



Datasheet

HBPR-200M-30K-SI-FST

High-Speed Balanced Photoreceiver



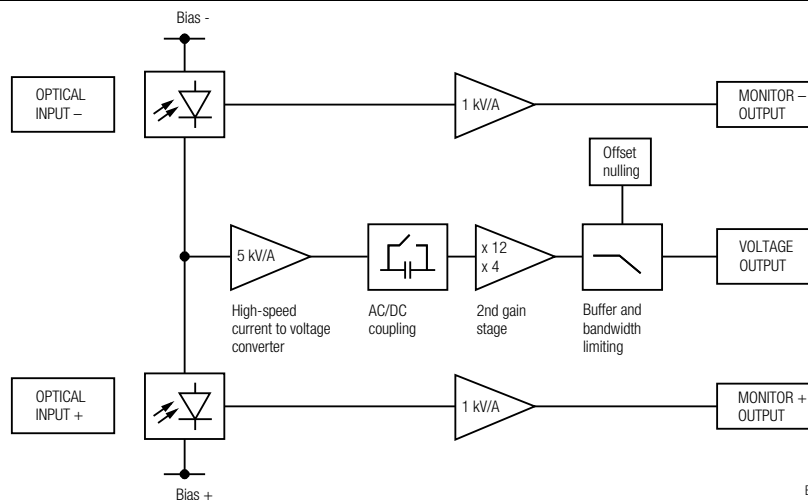
Features

- **Bandwidth DC to 200 MHz**
- **Common-Mode Rejection Ratio (CMRR) 45 dB typ.**
- **Si-PIN detectors, 0.8 mm active diameter**
- **Spectral range 320 – 1000 nm**
- **Very low NEP, down to 6.5 pW/√Hz**
- **Transimpedance gain switchable 10×10^3 V/A, 30×10^3 V/A**
- **High dynamic input range up to 2×10 mW balanced optical power**
- **Fast monitor outputs with 10 MHz bandwidth and 1×10^3 V/A gain**
- **Switchable low pass filter for minimizing wideband noise**
- **Free-space input 1.035"-40 threaded, easily convertible to fiber optic input (FC and FSMA) with optionally available screw-on adapters**
- **UNC 8-32 and M4 tapped holes for mounting on standard posts with metric and imperial thread**



Applications

- **Spectroscopy**
- **Heterodyne detection**
- **Optical coherence tomography (OCT)**
- **Optical delay measurement**
- **Differential optical front-end for oscilloscopes, spectrum analyzers, A/D converters and RF lock-in amplifiers**

Block Diagram



High-Speed Balanced Photoreceiver

<p>Intended Use</p>	<p>The HBPR-200M-30K-SI-FST photoreceiver consists of a combination of two anti-parallel connected photodiodes with a subsequent low-noise transimpedance amplifier. It is designed for fast conversion of the tiny difference of two optical signals into an equivalent output voltage. Operation is mostly self-explanatory. If in doubt, consult this document or contact support@femto.de.</p> <p>For safe operation, please refer to the damage thresholds specified in the "Absolute Maximum Ratings", "Temperature Range" and "Power Supply" sections of this document.</p> <p>The operating environment must be free of smoke, dust, grease, oil, condensing moisture, and other contaminants that could affect the operation or performance.</p>
<p>Application Notes</p>	<p>The damage threshold of 12 mW for each photodiode mentioned in the "Absolute Maximum Ratings" section applies to reasonably homogeneous illumination of the photodiodes. Extreme focusing of the light beam can lead to damage to the photodiodes, even at significantly lower light power.</p> <p>To achieve optimum performance, it is recommended that the CW light intensity at both inputs be well balanced. The monitor outputs can be used for continuous balance control. For setups with arbitrarily varying CW offset, the photoreceiver's AC mode can be helpful. Using AC mode increases the CW offset range to 850 μW (@ 850 nm), regardless of the gain setting.</p>
<p>Available Version</p>	<p>HBPR-200M-30K-SI-FST</p>  <p>1.035"-40 threaded flanges with internally threaded coupler rings mounted (outer dia. 30 mm), for free space applications, compatible with many optical standard accessories</p> <p>Optional: fiber adapters PRA-FC, PRA-FCA, PRA-FSMA</p> 
<p>Related Models</p> <p>Si Versions</p>	<p>Various free space or fiber coupled HBPR models, with bandwidth up to 500 MHz, in the spectral range from 320 nm to 1700 nm are available.</p> <p>Fiber-coupled with fix/permanent FC fiber connectors</p> <p>HBPR-100M-60K-SI-FC Si-PIN \varnothing 0.8 mm, DC – 100 MHz, 320 – 1000 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable</p> <p>HBPR-200M-30K-SI-FC Si-PIN \varnothing 0.8 mm, DC – 200 MHz, 320 – 1000 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable</p> <p>HBPR-500M-10K-SI-FC Si-PIN \varnothing 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable</p> <p>Free space versions with 1.035"-40 threaded flanges</p> <p>HBPR-100M-60K-SI-FST Si-PIN \varnothing 0.8 mm, DC – 100 MHz, 320 – 1000 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable</p> <p>HBPR-500M-10K-SI-FST Si-PIN \varnothing 0.4 mm, DC – 500 MHz, 320 – 1000 nm, CMRR 40 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable</p>

