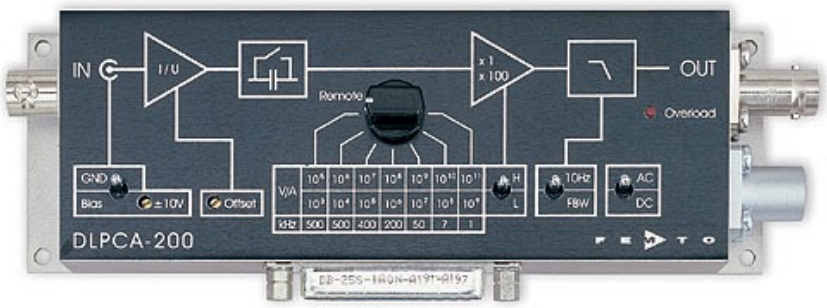
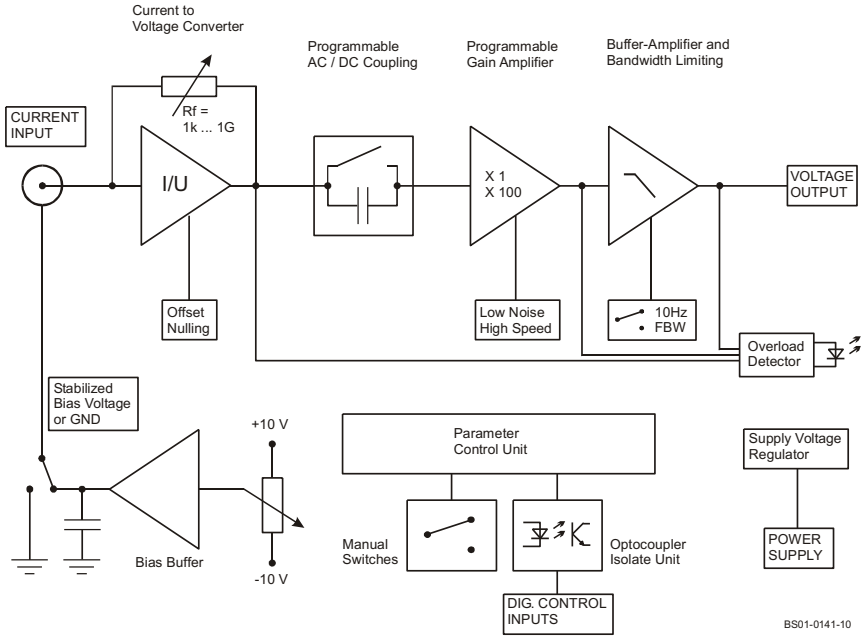
Datasheet 59-178

Variable-Gain
Low-Noise Current Amplifier



Features	• **Transimpedance (Gain) switchable from 1 x 10^3 to 1 x 10^{11} V/A** • **Bandwidth DC / 1 Hz ... 500 kHz** • **Bandwidth switchable to DC ... 10 Hz, for Low-Noise DC Measurements** • **Bandwidth independent of Detector-Capacitance (up to 1 nF)** • **BIAS-Voltage adjustable** • **Protection against ±3 kV Transients** • **Local and Remote Control**
Applications	• **Photodiode- and Photomultiplier-Amplifier** • **Scanning Tunneling Microscopy (STM)** • **Spectroscopy** • **Ionisation Detectors** • **Preamplifier for Lock-Ins, A/D-Converters, etc.**
Block Diagram	

Specifications

	Test Conditions	*Vs = ±15 V, Ta = 25°C*
Gain	Transimpedance	1 x 10^3 ... 1 x 10^{11} V/A
	Gain Accuracy	±1%
	Gain Drift	See Table below

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Frequency Response

Lower Cut-Off Frequency	DC / 1 Hz
Upper Cut-Off Frequency	Up to 500 kHz (See Table below), switchable to 10 Hz
Gain Flatness	±0.1 dB

Input

Equ. Input Noise Current	See Table below (Value per √Hz, @ 100 Hz)
Equ. Input Noise Voltage	4 nV/√Hz (@ 100 Hz)
Input Offset Current Drift	See Table below
Input Bias Current	1 pA typ. (max. 3 pA)
Max. Input Current	See Table below (Value for Linear Amplification)
Input Offset Compensation	Adjustable by Offset-Trimmer and external control
	Voltage, Max. Value see Table below

Performance depending on Gain Setting

Gain Setting (Low Noise) (V/A)	10^3	10^4	10^5	10^6	10^7	10^8	10^9
Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	45 kHz	7 kHz	1.2 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	8 µs	50 µs	300 µs
Equ. Input Noise Current (/√Hz)	20 pA	2.3 pA	460 fA	130 fA	43 fA	13 fA	4.3 fA
Offset Current Drift (/°C)	30 nA	3 nA	0.3 nA	27 pA	2.5 pA	0.2 pA	60 fA
Gain Drift (/°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
Max. Input Current (±)	10 mA	1 mA	0.1 mA	10 µA	1 µA	0.1 µA	10 nA
Max. Input Offset Compensat. (±)	100 µA	10 µA	1 µA	0.1 µA	10 nA	1 nA	0.1 nA
DC Input Impedance (// 5 pF)	50 Ω	50 Ω	50 Ω	60 Ω	150 Ω	1 kΩ	10 kΩ

