HAMAMATSU

PHOTON IS OUR BUSINESS

NEWS 2019 02

A sample emitting only
a whisper of light

. . . a scientific CMOS camera
so quiet it can detect it.

Content

ORCA-Fusion

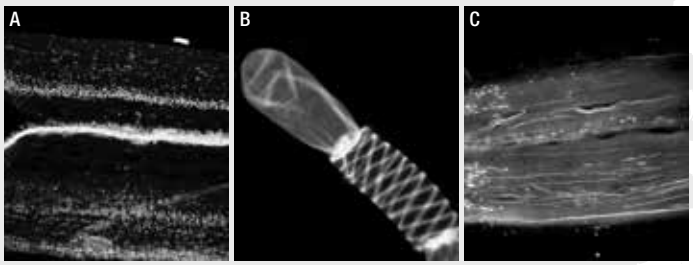
Introducing the new ORCA-Fusion CMOS Digital Camera

Built from the sensor up, the ORCA-Fusion balances the complex nuances of camera features to provide beautiful images and robust data at all light levels, but especially in tough low-light conditions.

The exceptionally low and highly uniform read noise of the ORCA-Fusion means that when the sample emits even just a handful of photons, either by default or by experimental design, they are not lost in the noise, but detected and reliably quantified.

After all, when you want to hear a whisper it's best to be in a quiet place.

See page 21 to find out more about the new ORCA-Fusion Digital CMOS Camera.



A. Image of a regenerated lamprey spinal cord labeled with DAPI, which reveals the distribution of cells throughout the spinal cord. The brightest signal in the center of the spinal cord is the central canal. Credits: E. Guadarrama and J. Morgan (Marine Biological Laboratory).

B. Plant tissue culture induced to make xylem. Fluorescent bands are cell wall thickenings needed to reinforce the cell wall for water transport. Credits: Sample prepared by T. Baskin, UMass Amherst and provided by R. Oldenbourg (Marine Biological Laboratory).

C. Image of a regenerated lamprey spinal cord labeled with a neurofilament antibody, which reveals numerous regenerating axons. Credits: E. Guadarrama and J. Morgan (Marine Biological Laboratory).

Hamamatsu Deutschland has Purchased a Minority Stake in Menlo Systems GmbH

Menlo Systems is a developer for optical frequency combs, ultra-stable lasers, femtosecond lasers and terahertz solutions. Dr. Reinhold Guth, managing director of Hamamatsu Deutschland, said “we are excited about this creating an opportunity to collaborate with Menlo Systems to develop measuring and spectroscopic systems that can be utilized by our OEM customers”. Dr. Michael Mei, CEO of Menlo Systems, emphasized that “the worldwide reach of Hamamatsu will allow us to bring our Nobel prize inspired technology to a much wider customer base. It is now possible for us to develop optical engines that can serve both our end users and manufacturers of complex systems”. Menlo and Hamamatsu believe that this purchase of a minority share will lead to new applications and markets for both companies, since there is almost no overlap in their product lines.

About Menlo Systems:
Menlo Systems GmbH is a leading developer and global supplier of instrumentation for high-precision metrology. The company with headquarters in Martinsried near Munich is known for its Nobel Prize winning optical frequency comb technology. With subsidiaries in the US and China and a global distributor network, Menlo Systems is closely connected to its customers from science and industry. The main product lines are optical frequency combs, time and frequency distribution, terahertz systems, ultrafast and ultrastable lasers, and corresponding control electronics. Besides standard production, Menlo Systems develops and manufactures custom made solutions for laser-based precision measurements.

From left to right:
Paul Blackborow, Peter Eggl (Hamamatsu), Michael Mei (Menlo Systems), Alex Cable (Thorlabs Inc), Theodor Hänsch (Menlo Systems), Yuji Kobayashi (Hamamatsu), Ronald Holzwarth, Megumi Hashiguchi and Caroline Eckl (Menlo Systems)

Product Spotlight:

Energetiq's Tunable Light Sources

In the last edition of Hamamatsu News we introduced Energetiq Technology's Laser-Driven Light Source (LDLS™) products. We will now take a deeper look into the most recent additions to the Energetiq product line – Laser-Driven Tunable Light Sources (LDTLS™).
The LDTLS product line contains compact, fully integrated broadband sources that allow for precise tuning to desired wavelength bands designed around proven LDLS technology.

Laser-Driven Light Sources (LDLS™)

While monochromator-based tunable light sources have been previously available, what sets the LDTLS apart from the pack is the fact that it is built around Energetiq's innovative Laser-Driven Light Source technology. Energetiq's LDLS is unique because it uses a laser to sustain the plasma inside of a high-pressured Xenon bulb. This results in a very small, spatially stable plasma that is approximately 100 microns in size and shifts the emission spectrum into the deep UV allowing the LDLS to produce a broad spectrum from 170 – 2400 nm. The key features of the LDLS are the broad spectral range, high brightness, high stability and long lifetime of the source which can be operated for more than 9,000 hours before a recommended bulb change.

Inspired by Our Customers

Energetiq developed this value-added line up of products in response to customer feedback and market demand. For many applications customers have paired their LDLS with a standard monochromator to enable wavelength selection. This necessitated the use of OAPs and other coupling optics and could result in the loss of flux, which is not ideal for many high-throughput applications. With this knowledge in mind, the development team at Energetiq applied their expertise in coupling the high-radiance light of the LDLS source to create a highly-efficient tunable light source.

Features and Benefits

With a focus on maximum output efficiency, the LDTLS systems are fully integrated and expertly designed to deliver a both high flux and a narrow band width. The TLS-EQ-9, TLS-EQ-77 and TLS-EQ-400 are built around the EQ-9, EQ-77 and EQ-400 LDLS systems, respectively. Each LDLS is precisely aligned, with a customized optical design and monochromator to maximize efficiency and throughput.

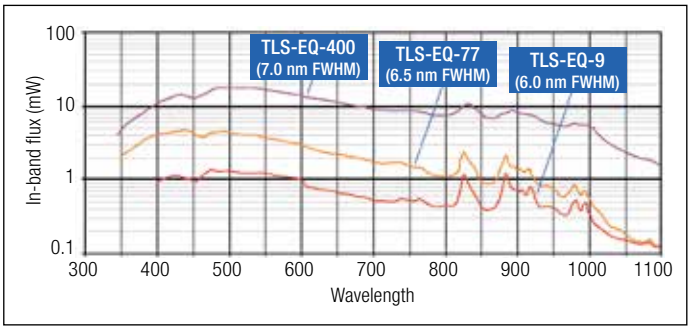
The spectral resolution of each LDTLS is configurable and offers fast wavelength tuning at 15 milliseconds per 2 nm step over the entire spectral range. The fast step time and extremely high brightness, illustrated in the graph below, enables very high throughput required for volume production applications.

Energetiq's LDTLS systems are easily controlled via USB connection using an intuitive GUI that allows for straightforward operation and wavelength selection. Users are able to define automated scans and select various modes such as cycling, white light or step to wavelength. Other adjustable features are step size and step speed. The sources are extremely stable and therefore allow for repeatable measurements time and again. Each LDTLS has a fiber-coupled SMA output for simple integration into a variety of applications.

Applications

- High throughput production applications
- Optical sensor and image sensor testing and characterization
- Diagnostic and biomedical imaging
- Lab use for R&D purposes
- Other OEM applications – Energetiq is adept at rapid development, so if adjustments are needed for a high-volume application we'd love to hear from any interested customers.

Model	TLS-EQ-9	TLS-EQ-77	TLS-EQ-400
Wavelength range	400 nm–1100 nm	350 nm–1100 nm	750 nm–1100 nm
Wavelength accuracy	+/- 0.5 nm		
Spectral resolution	User selectable: 1.0 nm-8.0 nm	Factory pre-set: 1.0 nm-8.0 nm	Factory pre-set: 4.0 nm-8.0 nm
Scan speed	< 15 ms for a 2 nm step		
Typical in-band flux (for ~6.5 nm FWHM)	400 nm: 1 mW 600 nm: 1 mW 750 nm: 0.4 mW 1,000 nm: 0.2 mW	400 nm: 4.5 mW 600 nm: 3.0 mW 750 nm: 2.0 mW 1,000 nm: 0.75 mW	400 nm: N/A 600 nm: N/A 750 nm: 3.0 mW 1,000 nm: 2.0 mW



U.S. Subsidiary Celebrating 50th Anniversary

This year, Hamamatsu Corporation in the U.S. will celebrate its 50th anniversary as a company. It's a significant milestone for any business, yet for our organization we are proud of not only the longevity of this company but our accomplishments, as well. The road to 2019 has been a challenging one, yet Hamamatsu Corporation is grateful to look back on five decades of continued growth, dedication, and advancement within the North American photonics industry.

The company that would eventually become Hamamatsu Corporation, or "HC" for short, first opened its office doors in 1965 in New York as a representative of Hamamatsu Photonics K.K. Four years later, the company was incorporated in Garden City, NY under its current name with Ralph Eno as President.

As the 1970s began, HC began attending its first selection of tradeshows in the United States, the first of which was Pittcon, a tradeshow for analytical chemistry. Throughout the decade as the business continued to expand, eventually HC's office was relocated to Middlesex, New Jersey, to accommodate the increased demand for Hamamatsu products in the region.

This early success in the 1970s eventually was followed by significant changes for Hamamatsu Photonics K.K. on a worldwide scale, as the demand for more advanced photonics technology increased. The year 1980 was particularly eventful, as HC's parent company, Hamamatsu Photonics K.K., organized their very first Photon Fair. That same year, HC hired their 50th employee. Soon after, as the company began to outgrow the Middlesex, NJ office, a new office building was purchased in Bridgewater, NJ, and would become the new home of Hamamatsu Corporation in 1986.

After relocating to Bridgewater, HC would go on to expand its office to other cities across the U.S., including San Jose and Boston. PMT production continued to climb and make great strides in technological improvement, while HC's parent company began expanding into other technologies and opening new research avenues. This led to Hamamatsu Photonics listing on the Tokyo Stock Exchange's first section for the first time in 1998. Only three years later HC posted $100 million in total revenue for the fiscal year, marking a significant business milestone for the company. Recently, the company's sales have consistently exceeded $300 million annually.

