ORCA®-Flash4.0LT

Digital CMOS camera C11440-42U

A brand new feature "W-VIEW Mode"

Be brilliant.

HAMAMATSU

PHOTON IS OUR BUSINESS

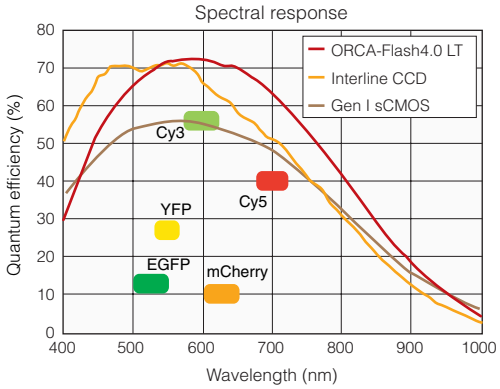
Be brilliant.

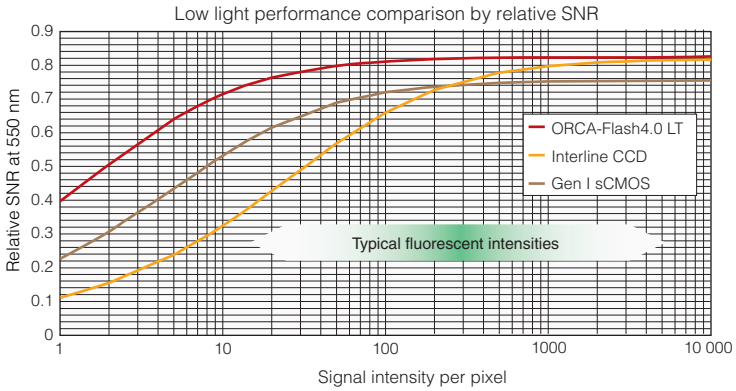
The ORCA-Flash4.0 LT makes it easy to be brilliant. With 2× the speed, 3× the field of view and up to 5× the signal to noise over even the best interline CCD cameras, the ORCA-Flash4.0 LT brings high end performance to every imaging project. From brightfield to fluorescence, from live cell to fixed tissue, from routine to ground-breaking, the ORCA-Flash4.0 LT is designed to be the new workhorse digital camera. The ORCA-Flash4.0 LT shines with the most experienced implementation of Gen II sCMOS technology, and realizes the long-awaited promise of luxury CCD performance at affordable CMOS price.

Performance beyond interline CCD

Excellent image quality

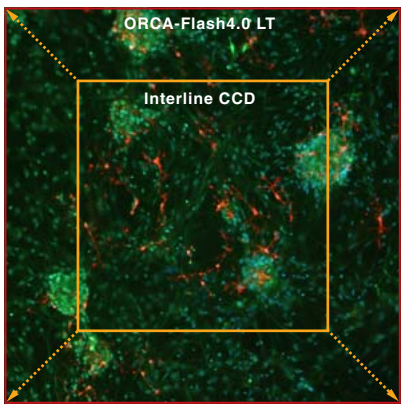
The combination of high quantum efficiency and low noise allows the ORCA-Flash4.0 LT to produce images that are both visually pleasing and quantitatively relevant. The ORCA-Flash4.0 LT exceeds the SNR performance of Gen I sCMOS at all input photon levels and that of interline CCDs at less than 5000 photons per pixel. This means reduced exposure times that maintain strong SNRs across a broad range of sample intensities while at the same time providing large field of view and better temporal resolution as compared to CCDs.





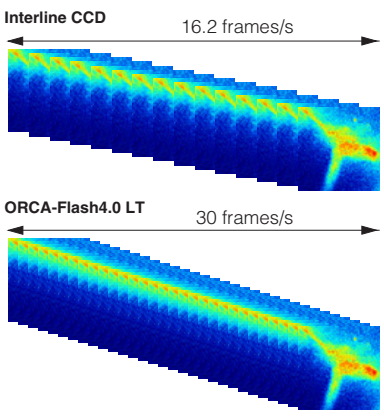
Large field of view

The ORCA-Flash4.0 LT provides 3× larger field of view compared to commonly used interline CCDs (e.g., ICX285) and is ideally suited to utilize the entire field of view of research microscopes.



Fast speed

The ORCA-Flash4.0 LT provides 2× frame rate at full resolution as compared to interline CCDs enabling high-speed image acquisition with large field of view.



NEW Function

W-VIEW Mode

In addition to the intrinsic quality of the sensor, W-VIEW Mode is newly implemented as one of the key features. This function is optimized for simultaneous image acquisition of dual wavelength images with our Image splitting Optics "W-VIEW GEMINI" and expands the possibilities of low light imaging applications.

