Technical Service Manual

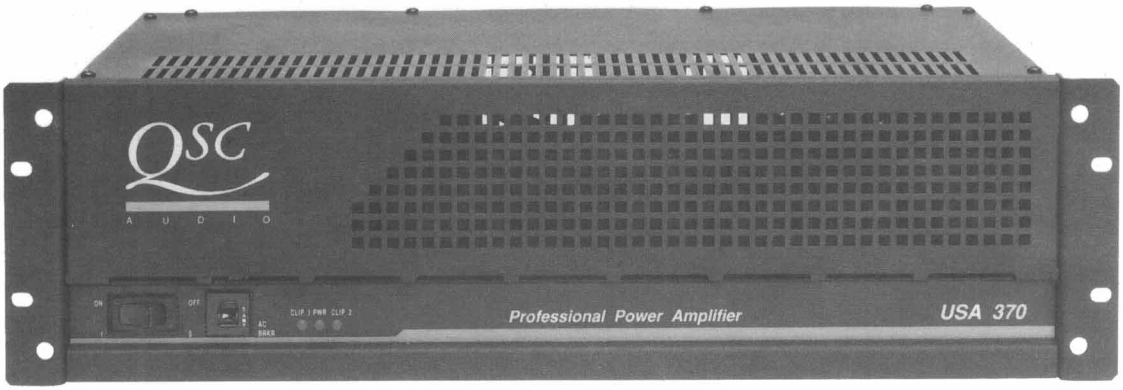
USA Series

- USA 370
- USA 850
- USA 1300

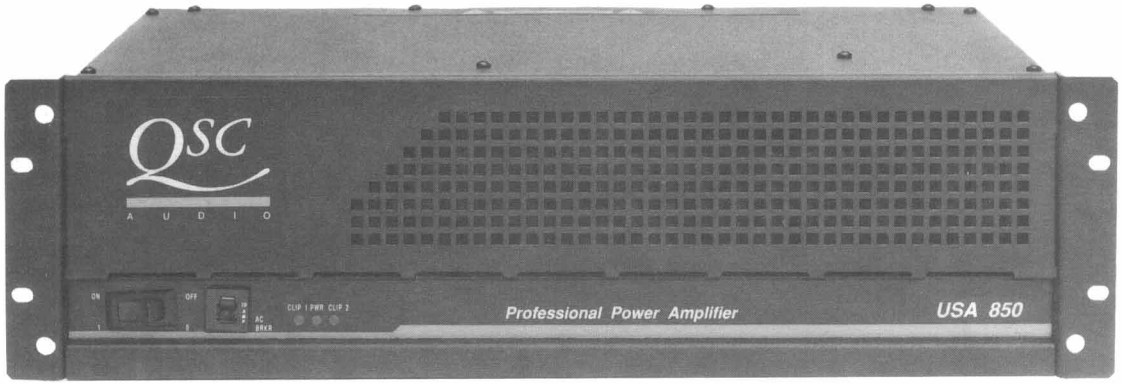
QSC®
AUDIO

TD-000037-00
Rev. A

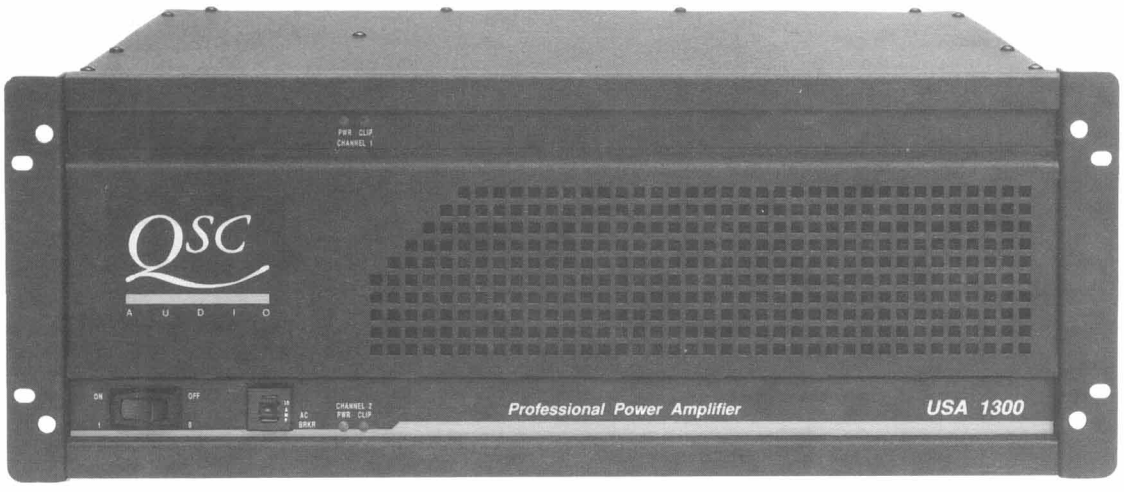
▲ USA 370



▲ USA 850



▲ USA 1300



USA SERIES AMPLIFIER SERVICE MANUAL

USA 370
USA 850
USA 1300

QSC CUSTOMER SERVICE
1-800-QSC AUDIO
(800-772-2834)

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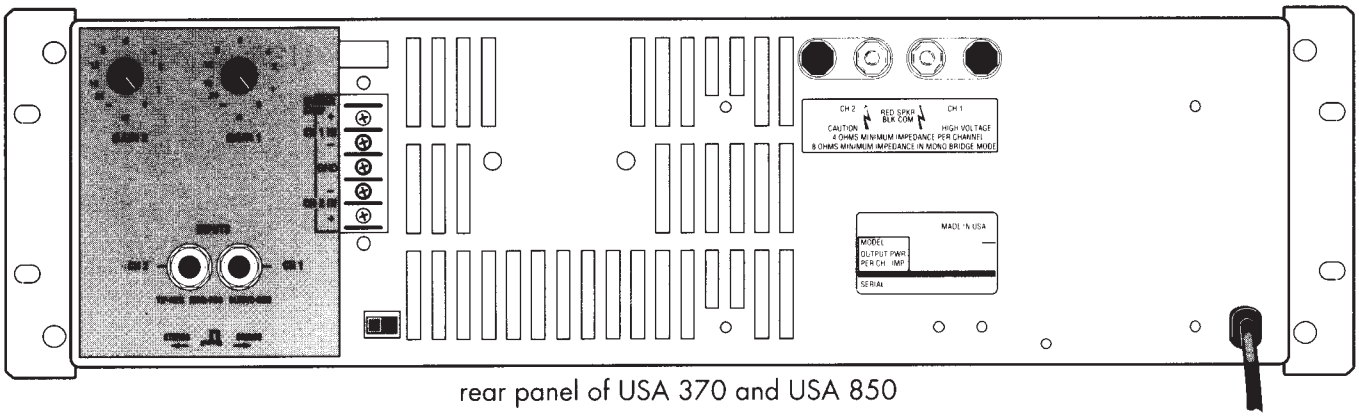
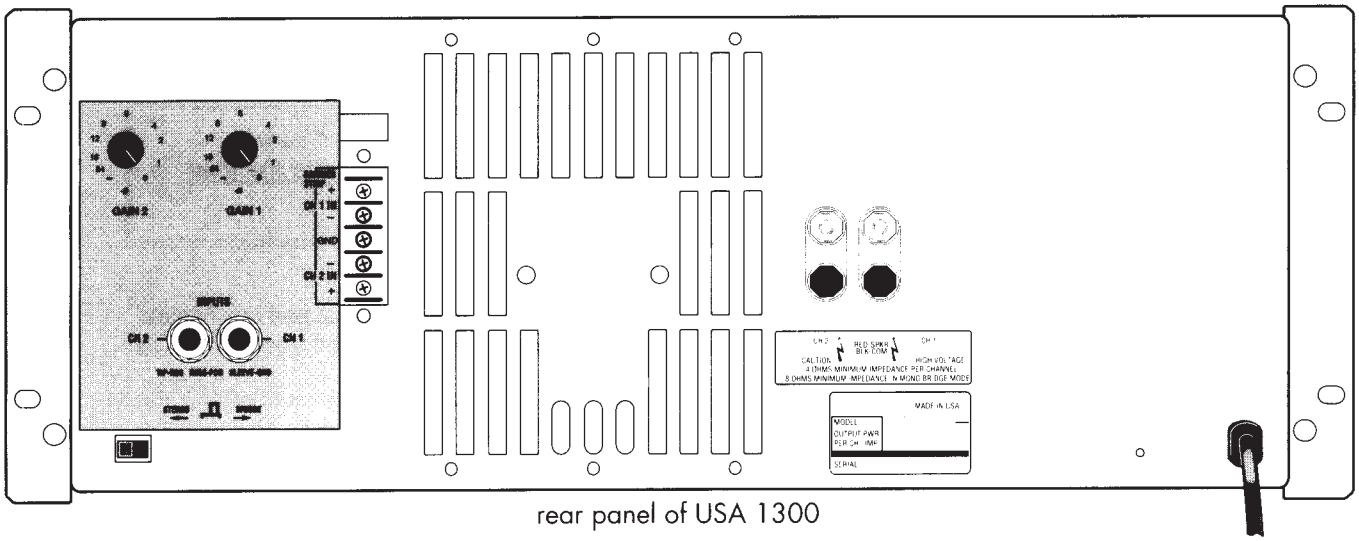


rear panel of USA 370 and USA 850



rear panel of USA 1300

	USA 370	USA 850	USA 1300
OUTPUT POWER (typical, both channels driven):			
4 ohms, 1 kHz, 1% THD	185	425	650
8 ohms, 1 kHz, 1% THD	125	270	400
8 ohms, 20 Hz to 20 kHz, 0.1% THD	110	240	365
2 ohms, 1 kHz, 1% THD: (typical, single channel driven)	250	550	1000
POWER BANDWIDTH:	5 Hz to 60 kHz	5 Hz to 60 kHz	5 Hz to 70 kHz
DISTORTION (8 ohms):	THD, 20 Hz–20 kHz at rated power < 0.1% SMPTE-IMD < 0.025%	THD, 20 Hz–20 kHz at rated power < 0.1% SMPTE-IMD < 0.025%	THD, 20 Hz–20 kHz at rated power < 0.1% SMPTE-IMD < 0.01%
DYNAMIC HEADROOM:	2 dB at 8 ohms	2 dB at 8 ohms	1.9 dB at 8 ohms
SENSITIVITY (with gain control at maximum):	29 dB voltage gain.1.12 Vrms for rated power at 8 ohms	32 dB voltage gain.1.16 Vrms for rated power at 8 ohms	34 dB voltage gain.1.13 Vrms for rated power at 8 ohms
POWER CONSUMPTION:	4.4 Aac at 120 V.	8.6 Aac at 120 V.	12.7 Aac at 120 V.
FREQUENCY RESPONSE:	20 Hz–20 kHz +0,–1 dB at 1 watt.	20 Hz–20 kHz +0,–1 dB at 1 watt.	20 Hz–20 kHz +0,–1 dB at 1 watt.
DAMPING FACTOR:	Greater than 200 at 8 ohms	Greater than 200 at 8 ohms	Greater than 200 at 8 ohms
NOISE:	–100 dB below full output, A weighted	–100 dB below full output, A weighted	–100 dB below full output, A weighted
INPUT IMPEDANCE:	20k Ω balanced and unbalanced noninverting or 10k Ω unbalanced inverting.	20k Ω balanced and unbalanced noninverting or 10k Ω unbalanced inverting.	20k Ω balanced and unbalanced noninverting or 10k Ω unbalanced inverting.
POWER REQUIREMENTS:	120, 220–240 Vac, 50/60 Hz	120, 220–240 Vac, 50/60 Hz	120, 220–240 Vac, 50/60 Hz
DIMENSIONS:	5.25" (13.3 cm) tall (3 RU), 19" (48.3 cm) wide, 9.5" (24.1 cm) deep	5.25" (13.3 cm) tall (3 RU), 19" (48.3 cm) wide, 9.5" (24.1 cm) deep	7" (17.8 cm) tall (4 RU), 19" (48.3 cm) wide, 10.8" (27.4 cm) deep
WEIGHT:	24 lb (10.9) net, 28 lb (12.7 kg) shipping	34 lb (15.4 kg) net, 37 lb (16.8 kg) shipping	54 lb (24.5 kg) net, 57 lb (25.9 kg) shipping

Specifications subject to change without notice

Introduction & General Information

This manual is prepared to assist technicians with the repair and calibration of the USA Series audio power amplifiers . The procedures described in this manual require advanced technical experience and sophisticated audio test equipment.

> ***WARNING:*** *There are **NO** user serviceable components inside these products. Opening these products or attempting the adjustments described in this manual may expose the user to electrical shock. Refer servicing to qualified service personnel.*

This manual contains schematics, printed circuit board (PCB) drawings, parts lists, and mechanical assembly drawings. This information should be used in conjunction with the test and troubleshooting guide.

The electrical and electronic components are identified by circuit identification numbers on the schematics and the parts list. The test & troubleshooting sections refer to designations shown in the schematics.

Although many of the electronic components used in this product may be available from electronic suppliers, some components are specially tested and approved by QSC. A product repaired with non-QSC supplied components may not meet factory specifications. Repairs performed using non-QSC parts may void the product warranty. When in doubt, you may contact QSC Customer Service for assistance.

Parts orders to QSC should include the product model number, the part description, and the QSC part number (from the parts list in this manual). Parts will be shipped via UPS, F.O.B. Costa Mesa, California. Shipping, handling and COD charges may be added to the cost of the parts.

Required Test Equipment:

1. Distortion Analyzer capable of 0.05% THD+N analysis
2. Function Generator
3. 20MHz Oscilloscope
4. Digital Multimeter
5. Variac (0-140 VAC, 10-20A, with AC Current Measuring)
6. High Power Load Bank (8, 4, & 2 ohm)

Suggested Test Equipment:

1. Audio Precision - System One
2. Thermocouple probe

USA Series Test & Calibration

NOTE: This test procedure will refer to the amplifier's channels as *CH1* (Channel 1) & *CH2* (Channel 2). Component designation will have the suffix "a" for CH1 and "b" for CH2.

USA370 & USA850 Test Procedure

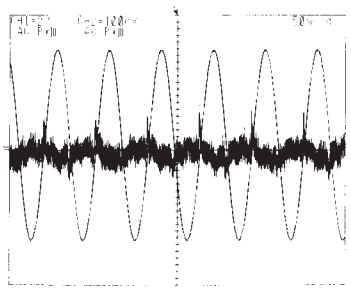
- SET-UP
  1. Connect a test load to the output terminals of the amplifier.
  2. Set the Stereo / Bridge switch to Stereo.
  3. Connect a distortion analyzer with a resolution of 0.05%, 20-20kHz (or better) to the output terminals of the amplifier.
  4. Connect a dual-channel oscilloscope to the following test points:
     Ch1 - a 10X (vertical sensitivity - 2V/cm) scope probe to the channel speaker output.
     Ch2 - a 1X scope probe (vertical sensitivity - 0.1V/cm) to the distortion analyzer output.
  5. Connect scope Ch. 2 (0.1V/cm) to distortion output.
  6. Set amp gain pots fully clockwise.
  7. Connect the output of the signal generator to the input terminals of the amplifier and select an output of 1.00 VRMS, 1KHz sine wave.
  8. Lift the ground on the scope and the distortion analyzer.

- POWER UP & MUTE DELAY TEST
  1. Slowly raise the variac voltage and watch for excessive current draw (Line current greater than 1A a.c. at 120 Volts.) *This is slightly less for 240V.* Pause at 95VAC *(200VAC European)* for three seconds until the mute / protect circuit disengages. Raise to 120VAC *(240V European)*.
  2. Turn the power switch off and on a few times to verify the 2 - 3 second power-up muting delay.

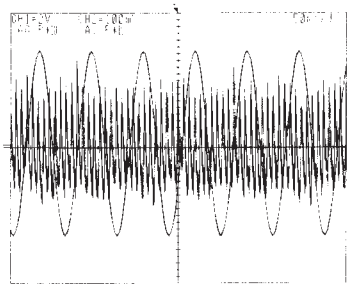
- CHANNEL OUTPUT
  1. Look for normal signal on the scope of channel 1. Switch the input signal and scope to channel 2 and repeat output test. Check for noisy / contaminated gain pots by observing general instability on your distortion waveform while adjusting the gain control levels.
  2. Select an 8 ohm load and confirm that this product is passing 125 watts for USA370 and 270 watts for USA850 at 1KHz 1% distortion.

- BRIDGE MODE *(1Vrms, sinewave, 1kHz)*
  Move the Bridge switch on the amp from the Stereo to Bridge position. Turn gain on CH2 fully counter clockwise (off). Remove the input plug from CH2. Check CH2 for full output with input applied to CH1. The output signal on CH2 should be 180 degrees out of phase with CH1output signal. Turn power off and place the amplifier under test back into the Stereo mode.

- BIAS & RIPPLE (HUM) NULL ADJUSTMENT
  HUM NULL:
  1. Use 0.1% scale on distortion analyzer. Adjust TR2 hum-null trimpot for minimum signal distortion. Make this adjustment with your input signal at 20kHz below full output. Let the amplifier cool down. See waveforms on next page for the correct adjustment.

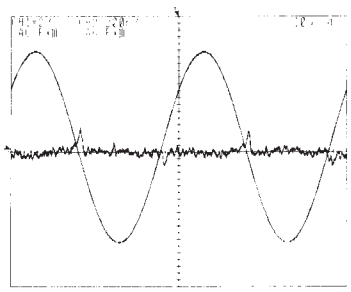


Correct Hum-null

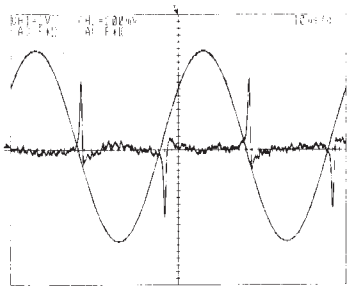


Incorrect Hum-null

CROSSOVER AND BIAS SETTING:
2. While still at 20kHz, reduce input signal 20dB (80%) from full output and adjust cross-over trimpot (TR3a & b) for a less than 400mVpk-pk cross-over spike protruding from the noise trace on the scope.
If a distortion analyzer is not available, a less accurate crossover distortion and bias adjustment can be made by monitoring the driver transistor (Q1 & Q2) bias current. With the amp at room temperature, and no input signal plugged into the amplifier, measure the DC voltage across the emitter resistors of Q1 and Q2. Adjust TR3a,b to obtain about 100mV d.c.



Correct Crossover



Incorrect Crossover

- SHORT CIRCUIT CURRENT *(1Vrms, sinewave, 1kHz)*

  1. Select a 2-ohm load and verify even clipping on both channels by adjusting a 1kHz input signal to just beyond 1VRMS (sine wave). Apply a short to the output binding posts of each channel one channel at a time and adjust the short circuit current limits. TR4a & b is for positive clip adjust and current limiting while TR5a&b is for negative clip adjust and current limiting. AC current draw from the wall of 2.0A on the USA370 and 4.5A on the USA850 *(1A, 240V and 2.25A, 240V respectively)* should be evident. If adjustment is necessary, a symetrical adjustment of the wipers on TR4 and TR5 will be necessary to maintain even clipping. This balanced adjustment should achieve two things. The setting of a 2.0 A (USA370), or 4.5A (USA850) a.c. current draw from the line voltage while at the same time maintaining even clipping on the negative and positive portions of your output sinewave.
  2. While the amplifier is driving a short between the black and red binding posts of the channel under test, observe the main supply rail voltages, ideally they will be no more than 3 volts from each other.
  3. Next, an important thing to look for is that the channel will recover from a short into a 2 ohm load.
  4. Perform the same procedure for the next channel to be calibrated.

- 2 OHM POWER

  Verify correct loading down to 2 ohms. 2 ohms is allowed to clip somewhat unevenly, but must pass 250W on the USA370 and 550W on the USA850 (one channel driven, 1kHz, 1% THD). At this point, verify CLIP and PILOT LED's by adjusting your generator control until the channel is just above clipping.

- FREQUENCY RESPONSE

  Set load to 8 ohms and scale your input to achieve 1 watt of power from the amplifier on each channel. Gain controls on the amplifier should be fully open. Check frequency response from 20Hz. (+0, -1dB at 1 watt) to 20KHz. (+0, -1dB at 1 watt) by sweeping random frequencies between these points. Check both channels.

- POWER VS. DISTORTION TEST

  Check to ensure that both channels will produce rated power at 20Hz, 2KHz, and 20kHz. While verifying rated power check that at all frequencies the distortion measurement is less than 0.1% (just below the onset of clipping.)

- THERMAL TEST

  Set input frequency to 2KHz and short both channels while they are producing power into a load. AC current of about 2.0-3.0 amps PER CHANNEL should be read from the 120v (*240v*) line voltage. Verify that the PTC circuit causes thermal shutdown after an extended period. When shutdown occurs, verify AC idle of .75 to 1.5 amps. While waiting for thermal shutdown, verify presence of IC (IC1a & b) voltage at pins 4 and 8 of 4 - 8 volts d.c..

- CM TEST

  Check the Common Mode Rejection by inserting the 1/4" input jack halfway into each channel and observe a 50% signal reduction, and a 180 degrees phase inversion at the output of the amplifier under test.

