

# Macro-Tech® 10,000

PROFESSIONAL POWER AMPLIFIER

## OWNER'S MANUAL

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## **FULL THREE-YEAR WARRANTY**



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You must notify us of your need for warranty service not later than ninety (90) days after expiration of the warranty period. All components must be shipped in a factory pack, which, if needed, may be obtained from us free of charge. Corrective action will be taken within a reasonable time of the date of receipt of the defective product by us or our authorized service center. If the repairs made by us or our authorized service center are not satisfactory, notify us or our authorized service center immediately.

### **DISCLAIMER OF CONSEQUENTIAL AND INCIDENTAL DAMAGES**

YOU ARE NOT ENTITLED TO RECOVER FROM US ANY INCIDENTAL DAMAGES RESULTING FROM ANY DEFECT IN THE NEW CROWN PRODUCT. THIS INCLUDES ANY DAMAGE TO ANOTHER PRODUCT OR PRODUCTS RESULTING FROM SUCH A DEFECT. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATIONS OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

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**THIS STATEMENT OF WARRANTY SUPERSEDES ANY OTHERS CONTAINED IN THIS MANUAL.**



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The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If you need special assistance, beyond the scope of this manual, please contact the Crown International Customer Services Department.

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## **WARNING**

**TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE!**

## **CAUTION**

**TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE COVERS. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. ONLY SUCH PERSONNEL SHOULD ATTEMPT THE MODIFICATIONS SUGGESTED IN THIS MANUAL. DISCONNECT POWER CORD BEFORE INTERCHANGING REAR PLUG-IN PANEL.**

## **ATTENTION**

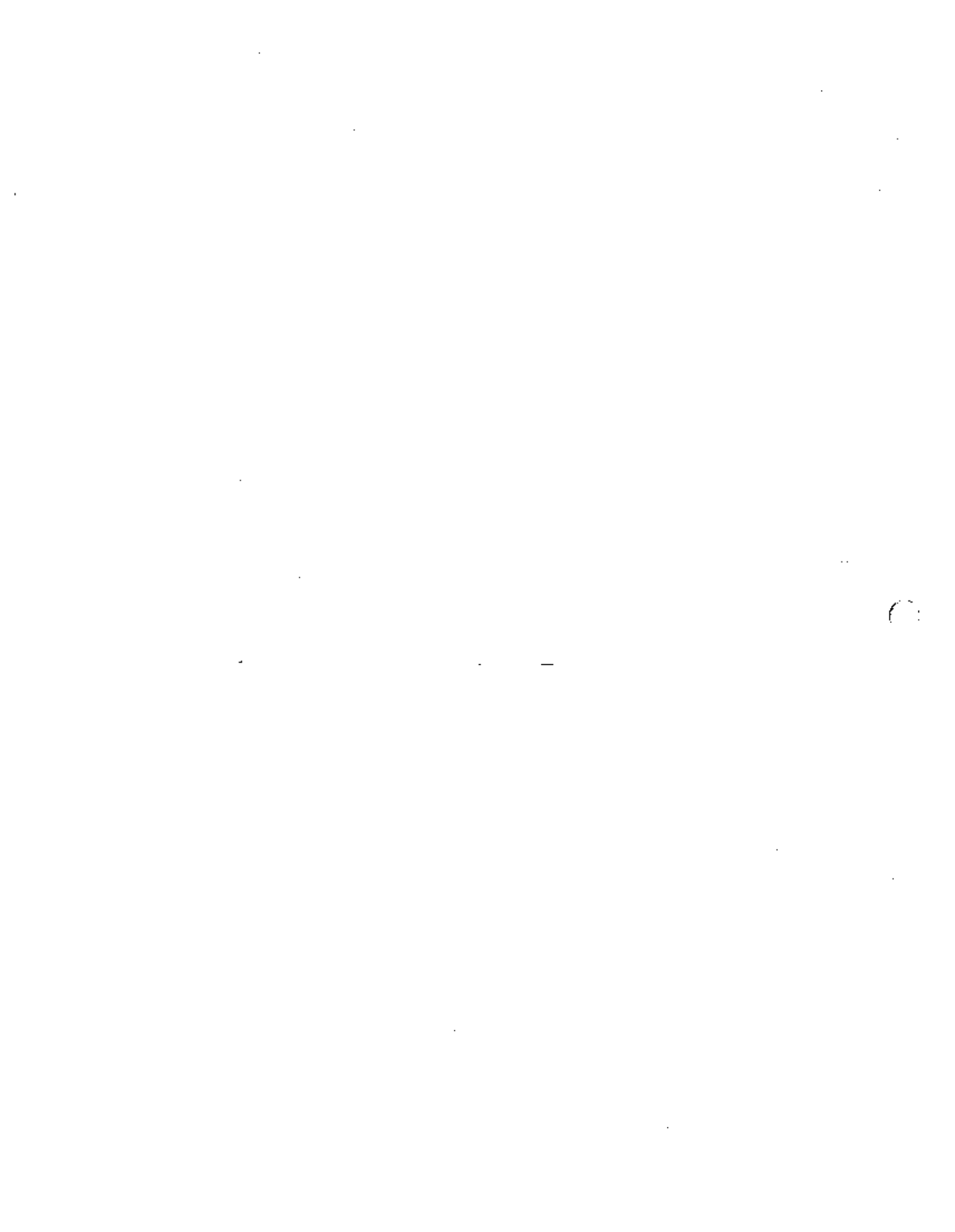
**À PREVENIR LE CHOC ÉLECTRIQUE, N'ENLEVER PAS LES COUVERTURES. PAS DES PIÈCES UTILE AU CLIENT À L'INTÉRIEUR. SERVICE ET MODIFICATIONS DANS CE MANUEL SEULEMENT PAR PERSONNES CAPABLES. DÉTACHER LA BORNE DE PUISSANCE AVANT D'ÉCHANGER LA MODULE ÉLECTRONIQUE.**

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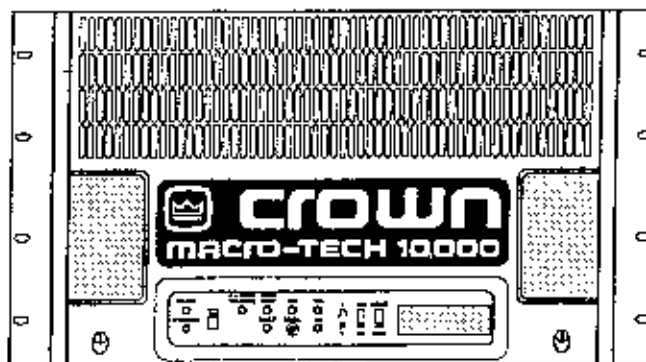
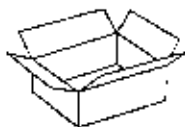


Fig. 1.1 Macro-Tech 10,000

## 1 Welcome

Congratulations on your purchase of the renowned *Macro-Tech*® professional power amplifier. *Macro-Tech* amplifiers are designed to provide enormous amounts of undistorted, pure power within a robust package – making them *the choice* for super-powered pro sound reinforcement. With its *P.I.P.*® (Plug-In Panel) system, future technology can be plugged in, making obsolescence a thing of the past. *P.I.P.* modules are already available to tailor your amp to your singular needs while many exciting new *P.I.P.*s are under development to forge your gateway to the future.

This manual will help you successfully install and use the newest and most powerful member of the *Macro-Tech* family, the MA-10,000 mono amplifier. In order to gain maximum benefit from your amp we strongly recommend you read all the instructions, warnings and cautions contained within. Be sure to read section 3.3, Wiring. Also for your protection, please send in your warranty registration card today and save your bill of sale since it is your **official proof of purchase**.



### 1.1 Unpacking

Please unpack and inspect your new amplifier for any damage that may have occurred during transit. If damage is found, notify the transportation company immediately. Only you, the consignee, may initiate a claim with the carrier for damage resulting during shipment. Crown will be happy to cooperate fully as needed. Save the shipping carton as evidence of damage for the shipper's inspection.

Even if the unit arrived in perfect condition, as most do, save all packing materials so you will have them if you ever need to transport the unit. **NEVER SHIP THE UNIT WITHOUT THE FACTORY PACK.**

### 1.2 Features

The MA-10,000 uses the latest technology and miniaturized design to provide the highest power and value for its size, weight and price. Its *grounded-bridge* circuitry offers many advantages over conventional designs.

- ❑ Patented Crown circuitry handles extreme voltage swings without putting output transistors in series resulting in lower distortion, greater reliability.
- ❑ Very low harmonic and intermodulation distortion gives excellent *dynamic transfer function*.
- ❑ Patented *ODEP*™ (Output Device Emulator Protection) circuitry detects and compensates for overheating and overload.
- ❑ Full protection against shorted outputs, open circuits, mismatched loads, general overheating, and high-frequency overloads.
- ❑ Output voltage or current can be increased by interlocking more than one amplifier.
- ❑ Patented *IOC*® (Input/Output Comparator) circuitry immediately alerts of any distortion exceeding 0.05%, providing proof of performance.
- ❑ Visual load impedance matching with output voltage and current indicators.
- ❑ *P.I.P.*® (Plug-In Panel) accepts accessories that tailor your amplifier to suit individual applications.
- ❑ Front panel is designed for fast, easy removal and has an extensive set of indicators: Ready, Standby, 3Φ Over Voltage, Over Temp, Fault, *IOC*, *V<sub>set</sub>*, *I<sub>set</sub>* and optional Output Meter.
- ❑ Selectable 15 and 12,000 Hz high-pass, band-pass and low-pass input filters.
- ❑ Massive 3-phase power supply stands ready to deliver power for the highest demands of your load.
- ❑ Efficient heat sinks and a self-contained on-demand forced air cooling system prevent overheating and prolong component life.
- ❑ Balanced input with adjustable gain and a high-current output barrier block are provided for connection.
- ❑ Rack mountable in a standard 19 inch equipment rack. Optional: rack-mountable pivot slides.

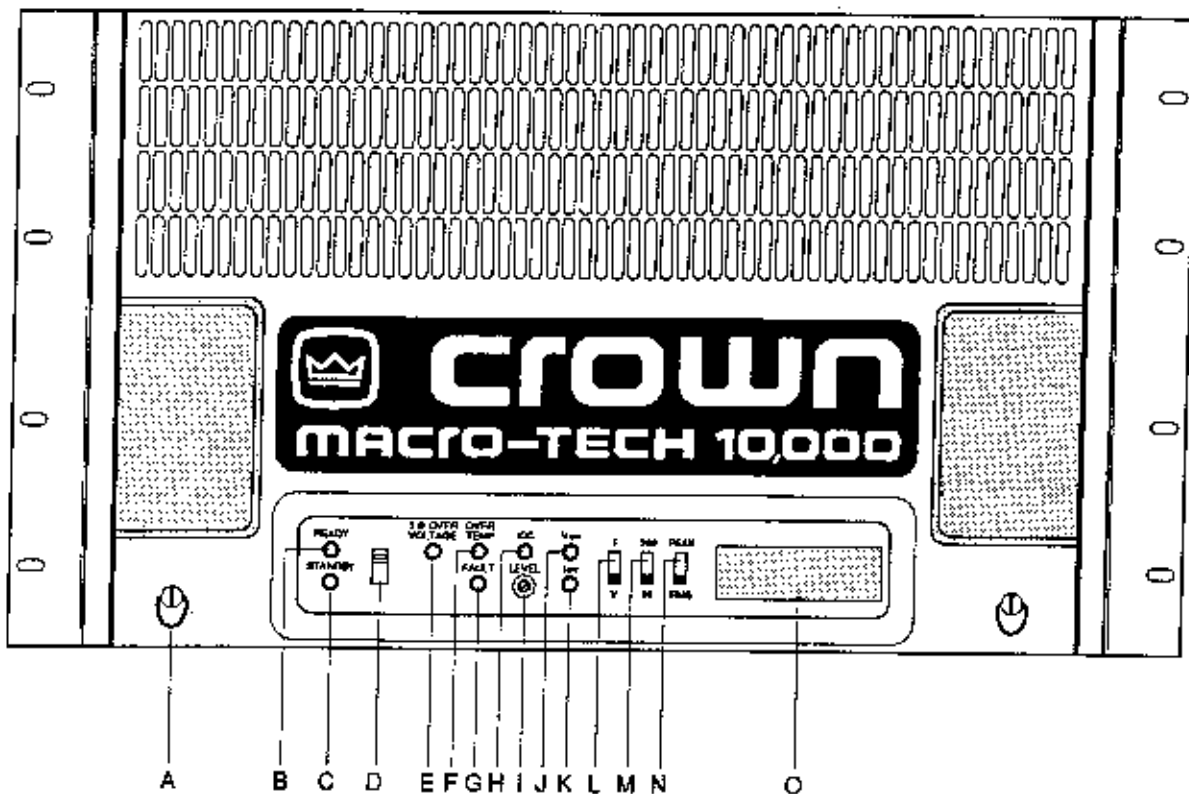


Fig. 2.1 Front Facilities

## 2 Facilities

### A. Quick-Release

Two quarter-turn fasteners hold the front panel in place. **CAUTION!** Because of risk of electric shock, only a qualified person should remove the front panel.

### B. Ready Indicator

A green LED which lights when the unit is placed in READY mode. (See the Ready-Standby Switch description below.)

### C. Standby Indicator

A yellow LED which lights when the unit is in STANDBY mode. (See the Ready-Standby Switch description below.)

### D. Ready-Standby Switch

While powered, this slide switch provides a convenient way to enable or disable the amplifier. In the down or STANDBY position, the amplifier output circuitry is off (not powered). In the up or READY position, the output circuitry is enabled.

### E. 3Φ Over Voltage Indicator

An amber LED which lights if the line voltage rises 10% or more above the nominally rated line voltage. If this happens, the amplifier is latched in STANDBY mode to protect its voltage-sensitive circuitry. Switch the unit off with the rear-panel breaker (T) to reset.

### F. Over Temp Indicator

A red LED which lights to warn that the unit has gotten too hot. If this happens, the amplifier will temporarily switch to STANDBY mode until it has cooled down.

