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F E M T O[®] P R O D U C T O V E R V I E W

S O P H I S T I C A T E D T O O L S F O R S I G N A L R E C O V E R Y



FEMTO AMPLIFIER SELECTION GUIDE

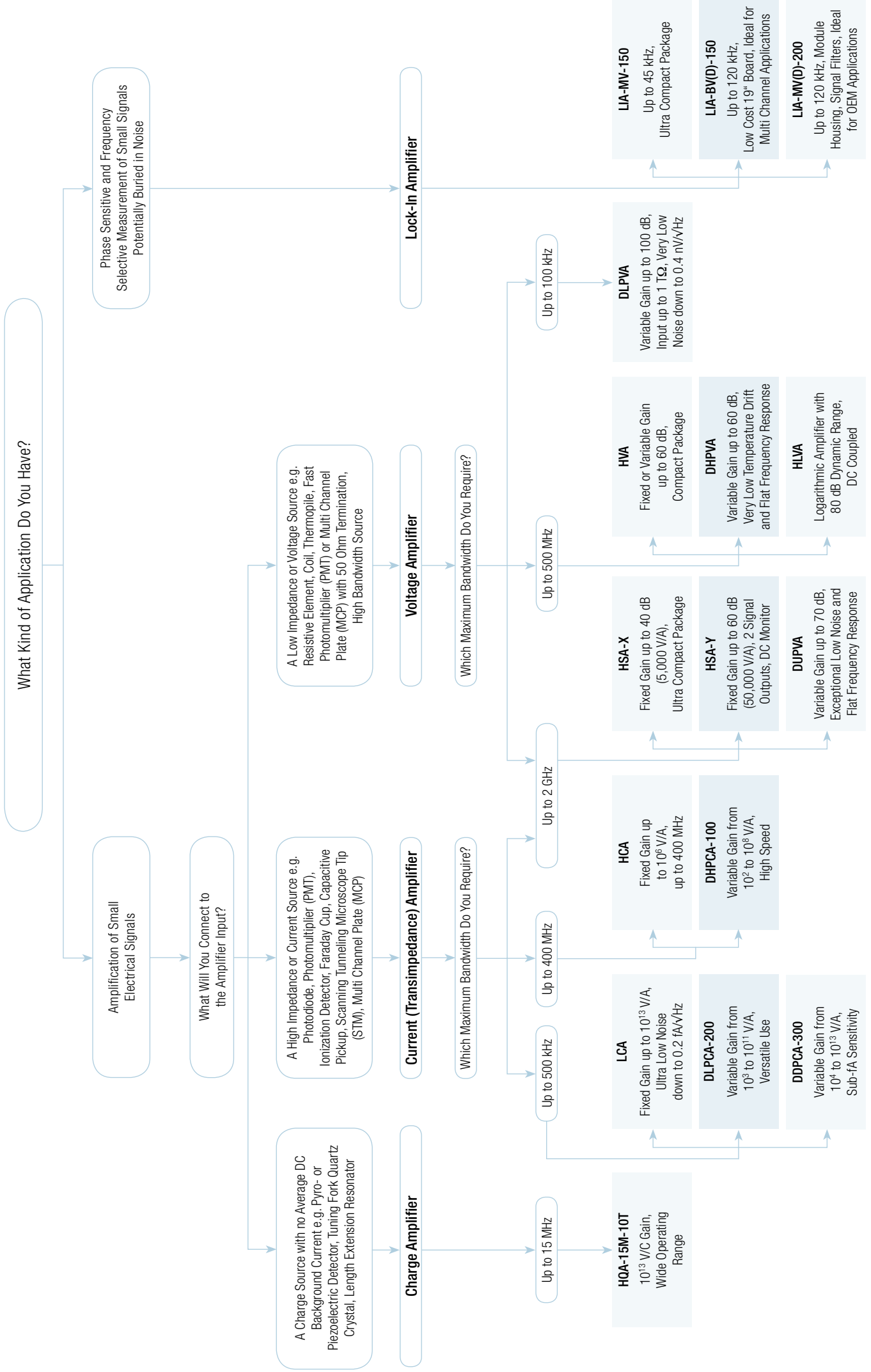


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High Speed Charge Amplifier ■ Model HQA-15M-10T



Model HQA-15M-10T

- High Gain of 10 V/pC
- Wide Operating Range from 250 Hz to 15 MHz
- Low Input Noise of 40×10^{-21} C/ $\sqrt{\text{Hz}}$ and 700 pV/ $\sqrt{\text{Hz}}$
- Ideal for AC Coupled Charge Sources Like Pyro- and Piezoelectric Detectors, Tuning Fork Quartz Crystals and Length Extension Resonators
- Typical Applications are Atomic Force Microscopy, Optical Measurements and Charged Particle Beam Monitoring

| Model | HQA-15M-10T |
|--------------------------------|--|
| Charge Gain | 10^{13} V/C |
| Equivalent Current Gain | 1.6×10^6 V/A @ 1 MHz Sinusoidal Input Signal |
| Lower Cut-Off Frequency | 250 Hz (AC only) |
| Upper Cut-Off Frequency | 15 MHz |
| Input Charge Noise | 40×10^{-21} C/ $\sqrt{\text{Hz}}$ |
| Equivalent Input Current Noise | 250 fA/ $\sqrt{\text{Hz}}$ @ 1 MHz Sinusoidal Input Signal |
| Input Voltage Noise | 700 pV/ $\sqrt{\text{Hz}}$ @ 1 MHz |
| Input Impedance | $1 \text{ G}\Omega // 1 \text{ nF}$ |
| Effective AC Input Impedance | 20Ω @ 1 MHz Sinusoidal Input Signal |
| Output Performance | 10 Vp-p @ $\geq 1 \text{ M}\Omega$ Load |
| Power Supply | $\pm 15 \text{ V}, \pm 35 \text{ mA Typ.}$ |
| Case | 115 x 60 x 45 mm (L x W x H), Weight 200 g (0.44 lbs) |

Maximum recommended source capacitance is 1 nF. Not suited for sources producing an average DC background current. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Ultra Low Noise Current Amplifiers ■ Series LCA



Series LCA

- Ultra Low Input Noise down to 0.2 fA/√Hz
- Gain up to 10^{13} V/A
- Bandwidth DC up to 400 kHz
- Bandwidth and Gain Independent of Source Capacitance up to 10 nF (1 nF for LCA-400K-10M)
- Compact and Highly Shielded Case for Use Close to the Signal Source
- Ideal for Photodiodes, STMs and Ionization Detectors

| Model | - 3 dB Bandwidth (DC ...) | Noise Current | Transimpedance (Gain) | Rise/Fall Time |
|--------------|---------------------------|---------------|---------------------------|----------------|
| LCA-2-10T | 2 Hz | 0.2 fA/√Hz | 10^{12} & 10^{13} V/A | 200 ms |
| LCA-30-1T | 30 Hz | 0.5 fA/√Hz | 1×10^{12} V/A | 12 ms |
| LCA-30-200G | 30 Hz | 0.5 fA/√Hz | 2×10^{11} V/A | 12 ms |
| LCA-200-100G | 200 Hz | 1.5 fA/√Hz | 1×10^{11} V/A | 2 ms |
| LCA-200-10G | 200 Hz | 1.5 fA/√Hz | 1×10^{10} V/A | 2 ms |
| LCA-1K-5G | 1 kHz | 3 fA/√Hz | 5×10^9 V/A | 400 μs |
| LCA-2K-2G | 2 kHz | 4.5 fA/√Hz | 2×10^9 V/A | 200 μs |
| LCA-4K-1G | 4 kHz | 6.5 fA/√Hz | 1×10^9 V/A | 100 μs |
| LCA-10K-500M | 10 kHz | 10 fA/√Hz | 5×10^8 V/A | 40 μs |
| LCA-20K-200M | 20 kHz | 14 fA/√Hz | 2×10^8 V/A | 20 μs |
| LCA-40K-100M | 40 kHz | 19 fA/√Hz | 1×10^8 V/A | 10 μs |
| LCA-100K-50M | 100 kHz | 30 fA/√Hz | 5×10^7 V/A | 4 μs |
| LCA-200K-20M | 200 kHz | 40 fA/√Hz | 2×10^7 V/A | 2 μs |
| LCA-400K-10M | 400 kHz | 65 fA/√Hz | 1×10^7 V/A | 1 μs |

Bandwidth and rise/fall times are independent of detector capacitance. Guaranteed and tested up to 10 nF for each amplifier (1 nF for LCA-400K-10M). Output voltage ± 10 V @ ≥ 1 M Ω load. Offset adjustable by trimpot. Output short-circuit protected. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

