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 USB 3.0 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 imaging and super resolution microscopy 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. 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 USB 3.0 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.

Each ORCA-Flash4.0 V3 is shipped with a mounting baseplate pre-installed.

Region of Interest[1]	**Output Bit Depth**	**Camera Link** frames per second[2]	**USB 3.0** 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	400	160
	12	400	212
	8	400	320
2048 x 8	16	25655	9329
	12	25655	12827
	8	25655	17103

[1] *Pixels centered on chip, horizontal x vertical* [2] *In standard scan mode*

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.

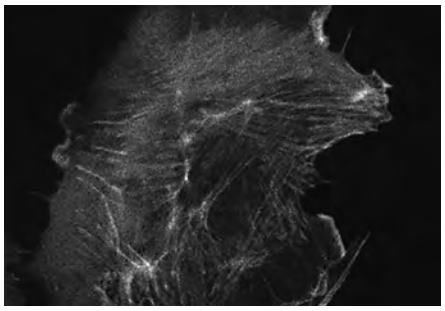
Focus on the Relevant Data

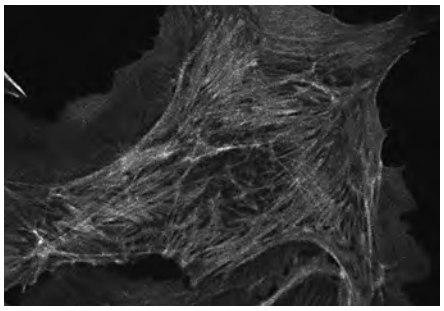
Our new "Enhanced Visualization Mode" was designed to help answer the question "Can I see it?" Many low light experiments, especially those that were previously imaged using EM-CCDs are now routinely accomplished—with better signal to noise, faster speeds and at far less expense—by sCMOS cameras. However, 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.

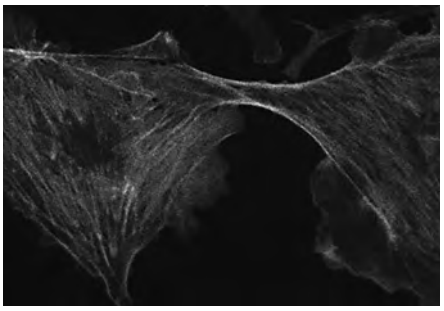
And sometimes our innate tendency to seek contrast can be a distraction. Even a few hot pixels in a time lapse or tracking experiment can divert our attention or our analysis from the real data. Enter our multi-level, user-selectable, hot pixel reduction. By applying a series of increasingly aggressive 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.

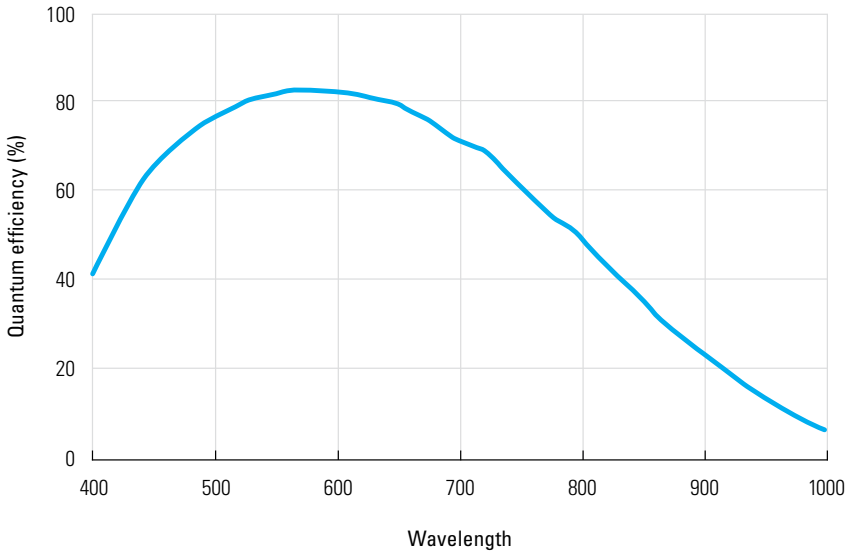
Powerful Triggering for Synchronization

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.









Specifications

	ORCA-Flash4.0 V3	
Product Number	C13440-20CU	
Imaging Device	sCMOS	
Cell (pixel) **Size** (μm²)	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 Range[1]	37 000	
	USB 3.0	With Optional Camera Link Board for PC
Readout Noise (N^r) **median in electrons slow scan**[1]	0.8 @ 30 fps	0.8 @ 30 fps
Readout Noise (N^r) **rms in electrons slow scan**[1]	**1.4 @ 30 fps**	**1.4 @ 30 fps**
Readout Noise (N^r) **median in electrons standard scan**[1]	1.0 @ 40 fps	1.0 @ 100 fps
Readout Noise (N^r) **rms in electrons standard scan**[1]	**1.6 @ 40 fps**	**1.6 @ 100 fps**
Maximum Full Resolution Frame Rate (fps)	40	100
Cooling Temperature Readout	Yes	
Dark Current (electrons/pixel/s) – **Air Cooled to -10° C**	0.06	
Dark Current (electrons/pixel/s) – **Water Cooled to -10° C**	0.06	
Dark Current (electrons/pixel/s) – **Water Cooled to -30° C**	0.006	
Full Well Capacity in electrons[1]	30 000	
Digital Outputs (with programmable LUT)	16, 12, 8 bits	
Readout Modes	Normal Area, Lightsheet, W-VIEW Mode, Dual Lightsheet	
Binning	2 x 2 / 4 x 4	
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- rms	
Photo Response Non-Uniformity (PRNU) at half level of full light range (15,000 electrons)[1]	0.06 % rms	
Photo Response Non-Uniformity (PRNU) at low light level (700 electrons)[1]	0.3 % rms	
Linearity error, full light range (EMVA 1288 standard)[1]	0.5 %	
Linearity error, low light range (< 500 electrons signal)[1]	0.2 % / Less than approx. 1 e- absolute error	
On-camera Connectivity	Both USB 3.0 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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Cat. No. SCAS0120E02
FEB/2017 HPK Created in the USA