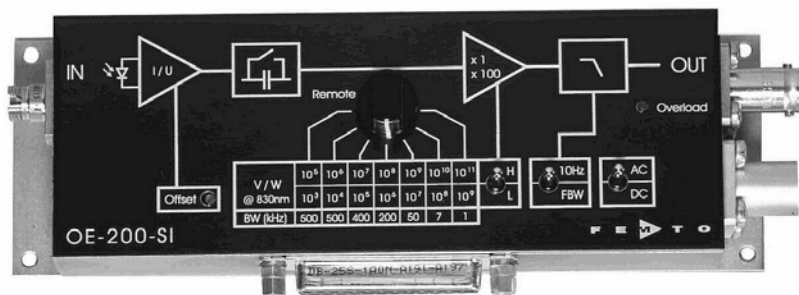


Variable-Gain, Balanced Photoreceiver (Customized Version)



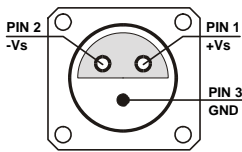
(Picture shows a similar unbalanced model with single photodiode input)

<p>Features</p>	<ul style="list-style-type: none"> • Balanced Si PIN Detectors with \varnothing 1.2 mm Active Diameter • Spectral Range 320 - 1060 nm • Conversion Gain Switchable from 1×10^3 to 1×10^{11} V/W • Bandwidth up to 500 kHz • Local and Remote Control
<p>Applications</p>	<ul style="list-style-type: none"> • Spectroscopy • General-Purpose Opto-Electrical Measurements • Optical Receiver for Use with Lock-In Amplifiers
<p>Block Diagram</p>	<p style="text-align: right; font-size: small;">BS01-0149059-</p>

Variable-Gain, Balanced Photoreceiver (Customized Version)

Specifications	<i>Test Conditions</i>	<i>V_s = ± 15 V, T_a = 25°C</i>						
Gain	Conversion Gain Gain Accuracy Conversion Gain Accuracy Gain Drift	1 x 10 ³ ... 1 x 10 ¹¹ V/W (@ 830 nm) ± 1 % electrical, between settings ± 15 % electro optical (P _{opt} ≤ 1 mW, @ 830 nm) see table below						
Frequency Response	Lower Cut-Off Frequency Upper Cut-Off Frequency Gain Flatness	DC / 1 Hz, switchable up to 500 kHz (see table below), switchable to 10 Hz ± 0.1 dB						
Input	Noise Equivalent Power (NEP) Max. CW Saturation Power Common Mode Rejection Offset Current Compensation	see table below see table below > 45 dB typ. ± 600 pA, adjustable by offset trimpot or ± 400 pA, adjustable by external control voltage						
Detector	Detector Active Area Spectral Response Sensitivity Dark Current	2x Si PIN photodiodes in free space flanges ∅ 1.2 mm 320 – 1060 nm 0.6 A/W (@ 830 nm) 4 pA typ.						
Performance depending on Gain Setting	Gain Setting (Low Noise) (V/W)	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁸	10 ⁹
	Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	50 kHz	7 kHz	1.2 kHz
	Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 μs	7 μs	50 μs	300 μs
	NEP (√Hz, @ 500 Hz, 830 nm)	80 pW	8 pW	1.1 pW	350 fW	110 fW	36 fW	16 fW
	Offset Current Drift (°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
	Gain Drift (°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
	cw-Saturation Power	2 mW	1 mW	0.1 mW	10 μW	1 μW	0.1 μW	10 nW
	Gain setting (High Speed) (V/W)	10 ⁵	10 ⁶	10 ⁷	10 ⁸	10 ⁹	10 ¹⁰	10 ¹¹
	Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	50 kHz	7 kHz	1.2 kHz
	Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 μs	7 μs	50 μs	300 μs
	NEP (√Hz, @ 500 Hz, 830 nm)	50 pW	6 pW	1.2 fW	360 fW	110 fW	38 fW	16 fW
	Offset Current Drift (°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
	Gain Drift (°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
	cw-Saturation Power	0.1 mW	10 μW	1 μW	0.1 μW	10 nW	1 nW	0.1 nW
Output	Output Voltage Output Impedance Max. Output Current	± 10 V (@ ≥ 1 MΩ load) 50 Ω (terminate with ≥ 1 MΩ load for best performance) ± 30 mA						
Indicator LED	Function	overload						
Digital Control	Control Input Voltage Range Control Input Current Overload Output	LOW bit: - 0.8 ... + 1.2 V, HIGH bit: + 2.3 ... + 12 V 0 mA @ 0 V, 1.5 mA @ + 5 V, 4.5 mA @ + 12 V non active: 0 V, max. - 1 mA, active: 5.1 V, max. 7 mA						
Ext. Offset Control	Control Voltage Range Offset Control Input Impedance Conversion Factor	± 10 V 20 kΩ 40 pA/V						

