

# Technical Service Manual

**MX 3000a**



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# MX3000a AMPLIFIER SERVICE MANUAL

## **MX3000a**

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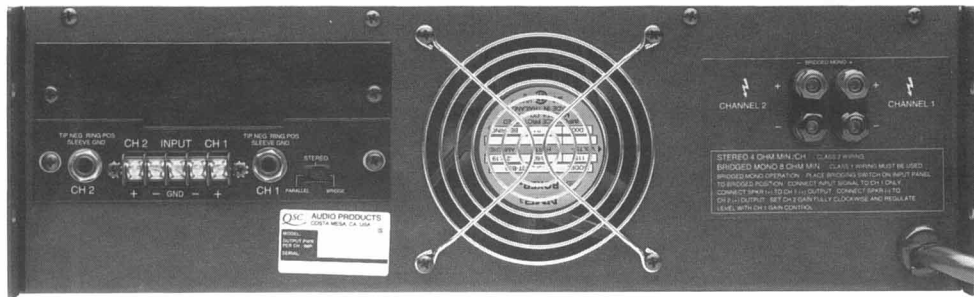
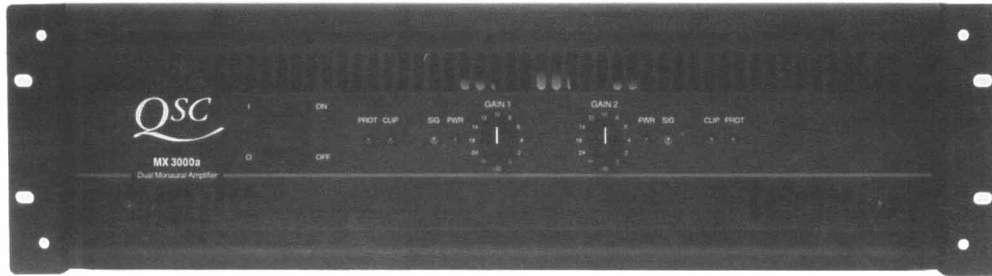
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## Table of Contents

Product Specifications .....	1
MX3000a Test and Calibration .....	4
MX3000a Troubleshooting .....	7
MX3000a Parts List	
<i>Input Board</i> .....	10
<i>Output Board</i> .....	10
<i>Display Board</i> .....	10
<i>Main Board Assembly</i> .....	10
<i>Chassis Assembly</i> .....	11
Chassis Drawings .....	13
Wiring Diagrams .....	16
Schematics	
<i>Input Board</i> .....	20
<i>Output Board</i> .....	20
<i>Display Board</i> .....	21
<i>AC PCB Assembly</i> .....	21
<i>Main Board Assembly</i> .....	22

# MX3000a Product Specifications



## MX3000a

### Output Power (per channel):

Continuous Average Output Power both channels driven:

8 ohms, 20Hz - 20kHz, 0.1% THD      800 watts

4 ohms, 20Hz - 20kHz, 0.1% THD      1200 watts

Continuous Average Output Power bridged mono operation:

8 ohms, 20Hz - 20kHz, 0.1% THD      2400 watts

### Dynamic Headroom (dB):

4 ohms      3

Voltage Gain (dB):      38

### Distortion, THD @ 8 ohms:

SMPTE-IM at rated power      Less than 0.05%

Frequency Response      20Hz to 20kHz, +/- 0.15 dB

Damping Factor      Greater than 200 @ 8 ohms

Noise (A weighted)      100dB below rated power

Sensitivity      1.0 V rms for rated power (8 ohms)

Input Impedance      10k ohms unbalanced, 20k ohms balanced

### Dimensions

Faceplate Width      Standard 19" Rack Mounting

Faceplate Height      5.25"

Chassis Depth      17.9"

### Weight

Shipping, Lbs/kg      77 / 34.93

Net, Lbs/kg      69 / 31.30

# I n t r o d u c t i o n

This manual is prepared to assist service personnel with the repair and calibration of MX3000a power amplifiers . The procedures described in this manual require advanced technical experience and sophisticated audio test equipment.



**CAUTION:** To reduce the risk of electric shock, do not remove the cover. No user-serviceable parts inside. Refer servicing to qualified service personnel.

**WARNING:** To prevent fire or electric shock, do not expose this equipment to rain or moisture.

## Documentation

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.

## Equivalent Parts

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 Technical Services 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.

## Factory Repair

It may become necessary to return a product to the factory for repair. Call QSC Technical Services for return instructions. QSC Technical Services may be reached at (800) 772-2834.

## Test Equipment

For testing, as outlined in this manual, the following equipment will be needed.

### REQUIRED TEST EQUIPMENT

- Distortion Analyzer capable of 0.05% THD+N
- High Power Load Bank (8, 4, & 2 ohms)
- Function Generator
- 20MHz Oscilloscope
- Digital Multimeter
- Variac (0-140 VAC, 10-20A)

### SUGGESTED TEST EQUIPMENT

- Audio Precision - System One
- Thermocouple probe

Audio Precision test and procedures files are made available, free of charge, from QSC Technical Services by either sending a self addressed stamped envelope and a 3 1/2" disk to QSC, or by logging on to QSC Online and downloading the appropriate files.

# MX3000a 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.

- SET-UP

1. Connect a test load to the output terminals of the amplifier. Test loads should be capable of handling 800 watts @8 ohms and 1200 watts @4 ohms.
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. Set amp gain pots fully clockwise and turn on power switch.
6. 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.
7. Lift the ground on the scope and the distortion analyzer.
8. Plug the amplifier in to a variac and set up an AC line current monitor.

- POWER UP & MUTE DELAY TEST

1. Slowly raise the variac voltage and watch for excessive current draw (Line current greater than 1.0A a.c. at 120 Volts.) *This is slightly less for 240V.* Pause at 90VAC (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. Check both channels.

- 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 750 - 800 watts at 1kHz just below the point of clipping. Check both channels.

- BRIDGE MODE

1. Turn the amplifier power switch off.
2. Move the bridge switch on the amp from the Stereo to Bridge position. Remove the input plug from CH2.
3. Check CH2 for full output with a 1Vrms sinewave (1kHz) input applied to CH1. The output signal on CH2 should be 180 degrees out of phase with the output signal from CH1.

4. Turn power off and place the amplifier under test back into the Stereo mode.
- CROSSOVER AND BIAS SETTING:
    1. Let the amplifier cool down.
    2. With an input amplitude of 1Vrms, increase the input frequency to 20kHz. Reduce the input signal 20dB (90%) from full output and adjust the crossover trimpot (VR901) for a less than 400mVpk-pk crossover spike protruding from the noise trace on the oscilloscope. It will be necessary to have the oscilloscope measure an unfiltered distortion from the amplifier under test to be able to see the crossover spike. Set the bias such that the total distortion for that channel is no more than 0.15% THD+N.
    3. If a distortion analyzer is not available, a less accurate crossover distortion and bias adjustment can be made by monitoring the driver transistor (Q933 and Q934) bias current. With the amplifier at room temperature, and with no input signal plugged into the amplifier, measure the DC voltage across emitter resistors R937 or R938. Adjust VR901 to obtain about 100 - 110mV d.c. across one of these resistors.
    4. Let the amplifier cool down and check channel 2.
  - SHORT CIRCUIT CURRENT
    1. Select a 4 ohm load and apply a 1Vrms sinewave (1kHz) input signal to one channel of the amplifier.
    2. While the amplifier channel is producing power into a load, apply a short to the output binding post of the channel under test. In other words, apply a jumper between the red and black binding posts. Do not connect two red binding posts together as this will cause a failure. Once this is done, the AC line current draw should be no greater than 5.0A a.c. (4.5A nominal).
    3. Remove the short from the channel under test and verify recovery into a 4 ohm load. The output should not experience any hang up and a full sinewave should be present just as it was before a short was applied for this test.
    4. Repeat these steps for the next channel.
  - FREQUENCY RESPONSE
    1. Set load to 8 ohms and scale your input gain 10dB down from maximum power from the amplifier. Gain controls on the amplifier should be fully open.
    2. Check frequency response from 20Hz to 20kHz. (+/- 0.15dB) by sweeping random frequencies between these extremes. This is done by verifying the same voltage amplitude at each of frequencies selected (within 20Hz to 20kHz). Check both channels.
  - POWER vs. DISTORTION TEST
    1. Check to ensure that both channels will produce rated power at 20Hz, 2KHz, and 20kHz. into an 8 ohm load.
    2. While verifying rated power, check that at all frequencies the THD+N measurement is less than or equal to 0.1%.
  - THERMAL TEST
    1. Set input frequency to 1KHz and short both channels while they are producing power into a load.
    2. AC line current draw should be about 8.0 - 8.5 amps for both channels. As the amplifier gets hot, there will be some current drift upwards. This is not a problem as long as the case temperature on the output transistors do not exceed 105 degrees celcius.



3. Verify that the fan goes into high speed mode.
4. When thermal shutdown occurs, verify AC idle current of less than 1.3 amperes.

- CM TEST

1. Check the Common Mode Rejection of the amplifier by inserting a 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

1. Set the amplifier gain all the way up with a 1kHz 1.00Vrms sinewave input signal. Note the output level from the amplifier.
2. Remove the input signal connector from the amplifier and measure the residual noise level produced into the load by the amplifier with an A-weighting filter. The noise signal should be 100 dB down from the full output power point measured. A signal to noise ratio should be better than or equal to 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.

# MX3000a Troubleshooting

## Current Draw

*(Fuses blow. Burning smell or smoke)*

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### **Symptoms:**

- Fuses immediately blow
- Amplifier quickly gets very hot
- 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. 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):
  1. Reversed or shorted main bridge rectifiers.
  2. Both supply clamping diodes D907, D908 reversed or shorted
  3. Both polarities output transistors or drivers shorted.
- **MEDIUM CURRENT DRAW** (increases slowly, can go to 30 VAC before current becomes excessive.):
  1. Single polarity driver or output short.
  2. Single supply clamping diode D907 or D908 reversed or shorted.
  3. Open or missing bias diodes D903, D904 or bias trim pot VR901.
- **SLOW CURRENT DRAW** (above 60 volts AC before current begins to increase, amp may pass signal).
  1. Severely misadjusted bias circuit or defective bias diodes D903, D904.
  2. Severe oscillation causing current drain.
- **RUNAWAY CURRENT DRAW** (30-40V AC before current begins to increase or runaway):
  1. A reversed filter capacitor: caution, may vent explosively.

