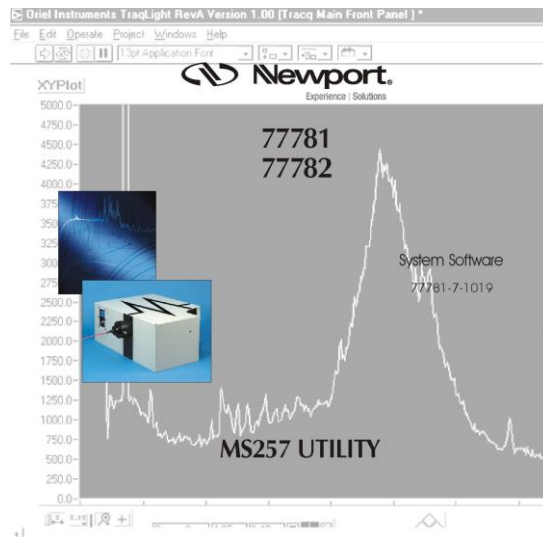


MS257 USB/RS232

MONOCHROMATOR AND SPECTROGRAPH



Programming Manual

MODELS: MS257-M-FH-A, MS257-M-FH-L, MS257-M-FH-D, MS257-M-MC-A, MS257-M-MC-L, MS257-M-MC-D, MS257-M-MT-A, MS257-M-MT-L, MS257-M-MT-D, MS257-S-FH-A, MS257-S-FH-L, MS257-S-FH-D, MS257-S-MC-A, MS257-S-MC-L, MS257-S-MC-D, MS257-S-MT-A, MS257-S-MT-L, MS257-S-MT-D

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1 INTRODUCTION

1.1 CONVENTIONS USED IN THIS MANUAL

Various typefaces are used to represent different types of input and responses to and from the MS257.

- This typeface, **RESPONSES**, indicates responses that are sent by the MS257 over the USB or RS232 interface.
- This typeface, **COMMANDS**, indicates commands that are sent from a Hand Controller or computer to the MS257 over the USB or RS232 interface.
- Unless otherwise stated, bold characters enclosed in square brackets, e.g. **[CR]**, refer to ASCII control characters.
- Commands that require a device selector are shown using 'n', e.g. **?FILTn**. As an example, **?FILT1** or **?FILT2** would be entered to choose querying filter wheel #1 or filter wheel #2.
- Command parameters can be one of three types:
 - Wavelength command parameters are shown as 'www', e.g. **!GW www**. An example of its use would be **!GW 546.1**. Note that all wavelength parameters, both sent and received, will be in the currently selected wavelength units (**UNITS**).

Note: Although wavenumber are a unit of frequency (cm^{-1}), for ease of use they are also grouped under the generic "wavelength units" category.
 - Integer command parameters are shown as 'x', e.g. **!GRAT x**. An example of its use would be **!GRAT 1**
 - Alphanumeric command parameters are shown as 'a', e.g. **=UNITS aa**. An example of its use would be **=UNITS NM**

2 GETTING STARTED WITH THE USB INTERFACE

The Oriel MS257 can be completely controlled and configured by commands sent to its USB or RS232 port.

2.1 CONNECTING THE MS257 TO THE COMPUTER

Cabling

The MS257 is configured as a USB II Serial Port or RS232 Port. Use the cable provided to connect the MS257 to the computer.

The Oriel MS257 can be completely controlled and configured by commands sent by RS232 port through a splitter cable to two instruments.

2.2 WRITING A PROGRAM TO COMMUNICATE WITH THE MS257

- The Monochromator Utility CD is supplied with an executable which can perform the basic functions on the MS257. The program is written in LabView® and the VIs are also provided.
- The Monochromator Utility CD is supplied with a dll for USB communication, which can be called from various languages. The LabView® VIs provide an example showing how to use the dll. The programming conventions are detailed in subsequent chapters.

2.3 TIPS FOR SUCCESS IN WRITING USB PROGRAMS

- Use the .dll program provided to read and write from the USB port to which the MS257 is connected to. This will ensure the proper USB communication rate. Many development environments accommodate .dll programs such as Visual Basic®, LabView®, and Matlab®.
- When reading responses from the MS257, one must be aware that the length of the response may vary, especially if an error is reported. The longest response is 96 characters.
- Note that a **[CR][LF]** comes at the beginning of all responses from the MS257. Responses are normally terminated by a greater-than sign (>). During a scan, a colon (:) is used to terminate data point responses.
- Error responses from the MS257 start with an **E** following the initial **[CR][LF]**. This can be used to uniquely identify errors, as there are no normal responses from the MS257 that begin with this letter. When the MS257 is not scanning, error responses take the form **[CR][LF]Exxxx**. Errors encountered while the MS257 is scanning are reported as **[CR][LF]Exxxx[CR][LF]www:**, where **www** is the current scan data point.
- Always wait for the MS257 to respond to a command before issuing the next command.
- Set a suitably long communications timeout for read operations. Several seconds can elapse even during a simple move if automatic grating, filter wheel, and output port changes are triggered. A timeout of 30 seconds is not unreasonable.

3 COMMAND SYNTAX

The MS257 is configured and controlled using the Oriol Standard Instrumentation Command Set. Instructions are simple ASCII character strings that can be entered from a software program. Commands are not case sensitive and must be terminated by a **[CR]**. Line-feeds after the **[CR]** are ignored.

3.1 COMMAND ECHO

The MS257 does not echo any of the characters or command strings sent to it via USB or RS232. Therefore, if one is controlling the instrument via a terminal emulation program, local echo should be enabled so one can see what is being typed.

3.2 COMMAND RESPONSE

During normal operation, the MS257 indicates successful completion of the previous command and its readiness to accept the next command by issuing a 3 character prompt:

[CR][LF]>

If an error occurred during execution of the previous command, the prompt will include a 4-digit error code. For example, a prompt of

[CR][LF]E0001>

would indicate that the previous command was not recognized.

