Features and Benefits

• **High sensitivity detectors**
  Ultra-sensitive CCDs, ICCDs and EMCCDs cameras for maximum photon detection and speed. Ideal for fast and photon starved chemical mapping or microfluidics setups.

• **Highly configurable spectrograph platforms**
  Extensive range of multi-input & output, motorized Czerny-Turner spectrographs with seamlessly interchangeable and configurable accessories.

• **Seamlessly configurable spectrograph-microscope interfaces**
  - fibre optics
  - direct C-mount
  - ‘cage’ system
  - enclosed optical relay
  Dedicated feet sets allow easy optical height matching between spectrographs and inverted Nikon, Olympus, Zeiss & Leica microscopes.

• **Wide-aperture slit**
  Kymera and Shamrock input accessory for extended sample image relay AND spectral analysis through the same optical path.

• **μManager software integration**
  Simultaneous control of Andor cameras & spectrographs and a wide range of microscopes and accessories through a single software platform. Dedicated, user-friendly spectrum handling interface.

• **Software Development Kit (SDK)**
  Ease of control integration into custom, complex setups: Matlab, Labview, Visual Basic and C/C++ supported.

Highly configurable micro-spectroscopy interfaces

Andor’s dedicated, highly configurable micro-spectroscopy interfaces allow seamless integration to microscopy systems. μManager’s user-friendly control of the Kymera spectrographs and accessories provide a quick and easy setup of complex micro-spectroscopy acquisition sequences including chemical mapping. Wide-aperture slit options are also available for extended sample image relay and spectral analysis through the same optical path.

Key Applications

- **Micro-Raman**
  - Surface-Enhanced Raman Scattering (SERS)
  - Tip-Enhanced Raman Spectroscopy (TERS)
  - Semiconductors & Graphene study

- **Micro-Luminescence / Photoluminescence / Fluorescence**
  - Carbon nanotubes study
  - Spectrally-resolved FRET
  - Single Molecule spectroscopy
  - Quantum Dots study
  - Semiconductors study

- **Plasmonic nanoparticle study**

- **Dark-field scattering spectroscopy**

- **Spectrally-resolved microfluidics / flow cytometry**

- **Broadband transient spectroscopy**
INVERTED side microscope output – micro-spectroscopy options overview

Key

| Andor Parts | Please contact your local Andor representative | Existing Parts |

Microscope (Inverted side output port)

- Microscope accessories (inc. filters)
- External light source & microscope coupling (e.g. laser)
- Fibre optic microscope adapter
- Fibre optic (SMA, FC, ferrule)
- Fibre optic adapter
- Microscope C-mount flange
- Enclosed optical relay
- C-mount adapter
- Motorized/manual input slits
- Wide aperture slit
- Filter wheel
- Shutter
- Flat Mirror (grating turret)
- Adjustable Feet

Kymera (193i/328i)
Shamrock (500i/750)

CCD, EMCCD, ICCD, InGaAs detectors

Software options

- Solis (S)
- SDK
- Micro-Manager

Microscope feet (150 mm optical height)

Cage system microscope adapter

Cage system opto-mechanical setup (inc. excitation source)

Cage system adapter

Fibre optic adapter

Fibre optic (SMA, FC, ferrule)

External light source & microscope coupling (e.g. laser)

Software options

- Solis (S)
- SDK
- Micro-Manager
UPRIGHT microscope output – micro-spectroscopy options overview

Software options

- Solis (S)
- SDK
- Micro-Manager

Microscope accessoires (inc. filters)

External light source & microscope coupling (e.g. laser)

Microscope (Upright output port)

- Microscope feet (150 mm optical height)
- Microscope C-mount flange
- Enclosed optical relay
- C-mount adapter
- Filter wheel
- Shutter

Fibre optic adapter

Fibre optic (SMA, FC, ferrule)

Motorized/manual input slits

Wide aperture slit

Cage system opto-mechanical setup (inc. excitation source)

Cage system microscope adapter

Cage system adapter

Fibre optic adapter

Fibre optic (SMA, FC, ferrule)

Cage system microscope adapter

Cage system adapter

Microscope C-mount flange

Cage system opto-mechanical setup (inc. excitation source)

Cage system microscope adapter

Cage system adapter

Kymera (193i/328i)

Shamrock (500i/750)

CCD, EMCCD, ICCD, InGaAs detectors

Key

- Andor Parts
- Please contact your local Andor representative
- Existing Parts

Please contact your local Andor representative

Kymera/Shamrock upright setup (table, railing etc.)
Modular Micro-spectroscopy Solutions

