

USERS GUIDE



SR-500



SR-750

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Shamrock SR-500



Shamrock SR-750

Firstly thank you for choosing the Andor Shamrock SR-500 / Shamrock SR-750. We appreciate you have a choice and are delighted you have selected our equipment to fulfil your requirements.

The Shamrock SR-500/ Shamrock SR-750 is available in two types:

1. As a pre-aligned detector/spectrometer allowing fast and efficient set-up.
2. As a stand-alone spectrograph, to retrofit existing cameras.

Your Shamrock SR-500 / Shamrock SR-750 comes with a range of features including:

- A USB 2.0 interface giving the user the benefit of “plug-and-play” convenience.
- An intuitive graphical user interface (dashboard) giving the user complete control over the spectrograph functionality including wavelength control and calibration, grating selection, shutter control, motorized slit control and filter selection.
- A range of accessories including optical fibers & inputs, motorised filter wheel and camera adaptors.

1.1 - WORKING WITH THE USERS GUIDE

This manual is aimed at experienced researchers who will be using the Shamrock SR-500 / Shamrock SR-750 to analyse samples spectroscopically. Details are provided on all features and functionality. As far as possible, the descriptions in this **User's Guide** are laid out in sections that mirror the **Windows Interface**. So, whenever you're working with a particular window, you'll find a section in the User's Guide that sets that window in context, reminding you how the window is launched, letting you know what it can do, and telling you what other windows and operations are associated with it.

We hope you find use of our product rewarding. If you have any suggestions as to how our software, hardware or documentation could be improved, please let us know. Contact details of your nearest representative can be obtained on **page 8**.

1.2 - DISCLAIMER

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2. The publication of information in this documentation does not imply freedom from any patent or proprietary right of Andor Technology plc or any third party.

1.4 - TRADEMARKS AND PATENT INFORMATION

- Andor, the Andor logo, Shamrock SR-500 & Shamrock SR-750 (**hereinafter referred to as SR-500 & SR-750**) are trademarks of Andor Technology plc.
- All other marks are property of their owners.
- Changes are periodically made to the product and these will be incorporated into new additions of the manual.

1.5 - TECHNICAL SUPPORT

If you have any questions regarding the use of this equipment, please contact the representative* from whom your system was purchased or via one of the following addresses:

<p style="text-align: center;">Europe</p> <p style="text-align: center;">Andor Technology 7 Millennium Way Springvale Business Park Belfast BT12 7AL Northern Ireland Tel. +44 (0)28 9023 7126 Fax. +44 (0)28 9031 0792 e-mail: productsupport@andor.com</p>	<p style="text-align: center;">USA</p> <p style="text-align: center;">Andor Technology 425 Sullivan Avenue - Suite 3 South Windsor CT 06074 USA Tel. +1 (860) 290-9211 Fax. +1 (860) 290-9566 e-mail: productsupport@andor.com</p>
<p style="text-align: center;">Asia-Pacific</p> <p style="text-align: center;">Andor Technology (Japan) 7F Ichibancho Central Building 22-1 Ichiban-Cho Chiyoda-Ku Tokyo 102-0082 Japan Tel. +81-3-3511 0659 Fax. +81-3-3511 0662 e-mail: productsupport@andor.com</p>	<p style="text-align: center;">China</p> <p style="text-align: center;">Andor Technology Room 1116 Zhejiang Building No. 26 An Zhen Xi Li Section 3 Chaoyang District Beijing 100029 China Tel. +86-10-5129-4977 Fax. +86-10-6445-5401 e-mail: productsupport@andor.com</p>

***NOTE: The latest contact details for your local representative can be found on our website.**

NOTE: Unless otherwise stated, specifications obtained use 1200l/mm gratings and 10µm slits.

SR-500 (General)	
Type	Czerny-Turner arrangement with imaging toroidal optics
Focal Length	500mm
Aperture	f/6.5
Reciprocal Dispersion	1.7nm/mm (nominal)
Wavelength Range	190nm to 10µm (detector dependent)
Wavelength Resolution	0.05nm (<0.1nm with 25µm pixel CCD detector)
Wavelength Reproducibility	± 0.05nm
Wavelength Accuracy	± 0.2nm
Focal Plane Size	28mm wide x 14mm high
Time to switch gratings	<10 secs
Stray Light	1.5×10^{-4} (measured at 20nm from 633nm laser line)
Sizes & Weights	
Length = 550mm (21.65"), Width = 343mm (13.5"), Height = 206.5mm (8.1")	
Optical Axis Height	136.5mm (5.37") with fixed pad feet
Weight	25kg (55.12lb approx)
Slit	
Type	Motorised or manual, 10µm to 3mm
Maximum height	14mm (height selectable with optional interchangeable plates)
Gratings	
Size	68mm x 68mm
Mount Type	Triple grating turret
SR-750 (General)	
Type	Czerny-Turner arrangement with imaging toroidal optics
Focal Length	750mm
Aperture	f/9.8
Reciprocal Dispersion	1.1nm/mm (nominal)
Wavelength Range	190nm to 10µm (detector dependent)
Wavelength Resolution	0.03nm (<0.06nm with 25µm pixel CCD detector)
Wavelength Reproducibility	± 0.05nm
Wavelength Accuracy	± 0.2nm
Focal Plane Size	28mm wide x 14mm high
Time to switch gratings	<10 secs
Stray Light	1.5×10^{-4} (measured at 20nm from 633nm laser line)
Sizes & Weights	
Length = 800mm (31.5"), Width = 393mm (15.47"), Height = 213.5mm (8.41")	
Optical Axis Height	136.5mm (5.37") with fixed pad feet
Weight	35kg (77.16lb approx)
Slit	
Type	Motorised, 10µm to 3mm
Maximum height	14mm (height selectable with optional interchangeable plates)
Gratings	
Size	68mm x 68mm
Mount Type	Triple grating turret

SECTION 2 - INSTALLATION**2.1 - SAFETY PRECAUTIONS**

THERE ARE NO USER-SERVICEABLE PARTS INSIDE THE SR-500/SR-750. A NUMBER OF SCREWS ON THE SR-500/SR-750 HAVE BEEN MARKED WITH RED PAINT TO PREVENT TAMPERING. IF YOU ADJUST THESE SCREWS, YOUR WARRANTY WILL BE VOID.

NOTE: The cover should only be opened when absolutely necessary.

2.1.1 - Working with Electronics

The computer equipment that is to be used to operate the SR-500/SR-750 should be fitted with appropriate surge/EMI/RFI protection on all power lines. Dedicated power lines or line isolation may be required for some extremely noisy sites.

Appropriate static control procedures should be used during the installation of the system. Attention should be given to grounding. All cables should be screwed (finger tight only) into place in order to provide a reliable connection and to prevent accidental disconnection. The power supply to the computer system should be switched off when changing connections between the computer and the SR-500/SR-750. The computer manufacturer's safety precautions should be followed when installing the Interface Card into the computer.

The circuits used in the SR-500/SR-750 & the interface Card are extremely sensitive to static electricity and radiated electromagnetic fields, and therefore they should neither be used nor stored in close proximity to EMI/RFI generators, electrostatic field generators, electromagnetic or radioactive devices, or other similar sources of high energy fields. Some examples of equipment which can cause problems are plasma sources, arc welders, radio frequency generators, X-ray instruments, and pulsed discharge optical sources. Operation of the system close to intense pulsed sources (lasers, xenon strobes, arc lamps, and the like) may compromise performance if shielding is inadequate.

NOTE: In the event of extreme power or ESD surges, the software may crash.

If this occurs, the SR-500/SR-750 must be powered OFF/ON, then the software must be restarted

2.2 - UNPACKING THE SHAMROCK SR-500/SR-750

BEFORE unpacking the SR-500/SR-750, allow the shipping box to fully acclimatise to room temperature.

Whilst the SR-500/ SR-750 requires no special placement in a controlled environment it should be noted that it is a precision instrument that will perform best when set up and operated properly.

Please read this manual carefully before using and always handle with the care accorded to any precision instrument.

Carefully remove the SR-500/SR-750 from the packaging. The following should be included:

- Shamrock SR-500 or SR-750 base unit
- Universal power supply (with relevant lead and plug - country specific)
- Allen Key set comprising 2mm, 2.5mm & 3mm keys
- USB 2.0 Cable
- Users guide (this manual) and Certificate of Conformance

Depending on the options purchased the following may also be included:

- Flange (for connection to the SR-500/SR-750)
- Custom flange to connect non-Andor cameras to the SR-500/SR-750

For further information on any of the accessories available for the SR-500 /Sr-750, please contact either your local representative or one of the contacts listed on **page 8**.

