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Model ORION

Fiber Alignment System



Operator Manual

Newport

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ORION
Fiber Alignment System

Operator Manual

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Legal and Warranty Statements

Limitations of Liability

Newport makes no warranties express or implied with regards to the performance or accuracy of Orion and pertaining documentation. Newport makes no claims as to the suitability of this product for any particular purpose. The user agrees that Newport and their assigns shall not be held liable for any consequential or incidental damages that may possibly be incurred through the use of this product whether through Newport's negligence or not. Newport's liability is limited to the purchase price of this product.

Warranty and Trademarks

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will the either repaired or replaced at Newport's option.

To exercise this warranty, write or call your Newport Representative, or call the Newport Headquarters in Irvine, CA at 800-222-6440. You will be given assistance and return instructions. Send the product, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period or at least 90 days.

Limitations of Warranty

This warranty does not cover annual calibration or defects resulting from modification to misuse of any product or part. This warranty does not apply to fuses or other consumable items.

Statement of Calibration

This instrument has been inspected and tested in accordance with specifications published by Newport Corporation. The accuracy and calibration of this instrument and photodetector is traceable to the National Institute for Standards and Technology through equipment which is calibrated at planned intervals by comparison to the certified standards maintained at Newport Corporation. Photodetectors require annual calibration to maintain accuracy and traceability.

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IN-03961 (01-00)

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EC DECLARATION OF CONFORMITY

We declare that the accompanying product, identified with the "CE" mark, meets the intent of the Electromagnetic Compatability Directive, 89/336/EEC and Low Voltage Directive 73/23/EEC.

Compliance was demonstrated to the following specifications:

EN50081-1 EMISSIONS:

Radiated and conducted emissions per EN55011, Group 1, Class A

EN50082-1 IMMUNITY:

Electrostatic Discharge per IEC 1000-4-2, severity level 3
Radiated Emission Immunity per IEC 1000-4-3, severity level 2
Fast Burst Transients per IEC 1000-4-4, severity level 3
Surge Immunity per IEC 1000 4-5, severity level 3

IEC SAFETY:

Safety requirements for electrical equipment specified in IEC 1010-1.

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VP European Operations
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System Warnings



This instrument contains voltages which can cause injury or death if contacted. Defeating the designed-in safety features such as grounding, shielding or the use of the specified fuse could expose you to a variety of hazards. Do not attempt to open, modify or disassemble any of the components of this system. You do so at your own risk. NEVER attempt to operate this equipment if you suspect it is damaged or not working properly.



For your safety and the safety of your equipment you should heed the following cautions:

Never attempt to power-up the unit if there is evidence of shipping damage or you suspect internal damage to the unit.

Do not power-up the unit if it has been exposed to moisture or wet.

Do not power-up the unit if any of the cables are frayed or damaged.

Do not attempt to power-up the unit with the covers or safeties removed.

Never operate the system if you suspect that it is damaged, malfunctioning or not operating properly.

Never insert or probe openings on the unit when plugged in or turned on.

Never expose the controller or devices to solvents or chemicals, especially when the unit is plugged in or operating.

If you have any questions or concerns about the safe operation of this equipment contact Newport.

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Symbols and Conventions

The following symbols and conventions are used in this manual. They indicate warnings or information that is important to the user. You are urged to carefully read the adjacent text to any of the symbols below. The symbols indicate cautions for your safety and that of the equipment.



This symbol indicates actions that may bring the user into potential contact with electrical supplies or electrical current. Any mishandling could result in personal injury or death. You should heed instructions adjacent to this symbol.



This symbol cautions you to read the adjacent text before proceeding.



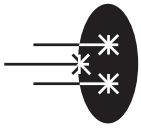
This symbol indicates procedures or processes that you must complete before continuing.



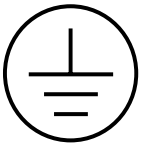
This symbol highlights important INFORMATION about the product.



When used in the command reference section, this symbol indicates commands for the Actuator and Alignment portion of the instrument.



When used in the command reference section, this symbol indicates commands for the Optical power meter portion of the instrument.



This symbol is the chassis protective grounding terminal. It indicates an earth ground connection to the controller chassis, which includes all exposed metal structures.

Conventions

The following special typefaces are used to help you distinguish between commands, text you type and displayed information.

Commands and typed text are shown in courier font: `XR?`

Displayed information on the ORION unit's front panel is indicated in segmented display font: 870

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Section 1
Getting Started

1.0 Outline of Section 1

The following topics will be covered in this section:

1.1 Unpacking and Handling

1.2 Inspection for Damage

1.3 Part identification and part list



WARNING

Read and follow the instructions in this section entirely if you are using this equipment for the first time. Equipment can become easily damaged from improper handling.

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1.1 Unpacking and Handling

It is recommended that the ORION system be unpacked in your lab or work site rather than at the receiving dock. Unpack the system carefully, small parts and cables are included with the instrument. Inspect the boxes carefully for loose parts before disposing of the packaging.

You are urged to save the packing material in case you need to ship your equipment.

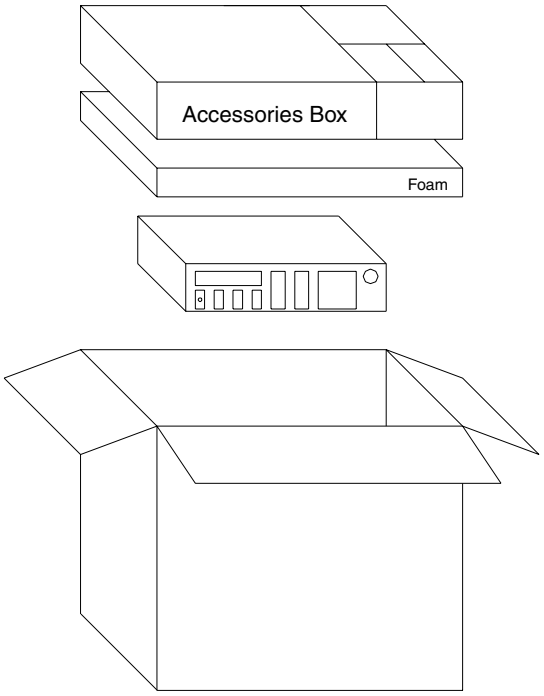


Figure 1.1.1 Illustration showing the factory packing for the ORION fiber alignment system.

1.2 Inspection for Damage

Inspect the boxes for external signs of damage or mishandling. Inspect the contents for damage. There should be no loose parts inside the boxes. Should you find evidence of damage contact the shipper and retain the shipping container as evidence.



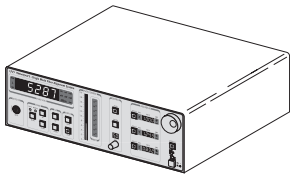
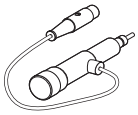
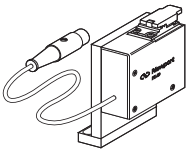
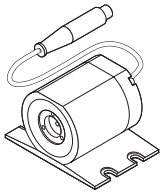
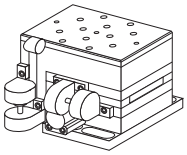
WARNING

Do not attempt to operate this equipment if there is evidence of shipping damage or you suspect the unit is damaged. Damaged equipment may present additional hazards to you. Contact Newport technical support for advice before attempting to plug in and operate damaged equipment.

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1.3 Parts List

The following is a list of parts included with a standard ORION System. Please note there are various options provided with ORION. Check your purchase order for a list of additional items.

Description	Model
	ORION-FX2 or FX 3 Instrument Controller 3 -prong line cord, Users Manual
	AD-100 Electro-strictive Actuators. *FX2 - 2* actuators and 1 micrometer included, *FX3 - 3* actuators included.
	ORION-DH XY Dither Module *1 required.*
	818-IS-1 Integrating sphere photodetector with connectorized accessories.
	562F-XYZ Manual Translation stage

If you are missing any hardware or have questions about the hardware you have received, contact Newport.

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Section 2
Initial Setup

2.0 Outline of Section 2

The following topics are covered in this section:

Setup Requirements

Choosing and Preparing a Suitable Worksurface

Rack ear installation (ORION-CM controller)

Mounting Configuration (562F Translation Stage)

Mounting Considerations: Maintaining the Alignment Coordinate System

Line Voltage Selection

Connecting Devices

Connecting Optical Detector

Integrating sphere connection—to bare fiber, connectorized fiber, etc.

Rear dip switch setting

Polarity switch setting



This section covers the basic setup of the ORION fiber alignment system. A critical factor in the performance and successful use of this product depends upon its proper setup. If you are setting up this system for the first time, you are urged to read this section and the following section entirely.

Follow these guidelines when setting up your system:

Assure the cables are connected properly to the correct port on the instrument.

Fasten screws and actuators securely. Loose mechanical components can cause degradation in performance.

Center loads on the stage and fasten them securely with bolts or clamps. Avoid tape, glue or other temporary methods of attachment. They can degrade or fail over time.

Never force or overtighten screws. The components of your system are manufactured to fit together easily.

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Be aware and heed the loading limits of the stage, especially the Dither module. Overloading can cause performance degradation or failure.

If you have doubts as to the proper setup and use of an item, consult this manual or contact Newport technical support.

2.1 Setup Requirements

The following tools are required for the successful setup of your system.

1/4-20 or M6 (metric) socket head cap screws (SHCS) of various lengths—for bolting down components. *Not included*

Metric or English Hex Ball driver set *Not included*

2.2 Choosing and Preparing a Suitable Worksurface

It is recommended that the user select a rigid worksurface—such as a honeycomb core optical breadboards.

The worksurface should be flat, smooth and free of dirt and contamination.

2.3 Rack Ear Installation (Optional)

The ORION-CM controller can be fitted with standard 19" instrument rack ears. The rack ears are attached to the bottom of the unit as indicated in the illustration below. The feet on the bottom of the ORION-CM unit are not removable. **Leave them on.**

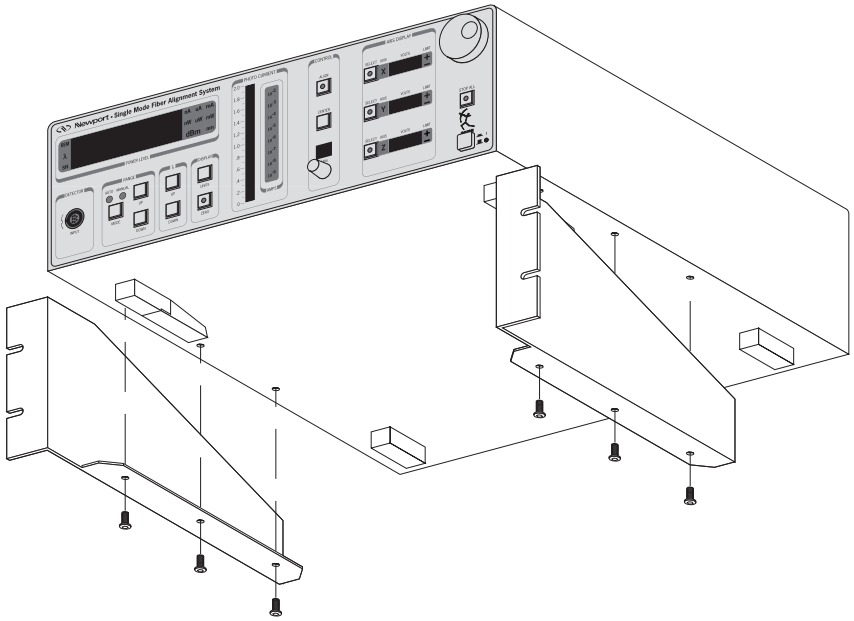


Figure 2.3.1 Exploded view showing the installation of the rack ear option for the ORION controller.

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2.4 Mounting Configuration

The dither module and the translation stage can be mounted in one of two configurations. In the standard mounting configuration, the dither module is mounted "in-line" with the 562F stage (as shown in Figure 2.4.1). In the second mounting configuration, the dither module is mounted directly to the 562F stage (as shown in figure 2.4.2).

The direction of the AD-100 actuators must match the alignment coodinate system in order for the system to function correctly. The following considerations must be made when aligning and mounting the dither module in the standard configuration:

Orient the translation stage and dither module so the AD-100 actuators axis are as shown in Figure 2.4.1.

