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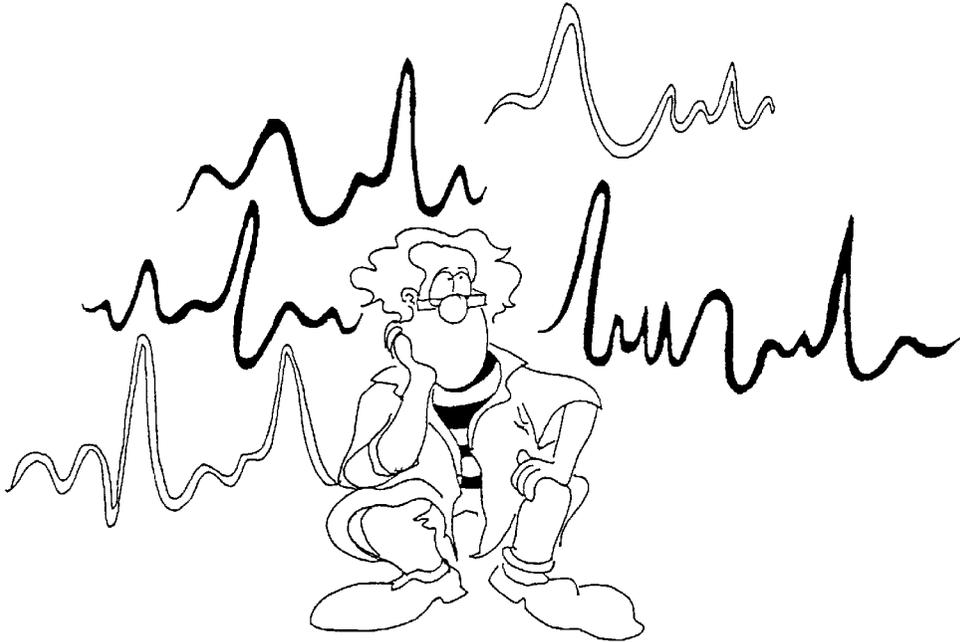
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MCP-Plus

Multi Channel Processor

User's Manual

Ver. 3.73



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Preface

The **MCP-Plus** User's Manual provides all the information needed to install and operate the **MCP-Plus** effectively. We recommend that the first-time user read through the entire manual before operating the **MCP-Plus**.

The **MCP-Plus** User's Manual is divided into the following sections:

- 1. Introduction:** This section provides an overview of **MCP-Plus** highlights and its operating environment, including diagrams of the **MCP-Plus** signal conditioning system.
- 2. Installation:** This section describes the installation procedure for the system's various modules.
- 3. Operation:** This section provides detailed instructions on operating the **MCP-Plus**.
- 4. Troubleshooting:** This section presents solutions to possible problems that may arise while operating the **MCP-Plus**.

1 Introduction

1.1 General Description

The **MCP-Plus** is a modular amplification and filtering system designed to amplify and filter almost any physiological analog input.

The **MCP-Plus** is available in two models:

1. **MCP-Plus 8** - a non-modular 8 channel Multi Channel Processor.
2. **MCP-Plus** - a modular Multi-Channel Processor, up to 256 channels, with a minimum of 16 channels, channels can be added in multiples of 4.

Both models offer the same functions are offered for both systems, these include:

- Gain amplification
- AC and DC coupling
- Low pass filtering
- DC level shifting
- Sine Generator for Impedance Measure of input electrode

The **MCP-Plus** is a rack-mountable system that is controlled by a computer. Since the signal conditioning and data acquisition software control all parameters there are no manual controls on the front panel, eliminating the need to record or remember the parameters setting. Parameters and setting are saved and set by the software providing increased user convenience, especially when using a large number of channels.

The **MCP-Plus** consists of the following components:

- A chassis that holds the different modules
- A linear power supply
- Control module
- Analog Input/Output modules
- 8 - 256 outputs (both modular and non-modular)

The **MCP-Plus** has up to 256 differential, low noise, inputs. Inputs can be sent directly to the MCP, or they can be received from a Pre-amplifier or a Head Stage.

Each MCP channel has 2 outputs: a filtered output, and an "unfiltered" output that can be used for further conditioning or for archiving.

The gain, filters and DC level shifting are controlled by the software and can be easily adjusted on the PC screen and saved to disk.

A 2-pole Butterworth High-pass filter and a 4-pole Low-pass filter are provided and can be controlled by the software.

The status of the **MCP-Plus** can always be read on the PC screen.

The **MCP-Plus** also provides special functions that are useful for measuring activities from the nervous system using extra cellular microelectrodes.

The electrode's impedance can be measured easily using the mouse, by clicking the on/off impedance circle on the PC screen.

A stimulus option can be switched **On/Off** by using the mouse to click the on/off stimulus control on the PC screen.

The **MCP** allows the user to control the electrode selection for current injection and stimulus.

The MCP is equipped with DC floating power supplies that supply the DC voltages to the MCP, and for Pre-amplifiers or for Head Stage units.

An RS232 link to the **PC** is provided to control the **MCP** via the **PC**.

The **MCP-Plus** is designed for specific user defined configurations.

An external shut-off connector on the rear panel enables the user to shut off all channels simultaneously.

The head stage control connector on the rear panel of each module may be used to shut off each channel individually.

1.2 Features and Benefits

- Up to 256 Modular Channels (electrodes)
- High Impedance Differential Inputs
- Filtered Outputs
- Notch Filter (50-60Hz)
- Unfiltered Outputs
- Flexible Gain Selection
- Flexible Filter Selection (2 and 4 pole Butterworth)
- DC Level Shifting
- Electrode Impedance Measure per Module
- External Stimulation On/Off switch
- Head Stage Control per Module
- Stimulus Control
- Audio Mixer
- Serial Communication (RS232) to PC
- User-Friendly Software Package
- Compatible with the MSD - Multi-Spike Detector and other standard data acquisition systems.

Figure1: MCP-Plus Modular system Front Panel

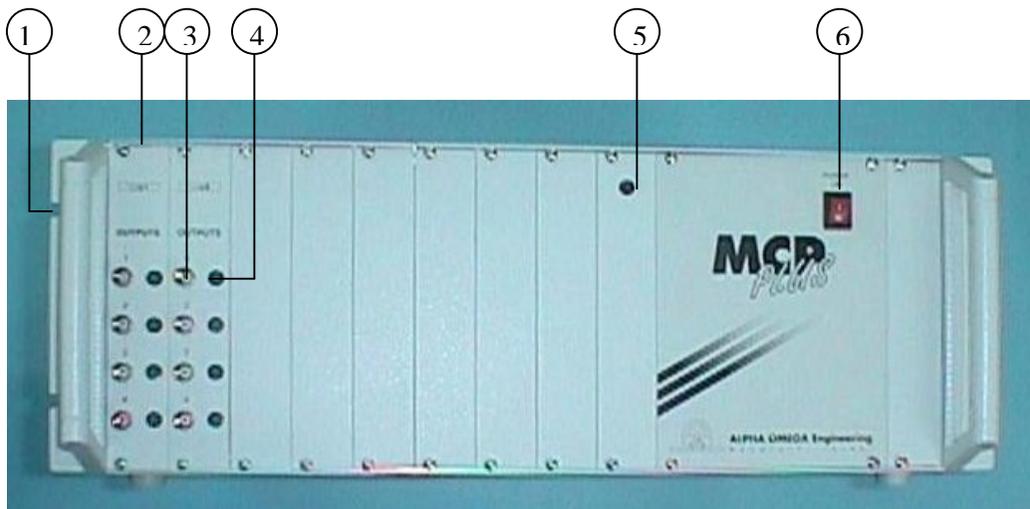
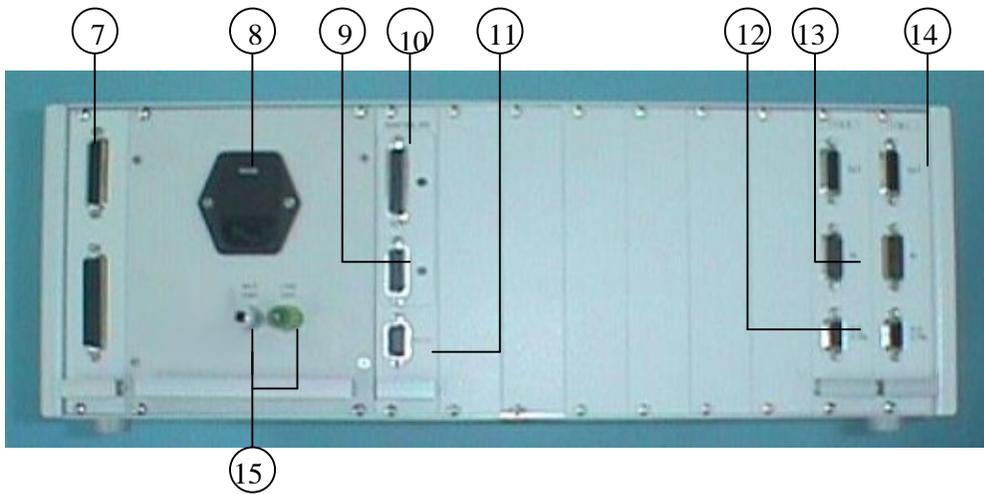


Figure 2: MCP-Plus Modular system Rear Panel



MCP-Plus Modular system - Identification of Parts

- 1 Hole for mounting the MCP-Plus on Rack
- 2 Fastening screw
- 3 BNC Output
- 4 Channel On/Off LED Indicator
- 5 Communication error LED Indicator
6. Power On/Off Switch
7. Control Lines Connector for cascading
8. Mains power receptacle, Line Filter, 110/220 Voltage control and fuses
9. Digital I/O (stimulator control)
10. Digital I/O (Mixer control)
11. Serial RS232 connector for communication with PC
12. Control and DC power supply for Pre-Amp
13. Input Connector
14. Output Connector
15. Ground Connectors

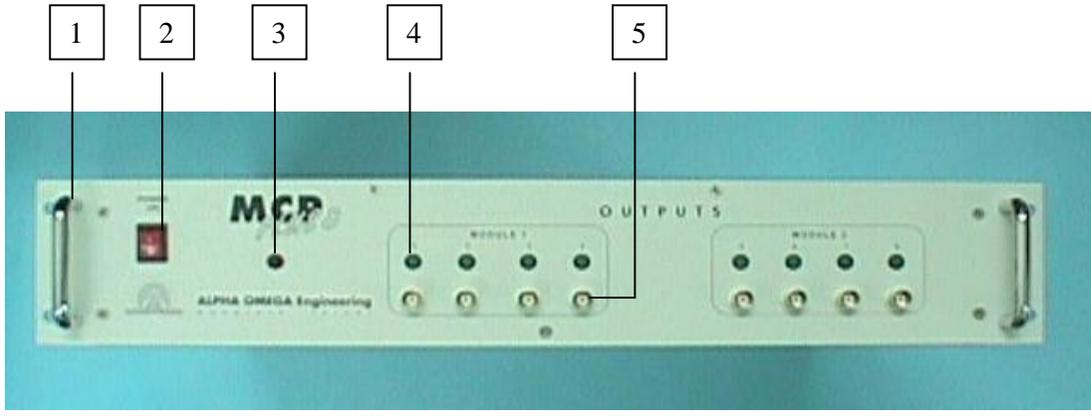
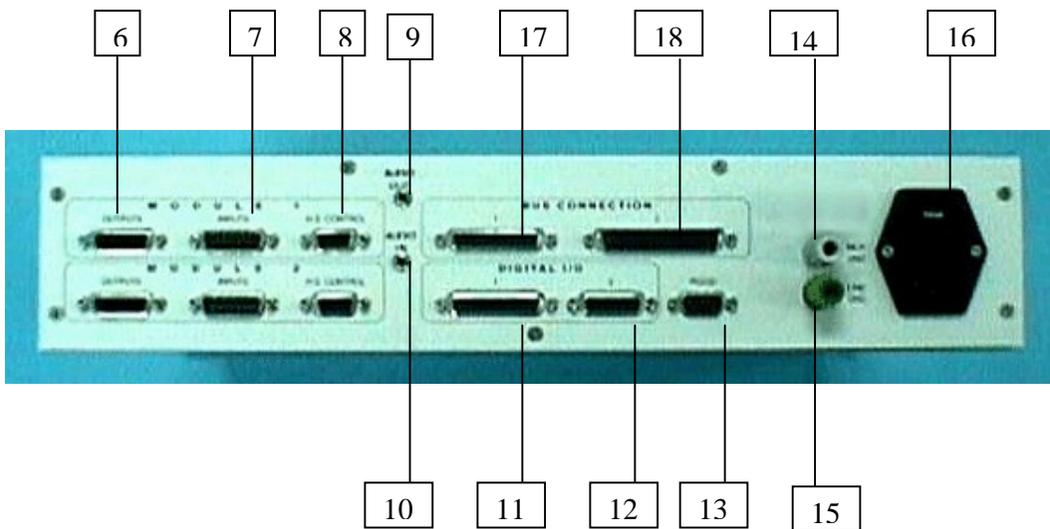