### G. Fault Indicator

A red LED which lights to warn that the output circuitry has malfunctioned. In this rare event, the amplifier will latch in STANDBY mode. Switching the rear-panel breaker (T) off will reset the Fault circuitry if the fault is not permanent.

### H. IOC Indicator

A yellow LED which shows the status of the Input/Output Comparator. It is normally off and will flash in the rare event that the output waveform differs from that of the input by 0.05% or more. Since transient distortion happens very fast, a delay is used to keep the indicator on long enough to be easily noticed. It is provided as "proof-of-performance."

### I. Level Control

The input level is set with this gain control. Use a flat-blade screwdriver to adjust it. A lock nut is provided for security. Turn full counterclockwise to turn the input level off.

### J. VSP

The green Voltage Signal Presence Indicator flashes synchronously with the output signal voltage. It may flash infrequently or continuously depending upon the strength of the signal. If the voltage headroom of the amplifier is exceeded, it turns off and the IOC indicator (H) turns on.



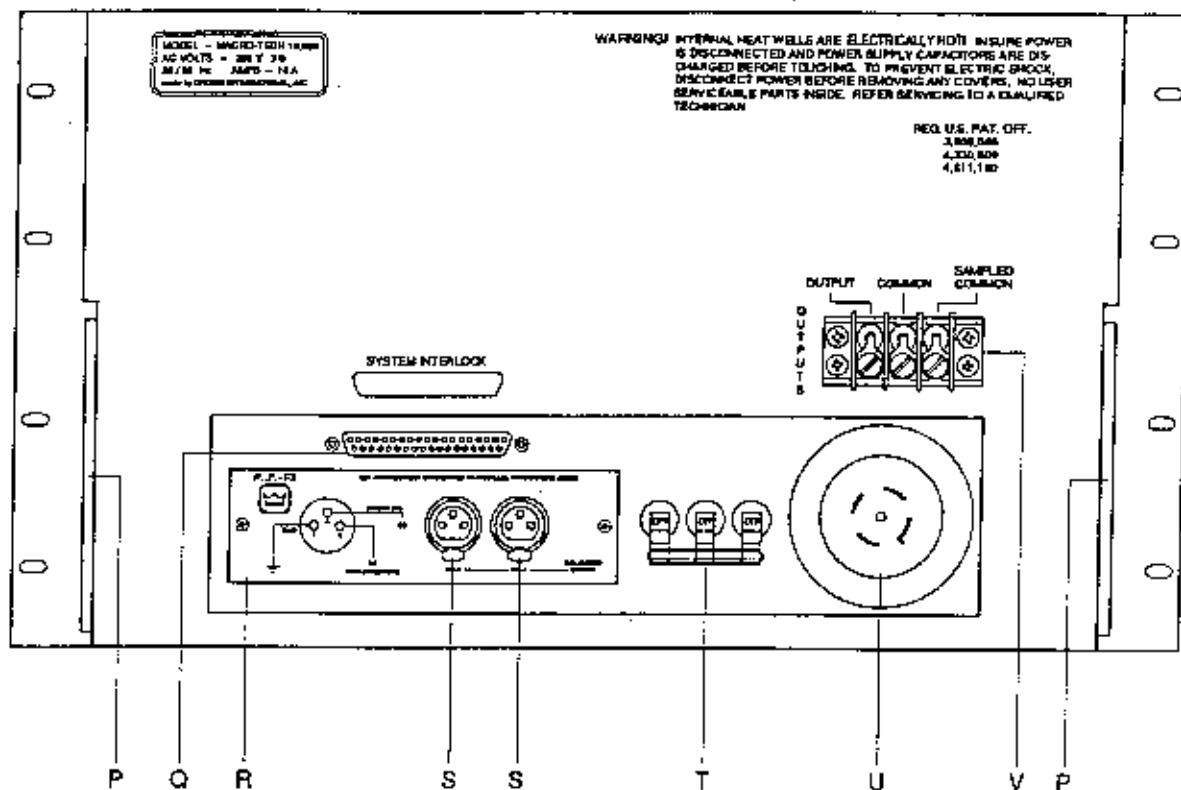


Fig. 2.2 Rear Facilities

**K. ISP**

The green Current Signal Presence Indicator flashes synchronously with the output signal current. It may flash infrequently or continuously depending upon the strength of the signal. If the current headroom of the amplifier is exceeded, it turns off and the *JOC* indicator (H) turns on. The Isp will also stay off if no load is connected to the amplifier.

**L. I-V Switch (optional)**

This optional switch is a part of the Output Meter option (O). It controls whether the Output Meter displays the output current, I, or output voltage, V.

**M. 200-20 Switch (optional)**

This optional switch is a part of the Output Meter option (O). It selects the current or voltage range which the Output Meter will display.

**N. Peak-RMS Switch (optional)**

This optional switch is a part of the Output Meter option (O). It controls whether the Output Meter displays peak current or voltage or whether it displays RMS current or voltage.

**O. Output Meter (optional)**

An optional 3 1/2 digit two-range LCD meter which can be set to display either the peak or RMS output current or voltage.

**P. Fans**

Four fans (two per side) are provided for on-demand forced-air cooling. The single-speed fans are turned on whenever

the amplifier temperature equals or exceeds 122° F (50° C). Remember to periodically check and clean their filters.

**Q. System Interlock**

A female 37-pin "D-shell" connector used to interlock two or more amplifiers together in a push-pull, series, or parallel configuration to increase system output power.

**R. P.I.P. Module**

A P.I.P.-FX is provided as standard equipment and is shown inserted in the P.I.P. (Plug-In Panel) connector at the back of the amplifier. See Accessories (section 8) for information on the P.I.P. modules that are currently available.

**S. Balanced XLR Input**

Balanced 3-pin female XLR connectors are provided on the P.I.P.-FX. Since the MA-10,000 is a mono amplifier, the Channel 1 XLR connector is used for input while the Channel 2 connector is available for "daisy chaining" to the inputs of other equipment.

**T. Triple Circuit Breaker**

Disconnects the AC mains in the event that excessive current is drawn. The breakers are rated at 20 amps per phase.

**U. Power Connector**

Standard NEMA twist-lock 3-phase male connector.

**V. Output Barrier Block**

A three-terminal barrier block is provided for output connection.

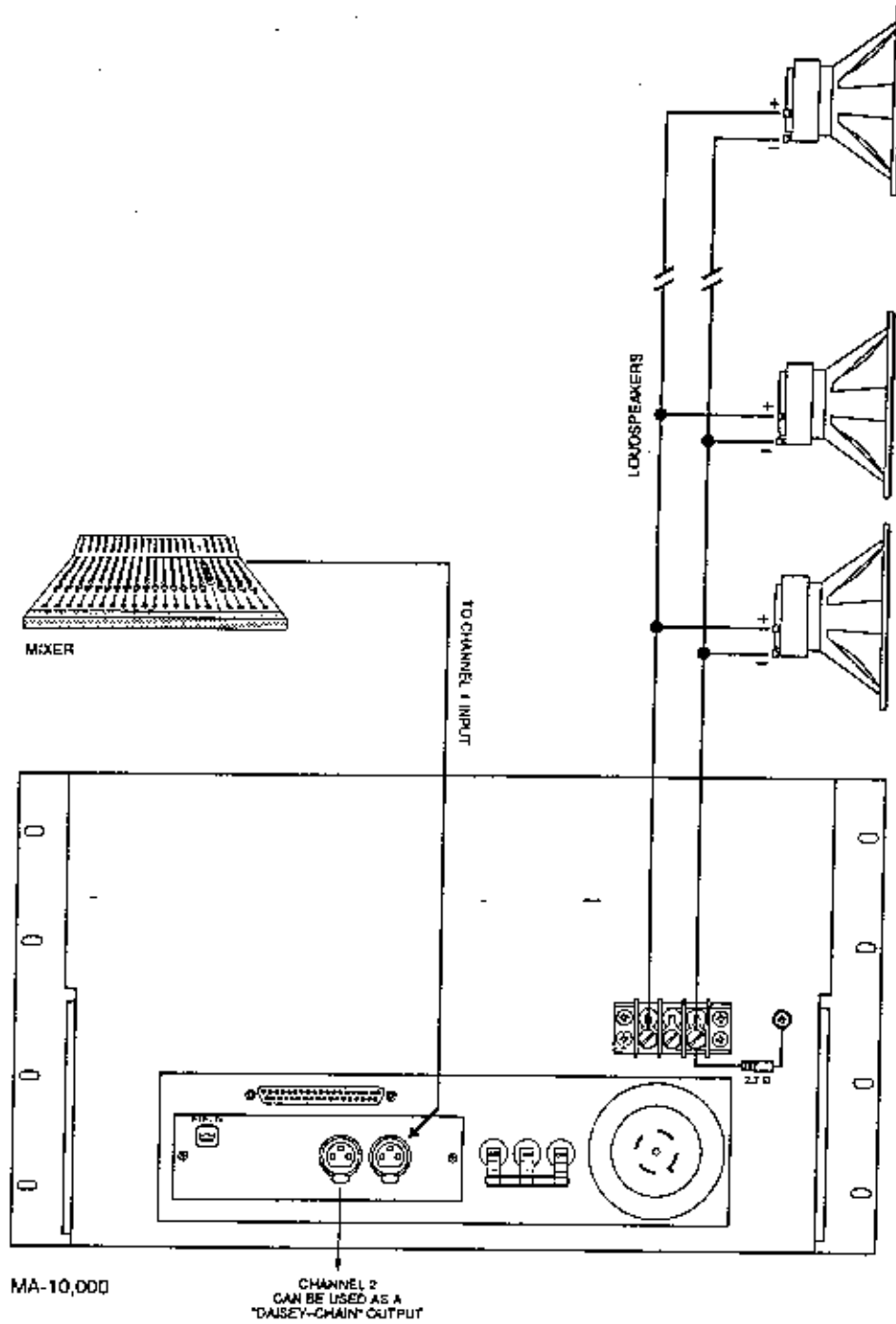


Fig. 3.1 System Connection

## 3 Installation

### 3.1 Mounting

Macro-Tech amplifiers are designed for standard 19 inch equipment rack mounting.

**Important:** Because the unit weighs 128 pounds, it must be securely mounted in a strong equipment rack.

If desired, install additional support brackets inside the rack to support the rear of the unit. If this is done, support the unit only from below. (Optional rack-mounting pivot slides are available from Crown for convenient access to the unit.)

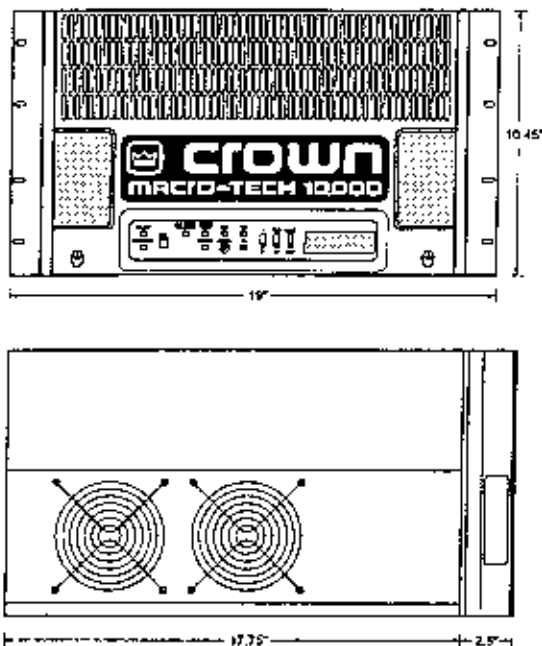


Fig. 3.2 Mounting Dimensions

### 3.2 Cooling

The unit is equipped with four cooling fans which turn on when the amplifier temperature equals or exceeds 122°F (50°C). A good source of cooling air is required and care must be taken not to impede the air flow going into the sides or coming out of the front of the amplifier. There should be an air flow of at least 300 cubic feet per minute (CFM). If the rack is crowded or the ventilation is poor, add a vent tube to bring outside air into the rack. If the load seen by the amplifier is less than 1 ohm and the amplifier is being run at high output levels (as for concert sound reinforcement), it would be wise to augment the amplifier cooling system with a rack cooling/filter system.

When mounting the amplifier in a rack cabinet, the side walls of the rack must be at least 2 inches away from the chassis as

shown in Figure 3.3. Be sure to take this precaution and be careful to maintain proper air flow.

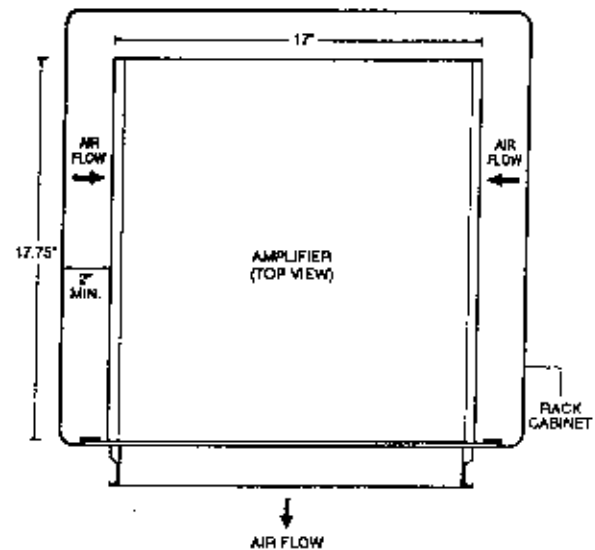


Fig. 3.3 Top View of a Rack-Mounted Unit

If your installation has a front door covering stacked amplifiers, you must provide adequate air flow through the grill in the door. If the door is solid you MUST add vents to allow air to flow out.

