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FEMTO®

CURRENT / TRANSIMPEDANCE AMPLIFIERS

Ultra-Low-Noise Amplifiers
For High-Speed Precision Measurements

DDPCA-300 Variable Gain Ultra-Low-Noise Current Amplifier

- 0.4 fA peak-to-peak noise
- Variable transimpedance gain from 10^4 to 10^{13} V/A
- 240 dB dynamic range for sub-fA to mA measurements
- Adjustable bias voltage
- Compact and highly EMI-shielded case for use close to the signal source
- Manual and remote control

APPLICATIONS

Photo and ionization detector amplifier | I/V characterization of MOS and JFET structures | measurement of ultra-low currents | Quantum and biotech experiments | Spectroscopy | High resistance measurements | Easy-to-use FEMTO® amplifier add-on to existing digital voltmeter or A/D converter

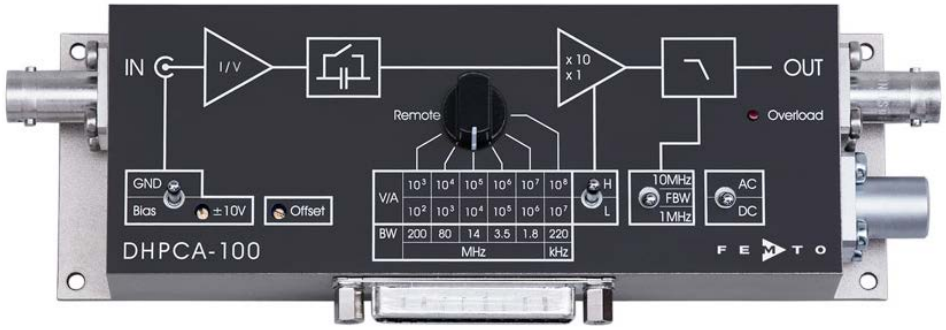
DLPCA-200 Variable Gain Low-Noise Current Amplifier

- Variable transimpedance gain from 10^3 to 10^{11} V/A
- Input noise down to 4.3 fA/√Hz
- Bandwidth up to 500 kHz
- Rise time down to 700 ns
- Adjustable bias voltage
- Manual and remote control

APPLICATIONS

Photodetector amplifier | Scanning tunneling microscopy (STM) | Spectroscopy | Beam monitoring for particle accelerators/synchrotrons | Ionization detectors | Preamplifier for lock-ins, A/D converters, etc.

DHPCA-100 Variable Gain High-Speed Current Amplifier



- Variable transimpedance gain from 10^2 to 10^8 V/A
- Bandwidth up to 200 MHz
- Rise time down to 1.8 ns
- Adjustable bias voltage
- Manual and remote control

APPLICATIONS

Photodetector amplifier | Fast ionization detection | Spectroscopy | Preamplifier for oscilloscopes, A/D converters and RF lock-in amplifiers

For detailed information about DDPCA-300, DLPCA-200, and DHPCA-100 see next page!

DDPCA-300 Sub-Femto Ampere Sensitivity

Model	DDPCA-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 %) [ms]	0.8	0.8	0.8	0.8	2.3	2.3	17	17	350	350
Equ. Input Noise [/√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
Accuracy	Transimpedance (Gain) ±1 %									
Low Pass Filter	3 settings: full bandwidth, 0.7 Hz and 0.1 Hz									
Output Range	±10 V, ±30 mA									
Bias Voltage Range	±10 V, max. 10 mA, connected to amplifier input, adjustable by trimpot or remote control voltage									
Power Supply	±15 V, +70 mA / –15 mA typ.									
Control Interface	4 opto-isolated digital inputs, TTL/CMOS compatible, analog voltage input for bias control									
Case	170 x 60 x 45 mm (L x W x H), weight 320 g (0.74 lbs)									

* The values for bandwidth, rise time and integrated input noise stated in the table above are achieved with the low pass filter set to full bandwidth. Lower noise values can be achieved by setting the low pass filter to 0.7 Hz or 0.1 Hz. The minimum of 0.4 fA peak-to-peak noise is achieved in the gain settings 10^{12} and 10^{13} V/A with the low pass filter set to 0.1 Hz.

Offset adjustable by potentiometer. Overload indication by LED and digital control output. 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 or contact FEMTO®.

DLPCA-200 Broad Application Range

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 [/√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
Accuracy	Transimpedance (Gain) ±1 %													
Low Pass Filter	2 settings: full bandwidth and 10 Hz													
Output Range	±10 V, ±30 mA													
Bias Voltage Range	±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 voltage input for offset control													
Case	170 x 60 x 45 mm (L x W x H), weight 320 g (0.74 lbs)													

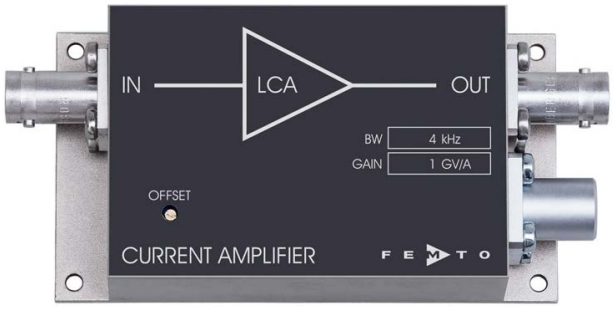
Offset adjustable by potentiometer or external control voltage. LED overload indication. Input protected against ±3 kV transients. Output short-circuit protected. Power supply via 3-pin Lemo® socket, a mating connector is provided with the device. Optional power supply PS-15 available. For further information please view the datasheet or contact FEMTO®.

