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## DIGITAL EXPOSURE SYSTEM

MODELS 68950, 68951

## DIGITAL EXPOSURE CONTROLLER

MODEL 68945

## USER MANUAL

Please read these instructions completely before operating this equipment. The specification and operating instructions apply only to the model(s) covered by this manual. If there are any questions or problems regarding the use of this equipment, please contact Newport or the representative from whom this equipment was purchased.

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## 1 INTRODUCTION

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The Digital Exposure System family of instruments provides a powerful, yet easy to use, set of tools for control of light. It enables exposure to highly stable ultraviolet (UV), visible (VIS), or infrared (IR) output radiation in a precisely metered manner.

### 1.1 DESCRIPTION

The microprocessor-based controller model 68945 allows a multitude of functions to be easily implemented and computer controlled. A crystal oscillator assures accurate exposure timing of the light source via shutter control. High stability analog circuitry and high quality light sensor construction, with thermo-electric (TE) temperature stabilization, lead to long-term output reproducibility.

All timing functionality and shutter drive circuitry are contained in the 68945 Digital Exposure Controller. The complete exposure systems, models 68950 and 68951, add light sensors to enable output stabilization and dose-based exposure control.

Notes:

Anticipating a frequently asked question:

- Why does Oriel use the word FLUX for  $\mu\text{V}$  or Light Intensity or Irradiance?
- The answer is: Because it is short enough to fit on a front panel control button.

In this manual, we will use the general phrase “power control”. If the operator is using a power supply in current control mode, substitute current for power whenever it is mentioned.

Updates:

Firmware version number is displayed on the 68945 controller at power on; please take note of it in case support is needed.

## 2 FEATURES

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### Digital Exposure Controller 68945

- Microprocessor-controlled
- Digital display and multiple status indicators
- RS-232 communication - for computerized control and data logging
- Shutter control output
- Single or repeated exposure cycles
- Internal or external event triggers
- Audible and electronic fault indicators
- Exposure logging
- Shutter open time or remaining time display options
- CE marked

### DIGITAL EXPOSURE SYSTEM MODELS 68950/68951 additionally offer:

- Light intensity control with TE stabilized light sensor
- Auto-Setup function for Oriel power supplies
- Idle status indicator
- Dose-based exposure control
- Single cycle or total exposure time and dose counters
- Easy interface to Oriel light sources using the optional adapters

## 2.1 COMPONENTS AND ACCESSORIES

### 2.1.1 COMPONENTS

The 68945 Digital Exposure Controller comes with:

- A power cord appropriate for the country of use
- This manual

The 68950 Digital Exposure System for Research Lamp Sources comes with:

- All of the 68945 items
- 70043 connection cable to Oriel light source power supplies
- 71582 TE cooled light sensor
- 70062 TE cooler cable
- 70018 BNC signal cable

The 68951 Digital Exposure System for Solar Simulators and Flood Exposure sources comes with

- All of the 68950 items
- 68957 fiber optic probe assembly including mounting brackets for the sensor and probe

### 2.1.2 ACCESSORIES

A number of accessories are available from Oriel to facilitate applications of these systems:

- 68952 Adapter kit for Oriel line of Research Housings
- 68954 Adapter kit for Oriel line of Q Housings
- 68955 Remote pendant switch

### 3 SAFETY AND CAUTIONS

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The Digital Exposure Systems and Components do not add any particular operator safety concerns. However, they are designed for use with an Oriel high intensity, high voltage-operated, high temperature lamp, UV emitting light source. Therefore, all the precautions associated with using that source need to be observed for safe use with these Digital Exposure Components.

**CAUTION:** As a general rule, all the cable connections to the unit should be made with power off to avoid damaging the high performance electronics.

**CAUTION:** When turning the complete system on, the power supply must reach its set point value before any FLUX control functions are initiated (Auto Setup or Flux control). Otherwise, system malfunction or lamp damage may occur. In addition, the lamp should be allowed to warm up for 10 to 15 minutes for optimal Auto Setup parameters.

## 4 LIGHT SAMPLING TECHNIQUES

### 4.1 BASICS

For the most stable performance, the best advice we can offer is to sample the illumination as close to the final illuminated area as possible.

A schematic of a frequently used arrangement is shown below, wherein the uncoated glass wedge or fused silica window provides interference, fringe-free sampling. Care needs to be taken to screen the sensor from ambient light, otherwise inconsistent performance can occur. Choose a window material that best matches the spectral range of the application or experiment at hand.

