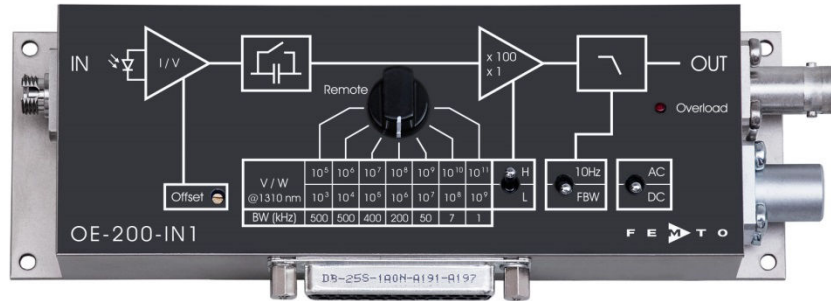


# Variable Gain Photoreceiver - Fast Optical Power Meter



The picture shows model OE-200-IN1-FC with fiber optic input.

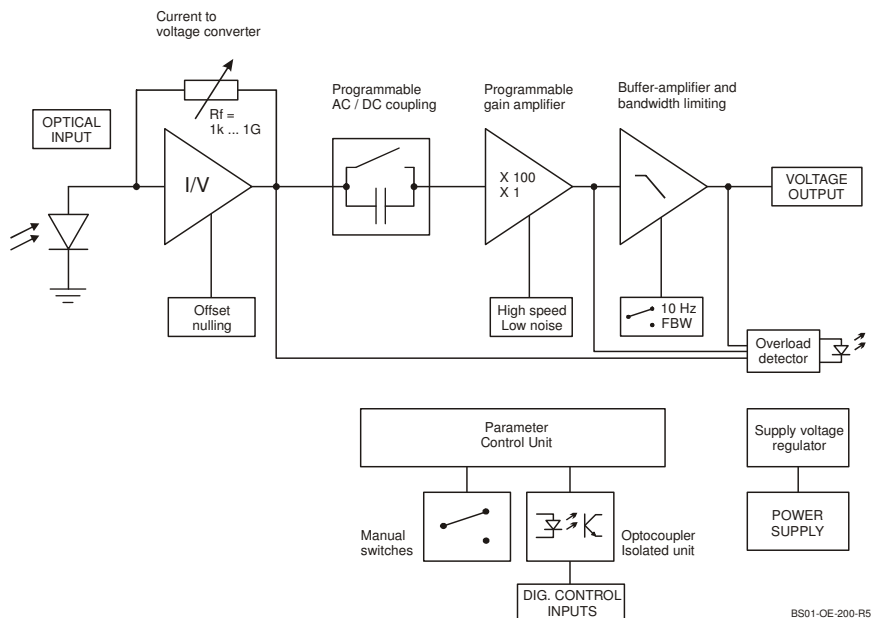
Features

- Conversion gain switchable from  $1 \times 10^3$  to  $1 \times 10^{11}$  V/W
- InGaAs-PIN detector
- Spectral range 900 - 1700 nm
- Calibrated at 1310 nm (fiber optic “-FC” version 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	Test conditions	$V_s = \pm 15 \text{ V}$ , $T_A = 25 \text{ }^\circ\text{C}$ , load impedance $1 \text{ M}\Omega$						
Gain	Conversion gain	$1 \times 10^3 \dots 1 \times 10^{11} \text{ V/W}$ (@ 1310 nm, load $\geq 100 \text{ k}\Omega$ )						
	Gain accuracy	$\pm 1 \%$ electrical, between settings						
	Conversion gain accuracy	OE-200-IN1-FS: $\pm 15 \%$ electro-optical						
	(@ $P_{\text{OPT}} \leq 2 \text{ mW}$ , @ 1310 nm)	OE-200-IN1-FC: $\pm 5 \%$ electro-optical (9/125 SM fiber)						
	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	$\pm 0.1 \text{ dB}$						
Input	Noise equivalent power (NEP)	see table below						
	Max. CW saturation power	see table below						
	Offset current compensation	$\pm 600 \text{ pA}$ , adjustable by offset potentiometer or $\pm 400 \text{ pA}$ , adjustable by external control voltage						
Detector	Detector	InGaAs-PIN photodiode						
	Active area	$\varnothing 300 \text{ }\mu\text{m}$ (free space “-FS” version only)						
	Spectral response	900 ... 1700 nm						
	Sensitivity	0.87 A/W (@ 1310 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 $\mu\text{s}$	7 $\mu\text{s}$	50 $\mu\text{s}$	300 $\mu\text{s}$
	NEP ( $\sqrt{\text{Hz}}$ , 1310 nm)	22 pW	2.7 pW	560 fW	170 fW	51 fW	16 fW	7 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 ( $^\circ\text{C}$ )	40 nW	4 nW	0.4 nW	34 pW	3.4 pW	0.5 pW	0.4 pW
	Gain drift ( $^\circ\text{C}$ )	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 $\mu\text{W}$	1 $\mu\text{W}$	0.1 $\mu\text{W}$	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 $\mu\text{s}$	7 $\mu\text{s}$	50 $\mu\text{s}$	300 $\mu\text{s}$
	NEP ( $\sqrt{\text{Hz}}$ , 1310 nm)	16 pW	2.2 pW	550 fW	170 fW	52 fW	16 fW	8 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 ( $^\circ\text{C}$ )	40 nW	4 nW	0.4 nW	34 pW	3.4 pW	0.5 pW	0.4 pW
	Gain drift ( $^\circ\text{C}$ )	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
	CW saturation power	0.1 mW	10 $\mu\text{W}$	1 $\mu\text{W}$	0.1 $\mu\text{W}$	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:

$$P_{\text{Input noise peak-to-peak}} = P_{\text{Input noise RMS}} \times 6$$

The output noise is given by:

$$U_{\text{Output noise RMS}} = P_{\text{Input noise RMS}} \times \text{Gain}$$

$$U_{\text{Output noise peak-to-peak}} = U_{\text{Output noise RMS}} \times 6 = P_{\text{Input noise RMS}} \times \text{Gain} \times 6$$

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)

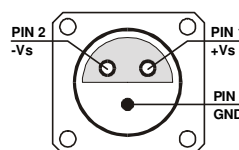
