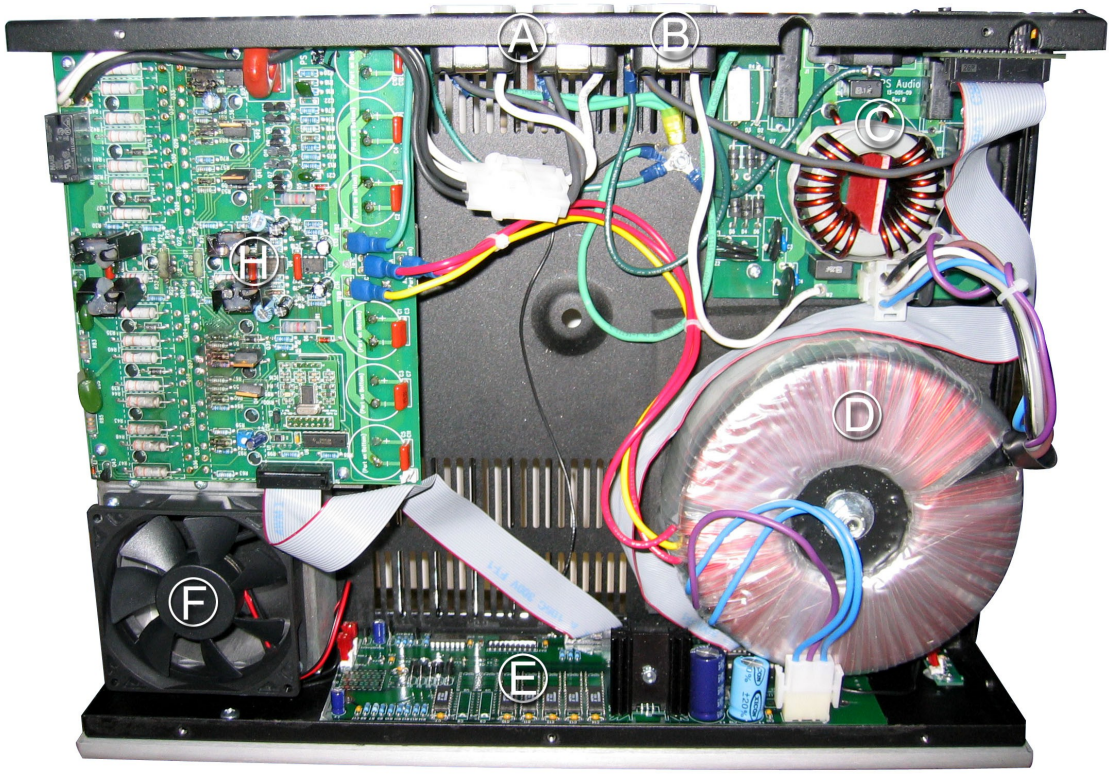
PS Audio
Power Plant P500 Service manual

P500 Service Overview



The P500 is a self contained AC power generating device first introduced in the spring of 2003 and still in production. Its primary function is to provide consistent, regulated AC power for audio and video equipment drawing less than 500 watts (maximum continuous output power is 350 – 500 watts dependant on the power factor of the connected gear). It also provides a filtered AC outlet for equipment that requires more current than the regenerated outlets can provide.

Incoming power goes first to the AC input board (C) which contains surge protection circuitry as well as the AC filtering balun. The “Filtered AC” outlet (B) is wired directly to the AC input board.

The input transformer (D) connects to the AC input board and in turn provides power to the display board and output boards.

