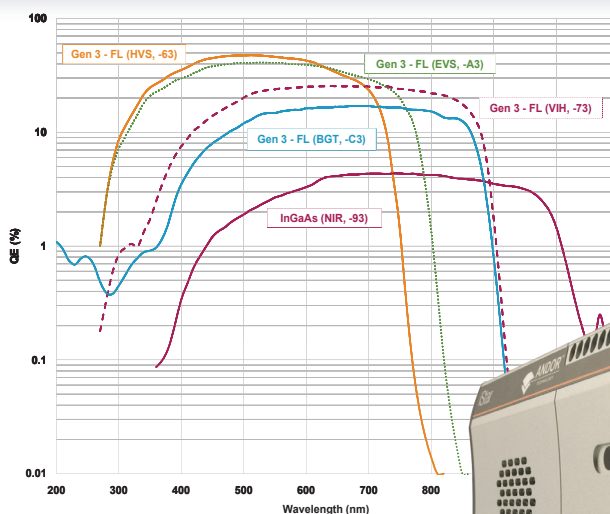


Fast photography of a plasma plume emission.  
Courtesy of Laurent Philippet, Laboratoire de Physique des Lasers, CNRS, Paris 13 University.



Time-Resolved



## Features and Benefits

- **USB 2.0 connection**  
Simple Plug & Play connection
- **Multi-MHz Readout speeds**  
Rapid image capture for fast transition phenomena analysis and "focusing mode"
- **Integrated Digital Delay Generator**  
With comprehensive software controls
- **Close-Coupled Gating**  
< 2 ns true optical gating speeds - ultimate temporal resolution
- **Lowest insertion delay**  
As low as 19 ns
- **Fibre-optic coupling**  
High optical throughput without vignetting
- **IntelliGate™**  
MCP gating for On/Off ratios >10<sup>8</sup> in the UV
- **Photocathode gating rate up to 500 kHz**  
Increased Signal to Noise ratio for high speed laser-based experiments
- **Cropped sensor mode**  
Specialised acquisition mode to achieve fastest image acquisition rate
- **High resolution Gen 2 and 3 intensifiers**  
Highest available intensifier resolution with QE up to 50% and sensitivity options from 120 nm to 1,100 nm
- **Thermo-Electric cooling down to -40°C**  
Ideal for low-light applications
- **Real-time control**  
Intuitive Windows user interface for real-time acquisition optimisation
- **Photocathode dry gas purge port**  
Provides further EBI reduction for low-light applications

## Industry workhorse for high-resolution, nanosecond, time-resolved Imaging

Andor's iStar DH334T intensified CCD camera series is designed to offer the ultimate integrated detection solution for high resolution, ns-scale time-resolved Imaging. The 1024 x 1024 array is ideally suited for a wide variety of time-resolved applications including Plasma analysis, LIBS when fitted to Andor Mechelle spectrograph, or fast transient phenomena. It offers Multi-MHz readout, along with laptop-friendly, USB 2.0 connectivity and a fully integrated, software-controlled **Digital Delay Generator (DDG™)**. This allows seamless integration of complex experiments at the touch of a button, with full timing and gain control through a single interactive interface. Generation 2 & 3 image intensifiers with various entrance input windows and phosphor options are available to match wavelength range requirements from 120 nm to 1,100 nm.

## Specifications Summary

	Ø 18mm	Ø 25mm
Effective active area of CCD (mm)	13.3 x 13.3 mm	
Fibre optic taper magnification	1:1	1.5:1
Effective CCD pixel size	13 x 13 μm (100% fill factor)	19.5 x 19.5 μm (100% fill factor)
Active pixels	1024 x 1024	
Read noise (rms)	As low as 4 e <sup>-</sup>	
Frame rate image/sec [spectra /sec]	Up to 4 [3,450]	
Useful photocathode spectral range	120 - 1,100 nm*	
Photocathode QE	Up to 50%*	Up to 45%*
Minimum optical gate width	< 2 ns*	

