HAMAMATSU

PHOTON IS OUR BUSINESS

NEWS 2021 01

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IGNITING QUESTIONS

DETECTING ANSWERS

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Hamamatsu News – now also online:

www.hamamatsu-news.com

Hamamatsu Introduces the World's First Photon-number-resolving Scientific Camera With Incredibly Low Noise and 9.4 Megapixels

Hamamatsu Photonics are proud to introduce our new scientific camera – the ORCA®-Quest qCMOS®.
It has incredibly low noise of 0.27 electrons rms and a high pixel count of 9.4 megapixels.

In quantitative imaging, the photoelectric noise generated when light is converted into electrical signals is the all-important factor that determines the lower detection limit of the camera. The ORCA®-Quest reduces this photoelectric noise to a level below the signals generated by photons (particles of light), which are the minimum unit of light. This makes the ORCA®-Quest the world's first camera to achieve 2D photon-number-resolving measurement, meaning that it accurately measures the number of photons to create an image.

Its ability to identify the number of photons invites new possibilities for a wide range of fields. For example, it accurately observes the quantum state by quantitatively imaging the amount of light from ions and neutral atoms. This makes it a promising tool for speeding up research and development work on quantum computers and other quantum technology. In addition, due to its wide field of view capable of capturing ultra-low light level phenomena, the ORCA®-Quest is likely to find applications in the astronomical research and life science fields.

At the heart of the ORCA®-Quest camera is a new high-performance CMOS (complementary metal-oxide semiconductor) 2D image sensor, designed and fabricated using our unique in-house design and manufacturing technologies. This CMOS sensor delivers excellent performance with incredibly low noise (0.27 electrons rms), high pixel count (4096 × 2304), and high resolution, yet attains high-speed readout. Other features include a back-illuminated structure, 4.6 μm × 4.6 μm pixel size, reduced crosstalk between pixels, and suppressed variations in the electrical characteristics of each pixel.

The next issue of the Hamamatsu News 2/2021 will include an interview with the engineering team who developed our groundbreaking new camera.

For more information about the ORCA®-Quest camera, please contact Hamamatsu Photonics at the company's website, https://www.hamamatsu.com.

Fast-track Photonics Innovation Support for Europe

Most companies, especially SMEs, do not have in-house expertise in photonics and struggle to benefit from the enabling power of photonics. “To solve this problem, we have created ACTPHAST,” says Professor Hugo Thienpont from the Brussels Photonics group of Vrije Universiteit Brussel VUB, coordinator of this initiative and winner of the SPIE gold medal in 2021 for outstanding contribution to Photonics. ACTPHAST offers a unique one-stop-shop photonics innovation hub which integrates the best-in-class technologies and expertise of Europe’s top photonics research centres to deliver targeted innovation support to industry. Thienpont continues: “ACTPHAST is financially supported by the European Commission and provides a full range of photonics innovation support capabilities, that are particularly focused on high-risk early-stage prototyping (TRL 3-4) and upscaling (TRL 5-6).”

Since launching in 2014, ACTPHAST has successfully completed nearly 200 innovation projects with companies from various industry sectors, mostly SMEs including many first-time users of photonics with a great economic and societal impact. This success has also led to extending support to entrepreneurially-minded European researchers who want to turn their proof-of-concept breakthroughs into advanced prototypes. Companies and researchers are invited to register their interest on www.actphast.eu.

Hamamatsu Photonics entered into a collaborative working relationship with Brussels Photonics VUB with the formation of the so called HAPI (Hamamatsu Applied Photonics Innovation) chair in November 2019. Tim Stokes, Managing Director, Hamamatsu Photonics UK Limited, comments “it has been very beneficial for Hamamatsu to be able to collaborate with some of the best photonics researchers in Europe. Now, we are pleased to announce that this month we have agreed an extension to the original HAPI chair agreement to the end of 2023, and hopefully beyond. Although the global pandemic may have slightly curtailed a few of the research activities that had been planned for 2020, we have not let the severe restrictions in travel stop this collaboration; our frequent and engaging video engagement between the Brussels Photonics researchers in Belgium and engineering teams at Hamamatsu Japan, has resulted in several new collaborative R&D projects which have started in recent weeks and we look forward to building on this for the future”.

30 year Anniversary 1991-2021
HAMAMATSU
HAMAMATSU PHOTONICS ITALIA

HAMAMATSU PHOTONICS ITALIA

30th Anniversary 1991-2021

The 30th anniversary of Hamamatsu Photonics Italia (HPI) occurred in March 2021, and despite the Covid-19 pandemic situation, HPI Staff wished to celebrate this important and significant milestone.

HPI business started in Italy 30 years ago with only 3 people in a small office. Over the years, HPI has grown and evolved, now with a workforce of 22 people, with the aim of developing and growing the subsidiary even further in the years to come.

All staff at HPI know very well how difficult it is to be chosen by customers: what we offer must always and rightly be impeccable. We must be professional, meticulous and punctual, to prevail over our competitors. We all pursue this goal every day; it is not easy and, above all, never definitive, but our daily efforts are fully rewarded not just when the turnover grows, but also when our customers remain loyal and thank us, saying they are satisfied with our services.

The Company Anniversary is an opportunity to look forward and focus our mission on younger generations, with the goal of spreading our passion for Science and demonstrating the opportunities that can be generated by Photonics.

Concentrating on new generations represents for us the most appropriate way to celebrate our past, and at the same time, look towards our future. Therefore, in collaboration with INFN (Italian National Institute for Nuclear Physics), we are planning activities to introduce some of the most important topics/phenomena of Photonics.

Over the past 30 years, HPI has faced many difficulties and, for sure, we will also overcome this critical one that is affecting people across the globe. We look forward to better times in the near future and we hope it will not be too long before we can all meet each other and celebrate our anniversary with a physical event.

COMPANY NEWS

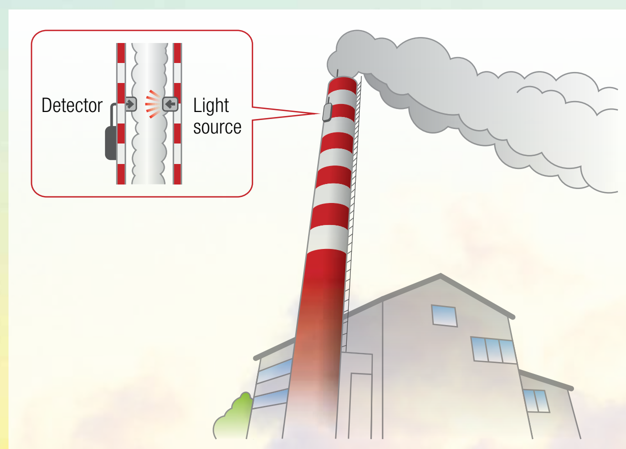
Exciting Developments in Absorption Spectroscopy for Environmental Gas Sensing

An innovative light source improves the measurement accuracy of continuous emission monitoring systems (CEMS) tracking the concentration of greenhouse gases in the environment.

The global warming crisis calls for novel and innovative solutions. In most areas of the world there are environmental regulations in place that require corporations to monitor the concentration of greenhouse gases in the local environment using continuous emissions monitoring systems (CEMS). The most precise CEMS instruments are based on differential optical absorption spectroscopy (DOAS).

DOAS is based on the principle that each gas absorbs specific narrow bands of UV and visible light. A typical DOAS system is composed of a light source and spectrometer or photodetector that measures the spectral absorption to determine the concentrations of various gases. Some CEMS systems are meant to measure an area contained within a smokestack as shown in Figure 1 or use long-path DOAS (LP-DOAS) to monitor ranges from several hundred meters to many kilometers.

