

# pco.1300 solar cooled digital 12bit CCD camera system

- designed for electroluminescence (EL) applications
- quantum efficiency of up to 13 % @ 880 nm
- superior low noise of typ. 6 e<sup>-</sup> rms @ 10 MHz
- resolution of 1392 x 1040 pixel
- cooling of -25 °C vs. ambient
- optimal offset stability and control (< 1 count/h)
- 12 bit dynamic range
- exposure times range from 5 μs - 1 h
- standard IEEE 1394a ("Firewire") interface
- free software camware and software development kit included



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# pco.1300 solar

This versatile high performance 12 bit CCD camera system is specifically designed for electroluminescence (EL) applications in the range of 850 nm to 1200 nm. The pco.1300 solar has an extraordinary quantum efficiency (QE) of up to 13 % @ 880 nm. In addition a proprietary offset control algorithm has been developed which provides very high offset stability (drift  $\leq 1$  count/h), regardless of ambient temperature or signal changes ensuring accurate and repeatable quantitative data over long periods of time. The pco.1300 solar's most unique features are its increased sensitivity in the NIR range of the spectrum and the „no glow“ functionality. ROI, binning, cooling can be selected to accommodate the user's application. Camera features excellent resolution (1392 x 1040 pixel), 12 bit dynamic range, exposure times from 5  $\mu$ s to 1 hour, internal frame buffer for continuous image capture (64 MB min), excellent low noise of 6 e<sup>-</sup> rms @ 10 MHz, cooling of -25 °C vs. ambient, standard interface IEEE1394a („Firewire“).

## technical data

	unit	setpoint	pco.1300 solar
resolution (hor x ver) <sup>1</sup>	pixel	@ normal @ extended mode	1392 x 1040 1424 x 1060
pixel size (hor x ver)	$\mu$ m <sup>2</sup>		6.45 x 6.45
sensor format / diagonal	inch / mm		2/3" / 11.14
quantum efficiency	%	@ 880 nm typical @ + 15 °C	13
full well capacity	e <sup>-</sup>		16 000
dark current	e <sup>-</sup> / pixel·s	@ + 10 °C typical @ standard mode	0.05
image sensor			ICX285AL
maximum dynamic range	dB	CCD + camera @ 10 MHz	68.5
dynamic range A/D <sup>2</sup>	bit		12
readout noise	e <sup>-</sup> rms	@ 10 / 20 MHz	6 / 10
imaging frequency, frame rate	fps	@ full frame @ 10 / 20 MHz	5.9 / 11.7
pixel scan rate	MHz		10 / 20
A/D conversion factor	e <sup>-</sup> / count	standard / IR boost	3.8 / 1.9
spectral range	nm	normal	290 .. 1200
exposure time	s	@ standard mode @ IR boost mode	5 $\mu$ s .. 1 h 100 ms .. 1 h

## technical data

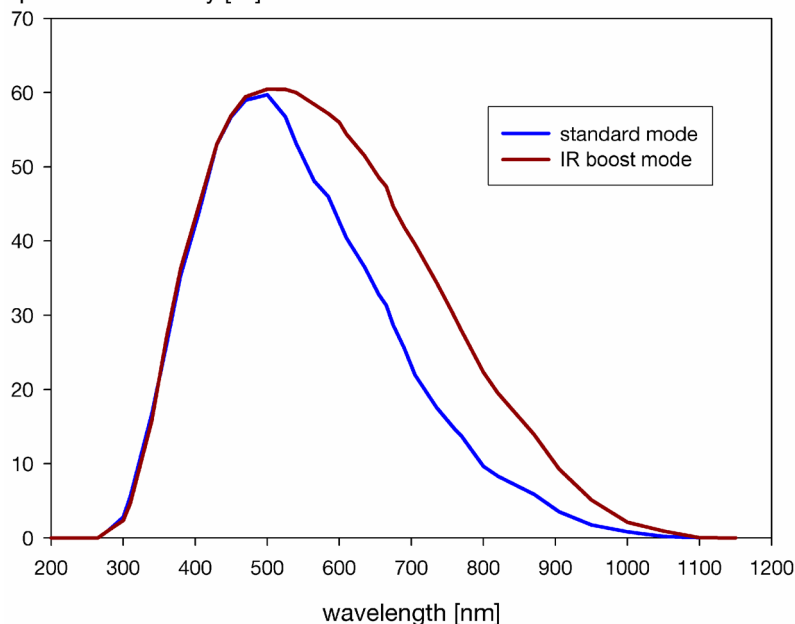
	unit	setpoint	pco.1300 solar
anti-blooming factor		@ stand.light mode / @ IR boost mode @ 100 ms expos. time	> 400 / > 4
smear	%		< 0.002
binning (hor x ver)	pixel		1 x 1, 1 x 2, 2 x 1, 2 x 2
optical input			c-mount
trigger, auxiliary signals		internal / external	software / TTL level
power supply	VDC	typical	18..28 V 24 V
cooling method			1 stage Peltier cooler with forced air cooling
cooled CCD temperature	°C	versus ambient temperature	-25
power consumption	W	max.	20
mechanical dimensions (w x h x l)	mm <sup>3</sup>		113 x 104 x 110
weight	kg		1.1
ambient temperature	°C	range	+10 .. +40
operating humidity	%	range	10 .. 80
storage temperature	°C	range	-20 .. +70
data interface			IEEE 1394a

