COUNTERPOINT

NATURAL PROGRESSION STEREO NPS-200 AND NPS-400 POWER AMPLIFIERS

SERVICE MANUAL

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Applies To
NPS-200 Serial Numbers starting at: 1NPS200
NPS-400 Serial Numbers starting at: 1NPS401

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COUNTERPOINT

1. CONTENTS

2. WARNINGS

Normal precautions should be observed when servicing this mains powered unit. Some of the following procedures require removing the top cover of the amplifier. Be aware that the voltages within can be LETHAL! Unless otherwise instructed, keep your fingers off components and the circuit board. Always unplug the unit from the AC wall outlet before removing or replacing the cover. Something falling onto the circuit board could cause substantial damage.

Safety regulations require that this unit must be restored to its original condition and that parts identical to those specified be used.

All ICs and many other semi-conductors are susceptible to electrostatic discharges (ESD). Careless handling during repair can reduce the life of a component drastically. When repairing make sure that you are connected (are at the same potential as the mass of the set) via a wrist strap which incorporates current-limiting resistance. Keep components and tools at this potential also.

3. GENERAL DESCRIPTION

Counterpoint's Natural Progression Stereo power amplifiers are precisely engineered high quality components intended for use in home stereo systems where sonic performance is paramount. Some of the sophisticated circuitry features of the Natural Progression Stereos are:

The Natural Progression Stereo 200 and 400 power amplifiers are a continuation, a natural progression, of the technology developed for the Natural Progression Monaural amplifiers. The NPS-200 and NPS-400 use the same vacuum-tube power supply and differential voltage amplifier stage as the NPM's, but unlike the Mono's, the NPS-class amplifiers use a novel bipolar output stage that allows the signal tube to "speak" with unsurpassed clarity and purity. Furthermore, the bipolar output stage is rugged and reliable, capable of delivering high current with high accuracy. The NPS-200 can deliver over 100 amperes of peak-to-peak current; the NPS-400 is capable of over 220 amperes.

3.1 A Brief Technical Discussion

Counterpoint's Natural Progression Stereos are hybrid stereo power amplifiers which use vacuum tubes and bipolar transistors. They have fully symmetrical balanced inputs, no global feedback, and are rated at 200 watts/8 ohms, 400 watts/4 ohms (NPS-400); and 100 watts/8 ohms, 200 watts/4ohms (NPS-200).

There are four circuit boards in the amplifier: the right and left channel audio boards (located on the side heatsinks), which hold the audio tube and output stage devices as well as all power supplies except for the main output stage "rail" supplies, the main output stage rail power supply board (located centrally in the amplifier), which handles power supply rectification and filtration for the output devices, and the signal input board (located at the rear of the amplifier), which handles input signal routing and control for balanced/normal operation, mono/stereo and input muting. This board also houses the operate/standby circuitry.

3.1.1 Output stage

99.9% of all amplifiers sold use bipolar transistors in the output stage. They have very high output current capability, but their current gain is normally quite low, as a result of which they present so low an input impedance that they can't be driven by a tube. Also, the typical biasing circuit used with bipolar devices does not easily permit connection to a voltage amplifier with a single output. The circuit used in the Natural Progression Stereo amplifiers has a single input, which allows easy connection to the tube stage, and offers extremely high current gain: the input impedance of the output stage is more than 3 million ohms; almost no current is required by the tube to drive the output stage. This gives the tube a very easy load to drive, allowing it to operate in its most linear range.

Another feature of the output stage is that the DC feedback return node and the biasing circuitry are completely removed from the signal path.

3.1.2 Differential triode gain stage

The NPS's use the same voltage gain stage that is used in Counterpoint's NPMono amplifiers: a dual triode configured as a differential common-cathode amplifier, with bipolar constant-current cathode and anode loads. This circuit offers low distortion and relaxed sound quality, even at high levels.

3.1.3 Zero Feedback

Negative feedback is a technique used in most power amplifiers to improve measured performance. These "bench tests" determine the amplifier's performance in such areas as frequency response and distortion. Though impressive numbers are admittedly useful for marketing a product, it is generally acknowledged that there are limits beyond which improvements in measured response will have no effect on the product's sound quality. Furthermore, if an amplifier's measured performance is within acceptable limits before feedback is applied, the application of feedback can actually degrade its sound quality. The distortion which is generated by the output stage is fed back to the input circuitry. Consequently, the pre-output stages process both the desired music signal and the output stage distortion.

Because the loudspeaker load is non-linear, and feeds energy back into the amplifier's output stage, these distortion components are again fed back to the amplifier's input stage.

The Natural Progression Stereo amplifiers neither employ nor need feedback to achieve quite good measurements. All the circuit design techniques evolved in the amplifiers were intended to offer, first, the best sound quality possible, and second, to dramatically linearize each stage's characteristics with respect to both voltage transfer and current transfer.

3.1.4 Separate DC loop

Many amplifiers incorporate some kind of DC servo to control DC offset, the presence of DC at the output (speaker) terminals. This causes the loudspeaker's cone to be "offset" (either in or out) of the magnet structure from its (optimally) central position, In an attempt to correct for the presence of this offsetting voltage, many amplifiers connect the servo's output to the audio signal path at the amplifier's first signal stage--an unnecessarily large loop. Furthermore, servos are not inaudible. In fact, you can change the sound of a servo'ed amplifier by changing the type of servo IC op-amp. The Natural Progression philosophy considers that as DC offset errors area problem only at the output stage, that's all that should, properly, be enclosed in the DC loop. This technique retains all the benefits of DC servo correction, but servo/signal interaction (and the sonic evils it brings) is eliminated.

3.1.5 Protection

If the amplifier is connected to damaging or misconnected loads, rail fuses protect the output devices. An output fuse protects loudspeakers from damaging voltages.

For specific circuit descriptions, refer to the included schematics and circuit descriptions.

4. SPECIFICATIONS

4.1 Tube Complement

(per channel, 2 channels in each amplifier)
1-6922/6DJ8, audio amplification. V1.
1-6CA4, rectifier, V2

4.2 Signal Polarity

("Absolute Phase")
RCA-type input does not invert signal polarity,
XLR input is polarized with Pin 1 as Ground (Earth),
Pin 2 as non-inverting input, Pin 3 as inverting input.

4.3 Electrical Specifications

All measurements made with the AC mains at nominal voltage
Output Power
(@120VAC mains, U.S. transformer, both channels driven).

NPS-200 (Stereo Mode):
100 W into 8 ohms,
200 W into 4 ohms,
350 W into 2 ohms.
load impedances below 2 ohms not recommended.

NPS-200 (Bridged Mode)
320 W into 8 ohms,
350 W into 4 ohms.
load impedances below 4 ohms not recommended when bridged.

NPS-400: (Stereo Mode)
200 W into 8 ohms,
400 W into 4 ohms,
700 W into 2 ohms,
700 W into 1 ohm,
load impedances below 1 ohm not recommended.

NPS-400: (Bridged Mode)
650 W into 8 ohms,
700 W into 4 ohms,
700 W into 2 ohms,
load impedances below 2 ohms not recommended when bridged.

Gain
voltage: 28.5dB.
current: 112dB (full-scale output rms current, ref. to input rms current)

Input Sensitivity.
Per IHF: 106mVrms/1W/8 ohms
To rated power: NPS-200: 1.00Vrms
NPS-400: 1.50Vrms

Input Impedance.
100k, 470pF, any input to ground.

Frequency Response (to -3dB point)
less than 10Hz to 50kHz

Signal-to-Noise.
90dB min., referenced to 1W, IHF-weighted.

Damping Factor (ref 8 ohm)
NPS-200: 44 @ 1kHz
NPS-400: 88 @ 1kHz

Output Impedance.
NPS-200: 0.18 ohms
NPS-400: 0.09 ohms

Maximum Output Current
NPS-200: 100 Amps peak-peak, (20/480mS pulse, 10V p-p/0.1 ohm load).
NPS-400: 200 Amps peak-peak, (20/480mS pulse, 20V p-p/0.1 ohm load).

DC Offset.
less than 10mV, servo-corrected.

Power Requirements.
NPS-200 and NPS-400: 160W @ 120VAC

Replacement Fuse Values. (All fuses are North American 1 ¼ " x ¼ ")
NPS-200:
Mains: 10-amp slow (100-120VAC)
6-amp slow (230VAC)
Speaker: 15-amp fast
Rails: 20-amp fast
NPS-400:
Mains: 20-amp slow (100-120VAC)
10-amp slow (230VAC)
Speaker: 15-amp fast
Rails: 20-amp fast

Dimensions.
NPS-200: 19 inches (480 cm) wide; 7.4 inches (190 cm) tall; 18 inches (460 cm) deep.
NPS-400: 19 inches (480 cm) wide; 7.4 inches (190 cm) tall; 18 inches (460 cm) deep.

Weight.
NPS-200: 41 lbs (19KG).
NPS-400: 56 lbs (26KG).