2.4 - CONNECTING THE SPECTROGRAPH & USB SOFTWARE INSTALLATION

1. Firstly ensure the Power switch on the rear of the spectrograph is set to 0.
2. Connect the Power & USB cables e.g.:

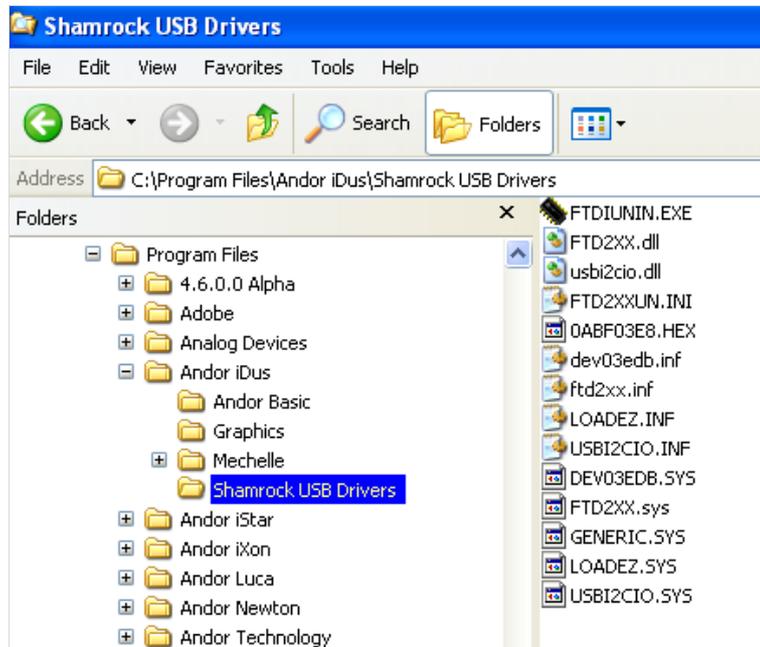


NOTE: Do not switch on the spectrograph at this stage.

3. Connect the other end of the USB cable to the PC and plug in the power supply to the mains, but do not switch the power on.

2.4.1 - Windows XP Hardware Wizard

When the Andor Solis software is installed, the drivers for the SR-500/SR-750 USB should have been placed in the Shamrock USB Drivers folder, e.g.:



NOTE: If the drivers are not there, copy the Shamrock USB Drivers folder from the installation CD-ROM to the Andor Solis folder.

1. After the Power & USB cables have been plugged in as described on the previous page, switch the power on to the spectrograph. A dialog box should then appear similar to the following:



NOTE: If this dialog box does not appear, firstly check that the USB cable is securely connected. If that is OK then double-click on the “New unknown USB device” icon, e.g. the icon circled in red below:

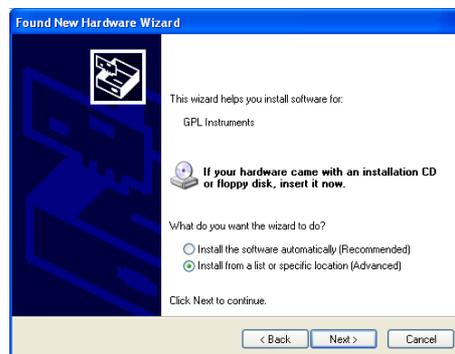


The dialog box should then appear.

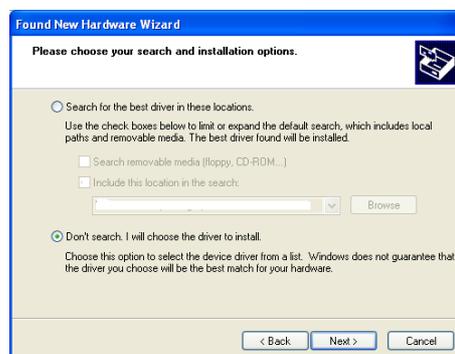
- When the dialog box is active, select the **No, not this time** option, e.g.:



- Click **Next>**
- A dialog box similar to the following should appear:



- Select the **Install from a list or specific location (Advanced)** option then click **Next>**. A dialog box similar to the following should appear:



- Select the **Don't search. I will choose the driver to install** option then click **Next>**.

7. The following dialog box should appear:



8. Click on the **Next>** button and the software should begin to install, e.g.:



9. After the software is installed, the following dialog box should appear:

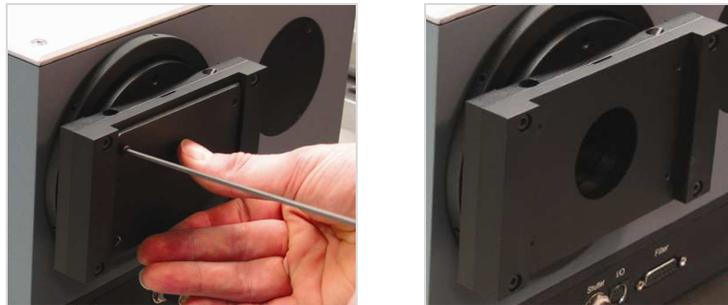


10. Click **Finish**.

11. The spectrograph software is now ready for use.

2.5 - FITTING A CAMERA TO THE SHAMROCK SR-500/SR-750

1. Remove the blanking plate from the spectrograph, e.g.:



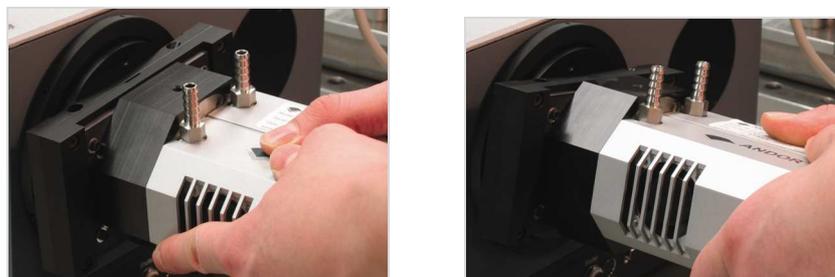
2. Hold the camera horizontally, locate it on the flange and replace the screws, e.g.:



3. Loosen the rotation locking screws, e.g.:



4. Ensure the camera is free to rotate, e.g.:



5. Once the camera is in the correct position, use the screw underneath the front of the camera at the bottom of the flange to unlock the focusing ring:



6. Finally, check that the focusing ring is free to rotate, e.g.:



The camera is now ready for electrical connection. **NOTE: This will differ depending on the type of camera being used.**

2.5.1 - USB Camera electrical connections

The photographs below show the typical electrical connections used when using the Shamrock SR-500/SR-750 with an Andor iDus camera.



Shutter cable



USB connection



Power connection



Connections showing PS-24 Power Supply

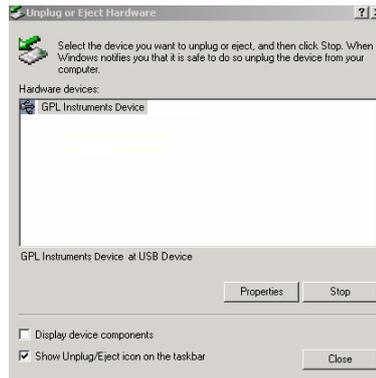
2.5.2 - Disconnecting the USB Interface

Before the USB cable can be disconnected the following steps must be followed:

1. Scroll over the USB icon at the bottom-right of the screen, and the Safely Remove Hardware indication should appear, e.g.:



2. The unplug or Eject Hardware dialog should appear, e.g.:



3. Select the **GPL Instruments Device** then click **Stop** and the **Stop a Hardware device** dialog box should appear, e.g.:



4. Click **OK** to confirm the device can be safely removed from the system and the following dialog should appear in the the Windows screen, e.g.:



5. The USB cable can now be unplugged.

2.5.3 - Standalone Spectrograph

Where a “standalone” spectrograph (i.e. purchased without, or separately from, an Andor camera) has been purchased the unit is supplied with an appropriate camera flange to allow the camera to be attached to the spectrograph body. The camera must be attached to the flange and the flange attached to the spectrograph body with the screws supplied, e.g.:

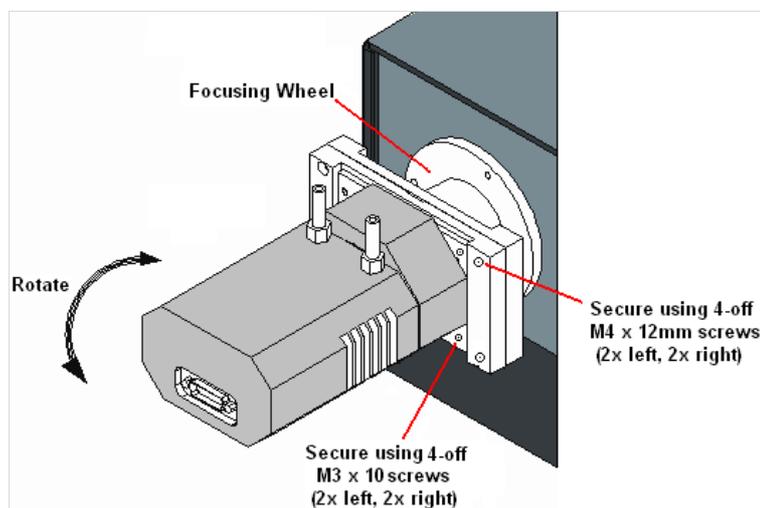


Figure 1: Attaching a camera to the SR-500/SR-750

In this instance, the focusing tube is not pre-set before shipping, so the unit must be adjusted to achieve the best possible results with the camera being used. This should be done (after installation has been completed) as follows:

1. Mount the camera onto the SR-500/SR-750 and start data acquisition.
2. Mount a suitable light source at the entrance slit of the spectrograph (e.g. a Mercury, or Neon discharge lamp).
3. Power the SR-500/SR-750 on and move the spectrograph to a known spectral line wavelength (e.g. Mercury 435.8nm or the Neon 585.2nm line).
4. Loosen the focusing wheel clamp screw as shown on **page 17**.
5. Acquire data using the camera and check the image of the light source, or alternatively, the line intensity and shape. Slowly rotate the focusing wheel until the sharpest image is achieved. It is then necessary to rotate the camera for best alignment, by loosening the screws in the flange as shown in the drawing above and rotate the camera.
6. When complete re-tighten the clamping screw, please refer to **Offset Adjustment Control** on **pages 32 - 33** for details of how to adjust the calibration of the system to the fitted camera.

2.5.4 - Pre-aligned Camera & Spectrograph

When a pre-aligned camera & spectrograph package has been purchased the camera comes pre-fitted with a flange. This flange accurately locates relative to the spectrograph body via precision pins and matching bushings (see figure below). These precision pins enable the camera and flange assembly to be repeatedly attached without the need for any additional calibration, or adjustments, to be made.

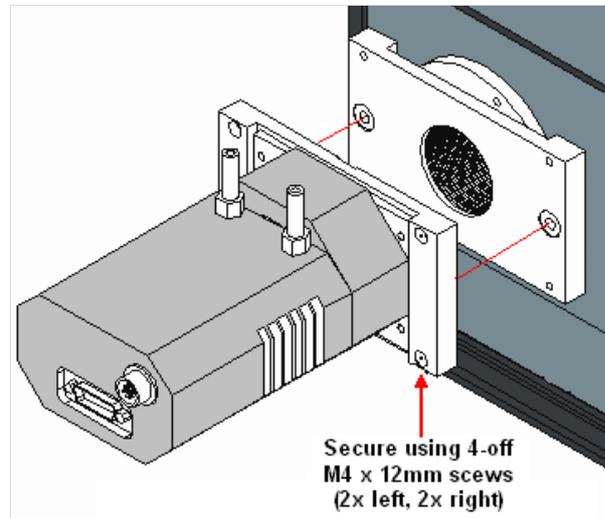
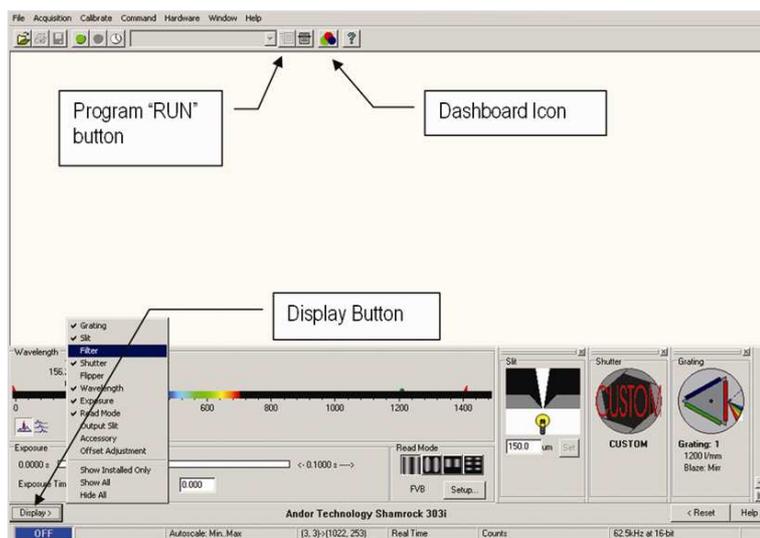


Figure 2: Attaching the pre-aligned detector to the SR-500/SR-750

To attach the camera, simply insert the alignment pins into the relevant locators and secure in place using the four M4x12mm screws. Once connected, no further adjustment is necessary as the unit is aligned and calibrated at the factory.

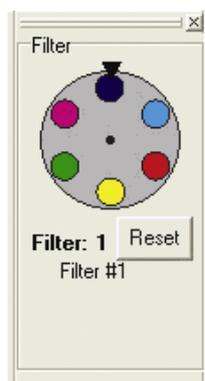
2.5.5 - Update of the variables stored in the spectrograph EEPROM

1. Connect the spectrograph and start-up the Andor Solis software
2. Run the EEPROM modifier program saved on the stored CD (**EEPROM SR-xxxx.pgm**, where **xxxx** is the filter wheel serial number). **Note: Some of the numbers are specific to each filter wheel and the label on the CD should match the serial number on the filter wheel label.** This program will update the spectrograph's non-volatile memory with the parameters needed to drive the filter wheel. The **Program 'RUN' button** is located on the main Andor Solis toolbar, e.g.:



Further details on how to run Andor Basic program files can be found in the Andor Solis help facility.

3. When the software is restarted, the system will automatically sense that a filter wheel assembly has been fitted and the filter wheel control graphic will be displayed:



Alternatively, to avoid restarting the software, select the **Filter** option from the display menu and open and close the dashboard control using the icon on the main toolbar.

4. In order to synchronise the filter wheel hardware with the software it will be necessary to perform a reset operation after the Filter Wheel assembly has been fitted. Simply press the  button on the filter wheel control graphic. The filter wheel is now ready for use.

2.6 - INSTALLATION OF FILTERS

Filters may be added, removed or replaced in the filter wheel via the filter access hole on the front face of the filter wheel housing

2.6.1 - Filter Access

Access to the filters may also be gained via the filter access hole located on the front face of the filter wheel.

1. Remove the magnetic filter wheel access cover by gently pulling it, i.e.:



2. The filter position ID number will now be visible, e.g.:



NOTE: The filter position accessible via the access hole has an ID number 2 less than the filter position in the optical path, and the number displayed in the software (e.g. filter position 2) will be accessible via the access hole when filter position 4 has been selected in the software (i.e. 2 → 4).

Similarly, 3 → 5, 4 → 6, 5 → 1, 6 → 2, 1 → 3.

3. Using the software select the filter position needed to bring the required filter position into place. Fit filter and secure.

2.6.2 - Initialising the filter wheel

After fitting, or replacing filters, it is good practice to synchronise the filter wheel hardware with the software interface. Simply press the  button on the filter wheel control graphic.

2.6.3 - Filter wheel control and updating the filter details stored in the spectrograph memory

The optional filter wheel accessory is controlled by the Filter Wheel Control. This is described in more detail in on **page 35**.

1. The Filter Wheel Control indicates the currently selected filter and provides details of the filter at the bottom of the control. The filter positions and their details are stored in non-volatile memory (**EEPROM**) in the instrument and should be input by the user after a filter has been fitted. To input (or modify) the details of a particular filter position place the mouse cursor on the required filter position. **Right** click and a filter details input box will appear. Enter the filter details (up to a maximum of 9 characters) and **Left** click when complete.
2. The operation of the filter wheel is very similar to that of the grating turret control. Positioning the cursor over each filter position changes the cursor to a pointing hand and details about the filter are displayed. **NOTE: If the information is not automatically displayed, simply move the cursor out of the filter wheel control box and then back onto the required filter to refresh the information.**
3. To select a filter, simply position the mouse cursor on the required filter and **LEFT** click. The hardware responds by rotating the filter wheel and the filter wheel graphic in the software control rotates to reflect the change. The accessory may be reset by clicking the  button. On completion of a reset the filter wheel defaults to the **Filter 1** position.
4. As the optical path difference will vary with the introduction of the filters into the beam path it may be necessary to re-focus the spectrograph. This is achieved by adjusting the position of the detector. Please refer to **Standalone Spectrograph** on **page 20** for details of adjusting the detector focus.
5. If the filter wheel assembly and/or the motorised slits assembly has been removed from the spectrograph body it may be necessary to adjust the detector offset value stored in the spectrograph memory. Please refer to **Offset Adjustment Control** on **page 32** for further details of this function.