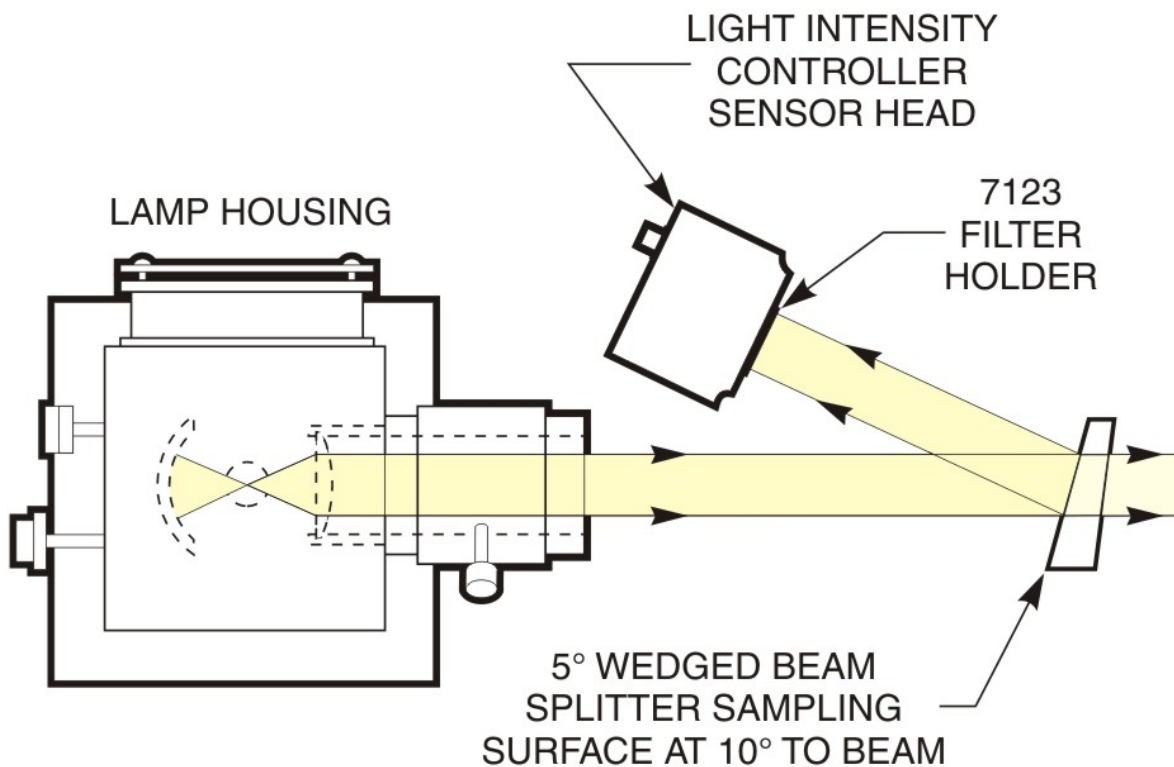


Figure 1



## 4.2 LIGHT SOURCE SPECIFIC

### 4.2.1 RESEARCH HOUSING

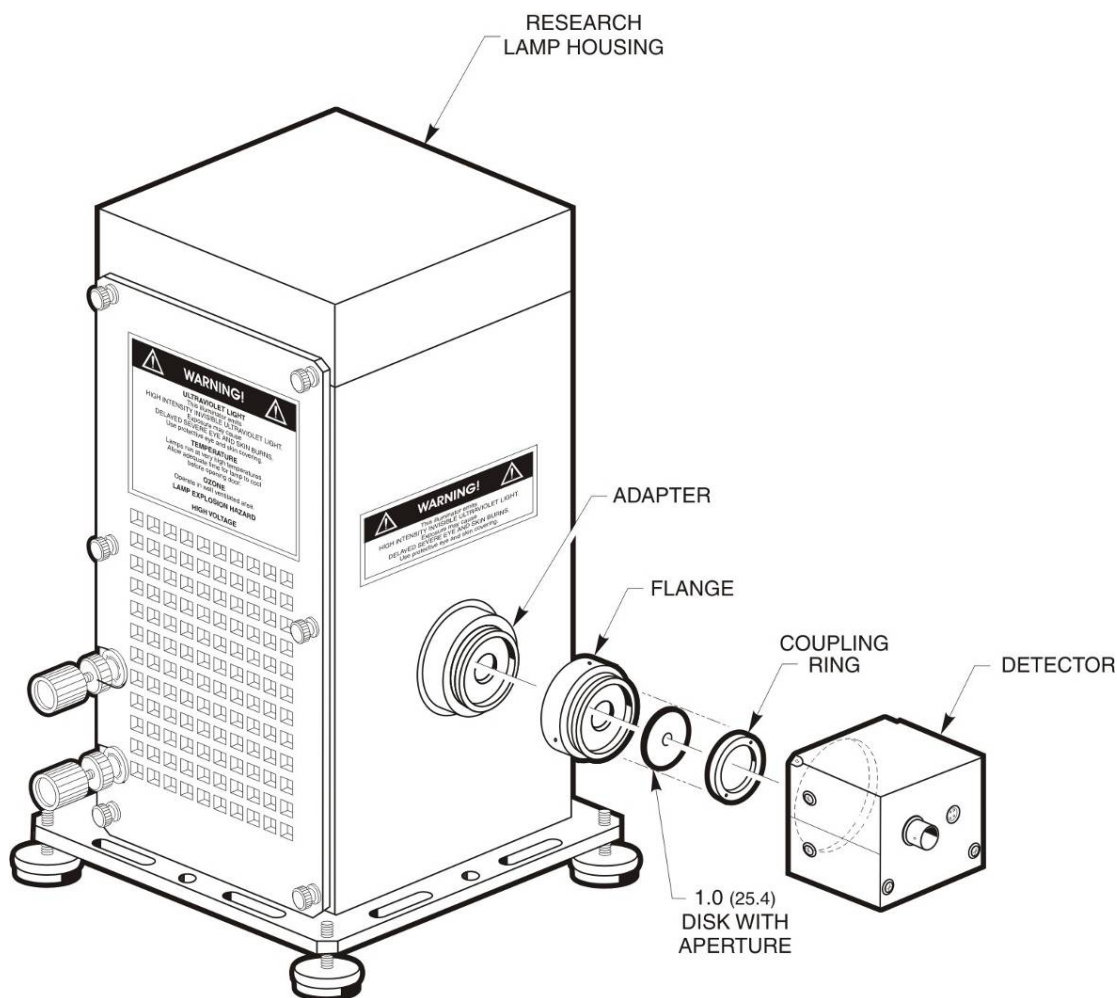
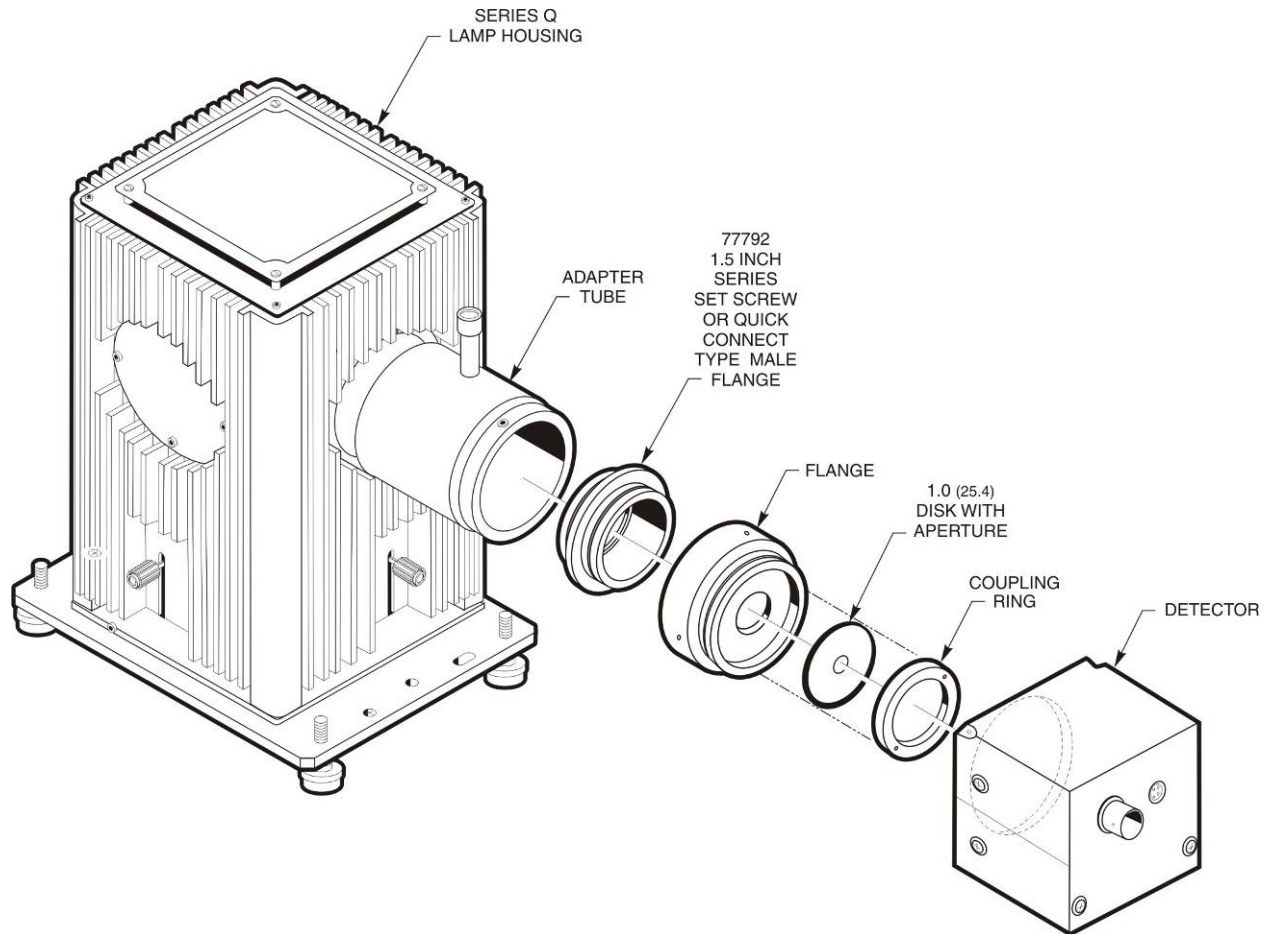


