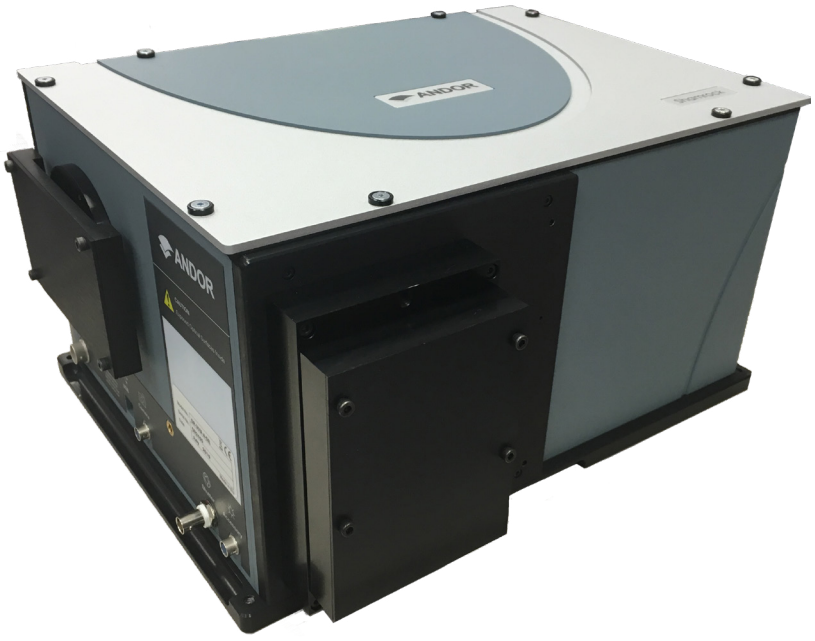
ANDOR
an Oxford Instruments company

Shamrock 303i

Version 4.2 revised 15 October 2024



User Guide

Covers Shamrock model: 303i

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Revision History

Version	Released	Description
4.0	11 Oct 2016	Content prepared from, and replacing previous Shamrock 303i User Guide Version 3.0 Aug 2008. Updated content in line with the machinery directive 2006/42/EC (all Sections) Presentation and manual structure updated to current company format (All sections) Revision History added Added link to Customer Support page on Website (Sections 1.1 and 5) Added extra images of product and software to improve descriptions (all Sections) New Packing List added (Section 1.5) Removed reference to changing EEPROM Settings using CD (Section 3.2.4) Updated Grating Replacement procedure (Section 3.4) Further detail added to the Grating Adjustment procedure (Section 3.5.1) Added Cross References (all Sections) Added warning symbols to highlight warning text (all Sections) Updated dimensions and mechanical drawings (Section 7 & Appendix A)
4.1	20 Dec 2016	Corrected USB connection instructions (Section 3.2.1)
4.2	15 Oct 2024	Added AI translation Disclaimer (Section 1.2)

Safety and Warning Information

PLEASE READ THIS INFORMATION FIRST

1. If the equipment is used in a manner not specified by Andor, the protection provided by the equipment may be impaired.

CAUTION – USE OF CONTROLS OR ADJUSTMENTS OR PERFORMANCE OF PROCEDURES OTHER THAN THOSE SPECIFIED HEREIN MAY RESULT IN HAZARDOUS RADIATION EXPOSURE.

2. Do not position this product so that it is difficult to operate the Mains disconnecting device. See “Emergency Mains Disconnection” on page 33.
3. Before using the system, please follow and adhere to all warnings, safety, manual handling and operating instructions located either on the product or in this manual.
4. Keep this manual in a safe place for future reference.
5. Users must be authorised and trained personnel only; otherwise this may result in personal injury, and/ or equipment damage and impaired system performance.
6. There are no user-serviceable parts inside the product beyond those specified in the defined user accessible areas. Only authorised service personnel may service this equipment.
7. This equipment has not been designed and manufactured for the medical diagnosis of patients.
8. Protective earth is an integral part of the protection against electric shock in this product, and is provided via the earth pin of the external power supply. Ensure that this is plugged into the building earth system via the mains socket. Do not tamper with any of the earthing measures.
9. Always disconnect the power supply from the product in the event that the top or bottom panels must be removed- for example, accessing the grating turret or electronics.
10. Only the correctly specified mains supply should be used.
11. Only the AC/DC external power supply provided with the product should be used.
12. Only the power supply cord provided with the product should be used. Should this not be correct for your geographical area, contact your local Andor representative.
13. Make sure the power supply cord is located so that it will not be subject to damage. If replacement of the detachable power supply cord is required, ensure replacement is of same type and rating.
14. While running an experiment, keep room temperature as stable as possible.
15. Performance of the system may be adversely affected by rapidly changing environmental conditions or operation outside of the operating conditions specified in “SPECIFICATIONS” on page 55.
16. Electromagnetic Compatibility: This is a Class A product. In a domestic environment this product may cause electromagnetic interference, in which case the user may be required to take adequate measures.
17. This product has been designed and tested to perform successfully in a normal (basic) electromagnetic environment, e.g. a typical life science test laboratory, as per the EU EMC Directive. It is not designed to operate in a harsh electromagnetic environment, e.g. close to the following equipment: EMI/RFI generators, electrostatic field generators, electromagnetic or radioactive devices, plasma sources, arc welders, x-ray instruments, intense pulsed sources, or other similar sources of high energy fields whose emissions are not within the normal range expected under the EU EMC Directive.

18. Please note that this product is not designed to provide protection from ionising radiation. Any customer using this product in such an application should provide their own protection.
19. Your product is a precision scientific instrument containing fragile components. Always handle it with care.
20. Do not use with intense light sources, e.g. lasers that could damage the optical coatings.
21. If purging, use a dry inert gas e.g. N_2
22. Take appropriate measures to avoid spills and do not store or place liquids on the product.
23. If spillage occurs on the product, switch off power immediately, and wipe off with a dry, lint-free cloth.
24. If any ingress of liquids has occurred or is suspected, unplug the mains cables, do not use, and contact Andor Customer Support for further instruction.
25. The Shamrock does not have specific ventilation requirements, if used within the stated operational temperature range. However, accessories such as cameras and other accessories used with the spectrograph may require a defined space to enable adequate ventilation.
26. Do not expose the product to extreme hot or cold temperatures.
27. Do not expose the product to open flames.
28. Do not allow objects to fall on the product.
29. See “MAINTENANCE” on page 53 for cleaning and decontamination information.

Safety Symbols

The following are explanations of the safety symbols found on this product:

Caution, potential hazard

Caution Sharp

Caution, risk of electric shock

Regulatory Information

- The Shamrock spectrograph series complies with the requirements of the EU Electromagnetic Compatibility and Low Voltage Directives, specifically by satisfying the requirements of EN61326-1 and EN61010-1.
- This product complies with the Machinery Directive 2006/42/EC.
- This product requires a DC power supply.

Shipping and Storage Precautions

- Product must be kept dry and free from condensation, <70% humidity, non-condensing.
- Storage temperature range: -25°C to +50°C.
- Do not stack heavy objects on top of the product- observe any warning symbols displayed on the packaging.
- Retain packaging in case it is necessary to return equipment for servicing.
- If the equipment appears damaged in any way upon receipt, please contact customer support for further instruction.

Operational Precautions

- Product must be kept dry and free from condensation, <70% humidity, non-condensing.
- Operating Temperature: 0°C to 30°C ambient.

Unpacking the Shamrock and Manual Handling

IMPORTANT PRECAUTIONARY NOTICE:

Correct manual handling techniques are important when installing Shamrock spectrographs so the integrity of the products is maintained and individuals involved are not exposed to unnecessary risks or possible injury, whilst performing any of the following actions:

- Lifting a load which is too heavy
- Poor posture or technique during lifting
- Dropping the device during transfer
- Lifting objects with sharp edges

Due to the delicate nature of some of the components within, and overall weight (~20 kg) care must be exercised when unpacking/relocating the spectrograph.

The Shamrock 303i is a precision instrument that will perform at its best when set up and operated properly:

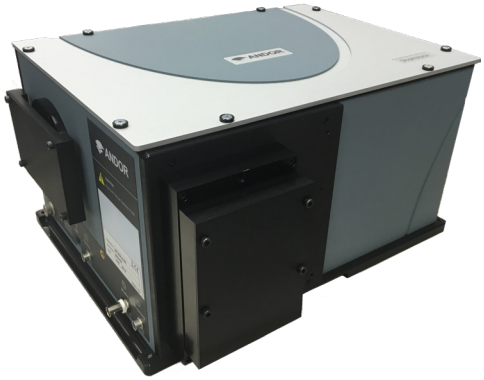
- Open the shipping box and allow it to fully acclimatise to room temperature.
- Ensure there is an appropriate space available to manoeuvre and put the spectrograph in place.
- Remove any accessories which may be in the top section of the box and store them in a safe location for later use.
- Lift the spectrograph out of the shipping box carefully and place on a suitable surface.
- Remove the protective packaging from around the spectrograph.
- Check the contents are as per the Packing List (see “PACKING LIST” on page 13) and they are as specified at the time of ordering.
- Your spectrograph is now ready to be set up and prepared for use. Refer to “INSTALLATION” on page 18.

SECTION 1: INTRODUCTION

Thank you for choosing an Andor Shamrock spectrograph. Please read this manual and information supplied with any other system components and software before using your Shamrock spectrograph.

This manual covers the following models:

1. **Shamrock 303i**



The Shamrock 303i is available in two configurations:

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

Your Shamrock comes with a range of features including:

- A USB 2.0 interface giving the user the benefit of “plug-and-play” convenience
- Software functionality is described in the integrated help function of **Solis for Spectroscopy** Software and in the **SDK** software guide.
- An intuitive graphical user interface (dashboard) giving the user complete control over the spectrograph functionality (Solis only) including wavelength control and calibration, grating selection, shutter control, motorised slit control and filter selection.
- Compatibility with many accessories including optical fibres and inputs, motorised filter wheel, and camera adaptors. Please refer to MyAndor for further information.

1.1 Technical Support

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

Europe

Andor Technology Ltd.

7 Millennium Way

Springvale Business Park

Belfast

BT12 7AL

Northern Ireland

Tel. +44 (0) 28 9023 7126

Fax. +44 (0) 28 9031 0792

www.andor.com/contact_us/support_request

USA

Andor Technology

425 Sullivan Avenue

Suite # 3

South Windsor

CT 06074

USA

Tel. +1 (860) 290-9211

Fax. +1 (860) 290-9566

www.andor.com/contact_us/support_request

Asia-Pacific

Andor Technology (Japan)

IS Building

3-32-42 Higashi-Shinagawa

Shinagawa-ku,

Tokyo 140-0002

Japan

Tel: +81-3-6732-8968

Fax: +81-3-6732-8939

www.andor.com/contact_us/support_request

China

Andor Technology

Unit 1, Building A,

66 Zhufang Rd, Haidian Dist.

Beijing 100085

China

Tel: +86 (0)10 8271 9066

Fax. +86(0)10 8271 9055

www.andor.com/contact_us/support_requestt

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

Technical Notes and further product support information including video tutorials are available from the Andor Product Support page.

1.2 Disclaimer

THE INFORMATION CONTAINED HEREIN IS PROVIDED “AS IS” WITHOUT WARRANTY, CONDITION OR REPRESENTATION OF ANY KIND, EITHER EXPRESS, IMPLIED, STATUTORY OR OTHERWISE, INCLUDING BUT NOT LIMITED TO, ANY WARRANTY OF MERCHANTABILITY, NON-INFRINGEMENT OR FITNESS FOR A PARTICULAR PURPOSE.

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PLEASE NOTE, AI TRANSLATIONS OF THIS USER MANUAL MAY RESULT IN INCORRECT INFORMATION. IN THE EVENT OF A CONFLICT WITH A FOREIGN LANGUAGE TRANSLATION, ANDOR’S ENGLISH TRANSLATION WILL PREVAIL.

