

# Balanced detectors



C12668 series

## Balanced detectors with reduced multiple reflections

These are differential amplification type photoelectric conversion modules containing two Hamamatsu photodiodes with balanced characteristics. The photodiodes are connected in a direction that cancels out the photocurrent of each photodiode. This configuration cancels out the common mode noise of the two incident light rays. The minute difference in light levels is treated as a displacement signal, converted into an electrical signal, and output. Moreover, the adoption of our unique structure that suppresses multiple reflections of incident light has made it possible to reduce the noise caused by the reflections. These products can be applied to optical coherence tomography (OCT) used in ophthalmologic examinations and the like. The balanced detector can convert into electrical signals the minute difference in the signal light produced when the back scattering light from the subject is made to interfere with the reference light.

### Features

- Employs our unique (patented) structure that reduces multiple reflections at the incident light wavelength of 1.0  $\mu\text{m}$  or 1.3  $\mu\text{m}$  (-01, -02, -03, -04)
- Cutoff frequency:  
200 MHz (-01, -02), 400 MHz (-03, -04), 800 MHz (-05, -06)
- Common-mode rejection ratio (CMRR: Common-Mode Rejection Ratio):  
35 dB typ. (-01, -02), 30 dB typ. (-03, -04, -05, -06)
- Input section: FC receptacle (APC polished)  
A single-mode fiber with an FC connector can be connected.
- Output section: SMA receptacle
- Compact

### Application

- OCT

### Structure

| Type no.             | Built-in element      | Dimensions (mm) | Weight (g)   | Input section                | Output section |
|----------------------|-----------------------|-----------------|--------------|------------------------------|----------------|
| C12668-01            | InGaAs PIN photodiode | 25 × 54.5 × 65  | 168          | FC receptacle (APC polished) | SMA receptacle |
| C12668-02            |                       |                 | 190          |                              |                |
| C12668-03            |                       | 25 × 78 × 72    | 115          |                              |                |
| C12668-04            |                       |                 | 18 × 63 × 70 |                              |                |
| <b>NEW</b> C12668-05 |                       |                 |              |                              |                |
| <b>NEW</b> C12668-06 |                       |                 |              |                              |                |

### ➤ Absolute maximum ratings (Ta=25 °C, unless otherwise noted)

| Type no.             | Supply voltage<br>(V) | Incident light level<br>$\lambda=1.55 \mu\text{m}$<br>(mW) | Operating temperature*1<br>(°C) | Storage temperature*1<br>(°C) |
|----------------------|-----------------------|--|---------------------------------|-------------------------------|
| C12668-01            | ±17                   | 5  | 0 to +50                        | -10 to +60                    |
| C12668-02            |                       | 4.5  |                                 |                               |
| C12668-03            |                       | 5  |                                 |                               |
| C12668-04            |                       | 4.5  |                                 |                               |
| <b>NEW</b> C12668-05 | ±13.5                 | 5  |                                 |                               |
| <b>NEW</b> C12668-06 |                       | 4.5  |                                 |                               |

\*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.

### ➤ Recommended operating conditions (Ta=25 °C)

| Type no.             | Supply voltage*2<br>Vs<br>(V) |      |       |
|----------------------|-------------------------------|------|-------|
|                      | Min.                          | Typ. | Max.  |
| C12668-01            | ±11                           | ±12  | ±13   |
| C12668-02            |                               |      |       |
| C12668-03            |                               |      |       |
| C12668-04            |                               |      |       |
| <b>NEW</b> C12668-05 | ±11.9                         |      | ±12.1 |
| <b>NEW</b> C12668-06 |                               |      |       |

\*2: Use a power supply with 200 mA or higher output.

