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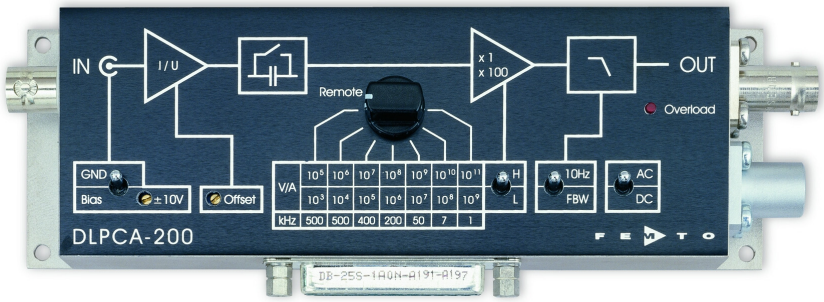
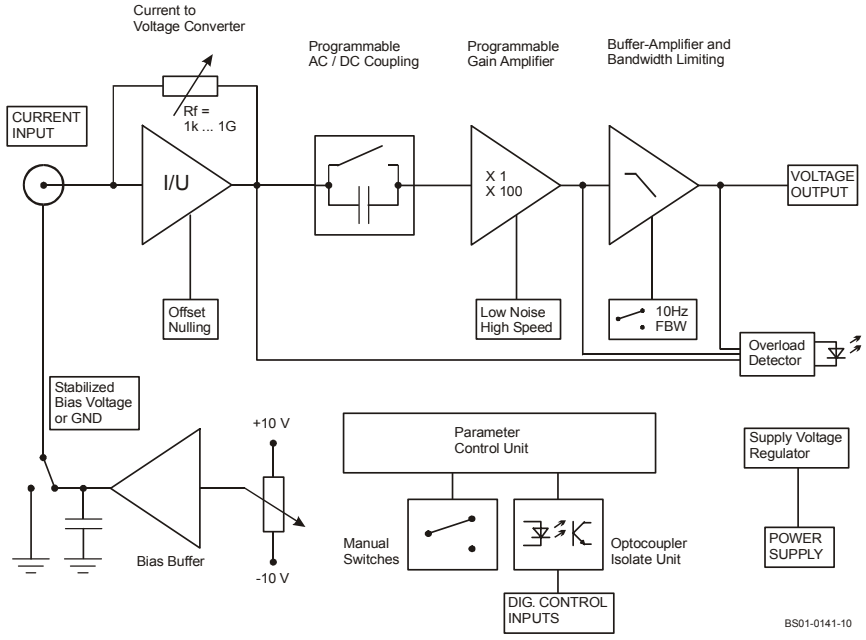
Datasheet DLPCA-200

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)** • **Adjustable Bias Voltage** • **Protection Against ± 3 kV Transients** • **Local and Remote Control**
Applications	• **Photodiode and Photomultiplier Amplifier** • **Scanning Tunneling Microscopy (STM)** • **Spectroscopy** • **Beam Monitoring for Particle Accelerators / Synchrotrons** • **Ionisation Detectors** • **Preamplifier for Lock-Ins, A/D-Converters, etc.**
Block Diagram	

Variable Gain Low Noise Current Amplifier

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

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
Equ. Input Noise Voltage	4 nV/√Hz (@ 1 kHz)
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 trimpot and external control voltage; max. range 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	50 kHz	7 kHz	1.1 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
Input Noise Current Density (/√Hz)	20 pA	2.3 pA	450 fA	130 fA	43 fA	13 fA	4.3 fA
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise Current (rms)*	21 nA	2.4 nA	500 pA	130 pA	41 pA	5.8 pA	0.8 pA
Offset Current Drift (/°C)	30 nA	3 nA	0.3 nA	30 pA	3 pA	0.3 pA	0.1 pA
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
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	50 kHz	7 kHz	1.1 kHz
Rise / Fall Time (10% - 90%)	700 ns	700 ns	900 ns	1.8 µs	7 µs	50 µs	300 µs
Input Noise Current Density (/√Hz)	13 pA	1.8 pA	440 fA	130 fA	43 fA	13 fA	4.3 fA
measured at	10 kHz	10 kHz	10 kHz	1 kHz	1 kHz	100 Hz	100 Hz
Integr. Input Noise Current (rms)*	12 nA	1.8 nA	450 pA	120 pA	37 pA	5.3 pA	0.8 pA
Offset Current Drift (/°C)	30 nA	3 nA	0.3 nA	30 pA	3 pA	0.3 pA	0.1 pA
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
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

