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COOLED SILICON DETECTOR HEADS
MODELS 70113 & 70118
INCLUDING CALIBRATION MODULES
MODELS 70110, 70112 & 70117

Please read these instructions completely before operating this equipment. If there are any questions or problems regarding the use of this equipment, please contact: ORIEL INSTRUMENTS - or - the representative from whom this equipment was purchased.

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Tell us about the problem you're experiencing.

How long have you been using the product?
Is this the first time you've experienced this problem?

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WARRANTY AND RETURNS

I. INTRODUCTION

The Oriel Models 70113 (VIS-NIR) and 70118 (UV) Silicon Detectors are configured for use with the Merlin Radiometer. Each of these detector heads contains a 5.1mm diameter, thermoelectrically cooled, silicon photodiode operated in the photovoltaic (unbiased) mode and a low noise transimpedance amplifier. The single stage thermoelectric cooler provides a stable responsivity, especially at longer wavelengths. Internal switches allow transimpedance gain and time constant selection.

Both the 70113 and 70118 Silicon Detector Heads come calibrated at 633 nm. This single point calibration can be used both as an accurate value at that one wavelength, and as a scaling value for the typical responsivity curve in Figure #1. Scaling the curve in Figure #1 will only provide an approximate calibration, for much better accuracy a 70112 or 70117 Calibration Module should be used. These modules contain responsivity values across the useful wavelength range of that head. With narrow band radiation, you simply key in the wavelength and Merlin™ automatically calculates and displays the power level you are measuring.

The 70110 Calibration Module provides photometric calibration data from 400nm to 700nm.

To obtain accurate power readings in real time, follow the directions here in the section titled "Entry of Calibration Data into Merlin™".

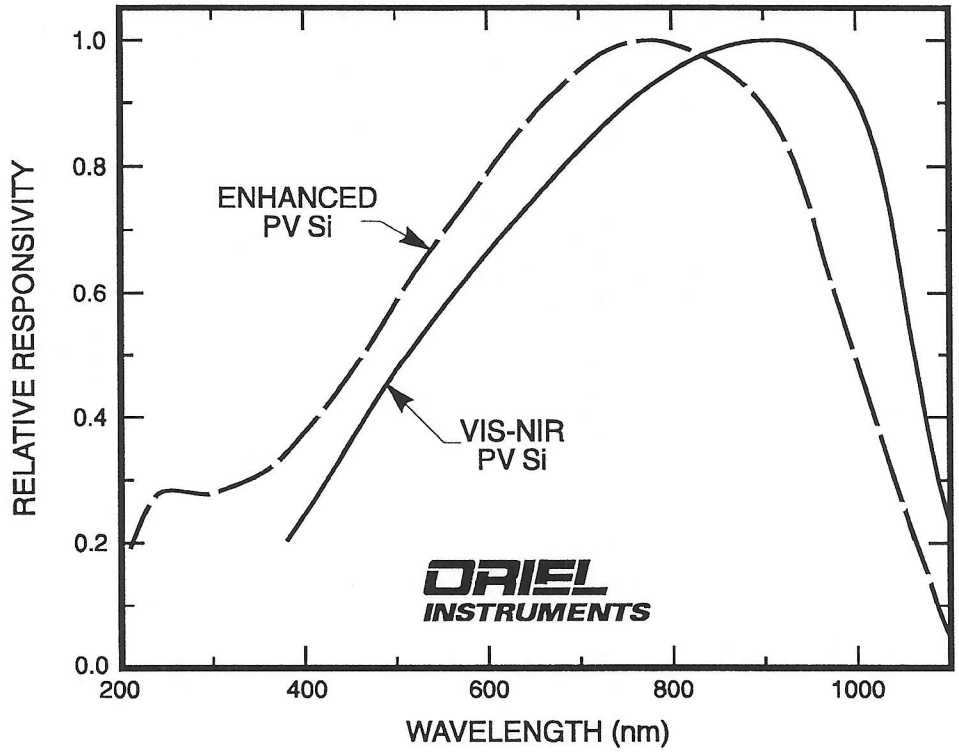


Figure 1 Relative Responsivity of Silicon Detectors

II. SETUP

The package you have received should contain:

- Cooled Silicon Detector Head. Oriel P/N 70113 or 70118.
- Cable, Detector Head to Merlin; 5 pin mini-DIN to 9 pin male Dsub. Oriel P/N 70111-1400.
- Cable, Detector Head Cooler; 4 pin LEMO to 12 pin Viking. Oriel P/N 68850-2100.
- This manual.
- Optional Calibration Module. Oriel P/N 70110, 70112 or 70117.

