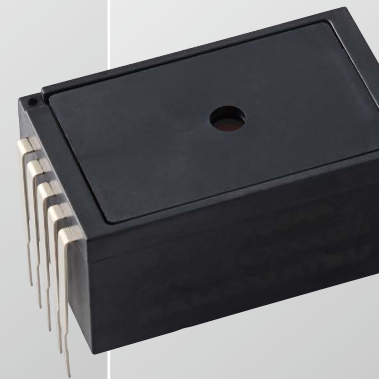


Compact spectrometers with built-in Hamamatsu image sensor, optical element, etc.

# Mini-spectrometers



## Related product



Raman spectroscopic module



FTIR engines (FT-NIR spectrometer)



MEMS-FPI spectroscopic modules

# Mini- spectrometers



**We have more than  
20 different  
mini-spectrometers  
for the ultraviolet to  
near infrared regions.**

# What are mini-spectrometers?

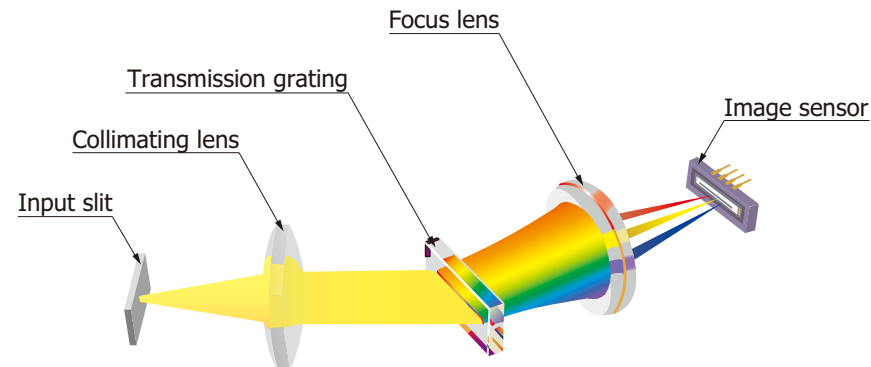
Mini-spectrometers are small spectrometers (polychromators) with an integrated optical system, image sensor, and driver circuit. They are portable devices that make them possible to do real-time measurement on-site.



## Applications

- Color measurement
- Sugar content measurement
- Film thickness measurement
- Plastic screening
- Fluorescence measurement
- Environmental analysis
- Mobile measuring devices

## ● Example of mini-spectrometer optical system



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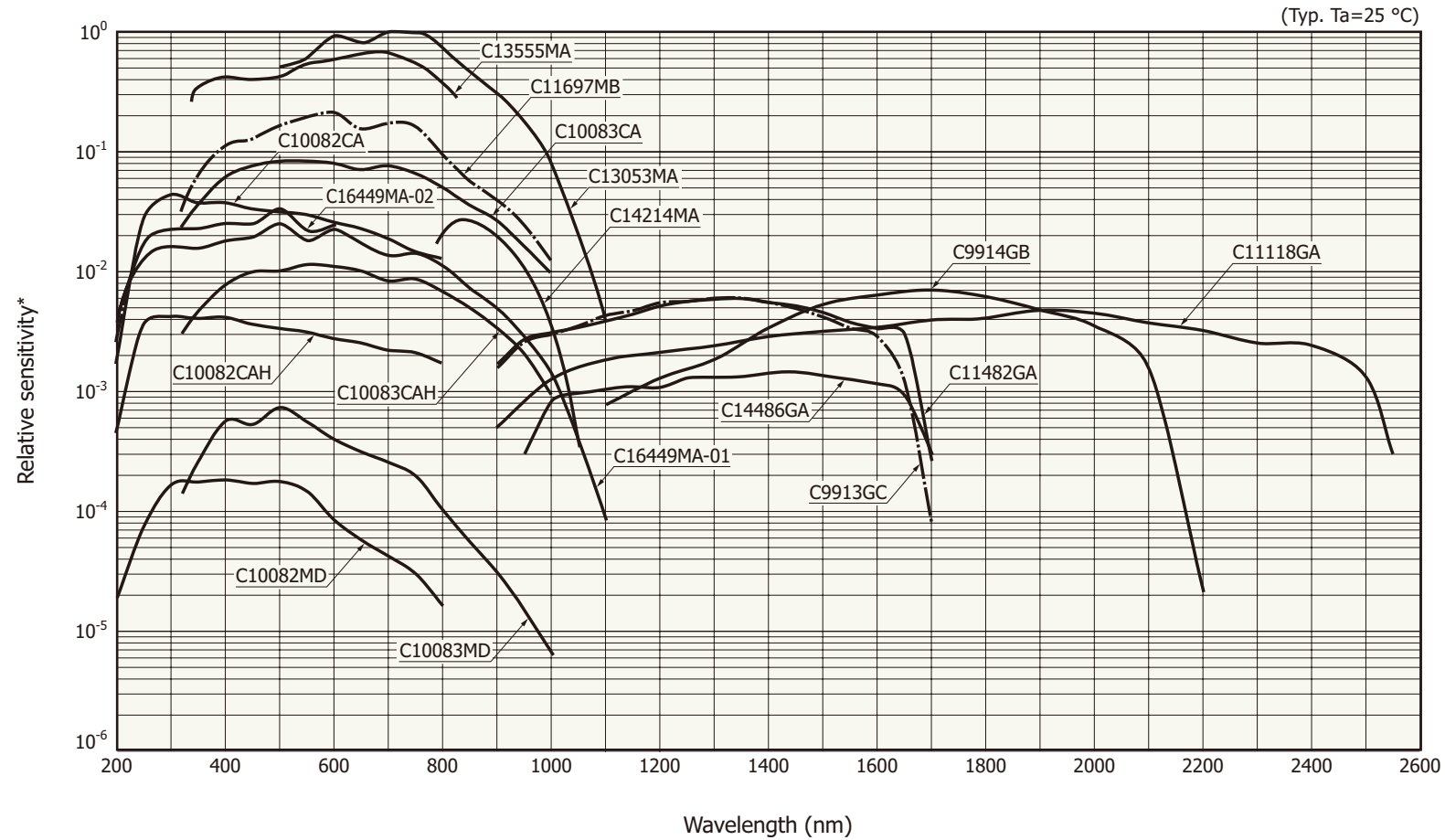