- OUTPUT NOISE

  Set the amplifier **GAIN** to 0dB, with a 2kHz 1.00Vrms input signal. Note the output level. Remove the signal input connector and measure the residual noise level produced into the load.

- CHANNEL OUTPUT

  1. Look for normal signal on the scope of channel 1. Switch the input signal and scope to channel 2 and repeat output test. Check for noisy / contaminated gain pots by observing general instability on your distortion waveform while adjusting the gain control levels.
  2. Select an 8 ohm load and confirm that this product is passing 400 watts at 1KHz 1% distortion.

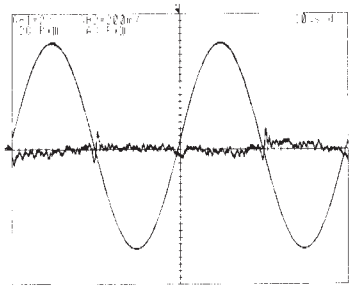
- BRIDGE MODE

  Move the Bridge switch on the amp from the Stereo to Bridge position. Turn gain on CH2 fully counter clockwise (off). Remove the input plug from CH2. Check CH2 for full output with input applied to CH1. The output signal on CH2 should be 180 degrees out of phase with CH1output signal. Turn power off and place the amplifier under test back into the Stereo mode.

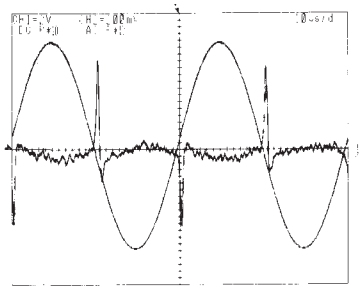
- BIAS ADJUSTMENT

  While still at 20kHz, reduce input signal 20dB (80%) from full output and adjust cross-over trimpot (TR1a & b) for a less than 400mVpk-pk cross-over spike protruding from the noise trace on the scope. An idle current (no signal applied with an 8 ohm load) should be less than or equal to 1.2A a.c.

  If a distortion analyzer is not available, a less accurate crossover distortion and bias adjustment can be made by monitoring the driver transistor (Q1 & Q2) bias current. With the amp at room temperature, and no input signal plugged into the amplifier, measure the DC voltage across the emitter resistors of Q1 and Q2. Adjust TR1a,b to obtain about 80mV d.c.



Correct Crossover



Incorrect Crossover

- SHORT CIRCUIT CURRENT

  1. Select a 4-ohm load and verify even clipping on both channels by adjusting a 1kHz input signal to just beyond 1.13VRMS (sine wave) with gain control fully up on the channel under test. Apply a short to the output binding posts of each channel one channel at a time and adjust the short circuit current limits. TR2a &b is for current limit adjustments. Upon shorting the channel, AC current draw from the wall of 5.5A *(2.5A, 240V)* should be evident.
  2. While the amplifier is driving a short between the black and red binding posts of the channel under test, observe the main supply rail voltages, ideally they will be no more than 3 volts from each other.
  3. Next, an important thing to look for is that the channel will recover from a short into a 2 ohm load and clip evenly. In order to set even clipping, adjust TR3a&b. If an adjustment with TR3 is necessary it is very important to re-measure the d.c. voltage rails and ensure that they do not deviate more that 3 volts from each other (ignoring the polarity difference).
  4. Perform the same procedure for the next channel to be calibrated.

- 2 OHM POWER

  Verify correct loading down to 2 ohms. 2 ohms is allowed to clip somewhat unevenly, but must pass 1000W (one channel driven, 1kHz, 1% THD). At this point, verify CLIP and PILOT LED's by adjusting your generator control until the channel is just above clipping.

- FREQUENCY RESPONSE

  Set load to 8 ohms and scale your input to achieve 1 watt of power from the amplifier on each channel. Gain controls on the amplifier should be fully open. Check frequency

response from 20Hz. (+0, -1dB at 1 watt) to 20KHz. (+0, -1dB at 1 watt) by sweeping random frequencies between these points. Check both channels.

- POWER VS. DISTORTION TEST

  Check to ensure that both channels will produce rated power at 20Hz, 2KHz, and 20kHz. While verifying rated power check that at all frequencies the distortion measurement is less than 0.1% (just below the onset of clipping.)

- THERMAL TEST

  Set input frequency to 2KHz and short both channels while they are producing power into a load. AC current of about 4.0-5.0 amps PER CHANNEL should be read from the 120v (240v) line voltage

[redacted]

  Verify that the PTC circuit causes thermal shutdown after an extended period. When shutdown occurs, verify AC idle of .75 to 1.5 amps. While waiting for thermal shutdown, verify presence of IC (IC1a & b) voltage at pins 4 and 8 of 4 - 8 volts d.c..

- CM TEST

  Check the Common Mode Rejection by inserting the 1/4" input jack halfway into each channel and observe a 50% signal reduction, and a 180 degrees phase inversion at the output of the amplifier under test.

- OUTPUT NOISE

  Set the amplifier **GAIN** to 0dB, with a 2kHz 1.00Vrms input signal. Note the output level. Remove the signal input connector and measure the residual noise level produced into the load. The noise signal should be 100 dB down from the full output power point measured. A signal to noise ratio should be better than 100dB (A weighted). Check both channels.

- FINAL CHECK

  This completes the electronic test procedure. Inspect the amplifier for mechanical defects. Inspect the solder connections. Reassemble the amplifier and verify the amplifier's operation before returning the product to service.

USA Series Troubleshooting

Current Draw

(Circuit breakers and fuses blow. Burning smell or smoke)

Symptoms: *All MODELS*

- Fuses immediately blow
- Amplifier quickly gets very hot
- Line circuit breakers tripping upon turn on
- Amplifier exhibits very loud hum with chassis vibration
- Amplifier emits smoke
- A burning smell is emanating from the amplifier

Possible Causes:

- EXCESSIVE CURRENT WITHOUT SIGNAL PRESENT
  The amplifier draws high current when the AC supply voltage is first applied up (with signal but no load). This symptom means there is a short in the power stages of the circuit. It is possible to lift the fuse for each channel to isolate the problem to one channel (the USA1300 has two fuses per channel). This could also show a misadjusted bias setting. See calibration procedures in this manual for setting bias.
- FAST CURRENT DRAW (increases rapidly at only a few volts AC voltage):
  Reversed or shorted main bridge rectifier B1.
  Both supply clamping diodes D6, D7 reversed or shorted
  Both polarities output transistors or drivers shorted.
- MEDIUM CURRENT DRAW (increases slowly, can go to 30 VAC before current becomes excessive.):
  Single polarity driver or output short.
  Single supply clamping diode D6 or D7 reversed or shorted.
  Open or missing bias diodes D1, D2 or bias trim pot TR3 and R38.
- SLOW CURRENT DRAW (above 60 volts AC before current begins to increase, amp may pass signal).
  Severely misadjusted bias circuit or defective bias diodes D1-2.
  Severe oscillation causing current drain.
- RUNAWAY CURRENT DRAW (30-40V AC before current begins to increase or runaway):
  A reversed filter capacitor: caution, may vent explosively.

Protection, Muting Circuit & Power On/Off Delay

(The amplifier locks up or does not startup and shut off correctly)

Symptoms : *All MODELS*

USA370, & USA850

- Both channels do not come out of protect
- Amplifier will not thermally protect
- Pilot LED not working
- Too little or too much muting delay

USA1300

- Relay won't turn on
- Poor mute circuit timing
- No D.C. protect
- Shuts off under signal
- No Red protect LED
- No thermal shutdown

Possible Causes: *USA370, & USA850*

- BOTH CHANNELS DO NOT COME OUT OF PROTECT
  Q11 or Q12 shorted base emitter
  Voltage on Z5 should be 14v - 15v. If this voltage is low, check for leaky E8, E9, defective Z5, or open R33.
  Check for open LD3 and open PTC.
- AMPLIFIER WILL NOT THERMALLY PROTECT
  Check for shorted LD3 and PTC, incorrect R35, R34, open pilot LD2, or open R39.
- MUTING DELAY
  Too Much: Check for open LD2 or R39, incorrect R33, R34, R35 or shorted LD3.
  Too Little: Check for incorrect E8, E9, or R33.
- PILOT LED NOT WORKING
  Check for shorted or open pilot LD2. Check R39.

Possible Causes: *USA1300*

- RELAY WON'T TURN ON
  Check speaker bus for DC; if over 10V DC is present, the protect circuit is operating normally to prevent operation. If DC is present, (presumably without current draw), continue below; if no DC is present on the output, skip to the section below other protection related faults.
  Check relay power voltage. With relay off, voltage at E5 should measure 36V (set by Zener Z6). If not check R31, D9, or shorted Z6.
  If power voltage is OK, check voltage on timing capacitor E4. Should rise to 12-15V, in three seconds, which triggers Q19. If not, check R19, R20, E4's polarity, or for a shorted Q20.
  If timing voltage is OK, check relay transistor Q21. If good, a 47K resistor from base to speaker bus should activate relay.
  If relay driver Q21 is OK, check driver Q19 and LED LD3.
- POOR MUTE CIRCUIT TIMING
  NO MUTING DELAY *(relay or circuit is "stuck on")*
  Relay driver Q21 shorted or wrongly mounted. Check by jumping base to emitter, should turn it off if OK.
  Driver Q19 shorted or wrongly stuffed (check by jumping base to emitter as above).
  D7 reversed (charges timing capacitor E7 immediately)
  R20 low (fast E4 charge)
  R19 low (low voltage on E4 turns Q19 on too soon)
  Missing or high R23 (no off current)
  EXCESSIVE MUTING DELAY
  Check timing capacitor E4 voltage. If it rises normally but circuit is slow to turn on, check Z7 (lift temporarily while checking circuit), LD3 bad or intermittent, R23 too low.
  Timing capacitor voltage wrong; check for R19, R20, reversed E4, missing R22.
  Reversed or wrong Q20 type.
- NO D.C. PROTECT
  DC FAULT WITHOUT CURRENT DRAW. In most cases, shorts in the output circuit will cause current draw, but certain shorts will only cause DC offset in the output. In both cases, measure the various circuit voltages, and look for abnormal values to help trace the fault, which can be a solder or component short (zero volts), reversed zener or diode (.6V) reversed electrolytic (several volts), or wrong value parts (abnormal voltage). Look at the following points in the circuit.
  Shorted IC rail, sometimes both shorted together; including input cable connectors and jacks
  Defective Z2-3 gives zero volts on IC rail.
  Collector-base short on driver (rare without further damage)
  Sometimes IC forces the rest of the circuit into DC due to shorts in the feedback network, etc. To check this, remove IC, check for +15V, -15V on IC rails, and balanced voltages in the drivers and outputs. If so, output stage is probably OK, look for problems in IC, or its associated parts.
  Defective or reversed IC (pull and check voltages).
  R30 missing or very high.
  B2 defective or wrongly mounted on PCB.
  Q20 defective or wrong type.
  D7 reversed (also no muting delay).
  Replace LD-3 if voltage drop across it is less than 1.5V.

- SHUTS OFF UNDER SIGNAL
  E6 missing, defective, or much too small.
- NO RED PROTECT LED
  Check LED voltage. If over +2V, LED is defective. If 0V with relay off (meaning no positive voltage to LED), check for solder short, or there is no "protect" power, (missing R29), which defeats shut-down circuits. Be sure to correct before proceeding.
- NO THERMAL SHUTDOWN
  Short amplifier load with full signal to raise heat sink temperature and put voltmeter across PTC, (yellow sensor on heat sink), looking for voltage across PTC to rise from .7V cold to about 5.5V at shutdown.
  No Red "Protect", may have no R29, which defeats whole thermal circuit (no voltage across PTC).
  If the PTC reaches 6V but won't shut down, check Z7, or relay drive circuit stuck on (see above).
  If red "protect" /R12 is OK, but no voltage across PTC, then the PTC is defective or shorted (lift temporarily or replace with 10K pot, confirm shutdown).

Faults with Signal Present

(The amplifier passes a signal but is not running correctly)

Symptoms : All MODELS

- Output power "breaking up"
- 'Ringing' sound with no input to amplifier
- Output collapses into a 8, 4 or 2 ohm load
- Voltage rails ok without signal.
- Amplifier gets too hot
- One channel clips prematurely
- Excessive hum with no input to amplifier

Possible Causes:

- OUTPUT POWER "BREAKING UP" (*Output distorted*)
  Hum-null components may have burned open. Check R7, R8 and TR2.
  Ground traces may be bad. Check for continuity between speaker ground, input ground and ac ground.
- "RINGING' SOUND WITH NO INPUT TO AMPLIFIER
  C2 and/or C4 (C4, C7, USA1300) may be bad.
  Check op amp IC1.
- OUTPUT COLLAPSES INTO A LOAD
  No continuous ground between main pcb to heatsink through pem stud. The spring tooth lock washer may not be biting through anodized surface on main heatsink.
  Misadjusted TR4 or TR5.
  Check for R20 and R21.
- VOLTAGE RAILS OK WITHOUT SIGNAL *Collapses with a signal*
  E2 or E3 leaking.
  Check for capacitance value of C2 and C4 (C7, C13, E1, USA1300).
- AMPLIFIER GETS TOO HOT WITHOUT LOAD
  TR3 (TR1, USA1300), misadjusted, opened or burned.
  Incorrect bias diode (should be 1N4934) D1, D2 (D5, D6, USA1300).
  Missing C2 or C4 (C4, C7, USA1300). High frequency oscillations evident.
  Open R17, R18 (R16, R17, USA1300).
  Defective op amp IC1. Unstable and generating high frequencies).
- ONE CHANNEL CLIPS PREMATURELY
  R15 or R16 may be open.
  Misadjusted TR4 & TR5.
  Into a 4 ohm load, check for open R22, or open D4 & D5 (D1 & D2, USA1300).
  Check R7 & R8 for open or incorrect value.
  Check for open R12, R13, R20, R21 (R14, R15, R52, R53, USA1300)
  450 ohm chargeback resistor R22 may be open.

Check for open on D4 and D5.

- EXCESSIVE HUM WITH NO INPUT TO AMPLIFIER
  TR2 (hum-null trim potentiometer) misadjusted, opened or burned.
  Check for mismatched capacitance value of output filter capacitors.

Instability

(Gain problems, spurious noises, and oscillations)

Symptoms : All MODELS

- General Output Distortion
- "Ringing" sound with no input to amplifier
- Excessive or unbalanced crossover
- Output waveform appears "fuzzy"

Possible Causes:

First, distinguish between instability (fuzziness), "ringing" which is momentary instability after a transition, "step" distortion, crossover distortion (both often show ringing), or general distortion.

- GENERAL OUTPUT DISTORTION
  SEVERE:
  All loads, often with current draw: usually very low or missing slew rate capacitor C4, or feedback capacitor C2.
  MEDIUM:
  Especially with a light load, often too high a value of a stability capacitor; check feedback capacitor C2, secondary stability capacitors C9, (C5,6 USA1300); and output filter R32/C5 (USA1300-R27,28/C10). Jump with comparable value, if better, replace with increased value, if worse, try replacing with 50% lower value).
  LOW GAIN:
  Suspect open circuit in feedback shunt R5 (USA1300-R7/E1). Check for broken circuit trace.
  Substitute IC, and check IC socket for contamination.
- "RINGING" SOUND WITH NO INPUT TO AMPLIFIER
  Usually indicates marginal instability, usually triggered after passing through the crossover. Can indicate problem in "minor" stability components. Also check output filter.
  Possibly the crossover is larger than usual.
- EXCESSIVE OR UNBALANCED CROSSOVER (*Excess notch or ringing at zero crossing*)
  Severe: shorted bias diode D1-2 (D5, D6, USA1300).
  Moderate: Out-of-spec bias diodes.
  Defective bias trimmer components TR3 (TR1, USA1300) and R38 (R54, USA1300).
  Check for open base resistors R17,18 (R16, R17, USA1300) on output devices.
- OUTPUT WAVEFORM APPEARS "FUZZY"
  Instability on one side of the waveform:
  Add .015uF trimmer bypass capacitor around bias trimmer TR3 (TR1, USA1300).
  Check/adjust driver emitter capacitors C8 and C9 (C5,6 on USA1300).

Power Supply & Voltage Rail Balancing

(Uneven rails and power supply problems)

Symptoms : All MODELS

- Current limiting wrong
- Current limiting too high into short
- IC Rail too high into short
- Current limiting too low into short
- Uneven voltage rails

Possible Causes:

- CURRENT LIMITING WRONG
  Current limits should remain high down to 2 ohms, and collapse to a lower value for short circuits. This is caused by the IC rails going from normal 14 - 15 volts to about 5-6 volts. Current limit trimmers TR4 & TR5 (TR2 on USA1300) permits adjustment of each channel to specified range. See Test & Calibration Procedures for correct adjustment of the current limiting.
- CURRENT LIMITING TOO HIGH INTO SHORT *(IC RAILS CHECK NORMAL 5-6 volts)*
  Reversed or shorted 3.9 or 4.7V zeners Z15, Z16.
  Shorted bias diode D1,2 (also shows severe crossover), (D5, 6, USA1300).
- IC RAIL TOO HIGH INTO SHORT
  Check op amp (weak output current).
  Clip LED open.
  B2 defective, (B1, USA1300)
  Check for short circuit current balance on the USA370 and USA850 by measuring the main rail voltages during short circuit; they should be balanced within 3V. If severely offset, check Z3 (3.9V) and Z4 (4.7V) for correct voltage, and check values of R15 and R16.
- CURRENT LIMITING TOO LOW INTO SHORT AND 2 OHM LOAD
  IC RAILS OK
  Bias resistor R12, R13 high.
  Very low gain driver transistors (see below).
  Missing connection or emitter resistors in some of the paralleled output transistors.
- CURRENT LIMITING TOO LOW INTO SHORT ONLY *(OK into normal loads)*
  Check Clip LED shorted, 1.5A rectifier B1 shorted.
  3.9 or 4.7V zeners high (7.5V or 15V).
- OK INTO SHORT BUT LOW INTO 2 OHMS: *(Usually on one side only)*
  IC RAIL LOW (driving two ohms even before clipping): check for high or missing charge-back R22 (USA1300-R49), or missing/reversed charge-back diodes D4 or D5 (usually causes premature clipping at 4 ohms as well).
  IC RAIL OK (until clipping starts) usually indicates low output section gain caused by weak driver, open output devices, or open emitter resistors. Also check value of driver emitter resistors R15, R16.
- UNBALANCED RAIL VOLTAGES: *(USA370 and USA850)*
  Rail voltage is determined by R7 and R8 from the positive and negative rails.
  If the amplifier is passing a signal but clipping unevenly due to uneven rail voltages, check and replace R7,8 (47K, 1watt, Metal Oxide).

NOTES

USA1300 Power Supply

The USA1300 power supply has a transformer center-tap return (DC-coupled), so the rails are forced to remain balanced. Check current balance by raising scope gain during short, and looking at the small voltage across the residual resistance of the short. The voltages (and thus currents) must be balanced within 33% (2:3 ratio maximum). They may be quite uneven. If so, check Z4 (3.9V) and Z1 (4.7V) for correct voltage, check values of R12 and 13, and if necessary adjust values of R10 and R11 within 750 -15K to balance the currents. Concentrate on the parts mentioned above, connected to the side with the high current (remember "reverse" polarity of QSC circuit --see below).

Driver Transistor Gain

To check driver gain, note the "REVERSED" polarity of QSC circuitry. The positive side of the circuit pulls the rails and output DOWN and thus is responsible for NEGATIVE output problems; the negative side of circuit is responsible for positive output. First, confirm their value, and then scope probe or measure the DC voltage on driver emitter resistors R15 or R16. If the driver's emitter resistor on the weak side has low voltage, its current is low, caused by poor drive or low gain. Inspect drive components shown above in Short Circuit Limit sections, or substitute drivers with an approved part. If a driver shows equal or greater current, it is OK and is trying to overcome weakness in outputs. Check that all devices and emitter resistors are good.

How to determine which power transistors are shorted:

Determine which power supply rail (+ or -) is being clamped to ground. A positive side short (Q1-6) will clamp the positive rail to ground, and a negative side short (Q2, Q7-10) will clamp the negative rail to ground.

Raise the AC supply voltage current until the current draw is 2-5 amps. Measure the voltage on the supply rail and output transistors. A hard short to ground will read virtually zero volts. A shorted output device will read 0-.5V depending on the short current.

Confirm that a voltage drop exists across that device's emitter resistor as well. A measurement of .6-1V above ground indicates clamping due to reversed or defective diode D6-7, or a shorted output. A measurement of 1-2 volts could mean a bad driver, but the outputs may be OK (especially if all emitter resistors have the same voltage drop).

Determine which individual devices in a parallel bank are shorted by measuring the voltage across the emitter resistors on the side with the low rail (the faulty side). The shorted devices will draw more current, causing higher voltages on their emitter resistors. The good devices on the opposite rail will all be conducting equal current.

If the base voltage to a group of outputs measures zero, there is a probable solder short to the heat sink or an output collector-to-base short (rare). If output collector to base junction is shorted, all outputs on the same bank must be removed from the circuit board and check the same collector to base junction carefully.

Check for a driver transistor short by measuring across the emitter resistors R15 and R16 (USA1300-R12/13). If the voltage drop is near zero, there is no driver transistor current draw and no driver transistor short. Don't forget to check for open emitter resistors (burned open by a shorted output device).