4.4 DETAILED CIRCUIT DESCRIPTION

4.4.1 Voltage amplifier

Refer to Schematic Detail Drawing, Audio Amplification and Voltage Regulation. V1, a dual triode, is operated as a differential amplifier. Transistor Q18 is a constant-current supply which is biased to pull 7mA through the differential amplifier. Transistor Q19 is cascoded above Q18; this buffers Q18 from signal voltages, assuring a constant current.
The first anode of V1 is loaded by R34, the value of which is selected to balance the voltage of the first anode with the second. The second anode is loaded by transistor constant-current source Q21 and cascode transistor Q20. This source supplies 3.5mA. Constant-current loading of a voltage amplifier linearizes the device's transfer function, resulting in lower distortion; however, this technique raises the output impedance of the amplifier considerably: the normal output impedance of the 6DJ8 triode when configured as a common-cathode amplifier is »5 000 ohm, but when loaded by a constant-current source the output impedance is closer to 50 000 ohm. For best performance, any following stages should not present a load less than 10 times the output impedance of a voltage amplifier. In the case of the NPS's voltage amplifier, the output stage should present more than 500 000 ohm input impedance.

4.4.2 Output stage

Refer to Schematic Detail Drawing, Output Stage. The input impedance of the output stage is 3 000 000 ohms. This presents a trivially easy load for the tube stage to drive, permitting the tube to operate as though it had no load at all, as well as allowing a very small coupling capacitor, C7, to couple signals to less than 10 Hz.

Transistors Q2 and Q1 comprise the pre-driver stage. They are operated Class-A with constant-current emitter loads, supplied by transistors Q15 and Q16 with an idle current of about 6.5mA. The voltage drop across resistors R14 and R10 establish the output stage's idling bias current. For voicing purposes, less than the entire current from Q15/Q16 is passed through Q1/Q2; a portion of it is diverted through the resistor inserted into position MJ5. See Adjusting the amplifier's "voice", in the INTERNAL ADJUSTMENTS section of this Service Manual.

The input pre-driver section of the output stage operates in the opposite sense compared to a standard output stage in that predriver transistor Q2, a PNP, controls the NPN portion of the output stage while predriver Q1, an NPN, controls the PNP portion. When the input signal swings positive in a standard output stage (where NPN's drive NPN's and PNP's drive PNP's) the NPN predriver must supply the current to turn on the output stage's NPN /drivers and final output devices; this requires current to flow into the base of the predriver from the input voltage gain stage, presenting increased loading as the output current increases. In the Natural Progression Stereo, a positive-going input signal shuts off transistor Q2, permitting its emitter to go positive, and the constant current supplied by Q15 swings the base of Q4 positive in proportion to how much Q2 has been shut off. There is no increase in predriver base current thus no loading on the tube voltage amplifier stage: the predrivers do not actually supply current to the output stage, the current is supplied by the current sources.

Driver transistors Q3 and Q4 are operated in Class-A mode, with about 45mA idle current. Transistors Q5-Q12 are the final output stage. They are rugged, fast Sanken devices with high current gain (hfe). All the transistors in the pre-driver, driver and final output stage have been selected for high hfe , reliability and sound quality. All the transistors in the final output stage have been hand-matched to assure equal current-sharing. The total idle current through the output stage is typically 300mA (NPS-200 and NPS-400).

Biasing. Refer to Schematic Detail Drawing, Output Stage Bias Core The purpose of a bias circuit is to prevent bipolar "thermal runaway", because bipolar transistors have a positive thermal coefficient: when they get warmer, they draw more current, which makes them warmer.....and so on. In the Natural Progression Stereo, transistor Q28 is mounted on the heatsink. As the heatsink warms up, the transistor's base-emitter voltage (Vbe) drops. The first section of dual op-amp IC2 is wired as a differential amplifier which measures the difference between Q22's Vbe and the P-N voltage drop across diode D16, which is mounted on the circuit board's underside in a free flow of air. (Using two P-N junctions (D16 and Q22) makes the circuit immune to line voltage variations.) When the heatsink becomes warm, the voltage across Q22 drops in relation to D16, causing the output of the first section of IC2 to drop.

In the first half of the bias circuit: Transistors Q25 and Q17 are wired as a voltage-controlled current source. When the voltage on Q25's emitter drops, the collector current of Q17 goes down proportionally. This reduction of current is reflected through transistor Q13 (see Schematic Detail Drawing, Output Stage.), which controls Q15's operating point, causing the idle current through Q15 to become smaller, reducing the voltage drop across R14, which then reduces the bias voltage supplied to driver Q4, reducing the overall bias of the final output stage.

In the other half of the bias circuit (Schematic Detail Drawing, Output Stage Bias Core), the second half of IC2 is configured as a simple inverting amplifier with a gain of unity, or 1. It reacts to the output of the first half of IC2, but reverses the signal polarity for the purpose of controlling the other half of the output stage. As the output of the first half section becomes more negative in voltage in response to a warming heatsink, the output of the second half goes proportionally more positive. Transistors Q26 and Q24 reflect the reduction of current to transistor Q14 (see Schematic Detail Drawing, Output Stage.), which controls the current of Q16, reducing its current. The voltage across R10 drops, reducing the driver and final output stage idle current.

Bias rheostat VR2 is used to set the desired operating bias point. As the resistance of this rheostat decreases, the current through Q17 and Q24 increases, biasing the output stage more strongly. In normal operation, the total idle current of the output stage is set to 300mA (75mA per final output transistor in the NPS400, 150mA per device in the NPS-200. Should the normal operation of this circuit be insufficient to control excessive temperature rise of the heatsink, or should a fault occur, a thermally-activated switch mounted on the heatsink will open, reducing bias current to zero.

DC Servo. Refer to Schematic Detail Drawing, Output Stage Bias Core. IC1 is configured as a non-inverting integrator, with time constants set by resistor R21 and capacitor C3. One input of the integrator is connected to the output stage through resistor R20, and the other is connected to ground through R21 (to cancel the input bias current-induced DC offset of IC1). If the output stage DC offset changes from zero volts, IC1 amplifies the difference voltage which is connected to the junction of resistors R45 and R17. This node is the inverting input to the output stage, so when the output stage's DC offset goes positive, the amplified error signal presented to this node causes a corrective action, forcing the output back to zero. The time constant of the integrator is 3 seconds. Resistor R20 and capacitor C2 prevent the integrator from "seeing" any audio, thus preventing the integrator from having to cope with and try to correct for high-amplitude audio signals. Diodes D2 and D3 prevent excess voltage from damaging IC1.

Input stage power supplies. Refer to Schematic Detail Drawing, Audio Amplification and Voltage Regulation. There are four power supplies required to operate the input stage: DC anode (B+) voltage, DC cathode (B-) voltage, DC audio tube heater voltage, and AC rectifier tube heater voltage.

Unregulated anode (B+) voltage is supplied by tube V2, a 6CA4 full-wave rectifier. Capacitor C22 filters the unregulated voltage; resistors R39 and R40 discharge C22 when power is turned off. High-voltage AC is present on the rectifier anodes at all times. When the NPS is in "Standby" mode, V2's heater filaments are unpowered and cold: no rectification can occur and there is no DC output voltage. When the NPS is placed into the "Operate" condition, 6 VAC is applied to V2's heaters and, after a few seconds, V2 begins to conduct current and rectify the high voltage AC to about +265 VDC. Operate and Standby functions are controlled by the front panel switch; refer to the description of the Muting circuit, below, for further details.

To prevent arcing between V2's cathode and heater, the AC heater supply is floated up to the cathode voltage by R41, resulting in a 6 VAC supply floated about 265 VDC above ground.

V2's unregulated +265 VDC output voltage is regulated down to about +245 VDC by emitter-follower transistor Q23. The output voltage is set by voltage divider resistors R42 and R43; because a voltage divider is used to establish the base voltage of Q23, the regulated voltage floats up and down with the unregulated voltage, but capacitor C23 filters all AC ripple voltage, while the time constant of C23 and R43 keeps any voltage fluctuations with a period shorter than 5s from affecting the regulated voltage.

Diodes D9, D11 and resistor R44 form a current-limiter circuit to protect Q23. When the current drawn by the load exceeds 50mA (a fault condition), the diodes conduct, discharging C23 and causing the output voltage of the regulator to fall. Back-bias diode D12 protects Q23 in the event that the unregulated voltage drops below the regulated voltage; D8 discharges C23 at the same time.

Unregulated cathode (B-) voltage is taken from the main output stage negative rail. The regulator circuit, comprised of Q22, C18, R11 and R38 operates exactly the same as the regulator circuitry in the anode regulator, while D4, D5, D6, D7 and R37 protect Q22 from over-current or reverse bias conditions. The precise voltage is different for the NPS-200 and NPS400 due to the different rail voltage supplies for these two amplifiers.

Heater voltage for audio tube V1 is supplied by full-wave bridge rectifier BR1, filter capacitor C15 and 6V regulator U2.

4.4.3 Main output stage power supplies

Rectification and filtration of the positive and negative output stage voltages is done on the centrally-located circuit board. The power supplies are dual-mono, with separate right and left channel rectifiers and filter/storage capacitors.

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4.4.4 Power transformer

The construction of the power transformer is dual-mono on all the secondaries. There is no electrical connection between the right and left channels. The transformer supplies AC voltage for the + and - rail supplies, audio tube heater supply, rectifier tube heater supply, and anode supply.

4.4.5 Input signal routing

Refer to Schematic Detail Drawing, Input Board Signal Routing and Control Functions The NPS amplifiers offer balanced and unbalanced input connections. Switch SW2 selects between balanced and unbalanced by grounding the XLR - input when unbalanced operation is desired. The RCA jack is connected to the XLR + input, so the RCA jack is the non-inverting input when the amplifier is in the stereo mode.