3.3 ACTION COMMANDS

Commands that cause the MS257 to perform an immediate action are considered Action Commands. An Action Command always begins with an exclamation mark (!) followed by the command name. Optional parameters can follow, separated by spaces. For example, to set the wavelength to 200 nm, one would send:

!GW 200 [CR]

3.4 READ COMMANDS

The MS257 maintains an extensive list of operating parameters. All parameters can have their current values read by sending a command that consists of a question mark (?) followed by the parameter name. The MS257 will display the parameter's current value followed by the greater-than (>) completion prompt.

For example, to ask the instrument to display its current position in the currently selected wavelength units, one would send:

?PW [CR]

If the instrument is currently positioned at 375 nm and the wavelength units are set to nanometers, it will respond with:

[CR][LF]375.00>

3.5 WRITE COMMANDS

Some parameters are read-only and are set internally by the instrument only as a result of some other operation. Others are considered read/write (R/W) and can be set directly. Writing a parameter is accomplished by sending an equal sign (=) followed by the variable name and the new parameter value.

For example, to set the starting wavelength for a scan to 450 nm, one would send:

=BLAZE 1200 [CR]

To query the start wavelength, one would send:

?BLAZE [CR]

The response would be:

[CR][LF]1200>

4 ALPHABETICAL COMMAND INDEX

Commands & Parameters	Description	Hand Controller	Page Reference
!ABORT	Abort the current scan and return to home	Abort	23
!ADH	Go to absolute drive home	-	24
=BANDPASS www	Set automatic slit bandpass	Band	26
?BANDPASS www	Query automatic slit bandpass	Band	26
=BLAZE aaaa	Blaze wavelength for selected grating	Blaze	14
?BLAZE	Query blaze wavelength for selected grating	Blaze	14
=CALWAV www	Set calibration wavelength at current position	Calib	15
?CALWAV	Query calibration wavelength at current position	Calib	15
=CHNGF1 x:www:x	Changeover points for filter wheel 1	(F1) Table	25
?CHNGF1	Query changeover points for filter wheel 1	(F1) Table	25
=CHNGF2 x:www:x	Changeover points for filter wheel 2	(F2) Table	25
?CHNGF2	Query changeover points for filter wheel 2	(F2) Table	25
=CHNGGR x:www:x	Changeover points for grating mount	(Grat) Table	12, 15
?CHNGGR	Query changeover points for grating mount	(Grat) Table	16
=CHNGPI x:www:x	Changeover point for input port	-	28
?CHNGPI	Query changeover point for input port	-	28
=CHNGPO x:www:x	Changeover point for output port	(Port) Table	27
?CHNGPO	Query changeover point for output port	(Port) Table	27
=ENDW www	End wavelength for a scan	End	18
?ENDW	Query end wavelength for a scan	End	18
!FASTSH xxx	Activate fast shutter for xxx milliseconds	-	29
!FILT1 x	Select filter position for filter wheel 1	F1	24, 25
?FILT1	Query current filter in filter wheel 1	F1	24
!FILT2 x	Select filter position for filter wheel 2	F2	24, 25
?FILT2	Query current filter in filter wheel 2	F2	24
!GH	Go to grating home	Go Hom	12, 26

Commands & Parameters	Description	Hand Controller	Page Reference
!GO	Start or continue a scan	Go	15, 17, 20
!GRAT x	Select a grating, 0 to 4	Grat	11, 15
?GRAT	Query current grating	Grat	11
?GRMOUNT	Query which grating turret is installed	-	12, 15
!GS xxxx	Go to position by motor steps	-	23
!GW www	Go to position by wavelength	Go Wav	12, 26
=HOME x	Home for current grating	Home	14
?HOME	Query home for current grating	Home	14
=HS 1	Handshake mode on	-	20
=HS 0	Handshake mode off	-	20
?HS	Query handshake mode	-	20
=INTERVAL www	Wavelength interval between scan moves	Intvl	19
?INTERVAL	Query wavelength interval between scan moves	Intvl	19
=LABELF1 aaaa	Label for selected filter for filter wheel 1	F1 Labl	24
?LABELF1	Query label for selected filter for filter wheel 1	F1 Labl	25
=LABELF2 aaaa	Label for selected filter for filter wheel 2	F2 Labl	24
?LABELF2	Query label for selected filter for filter wheel 2	F2 Labl	25
=LINES xxxx	Lines per millimeter for current grating	Lines	13
?LINES	Query lines per millimeter for current grating	Lines	13
[LOCAL] †	Transfer control to hand controller	Local	20, 30
?MAXW	Query maximum wavelength for current grating	-	13
!MS +xxxx	Move forward by motor steps	Step >	23
!MS -xxxx	Move backward by motor step	Step <	23
=OFFSET xxxx	Set offset angle for current grating in radians	-	14
?OFFSET	Query offset angle for current grating in radians	-	14
=ORDER x	Set order for current grating	-	13
?ORDER	Query order for current grating	-	13
!PAUSE	Pause during a scan	-	17, 33
=POINTS xxxx	Set number of data points in a scan	Points	19
?POINTS	Query number of data points in a scan	Points	19
!PORTIN a	Select input port A, D or 0	-	28

† Available on hand controller only

Commands & Parameters	Description	Hand Controller	Page Reference
?PORTIN	Query input port	-	28
!PORTOUT a	Select output port B, C or 0	Port	27, 28
?PORTOUT	Query output port	Port	27
?PS	Query current step position	-	23
?PW	Query current wavelength position	[displayed]	12, 15
[REM] [†]	Transfer control to computer	Rem	30
=SHTRTYPE a	Set shutter type to slow, fast or manual	-	29
?SHTRTYPE	Query shutter type	-	29
!SHUTTER 1	Activate slow shutter	Cl Sh	29
!SHUTTER 0	Deactivate slow shutter	Op Sh	29
!SLITA xxxx	Set slit A width in microns	Slit A	26
?SLITA	Query slit A width in microns	Slit A	26
!SLITB xxxx	Set slit B width in microns	Slit B	26
?SLITB	Query slit B width in microns	Slit B	26
!SLITC xxxx	Set slit C width in microns	Slit C	26
?SLITC	Query slit C width in microns	Slit C	26
=STARTW www	Start wavelength for a scan	Start	18
?STARTW	Query start wavelength for a scan	Start	18
!SYSINFO 0	Disable system information during scan	No Inf	22
!SYSINFO 1	Enable system information during scan	Inf	22
?SYSINFO	Query system information mode	-	22
=UNITS aa	Set wavelength units to nm, μm or wn	Units	21
?UNITS	Query wavelength units	Units	21
?VER	Query firmware version	Ver	21
=WAIT xxxx	Set wait time during a scan	Wait	19
?WAIT	Query waiting time during a scan	Wait	19
?ZEROSTEP	Query step position of system zero angle	-	23
!ZEROANG	Set the system zero angle	-	23

