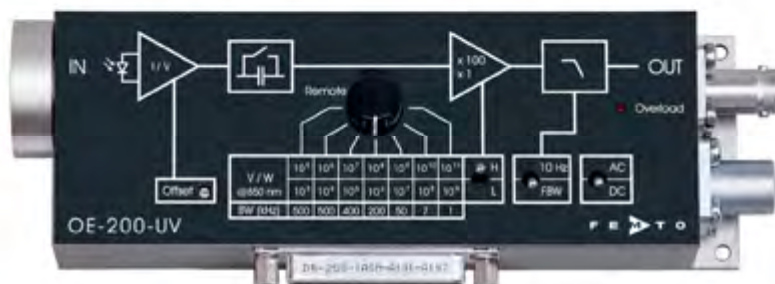




Datasheet

OE-200-UV

Variable Gain Low Noise Current Amplifier



The picture shows model OE-200-UV-FST

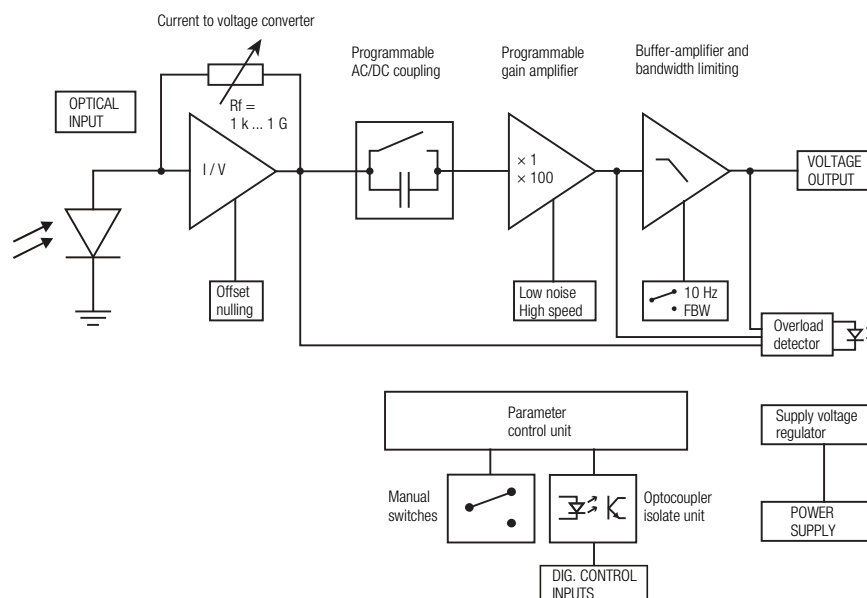
Features

- **Si-PIN detector, active area $1.1 \times 1.1 \text{ mm}^2$**
- **Spectral range 190 - 1000 nm**
- **Very low noise, NEP down to $17 \text{ fW}/\sqrt{\text{Hz}}$**
- **Bandwidth up to 500 kHz**
- **Conversion gain adjustable from 1×10^3 up to $1 \times 10^{11} \text{ V/W}$**
- **Free-space input 1.035"-40 threaded, easily convertible to fiber optic input (FC and FSMA) with optionally available screw-on adapters**
- **Fiber optic input also available as permanently mounted FC-input**
- **Factory calibrated at 850 nm (fiber optic FC version only)**
- **Full manual and remote control capability**



Applications

- **All-purpose very low-noise photoreceiver (O/E converter)**
- **Time resolved optical pulse and power measurements**
- **Optical front-end for oscilloscopes, spectrum analyzers, A/D converters and lock-in amplifiers**
- **Fast fiber optic power meter**

