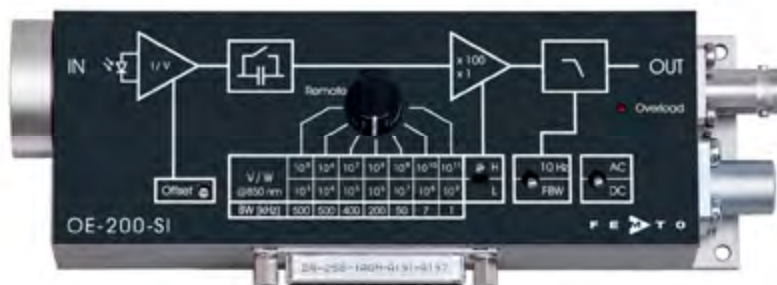




Datasheet

OE-200-SI

Variable Gain Photoreceiver – Fast Optical Power Meter



The picture shows model OE-200-SI-FST

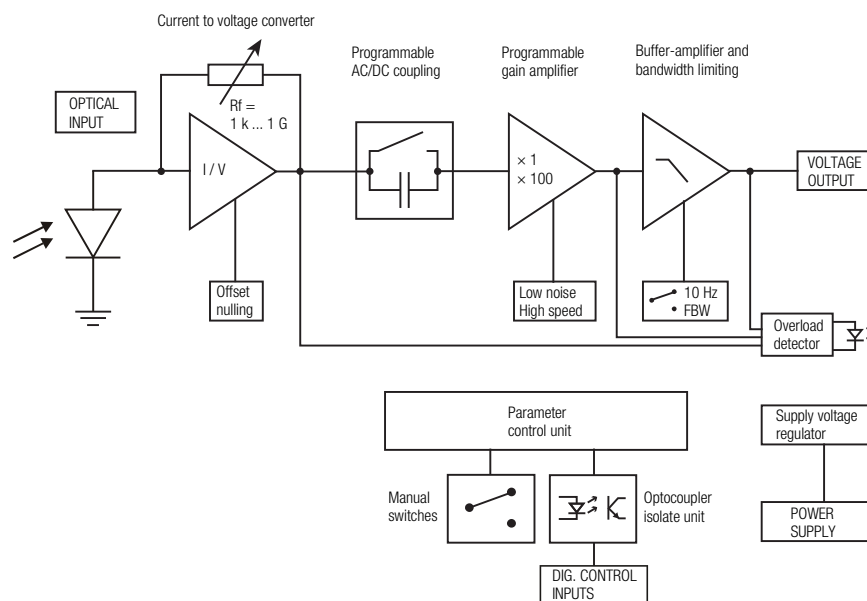
Features

- Si-PIN detector, active diameter 1.2 mm
- Spectral range 320 - 1060 nm
- Very low noise, NEP down to 8 fW/√Hz
- Bandwidth up to 500 kHz
- Conversion gain adjustable from 1×10^3 up to 1×10^{11} 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 Photoreceiver – Fast Optical Power Meter

Intended Use

The OE-200-SI 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.

For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.

The operating environment must be free of smoke, dust, grease, oil, condensing moisture, and other contaminants that could affect the operation or performance.

Available Versions

OE-200-SI-FST



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.

Optionally available:

Fiber adapters PRA-FC, PRA-FCA and PRA-FSMA. With the relative large 1.2 mm dia. photodiode installed in the OE-200-SI 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.

OE-200-SI-FC



Fix/permanent FC fiber connector for high coupling efficiency and excellent conversion gain accuracy.

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.

The electro optical conversion gain factor of the FST free space model is set to fit nominally at 850 nm.

Related OE-200 Models

Si Versions

See separate datasheets for following models on www.femto.de:

OE-200-UV-FST

Si-PIN, $1.1 \times 1.1 \text{ mm}^2$, 190 - 1000 nm conversion gain adjusted at 850 nm, free space input, 1.035"-40 threaded flange

OE-200-UV-FC

Si-PIN, $1.1 \times 1.1 \text{ mm}^2$, 190 - 1000 nm conversion gain calibrated at 850 nm, FC fiber connector (fix/permanent)

Variable Gain Photoreceiver – Fast Optical Power Meter

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 Photoreceiver – Fast Optical Power Meter