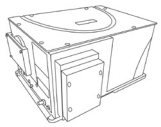
1.3 Copyright and Protective Notices

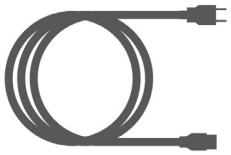
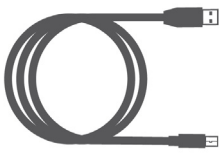
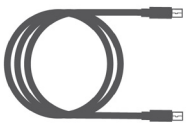
1.4 Trademarks and Patent Information

Changes are periodically made to the product and these will be incorporated into new editions of the manual. New releases of the manual are available through MyAndor. If you find a mistake in this manual, or have a suggestion for improvements, please inform your customer support representative.

1.5 PACKING LIST

After having removed the spectrograph from its packaging, confirm that the following standard items are included:

Item	Quantity	
Shamrock Spectrograph Model 303i	1	

Description		Quantity
	Power Supply Unit (PSU)	1
	Power Cable (3 m)	1
	USB 2.0 cable Type A to Type B (3 m)	1
	User Guide- included on Product Manuals CD	1
	SR-303i-B model only: Flipper Mirror Document and M2 T-bar.	1
	I²C cable	1

Description		Quantity
	System performance booklet	1
	Allen key set	1
	Certificate of Conformity (included on Product Manuals CD)	-
	Spectrograph Interface software	1*
	Filter insertion/ removal tool (if filter wheel has been installed).	1

* Software must be specified and ordered separately at time of ordering

1.5.1 Optional Accessories

Depending on the Shamrock model and options purchased, the following optional accessories may also be included:

- Detector flange(s) for output port(s).
- Grating turret(s): The main grating turret may already be installed in the spectrograph.
- 1x CD containing either Solis software or SDK (if requested at time of order).
- Light-coupling interfaces: Accessories such as shutter, filter wheel, and motorised slits may already been installed on the spectrograph prior to shipping if they have been specified.
- Detector(s).
- Purpose-built accessories as ordered through Andor's Customer Special Request (CSR) programme.

If any of the items you ordered are missing or for further information on any of the accessories available for the Shamrock series, please contact your local representative.

1.6 Accessories for the Shamrock Series

A wide range of accessories are available to upgrade your Shamrock spectrograph to suit various applications. For further information on any of the accessories, refer to MyAndor or contact your local representative.

SECTION 2: PRODUCT OVERVIEW

The Shamrock 303i imaging spectrograph is a research-grade, high performance, flexible and rugged platform designed for use in demanding low-light applications, but equally suited to routine measurements. Shamrock spectrographs are compatible with a wide range of Andor detectors, as well as those from other manufacturers. This section provides an overview of the main external features and the signal and power connections.

2.1 External Features and Model Options

2.1.1 The Shamrock 303i

The main external features of the Shamrock 303i are shown below. Features will vary depending on model type (see table below).

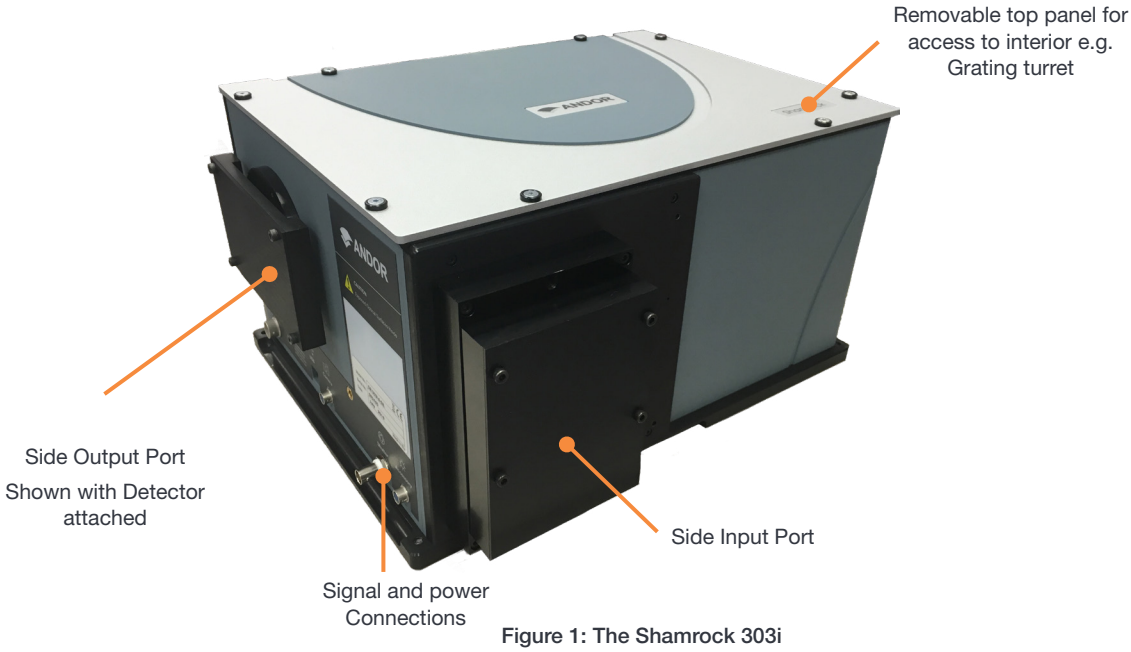


Figure 1: The Shamrock 303i

Model	Side input port	Side output port	Motorised flipper mirror
SR-303i-A	Manual slit	-	-
SR-303i-B	Motorised slit	Camera (standard) Optional motorised slit	√
SR-303i-X-SIL	Protected silver coated optics options for models shown above (replace X with relevant model number)		

2.2 Signal and Power Connections

2.2.1 Front Panel

The connections on the front panel of the Shamrock 303i are shown below:

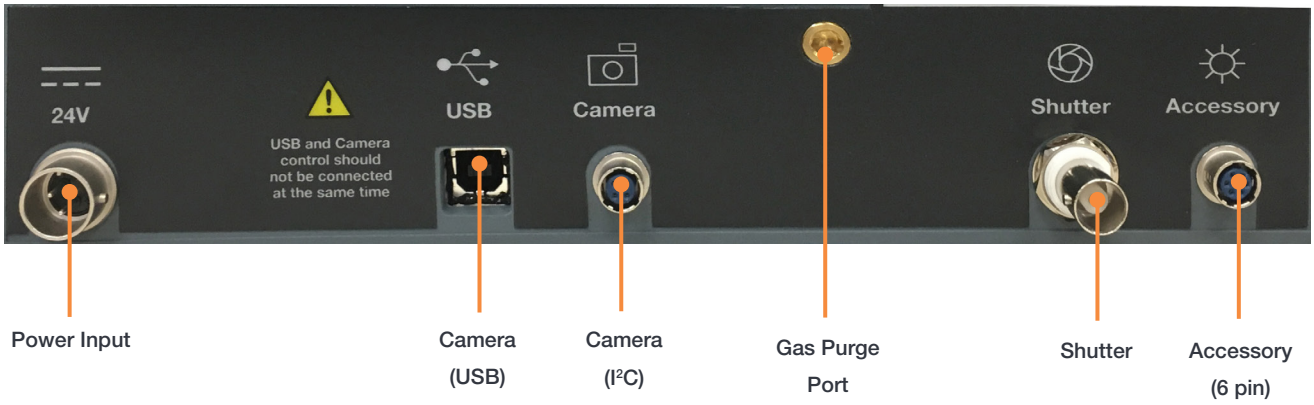
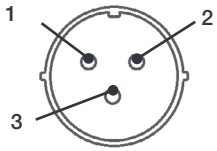


Figure 2: Front Panel Connections

Power Input (24V DC)

Power input connection (3-pin) from the external power supply unit.



Pin 1: Not used
Pin 2: 24 V 3.3 A DC
Pin 3: Neutral

USB

USB (2.0) connection allowing control of the spectrograph through the PC.

Camera

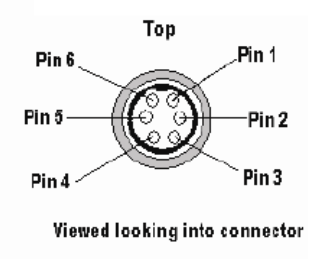
I²C interface for supported Andor cameras, providing a simplified and faster communication with the Shamrock 303i. The cable is supplied with compatible cameras; if you are missing the cable, or require a replacement, please contact Product Support. Note: Connector Hirose part # HR10-7P-4P type: 1 = I²C data, 2 = I²C clock, 3 = Earth, 4 = Shutter TTL, 5 = 5 V.

Shutter

The shutter may also be operated by an external TTL signal (BNC, 50 Ω). This allows the shutter to be operated by, and synchronised to, other laboratory equipment.

Accessory

6 pin I/O connection for connection to other devices e.g. filter wheel. Suitable connector: Hirose part # HR10-7P-6P.



6-Way Accessory Connector	
Pin 1	Ground
Pin 2	O/P 1
Pin 3	O/P 2
Pin 4	Auto-sense
Pin 5	24, 12, 5V selectable (Jumper 1)
Pin 6	24, 12, 5V selectable (Jumper 2)

IMPORTANT NOTE: The output voltages are intended for attachment of Andor designed accessories. Other devices should only be connected with caution. Maximum current values are 24V@200mA, 12V@100mA and 5V@100mA. Failure to observe these limits may damage the system. For information on voltage selection using the jumpers, please contact your local Andor representative for further information.

2.3 Gas Purge Port

Absorption in air (mainly by water vapour) may decrease useful signal on measurements in the UV or IR regions. To mitigate this, the Shamrock 303i has a gas purge port. To use the gas purge port the protective plug should be replaced by a 1/8" NPT barb hose connector. The use of hose made of black material is strongly recommended to avoid light leaks to the spectrograph. An inert gas, such as nitrogen or argon, should be used (certified as being dry, to scientific research standards) to maintain a slow steady flow of the gas into the Shamrock 303i. The connection type is 1/8" NPT.

2.4 Power Supply

The Shamrock series are powered by external PSUs- requirements for the Shamrock 303i are shown in the table below.

Parameter	Specification
Mains Power Supply Requirements	100 - 240 VAC, 47 - 63 Hz
PSU Output	24 VDC, 3.3 A Max
Power Connector Type	3-pin

NOTES:

1. The electrical mains lead should be certified for use in your country and in applicable countries the plug must be fitted with a 240V 5A fuse.
2. If users use any other power supply, they do so at their own risk.
3. The Shamrock series of spectrographs is for use with Telecommunications, Computer, Industrial Controller, and OA Systems and must only be used indoors.
4. Shamrock spectrographs require a Direct Current (DC) supply.

SECTION 3: INSTALLATION

3.1 An Overview for Setting up your Shamrock Spectrograph

After you have removed the spectrograph from the box and checked all components against the packing list and they are as ordered, please follow the instruction below to prepare your spectrograph for use. An overview of the main steps is shown below:

1. Installing the software (Solis for Spectroscopy or SDK).
2. Connecting the power and USB cables to spectrograph and computer.
3. Attaching camera(s) to spectrograph output port(s) - if applicable.
4. Connecting the camera data and power interface, e.g. USB or I^2C, and power supply (some cameras may require a PCI card. If this is applicable, refer to the relevant manual for instruction on how to install the PCI card into your computer).
5. Turning the system on.
6. Installing the spectrograph and detector drivers.

Once these steps are completed, your spectrograph is ready for use.

