# iStar 334T Series

13.3 x 13.3 mm
1024 x 1024 pixel
Time-Resolved ICCD
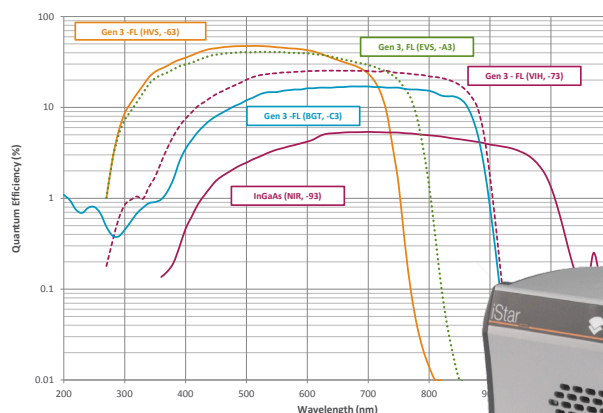
**ANDOR**
an **Oxford Instruments** company

Time-Resolved



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

## 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™**[1]
  MCP gating for On/Off ratios >$10^8$ 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 optimization
- **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 **D**igital **D**elay **G**enerator (**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 18 mm | Ø 25 mm |
|---|---|---|
| **Effective active area of CCD (mm)** | 13.3 x 13.3 mm | |
| **Active pixels** | 1024 x 1024 | |
| **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) |
| **Read noise (rms)** | As low as 4 e- | |
| **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* | |
| **Digitization** | 16 bit | |

* Dependant on intensifier type

# iStar 334T Series

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

**ANDOR**
an **Oxford Instruments** company

## Specifications - Gen 2 Image Intensifiers •2

| Photocathode model | 18*-03 | 18*-04 | 18*-05 † | 18H-13 | 18H-83 | 18*-E3 | 25*-03*1 |
|---|---|---|---|---|---|---|---|
| Useful aperture | Ø 18 mm | | | | | | Ø 25 mm |
| Input window | Quartz | Quartz | MgF$_2$ | Quartz | Quartz | Quartz | Quartz |
| Photocathode type | W-AGT | W-AGT | W-AGT | WR | UW | WE-AGT | W-AGT |
| Minimum guaranteed peak QE @ room temperature •3 | 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 •4 | 25 µm | 30 µm | 25 µm | 25 µm | 25 µm | 25 µm | 35 µm |
| 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) •5, 6 U (Ultrafast) F (Fast) H (High QE) | < 2 < 5 - | < 2 < 5 - | < 5 < 10 - | - - < 50 | - - < 100 | < 2 < 5 - | < 3 < 7 - |
| Maximum relative gain •7 | > 1000 | > 500 | > 1000 | > 850 | > 500 | > 300 | > 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⁻/pix/sec | | | < 0.4 e⁻/pix/sec | < 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

