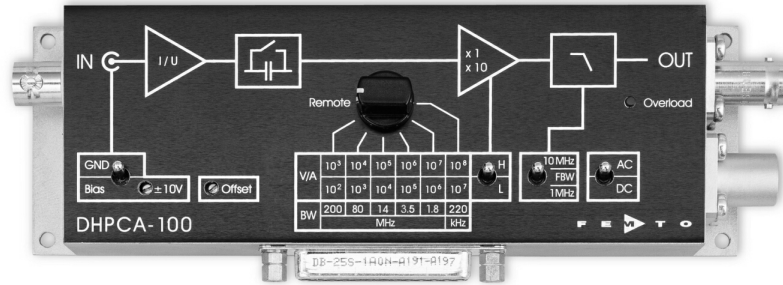


Variable Gain High Speed Current Amplifier



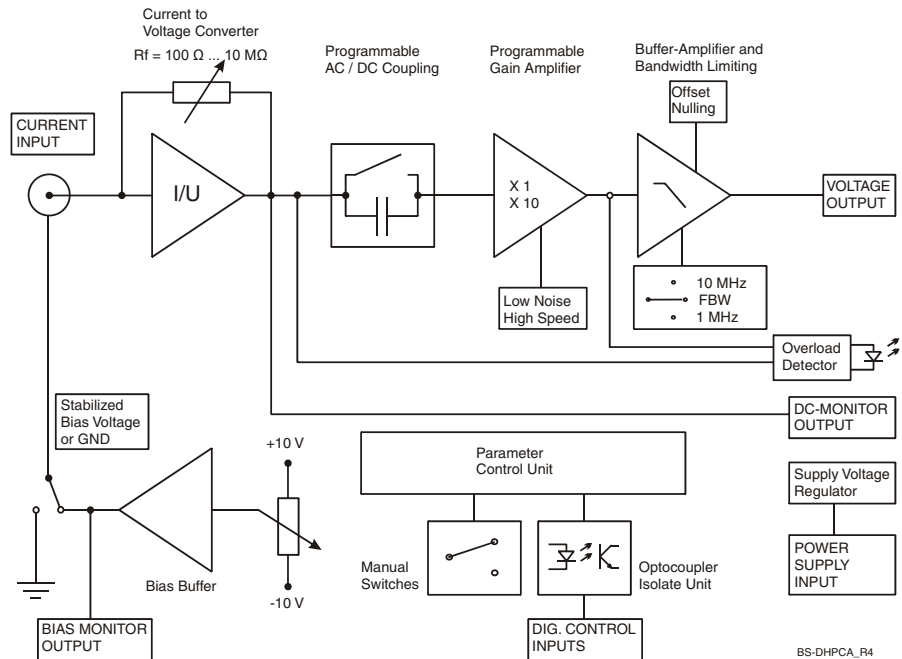
Features

- Transimpedance (Gain) Switchable from 1 x 10² to 1 x 10⁸ V/A
- Bandwidth from DC up to 200 MHz
- Upper Cut-Off Frequency Switchable to 1 MHz, 10 MHz or Full Bandwidth
- Switchable AC/DC Coupling
- Adjustable Bias Voltage for Use with External Photo Detectors
- Input Protection Against ± 1.5 kV Transients
- Local and Remote Control of All Main Functions

Applications

- Photodiode and Photomultiplier Amplifier
- Spectroscopy
- Beam Monitoring for Particle Accelerators / Synchrotrons
- Ionisation Detectors
- Pre-amplifier for A/D-Converters, HF Lock-Ins, etc.

