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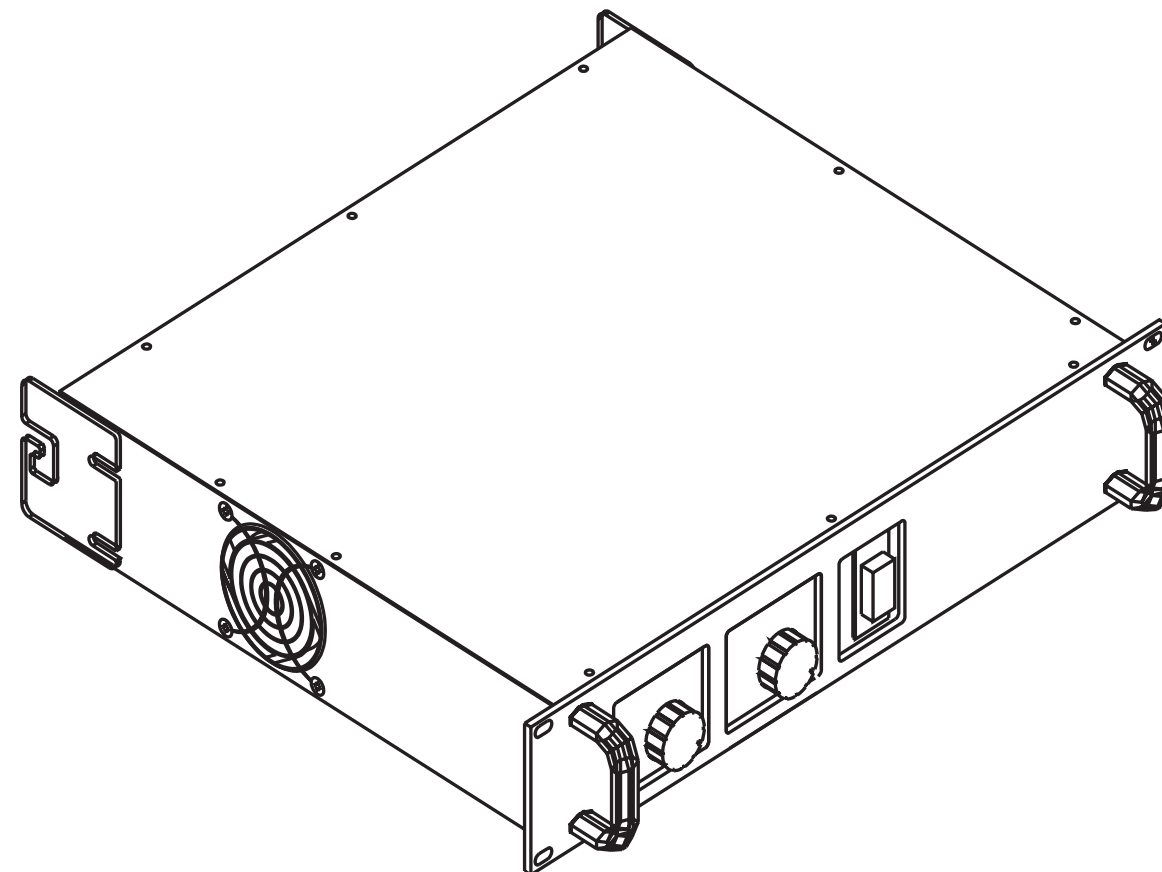
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Quality and Innovation Since 1963
Printed in Canada

AUDIOPRO
3400
HIGH EFFICIENCY STEREO POWER AMPLIFIER



SERVICE MANUAL

IMPORTANT SAFETY INSTRUCTIONS



This lightning flash with arrowhead symbol, within an equilateral triangle, is intended to alert the user to the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

Ce symbole d'éclair avec tête de flèche dans un triangle équilatéral est prévu pour alerter l'utilisateur de la présence d'un « voltage dangereux » non-isolé à proximité de l'enceinte du produit qui pourrait être d'ampleur suffisante pour présenter un risque de choqué électrique.



S2125A

CAUTION AVIS

RISK OF ELECTRIC SHOCK
DO NOT OPEN

RISQUE DE CHOC ELECTRIQUE
NE PAS OUVRIR



The exclamation point within an equilateral triangle is intended to alert the user to the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

Le point d'exclamation à l'intérieur d'un triangle équilatéral est prévu pour alerter l'utilisateur de la présence d'instructions importantes dans la littérature accompagnant l'appareil en ce qui concerne l'opération et la maintenance de cet appareil.

FOLLOW ALL INSTRUCTIONS

Instructions pertaining to a risk of fire, electric shock, or injury to a person

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT REMOVE COVER (OR BACK).

NO USER SERVICEABLE PARTS INSIDE.

REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

SUIVEZ TOUTES LES INSTRUCTIONS

Instructions relatives au risque de feu, choc électrique, ou blessures aux personnes

AVIS: AFIN DE REDUIRE LES RISQUE DE CHOC ELECTRIQUE, N'ENLEVEZ PAS LE COUVERT (OU LE PANNEAU ARRIERE) NE CONTIENT AUCUNE PIECE

REPARABLE PAR L'UTILISATEUR.

CONSULTEZ UN TECHNICIEN QUALIFIE POUR L'ENTRETIEN

Read Instructions: The Owner's Manual should be read and understood before operation of your unit. Please, save these instructions for future reference and heed all warnings.

Clean only with dry cloth.

Packaging: Keep the box and packaging materials, in case the unit needs to be returned for service.

Warning: To reduce the risk of fire or electric shock, do not expose this apparatus to rain or moisture. *Do not use this apparatus near water!*

Warning: When using electric products, basic precautions should always be followed, including the following:

Power Sources

Your unit should be connected to a power source only of the voltage specified in the owners manual or as marked on the unit. This unit has a polarized plug. Do not use with an extension cord or receptacle unless the plug can be fully inserted. Precautions should be taken so that the grounding scheme on the unit is not defeated.

Hazards

Do not place this product on an unstable cart, stand, tripod, bracket or table. The product may fall, causing serious personal injury and serious damage to the product. Use only with cart, stand, tripod, bracket, or table recommended by the manufacturer or sold with the product. Follow the manufacturer's instructions when installing the product and use mounting accessories recommended by the manufacturer.

The apparatus should not be exposed to dripping or splashing water; no objects filled with liquids should be placed on the apparatus.

Terminals marked with the "lightning bolt" are hazardous live; the external wiring connected to these terminals require installation by an instructed person or the use of ready made leads or cords.

Ensure that proper ventilation is provided around the appliance. Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.

No naked flame sources, such as lighted candles, should be placed on the apparatus.

Power Cord

Do not defeat the safety purpose of the polarized or grounding-type plug. A polarized plug has two blades with one wider than the other. A grounding type plug has two blades and a third grounding prong. The wide blade or the third prong are provided for your safety. If the provided plug does not fit into your outlet, consult an electrician for replacement of the obsolete outlet. The AC supply cord should be routed so that it is unlikely that it will be damaged. If the AC supply cord is damaged DO NOT OPERATE THE UNIT.

Unplug this apparatus during lightning storms or when unused for long periods of time.

Service

The unit should be serviced only by qualified service personnel.

Veillez Lire le Manuel: Il contient des informations qui devraient être comprises avant l'opération de votre appareil. Conservez. Gardez S.V.P. ces instructions pour consultations ultérieures et observez tous les avertissements.

Nettoyez seulement avec le tissu sec.

Emballage: Conservez la boîte au cas où l'appareil devait être retourner pour réparation.

Avertissement: Pour réduire le risque de feu ou la décharge électrique, n'exposez pas cet appareil à la pluie ou à l'humidité. *N'utilisez pas cet appareil près de l'eau!*

Attention: Lors de l'utilisation de produits électrique, assurez-vous d'adhérer à des précautions de bases incluant celle qui suivent:

Alimentation

L'appareil ne doit être branché qu'à une source d'alimentation correspondant au voltage spécifié dans le manuel ou tel qu'indiqué sur l'appareil. Cet appareil est équipé d'une prise d'alimentation polarisée. Ne pas utiliser cet appareil avec un cordon de raccordement à moins qu'il soit possible d'insérer complètement les trois lames. Des précautions doivent être prises afin d'éviter que le système de mise à la terre de l'appareil ne soit désengagé.

Risque

Ne pas placer cet appareil sur un chariot, un support, un trépied ou une table instables. L'appareil pourrait tomber et blesser quelqu'un ou subir des dommages importants. Utiliser seulement un chariot, un support, un trépied ou une table recommandés par le fabricant ou vendus avec le produit. Suivre les instructions du fabricant pour installer l'appareil et utiliser les accessoires recommandés par le fabricant.

Il convient de ne pas placer sur l'appareil de sources de flammes nues, telles que des bougies allumées.

L'appareil ne doit pas être exposé à des égouttements d'eau ou des éclaboussures et qu'aucun objet rempli de liquide tel que des vases ne doit être placé sur l'appareil.

Assurez que l'appareil est fourni de la propre ventilation. Ne procédez pas à l'installation près de source de chaleur tels que radiateurs, registre de chaleur, fours ou autres appareils (incluant les amplificateurs) qui produisent de la chaleur.

Les dispositifs marqués d'une symbole "d'éclair" sont des parties dangereuses au toucher et que les câblages extérieurs connectés à ces dispositifs de connection extérieure doivent être effectués par un opérateur formé ou en utilisant des cordons déjà préparés.

Cordon d'Alimentation

Ne pas enlever le dispositif de sécurité sur la prise polarisée ou la prise avec tige de mise à la masse du cordon d'alimentation. Une prise polarisée dispose de deux lames dont une plus large que l'autre. Une prise avec tige de mise à la masse dispose de deux lames en plus d'une troisième tige qui connecte à la masse. La lame plus large ou la tige de mise à la masse est prévu pour votre sécurité. La prise murale est désuète si elle n'est pas conçue pour accepter ce type de prise avec dispositif de sécurité. Dans ce cas, contactez un électricien pour faire remplacer la prise murale. Évitez d'endommager le cordon d'alimentation. N'UTILISEZ PAS L'APPAREIL si le cordon d'alimentation est endommagé.

Débranchez cet appareil durant les orages ou si inutilisé pendant de longues périodes.

Service

Consultez un technicien qualifié pour l'entretien de votre appareil.

AUDIOPRO 3400

SERVICE MANUAL

AUDIOPRO AP-3400 SERVICE MANUAL

M1012A "THE INPUT BOARD"

The input board processes the audio signal from the input jacks to the voltage amplifier board, (M1011A).

Each channel consists of a balanced gain stage, defeatable bass boost filter, and a preemphasis filter network.

The balanced input, (XLR Jack) and unbalanced input (phone jack) are wired in parallel to the input of a balanced operational amplifier, (U1). The gain of this stage is 1.6 (4dB) balanced and 1.6 (4dB) unbalanced. Resistors R1, R5 along with capacitors C1 and C2 form a radio interference elimination filter.

Switch S1 selects a flat or bass boosted frequency response. The bass boost filter provides a 20Hz high pass, high Q filter response with a +4dB peak at 55Hz. The filter consists of a tee network on the input of U1A along with R9, R10, R11, C5 and C6. The gain is 1 (0dB) in the passband, (above 100Hz).

Operational amplifier U3B is a high pass shelving filter with a +2dB shelf above 20KHz. This filter provides the pre-emphasis required to obtain a flat frequency response (to 20KHz) on the power amplifier output at full power.

M1011A "VOLTAGE AMPLIFIERS AND SYSTEM CONTROL"

This board contains:

- Voltage amplifiers to drive the current amplifiers on the M1002A boards.
- The front panel volume control circuitry.
- The EMS control system with its associated circuits: Pre clipping and line current sensing heater circuits.
- Clip and activity LED's. Driver circuitry for the amplifier disable relay (used during amplifier turn on, turn off, thermal shutdown and current limiting).

Circuit Explanation:

Refer to the schematic of M1011A as the sections of the circuit are explained.

The audio signal enters the board from M1012A through connector MS4. The two channels are marked "L" and "R" for left and right. The signals are to be considered as differential sources and therefore are marked as L+, L-,R+ and R-. Since the left channel has the same topology as the right channel we will only look at the left channel.

The signal ("L+") at the terminal block (MS4) passes through the front panel level control (P1) and the desired level enters the inverting input of U1.

