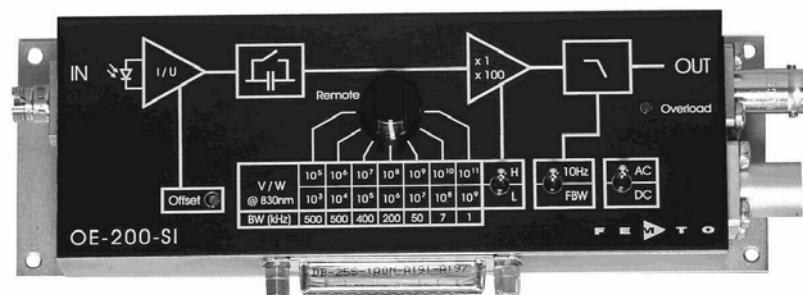


**Datasheet**

**OE-200-S Ser.No. 08-39-023**

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



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

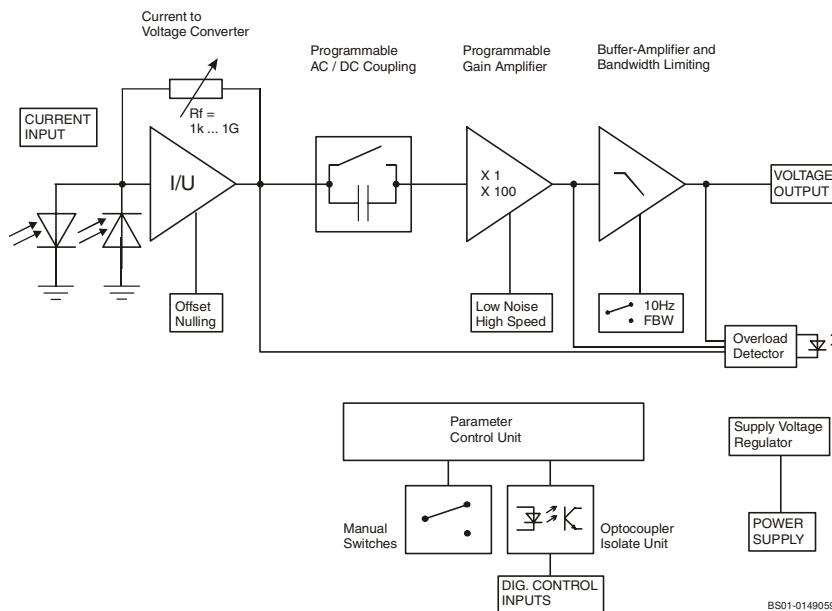
Features

- **Balanced Si PIN Detectors with Ø 1.2 mm Active Diameter**
- **Spectral Range 320 - 1060 nm**
- **Conversion Gain Switchable from  $1 \times 10^3$  to  $1 \times 10^{11}$  V/W**
- **Bandwidth up to 500 kHz**
- **Local and Remote Control**

Applications

- **Spectroscopy**
- **General-Purpose Opto-Electrical Measurements**
- **Optical Receiver for Use with Lock-In Amplifiers**