USA Series Circuit Description

This circuit description pertains to the USA850 amplifier which in turn corresponds to the USA370. Reference designators given on the schemtics can be referred to to make comparisons when review this description. Refer to the appropriate schematic when following the description given on the coming pages.

Power Supply

AC Power comes in through a thermal (slow-blow) circuit breaker and AC switch. A row of terminals on the main circuit board allows the transformer primary to be wired in parallel for 120V, 60Hz operation, or in series for 220V, 50Hz operation. Transformer exciting current will rise to the limit at 240V, 50Hz, which may increase AC hum in the amplifier. Also, note that there will be an 8% voltage reduction at 220V (110V volts per primary section) compared to 120V operation. This results in a 15% loss of amplifier power but increases transformer capacity for the primary US market.

The fan speed is controlled by R42, a 250 ohm, 15W resistor and a 55C thermostat. With the resistor in series, the fan operates at about half speed. When heat sink temperatures exceed 55C, the thermostat clicks in and bypasses the resistor, giving full voltage to the fan.

The transformer has independent secondary windings for each channel. Each channel has its own filter capacitors (E4, 5, 6, 7) and power rectifier (B1). A fault fuse (F1) is located prior to the rectifier to disconnect a faulty channel. The current rating of the fuse, 12A, is high enough to carry the maximum current of a properly operating channel, even into a short circuit, so the fuse should only blow in case of an actual fault (i.e. shorted output transistor).

There are two unusual features of the QSC power supply circuit. First, while we use conventional positive and negative filter capacitors, for a balanced bipolar power supply, there is no return from the center point to the center-tap of the power transformer. This means that the center voltage of the two capacitors is free to float. Since audio currents have no average DC content, equal power is drawn off both capacitors, and the positive and negative voltages remain equal. This is assisted by feedback circuits described below. However, if the amp develops a DC fault, such as a power transistor short to one of the rails, no long-term DC can flow to the load. Instead, the voltage on the capacitors becomes unbalanced, and the "DC fault" is blocked. The net effect is the same as adding a bipolar output capacitor, without and added expense.

The second unusual feature is that we reverse the usual location of the speaker and ground terminals. For reasons explained in following sections 4 and 5, we ground the common collectors of the output transistors, and take the audio output from the midpoint of the power supply capacitors. This requires separate filters, rectifiers, and transformer secondaries for each channel, but results in minimal cross-talk, and permits one channel to fail without affecting the other.

The bipolar 15V rails for the op amp are derived using dropping resistors (R20 and R21) and zener stabilizers (Z1 and Z2) from the main rails. The op-amp supply rails are involved in our short-circuit protection scheme, as described in a following section.

Balanced Input Circuit, Gain Control & Frequency Limits

The first stage of the dual op-amp is used as a differential input. Matched precision resistive dividers R1/R3, and R2/R4, are arranged so that any signal appearing equally on both the positive and negative inputs results in no voltage across the op-amp input terminals, and no voltage at the output of the op-amp. In other words, noise signals which normally occur equally on both sides of the balanced line are rejected. The audio signal appears as a difference between the balance-line conductors, and these signals are picked up and appear at the same gain at the output of the op-amp. For unbalanced inputs, either input line may be grounded, and the circuit will respond at unity gain to the other line. For reasons of overall stability in actual use, QSC uses the inverting input for unbalanced signals.

After balanced-to-unbalanced conversion, the audio signal flows through a 4.7uF NP (E1), for low frequency rolloff (-3dB at 8Hz), with the 4.7k outboard resistors (R11 and one mounted on jack panel) gives a uniform attenuation slope as calibrated on the Gain control label. Finally, R10 and C1 establish a high frequency rolloff (-3dB at 75kHz). The net audio response is typically down less than 0.5dB from 20 - 20kHz.

Amplifier Feedback Network, Gain Stage, Distortion LED, Short Circuit Protection, and Bridging.

The actual power amplifier begins at the input to the second stage of the op-amp. Audio feedback is established across R6, from the speaker, and R5 to ground. DC feed back to keep the rail voltages equal is established by matched resistors R7 and R8. If the filter capacitors, are slightly mismatched, ripple on the positive and negative supplies are unequal, and hum can appear at the output during large signal loading. A "hum null" trim, R9, C3, and TR2, allows this to be canceled out.

High frequency stability is established by C4 and C2. C4 is the primary "phase lag" capacitor, which sets slew rate and thus the overall "speed limit" of the circuit. C2 establishes "phase lead" in the speaker feedback network, increases feedback at very high frequencies and thus improves control at frequencies where oscillations might occur. C7, at the output of the op-amp, and L1, R31, R32, and C5, at the speaker output, and C9 (in later versions only) further improve stability.

Most of the gain in the amplifier is contribute by the second stage of the op-amp. this stage's primary job is to feed the driver transistors, but is also used to drive the Distortion LED (LD1) and is tied in to the short circuit protection scheme.

As long as the output of the amp is not clipping, the drive voltage to the bases of the driver transistors, Q1 and Q2, remains below 1.5 volts peak. If the amp clips, the op-amp will attempt toe overcome this by instantly delivering a higher than normal voltage to the drivers. This excess voltage is used to driver the distortion (clip) LED, which requires a voltage in excess of about 2 volts to operate. Thus any form of clipping immediately results in illumination of the distortion LED.

One of the feature advantages of the QSC circuit is our effective short circuit protection., In order to maintain good audio performance into low impedance loads, it is necessary to maintain a high output current limit. The normal current limit is determined by the base current to each driver through 1K resistors and 3.9V zener diodes (R12/Z3, and R13/Z4). When the op-amp rails are at their normal 15V, this current is about 9ma, and results in about 20A of output current. This is sufficient to deliver rated power into a two ohm load. The output transistors can withstand this much current into a short for a few seconds, but would overheat and fail before thermal shutdown can occur. Therefore, we need a method of reducing current into shorts without affecting normal operation.

The normal range of currents from the op-amp is less than the current supplied from the main pwer supply rails by R20 and R21. however, as full pwer is reached, and especially if the amp is clipped and the op-amp has to deliver extra current to the distortion LED, more current is drawn than these resistors can supply, and the op-amp rail voltage would normally be drawn down. To prevent this, we have a replenishing circuit, from the speaker output voltage, through R22 and rectifiers D4 and D5. As long as the load impedance is above 2 ohms, there will be enough output voltage to recharge the op-amp rails through this network. If the output is shorted, however, the output voltage will be clamped to a low value, the recharged will no occur, and the op-amp will deplete its supply rails to about 6 volts. This will cut the current tot he drivers drastically (through R12 and R13), and reduces output current to a safe level which the amp can withstand until thermal shutdown occurs. The exact short-circuit current is adjusted by trimpots TR4 and TR5, which varies the voltage drop between the op-amp and the driver transistors, ultimately determining the maximum depletion of the op-amp rails.

Bridged-mono operation requires that channel 2 operates at the same level but out-of-phase with channel 1. This is achieved by connecting the output from channel 1 through the bridge switch and R19 into the inverting input of channel 2. R19's value matches that of the feedback network, for unity gain in Ch.2. Since Ch.2's gain control is bypassed, the gain for Ch.1 controls the entire signal, and equal signal in both channels is assured.

Complementary Driver Transistors & Crossover Bias

The problem now becomes to amplify the low voltage and current from the op-amp to the full power of the amplifier. We can do this with only two stages of discrete transistors by using careful design.

Complementary drivers Q1 and Q2 are connected to the op-amp through bias diodes D1 and D2. the forward voltage drop of the diodes matches the forward base voltage of Q1 and Q2, so that as the op-amp swings on either side of zero, it immediately drives Q1 or Q2. This eliminates and "dead zone" which would cause crossover distortion. The bias trimpot TR3 was added in series with D1 and D2 to permit the bias to be fine tuned. Emitter resistors R15 and R16 are used to stabilize the gain of Q1 and Q2, and to minimize any tendency to draw more idle current as they heat up. These resistors drop about 1.5 volts at full current, which reduces the output power slightly. The final collector current from Q1 and Q2 is about 500ma, and goes to the bases of the output transistors.

Complementary Output Transistors

The emitters of the positive and negative output transistors (Q3, 4, 5, 6 and Q7, 8, 9 10) are connected to the main rails through load-sharing emitter resistors R23, 24, 25, 26 and R27, 28, 29, 30. The parallel bases of each bank are bypassed with 22 ohm resistors R17 and R18, which assure positive shut off of the outputs. The 500ma currents from the collectors of Q1 and Q2 are connected to the output transistor bases and amplified to about 20A peak.

Note that the collectors of all output transistors meet at a common ground. This is possible because of the special power supply arrangement outlined earlier. This means we can simply screw the cases to a grounded heat sink, with no need for the usual insulating mica. This saves money and improves reliability through better cooling.

As mentioned earlier, the speaker output is taken from the midpoint of the power supply capacitors. this means that the audio output voltage is superimposed on top of the DC supply voltages, which must be kept in mind when checking these voltages. A stability filter, L1, R31, R32, and C5, eliminates the effects of reactive loads at frequencies way above the audio range where the amp might be unstable.

Muting Delay & Thermal Shutdown

A small independent power supply is derived through D8 and R33. This a half-wave rectified signal brought from the secondary of the transformer. This supply is used to provide voltage to the pilot LED, mute RC time constant, and thermal shutdown circuits. When the amplifier is turned on, a 47uF 50V (E9) begins to charge until it reaches a point to where is energizes the rest of the circuit to bias Q11 on. When Q11 is biased on, Q12 is no longer conducting. Q12 in its default state is biased on to where its conducting current from the collector - emitter junction. This effectively cancels the 15 volt op-amp rails that appear at this junction. After approximately three seconds, when E9 charges, up Q11 is turned on thereby turning off Q12. When Q12 is no longer in conduction, then the 15 volt rails are free to supply voltage to the op-amps on channel 1 and 2. A 4.7uF 160v capacitor (E8) serves as an immediate drain of voltage upon power up of the amplifier.

Excessive heat sink temperatures are sensed by a PTC resistor. This special part has a positive temperature coefficient which starts to increase rapidly above 80C. When the heat sink temperature reaches about 95C, the resistance is high enough to block power to Q11, and the signal is muted until the amplifier cools down. One drawback of this scheme is that it will not correct overheating due to run away idle current, so careful adjustment of crossover bias is essential.

USA 1300 Ch. 1 Main Board Assembly

Part Number	Description	Reference
CA-027100-BM	27PF,100V,10%,MICA	C4
CA-110100-BM	100PF,100V,5%,MICA	C1,2
CA-147100-BD	470PF, 100V, 10%, DISK	C5
CA-215200-BP	.0015UF,200V,10%,MYLAR	C7
CA-222100-BP	.0022UF,100V,10%,MYLAR	C8
CA-310100-BP	.01UF,100V,10%,MYLAR	C6
CA-333100-BP	.033UF,100V,10%,MYLAR	C9
CA-410250-AS	.1UF, 250V, SURGE CAP.	C10
CA-412100-CP	.12UF, 100V, 5%, MYLAR	C3
CA-610035-BE	10UF, 35V, ELEC., RADIAL, 10%	E4
CA-647010-BN	47UF, 10V, RADIAL, NON-POLAR	E1
CA-647050-BE	47UF, 50V, ELEC., RADIAL, 10%	E5
CA-722010-BN	220UF, 10V, RADIAL, NON-POLAR	E6
CA-722025-BE	22OUF, 25V, ELEC., RADIAL, 10%	E2,3
CA-822100-BE	22OOUF, 100V, ELEC, RADIAL,10%	E7-14
CH-140208-LX	1200/1400/1700 HEATSINK, FAB.	
CO-000008-IC	8 PIN IC SOCKET	IC1
CO-350432-AP	.084" PIN 9 CONTACT PCB HEADER	CO2
CO-641119-AH	8 PIN .156"/C HEADER	CO1
HW-000001-FC	FUSE CLIPS	F1,2
HW-060100-PS	#6-32 X 10 PEM STUD	P
HW-060405-SP	#6 X 1/4" X 5/32" RND. SPACER	P
HW-060600-SO	1/4"X1/4" MALE/FEMALE 6-32	S
IC-005532-OP	5532 OP-AMP	IC1
LB-100007-PC	PRODUCTION CONTROL LABEL LAR	PCB
MS-000044-FT	FOAM ADHESIVE TAPE 1/8X 1/2 X1	PCB
MS-000066-HS	TO-66 HEATSINK AAVID #E5020B	Q1,2
MS-150250-FU	15A, 250V, FUSE	F1,2
NW-060010-SL	#6 SPLIT TOOTH LOCKWASHER	Q1,2
NW-060500-KP	#6-32 KEPS NUT	
PC-170053-CX	1700 UPPER MAIN PCB (CH.1)	
PL-000000-AF	ADHESIVE FEET	PCB
PL-903125-SP	BIVAR 903-125 SPACER	D5,6,R54
PL-905100-SP	BIVAR 905-100 SPACER	L1
PL-905156-SP	SPACER, BIVAR 905-156	LD3
PL-905200-SP	BIVAR 905-200 SPACER	LD1,2
PL-909235-SP	BIVAR 909-235 SPACER	LD1,2
PT-110000-AT	100 OHM TRIMPOT	TR1,2
QD-000004-TX	MPS-U05 TRANSISTOR, NPN	Q21
QD-000005-QD	TO-220 NPN 250V	Q1
QD-000006-QD	TO-220 PNP 250V	Q2
QD-000032-QD	MOTOROLA MJ15022 NPN PWR XSTR	Q11-Q18
QD-000033-QD	MOTOROLA, MJ15023 PNP PWR XST	Q3-Q10
QD-000134-LR	RED T-1 3/4 LED, XC 4655	LD2
QD-000134-LX	RED/GREEN T-1 3/4, XC 5491	LD1
QD-0003.9-ZT	3.9V TESTED ZENER	Z4
QD-0004.7-ZT	4.7V TESTED ZENER	Z1
QD-0007.5-ZT	7.5V TESTED ZENER	Z5
QD-001340-LR	RED T-1 3/4 LED, UTILITY	LD3
QD-004004-DX	1N4004 DIODE	D1,2,7,8, D9,10
QD-004744-ZA	1N4744A 15 VOLT ZENER DIODE	Z2,3
QD-004753-ZT	1N4753, 36 VOLT ZENER DIODE	Z6
QD-004934-DX	1N4934 DIODE	D5,6
QD-005402-DX	1N5402 DIODE	D3,4
QD-008599-TX	MPS 8599 TRANSISTOR, PNP	Q19,20
QD-1.5200-BX	1.5A 200 VOLT BRIDGE RECTIFIER	B1,2
QD-250400-BX	BR-254, 25A 400 VOLT BR. RECT.	B3
RE-.04705-FW	.47 OHM, 3 WATT, WIREWOUND 10%	R33-48
RE-.56005-EM	5.6 OHM, 2 WATT METAL OXIDE 5%	R26
RE-.68005-DM	6.8 OHM, 1 WATT, MET. OXIDE 5%	R12,13
RE-000009-PT	90 C PTC RESISTOR	PTC
RE-000050-NR	SC-50 NTC RESISTOR	R54
RE-001005-EM	10 OHM, 2 WATT, METAL OXIDE 5%	R27,28
RE-002205-DM	22 OHM, 1 WATT, METAL OXIDE 5%	R16,17
RE-015005-BC	150 OHM, 1/4 WATT, CARBON, 5%	R25
RE-025010-NW	250 OHM, 15 WATT, WIREWND, 10%	R50
RE-033010-NW	330 OHM, 15 WATT WIREWOUND 10	R50
RE-033201-BM	332 OHM, 1/4 WATT, MET.FILM,1%	R7
RE-045010-HW	450 OHM, 5 WATT, WIREWOUND 10%	R31,49
RE-110005-BC	1K OHM, 1/4 WATT, CARBON, 5%	R5,14,15
RE-115005-BC	1.5K OHM, 1/4 WATT, CARBON 5	R10,R24
RE-127005-BC	2.7K OHM, 1/4 WATT, CARBON, 5%	R11
RE-135005-HW	3.5K OHM, 5 WATT WIREWOUND 10%	R52,53
RE-147005-BC	4.7K OHM, 1/4 WATT, CARBON, 5%	R6
RE-210001-BM	10.0K OHM, 1/4W., MET. FLM. 1%	R1-4
RE-210005-EM	10K OHM, 2 WATT, MET. OXIDE 5%	R29,30
RE-221001-CM	21K OHM, 1/2 WATT, MET.FLM 1%	R9
RE-247005-CC	47K OHM, 1/2 WATT, CARBON, 5%	R21
RE-275001-BM	75K OHM, 1/4 WATT, MET. FLM 1%	R8
RE-310005-BC	100K OHM, 1/4 WATT. CARBON 5%	R22,23
RE-333005-BC	330K OHM, 1/4 WATT, CARBON 5%	R19,20
SC-060060-PP	#6-32 X 3/8" P/P ZINC	Q1,2
SC-061041-SP	#6-32X1/4" "A" P/P W/SCRAPING	CUT-IN & PTC
SC-062050-PP	#6 X 5/16" "B" P/P ZINC	Q3-18
SW-000013-RY	RELAY, SPDT, 15A, 24VDC	K1
SW-000055-TS	55C THERMAL CUT-IN SWITCH	CUT-IN
WC-0.6022-JW	.6" JUMPER, WHITE, 22 GA, SLD	J4
WC-001102-SQ	INSUL. SLEEVE QSC 1102,.6",CLR	PTC
WC-001103-SQ	INSUL SLEEVE 1103,.875",CLEAR	CUT-IN
WC-1.2518-JW	1.25" JUMPER, WHITE 18 GA, SLD	J2,3
WC-2.5018-JW	2.5" JUMPER, WHT, 18 GA, SLD	J1
XF-200014-CR	2UH, 14 GA, COIL/VERTICAL	L1

USA 1300 Ch. 2 Main Board Assembly

Part Number	Description	Reference
CA-027100-BM	27PF,100V,10%,MICA	C4
CA-110100-BM	100PF,100V,5%,MICA	C1,2
CA-147100-BD	470PF, 100V, 10%,	C5
CA-215200-BP	.0015UF,200V,10%,M	C7
CA-222100-BP	.0022UF,100V,10%,M	C8
CA-310100-BP	.01UF,100V,10%,MYL	C6
CA-333100-BP	.033UF,100V,10%,MY	C9
CA-368250-AS	.068UF,250V,SURGE	C11
CA-410250-AS	.1UF, 250V, SURGE	C10
CA-412100-CP	.12UF, 100V, 5%, M	C3

USA 1300 Ch. 2 Main Board (cont.)