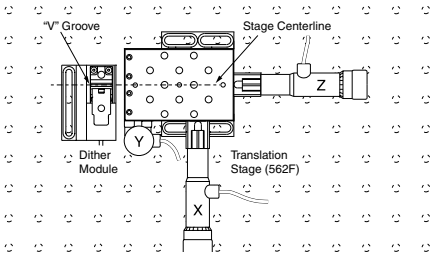


Figure 2.4.1 Standard mounting configuration showing the correct orientation of the dither module, 562F stage and the AD-100 actuator assignments.

The following considerations must be made when mounting the dither module to the 562F stage:

Remove the "L" mounting bracket from the back of the ORION-DH dither module by removing the three cap head screws.

CAUTION: Do not touch the insides of the dither module since it contains very sensitive devices!

Using the same cap head screws, attach the stage mounting plate supplied with the ORION to the dither module. The dither module is now ready to be attached to the 562F stage. Using two 1/4-20 cap head screws, attach the dither module to the 562F stage and secure it to the stage ensuring that the optical axis of the dither module is lined up with that of the 562F stage. Orient the translation stage and dither module so the AD-100 actuators axis are as shown in Figure 2.4.2.

NOTE: With the dither module mounted on the 562F stage, you must configure the Auxiliary DIP switch on the rear panel to change the Y Axis polarity to a state of "1" (see Figure 2.7.2)

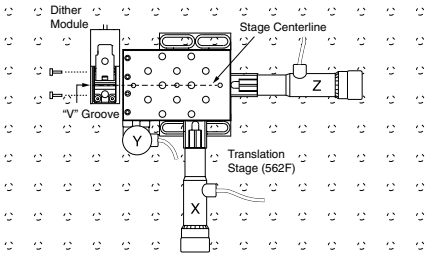


Figure 2.4.2 Stage mounting configuration showing the dither module mounted to the 562F stage and the correct orientation of the AD-100 actuator assignments.

NOTE

During alignment, the dither module flexure oscillates at 400Hz. As a result, secondary vibrations can occur if the dither module body is allowed to move during operation. This can induce phase errors and as a result degrade performance. For this reason the dither module must be bolted soundly to the worksurface with 2 bolts.

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2.5 Mounting Considerations: Maintaining the Alignment Coordinate System

If you are using a translation stage other than the Newport 562, be certain that the axis of travel corresponds correctly with the alignment coordinate system of ORION. The axes of the ORION alignment coordinate are as follows:

X: Horizontal axis

Y: Vertical Axis (up/down—relative to table top)

Z: Optical Axis (distance between optical devices)

You must maintain this coordinate system relative to the dither module. It is also important that the direction of travel for the AD-100 actuators (+/-) correctly corresponds to the ORION alignment coordinate system. See Figure 2.5.1.

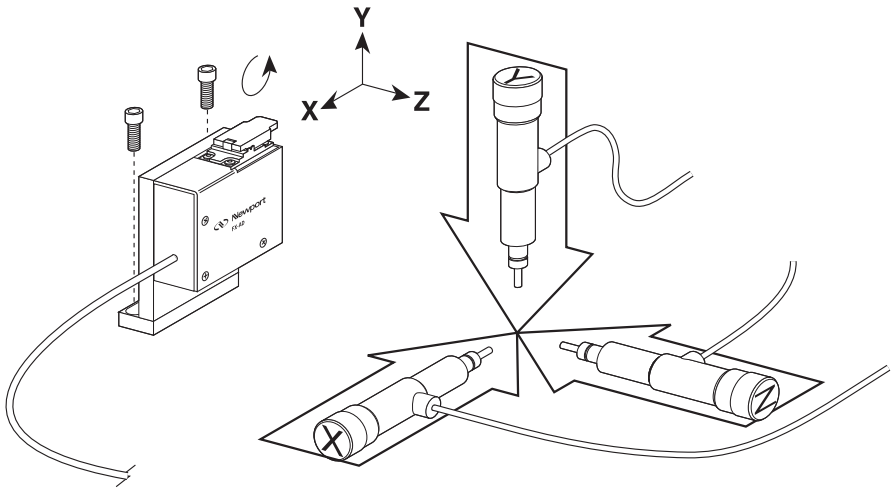


Figure 2.5.1 An illustration showing the alignment coordinate system relative to the dither module. When setting up your system you must orient the AD-100 direction and axis assignments correctly.

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2.6 Initial Power Up

CAUTION

Before connecting power to the controller, the following precautions must be followed:

The line voltage selector switch, located at the rear of the controller (see Figure 2.6.1), must be set to the AC power line voltage being used. Select the 115V position for voltages between 100VAC and 120VAC. Select the 230V position for voltages between 200VAC and 240VAC. Operate on either 50Hz or 60Hz power line.

Have a qualified electrician verify the wall socket that will be used is properly polarized and properly grounded. If the wall socket does not provide a ground terminal for the power cord, the controller has a GROUND POST, located at the rear of the controller, to be used for the specific purpose of providing a means to connect earth ground to the controller.

It is important that all peripheral devices be connected to the system before power is applied for the protection of your fixture due to possible transient behavior of actuators during this process.

Provide adequate distance between the controller and adjacent walls for ventilation purposes. Approximately 2 inch spacing for all controller surfaces is adequate. Make certain exhaust fan port, located on rear panel of controller, is not obstructed.

There are no user serviceable parts except for the power line fuse. Should this fuse blow, disconnect the power cord from the controller and replace the fuse with a 1 Amp, 250V, Type T, 5x20mm, Slo-Blo. The fuse may be obtained from Newport Corporation, part number 20037-10, or Little Fuse, Catalog #218 001.

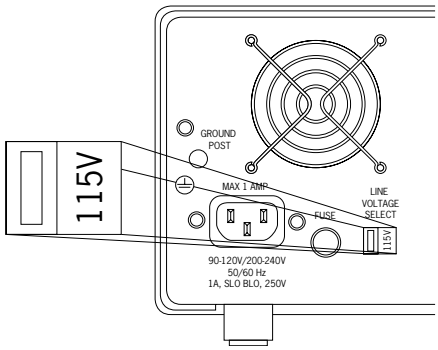


Figure 2.6.1 Illustration showing the location of the voltage line select switch on the ORION-CM controller.

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2.7 Device Connection

IMPORTANT

It is important that all peripheral devices be connected to the system before power is applied.

Once the hardware is oriented and attached to the worksurface the devices may be connected to the ORION controller. The electrical connections for the AD-100 actuators, dither module and photodetector are keyed to prevent misconnection. The connectors for the actuators and dither modules are located on the rear of the unit. The photodetector connector is on the front panel. Refer to Figures 2.7.1 and 2.7.2.

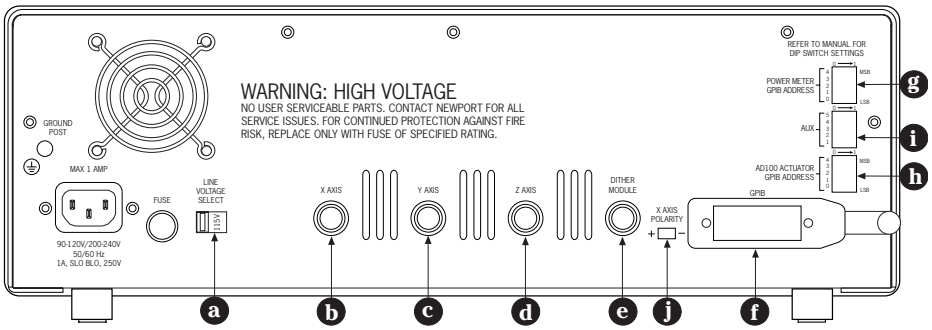


Figure 2.7.1 Rear panel unit identifying connection ports.

a Line voltage selector switch
b X AD-100 actuator axis
c Y AD-100 actuator axis
d Z AD-100 actuator axis
e Dither module
f GPIB connector
g Power meter address
h AD-100 controller address
i Auxiliary switch set
j Polarity switch

GPIB DIP switch settings: The figure below shows the dip switch setting and the corresponding GPIB address settings. Address zero cannot be used because it is reserved for the host computer.

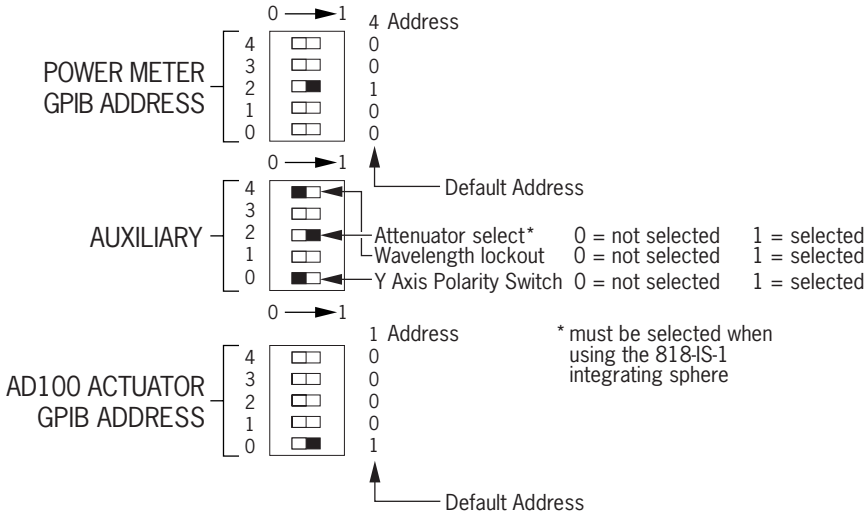


Figure 2.7.2 GPIB DIP switch settings

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2.8 Connecting the Optical Detector

The optical detector provides the feedback for the alignment engine and is an integral part of the ORION system. The 818-IS-1 Detector Integrating Sphere is ideal for fiber optic applications.

The optical detector is connected to the ORION front panel as shown in Figure 2.8.1. When the controller is first turned on, the system will read the calibration data resident in the detector CAL module. If you change detectors during power-on you must restart the system for the new detector settings to take effect.

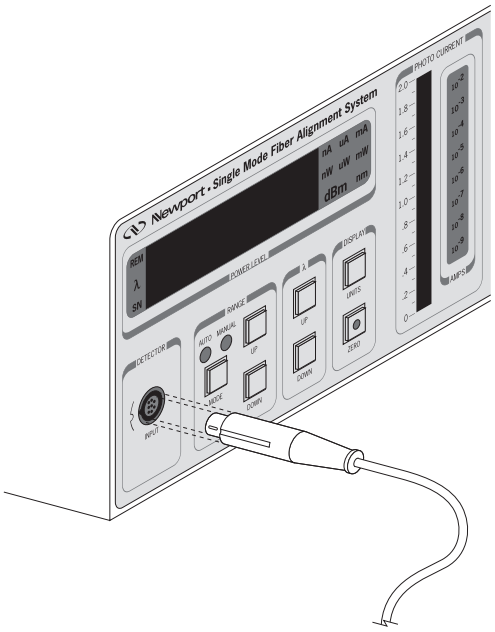


Figure 2.8.1 Detail of the location of the optical detector connector on the ORION controller. NOTE: the CAL module has an indexing notch to correctly orient the connector pins.

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2.9 Optical Detector Integrating Sphere Connection

The 818-IS-1 Integrating sphere detector has a wide selection of optional coupling connectors and adapters offering great flexibility in making optical measurements. Adapters for bare fiber and the most popular fiber connectors are offered for the 818-IS-1.

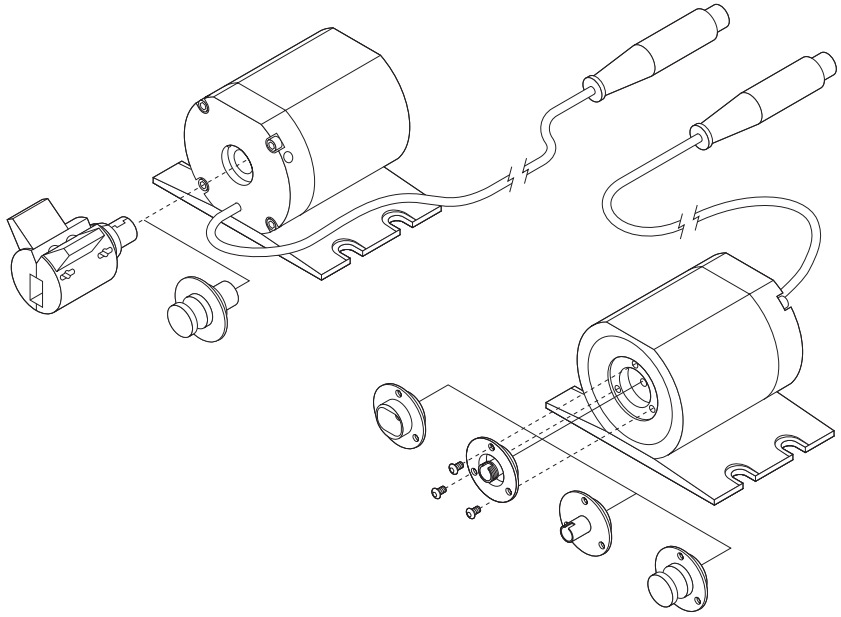


*Figure 2.9.1 An illustration of the 818-IS-1 and the various optional coupling attachments.**

** not all items shown are included.*

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Section 3
System Operation

3.0 Outline of Section 3

This section is divided into three major parts and details the various individual functions of the ORION-CM system.