Block Diagram



Variable Gain Low Noise Current Amplifier

Intended Use	<p>The OE-200-UV is a ultra-low noise variable gain photoreceiver. It is designed for fast and precise conversion of small optical signals into equivalent output voltages. Operation is mostly self-explanatory. If in doubt, consult this document or contact support@femto.de.</p> <p>For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.</p> <p>The operating environment must be free of smoke, dust, grease, oil, condensing moisture, and other contaminants that could affect the operation or performance.</p>
Available Versions	<div data-bbox="560 558 706 579">OE-200-UV-FST</div> <div data-bbox="560 590 837 793">  </div> <div data-bbox="870 558 1401 877"> <p>1.035"-40 threaded flange with internally threaded coupler ring (outer diameter 30 mm) for free space applications. Compatible with many optical standard accessories and for use with various types of fiber connector adapters.</p> <p>Optionally available: Fiber adapters PRA-FC, PRA-FCA and PRA-FSMA. With the relative large 1.1 × 1.1 mm dia. photodiode the OE-200-UV input coupling is not critical. However, standard SM 9/125 fibers (PC or APC) with low numerical aperture (NA) are recommended for ensuring near 100% coupling efficiency.</p> </div> <div data-bbox="560 947 701 968">OE-200-UV-FC</div> <div data-bbox="626 978 837 1192">  </div> <div data-bbox="870 947 1417 1003"> <p>Fix/permanent FC fiber connector for high coupling efficiency and excellent conversion gain accuracy.</p> </div> <div data-bbox="560 1247 1357 1367"> <p>Since illumination conditions with the permanently mounted fiber optic connector are well defined, the FC model is delivered with a factory calibrated conversion gain at 850 nm.</p> <p>The electro optical conversion gain factor of the FST free space model is set to fit nominally at 850 nm.</p> </div>
<p>Related OE-200 Models</p> <p>Si Versions</p>	<p>See separate datasheets for following models on www.femto.de:</p> <div data-bbox="560 1461 699 1482">OE-200-SI-FST</div> <div data-bbox="870 1461 1268 1541"> <p>Si-PIN, Ø 1.2 mm, 320 - 1060 nm, conversion gain adjusted at 850 nm, free space input, 1.035"-40 threaded flange</p> </div> <div data-bbox="560 1556 688 1577">OE-200-SI-FC</div> <div data-bbox="870 1556 1208 1640"> <p>Si-PIN, Ø 1.2 mm, 320 - 1060 nm, conversion gain calibrated at 850 nm, FC fiber connector (fix/permanent)</p> </div>

Variable Gain Low Noise Current Amplifier

Related OE-200 Models (continued)

InGaAs Versions

OE-200-IN1-FST	InGaAs-PIN, \varnothing 300 μ m, 900 - 1700 nm, conversion gain adjusted at 1310 nm, free space input, 1.035"-40 threaded flange
OE-200-IN1-FC	InGaAs-PIN, integrated ball lens, 900 - 1700 nm, conversion gain calibrated at 1310 nm, FC fiber connector (fix/permanent)
OE-200-IN2-FST	InGaAs-PIN, \varnothing 300 μ m, 900 - 1700 nm, conversion gain adjusted at 1550 nm, free space input, 1.035"-40 threaded flange
OE-200-IN2-FC	InGaAs-PIN, integrated ball lens, 900 - 1700 nm, conversion gain calibrated at 1550 nm, FC fiber connector (fix/permanent)

Available Accessories

PRA-FC
PRA-FCA
PRA-FSMA



Fiber-adapter with external
1.035"-40 thread

PRA-PAP



Alternative mounting option:
post adapter plate, easy to mount
on FEMTO photoreceiver series OE,
FWPR, PWPR, HCA-S and LCA-S

PS-15-25-L



Power Supply
input: 100 – 240 VAC
output: \pm 15 VDC

LUCI-10



Compact digital I/O interface for USB
remote control, supports opto-isolation of
amplifier signal path from PC USB port,
16 digital outputs, 3 opto-isolated digital
inputs, bus-powered operation

Variable Gain Low Noise Current Amplifier

Specifications

Test conditions

$V_s = \pm 15 \text{ V}$, $T_A = 25 \text{ }^\circ\text{C}$, output load impedance $1 \text{ M}\Omega$, warm-up 20 minutes (min. 10 minutes recommended)

Gain

Conversion gain

$1 \times 10^3 \dots 1 \times 10^{11} \text{ V/W}$ (@ 850 nm, output load $\geq 100 \text{ k}\Omega$)

Gain accuracy

$\pm 1 \%$ electrical, between settings

Conversion gain accuracy

OE-200-UV-FST (@ $P_{\text{OPT}} \leq 2 \text{ mW}$, 850 nm) $\pm 15 \%$ nominal

OE-200-UV-FC (@ $P_{\text{OPT}} \leq 1 \text{ mW}$, 850 nm) $\pm 5 \%$ guaranteed by factory calibration*

* factory verified with MM 50/125, FC/APC, NA 0.22 (when using FC/PC fiber connector, coupling efficiency may differ slightly), coupling efficiency depends on fiber type.

