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FOR M257™

MODELS 77700 and 77702

PROGRAMMING 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

1.1   CONVENTIONS USED IN THIS MANUAL

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

- This typeface, *RESPONSES*, indicates responses that are sent by MS257™ over the RS-232 or GPIB interface.

- This typeface, **COMMANDS,** indicates commands that are sent from a Hand Controller, terminal or computer to MS257™ over the RS-232 or GPIB interface.

- Unless otherwise stated, bold characters enclosed in square brackets refer to ASCII control characters, e.g. **[CR].**

- Commands that require a device selector are shown using 'n', e.g. **?FILTn** which can be used as either **?FILT1 or ?FILT2** .

- Command parameters can be one of three types:

  - Wavelength command parameters are shown as 'www', e.g. **!GW www** which can be used as **!GW 546.1.** Note, that all wavelength parameters, both sent and received, will be in the currently selected wavelength units (**UNITS**).

    Note: Although wavenumbers are a unit of frequency (cm^{-1}), for ease of use we group them under the generic "wavelength units" banner, also.

  - Integer command parameters are shown as 'x', e.g. **!GRAT x** which can be used as **!GRAT 1**

  - Alphanumeric command parameters are shown as 'a' e.g. =**UNITS aa** which can be used as =**UNITS NM**

2   GETTING STARTED WITH THE RS-232 INTERFACE

The Oriel MS257™ can be completely controlled and configured by commands sent to its RS-232 serial port. This is a simple, 3-wire serial interface running at 9600 baud. The communications parameters are fixed, see below.

Bound Rate	9600
Data Bits	8
Parity	None
Stop Bits	1

Table 1: RS-232 communications parameters

2.1   CONNECTING THE MS257™ TO YOUR COMPUTER

Cabling

The MS257™ is configured as a Data Communications Equipment (DCE). In other words, it will appear the same as an external modem to your computer. Its serial port is a standard DB-9 female connector. Most personal computers (PCs) are configured as Data Terminal Equipment, or DTE's, and have male DB-25 or DB-9 connectors.

- If your computer's serial connector is a 06-9 male, then use the supplied straight-through' DB-9 female-to-male cable.

- If your computer's serial connector is a DB-25 male, then you can use the supplied cable with a standard DB-9 to DB-25 adapter (not included) or you can use a standard DB-9 to DB-25 conversion cable (not included).

RS-232 Signal Usage and Handshaking

The MS257™ uses a simple, 3-wire serial communications scheme. Hardware handshaking is not used. The MS257™ does, however, keep several of the handshaking lines asserted for those computers that require them. Table 2. outlines the relevant RS-232 signals, their direction, and connector pin assignments:

RS-232 Signal		PC DB-25 Male (DTE)	Supplied DB-9 Male to Female Cable		
			PC DB-9 Male (DTE)	Signal Direction	MS257™ DB-9 Female (DCE)
Transmit Data	TxD	2	3	→	3
Receive Data	RxD	3	2	←	2
Signal Ground	GND	7	5	↔	5
The following 3 signals, although not strictly needed for 3-wire serial communications, are available for those DTE's that require them. CTS is always asserted by the MS257™, DSR is looped back from the incoming DTR signal.					
Clear To Send	CTS	5	8	←	8
Data Set Ready	DSR	6	6	←	6
Data Trm Ready	DTR	20	4	→	4

Table 2: RS-232 signals, and pin assignments

2.2   WRITING A QUICKBASIC PROGRAM TO COMMUNICATE WITH THE MS257™

Every version of Microsoft's MS-DOS® since v5.0 comes with QBasic®. This version of the BASIC language supports high speed serial communications through your computer's COM1 or COM2 serial ports. It provides an easy way to get up and running quickly with your MS257™.

- Bring up QBasic by typing:
     ```
     QBASIC
     ```
  at the DOS prompt

- In the main editing window, enter the following short program. Make sure to substitute the COM port actually connected to MS257™ for COM1 on the first line.

     ```
     OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1
     PRINT #1, "!GRAT 1"
     RESP$ = INPUT$ (3, #I)
     PRINT #1, "!GW 350"
     RESP$ = INPUT$ (3, #1)
     ```

- Run the program and your MS257™ should select grating #1 and position itself to 350 nm. Note that this program is very simple and makes several assumptions about how your MS257™ is configured. If the program does not work, several possibilities exit:

     - The program assumes that each command will be met with a 3 character response from your MS257™ indicating success:
          [CR][LF]>
       If error is signaled by your MS257™, the program will not detect it.

     - The program assumes that MS257™ has its Wavelength Units set to nanometers. If your MS257™ is configured for microns or wavenumbers, a position of 350 is probably not valid.

     - The program assumes that 350 nm is within the positioning range of the first grating installed in your system. This will be the case for gratings from 300 - 2400 lines/mm. when set to use the first order.

2.3   TIPS FOR SUCCESS IN WRITING MORE ADVANCED RS-232 PROGRAMS

- Use buffered, interrupt-driven serial communication routines to read and write from the COM port to which you have connected your MS257™. This will ensure that you do not drop characters at the 9600 baud communication rate. Many development environments have such serial communication routines built-in (e.g. QBasic®, Visual Basic®, Labwindows®, Labview® Other languages, such as Borland® or Microsoft® C, rely on your PC's relatively slow BIOS communications functions. In these cases, a third party serial communications library will help guarantee success.

- When reading responses from your MS257™, remember that the length of the response may vary, especially if an error is reported. The longest response is 100 characters from retrieving a fully populated filter wheel changeover table.

- Remember 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. For a BASIC programming example, see the ReadResponse routine on page 51.

- 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. Error responses when the MS257™ is not scanning 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 MS257™'s response to a command before issuing the next command.

- Set a suitably long communications timeout on 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 GETTING STARTED WITH THE GPIB INTERFACE

The Oriel MS257™ can be completely controlled and configured by commands sent through its GPIB parallel port. The communications parameters are in accordance with IEEE std. 488.2 electronically and mechanically.

Up to 15 instruments can be connected in one system, but the total length of the communications cables should not exceed 20 m.

The GPIB-RS232 Converter is comprised of
- 77793 converter module
- Converter Software CD
- power adapter, 100-240 Vac input, 12 Vdc output
- serial cable to connect the converter to the MS257 RS-232 input
- ac line cord
- strip of adhesive backed, self-lock, mushroom head fastener which can be used to secure the converter box if desired. Simply attach some of this strip to the converter box (please don't cover the ventilation holes with the strip) and a matching pattern to the mounting surface.

3.1 ADDRESSING THE MS257™ WITH EXTERNAL GPIB DEVICE

Use of the GPIB interface requires that it be configured with the NI GPIB-Serial Converter Software. The first step is to install the NI GPIB-Serial Converter Software from the CD that comes with the GPIB-Serial Converter.

