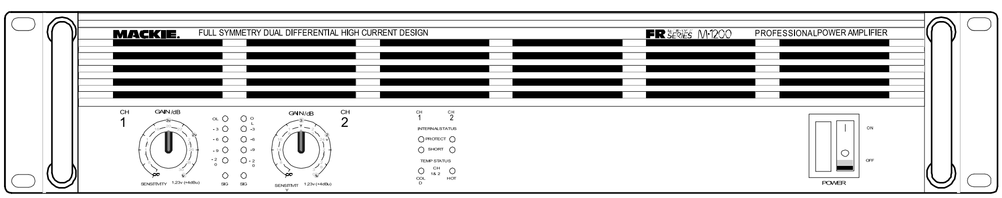
MACKIE®

FR FAST RECOVERY SERIES

M•1400 / M•1400i / M•1200



SERVICE MANUAL

Version 1.2

820-179-00

Page 3 is interactive

CAUTION *AVIS*

RISK OF ELECTRIC SHOCK
DO NOT OPEN
RISQUE DE CHOC ELECTRIQUE
NE PAS OUVRIR

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK DO NOT REMOVE THE COVER
NO USER SERVICEABLE PARTS INSIDE
REFER SERVICING TO QUALIFIED PERSONNEL

WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS PRODUCT TO RAIN OR MOISTURE

TO PREVENT ELECTRIC SHOCK, DO NOT USE THIS POLARIZED PLUG WITH AN EXTENSION CORD, RECEPTACLE OR OTHER OUTLET UNLESS THE BLADES CAN BE FULLY INSERTED TO PREVENT BLADE EXPOSURE.

ATTENTION: POUR EVITER LES RISQUES DE CHOC ELECTRIQUE, NE PAS ENLEVER LE COUVERCLE. AUCUN ENTRETIEN DE PIECES INTERIEURES PAR L'USAGER. CONFIER L'ENTRETIEN AU PERSONNEL QUALIFIE.

AVIS:POUR EVITER LES RISQUES D'INCENDIE OU D'ELECTROCUTION, N'EXPOSEZ PAS CET ARTICLE A LA PLUIE OU A L'HUMIDITE.

POUR PREVENIR LES CHOCS ELECTRIQUES NE PAS UTILISER CETTE FICHE POLARISEE AVEC UN PROLONGATEUR, UN PRISE DE COURANT OU UNE AUTRE SORTIE DE COURANT, SAUF SI LES LAMES PEUVENT ETRE INSEREES A FOND SANS LAISSER AUCUNE PARTIE A DECOUVERT.

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

Le symbole éclair avec point de fléche à l'interieur d'un triangle équilatéral est utilisé pour alerter l'utilisateur de la présence à l'interieur du coffret de "vlotage dangereux" non isole d'ampleur suffisante pour constituer un risque d'éléctrocution.

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

Le point d'exclamation à l'intérieur d'un triangle de la présence d'instructions importantes pour le fonctionnement et l'entretien (service) dans le livret d'instrucion accompagnant L'appareil.

HOME

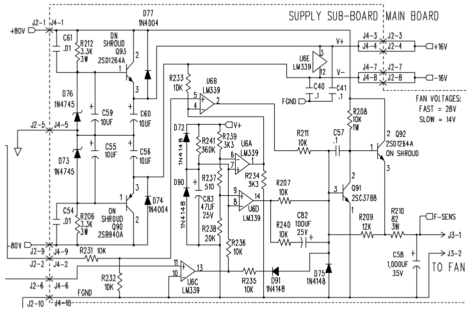


TABLE OF CONTENTS

INTRODUCTION

This manual contains complete service information for the M•1200, M•1400 and M•1400i audio power amplifiers. Operating instructions will be touched on briefly. For complete operating instructions refer to the owner's manual.

The FR Series™ M•1200 and M•1400 are high power audio amplifiers designed for professional applications. They feature audiophile quality sound, excellent stability, extensive protection circuitry, and legendary Mackie reliability. Patented Fast Recovery circuitry allows the M•1200/M•1400 to recover from clipping without generating undesirable artifacts.

SERVICE ON THE M•1200/M•1400 IS TO BE PERFORMED BY EXPERIENCED TECHNICIANS ONLY!

To service the M•1200/M•1400, technicians should be familiar with op-amps, discrete analog circuitry, and troubleshooting high power solid state amplifiers. Presentation of this manual does not constitute endorsement of qualifications by Mackie Designs.

! SMD !

The M•1200/M•1400 makes extensive use of surface mount components. Servicing technicians should have the tools and experience to perform surface mount rework.

TECHNICAL SUPPORT

Mackie Designs Technical Support Department is available 8AM - 5PM PST, Monday - Friday at 1-800-258-6883 (outside US call 011-425-487-4333) Please feel free to call with any questions (Better safe than sorry!).

DISCLAIMER

SYSTEM OVERVIEW

This section provides a quick summary of the M•1200/M•1400's major features. It is not intended to take the place of the owner's manual. It is included here to help servicing technicians familiarize themselves with the M•1200/M•1400.

DIFFERENCES BETWEEN THE M•1400, M•1400i AND M•1200

The M•1200 and M•1400 are electronically identical products with the following exceptions:

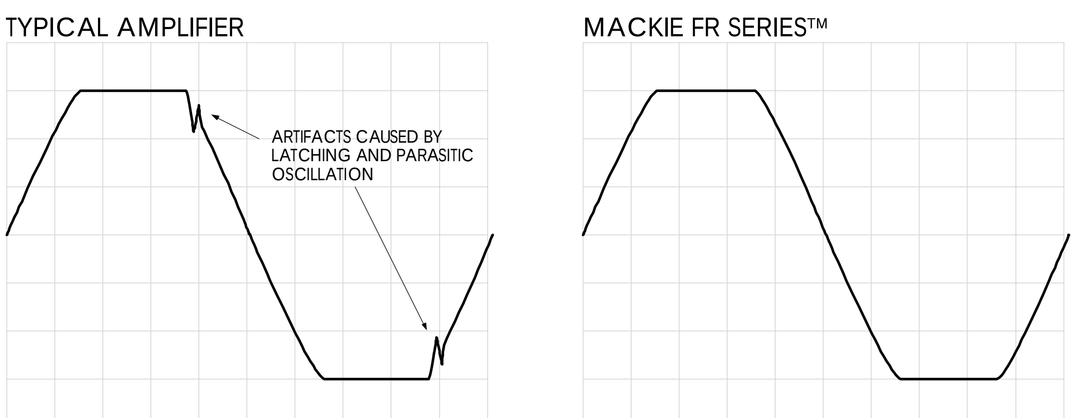
1. The M•1400 has 12,000uF main filter caps, where the M•1200 and M•1400i have 10,000uF.
2. The M•1400 and M•1400i use a more powerful fan than the M•1200.
3. The M•1400 has Speakon® connectors where the M•1200 and M•1400i have ¼" speaker outputs (both in addition to binding posts).

The M•1200 was discontinued in 1998 and replaced by the M•1400i.

Export M•1400's also have a "Soft Start" circuit that is not installed on American units.

FAST RECOVERY DESIGN

Solid state power amplifiers have a reputation for sounding harsh when driven into clipping. The usual explanation is odd harmonics generated by hard clipping, but In fact much of the unpleasant sound is caused by latching and parasitic oscillations that occur as the amplifier recovers from clipping.



Mackie's Fast Recovery design recovers from clipping quickly without generating any undesirable artifacts. This performance is achieved by two unique design elements; the *Full Symmetry Dual Differential* front end provides excellent linearity while minimizing the need for negative feedback, and the *Baker Clamp* prevents output/driver device saturation. How these circuits operate is covered in depth in the circuit theory section.

SUMMARY OF FEATURES

FRONT PANEL

1. GAIN
Detented gain controls adjust the level sent to each output section. The gain structure is designed so that a +4dBu (1.23V rms) input signal drives the amplifier to full rated power into 4Ω.

2. METERS
The M•1200/M•1400's meters indicate the relative output level of the amplifier referenced to full power. The SIG (signal present) senses the input prior to the gain control.

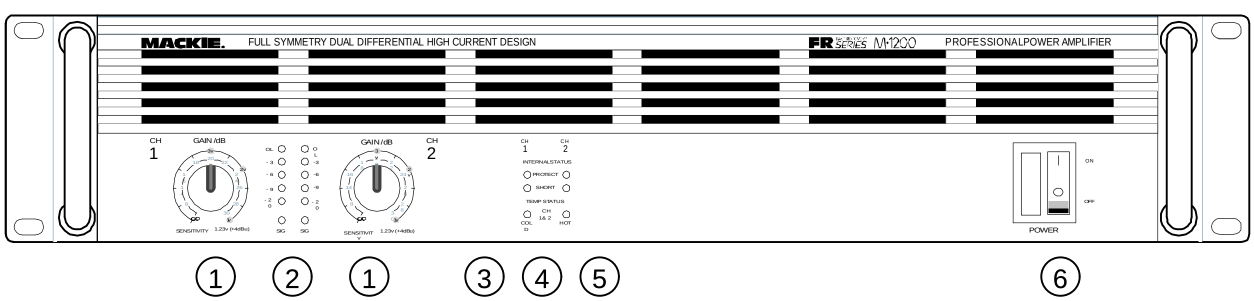
3. PROTECT
The Protect LEDs light indicating the channel has been muted for one of the following reasons:

- 4 second turn on delay
- Output devices beyond Safe Operating Area (SOA), also lights SHORT LED(s).
- Heatsink temperature beyond 80 degrees Celsius.

4. SHORT
The Short LEDs light to show that the amplifier has engaged protection due to a short or low impedance on the output.

5. TEMP STATUS
The HOT LED lights to indicate that the amplifier has engaged protection due to heatsink temperature or power transformer core temperature.

6. POWER SWITCH
This remarkable device requires years of study to full comprehend.



HOME

REAR PANEL

1. SPEAKER OUTPUTS

The M•1400 has Speakon® connectors where the M•1200 has ¼" speaker outputs. Both models have binding posts. For bridged mono operation, the + output comes from channel one's positive terminal and - from channel two's positive.

2. INPUT

The M•1200/M•1400 has both XLR and ¼" TRS inputs. They are electrically identical (wired in parallel). In bridged mono or parallel mono mode channel 2 input is disabled.

3. THROUGH

Yet another jack wired in parallel with the Inputs, the through jack provides a convenient way to chain amplifiers or pass the signal to any other device.

4. LOW CUT FILTER

Sweeps the built in high pass filter from 10Hz to 170Hz.

5. CONSTANT DIRECTIVITY HORN EQ/AIR EQ

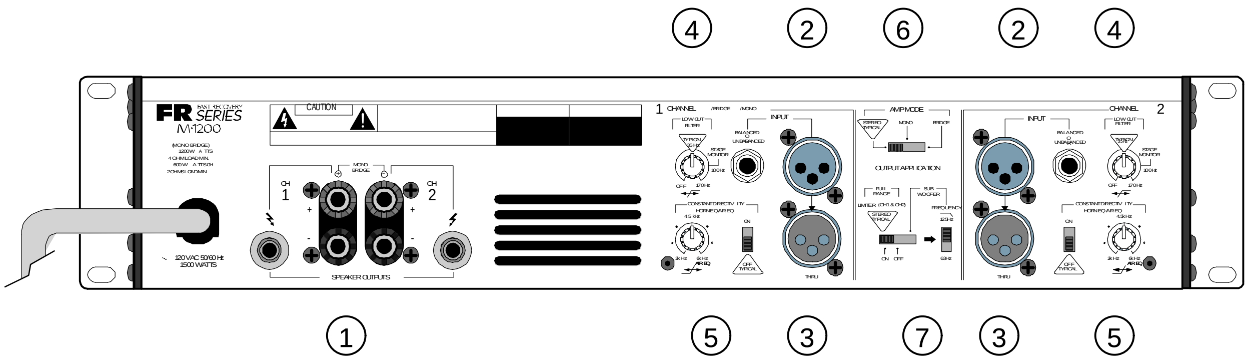
Built in shelving EQ provides high frequency compensation when using constant directivity horns.

6. AMP MODE

Three position slide switch selects STEREO, PARALLEL MONO or BRIDGE MONO operation. Channel One's input signal is used for PARALLEL MONO and BRIDGE MONO operation. AMP MODE and OUTPUT APPLICATION switches should not be changed while the unit is on.

7. OUTPUT APPLICATION

Placing the three position slide switch in its center position defeats the built in LIMITER for both channels. Selecting SUB WOOFER engages the built in low pass filter. The FREQUENCY switch selects between 125Hz and 63Hz cutoff for the low pass filter. In SUB WOOFER mode, inputs 1 and 2 are summed regardless of AMP MODE setting. (Remember, human hearing is unable to discern direction at frequencies where the wavelenth is greater than the distance between your ears, ~250Hz unless you have a grossly large head!)



SPECIFICATIONS

CONTINUOUS AVERAGE OUTPUT POWER, BOTH CHANNELS DRIVEN:

M•1200

225 watts per channel into 8 ohms from 20Hz to 20kHz, with no more than 0.025% THD

400 watts per channel into 4 ohms from 20Hz to 20kHz, with no more than 0.050% THD

600 watts per channel into 2 ohms from 20Hz to 20kHz, with no more than 0.095% THD

Bridged mono operation:

800 watts into 8 ohms from 20Hz to 20kHz, with no more than 0.050% THD

1200 watts into 4 ohms from 20Hz to 20kHz, with no more than 0.095% THD

Maximum Power at 1% THD:

250	watts per channel into 8 ohms
425	watts per channel into 4 ohms
640	watts per channel into 2 ohms
850	watts into 8 ohms bridged
1280	watts into 4 ohms bridged

M•1400 / M•1400i

250 watts per channel into 8 ohms from 20Hz to 20kHz, with no more than 0.012% THD

425 watts per channel into 4 ohms from 20Hz to 20kHz, with no more than 0.025% THD

630 watts per channel into 2 ohms from 20Hz to 20kHz, with no more than 0.050% THD

Bridged mono operation:

850 watts into 8 ohms from 20Hz to 20kHz, with no more than 0.025% THD

1260 watts into 4 ohms from 20Hz to 20kHz, with no more than 0.050% THD

Maximum Power at 1% THD:

300	watts per channel into 8 ohms
500	watts per channel into 4 ohms
700	watts per channel into 2 ohms
1000	watts into 8 ohms bridged
1400	watts into 4 ohms bridged

Note: Power ratings are specified at 120VAC (U.S. and Canada) and 240VAC (Export) line voltages.

The M•1200/M•1400 power amplifiers draw large amounts of current from the AC line with continuous sine wave testing. Accurate measurement of power requires a steady and stable AC supply. This means the line impedance must be very low to insure that the peak AC line voltage does not sag to less than 97% of its value.

If driving highly reactive loads, we recommend that the limiter circuit be engaged.