Op amp U1 is an inverting amplifier with a set gain of 2.40 (7.6dB). Built around U1 is a dual purpose circuit controlled by a voltage divider consisting of R15, R16, R17, R18, R19, R20 and R21. The voltage divider sets two reference levels, (HDRM & CLP). Reference voltage levels vary with the voltage levels on the +/-144VDC supply rails. As the amplifier's output is loaded, the supply rails voltage decreases and so do the reference levels.

Transistors Q1, Q3 the surrounding resistors provide a pre-clipping function that tracks the supply rails through the HDRM voltage reference and clips the audio signal at approximately 11.2V pk. The clip LED indicator circuit is connected through D1 and D2 to the output of U1, The bases of Q2 and Q4 are connected to the "CLP" reference voltage, and when the peak output voltage of U1 (+/-Vp) is enough to forward bias the transistor junctions, Q2 or Q4 will trigger the clip led circuit (Q5), and illuminate the clip LED.

The audio signal on the output of U1 enters U3 through R43 and RV1. Under normal operating conditions the gain of U3 is 1(0dB). The signal then passes through U2 to the voltage amplifier.

VOLTAGE AMPLIFIER:

The voltage amplifier amplifies the audio signal's voltage from 4.8 volts peak (at the output of U2) to approximately 97v peak which is required to drive the current amplifier board M1002A. M1002A provides the current required for the 97v peak signal to drive 1200 watts into 4 ohms out of the binding posts.

Before the circuit is described in detail here is a quick rundown on the signal's path through the voltage amplifier stage. Refer to the schematic of M1011A. Let's consider that a positive going AC signal is present @ test point 3. The positive going signal will turn on the positive side of the voltage amplifier. The signal at test point 3 turns on Q12 (through R40, D14 and D13). The collector of Q12 pulls down on the base of Q14, turns this transistor on further and allows a greater current to flow out of Q14's collector. This increase in current passes through Q15 and it's collector to emitter voltage drop decreases. The collector of Q15 now being more positive in voltage turns the base of Q18 on causing an increase in Q18's collector current resulting in test point 5 going positive.

As the positive side of the amplifier was turning on the negative side would have been turning off. This is how test point 5 was able to move positive following the input signal. The reverse would hold true if a negative going signal was present on the input of the voltage amplifier.

CIRCUIT DESCRIPTION:

The voltage amplifier is a mirrored image with circuitry connected to the positive power supply rail being identical (but opposite polarity) to the circuitry connected to the negative power supply rail.

For this reason we will look in detail at the positive side of the amplifier.

The audio signal enters the voltage amplifier at test point 3. The signal passes through R40, D14 and D13 to the base of Q12. Diodes D13 and D14 set up the DC bias on Q12 to approximately 0.6 mA.

The first voltage gain stage consists of Q12 along with the resistor chain on its collector and the emitter resistor (R44).

Transistor Q12 drives the base of Q14 through the resistor chain. A DC current of approximately 6 mA should flow through the collector of Q14. The voltage drop across Q14 remains constant and is derived from the voltage drop across the voltage reference Q20, resistor R58, and the base/emitter junction of Q15. This total voltage should equal approximately 3 VDC. Transistor Q14 is the second gain stage and its output current flows through Q15. Transistor Q15 is a common base stage with the collector driving the base of output buffer Q18.

Diode D17 is a clamping diode that prevents the maximum peak of the audio signal from coming within 4V of the 144 VDC rail. This is to prevent the output current amplifier (board M1002A) from going into saturation during clipping and therefore having storage delay problems.

Transistor Q18 buffers the high impedance present on the collector of Q15. The output of the buffer provides a low output impedance at test point 5 and is current limited to 25mA through the clamping action of D19, D20 and D23. The signal at TP-5 drives the current amp board M1002A.

DC offset on the amplifier's output is corrected by operational amplifier U2. The DC offset forms a current through R54, R14 and is blocked by C5 giving a DC offset correction gain of -1.

The activity L.E.D. function is a simple charge pump circuit with a transistor that redirects a constant current path through the activity L.E.D.

SHUTDOWN CIRCUIT:

The last circuit on board M1011A is the shutdown relay and its associated drive circuitry. The relay circuit has two possible operating states.

1. Amplifier on under normal operating conditions.
2. Amplifier power switch has just been turned OFF/ON or the amplifier is in current limit protecting the amplifier's output or the amplifier has overheated.

CIRCUIT DESCRIPTION

Here is how the circuit accomplishes these functions. The relay's normally closed contacts short the output of the voltage amplifiers to ground when the power switch is off. When the power switch is turned on, the relay remains off (normally closed) for about 6 seconds. C52 charges to 35V and results in Q37 turning off allowing Q36 to turn on. As Q36 turns on, it connects the negative terminal of the relay's coil (Pin 16) to ground energizing the relay and opening the normally closed contacts.

If prolonged current limiting occurs on the amplifier's output transistors then D50 or D51 (depending on which channel is current limiting) will be forward biased turning on Q38 (from its off state). Now +144VDC appears on the collector of Q38 and through R130 and R128 turn on Q37 therefore turning off Q36 by shorting its base emitter junction. Q36 turning off will turn the relay off and the normally closed contacts (off state) will short the outputs of the voltage amplifiers to ground so as not to continuously stress the amplifier's output transistors. A cycle now occurs. With the voltage amplifiers now disabled there is no signal driving the output transistors (Q14 to Q28) on board M1002A.

The current limit circuit on M1002A turns off and D50 and/or D51 are not forward biased and Q38 turns off. Through Q37 and Q36 the relay is turned back on and the voltage amplifiers are now active again, driving the output transistors. If current limiting still occurs, then the same cycle will occur. If the cause of current limiting (low impedance or short on the speaker output terminals) has been removed, then the amplifier will continue to operate normally.

The third operation that the relay provides is "overheat shutdown". If for some reason the fan cannot keep the heatsinks in a safe operating temperature area then the fan control circuit (on board M1013A) will deliver through the "kill" signal line a positive current to turn Q37 on and turn Q36 off to turn off the relay and disable the voltage amplifiers. When the temperature of the amplifier has been cooled down by the fan, then the kill signal will disappear and the relay circuit will turn on the relay to resume normal operation. Anytime the relay is in the "protect" mode (due to the abnormal states) then contact pin 8 of the relay will illuminate LD5 (the protect LED on the front panel).

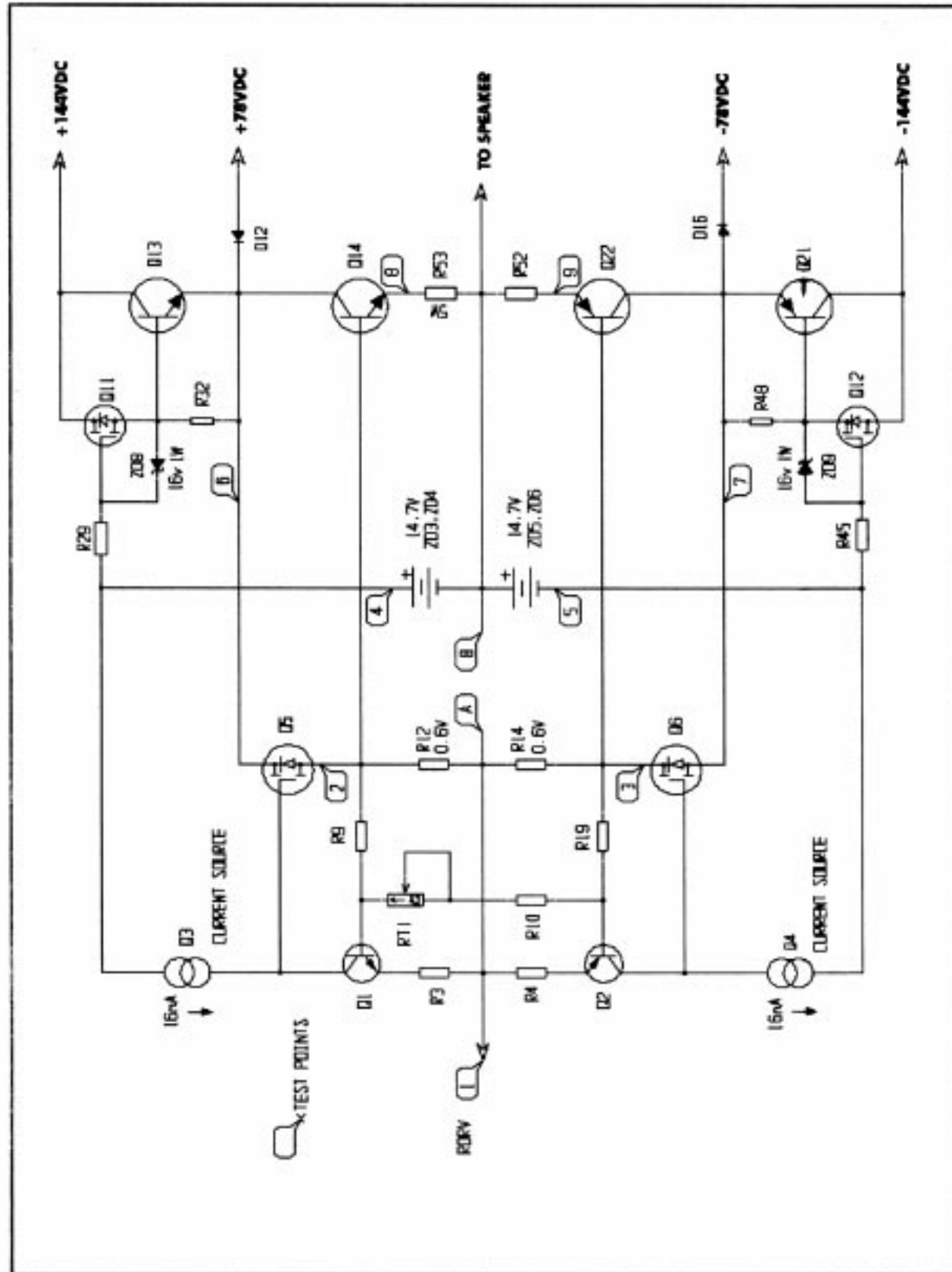
M1002A "CURRENT AMPLIFIER BOARD"

The current amplifier board (M1002A) receives a high voltage audio signal from voltage amplifier board (M1011A) and provides the current drive necessary to drive speaker cabinets.

The current amplifier is a two tier complimentary output driver design controlled by a complimentary mos-fet stage.

CIRCUIT DESCRIPTION - REFER TO THE SIMPLIFIED SCHEMATIC #1 ON THE FOLLOWING PAGE

SIMPLIFIED SCHEMATIC #1



QUIESCENT CONDITION:

This design is class A/B and therefore the output driver transistors must be forward biased to provide low crossover distortion. In most class A/B designs, a diode chain or VBE multiplier is used to control the bias voltage and provide a means of adjusting the bias. This design is different as there isn't a diode chain or VBE multiplier. For simplicity let's consider only the positive side of the current amplifier, that is all parts between the positive power supply rails and the audio signal output/input terminals. The negative side is the same as the positive, except for polarity changes.

To bias Q14, greater than 0.5V is needed from base to emitter, (or for simplicity from base to amplifier output). Points A and B are at the same potential, so consider them to be connected. If this is true then 0.5V from test point 2 to the amplifier output must appear across R12. There must be some way of developing this voltage across R12, and there is using the mos-fet (Q5) driver along with local feedback.

Simplified schematic Fig. #1 shows the biasing circuit. The current needed to develop 0.5V across R12 comes from the source of Q5. When the amplifier is first turned on the current source (Q3) turns on Q5 and current flows through R12 developing a voltage. When this voltage approaches 0.5V Q1 turns on and robs current from the gate of Q5.

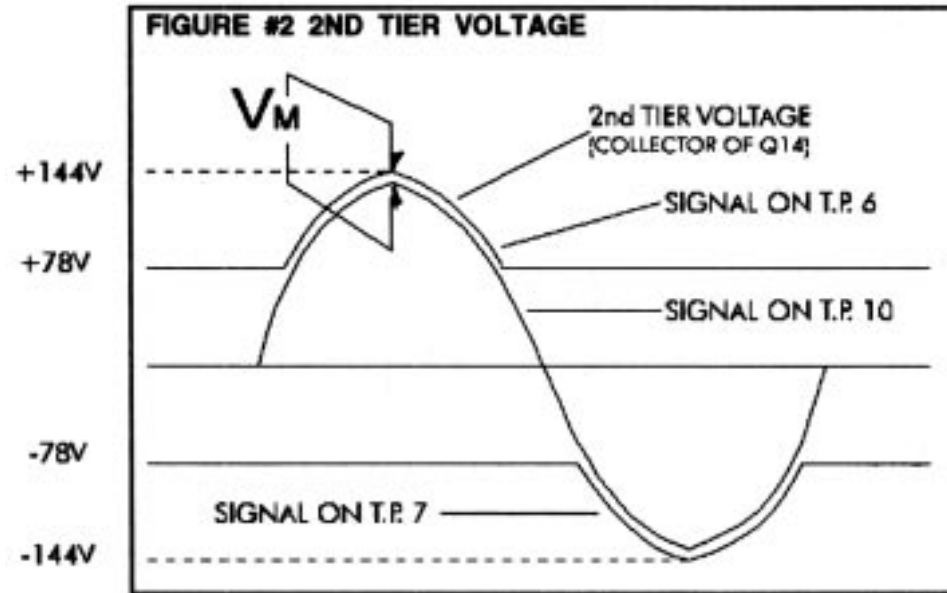
This causes Q5 to turn off until the reduced current flowing through Q5 maintains 0.5V across R12. Q1 will turn off slightly causing Q5 to increase its source current. The circuit reaches a point of equilibrium with approximately 0.5V across R12.

