CAMERA LINE UP CATALOG

HAMAMATSU

PHOTON IS OUR BUSINESS

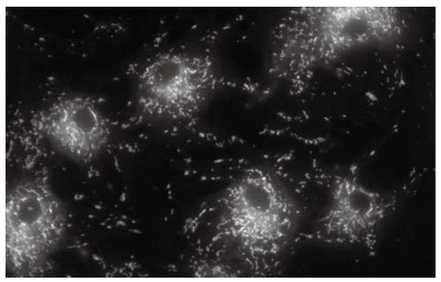
APPLICATION

We have a diverse lineup of cameras that support a wide range of wavelengths from X-rays to the near-infrared and support a variety of applications.

Life science

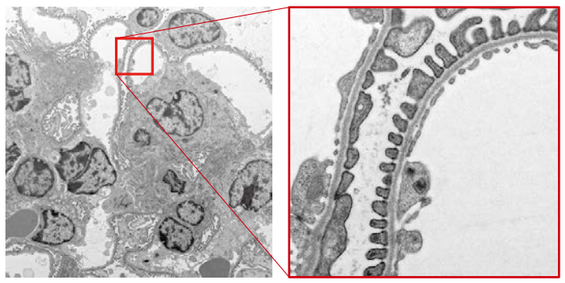
Time-lapse imaging of live cells

Mitochondria in living cells are observed by long-time time-lapse imaging.



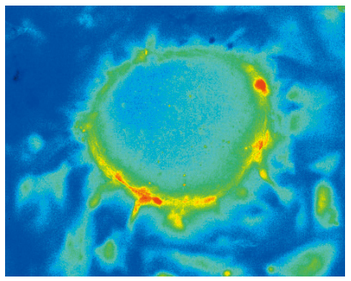
Observation of mouse kidney cells

Micron-sized mouse kidney cells are observed by high-resolution imaging under an electron microscope.



Cardiomyocyte pulsation observation

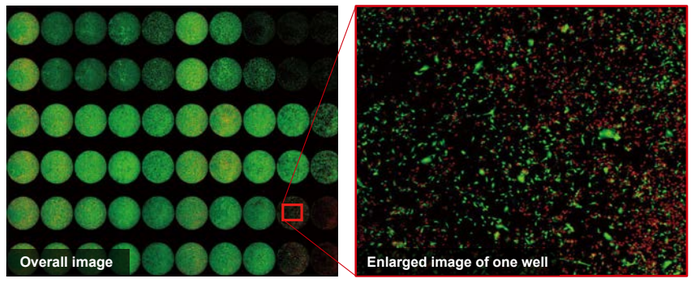
The pulsation of cardiomyocytes associated with changes in calcium ion concentration is observed by high-speed imaging using fluorescence images.



* Displayed with pseudo color by image processing.

Observation of cultured cells

Cells cultured in one well of a microplate are observed by high-resolution imaging with fluorescent images.



* Displayed with pseudo color by image processing.

Medical

Medical diagnosis

The condition of the affected area is observed for diagnosis by infrared imaging.

Astronomy

Lucky imaging

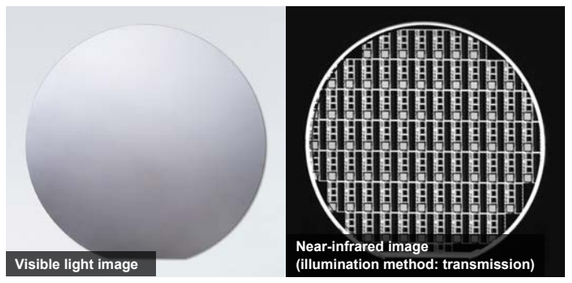
Wide field of view and low-noise imaging is used to obtain a clear image of the stars by integrating, from among many acquired images, that are less affected by atmospheric turbulence.

* Displayed with pseudo color by image processing.

