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DET-L SERIES

Oriel® Amplified Detectors









ORIEL® INSTRUMENTS
A Newport Corporation Brand

1 GENERAL INFORMATION

Thank you for purchasing one or more amplified detector from Oriel Instruments.

Please carefully read all documents supplied with all the equipment and instruments to be used with this detector, as well as this user's manual for important safety precautions prior to setting up and operating the system.

The following models are covered by this user's manual:

<table>
<tr><th>Model</th><th>Spectral Range</th><th>Detector Type</th><th>Active area</th><th>TE Cooled</th><th>Bandwidth</th><th>Gain (V/A)</th></tr>
<tr><td>DET-L-SIUV-R-C</td><td rowspan="2">200-1100 nm</td><td rowspan="2">UV-enhanced Si</td><td>10 x 10 mm</td><td>No</td><td rowspan="4">0.01 Hz to 100 kHz</td><td rowspan="4">10^4 to 10^9</td></tr>
<tr><td>DET-L-SIUV-T-C</td><td rowspan="4">5 mm dia.</td><td>1-stage, 1.2 A, Δ25˚C</td></tr>
<tr><td>DET-L-GE-R-C</td><td rowspan="2">700-1800 nm</td><td rowspan="2">Ge</td><td>No</td></tr>
<tr><td>DET-L-GE-T-C</td><td>2-stage, 1.2 A, Δ50˚C</td></tr>
<tr><td>DET-L-PYC5-R-P</td><td>0.45-9 µm</td><td rowspan="2">Pyroelectric</td><td rowspan="3">No</td><td rowspan="2">8 Hz to 1.1 kHz</td><td>Fixed</td></tr>
<tr><td>DET-L-PYK5-R-P</td><td>0.6-50 µm</td><td>Fixed</td></tr>
<tr><td>DET-L-PBS-R-U</td><td>0.7-3 µm</td><td>PbS</td><td>3 x 3 mm</td><td>10 Hz to 8 kHz</td><td>2, 10 or 50</td></tr>
</table>

2 INTRODUCTION

The DET-L series of detectors are intended for use with Oriel's lock-in digital amplifier (LIDA) kit, model LIDA-SRS-KIT. Using the LIDA with these detectors enables very small signals to be extracted from background noise.

All necessary cables are provided to interface with the LIDA. Each model features a standard 1.5-inch series flange, making all of these detectors compatible with a wide variety of Oriel accessories and instruments. They may also be rod mounted, if desired.

Each of these detectors comes with a low-noise transimpedance amplifier (TIA) built into the detector case, simplifying setup and operation. Switch selection of transimpedance gain and time constant are provided on most models. The TIA converts the current output of an unamplified detector to a voltage signal. The TIA requires a power source to operate, which is provided by the LIDA.

Although the LIDA is able to read either current or voltage signals, the LIDA has a much wider dynamic range when reading a voltage signal. In other words, higher voltage signal levels may be read before reaching an "Overload" condition on the LIDA, when compared to current.

The use of these detectors is not limited to applications involving only the LIDA-SRS-KIT. As long as the detector's transimpedance amplifier is connected to a power source, it will continue to operate. Oriel offers stand-alone power supplies with the appropriate detector interface cable for those users who wish to measure continuous (not optically chopped) signals using a power meter, such as Newport's model 1936-R.

What's included:

Model	Detector	Cables	USB Memory Stick Contents
DET-L-SIUV-R-C	Silicon, UV-Enhanced	CBL-70054-LIDA (power) 70018 (signal)	User's manual Spectral Responsivity files (tab-delimited .txt and Excel files)
DET-L-SIUV-T-C	Silicon, UV-Enhanced, TE Cooled	CBL-70054-LIDA (power) 70018 (signal) 70062 (cooler)	User's manual Spectral Responsivity files (tab-delimited .txt and Excel files)
DET-L-GE-R-C	Germanium	CBL-70054-LIDA (power) 70018 (signal)	User's manual Spectral Responsivity files (tab-delimited .txt and Excel files)
DET-L-GE-T-C	Germanium, TE Cooled	CBL-70054-LIDA (power) 70018 (signal) 70062 (cooler)	User's manual Spectral Responsivity files (tab-delimited .txt and Excel files)
DET-L-PYC5-R-P	Pyroelectric with CaF2 Window	CBL-70054-LIDA (power) 70018 (signal)	User's manual Certificate of Calibration
DET-L-PYK5-R-P	Pyroelectric with KRS5 Window	CBL-70054-LIDA (power) 70018 (signal)	User's manual Certificate of Calibration
DET-L-PBS-R-U	Lead Sulfide	70063 (power) 70018 (signal)	User's manual

3 LIDA DETECTOR SETUP

All cables required to use the LIDA detectors are provided. For TE cooled models, a cooler controller such the Oriel model 77055 may be purchased separately. The PbS detector requires a stand-alone power supply for its amplifier. Newport offers the Oriel stand-alone lab power supply model 70703 (120 VAC) and model 70709 (220 VAC).

Uncooled Si or Ge Model



TE Cooled Si or Ge Model



Pyroelectric Model



PbS Model



Detector Connectors

Model 70018



Model CBL-70054-LIDA



Cables Supplied with Si, Ge and Pyro Detectors

Model 70063



Model 70018



Cables Supplied with PbS Detector

Model 70062



Cable Supplied with TE Cooled Detectors

The built-in transimpedance amplifiers for LIDA detectors require an auxiliary power source. The back panel of the LIDA includes a DB9 connector labeled “PREAMP”. This can be utilized by Si, Ge and Pyro detectors as a preamplifier power source. The cable model CBL-70054-LIDA is provided with the detector. It includes a circuit to convert the LIDA output to ±15 VDC required by the detectors.

Note: never use any other cable with the LIDA – permanent damage to the transimpedance amplifier will result, which is not covered under warranty.



LIDA Preamplifier Power Connection (Si, Ge, Pyro Models)



Pyro Detector Amplified Powered by LIDA

The PbS detector is not compatible with the PREAMP connector on the back panel of the LIDA. A separate power supply providing ±15 VDC and +5 VDC is required. The PbS detector includes cable mode 70063, which is a convenient way to connect to the Oriel 70703 or 70709 stand-alone lab power supplies.