Because all output devices are not identical and base emitter voltages vary, some adjustment must be available to slightly adjust the 0.5V across R12. This is accomplished with RT1. RT1 causes Q1 to turn on slightly more or less resulting in Q5 turning on slightly more or less and therefore R12's voltage will be slightly more or less than 0.5V. The proper quiescent current adjustment is 4mV (to be measured between test points 8 and 9).

THE SECOND TIER:

Refer to the simplified schematic Fig. #1 while reading the following text. One way of making an amplifier more efficient is to vary the Power Supply Voltage on the collectors of the output transistors (Q14 & Q22). The lower the voltage from collector to emitter, the lower the device dissipation. During quiescent conditions, there is 78VDC on the collectors of output transistors Q14 and Q22. The peak AC voltage that can appear on the amplifier's output is approximately 132V peak. How can an output transistor deliver a 132V peak when its collector is only at 78VDC? It can if its collector is pulled up to 144VDC as the output signal's peak rises above 78VDC. (refer to Fig. #2). The second tier voltage must remain above the amplifier's output voltage by amount V_m . Therefore the circuitry controlling the second tier voltage must increase the tier voltage before the amplifier's output voltage reaches 78VDC. This leading voltage is necessary to compensate for time lag of the second tier circuit during fast rising amplifier output signals.

The voltage between the amplifier's output and test point 4 is approximately 14.7VDC derived from the voltage drop across ZD3 @ ZD4. We call this voltage the "floating battery" because it floats on top of the output audio signal with point 4 always being 14.7VDC greater than the peak of the output signal. Point 4 drives the gate of mos-fet Q11. Q11 controls the transistors of the upper tier. As Q11 turns on it's source forward biases the base of Q13 and Q13 pulls the collector of Q14 towards the 144 volt rail. The gate to source voltage needed to turn on Q11 is approximately 3.5 volts. When the peak output signal is about 67vp (55v-(14.7v-3.5v)) then Q11 will start to turn on the second tier. The second tier voltage will remain about 11 volts (Vm) above the peak of the output signal to the point of clipping where this voltage is reduced to about 4 volts. Zener ZD8 protects the gate source junction of Q11 and also provides a current path through R29 for the "floating battery".

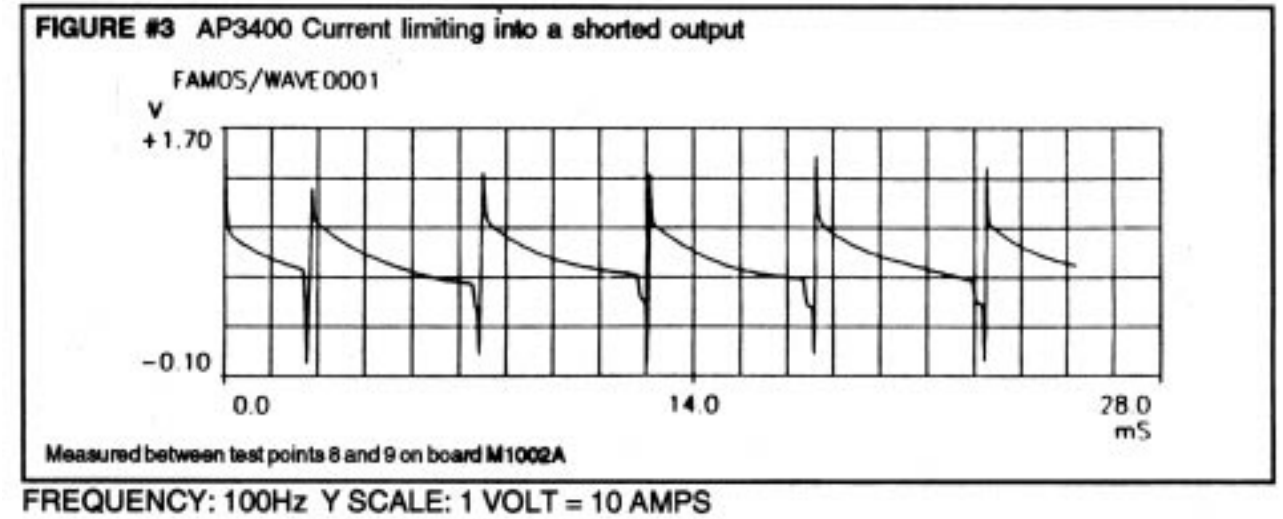


Current Limit Protection Circuitry

To have an amplifier drive 3000 watts into practically any combination of speaker cabinets and know what is a safe load and what is not is a very difficult task. An extensive amount of time was spent on the current limit circuitry so that it may simulate the safe operating area of the output transistors (SOAR curve). No matter how reactive the load may be the phase shift that it presents, along with it's resistive component is used to set the output current limit of the output transistor stage.

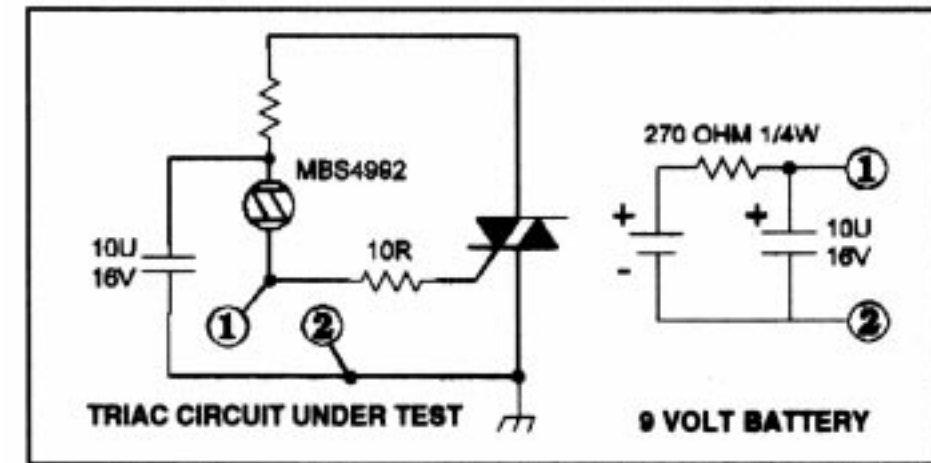
Refer to the schematic of board M1002A while reading the following text. The current limit circuitry is a mirrored image with circuitry connected to the positive power supply rail being identical (but opposite polarity) to the circuitry connected to the negative power supply rail. For this reason we will look at the positive side of the circuitry.

Transistor Q9 measures the peak current flowing through resistor R53. The voltage across R53 (as a result of the current flowing through it) is scaled down by R55, R35, R36, R37, D7 and D11- these parts make up the safe operating area along with the time constants of C26, R34, C12 and R26. Fig. #3 shows a waveform of the current that passes through R52 and R53 when the output of the amplifier is shorted to ground. This can only be seen by using an oscilloscope to measure differentially across R52 and R53. The conditions of the measurement are contained on the diagram. During current limit when Q9 turns on it reduces the voltage across R42. R42 is in series with a 16 volt zener (ZD7) and is also in parallel with the junction of Q8. Q8 is normally saturated by the current that flows through R20, ZD7, R42, and R22. When Q9 reduces the voltage across ZD9 and R42 to below 16.6 volts then Q8 turns off allowing a charge to build up on C8 through resistors R24 and R25. If current limiting occurs for a long enough duration to allow C8 to charge to 1.2 volts then Q7 will turn on tripping the relay circuit on board M1011A. As soon as the relay is turned off the audio signal will be turned off at the voltage amplifiers and will remain off for about 5 seconds before the relay turns on and allows the audio signal to pass through the amplifier. If a current limit condition is still present then the whole cycle will occur again and repeat until the load conditions on the amplifier's output are safe for the amplifier. When a safe load reappears the amplifier will automatically reset and drive that load (the speaker cabinet). Subwoofers present large inductive loads to the amplifier and are driven at low frequencies where the large current peaks must be tolerated for short periods of time. To accomodate this type of loading C26 and R34 are used to retard the firing of Q9 at low frequencies.



DC Protection

If a DC voltage greater than 8 volts appears on the output of the amplifier for more than 200 milliseconds then triac Q30 will turn on holding the output at ground potential. MBS4992 is a device that turns on at either + or - 8 volts DC.



NOTE: Everytime you replace blown output transistors on a M1002A board test the DC protection triac with the following circuit.

Conditions of test:

- A. Pass a 100Hz 25v peak signal through the M1002A board under test with no load connected to the amplifier output.
- B. Connect points 1 and 2 as shown in the diagram. The amplifier should go into protect mode as the triac (if working) shorted the output of the amplifier to ground, and the amplifier goes into current limit.
- C. Disconnect the triac test circuit and allow the amplifier to complete it's protect cycle.
- D. Reverse connections 1 to 2 and 2 to 1 and test again. The same results as in B) should be observed if the triac is working.

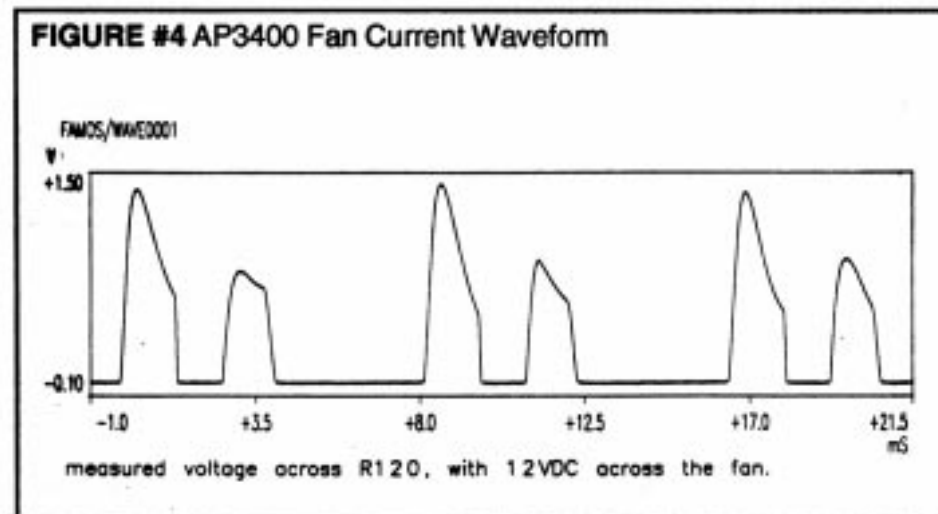
Only test the triac for one protect cycle as prolonged testing will heat the triac to a high temperature.

EMS Circuit

The Energy Management System circuit only applies to North American line voltage products. A North American AC receptacle can provide 1850 watts before the wall breaker would trip, but how can a amplifier provide 2 x 1200 watts out when only 1850 watts is available out of the AC receptacle? A sinewave source connected to the amplifier driving the amplifier to full power output will cause the circuit breaker on the amplifier to trip. Music driving the amplifier to clipping can be equal an average power output between 12 and 30 percent of the amplifier's maximum capable power output. Under this condition less than 12 amperes of current is drawn from the AC line. Some synthesized music may go beyond the 12 to 30 percent level and make the amplifier draw more than 12 amperes from the AC line. If this occurs the coil on board M1013A heats up to the point where through the heating of thermistor RV5, Q32 sinks current through R109. On board M1011A Q11 starts conducting through the connection to R109. Q11 heats thermistors RV2 and RV4 attenuating the audio signal going to each amplifier channel, thus decreasing the current drawn from the AC line to the point where less than 12 amperes is being drawn.