SETTING GAIN AND TIME CONSTANT

To access the switches for setting gain and time constant, unscrew the front knurled male flange and slide off the tube. The gain should be set as high as practical to give the best signal resolution. In chopped systems be wary of DC saturation problems associated with high levels of background light. Checking the DC levels at the BNC on the detector with a scope or meter is usually advisable. "Light" levels should not exceed +10 volts. You can stop the chopper in its open position and use a volt meter to measure to measure the DC voltage on the BNC connector. The time constant may be set slower to reduce noise. With chopped systems care must be taken so that any bandwidth limitation created does not significantly affect the chopped signal waveshape: the frequency response of the amplifier should be at least 5 times the chopper frequency. Consult the table for the gain/bandwidth limitations.

Bandwidth (BW) and Time Constants (τ)

Time Constant Setting		GAIN, V/A					
		10^4	10^5	10^6	10^7	10^8	10^9
MIN (C = 2pF)*	BW τ	100 kHz <2µs ***	100 kHz <2µs ***	80 kHz 2 µs**	8 kHz 20 µs**	800 Hz 200 µs**	80 Hz 2 ms**
MED (C = 150pF)*	BW τ	100 kHz 1.5 µs	10 kHz 15 µs	1 kHz 150 µs	100 Hz 1.5 ms	10 Hz 15 ms	1 Hz 150 ms
MAX (C = .015µF)*	BW τ	1 kHz 150 µs	100 Hz 1.5 ms	10 Hz 15 ms	1 Hz 150 ms	0.1 Hz 1.5 s	0.01 Hz 15 s

* C is the circuit capacitance.

** These values are based on the residual capacity of the circuit and may vary substantially.

*** These values are determined by the full signal capability of the operational amplifier.

All other bandwidth and time constant values are determined by the gain and time constant settings.

CONNECTIONS

Cables are provided with the detector to connect to an Oriel 70708 Cooler/Bias Supply. The power and signal are conducted through the coiled black cable which connects to the detector on the 5 pin DIN and the 70708 at the 9 pin D-sub, labelled DETECTOR. The cooler drive and temperature sensing are passed through the gray cable which connects to the 4 pin miniature connector on the head and the 12 pin connector on the 70708. The 70708 has a short cable which connects from the 70708 9 pin D-sub labelled Merlin to the detector input on Merlin.

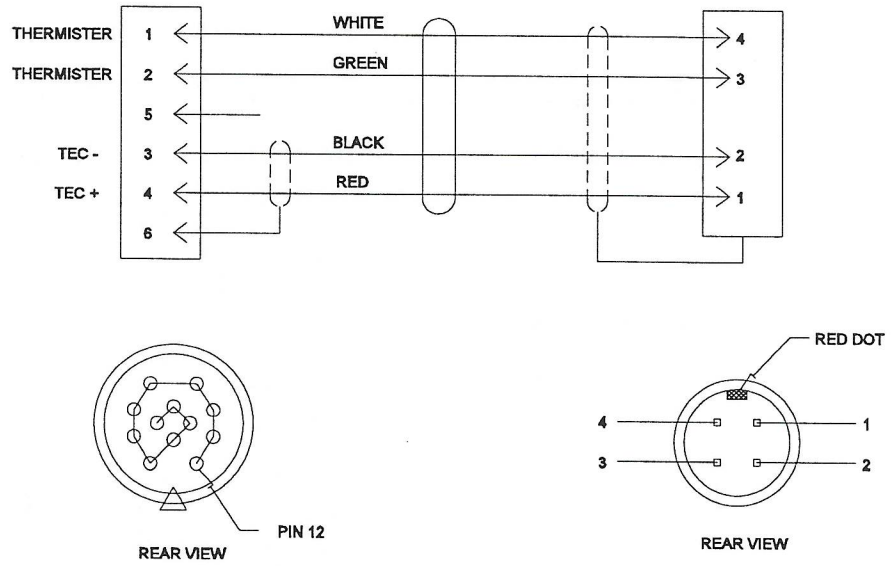


Figure 2 Cable, Detector Head Cooler

If a calibration module is being used, it should be connected to the detector input on Merlin.

