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.

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 >10⁸ in the UV

- **Photocathode gating rate up to 500 kHz**
  Increased Signal to Noise ratio for high speed laser-based experiments

- **Cropped sensor mode**
  Specialized 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

Specifications Summary

<table>
<thead>
<tr>
<th>Specification</th>
<th>Ø 18 mm</th>
<th>Ø 25 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective active area of CCD (mm)</td>
<td>13.3 x 13.3 mm</td>
<td>13.3 x 13.3 mm</td>
</tr>
<tr>
<td>Active pixels</td>
<td>1024 x 1024</td>
<td>1024 x 1024</td>
</tr>
<tr>
<td>Fibre optic taper magnification</td>
<td>1:1</td>
<td>1.5:1</td>
</tr>
<tr>
<td>Effective CCD pixel size</td>
<td>13 x 13 μm (100% fill factor)</td>
<td>19.5 x 19.5 μm (100% fill factor)</td>
</tr>
<tr>
<td>Read noise (rms)</td>
<td>As low as 4 e⁻</td>
<td>As low as 4 e⁻</td>
</tr>
<tr>
<td>Frame rate image/sec [spectra /sec]</td>
<td>Up to 4 [3,450]</td>
<td>Up to 4 [3,450]</td>
</tr>
<tr>
<td>Useful photocathode spectral range</td>
<td>120 - 1,100 nm*</td>
<td>120 - 1,100 nm*</td>
</tr>
<tr>
<td>Photocathode QE</td>
<td>Up to 50%*</td>
<td>Up to 45%*</td>
</tr>
<tr>
<td>Minimum optical gate width</td>
<td>&lt; 2 ns*</td>
<td>&lt; 2 ns*</td>
</tr>
<tr>
<td>Digitization</td>
<td>16 bit</td>
<td>16 bit</td>
</tr>
</tbody>
</table>

* Dependant on intensifier type

Fast photography of a plasma plume emission. Courtesy of Laurent Philippet, Laboratoire de Physique des Lasers, CNRS, Paris 13 University.
Specifications - Gen 2 Image Intensifiers  

<table>
<thead>
<tr>
<th>Photocathode model</th>
<th>18*-03</th>
<th>18*-04</th>
<th>18*-05 †</th>
<th>18H-13</th>
<th>18H-83</th>
<th>18*-E3</th>
<th>25*-03</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Useful aperture</strong></td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
<td>Ø 18 mm</td>
</tr>
<tr>
<td><strong>Input window</strong></td>
<td>Quartz</td>
<td>Quartz</td>
<td>MgF₂</td>
<td>Quartz</td>
<td>Quartz</td>
<td>Quartz</td>
<td>Quartz</td>
</tr>
<tr>
<td><strong>Photocathode type</strong></td>
<td>W-AGT</td>
<td>W-AGT</td>
<td>W-AGT</td>
<td>WR</td>
<td>UW</td>
<td>WE-AGT</td>
<td>W-AGT</td>
</tr>
<tr>
<td><strong>Peak QE @ room temperature</strong></td>
<td>18</td>
<td>18</td>
<td>15</td>
<td>13.5</td>
<td>25</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td><strong>Wavelength range</strong></td>
<td>180 - 850 nm</td>
<td>180 - 850 nm</td>
<td>120 - 850 nm</td>
<td>180 - 920 nm</td>
<td>180 - 850 nm</td>
<td>180 - 850 nm</td>
<td>180 - 850 nm</td>
</tr>
<tr>
<td><strong>Image intensifier resolution limit</strong></td>
<td>25 µm</td>
<td>30 µm</td>
<td>25 µm</td>
<td>25 µm</td>
<td>25 µm</td>
<td>25 µm</td>
<td>35 µm</td>
</tr>
<tr>
<td>**Minimum optical gate width (ns) **</td>
<td>&lt; 2</td>
<td>&lt; 5</td>
<td>&lt; 10</td>
<td>-</td>
<td>-</td>
<td>&lt; 2</td>
<td>&lt; 7</td>
</tr>
<tr>
<td><strong>Maximum relative gain</strong></td>
<td>&gt; 1000</td>
<td>&gt; 500</td>
<td>&gt; 1000</td>
<td>&gt; 850</td>
<td>&gt; 500</td>
<td>&gt; 300</td>
<td>&gt; 1000</td>
</tr>
</tbody>
</table>

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-/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 *
### Specifications - Gen 3 Image Intensifiers