SW4 selects between stereo and bridged monaural mode. When SW4 is set to the bridged position, the left channel input becomes the main input to the amplifier. Input signals are routed to the left channel of the amplifier in normal (non-inverting) fashion; at the same time, the signal is also connected to the right channel of the amplifier in an inverted (out-of-phase) fashion. Since the two channels of the amplifier are now driven out-of-phase, a loudspeaker connected to the right and left channel speaker "+" terminals will be driven by both amplifiers in bridged fashion. To preserve absolute polarity ("phase"), the left channel "+" speaker terminal should be connected to the loudspeaker's "+" input (because it is the non-inverting half of the amplifier), while the loudspeaker's "-" input should be connected to the right channel's "+" speaker terminal, which has the out-of-phase signal.

Switches SW1 and SW3 mute the input signal, to prevent speaker (and eardrum) damaging noises when input cables or preamplifiers are being changed.

4.4.6 Muting circuit

Refer to Schematic Detail Drawing, Operate/Standby Control Functions. When the NPS ins in Standby mode, +6VDC, supplied from the Left Channel Audio Board, connects through relay K1 to light the front panel pilot lamp's Red section.

When the amplifier's front panel switch is changed to the Operate position, the +6VAC that powers the rectifier tube heaters is also closes K1. Diode D9 and capacitor C5 rectify and filter the AC voltage to power the relay coil. K1 removes the +6VDC from the Red lamp, and applies it to the Mute Timer circuit U1 and the lamp blinker circuit, U2. Caution: High Voltage! The coil circuit, D9, C5, and C3 is "floated" to 265 volts above ground.
U1 is configured as a monostable timer, with time constants set by R1 and C6. It takes ~90 seconds for this circuit to time out. During the period of time between setting the front panel switch to the Operate position and the time out of U1, the blinker circuit pulses the Red and Green sections of the front panel pilot lamp.

After U1 times out, the lamp changes to green, and the muting relays on the audio boards are powered, causing the amplifier to un-mute.

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5. SERVICE DATA

5.1 Internal Adjustments

5.1.1 Grounding Or Earthing Adjustments

Only the left channel of the NPS amplifier is connected to the amplifier's chassis ground; the right channel is "floated" from ground to avoid hum-inducing ground loops. In a normal system, both channels will receive their grounds from the source preamplifier. However, if the customer's system uses an unusual, completely dual-mono, arrangement all the way to the program source equipment (unlikely, absent a dual-mono CD player!), the right channel may develop a mild buzz or hum.

In this case, the right channel may be connected to the amplifier's chassis ground internally by setting a jumper. To do so:

- Disconnect the amplifier from the AC mains.
- Remove the top cover.
- On the rear circuit board, locate jumper block 1, JB1, located at the right side of the circuit board.
- Move this jumper from "FLOAT" to "GND" and replace the top cover.

The shells, or bodies, of the balanced XLR input jacks are not connected to the amplifier ground because pin 1 of a balanced line is commonly the ground or earth connection, while the cable shield (which is sometimes connected to the connector's shell) should be connected at one end only. (Either at the source preamp or at the power amp; not both.) If the cable is built with an internal connection between the ground wire and the shield there will be no problem. If, however, there is no such connection in the cable, and the customer's source preamp does not make a connection to the cable shield, it is advisable to ground the shield somewhere in the system.

The XLR connector shells can be grounded by changing two internal jumpers in the NPS amplifier:

- Disconnect the amplifier from the AC mains.
- Remove the top cover.
- On the rear circuit board, locate Jumper Blocks JB4 and JB5, located next to the XLR connectors.
- Move both jumpers from "FLOAT" to "GND" and replace the top cover.

5.2 BIASING THE OUTPUT STAGE

This procedure should be performed whenever any output, pre-driver, or driver transistors are replaced or when the "voicing" has been altered.

Disconnect the amplifier from the AC mains and wait 1 minute for the internal voltages to drop to zero.

Remove one of the rail fuses and connect an ammeter across the fuse terminals. Alternately, you may install a 1-ohm resistor soldered in parallel with a opened (broken) fuse and install this into the fuse terminals--in this case, connect a DC voltmeter across the resistor and note that each millivolt measured represents a milliamp of current flowing.

Connect the amplifier to an autotransformer (Variac) and increase the AC mains to nominal voltage. The output stage current may increase to a large value with low AC mains voltage, but will drop back to a lower level. Verify that less than 10mvdc appears across the output terminals of each channel when full mains voltage has been applied and the amplifier has settled for a few seconds.

Use BIAS trimmer VR2 to set the output stage bias current to nominal value:
NPS-200: Target bias value is 300mA (300mV across a 1-ohm resistor).
NPS-400: Target bias value is 300mA (300mV across a 1-ohm resistor)

The bias current will move slowly above and below the target value due to the thermal delay of the heatsink. A ± 15mA change is normal.

- Check the currents of all output transistors. To do this, connect the a DVM's ground lead to the amplifier's output.
- Measure the bias currents of each of the output devices to ensure that all devices are sharing the total current reasonably equally. There are test points on the board, next to the emitter of each device.

The NPS-200 has 4 output transistors per channel; test at "eQ5", "eQ7", "eQ6", and "eQ8".
The NPS-400 has 8; test at "eQ5", eQ7", "eQ9", and "Q11", "eQ6", eQ8", "eQ10", and "eQ12".

Note that half of the readings will be positive and half will be negative!

All readings should be within approximately 20%, i.e., the difference between the highest & lowest voltage reading should be less than 20% above the lowest reading. Differences much greater than this may indicate badly matched output devices or damaged emitter resistors.

- Reduce the Variac to 0V.
- Discharge rails with a suitable load resistor (15Ohm, 10W).

Check Output Stage Balance:

- Measure the DC voltage across resistor R14; it should be between .5 and .7 VDC.
- Measure the DC voltage across resistor R10; it should be between .5 and .7 VDC.

The output stage must be balanced so that the voltages across R10 and R14 are equal.

If "O/S BAL SELECT" Jumper Block JB2 is set to the "+" position, adjust trimmer VR1 "+ O/S BALANCE" to try to match the voltages across R10 and R14.

If you cannot match the voltages with trimmer VR1, change "O/S BAL SELECT" Jumper Block JB2 to the "-" position and use trimmer VR3 "- O/S BALANCE" to match the voltages across R10 and R14.

NOTE: Adjusting the output stage balance will also change the output stage bias current to a small degree, so you may need to compensate with the BIAS trimmer.
Adjust the output stage balance so that the voltages across R10 and R14 are matched to within 20mVDC.

5.2.1 ADJUSTING THE AMPLIFIER'S "VOICE"

In the days of the great chapel and cathedral organ builders, the builder made careful adjustments to the organ voicing to match the acoustic of the space after the organ was installed. Should Counterpoint ship an amplifier with one voice and claim that it is neutral and perfect for every system? This is not only inflexible, arrogant and short-sighted, it is pure nonsense!

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Every system is different, every acoustic is different. I know what sounds good in my system, and for most systems the Factory Standard setting will offer a pleasing sound. But if you use the following voicing information carefully, you can satisfy customers with a broad range of systems.

Before production began, the prototype Natural Progression Stereo amplifier was listened to in over 15 systems and adjusted to have an extremely neutral-sounding voice. However, in systems with dull or soft-sounding speakers or cables the amplifier can be adjusted to emphasize the high-frequency treble region...this also works with speakers using massless ion tweeters, which are not slow, but more capable of handling the extremely high "speed" of the signal without resonating. Conversely, the amplifier's treble region can be softened to provide a "warmer" sound for systems with bright speakers (with tweeters easily driven into resonance or bad behavior) or bright-sounding cables.

Please note that changing the input stage bias current does not change the frequency response in any way.

Because the amplifier's voice makes small changes to the amplifier output stage bias and pre-drive stage balance, it is recommended that this procedure be done by you, a technician you trust, or a dealer with above-average skill with electronics. It requires an autotransformer ("Variac"), and three digital voltmeters. It requires adult supervision. There is soldering involved.

The current through pre-driver stage transistors Q1 and Q2 is critical to the amplifier's voice: less current will emphasize the treble; more current will soften it. There are socketed resistors on the Audio boards to adjust the input stage current. By changing these resistors, the input stage current can be controlled.

Early NPS-200's and 400's were voiced different from later production. Amplifiers shipped before February 1995 were voiced somewhat brighter than subsequent units.
NPS-200 amplifiers with serial numbers of 3NPS200 or smaller used the older voicing except for 2NPS273, 2NPS274, 2NPS275, 2NPS279, 2NPS281, 2NPS283, 2NPS286, 2NPS296, 2NPS297, 2NPS298 and2NPS299. The older voicing used voicing resistors in positions MJ3 and MJ4 of 374 ohms, and 1.24k ohms in position MJ5.

NPS-400 amplifiers with serial numbers of 2NPS400 or lower and 2NPS401, 2NPS403-412 and 2NPS414-417 used the older voicing. The older voicing used voicing resistors in positions MJ3 and MJ4 of 348 ohms, and 976 ohms in position MJ5.
If neither the old voicing nor the new is correct for your customer, you may change the voice by installing different values. First determine if the treble needs to be emphasized or reduced. Below is the suggested range for the resistors you will need to make the adjustment. These resistors can be metal-film 1%, 1/4W or 1/2W size, but small flame-proof types are preferred.