## Protection, Muting Circuit and Power On/Off Delay

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

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### **Symptoms:**

- Both channels remain in protect mode
- Too little or too much muting delay
- Relay won't turn on

- No thermal shutdown
- No Red protect LED
- No D.C. protect
- Shuts off under signal

The output of this amplifier is "AC coupled" through the filter capacitors. This eliminates the need for DC load protection. A "PTC" (Positive Temperature Coefficient) sensing resistor is mounted on the main heatsink. This component's resistance increases with increasing temperature. When the resistance of these temperature dependent resistors increases to approximately 10k ohms, the protection circuit will eventually disable both channels.

U910 is a SMT board that houses most of the parts involved with the protection circuitry. Whenever there is a problem with this board, the proper solution to the problem is to change the board. This can be done, but extreme care should be given to this operation. There are delicate traces and eyelets that will be permanently damaged if this board is not removed properly with the right desoldering equipment.

The protection circuit functions within this board are muting, thermal, DC, and high frequency shutdown. Please refer to the schematic to find the connect / sense pins on U910.

The pins that are on U910 have signals that monitor and control the status of the amplifiers protect and limit features. Pin T1 is powered by an unregulated power supply through B901. If a channel is not coming out of mute, then it could be that T1 is not receiving the voltage necessary to bias the transistors within U910. Thus, leaving the channel disengaged via the output relay.

## Instability

*(Gain problems, spurious noises, and oscillations)*

### Symptoms:

- General Output Distortion
- 'Ringing' sound with no input to amplifier
- Excessive or unbalanced crossover
- Low and inconsistent gain

### 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.*

#### • HIGH FREQUENCY OSCILLATION

(The oscillation is usually worse on a particular part of the waveform.)

If the amplifier exhibits a severe oscillation, this is often affected by a change in the output impedance.

If this is the case:

- Check capacitors C914, C915, C916, & C951.
- High frequency snubber circuit R933, R934, C913.
- Substitute the IC and check the IC socket for contamination (U901, U902).

#### • EXCESSIVE OR UNBALANCED CROSSOVER (*Excess notch or ringing at zero crossing*)

- Shorted bias diodes D903, D904.
- A defective trimpot (VR901).
- Open pull-up resistors on the output devices (R927, R955).

If the distortion is present with no output no-load, look at the feedback components

- MINIMAL POWER INTO A LOAD

- Short circuit current limits (VR902 & VR903) that are set too low.
- Several open output transistors (Base-Emitter or Emitter-Collector).  
(NOTE: Check the driver transistor gain.) To test for this, check the voltage dropped across the output transistor emitter resistors (R927, R928) with an input signal and an output load. Any resistor that has a significantly different voltage drop indicates a defect in the associated output transistor or the emitter resistor.
- Shorted D951, D965

- MISSING OUTPUT SIGNAL

- A defective U901. It is not practical to test the IC, but it is possible to check for Signal presence at the input and output terminals of the IC.
- A damaged or defective resistor network RN909.
- A defective input connector or input wiring multi-conductor cable.

## Power Supply and Voltage Rail Balancing

*(Uneven rails and power supply problems)*

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### **Symptoms:**

- Current limiting wrong
- Uneven voltage rails

### **Possible Causes:**

If the high voltage power supplies are severely unbalanced, the fault may be caused by either an AC feedback defect or a DC component failure. First, remove IC1 and re-measure the power supplies. If the supplies are balanced with the opamp removed, the fault is in the feedback loop. Check the following components:

- The opamp (U901,U902)
- The FET switches (Q901-Q904, Q917-Q920).

If the DC supplies remain offset with the opamp removed, inspect the +/-15VDC supplies. If either of these low voltage power supplies is at, or very near, 0 volts, a 15V regulator, 18V zener, or a 15V filter capacitor is shorted. The +/- 15V supplies are regulated and constant. If the op amp is defective, it will be burned open and the 15 volt rails will still maintain the same level.

If the +/- high voltage supplies are both near 0 volts, the power supply transformer or its connections may be defective. Inspect the AC voltage at the transformer secondary connections.

## MX3000a Input Board

Part Number	Description	Reference
CA-122001-10	CAP CER 220PF 10% 100V	C31
CA-147001-10	CAP CER 470PF 10% 100V	C301,302, C401,402
CH-004112-00	INPUT PANEL, LOWER MX SERIES	
CO-000035-CO	B/STRP RT.ANG PLMNT 3/8" CTRNI	J31
CO-000049-CO	HEADER 1 X 5 VERT	J32
CO-000056-CO	HDR LATCHING BOX 16-PIN	J33
CO-108112-PJ	.25" PHONE JACK RT ANGLE PC MT	J301,401
HW-000630-HW	BRACKET, RIGHT ANGLE, ZIERECK	REF: J31
HW-060040-PS	#6-32 X 4 PEM STUD	REF: J31
LB-004002-00	LBL,INPUT PNL,LWR,MXA SERIES	
NW-060010-SL	#6 SPLIT TOOTH LOCKWASHER	REF: J31
NW-060400-HN	#6-32 X 1/4" HEX NUT	REF: J31
NW-060410-ET	#6 EXTERNAL TOOTH LOCKWASHE	REF:J31
PC-001512-00	MX A INPUT PCB	
RE-220001-BM	RES MF 20.0K 1% 1/4W	R31
RE-224005-BC	RES CF 24K 5% 1/4W	R32
SC-060081-PP	#6-32 X 1/2" P/P BLACK	REF:J31
SW-000031-SW	SWITCH BRIDGE DP3T SLIDE	SW31
WC-000001-10	JUMPER INS .5" 22AWG SOLID WHT	W301-304, W401-404

## MX3000a Output Board

Part Number	Description	Reference
CA-147100-BD	CAP CER 470PF 10% 100V	C701,801
CA-310100-BP	CAP MYLAR .01UF 10% 100V	C72
CA-647010-BN	CAP LYTIC RL 47UF 10% 10V NP	C70
CA-722003-00	CAP 220UF 25V 20% LYTIC RL	C71
CO-641119-AH	8 PIN .156"/C HEADER	J73
HW-000001-FC	FUSE CLIPS	F801 REF:F701,
MS-000050-MS	FUSE, 20A, 250V	F701,801
MS-000220-HS	TO-220 HEAT SINK AAVID #5943B	REF:Q70
PC-004004-00	OUTPUT PCB EX 3 SPACE FAB.	
QD-002763-TU	XISTOR PNP TO-220 150V 8A	Q70
QD-004004-DX	DIODE RECT DO41 400V 1A	D701,801
QD-004148-DX	DIODE SWITCH DO35 75V 75MA	D701,71, D702,802
QD-004410-TX	XISTOR NPN TO-92 80V 0.25A	Q72
QD-008599-TX	XISTOR PNP TO-92 60V 0.5A	Q71
RE-012005-EM	RES MOFP 120 5% 2W	R76
RE-127005-BC	RES CF 2.7K 5% 1/4W	R75
RE-147005-BC	RES CF 4.7K 5% 1/4W	R70,71
RE-222005-BC	RES CF 22K 5% 1/4W	R72
RE-318005-BC	RES CF 180K 5% 1/4W	R73,74
SW-000029-SW	RELAY, SPKR PROTECT,SPDT,24VD	RY701,801
WC-0.5018-JW	.5" JUMPER, WHT., 18 GA, SOLID	W71
WC-1.2518-JW	1.25" JUMPER, WHITE 18 GA, SLD	W701

## MX3000a Display Board

Part Number	Description	Reference
CA-047001-10	CAP CER 47PF 10% 100V NPO	C101,102, C201,202
CA-547002-10	4.7UF,16V,20% RADIAL NON-POLAR	C103,203
CA-610002-10	10UF,35V,20%,RADIAL ELECT	C1,2,104, C105,204, C205

CO-000044-CO	HEADER PCB 2 X 7 .1 X .1 BOX	J101,201
CO-000048-CO	HEADER 2 X 8 VERT	J1
IC-000072-OP	OPAMP,DUAL,TL072	U1
IC-005532-OP	IC LIN DUAL OP AMP 5532 EX/MPA	U101,201
PC-003002-00	PCB, DISPLAY, MX 3000A	
PL-905385-SP	SPACER RND NYL#6 0.385"L BLK	LD101-104, LD201-204 REF:
PT-310001-CR	RES VAR IT 10K 20% 0.2W	VR101,201
QD-000001-TX	XISTOR NPN TO-226AE 30V 1A	Q101,201
QD-000045-00	DIODE BRIDGE RECT DIP 200V 1A	BR101,201
QD-000134-LR	LED RED T-1 3/4	LD103,104, LD203,204
QD-000134-LY	LED YEL T-1 3/4	LD102,202
QD-000135-QD	LED GRN T-1 3/4	LD101,201
QD-004004-DX	DIODE RECT DO41 400V 1A	2 D101,201
QD-004410-TX	XISTOR NPN TO-92 80V 0.25A	2 Q102,202
RE-003305-BC	RES CF 33 5% 1/4W	R105,106, R205,206
RE-041201-AM	RES MF 412 1% 1/8W	R110,210
RE-051001-00	RES MOFP 510 5% 1W	R111,112, R211,212
RE-053601-AM	RES MF 536 1% 1/8W	R104,204
RE-063401-AM	RES MF 634 1% 1/8W	R108,208
RE-110001-AM	RES MF 1.00K 1% 1/8W	R101,103, R201,203
RE-122005-BC	RES CF 2.2K 5% 1/4W	R107,207
RE-147501-AM	RES MF 4.75K 1% 1/8	R102,202
RE-212101-AM	RES MF 12.1K 1% 1/8W	R109,209
RN-110002-BM	RES NTWK 8-PIN SIP 1K 2% 4R	RN103,104, RN203,204
RN-210002-BM	RES NTWK 8-PIN SIP 10K 1% 4R	RN101,201