SECTION 3 - OPERATION

The SR-500/SR-750 is controlled via the **Dashboard** control (**figure 3** below). This easy-to-use graphical user interface allows you to control the main hardware components of the SR-500/SR-750 as well as several acquisition parameters. It is designed to be open during acquisition, allowing continuous adjustment of the available parameters with immediate feedback visible in the acquired data.

The dashboard features large simple controls that graphically represent the associated hardware items. In addition, the controls visually show the state of the hardware, providing an 'at-a-glance' overview of the current setup.

The software is launched by double-clicking the  icon that was created on your desktop when the software was installed. You are firstly presented with the Shamrock SR-500/SR-750 splash screen, indicating the software is specifically configured to control the SR-500/SR-750 which in turn, automatically launches the **Dashboard**. The dialog starts up aligned along the bottom of the screen leaving space for an acquisition window to be displayed above it.



Figure 3: Dashboard controls

When the dashboard is launched, it displays only the graphic for the accessories that have been installed (e.g. **Shutter**, **Filter**, **Flipped**, **Grating** and **Output Slit**). Clicking on the **Display** button and selecting **Show All** allows you to select which graphics are displayed. If you display any that are not installed then the graphic indicates that it is only for demonstration purposes only.

The graphics are 'dockable' and may be pulled in and out of the dashboard and arranged as required. Although the dashboard control is primarily used to control the spectrograph hardware there are also some additional real time controls provided that allow several camera-related parameters to be easily changed.

3.1 - DETECTOR CONTROLS

The following paragraphs describe the basic camera controls incorporated on the **Dashboard** control. For more detailed descriptions of these parameters and other available adjustments please refer to the supplied camera manual.

3.1.1 - Exposure Time Control

The **Exposure Time Control** (figure 4 below) can be set to any value between the minimum valid exposure time (detector dependent) and 3600 secs. The exposure time can be set in one of two ways by:

1. Using the Exposure Time Edit Box by:
 - Clicking in the Exposure Time Edit Box
 - Deleting the current value
 - Entering the new value
 - Pressing Enter
2. Using the Exposure Time Slider Bar by left clicking on the indicator and dragging it along the bar. As the indicator approaches the end of the slider bar the bar may automatically re-scale itself to new values. Possible scale ranges run from 0 to 0.5, 2.0, 10.0, 100.0, 1000.0 and 3600.0 seconds. As the slider automatically rescales, the arrows at either side of the bar indicate how much the slider bar is able to rescale itself.

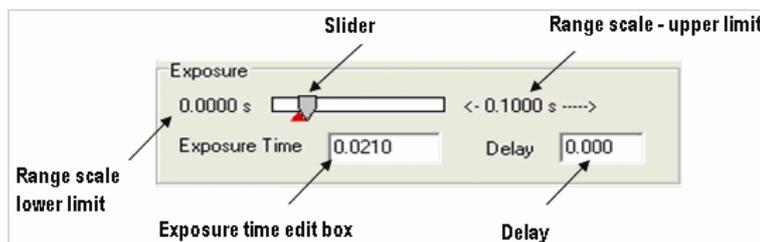


Figure 4: Exposure Time control

A delay may be set by entering a value in the **Delay** edit box. The delay (in seconds) is the time you require between the on-going scans. The system will default to a minimum delay should you attempt to enter too low a value.

NOTE: You cannot enter an exposure time of 0, by either method. If this is tried then the system automatically defaults to the minimum exposure time indicated by the red triangle.

The **Read Mode Control** dialog box (**figure 5** below) is located to the right of the Exposure control and can be used to change the way in which the information from the CCD in the camera is read. The mode is selected by clicking one of the buttons in the dialog box. Moving the cursor over each button displays a pop-up, indicating the mode selected by clicking on the button. Once a button has been clicked the selected mode is displayed beneath the buttons. There are four modes available (please refer to the camera manual for more details).

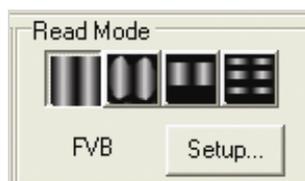


Figure 5: Read Mode control

1. **Full Vertical Binning (FVB):** this allows you to use the CCD as a Linear Image Sensor with the charge from each column of pixels (each column being chip height) being combined, or binned, to give a single value per column
2. **Image Readout:** this is associated with image data display
3. **Single Track:** this differs from FVB in that you can specify the height (in pixels) and vertical position on the CCD of a track from which to bin charge. The aim is to define a horizontal track which corresponds to the position of a spectrum under analysis
4. **Multi-track:** Multi track modes are associated with 2-D data display and allow you to define multiple tracks on the CCD with two options available, i.e. **Standard & Custom**. When one option is selected, the parameters for the other option are disabled

Once a mode has been selected, click **Setup...** for more configuration options.

NOTE: Switching the readout mode automatically changes the way in which the acquired data is displayed. The display mode can also be changed at any time using the speed buttons on the toolbar.

3.2 - SPECTROGRAPH CONTROLS

3.2.1 - Reset Menu Options

When the **<Reset** button on the **Reset Menu** (figure 6 below) is clicked, you then have several options that allow you to reset the various mechanisms in the system. This may be found to be necessary if a mechanism setting appears to have deviated from the displayed value (e.g. if the stepper motors have been rotated by hand).

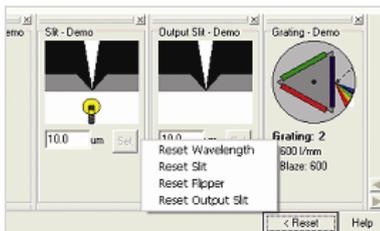


Figure 6: Reset menu options

- **Reset Wavelength** initialises the wavelength drive to a precisely known position. After initialisation the wavelength drive is then set back to the wavelength selected on the dashboard control.
- **Reset Slit & Reset Output Slit** width initialises the motorised slit mechanism. After initialisation the slit width is set to 10µm.
- **Reset Flipper** will set the flipper mirror to the **Port 1** position

3.2.2 - Wavelength Drive Control

The wavelength drive hardware not only sets the system to the target wavelength but is also used to control grating selection. The **Wavelength Drive Control** (figure 7 below) is used for setting the wavelength range for the current grating. The **Grating Control** is concerned with **grating selection** (see page 33).

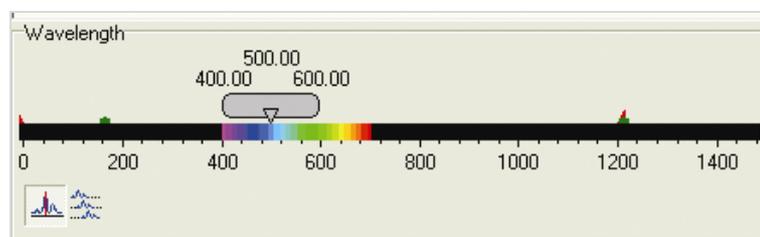


Figure 7: Wavelength Drive Control

The wavelength range that can be measured in a single scan is dependent on the selected grating, the centre wavelength and the width of the CCD detector fitted in the camera. It is calculated by the software and accurately displayed in the visual control section of the dashboard. The slide bar control has three labels floating above it displaying the start, centre and end wavelengths currently in effect. The values displayed correspond to the position and width of the slide bar in relation to the wavelength scale shown.

The start, centre and end wavelengths can be changed in one of two ways:

1. By dragging the wavelength slider with the mouse. This is done by positioning the cursor within the slider (cursor changes to pointing hand), holding down the LEFT mouse button and dragging the slider to the new centre wavelength required. Placing the cursor at either side of the slider allows you to nudge it towards the cursor (use the LEFT mouse button for coarse nudges and the RIGHT mouse button for fine nudges). The size of the nudges can be defined by the user but the defaults are 10nm for course nudges and 1nm for fine nudges.
2. By using the **Wavelength Menu** :



Figure 8: Wavelength menu

This is accessed by positioning the cursor within the slider (cursor changes to pointing hand) and holding down the **Right** mouse button. Selecting an item from the wavelength menu displays a simple dialog that allows you to change the current values.

NOTE: While the wavelength drive motor is moving the grating, the cursor changes to the hourglass symbol to indicate that the hardware is busy. The cursor reverts to its previous appearance once the movement is complete.

3.2.3 - Step and Glue Function

The **Step and Glue** function allows to user to build up a composite spectrum made up of individual spectra. The user selects the start and wavelength of the scan region and the grating to be used. The software will then control the acquisition of several spectra that cover this spectral region. **Step and Glue** mode is only available with the CCD set in **Single Scan** mode (see **Acquisition, Setup Acquisition** menu selection).

