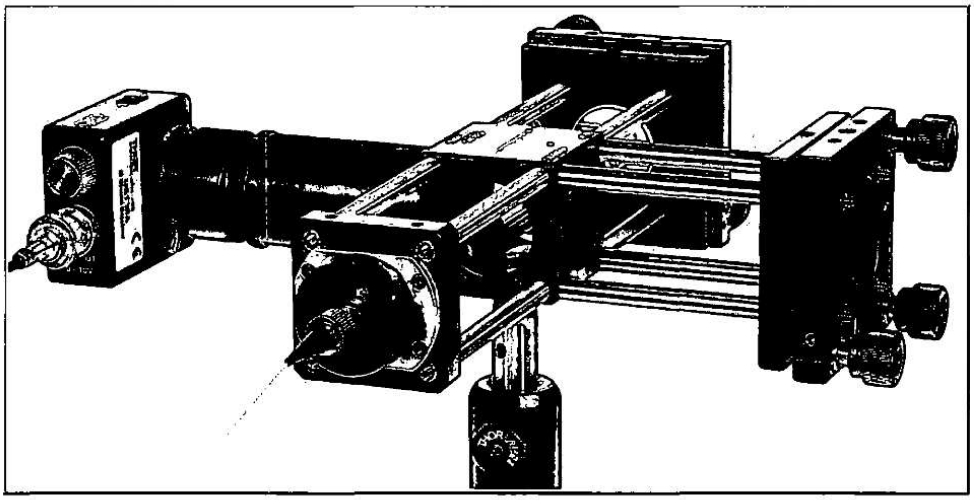


This picture shows a PDA series photodetector attached to a CP02 cage plate using an SM1T2 adapter in addition to the SM1T1 that comes with the PDA series detector.

Although not pictured here, the PDA photodetector housing can be connected to a 16 mm cage system by purchasing a SM05T2. It can be used to connect the PDA photodetector housing to a SP02 cage plate.

Application

The image below shows a Michelson Interferometer built entirely from parts available from Thorlabs. This application demonstrates the ease with which an optical system can be constructed using our lens tube, TR series post, and cage systems. A PDA series photodetector is interchangable with the DET series photodetector shown in the picture.



Item#	Quantity	Description	Item#	Quantity	Description
KC1	2	Mirror Mount	SM1V05	1	Ø1" Adjustable Length Lens Tube

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Item#	Quantity	Description	Item#	Quantity	Description
BB1-E03	2	Broadband Dielectric Laser Mirrors	SM1D12	1	SM1 Threaded Lens Tube Iris
ER4	12	Cage Rods	CP02FP	1	30 mm Cage Plate for FiberPorts
CM1-BP2	1	Mounted Pellicle Beamsplitter	SM1L20	1	Ø1" Lens Tube, 1" in Length
DET36A	1	Biased Photodiode Detector	PAF-X-2-B	1	FiberPort
TR2	1	Ø1/2" Post, 2" in Length	BA2	1	Post Base (not shown in picture)
PH2-ST	1	Ø1/2" Post Holder	P1-830A-FC-2	1	Single Mode Fiber Patch Cable

The table contains a part list for the Michelson Interferometer with links to the pages that contain information about the individual parts.

Si Photodetectors: VIS - NIR Wavelengths

Order PartNumber	Description	Price	Availability
PDA8A	NEW! 320 - 1000 nm Fixed Gain, Low Noise Si Detector, 120 VAC	$600.00	Lead Time
PDA10A	200-1100 nm Fixed Gain Si Detector, 120 VAC Power Supply	$278.00	Today
PDA36A	350-1100 nm Switchable Gain Si Detector, 120 VAC Power Supply	$299.00	Today
PDA100A	400-1100 nm Large Area, Switchable Gain Si Detector, 120 VAC Power Supply	$305.00	Today
PDA8A/M	NEW! 320 - 1000 nm Fixed Gain, Low Noise Si Detector, 230 VAC	$600.00	Today
PDA10A-EC	200-1000 nm Fixed Gain Si Detector, 230 VAC Power Supply	$278.00	Today
PDA36A-EC	350-1100 nm Switchable Gain Si Detector, 230 VAC Power Supply	$329.00	Today
PDA100A-EC	400-1100 nm Large Area, Switchable Gain Si Detector, 230 VAC Power Supply	$335.00	Today

Ge Photodetectors: NIR Wavelengths

Order PartNumber	Description	Price	Availability
PDA50B	800-1800 nm Large Area, Switchable Gain Ge Detector, 120 VAC Power Supply	$469.00	Today
PDA50B-EC	800-1800 nm Large Area, Switchable Gain Ge Detector, 230 VAC Power Supply	$499.00	Today

