Variable Gain

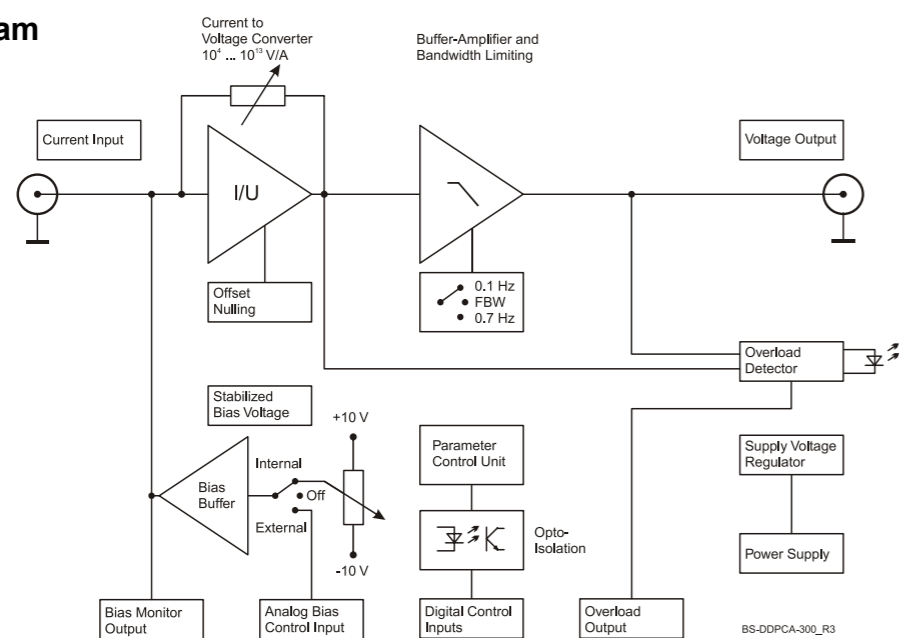## Sub Femto Ampere Current Amplifier

DDPCA-300

FEATURES

- 0.4 fA Peak-Peak Noise
- Very High Dynamic Range: Sub-fA to 1 mA (> 240 dB)
- Transimpedance (Gain) Switchable from 1 x 104 to 1 x 1013 V/A
- Bandwidth up to 400 Hz, Rise Time Down to 0.8 ms - Independent of Source Capacitance (up to 10 nF)
- Adjustable Bias Voltage on Input Relative to Ground
- Compact Housing for Use Close to the Signal Source
- Local and Remote Control
- Easy to Use:
  Convert Your Standard Digital Voltmeter or DAQ Board to a High-End
  Digital Sub Femto Amperemeter

APPLICATIONS

- Photodetector Amplifier
- I/V Characterization of Small MOS Structures
- DC Measurements of Ultra Low Currents
- Ionization Detectors, Mass Spectrometry, Quantum and Biotech Experiments
- Characterization of High Impedance Nanomaterials
- Spectroscopy
- High Resistance Measurements

Block Diagram

BS-DDPCA-300_R3

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C, Relative Humidity < 35 %
Gain	Transimpedance	$1 \times 10^4 \ldots 1 \times 10^{13}$ V/A
	Gain Accuracy	± 1 %
	Gain Drift	see table below
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	up to 400 Hz (see table below)
	Adjustable Low Pass Filter	switchable to 3 settings (full bandwidth, 0.7 Hz and 0.1 Hz)

Upper Cut-Off	Rise Time
Full BW (see table below)	Fast (see table below)
0.7 Hz	0.5 s
0.1 Hz	5 s

	Setting the low pass filter to full bandwidth is recommended for high measurement speed. By setting the low pass filter to 0.7 Hz or 0.1 Hz the peak-peak noise performance can be improved but the signal settling time will be longer.	

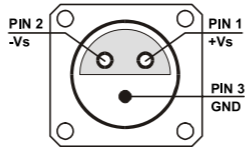| **Input**	Equ. Input Noise Current	gain setting dependent, see table below minimum input noise is 0.4 fA peak-peak (at gain setting 10^{12} or 10^{13} V/A with low pass filter switched to 0.1 Hz)
	Input Bias Current	< 10 fA typ.
	Input Bias Current Drift	factor 2 / 10 °C
	Max. Input Current (Full Scale)	see table below (value for linear amplification)
	Input Offset Compensation	adjustable by offset trimpot, ± 100 fA

Performance Depending on Gain Setting

Gain Setting (V/A)	10^4	10^5	10^6	10^7	10^8
Upper Cut-Off Frequency (- 3 dB)*	400 Hz	400 Hz	400 Hz	400 Hz	150 Hz
Rise / Fall Time (10 % - 90 %)*	0.8 ms	0.8 ms	0.8 ms	0.8 ms	2.3 ms
Integrated Input Noise Current (Peak-Peak)*	7 nA	7 nA	70 pA	70 pA	1.2 pA
Spectral Input Noise Current Density (/√Hz)	45 pA	45 pA	0.45 pA	0.45 pA	15 fA
Measured at	10 Hz	10 Hz	10 Hz	10 Hz	10 Hz
Gain Drift (/°C)	0.01 %	0.01 %	0.01 %	0.01 %	0.01 %
Max. Input Current (± Full Scale)	1 mA	0.1 mA	10 µA	1 µA	0.1 µA
DC Input Impedance (// 5 pF)	< 1 Ω	< 1 Ω	< 1 Ω	< 1 Ω <	100 Ω
Gain Setting (continued) (V/A)	10^9	10^{10}	10^{11}	10^{12}	10^{13}
Upper Cut-Off Frequency (- 3 dB)*	150 Hz	20 Hz	20 Hz	1 Hz	1 Hz
Rise / Fall Time (10 % - 90 %)*	2.3 ms	17 ms	17 ms	350 ms	350 ms
Integrated Input Noise Current (Peak-Peak)*	1.2 pA	50 fA	50 fA	2 fA	2 fA
Spectral Input Noise Current Density (/√Hz)	15 fA	1.3 fA	1.3 fA	0.2 fA	0.2 fA
Measured at	10 Hz	1 Hz	1 Hz	0.4 Hz	0.4 Hz
Gain Drift (/°C)	0.01 %	0.03 %	0.03 %	0.03 %	0.03 %
Max. Input Current (± Full Scale)	10 nA	1 nA	0.1 nA	10 pA	1 pA
DC Input Impedance (// 5 pF)	< 100 Ω	< 10 kΩ	< 10 kΩ	< 1 MΩ	< 1 MΩ

* The values for upper cut-off frequency, rise / fall time and integrated input noise current stated in the table above are achieved with the low pass filter set to "Full BW / Fast" (full bandwidth / fast rise time). Lower peak-peak noise values can be achieved by setting the low pass filter to 0.7 Hz or 0.1 Hz. In that case the bandwidth will be lower and the signal rise / fall time will be longer though.

Specifications (continued)

Output	Output Voltage	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
	Max. Output Current	± 30 mA
Adjustable Bias Voltage	General	An adjustable bias voltage is provided for directly biasing the device under test DUT (e.g. photodiode, high resistance semiconductor component). The bias voltage is connected to the inner conductor of the BNC input socket; the BNC-shield is always connected to analog ground. The bias voltage can be set either locally at the amplifier or through the remote interface. For measurements not requiring a bias voltage it can be fully disabled.
	Bias Voltage Range	± 10 V at inner conductor of BNC input socket

Local Bias Adjustment	Bias Current	max. ± 10 mA
	Bias Switch Setting	set bias switch to position "Int."
	Bias Adjustment	adjust bias voltage by bias trimpot
Remote Bias Adjustment	Bias Switch	Setting set bias switch to position "Ext."
	Bias Adjustment	adjust bias by analog control voltage fed to pin 8 of Sub-D connector (referred to AGND pin 3)
	Input Impedance of Control Pin 8	200 kΩ
	Bias Control Voltage Range	± 10 V at pin 8 (referred to AGND pin 3)
	Bias Control Polarity	inverting
	Example:	feeding a control voltage of + 2 V to pin 8 of the Sub-D connector leads to - 2 V bias voltage at the inner conductor of the BNC input socket referred to BNC shield (analog ground, AGND)
Bias Deactivation	Bias Switch Setting	set bias switch to position "Off"
Bias Monitor Output	Range	± 10 V, mirrors the adjusted bias voltage at the BNC input (inner conductor referred to AGND pin 3)
	Connector	pin 7 of Sub-D connector (referred to AGND pin 3)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
Overload Indication	LED	lights when overload is detected
	Digital Output	active when overload is detected (non active: 0 V, max. -1 mA, active: 5.1 V, max. 7 mA; referred to AGND pin 3)
Digital Control	Control Input Voltage Range	LOW bit: - 0.8 ...+ 1.2 V, HIGH bit: + 2.3 ... + 12 V
	Control Input Current	0 mA @ 0 V; 1.5 mA @ + 5 V; 4.5 mA @ + 12 V
Auxiliary Power Output	Voltage	± 12 VDC, stabilized, max. ± 50 mA (at Sub-D, may be used for supplying external devices up to ± 50 mA)
Power Supply	Supply Voltage	± 15 V
	Supply Current	+ 70 mA / -15 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	320 g (0.74 lb.)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	- 40 ... + 100 °C
	Operating Temperature	0 ... + 50 °C

Current Amplifiers

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Absolute Maximum Ratings	Signal Input Voltage	± 15 V relative to bias
	Transient Input Voltage	± 2 kV (discharge from 1 nF source)
	Digital Control Input Voltage	- 5 V / + 16 V
	Bias Control Input Voltage	± 12 V
	Power Supply Voltage	± 20 V
Connectors	Input	BNC
	Output	BNC
	Bias Voltage Output	center pin of BNC input socket
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND
	Control Port	Sub-D 25-pin, female, qual. class 2 Pin 1: +12V (stabilized power supply output) Pin 2: -12V (stabilized power supply output) Pin 3: AGND (analog ground) Pin 4: NC Pin 5: overload output (refers to AGND) Pin 6: signal output (connected to BNC output connector) Pin 7: bias voltage monitor output (refers to AGND) Pin 8: bias control voltage input (refers to AGND) Pin 9: DGND (ground for digital control pins 10 - 13) Pin 10: digital control input: gain, LSB Pin 11: digital control input: gain Pin 12: digital control input: gain Pin 13: digital control input: gain, MSB Pin 14 - 25: NC

Remote Control Operation	General	Remote control input bits are opto-isolated. For remote control operation set the rotary gain switch to the "Remote" position and select the desired gain setting via a bit code at the digital inputs.
		Switch settings "0.1 Hz / Full BW / 0.7 Hz" and "Bias Ext. / Off / Int." are not remote controllable.

	Gain (V/A)	Pin 13 MSB	Pin 12	Pin 11	Pin 10 LSB
Gain Setting	10^4	LOW	LOW	LOW	LOW
	10^5	LOW	LOW	LOW	HIGH
	10^6	LOW	LOW	HIGH	LOW
	10^7	LOW	LOW	HIGH	HIGH
	10^8	LOW	HIGH	LOW	LOW
	10^9	LOW	HIGH	LOW	HIGH
	10^{10}	LOW	HIGH	HIGH	LOW
	10^{11}	LOW	HIGH	HIGH	HIGH
	10^{12}	HIGH	LOW	LOW	LOW
	10^{13}	HIGH	LOW	LOW	HIGH