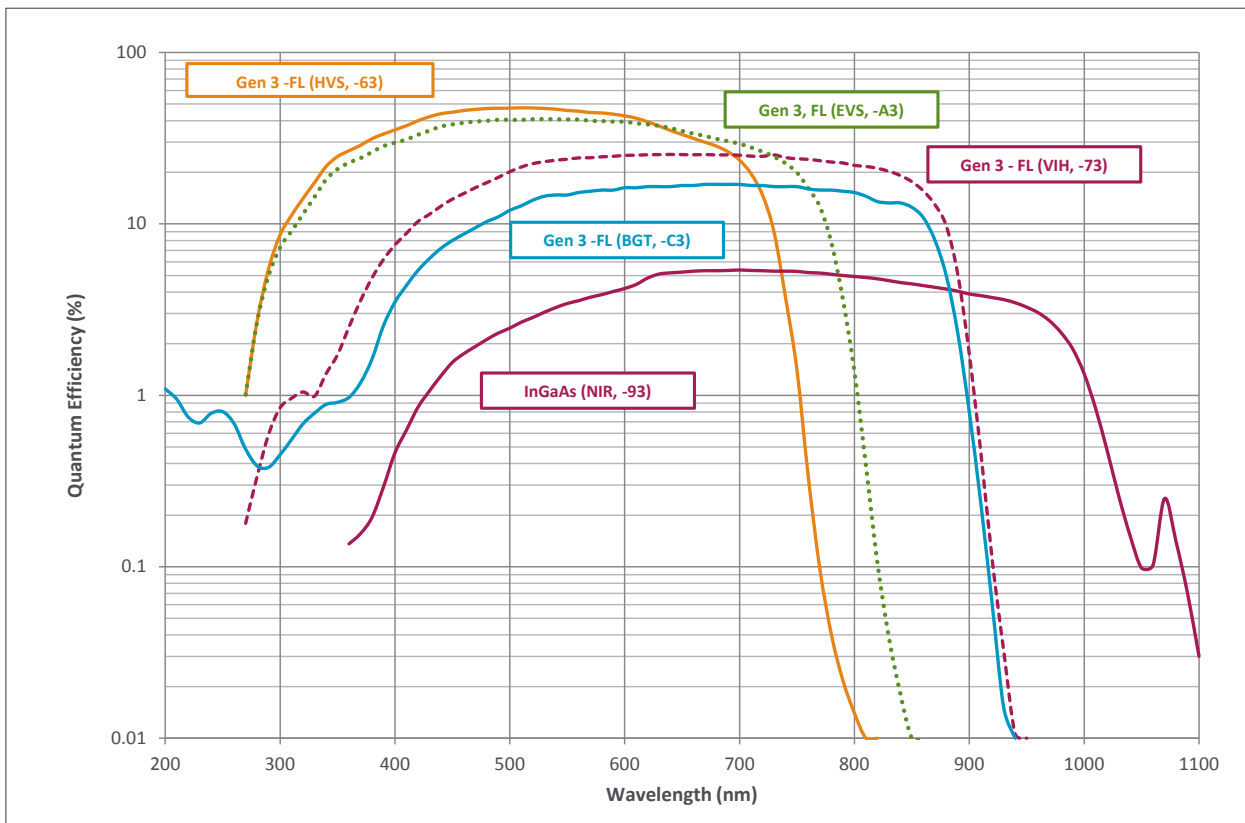## Quantum Efficiency Curves for Gen 2 Image Intensifiers •3

# iStar 334T Series

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

**ANDOR**
an **Oxford Instruments** company
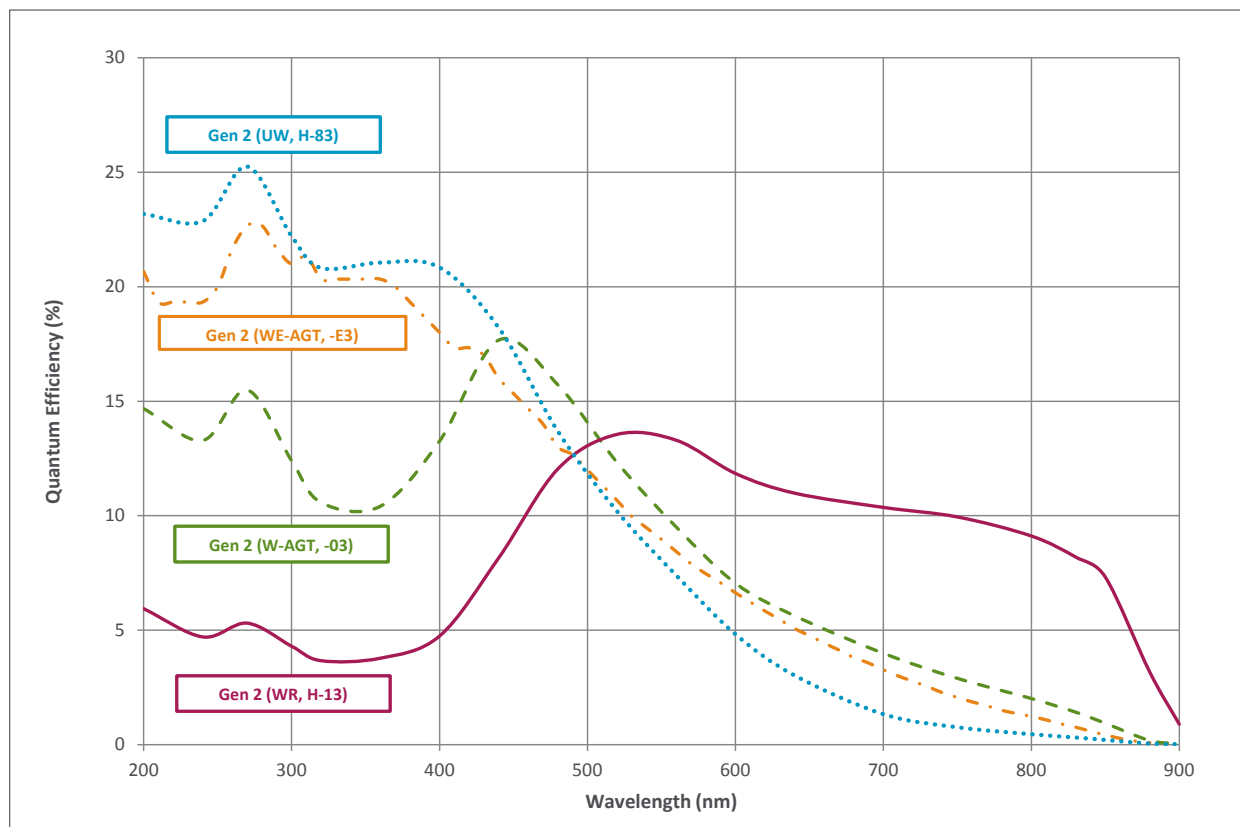
## Specifications - Gen 3 Image Intensifiers [2]

