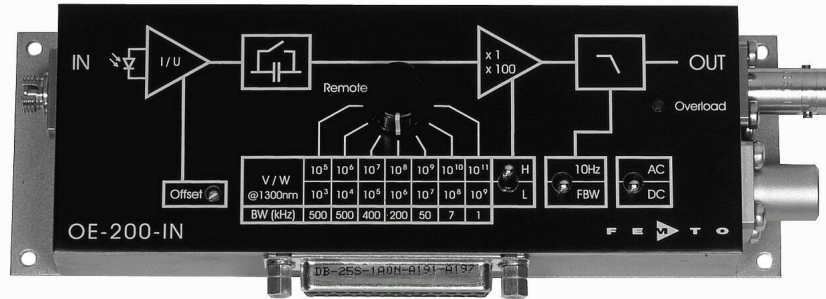


# Variable Gain Photoreceiver - Fast Optical Power Meter



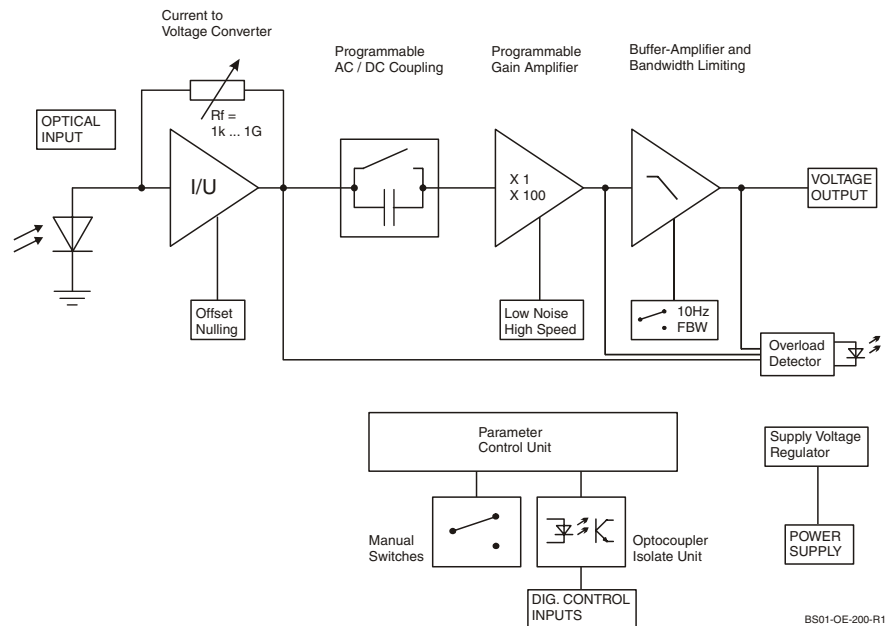
Features

- Conversion Gain Switchable from  $1 \times 10^3$  to  $1 \times 10^{11}$  V/W
- InGaAs PIN Detector with 300  $\mu\text{m}$  Active Diameter
- Spectral Range 900 - 1700 nm
- Calibrated at 1300 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



## Variable Gain Photoreceiver - Fast Optical Power Meter

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 (@ 1300 nm)						
	Gain Accuracy	± 1 % electrical, between settings						
	Conversion Gain Accuracy (P <sub>opt</sub> ≤ 1 mW, @ 1300 nm)	OE-200-IN1-FS:	± 15 % electro-optical					
		OE-200-IN1-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	Ø 300 µm						
	Spectral Response	900 ... 1700 nm						
	Sensitivity	0.85 A/W (@ 1300 nm)						
	Dark Current	2 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	1.1 kHz
	Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
	NEP (√Hz, 1300 nm)	22 pW	2.7 pW	560 fW	170 fW	52 fW	20 fW	13 fW
	measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
	Integr. Input Noise (rms)*	25 nW	3.2 nW	750 pW	200 pW	56 pW	8.3 pW	1.3 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 <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	1.1 kHz
	Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
	NEP (√Hz, 1300 nm)	16 pW	2.2 pW	550 fW	170 fW	53 fW	21 fW	14 fW
	measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
	Integr. Input Noise (rms)*	15 nW	2.2 nW	630 pW	180 pW	52 pW	7.5 pW	1.2 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:

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

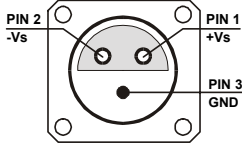
$$U_{\text{Output Noise peak peak}} = U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times 6$$

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.

