Filter Wheels and Focusers

CFW Filter Wheels

FLI’s color filter wheels’ robust mechanical designs provide 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Positions</th>
<th>Filter Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFW-1-5</td>
<td>5</td>
<td>2” / 50 mm</td>
</tr>
<tr>
<td>CFW-1-8</td>
<td>8</td>
<td>28 mm</td>
</tr>
<tr>
<td>CFW-2-7</td>
<td>7</td>
<td>2” / 50 mm</td>
</tr>
<tr>
<td>CFW-3-10</td>
<td>10</td>
<td>50 mm SQ</td>
</tr>
<tr>
<td>CFW-3-12</td>
<td>12</td>
<td>2” / 50 mm</td>
</tr>
<tr>
<td>CFW-3-20</td>
<td>20</td>
<td>28 mm</td>
</tr>
<tr>
<td>CFW-4-5</td>
<td>5</td>
<td>50 mm SQ</td>
</tr>
<tr>
<td>CFW-5-7</td>
<td>7</td>
<td>50 mm SQ</td>
</tr>
<tr>
<td>CFW-7-7</td>
<td>7</td>
<td>80 mm SQ</td>
</tr>
<tr>
<td>CFW-8-5</td>
<td>5</td>
<td>65 mm SQ</td>
</tr>
<tr>
<td>CFW-10-7</td>
<td>7</td>
<td>65 mm SQ</td>
</tr>
<tr>
<td>CenterLine CL-1-10</td>
<td>10 (5x2)</td>
<td>50 mm SQ</td>
</tr>
<tr>
<td>CenterLine CL-1-20</td>
<td>20 (10x2)</td>
<td>25 mm</td>
</tr>
<tr>
<td>HS-425 High Speed</td>
<td>8</td>
<td>25 mm</td>
</tr>
<tr>
<td>HS-1025 High Speed</td>
<td>10</td>
<td>25 mm</td>
</tr>
<tr>
<td>HS-1032 High Speed</td>
<td>10</td>
<td>32 mm</td>
</tr>
</tbody>
</table>

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

Add 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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**Cooled CCD Cameras**

**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 7°C below ambient

Large Format CCDs to 50 x 50 mm

Full Frame Sensor Digitization to 14 MHz

Interline Sensor Digitization to 12 MHz (or two channel at 10 MHz each)

Separate Low Noise Digitization channel

channels at 10 MHz each)

**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 60°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

**Standard Features for Both ProLine & MicroLine Cameras**

16-bit Digitization (all modes)
Reach 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

**Deep Cooling**

We specialize in unique solutions.

Light and Compact

**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.

**MicroLine MX694**

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 for short focal length scopes. Lightweight camera head with a short back focal distance (17.5 mm). FLI’s 3-stage cooler drops the camera head with a short back focal distance to short focal length scopes. Lightweight

**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 MHz (PL) / 2 MHz (ML) (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.

**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 MHz (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.

**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.

**PL1001**

This unique CCD has several readout modes, one of which provides extraordinary 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.

**PL4710**

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 750 kHz and 2 MHz (software selectable). The three-stage TEC cools the sensor to 60°C below ambient.

**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 60°C below ambient in the ProLine.

**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 CCD: KAI-16050, 8050, 4050, 2150, 2050, 1050, 16000, 4022, and 2020.

Truesense full frame front-illuminated CCDs: KAF-4320, 50100, 99000, 16801, 6303, 3200, 1603, 261, 402, 6303, 3200, 1603, 261, 402.