Figure 1: Exhaust gas analysis (SO_X, NO_X)



Consistent findings

Scientists in the central region of Shanghai, China, installed an LP-DOAS system to measure the nitrogen dioxide (NO_2) concentration to prevent and control pollution.

Their system was composed of a light source, retroreflecting mirror placed over 1 km away and a high sensitivity spectrometer. They compared the results of their measurements using different light sources including a xenon arc lamp, light emitting diodes (LEDs) and a Laser-Driven Light Source (LDLS). They found that the LDLS showed better stability and high optical efficiency when compared to the alternative sources.

Similar findings were published by researchers from the University of Heidelberg performing LP-DOAS in Antarctica to track the level of carbon dioxide (CO_2) and methane entering the atmosphere as a result of the thawing arctic permafrost. Their findings state that using an LDLS "significantly improves the measurement quality compared to conventional light sources."

Innovative light source

LDLS technology uses a laser to excite and sustain a very small xenon plasma creating extremely bright, broadband light from 170 nm – 2500 nm. In traditional sources such as xenon arc lamps, the brightness, spatial stability, and lamp lifetime are limited by the use of electrodes to couple power to the plasma. The LDLS allows for extremely stable light production for the duration of the lamp's life because the laser sustains the plasma.

The emitting plasma in an LDLS is about ten times smaller than the illuminating plasma in a 75 W xenon arc lamp. The very small, spatially coherent spot allows for precise coupling into a variety of optics, including fiber optic output cables with minimal loss of light.

Visit **www.energetiq.com/gas-analysis** for more information and to review the published research discussed.

ENERGETIQ
A HAMAMATSU Company

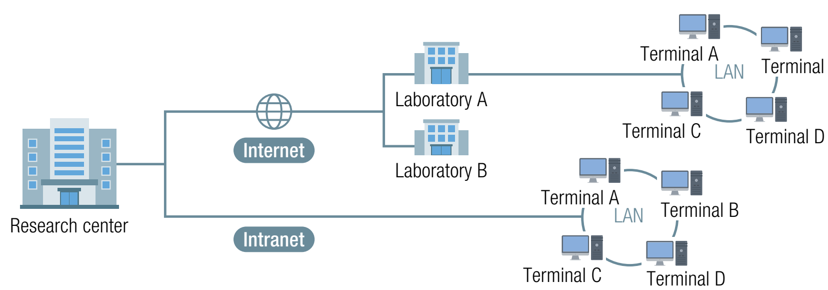
Whole Slide Image Scanner NanoZoomer® With High Speed and High-resolution

Whole Slide Image Scanner That Strongly Supports Remote Consultation Between Pathologists

It is said that about one in two Japanese people will be affected by “Cancer” in their lifetime*. To confirm cancer, pathologists need to observe the tissues and cells collected from the patient on a glass slide and make a diagnosis based on many other pieces of medical data. However, the chronic shortage of pathologists in Japan today is a major issue. There are great expectations for remote consultation using networks as one of the means to solve this problem. Hamamatsu Photonics has been strongly supporting the spread of remote consultation by providing “NanoZoomer®,” the product that digitizes glass slides.

* As of July 2016 I Source: National Cancer Center I Cancer Information Services

What is “Remote consultation”?
Remote consultation, which is spreading all over the world, is a system for exchanging opinions between pathologists and receiving advice from experienced specialists while sharing data.



Quickly creates and shares high-definition whole slide images with billions of pixels

Hamamatsu Photonics’ NanoZoomer® is a digital whole slide image scanner that scans glass slides and converts them into high-definition image data “whole slide images” with billions of pixels. It shares the digitized images with remote doctors over a network to provide powerful support for remote consultations with pathologists.

Features of whole slide images

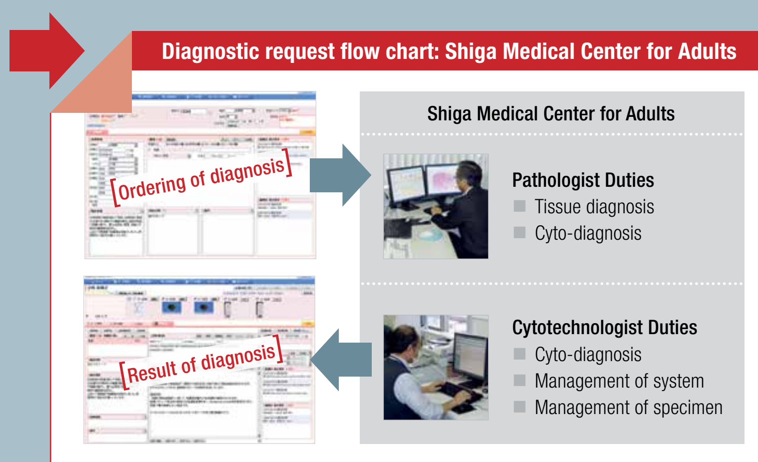
- Tissue images can be shared over the network
- Excellent storage and searchability, easy to manage
- It can be linked with medical information systems such as electronic medical records

NanoZoomer® S360 C13220-01
Note: NanoZoomer S360 is CE marked under EU’s In VitroDiagnostics Directive (IVDD) for in vitro diagnostic use. In China, NanoZoomer S360 is registered for in vitro diagnostic use. NanoZoomer S360 is for Research Use Only in US and Japan. For other countries and other models, please consult with Hamamatsu.

Remote consultation used for medical cooperation throughout Japan

Remote consultation using whole slide images is also used to support community medicine. As a model for local areas in Japan, Shiga Prefecture's "Sazanami Pathology Network" is centered on the Shiga Medical Center for Adults (currently Shiga General Hospital), which connects hospitals with pathologists and hospitals without pathologists through the network. It was established as a prefecture-based 'Virtual Pathology Department'. Remote consultation has become more active, and the burden for individual pathologists has been reduced, leading to faster medical care.

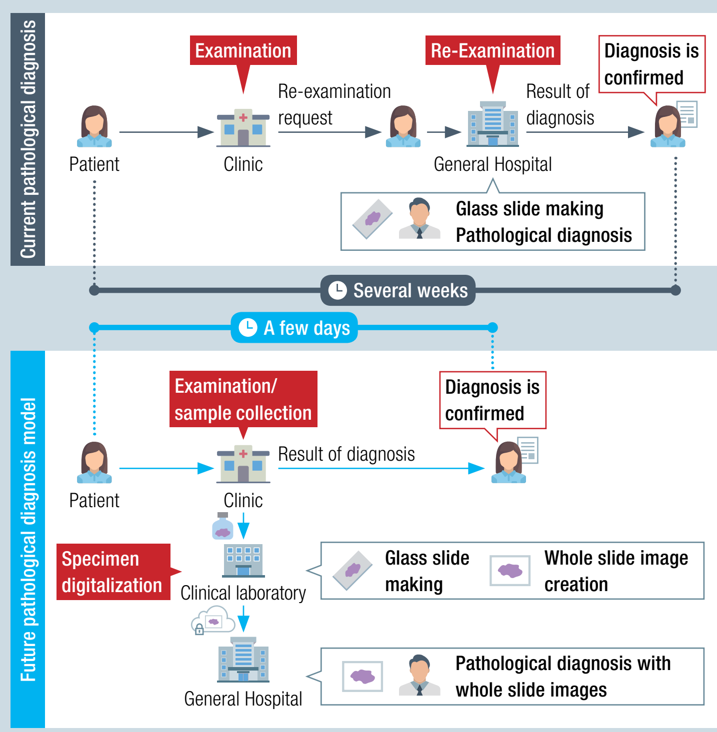
The reference laboratory receives tissue diagnosis orders from clinic (skin and gastrointestinal biopsies).