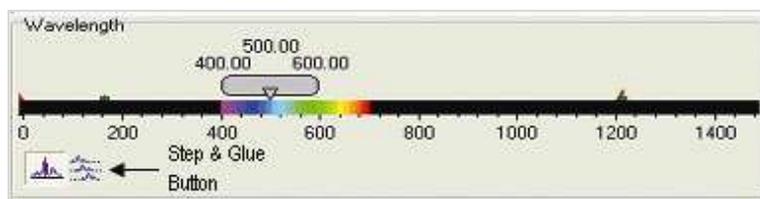


Figure 9: Step & Glue mode selection button

In Step and Glue mode (**figure 9**) the individual scans (datasets) are merged by taking the average of the values in the overlap region from the two input datasets. The points outside the overlap region of the input datasets are used directly. For points falling within the overlap region, the value used is a varying scaled average of the values from each of the datasets. The scale changes linearly between the start and end of the overlap region putting more emphasis on the value from the closest edge of the overlap. To enter the Step and Glue mode click the button on the Wavelength Control (see **figure 9** above). On selection of Step and Glue mode the Wavelength Control will change to the layout shown here:

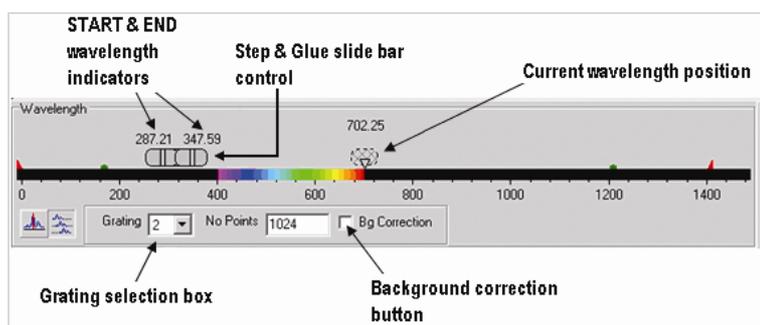


Figure 10: Step & Glue mode selectors

There are now several new graphic features. The hatched slide control bar gives an indication of the current wavelength position and current active grating in the system. The Step and Glue slide bar control will also appear. the slider bar allows the user to enter the start and end wavelengths for the Step and Glue mode and select the grating with which to take the data. The start and end wavelengths can be input in several ways:

1. Left-click and drag the appropriate wavelength indicator
2. Right-click, then manually input the start and end wavelength (see **figure 11** below)
3. Step and Glue Setup dialog under the menu Acquisition: Setup Acquisition

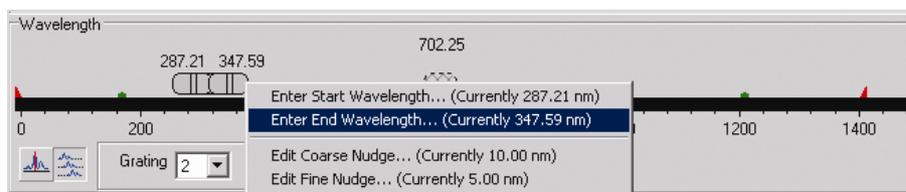


Figure 11: Direct input of Start and End wavelengths

It will be noticed that the Step and Glue slide bar control (**figure 12** below), will expand or contract in length to indicate the number of scans that the system must perform to acquire this data (note that the acquire spectra overlap slightly). This allows the Step and Glue algorithm to glue the spectra together.

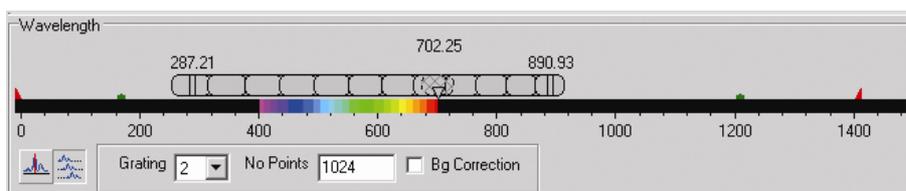


Figure 12: Selecting the Step & Glue scan range

It is also possible to easily change the centre wavelength about which the scan will be performed. This can be achieved by either clicking on any part of the step and glue slide control bar (except the start and end wavelength indicators) and dragging the wavelength bar to the required wavelength region. It can also be modified by 'nudging' the slide control bar. This is achieved by positioning the cursor to either side of the sidebar control then clicking the left or right mouse button. Please refer to **Wavelength Drive Control** on **page 29**.

NOTE: It is not necessary for the grating control to be set at the required grating. The grating to be used is selected using the Grating Setup dialog box (see page 33).

The scan is initiated by clicking the **Take Signal** button  on the main Andor Solis toolbar. If the grating specified in the grating selection box is different from the currently set grating the system will first drive to the selected grating before commencing the scan. If the background (**Bg**) correction box has been ticked an initial background will also be acquired. Progress of the scan is indicated by the movement of the hatched region along the step and glue slide control bar.

Figure 13 shows the Hg/Ne spectrum acquired with a 1200l/mm grating over the range 300 to 900nm (approx.). It is composed from 13 individual spectra:

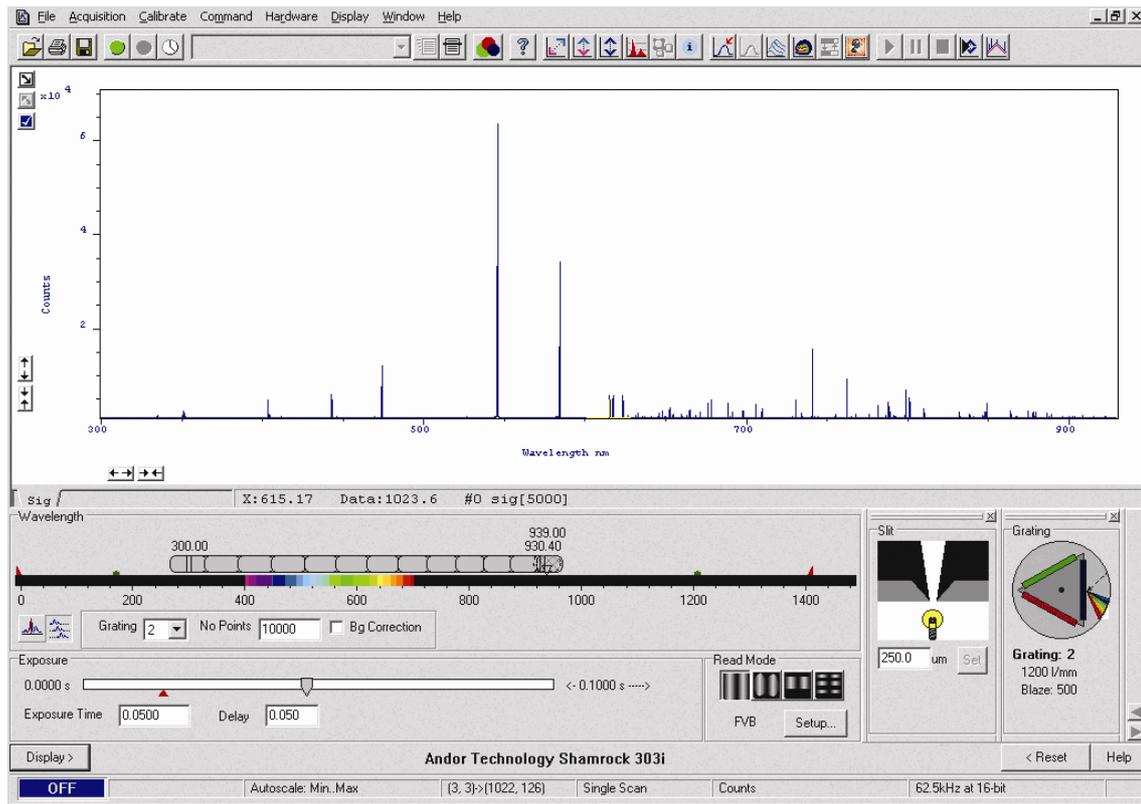


Figure 13: Hg/Ne spectrum

The **Grating Turret Control** (figure 14) is used to select a new grating by rotating the grating turret to a new position. There are three turret positions available so that a maximum of three gratings can be fitted at any one time. If additional gratings are needed then the turret can be changed to install three new gratings. The values for up to three grating turrets may be stored in the system.

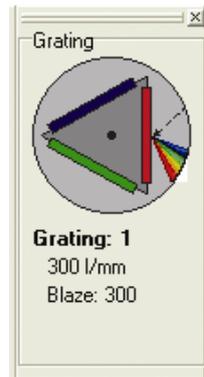


Figure 14: Grating Turret Control

The currently selected grating is always orientated vertically on the right of the display and is also indicated by the arrow and the spectrum graphic. As the cursor is placed over each grating position, the cursor changes to a pointing hand and details about the grating are displayed.