<table>
<thead>
<tr>
<th>Photocathode model</th>
<th>18*-63</th>
<th>18*-73</th>
<th>18*-93</th>
<th>18*-A3</th>
<th>18*-C3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Useful aperture</td>
<td>Ø 18 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input window</td>
<td>Glass</td>
<td>Glass</td>
<td>Glass</td>
<td>Glass</td>
<td>MgF₂ + F/O + Lumogen</td>
</tr>
<tr>
<td>Photocathode type</td>
<td>HVS</td>
<td>VIH</td>
<td>NIR</td>
<td>EVS</td>
<td>BGT</td>
</tr>
<tr>
<td>Peak QE @ room temperature</td>
<td>&gt; 47.5</td>
<td>&gt; 25.5</td>
<td>&gt; 4</td>
<td>&gt; 40</td>
<td>&gt; 17</td>
</tr>
<tr>
<td>Wavelength range</td>
<td>280 - 760 nm</td>
<td>280 - 910 nm</td>
<td>380 - 1090 nm</td>
<td>280 - 810 nm</td>
<td>&lt; 200 - 910 nm</td>
</tr>
<tr>
<td>Image intensifier resolution limit</td>
<td>30 µm</td>
<td>30 µm</td>
<td>30 µm</td>
<td>30 µm</td>
<td>40 µm</td>
</tr>
<tr>
<td>Phosphor type [decay time to 10%]</td>
<td>P43 [2 ms]</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum optical gate width (ns)</td>
<td>&lt; 2</td>
<td>&lt; 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum relative gain</td>
<td>&gt; 200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum photocathode repetition rate (with Intelligate™ OFF)</td>
<td>500 kHz (continuous)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum photocathode repetition rate (with Intelligate™ ON)</td>
<td>5 kHz (continuous)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equivalent Background Illuminance (EBI)</td>
<td>&lt; 0.1 e-/pix/sec</td>
<td>&lt; 0.3 e-/pix/sec</td>
<td>&lt; 2 e-/pix/sec</td>
<td>&lt; 0.2 e-/pix/sec</td>
<td>&lt; 0.3 e-/pix/sec</td>
</tr>
</tbody>
</table>

* 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

![Quantum Efficiency Curves](chart.png)
**CCD Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>1024 x 1024</th>
<th>Ø 25 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total CCD matrix size</strong></td>
<td>1024 x 1024</td>
<td>Ø 25 mm</td>
</tr>
<tr>
<td><strong>Fibre optic taper magnification</strong></td>
<td>Ø 18 mm 1:1</td>
<td>Ø 25 mm 1.5:1</td>
</tr>
<tr>
<td><strong>Effective CCD pixel size</strong></td>
<td>Ø 18 mm 13 x 13 µm</td>
<td>Ø 25 mm 19.5 x 19.5 µm</td>
</tr>
<tr>
<td><strong>Effective active area</strong></td>
<td>13.3 x 13.3 mm</td>
<td></td>
</tr>
<tr>
<td><strong>Image pixel well depth</strong></td>
<td>100,000 e-</td>
<td></td>
</tr>
<tr>
<td><strong>Register well depth</strong></td>
<td>150,000 e-</td>
<td></td>
</tr>
<tr>
<td><strong>Read noise e-</strong></td>
<td>50 kHz 5</td>
<td>3 MHz 14</td>
</tr>
<tr>
<td><strong>Maximum frame and spectral rates</strong></td>
<td>Frame 7.3 fps (2x2 binning)</td>
<td>FVB 145 sps</td>
</tr>
<tr>
<td><strong>Sensitivity</strong></td>
<td>1 to 5 e-/count</td>
<td>(software selectable)</td>
</tr>
<tr>
<td><strong>Linearity</strong></td>
<td>Better than 99%</td>
<td></td>
</tr>
</tbody>
</table>

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

- **Gate pulse delay & width**
  - Adjustable from 0 ns to 10 s in 10 ps steps
  - Software controlled, pre-programmed or real-time

- **Trigger Outputs**
  - Output A, B and C
    - 3x output, +5V CMOS level with 50 Ω source impedance; can drive 5V into a non-terminating load or 2.5V into 50 Ω load; output synchronized triggers for auxiliary equipment, e.g. lasers, flash lamps, National Instrument™ hardware
    - Individual delays control from 0 ns to 10 s in 10 ps steps
    - Configurable Polarity
    - Software controlled, pre-programmed or real-time
  - Fire
    - 5V CMOS level reference signal for beginning and end of individual CCD exposure
  - Arm monitor
    - 5V CMOS level reference signal to indicate when system is ready to accept external triggers. Signal goes high when system is ready to accept external triggers (after a readout has finished) and goes low when the exposure is finished
  - Gate & output A, B and C jitter
    - 35 ps rms (relative to external trigger signal)

