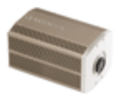
| Specification | Evolve 512 | QuantEM | Evolve 128 | CoolSnap HQ² | PCO.Edge | PCO.pixelfly usb | CoolSnap ES² | CoolSnap EZ | CoolSnap cf² | Rolera MGi-PLUS | EXi Blue | Retiga SRV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | |  | new! | | | | | | | | | |
| Sensor | e2v CCD97 | e2v CCD97 | e2v CCD60 | Sony ICX-285 | CIS2051(sCMOS) | ICX285AL | Sony ICX-285 | Sony ICX-285 | ICX-205 | e2v L3Vision CCD97 | Sony ICX-285 | Sony ICX-285 |
| Pixels | 512 x 512<br>(back-illuminated/back-thinned) | 512 x 512<br>(back-illuminated/back-thinned) | 128 x 128<br>(back-illuminated/back-thinned) | 1392 x 1040 | 2560 x 2160 pixel | 1392 x 1040 pixel (normal)<br>800 x 600 (center) | 1392 x 1040 | 1392 x 1040 | 1392 x 1040 | 512 x 512<br>(back-illuminated/back-thinned) | 1392 x 1040 | 1392 x 1040 |
| Pixel Size | 16 x 16 µm | 16 x 16 µm | 24 x 24 µm | 6.45 x 6.45 µm | 6.5 µm x 6.5 µm | 6.45 µm x 6.45 µm | 6.45 x 6.45 µm | 6.45 x 6.45 µm | 4.65 x 4.65 µm | 16 x 16 µm | 6.45 x 6.45 µm | 6.45 x 6.45 µm |
| Well Size | 800,000 e- (EM mode)<br>200,000 e- (conventional) | 800,000 e- (EM mode)<br>200,000 e- (conventional) | 750,000 e- (EM mode)<br>250,000 e- (conventional) | 16,000 e-/30,000e- @ 2x2 | 30,000 e- | 16,000 e- (full frame)<br>24,000 e- (binning) | 13,500 e-/25,000e- @ 2x2 | 12,300 e-/24,500 @2x2 | 10,200 e- | 800,000 e- (EM mode)<br>200,000 e- (conventional) | 18,000 e-/27,000e- @ 2x2 | 18,000 e-/22,000e- @ 2x2 |
| Sensor Format | 11.6 mm Diagonal | 11.6 mm Diagonal | 4.34 mm Diagonal | 11 mm Diagonal | 16.6 mm x 14.0 mm / 21.8 mm | 2/3" / 11.14 mm | 11 mm Diagonal | 11 mm Diagonal | 8 mm Diagonal | 11.6 mm Diagonal | 2/3" Diagonal | 2/3" Diagonal |
| Max QE | > 90% at 480-700 nm | > 90% at 480-700 nm | > 90% at 500 - 680 nm | 62% at 550 nm | 57% @ peak | 65% @ peak | 62% at 550 nm | 62% at 500 nm | 40% at 550 nm | >90% at 500 - 650 nm | 62% at 650 nm (in high-sensitivity mode) | 62% at 500 - 600 nm<br>(in high-sensitivity mode) |
| Digital Output | 8, 10, 12, 14, and 16 bit (user selectable) | 16 bit | 16 bit | 14 bit | 16 bit | 14 bit | 12 bit | 12 bit | 12 bit mono / 36-bit color | 14 bit | 8/14 bit | 8/12 bit |
| Readout Frequency | 10 or 5 MHz (EM mode)<br>5 or 1 .25 MHz (conventional) | 10 or 5 MHz (EM mode)<br>5 or 1 .25 MHz (conventional) | 12 MHz | 20 MHz or 10 MHz | 95.3 MHz (ssc2) / 286 MHz (fsc2) | 12 MHz / 24 MHz | 20 MHz | 20 MHz | 20 MHz | 10 or 5 MHz (EM mode)<br>5 or 1 MHz (conventional) | 30, 20, or 10 MHz | 20Mhz or 10 MHz |
| Frame Rate | 33.7 fps full resolution<br>> 224 fps @ 8x8 | 31.5 fps full resolution<br>157 fps @ 8x8 | 510 fps full resolution; 1656 fps@ 4x4.<br>Up to 4149 fps with ROI and binning | 11 fps full resolution<br>56 fps@ 8x8 | 100 fps @ 2560 x 2160 pixel (rs1, fsc2)<br>50 fps @ 2560 x 2160 pixel (gs1, fsc2) | 1392 x 1040 @ 7.3 fps- 12 MHz<br>1392 x 1040 @ 13.5 fps -25MHz | 10 fps full res, 55 fps@ 8x8 | 10 fps full res, 50 fps@ 8x8 | 10 fps full res, 55 fps@ 8x8 | 30 fps full resolution up to 400 fps | 15 fps full res, 36 fps@ 4x4 | 11 fps full res, 33 fps@ 4x4. Up to 200 fps with ROI, 8 and 12 bit |