NOTE 1: If the information is not automatically displayed, Simply move the cursor out of the turret control box and then back onto the grating to refresh the information.

To change the grating, simply left-click on the grating you want to select. The hardware responds by rotating the grating turret and the turret graphic in the software control rotates to reflect the change.

NOTE 2: If the wavelength drive is reset then the grating turret automatically resets the grating to position one.

While the grating is being changed the software indicates that it is busy by displaying the hourglass symbol and the grating information text will read "changing grating..". The maximum time needed to change between gratings is approximately 15 seconds.

NOTE 3: The text information displayed about each grating is stored in the SR-500/SR-750 EEPROM. Edit EEPROM dialogs are provided to allow this information to be updated if you change the turret to add new gratings.

3.3 - OFFSET ADJUSTMENT CONTROL

The **Offset Adjustment Control** (figure 15) allows the user to adjust the calibration of the instrument. We shall define two types of offset. A detector offset and a grating offset.

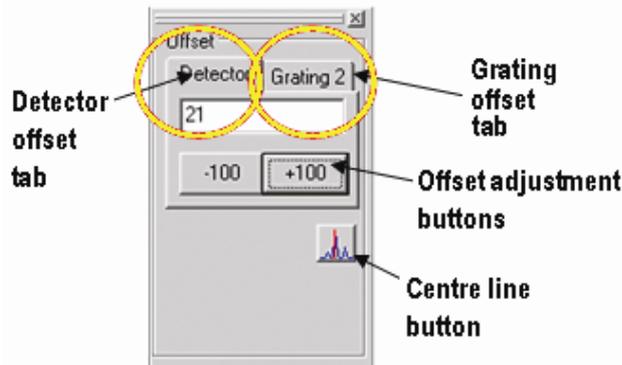


Figure 15: Detector and Grating Offset Adjustment Control

The Detector offset value can be adjusted to correct for any mechanical change that shifts (offsets) the displayed spectrum from the expected calibrated position. For example, if a camera is removed and refitted, or a grating turret is removed and refitted there will most likely be a small mechanical non-repeatability in the exact re-positioning of the component. Any offset introduced will be 'global', i.e. any offset (measured in pixels) will be independent of the grating being used. The grating offset values are also used to correct for any shift between the displayed spectrum from the expected calibrated position.

NOTE: The grating offsets are not global in that they are only applied to the respective gratings.

3.3.1 - Offset Adjustment Procedure

Detector or grating offset adjustment is selected via the tabs on the **Offset Adjustment Control**. The following describes the procedure for the detector offset adjustment but the grating offset adjustments are performed in the same manner.

1. If the offset adjustment control is not already displayed press the Display button and select the offset adjustment control. Click the Detector tab on the offset adjustment control.
2. Set a low-pressure mercury (Hg) pen-ray, or Neon (Ne) lamp (or similar) at the entrance slit of the system.
3. Set the entrance slit width to 10microns and input the wavelength of a known and recognisable spectral line into the wavelength control slider. For example the mercury 546.07 or 435.83nm line or the Neon 703.24nm line.
4. Acquire data. The target line should appear close to the centre of the display. Pressing the centre line button on the offset adjustment control will draw a red line on the centre CCD column of the display and serves as a useful aid to offset adjustment (see **figure 16** below).
5. If the spectral line is positioned on the centre line then an adjustment to the detector offset value is not required. If there is a discrepancy between the displayed centre wavelength and the actual wavelength position of the spectral line the offset should be adjusted.
6. Press the appropriate + or - offset adjustment buttons to bring the centre of the spectral line onto the red centre line. The adjustment step size may be selected from a drop down list (right-click either of the keys). It will be found that “zooming” the acquisition display will help the final fine adjustments.
7. When the target spectral line has been centred the procedure is complete. As a rough rule-of-thumb an offset adjustment of approx. 3 units will offset the spectral line by 1 pixel (26 micron wide pixel)

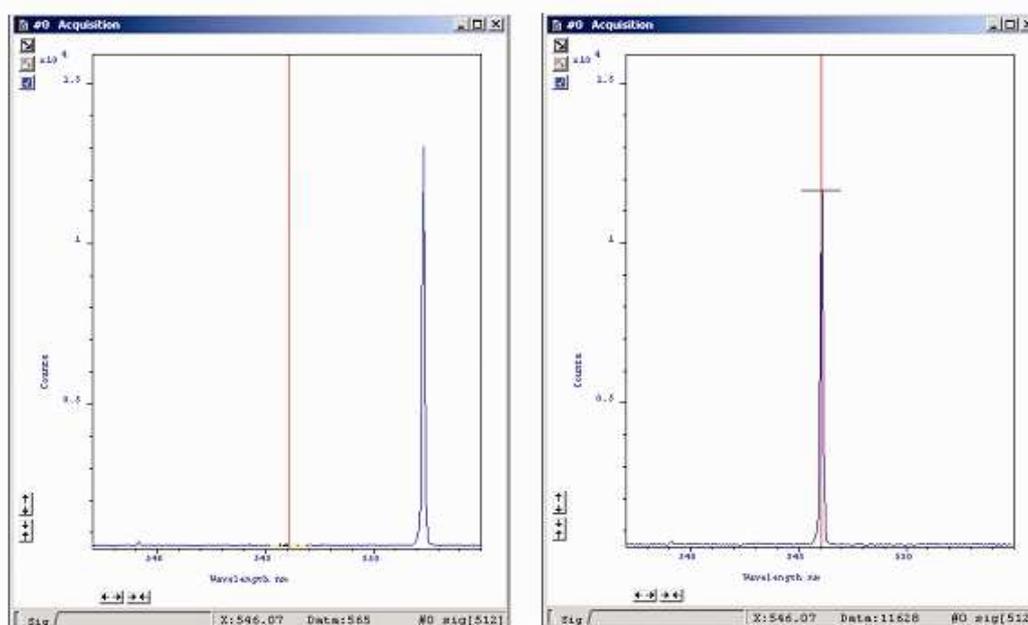


Figure 16: Spectra acquired before (left) & after (right) Detector Offset Adjustment

3.4 - SLIT DRIVE CONTROL

The **Slit Drive Control** (figure 17) is used to control the **Motorised Slit Assembly**. The slits are used to control the amount of incident light that enters the spectrograph. The width can be varied between 10 μ m and 2500 μ m (in steps of 2.5 μ m). The slit height may be altered by interchanging optional baffle plates (attached to the slit assembly using 5x M2 cross-head screws). The system is supplied with a standard 4mm high x 6mm wide rectangular aperture baffle plate but there are also 8mm and 14mm high options available. A 15mm diameter circular aperture is also available. If additional baffle options are required please contact your nearest Andor representative.

In addition to controlling the level of illumination, the slit width also affects the resolution of the acquired data. There is a trade-off between resolution and throughput. The narrower and shorter the slit the higher the achievable resolution, but at the expense of throughput. As a general rule, it is best if the slit width is set as narrow as possible while still achieving the required throughput. If the signal is too weak the slit width should then be increased.

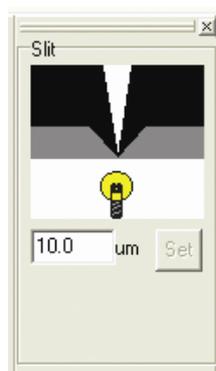


Figure 17: Slit Drive Control

The slit width can be input in a variety of ways:

1. By typing a new value into the slit width edit box and pressing **Enter**
2. By typing a new value into the slit width edit box and clicking the **Set** button
3. Clicking and dragging the edges of the slit in the graphic. Position the cursor over the grey “blade” area of the slit graphic
4. When the cursor changes to a pointing hand, hold down the left mouse button and move the cursor to open, or close, the slit edges. Regardless of which blade you drag, both blades move about the centre of the slit

As you drag the blade the displayed slit width changes to reflect the selected width. The slit drive will drive to the new width value when the mouse button is released.

The minimum and maximum operating values of the motorised slit are 10 and 2500 microns, respectively. If a slit width input is outside of this range the system defaults to the nearest limit value.

The mechanism may be reset via the Reset button and selecting the Reset Slit option. On completion of a ‘reset’ the slit width will default to 10 microns.

3.5 - FILTER WHEEL CONTROL

The optional filter wheel accessory is controlled by the **Filter Wheel Control**:



Figure 18: Filter Wheel Control

The Filter Wheel Control indicates the currently selected filter and provides details of the filter at the bottom of the control. The filter positions and their details are stored in non-volatile memory (**EEPROM**) in the instrument and should be input by the user on first use of the system).

To input, or modify, the details of a particular filter position the mouse cursor on the required filter position. Right-click and a filter details input box will appear. Enter the filter details (up to a maximum of 9 characters) and left-click when complete.