Ultra-small spectrometer heads (without a driver circuit) are also available.

Series	Products	Spectral response range (nm)												
		UV		Visible				Near infrared						
		200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600
<a href="#">For ultraviolet range</a>	High sensitivity <a href="#">C10082CA</a> High resolution <a href="#">C10082CAH</a> Wide dynamic range <a href="#">C10082MD</a>	200 to 800												
	High resolution <a href="#">C16449MA-02</a>	200 to 600												
<a href="#">For ultraviolet to near infrared range</a>	High sensitivity <a href="#">C16449MA-01</a>	190 to 1100												
<a href="#">For visible range</a>	High sensitivity <a href="#">C10083CA</a> High resolution <a href="#">C10083CAH</a> Wide dynamic range <a href="#">C10083MD</a> High sensitivity <a href="#">C11697MB</a>	320 to 1000												
	High sensitivity <a href="#">C13555MA</a>	340 to 830												
<a href="#">For visible to near infrared range</a>	High near IR sensitivity <a href="#">C9405CC</a> High sensitivity <a href="#">C13053MA</a>	500 to 1100												
<a href="#">For near infrared range</a>	Non-cooled type <a href="#">C11482GA</a> Cooled type <a href="#">C9913GC</a>	900 to 1700												
	Cooled type <a href="#">C9914GB</a>	1100 to 2200												
	Cooled type <a href="#">C11118GA</a>	900 to 2550												
	Compact type <a href="#">C14486GA</a>	950 to 1700												
<a href="#">For Raman spectroscopy</a>	High resolution <a href="#">C14214MA</a>	790 to 1050												

Note: See [P.13](#) for details on spectrometer heads.