Typical Performance Characteristics
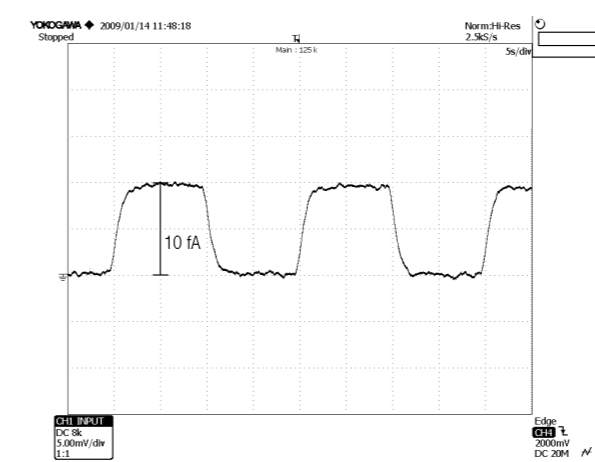
Long Term Drift
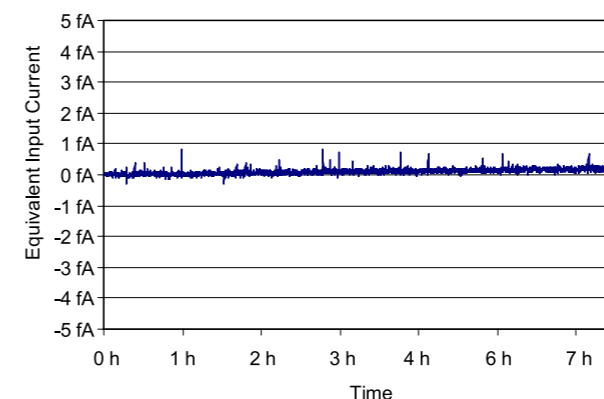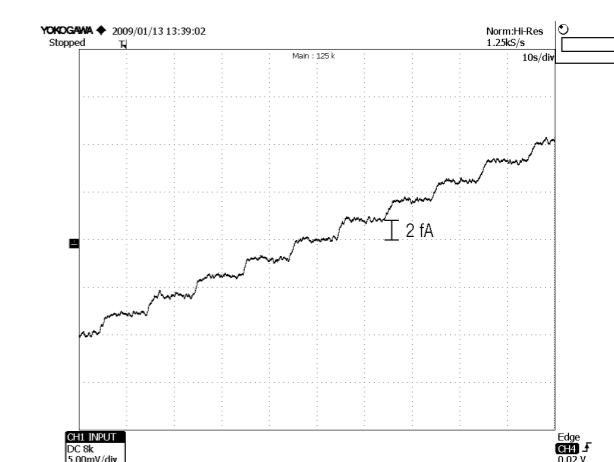
Short Term Drift
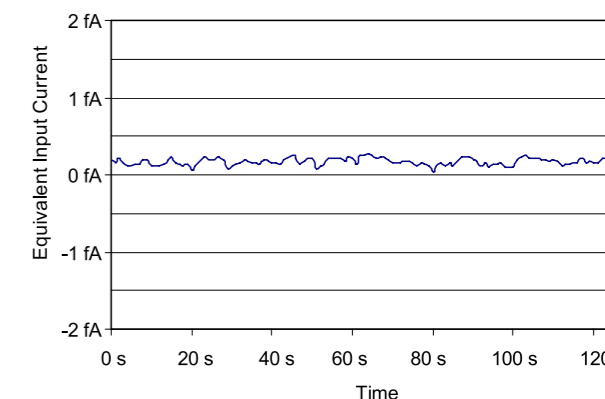
Both drift curves were recorded with shielded input in the gain setting 1012 V/A, filter setting 0.1 Hz.
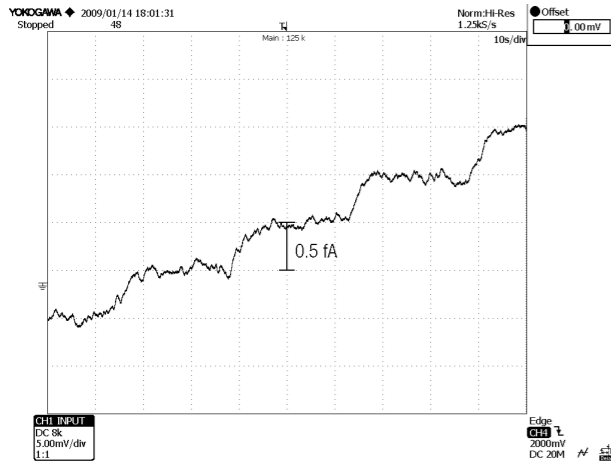
10 fA square wave

2 fA step curve

Both curves were recorded in the gain setting 1012 V/A, filter setting 0.7 Hz, no external averaging.
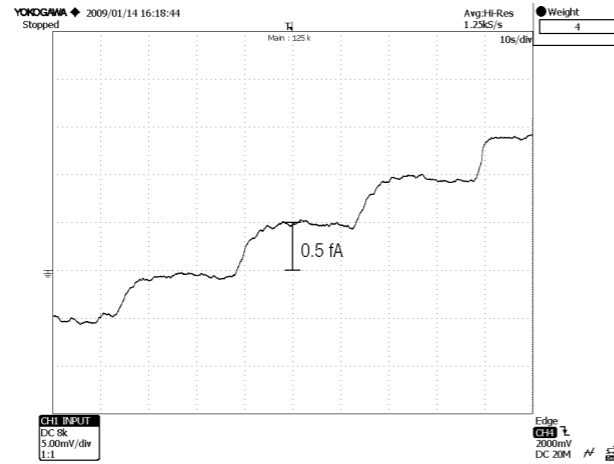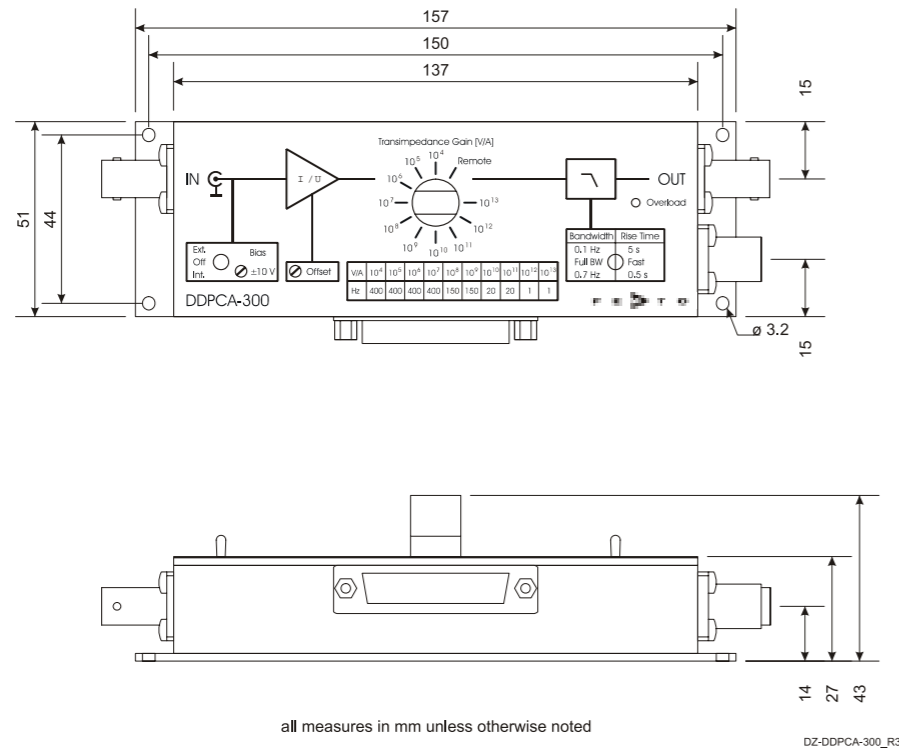
0.5 fA step curve, no averaging

0.5 fA

Both curves were recorded in the gain setting 1013 V/A, filter setting 0.1 Hz.

Dimensions

all measures in mm unless otherwise noted

DZ-DDPCA-300_R3

0.5 fA step curve, 4 times external averaging

0.5 fA

Ultra Low Noise Current Amplifier

LCA-2-10T

FEATURES
- Switchable Transimpedance (Gain) 1 x 10^{12} V/A and 1 x 10^{13} V/A
- Extremely Low Input Noise Current of 0.18 fA/√Hz
- Rise Time 0.2 s
- Switchable Low Pass Filter 2 Hz, 0.3 Hz and 0.1 Hz
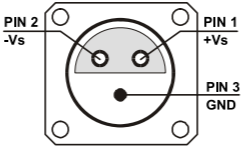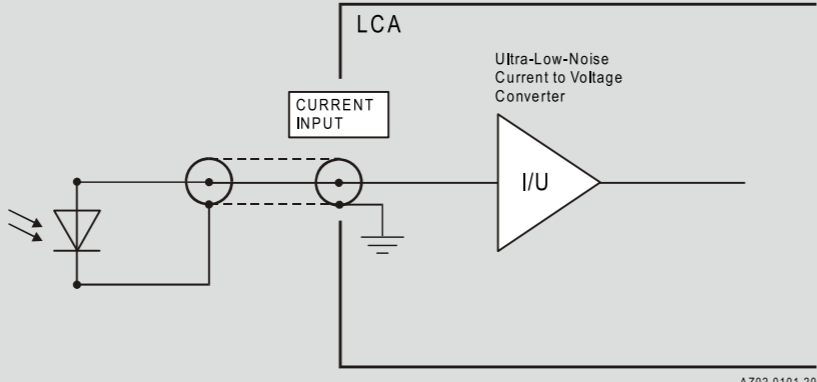- Protection against ± 2 kV Transients

APPLICATIONS
- Very Sensitive Current and Charge Measurements
- Spectroscopy
- Photodiode Amplifier
- Conductive Atomic Force Microscopy (cAFM)
- Amplifier for Ionization and Charge Detectors
- Characterization of Active Electronic Components
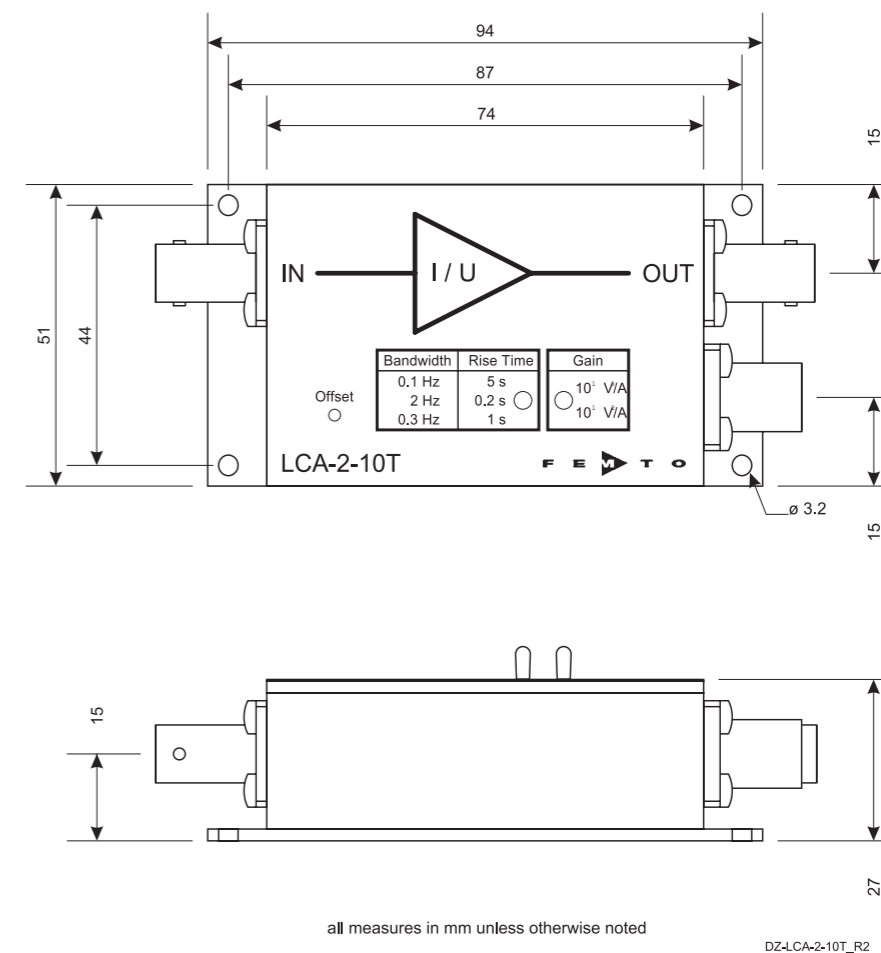- Preamplifier for Oscilloscopes, A/D-Converters, Digital Voltmeter etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1 x 10^{12} V/A and 1 x 10^{13} V/A (@ ≥ 1 MΩ load)
	Accuracy	± 2 %
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	2 Hz, 0.3 Hz and 0.1 Hz
	Rise- / Fall-Time (10 % - 90%)	0.2 s, 1 s and 5 s
Input	Equ. Input Noise Current	0.18 fA/√Hz (@ 0.2 Hz)
	Integrated Input Noise	0.3 fA peak-peak (@ 0.1 Hz bandwidth setting) 0.6 fA peak-peak (@ 0.3 Hz bandwidth setting) 2 fA peak-peak (@ 2 Hz bandwidth setting)
	Input Bias Current	10 fA typ.
	Input Bias Current Drift factor	2 / 10 °C
	Offset Compensation Range	± 50 fA, adjustable by offset trimpot
	Max. Input Current	± 10 pA (for linear amplification @ 1 x 1012 V/A gain) ± 1 pA (for linear amplification @ 1 x 1013 V/A gain)
	Input Offset Voltage	< 0.5 mV
	DC Input Impedance	1 kΩ (virtual) // 5 pF
Output	Output Voltage	± 10 V (@ ≥ 1 MΩ load)
	Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
	Max. Output Current	± 10 mA (for linear amplification)
Power	Supply Supply Voltage	± 15 V
	Supply Current	± 15 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 50 mA)

Specifications (continued)

Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	- 40 ... + 100 °C
	Operating Temperature	0 ... + 60 °C
Absolute Maximum Ratings	Input Voltage	± 10 V
	Power Supply Voltage	± 20 V
	Transient Input Voltage	± 2 kV (discharge from 1 nF source)
Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs　PIN 1 +Vs　PIN 3 GND
Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. LCA CURRENT INPUT Ultra-Low-Noise Current to Voltage Converter I/U AZ02-0101-20	

Dimensions

94
87
74
15

51
44

IN　I / U　OUT

Bandwidth　Rise Time　Gain
0.1 Hz　5 s
2 Hz　0.2 s　10⁷ V/A
0.3 Hz　1 s　10⁹ V/A
Offset

LCA-2-10T　FEMTO

ø 3.2
15

15
27

all measures in mm unless otherwise noted

DZ-LCA-2-10T_R2

Current Amplifiers

Spectroscopes · CCD Cameras · Imaging · Semiconductors · Communications · Solar Cells · Lighting · Tests · Instruments · Detection · Sensors · Components · Mechanics · Positioning · Lasers · Light Sources

Ultra-Low-Noise Current Amplifier

LCA-30-1T

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 0.5 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 30 Hz
- Transimpedance (Gain) 1 x 10   V/A
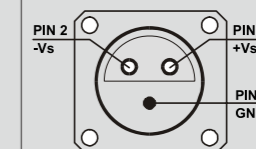
APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1×10^{12} V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	30 Hz (- 3 dB)
	Rise- / Fall-Time	12 ms (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	0.5 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	90 nV/√Hz (@ 10 Hz)
	Input Bias Current	10 fA typ.
	Input Bias Current Drift	Factor 2 / 10 K
	Offset Current Compensation	± 3 pA, Adjustable by Offset-Trimpot
	Max. Input Current	± 10 pA (Linear Amplification)
	Input Offset Voltage	< 0.5 mV
	DC Input Impedance	1 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 15 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 10 V
	Power Supply Voltage	± 22 V

Specifications (continued)

Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance.