Ensure the tabs on the banana plugs line up with the connectors as shown in the photo.

The Oriel lab power supplies are small, inexpensive and convenient for powering the PbS detector or other products. However, another power supply may be used by cutting off the banana plugs and stripping back the wires.

Note: altering the cable voids the warranty on the cable. Use of incorrect supply voltages may result in detector performance issues or damage to the product. This type of damage is not covered under warranty.



Stand-Alone Preamplifier Power Supply Connection (PbS Detector)

The Si, Ge and Pyro detectors are not limited for use with only the LIDA-SRS-KIT. If a detector is being utilized in a different application, a cable is available to provide power from Oriel's lab power supplies to the built-in transimpedance amplifier. This cable is available separately.

Cable
Model
70055



Lab Power Supply to Preamplifier Power Cable (Si, Ge, Pyro Models)



Stand-Alone Preamplifier Power Supply Connection (Si, Ge, Pyro Detectors)

The 70018 low-noise cable supplied with the detector is used to send the signal to the readout instrument, such as Oriel's LIDA-SRS-KIT. It is a 2 meters long. It is typically connected to Channel "A" on the front of the LIDA. Please refer to the LIDA-SRS-KIT user's manual for more information.



Detector Signal Connection to LIDA

These detectors may also be used with other voltage reading devices, such as the Newport 19xx and 29xx power meter series. Examples of some popular models include the 1918-R, 1936-R and 2936-R. In order to connect the BNC signal cable from the LIDA detector to the Newport power meter, adapter 71686 is required. This item is sold separately.



71686 Adapter for Newport Power Meters

Note: Pyroelectric and Lead Sulfide (PbS) detectors are inherently noisier than Silicon or Germanium detectors. Therefore, it is suggested to use Pyro and PbS detectors with a lock-in digital amplifier and chopped signal.

4 COOLER CONTROLLER SETTINGS

The primary benefit of thermoelectric (TE) cooling is to stabilize the detector responsivity, especially at the extremes of the responsivity range. The model 70062 cable is provided with cooled detector models. This cable is for use with Oriel's 77055 TE Cooler Controller, which is sold separately.

Cooled detectors include a datasheet providing resistance values of the photodiode thermistor with respect to temperature settings. Enter the resistance for the desired temperature on the front panel of the 77055 TE Cooler Controller. Always limit the thermoelectric current to 1.2 amperes.

The Si cooled model DET-L-UVSI-T-C features a single-stage thermoelectric cooler that can reduce the detector temperature by about 25°C from room ambient.

The Ge cooled model DET-L-GE-T-C features a two-stage thermoelectric cooler that can reduce the detector temperature by about 50°C from room ambient.



Model 77055 TE Cooler Controller

If an Oriel cooler controller is not being used, the 9 pin D-sub connector can be removed and the cable terminated for use with another controller. The red wire is the "TEC +"; black is the "TEC -"; white and green are the thermistor; the cable shield should be connected to the controller chassis.

5 GAIN AND TIME CONSTANT

The switches for setting gain and time constant are accessible on the top of the Si and Ge detectors. Pyroelectric detectors have fixed settings. The PbS detector has three gain switches (2, 10 or 50 V/A).

The time constant may be set to a higher value to reduce noise, especially in DC systems, although response time will suffer. With chopped systems, care must be taken so that any bandwidth limitation created does not significantly affect the chopped signal wave shape (the frequency response of the amplifier should be at least 5 times the chopper frequency). Consult the following table for the gain/bandwidth limitations. The gain should be set as high as practical to give the best signal resolution.

To assist in setting the gain, a voltage measuring device such as oscilloscope or meter may be used to monitor the output voltage while changing gain settings at the BNC signal output connector. While setting the gain, ensure that the output voltage does not exceed the maximum input signal allowable by the readout instrument (LIDA or other power meter). Some margin is advisable. When initially adjusting the gain, use of the MAX time constant setting is generally not advised. This time constant setting results in a slow change of the output voltage.

Si and Ge Detectors							
Time Constant	**BW**	**GAIN (V/A)**					
		10^4	**10^5**	**10^6**	**10^7**	**10^8**	**10^9**
MIN	-3dB	100 kHz	10 kHz*	3 kHz*	1 kHz*	1 kHz	100 Hz
MED	-3dB	100 kHz	10 kHz	1 kHz	100 Hz	10 Hz	1 Hz
MAX	-3dB	1 kHz	100 Hz	10 Hz	1 Hz	0.1 Hz	0.01 Hz

* There is significant bandwidth above these frequencies, but peaking in the amplifier circuit affects the absolute gain value.

For measuring chopped (AC) signals, high levels of background light may result in DC saturation. In this situation, the output will be asymmetrical with respect to ground. Although this offset should not affect most AC measuring systems, ensure that the peak voltage signal does not exceed the maximum allowable by the lock-in digital amplifier. An advantage of using Oriel's LIDA-SRS-KIT is that the chopper head is enclosed, so that background signals do not become a problem.

It is advisable to note the level of "dark" signal generated by the detector/amplifier if it is not being used with a lock-in digital amplifier. DC measurements require background subtraction. Oriel's TracQ Basic software is able to interface with popular Newport power meters and conveniently includes a background subtraction feature.

6 SPECTRAL RESPONSIVITY

All detectors except for the PbS model come with spectral responsivity data. The characterization of spectral responsivity is referred to as a “calibration” of the detector.

Pyroelectric detectors exhibit flat responsivity over a wide wavelength range, so a single wavelength is calibrated for a 1000 V/W output.

The Si and Ge models have varying spectral responsivity over their entire operating ranges. These detectors have their spectral responsivities characterized every 10 nm.

A typical responsivity curve for a PbS detector is provided in this user’s manual, which may be used to determine the approximate output beam power. An uncalibrated detector may be used to compare signal levels between multiple samples.