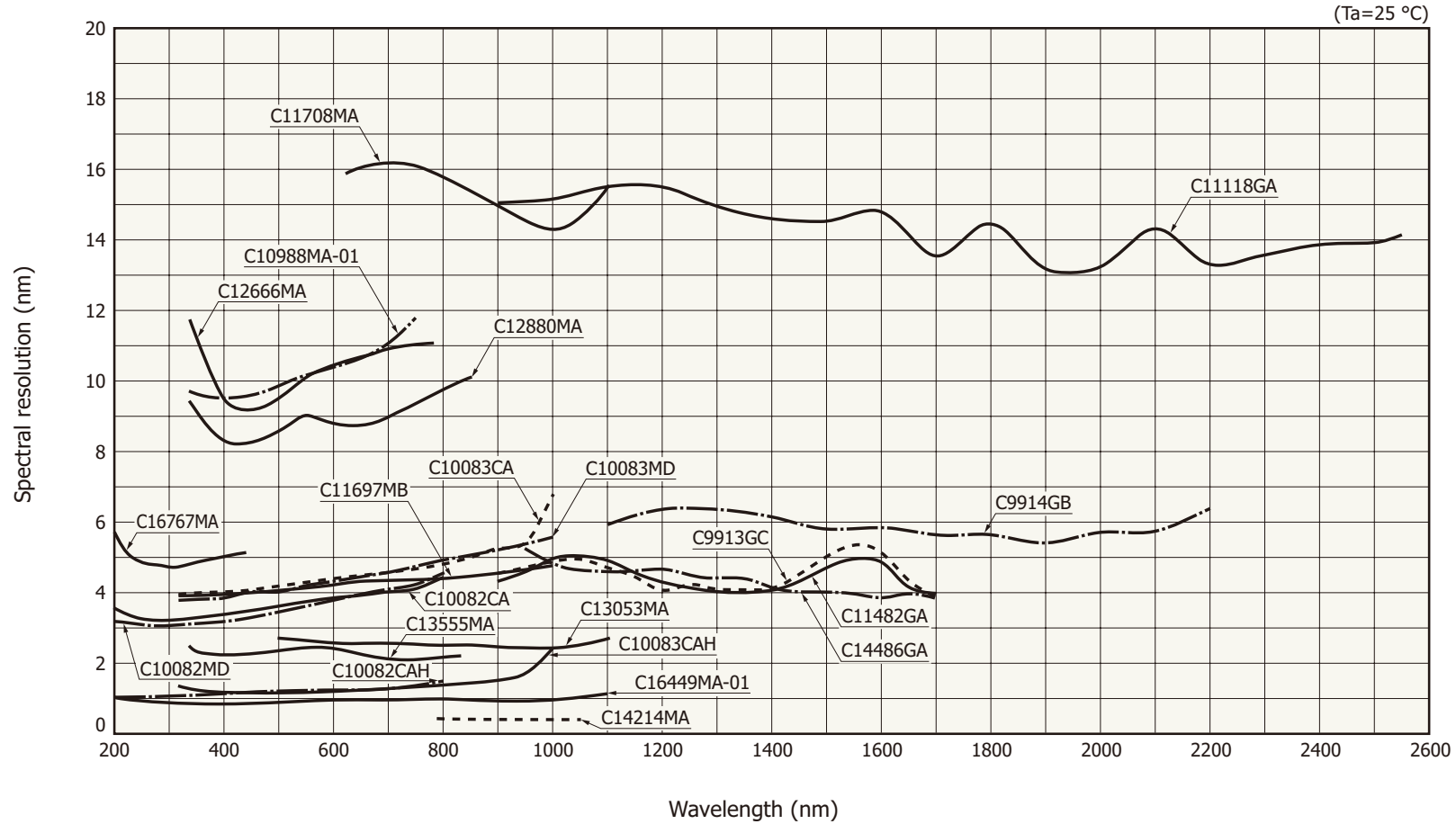
## Spectral response



\* A/D count when constant light level enters optical fiber  
(Fiber core diameter: 600  $\mu\text{m}$ , assuming no attenuation in optical fiber)

KACCB0137ER





### Spectral resolution vs. wavelength (typical example)



KACCB0139ER


## For ultraviolet range

These are products with sensitivity in the ultraviolet range.

Type no.	Type	Spectral response range (nm)						Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo
		UV	Visible			Near infrared							
		200	400	600	800								
<a href="#">C10082CA</a>	High sensitivity	200 to 800						4	446 : 1	+5 V	Back-thinned CCD S10420-1106-01	95 × 92 × 76	
<a href="#">C10082CAH</a>	High resolution	200 to 800						1	446 : 1	+5 V	Back-thinned CCD S10420-1106-01	95 × 92 × 76	
<a href="#">C10082MD</a>	Wide dynamic range	200 to 800						4	4390 : 1	Not required (USB bus power only)	CMOS linear image sensor S8378-1024Q	94 × 90 × 55	
<a href="#">C16449MA-02</a>	High sensitivity	200 to 600						0.45	316 : 1	Not required (USB bus power only)	High-sensitivity CMOS image sensor	80 × 75 × 25	






## For ultraviolet to near infrared range

It is a wide spectral response type with sensitivity extending from the UV region.

Type no.	Type	Spectral response range (nm)						Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo
		UV	Visible			Near infrared							
		200	400	600	800	1000	1200						
<a href="#">C16449MA-01</a>	High resolution	190 to 1100						1	316 : 1	Not required (USB bus power only)	High-sensitivity CMOS image sensor	80 × 75 × 25	



## For visible range

These are products with sensitivity in the visible range.

Type no.	Type	Spectral response range (nm)							Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo
		UV		Visible			Near infrared							
		200	400	600	800	1000								
<a href="#">C10083CA</a>	High sensitivity			320 to 1000					5	446 : 1	+5 V	Back-thinned CCD S10420-1106-01	95 × 92 × 76	
<a href="#">C10083CAH</a>	High resolution			320 to 1000					1	446 : 1	+5 V	Back-thinned CCD S10420-1106-01	95 × 92 × 76	
<a href="#">C10083MD</a>	Wide dynamic range			320 to 1000					5	4390 : 1	Not required (USB bus power only)	CMOS linear image sensor S8378-1024Q	94 × 90 × 55	
<a href="#">C11697MB</a>	High sensitivity			320 to 1000					5	260 : 1	Not required (USB bus power only)	High-sensitivity CMOS linear image sensor S11639	94 × 90 × 55	
<a href="#">C13555MA</a>	High sensitivity			340 to 830					2.3	230 : 1	Not required (USB bus power only)	High-sensitivity CMOS linear image sensor	80 × 60 × 12	






## For visible to near infrared range

These are products with sensitivity in the visible to near infrared range.