Figure 2

Use the 68952 Adapter Kit (an approximate representation above) for applications involving Oriel Research Arc Lamp housings. This kit, as well as the 68954 on the next page, comes with a selection of pinholes to allow reduction of radiation incident on the sensor. Use either the 1 mm or 2 mm aperture, as needed, to bring sensor reading, with the lamp at its nominal operating point, to a range of between 1 and 500  $\mu\text{A}$  (see the QUICK START section for details).

Please note: this adapter allows for convenient mounting of the sensor head, but it does not provide performance as stable as employing the suggestions on the preceding page. Adding a diffuser and extension tubes often improves the performance of systems using this adapter kit.

## 4.2.2 SERIES Q HOUSING



**Figure 3**

Use the 68954 Adapter Kit (an approximate representation above) for applications involving Oriol Series Q housings.

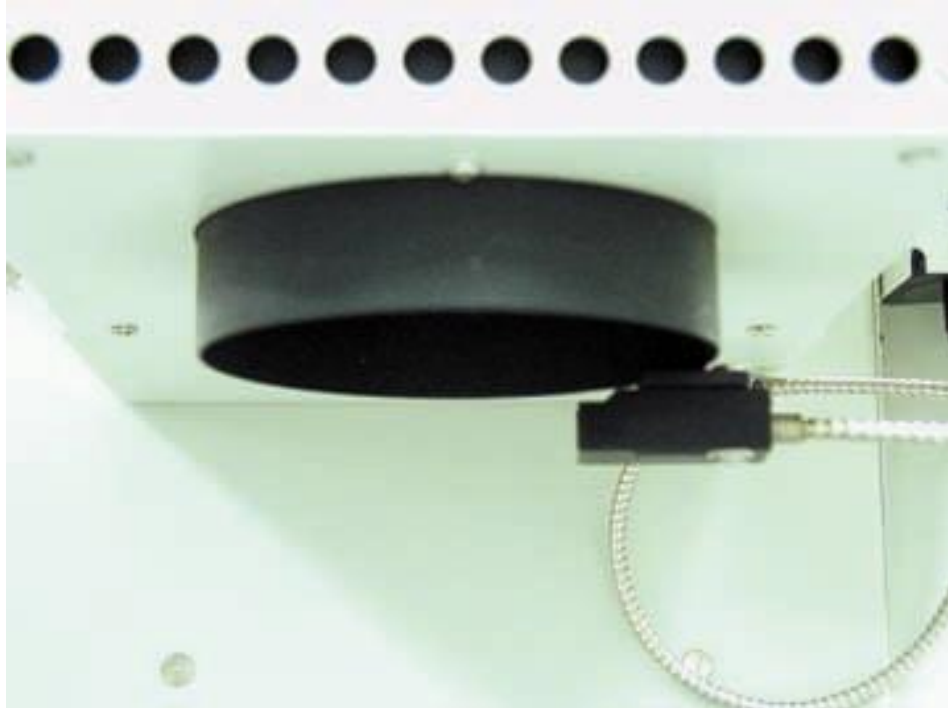
Please take a look at the preceding pages for comments on obtaining the best performance.

### 4.2.3 SOLAR SIMULATORS



**Figure 4**

Light collecting and sensing components of the 68951 Digital Exposure System are shown mounted to a 1 kW Flood Exposure system in Figure 4. Fiber adapter, shown in more detail below (Figure 5), collects light FROM THE UNIFORM SECTION of the illuminated area and sends it through a fiber optic bundle to the light sensor. System stability WILL be compromised if light is collected from the non-uniform edge of the beam.



**Figure 5**

**Wiggle Test:**

We often use a “wiggle” test to determine if the light is sampled correctly. To perform this test, the operator will need an additional detector placed in the working plane of the illuminator.

