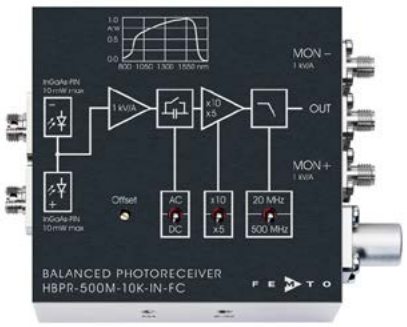
Measurement Devices

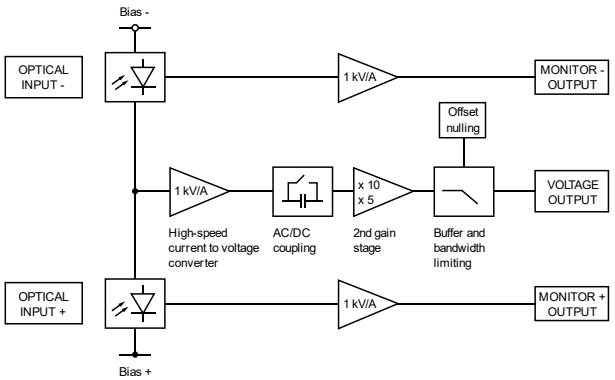
FEMTO®

LASER COMPONENTS®

Datasheet HBPR-500M-10K-IN-FC

High-Speed Balanced Photoreceiver



Features	• Bandwidth DC to 500 MHz • Common-Mode Rejection Ratio (CMRR) 45 dB typ. • InGaAs-PIN photodiodes • FC fiber optic inputs • Spectral range 900 - 1700 nm • Very low NEP, down to 6.7 pW/√Hz • Transimpedance gain switchable 5 x 10^3 V/A, 10 x 10^3 V/A • High dynamic input range up to 2 x 10 mW balanced optical power • Fast monitor outputs with 10 MHz bandwidth and 1 x 10^3 V/A gain • Switchable low pass filter for minimizing wideband noise • 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	

SOPHISTICATED TOOLS FOR SIGNAL RECOVERY FEMTO

HBPR-500M-10K-IN-FC_R2/TH/08APR2021

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Available Input Version	HBPR-500M-10K-IN-FC 		fix/permanent FC fiber connector for high coupling efficiency, excellent conversion gain accuracy and common mode rejection ratio (CMRR).
Related Models	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. Example: FST input 		1.035"-40 threaded flange for free space applications, compatible with many optical standard accessories. See further information and separate datasheets on www.femto.de
Available Accessory	PS-15 		power supply, input: 100 - 240 VAC, output: ±15 VDC, +400/–250 mA
Specifications		Test conditions	V_S = ±15 V, T_A = 25 °C, signal output terminated with 50 Ω, Monitor outputs terminated with 1 MΩ
	Gain	Transimpedance gain	5 x 10^3 V/A (2nd gain x5), 10 x 10^3 V/A (2nd gain x10) switchable (@ 50 Ω load)
		Gain accuracy	±1 % electrical
		Conversion gain	4.75 x 10^3 V/W typ. (@ 2nd gain x5, 1550 nm) 9.50 x 10^3 V/W typ. (@ 2nd gain x10, 1550 nm)
		Common mode rejection ratio (CMRR)	55 dB typ. (f ≤ 100 MHz) 45 dB typ. (f ≤ 500 MHz)
	Frequency Response	Lower cut-off frequency	DC / 10 Hz, switchable
		Upper cut-off frequency	500 MHz, switchable to 20 MHz
	Time Response	Rise/fall time (10 % - 90 %)	0.78 ns (@ 2nd gain x5); 0.9 ns (@ 2nd gain x10) 17.5 ns (low pass filter 20 MHz)
	Input	Noise equivalent power (NEP)	minimum 6.7 pW/√Hz (@ 1550 nm) 6.9 pW/√Hz (@ 1550 nm, 20 MHz) 15.0 pW/√Hz (@ 1550 nm, 200 MHz) 28.0 pW/√Hz (@ 1550 nm, 500 MHz)
		Maximum differential CW power for linear amplification	210 µW (@2nd gain x5, DC-coupled, 1550 nm) 105 µW (@2nd gain x10, DC-coupled, 1550 nm) 1.3 mW (@ AC-coupled, 1550 nm)
		Max. optical CW balanced power (common mode power)	10 mW (on each photodiode, @ 1550 nm)
		Monitor optical saturation power (limited for linear amplification)	10.5 mW (@ 1550 nm)

