

Accessories

Remote Power Supply

PS-15-2-L

- Input voltage 220 - 240 VAC
- Output $\pm 15\text{ V}$, + 400/- 250 mA
- Shielded output cord with LEMO plug
- Floating design to avoid ground loops
- Short circuit protected
- Linear regulated
- Ripple max. 20 mVpp
- Suitable for all FEMTO modules

PS-15-3-L

- Input voltage 110 - 130 VAC
- Other specifications identical to PS-15-2-L



LEMO Connectors and Cables

- High quality connectors
- 3 pin and 4 pin versions available
- For use with shielded cables
- Suitable for all FEMTO modules
- LEMO to Banana adapter cables available

Femtowatt Photoreceiver with Si Photodiode

FWPR-20-SI

FEATURES

- Ultra-Low-Noise, Minimum NEP 0.7 fW/ $\sqrt{\text{Hz}}$
- Amplifier Transimpedance Gain $1 \times 10^{12}\text{ V/A}$
- Si Photodiode, $1.1 \times 1.1\text{ mm}^2$ Active Area

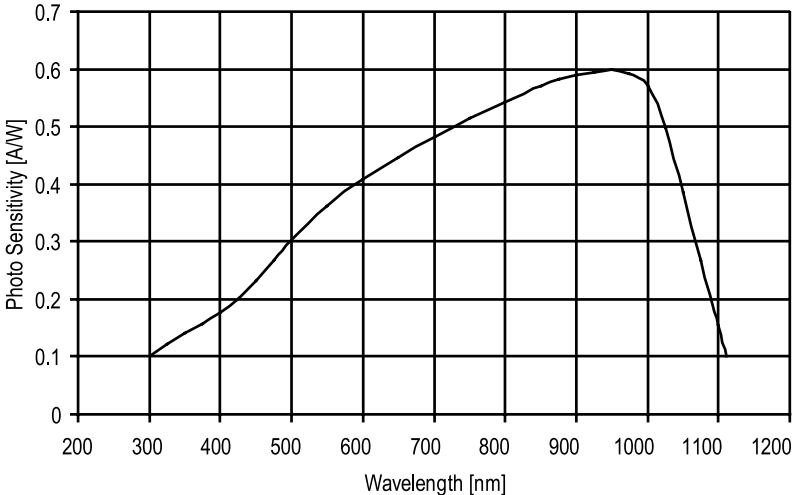
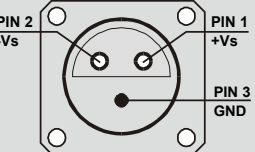
APPLICATIONS

- Fluorescence Measurements
- Spectroscopy
- Electrophoresis
- Replacement for Photomultiplier Tubes (PMTs) and Avalanche Photodiodes (APDs)

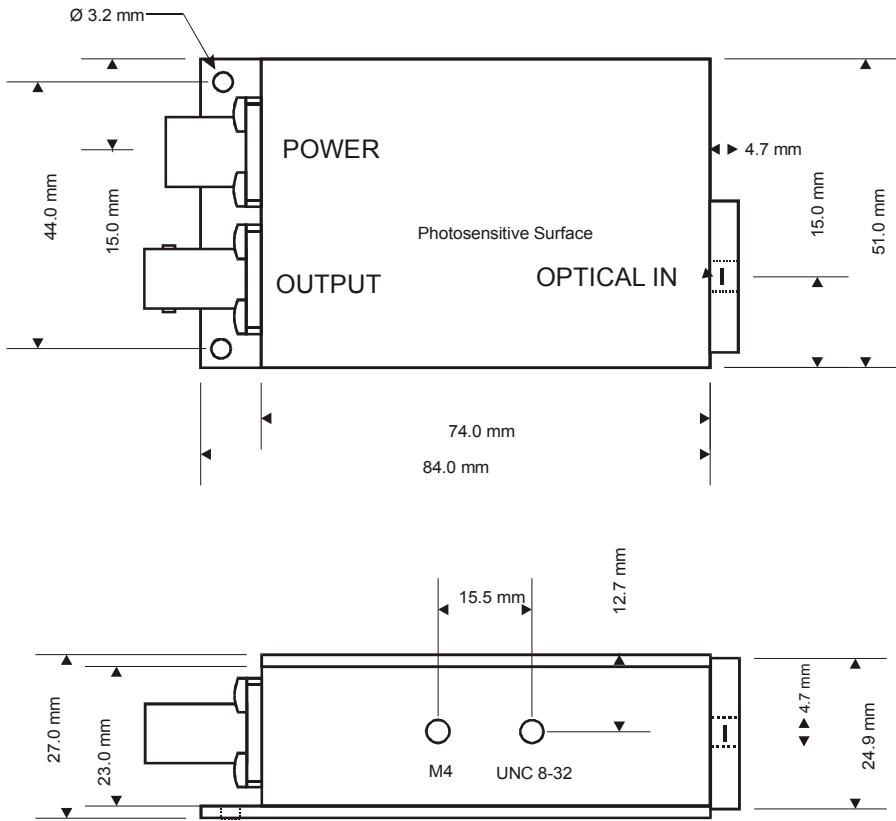


The Photoreceiver will be delivered without post holder and post.

Specifications	Test Conditions	$V_s = \pm 15\text{ V}$, $T_a = 25^\circ\text{C}$
Gain	Transimpedance	$1.0 \times 10^{12}\text{ V/A}$
	Max. Conversion Gain	$0.6 \times 10^{12}\text{ V/W}$ (@ 960 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	20 Hz (- 3 dB)
	Rise/Fall-Time	18 ms (10% - 90%)
Detector	Detector Material	Si Photodiode
	Active Area	$1.1 \times 1.1\text{ mm}^2$
	Spectral Response	320 nm - 1100 nm
Input	Optical Saturation Power	18 pW (@ 960 nm)
Noise	Min. NEP	0.7 fW/ $\sqrt{\text{Hz}}$ (@ 960 nm, 1 Hz)
Output	Output Voltage	$\pm 10\text{ V}$ (@ $\geq 10\text{ k}\Omega$ Load)
	Output Impedance	50 Ω (Terminate with $>10\text{ k}\Omega$ for Best Performance)
	Offset Voltage	0 V, Adjustable by Offset-Trimpot within $\pm 1.6\text{ V}$
	Max. Output Current	$\pm 25\text{ mA}$
Power Supply	Supply Voltage	$\pm 15\text{ V}$ ($\pm 14.5\text{ V}$ to $\pm 16\text{ V}$)
	Supply Current	$\pm 15\text{ mA}$ typ. (Depends on Operating Conditions, Recommended Power Supply Capability Minimum $\pm 50\text{ mA}$)
Case	Weight	0.19 kg (0.42 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40°C to $+100^\circ\text{C}$
	Operating Temperature	0°C to $+60^\circ\text{C}$

Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors	Input	Optical, Free Space, 25 mm Ø Round Flange Compatible with Microbench Systems
	Output	BNC
	Power Supply	LEMO Series 1S, 3-pin fixed Socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 

Dimensions



DZ-FWPR_1.cdr

Femtowatt Photoreceiver with InGaAs-PIN Photodiode

FWPR-20-IN

FEATURES

- Ultra-Low-Noise, Minimum NEP 7.5 fW/√Hz
- Amplifier Transimpedance Gain 1 x 10¹¹ V/A
- InGaAs-PIN Detector, 0.5 mm Active Diameter

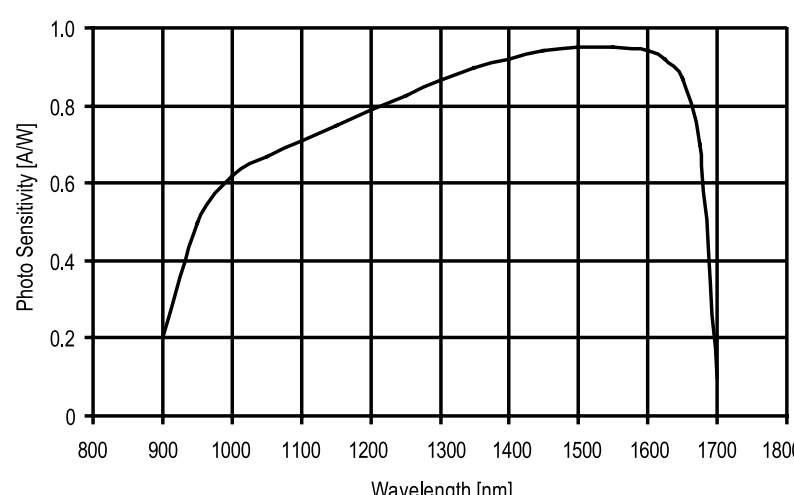
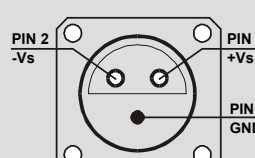
APPLICATIONS

- Fluorescence Measurements
- NIR Spectroscopy
- Electrophoresis
- Replacement for (liquid nitrogen) cooled Ge-Photodiodes and Avalanche Photodiodes (APDs)

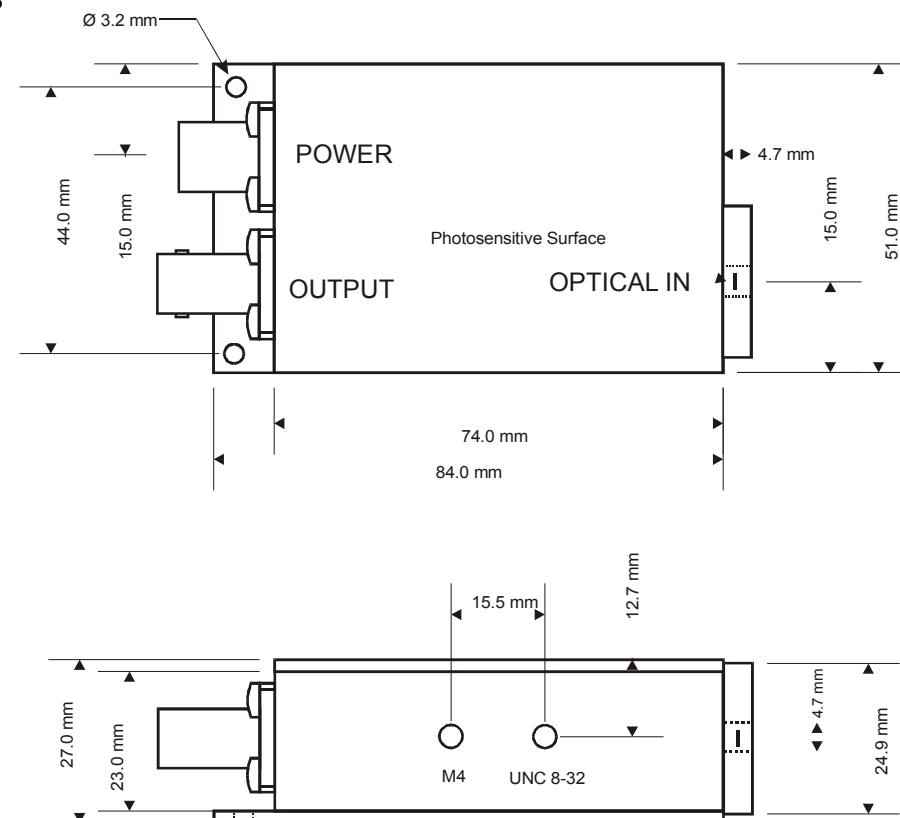


The Photoreceiver will be delivered without post holder and post.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25 °C
Gain	Transimpedance	1.0 x 10 ¹¹ V/A
	Max. Conversion Gain	0.95 x 10 ¹¹ V/W (@ 1550 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	20 Hz (- 3 dB)
	Rise/Fall-Time	18 ms (10% - 90%)
Detector	Detector Material	InGaAs-PIN Photodiode
	Active Area	Ø 0.5 mm
	Spectral Response	900 nm - 1700 nm
Input	Optical Saturation Power	110 pW (@ 1550 nm)
Noise	Min. NEP	7.5 fW/√Hz (@ 1550 nm, 1 Hz)
Output	Output Voltage	± 10 V (@ ≥ 10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for Best Performance)
	Offset Voltage	0 V, Adjustable by Offset-Trimpot within ± 1.6 V
	Max. Output Current	± 25 mA
Power Supply	Supply Voltage	± 15 V (± 14.5 V to ± 16 V)
	Supply Current	± 15 mA typ. (Depends on Operating Conditions, Recommended Power Supply Capability Minimum ± 50 mA)
Case	Weight	0.19 kg (0.42 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 °C to +100 °C
	Operating Temperature	0 °C to +60 °C

Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors	Input	Optical, Free Space, 25 mm Ø Round Flange Compatible with Microbench Systems
	Output	BNC
	Power Supply	LEMO Series 1S, 3-pin fixed Socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 

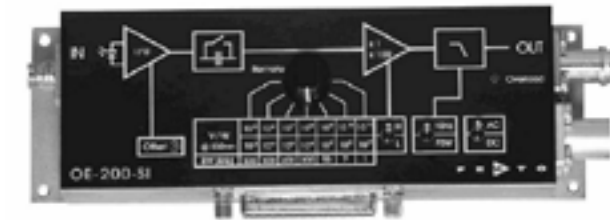
Dimensions



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Variable Gain Photoreceiver - Fast Optical Power Meter

OE-200-SI



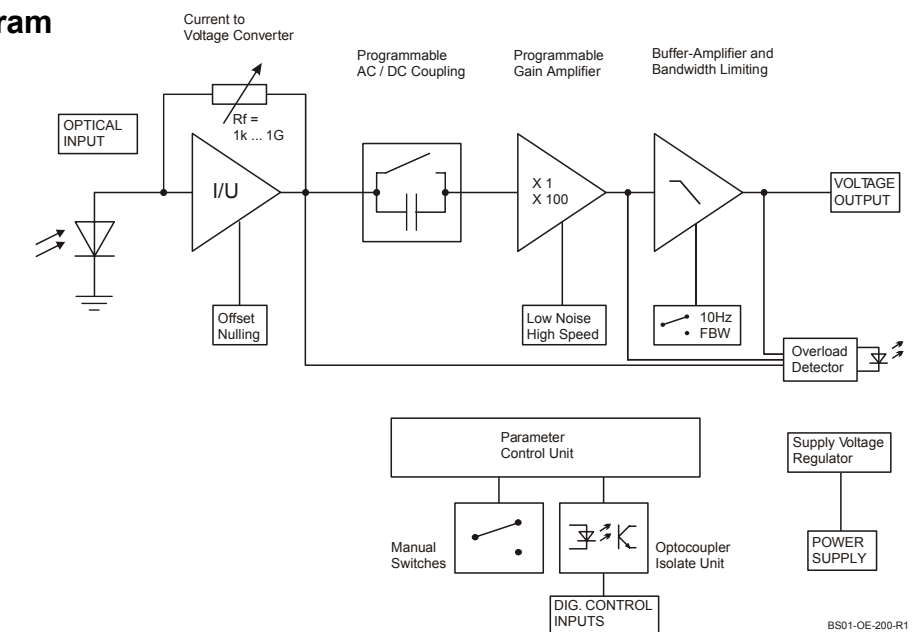
FEATURES

- Conversion Gain Switchable from 1×10^3 to 1×10^{11} V/W
- Si PIN Detector with 1.2 mm Active Diameter
- Fiber Optic or Free Space Input
- Spectral Range 320 - 1060 nm
- Calibrated at 830 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



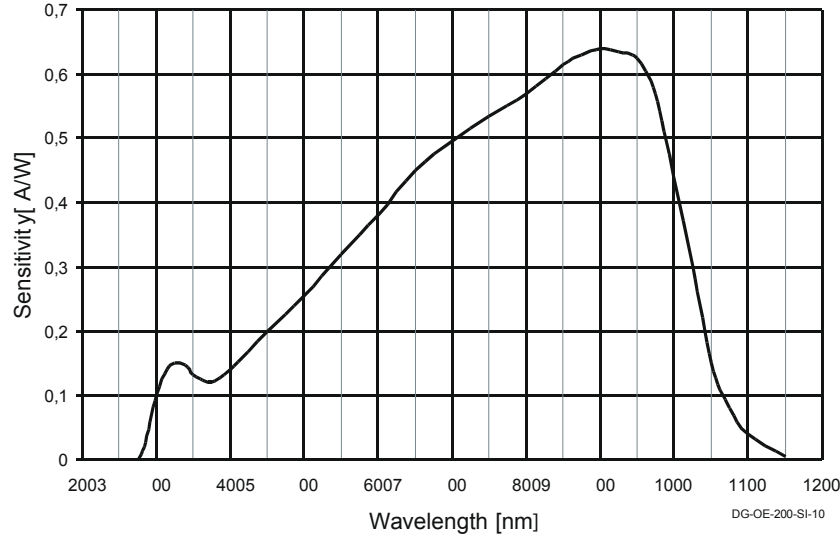
BS01-OE-200-R1

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Conversion Gain	1 x 10 ³ ... 1 x 10 ¹¹ V/W (@ 830 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy	OE-200-SI-FS: ± 15 % electro optical
	(Popt ≤ 1 mW, @ 830 nm)	OE-200-SI-FC/-SMA: ± 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	Si PIN photodiode
	Active Area	Ø 1.2 mm
	Spectral Response	320 – 1060 nm
	Sensitivity	0.6 A/W (@ 830 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 (1/√Hz, 830 nm)	33 pW	3.8 pW	800 fW	240 fW	80 fW	24 fW	10 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 (1°C)	60 nW	6 nW	0.6 nW	51 p	5.1 pW	0.8 pW	0.6 pW
Gain Drift (1°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 (1/√Hz, 830 nm)	25 pW	3.5 pW	800 fW	240 fW	80 fW	24 fW	10 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 (1°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
Gain Drift (1°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:							
The output noise is given by:	$P_{\text{Input Noise peak peak}} = P_{\text{Input Noise rms}} \times 6$						
	$U_{\text{Output Noise rms}} = P_{\text{Input Noise rms}} \times \text{Gain}$						
	$U_{\text{Output Noise peak peak}} = U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times 6$						
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.							