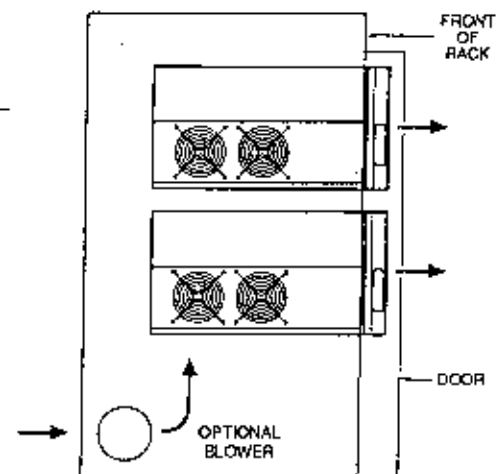


Fig. 3.4 Proper Air Flow in a Rack Cabinet

A filtered "squirrel cage" blower can be mounted in the rack to blow cooler outside air into it. Use a blower that is UL and CSA approved such as the BDS5-HF-19-6 with outlet guard and no speed control from Amco Engineering, Schiller Park, IL (phone: 312/671-6670). Figure 3.4 shows the proper position and air flow for such a blower. Be sure it has its own dust filter to prevent rapid loading of the amplifier filters (a commercial furnace filter can be used). Both the blower and amplifier filters can be cleaned with mild soap and water.

### 3.3 Wiring

Figure 3.1 depicts the most common way to install a MA-10,000 amplifier into a sound system. The input and output connectors are located on the rear panel. Please use care in making connections, selecting signal sources and controlling the output level. (This amplifier has enough power to permanently "rain" your day.) The load you save may be your own! Crown can assume no liability for any damage done to loads due to careless amplifier usage and deliberate overpowering.

*It is always wise to remove power from the unit and turn the input level controls off while making connections—especially if the load is a loudspeaker. This eliminates any chance of loud blasts or damage to the loudspeaker(s).*

#### 3.3.1 Input

The balanced input has a nominal impedance of 20 K ohms (10 K ohms unbalanced) and will accept the line-level outputs of most devices. Balanced 3-pin female XLR connectors are provided for input on the P.I.P.-FX module which comes as the standard configuration. Use the Channel 1 XLR connector for input. The Channel 2 connector can be used as a "daisy chain" output to feed other equipment.

#### Input Wiring Tips

1. Use only shielded cable. The higher the density of the shield (the outer conductor), the better the cable. Spiral wrapped shield is not recommended.
2. When using unbalanced lines, keep the cables as short as possible. (Avoid cable lengths greater than 10 feet.)
3. Do not run signal cables together with high-level wiring such as loudspeaker wires or AC cords. (This greatly lessens the chance of hum or noise being induced or picked up from asymmetrical ground loops.)
4. Turn the entire system off before changing any connections and turn the Level control all the way down before powering the system back up. Crown is not liable for damage incurred when any transducer or component is overdriven.
5. In installations where both the input and output lines are attached to AC powered devices, it may be necessary to low-pass filter the input to the amplifier in order to eliminate capacitive coupling through the AC mains.

Figures 3.5 and 3.6 show how to connect the input cable to the amplifier:

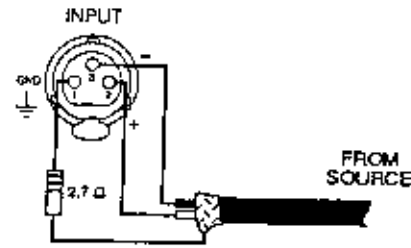


Fig. 3.5 Balanced Input Wiring (Superior method)

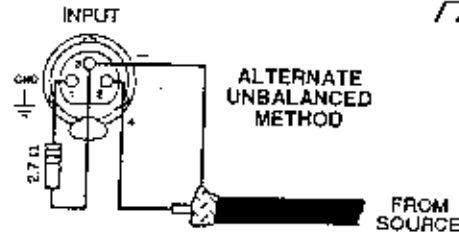
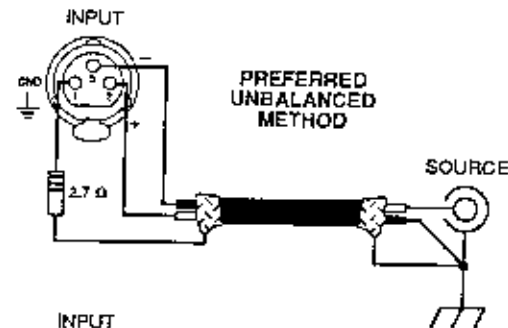


Fig. 3.6 Unbalanced Input Wiring

There are two important problems to try to avoid with the input signal: large subsonic (subaudible) frequency levels and large ultrasonic frequency levels (also known as RF or radio frequencies). Excessive subsonic frequencies in the input signal can overload, overheat or otherwise damage loudspeakers or "constant voltage" transformers. Excessive ultrasonic frequencies, such as the bias signal in tape recorders, can activate the amplifier's protection system or overload its controlled slew rate stage (a stage designed to give RF protection).

A selectable input filter is provided as a standard feature to prevent either of these problems. The filter can be placed in one of five modes: Flat, High-pass, Band-pass, Low-pass and Mute. Since the MA-10,000 is most often used to drive woofers, it is configured in Band-pass mode at the factory. The filter mode is selected with a five-switch DIP located on the Filter/Display Driver circuit board immediately behind the front panel. See Figure 3.7 and 4.2.

**CAUTION:** Because of the risk of electric shock, only a qualified person should adjust the input filter.

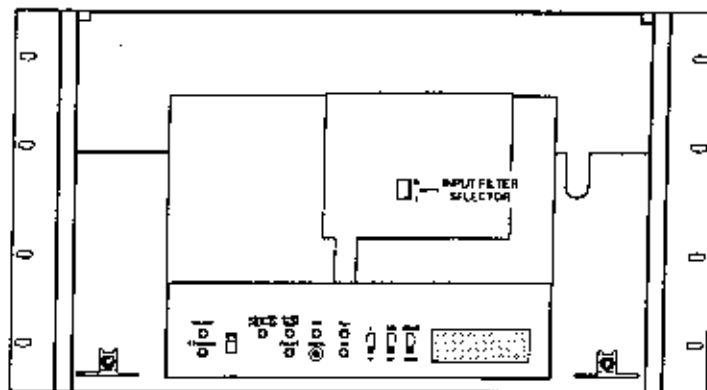
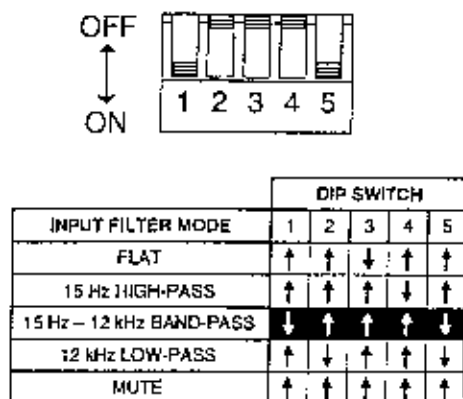


Fig. 3.7 MA-10,000 with Front Panel Removed

Figure 3.8 includes a table showing the available settings for the input filter DIP switch.



DEFAULT SETTINGS FOR A BAND PASS FILTER ARE HIGHLIGHTED.

Fig. 3.8 Input Filter Switch Settings

**CAUTION!** We highly recommended you use a band-pass filter to protect the load and to prevent the amplifier from prematurely activating its protection circuitry.

The following information will help you design an additional subsonic and/or ultrasonic (RF) filter if you do not want to use the ones provided.

The graph in Figure 3.9 shows the relative high-pass response of various input capacitors. Use only a low-leakage paper, mylar or tantalum capacitor.

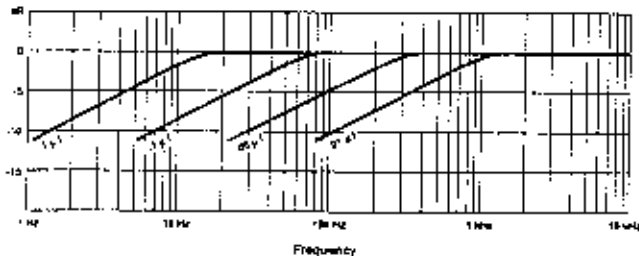


Fig. 3.9 Input-Capacitor Selection for High-Pass Filter

Figure 3.10 depicts three low-pass filters for unbalanced input signals. Figure 3.11 depicts three low-pass filters and one band-pass filter for balanced input signals.

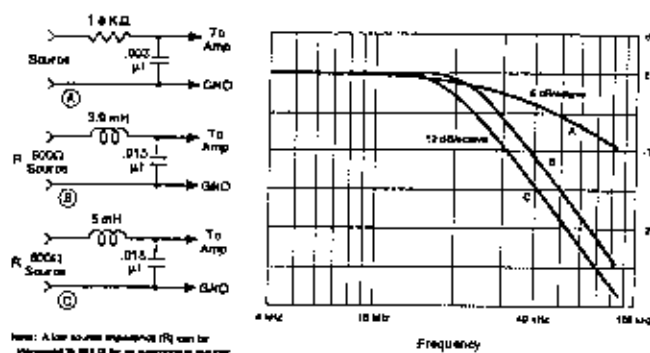
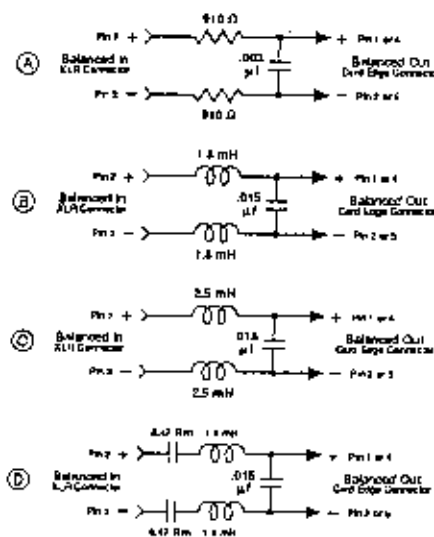


Fig. 3.10 Unbalanced Low-Pass (RF) Filters



Note: A, B and C are balanced versions of the filters shown in Figure 3.10. D is a band-pass filter which combines Filter B with a subsonic filter capacitor as depicted in Figure 3.9.

Fig. 3.11 Balanced Input Filters

Another problem to prevent is ground loops—undesirable currents flowing in a grounded system, possibly causing hum in the output. A common form of loop is a pair of input cables whose area is subjected to a magnetic hum field. To prevent ground loops causing magnetic induction, lace both cables together along their length, and away from the power transformer. **DO NOT CONNECT THE INPUT AND OUTPUT GROUNDS TOGETHER.**

Yet another facet of this problem occurs when input and output grounds, tied together as in testing or metering, allow feedback oscillation from load current flowing in the loop. In some systems, even the AC power line may provide this feedback path. Proper grounding, isolation of inputs and common AC-line devices is good practice.

### INPUT MIXER

It is possible to use both the Channel 1 and 2 inputs as an input mixer to equally mix two different input signals into the mono input of the MA-10,000. This is accomplished by removing four jumpers on the P.I.P. connector assembly inside the rear of the unit. (With these jumpers in place, the Channel 2 input can only be used as a "daisy chain" output.) Removing the jumpers is described next.

**CAUTION:** Because of risk of electric shock, only a qualified person should attempt these adjustments.

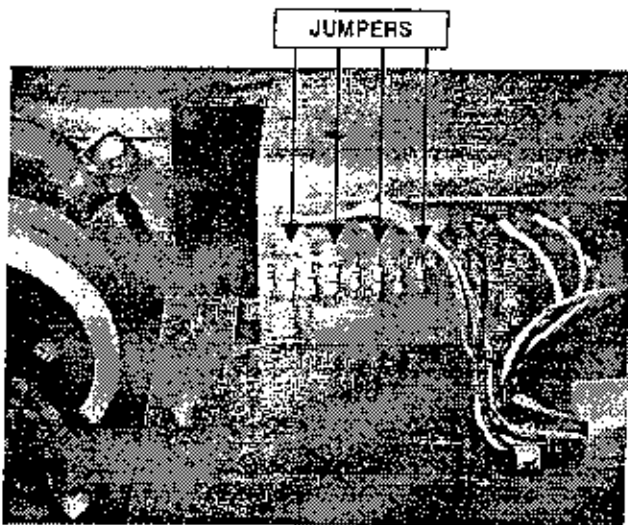


Fig. 3.12 Input Jumpers

1. Turn OFF the amplifier AND DISCONNECT IT FROM THE AC POWER SOURCE.

**WARNING!** After turning off the power and BEFORE removing the cover, allow the amplifier to rest for ONE MINUTE to allow the supply capacitors to discharge.

2. Remove the rear panel.

**CAUTION!** To prevent electric shock, do not touch the large supply capacitors.

3. Locate the four jumpers on the circuit board protruding from the back of the P.I.P. connector assembly (see Figure 3.12).
4. Remove the jumpers by clipping them with a pair of wirecutters.
5. Replace the amplifier rear panel and restore the AC power connection.

Once the jumpers are removed, both inputs are electronically paralleled, making the input impedance of each individual input 30 K ohms (balanced). If both inputs are driven with a low source impedance, each input will have an impedance of approximately 16 K ohms. The Channel 2 input should now be treated identically as the Channel 1 input. Do not attempt to use the Channel 2 input for for "daisy chaining" unless the jumpers are first restored.

### 3.3.2 Output

Consider the power handling capacity of your load before connecting it to the amplifier. Crown is not liable for damage incurred at any time due to its being overpowered. The use of loudspeaker protection fuses is highly recommended (see section 3.3.3). Please also pay close attention to the Operating Precautions section (4.1).

**WARNING!** OUTPUT POTENTIALS CAN BE HAZARDOUS. MAKE CONNECTIONS ONLY WITH THE AC POWER OFF.

The load should be connected between the "output" and "sampled common" terminals (see Figure 3.13). The output current can be monitored across the "common" and "sampled common" terminals. Notice the 2.7 ohm resistor between the "sampled ground" and the chassis. It is used to reference the chassis to the signal ground in order to prevent oscillations. Removing the resistor is NOT recommended.