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Related Models (continued)

InGaAs Versions

Fiber-coupled with fix/permanent FC fiber connectors (ball lense coupled)	
HBPR-100M-60K-IN-FC	InGaAs-PIN \varnothing 0.08 mm, DC – 100 MHz, 900 – 1700 nm, CMRR 55 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable
HBPR-200M-30K-IN-FC	InGaAs-PIN \varnothing 0.08 mm, DC – 200 MHz, 900 – 1700 nm, CMRR 50 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable
HBPR-500M-10K-IN-FC	InGaAs-PIN \varnothing 0.08 mm, DC – 500 MHz, 900 – 1700 nm, CMRR 45 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable
Free space versions with 1.035"-40 threaded flanges	
HBPR-100M-60K-IN-FST	InGaAs-PIN \varnothing 0.3 mm, DC – 100 MHz, 800 – 1700 nm, CMRR 50 dB, gain $2.0 \times 10^4 / 6.0 \times 10^4$ V/A switchable
HBPR-200M-30K-IN-FST	InGaAs-PIN \varnothing 0.3 mm, DC – 200 MHz, 800 – 1700 nm, CMRR 45 dB, gain $1.0 \times 10^4 / 3.0 \times 10^4$ V/A switchable
HBPR-450M-10K-IN-FST	InGaAs-PIN \varnothing 0.3 mm, DC – 450 MHz, 800 – 1700 nm, CMRR 35 dB, gain $5.0 \times 10^3 / 10.0 \times 10^3$ V/A switchable

Available Accessories

PRA-FC PRA-FCA PRA-FSMA		Fiber-adaptor with external 1.035"-40 thread
PS-15-25-L		Power Supply Input: 100 – 240 VAC Output: ± 15 VDC

Specifications

Test conditions	$V_S = \pm 15$ V, $T_A = 25$ °C, output load impedance 50 Ω , warm-up 20 minutes (min. 10 minutes recommended), monitor outputs terminated with 1 M Ω
Gain	<p>Transimpedance gain 10×10^3 V/A (@ 2nd gain $\times 2$, 50 Ω load) 30×10^3 V/A (@ 2nd gain $\times 6$, 50 Ω load)</p> <p>Gain accuracy ± 1 % electrical</p> <p>Conversion gain 5.4×10^3 V/W typ. (@ 2nd gain $\times 2$, 850 nm, 50 Ω load) 16.2×10^3 V/W typ. (@ 2nd gain $\times 6$, 850 nm, 50 Ω load)</p> <p>Common mode rejection ratio (CMRR) 50 dB typ. ($f \leq 100$ MHz) 45 dB typ. ($f \leq 200$ MHz)</p>
Frequency Response	<p>Lower cut-off frequency DC / 10 Hz, switchable</p> <p>Upper cut-off frequency (–3 dB) 200 MHz / 20 MHz, switchable</p>
Time Response	Rise/fall time (10 % – 90 %) 1.75 ns (@ 2 nd gain $\times 2$); 1.85 ns (@ 2 nd gain $\times 6$) 17.5 ns (@ bandwidth set to 20 MHz)
Input	<p>Noise equivalent power (NEP) minimum 7.8 pW/$\sqrt{\text{Hz}}$ (@ 850 nm) 8.8 pW/$\sqrt{\text{Hz}}$ (@ 850 nm, 20 MHz) 19.0 pW/$\sqrt{\text{Hz}}$ (@ 850 nm, 100 MHz) 33.0 pW/$\sqrt{\text{Hz}}$ (@ 850 nm, 200 MHz)</p> <p>Maximum differential CW power (for linear amplification) 185 μW (@ 2nd gain $\times 2$, DC-coupled, 850 nm) 62 μW (@ 2nd gain $\times 6$, DC-coupled, 850 nm) 850 μW (@ AC-coupled, 850 nm)</p> <p>Max. optical CW balanced power (common mode power) 10 mW (on each photodiode, @ 850 nm)</p> <p>Monitor optical saturation power 12 mW (@ 850 nm) (limited by maximum ratings)</p>