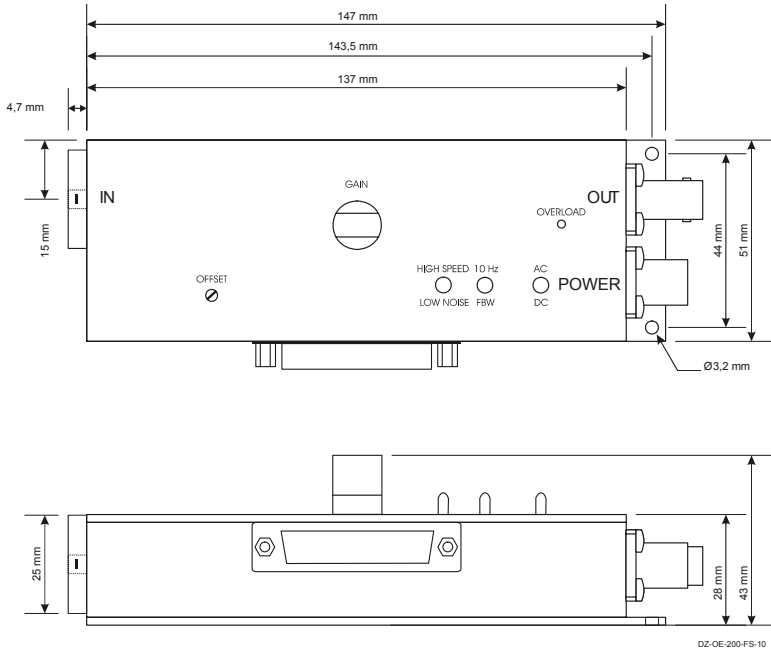
Specifications (continued)		
Output	Output Voltage Range	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
	Max. Output Current	± 30 mA
Indicator LED	Function	overload
Digital Control	Control Input Voltage Range	LOW bit: - 0.8 ... + 1.2 V, HIGH bit: + 2.3 ... + 12 V
	Control Input Current	0 mA @ 0 V, 1.5 mA @ + 5 V, 4.5 mA @ + 12 V
	Overload Output	non active: 0 V , max. - 1 mA, active: 5.1 V, max. 7 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 minimum ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5 V, max. 50 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	± 22 V



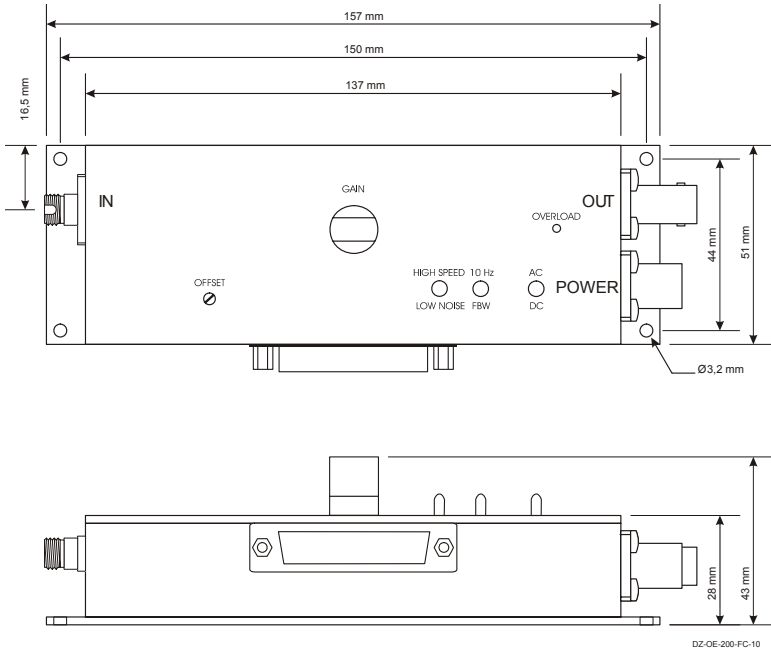
Connectors	Input	OE-200-SI-FS 25 mm round flange for free space applications				
	OE-200-SI-FC	FC fiber optic receptacle				
	OE-200-SI-SMA	SMA fiber optic receptacle				
	Output	BNC				
	Power Supply	LEMO series 1S, 3-pin fixed socket				
	Control Port	Sub-D 25-pin, female, qual. class 2				
Available Models	OE-200-SI-FS	free space input, no calibration				
	OE-200-SI-FC	FC receptacle, calibrated at 830 nm				
	OE-200-SI-SMA	SMA receptacle, calibrated at 830 nm				
	OE-200-S	customized versions available on request				
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						

Dimensions

Free Space Input OE-200-SI-FS:

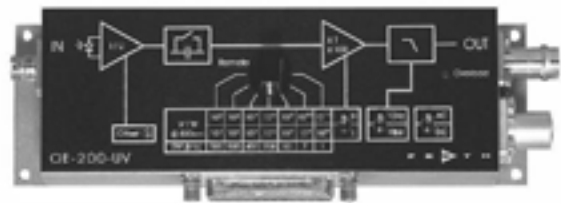


Fiber Optic Input OE-200-SI-FC and OE-200-SI-SMA:



Variable Gain Photoreceiver - Fast Optical Power Meter

OE-200-UV



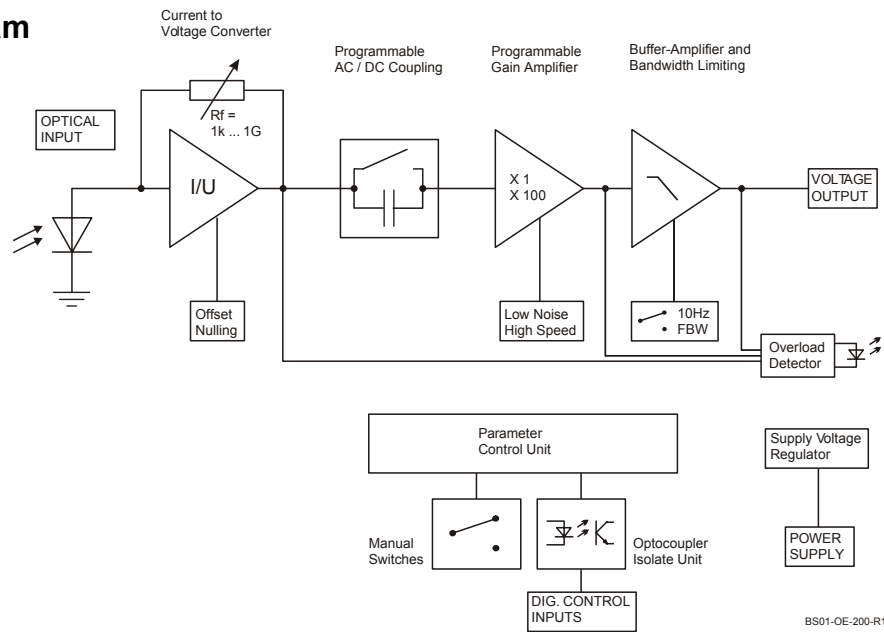
FEATURES

- Conversion Gain Switchable from 1 x 10³ to 1 x 10¹¹ V/W
- Si Detector with 1.1 x 1.1 mm² Active Area
- Fiber Optic or Free Space Input
- Spectral Range 190 - 1000 nm, UV Enhanced
- Calibrated at 830 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



Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Conversion Gain	1 x 10 ³ ... 1 x 10 ¹¹ V/W (@ 830 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy (Popt ≤ 1 mW, @ 830 nm)	OE-200-SI-FS: ± 15 % electro optical OE-200-SI-FC/-SMA: ± 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	Si photodiode
	Active Area	1.1 x 1.1 mm ²
	Spectral Response	190 – 1000 nm, UV enhanced
	Sensitivity	0.3 A/W (@ 830 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 (1/√Hz, 830 nm)	33 pW	3.8 pW	800 fW	240 fW	80 fW	24 fW	10 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 (1/°C)	60 nW	6 nW	0.6 nW	51 p	5.1 pW	0.8 pW	0.6 pW
Gain Drift (1/°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 (1/√Hz, 830 nm)	25 pW	3.5 pW	800 fW	240 fW	80 fW	24 fW	10 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 (1/°C)	60 nW	6 nW	0.6 nW	51 pW	5.1 pW	0.8 pW	0.6 pW
Gain Drift (1/°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

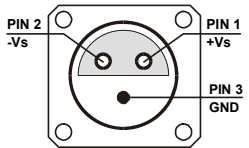
* The integrated input noise is measured with a shaded input in the full bandwidth („FBW“) setting. The input referred peak-peak noise can be calculated from the rms noise as follows:

The output noise is given by:	$P_{\text{Input Noise peak peak}} = P_{\text{Input Noise rms}} \times 6$
	$U_{\text{Output Noise rms}} = P_{\text{Input Noise rms}} \times \text{Gain}$
	$U_{\text{Output Noise peak peak}} = U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times 6$

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.

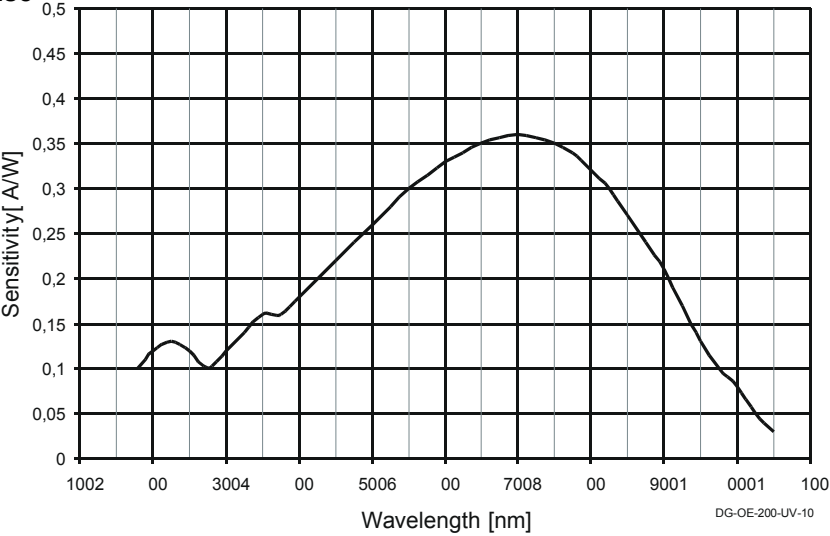
Specifications (continued)		
Output	Output Voltage Range	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
	Max. Output Current	± 30 mA
Indicator LED	Function	overload
Digital Control	Control Input Voltage Range	LOW bit: - 0.8 ... + 1.2 V, HIGH bit: + 2.3 ... + 12 V
	Control Input Current	0 mA @ 0 V, 1.5 mA @ + 5 V, 4.5 mA @ + 12 V
	Overload Output	non active: 0 V , max. - 1 mA, active: 5.1 V, max. 7 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 minimum ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5 V, max. 50 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	± 22 V

External Connectors (at backside, Standard Configuration)	
Input	OE-200-UV-FS 25 mm round flange for free space applications OE-200-UV-FC FC fiber optic receptacle OE-200-UV-SMA SMA fiber optic receptacle
Output	BNC
Power Supply	LEMO series 1S, 3-pin fixed socket 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: status output: HIGH = overload 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 830 nm OE-200-UV-SMA SMA receptacle, calibrated at 830 nm OE-200-S customized versions available on request



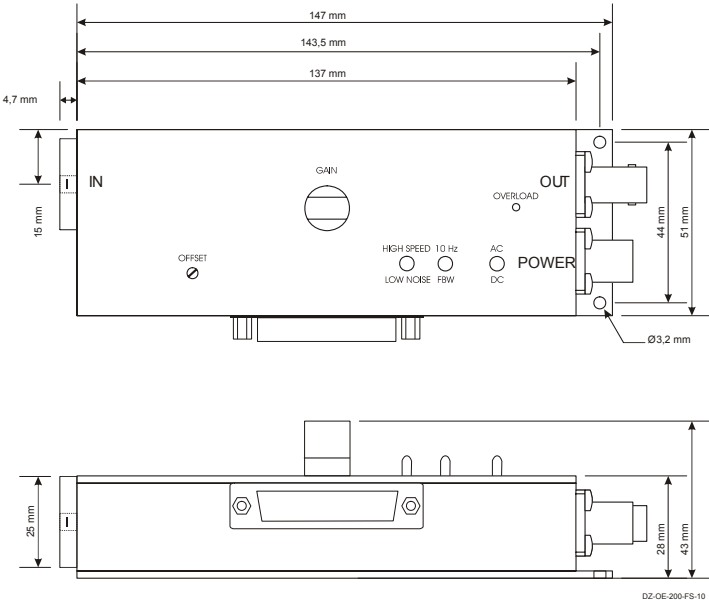
Remote Control Operation	General	Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" and select the desired setting via a bit code at the corresponding digital 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

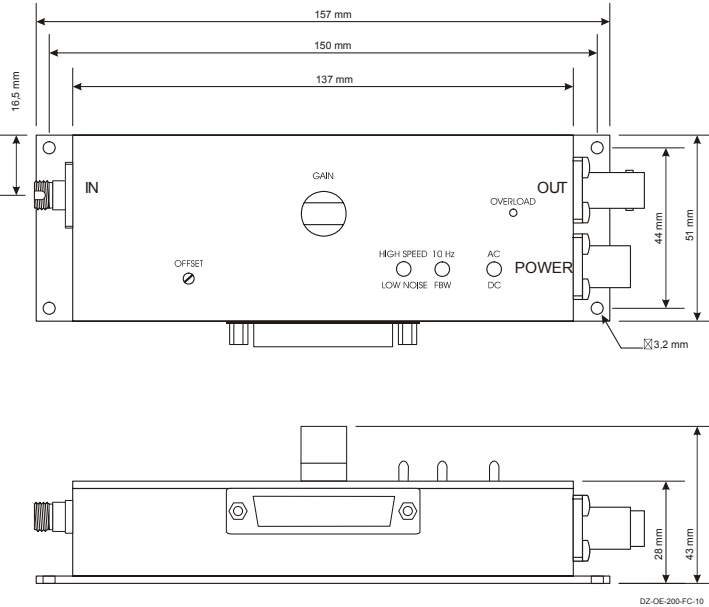


Dimensions

Free Space Input OE-200-UV-FS:

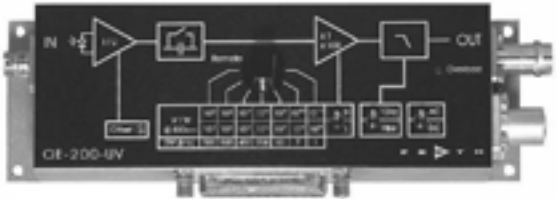


Fiber Optic Input OE-200-UV-FC and OE-200-UV-SMA:



Variable Gain Photoreceiver - Fast Optical Power Meter

OE-200-IN1



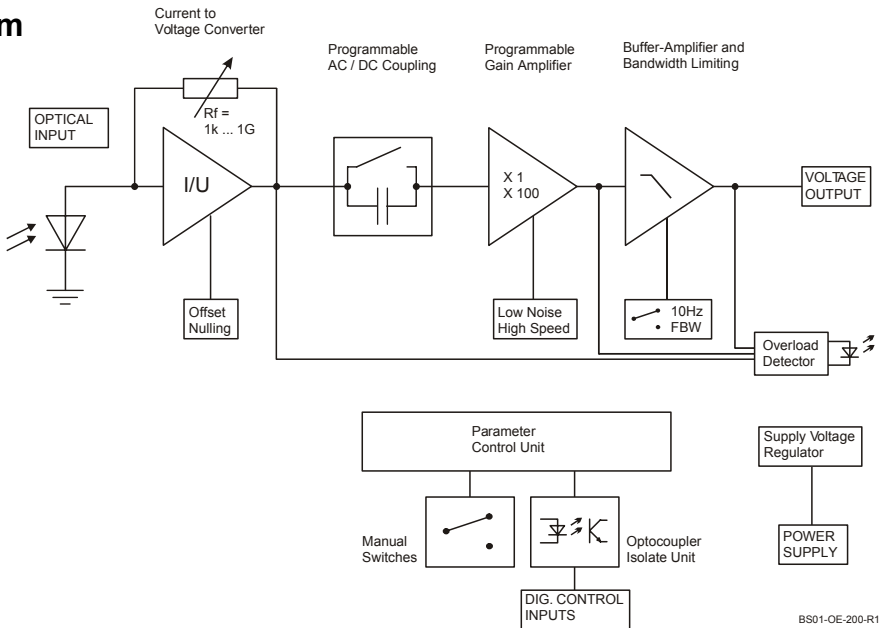
FEATURES

- Conversion Gain Switchable from 1×10^3 to 1×10^{11} V/W
- InGaAs PIN Detector with 100 μ m Active Diameter in FC Fiber Optic Receptacle
- Spectral Range 900 - 1700 nm
- Calibrated at 1300 nm
- 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

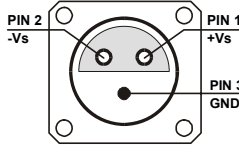


BS01-OE-200-R1

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Conversion Gain	1 x 10 ³ ... 1 x 10 ¹¹ V/W (@ 1300 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy	± 5 % electro-optical (Popt ≤ 1 mW, @ 1300 nm)
	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 with ball lens in FC fiber receptacle
	Active Area	Ø 100 µm
	Spectral Response	900 – 1700 nm
	Sensitivity	0.85 A/W (@ 1300 nm)
	Dark Current	2 pA typ.

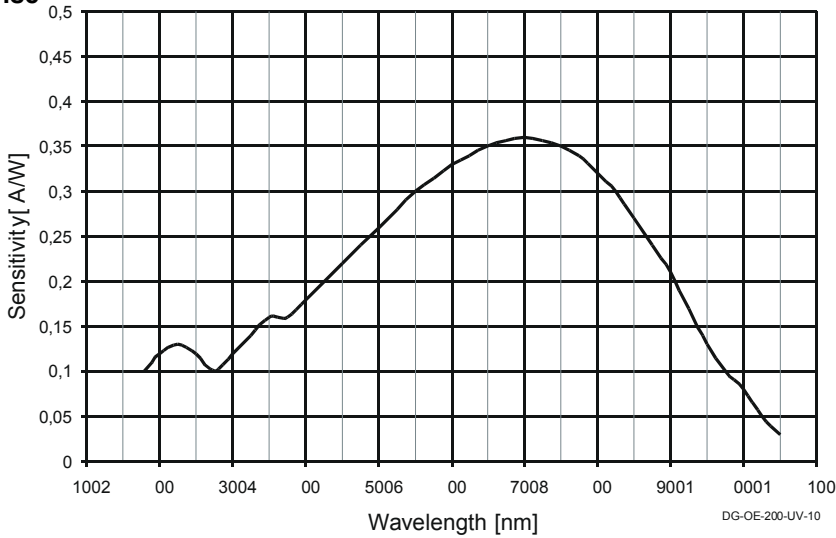
Performance Depending on Gain Setting							
Gain Setting (Low Noise) (V/W)	10 ³	10 ⁴	10 ⁵	10 ⁶	10 ⁷	10 ⁸	10 ⁹
Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	50 kHz	7 kHz	1.1 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 μs	7 μs	50 μs	300 μs
NEP (1/√Hz, 830 nm)	22 pW	3.7 pW	550 fW	170 fW	52 fW	19 fW	8 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise (rms)*	25 nW	3 nW	650 nW	160 pW	50 pW	7 pW	1 pW
Input Offset Drift (1°C)	40 nW	4 nW	0.4 nW	34 p	3.4 pW	0.5 pW	0.4 pW
Gain Drift (1°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 (1/√Hz, 830 nm)	17 pW	2.2 pW	550 fW	170 fW	52 fW	19 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	550 nW	150 pW	46 pW	6.5 pW	1 pW
Input Offset Drift (1°C)	40 nW	4 nW	0.4 nW	34 pW	3.4 pW	0.5 pW	0.4 pW
Gain Drift (1°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:							
The output noise is given by:	$P_{\text{Input Noise peak peak}} = P_{\text{Input Noise rms}} \times 6$						
	$U_{\text{Output Noise rms}} = P_{\text{Input Noise rms}} \times \text{Gain}$						
	$U_{\text{Output Noise peak peak}} = U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times 6$						
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.							

Specifications (continued)		
Output	Output Voltage Range	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ 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 V , max. - 1 mA, active: 5.1 V, max. 7 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 minimum ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5 V, max. 50 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	± 22 V

External Connectors (at backside, Standard Configuration)	
Input	OE-200-UV-FS 25 mm round flange for free space applications OE-200-UV-FC FC fiber optic receptacle OE-200-UV-SMA SMA fiber optic receptacle
Output	BNC
Power Supply	LEMO series 1S, 3-pin fixed socket 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: status output: HIGH = overload 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 830 nm OE-200-UV-SMA SMA receptacle, calibrated at 830 nm OE-200-S customized versions available on request

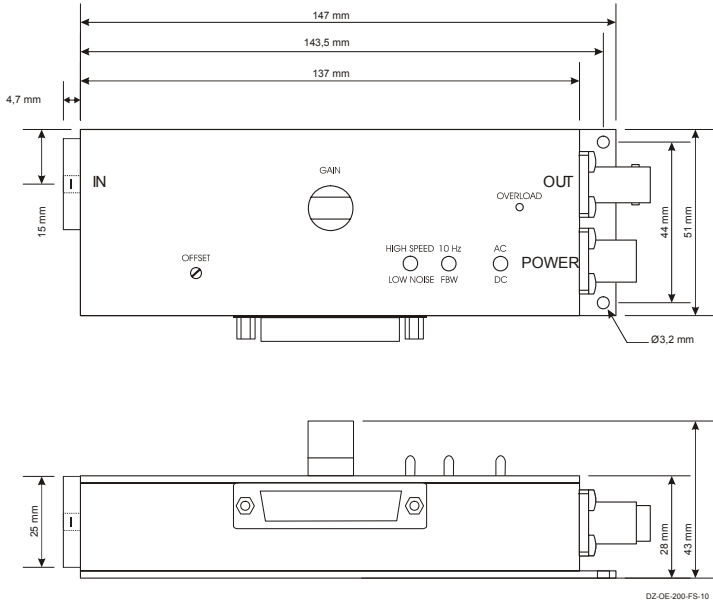
Remote Control Operation	General	Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" and select the desired setting via a bit code at the corresponding digital 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

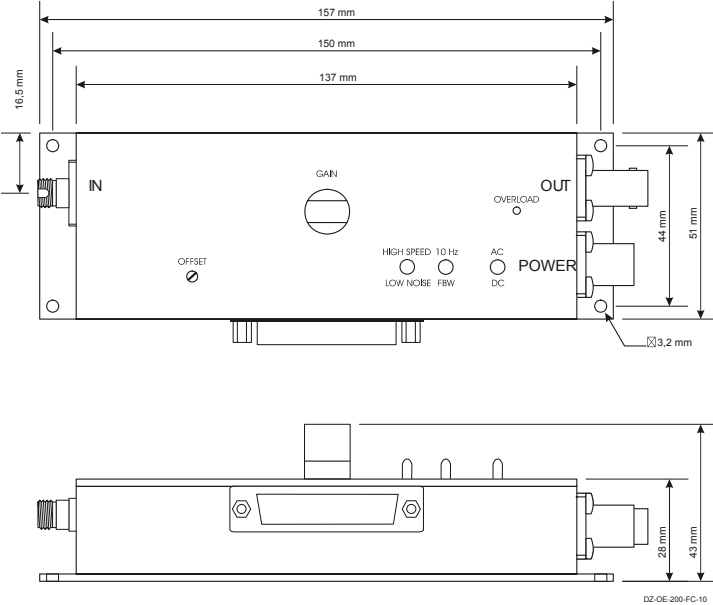


Dimensions

Free Space Input OE-200-UV-FS:

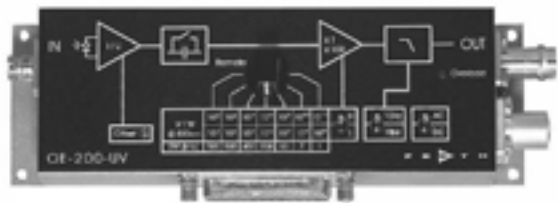


Fiber Optic Input OE-200-UV-FC and OE-200-UV-SMA:



Variable Gain Photoreceiver - Fast Optical Power Meter

OE-200-IN2



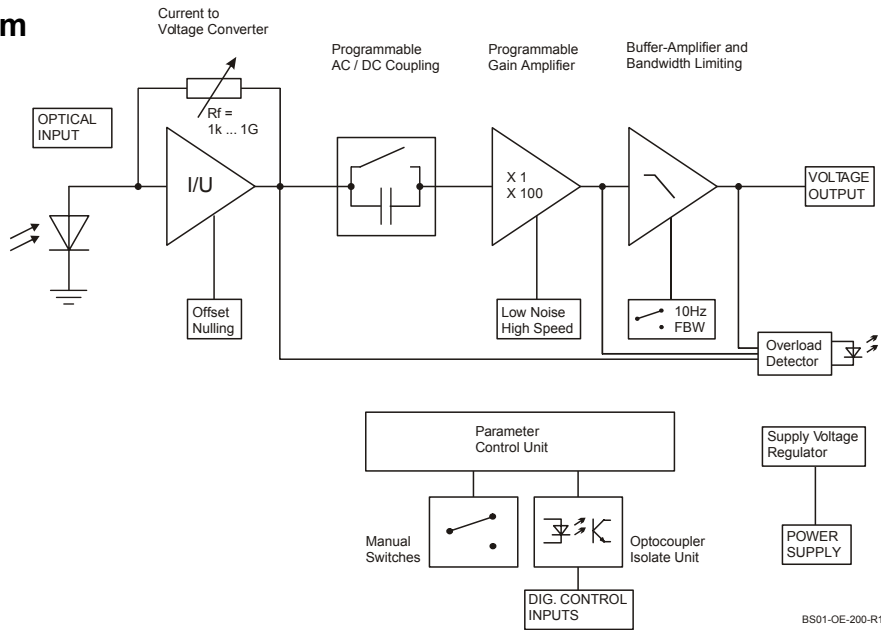
FEATURES

- Conversion Gain Switchable from 1×10^3 to 1×10^{11} V/W
- InGaAs PIN Detector with 100 μm Active Diameter in FC Fiber Optic Receptacle
- Spectral Range 900 - 1700 nm
- Calibrated at 1550 nm
- 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



Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Conversion Gain	$1 \times 10^3 \dots 1 \times 10^{11}$ V/W (@ 1300 nm)
	Gain Accuracy	± 1 % electrical, between settings
	Conversion Gain Accuracy	± 5 % electro-optical (Popt ≤ 1 mW, @ 1300 nm)
	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 with ball lens in FC fiber receptacle
	Active Area	Ø 100 μm
	Spectral Response	900 – 1700 nm
	Sensitivity	0.95 A/W (@ 1550 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 ($\sqrt{\text{Hz}}$, 830 nm)	20 pW	2.4 pW	480 fW	150 fW	47 fW	17 fW	7 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise (rms)*	23 nW	2.8 nW	570 nW	140 pW	44 pW	6.2 pW	1 pW
Input Offset Drift ($^{\circ}\text{C}$)	40 nW	4 nW	0.4 nW	34 p	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 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 ($\sqrt{\text{Hz}}$, 830 nm)	15 pW	2.0 pW	480 fW	150 fW	47 fW	17 fW	7 fW
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise (rms)*	13 nW	1.9 nW	480 nW	130 pW	40 pW	5.7 pW	1 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 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:

The output noise is given by:

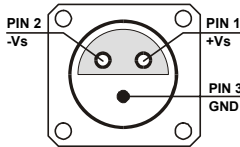
$$\begin{aligned} P_{\text{Input Noise peak peak}} &= P_{\text{Input Noise rms}} \times 6 \\ U_{\text{Output Noise rms}} &= P_{\text{Input Noise rms}} \times \text{Gain} \\ U_{\text{Output Noise peak peak}} &= U_{\text{Output Noise rms}} \times 6 = P_{\text{Input Noise rms}} \times \text{Gain} \times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

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.