Fan Circuit

Looking at the schematic to board M1013A, here is a quick explanation of the fan control circuit. There is a thermistor on each M1002A board. When the amplifier is first turned on, Q33 is saturated sinking the current source through ZD10. As either negative temperature coefficient thermistor begins to heat up, more current flows through D38 or D39 decreasing the conductor of Q33 until the increasing VCE of Q33 is enough to turn on Q34 and Q35. Further heating of the thermistor causes an increasing of Q33's collector to emitter voltage. Q34 and Q35 are a common emitter stage with Q35 providing the drive current for the fan. To lower the dissipation of Q35, D42, D43, ZD12, ZD13 and R118 turn off Q35 when the full wave rectified voltage present of the collector of Q35 reaches approximately 50V by robbing current from the base of Q34. The maximum fan voltage is 20.5 VDC. ZD14 and R120, R121 and R122 provide a current limiting function. Figure #4 shows the current through these resistors when there is 12VDC across the fan.



Thermal Shutdown Circuit

Test point 7 in the fan circuit is the measuring point for the shutdown voltage. As the temperature sensing thermistors that control the fan circuit heat up the voltage on test point 7 rises until at 85 degrees celcius on the M1002A heatsinks the voltage on test point 7 reaches 34.5 VDC and the amplifier must be shutdown to protect the output power transistors. ZD15 and D47 become forward biased and through the kill connection to board M1011A, Q37 on M1011A turns on turning the relay off and muting the audio signal. After the amplifier cools down the kill voltage will decrease FIGURE #4 AP3400 Fan Current Waveform until Q37 turns off turning the relay back on enabling the amplifier.

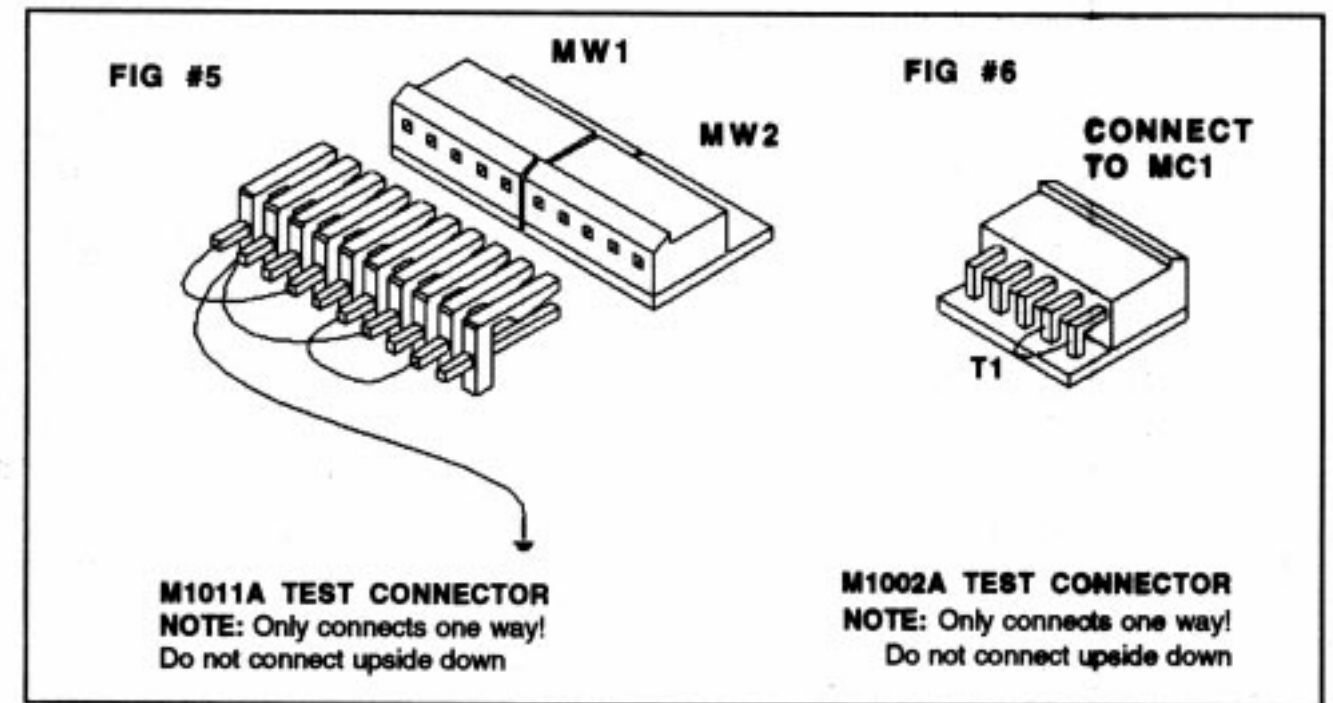
Identifying Defective Boards in the AP-3400

STEP 1: VISUAL INSPECTION OF FRONT PANEL AND FAN

- A. Check to see whether the green power LED is lit. If not, the amplifier has a power supply (M1013A board), transformer, A.C. switch or line cord problem.
- B. If the red protect LED stays on or samples off and on, this usually indicates a problem with one or both of the M1002A current amplifier modules and possibly damage to the M1011A voltage amplifier board. Check for misaligned pin connections or see if the ribbon cables have been cut or pinched through their insulation.
- C. The fan running at full speed on power up usually indicates a problem with the fan circuitry on the M1013A board, but it can also be caused by M1011A circuit problems. Erractic fan behaviour can be caused by damaged thermistors located under the M1002A heatsinks.
- D. No output on either or both channels can be caused by intermittent push switches at the input.

STEP 2: VISUAL INSPECTION OF INTERNAL CHASSIS

- A. a) After removing the lid, look for any signs of smoke, charring or burnt components. If the M1002A boards have such damage there may be some damage to the M1011A voltage amp board in the form of blown ICs, or possibly open or shorted diodes, LED's, resistors, transistors or capacitors. Exploded electrolytic capacitors indicate you have major repairs to the M1002A, M1011A and M1013A boards.



STEP 3: POWER UP PROCEDURE WITHOUT M1002A BOARDS

It is extremely important that you never power up an AP3400 with the interconnecting cables between the circuit boards not connected.

Time and possible further damage will be reduced if you test M1011A and M1002A boards separately. To do this you must use the M1011A and M1002A test connectors. These are shown in figures #5 and #6. These can be made if the Molex connector parts are available or order them from the Yorkville Service Parts Dept. With the test connectors connected to every board, slowly variac up the line AC voltage.

NOTE: It may be simpler to remove the power supply connections to M1002A boards not being troubleshooted to reduce the possibility of further damage. With the M1011A test connector connected, a sinewave can be passed through the board and be seen on test points 5 and 6. With the M1002 Atest connector installed, static DC measurements can be made. A slight DC offset may be present on the board's output as there will not be any DC correcting feedback.

STEP 4: DISMANTLING AND REASSEMBLY PRECAUTIONS

- A. When removing power supply wires or resoldering wires to eyelets on the M1011A board, double check that there are no solder bridges or icicles bridging traces or other eyelets. Failure to do so will result in the destruction of newly installed boards as well as other boards in the unit. Also make sure wire color codes are correctly oriented in their proper eyelets, and be careful that ribbon cables don't get pinched or cut under the M1011A board.
- B. When reinstalling M1002A boards, make sure the output wires, i.e. the red and yellow signal and black ground wires, are not reversed. If either or both channels are reversed, the amp will stay in protect mode with the red protect LED staying on or sampling on and off.

SPECIFICATIONS

POWER

- All values are in WATTS at 1KHz, except FTC 20Hz-20KHz.
- Measurements made with regulated 120 VAC sine wave at line cord.
- All values are rounded down to the nearest 25 watts

BURST AVERAGE

Measured as a 2 cycle burst at 1KHz, 8:1 duty. (Continuous measurements may require line currents >15 Amps).

ONE CHANNEL DRIVEN (WATTS).

LOAD	CONT. AVG.	BURST AVG.	PEAK INSTANT	FTC 20-20KHz
8ohms900	1250	3000	800	
4ohms1500	2250	6000	1200	

BOTH CHANNELS DRIVEN (WATTS).

LOAD	CONT. AVG.	BURST AVG.	PEAK INSTANT	FTC 20-20KHz
8ohms750	1200	3000	650	
4ohms1200	2175	6000	950	

BRIDGED (WATTS)

LOAD	CONT. AVG.	BURST AVG.	PEAK INSTANT	FTC 20-20KHz
16ohms1500	2400	6000	1300	
8ohms2400	4350	12000	1900	

THD DISTORTION

LOAD	AT 1KHz	20Hz - 20KHz
8 ohms	<0.003 %	<0.04 %
4 ohms	<0.004%	<0.05 %

- CROSSTALK:** -75 dB below full power at 1KHz
-60 dB below full power, 20Hz - 20KHz
- INPUT IMPEDANCE:** 20K ohms balanced, 10 Kohms unbalanced
- INPUT SENSITIVITY:** 1.4 VRMS sine wave = full power (36 dB gain).
- FREQUENCY RESPONSE:** Within 1dB, 20Hz to 20KHz (50Hz boost sw out)
- HUM AND NOISE:** -105 dB below max output RMS voltage, unweighted
- DC OFFSET:** less than 25 millivolts
- PROTECTION:** fully protected, DC, LOAD and THERMAL
- COOLING:** interleaved heatsink with DC servo controlled fan
- SLEW RATE:** Power amp: 30 V/usec, 60 V/usec in bridged mode (rise time limited to 18 V/usec by input filter).
- DAMPING FACTOR:** >500, 20Hz - 400Hz, into 8 ohms
- MAX OUTPUT CURRENT:** 100 amperes for 10 milliseconds, 50 amperes continuous
- TURN ON/OFF:** < 15 milliwatts / seconds, 0.5 Wpk (1s on delay).
- EFFICIENCY:** Better than 75% at full power into 4 ohms
- WEIGHT:** 42 pounds 17.75 Kilograms
- SIZE:** 3.5" x 19" x 15.75" (front panel to binding posts)
- POWER SUPPLY:** Toroidal transformer and combination power switch/circuit breaker
- POWER COMSUMPTION:** Will not exceed 13.5 Amps under actual conditions



Identifying Defective Boards in the AP-3000 & AP-3400

Please note: All boards used in the AP-3400 are designated with an 'A' suffix (e.g. M1002A) and use bright red solder mask

STEP 1: VISUAL INSPECTION OF FRONT PANEL AND FAN

a) Check to see whether the green power LED is lit. If not, the amplifier has a power supply (M1013 board), transformer, A.C. switch or line cord problem.

b) If the red protect LED stays on or samples off and on, this usually indicates a problem with one or both of the M1002 current amplifier modules and possibly damage to the M1012 voltage amplifier board.

Note: Any of the Molex cables from the M1011 circuit board to the M1012 input board as well as the M1002 current amplifiers can cause the protect LED to stay on or sample on and off. Check for misaligned pin connections or see if the ribbon cables have been cut or pinched through their insulation.

c) The fan running at full speed on power up usually indicates a problem with the fan circuitry on the M1013 board, but it can also be caused by M1011 circuit problems. Erratic fan behaviour can be caused by damaged thermistors located under the M1002 heat sinks.

d) No output on either or both channels can be caused by intermittent push switches at the input.

STEP 2: VISUAL INSPECTION OF INTERNAL CHASSIS

a) After removing the lid, look for any signs of smoke, charring or burnt components. If the M1002 boards have such damage, the M1011, M1012 and M1013 boards may also be damaged even if there is no similar charring on their components. At the least, there will be some damage to the M1011 voltage amp board in the form of blown ICs, or possibly open or shorted diodes, LEDs, resistors, transistors or capacitors. Exploded electrolytic capacitors indicate you have major repairs to the M1002, M1011 and M1013 boards.

STEP 3: POWER UP PROCEDURE WITHOUT M1002 BOARDS

It is extremely important that you never power up an AP-3000 or AP-3400 without following the procedure located on the M1011 schematic highlighted within the box drawn in dashed lines. Failure to do so will possibly result in damaging a good board. This procedure should only be done on a no load scoped output to insure the rest of the circuit boards are working before installing new or repaired M1011 modules. The output of a fully operational M1011 will give a 70V peak to peak sinusoidal (undistorted) wave form when a patch plug is attached at Pin #1. If the wave form is distorted or non-existent, or there is DC offset, do not attempt to connect any M1002 module to the M1011 or you will immediately destroy the new or repaired M1002 and will also cause more damage to the rest of the amplifier.

Note: M1002's power supply wires (red, yellow, white, blue and black) must be removed as well as the input Molex ribbon to the M1002 when attempting to power up an M1011.