POWER BANDWIDTH:

20Hz to 70kHz (+0, –3 dB)

FREQUENCY RESPONSE:

20Hz to 40kHz (+0, –1 dB)
10Hz to 70kHz (+0, –3 dB)

DISTORTION:

THD, SMPTE IMD, TIM	< 0.025% @ 8Ω
	< 0.050% @ 4Ω
	< 0.150% @ 2Ω

SIGNAL-TO-NOISE RATIO:

> 107 dB below rated power into 4 ohms

CHANNEL SEPARATION:

> 80 dB @ 1kHz

DAMPING FACTOR:

350 minimum

INPUT IMPEDANCE:

20k balanced bridging

INPUT SENSITIVITY:

1.23 volts (+4 dBu) for rated power into 4 ohms

GAIN:

30.25 dB (32.5V/V)

MAXIMUM INPUT LEVEL:

9.75 volts (+22 dBu)

HOME

RISE TIME:

< 4.4µs

SLEW RATE:

Voltage Slew Rate	> 50V/µs > 100V/µs bridged
Current Slew Rate	> 32A/µs at 2Ω

CMRR:

> 40 dB, 20Hz to 20kHz

LOAD ANGLE:

8(±jx) time independent at 8Ω
4(±jx) time dependent, T > 6 min. at 4Ω
2(1±jx) time dependent, T > 2 min. at 2Ω

TRANSIENT RECOVERY:

< 1µs for 20 dB overdrive @ 1kHz

HIGH FREQUENCY OVERLOAD AND LATCHING:

No latch up at any frequency or level.

HIGH FREQUENCY STABILITY:

Unconditionally stable driving any reactive or capacitive load.

TURN ON DELAY:

3 seconds

VARIABLE LOW-CUT FILTER:

10Hz (Off) to 170Hz, 2nd Order Bessel

SUBWOOFER LOW-PASS FILTER:

Switched: 63Hz/125Hz, 3rd Order Bessel

CONSTANT DIRECTIVITY HIGH FREQUENCY BOOST:

2kHz to 6kHz (+3 dB points)
6 dB/octave high-frequency shelving filter, (shelving occurs at approximately 30kHz)

LIMITER SECTION:

Complementary Positive and Negative Peak Detecting

INDICATORS:

6 meter LEDs per channel
SIG (Signal Present), –20, –9, –6, –3, OL (Overload)

CH 1 & 2
PROTECT LEDs
SHORT LEDs

TEMP STATUS
COLD/HOT LEDs

POWER CONSUMPTION:

65	watts at idle
900	watts with musical program fully loaded (2 ohms per side, or 4 ohms bridged)
550	watts with musical program fully loaded (4 ohms per side, or 8 ohms bridged)
850	watts at full power into 8 ohms (continuous sine wave)
1500	watts at full power into 4 ohms (continuous sine wave)
2500	watts at full power into 2 ohms (continuous sine wave)

AC LINE POWER:

US	120VAC, 60Hz
Europe	240VAC, 50/60Hz
Japan	100VAC, 50/60Hz
Korea	220VAC, 60Hz

AC DROP-OUT VOLTAGE:

At approximately 50% of rated line voltage

PHYSICAL:

Height	3.5 inches	(89mm)
Width	19.0 inches	(483mm)
Depth	15.25 inches	(387mm)
Overall Depth	16.25 inches	(413mm)
Handle Depth	1.25 inches	(32mm)
Weight	36 pounds	(16.3kg)

Since we are always striving to make our stuff better at Mackie Designs by incorporating new and improved materials, components, and manufacturing methods, we reserve the right to change these specifications at any time without notice.

CIRCUIT THEORY

Much of the circuitry in the M•1200/M•1400 is self explanatory from the schematic. This section will explain the unique circuits and architecture. Samples in this section will refer to Channel 1 (Left) for circuitry that is identical on both channels.

INPUT CIRCUITRY

Refer to schematic on page 23.

The signal path begins with the INPUT BOARD. Following Channel 1's input, signal is fed to a unity gain differential op-amp, U1A. The signal is next sent to U1B which serves as both HPF and CD horn EQ. If not in SUBWOOFER mode, the summing amp (U2B) and LPF's (U3A, U3B) are bypassed. The signal is sent via J11 to the gain control on the DISPLAY BOARD. After the gain control, the signal is buffered by U7A, returned to the INPUT BOARD and routed to the MAIN BOARD via J16.

Channel 2's input signal path is electrically identical to Channel 1's in STEREO mode. In PARALLEL MONO mode Channel 2's input signal is ignored and Channel 1's input is sent to Channel 2's gain control via SW5A. For BRIDGE MONO operation, Channel 1's input signal is inverted by U2A and routed to the MAIN BOARD via SW5C.

POWER AMPLIFIER CIRCUITRY

Refer to schematic on page 27.

The M•1200/M•1400 use a class AB triple darlington output with complementary output devices. The main power supply is +/- 80V, there is also a +/- 90V supply for the front end circuitry. Channels are muted for 4 seconds on power up as C53 charges via R203. Muting is achieved by turning off Q73, removing current sources for the differential pairs. (Wait a minute! PAIRS? Read on...)

An immediately obvious departure from standard designs is the *Dual Differentials* and *Symmetrical Voltage Amps*. The reasoning behind this front end architecture is actually quite simple. Transistors transfer characteristics are not entirely linear, so even the best conventional front end design will introduce some distortion. Most amplifiers use negative feedback to reduce this problem (creating a few more in the process). Mackie FR Series amplifiers take a different approach. By using two complementary "mirror image" front end circuits any distortion caused by non-linear transistor curves is effectively canceled out in the bias string, without feedback!

Another design feature unique to Mackie FR Series Amplifiers is the *Baker Clamp*. The *Baker Clamp* has two functions; 1) Prevent output/driver transistors saturating, 2) Drive the LIMITER LDR. Referring to the left main amp schematic, Q27 is a common base amplifier, it will turn on if Q31's collector rises more than two diode drops above the +80V supply, preventing it from rising further. There are three diode drops between Q31's collector and the base of driver transistor Q28 (D3, D2, Q29V_{be}). Q29 will never see a voltage greater than one diode drop below the +80V supply, even if the +80V supply fluctuates. Q27 also drives the limiter LDR LED U2A. The negative side has the same circuit mirrored.

PROTECTION CIRCUITS

Refer to schematics on pages 27-29.

The M•1200/M•1400 has two output protection circuits in addition to the rail fuses. The first mutes the amp if the output devices are loaded beyond their safe operating area (SOA). The second is a crowbar circuit that ensures the rail fuses blow if there is DC on the output.

SOA PROTECTION

The SOA protection circuit senses the voltage drop across the emitter resistors much like standard VI current limiting transistors. Q76 and Q77 will turn on if the emitter drop exceeds ~1V. If they are on for long enough to charge C38 (through R159), the SOA protection circuit is activated by transistor switches Q79 and Q78.

If SOA detection is tripped, the channel is muted by discharging C53 through R200 and D65, fan speed is increased, and the “SHORT” LED lights.

DC CROWBARS

The DC Crowbar circuit protects speakers in the event of an output failure by blowing all rail fuses. SCRs Q21-24 are used to short the +/- 80V supply supplies to ground. Output signal from both sides is fed through 100K resistors R90, R89 to C21, essentially forming a LPF. DC on either output will trigger comparator U4A (positive) or U4B (negative). The SCRs are then fired via driver transistors Q87, Q88.

NOTE:
The LM339 comparator IC is used extensively in the M•1200/M•1400. It differs from a standard op-amp used as a comparator in that it has an open collector output. If the voltage at the inverting input exceeds the non-inverting, the LM339’s output switches to it’s negative supply. Otherwise, the output is open.

THERMAL MANAGEMENT

Refer to schematic on page 29.

The M•1200/M•1400 T-Design Heatsink/Fan cools output devices evenly and does not collect dust on the circuitry. The fan operates at two speeds, controlled by the amplifier. An LM35DZ mounted in the center of the heatsink provides temperature information to the fan control and overtemp circuits. There is also a thermal breaker in the power transformer.

FAN CONTROL CIRCUIT

The fan voltage comes from a feedback regulator circuit formed by Q91 and Q92. The output voltage is programmed by the ratio of R209 to R211// R207 (//=parallel). When the unit is powered up C83 charges through R241 providing a 40 second delay before the fan starts. As C83 charges, U6D's output switches to -16V, starting the fan. Then U6A's output switches to open, allowing U6B to increase the fan speed, if triggered. R240 and C82 give the fan extra voltage when starting.

The fan speed is increased by U6B adding R211 in parallel with R207. (Q91 wants it's base a diode drop above ground, so Q92 doubles its Emitter voltage). U6B is triggered by U4D to increase fan speed if;

- Channel 1 SOA protection is activated (U5C), *OR*
- Channel 2 SOA protection is activated (U5D), *OR*
- The heatsink is above 60 deg C (U5B) *AND* program is detected (U4C), *OR*
- The heatsink temperature is above 80 deg C (U5A).

U6C and Q89 are used to reset the circuit on power down. Under normal operation C50 is charged via D57, Holding Q89 off. When power is removed C50 discharges and Q89 switches on as the rails collapse. When the voltage on Q89's collector falls below ground U6 switches to the negative rail discharging C82 and C83.

THERMAL SHUTDOWN

Extreme heatsink or transformer core temperature will activate OVERTEMP. U5A activates overtemp if the LM35DZ detects heatsink temperature above 80 deg C. Feedback resistor R137 rescales U5A's voltage reference so that the heatsink must cool to below 50 deg C before overtemp is deactivated. Overtemp can also be activated by the power transformer thermal breaker (via Q89). In either case, both channel are muted via D69 and D66.

SERVICE PROCEDURES

MECHANICAL PROCEDURES

The M•1200/M•1400 design allows easy removal of all components and assemblies. Disassembly and reassembly should be self evident. This manual has exploded diagrams in the parts section.

Several important points concerning the assembly:

- 4 of the screws that secure the top cover also hold the front extrusion (curved piece) in place. When removing the top cover, be careful that the front extrusion is not dropped.
- If the MAIN PCB is removed, be sure the smaller head machine screws (750-050-04) are replaced next to the filter caps. The larger head machine screws can arc to the capacitor body.
- Be sure all tywraps are replaced and that no wires are in danger of being pinched in-between the cover and heatsink.

REQUIRED EQUIPMENT LIST

- 30 MHz dual trace oscilloscope
- DMM (Must be capable of measuring 8mV DC with a minimum of 2 digits of accuracy, and down to .1Ω)
- Sine wave oscillator / Function generator (20Hz - 20KHz)
- 4 load resistors (8Ω with a minimum 500W power rating)
- 10A / 120V Variac With AC voltmeter and a defeatable ammeter (1 Amp full range) or wattmeter (300 Watts full range)
- 0.1uF 400V film capacitor installed across dual banana plug
- 16 AWG shorting jumper installed across dual banana plug

RECOMMENDED EQUIPMENT LIST (PERFORMANCE VERIFICATION)

- Distortion analyzer and low distortion oscillator.

(Capable of resolving distortion as low as 0.002% from 20Hz to 20KHz)

- 2500W AC power source.

TROUBLESHOOTING TIPS - OUTPUT FAILURES

After a catastrophic failure, it is likely that the four +/-80V supply fuses will be blown. Replace fuses and ***very slowly*** bring up the Variac while monitoring line consumption. It is likely that substantial line current will be pulled due to shorted output parts. At the same time, look for DC offset at the output. Offset of greater than +/- 2.8V will trigger the protection circuits and re-blow the four fuses. Keep the output offset below +/- 2V, or temporarily defeat the DC-offset detector (Lift one side of D56).

Remove the main board from the unit and check for shorted output transistors. If one bad output is found, replace all eight in the channel. When an output device shorts it can place high current stresses on the other output parts. These output parts can fail over time. Since long term reliability is paramount, please replace all the outputs.

All eight of the 3W 0.22Ω emitter resistors must be verified for proper value. Any off-tolerance, or open parts, need to be replaced. An off tolerance (higher resistance) emitter resistor will prevent it's related output transistor from "doing it's share" and will place more stress on it's mates in the output section. Also verify the 8 base drive resistors (2.2Ω, 1/4W, fusible) are all OK. Verify that the drivers and pre-drivers are not shorted. If one driver is shorted replace it's mate. Do the same with the pre-drivers. Also check all the resistors surrounding the drivers and pre-drivers.

Check the VI limiters and detectors. It is not uncommon to damage these parts when the amplifier fails in a spectacular way! Look for shorts on Q76, Q77, Q94, Q95, Q83, Q84, Q96, and Q97. Verify proper value on the resistors that go to the bases of these devices. It is critical that these sections are working correctly. Shorted transistors can cause some odd asymmetrical clipping problems. Open parts will not allow the current limiting to operate effectively. If problems exist in these sections the amplifier might fail into a short, or might clip prematurely when loaded to 2Ω.

All of the above trouble shooting (Not including part replacement) takes perhaps 15 to 30 minutes to do. If you take the time, and do all that is indicated above, it will allow 99% of the amplifiers to come up the first time! Trying to hurry, and skipping what is suggested, can lead to a frustrating and time consuming repair.

Slowly bring up the supply and verify that line consumption isn't excessive and that the output is centered (no DC offset). It might be desirable to defeat the amplifier muting (Connect U5-12, 13, & 14 together) temporarily so the amplifiers are active even when the supplies are still very low. If the amp stays centered, verify that it will pass a nice clean sine wave. Remove any test jumpers (I.E. DC-fault defeat & muting defeat) and proceed to the "Reliability Verification" section.

BIAS AND TEST PROCEDURE

After the unit has been repaired, the following should be done to assure long term reliable operation. If a distortion analyzer is present, distortion specifications should be verified.

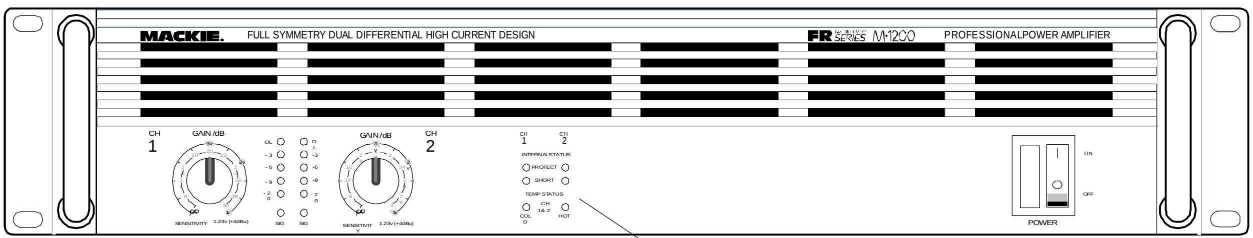
1. Adjusts bias in both channels (R1 & R51) for 8mV +/- 0.3mV at bias test points (J53 & J54) after unit has idled for a few minutes. With Full AC line voltage applied to unit, it will pull around 65W from the line (900mA at 120V). Measure for DC offset on both output connectors. DC offset should be less than +/- 50mV.
2. Apply a 1KHz sine wave to the inputs and verify that the unloaded outputs have a waveform that is symmetrical and undistorted. Drive the outputs into clipping and verify symmetrical “flat-topping” on the waveform.
3. Reduce output levels, install the 0.1uF capacitor jumper from the output to ground connections, and verify that clipping behavior is proper. Verify that no high frequency oscillation occurs near and at clipping (parasitic oscillation).
4. Remove capacitive loading and minimize sine output. Verify and re-adjust bias if required. Note that the bias will not drift appreciably in a unit that is functioning properly.
5. Connect the amplifier directly to the AC line and connect an 8Ω dummy load to both channels. Bring sine wave level up on both channels and verify symmetrical clipping. The output will clip somewhere between 120V - 140V pk/pk depending on how stiff the line is. Clipping should be as described above. Add the 0.1uF capacitive loading and verify clipping is still well behaved.
6. Individually load Channel 1 and Channel 2 with 2Ω. Clipping should be symmetrical, well behaved , and occur somewhere around 80V - 100V pk/pk. Verify that clipping is well behaved after adding the 0.1uF capacitive loading.
7. Reduce output level to 20V pk/pk and short first channel one and then channel two. The front panel “short” and “protect” LEDs should flash on the respective channels.
8. Place amplifier in bridge mode and connect 4Ω loading to bridge outputs (across both “+” output binding posts). Slip some card stock between the heatsink-outlets and chassis sides. Monitor one of the outputs and adjust for a 20V pk/pk signal. Short across both outputs and verify that all four ‘Short” and “Protect” LEDs light and the amplifier mutes.
9. Remove short, monitor one of the outputs, and adjust for a 60V pk/pk sine output (450W of output power bridged). After a few minutes the fan will begin running fast (heatsink at 60°C) and a short time later the amplifier will mute (heatsink at 80°C). The “Hot” and “protect” LEDs will come on. Remove card stock and after a few minutes the amplifier will come out of mute mode and the “cold” LED will return.
10. Disconnect loading and remove drive. Reconnect amplifier to Variac and confirm that the idle consumption is roughly 65W or 900mA, as before. Connect the amplifier to speakers and verify that it sounds OK with music.