Optical Meter

Description of the ORION-CM Optical Power Meter

Configuring the Optical Meter

Using Offsets

Taking Optical Measurements

AD-100 Actuator Controller

Description of the AD-100 Motion System

Using AD-100 Actuators

Alignment

Overview of the Alignment System

Conditions required for Alignment

Conducting a 2D Alignment

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3.1 Description of the ORION Optical Power Meter

All of the front panel controls for the optical power meter portion of the ORION-CM controller are found on the left side of the instrument's front panel. Refer to Figure 3.1.1 below.

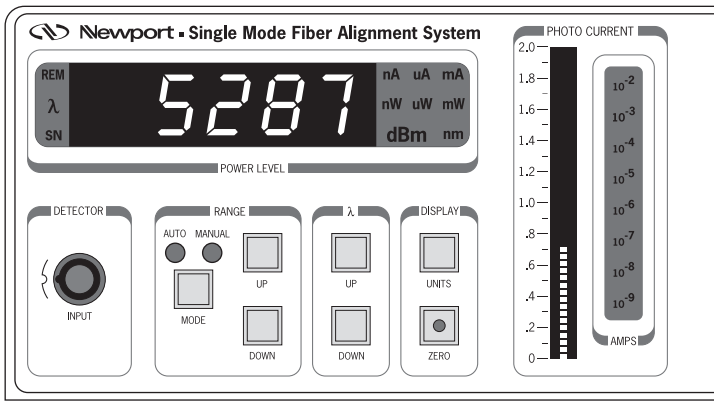


Figure 3.1.1 The optical meter section of the ORION controller.

The ORION optical meter features 2 optical reading displays:

Large Numeric LED segment

Segmented Bar graph

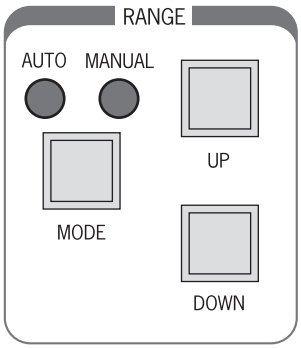
In addition to showing the current optical power reading, the LED display shows the detector serial number and wavelength during boot-up and setup mode. The LED bar graph displays the current optical power reading in graphical form.

3.1.1 PHOTODETECTOR

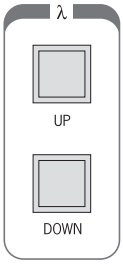
The electrical connection for the photodetector is designed to accommodate the Newport 818-IS-1 optical detector and Newport patented CAL module. You should not attempt to probe or connect any device other than the proper Newport detector in the ORION-CM photodetector port.

3.1.2 RANGE

The range function allows you to set the optical meter ranging mode to AUTO or MANUAL. When in AUTO mode the meter will automatically select the best amplification range based on the incoming signal. When used in the manual range, you must select the correct range by pressing the UP/DOWN buttons until the desired range is selected. The units indicator on the optical reading display will show the current set range.

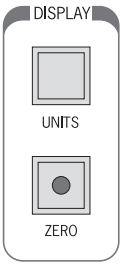


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3.1.3 λ

The λ (lambda) panel allows the wavelength to be set. The correct wavelength must be set in order to achieve calibrated optical power readings. When using multiple wavelength sources select the strongest wavelength or the wavelength you wish to couple to. To change the wavelength press the UP/DOWN keys. The LED display will show the current wavelength setting. Once set, the wavelength value will be used as power-up default.



3.1.4 DISPLAY

The display panel allows you to select the display units of the optical power readings in Watts, dBm or Amps. To set the units, press the UNITS button until the LED units portion of the display shows the desired setting.

The ZERO mode, when active (indicated by the ZERO button LED lit), allows an optical power offset to be subtracted from the current optical power reading. The ZERO function is used to eliminate background noise.

3.2 Configuring the Optical Meter

For most applications, setup of the optical meter encompasses:

Setting the correct wavelength

Setting the measurement units.

Adjust ZERO to eliminate background noise (if required)

Set Meter Range mode

3.3 Using Offsets

Using the ZERO function of the meter is designed to compensate for ambient light. This is of greatest concern when making free beam measurements. Newport connectorized or bare fiber adapters are designed to block ambient light from reaching the active area of the detector. In these instances the ZERO function is useful to compensate for any offset in the detector itself.



NOTE

Improperly setting a ZERO offset can cause errors in the accuracy of optical power readings.

For more information about optical noise and measurements accuracy refer to Appendix B: Performing Optical Measurements in this manual.

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3.4 Taking Optical Measurements

The ORION-CM optical meter constantly updates optical readings and displays them on the LED segment display and bar graph at all times.

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3.5 Description of the AD-100 Motion System

The ORION-CM controller incorporates a 3 axis AD-100 electro-strictive motion system. The actuator is a hybrid manual micrometer/AD-100 crystal motion device. The micrometer allows 0.5 in. (13 mm) of manual positioning and 100 µm remote positioning. The AD-100 actuators are controlled by applying a voltage from the ORION-CM controller.

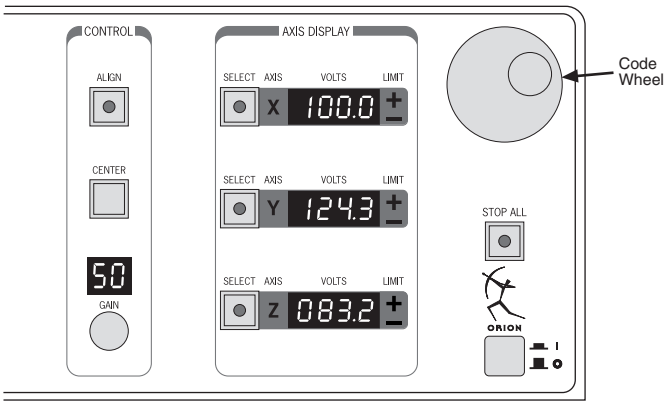


Figure 3.5.1 The front panel of the ORION-CM controller detailing the AD-100 motion control panel.

The AD-100 axis display shows the current voltage setting of the X, Y and Z axis at all times. The display will show " - - - -" for an axis with no AD-100 actuator installed. The minimum voltage displayed is 10.0 volts. The maximum AD-100 voltage is 160.0 Volts. The actuator shafts extend further as this voltage is increased.

3.5.1 SELECT

Each AD-100 axis display has a SELECT button associated with it. When the select button is pressed the LED in the middle of the button lights up indicating the code-wheel is activated. The AD-100 actuator can now be moved by turning the positioning knob (code wheel) located in the upper right-hand corner of the ORION-CM controller. Only one axis can be move at a time from the front panel. During automatic alignments the X & Y select buttons are disabled. The Z axis control is not.

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3.5.2 STOP ALL

The STOP ALL button immediately halts all AD-100 motion or alignment in progress and prevents alteration of the x, y and z actuator voltages. The STOP ALL button is active when the ORION-CM controller is under computer control. Once activated, the STOP ALL button must be de-selected to turn it off.

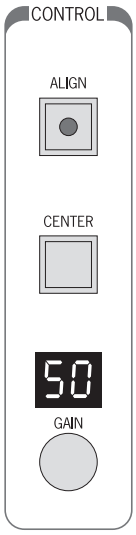
3.5.3 VOLTS LIMITS

The Volts display shows the current voltage (position) for all installed AD-100 actuators. When the minimum (10.0V) or the maximum voltage (160.0V) is reached the + or - limit indicators will light and flash.

Limit indicators may also light when an axis has reached a limit during automatic alignment. If this happens, the alignment will terminate.

3.6 Overview of Alignment System

3.6.1 ALIGN



When depressed, the align button commences a 2D alignment. The system will maintain alignment until the ALIGN button is pressed again or an axis has reached a travel limit. Alignment will stop under any of the following conditions:

The ALIGN button is pressed again (LED off)

The STOP ALL button when pressed will terminate alignment.

The X or Y AD-100 axis encounters a travel limit

ALIGN ∅ or STOP command is received via the GPIB computer interface.

3.6.2 CENTER

The CENTER button, when pressed, causes the X and Y AD-100 actuator voltage to go to about 80.0 Volts. This is defined as the center of travel. The Z AD-100 actuator is not affected by the center button. The center feature is useful just prior to conducting an alignment. Pressing the CENTER button assures that the AD-100 crystal is at its center of travel before an automated alignment is begun. The center button is disabled when the ALIGN BUTTON is activated.

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3.6.3 GAIN

The GAIN knob allows the user to increase or decrease the GAIN used in the alignment algorithm. The GAIN is factory set to 50. This setting will provide excellent performance for most devices and applications.

Decreasing the GAIN <50 may be required when the system motion is too fast causing vibration or overshoot.

Increasing the GAIN >50 will decrease alignment time slightly. You are cautioned from setting the GAIN too high. This can create overshooting and oscillation at the peak. At worst case alignment may actually take *longer* to achieve when gain is too high.

3.7 Conditions Required for Alignment

Initial coupling is required to commence automatic alignment. The ORION optical power meter has very high gain allowing one to capture optical signals as low as 100 nW. For best results, the ORION optical meter should be set to AUTO range mode to avoid the meter from saturating at higher coupled power.

The detector should be blocked from ambient light and if possible the ZERO offset feature should be used to remove ambient noise and optical offsets. Use the ZERO function to achieve higher accuracy optical power readings.

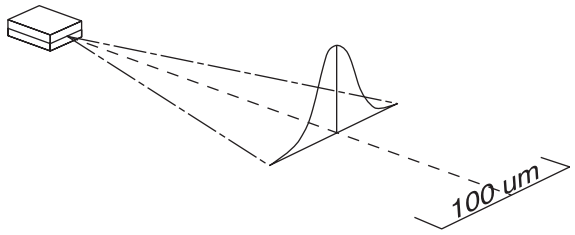


Figure 3.7.1 Illustration showing how the travel range of the XY actuators relates to the optical peak.

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3.8 Conducting a 2D Alignment

Recommend system settings for 2D alignment:

Set Lambda to the correct wavelength.

Set the power meter to **AUTO** range mode.

Use the ZERO offset if appropriate.

Set GAIN to 50.

Check that **STOP ALL** button is off (Button LED is off).

The typical procedure for conducting a 2D alignment is the following:

Set fiber in fiber chuck. The extension of the fiber past the front of the chuck should be kept to a minimum in order to avoid alignment problems.

Press the **CENTER** button

Using the manual AD-100 knobs, coarse align the devices to achieve minimal coupling (>100 nW).

Press the **ALIGN** button - observe the Optical Power display or Bar graph - alignment is achieved when the optical power settles on the highest reading. *This should take less than 2 seconds.*

Press the **ALIGN** button again to turn off alignment.

3.8.1 AD-100 Travel Limits During Alignments

If a travel limit is encountered the +/- limit LED will light and blink next to the voltage position display indicating whether the axis is in a forward to reverse limit.

If the X or Y axis encounters a travel limit during alignment:

Turn the alignment off by pressing the **ALIGN** button again (LED off). (This will happen automatically).

Observe the direction of the limit (forward or reverse)

Press the **CENTER** button

Manually move the AD-100 actuator to bring the actuator in from the limit direction.

Re-attempt alignment.

Should the system again encounter a travel limit during alignment decrease the Z distance (along the optical axis) to bring the devices closer together - effectively decreasing the FWHM of the device.

Change the rear polarity switch to the opposite polarity.

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Section 4
Command Reference

4.0 Outline of Section 4

The following topics are covered in this section:

- Overview of GPIB interface
- Syntax and conventions for GPIB commands
- Syntax examples
- Response syntax
- Numeric formats and units
- Error messages and error handling
- Essential commands
- Command listing by type
- Alphabetical listing of commands
- Command reference

The GPIB interface allows full access to all of the front panel features on the ORION-CM controller. Two GPIB addresses are used for the ORION-CM controller. One address for the power meter/alignment portion and one for the AD-100 motion controller portion. The two addresses allow the ORION-CM to operate as two separate instruments.