Figure 3: MCP-Plus 8 system Front Panel



MCP-Plus 8 - List of Parts

1. Hole for mounting the MCP-Plus on Rack
2. Power On/Off Switch
3. Power On Indicator
4. Channel On/Off LED Indicator
5. BNC Output
6. Output Connector
7. Input Connector
8. Control and DC power supply for Pre-Amp.
9. Audio Mixer input.
10. Audio Mixer output.
11. Digital Control I/O connector 1 (Audio Mix Control, External Stimulation On/Off switch)
12. Digital Control I/O connector 2 (Stimulator control)
13. Serial RS232 connector for communication with PC
14. MCP+ Ground
15. Line Ground
16. Mains power receptacle, Line Filter, 110/220 Voltage control and fuses
17. & 18. Bus connectors, these connectors are for future use.

1.3 MCP-Plus Technical Specifications

MCP-Plus modules and components:

- Analog I/O modules
- Notch filter
- Control Module
- Linear power supply / Isolation transformer
- Linear power supply for Pre-amplifier or Head Stage
- Casing
- Power cord
- Communication software package
- Communication cable

Technical Specifications

Dynamic range	$\pm 10V$
Input impedance	$1M\Omega \parallel 2PF$
Frequency response	DC- 10KHz
Noise (1 Hz- 10KHz BW)	$<10 \mu V$ RMS
Differential Inputs CMRR	110 dB
DC level shifting (R.T.I)	$\pm 50\mu V$ to $\pm 3V$
Gain selection (including HS gain, "X 25")	Up to 63,750
High pass (2 pole Butterworth)	DC -1KHz
Low pass (4 pole Butterworth)	100Hz-10KHz
Sine wave generator (for imp. measure)	100mV, 1KHz
RS232 (Serial Communication to PC)	
Baud rate	9600

Linear Power Supply

Line voltage	100VAC, 60Hz 50Hz 110VAC, 60Hz or 220VAC, 50Hz
DC outputs	+12V, -12V, +5V

Housing

Rack mountable	19"
----------------	-----

1.4 Differential input Head Stage -Technical Specifications

Dynamic Input range	$\pm 1V$
Dynamic Output range	$\pm 10V$
Input impedance	100M Ω
CMRR	~110 dB
Frequency response	DC - 10KHz
Noise (1 Hz- 10KHz BW)	<10 μV RMS
Gain	10
Supply	$\pm 12V$, 5V - Supplied from the MCP
Case dimensions	3" X 1" X 0.5" (75 X 26 X 13 mm)
Weight	55 Grams

2 Installation

2.1 General

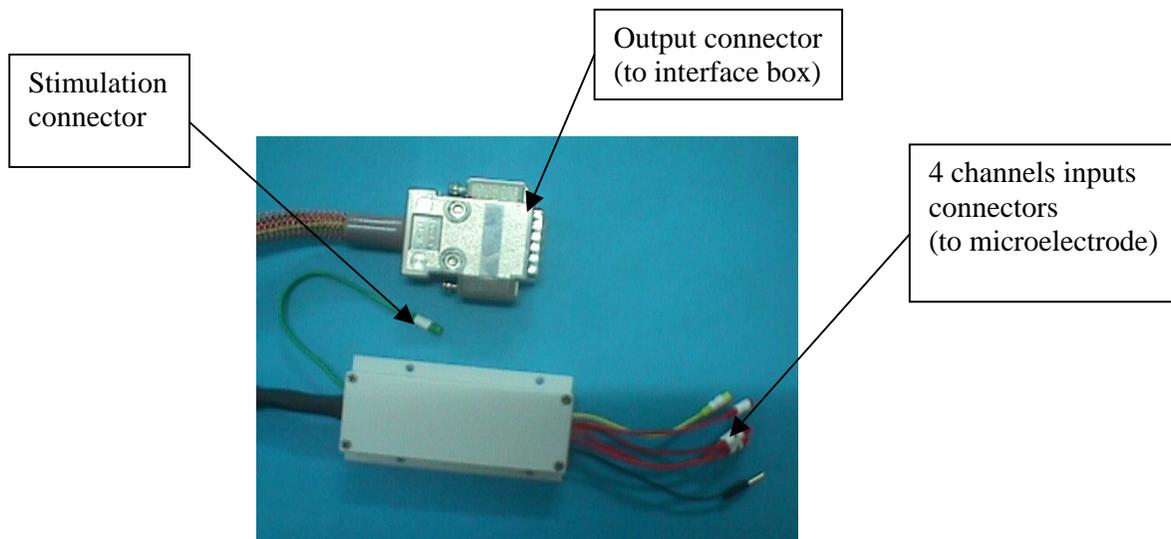
The **MCP-Plus** is a signal-conditioning system that can receive 8 to 256 channels from the input signal or from Pre-amplifiers or Head Stages via a cable, outputting the processed signals to a system like the **MSD** or any other data acquisition system.

2.2 Installing the MCP-Plus in Rack

Mount the MCP-Plus on the rack by inserting screws into the holes on the sides of the MCP-Plus.

2.3 The Pre-Amplifier Head Stage

The Pre-Amplifier Head Stage, along with the MCP-Plus, makes a very low noise and easy to install system that can accommodate all kinds of electrophysiological labs. They are designed in a way that they can be suited to the ground setup of the lab. Installing the head stage Pre-Amplifier and connecting it to the subject animal and to the MCP-Plus and to the ground is the most delicate part and should be done by an expert who is familiar with handling low noise systems for measuring small signals. If the input source comes from a high impedance source, such as a microelectrode that has a high impedance of several Mega Ohms, it makes it more difficult to eliminate the noise, as the high impedance source works like an antenna that might collect all kinds of surrounding noises. In addition to all the functions and options supplied by the Head Stage Pre-Amplifier, it is recommended to shield the area surrounding the place of recording with a good shielding to help eliminate surrounding noises collected by the high impedance microelectrode.



Head stage pre-amps

2.4 MCP-Plus and Pre-Amplifier Head Stage Connections

If the Head Stage Preamplifiers are purchased along with the MCP-Plus, an interface box & two cables are supplied together with the pre-Amps. The pre-amps can be 1 OR 2 OR 3 OR 4 channels, and connected to the interface box, with the short cable, then the interface box is connected to the MCP with the long cable. The long cable connects between the MCP-Plus and the interface box outputs. D-type 15 pin connectors terminate the cable. Plug the designated MCP connector into the corresponding input located on the rear panel of the MCP-Plus. Plug the designated HS connector to the interface box. Fasten the screws of the D-type connectors to ensure good connections.

Since the connection carries the power supply to the Head Stage, it is imperative to turn the power off before connecting the Head Stage, and the interface box.

Refer to ‘Connector Pin Assignment’ (section 2.6) for a detailed description of the pin assignment.

2.5 Ground Connections and Shielding

The Head Stage pre-amp has instrumentation (differential) input, which makes it easier to overcome grounding problems. The Head Stage Pre-amp Box can handle up to 4 Channels.

The Head Stage pre-amp channels have a common ground input connector (GND-black connector) and a common minus input connector (In-), The In- of all the pre-amps connected together (yellow connector).

The In- and GND should be connecting to the same reference point.

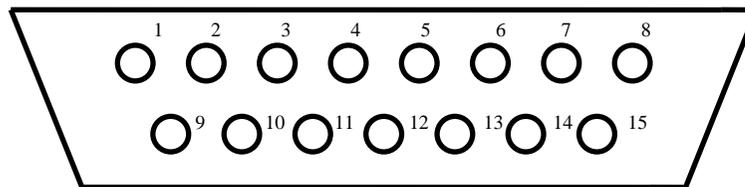
GND connections should be made so that no ground loops will be generated. The user some times should play around with these connections until the best results are achieved.

Tips and recommendations:

- All systems used for measurement should be connected to the same electrical outlet to minimize ground loops.
- The space in which the subject animal is located should be shielded, preferably a noise-free shielded room.
- Do not use any devices that operate on AC power, like 100,110 or 220VAC, in close proximity to the (shielded) area.
- Do not use any device that transmits electromagnetic noise (e.g., a monitor) in close proximity to the (shielded) area. If such devices are used, they should be shielded.
- Do not leave any unused unconnected inputs. These devices should be switched off or connected to the ground.