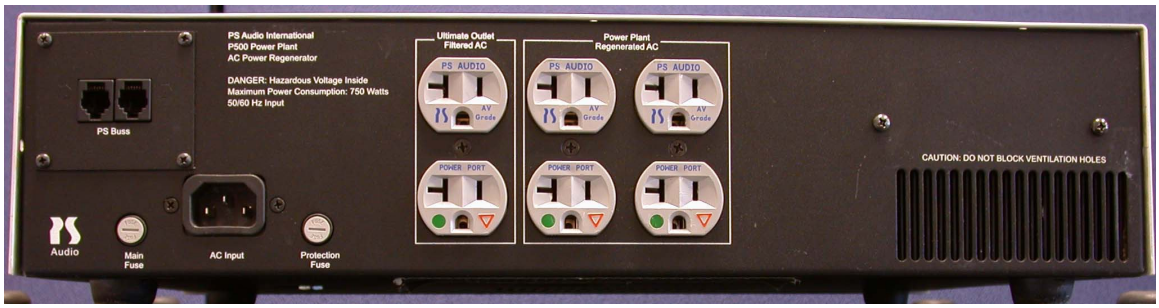
The display board (E) contains the main microprocessor, display segments and user interface buttons as well as the power supply for the cooling fan (F) and the ‘PS’ logo LED.

The output board (H) contains the AC regenerator circuitry and power meter circuitry. On 100 and 120V models (as pictured above) the regenerated AC outlets (A) are wired directly to the output board. On 220-240V units there is a step-up autoformer (not shown) that is wired between the output board and the rear panel outlets.

P500 Domestic/Export Model Information

The P500 is available as 5 different models. These are:

Standard US model: 120V input/output with IEC 320 AC input socket and 4 Power Port regenerated AC outlets plus 2 Power Port Filtered AC outlets. Pictured is the back panel of the standard US model P500.



Standard Export model: 220-240V with IEC 320 AC input socket and 4 Power Port regenerated AC outlets plus 2 Power Port Filtered AC outlets. Pictured above is the back panel of the Standard Export P500.

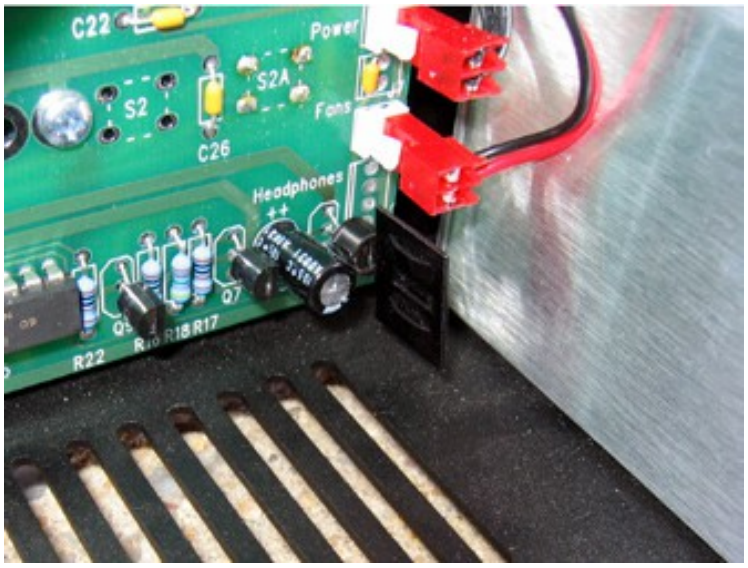
Japanese model: 100V input/output with IEC 320 AC input socket and 4 Power Port regenerated AC outlets plus 2 Power Port Filtered AC outlets. The back panel of the Japanese P500 looks the same as the standard US model.

Schuko Model: 220-240V input/output with IEC 320 AC input socket and 3 Schuko style outlets for regenerated AC and 1 Schuko style Filtered AC Outlet. Pictured at right is the back panel of a P500 Schuko model.

United Kingdom model: 220-240V input/output with IEC 320 AC input socket and 3 UK style outlets for regenerated AC and 1 UK style Filtered AC Outlet. The UK model is not yet pictured.