| Photocathode model | 18*-63 | 18*-73 | 18*-93 | 18*-A3 | 18*-C3 |
|---|---|---|---|---|---|
| Useful aperture | Ø 18 mm | | | | |
| Input window | Glass | Glass | Glass | Glass | $MgF_2$ + F/O + Lumogen |
| Photocathode type | HVS | VIH | NIR | EVS | BGT |
| Peak QE @ room temperature [3] | > 47.5 | > 25.5 | > 5 | > 40 | > 17 |
| Wavelength range | 280 - 760 nm | 280 - 910 nm | 380 - 1090 nm | 280 - 810 nm | < 200 - 910 nm |
| Image intensifier resolution limit [4] | 30 µm | 30 µm | 30 µm | 30 µm | 40 µm |
| Phosphor type [decay time to 10%] | P43 [2 ms] | | | | |
| Minimum optical gate width (ns) [6]<br>U (Ultrafast)<br>F (Fast) | < 2<br>< 5 | < 2<br>< 5 | < 3<br>< 5 | < 2<br>< 5 | < 3<br>< 5 |
| Maximum relative gain [7] | > 200 | | | | |
| Maximum photocathode repetition rate (with Intelligate™ OFF) | 500 kHz (continuous) | | | | |
| Maximum photocathode repetition rate (with Intelligate™ ON) | 5 kHz (continuous) | | | | |
| Equivalent Background Illuminance (EBI) | < 0.1 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 [3, 8]

# iStar 334T Series

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

# ANDOR
an **Oxford Instruments** company

## CCD Specifications [2]

| Total CCD matrix size | 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 | | | |
| Image pixel well depth | 100,000 $e^-$ | | | |
| Register well depth | 150,000 $e^-$ | | | |
| Read noise $e^-$ [9] | 50 kHz | 1 MHz | 3 MHz | 5 MHz |
| Typical | 5 | 8 | 14 | 20 |
| Maximum | 7 | 12 | 18 | 50 |
| Vertical shift speeds | 6.5 to 12.9 µs (software selectable) | | | |
| Maximum frame and spectral rates | Frame | FVB | Crop Mode (10 rows) | Fast Kinetics (4 rows) |
| | 4.2 full fps 7.3 fps (2x2 binning) | 145 sps | 333 fps 3,450 sps | 29,850 Hz |
| Sensitivity | 1 to 5 $e^-$/count (software selectable) | | | |
| Linearity [10] | Better than 99% | | | |
| Minimum temperature air cooled [dark current, $e^-$/pixel/sec] Coolant chiller, coolant @ 10°C, 0.75 l/min [dark current, $e^-$/pixel/sec] | Ø 18 mm -30°C [0.2] -40°C [0.1] | | Ø 25 mm -25°C [0.4] -35°C [0.15] | |

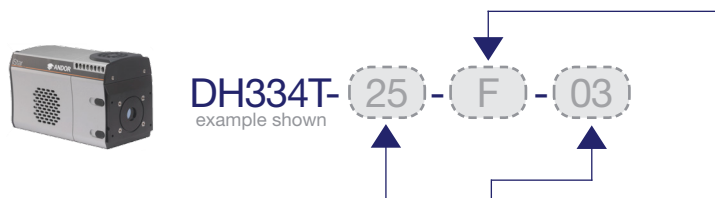## Internal Digital Delay Generator (DDG™) Key Functions

| Gate pulse delay & width | • Adjustable from 0 ns to 10 s in 10 ps steps<br>• 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<br>• Individual delays control from 0 ns to 10 s in 10 ps steps<br>• Configurable Polarity<br>• 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<br>• Up to 500 kHz for Integrate-On-Chip mode<br>• Software-configurable Polarity, Termination and Trigger Threshold<br>• 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 a 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.