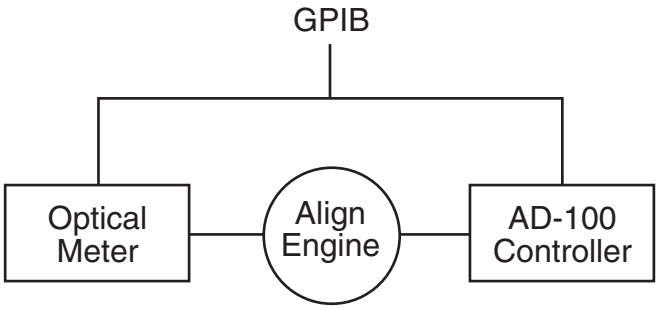
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4.1 Overview of GPIB Interfacing ORION

The ORION system is unique as it contains 2 internal instruments each with its own GPIB address. The system is instrumentally divided in the following way:

Optical power meter

AD-100 motion controller and alignment controller



The Optical Power Meter is an embedded form of the Newport 1830 Optical Power Meter and performs all the optical power metrology functions. Internally it provides optical power data for the alignment engine. The user can configure the optical meter functions and query optical readings via the GPIB interface. The default power meter GPIB Address is 4.

The AD-100 and Alignment Engine portion controls the 3 AD-100 actuators and drives the dither module. The user can position any of the 3 AD-100 actuators via the GPIB interface. Control of the alignment engine entails the ability to turn the alignment ON/OFF and set alignment gain and dither radius. No user access to the Dither module is allowed via the GPIB interface or front panel. The default GPIB Address is 1.

GPIB DIP switch settings: The figure below shows the dip switch setting and the corresponding GPIB address settings. Address zero cannot be used because it is reserved for the host computer.

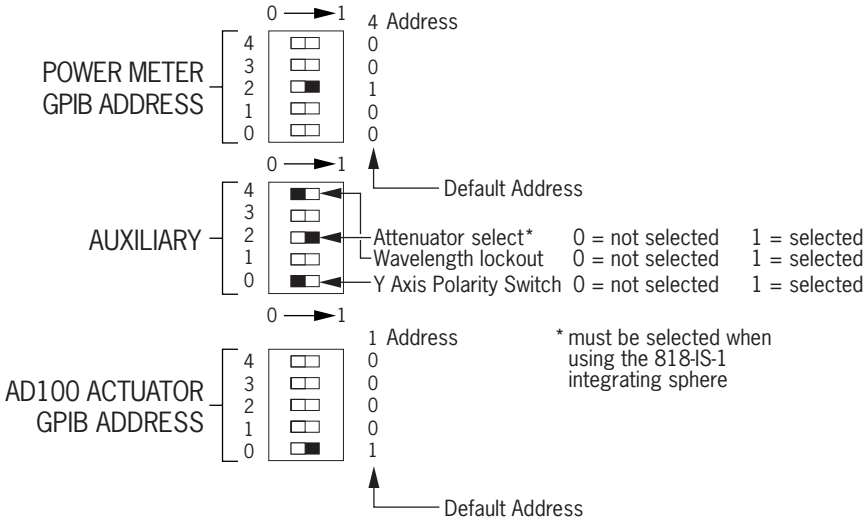


Figure 4.1.1 GPIB DIP switch settings

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4.2 Command Syntax and Conventions

The following syntax conventions are used in the GPIB interface of ORION :

```
<axis ID>CMD<argument><?><n>
```

<axis ID> Axis Identifier

When directing commands to an ORION AD-100 actuator device, the user must specify which device, by axis ID, the command or query is directed to. Valid values are integer values of 1, 2 or 3. This corresponds to the X, Y and Z axis ports on the ORION-CM controller. No space is allowed between the `<axis ID>` and the command word, CMD. If there is a space an error will be posted.

CMD Command

The CMD parameter refers to the actual command or query word. Only those commands listed in the command section are valid command words. The controller is not case sensitive and will accommodate mixed case command words. No spaces are allowed between the characters of the command word. If there is a space an error will be posted.

<*argument*> Parameter

The `<argument>` parameter refers to the modifier or parameter argument the specific command requires. Depending upon the actual command, parameters can be numbers or characters. A space is allowed between the CMD and the `<argument>` parameter but is not required. Spaces are not allowed between the characters of the parameter.

<?> Query terminator

The `<?>` is used to terminate query commands. A query command is a command used to request data from the instrument. Not all commands support query mode. Refer to the specific command definition for query modes.

<n> Command terminator

ORION requires `<n>`, the new line character, at the termination of every command. This signals ORION that it has received the full command from the computer. If the `<n>` termination is not appended to the command the system will ignore the command. Certain GPIB software packages can be configured to automatically append a termination character. Refer to your documentation texts for details.

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4.3 Syntax Examples

Example 1: Commanding an axis move:

```
1MR50.0 <n>
```

In the above example, the AD-100 axis 1 is commanded to 'Move Relative' (MR) 50.0 Volts.

Acceptable variations of the above example are:

`1MR_50.0 <n>`	*The "_" symbol indicates a <space> and not the actual character*
`1mr50.0 <n>`	*Lower case characters used in the command word.*
`1mR50.0 <n>`	*Mixed lower and upper case characters used in the command word.*

Example 2: Query Syntax
1V? <n>

The above example queries the ORION-CM controller for the current voltage setting for axis 1.

Concatenation

ORION does not support command concatenation. Should you concatenate or send more than one command at a time, the commands will be ignored and an error will be posted.

4.4 Response Syntax

Return and Response Syntax from ORION is the following:

<response data><n>
45.0<n>

Response data and <n>; new line

4.5 Numeric Formats and Units

Numeric Formats for AD-100 and Alignment Engine

ORION supports decimal numeric format. The instrument does not support hexadecimal entry or exponential notation. Responses from the instrument will always be in decimal format. A number can be signed or unsigned, which is defined by the individual command.

Units for AD-100 and Alignment Engine

Actuator motion units are in VOLTS DC to 1 place of decimal of precision.

Velocity units are in VOLTS DC per second (VDC/sec).

All other units for setting status registers and axis ID's are in integer form.

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Numeric Formats for the Optical Power Meter

The optical power meter instrument portion of the ORION-CM controller supports decimal and exponential format. Responses from the instrument can be in decimal integer format or exponential depending upon the specific data requested i.e. optical reading returns are in exponential format. Numbers can be signed or unsigned.

Units for Optical Power Meter

Optical power reading units are dependent upon the currently set unit format, which is user selectable. Watts and Amps can be in exponential notation.

Example: `10.00E-9`

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4.6 Essential Commands

The following is a list of the most often used commands. For specifics about any of these commands, please refer to its definition in the command reference section later in this chapter.

4.6.1 Initialization Commands

Initialization commands are commands used to configure the communication protocol of the ORION-CM instrument. They should be used at the start of your program to assure the system will react and respond to commands in a consistent way.

CMD	Comments
*SRE	Configure Service Request Register
*ESE	Configure Event Status register
*CLS	Clear status and error bytes
M	Service request enable mask (Optical meter)
C	Clear Status byte register (Optical meter)

4.6.2 Motion Commands

These commands direct the AD-100 actuator axis to move. Values are in Voltage increments.

CMD	Comments
MR	Move Relative Voltage
MA	Move Absolute Voltage
V?	Read Voltage
S	Stop All (also stop any alignment in progress)

4.6.3 Optical Meter Commands

CMD	Comments
D?	Request data (current optical reading)
Wn	Set wavelength
Un	Units - set optical units

4.6.4 Alignment Commands

Alignment	Comments
An	Alignment ON or OFF (1 or ∅)
GRAD	Gradient Query
RAD	Set Dither radius
S	Stop all (also stops actuator motion)

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4.7 Command Listing By Type

4.7.1 Initialization and Configuration Commands

CMD	Comments
*CLS	Clear Event Status Register
*ESE	Configure Event Status Register
*OPC	Enable Operation Complete bit
*PRE	Enable Parallel Poll Register
*SRE	Enable Service Request Register
*ERR?	Query Errors
*IDN?	Query instrument identification string
*IST?	Query Parallel Poll Byte
*STB?	Query Status Byte Register
Ln	Local Lockout enable/disable
Mn	Service Request Enable
O	Auto calibration
C	Clear Status Byte Register
Q?	Status Byte Register Query

4.7.2 Actuator Commands

CMD	Comments
MR	Move Relative
MA	Move Absolute
V?	Query Voltage
VEL	Set Velocity in VDC/sec
S	Stop Motion (also stops alignment in process)

4.7.3 Alignment Commands

CMD	Comments
An	Align ON/OFF
GRAD	Query gradient
RAD	Set dither radius
S	Stop Alignment (also stops actuator motion)

4.7.4 Optical Meter Commands

CMD	Comments
D?	Query optical reading
Rn	Set meter range
Un	Set optical units
Wn	Set wavelength
Zn	Zero (offset) ON/OFF

This icon indicates commands for the optical power meter
This icon indicates commands for AD-100 and alignment.

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4.8 Alphabetical Command Listing

CMD		Comments
ALN		Align ON/OFF
C		Clear Status Byte register
D		Data query - optical reading
DR		Set Dither Radius
G		Set gain (alignment)
LLO		Local Lockout
MA		Move absolute voltage
Mn		Service Request mask enable
MR		Move relative voltage
O		Autocalibrate
Q?		Status Byte query
Rn		Range set and query
S		Stop All
Un		Units set and query
VEL		Set velocity VDC/sec
Wnnnn		Wavelength set and query
V?		Read AD-100 Voltage
Zn		Zero ON/OFF and query
*CLS		Clear Status Byte register
*ERR?		Error query
*ESE		Enable Event Status Register
*ESR		Event Status register byte query
*IDN		Identification Query
*IST		Parallel Poll Status byte
*OPC?		Operation Complete bit enable
*PRE		Parallel Poll register enable
*SRE		Service Request register enable
*STB		Status Byte query
*WAI		Wait for complete


This icon indicates commands for the optical power meter.


This icon indicates commands for AD-100 and alignment.

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Syntax: ALN<state><n>

Parameters: <state> defines the desired mode of alignment, 1 = ON, ∅ = OFF. A space is allowed between the command and the parameter but is not required. <n> indicates the New Line character required for command termination.

Function: This command turns active alignment ON or OFF. By setting this command the user can commence active alignment or terminate alignment in progress. This performs the same function as pressing the ALIGN front panel button of the instrument. The currently set G[Gain] and DR [Dither radius] values will be used for alignment. By appending a <?> question mark with no parameter the user can query the current setting of this parameter. The user may initiate or stop an alignment from computer control or front panel without restriction. Alignments can be stopped by the ALN∅ command, by pressing the front panel align button, or by pressing the STOP ALL button.

Range: <state> Integer value between ∅ and 1.

Default: ∅ = alignment OFF

Query: By appending a <?> question mark with no parameter the system will return the current setting of this parameter.

Query Example: Send: ALN?<n>
Receive: ∅<n>

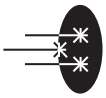
Example: Send: ALN<n>
Receive: 1<n>

Recommendations: The user should assure the proper setting of dither radius and gain before commencing alignment. See Related Commands.

Related Commands: **D**[Dither Radius], **G**[Dither Gain], **S**[Stop All]

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C
Clear Status Byte Register



Syntax: C<n>

Parameters: This command has no parameters. <n> indicates the New Line character required for command termination.

Function: This command is used to clear the status byte register of the optical meter. All bits, except the MAV bit, are set low by sending this command. The status byte register contents are described in the Q? (Status Byte query) command description

Range: None

Default: N/A

Query: This command has no query mode. There are specific commands to query the byte values of the status registers, see the 'commands by type' listing.

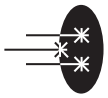
Example: Send: C<n>
Receive: Nothing
The above example clears the status byte registers of the optical meter instrument. <n> indicates the New Line command termination character.

Recommendations: It is advised to clear the status registers at the beginning of your program sequence or after long durations between readings. This will clear any errors that may have queued in the meter over time.

Related Commands: **Mn** [Service Request Mask]

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D?
Query Optical Reading



Syntax: D?<n>

Parameters: This command is a query only and has no parameters. The <?> question mark is part of the command word and required. The <n> indicates the New Line character required for command termination.

