



Balanced Photoreceivers

How Differential Photodetection Works

7/2023

The method of *balanced photodetection* (or *differential photodetection*) has been developed for detecting small differences in optical power between two optical input signals while largely suppressing any common fluctuations of the inputs.

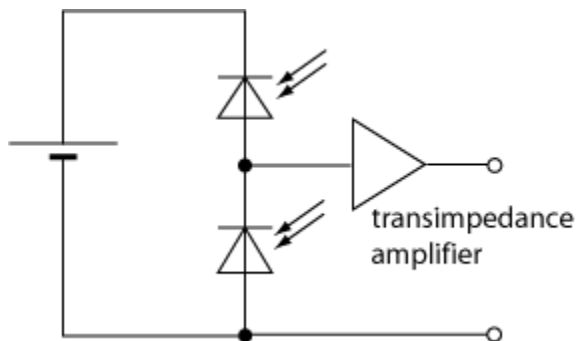


Figure 1: A simple electronics circuit for balanced photodetection.

photodetection.

In its simplest form, one uses two photodiodes connected in series, so that their photocurrents cancel each other when they are equal (see Figure 1). The difference in photocurrents is sent to the transimpedance amplifier in the balanced photoreceiver, which produces an output voltage proportional to that difference.

As an example for an application, you can consider the measurement of weak absorption features in spectroscopy. One photodetector is used for light which is transmitted through a spectroscopic sample, while the other photodetector is illuminated with light from the same source but which has not gone through the sample. The two light beams are generated with a beam splitter between the light source and the sample. Any noise from the light source is canceled out with this balanced detection scheme, so measurements have an extremely low signal-to-noise ratio.