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DESIRED SOUND	Q1, Q2 INPUT STAGE BIAS	MJ3, MJ4 (ohms)	MJ5 (ohms)
Maximum Treble	2.7mA	1100	665
Moderate Treble	3.2mA	549	787
Slight Treble Boost	3.8mA	348	976
Neutral (New Factory Standard)	**4.0mA**	**301**	**1100**
Softer Treble	4.2mA	274	1180
Very Soft Treble	4.6mA	232	1470
Minimum Treble	5.0mA	196	2050

Table 5-1 Voice Values

For voicing between these values, simply interpolate.

- Disconnect the NPS 200 or 400 from the AC mains and remove the top cover.

Work on one channel at a time. Remove the three voicing resistors soldered to positions MJ3, MJ4 and MJ5 from the right channel and install the desired values as determined from the NPS-200/400 table above.

- Connect the three digital voltmeters:

Voltmeter Number 1 is for measuring the Output Stage Bias. Remove one of the rail fuses and connect an ammeter across the fuse terminals. (Alternately, you may install a 1-ohm resistor soldered in parallel with a opened (broken) fuse and install this into the fuse terminals--in this case, connect a DC voltmeter across the resistor.)

Voltmeter Number Two is for measuring 1/2 of the Pre-driver Stage's Bias. Connect it across resistor R10.

Voltmeter Number Three is for measuring the other half of the Pre-driver Stage's Bias. Connect it across resistor R14.

- Connect the NPS amplifier to an autotransformer ("Variac") and set the autotransformer to 0 VAC.
- Adjust the autotransformer (Variac) to nominal AC mains voltage.

The Output Stage current may increase to a large value with low AC mains voltage, but will drop back to a lower level.

- Use BIAS trimmer VR2 to set the output stage bias current to nominal value:

Target bias value is 300mA (300mV across a 1-ohm resistor).

Adjust Output Stage Balance:

- Observe the DC voltage across resistor R10; it should be between .5 and .7 VDC.
- Observe the DC voltage across resistor R14; it should be between .5 and .7 VDC.

The output stage must be balanced so that the voltages across R10 and R14 are matched (equal).
If "O/S BAL SELECT" Jumper Block JB2 is set to the "+" (rear) position, adjust trimmer VR1 "+ O/S BALANCE" to match the voltages across R10 and R14.
If "O/S BAL SELECT" Jumper Block JB2 is set to the "--" (front) position, adjust trimmer VR2 "- O/S BALANCE" to match the voltages across R10 and R14.
If you cannot match the voltages with trimmer VR1, change "O/S BAL SELECT" Jumper Block JB2 to the other position and use the other "OS" trimmer to match the voltages across R10 and R14.
NOTE: Adjusting the output stage balance will also change the output stage bias current to a small degree, so you may need to compensate with the BIAS trimmer.

Adjust the output stage balance so that the voltages across R10 and R14 are matched to within 10mVDC.

Allow the heatsink to warm up fully and make adjustments to the bias trimmer as required to keep the output stage bias at 300mA.

Repeat this procedure for the left channel.

5.3 REPAIR PROCEDURES

All the components in the Natural Progression Stereo amplifiers are of the highest quality and should have long, trouble-free lives since they are operated well below their manufacturer's rating. The following procedure may facilitate locating the source of trouble if the Natural Progression Stereo does not function properly..

The likeliest sources of failure are the solid-state components since they are inherently more fragile and susceptible to failure in the high-voltage/high temperature environment of the Natural Progression Stereo. Another common problem is failure of an electron tube since these devices have a shorter life than the passive parts. Check first to see if all the tubes are inserted securely in the sockets. Check also to see if the tubes are located in the proper sockets, and that they are the correct RETMA type as specified in the Specifications Section of this manual.

Fuses. There are seven fuses in the Natural Progression Stereo: the AC mains fuse is located on the rear apron of the amplifier. Two "rail" fuses for each the output stage are located on the side audio pcb's; and there is one speaker fuse per channel located next to the speaker terminals on the amplifier's rear panel. For replacement values, refer to the "Specifications" section of this manual.

Visual inspection of power supply operation. Visual inspection can be used to check operation of the tube filaments: with the exception of the 6CA4 rectifier tubes, tube heaters should light whenever the Natural Progression Stereo is connected to AC mains. Changing the front panel switch to the "Operate" position should cause the 6CA4 rectifier tubes to light.

5.3.1 Check DC Operating Voltages

Each schematic diagram shows nominal DC operating voltages at selected test points in the in the Natural Progression Stereo. Careful use of the schematic diagrams and circuit board layouts permit troubleshooting the Natural Progression Stereo circuitry. If a test point's voltage differs significantly from the correct voltage, all of the components, wiring, and voltage and resistance to ground readings associated with that circuitry and the circuitry preceding the test point should be made.

Always refer to the Notes section of the specific DC Operating Voltage drawings for information on measurement techniques.

Please note that anode voltages in the audio circuit are dependent upon individual tubes and should be used only as a rough guide, due to variations in different brands of electron tubes.

5.3.2 Check AC Signal Levels

Normal signal tracing techniques can be used to localize a problem in the audio circuit. If a test point's signal level differs significantly from the expected voltage, all of the components wiring and voltage and resistance readings to ground associated with that circuitry and the circuitry preceding the test point should be made.

5.3.3 Totally Dead Natural Progression Stereo

A cartridge fuse, located on the rear panel of the product, is used in the primary circuit of the power transformer to protect the power supply components from short circuits. The rating of this fuse was selected for proper protection of the Natural Progression Stereo and should be replaced with the same type and rating.

If a failure is detected the following procedure is recommended before replacing the fuse:

(a) Check for proper connection of power transformer primaries for your AC mains voltage. Refer to Transformer Wiring for more information.

(b) Check for a failed power transformer:

Check dc resistances according to the following table:.

Product	115 VAC operation	230 VAC operation
NPS-200	0.35 ohms	1.5 ohms
NPS-400	0.25 ohms	1 ohm

This is also an easy way to determine (without opening) if an amplifier has been wired for 115 VAC or 230 AC; measure from the AC input terminals on the rear panel. Allow a small additional amount of resistance for the fuse.

Disconnect all connections to transformer secondary windings and recheck primary current (the tendency to blow fuses). If the transformer still draws too much current with all secondaries disconnected, it has failed and must be replaced.

(c) If the transformer has not failed, re-connect the secondaries one at a time until the problem occurs. Use trouble-shooting techniques to determine the failed components responsible for the excess current.

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6. SCHEMATICS

Output stage
Output stage bias core detail
Input stage and regulator
Input board signal routing and control functions
Operate/Standby control functions

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7. PC BOARD LAYOUTS

INPUT BOARD

RIGHT AUDIO OUTPUT BOARD

LEFT AUDIO OUTPUT BOARD

8. CUSTOMER FEEDBACK

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Please list errors by section/page number. Include a marked-up copy of the page.
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Suggestions for improvement:____
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Address____
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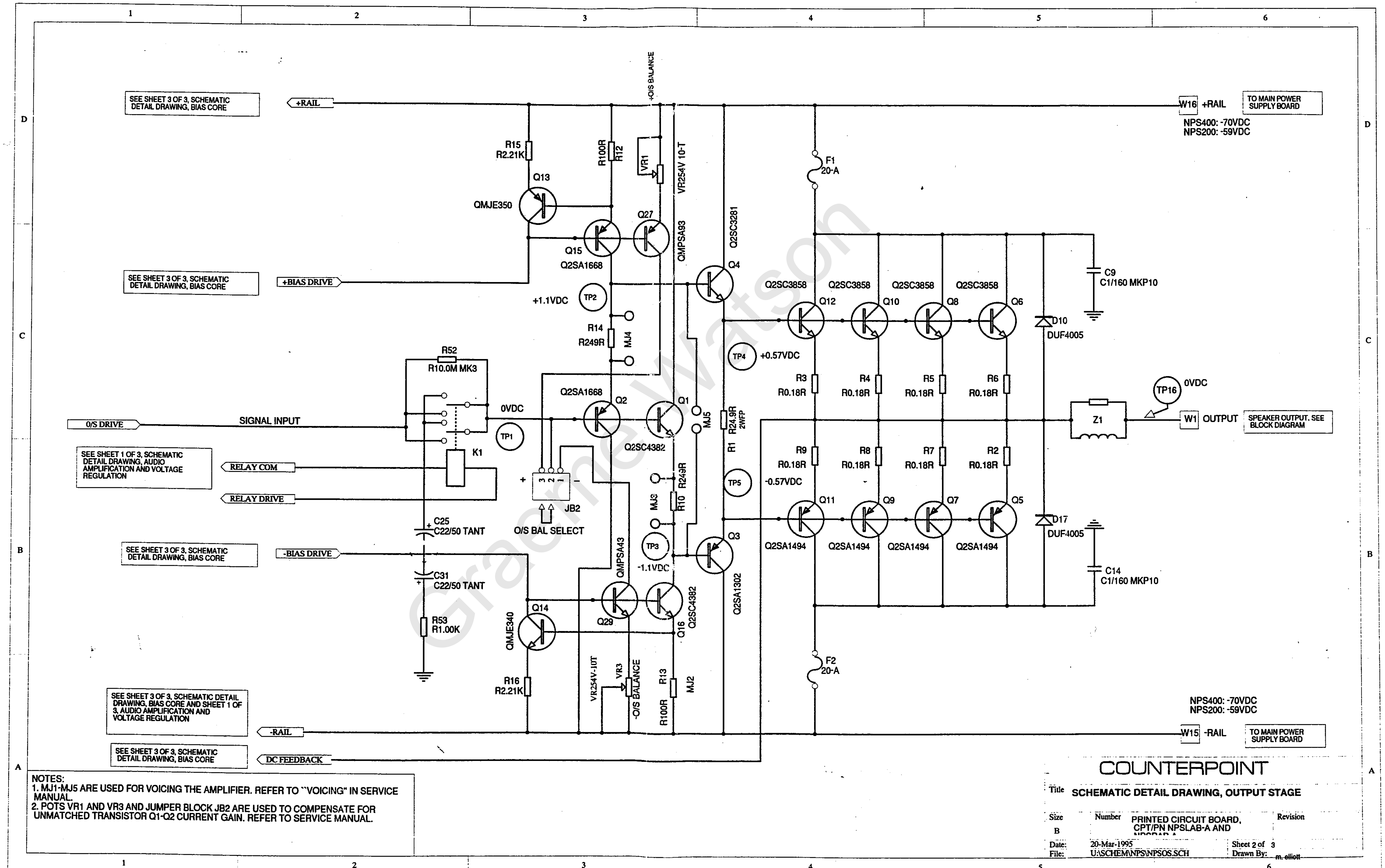
9. REVISIONS