<table>
<tr><th>Model</th><th>Spectral Range</th><th>Calibration</th><th>Calibrated Wavelength(s)</th></tr>
<tr><td>DET-L-SIUV-R-C</td><td rowspan="2">200-1100 nm</td><td rowspan="5">NIST traceable</td><td rowspan="2">200-1100 nm</td></tr>
<tr><td>DET-L-SIUV-T-C</td></tr>
<tr><td>DET-L-GE-R-C</td><td rowspan="2">700-1800 nm</td><td rowspan="2">700-1800 nm</td></tr>
<tr><td>DET-L-GE-T-C</td></tr>
<tr><td>DET-L-PYC5-R-P</td><td>0.45-9 µm</td><td rowspan="2">633 nm</td></tr>
<tr><td>DET-L-PYK5-R-P</td><td>0.6-50 µm</td></tr>
<tr><td>DET-L-PBS-R-U</td><td>0.7-3 µm</td><td>N/A</td><td>N/A</td></tr>
</table>

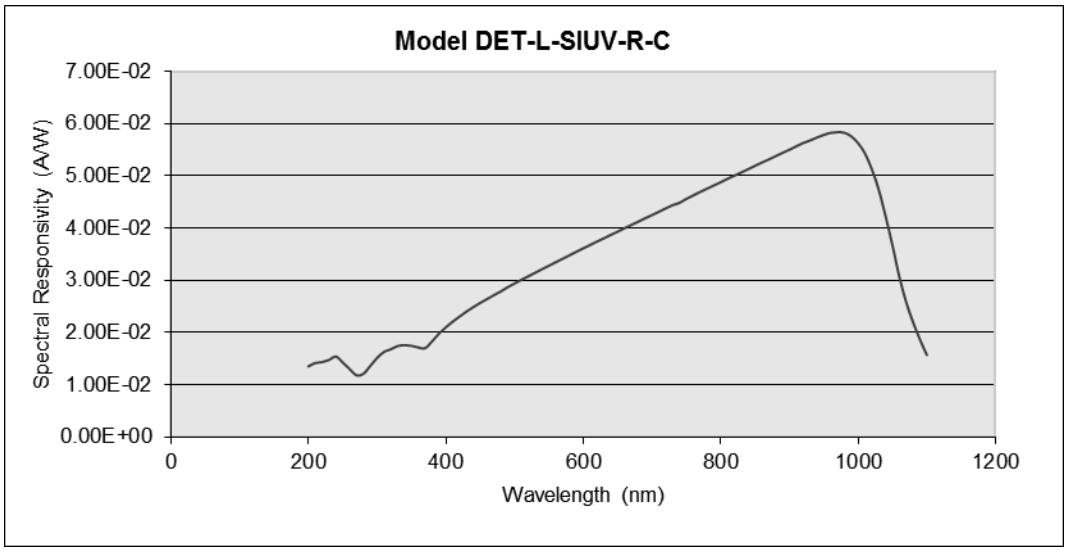
Newport suggests to have the detector returned for annual recalibration, as the spectral responsivity changes with time and use of the detector.

TracQ 2.2 Service Update:

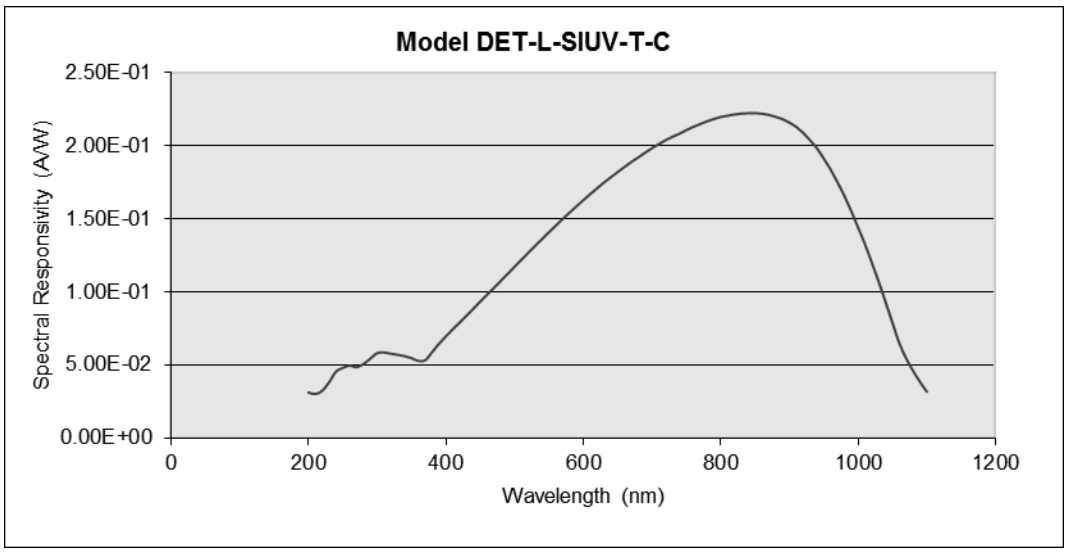
If experiencing significantly lower, for example less than half, than expected Quantum Efficiency (QE) values (with a known test sample) when using an Oriel detector, this is a clear indication of an incompatibility between detectors and older TracQ software versions 6.6 and below. Newport recommends using TracQ BASIC v6.7 or higher for full functionality.

If you are experiencing issues, Newport Corp has set up a process to quickly and easily upgrade your software. Please contact Newport Corp or your local Newport representative below