- **Independent Exposure Times**

For two halves of the sensor, the different exposure time can be set independently by software.

- **Independent and Selectable Readout Directions**

W-VIEW Mode enables multiple scanning directions under favor of rolling shutter mechanism. Scanning options for both sides of sensor can be set separately. When combining W-VIEW GEMINI, it enables the user to acquire sophisticated dual wavelength images simultaneously which are synchronized the readout with the scanning light source.

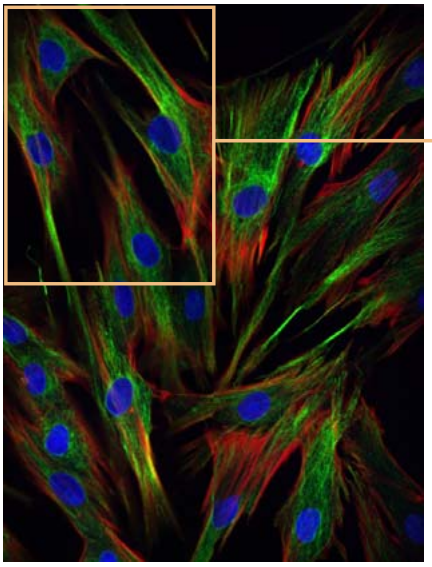
- **Independent Subarray**

Each ROI on top and bottom halves of the sensor is configurable. Data reduction and faster frame rate are feasible due to appropriate ROI setting.

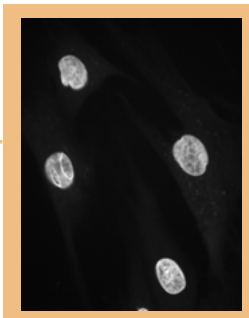
Applications where ORCA-Flash4.0 LT shines

Multi-dimensional imaging

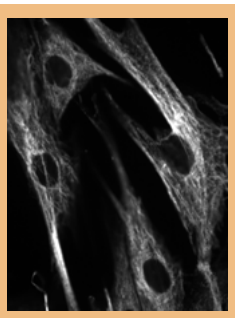
Collect large data sets from x, y or z with multiple wavelengths more efficiently.
The combined features of large field of view, low light performance and speed means less time at the scope and more time finding the answers.



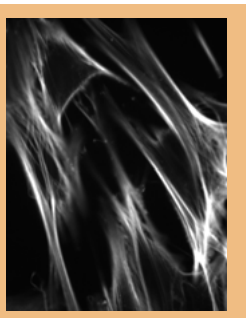
▲12 images (4 positions × 3 wavelengths) merged and tiled to create one composite image.



▲ nucleus (blue)



▲ tubulin (green)



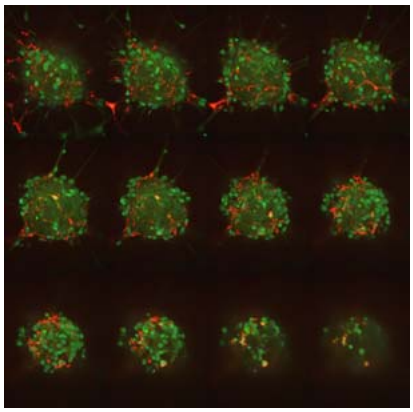
▲ F-actin (red)

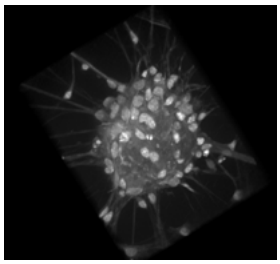
Sample: Porcine Aortic Smooth Muscle Cells
Fluorescent Probe: nucleus (Hoechst 33342),
tubulin (Alexa Fluor 488), F-actin (Alexa Fluor 546)
Objective Lens: 60× oil
Confocal Scanner: Yokogawa CSU-X1
Light source: Light Engine Spectra X

Courtesy of Kazuaki Nagayama, Ph.D., Associate Professor, Nagoya Institute of Technology

3D imaging

Multi-wavelength Z-series with resulting 3D reconstruction.





