# Apogee Alta F16

High Performance Cooled CCD Camera System

ANDOR
an Oxford Instruments company


## System Features[*1]

- **High Resolution Sensor**
  16.8 Megapixel sensor with 9 μm pixels delivers an exceptionally large field of view with high resolution.
- **Programmable TE cooling down to 45°C below ambient**
  Ideal for detection of weak chemiluminescence or astronomy images, enabling long exposure acquisitions with optimized signal to noise ratio.
- **USB 2.0 interface**
  Direct 'Plug and Play' simplicity of USB 2.0.
- **16-Bit digitization**
  High photometric accuracy.
- **High longevity shutter**
  Shutter during readout and take dark reference frames - 63 mm.
- **Programmable I/O port**
  Synchronization with intricate experimental set-ups.
- **Remote Triggering**
  LVTTL input allows exposure to start within 25 microseconds of the rising edge of the trigger.
- **Focusing mode**
  Faster readout option, ideal for focus optimisation.
- **Precision locking filter wheels optional**
  Choose from a range of Apogee family filter wheels with up to 17 positions.
- **Andor OEM optimisation**
  Compact and robust, Andor integration support, Andor quality enhancement, Andor post-sale support. Now also supported by 'Andor SDK'

## Apogee Alta F16: Optimised for High Resolution Photometry

Ideal for OEM and astronomy applications, the Apogee Alta family has been a mainstream of high end imaging for many years, offering a wide range of full frame and interline CCDs. Cooling performance down to 45ºC below ambient ensures optimal signal to noise for long exposure applications. A USB 2.0 interface offers the convenience of simple, robust connection to PC.

The Apogee Alta F16 features a 16.8 megapixel full frame sensor with micro-lenses and no anti-blooming. The lack of anti-blooming structures renders the F16 ideal for accurate photometric measurements over a wide dynamic range, and a large field of view. The exceptional performance of the Apogee Alta F16 makes it the perfect solution for many demanding astronomy applications.

## Specifications Summary[*1]

| | |
|---|---|
| **Array Size (pixels)** | 4096 x 4096 (16.8 Megapixel) |
| **Pixel Size** | 9 x 9 μm |
| **Sensor Size** | 36.8 x 36.8 mm (1359 $mm^2$)<br>52.1 mm diagonal |
| **Pixel Well Depth (typical)** | 94,000 $e^-$ |
| **Dark Current**[*2] | 0.007 $e^-$/pixel/sec |
| **Read Noise**[*3] | 7.4 $e^-$ (RMS @ 0.87 MHz) |
| **Maximum Dynamic Range** | 82.1 dB (12702:1) |
| **Quantum Efficiency** | 65% maximum @650 nm<br>40% @450 nm |

# SPECIFICATIONS

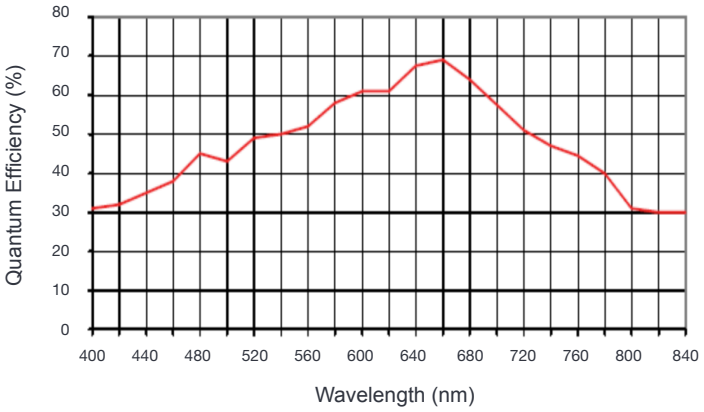
## Technical Specifications[*1]