Set FLUX CONTROL to off and set the light source power supply to an appropriate operating setpoint for the lamp. Record the  $\mu\text{A}$  reading on the 68945 display from the light sensor as well as the signal reading from the second detector as the lamp position adjustments of the source are slightly wiggled. The two sets of readings should move up and down together, and by approximately same percentages, when the light sensor is properly positioned.

## 5 BUTTONS, DISPLAYS, INDICATORS AND CONNECTORS

### 5.1 FRONT PANEL BUTTONS

The following buttons are located on the front panel as shown in Figure 6. Their functions are described below:

- TIMER/FLUX button is used to toggle between the TIMER and LIGHT FLUX control groupings and to cause the applicable information to be presented on the digital display.
- START/OPEN and STOP/CLOSE buttons are used to activate or stop exposure cycles, manual and automatic.
- PAUSE button suspends the exposure cycle without resetting to the original time or dose set point. It then resumes the exposure when pressed again.
- UP and DOWN buttons, are used to adjust values.
- SELECT button is used to scroll through different modes (as indicated by LEDs in the TIMER or LIGHT FLUX groupings) to allow value adjustments and operating mode selections. Additionally, when in edit mode (by pressing SET/ENTER) it is used to select the digit to be changed by the UP or DOWN buttons. In addition, this button is used as an escape when held down for approximately 1 second in edit mode.
- SET/ENTER button, when held for a moment, allows changes to values/settings for the mode currently active in the display (as indicated by flashing of one of the LED's in TIMER or LIGHT FLUX groupings). The changes are not saved until the button is pressed again and the LED stops flashing. As mentioned above, pressing and holding the SELECT button is used to exit adjustment mode without saving the changed values.
- FLUX CONTROL button toggles intensity stabilization function on and off.
- AUTO SETUP, when held for a moment, starts the auto tuning function to optimize flux control functionality for a particular power supply/lamp combination.

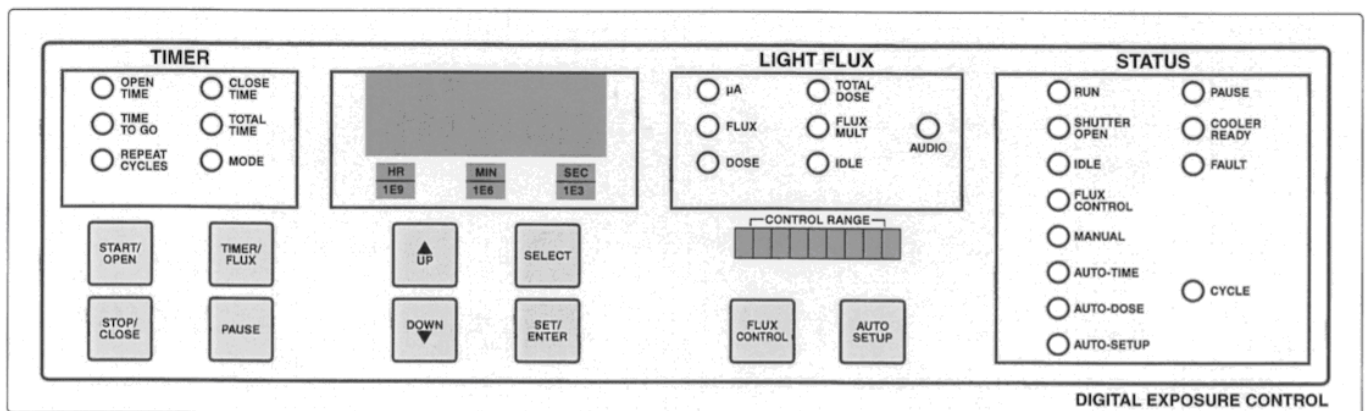


Figure 6: Front panel of the Digital Exposure Controller

## 5.2 FRONT PANEL DISPLAY

The following display and LEDs are located on the front panel as shown in Figure 6. Their functions are described below.

### MAIN DISPLAY

The main display can be switched between TIMER and LIGHT FLUX modes, using the TIMER/FLUX button, and is used to display selected values or choices for the different operating modes. Time unit/engineering exponent LEDs are used with this display to complement its information content.

Some display modes or LEDs are only accessible when exposure is off and others only when exposure is running to avoid confusion about their meaning or the possibility of causing malfunction. If the operator cannot access one of these, enable the opposite exposure status condition and try navigating to it.

### TIMER LED's (when lit)

- OPEN TIME indicates that the display shows the exposure/accumulated time during exposure. When no exposure is running, the display shows a single exposure preset for AUTO-TIME mode; in other modes the display shows the last exposure time.
- TIME TO GO indicates that the display shows the remaining time for the complete cycle.
- REPEAT CYCLES indicates that the display shows the number of exposure cycles selected (1 means single exposure).
- CLOSE TIME indicates that the display shows the single exposure cycle preset value for shutter-close time.
- TOTAL TIME indicates that the display shows the total exposure time accumulated since the last reset to zero.
- MODE indicates that the controller is in the status selection menu on the right side of the front panel and that the operator can make adjustments in that grouping.

### LIGHT FLUX LED's (when lit)

- $\mu$ A indicates that the display shows the light sensor current.
- FLUX (sensor  $\mu$ A reading  $\times$  flux multiplier value, see below) indicates that the display shows the calibrated intensity value.
- DOSE (flux  $\times$  seconds) indicates that the display shows the accumulated dose when an exposure is running. When no exposure is running, the display shows a single exposure preset for AUTO-DOSE mode; in other modes the display shows the last exposure dose.
- TOTAL DOSE indicates that the display shows the total dose accumulated since the last reset to zero.
- FLUX MULT indicates that the display shows the sensor calibration factor obtained utilizing an external standard.
- IDLE indicates that the display shows the idle mode (1 = on, 0 = off).
- AUDIO indicates that the display shows the audio on/off selection (a buzzer which can be actuated to signal out-of-control flux control situation).