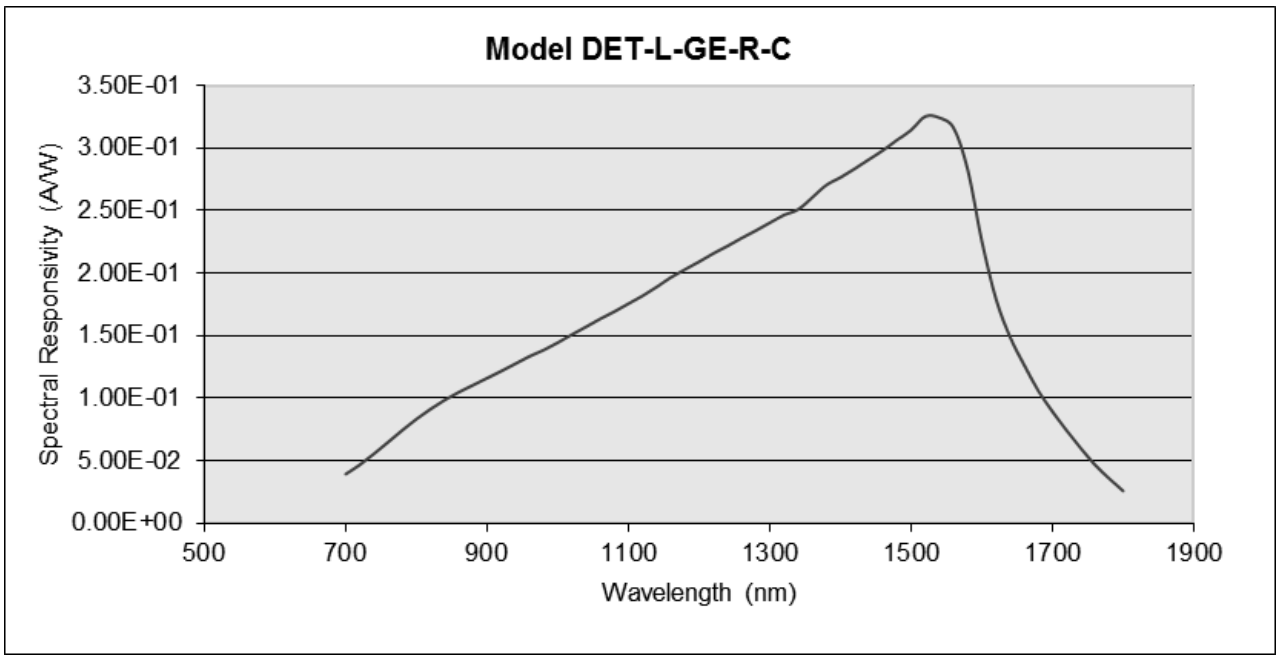
United States	EMEA	APAC
Newport Corp.	Newport-Spectra Physics GmbH	Newport Opto-Electronics
1791 Deere Ave.	Guerickeweg 7	Lot J3-8, Wuxi Export Processing
Irvine, CA 92606 USA	64291 Darmstadt, Germany	Jiangsu, 214028 China
Telephone: 800-222-6440	Telephone: +49 6151-708-0	Telephone: +86-510-8113-5000
Sales: sales@newport.com		Sales: china@newport.com
Technical Assistance: oriel.tech@newport.com	Technical Assistance: serviceeurope@newport.com	Technical Assistance: asiatech@newport.com



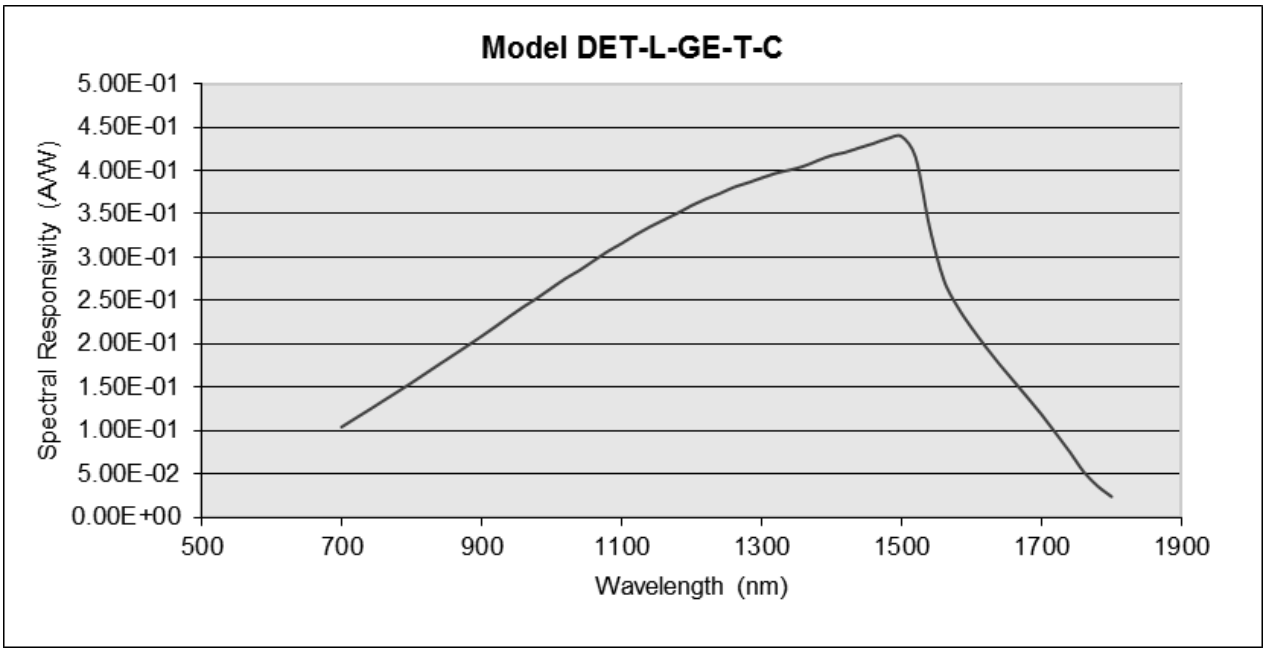
Typical Responsivity of Oriel's Uncooled Silicon Detector