After installing the Converter Software, press Start and select All Programs\National Instruments\GPIB-Serial Converter\GPIB-Serial Converter Wizard. You should get the following:
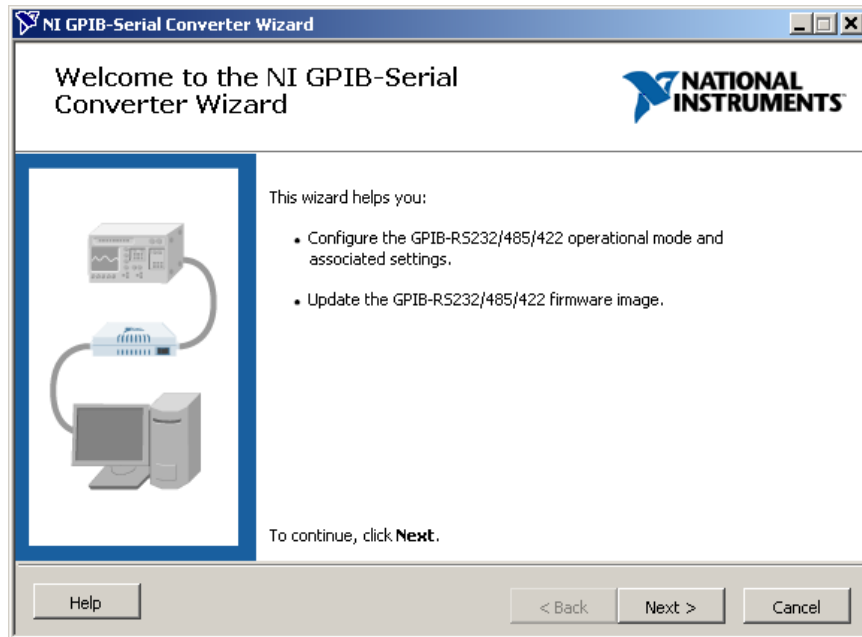
Click Next and follow the directions connecting the hardware Converter to your computer using the GPIB interface.
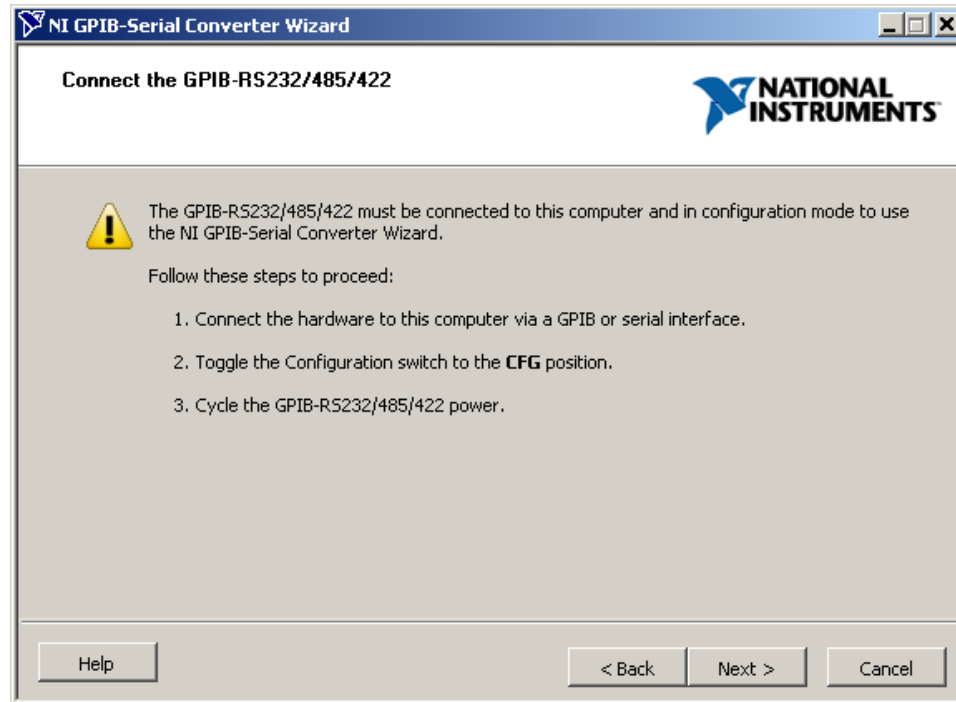
Select the GPIB Interface
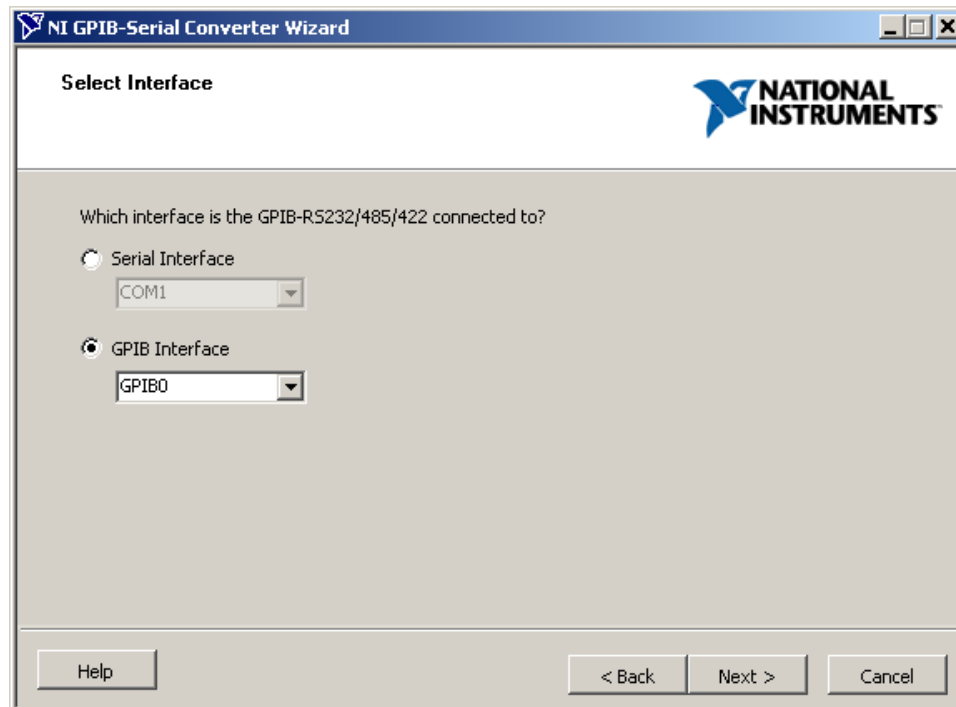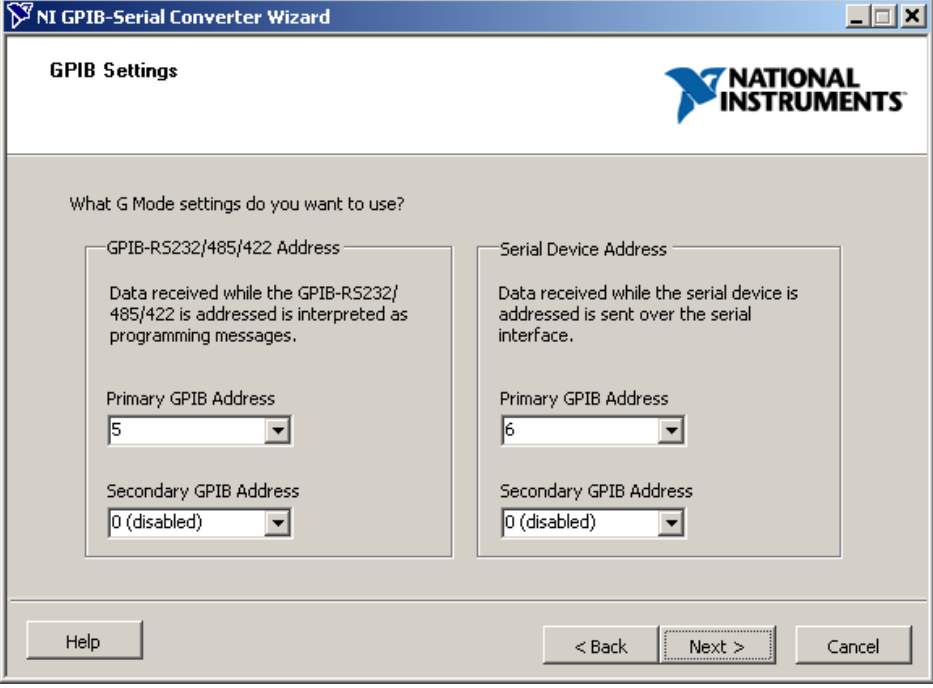