## Variable Gain Photoreceiver - Fast Optical Power Meter

Specifications (continued)	
Output	Output Voltage Range $\pm 10\text{ V}$ (@ $\geq 1\text{ M}\Omega$ load) Output Impedance $50\ \Omega$ (terminate with $\geq 1\text{ M}\Omega$ load for best performance) Max. Output Current $\pm 30\text{ mA}$
Indicator LED	Function                                overload
Digital Control	Control Input Voltage Range      LOW bit: $-0.8 \dots +1.2\text{ V}$ , HIGH bit: $+2.3 \dots +12\text{ V}$ Control Input Current $0\text{ mA @ }0\text{ V}$ , $1.5\text{ mA @ }+5\text{ V}$ , $4.5\text{ mA @ }+12\text{ V}$ Overload Output                    non active: $0\text{ V}$ , max. $-1\text{ mA}$ , active: $5.1\text{ V}$ , max. $7\text{ mA}$
Ext. Offset Control	Control Voltage Range $\pm 10\text{ V}$ Offset Control Input Impedance $20\text{ k}\Omega$ Conversion Factor $40\ \mu\text{A/V}$
Power Supply	Supply Voltage $\pm 15\text{ V}$ Supply Current $+110 / -80\text{ mA}$ (depends on operating conditions, recommended power supply capability minimum $\pm 200\text{ mA}$ ) Stabilized Power Supply Output $\pm 12\text{ V}$ , max. $150\text{ mA}$ , $+5\text{ V}$ , max. $50\text{ mA}$
Case	Weight $320\text{ g}$ ( $0.74\text{ lb.}$ ) Material                                AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature $-40 \dots +80\text{ }^\circ\text{C}$ Operating Temperature $0 \dots +60\text{ }^\circ\text{C}$
Absolute Maximum Ratings	Max. CW Power (Averaged) $20\text{ mW}$ 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 $\pm 22\text{ V}$

## Variable Gain Photoreceiver - Fast Optical Power Meter

Connectors	<p>Input</p> <p style="margin-left: 20px;">OE-200-IN1-FS      25 mm round flange for free space applications</p> <p style="margin-left: 20px;">OE-200-IN1-FC      FC fiber optic receptacle</p> <p>Output</p> <p style="margin-left: 20px;">BNC</p> <p>Power Supply</p> <p style="margin-left: 20px;">LEMO series 1S, 3-pin fixed socket</p> <p style="margin-left: 20px;">Pin 1:      + 15 V</p> <p style="margin-left: 20px;">Pin 2:      - 15 V</p> <p style="margin-left: 20px;">Pin 3:      GND</p>
	
	<p>Control Port</p> <p style="margin-left: 20px;">Sub-D 25-pin, female, qual. class 2</p> <p style="margin-left: 20px;">Pin 1:      + 12 V (stabilized power supply output)</p> <p style="margin-left: 20px;">Pin 2:      - 12 V (stabilized power supply output)</p> <p style="margin-left: 20px;">Pin 3:      AGND (analog ground for pins 1 - 8)</p> <p style="margin-left: 20px;">Pin 4:      + 5 V (stabilized power supply output)</p> <p style="margin-left: 20px;">Pin 5:      status output: HIGH = overload</p> <p style="margin-left: 20px;">Pin 6:      signal output (connected to BNC)</p> <p style="margin-left: 20px;">Pin 7:      NC</p> <p style="margin-left: 20px;">Pin 8:      input offset control voltage</p> <p style="margin-left: 20px;">Pin 9:      DGND (ground for digital control pins 10 - 14)</p> <p style="margin-left: 20px;">Pin 10:     digital control input: gain, LSB</p> <p style="margin-left: 20px;">Pin 11:     digital control input: gain</p> <p style="margin-left: 20px;">Pin 12:     digital control input: gain, MSB</p> <p style="margin-left: 20px;">Pin 13:     digital control input: AC/DC</p> <p style="margin-left: 20px;">Pin 14:     digital control input: high speed / low noise</p> <p style="margin-left: 20px;">Pin 15 - 25: NC</p>
Available Models	<p>OE-200-IN1-FS      free space input, no calibration</p> <p>OE-200-IN1-FC      FC fiber optic receptacle, calibrated at 1300 nm</p> <p>OE-200-S             customized versions available on request</p>

## Variable Gain Photoreceiver - Fast Optical Power Meter

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.