Current Amplifiers

6 - 12

6 - 13

Spectroscopes

CCD Cameras · Imaging

Semiconductors · Communications

Solar Cells · Lighting

Tests · Instruments

Detection · Sensors

Components · Mechanics · Positioning

Lasers · Light Sources

Ultra-Low-Noise Current Amplifier

LCA-30-200G

Dimensions

DZ01-0101-21

FEATURES
• Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
• Extremely Low Noise, 0.5 fA/√Hz Equivalent Input Noise Current
• Bandwidth DC ... 30 Hz
• Transimpedance (Gain) 2×10^{11} V/A

APPLICATIONS
• Photodiode- and Photomultiplier-Amplifier
• Spectroscopy
• Charge-Amplifier
• Ionisation Detectors
• Preamplifier for Lock-Ins, A/D-Converters, etc.
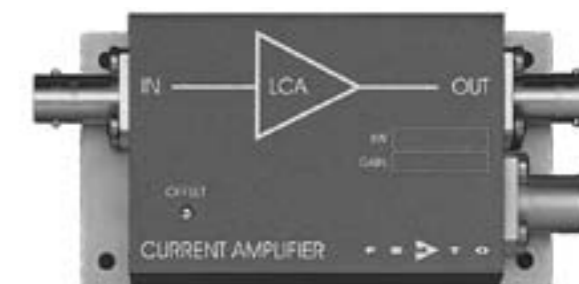
Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	2×10^{11} V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	30 Hz (- 3 dB)
	Rise- / Fall-Time	12 ms (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	0.5 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	90 nV/√Hz (@ 10 Hz)
	Input Bias Current	10 fA typ.
	Input Bias Current Drift	Factor 2 / 10 K
	Offset Current Compensation	± 15 pA, Adjustable by Offset-Trimpot
	Max. Input Current	± 50 pA (Linear Amplification)
	Input Offset Voltage	< 0.5 mV
	DC Input Impedance	1 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 15 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 10 V
	Power Supply Voltage	± 22 V

Current Amplifiers

Specifications (continued)

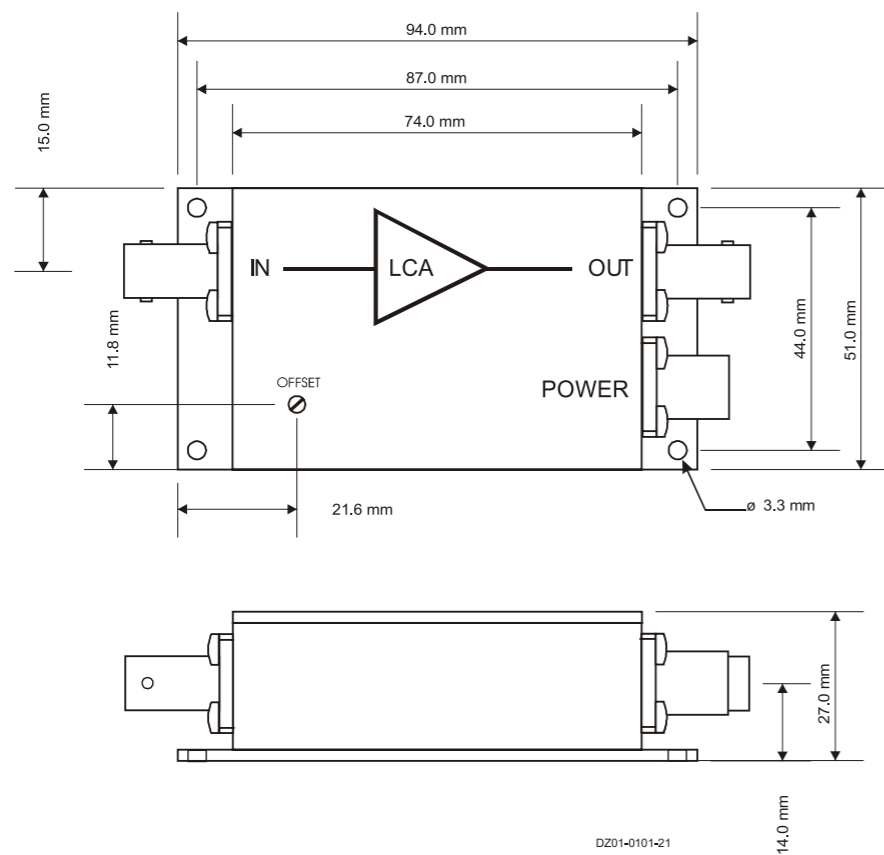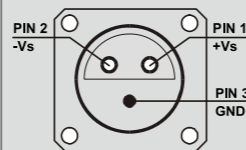| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs　PIN 1 +Vs　PIN 3 GND
Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. LCA Ultra-Low-Noise Current to Voltage Converter CURRENT INPUT I/U AZ02-0101-20 Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance. + BIAS VOLTAGE Use additional Bypass Capacitor close to the Detector (~100 nF, Ceramic) LCA Ultra-Low-Noise Current to Voltage Converter CURRENT INPUT I/U AZ01-0101-20	

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
21.6 mm
44.0 mm
51.0 mm
ø 3.3 mm
27.0 mm
14.0 mm

IN　LCA　OUT
OFFSET
POWER

DZ01-0101-21

Spectroscopes
CCD Cameras · Imaging
Semiconductors · Communications
Solar Cells · Lighting
Tests · Instruments
Detection · Sensors
Components · Mechanics · Positioning
Lasers · Light Sources

Ultra-Low-Noise Current Amplifier

LCA-200-100G

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 1.5 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 200 Hz
- Transimpedance (Gain) 1 x 10^{11} V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1 x 10^{11} V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	200 Hz (- 3 dB)
	Rise- / Fall-Time	2 ms (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	1.5 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	90 nV/√Hz (@ 10 Hz)
	Input Bias Current	10 fA typ.
	Input Bias Current Drift	Factor 2 / 10 K
	Offset Current Compensation	± 30 pA, Adjustable by Offset-Trimpot
	Max. Input Current	± 100 pA (Linear Amplification)
	Input Offset Voltage	< 0.5 mV
	DC Input Impedance	1 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 15 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 10 V
	Power Supply Voltage	± 22 V

Specifications (continued)

Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

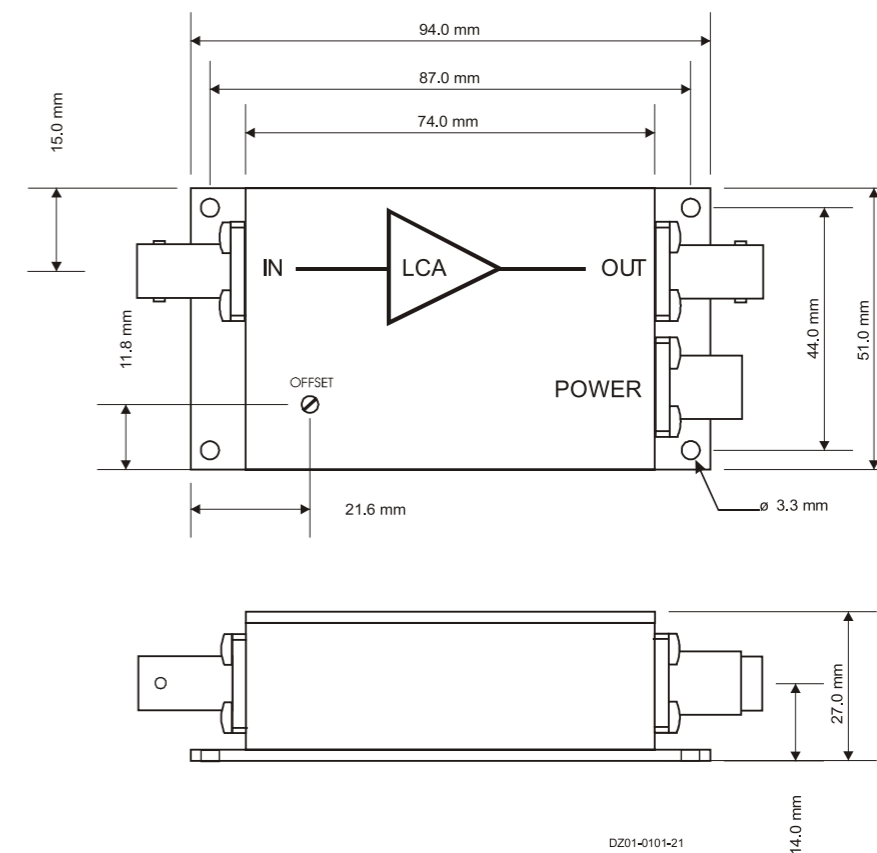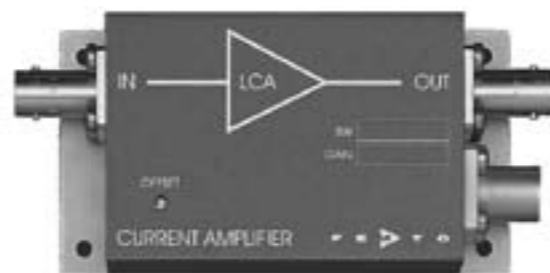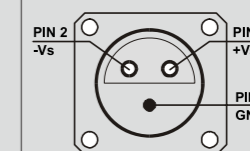| Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current.
	Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance.