DATE	FROM	TO	CHANGES
4/7/95	A	B	200 - Rail fuses changed from 10a to 20a 400 - Rail fuses changed from 15a to 20a


SEE SHEET 3 OF 3, SCHEMATIC DETAIL DRAWING, BIAS CORE
+RAIL
+O/S BALANCE
W16 +RAIL
TO MAIN POWER SUPPLY BOARD
NPS400: -70VDC
NPS200: -59VDC
R15 R2.21K
Q13
QMJE350
R100R R12
VR1
VR254V 10-T
F1 20-A
Q27
Q15
Q2SA1668
QMPSA93
Q2SC3281
+BIAS DRIVE
Q4
C9 C1/160 MKP10
Q2SC3858
Q12
Q10
Q8
Q6
+1.1VDC
TP2
D10 DUF4005
R14 R249R
MJ4
R52 R10.0M MK3
TP4 +0.57VDC
R3 R0.18R
R4 R0.18R
R5 R0.18R
R6 R0.18R
TP16 0VDC
0VDC
Q2
Q1
O/S DRIVE
SIGNAL INPUT
TP1
MJ5
R24.9R 2WFP
R1
Z1
W1 OUTPUT
SPEAKER OUTPUT, SEE BLOCK DIAGRAM
Q2SC4382
K1
SEE SHEET 1 OF 3, SCHEMATIC DETAIL DRAWING, AUDIO AMPLIFICATION AND VOLTAGE REGULATION
RELAY COM
RELAY DRIVE
R9 R0.18R
R8 R0.18R
R7 R0.18R
R2 R0.18R
-0.57VDC
TP5
R249R R10
MJ3
JB2
Q11
Q9
Q7
Q5
C25 C22/50 TANT
O/S BAL SELECT
D17 DUF4005
-BIAS DRIVE
TP3
-1.1VDC
Q3
Q2SA1494
C31 C22/50 TANT
QMPSA43
Q2SA1302
C14 C1/160 MKP10
Q14
Q29
Q16 Q2SC4382
R53 R1.00K
QMJE340
F2 20-A
R16 R2.21K
VR254V-10T
VR3
-O/S BALANCE
R100R R13
MJ2
SEE SHEET 3 OF 3, SCHEMATIC DETAIL DRAWING, BIAS CORE AND SHEET 1 OF 3, AUDIO AMPLIFICATION AND VOLTAGE REGULATION
-RAIL
W15 -RAIL
SEE SHEET 3 OF 3, SCHEMATIC DETAIL DRAWING, BIAS CORE
DC FEEDBACK
NOTES:
1. MJ1-MJ5 ARE USED FOR VOICING THE AMPLIFIER. REFER TO "VOICING" IN SERVICE MANUAL.
2. POTS VR1 AND VR3 AND JUMPER BLOCK JB2 ARE USED TO COMPENSATE FOR UNMATCHED TRANSISTOR Q1-Q2 CURRENT GAIN. REFER TO SERVICE MANUAL.
COUNTERPOINT
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Size B
Number PRINTED CIRCUIT BOARD, CPT/PN NPSLAB-A AND
Revision
Date: 20-Mar-1995
Sheet 2 of 3
File: U:\SCHEM\NPS\NPSOS.SCH
Drawn By: m. elliott

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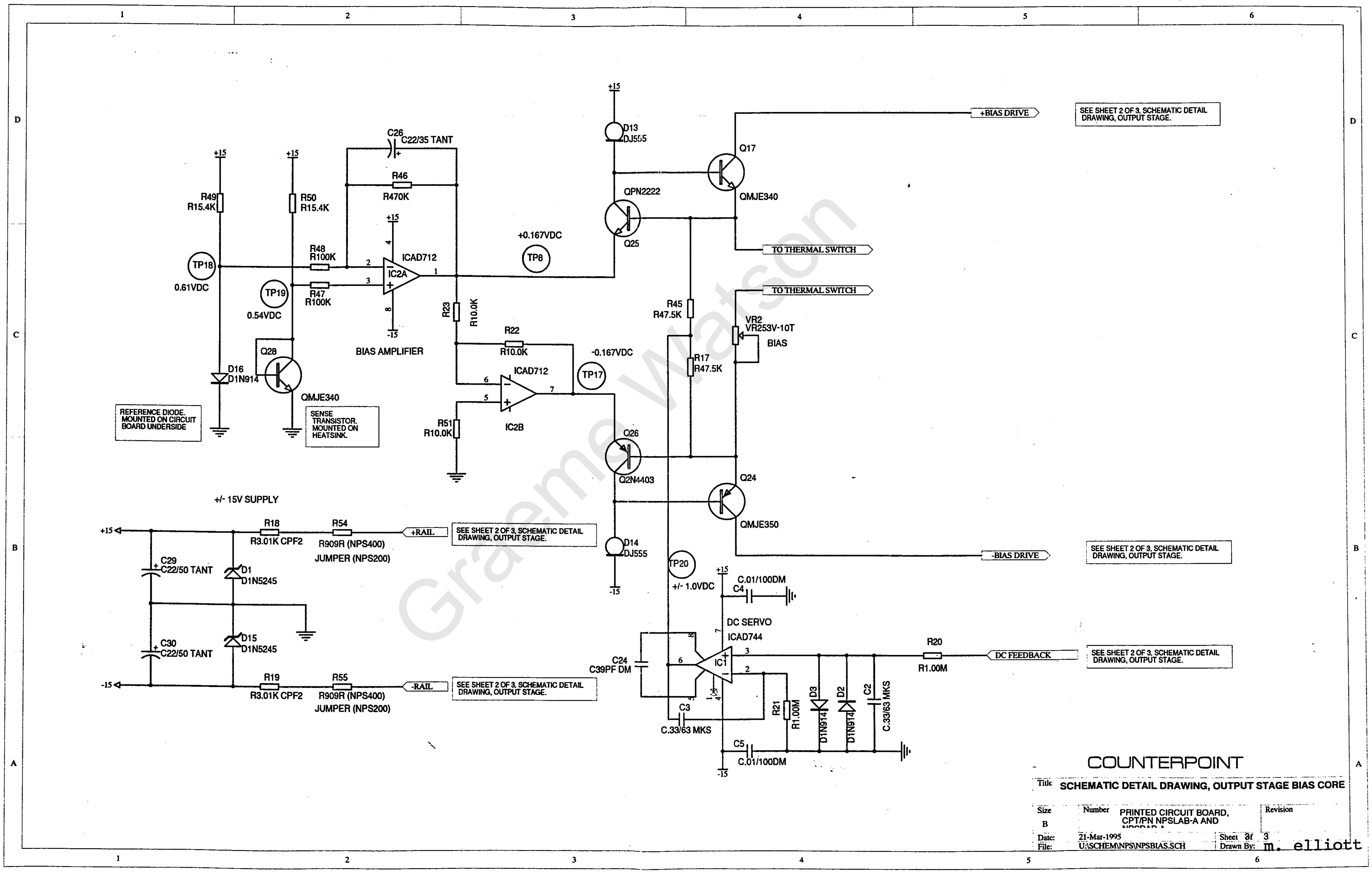

