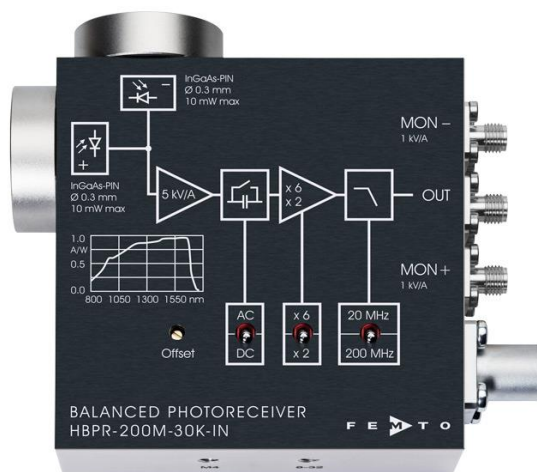


# Datasheet

## HBPR-200M-30K-IN-FS(T)

### High-Speed Balanced Photoreceiver



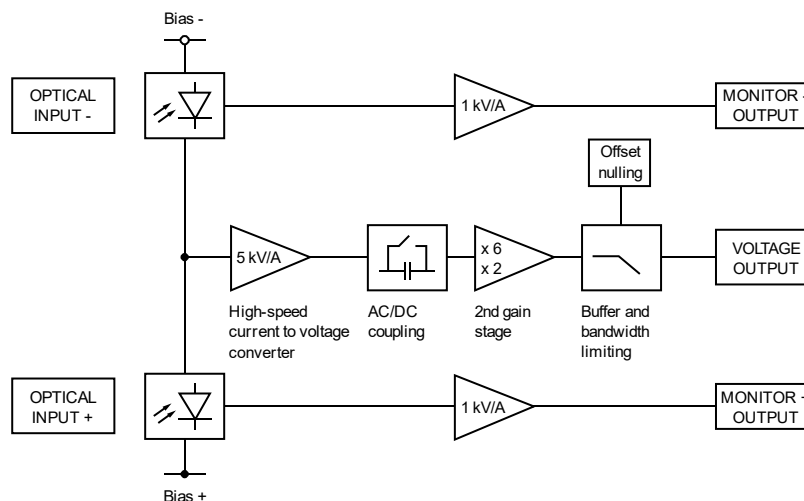
#### Features

- Bandwidth DC to 200 MHz
- Common-Mode Rejection Ratio (CMRR) 45 dB typ.
- InGaAs-PIN detectors, 0.3 mm active diameter
- Spectral range 800 - 1700 nm
- Very low NEP, down to 4.4 pW/√Hz
- Transimpedance gain switchable  $10 \times 10^3$  V/A,  $30 \times 10^3$  V/A
- High dynamic input range up to  $2 \times 10$  mW balanced optical power
- Fast monitor outputs with 10 MHz bandwidth and  $1 \times 10^3$  V/A gain
- Switchable low pass filter for minimizing wideband noise
- Free-space input 1.035"-40 threaded, alternatively 25 mm diameter unthreaded
- 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

### Available Input Versions

#### HBPR-200M-30K-IN-FST



Picture shows two 1.035"-40 threaded flanges with internally threaded coupler rings mounted (outer diameter 30 mm)

1.035"-40 threaded flange for free space applications, compatible with many optical standard accessories.

#### HBPR-200M-30K-IN-FS



25 mm dia. unthreaded flange for free space applications compatible with many optical standard accessories.

### 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: FC input



fix/permanent FC fiber connector for high coupling efficiency, excellent conversion gain accuracy and common mode rejection ratio (CMRR).

See further information and separate datasheets on [www.femto.de](http://www.femto.de)

### Available Accessory

#### PS-15



power supply,  
input: 100 - 240 VAC,  
output:  $\pm 15$  VDC, +400/-250 mA

### Specifications

#### Gain

#### Test conditions

$V_S = \pm 15$  V,  $T_A = 25$  °C, signal output terminated with 50  $\Omega$ , Monitor outputs terminated with 1 M $\Omega$

#### Transimpedance gain

$10 \times 10^3$  V/A (2<sup>nd</sup> gain x2),  $10 \times 10^3$  V/A (2<sup>nd</sup> gain x6) switchable (@ 50  $\Omega$  load)

#### Gain accuracy

$\pm 1$  % electrical

#### Conversion gain

$9.5 \times 10^3$  V/W typ. (@ 2<sup>nd</sup> gain x2, 1550 nm)  
 $28.5 \times 10^3$  V/W typ. (@ 2<sup>nd</sup> gain x6, 1550 nm)

#### Common mode rejection ratio (CMRR)

50 dB typ. ( $f \leq 100$  MHz)  
45 dB typ. ( $f \leq 200$  MHz)

#### Frequency Response

#### Lower cut-off frequency

DC / 10 Hz, switchable

#### Upper cut-off frequency

200 MHz, switchable to 20 MHz

# High-Speed Balanced Photoreceiver

## Specification (continued)

### Time Response

Rise/fall time (10 % - 90 %) 1.85 ns  
17.5 ns (low pass filter 20 MHz)