Current Amplifiers

Spectroscopes · CCD Cameras · Imaging · Semiconductors · Communications · Solar Cells · Lighting · Tests · Instruments · Detection · Sensors · Components · Mechanics · Positioning · Lasers · Light Sources

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Ultra-Low-Noise Current Amplifier

LCA-200-10G

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 1.5 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 200 Hz
- Transimpedance (Gain) 1×10^{10} V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Dimensions

DZ01-0101-21

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1×10^{10} V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	200 Hz (- 3 dB)
	Rise- / Fall-Time	2 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	1.5 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	90 nV/√Hz (@ 10 Hz)
	Input Bias Current	10 fA typ.
	Input Bias Current Drift	Factor 2 / 10 K
	Offset Current Compensation	± 300 pA, Adjustable by Offset-Trimpot
	Max. Input Current	± 1 nA (Linear Amplification)
	Input Offset Voltage	< 0.5 mV
	DC Input Impedance	1 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 15 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 10 V
	Power Supply Voltage	± 22 V

Current Amplifiers

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Solar Cells · Lighting

Tests · Instruments

Detection · Sensors

Components · Mechanics · Positioning

Lasers · Light Sources

Specifications (continued)

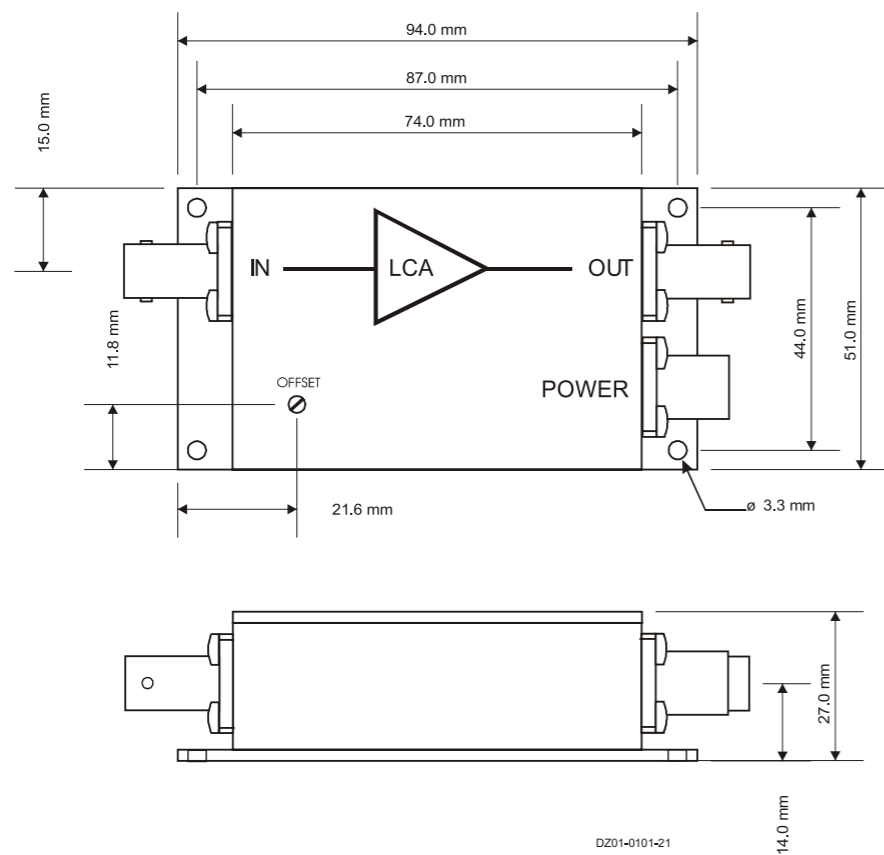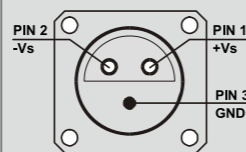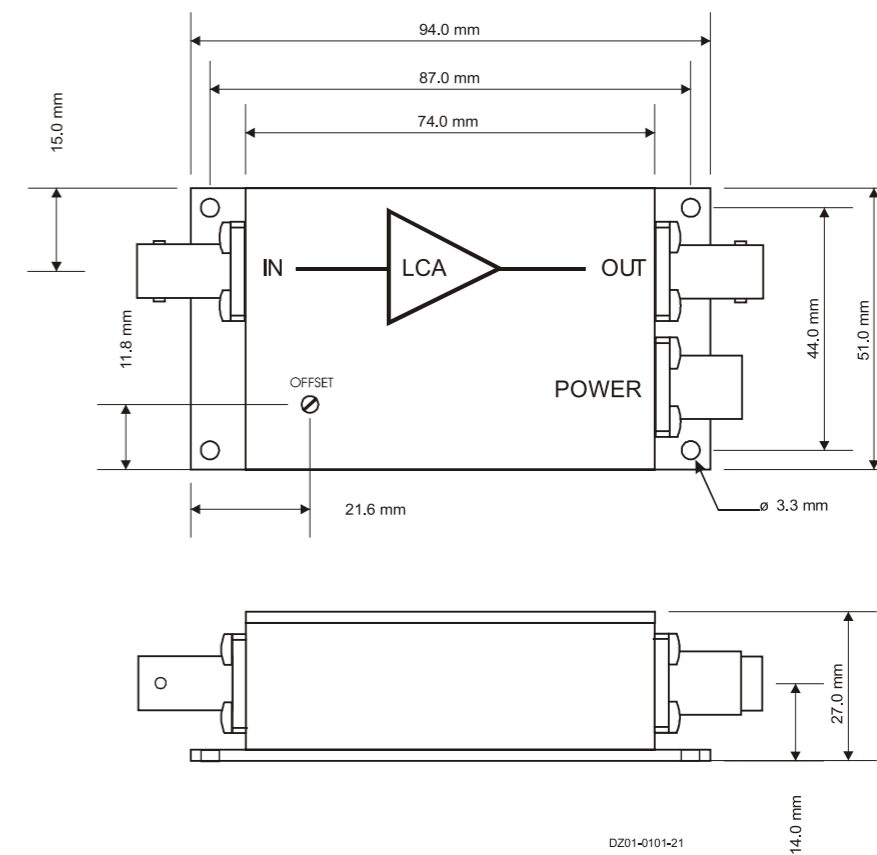| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs PIN 1 +Vs PIN 3 GND

Application Diagrams

Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current.

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Photo Detector Biasing in Photoconductive Mode:
Use for Fast Applications and if More Dark Current is Tolerable.
Bias Voltage Decreases Detector Capacitance.

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Dimensions

DZ01-0101-21

Current Amplifiers

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Components · Mechanics · Positioning

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TSC

Ultra-Low-Noise Current Amplifier

LCA-1K-5G

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 3 fA/$\sqrt{Hz}$ Equivalent Input Noise Current
- Bandwidth DC ... 1 kHz
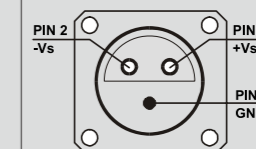- Transimpedance (Gain) 5×10^9 V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
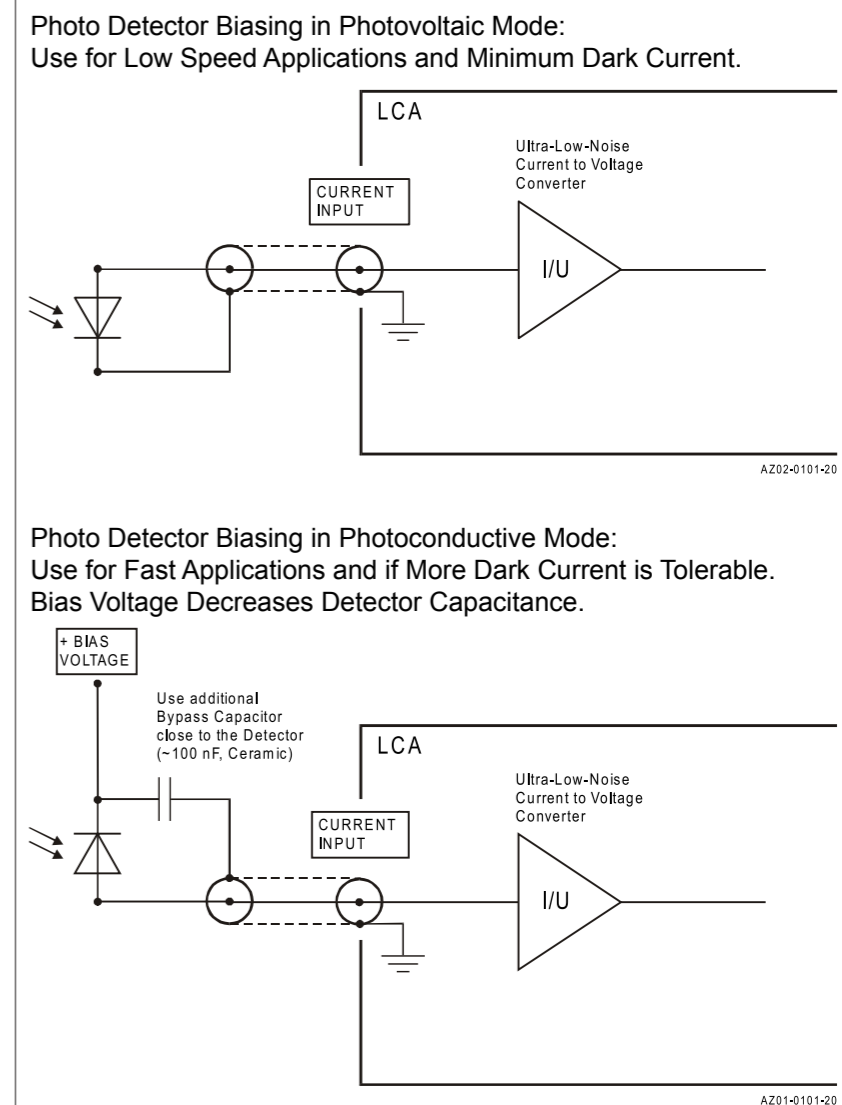- Preamplifier for Lock-Ins, A/D-Converters, etc.

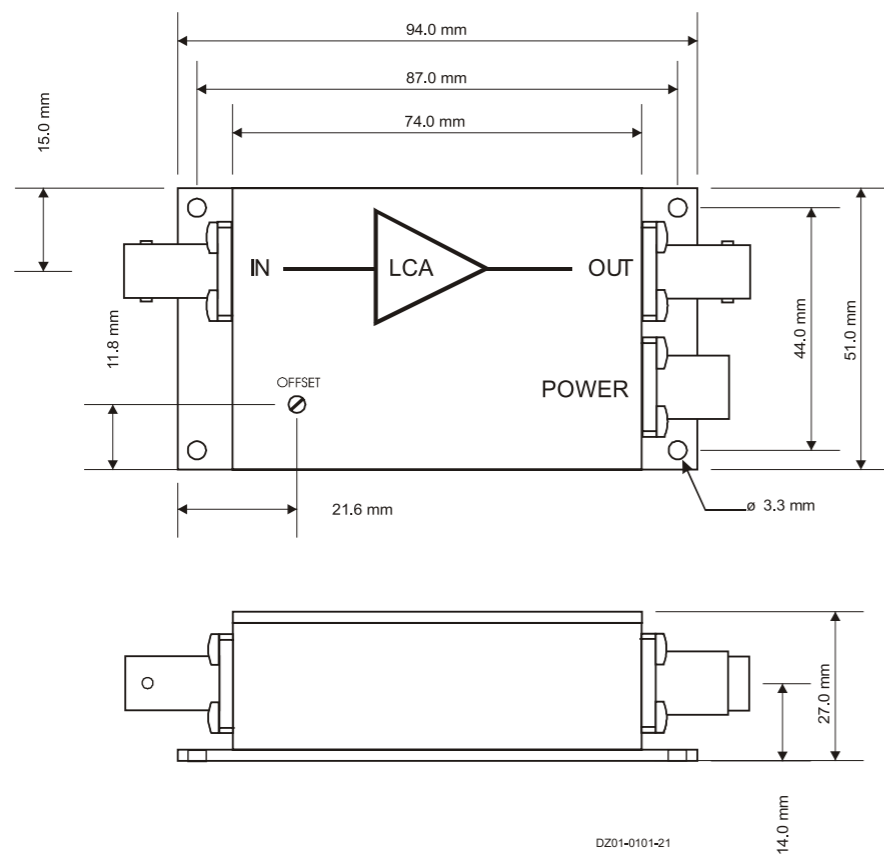| Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	5×10^9 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	1 Hz (- 3 dB)
	Rise- / Fall-Time	400 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	3 fA/$\sqrt{Hz}$ (@ 10 Hz)
	Equ. Input Noise Voltage	8 nV/$\sqrt{Hz}$ (@ 10 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 2.3 / 10 K
	Offset Current Compensation	± 600 pA, Adjustable by Offset-Trimpot
	Max. Input Current	± 2 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 45 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 7 V
	Power Supply Voltage	± 22 V

Specifications (continued)

Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current.
	Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance.

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Ultra-Low-Noise Current Amplifier

LCA-2K-2G

FEATURES
• Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
• Extremely Low Noise, 4.5 fA/√Hz Equivalent Input Noise Current
• Bandwidth DC ... 2 kHz
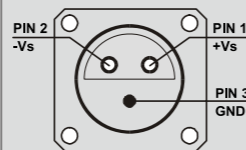• Transimpedance (Gain) 2×10^9 V/A

APPLICATIONS
• Photodiode- and Photomultiplier-Amplifier
• Spectroscopy
• Charge-Amplifier
• Ionisation Detectors
• Preamplifier for Lock-Ins, A/D-Converters, etc.

Dimensions

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	2×10^9 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	2 Hz (- 3 dB)
	Rise- / Fall-Time	200 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	4.5 fA/√Hz (@ 300 Hz)
	Equ. Input Noise Voltage	8 nV/√Hz (@ 300 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 2.3 / 10 K
	Offset Current Compensation	± 1.5 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 5 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 45 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 7 V
	Power Supply Voltage	± 22 V

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
44.0 mm
51.0 mm
21.6 mm
ø 3.3 mm
27.0 mm
14.0 mm
IN   LCA   OUT
OFFSET
POWER
DZ01-0101-21

Current Amplifiers

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Specifications (continued)

	Input	BNC
Connectors	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs　PIN 1 +Vs　PIN 3 GND

Application Diagrams

Photo Detector Biasing in Photovoltaic Mode:
Use for Low Speed Applications and Minimum Dark Current.

