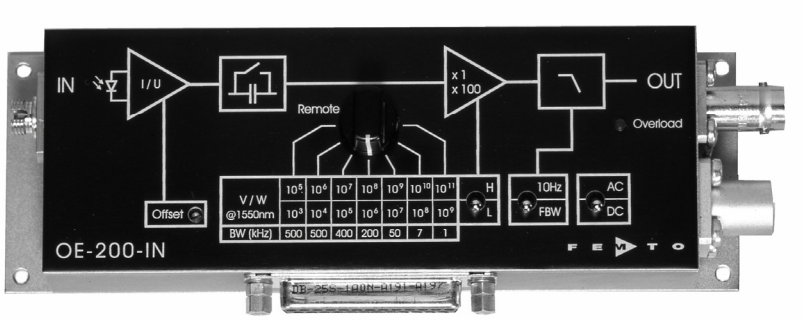
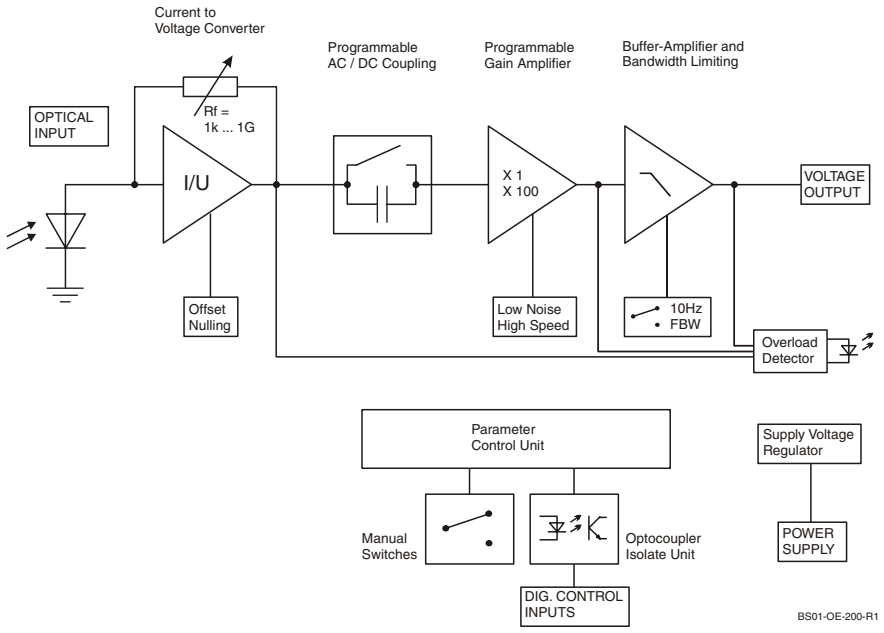
Variable Gain Photoreceiver - Fast Optical Power Meter



Features	• **Conversion Gain Switchable from 1 x 10^3 to 1 x 10^{11} V/W** • **InGaAs PIN Detector with 300 µm Active Diameter** • **Spectral Range 900 - 1700 nm** • **Calibrated at 1550 nm (Fiber Optic Versions Only)** • **Bandwidth up to 500 kHz** • **Local and Remote Control**
Applications	• **Fast Fiber Optic Power Meter** • **Spectroscopy** • **General Purpose Opto-Electronic Measurements** • **Optical Receiver for Use with Lock-In Amplifiers**
Block Diagram	

