Berkeley Nucleonics Corporation
Model 500 Digital Delay Generator – Manual Summary

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INTRODUCTION

This manual is designed to help you quickly and easily learn to use your Berkeley Nucleonics Model 500A pulse generator. Rather than the usual array of knobs and switches, the 500A uses a menu-driven user interface with "on-line" help -- once you learn the basics of operating your 500A, you may never need to refer to this manual again. The 500A has some unique features that are designed exclusively for use as a laser trigger signal generator, but can also be used as a general purpose pulse generator. Because it employs a flexible microprocessor-controlled architecture, the 500A can be customized to fit your exact requirements -- contact Berkeley Nucleonics for details.

Technical Support

For questions or comments about operating the 500A, contact Berkeley Nucleonics via one of the following methods:
1. Phone - (415) 453-9955
2. Fax - (415) 453-9956
3. Internet - www.BerkeleyNucleonics.com

Parts List

The following parts are Included with the 500A -- contact Berkeley Nucleonics if any parts are missing:
1. 500A Pulse Generator
2. AC Power Cord
3. User's Manual
4. Quick Reference Card

Warranty

In addition to a 30-day money back guarantee, the 500A has a one-year limited warranty from the date of delivery. This warranty covers defects in material and workmanship. Berkeley Nucleonics will repair or replace any defective unit. Contact us for information on obtaining warranty service.

Custom Modifications

The 500A is microprocessor-controlled and employs a flexible and expandable user-interface. New features and operating modes often can be added, without hardware modifications, by merely modifying the software contained inside the 500A. Most modifications can be made for a very modest charge -- contact Berkeley Nucleonics for details.

Safety Issues

Normal use of test equipment exposes you to a certain amount of danger from electrical shock because testing must be performed where exposed voltage is present. An electrical shock causing 10 milliamps of current to pass through the heart will stop most human heartbeats. Voltage as low as 35 VDC or RMS AC should be considered dangerous and hazardous since it can produce a lethal current under certain conditions. Higher voltages pose an even greater

threat because such voltage can more easily produce a lethal current. Your normal work habits should include all accepted practices that will prevent contact with exposed high voltage, and that will steer current away from your heart in case of accidental contact with a high voltage. You will significantly reduce the risk factor if you know and observe the following safety precautions:

1. Do not expose high voltage needlessly. Remove housings and covers only when necessary. Turn off equipment while making test connections in high-voltage circuits. Discharge high-voltage capacitors after removing power.
2. If possible, familiarize yourself with the equipment being tested and the location of its high voltage points. However, remember that high voltage may appear at unexpected points in defective equipment.
3. Use an insulated floor material or a large, insulated floor mat to stand on, and an insulated work surface on which to place equipment. Make certain such surfaces are not damp or wet.
4. Use the time-proven "one hand in the pocket" technique while handling an instrument probe. Be particularly careful to avoid contacting a nearby metal object that could provide a good ground return path.
5. When testing AC powered equipment, remember that AC line voltage is usually present on some power input circuits, such as the on-off switch, fuses, power transformer etc., any time the equipment is connected to an AC outlet, even if the equipment is turned off.
6. Never work alone. Someone should always be nearby to render aid if necessary. Training in CPR first aid is highly recommended.

CONTROLS AND CONNECTORS

This chapter explains the function of each control and connector on the 500A.

Front Panel
The front panel contains the most frequently used controls and connectors.

Display
The 500A features a backlit liquid crystal display, on which menu selections and settings are shown. The left half of the display shows the current menu selection, while the right half shows the current setting of the item associated with that menu.

Control Buttons

Item Button
Toggles between the various items in a menu.

Menu Button
Toggles between the various sets of menus.

Up Button
Increments a number or increments the selection for the current item.

Down Button
Decrements a number or increments the selection for the current item.

Left Button (Help)
For numeric items, this button is used to select which digit in a numeric entry is selected for editing. For other items or when the left most digit is already selected for numeric items, pressing and holding this button down displays a brief description of the current item.

Right Button (range)
For numeric items, this button is used to select which digit in a numeric entry is selected for editing. For other items or when the right most digit is already selected for numeric items, pressing and holding this button down displays the range and units for the current item.

Stop Button
Disables output of pulses on all channels.

Run Button
Enables output of pulses.