Spectrograph to microscope – key coupling considerations

<table>
<thead>
<tr>
<th>Coupling interface</th>
<th>Microscope</th>
<th>Spectrograph</th>
<th>Optical height matching required?</th>
<th>Configurability</th>
<th>Light collection efficiency</th>
<th>Confocality</th>
<th>Microscope port connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fibre optics</td>
<td>SMA or FC -to-C- mount adapter</td>
<td>X-Y fibre optic adapter (ferrule, SMA, or FC)</td>
<td>No</td>
<td>Limited - Choice of UV-VIS, VIN-NIR single or multicore fibres</td>
<td>Good</td>
<td>Low-d dictated by fibre optic core size</td>
<td>Yes</td>
</tr>
<tr>
<td>Direct coupling</td>
<td>Standard ‘male’ C-mount adapter (infinity corrected)</td>
<td>C-mount adapter plate</td>
<td>Yes</td>
<td>-</td>
<td>Best</td>
<td>Lowest – collection from entire objective field of view</td>
<td>Yes</td>
</tr>
<tr>
<td>Enclosed optical relay</td>
<td>Standard ‘male’ C-mount adapter (infinity corrected)</td>
<td>C-mount adapter plate</td>
<td>Yes</td>
<td>-</td>
<td>Good</td>
<td>Lowest – collection from entire objective field of view</td>
<td>Yes</td>
</tr>
<tr>
<td>Cage system</td>
<td>Standard ‘male’ C-mount adapter OR free-space (infinity corrected)</td>
<td>30 mm cage adapter</td>
<td>Yes</td>
<td>Highest – User-defined, large range of ‘cage’ accessories</td>
<td>Dependant on user optical configuration</td>
<td>User setup-dependent - possibility of pinhole integration</td>
<td>Yes</td>
</tr>
</tbody>
</table>

* Requires user to provide custom spectrograph positioning setup to accommodate this configuration

A Fibre optic coupling – interfacing to microscope upright & side port

Andor Kymera and Shamrock spectrographs offer a range of adjustable X-Y fibre optics input that can accommodate SMA, FC or Ø11 mm ferrule interfaces. F/# matchers allow maximum collection from NA=0.22 fibre optics assemblies for photon starved applications.

Andor fibre couplers

Fibre optics

SMA-SMA, FC-FC or Ferrule to SMA/FC

SMA/FC microscope adapters

Off-the-shelf side-port adapters can be found at www.Thorlabs.com

<table>
<thead>
<tr>
<th>Microscope side port connection (Thorlabs references)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Olympus IX71/81 &amp; 73/83</td>
</tr>
<tr>
<td>Leica DMI</td>
</tr>
<tr>
<td>Nikon Eclipse T-E</td>
</tr>
</tbody>
</table>

More fibre optics options at: andor.com/spectrographs (Accessories section)
Modular Micro-spectroscopy Solutions

Opto-mechanical coupling - interfacing to microscope side port

1 Microscope & spectrographs feet sets

Free-space optical coupling or 'hard' opto-mechanical coupling between Kymera or Shamrock spectrographs and microscope side output ports require optical axis height matching. Andor offers a range of fixed, rugged microscope feet and adjustable spectrograph feet to allow perfect alignment between micro-spectroscopy system components at an optical height of 150 mm.

<table>
<thead>
<tr>
<th>Microscope</th>
<th>Microscope fixed feet set</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leica DMI 4000/6000B</td>
<td>TR-LCDM-MNT-150</td>
</tr>
<tr>
<td>Leica Dmi 8</td>
<td>TR-DMi8-MNT-150</td>
</tr>
<tr>
<td>Nikon Eclipse Ti (not Ti2)</td>
<td>TR-NKTI-MNT-150</td>
</tr>
<tr>
<td>Nikon Eclipse Ti2</td>
<td>TR-NKTI2-MNT-150</td>
</tr>
<tr>
<td>Nikon TE-2000</td>
<td>TR-NKTE-MNT-150</td>
</tr>
<tr>
<td>Olympus IX71/81 (left port)</td>
<td>TR-OLIX-MNT-150-LP</td>
</tr>
<tr>
<td>Olympus IX73/83 (left port)</td>
<td>TR-OL83-MNT-150-LP</td>
</tr>
<tr>
<td>Zeiss Axiovert 200</td>
<td>TR-ZSAV-MNT-150</td>
</tr>
<tr>
<td>Zeiss Axio Observer</td>
<td>TR-ZAXO-MNT-150</td>
</tr>
</tbody>
</table>

2 Direct C-mount coupling

Kymera/Shamrock ‘female’ C-mount is directly coupled to specific microscope C-mount ‘male’ – provides the best light collection efficiency at the expense of confocality.