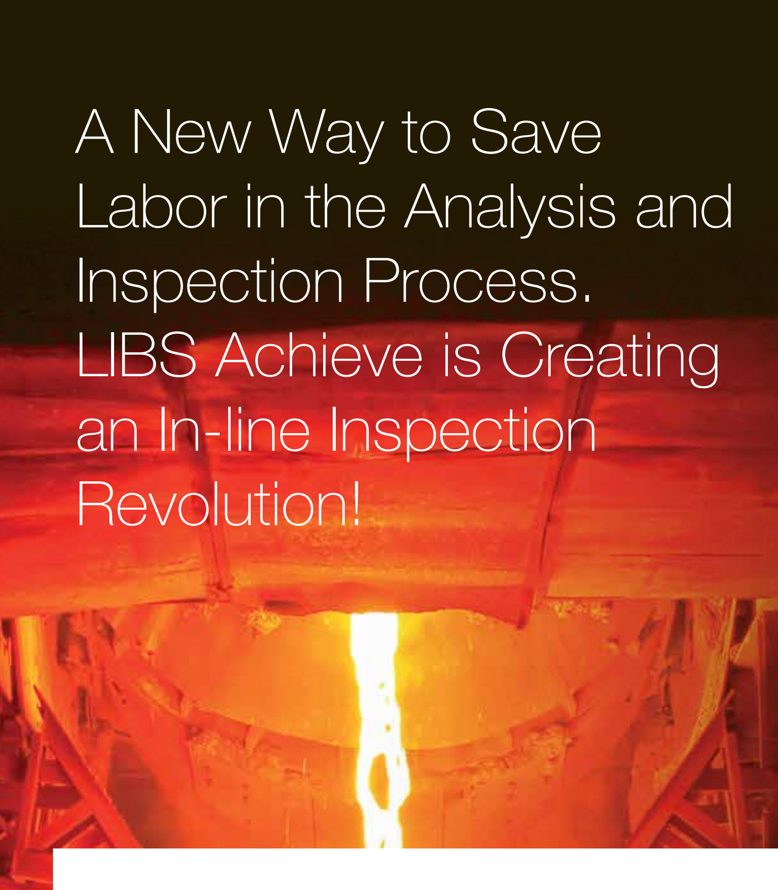


* Currently Shiga General Hospital

Future pathological diagnosis model pioneered by remote consultation

The pathological diagnosis model may be changed significantly for the application of a remote consultation system. In Japan today, it is difficult to make pathological diagnosis at a clinic. If a pathological diagnosis is required, a patient must go to the general hospital that has a pathologist. It can sometimes take several weeks from the first examination in the clinic to confirm a diagnosis, which imposes a heavy physical and mental burden on the patient. If the remote consultation system is applied, it will be possible to exchange information on the network between the clinic and general hospital until the diagnosis is confirmed, enabling a patient to receive the result of diagnosis at the clinic without re-examination at the general hospital. As a result, this model will significantly reduce the time taken for patients to receive a diagnosis.





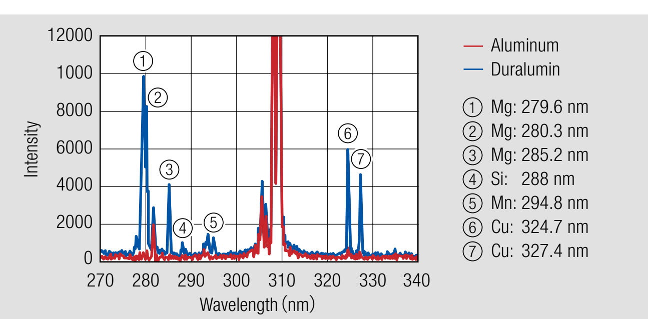
A New Way to Save Labor in the Analysis and Inspection Process. LIBS Achieve is Creating an In-line Inspection Revolution!

In the industrial field, continuous efforts are underway to achieve a smart factory where manufacturing lines spanning processes from raw material acceptance inspection to final products are linked by a network aimed at improving quality control and saving labor. One of these efforts is the integration of the manufacturing line with the analysis and inspection process. In recent years, in the manufacturing industry, product quality problems stemming from human factors and labor shortages due to the declining birthrate and aging population have been cited as major issues. One solution is achieving the urgent task of saving labor in the analysis and inspection process. Up until now, however, it has been difficult to make in-line inspections because inspection processes using analytical equipment usually involve complicated measurements and cost issues. This situation makes LIBS the current focus of attention as a promising technique to support in-line analysis and inspections.

Measurement examples

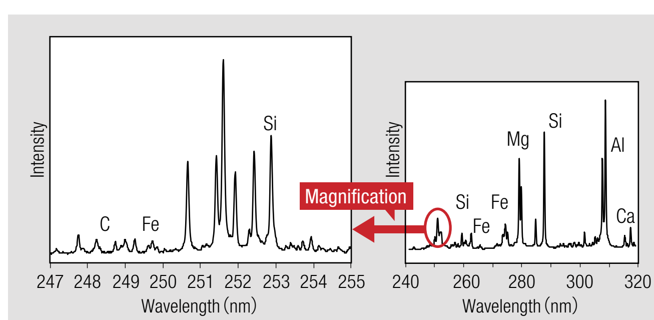
LIBS is capable of rapidly measuring the element composition of objects made up of mixed multiple elements, making it a promising tool for various industrial applications.

Duralumin (2000 series aluminum alloy)



Comparing the measurement data for high-purity aluminum or duralumin (2000 series aluminum) allows us to see spectral properties unique to Cu, Mg, Si, etc. in duralumin that appear only in the duralumin data. In this way, you can identify metal material types such as high-purity aluminum and various aluminum alloys that cannot be visually recognized. LIBS is also expected to prove extremely effective in the recycling field where a wide variety of waste materials must be identified with high accuracy.

Fly ash (coal ash)



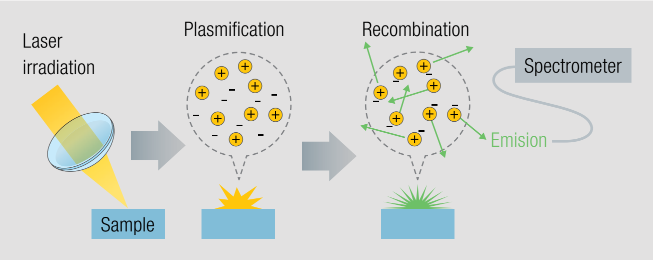
LIBS can detect spectral properties for Si, Fe, C, and Ca which are the main constituent elements of fly ash of coal combustion products. This makes LIBS promising for real-time quality control by measuring properties such as steel slag which is composed of similar main materials that are by-products of steel manufacturing. In addition, it has the ability to measure the amount of carbon contained in fly ash and feed it back to control the combustion temperature of the furnace.

Data courtesy of Prof. Yoshihiro Deguchi, (Faculty of science and engineering, industry, graduate school of society, Tokushima University)

Substances can be identified at the element level

LIBS is an abbreviation for Laser-Induced Breakdown Spectroscopy – a spectroscopic analytical technique that uses a laser to rapidly analyze multiple elements contained in the target object. When a short pulse laser beam is irradiated onto the surface of the target object, it causes the target object to thermally evaporate and create a plasma. Within the plasma, the electrons emitted from the atoms recombine with the ionized atoms and generate a unique spectrum in the process of returning back to their original atomic state. By measuring this spectrum, substances can be identified at the element level. By combining such complex element information with AI technology, it is now possible to acquire highly accurate analytical information.