High Speed Current Amplifiers ■ Series HCA



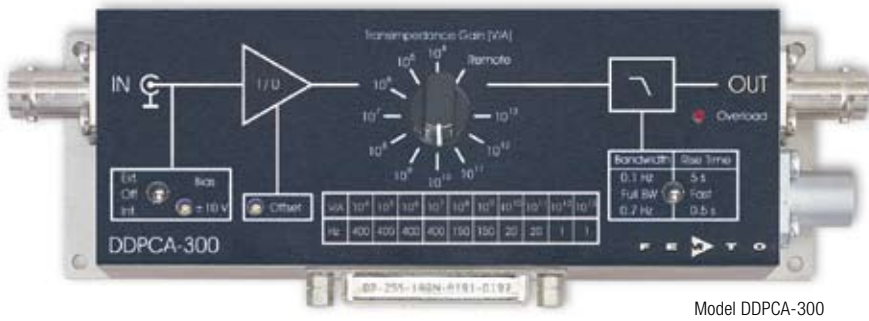
Series HCA

- High Bandwidth from DC up to 400 MHz
- Optimized Models for High Source Capacitance up to 2 nF
- Adjustable Bias Voltage and Offset
- Ideal for Fast and Large Area Photodiodes, PMTs and Ionization Detectors

| Model | - 3 dB Bandwidth (DC ...) | Noise Current | Transimpedance (Gain) | Rise/Fall Time | Max. Detector Capacitance |
|----------------|---------------------------|---------------|-----------------------|----------------|---------------------------|
| HCA-1M-1M | 1 MHz | 270 fA/√Hz | 1×10^6 V/A | 350 ns | 50 pF |
| HCA-1M-1M-C | 1 MHz | 3.5 pA/√Hz | 1×10^6 V/A | 350 ns | 2 nF |
| HCA-2M-1M | 2 MHz | 340 fA/√Hz | 1×10^6 V/A | 180 ns | 25 pF |
| HCA-2M-1M-C | 2 MHz | 3.5 pA/√Hz | 1×10^6 V/A | 180 ns | 1 nF |
| HCA-4M-500K | 4 MHz | 490 fA/√Hz | 5×10^5 V/A | 90 ns | 15 pF |
| HCA-4M-500K-C | 4 MHz | 3.5 pA/√Hz | 5×10^5 V/A | 90 ns | 500 pF |
| HCA-10M-100K | 10 MHz | 1.1 pA/√Hz | 1×10^5 V/A | 35 ns | 15 pF |
| HCA-10M-100K-C | 10 MHz | 3.5 pA/√Hz | 1×10^5 V/A | 35 ns | 150 pF |
| HCA-20M-100K-C | 20 MHz | 3.5 pA/√Hz | 1×10^5 V/A | 18 ns | 50 pF |
| HCA-40M-100K-C | 40 MHz | 3.7 pA/√Hz | 1×10^5 V/A | 10 ns | 30 pF |
| HCA-100M-50K-C | 100 MHz | 3.8 pA/√Hz | 5×10^4 V/A | 3.5 ns | 20 pF |
| HCA-200M-20K-C | 200 MHz | 4.9 pA/√Hz | 2×10^4 V/A | 1.9 ns | 8 pF |
| HCA-400M-5K-C | 400 MHz | 21 pA/√Hz | 5×10^3 V/A | 1.0 ns | 10 pF |

The maximum detector capacitance listed above means that up to this value the specified bandwidth ($\pm 15\%$) is guaranteed. Larger capacitances are also possible but will influence the bandwidth. Output voltage ± 1.5 V @ 50 Ω load. Offset adjustable by trimpot. Output short-circuit protected. Adjustable bias output (-12 V ... +12 V) for biasing photodetectors. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain Sub Femto Ampere Current Amplifier ■ Model DDPKA-300



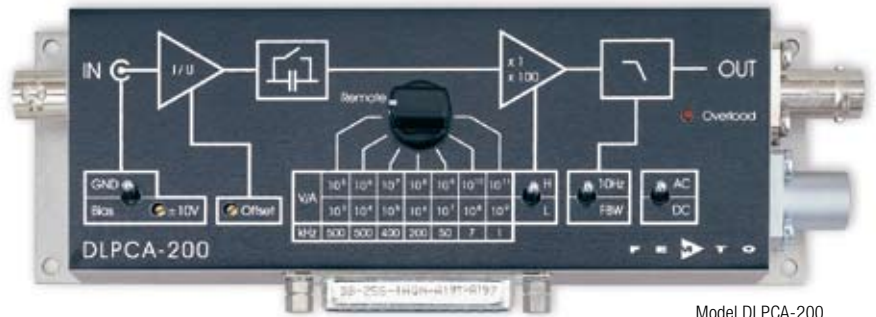
- 0.4 fA Peak-Peak Noise
- Variable Gain over 10 Decades from 10⁴ to 10¹³ V/A for Sub-fA to mA Measurements
- Sub-fA Drift
- Optimized for DC to 400 Hz Measurements
- Adjustable Bias Voltage on Input for DUT Biasing
- Manual and Remote Control Operation
- Ideal for I/V Characterization of MOS and JFET Structures, Ultra Low Current and High Resistance Measurements, Quantum and Biotech Experiments, and as Easy to Use Sub Femto Amp Add-on to an Existing Digital Voltmeter or A/D Converter

| Model | DDPKA-300 | | | | | | | | | |
|---------------------------|--|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|
| Transimpedance [V/A] | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁸ | 10 ⁹ | 10 ¹⁰ | 10 ¹¹ | 10 ¹² | 10 ¹³ |
| Bandwidth (-3 dB) [Hz] | 400 | 400 | 400 | 400 | 150 | 150 | 20 | 20 | 1 | 1 |
| Rise Time (10% - 90 %) | 0.8 ms | 0.8 ms | 0.8 ms | 0.8 ms | 2.3 ms | 2.3 ms | 17 ms | 17 ms | 350 ms | 350 ms |
| Equ. Input Noise [fA/√Hz] | 45 pA | 45 pA | 0.45 pA | 0.45 pA | 15 fA | 15 fA | 1.3 fA | 1.3 fA | 0.2 fA | 0.2 fA |
| Low Pass Filter | Switchable to 0.1 Hz, 0.7 Hz or Full Bandwidth | | | | | | | | | |
| Output Performance | ± 10 V @ ≥ 1 MΩ Load | | | | | | | | | |
| Bias Voltage | ± 10 V, Adjustable by Trimpot or External Control Voltage, max. 10 mA, Connected to Center Pin of BNC Input Socket | | | | | | | | | |
| Power Supply | ± 15 V, + 70 mA / - 15 mA Typ. | | | | | | | | | |
| Control Interface | 4 Opto-Isolated Digital Inputs, TTL/CMOS Compatible, Analog Bias Control Voltage Input | | | | | | | | | |
| Case | 170 x 60 x 45 mm (L x W x H), Weight 320 g (0.74 lbs) | | | | | | | | | |

Offset adjustable by trimpot. LED overload indication. Input protected against ± 2 kV transients. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain Low Noise Current Amplifier ■ Model DLPCA-200

- Variable Gain over 9 Decades from 10³ to 10¹¹ V/A
- Low Input Noise down to 4 fA/√Hz
- Bandwidth up to 500 kHz
- Adjustable Offset and Bias Voltage
- Switchable AC/DC Coupling and 10 Hz Low Pass Filter for Precise DC Measurements
- Manual and Remote Control Operation
- Designed for Photodetectors, STMs, Ionization Detectors, as Pre-Amplifier for Lock-Ins, A/D Converters and for General Lab Use