Function: This command queries and returns the current optical power reading. Querying this command gives the user the most recent valid optical reading. The actual value returned is dependent upon the current setting of the U [Units].

Range: Dependent upon the U [Units] and R[Range] setting. The reading can be in exponential notation for Amps or Watts. It can be a signed or unsigned number.

Default: N/A

Query: Send: D?<n>
Receive: 4.000E-09<n>
The above example queries the current optical reading. The return is in scientific notation. The actual value of the reading depends on the current U [Units] setting of the meter.

Recommendations: It is advised that the first user check the status register of the meter to assure that the reading is posted with no errors. The Status byte register provides the current status of the meter including any errors. The Status register can be polled in several ways: GPIB Serial Poll: Polls and returns the current decimal value of the Status Byte Register - will be the same value returned by Q?. GPIB Serial Polls are faster than queries and can provide a small speed improvement. GPIB Service Request (RQS/SRQ): by properly masking the Service Request register within the meter the instrument can be configured to assert a GPIB SRQ only when the Done and MAV bits are set. Q? [Status Byte query] should return a 144 - indicating a MAV[bit4] (the optical data requested is in the meters GPIB output buffer) and READ DONE[bit7] (the read operation is complete). Any other bits of the Status bytes high indicates an error or the meter is busy. Refer to the program flowchart section for full details on programming methods.

Related Commands: **Mn** [Service Request Mask], **Q?** [Status Byte Query]

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DR/DR?
Define Alignment Dither Radius

Syntax: DR<value><n>

Parameters: <value> defines the dither radius in mm. A space is allowed between the command and parameter but is not required. <n> indicates the New Line character required for command termination.

NOTE

This is an advanced user command. Modifying this parameter is not recommended without an understanding of the gradient search method. Changing this parameter incorrectly can cause system performance to degrade or fail completely.

Function: This command defines the dither radius in µm for gradient alignment. This value is an **approximation**. The actual value may be slightly different. Modifying this parameter allows the user to increase or decrease the dither sweep of the gradient search. Modifying the dither radius can improve alignment performance. This only takes effect during alignment. Modifying this parameter also modifies the dither radius from alignments executed from the front panel ALIGN button. By appending a <?> question mark with no parameter the user can query the current setting of this parameter.

Range: 0.025 - 2.5

Default: 1.0

Query: In query mode the return will be the last programmed value of DR.
Send: DR?<n>
Receive: 1.0<n>
The above example queries the currently set DR value, the return is 1.0(um).

Example: Send: DR1.5<n>
Receive: Nothing
The above example sets the new dither radius to 1.5 for the next instance of alignment. <n> indicates the New Line command termination character.

Recommendations: The factory setting of dither radius will provide excellent performance over a broad range of applications. The user is discouraged from modifying this parameter without an understanding of the gradient search method.

Related Commands: **G** [Alignment Gain], **ALN** [Alignment ON/OFF]

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G
Define Alignment Gain

Syntax: G<value><n>

Parameters: <value> defines the gain value for alignment. A space is allowed between the command and parameter but is not required. <n> indicates the New Line character required for command termination.

NOTE

This is an advanced user command. Modifying this parameter is not recommended without an understanding of the gradient search method. Changing this parameter incorrectly can cause system performance to degrade or fail completely.

Function: This command defines the gain for gradient alignment. Modifying this parameter allows the user to increase or decrease the multiplier for the calculated step to peak. This command performs the same function as the front panel GAIN setting knob. Modifying the gain can improve alignment speed. Increasing the gain too much can cause overshooting of the peak and resultant oscillation. Modifying this parameter also modifies the gain from alignments executed from the front panel ALIGN button. By appending a <?> question mark with no parameter the user can query the current setting of this parameter.

Range: 1 - 99 **Gain is unitless*

Default: 50

Query: In query mode the return will be the last programmed value of G.
Send: G?<n>
Receive: 75<n>
The above example queries the currently set gain value, the return is 75. **Gain is unitless.*

Example: Send: G45<n>
Receive: Nothing
The above example sets the new alignment gain to 45 for the next instance of alignment. <n> indicates the New Line command termination character.

Recommendations: The factory setting of gain will provide excellent performance over a broad range of applications. The user is discouraged from modifying this parameter without an understanding of the gradient search method. Excessive gain will cause peak overshoot and resultant oscillation. This can actually lengthen alignment time or cause the alignment to never be achieved.

Related Commands: **DR** [Dither Radius], **ALN** [Alignment ON/OFF]

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Syntax: LLO<value><n>

Parameters: <value> defines the state of the lockout 1 = ON, ∅ = OFF. A space is allowed between the command and parameter but is not required. <n> indicates the New Line character required for command termination.

Function: This command enables or disables local lockout of the instruments front panel. By modifying this parameter the user can lock the front panel controls of the system from manual control. (With exception to the STOP ALL and POWER button). This is useful when the system is under computer control and the programmer wishes to prevent manual adjustments from affecting the system. By appending a <?> question mark with no parameter the user can query the current setting of this parameter. This command only locks out the alignment controls. The power meter is not locked out.

Range: 1 = ON, ∅ = OFF

Default: ∅ = OFF

Query: In query mode the return will be the current state of LLO.
Send: LLO?<n>
Receive: 0<n>
The above example queries the currently state of lock lockout, the return is 0 local lockout is off.

Example: Send: LLO1<n>
Receive: Nothing
The above example turns the local lockout ON (=1). Immediately after the command is received the instruments front panel is locked out of manual control. <n> indicates the New Line command termination character.

Recommendations: Local Lockout can be released by either sending LLO∅ or pressing the STOP ALL button on the front panel. If the system is turned off , local lockout will be off when restarted.

Related Commands: none

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MA
Move Absolute Voltage



Syntax: `<axis>MA<voltage><n>`

Parameters: `<axis>` defines the axis 1, 2 or 3 to be commanded. `<voltage>` is the desired voltage increment to move for the specified axis. This command requires and axis id `<axis>` without the ID the command will be ignored and an error posted. `<n>` indicates the New Line character required for command termination.

Function: This commands the specified AD-100 axis to move to the defined voltage. Modifying this parameter allows the user to move any of the AD-100 axis to specific voltage. NOTE: Actual distance moved varies with loading and mechanics, no calibration is implied.

Range: 0.0 to 160.0 Volts. The smallest commanded voltage increment is 0.1 volts.

Default: N/A

Query: This command does not support query mode. The R? Read Voltage command will return the voltage of the specified axis.

Example: Send: `1MA55.0<n>`
Receive: `Nothing`
The above example commands AD-100 axis 1 to move to 55.0 volts. `<n>` indicates the New Line command termination character.

Recommendations: None

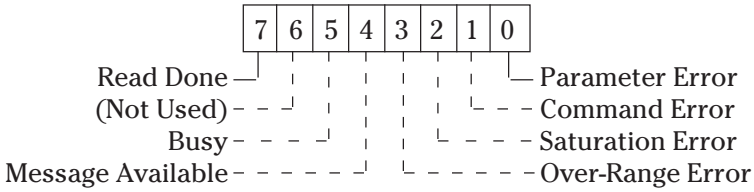
Related Commands: **MR**[Move Relative], **R?** [Read Volts], **S**[Stop All]

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Syntax: `M<decimal value><n>`

Parameters: `<decimal>` is the decimal byte value for masking the SRQ register. `<n>` indicates the New Line character required for command termination.

Function: The Service Request Enable Register is used to define the conditions that will generate an IEEE-488.1 service request, `<SRQ>`. Modifying this parameter allows the user to customize what event within the optical meter will cause an SRQ hardware assertion. An SRQ assertion draws attention of the GPIB controller (your computer) to the optical meter. This register performs a bit-wise AND'ing operation with the Status Byte Register. The Service Request register is a mirror of the Status byte register. The Service Request register serves as a 'mask' allowing the user to open or close a window on specific events on the Status byte register defining what events will cause the instrument to assert a GPIB SRQ. By appending a question mark `<?>` with no parameter the user can query the current setting of this parameter.



Range: `<value>` = Integer value 0 - 255

Default: ∅

Query Example: In query mode the command will return the current setting of the Service Request register. (Use the Q? command to query the current bit state of the Status register)
Send: `M?`
Receive: `144<n>`

Example: Send: `M255<n>`
Receive: `Nothing`
The above example masks all the bits on the Service Request register so that any event will cause an SRQ assertion. `<n>` indicates the New Line command termination character.

Recommendations: None

Related Commands: **Q?**[Status Byte query]

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MR
Move Relative Voltage



Syntax: `<axis>MR<voltage><n>`

Parameters: `<axis>` defines the axis 1, 2 or 3 to be commanded. `<voltage>` is the desired voltage increment to move for the specified axis. This command requires and axis ID `<axis>`. Without the ID the command will be ignored and an error posted. `<n>` indicates the New Line character required for command termination.

Function: This commands the specified AD-100 axis to move to the defined voltage relative to the current voltage. Modifying this parameter allows the user to move any of the AD-100 axis a specific voltage increment. The MR voltage increment will be added to the current voltage of the specified axis. NOTE: Actual distance moved varies with loading and mechanics no calibration is implied.

Range: -150.00 to +150.00 Volts. The smallest commanded voltage increment is +/-0.1 volts.

Default: N/A

Query: This command does not support query mode. The R? Read Voltage command will return the voltage of the specified axis.

Example: Send: `1MR-15.0<n>`
Receive: `Nothing`
The above example commands AD-100 axis 1 to move relative -15.0 volts i.e. subtract 15.0 volts from the current voltage 'position' . `<n>` indicates the New Line command termination character.

Recommendations: None

Related Commands: **MA**[Move Absolute], **R?** [Read Volts], **S**[Stop All]

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Syntax: O<n>

Parameters: This command has no parameters. If a parameter is appended the command will be ignored and an error posted. <n> indicates the New Line character required for command termination.

Function: This command commences an internal autocalibration routine. Starting an autocalibration begins a process of measuring amplifier offset voltages which arise from aging and temperature effects. These offsets are then appropriately corrected for normal operation. The meter will automatically disconnect the input signal from the amplifier during the autocalibration operation. To achieve stable readings at the specified accuracy, autocalibration should be executed after a 60 minute warm-up period.

The status byte register can be used to monitor the completion of the autocalibration process, because during the autocalibration the BUSY bit remains high.

NOTE

To achieve stable readings at the specified accuracy, autocalibration should be executed after a 60 minute warm-up period.

Range: N/A

Default: N/A

Query: This command does not support query mode.

Example: Send: O<n>
Receive: Nothing
The above example commences an autocalibration of the meter. The status byte register can be used to monitor the completion of the autocalibration process, because during the autocalibration the BUSY bit remains high.

Recommendations: Autocalibration should be conduced after each power-up to assure the best accuracy and ensure traceability of optical readings. Autocalibrate only calibrates the internal amplifier of the optical meter. It does not usurp the need for annual calibration of the detector.

Related Commands: None

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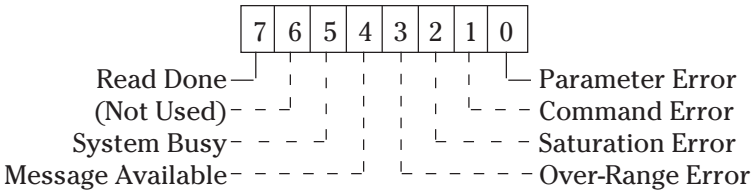
Q?
Status Byte Query

Meter

Syntax: Q?<n>

Parameters: This command has no parameters. The <?> question mark is part of the command word and is required. Should the <?> question mark not be appended the command will be ignored and an error posted. <n> indicates the New Line character required for command termination.

Function: This command reports the value of the status byte. This query informs the user about the current status of ORION's power meter. The Status byte register indicates the current status of the meter including errors and the status of optical readings. All bits in the status byte register, except the MAV bit, can be cleared using the clear status command but will be reset if the condition that caused bit assertion still exists.



** See error message section 5.6 for details on error reporting and handling.*

Range: 0 - 255

Default: N/A

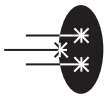
Query Example: Send: Q?<n>
Receive: 16<n>
The above example queries the current state of the status register. The return is 16 indicating bit 4: Message Available.

Recommendations: The GPIB Serial Poll function will also return the current state of the Status Byte register.

Related Commands: **Mn**[Service Request mask]

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Rn
Set Optical Range



Syntax: R<range><n>

Parameters: <range> is the numeric parameter indicating the desired range. <n> indicates the New Line character required for command termination.