### ➤ Electrical characteristics (Ta=25 °C)

| Type no.             | Current consumption<br>Ic<br>Vs=±12 V<br>(mA) |      |      | Output impedance<br>Zo<br>(Ω) |                  |
|----------------------|---|------|------|-------------------------------|------------------|
|                      | Min.  | Typ. | Max. | OUT terminal                  | Monitor terminal |
| C12668-01            | ±52   | ±60  | ±64  | 50                            | 220              |
| C12668-02            |   |      |      |                               |                  |
| C12668-03            |   |      |      |                               |                  |
| C12668-04            | ±50   | ±54  | ±60  |                               |                  |
| <b>NEW</b> C12668-05 |   |      |      |                               |                  |
| <b>NEW</b> C12668-06 |   |      |      |                               |                  |

### Electrical and optical characteristics (Typ. $T_a=25\text{ }^\circ\text{C}$ , $V_s=\pm 12\text{ V}$ , unless otherwise noted)

| Type no.             | Optimal wavelength band* <sup>3</sup><br>$\lambda_{op}$<br>( $\mu\text{m}$ ) | Photosensitivity SPD<br>$\lambda=\lambda_{op}$<br>(A/W) | Cutoff frequency $f_c$<br>-3 dB<br>(MHz) |                  | Common-mode rejection ratio<br>CMRR* <sup>4</sup><br>(dB) | Conversion impedance $Z_t$<br>(V/A) |                  | Output noise voltage* <sup>5</sup><br>$V_n$<br>(mVp-p) |     |
|----------------------|--|---|--|------------------|---|-------------------------------------|------------------|--|-----|
|                      |  |   | OUT terminal                             | Monitor terminal |   | OUT terminal                        | Monitor terminal | OUT terminal   |     |
|                      |  |   |  |                  |   |                                     |                  | Typ.   | Max |
| C12668-01            | 1.0  | 0.75  | DC to 200                                | DC to 0.1        | 35  | $3 \times 10^4$                     | $1 \times 10^4$  | 20   | 40  |
| C12668-02            | 1.3  | 0.95  |  |                  |   |                                     |                  |  |     |
| C12668-03            | 1.0  | 0.75  | DC to 400                                | DC to 1          | 30  | $1 \times 10^4$                     |                  |  |     |
| C12668-04            | 1.3  | 0.95  |  |                  |   |                                     |                  |  |     |
| <b>NEW</b> C12668-05 | 1.0  | 0.60  | 0.1 to 800                               | DC to 1          | 30  | $5.8 \times 10^4$                   | 80               | 160  |     |
| <b>NEW</b> C12668-06 | 1.3  | 0.85  |  |                  |   |                                     |                  |  |     |

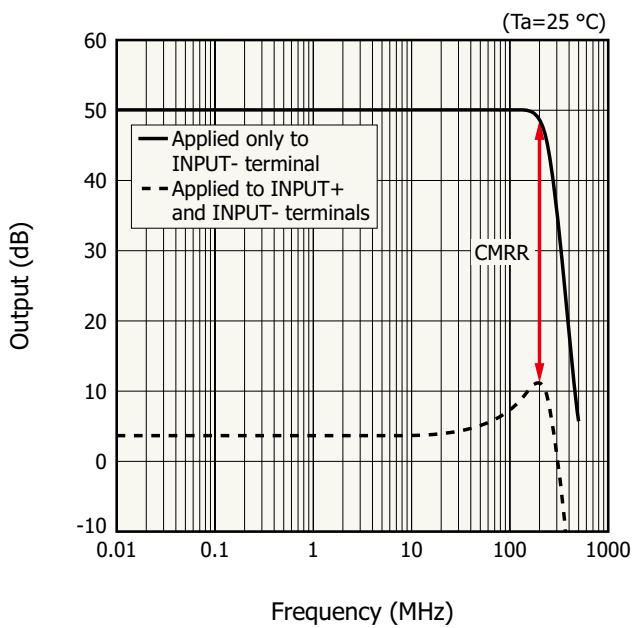
\*3: Wavelength at which multiple reflections can be reduced the most

\*4: Output difference when an approximately 70  $\mu\text{W}$  light is applied to only the INPUT- terminal and when applied to INPUT+ and INPUT- terminals (see the frequency characteristics)