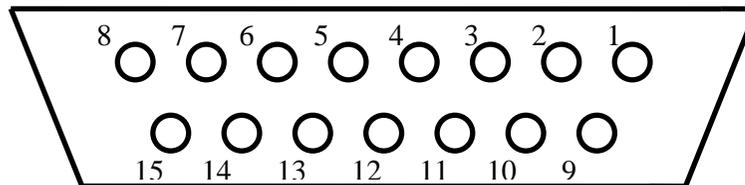
2.6 Head Stage & Interface Box Pin-out Connections

Interface Box Output Connector (male)



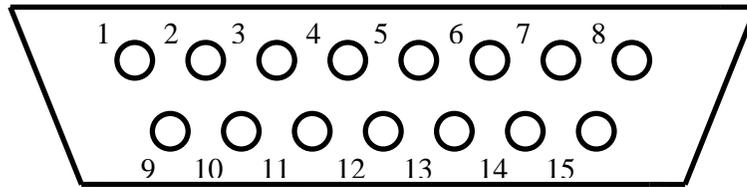
- 1- NC
- 2- NC
- 3- KEY
- 4- Sine Input for Impedance measure
- 5- Output 4
- 6- Output 3
- 7- Output 2
- 8- Output 1
- 9- VEE (-12V)
- 10- VCC (12V)
- 11- GND
- 12- GND
- 13- GND
- 14- GND
- 15- GND

Interface Box Input Connector (female)



- 1. Input 1
- 2. Input 2
- 3. Input 3
- 4. Input 4
- 5. GND
- 6. Sine for Impedance measure
- 7. RELAY2
- 8. RELAY4
- 9. GND
- 10. VCC (12V)
- 11. GND
- 12. -VEE (-12V)
- 13. GND
- 14. RELAY1
- 15. RELAY3

Head Stage Pre-Amp Output Connector

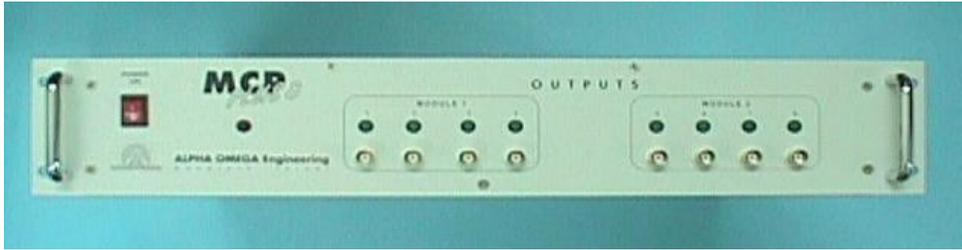


1. Input 1
2. Input 2
3. Input 3
4. Input 4
5. GND
6. Sine for Impedance measure
7. RELAY2
8. RELAY4
9. GND
10. VCC (12V)
11. GND
12. -VEE (-12V)
13. GND
14. RELAY1
15. RELAY3

Head Stage Instrumentation Pre-Amp Input Connector

- 1- Input + (red connector labeled with channel number)
- 2- GND (one black connector for all channels)
- 3- Input - (one yellow connector for all channels)

Head Stage Pre-Amp. , Interface box & MCP-Plus8



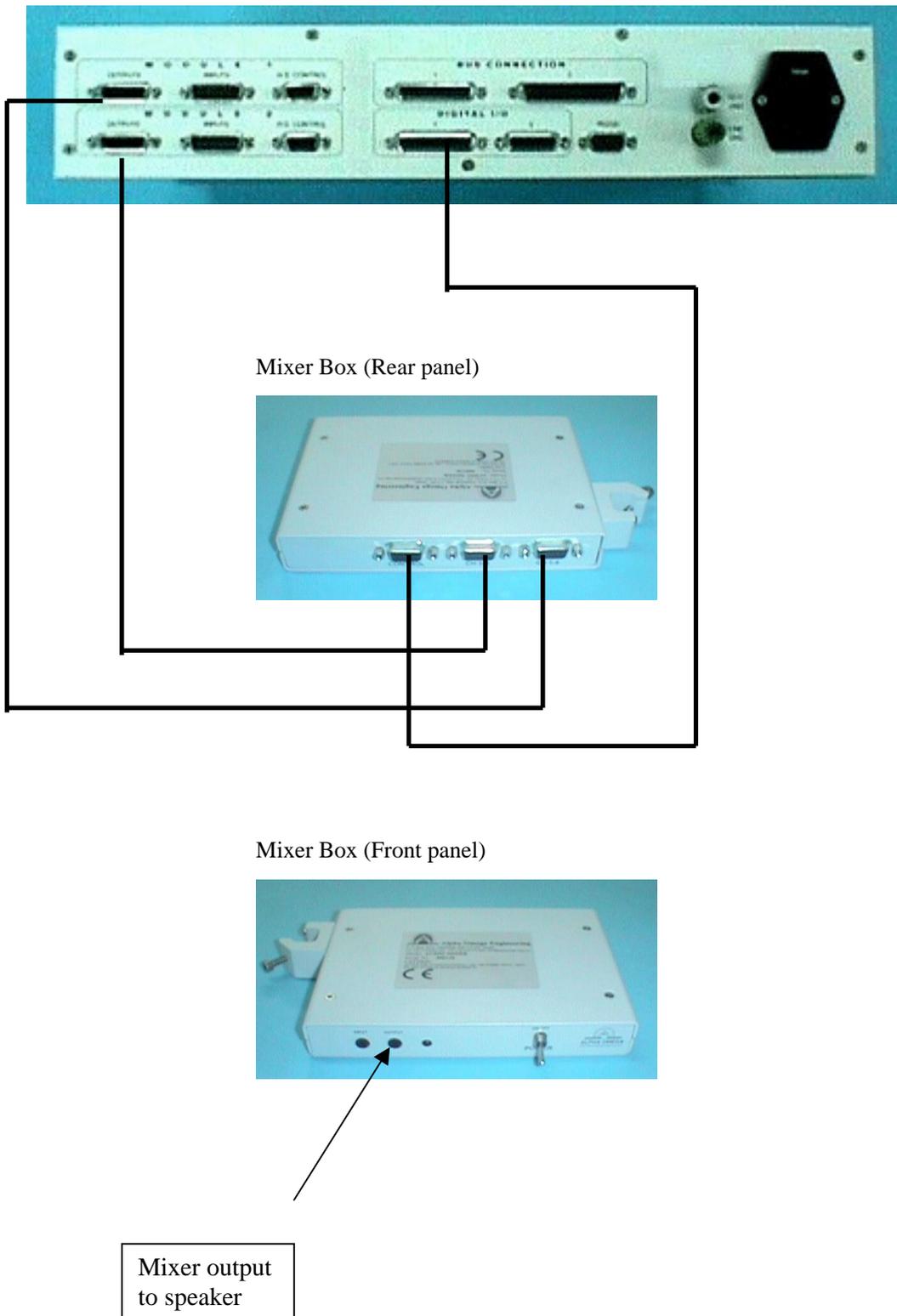
Interface Box



Head Stage Pre-Amp

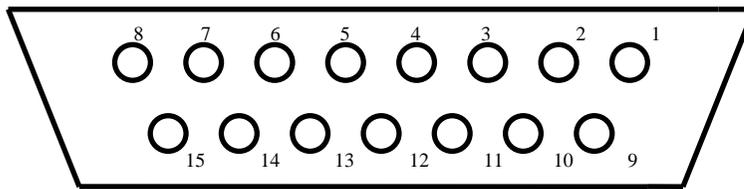


Mixer & MCP-plus8



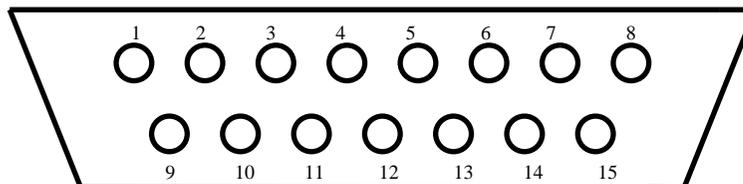
2.7 MCP-Plus Pin-out Connections

MCP-Plus Output Connector (female)



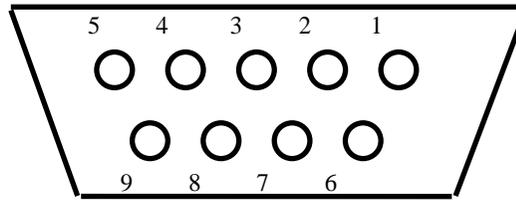
- 1- Filtered out 1
- 2- Filtered out 2
- 3- Filtered out 3
- 4- Filtered out 4
- 5- Unfiltered out 1
- 6- Unfiltered out 2
- 7- Unfiltered out 3
- 8- Unfiltered out 4
- 9- Analog Ground
- 10- +12V
- 11- Analog Ground
- 12- -12V
- 13- Digital Ground
- 14- +5V
- 15- Analog Ground

MCP-Plus Input Connector (male)



- 1- Digital Ground
- 2- +5V
- 3- Analog Ground
- 4- Sine Output
- 5- Input4 +
- 6- Input3 +
- 7- Input2 +
- 8- Input1 +
- 9- -12V
- 10- +12V
- 11- Analog Ground
- 12- Input4 -
- 13- Input3 -
- 14- Input2 -
- 15- Input1 -

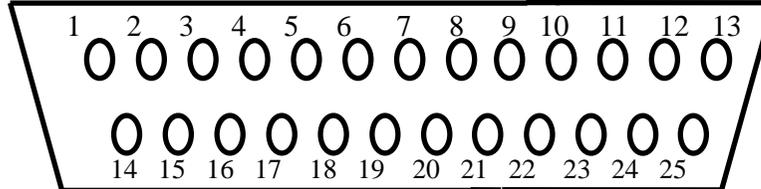
MCP-Plus Control Connector on I/O module (female)



- 1- Floating +12V for Pre-Amp H.S.
- 2- Floating Ground for Pre-Amp H.S.
- 3- Control line 1 (On/Off) output
- 4- Control line 3 (On/Off) output
- 5- +5V
- 6- Control I/N output
- 7- Floating -12V for Pre-Amp H.S.
- 8- Control line 2 (On/Off) output
- 9- Control line 4 (On/Off) output

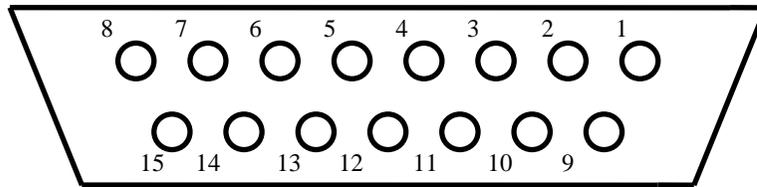
MCP-Plus Digital I/O 1 connector (female)

This connector is used to connect all the control signals and power to the Audio-Mix “Electrode Stimulus Multiplexer”. This connector should be connected to the “Power and Control” connector situated at the rear panel of the Audio-Mix.



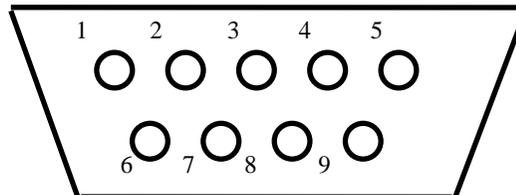
- | | |
|------------|-------------------------|
| 1 - IN0 | 14 - IN1 |
| 2 - IN2 | 15 - IN3 |
| 3 - IN4 | 16 - IN5 |
| 4 - IN6 | 17 - OUT0 |
| 5 - OUT1 | 18 - OUT2 |
| 6 - OUT3 | 19 - OUT4 |
| 7 - OUT5 | 20 - OUT6 |
| 8 - OUT7 | 21 - Digital Ground |
| 9 - +5V | 22 - Stimulation On/Off |
| 10 - +5V | 23 - OPTN |
| 11 - VCC | 24 - AUD-CLK |
| 12 - -VEE | 25 - EN |
| 13 - ONOFF | |

MCP-Plus Digital I/O 2 connector (female)



1. RS1 (RANGE SELECT1)
2. RS0 (RANGE SELECT0)
3. CS-POT
4. SD-IN (SEARIAL DATA INPUT)
5. CLK-POT
6. GND
7. MAN-CON (MANUAL CONTROL MODE)
8. STIM-ON/OFF
9. SHDN-POT
10. STIM-BACK
11. AD1-BACK
12. AD0-BACK
13. VCC
14. GND
15. -VEE

RS232 Serial communication Connector to PC (male)



- 1- NC
- 2- Transmit (TXD)
- 3- Receive (RXD)
- 4- Clear To Send (CTS)
- 5- Digital Ground
- 6- NC
- 7- NC
- 8- Ready To Send (RTS)
- 9- NC

2.8 Power Cord Connection

Check that the MCP-Plus power switch is off. Verify that the line filter sign (100V/110V /220V) is compatible with the line voltage supplied. Then plug the power cord's female plug into the electricity connector on the rear panel and plug the male plug into the main power connection (wall socket).

2.9 Installing an Analog I/O Module Card

This section includes instruction for the installation of an additional analog I/O module in an MCP-Plus system.