GaP Photodetectors: UV - VIS Wavelengths

Order PartNumber	Description	Price	Availability
PDA25K	150-550 nm Switchable Gain, GaP Detector, 120 VAC Power Supply	$369.00	Today
PDA25K-EC	150-550 nm Switchable Gain, GaP Detector, 230 VAC Power Supply	$399.00	Today

InGaAs Photodetectors: NIR - IR Wavelengths

Order PartNumber	Description	Price	Availability
PDA10CF	700-1800 nm Fixed Gain InGaAs Detector, 120 VAC Power Supply	$369.00	Today
PDA10CS	700-1800 nm Switchable Gain InGaAs Detector, 120 VAC Power Supply	$369.00	3- 5 Days
PDA10D	1.2-2.6 µm Fixed Gain InGaAs Detector, 120 VAC Power Supply	$460.00	Today
PDA10CF-EC	700-1800 nm Fixed Gain InGaAs Detector, 230 VAC Power Supply	$369.00	Today
PDA10CS-EC	700-1800 nm Switchable Gain InGaAs Detector, 230 VAC Power Supply	$399.00	Today
PDA10D-EC	1.2-2.6 µm Fixed Gain InGaAs Detector, 230 VAC Power Supply	$460.00	Today

PbS and PbSe Photodetectors: IR Wavelengths

Order PartNumber	Description	Price	Availability
PDA20H	1.5-4.8 µm PbSe Detector, Fixed Gain AC Coupled Amplifier, 120 VAC Power Supply	$398.00	Today
PDA30G	1.0-2.9 µm PbS Detector, Fixed Gain AC Coupled Amplifier, 120 VAC Power Supply	$364.00	Today
PDA30G-EC	1.0-2.9 µm PbS Detector, Fixed Gain AC Coupled Amplifier, 230 VAC Power Supply	$364.00	Today

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PDA20H-EC	1.5-4.8 µm PbSe Detector, Fixed Gain AC Coupled Amplifier, 230 VAC Power Supply	$398.00	Today

PDA Power Supply Cable



The PDA-C-72 is a power cord for the PDA line of amplified photodetectors. The cord has tinned leads on one end and a PDA compatible 3-pin connector on the other end. It can be used to power the PDA series of amplified photodetectors with any suitable power supply. PDA pin descriptions are shown here.



Pin 1: +12 V
Pin 3: -12 V
Pin 4: GND

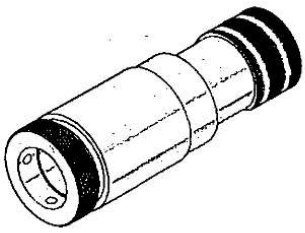
Female Connector on PDA

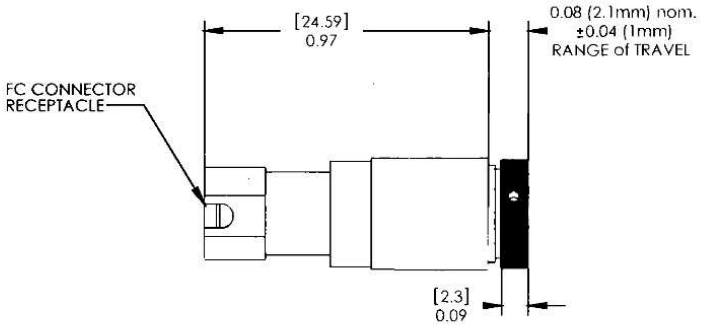
Order

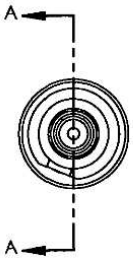
PartNumber	Description	Price	Availability
PDA-C-72	72" PDA Power Supply Cable, 3- pin connector	$16.95	Today

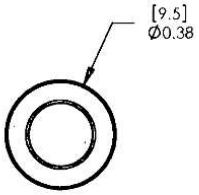
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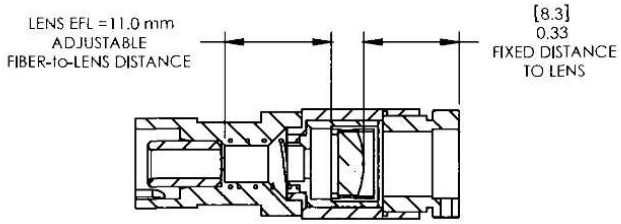
ITEM #	EFL (mm)	INPUT MFD (um)	OUTPUT BEAM DIA. (mm)	MAX WAIST DIST (mm)	DIVERGENCE (mrad)	CA (mm)	NA	AR COATING	CONNECTOR
CFC-11-A	11	3.5	1.8	2800	0.32	4.4	0.20	400-600nm	FC/PC
CFC-11-B	11	4.3	2.1	2700	0.39	4.4	0.20	600-1050nm	FC/PC
CFC-11-C	11	10.4	2.1	1100	0.95	4.4	0.20	1050-1600nm	FC/PC