[†] Available on hand controller only

5 COMMAND REFERENCE CATEGORIZED BY FUNCTION

In all of the following examples, the **[CR]** used to terminate commands sent to the MS257 is implied. Similarly, the **[CR][LF]** that prefixes all responses from the MS257 is also assumed.

Note: Many of the examples listed here assume wavelength units to be nm. In all cases, wavelength parameters sent and received will be interpreted according to the current units in effect (nm, μm , or wn).

5.1 GRATING AND WAVELENGTH POSITIONING COMMANDS

These commands affect the grating turret and wavelength positioning of each grating.

Select Grating **!GRAT x**

The grating changer mechanism selects the desired grating and drives the grating to its Home wavelength position. The requested grating must be valid for the current Grating Mount Assembly (**GRMOUNT**).

Parameters: x

The parameter equals the grating to select. To select a specific grating, x must be in the range 1 to **GRMOUNT**. If x equals 0, then Automatic Grating Selection is enabled. The selection of a particular grating will then depend upon the grating changeover table.

Example: **!GRAT 2**

Select grating number 2

Query Current Grating **?GRAT**

The response will give the currently selected grating. The current grating will always be reported as a number from 1 to 4. The response will be **A:x** if Auto Grating Selection is enabled, and **M:x** if Auto Grating Selection is disabled.

Example: **?GRAT**

Response: **A:1>**

It is in Auto Grating Selection mode and the grating number 1

or **M:1>**

It is in Manual Grating Selection mode and the grating is number 1

Go to a Wavelength !GW www

This positions the current grating to the desired wavelength. Because the grating drive is positioned in increments of approximately 3.6 arc-seconds, the actual selected wavelength may differ slightly from the desired position. The actual wavelength to which the grating has been positioned can be retrieved via the **?PW** command.

If Automatic Grating Selection is enabled, (see **!GRAT**), this command will not necessarily position the current grating to the specified wavelength. Instead, the MS257 will use the grating changeover table (**=CHNGGR**) to determine which grating should be chosen for the specified wavelength, change to that grating, and then position to the desired wavelength. The wavelength must be valid and within the range of one of the gratings in the changeover table. Otherwise, an error code is reported.

Parameters: www Wavelength in currently selected units to position the grating. The value of www must be valid for the current grating by being within the range 0 to **MAXW**

Example: **!GW 546.1** Go to the wavelength 546.1 nm

Query Current Position in Wavelength ?PW

The response displays the current grating position in currently selected units.

Example: **?PW**

Response: **250>** The grating is set at 250 nm

Go to Grating Home !GH

This positions the current grating to its Home wavelength or to the Auto Grating Home, if Automatic Grating Selection is enabled. See **=HOME**.

Example:	?PW	Query current wavelength
	567>	The grating is set at 567 nm
	!GH	Go to the home wavelength
	>?PW	Query current wavelength
	250>	The grating is positioned at its home wavelength of 250 nm

Query Grating Mount Assembly ?GRMOUNT

The response states which grating mount is currently installed in the instrument.

Example: **?GRMOUNT**

Response: **4>** It is a quadruple grating turret

Query Max Wavelength for Current Grating ?MAXW

The response displays the maximum wavelength (in currently selected units) that can be obtained with the current grating. It is calculated for the selected grating from the number of lines per millimeter, the order, any angular offsets, and the maximum grating angle (65.5°).

Note: If Automatic Grating Selection is enabled, the maximum wavelength that can chosen will be the highest maximum wavelength of all the gratings in the current Grating Changeover Table.

Example: ?MAXW

Response: **1514.2>** The maximum wavelength is 1514.2 nm with this 1200 lines per mm grating

Set Lines/mm for Current Grating =LINES xxxx

This allows one to enter the lines per mm spacing for the current grating. In order to change the parameters for other gratings each grating must be selected in turn, and then the parameters set.

Parameters: xxxx Number of lines per millimeter, the range is 1 to 4096

Example: =LINES 1200 Set the number of lines to 1200 lines per millimeter

Query Lines/mm for Current Grating ?LINES

Example: ?LINES

Response: **1200>** The current grating has 1200 l/mm

Set Order for Current Grating =ORDER xxx

This allows one to set the order for the current grating. In order to change the parameters for other gratings each grating must be selected in turn, and then the parameters set.

Parameters: xxx Grating order, the range is 1 to 256

Example: =ORDER 2 Set the grating order to 2

Query Order for Current Grating ?ORDER

Example: ?ORDER

Response: **1>** The order is 1

Set Blaze Label for Current Grating =BLAZE aaaa

This sets the wavelength label for the current grating, which is the wavelength of optimal efficiency. In order to change the parameters for other gratings, select each grating in turn, and then set the parameters.

Note: This parameter is only a user label. It is not used for any calculations.

Parameters: aaaa Wavelength number or label, up to 4 characters

Example: =BLAZE 250n Set the blaze label to "250n" to signify peak efficiency of 250 nm

Query Blaze Label for Current Grating ?BLAZE

Example: ?BLAZE

Response: 250> The grating blaze is 250 nm

Set Offset Angle for Current Grating and Output Port =OFFSET xxxx

Set the offset angle for the current grating and output port combination, in radians. The offset angle for each grating is adjusted more easily by using the **CALWAV** command and should not normally be directly altered. This command is available for factory use.