Type no.	Type	Spectral response range (nm)						Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo
		UV	Visible			Near infrared							
		200	400	600	800	1000	1200						
<a href="#">C9405CC</a>	High near IR sensitivity			500 to 1100				4	446 : 1	+5 V	Back-thinned CCD S16010-1006	125.7 × 115.7 × 75	
<a href="#">C13053MA</a>	High sensitivity			500 to 1100				2.5	230 : 1	Not required (USB bus power only)	High-sensitivity CMOS linear image sensor	80 × 60 × 12	


## For near infrared range

These are products with sensitivity in the near infrared range.

Type no.	Type	Spectral response range (nm)											Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo	
		Near infrared																	
		800	1000	1200	1400	1600	1800	2000	2200	2400	2600								
<a href="#">C11482GA</a>	Non-cooled type													5	7700 : 1	Not required (USB bus power only)	InGaAs linear image sensor G9204-512DA	38.5 × 106 × 86	
<a href="#">C9913GC</a>	Cooled type													5	6100 : 1	+5 V, +12 V	InGaAs linear image sensor G9204-512SA	142 × 218 × 82	
<a href="#">C9914GB</a>	Cooled type													6	6100 : 1	+5 V, +12 V	InGaAs linear image sensor	142 × 218 × 82	
<a href="#">C11118GA</a>	Cooled type													15	7700 : 1	+5 V, +12 V	InGaAs linear image sensor G9208-256WB-02	142 × 218 × 82	
<a href="#">C14486GA</a>	Compact type													5	6900 : 1	Not required (USB bus power only)	InGaAs linear image sensor	80 × 60 × 12	


## For Raman spectroscopy

It is a product with sensitivity in the Raman spectroscopy.

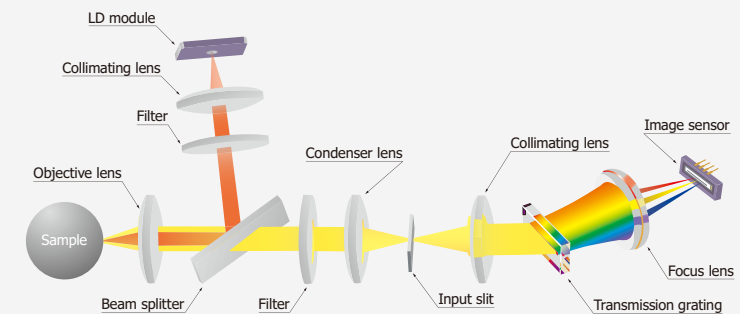
Type no.	Type	Spectral response range (nm)						Spectral resolution typ. (nm)	S/N max.	External power supply	Built-in image sensor	Size (mm)	Photo
		UV		Visible		Near infrared							
		200	400	600	800	1000							
<a href="#">C14214MA</a>	High resolution							0.4	230 : 1	Not required (USB bus power only)	High-sensitivity CMOS linear image sensor	100 × 60 × 12	

### Related product Spectroscopic module

This Raman spectroscopic module integrates various Hamamatsu technologies, including our mini-spectrometers and compact optical system (excitation wavelength: 785 nm).

Type no.	Laser output (mW)	External power supply	Internal image sensor	Size (mm)	Photo
<a href="#">C15471</a>	5, 25, 50	+5 V	High-sensitivity CMOS linear image sensor	130 × 60 × 20 (excluding the lens unit)	






#### ● Optical component layout



KACCC1027EA

# Spectrometer heads

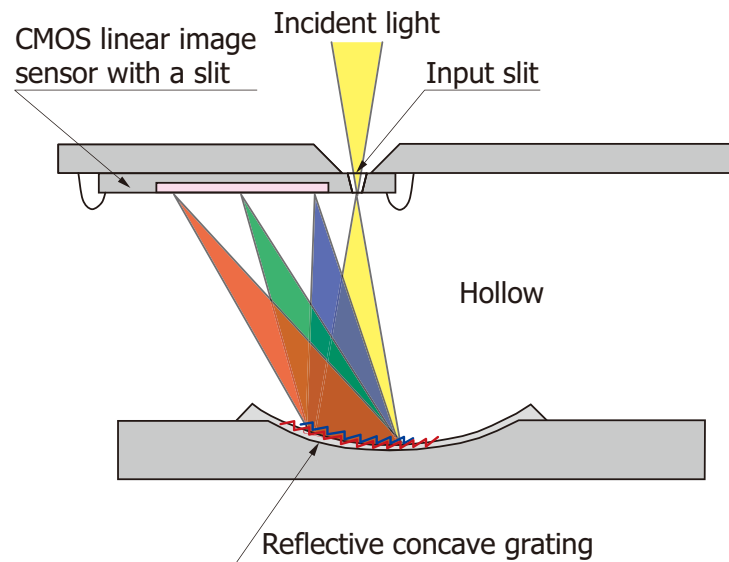
The compact spectrometer heads (without a driver circuit) integrate an optical system and an image sensor.

