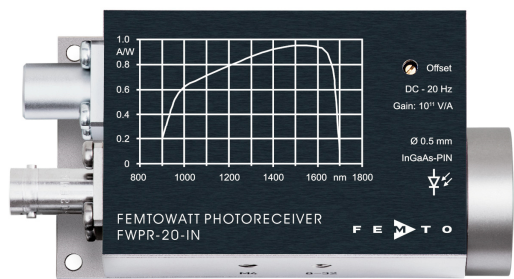






Femtowatt Photoreceiver  
with InGaAs-PIN Photodiode



Features	<ul style="list-style-type: none"><li>• InGaAs-PIN photodiode, 0.5 mm active diameter</li><li>• Ultra low noise, NEP 7.5 fW/√Hz</li><li>• Amplifier transimpedance gain <math>1 \times 10^{11}</math> V/A</li><li>• Max. conversion gain <math>0.95 \times 10^{11}</math> V/W @ 1550 nm</li><li>• Spectral range 900 – 1700 nm</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>• Fluorescence measurements</li><li>• NIR spectroscopy</li><li>• Electrophoresis</li><li>• Replacement for (liquid nitrogen) cooled Ge photodiodes and avalanche photodiodes (APDs)</li></ul>
Block Diagram	<div><p>The block diagram illustrates the internal circuitry of the photoreceiver. It begins with an "OPTICAL INPUT" represented by a photodiode symbol. The output of the photodiode is connected to the non-inverting input of an "I/V" (transimpedance) amplifier. The feedback path of the I/V amplifier is a resistor labeled "Rf". The output of the I/V amplifier is connected to the input of a "Buffer amplifier". The output of the buffer amplifier is labeled "VOLTAGE OUTPUT". An "Offset nulling" block is connected to the non-inverting input of the I/V amplifier. The diagram is labeled "BS01-FWPR_R03" in the bottom right corner.</p></div>
Intended Use	<p>The FWPR-20-IN photoreceiver consists of an InGaAs photodiode and a subsequent low-noise fixed gain transimpedance amplifier. It is designed for conversion of optical signals in the range from fW to pW 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>