\* Dependant on intensifier type

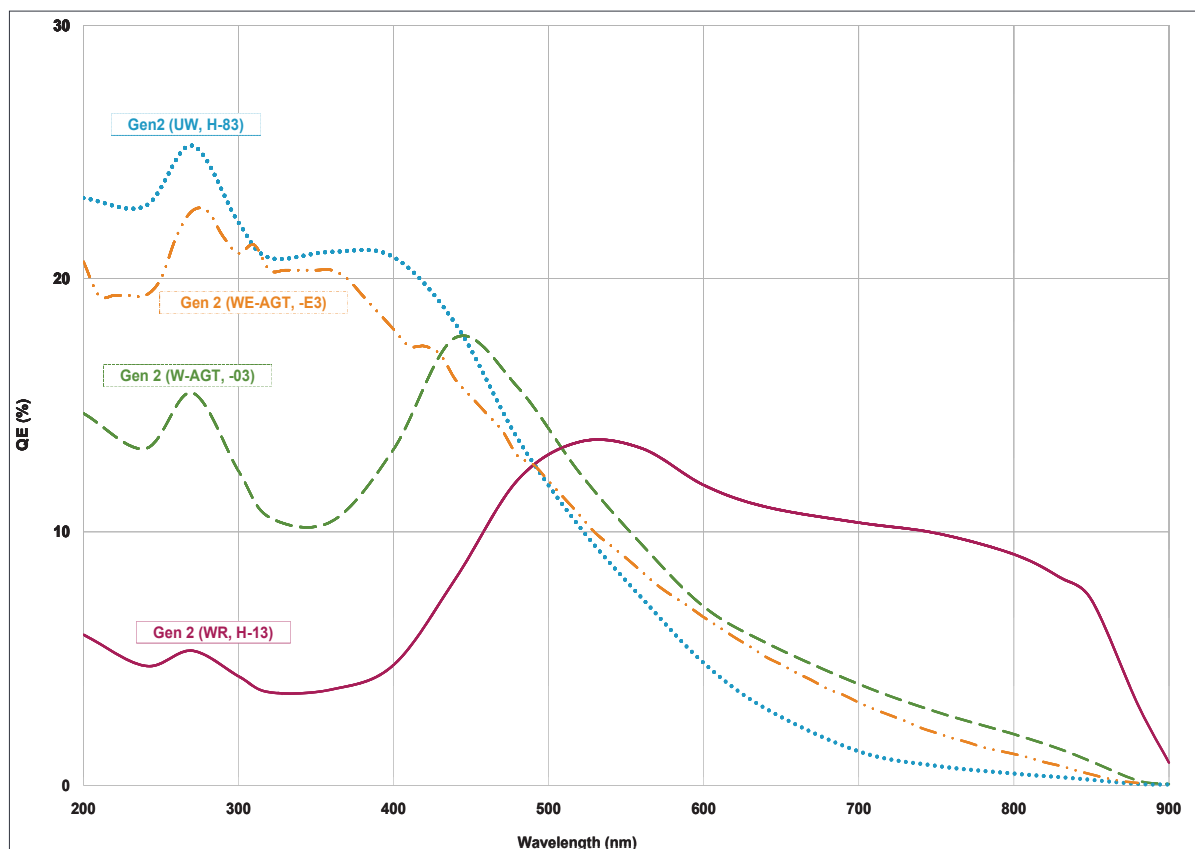
## Specifications - Gen 2 Image Intensifiers <sup>•1</sup>

Photocathode model	18*-03	18*-04	18*-05 †	18H-13	18H-83	18*-E3	25*-03
Useful aperture	Ø 18 mm						Ø 25 mm
Input window	Quartz	Quartz	MgF <sub>2</sub>	Quartz	Quartz	Quartz	Quartz
Photocathode type	W-AGT	W-AGT	W-AGT	WR	UW	WE-AGT	W-AGT
Peak QE @ room temperature <sup>*2</sup>	18	18	15	13.5	25	22	16
Wavelength range	180 - 850 nm	180 - 850 nm	120 - 850 nm	180 - 920 nm	180 - 850 nm	180 - 850 nm	180 - 850 nm
Image intensifier resolution limit <sup>*3</sup>	25 µm	30 µm	25 µm	25 µm	25 µm	25 µm	35µm
Phosphor type [decay time to 10%]	P43 [2 ms]	P46 [200 ns]	P43 [2 ms]	P43 [2 ms]	P43 [2 ms]	P43 [2 ms]	P43 [2 ms]
Minimum optical gate width (ns) <sup>*4, 5</sup>							
U (Ultrafast)	< 2	< 2	< 5	-	-	< 2	< 3
F (Fast)	< 5	< 5	< 10	-	-	< 5	< 7
H (High QE)	-	-	-	< 50	< 100	-	-
Maximum intensifier gain <sup>*6</sup>	> 1000	> 500	> 1000	> 850	> 500	> 1000	> 1000
Maximum photocathode repetition rate (with Intelligate™ OFF)	500 kHz (continuous)						
Maximum photocathode repetition rate (with Intelligate™ ON)	5 kHz (continuous)						
Equivalent Background Illuminance (EBI)	< 0.2 e <sup>-</sup> /pix/sec						