SECTION A-A

FOR INFORMATION ONLY, NOT FOR MANUFACTURING

	NAME	DATE
DRAWN	EJM	07/23/08
ENG APPR.	JMM	07/23/08
MFG APPR.	JMM	07/23/08

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THORLABS INC. PO BOX 366 NEWTON NJ

TITLE: 11mm FL ADJUSTABLE COLLIMATOR

MATERIAL: N/A

SIZE: A REV: A

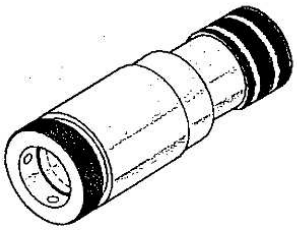
SCALE: 2:1

SHEET 1 OF 1

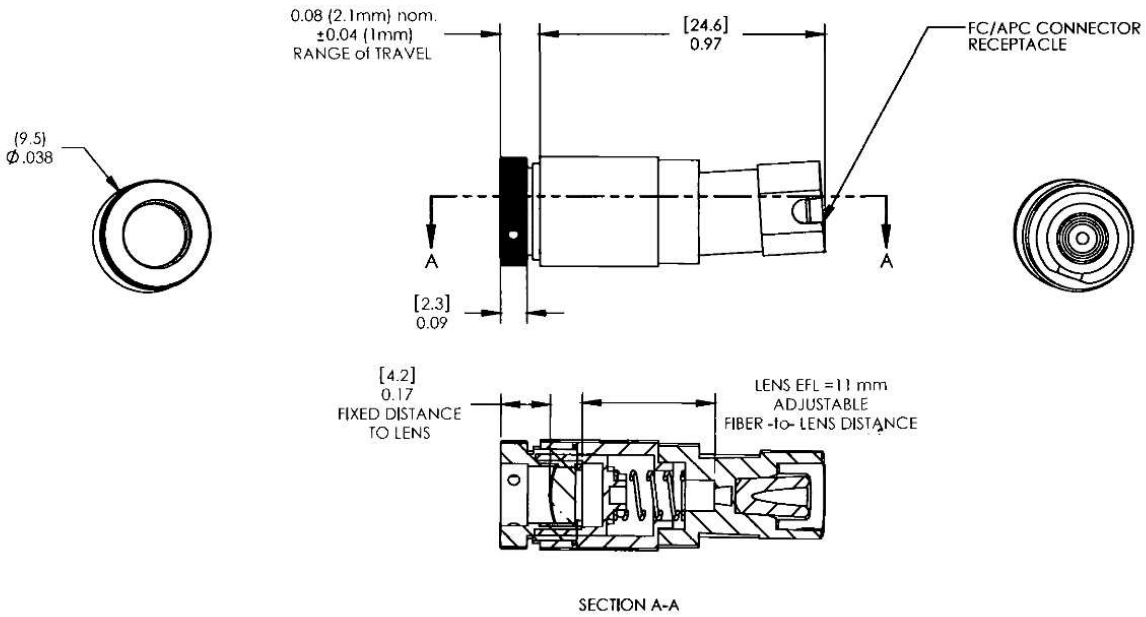
DWG. NO. 17439-E0W

PART NO. CFC-11-A,B,C

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ITEM #	EFL (mm)	INPUT MFD (um)	OUTPUT WAIST DIA. (mm)	MAX WAIST DIST (mm)	DIVERGENCE (mrad)	CA (mm)	NA	AR COATING	CONNECTOR
CFC-11-A-APC	11	3.5	1.8	2800	0.32	4.4	0.20	400-600nm	FC/APC
CFC-11-B-APC	11	4.3	2.1	2700	0.39	4.4	0.20	600-1050nm	FC/APC
CFC-11-C-APC	11	10.4	2.1	1100	0.95	4.4	0.20	1050-1600nm	FC/APC



SECTION A-A

FOR INFORMATION ONLY, NOT FOR MANUFACTURING

	NAME	DATE
DRAWN	EJM	07/25/08
ENG APPR.	JMM	07/25/08
MFG APPR.	JMM	07/25/08

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THORLABS INC. PO BOX 366 NEWTON NJ

TITLE: 11mm ADJUSTABLE APC COLLIMATOR

MATERIAL: N/A | SIZE A | REV. A

SCALE: 2:1 | SHEET 1 OF 1

DWG. NO. 17440-E0W | PART NO. CFC-11-(A,B,C)-APC

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