(THIS PAGE UNINTENTIONALLY LEFT BLANK), THOSE RESPONSIBLE HAVE BEEN PUT TO THE SWORD

PARTS

QUICK PARTS

FRONT PANEL



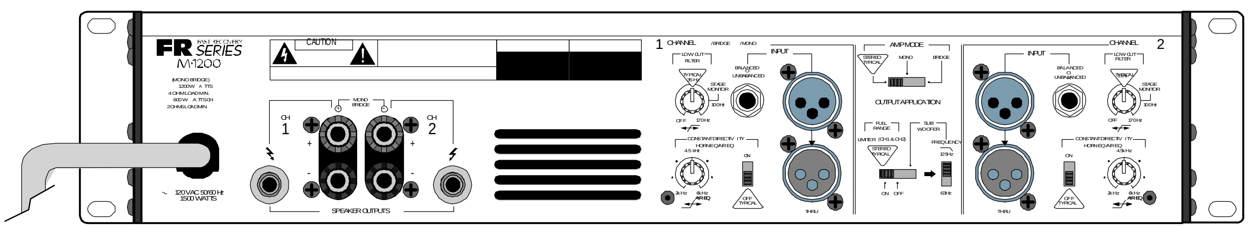
HANDLE ASSEMBLYS
RIGHT, 080-023-10
LEFT, 080-023-20
SCREW(TO CHASSIS),700-028-04

GAIN CONTROLS
5KL POT, 130-036-00
KNOB, 760-061-00
NUT, 705-013-00
STAR WASHER, 710-023-00

ALL LEDS
RED T-1, 304-001-00
GREEN T-1, 304-004-00

POWER SWITCH
500-022-00

REAR PANEL



AC LINE CORD
US, 640-006-00
EUROPE, 640-007-01
JAPAN, 640-007-02
ENGLAND, 640-007-03
ITALY, 640-007-04
AUSTRALIA, 640-007-05
SWITZERLAND, 640-007-06

STRAIN RELIEF
740-004-00

INTERNAL FUSES
RAIL FUSES;
10A 5X20MM, 510-021-00
MAIN FUSE;
20A, 510-017-00
8A, 510-023-00

SPEAKER OUTPUTS
BINDING POSTS, 400-119-00
BINDING POST SCREW, 700-011-00

M•1200/M•1400i
¼” JACK, 400-118-00
WASHER, 710-019-00
SLOTTED NUT, 705-015-00

M•1400
SPEAKON®, 400-138-00
SCREW, 700-055-00

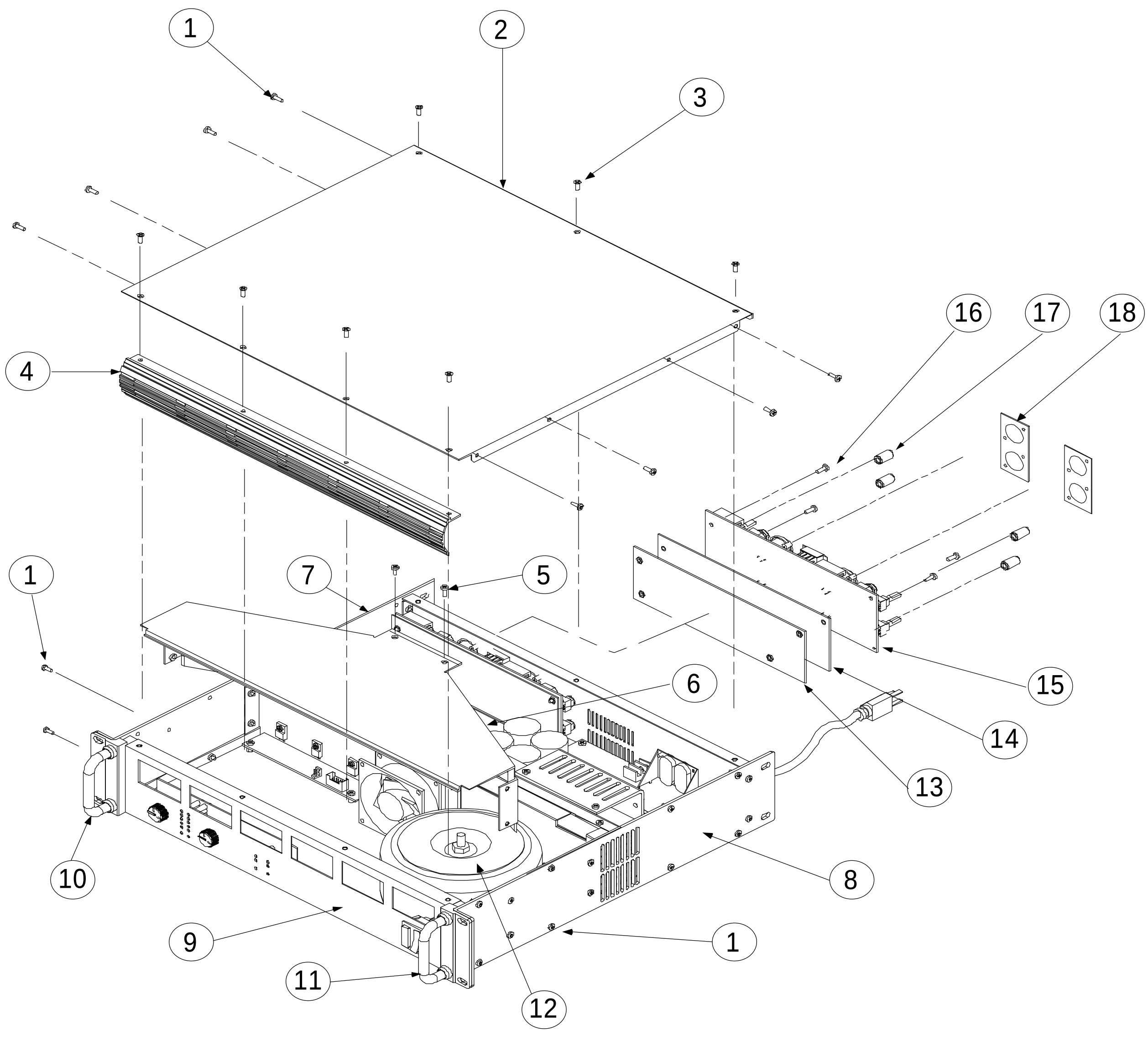
INPUT SECTION
ALL KNOBS, 760-048-04
LOW CUT, 50KZx2 POT, 130-017-02
CD HORN EQ, 10KC POT, 130-037-02

¼” INPUT JACK, 400-214-00
¼” JACK WASHER, 710-002-00
¼” JACK NUT, 705-003-00

MALE XLR JACK, 400-142-00
FEMALE XLR JACK, 400-141-00
XLR JACK SCREWS,700-055-00

DP3T SWITCHES, 500-023-00
DPDT SWITCHES, 500-024-00

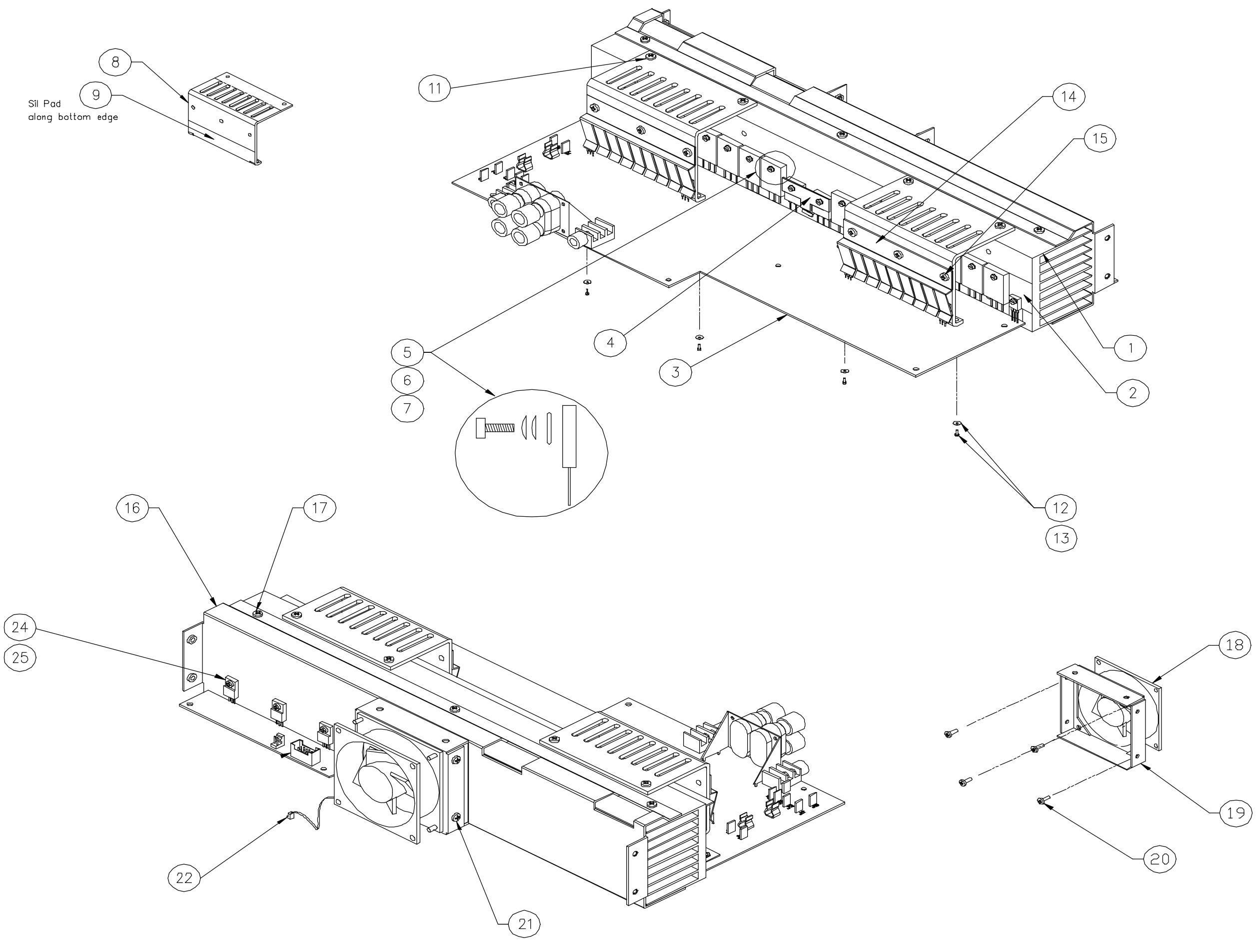
CHASSIS ASSEMBLY



CHASSIS ASSEMBLY PARTS LIST

ITEM #	PART #	DESCRIPTION	NOTES
1	700-028-02	SEMS 6-32X3/8 PHP BLKZC	ALL SIDE PANEL SCREWS
2	550-221-00	TOP COVER - M1200	
3	700-041-04	MCH 6-32X3/8 FL 100DG BLK	TOP COVER TO CHASSIS
4	551-029-00	EXTR SCRN DSPLY BZL-M1200	
4	551-029-10	EXTR SCRN DSPLY BZL-M1400	
5	700-041-04	MCH 6-32X3/8 FL 100DG BLK	MANIFOLD TO FAN
6	550-277-00	SCREEN MANIFOLD - M1400	
7	550-223-20	SIDE RAIL LEFT - M1200	
8	550-223-10	SIDE RAIL RIGHT - M1200	
9	550-222-00	BTM COVER - M1200	
9	550-244-00	BOTTOM COVER - M1400	
10	080-023-20	PNT HANDLE ASSY LEFT	
11	080-023-10	PNT HANDLE ASSY RIGHT	
	700-028-04	SEMS 6-32X3/4 PHP BLKZC	HANDLE ASSY TO CHASSIS
	700-041-04	MCH 6-32X3/8 FL 100DG BLK	HEATSINK TO CHASSIS BOTTTOM
12	TRANSFORMER / MOUNTING		
	600-016-00	XFMR M1200 120V	
	600-016-01	XFMR M1200 230V	
	600-016-02	XFMR M1200 100V	
	705-019-00	NUT HEX 5/16-18	
	710-017-00	WASH SPLTLCK 5/16 HEAVY	
	710-024-00	WASH FLAT 5/16 HARD (USS)	
	550-249-00	PLATE XFMR MTG - M1200	
	780-111-00	RUBBER PAD	
	700-059-00	HEX 5/16-18X3IN GD-5	
13	550-247-00	SHIELD INPUT - M1200	
14	780-042-00	INSUL MYLAR INPUT SHIELD	
15	055-079-00	PCB ASSY INPUT 1200/1400	
16	700-028-02	SEMS 6-32X3/8 PHP BLKZC	INPUT PCB TO SHIELD
17	760-048-04	KNOB 9MM DARK GRAY	
18	550-275-00	SPACER PLATE - AMPLIFIER	
	710-002-00	WASHER FOR ¼" JACKS	
	705-003-00	NUT FOR ¼" JACKS	
	700-055-00	MCH 4-24X3/8 PHP BLK HILO	XLR JACK SCREWS
	055-080-00	PCB ASSY DISPLY 1200/1400	
	055-081-00	PCB ASSY MAIN - 1200	
	080-072-01	PCB ASSY MAIN - M1400	
	080-072-02	PCB ASSY MAIN - M1400i	
	700-028-02	SEMS 6-32X3/8 PHP BLKZC	MAIN PCB TO CHASSIS EXCEPT FOR:
	700-050-04	MCH 6-32X3/8 FIL PHL CLR	! USE THESE NEXT TO CAPS !
	700-011-00	MCH 4-40X1/4 BTNSKT BLKOX	OUPTUT TERMINALS TO CHASSIS
	710-019-00	WASH FIBRE BLK (W/JACK)	
	705-015-00	NUT SLOT NCKL	
	700-055-00	MCH 4-24X3/8 PHP BLK HILO	