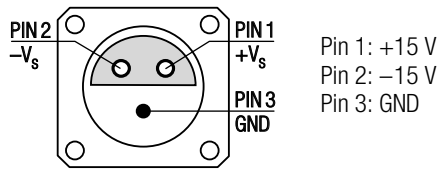
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Specifications (continued)

Detector	Detector type Active area Spectral range Sensitivity	Si-PIN photodiode Ø 800 µm 320 – 1000 nm 0.54 A/W typ. (@ 850 nm)
Output	Output voltage range Max. output voltage Offset voltage compensation Output impedance Slew rate Max. output current Output reflection S22 Output noise (typ.)	±1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion ±2.0 V (@ 50 Ω load) ±100 mV typ., adjustable by offset potentiometer 50 Ω (terminate with 50 Ω load) 2800 V/µs 70 mA -30 dB @ < 100 MHz -20 dB @ < 800 MHz 2.0 mV RMS (13 mV peak-peak) (@ 2 nd gain ×2) 5.5 mV RMS (36 mV peak-peak) (@ 2 nd gain ×6) 0.3 mV RMS (2.0 mV peak-peak) (@ 2 nd gain ×2, BW 20 MHz) 0.8 mV RMS (5.3 mV peak-peak) (@ 2 nd gain ×6, BW 20 MHz) (@ 50 Ω load, no signal on detectors, measurement bandwidth 2 GHz)
Monitor Outputs	Gain Voltage range Output impedance Max. output current Bandwidth Output noise	1 × 10 ³ V/A (@ ≥ 100 kΩ load) 0 ... +10 V (@ ≥ 100 kΩ load) 50 Ω (terminate with ≥ 100 kΩ load) 30 mA typ. DC – 10 MHz 0.6 mV RMS (4 mV peak-peak) (@ 100 kΩ load, no signal on detectors, measurement bandwidth 200 MHz)
Power Supply	Supply voltage Supply current	±15 V (±14.5 V ... ±16.5 V) -90 / +120 mA typ. (depends on operating conditions, recommended power supply capability min. ±200 mA)
Optical Input Connector	Material FST flange Material FST coupler ring	1.4305 stainless steel, nickel-plated 1.4305 stainless steel, glass bead blasted
Case	Weight Material	410 g (0.9 lbs) including coupler rings AlMg3Mn, nickel-plated
Temperature Range	Storage temperature Operating temperature	-40 °C ... +85 °C 0 °C ... +60 °C

Absolute Maximum Ratings	Optical input power (CW) Power supply voltage	12 mW (on each photodiode) ±20 V
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Connectors	Inputs Outputs Power supply	1.035"-40 threaded flanges for free space applications and for use with various types of optical standard accessories SMA jacks (female) LEMO® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)
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Scope of Delivery

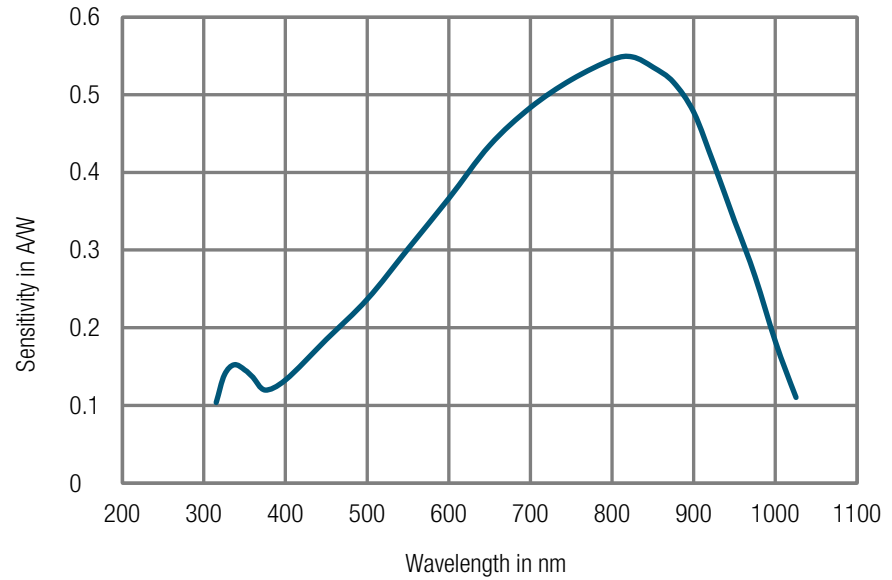
HBPR-200M-30K-SI-FST, 2 × threaded coupler ring, Lemo® 3-pin connector, 3 × adapter SMA (male) to BNC (female), datasheet

Ordering Information

HBPR-200M-30K-SI-FST 1.035"-40 threaded flanges for free space applications and for use with various types of optical standard accessories

Spectral Response

HBPR-200M-30K-SI-FST



DB-Sens-HBPR-100-200-SI_R2