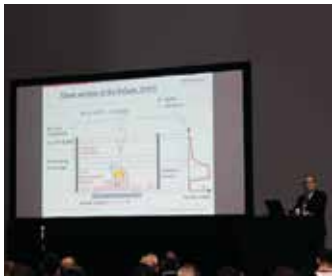
In 2019, HC is led by President Craig Walling, who accepted the position in 2009. In looking back on the last 50 years of company history, Craig shared the following:

"Quality, Technology, and Service has been a cornerstone at Hamamatsu Corporation (HC) through the years. In the 70s and 80s we were much smaller. Our people were focused on servicing our customers and handled all parts of the operation. Our products were one of a kind, build at the leading edge of the technology with the quality one might expect from a master craftsman.

Today, Hamamatsu is a Photonics leader supplying applications from theoretical physics experiments to specialty sensors you carry in your mobile devices. Our staff has grown and continues to specialize in a variety of fields, yet they remain focused on helping customers solve problems with photonics. This commitment to advancing research and exceptional service has led to an ever-growing product line.

I want to thank everyone – customers, vendors, and our staff both past and present – because it is the brainstorming, discussions, and even arguments between these extraordinary individuals that have made HC a success over the last 50 years. Thanks to their exceptional work and dedication, we are poised to achieve greater levels of Quality, Technology, and Service in the next 50 years and beyond."

Looking forward, Hamamatsu Corporation embraces our role as a leader in the photonics industry these past 50 years. Providing innovative photonics technologies to a variety of fields has been a source of pride and distinction for HC, but without the continued support from our colleagues and customers, none of it would have been possible. We invite you to join us for the next 50 years and beyond as we continue to pioneer photonics innovations that are exciting, dynamic, and fulfill our promise to improve the lives of individuals across the world.



SPIE. PHOTONICS WEST

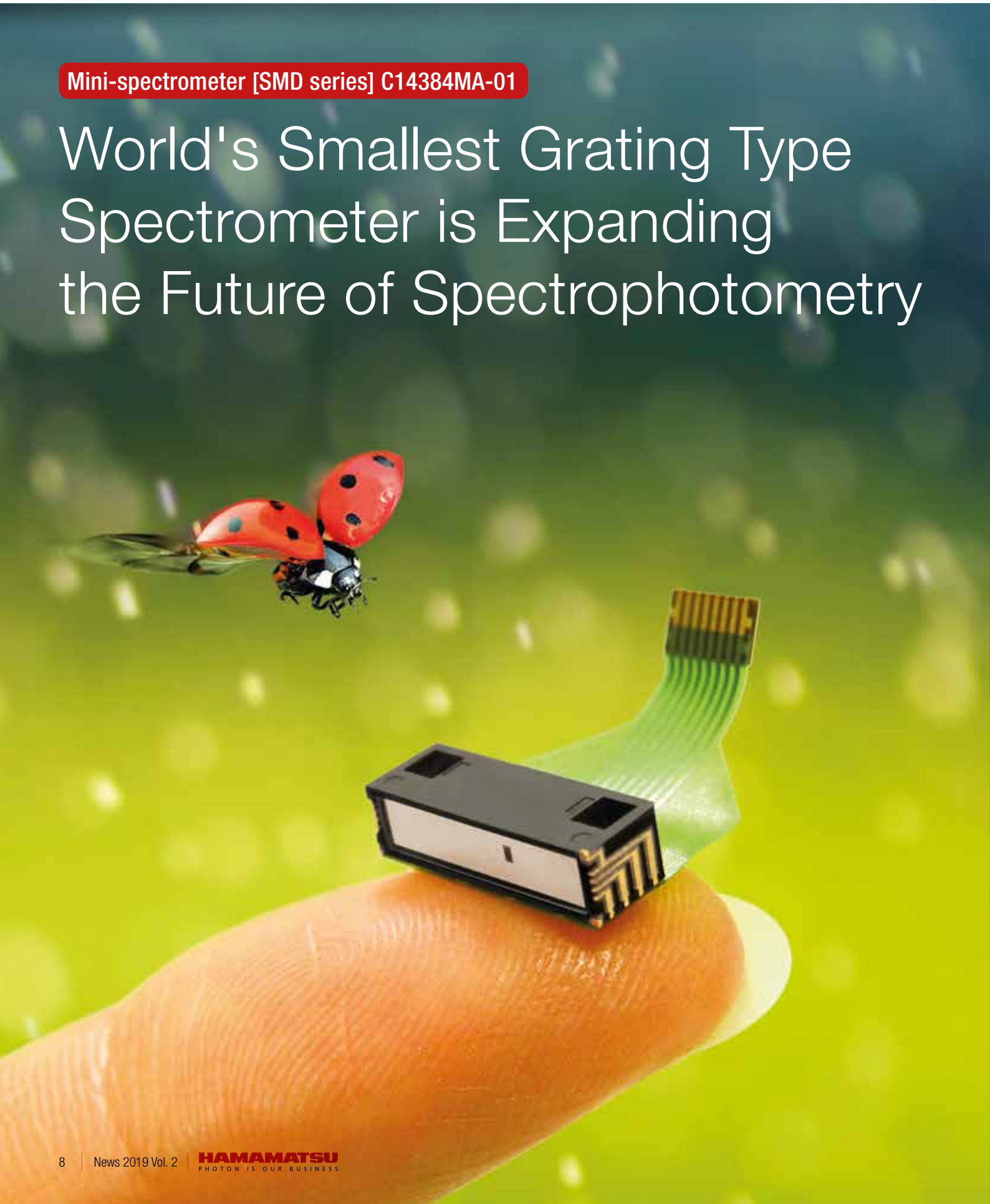
Photonics West 2019 Review

Celebrating our 50-Year Anniversary at Photonics West 2019

February saw the arrival of Photonics West 2019 in San Francisco, and after all the preparation and planning Hamamatsu had another successful year. As 2019 marks the 50th anniversary of Hamamatsu Corporation in the U.S., this Photonics West conference was particularly meaningful and special. We were grateful to receive incredible feedback from colleagues across the industry throughout the conference. In addition, we were honored to have Senior Managing Director for Solid State Division, Koei Yamamoto, attend the conference and speak at our day-long workshop. It was a genuine pleasure to visit San Francisco and see how far both Hamamatsu and the photonics industry has come; and we look forward to presenting our newest innovations at next year's conference. Thanks to everyone who visited our booth and those who helped make Photonics West 2019 a tremendous success!

Mini-spectrometer [SMD series] C14384MA-01

World's Smallest Grating Type Spectrometer is Expanding the Future of Spectrophotometry



Spectrophotometry, which examines the light spectrum emitted or absorbed by materials and analyzes their composition, is used in a wide variety of fields including food, agriculture and medicine. Up until now, spectrophotometry was typically performed in a chemical laboratory using large benchtop spectrometers.

For many years, Hamamatsu has been developing compact spectrometers to meet the needs for performing measurements on-site using portable instruments. The newly released SMD series C14384MA-01 represents a culmination of years of work designing and improving our past compact spectrometers. The result is the world's smallest near infrared spectrometer (according to our research).

This SMD series spectrometer is expected to be used in hand-held instruments with limitations to their size or weight, simultaneous multipoint measurements, and other applications.

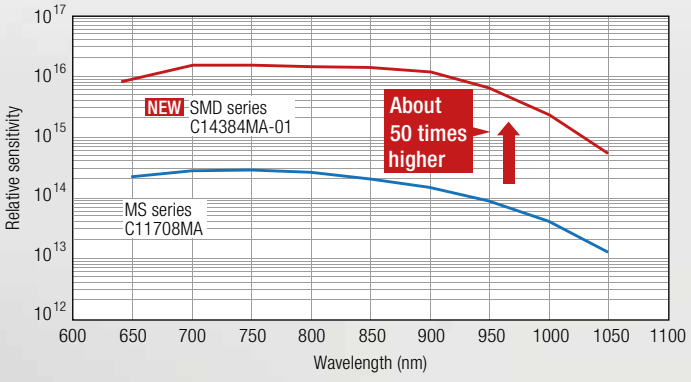
Remarkably compact next-generation grating type spectrometer

The most distinctive feature of the SMD series is that while the volume has been reduced 40 to 1 and the weight 30 to 1 as compared to the previous mini-spectrometer MS series, the sensitivity in the near infrared region has been increased about 50 times by employing the latest high-sensitivity image sensor.

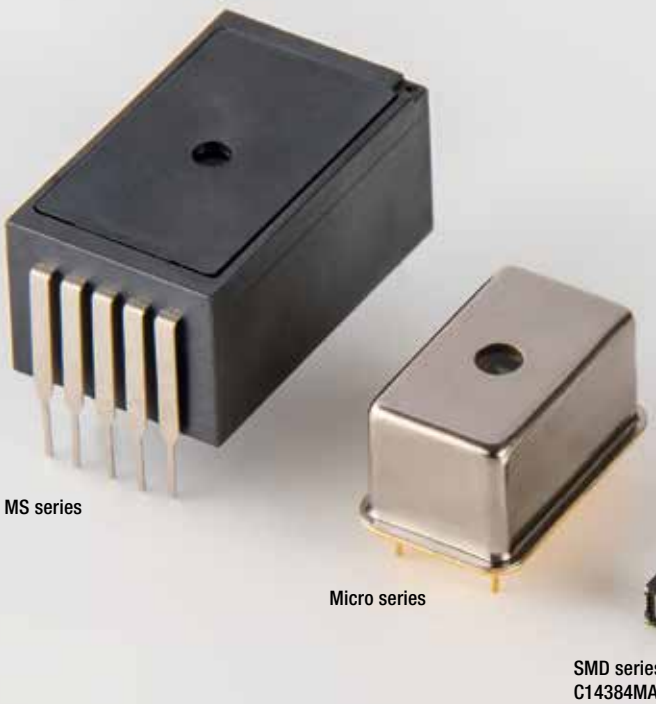
This makes it easier to mount the device in portable spectrophotometers quadcopters and drones, with limitations for size and weight.
It also allows the device to be used in various other applications such as making multipoint measurements by using several units of this device in parallel and making observations by attaching the device directly to a living body.