\* Substitute with appropriate gate width option, e.g. 18F-03 (please refer to page 5 for detailed ordering information)

† Available with VUV-compatible spectrograph interface

## Quantum Efficiency Curves for Gen 2 Image Intensifiers <sup>\*2</sup>

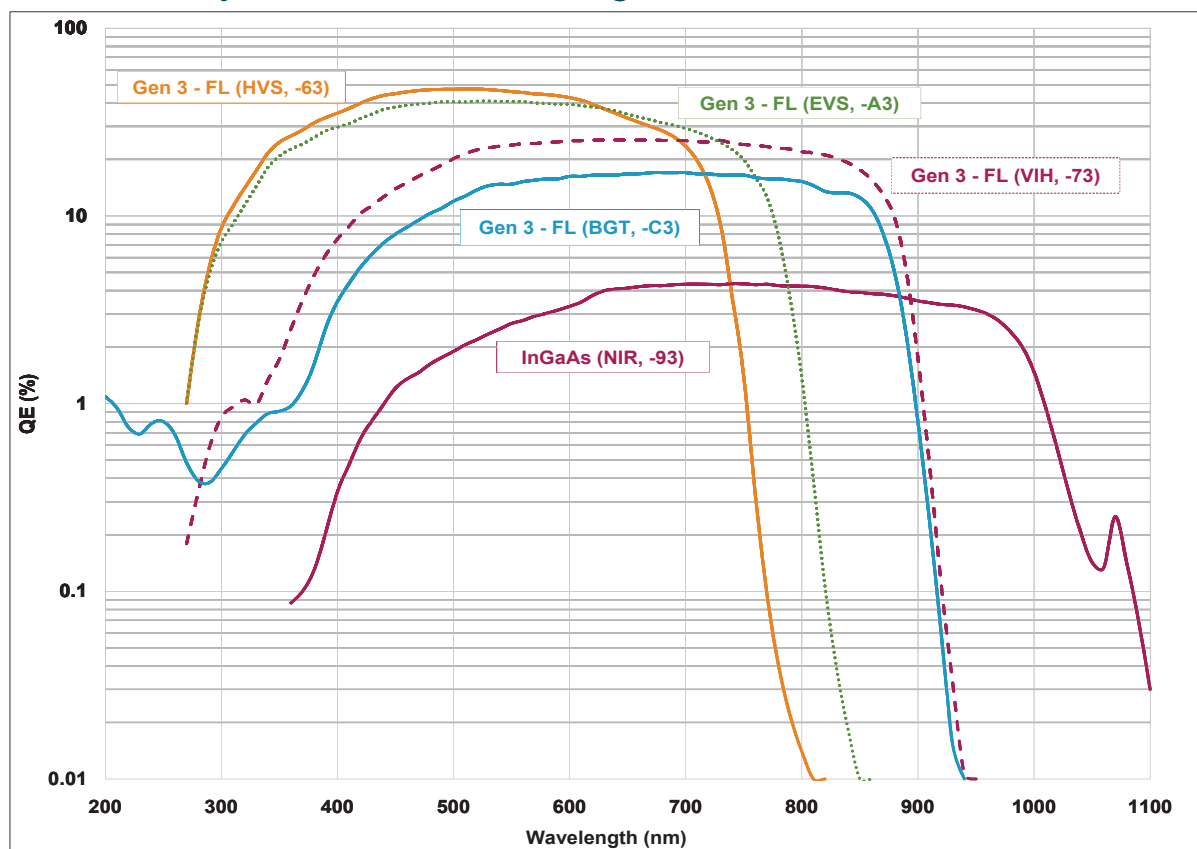


## Specifications - Gen 3 Image Intensifiers •<sup>1</sup>

Photocathode model	18*-63	18*-73	18*-93	18*-A3	18*-C3
Useful aperture	Ø 18 mm				
Input window	Glass	Glass	Glass	Glass	MgF <sub>2</sub> + F/O + Lumogen
Photocathode type	HVS	VIH	NIR	EVS	BGT
Peak QE @ room temperature • <sup>2</sup>	> 47.5	> 25.5	> 4	> 40	> 17
Wavelength range	280 - 760 nm	280 - 910 nm	380 - 1090 nm	280 - 810 nm	< 200 - 910 nm
Image intensifier resolution limit • <sup>3</sup>	30 µm	30 µm	30 µm	30 µm	40 µm
Phosphor type [decay time to 10%]	P43 [2 ms]				
Minimum optical gate width (ns) • <sup>5</sup>	U (Ultrafast) < 2 F (Fast) < 5				
Maximum intensifier gain • <sup>6</sup>	> 200				
Maximum photocathode repetition rate (with Intelligate™ OFF)	500 kHz (continuous)				
Maximum photocathode repetition rate (with Intelligate™ OFF)	5 kHz (continuous)				
Equivalent Background Illuminance (EBI)	< 0.1 e/pix/sec	< 0.3 e/pix/sec	< 2 e/pix/sec	< 0.2 e/pix/sec	< 0.3 e/pix/sec

\* Substitute with appropriate gate width option, e.g. 18U-63 (please refer to page 5 for detailed ordering information)

## Quantum Efficiency Curves for Gen 3 Image Intensifiers •<sup>2,•7</sup>



## CCD Specifications •<sup>1</sup>

Active pixels	1024 x 1024			
Fibre optic taper magnification	Ø 18 mm 1:1		Ø 25 mm 1.5:1	
Effective CCD pixel size	Ø 18 mm 13 x 13 µm		Ø 25 mm 19.5 x 19.5 µm	
Effective active area	13.3 x 13.3 mm			
Pixel well depth	100,000 e <sup>-</sup>			
Image pixel well depth	150,000 e <sup>-</sup>			
Read noise e <sup>-</sup> *8	50 kHz	1 MHz	3 MHz	5 MHz
Typical	5	8	14	20
Maximum	7	12	18	50
Maximum acquisition rates	Frame  4 full fps 7.3 fps (2x2 binning)	FVB  145 sps	Crop Mode (10 rows) 77 fps 3,450 sps	Fast Kinetics (4 rows) 29,850 Hz
Linearity *9	Better than 99%			