3.1.1 Installing the Software (Solis Spectroscopy/SDK)

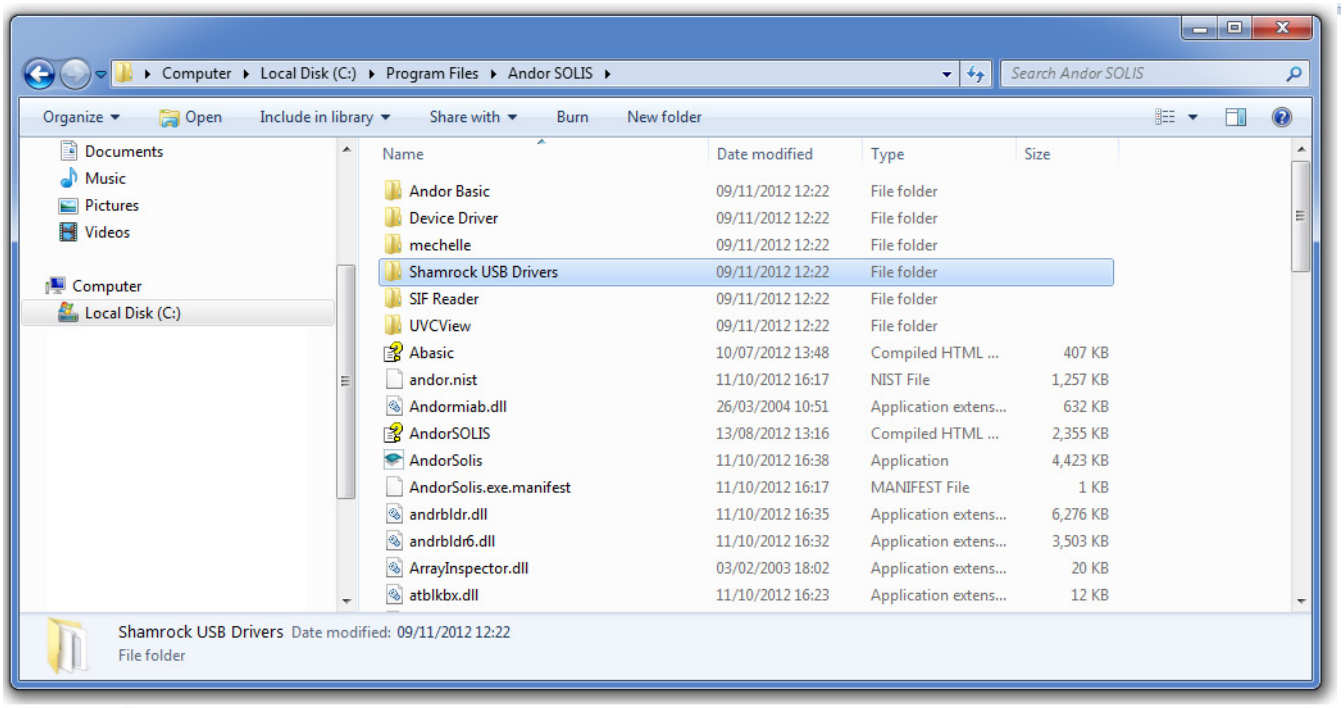
These guidelines provide a general overview; please refer to the software installation information supplied with your software.

1. Terminate and exit any programmes which are running on the PC.
2. Insert the Andor CD. The InstallShield Wizard should now start. If it does not start automatically, run the file setup.exe directly from the CD and follow the on-screen prompts that will guide you through the install process.
3. At the camera selection step, tick the required camera being used e.g. Andor iStar.
4. At the file save location accept the default location or alternatively click on Browse… and choose your own file destination.
5. Follow the installation steps to completion, the progress is shown in the update progress bar.

   Note in some cases you may need to restart the PC e.g. if the camera requires a PCI card.
6. The Solis icon should now be installed on your desktop. Click on this to start the application.

3.1.2 Software and Driver Installation

When the Andor Solis software is installed, the drivers for the Shamrock should be found in the Shamrock USB Drivers folder. This is shown in the example below:



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

1. After the power and USB cables have been plugged in as described in **"Connecting the Shamrock to the Power Supply and PC" on page 21**, switch the power on to the spectrograph.
2. The Found New Hardware Wizard appears.

   NOTE: If this 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.

The found New Hardware Wizard will now appear.

3. When the dialog box is active, select the "No, not this time" option.
4. Click **Next>.**
5. Select the **Install** from a **list or specific location (Advanced)** option then click **Next>**.
6. Select the **Don't search. I will choose the driver to install** option then click **Next>**.
7. Proceed through the remaining prompts.
8. Click **Finish** to complete the installation.

3.1.3 Connecting the Shamrock to the Power Supply and PC

1. Ensure that the power to the spectrograph PSU is turned off.
2. Connect the power cable to the power supply input of the spectrograph.
3. Connect the USB cable between the USB input of the spectrograph and an available USB connection on the PC.
4. Plug in the power supply to the mains, but do not switch the power on.

Figure 3: Connecting the power and USB cables to the spectrograph

3.2 Attaching a Camera to the Shamrock

If the spectrograph is not supplied with a camera/detector pre-attached, refer to the guidelines below and also the user or installation guide(s) provided with your camera/detector.

1. Remove the blanking plate from the spectrograph (4x M3 cap head screws, using a M2.5 allen key).
2. Hold the camera horizontally, locate it on the flange and replace the screws- do not tighten fully.
3. Open spectrograph lid, slightly loosen the flange clamp screw inside of the spectrograph body
4. Ensure the camera is free to rotate.
5. The camera is now ready for electrical connection (see Section **3.2.1 on page 23**).

   NOTE: This will differ depending on the type of camera being used.

3.2.1 Camera Signal and Power Connections

The following instructions provide a simple overview of the connections required. Camera and power connections will vary with your specific model of camera- refer to your camera user manual for additional information.

For Connection by USB

1. Connect the USB cable between the USB connection on the Shamrock and a free USB socket on the PC.

For Connection by I^2C

1. Connect the I^2C cable between the I^2C connection on the camera and the other end to the I^2C connection on the Shamrock.

Connecting the Camera to the Power Supply

1. Connect the power cable between the camera and the power supply unit (PSU).
2. Connect the power supply to the mains supply.

3.2.2 Standalone Spectrograph

Where a “standalone” spectrograph (i.e. without an Andor camera) has been purchased, the unit is supplied with an appropriate camera flange to allow a 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.

In this instance, the focusing tube will not be 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 Shamrock spectrograph 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 Shamrock on and move the spectrograph to a known spectral line wavelength (e.g. Mercury 435.8 nm or the Neon 585.2 nm line).
4. Loosen the tube and clamp screw.
5. Acquire data using the camera and check the image of the light source, or alternatively, the line intensity and shape. Slowly move the tube and camera assembly until the sharpest image is achieved. It is then necessary to rotate the camera for best alignment, by loosening the screws in the flange and rotate the camera.
6. When complete re-tighten the clamping screw, please refer to **“Offset Adjustment Control” on page 42** for details of how to adjust the calibration of the system to the fitted camera.

3.2.3 Pre-aligned Camera and Spectrograph

When a pre-aligned camera and spectrograph package has been purchased the camera comes pre-fitted with a flange. This flange accurately locates the camera and flange assembly to the spectrograph body via precision pins and matching bushings (see figure below). The camera and flange assembly can be easily be removed and re-attached without the need for additional calibration, or readjustments.

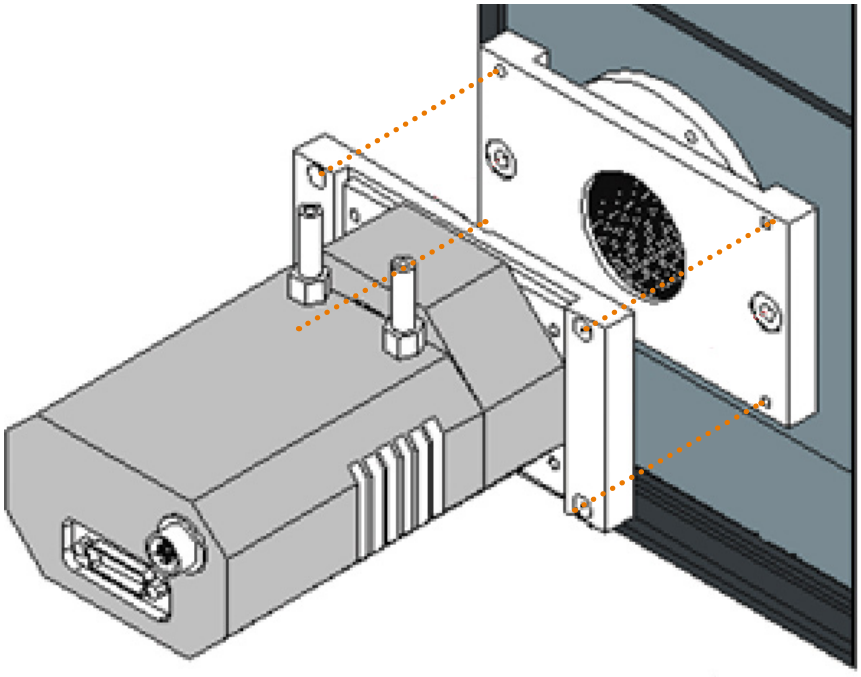


Figure 4: Attaching a Pre-aligned Camera and Shamrock Spectrograph

3.2.3.1 Attaching the camera

1. Insert the alignment pins into the relevant locators.
2. Secure the four M4x12 mm screws using a 3 mm Allen key.
3. Once connected, no further adjustment is necessary as the unit is aligned and calibrated at the factory.

3.3 Installation of Filters (if applicable)

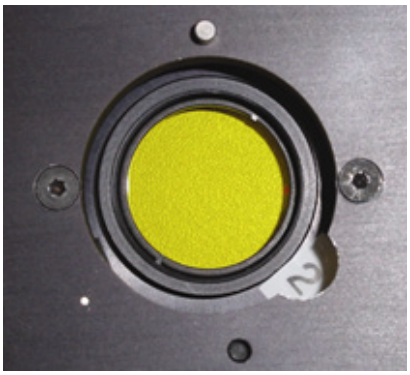
Filters may be added, removed or replaced in the filter wheel via the filter access hole on the front face of the filter wheel housing. If this is necessary, please refer to the following procedures:

3.3.1 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 gently pulling it with the handle.

2. The filter is held in place by a retaining ring. To remove the filter retaining ring, use the supplied filter insertion/removal tool.



NOTE: The filter position accessible via the access hole has an ID number 2 less than the filter position in the optical path:

Desired filter position	1	2	3	4	5	6
Filter position to select in software	3	4	5	6	1	2

3. Using the software select the filter position needed to bring the required filter position into place as shown in the table above e.g. if you need to access filter position 4, you would select position 6 in the software.
4. Install the filter and use the filter insertion/removal tool to secure it in place.

3.3.2 Initializing the Filter Wheel

After fitting, or replacing filters, it is good practice to synchronise the filter wheel hardware with the software interface.

To re-initialise the filter wheel, press the reset button on the filter wheel control graphic.

3.3.3 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.

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 reset 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** 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 42** for further details of this function.