HEATSINK ASSEMBLY



HEATSINK ASSEMBLY PARTS LIST

ITEM #	PART #	DESCRIPTION
1	551-032-00	EXTR FAB HEATSINK - M1200
2	410-003-00	INSL SILPAD K6 W/ADHESIVE
3	055-081-00	PCB ASSY MAIN - 1200
3	080-072-01	PCB ASSY MAIN - M1400
3	080-072-02	PCB ASSY MAIN - M1400i
4	550-255-00	PIGGYBACK CLIP
5	700-058-02	MCH 4-40X1/2 SKT CLRZC
6	710-020-00	WASH NO.4 COMPRESSION
7	710-022-00	WASH FLAT NO.4 FENDER
8	550-224-00	BRACKET SUBSINK - M1200
9	410-003-00	INSL SILPAD K6 W/ADHESIVE
11	700-010-00	TF 6-32X1/4 PHP BLKZC
12	710-013-00	WASH FLAT NO.6 FIBRE
13	700-010-04	TF 6-32X3/8 PHP BLKZC
14	550-237-00	SPRING CLIP SUBSINK-M1200
15	700-028-02	SEMS 6-32X3/8 PHP BLKZC
16	550-225-00	HEATSINK COWLING - M1200
17	700-010-00	TF 6-32X1/4 PHP BLKZC
18	770-006-00	FAN 80MM 24VDC-MECHATRONI
18	770-007-00	FAN 80MM 24VDC-PANASONIC
19	550-219-00	BRKT FAN PS - SR40.8
20	700-047-04	MCH 10-32X3/8 FIL PHL CLR
21	700-028-02	SEMS 6-32X3/8 PHP BLKZC
22	400-083-00	2P .100X1 22GA END
24	700-058-02	MCH 4-40X1/2 SKT CLRZC
25	710-020-00	WASH NO.4 COMPRESSION

COMPLETE PARTS LIST

040- Cables
055- Finished PCB Assys
100- Pots and Resistors
200- Capacitors
300- Semiconductors
400- Jacks/Connectors
500- Switches
510- Fuses
550- Chassis Metal
600- Transformers
601- Inductors
610- Wires and Cables
640- AC Line Cords
700- Hardware
760- Knobs/Plastic
790- Misc./Packing
800- Printed Material

PART #	DESCRIPTION
040-033-02	RIB 28GA TRANS 20C 18IN
040-033-03	RIB 28GA TRANS 20C 4IN
040-117-02	RIB 28G TRNS 10C .10 11.5
055-079-00	PCB ASSY INPUT 1200/1400
055-080-00	PCB ASSY DISPLY 1200/1400
055-081-00	PCB ASSY MAIN - 1200
080-072-01	PCB ASSY MAIN - M1400
080-072-02	PCB ASSY MAIN - M1400i
080-034-00	PCB ASSY SOFT START – 120V
080-034-01	PCB ASSY SOFT START – 240V
080-023-10	PNT HANDLE ASSY RIGHT
080-023-20	PNT HANDLE ASSY LEFT
080-035-00	PWR SW HARNESS - AMP
100-001-00	RES CF .125W 5% 10 OHM
100-017-00	RES CF .125W 5% 47 OHM
100-023-00	RES CF .125W 5% 82 OHM
100-027-00	RES CF .125W 5% 120 OHM
100-030-00	RES CF .125W 5% 160 OHM
100-031-00	RES CF .125W 5% 180 OHM
100-035-00	RES CF .125W 5% 300 OHM
100-040-00	RES CF .125W 5% 430 OHM
100-042-00	RES CF .125W 5% 510 OHM
100-045-00	RES CF .125W 5% 680 OHM
100-049-00	RES CF .125W 5% 1K OHM
100-050-00	RES CF .125W 5% 1K1 OHM
100-056-00	RES CF .125W 5% 2K OHM
100-061-00	RES CF .125W 5% 3K3 OHM
100-068-00	RES CF .125W 5% 6K2 OHM
100-071-00	RES CF .125W 5% 8K2 OHM
100-072-00	RES CF .125W 5% 9K1 OHM
100-073-00	RES CF .125W 5% 10K OHM
100-075-00	RES CF .125W 5% 12K OHM
100-076-00	RES CF .125W 5% 13K OHM
100-080-00	RES CF .125W 5% 20K OHM
100-082-00	RES CF .125W 5% 24K OHM
100-083-00	RES CF .125W 5% 27K OHM
100-084-00	RES CF .125W 5% 30K OHM
100-086-00	RES CF .125W 5% 36K OHM
100-089-00	RES CF .125W 5% 47K OHM
100-092-00	RES CF .125W 5% 62K OHM
100-093-00	RES CF .125W 5% 68K OHM

PART #	DESCRIPTION
100-094-00	RES CF .125W 5% 75K OHM
100-097-00	RES CF .125W 5% 100K OHM
100-109-00	RES CF .125W 5% 1M OHM
100-110-00	RES CF .125W 5% 360K OHM
100-111-00	RES CF .125W 5% 390K OHM
105-277-00	RES MF .125W 1% 750 OHM
105-331-00	RES MF .125W 1% 2K49 OHM
110-036-00	RES CF .25W 5% 300 OHM
110-046-00	RES CF .25W 5% 750 OHM
115-427-00	RES MF .25W 1% 24K9 OHM
121-097-00	RES MO 1W 5% 10K OHM
123-009-00	RES MO 3W 5% .22 OHM
123-033-00	RES MO 3W 5% 2.2 OHM
123-056-00	RES MO 3W 5% 20 OHM
123-071-00	RES MO 3W 5% 82 OHM
123-085-00	RES MO 3W 5% 330 OHM
123-109-00	RES MO 3W 5% 3.3K OHM
123-124-00	RES MO 3W 5% 13K OHM
125-020-00	RES WW 15W 5% 82 OHM CMNT
130-017-02	POT RTY 50KC 12MM DUAL TN
130-036-00	POT RTY 5KA 16MM DL DTNT
130-037-02	POT RTY 10KC 9MM TN
130-038-00	POT TRIM 500B HORIZ
140-025-00	RES TF SM .1W 5% 10 OHM
140-057-00	RES TF SM .1W 5% 220 OHM
140-060-00	RES TF SM .1W 5% 300 OHM
140-065-00	RES TF SM .1W 5% 470 OHM
140-068-00	RES TF SM .1W 5% 620 OHM
140-073-00	RES TF SM .1W 5% 1K0 OHM
140-076-00	RES TF SM .1W 5% 1K3 OHM
140-078-00	RES TF SM .1W 5% 1K6 OHM
140-080-00	RES TF SM .1W 5% 2K0 OHM
140-081-00	RES TF SM .1W 5% 2K2 OHM
140-083-00	RES TF SM .1W 5% 2K7 OHM
140-087-00	RES TF SM .1W 5% 3K9 OHM
140-089-00	RES TF SM .1W 5% 4K7 OHM
140-092-00	RES TF SM .1W 5% 6K2 OHM
140-094-00	RES TF SM .1W 5% 7K5 OHM
140-097-00	RES TF SM .1W 5% 10K OHM
140-106-00	RES TF SM .1W 5% 24K OHM
140-108-00	RES TF SM .1W 5% 27K OHM

HOME

PART #	DESCRIPTION
140-111-00	RES TF SM .1W 5% 36K OHM
140-115-00	RES TF SM .1W 5% 51K OHM
140-123-00	RES TF SM .1W 5% 100K OHM
140-124-00	RES TF SM .1W 5% 120K OHM
140-139-00	RES TF SM .1W 5% 470K OHM
140-147-00	RES TF SM .1W 5% 1M OHM
145-318-00	RES MF SM .1W 1% 2K00 OHM
145-389-00	RES MF SM .1W 1% 10K0 OHM
145-397-00	RES MF SM .1W 1% 12K1 OHM
145-406-00	RES MF SM .1W 1% 15K0 OHM
145-469-00	RES MF SM .1W 1% 68K1 OHM
145-478-00	RES MF SM .1W 1% 84K5 OHM
145-485-00	RES MF SM .1W 1% 100K OHM
145-547-00	RES MF SM .1W 1% 442K OHM
150-009-00	RES FUS .25W 5% 2.2 OHM
150-037-00	RES FUS .25W 5% 33 OHM
150-045-00	RES FUS .25W 5% 68 OHM
200-001-02	PLY .012UF 10% 100V TR
200-004-02	PLY .047UF 10% 100V TR
200-007-02	PLY .01UF 10% 100V TR
200-015-02	PLY .0047UF 10% 100V PEI
200-022-02	PLY .47UF 5% 50V TR
200-023-00	PLY/BX .001UF 20% 250V Y2
200-024-00	PLY/BX .01UF 20% 250V Y2
200-025-02	PLY/BX .56UF 5% 63V TR
200-036-00	PLY/BX .1UF 10% 250V
205-002-02	MICA 270PF 5% 500V TR
210-001-02	CER .01UF +80/-20% 50V TR
210-010-02	CER 47PF 5% 500V NPO TR
210-017-02	CER 470PF 5% 500V Y5E TR
211-003-00	CER .001UF 10% 50V AX
211-009-00	CER .1UF 20% 50V AX
212-001-00	CER .01UF 10% 50V X7R SM
212-004-00	CER 220PF 5% 50V NPO SM
212-009-00	CER 47PF 5% 50V NPO SM
212-010-00	CER .1 +80/-20 25V Z5U SM
220-001-02	LYT 22UF 20% 25V RAD TR
220-002-02	LYT 47UF 20% 25V RAD TR
220-004-02	LYT 470UF 20% 6.3V RAD TR
220-007-00	LYT 100UF 20% 100V RAD
220-011-02	LYT 100UF 20% 25V RAD
220-014-00	LYT 2.2UF 20% 50V RAD
220-025-00	LYT 1000UF 20% 35V RAD
220-027-02	LYT 10UF 20% 50V RAD TR
220-033-00	LYT 10000UF 20% 80V RAD
220-034-00	LYT .47UF 20% 100V RAD
220-035-00	LYT 12000UF 20% 80V RAD
220-039-00	LYT 1000 20 25V RAD SMDIA
220-040-00	LYT 10UF 20% 160V RAD
300-001-00	DIO SIG 1N4148 100V 500MW
300-003-00	DIO SW DL4148 100V SM
300-007-00	DIO SW 1SS244-SUB 1SS245
301-006-00	THY 2N6507 400V
301-007-00	DIO PWR DUAL FEP30 (D7)
301-008-00	DIO PWR DUAL FEN30 (D8)
301-009-00	DIO PWR 1N4004
301-010-00	DIO PWR 1N5404 3A 400V
301-014-00	DIO PWR 1N4007
302-001-00	DIO ZEN 1N5261B 47V 500MW
302-003-00	DIO ZEN 1N4745A 16V 1W
304-001-00	LED RED T-1
304-004-00	LED GREEN T-1
310-002-00	XSTR PNP 2N4403
310-007-00	XSTR NPN 2N4401
310-023-02	XSTR NPN 2SC2362K TR
310-028-00	XSTR PNP 2SB940A POWER
310-029-00	XSTR NPN 2SD1264A POWER
310-032-02	XSTR PNP 2SA1016K TR
310-033-00	XSTR PNP MJL21193
310-034-00	XSTR NPN MJL21194
310-035-00	XSTR PNP 2SA1478
310-036-00	XSTR NPN 2SC3788
310-037-00	XSTR NPN MJE340 POWER
310-038-00	XSTR PNP MJE350
310-042-00	XSTR NPN MJE15032
310-043-00	XSTR PNP MJE15033
311-002-00	XSTR PNP MMST4403 SM
320-004-00	OPAMP 4560F
323-001-00	LM339 QUAD COMP
323-002-00	LM339D QUAD COMP SM
329-012-00	VTL5C10 OPTOCOUPLER
329-014-00	LM35DZ PREC TEMP SENSOR
400-059-00	TERM QDISC .250 MALE PCMT
400-060-00	FUSE CLIP PCMT 5MM DIA
400-061-00	HDR 2P .100X1 STR LOCK
400-065-00	TERM QDISC .250 F 18-22GA
400-077-00	HDR 20P .1X2 STR LCK SHRD
400-078-00	HDR 10P .1X2 STR LCK SHRD
400-083-00	2P .100X1 22GA END
400-118-00	JACK 1/4 HORIZ PCMNT MONO
400-119-00	TERM BANANA QUAD HRZ PCMT
400-129-00	FUSE CLIP .25 DIA PC MNT
400-133-00	HDR 6CK 11A/600V
400-134-00	RECP 6CK 11A/600V
400-135-00	TERM 11A/600V F 18-20GA
400-138-00	SPEAKONS HORIZ 4 CKT
400-141-00	XLR 3P F VERT A-SERIES
400-142-00	XLR 3P M VERT A-SERIES
400-143-00	HDR 3P .100X1 STR
400-171-00	HDR 2P .100X1 STR

HOME

PART #	DESCRIPTION
400-172-00	TERM SOLDER-IN 18AWG
400-173-00	TERM .25 QKDS PCMT STABLE
400-210-00	TERM QDISC .250 F 18-22GA
400-214-00	JACK 1/4 V PCMNT 1MM WASH
410-003-00	INSL SILPAD K6 W/ADHESIVE
500-022-00	SW RCKR ILLUMINATED
500-023-00	SW SLIDE 4P3T MINI
500-024-00	SW SLIDE DPDT MINI
501-002-00	RELAY SPDT 30AMP 110VDC
510-017-00	FUSE SB 20A 3AB 1/4X1-1/4
510-021-00	FUSE FB 10A 5X20MM 250V
550-219-00	BRKT FAN PS - SR40.8
550-221-00	TOP COVER - M1200
550-222-00	BTM COVER - M1200
550-223-10	SIDE RAIL RIGHT - M1200
550-223-20	SIDE RAIL LEFT - M1200
550-224-00	BRACKET SUBSINK - M1200
550-225-00	HEATSINK COWLING - M1200
550-237-00	SPRING CLIP SUBSINK-M1200
550-244-00	BOTTOM COVER - M1400
550-247-00	SHIELD INPUT - M1200
550-249-00	PLATE XFMR MTG - M1200
550-255-00	PIGGYBACK CLIP
550-275-00	SPACER PLATE - AMPLIFIER
550-277-00	SCREEN MANIFOLD - M1400
551-029-00	EXTR SCRN DSPLY BZL-M1200
551-029-10	EXTR SCRN DSPLY BZL-M1400
551-032-00	EXTR FAB HEATSINK - M1200
553-002-01	CRS 18GA 36 X 120
553-002-03	CRS 18GA 48 X 120
553-006-03	EG 18GA 48 X 120
553-007-03	AL .063 48 X 120
553-010-03	EG 20GA 48 X 120
553-015-03	AL .125 1100 H14 48 X 120
553-017-01	SS .048 17-7 36 X 120
600-016-00	XFMR M1200 120V
601-006-00	INDUCTOR AIR COIL 1UH
611-029-02	WIR 18GA 1007 BLK 5IN ST2
611-038-00	WR 18G 1010 GN/YL 4IN ST2
660-005-00	22GA JUMPER WIRE
700-005-00	SEMS 8-32X1/2 PHP BLKZC
700-010-00	TF 6-32X1/4 PHP BLKZC
700-010-04	TF 6-32X3/8 PHP BLKZC
700-011-00	MCH 4-40X1/4 BTNSKT BLKOX
700-028-02	SEMS 6-32X3/8 PHP BLKZC
700-028-04	SEMS 6-32X3/4 PHP BLKZC
700-041-04	MCH 6-32X3/8 FL 100DG BLK
700-047-04	MCH 10-32X3/8 FIL PHL CLR
700-050-04	MCH 6-32X3/8 FIL PHL CLR
700-055-00	MCH 4-24X3/8 PHP BLK HILO

PART #	DESCRIPTION
700-058-02	MCH 4-40X1/2 SKT CLRZC
700-059-00	HEX 5/16-18X3IN GD-5
704-001-01	PEMNUT 6-32 .038 STL
704-001-02	PEMNUT 6-32 .054 STL
704-007-01	PEMNUT 4-40X.060L SS FLSH
704-023-03	STUD 6-32X.500 STL FLSH
705-001-00	KEPNUT 6-32
705-003-00	NUT (SPLD W/JACK)
705-013-00	NUT HEX M7 BLK
705-015-00	NUT SLOT NCKL SPLD W/JACK
705-018-00	NUT HEX 5/16-18 (GD-5)
706-036-01	6-32X.188L STL PEM
706-036-03	STDF 6-32X.312L STL PEM
706-045-00	SPCR PVC .770 LED HI TEMP
710-002-00	WASHER (SPLD WITH JACK)
710-013-00	WASH FLAT NO.6 FIBRE
710-017-00	WASH SPLTLCK 5/16 HEAVY
710-019-00	WASH FIBRE BLK (W/JACK)
710-020-00	WASH NO.4 COMPRESSION
710-022-00	WASH FLAT NO.4 FENDER
710-023-00	WASH STAR M7 .020 THK
710-024-00	WASH FLAT 5/16 HARD (USS)
711-001-00	LUG NO.6 SOLDER STAR
712-020-00	BRKT ANG 6-32X.037THK STL
712-021-01	RVT CL END .125X.062-.125
740-004-00	STRAIN RELIEF HEYCO 1244
760-048-04	KNOB 9MM DARK GRAY
760-061-00	KNOB VOLUME M1200
770-006-00	FAN 80MM 24VDC-MECHATRONI
770-007-00	FAN 80MM 24VDC-PANASONIC
780-042-00	INSUL MYLAR INPUT SHIELD
780-114-00	RUBBER WASHER - THIN
790-002-00	BAG POLY 12 X 18 2MIL
790-016-00	BAG POLY 24X30 4MIL-M1200
800-066-00	BOX M1200
800-069-00	BOX M1400
810-056-00	INST TOP/BOTTOM - AMP
820-062-00	OWN MNL - M1200/M1400
820-062-10	OWN MNL – M1400i
830-016-00	REG & WARR CARD FR SERIES

MACKIE.