Gain setting (High Speed) (V/A)	10^5	10^6	10^7	10^8	10^9	10^{10}	10^{11}
Upper Cut-Off Frequency (- 3 dB)	500 kHz	500 kHz	400 kHz	200 kHz	45 kHz	7 kHz	1.2 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	8 µs	50 µs	300 µs
Equ. Input Noise Current (/√Hz)	13 pA	1.8 pA	450 fA	130 fA	43 fA	13 fA	4.3 fA
Offset Current Drift (/°C)	30 nA	3 nA	0.3 nA	27 pA	2.5 pA	0.2 pA	60 fA
Gain Drift (/°C)	0.008%	0.008%	0.008%	0.01%	0.01%	0.01%	0.02%
Max. Input Current (±)	100 µA	10 µA	1 µA	0.1 µA	10 nA	1 nA	0.1 nA
Max. Input Offset Compensation	100 µA	10 µA	1 µA	0.1 µA	10 nA	1 nA	0.1 nA
DC Input Impedance (// 5 pF)	50 Ω	50 Ω	50 Ω	60 Ω	150 Ω	1 kΩ	10 kΩ

Output

Output Voltage	±10 V (@10 kΩ Load)
Output Impedance	50 Ω
Max. Output Current	±30 mA

Detector Bias

Bias Voltage Range	±10 V, max. 22 mA, switchable to GND

Indicator LED

Function	Overload

Digital Control

Control Input Voltage Range	Low: -0.8...+1.2V, High: 2.3...+12V
Control Input Current	0 mA @ 0V, 1.5 mA @ +5 V, 4.5 mA @ +12V
Overload Output	Non Active: 0 V , max.-1mA, Active: 5.1 V, max. 7mA

Ext. Offset Control

Control Voltage Range	±10 V
Offset Control Input Impedance	20 kΩ

Power Supply

Supply Voltage	± 15 V
Supply Current	+ 150 / -100 mA
Stabilized Power Supply Output	±12 V, max. 150 mA, +5V, max. 50 mA

Case

Weight	320 gr. (0.74 lbs)
Material	AlMg4.5Mn, nickel-plated

Temperature Range

Storage Temperature	-40 ... +100 °C
Operating Temperature	0 ... +60 °C

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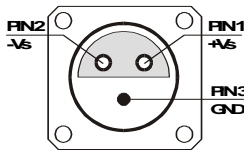
Absolute Maximum Ratings	Signal Input Voltage	-16 V / + 12 V
	Transient Input Voltage	±3 kV (from 200 pF Source)
	Control Input Voltage	-5 V / +16 V
	Power Supply Voltage	±22 V
Connectors	Input	BNC, Isolated
	Output	BNC
	Power Supply	LEMO Series 1S, 3-pin fixed Socket Pin 1: + 15V Pin 2: - 15V Pin 3: GND
	Control Port	Sub-D 25-pin, female, Qual. Class 2 Pin 1: +12V (Stabilized Power Supply Output) Pin 2: -12V (Stabilized Power Supply Output) Pin 3: AGND (Analog Ground) Pin 4: +5V (Stabilized Power Supply Output) Pin 5: Digital Output: Overload Pin 6: Signal Output (connected to BNC) Pin 7: NC Pin 8: Input Offset Control Voltage Pin 9: DGND (Ground for Digital Control Pin 10-14) 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 Pin 15 – 25: NC



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Remote Control Operation

General

Remote Control Input Bits are opto-isolated and connected by logical OR to local switch setting. For remote control, set the corresponding local switch to “Remote”, "AC" or "H” (High Speed) and select the wanted setting via a bit-code at the corresponding digital inputs. Mixed operation, e.g. local gain setting and remote controlled AC/DC setting, is also possible. Switch settings “FBW/10 Hz” and “Bias/GND” are not remote controllable.

Gain Setting

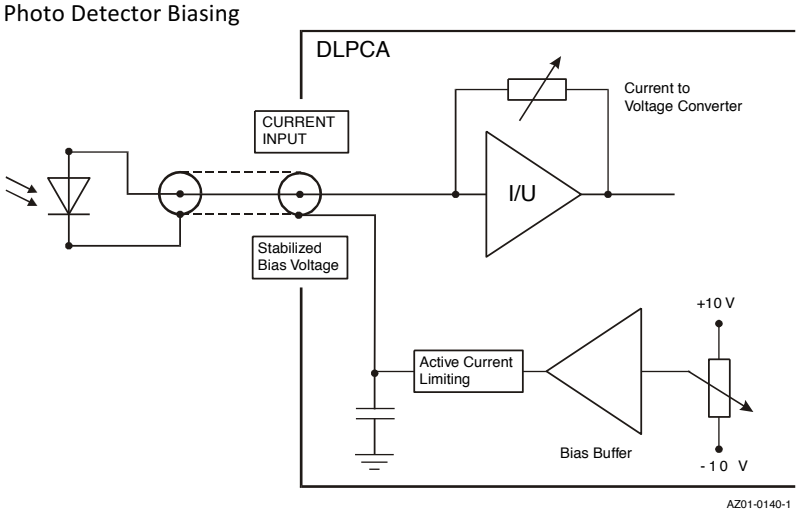
Low Noise Gain (V/A) Pin 14=High	High Speed Gain (V/A) Pin 14=Low	Pin 10 LSB	Pin 11	Pin 12 MSB
10^3	10^5	Low	Low	Low
10^4	10^6	High	Low	Low
10^5	10^7	Low	High	Low
10^6	10^8	High	High	Low
10^7	10^9	Low	Low	High
10^8	10^{10}	High	Low	High
10^9	10^{11}	Low	High	High

AC/DC Setting

Coupling	Pin 13
AC	Low
DC	High

Application Diagram

Photo Detector Biasing



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Dimensions