Block Diagram



Variable Gain High Speed Current Amplifier

Specifications	<i>Test Conditions</i>	<i>V_s = ± 15 V, T_a = 25°C</i>					
Gain	Transimpedance	$1 \times 10^2 \dots 1 \times 10^8$ V/A					
	Gain Accuracy	$\pm 1 \%$					
Frequency Response	Lower Cut-Off Frequency	DC / 100 Hz, switchable					
	Upper Cut-Off Frequency	dependent on gain setting up to 200 MHz (see table below), switchable to 10 MHz or 1 MHz					
Input	Equ. Input Noise Current	see table below					
	Equ. Input Noise Voltage	typ. 2.8 nV/ $\sqrt{\text{Hz}}$					
	Input Bias Current	typ. 20 pA					
Performance depending on Gain Setting	Gain Setting (Low Noise) (V/A)	10^2	10^3	10^4	10^5	10^6	10^7
	Upper Cut-Off Frequency (-3 dB)	200 MHz	80 MHz	14 MHz	3.5 MHz	1.8 MHz	220 kHz
	Rise / Fall Time (10% - 90%)	1.8 ns	4.4 ns	25 ns	0.1 μ s	0.2 μ s	1.6 μ s
	Input Noise Current Density ($\sqrt{\text{Hz}}$)	200 pA	16 pA	2.1 pA	500 fA	170 fA	60 fA
	measured at	1 MHz	1 MHz	1 MHz	10 kHz	10 kHz	10 kHz
	Integr. Input Noise Current (rms)*	2.2 μ A	270 nA	33 nA	5.4 nA	1.1 nA	140 pA
	Max. Input Current (\pm)	10 mA	1 mA	0.1 mA	10 μ A	1 μ A	0.1 μ A
	DC Input Impedance	50 Ω	50 Ω	60 Ω	100 Ω	1 k Ω	10 k Ω
	Gain setting (High Speed) (V/A)	10^3	10^4	10^5	10^6	10^7	10^8
	Upper Cut-Off Frequency (-3 dB)	175 MHz	80 MHz	14 MHz	3.5 MHz	1.8 MHz	220 kHz
	Rise / Fall Time (10% - 90%)	2.0 ns	4.4 ns	25 ns	0.1 μ s	0.2 μ s	1.6 μ s
	Input Noise Current Density ($\sqrt{\text{Hz}}$)	140 pA	6.0 pA	1.5 pA	450 fA	150 fA	55 fA
	measured at	1 MHz	1 MHz	1 MHz	10 kHz	10 kHz	10 kHz
	Integr. Input Noise Current (rms)*	1.5 μ A	230 nA	30 nA	5.3 nA	1.1 nA	140 pA
	Max. Input Current (\pm)	1 mA	0.1 mA	10 μ A	1 μ A	0.1 μ A	10 nA
DC Input Impedance	50 Ω	50 Ω	60 Ω	100 Ω	1 k Ω	10 k Ω	

* The integrated input noise is measured with an open but shielded amplifier input in the full bandwidth ("FBW") setting. The input referred peak-peak noise can be calculated from the rms noise as follows:

$$I_{\text{peak-peak}} = I_{\text{rms}} \times 6$$

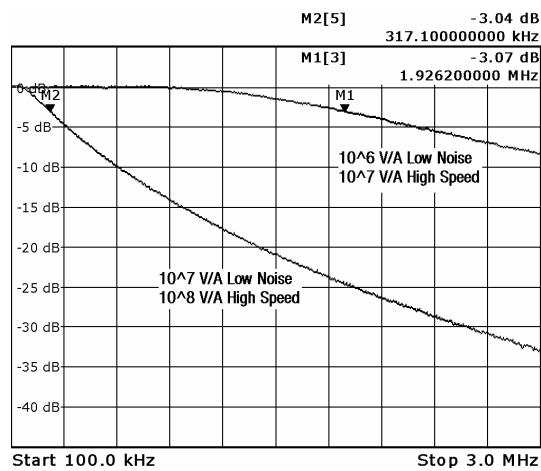
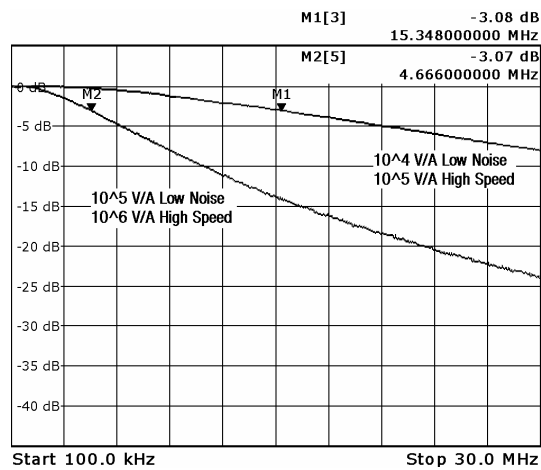
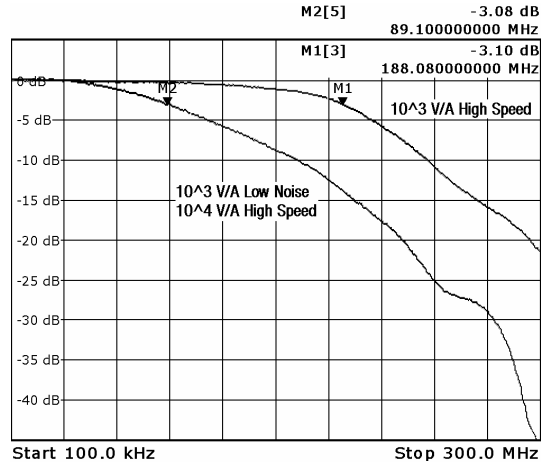
The output noise is given by: $U_{\text{peak-peak}} = I_{\text{peak-peak}} \times \text{Gain}$

Upper cut-off frequencies and equivalent input noise currents given in this table are typical values only which will depend on the source capacitance. Keep the source capacitance as low as possible by using short cables at the input to achieve best possible bandwidth and noise performance. For the dependence of the upper cut-off frequencies on the source capacitance please see the diagrams on the next page.

Variable Gain High Speed Current Amplifier

Specifications (continued)

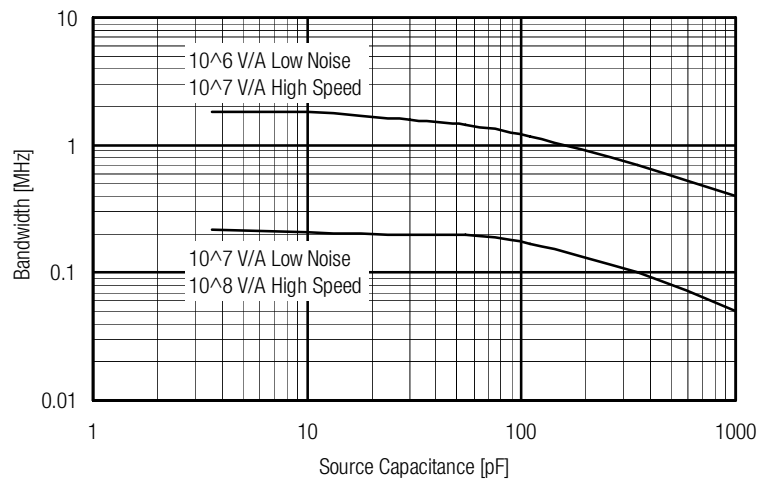
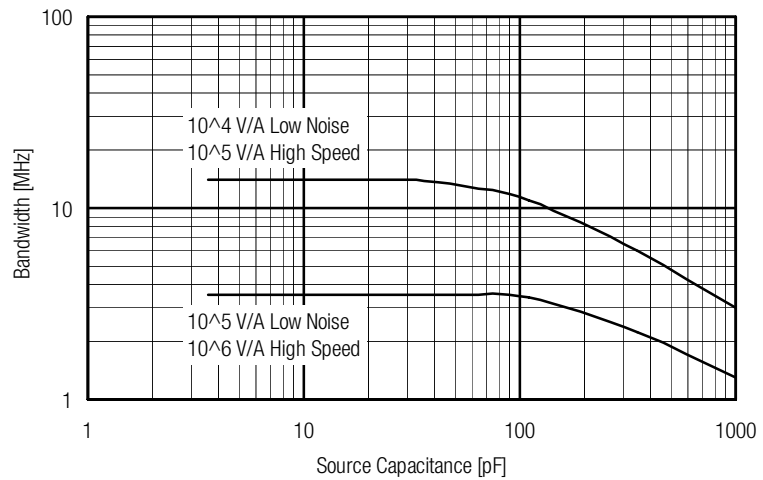
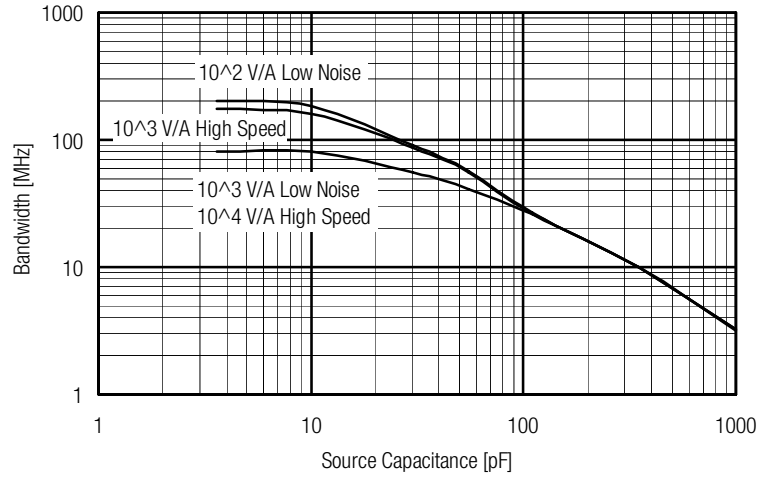
Frequency Response Plots