Parameters: xxxx Angle in radians

Query Offset Angle for Current Grating ?OFFSET

Example: ?OFFSET

Response: 0.0174533> The offset is 0.0174533 radians

Set Home for Current Grating =HOME www

This sets the Home wavelength for the current grating. At any one time, only the value for the current manually selected grating is accessible.

Parameters: www Wavelength in currently selected units, the range is 0 to the maximum wavelength possible with the grating

Home for Current Grating ?HOME

Example: ?HOME

Response: 550> The home wavelength is 550 nm

Set Wavelength Calibration =CALWAV www

This is used to fine tune the calibration profile for each grating and output port combination. This sets the **OFFSET** for the active grating and output port combination so that the current grating position corresponds to the specified wavelength.

Parameters: www Wavelength in units of nanometers, microns, or wave numbers

Example: **?PW**
 545.83> The current wavelength is 545.83 nm
 =CALWAV 546.1 Adjusts the calibration so that the current wavelength position (545.83) becomes

?PW
 546.1> The current wavelength is 546.1 nm

Query Current Calibration Wavelength ?CALWAV

This returns the calibrated wavelength value by displaying the default wavelength plus wavelength offset at the present position.

Example: **>?PW** What is the present wavelength?
 190> ?CALWAV It is 190 nm. What is the offset?
 180+(10)> The offset is 10 nm from the default position of 180 nm.

Set Changeover Points for Grating Turret =CHNGGR x:www:x

Changeover Points are wavelength transition points for different gratings. Auto Grating Selection Mode must be enabled for gratings to change automatically (**IGRAT 0**). The grating changes have to be defined as a Changeover Table. Up to four grating changes may be entered depending on the grating mount (**?GRMOUNT**). The list must begin and end with a grating number. Gratings cannot be repeated at different positions.

The MS257 will give a scan error (E0102) for an illegal grating changeover table. This will occur if a scan is initiated (**!GO**) with automatic grating changes enabled even if the start and ending wavelengths for the present scan do not include a changeover point.

Parameters: x Grating number
 www Wavelength in nm

Example: **=CHNGGR 1:300:2:800:3:2000:4**
 Grating #1 is in place up to 300 nm
 Grating #2 is in place from 300 nm to 800 nm
 Grating #3 is in place from 800 nm to 2000 nm
 Grating #4 is in place from 2000 nm to the grating maximum

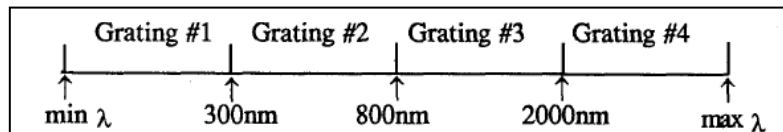


FIGURE 1: Grating Changeover Points

Query Grating Changeover Points ?CHNGGR

Response: **x:www:x:www:>** Grating and wavelength change points

Example: **?CHNGGR** Query the Changeover points

Response: **1:300:2:800:3:2000:4>**
Grating #1 is in place up to 300 nm
Grating #2 is in place from 300 nm to 800 nm -
Grating #3 is in place from 800 nm to 2000 nm
Grating #4 is in place from 2000 nm to the grating maximum

5.2 SCAN COMMANDS

The scan commands are listed by groups:

- Execution Commands
- Wavelengths
- Data Points

Execution Scan Commands:

Start Scanning !GO

Start a scan at **STARTW** and end at **ENDW** or resume scanning if currently paused.

Pause !PAUSE

Pause at the next data point during a scan. Resume scanning with **!GO**

Abort Scanning !ABORT

This terminates a scan at any time. If the abort command is given during a scan which has no stopping at data points, then the abort will only occur at the end of the scan or at a filter, port, or grating switchover.

Wavelength Scan Commands:

Set Start Wavelength =STARTW www

Set the start wavelength for a scan in the currently selected units. If the scan **INTERVAL** was last specified, the number of scan **POINTS** is recalculated based on the new scan parameters. If **POINTS** was last specified, then the scan **INTERVAL** is recalculated.

Parameters: www Wavelength in currently selected units

Example: **=STARTW 250** Set the starting wavelength to 250 nm

Query Start Wavelength ?STARTW

Example: **?STARTW**

Response: **350>** The starting wavelength is 350 nm

Set End Wavelength =ENDW www

This sets the end wavelength for a scan in the currently selected units. If the scan **INTERVAL** was last specified, the number of scan **POINTS** is recalculated based on the new scan parameters. If **POINTS** was last specified, then the scan **INTERVAL** is recalculated.

Parameters: www Wavelength in currently selected units

Example: **=ENDW 900** Set the ending wavelength to 900 nm

Query End Wavelength ?ENDW

Example: **?ENDW**

Response: **900>** The ending wavelength is 900 nm

Data Point Scan Commands:

Set Number of Data Points =POINTS xxxx

This sets the number of data points in a scan. The step interval between data points is calculated from the number of data points and starting and ending wavelengths.

Parameters: xxxx Number of data points, the range is 2 to 65,535.

Example: **=POINTS 500** Set the number of data points to 500

Query Number of Data Points ?POINTS

Example: **?POINTS**

Response: **500>** The number of data points is 500.

Set Step Interval =INTERVAL www

This is the wavelength interval between data points. If the step interval between data points is entered, then the number of data points is calculated from the step interval and start and ending wavelengths. If the step interval is less than one motor step, then the default will be one motor step converted to the appropriate wavelength units. If the step interval is greater than the scan range, an error is reported.

Parameters: www Wavelength interval in currently selected units.

Example: **=INTERVAL 5** Set the wavelength interval to 5 nm

Query Step Interval ?INTERVAL

Example: **?INTERVAL**

Response: **1>** The wavelength interval is 1 nm

Set Wait Time =WAIT xxxx

This sets the wait time during a scan. The wait time is defined as the period after slewing to a given wavelength and before the next move, i.e. the time available to take stable data. Wait time is only in effect when scanning with Handshaking mode disabled.