| Read Noise | EM Channel: 45 e- rms @ 5 MHz<br>32 e- rms @ 10 MHz<br>(< 1 e- rms with EM gain enabled) | Normal Channel: 12 e- rms @1.25 MHz<br>6 e- rms @ 5 MHz | EM Channel: 37 e- rms @ 5 MHz<br>45 e- rms @ 10 MHz<br>(< 1 e- rms with EM gain enabled) | Normal Channel: 7.5 e- rms @1.25 MHz<br>12.5 e- rms @ 5 MHz | < 65 e- rms<br>(< 1 e- rms with EM gain) | 20 MHz Channel: 5.5 e- rms | 10 MHz Channel: 4.5 e- rms | < 1.4rms / 1.2med e- @ (rs1, ssc2)<br>< 2.0rms / 1.7med e- @ (rs1, fsc2) | 5 .. 7 e- rms @ 12 MHz (typ.)<br>6 .. 8 erms @ 24 MHz (typ.) | 8 e- rms | 10 e- | <1 e- (EM mode)<br>8 e- (conventional) | 4.5 e-, 6.6 e-, 12.3 e- | 8 e- |
| Dark Current | 0.001 e/p/s typical @ -30 °C | 0.001 e/p/s typical @ -30 °C | < 1 e/p/s | 0.15 e/p/s with cooling | 2 .. 6 e-/pixel/s (rs1) @ 5 °C<br>2 .. 6 e-/pixel/s + 0.6 / 1.8 e-/pixel (gs1) @ 5°C | 1 e-/pixel/s @ 23 °C | 0.01 e/p/s | 1 e/p/s | < 1 e/p/s | 0.5 e/p/s | 0.15 e/p/s | 0.0013 e/p/s with cooling at -45C |
| Background Events | 0.0045 events/pixel/second<br>Not detectable using BERT™ | | 0.0045 events/pixel/second<br>Not detectable using BERT™ | | | | | | | | | |
| Field Uniformity | EM Channel: 1.04 @ 10 MHz<br>1.10 @ 5 MHz | Normal Channel: 1.06 @ 5 MHz<br>1.02 @1.25 MHz | EM Channel: 1.04 @ 10 MHz<br>1.10 @ 5 MHz | Normal Channel: 1.06 @ 5 MHz<br>1.02 @1.25 MHz | | | | | | | | |
| Bias Stability | <0.0006 @ 10 MHz, 350X EM gain, 4X analog gain | | < 0.0006 @ 10 MHz, 350X EM gain, 4X analog gain | | | | | | | | | |
| Gain Stability | 0.0012 @ 10 MHz, 350X EM gain, 4X analog gain | | 0.0012 @ 10 MHz, 350X EM gain, 4X analog gain | | | | | | | 1 - 1000X (0-4095 DAC) | 0.8 to 34.7X | 0.817 to 39X |
| Gain States (Analog) | 0.5x, 1x, 4x | 0.5x, 1x, 4x | 0.5x, 1x, 4x | 0.5x, 1x, 4x | | | 0.5x, 1x, 4x | 1/2x, 1x | 0.5x, 1x, 4x | | | |
| Gain States (Electron Multiplication) | 1 to 1000x (self calibrated) | 1 to 1000x (self calibrated) | 1 to 1000x (self calibrated) | NA | | | NA | NA | NA | | | |
| Integration Time (Minimum) | 1 µs<br>359 µs per frame<br>(due to 0.7 us parallel shift) | 500 µs | 1 µs<br>359 us per frame<br>(due to 0.7 us parallel shift) | 30 µs | 500 µs .. 2 s (rs¹)<br>10 µs .. 100 ms (gs¹) | 5 µs .. 60 s | 30 µs | 30 µs | 30 µs | 10 µs to days | 10 µs to 17.9 min | 10 µs to 17.9 min |
| Cooling | -85 °C<br>-100 °C | -30 °C | -85 °C<br>-100 °C | -30 °C (regulated) | + 5 °C<br>(@ +10 °C .. + 30 °C, controlled) | Ambient Cooling with | 0 °C (regulated) | 5 °C below ambient | 5 °C below ambient | -25 °C | 0 °C (regulated) | -45 °C (user selectable) |
| Binning Modes | Up to 256x1 in parallel direction, arbitrary in serial direction. | Up to 256x1 in parallel direction, 1, 2, 4, 8 in serial direction. | Up to 256x1 in parallel direction, arbitrary in serial direction. | Up to 16x16, flexible | No binning in sCMOS | 1 x 1 .. 2 x 2 | Up to 16x16, flexible | Up to 16x16, flexible | 2x2, 4x4, 8x8, flexible | 2x2, 3x3, 4x4, 5x5, 6x arbitrary | 2x2, 4x4, 8x8 | 2x2, 4x4, 8x8 |
