Programmable Gain Amplifier
User Manual

Printed: 2005-01-31

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1 Welcome to the Programmable Gain Amplifier

The Multi Channel Systems device PGA64 is an amplifier of analog signals with the option to change the gain. The input signal amplitude can be increased from a factor of 10 up to 5000. The gain is selectable by software and can be set for each of the 64 signal channels individually. The main parts consist of the analog filter stages, of a logic part to set the amplification, of an EEPROM to save the potentiometer settings, of a level converter accepting RS232 signals and of a power stage.

The signals of the 64 input channels are amplified according to the frequency band. The band filter the signals according to the frequency parts. The outputs are observable on the output connector. Examples of output signals are given. A figure in the appendix demonstrates the dependance of the output signal amplitude from the frequency for the used frequency band.

Input signals are connected using a 68-pin connector. Output signals are transferred to other devices using a 68-pin connector, too. The pin layout of both connectors is given in a table. The digital signals to change the gain are delivered using a 9-pin SUB-D connector via the serial interface of a PC.

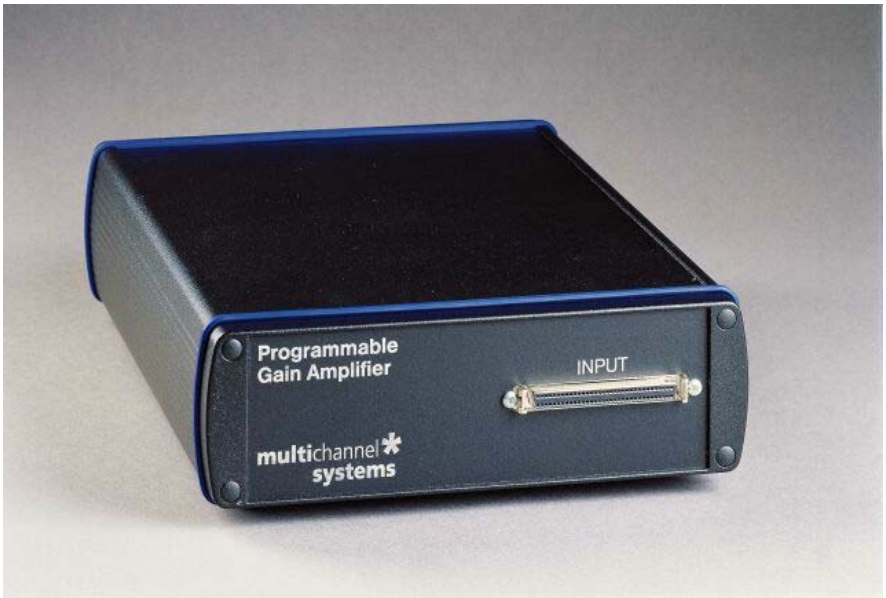
An internal power supply stage transforms the input voltages of any external power supply bin into the supply voltages of ±3.0 V and ±5.0 V. The supply bin should deliver raw voltages of ± 6.0 V at least, for connecting use 4 mm-connectors.

A software package installed on a computer with a Windows operating system makes it easy to set the digital potentiometers to the selected values. Note: check the serial connection using a test button first.

In a next step, the gain can be selected individually for each channel. Or use the pull-down menu for a general setting. Push the download button and the values are written to an EEPROM in the PGA64. Automatically, the new values are written into the digital potentiometers, too. If you switch off the PGA64, the last setting of the potentiometers are stored. After switching on again, these values will be restored.

An online Help is available and will explain the program functions.

During loading down the settings to the PGA, please, stop any running program or set to sleep mode!