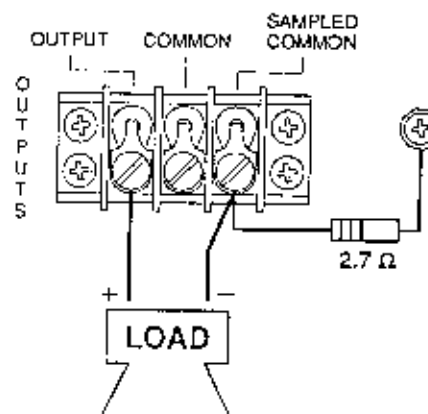


Fig. 3.13 Output Wiring

Use speaker cables of sufficient gauge (thickness) for the length used. Otherwise, power is lost through cable heating and the damping factor decreased due to cable resistance.

Please refer to the nomograph in Figure 3.14 for recommended wire size.

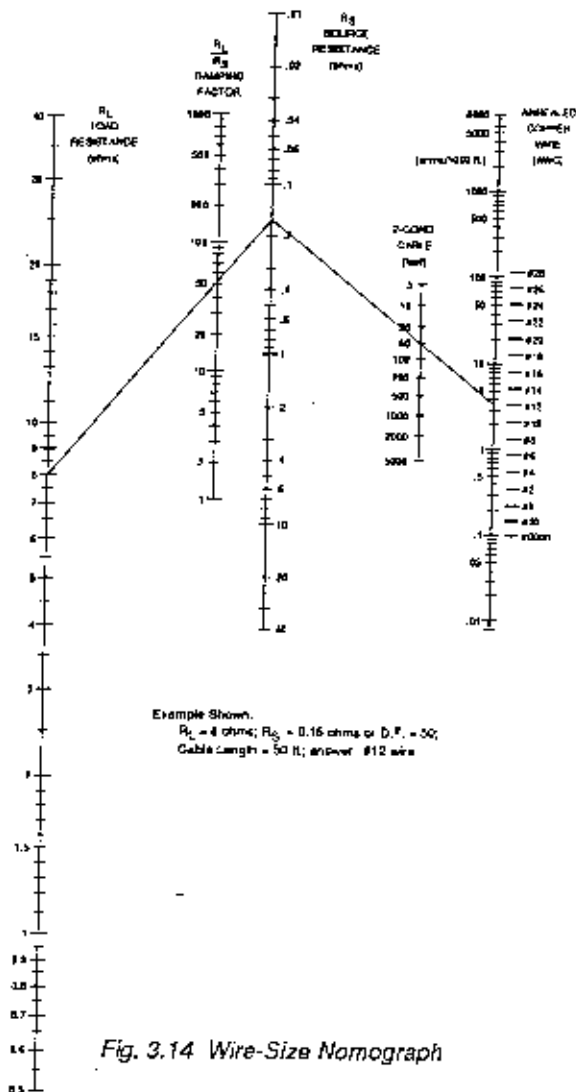


Fig. 3.14 Wire-Size Nomograph

Use the nomograph as follows:

1. Note the load resistance of the speakers connected to each channel of the amplifier. Mark this value on the nomograph "Load Resistance" line.
2. Choose an acceptable system damping factor (50 is typical). Mark this value on the "Damping Factor" line.
3. Draw a pencil line through these two points, intersecting the "Source Resistance" line.
4. On the "2-Cond. Cable" line, mark the length of cable run.
5. Draw a pencil line from the intersection point on the "Source Resistance" line through the mark on the "2-Cond. Cable" line.
6. Note where the pencil line intersects the "Annealed Copper Wire" line. This value is the required gauge of speaker cable.
7. If the cable size is too large, settle for a lower damping factor and try again or use more than one cable for each line. A "rule of thumb" for the latter choice is: Every time you double the number of conductors (of equal gauge) the resulting apparent gauge is three less. For example, you determine that you need #10 AWG wire but this is too large, so you decide instead to use two #13 AWG wires in place of each #10 wire and achieve the same effect. In this same example you could also substitute four #16 AWG wires.

If a distribution box is built or purchased, make sure to use large enough cable between it and the amplifier to support the total current and damping factor required.

To prevent high-frequency oscillations:

1. Lace the loudspeaker cables together.
2. Keep speaker cables well separated from input cables.
3. Never connect the input and output grounds together.
4. Use a low-pass or band-pass filter on the signal input line (see preceding input section).

### TRANSFORMER COUPLING

Loads that are primarily inductive, such as "step-up" transformers, require special attention. To prevent large low-frequency currents from damaging them (and prevent the amplifier from prematurely activating its protective systems), operate the MA-10,000 with its input filter set to either Band-pass (15 Hz - 12 kHz) or High-pass mode (15 Hz). See section 3.3.1 for details about setting this filter.

### Use Good Connectors

1. Male connectors on speaker cables should not be exposed to prevent possible short circuits.
2. Connectors which can be plugged into AC power receptacles should never be used.
3. Connectors having low-current-carrying capacity should not be used.
4. Connectors having any tendency to short, or having shorted leads should never be used.

### 3.3.3 Load Protection

Since this amplifier generates enormous power, you may desire to protect your loudspeakers (or other sensitive loads) from damage resulting from excessive power. A common way to do this is to put a fuse in series with the load. (Use one fuse per each driver.)

Fuses help prevent damage due to prolonged overload, but provide essentially no protection against damage from large transients. To minimize this problem, use high-speed instrument fuses such as the Littlefuse 361000 series. Figure 3.15 is a nomograph showing fuse size versus loudspeaker peak power ratings. If, on the other hand, the loudspeaker is only susceptible to damage caused by overheating, use a fuse or circuit breaker having the same slow thermal response as the loudspeaker itself (such as a slow-blow fuse).

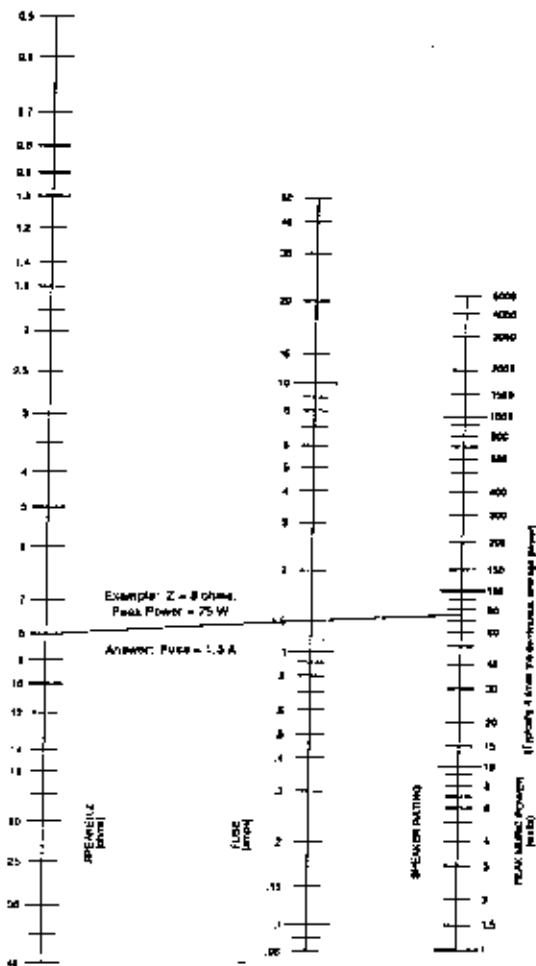


Fig. 3.15 Fuse Selector Nomograph for Loudspeaker Protection

**3.3.4 Power**

The MA-10,000 amplifier is furnished with a NEMA style locking three-phase AC plug on the rear panel. Wiring the AC connector requires that the three line wires be connected to posts X, Y and Z plus the safety ground connecting to G. Three-phase 208 VAC is required (see Power Requirements under the Specifications section).

Fig. 3.16 Three-Phase NEMA Connector



**WARNING!** Only qualified personnel should wire the connector supplied with the unit. **DO NOT ATTEMPT TO WIRE THE CONNECTOR WHILE THE AC POWER SOURCE IS CONNECTED.**

When testing the amplifier, the peak line voltage must be equivalent to the peak voltage of a sinusoid of the specified RMS line voltage when at full load. Line regulation problems can reduce the available output power.

**3.3.5 Interlocking Multiple Amplifiers**

More than one MA-10,000 can be interlocked together to drive a single load with *enormous* power. If you do not plan to use this feature, please skip this section.

There are three primary configurations which accomplish this: Push-Pull, Series, and Parallel. Combinations of these configurations are also possible. Before proceeding further, please note the following:

- In an interlocked system, one amplifier will act as the "master" and all others will operate as "slaves." This requires the Master-Slave switch to be correctly positioned for each amplifier. (Make sure the switch is **fully up** or **down**—NOT centered!) It is located on the Main circuit board directly behind the Filter/Display Driver circuit board.

**CAUTION!** Because of risk of electric shock, only a qualified person should remove the front panel and change the position of the Master-Slave switch.

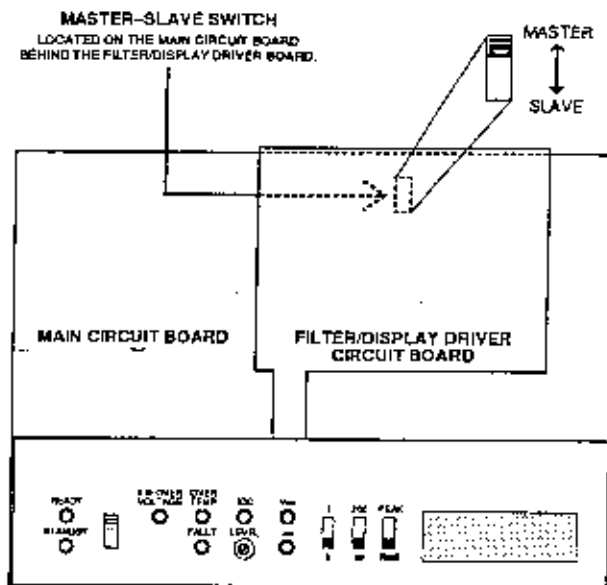


Fig. 3.17 Master-Slave Switch

- **NEVER DIRECTLY CONNECT THE OUTPUT TERMINALS OF SEPARATE AMPLIFIERS TOGETHER.** The result is excessive power consumption, overheating and possible amplifier damage.

- **LETHAL VOLTAGES ARE PRESENT WITHIN MA-10,000 AMPLIFIERS.** While the MA-10,000 chassis is grounded to earth, all internals have a floating ground. The internal circuitry of SLAVE amps, particularly in systems configured for increased voltage, can carry lethal voltages.

- The wire length of each output cable is critical — particularly in Parallel configurations. The wire length must match within a tolerance of 1/4 inch. This also holds true for any output wiring which forms a "Y" branch.



• Because of the large currents involved, be sure to use adequate wire size. See Figure 3.18 below for minimum wire gauge for different continuous-duty current capacities.

COPPER WIRE			
WIRE SIZE (AWG)	DIAMETER (MILS or 0.001 INCHES)	DC RESISTANCE (OHMS/1000 FT AT 77° F, 25° C)	CONTINUOUS DUTY CURRENT CAPACITY* (AMPERES)
8	128.5	0.6404	55
10	101.9	1.018	40
12	80.8	1.62	25
14	64.1	2.57	20

\*Minimum value for insulated wire in free air (i.e. not bundled or in conduit).

Fig. 3.18 Wire Continuous Current Capacity

Be certain the insulation of the wire you choose can handle the output voltage and environmental conditions (heat and moisture exposure) of the system. For more information about wire capacities and ratings see the "National Electrical Code" published by the National Fire Protection Association.

The different interlocking methods can be broken down as follows: Use the Push-Pull configuration where double output voltage is required to drive a balanced load (above ground) utilizing two amplifiers. Use the Series configuration in place of the Push-Pull mode when double or greater output voltage is needed and one side of the load must be grounded. (In both Push-Pull and Series modes, the minimum output impedance is double that of one amplifier.) Use the Parallel configuration when increased output current is required. In the Parallel configuration, much larger (lower impedance) loads can be driven but the output voltage remains the same as that of one amplifier.

Combinations of these configurations are also possible to further increase output voltage and output current. For example, a Push-Pull Series configuration will interlock up to ten amplifiers to provide extraordinarily high output voltage. And a Push-Pull Parallel configuration uses four amplifiers to give both higher voltage and higher current output. This enables extremely low-impedance loads (relative to one amp) to be driven with very high voltages.

Before getting into the actual wiring of each configuration, please note that interlocked amplifiers must be interconnected via the 37-pin System Interlock connector located on the rear panel of each amplifier. The following paragraphs and illustrations will describe which pins to connect at each amplifier. The pin functions are listed next.

PIN	FUNCTION
1	Amplifier Output
2	Sampled Common
3	Unsampled Common
4	Reset + In
5	Master Error + Out
6	Overload + Out
7	Over Temp +Out
8	Over Voltage +Out
9	Ready +Out
10	Supply, +15 VDC
11	Interlock Common
12	Interlock Common
13	Enable +In
14	Current Sum 1 (-)
15	Current Sum 2 (+)
16	Current Sum 3 (-)
17	J100 Pin 8 (Spare)
18	J100 Pin 6 (Spare)
19	J100 Pin 4 (Spare)
20	Common
21	Input, +1
22	Input, -1
23	Reset -In
24	Master Error -Out
25	Overload -Out
26	Over Temp -Out
27	Over Voltage -Out
28	Ready -Out
29	Interlock
30	Amp Ready
31	Supply, -15 VDC
32	Enable -In
33	Current Sum 1 (+)
34	Current Sum 2 (-)
35	Current Sum 3 (+)
36	J100 Pin 7 (Spare)
37	J100 Pin 5 (Spare)

### PUSH-PULL

In the Push-Pull configuration, both amplifiers are at ground potential and the system output is balanced above ground. It is therefore mandatory that neither side of the load be grounded. If this is not possible, use the Series configuration. Figure 3.19 shows the basic system connections:

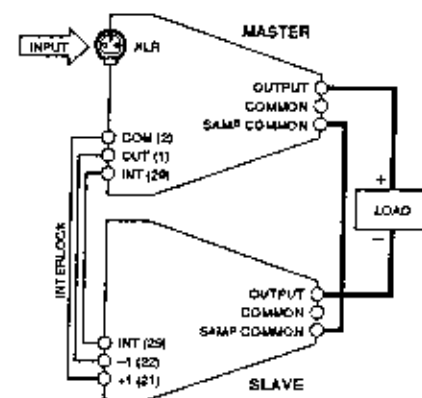


Fig. 3.19 Interlock Push-Pull System Wiring

To assemble a Push-Pull system:

1. Turn OFF the amplifiers and DISCONNECT THEM FROM THE AC POWER SOURCE.
2. Identify the MASTER unit and turn its Master-Slave switch to the up or "Master" position.
3. Switch the Master-Slave switch of the remaining amplifier to the down or "Slave" position.
4. Make an interlock cable as shown in Figure 3.19 and connect it to the 37-pin System Interlock connector of each amplifier.
5. Connect a ground cable between the Sampled Commons of both amplifiers.
6. Connect the load between the positive Output terminals of both amplifiers with the positive terminal of the load connecting to the MASTER amplifier.
7. Connect the input signal to the XLR input connector on the MASTER amplifier.
8. Restore power to the amplifiers.