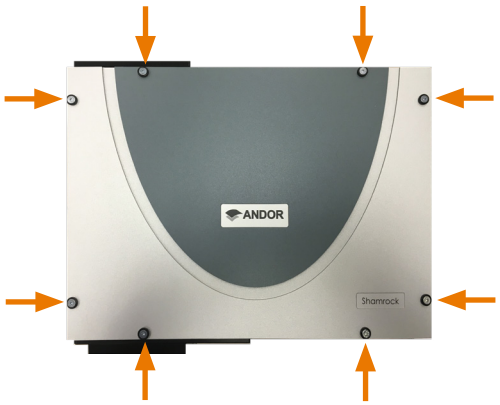
3.4 Grating Turret Replacement

The grating turret contained within the Shamrock spectrographs can be easily replaced by end-users. The procedure for replacing the Grating turret is outlined below:

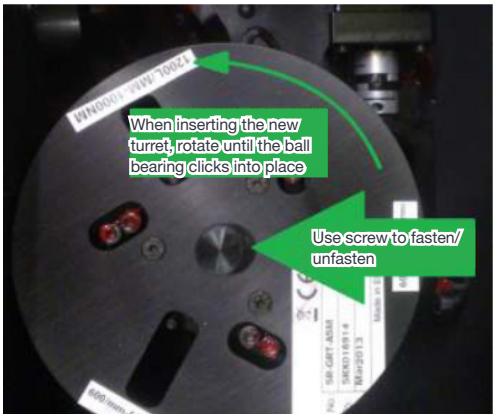
WARNINGS:

- **ENSURE THE SPECTROGRAPH IS SWITCHED OFF BEFORE REMOVING THE LID**
- **BE CAREFUL WHEN WORKING WITH THE SPECTROGRAPH WITH THE LID REMOVED AS OPTICAL AND ELECTRONIC PARTS MAY EASILY BE DAMAGED.**
- **OBSERVE APPROPRIATE ESD PRECAUTIONS**
- **ONLY REMOVE THE LID FOR THE PURPOSE OF GRATING TURRET REPLACEMENT OR OTHER PROCEDURES AS INSTRUCTED BY ANDOR, ENSURING THAT THE LID IS PUT BACK IN PLACE AFTERWARDS.**

1. Remove the lid of spectrograph (8x allen head screws).

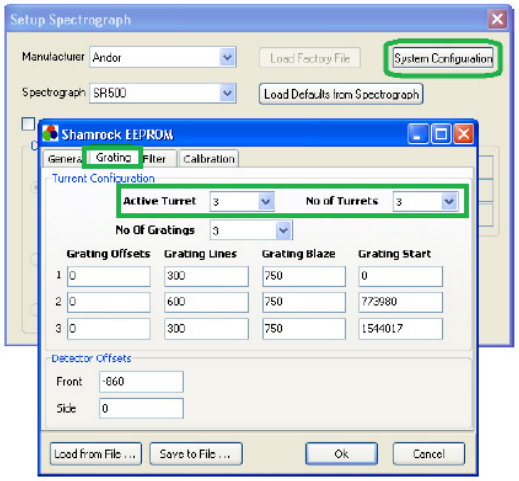


2. This will expose the grating turret.
3. At this point, put on protective gloves before continuing.



4. Loosen the screw at the top of the grating turret ,then carefully remove the turret using a twisting motion.
5. The grating should be stored in a safe place- for example in the packaging of the newly installed turret.
6. Lower the new grating turret gently into position so that the ball bearing clicks into the groove.

7. Ensure the turret is correctly in position then carefully tighten the top screw.
8. When you are satisfied that the grating turret is installed correctly, replace the lid.
9. Navigate to the EEPROM settings (Hardware/Setup Spectrograph).
10. Click on the “System Configuration” and select the new turret.
11. Now enter the grating and blaze values for the new turret as shown below.



Entering the new turret values

- Enter values for:
  - No of gratings
  - Grating lines/mm
  - Grating blaze (nm)
- **Grating Start** should be left with the default values.
- When complete select the **Active Turret** (turret number you wish to use)
- Click “OK” when finished.

3.5 Installation of Accessory Parts

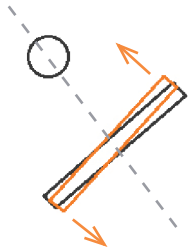
PLEASE CONTACT CUSTOMER SUPPORT FOR INFORMATION AND GUIDANCE ON THE INSTALLATION OF ACCESSORY PARTS.

3.5.1 Grating Adjustment

Grating fine adjustment may become necessary after your Shamrock has been shipped, or otherwise moved. Whilst every effort is made to limit the shifting of optical components during shipment, it is possible that some misalignment may occur. Even a very small change in tilt of 0.03° will cause a significant image shift of 10 x 26 µm pixels on an iDus sensor. Once your spectrograph is securely located no further adjustment will be necessary. The following terminology is used:

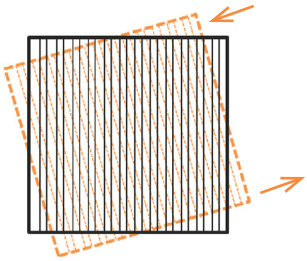
Yaw: This is movement of the grating rotating about a vertical axis through its centre – illustrated, right, which affects where the grating zero position lies. The zero position of each grating may change by a small amount during shipping, but this is accounted for using the grating offset utility in the Shamrock control panel and therefore physical adjustment of yaw is not necessary.

Top down view of turret



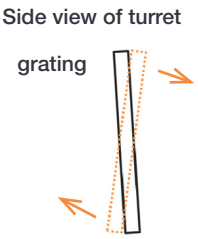
Roll: This affects how perpendicular the grating grooves are to the system's horizontal axis. The groves should always be vertical; if they are not, different wavelengths will fall at different heights on the sensor. Typically, roll does not need to be adjusted after moving your spectrograph.

Side view of turret



Tilt: Tilt is the parameter most likely to need adjustment after shipping/moving your spectrograph. A fibre centred at the middle of the entrance slit should produce an image at the vertical middle of your detector. It is sometimes found that the 3 gratings on a turret produce images at 3 different heights. The tolerance required depends on your experimental setup, but during Andor quality control tests the adjustment is made to ±5 pixels (26 µm pixels).

Side view of turret

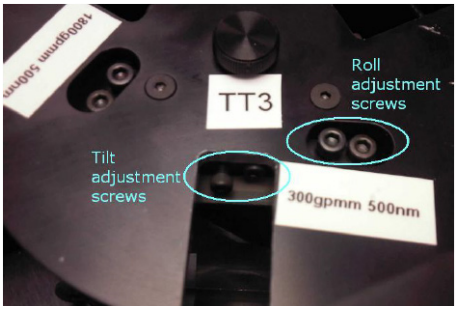


3.5.1.1 Correcting for Yaw

Grating adjustment for yaw is corrected for in the software, using the offset adjustment. No manual adjustment is required.

3.5.1.2 Correcting for Roll and Tilt

Screws are used for Roll and Tilt correction adjustment as shown below:

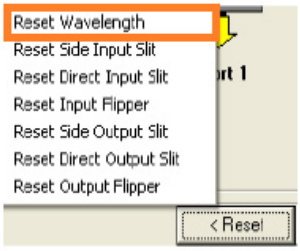


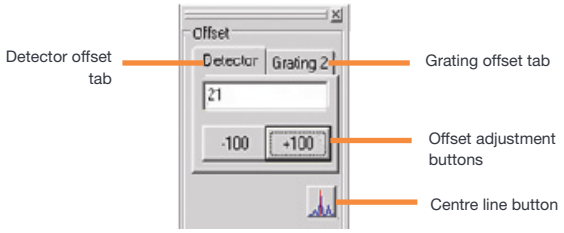
There are two pairs of adjustment screws for **Roll**, and for **Tilt** (shown above). Each pair of screws work in opposition to each other, therefore for adjustment one should be loosened, then the other tightened. When you are happy with the grating position they should be gently tightened against each other and the final position re-confirmed. When one screw is tightened the other may become loose, so it is best to go back and forth incrementally tightening them both.

Grating adjustment is an iterative process, and can be done with just a slit and any light source, such as a weak laser – but ideally is performed using a fibre input and a calibration light source. It is best to check the roll before the tilt (because adjusting the roll may affect the tilt.

The adjustment procedure is as follows:

1. Reset the wavelength drive (shown below) and set the wavelength drive to the 'zero' order position.





2. Acquire an image in real-time mode showing a non-saturated image of fibre optic onto the sensor. If your system has a shutter, set it to 'Auto' to acquire an image with no smearing during readout.
3. Use the offset adjustment on the Shamrock real-time control bar to move the image to the approximate horizontal centre of the sensor, and make a note of the height (see image above).
4. Move to a wavelength, λ, at a higher grating angle. The control panel wavelength slider will show a red mark for the maximum operating angle of 60°. For the best roll adjustment accuracy, move to an angle that is greater than half this wavelength e.g. 400 nm is the maximum attainable wavelength for 800 nm, for a given grating. With low density gratings you may need to use higher orders of calibration wavelengths, e.g. when using a 300 gpmm grating you may wish λ to be the 8th order of the 546 nm mercury line (appearing at 4368 nm), which is a grating angle of 42°.
5. If the fibre image is at the same height in the centre of the detector at the zero order and at the high wavelength, then you do not need to make any adjustment to your grating.
6. Otherwise, remove the top plate, familiarise yourself with the adjustment screws on the grating, and if possible, reduce your room lighting and use a cloth over the opening to help with the real-time adjustment of the grating assembly while the camera is acquiring.
7. If the fibre image height changes between the zero order and the high wavelength, then you need to adjust the roll of the grating. Only make tiny adjustments with the push-pull screws before moving between 0 nm and λ nm to check the effect. If the image is higher at λ than at the zero order, then loosen the inner push screw and tighten the outer pull screw.
8. When the roll of the grating is satisfactory, adjust the tilt of the grating to centre the image vertically on the sensor. If the image is too high, then loosen the pull screw (right of the 2 screws) and tighten the push screw (left of the 2 screws).
9. Repeat for other gratings on the turret.

If you experience any difficulty with this procedure, please contact your local Andor Representative.

SECTION 4: OPERATION

The Shamrock is controlled via the **Dashboard** control. This easy-to-use graphical user interface allows you to control the main hardware components of the Shamrock as well as several acquisition parameters. This can be seen in the figure below.

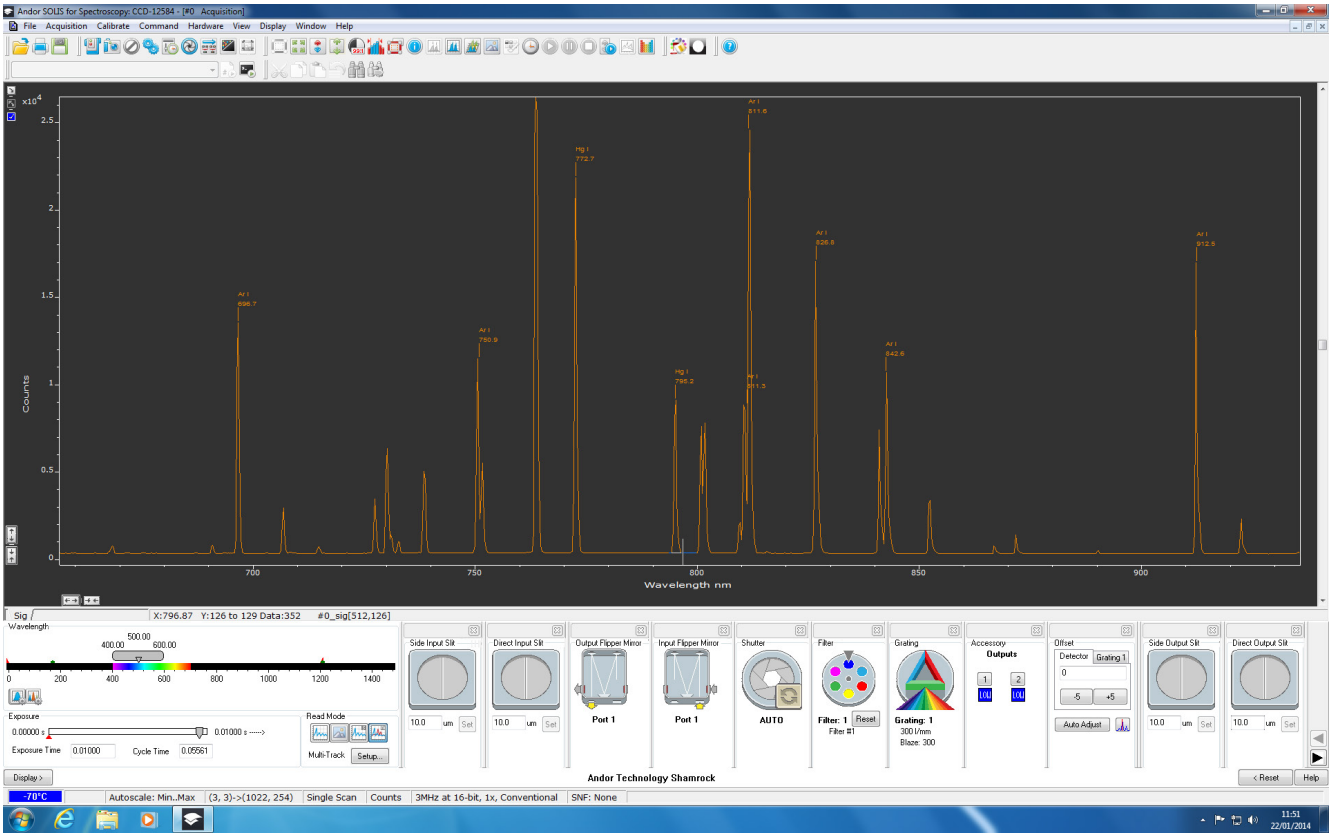


Figure 5: Andor Solis for Spectroscopy Dashboard Interface

When the dashboard is launched it displays only the graphic for the accessories that have been installed (for example, Shutter, Filter, Flipper, 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 (Demo) 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 detector-related parameters to be easily changed.