2 Setting Up and Operating the PGA

2.1 Power Supply

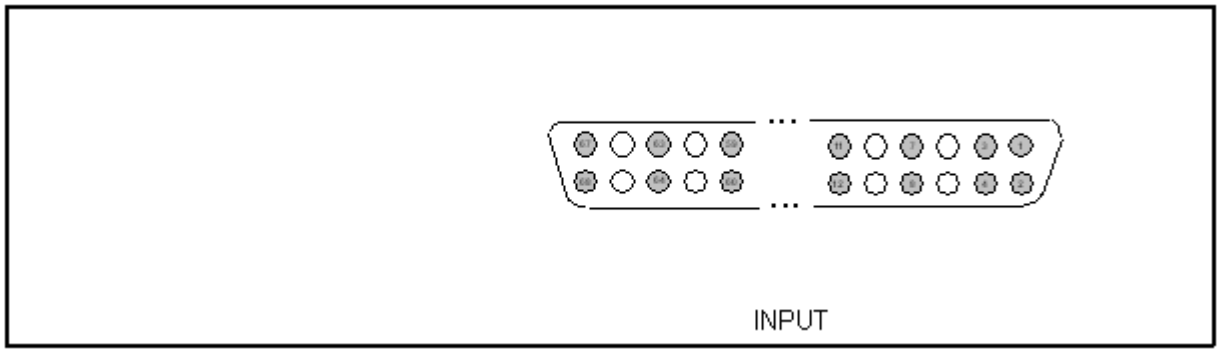
The recommended value of supply voltage should be $U_s = \pm 6.0$ V. The limits of proper operation ranges from ± 5.7 V to ± 12.0 V. Please, be careful. Use the lowest voltage as possible. As higher the input supply voltage, as higher the internal heat produced by the voltage regulators!

+6.0 V:	4 mm red plug connector	positive supply voltage
GND:	4 mm black plug connector	ground
–6.0 V:	4 mm blue plug connector	negative supply voltage

Warning: Do not mismatch the polarity of the power supply. False connection may damage the device.

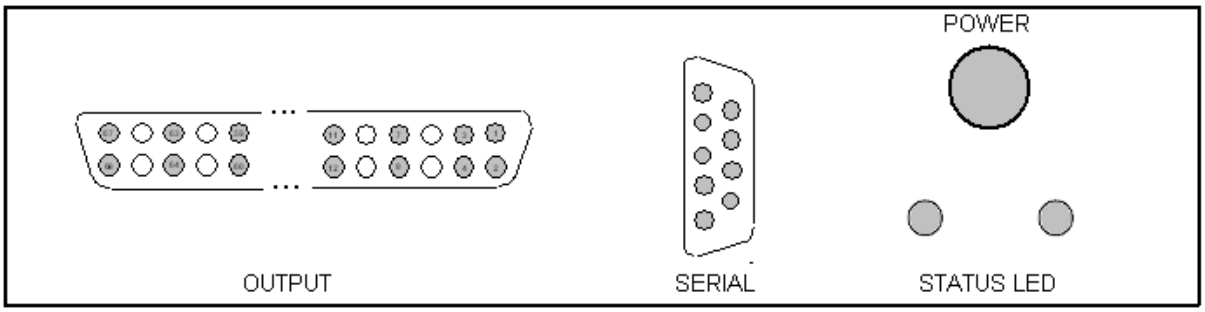
2.2 Front Panel Connection

The only connection on the front of the PGA64 is the connector for in-coupling the analog signals. The input connector has to be plugged into the 68-pin front connector.



2.3 Rear Panel Connection

The output signal cable (OUTPUT), the download cable (SERIAL COM), and the power supply cable (POWER), have to be connected on the rear side of the case. The positions are indicated below.