Minimum temperature air cooled [dark current, e <sup>-</sup> /pixel/sec] Coolant chiller, coolant @ 10°C, 0.75 l/min [dark current, e <sup>-</sup> /pixel/sec]	-30°C [0.2] -40°C [0.1]			

## Internal Digital Delay Generator (DDG™) Key Functions

Gate pulse delay & width	<ul style="list-style-type: none"> <li>Adjustable from 0 ns to 10 s (Delay) and from 0.5 ns to 10 s (Width) in 10 ps steps</li> <li>Software controlled, pre-programmed or real-time</li> </ul>
Trigger Outputs	
Output A, B and C	<ul style="list-style-type: none"> <li>3x output, +5V CMOS level - compatible with 50 Ω source impedance; can drive 5V into a non-terminating load or 2.5V into 50 Ω load; output synchronised triggers for auxiliary equipment, e.g. lasers, flash lamps, National Instrument™ hardware</li> <li>Individual delays control from 0 ns to 10 s in 10 ps steps</li> <li>Configurable Polarity</li> <li>Software controlled, pre-programmed or real-time</li> </ul>
Fire	<ul style="list-style-type: none"> <li>5V CMOS level reference signal for beginning and end of individual CCD exposure</li> </ul>
Arm monitor	<ul style="list-style-type: none"> <li>5V CMOS level reference signal for beginning and end of individual CCD exposure + associated CCD readout sequence</li> </ul>
Gate & output A, B and C jitter	<ul style="list-style-type: none"> <li>35 ps rms (relative to external trigger signal)</li> </ul>
Trigger Inputs	
External trigger	<ul style="list-style-type: none"> <li>Trigger input for CCD and Digital Delay Generator</li> <li>Up to 500 kHz for Integrate-On-Chip mode</li> <li>Software-configurable Polarity, Termination and Trigger Threshold</li> <li>Fast external software option for most rapid camera response to external trigger (CCD keep clean interruption) – no need for pre-trigger pulse</li> </ul>
Direct gate	<ul style="list-style-type: none"> <li>TTL input for exact external control of photocathode width and timing with smallest insertion delay.</li> </ul>
Additional Controls	
Gate monitoring	<ul style="list-style-type: none"> <li>AC coupling from photocathode to monitor exact photocathode on/off switching and timings</li> </ul>
Insertion delay	< 19 ns in direct gate operation