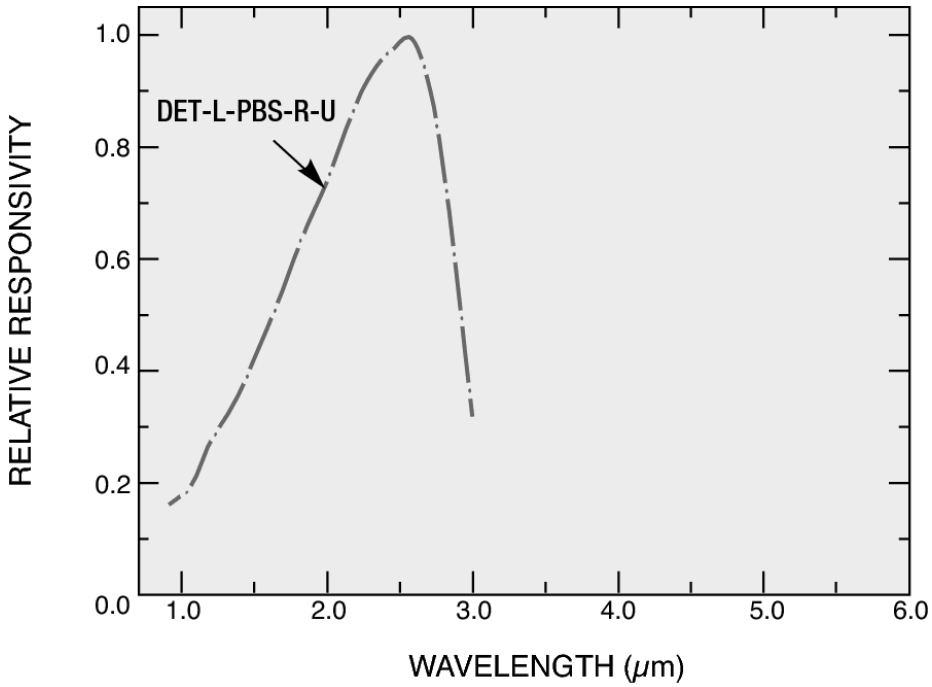
Typical Responsivity of Oriel's TE Cooled Silicon Detector



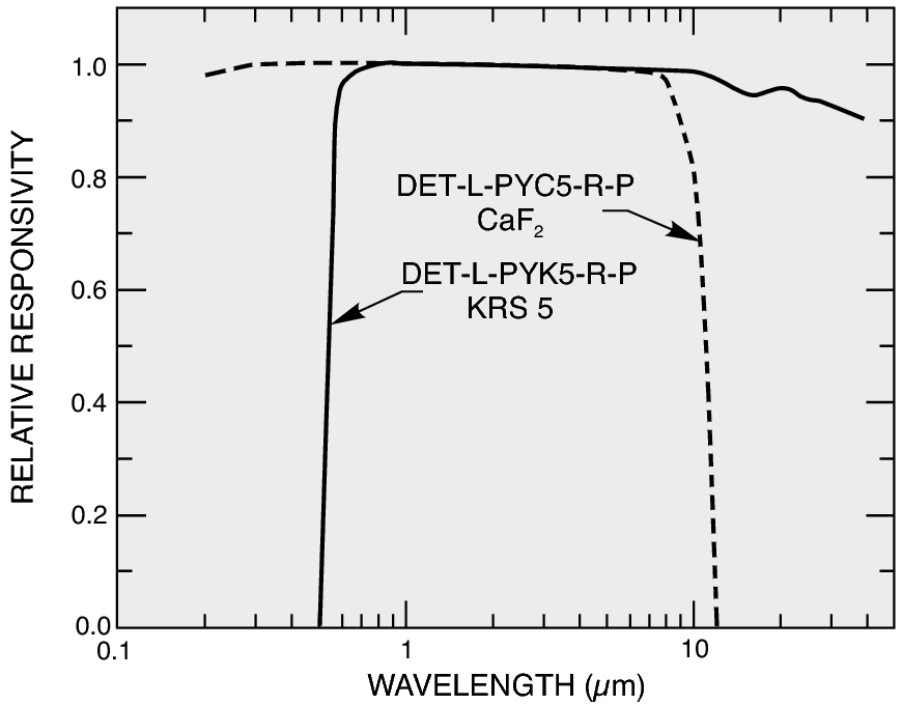
Typical Responsivity of Oriel's Uncooled Germanium Detector



Typical Responsivity of Oriel's TE Cooled Germanium Detector



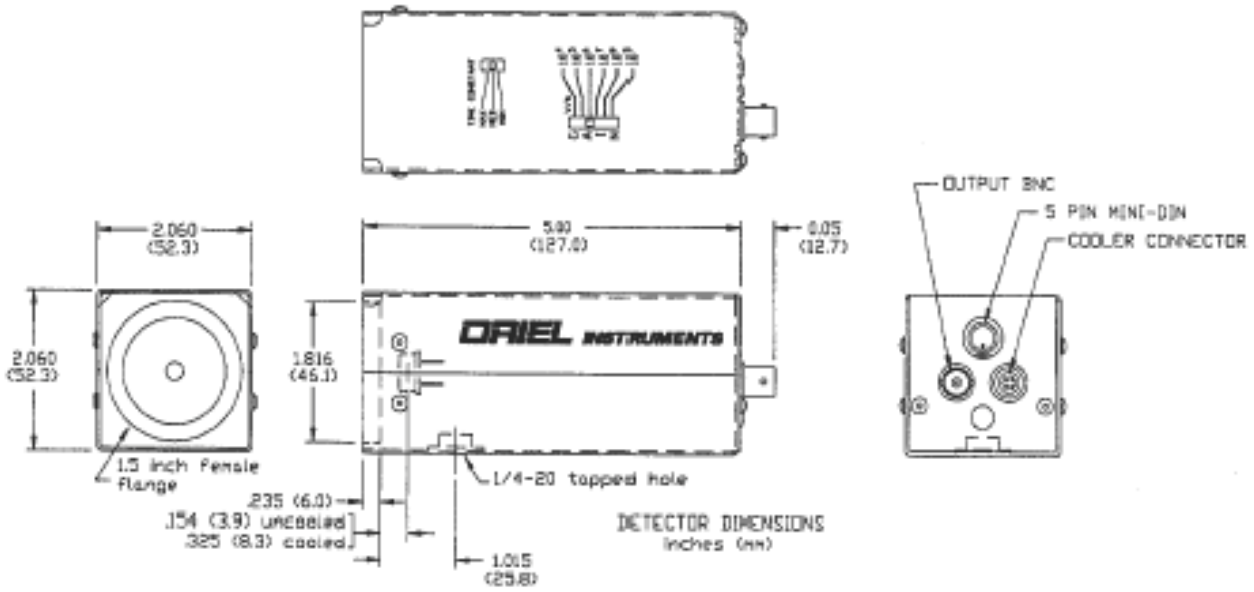
Typical Responsivity of Oriel's PbS Detector