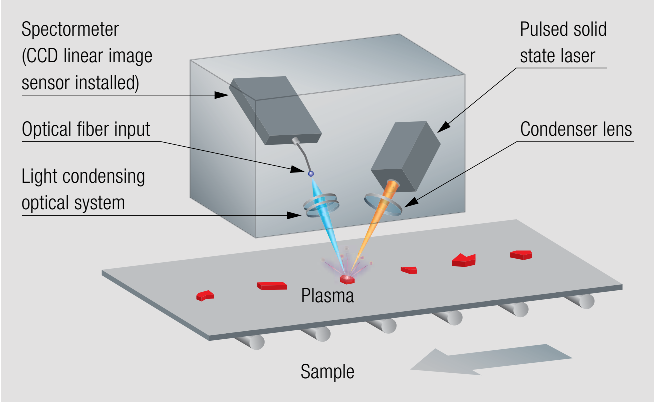
Principle



LIBS delivers high-speed and highly accurate in-line measurements

LIBS has the advantage of not requiring complicated pre-measurement processing of the target object, regardless of the object's state (gas, liquid, solid). This enables the high-speed, non-contact inspections required for in-line inspection and also allows analyzing a diverse range of substances such as plastics, metals, and glass. As a result, LIBS will prove a promising technique for in-line inspections at many kinds of manufacturing sites.

In-line measurement image



Promising application areas of LIBS

Steel manufacturing process

In high temperature environments such as steel manufacturing processes, analytical equipment cannot be installed nearby due to the extreme heat. This makes it difficult to obtain accurate results in analysis and inspections. However, applying LIBS now ensures highly accurate properties analysis even from remote locations. There are already plans to carry out all inspection processes in steel manufacturing; from selection of raw materials to the rolling process, in order to improve product quality.

Recycling sorting

In the recycling field, technology for accurately identifying large quantities of mixed waste materials is essential for achieving more efficient recycling. Using LIBS allows highly accurate screening of materials whose properties are difficult to identify visually and so will help reuse resources more effectively.

Furthermore, LIBS will play roles in various areas including energy-related facilities and the semiconductor manufacturing field.

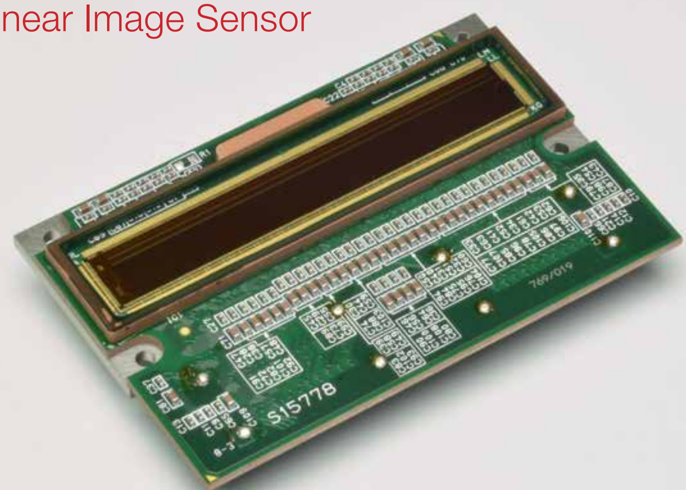
We offer light sensors and emitters that are an ideal match for LIBS equipment

"LIBS" is now showing the way toward in-line inspections using analytical equipment which up to now has been considered difficult in inspection processes in the manufacturing industry.

We provide a wide lineup of light sources and sensors suitable for LIBS equipment. These include CCD linear image sensors, and mini-spectrometer modules which include image sensor, optical system and circuit. We also offer compact and lightweight solid-state lasers that can be easily mounted into LIBS equipment.

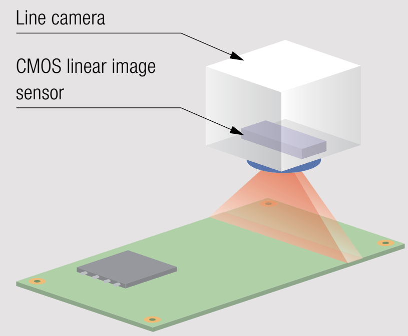
NEW OPTO-SEMICONDUCTOR PRODUCTS

CMOS Linear Image Sensor S15778



Application example

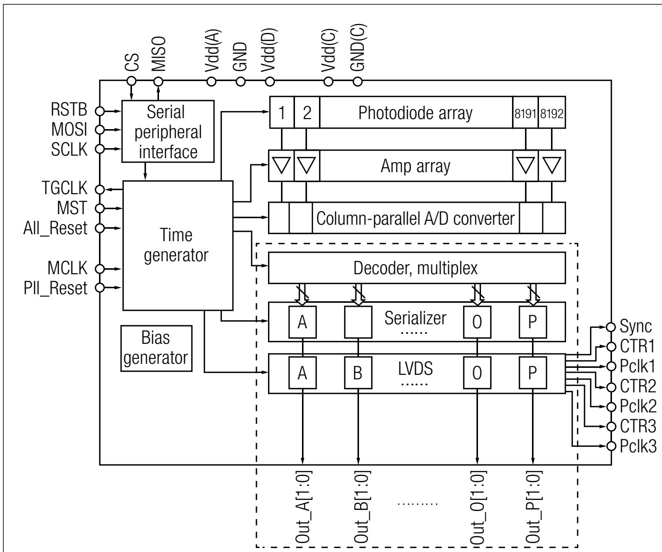
Line camera (printed circuit board inspection)



Line-up

Parameter	S14772	S13774	NEW S15778	Unit
Photo				–
Effective number of pixels	2048	4096	8192	pixels
Pixel size (H × V)	14 × 14	7 × 7		μm
Image size (H × V)	28.672 × 0.014	28.672 × 0.007	57.334 × 0.007	mm
Spectral response range	400 to 1000			nm
A/D resolution	10-bit / 11-bit	10-bit / 12-bit	10-bit / 11-bit	–
Line rate (max.)	125 (10-bit) 62.5 (11-bit)	100 (10-bit) 25 (12-bit)	100 (10-bit) 50 (11-bit)	klines/s

Block diagram



High-speed Readout (100 klines/s)

The S15778 is a CMOS linear image sensor developed for industrial cameras that require high-speed scanning. The column-parallel readout system, which has a readout amplifier and an A/D converter for each pixel, allows high-speed readout. For the A/D converter resolution, either 10-bit (high-speed mode: 100 klines/s max.) or 11-bit (low-speed mode: 50 klines/s max.) can be selected. Video signal is output serially in 360 MHz LVDS format.

Differences from the previous product

In addition to the 2048-pixel (S14772) and 4096-pixel (S13774) types, an 8192-pixel high resolution type has been added to the lineup. It has achieved power consumption equivalent to the previous products.

