

Filter Wheels and Focusers



www.flicamera.com

Cameras, Filter Wheels, & Focusers

CFW Filter Wheels



ProLine Camera with CFW-4-5 Filter Wheel

FLI's color filter wheels' robust mechanical designs provides the basis for stunning, uncompromising images. Each FLI color filter wheel is precision engineered with a highly accurate no-slip drive chain and stepper motor. The large diameter pivot pin and bushings are precision ground and matched for smooth, quiet no-fuss operation night after night. FLI color filter wheels do not use internal lights for homing, so your images are protected from stray light interference.

Filter wheels below are for round filters unless the size includes "SQ," square.

Model	Positions	Filter Size
CFW-1-5	5	2" / 50 mm
CFW-1-8	8	28 mm
CFW-2-7	7	2" / 50 mm
CFW-3-10	10	50 mm SQ
CFW-3-12	12	2" / 50 mm
CFW-3-20	20	28 mm
CFW-4-5	5	50 mm SQ
CFW-5-7	7	50 mm SQ
CFW-7-7	7	80 mm SQ
CFW-9-5	5	65 mm SQ
CFW-10-7	7	65 mm SQ
CenterLine CL-1-10	10 (5x2)	50 mm SQ
CenterLine CL-1-20	20 (10x2)	25 mm
HS-625 High Speed	6	25 mm
HS-1025 High Speed	10	25 mm
HS-1032 High Speed	10	32 mm

CenterLine Filter Wheels



The CenterLine color filter wheels have two overlapping filter carousels with a central aperture. Symmetrical mass distribution eliminates changes in the telescope's balance as it tracks across the sky. CenterLines are ideal for prime focus installations where a symmetric location over the secondary mirror is critical. The CL-1-10 has two 5 position carousels for 50 mm square filters, ideal for the PL16803; the CL-1-20 has two 10-position carousels for 25 mm filters.

Zero Tilt Adapter (ZTA™)

The ZTA™ is an FLI adapter design that eliminates the common deficiencies found in most astronomical adapters. When you use the ZTA™ you will never experience tilted components, marred adapters, or wobbly interfaces!

The ZTA™ adapter system employs a circular spring that evenly distributes the pressure of three set screws against the ZTA™ dovetailed surface. The resulting clamping force between the two machined surfaces results in zero tilt, zero adapter marring and a complete elimination of problems associated with loose connections. The ZTA™ adapter can be machined to fit nearly any type of camera, color filter wheel or telescope. ZTA™ - featured in the Atlas focuser and the CenterLine color filter wheel.

Atlas Focuser



The finest available focuser for large sensors: 105,000 steps with 85 nm per step

Precision drive screws guarantee superior positional accuracy
High-load-bearings support adjustment screws

The Zero Tilt Adapter™ ensures no tilt, tip, or marred surfaces
Custom linear bearings provide extreme torsional rigidity

Guaranteed consistent performance in any orientation

Fully enclosed electrical and mechanical components

Adds only 1.25" (3.2 cm) to back focus distance

Maximum Payload: 25 lbs. (11.3 kg)

Payload at 6" Distance: 10 lbs. (4.5 kg)

Minimum Travel: 0.35" (8.9 mm)

Number of Steps: 105,000

Resolution per Step: 85 nm/step

Weight: 3 lbs. (1.4 kg)

PC Interface: USB 2.0

Mechanical Interface: Zero-Tilt Adapter

Compatibility: ASCOM Compatible, Auto-Focus Capable

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NGC3576

Image courtesy of Wolfgang Promper.

Finger Lakes Instrumentation Proline PL3041 camera

(2048 x 2048 Fairchild back-illuminated CCD)

16" f/8 Cassegrain telescope (design by Philip Keller)

Tivoli Farm, Namibia



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ProLine Camera Systems

The ProLine cameras have a larger housing than the MicroLines, with additional cooling. ProLines provide two power and two USB ports for FLI filter wheels and focusers. The outer chamber for electronics is also sealed.

- Sensor Cooling to 70°C below ambient
- Large Format CCDs to 50 mm x 50 mm
- Full Frame Sensor Digitization to 14 MHz
- Interline Sensor Digitization to 12 MHz (or two channels at 10 MHz each)
- Separate Low Noise Digitization channel
- Single or Dual Channel Capable



Deep Cooling

Standard Features for Both ProLine & MicroLine Cameras

- 16-bit Digitization (all modes)
- Reaches Operating Temperature in 5 Minutes
- USB 2.0 Interface
- Liquid or Air Cooled Base
- Three-stage thermoelectric coolers
- Professional Grade Long Life Shutters
- RBI Anti-Ghosting Technology Standard
- Fused Quartz Chamber Window with Low Reflectance Coating
- Arbitrary Binning / Subarray Readout
- Time Delayed Integration (TDI) Mode
- External Triggering
- Simultaneous readout and exposure (Interline Sensors only)
- Precise, tested perpendicular alignment to the optical path



We specialize in unique solutions.

MicroLine Camera Systems

The MicroLine cameras have a smaller, lighter housing than the ProLines. Smaller sensors have C-mount back focal distance (17.5 mm).