BNC Connectors
There are five (5) connectors on the front of the 500A, 4 outputs and 1 input.
T1
Channel 1 output -- a general-purpose pulse output with programmable delay, pulse width and pulse polarity. The maximum output voltage is adjustable and varies from 20 Volts open-circuit to 10 Volts when driving a 50 Ohm load. The maximum voltage is adjusted by a potentiometer located on the back of the 500A.

T2
Channel 2 output -- designed specifically for use as a solid-state laser Q-switch trigger and has all the capabilities of the other output channels, including several special modes which affect only the output of Channel 2.

T3
Channel 3 output -- same specifications as Channel 1.

T4 Output
Channel 4 output -- same specifications as Channel 1.

Ext/Gate
External Trigger or Gate signal input -- used as either an external signal to trigger the generation of pulses or as a gate signal to enable and disable the outputs. The gate may be used to enable all channels or just Channel 2.

Back Panel

Output Voltage Adjustment
The maximum output voltage of all output channels is adjusted by turning the potentiometer labeled **VOUT**. Turn clockwise to increase the voltage, counter-clockwise to decrease the voltage. The maximum voltage possible is 20 Volts into a high-impedance load or 10 Volts into a 50 Ohm load.

Serial Port
This is a 9-pin D-sub connector for the RS232 interface that comes standard with the 500A. It is pinned to be directly connected to a standard IBM-PC serial port -- use a straight-through cable (not a null modem cable) to connect to a PC.

GPIB Port
A GPIB (IEEE 488) interface is available as an option with the 500A.

AC Input
A standard IEC instrument-type cord should be used. The 500A is supplied with a power cord that fits the type of socket used in your country.
Before plugging in, please make sure that the voltage selection switch is set to the proper setting for your country (either 110V or 220V).

Line Voltage Selection
This switch is used to select the voltage level used in your country -- make sure it is on the proper setting or the 500A could be damaged.

OPERATING INSTRUCTIONS

This chapter presents detailed instructions on the operation of the 500A.

Overview

The 500A uses a single-line LCD to display menu selections. The front panel keys are used to "navigate" through sets of menus to set various options and control the pulse generator. Some keys are only active at certain times or have different behavior depending on what state the menus are in -- once understood, the menus can be quickly and easily manipulated. The 500A also contains non-volatile memory for storing up to twelve (12) configurations. You need not go through the entire setup process each time the instrument is used.

Selecting Menu Items

The menu items in the 500A are arranged in a set. Pressing the key will toggle between sets of menus, while the key will toggle between menu items within the current set. Hold down the Left arrow key to receive a short description of the current menu item. Pressing and holding the Right arrow key will display the valid range for that item.

Numeric Input Mode

When the current item is numeric, the system enters the Numeric Input mode. In this mode, the Left and Right arrow keys are used to select a digit to edit. The selected digit blinks to identify itself as the active digit. The Up and Down arrow keys are used to increment or decrement this digit. When the left most digit is active, pressing and holding the Left arrow key will display a brief description of the current item. When the right most digit is active, pressing and holding the Right arrow key will display the range and units for the current item.

Item Edit Mode

When the current item is non-numeric, the Up and Down arrow keys are used to select among different options for the entry. The Left and Right arrow keys are used to display a description of the item.

Main Menu

The Main Menu consists of a set of menus selections used to set the operating mode, time period and frequency of the 500A.

MODE - Pulse Modes

There are five (5) different pulse modes available.

Continuous Mode

While in Continuous mode, the 500A will generate pulses at the rate set by the internal To Period as set in the **ToPer** menu. The delay of each of the outputs is relative to To, except for Channel 2 which is delayed from the active edge of Channel 1 (this is always the case for Channel 2).

The Ext/Gate input may be used as a gate or interlock by setting the **GATE** menu to **Low** or **High**. Pulses will only be generated while the Ext/Gate input is active. Selecting **Low** will make the gate active low, while selecting **High** will make the gate active high. Set to **Off** to disable the gate function.

Note: No pulses are generated until the Run key has been pressed.

External Trigger Mode

In the External Trigger mode, one pulse is output each time an active edge occurs on the Ext/Gate input. The external trigger polarity menu (**TRIG**) is used to determine whether the 500A is triggered on the rising or falling edge of the external trigger.

The delay of each output is relative to the active edge of the external trigger except for Channel 2 which is delayed from the active edge of Channel 1.