The features and functions of Solis Spectroscopy are also described in the on-board help within Solis for ease of access during operation.

4.1 Emergency Mains Disconnection

In case of emergency, the disconnecting point of the equipment is the mains power cord connected to the external power supply, or the mains socket switch:

FOR EMERGENCY MAINS DISCONNECTION, SWITCH OFF THE POWER AT THE MAINS SOCKET AND REMOVE THE MAINS LEAD FROM THE EXTERNAL POWER SUPPLY.

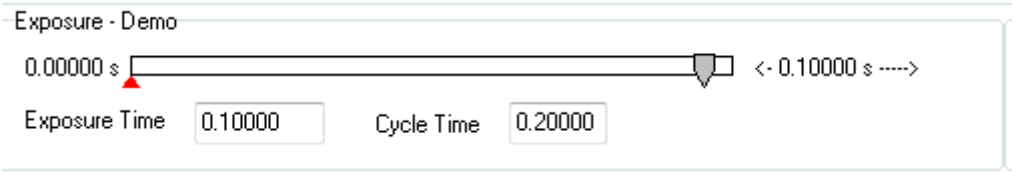
4.2 Detector Controls

The following sections 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.

4.2.1 Exposure Time Control

The Exposure Time Control 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:
   a. Clicking in the Exposure Time Edit Box
   b. Deleting the current value
   c. Entering the new value
   d. Pressing ENTER
2. Using the Exposure Time Slider Bar- left click the indicator and drag it along the bar. The slider bar automatically re-scales 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 re-scales, the arrows at either side of the bar indicate how much the slider bar is able to re-scale itself.

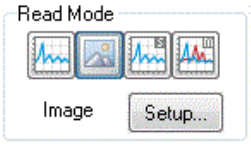


A delay may be set by entering a value in the Delay edit box. The delay (in seconds) is the time you require between the on-going scans. The system will default to a minimum delay should you attempt to enter too low a value.

Note: you cannot enter an exposure time of 0, by either method. The system will automatically default to the minimum exposure time.

4.2.2 Read Mode Control

The **Read Mode Control** dialog box 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.



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 quick access buttons on the toolbar.

There are four modes available (please refer to the camera manual for more details).

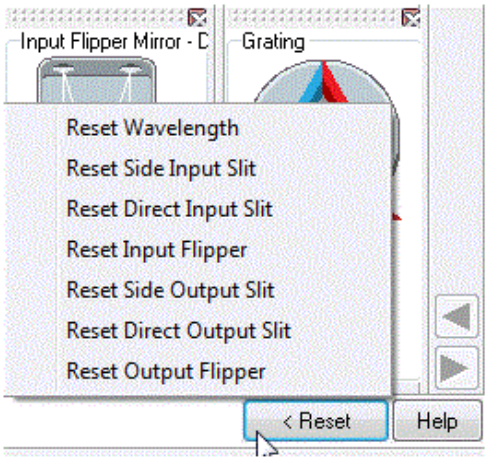
1. **Full Vertical Binning (FVB)**: this allows you to use the CCD as a Linear Image Sensor with the charge from each column of pixels (each column being chip height) being binned (combined), to give a single value per column.
2. **Image Readout:** this is associated with image data display.
3. **Single 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** and **Custom**. When one option is selected, the parameters for the other option are disabled.

Setup: adjust configuration options for the selected mode.

4.3 Spectrograph Controls

4.3.1 Reset Menu Options

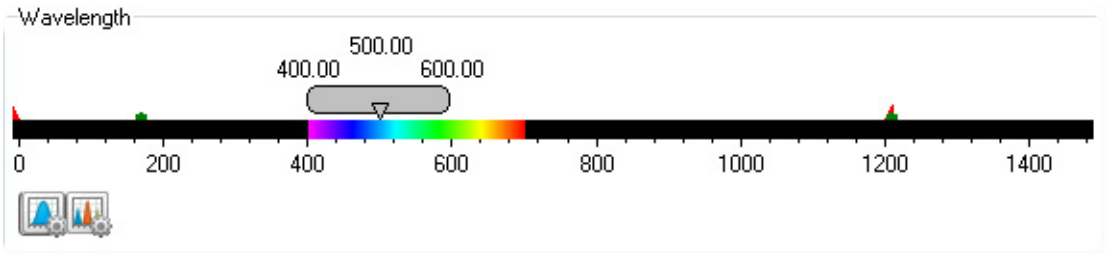
When the **Reset** button on the **Reset Menu** is clicked, you then have several options that allow you to reset the various mechanisms in the system. This may be found to be necessary if a mechanism setting appears to have deviated from the displayed value (e.g. if the stepper motors have been rotated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



- **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 and Reset Output Slit** The slit width is set to 10 µm after a reset.
- **Reset Flipper** The filter wheel is set to Filter 1 position after a reset.

4.3.2 Wavelength Drive Control

The wavelength drive hardware sets the system to the target wavelength and also allows control of the grating selection.

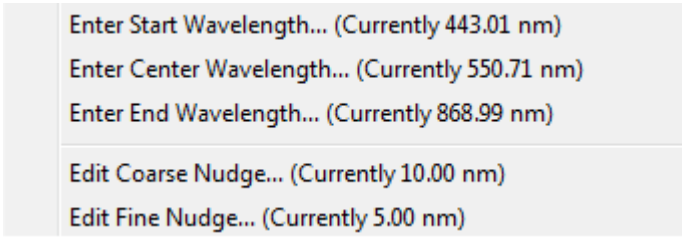


The wavelength range covered by the camera is calculated and displayed in the Wavelength section of the Dashboard. It is calculated by the software and accurately displayed in the visual control section of the dashboard. The slide bar control has three labels floating above it displaying the start, centre 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.

4.3.2.1 Changing the Wavelength Range

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

1. Drag the wavelength slider with the mouse. Position the cursor within the slider (cursor changes to pointing hand), click the LEFT mouse button and drag the slider to the required centre wavelength. Place the cursor at either side of the slider to move it towards the cursor (LEFT mouse button for coarse nudges and the RIGHT mouse button for fine nudges).
2. The size of the nudges can be defined by the user but the defaults are 10 nm for course nudges and 1 nm for fine nudges from the **Wavelength** Menu end point.



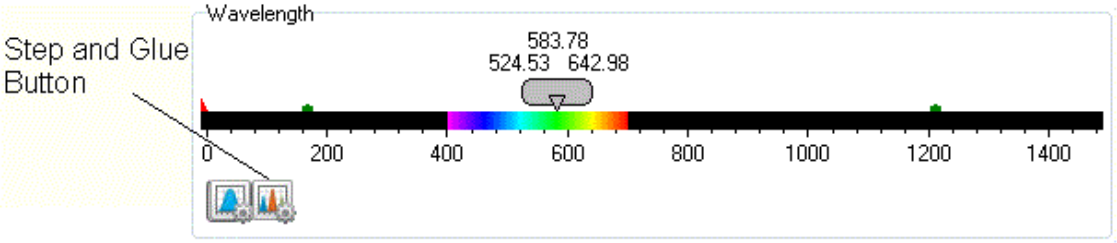
This is accessed by positioning the cursor within the slider (cursor changes to pointing hand) and holding down the **Right** mouse button. Selecting an item from the wavelength menu displays a simple dialog that allows you to change the current values.

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.

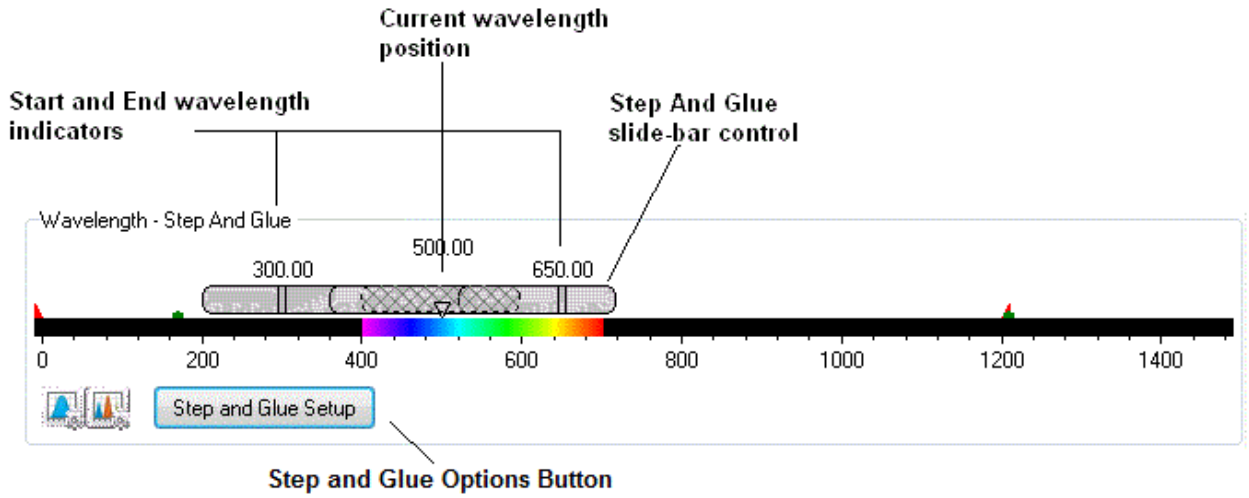
4.3.3 Step and Glue

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 end wavelengths 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. The Step and Glue mode is only available with the CCD set in Single Scan mode (see ACQUISITION, SETUP ACQUISITION menu).

In Step and Glue mode 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 press the button on the Wavelength Control:



On selection of Step and Glue mode the Wavelength Control will change to the following layout and several new graphic features will appear:



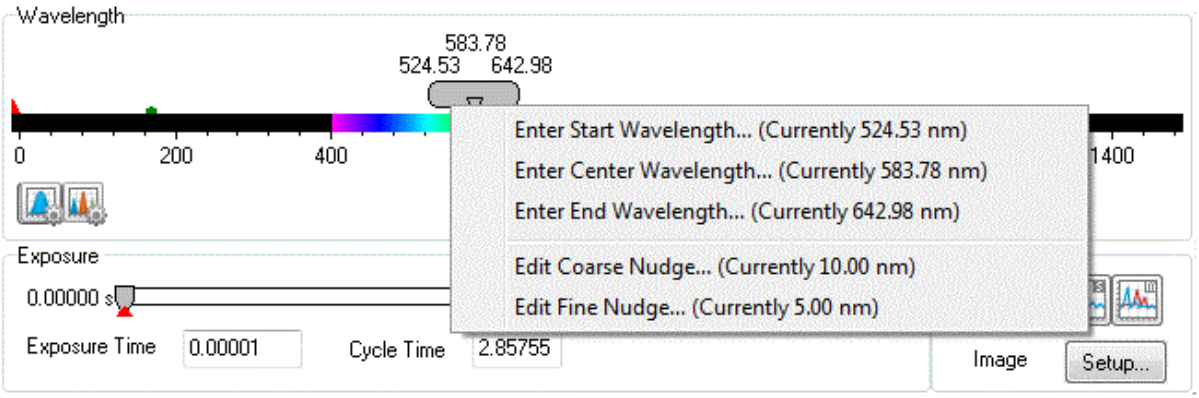
The hatched slide control bar gives an indication of the current wavelength position and current active grating in the system. The Step and Glue slide bar control will also appear. The slide bar allows the user to enter the start and end wavelengths for the Step and Glue mode and select the grating with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

- Left click and drag the appropriate wavelength indicator.
- Right click and manually input the start and end wavelength (see below).
- Step and Glue Setup dialog under the menu Acquisition: Setup Acquisition.