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

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

Output

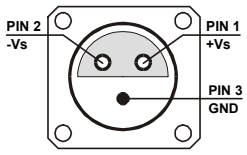
Output Voltage	± 10 V (@ ≥ 1 MΩ load)
Output Impedance	50 Ω (terminate with ≥ 1 MΩ load for best performance)
Max. Output Current	± 30 mA

Detector Bias

Bias Voltage Range	± 10 V, max. 22 mA (bias voltage connected to shield of BNC input socket, adjustable by trimpot, switchable to GND)

Variable Gain Low Noise Current Amplifier

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	± 10 V
	Offset Control Input Impedance	20 kΩ
Power Supply	Supply Voltage	± 15 V
	Supply Current	+ 120 / - 80 mA typ. (depends on operating conditions, recommended power supply capability min. ± 200 mA)
	Stabilized Power Supply Output	± 12 V, max. ± 150 mA, + 5V, max. 50 mA
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	-16 V / + 12 V
	Transient Input Voltage	± 3 kV (out of 200 pF source)
	Control Input Voltage	- 5 V / + 16 V
	Power Supply Voltage	± 22 V
Connectors	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: signal output (connected to BNC) Pin 7: NC Pin 8: input offset control voltage Pin 9: DGND (ground for digital control pins 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

Variable Gain Low Noise Current Amplifier

Remote Control Operation

General

Remote control input bits are opto-isolated and connected by logical OR function to local switch settings. For remote control set the corresponding local switches to “Remote”, "AC" and "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

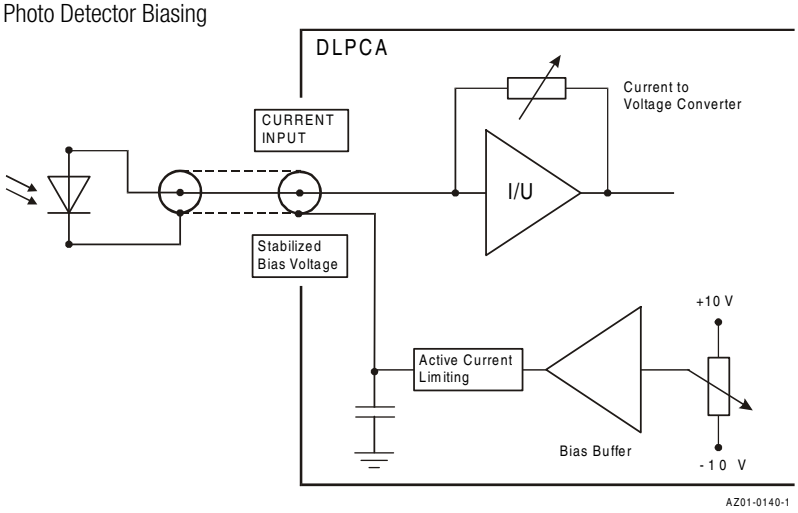
Low Noise Pin 14=HIGH Gain (V/A)	High Speed Pin 14=LOW Gain (V/A)	Pin 12 MSB	Pin 11	Pin 10 LSB
10^3	10^5	LOW	LOW	LOW
10^4	10^6	LOW	LOW	HIGH
10^5	10^7	LOW	HIGH	LOW
10^6	10^8	LOW	HIGH	HIGH
10^7	10^9	HIGH	LOW	LOW
10^8	10^{10}	HIGH	LOW	HIGH
10^9	10^{11}	HIGH	HIGH	LOW

AC/DC Setting

Coupling	Pin 13
AC	LOW
DC	HIGH

Application Diagram

Photo Detector Biasing



Variable Gain
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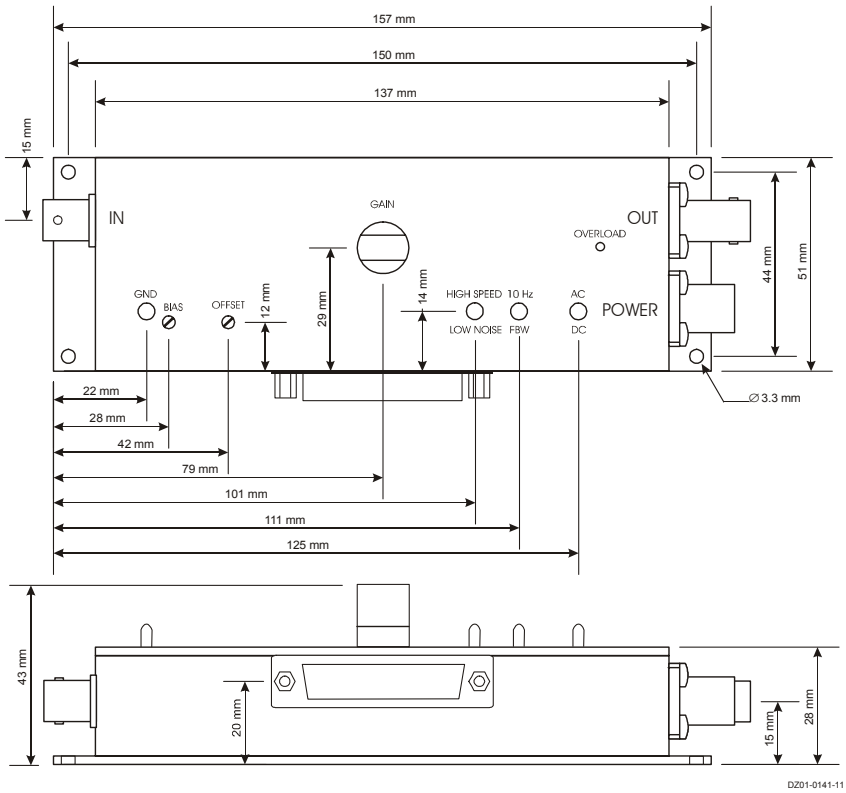
Dimensions