3 Enclosed optical relay

Direct mechanical coupling between a spectrograph and a microscope is the ideal configuration from an optical efficiency point-of-view. However, in case of physical interference between both instruments footprint, or the presence of an incubator around the microscope, an optical extender might be required.

Andor’s optical extender ‘4f’ configuration accommodates collimated and pseudo-collimated beam from the microscope, delivering uncompromising image relay performance to the Kymera/Shamrock spectrograph input aperture.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Details and Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Microscope interface</td>
<td>C-mount (female)</td>
</tr>
<tr>
<td>Spectrograph interface</td>
<td>C-mount (male)</td>
</tr>
<tr>
<td>Focal plane size</td>
<td>20 x 20 mm</td>
</tr>
<tr>
<td>Lens clear aperture</td>
<td>Ø 25 mm</td>
</tr>
<tr>
<td>Lens material</td>
<td>Fused silica, 400 – 1,000 nm (**)</td>
</tr>
<tr>
<td>Magnification</td>
<td>1:1 (horizontal &amp; vertical)</td>
</tr>
<tr>
<td>Distortion</td>
<td>&lt; 13 µm smile / barrel over focal plane</td>
</tr>
<tr>
<td>Overall length</td>
<td>375 mm</td>
</tr>
</tbody>
</table>

(*) 3 sets are required to accommodate microscope 150 mm optical height

(**) For alternative wavelength range, please contact your regional sale representative
Modular Micro-spectroscopy Solutions

4 Cage system adapter

Provides a highly modular, seamlessly upgradable and expandable platform for micro-spectroscopy setups. Andor Kymera/Shamrock spectrograph-to-microscope cage adapters are compatible with Thorlabs and Edmund Optics large range of 30 mm (*) cage system opto-mechanical accessories.

(*) For different size, please contact your local Andor representative

Wide range of opto-mechanical assemblies available:
- Ø 25 mm X-Y-Z-tilt lens or filter holders
- SMA/FC fibre connectors
- Beamsplitter and prism holders
- Pinhole holders
- Polarizer holders
- Iris and iris mounts
- Alignment targets

Andor offers a range of 30 mm cage to microscope adapters:

<table>
<thead>
<tr>
<th>Microscope</th>
<th>Microscope to cage system adapter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leica DMI 4000/6000B</td>
<td>TR-LCDM-CAGE-ADP</td>
</tr>
<tr>
<td>Leica DMI 8</td>
<td>TR-DMI8-CAGE-ADP</td>
</tr>
<tr>
<td>Nikon Eclipse Ti-series</td>
<td>TR-NKTI-CAGE-ADP</td>
</tr>
<tr>
<td>Nikon TE-2000</td>
<td>TR-NKTE-CAGE-ADP</td>
</tr>
<tr>
<td>Olympus IX71/81 (left port)</td>
<td>TR-OLIX-CAGE-ADP</td>
</tr>
<tr>
<td>Olympus IX73/83</td>
<td>TR-OL83-CAGE-ADP</td>
</tr>
<tr>
<td>Zeiss Axiovert 200</td>
<td>TR-ZSAV-CAGE-ADP</td>
</tr>
<tr>
<td>Zeiss Axio Observer</td>
<td>TR-ZAXO-CAGE-ADP</td>
</tr>
</tbody>
</table>