Have you found what you are looking for?

**Need faster response phosphor for Fast Kinetics?** P46 phosphor is available as an option for all models.

**Need a customised version?** Please contact us to discuss our Customer Special Request (CSR) options.

## Creating The Optimum Product for You

How to customise the New iStar DH334T:

### Step 1.

Select the diameter of intensifier required.

### Step 2.

Select the minimum gating speed option that best suits your needs. For the available combinations please refer to the image intensifier tables on pages 2 and 3.

### Step 3.

Select the image intensifier type that best suits your needs.

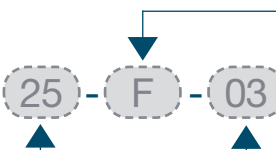
### Step 4.

Please indicate which software you require.

### Step 5.

For compatibility, please indicate which accessories are required.

DH334T-  
example shown



### Step 1.

Choose intensifier diameter

18: Ø 18 mm  
25: Ø 25 mm

### Step 2.

Choose minimum gating speed

H: High QE, slow gating  
F: Fast gating  
U: Ultra fast gating

### Step 3.

Choose image intensifier option (Gen 2):

03: W-AGT photocathode, P43 phosphor  
04: W-AGT photocathode, P46 phosphor  
05: W-AGT photocathode, MgF<sub>2</sub> window, P43 phosphor  
13: WR photocathode, P43 phosphor  
83: UW photocathode, P43 phosphor  
E3: WE-AGT photocathode, P43 phosphor

Choose image intensifier option (Gen 3):

63: HVS photocathode, P43 phosphor  
73: VIH photocathode, P43 phosphor  
93: NIR photocathode, P43 phosphor  
A3: EVS photocathode, P43 phosphor  
C3: BGT photocathode, P43 phosphor

### Step 4.

**The New iStar ICCD also requires at least one of the following software options:**

**Solis for Time-Resolved** A 32-bit application compatible with 32 and 64-bit Windows (XP, Vista and 7) offering rich functionality for data acquisition and processing. AndorBasic provides macro language control of data acquisition, processing, display and export.

**Andor SDK** A software development kit that allows you to control the Andor range of cameras from your own application. Available as 32 and 64-bit libraries for Windows (XP, Vista and 7) and Linux. Compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab.

### Step 5.

**The following accessories are available:**

**LM-C** C-mount lens adaptor

**LM-NIKON-F** F-mount lens adaptor

**ACC-XW-CHIL-160** Oasis 160 Ultra compact chiller unit

In addition to the accessories listed the following special options are also available:

**90°** USB connection

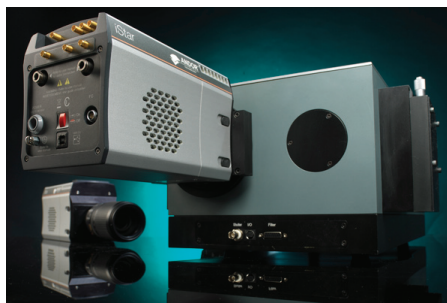
**UV** or visible lenses or adapter extension tubes

Please contact your local Sales representative for details of how to order any of these items.