Since it is being used as a trigger source, the Ext/Gate input cannot be used as a gate in this mode.

Single Shot Mode

During Single Shot operation, one pulse is generated each time the Run key is pressed. The rate at which pulses are produced is totally dependent on how fast the Run key is pressed. The delay of each of the outputs is relative to To except for Channel 2 which is delayed from the active edge of Channel 1.

The external trigger input may be used as a gate or interlock by setting the **GATE** menu to **Low** or **High**, pulses will then only be generated while the external trigger input is active. Selecting **Low** will make the gate active low, while selecting **High** will make the gate active high.

Duty Cycle
The Duty Cycle mode is similar to Continuous mode in that a continuous stream of pulses is output. The exception is the outputs are only active for a set number of seconds (**DC:On** menu), then disabled for another set time period (**DC:Off** menu) before being re-enabled. This cycle is repeated for a set number of times (**CYCLES** menu), after which all output cease. Setting the number of cycles to zero results in continuous cycling, until the Stop Key is pressed.

The Ext/Gate input may be used as a gate or interlock by setting the **GATE** menu to **Low** or **High**. Pulses will then only be generated while the external trigger input is active. Selecting **Low** will make the gate active low, while selecting **High** will make the gate active high.
The Run key must be pressed to start the Duty Cycle mode.

Burst
Burst mode is similar to Continuous, except only a certain number of pulses will be output (**#/BURST** menu), after which outputs are disabled.

The Ext/Gate input may be used as a gate or interlock by setting the **GATE** menu to **Low** or **High**. Pulses will then only be generated while the external trigger input is active. Selecting **Low** will make the gate active low, while selecting **High** will make the gate active high.
The Run key must be pressed to start Burst mode.

GATE - Gate Select
When not in External Trigger mode, the Ext/Gate input on the 500A can be used as a gate signal instead. When the gate is enabled, pulses will only be output while the signal into the Ext/Gate input is active -- thus, this signal can act as a safety interlock or external control signal.

The Ext/Gate input may be used as a gate or interlock by setting the **GATE** menu to **Low** or **High**. Pulses will then only be generated while the external trigger input is active. Selecting **Low** will make the gate active low, while selecting **High** will make the gate active high. Setting the **GATE** menu to **Off** will disable the Gate function.
The setting of the **GATE** menu is used to determine when the signal is active. If the gate menu is set (active) **High**, pulses will only be generated if the Ext/Gate input signal is greater than 3.5 Volts. If set to (active) **Low,** then outputs will be enabled as long as the Ext/Gate input signal is less than 2.0 Volts.

ToPer - To Period
Except when in External Trigger or Single Shot mode, all pulse outputs are based on an internal timer called To. This menu is used to select the rate at which To runs by selecting the time period in microseconds between timer pulses. When in Continuous, Burst, or Duty Cycle mode, pulses are output at the rate determined by To. The frequency of pulse outputs in these modes can be found by taking the reciprocal of the To Period setting.

Width and Delay Menus
This set of menus is used to set the delay and pulse width for each of the output channels.
Note: Channel 2 delay is slightly different than the other channels in that it is delayed from the channel 1 (T1) output.

T*n*:Dly - T*n* Delay
Each of the four channels has an independent delay setting which is set from the T*n*:Dly menu, where n = 1, 2, 3, or 4.

When in any mode but External Trigger, the Delay setting sets the delay from the time the internal timer To goes high until a pulse is output on a particular channel.

Note: In the case of Channel 2 (T2), the output is delayed from the active edge of T1 - not To as with the other channels.

When in External Trigger mode, the delays are with respect to the active edge of the external trigger input signal.

T*n*:Wid - T*n* Pulse Width
Each of the four channels has an independent pulse width setting which is set from the T*n*:Wid menu, where *n* = 1, 2, 3, or 4.
The pulse width is used to specify the duration of the output pulse in mS. The setting of the output polarity (the T*n*:Pol menu) for a particular channel determines whether the output is high for this duration or low.

T*n*:Pol - T*n* Polarity

Each of the four channels has an independent output polarity setting from the T*n*:Pol menu, where *n* = 1, 2, 3, or 4. When set to **Positive**, the output will initially be at 0 Volts. When active, the output will go high for the specified pulse width time, after which it will return to 0. The voltage level while high will depend upon the load and the setting of the output voltage adjustment on the back panel.
If set to **Negative**, the output will normally be at the high voltage level. When the output is activated, it will go to 0 Volts for the specified pulse width time, after which it will return to the high level again.