**SERIES**

In the Series configuration, as many as five amplifiers can be interlocked. This method allows one side of the load to be common with ground.

**WARNING!** Exercise extreme caution with Series systems. The floating ground principle which allows this configuration to produce increased voltage also causes **LETHAL VOLTAGES** to be present throughout the system.

**IMPORTANT:** To protect each amplifier from damage, the interlock system for each unit above ground **MUST** be protected with an optical isolator. These optical isolators are available from Crown. (Contact the Crown Technical Support Department for further information.) Figure 3.20 shows the basic system connections:

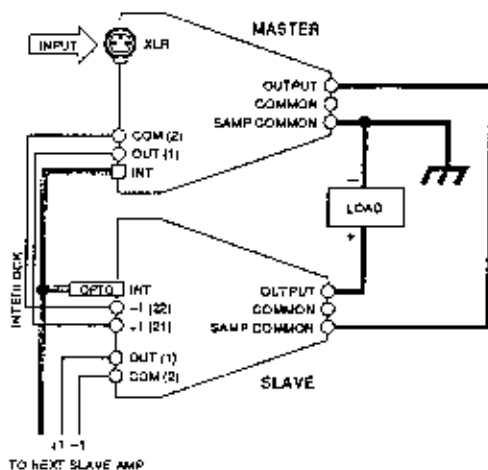


Fig. 3.20 Interlock Series System Wiring

To assemble a Series system:

1. Turn OFF the amplifiers and DISCONNECT THEM FROM THE AC POWER SOURCE.
2. Identify the MASTER unit and turn its Master-Slave switch to the up or "Master" position.
3. Switch the Master-Slave switch of the remaining amplifier(s) to the down or "Slave" position.
4. Make an interlock cable as shown in Figure 3.20 and connect it to the 37-pin System Interlock connector of each amplifier. Be sure to use optical isolators (available from Crown) for protection.
5. Connect the positive Output terminal of the MASTER amplifier to the Sampled Common terminal of the SLAVE amplifier.
6. Connect the load between the positive Output terminal of the SLAVE amplifier and the Sampled Common terminal of the MASTER amplifier.
7. Connect the input signal to the XLR input connector on the MASTER amplifier.
8. Restore power to the amplifiers.

**PARALLEL**

Two or more amplifiers can be interlocked in a Parallel configuration to greatly increase the output current for driving large loads with extremely low impedance. Figure 3.21 shows the basic system connections:

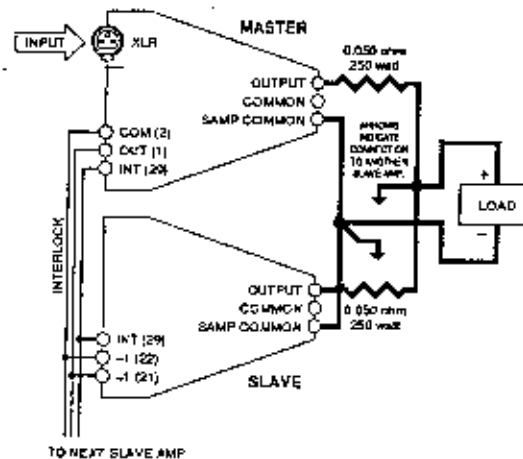


Fig. 3.21 Interlock Parallel System Wiring

To assemble a Parallel system:

1. Turn OFF the amplifiers and DISCONNECT THEM FROM THE AC POWER SOURCE.
2. Identify the MASTER unit and turn its Master-Slave switch to the up or "Master" position.
3. Switch the Master-Slave switch of the remaining amplifier(s) to the down or "Slave" position.

4. Make an interlock cable as shown in Figure 3.21 and connect it to the 37-pin System Interlock connector of each amplifier.
5. Connect ground cables between the Sampled Commons of all amplifiers. Be very careful that the cable length between each amplifier varies by no more than 1/4 inch.
6. Connect positive cables between the Output terminals of all amplifiers. Include a 0.050 ohm, 250 watt power resistor (such as a Dale™ RH250) in series with the output of each amplifier. Be very careful that the cable length between each amplifier varies by no more than 1/4 inch.
7. Connect the load across the positive and common output cables as shown in Figure 3.21. The load should be connected in such a way that the cable lengths feeding it from the output of each amplifier vary no more than 1/4 inch from each other.
8. Connect the input signal to the XLR input connector on the MASTER amplifier.
9. Restore power to the amplifiers.

### PUSH-PULL SERIES

A Push-Pull Series configuration may be desired when an application requires more voltage than can be provided by a Series configuration with a maximum of five MA-10,000

amplifiers. Up to ten amplifiers can be interlocked in a Push-Pull Series configuration. Figure 3.22 shows the basic system connections.

**IMPORTANT:** Note that the bottom two amplifiers in each Series stack **MUST** have an optical isolator in the interlock cable. Also, please be careful to observe the warnings in the Series configuration instructions.

To assemble a Push-Pull Series system:

1. Turn OFF the amplifiers and DISCONNECT THEM FROM THE AC POWER SOURCE.
2. Identify the MASTER unit and turn its Master-Slave switch to the up or "Master" position.
3. Switch the Master-Slave switch of the remaining amplifiers to the down or "Slave" position.
4. Make an interlock cable as shown in Figure 3.22 and connect it to the 37-pin System Interlock connector of each amplifier. Be sure to protect the system with optical isolators (available from Crown) as shown in Figure 3.22.
5. Interconnect the Output and Sampled Common terminals of each amplifier as shown in Figure 3.22.
7. Connect the input signal to the XLR input connector on the MASTER amplifier.
8. Restore power to the amplifiers.

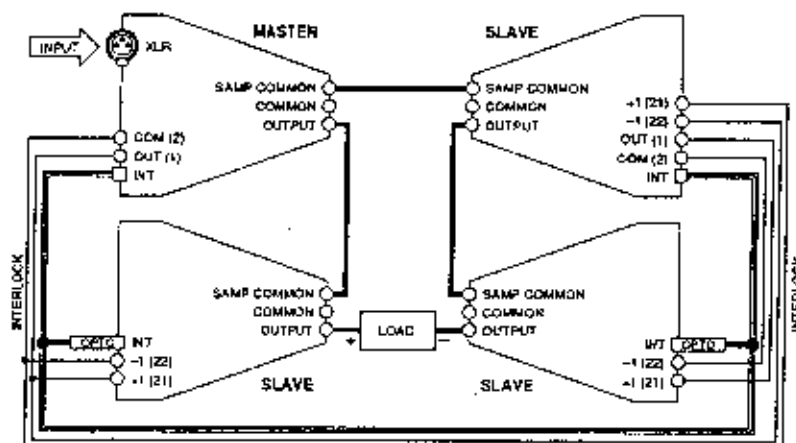


Fig. 3.22 Interlock Push-Pull Series System Wiring

### PUSH-PULL PARALLEL

A Push-Pull Parallel configuration gives the capability of greatly increasing both output voltage and output current at the same time. Care must be exercised with regard to wire lengths as in the Parallel configuration. Figure 3.23 shows the basic system connections.

The following important points should be noted:

- The output of the MASTER amplifier drives the inputs of all the SLAVE amplifiers.
- The output of the MASTER amplifier is noninverted to its associated SLAVE (lower left) and inverted to the two SLAVE amplifiers on the right.
- Current summing occurs only between the MASTER and its associated SLAVE.

To assemble a Push-Pull Parallel system:

1. Turn OFF the amplifiers and DISCONNECT THEM FROM THE AC POWER SOURCE.
2. Identify the MASTER unit and turn its Master-Slave switch to the up or "Master" position.
3. Switch the Master-Slave switch of the remaining amplifiers to the down or "Slave" position.

4. Make an interlock cable as shown in Figure 3.23 and connect it to the 37-pin System Interlock connector of each amplifier.
5. Connect ground cables between the Sampled Commons of all amplifiers. Be very careful that the cable length between each amplifier varies by no more than 1/4 inch.
6. Connect positive cables between the Output terminals of the amplifiers as shown in Figure 3.23. Include a 0.050 ohm, 250 watt power resistor (such as a Dale™ RH250) in series with the output of each amplifier. Be very careful that the cable length between each amplifier varies by no more than 1/4 inch.
7. Connect the load across the output cables as shown in Figure 3.23 where the positive side of the Load connects to the output cable of the MASTER amplifier. The load should be connected in such a way that the cable lengths feeding it from the output of each amplifier vary no more than 1/4 inch from each other.
8. Connect the input signal to the XLR input connector on the MASTER amplifier.
9. Restore power to the amplifiers.

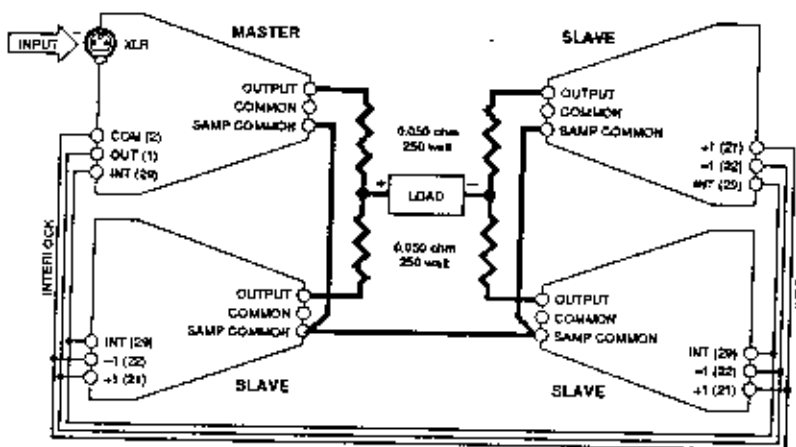


Fig. 3.23 Interlock Push-Pull Parallel System Wiring

## 4 Operation

### 4.1 Precautions

Although your amplifier is well protected from any external faults, we recommend the precautions listed below be carefully observed for safe operation. Remember, the MA-10,000 can produce enormous power—enough power to cause you a serious electrical shock. In fact, if multiple units are interlocked together, they can easily produce a LETHAL shock!

#### BE CAREFUL!

- 1. WARNING! OUTPUT POTENTIALS CAN BE HAZARDOUS.** Turn the amplifier off and unplug it from the AC line before removing a *P.I.P.* card or before removing and cleaning the dust filters. (If several amplifiers are interlocked in a system, turn off and unplug ALL of them before removing a *P.I.P.* card, etc.)
- 2. WARNING! ALLOW THE AMPLIFIER TO REST FOR ONE MINUTE AFTER TURNING OFF THE POWER BEFORE REMOVING A COVER PANEL SO THE SUPPLY CAPACITORS WILL HAVE TIME TO DISCHARGE.**
- Use care when making connections, selecting signal sources and controlling the output level. The load you save may be your own.
- IMPORTANT:** Do not short the ground lead of an output cable to the input signal ground. This may form a ground loop and cause oscillations.
- Use a band-pass filter at the input to prevent subsonic overload and ultrasonic oscillations from occurring.
- Operate the amplifier from AC mains of not more than 10% variation above or below the selected line voltage and only the specified line frequency. Failure to comply with these voltage and frequency limits will invalidate the warranty.
- Never connect the output to a power supply output, battery or power main. Damage incurred by such a hookup is not covered by the warranty.
- Tampering with the circuitry by unqualified personnel, or making unauthorized circuit changes is NOT permitted and can cause serious injury.
- NEVER ATTEMPT TO CONNECT THE OUTPUTS OF MULTIPLE AMPLIFIERS TOGETHER WITHOUT STRICTLY FOLLOWING CROWN'S INTERCONNECT PROCEDURE.**

**Remember:** Crown is not liable for any damage to other components in your system. Don't overdrive them.

### 4.2 Front Panel Display

The front panel contains numerous indicators to help you properly operate the unit.

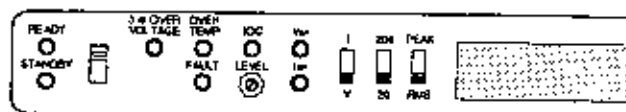


Fig. 4.1 Front Panel Display

#### 4.2.1 Ready/Standby

The Ready and Standby indicators show whether or not the output circuitry is enabled (i.e. ready). The Ready-Standby switch to the right of the indicators controls this function. With it, the amplifier can be enabled/disabled while it is powered. Three conditions can cause the amplifier to automatically go into STANDBY mode: excessive line voltage, overheating, and circuit faults. More on this below.

**Note:** Whenever the Standby indicator lights, the IOC indicator will also light since the output waveform will no longer match that of the input.

#### 4.2.2 3Φ Over Voltage

The amber 3Φ Over Voltage indicator lights when the line voltage is greater than 10% over the rated line voltage for the unit. This condition also latches the unit in STANDBY mode. To reset circuit, turn off the AC mains breaker on the back panel, wait a few seconds, and turn the unit back on.

#### 4.2.3 Over Temp

A red Over Temp indicator lights when the unit has become too hot. When this happens, the amplifier will TEMPORARILY go into STANDBY mode until it has cooled down. Upon cooling down, the unit will return to READY mode. (This condition usually indicates loss of air flow through the amplifier. Check air filters for clogging.)