\*5: Dark state, 50  $\Omega$  termination

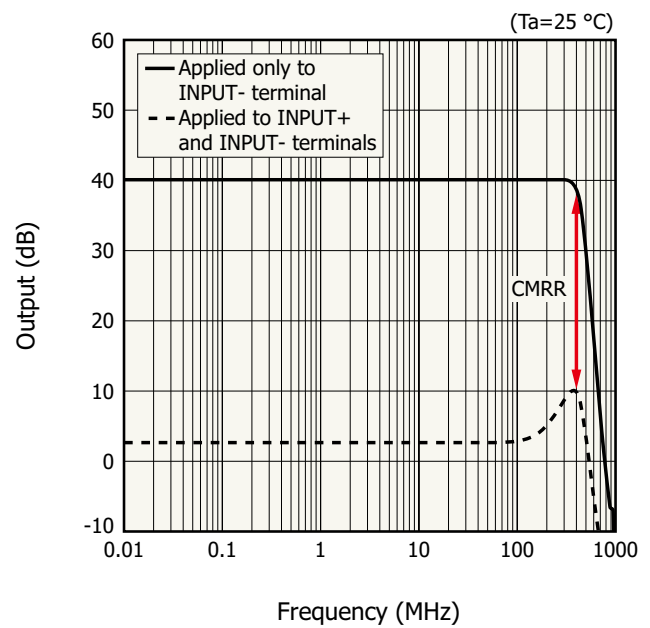
### Frequency characteristics (measured with network analyzer, typical example)

C12668-01/-02



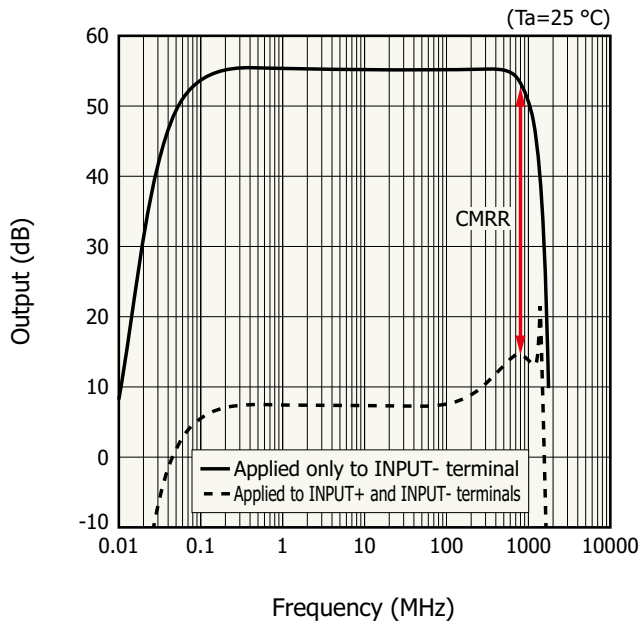
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C12668-03/-04



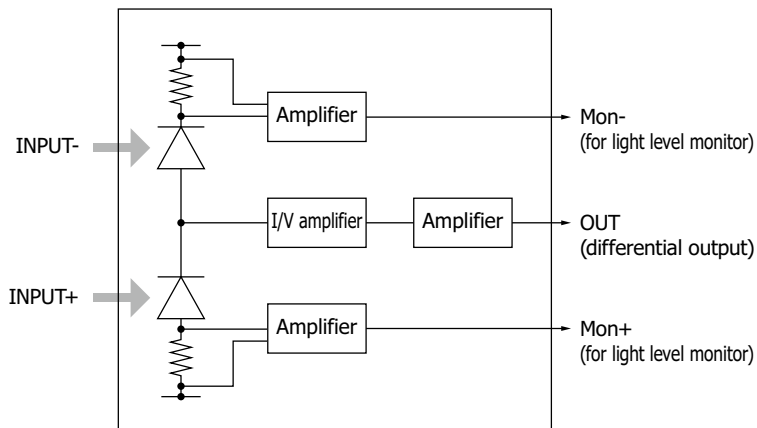
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C12668-05/-06