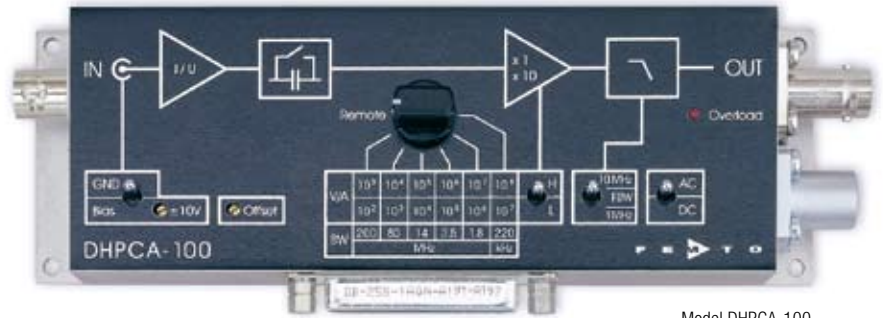


| Model | DLPCA-200 | | | | | | | | | | | | | |
|---------------------------|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|------------------|------------------|
| Performance Range | Low Noise | | | | | | | High Speed | | | | | | |
| Transimpedance [V/A] | 10 ³ | 10 ⁴ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁸ | 10 ⁹ | 10 ⁵ | 10 ⁶ | 10 ⁷ | 10 ⁸ | 10 ⁹ | 10 ¹⁰ | 10 ¹¹ |
| Bandwidth (-3 dB) [kHz] | 500 | 500 | 400 | 200 | 50 | 7 | 1.1 | 500 | 500 | 400 | 200 | 50 | 7 | 1.1 |
| Rise Time (10% - 90 %) | 700 ns | 700 ns | 900 ns | 1.8 μs | 7 μs | 50 μs | 300 μs | 700 ns | 700 ns | 900 ns | 1.8 μs | 7 μs | 50 μs | 300 μs |
| Equ. Input Noise [fA/√Hz] | 20 pA | 2.3 pA | 450 fA | 130 fA | 43 fA | 13 fA | 4.3 fA | 13 pA | 1.8 pA | 440 fA | 130 fA | 43 fA | 13 fA | 4.3 fA |
| Low Pass Filter | Switchable to 10 Hz | | | | | | | | | | | | | |
| Output Performance | ± 10 V @ ≥ 1MΩ Load | | | | | | | | | | | | | |
| Bias Voltage | Adjustable ± 10 V, max. 22 mA, Connected to Shield of BNC Input Socket, Switchable to GND | | | | | | | | | | | | | |
| Power Supply | ± 15 V, + 120 mA / - 80 mA Typ. | | | | | | | | | | | | | |
| Control Interface | 5 Opto-Isolated Digital Inputs, TTL/CMOS Compatible, Analog Offset Control Voltage Input | | | | | | | | | | | | | |
| Case | 170 x 60 x 45 mm (L x W x H), Weight 320 g (0.74 lbs) | | | | | | | | | | | | | |

Bandwidth and rise/fall times are independent of detector capacitance up to 1 nF. Offset adjustable by trimpot or external control voltage. LED overload indication. Input protected against ± 3 kV transients. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain High Speed Current Amplifier ■ Model DHPCA-100

- Variable Gain over 7 Decades from 10^2 to 10^8 V/A
- Bandwidth up to 200 MHz
- 1.8 ns Minimum Rise Time
- Switchable Signal Filters and AC/DC Coupling
- Adjustable Offset and Bias Voltage
- Manual and Remote Control Operation
- Ideal for Fast Photodetectors, as Pre-Amplifier for Oscilloscopes, RF Lock-Ins and for General Lab Use



Model DHPCA-100

| Model | DHPCA-100 | | | | | | | | | | | |
|---|---|--------|--------|-------------|-------------|-------------|------------|--------|--------|-------------|-------------|-------------|
| Performance Range | Low Noise | | | | | | High Speed | | | | | |
| Transimpedance [V/A] | 10^2 | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | 10^3 | 10^4 | 10^5 | 10^6 | 10^7 | 10^8 |
| Bandwidth (-3 dB) [MHz] | 200 | 80 | 14 | 3.5 | 1.8 | 0.22 | 175 | 80 | 14 | 3.5 | 1.8 | 0.22 |
| Rise Time (10% - 90 %) | 1.8 ns | 4.4 ns | 25 ns | 0.1 μ s | 0.2 μ s | 1.6 μ s | 2.0 ns | 4.4 ns | 25 ns | 0.1 μ s | 0.2 μ s | 1.6 μ s |
| Equ. Input Noise [$\sqrt{\text{V/Hz}}$] | 200 pA | 16 pA | 2.1 pA | 500 fA | 170 fA | 60 fA | 140 pA | 6.0 pA | 1.5 pA | 450 fA | 150 fA | 55 fA |
| Low Pass Filter | Switchable to 1 MHz, 10 MHz or Full Bandwidth | | | | | | | | | | | |
| Output Performance | ± 1 V @ 50 Ω Load | | | | | | | | | | | |
| Bias Voltage | Adjustable ± 10 V, max. 22 mA, Connected to Shield of BNC Input Socket, Switchable to GND | | | | | | | | | | | |
| Power Supply | ± 15 V, + 110 mA / - 90 mA Typ. | | | | | | | | | | | |
| Control Interface | 7 Opto-Isolated Digital Inputs, TTL/CMOS Compatible, Analog Offset Control Voltage Input | | | | | | | | | | | |
| Case | 170 x 60 x 45 mm (L x W x H), Weight 320 g (0.74 lbs) | | | | | | | | | | | |

Offset adjustable by trimpot or external control voltage. LED overload indication. Input protected against ± 3 kV transients. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain Current Amplifiers ■ Comparison

| Model | DDPCA-300 | DLPCA-200 | DHPCA-100 |
|---------------------------------|--|-------------------------------|-------------------------------|
| Gain Range | $10^4 - 10^{13}$ V/A | $10^3 - 10^{11}$ V/A | $10^2 - 10^8$ V/A |
| Max. Bandwidth | DC to 400 Hz | DC to 500 kHz | DC to 200 MHz |
| Min. Rise Time | 800 μ s | 700 ns | 1.8 ns |
| Min. Spectral Noise | 0.2 fA/ $\sqrt{\text{Hz}}$ | 4 fA/ $\sqrt{\text{Hz}}$ | 55 fA/ $\sqrt{\text{Hz}}$ |
| Min. Integrated Broadband Noise | 0.4 fA peak-peak or 0.06 fA rms | 200 fA peak-peak or 30 fA rms | 500 pA peak-peak or 75 pA rms |
| Main Differentiator | Sub Femto Ampere Sensitivity | Broad Application Range | MHz Speed |
| Common Features | Manual and Remote Control Operation Adjustable Offset and Bias Voltage Compact Design for Use Close to the Signal Source Extremely Well Shielded Housing to Avoid Noise Pick-Up | | |

Variable Gain 100 kHz Voltage Amplifiers ■ Series DLPVA-100

- Low Input Noise down to 400 pV/√Hz
- Variable Gain up to 100 dB (x 100,000)
- Single Ended or Differential Input with Common Mode Rejection (CMRR) up to 120 dB
- High Input Impedance up to 1 TΩ
- For Amplification of Low Frequency Signals from Low to Medium Impedance Sources

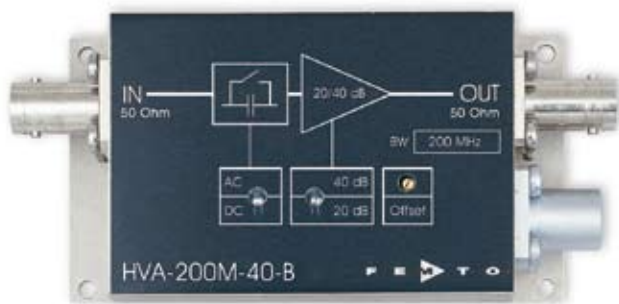


Model DLPVA-100-B-S

| Model | DLPVA-100-BUN-S | DLPVA-100-BLN-S | DLPVA-100-B-S | DLPVA-100-B-D | DLPVA 100-F-S | DLPVA-100-F-D |
|-------------------------|-------------------------|-------------------------|-------------------------|----------------------------|-------------------------|-------------------------|
| Input stage | Single Ended, Bipolar | Single Ended, Bipolar | Single Ended, Bipolar | True Differential, Bipolar | Single Ended, FET | True Differential, FET |
| Input | 1 kΩ, BNC | 1 MΩ, BNC | 1 MΩ, BNC | 1 MΩ, LEMO | 1 TΩ, BNC | 1 TΩ, LEMO |
| Lower Cut-Off Frequency | 1.5 Hz (AC only) | DC/1.5 Hz | DC/1.5 Hz | DC/1.5 Hz | DC/1.5 Hz | DC/1.5 Hz |
| Upper Cut-Off Frequency | 1/100 kHz | 1/100 kHz | 1/100 kHz | 1/100 kHz | 1/100 kHz | 1/100 kHz |
| Gain | 40/60/80/100 dB | 40/60/80/100 dB | 20/40/60/80 dB | 20/40/60/80 dB | 20/40/60/80 dB | 20/40/60/80 dB |
| Input Noise Voltage | 0.4 nV/√Hz | 0.7 nV/√Hz | 2.4 nV/√Hz | 3.6 nV/√Hz | 5.5 nV/√Hz | 6.9 nV/√Hz |
| Input Voltage Drift | – | 0.5 μV/°C | 0.7 μV/°C | 0.7 μV/°C | 1.3 μV/°C | 1.3 μV/°C |
| CMRR | – | – | – | 120 dB Max. | – | 120 dB Max. |
| Output | 50 Ω, BNC | 50 Ω, BNC | 50 Ω, BNC | 50 Ω, BNC | 50 Ω, BNC | 50 Ω, BNC |
| Output Voltage | ± 10 V @ ≥ 1 MΩ | ± 10 V @ ≥ 1 MΩ | ± 10 V @ ≥ 1 MΩ | ± 10 V @ ≥ 1 MΩ | ± 10 V @ ≥ 1 MΩ | ± 10 V @ ≥ 1 MΩ |
| Control Interface | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated |

Offset adjustable by trimpot or external analog control voltage. LED gain setting and overload indication. Output short-circuit protected. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Wideband Voltage Amplifiers ■ Series HVA