The operation of the filter wheel is very similar to that of the grating turret control. Positioning the cursor over each filter position changes the cursor to a pointing hand and details about the filter are displayed.

NOTE: If the information is not automatically displayed, simply move the cursor out of the filter wheel control box and then back onto the required filter to refresh the information. To change the filter, simply position the mouse cursor on the required filter and left-click. The hardware responds by rotating the filter wheel and the filter wheel graphic in the software control rotates to reflect the change. The accessory may be reset by clicking the  button. On completion of a reset the filter wheel defaults to the FILTER 1 position.

3.6 - SHUTTER CONTROL

If you have a shutter attached to your system the **Shutter Control** can be used to set the shutter mode of operation:



Figure 19: Shutter Control

There are four modes of operation available:

1. **Always Open:** The shutter will be open before, during, and after any data acquisition.
2. **Always Closed:** This option is selected if you wish to take a series of acquisitions in darkness and do not require the shutter to open between acquisitions. You might, for example, wish to capture a sequence of background values. The shutter remains closed before, during and after any data acquisition.
3. **Fully Automatic (AUTO):** This is the simplest shutter mode as it leaves all shuttering decisions to the system. The software controls the shutter based on the information supplied (e.g. TTL pulse polarity, time to open). In this mode the shutter will open during acquisitions but will automatically close during background acquisitions and during the readout of image acquisitions. **NOTE: This mode is not available with the USB interface.**
4. **Custom:** This mode gives you a greater degree of control over the circumstances in which the shutter opens and closes. This mode is designed to cover any specific behaviour you may require that is not covered by the other three modes. In this mode you must use the shutter dialog to configure the shutter to meet your requirements.

To change the shutter mode, simply place the cursor over the shutter and left-click. This toggles the shutter through the four available options and the change is reflected in the shutter graphic. More detailed descriptions of the various shutter mode control options can be found in the manual supplied with your camera.

3.6.1 - Control of Shutter via External TTL Signal

For flexibility, the shutter in the SR-500/SR-750 system may also be operated by an external TTL signal. This allows the shutter to be operated by, and synchronised to, other laboratory equipment. The shutter connector is a standard female BNC type and is located at the front of the spectrograph below the flange mount, e.g.:



Figure 20: External shutter connector

NOTE: For correct shutter operation, via the shutter connector, it is first necessary to ensure that the shutter mode is set to CLOSED in the software interface. Similarly, if the shutter control is returned to the software interface it is necessary to either set the external signal to TTL LOW, or disconnect the cable. Failure to do so will mean that the shutter will remain in the open state and will not open and close as desired.

3.7 - FLIPPER MIRROR CONTROL

The **Flipper Mirror Control** (figure 21) allows you to rapidly select the required exit port. Port 1, or Port 2, is selected by simply clicking on the appropriate port on the Flipper Mirror Control dialog. The selected port is highlighted in yellow and also identified below the graphic.

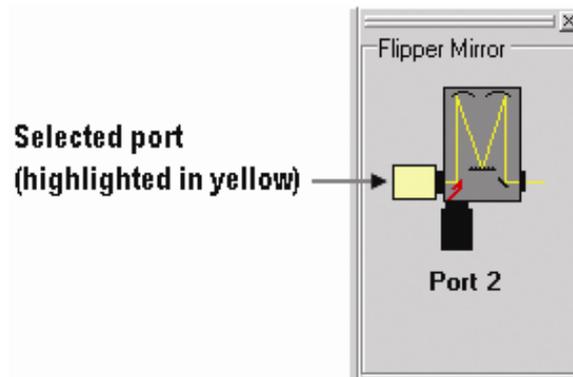


Figure 21: Flipper Mirror Control

NOTE: The Dual Exit Port option is not available as an accessory. It must be specified at time of manufacture (SR-500/SR-750 model # SR-500/SR-750-B).

3.8 - ACCESSORY PORT CONTROL

The **Accessory Port Control** (figure 23) allows for simple control and communication with other electronic devices via the Shamrock SR-500/SR-750 software interface. Two TTL compatible outputs are provided and can be controlled via the Accessory Port Control. The accessory connector is located on the side of the spectrograph.

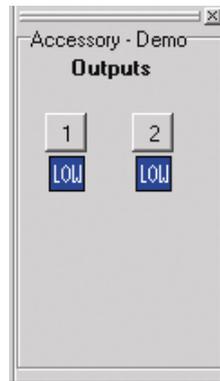


Figure 22: Accessory Port Control

APPENDIX
A1.1 - SR-500 DIMENSIONS

* The optical path height with standard pad feet attached as shown.

** The overall length with a standard Andor iDus DV model attached. The length with an iDus DU model is 750.9mm [29.56"] and with an Andor iStar is 802.6mm [31.6"]

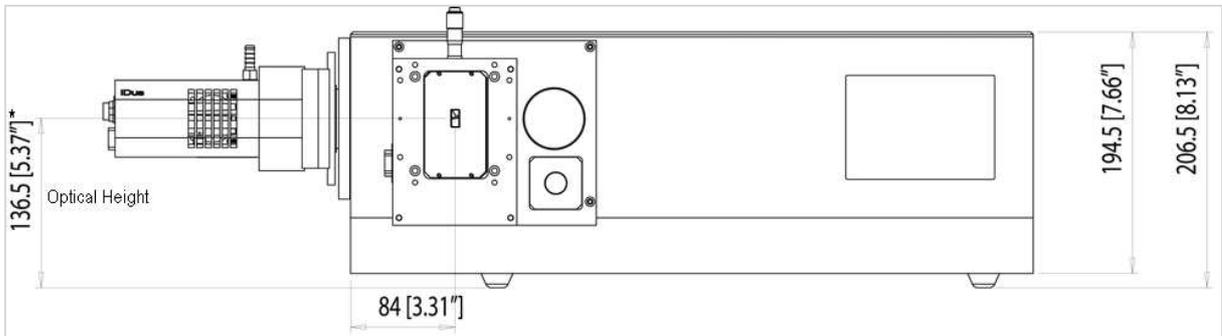


Figure 23: SR-500 side dimensions

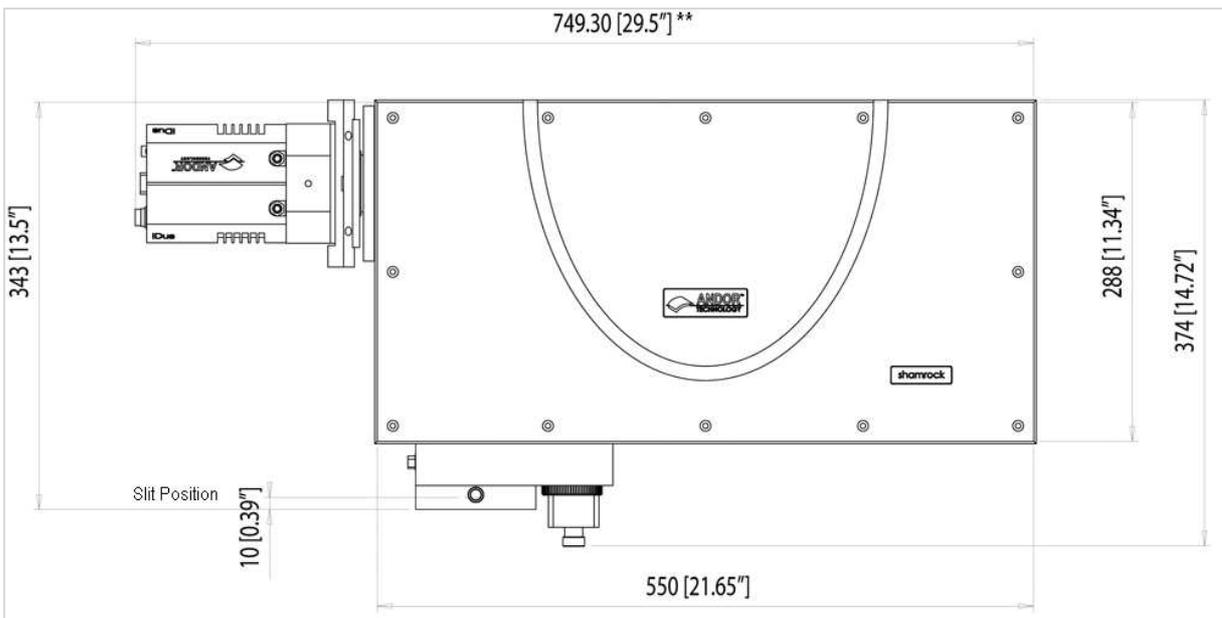
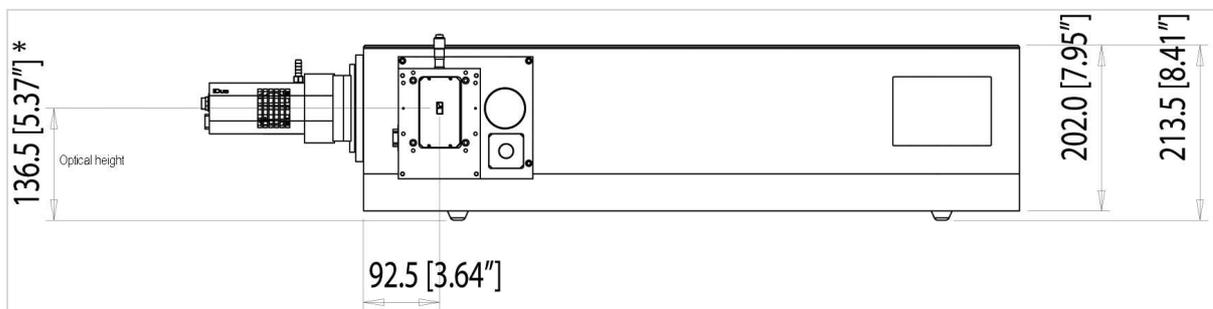