Moreover, because this spectrometer combines a grating and an image sensor, it can acquire changes in the light intensity for each wavelength as continuous data to be used in more advanced analysis methods.

Furthermore, a flexible cable connection has been employed to improve the usability of the device whilst also offering high levels of freedom in mountability.



Sensitivity comparison (typical example)



MS series

Micro series

SMD series
C14384MA-01

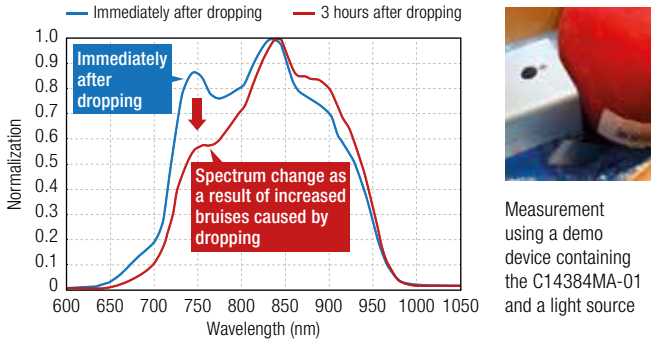
In Focus

High sensitivity to near infrared light, suitable for food and agricultural inspection

In recent years, there has been a growing global concern for safety and productivity in the food and agriculture fields and there are high expectations for spectrophotometry, which is an easy and efficient inspection method.

The SMD series provides high sensitivity to near infrared light in the range of 640 nm to 1,050 nm, which allows measurements of moisture, sugar, organic acids and other components derived from organisms. This makes them suitable not just for food and agricultural applications, but for many other fields and applications such as medical and pharmaceutical.

Example: spectral measurement of apple (observation of bruises caused by dropping)



Measurement using a demo device containing the C14384MA-01 and a light source

Hamamatsu Photonics technologies applied to world's smallest devices

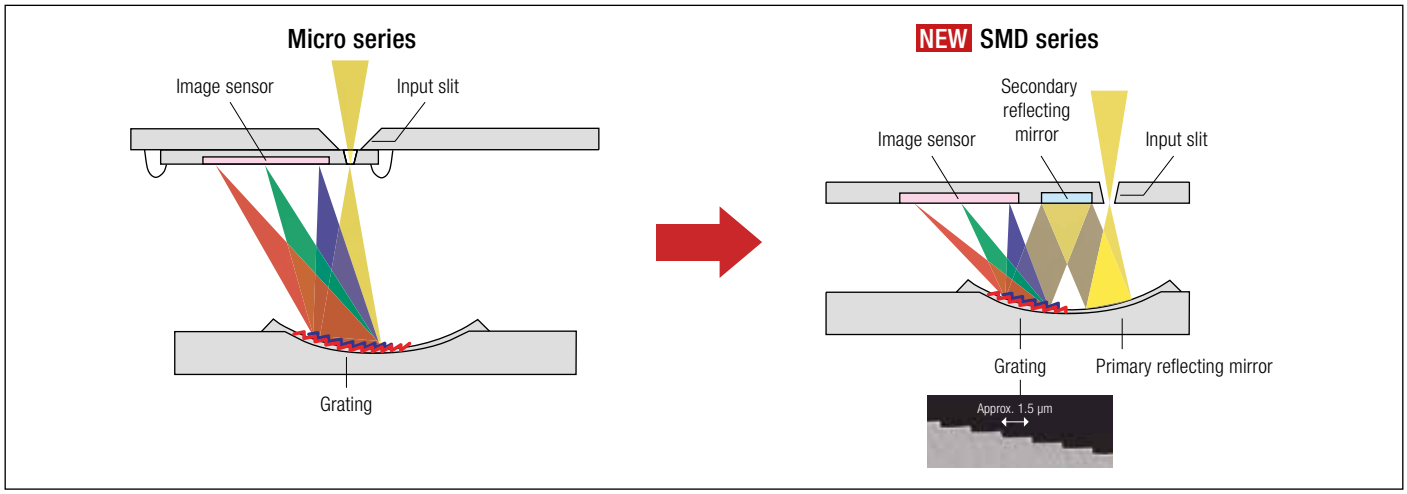
The world's smallest grating type spectrometer was made possible through the integration of the unique optical design technologies developed by Hamamatsu Photonics and the MOEMS technology that achieves high quality in mass production.

In a grating type spectrometer, the positional relationship is important between the slit passing the light in, the grating separating the light into each wavelength, and the sensor. However, the process of micro-machining gratings was approaching its limits using the previous structure for minimizing the number of reflections in order to achieve the needed accuracy.

To overcome this limitation, the SMD series was developed with a completely new approach. Ultra-miniaturization was accomplished by employing optics using multiplex reflection that utilizes MOEMS technologies such as replication technology that replicates sub-micron-level shapes through nanoimprints and high-added-value CMOS sensor technology that integrates a slit and mirror.

In addition, the latest high-sensitivity image sensor has successfully increased the sensitivity even further. Low cost is another feature achieved by consolidating the input slit, secondary reflecting mirror, and image sensor all on a single chip to reduce the number of components.

Optical system layouts



Mini-spectrometer
SMD Series C14384MA-01

Ultra-compact grating type spectrometer with high sensitivity in the near infrared

The C14384MA-01 is an ultra-compact grating type spectrometer that provides high sensitivity in the near infrared region. With the employment of Hamamatsu's unique optical design and latest high-sensitivity image sensor, the sensitivity in the near infrared region has been increased by about 50 times while the volume has been reduced by about 40 times as compared to the previous mini-spectrometer MS series.

C14384MA-01

Features

- Ultra-compact: 11.7 x 4.0 x 3.1 mm
- Ultra-lightweight: 0.3 g
- Spectral response range: 640 to 1,050 nm
- High sensitivity: 50 times (λ = 1,000 nm) the previous product (C11708MA)
- Flexible cable included

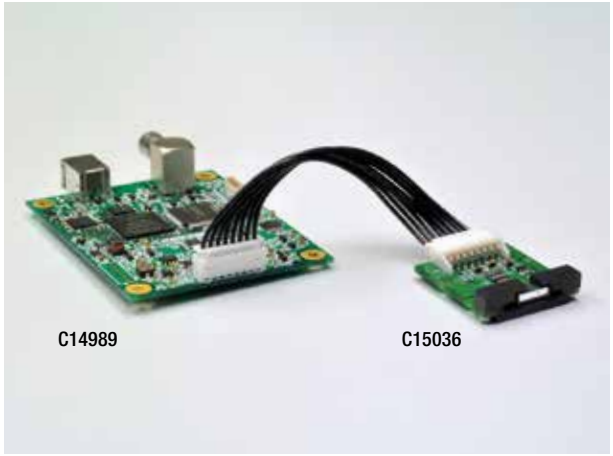
Specifications

Parameter		Specification	Unit
Spectral response range		640 to 1,050	nm
Spectral resolution (FWHM)	640 to 800 nm	25 max.	nm
	800 to 1,050 nm	20 max.	nm
Wavelength reproducibility		± 0.5	nm
Wavelength temperature dependence		± 0.1	nm/deg. C.
Spectral stray light		-23 max.	dB
Slit size (H × V)		15 × 300	µm
Numerical aperture		0.22	–
Video rate		5	MHz
Dimensions (W × D × H)		11.7 × 4.0 × 3.1*	mm
Weight		0.3	g

* Flexible cable not included

Evaluation kit (C14989 + C15036)

This evaluation kit can be used to easily evaluate the characteristics of the SMD series C14384MA-01. The C14989 is an evaluation circuit (with evaluation software and connection cable). The C15036 is a circuit with a mini-spectrometer head (C14384MA-01 built in). By connecting the evaluation kit to a PC through a USB cable, you can easily evaluate the characteristics of the C14384MA-01 using the dedicated software.



C14989 C15036

Features

- Initial evaluation circuit for the C14384MA-01 mini-spectrometer
- The wavelength conversion factor of the mini-spectrometer can be entered from a PC
- High A/D resolution (16-bit)
- Operated only with USB power supply

Mini-spectrometer TF Series C14486GA

NEW

Near-infrared mini-spectrometer (950-1,700 nm) in a compact/thin case

The mini-spectrometer TF series C14486GA has an InGaAs linear image sensor and is only 12 mm thick. The trigger function can be also used for short-term integration enables spectroscopic measurement of pulse emissions.

Differences from previous products

High sensitivity in the near infrared region and miniaturization have been achieved.

C14486GA

Features

- Spectral response range: 950 to 1,700 nm
- Compact, thin case
- High line scan rate with short integration time (1 µs to 100 ms)
- High spectral resolution: 7 nm max.
- External power supply is not necessary (USB bus powered)
- High throughput using quartz transmission grating

Applications

- Sugar content of food, moisture measurement
- Film thickness measurement

Lineup of TF series

Type	Type no.	Photo	Spectral response range (nm) (200 400 600 800 1000 1200 1400 1600)	Spectral resolution max. (nm)	Integration time (µs)	Trigger function	Built-in image sensor: Type	Built-in image sensor: Number of pixels
NEW For NIR	C14486GA		950 to 1,700	7	1 to 100,000	Yes	InGaAs linear image sensor	256
High sensitivity	C13555MA		340 to 830	3	11 to 100,000	Yes	High sensitivity CMOS linear image sensor	512
	C13053MA		500 to 1,100	3.5				
For Raman spectroscopy High resolution	C13054MA		790 to 920	0.7	11 to 100,000	Yes	High sensitivity CMOS linear image sensor	512
	C14214MA		790 to 1,050	0.6				2,048

Si APD
S11051-20

NEW

APD with high sensitivity at λ = 266 nm

The S11051-20 is an APD that has been designed to detect high sensitivity light at λ = 266 nm used in semiconductor and laser processing equipment. Quantum efficiency of about 60 % has been achieved at λ = 266 nm.