Model HVA-200M-40-B

- Bandwidth DC up to 500 MHz
- Switchable Gain up to 60 dB (x 1,000)
- Very Low Noise down to 0.9 nV/√Hz
- True DC Coupling Allows Accurate Amplification of Digital Codes and Transients with Long Decay Time (No Baseline Shift or Signal Over/Under-Shoots)
- Ideal as Pre-Amplifier for Oscilloscopes and Transient Recorders, and for Time-Resolved Pulse and Transient Measurements

| Model | HVA-10M-60-B | HVA-10M-60-F | HVA-200M-40-B | HVA-200M-40-F | HVA-500M-20-B |
|-------------------------|----------------|----------------|---------------|---------------|---------------|
| Lower Cut-Off Frequency | DC/1 kHz | DC/1 Hz | DC/1 kHz | DC/1 Hz | DC |
| Upper Cut-Off Frequency | 10 MHz | 10 MHz | 200 MHz | 200 MHz | 500 MHz |
| Input Impedance | 50 Ω, BNC | 1 MΩ, BNC | 50 Ω, BNC | 1 MΩ, BNC | 50 Ω, BNC |
| Gain | 40/60 dB | 40/60 dB | 20/40 dB | 20/40 dB | 20 dB |
| Input Noise Voltage | 0.9 nV/√Hz | 4.7 nV/√Hz | 1.2 nV/√Hz | 4.5 nV/√Hz | 3.0 nV/√Hz |
| Input Voltage Drift | 1 μV/°C | 2 μV/°C | 1 μV/°C | 5 μV/°C | 10 μV/°C |
| Output Voltage | ± 3.5 V @ 50 Ω | ± 3.5 V @ 50 Ω | ± 1 V @ 50 Ω | ± 1 V @ 50 Ω | ± 1 V @ 50 Ω |

Output: 50 Ω, BNC. Offset adjustable by trimpot. Output short-circuit protected. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain 100/200 MHz Voltage Amplifiers ■ Series DHPVA



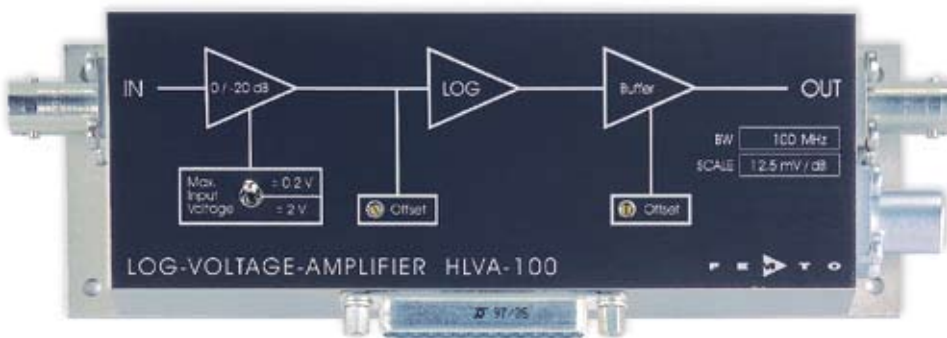
Model DHPVA-200

| Model | DHPVA-100 | DHPVA-200 |
|-------------------------|-----------------------------|-----------------------------|
| Lower Cut-Off Frequency | DC/10 Hz | DC/10 Hz |
| Upper Cut-Off Frequency | 10/100 MHz, Switchable | 20/200 MHz, Switchable |
| Gain | 10/20/30/40/50/60 dB | 10/20/30/40/50/60 dB |
| Gain Accuracy | ± 0.3 dB | ± 0.3 dB |
| Input Noise Voltage | 2.5 nV/√Hz | 2.5 nV/√Hz |
| Input Voltage Drift | 0.6 μV/°C | 0.6 μV/°C |
| Input/Output | 50 Ω, BNC | 50 Ω, BNC |
| Output Voltage (Power) | ± 1 V (+10 dBm) @ 50 Ω Load | ± 1 V (+10 dBm) @ 50 Ω Load |
| Monitor Output | DC - 100 kHz | DC - 100 kHz |
| Control Interface | TTL/CMOS, Opto-Isolated | TTL/CMOS, Opto-Isolated |

Bandwidth and rise/fall times are independent of gain setting – guaranteed and 100% tested. Offset adjustable by trimpot or external analog control voltage. LED gain setting indication. Output short-circuit protected. Power supply ± 15V via 3-pin-LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

- Variable Gain from 10 dB to 60 dB (x 3 to x 1,000)
- Bandwidth DC to 200 MHz for all Gain Settings
- Exceptional Low DC Drift of just 0.6 μV/°C
- Switchable AC/DC Coupling
- Adjustable Offset
- Ideal as Pre-Amplifier for Oscilloscopes, A/D Converters and Transient Recorders

Logarithmic Wideband Voltage Amplifier ■ Model HLVA-100



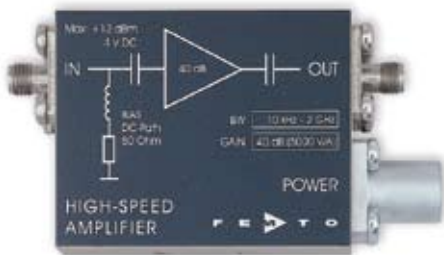
Model HLVA-100

| Model | HLVA-100 |
|----------------------|---|
| Input Voltage Range | Switchable, ± 20 μV ... ± 200 mV and ± 200 μV ... ± 2 V |
| Dynamic Range | Typ. 60 dB (for Accurate Amplitude Measurement), Max. 80 dB (Signal Detection) |
| Scaling | 12.5 mV/dB, 250 mV/Decade @ 50 Ω Load |
| Linearity | ± 1 dB (for Pulse of Min. 20 ns Pulse Width) |
| Signal Path | DC Coupled, Rectifying |
| Input Noise Voltage | 2 nV/√Hz |
| Input Voltage Drift | 0.6 μV/°C |
| Input/Output | 50 Ω, BNC |
| Rise/Fall Time | 5 ns @ 40 dB Step |
| Output Voltage Range | + 50 ... + 1,075 mV Typ. @ 50 Ω Load (if Output Is Adjusted to 1 V at 100 mV Input) |
| Offset Voltage Range | ± 2.5 mV on Input, ± 500 mV on Output |
| Control Interface | TTL/CMOS, Opto-Isolated |

Offset adjustable by trimpot or external control voltage. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

- Wide Dynamic Range up to 80 dB
- 5 ns Rise/Fall Time @ 40 dB Step
- Switchable Input Range
- DC Coupled, Rectifying Input
- 2 nV/√Hz Input Noise
- Integrated Sample & Hold Baseline Correction
- Typical Applications: LIDAR Systems, Signal Compression, Time-Resolved Pulse and Transient Measurements

High Speed GHz Amplifiers ■ Series HSA-X



Model HSA-X-2-40

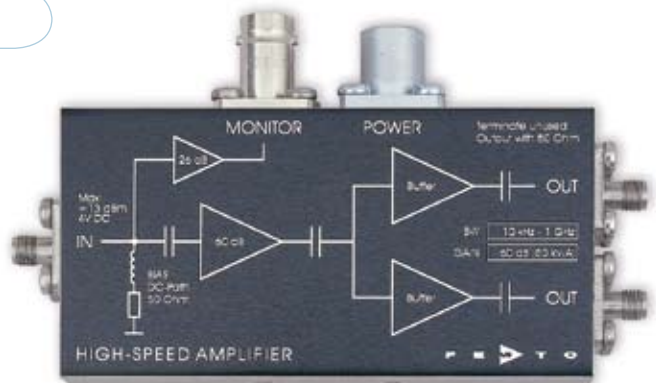
- Bandwidth 10 kHz up to 2 GHz
- Fixed Gain of 20 or 40 dB (x 10 or x 100)
- Very Low Input Noise down to 330 pV/√Hz (6.6 pA/√Hz)
- Integrated DC Path for Easy Operation with Fast Photodiodes
- Ultra Compact Package for Use Close to the Signal Source
- Designed for High Speed Photodiodes, APDs, PMTs and as Pre-Amplifier for Fast Oscilloscopes and Transient Recorders

| Model | HSA-X-2-20 | HSA-X-2-40 | HSA-X-1-40 |
|----------------------------|--|------------------------|-------------------------|
| Lower Cut-Off Frequency | 10 kHz | 10 kHz | 10 kHz |
| Upper Cut-Off Frequency | 2 GHz | 2 GHz | 1.1 GHz |
| Rise/Fall Time (10% - 90%) | 180 ps | 180 ps | 320 ps |
| Gain/Transimpedance | 20 dB / 500 V/A | 40 dB / 5,000 V/A | 40 dB / 5,000 V/A |
| Input Noise | 650 pV/√Hz (13 pA/√Hz) | 670 pV/√Hz (13 pA/√Hz) | 330 pV/√Hz (6.6 pA/√Hz) |
| Input VSWR | 1.1 | 1.1 | 1.3 |
| Output Voltage | 1.9 Vp-p (@ 50 Ω Load) | 1.9 Vp-p (@ 50 Ω Load) | 2 Vp-p (@ 50 Ω Load) |
| Input/Output | 50 Ω, SMA | 50 Ω, SMA | 50 Ω, SMA |
| Power Supply | + 15 V, + 85 mA Typ. | + 15 V, + 125 mA Typ. | + 15 V, + 120 mA Typ. |
| Case | 80 x 45 x 25 mm (L x W x H), Weight 100 g (0.23 lbs) | | |