### Input

Noise equivalent power (NEP) minimum 4.4 pW/√Hz (@ 1550 nm)  
4.9 pW/√Hz (@ 1550 nm, 20 MHz)  
12.0 pW/√Hz (@ 1550 nm, 100 MHz)  
19.0 pW/√Hz (@ 1550 nm, 200 MHz)

Maximum differential CW power for linear amplification 105 μW (@ 2<sup>nd</sup> gain x2, DC-coupled, 1550 nm)  
35 μW (@ 2<sup>nd</sup> gain x6, DC-coupled, 1550 nm)  
500 μW (@ AC-coupled, 1550 nm)

Max. optical CW balanced power (common mode power) 10 mW (on each photodiode, @ 1550 nm)

Monitor optical saturation power (limit for linear amplification) 10.5 mW (@ 1550 nm)

### Detector

Detector InGaAs-PIN photodiode

Active area Ø 300 μm

Spectral range 800 - 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 2.1 mV<sub>RMS</sub> (14 mV<sub>PP</sub>) (@ 2<sup>nd</sup> gain x2)  
6.0 mV<sub>RMS</sub> (40 mV<sub>PP</sub>) (@ 2<sup>nd</sup> gain x6)  
0.3 mV<sub>RMS</sub> (2.0 mV<sub>PP</sub>) typ. (@ 2<sup>nd</sup> gain x2, BW: 20 MHz)  
0.8 mV<sub>RMS</sub> (5.2 mV<sub>PP</sub>) typ. (@ 2<sup>nd</sup> gain x6, BW: 20 MHz)  
(@ 50 Ω load, no signal on detectors, measurement bandwidth 2 GHz)

### Monitor Outputs

Monitor output gain 1 x 10<sup>3</sup> 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<sub>RMS</sub> (4 mV<sub>PP</sub>)  
(@ 100 kΩ load, no signal on detectors, measurement bandwidth 200 MHz)

### Input Flange

Material 1.4305 stainless steel, nickel-plated (FST flange)  
AlMg4.5Mn, nickel-plated (FS flange)

## High-Speed Balanced Photoreceiver

### Specification (continued)

Coupler Ring  
(FST version only)

Material 1.4305 stainless steel, glass bead blasted

Power Supply

Supply voltage  $\pm 15 \text{ V}$  ( $\pm 14.5 \text{ V} \dots \pm 16.5 \text{ V}$ )  
Supply current  $-90 / +120 \text{ mA}$  (depends on operating conditions, recommended power supply capability min.  $\pm 200 \text{ mA}$ )

Case

Weight 350 g (0.77 lbs)  
Material AlMg3Mn, nickel-plated

Temperature Range

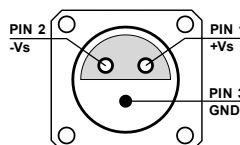
Storage temperature  $-40 \dots +85 \text{ }^{\circ}\text{C}$   
Operating temperature  $0 \dots +60 \text{ }^{\circ}\text{C}$

### Absolute Maximum Ratings

Max. CW power (averaged) 12 mW (on each photodiode)  
Power supply voltage  $\pm 20 \text{ V}$

### Connectors

Input FS version 25 mm dia. unthreaded flange for free space applications  
FST version 1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories  
Output SMA jack (female)  
Power supply Lemo® series 1S, 3-pin fixed socket (mating plug type: FFA.1S.303.CLAC52)



Pin 1:  $+15 \text{ V}$   
Pin 2:  $-15 \text{ V}$   
Pin 3: GND

### Scope of Delivery

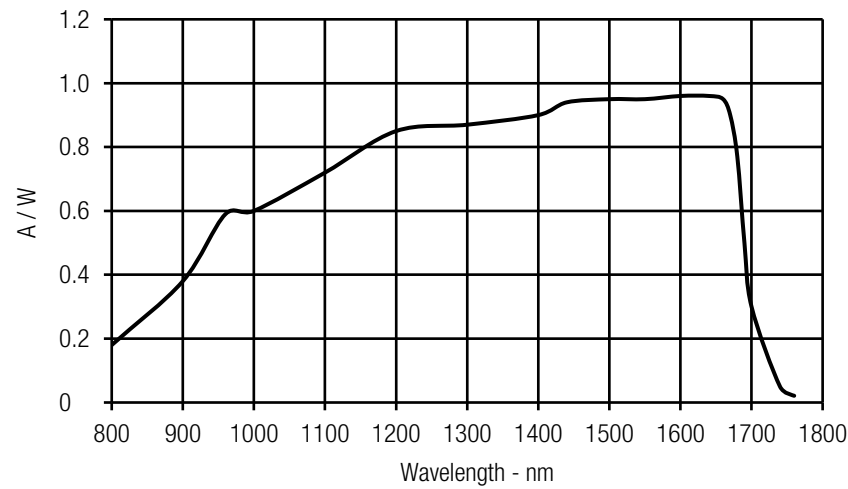
HBPR-200M-30K-IN, 2 x threaded coupler ring (FST version only), Lemo® 3-pin connector, 3 x adapter SMA (male) to BNC (female), datasheet