Features

- 8192 pixels
- High-speed readout: 100 klines/s (max.)
- Simultaneous integration of all pixels
- 3.3/1.8 V power supply operation
- SPI communication function
- Built-in 10-bit/11-bit A/D converters

Applications

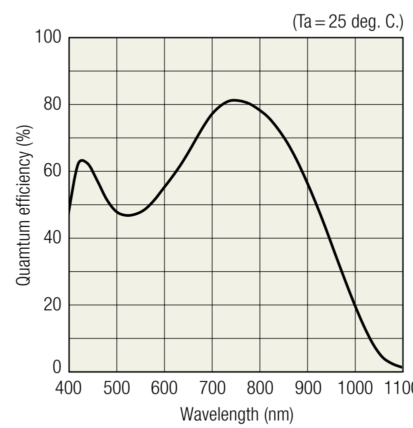
- Machine vision
- Film inspection
- Printed circuit board inspection
- Print inspection

CCD Linear Image Sensor S15729-01

Specifications

Parameter	Specification	Unit
Effective number of pixels	2048	pixels
Pixel size (H × V)	10 × 180	μm
Pixel pitch	10	μm
Image size (H × V)	20.48 × 0.18	mm
Spectral response range	400 to 1100	nm
Line rate (max.)	70	klines/s
Window	Borosilicate glass with anti-reflection coat	–

Spectral response (typical ex., with window)



High Near-infrared Sensitivity, High-speed Response

The S15729-01 is a front-illuminated CCD linear image sensor developed for SD-OCT (spectral domain-optical coherence tomography). It has high sensitivity in the near infrared region and achieves high-speed line rate.

Features

- Vertically long pixels: 10 × 180 μm
- High sensitivity in near infrared region
- High-speed line rate: 70 klines/s max.

Applications

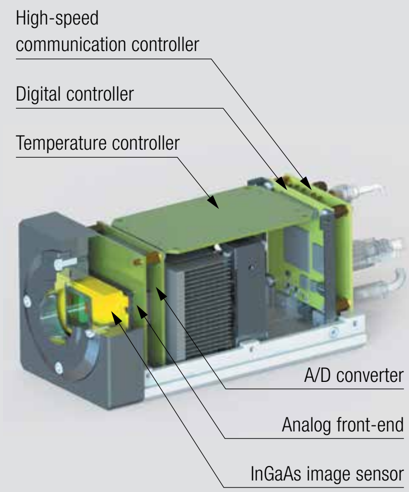
- SD-OCT
- Spectroscopy

Multichannel detector head C15821
The multichannel detector head optimized for driving CCD linear image sensor S15729-01 is available.

NEW OPTO-SEMICONDUCTOR PRODUCTS

Image Sensor Module C16090/C16091 Series

Structure



Line-up

Type No.	Spectral response range (μm)	Built-in image sensor: Number of pixels	Built-in image sensor: Type No.	Built-in image sensor: Photo
C16090-01	0.95 to 1.69*1	320 × 256	G14671-0808W	 InGaAs area image sensor
C16090-02	1.12 to 1.85*2		G14672-0808W	
C16090-03	1.3 to 2.15*2		G14673-0808W	
C16090-04	1.7 to 2.55*2		G14674-0808W	
C16091-01/-02	0.9 to 1.85*2	256/512	G11475 series	 InGaAs linear image sensor
C16091-03	0.9 to 2.05*2	256	G11476-256WB	
C16091-04/-05	0.9 to 2.15*2	256 / 512	G11477 series	
C16091-06/-07	0.9 to 2.55*2		G11478 series	
C16091-08/-09	0.9 to 1.67*3		G11508 series	
C16091-10	0.85 to 1.4*2	512	G14237-512WA	
C16091-11/-12	0.95 to 1.67*3	256/512	G11620 series	
C16091-13	0.95 to 1.65*2 1.4 to 2.15*2	512	G12230-512WB*4	

*1 Tchip = 15 deg. C. *2 Tchip = -20 deg. C. *3 Tchip = -10 deg. C. *4 Two InGaAs chips with different cutoff wavelengths are arranged in series

Built-in InGaAs Image Sensor, USB 3.1 Gen 1 Interface

These are image sensor modules with an InGaAs image sensor. They consist of a driver circuit, temperature controller, and high-speed communication controller. They output analog video signals from an InGaAs image sensor as digital output. The driver circuit consists of an analog front end, A/D converter, and digital controller.
From a PC connected via USB 3.1 Gen 1 interface, various settings can be configured, images can be retrieved, and the temperature of the InGaAs image sensor can be controlled.

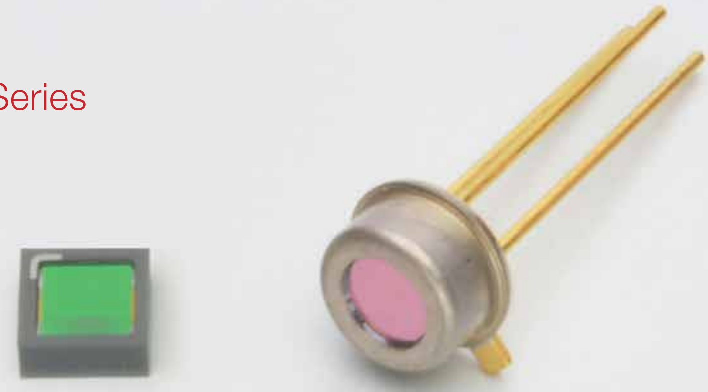
Features

- Built-in 16-bit A/D converter
- Temperature control of InGaAs image sensor (Can be set in 1 deg. C. steps)
- USB 3.1 Gen 1 interface (Data transfer speed: 5 Gbps)
- Internal/external trigger mode selectable
- C mount lens compatible

Applications

- Hyperspectral imaging
- Near infrared non-destructive inspection (Farm product inspection, Semiconductor inspection)

Mid Infrared LED
L15893/L15894/L15895 Series



Ceramic type
L15893-0330C
L15894-0390C
L15895-0430C

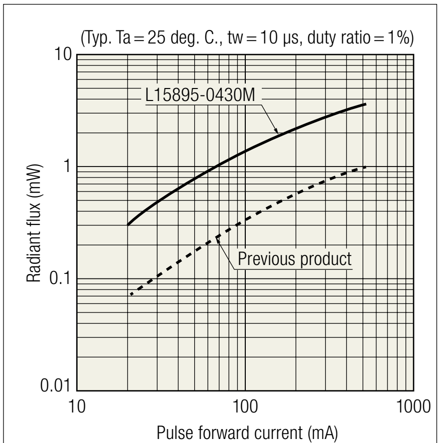
Metal type
L15893-0330M
L15894-0390M
L15895-0430M

Specifications

Parameter	L15893-0330M	L15894-0390M	L15895-0430M	Unit
Peak emission wavelength*	3.3	3.9	4.3	μm
Spectral half width*	0.4	0.6	1	μm
Radiant flux*	1.9	1.7	1	mW
Forward voltage*	2.7	2.2	2	V
Reverse current (max.)	1	5	8	mA
Rise time (max.)		1		μs

* I_F = 80 mA, QCW mode
Note: For the specifications of ceramic type, refer to the datasheet.

Radiant flux vs. pulse forward current



Peak Emission Wavelength: 3.3 μm, 3.9 μm, 4.3 μm

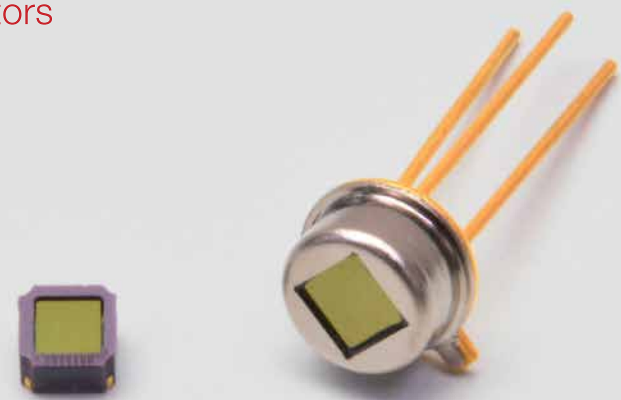
They are mid infrared LEDs with the peak wavelength of 3.3 μm, 3.9 μm, and 4.3 μm respectively. Manufactured using Hamamatsu unique crystal growth technology and process technology. We provide two package types: ceramic (C type) and metal (M type). These are suitable as light sources mounted in gas detectors.