| Region of Interest | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip | Selectable | | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip | Arbitrary on-chip |
| Digital Interface | IEEE-1394a | IEEE-1394a | IEEE-1394a | IEEE-1394a | Dual Camera Link (full, 10 taps) | USB 2.0 | IEEE-1394a | IEEE-1394a | IEEE-1394a | IEEE-1394a | IEEE-1394b | IEEE-1394a |
| Operating System | Win 2000, XP, Vista, Mac 10.x | Win 2000, XP, Vista, Mac 10.x | Win 2000, XP, Vista, Mac 10.x | Win 2000, XP, Vista, Mac 10.x | WinXP and later | Win XP and later | Win 2000, XP, Vista, Mac 10.x | Win 2000, XP, Vista, Mac 10.x | Win 2000, XP, Vista, Mac 10.x,<br>Linux 2.4 and 2.6.8 | Win 7, XP, Vista, Mac 10.x | Win 7, XP, Vista | Win 7, XP, Vista, Mac 10.x |
| Warranty | One Year (Five Years on Vacuum) | One Year (Two Years on Vacuum) | One Year (Five Years on Vacuum) | One Year (Two Years on Vacuum) | Two Year | Two Year | One Year | One Year | One Year | Two Years | Two Years | Two Years |
| Application Examples | Spinning-disk confocal, Quantitative FRET, Multiprobe experiments, Ratiometric ion imaging, Confocal microscopy, Live-cell fluorescence imaging | Spinning-disk confocal, Quantitative FRET, Multiprobe experiments, Ratiometric ion imaging, Confocal microscopy, Live-cell fluorescence imaging | Neurosciences, Single-molecule fluorescence, Live-cell microscopy, Spinning-disk confocal microscopy | Live-cell imaging, High-speed emission ratio imaging, Low-copy gene analysis, Gene expression profiling, Quantitative FRET, FRAP, FISH, Luminescence | Live Cell Microscopy, Single Molecule Detection, Super resolution microscopy, TIRF microscopy, Spinning Disk microscopy, FRET/FRAP, Fluorescence Spectroscopy, Bio-ChemiLuminescence, HyperSpectral Imaging, Genome Sequencing, Flo Cytometry | Scientific imaging, Low light level imaging high resolution microscopy, machine vision, particle image velocimetry (PIV) spectroscopy, flow visualization (hydrodynamics), material testing, luminescence spectroscopy, red and NIR fluorescence, imaging of bio markers (e.g. GFP) | Fixed-cell fluorescence, Immunofluorescence, FISH, Ion concentration imaging, Near-infrared (NIR) DIC | Atomic force microscopy (AFM), Fixed-cell fluorescence, Immunofluorescence, FISH Ion concentration imaging, Near-infrared (NIR) DIC | Fixed-cell fluorescence, Pathology, Histology, DIC / Phase-contrast imaging, Darkfield imaging | | | |
| Software Included | RS Image<br>RSConfig<br>PVCAM<br>Supported by Micro-Manager<br>(open source) | RS Image<br>RSConfig<br>PVCAM | RS Image<br>RSConfig<br>PVCAM | RS Image<br>RSConfig<br>PVCAM | PCO Cameware | PCO Cameware | RS Image<br>RSConfig<br>PVCAM | QCapture Suite for PC and Mac. | RS Image<br>RSConfig<br>PVCAM | QCapture PRO for PC | QCapture Suite for PC | QCapture Suite for PC and Mac |
| External Synch/ Trigger? | Yes | Yes | Yes | Yes | Yes | Yes, External sync cable required | Yes | Yes | Yes | Yes | Yes | Yes |