### **STATUS LED's (when lit)**

- RUN indicates that the exposure function is in progress (LED on even when shutter closed during >1 cycles mode).
- SHUTTER OPEN is self-explanatory (or, in the case of no shutter, it indicates that the timer is on).
- IDLE indicates that the idle function is activated (useful in systems where the light sensor is located after the shutter). This will be lit when the shutter is closed, FLUX CONTROL is on, and IDLE is set to 1.
- FLUX CONTROL indicates that the light flux (intensity) control is on.
- MANUAL indicates that the shutter control is in manual mode.
- AUTO-TIME indicates that the internal system clock is used to time the shutter operation.
- AUTO-DOSE indicates that the shutter open time is controlled based on the light dose preset value.
- AUTO-SETUP indicates that the system is self-tuning. This process may take up to several seconds.
- PAUSE is self-explanatory.
- COOLER READY indicates that the detector is at operating temperature.
- FAULT indicates that an out-of range control condition or other error has occurred (see the RS232 section for a listing).
- CYCLE indicates that the system is executing multiple exposures. This will light up when CYCLES > 1 and exposure is running.

### **CONTROL RANGE LED BAR**

The control range LED bar provides an indication of the flux intensity control status and can be used as a predictor of the remaining useful life of the lamp. When the operating control point is at the extreme right or left point, i.e. the unit cannot control the output because of lamp aging or incorrect set points, the AUDIO alarm goes off, if enabled. Additionally, a TTL high signal is applied to the rear J2 ALARM OUTPUT BNC connector to allow additional warning methods to be used.

### 5.3 REAR PANEL CONNECTORS AND SWITCHES

The following switches and connectors are located on the rear panel as shown in figure 7. Their functions are described below.

#### SWITCHES

- The main power switch can be found on the back of the unit in the AC input module. This module also contains user replaceable fuses. For convenience, a module can be switched to indicate the fuse installed based on the AC line voltage. It has no other effect.
- S1 SHUTTER OPEN slider switch enables the user to match the TTL shutter control signal sense (HI or LOW) to the requirements of the application.

#### CONNECTORS

- AC INPUT (AC Power Cord) - universal voltage capable
- J7 DETECTOR INPUT (BNC) - BNC for detector signal
- J6 POWER SUPPLY OUTPUT (HD15 Cable) - control output level to the power supply
- J5 RS232 (DB9 Cable) - PC communications
- J4 TRIGGER INPUT (BNC) - remote switch closure or TTL shutter control input. In MANUAL mode, the shutter will remain open for as long as the LOW condition persists. In any of the automatic modes, the first edge (high to low) triggers the cycle which then runs to its conclusion. The minimum LOW pulse time in automatic modes is 70 milliseconds
- J3 SHUTTER OUTPUT (BNC) - TTL, selectable LO or HI, to indicate when to activate the output to the shutter
- J2 ALARM OUTPUT (BNC) - out of range error flag for process control
- J1 TE COOLER (DB9) - driver for the TE cooler of the highly stable light sensor

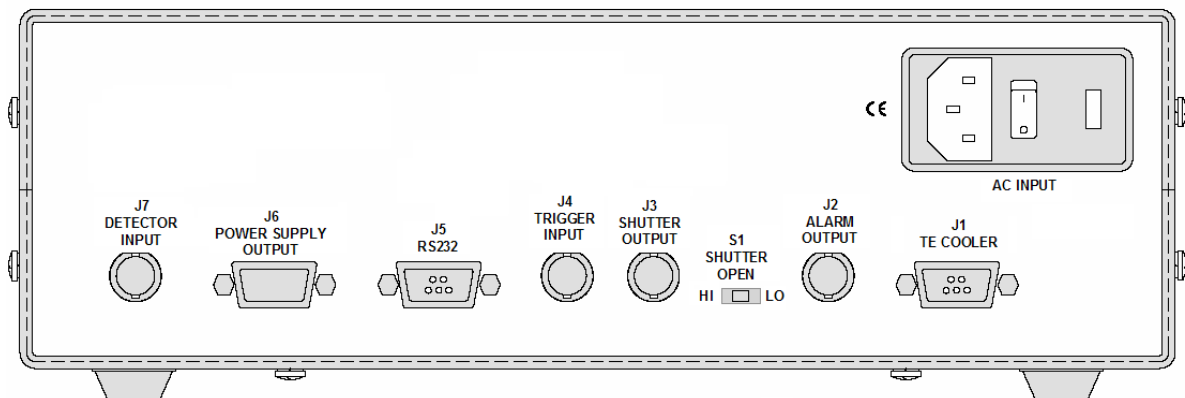


Figure 7: Rear Panel of Digital Exposure Controller



## 6 OPERATION

### 6.1 QUICK START

This section will walk through a typical set of steps leading to a flux controlled operation and an automatic exposure sequence for an illumination system.

**NOTE:** Most adjustment to the controller settings can only be made when the shutter is closed, to avoid operational conflicts.

We will assume that the operator has familiarized themselves with the safety information relating to the light source and that the illumination system is ready to be run (lamp installed, all electrical connections made, safety enclosures in place, etc.).

We will also assume that the operator is working with the light sensor installed and capable of collecting a sample of the light flux to be stabilized (see the LIGHT SAMPLING TECHNIQUES section if this is not the case).

1. Turn off the power to the light source and the Digital Exposure Controller before making cable connections.
2. Connect the light sensor to the J7 DETECTOR INPUT using the low noise BNC cable provided.
3. Connect the TE cooler cable to the J1 TE COOLER connector and the light sensor.
4. Foot-switch or pendant switch cable, if used, should be plugged into J4 TRIGGER INPUT connector on the rear panel.
5. Connect the J6 POWER SUPPLY OUTPUT to the power supply remote I/O connector using the supplied cable.

A typical connection diagram is shown in Figure 8.