THE MIXER FIXER • MACKIE DESIGNS SERVICE

NEWS

FR Series Fuse Upgrade

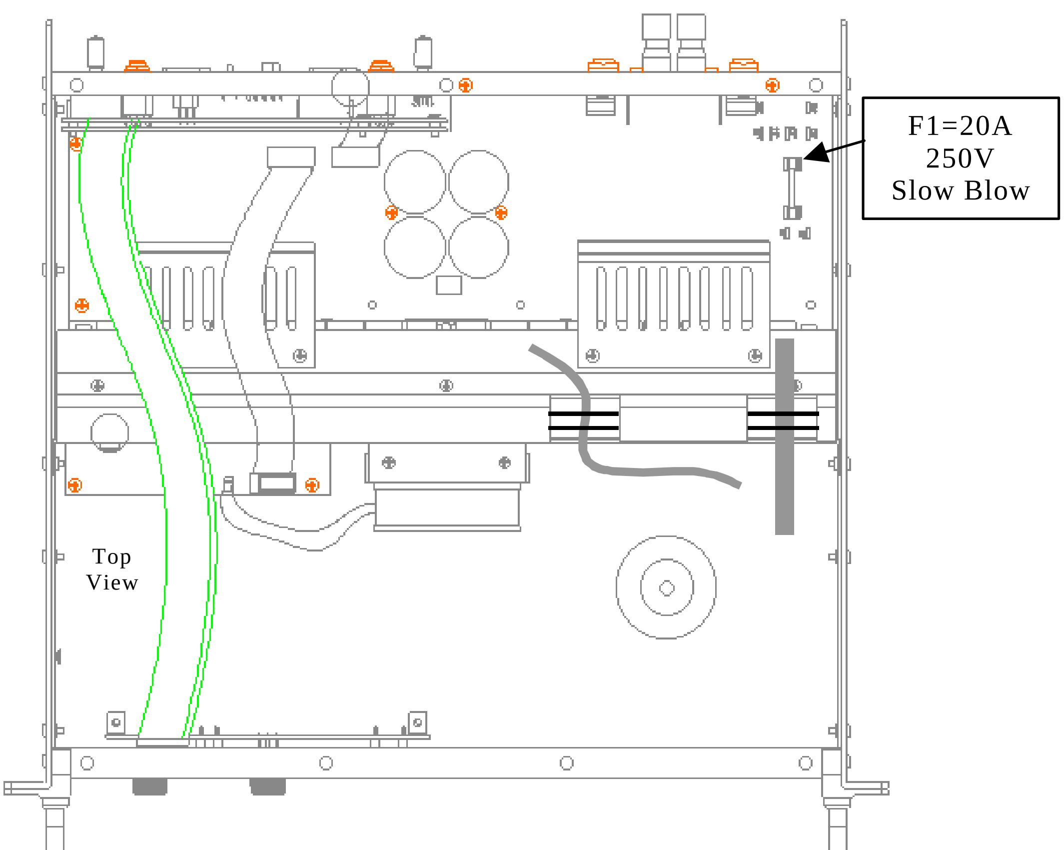
Model: FR Series M1200/1400, 110V only

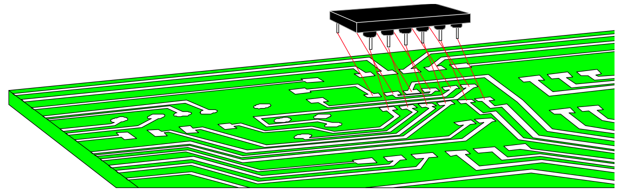
Serial #: M1200 prior to SN# AF12626 Effective 4/28/97
M1400 prior to SN# AH12657

Problem: Original fuse (15A) rated too low. Turn on inrush current causes fuse to open.

Solution: Replace the main (F1) fuse with a 20A 250V slow blow fuse.

Attention!: Since you will be working directly with the AC power line, ***great care should be taken in all aspects of the installation***. Power should be disconnected from the unit prior to the installation process.





THE MIXER FIXER • MACKIE DESIGNS SERVICE

NEWS

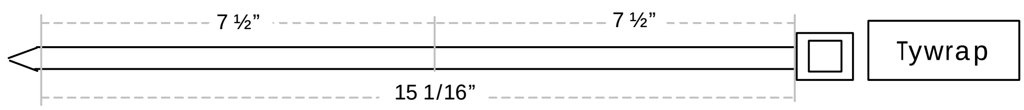
FR Tywrap Mod

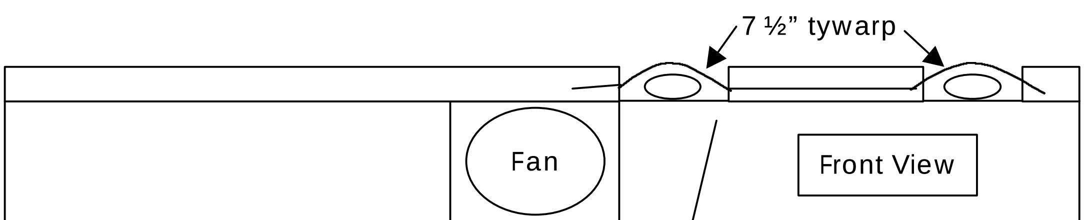
Model: FR Series M1200/1400

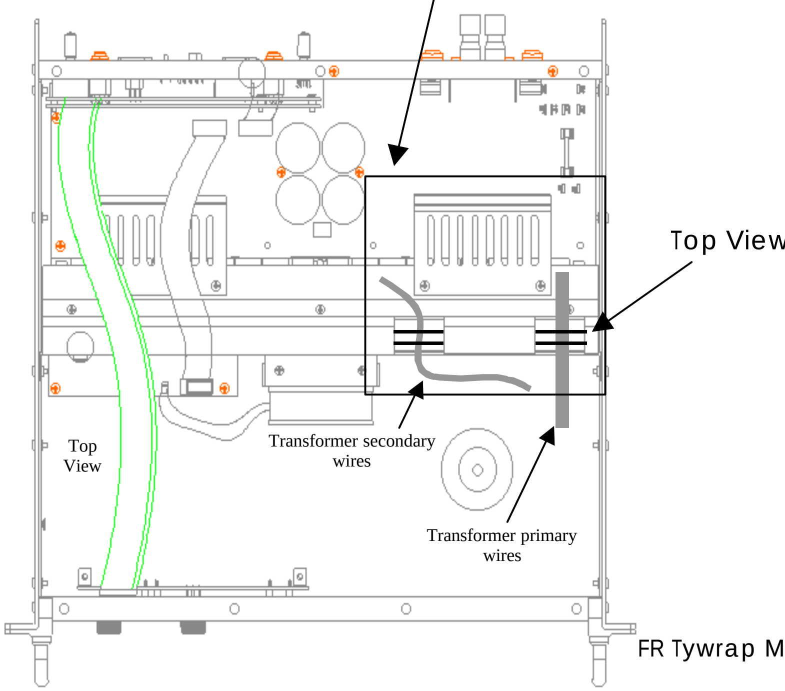
Serial #: AFXXXXX to AFXXXXX Effective 5/8/97

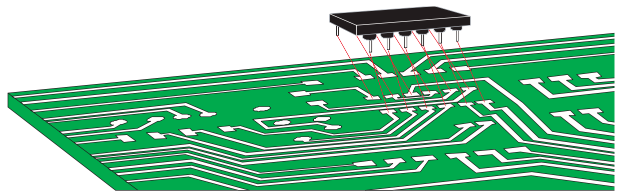
Problem: The primary and secondary wires get pinched between the top cover and the fan shroud.

Solution: Install a 7 ½” tywrap through the fan shroud tunnels. (740-016-00 15 1/16” tywrap, cut to 7 ½”)









MACKIE®

THE MACKIE FIXER • MACKIE DESIGNS SERVICE NEWS

FR series Amplifier ribbon replacement instructions (NEW! IMPROVED! July 2000)*

Models affected: FR series M1200, M1400, M1400i

M1200: All models. **M1400i:** Before Serial # DA20889 and all models with “AM” prefix.
M1400 and 230v versions: Before Serial # DB12700 and all models with “AH” prefix.
Add this as part of your normal repair procedures.
Note: This bulletin replaces all previous ribbon bulletins.

Symptom:

Ch.1 or 2 output signal intermittently fades out, or cuts out completely and/or the DC supply rail fuses blow.

Possible Cause:

The two ribbon cables from the input board may be defective

Solution:

*Replace the input ribbon cables with an improved type in all of the above models, (including any which have had the previous ribbon bulletin completed).

Safety Warning:

⚠ Caution! These instructions are for use by qualified personnel only. To avoid electric shock, do not perform any servicing unless you are qualified to do so. Refer all service to qualified personnel.

Tools Required:

Phillips screwdriver, Torx and Allen drivers, needle nose pliers, safety glasses.

Parts Required:

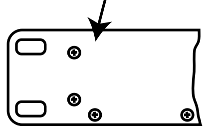
040-359-00	Ribbon cable, 28GA, 20 Pin, Length 4.25”, PLZD	Quantity = 1
040-360-00	Ribbon cable, 28GA, 20 Pin, Length 18”, PLZD	Quantity = 1
400-077-00	20 Pin Headers	Quantity = 2

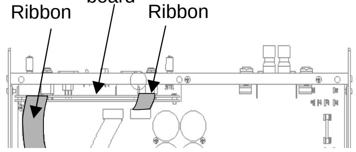
Procedure:

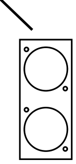
1. Remove all cords (including the power cable and speaker outputs) from the amplifier.
2. Take off the top cover and inspect the ribbon cables. If they are not marked 040-359-00 or 040-360-00 then proceed as follows:

Remove the input board:

3. Undo the XLR screws, TRS nuts, and pull out the four pot knobs.
4. Disconnect the short ribbon cable from the amp board, and the long cable from the front panel display board. On later amplifiers, you will have to remove the front display board first.
5. Disconnect the black ground wire from the amp board.
6. Undo the four screws on the right side of the chassis. This will give enough room to pull out the input board. Catch the two metal XLR plates before they fall inside (not present on later amplifiers).







Continued....

Procedure continued.

Input board work:

If the two ribbon cables are soldered to the input board, follow steps 7 to 11. If not, then go to step 12.

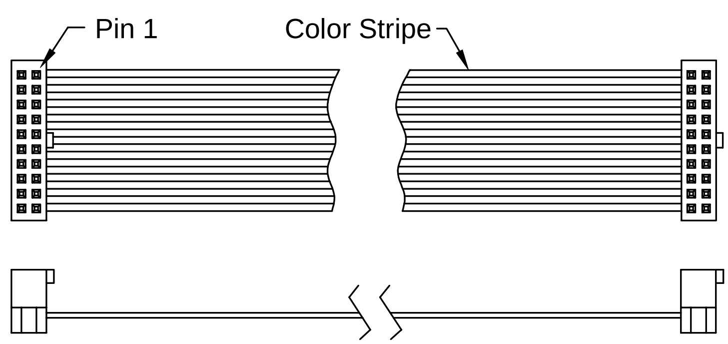
7. Remove the metal shield plate and insulator sheet from the back of the input board.
8. Carefully unsolder the ribbon cable headers from J16 and J11.
   Discard part# 040-033-03, 4 inch ribbon cable.
   Discard part# 040-033-02, 18 inch ribbon cable.
9. Solder two new headers (#400-077-00) to the input board, with the cutout side pointing towards the center of the input board (i.e. downwards).
10. Replace the metal shield plate and insulator sheet onto the back of the input board.
11. Add part# 040-359-00, 4.25 inch ribbon cable to J11.
    Add part# 040-360-00, 18 inch ribbon cable to J16.
    Align each cable's color stripe with the header's pin 1.
    Make sure both ribbons are **fully inserted**, then proceed to step 15.

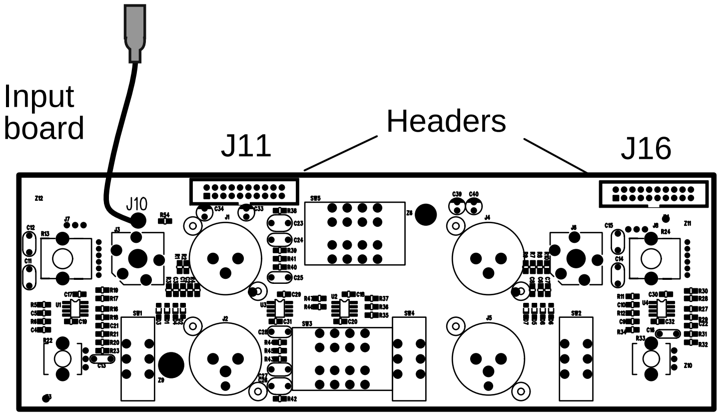
If the two ribbon cables are not soldered to the board, follow steps 12 to 14.

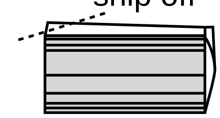
12. Discard part# 040-062-00, 4.25 inch ribbon cable.
    Discard part# 040-062-02, 18 inch ribbon cable. You may have to undo the display board screws in order to remove it from J1.
13. Add part# 040-359-00, 4.25 inch ribbon cable to J11.
    Add part# 040-360-00, 18 inch ribbon cable to J16.
    Align each cable's color stripe with the header's pin 1.
    Make sure both ribbons are **fully inserted**.
14. Refit the display board, once the long ribbon cable is securely attached to J1.