#### 4.2.4 Fault

The red Fault indicator lights to warn that the output circuitry has malfunctioned. In this rare event the amplifier will latch in STANDBY mode, requiring the unit to be powered down with the AC mains circuit breaker on the back panel. If a fault ever occurs, try resetting the unit. If the fault condition persists, contact Crown for service.

#### 4.2.5 IOC

A yellow IOC (Input/Output Comparator) LED provides "proof-of-performance" by flashing in the unlikely event the output waveform differs from that of the input by 0.05% or more. Normally off, the indicator has a delay circuit which holds it on long enough to be noticed even when the distortion is of a high-speed transient nature. The V<sub>SM</sub> and I<sub>SM</sub> LEDs can be used in conjunction with the IOC indicator to determine the cause of the distortion. It is normal for the IOC indicator to be on when the amplifier is first turned on.

#### 4.2.6 V<sub>SP</sub>I

The green V<sub>SP</sub>I or Voltage Signal Presence Indicator flashes synchronously with the output signal voltage. It may flash infrequently or continuously depending upon the strength of the signal. If the voltage headroom of the amplifier is exceeded, it turns off and the I<sub>OC</sub> indicator turns on.

#### 4.2.7 I<sub>SP</sub>I

The green I<sub>SP</sub>I or Current Signal Presence Indicator flashes synchronously with the output signal current. It may flash infrequently or continuously depending upon the strength of the signal. If the current headroom of the amplifier is exceeded, it turns off and the I<sub>OC</sub> indicator turns on. Remember that without a load connected to the output of the amplifier, no current can flow. This is why the indicator will remain off when no load is attached.

#### LOAD OPTIMIZATION WITH V<sub>SP</sub>I, I<sub>SP</sub>I

Together, the V<sub>SP</sub>I and I<sub>SP</sub>I indicators may be used to optimize the load impedance. An optimum load is achieved when a signal just larger than the largest desirable peak signal, causes both the V<sub>SP</sub>I and I<sub>SP</sub>I indicators to flicker. This means that the amplifier is exceeding both its voltage and current headroom at the same time, indicating that the load has the smallest possible impedance while still achieving the desired maximum peak signal level with less than 0.05% distortion. It is very important to note that this "largest desirable peak signal" must include the desired headroom.

The following procedure describes how to achieve the optimum load impedance:

**WARNING!** Before connecting the load to the amplifier, be certain it can handle the maximum peak output signal level or the load may be damaged.

**Remember:** Crown is not liable for any damage resulting from overdriving other components of your system.

1. Turn on the MA-10,000 and place it in READY mode with the Level control turned down (full counterclockwise).
2. Feed the amplifier a signal whose level reflects the absolute maximum peak level.
3. Adjust the Level control on the amplifier so the maximum peak output level is achieved.
4. One-by-one begin to connect loudspeakers to the output of the amplifier in parallel.
5. As each loudspeaker is connected, carefully watch the V<sub>SP</sub>I and I<sub>SP</sub>I indicators to see when they begin to flicker. When the I<sub>SP</sub>I indicator begins to flicker just before the V<sub>SP</sub>I does, the minimum (optimum) load impedance has been achieved.

When the optimum load is achieved, your MA-10,000 will be able to drive the largest load possible for your maximum peak signal level. The smaller the maximum peak signal level; the larger the load you will be able to drive.

#### 4.2.8 Optional Output Meter

The optional Output Meter is a 3 1/2 digit two-range LCD display which can be set to show either the output voltage or current. It will operate as either a peak or RMS meter. If the range of the meter is exceeded, a one ("1") will appear immediately to the right of the +/- sign.

### 4.3 Controls

A Ready-Standby switch is provided for enabling/disabling the amplifier while it is powered.

A Level control is provided on the front panel to control the gain of the amplifier. A flat-blade screwdriver is required for adjustment. The control can also be locked in place with the locknut provided. The gain is full when the control is turned full clockwise and off when turned full counterclockwise.

Three additional switches are provided with the Output Meter option. They are the I-V switch, 200-20 switch and the Peak-RMS switch. The I-V switch determines whether the Output Meter will display current (I) or voltage (V). The 200-20 switch controls the range of the meter. The Peak-RMS switch controls whether the meter will display peak amps/volts or RMS amps/volts.

Please follow these steps when turning on your amplifier:

1. Turn down the level of your audio source (for example, turn down the master volume control of your mixer).
2. Turn the Ready-Standby switch to the STANDBY.
3. Turn down the Level control on the front display panel of the amplifier. (If it is locked in place, you will need to loosen the lock nut.)
4. Turn on the AC mains breaker at the rear of the amplifier. The unit should now have power and the yellow Standby indicator should come on.
5. Switch the Ready-Standby switch to the READY position. The green Ready indicator should light.
6. Turn up the level of the audio source to a desired loudness.
7. Cautiously turn up (rotate clockwise) the Level control on the front panel display of the amplifier until a desired maximum level is reached.

### 4.4 Input Sensitivity Adjustment

The input sensitivity is factory set to 1.55 volts. It can be altered by adjusting potentiometer R516 located behind the front panel on the Filter/Display Driver circuit board. R516 allows the input sensitivity to be set from 0.9 to 2.88 volts.

**CAUTION!** Because of risk of electric shock, only a qualified person should attempt to change the input sensitivity.

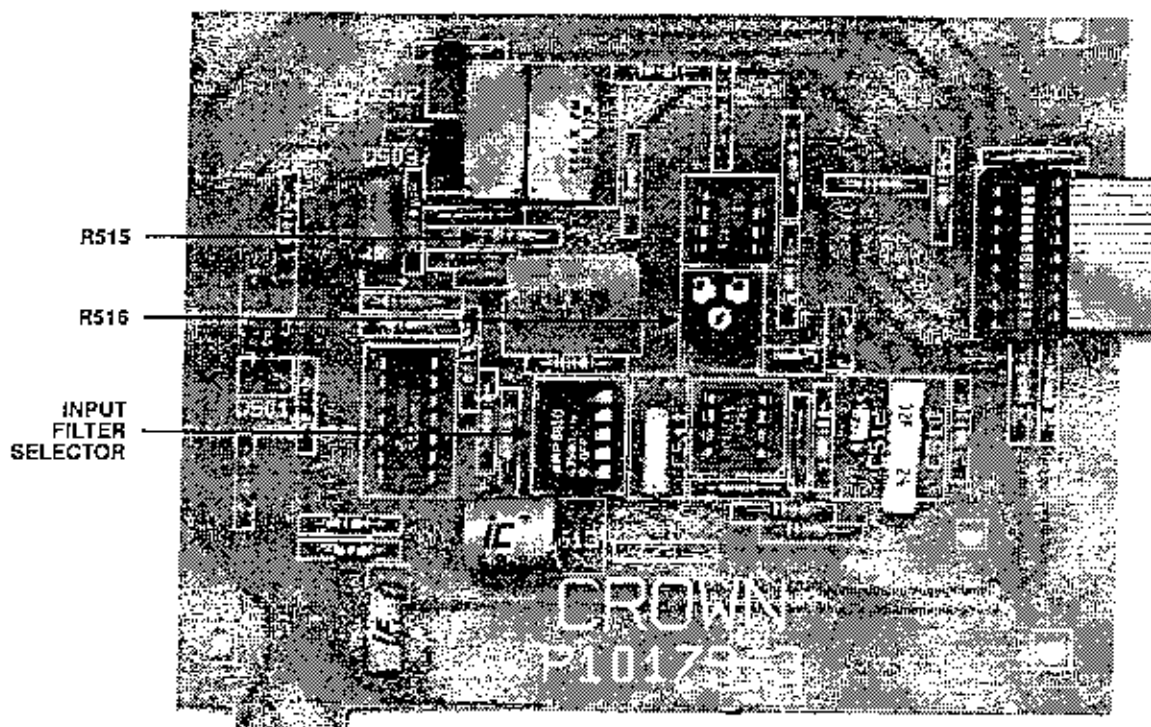


Fig. 4.2 Filter/Display Driver Circuit Board

To change the input sensitivity:

1. Turn OFF the amplifier AND DISCONNECT IT FROM THE AC POWER SOURCE.
2. Rotate the quick-release fasteners which hold the front panel in place one quarter turn counterclockwise and remove the front panel.
3. Locate the potentiometer R516 near the center of the Filter/Display Driver circuit board and set it to the desired position (see Figure 4.2).
4. Replace the front panel and restore power.

**Note:** If a greater input sensitivity adjustment is required than is available via R516, resistor R515 can be replaced. The factory value for R515 is 910 ohms. Contact the Crown Technical Service Department for details.

#### 4.5 Protection

The *Macro-Tech* is protected against all common hazards that plague high-power amplifiers, including shorted, open or mismatched loads; overloaded power supplies; excessive temperature, chain-destruction phenomena, input-overload damage, and high-frequency blowups. The unit protects loudspeakers from DC in the input signal and from turn-on / turn-off transients.

The basic output-protection mechanism represents a dramatic departure from conventional designs. Computer

analysis of transistor stress-test data, leading to design of appropriate dynamic transistor environment analog circuits, forms the heart of the system.

A continuous flow of operating data produces an analog output proportional to the changing Safe Operating Area (SOA) of the transistor. This output controls the limits imposed by a current gain stage ahead of the output section. The output limits this change along with actual operating conditions. The maximum advantage may then be taken of the transistor's SOA, without risk of destroying the device when conditions are less than ideal.

Rear-panel breakers, in combination with thermal switches embedded in the windings of the high-voltage power transformer and mounted on the heat-sinks protect the power supplies against overload. If the transformer and/or heat-sinks overheat, the thermal switches shut off automatically, wait until the unit has cooled to a safe temperature and then reset themselves. In the rare event that an internal fuse blows, refer the amplifier to a qualified technician.

#### 4.6 Fuse Replacement

The low-voltage supply transformer is protected by a 1 A 3AG slow-blow fuse located on the left side of the amplifier. The use of any other fuse will invalidate the warranty. A procedure for changing the fuse is listed next.

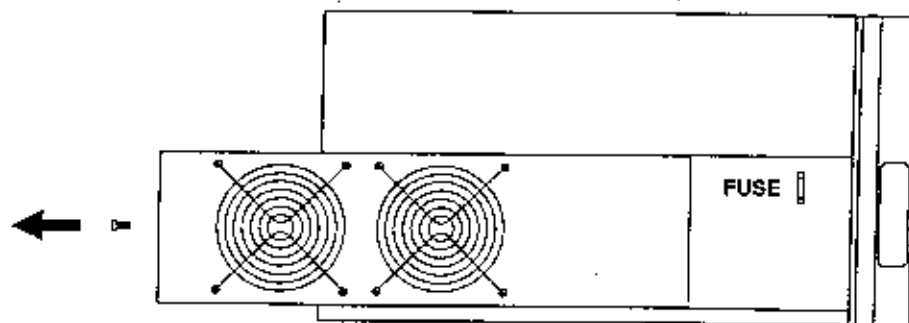


Fig. 4.3 Fuse Access Behind Left Side Panel.

**CAUTION!** Because of risk of electric shock, only a qualified person should change the fuse.

1. Turn OFF the amplifier AND DISCONNECT IT FROM THE AC POWER SOURCE.

**WARNING!** The fuse is in a 240 VAC line. This can be LETHAL—be sure the power is unplugged.

2. Remove the philips-head screw which secures the lower left side panel (the panel with the fan filter grills) to the back cover and remove it by sliding it toward the rear.
3. Locate and replace the fuse with a 1 A 3AG slow-blow fuse ONLY. (See Figure 4.3)
4. Reassemble the amplifier and restore power.

#### 4.7 Cleaning

A dust filter is provided on the air intake to each of the four fans mounted in the side panels of the amplifier. If the filters become clogged, the unit will not cool as efficiently as it should and may produce lower-than-normal output levels due to high heat-sink temperature.

The quickest way to clean the filters is to carefully remove the side panels to which they mount.

**CAUTION!** Because of risk of electric shock, only a qualified person should remove the side panels for filter cleaning.

This can be done by removing the philips screw which secures the side panel to the rear chassis and slide the panel toward the rear as shown in Figure 4.3 above. Gently blow air in a reverse direction through the filters to clear them.

If a more thorough cleaning is required, remove the filter wire guards (four screws) and remove the filters. Gently wash each filter with mild dishwashing detergent and warm water. Replacement filters may be ordered from the factory.

**Note:** The front panel filter is provided for aesthetic reasons and does not normally need to be cleaned.

Dust filters are not 100% efficient—long term use will require that the internal heatsinks be cleaned by a qualified technician. Internal cleaning information is available from our Technical Services Department.



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## 5 Service

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Your amplifier has very sophisticated circuitry which should only be serviced by a fully trained technician. This is one reason why each unit bears the following label:

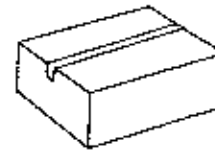
**CAUTION: TO PREVENT ELECTRIC SHOCK DO NOT OPEN. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO A QUALIFIED TECHNICIAN.**

The MA-10,000 may be serviced **ONLY** at the Crown factory.

### 5.1 Factory Service

To obtain factory service, fill out the Service Information card in the back of this manual and send it along with proof of purchase and the defective unit to the Crown factory. Enclose a letter explaining the nature of the problem and

what service you would like. Include your return shipping address and telephone number. (Amcron customers please contact your local representative.)



**THE UNIT MUST BE SHIPPED IN THE ORIGINAL FACTORY PACK.** If you no longer have the original shipping container, contact us and we will promptly send you a replacement.

Crown will pay ground shipping costs both ways in the United States **for warranty service** upon receiving copies of all shipping receipts. Shipments should be sent by truck via a common carrier. (If the unit is under warranty, you may send it freight-collect.) The factory will return your serviced unit by truck via a common carrier. If you need assistance in shipping, please call (219) 294-8256.