Counting from left to right, the output modules have addresses of 1 to 64 (e.g. the first module has address 1; the second Module has address 2 etc.). The new module card will be installed at the address N. Remove the blank front panel and the blank rear panel of address N by removing the 2 fastening screws at the top and bottom of the each panel. Check the module address in the dipswitch table. (Ref. to Output Module Card Layout and the Analog I/O Board Base Address dipswitch table). After setting the dipswitches, insert the new Module in the rear panel within the top and bottom card guides and guide it carefully until it reaches the end and press firmly until you feel that the connector is engaged. Fix in position using the two fastening screws. Connect the 20-pin connector to the connector on the front panel using the short flat cable supplied and fix in position using the two fastening screws. The new Module is now positioned within the frame.

Note : To remove an analog I/O module, first unscrew the front panel and disconnect the 20 pin flat cable and then take out the module from the rear panel by unscrewing the 2 fastening screws, and pulling the module out.

Table 2-1 SW1 - Analog I/O Board Base Address Dip-Switch Set

SW1 Dip switches	1	2	3	4	5	6	7	8	Address
on = "0" off = "1"	off	on	on	on	on	on	on	on	1
	on	off	on	on	on	on	on	on	2
	off	off	on	on	on	on	on	on	3
	on	on	off	on	on	on	on	on	4
	off	on	off	on	on	on	on	on	5
	on	off	off	on	on	on	on	on	6
	off	off	off	on	on	on	on	on	7
	on	on	on	off	on	on	on	on	8
	off	on	on	off	on	on	on	on	9
	on	off	on	off	on	on	on	on	10
	off	off	on	off	on	on	on	on	11
	on	on	off	off	on	on	on	on	12
	off	on	off	off	on	on	on	on	13
	on	off	off	off	on	on	on	on	14
	off	off	off	off	on	on	on	on	15
	on	on	on	on	off	on	on	on	16
	off	on	on	on	off	on	on	on	17
	on	off	on	on	off	on	on	on	18
	off	off	on	on	off	on	on	on	19
	on	on	off	on	off	on	on	on	20

on = "0"	off	on	off	on	off	on	on	on	21
	on	off	off	on	off	on	on	on	22
	off	off	off	on	off	on	on	on	23
	on	on	on	off	off	on	on	on	24
	off	on	on	off	off	on	on	on	25
	on	off	on	off	off	on	on	on	26
off = "1"	off	off	on	off	off	on	on	on	27
	on	on	off	off	off	on	on	on	28
	off	on	off	off	off	on	on	on	29
	on	off	off	off	off	on	on	on	30
	off	off	off	off	off	on	on	on	31
	on	on	on	on	on	off	on	on	32
off	on	on	on	on	off	on	on	33	
on	off	on	on	on	off	on	on	34	
off	off	on	on	on	off	on	on	35	
on	on	off	on	on	off	on	on	36	
off	on	off	on	on	off	on	on	37	
on	off	off	on	on	off	on	on	38	
off	off	off	on	on	off	on	on	39	
on	on	on	off	on	off	on	on	40	
off	on	on	off	on	off	on	on	41	
on	off	on	off	on	off	on	on	42	
off	off	on	off	on	off	on	on	43	
on	on	off	off	on	off	on	on	44	
off	on	off	off	on	off	on	on	45	
on	off	off	off	on	off	on	on	46	
off	off	off	off	on	off	on	on	47	
on	on	on	on	off	off	on	on	48	
off	on	on	on	off	off	on	on	49	
on	off	on	on	off	off	on	on	50	
off	off	on	on	off	off	on	on	51	
on	on	off	on	off	off	on	on	52	
off	on	off	on	off	off	on	on	53	
on	off	off	on	off	off	on	on	54	
off	off	off	on	off	off	on	on	55	
on	on	on	off	off	off	on	on	56	
on = "0"	off	on	on	off	off	off	on	on	57
	on	off	on	off	off	off	on	on	58
	off	off	on	off	off	off	on	on	59
off = "1"	on	on	off	off	off	off	on	on	60
	off	on	off	off	off	off	on	on	61
	on	off	off	off	off	off	on	on	62
	off	off	off	off	off	off	on	on	63
	on	on	on	on	on	on	off	on	64

2.10 Communication Installation

The PC Requirements

- IBM- AT or compatible that can run Windows 9x/2000/NT/XP
- Minimum 640KB RAM
- CD ROM Drive
- Hard Disk
- RS232 port
- Monitor SVGA

Hardware Installation

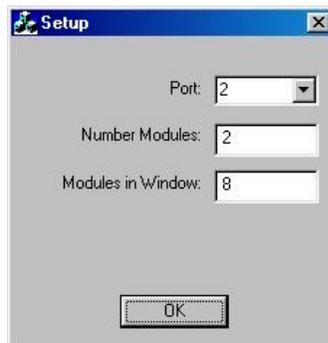
Connect the communication cable to the 9-pin D type male connector on the rear panel of the **MCP-Plus** and to the serial communication card (RS232 port) on the rear panel of the PC (either COM1 or COM2).

Software Installation

Insert the CD supplied into the CD ROM drive and run setup.

Follow the Installation instructions that appear on the screen.

At the end of the setup process the user is requested to enter the below values according to the system purchased.



Click OK and then Finish to finalize the installation.

The installation program will create a new sub directory on the hard disk called **MCP-Plus**, containing all the relevant files.

3 Operation

3.1 General

The **MCP-Plus** is simple to operate. This section explains the principles that are fundamental to the **MCP-Plus** and provides detailed operating instructions.

The operating procedure consists of the following steps:

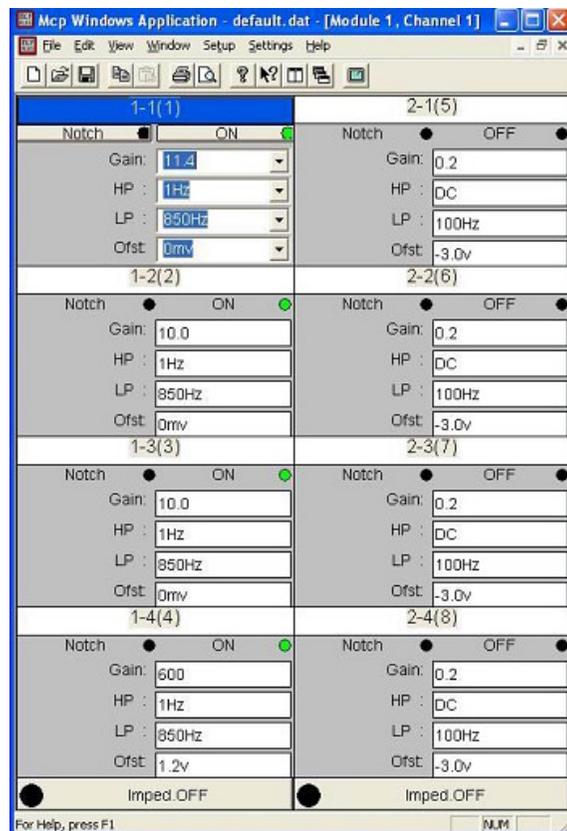
- a. Make sure that the **MCP-Plus** is connected to the main power source, that the serial communication cable is connected to the PC, and that the input cables are properly connected.
- b. To turn on the **MCP-Plus**, turn on the power switch on the front panel.
All **MCP-Plus** inputs are differential with a very high CMRR (Common Mode Rejection Ratio) that enables the user to use long input cable without affecting the signal immunity to surrounding electromagnetic fields like line 50Hz or 60Hz.

3.2 Ready to go

Double click the **MCP-Plus** icon



The following window appears:



Channel On /Off

By clicking the On/Off field you can turn the desired channel on and off.

Warnings

A. In order to avoid noise problems perform one of the followings:

- 1. In case a stimulator is connected to the Head Stage – ground all unused channels.**
- 2. In case there is no stimulator – turn unused channels off.**
- 3. In case there is no stimulator – for unused channels lower the gain level to 0.**

B. All channels in a module should stay on if stimulation current is injected into the Head Stage that belongs to this module. Turning a channel off would inject the current into that electrode.

Notch Filter On /Off

Available only if “Notch Installed” box is checked during setup. Click the "Notch" button to turn the Notch filter of the desired channel on and off.

Gain Select

One out of possible 500 gains can be applied. The number shown in the gain display can be set to include the gain of the pre amp. To change the gain amplification just click the gain field and select the desired gain.

High and Low Pass Filters (HP and LP)

These two fields control the high pass and the low pass filters. The filters used are Butterworth filters that have a very flat pass band response. The amplitude response of this kind of filter is:

$$V_{out} / V_{in} = 1 / [1 + (f / f_c)^{2n}]^{\frac{1}{2}} \quad n=2 \text{ (No. of poles)}$$

The high pass is a 2 pole variable filter. The cutoff frequencies applied within the high pass filter are from DC to 1Khz with 65 discrete frequencies. The low pass is a 4 pole variable filter. The cutoff frequencies applied within the low pass filter are from 100Hz to 10khz with 57 discrete frequencies.

DC offset

It is possible to change the DC offset by clicking the offset field and selecting the desired DC shift that can range from $\pm 50\mu\text{V}$ - $\pm 3\text{V}$, with over 450 DC levels.

Microelectrode Impedance Measure

The microelectrode impedance measure field is usually off during normal operation. When switched on, a sine wave generator (100 mV - scientific, 2V – medical version,

1 kHz) is activated and connected to the cable going to the Head Stage. The outputs from the Head Stage now give a sine wave of amplitude proportional to the impedance of each microelectrode. These outputs are fed to the inputs of the **MCP-Plus**. In this mode, the gain in all the Output Module is fixed to 1000(1000 is optional), the high pass to 300Hz, the low pass to 5khz and the offset to zero automatically. The user can now measure the voltage at the filtered outputs in the selected Analog I/O Module. The microelectrode impedance can be calculated using the following equation:

$$Z = V_o$$

where **Z** is the microelectrode impedance in Mega Ohms

and **V_o** is the voltage measured at the spike outputs in Volts

When the user switches the Impedance Measure off, the sine wave generator is deactivated and disconnected from the cable going to the Head Stage, and instead the analog ground is reconnected. The gain, the Low and High Pass filters and the Offset are also restored to their previous settings; i.e. settings existing before entering the impedance measure mode.

3.3 Central Processing Unit

The central processing unit controls all parameters of gain and filters of the **MCP-Plus** at start up and shut down. At start up, it recalls all parameters from the PC so that the user is not required to reset the parameters.