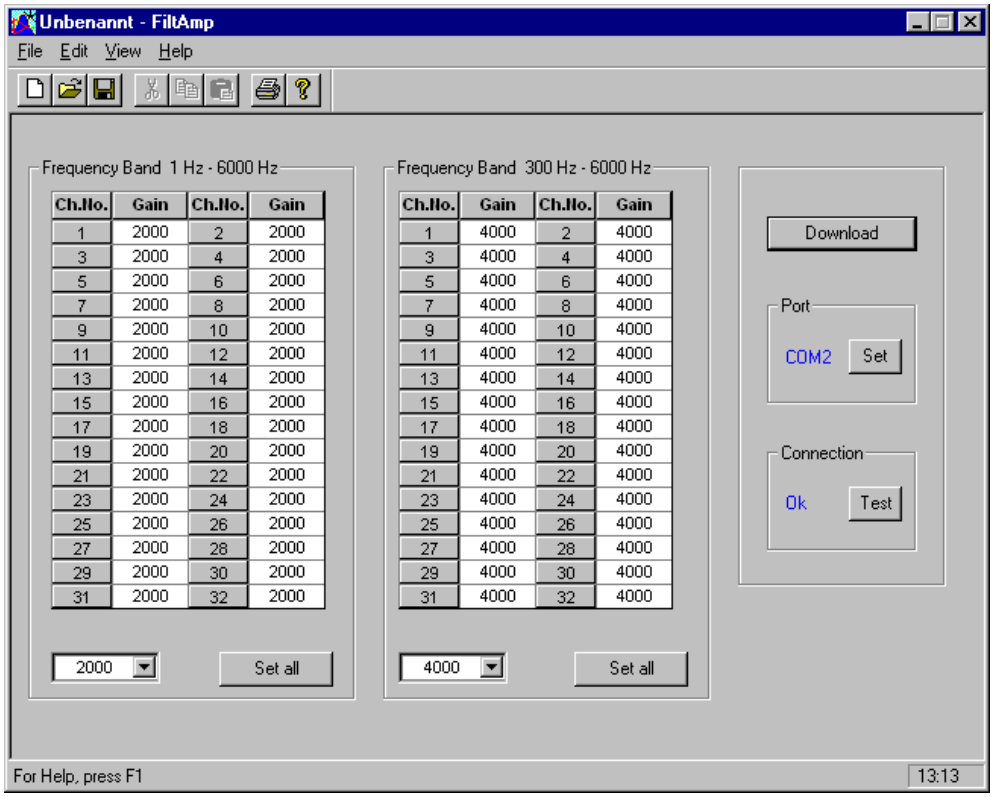


Two LEDs light up if the supply voltages are correct. Their brightness should not change, otherwise the DC shows instabilities.