Semiconductor inspection

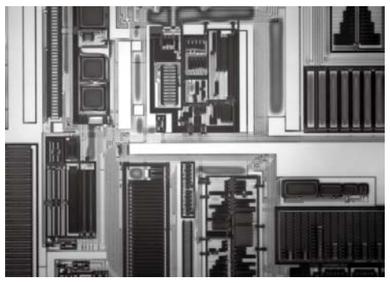
Transmission observation of Si wafer

The pattern formed on the backside of the Si wafer is observed transmittedly through the front side by infrared imaging.



Semiconductor device observation

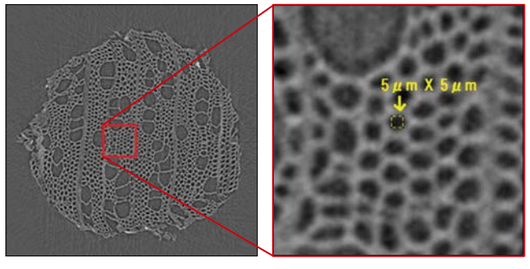
The pattern under the Si layer is observed by infrared imaging.



Synchrotron imaging

X-ray CT

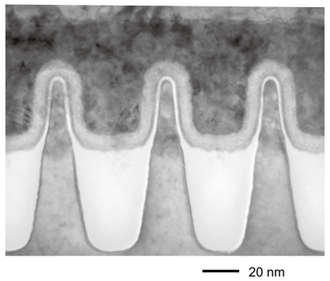
The cross-sectional structure of the toothpick is clearly shown by high-resolution X-ray imaging.



Electronic microscope

Structure observation of semiconductor devices

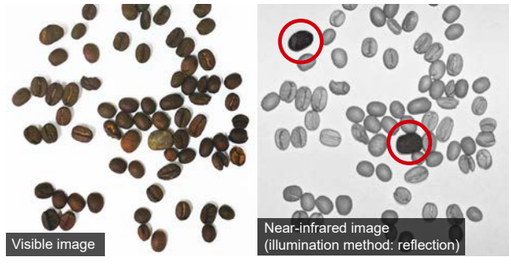
The interior structure of a semiconductor device is analyzed at the nano-level by high-resolution imaging using an electron microscope.



Food inspection

Foreign object detection

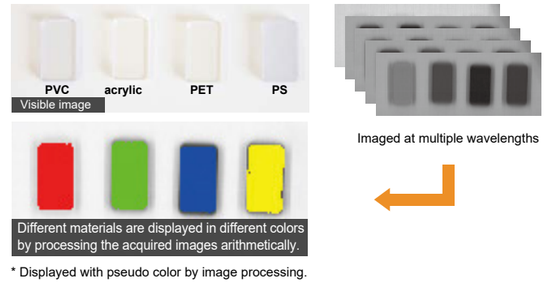
Small stones mixed in coffee beans that are difficult to see with visible light are detected by the infrared imaging.



Analysis/spectroscopy

Material identification

Infrared imaging identifies materials that are difficult to distinguish in visible light, such as PVC, acrylic, PET, and PS.

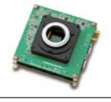


* Displayed with pseudo color by image processing.