Variable Gain High Speed Current Amplifier

Specifications (continued)

Dependence of Upper Cut-Off Frequency on Source Capacitance



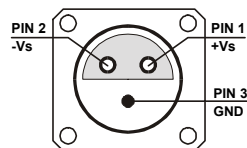
Variable Gain High Speed Current Amplifier

Specifications (continued)

Output	Output Voltage Range $\pm 1\text{ V}$ (@ 50 Ω load), for linear amplification Output Impedance 50 Ω (designed for 50 Ω load) Slew Rate 1,000 V/ μ s Max. Output Current $\pm 40\text{ mA}$ Output Offset Compensation adjustable by offset trimpot and external control voltage, output offset compensation range min. $\pm 100\text{ mV}$									
DC Monitor Output	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Monitor Output Gain</th> <th style="text-align: left;">Mode</th> <th style="text-align: left;">Monitor Gain</th> </tr> </thead> <tbody> <tr> <td></td> <td>low noise</td> <td>gain setting divided by -1</td> </tr> <tr> <td></td> <td>high speed</td> <td>gain setting divided by -10</td> </tr> </tbody> </table> Monitor Output Polarity inverting Monitor Output Voltage Range $\pm 1\text{ V}$ (@ $\geq 1\text{ M}\Omega$ load) Monitor Output Bandwidth DC ... 1 kHz Monitor Output Impedance 1 k Ω (designed for $\geq 1\text{ M}\Omega$ load)	Monitor Output Gain	Mode	Monitor Gain		low noise	gain setting divided by -1		high speed	gain setting divided by -10
Monitor Output Gain	Mode	Monitor Gain								
	low noise	gain setting divided by -1								
	high speed	gain setting divided by -10								
Detector Bias	Bias Voltage Range $\pm 10\text{ V}$, max. 22 mA, connected to shield of BNC input socket, adjustable by trimpot, switchable to GND Warning A bias current of 20 mA may destroy sensitive detectors. Please pay attention to the correct polarity and careful adjustment of the bias voltage to protect your detector. Put the bias switch to GND (ground) if you do not want to use the internal bias voltage. The positive and the negative supply voltage of the amplifier must be switched "on" and "off" simultaneously in order to avoid overvoltage at the bias output.									
Bias Voltage Monitor Output	Description The signal at the bias voltage monitor output (pin 7 of the Sub-D control socket) is identical to the detector bias voltage present on the shield of the input BNC socket. By monitoring the signal on pin 7 the desired bias voltage can be adjusted through the bias trimpot. Even if the bias switch is set to "GND", the bias voltage can be monitored and set to the desired value. Monitor Output Polarity non-inverting Monitor Output Voltage Range $\pm 10\text{ V}$ (@ $\geq 1\text{ M}\Omega$ load) Monitor Output Impedance 1 k Ω (designed for $\geq 1\text{ M}\Omega$ load)									
Indicator LED	Function overload									
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 Overload Output non active: 0 V, max. - 1 mA, active: 5.1 V, max. 7 mA									
Ext. Offset Control	Control Voltage Range $\pm 10\text{ V}$ Offset Control Input Impedance 15 k Ω									
Power Supply	Supply Voltage $\pm 15\text{ V}$ Supply Current typ. + 110 / - 90 mA (depends on operating conditions, recommended power supply capability min. $\pm 200\text{ mA}$) Stabilized Power Supply Output $\pm 12\text{ V}$, max. 50 mA, + 5 V, max. 150 mA									