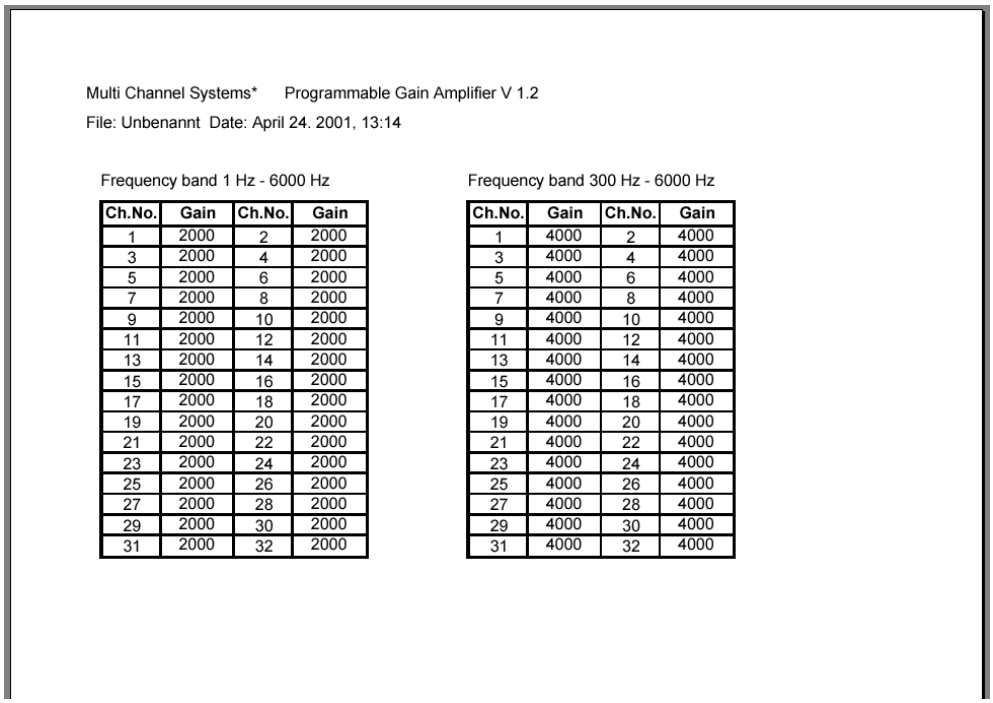
2.4 FiltAmp Program

Important: For proper use, do not switch OFF the amplifier and ON again while the program is running!

Program settings example:



Output of the PGA:



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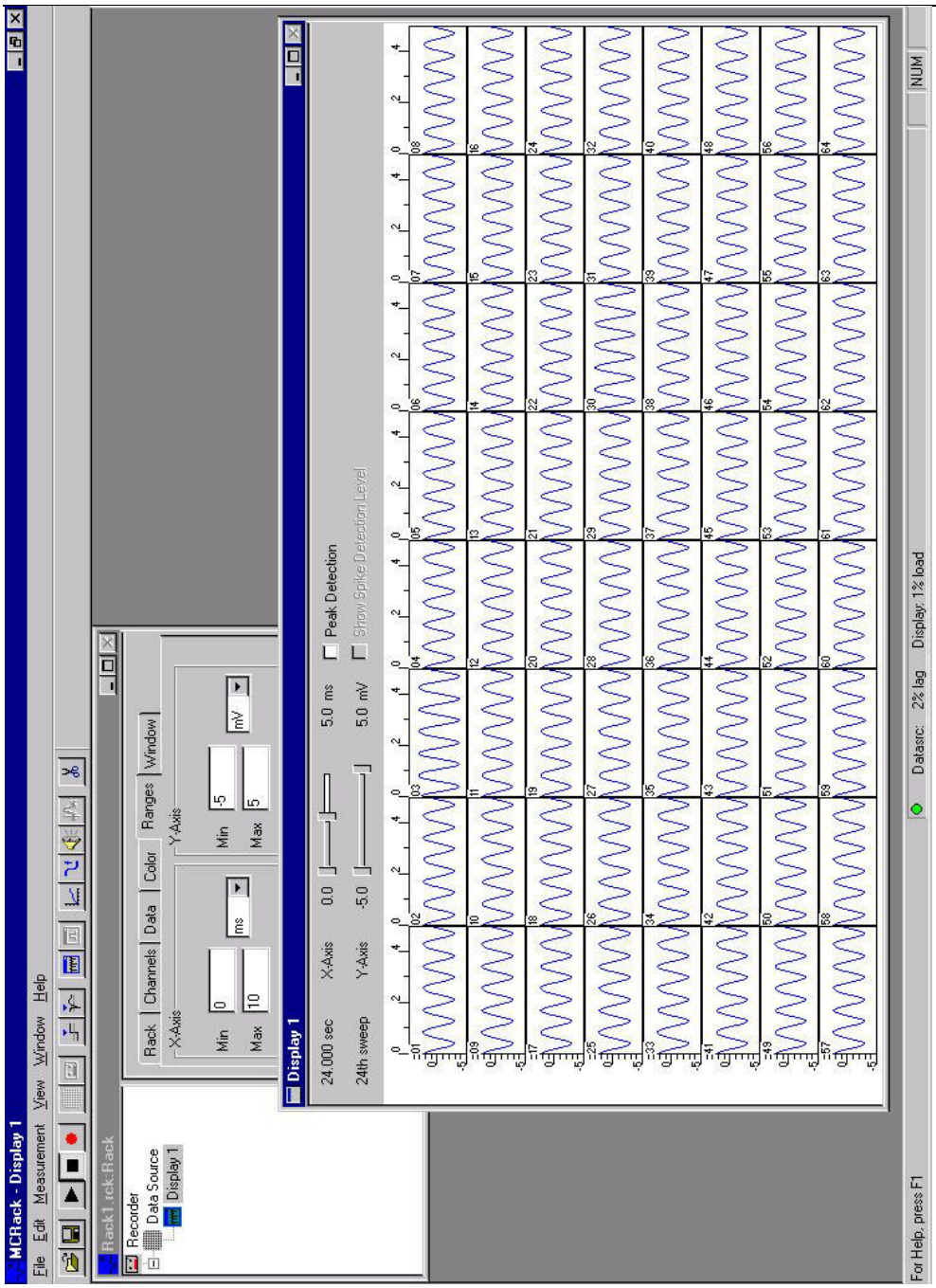
Frequency band 1 Hz - 6000 Hz