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Specifications (continued)		
Detector	Detector	InGaAs-PIN photodiode FC fiber connector
	Active area	∅ 80 µm, integrated ball lens suitable for fibers up to 50 µm core diameter
	Spectral range	900 - 1700 nm
	Sensitivity	0.95 A/W typ. (@ 1550 nm)
Signal Output	Output voltage range	±1.0 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Max. output voltage	±2.0 V (@ 50 Ω load)
	Offset voltage compensation	±100 mV typ., adjustable by offset potentiometer
	Output impedance	50 Ω (terminate with 50 Ω load)
	Slew rate	2800 V/µs
	Max. output current	70 mA
	Output return loss S22	–30 dB @ < 100 MHz –20 dB @ < 800 MHz
	Output noise	2.2 mV_{RMS} (15 mV_{PP}) (@ 2nd gain x5) 3.8 mV_{RMS} (25 mV_{PP}) (@ 2nd gain x10) 0.25 mV_{RMS} (1.7 mV_{PP}) typ. (@ 2nd gain x5, BW: 20 MHz) 0.4 mV_{RMS} (2.7 mV_{PP}) typ. (@ 2nd gain x10, BW: 20 MHz) (@ 50 Ω load, no signal on detectors, measurement bandwidth 2 GHz)
Monitor Outputs	Monitor output gain	1 x 10^3 V/A (@ ≥ 100 kΩ load)
	Monitor output voltage range	0 ... +10 V (@ ≥ 100 kΩ load)
	Monitor output impedance	50 Ω (terminate with ≥ 100 kΩ load)
	Monitor output max. output current	30 mA typ.
	Monitor output bandwidth	DC ... 10 MHz
	Monitor output noise	0.6 mV_{RMS} (4 mV_{PP}) (@ 100 kΩ load, no signal on detectors, measurement bandwidth 200 MHz)
Power Supply	Supply voltage	±15 V (±14.5 V ... ±16.5 V)
	Supply current	–90 / +120 mA (depends on operating conditions, recommended power supply capability min. ±200 mA)
Case	Weight	350 g (0.77 lbs)
	Material	AlMg3Mn, nickel-plated
Temperature Range	Storage temperature	–40 ... +85 °C
	Operating temperature	0 ... +60 °C
Absolute Maximum Ratings	Max. CW power (averaged) Power supply voltage	12 mW (on each photodiode) ±20 V

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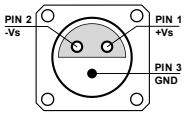
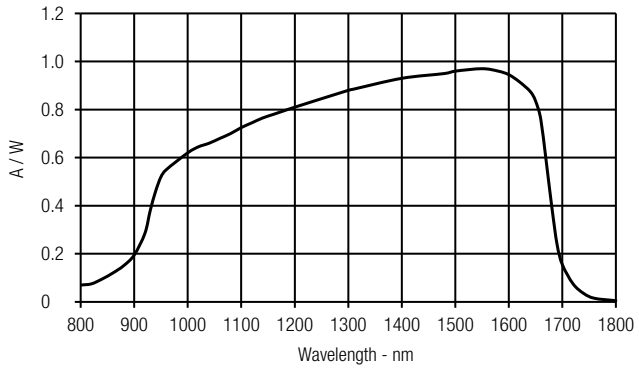
Connectors	Input	FC fiber optic connector (FC/PC and FC/APC compatible)
	Output	SMA jack (female)
	Power supply	Lemo® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)



Pin 1: +15 V
Pin 2: –15 V
Pin 3: GND

Scope of Delivery	HBPR-500M-10K-IN-FC, Lemo® 3-pin connector, 3 x adapter SMA (male) to BNC (female), datasheet
Ordering Information	HBPR-500M-10K-IN-FC FC fiber optic connector (FC/PC and FC/APC compatible)

Spectral Responsivity



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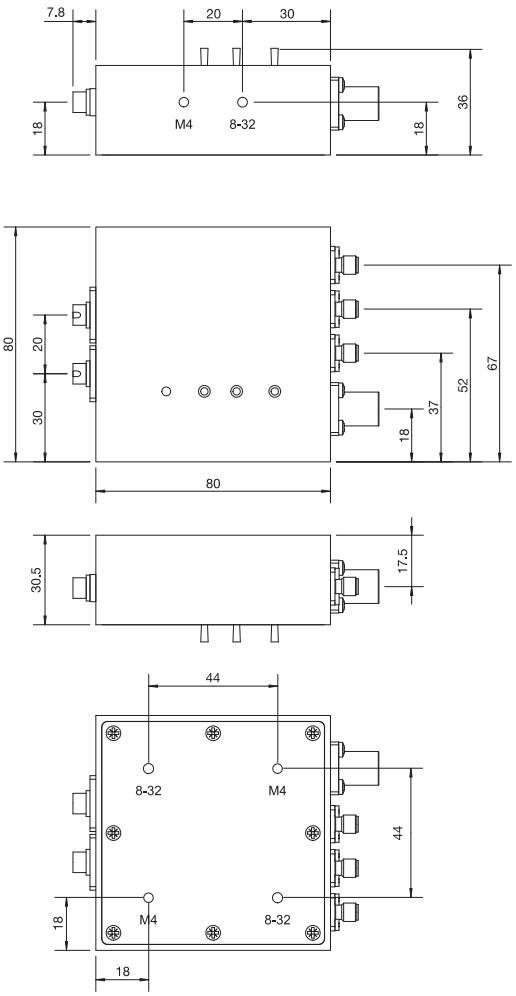
Dimensions

Case dimensions for HBPR-500M-10K-IN-FC:



All measures in mm unless otherwise noted.

The bottom plate may be rotated to match the appropriate mounting thread to the optical axis by unscrewing the 8 screws.

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