Integrated DC Path. 8-32 and M4 mounting threads. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

High Speed GHz Amplifiers ■ Series HSA-Y

- Bandwidth 10 kHz up to 2 GHz
- Fixed Gain of 20, 40 or 60 dB (x 10, x 100 or x 1,000)
- Very Low Input Noise down to 330 pV/√Hz (6.6 pA/√Hz)
- Two Identical Signal Outputs to Avoid External HF Signal Splitters
- Additional DC Monitor Output for Measuring Low Frequency Background
- Integrated DC Path for Easy Operation with Fast Photodiodes
- Designed for High Speed Photodiodes, APDs, PMTs and as Pre-Amplifier for Fast Oscilloscopes and Transient Recorders

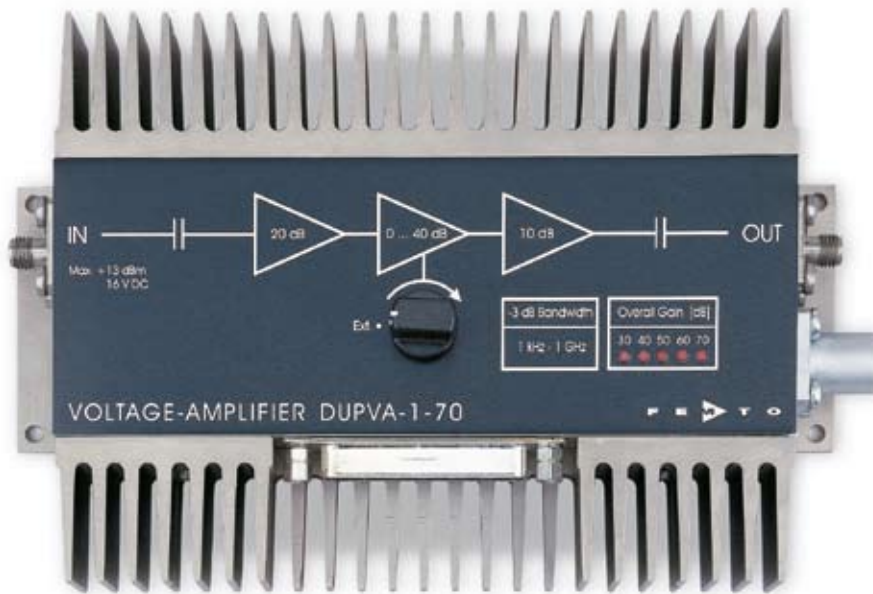


Model HSA-Y-1-60

| Model | HSA-Y-2-20 | HSA-Y-2-40 | HSA-Y-1-40 | HSA-Y-1-60 |
|----------------------------|--|------------------------|-------------------------|-------------------------|
| Lower Cut-Off Frequency | 10 kHz | 10 kHz | 10 kHz | 10 kHz |
| Upper Cut-Off Frequency | 2 GHz | 1.9 GHz | 1.1 GHz | 1.1 GHz |
| Rise/Fall Time (10% - 90%) | 180 ps | 185 ps | 320 ps | 320 ps |
| Gain/Transimpedance | 20 dB / 500 V/A | 40 dB / 5,000 V/A | 40 dB / 5,000 V/A | 60 dB / 50,000 V/A |
| Input Noise | 680 pV/√Hz (14 pA/√Hz) | 650 pV/√Hz (13 pA/√Hz) | 330 pV/√Hz (6.6 pA/√Hz) | 330 pV/√Hz (6.6 pA/√Hz) |
| Input VSWR | 1.15 | 1.2 | 1.45 | 1.4 |
| Input | 50 Ω, SMA | 50 Ω, SMA | 50 Ω, SMA | 50 Ω, SMA |
| Signal Output | Two Identical Signal Outputs, 50 Ω, SMA, Output Voltage 2 Vp-p (@ 50 Ω Load) | | | |
| Monitor Output | Gain 1,000 V/A, Output Voltage: +/- 10 V (@ ≥ 1 MΩ Load), Bandwidth: DC - 100 kHz, BNC | | | |
| Power Supply | ± 15 V, + 190 mA / - 10 mA Typ. | | | |
| Case | 110 x 70 x 25 mm (L x W x H), Weight 180 g (0.41 lbs) | | | |

Integrated DC Path. 8-32 and M4 mounting threads. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Variable Gain GHz Amplifiers ■ Series DUPVA



Model DUPVA-1-70

- Bandwidth 1 kHz to 1 GHz for all Gain Settings
- Variable Gain from 20 dB to 70 dB (x 10 to x 3,000)
- Very Low Input Noise of 330 pV/√Hz
- Exceptional Gain Flatness of ± 0.15 dB
- Ideal as Broadband Pre-Amplifier for Oscilloscopes and Transient Recorders

| Model | DUPVA-1-60 | DUPVA-1-70 |
|----------------------------|--|----------------------------------|
| Lower Cut-Off Frequency | 1 kHz | 1 kHz |
| Upper Cut-Off Frequency | 1.2 GHz | 1.1 GHz |
| Rise/Fall Time (10% - 90%) | 380 ps | 390 ps |
| Gain | 20/30/40/50/60 dB | 30/40/50/60/70 dB |
| Gain Flatness | ± 0.15 dB | ± 0.15 dB |
| Input Noise | NF 3.0 dB (450 pV/√Hz) | NF 1.9 dB (330 pV/√Hz) |
| Output Power | 10 dBm (-1 dB Compression) | 11 dBm (-1 dB Compression) |
| Output Voltage | 1.7 Vp-p (@ 50 Ω Load) | 1.7 Vp-p (@ 50 Ω Load) |
| Input/Output | 50 Ω, SMA | 50 Ω, SMA |
| Power Supply | ± 15 V, + 350 mA / - 100 mA Typ. | ± 15 V, + 250 mA / - 100 mA Typ. |
| Monitor Output | DC ... 100 kHz, Monitor Output at D-Sub Connector, Gain x1 | |
| Control Interface | 3 Opto-Isolated Digital Inputs, TTL/CMOS Compatible | |
| Case | 165 x 105 x 45 mm (L x W x H), Weight 510 g (1.2 lbs) | |

LED gain setting indication. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Miniature Lock-In Amplifier Modules ■ Series LIA-MV-150



Model LIA-MV-150-S

- Working Frequency up to 45 kHz
- Single Ended or True Differential Voltage and Current Input with Sensitivity down to 3 μV and 3 nA for Full Scale Output
- Phase Shifter 0° to 360°
- Manual and Remote Control Operation
- Ultra Compact Package
- For Laser Stabilization, Spectroscopy, Surface Analysis and Process Control in Scientific and Industrial Applications

| Model | LIA-MV-150-S Standard | LIA-MV-150-D True Differential Input |
|--------------------------|--|--|
| Voltage Input | BNC, Single Ended Instrumentation Amplifier, Noise 12 nV/ $\sqrt{\text{Hz}}$ | LEMO, True Differential Instrumentation Amplifier, Noise 12 nV/ $\sqrt{\text{Hz}}$ |
| Current Input | BNC, Transimpedance Amplifier, Gain 1 kV/A, Noise 13 pA/ $\sqrt{\text{Hz}}$ | LEMO, Transimpedance Amplifier, Gain 1 kV/A, Noise 13 pA/ $\sqrt{\text{Hz}}$ |
| Sensitivity (Full Scale) | Voltage: 3 μV - 100 mV, Switchable in 1-3-10 Steps / Current: 3 nA - 100 μA , Switchable in 1-3-10 Steps | |
| Gain Accuracy | $\pm 2\%$ for a Sinusoidal Input Signal | |
| Working Frequency | 10 Hz - 45 kHz | |
| Reference Input | BNC, ± 100 mV to ± 5 V, Switchable to TTL | |
| Phase | Adjustable 0° - 360° | |
| Demodulator | 55 dB Max. Dynamic Reserve, Square Wave Mixer | |
| Time Constants | 3 ms - 10 s, Switchable in 1-3-10 Steps, Slope Switchable 6 or 12 dB/Octave | |
| Output | BNC, X (In Phase), ± 10 V Full Scale, Short-Circuit Protected | |
| Control Interface | 16 Opto-Isolated Digital Inputs, TTL/CMOS Compatible, 8 Bit Phase, 4 Bit Time Constant, 4 Bit Sensitivity | |
| Power Supply | ± 15 V, + 100 mA / - 60 mA Typ. | |
| Case | 170 x 60 x 30 mm (L x W x H), Weight 370 g (0.82 lbs) | |