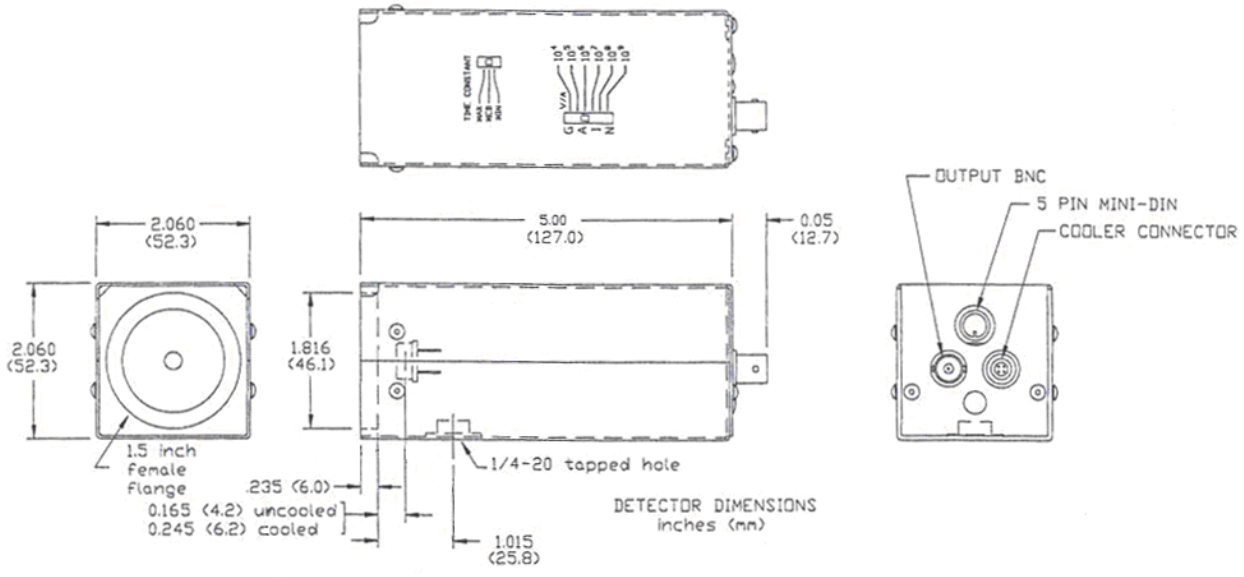
Typical Responsivity of Oriel's Pyroelectric Detectors

7 DIMENSIONS

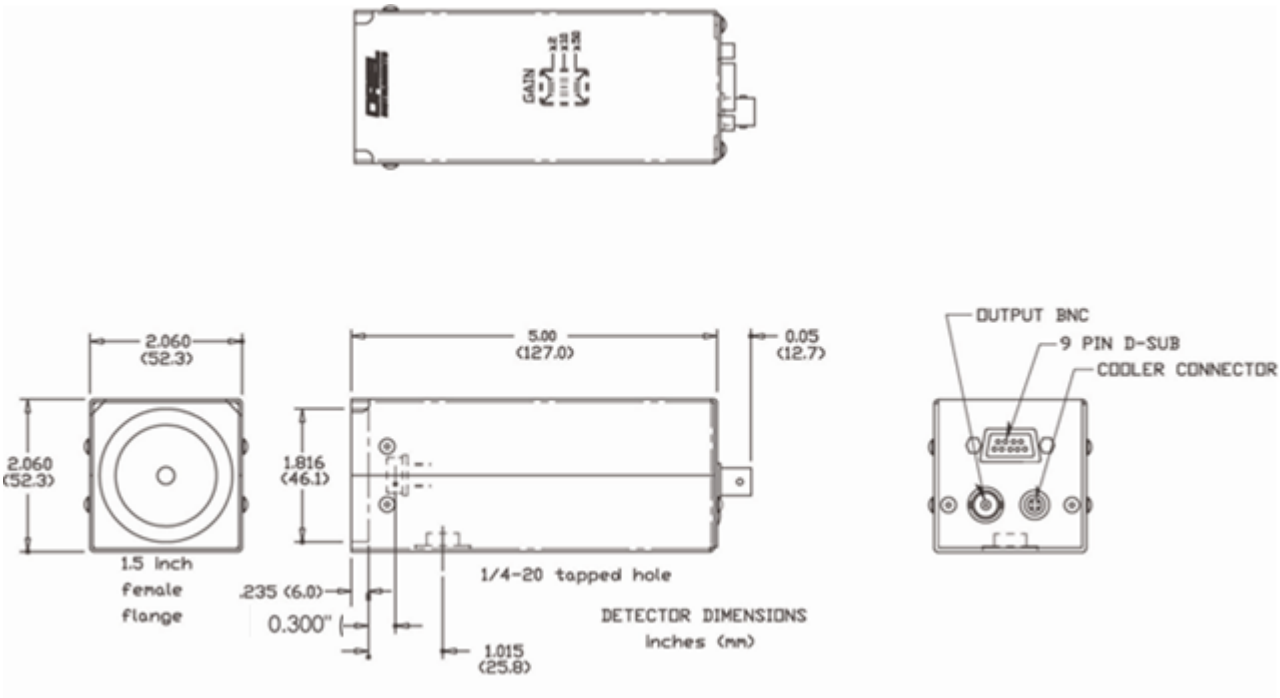
Each detector head has a tapped hole for rod mounting and an Oriel 1.5 inch Series Female Flange. This flange can be used to mount the detector directly to the output port of an Oriel monochromator. The flange also accepts a variety of filter holders and other optical accessories.