### Spectrograph Compatibility

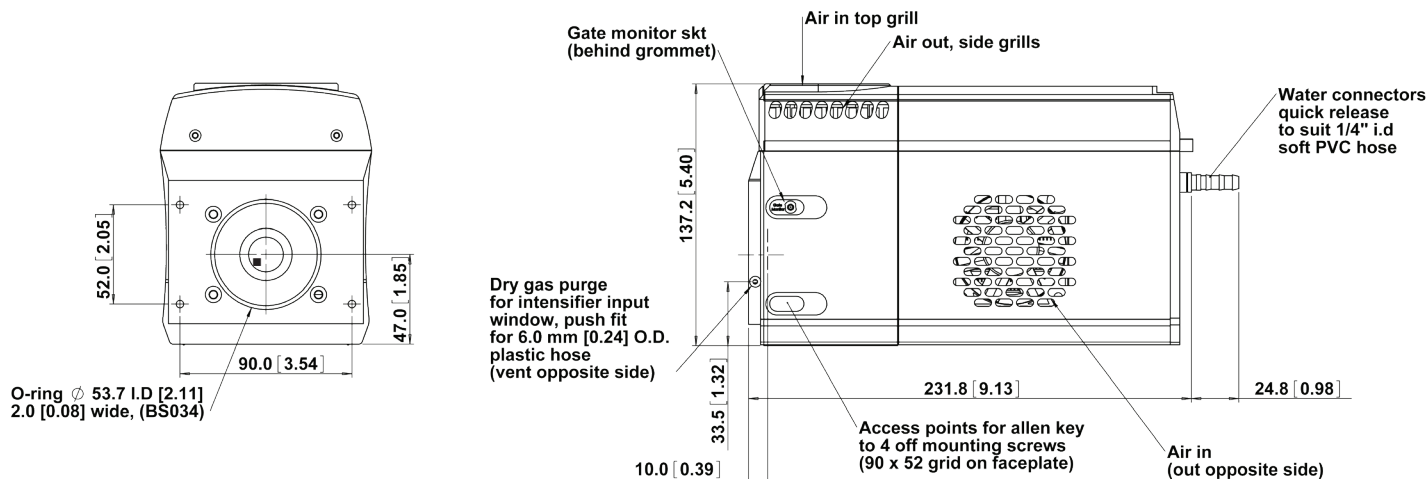
The iStar series is fully compatible with Andor's Shamrock spectrograph (163 - 750 mm focal lengths) family. Spectrograph mounting flanges and software control are available for a wide variety of 3rd party spectrographs including, McPherson, JY/Horiba, PI/Acton, Chromex/Bruker, Oriel/Newport, Photon Design, Dongwoo, Bentham, Solar TII and others.

No specific flange is required for the **Andor Mechelle 5000** as this combination comes as a fully integrated system.



## Product Drawings

Dimensions in mm [inches]



Weight: 4.2 kg [9 lb 4 oz]

■ = position of pixel 1,1

## Connecting to the iStar

### Camera Control

Connector type: USB 2.0

### Logic Input / Output

Connector type: SMA, provided with SMA - BNC cable

5x outputs: FIRE pulse, Output A, B, C from DDG™ and ARM

2x inputs: Camera trigger from 3<sup>rd</sup> party source & direct gate for complete, direct external control of intensifier gating

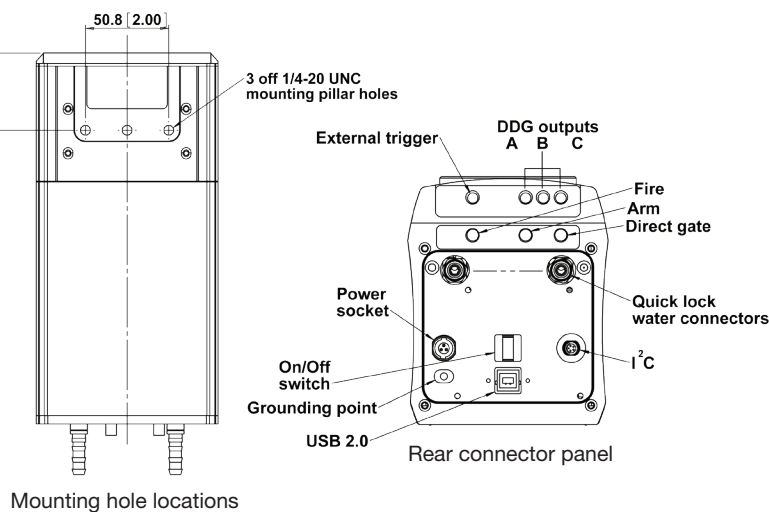
### I<sup>2</sup>C connector

Compatible with Fischer SC102A054-130, pin-outs as follow:

1 = Shutter (5V CMOS level with 50 Ω impedance), 2 = I<sup>2</sup>C Clock (5V), 3 = I<sup>2</sup>C Data (5V), 4 = +5 Vdc, 5 = Ground

### Gate Monitor

1x output: AC coupling to photocathode



## Applications Guide

	Gen 2	Gen 2 UV Enhanced (-05, -83, -E3)	Gen 3*	InGaAs
Plasma Studies	✓	✓	✓	✓
Laser Induced Fluorescence (LIF, PLIF)	✓	✓	✓	
Time Resolved Luminescence Imaging & Spectroscopy	✓	✓	✓	
Laser Induced Breakdown Spectroscopy (LIBS)	✓	✓	✓	
Transient Absorption Imaging	✓	✓	✓	✓
Time Resolved Photoluminescence Imaging			✓	✓
Particle Image Velocimetry (PIV)	✓	✓	✓	

\* Gen 3 typically do not exhibit any UV response - Andor -C3 is constructed with an additional input phosphor interface to provide this UV response.

✓ = Suitable  
✓ = Optimum





## Order Today

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 Fax +1 (860) 290 9566

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 Phone +86 (10) 5129 4977  
 Fax +86 (10) 6445 5401

### Items shipped with your camera

Power Brick, 12V, 120W single line  
 2 x 2m BNC to SMA cable  
 3 Metre USB cable A to B type, shielded (1off)  
 1x Quick launch guide  
 1x CD containing Andor user guides  
 1x Individual system performance booklet

### Regulatory Compliance

Compliant with the requirements of the EU EMC and LV Directives through testing to EN 61326-1 and EN 61010-1.  
 External power supply PSE-approved

### Footnotes: Specifications are subject to change without notice

- Figures are typical unless otherwise stated.
- Typical photocathode Quantum Efficiency and standard quartz input window transmission as measured by the tube manufacturer.  $MgF_2$  window allows extended operation down to 120 nm.
- Typical resolution of the image intensifier tube only, not the overall resolution of the system. As a rough guide, the smallest resolvable FWHM feature will be approximately 2x the CCD pixel size. This is a very important consideration for optical resolution calculations in spectrograph-based systems.
- Gen 2 High QE (H) option – Photocathode QE is inherently linked to the gating speed of the intensifier. High QE option (H) offers higher peak QE than Ultrafast (U) or Fast (F) intensifiers, while exhibiting minimum gating speed one order of magnitude lower.
- Actual measured minimum optical gating of the photocathode, reflecting not only the electrical pulse width applied to the photocathode but also its inherent iris time.
- Gain is software-selectable through a 12-bit DAC and varies exponentially with DAC setting.
- Combination of -73 GaAsP photocathode with a lumogen-coated fibre-optic plate and protective  $MgF_2$  window. The latter additional optical interfaces are the reason for the lowered QE in the visible NIR region, for the -C3 model.
- Measured for the entire system. Combination of CCD readout noise and A/D noise - measurement is for single pixel readout with -20°C CCD cooling and at minimum exposure time under dark conditions. Values quoted are measured with highest available PAG setting.
- Linearity is measured from a plot of counts vs signal up to the saturation point of the system.

### Minimum Computer Requirements:

- 3.0 GHz single core or 2.4 GHz multi core processor
- 2 GB RAM
- 100 MB free hard disc to install software (at least 1 GB recommended for data spooling)
- USB 2.0 High Speed Host Controller capable of sustained rate of 40MB/s
- Windows (XP, Vista and 7) or Linux

### Operating & Storage Conditions

Operating Temperature 0°C to 40°C ambient  
 Relative Humidity < 70% (non-condensing)  
 Storage Temperature -20°C to 55°C



Windows is a registered trademark of Microsoft Corporation.  
 Labview is a registered trademark of National Instruments.  
 Matlab is a registered trademark of The MathWorks Inc.

TiStar334TSS 0311 R2