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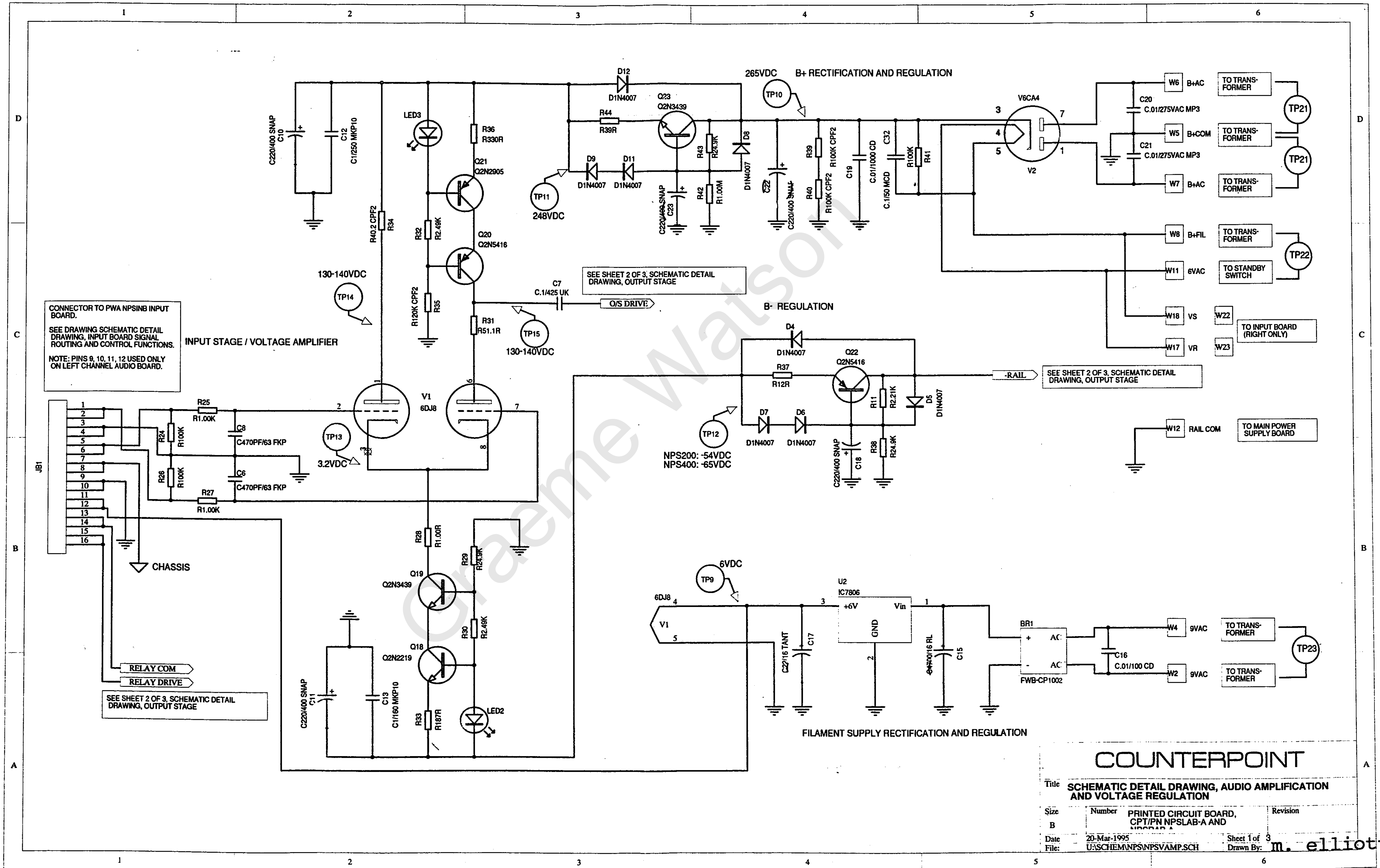

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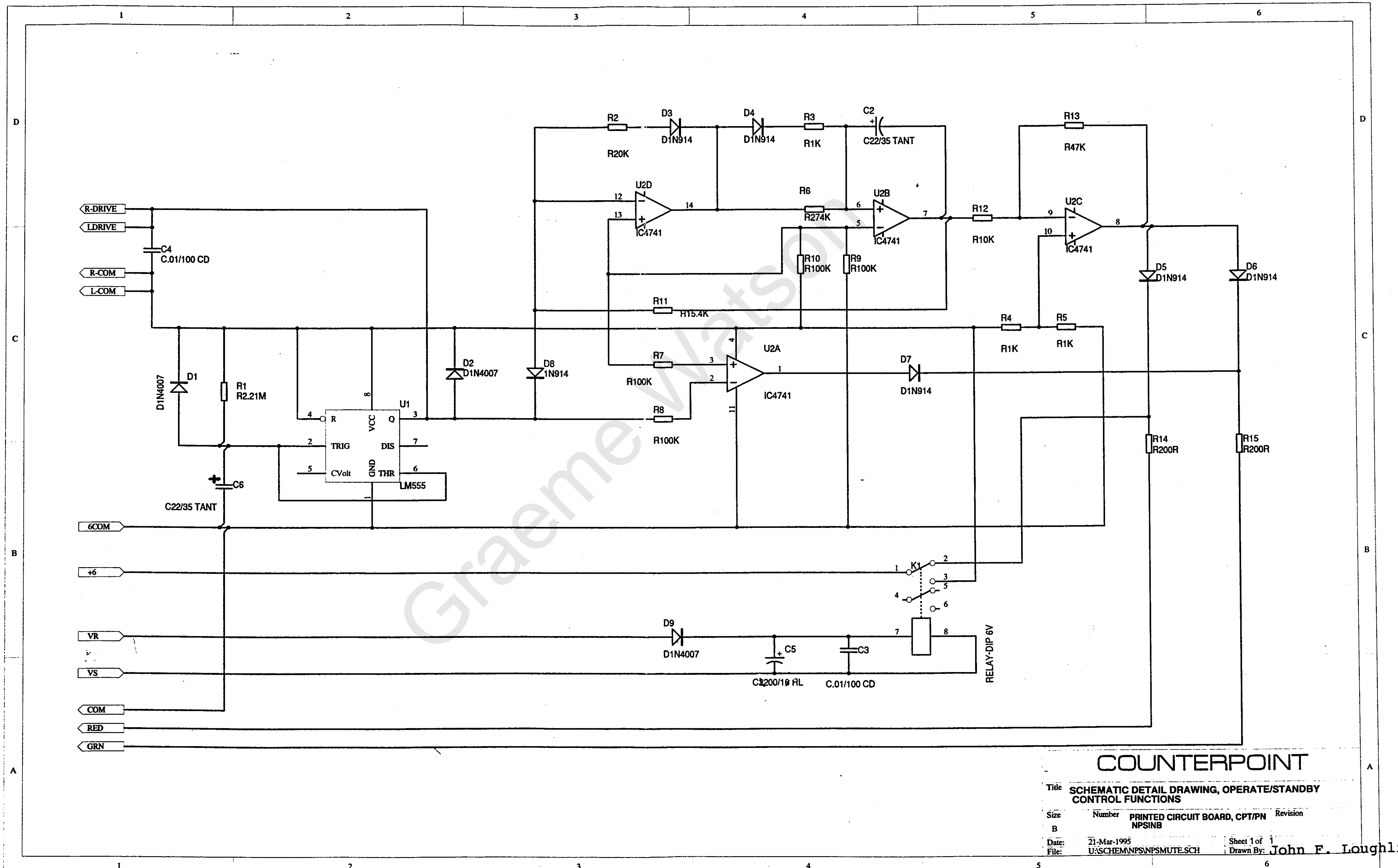

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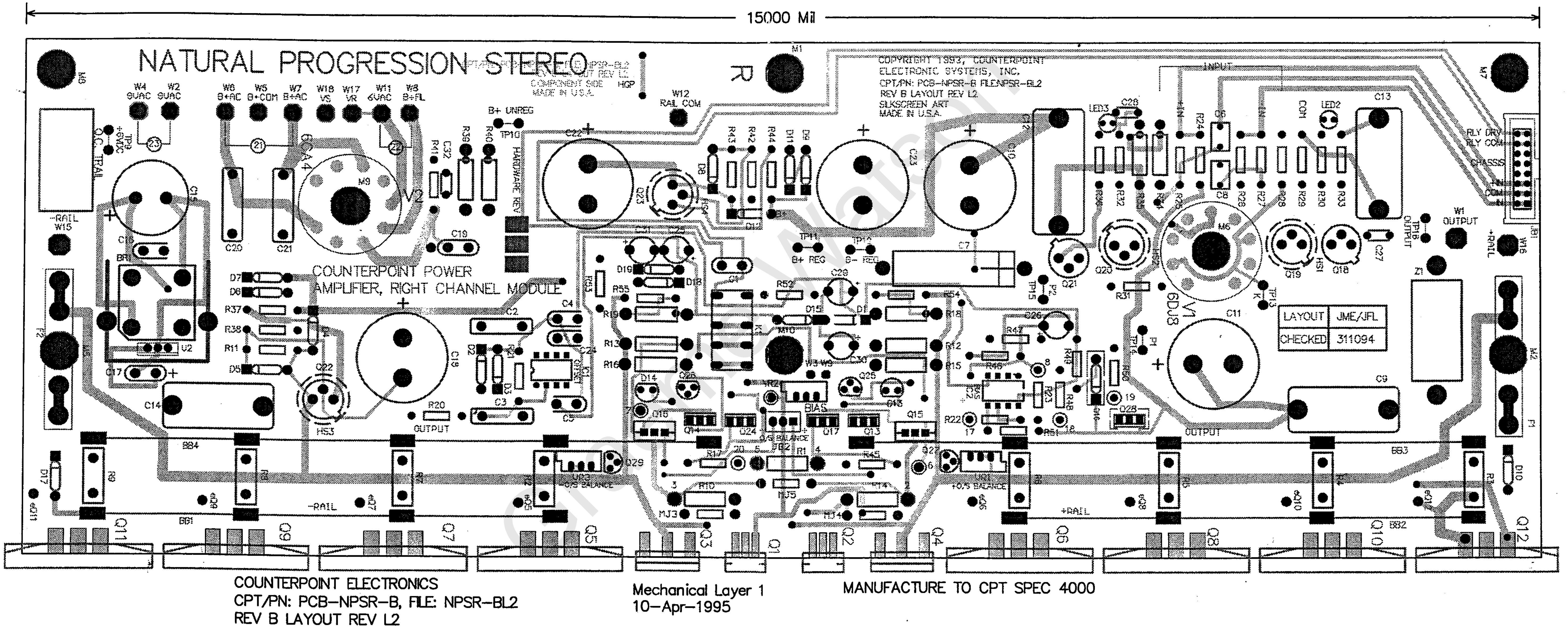