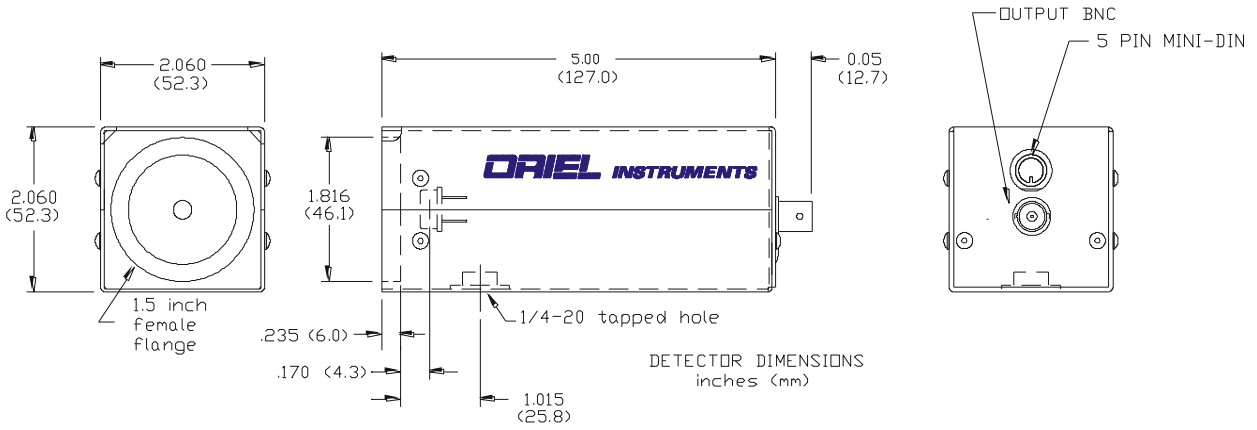
Silicon Detector Dimensions



Germanium Detector Dimensions



Lead Sulfide Detector Dimensions



Pyroelectric Detector Dimensions

8 OPTIONAL INSTRUMENTS AND ACCESSORIES

A wide variety of instruments and accessories are available from Newport. A selection of popular items are listed here. Many more items are available at www.newport.com.

READOUT INSTRUMENTS	
Model	**Description**
LIDA-SRS-KIT	Lock-In Digital Amplifier Kit
1918-R	Newport Power Meter, Hand-Held
1936-R	Newport Power Meter, Single Channel
2936-R	Newport Power Meter, Dual Channel

STAND-ALONE POWER SUPPLIES	
Model	**Description**
70703	Lab Power Supply (120 VAC)
70709	Lab Power Supply (230 VAC)

TE COOLER CONTROLLER	
Model	**Description**
77055	TE Cooler Controller

CABLES AND CABLE ADAPTERS	
Model	**Description**
70055	Cable, Amplified Oriel Detector to Lab Power Supply (Si, Ge, Pyro)
71686	Adapter, BNC Signal Cable to Newport Power Meter

MONOCHROMATORS	
Model	**Description**
77250	1/8m Hand Operated Monochromator
CS130-XX-X-XX	1/8m Cornerstone 130 Monochromator
CS260-XX-X-XX-X	1/4m Cornerstone 260 Monochromator
77781	1/4m MS257 Monochromator

8 EU DECLARATION OF CONFORMITY

We declare that the accompanying product, identified with the CE mark, complies with requirements of the Electromagnetic Compatibility Directive, 2014/30/EU and the Low Voltage Directive 2006/95/EC.

Model Numbers:

71617, DET-L-GE-R-C, DET-L-GE-T-C

71883, 71889, DET-L-SIUV-T-C, DET-L-SIUV-R-C

DET-L-PYC5-R-P, DET-L-PYK5-R-P

DET-L-PBS-R-U

Year CE mark affixed: 2015

Type of Equipment: Electrical equipment for measurement, control and laboratory use in industrial locations.

Manufacturer: Newport Corporation
1791 Deere Avenue
Irvine, CA 92606

Standards Applied:

Compliance was demonstrated to the following standards to the extent applicable:

BS EN61326-1: 2013 "Electrical equipment for measurement, control and laboratory use – EMC requirements" for use in a controlled electromagnetic environment.

This equipment meets the EN55011:2009+A1:2010 Class A Group 1 radiated and conducted emission limits.

BS EN 61010-1:2010, "Safety requirements for electrical equipment for measurement, control and laboratory use".

Mark Carroll
Sr. Director, Instruments Business
Newport Corporation
1791 Deere Ave, Irvine, CA92606 USA

APPENDIX I: LIDA DETECTORS WITH LEGACY MERLIN™

The LIDA-compatible detectors discussed in this user's manual are backward compatible with Oriel's legacy Merlin lock-in digital amplifier. However, the Merlin requires use of different cables.

The model 70042 cable used to connect the PbS detector to the Merlin is offered by Newport. However, other Merlin-specific detector cables are no longer available. Users intending to employ a LIDA detector with an existing Merlin must have the detector cable that came with the original Merlin-compatible detectors.

Note: if the Merlin detector cable contains calibration data in an EEPROM, this data will no longer be valid when the cable is used with a new detector.

LIDA vs. Merlin Detectors	
LIDA Detector	**Merlin Equivalent Detector**
DET-L-SIUV-R-C	70356
DET-L-SIUV-T-C	70358
DET-L-GE-R-C	70359
DET-L-GE-T-C	70360
DET-L-PYC5-R-P	70362
DET-L-PYK5-R-P	70363
DET-L-PBS-R-U	70343*

* The 70343 was calibrated at a single point.
The DET-L-PBS-R-U is not calibrated.



Legacy Merlin Lock-In Digital Amplifier

APPENDIX II: USING MERLIN LEGACY DETECTORS WITH LIDA

Oriel's legacy Merlin-compatible detectors are compatible with the LIDA-SRS-KIT, as well as Oriel's stand-alone lab power supplies. However, the LIDA requires use of different cables.

For users with Merlin-compatible Silicon, Germanium or Pyroelectric detectors, these detectors were shipped with cable model 70054 or 70060. This cable must be replaced by the model CBL-70054-LIDA in order to power the transimpedance amplifier from the LIDA-SRS-KIT. The use of the legacy Merlin cable with the LIDA will result in damage to the detector. Because these cables look identical, it is extremely important to discard the legacy Merlin cables. A BNC signal cable, such as the model 70018 low-noise model, is also required to send the signal to the LIDA.