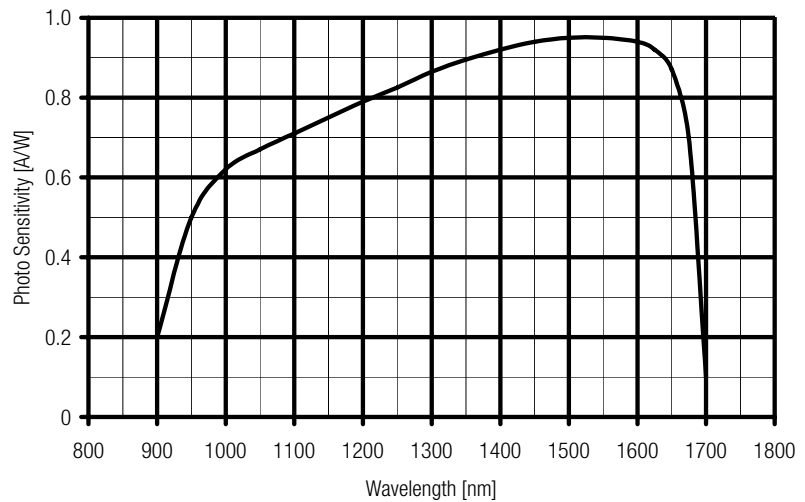
Gain Setting

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

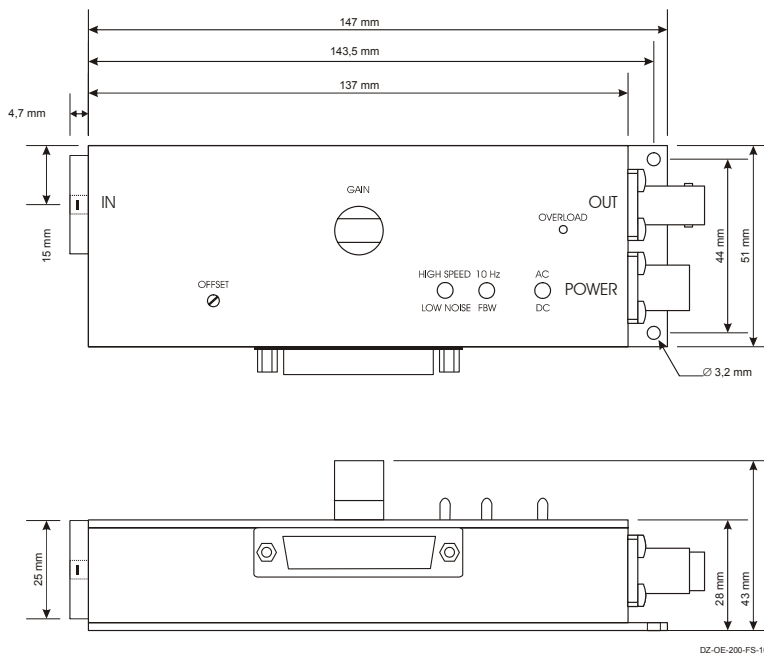
Spectral Response



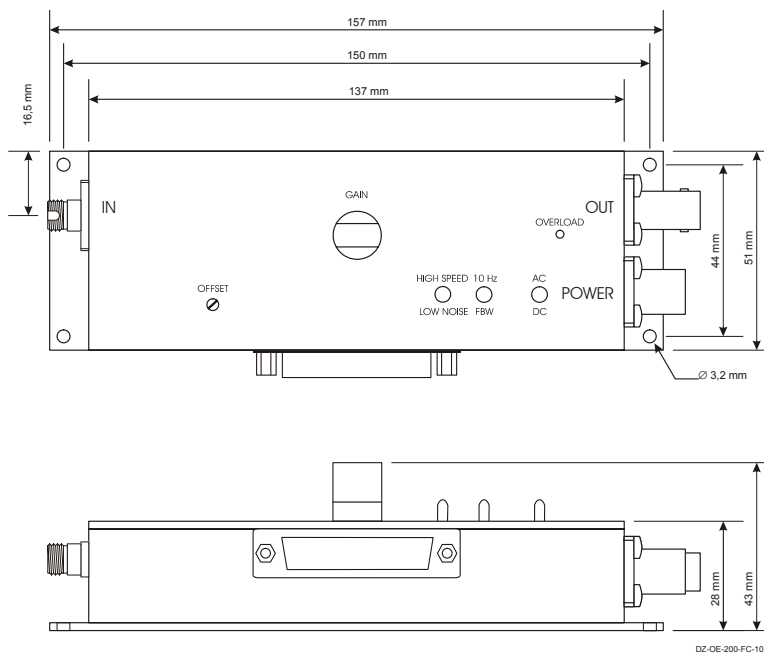
# Variable Gain Photoreceiver - Fast Optical Power Meter

Dimensions

Free Space Input OE-200-IN1-FS:



Fiber Optic Input OE-200-IN1-FC:



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