CAMERA LINE UP

Wavelength range	UV to near-infrared	Visible to near-infrared								Visible to near-infrared (for weak light)		Near-infrared				
Name	ORCA® II Digital CCD camera	ORCA®-Quest qCMOS® camera	ORCA®-Fusion BT Digital CMOS camera	ORCA®-Fusion Digital CMOS camera	ORCA®-Flash4.0 V3 Digital CMOS camera	ORCA®-Flash4.0 LT+ Digital CMOS camera	ORCA®-Lightning Digital CMOS camera	ORCA®-spark Digital CMOS camera	TDI camera	ImagEM® X2 EM-CCD camera	ImagEM® X2-1K EM-CCD camera	InGaAs camera				InGaAs line scan Camera
Type	C11090-22B	C15550-20UP	C15440-20UP	C14440-20UP	C13440-20CU	C11440-42U30	C14120-20P	C11440-36U	C10000-801	C9100-23B	C9100-24B	C14041-10U	C12741-03	C12741-11		C15333-10E
Appearance																
Image sensor type	Area sensor	Area sensor							TDI sensor	Area sensor		Area sensor				Line sensor
Sensitivity wavelength range (nm) (Spectral response: See P5)	200 to 1000 ①	300 to 1000 ②	350 to 1000 ③	④	⑤		⑥	⑦	200 to 1000 ⑧	300 to 1100 ⑨		950 to 1700 ⑩		900 to 1550 ⑪		950 to 1700 ⑫
Effective number of pixels (H × V)	1024 × 1024	4096 × 2304	2304 × 2304	2304 × 2304	2048 × 2048	2048 × 2048	4608 × 2592	1920 × 1200	2048 × 128	512 × 512	1024 × 1024	320 × 256	640 × 512	640 × 512		1024 × 1
Pixel size ((H) µm × (V) µm)	13 × 13	4.6 × 4.6	6.5 × 6.5	6.5 × 6.5	6.5 × 6.5	6.5 × 6.5	5.5 × 5.5	5.86 × 5.86	12 × 12	16 × 16	13 × 13	20 × 20				12.5 × 12.5
Effective area ((H) mm × (V) mm)	13.3 × 13.3	18.841 × 10.598	14.976 × 14.976	14.976 × 14.976	13.312 × 13.312	13.312 × 13.312	25.344 × 14.256	11.25 × 7.03	24.58 × 1.536	8.19 × 8.19	13.3 × 13.3	6.4 × 5.12	12.8 × 10.24	12.8 × 10.24		12.8 × 0.0125
Full well capacity (electrons) typ.*1	80 000	7000	15 000	15 000	30 000	30 000	38 000	33 000	80 000	370 000	400 000	-		300 000		-
Dynamic range typ.*1	13 333:1	25 900:1	21 400:1	21 400:1	37 000:1	33 000:1	17 000:1	5000:1	1600:1	-		-		-		-
Cooling method	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forced-air cooled/ Water cooled	Forces-air cooled	Forced-air cooled/ Water cooled	-	-	Forced-air cooled/Water cooled		Forced-air cooled		Forced-air cooled/ Water cooled		-
Cooling temperature (°C)*1	-75 (Water cooled)	-35 (Water cooled)	-15 (Water cooled)	-15 (Water cooled)	-30 (Water cooled)	+10	+20	-	-	-100 (Water cooled)	-80 (Water cooled)	+10		-70 (Water cooled)		-
Readout speed (frame/s) (Full resolution)*1	3.15	120	89.1	89.1	100	30	121	64.9	50 kHz (Line rate)	70.4	18.5	216.6	59.774	7.2		40 kHz (Line rate)
Readout noise (electrons) rms typ.*1	6	0.27	0.7	0.7	1.4	1.5	2	6.6	50	1 max.		-		-		-
Dark current (electrons/pixel/s) typ.*1	0.0012 (Water cooled)	0.006 (Water cooled)	0.7 (Water cooled)	0.2 (Water cooled)	0.006 (Water cooled)	0.6	15	-	-	0.0005 (Water cooled)	0.001 (Water cooled)	-		130 (Water cooled)		-
Interface	IEEE 1394b	CoaXPress (Quad CXP-6)/ USB 3.1 Gen1	CoaXPress (Dual CXP-6)/ USB 3.0 *2	CoaXPress (Dual CXP-6)/ USB 3.0 *2	Camera Link/USB 3.0 *2	USB 3.0 *2	CoaXPress (Quad CXP-6)	USB 3.0 *2	Camera Link	IEEE 1394b		USB 3.0 *2	USB 3.0 *2/EIA	Camera Link		Gigabit Ethernet
Applications	Analysis/spectroscopy Synchrotron imaging	Life science imaging Astronomy Semiconductor inspection Synchrotron imaging Electronic microscope	Life science imaging Synchrotron imaging Electronic microscope	Life science imaging Semiconductor inspection Synchrotron imaging Electronic microscope	Life science imaging Semiconductor inspection Synchrotron imaging Electronic microscope	Life science imaging Semiconductor inspection	Life science imaging Synchrotron imaging	Life science imaging Synchrotron imaging	Life science imaging Semiconductor inspection	Life science imaging Synchrotron imaging		Semiconductor inspection Food inspection Analysis/spectroscopy		Life science imaging		Semiconductor inspection Food inspection