P500 Critical Updates

Heat sink for fan driver transistor: The fan circuit driver transistor can fail under some circumstances unless a heat sink is added to it. This transistor is specifically the 8099 type found at position Q10 on the P500 display board. P500 production starting in 2003 includes this heat sink and PS Audio will provide this part free of charge to any P500 owner who needs it. It is strongly recommended that this heat sink be used on the Q10 transistor on the display PCB in all P500's. The photo below shows the heat sink installed:



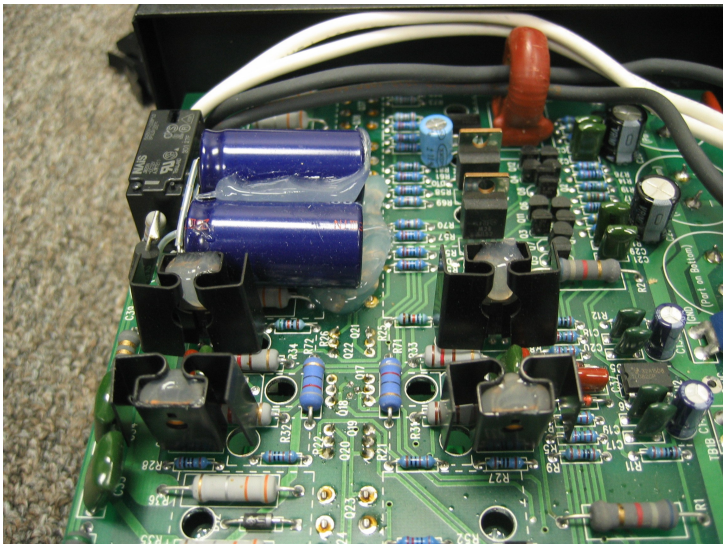
If the transistor at Q10 fails before the heat sink is added the symptom will be that the P500 shut down flashing "HOT" on the display even if only a light load is connected. The fan will also not be running.

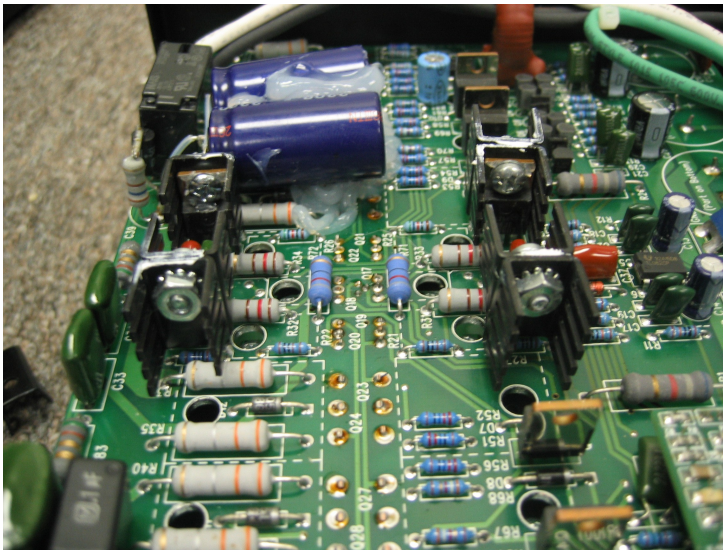
AC Inlet board resistor and capacitor change: The large ceramic resistors used in the relay circuit on the AC inlet board can generate too much heat and fail. 100 and 120V units have just a single resistor at position R3 while 220 & 240V units have this resistor plus an additional one found at position R4 (100-120V models have a jumper wire here instead of a resistor). Use the table below to choose the correct resistors for the P500:

		Old value:	New value:
120V	R3:	1 KΩ 5w	560 Ω 5w
	R4:	none	560 Ω 5w
240V	R3:	1 KΩ 5w	1.5 KΩ 5w
	R4:	1 KΩ 5w	1.5 KΩ 5w

The capacitor at position C5 on the AC inlet board should also be changed from 470 uF 50V to 100 uF 100V. These values are the same for all versions of the P500.

Software & voltage regulator updates: The software in the P500 has gone through several revisions which mainly affect the operation of the cooling fan. If you have an early P500 (built before 2004), updating the software may require changing the heat sinks for the voltage regulators (positions Q13-Q16) on the output board. The photo below shows the old style heat sinks and the new style for comparison:





Replacing these heat sinks basically involves just pulling the old ones off and using small screws and nuts (#4 hardware is used in production but #6 will work too) along with a little thermally conductive heat sink grease to attach the new heat sinks. As you can see in the picture, some of the bottom fins on the heat sinks need to be broken off to clear resistors adjacent to the regulators. Thermally conductive grease is also used between the heat sink surfaces and the surface of the regulators.