Gain drift

see table below

Frequency Response

Lower cut-off frequency

DC / 1 Hz, switchable

Upper cut-off frequency (–3 dB)

up to 500 kHz (see table below), switchable to 10 Hz

Input

Input offset current (dark current)

2 pA typ.

Input offset drift

see table below

Input offset compensation range

$\pm 600 \text{ pA}$, adjustable by offset potentiometer or $\pm 400 \text{ pA}$, adjustable by external control voltage

Optical CW saturation power

see table below

Noise equivalent power (NEP)

see table below

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 ($\sqrt{\text{Hz}}$)**	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 ($^\circ\text{C}$)**	100 nW	10 nW	1 nW	85 pW	8.5 pW	1.3 pW	1 pW
Gain drift ($^\circ\text{C}$)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
Optical 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 ($\sqrt{\text{Hz}}$)**	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 ($^\circ\text{C}$)**	100 nW	10 nW	1 nW	85 pW	8.5 pW	1.3 pW	1 pW
Gain drift ($^\circ\text{C}$)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
Optical CW saturation power**	0.1 mW	10 μW	1 μW	0.1 μW	10 nW	1 nW	0.1 nW

** referred to 850 nm

*** The integrated input noise is measured with a shaded input in the full bandwidth ("FBW") setting (referred to 850 nm).

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.

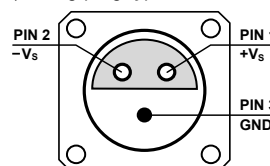
Variable Gain Low Noise Current Amplifier

Specifications (continued)

Detector	Detector type Active area Spectral range Sensitivity	Si-PIN photodiode $1.1 \times 1.1 \text{ mm}^2$ 190 - 1000 nm 0.29 A/W (@ 850 nm) 0.36 A/W (@ 700 nm)
Output	Output voltage Output impedance Max. output current	$\pm 10 \text{ V}$ (@ $\geq 100 \text{ k}\Omega$ output load) 50Ω (terminate with $\geq 100 \text{ k}\Omega$ load) $\pm 30 \text{ mA}$ (short-circuit proof)
Indicator LED	Function	overload
Digital Control	Control input voltage range Control input current Overload output	LOW bit: $-0.8 \text{ V} \dots +1.2 \text{ V}$, HIGH bit: $+2.3 \text{ V} \dots +12 \text{ V}$ 0 mA @ 0 V , 1.5 mA @ $+5 \text{ V}$, 4.5 mA @ $+12 \text{ V}$ non active: $<0.4 \text{ V}$ @ $0 \dots -1 \text{ mA}$ active: typ. $5 \dots 5.1 \text{ V}$ @ $0 \dots 2 \text{ mA}$
Ext. Offset Control	Control voltage range Offset control input impedance Conversion factor	$\pm 10 \text{ V}$ $20 \text{ k}\Omega$ 40 pA/V
Optical Input Connector	Material FST flange Material FST coupler ring Material FC receptacle	1.4305 stainless steel, nickel-plated 1.4305 stainless steel, glass bead blasted nickel silver
Power Supply	Supply voltage Supply current	$\pm 15 \text{ V}$ ($\pm 14.75 \text{ V} \dots \pm 16.5 \text{ V}$) $\pm 110 / -80 \text{ mA}$ typ. (depends on operating conditions, recommended power supply capability min. $\pm 200 \text{ mA}$)
Case	Weight Material	360 g (0.79 lbs) AlMg4.5Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	$-40 \text{ }^\circ\text{C} \dots +80 \text{ }^\circ\text{C}$ $0 \text{ }^\circ\text{C} \dots +60 \text{ }^\circ\text{C}$