For users with Merlin-compatible PbS detectors, refer to the section in this manual for the DET-L-PBS-R-U for more information on required cables and connection options.



Model 70054



Model 70060



Model CBL-70054-LIDA

Replace Legacy Merlin Cables with LIDA-Compatible Cable

10 WARRANTY

CONTACTING ORIEL INSTRUMENTS

Oriel Instruments belongs to Newport Corporation's family of brands. Thanks to a steadfast commitment to quality, innovation, hard work and customer care, Newport is trusted the world over as the complete source for all photonics and laser technology and equipment.

Founded in 1969, Newport is a pioneering single-source solutions provider of laser and photonics components to the leaders in scientific research, life and health sciences, photovoltaics, microelectronics, industrial manufacturing and homeland security markets.

Newport Corporation proudly serves customers across Canada, Europe, Asia and the United States through numerous international subsidiaries and sales offices worldwide. Every year, the Newport Resource catalog is hailed as the premier sourcebook for those in need of advanced technology products and services. It is available by mail request or through Newport's website. The website is where one will find product updates, interactive demonstrations, specification charts and more.

To obtain information regarding sales, technical support or factory service, United States and Canadian customers should contact Oriel Instruments directly.

Newport - Oriel Instruments
1791 Deere Avenue
Irvine, CA 92606 USA

Telephone: 800-222-6440 (toll-free in United States)
949-863-3144

Fax: 949-253-1680

Sales: oriel.sales@newport.com
Technical assistance: oriel.tech@newport.com
Repair Service: rma.service@newport.com

Customers outside of the United States must contact their regional representative for all sales, technical support and service inquiries. A list of worldwide representatives can be found on Oriel's website: https://www.newport.com/contact/contactslocations

REQUEST FOR ASSISTANCE / SERVICE

Please have the following information available when requesting assistance or service:

- Contact information for the owner of the product.
- Instrument model number (located on the product label).
- Product serial number and date of manufacture (located on the product label).
- Description of the problem.

To help Oriel's Technical Support Representatives diagnose the problem, please note the following:

- Is the system used for manufacturing or research and development?
- What was the state of the system right before the problem?
- Had this problem occurred before? If so, when and how frequently?
- Can the system continue to operate with this problem, or is it non-operational?
- Were there any differences in the application or environment before the problem occurred?

REPAIR SERVICE

This section contains information regarding factory service for this product. The user should not attempt any maintenance or service of the system beyond the procedures outlined in this manual. This product contains no user serviceable parts other than what is noted in this manual. Any problem that cannot be resolved should be referred to Oriel Instruments.

If the instrument needs to be returned for service, a Return Material Authorization (RMA) number must be obtained prior to shipment to Oriel Instruments. This RMA number must appear on both the shipping container and the package documents.

Return the product to Oriel Instruments, freight prepaid, clearly marked with the RMA number and it either will be repaired or replaced it at Oriel's discretion.

Oriel is not responsible for damage occurring in transit. The Owner of the product bears all risk of loss or damage to the returned Products until delivery at Oriel's facility. Oriel is not responsible for product damage once it has left the facility after repair or replacement has been completed.

Oriel is not obligated to accept products returned without an RMA number. Any return shipment received by Oriel without an RMA number may be reshipped by Newport, freight collect, to the Owner of the product.

NON-WARRANTY REPAIR OR RECALIBRATION

For Products returned for repair that are not covered under warranty, Newport's standard repair charges shall be applicable in addition to all shipping expenses. Unless otherwise stated in Newport's repair quote, any such out-of-warranty repairs are warranted for ninety (90) days from date of shipment of the repaired Product.

Oriel will charge an evaluation fee to examine the product and determine the most appropriate course of action. Payment information must be obtained prior to having an RMA number assigned. Customers may use a valid credit card, and those who have an existing account with

Newport Corporation may use a purchase order.

When the evaluation had been completed, the owner of the product will be contacted and notified of the final cost to repair or replace the item. If the decision is made to not proceed with the repair, only the evaluation fee will be billed. If authorization to perform the repair or provide a replacement is obtained, the evaluation fee will be applied to the final cost. A revised purchase order must be submitted for the final cost. If paying by credit card, written authorization must be provided that will allow the full repair cost to be charged to the card.

WARRANTY REPAIR

If there are any defects in material or workmanship or a failure to meet specifications, notify Oriel Instruments promptly, prior to the expiration of the warranty.

Except as otherwise expressly stated in Oriel's quote or in the current operating manual or other written guarantee for any of the Products, Oriel warrants that, for the period of time set forth below with respect to each Product or component type (the "Warranty Period"), the Products sold hereunder will be free from defects in material and workmanship, and will conform to the applicable specifications, under normal use and service when correctly installed and maintained. Oriel shall repair or replace, at Oriel's sole option, any defective or nonconforming Product or part thereof which is returned at Buyer's expense to Oriel facility, provided, that Buyer notifies Oriel in writing promptly after discovery of the defect or nonconformity and within the Warranty Period. Products may only be returned by Buyer when accompanied by a return material authorization number ("RMA number") issued by Oriel, with freight prepaid by Buyer. Oriel shall not be responsible for any damage occurring in transit or obligated to accept Products returned for warranty repair without an RMA number. Buyer bears all risk of loss or damage to the Products until delivery at Oriel's facility. Oriel shall pay for shipment back to Buyer for Products repaired under warranty.

WARRANTY PERIOD

All Products (except consumables such as lamps, filters, etc.) described here are warranted for a period of twelve (12) months from the date of shipment or 3000 hours of operation, whichever comes first.

Lamps, gratings, optical filters and other consumables / spare parts (whether sold as separate Products or constituting components of other Products) are warranted for a period of ninety (90) days from the date of shipment.

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The above warranty does not apply to Products which are (a) repaired, modified or altered by any party other than Oriel; (b) used in conjunction with equipment not provided or authorized by Oriel; (c) subjected to unusual physical, thermal, or electrical stress, improper installation, misuse, abuse, accident or negligence in use, storage, transportation or handling, alteration, or tampering, or (d) considered a consumable item or an item requiring repair or replacement due to normal wear and tear.

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