Updating the P500 socketed chip found on the display board at position U1. To replace it the input transformer needs to be removed, or moved aside as illustrated in the photo at right. The size of the nut and bolt for the transformer is ½".

Appendix C contains additional information on P500 software and hardware revisions both.

P500 Common Problems

Display is flashing 'HOT': The most common reason for this problem is failure of the fan driver transistor at Q10 on the display PCB. If this is the problem the P500 will heat up and shut down without the fan running. See the 'Critical Updates' section of this document for detailed information about fixing this problem.

If the fan is running and the P500 is not hot to the touch, check the connection of the large gray ribbon cable that connects the output board and display board to each other. If this cable is not making good contact the P500 will give a false 'HOT' indicator and the fan will run full speed.

A final check is to look at the heat sink temperature in the diagnostic mode of the P500 (see 'Diagnostic Mode' section later in this document for more details). The fan should be running when the P500 reaches 62°.

No Power to Filtered AC Outlets: The most common reason for this problem is the failure of one or both of the resistors at positions R3 and R4 on the AC inlet card. See the 'Critical Updates' section of this document for more detailed information on this problem and solution.

Other reasons for this problem include failure of the surge protection devices on the AC inlet board. There are 6 transorb diodes at positions D1-D6 and 4 MOV's at positions Z1-Z4. If these devices are damaged they will usually blow the 1A fast blow 'protection fuse' accessible from the rear panel of the P500.

Unit shuts down but is not blowing fuses: If the P500 is shutting down with no fault indication and is not blowing fuses it may be a thermal overload of the input transformer. Symptoms will include a unit that is very warm and it should power back up OK once it cools down for a while. The P500 may only be able to drive a load of approximately 350 watts continuous if the connected gear has a high power factor. Tubed audio gear and nearly all video gear has a high power factor and may cause this type of shut-down.

P500 Fault Indicators

Display flashing “HOT!”

The P500 will display “HOT” if the heat sink temperature exceeds 85° Celsius. This temperature can be seen on the P500 display in the ‘Diagnostic Mode’ (see this section elsewhere in this document for details). See the ‘Common Problems’ section of this document for specific troubleshooting information for “HOT” P500’s.

Display flashing “FAULT”

The P500 will display “FAULT” when there is a shorted output transistor or a problem with the output transistor voltage supply rails. The P500 may also display fault mode if a component is plugged into or unplugged from the regenerated AC outlets while the unit is operation. The P500 can also display fault if subjected to a heavy electrostatic discharge. The Fault condition can be cleared by pressing the power button. If this does not clear the “FAULT” display then check the output board for problems.

Display flashing “SHORT”

The P500 will display “SHORT” if the current draw of gear connected to the regenerated outlets exceeds 20A for more than 3 seconds. If the connected load is known to be in proper working order AND under 20 amps draw see the following paragraph. Otherwise, check the connected gear for short circuits or just lighten the load.

If the P500 is displaying “SHORT” even with a light load (or no load) connected then the problem is most likely in the meter board that is on a removable card found at position JP1 on the output board. The entire card can be removed and replaced.

P500 Service Menu

This is a hidden service menu that is not available to the user. To reach this menu, first put the P500 into the regular set-up menu (Press and hold both “MODE UP” and “MODE DOWN” buttons simultaneously while also pressing the power button) and then simply press and hold the mode up button for a few seconds until the display changes (should read “N PWR”). The display will scroll through the normal set-up procedures and then show the following new screens:

Diagnostic mode (DIAG) Turning this mode on will show additional data about the P500 not normally available to the end user. This data can be helpful for troubleshooting. See the “P500 Diagnostic Mode” on the next page for more details.