Differences from the previous product
Output is significantly increased compared to the previous products.

Features
- Peak emission wavelength:
  3.3 μm (L15893-0330 series)
  3.9 μm (L15894-0390 series)
  4.3 μm (L15895-0430 series)
- High output power
- High-speed response
- Low power consumption

Application
- Gas detection (CH_4, CO_2)

InAsSb Photovoltaic Detectors P13243-045CF/-045MF



Ceramic type
P13243-045CF

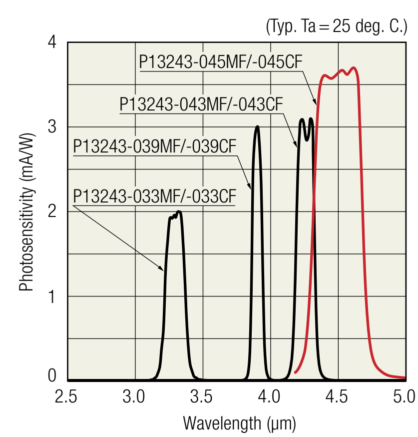
Metal type
P13243-045MF

Specifications

Type No.	Center wavelength (µm)	Spectral response half width (nm)	Photo-sensitivity* (mA/W)	Detectivity (cm · Hz$^{1/2}$/W)
P13243-033CF/-033MF	3.3	160	2.3	5.1×10^8
P13243-039CF/-039MF	3.9	90	3	6.5×10^8
P13243-043CF/-043MF	4.26	140	3.1	6.9×10^8
NEW P13243-045CF/-045MF	4.45	350	3.7	8.2×10^8
P13243-015CF	3.3	160	2.3	5.1×10^8
	3.9	90	3	6.5×10^8
P13243-016CF	3.9	90	3	6.5×10^8
	4.26	140	3.1	6.9×10^8

*Uniform irradiation on the entire photosensitive area

Spectral response



Infrared Detectors with Band-pass Filter (4.45 µm)

These are InAsSb photovoltaic detectors that use a band-pass filter for the window. These are environmentally friendly infrared detectors and do not use lead, mercury, or cadmium, which are substances restricted by the RoHS Directive. They are replacements for conventional products containing these substances.

Differences from the previous product

In addition to types with band-pass filter center wavelengths of 3.3 µm, 3.9 µm, and 4.26 µm, 4.45 µm type has been added to the lineup.

Features

- High sensitivity
- High-speed response: 15 ns
- High shunt resistance: 300 kΩ
- Compatible with leadfree solder reflow (Ceramic package)

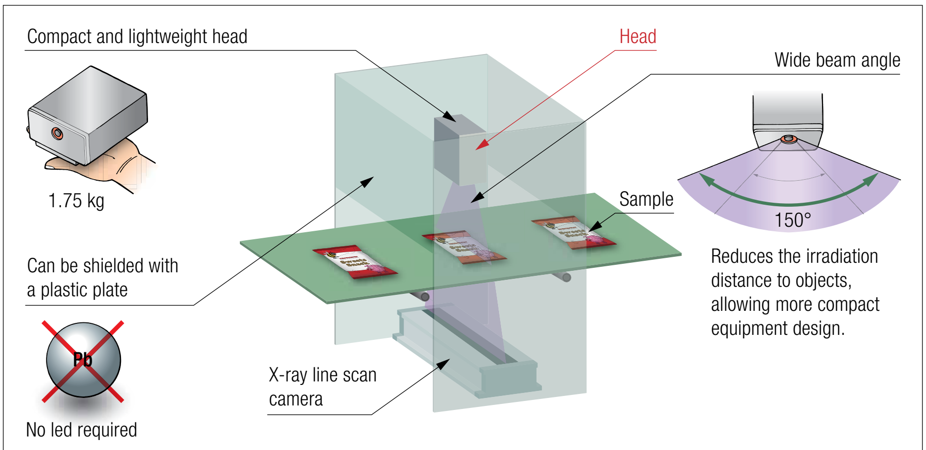
Application

- Flame monitors (CO_2 resonance radiation)

Soft X-ray Source
L11754-01W

Left: Controller, Right: Head

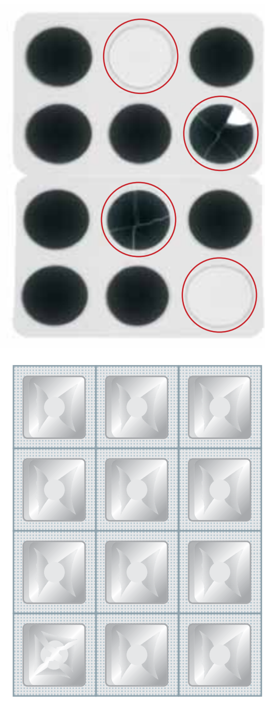
Features



Specifications

Parameter	Specification	Unit
X-ray tube voltage	15	kV
X-ray tube current	1	mA
Maximum output	15	W
X-ray focal spot size	0.8	mm
X-ray beam angle	150	deg. C.

X-ray imaging example (tablet)



Cracks, chips and the number of tablets can be detected.

X-ray tube voltage: 15 kV, X-ray tube current: 1 mA, Detector: X-ray TDI camera C12300-321B

No Lead Shield is Required Allows Non-destructive X-ray Inspection of Light-element Materials

The L11754-01W emits soft low-energy X-rays (15 kV) that allow inspection of light-element foreign matter and impurities, which has been difficult up to now.
Its compact and lightweight design with a wide beam angle enables easier installation and use in compact inspection equipment.
A plastic plate can be used for shielding instead of lead, which helps reduce the cost of shielding.

Applications

- Food and pharmaceutical packaging inspection
- Biting
- Detection of foreign objects

NEW ELECTRON TUBE PRODUCTS

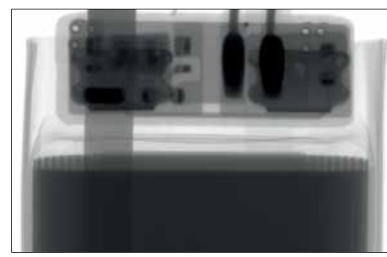
X-ray CMOS Camera DX-CUBE™ H8953-30

Specifications

Parameter	Specification	Unit
Effective field of view (H × V)	20 × 12.5	mm
Resolution (typ.)	20	Lp/mm
Image sensor	CMOS image sensor with 2.35M pixels 1/1.2 type global shutter	–
Pixel size (H × V)	5.86 × 5.86	µm
Effective number of pixels (H × V)	1936 × 1216	–
Frame rate (max.)	165.5	frames/sec

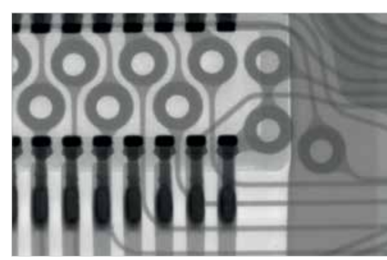
X-ray imaging example

Lithium-ion battery and protection circuit



X-ray tube voltage: 100 kV
Geometric magnification: 1.4 times

Flexible printed circuit board



X-ray tube voltage: 100 kV
Geometric magnification: 3.1 times

Palm Size, Compact X-ray Camera

The H8953-30 is a compact X-ray CMOS camera optimized for non-destructive inspection. It uses a consumer CMOS camera in combination with our high-sensitivity CsI scintillator. Due to its large light-receiving area, the imaging field-of-view is expanded by 20 %. The resolution is also increased from 16.7 Lp/mm to 20.0 Lp/mm, making it possible to recognize the details of objects. The gain is adjustable to enhance the brightness by more than 16 times so that the image of dark objects can be captured. The output is digital (Mini Camera Link) and not analog.