Differences from previous products

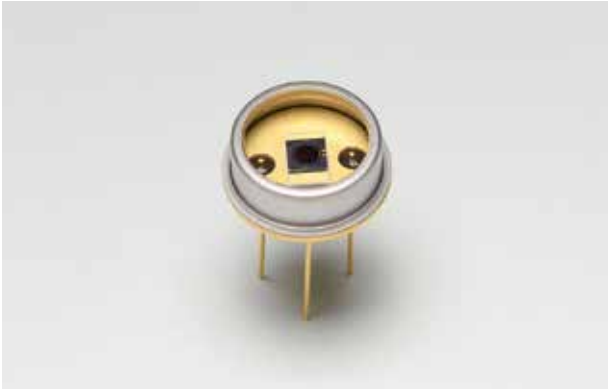
The sensitivity at λ = 266 nm has been greatly increased compared to the previous APD for UV.

Features

- High UV sensitivity (λ = 266 nm)
- TO-8 package
- Photosensitive area: φ2.0 mm
- Breakdown voltage: 500 V max.

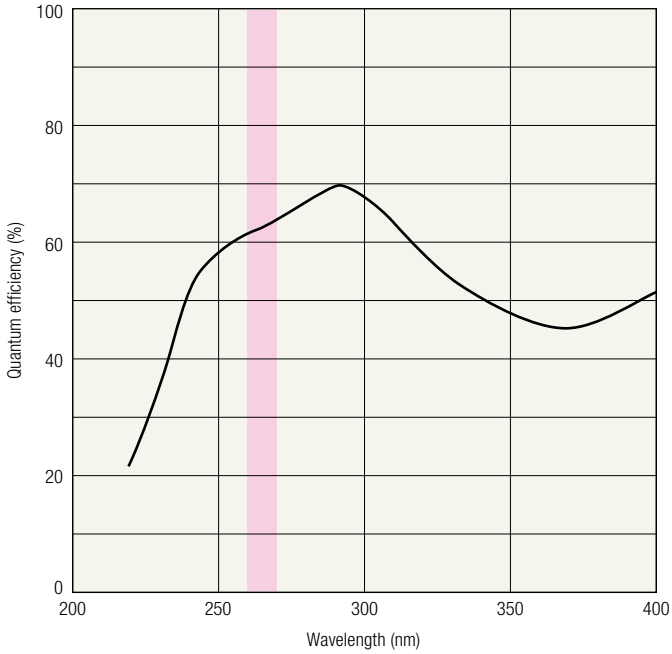
Applications

- Semiconductor test equipment
- Laser processing equipment



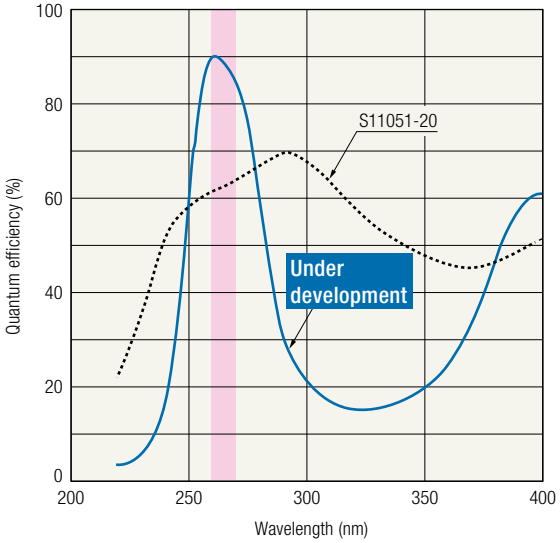
S11051-20

Spectral response (Typ., Ta = 25 deg. C.)



Development information

Development is underway to increase the sensitivity further at λ = 266 nm.



Si Strip Detector (SSD)
S13804

NEW

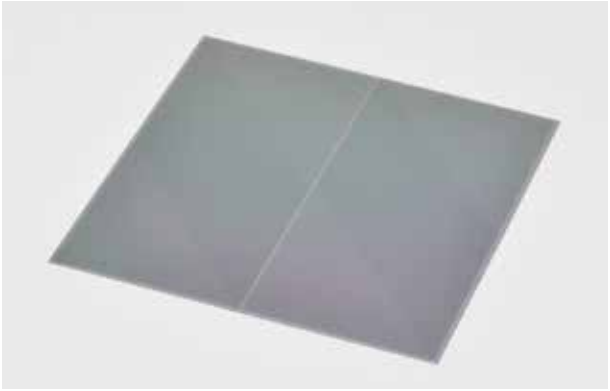
Single-sided SSD for high energy particle detection

This is an SSD developed for J-PARC muon g-2/EDM experiment.*
It has a 190 µm narrow pitch strip structure to achieve highly accurate position detection of high energy particles. The S13804 can be used extensively in high energy particle detection.

* http://g-2.kek.jp/portal/index.html

Features
- High voltage tolerance
- High radiation tolerance
- Low dark current

Application
- High energy particle detection

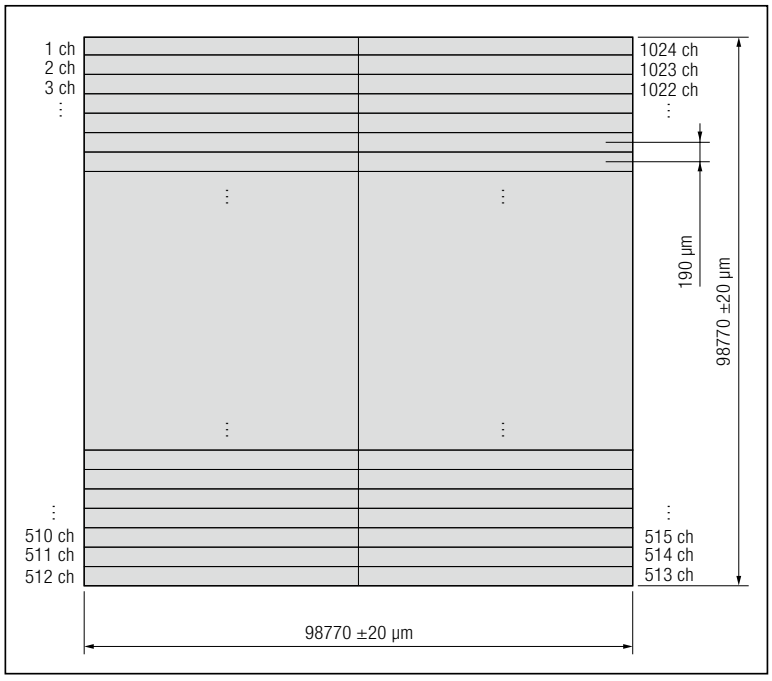


S13804

Specifications

Parameter	Specification	Unit
Type	PolySi-bias AC-readout	–
Si thickness	320 ± 15	µm
Si crystal plane direction	<100>	–
Chip size	(98,770 ± 20) × (98,770 ± 20)	µm
Active area	97,280 × 97,280	µm
Strip layout	512 ch × 2 columns	–
Number of strips	1,024	ch
Strip pitch	190	µm
Strip implant width	80	µm
Strip readout Al width	90	µm
Readout pad size	165 × 100 × 2	µm

Structure



Electrical and optical characteristics (Ta = 25 deg. C.)

Parameter	Condition	Min.	Typ.	Max.	Unit
Breakdown voltage		200	–	–	V
Dark current	V_R = 200 V	–	–	3	µA
Full depletion voltage		–	–	100	V
Defective strip rate		–	–	5	%
PolySi resistor		5	10	15	MΩ

What is a Si strip detector (SSD)?
An SSD is a Si photodiode array with strips of photosensitive areas (PN junctions) with a width ranging from several micrometers to several tens of micrometers formed on a substrate. It can detect incident positions of high energy particles at the micron level.

CMOS Area Image Sensor S14250

NEW

Low resolution, high sensitivity image sensor with privacy considerations

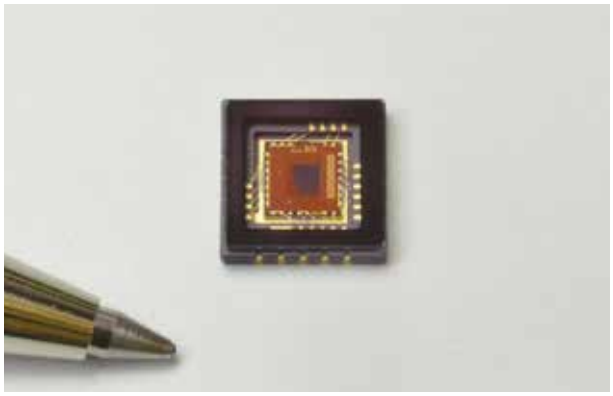
This is a low resolution CMOS area image sensor for security cameras with consideration to privacy. Because the pixels are large, data acquisition is possible even in low illuminance environments. Handling is easy because it has a digital I/O and can be driven by a single 3.3 V power supply.

Features

- Pixel size: 50 × 50 µm
- Number of pixels: 30 × 30
- Imaging at low illuminance is possible
- Frame rate: 1,103 frames/s

Applications

- Security camera (night vision, moving object detection)
- Monitoring camera

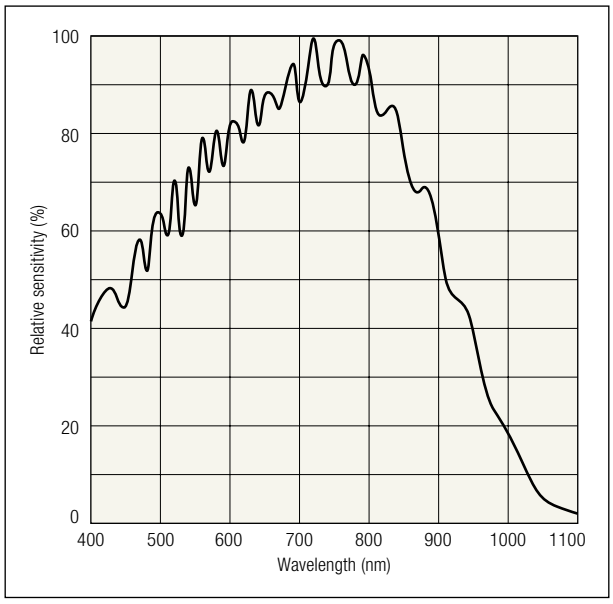


S14250

Specifications

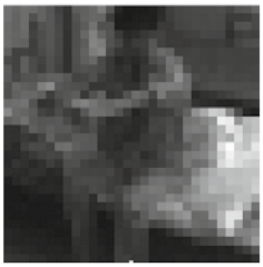
Parameter	Specification	Unit
Image size (H × V)	1.5 × 1.5	mm
Pixel size	50 × 50	µm
Pixel pitch	50	µm
Total number of pixels (H × V)	32 × 32	pixels
Number of effective pixels (H × V)	30 × 30	pixels
Boundary pixels	1 column enclosing the effective pixel region	–
Package	Ceramic	–
Window material	Borosilicate glass	–

Spectral response (Ta = 25 deg. C.)