Spectroscopes
·
Imaging
·
CCD Cameras
·
Semiconductors
·
Communications
·
Lighting
·
Solar Cells
·
Tests
·
Instruments
·
Detection
·
Sensors
·
Components
·
Mechanics
·
Positioning
·
Lasers
·
Light Sources

Specifications (continued)		
Output	Output Voltage Range	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ 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 V , max. - 1 mA, active: 5.1 V, max. 7 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 minimum ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. 150 mA, + 5 V, max. 50 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	± 22 V

External Connectors (at backside, Standard Configuration)	
Input	FC fiber optic receptacle
Output	BNC
Power Supply	LEMO series 1S, 3-pin fixed socket 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: status output: HIGH = overload 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-IN2-FC FC receptacle, calibrated at 1550 nm OE-200-S customized versions available on request

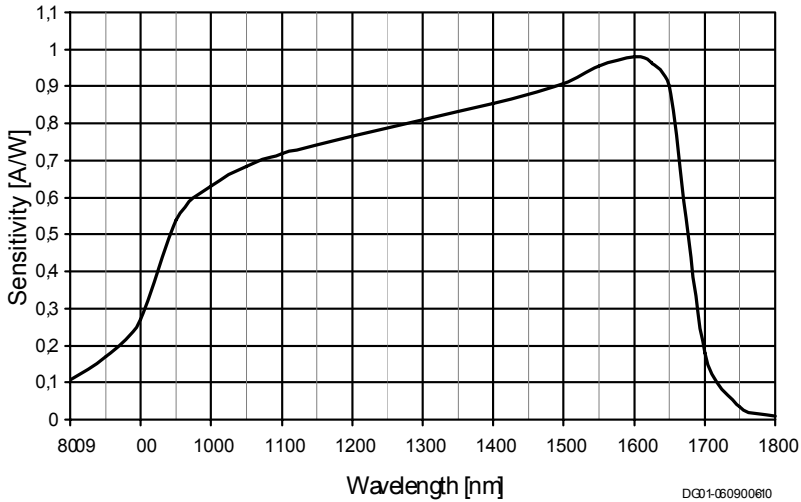


Remote Control Operation	General	Remote control input bits are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "AC" and "H" and select the desired setting via a bit code at the corresponding digital 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	

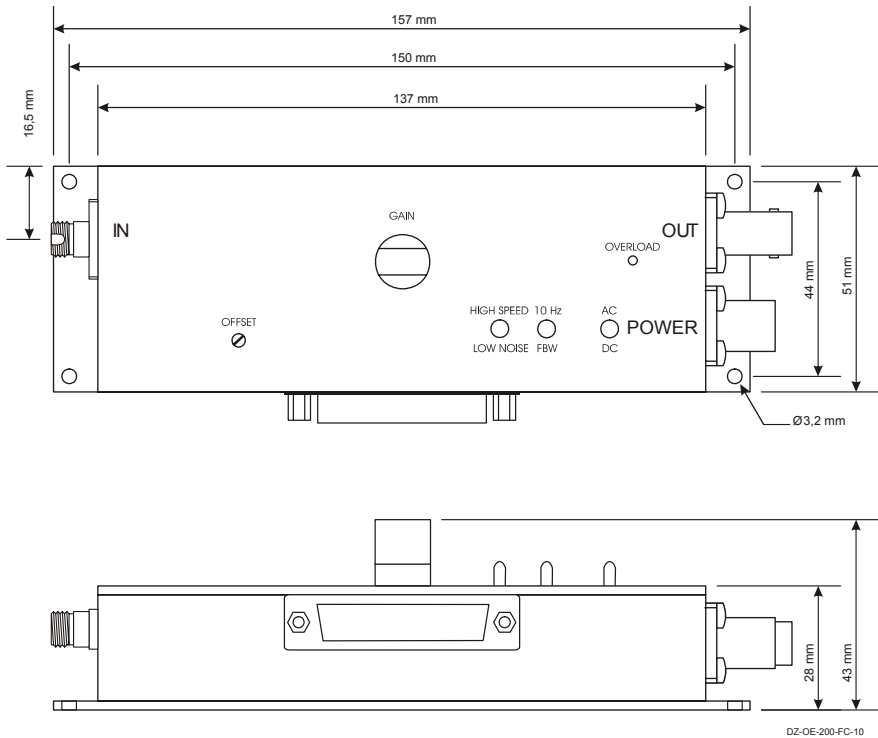
Low-Noise Photoreceiver with Si PIN Photodiode

LCA-S-400K-SI

Spectral Response



Dimensions



FEATURES

- Large Area Si PIN Detector, 2.5 mm Active Diameter
- Spectral Range 400 ... 1100 nm
- Amplifier Transimpedance (Gain) 1.0×10^7 V/A
- Max. Conversion Gain 6.2×10^6 V/W @ 900 nm
- Bandwidth DC ... 400 kHz

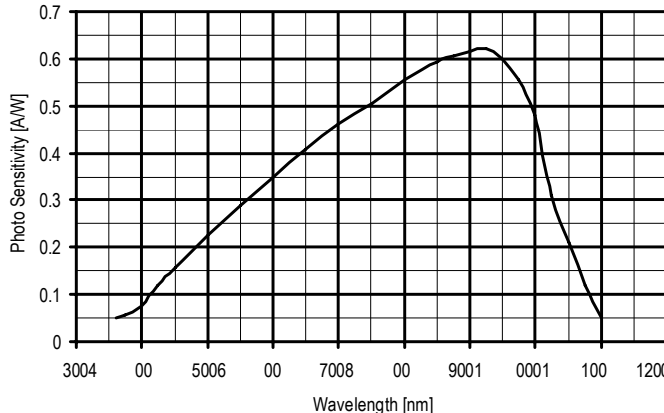
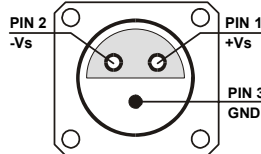
APPLICATIONS

- Spectroscopy
- General Purpose Opto-Electronic Measurements
- Optical Front-End for Oscilloscopes, A/D Converters and Lock-In Amplifiers

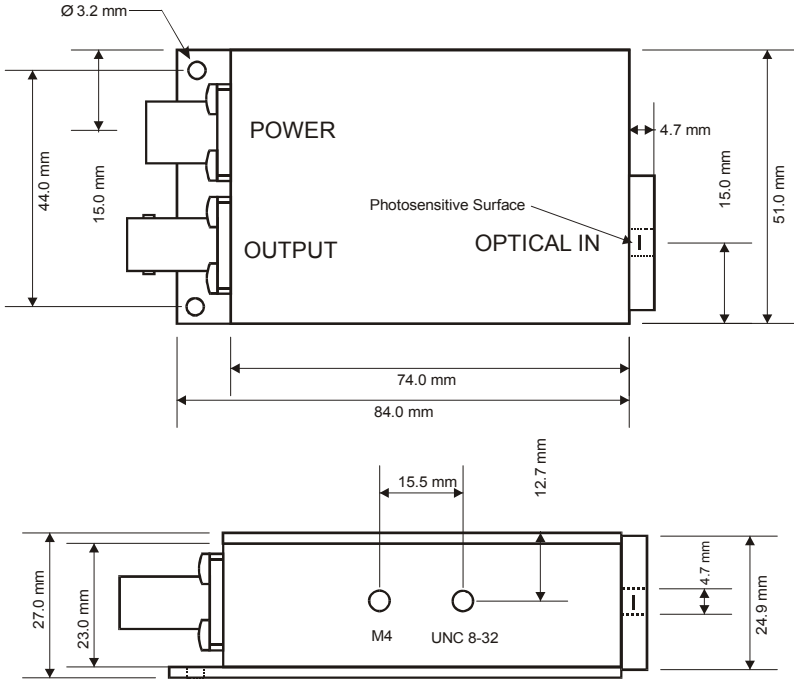


The photoreceiver will be delivered without post holder and post

Specifications	Test Conditions	$V_s = \pm 15$ V, $T_a = 25^\circ\text{C}$
Gain	Transimpedance	1.0×10^7 V/A (@ >10 k Ω load)
	Max. Conversion Gain	6.2×10^6 V/W (@ 900 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	400 kHz
	Rise- / Fall-Time (10% - 90%)	1 μ s
	Gain Flatness	± 0.5 dB
Detector	Detector Material	Si PIN photodiode
	Active Area	$\varnothing 2.5$ mm
	Spectral Response	400 ... 1100 nm
Input	Input Offset Compensation	± 300 nA, adjustable by offset trimpot
	Max. Optical Input Power	1.6 μ W (for linear amplification @ 900 nm)
Noise	Min. NEP	130 fW/ $\sqrt{\text{Hz}}$ (@ 900 nm, 10 kHz)
Output	Output Voltage Range	± 10 V (@ ≥ 10 k Ω load)
	Max. Output Current	± 30 mA
	Output Impedance	50 Ω (terminate with ≥ 10 k Ω load for best performance)
	Output Noise	10 mV peak-peak (@ 1 M Ω load, no signal on photodiode)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, free space, 25 mm Ø round flange compatible with microbench systems	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 	

Dimensions



DZ-FWPR_1.cdr

Low-Noise Photoreceiver with InGaAs PIN Photodiode

LCA-S-400K-IN

FEATURES

- Large Area Si PIN Detector, 2.5 mm Active Diameter
- Spectral Range 400 ... 1100 nm
- Amplifier Transimpedance (Gain) 1.0×10^7 V/A
- Max. Conversion Gain 6.2×10^6 V/W @ 900 nm
- Bandwidth DC ... 400 kHz

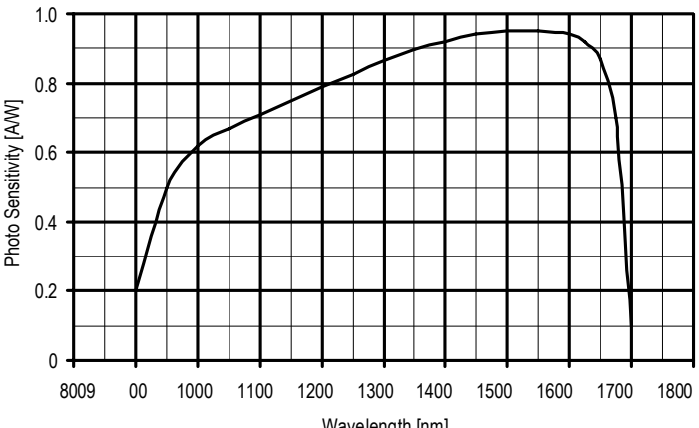
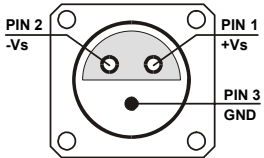
APPLICATIONS

- Spectroscopy
- General Purpose Opto-Electronic Measurements
- Optical Front-End for Oscilloscopes, A/D Converters and Lock-In Amplifiers

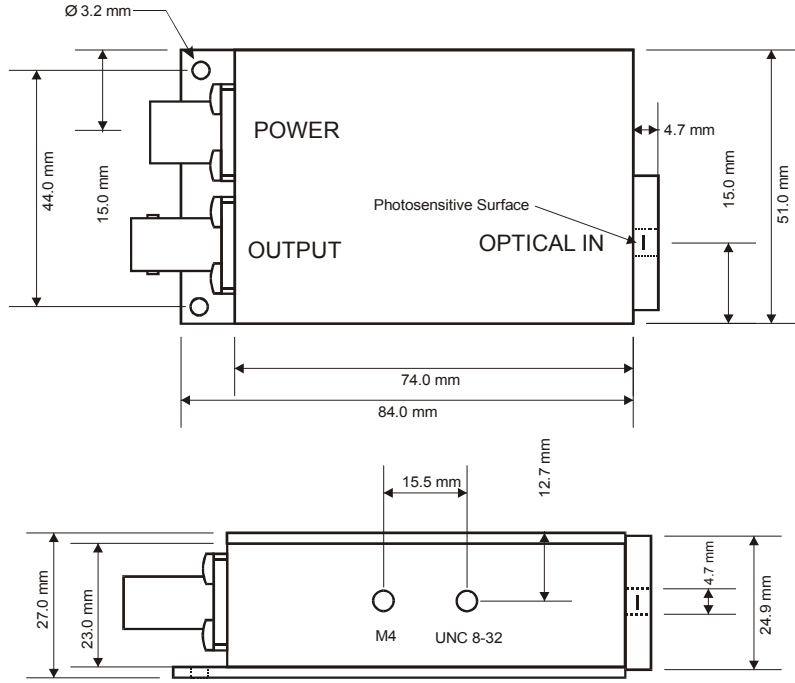


The photoreceiver will be delivered without post holder and post

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1.0×10^7 V/A (@ >10 kΩ load)
	Max. Conversion Gain	9.5×10^6 V/W (@ 1550 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	400 kHz
	Rise- / Fall-Time (10% - 90%)	1 μs
	Gain Flatness	± 0.5 dB
Detector	Detector Material	InGaAs PIN photodiode
	Active Area	Ø 0.5 mm
	Spectral Response	900 ... 1700 nm
Input	Input Offset Compensation	± 300 nA, adjustable by offset trimpot
	Max. Optical Input Power	1 μW (for linear amplification @ 1550 nm)
Noise	Min. NEP	75 fW/√Hz (@ 1550 nm, 10 kHz)
Output	Output Voltage Range	± 10 V (@ ≥ 10 kΩ load)
	Max. Output Current	± 30 mA
	Output Impedance	50 Ω (terminate with ≥ 10 kΩ load for best performance)
	Output Noise	10 mV peak-peak (@ 1 MΩ load, no signal on photodiode)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, free space, 25 mm Ø round flange compatible with microbench systems	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND	
		

Dimensions



DZ-FWPR_1.cdr

Low-Noise Photoreceiver with InGaAs PIN Photodiode

HCA-S-200M-SI

FEATURES

- Si PIN Detector, 0.8 mm Active Diameter
- Spectral Range 320 ... 1000 nm
- Bandwidth DC ... 200 MHz
- Amplifier Transimpedance (Gain) 2.0×10^4 V/A
- Max. Conversion Gain 1.1×10^4 V/W (@ 800 nm)

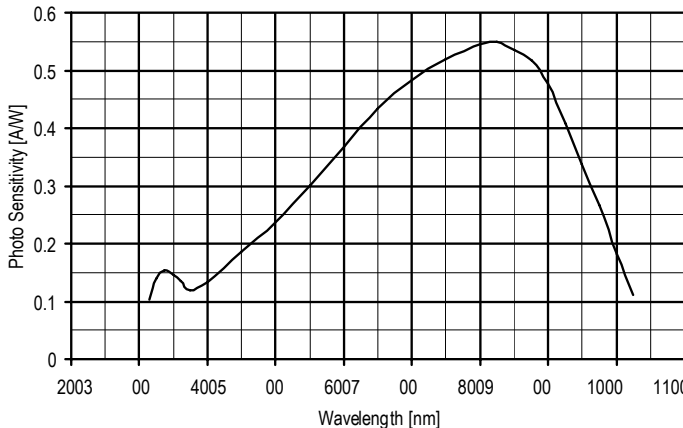
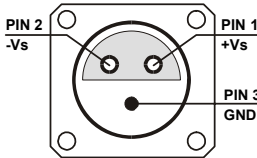
APPLICATIONS

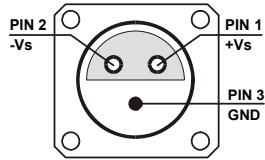
- Spectroscopy
- Fast Pulse and Transient Measurements
- Optical Triggering
- Optical Front-End for Oscilloscopes, A/D Converters and Fast Lock-In Amplifiers



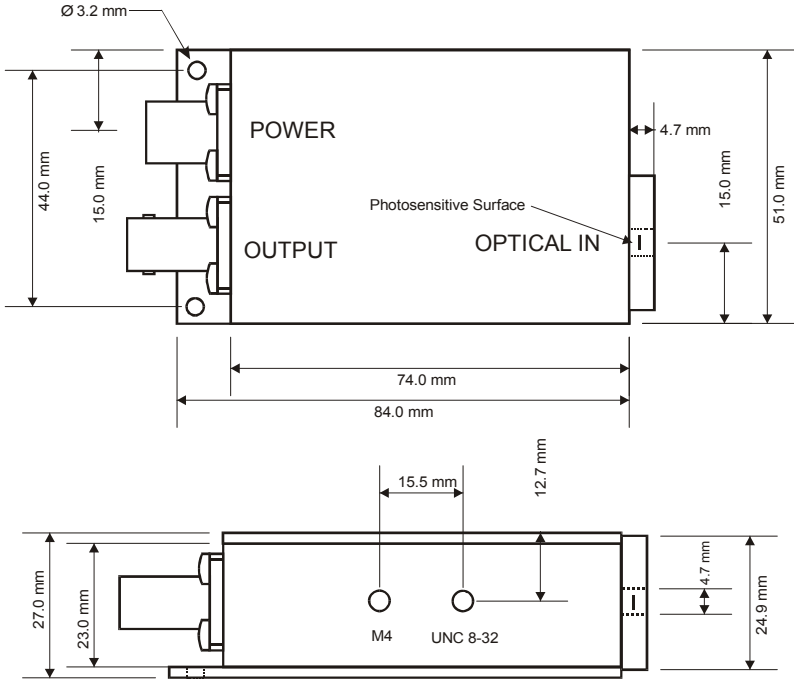
The photoreceiver will be delivered without post holder and post

