

SPECS

ORCA-Flash4.0 V3	
Product Number	C13440-20CU
Imaging Device	sCMOS
Cell (pixel) Size (μm^2)	6.5
Pixel Array (horizontal by vertical)	2048 x 2048
Effective Area (horizontal by vertical in mm)	13.312 x 13.312
Peak Quantum Efficiency (QE)	82% @ 560 nm
Dynamic Range¹	37,000:1
Readout Noise (Nr) median in electrons slow scan¹	0.8 @ 40 fps
Readout Noise (Nr) rms in electrons slow scan¹	1.4 @ 40 fps
Readout Noise (Nr) median in electrons standard scan¹	1.0 @ 40 fps
Readout Noise (Nr) rms in electrons standard scan¹	1.6 @ 40 fps
Maximum Full Resolution Frame Rate (fps)	40 100
Cooling Temperature Readout	Yes
Dark Current (electrons/pixel/sec.) – Air Cooled to -10° C	0.06
Dark Current (electrons/pixel/sec.) – Water Cooled to -10° C	0.06
Dark Current (electrons/pixel/sec.) – Water Cooled to -30° C	0.006
Full Well Capacity in electrons¹	30,000
Digital Outputs (with programmable LUT)	16, 12, 8 bits
Readout Modes	Normal Area, Multiple ROI, Lightsheet, W-VIEW mode, Dual Lightsheet
In-camera digital binning	Yes
Master Pulse Generator (Pulse Modes)	Internal Sync, Start Trigger, Burst
Master Pulse Generator (Pulse Interval in 1 μs increments)	10 μs to 10 s
Hot Pixel Correction	Off, Low, Medium, High
Dark Signal Non-Uniformity (DSNU)¹	0.3 e- r.m.s.
Photo Response Non-Uniformity (PRNU) at half level of full light range (15,000 e-)¹	0.06% r.m.s.
Photo Response Non-Uniformity (PRNU) at low light level (700 e-)¹	0.3 % r.m.s.
Linearity error, full light range (EMVA 1288 standard) ¹	0.5%
Linearity error, low light range (< 500 e- signal)¹	0.2 % / Less than approx. 1 e- absolute error
On-camera Connectivity	Both USB3.0 and Camera Link ²
V2 Compatibility Mode (for use with legacy software)	Yes
Lens Mount	C-mount

¹ Typical value

² Enabled with optional Camera Link board for PC

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ORCA-Flash4.0 V3

We've advanced our camera technology,
so you can advance your science

Building on our extensive experience with high performance scientific cameras and advanced imaging applications, Hamamatsu introduces the new ORCA-Flash4.0 V3. This one camera expertly handles applications ranging from the acquisition of beautiful scientific images to experiments that demand detection, quantification and speed. With on-board FPGA processing enabling intelligent data reduction, highly refined in-camera, pixel-level calibrations, increased USB3.0 frame rates, purposeful and innovative triggering capabilities, patented lightsheet read out modes and individual camera noise characterization the ORCA-Flash4.0 V3 is the precision instrument for imaging.

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Calibrated for Quantitative Accuracy

Our ORCA-Flash4.0 cameras have always provided the advantage of low camera noise. In quantitative applications, like single molecule and super resolution imaging, fully understanding camera noise is also important. Every ORCA-Flash4.0 V3 is carefully calibrated... as a precision instrument must be. Our attention to this detail delivers outstanding linearity, especially at low light, and offers improved photo response non-uniformity (PRNU) and dark signal non-uniformity (DSNU) to minimize pixel differences and reduce fixed pattern noise.¹ Each camera ships with a certificate providing the read noise and photoelectron conversion factor specific for that camera.

Flexibility for Customized Data Control

Like its predecessors, each ORCA-Flash4.0 V3 is capable of both USB3.0 or Camera Link output. In addition, the ORCA-Flash4.0 V3 offers data reduction through user-controllable look up tables (LUT) for 12 or 8-bit output. These two choices, combined with region of interest selection enable you to fine tune acquisition speed and image data requirements.



Region of Interest ¹	Output Bit Depth	Camera Link frames per second ²	USB3.0 frames per second ²
2048 x 2048	16	100	40
	12	100	53
	8	100	80
2048 x 1024	16	200	80
	12	200	106
	8	200	160
2048 x 512	16, 12 or 8	400	200
2048 x 8	16, 12 or 8	25655	20524