Amp meter calibration (CAL A) This mode allows you to set an offset for the P500 amp meter. The “EDIT UP” and “EDIT DOWN” buttons will allow you to raise or lower the amperage meter reading by 10%

Volt meter calibration (CAL V) This mode allows you to set an offset for the P500 volt meter. The “EDIT UP” and “EDIT DOWN” buttons will allow you to raise or lower the voltage meter reading by 10%

Watt meter calibration (CAL W) This mode allows you to set an offset for the P500 volt meter. The “EDIT UP” and “EDIT DOWN” buttons will allow you to raise or lower the watt meter reading by 10%

Model (MODEL) This mode allows you to select if this power plant is a 100, 120 or 240V unit. NOTE: This information ONLY changes the default turn on voltage and frequency. It WILL NOT allow a 120V model to output 240V or the other way around! A step-up autoformer is used in 240V power plants.

P500 Diagnostic mode

The P500 has a software diagnostic mode to report technical information not normally available to the user. To place the P500 into diagnostic mode, first enter setup mode by pressing and holding both “MODE UP” and “MODE DOWN” buttons simultaneously while also pressing the “POWER” button. The display should now read “SETUP”. Next press and hold the “MODE UP” button until the display changes to the next screen (“PWR”). Now push the mode up button 4 times until the display reads “DIAG”. Pres the “EDIT UP” button twice and the display should read “ON”. Now turn the P500 off with the “POWER” button and then turn it back on. Press the “MODE UP” button repeatedly and you will see several new screens are available. The new modes are listed below:

Measured Output Voltage This is the output voltage being read by the P500’s internal meter. It should match the user selected output voltage and if it does not the P500 may need to have its voltage calibrated. See the “Output Voltage Calibration” document.

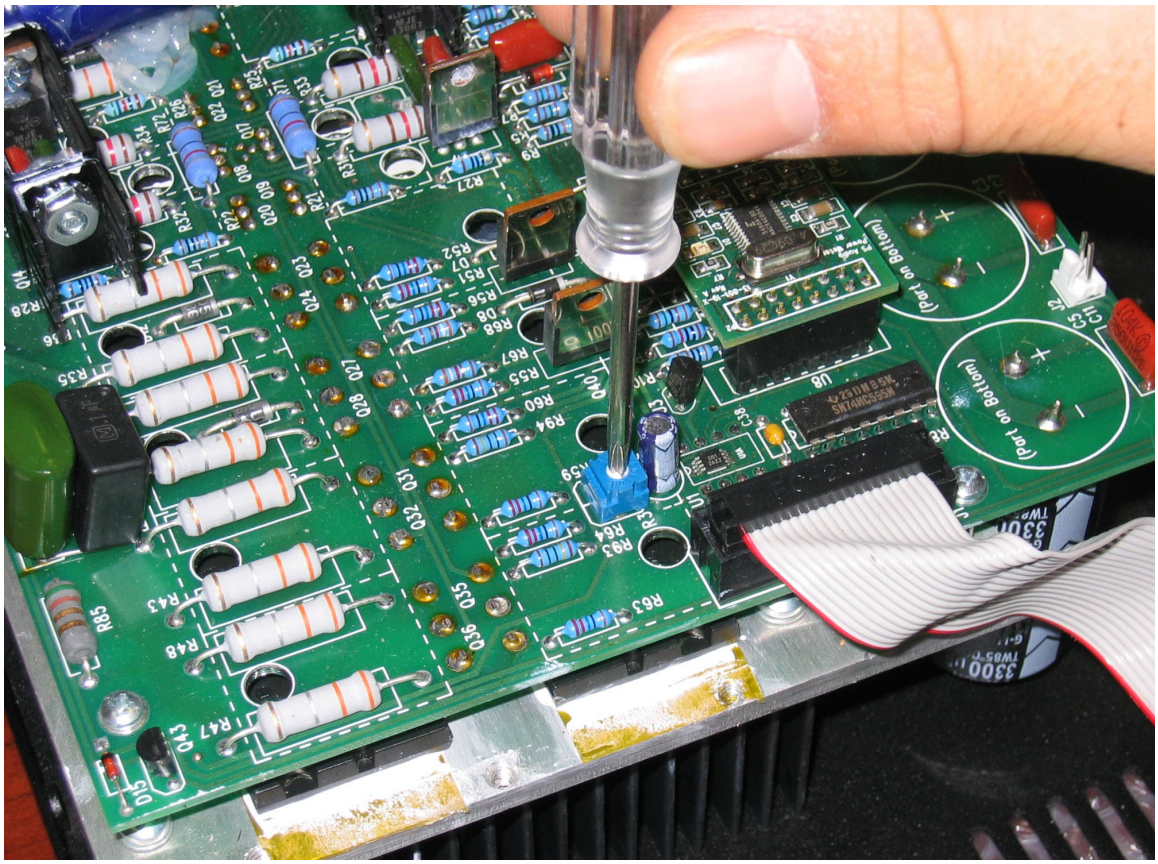
Amperage meter: This will display the approximate amperage (current) draw of the equipment connected to the regenerated outlets.