## Femtowatt Photoreceiver with InGaAs-PIN Photodiode

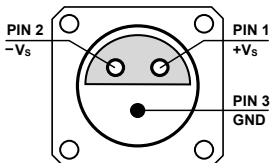
Available Version	<p>FWPR-20-IN-FST</p>  <p>Picture shows 1.035"-40 threaded flange with internally threaded coupler ring (outer diameter 30 mm)</p> <p>1.035"-40 threaded flange for free space applications, compatible with many optical standard accessories and for use with various types of fiber connector adapters.</p> <p>Optionally available: Fiber adapters PRA-FC, PRA-FCA and PRA-FSMA. The coupling efficiency will depend on fiber type. With the relative large 0.5 mm dia. photodiode installed in the FWPR-20-IN 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>FWPR-20-SI-FST</p> <p>Si photodiode, <math>1.1 \times 1.1 \text{ mm}^2</math>, 320 - 1100 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</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 \text{ VDC}</math></p> </div>												
Specifications	<table> <tr> <td>Test conditions</td><td><math>V_s = \pm 15 \text{ V}</math>, <math>T_A = 25^\circ \text{C}</math>, output load impedance <math>1 \text{ M}\Omega</math>, warm-up 20 minutes (min. 10 minutes recommended)</td></tr> <tr> <td>Gain</td><td> <p>Transimpedance gain <math>1.0 \times 10^{11} \text{ V/A}</math> (@ output load <math>\geq 100 \text{ k}\Omega</math>)</p> <p>Gain accuracy <math>\pm 1 \%</math> (electrical)</p> <p>Conversion gain <math>0.95 \times 10^{11} \text{ V/W typ.}</math> (@ 1550 nm, output load <math>\geq 100 \text{ k}\Omega</math>)</p> </td></tr> <tr> <td>Frequency Response</td><td> <p>Lower cut-off frequency DC</p> <p>Upper cut-off frequency (<math>-3 \text{ dB}</math>) <math>20 \text{ Hz}</math> (<math>\pm 20 \%</math>)</p> </td></tr> <tr> <td>Time Response</td><td>Rise/fall time (10 % – 90 %) <math>18 \text{ ms}</math> (<math>\pm 20 \%</math>)</td></tr> <tr> <td>Input</td><td> <p>Noise equivalent power (NEP) <math>7.5 \text{ fW}/\sqrt{\text{Hz}}</math> (@ 1550 nm, 1 Hz)</p> <p>Optical saturation power <math>110 \text{ pW}</math> (for linear amplification, @ 1550 nm)</p> </td></tr> <tr> <td>Detector</td><td> <p>Detector InGaAs-PIN photodiode</p> <p>Active area <math>\varnothing 0.5 \text{ mm}</math></p> <p>Spectral range 900 – 1700 nm</p> <p>Max. sensitivity <math>0.95 \text{ A/W typ.}</math> (@ 1550 nm)</p> </td></tr> </table>	Test conditions	$V_s = \pm 15 \text{ V}$ , $T_A = 25^\circ \text{C}$ , output load impedance $1 \text{ M}\Omega$ , warm-up 20 minutes (min. 10 minutes recommended)	Gain	<p>Transimpedance gain <math>1.0 \times 10^{11} \text{ V/A}</math> (@ output load <math>\geq 100 \text{ k}\Omega</math>)</p> <p>Gain accuracy <math>\pm 1 \%</math> (electrical)</p> <p>Conversion gain <math>0.95 \times 10^{11} \text{ V/W typ.}</math> (@ 1550 nm, output load <math>\geq 100 \text{ k}\Omega</math>)</p>	Frequency Response	<p>Lower cut-off frequency DC</p> <p>Upper cut-off frequency (<math>-3 \text{ dB}</math>) <math>20 \text{ Hz}</math> (<math>\pm 20 \%</math>)</p>	Time Response	Rise/fall time (10 % – 90 %) $18 \text{ ms}$ ( $\pm 20 \%$ )	Input	<p>Noise equivalent power (NEP) <math>7.5 \text{ fW}/\sqrt{\text{Hz}}</math> (@ 1550 nm, 1 Hz)</p> <p>Optical saturation power <math>110 \text{ pW}</math> (for linear amplification, @ 1550 nm)</p>	Detector	<p>Detector InGaAs-PIN photodiode</p> <p>Active area <math>\varnothing 0.5 \text{ mm}</math></p> <p>Spectral range 900 – 1700 nm</p> <p>Max. sensitivity <math>0.95 \text{ A/W typ.}</math> (@ 1550 nm)</p>
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## Femtowatt Photoreceiver with InGaAs-PIN Photodiode

### Specifications (continued)

Output	Output voltage range Offset compensation range Output impedance Max. output current Output noise	−1.6 V ... +10 V (@ ≥ 100 kΩ output load) ±1.6 V typ. (adjustable by offset potentiometer) 50 Ω (terminate with ≥ 100 kΩ load) 25 mA (short-circuit proof) 3 mV RMS (20 mV peak-peak) typ. (@ ≥ 100 kΩ 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	±15 V (±14.5 V ... ±16.5 V) ±15 mA (depends on operating conditions, recommended power supply capability min. ±50 mA)
Case	Weight Material	203 g (0.45 lbs) incl. coupler ring AlMg3/4.5Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	−30 °C ... +85 °C 0 °C ... +60 °C