MOUNTING

Two 1/4-20 threaded holes are provided as well as the standard male adapter.

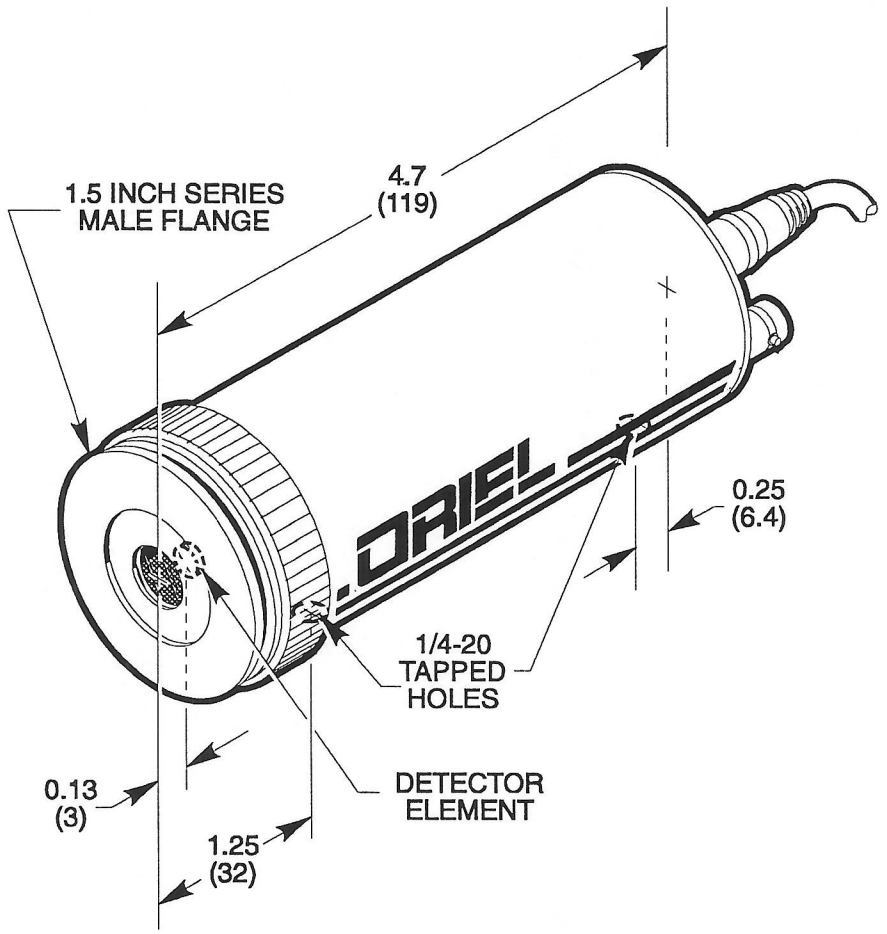


Figure 3 Dimensional Diagram

III. OPERATION

With the cable connections made, set the operating temperature on the 70708 Cooler Controller. Turn on the 70708 and note that the LED on the front panel changes from red to green within a minute to indicate that the set point temperature has been reached at the sensor. Other cooler controllers will have similar operating features. Wait about 15 minutes for thermal equilibrium to be achieved and begin testing.

The single stage thermoelectric cooler can maintain the detector temperature nominally 25°C below ambient. We suggest an operating temperature at 5°C - that is where we perform our calibration. To minimize dark current and noise you may want to experiment with the controller to achieve the coldest operating point, but the cooling capability is relative to ambient and environmental changes (temperature, humidity) will affect cooler operation in terms of absolute temperature. In general, operating at a temperature that gives a few degrees of headroom is advisable since the benefits of achieving maximum differential are relatively small. For stability the absolute operating temperature is not very significant as long as it is constant.

IV. ENTRY OF CALIBRATION DATA INTO MERLIN™

The following is a brief description of how to make Merlin™ give readings in watts when using a calibrated silicon detector. The first set of directions pertains to all Merlin™ silicon detector heads purchased from Oriel, and describes how this single point can be used at a single wavelength. The second set of directions describes how to use that single point calibration to obtain an approximate broadband calibration. The third set of directions details how to obtain accurate broadband calibrations if you have also purchased a Calibration Module with your detector head. In all cases, the information is valid only when operating your cooled Si detector at 5 °C as recommended in this manual.