Specifications	Test Conditions	$V_s = \pm 15$ V, $T_a = 25^\circ\text{C}$
Gain	Transimpedance	2.0×10^4 V/A (@ 50 Ω load)
	Max. Conversion Gain	1.1×10^4 V/W (@ 800 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	200 kHz($\pm$ 10 %)
	Rise- / Fall-Time (10% - 90%)	1.8 μ s
	Gain Flatness	$\pm$ 1 dB
Detector	Detector Material	Si PIN photodiode
	Active Area	$\varnothing$ 0.8 mm
	Spectral Response	320 ... 1000 nm
Input	Input Offset Compensation	$\pm$ 100 μ A adjustable by offset trimpot
	Max. Optical Input Power	110 μ W (for linear amplification, @ 800 nm)
Noise	Min. NEP	9.3 pW/ $\sqrt{\text{Hz}}$ (@ 800 nm, 10 MHz)
Output	Output Voltage Range	$\pm$ 1.2 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Max. Output Voltage Range	$\pm$ 1.7 V (@ 50 Ω load)
	Output Impedance	50 Ω (terminate with $\geq$ 10 k Ω load for best performance)
	Output Noise	18 mV peak-peak (@ 50 Ω load, no signal on photodiode)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 50 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, free space, 25 mm Ø round flange compatible with microbench systems	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 	



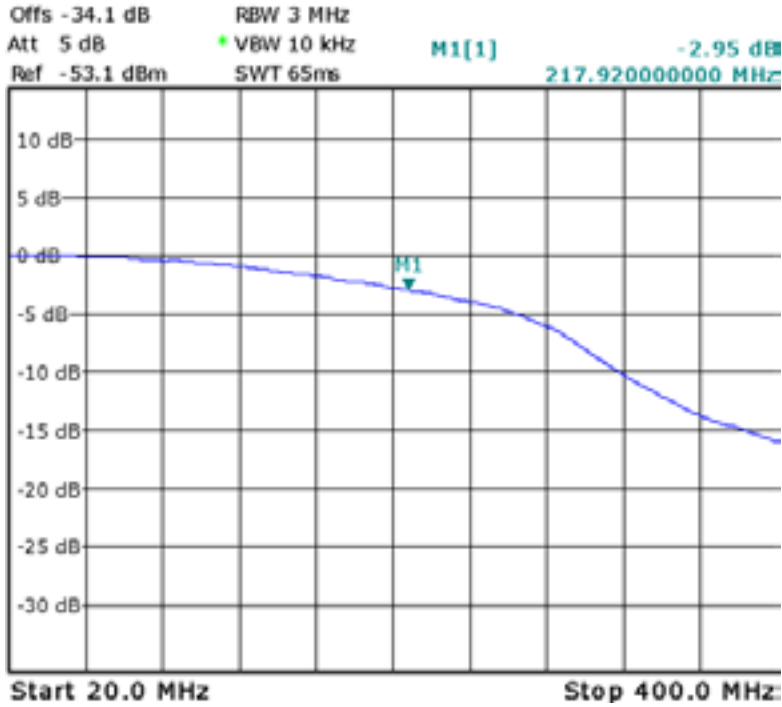
Dimensions



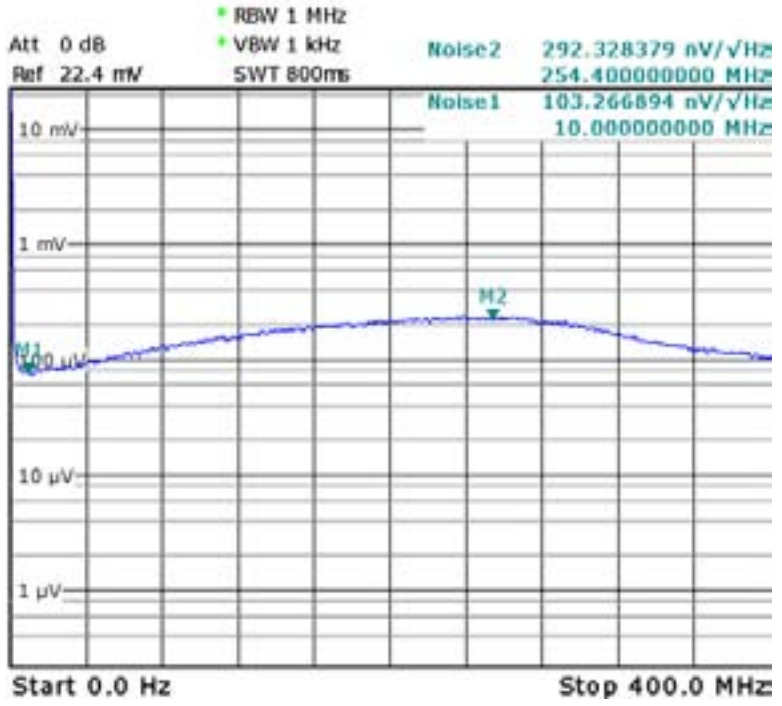
DZ-FWPR_1.cdr

Typical Performance Characteristics

Frequency Response



Noise Spectrum



Note: Spectral noise data is measured at the amplifier output with darkened photo diode.
To determine the spectral input noise divide the measured output noise by the amplifier conversion gain.
Conversion gain (V/W) = amplifier gain (20,000 V/A) x photo sensitivity (A/W).

Marker	Frequency	Output Noise	Resulting Input Noise (NEP)
1	10 MHz	103 nV/√Hz	9.3 pW/√Hz (@ 800 nm)
2	254 MHz	292 nV/√Hz	27 pW/√Hz (@ 800 nm)

Typical Performance Characteristics (continued)

Pulse Response to Square Wave Input Signal (with 16 times averaging)



Large Signal Response

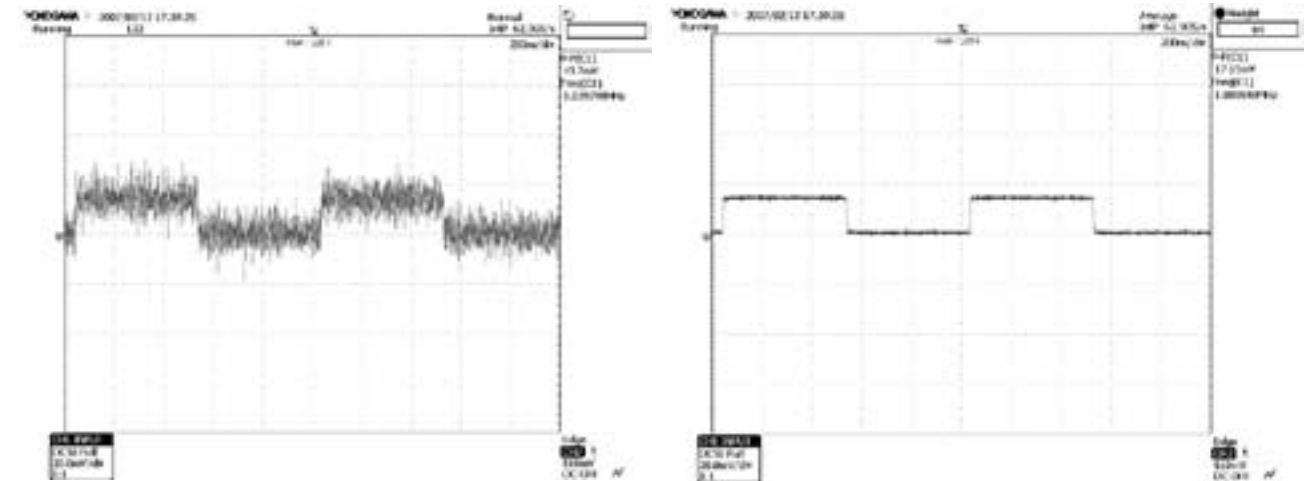
output signal for 100 MHz, 100 μ W modulated optical input signal (with 4 times averaging)



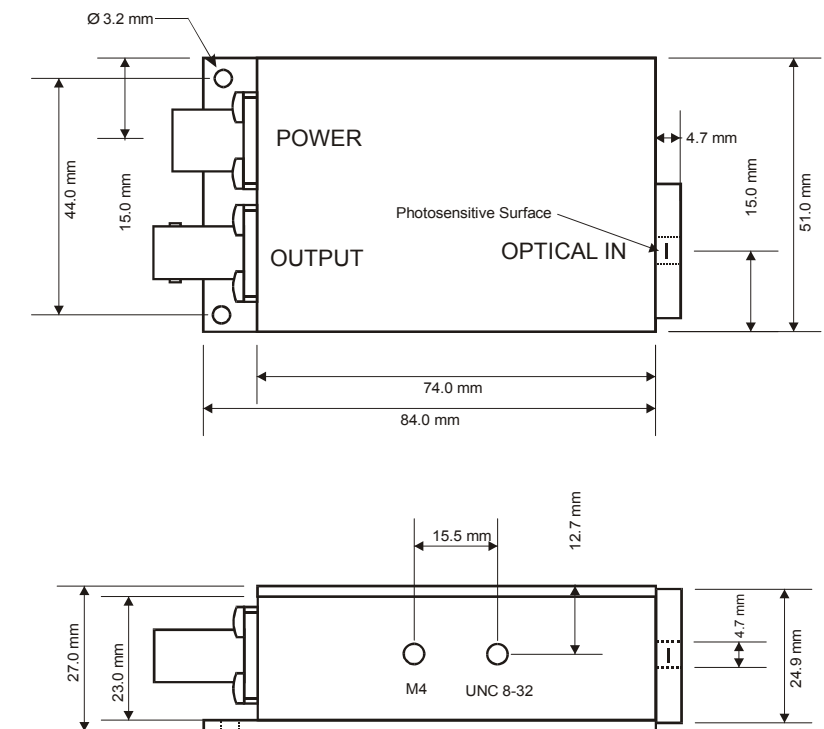
Typical Performance Characteristics

Small Signal Response

output signal for 1.5 μ W modulated optical input signal, 1 MHz square wave (without (top) and with 64 times averaging (bottom))



Dimensions



DZ-FWPR_1.cdr

High-Speed Photoreceiver with InGaAs PIN Photodiode

HCA-S-200M-IN

FEATURES

- InGaAs PIN Detector, 0.3 mm Active Diameter
- Spectral Range 900 ... 1700 nm
- Bandwidth DC ... 200 MHz
- Amplifier Transimpedance (Gain) 2.0×10^4 V/A
- Max. Conversion Gain 1.9×10^4 V/W (@ 1550 nm)

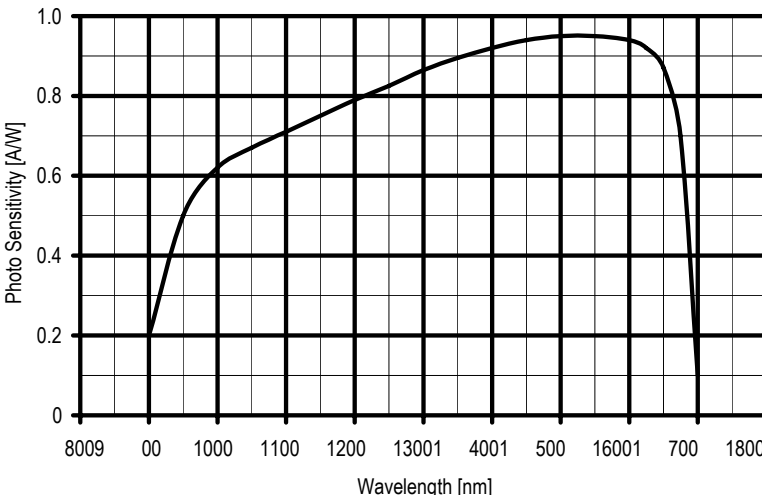
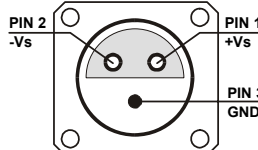
APPLICATIONS

- Spectroscopy
- Fast Pulse and Transient Measurements
- Optical Triggering
- Optical Front-End for Oscilloscopes, A/D Converters and Fast Lock-In Amplifiers

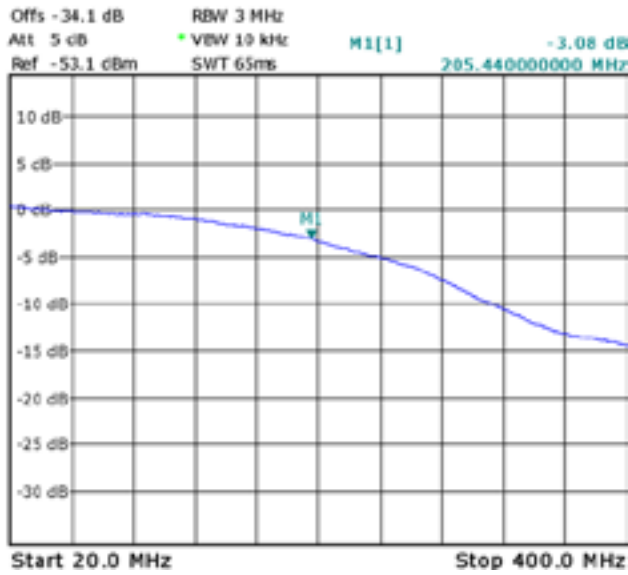


The photoreceiver will be delivered without post holder and post

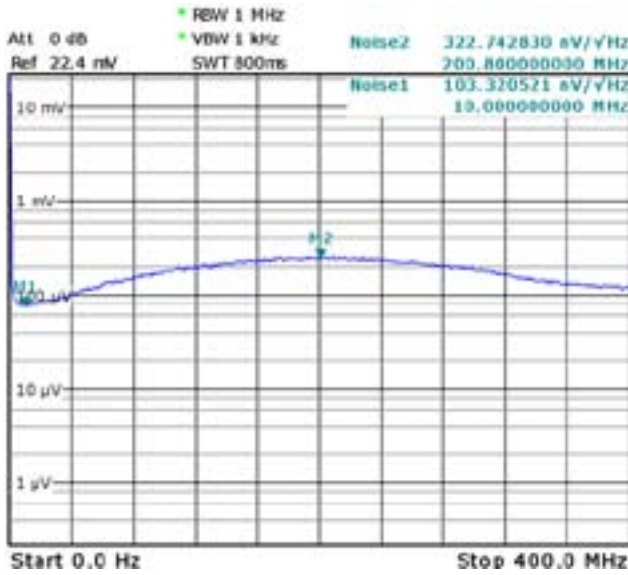
Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	2.0×10^4 V/A (@ 50 Ω load)
	Max. Conversion Gain	1.9×10^4 V/W (@ 1550 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	200 MHz (± 10 %)
	Rise- / Fall-Time (10% - 90%)	1.8 μs
	Gain Flatness	± 1 dB
Detector	Detector Material	InGaAs PIN photodiode
	Active Area	Ø 0.3 mm
	Spectral Response	900 ... 1700 nm
Input	Input Offset Compensation	± 100 μA adjustable by offset trimpot
	Max. Optical Input Power	60 μW (for linear amplification, @ 1550 nm)
Noise	Min. NEP	5.4 pW/√Hz (@ 1550 nm, 10 MHz)
Output	Output Voltage Range	± 1.2 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Max. Output Voltage Range	± 1.7 V (@ 50 Ω load)
	Output Impedance	50 Ω (terminate with 50 Ω load for best performance)
	Output Noise	20 mV peak-peak (@ 50 Ω load, no signal on photodiode)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 60 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, free space, 25 mm Ø round flange compatible with microbench systems	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND	
		

Typical Performance Characteristics
Frequency Response



Noise Spectrum



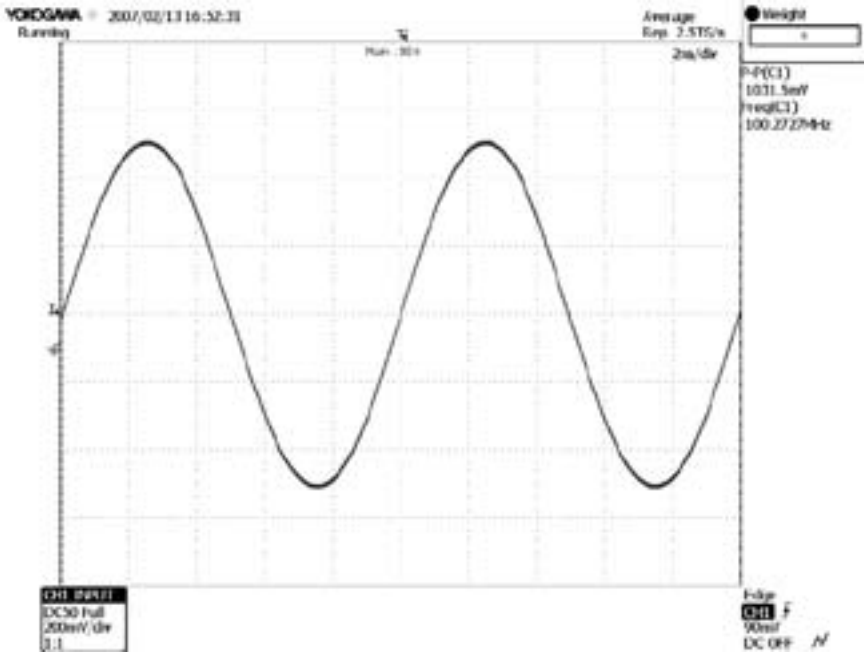
Note: Spectral noise data is measured at the amplifier output with darkened photo diode.
To determine the spectral input noise divide the measured output noise by the amplifier conversion gain.
Conversion gain (V/W) = amplifier gain (20,000 V/A) x photo sensitivity (A/W).