T2 Menus
Channel 2 (T2) has some special features designed to be specifically useful when used as a Q-switch trigger.

T2:Enable
This menu is used to separately enable or disable the output of Channel 2, independent of the other channels. If set to **On**, Channel 2's output will be active under the same conditions as the other channels. When set to **Off**, Channel 2's output will remain disabled under all conditions.

T2:Gate
When not in External Trigger mode, the Ext/Gate input can be used to gate the output of <u>all</u> the output channels, or just the output of channel 2. In order to use the input to gate channel 2, the **GATE** selection in the Main Menu set must be set to **Off** and the **T2:Gate** selection must be set to **Low** or **High**.
The setting of the **T2:Gate** menu is used to determine when the signal is active. If the gate menu is set (active) **High**, Channel 2 pulses will only be generated if the Ext/Gate input signal is greater than 3.5 Volt. If set to (active) **Low,** outputs will be enabled as long as the Ext/Gate input signal is less than 2.0 Volts.

T2:Wait
The output of Channel 2 can be delayed for a number of pulses -- this menu is used to set the number of pulses that must occur on the other channels before the output of Channel 2 is enabled. This is particularly useful when using Channel 2 as a Q-switch trigger, as it allows the laser to thermally stabilize before activating the Q-switch.
This function is active only in Continuous, Burst, and Duty Cycle modes. Channel 2 is delayed at the start of each burst in the Burst mode or at the start of each cycle in the Duty Cycle mode.

T2*n - T2 Period Factor
The period at which Channel 2 (T2) is pulsed can be set as a multiple of the other channels. This menu item is used to select the multiplier. For example, if the To Period (**ToPer**) is set to .100 sec (10Hz) setting T2*n to 2, will cause the Channel 2 period to be .200 sec (5Hz).

Store/Recall/Misc. Menus
The 500A contains non-volatile memory for storing twelve (12) different configurations. The settings of all menu selections are stored and can be quickly recalled.

STORE Configuration
Stores the current menu settings in the specified memory location one (1) - twelve (12).
Note: If you overwrite a particular location, its previous contents are destroyed.

A configuration is stored by using the Up and Down arrow keys to select the memory location number and pressing the Left or Right arrow key. You will be prompted to press the key to verify that you want to overwrite the existing stored configuration. If you press any other key, the configuration will not be saved.

RECALL Configuration
Recalls a previously stored configuration from the specified memory location. To recall a configuration use the Up and Down arrow keys to select the memory location number and press the Left or Right arrow key. You will prompted to press the key to verify that you want to overwrite the active configuration. If you press any other key, the configuration will not be recalled.
Note: A zero configuration is available for recall. This configuration resets the instrument to the factory default settings.

Shot Counter
The 500A includes a nine (9) digit shot counter. The maximum count displayed is 4,294,967,295 after which the count rolls over to zero. To manually reset the counter to zero, press the Left or Right arrow key, at which time you will prompted to press the key to verify that you want to zero the counter. If you press any other key, the shot counter will not be reset.

Fmark
The character used as a decimal point can be set to either a "." (period) or a "," (comma). The period is generally used in North America, while the comma is used in Europe.

Volume
The key click volume may be adjusted from 0 (disabled) to 9. The default value is 2.

GPIB Address
For systems with the optional GPIB interface this menu sets the GPIB address. The valid address range is from 0 to 30.

COMPUTER INTERFACE
The 500A comes standard with an RS232 serial interface; a GPIB (IEEE-488) interface is available as an option. All menu settings can be set and retrieved over the computer interface using a simple command language.

Serial (RS232) Pinout
The serial port is located on the back of the 500A, and uses a 9-pin D-type connector with the following pinout (as viewed from the back of the 500A):
1. No connection
2. Tx - Transmit (to computer)
3. Rx - Receive (from computer)
4. DTR - connected to pin 6
5. Ground
6. DSR - connected to pin 4
7. RTS - connected to pin 8
8. CTS - connected to pin 7
9. No connection

The voltage level of the Transmit signal is +/-10V, the Receive signal should be at least +/-5V.