**Variable-Gain, Balanced Photoreceiver
(Customized Version)**

Specifications (continued)	<p>Power Supply</p> <p>Supply Voltage $\pm 15\text{ V}$ Supply Current $+ 110 / - 80\text{ mA}$ (depends on operating conditions, recommended power supply capability min. $\pm 200\text{ mA}$) Stabilized Power Supply Output $\pm 12\text{ V}$, max. 150 mA, $+ 5\text{V}$, max. 50 mA</p> <p>Case</p> <p>Weight 320 g (0.74 lb.) Material AlMg4.5Mn, nickel-plated</p> <p>Temperature Range</p> <p>Storage Temperature $- 40 \dots + 80\text{ }^\circ\text{C}$ Operating Temperature $0 \dots + 60\text{ }^\circ\text{C}$</p>
Absolute Maximum Ratings	<p>Max. CW-Power (Averaged) 20 mW Digital Control Input Voltage $- 5\text{ V} / + 16\text{ V}$ relative to digital ground DGND (pin 9) Analog Control Input Voltage $\pm 15\text{ V}$ relative to analog ground AGND (pin 3) Power Supply Voltage $\pm 22\text{ V}$</p>
Connectors	<p>Input optical, 2x free space</p> <p>Output BNC</p> <p>Power Supply LEMO series 1S, 3-pin fixed socket Pin 1: $+ 15\text{V}$ Pin 2: $- 15\text{V}$ Pin 3: GND</p> <div style="text-align: center;">  </div> <p>Control Port Sub-D 25-pin, female, Qual. Class 2 Pin 1: $+ 12\text{ V}$ (stabilized power supply output) Pin 2: $- 12\text{ V}$ (stabilized power supply output) Pin 3: AGND (analog ground) Pin 4: $+ 5\text{ V}$ (stabilized power supply output) Pin 5: digital output: HIGH = overload Pin 6: signal output (connected to BNC) Pin 7: NC Pin 8: input offset control voltage Pin 9: DGND (ground for digital control pins 10 - 14) Pin 10: digital control input: Gain, LSB Pin 11: digital control input: Gain Pin 12: digital control input: Gain, MSB Pin 13: digital control input: AC/DC Pin 14: digital control input: high speed / low noise Pin 15 - 25: NC</p>

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Remote Control Operation

General

Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" and select the desired setting via a bit code at the corresponding digital inputs. Mixed operation, e.g. local AC/DC setting and remote controlled gain setting, is also possible.

The switch setting "FBW / 10 Hz" of the low pass signal filter is not remote controllable.