# iStar 334T Series

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

**ANDOR**
an **Oxford Instruments** company

## Creating The Optimum Product for You

DH334T- ( 25 )-( F )-( 03 )
example shown

### Step 1.  Choose the intensifier diameter

**Intensifier Diameter**

| Intensifier diameter | Code |
|---|---|
| Ø 18 mm | 18 |
| Ø 25 mm | 25 |

### Step 2.  Choose a minimum gating speed

**GATING SPEED**

**Gating Speed**

| Gating Speed | Code |
|---|---|
| High QE, slow gating | H |
| Fast Gating | F |
| Ultra Fast Gating | U |

### Step 3.  Select an image intensifier option

**Intensifier**

| Gen 2 Intensifier option | Code |
|---|---|
| W-AGT photocathode, P43 phosphor | 03 |
| W-AGT photocathode, P46 phosphor | 04 |
| W-AGT photocathode, MgF$_2$ window, P43 phosphor | 05 |
| WR photocathode, P43 phosphor | 13 |
| UW photocathode, P43 phosphor | 83 |
| WE-AGT photocathode, P43 phosphor | E3 |

| Gen 3 Intensifier option | Code |
|---|---|
| HVS photocathode, P43 phosphor | 63 |
| VIH photocathode, P43 phosphor | 73 |
| NIR photocathode, P43 phosphor | 93 |
| EVS photocathode, P43 phosphor | A3 |
| BGT photocathode, P43 phosphor | C3 |

### Step 4.  Select the required accessories and adapters

**Accessories & Adapters**

| Description | Order Code |
|---|---|
| C-mount lens adaptor | LM-C |
| F-mount lens adaptor | LM-NIKON-F |
| Oasis 160 Ultra compact chiller unit | ACC-XW-CHIL-160 |
| 6 mm tubing option for ACC-XW-CHIL-160 | ACC-6MM-TUBING-2xxxxM |
| i²c to BNC cable for Shamrock shutter control | ELC-05323 |
| Metric Bracket | ACC-ISTAR-METRIC ADP |

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.

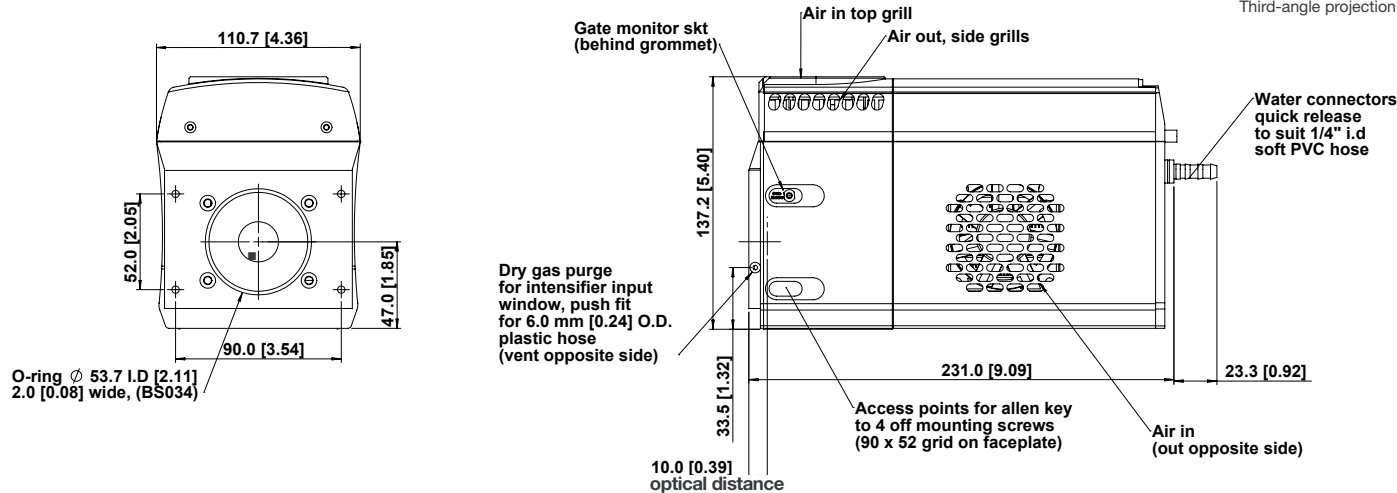### Step 5.  Select the required software

**Software**

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

**Solis for Time-Resolved** A 32-bit and fully 64-bit enabled application for Windows (XP, Vista, 7 and 8) 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, 7 and 8) and Linux. Compatible with C/C++, C#, Delphi, VB6, VB.NET, LabVIEW and Matlab.

