Shamrock 163
Versatile, Compact Benchtop Spectrograph

Key Specifications
✓ 163 mm focal length
✓ F/3.6 aperture
✓ Compact form factor
✓ Field adjustable gratings and light coupling accessories

Key Applications
✓ Raman
✓ Absorption/Transmission/Reflection
✓ Fluorescence/Luminescence/Photoluminescence
✓ Non-linear spectroscopies (SFG, SHG)

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Introducing Shamrock 163

The Shamrock 163 is the most compact research-grade Czerny-Turner spectograph on the market. Its 163 mm focal length, high F/3.6 aperture and wide range of seamlessly interchangeable gratings, slits and light coupling accessories make it the ideal tool for general benchtop spectroscopy measurements.

Specifications Summary

<table>
<thead>
<tr>
<th>Feature</th>
<th>Benefit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Portability &amp; ease of integration</td>
<td>Compact &amp; rugged design with horizontal and vertical mounting positions</td>
</tr>
<tr>
<td>Imaging-configurable platform for multi-track spectroscopy</td>
<td>Lens-based accessories enable optimization of system performance for low cross-talk, multi-leg fibre signal simultaneous acquisition</td>
</tr>
<tr>
<td>Wide range of interchangeable gratings</td>
<td>Simple precision locking mechanism for rapid upgradability to different resolution, blaze and bandpass options</td>
</tr>
<tr>
<td>Variety of fixed slits</td>
<td>Interchangeable laser-cut precision slits with widths ranging from 10 μm to 200 μm</td>
</tr>
<tr>
<td>Large choice of light coupling interfaces</td>
<td>Free space or using fibre-optic couplers</td>
</tr>
<tr>
<td>Simple &amp; rapid wavelength adjustment</td>
<td>Calibrated micrometer drive for wavelength selection</td>
</tr>
</tbody>
</table>

Above: Biphasic reaction monitoring of oxidation of styrene with a dinuclear manganese catalyst. Courtesy of Wesley Browne & David Angelone, University of Groningen
Step-by-Step System Configuration

How to customise the Shamrock 163:

1. **Chassis configuration**
   Select type of optics coating required (aluminium + MgF₂ is standard, protected silver-coated optics available on request for NIR detection).

2. **Resolution & band-pass**
   Select gratings and detector to fulfil resolution and wavelength requirements.

3. **Input light coupling interface**
   Refer to accessory tree for available configurations (direct coupling, fibre coupling or 3rd party hardware connectivity).

4. **Software interface**
   Select either state-of-the-art Solis software or Software Development Kit (SDK) option – please refer to the appropriate section for further information.
Step 1 - Chassis Configuration

Ordering Information

<table>
<thead>
<tr>
<th>Description</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base unit for spectrally optimized configuration</td>
<td>SR-163</td>
</tr>
<tr>
<td>Base unit for spectrally optimized configuration, protected silver coated optics</td>
<td>SR-163-SIL</td>
</tr>
</tbody>
</table>

Optics Coatings Reflectivity Graph

The graph shows the standard Al + MgF₂ optics coatings reflection efficiency versus wavelengths.

Protected silver coated optics option is also available on request for maximum efficiency in the NIR region and is recommended for working with Andor iDus InGaAs detectors.

When choosing protected silver coatings, it is strongly recommended to also order **protected silver coated gratings** for maximum efficiency throughout the system.

Chassis Accessories

![Flange (Standard)](Image)

![InGaAs Flange (SR1-ASZ-8044)](Image)

*NOTE: Not to be used in conjunction with imaging corrected (multi-track enabling) input accessories*
Czerny-Turner spectrographs are designed to provide the best optical performance for a range of grating angles as reflected on the green parts of the graph above. Outside this range, the spectral lines may exhibit a degree of optical aberration (such as coma), which will become more prominent at the steeper angles. These configurations are reflected by the orange to red scales on the graph. In these regions, consideration should be given to higher spectrograph focal length models with lower groove density gratings to achieve the desired resolution.