CA-610035-BE	10UF, 35V, ELEC.,	E4
CA-647010-BN	47UF, 10V, RADIAL,	E1
CA-647050-BE	47UF, 50V, ELEC.,	E5
CA-722010-BN	220UF, 10V, RADIAL	E6
CA-722025-BE	22OUF, 25V, ELEC.,	E2,3
CA-822100-BE	22OOUF, 100V, ELEC	E7-E14
CH-140208-LX	1200/1400/1700 HEA	
CO-000008-IC	8 PIN IC SOCKET	IC1
CO-350432-AP	.084" PIN 9 CONTAC	CO-2
CO-641119-AH	8 PIN .156"/C HEAD	CO-1
HW-000001-FC	FUSE CLIPS	F1,2
HW-060100-PS	#6-32 X 10 PEM STU	P
HW-060405-SP	#6 X 1/4" X 5/32"	P
MS-000066-HS	TO-66 HEATSINK AAV	Q1,2
MS-150250-FU	15A, 250V, FUSE	F1,2
NW-060010-SL	#6 SPLIT TOOTH LOC	Q1,2
NW-060500-KP	#6-32 KEPS NUT	P
PC-170054-CX	1700 LOWER MAIN PC	
PL-903125-SP	BIVAR 903-125 SPAC	D5,6,R54
PL-905100-SP	BIVAR 905-100 SPAC	L1
PL-905156-SP	SPACER, BIVAR 905-	LD3
PL-905200-SP	BIVAR 905-200 SPAC	LD1,2
PL-909235-SP	BIVAR 909-235 SPAC	LD1,2
PT-110000-AT	100 OHM TRIMPOT	TR1,2
QD-000004-TX	MPS-U05 TRANSISTOR	Q21
QD-000005-QD	TO-220 NPN 250V	Q1
QD-000006-QD	TO-220 PNP 250V	Q2
QD-000032-QD	MOTOROLA MJ15022 N	Q11-Q18
QD-000033-QD	MOTOROLA, MJ15023	Q3-Q10
QD-000134-LR	RED T-1 3/4 LED, X	LD2
QD-000134-LX	RED/GREEN T-1 3/4,	LD1
QD-0003.9-ZT	3.9V TESTED ZENER	Z4
QD-0004.7-ZT	4.7V TESTED ZENER	Z1
QD-0007.5-ZT	7.5V TESTED ZENER	Z5
QD-001340-LR	RED T-1 3/4 LED, U	LD3
QD-004004-DX	1N4004 DIODE	D1,2,7
		D8,9,10
QD-004744-ZA	1N4744A 15 VOLT ZE	Z2,3
QD-004753-ZT	1N4753, 36 VOLT ZE	Z6
QD-004934-DX	1N4934 DIODE	D5,6
QD-005402-DX	1N5402 DIODE	D3,4
QD-008599-TX	MPS 8599 TRANSISTO	Q19,20
QD-1.5200-BX	1.5A 200 VOLT BRID	B1,2
RE-.04705-FW	.47 OHM, 3 WATT, W	R33-R48
RE-.56005-EM	5.6 OHM, 2 WATT ME	R26
RE-.68005-DM	6.8 OHM, 1 WATT, M	R12,13
RE-000009-PT	90 C PTC RESISTOR	PTC
RE-000050-NR	SC-50 NTC RESISTOR	R54
RE-000140-NR	SG-140 NTC RESISTO	2
RE-001005-EM	10 OHM, 2 WATT, ME	R27,28
RE-002205-DM	22 OHM, 1 WATT, ME	R16,17
RE-015005-BC	150 OHM, 1/4 WATT,	R25
RE-033201-BM	332 OHM, 1/4 WATT,	R7
RE-045010-HW	450 OHM, 5 WATT, W	R31,49
RE-110005-BC	1K OHM, 1/4 WATT,	R5,14,15
RE-115005-BC	1.5K OHM, 1/4 WATT	R11,R24
RE-127005-BC	2.7K OHM, 1/4 WATT	R10
RE-135005-HW	3.5K OHM, 5 WATT W	R52,53
RE-147005-BC	4.7K OHM, 1/4 WATT	R6
RE-210001-BM	10.0K OHM, 1/4W.,	R1-R4
RE-210005-EM	10K OHM, 2 WATT, M	R29,30
RE-216501-CM	16.5K, 1/2 WATT, M	R51
RE-221001-CM	21K OHM, 1/2 WATT,	R9
RE-247005-CC	47K OHM, 1/2 WATT,	R21
RE-275001-BM	75K OHM, 1/4 WATT,	R8
RE-310005-BC	100K OHM, 1/4 WATT	R22,23
RE-333005-BC	330K OHM, 1/4 WATT	R19,20
SC-060060-PP	#6-32 X 3/8" P/P Z	Q1,2
SC-061041-SP	#6-32X1/4" "A" P/P	CUT-IN &
		PTC
SC-062050-PP	#6 X 5/16" "B" P/P	Q3-Q18
SW-000055-TS	55C THERMAL CUT-IN	CUT-IN
WC-0.6022-JW	.6" JUMPER, WHITE,	J4
WC-001102-SQ	INSUL. SLEEVE QSC	PTC
WC-001103-SQ	INSUL SLEEVE 1103,	CUT-IN
WC-1.2518-JW	1.25" JUMPER, WHIT	J2,3
WC-2.5018-JW	2.5" JUMPER, WHT,	J1
XF-200014-CR	2UH, 14 GA, COIL/V	L1

USA 1300 Chassis Assembly

Part Number	Description	Reference
CH-140210-BX	1400 KNOB FABRICATION	
CH-170100-00	FACEPLATE PANEL SA650	
CH-170101-00	CHASSIS FABRICATION SA650	
CH-170205-AX	1700 FAN SHROUD	
CO-000001-DB	DUAL BINDING POST	
LB-000010-00	LABEL, SERIAL NO. SLC GENERIC	
LB-001403-00	LABEL, LOGO FACEPLATE USA	
LB-001702-00	LBL, FACEPLATE LOWER USA 1300	
LB-001703-00	LBL, FACEPLATE UPPER USA 1300	
LB-100000-CT	CHASSIS CONTROL TAG	
LB-100007-PC	PRODUCTION CONTROL LABEL LARGE	
LB-140101-00	LABEL INPUT SLC	
LB-140102-00	LABEL OUTPUT SLC	
NW-060400-HN	#6-32 X 1/4" HEX NUT	
NW-380801-IL	3/8" INTERNAL TOOTH LOCKWASHER	
NW-380803-HN	3/8" DRESS NUT	
NW-381023-F	3/8" DRESS WASHER	
PL-000003-CP	AC CORD PROTECTOR	
PL-000008-SR	HEYCO SR-7P-2 STR. RELIEF 14/3	
PL-000011-TW	TIE WRAP, LONG	
PL-000012-SB	BUSHING, 0.625" OD, 0.50" ID	
PL-003.65-TW	TIE WRAP, SMALL	
SC-060041-PP	6-32 X 1/4" TYPE I PH PAN, BLK	
SC-060081-PP	#6-32 X 1/2" P/P BLACK	
SC-061041-SP	#6-32X1/4" "A" P/P W/SCRAPING	
SC-063061-PP	#6-32 X 3/8" "F" P/P BLACK	
SC-081101-SP	#8-18,AB,5/8,TYPE 1 (PHIL) PH	
SC-100061-PS	#10-32 X 3/8" P/P SEMS BLACK	

USA 1300 Chassis Assembly (cont.)

SW-000008-CB	8A CIRCUIT BREAKER-THERMAL
SW-000015-CB	15A. CIRCUIT BREAKER
SW-000016-SW	SPST SNAP IN POWER SWITCH
WC-001038-BX	1038 AC CORD, 88", BLACK
WC-001043-TQ	WIRE 1043, 8", RED
WC-001044-TQ	WIRE 1044, 8", WHITE
WC-001045-TQ	WIRE 1045, 8", BLACK
WC-001048-TQ	WIRE 1048, 4", BLACK
WP-170001-CP	SOB-1700 FAN ASSEMBLY
WP-170002-CP	OBS-1700 INPUT JUMP.(R/Y) ASSY
WP-170003-CP	OBS-1700 INPUT JUMP. (W/B)ASSY
WP-170004-CP	OBS-1700 XFMR ASSY

USA 850 Main Board Assembly

Part Number	Description	Reference
CA-068100-BD	68PF,100V,10%,DISK	C2A,B
CA-110100-BM	100PF,100V,5%,MICA	C1ab,6ab
CA-222100-BP	.0022UF,100V,10%,MYLAR	C11ab
CA-222200-BP	.0022UF,200V,10%,MYLAR	C4ab,12ab
CA-233100-BP	.0033UF,100V,10%,MYLAR	C8ab,9ab
CA-310100-BP	.01UF,100V,10%,MYLAR	C7ab
CA-368100-BP	.068UF,100V,10%,MYLAR	C3ab,5ab
CA-368250-AS	.068UF,250V,SURGE CAP.	C10
CA-547016-BN	4.7UF, 16V, RADIAL, NON-POLAR	E1ab
CA-547160-BE	4.7UF, 160V, ELEC, RADIAL, 10%	E8
CA-647050-BE	47UF, 50V, ELEC., RADIAL, 10%	E9
CA-710035-BE	100UF, 35V, ELEC., RADIAL, 10%	E2ab,3ab
CA-822100-BE	22OOUF, 100V, ELEC, RADIAL,10%	E4ab,5ab, E6ab,7ab
CH-140208-LX	1200/1400/1700 HEATSINK, FAB.	
CO-000008-IC	8 PIN IC SOCKET	IC1ab
CO-350432-AP	.084" PIN 9 CONTACT PCB HEADER	P1
HW-000001-FC	FUSE CLIPS	F1ab
HW-060100-PS	#6-32 X 10 PEM STUD	
HW-060405-SP	#6 X 1/4" X 5/32" RND. SPACER	
HW-060600-SO	1/4"X1/4" MALE/FEMALE 6-32	
IC-005532-OP	5532 OP-AMP	IC1ab
LB-100002-EG	EXPORT GROUND LABEL	
LB-100007-PC	PRODUCTION CONTROL LABEL LARGE	
MS-000048-HS	HEAT SINK, ISOL TO-220	REF:Q1A,B, REF:Q2A.B
MS-120250-FU	12A 250V, FUSE	F1ab
NW-060500-KP	#6-32 KEPS NUT	
PC-140044-LX	PCB, MAIN BOARD, 1200/1400	
PL-000000-AF	ADHESIVE FEET	
PL-903125-SP	BIVAR 903-125 SPACER	D1ab,2ab, L1ab,R38ab
PL-905156-SP	SPACER, BIVAR 905-156	REF: LD3
PL-905325-SP	BIVAR 905-325 SPACER	LD1ab,2
PL-909235-SP	BIVAR 909-235 SPACER	LD1ab,2
PT-110000-AT	100 OHM TRIMPOT	TR3ab
PT-250000-AT	5K OHM TRIMPOT	TR4ab,5ab
PT-422000-AT	220K OHM, 1/2 WATT, TRIMPOT	TR2ab
QD-000004-TX	MPS-U05 TRANSISTOR, NPN	Q12
QD-000018-QD	2SC3298B DRIVER TRANSISTOR	Q1A,B
QD-000019-QD	2SA1306B DRIVER TRANSISTOR	Q2A,B
QD-000032-QD	MOTOROLA MJ15022 NPN PWR XSTR	Q7AB-10AB
QD-000033-QD	MOTOROLA, MJ15023 PNP PWR XST	Q3AB-6AB
QD-000134-LG	GREEN T-1 3/4 LED, HLMP 3519	LD2
QD-000134-LR	RED T-1 3/4 LED, XC 4655	LD1ab
QD-0003.9-ZT	3.9V TESTED ZENER	Z3ab
QD-0004.7-ZT	4.7V TESTED ZENER	Z4ab
QD-001340-LR	RED T-1 3/4 LED, UTILITY	LD3
QD-004004-DX	1N4004 DIODE	D11ab D4ab-7ab D8,10ab,
QD-004744-ZA	1N4744A 15 VOLT ZENER DIODE	Z1ab,2ab, Z5
QD-004934-DX	1N4934 DIODE	D1ab,2ab
QD-008599-TX	MPS 8599 TRANSISTOR, PNP	Q11
QD-1.5200-BX	1.5A 200 VOLT BRIDGE RECTIFIER	B2ab
QD-400400-BX	40 AMP,400 VOLT, BR. RECTIFIER	B1ab
RE-.02205-FW	.22 OHM, 3WATT, WIREWOUND, 10%	R23ab-30ab
RE-.56005-EM	5.6 OHM, 2 WATT METAL OXIDE 5%	R31ab
RE-.68005-DM	6.8 OHM, 1 WATT, MET. OXIDE 5%	R15ab,16ab
RE-000009-PT	90 C PTC RESISTOR	PTC
RE-000050-NR	SC-50 NTC RESISTOR	R38ab
RE-000140-NR	SG-140 NTC RESISTOR 1400/1500	R37
RE-001005-EM	10 OHM, 2 WATT, METAL OXIDE 5%	R32ab
RE-002205-DM	22 OHM, 1 WATT, METAL OXIDE 5%	R17ab,18ab
RE-015001-BM	150 OHM, 1/4 WATT, MET.FLM 1%	R14ab,36ab
RE-016501-BM	165 OHM, 1/4 WATT, MET.FLM 1%	R5ab
RE-025010-NW	250 OHM, 15 WATT, WIREWND, 10%	R42
RE-045010-HW	450 OHM, 5 WATT, WIREWOUND 10%	R22ab
RE-075001-BM	750 OHM,1/4 WATT, MET.FILM, 1%	R10ab
RE-110005-BC	1K OHM, 1/4 WATT, CARBON, 5%	R12ab,13ab
RE-130005-EM	3K OHM, 2 WATT, MET. OXIDE 5%	R20ab,21ab
RE-147005-BC	4.7K OHM, 1/4 WATT, CARBON, 5%	R11ab
RE-162005-CC	6.2K OHM, 1/2 WATT, CARBON 5%	R19
RE-168005-BC	6.8K OHM, 1/4 WATT, CARBON 5%	R34,41
RE-210001-BM	10.0K OHM, 1/4W., MET. FLM. 1%	R1ab-4ab
RE-210002-CM	10K OHM, 1/2 WATT, MET.FLM 2%	R6ab
RE-210005-EM	10K OHM, 2 WATT, MET. OXIDE 5%	R39
RE-247005-CC	47K OHM, 1/2 WATT, CARBON, 5%	R9ab
RE-247005-DM	47K OHM, 1W, 5% METAL OXIDE	R35 R7AB,8AB,
RE-310005-BC	100K OHM, 1/4 WATT. CARBON 5%	R40
RE-318005-BC	180K OHM, 1/4 WATT, CARBON 5%	R33
SC-061041-SP	#6-32X1/4" "A" P/P W/SCRAPING	PTC,55C
SC-062050-PP	#6 X 5/16" "B" P/P ZINC	
SW-000005-CB	5A. CIRCUIT BREAKER	
SW-000055-TS	55C THERMAL CUT-IN SWITCH	55C
SW-000151-S	SPDT SLIDE SWITCH SW-GP1-151	NORM BR
WC-0.6022-JW	.6" JUMPER, WHITE, 22 GA, SLD	J2,8,9,19
WC-0.9022-JW	.9" JUMPER, WHITE, 22 GA, SLD	J1,3,4,15, J21,22,28, J29,31
WC-001102-SQ	INSUL. SLEEVE QSC 1102,.6",CLR	PTC
WC-001103-SQ	INSUL SLEEVE 1103,.875",CLEAR	REF: 55C

USA 850 Main Board Assembly (cont.)

WC-1.2518-JW	1.25" JUMPER, WHITE 18 GA, SLD	J23
WC-1.5022-JW	1.5" JUMPER, WHITE, 22 GA, SLD	J11,12,16, J17,18,20 J5,6,7,10,
WC-2.5018-JW	2.5" JUMPER, WHT, 18 GA, SLD	J13,14,24, J25-27
XF-200016-CR	2UH,16GA., COIL/VERTICAL	L1ab

USA 850 Chassis Assembly

Part Number	Description	Reference
CH-140100-00	FACEPLATE PANEL SA185/SA425	
CH-140101-00	CHASSIS FAB SA185,SA425	
CH-140210-BX	1400 KNOB FABRICATION	
CO-000001-DB	DUAL BINDING POST	
LB-000010-00	LABEL, SERIAL NO. SLC GENERIC	
LB-001402-00	LABEL, FACEPLATE USA 850	
LB-001403-00	LABEL, LOGO FACEPLATE USA	
LB-100000-CT	CHASSIS CONTROL TAG	
LB-100007-PC	PRODUCTION CONTROL LABEL LARGE	
LB-140101-00	LABEL INPUT SLC	
LB-140102-00	LABEL OUTPUT SLC	
NW-040422-SW	TOSHIBA SHOULDER WASHER	
NW-060400-HN	#6-32 X 1/4" HEX NUT	
NW-380801-IL	3/8" INTERNAL TOOTH LOCKWASHER	
NW-380803-HN	3/8" DRESS NUT	
NW-381023-FW	3/8" DRESS WASHER	
PL-000001-SR	HEYCO 6W-1 STRAIN RELIEF 16/3	
PL-000003-CP	AC CORD PROTECTOR	
PL-000011-TW	TIE WRAP, LONG	
SC-060030-PU	#6-32 X 3/16 P/F UNDERCUT ZINC	
SC-060081-PP	#6-32 X 1/2" P/P BLACK	
SC-062050-PP	#6 X 5/16" "B" P/P ZINC	
SC-081101-SP	#8-18,AB,5/8,TYPE 1 (PHIL) PH	
SC-100061-PS	#10-32 X 3/8" P/P SEMS BLACK	
SW-000010-CB	10A. CIRCUIT BREAKER	
SW-000016-SW	SPST SNAP IN POWER SWITCH	
WC-001001-AX	OBS-QSC WIRE 1001,8.5",BLACK	
WC-001002-AX	OBS-QSC WIRE 1002, 7.5",YELLOW	
WC-001003-AX	OBS-QSC WIRE 1003,7.5", ORANGE	
WC-001004-CX	QSC AC CORD 1004, 72", BLACK	
WC-001005-AX	QSC WIRE 1005, 2.5", BLACK	
WC-001007-AX	QSC WIRE 1007, 2", BLACK	
WC-001015-AX	OBS-QSC WIRE 1015,4.50",BLACK	
WP-140001-CP	SOB-1400 XFMR ASSY (120V)	
WP-140002-CP	SOB-1400 PREPPED FAN ASSY	

USA 370 Main Board Assembly

Part Number	Description	Reference
CA-047100-BD	47PF,100V,10%,DISK	C2AB
CA-110100-BM	100PF,100V,5%,MICA	C1ab,6ab
CA-222100-BP	.0022UF,100V,10%,MYLAR	C11ab
CA-222200-BP	.0022UF,200V,10%,MYLAR	C12ab
CA-233100-BP	.0033UF,100V,10%,MYLAR	C4ab,8ab, C9ab
CA-310100-BP	.01UF,100V,10%,MYLAR	C7ab
CA-368100-BP	.068UF,100V,10%,MYLAR	C3ab,5ab
CA-368250-AS	.068UF,250V,SURGE CAP.	C10
CA-547016-BN	4.7UF, 16V, RADIAL, NON-POLAR	E1ab
CA-547160-BE	4.7UF, 160V, ELEC, RADIAL, 10%	E8
CA-647050-BE	47UF, 50V, ELEC., RADIAL, 10%	E9
CA-710035-BE	100UF, 35V, ELEC., RADIAL, 10%	E2ab,3ab
CA-833080-BE	33OOUF, 80V, ELEC., RADIAL,10%	E4b,5a,7ab
CH-140208-LX	1200/1400/1700 HEATSINK, FAB.	
CO-000008-IC	8 PIN IC SOCKET	IC1ab
CO-350432-AP	.084" PIN 9 CONTACT PCB HEADER	P1
HW-000001-FC	FUSE CLIPS	F1ab
HW-060100-PS	#6-32 X 10 PEM STUD	
HW-060405-SP	#6 X 1/4" X 5/32" RND. SPACER	
HW-060600-SO	1/4"X1/4" MALE/FEMALE 6-32	
IC-005532-OP	5532 OP-AMP	IC1ab
LB-100007-PC	PRODUCTION CONTROL LABEL LARGE	
MS-000048-HS	HEAT SINK, ISOL TO-220	REF:Q1A,B, REF:Q2A,B
MS-070125-FU	7A, 250V, FUSE	F1ab
NW-060500-KP	#6-32 KEPS NUT	
PC-140044-LX	PCB, MAIN BOARD, 1200/1400	
PL-000000-AF	ADHESIVE FEET	
PL-903125-SP	BIVAR 903-125 SPACER	D1A,B, D2A,B, L1A,B, R38A,B
PL-905156-SP	SPACER, BIVAR 905-156	REF: LD3
PL-905325-SP	BIVAR 905-325 SPACER	LD1ab,2
PL-909235-SP	BIVAR 909-235 SPACER	LD1ab,2
PT-110000-AT	100 OHM TRIMPOT	TR3ab
PT-250000-AT	5K OHM TRIMPOT	TR4ab,5ab
PT-422000-AT	220K OHM, 1/2 WATT, TRIMPOT	TR2ab
QD-000004-TX	MPS-U05 TRANSISTOR, NPN	Q12
QD-000018-QD	2SC3298B DRIVER TRANSISTOR	Q1A,B
QD-000019-QD	2SA1306B DRIVER TRANSISTOR	Q2A,B
QD-000032-QD	MOTOROLA MJ15022 NPN PWR XSTR	Q10B
QD-000033-QD	MOTOROLA, MJ15023 PNP PWR XST	Q7A,8B,9A, Q3A,4B,5A, Q6B
QD-000134-LG	GREEN T-1 3/4 LED, HLMP 3519	LD2
QD-000134-LR	RED T-1 3/4 LED, XC 4655	LD1ab
QD-0003.9-ZT	3.9V TESTED ZENER	Z3ab
QD-0004.7-ZT	4.7V TESTED ZENER	Z4ab
QD-001340-LR	RED T-1 3/4 LED, UTILITY	LD3
QD-004004-DX	1N4004 DIODE	D10ab,11ab D4ab-7ab,8
QD-004744-ZA	1N4744A 15 VOLT ZENER DIODE	Z1ab,2ab,5
QD-004934-DX	1N4934 DIODE	D1ab,2ab
QD-008599-TX	MPS 8599 TRANSISTOR, PNP	Q11
QD-1.5200-BX	1.5A 200 VOLT BRIDGE RECTIFIER	B2ab
QD-400400-BX	40 AMP,400 VOLT, BR. RECTIFIER	B1ab
RE-.02205-FW	.22 OHM, 3WATT, WIREWOUND, 10%	R23a,24b,

USA 370 Main Board Assembly (cont.)