Ch.No.	Gain	Ch.No.	Gain
1	2000	2	2000
3	2000	4	2000
5	2000	6	2000
7	2000	8	2000
9	2000	10	2000
11	2000	12	2000
13	2000	14	2000
15	2000	16	2000
17	2000	18	2000
19	2000	20	2000
21	2000	22	2000
23	2000	24	2000
25	2000	26	2000
27	2000	28	2000
29	2000	30	2000
31	2000	32	2000

Frequency band 300 Hz - 6000 Hz

Ch.No.	Gain	Ch.No.	Gain
1	4000	2	4000
3	4000	4	4000
5	4000	6	4000
7	4000	8	4000
9	4000	10	4000
11	4000	12	4000
13	4000	14	4000
15	4000	16	4000
17	4000	18	4000
19	4000	20	4000
21	4000	22	4000
23	4000	24	4000
25	4000	26	4000
27	4000	28	4000
29	4000	30	4000
31	4000	32	4000

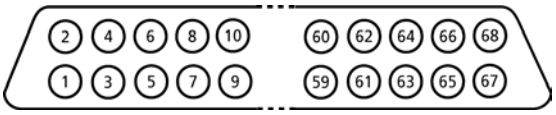
Test of all channels using the MC_Rack software:



As demonstrated, the 64 output signals coming from the frequency band shows the same output signal. The channels 3 & 30 of the frequency band have an other amplification compared to the other channels. The common input signal is a sinus wave of about 1000 Hz.

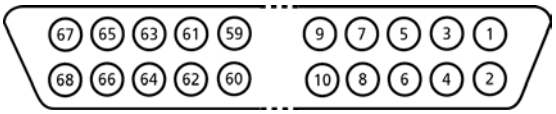
3 Connectors — Pin Layout

3.1 Input Connector



1	GNDP (power ground)
2	Reference electrode
3 ... 18	Channel 01 ... channel 16
19 ... 34	Channel 17 ... channel 32 (only used for FA32, FA48, FA64)
35 ... 50	Channel 33 ... channel 48 (only used for FA48, FA64)
51 ... 66	Channel 49 ... channel 64 (only used for FA64)
67	Positive supply voltage (+ 5 V ... + 9 V)
68	Negative supply voltage (– 5 V ... –9 V)

3.2 Output Connector



1	GNDP (power ground)
2	GNDI (connected to GNDP)
3 ... 18	Channel 01 ... channel 16
19 ... 34	Channel 17 ... channel 32 (only used for FA32, FA48, FA64)
35 ... 50	Channel 33 ... channel 48 (only used for FA48, FA64)
51 ... 66	Channel 49 ... channel 64 (only used for FA64)
67	Positive supply voltage (+ 5 V ... + 9 V)
68	Negative supply voltage