Calibration date entry and wavelength selection can be done with a computer. See your Merlin™ manual for more information.

USING THE SINGLE POINT CALIBRATION AT A SINGLE WAVELENGTH

1. Use the four buttons on the Merlin™ front panel and select EDITTABLE on the third menu screen. A table of wavelengths and responsivities will appear. Clear this table if it is not already empty. (An easy way to clear the table, although you will lose all of that data, is to select DELETE and then DELETE ALL.)

2. Now select ADD, type the calibration wavelength, "633", and the responsivity value from the detector head. Then press the ACCEPT key and the ESCAPE key. You should be back at menu screen #3.

3. Select WAVELENGTH from this menu. Then use the keypad to enter the desired wavelength, "633", and press ACCEPT and DONE. You will notice that the wavelength is shown at the top right side of the display. This should serve as a reminder that the calibration is only accurate at this single wavelength.

4. Finally, select UNITS from menu screen #2. Then select W, for watts, and enter the **inverse** of your gain setting as the Calibration Scale Number. For example, the default gain setting of a silicon detector head is 10^7, therefore your Calibration Scale Number should be 1.000E-07.

   When you have entered this value correctly, press ACCEPT and then DONE. Your Merlin™ display should now show Watts and the calibration wavelength.

5. Note that when you turn Merlin™ off and then on, all of your settings are saved.

USING THE SINGLE POINT CALIBRATION ACROSS A BROADBAND

1. First, you should scale the curve shown in Figure #1 using the single point calibration provided with your detector head. For example, looking at the 70118 curve in Figure #1, the responsivity at 460 nm is about 50% of the responsivity at 633 nm, therefore, your calibration value at 460 nm should be half of the single point calibration value provided with your detector head. Create a table like this of wavelengths and responsivities across your entire wavelength range. Although greater accuracy can be obtained by creating more data points, Merlin™ will interpolate between the values in your table. Merlin™ will accept up to 99 data points.

2. To enter your table into Merlin™, use the four buttons on the Merlin™ front panel and select EDITTABLE on menu screen #3. The "active" table of wavelengths and responsivities will appear. Clear this table if it is not already empty. (An easy way to clear the table, although you will lose all of that data, is to select DELETE and then DELETE ALL.)

3. Now select ADD, type the first calibration wavelength from the table you have created and the corresponding responsivity value. Then press the ACCEPT key. Continue this process until your entire table has been entered. Then press the ESCAPE key.

4. Select SAVETABLE to save the table you have just entered as the "user" table.

5. Now select UNITS from menu screen #2. Then select W, for watts, and enter the **inverse** of your gain setting as the Calibration Scale Number. For example, the default gain setting of a silicon detector head is 10^7, therefore your Calibration Scale Number should be 1.000E-07.

   When you have entered this value correctly, press ACCEPT and then DONE. Your Merlin™ display should now show Watts.

6. The Merlin™ reading is close only if you are measuring a narrow wavelength band within the limits of your table and if you tell Merlin which wavelength you are measuring. To do this select WAVELENGTH from menu screen #3. Then use the keypad to enter the desired wavelength, and press ACCEPT and DONE. You will notice that the wavelength is shown at the top right side of the display. This should serve as a reminder that the calibration is only accurate at this single wavelength.

7. Note that when you turn Merlin™ off and then on, all of your settings are saved.

USING A CALIBRATION MODULE WITH THE SILICON DETECTOR HEAD

1. With Merlin™ turned off plug your calibration module into the detector input port and then plug your detector into the calibration module. Turn Merlin™ on. The calibration module is automatically read at power up.

2. Next, go to menu screen #3 and select TABLE. Then highlight DETECTOR and press the ACCEPT key. You will return to menu screen #3 and the data from your detector calibration module will load into the current, or "active", table.

3. Select EDITTABLE from this menu. You are now looking at the "active" table. The data from your calibration module will display as a table of wavelengths and responsivities.

4. Now select UNITS from menu screen #2. Then select W, for watts, and enter the **inverse** of your gain setting as the Calibration Scale Number. For example, the default gain setting of a silicon detector head is 10^7, therefore your Calibration Scale Number should be 1.000E-07.

When you have entered this value correctly, press ACCEPT and then DONE. Your Merlin™ display should now show Watts.