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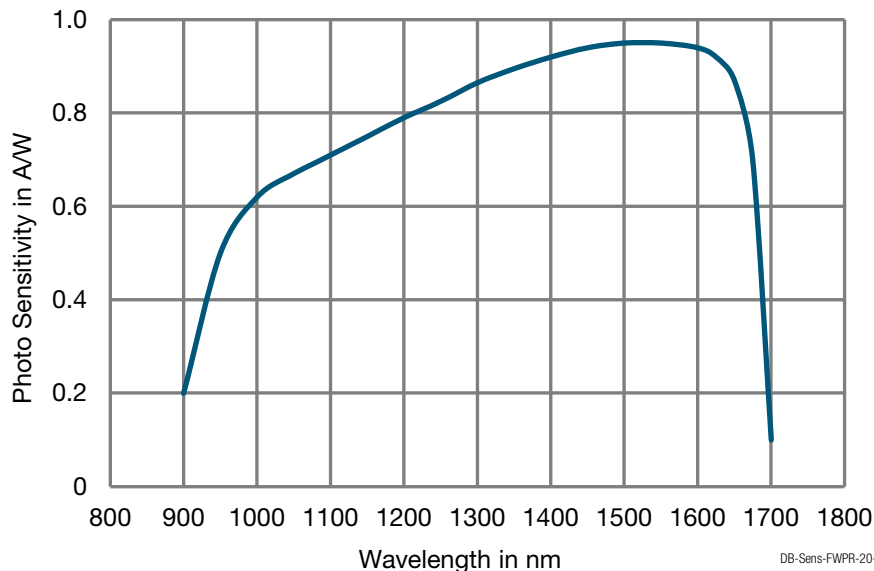
Connectors	Input Output Power supply	1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories BNC jack (female) LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)
 <p>PIN 1: +15 V PIN 2: −15 V PIN 3: GND</p>		

Scope of Delivery	FWPR-20-IN-FST, internally threaded coupler ring, LEMO® 3-pin connector, datasheet, transport package	
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Ordering Information	FWPR-20-IN-FST	1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories.
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## Femtowatt Photoreceiver with InGaAs-PIN Photodiode

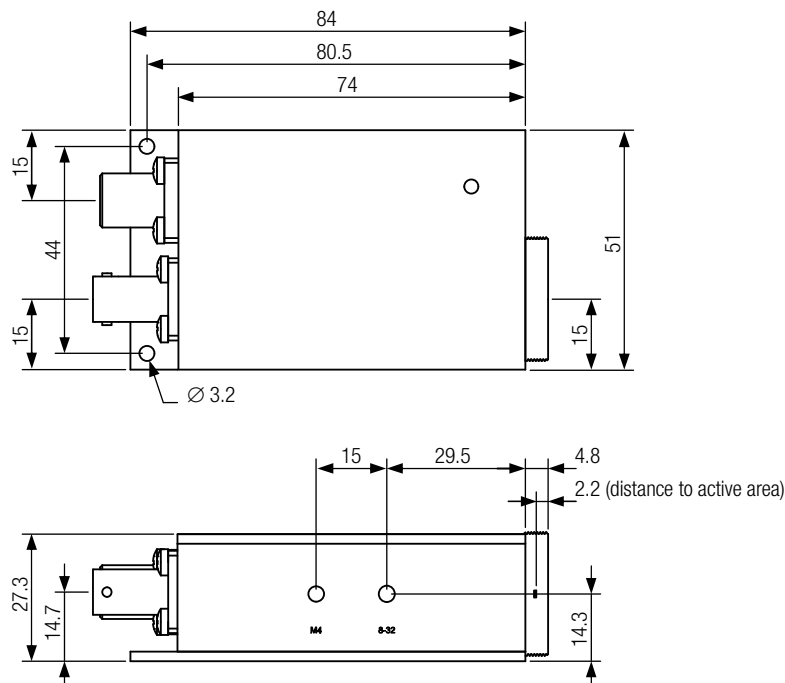
Spectral Response



DB-Sens-FWPR-20-IN\_R01

Dimensions

FWPR-20-IN-FST (1.035"-40 threaded free space input)



FWPR-20-IN-FST\_R2

all dimensions in mm unless otherwise noted

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