		R25a,26b,
		R27a,28b,
		R29a,30b
RE-.56005-EM	5.6 OHM, 2 WATT METAL OXIDE 5%	R31ab
RE-.68005-DM	6.8 OHM, 1 WATT, MET. OXIDE 5%	R15ab,16ab
RE-000009-PT	90 C PTC RESISTOR	PTC
RE-000050-NR	SC-50 NTC RESISTOR	R38ab
RE-001005-EM	10 OHM, 2 WATT, METAL OXIDE 5%	R32ab
RE-002205-DM	22 OHM, 1 WATT, METAL OXIDE 5%	R17ab,18ab
RE-015001-BM	150 OHM, 1/4 WATT, MET.FLM 1%	R14ab,36ab
RE-023701-BM	237 OHM, 1/4 WATT, MET. FLM 1%	R5ab
RE-030005-HW	300 OHM, 5 WATT, WIREWOUND 10%	R22ab
RE-075001-BM	750 OHM,1/4 WATT, MET.FILM, 1%	R10ab
RE-110005-BC	1K OHM, 1/4 WATT, CARBON, 5%	R12ab,13ab
RE-120005-EM	2K OHM, 2 WATT, MET.OXIDE 5%	R20ab,21ab
RE-147005-BC	4.7K OHM, 1/4 WATT, CARBON, 5%	R11ab
RE-162005-CC	6.2K OHM, 1/2 WATT, CARBON 5%	R19
RE-168005-BC	6.8K OHM, 1/4 WATT, CARBON 5%	R34,41
RE-210001-BM	10.0K OHM, 1/4W., MET. FLM. 1%	R1ab,2ab,
		R3ab,4ab
RE-210002-CM	10K OHM, 1/2 WATT, MET.FLM 2%	R6ab
RE-210005-EM	10K OHM, 2 WATT, MET. OXIDE 5%	R39
RE-247005-CC	47K OHM, 1/2 WATT, CARBON, 5%	R9ab
RE-247005-DM	47K OHM, 1W, 5% METAL OXIDE	
RE-310005-BC	100K OHM, 1/4 WATT. CARBON 5%	R40
RE-315005-BC	150K OHM, 1/4 WATT, CARBON 5%	R33
SC-061041-SP	#6-32X1/4" "A" P/P W/SCRAPING	PTC
SC-062050-PP	#6 X 5/16" "B" P/P ZINC	
SW-000151-SW	SPDT SLIDE SWITCH SW-GP1-151	NORM BRDGE
WC-0.3022-JW	.3" JUMPER, WHITE, 22 GA SLD	R37
WC-0.6022-JW	.6" JUMPER, WHITE, 22 GA, SLD	J2,8,9,19
WC-0.9022-JW	.9" JUMPER, WHITE, 22 GA, SLD	J1,3,4,15,
		J21,22,28,
		J29,31
WC-001102-SQ	INSUL. SLEEVE QSC 1102,.6",CLR	PTC
WC-1.2518-JW	1.25" JUMPER, WHITE 18 GA, SLD	J23
WC-1.5022-JW	1.5" JUMPER, WHITE, 22 GA, SLD	J11,12,16,
		J17,18,20
		J5,6,7,10,
WC-2.5018-JW	2.5" JUMPER, WHT, 18 GA, SLD	J13,14,
		J23-27
XF-200016-CR	2UH,16GA., COIL/VERTICAL	L1ab

USA 370 Chassis Assembly

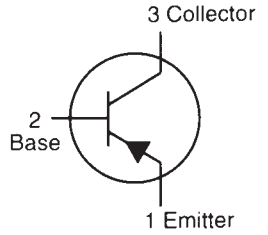
Part Number	Description	Reference
CH-140100-00	FACEPLATE PANEL SA185/SA425	
CH-140101-00	CHASSIS FAB SA185,SA425	
CH-140210-BX	1400 KNOB FABRICATION	
CO-000001-DB	DUAL BINDING POST	
LB-000010-00	LABEL, SERIAL NO. SLC GENERIC	
LB-001202-00	LABEL, FACEPLATE USA 370	
LB-100000-CT	CHASSIS CONTROL TAG	
LB-100007-PC	PRODUCTION CONTROL LABEL LARGE	
LB-140101-00	LABEL INPUT SLC	
LB-140102-00	LABEL OUTPUT SLC	
NW-040422-S	TOSHIBA SHOULDER WASHER	
NW-060400-HN	#6-32 X 1/4" HEX NUT	
NW-100600-KP	#10-32 KEPS NUT	
NW-380801-IL	3/8" INTERNAL TOOTH LOCKWASHER	
NW-380803-HN	3/8" DRESS NUT	
NW-381023-F	3/8" DRESS WASHER	
PL-000001-SR	HEYCO 6W-1 STRAIN RELIEF 16/3	
PL-000003-CP	AC CORD PROTECTOR	
PL-000011-TW	TIE WRAP, LONG	
PL-003.65-TW	TIE WRAP, SMALL	
SC-060030-PU	#6-32 X 3/16 P/F UNDERCUT ZINC	
SC-060081-PP	#6-32 X 1/2" P/P BLACK	
SC-062050-PP	#6 X 5/16" "B" P/P ZINC	
SC-081101-SP	#8-18,AB,5/8,TYPE 1 (PHIL) PH	
SC-100121-PS	#10-32 X 3/4" P/P SEMS BLACK	
SW-000003-CB	3A CIRCUIT BREAKER-THERMAL	
SW-000005-CB	5A. CIRCUIT BREAKER	
SW-000016-S	SPST SNAP IN POWER SWITCH	
WC-001001-AX	OBS-QSC WIRE 1001,8.5",BLACK	
WC-001002-AX	OBS-QSC WIRE 1002, 7.5",YELLOW	
WC-001003-AX	OBS-QSC WIRE 1003,7.5", ORANGE	
WC-001005-AX	QSC WIRE 1005, 2.5", BLACK	
WC-001007-AX	QSC WIRE 1007, 2", BLACK	
WC-001015-AX	OBS-QSC WIRE 1015,4.50",BLACK	
WC-003050-AX	PWR CORD 100/120VAC	
WP-120001-CP	SOB-1200 XFMR ASSY (120V)	

USA Series Input Jack Panel

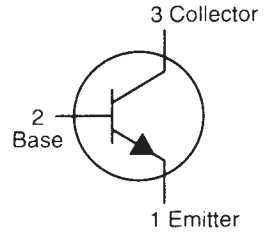
Part Number	Description	Reference
CO-000005-BS	5 POSITION BARRIER STRIP	
CO-300112-PJ	.25" PHONE JACK PC MOUNT	
CO-640385-AH	16 PIN .156/C RT ANGLE HEADER	
HW-060040-PS	#6-32 X 4 PEM STUD	
HW-060120-SO	STANDOFF,1/4" HEX AL 6-32X3/4"	
PC-140045-FX	USA SERIES JACKPLANE PCB	
PT-320300-CR	GAIN POT 20K 20% 0.2W	
RE-147005-BC	RES CF 4.7K 5% 1/4W	
WC-0.3022-JW	.3" JUMPER, WHITE, 22 GA SLD	

Semiconductors

MPS8598
MPS8599
PNP



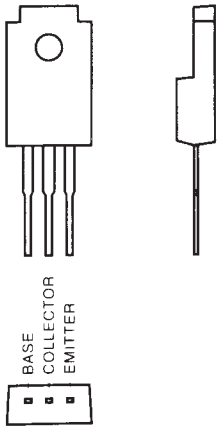
2N4409
2N4410
NPN



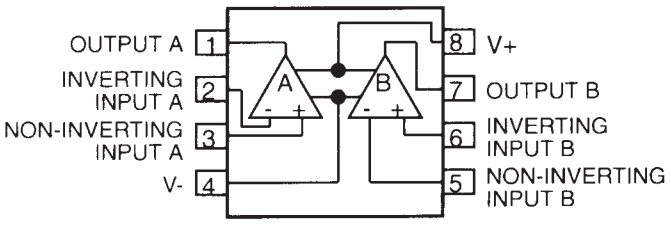
SMALL SIGNAL
TRANSISTORS

DRIVER TRANSISTORS

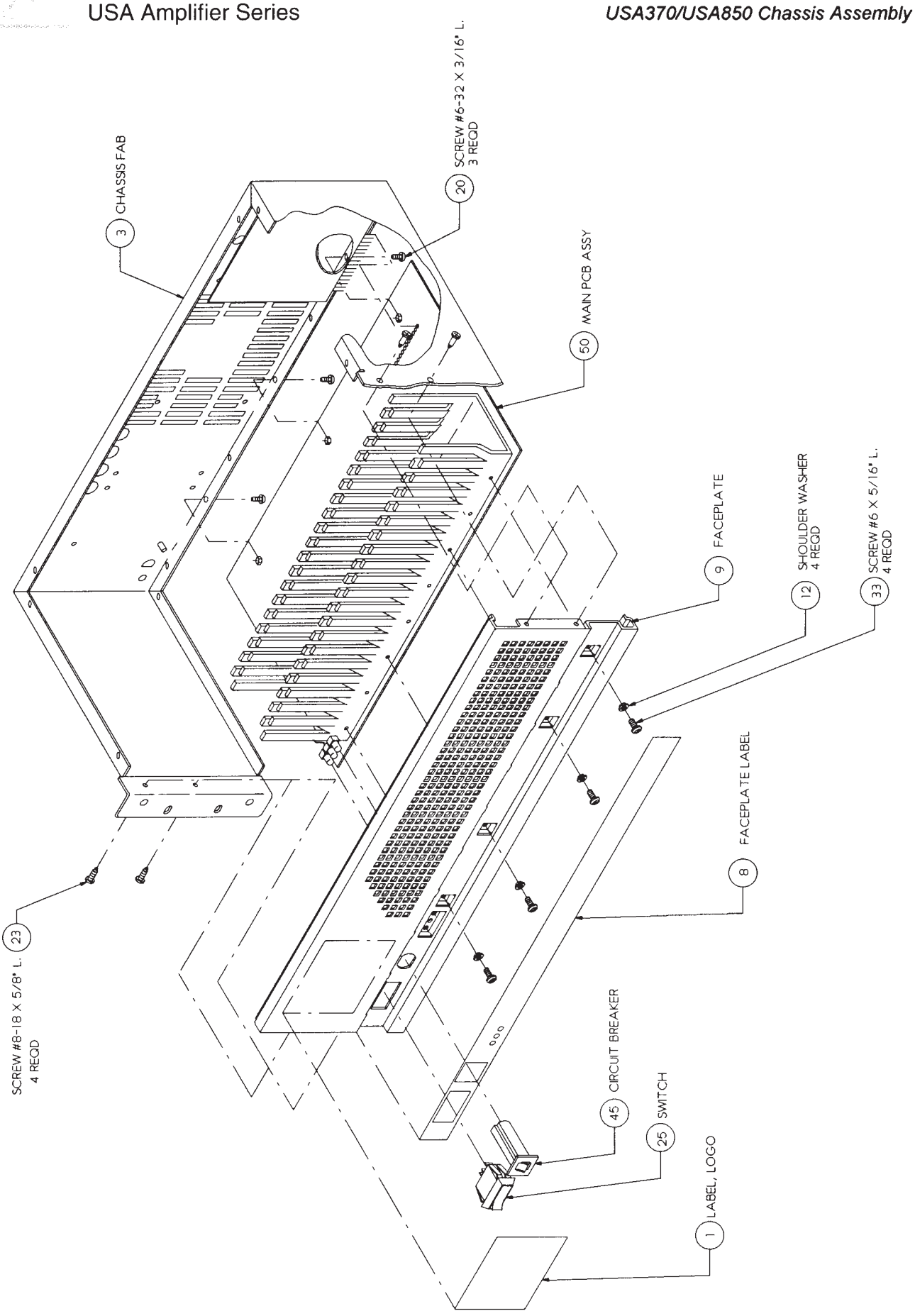
2SA1306 PNP
2SC3298 NPN

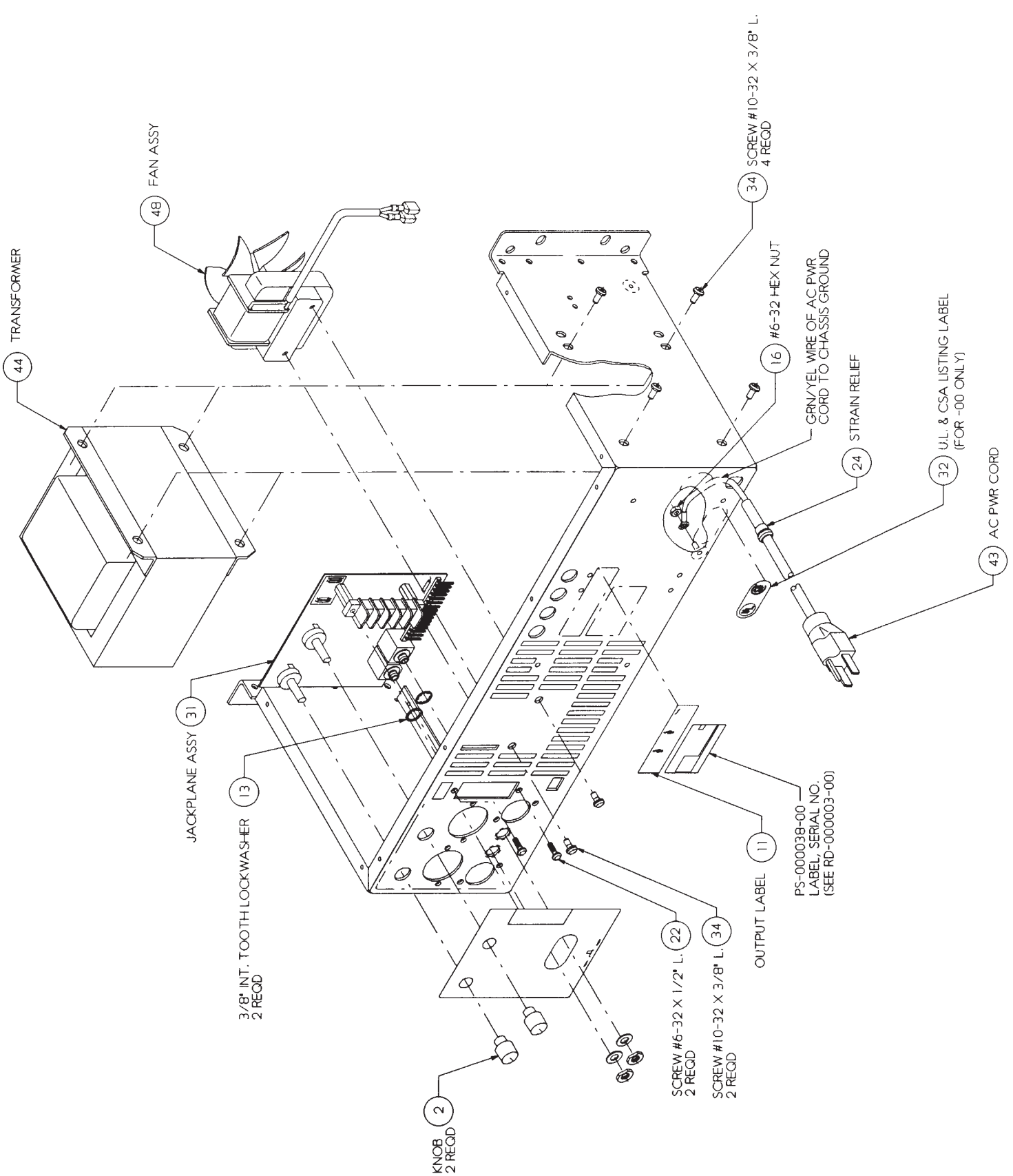


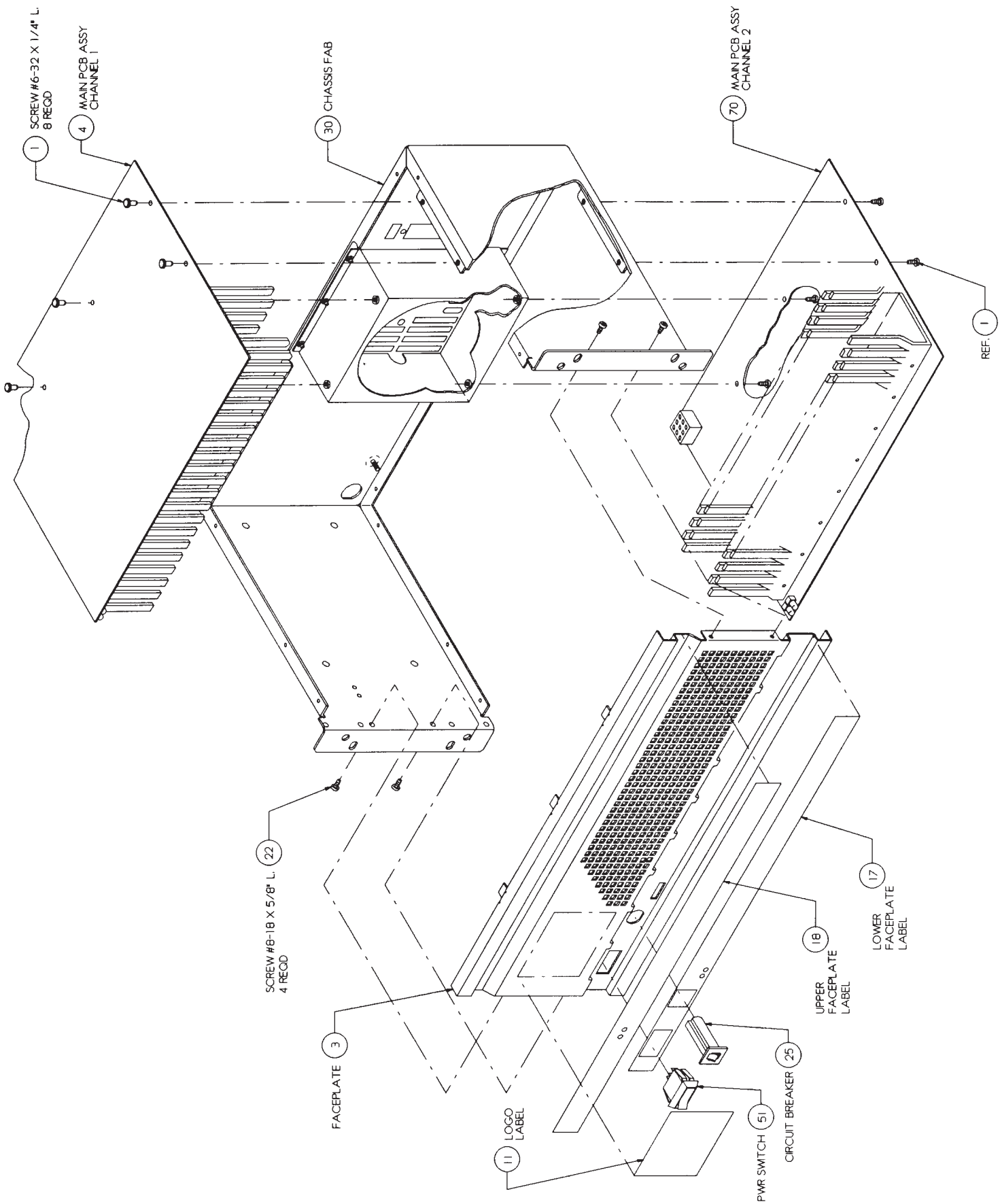
NE5532AN OP AMP

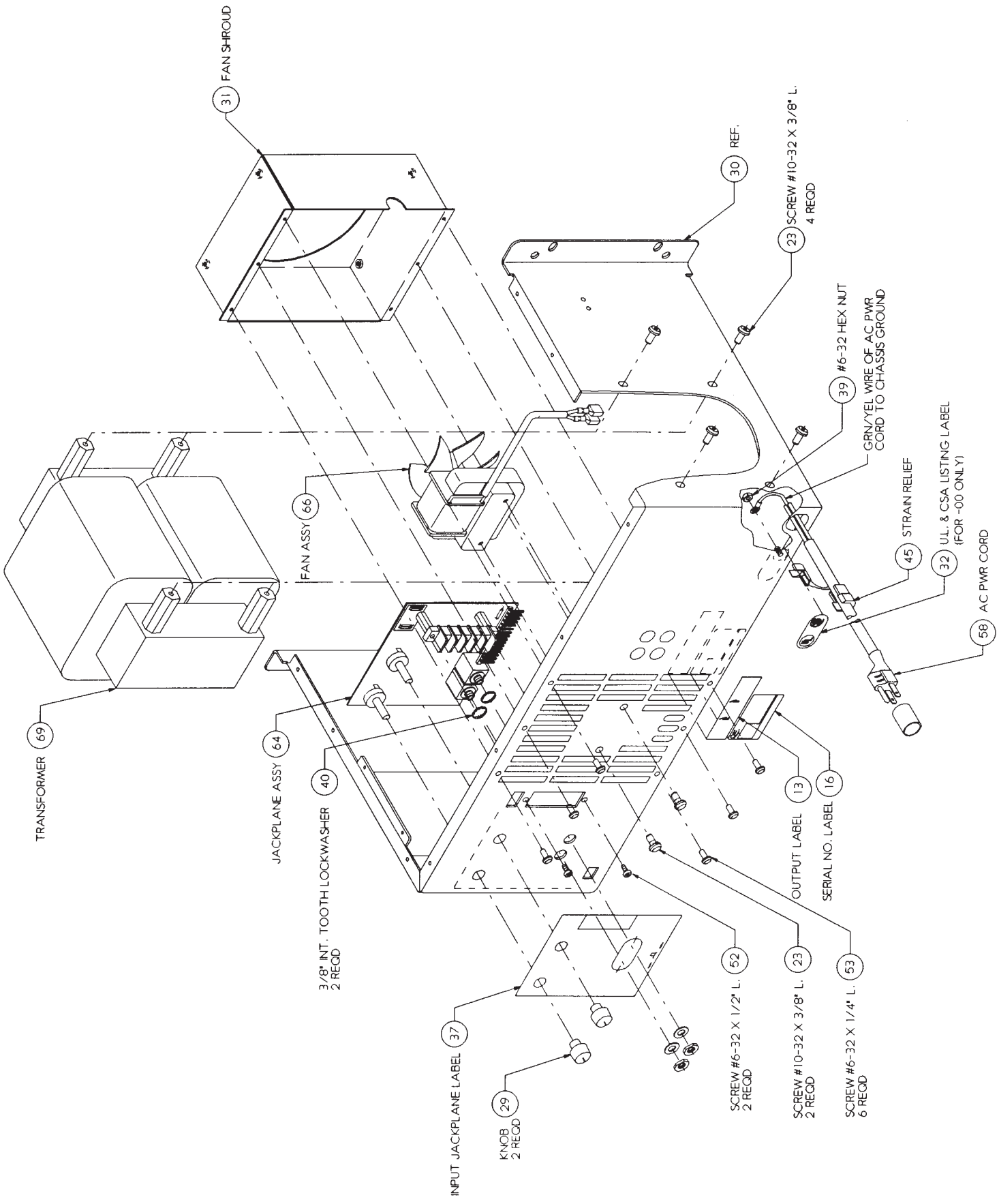


Top View


3 CHASSIS FAB
20 SCREW #6-32 X 3/16" L. 3 REQD
50 MAIN PCB ASSY
9 FACEPLATE
12 SHOULDER WASHER 4 REQD
33 SCREW #6 X 5/16" L. 4 REQD
8 FACEPLATE LABEL
23 SCREW #8-18 X 5/8" L. 4 REQD
45 CIRCUIT BREAKER
25 SWITCH
1 LABEL, LOGO