| Other | Rapid-Cal™ self calibration to assure linear response.<br>Quant-View™ mode for readout in units of electrons.<br>BERT™ Background Event Reduction™ technology to eliminate speckles.<br>Black-lock™ and Top-Lock™ technology<br>Vari-Bit™ technology for matching bit-depth to application needs.<br>Active Clocking Enhancement™ for precise transfer of charge.<br>Photometrics Active Regulation™ for precise and stable EM gain control.<br>Bias stability control.<br>Lowest fixed-pattern noise in the industry.<br>Lifetime vacuum seal.<br>EM overload protection.<br>Integrated lens cap. | Stabilized gain and bias for accurate quantitation. Electron-multiplying CCD technology AND low-noise standard read-out port. | Photometrics introduces the Evolve™ 128 EMCCD camera. The Evolve 128 delivers the highest frame rates available with extreme sensitivity for demanding low-light applications ranging from In Vivo imaging to Single Molecule Fluorescence. As the leader in quantitative performance, the Evolve 128 provides researchers an enhanced imaging tool with on board camera intelligence. Features such as Quant-View™ combined with superior stability, enables precise and accurate research measurement and reproducible results. | Premier camera for low-light, high-precision fluorescence microcopy.<br>Flexible and durable enough to handle almost all advanced quantitative microscopy applications. | 1 rs = rolling shutter / gs = global shutter.<br>2 ssc = slow scan mode - 16 bit / fsc = fast scan mode.<br>Visually lossless compression / decompression for data transfer in fsc and horizontal resolution greater than 1920 pixel (due to Camera Link limitations).<br>3 The readout noise values are given as root mean square (rms) and median (med) values, due to the different noise models, which can be used for evaluation.<br>4 The dark current in global shutter mode consists of an exposure time related part and of a sensor readout time related part, which is constant for a given pixelclock 0.6 e- @ 286 MHz / 1.8 e- @ 95.3 MHz and frame size (here full frame). A smaller ROI reduces the latter part of the dark current accordingly.<br>5 The high dynamic signal is simultaneously converted at high and low gain by two 11 bit A/D converters and the two 11 bit values are sophistically merged into one 16 bit value. | The new pco.pixelfly usb is a high performace digital 14 bit CCD camera system specially designed for low light applications in the spectral range of visible light if a small form factor is required. | Ideal camera for labs needing a quantitative camera for most low- to moderate-light applications. | Fanless design for Atomic Force Microscopy applications.<br>Precision camera for moderate light levels. | Low-cost precision camera for moderate light levels.<br>Small pixies are excellent for low-magnification microscopy. | Runs on PVCAM driver only.<br>Electron-multiplying CCD technology AND low-noise standard read-out port. | Supports RGB Filter Modules.<br>High-speed FireWire-B interface. | Supports RGB Filter Modules.<br>Blackout mode turns off all camera lights. |

**Information is subject to change without notice.**