Output	Output voltage range	±10 V (@ ≥ 100 kΩ load)
	Output impedance	50 Ω (terminate with ≥ 100 kΩ load for best performance)
	Max. output current	±30 mA
Indicator LED	Function	overload
Digital Control	Control input voltage range	LOW bit: -0.8 ... +1.2 V, HIGH bit: 2.3 ... +12 V
	Control input current	0 mA @ 0 V, 1.5 mA @ +5 V, 4.5 mA @ +12 V
	Overload output	non active: <0.4 V, @ 0 ... -1 mA active: typ. 5 ... 5.1 V @ 0 ... 2 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 min. ±200 mA)
	Stabilized power supply output	±12 V, max. 50 mA, +5 V, max. 30 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	±20 V

## Variable Gain Photoreceiver - Fast Optical Power Meter

<p>Connectors</p>	<table border="0"> <tr> <td style="vertical-align: top;">Input</td> <td style="vertical-align: top;">                 OE-200-IN1-FS      25 mm round flange for free space applications                  OE-200-IN1-FC      FC fiber optic receptacle             </td> </tr> <tr> <td style="vertical-align: top;">Output</td> <td style="vertical-align: top;">BNC jack (female)</td> </tr> <tr> <td style="vertical-align: top;">Power supply</td> <td style="vertical-align: top;">                 Lemo® series 1S, 3-pin fixed socket                  (mating plug type: FFA.1S.303.CLAC52)                  Pin 1:    +15 V                  Pin 2:    -15 V                  Pin 3:    GND             </td> </tr> <tr> <td style="vertical-align: top;">Control port</td> <td style="vertical-align: top;">                 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:    overload output: HIGH = overload (referred to pin 3)                  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             </td> </tr> </table>	Input	OE-200-IN1-FS      25 mm round flange for free space applications OE-200-IN1-FC      FC fiber optic receptacle	Output	BNC jack (female)	Power supply	Lemo® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52) 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:    overload output: HIGH = overload (referred to pin 3) 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
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<p>Available Models</p>	<table border="0"> <tr> <td style="vertical-align: top;">                 OE-200-IN1-FS                  OE-200-IN1-FC                  OE-200-S             </td> <td style="vertical-align: top;">                 free space input, no calibration                  FC fiber optic receptacle, calibrated at 1310 nm                  customized versions available on request             </td> </tr> </table>	OE-200-IN1-FS OE-200-IN1-FC OE-200-S	free space input, no calibration FC fiber optic receptacle, calibrated at 1310 nm customized versions available on request						
OE-200-IN1-FS OE-200-IN1-FC OE-200-S	free space input, no calibration FC fiber optic receptacle, calibrated at 1310 nm customized versions available on request								