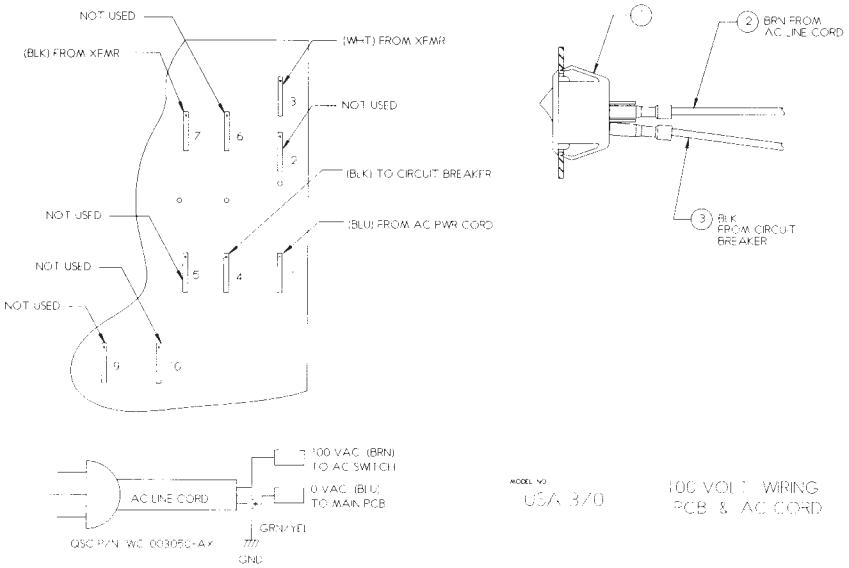

(44) TRANSFORMER
(48) FAN ASSY
(34) SCREW #10-32 X 3/8" L. 4 REQD
(16) #6-32 HEX NUT
GRN/YEL WIRE OF AC PWR CORD TO CHASSIS GROUND
(24) STRAIN RELIEF
(32) U.L. & CSA LISTING LABEL (FOR -00 ONLY)
(43) AC PWR CORD
(31) JACKPLANE ASSY
(13) 3/8" INT. TOOTH LOCKWASHER 2 REQD
(11) OUTPUT LABEL
PS-000038-00 LABEL, SERIAL NO. (SEE RD-000003-00)
(22) SCREW #6-32 X 1/2" L. 2 REQD
(34) SCREW #10-32 X 3/8" L. 2 REQD
(2) KNOB 2 REQD


1 SCREW #6-32 X 1/4" L. 8 REQD
4 MAIN PCB ASSY CHANNEL 1
30 CHASSIS FAB
70 MAIN PCB ASSY CHANNEL 2
1 REF.
22 SCREW #8-18 X 5/8" L. 4 REQD
3 FACEPLATE
11 LOGO LABEL
51 PWR SWITCH
25 CIRCUIT BREAKER
18 UPPER FACEPLATE LABEL
17 LOWER FACEPLATE LABEL


31 FAN SHROUD
30 REF.
23 SCREW #10-32 X 3/8" L. 4 REQD
39 #6-32 HEX NUT
GRN/YEL WIRE OF AC PWR CORD TO CHASSIS GROUND
45 STRAIN RELIEF
32 U.L. & CSA LISTING LABEL (FOR -00 ONLY)
58 AC PWR CORD
66 FAN ASSY
69 TRANSFORMER
64 JACKPLANE ASSY
40 3/8" INT. TOOTH LOCKWASHER 2 REQD
13 OUTPUT LABEL
16 SERIAL NO. LABEL
37 INPUT JACKPLANE LABEL
29 KNOB 2 REQD
52 SCREW #6-32 X 1/2" L. 2 REQD
23 SCREW #10-32 X 3/8" L. 2 REQD
53 SCREW #6-32 X 1/4" L. 6 REQD