## MX3000a Main Board

Part Number	Description	Reference
CA-010001-10	CAP CER 10PF 10% 100V	C962
CA-018001-10	CAP SM 18PF 5% 500V	C914
CA-068001-10	CAP CER 68PF 10% 100V	C957
CA-168001-10	CAP CER 680PF 10% 100V	C956
CA-222002-10	.0022UF,200V,10%,MYLAR	C915,955, C963
CA-233001-10	CAP MYLAR .0033UF 10% 100V	C961
CA-310001-10	CAP MYLAR .01UF 10% 100V	C911
CA-410002-10	CAP MYLAR .1UF 5% 100V	C901,902, C912,913, C917,920
CA-415001-10	CAP MYLAR .15UF 5% 100V	C916
CA-610002-10	10UF,35V,20%,RADIAL ELECT	C941
CA-647001-10	CAP LYTIC RL 47UF 10% 10V NP	C951
CA-647002-10	CAP LYTIC RL 47UF 20% 50V	C903,904, C943,944
CA-710001-10	CAP LYTIC RL 100UF 20% 35V	C953,954
CA-722001-10	CAP LYTIC RL 220UF 20% 10V NP	C952
CA-747001-10	CAP LYTIC RL 470UF 20% 16V	C921,924, C959,960
CA-822035-AE	CAP LYTIC RL 2200UF 20% 35V	C945, 946
CA-915050-AE	CAP LYTIC RL 15000UF 20% 50V	C929, 930 C931, 932 C933, 934 C935, 936 C937, 938

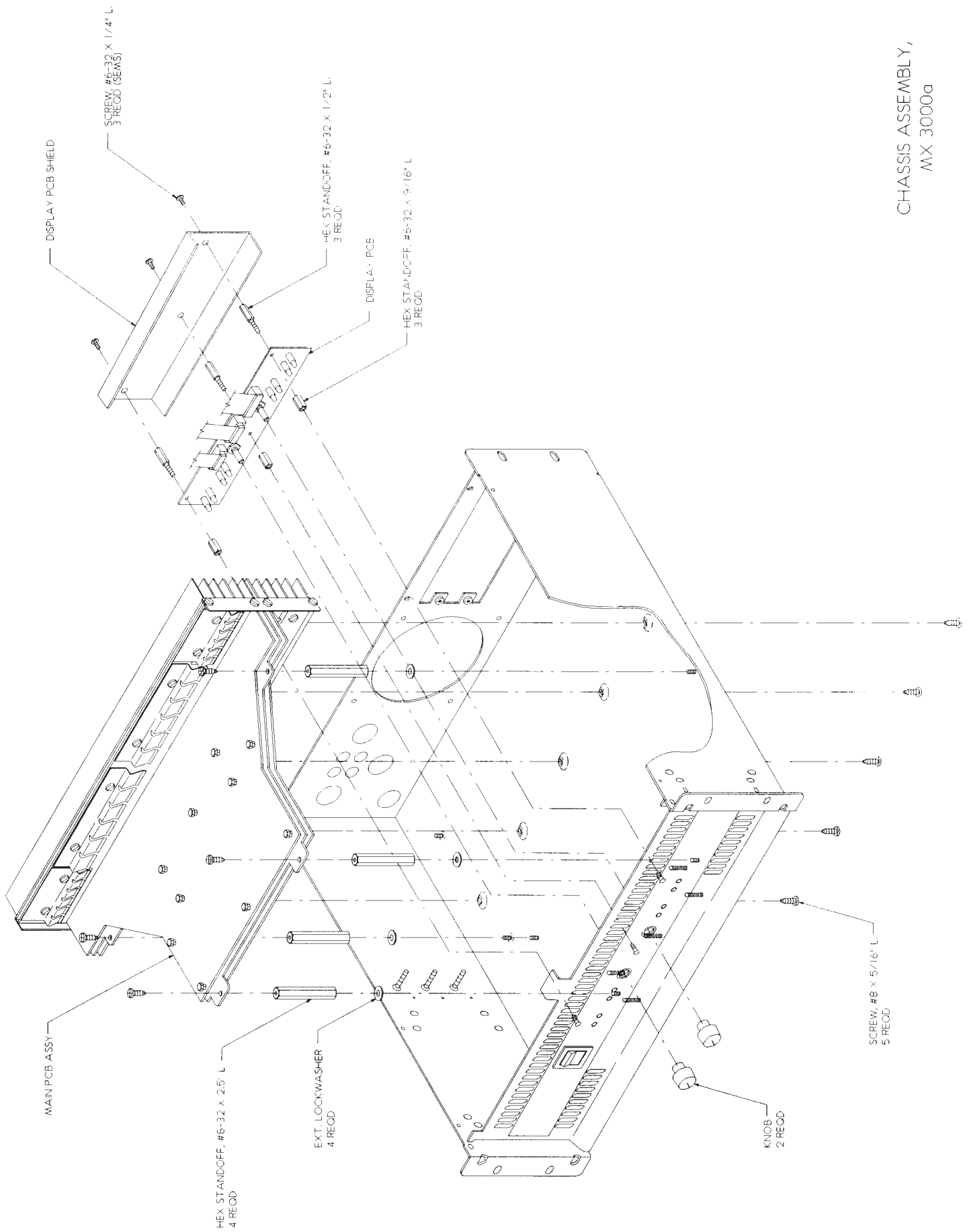
## MX3000a Main Board (continued)

Part Number	Description	Reference		
		C939, 940		
CH-000624-AX	CLAMP TO-3 PL 6 FINGER			
CH-400003-00	CLAMP TO-220 6 FINGER			R926,928
CH-400008-00	EX-4000 EXTRU & FAB HEATSINK			R929,930
CO-000008-IC	8 PIN IC SOCKET	U901, 902		R949,950
CO-000041-CO	HEADER PCB 3 X 4 AMP-TYPE	J901		R951,952
CO-000045-CO	HEADER PCB .156 4-POS	J902		R953,954
CO-000046-CO	HEADER PCB .156 5-POS	J904	RE-27005-EM	RESISTOR,METAL FLM, 2.7 5% 2W R903, 910
CO-000055-CO	HDR LATCHING BOX 14-PIN	J903	RE-27005-EM	RESISTOR,METAL FLM, 2.7 5% 2W R958, 961
CO-000074-00	HEADER POLARIZED 8-POS	J905	RE-39005-EM	RES MOFP 3.9 5% 2W R932
IC-000008-00	IC SMT POS STEP DRVR	U906,907	RE-47005-DM	RES MOFP 4.7 5% 1W R937, 938
IC-000009-00	IC SMT NEG STEP DRVR	U908,909		R939
IC-000010-00	IC SMT HOUSEKEEPING	U910	RE-000006-VP	RES PTC 60C 0.1K MAX COLD VP DIE:9610C R1007
IC-005532-OP	IC LIN DUAL OP AMP 5532 EX/MPA	U901, 902	RE-000050-NR	THERMISTOR NTC 50 OHM R931
MS-000054-MS	TO-220 HEATSINK, HIGHER POWER	Q933,934	RE-001005-EM	RES MOFP 10 5% 2W R933, 934
MS-001220-HS	TO-220 HEATSINK AAVID 5939B	REF. U904 U905	RE-002205-DM	RES MOFP 22 5% 1W R935, 936
NW-040010-IT	#4 INTERNAL TOOTH LOCKWASHER	Q934		R901,902
		REF: 933,		R906,907
NW-040400-HN	#4-40 X 1/4" HEX NUT	Q934		R927,955
		REF: Q933,		R959,960
PC-004200-00	EX-4000 POWER AMP PCB		RE-004705-BC	RES CF 47 5% 1/4W R941,1002
PL-000039-PL	TO-220 X 6 INSULATOR		RE-033201-BM	RES MF 332 1% 1/4W R947,948
PL-903125-SP	SPACER,ROUND,NYLON,0.125"L	D903,904	RE-041201-BM	RES MF 412 1% 1/4W R993
		REF. R931	RE-047005-DM	RES MOFP 470 5% 1W R982,992
PL-905156-SP	SPACER,ROUND,NYLON,#6,0.155"L	901	RE-059001-BM	RES MF 590 1% 1/4W R991
		REF: L901,	RE-110005-BC	RES CF 1K 5% 1/4W R945,R946
PT-110000-AT	RES VAR IT 100 20% 0.15W CARB	VR901	RE-127005-BC	RES CF 2.7K 5% 1/4W R995
PT-250000-AT	RES VAR IT 5K 20% 0.15W CARB	VR902, 903	RE-130005-EM	RES MOFP 3K 5% 2W R956,962,
QD-000009-VT	VACTROL LED SINGLE UNIT VTL5C	U903		R976
QD-000014-QD	DIODE TO220 ULTRAFAST 100V 15/	D901, 902	RE-168005-BC	RES CF 6.8K 5% 1/4W R990
		D905, 906	RE-210005-EM	RES MOFP 10K 5% 2W R1000
QD-000076-00	XISTOR NPN TO-220 250V	Q933		R988,R994,
QD-000077-00	XISTOR PNP TO-220 250V	Q934	RE-215001-BM	RES MF 15.0K 1% 1/4W R1001
QD-000022-QD	DIODE ZNR 18V 5% 1W 1N4746A	D939, 940	RE-222006-BM	RES MOFP 22K 5% 1W R911,917
QD-000024-QD	DIODE ZNR 6.2V 5% TESTED	D952,955	RE-227005-BC	RES CF 27K 5% 1/4W R996
QD-000031-QD	FET NCHAN TO220 60V 50A	Q901,902	RE-230101-CM	RES MF 30.1K 1% 1/2W R940
		Q903,904	RE-247005-DM	RES MOFP 47K 5% 1W R923
		Q917,918	RE-260401-BM	RES MF 60.4K 1% 1/4W R989
		Q919,920	RE-275001-BM	RES MF 75.0K 1% 1/4W R942
QD-000047-00	DIODE ZNR 200V 5% 1.5W 1N5956B	D921,924	RE-333005-BC	RES CF 330K 5% 1/4W R987
QD-0007.5-ZT	DIODE ZNR 7.5V TESTED	D951, 965	RE-375005-BM	RES MF 750K 5% 1/2W R943, 944
QD-001302-PN	XISTOR PNP TO-3P 200V 15A	Q905, 906	RN-110002-BM	RES NTWK 8-PIN SIP 1K 2% 4R RN910
		Q907, 908	RN-210002-BM	RES NTWK 8-PIN SIP 10K 1% 4R RN909
		Q909, 910	SC-040061-PT	#4-40 X 3/8" P/T BLACK Q934
QD-003281-NP	XISTOR NPN TO-3P 200V 15A	Q911, 912		REF: Q933,
		Q913, 914	SC-081101-SP	#8-18 X 5/8", TYPE 1 P/P BLACK
		Q915, 916	WC-0.5018-JW	.5" JUMPER, WHT., 18 GA, SOLID W901-905
QD-004004-DX	DIODE RECT DO41 400V 1A	D936,937	XF-200014-CR	INDUCTOR 2UH 14AWG VERT MNT L901
		D938,941		
		D942,947		
QD-004004-VP	DIODE RECT DO41 400V 1A VP	1/4W OR 9T		
		400-35		
		8500-7		
		D903,904		
		DIE P/N:		
QD-004148-DX	DIODE SWITCH DO35 75V 75MA	D922,923		
		D953,954		
QD-005402-DX	DIODE RECT DO27 200V 3A	D907, 908		