PGA Programmable Gain Amplifier

multichannel systems

	PGA16	PGA32	PGA64	PGA1632	PGA3264
Operating temperature	10 °C to 40 °C	10 °C to 40 °C	10 °C to 40 °C	10 °C to 40 °C	10 °C to 40 °C
Storage temperature	0 °C to 50 °C	0 °C to 50 °C	0 °C to 50 °C	0 °C to 50 °C	0 °C to 50 °C
Relative humidity	10 % to 85 %, non-condensing	10 % to 85 %, non-condensing	10 % to 85 %, non-condensing	10 % to 85 %, non-condensing	10 % to 85 %, non-condensing
Dimensions (W x D x H)	172 mm x 220 mm x 52 mm	172 mm x 220 mm x 52 mm	172 mm x 220 mm x 52 mm	172 mm x 220 mm x 52 mm	172 mm x 220 mm x 52 mm
Weight	1400 g	1400 g	1400 g	1400 g	1400 g
Supply voltage	± 5.7 V to ± 12 V DC	± 5.7 V to ± 12 V DC	± 5.7 V to ± 12 V DC	± 5.7 V to ± 12 V DC	± 5.7 V to ± 12 V DC
Supply current	350 mA (positive rail), 110 mA (negative rail)	550 mA (positive rail), 225 mA (negative rail)	725 mA (positive rail), 450 mA (negative rail)	550 mA (positive rail), 225 mA (negative rail)	725 mA (positive rail), 450 mA (negative rail)
Number of input channels	16	32	64	16	32
Input voltage	300 mV	300 mV	300 mV	300 mV	300 mV
Input impedance	> 10^{12} Ω paralleled by 8 pF	> 10^{12} Ω paralleled by 8 pF	> 10^{12} Ω paralleled by 8 pF	> 10^{12} Ω paralleled by 8 pF	> 10^{12} Ω paralleled by 8 pF
Input noise	< 2 µV $_{RMS}$ (full bandwidth, inputs short-circuited)	< 2 µV $_{RMS}$ (full bandwidth, inputs short-circuited)	< 2 µV $_{RMS}$ (full bandwidth, inputs short-circuited)	< 2 µV $_{RMS}$ (full bandwidth, inputs short-circuited)	< 2 µV $_{RMS}$ (full bandwidth, inputs short-circuited)
Noise density @ 1 kHz	$e_n = 25\ nV/\sqrt{Hz}$	$e_n = 25\ nV/\sqrt{Hz}$	$e_n = 25\ nV/\sqrt{Hz}$	$e_n = 25\ nV/\sqrt{Hz}$	$e_n = 25\ nV/\sqrt{Hz}$
Number of output channels	16	32	64	32	64
Output voltage	± 5 V	± 5 V	± 5 V	± 5 V	± 5 V
Output current	50 mA	50 mA	50 mA	50 mA	50 mA
Output impedance	50 Ω	50 Ω	50 Ω	50 Ω	50 Ω
Bandwidth	As specified	As specified	As specified	As specified	As specified
Filter slope	80 db/decade	80 db/decade	80 db/decade	80 db/decade	80 db/decade
Gain	Programmable from 10 to 5000	Programmable from 10 to 5000	Programmable from 10 to 5000	Programmable from 10 to 5000	Programmable from 10 to 5000

Programmable gain amplifiers with 16, 32, and 64 input channels are available under the name PGA16, PGA32, and PGA64, respectively.
The gain can be flexibly adjusted from 10 to 5000 with the program FiltAmp.
Amplifiers can be ordered with any bandwidth configurations by the user's choice. The name specifies the configuration. The first number after the channel number specifies the lowest frequency, followed by the highest frequency. For example, PGA16-300-3000 stands for a PGA with 16 channels, and 300 Hz to 3 kHz bandwidth.
The PGA1632 and the PGA3264 feature two different pass bands. Signals are split and the two pass bands are send to two separate channels. For 16 input and 32 output channels, or 32 input and 64 output channels,

FiltAmp program					
Operating system	Windows 98, ME, NT, 2000, or XP; English and German versions supported	Windows 98, ME, NT, 2000, or XP; English and German versions supported	Windows 98, ME, NT, 2000, or XP; English and German versions supported	Windows 98, ME, NT, 2000, or XP; English and German versions supported	Windows 98, ME, NT, 2000, or XP; English and German versions supported