LED overload and unlocked indication. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

Lock-In Amplifier Modules ■ Series LIA-MV(D)-200

| Model | LIA-MV-200-L Single Phase | LIA-MV-200-H Single Phase | LIA-MVD-200-L Dual Phase | LIA-MVD-200-H Dual Phase |
|--------------------------|--|------------------------------|-----------------------------|-----------------------------|
| Working Frequency | 5 Hz ... 10 kHz | 50 Hz ... 120 kHz | 5 Hz ... 10 kHz | 50 Hz ... 120 kHz |
| Time Constants | 3 ms - 10 s | 300 μs - 1 s | 3 ms - 10 s | 300 μs - 1 s |
| Outputs | X = In Phase, Y = Quadrature, R = Magnitude | | | |
| Sensitivity (Full Scale) | Voltage: 3 μV - 1 V in 1-3-10 Steps / Current: 30 pA - 10 μA in 1-3-10 Steps | | | |
| Gain Accuracy | $\pm 2\%$ for a Sinusoidal Input Signal | | | |
| Voltage Input | BNC, True Differential Instrumentation Amplifier, Noise 12 nV/ $\sqrt{\text{Hz}}$ | | | |
| Current Input | BNC, Transimpedance Amplifier, Gain 100 kV/A, Noise 0.4 pA/ $\sqrt{\text{Hz}}$ | | | |
| Signal Filter | High Pass 0.2 Hz - 1 kHz and Low Pass 100 Hz - 1 MHz, User Selectable | | | |
| Reference Input | BNC, ± 100 mV to ± 5 V, Switchable to TTL | | | |
| Phase | Adjustable 0° - 360° | | | |
| Demodulator | 80 dB Max. Dynamic Reserve, Square Wave Mixer | | | |
| Control Interface | 16 Opto-Isolated Digital Inputs, TTL/CMOS Compatible | | | |
| Case | 230 x 105 x 65 mm (L x W x H), Weight 1 kg (2.2 lbs) | | | |

LED overload, unlocked and power indication. Connectors for an optional reference oscillator are inside the module. Power supply ± 15 V via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.



Model LIA-MVD-200-H

- Single and Dual Phase Models
- Working Frequency 5 Hz up to 120 kHz
- Various Signal Filters and Configuration Options for Versatile Use
- Manual And Remote Control Operation
- Designed as Alternative to Expensive Desktop Lock-Ins for Use in Spectroscopy, Photonics and Laser Measurements

Single-Board Lock-In Amplifiers ■ Series LIA-BV(D)-150



Model LIA-BVD-150-H with Optional Mounting Kit MK-LIA-2

- Low-Cost 19" Plug-In Board Design
- Single and Dual Phase Models
- Working Frequency 5 Hz up to 120 kHz
- Phase Shifter 0° to 360°
- Voltage and Current Input
- Manual and Remote Control Operation
- Ideal for Multi-Channel, OEM and Cost-Sensitive Applications

| Model | LIA-BV-150-L | LIA-BV-150-H | LIA-BVD-150-L | LIA-BVD-150-H |
|---------------------------------|--|-------------------|-----------------|-------------------|
| | Single Phase | Single Phase | Dual Phase | Dual Phase |
| Working Frequency | 5 Hz ... 10 kHz | 50 Hz ... 120 kHz | 5 Hz ... 10 kHz | 50 Hz ... 120 kHz |
| Time Constants | 3 ms – 10 s | 300 μs – 1 s | 3 ms – 10 s | 300 μs – 1 s |
| Outputs | X = In Phase ± 10 V Full Scale, Short-Circuit Protected, Signal Monitor Output X = In Phase, Y = Quadrature, R = Magnitude | | | |
| Sensitivity (Full Scale) | Voltage: 3 μV – 1 V in 1-3-10 Steps / Current: 30 pA – 10 μA in 1-3-10 Steps | | | |
| Gain Accuracy | ± 2% for a Sinusoidal Input Signal | | | |
| Voltage Input | True Differential Instrumentation Amplifier, Noise 12 nV/√Hz | | | |
| Current Input | Transimpedance Amplifier, Gain 100 kV/A, Noise 0.4 pA/√Hz | | | |
| Signal Filter | High Pass 0.2 Hz – 1 kHz and Low Pass 100 Hz – 1 MHz, User Selectable | | | |
| Reference Input | ± 100 mV to ± 5 V, Switchable to TTL | | | |
| Phase | Adjustable 0° - 360° | | | |
| Demodulator | 80 dB Max. Dynamic Reserve, Square Wave Mixer | | | |
| Control Interface | 16 Opto-Isolated Digital Inputs, TTL/CMOS Compatible | | | |
| Dimensions | 160 x 100 x 20 mm (L x W x H), Weight 100 g (0.22 lbs) | | | |

LED overload, unlocked and power indication. Power supply ± 15 V. Connectors for an optional reference oscillator module are on board. Optional mounting kit MK-LIA-2 available. For further information please view the datasheet at www.femto.de.

Multi-Channel Lock-In Amplifier Rack ■ Series SC-LIA-S

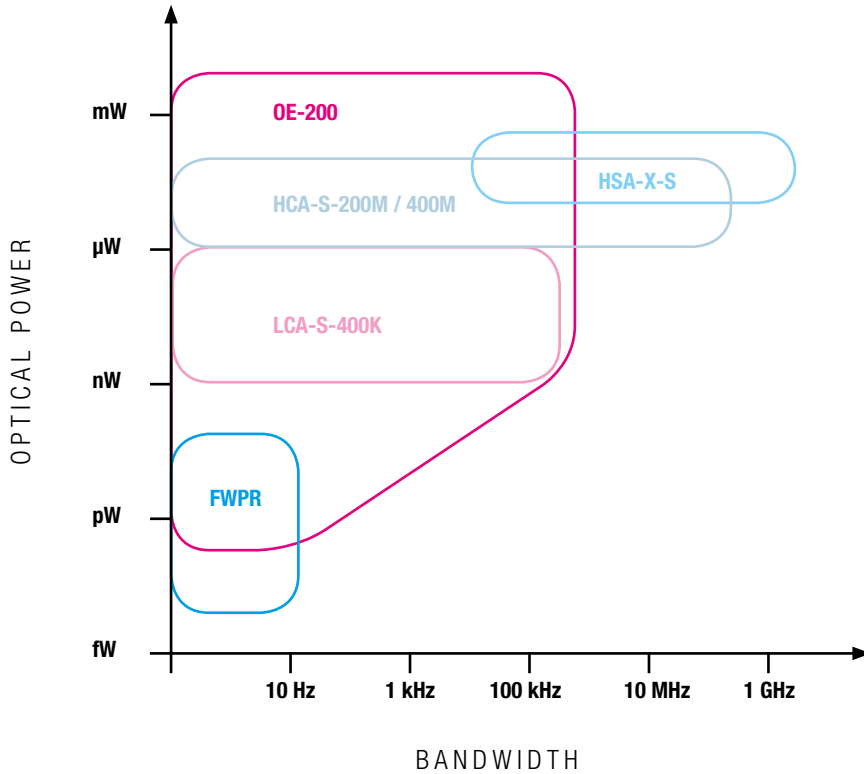
| Model | SC-LIA-S |
|--------------------------|---|
| Case Width | 28, 42, 63 or 84 TE |
| Case Height | 3 HE |
| Channel Count | Min. 3, Max. 10 LIA-BV(D)-150 Boards |
| Connections | Signal In-/Outputs: BNC; Control Interface: D-Sub 25 (if Installed) |
| Control Interface | Either Common for All Installed Channels, or Individual for Each Channel, or None |
| Power Supply | Input Voltage: 230 VAC or 110 VAC, Output Voltage: ± 15 VDC, Linear Regulated |
| Case | Depending on the Configuration up to ca. 370 mm x 490 mm x 140 mm (L x W x H), Weight up to ca. 8 kg (17 lbs) |

- 19" Rack System for Series LIA-BV(D)-150 Lock-In Amplifier Boards
- Different Rack Sizes Suitable for 3 up to 10 Channels
- Optional Interface for Remote Control of the Installed LIA Boards
- Integrated Power Supply
- BNC Sockets for Signal In- and Outputs
- Ideal for Applications Requiring Multi-Channel Lock-In Detection