Parameters: xxxx Time in ms, minimum is 10 ms, resolution is in 10 ms increments.

Example: **=WAIT 50** Set the wait time to 50 milliseconds

Query Wait Time ?WAIT

Example: **?WAIT**

Response: **700>** The wait time is 100 ms

Handshaking Scan Commands:

Set Handshaking mode =Hs x

Handshaking Mode allows the MS257 to perform a scan requiring a **!GO** command at each data point. When handshaking is disabled (the default case) a **WAIT** time elapses before moving to the next wavelength and the process is internally controlled (See **WAIT**). When control of the MS257 is transferred to the Hand Controller by pressing the **LOCAL** key on the keypad, the Handshaking mode is always disabled. When control is returned to the computer by pressing the **REMOTE** key, the Handshaking mode is re-enabled if Handshaking had previously been enabled.

Parameters: x 0 for disable, 1 for enable.

Example: **=HS 1** Enable Handshaking mode

Query Handshaking mode ?HS

Example: **?HS**

Response: **1>** Handshaking is enabled.

5.3 CONFIGURATION MANAGEMENT COMMANDS

Query Firmware Version ?VER

This is the version number of the instrument's internal software. It is composed of a major version number followed by a minor version number separated by a period.

Example: **?VER**

Response: **1.00>** It is version 1.00

Set Wavelength Units =UNITS aa

This sets the wavelength units to be in nanometers, microns, or the wavenumber.

Note: Although wavenumber is a unit of frequency (cm^{-1}), for ease of use it is grouped under the generic "wavelength units" category.

Parameters: aa Wavelength units as 'nm', 'um', or 'wn'

Example: **=UNITS NM** Set the units to nanometers

Query wavelength-units ?UNITS

Example: **?UNITS**

Response: **NM>** The units are nanometers

Set System Information !SYSINFO x

This enables or disables the reporting of system information back to the controlling computer or Hand Controller during a scan. When **SYSINFO** is disabled, only the wavelength is reported at scan data points during the **WAIT** time. When **SYSINFO** is enabled, the wavelength, grating, filter wheel position(s) and output port selection are reported at scan data points during the **WAIT** time.

Parameters: x 1 for enabled, 0 for disabled - -

Example: **!SYSINFO 0** System Information is disabled. At each scan data point, the MS257 will report only the current wavelength in the form:

{wavelength}:

Example: **!SYSINFO 1** System Information is enabled. At each scan data point, the MS257 will report the current wavelength, the current grating, the current filter wheel #1 position, the current filter wheel #2 position (if used) and the current output port selection, in the format:

{Wavelength},{Grating},{Filter1},{Filter2},{OutputPort}:

Query System Information ?SYSINFO

Example: **?SYSINFO**

Response: **1>** System Information is enabled

5.4 MOTOR POSITIONING COMMANDS

The following commands position the grating drive motor by step number.

Note: When positioning the MS257 by motor steps, all automatic changeover tables are temporarily disabled.

Move a Number of Steps **!MS xxxx**

Parameters: **xxxx** Relative distance (+ or -) to rotate the grating in terms of motor steps. Each step corresponds to approximately 3.6 arc-secs of rotation.

Example: **!MS +500** Move 500 steps forwards

Move to a Step Position **!GS xxxx**

Parameters: **xxxx** Absolute motor position to rotate the grating in terms of motor steps from the drive's home location. Each step corresponds to approximately 3.6 arc-secs of rotation.

Example: **!GS 0** Go to the step position zero

Query Current Position in Motor Steps **?PS**

This returns the current grating position in terms of motor steps from drive home. Each step corresponds to approximately 3.6 arc-secs of rotation.

Example: **?PS**

Response: **25973>** The grating is 25,973 steps from the absolute drive home position.

Query Zerostep Position in Motor Steps **?ZEROSTEP**

The step position designating the number of steps of the system zero angle position from the Absolute Drive Home position for the currently selected output port. Each step corresponds to approximately 3.6 arc-secs of rotation.

Example: **?ZEROSTEP**

Response: **52>** It is 52 steps from the drive home.

Set Position to System Zero Angle **!ZEROANG**

Set the current motor position to be the reference system zero angle for the currently selected output port. All wavelengths for that port are calculated from this step position. **ZEROANG** should be set for each port. This is set by first positioning the turret so that one of the gratings is sending light of zero order through the center of the exit port slit. This command is particularly useful when recalibrating a turret which has been removed and replaced, or when the focusing mirror has been adjusted. This enables the entire turret to be recalibrated at once without having to recalibrate each grating individually.

Example: **!ZEROANG** Reset the turret zero angle for the current output port.

Go to Absolute Drive Home **!ADH**

Drive the motor to the Absolute Drive Home position. This is a factory calibration point and should not be used during normal operation.

Example: **!ADH**

5.5 FILTER WHEELS

Two filter wheels can be used with the MS257. Each filter wheel holds five one-inch (25.4 mm) diameter filters. The wheel is rotated electronically to select the desired filter.

Select Filter Position for a Filter Wheel **!FILTx**

Select a filter in either filter wheel 1 or 2.

Parameters: n Filter wheel 1 or 2
 x Filter wheel position 1 to 5

If x is **0**, then Auto Filter Selection is enabled, and filters will be selected according to the changeover table.

Example: **!FILT1 4** Select position **4** on filter wheel #1

Query Current Filter in Filter Wheel **?FILTx**

Return the current filter wheel position number (1 to 5). The response will be **A:x** if Auto Filter Selection is enabled, and **M:x** if Auto Filter Selection is disabled.

Parameters: n Filter wheel 1 or 2

Example: **?FILTP**

Response: **A:3** Filter wheel #2 is in Auto Filter Selection mode and in position **#3**

or **M:3>** Filter wheel #2 is in Manual Filter Selection Mode and in position #3

Set Filter Label for Filter Wheel **=LABELFn aaaa**

Set an alphanumeric label for the currently selected filter. The label can be a maximum of 4 characters long.