## MX3000a Chassis Assembly

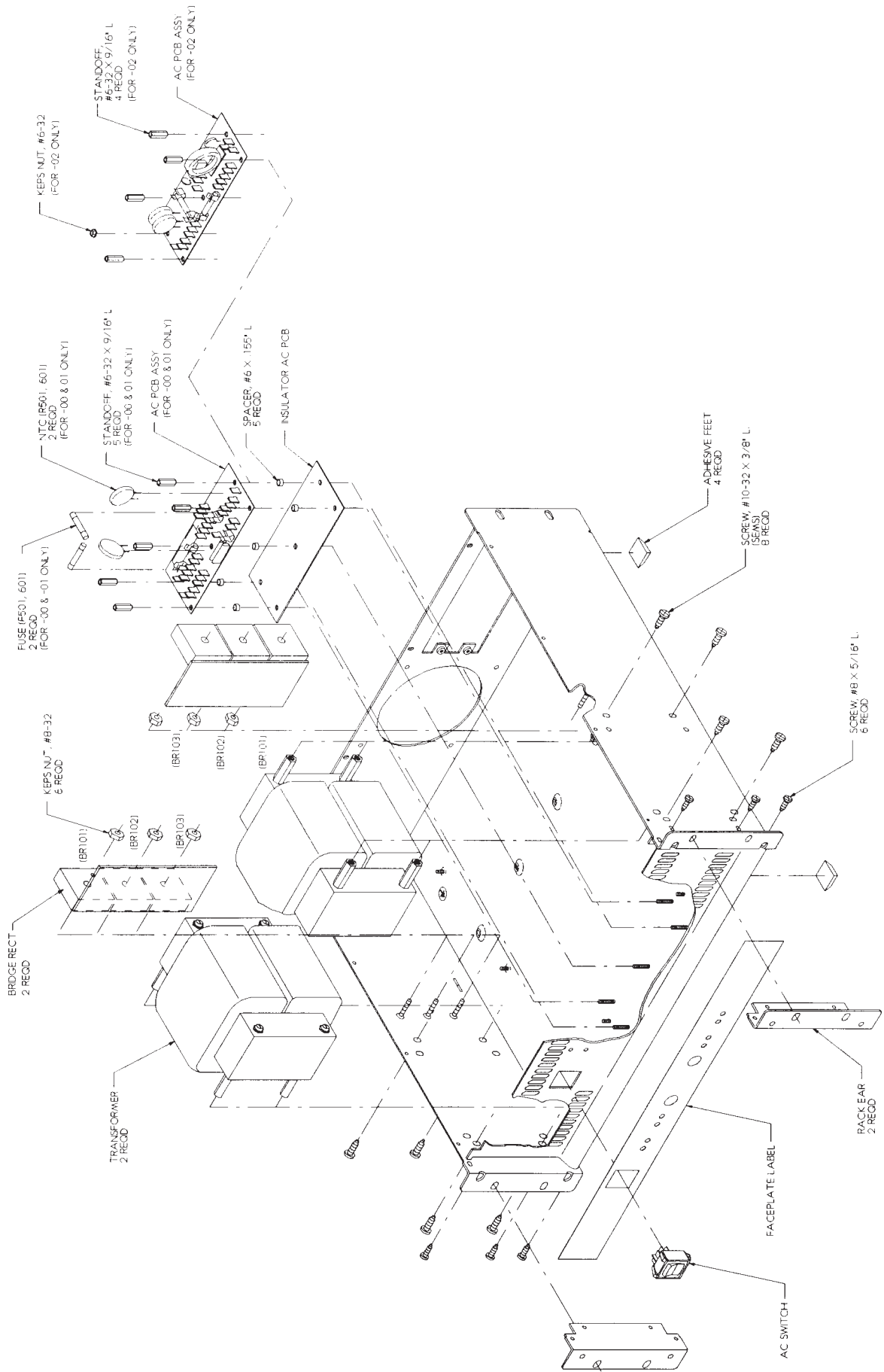
Part Number	Description	Reference
CH-140210-BX	1400 KNOB FABRICATION	
CH-400010-00	EX-4000 RACK EAR	
CH-400012-00	DISPLAY PCB SHIELD	
CH-400016-00	BLANK UPPER INPUT PANEL	
CH-420000-00	CHASSIS 3 SPACE, EX/MX SERIES	
CO-000011-00	CONN DUAL 5-WAY BIND RD/BLK R	
CO-000012-00	CONN DUAL 5-WAY BIND RD/BLK L	
HW-060000-HW	#6-32 x 9/16", NYLON STANDOFF	
HW-060080-HW	#6-32 X 1/2" HEX M/F STANDOFF	
HW-060090-SO	#6-32 X 9/16" HEX STANDOFF	
HW-060150-SO	#6-32 X 29/32" STANDOFF	
HW-080002-HW	#8-32 x 2.5", HEX STANDOFF	
HW-100001-HW	#10-32 x .7" HEX S/O,NIC PLTD,	
LB-000052-00	LABEL, cUL APPROVAL	
LB-000053-00	LBL, FRENCH, FUSE REPLACEMENT	
LB-003000-00	LABEL, FACEPLATE, MX 3000A	
LB-150002-00	LBL, OUTPUT, MX-A	
MS-000050-MS	FUSE, 20A, 250V	
MS-100005-FG	MX 2000 FAN GUARD	
NW-060010-IT	#6 INTERNAL TOOTH LOCKWASHER	
NW-080001-NW	#8 EXT TOOTH LOCKWASHER, ZINC	
NW-080500-KP	#8-32 KEPS NUT	
NW-100700-NW	#10 FLAT WASHER, NICKEL PLATED	
NW-100710-NW	#10EXT LOCKWASHER, NICKEL PLTD	
PL-000000-AF	ADHESIVE FEET	
PL-000003-CP	AC CORD PROTECTOR	
PL-000044-PL	BUSHING, STRAIN RELIEF	
PL-000057-00	INSULATOR, BR PCB	
PL-000069-00	INSULATOR, AC PCB	
PL-905156-SP	SPACER,ROUND,NYLON,#6,0.155"L	
RE-000170-NR	THERMISTOR NTC 30A CUR LIM	
SC-060042-PP	#6-32 X 1/4" P/P BLACK,SEMS,IT	
SC-080051-PS	#8-32 X 5/16" P/P SEMS BLACK	
SC-080121-PP	#8-32X3/4" TYPE 1 P/P BLACK	
SC-082051-PL	SCREW,TAP,PAN PH#8X5/16" "B"BK	
SC-100061-PS	SCREW 10-32X3/8" BLK P/P SEMS	
SC-100062-SC	SCREW 10-32 X 3/8" TYPE 1 PH	
SW-000027-SW	SWITCH, AC	
WC-000016-00	CABLE ASSY 16 COND RIB. 28" LG	
WC-000052-00	CABLE ASSY 14 COND RIB. 6" LG	
WC-003053-00	AC CORD, PREPPED	
WC-003056-00	12 PIN MATE N LOC ASSY, BLACK	
WC-003057-00	CABLE ASSY, RELAY/THERMAL	
WC-003059-00	12 PIN MATE N LOC ASSY, GREY	
WC-003060-00	AC SWITCH WIRE, RED/BLACK	
WC-003061-00	AC SWITCH WIRE, RED, 13.62"	
WC-003062-00	AC SWITCH WIRE, RED. 6.12"	
WP-000041-00	BRIDGE RECT ASSY	
WP-000134-00	MPX 1200 OUTPUT	
WP-001522-00	MX 2000A L. INPUT	
WP-003002-00	PCB ASSY, DISPLAY, MX 3000A	
WP-004006-00	ACPCB DOM	
WP-004012-01	SOB-FAN ASSEMBLY W/SHROUD	
WP-004201-00	4000/1100 MAIN	
XF-000003-00	MPX 1200 TRANSFORMER	