GPIB
An optional GPIB (also known as IEEE-488) computer interface is available for the 500A. Before using this interface, the address must be set using the GPIB Address menu item. The same command set is used for both the GPIB and the RS-232 interfaces. Both interfaces may be used at the same time. Responses will be made to the most recently used interface.

Command Language

All menu items can be accessed and selected via the computer interface using a simple command language. The command set is the same for both the RS232 and GPIB interfaces.

Command Protocol

All commands have the following syntax:
$<name> <##>CR
where
1. **$** indicates a command follows.
2. **<name>** is the command name. No spaces are allowed between the **$** and the **<name>**. The name is case sensitive.
3. **<##>** is an unsigned, integer associated with the command. A space must be inserted between **<name>** and **<##>**.
4. **CR** is a carriage return character (ASCII value 13).

With echo enabled, all characters sent will be echoed back to the sender.
Unidentified commands and most out of range conditions result in the pulse generator ignoring the command. If the command is properly identified, the pulse generator returns an **ok** followed by a carriage return and a line feed (ASCII 13, ASCII 10), otherwise it returns a **?1** (a question mark, followed by the number "one", a carriage return and a line feed). A **?2** is sent if a valid command is received but the parameter is out of range.
Example - send the following command to set the number of cycles:

$CYCLES 100
The pulse generator will return the following:
Echo Enabled: **CYCLES 100<cr><lf>**
ok<cr><lf>
Echo Disabled: **ok<cr><lf>**
Only one command will be processed per message. Commands are not processed until the carriage return is sent. If an error is made and identified prior to sending the carriage return, sending a new **$** will reset the input buffer and allow a corrected command to be sent.
To determine the current value of a parameter the syntax is:
$<name> ?CR
where name = a valid command name.
This will return an integer followed by a space, carriage return and a line feed character (ASCII 10).
Example - the following command would retrieve the current Cycles setting:
$CYCLES ?
The pulse generator will return the following:
Echo Enabled: **CYCLES ?<cr><lf>**
100<cr><lf>
Echo Disabled: **100<cr><lf>**

Communication Protocol

Communication parameters are set at 9600 baud, 8 bits, parity = none, and 1 stop bit. To help establish RS232 communications, the pulse generator emits the characters **BNC** approximately every 200 ms after power up and until the 500A receives a **$**. Both the GPIB and the RS232 interface may be used at the same time. The instrument will respond to the port which sent the command.

Command List

The following table summarizes all the commands.
Note: The name of the commands are identical to how they appear on the display of the 500A, with channel parameters preceded by a T.

500A Communication Commands		
Command Name	**Parameters**	**Description**
MODE	0 = Continuous mode	Sets the pulse generator mode.

	1 = Burst mode 2 = Duty Cycle mode 3 = Single Shot mode 4 = External Trigger mode	
GATE	0 = off 1 = active low 2 = active high	Enables the external trigger input to function as a gate controlling all outputs. Cannot be used with external trigger mode.
ToPer	1000 - 999999998	Sets the To internal sync period, in microseconds*10, used only in Continuous, Burst and Duty Cycle modes.
DC:On	1 - 10000 Sec	Sets the on time, in seconds, for the Duty Cycle mode.
DC:Off	1 - 10000 Sec	Sets the off time, in seconds, for the Duty Cycle mode.
TRIG	0 = falling edge 1 = rising edge	Sets the active edge of the Ext/Gate signal, when used as an external trigger.
CYCLES	0 - 10000 cycles	Sets the number of cycles for the Duty Cycle mode.
#/BURST	1 - 50000 pulses	Sets the number pulses in the Burst mode.
T1:Wid	4 - 999999998	Sets the pulse width, in microseconds*10, for Channel 1.
T1:Dly	0 - 999999998	Sets the delay, in microseconds*10, for Channel 1.
T1:Pol	0 = Negative (active low) 1 = Positive (active high)	Sets the polarity of the output for Channel 1.
T2:Wid	4 - 999999998	Sets the pulse width, in microseconds*10, for Channel 2.
T2:Dly	0 - 999999998	Sets the delay, in microseconds*10, for Channel 2. Note: The delay is relative to Channel 1.
T2:Pol	0 = Negative (active low) 1 = Positive (active high)	Sets the polarity of the output for Channel 2.
T3:Wid	4 - 999999998	Sets the pulse width, in microseconds*10, for Channel 3.
T3:Dly	0 - 999999998	Sets the delay, in microseconds*10, for Channel 3.
T3:Pol	0 = Negative (active low) 1 = Positive (active high)	Sets the polarity of the output for Channel 3.
T4:Wid	4 - 999999998	Sets the pulse width, in microseconds*10, for Channel 4.
T4:Dly	0 - 999999998	Sets the delay, in microseconds*10, for Channel 4.
T4:Pol	0 = Negative (active low) 1 = Positive (active high)	Sets the polarity of the output for Channel 4.
T2:Enable	0 = Off 1 = On	Turns the output of Channel 2 on and off.
T2:Gate	0 = Off 1 = Active low 2 = Active high	Enables the external input to act as a gate for Channel 2's output.
T2:Wait	0 - 10000 pulses	Set the number of pulses to wait after starting T1 before enabling T2. Note: This is used to allow time for the laser to stabilize when T1 is used as a flashlamp trigger and T2 is the Q-switch trigger.
T2*n	1 - 10000	Sets the period of T2 relative to T1. The period of T2 is the period of T1 multiplied by n.
BEEP	1 - 1000	Beeps the buzzer inside the 500A the specified number of times.
RUN	0 = Disable 1 = Enable	Enable / disables the pulse generator output.
RECALL	0 -12	Recall a stored configuration.
STORE	1 -12	Store a configuration.
SHOTS	0 = Reset to zero	Resets shot counter. SHOT ? will return the number of shots.
ECHO	0 = Disable 1 = Enable	Enables/Disables the RS232 echo. The result string is always sent back.
Fmark,	0 = , (comma) 1 = . (period)	Sets the character used as a decimal point on the display.

