

# ORCA®-Flash4.0 V2

Digital CMOS camera C11440-22CU

Low noise

1.0

electrons median

Standard scan

1.6

electrons rms

at 100 frames/s

0.8

electrons median

Slow scan

1.4

electrons rms

at 30 frames/s

High-speed readout

100

frames/s

Camera Link

at 4.0 megapixels

30

frames/s

USB 3.0

at 4.0 megapixels

High dynamic range

91

dB (37 000:1)

Hamamatsu's brilliantly designed ORCA-Flash4.0 V2 is truly a game changer in the world of scientific imaging.

Built on a revolutionary new Gen II sCMOS detector, the ORCA-Flash4.0 V2 is the first sCMOS camera that challenges the performance of all CCD, EM-CCD, and Gen I sCMOS cameras. With its combination of low noise and high quantum efficiency, the ORCA-Flash4.0 V2 delivers unprecedented sensitivity as well as high dynamic range, blazing fast speeds, large field of view, and excellent resolution--all at once.

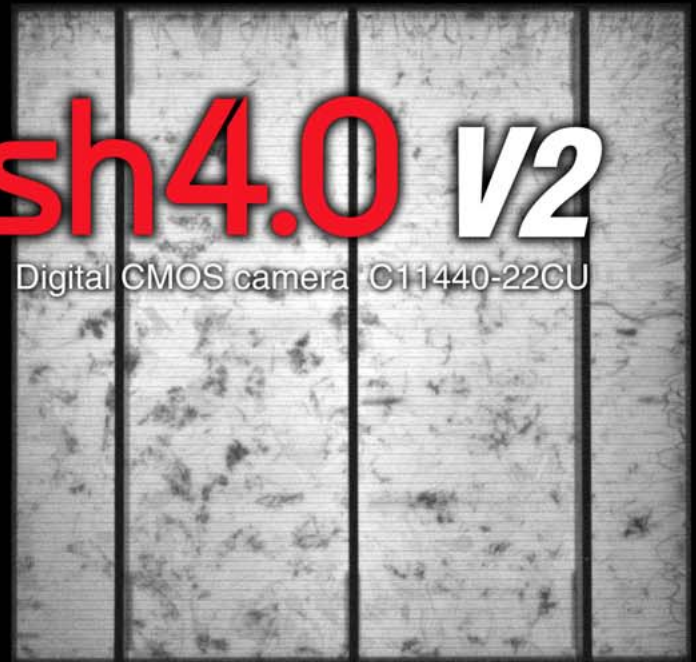
Furthermore, the camera's high NIR sensitivity (over 20 % Q.E. at 900 nm) is perfectly suitable for many NIR applications such as solar cell quality control, semiconductor inspection, IR reflectography, etc.

ORCA-Flash4.0 V2 has newly implemented readout mode, Slow scan mode, which realizes low readout noise as low as 0.8 electrons. It enables superior S/N imaging even under low light conditions.

The new standard for sensitivity, speed, and resolution is here. We think you will enjoy the results.

## Applications

- X-ray I.I., X-ray scintillator readout
- Electroluminescence imaging for photovoltaic cell inspection
- NIR semiconductor inspection
  - Internal inspection (TSV, MEMS, etc.)
  - Wafer inspection (appearance, defects, characteristics)
  - Bonded wafer inspection (Si/GaAs)
- TEM readout
- IR reflectography (art inspection)



▲ EL (electroluminescence) imaging from multi-crystal silicon PV cells

Exceptional sensitivity

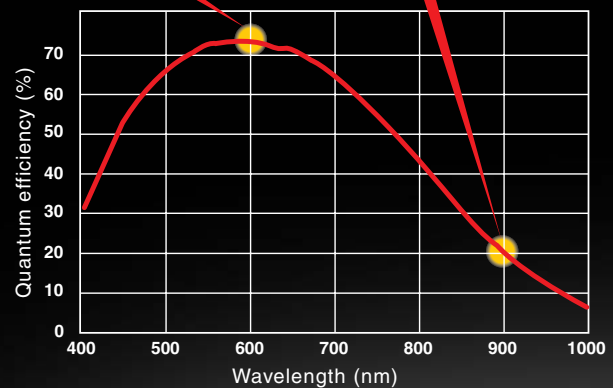
Over 70 %

at 600 nm

High sensitivity in NIR

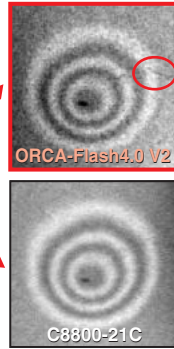
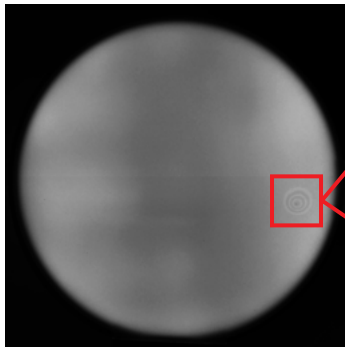
Over 20 %

at 900 nm



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## Sample images



Comparison under the same field of view as C8800-21C (NIR CCD Camera)

ORCA-Flash4.0 V2 enables much finer details to be resolved because of its higher resolution than the C8800-21C.