Generic 30 mm cage adapter | SR-ASM-0065

Example Configuration – ‘4F’ optical relay lens

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Part Code</th>
<th>#</th>
<th>Supplier</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Kymera 193i, 15 mm wide-aperture slit</td>
<td>SR-ASZ-0086</td>
<td>x1</td>
<td>Andor</td>
</tr>
<tr>
<td>B</td>
<td>30 mm cage adapter</td>
<td>SR-ASM-0065</td>
<td>x1</td>
<td>Andor</td>
</tr>
<tr>
<td>C</td>
<td>30 mm cage rods</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12” length</td>
<td></td>
<td>x4</td>
<td>Thorlabs</td>
</tr>
<tr>
<td></td>
<td>3” length</td>
<td></td>
<td>x4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1” length</td>
<td></td>
<td>x4</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.5” length</td>
<td></td>
<td>x4</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Ø25 mm lens, VIS-NIR achromatic</td>
<td>NT49374-INK</td>
<td>x2</td>
<td>Edmund Optics</td>
</tr>
<tr>
<td>E</td>
<td>XY lens holder, Ø25 mm</td>
<td>CXY1</td>
<td>x2</td>
<td>Thorlabs</td>
</tr>
<tr>
<td>F</td>
<td>Thread adapter for lens tube</td>
<td>SM1A16</td>
<td>x2</td>
<td>Thorlabs</td>
</tr>
<tr>
<td>G</td>
<td>Lens Tubes, Ø30 mm</td>
<td>SM30L10</td>
<td>x2</td>
<td>Thorlabs</td>
</tr>
<tr>
<td>H</td>
<td>Olympus IX81 cage adapter</td>
<td>TR-OLIX-CAGE-ADP</td>
<td>x1</td>
<td>Andor</td>
</tr>
</tbody>
</table>
Wide Aperture Slit - Combining sample imaging & spectral analysis through the same optical path

‘Infinity-corrected’ microscope ports exhibit quasi-collimated output beam with F/number typically > F/20. When this beam is relayed at the entrance slit of an ‘imaging-corrected’ spectrograph through direct coupling or low magnification optical arrangement, high fidelity images of the sample under the microscope objective can be acquired.

---

**Step 1:** Sample image visualisation
- Spectrograph input slits are opened widely
- Grating (or flat mirror) is positioned at the ‘zero’ order, reflecting the un-dispersed image of the sample
- Sample images are acquired by a camera at the output port of the spectrograph

**Step 2:** Sample positioning
- The image of the sample area of interest is positioned in the middle of the spectrograph input slit (by moving the microscope X-Y stage)

**Step 3:** Spectral acquisition
- Spectrograph input slits are closed to a few 10’s of µm
- Grating is rotated to allow access to the desired wavelength range
- Spectral information from the sample can be acquired with the detector operating in vertical binning of multi-track mode

---

Above: High fidelity image of a 25 µm pitch grid pattern on a microscope slide

**Microscope:** Olympus IX81 with x40 objective (N.A. 0.55) and wide-field illumination.

**Detection:** Kymera 193i directly coupled to the microscope side port, with a 15 mm wide-aperture slit, a grating at the ‘zero’ order and an iDus 420 CCD camera.

---

<table>
<thead>
<tr>
<th>Part Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-ASZ-0086</td>
<td>Wide-aperture entrance slit, motorised from 10 µm to 2.5 mm, manual up to 15 mm</td>
</tr>
<tr>
<td>SRx-GRT-yyyy-zzz</td>
<td>Grating options Please refer to individual spectrograph specification sheets at andor.com/spectrographs</td>
</tr>
<tr>
<td>SRx-GRT-MR-AL+MGF2</td>
<td>Flat mirror option, MgF2-protected aluminium, broadband UV-VIS-IR Please refer to spectrograph specification sheets for efficiency curves at andor.com/spectrographs</td>
</tr>
<tr>
<td>SRx-GRT-MR-SIL</td>
<td>Flat mirror options, silver-protected, highest efficiency in the VIS-IR Please refer to spectrograph specification sheets for efficiency curves at andor.com/spectrographs</td>
</tr>
</tbody>
</table>
C

Research-grade spectrographs for Micro-spectroscopy

Highly modular motorized platforms with dual output ports, dual/triple grating turret and wide range of motorized and field upgradable accessories

**Kymera 193i** – Compact 193 mm imaging Czerny-Turner spectrograph with Active Focus technology – ideal for lower spectral resolution applications.

**Kymera 328i** – Highly configurable platform, with advanced user controls to always access the very best spectral performance for routine measurements or more demanding optical setups.

**Shamrock 500i/750** – Ideal for more demanding, high and higher spectral resolution applications.

Learn more about the Andor spectrograph range and accessories at [andor.com/spectrographs](http://andor.com/spectrographs)