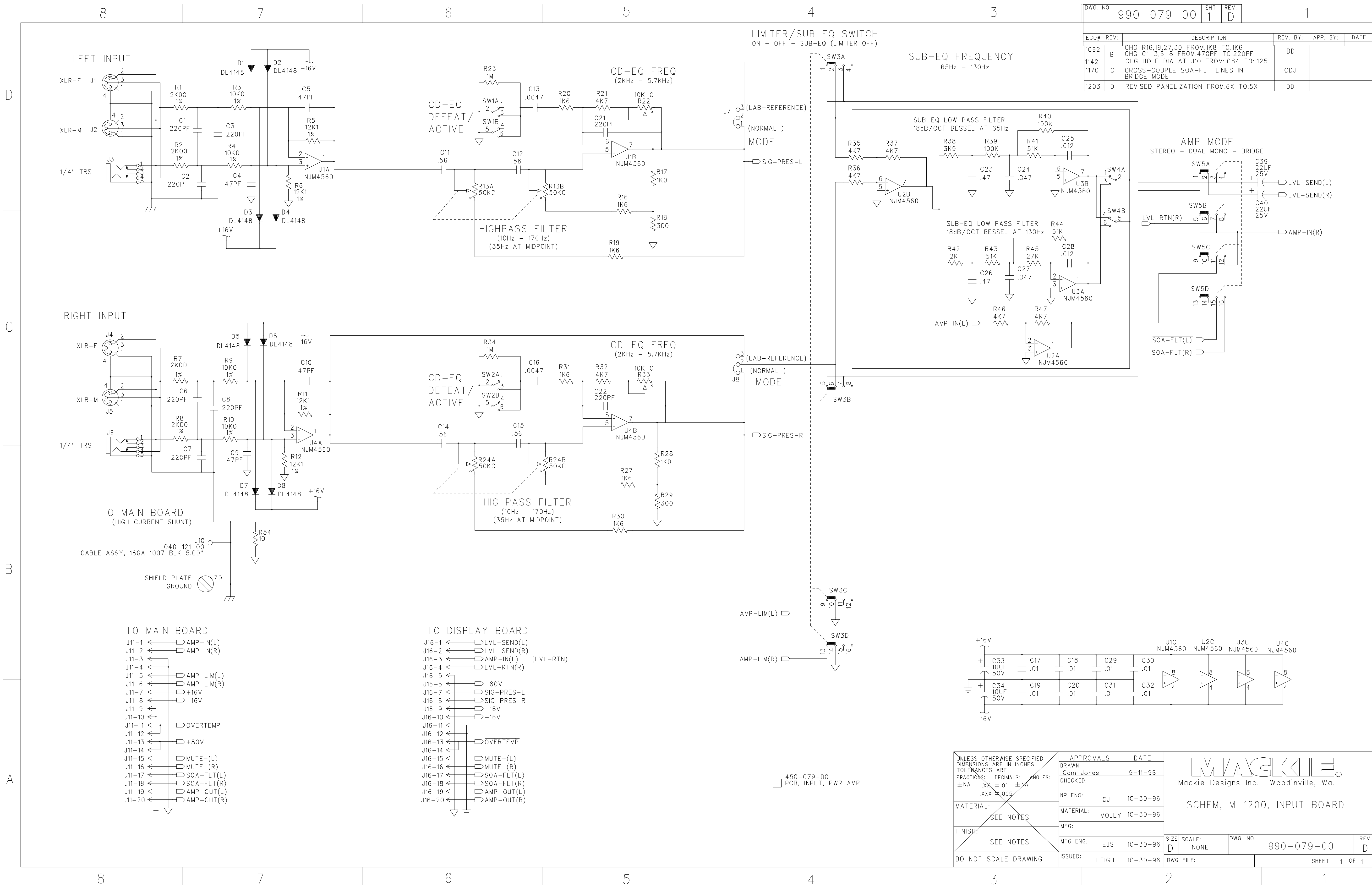
Putting the input board back in:

15. Add the two metal XLR plates (where fitted) and carefully fit the input board back in place. Put the four pot knobs back after the board is in place.
16. It can be difficult getting the knobs back on through the chassis holes, but you can make it easier by snipping off a bit of the plastic center ridge, as shown in the little knob diagram below.
17. Add and tighten all the nuts and screws, and the four chassis screws (removed in step 6).
18. Make sure that all ribbon cables are secure and that all ends are fully inserted.
19. Reconnect the black wire from the input board to the amp board.
20. Replace the top cover.
21/ Perform a complete specification and safety test before returning the unit to the customer.