Type no.	Type	Spectral response range (nm)							Spectral resolution typ. (nm)	S/N max.	Built-in image sensor	Size (mm)	Photo
		UV	Visible			Near infrared							
		200	400	600	800	1000							
<a href="#">C16767MA</a>	For ultraviolet range	190 to 440							5.5	293 : 1	High-sensitivity CMOS linear image sensor	20.1 × 12.5 × 10.1	
<a href="#">C16767MA-01</a>	For ultraviolet range	190 to 440							3.2	293 : 1	High-sensitivity CMOS linear image sensor	20.1 × 12.5 × 10.1	
<a href="#">C12666MA</a>	Wide dynamic range	340 to 780							12	5300 : 1	CMOS linear image sensor	20.1 × 12.5 × 10.1	
<a href="#">C12880MA</a>	High sensitivity	340 to 850							12	291 : 1	High-sensitivity CMOS linear image sensor	20.1 × 12.5 × 10.1	
<a href="#">C11708MA</a>	For near IR	640 to 1050							15	5300 : 1	CMOS linear image sensor	27.6 × 16.8 × 13	

## Optical system in the compact spectrometer heads

The miniaturization of the spectrometer head has been achieved by employing a CMOS image sensor with a slit formed by etching and a grating fabricated by nanoimprinting within the optical system.

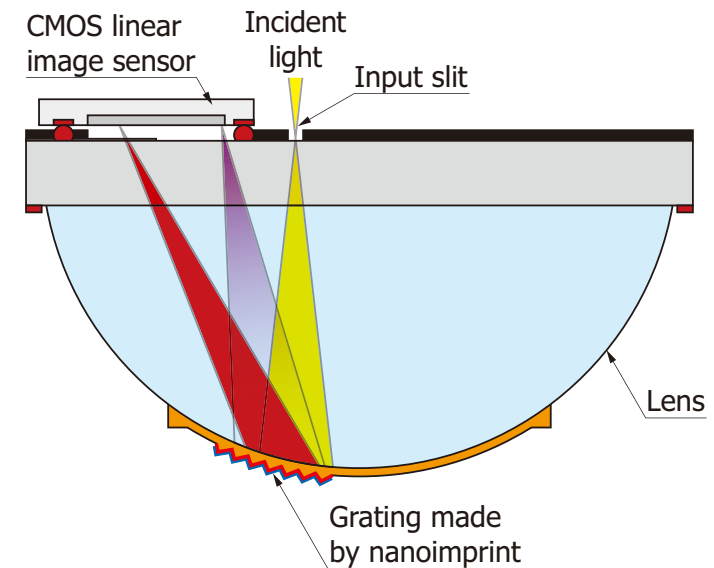
### C12666MA, C12880MA, C16767MA, C16767MA-01



KACCC1035EB

The metal package provides high humidity resistance (C12666MA, C12880MA). Low cost is achieved because it is a hollow type.

### C11708MA



KACCC0922EC

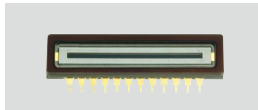
The glass used does not expand easily with rising temperatures, so the temperature dependency of the wavelength is extremely small.

Mini-spectrometers, employ MOEMS (micro-opto-electro-mechanical-systems) technology, combining an image sensor / optical system and MEMS.

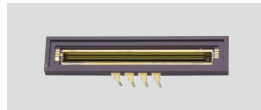
## MOEMS technologies

### Image sensors

- Uses one of Hamamatsu image sensor lineup to support various wavelengths
- Available with custom design



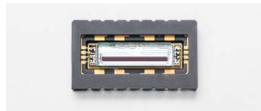
▲ CCD image sensor



▲ High-sensitivity CMOS linear image sensor



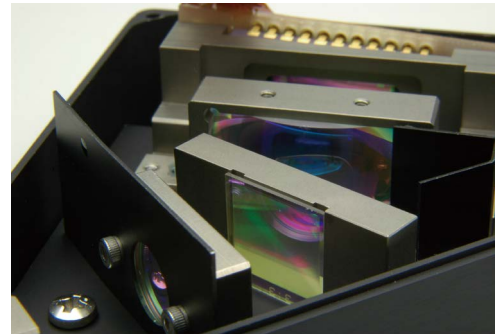
▲ TE-cooled InGaAs linear image sensor



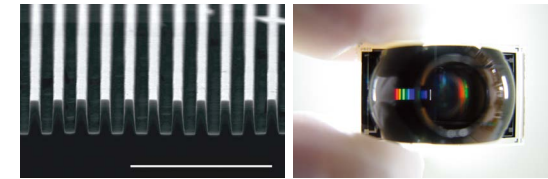
▲ IR-enhanced CMOS linear image sensor

### Optical system

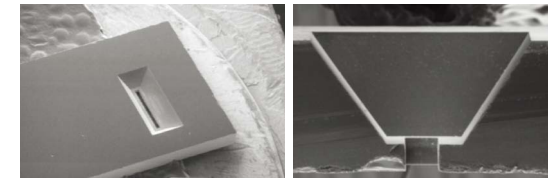
- Optical design suitable for spectrometers
- Optical simulation