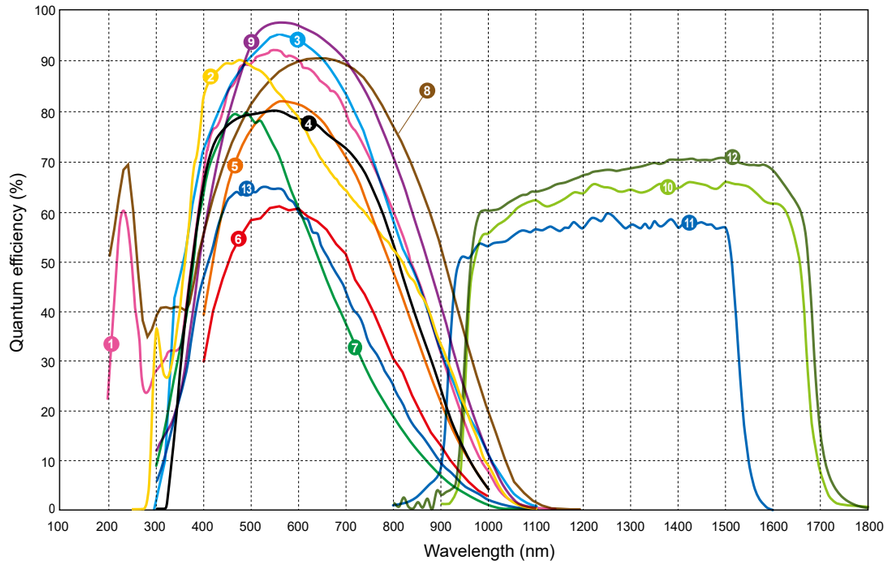
*1 Depends on the mode and conditions. For details, refer to each product catalog.
*2 Equivalation to USB 3.1 Gen1

Camera type	Board type camera for OEM					
Name	Scientific CMOS board level camera		Digital CMOS board level camera			TDI board level camera
Type	C11440-62U	C11440-52U30	C13949-50U	C13770-50U	C13752-50U	C10000-A01
Appearance						
Image sensor type	Area sensor		Area sensor			TDI sensor
Sensitivity wavelength range (nm) (Spectral response: See P5)	350 to 1000 ⑤		350 to 1000 ⑬			200 to 1000 ⑧
Effective number of pixels (H × V)	2048 × 2048		4096 × 3008	2464 × 2056	2048 × 1544	2048 × 128
Pixel size ((H) µm × (V) µm)	6.5 × 6.5		3.45 × 3.45			12 × 12
Effective area ((H) mm × (V) mm)	13.312 × 13.312		14.13 × 10.37	8.50 × 7.09	7.06 × 5.32	24.53 × 1.536
Full well capacity (electrons) typ.*1	30 000		10 500			80 000
Dynamic range typ.*1	20 000:1	18 000:1	4565:1			1600:1
Readout speed (frame/s) (Full resolution)*1	30		15	40	65	50 kHz (Line rate)
Readout noise (electrons) rms typ.*1	2.1	2.3	2.3			50
Interface	USB 3.0 *2		USB 3.0 *2			Camera Link
Applications	Contact us	Contact us	Contact us	Contact us	Contact us	Life science imaging Semiconductor inspection

