

Balanced detectors

These are differential amplification type photoelectric conversion modules containing two photodiodes with uniform 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. We offer a built-in InGaAs PIN photodiode type covering a spectral range of 0.9 to 1.7 μm .

1 Features

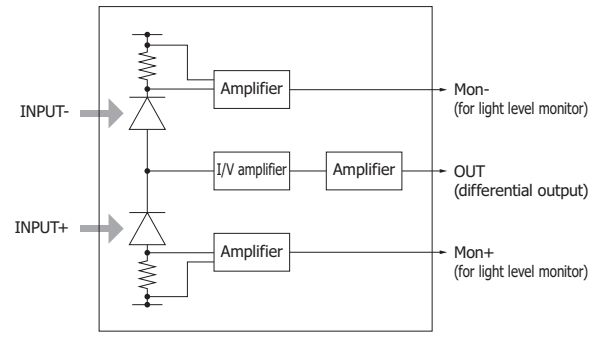
- ▶ Employs our unique (patented) structure that reduces multiple reflections at the incident light wavelength of 1.0 μm or 1.3 μm
- ▶ Input section: FC receptacle (APC polished)
A single-mode fiber with an FC connector can be connected.
- ▶ Output section: SMA receptacle
- ▶ Compact

2 Structure

The balanced detector has two inputs: (INPUT +/-), which receive signal light and reference light respectively. The differential signal of the two incident lights is output from the OUT terminal. The Monitor terminals (Mon +/-) output electrical signals, produced by conversion of the light level of light, which is incident from the optical fibers connected to the INPUT +/- terminals.

It employs a structure that reduces multiple reflections of incident light, which reduces light interference that would be caused by such reflections. With customer order products, it is possible to reduce reflections at specific wavelengths.

[Figure 1] Block diagram



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3 Characteristics

[Table 2] Specifications

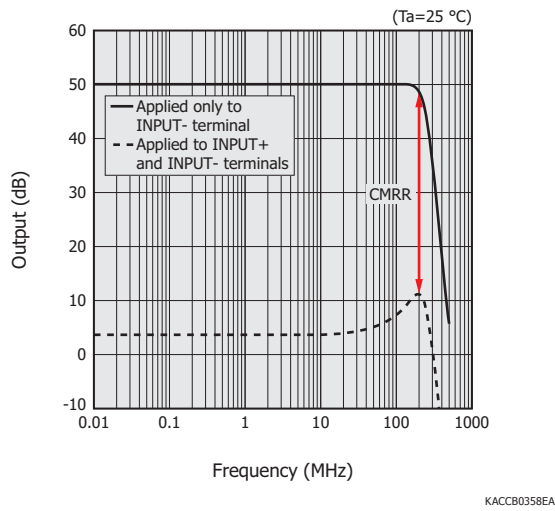
Parameter	Specification
Photosensor	InGaAs PIN photodiode
Spectral response range	0.9 to 1.7 μm
Output impedance	50 Ω
Input section	FC receptacle (APC polished)
Output section	SMA receptacle
Supply voltage	± 12 V (200 mA)

[Table 1] Hamamatsu balanced detectors

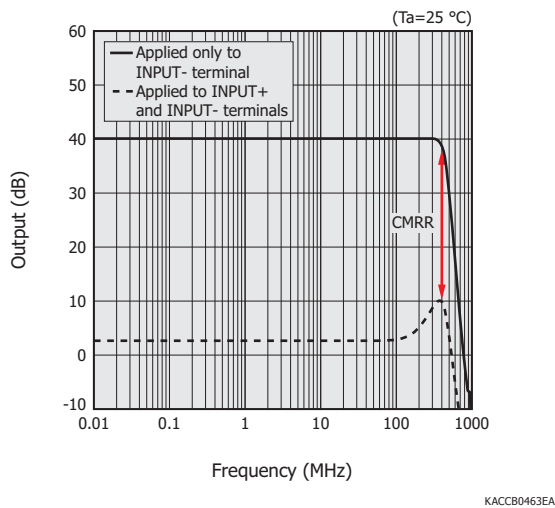
Type no.	Optimal wavelength band λ_{op} (μm)	Cutoff frequency f_c -3 dB (MHz)		Common-mode rejection ratio CMRR (dB)	Conversion impedance Z_t (V/A)	
		OUT terminal	Monitor terminal		OUT terminal	Monitor terminal
C12668-01	1.0	200	0.1	35	3 $\times 10^4$	1 $\times 10^4$
C12668-02	1.3					
C12668-03	1.0	400	1	30	1 $\times 10^4$	
C12668-04	1.3					

[Figure 2] Frequency characteristics
(measured with network analyzer, typical example)

(a) C12668-01/02



(b) C12668-03/04



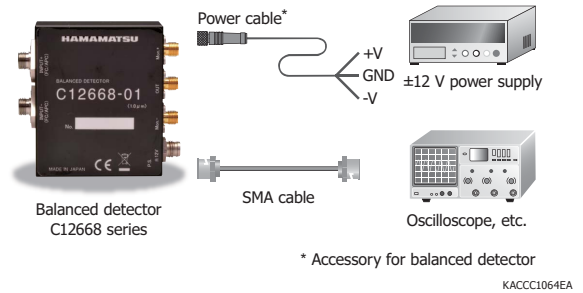
4 How to use

Using the supplied power cable, connect the balanced detector to a power supply. Use a dual power supply that can output $\pm 200\text{ mA}$ current.

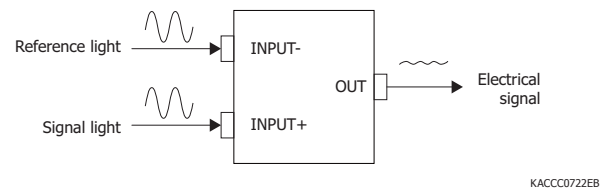
For optical input, two single mode fibers with FC connectors (APC polished) are used to apply a signal light and a reference light. If the light level and phase of these two incident lights are uniform, the output would be zero. If there is a difference in light level and phase between the signal light and reference light, the difference becomes the displacement signal, and this signal is converted into an electric signal, and output from the output terminal (SMA receptacle). Note that since the output impedance is $50\ \Omega$, you will need to set the input impedance of the connected measuring device to $50\ \Omega$. The length of the output coaxial cable should be three meters or less. The monitor terminal outputs electrical signals converted from the light

level of the two incident lights, so it can be used to adjust the light level of the incident light.

[Figure 3] Connection example



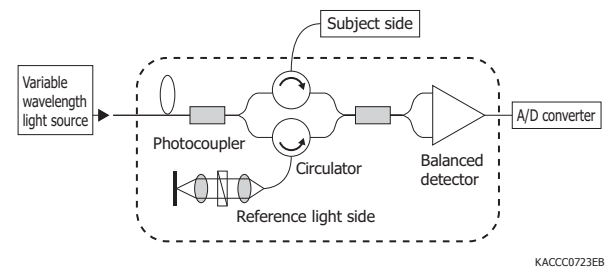
[Figure 4] I/O example of balanced detector



5 Applications

The balanced detector can be used in various measurement and analytical instruments that use optical interference signals. It is also used for medical equipment such as an optical coherence tomography (OCT), which captures images of internal structure with high resolution and high speed.

[Figure 5] OCT



Information described in this material is current as of December 2020.

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