STEP 4: DISMANTLING AND REASSEMBLY PRECAUTIONS

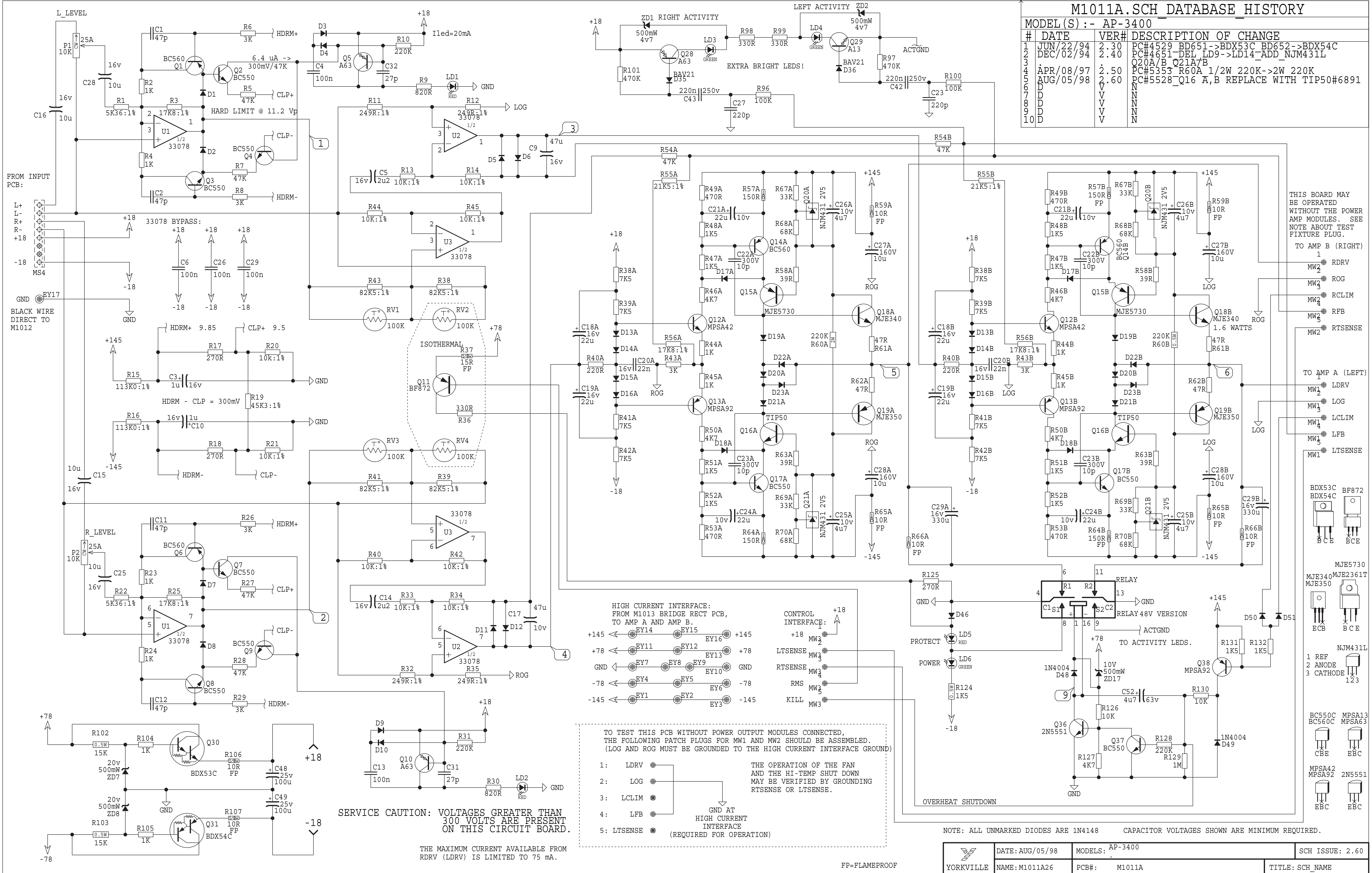
a) When removing power supply wires or resoldering wires to eyelets on the M1011 board, double check that there are no solder bridges or icicles bridging traces or other eyelets. Failure to do so will result in the destruction of newly installed boards as well as other boards in the unit. Also make sure wire color codes are correctly oriented in their proper eyelets, and be careful that ribbon cables don't get pinched or cut under the M1011 boards as this will result in shut down into the protect mode or even destruction of more boards.

b) When reinstalling M1002 boards, make sure the output wires, i.e. the red and yellow signal and black ground wires, are not reversed. If either channels or both are reversed, the amp will stay in protect mode with the red LED staying on or sampling on and off.

Table with 4 columns: YS #, Description, Qty., YS #, Description, Qty., YS #, Description, Qty. It lists various electronic components and their quantities for the AP3400 parts list.

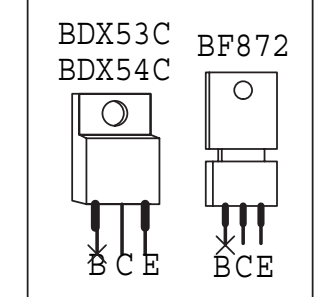
M1011A.SCH DATABASE HISTORY

#	DATE	VER#	DESCRIPTION OF CHANGE
1	JUN/22/94	2.30	PC#4529 BD651->BDX53C BD652->BDX54C
2	DEC/02/94	2.40	PC#4651-DEL LD9->LD14_ADD_NUM431L
3	APR/08/97	2.50	Q20A/B Q21A/B
4	AUG/05/98	2.60	PC#5353 R60A 1/2W 220K->2W 220K
5			PC#5528_Q16 A,B REPLACE WITH TIP50#6891
6			
7			
8			
9			
10			



THIS BOARD MAY BE OPERATED WITHOUT THE POWER AMP MODULES. SEE NOTE ABOUT TEST FIXTURE PLUG.

- TO AMP B (RIGHT)
- 1 RDRV
 - 2 MW2
 - 3 MW3
 - 4 MW4
 - 5 MW5
 - 6 MW2
- TO AMP A (LEFT)
- 1 LDRV
 - 2 LOG
 - 3 LCLIM
 - 4 LFB
 - 5 MW1
 - 6 LTSENSE



- HIGH CURRENT INTERFACE:
FROM M1013 BRIDGE RECT PCB,
TO AMP A AND AMP B.
- +145 ← EY14
 - +78 ← EY11
 - GND ← EY7
 - 78 ← EY4
 - 145 ← EY1
- CONTROL INTERFACE:
- +18 MW2
 - LTSENSE MW3
 - RTSENSE MW4
 - RMS MW3
 - KILL MW3
- TO TEST THIS PCB WITHOUT POWER OUTPUT MODULES CONNECTED, THE FOLLOWING PATCH PLUGS FOR MW1 AND MW2 SHOULD BE ASSEMBLED. (LOG AND ROG MUST BE GROUNDED TO THE HIGH CURRENT INTERFACE GROUND)
- 1: LDRV
 - 2: LOG
 - 3: LCLIM
 - 4: LFB
 - 5: LTSENSE
- THE OPERATION OF THE FAN AND THE HI-TEMP SHUT DOWN MAY BE VERIFIED BY GROUNDING RTSENSE OR LTSENSE.
- GND AT HIGH CURRENT INTERFACE (REQUIRED FOR OPERATION)

SERVICE CAUTION: VOLTAGES GREATER THAN 300 VOLTS ARE PRESENT ON THIS CIRCUIT BOARD.

THE MAXIMUM CURRENT AVAILABLE FROM RDRV (LDRV) IS LIMITED TO 75 mA.

NOTE: ALL UNMARKED DIODES ARE 1N4148 CAPACITOR VOLTAGES SHOWN ARE MINIMUM REQUIRED.

YORKVILLE	DATE: AUG/05/98	MODELS: AP-3400	SCH ISSUE: 2.60
	NAME: M1011A26	PCB#: M1011A	TITLE: SCH_NAME

FP=FLAMEPROOF

GUIDE ETCH



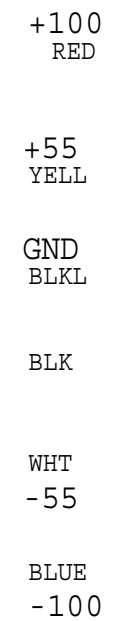
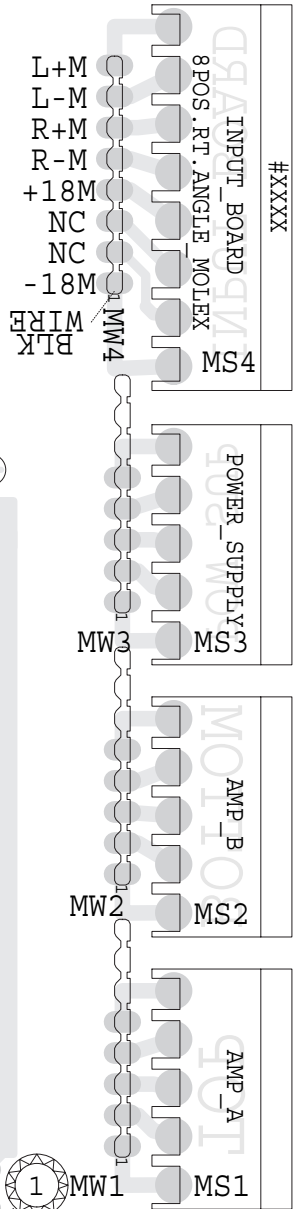
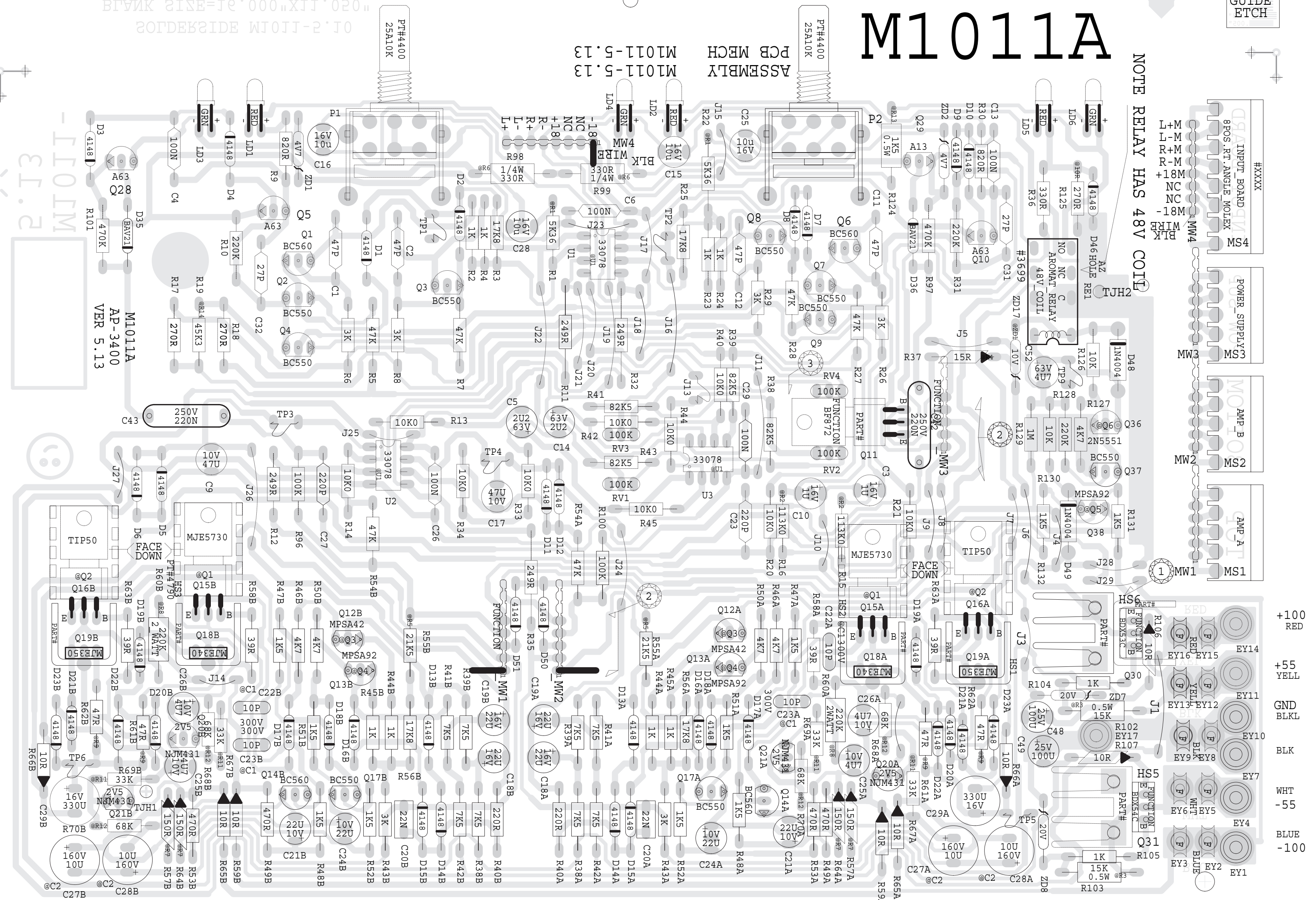
A1101M