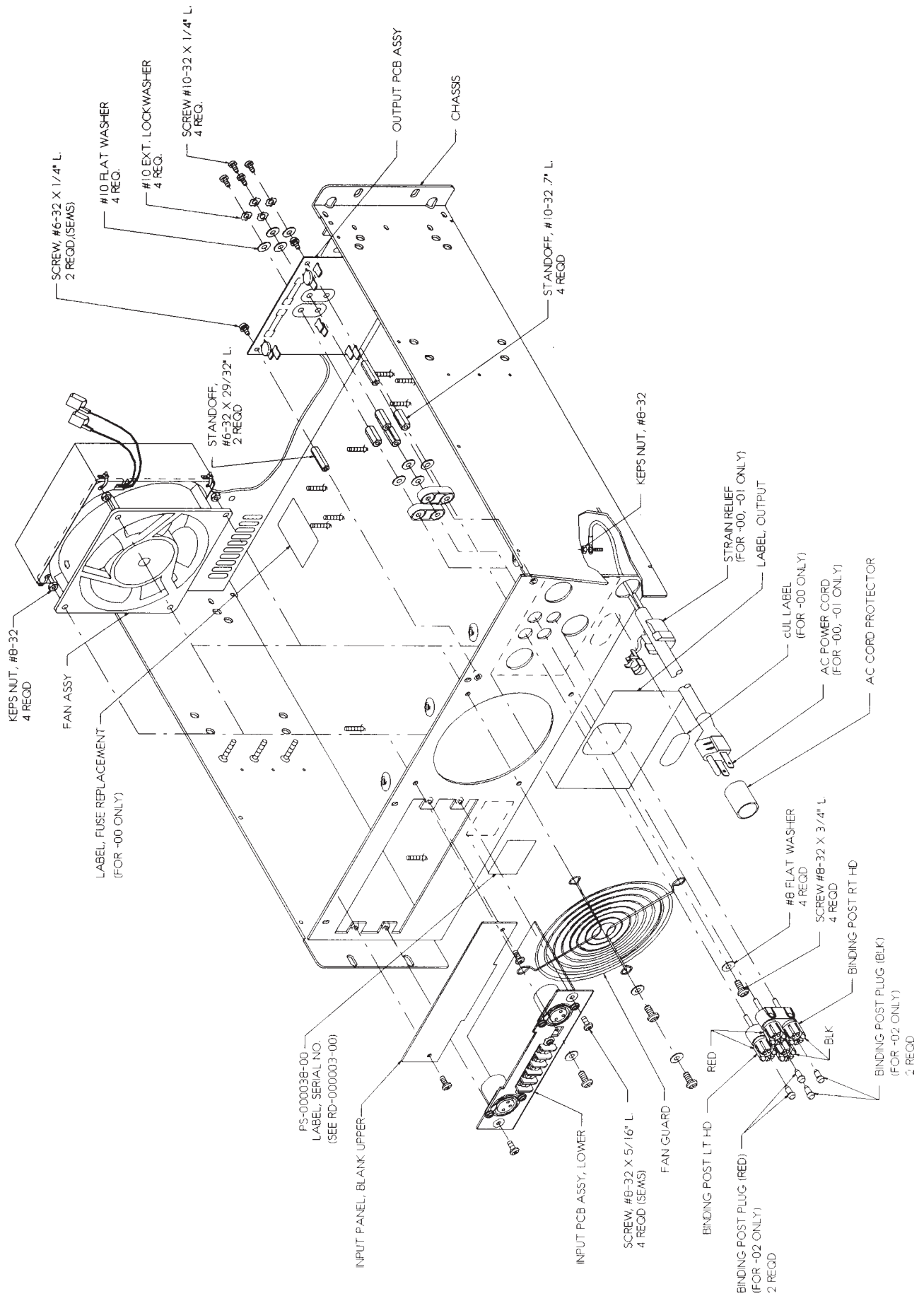




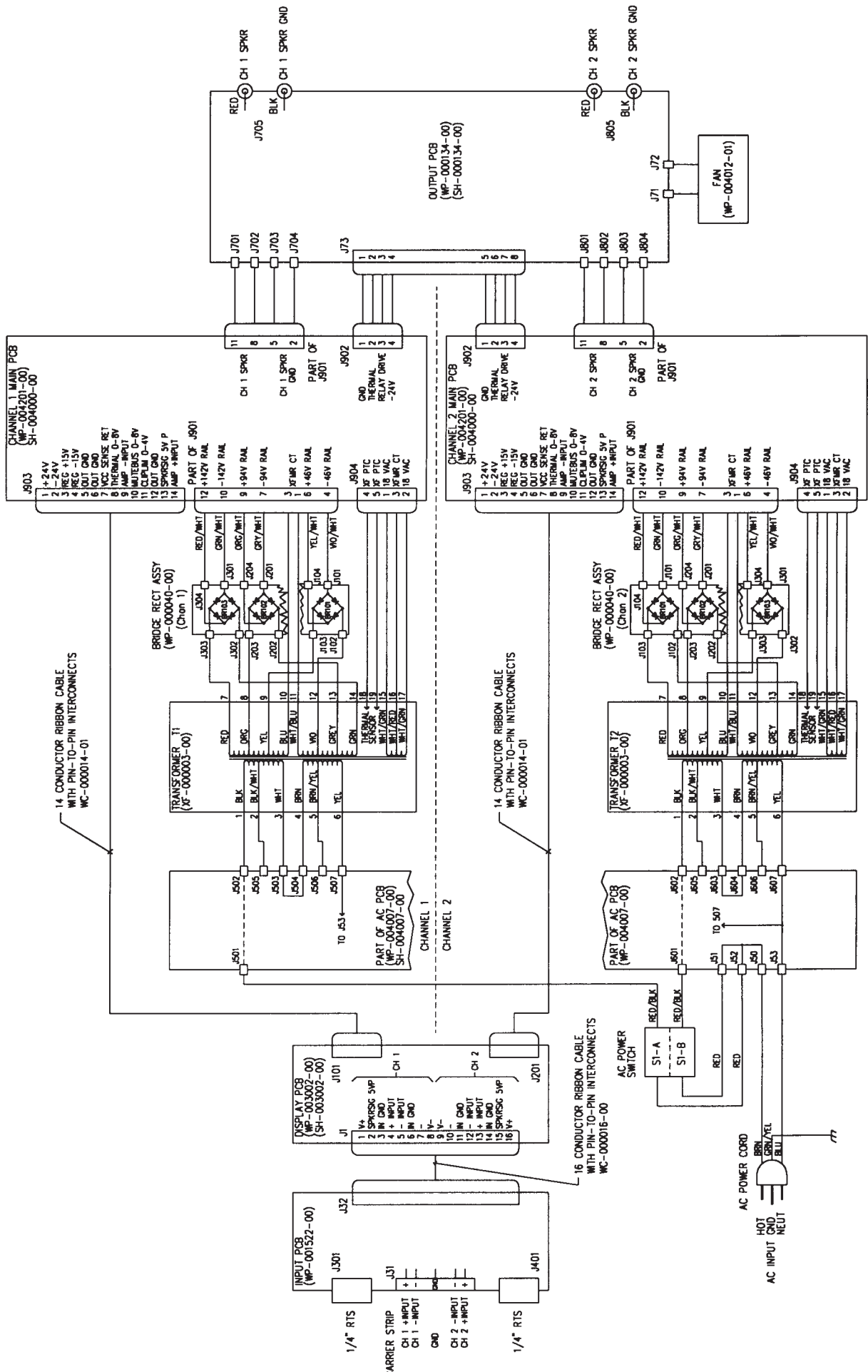
CHASSIS ASSEMBLY,  
MX 3000a



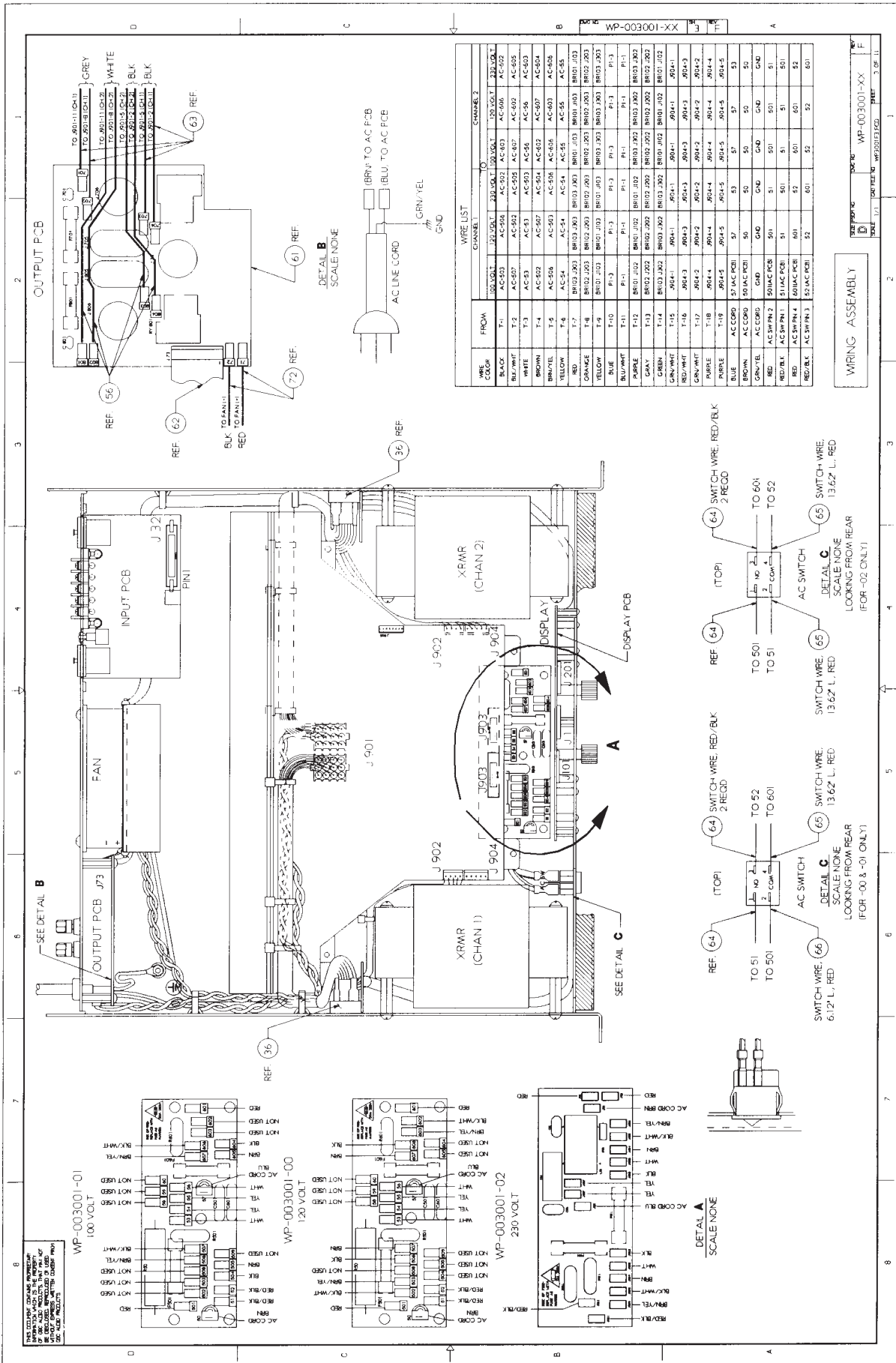






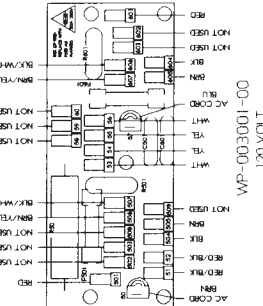


WIRING DIAGRAM - MX3000G, 230V SHOWN

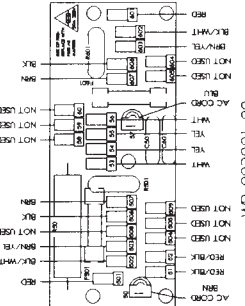


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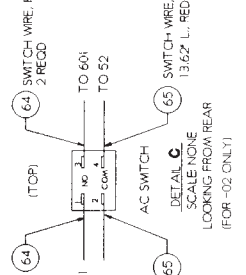
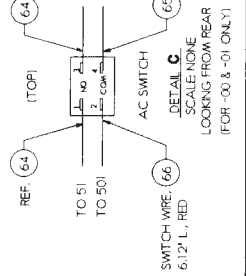
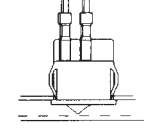
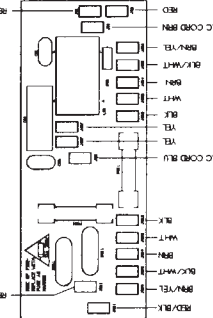
WP-003001-01  
100 VOLT



WP-003001-00  
120 VOLT



WP-003001-02  
230 VOLT

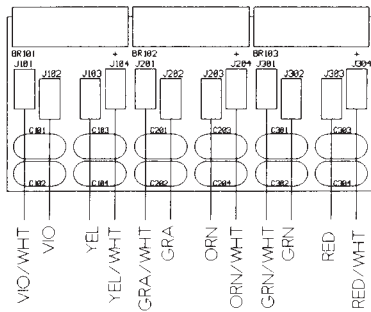


WIRE COLOR	FROM	CHANNEL 1		CHANNEL 2	
		TO	TO	TO	TO
BLACK	F1	200J01	200J01	200J01	200J01
BLK/WH	F2	AC-502	AC-502	AC-502	AC-502
WHITE	F3	AC-503	AC-503	AC-503	AC-503
BROWN	F4	AC-504	AC-504	AC-504	AC-504
BRN/YEL	F5	AC-505	AC-505	AC-505	AC-505
YELLOW	F6	AC-506	AC-506	AC-506	AC-506
ORANGE	F7	AC-507	AC-507	AC-507	AC-507
RED	F8	AC-508	AC-508	AC-508	AC-508
RED/BLK	F9	AC-509	AC-509	AC-509	AC-509
RED/YEL	F10	AC-510	AC-510	AC-510	AC-510
RED/BLK	F11	AC-511	AC-511	AC-511	AC-511
PURPLE	F12	AC-512	AC-512	AC-512	AC-512
GRAY	F13	AC-513	AC-513	AC-513	AC-513
GREEN	F14	AC-514	AC-514	AC-514	AC-514
GN/YEL	F15	AC-515	AC-515	AC-515	AC-515
RED/WH	F16	AC-516	AC-516	AC-516	AC-516
ORANGE	F17	AC-517	AC-517	AC-517	AC-517
RED/WH	F18	AC-518	AC-518	AC-518	AC-518
ORANGE	F19	AC-519	AC-519	AC-519	AC-519
RED/BLK	F20	AC-520	AC-520	AC-520	AC-520
RED/BLK	F21	AC-521	AC-521	AC-521	AC-521
RED/BLK	F22	AC-522	AC-522	AC-522	AC-522
RED/BLK	F23	AC-523	AC-523	AC-523	AC-523
RED/BLK	F24	AC-524	AC-524	AC-524	AC-524