Power Factor (PF): Approximate average power factor of connected gear. A reading of 100 represents a unity power factor (1.00). A reading of 71 would represent a power factor of 0.71

Output transistor heat sink temperature (L&R) Displayed in degrees Celsius (NOTE: the P500 does not have separate Left and Right heat sink temperature sensors; this portion of the software is common with the P1000 which does have two sensors)

P500 Adjustment/Calibrations

The P500 will not ordinarily require any calibration. The P500 does have, however, a potentiometer for adjustment of the regenerator circuitry output voltage, This small blue and white potentiometer is found on the P500 output board at position R3. The photo below shows the location of this trim pot.



There are no other hardware adjustments on the P500. See the ‘Service Menu’ section elsewhere in this document for details on software adjustments of the watt meter and voltage display.

P500 Assembly/Disassembly overview

Tools needed: #2 and #1 phillips head screwdrivers
5/16” and 1/2” sized wrench and or socket

The P500 uses a tub style steel chassis frame to comprise the floor, rear panel and front panel sub-structure. All other chassis parts attach to the P500 with #1 and #2 phillips head screws except for the transformers(s) which use a ½” sized bolt and the ground stud (where used) which is a 5/16” sized nut.

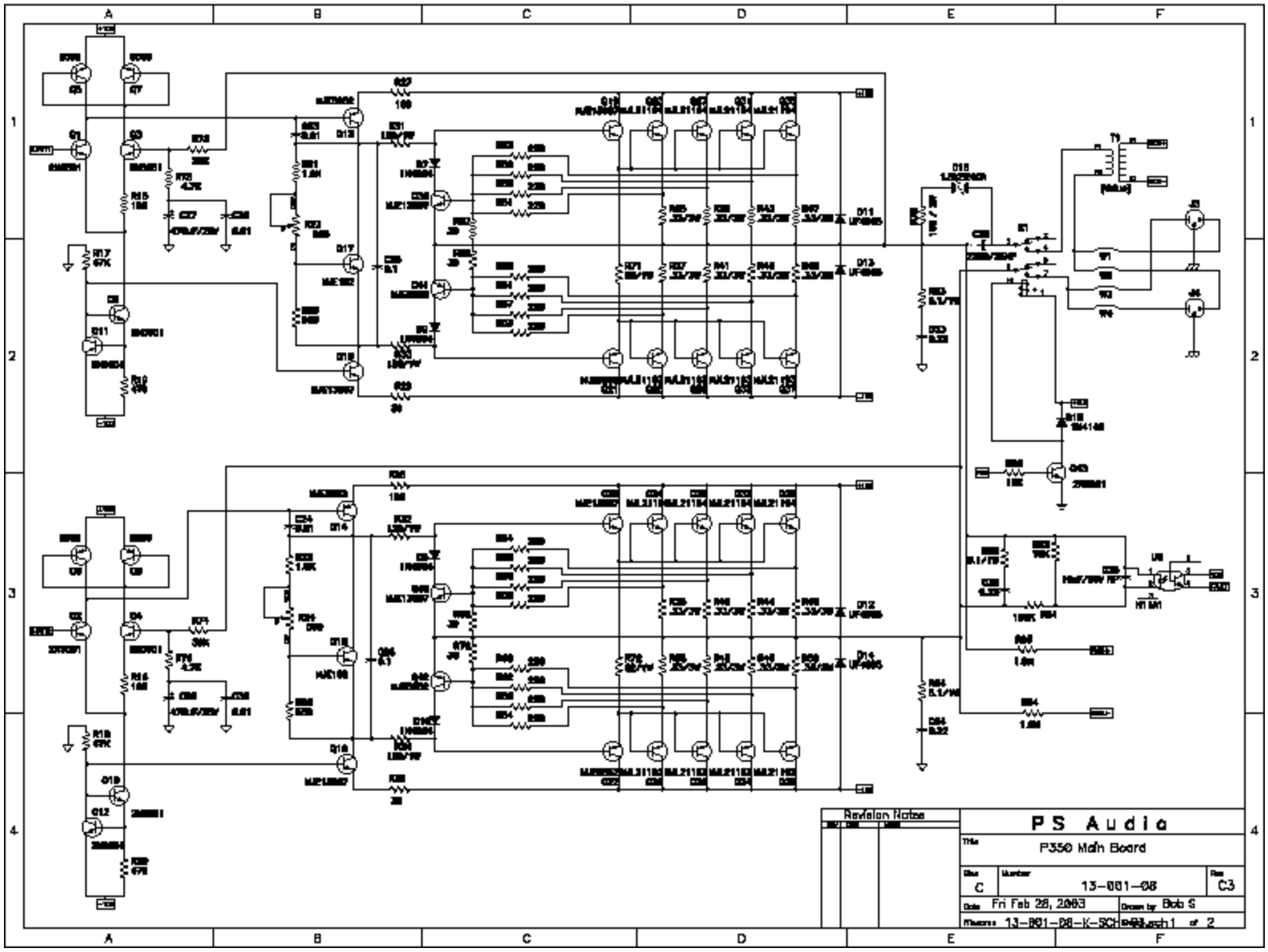
The top cover is always removed to gain access to the inside of the unit. It is attached to the chassis by a total of twelve #2 phillips head screws. Silver P500’s use an aluminum top cover while black P500’s have a steel cover. Please note that the screws used with the silver cover are very soft and can be damaged easily if a good quality screwdriver is not used.