Function: This command defines the signal range for subsequent optical readings. Modifying this parameter allows the user to define the specific range of the meter. The actual range is dependent upon the current U[Units] setting of the meter. By appending a <?> question mark with no parameter the user can query the current setting of this parameter.

The default mode, auto-ranging, is enabled by sending the R∅ command to the meter. In the auto-ranging mode, the meter automatically ranges between various signal ranges in response to the input signal.

NOTE

The user must exercise caution when setting ranges manually, amplifier saturation or under-amplification can occur if the optical signal is not within the range selected. Serious errors in optical readings can result. When uncertain of your optical signal; set the meter to auto-range mode = ∅

Range: ∅ = Auto-range
1 = Lowest range (highest gain for low signals)
: = :
8 = Highest range (Lowest gain for high power signals)
*Range increments are in decades of amplifier gain.

Default: ∅ = Auto-range

Query Example: Send: R∅<n>
Receive: Nothing
The above example sets the range to auto-range mode.

Recommendations: It is recommended that the meter be set to ∅ = auto-range. In auto-range the meter will constantly adjust the range to best accommodate the incoming optical signal. Assuring the most accurate reading. There is no advantage in the precision of optical readings from auto-range to a manually set range.

Related Commands: none

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Syntax: `S<state><n>`

Parameters: `<state>` defines the mode of the STOP ALL function. A space is allowed between the command and the parameter but is not required. `<n>` indicates the New Line character required for command termination.

Function: This command enables or disables the STOP ALL function of the AD-100 and alignment system. The STOP ALL function halts any alignment or AD-100 motion in progress. When enabled; the system will terminate any alignment in progress or AD-100 motion for any of the AD-100 axis. This command performs the same function as the instrument front panel STOP ALL button. This command is useful for emergency contingencies where the user wishes to stop all activity of the ORION System.

Range: `<state>` ∅ = OFF, 1 = ON

Default: ∅ = OFF

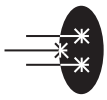
Example: Send: `S1<n>`
Receive: `Nothing`
This example enabled the STOP ALL function, terminating any alignment or motion in progress.

Query Example: Send: `S?`
Receive: `1<n>`
This example queries the current state of the STOP ALL function. The return indicates that the STOP ALL function is active. Either from the instrument front panel or from the GPIB command.

Recommendations:

Related Commands: none

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Syntax: `U<int><n>`

Parameters: `<int>` is the numeric parameter indicating the desired unit specifier. `<n>` indicates the New Line character required for command termination.

Function: This command defines the units of optical power measurements. By modifying this command the user can select the conversion unit the instrument will employ in the display, and return of optical readings. Units are in Amperes, Watts, or dBm. This performs the same function as the UNITS button on the instrument front panel. By appending a `<?>` question mark with no parameter the user can query the current setting of this parameter.

Range: ∅ = current (amps), 1 = watts, 2 = dBm

Default: N/A

Query Example: Send: `U?<n>`
Receive: `3`
The above example queries the current unit setting of the optical meter. The return is 3 indicating the unit is currently in dBm mode.

Example: Send: `U3<n>`
Receive: `Nothing`
The above example sets the current unit setting of the optical meter to 3 dBm mode.

Recommendations: none

Related Commands: **R**[Range], **D**[Data query]

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Syntax: `<axis>VEL<vel><n>`

Parameters: `<axis>` defines the axis 1, 2 or 3 who's velocity is to be specified. `<vel>` is the velocity in VDC/sec. `<n>` indicates the New Line character required for command termination.

Function: This command defines the velocity for the specified AD-100 axis. By modifying this parameter the user can define the rate of change in Volts DC/sec the system uses to move the specified AD-100 axis. The set velocity will effect both relative [MR] and absolute moves [MA]. By changing this parameter the user can set rapid or slow acceleration for AD-100 motions. Useful to reduce overshoot on long moves or systems with large loads. By appending a `<?>` question mark with no parameter the user can query the current setting of this parameter.

NOTE

Actual velocity is load dependent. No actual calibration is implied.

Range: 0.5 - 10.0 Volts DC/sec

Default: 0.0: A velocity setting of 0.0 (zero) sets the velocity to the maximum rate of the AD-100 D/A.

Query Example: Send: `1V?<n>`
Receive: `5.0<n>`
The above example queries the velocity of AD-100 axis 1. The return indicates that axis 1 velocity is currently set to 5.0 Volts DC/sec.

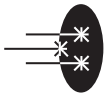
Command Example: Send: `1V3.5<n>`
Receive: `Nothing`
The above example sets the velocity of AD-100 axis 1 to 3.5 Volts DC/sec.

Recommendations: none

Related Commands: **MR**[Move Relative, **MA**[Move Absolute]

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Wnnnn
Set Optical Wavelength



Syntax: W<lambda><n>

Parameters: <lambda>is the desired wavelength setting. <n> indicates the New Line character required for command termination.

Function: This command defines the wavelength for optical power measurements in nanometers (nm). By modifying this command the user defines the responsivity calibration value used when the meter converts detector current to optical measurements. A responsivity vs wavelength table is stored in the calibration module included with the optical detector. The efficiency of the detector to convert photons into electrons is a function of wavelength. By appending a <?> question mark with no parameter the user can query the current setting of this parameter.

NOTE



To assure the accuracy and calibration of optical readings the meter should be set the to correct corresponding wavelength of your optical signal. Severe errors in optical reads can result if the incorrect wavelength value is used. The accuracy of optical reads is also dependent upon annual calibration of your detector. Contact Newport for calibration services.

Range: The valid wavelength range depends upon the detector model used. Refer to your detector documentation or the Newport catalog for wavelength ranges of detectors. <lambda> is a integer type. i.e. 780 Units are in nm; nanometers

Default: System dependent.

Query Example: Send: W?<n>
Receive: 780
The above example queries the current wavelength setting of the optical meter. The return is 780 indicating the wavelength setting is 780nm.

Command Example: Send: W632<n>
Receive: Nothing
The above example sets the current wavelength of the optical meter to 632nm.

Recommendations: none

Related Commands: **R**[Range], **D**[Data query]

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Syntax: <axis>V?<n>

Parameters: <axis> defines the axis 1, 2 or 3 to be queried. <?> is part of the command word and required. This command requires and axis id <axis>. Without the ID the command will be ignored and an error posted. <n> indicates the New Line character required for command termination.

Function: This returns the current absolute voltage of the specified AD-100 axis. Querying this commands allows the user to know the current voltage 'position' of the axis specified. NOTE: Actual distance moved varies with loading and mechanics, no calibration is implied.

Range: N/A

Default: N/A

Query Example: Send: 2Q?<n>
Receive: 56.4<n>
The above example queries AD-100 axis 2 voltage. The return indicates axis 2 is currently at 56.4 volts. <n> indicates the New Line command termination character.

Recommendations: Some small variation between the front panel display and the return of the V? may be observed. This discrepancy is from update speed between the display and microprocessor and averaging methods.

Related Commands: **MR**[Move Relative Volts], **MA**[Move Absolute Volts]

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Zn
Enable Zero; Optical Offset



Syntax: `Z<state><n>`

Parameters: `<state>` sets the desired mode 1 = ON or ∅ = OFF of the zero function. `<n>` indicates the New Line character required for command termination.

Function: This command enables the Zero function of the optical meter. By modifying this parameter the user can create an offset in optical readings. This is useful for eliminating background optical noise from future readings. When the Zero command is received the meter takes the current optical reading stores it into a buffer and subtracts it from all subsequent readings. By appending a `<?>` question mark with no parameter the user can query the current setting of this parameter.

Range: `<state>` ∅= OFF, 1 = OFF

Default: ∅= OFF

Query Example: Send: `Z?<n>`
Receive: `1`
The above example queries the current status of the offset. The return indicates that the meter is currently in offset mode.

Command Example: Send: `Z1<n>`
Receive: `Nothing`
The above example enables the zero offset feature.

Recommendations: The Zero - offset feature is useful to eliminate background optical noise. One method to set an offset is to block the detector and engage the offset. **Caution: Use a solid black opaque object to block the detector such as an anodized plate - do not use your hand to block the detector.** See Appendix C. Section C.4 for details on optical measurements.

Related Commands: **R**[Range], **D**[Data query]

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Section 5
Maintenance

5.0 Outline of Section 5

The Following topics will be covered in this section:

Service

Recommended list of replacement parts

Maintenance schedule for Photodetector

Maintenance for 562

Periodic Maintenance will improve performance and increase the usable life of the ORION system. The following section provides a maintenance schedule and routine for the systems and its components.

5.0.1 Cleaning

The ORION-CM controller should only be cleaned with a soapy water solution. Do not use an acetone or alcohol solution. This will damage the system.

5.1 Service

Other than the recommend procedures outlined in the maintenance schedule, you should not attempt to adjust or service the mechanics or electronics of your system. Should a failure occur, contact Newport.



WARNING

The ORION Controller and devices attached contain high voltages which could be lethal if exposed. Never disassemble the controller or probe the electrical outputs of the unit.

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5.2 Recommended Replacement Parts

In production applications it is recommend that the user stock on-hand specific replacement parts to reduce down-time when a failure occurs. Following is a recommend list of spare parts in order of likelihood for replacement:

Model	Description	Comments
AD-100	Electro-strictive actuators	Unit uses 3 each.
ORION-DH	Dither Module	
562F-XYZ	XYZ translation stage	
818-IS-1	Photodetector	Spare when primary is in calibration.

5.3 Photodetector Maintenance

The accuracy of optical measurements is dependent upon all the desired light emissions reaching the active area of the detector. Obstructions from oil or particulate contamination can cause severe errors in optical readings. Special precautions should be taken especially in production applications to periodically check the detector for contaminants and blockage.

Use	Light Duty/Laboratory	Production/Heavy
Monthly		*Check cable for wear or fraying. Check and clean optical surfaces of contamination*
Yearly	*Remit unit for annual calibration to maintain NIST traceability. Check cable for wear or fraying. Check and clean optical surfaces of contamination.*	*Remit unit for annual calibration to maintain NIST traceability*
Bi-annually		

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5.4 562 Translation Stage Maintenance Schedule

Rough handling and mechanical shock will dramatically reduce the life of the stage. Keeping the stage clean of contamination and the lubrication distributed through periodic end-to-end travel is all that is required.

Never attempt to make adjustments to your 562.

Use	Light Duty/Laboratory	Production/Heavy
Daily		
Weekly		*Move stage through its full travel range to redistribute lubricants.*
Monthly		*Check stage and clean stage for contamination.*
Yearly	*Move stage through its full travel range to redistribute lubricants*	*Lubricate stage with lube.*
Bi-annually	*Lubricate stage with way lube.*	

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Section 6
Troubleshooting

6.0 Troubleshooting

The following tables will help you locate the faulty elements of your system. The tables are organized from functional to performance problems and by type i.e. optical power meter, AD-100 controller and alignment controller. You are urged to follow through the troubleshooting procedures before contacting service. The goal is isolate the failed element. Other than the instructions given here, you should not attempt to repair failed items yourself.



IMPORTANT

It is important that all peripheral devices be connected to the system before power is applied.

You should refer to table T.6.4 directly for performance or alignment problems.



WARNING

Do not attempt to troubleshoot your system if you know the components are damaged. Do not power-up the system for troubleshooting purposes if any of the components show signs of visible damage or if the cables are frayed or broken. You may expose yourself to electrical hazards. Always replace broken or damaged components.

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6.1 Normal Operation

This outline describes the NORMAL operation of the ORION system at power-up. Use this as a comparison to the performance of your system. Follow the table references as indicated for areas where your system fails to correspond to the response indicated by this table. It is important that all peripheral devices be connected to the system before power is applied before proceeding with this operation.

Power-up:

After depressing the POWER button it should stay at the 'depressed' position. The following should be observed.

Normal Response
1. Cooling fan begins operation. The Cooling fan should operate at all times.
2. All front panel LEDs & indicators come ON for 3 seconds then display current values.
3. The Power meter should display current optical power. The bar graph value should always correspond to meter LED display value. NOTE: Detector should be plugged in.
4. AD-100 Axis display should default to 78.0 volts for the x and y axes. Display should show "- - - . - " for axis not installed.
5. The system should remain idle until commanded. Optical power readings will update real-time.