RED/BLK	F25	AC-525	AC-525	AC-525	AC-525
RED/BLK	F26	AC-526	AC-526	AC-526	AC-526
RED/BLK	F27	AC-527	AC-527	AC-527	AC-527
RED/BLK	F28	AC-528	AC-528	AC-528	AC-528
RED/BLK	F29	AC-529	AC-529	AC-529	AC-529
RED/BLK	F30	AC-530	AC-530	AC-530	AC-530
RED/BLK	F31	AC-531	AC-531	AC-531	AC-531
RED/BLK	F32	AC-532	AC-532	AC-532	AC-532
RED/BLK	F33	AC-533	AC-533	AC-533	AC-533
RED/BLK	F34	AC-534	AC-534	AC-534	AC-534
RED/BLK	F35	AC-535	AC-535	AC-535	AC-535
RED/BLK	F36	AC-536	AC-536	AC-536	AC-536
RED/BLK	F37	AC-537	AC-537	AC-537	AC-537
RED/BLK	F38	AC-538	AC-538	AC-538	AC-538
RED/BLK	F39	AC-539	AC-539	AC-539	AC-539
RED/BLK	F40	AC-540	AC-540	AC-540	AC-540
RED/BLK	F41	AC-541	AC-541	AC-541	AC-541
RED/BLK	F42	AC-542	AC-542	AC-542	AC-542
RED/BLK	F43	AC-543	AC-543	AC-543	AC-543
RED/BLK	F44	AC-544	AC-544	AC-544	AC-544
RED/BLK	F45	AC-545	AC-545	AC-545	AC-545
RED/BLK	F46	AC-546	AC-546	AC-546	AC-546
RED/BLK	F47	AC-547	AC-547	AC-547	AC-547
RED/BLK	F48	AC-548	AC-548	AC-548	AC-548
RED/BLK	F49	AC-549	AC-549	AC-549	AC-549
RED/BLK	F50	AC-550	AC-550	AC-550	AC-550
RED/BLK	F51	AC-551	AC-551	AC-551	AC-551
RED/BLK	F52	AC-552	AC-552	AC-552	AC-552
RED/BLK	F53	AC-553	AC-553	AC-553	AC-553
RED/BLK	F54	AC-554	AC-554	AC-554	AC-554
RED/BLK	F55	AC-555	AC-555	AC-555	AC-555
RED/BLK	F56	AC-556	AC-556	AC-556	AC-556
RED/BLK	F57	AC-557	AC-557	AC-557	AC-557
RED/BLK	F58	AC-558	AC-558	AC-558	AC-558
RED/BLK	F59	AC-559	AC-559	AC-559	AC-559
RED/BLK	F60	AC-560	AC-560	AC-560	AC-560

WIRING ASSEMBLY

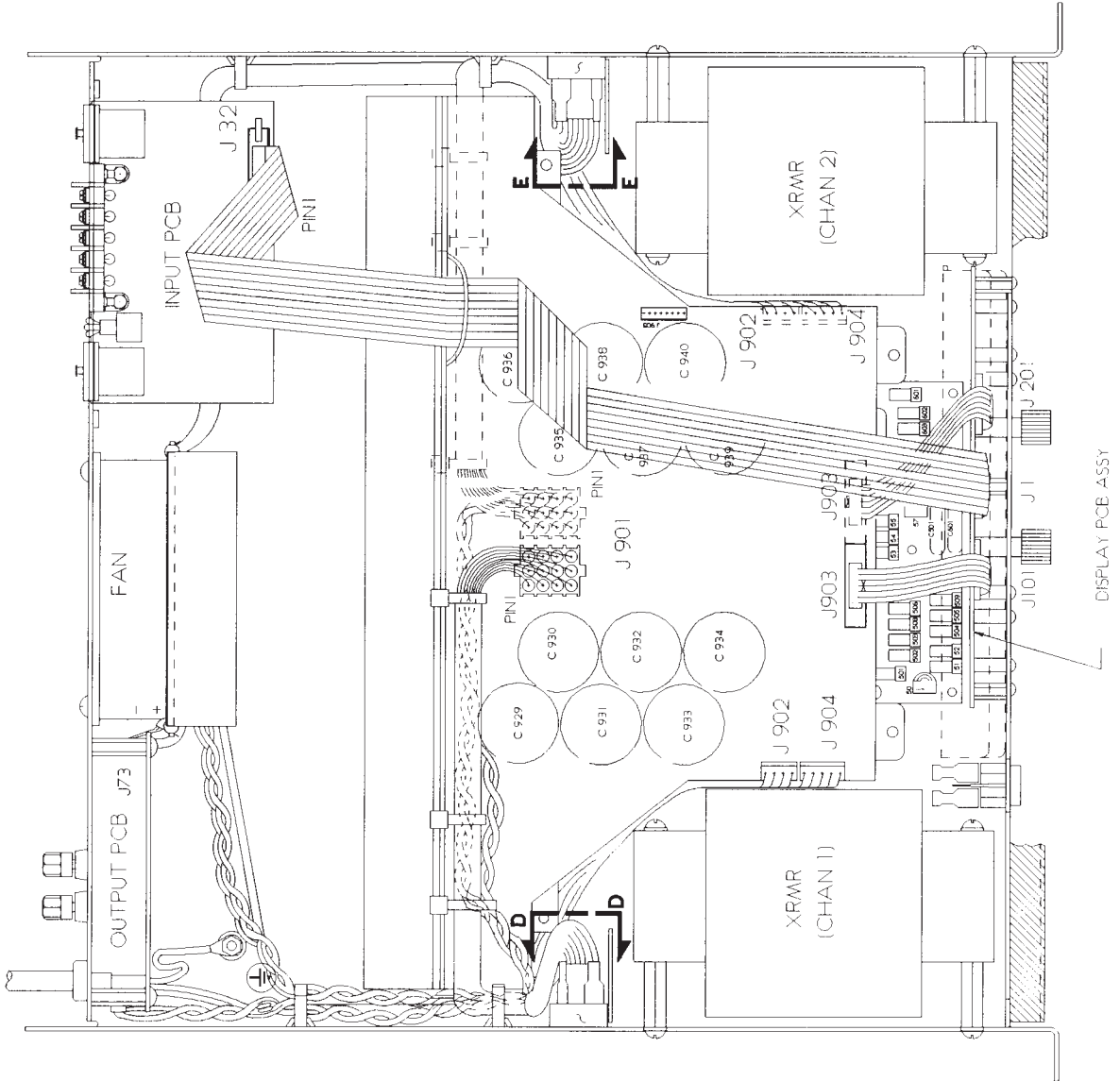
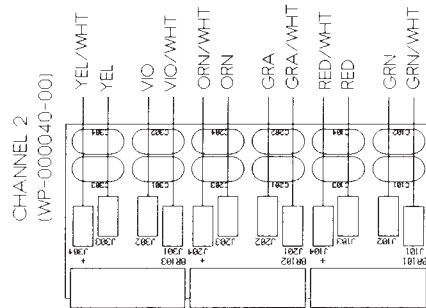
WP-003001-XX  
REV. 1/71  
DATE FILED WP-003001-XX  
PAGE 3 OF 11