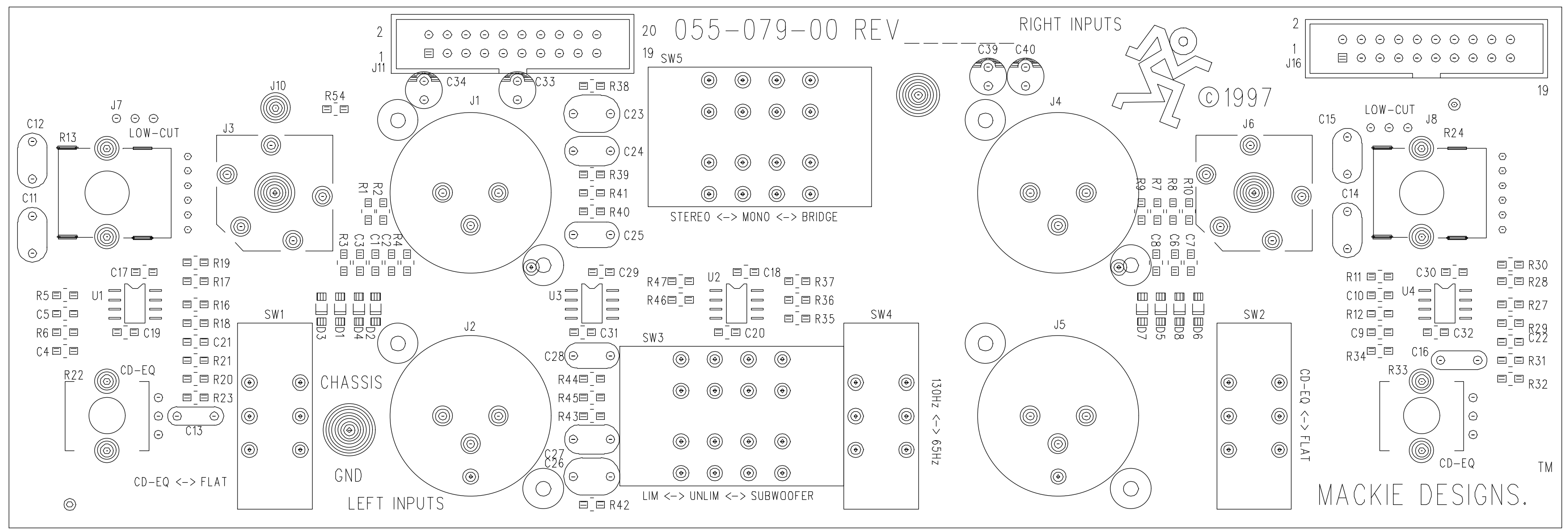


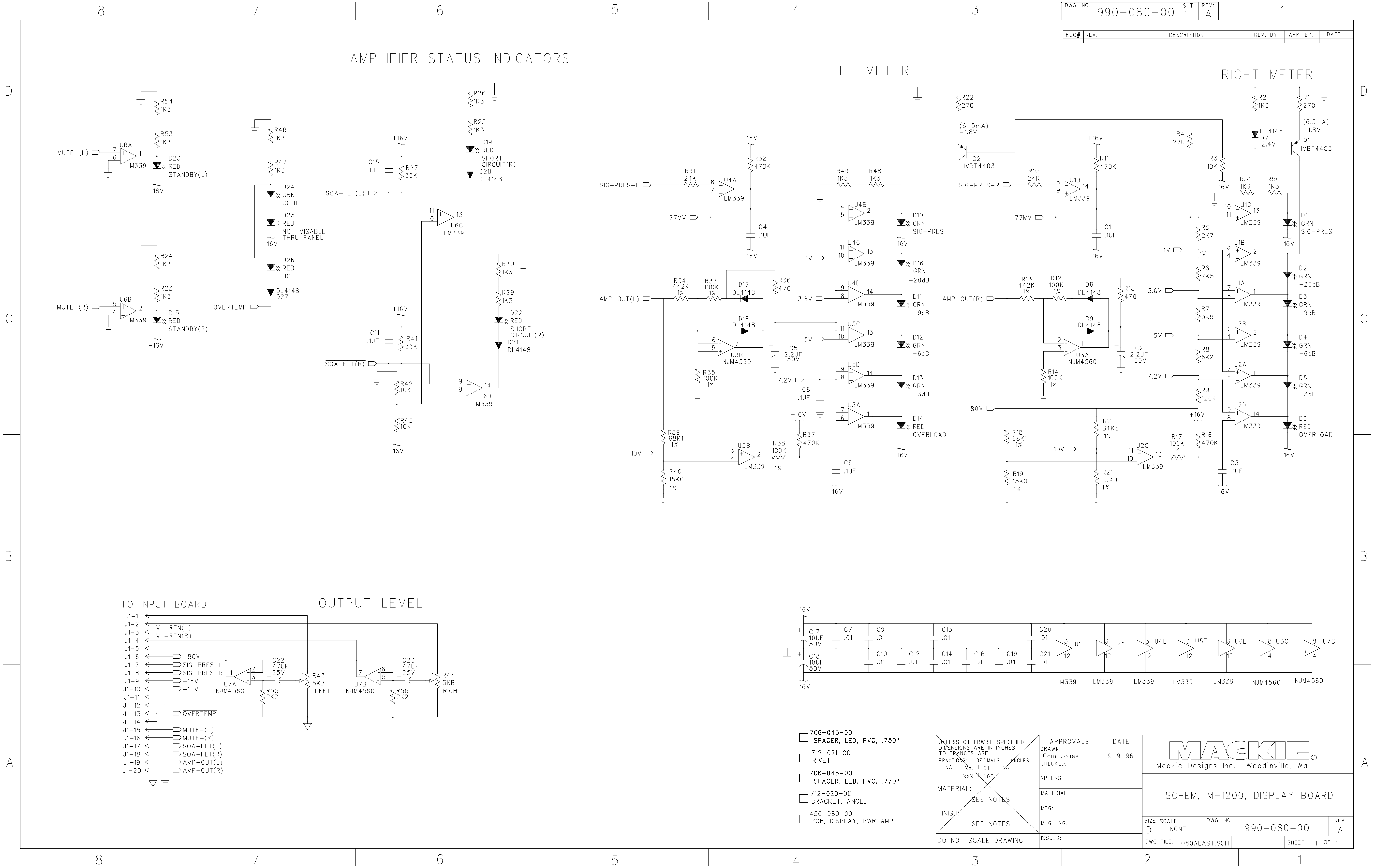


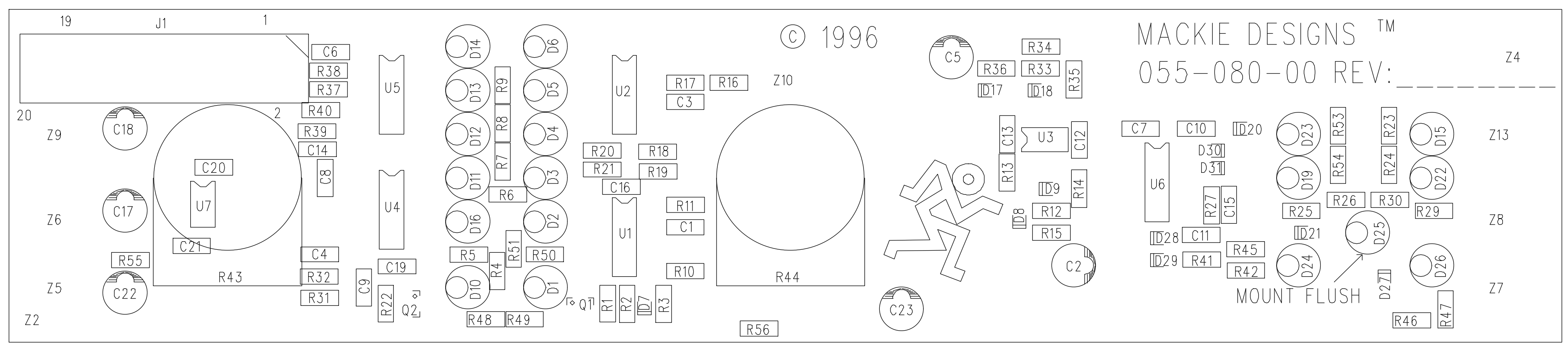


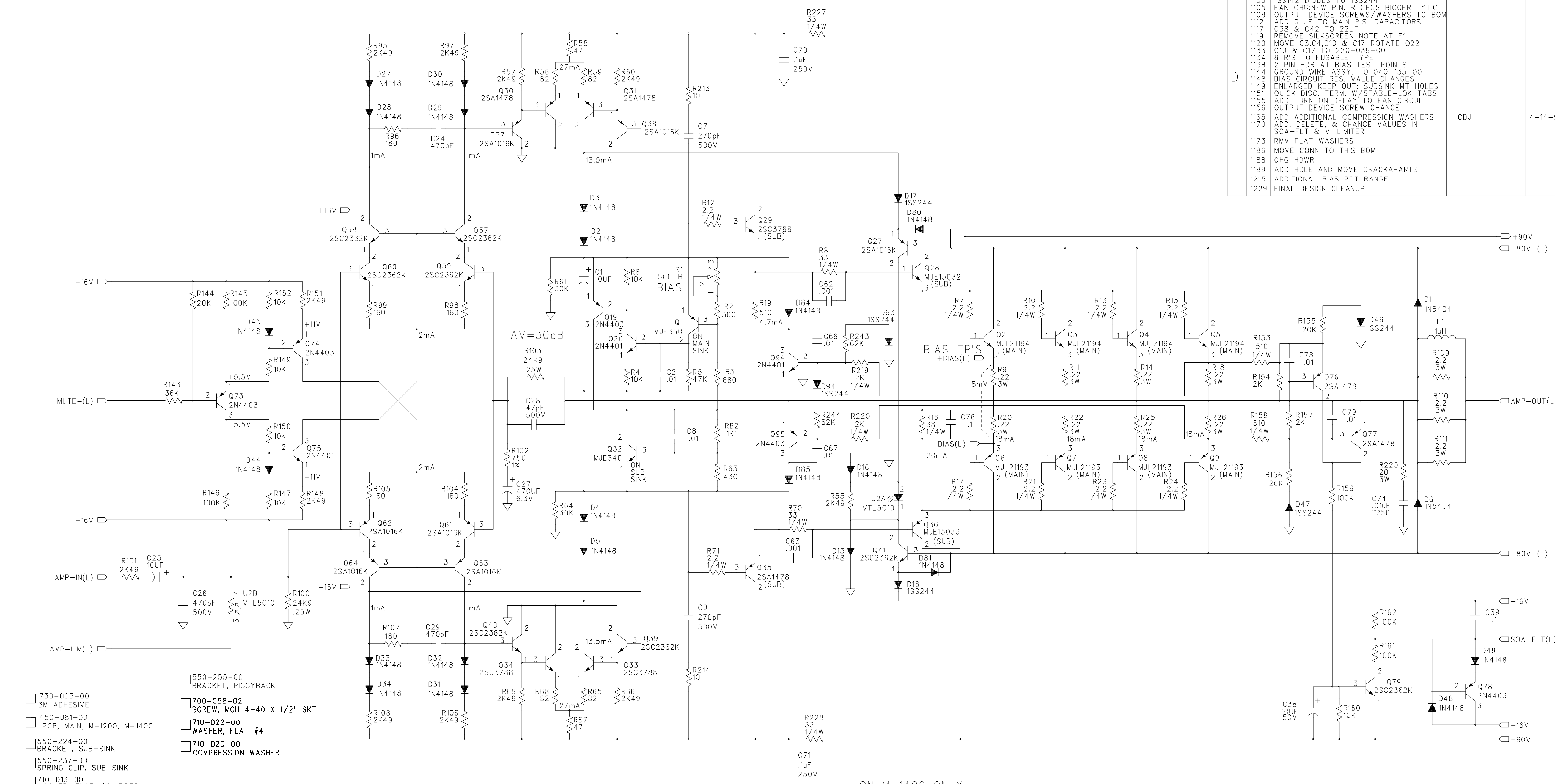

DWG. NO. 990-079-00 SHT 1 REV: D
ECO# REV: DESCRIPTION REV. BY: APP. BY: DATE
1092 B CHG R16,19,27,30 FROM:1K8 TO:1K6 CHG C1-3,6-8 FROM:470PF TO:220PF DD
1142 C CHG HOLE DIA AT J10 FROM:.084 TO:.125
1170 C CROSS-COUPLE SOA-FLT LINES IN BRIDGE MODE CDJ
1203 D REVISED PANELIZATION FROM:6X TO:5X DD
LEFT INPUT
RIGHT INPUT
XLR-F
XLR-M
1/4" TRS
CD-EQ DEFEAT/ ACTIVE
CD-EQ FREQ (2KHz - 5.7KHz)
HIGHPASS FILTER (10Hz - 170Hz) (35Hz AT MIDPOINT)
LIMITER/SUB EQ SWITCH ON - OFF - SUB-EQ (LIMITER OFF)
SUB-EQ FREQUENCY 65Hz - 130Hz
(LAB-REFERENCE)
(NORMAL) MODE
SIG-PRES-L
SIG-PRES-R
SUB-EQ LOW PASS FILTER 18dB/OCT BESSEL AT 65Hz
SUB-EQ LOW PASS FILTER 18dB/OCT BESSEL AT 130Hz
AMP MODE STEREO - DUAL MONO - BRIDGE
LVL-SEND(L)
LVL-SEND(R)
LVL-RTN(R)
AMP-IN(R)
AMP-IN(L)
SOA-FLT(L)
SOA-FLT(R)
AMP-LIM(L)
AMP-LIM(R)
TO MAIN BOARD (HIGH CURRENT SHUNT)
J10 040-121-00 CABLE ASSY, 18GA 1007 BLK 5.00"
SHIELD PLATE GROUND Z9
TO MAIN BOARD
J11-1 AMP-IN(L)
J11-2 AMP-IN(R)
J11-5 AMP-LIM(L)
J11-6 AMP-LIM(R)
J11-7 +16V
J11-8 -16V
J11-11 OVERTEMP
J11-13 +80V
J11-15 MUTE-(L)
J11-16 MUTE-(R)
J11-17 SOA-FLT(L)
J11-18 SOA-FLT(R)
J11-19 AMP-OUT(L)
J11-20 AMP-OUT(R)
TO DISPLAY BOARD
J16-1 LVL-SEND(L)
J16-2 LVL-SEND(R)
J16-3 AMP-IN(L) (LVL-RTN)
J16-4 LVL-RTN(L)
J16-6 +80V
J16-7 SIG-PRES-L
J16-8 SIG-PRES-R
J16-9 +16V
J16-10 -16V
J16-13 OVERTEMP
J16-15 MUTE-(L)
J16-16 MUTE-(R)
J16-17 SOA-FLT(L)
J16-18 SOA-FLT(R)
J16-19 AMP-OUT(L)
J16-20 AMP-OUT(R)
450-079-00 PCB, INPUT, PWR AMP
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
MATERIAL: SEE NOTES
FINISH: SEE NOTES
DO NOT SCALE DRAWING
APPROVALS DATE
DRAWN: Cam Jones 9-11-96
NP ENG: CJ 10-30-96
MATERIAL: MOLLY 10-30-96
MFG ENG: EJS 10-30-96
ISSUED: LEIGH 10-30-96
MACKIE.
Mackie Designs Inc. Woodinville, Wa.
SCHEM, M-1200, INPUT BOARD
SIZE D SCALE: NONE DWG. NO. 990-079-00 REV. D
SHEET 1 OF 1

BACK


055-079-00 REV
RIGHT INPUTS
©1997
LEFT INPUTS
CHASSIS
GND
STEREO <-> MONO <-> BRIDGE
LIM <-> UNLIM <-> SUBWOOFER
130Hz <-> 65Hz
CD-EQ <-> FLAT
LOW-CUT
MACKIE DESIGNS.


AMPLIFIER STATUS INDICATORS
LEFT METER
RIGHT METER
TO INPUT BOARD
OUTPUT LEVEL
DWG. NO. 990-080-00 SHT 1 REV: A
ECO# REV: DESCRIPTION REV. BY: APP. BY: DATE
706-043-00 SPACER, LED, PVC, .750"
712-021-00 RIVET
706-045-00 SPACER, LED, PVC, .770"
712-020-00 BRACKET, ANGLE
450-080-00 PCB, DISPLAY, PWR AMP
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS: ±NA DECIMALS: .XX ±.01 .XXX ±.005 ANGLES: ±NA
MATERIAL: SEE NOTES
FINISH: SEE NOTES
DO NOT SCALE DRAWING
APPROVALS DATE
DRAWN: Cam Jones 9-9-96
CHECKED:
NP ENG:
MATERIAL:
MFG:
MFG ENG:
ISSUED:
MACKIE.
Mackie Designs Inc. Woodinville, Wa.
SCHEM, M-1200, DISPLAY BOARD
SIZE D SCALE: NONE DWG. NO. 990-080-00 REV. A
DWG FILE: 080ALAST.SCH SHEET 1 OF 1


© 1996
MACKIE DESIGNS TM
055-080-00 REV:________
MOUNT FLUSH



DWG. NO.	SHT	REV:
990-081-00	1	D

REV:	ECO#	DESCRIPTION	REV. BY:	APP. BY:	DATE
D	1082	BOM CHG: T&R 2SC2362K & 2SA1016K	KR		1-10-97
	1086	LIMITER CIRCUIT RES. VALUE CHANGES			
	1094	CONSOLIDATION:1/4" JACKS TO 400-166			
	1100	1SS142 DIODES TO 1SS244			
	1105	FAN CHG:NEW P.N. R CHGS BIGGER LYTIC			
	1108	OUTPUT DEVICE SCREWS/WASHERS TO BOM			
	1112	ADD GLUE TO MAIN P.S. CAPACITORS			
	1117	C38 & C42 TO 22UF			
	1119	REMOVE SILKSCREEN NOTE AT F1			
	1120	MOVE C3,C4,C10 & C17 ROTATE Q22			
	1133	C10 & C17 TO 220-039-00			
	1134	8 R'S TO FUSABLE TYPE			
	1138	2 PIN HDR AT BIAS TEST POINTS			
	1144	GROUND WIRE ASSY. TO 040-135-00			
	1148	BIAS CIRCUIT RES. VALUE CHANGES			
	1149	ENLARGED KEEP OUT: SUBSINK MT HOLES			
	1151	QUICK DISC. TERM. W/STABLE-LOK TABS			
	1155	ADD TURN ON DELAY TO FAN CIRCUIT			
	1156	OUTPUT DEVICE SCREW CHANGE			
	1165	ADD ADDITIONAL COMPRESSION WASHERS	CDJ		4-14-97
	1170	ADD, DELETE, & CHANGE VALUES IN SOA-FLT & VI LIMITER			
	1173	RMV FLAT WASHERS			
	1186	MOVE CONN TO THIS BOM			
	1188	CHG HDWR			
	1189	ADD HOLE AND MOVE CRACKAPARTS			
	1215	ADDITIONAL BIAS POT RANGE			
	1229	FINAL DESIGN CLEANUP			

- 730-003-00 3M ADHESIVE
- 450-081-00 PCB, MAIN, M-1200, M-1400
- 550-224-00 BRACKET, SUB-SINK
- 550-237-00 SPRING CLIP, SUB-SINK
- 710-013-00 WASHER, FLAT, #6, FIBER
- 700-010-04 SCREW, PANPHP, TF, BLK ZC,6-32 X 3/8
- 700-028-02 SCREW, PANPHP, BLK SEMS,6-32 X 3/8
- 710-008-00 WASHER, SPLIT LOCK, #4
- 410-003-00 SILPAD, K6, W/ADHESIVE, 16.8"
- 551-032-00 HEATSINK, MAIN
- 700-022-00 SCREW PAN FIL STL ZC 6-32 X 5/8"
- 550-255-00 BRACKET, PIGGYBACK
- 700-058-02 SCREW, MCH 4-40 X 1/2" SKT
- 710-022-00 WASHER, FLAT #4
- 710-020-00 COMPRESSION WASHER
- 550-225-00 HEATSINK COWLING
- 550-219-00 FAN BRACKET
- 700-010-00 SCREW, PANPHP, TF, BLK ZC,6-32 X 1/4
- 700-047-04 SCREW PAN FILSTL ZC 10-32 X 3/8"
- 400-060-00 FUSE CLIP PC MT 5mm DIA
- 400-129-00 FUSE CLIP PC MT .25" DIA
- 770-006-00 FAN, 24V MECHATRONICS **FOR M1200**
- 410-003-00 SILPAD, K6, W/ADHESIVE, 4.1"
- 410-002-00 SILPAD .007THK SELF ADHESIVE
- 730-001-00 QTY AS REQ'D

ON M-1400 ONLY

- 220-035-00 12,000uF

SEE C11, C12, C15,C16

- 100-076-00 13K RESISTOR **REPLACES R209 FOR M1400**
- 770-007-00 FAN, 24V PANASONIC **FOR M1400**
- 400-083-00 CONN 2P .100 X 1 22GA END

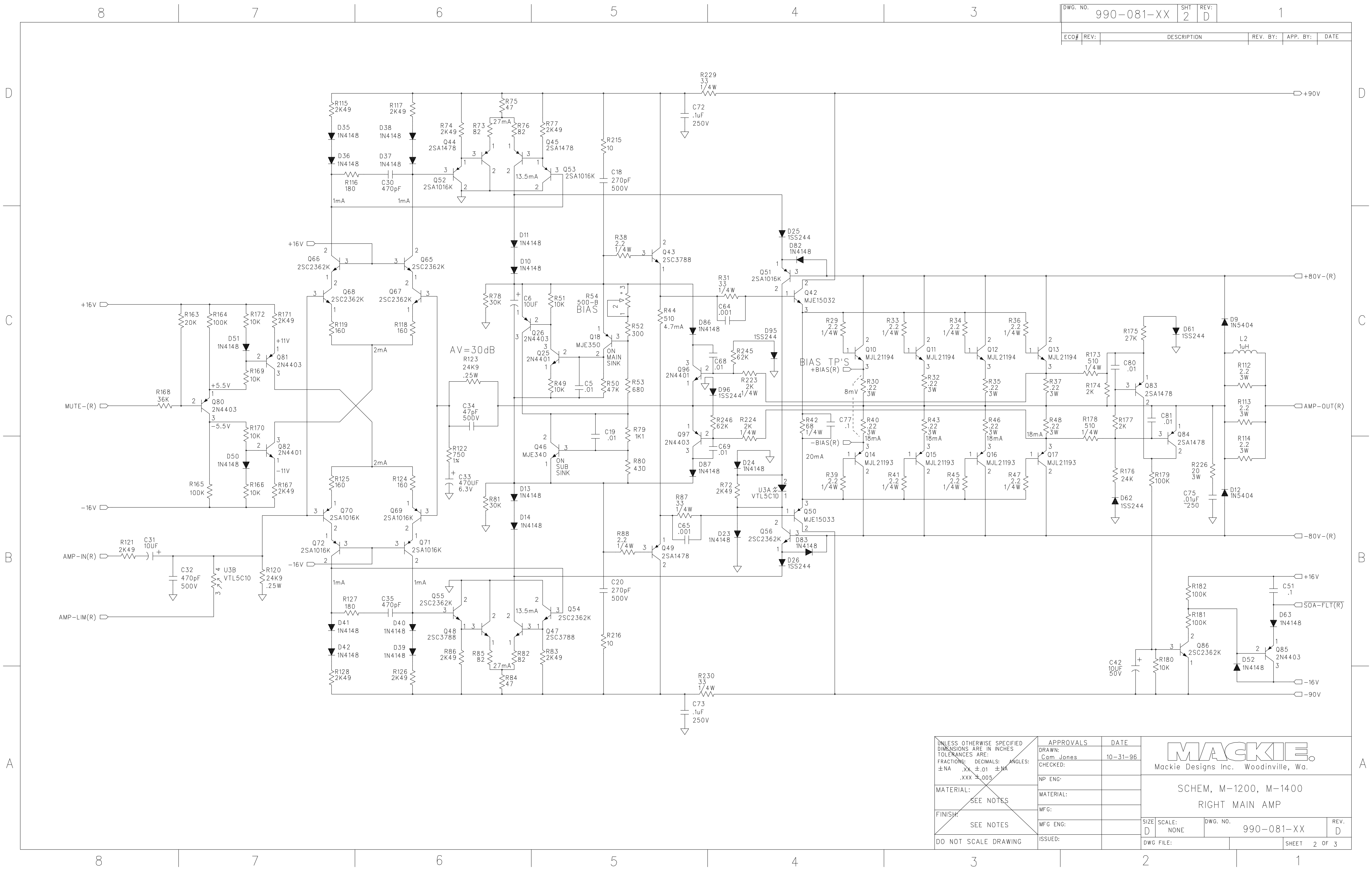
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE:
FRACTIONS: ±NA DECIMALS: .XX ±.01 .XXX ±.005 ANGLES: ±NA
MATERIAL: SEE NOTES
FINISH: SEE NOTES
DO NOT SCALE DRAWING

