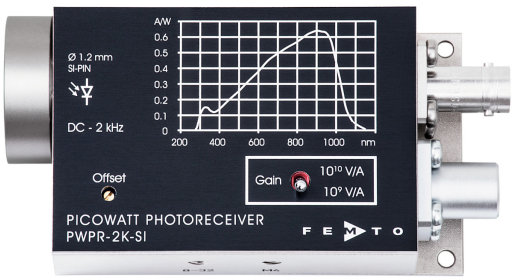






Ultra-Low Noise 2 kHz Photoreceiver  
with Si-PIN Photodiode



Features	<ul style="list-style-type: none"> <li>• Si-PIN photodiode, 1.2 mm active diameter</li> <li>• Bandwidth DC – 2 kHz</li> <li>• Amplifier transimpedance gain switchable <math>1.0 \times 10^9</math> V/A, <math>1.0 \times 10^{10}</math> V/A</li> <li>• Spectral range 320 – 1060 nm</li> <li>• Ultra-low noise, NEP 9 fW/√Hz</li> <li>• Free-space input 1.035"-40 threaded, easily convertible to fiber optic input (FC and FSMA) with optionally available screw-on adapters</li> <li>• UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread</li> </ul>
Applications	<ul style="list-style-type: none"> <li>• Spectroscopy, reflection and transmission measurements</li> <li>• Highly sensitive optoelectronic measurements</li> <li>• Applications utilizing optical chopper modulation</li> <li>• Optical front-end for oscilloscopes, A/D converters and lock-in amplifiers</li> </ul>
Block Diagram	<p>The block diagram illustrates the internal circuitry. An 'OPTICAL INPUT' is shown as an arrow entering a photodiode symbol. The photodiode's output is connected to the inverting input of an operational amplifier configured as a transimpedance amplifier. A feedback resistor labeled 'Rf = 1GΩ' connects the op-amp's output back to its inverting input. The non-inverting input is connected to an 'Offset nulling' block. The output of the first op-amp is connected to the input of a second op-amp, which is configured as a voltage follower with a 'Switchable gain' of either '× 10' or '× 1'. This second stage also has a feedback path labeled with '10<sup>10</sup> V/A' and '10<sup>9</sup> V/A'. The final output is labeled 'VOLTAGE OUTPUT'.</p>
Intended Use	<p>The PWPR-2K-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 <a href="mailto:support@femto.de">support@femto.de</a>.</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>