Specifications	Test conditions	V _S = ±15 V, T _A = 25 °C, output load impedance 1 MΩ, warm-up 20 minutes (min. 10 minutes recommended)						
Gain	Conversion gain	1 × 10 ³ ... 1 × 10 ¹¹ V/W (@ 850 nm, output load ≥ 100 kΩ)						
	Gain accuracy	±1 % electrical, between settings						
	Conversion gain accuracy	OE-200-SI-FST (@ P _{OPT} ≤ 2 mW, 850 nm) ±15 % nominal OE-200-SI-FC (@ P _{OPT} ≤ 1 mW, 850 nm) ±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.						
Frequency Response	Gain drift	see table below						
	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	±600 pA, adjustable by offset potentiometer or ±400 pA, adjustable by external control voltage						
Performance depending on Gain Setting	Optical CW saturation power	see table below						
	Noise equivalent power (NEP)	see table below						
	Gain setting (low noise) (V/W)**	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁸	10 ⁹
Performance depending on Gain Setting	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)**	33 pW	3.8 pW	800 fW	240 fW	75 fW	24 fW	8 fW
	Measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
	Integr. input noise (RMS)***	39 nW	5 nW	1.3 nW	400 pW	130 pW	17 pW	2.5 pW
	Input offset drift (°C)**	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
	Gain drift (°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 (√Hz)**	25 pW	3.5 pW	800 fW	240 fW	76 fW	24 fW	8 fW
	Measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
	Integr. input noise (RMS)***	24 nW	3.7 nW	1.1 nW	350 pW	110 pW	16 pW	2.3 pW
	Input offset drift (°C)**	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
	Gain drift (°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 Photoreceiver – Fast Optical Power Meter

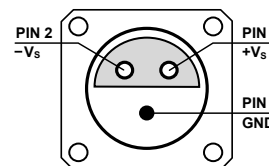
Specifications (continued)

Detector	Detector type Active area Spectral range Sensitivity	Si-PIN photodiode Ø 1.2 mm 320 - 1060 nm 0.61 A/W (@ 850 nm) 0.64 A/W (@ 900 nm)
Output	Output voltage Output impedance Max. output current	±10 V (@ ≥100 kΩ output load) 50 Ω (terminate with ≥100 kΩ load) ±30 mA (short-circuit proof)
Indicator LED	Function	overload
Digital Control	Control input voltage range Control input current Overload output	LOW bit: -0.8 V ... +1.2 V, HIGH bit: +2.3 V ... +12 V 0 mA @ 0 V, 1.5 mA @ +5 V, 4.5 mA @ +12 V non active: <0.4 V @ 0 ... -1 mA active: typ. 5 ... 5.1 V @ 0 ... 2 mA
Ext. Offset Control	Control voltage range Offset control input impedance Conversion factor	±10 V 20 kΩ 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	±15 V (±14.75 V ... ±16.5 V) ±110 / -80 mA typ. (depends on operating conditions, recommended power supply capability min. ±200 mA)
Case	Weight Material	360 g (0.79 lbs) AlMg4.5Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	-40 °C ... +80 °C 0 °C ... +60 °C

Absolute Maximum Ratings	Optical input power (CW) Digital control input voltage Analog control input voltage Power supply voltage	20 mW -5 V/+16 V relative to digital ground DGND (pin 9) ±15 V relative to analog ground AGND (pin 3) ±20 V
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Connectors

Input	OE-200-SI-FST 1.035"-40 threaded flange for free space applications
Output	OE-200-SI-FC FC fiber optic connector BNC jack (female)
Power supply	LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)



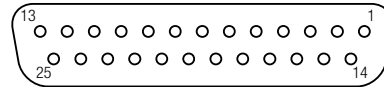
Pin 1: +15 V
Pin 2: -15 V
Pin 3: GND

Variable Gain Photoreceiver – Fast Optical Power Meter

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

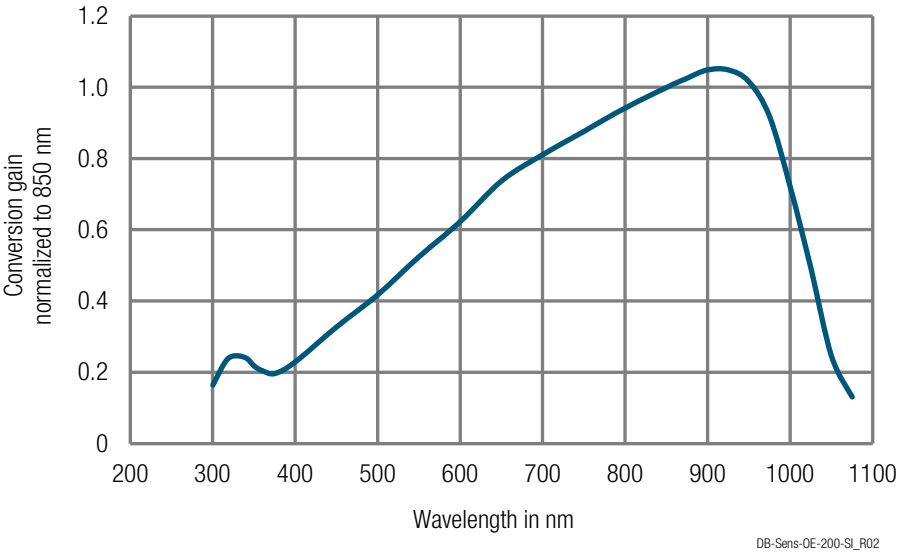
Variable Gain Photoreceiver –
Fast Optical Power Meter