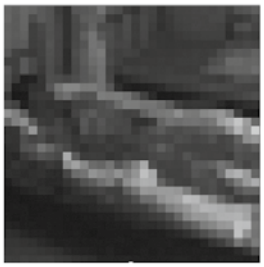


Imaging examples

Integration time: 1.5 ms, sensitivity: 1,870 V/lx · s



Sitting on the bed



Lying on the bed

Photosensor with Front-end IC S14847-01CR

NEW

APD with TIA for LiDAR and other distance measurements

The S14847-01CR is a compact optical device that integrates a Si APD and preamp. It has a built-in DC feedback circuit for reducing the effects of background light. It also provides excellent noise and frequency characteristics.

Differences from previous products

In addition to the ϕ0.2 mm photosensitive area type (S13282-01CR), a ϕ0.5 mm type has been added to the lineup.

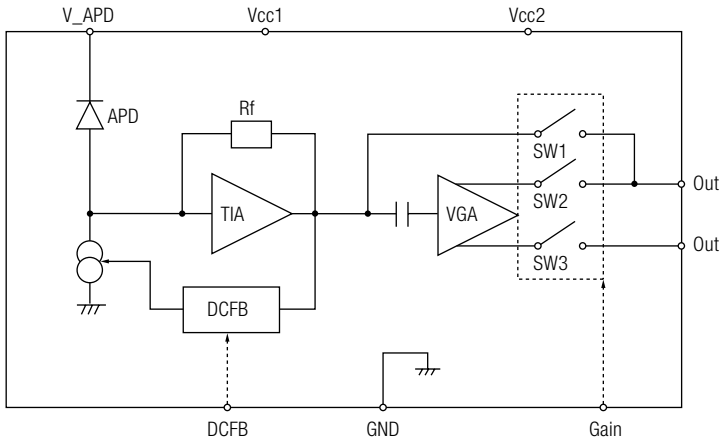
Features

- High-speed response: 170 MHz
- Two-level gain switch function (low gain: single output, high gain: differential output)
- Reduced background light effects
- Small waveform distortion when excessive light is incident

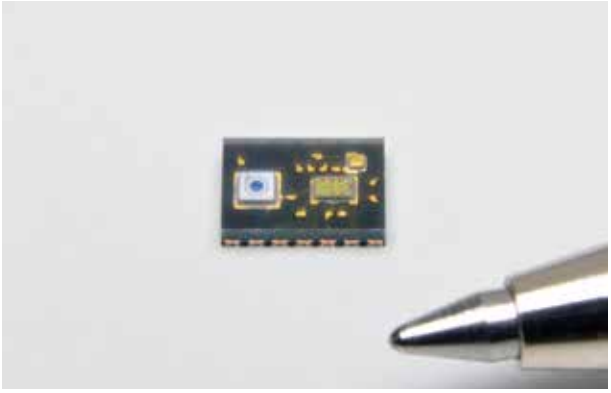
Application

- Distance measurement

Block diagram



The DCFB (DC feedback) circuit detects the photocurrent's DC component, and reduces the effects of background light through the differential processor.



S14847-01CR

Specifications

Parameter		S13282-01CR	NEW S14847-01CR	Unit
Photosensitive area size		ϕ0.2	ϕ0.5	mm
Peak sensitivity wavelength		840		nm
High cutoff frequency	Low gain	180	170	MHz
	High gain	160	150	
Input conversion noise power	f = 10 MHz	50	50	fW/Hz$^{1/2}$
	f = 100 MHz	65	100	
Photosensitivity*	Low gain	0.2		MV/W
	High gain	4		

* $\lambda = \lambda p$, M = 100

NEW

Photosensor Module H14447

Allows 1 Gbps-class communications
High-speed response photomultiplier tube module

The H14447 is a current output photosensor module incorporating a 28 mm diameter head-on photomultiplier tube and a high-voltage power supply. Compared to the previous product (H13661), the H14447 offers better performance such as less ringing and variation in output pulse height and also ensures a wider eye pattern opening, making it more suitable for optical communications.

Features

- High-speed response: up to 1.0 GHz
- Large effective area: ϕ25 mm
- Low power consumption

Applications

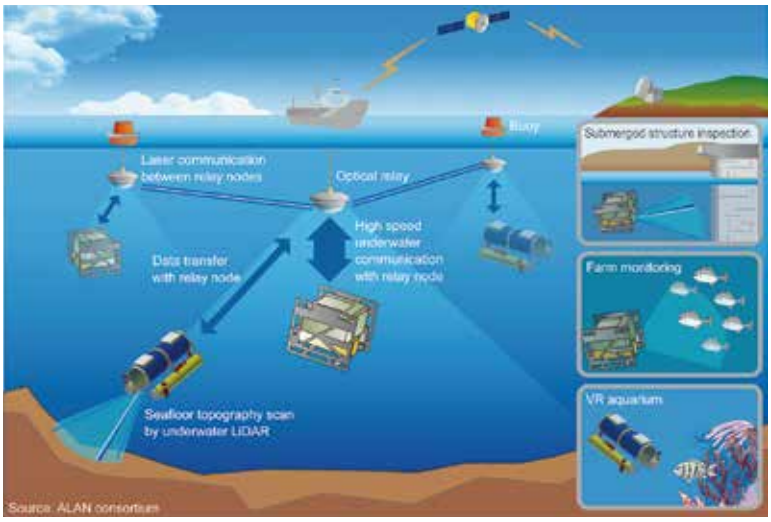
- Optical communication
  - Movie streaming
  - High-definition image/movie transfer
- Mass spectrometry (TOF-MS)
- LiDAR

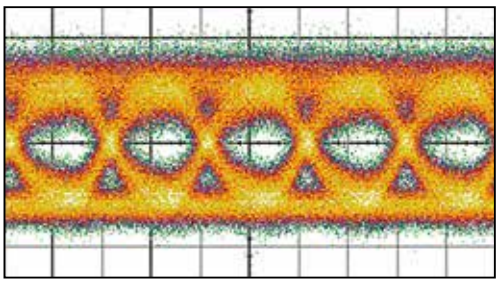
H14447

Specifications

Parameter	Specification	Unit
Input voltage	+4.8 to +5.5	V
Maximum input current	6	mA
Maximum output signal current	100	µA
Spectral response range	300 to 650	nm
Effective photocathode area	ϕ25	mm
Rise time	350	ps
FWHM	440	ps

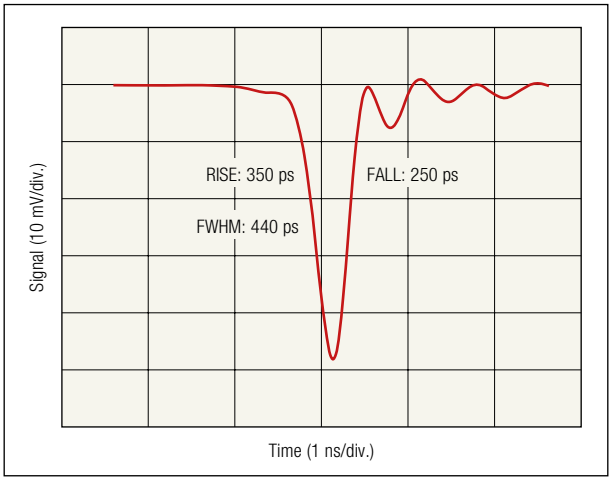
Example of underwater optical communication





Eye pattern (1 Gbps)

Time response (Typ.)



Photosensor Module H14600 Series

NEW

Compact photosensor module incorporating a TO-8 package photomultiplier tube

The H14600 series is a photosensor module that incorporates a TO-8 package photomultiplier tube along with a high-voltage power supply and a voltage divider and provides a current output pin. It is half of the size of the previous product (H10720 series), so it helps reduce the size of equipment.

Features

- Compact on-board type module
- Low voltage (+5 V) operation
- Low power consumption

Applications

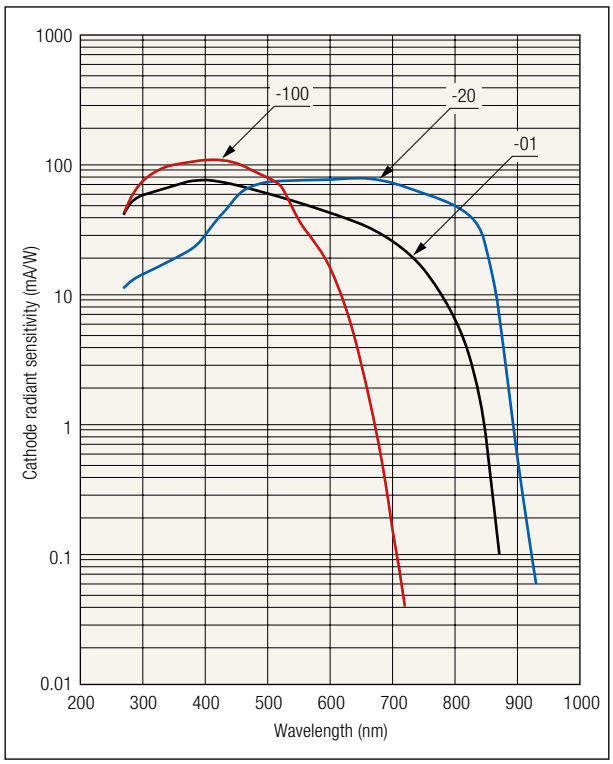
- Portable high-sensitivity devices
  - Environmental measurement
  - POCT (point-of-care testing)