VOLUME	0 - 9	Sets the key click volume level.

SPECIFICATIONS

DELAYS
1. CHANNELS Four (4) independent outputs, with digitally controlled delay and pulsewidth.
2. DELAY 0 to 99.9999998 sec
3. PULSEWIDTH 400 ns to 99.9999998 sec
4. RESOLUTION 200 ns
5. ACCURACY 20 ns + .0001 x delay
6. TIMEBASE 5 MHz, 25 PPM crystal oscillator
7. RMS JITTER 10 ns + .0001 x period, 100 ns max
8. TRIG DELAY Ext Trig to To < 10 ms

EXTERNAL TRIG / GATE
1. RATE Dc to 1/ (75 ms + largest delay + period)
2. THRESHOLD 3 VDc (3 mA into optoisolator)
3. TRIGGER SLOPE Rising or falling edge
4. GATE Active low or active high
5. IMPEDANCE 1000 W

INTERNAL RATE GENERATOR
1. MODES Single shot, burst, duty cycle, continuous, external trigger, external gate
2. RATE (To period) 100 ms to 99.9999998 sec (.01 Hz to 10 KHz)
3. ACCURACY 20 ns + .0001 x period
4. RMS JITTER 10 ns + .0001 x period
5. BURST MODE 1 to 50,000 pulses

OUTPUTS
(T1,T2,T3,T4)
1. IMPEDANCE 50 W
2. SLEW RATE > .2 V/ns
3. OVERSHOOT < 100 mV + 10% of pulse amplitude
4. AMPLITUDE 1-10V into 50W load 2-20V into high impedance load manually adjusted,
all outputs at same level.
1. PEAK CURRENT 400 mA per channel
2. AVERAGE CURRENT 200 mA average (total for all channels)

COMPUTER INTERFACE
1. RS232 9600 Baud. All instrument functions and settings may be controlled over the interface bus.

GENERAL
1. STORAGE Twelve (12) complete configurations may be stored and recalled from the front panel or the computer interface.
2. DIMENSIONS 7.5" x 9.0" x 4.0"
3. WEIGHT 5 lbs.
4. POWER < 20 watts @ 120 or 220 Vac

MAINTENANCE
Except for fuse replacement, the 500A should require no maintenance.

Replacing the Fuse

A pair of fuses are mounted in the power entry module. To replace fuses, follow the instructions given below:

1. Unplug the 500A from power source and remove power cord from the back panel.
2. Remove the fuse holder by pushing down on the center tab and pulling out.
3. Remove the faulty fuse and replace with one of a similar rating, (5 x 20 mm, .125 Amp).
4. Reinstall the fuse holder.
5. Reattach the power cord.