#### **Crown International, Inc.**

1718 West Mishawaka Road  
Elkhart, Indiana 46517-4095  
Phone: (219) 294-8200  
Fax: (219) 294-8FAX  
Twx: (810) 294-2160

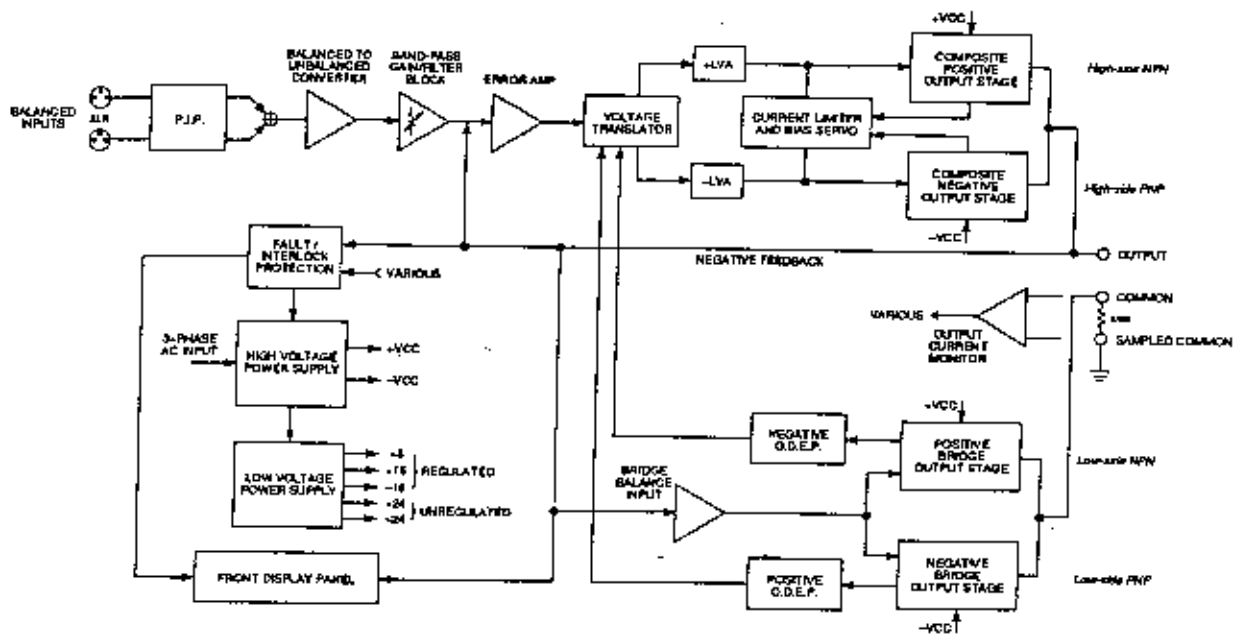


Fig. 6.1 Simplified Circuit Block Diagram

## 6 Technical Information

### 6.1 Overview

The *Macro-Tech* amplifier incorporates several new technological advancements including real-time computer simulation, low-stress output stages, and an advanced heatsink embodiment.

Extra circuitry is incorporated to limit temperature and current to safe levels—making it highly reliable and tolerant of faults. Unlike many lesser amplifiers, it can operate at its voltage and current limits without self-destructing.

Real-time computer simulation is used to create an analog of the junction temperature of the output transistors (herein referred to as the output devices). Current is limited only when the device temperature becomes excessive—and just by the minimum amount necessary. This patented approach maximizes the available output power and eliminates overheating—the major cause of device failure.

The topology used in the *Macro-Tech* amplifier output stages is called “the full bridge,” and makes full use of the power supply. This patented topology also provides peak-to-peak voltages available to the load that are twice the voltage the output devices are exposed to.

The full-bridge topology is ground-referenced. Composite devices are constructed to function as gigantic NPN and PNP devices, since the available currents exceed the limits of available devices. Each output stage has two of these composite NPN devices and two composite PNP devices.

The devices connected to the load are referred to as “high-side NPN and PNP” and the devices connected to ground are referred to as “low-side NPN and PNP.” Positive current is delivered to the load by increasing conductance simultaneously in the high-side NPN and low-side PNP stage, while decreasing conductance of the high-side PNP and low-side NPN in synchrony.

A wide-bandwidth multiloop design is used for state-of-the-art compensation. This produces ideal behavior and results in ultra-low distortion values.

Aluminum extrusions have been widely used for heat sinks in power amplifiers due to their relatively low cost and reasonable performance. However, measured on a watts per pound or watts per volume basis, the extrusion technology alone doesn't perform nearly as well as the enhanced extrusion heat-sink technology developed for this *Macro-Tech* power amplifier.

Our heat sinks are fabricated from custom convoluted fin

stock that provides an extremely high ratio of surface area to volume, or surface area to weight. All power devices are mounted directly to massive heat spreaders that are electrically hot. Making the heat spreaders electrically hot allows improved thermal performance by eliminating the insulating interface underneath the power devices.

The MA-10,000 has been designed to act as a power “module.” Incorporated into its design are the necessary electronics and packaging technologies to enable multiple modules (amplifiers) to be wired in push-pull, series and parallel configurations. This provides much greater latitude for matching a particular load to its required power source. (See section 3.3.5, *Interlocking Multiple Amplifiers*.) For further assistance, please call the Crown Technical Service Department at 1-219-294-8200.

### 6.2 Circuit Theory

The amplifier is powered by a three-phase AC high voltage power supply (T1). The rear panel circuit breaker (CB1) serves as the main power switch. Internal control level signals operate the solid state relays (K1, K2) which supply three-phase power to T1. Inside each coil of T1 is a thermal switch which opens, placing the amplifier in STANDBY mode, and turning on an Over Temp indicator on the front panel if the transformer exceeds its safe thermal limits.

The low-voltage supply is derived from one circuit of the three-phase power and is on whenever the main circuit breakers are on. Transformer T2 is used to generate +5, +/-15, and +/-24 DC volts and to step up the voltage for the fans. The fans run on-demand when the output modules reach 122°F (50°C).

The input signal(s) enter through the *P.I.P.* XLR connector(s). In the normal configuration, the Channel 1 connector feeds the amplifier's single input while the Channel 2 connector is available as a “daisy chain” output. By cutting jumpers Z1, Z2, Z3 and Z4, located on the *P.I.P.* back plane circuit board, the two XLR inputs will accept two different signals, passively mixing them at a reduced gain into the MA-10,000 input. (See section 3.3.1, *Input*.)

After being converted from a balanced to unbalanced signal (U100A), the signal passes through the level control stage (U510B, R517). This stage controls the overall gain of the amplifier.

Next the signal enters the filter block (U511B, U511A). It is set by the factory as a band-pass filter whose 3 dB attenuation points occur at 15 Hz and 12 kHz with a slope rate of 18 dB per octave. Switch S100 allows you to configure this filter as a high-pass, low-pass or band-pass filter. It can also be set flat (all-pass) or it can be set to mute the signal (no-pass). When used in a large system, Crown

recommends using the band-pass or low-pass modes as insurance against possible system oscillations. The roll-off frequency can be changed by replacing resistors R520, R521 and R522 in the high-pass circuit and capacitors C510, C511 and C512 in the low-pass circuit. Use the following formulae to calculate the parts for your application:

### HIGH-PASS

$$R520 = \frac{0.7184}{2\pi F_H C}$$

$$R521 = \frac{0.2820}{2\pi F_H C}$$

$$R522 = \frac{4.941}{2\pi F_H C}$$

Where:

$F_H$  = high-pass cut-off frequency (Hz)

$C$  = 0.22 microfarad

$R520 > 2$  Kohms

$R522 < 1$  Mohm

### LOW-PASS

$$R510 = \frac{1.392}{2\pi F_L R}$$

$$R511 = \frac{3.546}{2\pi F_L R}$$

$$R512 = \frac{0.2024}{2\pi F_L R}$$

Where:

$F_L$  = low-pass cut-off frequency (Hz)

$R$  = 10 Kohms

From the filter section, the signal passes into the amplifier section. U100B is used to precisely adjust the block gain to 20:1. The main error amplifier (U202) amplifies the difference between the output signal and drives the voltage translator stage (Q202, Q203, Q204, Q205).

The voltage translator channels the signal to the last voltage amplifiers (LVA). The push-pull affect of the +LVA (Q209, Q212) and -LVA (Q216, Q215), through the bias servos (Q652, Q852), drive the appropriate output stage. The bias servos are thermally coupled to the heat-sink and set the quiescent bias current in the output stages to lower the

distortion in the crossover region of the output signal.

After the added voltage swing provided by the LVAs, the signal gains current amplification through the Darlington drive circuitry (Q650, Q610, Q611, Q750, Q710, Q711).

Next, the signal enters the first half or "high side" of the output stage. Forty high-side (Q600 - Q609, Q612 - Q621, Q700 - Q709, Q712 - Q721) output transistors comprise this half of the output stage.

The bridge-balanced circuit (U203) receives a signal from the output of the high-side amplifier and differences it with the signal at the Vcc supply. The bridge-balanced circuit then develops a voltage to drive the bridge-balanced output stage comprised of forty low-side (Q800 - Q809, Q812 - Q821, Q900 - Q909, Q912 - Q921) output transistors. This results in the Vcc supply having exactly one half of the output voltage added to their quiescent voltage.

The protection mechanisms which affect the signal path are implemented to protect the amplifier under real-world conditions. These conditions are high instantaneous current, excessive temperature, and operation of the output devices outside safe conditions.

Q213 and Q214 act as a conventional current limiter, sensing current in the output stage. When current at any one instant exceeds the design criteria, the limiters remove the drive from the LVAs, thus limiting current in the output stage to a safe level.

To further protect the output stages, a specially developed "ODEP" (Output Device Emulator Protection) circuit is used. It produces an analog output proportional to the always-changing *safe operating area* (SOA) margin of the output transistor. This output controls the translator stage previously mentioned, removed any further drive that may exceed the SOA of the output stage.

Thermal sensors (U800, U900) give the ODEP circuits vital information about the operating temperature of the heat-sink on which the output devices are mounted.

Should the amplifier fail in such a way that would cause a large common mode current to flow in the output stages, the FAULT protection circuit senses this and shuts down the power supply until the FAULT is removed and the unit is reset by switching off and back on the main power breakers.

## 7 Specifications

**Please Note:** All of the following specifications are valid with the input filter (located on the Filter/Display Driver circuit board) set to FLAT.

**General Protection:** If unreasonable operating conditions occur the protection circuitry limits the drive level to protect the output transistor stages, particularly in the case of elevated temperature. Transformer overheating will result in a temporary shutdown. Controlled slew-rate voltage amplifiers protect the unit against RF burnouts. Input overload protection is furnished at the amplifier input to limit current.

**DC Output Offset:** (Shorted input) less than +/-10 millivolts.

**Hum and Noise:** At 36.4 dB gain with 4 ohm load: 105 dB, A-weighted, below rated continuous average output; 100 dB or <990 microvolts, 20 Hz to 20 kHz, below same rated output.

**Common Mode Rejection:** 70 dB.

**Phase Response:** +10/-45° from 10 Hz to 20 kHz at 1 W.

**Input Impedance:** Nominally 20 K ohms, balanced. Nominally 10 K ohms, unbalanced.

**Input Sensitivity:** Factory set to 1.55 V (balanced). Adjustable between 0.9 and 2.88 V for rated output. See section 4.4.

**HiPot:** Tested to 2,000 volt isolation.

**Output Power (4, 2, 1 and 0.5 ohms):** See Figure 7.1.

**Peak Response:** 163 peak volts or 180 peak amps. With multiple amplifiers interlocked; up to 2,000 V and/or 500 A peaks can be achieved.

**"Constant Voltage" Output:** 25, 50, 70 and 100 V line output for distribution is standard.

**Frequency Response:** +/-0.25 dB from 20 Hz to 20 kHz while driving 1 watt into a 4 ohm load.

**Harmonic Distortion:** Less than 1.0% at 50 Hz to 50 kHz while driving 2,190 watts into 4 ohms. Less than 0.1% from 50 Hz to 4.5 kHz and increasing linearly to 0.9% at 50 kHz.

**IM Distortion:** Less than 0.05% from 2,190 watts down to 2.19 watts into 4 ohms.

**Slew Rate:** >40 volts/microsecond.

**Damping Factor:** >1000 from 10 Hz to 400 Hz.

**Load Impedance:** Designed to drive very low impedance loads (less than 1 ohm). Can work safely with any type load

(even totally reactive ones). Works excellently with "constant voltage" distributed systems.

**Output Impedance:** <10 milliohms in series with less than 2 microhenries.

**Voltage Gain:** 66:1 +/- 2% or 36.4 dB +/-0.5 dB at maximum level setting.

**Output Signal:** Unbalanced, single-channel.

**Power Supply:** High voltage supply: 163 volts. Low voltage supply: +/- 24, +/- 15, and +5 VDC. (24 V is unregulated; 15 and 5 V is regulated.)

**Power Requirements:** 47 to 63 Hz, 3-phase, 208 VAC. A toggle switch circuit breaker opens all legs of the AC mains on excess current demand. This breaker is rated at 20 amps per phase.

**Turn On:** No dangerous transients. 0.7 sec. turn-on delay.

**Front Panel Controls:** Ready-Standby switch enables or disables the amplifier output circuitry. Locking input Level control adjusts the amplifier gain. Optional I-V switch configures the optional output meter to display current or voltage. Optional 200-20 switch selects the range of the optional output meter. Optional Peak-RMS switch selects the display mode of the optional output meter.

**Rear Panel Controls:** Triple rocker switch circuit breaker for 3-phase AC mains.

**Internal Control:** Variable sensitivity control (1.55 V for full output). Adjustable input filter can be configured as a low-pass, band-pass, high-pass, all-pass (flat) or no-pass (mute) filter. Master-Slave switch for interlocking multiple amplifiers.

**Display:** Green Ready indicator is on when the unit is turned on and enabled with the Ready-Standby switch.

Yellow Standby indicator is on when the unit is turned on and disabled with the Ready-Standby switch. It will also come on whenever an over-voltage, over-temp or FAULT condition causes the unit to go into STANDBY mode.

Amber 3Φ Over Voltage indicator alerts of excessive voltage in the AC mains. It comes on when the line voltage exceeds the rated value by 10% or more and latches the unit in STANDBY mode. (The over-voltage condition must be removed and the rear-panel circuit breakers must be switched to reset the unit.)