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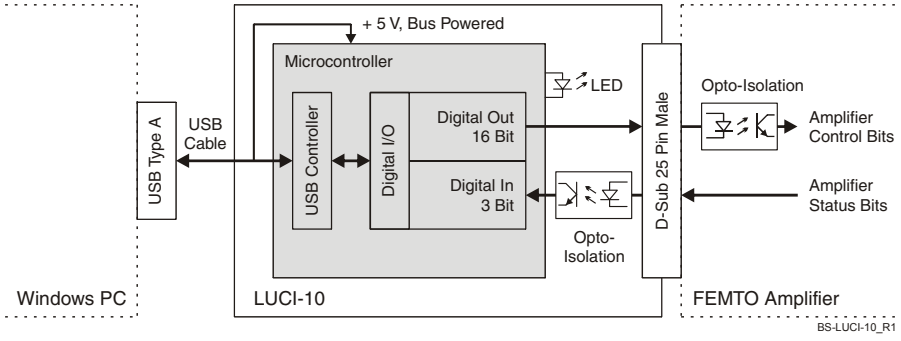
Datasheet LUCI-10

USB to D-Sub Control Interface for FEMTO Amplifiers

Features	• **Compact Digital I/O Interface for USB Remote Control of FEMTO Amplifiers** • **Supports Opto-Isolation of Amplifier Signal Path from PC USB Port** • **16 Digital Outputs, 3 Opto-Isolated Digital Inputs** • **Bus-Powered Operation** • **System Driver, Application Software and VI's for use with LabVIEW™ Included**
Applications	• **Remote Control of FEMTO® Amplifiers and Photoreceivers Directly from a PC**

Block Diagram



Hardware Specifications

General Characteristics	Bus Interface	USB 2.0 (full-speed)
	Digital I/O Channels	16 output lines 3 opto-isolated input lines
	Supply	PC USB port, + 5 V, typ. 100 mA, bus-powered (no auxiliary power supply required)
	Connectors	USB type A D-Sub, 25 pin, male
	Cable	AWG 28, length 1.8 m
Output	Number of Channels	16 output lines, supporting opto-isolation inside FEMTO amplifiers and photoreceivers
	Output Voltage Range	LOW bit: 0 … + 0.5 V (@ 0 … 2 mA output current) HIGH bit: + 4 … + 5.5 V (@ 0 … 2 mA output current)
	Max. Current	6 mA per channel
	Writing Rate	max. 800 operations per second

USB to D-Sub Control Interface for FEMTO Amplifiers

Input	Number of Channels	3 opto-isolated input lines
	Input Voltage Range	LOW bit: - 20 … + 1.5 V HIGH bit: + 3 … + 20 V
	Switching Current	1 mA typ. @ 5 V
	Reading Rate	max. 400 operations per second
Power Supply	USB Port, Bus Powered	+ 4.5 … + 5.5 V DC
	Active Current	max. 200 mA / typ. 100 mA
	Suspend Current	< 0.5 mA (standby mode of Windows®)
Case	D-Sub Case	metal hood (EMI/RFI shielding), with jack screws
	Weight	130 g (0.3 lb.)
	Material	zinc die-cast, nickel plated
Temperature Range	Storage Temperature	- 40 … + 100 °C
	Operating Temperature	0 … + 50 °C
Absolute Maximum Ratings	Max. Voltage at Input	+/- 30 V
	Max. Short Circuit Output Current	+/- 20 mA per channel, 200 mA total
	Max. Isolation Voltage	+/- 60 V (Input Ground to Output Ground)
Connectors	Device Port	D-Sub, 25 pin, male Pin 1: NC Pin 2: NC Pin 3: GND (IN) Pin 4: NC Pin 5: Digital IN Pin 6: Digital IN Pin 7: Digital IN Pin 8: NC Pin 9: GND (OUT) Pin 10: Digital OUT Low Byte, LSB Pin 11: Digital OUT Low Byte Pin 12: Digital OUT Low Byte Pin 13: Digital OUT Low Byte Pin 14: Digital OUT Low Byte Pin 15: Digital OUT Low Byte Pin 16: Digital OUT Low Byte Pin 17: Digital OUT Low Byte, MSB Pin 18: Digital OUT High Byte, LSB Pin 19: Digital OUT High Byte Pin 20: Digital OUT High Byte Pin 21: Digital OUT High Byte Pin 22: Digital OUT High Byte Pin 23: Digital OUT High Byte Pin 24: Digital OUT High Byte Pin 25: Digital OUT High Byte, MSB
	PC Port	USB type A