BLANK SIZE=16.000"X11.050"

BLANK SIZE=16.000"X11.050"

SOLDSIDE M1011-2.10

NOTE RELAY HAS 48V COIL

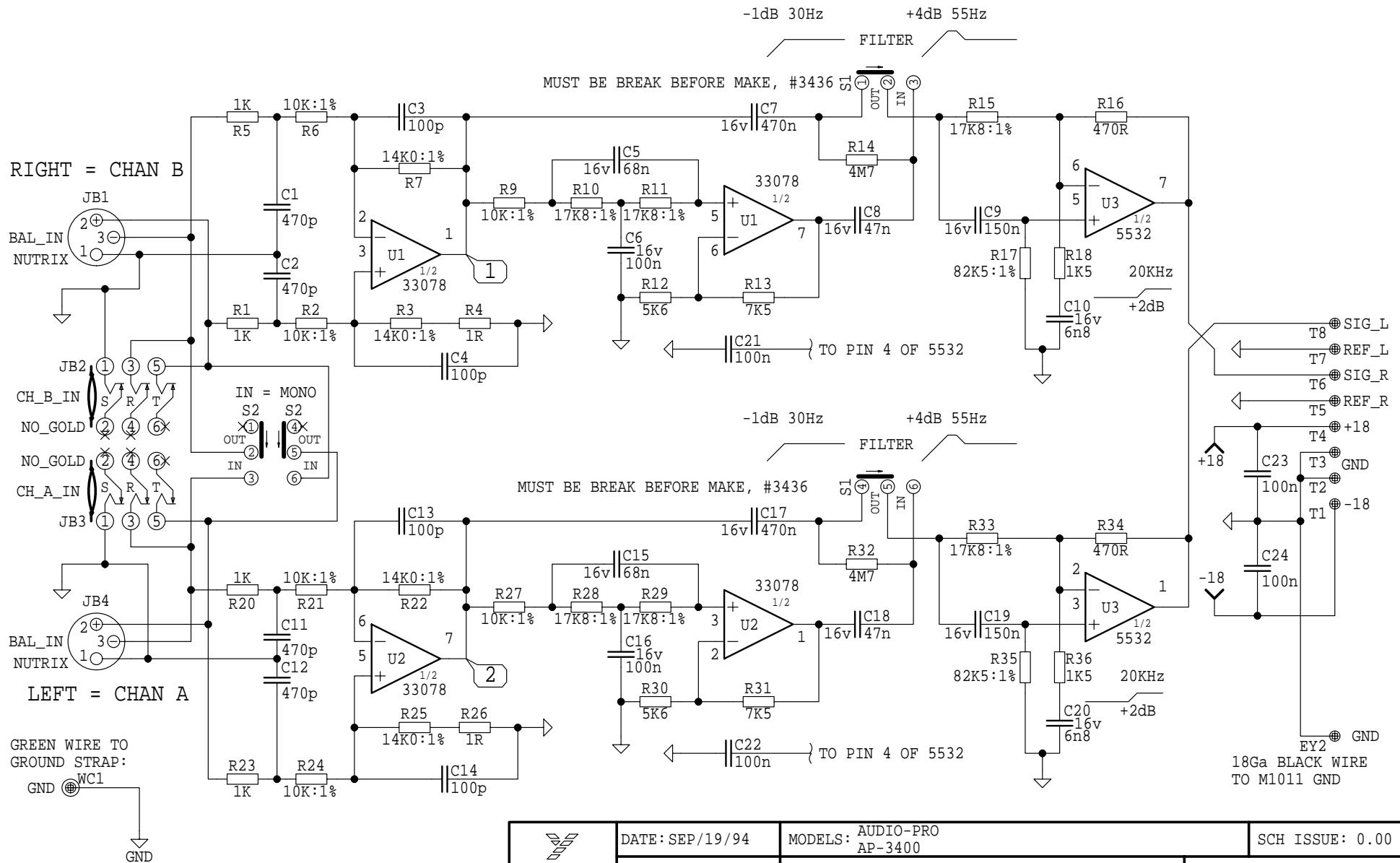



M1011.PCB DATABASE HISTORY			
MODEL(S)	VER#	DESCRIPTION OF CHANGE	ETCH GUIDE
AP-3000			
#	DATE	VER#	DESCRIPTION OF CHANGE
1	JUN/22/94	4.53	PC#4529 BD651->BDX53C BD652->BDX54C
2	NOV/29/94	5.00	PC4651 LED'S->NJM431+2 RESISTORS
3	FEB/15/95	5.10	Q14A/Q21A MOVED TO AID RAD INSERT
4	OCT/27/97	5.12	PC#5497 R66A/B 1/8WFP->1/4WFP
5	D	V	N
6	D	V	N
7	D	V	N
8	D	V	N
9	D	V	N
10	D	V	N
11	D	V	N

M1011A.PCB DATABASE HISTORY			
MODEL(S)	VER#	DESCRIPTION OF CHANGE	ETCH GUIDE
AP-3400			
#	DATE	VER#	DESCRIPTION OF CHANGE
1	AUG/06/93	4.51	PC#4443 R17,R18 470R->270R
2	.	.	R19 51K->43K
3	JAN/18/94	4.52	PC#4533 R19 43K->45K3
4	FEB/94	4.52	PC#4545 R1/R22 6K2->5K36
5	JUN/22/94	4.53	PC#4529 BD651->BDX53C BD652->BDX54C
6	NOV/29/94	5.00	PC#4651 LED'S->NJM431+2 RESISTORS
7	FEB/15/95	5.10	Q14A/Q21A MOVED TO AID INSERTION
8	APR/08/97	5.11	PC#5353 R60A/B ->2 WATT
9	OCT/27/97	5.12	PC#5497 R66A/B 1/8WFP->1/4WFP
10	AUG/05/98	5.13	PC#5528 Q16 A,B REPLACE WITH TIP50#6891
11	D	V	N

PRODUCTION NOTES
 1 RV2,RV4 TO BE HAND INSERTED
 C3 1U 16V TO BE HAND INSERTED





 YORKVILLE	DATE: SEP/19/94	MODELS: AUDIO-PRO AP-3400	SCH ISSUE: 0.00
	NAME: M1012A.SCH	PCB#&VER: M1012-2.00	TITLE: INPUT_&_FILTER

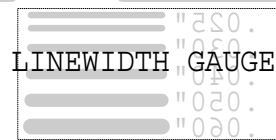
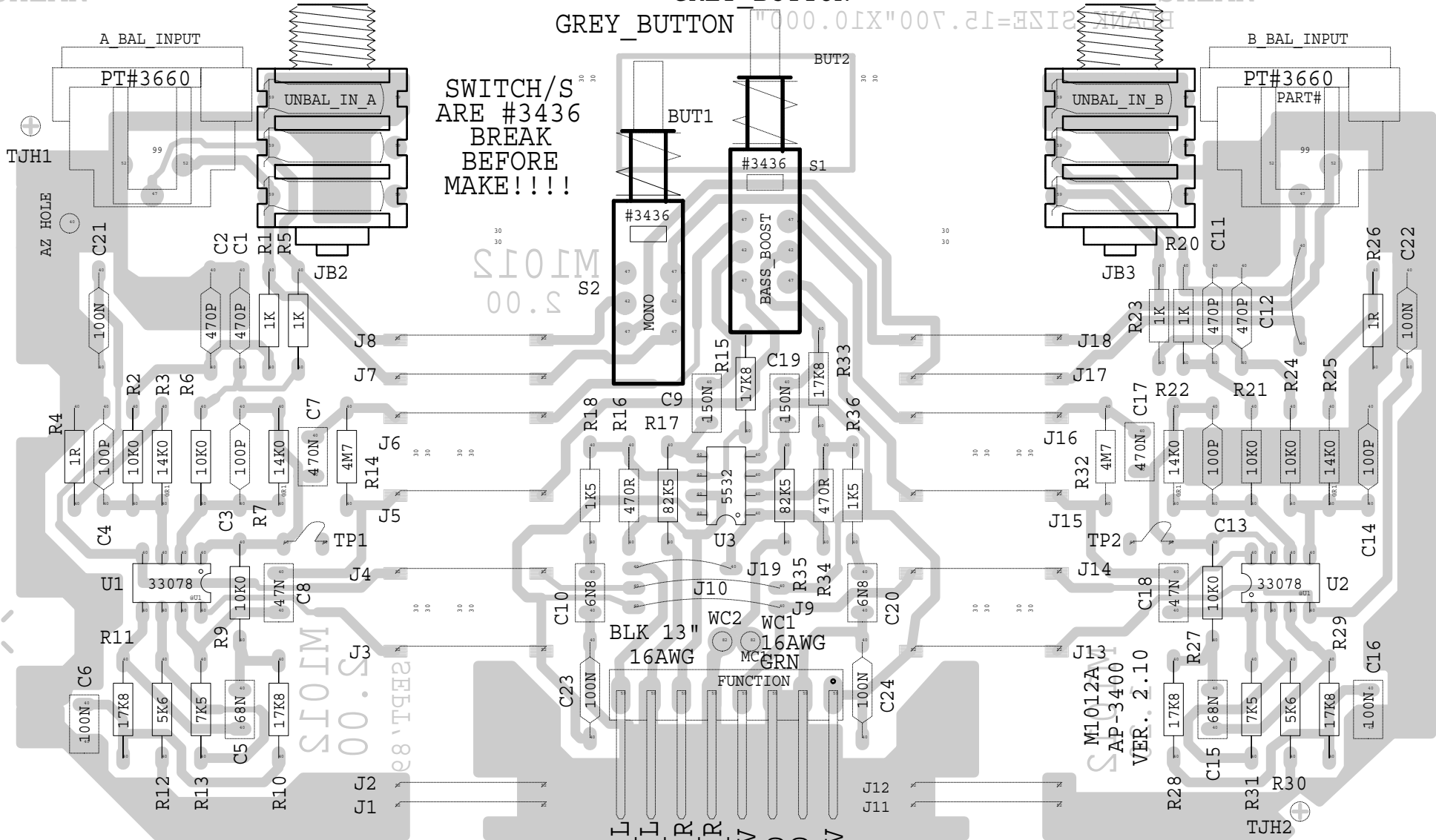


