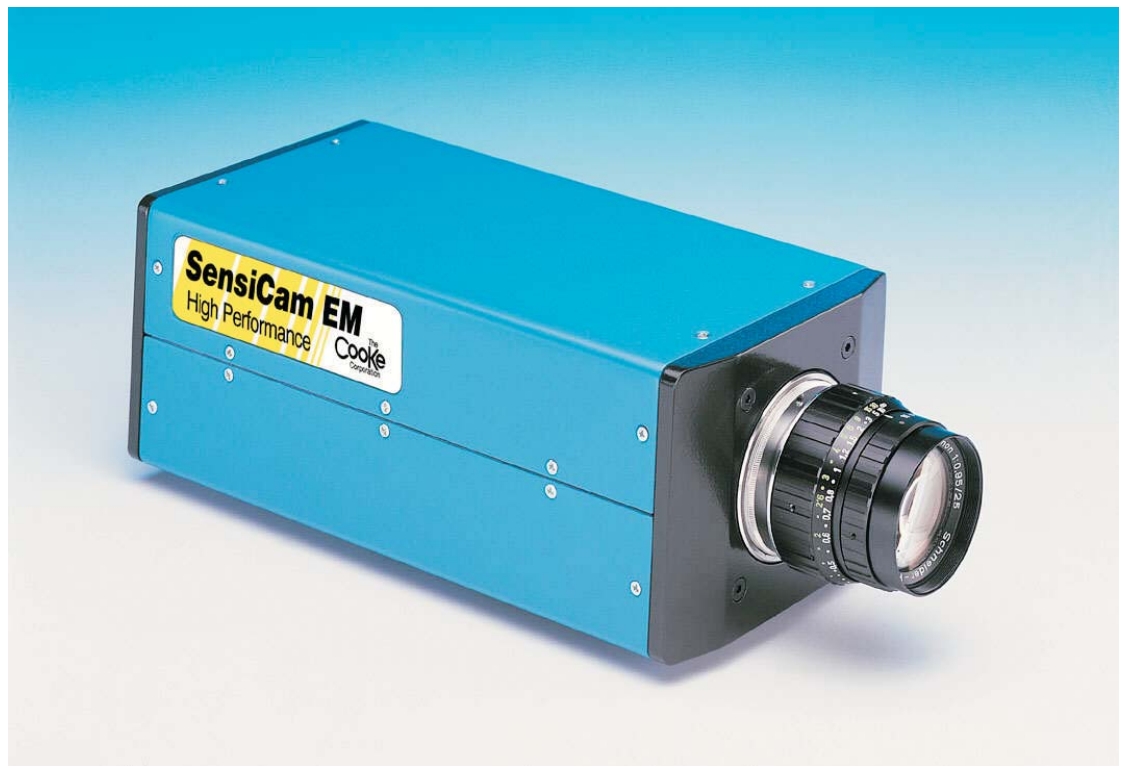


sensicam em

electron multiplication digital 12-bit CCD camera system

- electron multiplication gain of up to 1000
- superior resolution (1004x1002 pixel) for EM-CCDs
- extremely low noise $< 1e^-$ @ gain > 50
- excellent quantum efficiency of up to 65%
- 12-bit dynamic range @ gain = 2
- shutter / exposure times from 50 μ s to 1h
- thermo-electrical cooling down to -15°C



sensicam em

The new generation of electron multiplication CCD sensors is integrated into a sensicam camera system. With this on-chip multiplication of the light signal the readout noise of the camera can be neglected ($< 1 e^- \text{ rms @ gain } > 50$). With its excellent resolution of 1004x1002 pixel this high performance cooled digital 12-bit CCD camera system is best suited for extreme low light applications. The system features thermo-electrical cooling of the image sensor (down to $-15 \text{ }^\circ\text{C}$) and an outstanding quantum efficiency (up to 65%), which achieves a high spectral sensitivity in general and especially in the NIR. Exposure time modes (software selectable) range from $50 \mu\text{s} - 1\text{h}$. A high speed serial data link connects the system to the PC (fiber optic link available).

technical data

	unit	setpoint	sensicam em
resolution (hor x ver) ¹	pixel		1004x1002
pixel size (hor x ver)	μm^2		8.0 x 8.0
sensor format/ diagonal	mm ² / mm		8.03 x 8.02/ 11.35
peak quantum efficiency	%	@ 610nm typical	65
full well capacity	e^-		70 000
image sensor			TC285SPD
dynamic range	dB	@ CCD + camera	72
dynamic range A/D ²	bit		12
readout noise	$e^- \text{ rms}$	@em gain = 2 @em gain > 100	10 <1
imaging frequency, frame rate	fps	@full frame	13
pixel scan rate	MHz		16
A/D conversion factor	e^-/count	@em gain = 2	6
spectral range	nm		290..1100
exposure time	s		50 μs ..1hour
anti-blooming factor		typical	1000
smear	%		0.6
binning horizontal	pixel		1, 2, 4, 8
binning vertical	pixel	full resolution for 992pixel ver	1, 2 4, 8, 16, 32
dark current	$e^-/\text{pixel}\cdot\text{s}$	@-15 $^\circ\text{C}$ typical	0.9
region of interest	pixel	for 992pixel ver	down to 32
charge multiplication		9 steps	2, 5, 10..1000

technical data

non linearity	%	full temperature range @gain=2	<2
uniformity darkness DSNU ³	e ⁻ rms	@ 90% center zone & gain=2	2
uniformity brightness PRNU ⁴	% rms	typical	0.6
trigger, auxiliary signals		internal/ external	software / TTL level
power consumption	W	typical	36
power supply	VAC		90..260
mechanical dimensions camera (w x h x l)	mm ³		93 x 78 x 210
mechanical dimensions power supply (w x h x l)	mm ³		84 x 50 x 155
weight	kg		1.6
operating temperature range	°C		+5..+40
operating humidity range	%		10..90
storage temperature range	°C		-20..+70
optical input			c-mount, Nikon f-mount
optical input window			fused silica
data interface			PCI local bus, Rev 2.1, burst rate 132 MByte/s
CE certified			yes
cooled CCD	°C		-15
cooling method			2 stage Peltier cooler with forced air cooling

- [1] horizontal versus vertical
 [2] Analog-to-Digital-converter
 [3] dark signal non-uniformity
 [4] photo reponse non-uniformity

software:

Camware software for camera control, image acquisition and archiving of images in various file formats, WindowsNT, 2K and XP, 32-bit-dynamic link library (DLL) is available for user customisation and integration on PC platforms (software development kit - SDK), software is operational in either single mode or with built-in recorder functions, drivers for popular third party software packages are available (see website)

options:

CCD image sensor in color version
custom-made versions

areas of application

laser induced fluorescence ■ luminescence microscopy ■ fluorescence spectroscopy (up to NIR) ■ bioluminescence ■ chemoluminescence ■ low light level imaging ■ imaging of bio markers (e.g. green fluorescent protein, GFP) ■ absorption & luminescence spectroscopy ■ imaging of potential sensitive dyes (Neuroscience) ■ night vision ■ security ■ astronomy ■ combustion process analysis ■ gel imaging ■ single photon counting ■ fuel injection

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sensicam em preliminary 08/2004
subject to changes without prior notice

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