### MEMS



▲ Grating that uses nanoimprint



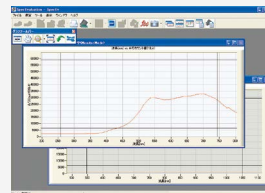
▲ Image sensor with a through-hole slit



### Software

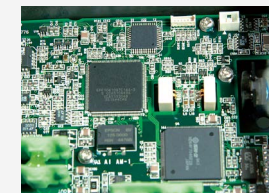
Supports various communication interfaces (e.g., USB)

Evaluation software available ▶



### Circuits

- Unique driver circuits
- Evaluation circuits available for spectrometer heads

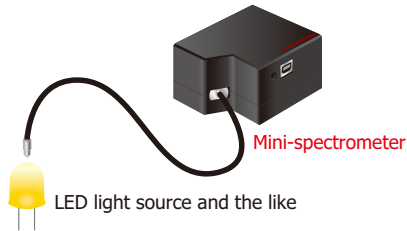


Mini-spectrometers

# Application examples

Mini-spectrometers can be incorporated into a variety of devices and are used in a wide range of applications.

## Color measurement (e.g., LED light source)



KACCC0796EA

A mini-spectrometer is used to perform spectral measurement and inspect LEDs or the like.

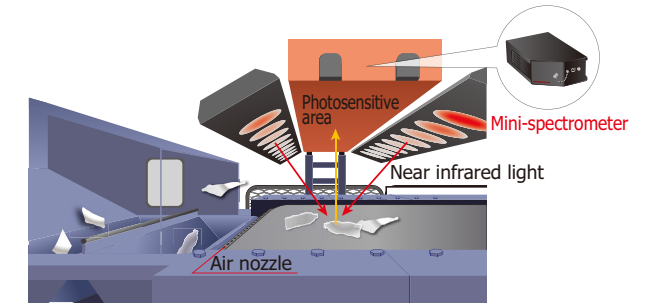
## Sugar content measurement



KACCC0797EA

A mini-spectrometer is used in applications such as handy brix meters, which measure sugar content by absorbance.

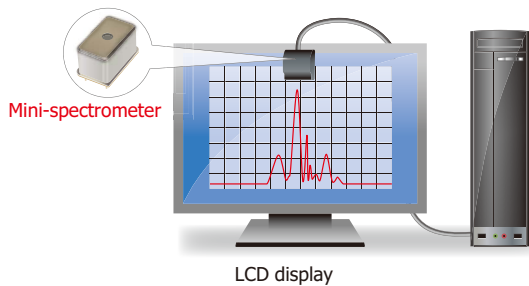
## Plastic screening



KACCC0601EB

Plastic screening is performed by using the fact that when near infrared light is directed at plastic, the wavelengths that are absorbed varies depending on the material.

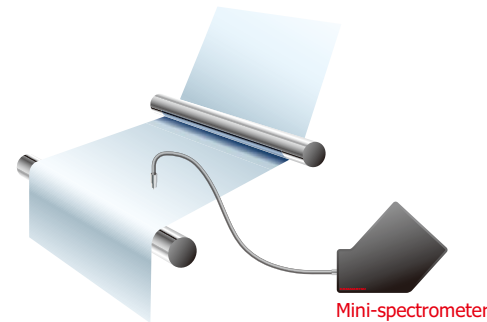
## Display color measurement



KACCC0599EC

The emission spectrum of LCDs is monitored with a mini-spectrometer.

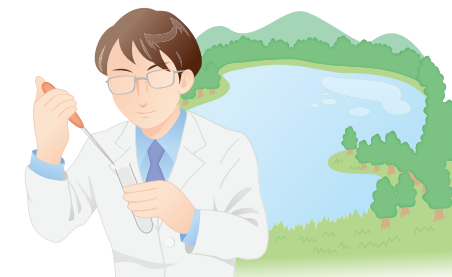
## Film thickness measurement



KACCC0600EB

White light interferometry is used to measure the spectrum peak count, film refractive index, and film thickness from the light incident angle.

## Environmental analysis



KACCC0798EB

A mini-spectrometer is used in environmental analysis of water, soil, and the like.

Accessories for mini-spectrometers (sold separately) are available.

### Input optical fibers A16962 series, A16963 series

UV/visible optical fiber (UV resistant) and visible/NIR optical fiber are available.

Type no.	Product name	Core diameter ( $\mu\text{m}$ )	Minimum bend radius (mm)	Specification
A16962-01	Ultraviolet/visible optical fiber (UV resistant)	600	132	NA=0.22 1.5 m in length, with SMA905D connector on each end Operating temperature: 0 °C to +60 °C Storage temperature: -10 °C to +70 °C
A16962-02		800	176	
A16963-01	Visible/near infrared optical fiber	600	132	
A16963-02		800	176	

### External trigger coaxial cables A10670, A12763

Cable	Applicable mini-spectrometers	Length (m)
A10670	C10082CA, C10082CAH, C10082MD, C10083CA, C10083CAH, C10083MD, C11118GA, C11697MB, C11482GA	1.5
A12763	C13555MA, C13053MA, C14486GA, C14214MA, C16449MA-01, C16449MA-02	

### 2 W xenon flash lamp modules L13651 series



These lamp modules integrate a 2 W xenon flash lamp with a power supply and trigger socket, and are designed to extract maximum performance from the lamp.