KACCB0674EA

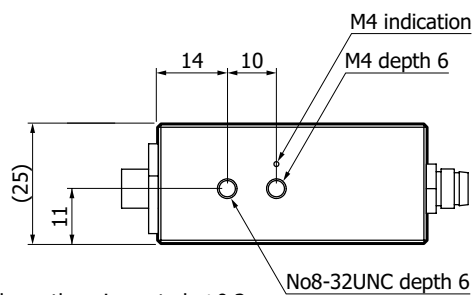
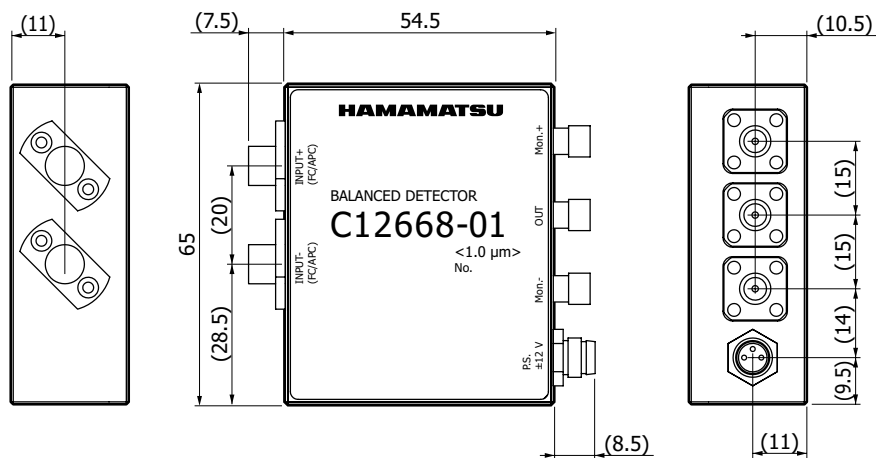
**Block diagram**



KACCC0761EB

Dimensional outlines (unit: mm)