3.4 Using the Menu Options

“File” menu options:

- New:** Opens a new window (group of modules) if there is a closed one.
- Open:** Start a dialog to open a file previously saved in the **MCP-Plus**.
Note: if the group of modules window was closed it can be re-opened by using the “New” option (the “Open” option will not work).
- Close:** Closes the active windows (group of modules). The closed window can be reopened by the new option.
- Save:** Save the parameter into the open file. If no file is opened, the PC opens a dialog to enter the file name.
- Save As:** Open a dialog to save the parameters into a new file.
- Print:** Prints the parameter of all the fields of the **MCP-Plus**
- Print Preview:** Displays the data, as it will be printed.
- Print Setup:** Opens the dialog for setting the printer options.
- Exit:** Exit the **MCP-Plus** program. If the parameters are not saved, the program saves them into the file Default.dat at before exiting

“Edit” menu options:

- Copy Field:** Copy the value of the currently selected field into the program’s memory. This copied value can be pasted later in the same field of any channel(s).
- Copy Channel:** Copy the values of all the fields in the current channel into the program’s memory in order to paste these values later in any channel(s).
- Copy Module:** Copy the values of all the field of all the channels in the current module (module is the 4 channels in one column on the screen. i.e. channels 2-1, 2-2, 2-3 and 2-4 are the channels of module number 2).
- Paste:** Paste the last copied value(s). If the last copied value is one field (Copy Field command), then the paste command loads the value of the copied field into the **same field** in the current channel. If the last copy command was Copy Channel, the values of all the fields of the copied channel are loaded into the field of the current channel. And if the last copy command was Copy Module, the values of the copied module are loaded into the current module.
- Paste Module:** Paste the last copied values into the current module. If the last copy command was copy field, then the **same field** of all channels in the current module is updated. If the last copy command was copy channel, then the values of the copied channel are loaded to all the channels in the current module. And if the last copy command was copy module, the values of the copied module are loaded into the current module.
- Paste All:** Pastes the last copied value(s) into all channels. If the last copy command was copy field, then the **same field** of all channels will be copied. If the last copy command was copy channel, then the values of the copied channel are loaded to all the channels. And if the last

copy command was copy module, the values of the copied module are loaded into all the modules.

“View” menu options:

Toolbar: Display / hide the toolbar.

Statusbar: Display / hide the status bar.

Zoom Channel: Zoom in on current active channel.

Zoom All: Zoom in / out. If the current display is too tight (when more than 8 modules are displayed on the screen) use the Zoom command to enlarge the size of each module. When in zoom, a scroll bar is shown to enable the user to scroll between all the modules in the same window.

“Window” menu options:

Cascade: Arranges all opened windows (groups) in a cascaded (overlapping) order.

Tile: Arrange all opened windows (groups) in a vertically tiled order.

Arrange Icons: Arrange all Minimized windows (groups) at the bottom of the main MCP window.

Next Channel: Select the next channel. (**F5**)

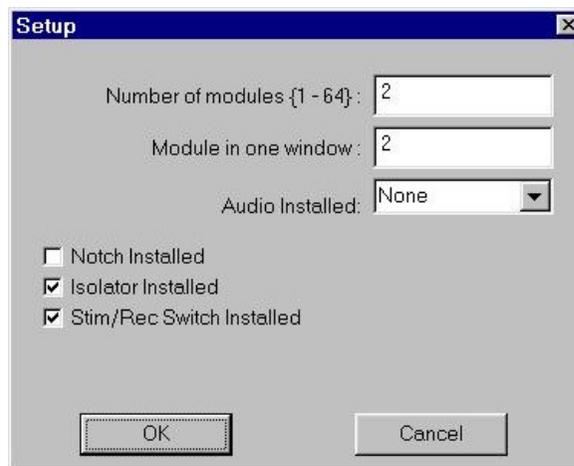
Prev Channel: Select the previous channel. (**SHIFT+F5**)

Impedance: Select the Impedance button of the current channel. Or, select back the current channel. (**F7**)

Note: To select the next window (the next group of channels) press the **F6** key, to select the previous window, press **CTRL+F6**.

“Setup” menu options:

The Options dialog box:



Specify the number of modules that are to be used and the number of modules in one window. Check the checkboxes according to the hardware installed on your system. See [Appendix B](#) for more details regarding the Stim/Rec Switch.

Select the audio device installed on the system. Check the Notch, Isolator and Stim/Rec Switch boxes if installed.

To finalize setup click the OK button.

Enable / Disable

Opens a dialog for enabling or disabling a module. Once disabled, a module is shown on the screen, but its field's values can not be altered unless it is enabled first.

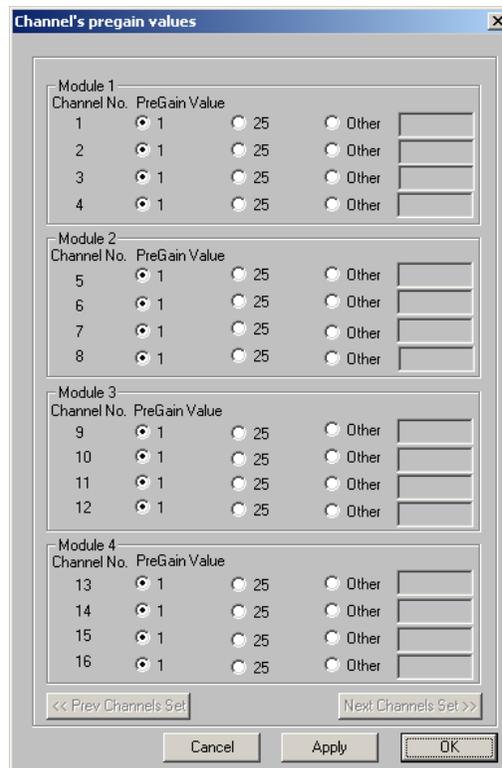
Serial COMM Number:

Opens a dialog for changing the serial communication port number. When the serial COMM number is changed, the PC attempts to open the new COMM, and if successful, it generates a "conversation" with the **MCP-Plus**. If the **MCP-Plus** responds, the communication is started. If any error occurred, the PC will inform the user.

Change PreGain Value

Opens a dialog for changing the PreGain value.

The user can change the value for each channel by selecting one of these options 1 or 25 or set other value in the edit box.



Use the Prev Channels and Next Channels buttons to navigate between channels.

Impedance Gain Value

This option controls the Impedance Gain of the **MCP-Plus**. User can change Gain of the output during impedance measure mode.

“Settings” menu options:

Stimulus

Open the **Stimulus Control** dialog box. In this dialog the user can activate/deactivate the stimulus, and if activated, you can select the stimulus and the stimulus return addresses.



Select: Select the channel of the stimulus.

Return: Ground.

According to Stim/Rec Switch:

Check this box to inform the MCP that the Alpha Stimulus Isolator triggers the stimulation externally (see [Appendix B](#)).

Start: Start stimulus.

Stop: Stop stimulus.

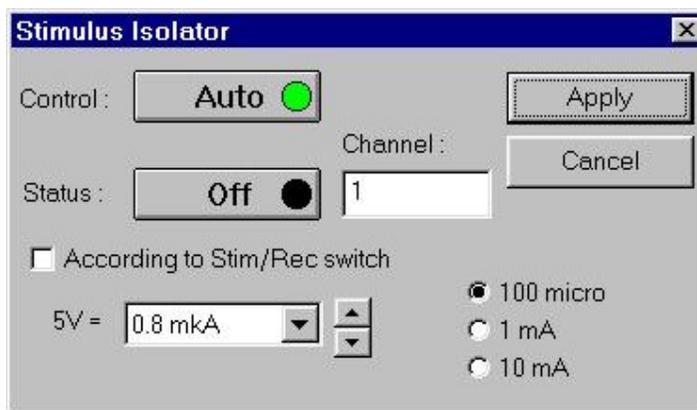
Close: Close the dialog. If the stimulus is active, the **Close** button will deactivate the stimulus.

* Refer to *Appendix A* for information about the Alpha Stimulus Isolator.

Isolator

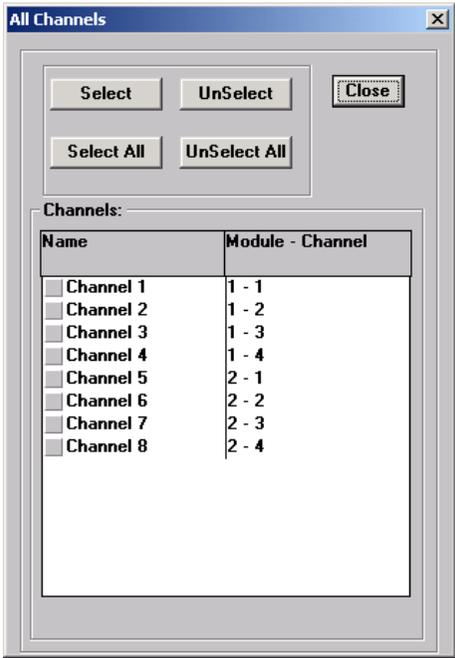
Open the Stimulus Isolator dialog box. In this dialog user can control the Stimulus Isolator. Stimulus Isolator is an optional external device. The user can select number of stimulated channel and the ratio of conversion for output current.

Check the “According to Stim/Rec Switch” box to inform the MCP that the Stim/Rec Switch triggers the stimulation externally.



Audio Mixer

Open the Audio Mixer dialog box. In this dialog user can activate the mixing of audio output from multiple channels.



4 Client Server

Signal conditioning (MCP) client connects to the signal-conditioning server
Controlling all the available features, excluding the HW configuration settings.

Available client features:

- Gain Control.
- .Filtration control
- Stimulus Isolation Control.
- Impedance Measurements Control.

4.1 Running the Signal Conditioning Client

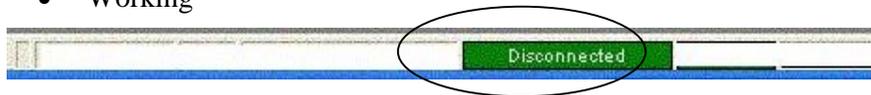
To run the Signal Conditioning Client application do one of the following:

- In the MCP client computer disk top click the MCP client icon.
- Or
Select **Start > Program > MCP client.**

Once the Signal Conditioning Client is running, verify at the status bar that it is automatically connected to the server.

The status bar may indicate either of the following:

- Disconnected
- Working



If the client is disconnected do, the following:

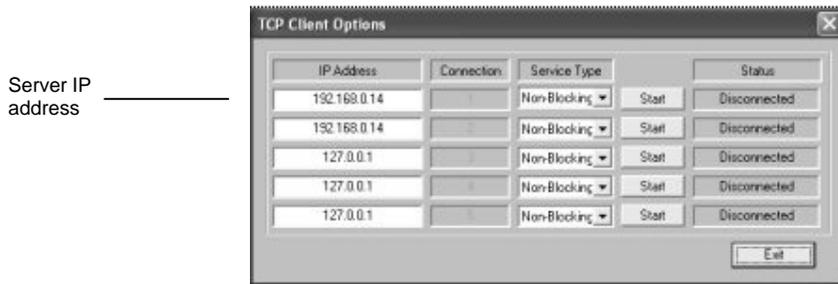
1. In the server, select **Options->TCP Server Options.**

The following window appears:



- Verify that the under **Status** appears **listen...** in **Connection 1**. If not, click **Start**.
- In the client select **Options > TCP options**.

The following window opens:



Server IP address

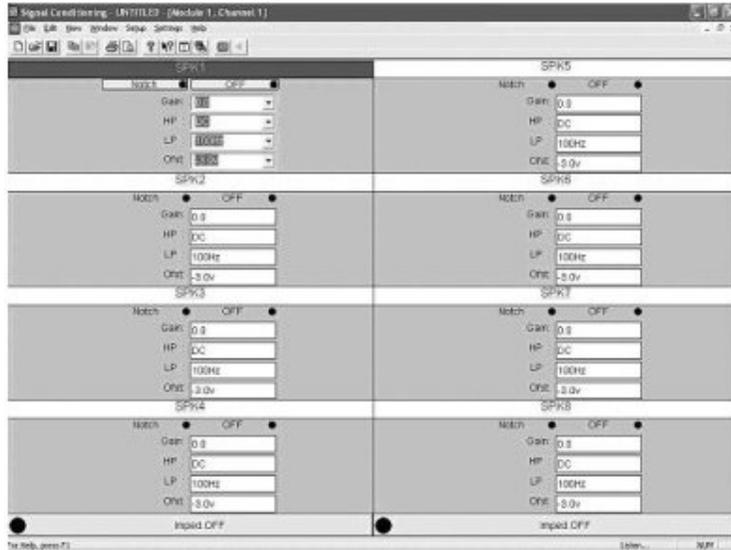
- Under **IP Address (connection 1)**, enter the IP address of the server as it appears at the bottom of the **TCP Server Options** window.
- To establish connection, click **Start**.
- Under **Status**, view the client connection status.
- Select **File > Get Server Settings** to open the workspace.