#### Features

- Compact: 42 mm × 42 mm × 37 mm
- Operates on 5 V mobile battery
- Long life:  $1 \times 10^9$  flash
- Repetition rate: 1250 Hz max.
- Broad spectrum:  
UV region to middle IR region

[Note: We offer a catalog of xenon flash lamps.](#)

# FTIR engines (FT-NIR spectrometer)

Compact FT-NIR spectroscopic modules that can be incorporated into portable measuring instruments and in-line measuring instruments



The Fourier transform infrared spectrometer (FTIR) engines are compact enough to carry in just one hand. A Michelson optical interferometer and a control circuit are built into a palm-sized case. Spectrum and absorbance can be measured by connecting a PC.

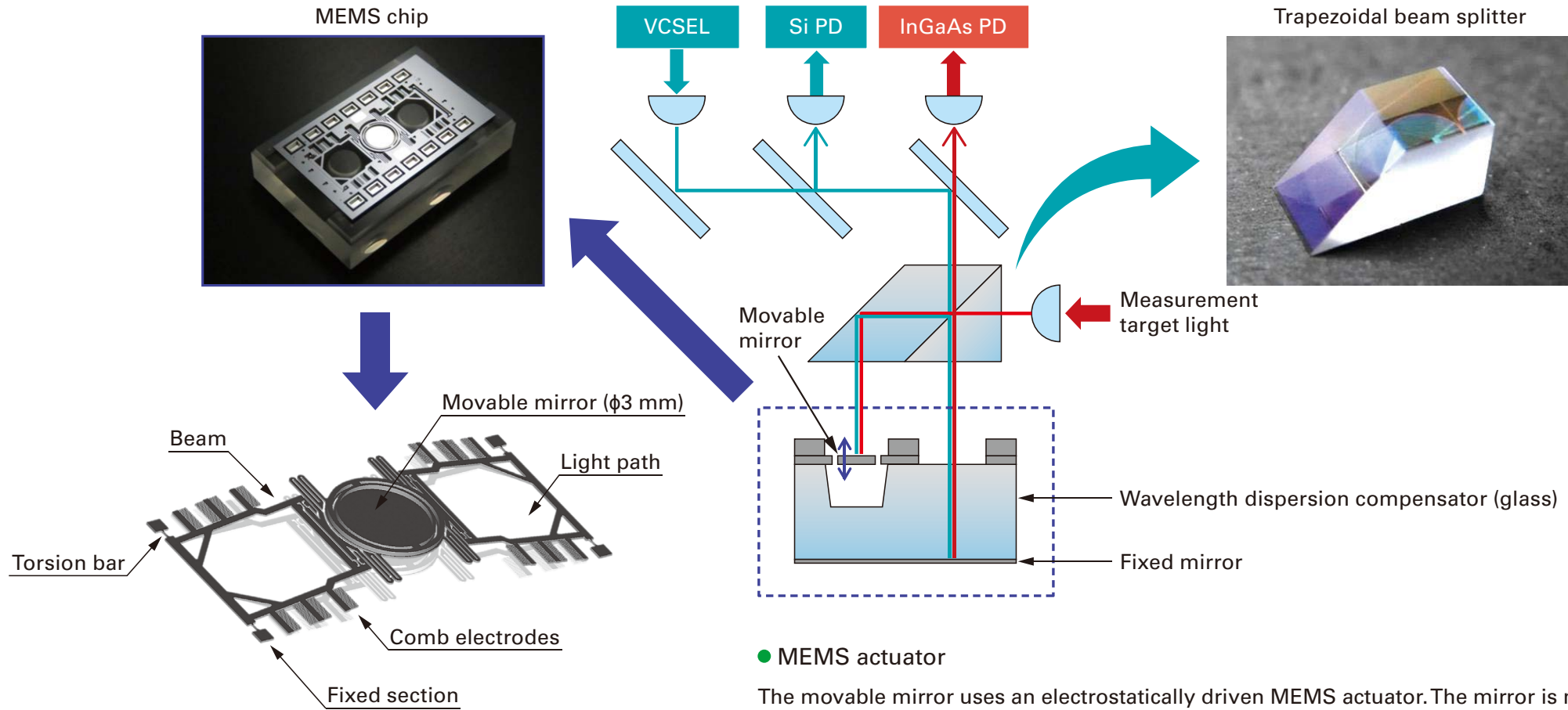
Features	Applications
<ul style="list-style-type: none"> <li>· Compact</li> <li>· High speed 275 frames/s typ. (C16511-01)</li> <li>· Optical fiber input type</li> <li>· High S/N</li> <li>· Suitable for diffuse reflection measurements and absorbance measurements</li> <li>· Spectral response range: 1100 nm to 2500 nm</li> <li>· Interface C15511-01: USB 2.0 C16511-01: Ethernet compatible (GigE Vision)</li> </ul>	<ul style="list-style-type: none"> <li>· FA, PAT (Process Analytical Technology)</li> <li>· Bioprocess analysis</li> <li>· Material analysis</li> <li>· Farm product and food inspection</li> <li>· Plastic sorting</li> <li>· Medicines inspection</li> </ul>