Figure 24: SR-500 plan dimensions

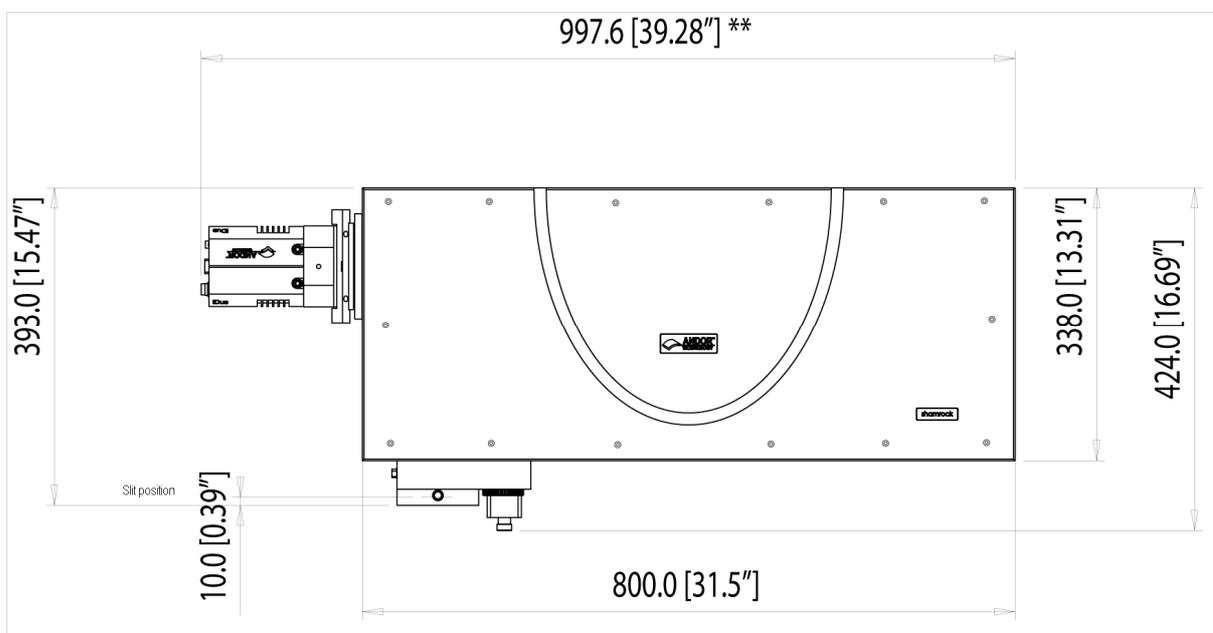
A1.2 - SR-750 DIMENSIONS

* The optical path height with standard pad feet attached as shown.

** The overall length with a standard Andor iDus DV model attached. The length with an iDus DU model is 750.9mm [29.56"] and with an andor iStar is 802.6mm [31.6"]



SR-750 side dimensions



SR-750 plan dimensions

A1.3 - TERMS & CONDITIONS

1. In these Conditions:

'BUYER' means the person who accepts a quotation of the Seller for the sale of the Goods or whose order for the Goods is accepted by the Seller.

'GOODS' means the goods (including any instalment of the goods or any parts for them) which the Seller is to supply in accordance with these Conditions.

'SELLER' means Andor Technology plc.

'CONDITIONS' means the standard terms and conditions of sale set out in this document and (unless the context otherwise requires) includes any special terms and conditions agreed in writing between the Buyer and Seller.

'CONTRACT' means the contract for the purchase and sale of the Goods.

'WRITING' includes telex, cable, facsimile transmission and comparable means of communication.

2. Any reference in these Conditions to any provision of a statute shall be construed as a reference to that provision as amended, re-enacted or extended at the relevant time.

3. The headings in these Conditions are for convenience only and shall not affect their interpretation.

A1.4 - WARRANTIES & LIABILITY

1. Subject to these Conditions set out below, the Seller warrants that the Goods will correspond with their specification at the time of delivery and will be free from defects in material and workmanship for a period of 12 months from the date of delivery.
2. The above warranty is given by the Seller subject to the following conditions:
 - 2.1 the Seller shall be under no liability in respect of any defect in the Goods arising from any drawing, design or specifications supplied by the Buyer;
 - 2.2 the Seller shall be under no liability in respect of any defect arising from fair wear and tear, wilful damage, negligence, abnormal working conditions, failure to follow the Seller's instructions (whether oral or in writing), misuse or alteration or repair of the Goods without the Seller's approval;
 - 2.3 the Seller shall be under no liability under the above warranty (or other warranty, condition or guarantee) if the total price for the Goods has not been paid by the due date for payment;
 - 2.4 the above warranty does not extend to parts, material or equipment not manufactured by the Seller, in respect of which the Buyer shall only be entitled to the benefit of any such warranty or guarantee as is given by the manufacturer to the Seller.
3. Subject as expressly provided in these conditions, and except where the Goods are sold to a person dealing as a consumer (within the meaning of the Unfair Contract Terms Act 1977), all warranties, conditions or other terms implied by statute or common law are excluded to the fullest extent permitted by law.
4. Any claim by the Buyer which is based on any defect in the quality or condition of the Goods or their failure to correspond with specification shall (whether or not delivery is refused by the Buyer) be notified in Writing to the Seller within 7 days from the date of delivery or (where the defect or failure was not apparent on reasonable inspection) discovery of the defect or failure. If delivery is not refused, and the Buyer does not notify the Seller accordingly, the Buyer shall not be entitled to reject the Goods and the Seller shall have no liability for such defect or failure, and the Buyer shall be bound to pay the price as if the Goods had been delivered in accordance with the Contract. In no event shall the Buyer be entitled to reject the Goods on the basis of any defect or failure which is so slight that it would be unreasonable for him to reject them.
5. Where any valid claim in respect of the Goods which is based on any defect in the quality or condition of the Goods or their failure to meet specification is notified to the Seller in accordance with these Conditions, the Seller shall be entitled to replace the Goods (or the part in question) free of charge or, at the Seller's sole discretion, refund to the Buyer the price of the Goods (or a proportionate part of the price), but the Seller shall have no further liability to the Buyer.

6. Except in respect of death or personal injury caused by the Seller's negligence, the Seller shall not be liable to the Buyer by reason of any representation (unless fraudulent), or any implied warranty, condition or other term, or any duty at common law, or under the express terms of the Contract, for any indirect, special or consequential loss or damage (whether for loss of profit or otherwise), costs, expenses or other claims for compensation whatsoever (whether caused by the negligence of the Seller, its employees or against otherwise) which arise out of or in connection with the supply of the Goods, or their use or resale by the Buyer and the entire liability of the Seller under or in connection with the Contract shall not exceed the price of the goods, except as expressly provided in these Conditions.

7. The Seller shall not be liable to the Buyer or be deemed to be in breach of the Contract by reason of any delay in performing, or any failure to perform, any of the Seller's obligations in relation to the goods, if the delay or failure was due to any cause beyond the Seller's reasonable control. Without prejudice to the generality of the foregoing, the following shall be regarded as causes beyond the Seller's reasonable control:

7.1 Act of God, explosion, flood, tempest, fire or accident;

7.2 war or threat of war, sabotage, insurrection, civil disturbance or requisition;

7.3 acts, restrictions, regulations, bye-laws, prohibitions or measures of any kind on the part of any governmental, parliamentary or local authority;

7.4 import or export regulations or embargoes;

7.5 strikes, lock-outs or other industrial actions or trade disputes (whether involving employees of the Seller or of third party);

7.6 difficulties in obtaining raw materials, labour, fuel, parts or machinery;

7.7 power failure or breakdown in machinery.