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Specifications	*Test Conditions*	*Vs = ± 15 V, Ta = 25°C*
Gain	Conversion Gain	1 x 10^3 ... 1 x 10^{11} V/W (@ 1550 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy (Popt ≤ 1 mW, @ 1550 nm)	OE-200-IN2-FS: ± 15 % electro-optical OE-200-IN2-FC: ± 5 % electro-optical
	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
	Offset Current Compensation	± 600 pA, adjustable by offset trimpot or ± 400 pA, adjustable by external control voltage
Detector	Detector	InGaAs PIN photodiode
	Active Area	∅ 300 µm
	Spectral Response	900 … 1700 nm
	Sensitivity	0.95 A/W (@ 1550 nm)
	Dark Current	2 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	1.1 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
NEP (/√Hz, 1550 nm)	22 pW	2.5 pW	500 fW	150 fW	47 fW	18 fW	13 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise (rms)*	23 nW	2.8 nW	650 pW	180 pW	51 pW	7.5 pW	1.1 pW
Input Offset Drift (/°C)	40 nW	4 nW	0.4 nW	34 pW	3.4 pW	0.5 pW	0.4 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	1.1 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
NEP (/√Hz, 1550 nm)	15 pW	2.0 pW	520 fW	150 fW	48 fW	20 fW	14 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise (rms)*	13 nW	1.9 nW	560 pW	160 pW	48 pW	7.2 pW	1.1 pW
Input Offset Drift (/°C)	40 nW	4 nW	0.4 nW	34 pW	3.4 pW	0.5 pW	0.4 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

* The integrated input noise is measured with a shaded input in the full bandwidth („FBW“) setting. The input referred peak-peak noise can be calculated from the rms noise as follows:

$$P_{\text{Input Noise peak peak}} = P_{\text{Input Noise rms}} \times 6$$

The output noise is given by:

$$U_{\text{Output Noise rms}} = P_{\text{Input Noise rms}} \times \text{Gain}$$

$$U_{\text{Output Noise peak peak}} = U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times 6$$

The integrated noise will be reduced considerably by setting the low pass filter to “10 Hz” instead of “FBW”. This is especially useful for continuous wave (cw) measurements.

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Specifications (continued)

Output	Output Voltage Range	± 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
Power Supply	Supply Voltage	± 15 V
	Supply Current	+ 110 / - 80 mA (depends on operating conditions, recommended power supply capability minimum ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5 V, max. 50 mA
Case	Weight	320 g (0.74 lb.)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	- 40 ... + 80 °C
	Operating Temperature	0 ... + 60 °C

Absolute Maximum Ratings	Max. CW Power (Averaged)	20 mW
	Digital Control Input Voltage	- 5 V / + 16 V relative to digital ground DGND (pin 9)
	Analog Control Input Voltage	± 15 V relative to analog ground AGND (pin 3)
	Power Supply Voltage	± 22 V

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Connectors

Input

OE-200-IN2-FS	25 mm round flange for free space applications
OE-200-IN2-FC	FC fiber optic receptacle

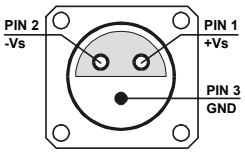
Output

BNC

Power Supply

LEMO series 1S, 3-pin fixed socket

Pin 1: + 15 V
Pin 2: - 15 V
Pin 3: GND



Control Port

Sub-D 25-pin, female, qual. class 2

Pin 1: + 12 V (stabilized power supply output)
Pin 2: - 12 V (stabilized power supply output)
Pin 3: AGND (analog ground for pins 1 - 8)
Pin 4: + 5 V (stabilized power supply output)
Pin 5: status 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

Available Models

OE-200-IN2-FS	free space input, no calibration
OE-200-IN2-FC	FC fiber optic receptacle, calibrated at 1550 nm
OE-200-S	customized versions available on request

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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.