*1 Depends on the mode and conditions. For details, refer to each product catalog.
*2 Equivalation to USB 3.1 Gen1

For X-ray	
X-ray sCMOS camera	
C12849-111U	
Appearance	
Area sensor	
25 kV to 90 kV (Recommended X-ray tube voltage range)	
2048 × 2048	
6.5 × 6.5	
13.312 × 13.312	
30 000	
18 000:1	
30	
2.3	
USB 3.0 *2	
Synchrotron imaging	

Spectral response



OEM CAMERA

We design and manufacture OEM cameras specific to each customer. We provide various types of cameras with options such as shape, sensor, interface, cooling method, software, etc. to meet customers' requests. The measurement wavelength range covers not only the visible range but spans widely from X-ray to infrared.

Cost reduction with minimum required functions

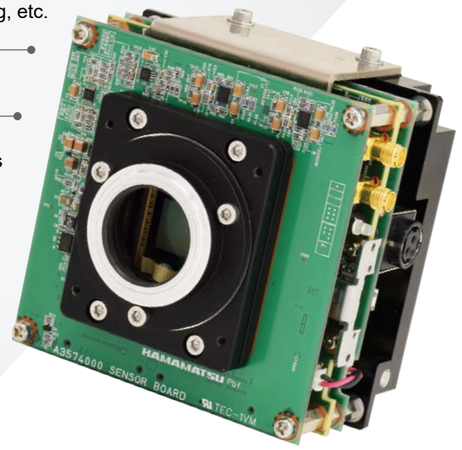
Cooling method
Air cooled
Water cooled
Peltier cooling, etc.

Camera type
Board type
Cased type
Camera head separated type
Integrated optical system

Interface
USB
Camera Link
Gigabit Ethernet
CoaXPress and others

Sensor type
sCMOS
TDI
Other company's sensor, etc.

Software/firmware
FPGA
Correction data
Library
Simulation



Shorten delivery time with simulation technology

We can perform imaging simulations that match the characteristics of various cameras (wavelength, sensitivity, speed, etc.).
By using this technology, we can shorten the process of repeating design and trial production, and provide cameras that meet your purpose efficiently and in a short time.

Flow from inquiry to delivery

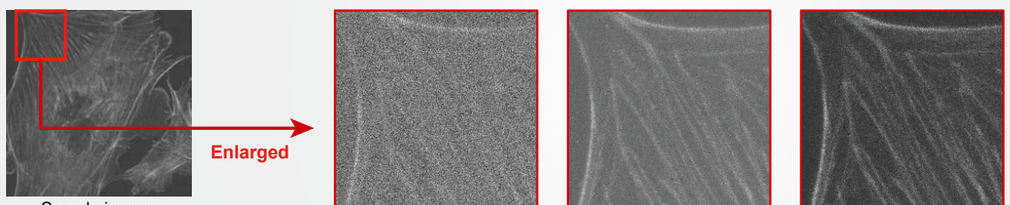
Without simulation

Inquiry → Consultation Planning → Repeating designs and trial productions → Delivery

With simulation (in our company)

Inquiry → Consultation Planning → Simulation → Design and trial production → Delivery

This is a simulation example using a cytoskeleton sample. The amount of light per pixel is set to the same value for simulation. Simulations can be performed by flexibly changing the acquisition conditions such as exposure time, and the results can be viewed not only as still images but also as movies.