The P500 output board has the output transistors and filter capacitors mounted underneath of it. It is attached to a large heat sink plate with either Kapton tape (early units) or sil pads (later units) is used for electrical insulation between the output transistors and chassis. Replacement P500 main boards can be shipped already attached to this heat sink plate for ease of installation.

P500 Schematics

Output board

Rev C: **Rev D:**


A
B
C
D
E
F
1
2
3
4
Revision Notes
PS Audio
P350 Main Board
13-001-08
C3
Fri Feb 28, 2003
Bob S
13-001-08-K-SCH.sch1 of 2

Acrobat Document

Display board

Rev C:

Acrobat Document

Rev E:

Acrobat Document

AC Inlet board

Rev A:

Acrobat Document

Rev B:

Acrobat Document

Rev C:

Acrobat Document

Appendix A: P500 user's manual

P500 owners manual:

Acrobat Document

Appendix B: P500 Revisions by Serial Number

Date	Serial#	Description of change
06/01/03	P5-3F001	New Rev D mainboard
10/02/03	P5-3J001	Rev 1.4 software
11/25/03	P5-3K032	German C.E compliant version
	P5-3K033	" "
	P5-3K034	" "
	P5-3K035	" "
02/12/04	P5B-4B001	P500 mainboard- First use of sil pads

Appendix C: P500 Revisions

P500 Hardware Revision Log

AC Input Board:
Rev A – First revision used in production P500
Rev B – Add inrush current limiter and second relay
Rev C – changes for CE compliance (blocking caps added)

Display Board:
Rev C – First revisions used in production P500
Rev D – Not used in P500 (used in PCA2)
Rev E – Added DC power supply for fan

Output Board:
Rev C – First revision used in production P500 NOTE: this board is not labeled but can be identified by two large blue 2200 uF capacitors on top of the board.
Rev D – Added DC servo circuit

P500 Software Revision Log

Version 1.0 – First version used in production units

Version 1.1 – Fix for PS Bus, Fix reset command for 100V units, Fix percent overload problem (no % shut down if value greater than 256)