Select Change Configuration
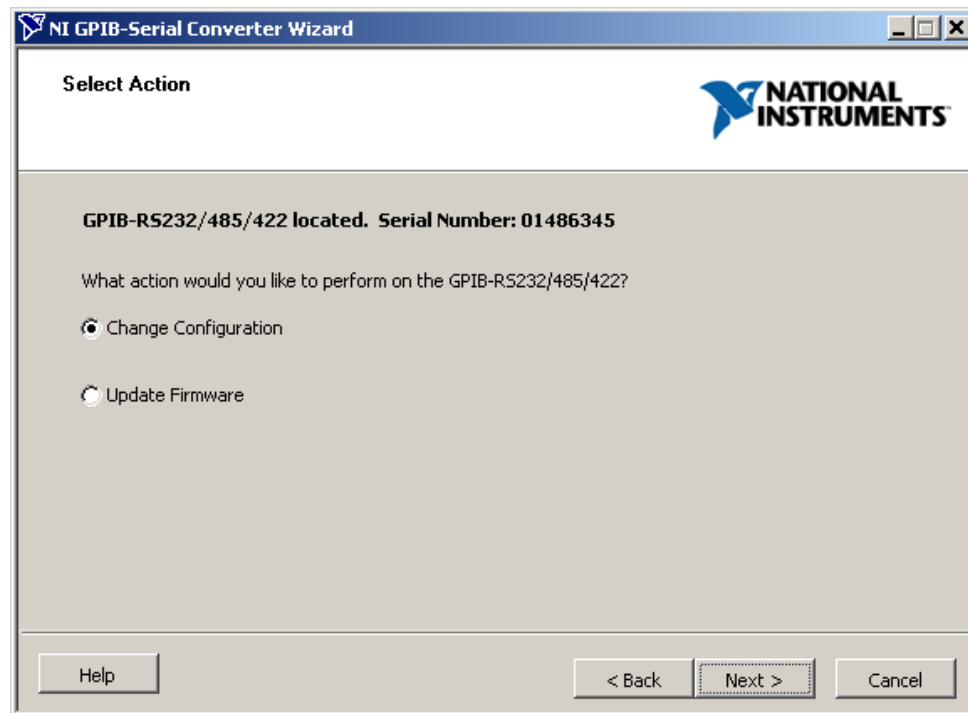
Select G mode
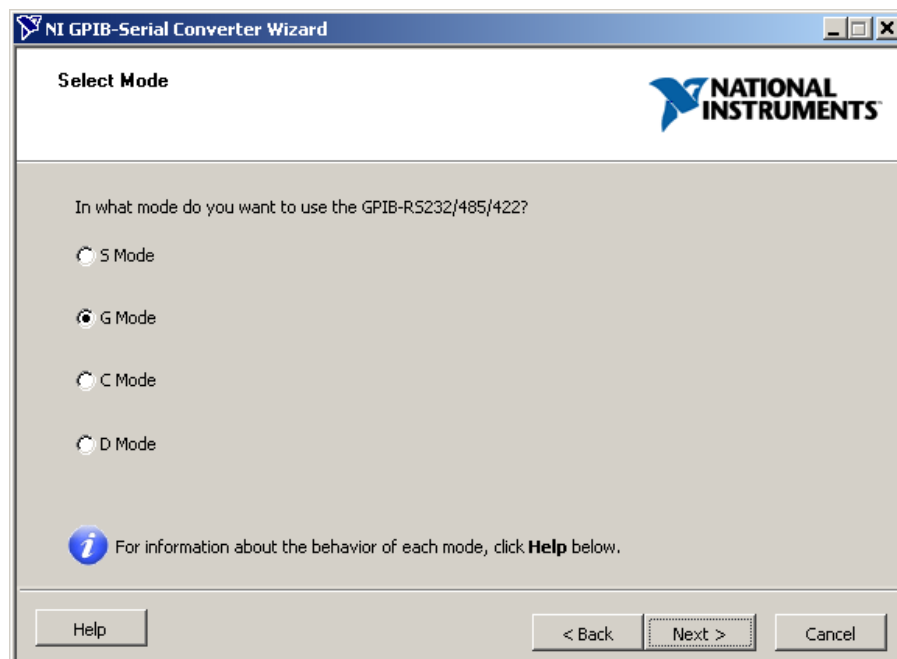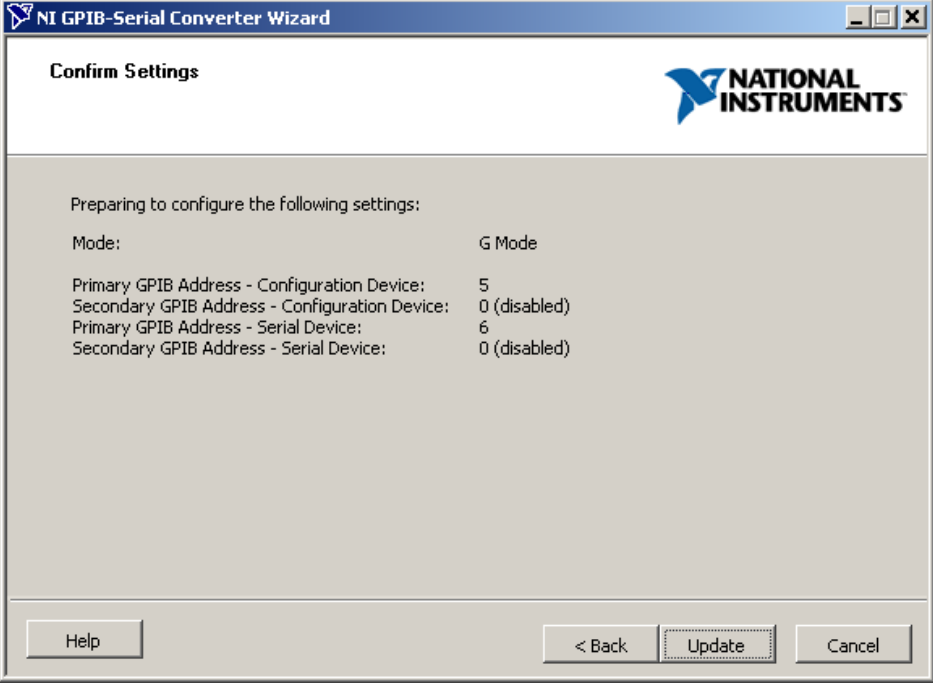
It is recommended to leave the GPIB addresses at the factory default. Notice both addresses 5 and 6 must be available. The MS257 when later connected to the Converter hardware through serial cable, and communicated to through GPIB software, will be at GPIB address 6 for the following example:

Confirm settings as the following and press update.

Follow the instructions on the display and press OK
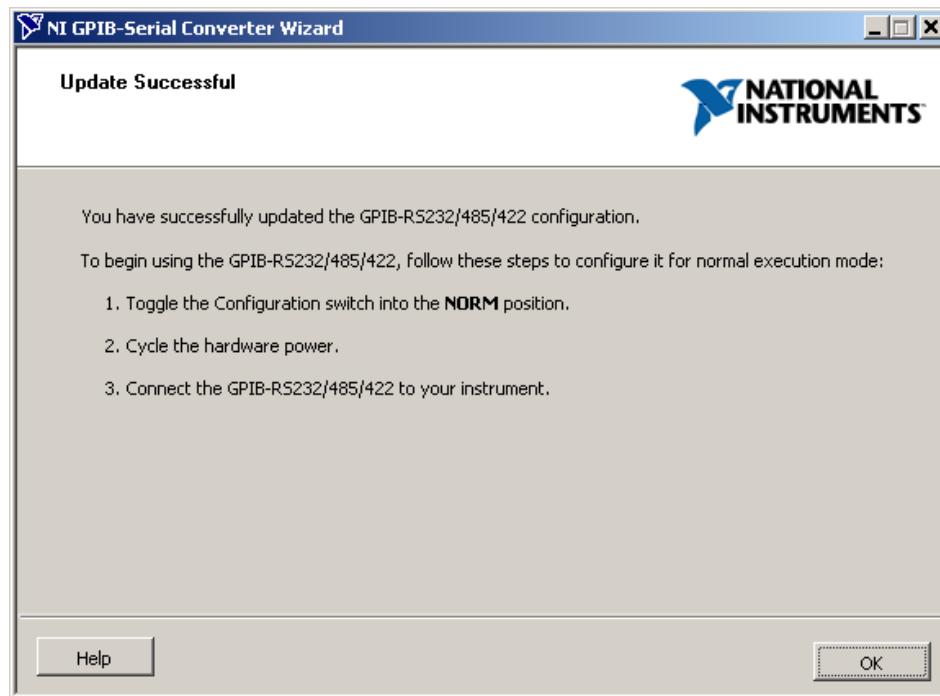
Now connect the provided RS232 cable from the MS257 RS232 9 pin D-type connector to the 9 pin D-type connector on the Converter hardware.

The MS257 should now function properly as a GPIB device.

COMMAND SYNTAX

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

COMMAND ECHO

MS257™ does not echo any of the characters or command strings sent to it via RS-232. Therefore, if you are controlling the instrument via a terminal or terminal emulation program, local echo should be enabled so you can see what you are typing.

COMMAND RESPONSE

During normal operation, 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 be preceded by the 4-digit error code. For example, a prompt of

[CR][LF]E0001>

would indicate that the previous command was not recognized.

ACTION COMMANDS

Commands that cause 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, you would send:

!GW 200 [CR]

READ COMMANDS

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. MS257™ will display the parameter's current value followed by the greater-than (**>**) completion prompt.

For example, to ask the spectrograph to display its current position in the current wavelength units you would send:

?PW [CR]

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

[CR][LF]375.00>

WRITE COMMANDS

Some parameters are read-only and are only set internally by the spectrograph as the 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 equals sign (=) followed by the variable name and the new parameter value.

=STARTW 450 [CR]

4 APHABETICAL COMMAND INDEX

Commands & Parameters	Description	Hand Control
!ABORT	Abort the current scan and return to home	Abort
!ADH	Go to absolute drive home	
=BANDPASS www	Set automatic slit bandpass	Band
?BANDPASS www	Query automatic slit bandpass	Band
=BLAZE aaaa	Blaze wavelength for selected grating	Blaze
?BLAZE	Query blaze wavelength for selected grating	Blaze
=CALWAV www	Set calibration wavelength at current position	Calib
?CALWAV	Query calibration wavelength at current position	Calib
=CHNGF1 x:www:x	Changeover points for filter wheel 1	(F1) Table
?CHNGF1	Query changeover points for filter wheel 1	(F1) Table
=CHNGF2 x:www:x	Changeover points for filter wheel 2	(F2) Table
?CHNGF2	Query changeover points for filter wheel 2	(F2) Table
=CHNGGR x:www:x	Changeover points for grating mount	(Grat) Table
?CHNGGR	Query changeover points for grating mount	(Grat) Table
=CHNGPI x:www:x	Changeover point for input port	
?CHNGPI	Query changeover point for input port	
=CHNGPO x:www:x	Changeover point for output port	(Port) Table
?CHNGPO	Query changeover point for output port	(Port) Table
!DL	Recall factory default parameters	
=ENDW www	End wavelength for a scan	End
?ENDW	Query end wavelength for a scan	End
=EXTGO 1	External Trigger Mode	Ext St
=EXTGO 0	Internal Trigger Mode	Int St
?EXTGO	Query Trigger Mode	
!FASTSH xxx	Activate fast shutter for xxx milliseconds	
!FILT1 x	Select filter position for filter wheel 1	F1
?FILT1	Query current filter in filter wheel 1	F1
!FILT2 x	Select filter position for filter wheel 2	F2
?FILT2	Query current filter in filter wheel 2	F2
!GH	Go to Grating Home	Go Hom
!GO	Start or Continue a scan	Go
!GRAT x	Select a grating, 0 to 4	Grat
?GRAT	Query current grating	Grat
?GRMOUNT	Query which grating turret is installed	
!GS xxxx	Go to position by motor steps	