Absolute Maximum Ratings	Optical input power (CW) Digital control input voltage Analog control input voltage Power supply voltage	20 mW $-5 \text{ V}/+16 \text{ V}$ relative to digital ground DGND (pin 9) $\pm 15 \text{ V}$ relative to analog ground AGND (pin 3) $\pm 20 \text{ V}$
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Connectors	Input Output Power supply	OE-200-UV-FST 1.035"-40 threaded flange for free space applications OE-200-UV-FC FC fiber optic connector BNC jack (female) LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)
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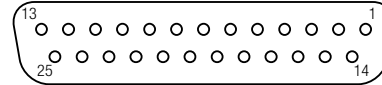
Pin 1: +15 V
Pin 2: -15 V
Pin 3: GND

Variable Gain Low Noise Current Amplifier

Connectors (continued)

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)
- Pin 4: +5 V (stabilized power supply output*)
- Pin 5: digital output: 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

*stabilized power supply output current
±12 V: max. ±50 mA, +5V: max. 30 mA

Remote Control Operation

General

Remote control input bits are opto-isolated and connected by logical OR function to local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" (High speed) and select the wanted setting via a bit code at the corresponding digital inputs.

Mixed operation, e.g. local gain setting and remote controlled AC/DC setting, is also possible.

Switch setting "FBW / 10 Hz" of the low pass signal filter is not remote controllable.

Gain setting

Low noise	High speed			
Pin 14=HIGH	Pin 14=LOW	Pin 12	Pin 11	Pin 10
Gain (V/W)	Gain (V/W)	MSB		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

Scope of Delivery

OE-200-UV, internally threaded coupler ring (FST version only), LEMO® 3-pin connector, datasheet, transport package

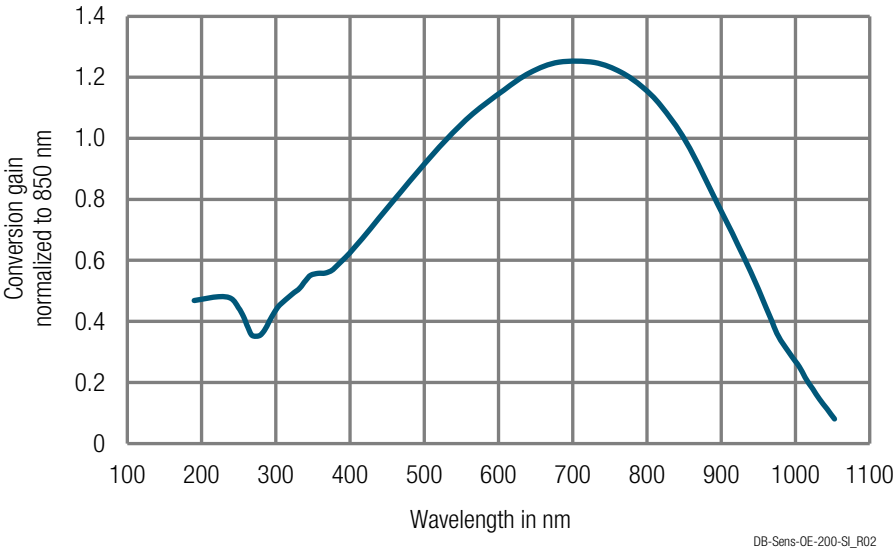
Variable Gain
Low Noise Current Amplifier

Ordering Information

OE-200-UV-FST 1.035"-40 threaded flange for free space applications and
for use with various types of optical standard accessories.