Model SC-LIA-S

Selection Guide ■ Photoreceivers



| Model | Spectral Range | Calibration Wavelength | Bandwidth (-3 dB) | Min. Rise Time (10% - 90%) | Max. Conversion Gain | Min. NEP |
|----------------|-----------------|------------------------|--------------------|----------------------------|--------------------------|------------|
| FWPR-20-SI | 320 ... 1100 nm | - | DC ... 20 Hz | 18 ms | 0.6×10^{12} V/W | 0.7 fW/√Hz |
| FWPR-20-IN | 900 ... 1700 nm | - | DC ... 20 Hz | 18 ms | 9.5×10^{10} V/W | 7.5 fW/√Hz |
| LCA-S-400K-SI | 400 ... 1100 nm | - | DC ... 400 kHz | 1 μs | 6.2×10^6 V/W | 130 fW/√Hz |
| LCA-S-400K-IN | 900 ... 1700 nm | - | DC ... 400 kHz | 1 μs | 9.5×10^6 V/W | 75 fW/√Hz |
| OE-200-SI | 320 ... 1060 nm | 830 nm* | DC ... 500 kHz | 700 ns | 1.0×10^{11} V/W | 10 fW/√Hz |
| OE-200-UV | 190 ... 1000 nm | 830 nm* | DC ... 500 kHz | 700 ns | 1.0×10^{11} V/W | 17 fW/√Hz |
| OE-200-IN1 | 900 ... 1700 nm | 1300 nm* | DC ... 500 kHz | 700 ns | 1.0×10^{11} V/W | 8 fW/√Hz |
| OE-200-IN2 | 900 ... 1700 nm | 1550 nm* | DC ... 500 kHz | 700 ns | 1.0×10^{11} V/W | 7 fW/√Hz |
| HCA-S-200M-SI | 320 ... 1000 nm | - | DC ... 200 MHz | 1.8 ns | 1.1×10^4 V/W | 9.3 pW/√Hz |
| HCA-S-200M-IN | 900 ... 1700 nm | - | DC ... 200 MHz | 1.8 ns | 1.9×10^4 V/W | 5.4 pW/√Hz |
| HCA-S-400M-SI | 320 ... 1000 nm | - | DC ... 400 MHz | 1.0 ns | 2.7×10^3 V/W | 40 pW/√Hz |
| HCA-S-400M-IN | 900 ... 1700 nm | - | DC ... 400 MHz | 1.0 ns | 4.8×10^3 V/W | 24 pW/√Hz |
| HSA-X-S-1G4-SI | 320 ... 1000 nm | - | 10 kHz ... 1.4 GHz | 250 ps | 2.5×10^3 V/W | 26 pW/√Hz |
| HSA-X-S-2G-IN | 900 ... 1700 nm | - | 10 kHz ... 2 GHz | 180 ps | 4.8×10^3 V/W | 14 pW/√Hz |

* Optical calibration available for fiber optic models only.

Femtowatt Photoreceiver ■ Series FWPR-20



Model FWPR-20-IN
Post holder and post not included

- **Ultra Low Noise:**
Min. NEP 0.7 fW/√Hz Allows Direct Detection down to 50 fW
- **Ultra High Gain Amplifier with**
Transimpedance of up to 10^{12} V/A
- **For Fluorescence Measurements,**
Spectroscopy, Chromatography,
Electrophoresis and as Replacement
for Photomultiplier Tubes (PMTs) and
Avalanche Photodiodes (APDs)

| Model | FWPR-20-SI | FWPR-20-IN |
|-----------------------|--|---------------------------------------|
| Spectral Range | 320 ... 1100 nm | 900 ... 1700 nm |
| Bandwidth (-3 dB) | DC ... 20 Hz | DC ... 20 Hz |
| Rise Time (10% - 90%) | 18 ms | 18 ms |
| Transimpedance Gain | 1×10^{12} V/A | 1×10^{11} V/A |
| Max. Conversion Gain | 0.6×10^{12} V/W (@ 960 nm) | 0.95×10^{11} V/W (@ 1550 nm) |
| Min. NEP | 0.7 fW/√Hz (@ 960 nm) | 7.5 fW/√Hz (@ 1550 nm) |
| Saturation Power | 18 pW (@ 960 nm) | 110 pW (@ 1550 nm) |
| Detector | Si, 1.1 x 1.1 mm ² | InGaAs PIN, \varnothing 0.5 mm |
| Input | Free Space, 25 mm \varnothing Flange | |
| Output | BNC | |
| Output Voltage Range | ± 10 V @ ≥ 1 M Ω Load | |
| Power Requirements | ± 15 V, ± 15 mA Typ. | |

Threaded M4 and 8-32 holes for mounting on standard posts. 25 mm \varnothing flange compatible with microbench systems. Offset adjustable by trimpot. Fiber optic input optional. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

400 kHz Low Noise Photoreceiver ■ Series LCA-S-400K

- **Low Noise:** Min. NEP 75 fW/√Hz Allows Detection down to 1 nW
- **High Gain:** Max. 9.5×10^6 V/W
- **Broad Wavelength Range:** 400 to 1700 nm
- **For Spectroscopy, General Purpose**
Opto-Electronic Measurements and as
Optical Front-End for Oscilloscopes,
A/D Converters and Lock-In Amplifiers

| Model | LCA-S-400K-SI | LCA-S-400K-IN |
|-----------------------|--|-----------------------------------|
| Spectral Range | 400 ... 1100 nm | 900 ... 1700 nm |
| Bandwidth (-3 dB) | DC ... 400 kHz | DC ... 400 kHz |
| Rise Time (10% - 90%) | 1 μ s | 1 μ s |
| Transimpedance Gain | 1×10^7 V/A | 1×10^7 V/A |
| Max. Conversion Gain | 6.2×10^6 V/W (@ 900 nm) | 9.5×10^6 V/W (@ 1550 nm) |
| Min. NEP | 130 fW/√Hz (@ 900 nm) | 75 fW/√Hz (@ 1550 nm) |
| Saturation Power | 1.6 μ W (@ 900 nm) | 1 μ W (@ 1550 nm) |
| Detector | Si PIN, \varnothing 2.5 mm | InGaAs PIN, \varnothing 0.5 mm |
| Input | Free Space, 25 mm \varnothing Flange | |
| Output | BNC | |
| Output Voltage Range | ± 10 V @ ≥ 1 M Ω Load | |
| Power Requirements | ± 15 V, ± 40 mA Typ. | |

Threaded M4 and 8-32 holes for mounting on standard posts. 25 mm \varnothing flange compatible with microbench systems. Offset adjustable by trimpot. Fiber optic input and AC-coupling optional. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.



Model LCA-S-400K-SI
Post holder and post not included

500 kHz Variable Gain Photoreceiver ■ Series OE-200



Model OE-200-IN1

- Variable Gain over 9 Decades Allows Detection of fW to mW
- High Speed: Min. Rise Time 700 ns, Max. Bandwidth 500 kHz
- Low Noise: NEP down to 7 fW/√Hz
- Broad Spectral Range: 190 to 1700 nm
- Optical Calibration for Fiber Optic Models
- Applications: All Purpose Lab Photoreceiver, Fiber Alignment Systems, Fast Power Monitoring, Linearity Measurements over 10 Decades, Industrial Control Systems

| Model | OE-200-SI | OE-200-UV | OE-200-IN1 | OE-200-IN2 |
|----------------------------|--|--|--|--|
| Spectral Range | 320 ... 1060 nm | 190 ... 1000 nm | 900 ... 1700 nm | 900 ... 1700 nm |
| Calibration Wavelength | 830 nm | 830 nm | 1300 nm | 1550 nm |
| Max. Bandwidth (-3 dB) | DC ... 500 kHz | DC ... 500 kHz | DC ... 500 kHz | DC ... 500 kHz |
| Min. Rise Time (10% - 90%) | 700 ns | 700 ns | 700 ns | 700 ns |
| Conversion Gain Range | 10 ³ - 10 ¹¹ V/W | 10 ³ - 10 ¹¹ V/W | 10 ³ - 10 ¹¹ V/W | 10 ³ - 10 ¹¹ V/W |
| Min. NEP | 10 fW/√Hz | 17 fW/√Hz | 8 fW/√Hz | 7 fW/√Hz |
| Optical Power Input Range | ca. 100 fW ... 2 mW | ca. 200 fW ... 2 mW | ca. 100 fW ... 2 mW | ca. 100 fW ... 2 mW |
| Detector | Si PIN, ø 1.2 mm | Si PIN, 1.1 x 1.1 mm ² | InGaAs PIN, ø 0.1 mm | InGaAs PIN, ø 0.1 mm |
| Input | Free Space, FC, SMA | Free Space, FC, SMA | Free Space, FC | Free Space, FC |
| Output | BNC | | | |
| Output Voltage Range | ± 10 V @ ≥ 1 MΩ Load | | | |
| Accuracy | ± 1 % Electrical, ± 5 % Electro Optical for Fiber Optic Models, ± 15 % Electro Optical for Free Space Models | | | |
| Lowpass Filter | Switchable to 10 Hz | | | |
| Power Requirements | ± 15 V, + 150 mA / - 100 mA Typ. | | | |
| Control Interface | 5 Opto-Isolated Digital Inputs, TTL/CMOS Compatible, Analog Offset Control Voltage Input | | | |
| Case | 170 x 60 x 45 mm (L x W x H), Weight 320 g (0.74 lbs) | | | |