ASSEMBLY M1012-2.10 BLANK SIZE=15.700"X10.000"
 PCB MECH M1012-2.00



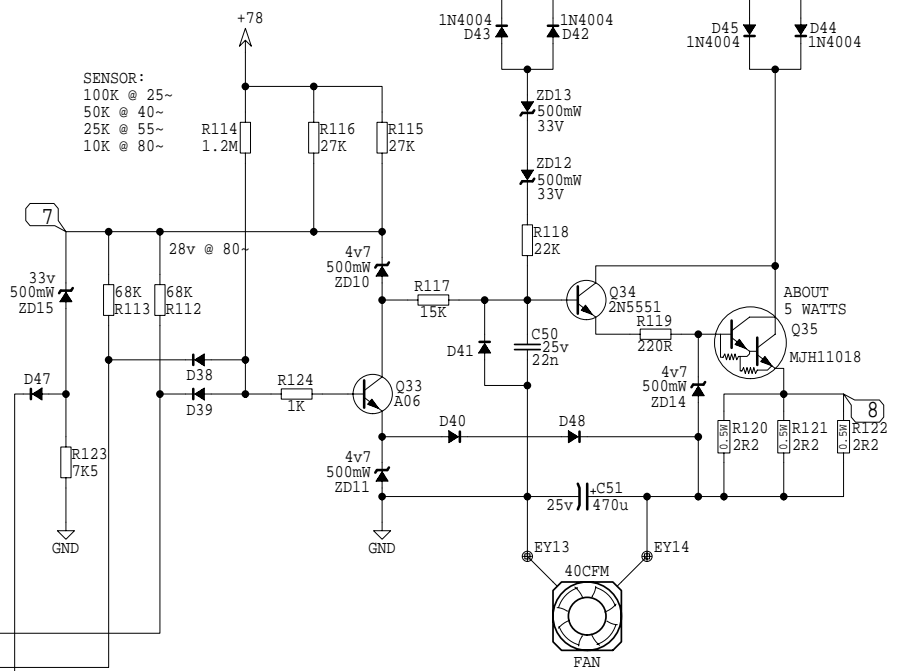
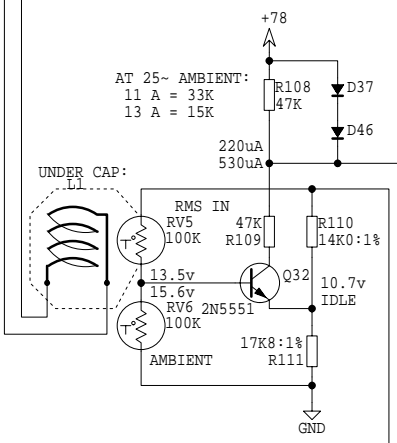
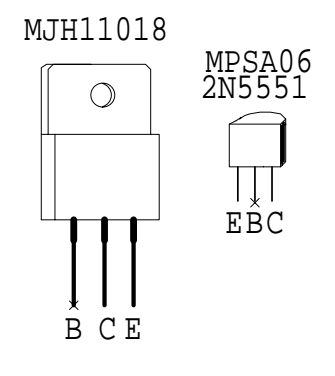
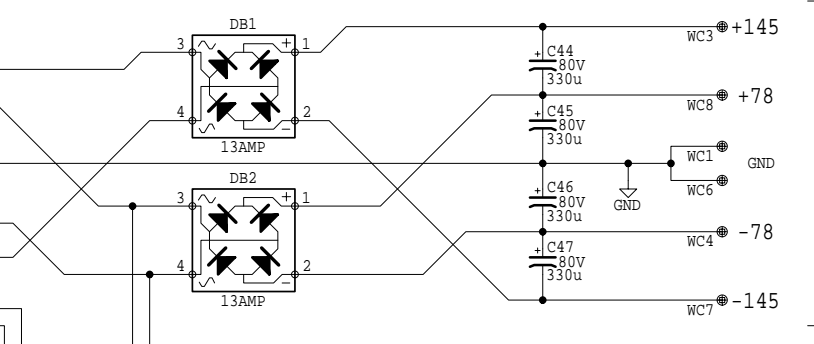
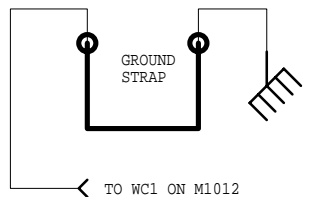
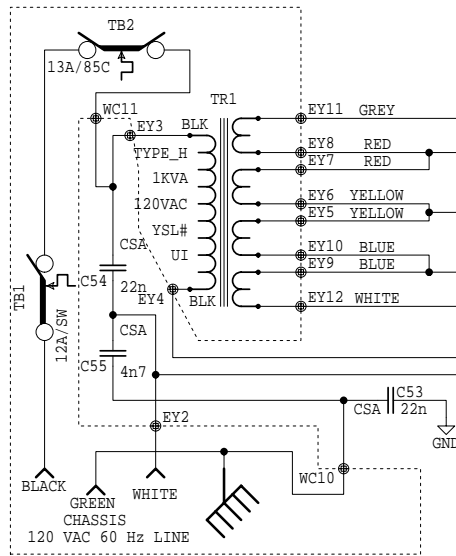
GREY BUTTON
 GREY_BUTTON

SWITCH/S
 ARE #3436
 BREAK
 BEFORE
 MAKE!!!!



AP-3400
 M1012A





M1013A.SCH_DATABASE_HISTORY

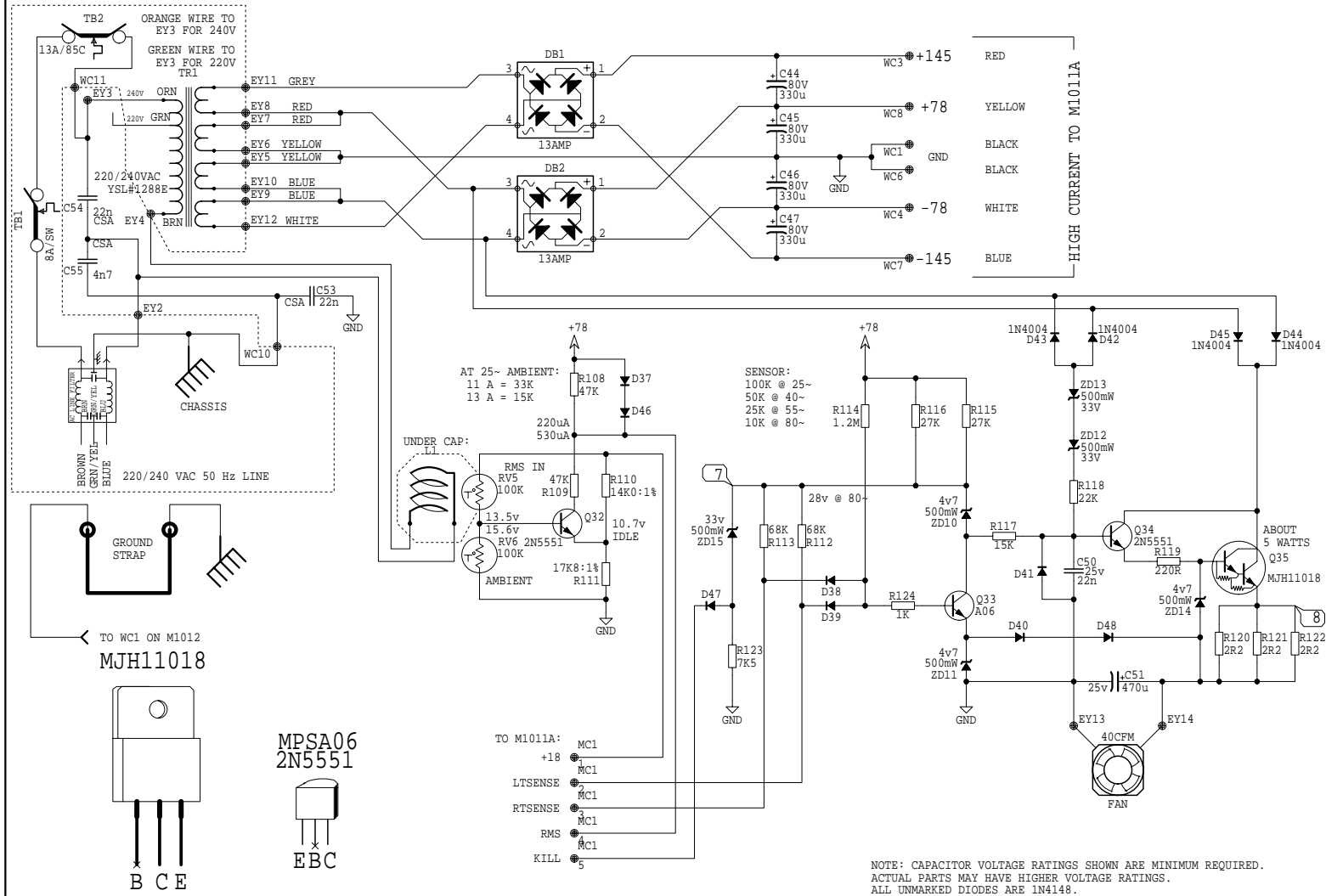
MODEL(S):- AP3400

#	DATE	VER#	DESCRIPTION OF CHANGE
1	AUG/12/97	1.40	PC#5444_R120->122_1/4W->1/2W
2	D	V	N
3	D	V	N
4	D	V	N
5	D	V	N
6	D	V	N
7	D	V	N
8	D	V	N
9	D	V	N
10	D	V	N

- TO M1011A: MC1
- +18 MC1
- LTSENSE MC1
- RTSENSE MC1
- RMS MC1
- KILL 5

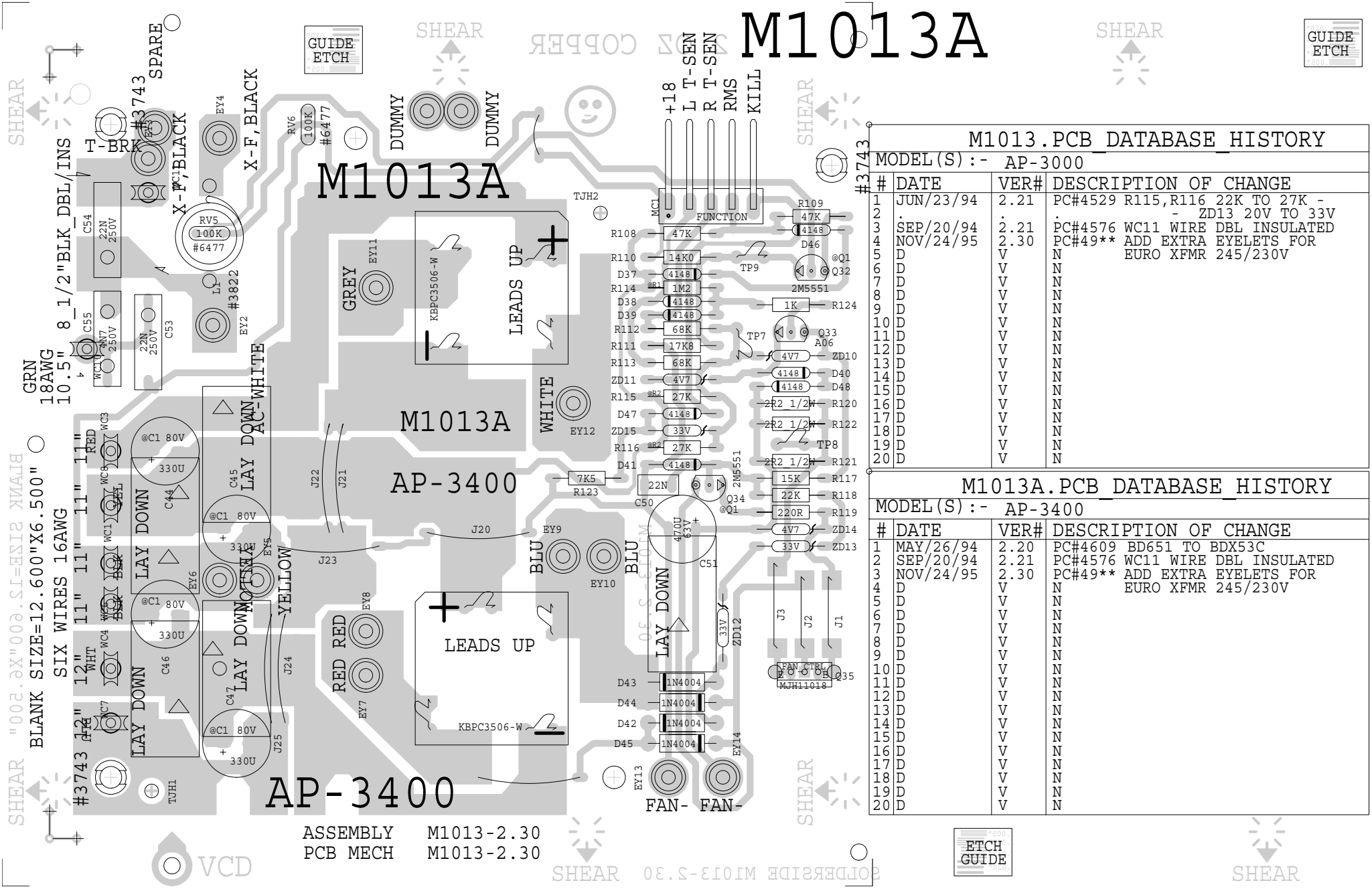
NOTE: CAPACITOR VOLTAGE RATINGS SHOWN ARE MINIMUM REQUIRED.
ACTUAL PARTS MAY HAVE HIGHER VOLTAGE RATINGS.
ALL UNMARKED DIODES ARE 1N4148.