LCA — Ultra-Low-Noise Current to Voltage Converter — CURRENT INPUT — I/U
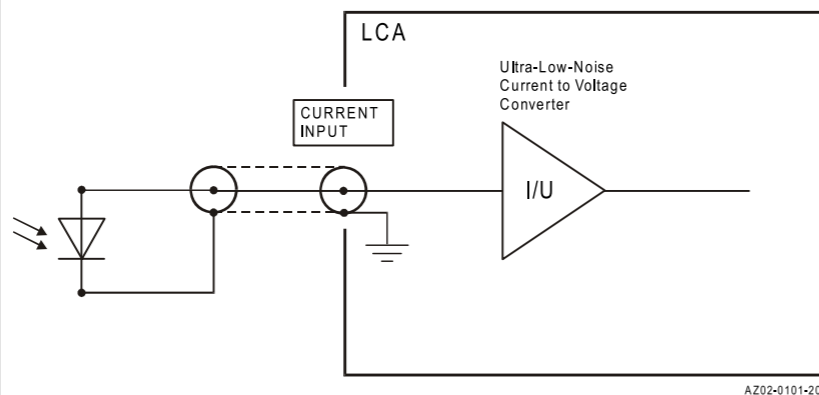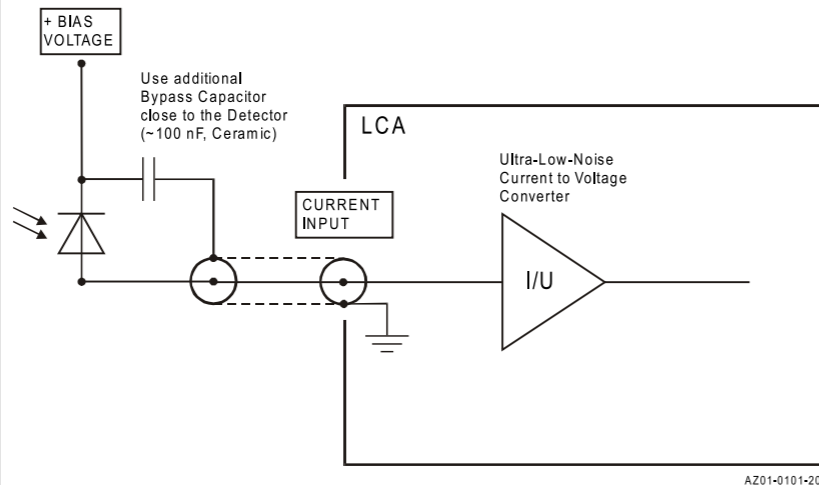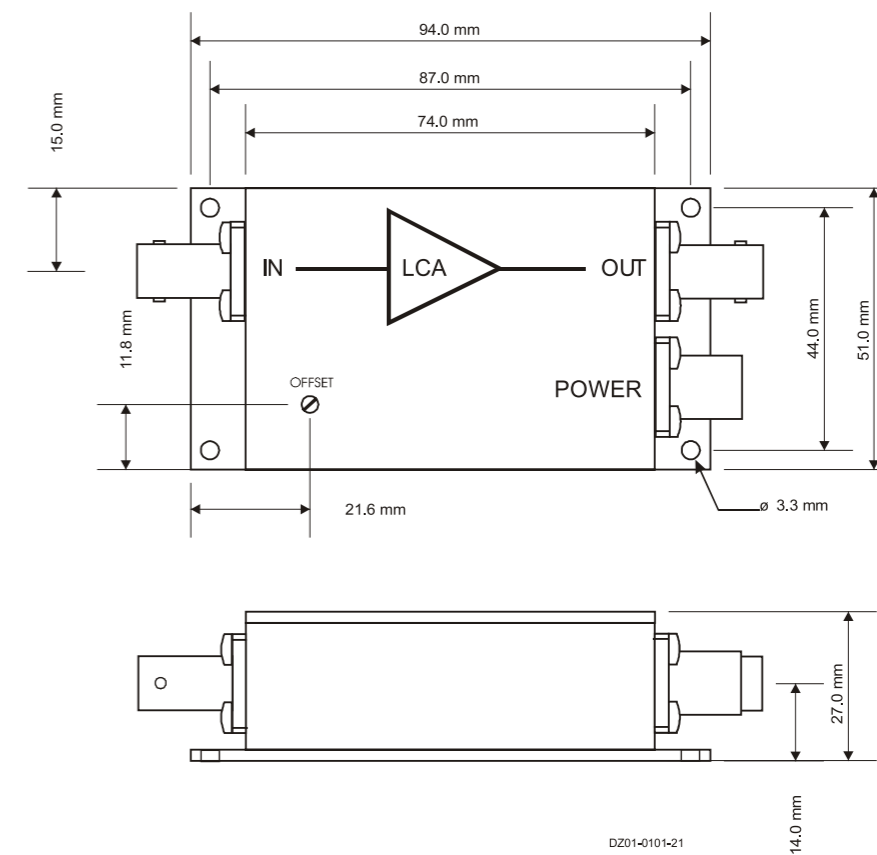
AZ02-0101-20

Photo Detector Biasing in Photoconductive Mode:
Use for Fast Applications and if More Dark Current is Tolerable.
Bias Voltage Decreases Detector Capacitance.

+ BIAS VOLTAGE
Use additional Bypass Capacitor close to the Detector (~100 nF, Ceramic)
LCA — Ultra-Low-Noise Current to Voltage Converter — CURRENT INPUT — I/U

AZ01-0101-20

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
21.6 mm
44.0 mm
51.0 mm
ø 3.3 mm
27.0 mm
14.0 mm

IN — LCA — OUT
OFFSET
POWER

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Current Amplifiers

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TSC

Ultra-Low-Noise Current Amplifier

LCA-4K-1G

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 6.5 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 4 kHz
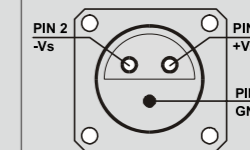- Transimpedance (Gain) 2×10^9 V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1×10^9 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	4 Hz (- 3 dB)
	Rise- / Fall-Time	100 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	6.5 fA/√Hz (@ 1 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 1 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 3 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 10 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 45 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Specifications (continued)

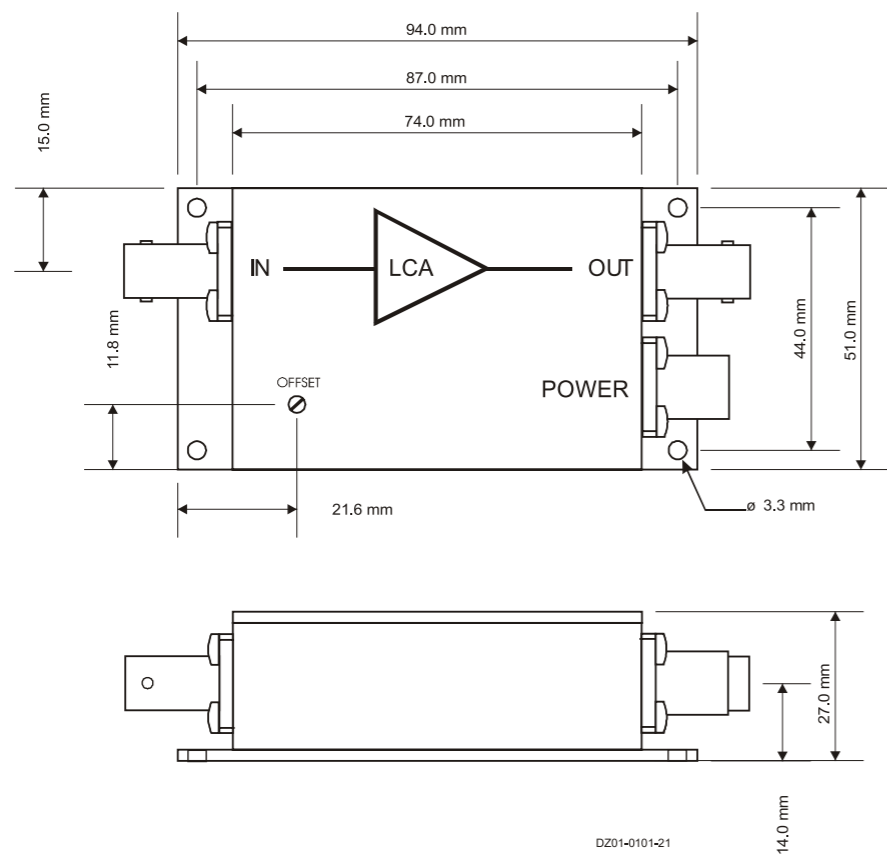| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs PIN 1 +Vs PIN 3 GND

Application Diagrams

Photo Detector Biasing in Photovoltaic Mode:
Use for Low Speed Applications and Minimum Dark Current.

LCA

CURRENT INPUT

Ultra-Low-Noise Current to Voltage Converter

I/U

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Photo Detector Biasing in Photoconductive Mode:
Use for Fast Applications and if More Dark Current is Tolerable.
Bias Voltage Decreases Detector Capacitance.

+ BIAS VOLTAGE

Use additional Bypass Capacitor close to the Detector (~100 nF, Ceramic)

LCA

CURRENT INPUT

Ultra-Low-Noise Current to Voltage Converter

I/U

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Current Amplifiers

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Solar Cells · Lighting

Tests · Instruments

Detection · Sensors

Components · Mechanics · Positioning

Lasers · Light Sources

Ultra-Low-Noise Current Amplifier

LCA-10K-500M

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 10 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 10 kHz
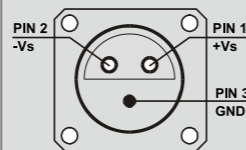- Transimpedance (Gain) 5 x 10^8 V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Dimensions

DZ01-0101-21
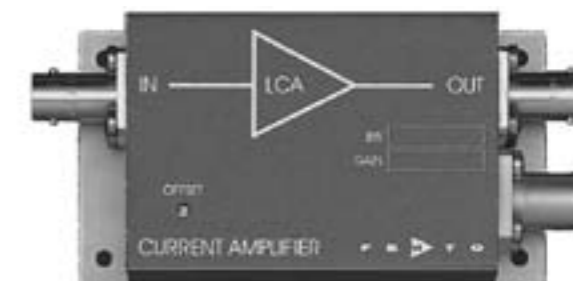
Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	5 x 10^8 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	10 Hz (- 3 dB)
	Rise- / Fall-Time	40 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	10 fA/√Hz (@ 1 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 1 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 6 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 20 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Current Amplifiers

Specifications (continued)