## Ultra-Low Noise 2 kHz Photoreceiver with Si-PIN Photodiode

Available Version	<p>PWPR-2K-SI-FST</p>  <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</p> <p>Optionally available: Fiber adapters PRA-FC, PRA-FCA and PRA-FSMA, with the relative large 1.2 mm dia. photodiode installed in the PWPR-2K-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</p>										
Related Model	<p>PWPR-2K-IN-FST</p> <p>InGaAs-PIN, <math>\varnothing</math> 0.5 mm, 900 - 1700 nm free space input, 1.035"-40 threaded flange</p>										
Available Accessories	<div> <p>PRA-FC PRA-FCA PRA-FSMA</p>  <p>Fiber-adapter with external 1.035"-40 thread (suitable for FST models only)</p> </div> <div> <p>PRA-PAP</p>  <p>Alternative mounting option: post adapter plate, easy to mount on FEMTO photoreceiver series OE, FWPR, PWPR, HCA-S and LCA-S</p> </div> <div> <p>PS-15-25-L</p>  <p>Power Supply input: 100 – 240 VAC output: <math>\pm 15</math> VDC</p> </div>										
Specifications	<table> <tr> <td>Test conditions</td><td><math>V_s = \pm 15</math> V, <math>T_A = 25</math> °C, output load impedance 1 M<math>\Omega</math>, warm-up 20 minutes (min. 10 minutes recommended)</td></tr> <tr> <td>Gain</td><td> <p>Transimpedance gain</p> <p>Gain accuracy</p> <p>Conversion gain</p> <p><math>1.0 \times 10^9</math> V/A, <math>1.0 \times 10^{10}</math> V/A, switchable (@ output load <math>\geq 100</math> k<math>\Omega</math>)</p> <p><math>\pm 1</math> % (electrical)</p> <p><math>6.4 \times 10^8</math> V/W, <math>6.4 \times 10^9</math> V/W typ. (@ 900 nm, output load <math>\geq 100</math> k<math>\Omega</math>)</p> </td></tr> <tr> <td>Frequency Response</td><td> <p>Lower cut-off frequency</p> <p>Upper cut-off frequency (–3 dB)</p> <p>DC</p> <p>2 kHz</p> </td></tr> <tr> <td>Time Response</td><td> <p>Rise/fall time (10 % – 90 %)</p> <p>165 <math>\mu</math>s</p> </td></tr> <tr> <td>Input</td><td> <p>Input offset current (dark current)</p> <p>Input offset current drift</p> <p>Input offset compensation range</p> <p>Optical saturation power</p> <p>NEP</p> <p>0.6 pA typ. factor 2 / 10 °C</p> <p><math>\pm 120</math> pA (adjustable by offset potentiometer)</p> <p>15.6 nW (@ <math>10^9</math> V/A, 900 nm) 1.56 nW (@ <math>10^{10}</math> V/A, 900 nm)</p> <p>9 fW/<math>\sqrt{\text{Hz}}</math> (@ 900 nm, 100 Hz)</p> </td></tr> </table>	Test conditions	$V_s = \pm 15$ V, $T_A = 25$ °C, output load impedance 1 M $\Omega$ , warm-up 20 minutes (min. 10 minutes recommended)	Gain	<p>Transimpedance gain</p> <p>Gain accuracy</p> <p>Conversion gain</p> <p><math>1.0 \times 10^9</math> V/A, <math>1.0 \times 10^{10}</math> V/A, switchable (@ output load <math>\geq 100</math> k<math>\Omega</math>)</p> <p><math>\pm 1</math> % (electrical)</p> <p><math>6.4 \times 10^8</math> V/W, <math>6.4 \times 10^9</math> V/W typ. (@ 900 nm, output load <math>\geq 100</math> k<math>\Omega</math>)</p>	Frequency Response	<p>Lower cut-off frequency</p> <p>Upper cut-off frequency (–3 dB)</p> <p>DC</p> <p>2 kHz</p>	Time Response	<p>Rise/fall time (10 % – 90 %)</p> <p>165 <math>\mu</math>s</p>	Input	<p>Input offset current (dark current)</p> <p>Input offset current drift</p> <p>Input offset compensation range</p> <p>Optical saturation power</p> <p>NEP</p> <p>0.6 pA typ. factor 2 / 10 °C</p> <p><math>\pm 120</math> pA (adjustable by offset potentiometer)</p> <p>15.6 nW (@ <math>10^9</math> V/A, 900 nm) 1.56 nW (@ <math>10^{10}</math> V/A, 900 nm)</p> <p>9 fW/<math>\sqrt{\text{Hz}}</math> (@ 900 nm, 100 Hz)</p>
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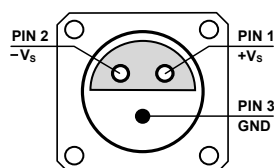
## Ultra-Low Noise 2 kHz Photoreceiver with Si-PIN Photodiode

### Specifications (continued)

Detector	Detector Active area Spectral range Max. sensitivity	Si-PIN photodiode Ø 1.2 mm 320 – 1060 nm 0.64 A/W typ. (@ 900 nm)
Output	Output voltage range Output impedance Max. output current Output noise	–1.2 V ... +10 V (@ $\geq 100\text{ k}\Omega$ output load) 50 $\Omega$ (terminate with $\geq 100\text{ k}\Omega$ load) 30 mA (short-circuit proof) 0.45 mV RMS (3 mV peak-peak) typ. (@ $10^9\text{ V/A}$ , $\geq 100\text{ k}\Omega$ load, no signal on detector, measurement bandwidth 8 KHz)
Optical Input Connector	Material FST flange Material FST coupler ring	1.4305 stainless steel, nickel-plated 1.4305 stainless steel, glass bead blasted
Power Supply	Supply voltage Supply current	$\pm 15\text{ V}$ ( $\pm 14.5\text{ V}$ ... $\pm 16.5\text{ V}$ ) +32 mA / –25 mA (depends on operating conditions, recommended power supply capability min. $\pm 100\text{ mA}$ )
Case	Weight Material	220 g (0.49 lbs) PWPR-2K-SI-FST incl. coupler ring AlMg4.5Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	–30 °C ... +85 °C 0 °C ... +50 °C