5. The Merlin™ reading is accurate only if you are measuring a narrow wavelength band within the limits of your table and if you tell Merlin which wavelength you are measuring. To do this select WAVELENGTH from menu screen #3. Then use the keypad to enter the desired wavelength, and press ACCEPT and DONE. You will notice that the wavelength is shown at the top right side of the display. This should serve as a reminder that the calibration is only accurate at this single wavelength. Also note that Merlin™ will interpolate (linearly) between values in the table.

7. Finally, note that when you turn Merlin™ off and then on, all of your settings are saved and the calibration module is read again. If you do not have a calibration module plugged in when you cycle power to Merlin™ the current table will not change but when you choose DETECTOR under the TABLE option, an empty chart will load.

WARRANTY AND RETURNS

WARRANTY

Oriel Instruments warrants that all goods described in this manual (except consumables such as lamps, bulbs, filters, ellipses, etc.) shall be free from defects in material and workmanship. Such defects must become apparent within the following period:

1. All products described here, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to buyer.

2. Spare parts: ninety (90) days after delivery of goods to buyer.

Oriel Instruments' liability under this warranty is limited to the adjustment, repair and/or replacement of the defective part(s). During the above listed warranty period, Oriel Instruments shall provide all materials to accomplish the repaired adjustment, repair or replacement. Oriel Instruments shall provide the labor required during the above listed warranty period to adjust, repair and/or replace the defective goods at no cost to the buyer ONLY IF the defective goods are returned, freight prepaid, to an Oriel Instruments designated facility. If goods are not returned to Oriel Instruments, and user chooses to have repairs made at their premises, Oriel Instruments shall provide labor for field adjustment, repair and/or replacement at prevailing rates for field service, on a portal-to-portal basis.

Oriel Instruments shall be relieved of all obligations and liability under this warranty if:

1. The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Oriel Instruments unless buyer furnishes reasonable evidence that such installations were not a cause of the defect. This provision shall not apply to any accessory, equipment or part which does not affect the safe operation of the device.

2. The goods are not operated or maintained in accordance with Oriel's instructions and specifications.

3. The goods have been repaired, altered or modified by other than Oriel authorized personnel.

4. Buyer does not return the defective goods, freight prepaid, to Oriel repair facility within the applicable warranty period.

IT IS EXPRESSLY AGREED THAT THIS WARRANTY SHALL REPLACE ALL WARRANTIES OF FITNESS AND MERCHANTABILITY. BUYER HEREBY WAIVES ALL OTHER WARRANTIES, GUARANTIES, CONDITIONS OR LIABILITIES, EXPRESSED OR IMPLIED, ARISING BY LAW OR OTHERWISE, WHETHER OR NOT OCCASIONED BY ORIEL'S NEGLIGENCE.

This warranty shall not be extended, altered or varied except by a written document signed by both parties. If any portion of this agreement is invalidated, the remainder of the agreement shall remain in full force and effect.

CONSEQUENTIAL DAMAGES -

Oriel Instruments shall not be responsible for consequential damages resulting from misfunctions or malfunctions of the goods described in this manual. Oriel's total responsibility is limited to repairing or replacing the misfunctioning or malfunctioning goods under the terms and conditions of the above described warranty.

INSURANCE -

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from Oriel, shall assume full responsibility for any and all damage while in their care, custody and control. If damage occurs, unrelated to the proper and warranted use and performance of the goods, recipient of the goods accepts full responsibility for restoring the goods to their condition upon original delivery, and for assuming all costs and charges.

RETURNS

Before returning equipment to Oriel for repair, please call the Customer Service Department at (203) 377-8282. Have your purchase order number available before calling Oriel. The Customer Service Representative will give you a Return Material Authorization number (RMA). Having an RMA will shorten the time required for the repair, because it ensures that your equipment will be properly processed. Write the RMA on the returned equipment's box. Equipment returned without a RMA may be rejected by the Oriel Receiving Department. Equipment returned under warranty will be returned with no charge for the repair or shipping. Oriel will notify you of repairs not covered by warranty, with the cost of the repair, before starting the work.

Please return equipment in the original (or equivalent) packaging. You will be responsible for damage incurred from inadequate packaging, if the original packaging is not used.

Include the cables, connector caps and antistatic materials sent and/or used with the equipment, so that Oriel can verify correct operation of these accessories.

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