Marker	Frequency	Output Noise	Resulting Input Noise (NEP)
1	10 MHz	103 nV/√Hz	5.4 pW/√Hz (@ 1550 nm)
2	200 MHz	323 nV/√Hz	17 pW/√Hz (@ 1550 nm)

Typical Performance Characteristics (continued)
Pulse Response to Square Wave Input Signal (with 16 times averaging)



Large Signal Response
output signal for 100 MHz, 50 μW modulated optical input signal (with 4 times averaging)

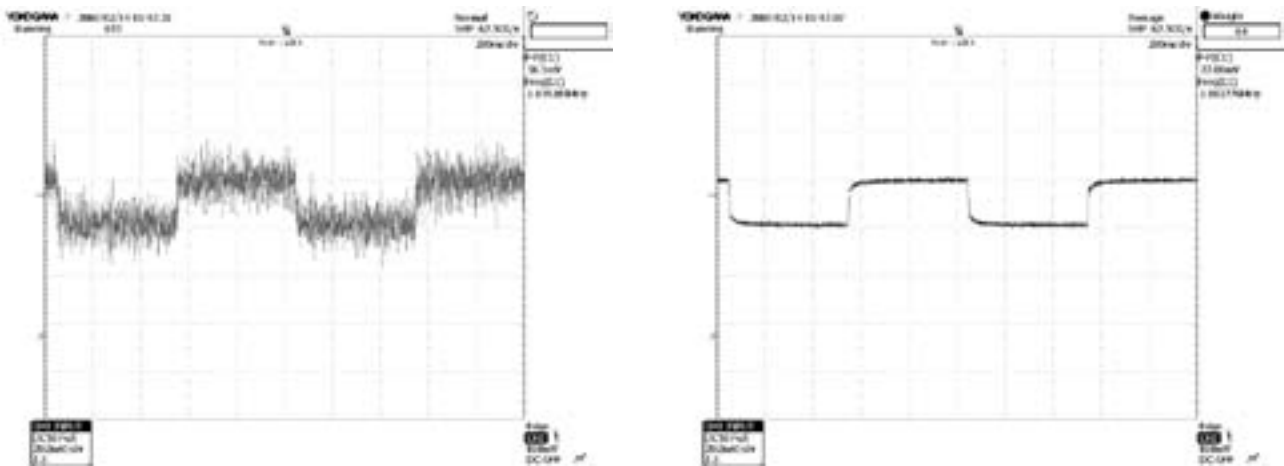


400 MHz Photoreceiver with Si PIN Photodiode

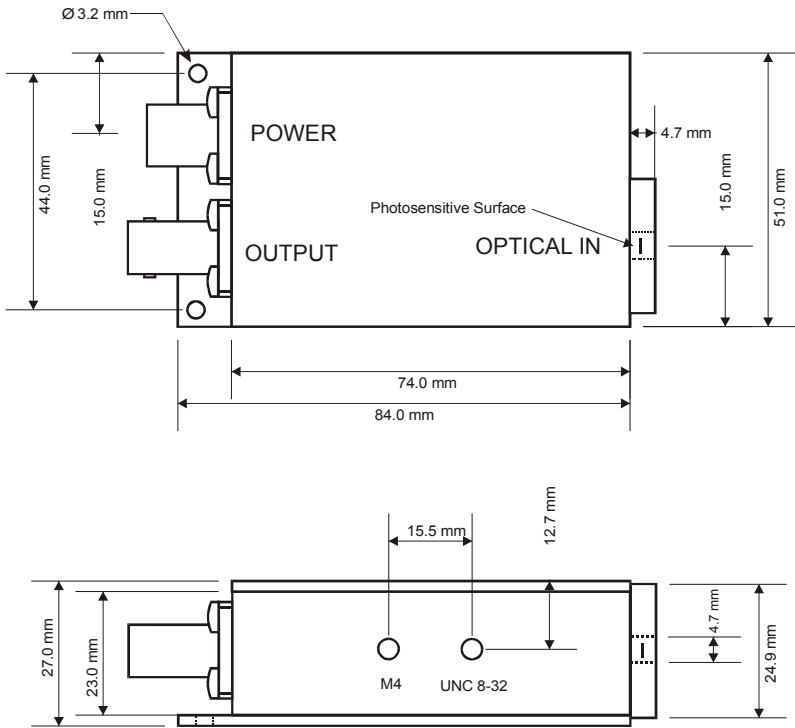
HCA-S-400M-SI

Typical Performance Characteristics

Small Signal Response
output signal for 1.5 μW modulated optical input signal, 1 MHz square wave
(without (top) and with 64 times averaging (bottom))



Dimensions



DZ-FWPR_1.cdr

FEATURES

- Si PIN Detector, 0.8 mm Active Diameter
- Spectral Range 320 ... 1000 nm
- Bandwidth DC ... 400 MHz
- Amplifier Transimpedance (Gain) 5.0×10^3 V/A
- Max. Conversion Gain 2.7×10^3 V/W @ 800 nm

APPLICATIONS

- Fast Pulse and Transient Measurements
- Fast Digital Links
- Optical Triggering
- Optical Front-End for Oscilloscopes and A/D Converters

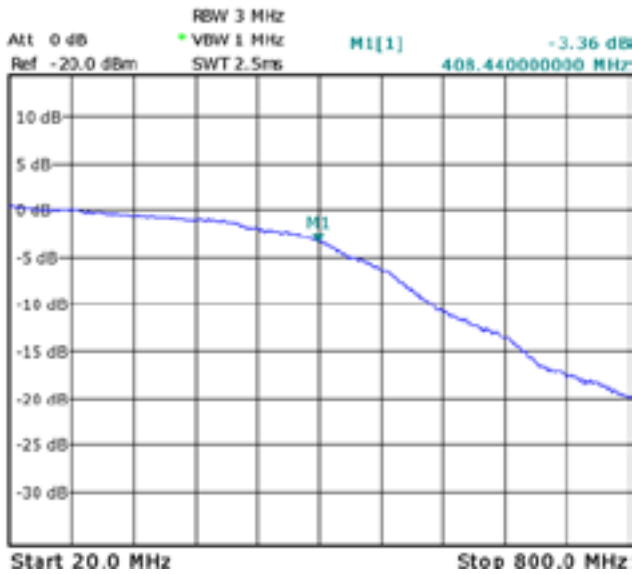


The picture shows the HCA-S-400M-SI-FS.
The photoreceiver will be delivered without post holder and post.

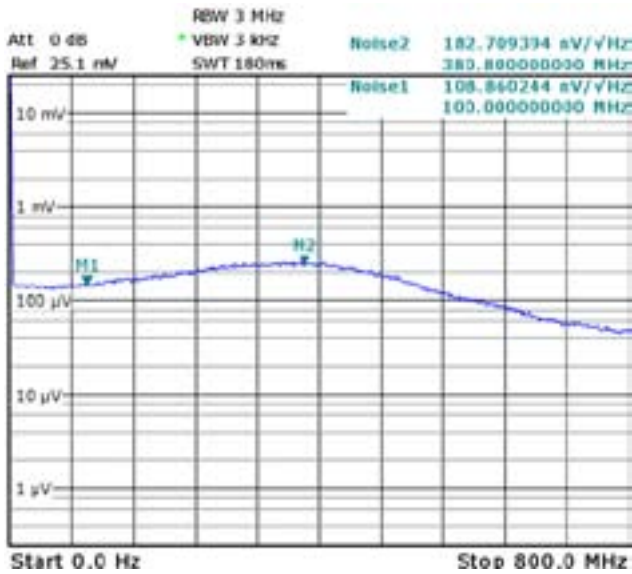
Specifications	Test Conditions	$V_s = \pm 15$ V, $T_a = 25^\circ\text{C}$
Gain	Transimpedance	5.0×10^3 V/A (@ 50 Ω load)
	Max. Conversion Gain	2.7×10^3 V/W (@ 800 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	400 MHz (± 10 %)
	Rise- / Fall-Time (10% - 90%)	1.0 μs
	Gain Flatness	± 1 dB
Detector	Detector Material	Si PIN photodiode
	Active Area	$\varnothing 0.8$ mm
	Spectral Response	320 ... 1000 nm
Input	Input Offset Compensation	± 200 μA adjustable by offset trimpot
	Max. Optical Input Power	400 μW (for linear amplification, @ 800 nm)
Noise	Min. NEP	40 pW/ $\sqrt{\text{Hz}}$ (@ 800 nm, 100 MHz)
Output	Output Voltage Range	± 1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Max. Output Voltage Range	± 1.5 V (@ 50 Ω load)
	Output Impedance	50 Ω (terminate with 50 Ω load for best performance)
	Output Noise	ca. 20 mV peak-peak (@ 50 Ω load, no signal on detector)

Typical Performance Characteristics

Frequency Response

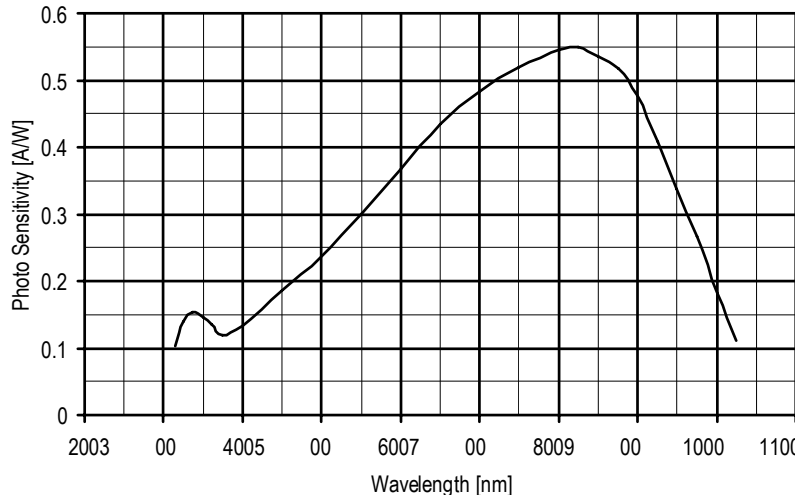
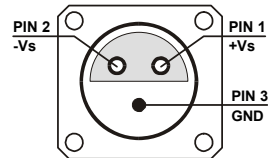


Noise Spectrum

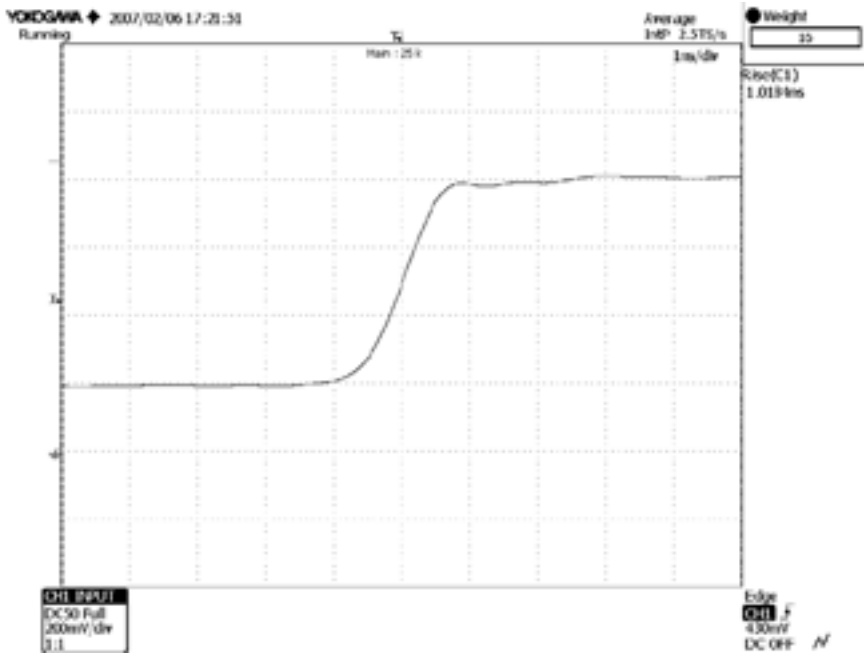


Note: Spectral noise data is measured at the amplifier output with darkened photo diode.
To determine the spectral input noise divide the measured output noise by the amplifier conversion gain.
Conversion gain (V/W) = amplifier gain (5,000 V/A) x photo sensitivity (A/W).