DHPCA-100 MHz Speed

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 µs	0.2 µs	1.6 µs	2.0 ns	4.4 ns	25 ns	0.1 µs	0.2 µs	1.6 µs
Equ. Input Noise [/√Hz]	220 pA	17 pA	2.2 pA	490 fA	140 fA	51 fA	155 pA	6.1 pA	1.5 pA	440 fA	140 fA	51 fA
Accuracy	Transimpedance (Gain) ±1 %											
Low Pass Filter	3 settings: full bandwidth, 10 MHz and 1 MHz											
Output Range	±1 V @ 50 Ω load											
Bias Voltage Range	±10 V, max. 22 mA, connected to BNC-shield, switchable to GND											
Power Supply	±15 V, +110 mA / –90 mA											
Control Interface	7 opto-isolated digital inputs, TTL/CMOS compatible, analog voltage input for offset control											
Case	170 x 60 x 45 mm (L x W x H), weight 320 g (0.74 lbs)											

Offset adjustable by potentiometer 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 or contact FEMTO®.

LCA Series Ultra Low-Noise Current Amplifier



- Input noise down to 180 aA/√Hz
- Bandwidth up to 400 kHz
- Gain up to 10^{13} V/A
- Flat frequency response
- EMI-shielded case

APPLICATIONS

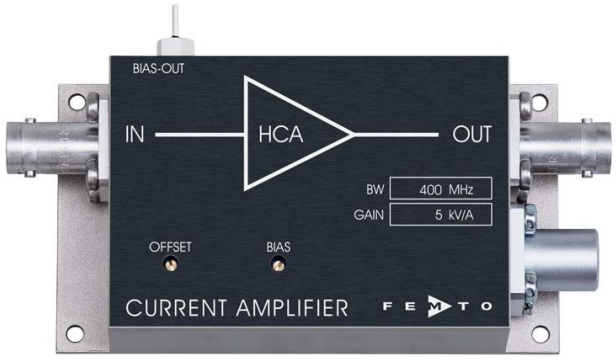
Photodetector amplifier | Spectroscopy | Scanning tunneling microscopy (STM) | Ionization detectors | Pyro- and piezoelectric detectors

Model	–3 dB Bandwidth (DC ...)	Noise Current [/√Hz]	Transimpedance (Gain)	Rise/Fall Time
LCA-2-10T	2 Hz	0.18 fA	10^{12} and 10^{13} V/A	200 ms
LCA-30-1T	30 Hz	0.5 fA	1 x 10^{12} V/A	12 ms
LCA-30-200G	30 Hz	0.5 fA	2 x 10^{11} V/A	12 ms
LCA-200-100G	200 Hz	1.5 fA	1 x 10^{11} V/A	2 ms
LCA-200-10G	200 Hz	1.5 fA	1 x 10^{10} V/A	2 ms
LCA-1K-5G	1 kHz	3 fA	5 x 10^{9} V/A	400 µs
LCA-2K-2G	2 kHz	4.5 fA	2 x 10^{9} V/A	200 µs
LCA-4K-1G	4 kHz	6.5 fA	1 x 10^{9} V/A	100 µs
LCA-10K-500M	10 kHz	10 fA	5 x 10^{8} V/A	40 µs
LCA-20K-200M	20 kHz	14 fA	2 x 10^{8} V/A	20 µs
LCA-40K-100M	40 kHz	19 fA	1 x 10^{8} V/A	10 µs
LCA-100K-50M	100 kHz	30 fA	5 x 10^{7} V/A	4 µs
LCA-200K-20M	200 kHz	40 fA	2 x 10^{7} V/A	2 µs
LCA-400K-10M	400 kHz	65 fA	1 x 10^{7} V/A	1 µs

NOTE: Bandwidth and frequency response are independent of detector capacitance. Guaranteed and 100 % tested up to 10 nF for each amplifier (up to 1 nF for LCA-400K-10M).

Output voltage ±10 V @ >10 kΩ load. Offset adjustable by trimpot. 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 or contact FEMTO®.

HCA Series High-Speed Current Amplifier



- Input noise down to 270 fA/√Hz
- Bandwidth up to 400 MHz
- Gain up to 10^{6} V/A
- Flat frequency response
- Stabilized and adjustable bias voltage output for biasing external photodiodes
- EMI-shielded case

APPLICATIONS

Fast detection with large area photodiodes | Spectroscopy | Photodetection with PMTs and photodiodes | Ionization detectors | Pyro- and piezoelectric detectors

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

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 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.

NOTE: The maximum detector capacitance listed above means that up to this value the specified –3dB-bandwidth (±15 %) is guaranteed. Larger capacitances are also possible, but will slightly influence the bandwidth and frequency response.

* For the ultra fast models HCA-100M-50K-C, HCA-200M-20K-C and HCA-400M-5K-C a reduction in bandwidth up to 25 % of the nominal values might occur if the source capacitance reaches the above noted maximum source capacitance values. Especially for these models short cables at the input and the use of low capacitance sources is of major importance. For further information please view the datasheet or contact FEMTO®.