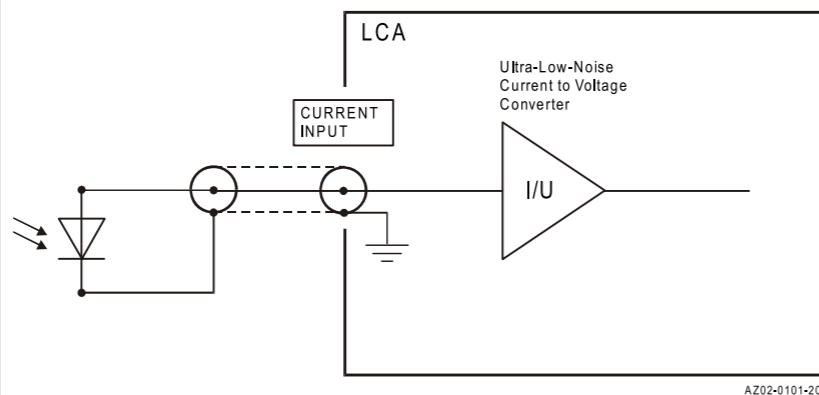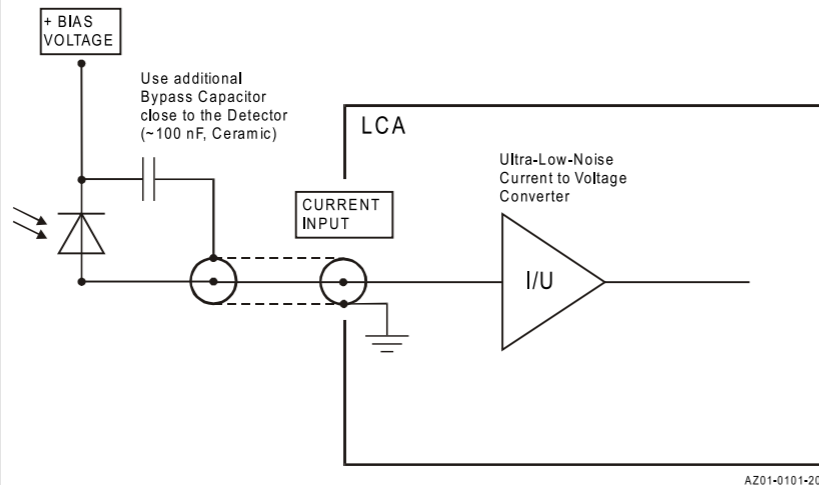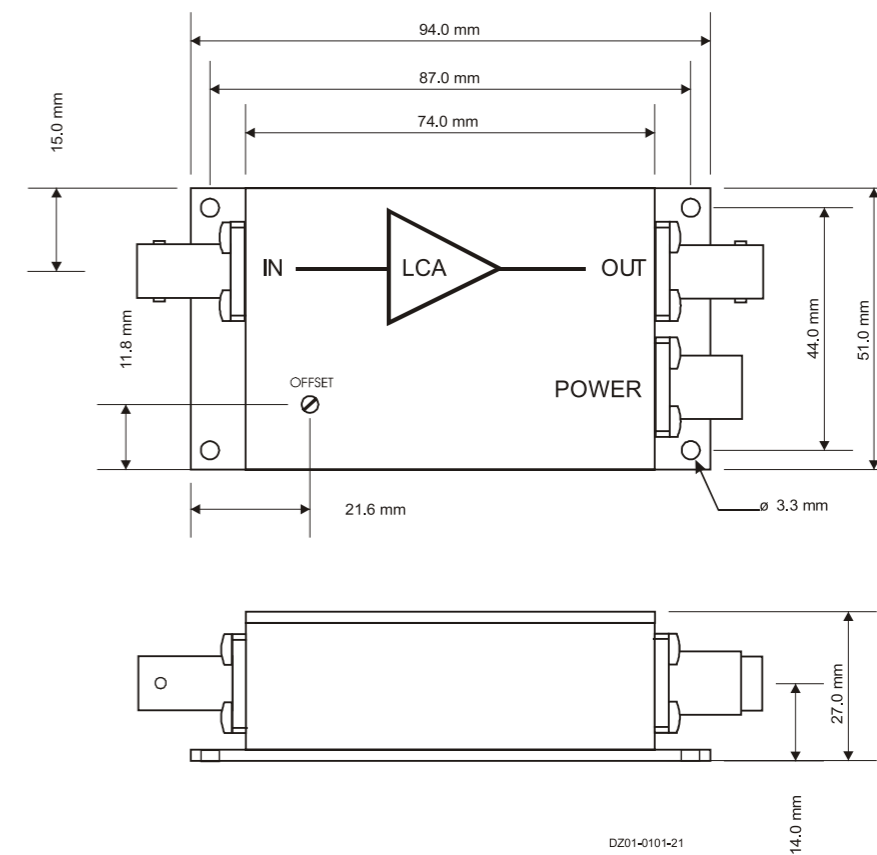| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs PIN 1 +Vs PIN 3 GND
Application Diagrams		Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. LCA CURRENT INPUT Ultra-Low-Noise Current to Voltage Converter I/U AZ02-0101-20 Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance. + BIAS VOLTAGE Use additional Bypass Capacitor close to the Detector (~100 nF, Ceramic) LCA CURRENT INPUT Ultra-Low-Noise Current to Voltage Converter I/U AZ01-0101-20

Dimensions

Current Amplifiers

Spectroscopes
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Lasers · Light Sources

# Ultra-Low-Noise Current Amplifier

LCA-20K-200M

FEATURES
• Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
• Extremely Low Noise, 14 fA/√Hz Equivalent Input Noise Current
• Bandwidth DC ... 20 kHz
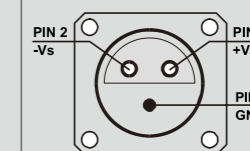• Transimpedance (Gain) 2×10^8 V/A

APPLICATIONS
• Photodiode- and Photomultiplier-Amplifier
• Spectroscopy
• Charge-Amplifier
• Ionisation Detectors
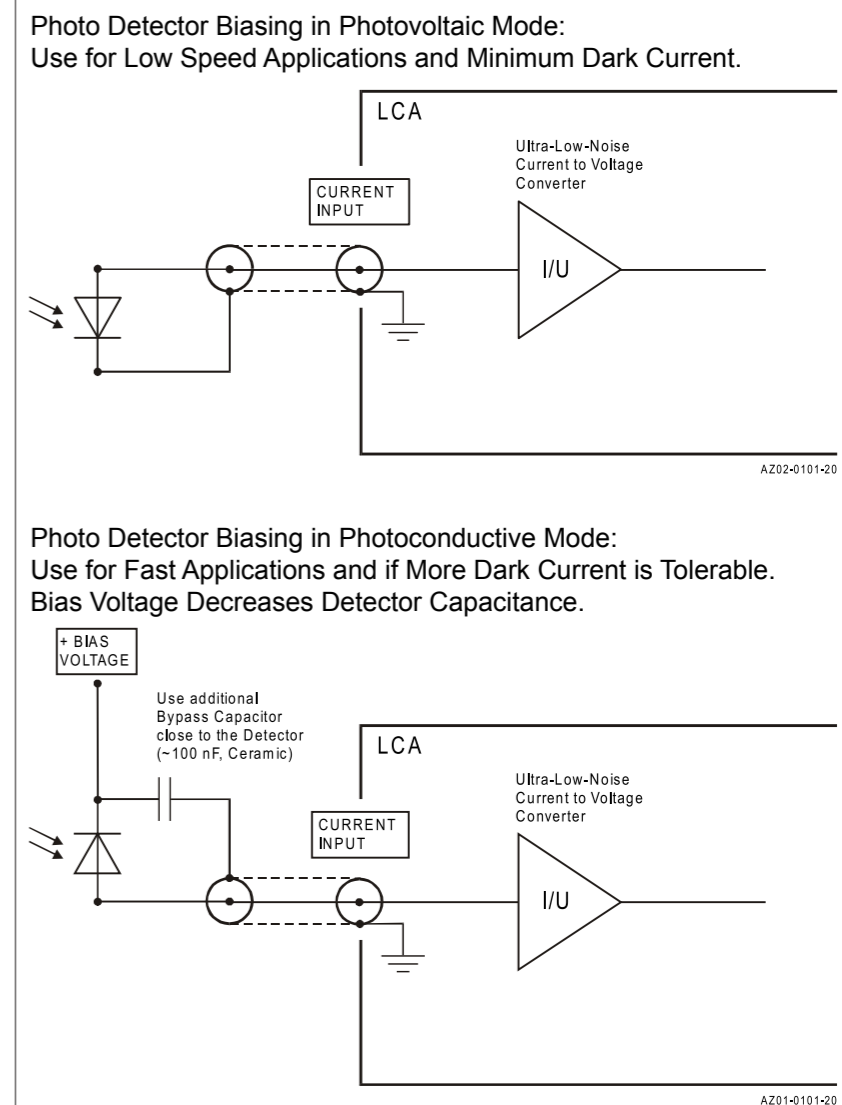• Preamplifier for Lock-Ins, A/D-Converters, etc.
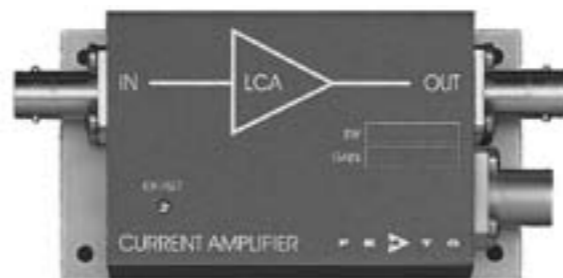
Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	2×10^8 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	20 Hz (- 3 dB)
	Rise- / Fall-Time	20 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	14 fA/√Hz (@ 1 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 1 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 15 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 50 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Specifications (continued)

Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

Application Diagrams

Photo Detector Biasing in Photovoltaic Mode:
Use for Low Speed Applications and Minimum Dark Current.

Photo Detector Biasing in Photoconductive Mode:
Use for Fast Applications and if More Dark Current is Tolerable.
Bias Voltage Decreases Detector Capacitance.

Current Amplifiers

鼎昕科技

TSC

Ultra-Low-Noise Current Amplifier

Dimensions

LCA-40K-100M

FEATURES
- Bandwidth and Frequency Response Independent of
- Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 19 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 40 kHz
- Transimpedance (Gain) 1 x 10^8 V/A
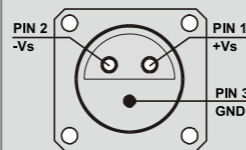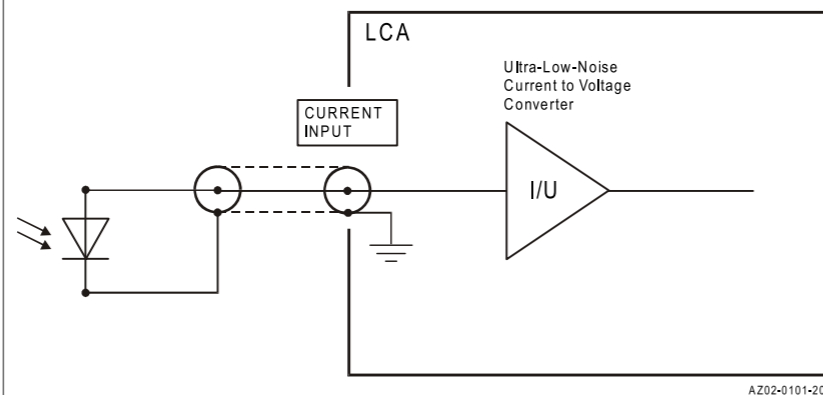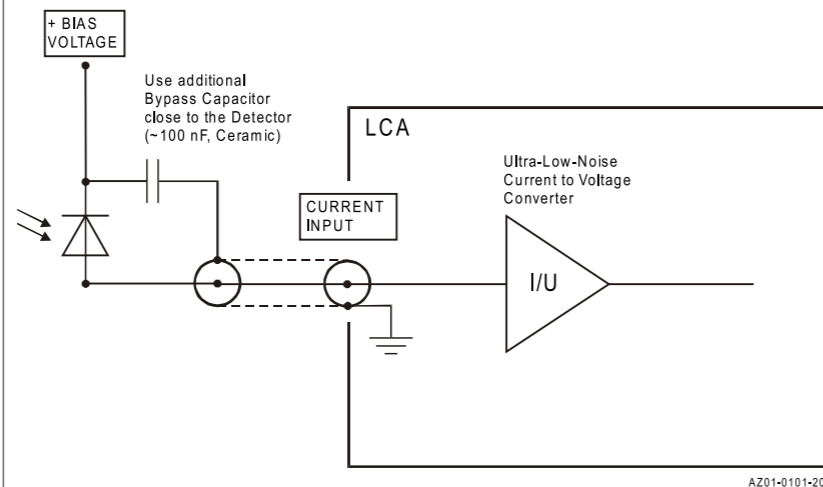
APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1 x 10^8 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	40 Hz (- 3 dB)
	Rise- / Fall-Time	10 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	19 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 10 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 30 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 100 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

94.0 mm

87.0 mm

74.0 mm

15.0 mm

IN   LCA   OUT

11.8 mm

OFFSET

POWER

44.0 mm   51.0 mm

21.6 mm

ø 3.3 mm

27.0 mm

DZ01-0101-21

14.0 mm

Current Amplifiers

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Semiconductors · Communications

Solar Cells · Lighting

Tests · Instruments

Detection · Sensors

Components · Mechanics · Positioning

Lasers · Light Sources

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Specifications (continued)

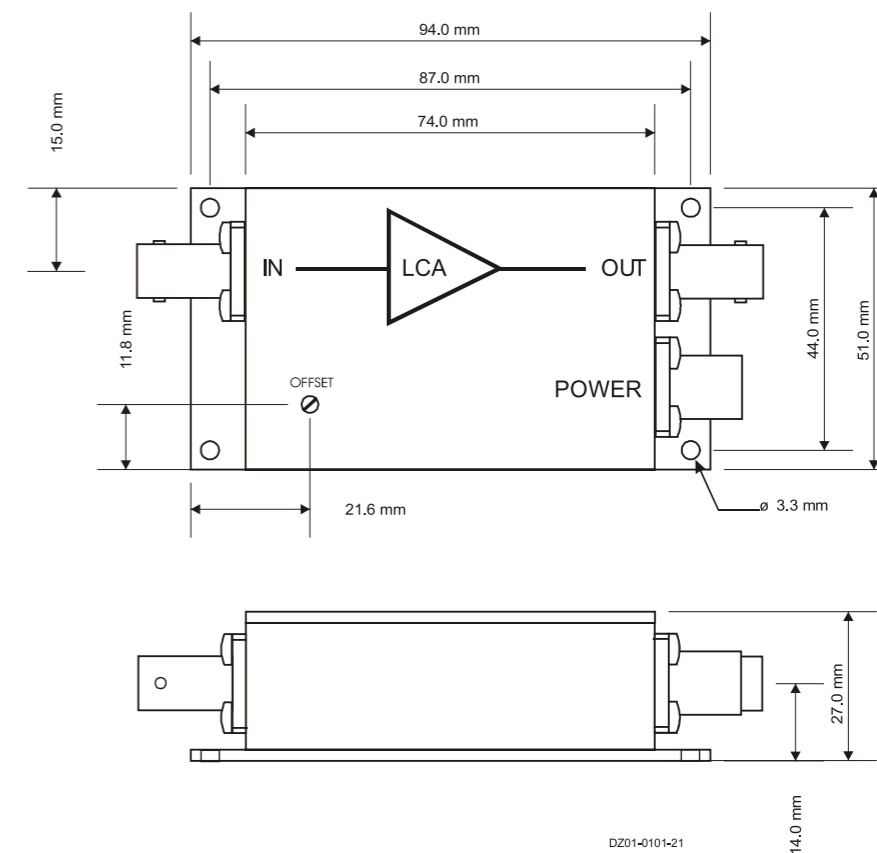|		
Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs PIN 1 +Vs PIN 3 GND
Application Diagrams		Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. LCA Ultra-Low-Noise Current to Voltage Converter CURRENT INPUT I/U AZ02-0101-20
		Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance. + BIAS VOLTAGE Use additional Bypass Capacitor close to the Detector (~100 nF, Ceramic) LCA Ultra-Low-Noise Current to Voltage Converter CURRENT INPUT I/U AZ01-0101-20