Commands & Parameters	Description	Hand Control
!GW www	Go to position by wavelength	Go Wav
=HOME x	Home for current grating	Home
?HOME	Query home for current grating	· Home
=HS 1	Handshake mode on	
=HS 0	Handshake mode off	
?HS	Query handshake mode	
=INTERVAL www	Wavelength interval between scan moves	Intvl
?INTERVAL	Query wavelength interval between scan moves	Intvl
=LABELF1 aaaa	Label for selected filter for filter wheel 1	F1 Labl
?LABELF1	Query label for selected filter for filter wheel 1	F1 Labl
=LABELF2 aaaa	Label for selected filter for filter wheel 2	F2 Labl
?LABELF2	Query label for selected filter for filter wheel 2	F2 Labl
=LINES xxxx	Lines/mm for current grating	Lines
?LINES	Query lines/mm for current grating	Lines
[LOCAL]†	Transfer control to Hand controller	Local
?MAXW	Query maximum wavelength for current grating	
!MS +xxxx	Move forwards by motor steps	Step >
!MS -xxxx	Move backwards by motor steps	Step <
=OFFSET xxxx	Set offset angle for current grating in radians	
?OFFSET	Query offset angle for current grating in radians	
=ORDER x	Set order for current grating	
?ORDER	Query order for current grating	
!PAUSE	Pause during a scan	
=POINTS xxxx	Set number of data points in a scan	Points
?POINTS	Query number of data points in a scan	Points
!PORTIN a	Select input port A, D, or 0	
?PORTIN	Query input port	
!PORTOUT a	Select output port B, C, or 0	Port
?PORTOUT	Query output port	Port
?PS	Query current step position	
?PW	Query current wavelength position	[displayed]
[REM]†	Transfer control to PC	Rem
=SHTRTYPE a	Set shutter type to Slow, Fast, or Manual	
?SHTRTYPE	Query shutter type	
!SHUTTER 1	Activate slow shutter	CL Sh
!SHUTTER 0	Deactivate slow shutter	Op Sh
!SLITA xxxx	Set Slit A width in microns	Slit A
?SLITA	Query Slit A width in microns	Slit A

Commands & Parameters	Description	Hand Control
!SLITB xxxx	Set Slit B width in microns	Slit B
?SLITB	Query Slit B width in microns	Slit B
!SLITC xxxx	Set Slit C width in microns	Slit C
?SLITC	Query Slit C width in microns	Slit C
=STARTW www	Start wavelength for a scan	Start
?STARTW	Query start wavelength for a scan	Start
!SYSINFO 0	Disable system information during scan	No Inf
!SYSINFO 1	Enable system information during scan	Inf
?SYSINFO	Query system information mode	
=UNITS aa	Wavelength units; nm, µm or wn	Units
?UNITS	Query wavelength units	Units
!UL	Recall the user default parameters	Load
!US	Save active parameters as user defaults	Save
?VER	Query firmware version	Ver
=WAIT xxxx	Set wait time during a scan	Wait
?WAIT	Query waiting time during a scan	Wait
?ZEROSTEP	Query step position of system zero angle	
!ZEROANG	Set the system zero angle	

†   Available from 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	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 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 gratings number 1
or	*M:1>*	It is in Manual Grating Selection mode and the grating is number 1

Go to a Wavelength	!GW www

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, 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 current grating position in currently selected units.

Example:	**?PW**	
Response:	*250>*	The grating is set at 250 nm

Go to Grating Home !GH

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 current grating mount assembly installed in the spectrograph.

Example:	**?GRMOUNT**	
Response:	*4>*	It is a four grating turret

Query Max Wavelength for Current Grating ?MAXW

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 be positioned to 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 l/mm grating

Set Lines/mm for Current Grating	=LINES xxxx

The lines/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

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

Wavelength label for the current grating, the wavelength of optimal efficiency. In order to change the parameters for other gratings you must 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**

The Home wavelength for the current grating or for the Auto-Grating mode if - Automatic Grating Selection is enabled. At any one time, only the value for the current manually selected grating or Auto-Grating mode 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 **(!GRAT 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 can not be repeated at different positions.

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
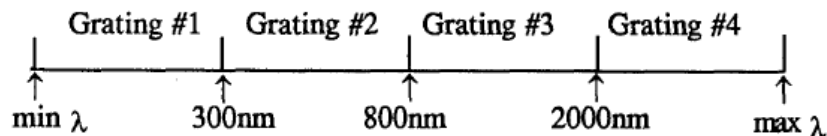
Figure 1: Grating changeover points

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

Start Scanning

The scan commands are listed by groups:

- ▪ Execution Commands
- ▪ Wavelengths
- ▪ Data Points
- ▪ External trigger
- ▪ Handshaking

Execution Scan Commands:

Start Scanning	!GO

Start a scan at **STARTW** and end at **ENDW** or resume scanning if currently paused. A **SCAN** signal (TTL high) is also output at the "SCAN" BNC connector at the rear panel. The signal remains high during the entire scanning process, and returns low when the **ENDW** is reached. A TTL pulse asserted at the external "GO" BNC connector duplicates the function of the **!GO** command (if **EXTGO** is enabled).

Pause	!PAUSE

Pause at the next data point during a scan. Resume scanning with **!GO** or external asserted TTL pulse at the "GO" BNC connector. (if **EXTGO** is enabled).

Abort Scanning	!ABORT

Terminate 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 switch.

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, then 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

Set the end wavelength for a scan in the currently selected units. If the scan **INTERVAL** was last specified, then 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

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

Wait time during a scan, the time 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. A **WAIT** signal (TTL high) is also output at the "WAITING" BNC connector at the rear panel.

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

External Trigger Scan Commands:

Set External Trigger	=EXTGO x

The external trigger command is used to set up MS257TM so that a scan can be initiated when an external trigger signal (TTL pulse) is input at the "GO" BNC connector located at the rear of the MS257TM. An external trigger can be used in all situations where the **!GO** command is valid (i.e. to begin a scan, to resume a paused scan, or to continue a scan in handshaking mode). The external trigger is always in addition to, and does not replace nor disable, the **!GO** command.

Parameters: x   0 to disable the external TTL signal from controlling a scan, 1 to enable the external trigger signal.

Example: **=EXTGO 1**   Enable the external trigger

Query External Trigger	?EXTGO

Example: **?EXTGO**

Response: **1>**   The external trigger is enabled.