¹ Pixels centered on chip, horizontal x vertical

² In standard scan mode

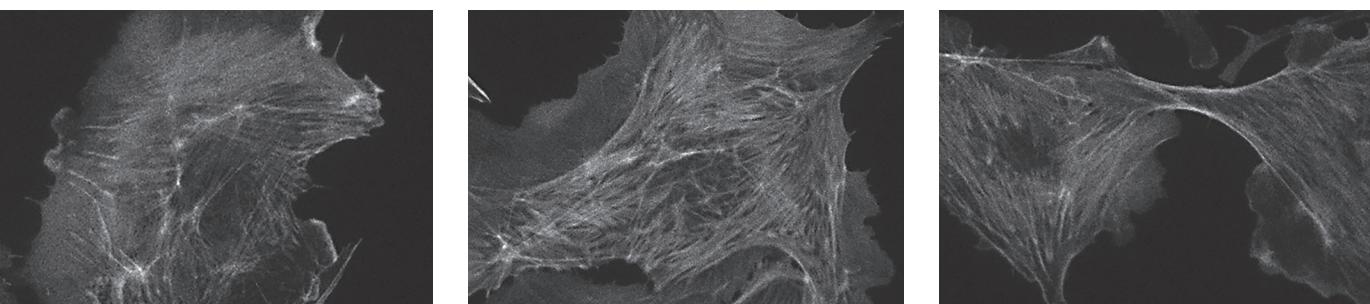
Focus on the Relevant Data

Our new "Enhanced Visualization Mode" was designed to help answer the question "Can I see it?" Many low light experiments, especially those that were previously imaged using EM-CCDs are now routinely accomplished—with better signal to noise, faster speeds and at far less expense—by sCMOS cameras. However, we sometimes miss the visual punchiness of EM-CCD images. Enhanced Visualization Mode pops the contrast of the displayed image, while saving the sCMOS raw image data to disk.

And sometimes our innate tendency to seek contrast can be a distraction. Even a few hot pixels in a time lapse or tracking experiment can divert our attention or our analysis from the real data. Enter our multi-level, user-selectable, hot pixel reduction. By applying a series of increasingly aggressive algorithms to detect noisy pixels, you can choose to eliminate these small but distracting elements. And since nobody appreciates having their data unexpectedly modified, the default setting for this hot pixel correction is off when you power up the camera.

Powerful Triggering for Synchronization

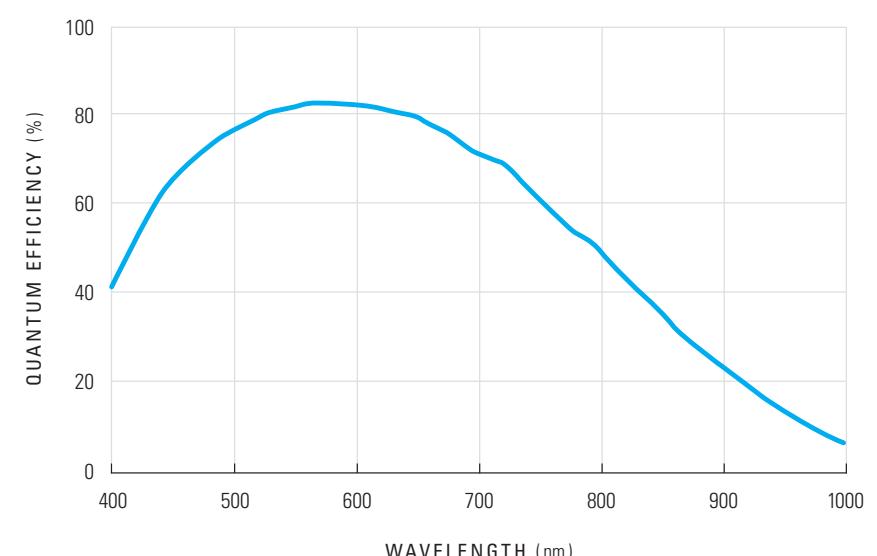
Joining a full complement of sophisticated triggering routines, our new Master Pulse timing generator allows the ORCA-Flash4.0 V3 to truly run the experiment. Performing functions that previously would have required an external pulse generator the ORCA-FLASH4.0 V3's Master Pulse has flexible timing delays built in. Powerful synchronization of multiple cameras and devices just became a lot simpler.



Patented Tools for Advanced Imaging

The ORCA-Flash4.0 V3 includes our now patented, Lightsheet Readout Mode which takes advantage of sCMOS rolling shutter readout to enhance the quality of lightsheet images.

When paired with our W-VIEW GEMINI image splitting optics, a single ORCA-Flash4.0 V3 camera becomes a powerful dual wavelength imaging device. In "W-VIEW Mode," each half of the sensor can be exposed independently, facilitating balanced dual color imaging with a single camera. And this feature can be combined with the new and patented "Dual Lightsheet Mode" making simultaneous dual wavelength lightsheet microscopy a reality. And finally, the ORCA-Flash4.0 V3 is the perfect complement to our new W-VIEW GEMINI-2C dual camera, super resolution-quality, image splitting optics.



¹ See our poster "Quantitative Evaluation of Accuracy and Variance of Individual Pixels in a Scientific CMOS (sCMOS) Camera for Computational Imaging", Shigeo Watanabe, Teruo Takahashi and Keith Bennett. Presented at SMLMS and LSFM, August, 2016