| | |
|---|---|
| **Sensor Type** | KAF-16801 (ON Semiconductor) |
| **Active pixels** | 4096 x 4096 W x H (16.8 Megapixel) |
| **Sensor Size** | 36.8 x 36.8 mm (1359 $mm^2$)<br>52.1 mm diagonal |
| **Pixel Size** | 9 x 9 µm |
| **Pixel Well Depth** | 94,000 $e^-$ |
| **Read Noise** [*3] | 7.4 $e^-$ (RMS @ 0.87 MHz) |
| **Pixel Binning** | 1 x 1 to 8 x 4096 on chip |
| **Quantum Efficiency** [*4] | 65% maximum @650 nm<br>40% @450 nm |
| **Cooling** | Maximum cooling up to 45°C below ambient temperature; -20°C at 25°C ambient<br>Thermoelectric cooler with forced air. |
| **Temperature Stability** | +/- 0.1°C |
| **Dark Current** [*3] | 0.007 $e^-$/pixel/sec |
| **Blemish Specification** | Grade 2 as standard, as per sensor manufacturer definition |
| **Maximum Dynamic Range** | 82.1 dB (12702:1) |
| **Linearity** | Better than 99% |
| **Frame Rate (fps)** [*5] | 0.05 Full frame (@0.87 MHz)<br>0.25 Full frame (@4.33 MHz, focusing mode) |
| **Frame Sizes** | Full frame, sub-frame |
| **Digital Resolution** | 16-bit |
| **Camera Window** | UV-grade fused silica |

## General Specifications

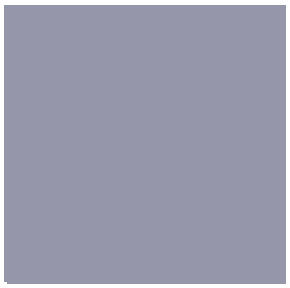
| | |
|---|---|
| **Interface Options** | USB 2.0 |
| **Remote Triggering** | LVTTL trigger input, expose strobe output |
| **Peripheral communications** | 8 pin mini-DIN I/O connector |
| **Image Sequencing** | 1 to 65535 image sequences under software control |
| **Exposure Time** | 100 milliseconds to 183 minutes<br>(2.56 microsecond increments) |
| **Operating System Support** | Windows, Linux |