Offset adjustable by trimpot or external control voltage. LED overload indication. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

200 MHz High Speed Photoreceiver ■ Series HCA-S-200M

- High Speed: Min. Rise Time 1.8 ns
- Low Noise: Min. NEP 5.4 pW/√Hz Allows Detection down to 1 μW
- High Gain: Max. 1.9 x 10⁴ V/W
- Applications: Spectroscopy, Optical Triggering, Fast Pulse and Transient Measurements

| Model | HCA-S-200M-SI | HCA-S-200M-IN |
|-----------------------|--------------------------------------|---------------------------------------|
| Spectral Range | 320 ... 1000 nm | 900 ... 1700 nm |
| Bandwidth (-3 dB) | DC ... 200 MHz | DC ... 200 MHz |
| Rise Time (10% - 90%) | 1.8 ns | 1.8 ns |
| Transimpedance Gain | 2 x 10 ⁴ V/A | 2 x 10 ⁴ V/A |
| Max. Conversion Gain | 1.1 x 10 ⁴ V/W (@ 800 nm) | 1.9 x 10 ⁴ V/W (@ 1550 nm) |
| Min. NEP | 9.3 pW/√Hz (@ 800 nm) | 5.4 pW/√Hz (@ 1550 nm) |
| Saturation Power | 110 μW (@ 800 nm) | 60 μW (@ 1550 nm) |
| Detector | Si PIN, ø 0.8 mm | InGaAs PIN, ø 0.3 mm |
| Input | Free Space, 25 mm ø Flange | |
| Output | 50 Ω, BNC | |
| Output Voltage Range | ± 1.7 V @ 50 Ω Load | |
| Power Requirements | ± 15 V, ± 60 mA Typ. | |

Threaded M4 and 8-32 holes for mounting on standard posts. 25 mm ø flange compatible with microbench systems. Offset adjustable by trimpot. Fiber optic input optional. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.



Model HCA-S-200M-IN
Post holder and post not included

400 MHz High Speed Photoreceiver ■ Series HCA-S-400M



Model HCA-S-400M-SI
Post holder and post not included

- High Speed: Min. Rise Time 1 ns
- High Gain: Max. 4.8×10^3 V/W
- DC Coupling for Precise Pulse Response
- Applications: Spectroscopy, Optical Triggering, Fast Pulse and Transient Measurements

| Model | HCA-S-400M-SI | HCA-S-400M-IN |
|-----------------------|----------------------------|-----------------------|
| Spectral Range | 320 ... 1000 nm | 900 ... 1700 nm |
| Bandwidth (-3 dB) | DC ... 400 MHz | DC ... 400 MHz |
| Rise Time (10% - 90%) | 1.0 ns | 1.0 ns |
| Transimpedance Gain | 5×10^3 V/A | 5×10^3 V/A |
| Max. Conversion Gain | 2.7×10^3 V/W | 4.8×10^3 V/W |
| Min. NEP | 40 pW/√Hz (@ 800 nm) | 24 pW/√Hz (@ 1550 nm) |
| Saturation Power | 400 μW (@ 800 nm) | 200 μW (@ 1550 nm) |
| Detector | Si PIN, ø 0.8 mm | InGaAs PIN, ø 0.3 mm |
| Input | Free Space, 25 mm ø Flange | |
| Output | 50 Ω, BNC | |
| Output Voltage Range | ± 1.5 V @ 50 Ω Load | |
| Power Requirements | ± 15 V, ± 55 mA Typ. | |

Threaded M4 and 8-32 holes for mounting on standard posts. 25 mm ø flange compatible with microbench systems. Offset adjustable by trimpot. Fiber optic input optional. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.

2 GHz High Speed Photoreceiver ■ Series HSA-X-S

- High Gain: Max. 4.8×10^3 V/W
- High Speed: Min. Rise Time 180 ps
- Low Noise: Min. NEP 14 pW/√Hz Allows Detection down to 10 μW
- Ideal for Fast Optical Measurements

| Model | HSA-X-S-1G4-SI | HSA-X-S-2G-IN |
|-----------------------|----------------------------------|-----------------------------------|
| Spectral Range | 320 ... 1000 nm | 900 ... 1700 nm |
| Bandwidth (-3 dB) | 10 kHz ... 1.4 GHz | 10 kHz ... 2 GHz |
| Rise Time (10% - 90%) | 250 ps | 180 ps |
| Transimpedance Gain | 5×10^3 V/A | 5×10^3 V/A |
| Max. Conversion Gain | 2.5×10^3 V/W (@ 760 nm) | 4.8×10^3 V/W (@ 1550 nm) |
| Min. NEP | 26 pW/√Hz (@ 760 nm) | 14 pW/√Hz (@ 1550 nm) |
| AC Saturation Power | 400 μW (@ 760 nm) | 240 μW (@ 1550 nm) |
| Detector | Si PIN, eff. ø 0.8 mm | InGaAs PIN, eff. ø 0.2 mm |
| Input | Free Space, 25 mm ø Flange | |
| Output | 50 Ω, SMA | |
| Output Voltage Range | 2 Vp-p @ 50 Ω Load | |
| Power Requirements | + 15 V, + 130 mA Typ. | |

Threaded M4 and 8-32 holes for mounting on standard posts. 25 mm ø flange compatible with microbench systems. Model with fiber optic input or DC monitor output optionally available. Output short-circuit protected. Power supply via 3-pin LEMO socket. A mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet at www.femto.de.



Model HSA-X-S-1G4-SI
Post holder and post not included

Power Supply ■ Series PS-15

- Power Supply Compatible with All FEMTO Amplifiers
- European, US and Asian Version Available
- Short-Circuit Protected
- Linear Regulated and Floating Design for Low Ripple

| Model | PS-15-2-L | PS-15-3-L |
|----------------|--|---------------|
| Input Voltage | 210 - 250 VAC | 100 - 135 VAC |
| Input Plug | Euro Plug, DIN 49464 | UL Plug |
| Output Voltage | ± 15 V, + 400 mA, - 250 mA on LEMO Series 1S, 3-Pin Plug | |
| Ripple | 20 mVp-p Typ. | |



Model PS-15-2-L

USB Control Interface ■ Model LUCI-10



Model LUCI-10

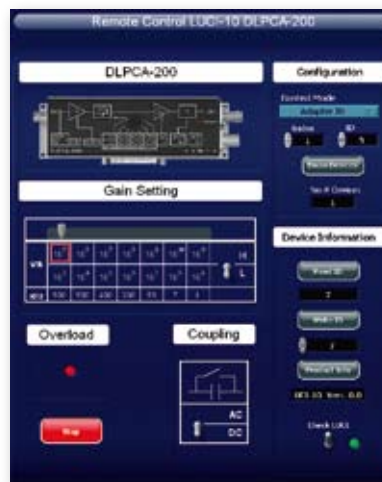
- Digital I/O Interface for USB Remote Control of FEMTO Amplifiers
- Supports Opto-Isolation of Amplifier Signal Path from PC USB Port
- Bus-Powered Operation
- System Driver and Application Software Included
- LabVIEW VI's for Easy Integration in LabVIEW Environment
- Ideal for Remote Control of FEMTO Amplifiers in Automated Systems and Measurement Setups

| Model | LUCI-10 |
|-------------------|--|
| Bus Interface | USB 2.0 Compatible |
| Control Interface | 16 Digital Output Lines, 3 Opto-Isolated Digital Input Lines |
| Connector | USB Typ A, D-Sub, Male (25 Pins) |
| Software | System Driver (.dll) Compatible with C/C++, LabVIEW Library, GUI |

For further information please view the datasheet at www.femto.de.



LabVIEW Library



GUI Frontpanel

In addition to our large variety of standard products we offer professional custom-designed modules and complete solutions for measurement systems. Here are some examples of previous work. Please contact us for details.

■ OEM Solutions with Cost and Size Optimized Design



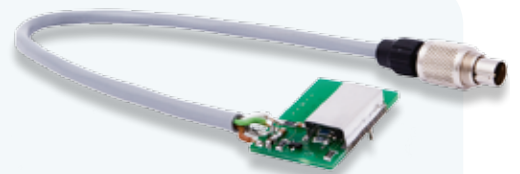
■ Small-Sized Photodetectors



■ Balanced Photoreceivers



■ Dual Channel Amplifiers



■ Miniature Pick-Up Electronics

This Short Form Catalog has been compiled to provide an overview of the amplifier and photoreceiver products available from FEMTO®.

Detailed datasheets are available for each product listed here. Please visit the datasheet download service at our website www.femto.de.

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