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
44.0 mm
51.0 mm
21.6 mm
ø 3.3 mm
IN   LCA   OUT
OFFSET   POWER
DZ01-0101-21
27.0 mm
14.0 mm

Current Amplifiers

Ultra-Low-Noise Current Amplifier

LCA-100K-50M

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 30 fA/$\sqrt{Hz}$ Equivalent Input Noise Current
- Bandwidth DC ... 100 kHz
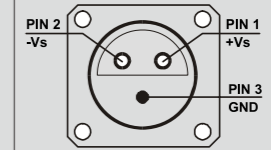- Transimpedance (Gain) 5×10^7 V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
- Preamplifier for Lock-Ins, A/D-Converters, etc.
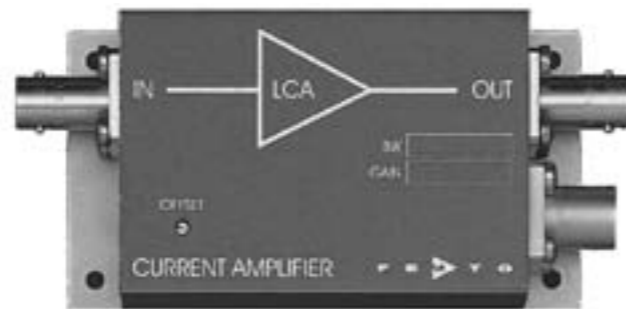
Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	5×10^7 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	100 Hz (- 3 dB)
	Rise- / Fall-Time	4 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	30 fA/$\sqrt{Hz}$ (@ 10 Hz)
	Equ. Input Noise Voltage	5 nV/$\sqrt{Hz}$ (@ 10 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 60 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 200 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Specifications (continued)

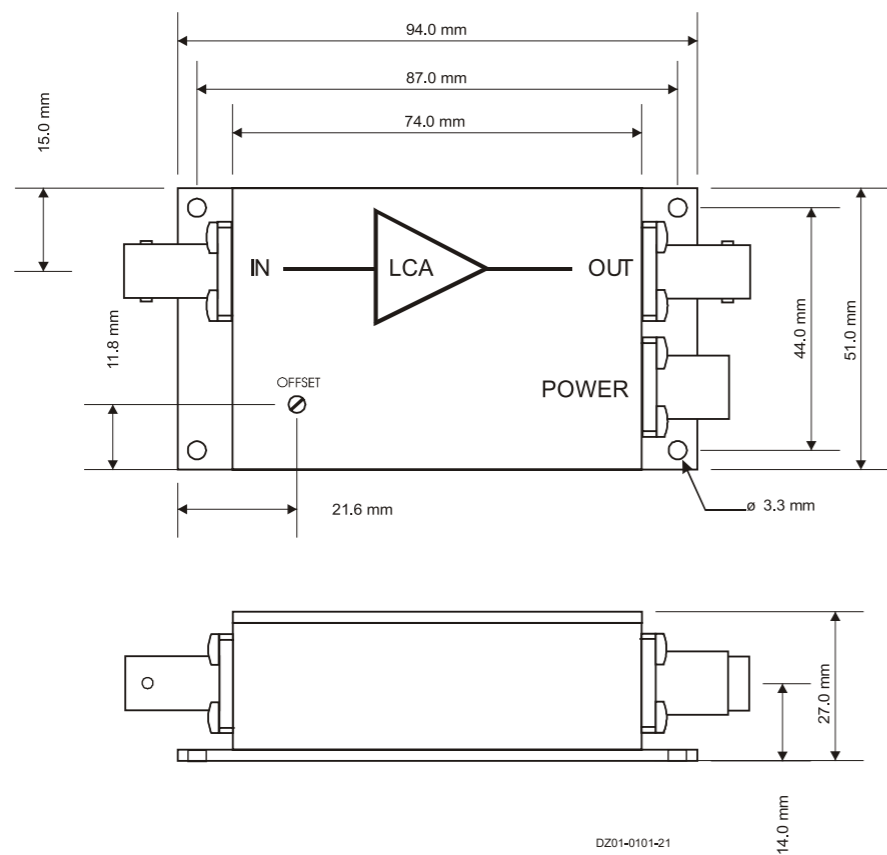| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance.

Current Amplifiers

Spectroscopes · CCD Cameras · Imaging

Semiconductors · Communications

Solar Cells · Lighting

Tests · Instruments

Detection · Sensors

Components · Mechanics · Positioning

Lasers · Light Sources

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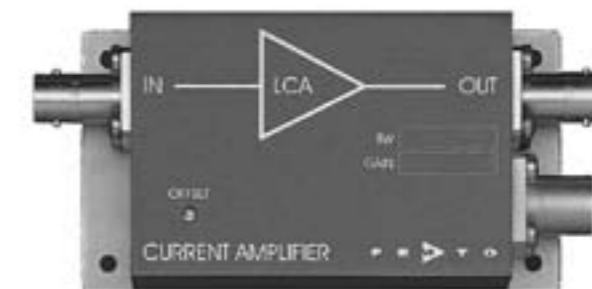TSC

Ultra-Low-Noise Current Amplifier

LCA-200K-20M

FEATURES
- Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 10 nF)
- Extremely Low Noise, 40 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 200 kHz
- Transimpedance (Gain) 2 x 10^7 V/A

APPLICATIONS
- Photodiode- and Photomultiplier-Amplifier
- Spectroscopy
- Charge-Amplifier
- Ionisation Detectors
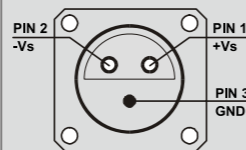- Preamplifier for Lock-Ins, A/D-Converters, etc.

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
IN LCA OUT
OFFSET
POWER
44.0 mm
51.0 mm
21.6 mm
ø 3.3 mm
27.0 mm
14.0 mm
DZ01-0101-21

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	2 x 10^7 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	200 Hz (- 3 dB)
	Rise- / Fall-Time	2 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	40 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 10 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 150 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 500 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Current Amplifiers

Spectroscopes · CCD Cameras · Imaging
Communications · Semiconductors · Solar Cells · Lighting
Instruments · Tests · Detection ·
Sensors
Mechanics · Positioning · Components · Lasers · Light Sources

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Specifications (continued)

Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs PIN 1 +Vs PIN 3 GND

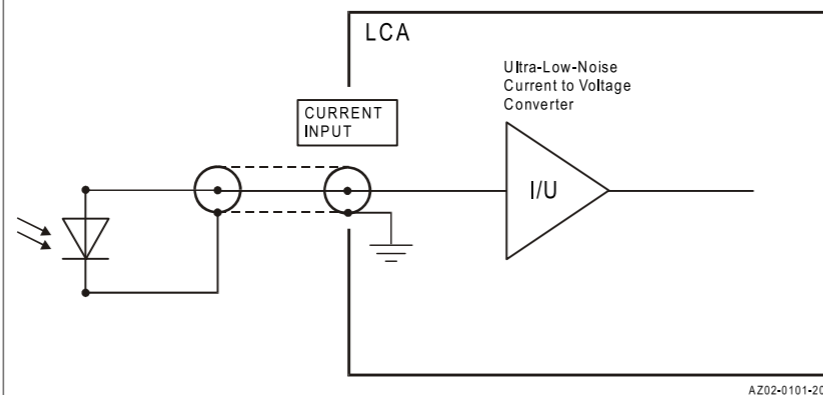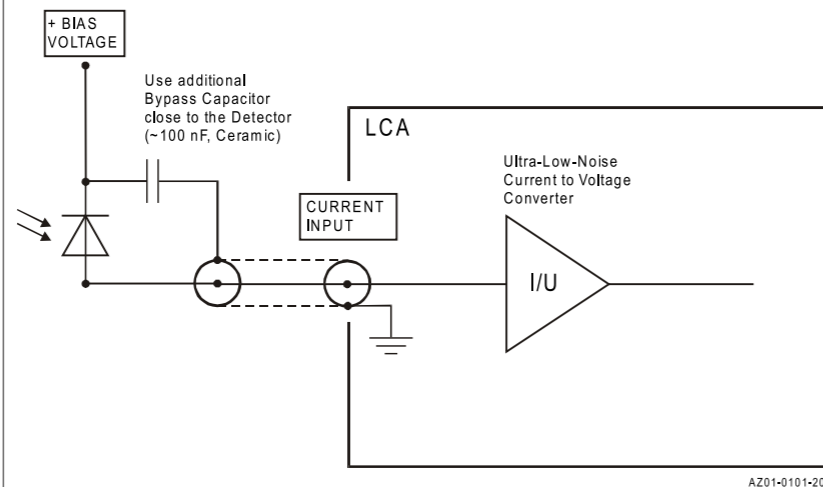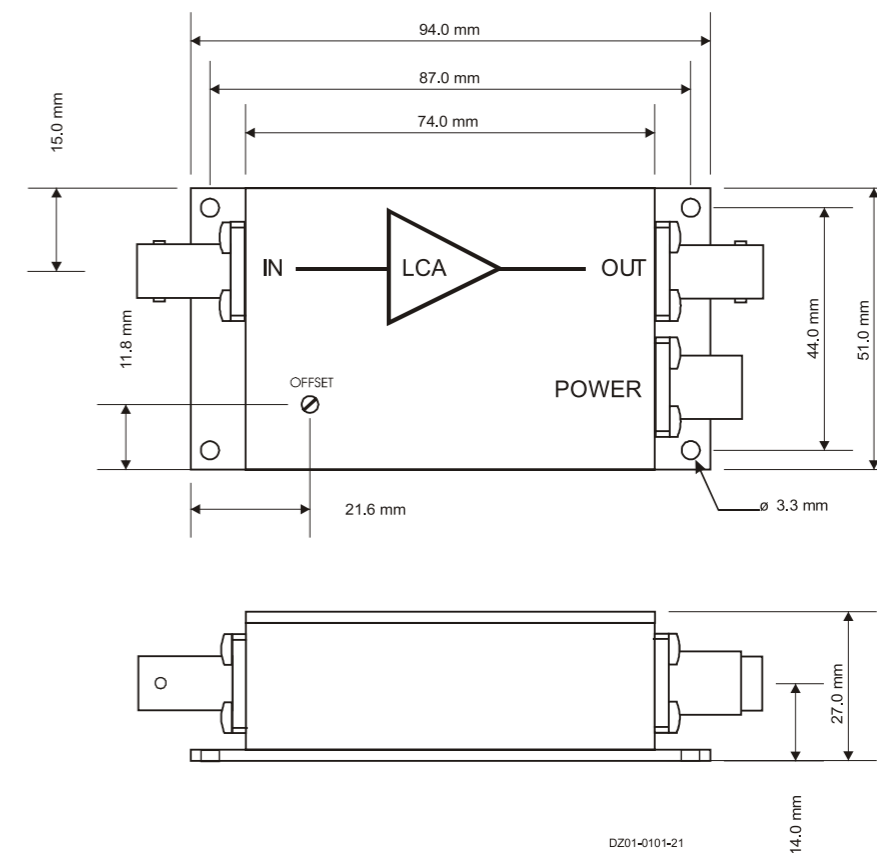| Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. AZ02-0101-20 Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance. AZ01-0101-20

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
21.6 mm
44.0 mm
51.0 mm
ø 3.3 mm
27.0 mm
14.0 mm

IN   LCA   OUT
OFFSET   POWER

DZ01-0101-21

Spectroscopes
CCD Cameras · Imaging
Semiconductors · Communications
Solar Cells · Lighting
Tests · Instruments
Detection · Sensors
Components · Mechanics · Positioning
Lasers · Light Sources

Current Amplifiers

Ultra-Low-Noise Current Amplifier

LCA-400K-10M

FEATURES
• Bandwidth and Frequency Response Independent of Detector-Capacitance (up to 1 nF)
• Extremely Low Noise, 65 fA/√Hz Equivalent Input Noise Current
• Bandwidth DC ... 400 kHz
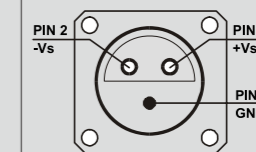• Transimpedance (Gain) 1 x 10^7 V/A

APPLICATIONS
• Photodiode- and Photomultiplier-Amplifier
• Spectroscopy
• Charge-Amplifier
• Ionisation Detectors
• Preamplifier for Lock-Ins, A/D-Converters, etc.