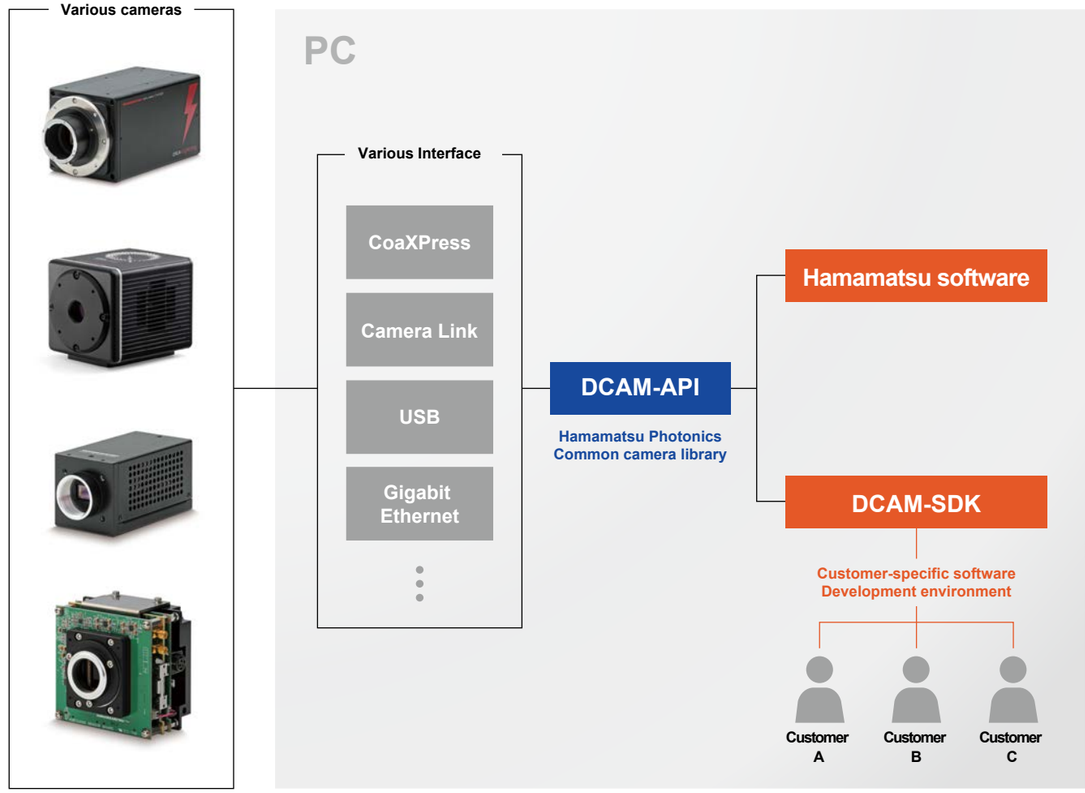


Sample image before enlargement | Cooled CCD camera | Gen II CMOS camera | Gen III CMOS camera

You can try the simulation on our website. Access it from the URL below to try it out.
Camera Simulation Engine URL: https://camera.hamamatsu.com/all/en/camera_simulation_engine/index.html

SOFTWARE

We provide a common camera library "DCAM-API," Hamamatsu Photonics software that can maximize the characteristics of your camera, and a tool "DCAM-SDK," that allows you to build your own control software. Through DCAM-API, even if the camera or interface is changed, the software modification/change can be minimized.



Compatible software/development environment

The followings are examples of the development environments and software that can be used with our cameras.

Development environment	Manufacturer	Features
LabVIEW (Windows)	National Instruments	Simple programming language, easy control of peripheral devices
MATLAB (Image acquisition toolbox)	The MathWorks	Simple programming language and a rich data analysis library
Micro-manager®	Open Imaging	A library that enables control of microscopes and peripheral devices of other companies

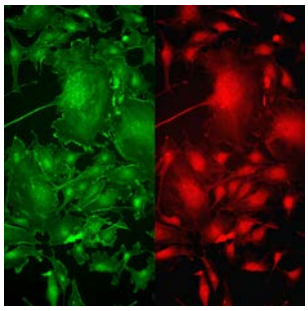
Software	Manufacturer	Features
MetaMorph® software suite of products	Molecular Devices	Image processing software for life science field

* For details on external software, contact the manufacturer.