CHANNEL 1  
(WP-000040-00)



VIEW D-D  
ROTATED CW 90°

CHANNEL 2  
(WP-000040-00)



VIEW E-E  
ROTATED CCW 90°

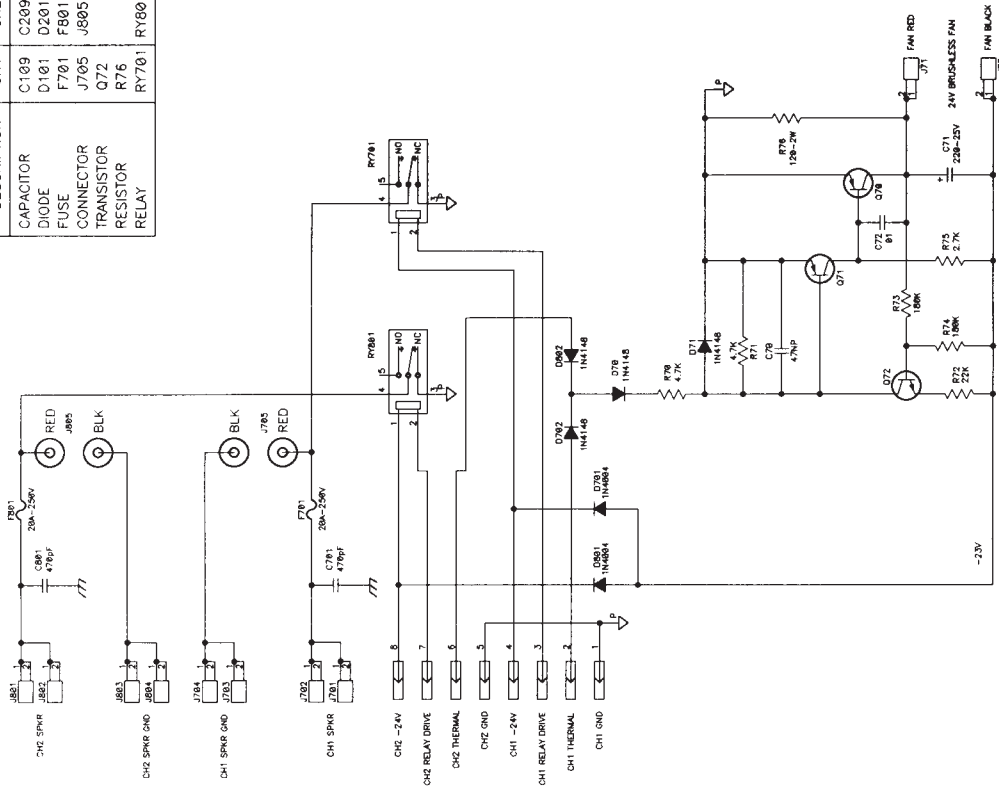
WIRE LIST (CHAN 1)	
FROM	TO
P1-2	BLK J704
P1-4	VIO/WHT BR101 +
P1-5	BLK J703
P1-6	YEL/WHT BR101 -
P1-7	GRA/WHT BR102 +
P1-8	GRA J702
P1-9	ORN/WHT BR102 -
P1-10	GRN/WHT BR103 +
P1-11	GRY J701
P1-12	RED/WHT BR103 -
J902-1	BRN J73-5
J902-2	RED J73-6
J902-3	YEL J73-7
J902-4	ORN J73-8
J101	GRA J903

WIRE LIST (CHAN 2)	
FROM	TO
P1-2	BLK J604
P1-4	VIO/WHT BR103 +
P1-5	BLK J603
P1-6	YEL/WHT BR103 -
P1-7	GRA/WHT BR102 +
P1-8	WHT J602
P1-9	ORN/WHT BR102 -
P1-10	GRN/WHT BR101 +
P1-11	WHT J601
P1-12	RED/WHT BR101 -
J902-1	BRN J73-1
J902-2	RED J73-2
J902-3	YEL J73-3
J902-4	ORN J73-4
J201	GRA J903

WIRE LIST (CHAN 1 & CHAN 2)	
FROM	TO
J1	GRA J32

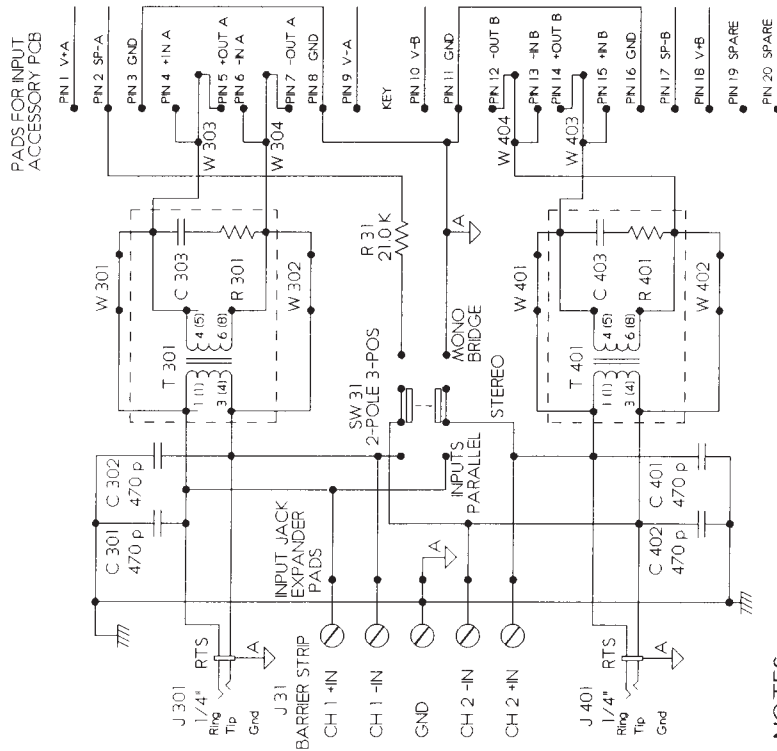
SCHEMATIC, OUTPUT BOARD, MX3000g  
PC-004004-00 REV D 1-26-94

REFERENCE DESIGNATION		HIGHEST NO. USED
DESCRIPTION	CH1	CH2
CAPACITOR	C109	C209
DIODE	D101	D201
FUSE	F701	F801
CONNECTOR	J705	J805
TRANSISTOR	Q72	Q75
RESISTOR	R76	R77
RELAY	RY701	RY801



- 8. 072, OSC PART QD-004410-TX
  - 7. 071, OSC PART QD-008599-TX
  - 6. 070, OSC PART QD-002763-TL
  - 5. PARTS IN COMMON TO CH 1 & 2 NUMBERED 70-79.
  - 4. CH 2 COMPONENTS NUMBERED 801-899.
  - 3. CH 1 COMPONENTS NUMBERED 701-799.
  - 2. ALL RESISTORS IN OHMS 1/4 WATT, ± 5%.
  - 1. ALL CAPACITORS IN μF. 100V, ± 10%.
- NOTES: UNLESS OTHERWISE SPECIFIED