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

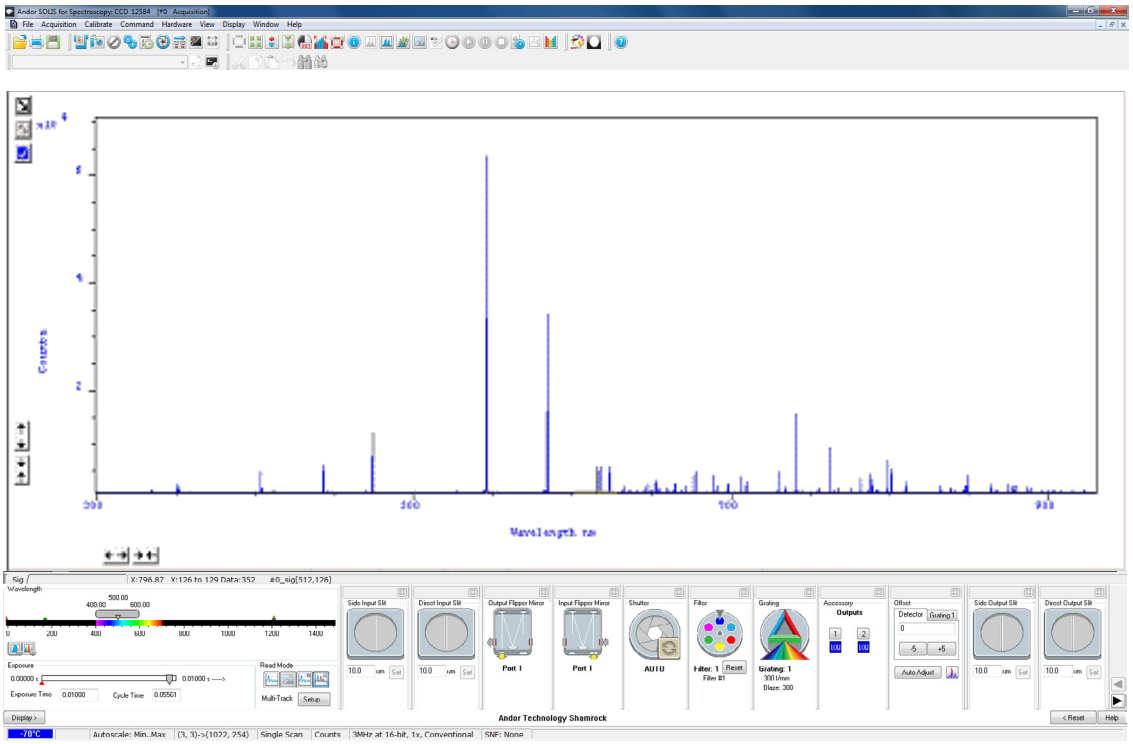
It is also possible to easily change the centre wavelength about which the scan will be performed. This can be achieved by either clicking on any part of the step and glue slide control bar (except the start and end wavelength indicators) and dragging the wavelength bar to the required wavelength region. It can also be modified by “nudging” the slide control bar. This is achieved by positioning the cursor to either side of the slide bar control and clicking the left or right mouse button (see wavelength drive control section).

Note that 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 selection box:



The scan is initiated by pressing the **Acquisition** button (camera icon) 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.

An Hg/Ne spectrum acquired with a 1200l/mm grating over the range 300 to 900nm (approx.) is shown below- It is composed of 13 individual spectra.

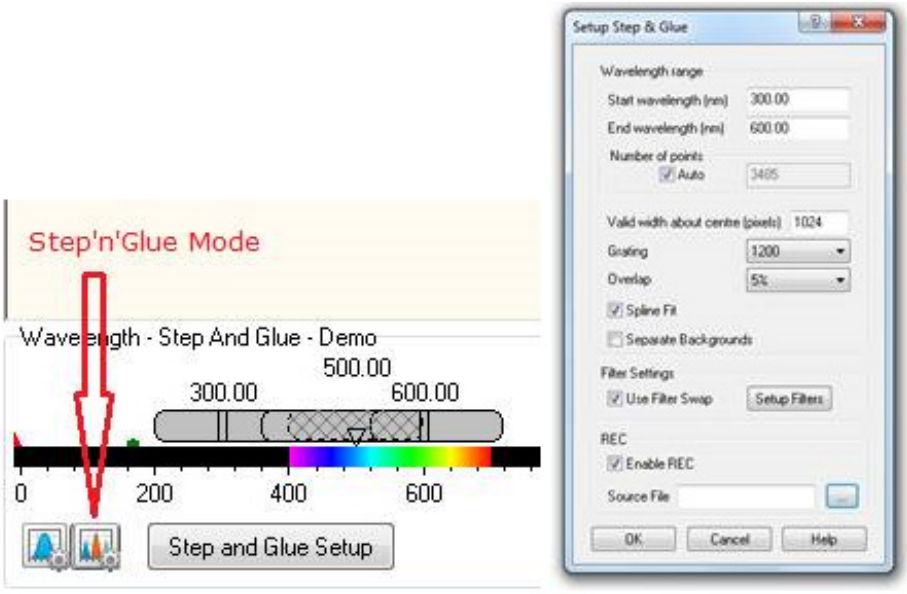


4.3.3.1 Relative Efficiency Correction

A Relative Efficiency Correction [REC] is possible in Step and Glue mode of your Andor Shamrock. This enables the quantitative measurement of peak intensity ratios, and to correct artefacts such as etaloning.

Setting up REC

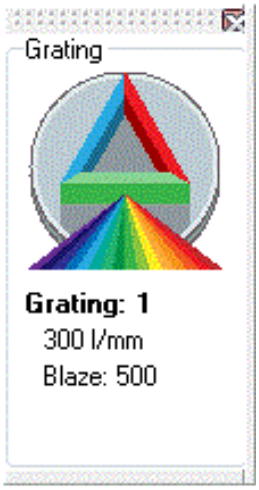
1. First ensure you are in “Single Scan” mode of the camera.
2. Select the Step and Glue mode on the Shamrock Control Panel.
3. Click the Step and Glue Setup button, which will bring up the settings dialog as shown below.



4. Enter the start and end wavelengths,
5. For most cases select ‘Auto’ number of points- this makes the final dataset have the same dispersion, in terms of nm per pixel, as a single acquisition.
6. The “Valid width about centre” should be used if you wish to only use the central portion of your camera – this is normally only changed from the full width if an ICCD is used which has a tube that is smaller diameter than the width of the sensor.
7. The Filter Swap should be used if your spectral range is such that there could be 2nd orders of light present. For example, if your range is 800nm to 1000nm then 2nd or 3rd order light from below 500nm could be present and invalidate the REC – a suitable high-pass filter is necessary. For larger step and glue ranges, multiple high-pass filters will be necessary and the “Setup Filters” dialog allows you to select the appropriate filter for the appropriate step: enter the number of the appropriate filter beside the step (the start and end wavelengths of each step are given). If you have labelled your filters this is accessible to guide your filter selection.
8. Enable REC and navigate to your source file for your broadband calibration lamp – if using an Ocean Optics DH2000-BAL then .LMP is likely to be file type.
9. Click on OK and you are ready to start taking your REC data.
10. Press <ctrl><b> to take a background.
11. Press <ctrl><r> to take a reference using the calibration lamp.
12. Then take your signal – the final Step and Glue REC will be presented in window #1. The data from the individual steps is stored in the different frames of window #0.

4.4 Grating Turret Control

The Grating Turret Control 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 grating can be fitted at any one time. If additional gratings are needed the turret can be changed to install three new gratings. The values for up to three grating turrets may be stored in the system.



The currently selected grating is always at the bottom 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.

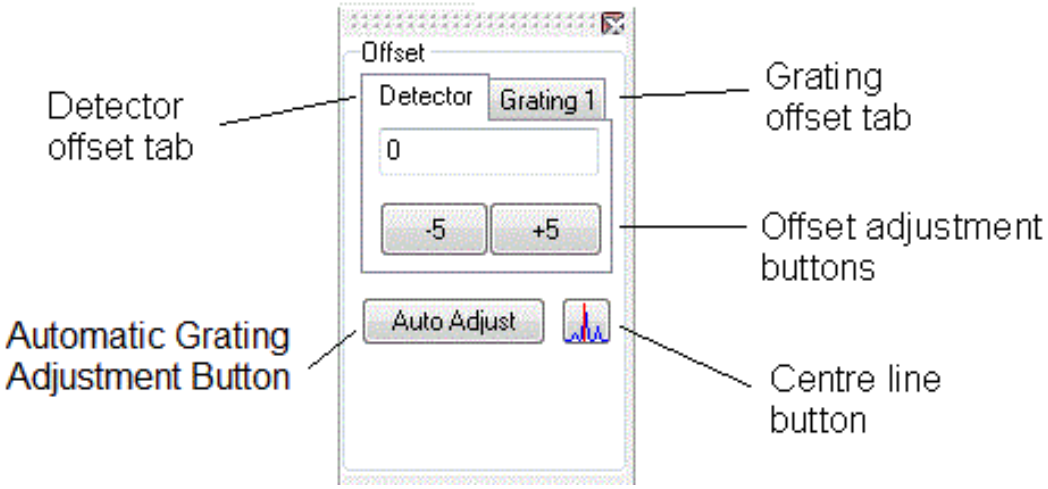
While the grating is being changed the software indicates that it is busy by displaying the hourglass symbol and the grating information text “busy”. The maximum time needed to change between gratings is approximately 15 seconds.

Note 3: The text information displayed about each grating is stored in the Shamrock EEPROM. Edit EEPROM dialogs allow this information to be updated if you change the turret to add new gratings.

4.5 Offset Adjustment Control

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

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.



Auto-Adjust

If you move to a known line of your calibration lamp, e.g. 435.83nm, and the spectral line is slightly to the side, you can press the 'Auto Adjust' offset button for Solis to handle the iterative process of centering the line.

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

4.5.1 Manual Grating Offset Adjustment Procedure

Manual adjustment of detector or grating offset 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 10 microns 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.
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).