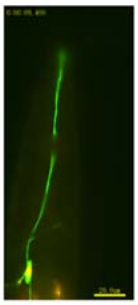
◀ 3D image (Cy2)

Sample: Mouse Neural Stem Cells
Fluorescent Probe: DAPI, Cy2, Cy3
Objective Lens: 60× oil
Z step: 0.6 μm
Confocal Scanner: Yokogawa CSU-X1
Light source: Light Engine Spectra X

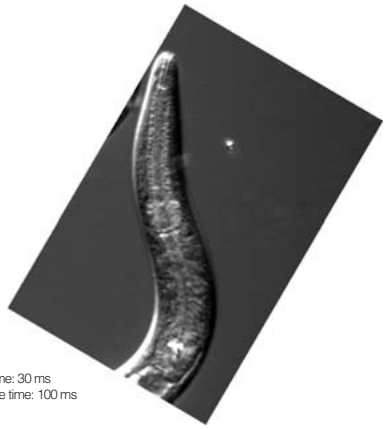
Ca^{2+} imaging

Ca^{2+} imaging using W-VIEW Mode (Independent exposure time setting)

▲
Left:
Ch1(mCherry) Exposure time: 30 ms
Ch2(G-GECO1.2) Exposure time: 30 ms



▲
Right:
Ch1(mCherry) Exposure time: 30 ms
Ch2(G-GECO1.2) Exposure time: 100 ms



Sample: C. elegans
Fluorophore: ASER-mCherry_ASER-G-GECO1.2
Stimulation: NaCl concentration change (50 mM to 0 mM), 5 sec interval
Lens: 60× oil
Camera: ORCA-Flash4.0 LT
Left: Ch1(mCherry) Exposure time: 30 ms Ch2(G-GECO1.2) Exposure time: 30 ms
Right: Ch1(mCherry) Exposure time: 30 ms Ch2(G-GECO1.2) Exposure time: 100 ms
Binning: 2×2
Scan mode: W-VIEW Mode
Optics: W-VIEW GEMINI
DIC image is prepared by HAMAMATSU PHOTONICS as reference

Sample and Image courtesy of Masahiro Kuramachi and Motomichi Doi, Ph.D.
University of Tsukuba
Biomedical Reserch Insitute,
NATIONAL INSTITUTE OF ADVANCED INDUSTRIAL SCIENCE AND TECHNOLOGY(AIST)

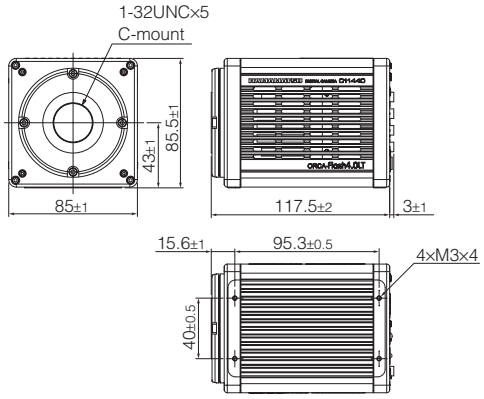
Specifications

Product number	C11440-42U	
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 noise (typ.)	0.9 electrons (median), 1.5 electrons (rms)	
Readout noise (Rapid rolling mode) (typ.)	1.3 electrons (median), 1.9 electrons (rms)	
Dynamic range (typ.)*1	33 000:1	
Quantum efficiency	Over 70 % at 600 nm	
Cooling temperature	+10 ˚C (Ambient +25 ˚C)	
Dark current (typ.)	0.6 electrons/pixel/s	
PRNU (Column fixed pattern noise*2)	≤ 0.1 %	
MTF (Theoretical)	76.9 lp/mm	
Frame rate*3		
Full resolution	30 frames/s	
2048 × 1024*4	60 frames/s	
2048 × 8*4	7696 frames/s	
512 × 8*4	25 000 frames/s (Rapid rolling mode only)	
AD conversion*5	16 bit	
Readout mode	Normal readout mode 1×1	
	Digital binning 2×2/4×4	
	Sub-array readout mode (Configurable different value in the top and bottom areas.)*6	
	Readout direction change*6	
Exposure time	Normal mode	Rapid rolling mode
Internal trigger mode*7	3 ms to 10 s	1 ms to 10 s
	3 ms to 6 s*6	1 ms to 2 s*6
Internal trigger mode with sub-array readout	130 µs to 10 s	40 µs to 10 s
	130 µs to 6 s*6	40 µs to 2 s*6
External trigger mode	3 ms to 10 s	1 ms to 10 s
	3 ms to 6 s*6	1 ms to 2 s*6
Interface	USB 3.0	
Lens mount	C-mount / F-mount*8	
Power requirement	AC 100 V to AC 240 V, 50 Hz/60 Hz	
Power consumption	Approx. 75 VA	
Storage ambient temperature	-10 ˚C to +50 ˚C	
Operating ambient temperature	0 ˚C to +40 ˚C	
Operating ambient humidity	70 % or less (with no condensation)	
Trigger in		
External trigger mode	Edge, Level, Synchronous readout, Start trigger	
	Global reset edge, Global reset level	
External trigger signal routing	SMA	
External trigger delay function	0 to 10 s (10 µs steps)	
Trigger out		
External signal output	3 programmable timing outputs	
	Global exposure timing output	
	Trigger ready output	
	Multi-channel sync output	
External signal output routing	SMA	
Software		
Software interface	PC-based acquisition package included	
	DCAM-SDK, commercially available software	