4.2 Defining a Workspace

In the following section you will divide the first 4 channels (1-4) in Module 1 and the channels 5-8 in module 2.

- In the server application, select **Setup > Options**.
- In the **Setup** window, in Number of Modules, type 2.
- In Module in One Window, type 1.
- Click **Save**.

The Signal Conditioning main window is as follows:



5. In the Signal Conditioning Client, select **File > Get Server Settings** at the application.
6. Verify that the Signal Conditioning application restarts with the server's workspace.
7. Close module 1.
8. Select **File > Save** to save the settings to the workspace.
9. In the server application, close module 2.

Each user can control the channels independently without distracting the other user.

4.3 MCP TCP server commands format

Command format:

a= ItemType & ItemName1=ItemVal1 &...& ItemName#=ItemVal#

Following is a list of supported commands for MCP TCP server:

List of ItemType:

MCP_SET	Set channel conditioning parameters
MCP_GET	Get channel conditioning parameters
MCP_STIMULATOR	Change parameters for stimulus
MCP_ISOLATOR	Change parameters for Isolator
MCP_IMPEDANCE	Set module to mode Impedance
MCP_MIXER	Change parameters for mixer

List of ItemNames:

MCP_CHANNEL_NUMBER	
MCP_MODULE_NUMBER	
MCP_PAR_ONOFF	
MCP_PAR_NOTCH	
MCP_PAR_GAIN	
MCP_PAR_LP	
MCP_PAR_HP	
MCP_PAR_OFFSET	
MCP_SET_VALUE	

If a parameter is not present then it should not be changed.

Port number is 8092.

Examples:

Set to "On" channel number 1

a=MCP_SET&MCP_CHANNEL_NUMBER=1&MCP_PAR_ONOFF=1

Set to "On" whole module number 1

a=MCP_SET&MCP_MODULE_NUMBER=1&MCP_PAR_ONOFF=1

Get all current parameters of channel number 1

a=MCP_GET&MCP_CHANNEL_NUMBER=1

Begin stimulation of channel number 1

a=MCP_STIMULATOR&MCP_CHANNEL_NUMBER=1&MCP_PAR_ONOFF=1

5 Stimulation support using the MCP

The MCP supports three modes of switching an electrode between recording and stimulation as follows:

1. Manual switching at Head stage level using a Start/Stop button
2. Triggered switching at Head stage level using an external TTL pulse.
3. Triggered switching at Stimulus Isolator level using an external TTL pulse with the option to drop the gain on the other channels.

The following section will instruct you on how to set your system for each one of the modes.

5.1 Manual stimulation according to Start/Stop Button

In this mode the user may select the desired electrode and start/stop stimulation manually by clicking a start/stop buttons. This mode could be run with AlphaOmega or any other stimulator/Stimulus Isolator.

Run the stimulation

1. Go to **Settings>Stimulus** and verify that the **Stimulus control** window opens.
2. Type the desired electrode number in the **select stimulation channel**.



3. To start stimulation, click the **Start** Button.
4. To stop the stimulation click the **Stop** button.
5. To close the window and exit the stimulation, click the **close** button.

Clicking this button while stimulation stops the stimulation and closes the Window.

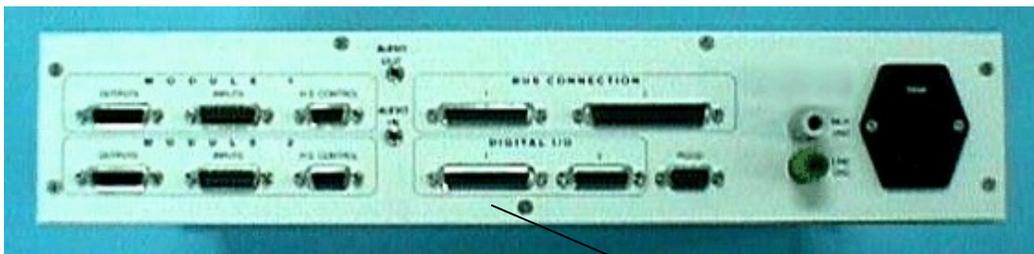
5.2 Stim/Rec according to an external trigger.

MCP ver. 3.5 or higher includes the option to enable/disable the Stim/Rec trigger and set the desired Stim channel.

The External Trigger:

Real-Time switching to stimulation or recording is performed when an External TTL Trigger (digital signal) is received. When the signal is High, then the selected channel is switched to Stimulation mode. When the signal is Low, then the selected channel is switched to Recording mode.

The external trigger should be connected to the digital I/O connector 1 (D-type female 25 pin) at the rear panel of the MCP when the digital ground at pin 21 and the stimulation on/off at pin 22. (See the MCP rear panel view).



MCP rear panel view.

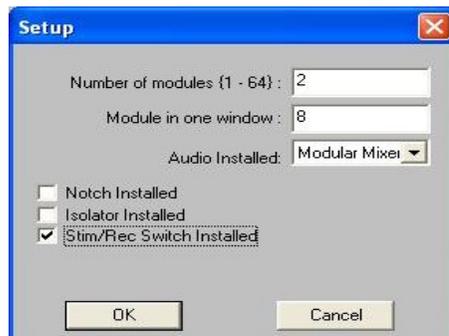
Digital I/O 1

Using the On/Off Stimulation Switch

Note: User should verify that the MCP has the correct software version.

See the MCP software upgrade instructions at appendix B.

1. Install MCP application 3.5
2. Select menu item **Setup>Options**.
The following window opens:



3. Check the box “**Stim/Rec Switch Installed**” to enable the TTL trigger to control switching from recording to stimulation.
4. Click “**OK**” to close the window.
5. Select menu item **Settings> Stimulus**.
The following window opens:



6. Check the box “**According to Stim/Rec switch**”.
7. Choose desired channel for stimulation and press “**Start**” button.
8. Circle of On/Off button, of the selected channel at the MCP’s main window, turns from green to pink color.
9. Now connection to external trigger signal is enabled and switching between Stimulation and Recording modes is possible. When the mode is switched then On/Off button turns from pink to red color.
10. To stop stimulation, press the “**Stop**” button in the “**Stimulus Control**” dialog.

To select a different channel, press the “**Stop**” button in “**Stimulus Control**” dialog and change Stimulation channel number.

5.3 Stim/Rec – Recording between stimulation . (only with AlphaOmega stimulator).

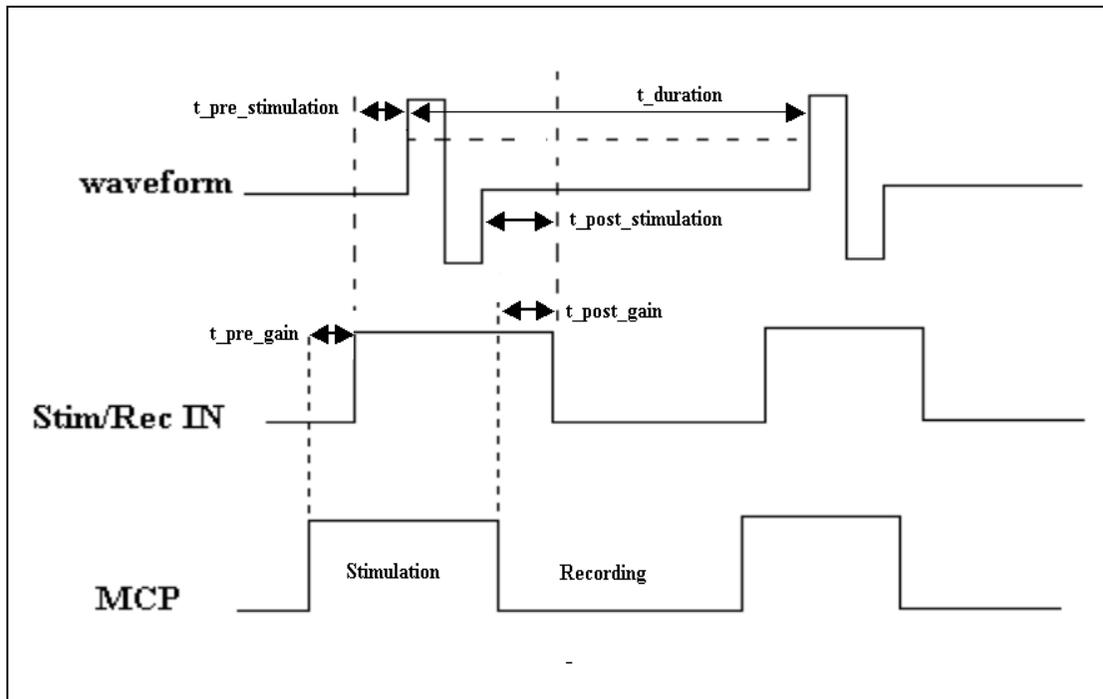
The stimulation-recording feature enables the researcher to stimulate with one electrode and to record with another between the stimulation periods.

The following should be available in order to be able to setup and run this feature:

- ✓ Alpha Stimulus Isolator.
- ✓ MCP (with the suitable Eproms).
- ✓ 2 TTL Generators.
- ✓ Waveform of the desired stimulation current.

5.3.1 Pulses and wave synchronization

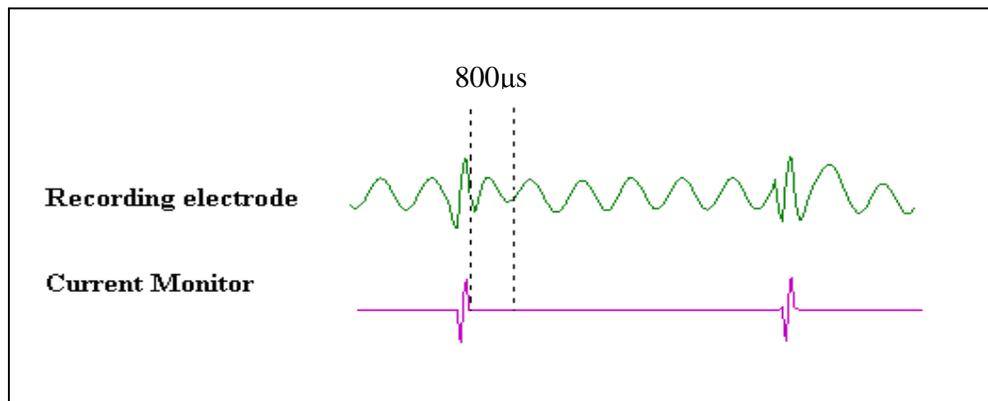
Without any relation to the source of the TTL pulses and of the waveform, they always should stand with the following time definitions to obtain the desired synchronization:



The following table summarizes the synchronization time values between the TTL's and the waveform pulses.