# iStar 334T Series

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

**ANDOR**
an **Oxford Instruments** company

## Product Drawings

Dimensions in mm [inches]

Third-angle projection

**110.7 [4.36]**

**52.0 [2.05]**

**47.0 [1.85]**

**90.0 [3.54]**

O-ring ⌀ 53.7 I.D [2.11]
2.0 [0.08] wide, (BS034)

Gate monitor skt
(behind grommet)

Air in top grill

Air out, side grills

Water connectors
quick release
to suit 1/4" i.d
soft PVC hose

**137.2 [5.40]**

Dry gas purge
for intensifier input
window, push fit
for 6.0 mm [0.24] O.D.
plastic hose
(vent opposite side)

**33.5 [1.32]**

**231.0 [9.09]**

**23.3 [0.92]**

Access points for allen key
to 4 off mounting screws
(90 x 52 grid on faceplate)

Air in
(out opposite side)

**10.0 [0.39]**
optical distance

Weight: 4.2 kg [9 lb 4 oz]

■ = position of pixel 1,1

**47.0 [1.85]**

**50.8 [2.00]**

3 off 1/4-20 UNC
mounting pillar holes

**58.9 [2.32]**

Mounting hole locations

External trigger

DDG outputs
A    B    C

Fire
Arm
Direct gate

Power
socket

Quick lock
water connectors

On/Off
switch

Grounding point

USB 2.0

I²C

Rear connector panel

## 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
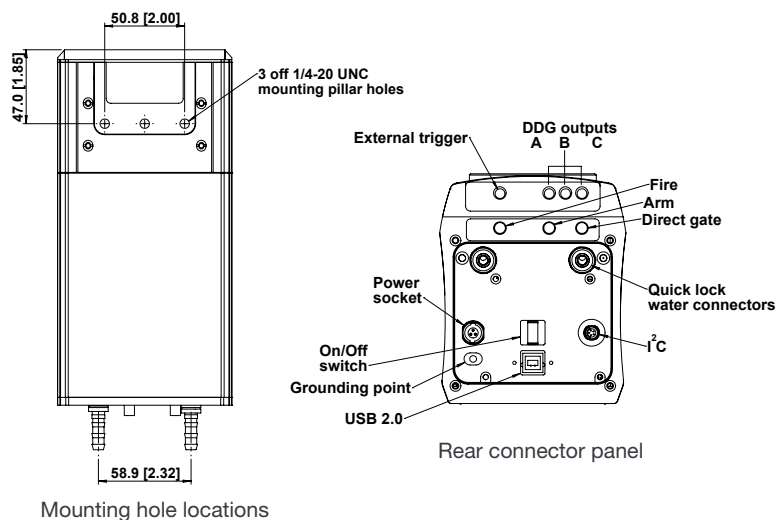
## Applications Guide

| | 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

# iStar 334T Series

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

**ANDOR**
an **Oxford Instruments** company

# 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**

## Our regional headquarters are:

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

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

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

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

---

## 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

## 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

**OXFORD** INSTRUMENTS
*The Business of Science®*

## Footnotes: Specifications are subject to change without notice

1. The On/Off ratio for the 'E3' image intensifier in the UV with MCP gating is typically $10^5$.
2. Figures are typical unless otherwise stated.
3. 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.
4. 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.
5. 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.
6. Actual measured minimum optical gating of the photocathode, reflecting not only the electrical pulse width applied to the photocathode but also its inherent irising time.
7. 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.
8. 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.
9. 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.
10. 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
  (at least 1 GB recommended for data spooling)
• USB 2.0 High Speed Host Controller
  capable of sustained rate of 40 MB/s
• Windows (XP, Vista, 7 and 8) 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

## Power Requirements
• 100 - 240 VAC, 50 - 60 Hz

bsi. ISO 9001 Quality Management FM40523
bsi. ISO 14001 Environmental Management EMS91062
CE
HI-SPEED USB

Windows XP | Windows Vista | Windows 7 | Windows 8 | Linux | LabVIEW | MATLAB

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.