Specifications	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1 x 10^7 V/A (>10 kΩ Load)
	Accuracy	± 1%
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency	400 Hz (- 3 dB)
	Rise- / Fall-Time	1 µs (10% - 90%)
	Gain Flatness	± 0.1 dB
Input	Equ. Input Noise Current	65 fA/√Hz (@ 10 Hz)
	Equ. Input Noise Voltage	5 nV/√Hz (@ 10 Hz)
	Input Bias Current	2 fA typ.
	Input Bias Current Drift	Factor 1.7 / 10 K
	Offset Current Compensation	± 300 nA, Adjustable by Offset-Trimpot
	Max. Input Current	± 1 nA (Linear Amplification)
	Input Offset Voltage	< 1 mV
	DC Input Impedance	50 kΩ (Virtual) // 5 pF
Output	Output Voltage	± 10 V (>10 kΩ Load)
	Output Impedance	50 Ω (Terminate with >10 kΩ for best Performance)
	Max. Output Current	± 10 mA (Linear Amplification)
Power Supply	Supply Voltage	± 15 V
	Supply Current	± 40 mA typ.
Case	Weight	210 gr. (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Power Supply Voltage	± 22 V

Specifications (continued)

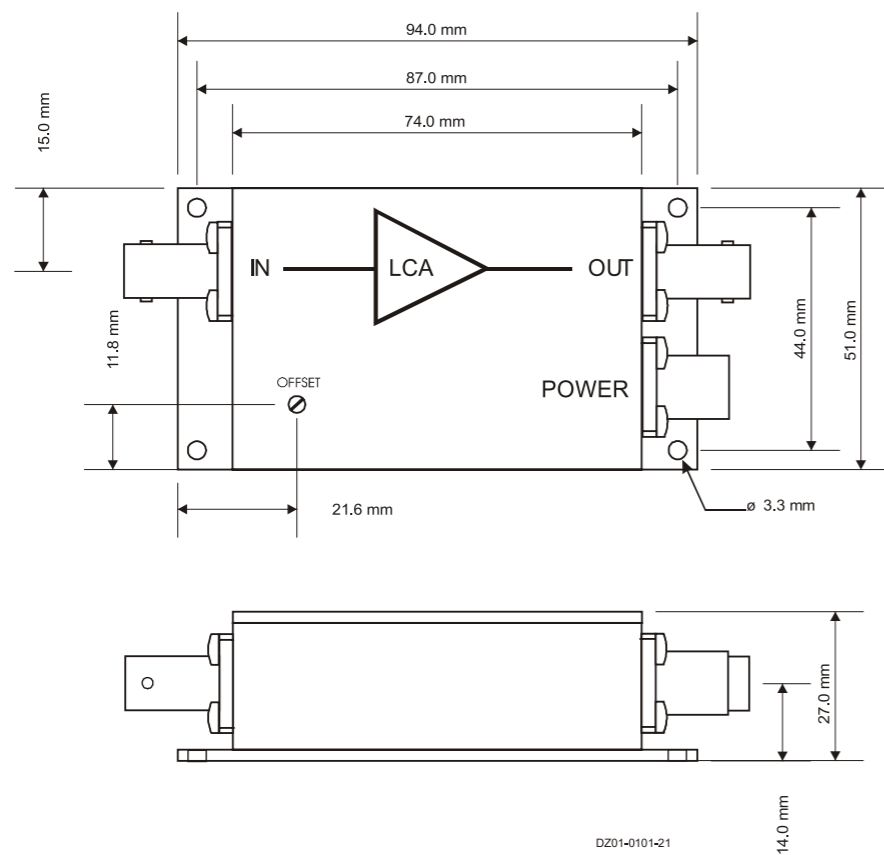| Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND

Application Diagrams	Photo Detector Biasing in Photovoltaic Mode: Use for Low Speed Applications and Minimum Dark Current. Photo Detector Biasing in Photoconductive Mode: Use for Fast Applications and if More Dark Current is Tolerable. Bias Voltage Decreases Detector Capacitance.

Dimensions

94.0 mm
87.0 mm
74.0 mm
15.0 mm
11.8 mm
IN   LCA   OUT
OFFSET
POWER
44.0 mm
51.0 mm
21.6 mm
ø 3.3 mm
27.0 mm
14.0 mm
DZ01-0101-21

# High Speed Current Amplifier

HCA-1M-1M

FEATURES
- Bandwidth and Frequency Response Independent of Detector Capacitance (up to 50 pF)
- Low Noise 270 fA/√Hz Equivalent Input Noise Current
- Bandwidth DC ... 1 MHz
- Transimpedance (Gain) 1 x 10^6 V/A
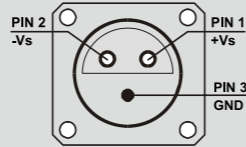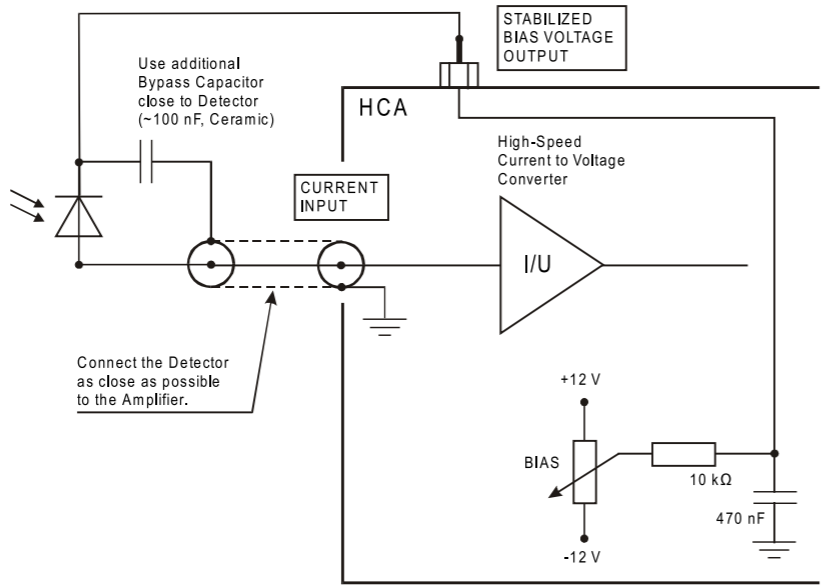- Protection against ± 3.5 kV Transients

APPLICATIONS
- Photodiode and Photomultiplier Amplifier
- Spectroscopy
- Charge Amplifier
- Ionisation Detectors
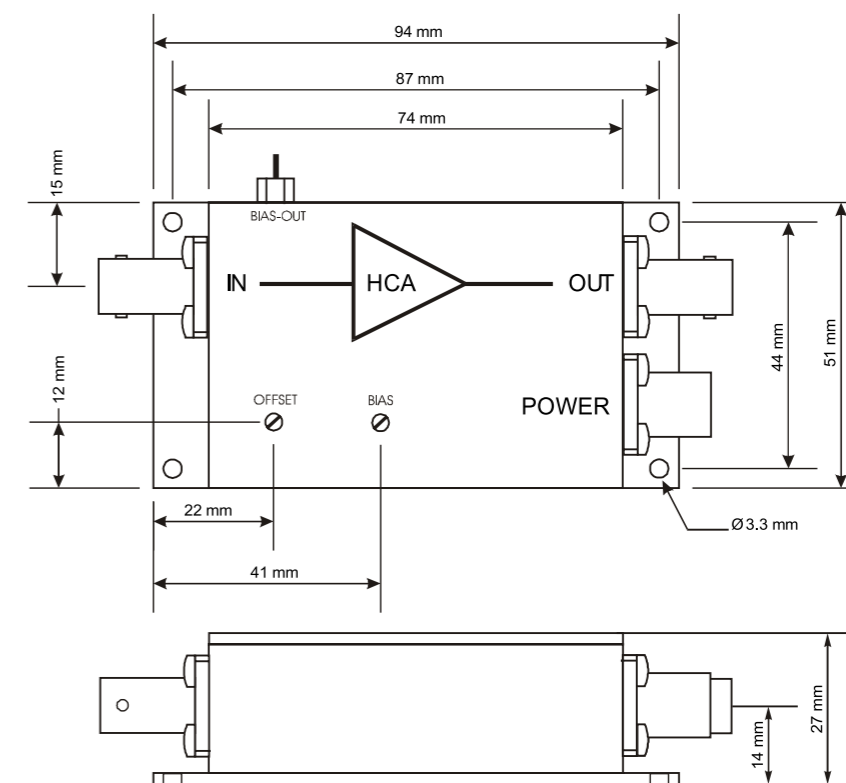- Preamplifier for Lock-Ins, A/D Converters, etc.
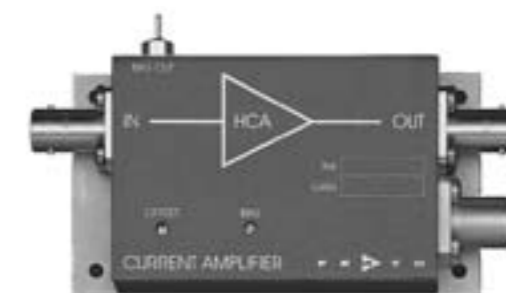
Specifications

	Test Conditions	Vs = ± 15 V, Ta = 25°C
Gain	Transimpedance	1 x 10^6 V/A (@ 50 Ω load)
	Gain Accuracy	± 1 %
Frequency Response	Lower Cut-Off Frequency	DC
	Upper Cut-Off Frequency (- 3 dB)	1 MHz
	Rise / Fall Time (10 % - 90 %)	350 ns
	Gain Flatness	± 0.3 dB
Input	Equ. Input Noise Current	270 fA/√Hz (@ 10 kHz)
	Equ. Input Noise Voltage	6 nV/√Hz (@ 10 kHz)
	Input Bias Current	5 pA typ.
	Input Bias Current Drift	factor 1.7 / 10 K
	Offset Current Compensation	± 2.7 µA adjustable by offset trimpot
	Input Current Range	± 1.5 µA (for linear amplification)
	Input Offset Voltage	2 mV
	DC Input Impedance	50 Ω (virtual) // 5 pF
Output	Output Voltage Range	± 1.5 V (@ 50 Ω load) for linear operation and low harmonic distortion
	Output Impedance	50 Ω (terminate with 50 Ω load for best performance)
Bias Output	Bias Output Voltage Range	± 12 V, adjustable by bias trimpot
	Bias Output Impedance	10 kΩ // 1 µF

Specifications (continued)

Power Supply	Supply Voltage	± 15 V
	Supply Current	± 50 mA typ. (depends on operating conditions, recommended power supply capability minimum ± 150 mA)
Case	Weight	210 g (0.5 lbs)
	Material	AlMg4.5Mn, nickel-plated
Temperature Range	Storage Temperature	-40 ... +100 °C
	Operating Temperature	0 ... +60 °C
Absolute Maximum Ratings	Input Voltage	± 5 V
	Input Voltage Transient	± 3.5 kV (pulsewidth 10 ns)
	Power Supply Voltage	± 22 V
Connectors	Input	BNC
	Output	BNC
	Power Supply	LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND PIN 2 -Vs　PIN 1 +Vs　PIN 3 GND
Application Diagrams	Photo Detector Biasing in Photoconductive Mode: Best choice for high speed applications and optimum signal to noise performance.	

Use additional Bypass Capacitor close to Detector (~100 nF, Ceramic)

STABILIZED BIAS VOLTAGE OUTPUT

HCA

CURRENT INPUT

High-Speed Current to Voltage Converter

I/U

Connect the Detector as close as possible to the Amplifier.

+12 V

BIAS

10 kΩ

470 nF

-12 V

AZ01-0201-20

Dimensions

94 mm
87 mm
74 mm
15 mm
BIAS-OUT
IN　HCA　OUT
12 mm
OFFSET　BIAS　POWER
44 mm　51 mm
22 mm
41 mm
Ø 3.3 mm

27 mm
14 mm

DZ01-0201-22

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Current Amplifiers