Variable Gain High Speed Current Amplifier

Specifications (continued)											
Case	Weight 320 g (0.74 lb.) Material AlMg4.5Mn, nickel-plated										
Temperature Range	Storage Temperature - 40 ... + 100 °C Operating Temperature 0 ... + 60 °C										
Absolute Maximum Ratings	Signal Input Voltage ± 5 V Transient Input Voltage ± 1.5 kV (out of a 1 nF source) Control Input Voltage - 5 V / + 16 V Power Supply Voltage ± 20 V										
Connectors	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Input</td> <td>BNC, isolated</td> </tr> <tr> <td>Output</td> <td>BNC</td> </tr> <tr> <td>Detector Bias Output</td> <td>shield of input BNC</td> </tr> <tr> <td>Power Supply</td> <td> LEMO series 1S, 3-pin fixed socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND </td> </tr> <tr> <td style="vertical-align: top;">Control Port</td> <td> Sub-D 25-pin, female, qual. class 2 Pin 1: + 12 V (stabilized power supply output) Pin 2: - 12 V (stabilized power supply output) Pin 3: AGND (analog ground) Pin 4: + 5 V (stabilized power supply output) Pin 5: digital output: overload Pin 6: DC monitor output Pin 7: bias monitor output Pin 8: output offset control voltage input Pin 9: DGND (ground for digital control pins 10 - 16) Pin 10: digital control input: gain, LSB Pin 11: digital control input: gain Pin 12: digital control input: gain, MSB Pin 13: digital control input: AC/DC Pin 14: digital control input: high speed / low noise mode Pin 15: upper cut-off frequency limit 10 MHz PIN 16: upper cut-off frequency limit 1 MHz PIN 17-25 NC </td> </tr> </table>	Input	BNC, isolated	Output	BNC	Detector Bias Output	shield of input BNC	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: + 12 V (stabilized power supply output) Pin 2: - 12 V (stabilized power supply output) Pin 3: AGND (analog ground) Pin 4: + 5 V (stabilized power supply output) Pin 5: digital output: overload Pin 6: DC monitor output Pin 7: bias monitor output Pin 8: output offset control voltage input Pin 9: DGND (ground for digital control pins 10 - 16) Pin 10: digital control input: gain, LSB Pin 11: digital control input: gain Pin 12: digital control input: gain, MSB Pin 13: digital control input: AC/DC Pin 14: digital control input: high speed / low noise mode Pin 15: upper cut-off frequency limit 10 MHz PIN 16: upper cut-off frequency limit 1 MHz PIN 17-25 NC
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Variable Gain High Speed Current Amplifier