Block Diagram



BS01-0149059-

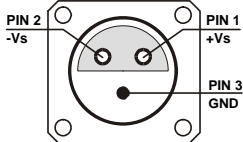
## Datasheet

OE-200-S Ser.No. 08-39-023

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

Specifications	<i>Test Conditions</i>	<i>V<sub>s</sub> = ± 15 V, T<sub>a</sub> = 25°C</i>								
Gain	Conversion Gain	1 x 10 <sup>3</sup> ... 1 x 10 <sup>11</sup> V/W (@ 830 nm)								
	Gain Accuracy	± 1 % electrical, between settings								
	Conversion Gain Accuracy	± 15 % electro optical (P <sub>opt</sub> ≤ 1 mW, @ 830 nm)								
	Gain Drift	see table below								
Frequency Response	Lower Cut-Off Frequency	DC / 1 Hz, switchable								
	Upper Cut-Off Frequency	up to 500 kHz (see table below), switchable to 10 Hz								
	Gain Flatness	± 0.1 dB								
Input	Noise Equivalent Power (NEP)	see table below								
	Max. CW Saturation Power	see table below								
	Common Mode Rejection	> 45 dB typ.								
	Offset Current Compensation	± 600 pA, adjustable by offset trimpot or ± 400 pA, adjustable by external control voltage								
Detector	Detector	2x Si PIN photodiodes in free space flanges								
	Active Area	∅ 1.2 mm								
	Spectral Response	320 – 1060 nm								
	Sensitivity	0.6 A/W (@ 830 nm)								
	Dark Current	4 pA typ.								
Performance depending on Gain Setting	Gain Setting (Low Noise) (V/W)	10 <sup>3</sup>	10 <sup>4</sup>	10 <sup>5</sup>	10 <sup>6</sup>	10 <sup>7</sup>	10 <sup>8</sup>	10 <sup>9</sup>		
	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 <sup>5</sup>	10 <sup>6</sup>	10 <sup>7</sup>	10 <sup>8</sup>	10 <sup>9</sup>	10 <sup>10</sup>	10 <sup>11</sup>		
	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	± 10 V (@ ≥ 1 MΩ load)							
Output Impedance		50 Ω (terminate with ≥ 1 MΩ load for best performance)								
Max. Output Current		± 30 mA								
Indicator LED	Function	overload								
Digital Control	Control Input Voltage Range	LOW bit: - 0.8 ... + 1.2 V, HIGH bit: + 2.3 ... + 12 V								
	Control Input Current	0 mA @ 0 V, 1.5 mA @ + 5 V, 4.5 mA @ + 12 V								
	Overload Output	non active: 0 V, max. - 1 mA, active: 5.1 V, max. 7 mA								
Ext. Offset Control	Control Voltage Range	± 10 V								
	Offset Control Input Impedance	20 kΩ								
	Conversion Factor	40 pA/V								

**Datasheet****OE-200-S Ser.No. 08-39-023****Variable-Gain, Balanced Photoreceiver  
(Customized Version)**

Specifications (continued)	<p>Power Supply</p> <p>Supply Voltage                    <math>\pm 15\text{ V}</math> Supply Current                    <math>+ 110 / - 80\text{ mA}</math> (depends on operating conditions, recommended power supply capability min. <math>\pm 200\text{ mA}</math>) Stabilized Power Supply Output   <math>\pm 12\text{ V}</math>, max. <math>150\text{ mA}</math>, <math>+ 5\text{V}</math>, max. <math>50\text{ mA}</math></p> <p>Case</p> <p>Weight                                <math>320\text{ g}</math> (0.74 lb.) Material                                AlMg4.5Mn, nickel-plated</p> <p>Temperature Range</p> <p>Storage Temperature                <math>- 40 \dots + 80\text{ }^\circ\text{C}</math> Operating Temperature                <math>0 \dots + 60\text{ }^\circ\text{C}</math></p>
Absolute Maximum Ratings	<p>Max. CW-Power (Averaged)        <math>20\text{ mW}</math> Digital Control Input Voltage        <math>- 5\text{ V} / + 16\text{ V}</math> relative to digital ground DGND (pin 9) Analog Control Input Voltage        <math>\pm 15\text{ V}</math> relative to analog ground AGND (pin 3) Power Supply Voltage                 <math>\pm 22\text{ V}</math></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:                                <math>+ 15\text{V}</math> Pin 2:                                <math>- 15\text{V}</math> Pin 3:                                GND</p> <div style="text-align: center;">  </div> <p>Control Port</p> <p>Sub-D 25-pin, female, Qual. Class 2 Pin 1:                                <math>+ 12\text{ V}</math> (stabilized power supply output) Pin 2:                                <math>- 12\text{ V}</math> (stabilized power supply output) Pin 3:                                AGND (analog ground) Pin 4:                                <math>+ 5\text{ V}</math> (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>

# Datasheet

# OE-200-S Ser.No. 08-39-023

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

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.