Type no.	Spectral response range (nm)										Spectral resolution (nm)	
	Near infrared											
	800	1000	1200	1400	1600	1800	2000	2200	2400	2600		
<a href="#">C15511-01</a> <a href="#">C16511-01</a>											1100 to 2500	5.7 typ. (λ=1533 nm)

# Optical system

The optical interferometer of the FTIR engine consists of a MEMS chip, as well as the light input section, beam splitter, fixed mirror, and photodetector.

## Optical system of FTIR engine



● MEMS actuator

The movable mirror uses an electrostatically driven MEMS actuator. The mirror is moved up and down in parallel by applying voltage to comb electrodes.

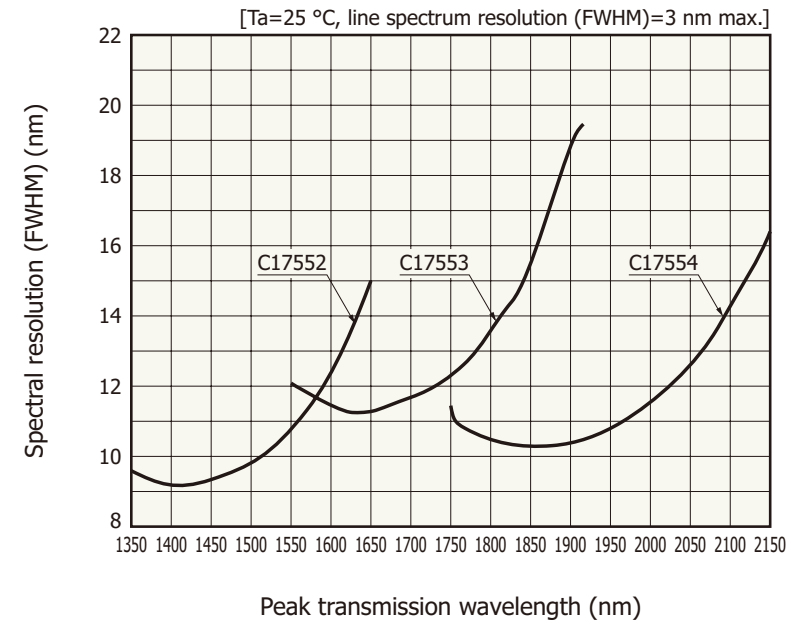
# MEMS-FPI spectroscopic modules

These compact modules have a built-in MEMS-FPI spectrum sensor and light source.



MEMS-FPI spectroscopic modules	Spectral response range (nm)								Spectral resolution (full width at half maximum) max. (nm)
	Near infrared								
	800	1000	1200	1400	1600	1800	2000	2200	
<a href="#">C17552</a>			1350 to 1650						18
<a href="#">C17553</a>			1550 to 1920						21
<a href="#">C17554</a>			1750 to 2150						22





- Spectral resolution vs. peak transmission wavelength (typical example)



KACCB0764EA

# Compact spectrometers for near infrared range

A wide variety of compact spectrometers for the near infrared region are available.

Product name	Type no.	Spectral response range (nm)											Features	Spectroscopic technology	Spectral resolution (nm)	Size (mm)	Photo			
		Near infrared																		
		800	1000	1200	1400	1600	1800	2000	2200	2400	2600									
FTIR engine (FT-NIR spectrometer)	<a href="#">C15511-01</a>														1100 to 2500	High precision measurement, high wavelength accuracy	MEMS-FTIR	5.7 typ. (λ=1533 nm)	49 × 57 × 76	
FTIR engine (FT-NIR spectrometer)	<a href="#">C16511-01</a>														1100 to 2500	High precision measurement, high wavelength accuracy, ethernet compatible	MEMS-FTIR	5.7 typ. (λ=1533 nm)	68 × 57 × 76	
MEMS-FPI spectroscopic modules	<a href="#">C17552</a> <a href="#">C17553</a> <a href="#">C17554</a>														1350 to 1650 1550 to 1920 1750 to 2150	Compact, suitable for portable devices, excellent high-volume producibility, built-in light source	Fabry-Perot	22 max. (C17554, λ=2150 nm)	74 × 32 × 16	
Mini-spectrometer	<a href="#">C14486GA</a>														950 to 1700	High-speed measurement, high sensitivity	Grating	5.0 typ.	80 × 60 × 12	

- [Disclaimer](#)
- [Precautions / Mini- spectrometers](#)

Information described in this material is current as of December 2025.

Product specifications are subject to change without prior notice due to improvements or other reasons. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.