[1] horizontal versus vertical

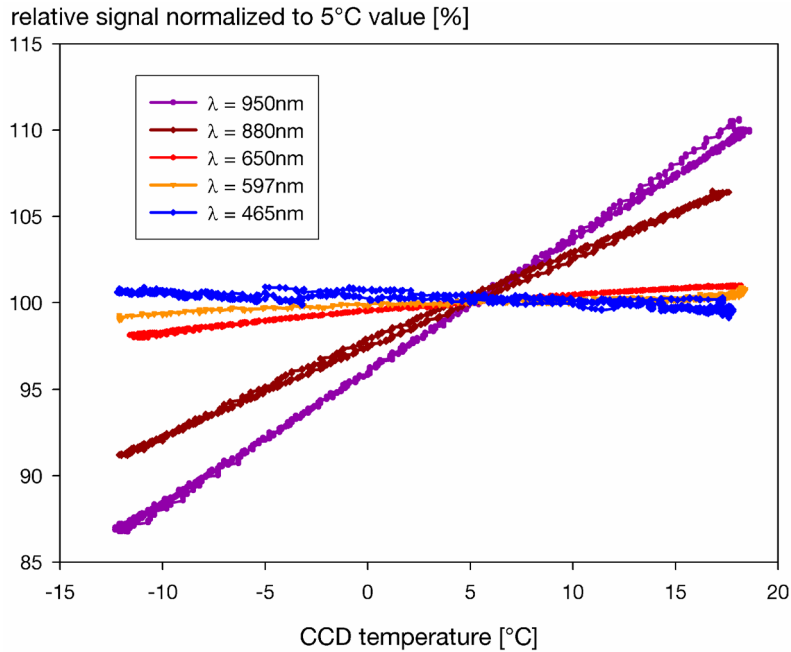
[2] Analog-to-Digital-converter

## quantum efficiency

quantum efficiency [%]



(measured by pco  
at -10°C)



The pco.1300 solar was operated at different CCD image sensor temperatures and a homogeneous light signal was measured. The measurement was repeated at different peak wavelengths of the light. The mean signal normalized to the 5°C value is displayed with respect to the temperature.

## areas of application

- solar cell in-line quality control
- solar panel quality control
- low light level imaging
- machine vision and industrial applications
- scientific imaging
- Red and NIR fluorescence applications
- spectroscopy

## examples of applications

Electroluminescence images of solar panels with poly-crystalline (upper photo) and mono-crystalline (lower photo) solar cells. Darker areas indicate areas or crystal layers, which do not contribute to the solar current generation.

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pro Terra, Regenerative Power Engineering, Memmingen,  
[www.pro-terra.de](http://www.pro-terra.de)

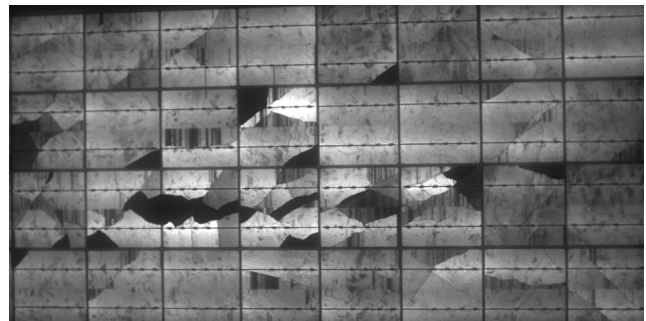
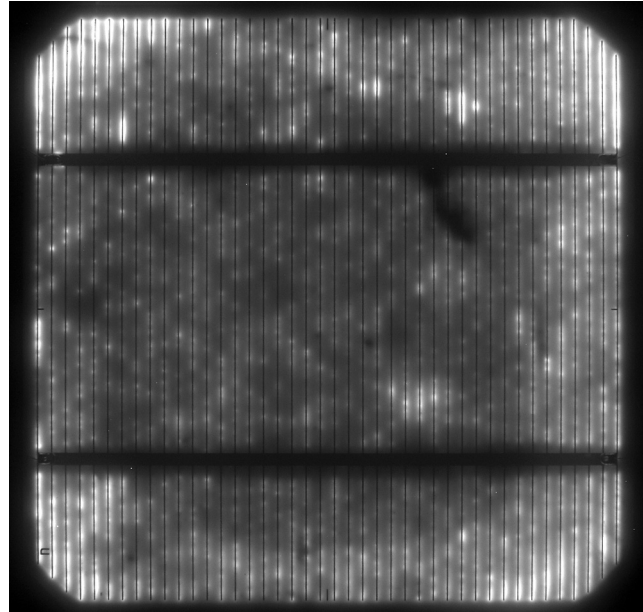


Image of a mono-crystalline solar cell, which is operated under forward bias condition. The electroluminescence (EL) of the cell below the bus bar and the grid electrodes is clearly visible. The image was recorded by a pco.1300 solar at 2s exposure time. The darker areas indicate areas of minor quality within the solar cell.

...measured by pco



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