Features

- Compact
- High resolution
- Uses high sensitivity CsI scintillator

Applications

- X-ray drilling
- X-ray non-destructive inspection

76 mm Head-on Type Photomultiplier Tube R15608

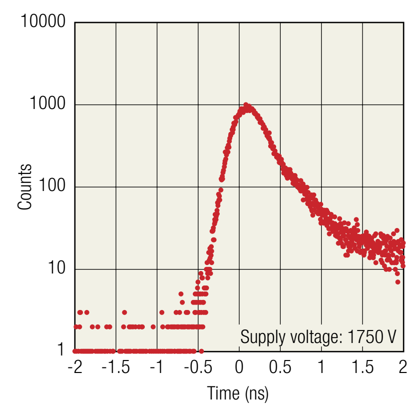
High speed PMT series
Back row: R13408, R13089, NEW R15608
Front row: R13478, R13449

Specifications

Parameter	Specification	Unit
Spectral response range	300 to 650	nm
Photocathode type	Bialkali	–
Gain (typ.)*	9.4×10^6	–
Rise time (typ.)*	1.9	ns
T.T.S. (FWHM) (typ.)*	400	ps

* Supply voltage 1750 V, at 25 deg. C.

T.T.S. (Transit Time Spread)



Large Effective Area Yet High-speed Response

The R15608 is a 3-inch (76 mm) diameter, high-speed photomultiplier tube that exhibits a very narrow transit time spread. The R15608 also features a high time resolution due to its simple tube design suitable for mass production, making it a powerful tool for precision timing measurements in many application fields.

Applications

- TOF-PET in nuclear medicine
- TOF counter in HEP experiment
- Radiation monitor in security instrument

NEW SYSTEMS PRODUCTS

MAICO® MEMS Confocal Unit C15890 Series

Product photo with four wavelengths and mechanical shutter

Installation image

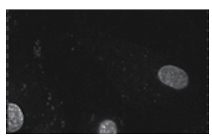
Designed in a compact A3 size* for use on a laboratory bench. It makes confocal florescence imaging available to the user by being mounted to the side port of an inverted microscope.

*329 mm (W) × 150 mm (H) × 300 mm (D) (with mechanical shutter, and non-extended legs)

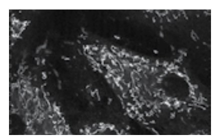
Live Cell Four-color Imaging

Confocal imaging of cell nucleus, mitochondria, cell membrane, and actin filament with different dyes and channels. Each structure is clearly observed.

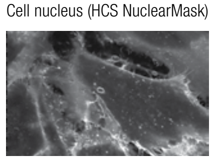
Sample: H9c2 cell line
Objective lens: 60×
Scan line: 960
Laser wavelength: 405 nm, 488 nm, 561 nm, 638 nm



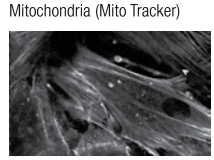
Wavelength 405 nm:
Cell nucleus (HCS NuclearMask)



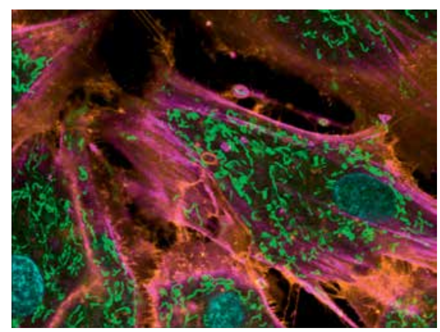
Wavelength 488 nm:
Mitochondria (Mito Tracker)



Wavelength 561 nm:
Cell membrane (CellMask)



Wavelength 638 nm:
Actin filament (SiR-Actin)



Superimposed four-color fluorescence image.
(Image is shown in pseudo-color.)

Making Confocal Imaging More Accessible

A unit that enables confocal fluorescence imaging once installed in your own inverted microscope. By adopting a subunit structure with all the necessary components included for each type of excitation and fluorescence, it supports from single channel observation up to four multi-channel simultaneous observation.

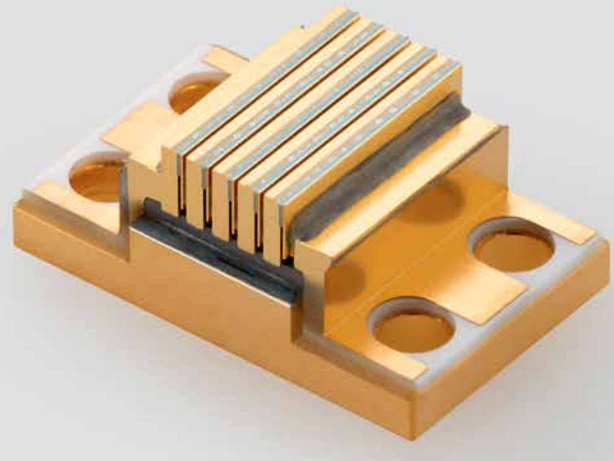
Features

- Confocal fluorescence unit installed in your own inverted microscope
- Subunit structure provides a unique modular add-on system which enable you to install imaging channels at your lab
- High sensitivity detectors
- High-speed scanning with MEMS mirror
- No laser controlled area required

Applications

- Live cell imaging
- High speed Ca^{2+} imaging
- Membrane potential imaging
- Time lapse imaging
- 3D/4D imaging

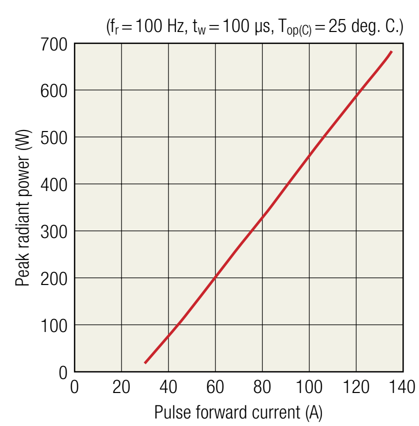
Pulsed Laser Diode Bar Module L14001-01



Specifications

Parameter (typ.)		Specification	Unit
Peak radiant power		650	W
Center emission wavelength		808	nm
Operating current		130	A
Operating voltage		10	V
Threshold current		25	A
Beam divergence angle	Horizontal	5	° (degrees)
	Vertical	26	

Peak radiant power-Forward current (example)



High Power and Small Size for Equipment Integration

This is a compact laser diode (LD) bar module with a peak radiant power of 650 W. By using a passive cooling with thermal conductivity and eliminating the need for chillers, it provides for greater design flexibility when assembling equipment.