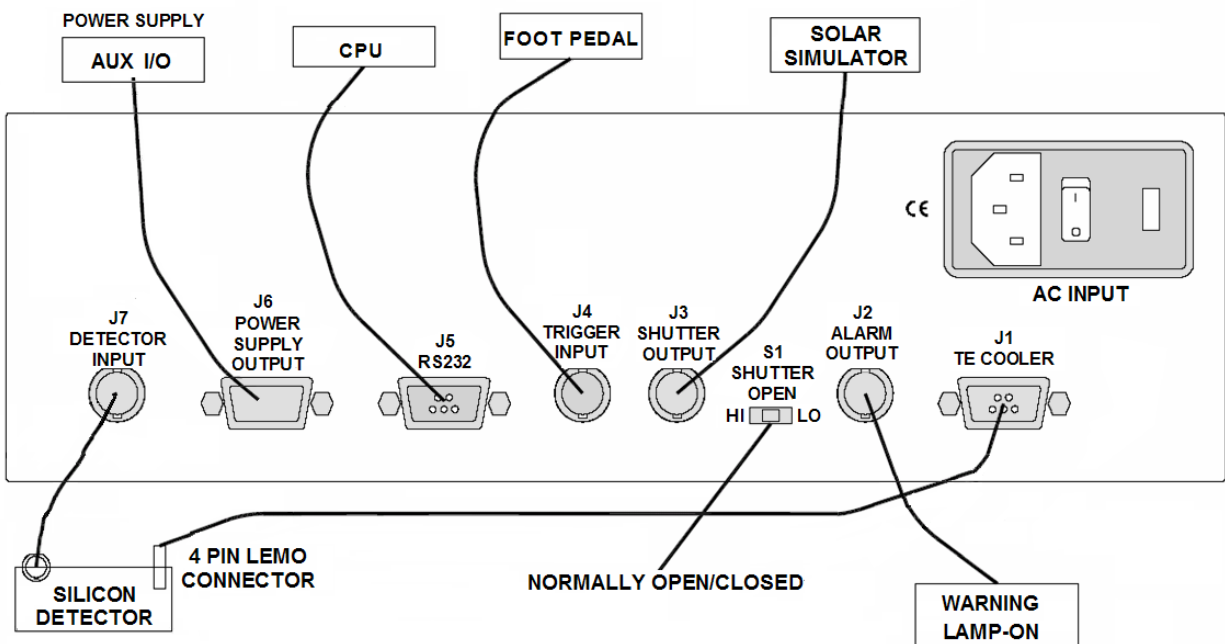


Figure 8: Typical Cable Connections

6. Turn on the lamp power supply.
  - Set it to the maximum power level of the lamp: typically 10% higher than the desired operating point.
    - (e.g. 1100 W for a 1000 W rated lamp - check the safe power levels for the type of lamp being used. Excess power can dramatically shorten lamp life, especially for QTH lamps).
  - Ignite the lamp and allow the power supply to settle to the preset value
    - (NOTE: The operator will be shortly relinquishing lamp power control to the light level stabilizing circuitry of the 68945. After the following set of steps, the operator will be setting lamp power indirectly by setting the reference level for the light signal. The maximum power setting on the supply will become the upper limit to which the automatic light level control will be allowed to push the lamp. This feature is designed to prevent lamp overdriving, which can lead to envelope breakage or filament burnout).
  - Allow the system to stabilize for approximately 15 minutes before proceeding for best operation.

**CAUTION:** When turning the complete system on, the power supply must reach its set point before any FLUX control functions are initiated (Auto Setup or Flux control). Otherwise, system malfunction or lamp damage may occur.

**SAFETY WARNING:** The shutter, if present, will be automatically opened during the following procedure – the operator should wear light safety items, goggles and/or clothing, required for the light source in use.

Continuing with the Quick Start steps:

7. Turn on the Digital Exposure Controller while holding down the STOP/CLOSE button. This action makes sure that instrument is starting at the factory default set values.
8. Using TIMER/FLUX and SELECT buttons scroll until the  $\mu\text{A}$  LED is lit.
9. Check that light sensor is reading somewhere between 1 and 500  $\mu\text{A}$  for best performance (use the START button to open the shutter, if present).
  - Modify the light sensing setup if the reading is outside of this range.
10. Press the AUTO SETUP button and hold it until the LED lights.
  - The controller will now open the shutter, if present, and sample the lamp's output fluctuations in response to the power supply output changes. This data is used to optimize the intensity control function.
  - At the end of this step, the Digital Exposure Controller will save the min-max values of the possible control range and use the mid-point as a starting reference level. This will typically result, when FLUX CONTROL is later turned on, in the power supply being controlled to deliver a light sensor reading at ~85% of the maximum power supply setting.
  - The shutter will now close and the AUTO-SETUP LED will go off. Typically 10 to 20 seconds elapse from the beginning to the end of this function.
  - If the FAULT LED lights up, refer to the recovery section below.
11. If closing the shutter results in  $\mu\text{A}$  readings close to zero (with the light sensor mounted after the shutter), IDLE mode should be selected to maintain remote control of the power supply.
  - Use the SET/ENTER and SELECT buttons to scroll through the LEDs until IDLE is lit.
  - Press the SET/ENTER button for a moment until the IDLE LED flashes.

- Use the UP/DOWN buttons to choose 1 from the 0 and 1 options for the IDLE function.
  - Press SET/ENTER to save this selection.
12. Press the FLUX CONTROL button to enable stable exposure.
  13. Set exposure mode to automatic.
    - Enable the MODE LED (using the TIMER/FLUX and SELECT buttons).
    - Enter the mode selection (SET/ENTER) and scroll to the AUTO-TIME LED (using the UP/DOWN buttons).
    - Save the selection (SET/ENTER).
  14. Enable the OPEN TIME LED (using the TIMER/FLUX and SELECT buttons) and enter the length of the desired exposure (using the SET/ENTER, UP/DOWN, SELECT, SET ENTER buttons).
  15. Press the START button to run this exposure.

## RECOVERY FROM FAULT CONDITION

Should a fault occur during AUTO SETUP, the AUTO SETUP sequence should be attempted again before any other steps are taken. It is possible that a destabilized light source caused the fault. If re-running AUTO SETUP doesn't resolve the fault, then proceed as follows:

- Check the power supply limit settings
- Check the light sensor signal level
- Check the cabling of the entire system

## RESETTING THE DIGITAL EXPOSURE CONTROLLER

Since digital memories can be stored indefinitely, the following sequence is a method to reset the 68945 controller settings:

1. Turn off both the light source power supply and the Digital Exposure Controller
2. Disconnect the Power Supply Output Control cable (J6) from the Digital Exposure Controller
3. Turn on the power supply and power up the lamp to the maximum setting
4. Turn on the Digital Exposure Controller
5. Re-connect the Power Supply Output Control cable to the controller
6. This resets the power supply operating set point by releasing control from the Digital Exposure Controller.