- **Trigger Inputs**
  - External trigger
    - Trigger input for CCD and Digital Delay Generator
    - Up to 500 kHz for Integrate-On-Chip mode
    - Software-configurable Polarity, Termination and Trigger Threshold
    - Fast external software option for most rapid camera response to external trigger (CCD keep clean interruption) – no need for pre-trigger pulse
  - Direct gate
    - TTL input for exact external control of photocathode width and timing with smallest insertion delay

- **Additional Controls**
  - Gate monitoring
    - AC coupling from photocathode to monitor exact photocathode on/off switching and timings
  - 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 customized version? Please contact us to discuss our Customer Special Request (CSR) options.
Creating The Optimum Product for You

How to customize 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.

---

**Choose intensifier diameter**

- 18: Ø 18 mm
- 25: Ø 25 mm

**Choose minimum gating speed**

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

**Choose image intensifier option (Gen 2):**

03: W-AGT photocathode, P43 phosphor
04: W-AGT photocathode, P46 phosphor
05: W-AGT photocathode, MgF₂ 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

---

**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.

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**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
- ACC-6MM-TUBING-2xxxxM 6 mm tubing option for ACC-XW-CHIL-160
- ELC-05323 Rs to BNC cable for Shamrock shutter control

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/Brucker, 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.
**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 3rd party source & direct gate for complete, direct external control of intensifier gating

**I2C connector**
Compatible with Fischer SC102A054-130, pin-outs as follow:
1 = Shutter (5V CMOS level with 50 Ω impedance), 2 = I2C Clock (5V), 3 = I2C Data (5V), 4 = +5 Vdc, 5 = Ground

**Gate Monitor**
1x output: AC coupling to photocathode

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**Applications Guide**

<table>
<thead>
<tr>
<th></th>
<th>Gen 2</th>
<th>Gen 2 UV Enhanced (-05, -83, -E3)</th>
<th>Gen 3*</th>
<th>InGaAs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plasma Studies</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Laser Induced Fluorescence (LIF, PLIF)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Time Resolved Luminescence Imaging &amp; Spectroscopy</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Laser Induced Breakdown Spectroscopy (LIBS)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Transient Absorption Imaging</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>Time Resolved Photoluminescence Imaging</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>Particle Image Velocimetry (PIV)</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

* 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

---

**Product Drawings**

Dimensions in mm [inches]

- 13.3 x 13.3 mm
- 1024 x 1024 pixel
- Time-Resolved ICCD

**Weight:** 4.2 kg [9 lb 4 oz]

= position of pixel 1,1
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

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North America
Connecticut, USA
Phone +1 (860) 290 9211
Fax +1 (860) 290 9566

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

Items shipped with your camera

- Power Brick, 12V, 120W single line
- 2x 2m BNC to SMA cable
- 1x Gate Monitor 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

Footnotes: Specifications are subject to change without notice

1. Figures are typical unless otherwise stated.
2. Typical photocathode Quantum Efficiency and standard quartz input window transmission as measured by the tube manufacturer. MgF₂ window allows extended operation down to 120 nm.
3. 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.
4. 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 slower.
5. Actual measured minimum optical gating of the photocathode, reflecting not only the electrical pulse width applied to the photocathode but also its inherent rising time.
6. Gain is software-selectable through a 12-bit DAC and varies exponentially with DAC setting. Value refers to the ratio of max to min intensifier gain as measured for individual cameras. Actual optical gain (counts/photoe-) for a DAC setting is accessed by the multiplication of the relative gain (at that DAC value) by the minimum system gain (at DAC = 0, CCD e-/photoe) and divided by the sensitivity (CCD e-/count) at a given CCD PAG. Sensitivities are individually measured and reported for each system.
7. Combination of -73 GaAsP photocathode with a lumogen-coated fibre-optic plate and protective MgF₂ window. The latter additional optical interfaces are the reason for the lowered QE in the visible NIR region, for the -C3 model.
8. Measured for the entire system. Combination of CCD readout noise and A/D noise - measurement is for single pixel readout with -30°C CCD cooling and at minimum exposure time under dark conditions. Values quoted are measured with highest available PAG setting.
9. Linearity is measured from a plot of counts vs exposure time under constant photon flux 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
- USB 2.0 High Speed Host Controller capable of sustained rate of 40 MB/s
- Windows (XP, Vista and 7) or Linux

Power Requirements
110 - 240 VAC, 50 - 60 Hz