## Quantum Efficiency (QE) Curve[5]

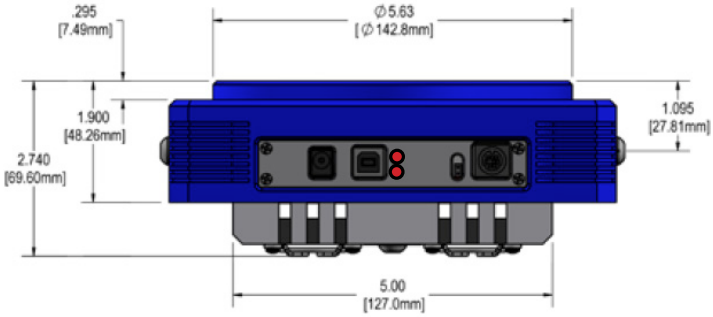


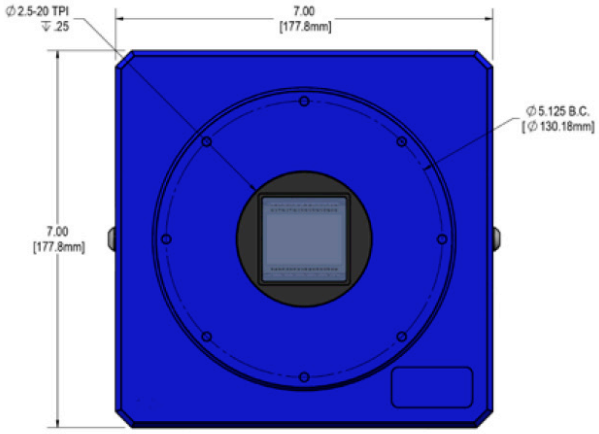

## Size of CCD Imaging Area

**36.8 x 36.8 mm**

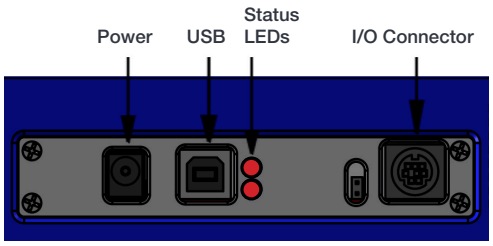


## Mechanical Drawings




## Connections




## Mechanical Specifications

| | |
|---|---|
| **Camera Housing** | Aluminum, hard anodized (D07) |
| **Camera Head Size** | 7”x7”x2.55” (17.8x17.8x6.48 cm) |
| **Back Focal Distance** | 1.005” (2.56 cm) [optical] |
| **Mounting** | 5.125” bolt circle. 2.5” 20 TPI thread. Optional Nikon F-mount or Canon EOS/EF or FD mount. |
| **Shutter** | 63 mm shutter. |
| **Weight** | 4.2 lb. (1.9 kg) |

# CREATING THE OPTIMUM PRODUCT FOR YOU

How to customize the Apogee Alta F16:

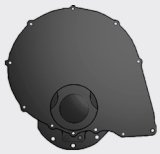
## Step 1: Select your camera type

Camera

| Description | Part Code |
|---|---|
| Apogee Alta F16 16.8 Megapixel Full frame CCD camera Grade 2 sensor and 63 mm Shutter | F16-2-D07-S63 |

**Note:** Please enquire for price and availability of Grade 1 sensor options.

## Step 2: Please indicate which adapters and accessories are required



Adapters & Accessories

**A wide range of mounting adapters and accessory options are available for the Alta. Please refer to the links below for further information on filter wheels, filters and adapters.**

### Filter Wheels

Filter wheels available with up to 17 filter positions. Please refer to Apogee Filter Wheels

### Filters

A comprehensive selection of Astrodon filters and filter sets are available to complement your selected filter wheel Please refer to Apogee Filters

### Lens Adapters and flanges

Select the required camera mounting option for your application, from our range of lens, telescope and slip-fit faceplate adapters. Please refer to Apogee Adapters

## Step 3: Please indicate which software you require

**The Alta also requires at least one of the following software options:**

| Description | Ordering Information |
|---|---|
| **Windows SDK for Apogee** | Please download from the Apogee Downloads Page |
| **ASCOM Camera and Filter Wheel Driver** | Please download from the Apogee Downloads Page |
| **Linux Driver CD** | 400053 |
| **Maxim DL Pro Software CD** | 400054 |
| **MicroManager** | Please see https://micro-manager.org/wiki/Apogee |

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Fax +81 (3) 6732 8939

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

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

## Footnotes

1. Figures are typical unless stated otherwise
2. At minimum temperature
3. Readout noise is for the entire system. It is a combination of sensor readout noise and A/D noise.
4. Quantum efficiency of the sensor at 25°C, as supplied by the sensor manufacturer.
5. Assumes internal trigger mode of operation and minimum exposure time.

**Front page image** M101, the Pinwheel Galaxy courtesy of Greg Morgan. Check out other astounding images captured with Apogee cameras at the Andor image gallery

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**PC 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 1GB recommended for data spooling)
- USB 2.0 High Speed Host Controller capable of a sustained rate of 40MB/s
- Windows (XP, Vista, 7 and 8) or Linux

**Operating and Storage Conditions**
- Operating Temperature: 0 to 40°C
- Relative Humidity: < 70% (non-condensing)
- Storage Temperature: -25°C to 50°C
- Altitude up to 2000 m

**Power Requirements**
- 100-240V, AC 50-60Hz, or alternate 12V input from user's source.
- 40W maximum power consumption (shutter open and cooling maximum)