H14600 series

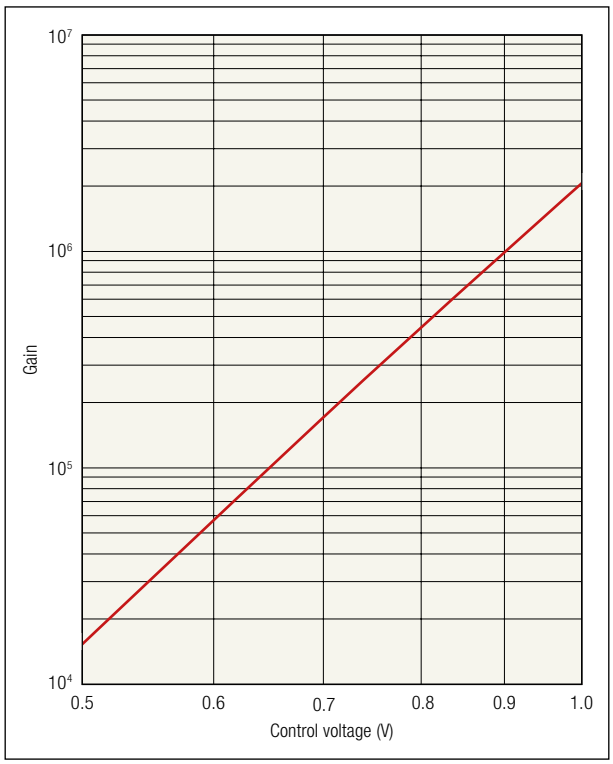
Specifications

Parameter	H14600-100	H14600-01	H14600-20	Unit
Spectral response range	300 to 650	300 to 870	300 to 920	nm
Effective photocathode area	ϕ8			mm
Input voltage	+4.5 to +5.5			V
Maximum input current	3.5			mA
Maximum output signal current	100			µA
Maximum ripple noise (p-p)	0.2			mV

Spectral response



Gain



NEW

High-Voltage Power Supply Module C14051-15

-10 kV/0.2 mA output
Designed for applications requiring high voltage such as mass spectrometry

The C14051-15 is a high-voltage power supply module that provides an output of -10 kV/0.2 mA. It is not designed for photomultiplier tube operation but for other applications requiring high voltage such as mass spectrometry.

Features

- Compact and high conversion efficiency
- High output voltage: -10 kV/0.2 mA
- Wide input voltage range: +11 V to +16 V
- Various protective functions
- Output monitor (voltage/current)

Applications

- Mass spectrometry
- Electrostatic chuck
- Ionization
- SEM

C14051-15

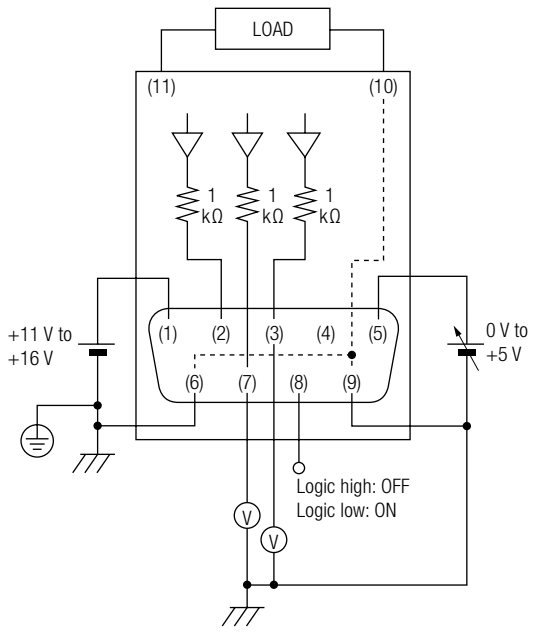
Specifications

Parameter	Specification	Unit
Input voltage	+11 to +16	V
Output voltage	-2,000 to -10,000	V
Maximum output current	0.2	mA
High voltage monitor output range	0 to +2.5	V
Current monitor output range	0 to +4.0	V
Ripple/noise (p-p)*	0.1	V

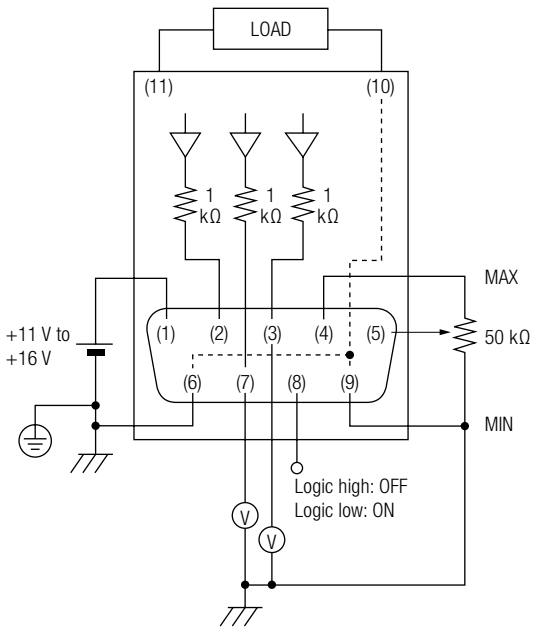
* at maximum output voltage/current

Output voltage control

By external voltage



By external potentiometer



Connector: D-sub 9 pin male

Pin assignment
(1)Vcc +11 V to +16 V
(2)ERROR OUT (0 V or +5 V)
(3)CURRENT MONITOR OUT
(4)Vref 5.1 V
(5)Vcont 0 V to +5 V
(6)Vcc GND
(7)HV MONITOR OUT
(8)ON / OFF IN
(9)Vcont GND
(10)HV GND
(11)HV OUT

* The instability in the external controlling voltage should be minimized as it directly affects the output voltage quality.
* The housing is internally connected to pin (6).
* Pins (6), (9), and (10) are internally connected.

MCP Assembly MIGHTION®
F14845-11

NEW

Hybrid type ion detector using semiconductor and MCP

An ion detector consisting of an MCP (microchannel plate) and AD (avalanche diode). It has various features, such as high-speed response and it provides performance unique to hybrid detectors.

Features

- Fast time response
- High output linearity
- Long life

Applications

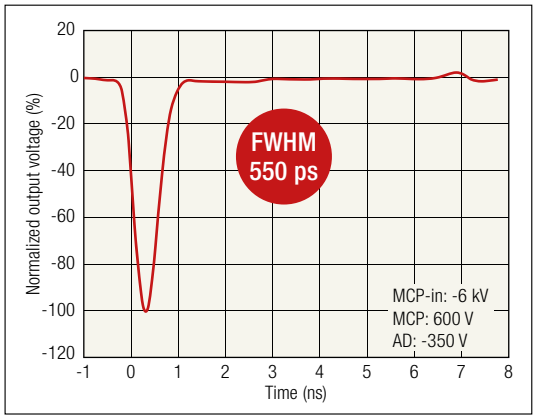
- Mass spectrometry
  - TOF-MS
  - MALDI TOF-MS

F14845-11

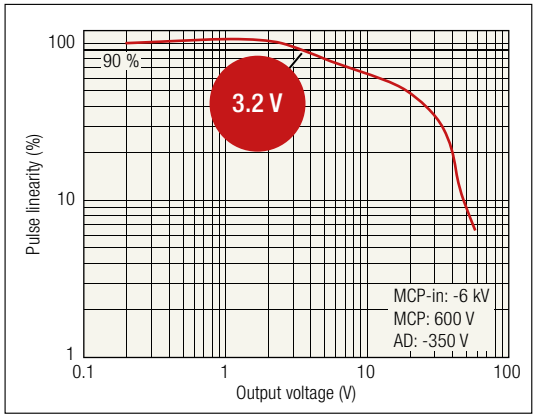
Specifications

Parameter	Specification	Unit
Effective area	ϕ25	mm
Gain (min.)	1×10^6	-
Maximum DC output	230	µA
Life	10 or more	C/cm^2

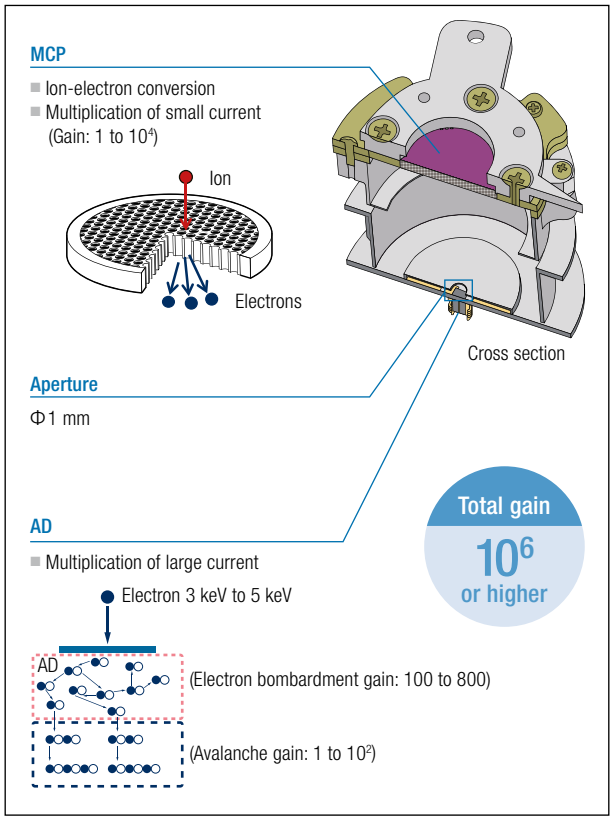
Output waveform



Pulse linearity When terminated at 50 Ω



Structure



NEW

ORCA®-Fusion Digital CMOS Camera C14440-20UP

High S/N and high quantitative observation in the low light range

ORCA-Fusion has significantly improved low-noise performance compared to conventional scientific cameras (sCMOS cameras), and has a higher S/N even when observing low light conditions. In addition, since pixel uniformity is excellent, dynamic pixel correction is unnecessary and observation and measurement can be performed with high quantitative efficiency.