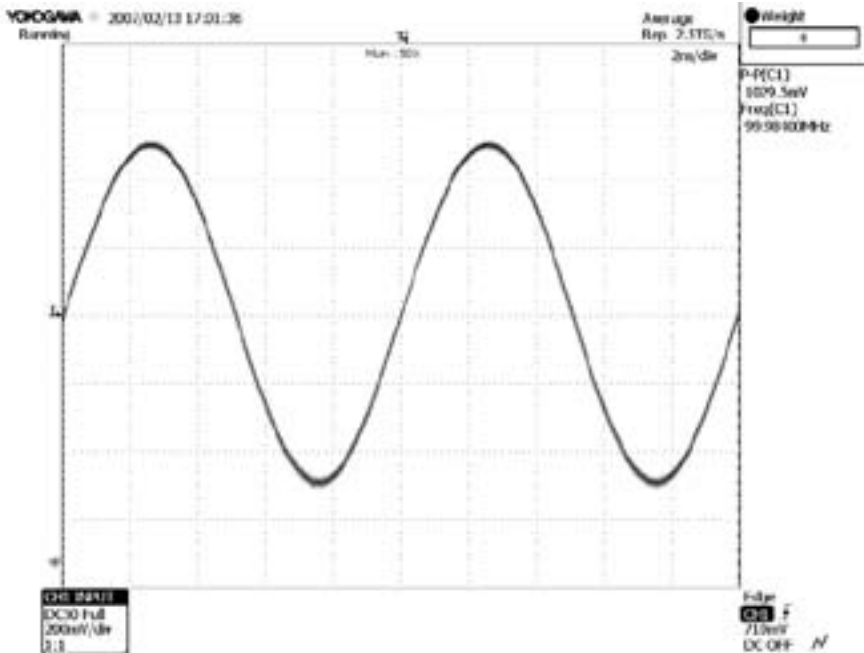
Marker	Frequency	Output Noise	Resulting Input Noise (NEP)
1	100 MHz	109 nV/√Hz	40 pW/√Hz (@ 800 nm)
2	380 MHz	183 nV/√Hz	68 pW/√Hz (@ 800 nm)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 55 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	20 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, free space, 25 mm Ø round flange compatible with microbench systems	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 	

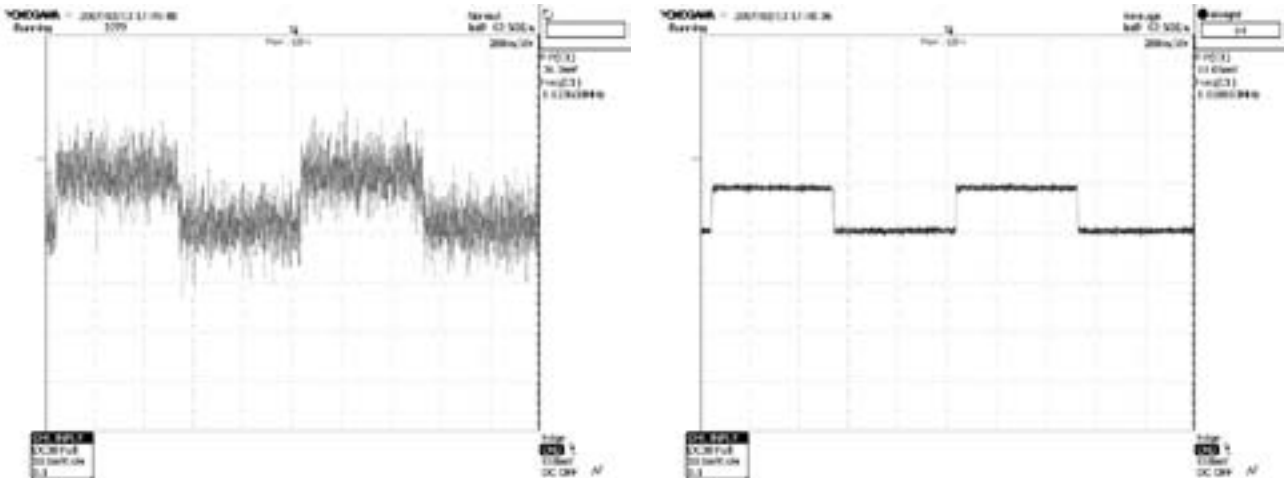
Pulse Response to Square Wave Input Signal
(with 16 times averaging)



Large Signal Response
output signal for 100 MHz, 370 μ W modulated optical input signal
(with 4 times averaging)

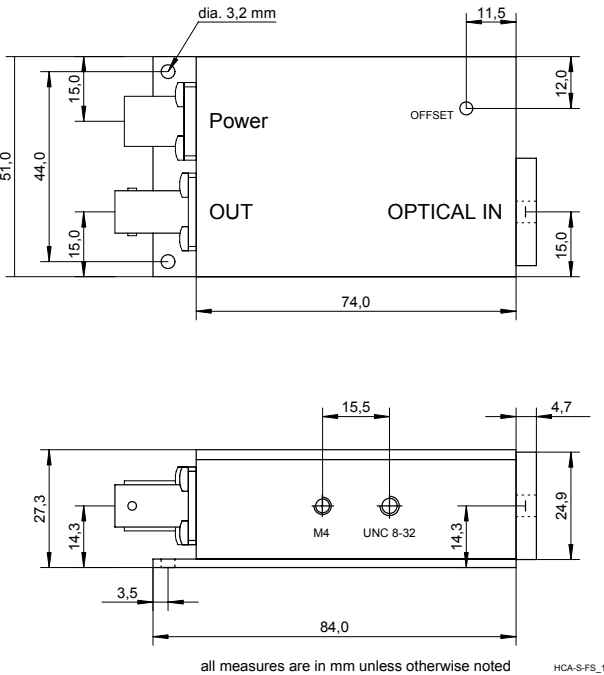


Small Signal Response
output signal for 3.7 μ W modulated optical input signal, 1 MHz square wave
(without (top) and with 64 times averaging (bottom))

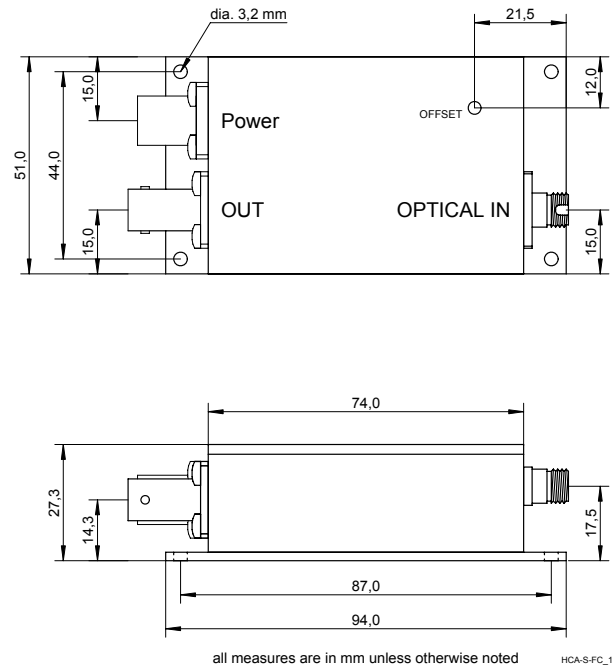


Available Models	HCA-S-400M-SI-FS	Free-space input
	HCA-S-400M-SI-FC	FC fiber receptacle input
	HCA-S-400M-SI-SMA	SMA fiber receptacle input

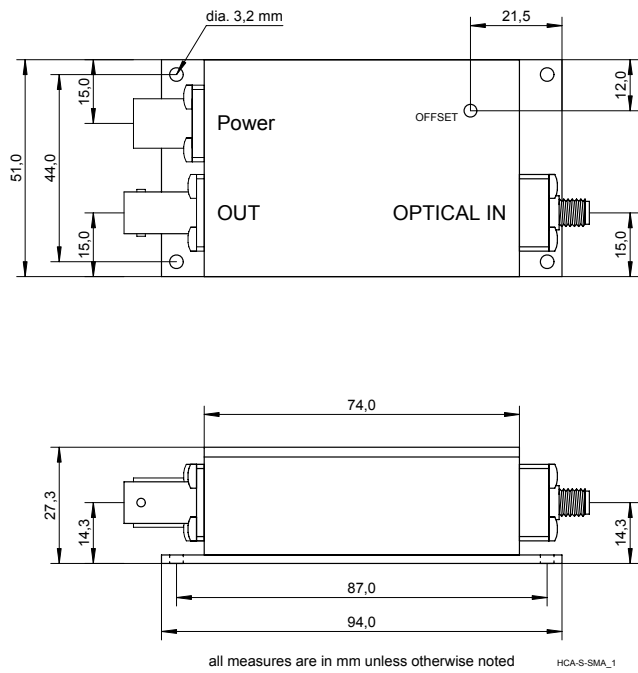
Dimensions
HCA-S-400M-SI-FS



HCA-S-400M-SI-FC



HCA-S-400M-SI-SMA



400 MHz Photoreceiver with InGaAs PIN Photodiode

HCA-S-400M-IN-FC

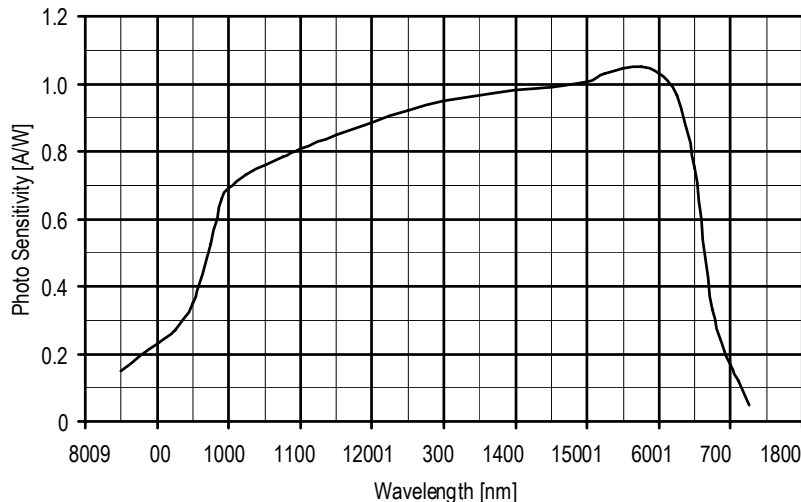
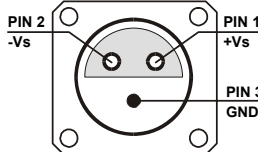
FEATURES

- InGaAs PIN Detector, 0.1 mm Active Diameter in FC Receptacle
- Spectral Range 900 ... 1700 nm
- Bandwidth DC ... 400 MHz
- Amplifier Transimpedance (Gain) 5.0×10^3 V/A
- Max. Conversion Gain 5.0×10^3 V/W (@ 1550 nm)

APPLICATIONS

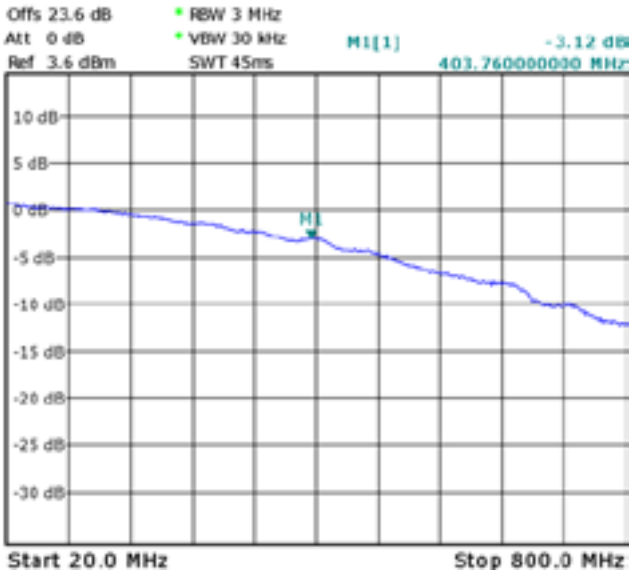
- Spectroscopy
- Fast Pulse and Transient Measurements
- Optical Triggering
- Optical Front-End for Oscilloscopes and A/D Converters

Specifications	Test Conditions	$V_s = \pm 15$ V, $T_a = 25^\circ\text{C}$
Gain	Transimpedance	5.0×10^3 V/A (@ 50 Ω load)
	Max. Conversion Gain	5.0×10^3 V/W (@ 1550 nm)
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	400 MHz (± 10 %)
	Rise- / Fall-Time (10% - 90%)	1.0 μs
	Gain Flatness	± 1 dB
Detector	Detector Material	InGaAs PIN photodiode
	Active Area	$\varnothing$ 0.1 mm in FC receptacle
	Spectral Response	900 ... 1700 nm
Input	Input Offset Compensation	± 200 μA adjustable by offset trimpot
	Max. Optical Input Power	200 μW (for linear amplification, @ 1550 nm)
Noise	Min. NEP	21 pW/ $\sqrt{\text{Hz}}$ (@ 1550 nm, 100 MHz)
Output	Output Voltage Range	± 1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Max. Output Voltage Range	$\pm 1.5\text{V}$ (@ 50 Ω load)
	Output Impedance	50 Ω (terminate with 50 Ω load for best performance)
	Output Noise	ca. 20 mV peak-peak (@ 50 Ω load, no signal on detector)

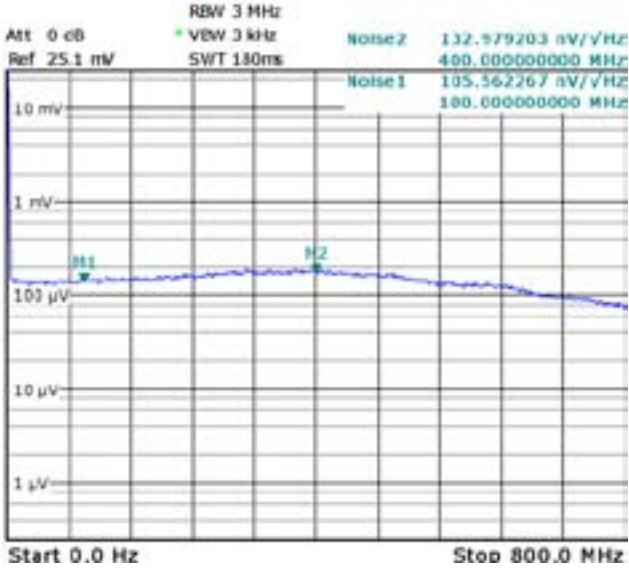
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 55 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Optical Input Power	10 mW
	Power Supply Voltage	± 22 V
Spectral Response		
Connectors		
Input	optical, FC receptacle	
Output	BNC	
Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND 	

Typical Performance Characteristics

Frequency Response



Noise Spectrum



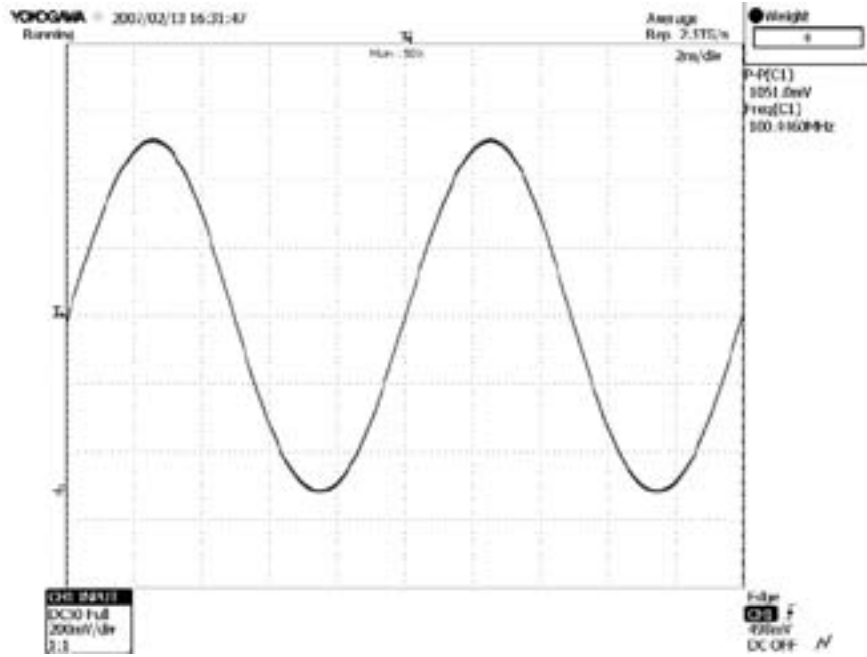
Note: Spectral noise data is measured at the amplifier output with darkened photo diode.
To determine the spectral input noise divide the measured output noise by the amplifier conversion gain.
Conversion gain (V/W) = amplifier gain (5,000 V/A) x photo sensitivity (A/W).