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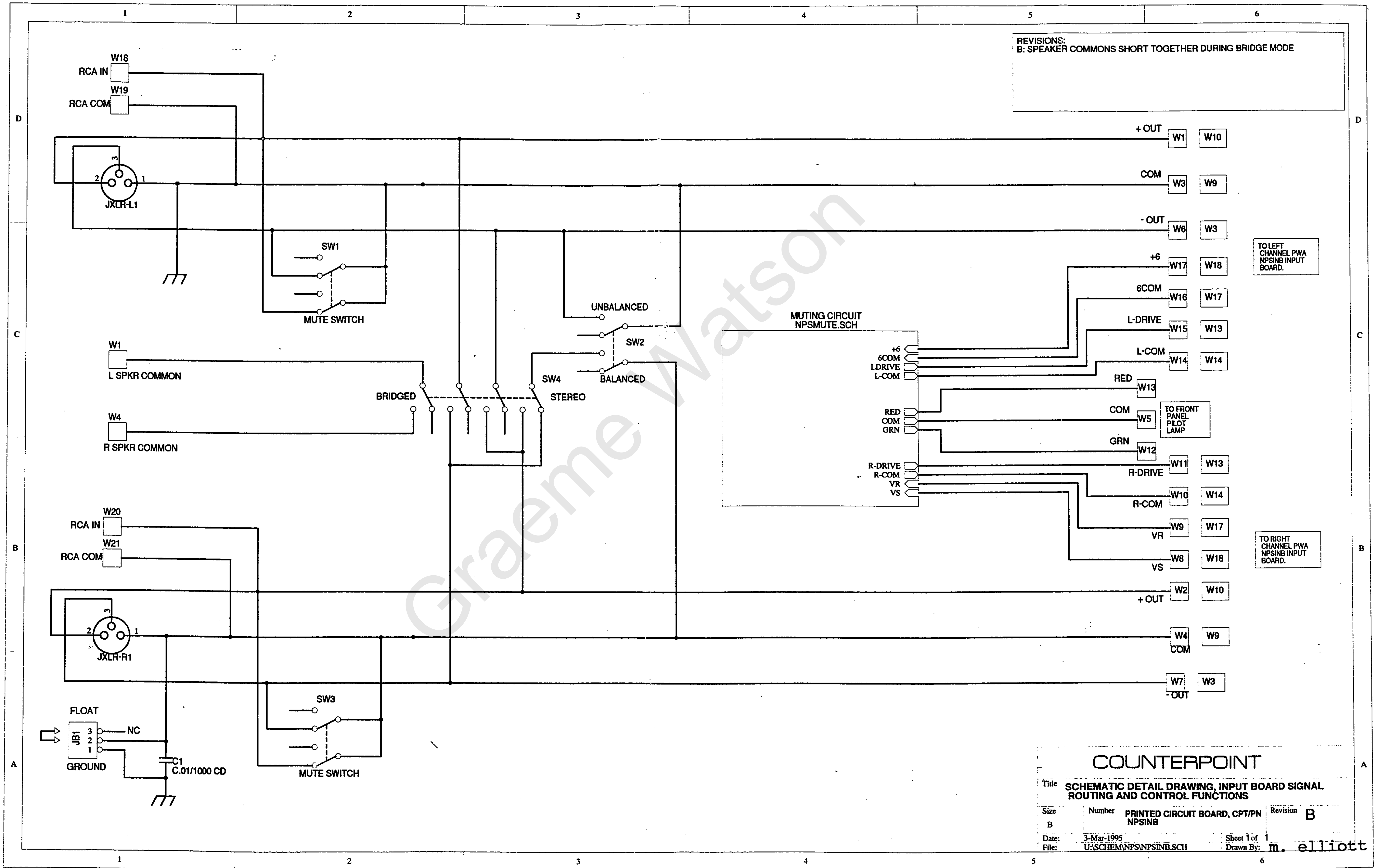
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W19
RCA COM
JXLR-L1
SW1
MUTE SWITCH
W1
L SPKR COMMON
W4
R SPKR COMMON
BRIDGED
SW4
STEREO
UNBALANCED
SW2
BALANCED
MUTING CIRCUIT
NPSMUTE.SCH
+6
6COM
LDRIVE
L-COM
RED
COM
GRN
R-DRIVE
R-COM
VR
VS
+ OUT
COM
- OUT
6COM
L-DRIVE
L-COM
R-DRIVE
R-COM
W1
W10
W3
W9
W6
W17
W18
W16
W15
W13
W14
W5
W12
W11
W2
W4
W7
W8
TO LEFT CHANNEL PWA NPSINB INPUT BOARD.
TO FRONT PANEL PILOT LAMP
TO RIGHT CHANNEL PWA NPSINB INPUT BOARD.
W20
RCA IN
W21
RCA COM
JXLR-R1
SW3
MUTE SWITCH
FLOAT
JB1
NC
GROUND
C1
C.01/1000 CD
COUNTERPOINT
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Size B
Number PRINTED CIRCUIT BOARD, CPT/PN NPSINB
Revision B
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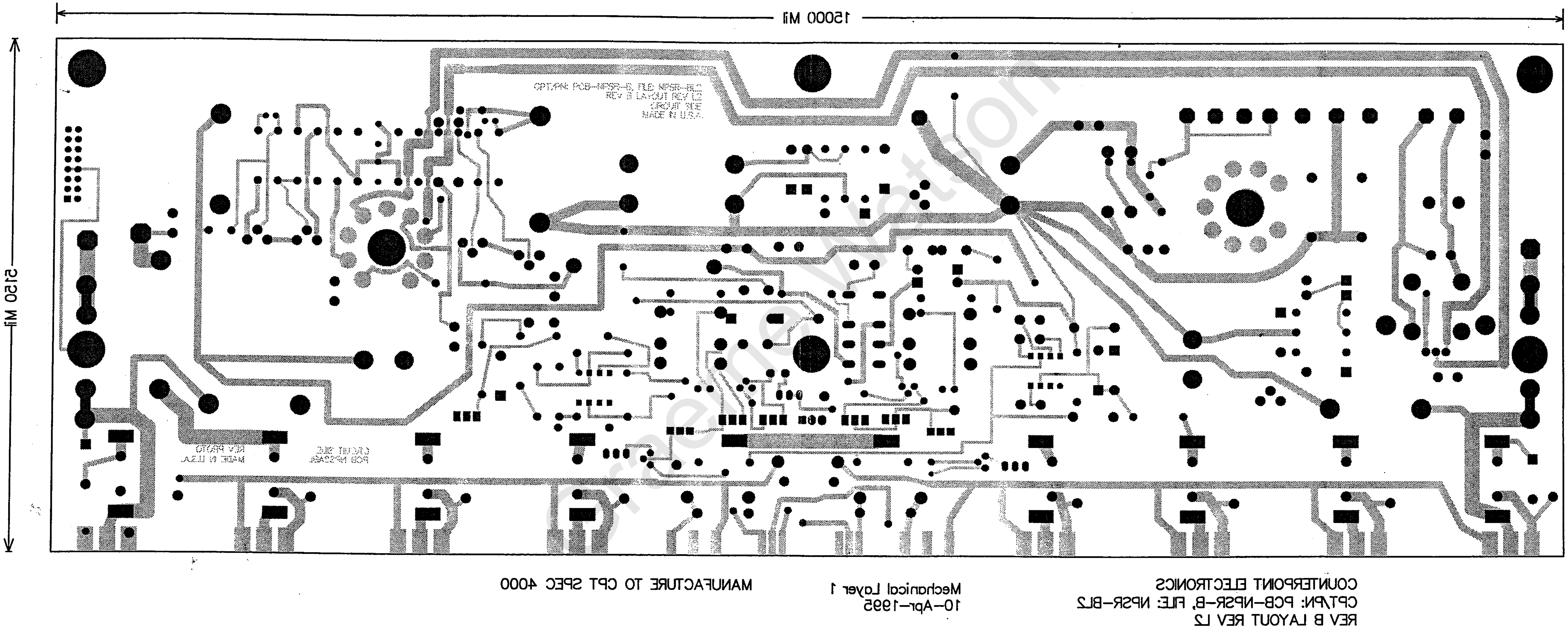
Drawn By: m. elliott