Absolute Maximum Ratings	Optical input power (CW) Power supply voltage	10 mW $\pm 20\text{ V}$
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Connectors	Input  Output  Power supply	1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories  BNC jack (female)  LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)
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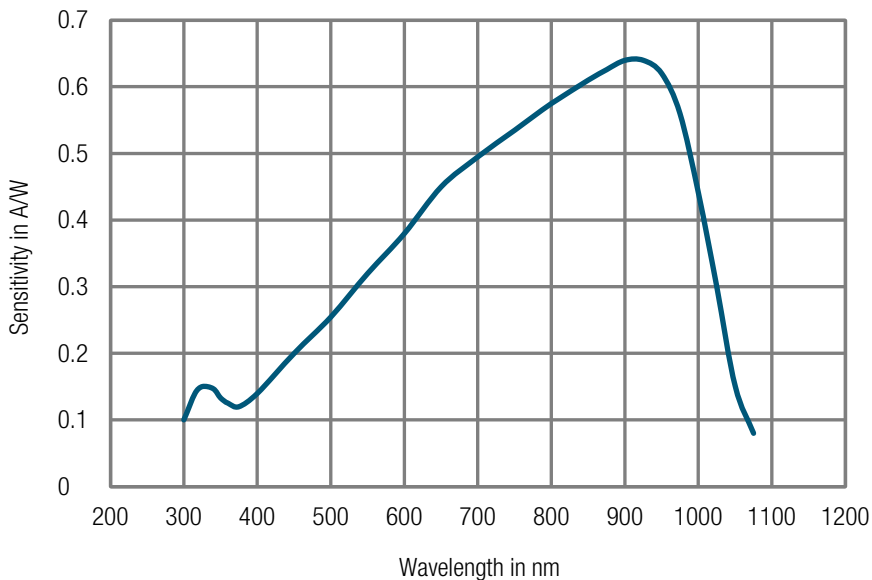
Pin 1: +15 V  
 Pin 2: –15 V  
 Pin 3: GND

Scope of Delivery	PWPR-2K-SI, internally threaded coupler ring, LEMO® 3-pin connector, datasheet, transport package	
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Ordering Information	PWPR-2K-SI-FST	1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories
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Ultra-Low Noise 2 kHz Photoreceiver  
with Si-PIN Photodiode

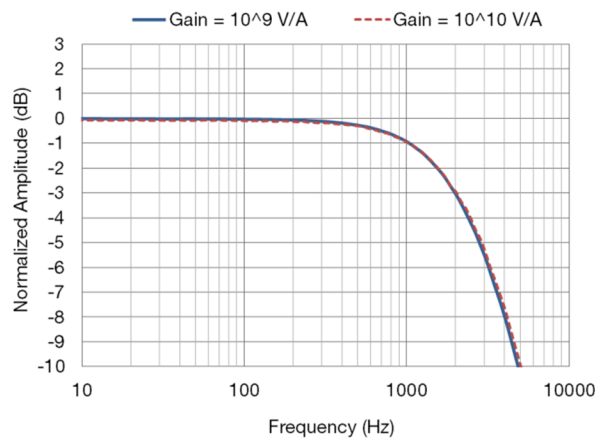
Spectral Responsivity



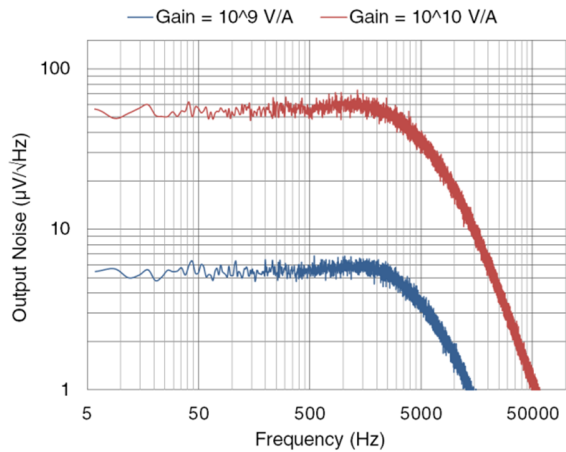
DB-Sens-PWPR-2K-SI\_R02

Typical Performance  
Characteristics

Frequency Response



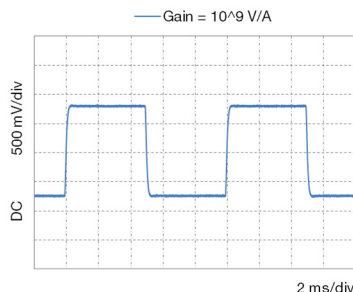
Output Noise



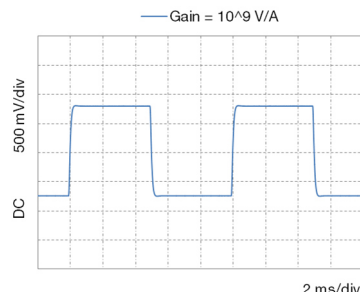
# Ultra-Low Noise 2 kHz Photoreceiver with Si-PIN Photodiode