SCHEMATIC, MXα SERIES STANDARD INPUT BOARD

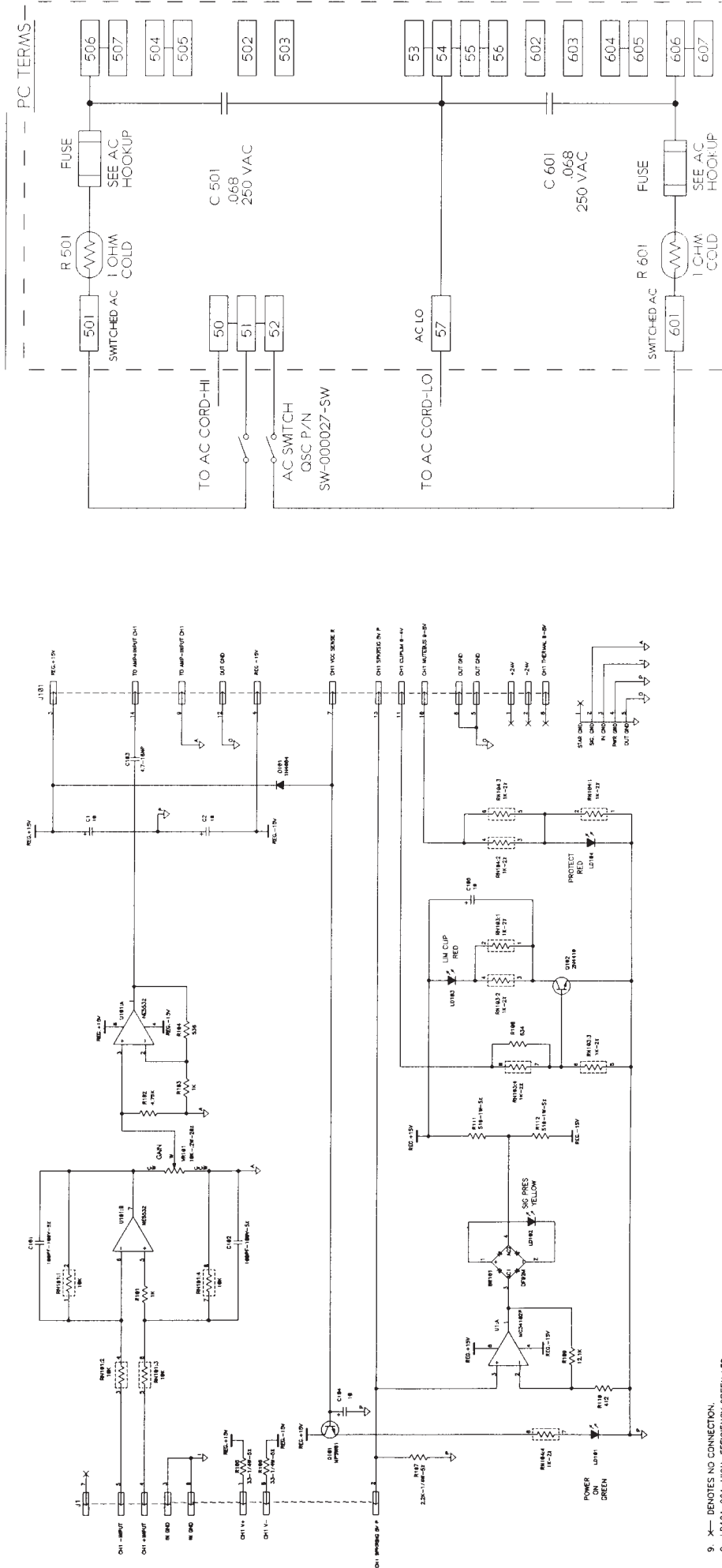


NOTES

- 1. BOARD SHIPPED WITH W 301-304, W 401-404 MOUNTED AS SHOWN.
- 2. PARTS WITH DOTTED OUTLINE FOR USER MODIFICATION. SEE MANUAL.
- 3. TRANSFORMER PIN NUMBERS: 1-8 OSC X F-1 (LENSON XFMR)

SCHEMATIC, DISPLAY BOARD, MX3000a  
 FOR PC-003002-00 REV A  
 DOC NO. SH-003002-00 REV A

SCHEMATIC, AC PCB, MX3000a

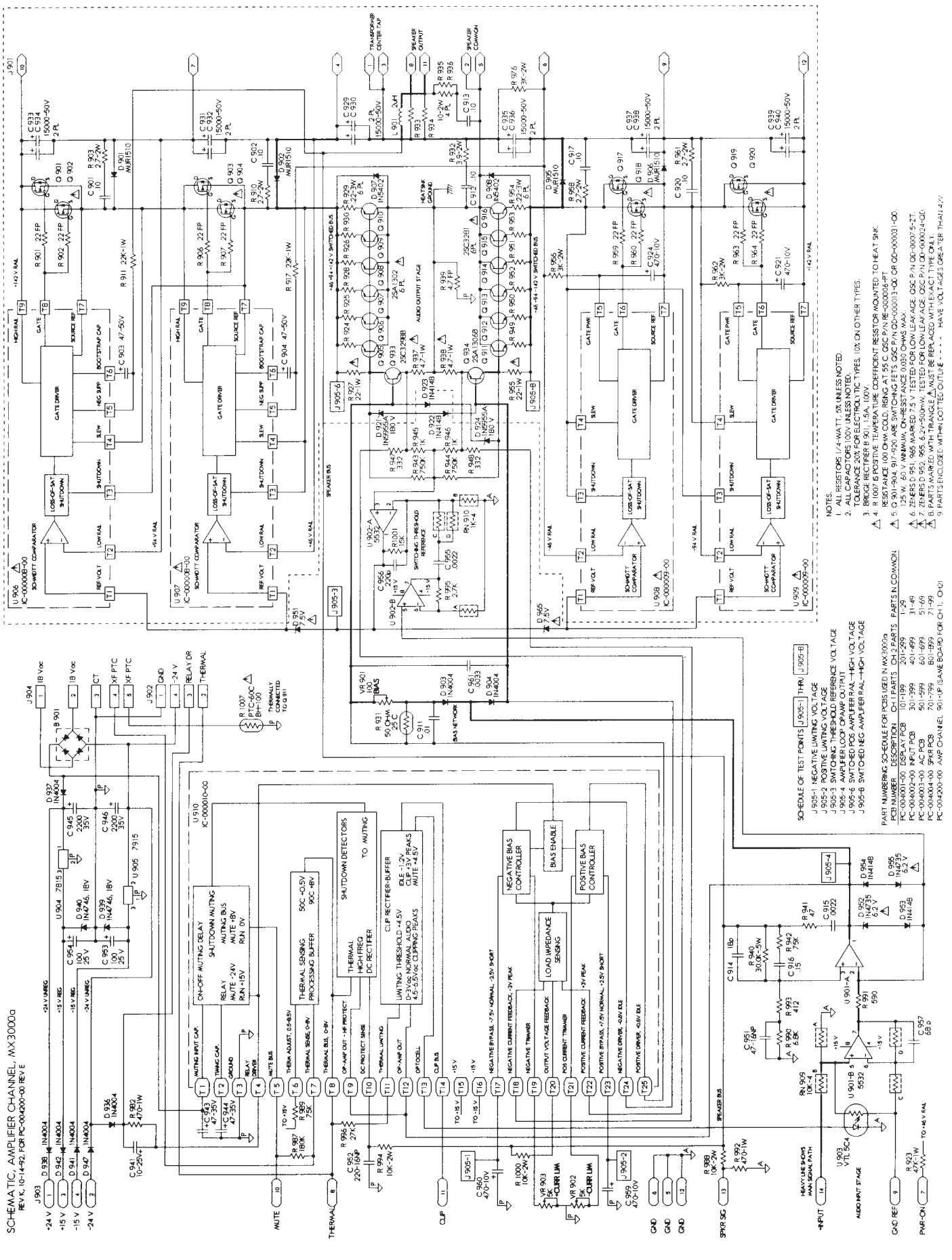


- 9. X— DENOTES NO CONNECTION.
- 8. LD101, 201, HIGH—EFFICIENCY GREEN LED.
- 7. LD102, 202, HIGH—EFFICIENCY YELLOW LED.
- 6. LD103, 104, 203, 204, HIGH—EFFICIENCY RED LED.
- 5. PARTS IN COMMON TO BOTH CHANNELS NUMBERED 1-99.
- 4. CH 2 COMPONENTS NUMBERED 201-299.
- 3. CH 1 COMPONENTS NUMBERED 101-199.
- 2. ALL RESISTORS IN OHMS, 1/8 WATT, 1%.  
1. ALL CAPACITORS IN  $\mu$ F, 35V, 20%.

SCHEMATIC DIAGRAM,  
 DISPLAY BOARD, MX3000a



**SCHEMATIC, AMPLIFIER CHANNEL, MX3000G**  
REV. V, 10-1-92, FOR PC-004000-00 REV E



- NOTES:**
1. ALL RESISTORS 1/4-WATT, 5% UNLESS NOTED.
  2. ALL CAPACITORS 100V UNLESS NOTED.
  3. ALL CAPACITORS ARE POLARIZED UNLESS NOTED.
  4. R 1007 IS POSITIVE TEMPERATURE COEFFICIENT RESISTOR MOUNTED TO HEAT SINK.
  5. Q 901-904, 917-920 ARE SWITCHING FET'S. OSC P/N: OC-000013-00 OR OC-000031-00.
  6. ZENERS D 951, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000 ARE TESTED FOR LOW LEAKAGE. OSC P/N: OC-000014-00.
  7. ALL PARTS ARE TESTED FOR LOW LEAKAGE. OSC P/N: OC-000014-00.
  8. PARTS ENCLOSED WITHIN COTTE/COUTLINE ARE TESTED FOR LOW LEAKAGE. OSC P/N: OC-000014-00.
  9. PARTS ENCLOSED WITHIN COTTE/COUTLINE ARE TESTED FOR LOW LEAKAGE. OSC P/N: OC-000014-00.

**SCHEDULE OF TEST POINTS (J905-1 THRU J905-8)**

J905-1	NEGATIVE LIMITING VOLTAGE
J905-2 <th>SWITCHING THRESHOLD REFERENCE VOLTAGE</th>	SWITCHING THRESHOLD REFERENCE VOLTAGE
J905-3 <th>AMPLIFIER LOOP OPAMP OUTPUT</th>	AMPLIFIER LOOP OPAMP OUTPUT
J905-4 <th>SWITCHED POS AMPLIFIER PAIR-HIGH VOLTAGE</th>	SWITCHED POS AMPLIFIER PAIR-HIGH VOLTAGE
J905-5 <th>SWITCHED NEG AMPLIFIER PAIR-HIGH VOLTAGE</th>	SWITCHED NEG AMPLIFIER PAIR-HIGH VOLTAGE

**PART NUMBERING SCHEME FOR PCB USED IN MX3000G**

PCB NUMBER	DESCRIPTION	CH-1 PARTS	CH-2 PARTS
PC-004001-00	DISPLAY PCB	101-199	201-299
PC-004002-00	INPUT PCB	301-399	401-499
PC-004003-00	AMPLIFIER PCB	501-599	601-699
PC-004004-00	SPKR PCB	701-799	801-899
PC-004005-00	AMP CHANNEL	901-999	1001-1099