Marker	Frequency	Output Noise	Resulting Input Noise (NEP)
1	100 MHz	106 nV/√Hz	21 pW/√Hz (@ 1550 nm)
2	400 MHz	133 nV/√Hz	27 pW/√Hz (@ 1550 nm)

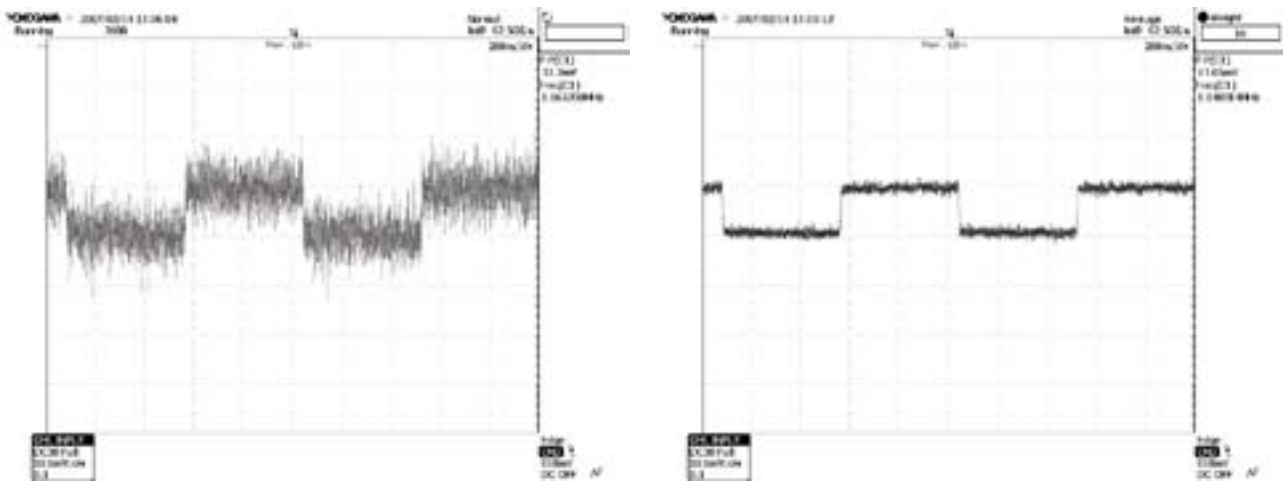
Pulse Response to Square Wave Input Signal
(with 16 times averaging)



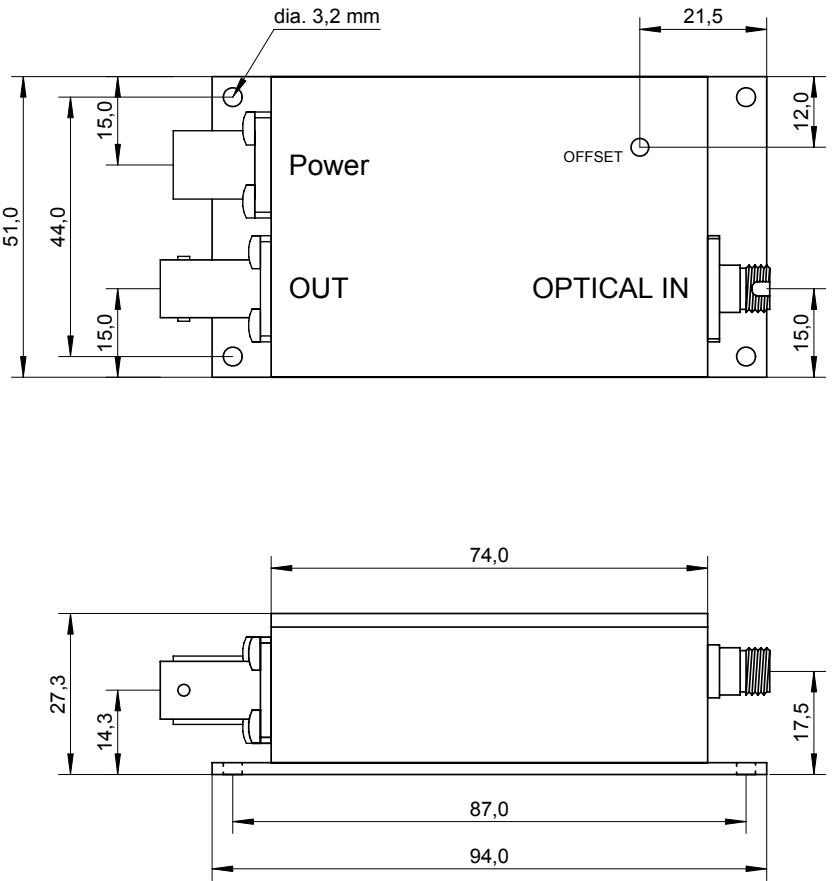
Large Signal Response
output signal for 100 MHz, 200 μW modulated optical input signal
(with 4 times averaging)



Typical Performance Characteristics (continued)
Small Signal Response
output signal for 2 μW modulated optical input signal, 1 MHz square wave
(without (top) and with 64 times averaging (bottom))



Dimensions



all measures are in mm unless otherwise noted HCA-S-FC_1

Ultra High Speed Photoreceiver with Si PIN Photodiode

HSA-X-S-1G4-SI

FEATURES

- Bandwidth 10 kHz ... 1.4 GHz
- Si-PIN-Detector, Ø 0.8 mm Effective Active Diameter
- Spectral Range 320 ... 1000 nm
- Amplifier Transimpedance (Gain) 5×10^3 V/A
- Max. Conversion Gain 2.5×10^3 V/W @ 760 nm

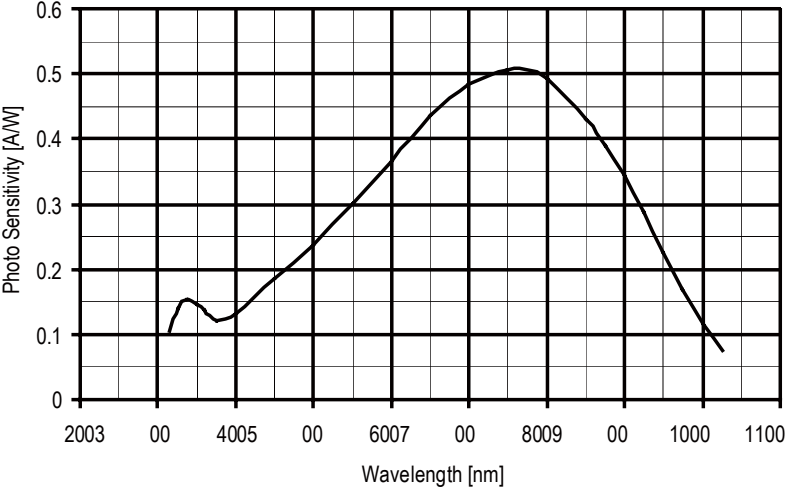
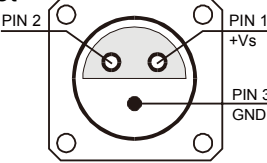
APPLICATIONS

- Spectroscopy
- Fast Pulse and Transient Measurements
- Optical Triggering
- Optical Front-End for Oscilloscopes and A/D Converters

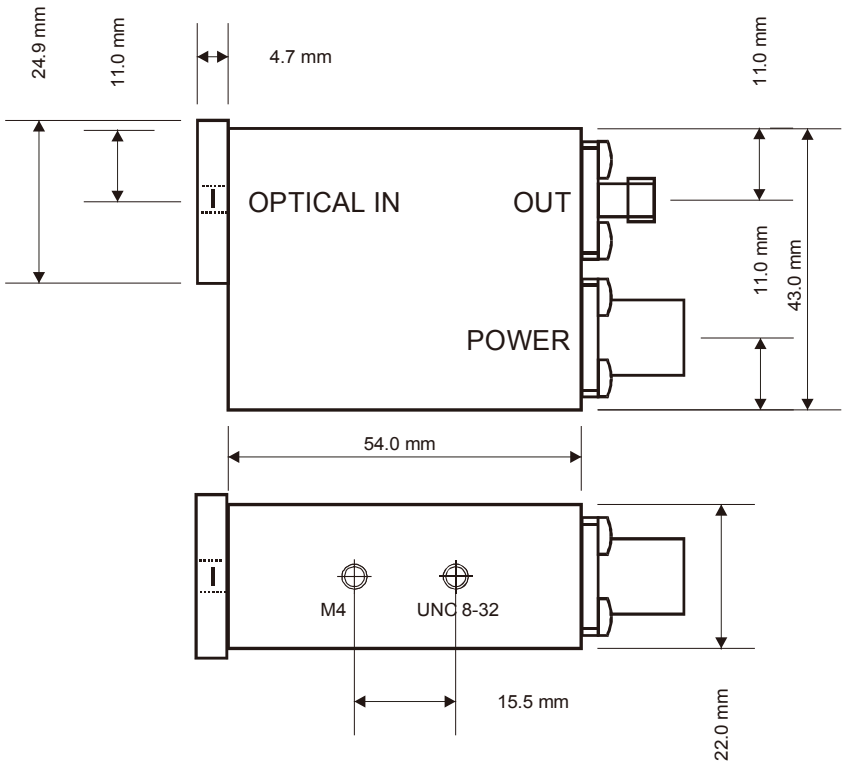
The photoreceiver will be delivered without post holder and post



Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Amplifier Transimpedance	5×10^3 V/A (@ 50 Ω load)
	Conversion Gain	2.5×10^3 V/W (@ 760 nm)
Frequency Response	Lower Cut-Off Frequency	10 kHz
	Upper Cut-Off Frequency	1.4 GHz (-3 dB)
	Rise- / Fall-Time	250 ps (10% - 90%)
	Gain Flatness	± 1 dB
Input / Detector	Detector Material	Si PIN photodiode
	Active Area	effective Ø 0.8 mm (actual Ø 0.4 mm plus ball lens)
	Spectral Response	320 ... 1000 nm
	Max. Optical Input-Power	400 µW
Noise	Min. NEP	21 pW/√Hz (@ 1550 nm, 100 MHz)
Output	Output Impedance	50 Ω
	Output Peak Voltage	1.9 Vpp
	Supply Voltage	+ 15 V, 130 mA typ. (depends on operating conditions, recommended power supply capability minimum 200 mA)

Case	Weight	100 g (0.23 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Power Supply Voltage	± 22 V
	Optical Input Power	10 mW (averaged)
Spectral Response		
Connectors	Input	optical, free space, 25 mm Ø round flange compatible with microbench systems
	Output	SMA
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: n.c. Pin 3: GND 

Dimensions



DZ-HSA-X-S_3.cdr

Ultra High Speed Photoreceiver with InGaAs Photodiode

HSA-X-S-2G-IN**FEATURES**

- Bandwidth 10 kHz ... 2 GHz
- InGaAs Detector, Ø 0.2 mm Effective Active Diameter
- Spectral Range 850 ... 1700 nm
- Amplifier Transimpedance (Gain) 5×10^3 V/A
- Max. Conversion Gain 4.8×10^3 V/W @ 1550 nm

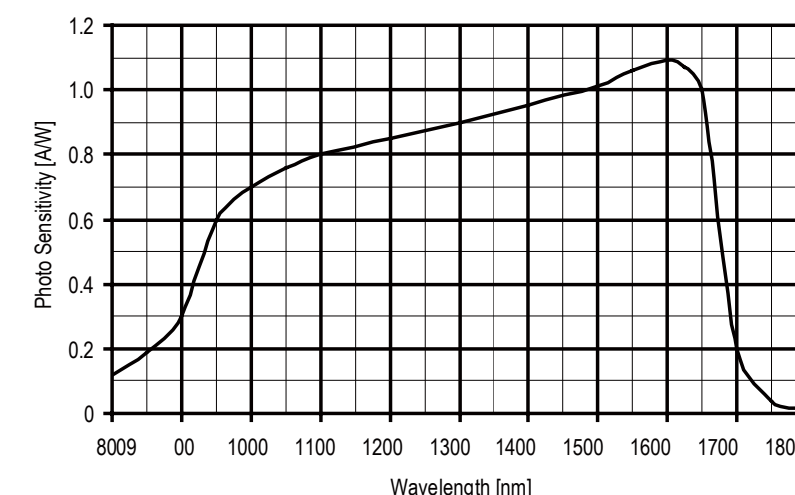
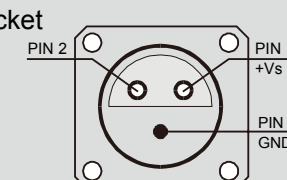
APPLICATIONS

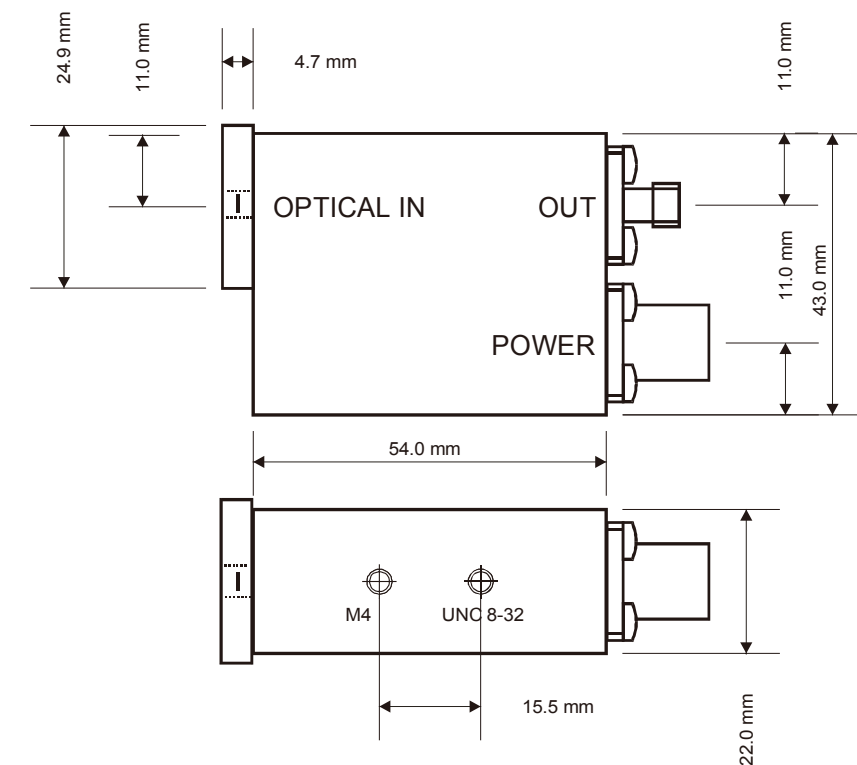
- Spectroscopy
- Ultra Fast Pulse and Transient Measurements
- Optical Triggering
- Optical Front-End for Oscilloscopes and Ultra Fast A/D Converters



The photoreceiver will be delivered without post holder and post

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Amplifier Transimpedance	5×10^3 V/A (@ 50 Ω load)
	Conversion Gain	4.8×10^3 V/W (@ 1550 nm)
Frequency Response	Lower Cut-Off Frequency	10 kHz
	Upper Cut-Off Frequency	2 GHz (-3 dB)
	Rise- / Fall-Time	180 ps (10% - 90%)
	Gain Flatness	± 1 dB
Input / Detector	Detector Material	InGaAs photodiode
	Active Area	effective Ø 0.2 mm (actual Ø 0.1 mm plus ball lens)
	Spectral Response	850 ... 1700 nm
	Max. Optical Input-Power	240 μW
Noise	Min. NEP	14 pW/√Hz (@ 1550 nm, 100 MHz)
Output	Output Impedance	50 Ω
	Output Peak Voltage	1.9 Vpp
	Supply Voltage	+ 15 V, 130 mA typ. (depends on operating conditions, recommended power supply capability minimum 200 mA)

Case	Weight	100 g (0.23 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Power Supply Voltage	± 22 V
	Optical Input Power	10 mW (averaged)
Spectral Response		
Connectors	Input	optical, free space, 25 mm Ø round flange compatible with microbench systems
	Output	SMA
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: n.c. Pin 3: GND 

Dimensions

DZ-HSA-X-S_3.cdr