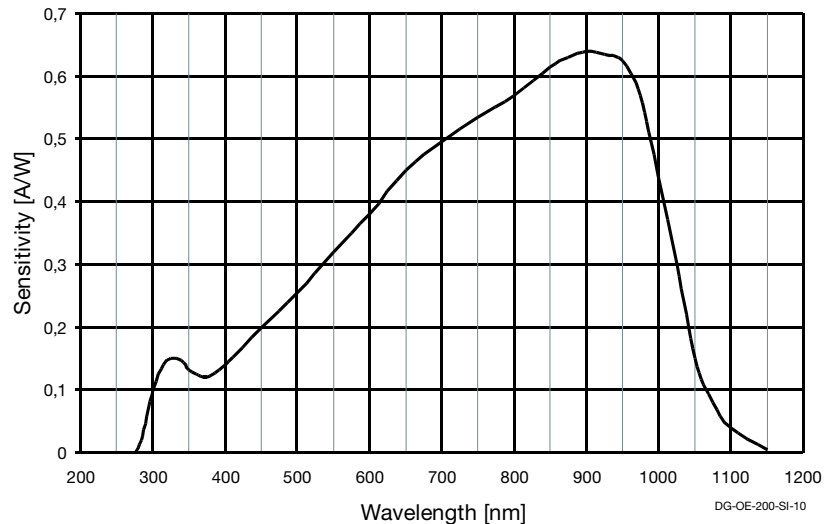
Gain Setting

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:

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

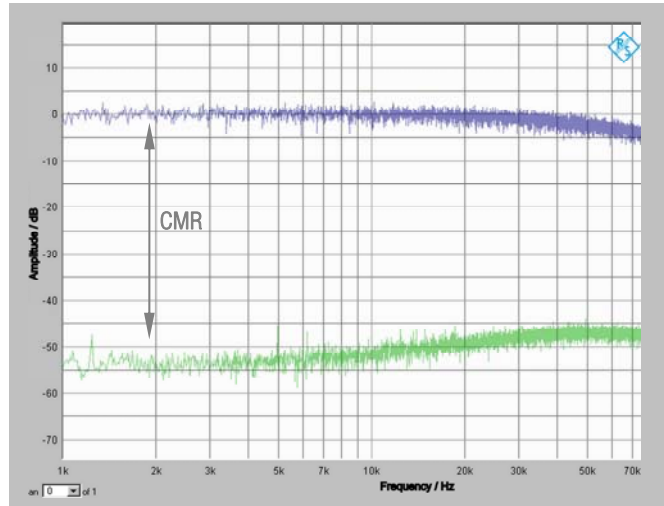
where

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

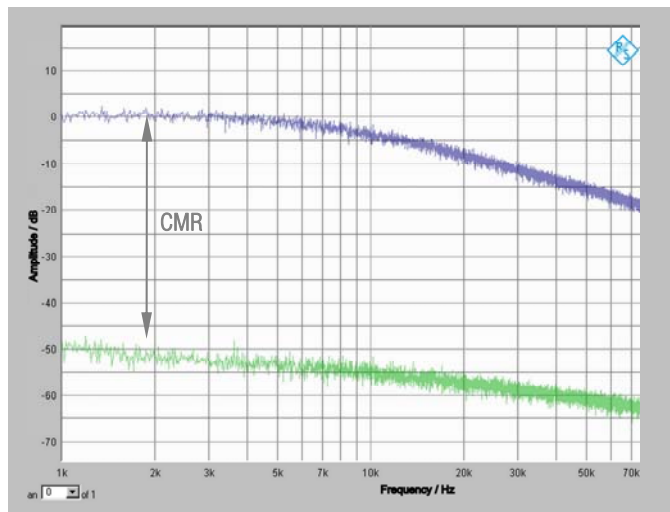
$U_{out, PD2}$  is the output voltage generated by the optical signal on the 2<sup>nd</sup> photodiode