Where aberration is a concern for a particular experimental set-up, the table above shows resolution and band-pass performance for a variety of alternative configurations. This should be used in conjunction with the graph above to assist in selecting the most appropriate spectrograph platform to meet resolution and band-pass needs, whilst minimising the risk of potential aberration.
Step 2b - Choosing The Right Grating vs Resolution and Band-pass

The Shamrock 163 grating mount has been designed for easy integration and interchangeability. A simple finger-tight locking mechanism combined with a precision locating fixture ensure accurate and rapid system upgradability. Please select the grating or gratings you require from the selection in the table below.

<table>
<thead>
<tr>
<th>Lines/mm</th>
<th>Blaze (nm)</th>
<th>Nominal dispersion (nm/mm)(^\star)</th>
<th>Bandpass (nm)(^3) (^4) (^5) (^6)</th>
<th>Resolution (nm)(^3) (^4) (^5) (^6)</th>
<th>Peak efficiency (%)</th>
<th>Andor part number</th>
<th>Maximum recommended wavelength (nm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>300</td>
<td>19.70</td>
<td>545</td>
<td>0.89-0.62</td>
<td>72</td>
<td>SR1-GRT-0150-0300</td>
<td>6820</td>
</tr>
<tr>
<td>150</td>
<td>500</td>
<td>19.60</td>
<td>542</td>
<td>0.88-0.62</td>
<td>73</td>
<td>SR1-GRT-0150-0500</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>800</td>
<td>19.50</td>
<td>539</td>
<td>0.88-0.62</td>
<td>80</td>
<td>SR1-GRT-0150-0800</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>1250</td>
<td>19.30</td>
<td>534</td>
<td>0.87-0.61</td>
<td>84</td>
<td>SR1-GRT-0150-1250</td>
<td></td>
</tr>
<tr>
<td>150</td>
<td>2000</td>
<td>18.90</td>
<td>523</td>
<td>0.85-0.60</td>
<td>88</td>
<td>SR1-GRT-0150-2000</td>
<td></td>
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<tr>
<td>300</td>
<td>300</td>
<td>9.80</td>
<td>271</td>
<td>0.44-0.31</td>
<td>88</td>
<td>SR1-GRT-0300-0300</td>
<td>3410</td>
</tr>
<tr>
<td>300</td>
<td>500</td>
<td>9.71</td>
<td>268</td>
<td>0.44-0.31</td>
<td>81</td>
<td>SR1-GRT-0300-0500</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>1000</td>
<td>9.46</td>
<td>262</td>
<td>0.43-0.30</td>
<td>72</td>
<td>SR1-GRT-0300-1000</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>1200</td>
<td>9.34</td>
<td>258</td>
<td>0.42-0.29</td>
<td>92</td>
<td>SR1-GRT-0300-1200</td>
<td></td>
</tr>
<tr>
<td>300</td>
<td>1700</td>
<td>9.00</td>
<td>249</td>
<td>0.41-0.29</td>
<td>89</td>
<td>SR1-GRT-0300-1700</td>
<td></td>
</tr>
<tr>
<td>600</td>
<td>300</td>
<td>4.83</td>
<td>134</td>
<td>0.22-0.15</td>
<td>84</td>
<td>SR1-GRT-0600-0300</td>
<td>1705</td>
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<tr>
<td>600</td>
<td>500</td>
<td>4.73</td>
<td>131</td>
<td>0.21-0.15</td>
<td>72</td>
<td>SR1-GRT-0600-0500</td>
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<tr>
<td>600</td>
<td>1000</td>
<td>4.38</td>
<td>121</td>
<td>0.20-0.14</td>
<td>72</td>
<td>SR1-GRT-0600-1000</td>
<td></td>
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<tr>
<td>600</td>
<td>1200</td>
<td>4.20</td>
<td>116</td>
<td>0.19-0.13</td>
<td>88</td>
<td>SR1-GRT-0600-1200</td>
<td></td>
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<tr>
<td>600</td>
<td>1900</td>
<td>3.39</td>
<td>94</td>
<td>0.15-0.11</td>
<td>88</td>
<td>SR1-GRT-0600-1900</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(@1600)(^\star)</td>
<td>3.78</td>
<td>105</td>
<td>0.17-0.12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>830</td>
<td>820</td>
<td>3.08</td>
<td>85</td>
<td>0.14-0.10</td>
<td>87</td>
<td>SR1-GRT-0830-0820</td>
<td>1230</td>
</tr>
<tr>
<td>830</td>
<td>1200</td>
<td>2.68</td>
<td>74</td>
<td>0.12-0.08</td>
<td>83</td>
<td>SR1-GRT-0830-1200</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>300</td>
<td>2.33</td>
<td>64</td>
<td>0.10-0.07</td>
<td>72</td>
<td>SR1-GRT-1200-0300</td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>500</td>
<td>2.19</td>
<td>61</td>
<td>0.10-0.07</td>
<td>81</td>
<td>SR1-GRT-1200-0500</td>
<td>850</td>
</tr>
<tr>
<td>1200</td>
<td>1000</td>
<td>1.62</td>
<td>45</td>
<td>0.07-0.05(^\star)</td>
<td>69</td>
<td>SR1-GRT-1200-1000</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(@ 800)(^\star)</td>
<td>1.89</td>
<td>52</td>
<td>0.09-0.06</td>
<td>69</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1200</td>
<td>Holographic (500 nm peak)</td>
<td>2.19</td>
<td>61</td>
<td>0.10-0.07</td>
<td>81</td>
<td>SR1-GRT-1200-EH(^\star)</td>
<td></td>
</tr>
<tr>
<td>1800</td>
<td>Holographic (250 nm peak)</td>
<td>1.30</td>
<td>36</td>
<td>0.06-0.04</td>
<td>70</td>
<td>SR1-GRT-1800-DH</td>
<td>570</td>
</tr>
<tr>
<td>1800</td>
<td>Holographic (380 nm peak)</td>
<td>1.52</td>
<td>42</td>
<td>0.07-0.05</td>
<td>62</td>
<td>SR1-GRT-1800-FH</td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>300</td>
<td>1.05</td>
<td>29</td>
<td>0.05-0.04</td>
<td>68</td>
<td>SR1-GRT-2400-0300</td>
<td>425</td>
</tr>
<tr>
<td>2400</td>
<td>Holographic (220 nm peak)</td>
<td>1.12</td>
<td>31</td>
<td>0.05-0.04</td>
<td>68</td>
<td>SR1-GRT-2400-BH</td>
<td></td>
</tr>
<tr>
<td>2400</td>
<td>Holographic (400 nm peak)</td>
<td>0.95</td>
<td>26</td>
<td>0.04-0.03</td>
<td>73</td>
<td>SR1-GRT-2400-GH</td>
<td></td>
</tr>
</tbody>
</table>