RELATED PRODUCTS

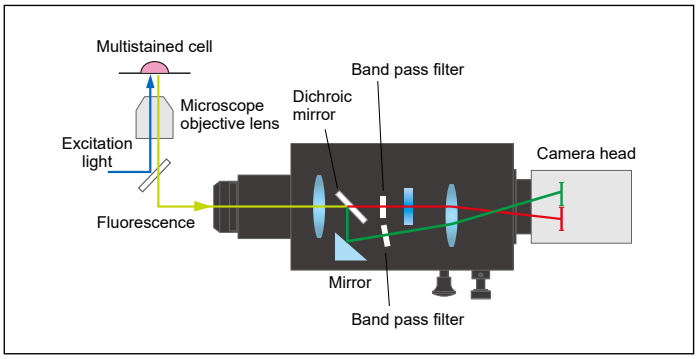
Image splitting optics
W-VIEW GEMINI/W-VIEW GEMINI-2C

W-VIEW GEMINI A12801-01 is an image splitting optical system for a fluorescence microscope that splits incident light into two wavelengths and forms an image on a single camera. You can easily adjust the optical axis and observe images of two wavelengths at the same time.
We also have a line-up of W-VIEW GEMINI-2C A12801-10, which forms images on two cameras.



A two wave lengths image by W-VIEW GEMINI

W-VIEW GEMINI
A12801-01



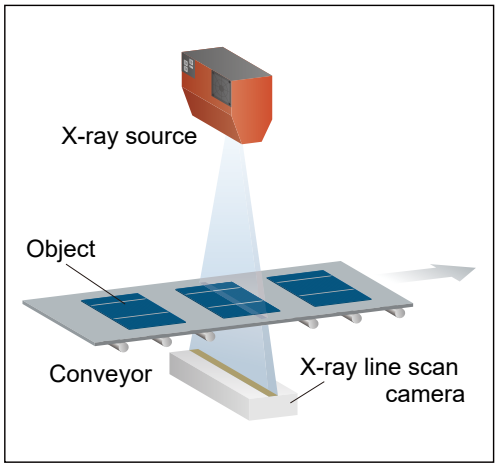
W-VIEW GEMINI principle diagram

X-ray line scan camera/X-ray TDI camera

We have a lineup of X-ray non-destructive inspection cameras that can be used in-line. Since it is possible to inspect the inside of substances that cannot be seen with visible light or infrared light, these cameras are suitable for foreign matter inspection of foods and pharmaceuticals, defect inspection of printed circuit board, etc.

X-ray line scan camera
C14300 series

X-ray TDI camera
C12300 series



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

Systems Division
812 Joko-cho, Higashi-ku, Hamamatsu City, 431-3196, Japan, Telephone: (81)53-431-0124, Fax: (81)53-433-8031, E-mail: export@sys.hpk.co.jp
U.S.A.: Hamamatsu Corporation: 360 Foothill Road, Bridgewater, NJ 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, 20044 Arese (Milano), Italy, Telephone: (39)02-93 58 17 33, Fax: (39)02-93 58 17 41 E-mail: info@hamamatsu.it
China: Hamamatsu Photonics (China) Co., Ltd.: 1201 Tower B, Jiaming Center, 27 Dongsanhuan Beilu, Chaoyang District, 100020 Beijing, P.R. China, Telephone: (86)10-6586-6006, Fax: (86)10-6586-2866 E-mail: hpc@hamamatsu.com.cn
Taiwan: Hamamatsu Photonics Taiwan Co., Ltd.: 8F-3, No.158, Section 2, Gongdao 5th Road, East District, Hsinchu, 300, Taiwan R.O.C. Telephone: (886)3-659-0080, Fax: (886)3-659-0081 E-mail: info@hamamatsu.com.tw

Cat. No. SCAS0142E02
MAY/2021 CR
Created in Japan