YORKVILLE	DATE: AUG/12/97	MODELS: AP-3400	SCH ISSUE: 1.40
	NAME: M1013A.SCH	PCB#&VER: M1013A	TITLE: SUPPLY/FAN_PCB



M1013AE.SCH DATABASE HISTORY		
#	DATE	DESCRIPTION OF CHANGE
1	SEPT7/28/95	1.40 PCH4883 ADDED EMI AC LINE FILTER
2		
3		
4		
5		
6		
7		
8		
9		
10		

YORKVILLE	DATE: SEP/28/95	MODELS: AP-3400E	SCH ISSUE: 1.40
	NAME: M1013AE.SCH	PCB#&VER: M1013A-2.20	TITLE: SUPPLY/FAN_PCB



M1013A

M1013.PCB DATABASE HISTORY

MODEL(S) :- AP-3000

#	DATE	VER#	DESCRIPTION OF CHANGE
1	JUN/23/94	2.21	PC#4529 R115,R116 22K TO 27K -
2			- ZD13 20V TO 33V
3	SEP/20/94	2.21	PC#4576 WC11 WIRE DBL INSULATED
4	NOV/24/95	2.30	PC#49** ADD EXTRA EYELETS FOR
5			EURO XFMR 245/230V
6			N
7			N
8			N
9			N
10			N
11			N
12			N
13			N
14			N
15			N
16			N
17			N
18			N
19			N
20			N

M1013A.PCB DATABASE HISTORY

MODEL(S) :- AP-3400

#	DATE	VER#	DESCRIPTION OF CHANGE
1	MAY/26/94	2.20	PC#4609 BD651 TO BDX53C
2	SEP/20/94	2.21	PC#4576 WC11 WIRE DBL INSULATED
3	NOV/24/95	2.30	PC#49** ADD EXTRA EYELETS FOR
4			EURO XFMR 245/230V
5			N
6			N
7			N
8			N
9			N
10			N
11			N
12			N
13			N
14			N
15			N
16			N
17			N
18			N
19			N
20			N

ASSEMBLY M1013-2.30
PCB MECH M1013-2.30

ETCH GUIDE

SHEAR

GUIDE ETCH

SHEAR

SHEAR

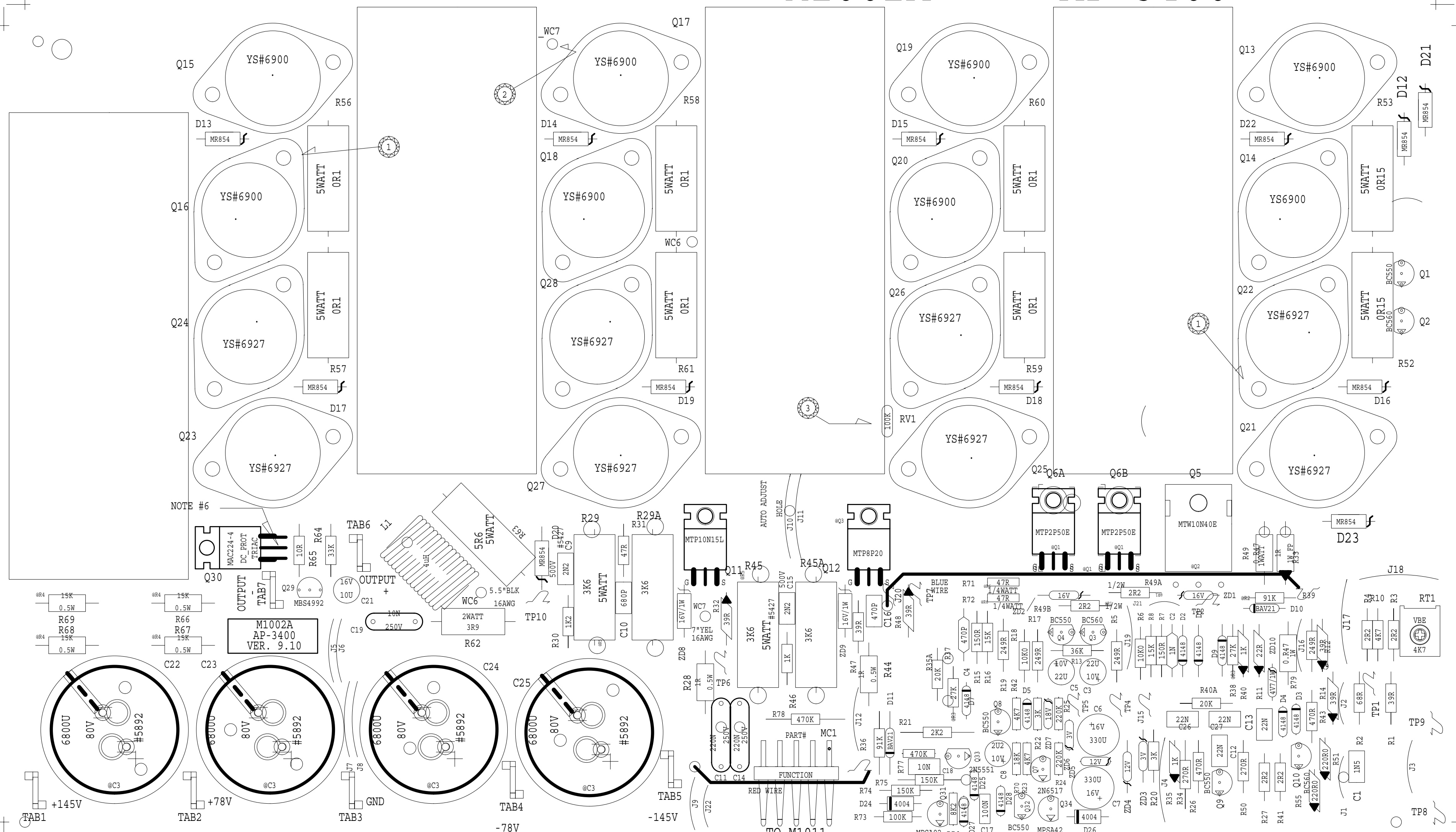
VCD

SHEAR

SHEAR

M1002A

AP-3400



NOTE #6

M1002A
AP-3400
VER. 9.10

TO M1011
ASSEMBLY
PCB MECH
M1002-9.00
M1002-9.00

BLANK SIZE=14.750"X8.850"

E:\1002A\PART.PRN

Testing Repaired Circuit Board

Now that you have rebuilt the M1002 or M1002A circuit board. It is just as important to properly power up the board. If the sinewave doesn't look right check the signal at test point (1) on M1002 to ensure that the voltage amplifier on board M1011 or M1011A isn't distorting the signal. If there is still a damaged part on the board instantly turning it on could blow up the board and you would be back where you started.

The best method is to connect the test connector shown in figure 3 to the 5 pin molex connector MC1 and connect the power wires and ground to the power supply.

Connect a digital multimeter to test pins 8 and 9 to measure the bias quiescent current and place a scope probe on the speaker output. Be sure to turn the quiescent current trimpot RT1 fully counter clockwise.

Now using a variac slowly turn up the AC main voltage while monitoring the quiescent voltage and the speaker output trace on the scope. Watching these two test points is a good indicator of the health of the board. If you have a second multimeter connect it up from the speaker output to test point 4 or 5. As you variac up also check these DC battery voltages to ensure that they both increase in voltage to approximately +14 or -14 vdc.

If the board looks OK after variacing up to 120vac then slowly turn up the bias (RT1 trimpot) to obtain 3 to 5 millivolts of bias voltage on test points 8 and 9.

Now power down the board; connect MC1 to circuit board M1011 and variac up the whole amplifier. Check the speaker output with a 1KHZ sinewave with no load. If this looks good place the minimum rated load (4 ohm for M1002A, 2 ohm for M1002) on the speaker output and increase the sinewave amplitude to the point of clipping. If the signal looks free of oscillation, place a short across the speaker posts. The amplifier should go into protect mode after 1/10 of a second. Remove the short and the sinewave will appear 6 seconds later.

Reassemble the complete amplifier and run just clipping music or pink noise into the minimum rated speaker load for that model of amplifier. Let the amplifier heat up for 20 minutes. This will check the thermal mounting of the transistors and for any weak parts not caught during troubleshooting.

If the amplifier passes this test the product is ready to return to the customer.

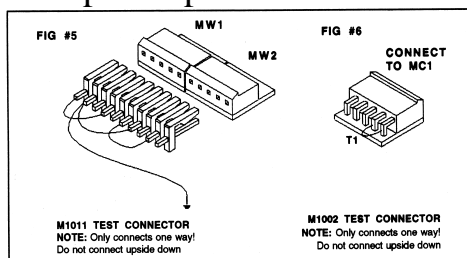


Figure 3.

See details of figure 3 in service manual.



YORKVILLE SOUND

AP3000 AND AP3400 SERVICE

Quick Fix for M1002 and M1002A

To speed up the servicing of the AP3000 or AP3400 on your bench, Yorkville Sound's service department has developed a method to replace the components most likely to fail when a M1002/A amplifier board requires service.

This Quick Fix kit contains the procedure, assembly drawings, and components to perform the Quick Fix to a M1002 or M1002A board.

It should be understood that the person using this procedure knows how to test resistors, diodes, and transistors to determine if they are defective. This procedure is not intended to be a substitute for one's lack of electronic capability.

Before starting, look at the board for repair and locate the version number. It is very important that you follow the procedure for the appropriate circuit board version number.

A complimentary service manual for the AP3000 power amplifier is supplied with this M1002KIT.

- STEP** 1. Locate the assembly drawing for the version number printed on the M1002 or M1002A circuit board to be serviced.
- Remove all of the transistors coloured RED on the assembly drawing.
 - Measure and remove any of the diodes coloured BLUE on the assembly drawing that may be damaged. Replace a 1N4732A 1W 4V7 zener (#6459) {These components already exist on version 9 and higher, add only in versions 9 and lower.} that may have been added to the component side of the board along with a series 0.5 ohm resistor. Refer to figure 1.

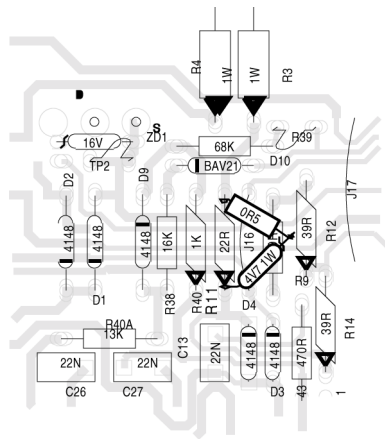


Figure 1

- Rotate the trim pot RT1 fully counter - clockwise as in figure 2. Inspect and replace any resistors that look burnt. Measure all of the resistor values coloured YELLOW on the assembly drawing. The value that you measure may not be exactly what is shown on the assembly drawing but if the resistor doesn't look damaged it should measure within + or - 5% of the printed value.

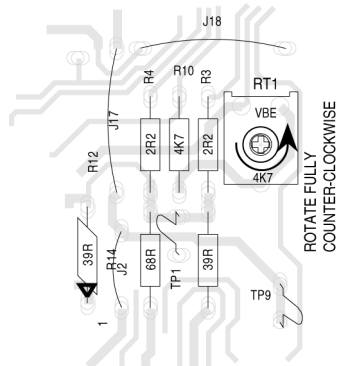


Figure 2

5. Measure the resistor coloured GREEN. The measured value should measure within + or – 5% value listed in the table below. Replace any resistor that measured beyond the + or – 5% value listed in the table below.

Resistor Number	Printed Value	Correct Measured Value		
		-5%	2K3	+5%
R10	4K7	2K25	2K3	2K35

6. Measure across the pair of test points listed in the table below. If the measured value is not within + or – 10% of the value listed in the table then replace the resistors shown in the table below.

Test Points	Layout Reference	Correct Measured Value		Replace Resistors
A to A	TP2 to J19	-10%	+10%	R11, R12, R14
		15ohm	17 ohm	19 ohm

7. Measure the resistors coloured ORANGE. Since the value of these resistors is 0.1 ohm, your ohmmeter will measure the higher series resistance of the test leads if the resistor is OK. If the resistor is damaged your ohmmeter will read a very high resistance (an open circuit). Replace any damaged resistors.
8. Measure the output TO –3 transistors (Q13 to Q28) to determine if any are damaged. Mark any damaged transistors with a marking pen.
9. Replace any output transistors that you have marked as being damaged. Replace any diodes that you have found to be damaged. Replace all of the red transistors that were removed.
10. Inspect the traces on the circuit board for any that have ‘fused’ open or look like they got very hot. Bridge and solder a piece of wire over any damaged traces.

AFTER YOU HAVE REPLACED ALL OF THE NECESSARY COMPONENTS INSPECT THE REPAIRED BOARD FOR ANY MISSING PARTS, CORRECT VALUES IN THE CORRECT POSITION AND THAT ALL COMPONENTS ARE SOLDERED.