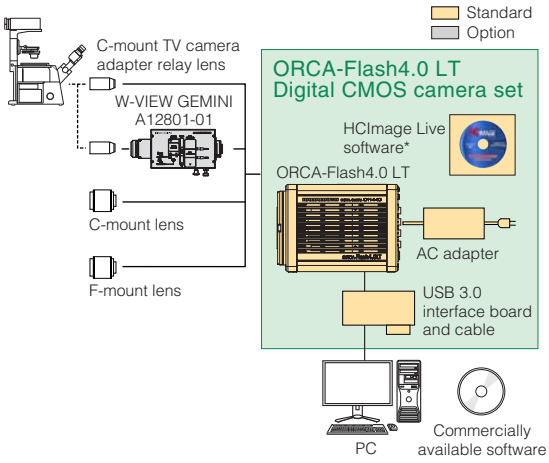
*1 Full well capacity/Readout noise median
*2 Measured at 70 % of full well capacity
*3 Optimal running condition. For more information refer to http://www.hamamatsu.com/resources/pdf/sys/SCAS0095E_Global.pdf
*4 Measured center of image.
*5 The true 16 bit image data is achieved through seamless merging of the output from two 11 bit A/D converters.
*6 At the time of W-VIEW Mode
*7 Minimum exposure time in internal trigger mode varies depending on sub-array size and position.
*8 Product number of F-mount camera is C11440-42U01

Dimensional outlines

Camera (Approx. 1.1 kg) Unit: mm



Configuration example



*HCImage Live software provides standard image measurements functions. Upgrades to more feature-rich versions are available.

Please contact your local Hamamatsu representative or distributor regarding actual configuration.

W-VIEW GEMINI
Image splitting optics
A12801-01 (Option)

For two wavelength imaging

HAMAMATSU PHOTONICS K.K. **www.hamamatsu.com**

HAMAMATSU PHOTONICS K.K., Systems Division
812 Joko-cho, Higashi-ku, Hamamatsu City, 431-3196, Japan, Telephone: (81)53-431-0124, Fax: (81)53-435-1574, E-mail: export@sys.hpk.co.jp

U.S.A.: Hamamatsu Corporation: 360 Foothill Road, Bridgewater, N.J 08807, U.S.A., Telephone: (1)908-231-0960, Fax: (1)908-231-1218 E-mail: usa@hamamatsu.com
Germany: Hamamatsu Photonics Deutschland GmbH.: Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany, Telephone: (49)8152-375-0, Fax: (49)8152-265-8 E-mail: info@hamamatsu.de
France: Hamamatsu Photonics France S.A.R.L.: 19, Rue du Saule Trapu, Parc du Moulin de Massy, 91882 Massy Cedex, France, Telephone: (33)1 69 53 71 00, Fax: (33)1 69 53 71 10 E-mail: infos@hamamatsu.fr
United Kingdom: Hamamatsu Photonics UK Limited: 2 Howard Court,10 Tewin Road, Welwyn Garden City, Hertfordshire AL7 1BW, UK, Telephone: (44)1707-294888, Fax: (44)1707-325777 E-mail: info@hamamatsu.co.uk
North Europe: Hamamatsu Photonics Norden AB: Torshamnsgatan 35 16440 Kista, Sweden, Telephone: (46)8-509-031-00, Fax: (46)8-509-031-01 E-mail: info@hamamatsu.se
Italy: Hamamatsu Photonics Italia S.r.l.: Strada della Moia, 1 int. 6 20020 Arese (Milano), Italy, Telephone: (39)02-93581733, Fax: (39)02-93581741 E-mail: info@hamamatsu.it
China: Hamamatsu Photonics (China) Co., Ltd.: B1201 Jiaming Center, No.27 Dongsanhuan Beilu, Chaoyang District, Beijing 100020, China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866 E-mail: hpc@hamamatsu.com.cn

Cat. No. SCAS0099E07
MAR/2015 HPK
Created in Japan