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. The **!GO** command can also be sent as an external trigger via the "GO" BNC connector located at the rear panel. This -' requires the external trigger to be enabled. When handshaking is disabled (the normal case) a **WAIT** time elapses before moving to the next wavelength, the process is internally controlled (See **WAIT).** When control of 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

Load Factory Default Parameters	!DL

Loads the Factory Default parameters as Active Parameters. Note that no immediate actions are taken as a result of the change in parameter values. The grating drive, the grating changer, the filter wheel, etc. are all left in their current state. The new parameters only take effect when a new command (**!GH**, **!GW**, or **!GO**) is given or by switching MS257™ off and on again.

Load Active Parameters	!UL

Load the last saved default parameters from MS257™ on-volatile memory.

Save Active Parameters	!US

Save the current, active parameters as default parameters in MS257™ non-volatile memory.

Query Firmware Version	?VER

This is the version number of the spectrograph'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

Wavelength units in nanometers, microns, or wavenumbers.

Note: Although wavenumbers are a unit of frequency (cm-3, for ease of use we group them under the generic "wavelength units" banner, also.

Parameters: aa   Wavelength units as 'nm', 'um', or 'wn'
Example: **=UNITS NM**   Set the units to nanometers

Query wavelength-units	?UNITS

Example: **?UNITS**

Response: *NIM>*   The units are nanometers

Set System Information   **=SYSINFO x**

Enable or disable the reporting of system information back to the controlling PC 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 #I, filter wheel #2 and output port 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, MS257™ will report only the current wavelength in the form:

              {wavelength}:

Example: **=SYSINFO 1**   System Information is enabled. At each scan data point, MS257™ will report the current wavelength, the current grating, the current filter wheel #I position, the current filter wheel #2 position, and the current output port selection in the form:

              {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 (+I-) 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

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, or 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 is not normally used.

Example: **!ADH**

5.5   FILTER WHEELS

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

Select Filter Position for a Filter Wheel	!FILTn x

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	?FILTn

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 #I
	=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 I 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 **(!FILTI 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 3.). 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: =   C**HNGF1 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
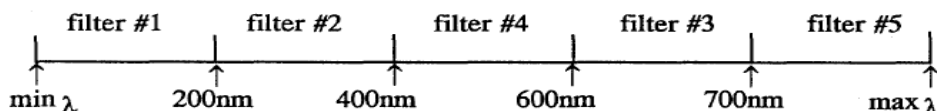
Figure 2: Filter wheel changeover points

Query the Filter Changeover Points   ?CHNGFn

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: **?CHNGFI**   Query the changeover points for filter wheel #I

Response: *1:200:2:300:4:350:3>*

                                      Filter #I 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

Slit width selection for setting the slit opening, 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 I00 pm

Query Current Slit Width	?SLITa

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 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

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 signal (TTL high = Port B) is also output at the "PORT" BNC connector at the rear panel.

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 portB 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: **=CHNGF1 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

Set Input Port   !PORTIN a

Set the "Auxiliary Input Port" BNC connector on the side panel for the desired input port. A TTL high signal = Port A on the external flip mirror. This signal may be used to control the optional external input port or an auxiliary device.

Parameters:	x	A for port A (TTL high), D for port D (TTL low), 0 for Auto Port Selection
Example:	**!PORTIN A**	Set the input port to port A

Query Input Port   ?PORTIN

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

Example:	**?PORTIN**	
Response:	*A:A>*	It is in Auto Port Selection mode, and port A is selected.
or:	*M:D>*	It is in Manual Port Selection mode, and port D is selected.

Set Changeover Point for Input Port   =CHNGPI a:www:a

The Changeover Point is the wavelength transition point for changing the source port. This requires the use of the Auxiliary Input Port accessory. This function may also be used to signal an auxiliary device at a particular wavelength position. 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 A or D
	www	Wavelength in currently selected units
Example:	**CHNGF1 A:300:D**	Port A (TTL high) is used up to 300 nm,
		Port D (TTL low) is used from 300 nm to the grating maximum.

Query the Input Port Changeover Point   ?CHNGPI

Response:	*a:www:a>*	Port and wavelength change point
Example:	**?CHNGPI**	Query the Changeover point
Response:	*A:300:D>*	Port A is being used up to 300 nm
		Port D is being used from 300 nm to the grating maximum

5.8   SHUTTERS

Shutter commands can be activated through the RS-232 or GPIB communication ports or through the "Shutter Input" BNC connector at the rear panel. TTL asserted high activates the shutter (System Shutter, 77739 normally closed Shutter, or 77717 Fast Shutter). In the case of the Fast Shutter only, a signal (TTL high) is output at the "Shutter Output" BNC connector in synchrony with the 90% open state of the shutter.

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

Sets the Shutter type and mode of operation. Use 'St for the normally open slow 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. Use 'F' for the fast shutter. 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 IF', 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 either the normally closed or the normally open slow shutters under complete manual control.

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 normally open slow shutter is present this will close the shutter. If the normally closed slow shutter is present this will open the shutter.

Pulse the Fast Shutter   **!FASTSH xxxx**

Activate the Shutter for xxxx milliseconds. If a zero or no parameter is specified, the previously entered parameter is used. This function is only applicable to the fast shutter, model 77717.

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) 110 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.)

7   MS257™ OPERATING STATES

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™.
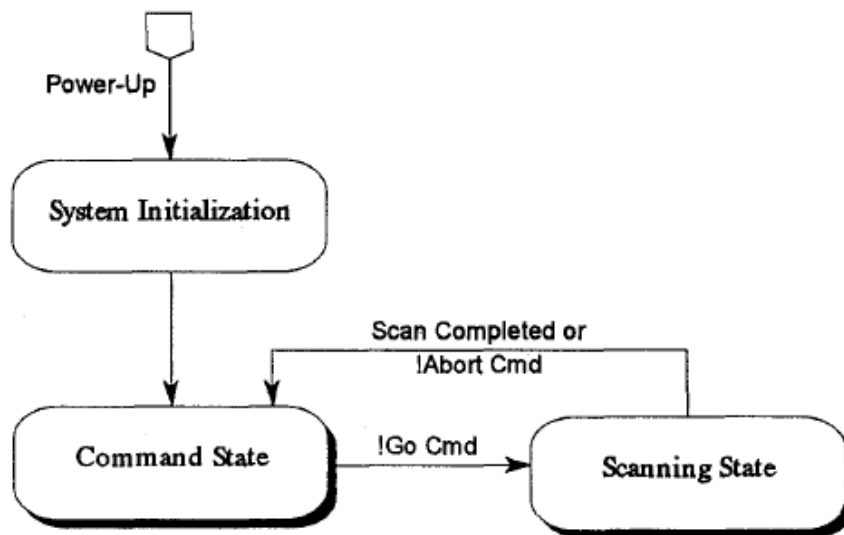
Figure 3: MS257™ Operating State transition diagram.