Remote Control Operation	<p>General</p> <p>Remote control input pins are opto-isolated and connected by a logical OR function to the local switch settings. For remote control set the corresponding local switches to "Remote", "DC", "L" (low noise mode) and "FBW", and select the desired setting via a bit code at the corresponding digital inputs. Mixed operation, e.g. local AC/DC setting and remote controlled gain setting, is also possible.</p> <p>Switch setting "Bias / GND" is not remote controllable.</p>																																			
Gain Setting	<table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Low Noise Pin 14=LOW Gain (V/A)</th> <th style="text-align: left;">High Speed Pin 14=HIGH Gain (V/A)</th> <th style="text-align: left;">Pin 12 MSB</th> <th style="text-align: left;">Pin 11</th> <th style="text-align: left;">Pin 10 LSB</th> </tr> </thead> <tbody> <tr><td>10^2</td><td>10^3</td><td>LOW</td><td>LOW</td><td>LOW</td></tr> <tr><td>10^3</td><td>10^4</td><td>LOW</td><td>LOW</td><td>HIGH</td></tr> <tr><td>10^4</td><td>10^5</td><td>LOW</td><td>HIGH</td><td>LOW</td></tr> <tr><td>10^5</td><td>10^6</td><td>LOW</td><td>HIGH</td><td>HIGH</td></tr> <tr><td>10^6</td><td>10^7</td><td>HIGH</td><td>LOW</td><td>LOW</td></tr> <tr><td>10^7</td><td>10^8</td><td>HIGH</td><td>LOW</td><td>HIGH</td></tr> </tbody> </table>	Low Noise Pin 14=LOW Gain (V/A)	High Speed Pin 14=HIGH Gain (V/A)	Pin 12 MSB	Pin 11	Pin 10 LSB	10^2	10^3	LOW	LOW	LOW	10^3	10^4	LOW	LOW	HIGH	10^4	10^5	LOW	HIGH	LOW	10^5	10^6	LOW	HIGH	HIGH	10^6	10^7	HIGH	LOW	LOW	10^7	10^8	HIGH	LOW	HIGH
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Variable Gain High Speed Current Amplifier

Application Diagrams

Photo Detector Biasing through Internal Bias Voltage Source

Set bias switch to "Bias". The photodiode is biased through the amplifier with the bias voltage applied to the shield of the isolated BNC input socket. The photodiode should be mounted in a metal case. For optimum shielding the metal case has to be isolated from the photodiode but connected to the housing of the DHPCA-100.

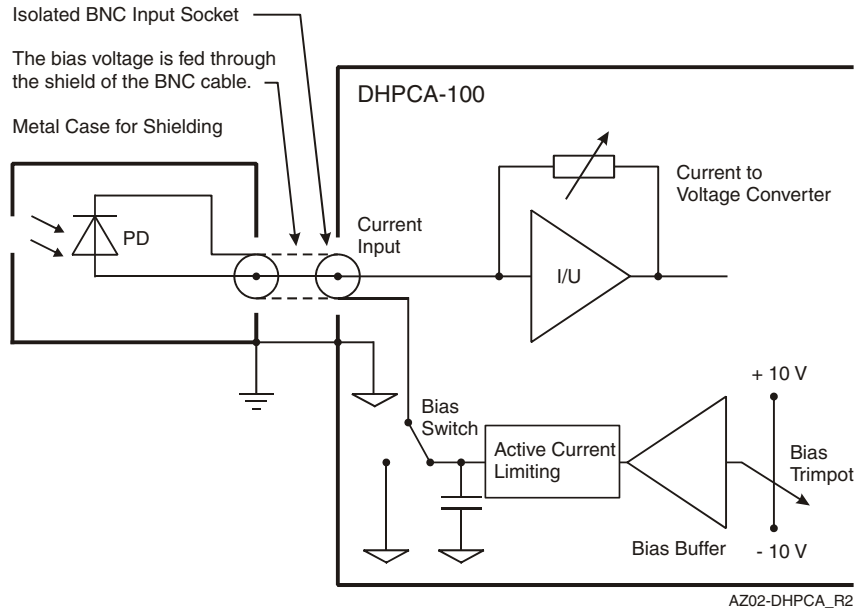
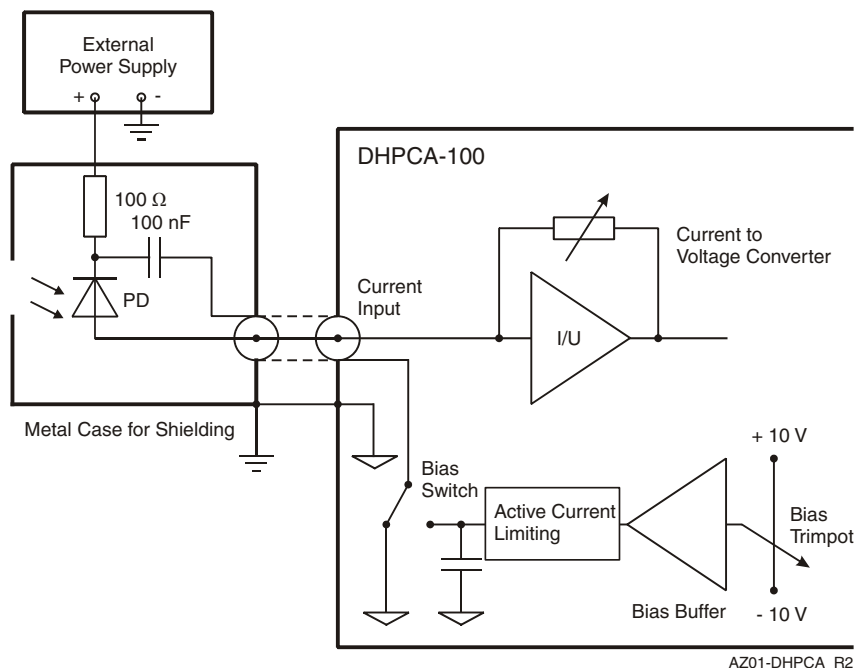