\(^\star\)Option for minimized scattered light.

Need to have maximum collection efficiency in the NIR/SWIR? All gratings are also available with protected silver coating. Please contact your local representative for further information.
Step 2c - Selecting The Correct Grating Efficiency Option

All graphs shown below represent efficiency for 45° polarisation.

Important Consideration
System throughput is dependent on the grating’s angle of operation and may decrease with higher grating operating angles.
Step 3 - Selecting The Correct Light Coupling Interfaces

Lens-corrected accessory for multi-track applications

<table>
<thead>
<tr>
<th>Standard Slit</th>
<th>Shutter Slit</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR1-SLT-0010-3</td>
<td>SR1-SLH-0010-3</td>
<td>10 µm x 3 mm (W x H)</td>
</tr>
<tr>
<td>SR1-SLT-0025-3</td>
<td>SR1-SLH-0025-3</td>
<td>25 µm x 3 mm (W x H)</td>
</tr>
<tr>
<td>SR1-SLT-0050-3</td>
<td>SR1-SLH-0050-3</td>
<td>50 µm x 3 mm (W x H)</td>
</tr>
<tr>
<td>SR1-SLT-0100-3</td>
<td>SR1-SLH-0100-3</td>
<td>100 µm x 3 mm (W x H)</td>
</tr>
<tr>
<td>SR1-SLT-0200-3</td>
<td>SR1-SLH-0200-3</td>
<td>200 µm x 3 mm (W x H)</td>
</tr>
</tbody>
</table>

Fixed Slit Dimensions
The Shamrock 163 requires at least one of the following software options:

1. **Solis Spectroscopy**: A 32-bit and fully 64-bit enabled application for Windows (8.1 and 10) offering rich functionality for data acquisition and processing, as well as Andor cameras, spectrograph and motorized accessories simultaneous control. AndorBasic provides macro language control of data acquisition, processing, display and export.