Time period Name	Related pulse	Pulse explanation	Related actions and results Actions	Value or Tolerance
t_pre_stimulation	Wave form	The time before stimulation pulse.	Before t_pre_stimulation (μs) connect the Isolator to the load.	$> 125\mu\text{s}$
t_post_stimulation	Wave form	The time after stimulation pulse	After t_post_stimulation (μs) disconnect the Isolator from the load	> 0
t_pre_gain	Stim/Rec IN	The time before connecting the Isolator to the load	In this the MCP drop the gain in the recording channel	$> 100\mu\text{s}$
t_post_gain	Stim/Rec IN	The time before or after disconnecting the Isolator from the load.	In this time the MCP returns the previous gain as before	$-100\mu\text{s} < t_{\text{post_gain}} < 100\mu\text{s}$
t_duration	Wave form	The time between two pulses.		$t_{\text{duration}} > 800\mu\text{s}$

According to the definitions in the above table we may have recording after $800\mu\text{sec}$ of the stimulation pulse up to $225\mu\text{sec}$ before the next stimulation pulse. See the following figure:



Recording electrode vs. stimulation pulse

5.3.2 Setup Configurations

The stimulation-recording feature can be run in two different configurations depending on the TTL's and the waveform source.

- Alphamap or AlphaLab Pro generates the TTL pulses and the waveform.
- External devices generate the TTL pulses and the waveform.

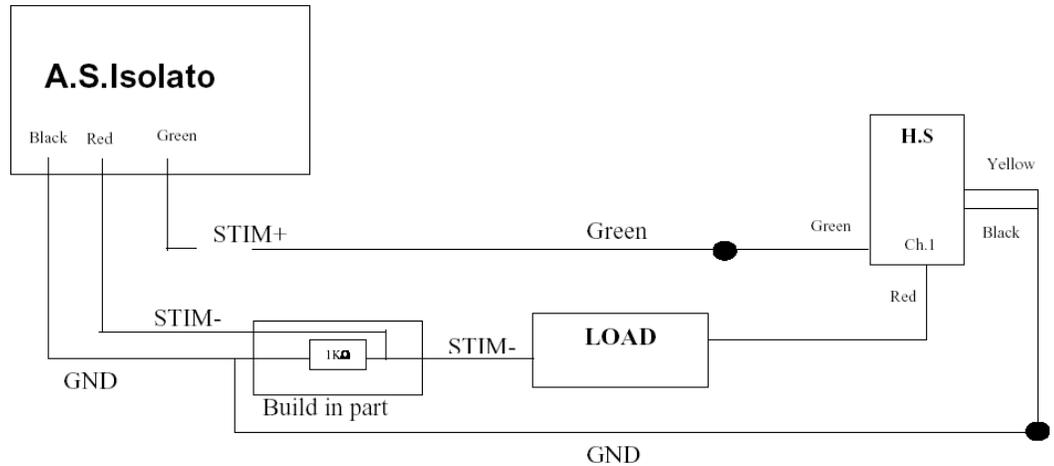
5.3.3. Connecting the wave form, the TTL's source, and the load to the Stimulator.

➡ **Needed Accessories:**

- ✓ Stimulator Isolator
- ✓ AlphaMap/AlphaLab or user's TTL's source device.
- ✓ Load Cable.
- ✓ Two BNC cables.
- ✓ Control cable.

1. Connect the control cable between the **Digital I/O 2** at the MCP and the **MCP control** connector at the stimulator.
2. Connect the **WAVE IN** at the stimulator to the **Analog Output** of the AlphaMap/AlphaLab pro or to your waveform source, by one of the BNC cables.
3. Connect **D.out1** at the **Digital I/O** of the AlphaLab/Alphamap or the TTL source device to the MCP **Digital I/O 1** connector at the MCP.
4. Connect **D.out2** at the **Digital I/O** of the AlphaLab/AlphaMap or the TTL source device to the **STIM/REC IN** connector I the stimulator.
5. Connect the Load cable to the stimulator according to the colors of the **REF**, **+STIM**, **-STIM**.
6. Connect the power cable to the power supply connector at the stimulator.
7. Verify that the **STIM/REC** switch is in "O" status.
8. Connect the load cable to the load according to the following diagram"

Note: regarding the Draw on the next page, you may use a resistor of 10KΩ instead of the load for training. In this case the red and green should be connected to one side of the resistor and the black to the other side.



5.4 Running the stimulation

This section will instruct you on how to run the stimulation when the TTL's and the waveform are from the AlphaLab or when they are used from an external device.

5.4.1 The waveform and TTL's are generated by the Alphalab pro

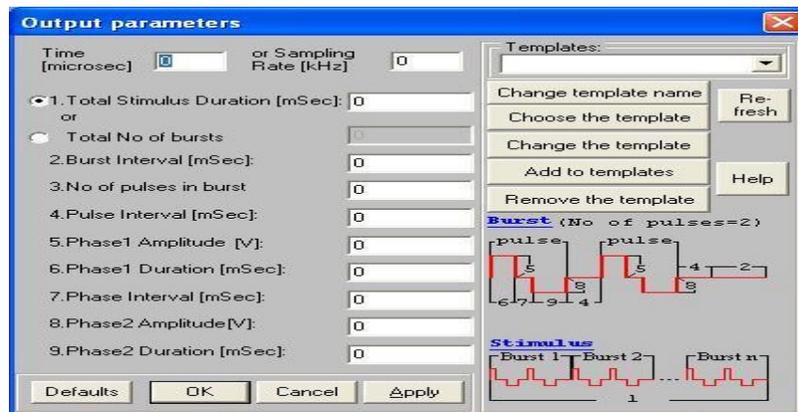
The waveform and TTL's in the AlphaLab can be generated in two ways:

1. From the AlphaMap.
2. From a predefined user text file read by the AlphaMap.

5.4.1.1 Wave form produced by the Alphamap

1. Turn on the AlphaLab or the AlphaMap and the MCP.
2. Activate the signal conditioning and the Data Acquisition applications.
3. Define the pulses shape in the data acquisition application, as follows:

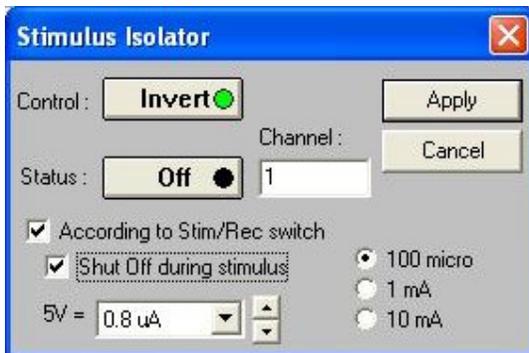
- Go to **Options > Output parameters advanced...** the following window opens:



- Define the desired waveform parameters. (For testing you may select the default). See the AlphaMap manual.
 - Click “**Ok**” to close the window and save the changes.
4. Check and activate the Stim/Rec and Isolator options in the MCP.
- Go to **Setup > options**. The following window opens:



- Check the **Isolator Installed** and the **Stim/Rec Switch installed** checkboxes.
 - Click “**OK**”.
4. Verify that the **Stim/Rec** switch is in the “I” status at the stimulator Isolator.
5. Turn on the stimulator Isolator.
6. In the signal conditioning application, go to **settings > Isolator**.



- Select the desired channel for stimulation.
- Click the **status** button so it becomes “on”.
- Verify that the green led on the isolator is on.
- Start the acquisition at the AlphaMap.
- Click the **start stimulus** button at the AlphaMap tool bar.
- The current will flow when the Stim/rec pulse is high.

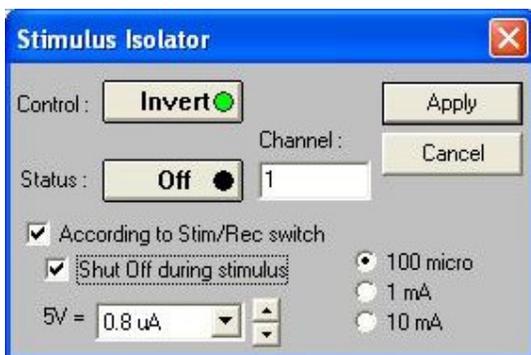
5.4.1.2 Wave form produced from a predefined text file.

1. Activate the MCP and the AlphaMap applications.
2. In the MCP go to **Setup > options**.



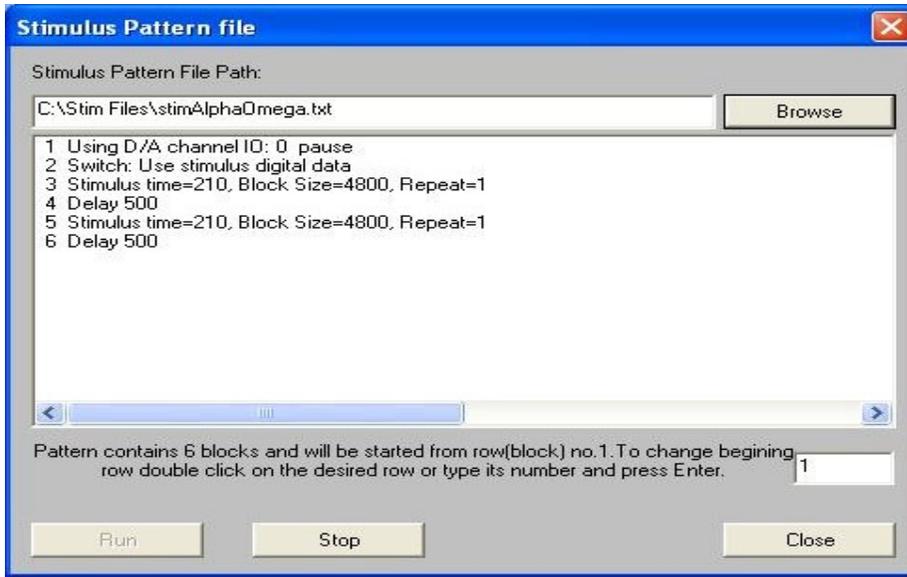
- Check the **Stim/rec switch Installed** and the **Isolator Installed** check boxes.
- Click **ok** to close the window.

3. Go to **settings > Isolator**. The following window opens.



- Verify that the according to **stim/Rec** and the **Shut off during stimulus** are checked.
- Type the desired channel number in the **Channel** edit field.
- Select the desired current range and value.
- Click the **Status** button and make it “**on**”.
- Verify that the **Stim/Active** LED in the stimulator isolator is on.

4. In the AlphaMap go to **Run > Load stimulus pattern**. The following window opens.



5. Click Browse. The following window opens:



Browse and select the desired stimulation file.

6. Select the desired data column to start from.
7. Start Acquisition.
8. To start the stimulation click the **Stimulus** button or the **Start pattern** button at the tool bar.
9. To stop the Stimulation click the **Stop** button.
10. To close the Application click the **Close** button.
11. You may restart the stimulation while the Acquisition is running by clicking the **Start pattern** button at the tool bar without opening the stimulus pattern file window.

5.4.2 The wave form and TTL's are generated by external devices

1. Activate the MCP and the Alphamap Applications.
2. Perform steps 2&3 from the previous section.
3. Start the Waveform and the TTL's pulses on the external device.

*Note: The TTL's should stand with the timing definitions. See **pulses and wave synchronization** section*

6 Troubleshooting

6.1 General

The following section discusses problems that may arise while operating the **MCP-Plus**, their possible causes, and the troubleshooting procedures that can be carried out by the user. If none of these procedures resolve the problem, contact your service representative.

6.2 No power

Possible Cause	Troubleshooting Procedure
Wall socket not live	Plug another electrical device into the wall socket to verify that the socket is live.
Power cord is not installed properly	Make sure that the power line cord is seated firmly in the mains receptacle
Blown (AC) fuse	Unplug the power line cord from the mains receptacle. Use a screwdriver to pry open the line filter access door (ref. to Rear Panel p.11) Replace the blown fuse and realign to correct 110V / 220V.

