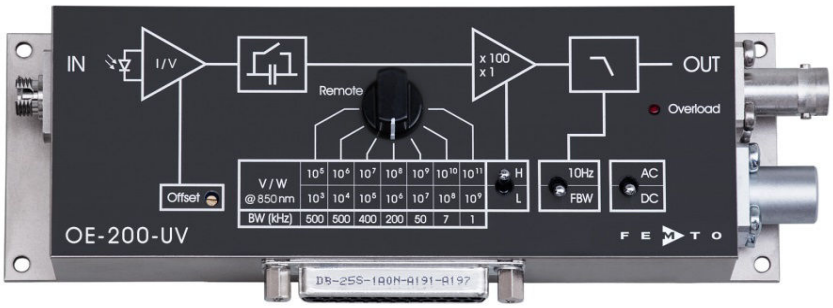
Variable Gain Photoreceiver - Fast Optical Power Meter



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

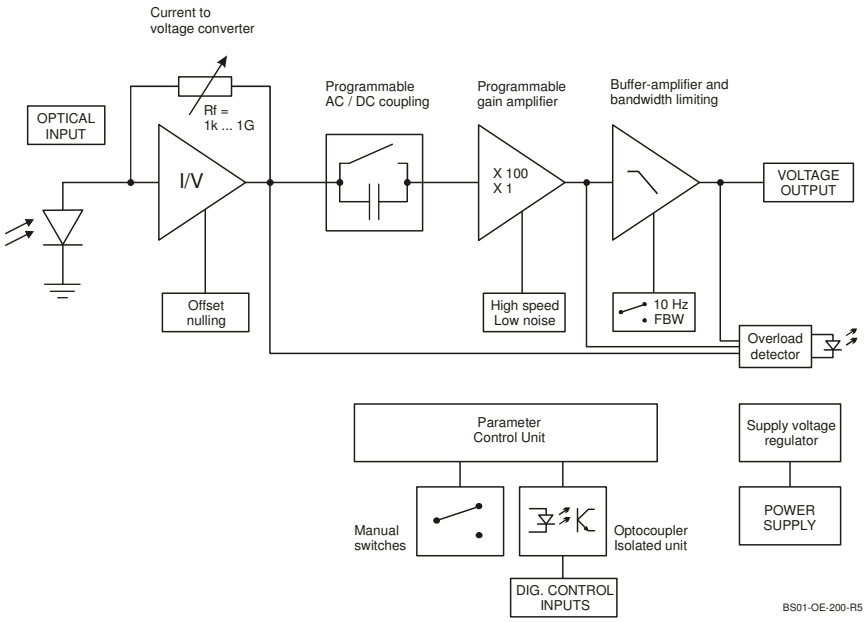
Features

- **Conversion gain switchable from 1 x 10^3 to 1 x 10^{11} V/W**
- **Si-PIN detector with 1.1 x 1.1 mm^2 active area**
- **Fiber optic or free space input**
- **Spectral range 190 - 1000 nm, UV enhanced**
- **Calibrated at 850 nm (fiber optic "-FC" 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

Test conditions: $V_S = \pm 15$ V, $T_A = 25$ °C, load impedance 1 MΩ

Gain

Conversion gain	1 x 10^3 ... 1 x 10^{11} V/W (@ 850 nm, load ≥ 100 kΩ)
Gain accuracy	±1 % electrical, between settings
Conversion gain accuracy (@ $P_{OPT} \leq 1$ mW, 850 nm)	OE-200-UV-FS: ±15 % electro optical OE-200-UV-FC: ±5 % electro optical (MM 50/125)
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 potentiometer or ±400 pA, adjustable by external control voltage

Detector

Detector	Si-PIN photodiode
Active area	1.1 x 1.1 mm^2
Spectral response	190 - 1000 nm, UV enhanced
Sensitivity	0.3 A/W (@ 850 nm) 0.1 A/W (@ 200 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, 850 nm)	60 pW	7.3 pW	1.5 pW	450 fW	150 fW	48 fW	17 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. input noise (RMS)*	63 nW	9 nW	2.8 nW	1 nW	320 pW	46 pW	6.2 pW
Input offset drift (/°C)	100 nW	10 nW	1 nW	85 pW	8.5 pW	1.3 pW	1 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, 850 nm)	48 pW	6.6 pW	1.5 pW	450 fW	150 fW	48 fW	17 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. input noise (RMS)*	41 nW	6.8 nW	2.5 nW	920 pW	300 pW	43 pW	6.1 pW
Input offset drift (/°C)	100 nW	10 nW	1 nW	85 pW	8.5 pW	1.3 pW	1 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:

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

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

Connectors

Input

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

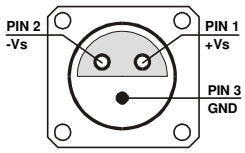
Output

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

Available Models

OE-200-UV-FS	free space input, no calibration
OE-200-UV-FC	FC receptacle, calibrated at 850 nm
OE-200-S	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