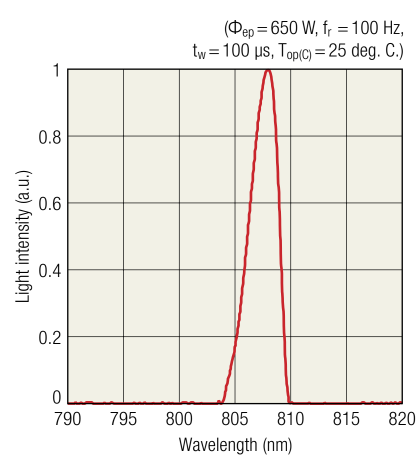
Features

- Peak radiant power: 650 W
- Passive cooling
- Compact

Applications

- Pumping of solid state laser
- Laser Heating

Emission spectrum (example)

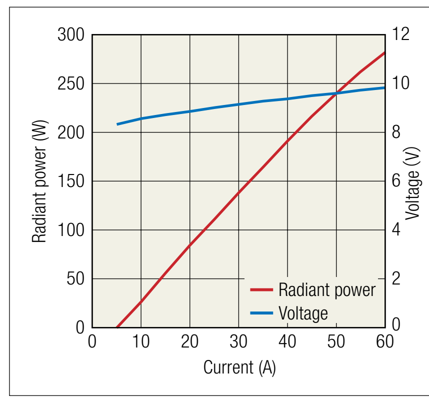


Fiber Output Laser Diode Bar Module L15856-01

Specifications

Parameter (typ.)	Specification	Unit
Radiant power	240	W
Center emission wavelength	940	nm
Wavelength full width at half maximum	4	nm
Operating current	50	A
Operating voltage	9.5	V
Threshold current	5	A

Radiant power-Current and voltage-Current characteristics (example)



High Power Fiber Output Laser

This is a fiber output LD bar module using 940 nm LD bars. It can output the information of temperature of its built-in LD, humidity in the package,leakage and radiant power through D-sub connector. It is also a water cooling method that does not require pure water.

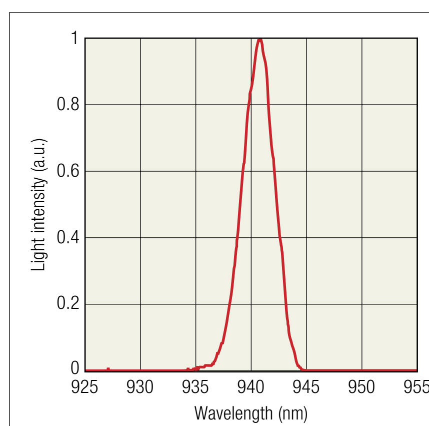
Features

- Radiant power: 240 W
- Fiber core diameter: 400 µm
- Equipped with a liquid leakage sensor
- Built-in PD for optical output monitor

Application

- Pumping of solid state laser
- Selective laser heating

Emission spectrum (example)



Hamamatsu Photonics K.K. Sales Offices

Japan:
HAMAMATSU PHOTONICS K.K.
325-6, Sunayama-cho, Naka-ku,
Hamamatsu City, Shizuoka Pref. 430-8587, Japan
Telephone: (81)53-452-2141, Fax: (81)53-456-7889
E-mail: intl-div@hq.hpk.co.jp

China:
HAMAMATSU PHOTONICS (CHINA) Co., Ltd.
Main Office
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

Shanghai Branch
4905 Wheelock Square, 1717 Nanjing Road West,
Jingan District, 200040 Shanghai, P.R. China
Telephone: (86)21-6089-7018, Fax: (86)21-6089-7017

Shenzhen Branch
14F China Merchants Tower 1#, No. 1166 Wanghai Road,
Shekou, Nanshan district, Shenzhen, P.R. China
Telephone: (86)755-2165-9058, Fax: (86)755-2165-9056
E-mail: hpcsz@hamamatsu.com.cn

Taiwan:
HAMAMATSU PHOTONICS TAIWAN Co., Ltd.
Main Office
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

U.S.A.:
HAMAMATSU CORPORATION
Main Office
360 Foothill Road, Bridgewater, NJ 08807, U.S.A.
Telephone: (1)908-231-0960, Fax: (1)908-231-1218
E-mail: usa@hamamatsu.com

California Office
2875 Moorpark Ave., San Jose, CA 95128, U.S.A.
Telephone: (1)408-261-2022, Fax: (1)408-261-2522
E-mail: usa@hamamatsu.com

Germany, The Netherlands, Poland, Denmark, Israel:
HAMAMATSU PHOTONICS DEUTSCHLAND GmbH
Main Office
Arzbergerstr. 10, D-82211 Herrsching am Ammersee, Germany
Telephone: (49)8152-375-0, Fax: (49)8152-265-8
E-mail: info@hamamatsu.de

Netherlands Office
Transistorstraat 7, NL-1322 CJ Almere, The Netherlands
Telephone: (31)36-5405384, Fax: (31)36-5244948
E-mail: info@hamamatsu.nl

Poland Office
10 Ciolka Street, RN 126-127 01-402 Warsaw, Poland
Telephone: (48)22-646-0016, Fax: (48)22-646-0018
E-mail: poland@hamamatsu.de

Danish Office
Lautruphøj 1-3, DK-2750 Ballerup, Denmark
Telephone: (45)70 20 93 69, Fax: (45)44 20 99 10
Email: info@hamamatsu.dk

Israel Office (Hamamatsu Photonics Israel Ltd.)
Ha-Menofim 10 st., third floor, 4672561 Herzliya, Israel
E-mail: Info@hamamatsu.co.il

France, Switzerland, Belgium, Spain:
HAMAMATSU PHOTONICS FRANCE S.A.R.L.
Main Office
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

Swiss Office
Dornacherplatz 7, 4500 Solothurn, Switzerland
Telephone: (41)32-625-60-60, Fax: (41)32-625-60-61
E-mail: swiss@hamamatsu.ch

Belgian Office
Axisparc Technology, Rue Andre Dumont 7
1435 Mont-Saint-Guibert, Belgium
Telephone: (32)10 45 63 34, Fax: (32)10 45 63 67
E-mail: info@hamamatsu.be

Spanish Office
C. Argenters, 4 edif 2 Parque Tecnológico del Vallés
08290 Cerdanyola (Barcelona), Spain
Telephone: (34)93 582 44 30, Fax: (34)93 582 44 31
E-mail: infospain@hamamatsu.es

North Europe and CIS:
HAMAMATSU PHOTONICS NORDEN AB
Main Office
Torshamnsgatan 35 16440 Kista, Sweden
Telephone: (46)8-509 031 00, Fax: (46)8-509 031 01
E-mail: info@hamamatsu.se

Russian Office
11, Christoprudny Boulevard, Building 1, Office 114,
101000, Moscow, Russia
Telephone: (7)495 258 85 18, Fax: (7)495 258 85 19
E-mail: info@hamamatsu.ru

Italy:
HAMAMATSU PHOTONICS ITALIA S.r.l.
Main Office
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

Rome Office
Viale Cesare Pavese, 435, 00144 Roma, Italy
Telephone: (39)06-50 51 34 54
E-mail: inforoma@hamamatsu.it

United Kingdom:
HAMAMATSU PHOTONICS UK Limited
Main Office
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

South Africa Contact:
9 Beukes Avenue, Highway Gardens, Edenvale
1609 South Africa
Telephone/Fax: (27)11-609-0367

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HAMAMATSU PHOTONICS K.K.
325-6, Sunayama-cho, Naka-ku, Hamamatsu City,
Shizuoka Pref., 430-8587, Japan
Telephone: (81)53 452 2141, Fax: (81)53 456 7889
http://www.hamamatsu.com
info@hamamatsu.eu

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