Version 1.2 – Tubewave added, Speed increase for initial cooling fan turn on

Version 1.3 – PS Bus Global On/Off command added, Delay added to overload shutdown (to accommodate inrush current demands)

Version 1.4 - % meter reading averaged over time

Version 1.5 – Fan turn on temp raised to 62ºC. Fan initial turn on speed increased

Version 1.6 – Autowave feature modified, waveform switches slower

Appendix D: P300 Warranty Statement

PS Audio's warranty is rather simple. We warranty the unit, not the customer. Therefore, when you purchase a PS Audio product, your equipment is fully warranted for three years, regardless of who owns it.

Below is the official warranty statement:

PS Audio International - Warranty Statement

For Products Manufactured From May 1, 1999

TERMS AND CONDITIONS

1. LIMITED WARRANTY

   PS Audio warrants the product designated herein to be free of manufacturing defects in material and workmanship, subject to the following conditions, for a period of three (3) years from the date of purchase by the original purchaser or date of shipment to the authorized PS Audio dealer, whichever comes first.

2. CONDITIONS

   This Warranty is subject to the following conditions and limitations. The Warranty is void and inapplicable if the product has been used or handled other than in accordance with the instructions in the owner's manual, abused, or misused, damaged by accident or neglect or in being transported, or the defect is due to the product being repaired or tampered with by anyone other than PS Audio or an authorized PS Audio repair center.

   a. The product must be packaged and returned to PS Audio or an authorized PS Audio repair center by the customer at his or her sole expense in the original packing material. PS Audio will pay return freight of its choice for original purchasers.

   b. Return Authorization Number (RA Number) is required before any product is returned to our factory for any reason. This number must be visible on the exterior of the shipping container for PS Audio to accept the return. Units shipped to us without a Return Authorization Number or without a visible RA Number on the exterior of the shipping container will be returned to the sender, freight collect.

   c. RETURNED PRODUCT MUST BE ACCOMPANIED BY A WRITTEN DESCRIPTION OF THE DEFECT.

3. PS Audio reserves the right to modify the design of any product without obligation to purchasers of previously manufactured products and to change the prices or specifications of any product without notice or obligation to any person.

4. REMEDY

   In the event the product fails to meet this Warranty and the above conditions have been met, the purchaser's sole remedy under this Limited Warranty shall be to return the product to PS Audio or an authorized PS Audio repair center where the defect will be repaired without charge for parts or labor.

5. TRANSFER OF WARRANTY

   This Warranty is for the benefit of the original purchaser of the covered product and may be transferred to a subsequent purchaser of the product.

6. DURATION OF WARRANTY

   This Warranty expires on the third anniversary of the date of original purchase or the date of shipment to the authorized PS Audio dealer, or PS Audio International, whichever comes first.

7. MISCELLANEOUS

   ANY IMPLIED WARRANTIES RELATING TO THE ABOVE PRODUCT SHALL BE LIMITED TO THE DURATION OF THIS WARRANTY. THE WARRANTY DOES NOT EXTEND TO ANY INCIDENTAL OR CONSEQUENTIAL COSTS OR DAMAGES TO THE PURCHASER. Some states do not allow limitations on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you. This Warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

8. WARRANTOR

   Inquiries regarding the above Limited Warranty may be sent to the following address: PS Audio International, Inc., 3050 Broadway, Boulder, Colorado 80304 ATTN: Customer Service; Email: customerservice@psaudio.com; Voice 720-406-8946; FAX: 720-406-8967.

Warranty Outside the U.S.A.

PS Audio has authorized distribution in many countries of the world. In each country, the authorized importing retailer or distributor has accepted the responsibility for warranty of products sold by that retailer or distributor. Warranty service should normally be obtained from the importing retailer or distributor from whom you purchased your product. In the unlikely event of service required beyond the capability of the importer, PS Audio will fulfill the conditions of the warranty. Such product must be returned at the owner's expense to the PS Audio factory, together with a photocopy of the bill of sale for that product, a detailed description of the problem, and any information necessary for return shipment.