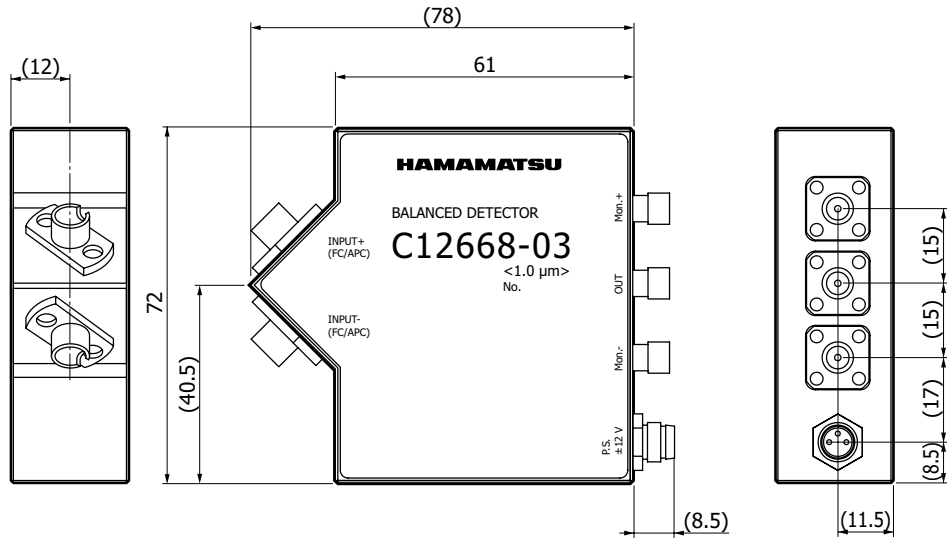
C12668-01/-02



Tolerance unless otherwise noted: ±0.3

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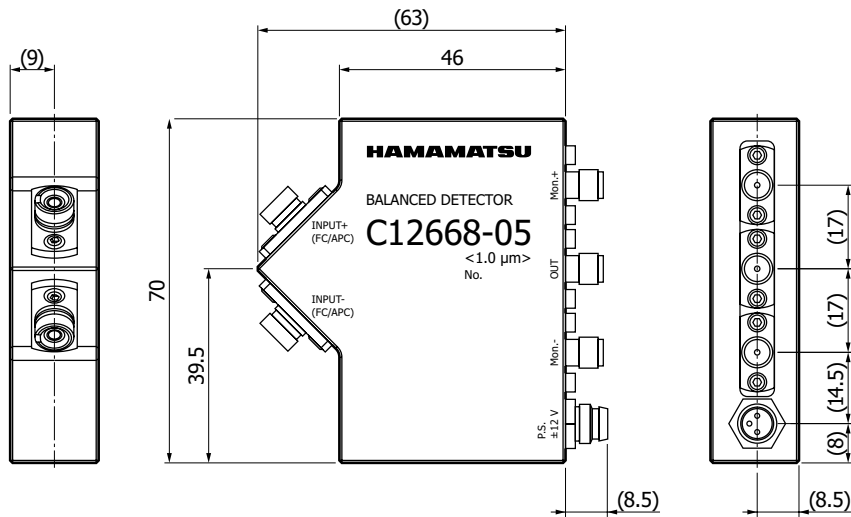
C12668-03/-04



Tolerance unless otherwise noted:  $\pm 0.3$

KACCA0393EA

C12668-05/-06

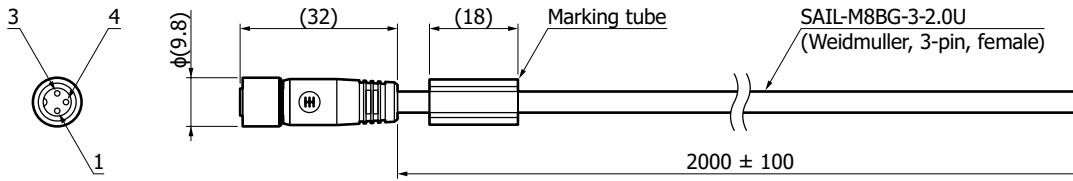


Tolerance unless otherwise noted:  $\pm 0.3$

KACCA0475EA

**Accessory (unit: mm)**

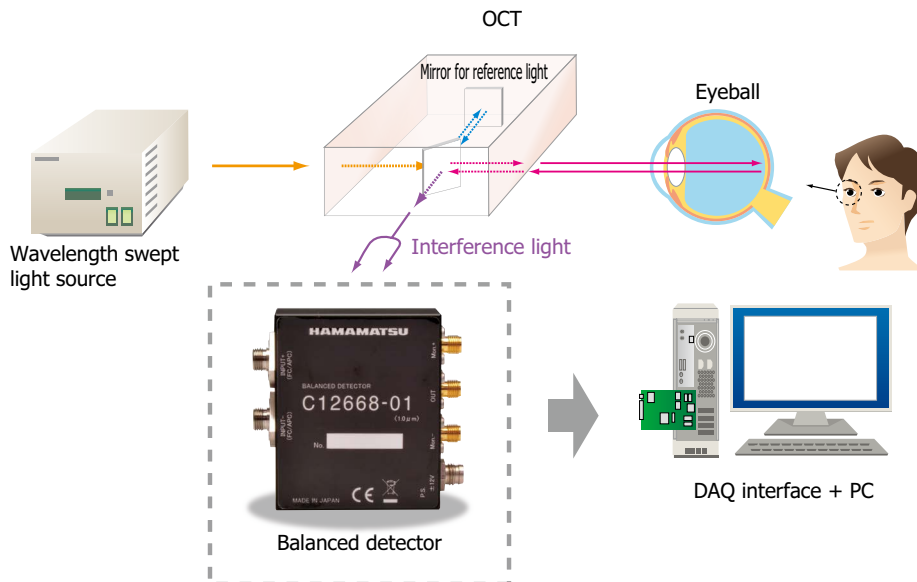
- Cable for power supply (no connector on one end)



| Pin no. | Wire color    |
|---------|---------------|
| 1       | Brown (+12 V) |
| 3       | Blue (-12 V)  |
| 4       | Black (GND)   |

KACCA0352EB

**Connection example (ophthalmic medical OCT)**



KACCC0762EA

## Related information

[www.hamamatsu.com/sp/ssd/doc\\_en.html](http://www.hamamatsu.com/sp/ssd/doc_en.html)

- Precautions
- Disclaimer

Information described in this material is current as of October 2021.

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