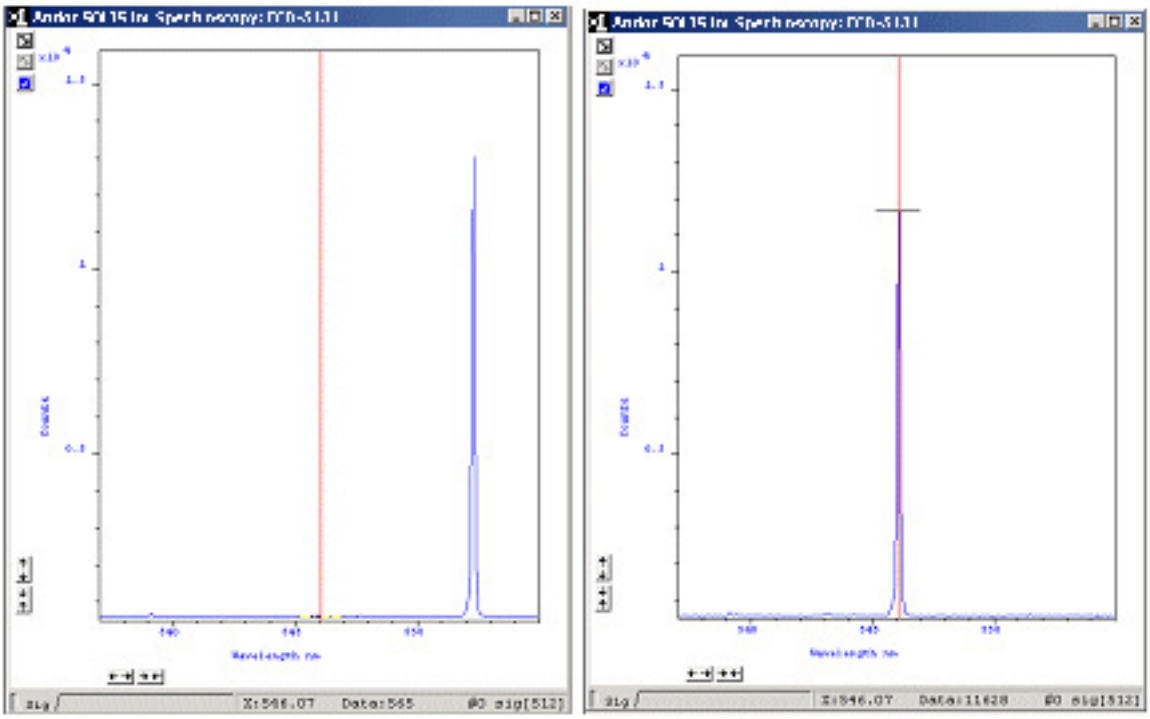
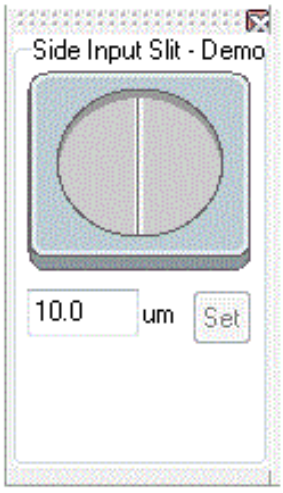


Figure 6: Spectra acquired before (left) and after (right) detector offset adjustment.

4.6 Slit Drive Control

The Slit Drive Control is used to control the **Motorised Slit Assembly** (refer to the spec sheet for further details). The slits are used to control the amount of incident light that enters the spectrograph. The width can be varied between 10µm and 2500µm (in steps of 2.5µm). The slit height may be altered by interchanging optional baffle plates (attached to the slit assembly using 5 x 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. When using optical fibres, ensure that the fibre is long enough to reach the slits through the baffle. 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.

The slit width can be set as follows:

1. Type a new value into the slit width edit box and press **Enter** or click **Set.**
2. Position the cursor over the grey “blade” area of the slit graphic. Then click and drag the edges of the slit in the graphic.

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.

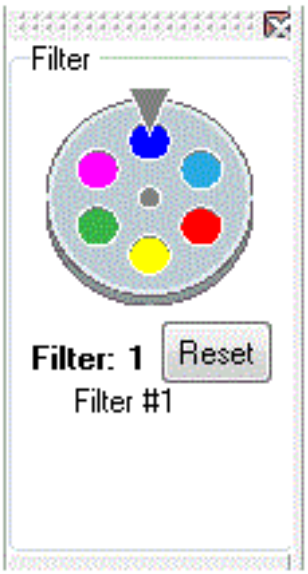
The minimum and maximum operating values of the motorised slit are 10 and 2500 microns, respectively. If a slit width input is outside of this range the system defaults to the nearest limit value.

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.

WARNING: If using the Wide Aperture Slit, do not perform adjustments when the plunger is fully open to prevent possible damage driving the motor against the end-point.

4.7 Filter Wheel Control

The optional filter wheel accessory is controlled through the 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.

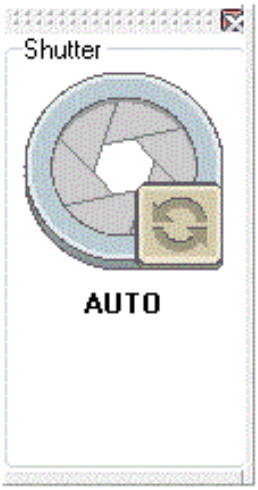
The operation of the filter wheel is very similar to that of the grating turret control. Positioning the cursor over each filter position changes the cursor to a pointing hand and details about the filter are displayed.

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 reset button. On completion of a reset the filter wheel defaults to the FILTER 1 position.

Refer to Section 3.3.1 for details on how to change filters.

4.8 Shutter Control

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



There are a number of modes of operation available including:

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, the BNC shutter or I^2C connection must be used.

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.

4.8.1 Control of Shutter via External TTL Signal

For flexibility, the shutter in Shamrock spectrographs may also be operated by an external TTL signal. This allows the shutter to be operated by, and synchronised to, other laboratory equipment such as an Andor camera. The shutter connector is a standard female BNC type and is located at the front of the spectrograph below the flange mount.

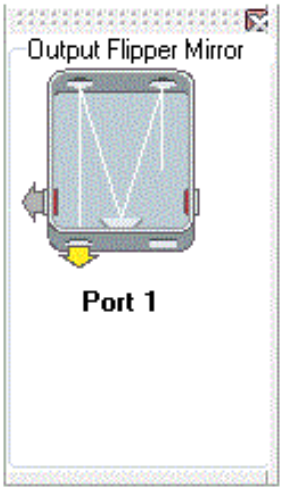
Figure 7: Shutter Connection (shown for a Shamrock 750)

4.8.1.1 External Control of the Shutter

- For correct shutter operation using an external device, ensure that the shutter mode is set to CLOSED in the software interface.
- 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.

4.9 Flipper Mirror Control

The Flipper Mirror Control allows you to rapidly select the required port. The port is selected by simply clicking on the appropriate port on the Flipper Mirror Control dialog. The selected port is highlighted in yellow.



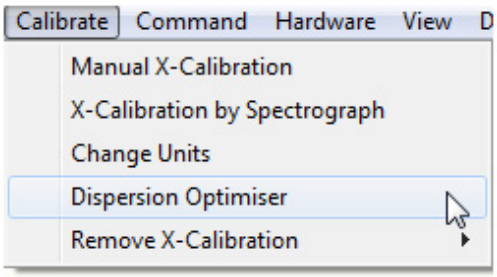
Note: The Dual Exit Port option is not available as an accessory. It must be specified at the time of manufacture (see also Section 2.1).

4.10 Dispersion Optimiser

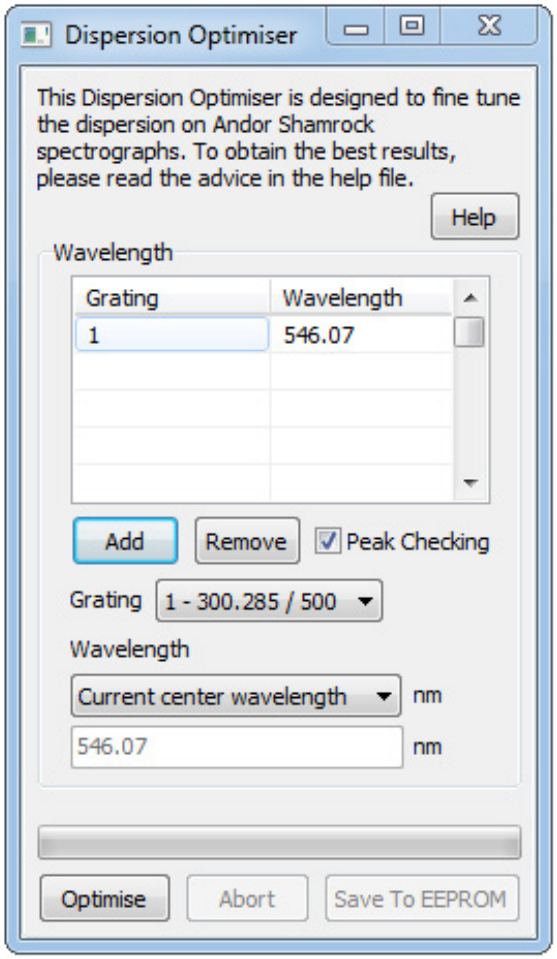
The Dispersion Optimiser is designed to fine tune the dispersion on Andor Shamrock spectrographs. Optimised dispersion will ensure that the calibration of wavelengths falling on the sides of the spectrum/sensor is accurate.

Using more than 1 wavelength on each grating will ensure that the new values calculated are optimised for the useful wavelength ranges on all installed gratings. A good calibration will be obtained if 2 wavelengths on each grating are tracked, at a total of 6 if there are 3 gratings installed. The wavelengths selected should be from either side of the wavelength region of interest, e.g. if a grating is being used to obtain spectra in the region of 400nm to 900nm then, if an Hg light source is available, the 912nm line should be used to ensure accuracy at the high end of the range and then either the 365nm line or the 435nm line in addition to cover the low end.

The Dispersion Optimiser is found under the Calibrate menu in Solis.



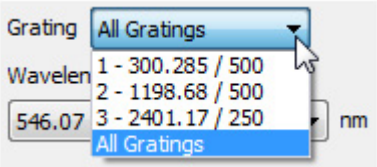
The Dispersion Dialog is as follows:



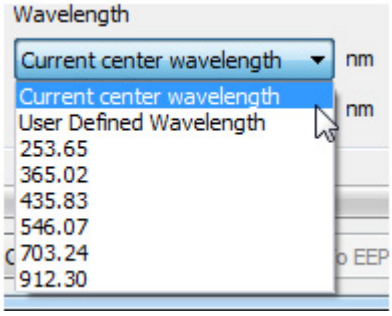
4.10.1 Steps to use the Dispersion Optimiser:

1. Choose a Grating and Wavelength and Add them to the list

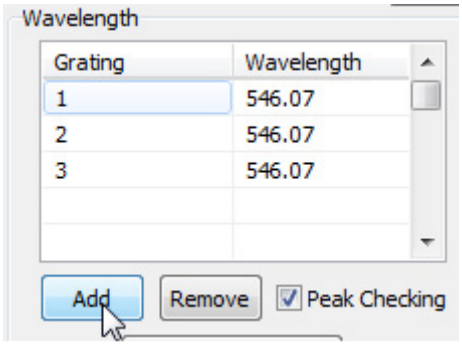
- Choose 1 grating, or the All Gratings Option:



- Choose the wavelength you want to use:



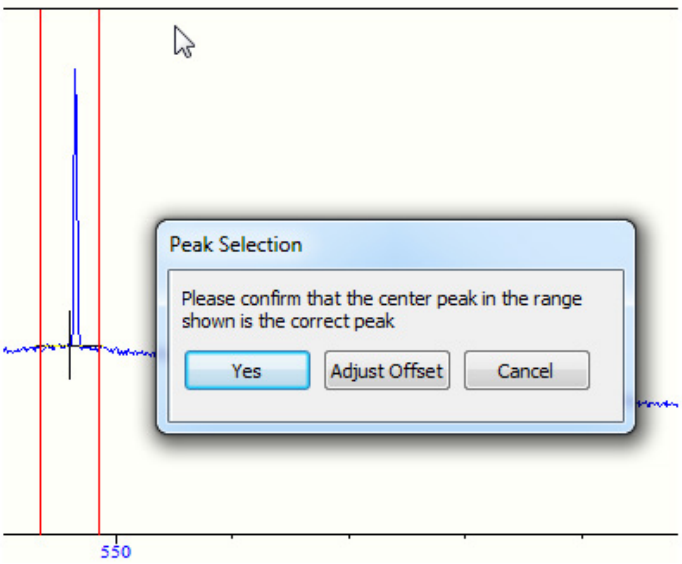
- Add the selected grating and wavelengths to the list



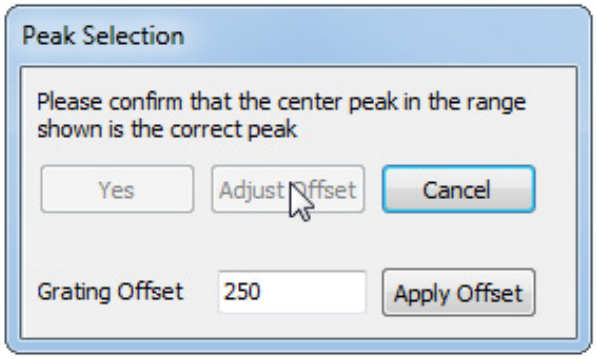
- Repeat for all gratings and wavelengths you intend to use