C14440-20UP

Features

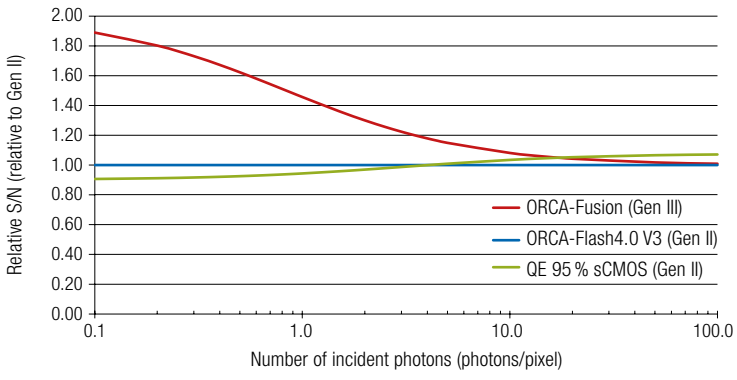
- Low readout noise: 0.7 electrons (rms)
- High image quality: Significantly fewer pixels with large readout noise
- High speed readout: 89.1 frames/s (2304 x 2304), 100 frames/s (2304 x 2048)
- Large field of view: 2304 x 2304 pixels (5.3M pixels), sensor with a diagonal dimension of 21.176 mm
- High resolution: pixel size 6.5 µm
- High sensitivity: ultraviolet to near infrared light region

Applications

- Ultra-low fluorescent live cell imaging
- Semiconductor internal observation
- EL emission observation of solar cells
- TEM image readout
- X-ray II/X-ray scintillator readout
- Observation of bonded wafers

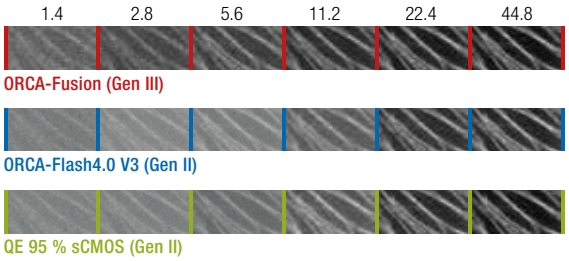
Comparing the S/N to the number of incident photons in new and old sCMOS cameras

This is the result of simulation among three cameras, ORCA-Fusion (Gen III), ORCA-Flash4.0 V3 (Gen II), and QE 95 % sCMOS camera (Gen II), for the difference of S/N and image quality when the number of incident photons in one pixel is changed. It can be seen that the S/N of ORCA-Fusion (Gen III) is higher in regions with fewer incident photons.



Imaging simulation example: ultra-low light fluorescence live cell imaging

Examples of images captured by each camera are shown according to the number of incident photons.



*The Gen III shows the new sCMOS camera and the Gen II shows the old sCMOS camera.

X-ray Line Scan Camera C14300 Series

NEW

Versatile camera for nondestructive in-line inspection in a wide range of fields

C14300 series are X-ray line scan cameras that enable nondestructive in-line inpection in a wide range of fields, including detection of foreign objects contaminating food.

Differences from conventional products

Due to its low noise and high full well capacity, C14300 series enable nondestructive inspection of thin and thick samples, which have been difficult to inspect in the past.

Features

- Low noise and high sensitivity for thin sample inspection
- High dynamic range for thick sample inspection
- Small footprint
- Support for high-speed imaging
- Waterproof and dustproof

Applications

- Foreign objects inspection in food
- Shards or air bubbles inspection in a packaging process
- Baggage inspection
- Content and weight inspection
- Shape and internal void inspection of parts

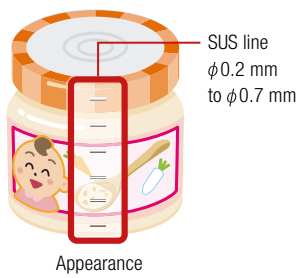
C14300 series

Specifications

Type number	C14300 series (Products available for various detection widths)	Unit
Camera type	X-ray line scan camera	–
Detection method	Scintillator method	–
Scintillator	Gd type scintillator	–
Recommended use range (X-ray sensitivity)	Approx. 25 to 160	kV
Pitch of detected element	0.4	mm
Detection width	153.6 to 614.4	mm
Line speed	4 to 200	m/min
Output signal (image data)	14 digital output	bit
Control interface	USB 3.0	–
Power supply	DC +24	V
Ambient operating temperature	0 to +40	deg. C.
Ambient operating humidity	30 to 70 (With no condensation)	%

Example: Baby food

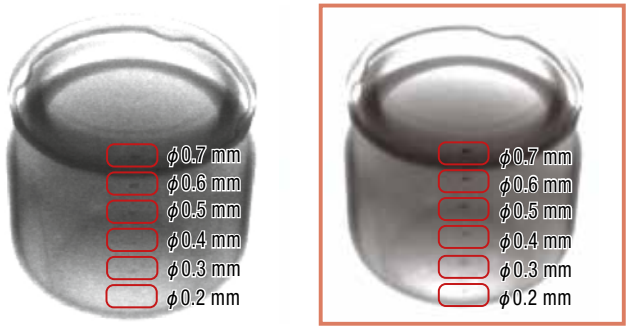
Handling a wide range of signals under high x-ray energy makes it possible to detect metallic objects, even beneath a metal lid.



Appearance

Conventional device
Tube current: 0.8 mA

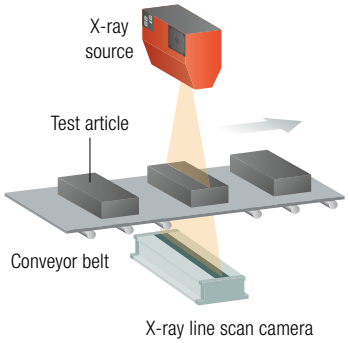
C14300
Tube current: 8.0 mA



Detection of the foreign objects that the metal lid overlapped

Configuration example

In-line detection of internal foreign objects and defects



Wavelength Swept Pulsed Quantum Cascade Laser
L14890-09

NEW

Mid-infrared laser source with high-speed, broadband wavelength sweep

This pulsed quantum cascade laser is capable of broad wavelength sweeps due to its external cavity configuration. It can measure mid-infrared spectrum remotely (without contact) and with high throughput. This product offers new benefits to mid-infrared spectroscopy, which was traditionally carried out with FTIR, by utilizing these laser features: high output and high wavelength resolution.

This product must not be brought into the United States of America. Hamamatsu will not assume any responsibility in the unlikely event that it is incorporated into your products and brought into the United States of America.

Features

- Swept wavelength by MEMS grating
- Broadband QCL based on DAU structure
- High speed and broadband wavelength sweeping
- Built-in collimation lens

Applications

- Mid-infrared spectroscopy
- Resin/plastic film measurement
- Glucose measurement
- Mid-infrared hyperspectral imaging
- Gas measurement

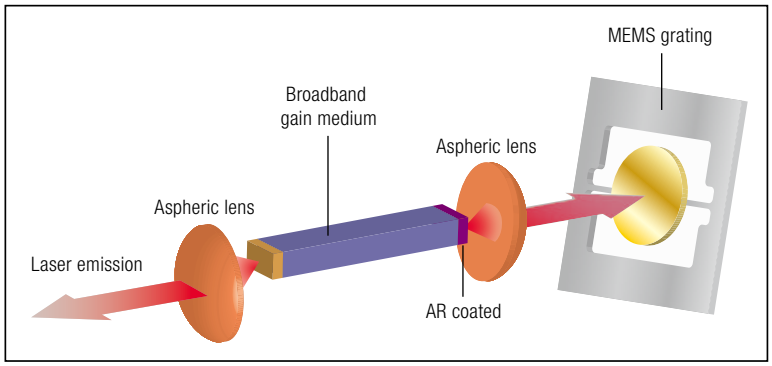
L14890-09

Specifications

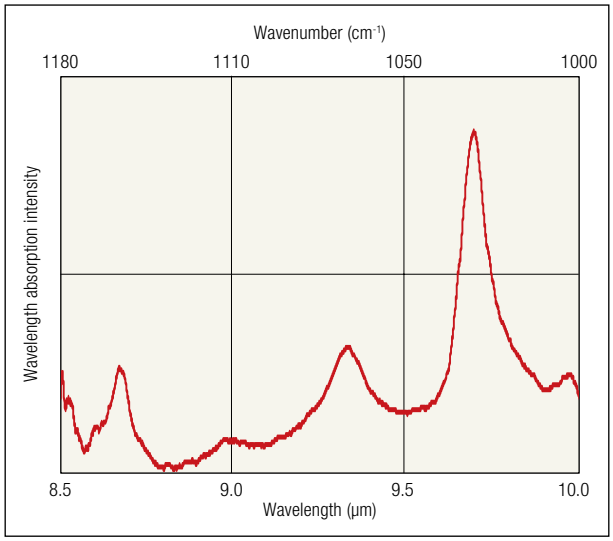
Items	Specifications (Typ.)	Unit
Wavenumber sweep frequency	1.8	kHz
Pulsed output power	600	mW
Optical pulse width	100	ns
Optical pulse repetition frequency	180	kHz
Spectrum linewidth	2.0	cm^{-1}
Center wavenumber	1,075	cm^{-1}
Wavenumber sweep width	200	cm^{-1}

Please contact your local sales office for further details.

Configuration



Example measurement of polystyrene film



* Measure the wavelength from the number of data points.

LD Irradiation Light Source SPOLD®
L13920-411M/-511M

NEW

Laser light source module (with thermal monitoring) for integration into laser processing systems

This is a compact laser irradiation light source that combines fiber output LD modules, drive circuits, and Peltier cooling devices. Its built-in monitoring function reliably acquires thermal information of the laser irradiation points. This enables the “visualization” and control of the laser machining quality, making this light source suitable for integration into a mass production process.

Differences from conventional products

Compliance with the CE standard.

