

CCD Cameras

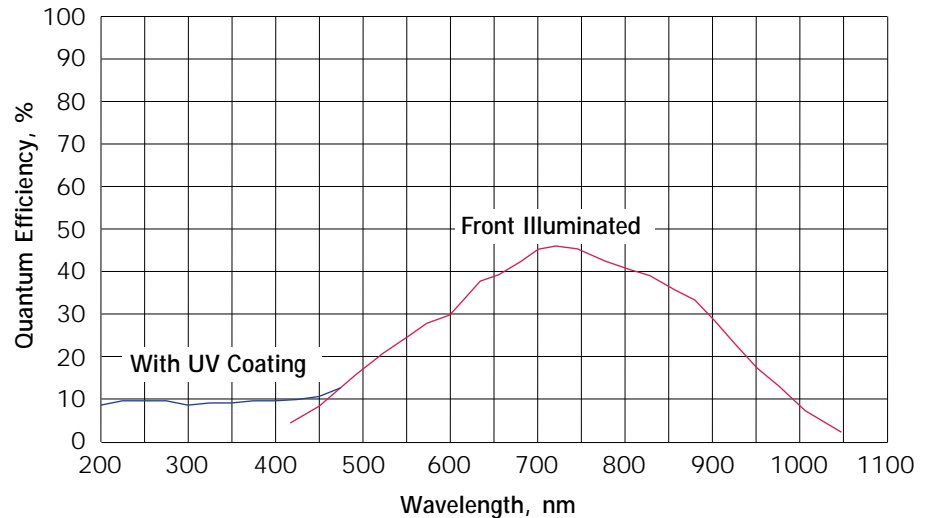
based on EEV 512 × 512 frame transfer CCD

TE/CCD-512EFT
RTE/CCD-512EFT
PentaMAX-512EFT

These new frame transfer cameras are ideal for imaging applications requiring high frame rates, vibration free operation, or acquisition of two frames in rapid succession.

When comparing slow scan CCD cameras, these are noted for the following features.

- Binary pixel format, 512 x 512
- High scan rate, up to 5 MHz
- High sensitivity, due to 100% detection duty cycle
- Relatively low cost
- Shutterless operation
- Frame transfer with on-array masking



Performance Characteristics

CCD Arrays: EEV CCD-37; Note that at the time this catalog was written, EEV unfortunately does not offer an MPP version of this CCD. Therefore cooling is particularly important for this CCD.

Format: 512 x 512 x 2;
7.7 x 7.7 mm overall;
15 x 15 μm pixels

Full Well Capacity: 200,000 electrons

Readout Noise: 10 electrons at 50 kHz; 18 electrons at 1 MHz;
For performance at 2.5 and 5 MHz contact your Princeton Instruments representative

Spectral Range: 400-1080 nm;
190-1080 nm with UV-to-visible converter

Dynamic Range: 14-15 bits at 50 kHz; 13-14 bits at 1 MHz; 12 bits at 2.5 and 5 MHz

Response Nonlinearity: < 1%

Response Nonuniformity: < $\pm 4\%$ over entire CCD area, except blemish regions

Blemish Definitions: EEV measures blemishes with 20 msec integration time and video rate readout at room temperature. Under these conditions a dark defect is made of pixels with <50% of the normal sensitivity and a hot defect would exceed 250,000 electrons/pixel-second at room temperature (i.e., ~25% normal)

Blemish Specifications: No full or partial dark columns; ≤ 2 white spots; ≤ 7 dark clusters containing three or fewer pixels, no dark clusters containing more than 3 pixels; Traps are counted as dark clusters

Operating Temperature: TE/CCD, -45°C with air circulation,
-60°C with tap water circulation,
-35°C with air circulation and nitrogen backfill

Thermostating Precision: $\pm 0.040^\circ\text{C}$ over entire temperature range

Typical Dark Charge: 11 electrons/pixel-second at -40°C using PI mode 1;
0.75 electrons/pixel-second at -40°C using PI mode 2

Scan Rate: TE/CCD and RTE/CCD maximum scan rate is 1 MHz;
PentaMAX models are available with maximum scan rates of 2.5 and 5 MHz

Full Frame Readout: 0.273 seconds at 1 MHz; 0.063 seconds at 5 MHz

Maximum Frame Rates: At 5 MHz, 15 frames/second without binning, 29 frames/second with 2 × 2 binning,
52 frames/second with 4 × 4 binning, 85 frames/second with 8 × 8 binning,
125 frames/second with 16 × 16 binning, 160 frames/second with 32 × 32 binning

Vertical Shift Time: < 1.6 milliseconds/frame