This compact module has a built-in light source, control circuit, and MEMS-FPI spectrum sensor consisting of an InGaAs PIN photodiode and MEMS-FPI (Fabry-Perot Interferometer) tunable filter which can vary its transmission wavelength by changing the applied voltage. Spectrum and absorbance can be measured by connecting a PC via USB. The product includes evaluation software with functions for setting measurement conditions, acquiring and saving data, drawing graphs, and so on. Furthermore, the dynamic link library (DLL) function specifications are disclosed, so users can create their original measurement software programs.

**Features**

- Compact, thin case
- MEMS-FPI spectrum sensor and light source are installed.
- Spectral response range
  - C15712: 1350 to 1650 nm
  - C15713: 1550 to 1850 nm
  - C15714: 1750 to 2150 nm
- External power supply not necessary: USB 2.0 bus powered
- Transmission wavelength shift due to the ambient temperature change is corrected.
- High-speed measurement

**Applications**

- Moisture detection
- Food inspection
- Farm product inspection
- Plastic screening
- Fabric identification, etc.

**Structure**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>C15712</th>
<th>C15713</th>
<th>C15714</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensor</td>
<td>MEMS-FPI spectrum sensor</td>
<td>C14272</td>
<td>C13272-03</td>
<td>C14273</td>
</tr>
<tr>
<td>Light source</td>
<td>Tungsten lamp</td>
<td>C14272</td>
<td>C13272-03</td>
<td>C14273</td>
</tr>
<tr>
<td>Interface</td>
<td>USB 2.0 micro-B</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Dimensions</td>
<td>74 × 32 × 16 mm</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Weight</td>
<td>82 g</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**Absolute maximum ratings**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature*1</td>
<td>Topr</td>
<td>-5 to +50</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature*1</td>
<td>Tstg</td>
<td>-20 to +70</td>
<td>°C</td>
</tr>
</tbody>
</table>

*1: No dew condensation

When there is a temperature difference between a product and the surrounding area in high humidity environments, dew condensation may occur on the product surface. Dew condensation on the product may cause deterioration in characteristics and reliability.

Note: Exceeding the absolute maximum ratings even momentarily may cause a drop in product quality. Always be sure to use the product within the absolute maximum ratings.
Optical characteristics (Ta=25 °C unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>C15712</th>
<th>C15713</th>
<th>C15714</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spectral response range*2</td>
<td>λ</td>
<td>1350</td>
<td>-</td>
<td>1650</td>
<td>nm</td>
</tr>
<tr>
<td>Spectral resolution (FWHM)*3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Wavelength reproducibility*4</td>
<td>λr</td>
<td>-</td>
<td>±2</td>
<td>-</td>
<td>nm</td>
</tr>
<tr>
<td>Wavelength temperature dependence*5</td>
<td>λTd</td>
<td>-0.1</td>
<td>+0.1</td>
<td>-0.1</td>
<td>nm/°C</td>
</tr>
</tbody>
</table>

*2: Minimum step 0.1 nm, maximum 901 wavelength points can be set.
*3: When the light [line spectrum resolution (FWHM)=3 nm max.] is input from the optical fiber (core diameter=600 μm, NA=0.22) connected by the fiber adapter A15719.
*4: When the incident light condition and usage environment are constant
*5: Topr=-5 to +50 °C, C15712: λ=1500 nm, C15713: λ=1700 nm, C15714: λ=1950 nm

Electrical characteristics (Ta=25 °C unless otherwise noted)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Specification</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>A/D conversion</td>
<td>16</td>
<td>bit</td>
</tr>
<tr>
<td>Gain*6</td>
<td>Low</td>
<td>1.05 × 10⁶ Ω</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td>1.05 × 10⁷ Ω</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>2.23 × 10⁷ Ω</td>
</tr>
<tr>
<td>USB bus power current consumption</td>
<td>Typ.</td>
<td>350 mA</td>
</tr>
<tr>
<td></td>
<td>Max.</td>
<td>450  mA</td>
</tr>
</tbody>
</table>

*6: Design value

Spectral resolution vs. peak transmission wavelength (typical example)

[Ta=25 °C, line spectrum resolution (FWHM)=3 nm max.]
Spectroscopic modules C15712, C15713, C15714

Spectral response (typical example)

C15712

[Graph showing spectral response with peaks at various wavelengths for C15712.]

C15713

[Graph showing spectral response with peaks at various wavelengths for C15713.]

[Graphs indicate the spectral response for C15712 and C15713 with typical examples of relative output at different wavelengths, with a maximum line spectrum resolution (FWHM) of 3 nm.]

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**Evaluation software (accessory)**

By installing the evaluation software (FPIModuleEvaluation.exe) into a PC, you can perform the following basic operations.

- Acquire, save measurement data
- Set measurement conditions
- Set built-in lamp
- Acquire module information (type number, serial number, spectral response range, etc.)
- Display graphs
- Calculation functions
  - Comparison with the reference data (reflectance, absorbance, etc.)

Note: Up to eight spectroscopic modules can be connected to a single PC and used.

Compatible OS: Microsoft® Windows® 10 (32-bit, 64-bit)

A DLL for controlling the hardware is available.
The DLL and sample software is created in the following development environment, so users can develop original measurement programs.

DLL: Microsoft Visual Studio® 2017 Visual C++®
Sample software: Microsoft Visual Studio 2017 Visual C#®

Note: Microsoft, Windows, Visual Studio, Visual C++, and Visual C# are registered trademarks of Microsoft Corporation in the United States and/or other countries.
**Connection examples**

<table>
<thead>
<tr>
<th>Reflective light measurement</th>
</tr>
</thead>
</table>
| Place cloth, plastic, etc. on the window material of the spectroscopic module connected to a PC via USB. The light from the light source built into the spectroscopic module strikes the object, and the spectroscopic module measures the reflected light.

![Diagram of reflected light measurement](image)

**Transmitting light measurement**

When measuring transmitted light, a light source must be prepared (the light source built into the spectroscopic module cannot be used).

![Diagram of transmitted light measurement](image)

**Measurement example (cloth)**

![Graph showing absorbance (SNV) vs. wavelength (nm) for cotton, polyester, and wool](image)
**Spectroscopic modules**  
C15712, C15713, C15714

- **Dimensional outline (unit: mm)**

![Dimensional outline diagram]

- **Accessories**
  - CD-ROM (instruction manual, evaluation software, sample software, DLL, etc.)
  - USB cable (USB 2.0 micro-B connector type)

- **Precautions**
  This product has a built-in high-voltage power supply. To avoid danger, do not disassemble.

- **Options (sold separately)**
  **Optical fiber adapter A15719**

  This is an adapter for simply coupling an optical fiber with an SMA connector to the spectroscopic module (C15712, C15713, C15714). Fix it to the spectroscopic module using the screw (included).

  Note: The optical fiber is not included.  
  Optical components such as a condenser lens are not installed.
Spectroscopic modules  C15712, C15713, C15714

Related information
www.hamamatsu.com/sp/ssd/doc_en.html

- Precautions
- Disclaimer

Technical information
- MEMS-FPI spectrum sensors, spectroscopic modules

Information described in this material is current as of July 2020.
Product specifications are subject to change without prior notice due to improvements or other reasons. This document has been carefully prepared and the information contained is believed to be accurate. In rare cases, however, there may be inaccuracies such as text errors. Before using these products, always contact us for the delivery specification sheet to check the latest specifications.

The product warranty is valid for one year after delivery and is limited to product repair or replacement for defects discovered and reported to us within that one year period. However, even if within the warranty period we accept absolutely no liability for any loss caused by natural disasters or improper product use.

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