Typical Performance Characteristics (continued)

Step Signal Response @ 2500 pW (p-p, 850 nm)

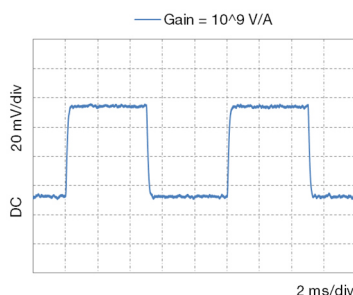


acquisition without averaging

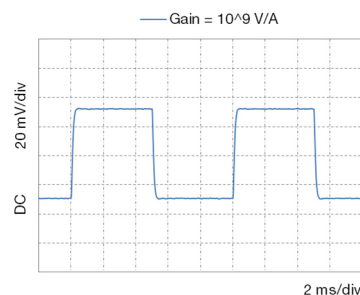


acquisition with 64x averaging

Step Signal Response @ 100 pW (p-p, 850 nm)

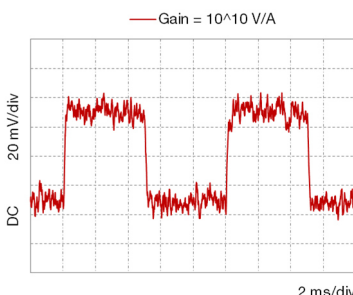


acquisition without averaging

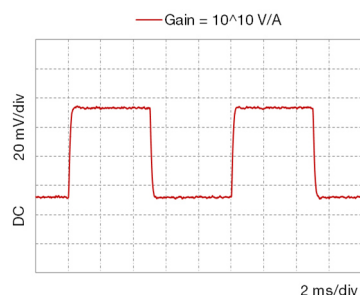


acquisition with 64x averaging

Step Signal Response @ 10 pW (p-p, 850 nm)



acquisition without averaging

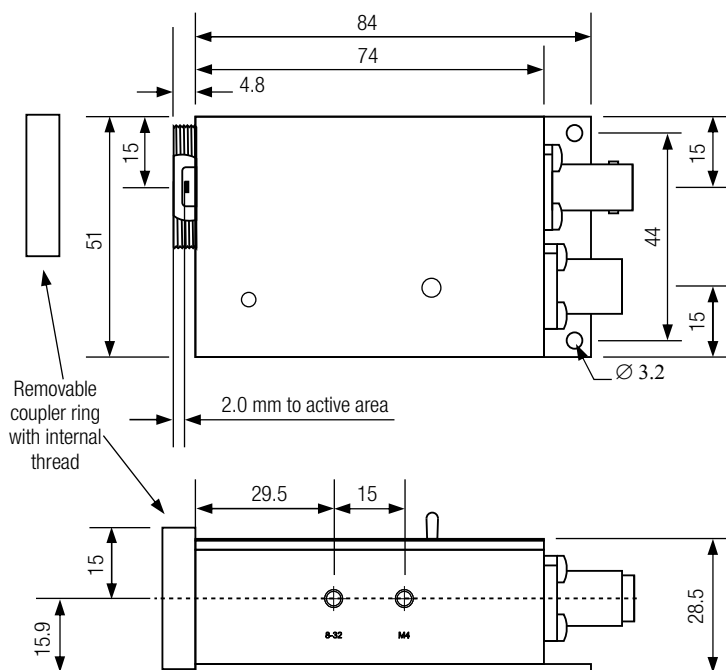


acquisition with 64x averaging

# Ultra-Low Noise 2 kHz Photoreceiver with Si-PIN Photodiode

## Dimensions

PWPR-2K-SI-FST



DZ-PWPR-2K-FST R02

all dimensions in mm unless otherwise noted

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## SOPHISTICATED TOOLS FOR SIGNAL RECOVERY

**F E M T O**