## 6.2 DETAILS OF SYSTEM CONTROLS

This microprocessor-controlled device offers great flexibility in managing light exposure needs. This configurability brings with it a certain degree of potential confusion as to which feature to use for a given application. In what follows, we will offer more detailed descriptions of these functions. Most of them are, however, pretty self-explanatory.

**CAUTION:** When turning on the complete system, the power supply must reach its set point value before any FLUX control functions are initiated (Auto Setup or Flux control). Otherwise, system malfunction or lamp damage may occur. In addition, optimal performance will be obtained if the light source is allowed to stabilize for at least 15 minutes before initiating the Digital Exposure System.

## GENERAL NOTES:

- Upon POWER-ON, the 68945 controller “remembers” the last used settings and mode selections. The controller always “wakes up” in shutter-closed mode with FLUX CONTROL disabled for safety reasons.
- START/OPEN is used to open the shutter and/or start an exposure sequence.
- TIMER/FLUX button is used to select whether the timer or light intensity function will be used.
- SELECT button is used to scroll between the various quantities that can be displayed. In edit mode it also functions as a digit select. In addition, by holding the SELECT button 1 second while in edit mode, the controller will exit edit mode and enable value adjustments without saving the changes.
- SET/ENTER button is used to enter the value or option in selection mode and then to save the choices. Typically, one of the status LEDs slowly flashes when adjustments are possible.
- UP/DOWN arrow keys are used to change digit values.

### 6.2.1 FLUX CONTROL

The QUICK START section above walked through the activation of the flux control function. Use the FLUX CONTROL button to turn this function on or off.

CAUTION: the power supply returns to the maximum setting when the intensity control function is disabled.

AUTO SETUP - should be performed after replacement of a major component (lamp, reflector, or light sensor) or when the out of range condition is encountered or soon to be expected. This system tuning function prepares the equipment for long-term, stable performance.

To fine tune the output level of the light source, follow this sequence:

1. Set exposure mode to MANUAL
  - Select the MODE LED (by using the TIMER/FLUX and SELECT buttons)
  - Enter the mode selection (SET/ENTER) and scroll to MANUAL (with the UP/DOWN arrows)
  - Save the selection (SET/ENTER)
2. Set the display to  $\mu\text{A}$  or FLUX
3. Make sure that FLUX CONTROL is on
4. Open the shutter
5. Press SET/ENTER for a moment
6. Use the UP/DOWN arrows to raise or lower the output while monitoring either the  $\mu\text{A}$  or power supply readings. Each press of the button results in a small adjustment to minimize the chance of a runaway operating condition. The size of the adjustment is ~2% of the control range or ~ 0.6% of the maximum light level.
7. Press SET/ENTER to save the new set point

Timed exposures can be accomplished in MANUAL mode by the operator, or automatically by using the AUTO TIME mode with single or multiple cycles

In multiple cycles mode, the shutter CLOSE TIME needs to be defined in addition to the shutter OPEN TIME.

## 6.2.2 DOSE CONTROL

Dose can be controlled by exposing for a fixed time with a constant flux illumination or by exposing until the preset dose value has been achieved. Both methods yield the same result.

Dose based control mode (AUTO-DOSE enabled), can be most beneficial toward the end of a lamp's life, when increasing the lamp current or wattage is not an option. Run the lamp at its nominal operating point without flux control on and have the DOSE control vary exposure times as needed to keep exposures within the operator's process window.

## 6.2.3 IDLE

IDLE function maintains remote control of the power supply when FLUX CONTROL is on and serves as a status indicator when the shutter is open and the system is in active Flux Control. IDLE must be enabled, set to 1, before selecting FLUX CONTROL. Refer to the Quick Start section for instruction. It is most useful in systems where the light sensor is placed after the shutter.

0 – IDLE function off; note that flux control will be disabled and result in a fault condition if selected.

1 – IDLE function on; when the shutter closes, the power supply is held at the last set point before Auto Setup was performed and the IDLE LED is lit. This indicates that the system is not in active flux control mode and that the controller is waiting.. When the shutter opens, the system returns to active flux control and the LED turns off. The power supply returns to the operating point in order to achieve the desired output irradiance level.

## 6.2.4 TOTAL TIME/TOTAL DOSE

TOTAL TIME/TOTAL DOSE can be zeroed by pressing SET/ENTER with the TOTAL TIME OR TOTAL DOSE LED LIT and holding the DOWN arrow.

## 6.2.5 FLUX MULTIPLIER

The easiest way to set the FLUX MULTIPLIER value is to set the display to FLUX mode, enter edit mode by selecting SET/ENTER, and then use the UP/DOWN arrows until the display on the controller matches the reading of the meter being used as a standard metrology tool. Saving the value at the end is done in the usual manner by selecting SET/ENTER. The saved multiplier value can be verified by switching the display to FLUX MULT mode.

## 6.2.6 AUDIO

AUDIO mode is used to signal an out of range ERROR condition in Flux Control mode via a built-in buzzer. It can be turned on or off in the usual manner when in edit mode.

## 6.2.7 ELECTRONIC BANDWIDTH SELECTION

Choose the appropriate bandwidth for flux control (100 Hz for arc and Deuterium lamps, 1 Hz for Quartz Tungsten Halogen (QTH) lamps since their thermal time constants limit their response time). The default setting is 100Hz.

Press the TIMER/FLUX button until one of the LEDs in the LIGHT FLUX grouping is lit. Press SELECT to scroll through the LEDs until either 1 or 100 appears on the display. Verify that the setting matches the type of lamp being used. If the wrong value appears, hold the SET/ENTER key for a moment, until the value flashes, and then use the UP or DOWN arrows to toggle to the correct value. Press SET/ENTER to save this value.

## 7 RS232 COMMUNICATIONS

RS232 communications offer additional ways of utilizing the Digital Exposure Systems. It offers a quick way of downloading different operating modes and presets. It also offers access to additional error information not accessible from the front panel.

### Serial Port Setup:

9600 Baud, 8 bits, 1 Stop, No Parity, No Flow Control

### Syntax:

ASCII Text

Received command lines are to be terminated by CR

Transmitted responses are terminated by CR/LF

Parameters separated by a space

Parameter and Response Types and Format:

ASCII strings representing:

fp : Floating Point	:	fff.ff
i : Integer	:	iiii
c : Character	:	c
t : Time	:	hh:mm:sec.th

Sample command: EXPMODE T sets exposure mode to AUTO-TIME

### Commands:

Commands are listed in Table 1. Syntax is as listed above.