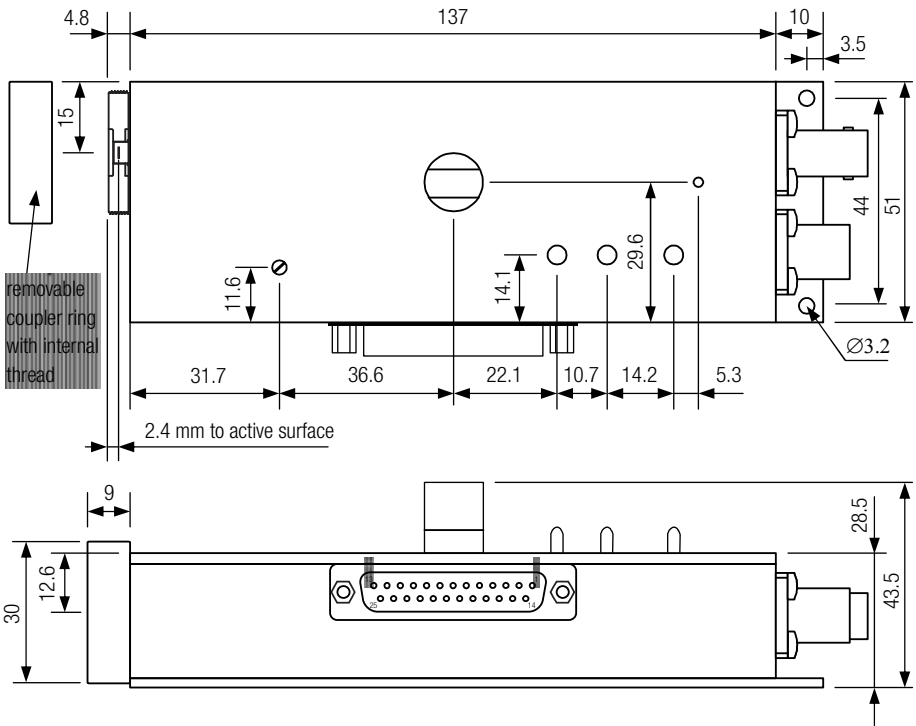
OE-200-UV-FC FC fiber optic connector
(fix/permanent, FC/PC and FC/APC compatible).

Conversion Gain



Dimensions

OE-200-UV-FST (1.035"-40 threaded free space input)



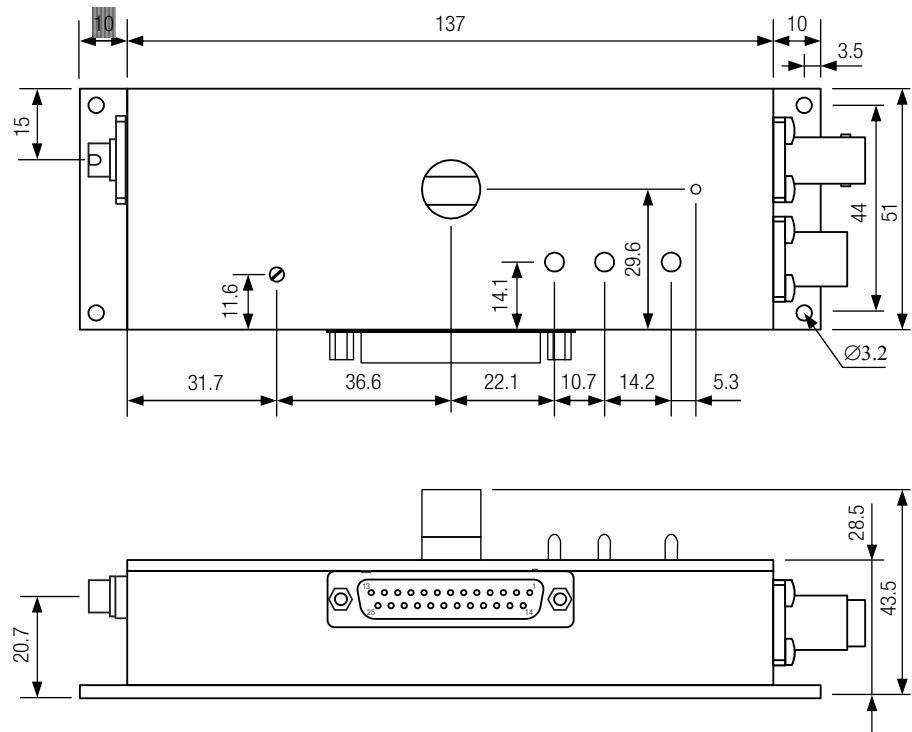
all dimensions in mm unless otherwise noted

DZ-OE-200-FST_R1

Variable Gain Low Noise Current Amplifier

Dimensions (continued)

OE-200-UV-FC (FC fiber optic input)



DZ-OE-200-FC_R06

all dimensions in mm unless otherwise noted

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