7.1   SYSTEM INITIALIZATION STATE

MS257™ enters the System Initialization State when:

- the system is powered up when MS257™ enters the Initialization State, it:
- 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 PC 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

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.
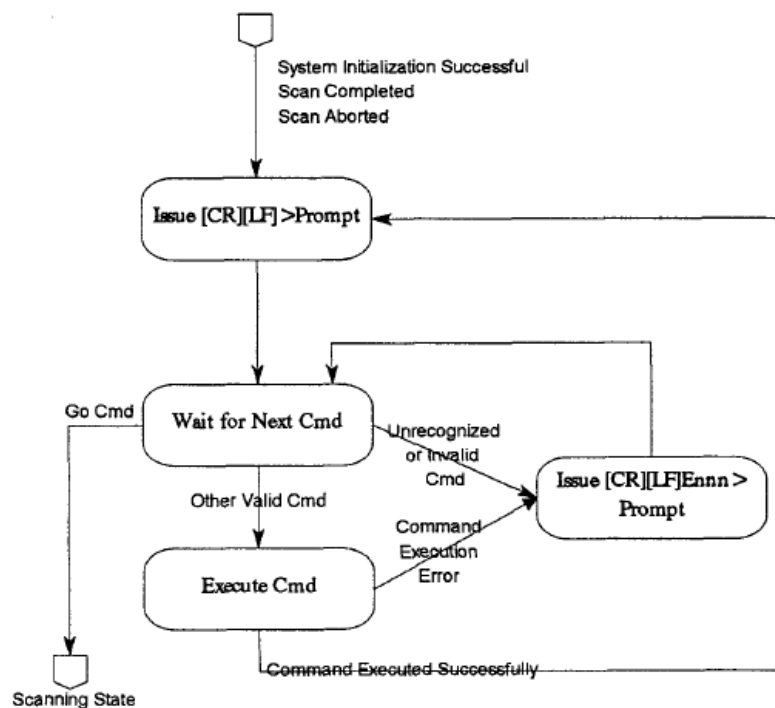
Figure 4: MS527™ Command State transition diagram

Commands Not Supported in the Command State

While in the Command State, the spectrograph 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 or an external trigger:

- A scan will start at **STARTW** and end at **ENDW.**

- At each data point, the actual wavelength is reported. If **SYSINFO** is turned on then grating, filter, and port information is also reported.

- If Handshaking mode is disabled, there is a delay for duration **WAIT** time - 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.
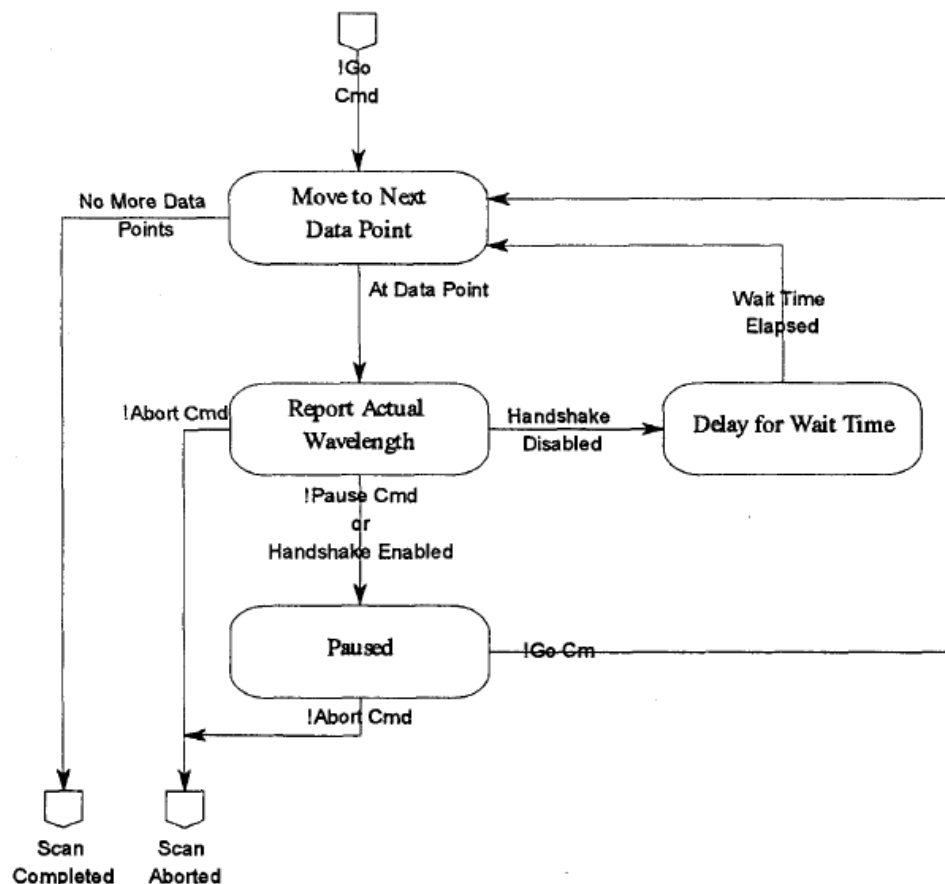
Figure 5: MS257™ Scanning State transition diagram

9   BASIC LANGUAGE RS-232 PROGRAMMING EXAMPLE

This QuickBASIC program was designed to demonstrate how to communicate with the ORIEL 77700, MS257™ spectrograph. It demonstrates several basic features of the instrument, such as selecting a grating, moving to a wavelength, inquiring which grating is selected and retrieving current wavelength information.

Since Microsoft QuickBASIC® supports only two communication ports, make sure you connect MS257™ to either COM1 or COM2.