2. **Standalone Solis Spectroscopy** GUI for standalone spectrograph operation.

3. **Kymera and Shamrock SDK**: A software development kit that allows you to control Andor products from your own application. Available as 32/64-bit libraries for Windows (8.1 and 10) and Linux. Compatible with C/C++, C#, Delphi, VB.NET, LabVIEW, MATLAB and Python.

Note: Motorised accessories control panel only available for Kymera and Shamrock 500i/750 series.

**Solis Spectroscopy: Dedicated spectroscopy acquisition software**
Shutter Specifications

- Maximum repetition rate: 1 Hz
- Minimum open/close time: 100 ms

Optical Property

- Focal plane size (mm, W x H): 28 x 10
- Magnification @ centre of CCD (independent of line elongation due to spectrograph astigmatism)
  Vertical, multi-track configuration: 1.8
Our Cameras for Spectroscopy

Spectroscopy-based diagnostics in the fields of Material Science, Chemistry, Life Science or Fundamental Physics & Optics rely on the capture and analysis of optical and chemical signatures with a high degree of precision.

Andor’s range of detectors offer a wide range of sensitivity, time-resolution and sensor formats to best suit specific experimental conditions from UV to SWIR, nanosecond to hours time resolution, high photon flux to single photon with super dynamic range and resolution.

High Sensitivity & Dynamic Range

- Long exposure
- High sensitivity UV-SWIR
- Large pixel well depths
- High resolution matrix

iDus CCD & InGaAs | Newton CCD & EM

ns to µs Time-Resolution

- Nanosecond gating
- High sensitivity down to single photon
- On-head DDG with ps accuracy

iStar CCD & sCMOS

kHz Spectral Rates

- µs to ms time-resolution
- High sensitivity down to single photon
- High resolution matrix

Newton CCD & EMCCD | iXon EMCCD | ZL41 Wave sCMOS | Marana sCMOS

Extended Multi-fibre Spectroscopy

- Large area sensors
- Ultrafast sCMOS and EMCCD options
- High sensitivity down to single photon

iKon-M CCD | iXon EMCCD | ZL41 Wave sCMOS | Marana sCMOS | iStar CCD & sCMOS

Learn more about our detector range [here](#).

Learn more about our spectrograph solutions [here](#).
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Fax +86 (10) 5884 7901

Items shipped with your spectrograph
1x Electronic copy of user guides
1x Individual system performance booklet
1x Set of Allen keys (1.5 mm, 2 mm & 2.5 mm)

Operating & Storage Conditions
- Operating Temperature 0°C to 30°C ambient
- Relative Humidity < 70% (non-condensing)
- Storage Temperature -25°C to 50°C

Footnotes: Specifications are subject to change without notice
1. Typical values quoted with 27.6 mm wide CCD, e.g. Newton DU940.
2. Typical values quoted with 10 μm slit and 13.5 μm pixel CCD, e.g. Newton DU940. Useful signal is assumed to be imaged on the entire height of the 6.9 mm sensor and fully vertically binned.
3. Typical values quoted @ 500 nm centre wavelength.
4. Typical values quoted @ 300 nm centre wavelength.
5. Typical values quoted at maximum efficiency wavelength or blaze wavelength unless otherwise stated.
6. Wavelength within the recommended operating spectral region.
7. Indicative values; the working range of these gratings is principally in the region where optical aberrations may alter the system resolution performance quoted.
8. 6 mm high options available on request.
9. Please refer to the local sales representative or website for further information on available options and complimentary accessories.
10. Slit width ranges from 10 μm to 2.5 mm.