USB to D-Sub Control Interface for FEMTO Amplifiers

Software Specifications

Software (included on CD)

Device Driver	dynamic link library (DLL) for integration in Microsoft Windows® operating system for use with C/C++, LabWindows™ /CVI™ or LabVIEW™
Application Software	GUI (graphical user interface) programs for simple remote control of FEMTO amplifiers and photoreceivers provided as executable programs and LabVIEW projects
LabVIEW Programs	sample programs to control and test the LUCI-10 hardware (including front panel and block diagram)
LabVIEW Library	special VI toolkit for integration in LabVIEW development environment

Note: A National Instruments LabVIEW™ license is not included in this software package. For use of the GUI application programs the LabVIEW Run-Time Engine is required. If not detected on the host PC during the installation process the LabVIEW Run-Time Engine will be installed automatically from the CD.

System Requirements

Operating System	Microsoft Windows XP with Service Pack 2, or higher
Processor	Intel Pentium III or AMD Athlon, or better
System Memory	512 MB of RAM, or more
Hard Disk Space	about 200 MB
Interface Port	USB 1.1 or USB 2.0
Supported FEMTO Modules	any standard FEMTO amplifier or photoreceiver with 25 pin D-Sub socket, except model HLVA-100

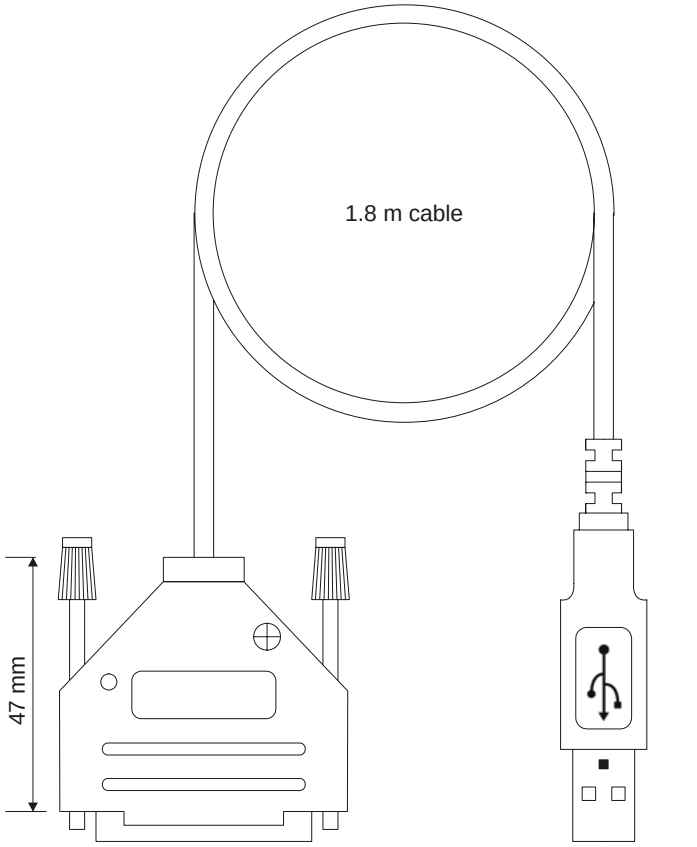
Optional Requirements

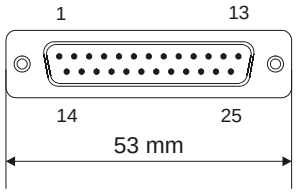
For development of own application programs an additional development environment like LabVIEW Version 8 (or higher) or C/C++ is required.

Legal Notice

USB to D-Sub Control Interface for FEMTO Amplifiers

Dimensions





DZ-LUCI-10_R1

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