Example Plots of CMR

The plot shows the output signal generated by the 1<sup>st</sup> photodiode (blue-curve) and the differential (balanced) signal (green-curve) at an amplifier setting of L 10<sup>7</sup> V/W, FBW, DC



The plot shows the output signal generated by the 1<sup>st</sup> photodiode (blue-curve) and the differential (balanced) signal (green-curve) at an amplifier setting of L 10<sup>8</sup> V/W, FBW, DC

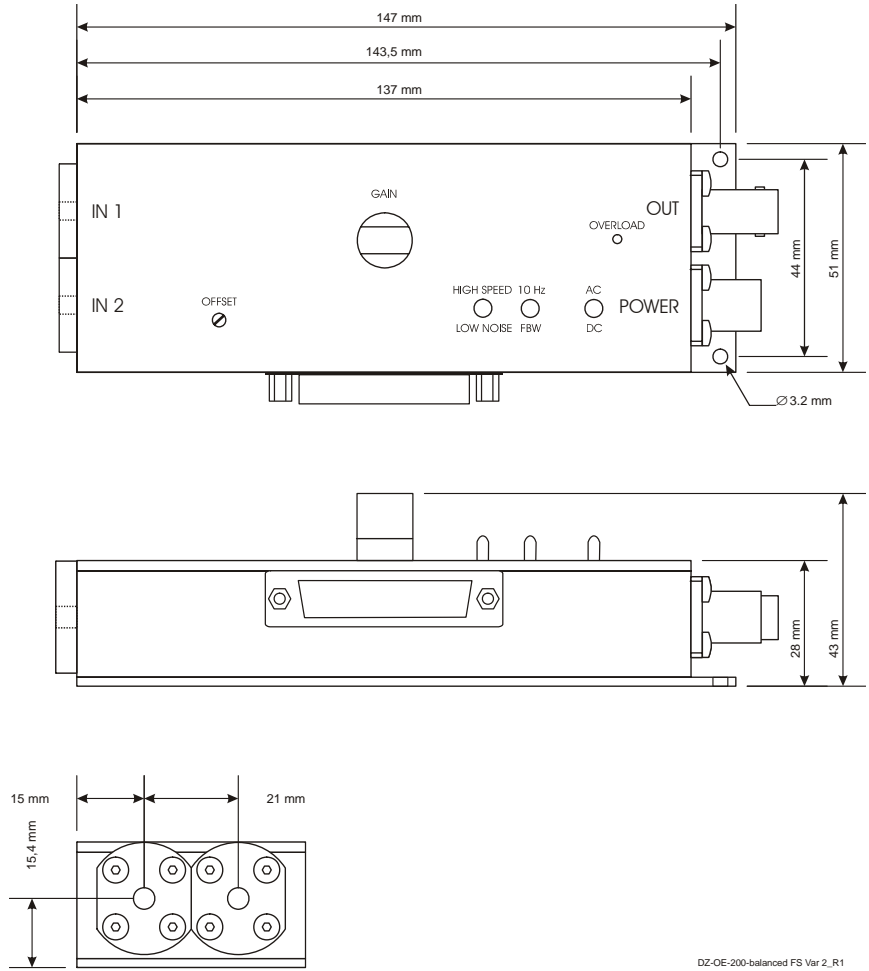


# Datasheet

# OE-200-S Ser.No. 08-39-023

## 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](mailto:info@femto.de)  
<http://www.femto.de>

Specifications are subject to change without notice. Information furnished herein is believed to be accurate and reliable. However, no responsibility is assumed by FEMTO Messtechnik GmbH for its use, nor for any infringement of patents or other rights granted by implication or otherwise under any patent rights of FEMTO Messtechnik GmbH. Product names mentioned may also be trademarks used here for identification purposes only.

© by FEMTO Messtechnik GmbH  
 Printed in Germany

SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