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T.6.1 - System power-up

Step	Symptom	Test	Action
1	No response at power-up. No LED display. No cooling fan operation.	Is unit line voltage selector set to correct voltage? 110 or 220VAC.	Go to Step 2
2	Line selector set incorrectly to actual voltage.	Is unit set to 110VAC and line voltage at 220VAC?	Go to Step 7
3		Is unit set to 220VAC and line voltage at 110VAC?	Go to Step 4
4	Reset line voltage selector.	Turn unit OFF - reset line selector to correct setting.	Go to Step 7
5	Still no response at power-up.	Disconnect line-cord check fuse. Replace fuse if blown.	Use correct replacement fuse value. Go to Step 7
		Check line cord for secure connection.	Secure line-cord restart. Go to Step 7
6	Unit set to 110VAC connected to 220VAC line voltage.	Power Supply is blown.	Go to Step 7
7	Still no response		Disconnect the line cord. Contact Newport Service Department

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T.6.2 - Optical Power Meter

Step	Symptom	Test	Action
1	Power meter display does not update	Is Detector with CAL module connected BEFORE power-up?	Turn system off - reinsert detector and CAL module restart system. Go to Step 4.
2	Meter display reads - OL -.	Meter is over load - detector is saturated or manual range is too low for incoming optical signal.	Press MODE button- put unit in AUTO range mode.
	Meter display reads - OL - in AUTO range.	Does incoming optical exceed detector power range?	Check output of source. Go to Step 4.
		Is wavelength set correctly?	Check and verify wavelength setting corresponds to source wavelength. Go to Step 4.
3	Display still does not update or displays - - OL - in any mode.	Possible faulty meter board or detector.	Contact Newport Service Department.

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T.6.3 - AD-100 Controller

Step	Symptom	Test	Action
1	Display reads “ - - -. -” for installed AD-100 axes.	Check problem axis for proper connection.	Reconnect actuator restart system. Go to Step 2
2		Swap AD-100 actuator with another channel. Does problem follow instrument channel or AD-100 actuator?	Go to Step 4
3	Display voltage does not change—nor any apparent actuator movement.	Swap AD-100 actuator with another channel. Does problem follow instrument channel or AD-100 actuator?	Go to Step 4.
4	A. Problem follows AD-100 actuator.	Actuator shorted or defective.	Contact Newport Service Department.
	B. Problem follows controller channel.	Controller axis driver faulty	Contact Newport Service Department.
6	AD-100 motion erratic—actuator seems to stick or jump. (usually observed in conjunction with optical readings through aligned devices)	Check translation stage for: stiction, slide lock engagement or excessive loading. Check fiber for cantilever. Is fiber stuck out too far from fixturing?	See Maintenance section of translation stage. Loosen slide lock on stage. Fiber may be vibrating from motion. Shorten cantilever on fiber. Go to Step 7
7	Stage and fixturing okay. AD-100 motion still erratic.	Internal binding of actuator or other problem.	Contact Newport Service Department.

T.6.4 - Performance and Alignment Problems

Step	Symptom	Test	Action
1	AD-100 motion erratic—actuator seems to stick or jump. (usually observed in conjunction with optical readings through aligned devices)	Check translation stage for: stiction, slide lock engagement or excessive loading. Check fiber for cantilever. Is fiber stuck out too far from fixturing?	See Maintenance section of translation stage. Loosen slide lock on stage. Fiber maybe vibrating from motion. Shorten cantilever on fiber. Go to Step 7
2	Stage and fixturing okay. AD-100 motion still erratic.	Internal binding of actuator or other problem.	Contact Newport Service Department.

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T.6.5 Alignment Problems

Step	Symptom	Test	Action
1	Unit appears to work, but does not align. Also AD100 displays when selected jump to 160V and is unstable.	Check line selector switch on back of unit	Line selector is at 220V when power is 115V.
2	System does not seem to align. Power readings erratic.	Set Gain to 10, Default dither radius to factory setting. Reattempt alignment.	Go to Step 3
3	System still will not align, will not settle on peak.	Check: 1. Fiber cleave - at/on both source and detector end. Refer to Appendix B for suggestions for fiber cleaving. 2. Is dither module mounted correctly? 3. Make sure the fiber jacket is stripped back far enough so that it is not sitting in the v groove of the fiber clamp.	Re-cleave fiber re-attempt alignment. Go to Step 4.
	System seems to de-align instead of align.	Check: Is actuator travel direction, orientation and polarity correct per setup in Section 2.0?	Change dither polarity switch on rear of unit if actuator direction is opposite of setup diagram 2.5.1. Increase the dither radius. This can only be accomplished by using the GPIB computer interface
		Check translation stage for stiction and fixturing for vibration.	Go to Step 5.
4	Stage and fixturing okay. AD-100 motion still erratic.	Internal binding of actuator or other problem.	Contact Newport Service Department.
5	System still will not settle on peak.	Could be dither module or other problem.	Contact Newport Service Department for assistance.

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T.6.5 Optical Meter Performance Problems

Step	Symptom	Test	Action
1	Power readings are not correct. Do not correspond with other readings	Check if wavelength setting is correct?	Check and adjust wavelength as required.
		Is unit in manual or auto range?	Set unit to auto-range - recheck reading.
		Is ZERO mode on?	Turn ZERO mode off? Recheck reading.
			If reading is higher than expected, background noise may be problem. Try eliminating noise using ZERO function. Go to Step 2.
		Is detector calibration valid?	Detector calibration is required annually. Go to Step 2.
2	Readings are still in error.	Refer to Appendix C on 'Performing Optical Measurements' for suggestions.	Contact Newport Service Department.

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Section 7
Theory of Operation

7.0 Outline of Section 7

The following topics will be covered in this section:

Theory of Operation of Gradient Alignment

Dither Radius

Gain

7.1 Theory of Operation of Gradient Alignment

ORION is an optical alignment system that uses optical signal feedback as a function of position to find and track optical peaks. The ORION System consists to 2 basic components:

Optical power meter

Dither and XY motion system

There are various methods of motion employed to find the peak—the method used in ORION is known as the 'Gradient Search'. The Gradient Search method consists of moving the receiver or detector in a small circular motion as a rate of about 400Hz in the XY plane. As this 'dither' occurs optical readings are taken along the circular path. The result of the optical data and position about the circle forms a 'gradient' of increasing to decreasing optical signals as a function of position. A simplified graphic of this is shown in Figures 7.1. and 7.2.

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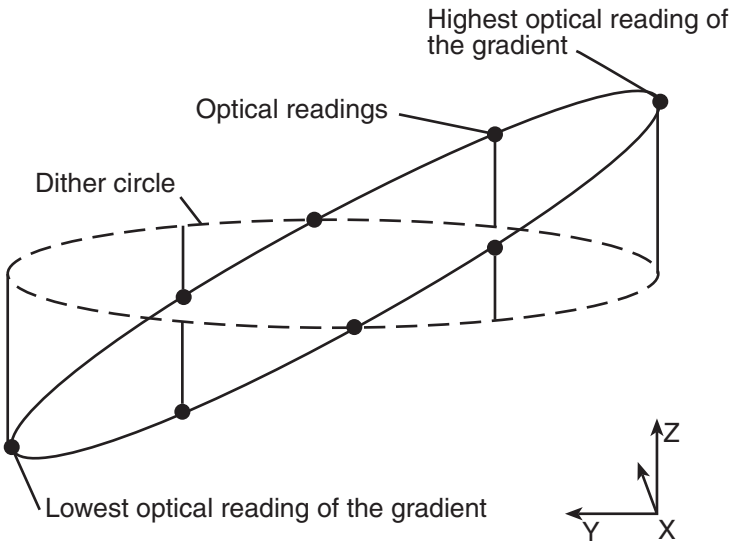


Figure 7.1.1 A graphical representation of a dither sweep about which optical readings are sampled.

The gradient method is very powerful and offers more advantages over other methods because of the information that can be derived from a single 'dither sweep'. From this simple string of data one can derive:

The location of the peak—referenced from the dither coordinate system

The approximate distance from the peak—from the power gradient

How these values are derived is by the following:

Where is the peak?

If we draw a line from the lowest optical reading through the center of the dither circle through the highest optical reading, it points us to the peak!

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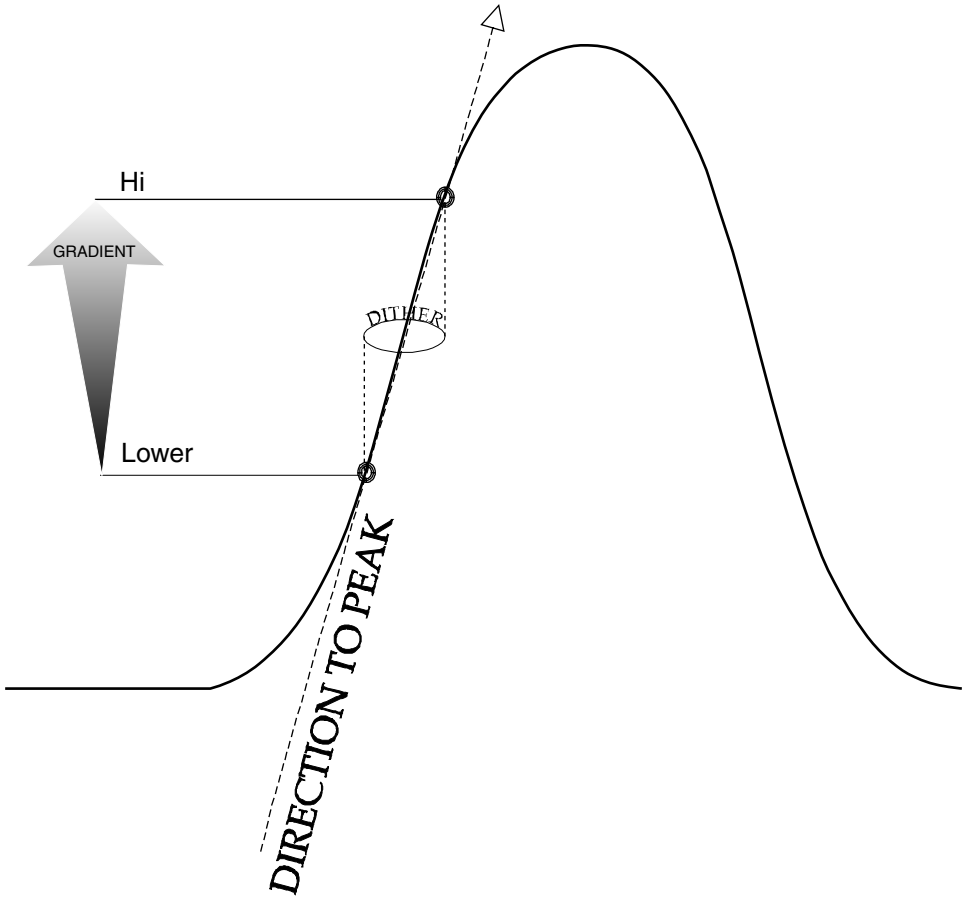


Figure 7.1.2 Beam profile for a single-mode fiber.

How far is the peak?

If we look at the difference between the highest and lowest optical reading— the gradient—we have a clue as to how far the peak is. Why? The bigger the difference the farther we are. The smaller the difference the closer - infact the 'definition of aligned' is when the 'gradient' is equal to zero - and all the readings are the same.

Good fixturing is critical for fast and robust alignment. Backlash or over extended fibers can cause phase lags which can fool the system (the location of the device is lagging somewhat behind the actual commanded position). This can cause the gradient vector to peak to point in the wrong direction. In most cases the system will find the peak. In worst case, the system will oscillate, bouncing back and forth about the peak never settling on the peak.

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7.2 Dither Radius

One of the adjustable parameters of the alignment algorithm is the 'Dither Radius' changing it allows one to increase or decrease the size of the dither module sweep. Dither sweeps are very small from 0.05 mm to 0.25 mm maximum. In most applications you'll never need to change the dither radius.

Too small of a dither radius will cause 'undersampling' of the source (effectively all the optical readings will be nearly the same) and the system will not move to the peak. (Larger dither sweeps are required for multi-mode devices or devices with short focal lengths)

Too large of a dither radius will prevent the system from finding the peak - this is because the dither radius will approach the actual size of the peak and overshoot it during the dither sweep. The dither radius also effects the gradient to a small degree as the gradient will increase with dither size.

7.3 Gain

Once the system has taken a dither sweep the resultant output is the vector to peak and the gradient value. The gain is a multiplier of the gradient value which is used as the input for the X and Y actuators to move in the peak direction. Effectively the gain only increases the speed of alignment by increasing the move size to peak.

Setting the gain too high will cause the moves to peak to be large which will cause the system to overshoot when it reaches the peak. The system default for the gain is 50 which will provide excellent performance over a broad range of devices.