The program is fully compatible with QBASIC® version 1.0 and Microsoft BASIC 7.0 Professional Development System®.

```
' ---------------------------------------------------------------------------
' ORIEL 77700, MS257 Spectrograph
' QuickBASIC Demonstration Program
'
' (c) Copyright 1993 Oriel Corp.
' 250 Long Beach Blvd., Stratford, CT 06497
' Voice: (203) 377-8282 Fax: (203) 378-2457
'
' Tab stops: 3
' ---------------------------------------------------------------------------
COMMON SHARED response$
DECLARE SUB GoToWL ()
DECLARE SUB GetCurrentWL ()
DECLARE SUB ReadResponse ()
DECLARE SUB GetGrating ()
DECLARE SUB SelectGrating ()
DECLARE SUB Initialize ()
DECLARE SUB GetPortNumber (port$)
CONST TRUE = 1, FALSE = NOT TRUE
CLS
COLOR 1, 11
PRINT
PRINT "=================================================================="
PRINT "                    ORIEL 77700, MS257 Spectrograph             "
PRINT "                    QuickBASIC Demonstration Program            "
PRINT "                                                               "
PRINT "                      (c) Copyright 1993 Oriel Corp.           "
PRINT "                 250 Long Beach Blvd., Stratford, CT 06497     "
PRINT "                   Voice: (203) 377-8282 Fax: (203) 378-2457   "
PRINT "=================================================================="
PRINT
COLOR 9, 8
PRINT "INITIALIZE THE INSTRUMENT"
CALL Initialize
CALL GetGrating
DO
PRINT
PRINT "QUIT", , 0
PRINT "SELECT GRATING", 1
PRINT "GET GRATING INFORMATION", 2
```

```
PRINT "GO TO WAVELENGTH", 3
PRINT "GET CURRENT WAVELENGTH", 4
INPUT ""; i%
SELECT CASE i%
    CASE 0
        SYSTEM
    CASE 1
        CALL SelectGrating
    CASE 2
        CALL GetGrating
    CASE 3
        CALL GoToWL
    CASE 4
        CALL GetCurrentWL
    CASE ELSE
        PRINT "Select 0, 1, 2, 3, or 4."
END SELECT
LOOP

SUB GetCurrentWL
    PRINT #1, "?PW"
    CALL ReadResponse
    PRINT "The current wave length is", , MID$(response$, 3)
    PRINT #1, "?PS"
    CALL ReadResponse
    PRINT "The current step position is", MID$(response$, 3)
END SUB

SUB GetGrating
    mode$ = "MANUAL"
    PRINT #1, "?GRAT"
    CALL ReadResponse
    PRINT response$
    IF MID$(response$, 3, 1) <> "A" AND MID$(response$, 3, 1) <> "M" THEN
        PRINT "Wrong response from MS257"
        END
    ELSE
        PRINT "The current grating number is", MID$(response$, 5, 1)
        IF MID$(response$, 3, 1) = "A" THEN
            mode$ = "AUTO"
        END IF
        PRINT #1, "?LINES"
        CALL ReadResponse
        PRINT "The lines are", , , MID$(response$, 3)
        PRINT #1, "?ORDER"
        CALL ReadResponse
        PRINT "The order is", , , MID$(response$, 3)
        PRINT "The current grating mode is", , mode$
    END IF
END SUB

SUB GetPortNumber (port$)
    DO
        answer% = TRUE
        PRINT "Enter comm port: 1 = COM1, 2 = COM2, or 0 to quit"
        INPUT ""; i%
        SELECT CASE i%
            CASE 0
                END
            CASE 1
```

```
                port$ = "COM1:"
            CASE 2
                port$ = "COM2:"
            CASE ELSE
                PRINT "Select 0, 1, or 2."
                PRINT
                answer% = FALSE
        END SELECT
    LOOP UNTIL answer% = TRUE
END SUB

SUB GoToWL
    PRINT "Enter wave length:"
    INPUT ""; wl#
    PRINT #1, "!GW" + STR$(wl#)
    ReadResponse
END SUB

SUB Initialize
    CALL GetPortNumber(port$)
    port.config$ = port$ + "9600,N,8,1"
    OPEN port.config$ FOR RANDOM AS #1
    PRINT #1, "!GRAT 0"
    CALL ReadResponse
    PRINT #1, "=LINES 400"
    CALL ReadResponse
    PRINT #1, "=ORDER 1"
    CALL ReadResponse
END SUB

SUB ReadResponse
        response$ = ""
        SLEEP 1
    DO
        valid% = TRUE
        IF NOT EOF(1) THEN
            S$ = INPUT$((1), #1)
            IF S$ = ">" THEN
                valid% = FALSE
            ELSE
                response$ = response$ + S$
            END IF
        END IF
    LOOP UNTIL valid% = FALSE
END SUB

SUB SelectGrating
    DO
        answer% = TRUE
        PRINT "Enter grating number:"
        INPUT ""; i%
        SELECT CASE i%
            CASE 0
                END
            CASE 1
                Grating$ = "1"
                Lines$ = "400"
                Order$ = "1"
            CASE 2
                Grating$ = "2"
```
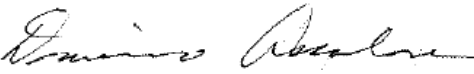
```
                Lines$ = "600"
                Order$ = "1"
            CASE 3
                Grating$ = "3"
                Lines$ = "1200"
                Order$ = "1"
            CASE 4
                Grating$ = "4"
                Lines$ = "1200"
                Order$ = "1"
            CASE ELSE
                PRINT "Valid grating numbers are: 1, 2, 3, 4; 0 - to quit"
                answer% = FALSE
        END SELECT
    LOOP UNTIL answer% = TRUE
    PRINT #1, "!GRAT " + Grating$
    CALL ReadResponse
    PRINT #1, "=LINES " + Lines$
    CALL ReadResponse
    PRINT #1, "=ORDER " + Order$
    CALL ReadResponse
END SUB
```

10 DECLARATION OF CONFORMITY

EC DECLARATION OF CONFORMITY	
Manufacturer's name:	Newport Corporation
Manufacturer's address:	150 Long Beach Boulevard
	Stratford, CT 06615 USA
Declares that the product:	
Product Name:	MS257™ MONOCHROMATOR AND SPECTROGRAPH
Model Numbers:	77700, 77702, 77722, 77738, 77755, 77757, 77759
Type of equipment:	Electrical equipment for measurement, control and laboratory use in industrial locations
conforms to the following Product Specifications:	
Safety:	EN 61010-1:2010
EMC:	EN 61326-1:2006 +cor:2008 +cor:2010
complies with the following Directives:	
	2004/108/EC EMC Directive
	2006/95/EC Low Voltage Directive
and accordingly, carries the $C\epsilon$ mark	
$C\epsilon$ **mark affixed:**	Beaune; May 6, 2011

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11 WARRANTY AND RETURNS

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

1. All products described here, except spare parts: one (1) year or 3000 hours of operation, whichever comes first, after delivery of the goods to the buyer.
2. Spare parts: ninety (90) days after delivery of goods to the buyer.

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

Newport shall be relieved of all obligations and liability under this warranty of:

1. The user operates the device with any accessory, equipment or part not specifically approved or manufactured or specified by Newport unless buyer furnishes reasonable evidence that such installations were not the cause of the defect. This provision shall not apply to any accessory, equipment or part which does not affect the safe operation of the device.
2. The goods are not operated or maintained in accordance with Newport's instructions and specifications.
3. The goods have been repaired, altered or modified by other than authorized Newport personnel.
4. Buyer does not return the defective goods, freight prepaid, to a Newport facility within the applicable warranty period.

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

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

CONSEQUENTIAL DAMAGES

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

INSURANCE

Persons receiving goods for demonstrations, demo loan, temporary use or in any manner in which title is not transferred from 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 condition upon original delivery, and for assuming all costs and charges.

RETURNS

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

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

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