Note: This parameter is only a user label. It is not used for any calculations.

Parameters: n Filter wheel 1 or 2
 aaaa Label for filter wheel

Example: **!FILT1 3** 3 Select filter #3 in filter wheel #1
=LABELF1 RED Label the filter as 'RED'

Query Filter Label for Filter Wheel ?LABELFn

Return the label for the currently selected filter.

Parameters: n Filter Wheel 1 or 2

Example: **!FILT1 2** Select filter wheel 1 and filter #2
?LABELF1 Query filter label

Response: **450 >** Filter #2 is labeled '450'

Set Changeover Points for Filter Wheel =CHNGFn x:www:x

Changeover Points are wavelength transition points for different filters. Auto Filter Selection Mode must be enabled for filters to change automatically (**!FILT1 0, !FILT2 0**). The filter changes have to be defined as a Changeover Table. Note: the Changeover Table must begin and end with a filter (see FIGURE 2.). Up to nine filter changes may be entered for each filter wheel. The filters do not have to be in ascending order. The same filter may be repeated at several different positions.

Parameters: n Filter wheel 1 or 2
 x Filter from 1 to 5
 www Wavelength in currently selected units

Example: = **CHNGF1 1:200:2:400:4:600:3:700:5**
 Filter #1 is in place up to 200 nm
 Filter #2 is in place from 200 nm to 400 nm
 Filter #4 is in place from 400 nm to 600 nm
 Filter #3 is in place from 600 nm to 700 nm
 Filter #5 is in place from 700 nm to the grating maximum

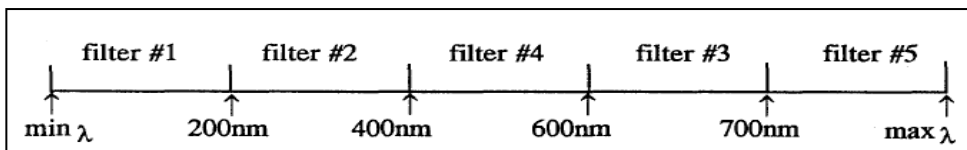


FIGURE 2: Filter wheel changeover points

Query the Filter Changeover Points ?CHNGFn

This returns the currently established Changeover Table for a filter wheel. The response is in the same format used to set the table, **x:www:x:www=x**

Parameters: n Filter wheel 1 or 2

Example: **?CHNGF1** Query the changeover points for filter wheel #1

Response: **1:200:2:300:4:350:3>**
 Filter #1 is in place up to 200 nm
 Filter #2 is in place from 200 nm to 300 nm
 Filter #4 is in place from 300 nm to 350 nm
 Filter #3 is in place from 350 nm to the grating maximum

5.6 MOTORIZED SLITS

Set Slit Width **!SLITa xxxx**

This sets the motorized slit opening width, in microns. Slits at ports A, B or C can be selected. If a slit width is entered for any slit (A, B, or C) then **BANDPASS** is reset to zero.

Parameters: a Slit at port A, B or C
 xxxx Microns, range is from 4 - 2000 μm in 2 μm steps.
 Example: **!SLITA 100** Set the slit for port A to 100 μm

Query Current Slit Width **?SLITa**

This returns the current slit width in microns.

Parameters: a Slit at port A, B, or C
 Example: **?SLITA**
 Response: **100>** The slit width for slit A is 100 μm

Set Bandpass **=BANDPASS www**

The slit width can be adjusted automatically by the MS257 to maintain a desired bandpass at all wavelengths. The bandpass units are set by the general **UNITS** command. The slits are readjusted automatically at each scan data point or when a **!GH** or **!GW** command is given. Setting **BANDPASS** to zero turns automatic slit adjustment off, and the system's bandpass is determined by the individual slit widths.

Parameters: www Bandpass in currently selected wavelength units, zero turns automatic bandpass off.
 Example: **=BANDPASS 2.5** Set the bandpass to 2.5 nm

Query Bandpass **?BANDPASS**

This returns the current bandpass.

Example: **?BANDPASS**
 Response: **5>** The slits are set to give a bandpass of 5 nm
 0> The slits are not adjusted automatically.

5.7 PORTS

Set Output Port `!PORTOUT a`

Position the flip mirror for the desired output port. A TTL high signal output is present at the "AUX OUT" BNC connector at the rear panel, when port B is selected.

Parameters: a B for port B, C for port C, 0 for Auto Port Selection

Example: **!PORTOUT B** Set the output port to port B

Query Output Port `?PORTOUT`

The response will be **A:x** if Auto Port Selection is enabled, and **M:x** if Auto Port Selection is disabled.

Example: **?PORTOUT**

Response: **A:B>** It is in Auto Port Selection mode, and port B is selected.
 or: **M:C>** It is in Manual Port Selection mode, and port C is selected.

Set Changeover Point for Output Port `=CHNGPO a:www:a`

The Changeover Point is the wavelength transition point for changing detector port. Auto Port Selection mode must be enabled to change port automatically (**!PORTOUT 0**). Note: the Changeover Table must begin and end with a port.

Parameters: a Port B or C
 www Wavelength in currently selected units

Example: **=CHNGPO B:1200:C**
 Port B is used up to 1200 nm
 Port C is used from 1200 nm to the grating maximum

Query the Output Port Changeover Point `?CHNGPO`

Response: **a:www:a>** Port and wavelength change point
 Example: **?CHNGPO** Query the Changeover point
 Response: **B:1200:C>** Port B is being used up to 1200 nm
 Port C is being used from 1200 nm to the grating maximum

5.8 SHUTTERS

Commands for the 77755 background shutter (normally closed) or 77717 fast shutter can be activated through the USB communication port or through the "Aux Input" BNC connector at the rear panel. A TTL high signal activates the shutter. In the case of the fast shutter only, a signal (TTL high) is output at the "Aux Output" BNC connector in synchrony with the 90% open state of the shutter.