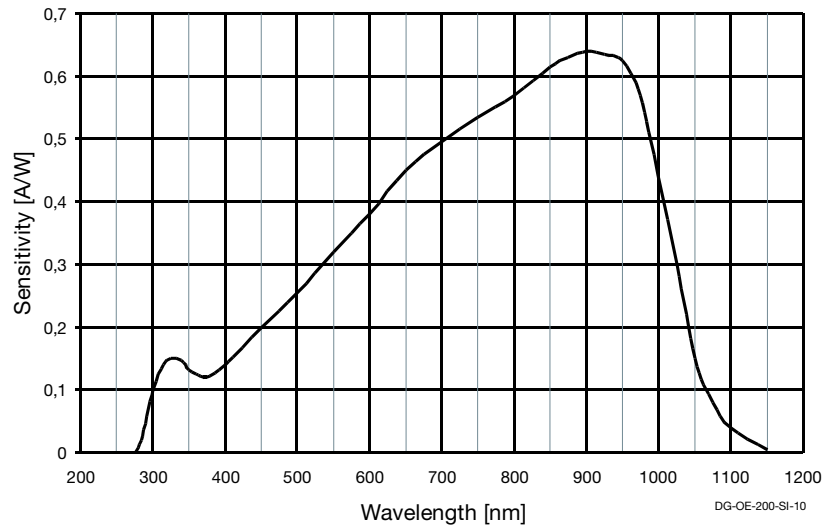
Gain Setting

Low Noise Gain (V/W) Pin 14=HIGH	High Speed Gain (V/W) Pin 14=LOW	Pin 12 MSB	Pin 11	Pin 10 LSB
10^3	10^5	LOW	LOW	LOW
10^4	10^6	LOW	LOW	HIGH
10^5	10^7	LOW	HIGH	LOW
10^6	10^8	LOW	HIGH	HIGH
10^7	10^9	HIGH	LOW	LOW
10^8	10^{10}	HIGH	LOW	HIGH
10^9	10^{11}	HIGH	HIGH	LOW

AC/DC Setting

Coupling	Pin 13
AC	LOW
DC	HIGH

Spectral Response



Variable-Gain, Balanced Photoreceiver (Customized Version)

Typical Performance Characteristics

Typical Common Mode Rejection

Using a balanced photoreceiver with equal optical input power on both photodiodes will reduce a common mode signal present on both signal paths. The common mode rejection (CMR) is a measure for the effectiveness of the balanced operation.

Common mode rejection is calculated as follows:

$$CMR = 20 \log (U_{out, PD1} / (U_{out, PD2} - U_{out, PD1})),$$

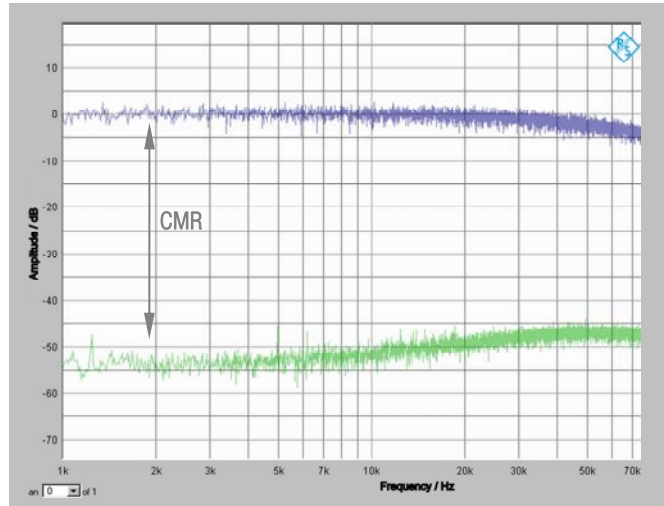
where

$U_{out, PD1}$ is the output voltage generated by the optical signal on the 1st photodiode

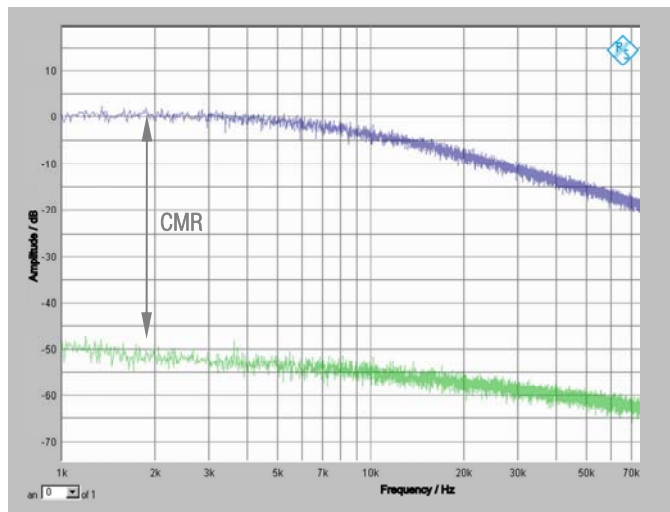
$U_{out, PD2}$ is the output voltage generated by the optical signal on the 2nd photodiode