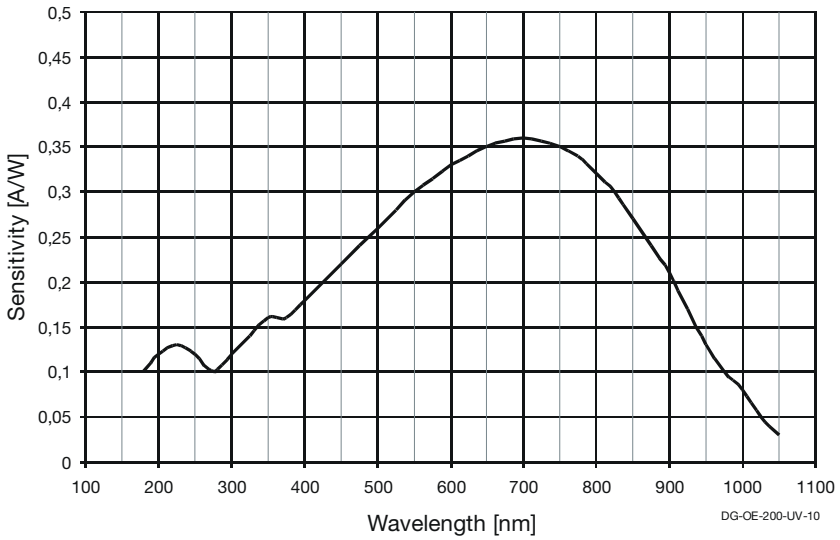
Gain settling time

<150 ms

AC/DC setting

Coupling	Pin 13
AC	LOW
DC	HIGH

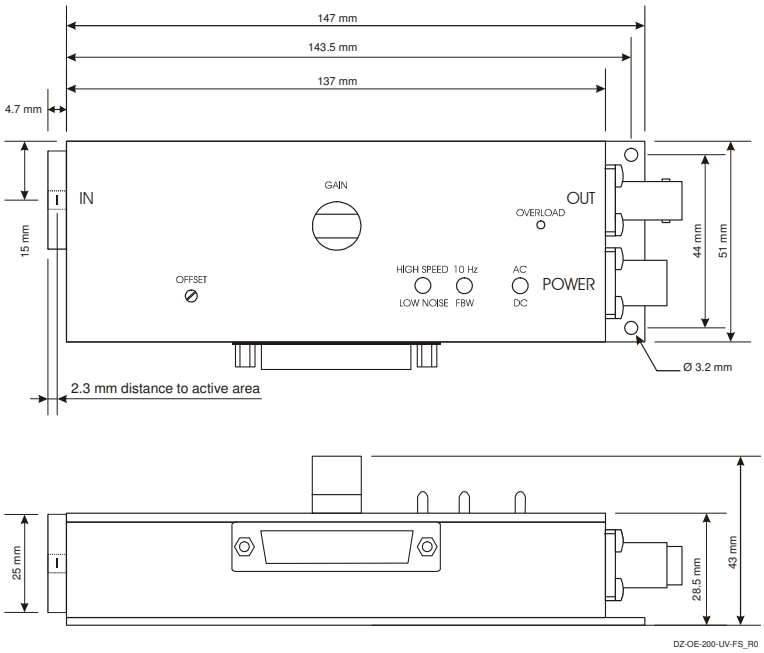
Spectral Response



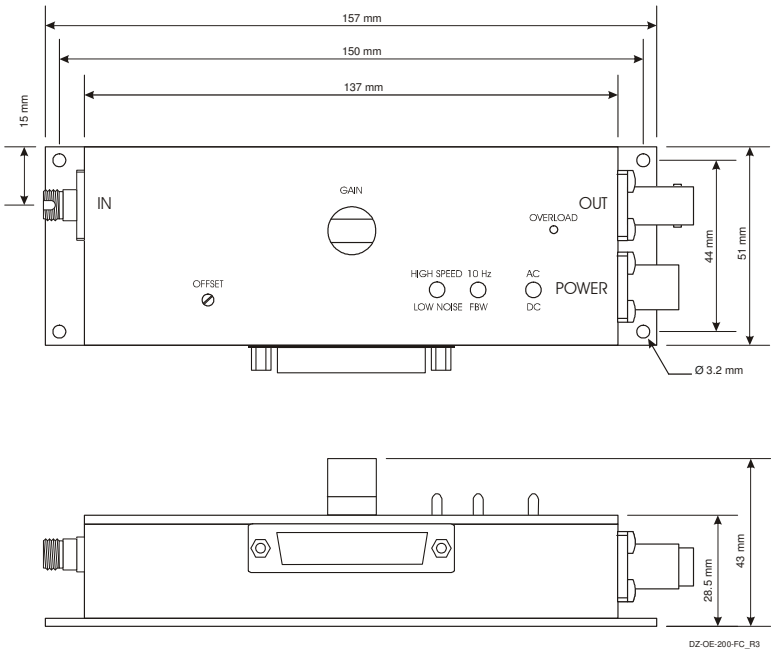
Variable Gain Photoreceiver - Fast Optical Power Meter

Dimensions

Free space input OE-200-UV-FS:



Fiber optic input OE-200-UV-FC:



FEMTO Messtechnik GmbH
Klosterstr. 64
10179 Berlin · Germany
Phone: +49 30 280 4711-0
Fax: +49 30 280 4711-11
Email: info@femto.de
www.femto.de