Set Shutter Type or Mode **=SHTRTYPE a**

This sets the shutter type and mode of operation. Use 'S' for the normally closed slow shutter and 'F' for the fast shutter to enable automatic closure during grating, filter, and output port changes. Use 'M' for either the normally open or normally closed shutters to operate them manually, without automatic closure enabled. If the **SHTRTYPE** is set to 'S' or 'M', the **!SHUTTER** command can be used to activate/deactivate the slow shutter. If the **SHTRTYPE** is set to 'F', then the **!FASTSH** command is used to trigger the fast shutter.

Parameters: a 'S' for the normally closed slow shutter with automatic closure enabled, 'M' for either slow shutter with completely manual operation, or 'F' for the fast shutter.

Example: **=SHTRTYPE S** Set the shutter mode for the normally closed slow shutter with automatic closure enabled.

Query Shutter Type **?SHTRTYPE**

Example: **?SHTRTYPE**

Response: **M>** The shutter mode is set to operate the slow shutter under complete manual control, either normally closed or normally open.

Activate or Deactivate the Shutter **!SHUTTER x**

Activate or Deactivate the shutter.

Parameters: x 1 for activate, 0 for deactivate.

Example: **!SHUTTER 1** If the slow shutter is present and set to normally open, this will close the shutter. If it is set to normally closed, this will open the shutter.

Pulse the Fast Shutter **!FASTSH xxxx**

Activate the fast shutter (model 77717) for xxxx milliseconds. If a zero or no parameter is specified, the previously entered parameter is used.

Parameters: xxxx Time in milliseconds, valid range is 10 -60,000 ms in 1.0 ms increments.

Example: **!FASTSH 100** Activate the fast shutter for 100 ms

5.9 HAND CONTROLLER COMMANDS

The hand held controller has a three line display and 40-key keypad. It communicates with the MS257 using a cable with an RJ-11 connector. The Hand Controller uses two commands in addition to some of the existing MS257 commands. These two additional commands are only available on the Hand Controller.

Set Local Control [LOCAL]

Transfer control from the computer to Hand controller. Handshaking mode is disabled.

Set Remote Control [REM]

Transfer control from the Hand controller back to the computer. Handshaking mode is restored to its previous setting.

6 ERROR CODES

(0000 - 0099) General Error Codes

Error codes 0000 - 0099 are non-fatal and refer to the previously entered command.

0000	Receive Error
0001	Command Not Recognized
0002	Illegal Parameters

(0100 - 0199) Motion Related Error Codes

Error codes 0100 - 0199 are non-fatal and refer to the previously entered command.

0100	Illegal Move Requested
0102	Illegal Scan Wavelength Parameter

(0200 - 0299) Hardware Related Error Codes

Error codes 0200 - 0299 are non-fatal and refer to the previously entered command.

0200	Device Not Available (i.e. grating, filter wheel, slit, etc.)
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7 OPERATING STATES

The MS257 has several distinct operating modes, or states. Since different commands are recognized in each mode, it is important to understand what these modes are and under what conditions the modes change. FIGURE 3 illustrates the major operating states of the MS257.

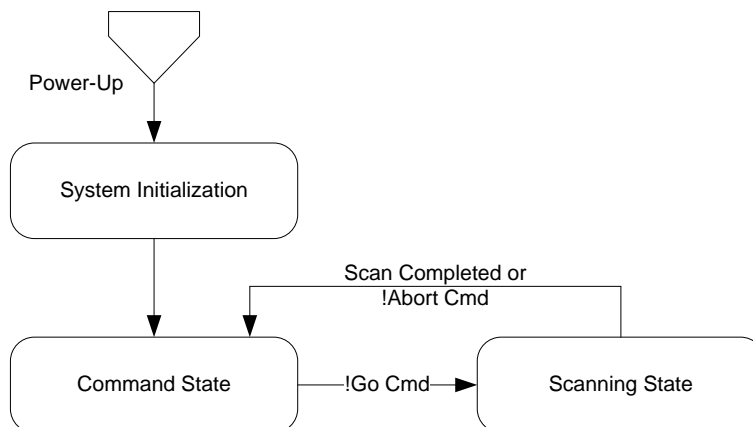


FIGURE 3: MS257 Operating State Transition Diagram

7.1 SYSTEM INITIALIZATION STATE

The MS257 enters the System Initialization State when the system is powered up. When the MS257 enters the Initialization State, it does the following:

- recalls the last stored parameters from non-volatile memory.
- reinitializes the grating drive by finding its absolute home.
- sets the grating selection, flip mirror, filter wheels, and slits to their last position or to their auto mode settings if auto mode was enabled.
- sets the grating to its home wavelength.

During system initialization and self-test, commands from the computer are not recognized. A **[CR][LF]>** prompt is issued when the start up procedure is completed and the system is ready to receive commands.

8 COMMAND STATE

The MS257 enters the Command State when:

- the System Initialization State completes successfully.
- a scan has completed.
- a scan has been terminated via the Abort (**!ABORT**) command.