▲ 6-inch SOI (silicon-on-insulator)

## Specifications

Product number	C11440-22CU	
Imaging device	Scientific CMOS sensor FL-400	
Effective number of pixels	2048 (H) × 2048 (V)	
Cell size	6.5 μm × 6.5 μm	
Effective area	13.312 mm × 13.312 mm	
Full well capacity (typ.)	30 000 electrons	
Readout time	Standard scan (at 100 frames/s)	10 ms
	Slow scan (at 30 frames/s)	33 ms
Readout noise	Standard scan (at 100 frames/s, typ.)	1.6 electrons rms (1.0 electrons median)
	Slow scan (at 30 frames/s, typ.)	1.4 electrons rms (0.8 electrons median)
Dynamic range (typ.) <sup>*1</sup>	37 000:1	
Quantum efficiency	Over 70 % at 600 nm and 50 % at 750 nm	
Cooling method	Dark current (typ.)	Sensor temp. (nominal)
Forced air (Ambient at +20 °C)	0.06 electrons/pixel/s	-10 °C
Water (+20 °C)	0.02 electrons/pixel/s	-20 °C
Water (+15 °C)	0.006 electrons/pixel/s	-30 °C
Readout speed	Camera Link	USB 3.0
Full resolution	100 frames/s	30 frames/s
	2048 × 1024 (at center position)	200 frames/s
	2048 × 8 (at center position)	25 655 frames/s
	2048 × 8 (at center position)	7894 frames/s
	512 × 8 (at center position)	25 655 frames/s
A/D conversion	16 bit output	
Readout modes	Digital binning 2 × 2 / 4 × 4	
	Sub-array readout mode	
Exposure time <sup>*2</sup>	Internal trigger mode (at full resolution)	1 ms to 10 s
	Internal trigger mode with sub-array readout	38.96 μs to 10 s
	External trigger mode with sub-array readout	1 ms to 10 s
Digital interface	Camera Link <sup>*3</sup> / USB 3.0	
Lens mount	C-mount / F-mount	
Power requirement	AC 100 V to AC 240 V, 50 Hz/60 Hz	
Power consumption	Approx. 70 VA	
Trigger in		
External trigger mode	Edge, Level, Synchronous readout, Start trigger, Global reset edge and Global reset level	
External trigger signal routing	SMA connector or Camera Link I/F	
External trigger delay function	0 to 10 s in 10 μs steps	
Trigger out		
External signal output	3 programmable timing outputs Global exposure timing and Trigger ready output	
External signal output routing	SMA connector	
Software		
Software interface	PC-based acquisition package included DCAM-SDK, commercially available software	

<sup>\*1</sup> Full well capacity / Readout noise median in slow scan

<sup>\*2</sup> Minimum exposure time in internal trigger mode varies depend on sub-array setting. Minimum exposure time is in standard scan.

<sup>\*3</sup> Proprietary mode equivalent of Camera Link 80-bit configuration

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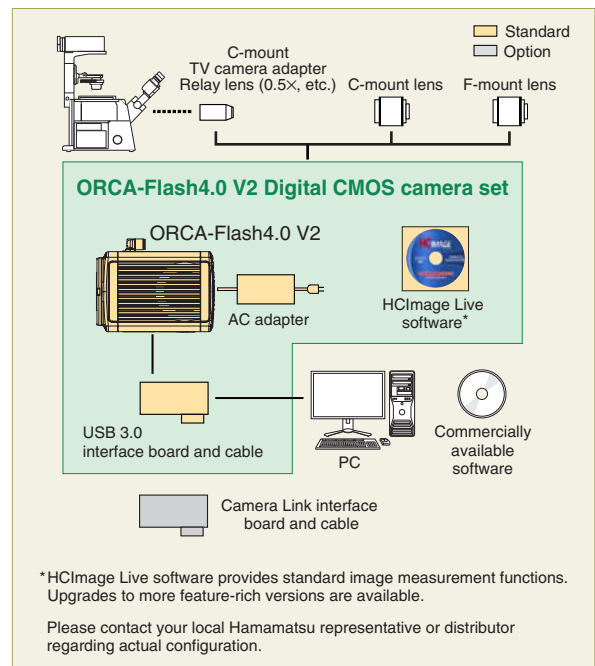
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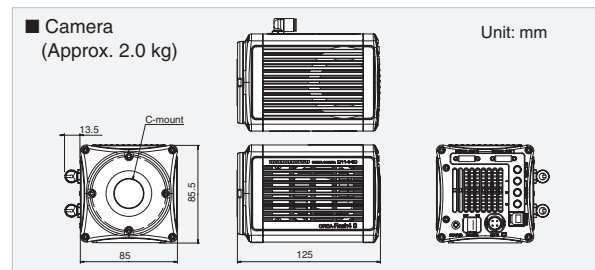
Specifications and external appearance are subject to change without notice.

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## Configuration example



## Dimensional outlines



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