100 VOLT

WP-120044-1D

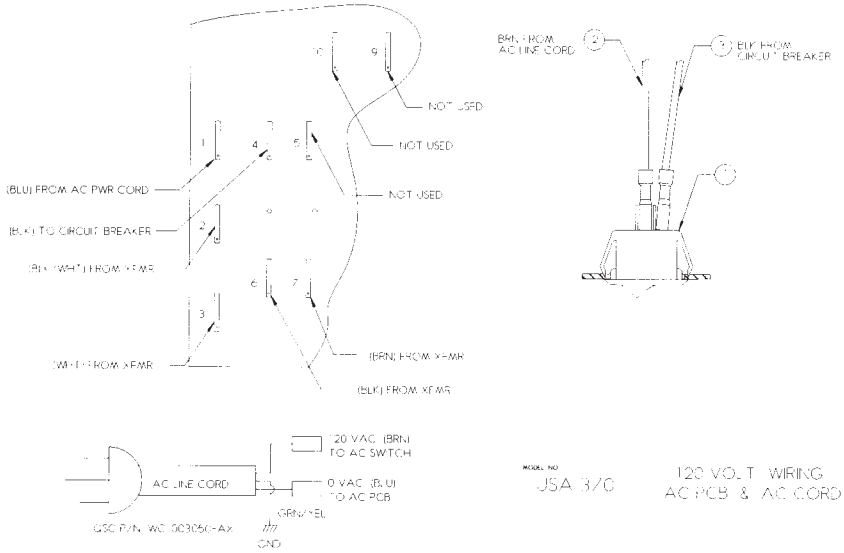


MODEL NO
USA 370

100 VOLT WIRING
PCB & AC CORD

120 VOLT

WP-120044-1D

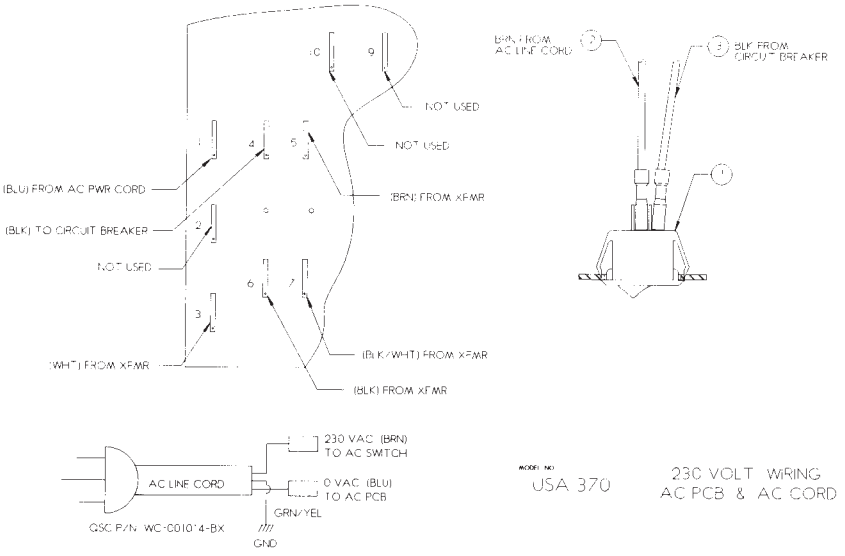


MODEL NO
USA 370

120 VOLT WIRING
AC PCB & AC CORD

230 VOLT

WP-120044-1E

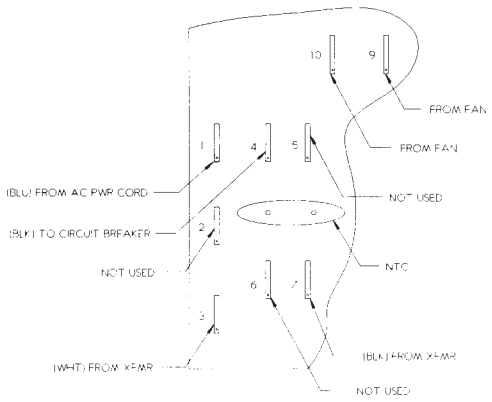


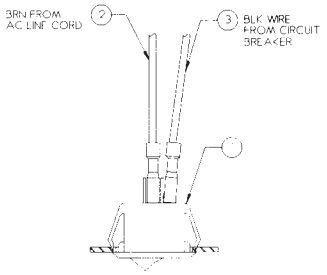
MODEL NO
USA 370

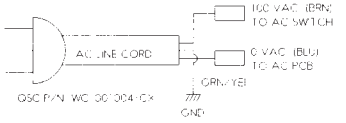
230 VOLT WIRING
AC PCB & AC CORD

100 VOLT

WP-140044-TJ





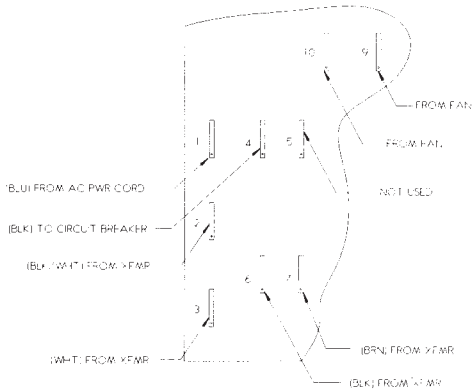


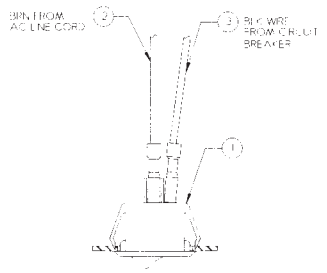
MODEL NO.
USA 850

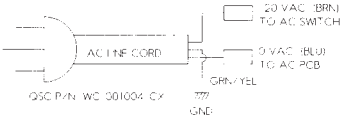
100 VOLT WIRING
AC PCB & AC CORD

120 VOLT

WP-140044-TD





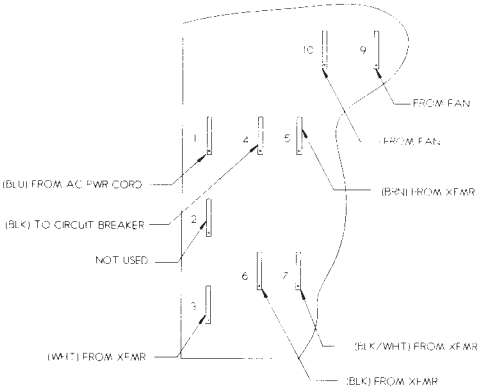


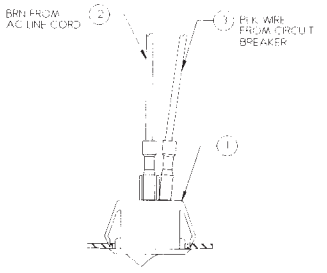
MODEL NO.
USA 850

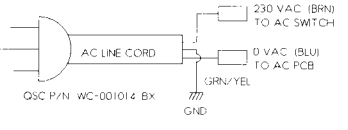
120 VOLT WIRING
AC PCB & AC CORD

230 VOLT

WP-140044-TE





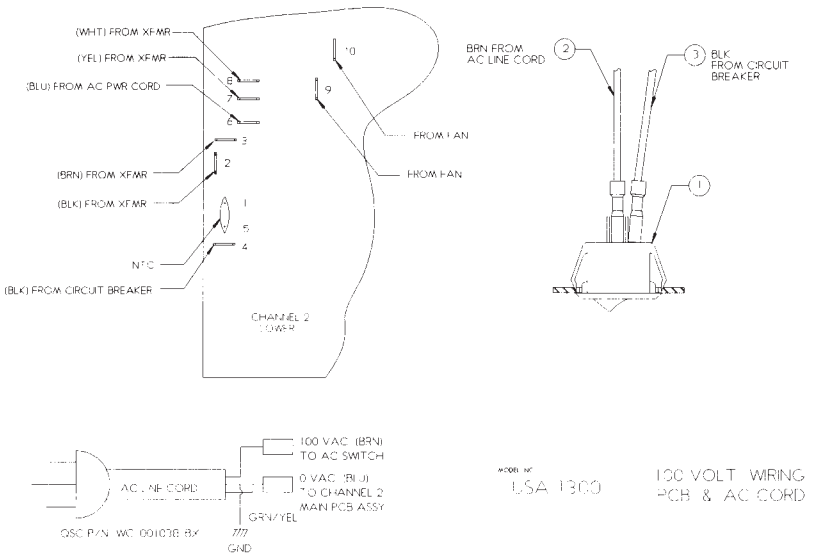


MODEL NO.
USA 850

230 VOLT WIRING
AC PCB & AC CORD

100 VOLT

WP-170054-TJ

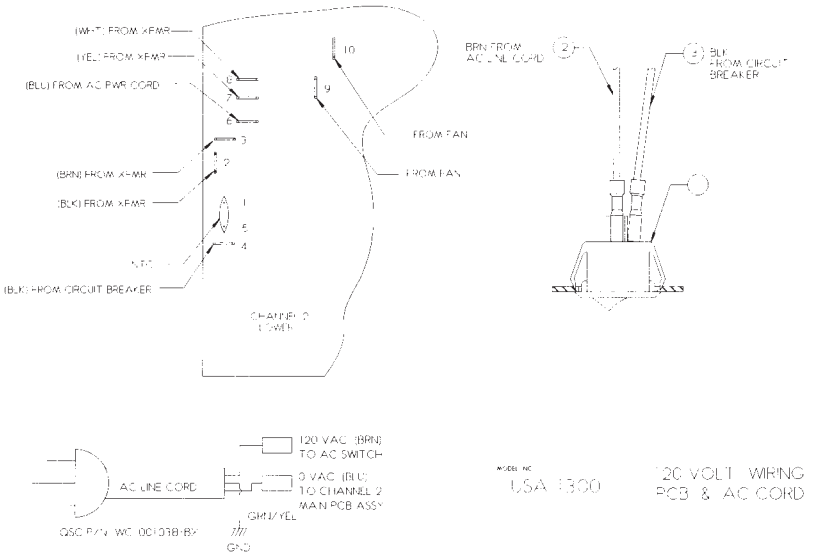


MODEL NO. USA 1300

100 VOLT WIRING PCB & AC CORD

120 VOLT

WP-170054-TD

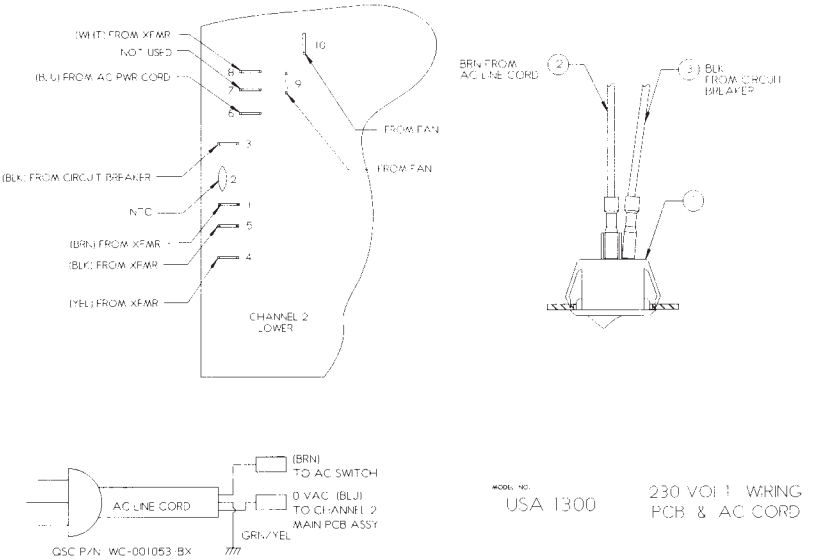


MODEL NO. USA 1300

120 VOLT WIRING PCB & AC CORD

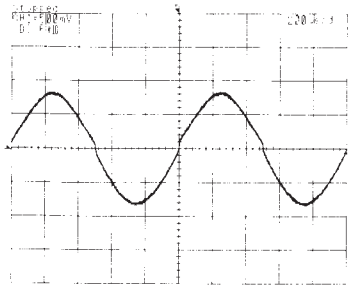
230 VOLT

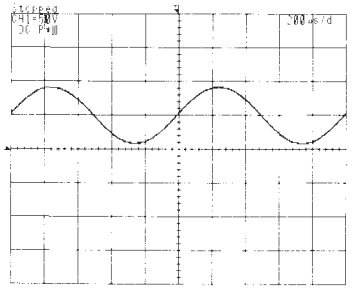
WP-170054-TE

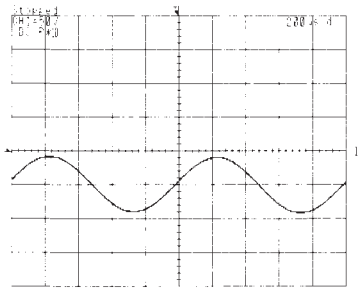


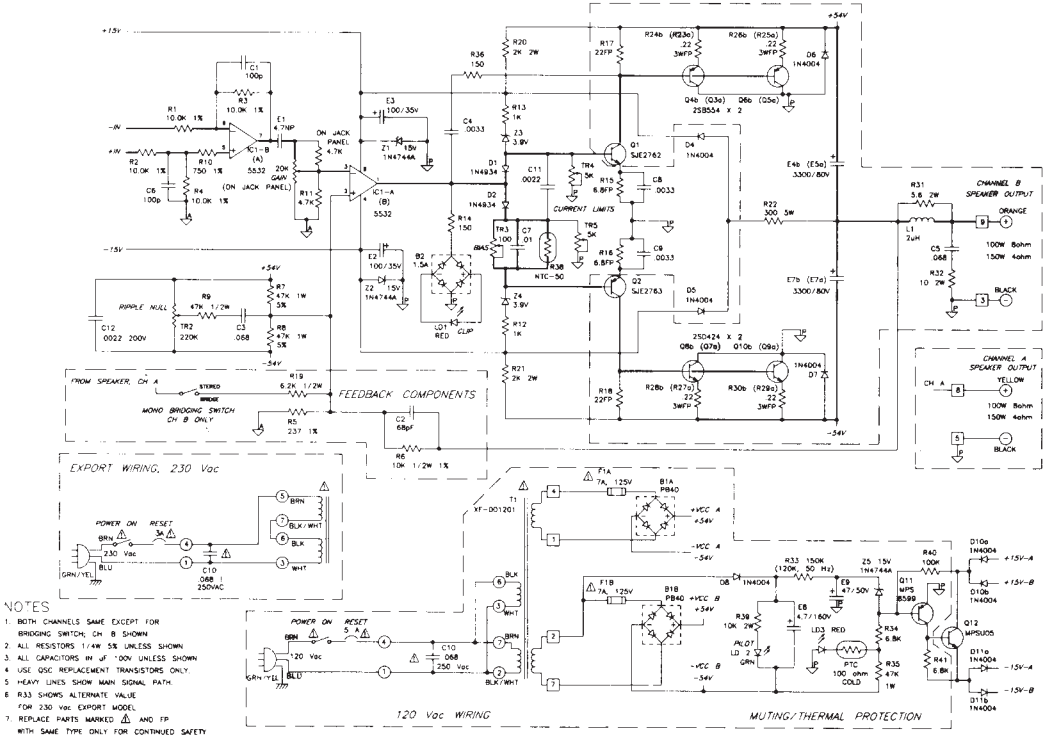
MODEL NO. USA 1300

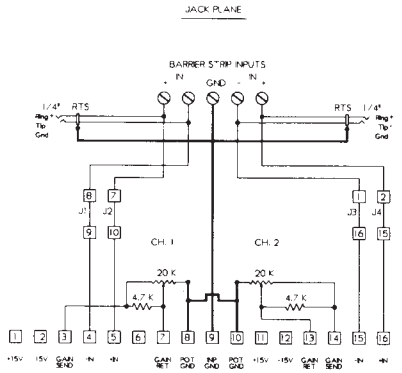
230 VOLT WIRING PCB & AC CORD







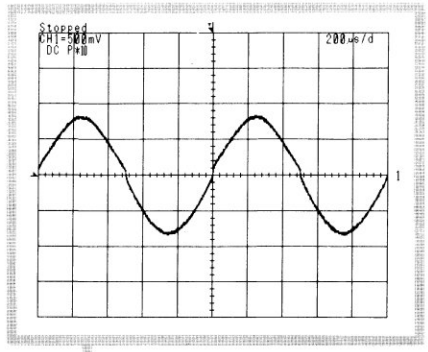


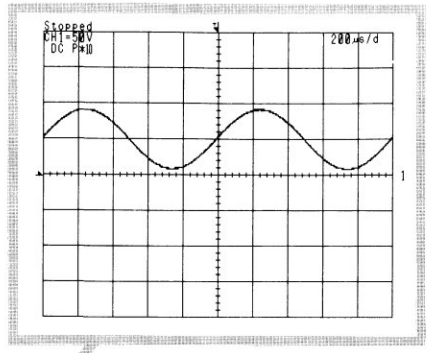


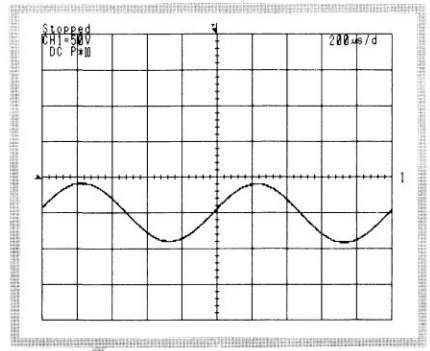
NOTES

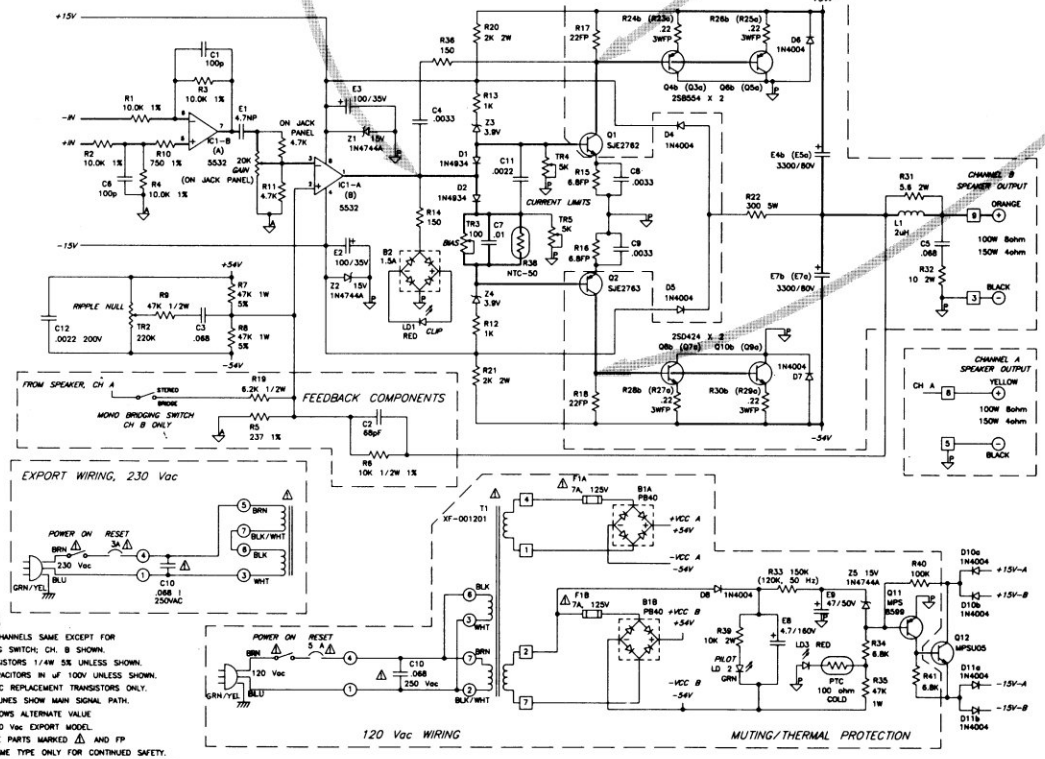
1. BOTH CHANNELS SAME EXCEPT FOR BRIDGING SWITCH; CH B SHOWN
2. ALL RESISTORS 1/4W 5% UNLESS SHOWN
3. ALL CAPACITORS IN µF 100V UNLESS SHOWN
4. USE QSC REPLACEMENT TRANSISTORS ONLY.
5. HEAVY LINES SHOW MAIN SIGNAL PATH.
6. R33 SHOWS ALTERNATE VALUE FOR 230 Vac EXPORT MODEL
7. REPLACE PARTS MARKED ⚠ AND FP WITH SAME TYPE ONLY FOR CONTINUED SAFETY
8. ALL RESISTORS MARKED "FP" ARE OF FLAMEPROOF CONSTRUCTION AND MINIMUM OF 1/2W.
9. CHANNEL "B" SHOWN, CHANNEL "A" IN PARENTHESES. (I.E. IC1-A PINOUTS 1,2,3 BECOME 7,6,5 ON CHANNEL A AND IC1-B PINOUTS 7,6,5 BECOME 1,2,3 ON CHANNEL A).

LAST USED	NOT USED
B2	
C12	
D11	D3, 9
E9	E4a, 5b, 6a, 6b
F1	
IC1	
LD3	
Q12	Q3a, 4a, 5b, 6a, 7b, 8a, 9b, 10a
R41	R23b, 24a, 25a, 26a, 27b, 28a, 29b, 30a, 37
TR5	TR1
Z5	





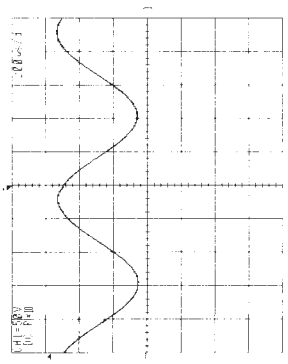


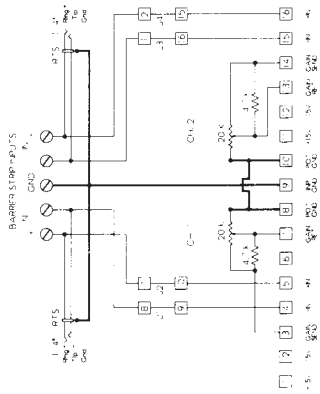


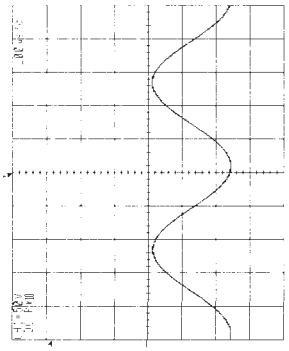
NOTES

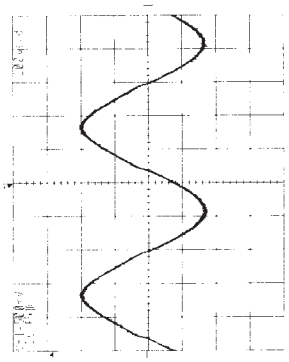
1. BOTH CHANNELS SAME EXCEPT FOR BRIDGING SWITCH; CH. B SHOWN.
2. ALL RESISTORS 1/4W 5% UNLESS SHOWN.
3. ALL CAPACITORS IN uF 100V UNLESS SHOWN.
4. USE QSC REPLACEMENT TRANSISTORS ONLY.
5. HEAVY LINES SHOW MAIN SIGNAL PATH.
6. R33 SHOWS ALTERNATE VALUE FOR 230 Vac EXPORT MODEL.
7. REPLACE PARTS MARKED ⚠ AND FP WITH SAME TYPE ONLY FOR CONTINUED SAFETY.
8. ALL RESISTORS MARKED "FP" ARE OF FLAMEPROOF CONSTRUCTION AND MINIMUM OF 1/2W.
9. CHANNEL "B" SHOWN, CHANNEL "A" IN PARENTHESES. (I.E. IC1-A PINOUTS 1,2,3 BECOME 7,6,5 ON CHANNEL A AND IC1-B PINOUTS 7,6,5 BECOME 1,2,3 ON CHANNEL A).

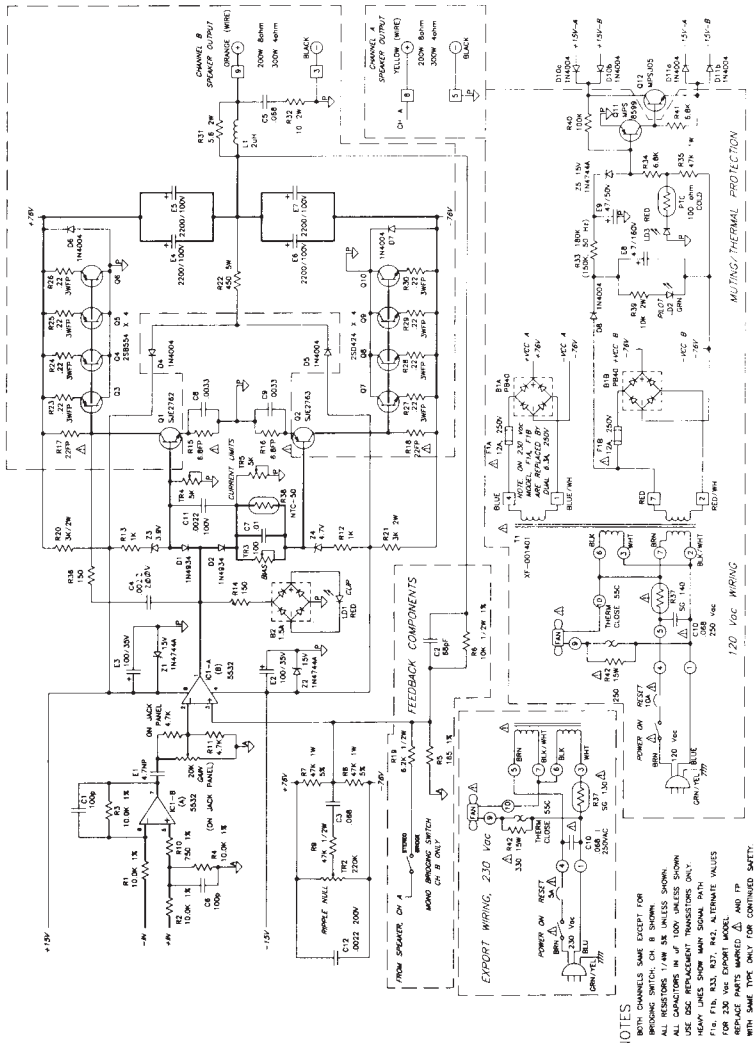
LAST USED	NOT USED
B2	
C12	
D11	D3, 9
E9	E4a, 5b, 6a, 6b
F1	
IC1	
LD3	
Q12	Q3b, 4a, 5b, 8a, 7b, 8a, 9b, 10a
R41	R22a, 24a, 25b, 26a, 27b, 28a, 29b, 30a, 37
TR5	TR1
Z5	

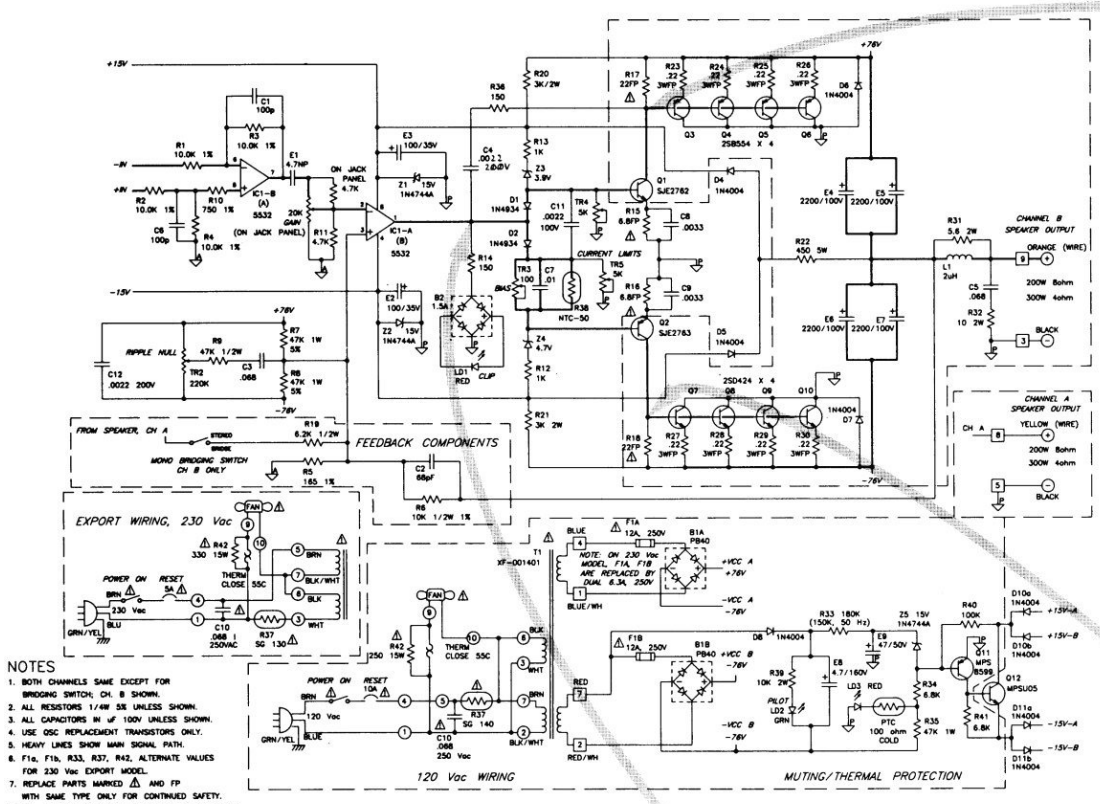








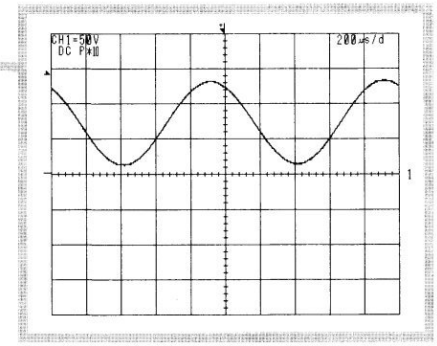


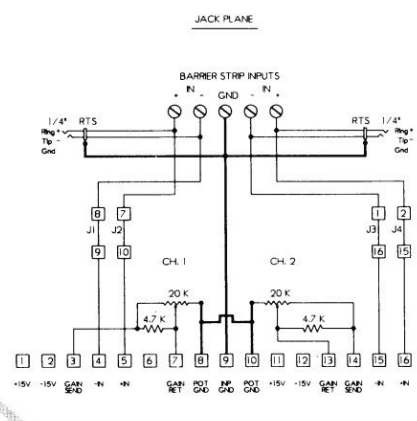


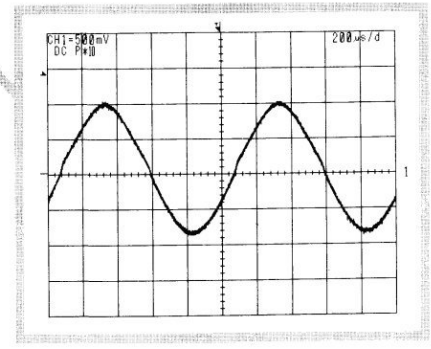
NOTES

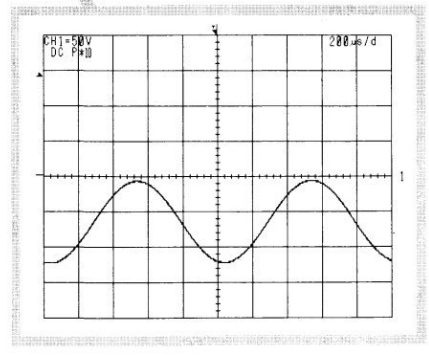
1. BOTH CHANNELS SAME EXCEPT FOR BRIDGING SWITCH; CH. B SHOWN.
2. ALL RESISTORS 1/4W 5% UNLESS SHOWN.
3. ALL CAPACITORS IN uF 100V UNLESS SHOWN.
4. USE QSC REPLACEMENT TRANSISTORS ONLY.
5. HEAVY LINES SHOW MAIN SIGNAL PATH.
6. F1a, F1b, R33, R37, R42, ALTERNATE VALUES FOR 230 Vac EXPORT MODEL.
7. REPLACE PARTS MARKED ⚠ AND FP WITH SAME TYPE ONLY FOR CONTINUED SAFETY.
8. ALL RESISTORS MARKED "FP" ARE OF FLAMEPROOF CONSTRUCTION AND MINIMUM OF 1/2 WATT.
9. CHANNEL "B" SHOWN, CHANNEL "A" IN PARENTHESES. (I.E IC1-A PINOUTS 1,2,3 BECOME 7,6,5 ON CHANNEL A, AND IC1-B PINOUTS 7,6,5 BCOME 1,2,3 ON CHANNEL A)

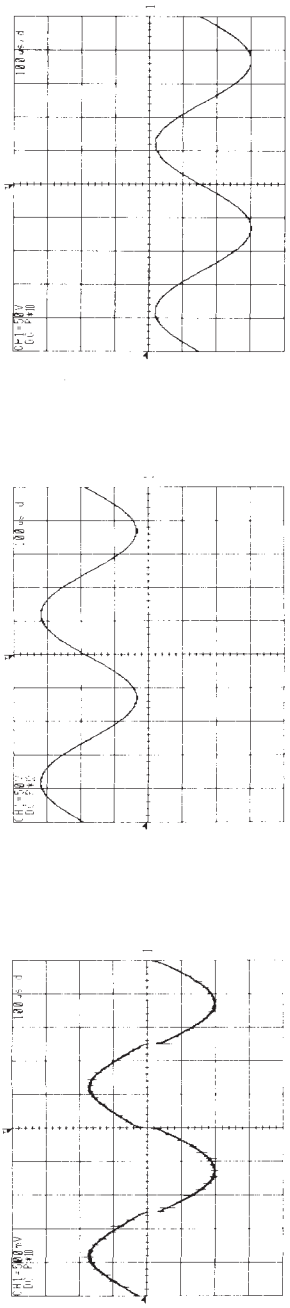
LAST USED	NOT USED
B2	
C12	
D11	D3, 9
E9	
F1	
IC1	
LD3	
Q12	
R42	
TR5	TR1
Z5	







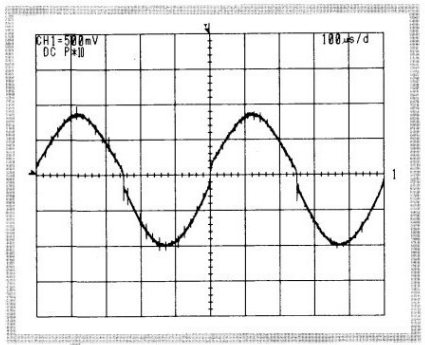


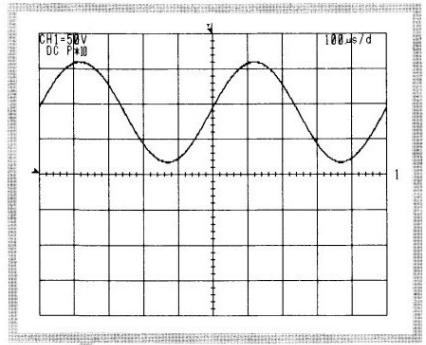


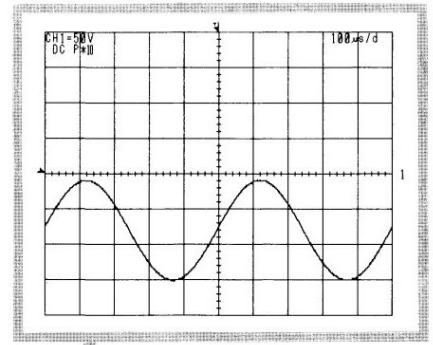
NOTES:
1. BOTH CH. SAME EXCEPT FOR BRIDGING SW (CH 2 SHOWN).
2. ALL RESISTORS 1/4 WATTS 5% UNLESS SHOWN.
3. ALL CAPACITORS IN UF. 100V UNLESS SHOWN.
4. HEAVY LINE SHOWS MAIN SIGNAL PATH.
5. USE QSC REPLACEMENT TRANSISTORS ONLY.
6. "FP"—FLAME PROOF RESISTORS.
7. Z1–Z6 ZENER DIODES.
8. B1–B3 BRIDGE RECTIFIRS .
9. LD1–LD2 FRONT PANEL LED'S .