Ordering Information

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

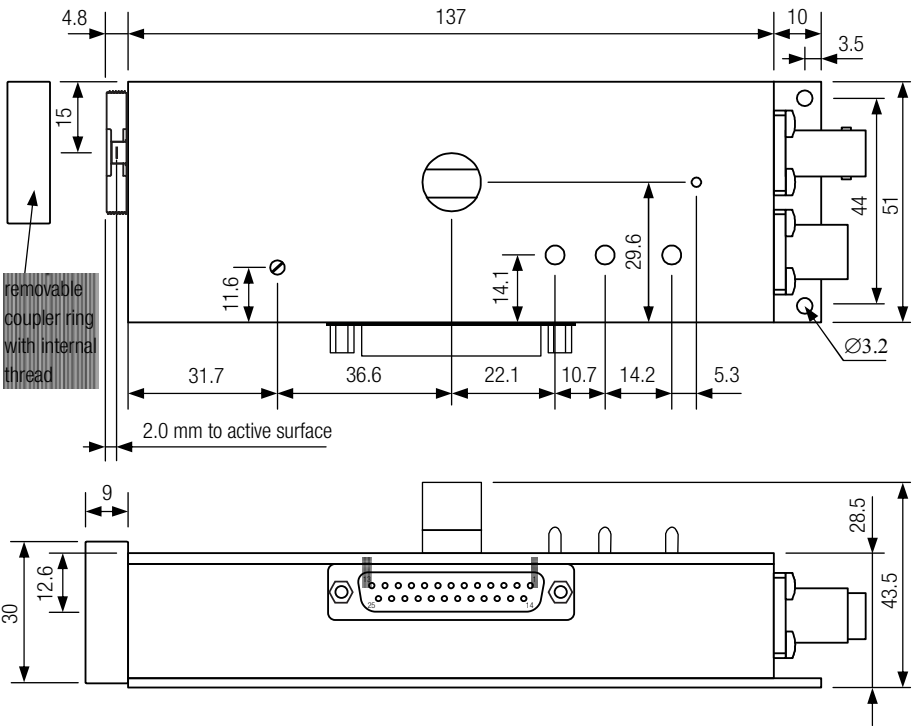
OE-200-SI-FC FC fiber optic connector
(fix/permanent, FC/PC and FC/APC compatible).

Conversion Gain



Dimensions

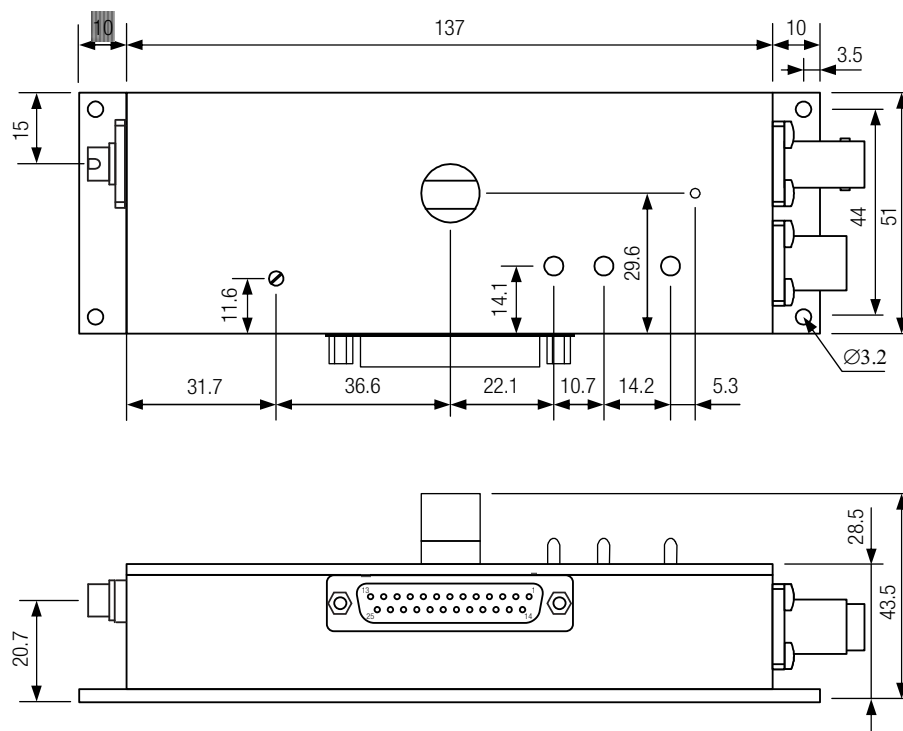
OE-200-SI-FST (1.035"-40 threaded free space input)



Variable Gain Photoreceiver – Fast Optical Power Meter

Dimensions (continued)

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



DZ-OE-200-FC_R06

all dimensions in mm unless otherwise noted

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