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Appendix A
System Specifications

A.0 Outline of Appendix A

The following topics are covered in this appendix:

- Specifications of the ORION Optical Power Meter
- Optical Measurement Calculations
- Specifications of the ORION Dither Module
- Specifications of the AD-100 Electro-Strictive Actuator

ORION Optical Power Meter

Signal Range:	Up to 8 decades (dependent upon detector type)
Display:	v4.5 digit 1” high Segmented LED Display v 100 Segment LED Bar graph display with decade range indicator
Display Update Rate:	75 msec
Auto-Ranging time:	200ms (typical)
GPIB bus transfer time:	1 msec (typical)
Operating Environment:	0 to +40° C; <80% RH (non-condensing)
Storage Environment:	-20 to +60° C; 90% RH (non-condensing)

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Optical Measurement Calculations

Units	Calculation	Comments
W (watts)	I/R	Zero disabled
W (watts)	(I-Iz)/R	Zero enabled
dBm		Zero disabled
dBm		Zero enabled

Where:

I = Detector current

Iz = Detector current background defined when the ZERO function was initiated.

R = Responsivity of the detector (A/W) (Amps/Watts)

ORION XY Dither Module

Dither Radius:	0.025 µm to 2.5 µm maximum (*Load dependent*)
Load Capacity:	75 grams
Load Center of gravity:	10 mm from top surface of dither module
Frequency:	382 Hz

ORION AD-100 Electro-strictive Actuator Controller

Load Number of outputs:	3
Output Voltage/channel:	10–160 Volts DC
Input Resolution:	40 mV
Front panel Display:	4 digit 0.5” segmented LED with limit indicator
External Input:	3 channel via 5 pin connector
Bandwidth:	Load dependent
CPU:	8 bit Zilog Z80
Manual Controls:	1: 8 - turn optical code wheel

AD-100 Electro-Strictive Actuator

Manual travel:	0.5 in. (13 mm)
Fine travel (crystal):	>100 µm (load dependant)
Mounting:	Standard 3/8 micrometer mountable
Load:	10 lbs. max per axis.

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Integrating sphere specs (818-IS-1):

Spectral range:	400-1600 nm
Max Ave Power:	200 mW
Max Pulse Energy:	100 nJ
Accuracy:	+/- 2.5%
Saturation current:	>2 mA
Responsivity:	>0.004 (400-1600 nm)-A/W
	>0.005 (600-1600 nm)-A/W
Risetime:	≤ 2 µs
Shunt Resistance:	≥ 20 MΩ
Die Capacitance:	800 pF max
Max Reverse Bias:	2 V
NEP:	≤10 pW/Hz^.5
Material:	InGaAs/Si
Dimensions:	Cylinder with detachable base

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Appendix B
Performing Optical Measurements

Appendix B Outline of Appendix B

This section contains detailed information on how to make various optical power measurements with the optical meter of your ORION System. This also illustrates problems and common pitfalls that can cause optical reading errors. You should read this section if you are using this instrument for the first time.

The following topics are covered in this Appendix:

Photodetector Considerations

Detector Calibration and Accuracy

Quantum Detector Temperature Effects

Ambient and Stray Light

Setting the Wavelength

Setting the Attenuator Mode

Performing Basic Measurements

Logarithmic Measurements dBm

Common Measurement Errors

B.1 Photodetector Considerations

This section describes detector and attenuator characteristics, optical and electrical considerations, and environmental influences on optical measurements. In general, the accuracy of measurement with the optical meter is limited by the calibration accuracy of the detector calibration. Making accurate measurements of optical power is, however, also dependent upon properly setting up the optical meter, controlling temperature and illumination conditions, and understanding the factors that affect power measurement.

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B.2 Detector Calibration and Accuracy

Newport Corporation calibrates its detectors using secondary standards directly traceable to the United States National Institute of Science and Technology (NIST). The details and accuracy of the calibration procedure vary with each detector model but a detailed description of the calibration results is supplied with each individually calibrated detector.

In general, detector calibration accuracy ranges from 2% to 7% in absolute terms and varies with wavelength. Each detector will have some variation in the response over different sections of its surface. Therefore, for the most reproducible measurements, light should illuminate the detector as uniformly as possible over 80% of the detector's active area.



IMPORTANT

Avoid focusing a light source onto the detector surface. Inaccurate readings and possible detector damage may result. Consult your detector manual for information on detector saturation or damage thresholds.

NIST traceability requires that detectors be re-calibrated on one year intervals. As individual detector responses change with time, especially in the ultraviolet spectral range, re-calibration is necessary to assure confidence in the accuracy of the measurement. The same detector should always be used for measurements which are to be directly compared, in order to obtain reproducible results.

B.3 Quantum Detector Temperature Effects

Semiconductor based photodiode detector characteristics (Newport Corporation Low-Power detectors) are significantly affected by temperature. At longer wavelengths, these quantum detectors typically lose sensitivity with increasing temperature. However the detector dark current increases exponentially with temperature. For silicon detectors, dark current is generally on the order of a few picoamps at room temperatures. With uncooled germanium detectors, however, this dark current is on the order of a nanoamp, or typically 1,000 to 10,000 times greater than silicon. These dark currents can be zeroed at any moment in time via the ZERO key on the optical meter control panel. Since dark currents drift with temperature, the ZERO should be adjusted just prior to taking any measurements. The noise or drift in the dark current sets a lower bound on the measurement resolution which can be achieved with any given detector.

If the detector temperature is constant, sensitivity changes and dark current drifts are significantly reduced. In addition, if the detector is cooled, the dark current and dark current noise will decrease. For the most accurate measurements, particularly with germanium detectors, the user can cool the detector to approximately 0°C and control the temperature to within ± 1°C.

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B.4 Ambient and Stray Light

Ambient and stray light striking the detector will be measured by the optical meter, and should be considered when making sensitive measurements. Ambient light can be distinguished from dark current (or the detector/meter noise floor) by turning off or blocking the source and covering the detector face with an opaque material such as a piece of black metal. *Using the human hand to cover the detector is not advised because it emits a significant amount of infrared radiation, and because it radiates a temperature significantly different from ambient*. With the detector covered, a reading of the dark current may be made. Next, remove the material which is covering the detector and take another reading. The difference is the ambient light level.

The effects of ambient light are greatly reduced when using a fiber-connectorized signal input to the detector. If free-space beam measurements are desired, using an attenuator (Low-Power detectors have an OD3 attenuator included) will reduce stray light and often improve the source signal to ambient signal noise level. Wavelength-specific filters, such as optical cutoff, bandpass, or spike filters can also be used if the signal wavelength spectrum permits. Other techniques to reduce stray light include using apertures, placing the detector in a box or other housing to shield the surface from light which is not coming from the source, and turning off room and other lights.

IMPORTANT

Changes in ambient light levels can occur from such factors as turning room lights on or off, or by moving people or equipment. Remember, if you can see your detector element, then your detector can see the light bouncing off your shirt!

B.5 Setting the Wavelength

In order to obtain accurate optical power measurements, it is necessary to set the calibration wavelength to the wavelength of the light incident upon the photodetector. This calibration wavelength is indicated in nanometers on the LCD display at power-up and whenever the l. keys are pressed. Upon power-up, the calibration wavelength used will be the last value entered into the meter (if this is the initial power-up on your calibration module, the wavelength will default to the shortest available wavelength).

To change the wavelength, do the following:

Determine the wavelength of the light being measured to the nearest nanometer. If the source is broadband, use either a value near the center wavelength of the light or the wavelength with greatest intensity. Pressing the l. keys will increase or decrease the calibration wavelength by 1nm. Wavelength will continue to change as long as the wavelength key is depressed.

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IMPORTANT

Different detectors are sensitive over different wavelength ranges. See the appropriate detector manual and calibration data to determine the range of wavelengths available for the detector being used. The responsivities stored in the calibration module span only the wavelength range appropriate for the detector and are specific to that detector.

B.6 Setting the Attenuator Mode

All Newport detectors are provided with calibrated optical attenuators. The responsivities for an attenuator/detector combination are stored in the calibration module. To measure optical powers above the saturation limit of the detector (see appropriate photodetector manual), use the optical attenuator that was shipped with your detector. When the attenuator mode is selected, the following occurs:

a. The ATTN annunciator is displayed.

b. The responsivity for the detector-with-attenuator is used in calculating the optical power being measured.

If the attenuator is subsequently removed, the ATTN key should be pressed to turn the attenuator mode off. All measurements will now be computed using the responsivity for the detector-alone.

NOTE

The transmission characteristics of each attenuator are slightly different; the user must therefore be careful to use ONLY the attenuator and detector pair with the same serial numbers for which the particular calibration module is calibrated.

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B.7 Performing Basic Measurements

Power Measurements

The optical meter most basic measurement mode is in the units of Watts. Power measurements may be made with background correction, which is initiated by pressing the ZERO key. The following equation illustrates this relationship:

Watt reading = Net Applied Power

= (I - Iz) / R

where

I = detector input current

Iz = detector background current defined when the ZERO key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

Select the Watt measurement mode, auto-range, and a wavelength. Use manual ranging if you want manual control of the range; over-range is indicated by an OL message.

Block the light to be measured.

Initiate background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

Illuminate the detector with the optical signal to be measured.

Take the reading from the display.

B.8 Logarithmic Measurements dBm

Logarithmic Measurements Using 1 mW Reference (dBm)

The dBm measurement mode displays the absolute value of 10 times the logarithm (base 10) of the input power, referenced to 1mW. The following equation illustrates this relationship:

dBm reading = 10 * log [Net Applied Power/1mW]

= 10 * log [((I - Iz)/R)/1 mW]

where

I = detector input current

Iz = detector background current defined when the ZERO key was pressed

R = responsivity of the detector (A/W) (or detector with attenuator)

Using this 1mW reference power, the dBm reading span is from - 90 dBm to +10 dBm (1 pW to 10 mW), when the detector responsivity equals 1.

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To make dBm measurements (relative to 1 mW optical power) with background correction, proceed as follows:

Select the dBm measurement mode, auto-range, and a wavelength.

Block the light to be measured.

Initiate background correction by pressing the ZERO key. Display should read approximately zero, but will fluctuate depending upon the variations in the amount of light reaching the detector and the detector dark current fluctuations.

Illuminate the detector with the optical signal to be measured.

Take the reading from the display.

NOTE

Log measurements should always be made on the lowest possible range (without over-ranging). Readings on high ranges will not allow optimum calculations of the logarithm. When in doubt, use auto-range.

NOTE

When using log measurements with background correction, the signal after the subtraction of the stored offset power level may be negative. In this case, OL will be displayed since the log of a negative number is not defined. This will be automatically cleared when the signal becomes positive.

B.9 Common Measurement Errors

The most common sources of optical power measurement errors are listed in Table below.

Type of Error	What should be done?
Radiometry	Check that all of the light is actually hitting the detector.
Ambient Light	Check that any ambient light was ZERO'ed before the measurement was made.
Wavelength Calibration	Check that the proper wavelength has been set.
Detector Saturation	Check that the optical power density remains below the detector's saturation threshold.
Meter Configuration	Check that the system was powered-up with the calibration module properly connected. Check that the optical attenuator mode (ATTN annunciator) is properly enabled/disabled.

Table B.1 - Common Measurement Errors

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Glossary
Definition of Terms

Alignment:

The optimization of the optical signal to the highest power—peak. This is not necessarily the maxima—local peaks can fool the system. ORION is intended to single-mode single peak phenomena.

Dither

A repetitive circular sweep motion during which optical power readings are taken. Optical power as a function of location about the dither circle is used to calculate the direction to peak the relative distance to peak. This is the primary part of the alignment function.

Dither Radius

The diameter of the motion sweep during alignment. The dither is a circular motion occurring at 400Hz the size (radius) can be made larger or smaller to accommodate a variety of devices.

Gain

A multiplier used to increase the step size for the move to peak can improve alignment speed. It can also lengthen alignment time if set too high, causing the system to oscillate about the peek.

Gradient

A collection of optical data points indexed to dither position. The optical readings should display a well differentiated range of readings—gradient. From this information the alignment system derives the direction of the peak and its relative distance from the current location.

ESA - Electro-Strictive Actuator

A motion device that employs a man-made structure of crystalle layers - when charged with an electrical voltage—a physical expansion of the structure occurs. Capable of producing fine motions on the nanometer scale. This technology is used in Scan Tunneling Microscope's (STM) and Electron Microscopes.

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