<table>
<thead>
<tr>
<th>Grating (l/mm)</th>
<th>150</th>
<th>300</th>
<th>600</th>
<th>1200</th>
<th>1800 (Holo)</th>
<th>2400 (Holo)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Kymera 193i</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandpass (nm)<strong>1,2,3</strong></td>
<td>902</td>
<td>445</td>
<td>215</td>
<td>98</td>
<td>56</td>
<td>46*</td>
</tr>
<tr>
<td>Resolution (nm)<strong>1,2,3</strong></td>
<td>1.96</td>
<td>0.96</td>
<td>0.47</td>
<td>0.21</td>
<td>0.12</td>
<td>0.10*</td>
</tr>
<tr>
<td><strong>NEW Kymera 328i</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandpass (nm)<strong>1,2,3</strong></td>
<td>542</td>
<td>268</td>
<td>131</td>
<td>61</td>
<td>41</td>
<td>29*</td>
</tr>
<tr>
<td>Resolution (nm)<strong>4,5,6,7</strong></td>
<td>0.88–0.62</td>
<td>0.44–0.31</td>
<td>0.21–0.15</td>
<td>0.10–0.07</td>
<td>0.06–0.05</td>
<td>0.05–0.04*</td>
</tr>
<tr>
<td><strong>Shamrock 500i</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandpass (nm)<strong>1,2,3</strong></td>
<td>357</td>
<td>177</td>
<td>86</td>
<td>40</td>
<td>26</td>
<td>19*</td>
</tr>
<tr>
<td>Resolution (nm)<strong>4,5,6</strong></td>
<td>0.52</td>
<td>0.26</td>
<td>0.13</td>
<td>0.06</td>
<td>0.04</td>
<td>0.03*</td>
</tr>
<tr>
<td><strong>Shamrock 750</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bandpass (nm)<strong>1,2,3</strong></td>
<td>242</td>
<td>120</td>
<td>59</td>
<td>28</td>
<td>18</td>
<td>14*</td>
</tr>
<tr>
<td>Resolution (nm)<strong>4,5,6</strong></td>
<td>0.35</td>
<td>0.18</td>
<td>0.09</td>
<td>0.04</td>
<td>0.03</td>
<td>0.02*</td>
</tr>
</tbody>
</table>

Looking for higher optical throughput?
The Andor HoloSpec is a high throughput transmission spectrograph with a robust, compact, low stray-light design ideal for photon-starved, fibre-coupled setups

D

Market leading detectors for Micro-spectroscopy

Best matching requirements for sensitivity at wavelengths of interest, acquisition speed and time-resolution.

**iDus 416 ‘low-dark current deep-depletion’ (LDC-DD) CCD** – Superior near-IR detection with up to 95% QE at 800 nm.

**Newton® and iXon Ultra EMCCD** – Unmatched sensitivity in the UV-visible range, superfast kHz acquisition capabilities, single photon sensitive.

**iDus & Newton ‘Dual AR CCD’ (BEX2-DD)** – Market leading broadband detection with >90% QE from 400 to 850 nm.

**iStar ICCD** – Nanosecond-gated detector for characterizing fast transient phenomena.

Learn more about Andor detectors range at [andor.com/scientific-cameras](http://andor.com/scientific-cameras)
Software solutions

**Solis Spectroscopy** A 32-bit and fully 64-bit enabled application for Windows (7, 8, 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.

**Kymera/Shamrock SDK** A software development kit that allows you to control the Andor range of Kymera/Shamrock spectrographs from your own application. Compatible as 32-bit and 64-bit libraries for Windows (7, 8, 8.1 and 10). Compatible with C/C++, C#, VBNet and LabVIEW and Linux.

**µManager** Integrated modular micro-spectroscopy setup control popular with the Life Science community. All market leading motorized microscope & accessories seamlessly controlled and maintained. Integrated sequence builder & macro interfaces for complex experiments building. Dedicated spectra display & processing interface plug-in, available through MyAndor.

5 steps to set up your micro-spectroscopy experiment

1. Set up spectrograph
2. Set up camera
3. Set up microscope
4. Set up experiment e.g. X-Y-Z chemical mapping
5. Display spectral data in real time & save acquisition series
Order Today

Need more information? At Andor we are committed to finding the correct solution for you. With a dedicated team of technical advisors, we are able to offer you one-to-one guidance and technical support on all Andor products. For a full listing of our local sales offices, please see: [andor.com/contact](http://andor.com/contact)

Our regional headquarters are:

**Europe**
Belfast, Northern Ireland
Phone +44 (28) 9023 7126
Fax +44 (28) 9031 0792

**Japan**
Tokyo
Phone +81 (3) 6732 8968
Fax +81 (3) 6732 8939

**North America**
Concord, MA, USA
Phone +1 (860) 290 9211
Fax +1 (860) 290 9566

**China**
Beijing
Phone +86 (10) 8271 9066
Fax +86 (10) 8271 9055

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.
3. Typical values quoted at 500 nm centre wavelength.
4. Typical values quoted at 300 nm centre wavelength.
5. With TrueRes™ option.