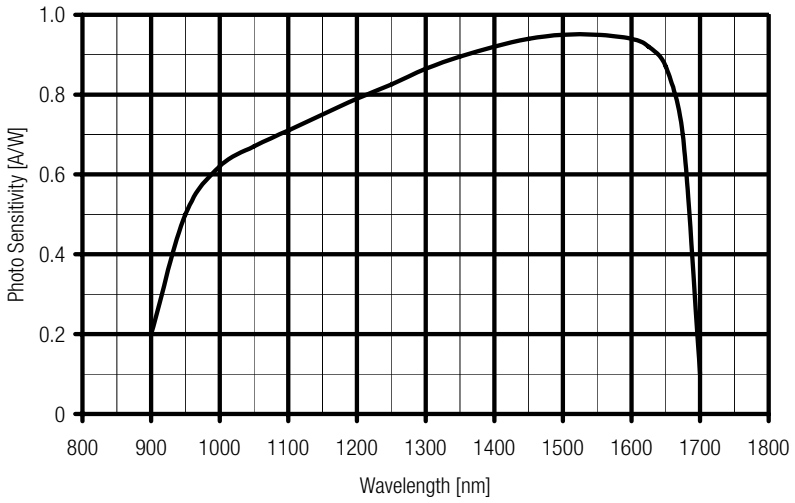
Gain Setting

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



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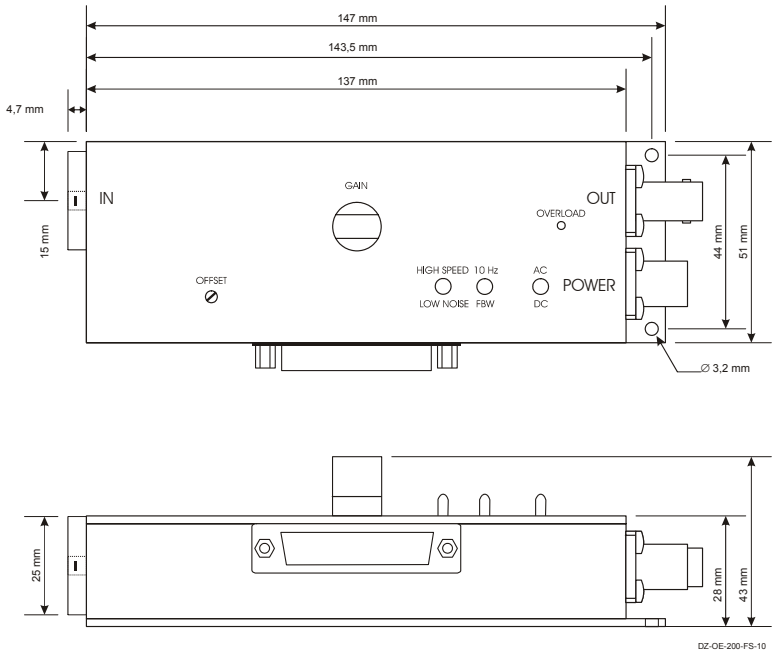
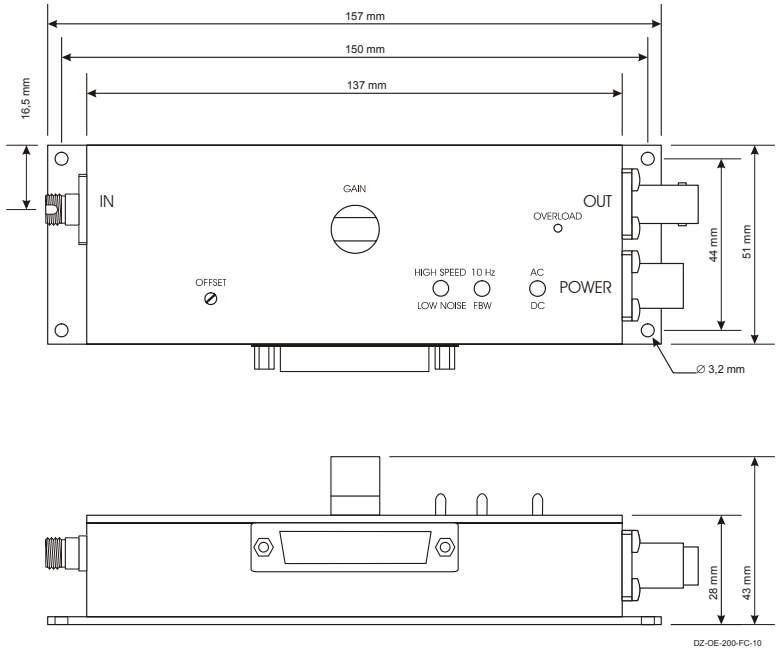
Dimensions

Free Space Input OE-200-IN2-FS:



Fiber Optic Input OE-200-IN2-FC:



FEMTO Messtechnik GmbH
Klosterstr. 64
D-10179 Berlin · Germany
Tel.: +49-(0)30-280 4711-0
Fax: +49-(0)30-280 4711-11
e-mail: info@femto.de
http://www.femto.de