If only one of the DC supplies is not supplied (you can check that on one of input or output connectors) identify which one +5V, +12V, -12V then turn off the system, unplug the power cord from the mains socket, and unscrew the fixing screws of the power supply module (in the Modular MCP-Plus). On the supply board there are four fuses F5: 5V, F6: 5V, F4: +12V, F3: -12V. Replace the blown fuse.

If none of the above helps to restore power contact your service representative.

Note: In addition to the four fuses mentioned above there are two additional fuses F1: -12V, F2: +12V, these fuses supply the power for the Head Stage Pre-Amplifiers.

6.3 Power Supply Unit Malfunction

Test the voltage at the input sockets to determine a possible malfunction of the power supply unit. While the input is connected to one socket, insert a tester in the other. The test should indicate readings of -12V, +12V, and +5V. Readings may vary to within 10% of these figures. Readings other than these indicate a problem in the power supply unit. If so contact your service representative. To test for a malfunction in the floating Head Stage power supply unit, proceed as follows:

- Check input receptacles with a probe to detect the reception of the signal. If a signal is not detected, inspect the fuses behind the Head Stage Control on the Rear Panel (ref. to Rear Panel p.11). To inspect these fuses, remove the covering of the Head Stage Power unit. The fuses are marked (F3, F4). Replace the fuse(s) if necessary.
- If the fuses are in working order, check for a gain or filter malfunction (see below).

6.4 Channel Malfunction

If a channel fails to respond, check that the External Shutoff or Remote Control In has not been activated.

6.5 Gain or Filtering Malfunction

If an error is detected in the signal at any of the analog outputs, the user can apply a known signal (Sine wave is recommended) to the **Input**. The user can check changing the amplitude and frequency of the input signal and selecting different channels, gains, and cutoff frequencies for every output module. Gain or filter malfunctions can originate in a specific Output Module, in the Input Control Module or in the Head Stage. Contact your service representative if a malfunction is detected.

6.6 Faulty Communication with PC

Possible Cause	Troubleshooting Procedure
Communication cable not connected	Check that the communication cable is firmly seated in the 9-pin plug at the Rear panel of the MCP-Plus and in the PC RS232 card .
MCP-Plus is not switched on	Switch on the MCP-Plus ensure that the red LED on the Control Panel is lit.
Incorrect RS232 channel was selected	Choose a different channel (the options are COM1 - COM4).
Another system is connected to the same RS232 channel	Make sure that the other system has the capability to work in this mode, if so ensure that the system is on.
PC RS232 card error	Change the RS232 card.
Malfunction in the MCP-Plus Control Module	Contact your service representative.

6.7 Frequently Asked Questions

Q) How do I connect the electrodes to your preamplifier?

A) The red wires labeled 1-4 should be connected to the positive (input) end of the electrode. The Yellow and black wire Labeled “G” and “-“ should be connected together and clamped using an alligator clip to the ground on the test subject.

Q) How do I connect stimulation?

A) Depending on the stimulation source you are using there should be two wires, positive lead and negative or ground. The positive lead from the stimulator should be connected to the green wire on the back of the preamplifier. The ground can be connected to the animal.

Q) How do I measure impedance?

A) From the MCP software press the bar at the bottom of each module to “I.M. ON” should come on as well as a green circle. Afterwards, connect the BNC output for each channel into an oscilloscope and measure the voltage peak-to-peak. 1 Volt = 1 M Ω of impedance. Repeat measurement for all channels.

Q) How can I set multiple channels with the same gain and filter settings in the MCP?

A) After setting the desired parameters in one channel, go to the “Edit” menu and select “copy channel” then select “paste to all” or “past module.”

Q) What happens to the gain settings after I turn off the PC?

A) The MCP will always keep the last setting used before closing the software. In addition, you could save the settings into a configuration file that you will open each time.

Q) After installing the MCP setup, every time I am trying to make a change in the MCP software I get the message: “Check that the MCP RS232 cable is connected”

A) Change the serial port number in the MCP software.

Q) Is it possible to have unfiltered output?

A) Yes, the MCP output can be filtered or unfiltered.

Q) Can I split a single channel into two outputs (i.e. for the purpose of having spikes and LFP for each channel)?

A) We can supply you with a splitter cable that splits every channel to two channels.

Q) I have some noise problems. I can see the noise in the MCP output even if I ground all the preamplifier inputs.

A) In order to pin point the problem and find the source of the noise:

- Change the MCP location. Place it away from electrical devices that may affect it.
- Check your Ground Loop.

Q) I have an internal mixer. How do I select a channel to hear sound output?

A) In the menu bar go to Settings, choose the audio mixer option and then choose the channel you want to hear by selecting it.

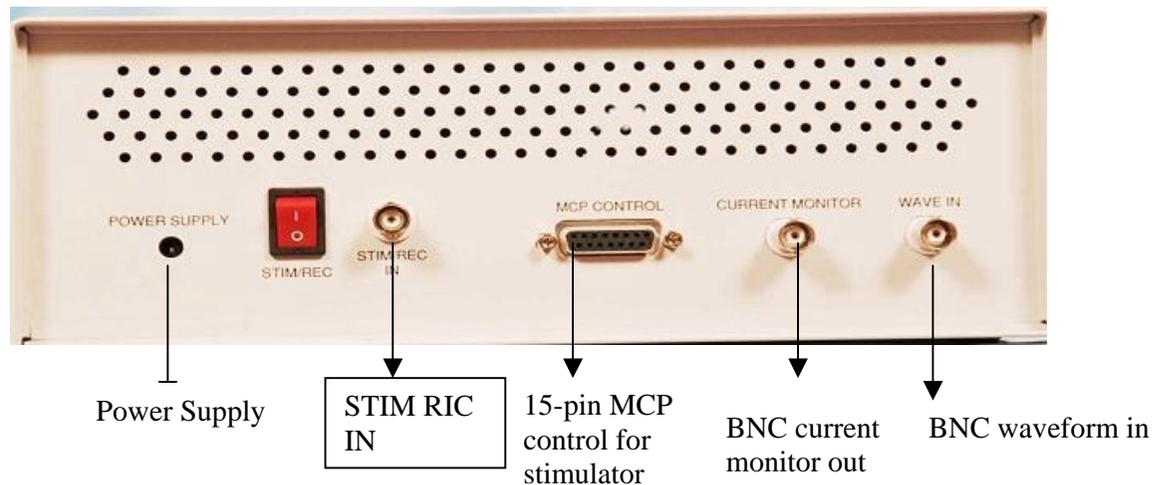
Appendix A

Alpha Stimulus Isolator

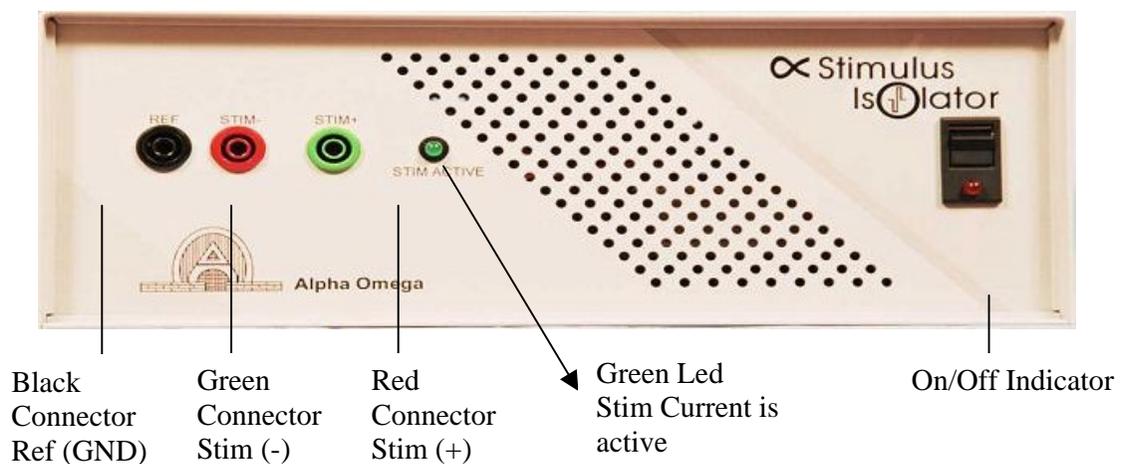
The new Alpha Stimulus Isolator introduces revolutionary flexibility by providing the researcher with many features that were previously not supported by other stimulators.

- The Alpha Stimulus Isolator can invert any supplied waveform into current.
- It has a wide Band Width, 100KHz on load of 10K Ω , and provides an important tool to perform stimulations in many patterns.
- The useful feature of Current Monitor enables the researcher to have information about the current in the load in real time.

Alpha Stimulus Isolator Rear Panel



Alpha Stimulus Isolator Front Panel



Alpha Stimulus Isolator Technical Specifications

Input

Signal type:	Arbitrary analog waveform.
Frequency range:	0 - 100 KHz
Signal range:	± 5 V
Input impedance:	10 K Ω min.
Safe input voltage:	± 30 V pp
Connector:	BNC

Output (tested with sine and square wave)

Bandwidth ± 3 dB:	0 -100 KHz at 10Kohm
Bandwidth ± 3 dB:	0 - 25 KHz at 100Kohm
Bandwidth ± 3 dB:	0 - 3 KHz at 1Mohm

Max output Voltage Range: ± 125 V or ± 175 V

Offset Current:	$\pm 0.01\%$ of full range
Noise RTO 100KHz BW:	0.1% of full range
Output current ranges:	

5uA - 100uA
100uA-1mA
1mA- 6mA

Output Current Accuracy: 1 %

Slew Rate: 40 V/ μ sec (Load=10K)
20 V/ μ sec (Load=100K)
2 V/ μ sec (Load=1M)

I=6mA, load = 10Kohm, Vout=60V
I=1mA, load = 100Kohm, Vout=125V

Isolation

2500VRMS

Control

Software control through the AO Multi Channel Processor through a 15 pin D-type connection.

Indicators

ON/OFF LED

Stimulus active LED

Current monitor output through a BNC connector, the CM have the same bandwidth of the output.

Range 100uA =5V in CM

Range 1mA =5V in CM

Range 10mA(6mA) =5V in CM

Weight

0.75Kg

Dimensions

250 X 145 X 90 mm

Power Supply

AC/DC that supplies the isolated parts,
+/-12V that supplies the non isolated parts.

Appendix B

Installation Instruction for MCP Upgrade

Older versions of MCP may be upgraded to include the On/Off Stimulation Switch feature.

In order to perform upgrade please follow the below steps:

Install PLM chips

1. Turn off power of MCP box and unplug power cable.
2. Open MCP box cover.
3. Carefully remove PLM chips U14 and U15 from MCP control card.



4. Install new PLM chips. Please note, every bank has label MSB or LSB. The same labels there are on every chip. Every chip should be inserted accordingly. Polarity of chips is important – please note small notch on chip and its bracket.
5. Turn power on and check that a buzz signal is not heard. If a buzz signal is heard it means that PLM chips are not inserted properly.
6. Turn power off. Close MCP box cover.



ALPHA OMEGA

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Email: info@alphaomega-eng.com Web site: www.alphaomega-eng.com

Registration Card

Surname: _____ First Name: _____

Institute: _____

Address: _____

Postal Code: _____

City: _____

Country: _____

Phone No.: _____

Fax: _____

E-mail: _____

System: _____ No. Of Channels: _____

Serial Number(s): _____

Software Version: _____

Purchase Date: _____

Problem Description: _____