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Mechanical Layer 1
10-Apr-1995
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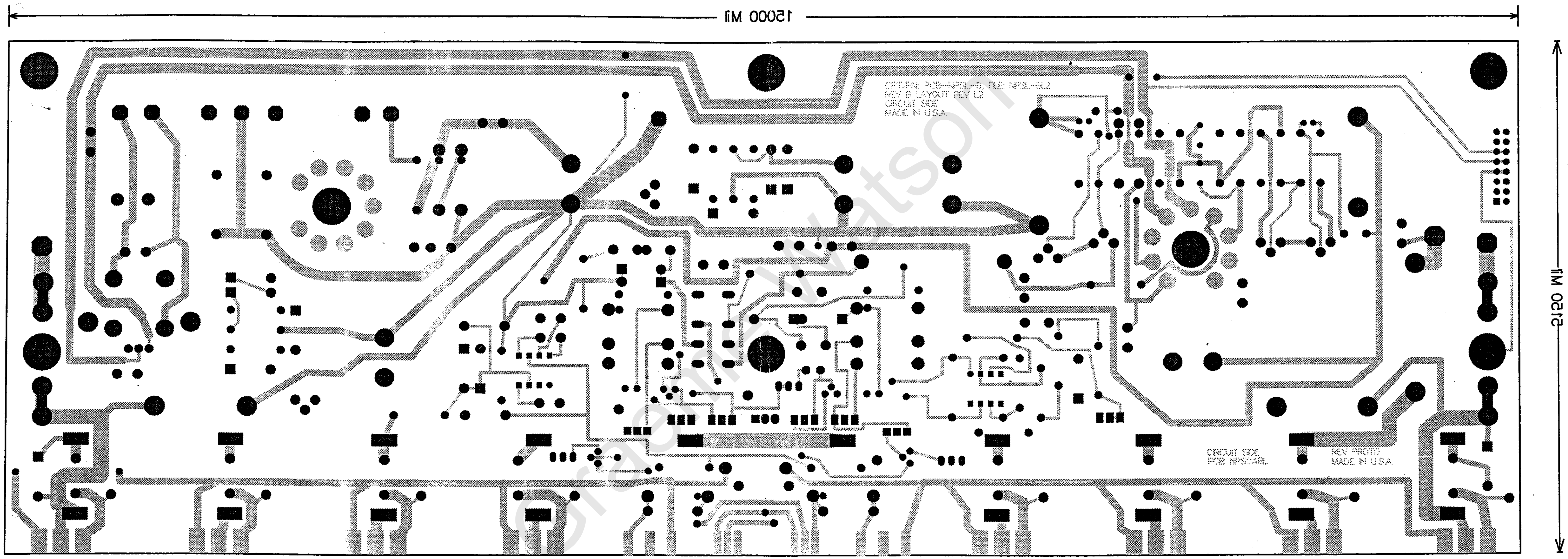

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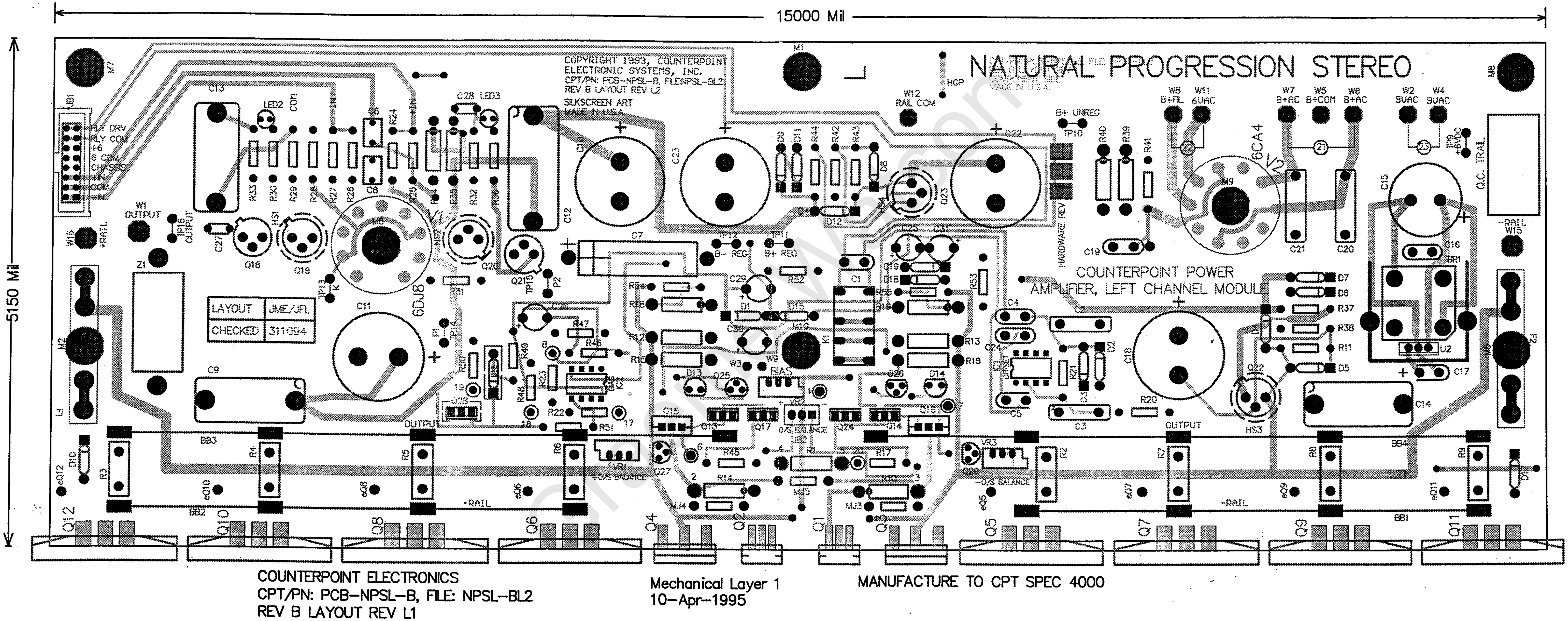

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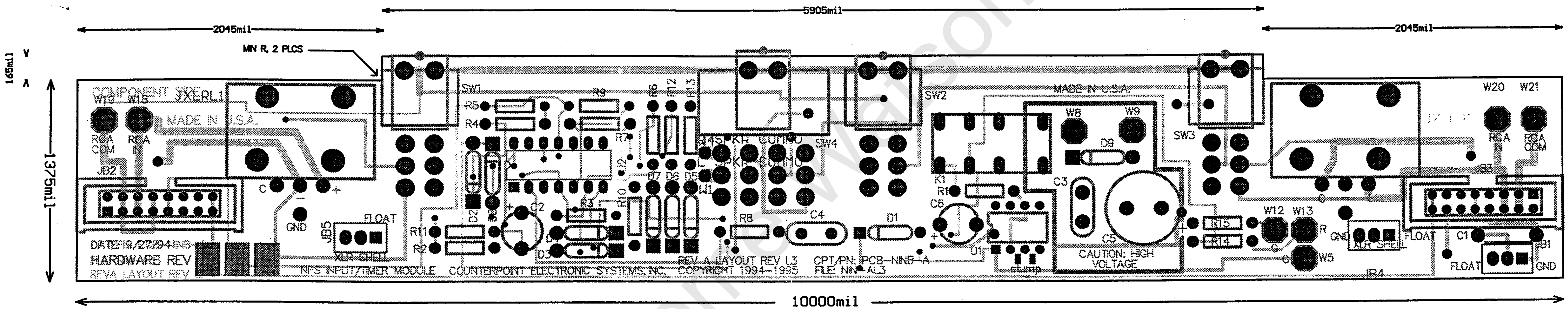

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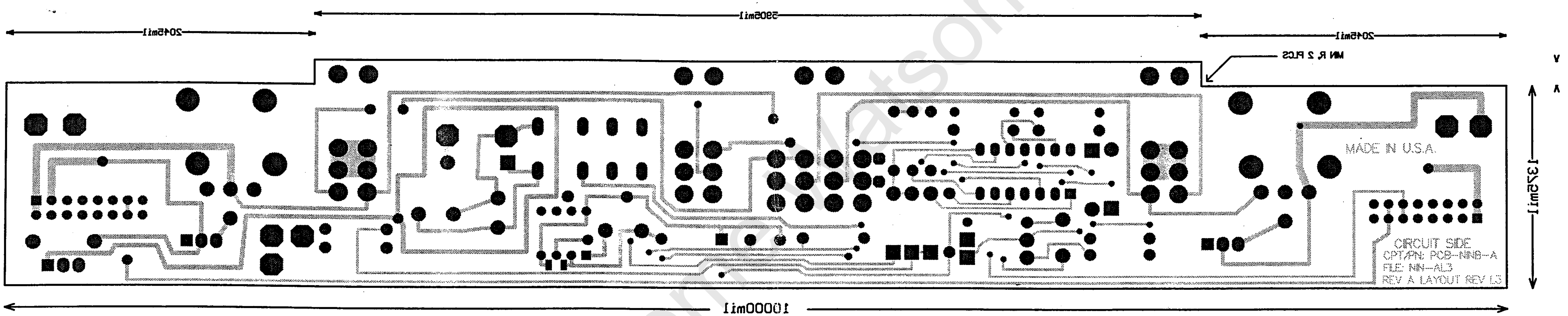

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