2. Click the Optimise button

- If you have Peak Checking enabled the following dialog will pop up at each of your chosen wavelength points to confirm the correct peak is being displayed



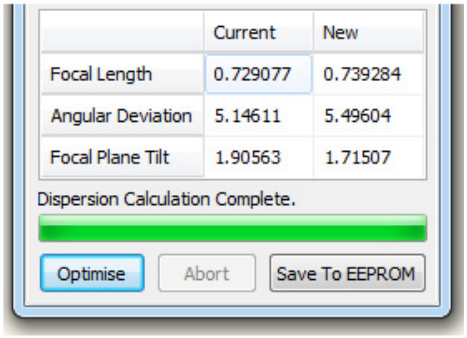
- Two red lines will be drawn around the centre range being used and the user should confirm that the peak they are expecting is within this range
- If the user selects Yes the optimisation will continue
- If not in range the user can select Adjust Offset



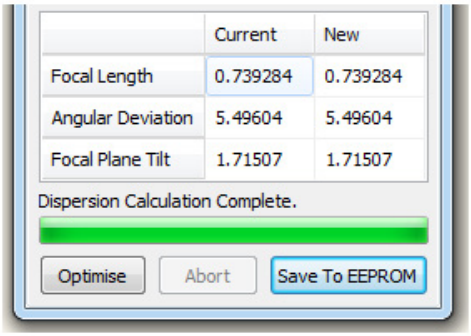
- By adjusting the grating offset the user can move the peak and try to move it in range
- The user can select Cancel at any time and this will abort the current optimisation procedure
- During the acquisition the user can choose to abort and the operation will terminate at the earliest opportunity

3. Choose to save (or not save) the values to the shamrock EEPROM

- Once the operation is complete the following display will be added to the dialog



- The Current column shows the Optical Parameters currently in use, and the New column shows the recommended values calculated by the Optimiser
- The user can then choose Save to EEPROM to save the new values to the EEPROM of the shamrock
- Note: This change is not reversible so the user may wish to save a copy of the Shamrock EEPROM before starting the optimisation process
- Once saving is complete the table of values will update to reflect the change in the current values



SECTION 5: MAINTENANCE

WARNINGS

- **THERE ARE NO USER-SERVICEABLE PARTS INSIDE THE SHAMROCK.**
- **A NUMBER OF SCREWS ON THE SHAMROCK HAVE BEEN MARKED WITH RED ANTI-TAMPER PAINT. IF THESE ARE REMOVED, YOUR WARRANTY WILL BE VOID.**
- **IF SERVICE IS REQUIRED PLEASE CONTACT YOUR ANDOR REPRESENTATIVE.**
- **THE LID SHOULD ONLY BE OPENED WHEN ABSOLUTELY NECESSARY, E.G. WHEN INSTALLING A NEW GRATING TURRET.**
- **TO REPLACE OR INSTALL OTHER ACCESSORIES PLEASE CONTACT ANDOR CUSTOMER SUPPORT FOR FURTHER INSTRUCTIONS.**

5.1 REGULAR CHECKS

- The state of the product should be checked regularly, especially the integrity of the External Power Supply and the mains cable.
- Do not use equipment that is damaged.

5.2 ANNUAL ELECTRICAL SAFETY CHECKS

- It is advisable to check the integrity of the insulation and protective earth of the product on an annual basis, e.g. U.K. PAT testing.

5.3 FUSE REPLACEMENT

In the U.K, Ireland and some other countries, the supplied mains cable has a BS 1363 (or Type G) plug that includes an integrated fuse. The characteristics of a replacement fuse are as follows:

- Rated Current: 5 A
- Rated Voltage: 240 VAC
- Size: ¼ × 1” (6.3 × 25.4 mm) cartridge
- Type: BS 1362

5.4 CLEANING (EXTERNAL)

- If the external surfaces need cleaned, remove power from the unit and use a water diluted mild detergent to lightly dampen the cloth - do not use Isopropyl alcohol, solvents or aerosol based cleaning solutions.
- Only use a clean, lint free cloth to clean the external painted surfaces.

SECTION 6: TROUBLESHOOTING

Spectrograph does not switch on

- Check power cord is plugged in and connected correctly to mains supply
- If the unit still does not switch on, check the correct fuse is properly installed
- If the unit still does not switch on after the checks above have been carried out, contact Andor Technical Support

Spectrograph is not recognised by PC/Software

- Check power to the spectrograph and signal connections between the spectrograph and PC
- If problems remain, please contact customer support for assistance.

Further troubleshooting information including video tutorials and technical notes are available from the Andor Product Support page:

www.andor.com/ContactSupport.aspx?type=s

SECTION 7: SPECIFICATIONS

7.1 (ELECTRICAL AND ENVIRONMENTAL)

Parameter	Shamrock 303i
Power supply ratings	100 - 240V, 50 - 60Hz, 2.5A
Fuse rating	5A/500V
Electrical safety	EN 61010
Communication	USB 2.0
Location to be used	Indoor use only
Altitude	Up to 2000 m
Operating temperature range	0°C to 30°C
Storage temperature	-25°C to +50°C
Operating relative humidity	< 70% non-condensing
Overvoltage category	CAT II. An overvoltage category of CAT II means that the equipment is designed to cope with transient voltages above the rated supply that would be experienced by any product connected to a mains socket in a building.
Pollution degree	Pollution degree 2. Normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation must be expected.
Ingress protection rating	IP20
Electromagnetic compatibility	Class A product. In a domestic environment this product may cause electromagnetic interference, in which case the user may be required to take adequate measures.
Dimensions (L x W x H)*	394 x 283 x 208 mm (15.5” x 11.1” x 7.9”)
Weight	20 kg (44.1 lb approx)

* refer to Appendix A: Mechanical Drawings for detailed information. Dimensions will vary depending on attached accessories.

7.2 SPECIFICATIONS (OPTICAL)

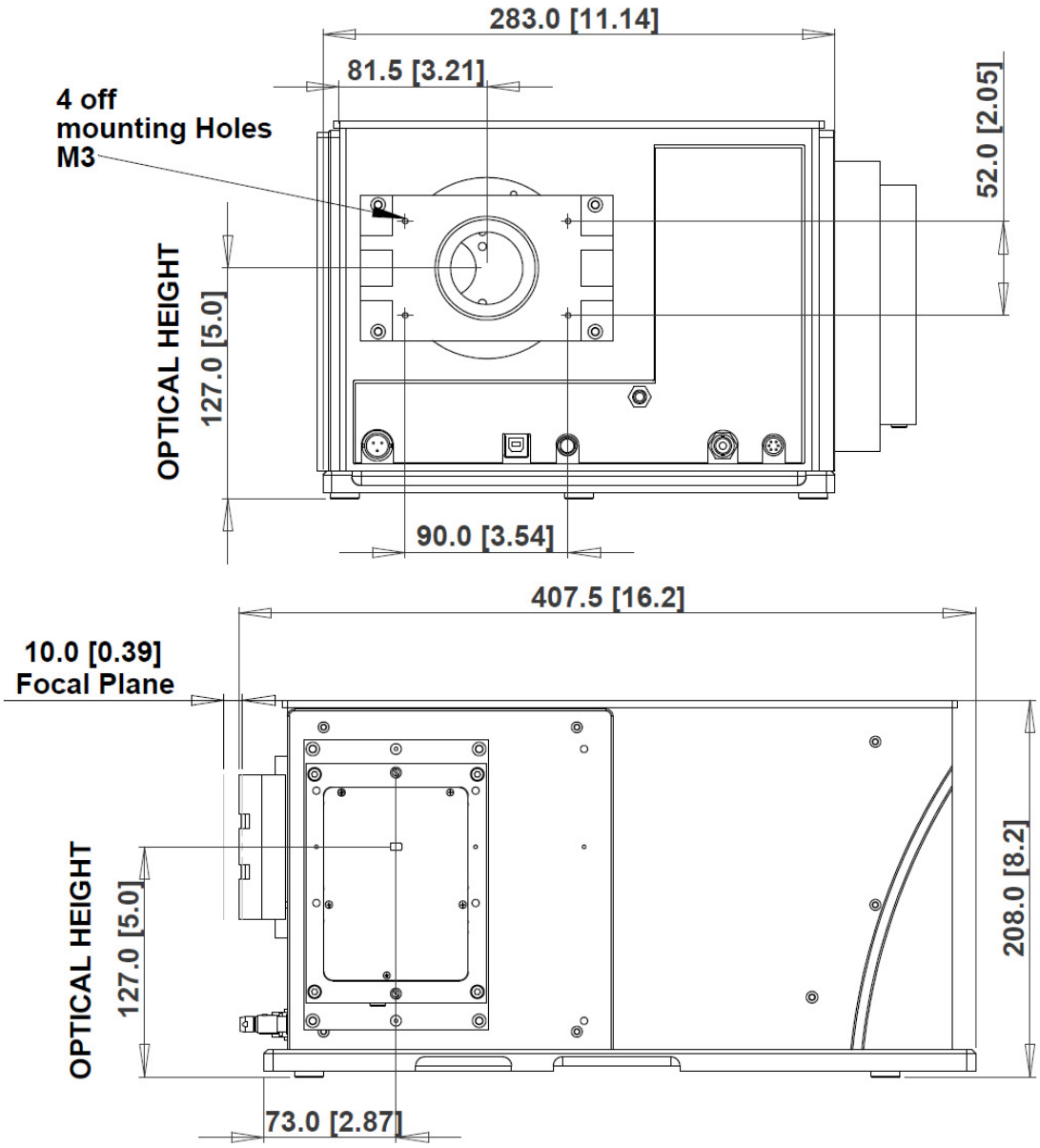
Unless otherwise stated, specifications are obtained using 1200l/mm gratings and 10 µm slits @ 500 nm central wavelength and Newton DU940 camera with 13.5 µm pixel and 26.7 mm wide array:

Parameter	303i
Optical configuration	Czerny-Turner with imaging toroidal optics
Focal length	303 mm
Aperture	F/4
Magnification (vertical at centre of CCD)	-
Reciprocal dispersion (nominal)	2.6 nm/mm
Wavelength range	190 nm to 16 µm (detector dependent)
Optics coating	Al + MgF_2 (standard). Protected silver coated optics available
Resolution (with Newton DU940 CCD) 1200 l/mm @ 500 nm	0.1nm (<0.2nm with 25µm pixel CCD detector)
Wavelength repeatibility	10 pm
Wavelength accuracy	± 0.03 nm
Focal plane size (W x H)	28 x 14 mm
Time to switch gratings	<10 secs
Grating mounting configuration	Triple indexable and lockable turret
Grating size	68 x 68 mm
Stray light	1.5×10^{-4} (measured at 20 nm from 633 nm laser line)
Slit type	Manual (standard) or motorised, 10 µm to 2.5 mm
Slit aperture (W x H)	6 x 4 mm (standard) (Options up to 6 x 14 mm and Ø 15 mm)
Optical axis (H)	127mm (5”) with standard fixed pad feet

APPENDIX A: MECHANICAL DRAWINGS

Dimensions in mm [inches]

Shamrock 303i



Optical Axis

127 mm [5”] with pad feet

The optical path height is shown with standard feet attached.

Screw Type Requirements

CCD flange to spectrograph flange	4 off, M4 x 16
Camera to CCD flange	4 off, M3 x 10
iXon camera to iXon flange	4 off, M5 x 10, countersunk, hex head

APPENDIX B: OTHER INFORMATION

Terms and Conditions of Sale and Warranty Information

The terms and conditions of sale, including warranty conditions, will have been made available during the ordering process. The current version may be viewed at: http://www.andor.com/pdfs/literature/Andor_Standard_Warranty.pdf

Waste Electronic and Electrical Equipment Regulations 2006 (WEEE)

The company's statement on the disposal of WEEE can be found in the Terms and Conditions available on the Andor website.