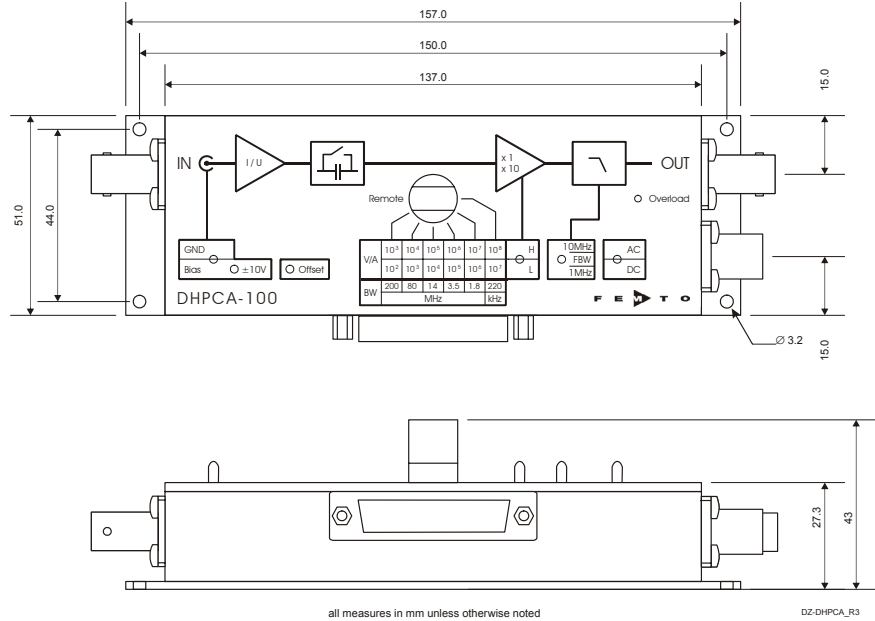
Photo Detector Biasing through External Voltage Source

Set bias switch to "GND". The photodiode is biased through an external voltage source. The shield of the isolated BNC input socket is internally set to amplifier GND. The photodiode should be mounted in a metal case. For optimum shielding the metal case has to be isolated from the photodiode but connected to the housing of the DHPCA-100.



Variable Gain High Speed Current Amplifier

Dimensions



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