### Ordering Information

HBPR-200M-30K-IN-FS 25 mm dia. unthreaded flange for free space applications  
HBPR-200M-30K-IN-FST 1.035"-40 threaded flange for free space applications and for use with various types of optical standard accessories

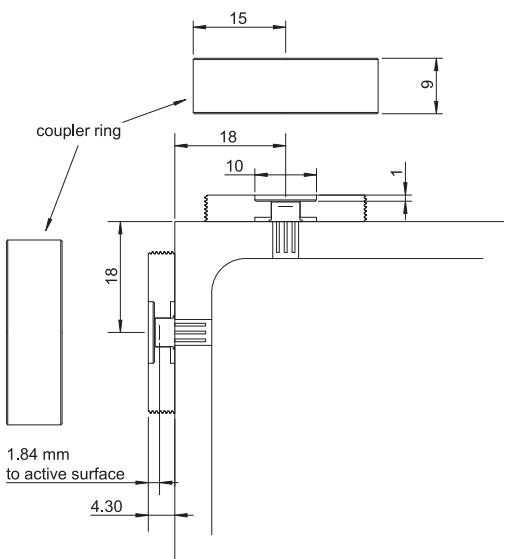
High-Speed Balanced Photoreceiver

Spectral Responsivity

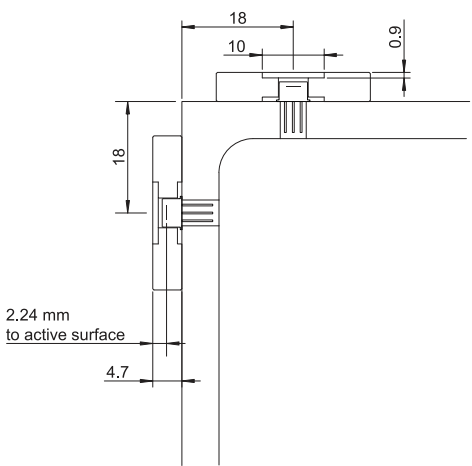


Detector Position

HBPR-200M-30K-IN-FST (1.035"-40 threaded free space input)



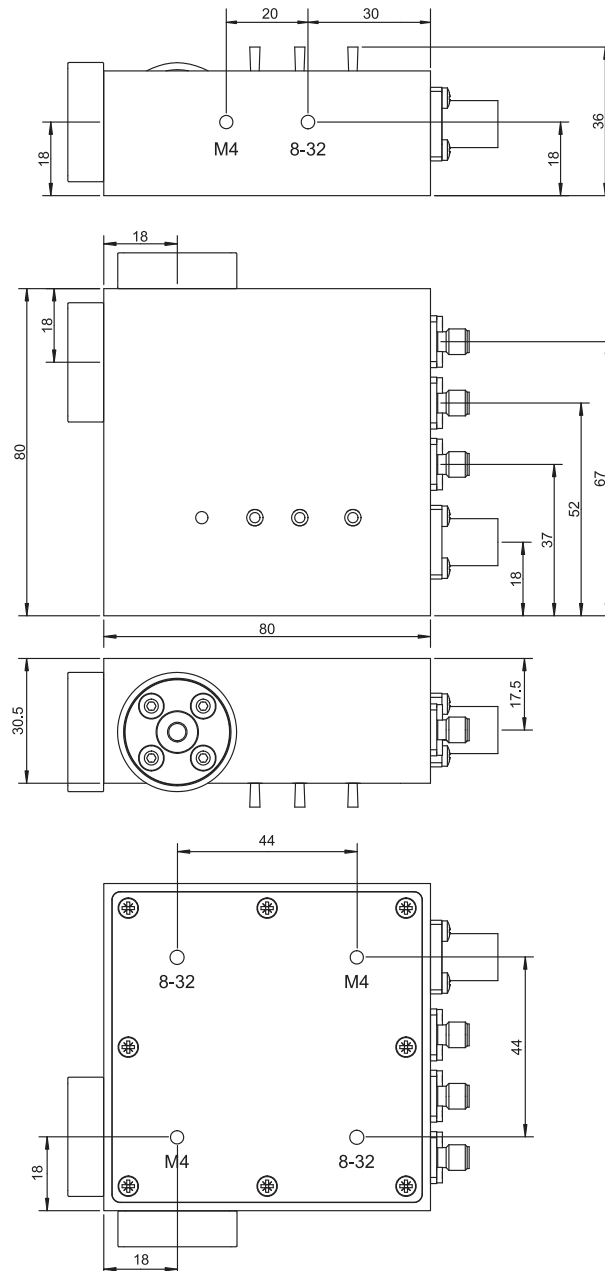
HBPR-200M-30K-IN-FS (25 mm dia. unthreaded free space input)



# High-Speed Balanced Photoreceiver

## Dimensions

Case dimensions for HBPR-200M-30K-IN (FS/FST model):



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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