□ TRANSFORMER AND OUTPUT CONNECTOR PINS
○ QUICK DISCONNECT TERMINALS (1–10)

USA1300 Schematic







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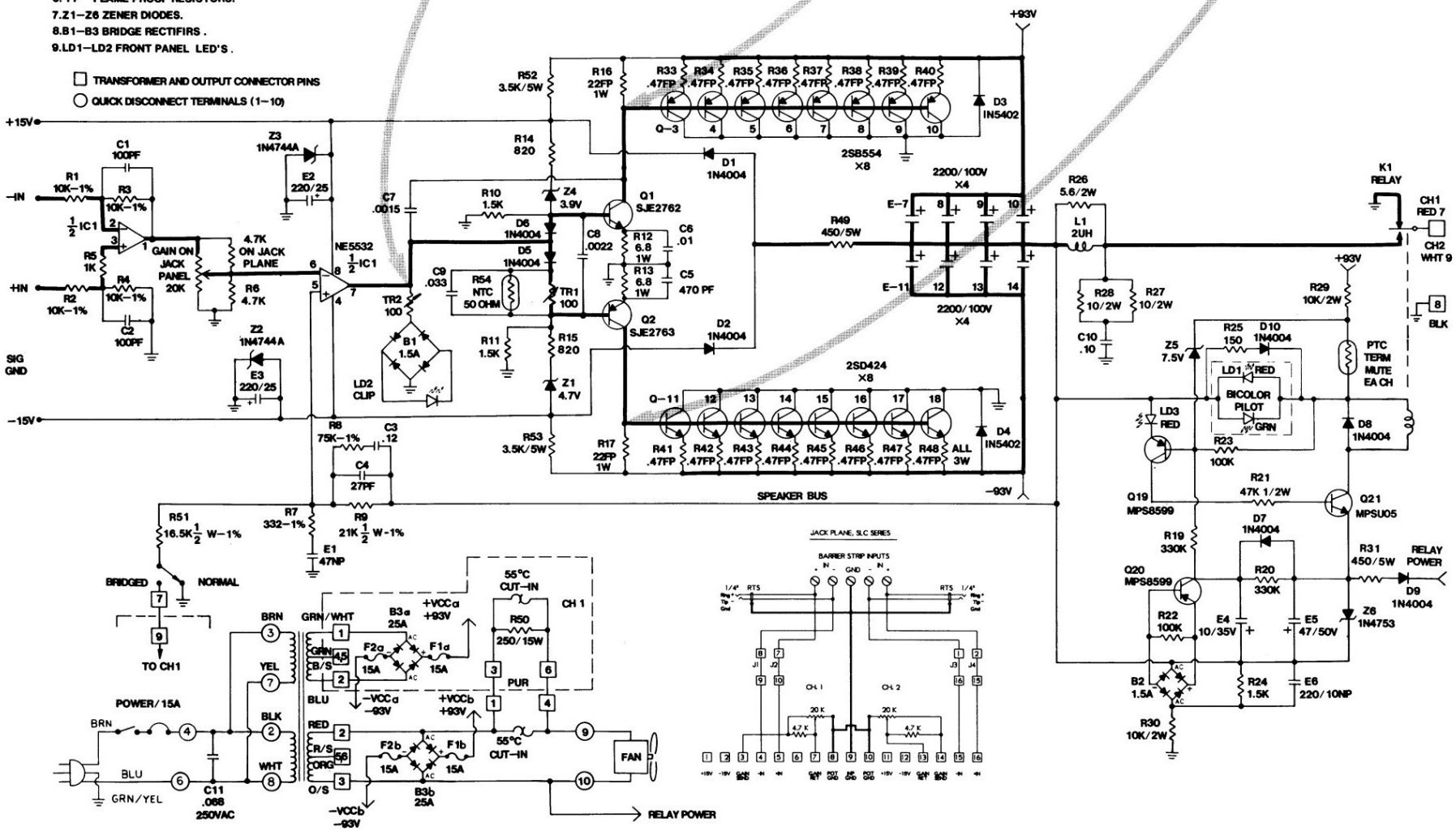
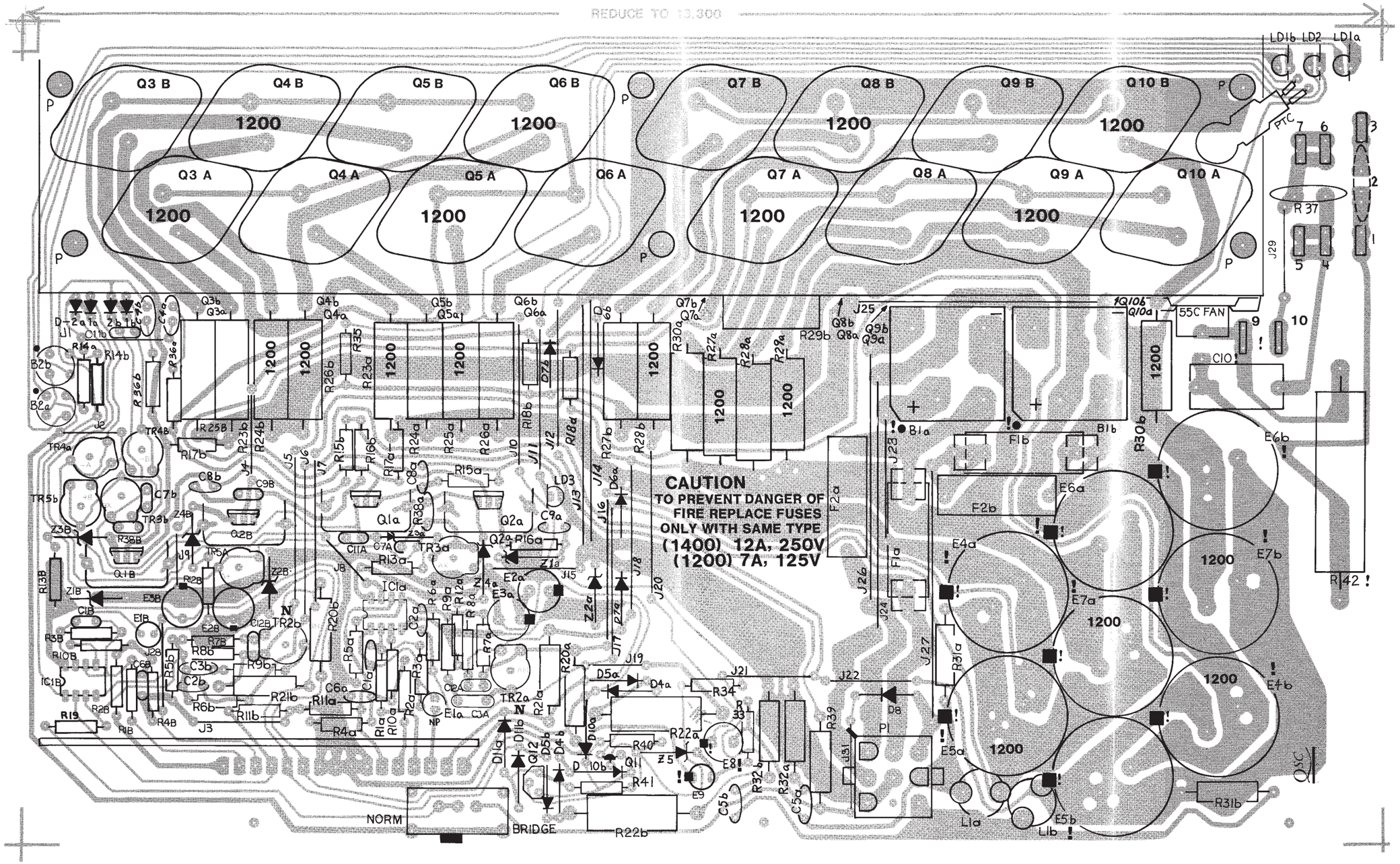
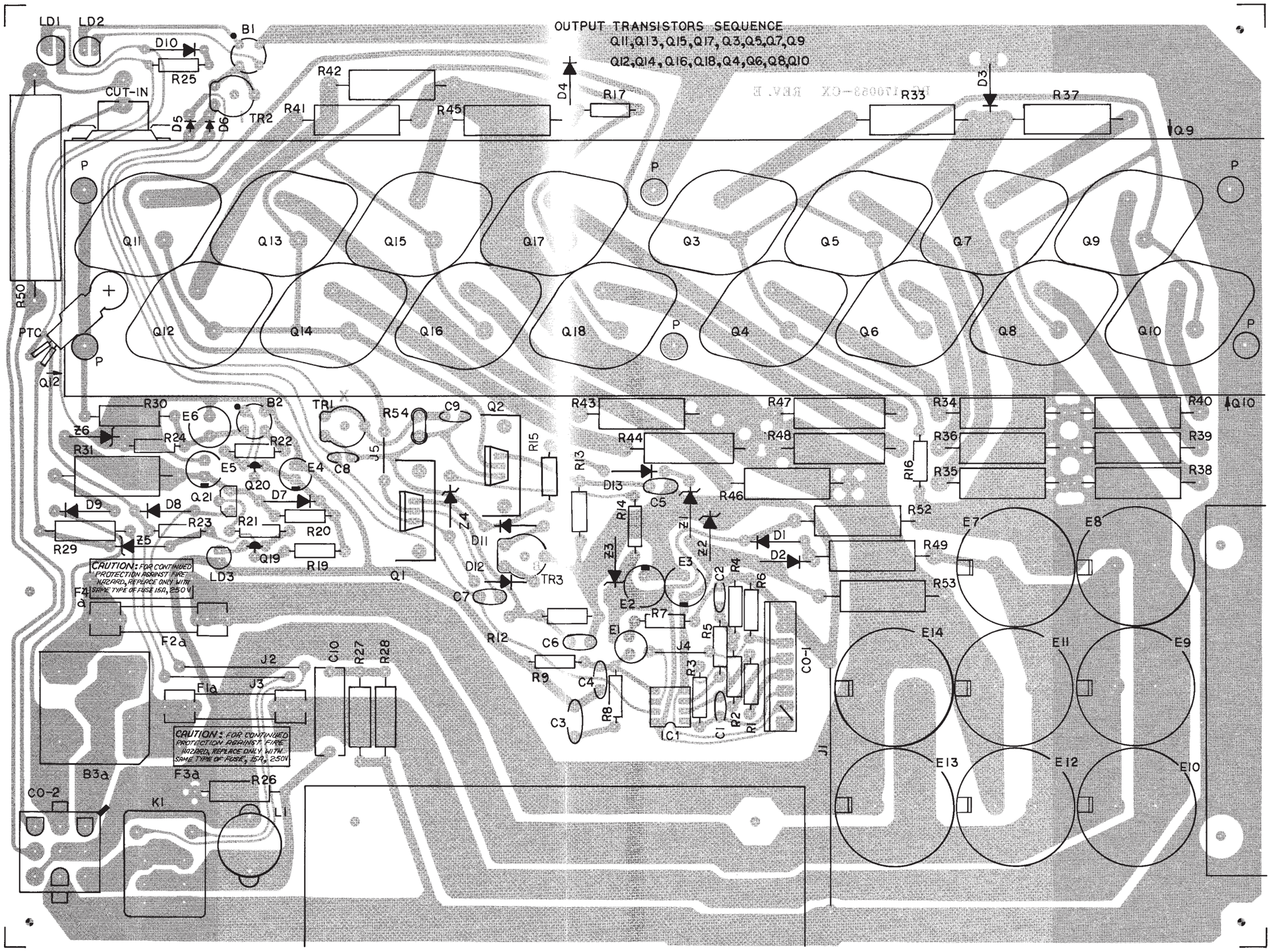
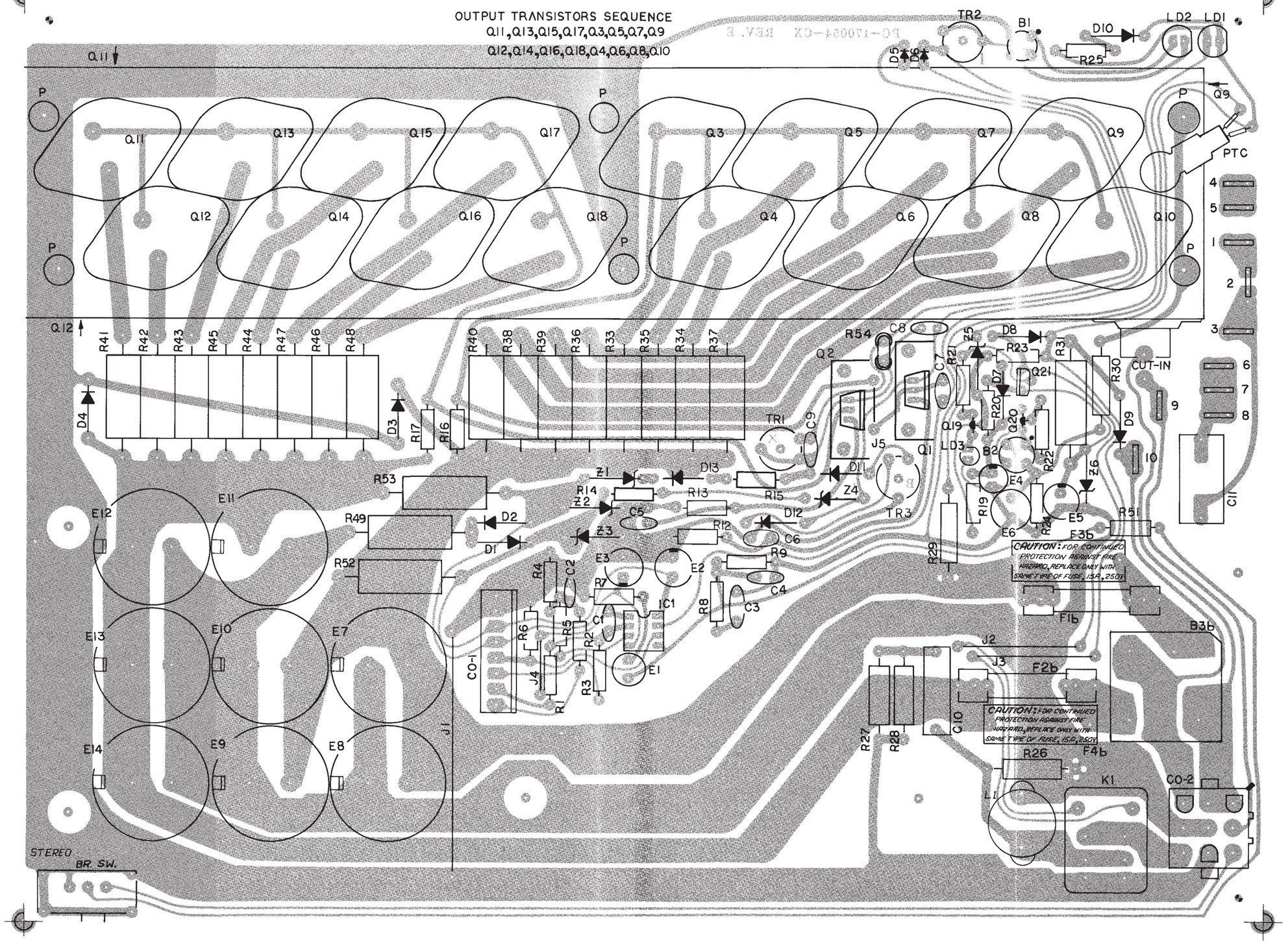
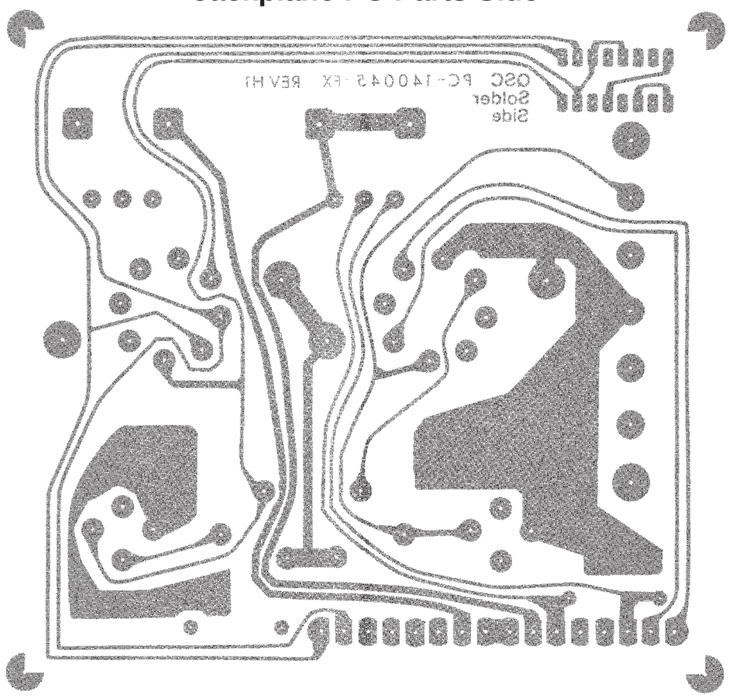



REDUCE TO 13.300
Q3 B
Q4 B
Q5 B
Q6 B
Q7 B
Q8 B
Q9 B
Q10 B
Q3 A
Q4 A
Q5 A
Q6 A
Q7 A
Q8 A
Q9 A
Q10 A
1200
P
LD1b LD2 LD1a
PTC
R37
J29
55C FAN
CIO
CAUTION
TO PREVENT DANGER OF
FIRE REPLACE FUSES
ONLY WITH SAME TYPE
(1400) 12A, 250V
(1200) 7A, 125V
NORM
BRIDGE
R42
R31b
R30b
OSC

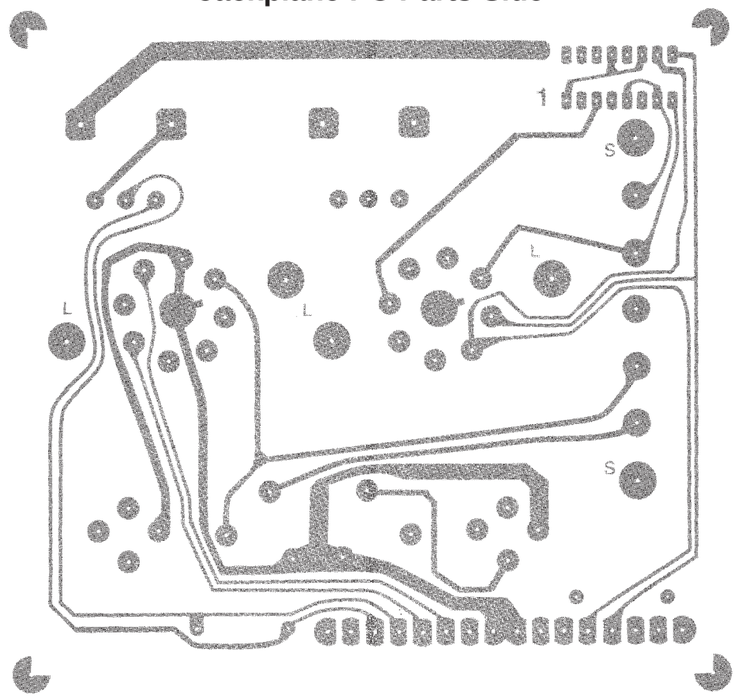

OUTPUT TRANSISTORS SEQUENCE
Q11,Q13,Q15,Q17,Q3,Q5,Q7,Q9
Q12,Q14,Q16,Q18,Q4,Q6,Q8,Q10
LD1
LD2
B1
D10
R25
CUT-IN
D5
D6
TR2
R41
R42
R45
D4
R17
R33
D3
R37
Q9
Q11
Q13
Q15
Q17
Q3
Q5
Q7
Q9
R50
PTC
Q12
Q14
Q16
Q18
Q4
Q6
Q8
Q10
Q10
R30
Z6
R24
R31
E6
B2
R22
E5
E4
C8
Q20
Q21
D7
D9
D8
R23
R21
R20
Z5
R29
Q19
R19
LD3
TR1
R54
C9
Q2
J5
R15
Z4
D11
DI2
TR3
C7
Q1
R12
C6
R9
C4
C3
R8
R43
R47
R44
R48
R13
DI3
C5
R46
R14
Z1
Z2
Z3
E3
E2
E1
R7
J4
C2
R4
R6
R5
R3
R2
R1
IC1
CO-1
J1
R34
R40
R36
R39
R16
R35
R38
R52
R49
R53
D1
D2
E7
E8
E14
E11
E9
E13
E12
E10
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH SAME TYPE OF FUSE 15A, 250V
F4a
F2a
F1a
J2
J3
C10
R27
R28
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH SAME TYPE OF FUSE, 15A, 250V.
F3a
B3a
R26
CO-2
K1
L1


OUTPUT TRANSISTORS SEQUENCE
Q11,Q13,Q15,Q17,Q3,Q5,Q7,Q9
Q12,Q14,Q16,Q18,Q4,Q6,Q8,Q10
Q11
Q12
P
Q11
Q13
Q15
Q17
Q12
Q14
Q16
Q18
Q3
Q5
Q7
Q9
Q4
Q6
Q8
Q10
PTC
TR2
B1
D10
LD2
LD1
R25
D5
D6
R41
R42
R43
R45
R44
R47
R46
R48
R40
R38
R39
R36
R33
R35
R34
R37
D4
D3
R17
R16
R54
C8
Q2
R21
Z5
D8
R23
R31
C7
D7
Q21
R20
R30
CUT-IN
Q19
Q20
D9
J5
Q1
LD3
B2
R22
Z6
TRI
C9
D11
Z4
TR3
E4
R19
E5
E6
R24
F3b
R51
R29
CAUTION: FOR CONTINUED PROTECTION AGAINST FIRE HAZARD, REPLACE ONLY WITH SAME TYPE OF FUSE, 1.5A, 250V.
F1b
B3b
J2
J3
F2b
C10
R27
R28
F4b
R26
K1
L1
CO-2
C11
R53
Z1
D13
R14
R13
R15
Z2
C5
D12
R12
C6
R9
R49
D2
D1
R52
E3
E2
R4
C2
R7
IC1
C4
R8
C3
C1
R6
R5
R2
CO-1
J4
R3
E1
E12
E11
E13
E10
E7
E14
E9
E8
J1
STEREO
BR. SW.

Jackplane PC Parts Side



Jackplane PC Parts Side



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