Features

- Simultaneous laser light transmission and thermal detection using a single fiber
- Thermal information of laser irradiation point can be acquired without any adjustment
- Compatible with galvano mirror system
- High speed 1 millisecond sampling to detect an instantaneous change
- Simplified laser processing

Applications

- Plastic welding
- Adhesive thermal curing
- Soldering
- Other process or principle using laser as heat source

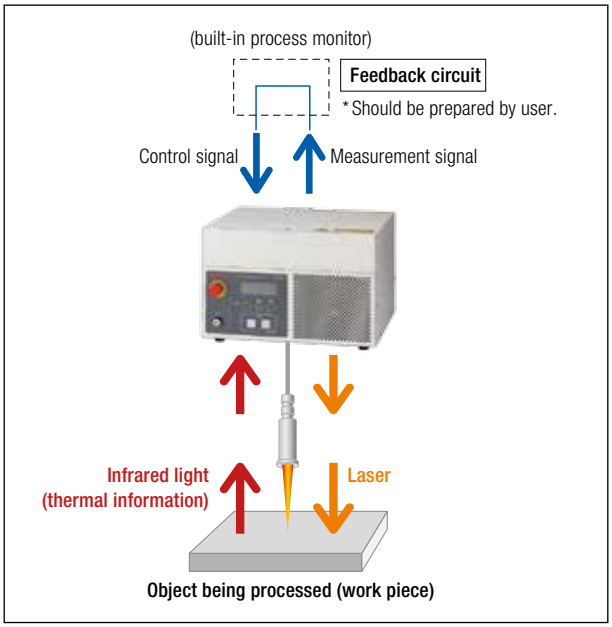
L13920-411M/-511M

Specifications

Items	L13920-411M	L13920-511M	Unit
Light output (with maximum current setting, at the focal spot of irradiation unit)	30	70	W (min.)
Laser type	Laser diode		–
Peak oscillation wavelength (25 deg. C.)	940 ± 20		nm
Cooling method	Air cooling		–
Dimensions (W × H × D)	Approx. 360 × 230 × 360 (excluding projecting parts)		mm
Light condensing spot diameter	Approx. ϕ0.8 ~ ϕ6.4*		mm

* Depending on the fiber core diameter and the condensing magnification.

System diagram



LD Irradiation Light Source SPOLD®
L13920-611

NEW

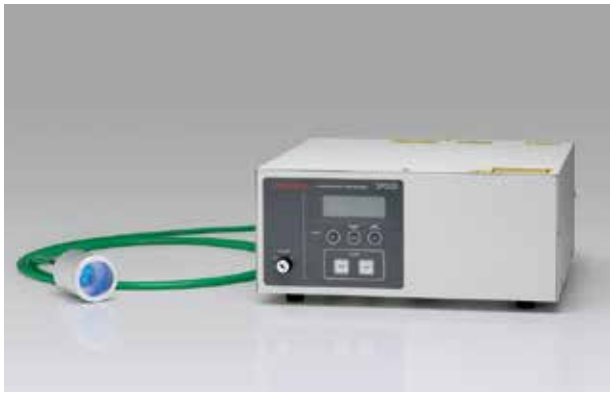
Compact, light-weight spot laser light source suitable for incorporation into equipment

A fiber output laser diode module which can be cooled by distilled water, in a compact package with integrated drive and control circuit. The simplified water cooling management makes it suitable for use in various production lines.

Differences from conventional products
Higher output was achieved.

Features
- High output of 200 W at the fiber output end
- Externally controllable by I/O

Applications
- Plastic welding
- Adhesive thermal curing
- Soldering
- Other process or principle using laser as heat source
- Brazing



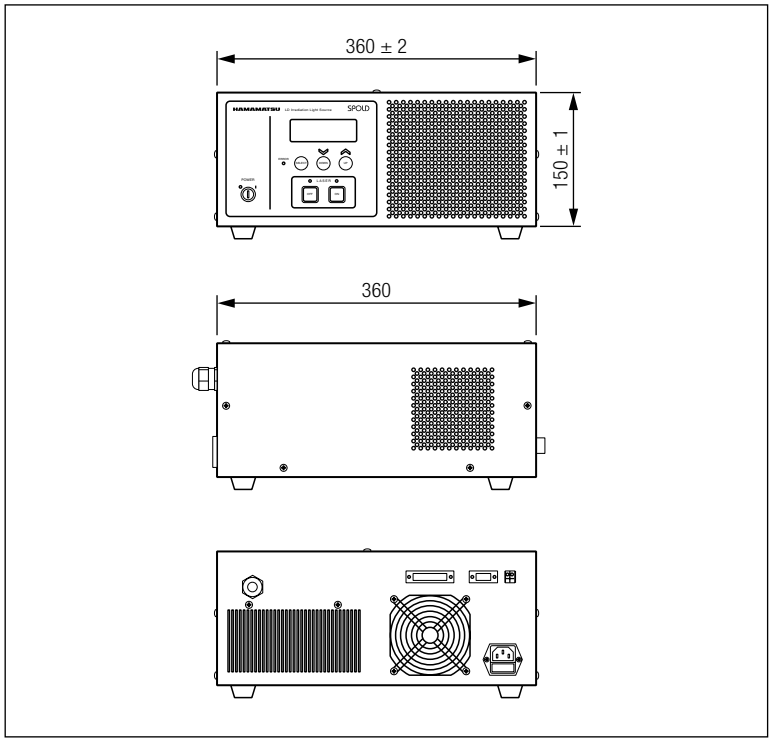
L13920-611

Specifications

Items		Specifications	Unit
Light output (with maximum current setting)	Light output at the fiber output end	200	W (min)
	Light output at irradiation unit output end	180	
Laser type		Laser diode	–
Peak oscillation wavelength (25 deg. C.)		940 ± 20	nm
Cooling method		Water cooling (distilled water circulation)*1	–
Dimensions (W × H × D)		Approx. 360 × 150 × 360 (excluding projecting parts)	mm
Light condensing spot diameter		Approx. ϕ0.8 ~ ϕ6.4*2, 3	mm

*1 The cooling unit must be prepared separately.
Cooling water condition: 2 L/min to 3 L/min, cooling capacity: over 300 W
*2 Depending on the fiber core diameter and the condensing magnification.
*3 It may be possible to cope with ϕ0.6 mm. Please consult us.

Outline L13920 series (unit: mm)



Global Exhibitions 2019

USA

May 2019

Pathology Informatics Summit
May 7-8 2019, Pittsburgh, PA US

CLEO
May 7-9 2019, San Jose, CA US

June 2019

ASMS
June 2-6 2019, Atlanta, GA US

Digital Pathology Congress USA
June 13-14 2019, New York City, NY US

World Preclinical Congress (WPC)
June 17-20 2019, Boston, MA US

CYTO
June 22-26 2019, Vancouver, BC US

Sensors Expo
June 26-27 2019, San Jose, CA US

July 2019

Semicon West
July 9-11 2019, San Francisco, CA US

ICRC
July 25-31 2019, Madison, WI US

August 2019

Optics and Photonics
Aug 13-15 2019, San Diego, CA US

September 2019

LRIG Regional
Sep 1-2 2019, Boston, MA US

WMIC
Sep 4-7 2019, Montreal, QC US

FiO
Sep 17-18 2019, Washington, DC US

CAP
Sep 21-25 2019, Orlando, FL US

Pack Expo
Sep 23-25 2019, Las Vegas, NA US

WEFTEC
Sep 23-25 2019, Chicago, IL US

Europe

May 2019

EOT
May 7-9 2019, Herning, Denmark

Vårmöte i Patologi
May 15-17 2019, Linköping, Sweden

TEC PL
May 16 2019, Warsaw, Poland

Advanced Engineering 2019
May 22-23 2019, Ghent, Belgium

Histologica
May 24-25 2019, Oberhausen, Germany

Optics & Photonics Days 2019
May 27-29 2019, Espoo, Finland

Photonika
May 27-31 2019, Novosibirsk, Russia

SmartAuto
May 28 2019, Warsaw, Poland

SPS IPC Drivers Italia 2019
May 28-30 2019, Parma, Italy

Respiratory Research Day
May 29 2019, Nottingham UK

June 2019

19. ELMI
June 4-7 2019, Brno, Czech Republic

Scandem
June 11-14 2019, Gothenburg, Sweden

WSRM 10th Congress
June 12-15 2019, Bologna, Italy

103. Jahrestagung DGP
June 13-15 2019, Frankfurt, Germany

Laser World of Photonics
June 24-27 2019, Munich, Germany

3rd Jagiellonian Symposium on Fundamental and Applied Subatomic Physics
June 24-28 2019, Krakow, Poland

Hamamatsu Photonics FDSS Symposium
June 25 2019, Barcelona, Spain

dXCT Conference
June 25-26 2019, Huddersfield, UK

Sensor und Test
June 25-27 2019, Nuremberg, Germany

Agri Food Innovation Event
June 26-27 2019, Venlo, Netherlands

SLAS Europe
June 26-28 2019, Barcelona, Spain

July 2019

Symposium on High-Reso Molecular Spectroscopy
July 1-5 2019, Nizh. Novgorod, Russia

Microscience Microscopy Congress
July 3-6 2019, Manchester, UK

IOP Nuclear Physics Conference
July 29-Aug 2 2019, Glasgow, UK

August 2019

OWL Conference
Aug 24-30 2019, Olginka, Russia

9. SMLMS
Aug 26-28 2019, Delft, Netherlands

September 2019

BMSS
Sep 2-5 2019, Manchester UK

IBIC 2019
Sep 8-12 2019, Malmö, Sweden

MipTec
Sep 9-12 2019, Basel, Switzerland

IAA
Sep 9-13 2019, Frankfurt, Germany

ESRIC Super Resolution Summer School
Sep 15-19 2019, Edinburgh, UK

17th Europ. Congress of Toxicologic Pathology
Sep 17-20 2019, Köln, Germany

ESREF
Sep 23-26 2019, Toulouse, France

Measurement World
Sep 24-26 2019, Paris, France

UK Space Conference
Sep 24-26 2019, Wales, UK

Labelexpo
Sep 24-27 2019, Brussels, Belgium

Ilmac
Sep 24-27 2019, Bern, Switzerland

98th Annual meeting of the German Physiological Society
Sep 30-Oct 2 2019, Ulm, Germany

October 2019

Seeing is Believing – Imaging the molecular processes of life
Oct 9-12 2019, Heidelberg, Germany

Radtech
Oct 15-16 2019, Munich, Germany

Evertiq Expo Cracow
Oct 17 2019, Cracow, Poland

19. Bundeskongress Pathologie
Oct 18-19 2019, Berlin, Germany

NSS MIC
Oct 26-Nov 2 2019, Manchester, UK

IJC Inkjet Conference
Oct 29-30 2019, Düsseldorf, Germany

November 2019

InPrint
Nov 12-14 2019, Munich, Germany

CompaMed
Nov 18-21 2019, Düsseldorf, Germany

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