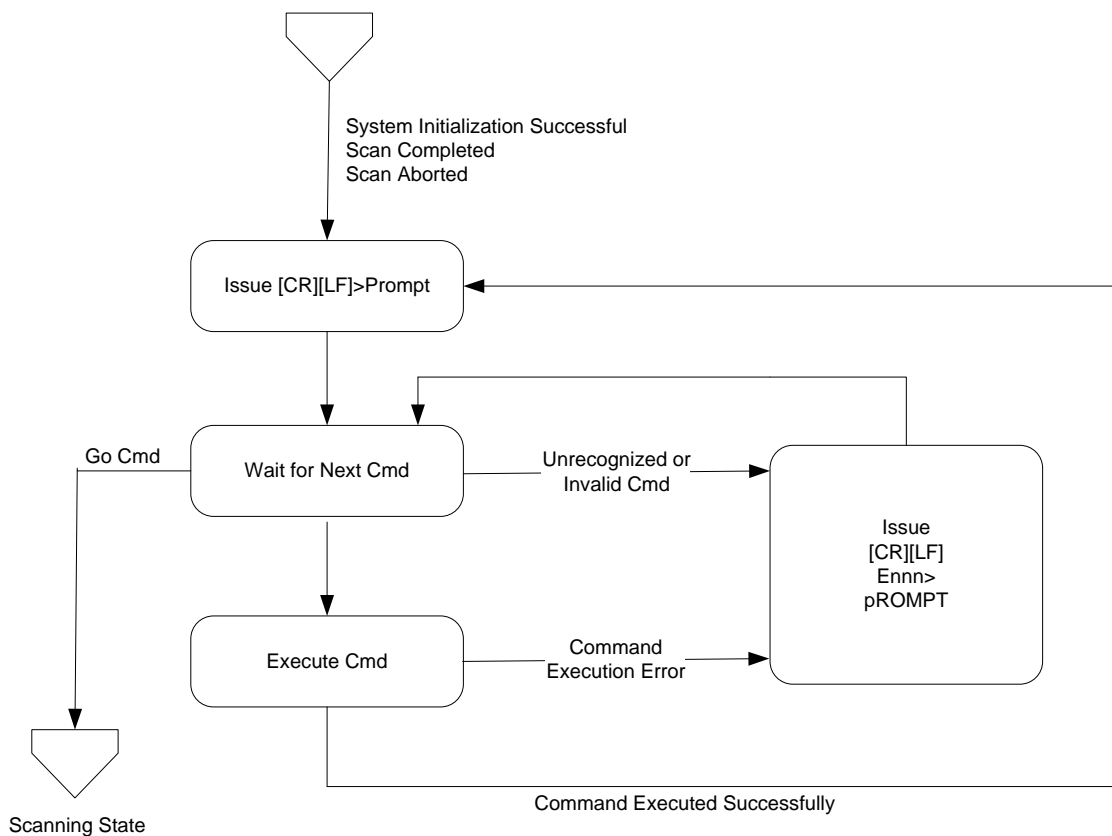


FIGURE 4: MS257 Command State Transition Diagram

While in the Command State, the instrument waits for and recognizes most commands. The commands that are **not** supported in this mode are those that are specific to the Scanning State:

- !PAUSE
- !ABORT

If one of these commands is sent, the error prompt **[CR][LF]E0001>** will be issued.

8.1 SCANNING STATE

The MS257 enters the Scanning State when a **!GO** command is issued through a software command.

- A scan will start at **STARTW** and end at **ENDW**.
- At each data point, the actual wavelength is reported. Grating, filter and port information is also reported if **SYINFO** is enabled.
- If Handshaking mode is disabled, a delay equal to the **WAIT** time occurs before moving to the next wavelength.
- If Handshaking mode is enabled, the scan is suspended at each data point until a **!GO** command is sent, or the scan is aborted.

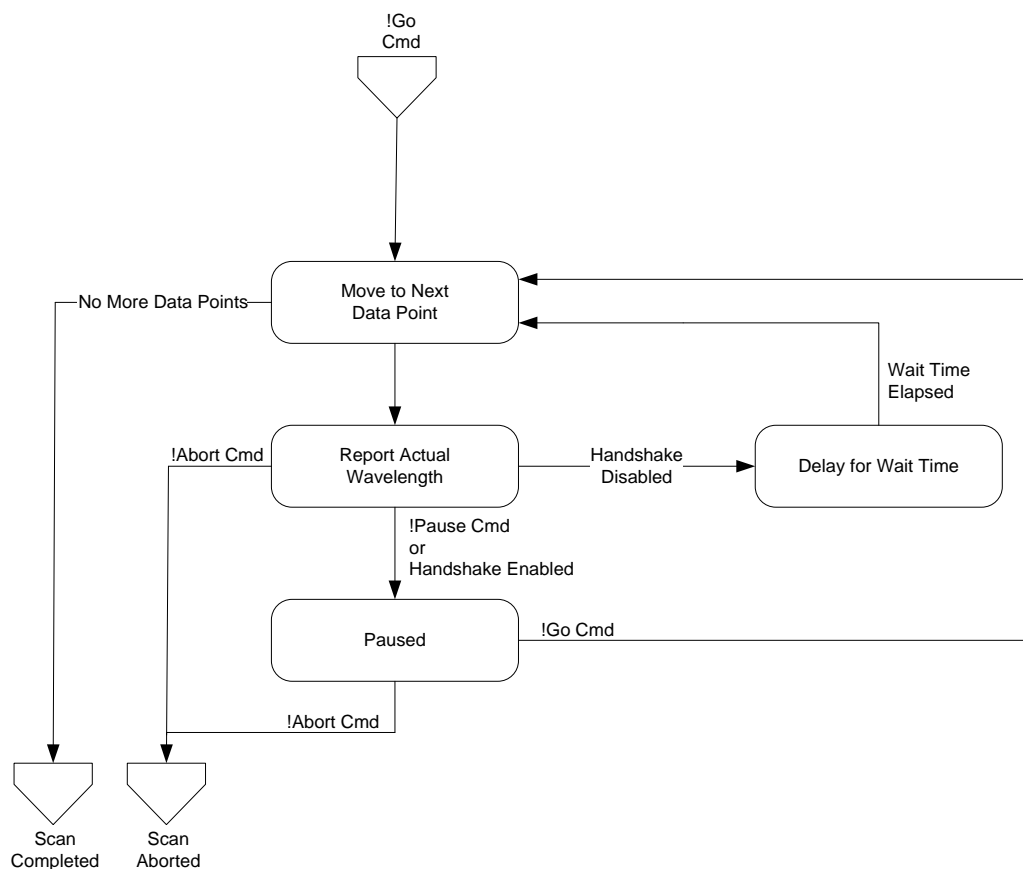


FIGURE 5: MS257 Scanning State Transition Diagram

9 WARRANTY AND RETURNS

9.1 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.

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

Oriel Instruments

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Telephone: 800-714-5393 (toll-free in United States)
203-377-8282
Fax: 203-378-2457

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

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

9.2 REQUEST FOR ASSISTANCE / SERVICE

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

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

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

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

9.3 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 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.

9.4 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.

9.5 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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