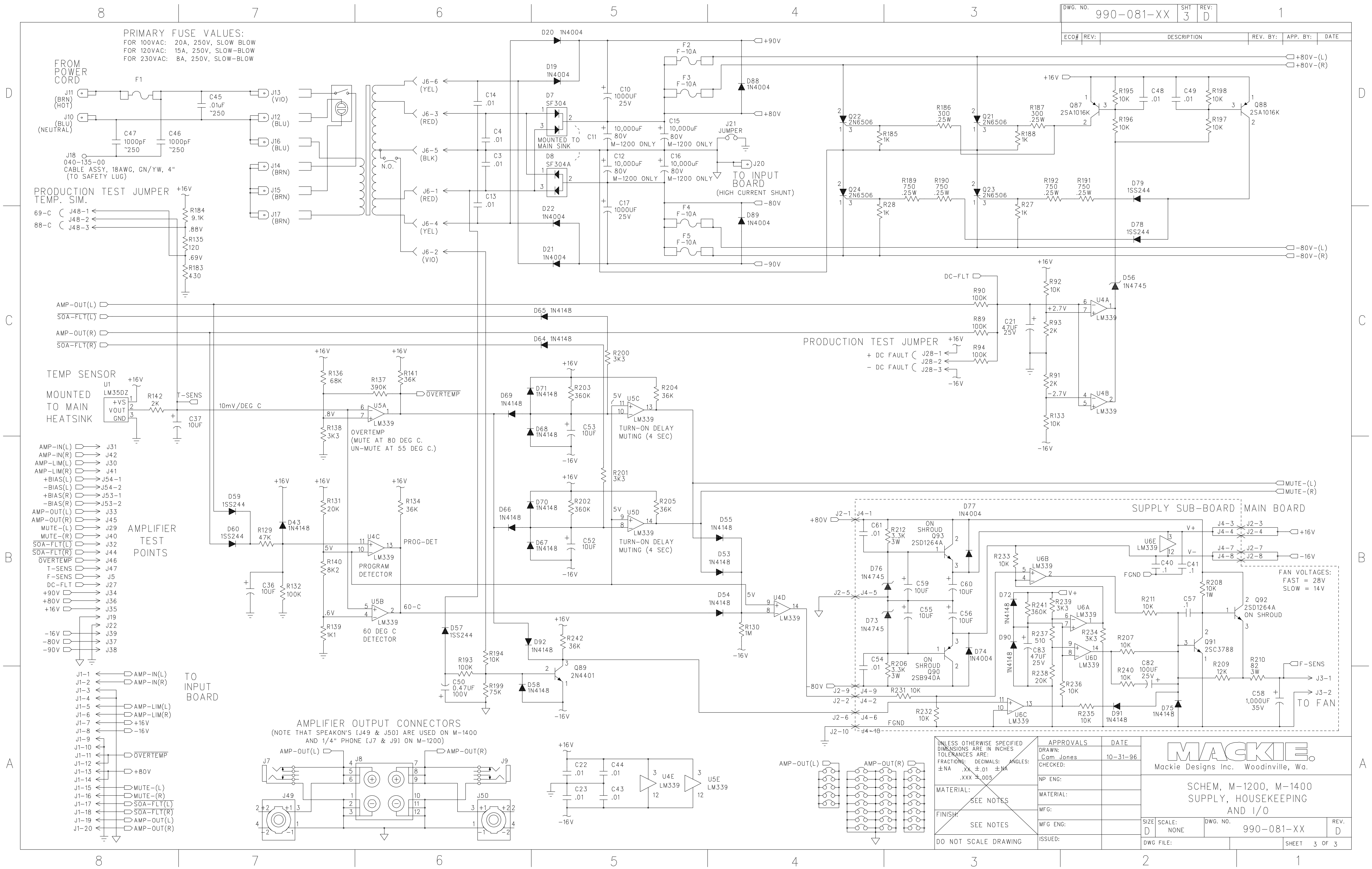
APPROVALS		DATE
DRAWN:	Cam Jones	10-31-96
CHECKED:		
NP ENG'	CJ	11-12-96
MATERIAL:	MS	11-12-96
MFG:	RR	11-12-96
MFG ENG:	ES	11-12-96
ISSUED:	LV	11-12-96

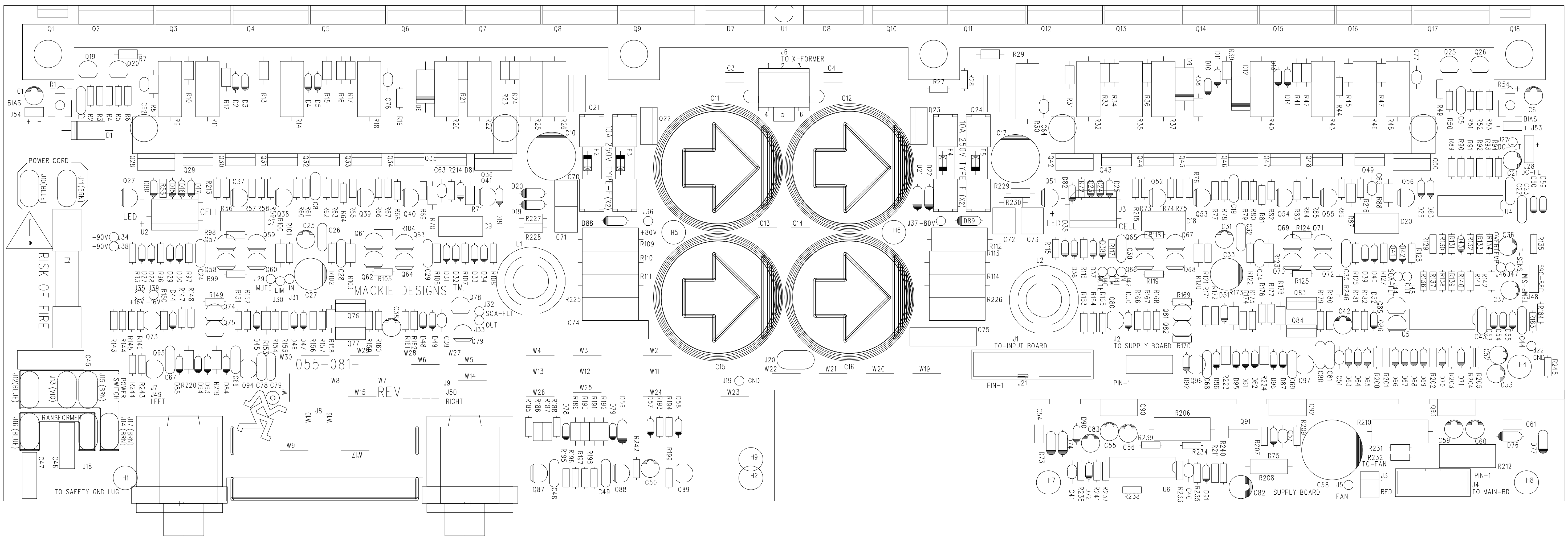
MACKIE.
Mackie Designs Inc. Woodinville, Wa.

SCHEM, M-1200, M-1400
LEFT MAIN AMP

SIZE: D SCALE: NONE DWG. NO. 990-081-00 REV. D
DWG FILE: SHEET 1 OF 3

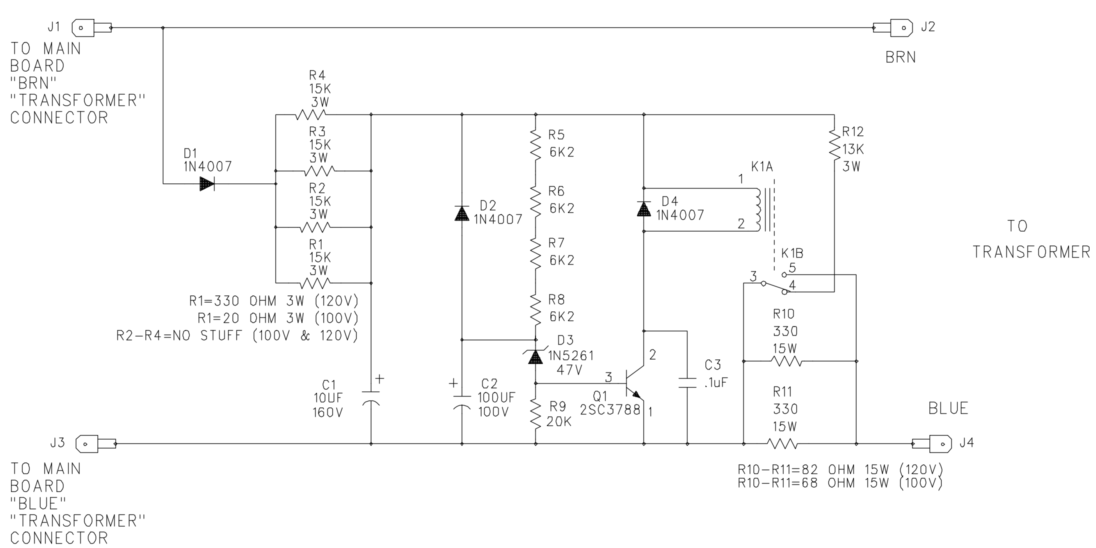



PRIMARY FUSE VALUES:
FOR 100VAC: 20A, 250V, SLOW BLOW
FOR 120VAC: 15A, 250V, SLOW-BLOW
FOR 230VAC: 8A, 250V, SLOW-BLOW
FROM POWER CORD
PRODUCTION TEST JUMPER TEMP. SIM.
TEMP SENSOR
MOUNTED TO MAIN HEATSINK
AMPLIFIER TEST POINTS
TO INPUT BOARD
AMPLIFIER OUTPUT CONNECTORS
(NOTE THAT SPEAKON'S (J49 & J50) ARE USED ON M-1400 AND 1/4" PHONE (J7 & J9) ON M-1200)
PRODUCTION TEST JUMPER
OVERTEMP (MUTE AT 80 DEG C. UN-MUTE AT 55 DEG C.)
TURN-ON DELAY MUTING (4 SEC)
PROGRAM DETECTOR
60 DEG C DETECTOR
SUPPLY SUB-BOARD
MAIN BOARD
FAN VOLTAGES: FAST = 28V SLOW = 14V
TO FAN
TO INPUT BOARD (HIGH CURRENT SHUNT)
DWG. NO. 990-081-XX SHT 3 REV: D
Mackie Designs Inc. Woodinville, Wa.
SCHEM, M-1200, M-1400 SUPPLY, HOUSEKEEPING AND I/O
DRAWN: Cam Jones 10-31-96
SIZE D SCALE: NONE DWG. NO. 990-081-XX REV. D
SHEET 3 OF 3
DO NOT SCALE DRAWING


MACKIE DESIGNS
RISK OF FIRE
10A 250V TYPE-F (X2)
POWER CORD
TRANSFORMER
TO SAFETY GND LUG
TO X-FORMER
TO INPUT BOARD
TO SUPPLY BOARD
SUPPLY BOARD
TO MAIN-BD
TO-FAN
055-081-
REV

DWG. NO.	SHT	REV:
990-162-00	1	A

ECO#	REV:	DESCRIPTION	REV. BY:	APP. BY:	DATE



NOTE: SCHEMATIC IS SHOWN WITH 240VAC VALUES

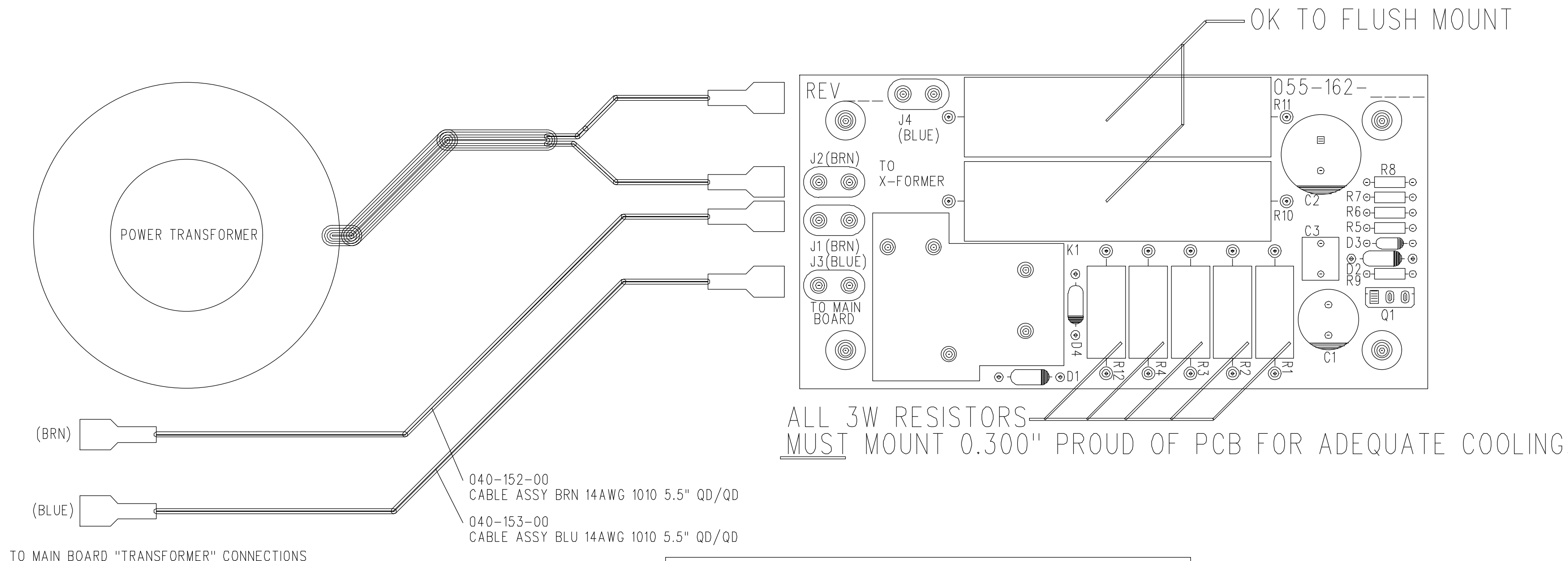
- ☐ **NO STUFF R2-R4 FOR 100VAC OR 120VAC VERSIONS**
  XXX
- ☐ **REPLACES R10-R11 FOR 120VAC VERSION**
  82 15W
- ☐ **REPLACES R1 FOR 120VAC VERSION**
  330 3W
- ☐ **REPLACES R10-R11 FOR 100VAC VERSION**
  68 15W
- ☐ **REPLACES R1 FOR 100VAC VERSION**
  20 3W
- ☐ PCB, M-1200/M-1400 SOFT START

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ARE: FRACTIONS: ±NA DECIMALS: .XX ±.01 .XXX ±.005 ANGLES: ±NA	APPROVALS	DATE	MACKIE. Mackie Designs Inc. Woodinville, Wa.
	DRAWN: Chuck J	4-15-97	
	CHECKED:		
MATERIAL: SEE NOTES	NP ENG: Cameron Jones	4-25-97	SCHEMATIC, M1400 SOFT START
	MATERIAL:		
FINISH: SEE NOTES	MFG:		
	MFG ENG:		SIZE: D SCALE: NONE DWG. NO. 990-162-00 REV. A
DO NOT SCALE DRAWING	ISSUED:		DWG FILE: SHEET 1 OF 1

DWG. NO.	SHT	REV:
055-162-00	1	A

REVISIONS

ECO#	REV:	DESCRIPTION	REV. BY:	APP. BY:	DATE



DIFFERENCES IN ASSEMBLY FOR VARIOUS VOLTAGES

AC-PRIMARY VOLTAGE	240VAC	120VAC	100VAC
ASSEMBLY NUMBER	055-162-01	055-162-00	055-162-02
R1 VALUE	15K 5% 3W MOF 123-125-00	330 5% 3W MOF 123-085-00	20 5% 3W MOF 123-056-00
R2-R4 VALUES	15K 5% 3W MOF 123-125-00	DO NOT STUFF	DO NOT STUFF
R10-R11 VALUES	330 5% 15W WW 125-021-00	82 5% 15W WW 125-020-00	68 5% 15W WW 125-019-00

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ARE:
FRACTIONS: ± NA DECIMALS: .XX ± NA .XXX ± NA ANGLES: ± NA

MATERIAL:

FINISH:

DO NOT SCALE DRAWING

APPROVALS		DATE
DRAWN:	CDJ	4-16-97
CHECKED:		
NP ENGINEERING:	Cameron Jones	4-25-97
MATERIAL:		
MANUFACTURING:		
MFG ENGINEERING:		
ISSUED:		

MACKIE.
Mackie Designs Inc. Woodinville, Wa.

PCB ASSY, M-1400
SOFT START

SIZE	SCALE:	DWG. NO.	REV.
D	2:1	055-162-00	A

DWG FILE: SHEET 1 OF 1