**Table 1**

Command String	Parameter	Response	Description
START	na	0 for success	Starts Exposure
STOP	na	0 for success	Stops Exposure
PAUSE	na	0 for success	Pauses Exposure
EXPSTATE?	na	O= running open cycle P = Paused C= running close cycle S = stopped	Queries the present exposure state
RUN?	na	1 = Exposure is running 0 = Exposure is stopped	Is exposure running?

Command String	Parameter	Response	Description
EXPMODE?	na	T = Auto timed D= Auto Dose M = Manual	Queries Exposure Mode
EXPMODE	T, D, or M	0 for success	Sets Exposure mode, see query above
SHUTTER?	na	1 = Activated (Open) 0 = Deactivated (Closed)	Queries the shutter state.
EXPDOSE?	na	fp	Queries the present dosage for a running exposure
DOSE	fp	0 for success	Sets Dosage to run an exposure cycle
DOSE?	na	fp	Queries the dosage for exposures cycles
TOTALDOSE?	na	fp	The total accumulated lifetime dosage
CLRTOTALDOSE	na	0 for success	Clears total dosage
CLRTOTALTIME	na	0 for success	Clears total time exposure
TOTALTIME?	na	t	Queries the total accumulated exposure time
OPENTIME?	na	t	Queries the shutter open time for exposure cycles
OPENTIME	t	0 for success	Sets the shutter open time for exposure cycles
EXPOPEN?	na	t	Queries present shutter open time for a running exposure
CLOSETIME	t	0 for success	Sets the shutter close time between exposure cycles
CLOSETIME?	na	t	Queries the shutter close time between exposure cycles
EXPCLOSE?	na	t	Queries present shutter close time for a running exposure



Command String	Parameter	Response	Description
TIMETOGO?	na	t	Queries the time left in the present exposure period (open or close)
EXPCYCLE?	na	i	Returns the number of exposure cycles currently running
REPEAT	i	0 for success	Sets the number of exposure cycles to run
REPEAT?	na	i	Returns the number of exposure cycles to run
CONTROLRANGE?	na	1= MIN... 9=MAX	Returns integer indicating the operating point within the control range, corresponds to a front panel LED
AUTOSETUP	na	0 for success	Begins Auto Setup Sequence
QTH?	na	'1'= on '0' = off	Queries status of the QTH Lamp filter
QTH	'1'= on '0' = off	0 for success	Sets status of the QTH Lamp filter
FLUX?	na	fp	Queries the Flux value
FLUXMULT?	na	fp	Queries the Flux Multiplier
FLUXMULT	fp	0 for success	Sets the Flux Multiplier
FLUXCONTROL	1= on 0 = off	0 for success	Sets status on Flux Control
FLUXCONTROL?		'1'= on '0' = off	Queries status on Flux Control
DETECTOR?	na	fp	Queries the detector, returns uA
INCSETPOINT	na	i how many units to increment setpoint by	Increments the setpoint by multiple units. <i>used to adjust the detector current (uA) and Flux</i>

Command String	Parameter	Response	Description
DECSETPOINT	na	i how many units to increment setpoint by	Decrements the setpoint by multiple units, <i>Used to adjust the detector current (uA) and Flux</i>
COOLER?	na	1= ready 0 = not ready	Queries the status of the cooler controller
IDLE%?	na	0 for success	Queries the percentage to run in Idle mode
IDLE%	fp	fp	1 sets the Idle on 0 sets the idle off
IDLEON?	na	1= on 0 = off	Queries the status of the Idle mode
FAULT?	na	decimal integer value 0 = no errors bit definitions for errors: bit 0 = flux control operating at max range bit 1 = flux control operated at min range bit 2 = auto setup failed to find range bit 3 = auto setup with cooler not ready bit 4 = auto setup failed to see signal bit 5 = auto setup detector saturated bit 6 = auto setup failed to find set point bit 7 = received command not understood bit 8 = received parameter invalid for command	Queries the system fault status
AUDIOOFF	na	0 for success	Disable the buzzer, <i>turns buzzer off if sounding.</i>
ADUIOON	na	0 for success	Enable the buzzer, <i>does not necessarily turn buzzer on, only enables it for a fault condition.</i>

## 8 DEFAULT SETTINGS

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OPEN TIME	1 s	
CLOSE TIME	1 s	
TOTAL TIME	0 s	
TOTAL DOSE	0	
REPEAT CYCLES	1	single exposure mode
FLUX MULT	1	
AUDIO	0	buzzer feature off
FILTER	100	appropriate for arc lamps and deuterium lamps
MODE	MANUAL	
FLUX CONTROL	OFF	

Please execute the following steps to return to factory default settings:

1. Turn off the Digital Exposure Controller for 10 seconds or longer
2. Press and hold the STOP/CLOSE button while turning power back on. This will load default values into their proper memory locations.

## 9 SPECIFICATIONS

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AC Mains Input:	90 - 264 VAC/ .250A max 50/60 Hz
Meter Accuracy:	± 0.1% of full scale
Operating Temperature:	10 - 35°C
Weight:	6 lbs
Detector	UV Enhanced Silicon - temperature stabilized to 5°C

## 10 WARRANTY AND RETURNS

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### CONTACTING ORIEL® INSTRUMENTS

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

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

Newport Corporation proudly serves customers across Canada, Europe, Asia and the United States through 9 international subsidiaries and 24 sales offices worldwide. Every year, the Newport Resource catalog is hailed as the premier sourcebook for those in need of advanced technology products and services. It is available by mail request or through Newport's website. The website is where one will find product updates, interactive demonstrations, specification charts and more.

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

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Sales: [orielPV.sales@newport.com](mailto:orielPV.sales@newport.com)  
Technical assistance or repair service: [orielPV.service@newport.com](mailto:orielPV.service@newport.com)

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

### REQUEST FOR ASSISTANCE / SERVICE

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

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

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

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

## **REPAIR SERVICE**

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

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

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

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

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

## **NON-WARRANTY REPAIR**

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

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

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

## **WARRANTY REPAIR**

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

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

### WARRANTY PERIOD

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

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

### WARRANTY EXCLUSIONS

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

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

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