- Sensor Cooling to 65°C below ambient
- Full Frame Sensor Digitization to 12 MHz
- Interline Sensor Digitization to 12 MHz (or two channels at 10 MHz each)
- Compact Housing (3.7 x 3.7 x 5 in.; 2.8 lbs.)
- Optional Dual or Quad Channel Output with some sensors



Light and Compact

High Quantum Efficiency Back-Illuminated CCDs

PL23042 Single channel ML23042 4-channel

For the ultimate in performance, this 2048 x 2048 back-illuminated CCD with 15 micron pixels has low-noise 16-bit readout at 500 kHz and 1.5 MHz (PL) / 2 MHz (ML) (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.



PL230 / ML230
e2v CCD230-42
2048 x 2048
15 micron pixels
30.7 x 30.7 mm
944 mm²
Full well: 150K e-

PL4240

Available with either a midband coating or UV (NIMO), this 2048 x 2048 back-illuminated CCD with 13.5 micron pixels has low-noise 16-bit readout at 500 kHz and 1.5 MHz (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.



PL42-40-1-MB
e2v CCD42-40
2048 x 2048
13.5 micron pixels
27.6 x 27.6 mm
764 mm²
Full well: 100K e-

PL4710

Long a favorite for astronomy, this family of 1024 x 1024 CCDs with 13 micron pixels includes midband, broadband, UV, and deep depletion (NIMO) versions. Low-noise 16-bit readout at 750 kHz and 2 MHz (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.



PL4710
e2v CCD47-10
1024 x 1024
13 micron pixels
13.3 x 13.3 mm
177 mm²
Full well: 100K e-

Front-illuminated CCDs

ML8300

Great sensor for getting started with cooled CCD imaging. The compact, lightweight ML8300 has an 8-megapixel sensor with 5.4 micron pixels that are ideal for short focal lengths. The total back focal distance for this camera plus CFW-2-7 filter wheel is less than 1.5" (38 mm). Deep cooling for less than an electron of dark current per minute. Blazing fast low noise 16 bit 8 MHz readout.



ML8300
Truesense KAF-8300
3326 x 2504
5.4 micron pixels
18 x 13.5 mm
243 mm²
Full well: >25.5K e-

PL1001

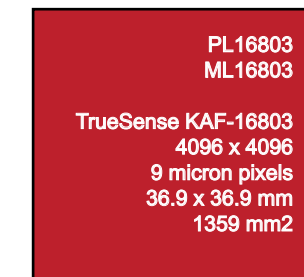
This unique CCD has several readout modes, one of which provides extraordinarily high dynamic range. 16-bit readout modes: 1 MHz and 3.4 MHz with low noise, plus 1 MHz with high dynamic range (>400K e). 1024 x 1024 with 24 micron pixels.



PL1001
Truesense KAF-1001
1024 x 1024
24 micron pixels
24.6 x 24.6 mm
604 mm²
Full well: >400K e-

ProLine PL16803 MicroLine ML16803

This camera features a 4096 X 4096 array with 9 micron pixels and a peak QE of 59%. Low noise digitization to 16 bits at both 1 MHz and 8 MHz (software selectable). The 3-stage TEC cools the sensor to 60C below ambient in the ProLine.



PL16803
ML16803
TrueSense KAF-16803
4096 x 4096
9 micron pixels
36.9 x 36.9 mm
1359 mm²

Wide Selection of Sensors

FLI supports a wide variety of sensors. Only a few of the sensors have been featured here. Please visit www.flicamera.com for a more complete listing. If you do not see what you need there, please contact us about supporting a new CCD.

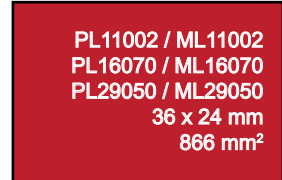
Other back-illuminated sensors supported: e2v CCD47-20 (frame transfer); CCD77-00; Hamamatsu spectroscopic format CCDs; Truesense interline CCDs: KAI-16050, 8050, 4050, 2150, 2050, and 1050; 16000, 4022, and 2020. Truesense full frame front-illuminated CCDs: KAF-4320, 50100, 09000, 16801, 6303, 3200, 1603, 261, 402.

Interline Transfer CCDs

ProLine PL11002, 16070, 29050 MicroLine ML11002, 16070, 29050

These three Truesense interline transfer CCDs provide the same imaging area as 35mm film (36 x 24 mm), ideal for DSLR lenses. Smaller pixels provide higher resolution but lower full well capacity and dynamic range. Also, smaller pixels gather less light per pixel for lower perceived sensitivity. Electronic shuttering allows much shorter exposure times.

Truesense	Array Size	Pixel	Full Well
KAI-11002	4008 x 2672	9 μ	60Ke-
KAI-16070	4864 x 3232	7.4 μ	44Ke-
KAI-29050	6576 x 4384	5.5 μ	20Ke-



PL11002 / ML11002
PL16070 / ML16070
PL29050 / ML29050
36 x 24 mm
866 mm²

MicroLine MLx694

Read noise as low as 3 electrons!

Six megapixel Sony sensor has exceptionally low noise and high quantum efficiency. Small pixels (4.54 micron) are a good fit to short focal length scopes. Lightweight camera head with a short back focal distance (17.5mm). FLI's 3-stage cooler drops the CCD to 50C below ambient, with dark current so low it's hard to measure.



MLx694
Sony ICX694
2750 x 2200
4.54 micron pixels
12.5 x 10 mm
125 mm²
Full well: 20K e-

Actual imager sizes shown in red