Example Plots of CMR

The plot shows the output signal generated by the 1st photodiode (blue-curve) and the differential (balanced) signal (green-curve) at an amplifier setting of L 10⁷ V/W, FBW, DC

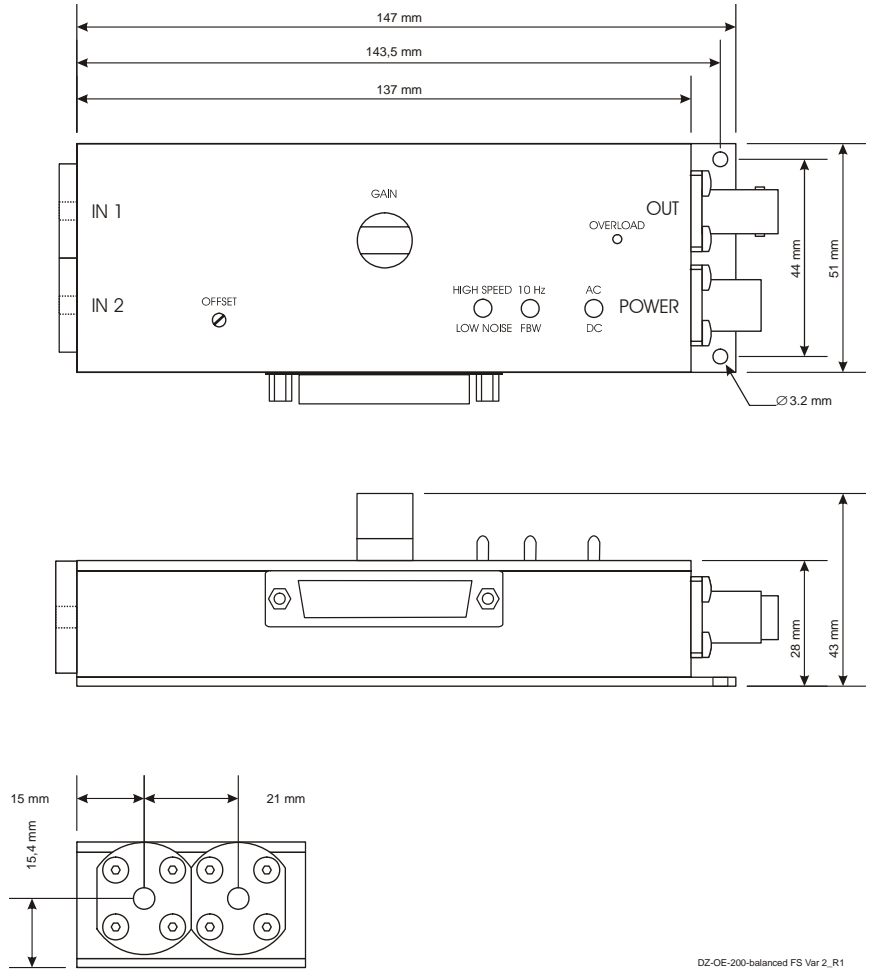


The plot shows the output signal generated by the 1st photodiode (blue-curve) and the differential (balanced) signal (green-curve) at an amplifier setting of L 10⁸ V/W, FBW, DC



Variable-Gain, Balanced Photoreceiver (Customized Version)

Dimensions



DZ-OE-200-balanced FS Var 2_R1

FEMTO Messtechnik GmbH
 Paul-Lincke-Ufer 34
 D-10999 Berlin · Germany
 Tel.: +49 (0)30 – 4 46 93 86
 Fax: +49 (0)30 – 4 46 93 88
 e-mail: info@femto.de
 http://www.femto.de

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