## 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

Gain settling time

<150 ms

AC/DC setting

Coupling	Pin 13
AC	LOW
DC	HIGH

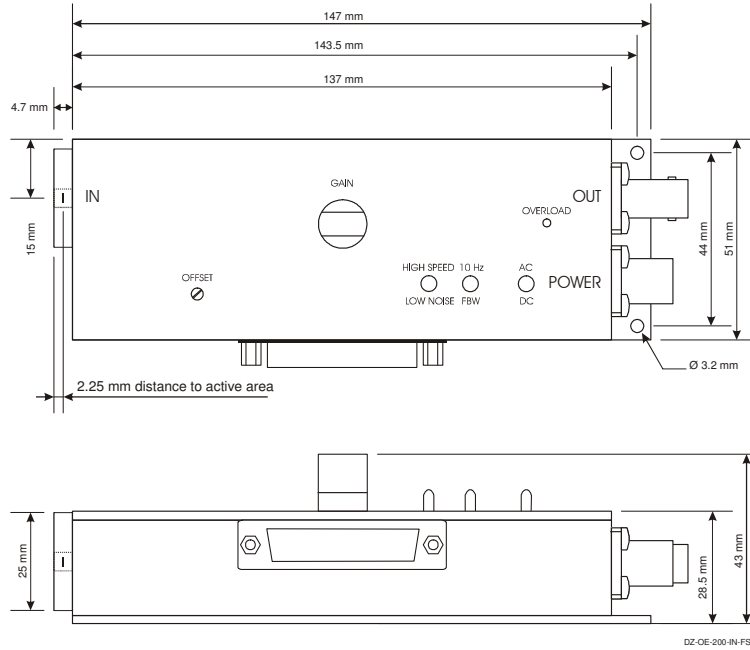
Conversion Gain



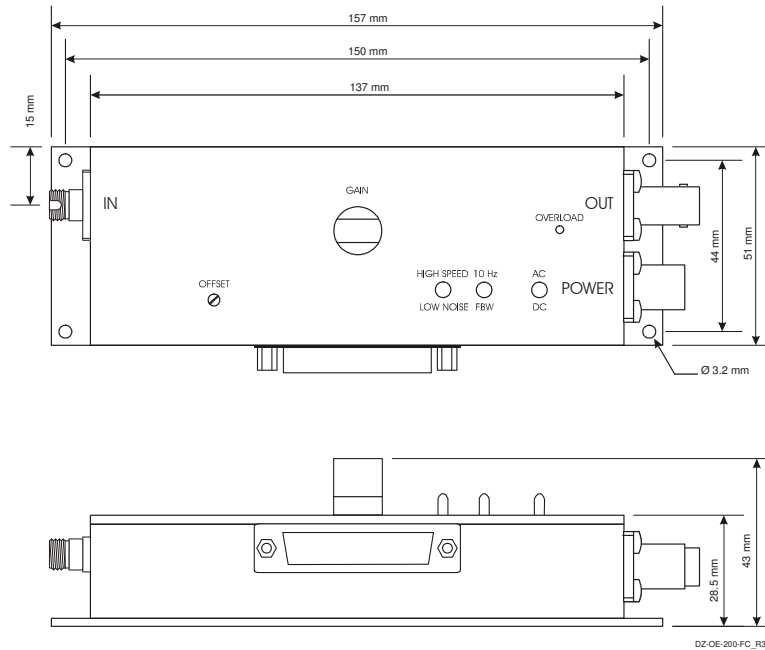
# Variable Gain Photoreceiver - Fast Optical Power Meter

Dimensions

OE-200-IN1-FS (free space input):



OE-200-IN1-FC (fiber optic input):



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