Red Over Temp indicator warns that the unit has gotten too hot and has temporarily gone into STANDBY mode. (The unit will return to READY mode after cooling down.)

Red Fault indicator lights to warn that the output circuitry has malfunctioned. In this rare event, the unit is latched in STANDBY mode for protection. Switching the unit off with the rear-panel breaker will reset the Fault circuitry if the problem is not permanent.

Yellow *IOC* (Input/Output Comparator) indicator is normally off. In the unlikely event that the output waveform differs from that of the input by 0.05% or more, it will flash. A delay circuit ensures it will remain on long enough to be visible even if very fast transient distortion is detected.

Green *Vsp* indicator flashes synchronously with the presence of input voltage. It will turn off and the *IOC* indicator will turn on if the voltage headroom of the amplifier is exceeded.

Green *Isp* indicator flashes synchronously with the presence of output current. It will turn off and the *IOC* indicator will turn on if the current headroom of the amplifier is exceeded.

An optional 3 1/2 digit LCD output meter displays the output voltage or current. The meter has two ranges and it can be set to display peak or RMS values.

### Connectors

**Input:** Balanced 3-pin female XLR connector on standard P.I.P.-FX module.

**Output:** 3-terminal barrier block mounted on rear panel.

**P.I.P.:** Standard internal P.I.P. connector is accessible through rear panel to provide Plug-In Panel compatibility.

**System Interlock:** Female 37-pin "D-shell" connector.

**AC Line:** Standard NEMA twist-lock 3-phase male connector on rear panel.

**Monitors:** A 1 k ohm unbalanced test point provides 1 volt per 20 amps of output current. Junctions and heatsink temperature can also be measured. The test points are located on the main circuit board behind the front panel and their signals are common to the amplifier ground.

**Dimensions:** Unit occupies 6 EIA 19-inch rack units. 10.5 inches (26.7 cm) high, 17.75 inches (45.1 cm) deep (behind front mounting surface). Unit extends a maximum of 2.5 inches (6.4 cm) from the front mounting surface.

**Mounting:** Standard EIA RS-310-C front-panel rack mounting. Provisions for optional rack slides with built-in pivots are optional.

**Weight:** 128 pounds (58 Kg).

**Finish:** Polyurethane silver and textured black finish.

**Construction:** Aluminum chassis with steel reinforcement. Internal modules are easily accessible.

**Cooling:** Four high efficiency "H" section heat sinks enable uniform and efficient cooling. Four 100 CFM fans with air intakes located at both sides of the amplifier discharge air through the front-panel grill. No space is required between rack-mounted units. Air filters are removable from the rear via one fastener per side and may be eliminated if cabinet filtration is provided. The fans are off below 122°F (50°C).

### Operating Environment

**Cooling Air Required:** 300 CFM per amplifier.

**Ambient Temperature:** 50° to 122° F (10° to 50° C).

Maximum power output is derated above 86° F (30° C).

**Humidity:** 0 - 70% non-condensing.

### Shipping / Non-Operating Environment

**Ambient Temperature:** -40° - 140° F (-40° to 60° C).

**Humidity:** 95% non-condensing.

MACRO-TECH 10,000								
Load (ohms)	FTC Continuous Average Power at 0.1% THD (See note 1)	Max Average Power at 1.0% THD (See note 2)	Single Cycle Tone Burst Watts at <0.05% THD (See note 3)			40 ms Tone Burst Watts at <0.05% THD (See note 4)		
			20 Hz	50 Hz	1 kHz	20 Hz	50 Hz	1 kHz
			1 kHz	1 kHz	1 kHz	1 kHz	1 kHz	1 kHz
4	2,190	2,150	1,915	2,075	2,560	1,900	2,060	2,165
2	3,895	3,770	3,285	3,610	4,910	3,255	3,610	3,850
1	5,880	5,950	4,645	5,365	8,505	4,595	5,315	5,860
0.5		7,900	5,280	6,485	9,490	5,280	6,420	7,330

Fig. 7.1 Power Matrix

### Power Specifications

Many manufacturers publish power specifications with a tolerance of ±1 dB or worse. That means their amplifier can deviate more than 20% in output! A 100 watt amplifier would meet their spec if it only produced 79.4 watts. Other manufacturers qualify their specs by saying they are "typical" or "subject to manufacturing tolerances," thereby removing any performance guarantee. We take a different approach at Crown—our published specifications are guaranteed for three years. Further, because our "in-house" specs are more stringent than our published specs, every Crown amplifier will exceed its published specs. We believe you should get what you pay for.

#### Notes:

1. Continuous power in the context of Federal Trade Commission testing is understood to be a minimum of five minutes of operation. Harmonic distortion is measured at the RMS sum total as a percentage of the fundamental output voltage. This applies for all wattages greater than 0.25 watts.
2. A 1 kHz sine wave is presented to the amplifier and the output monitored for non-linear distortion. The level is increased until the THD reaches 1.0%. At this level the average power per channel is reported.
3. A single cycle of sine wave is presented to the amplifier and monitored for non-linear distortion. The average power during the burst is reported. Speakers must be able to withstand this level if they are to be safely used with this amplifier.
4. A 40 millisecond burst or two cycles of sine wave (whichever is of greater duration) is used and the power computed as the average power during the burst. The duty cycle of this test is 10 percent. This power level is a measure of how loud an amplifier is as perceived by the hearing process.

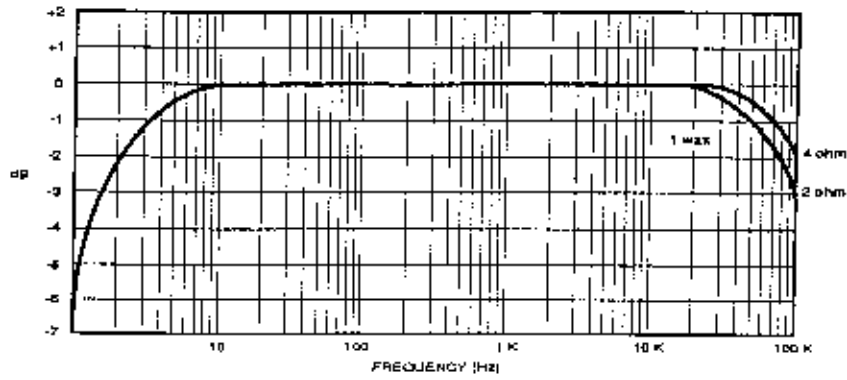


Fig. 7.2 Typical Frequency Response

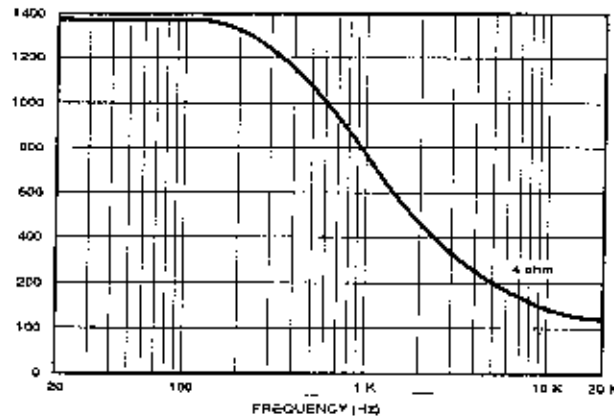


Fig. 7.3 Typical Damping Factor

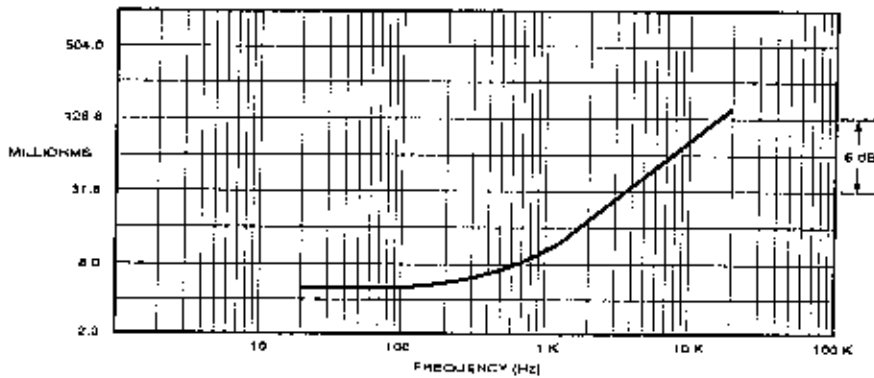


Fig. 7.4 Typical Output Impedance

TEF<sup>®</sup>  
Measurement

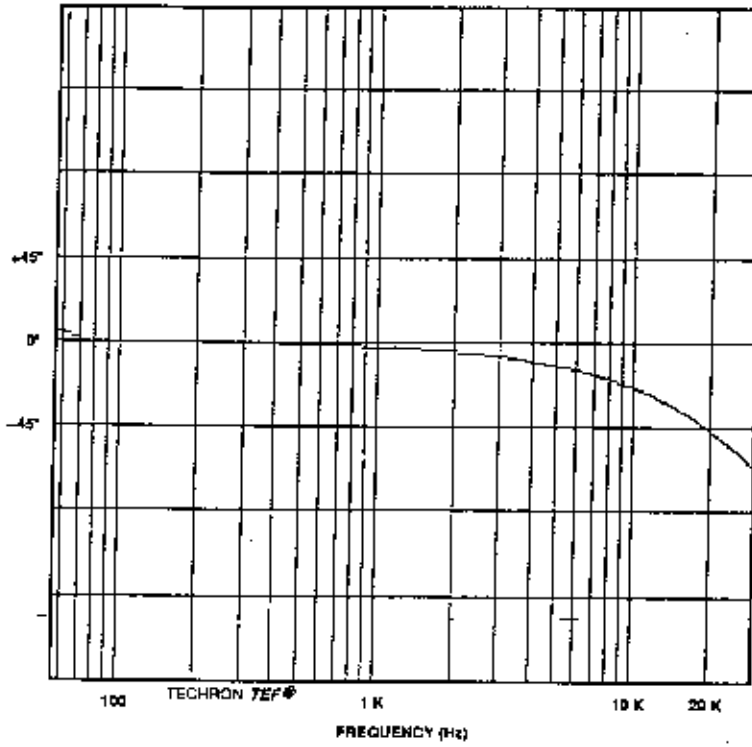


Fig. 7.5 Typical Phase Response



## 8 Accessories

### 8.1 P.I.P. Modules

One of the advantages of your *Macro-Tech* is its ability to be quickly customized via *P.I.P.* (Plug-In-Panel) modules. The MA-10,000 comes equipped with a *P.I.P.* card edge connector inside the rear panel. The modules install easily:

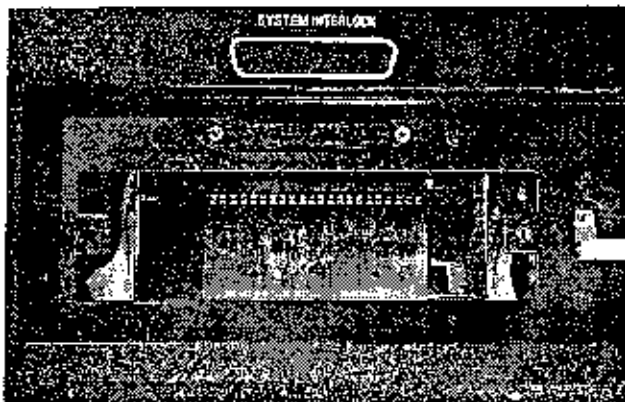


Fig. 8.1 P.I.P. Card Edge Connector

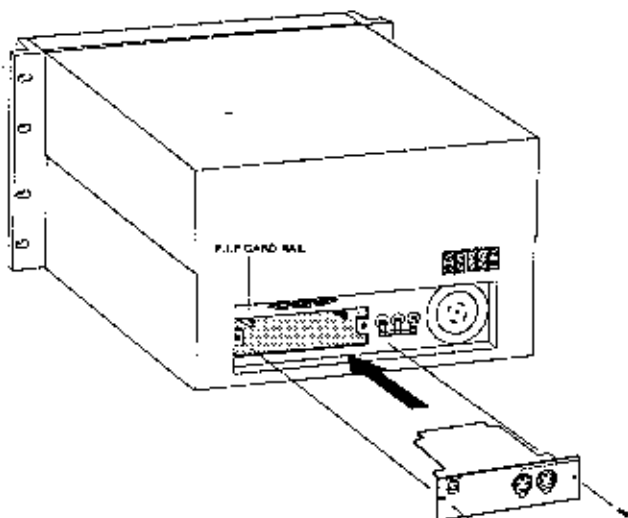


Fig. 8.2 Installing a P.I.P. Module

Here are some of the *P.I.P.* modules available:

**P.I.P.-FMX** facilitates "daisy-chaining" several amplifier balanced inputs together. Female to Male 3-pin XLR connectors are used to passively bridge the amplifiers input.

**P.I.P.-FXT** uses balanced 1:1 transformers to isolate the source from the inputs. It comes with balanced Female 3-pin XLR connectors.

**P.I.P.-ISO** is designed especially for 25 to 140 V distribution systems where full isolation is required. Using it, along with minor amplifier modifications, the amplifier outputs are safely isolated from both the input terminals and the chassis.

**P.I.P.-XOV** is a versatile, economical mono 12 or 18 dB/octave crossover/filter which offers bi-amping and tri-amping capability.

**P.I.P.-CLP** is designed to detect and prevent overload. The same error detecting circuit that is used to signal your *IOC* indicator is used to activate this error-driven compressor. It is not your typical signal driven compressor but a circuit to prevent any overload. It can yield up to 13 dB of additional signal safety margin without noticeable program change.

**P.I.P.-AMC** combines many of the features found in the *P.I.P.-XOV* and *P.I.P.-CLP* to provide both a variable 4th-order Linkwitz-Riley crossover and an *IOC*-driven variable-threshold compressor. In addition, variable equalization networks provide for "constant-directivity" horn equalization and filter-assisted  $B_6$  vented box equalization. Bi-amping and tri-amping capabilities are provided via XLR connectors.

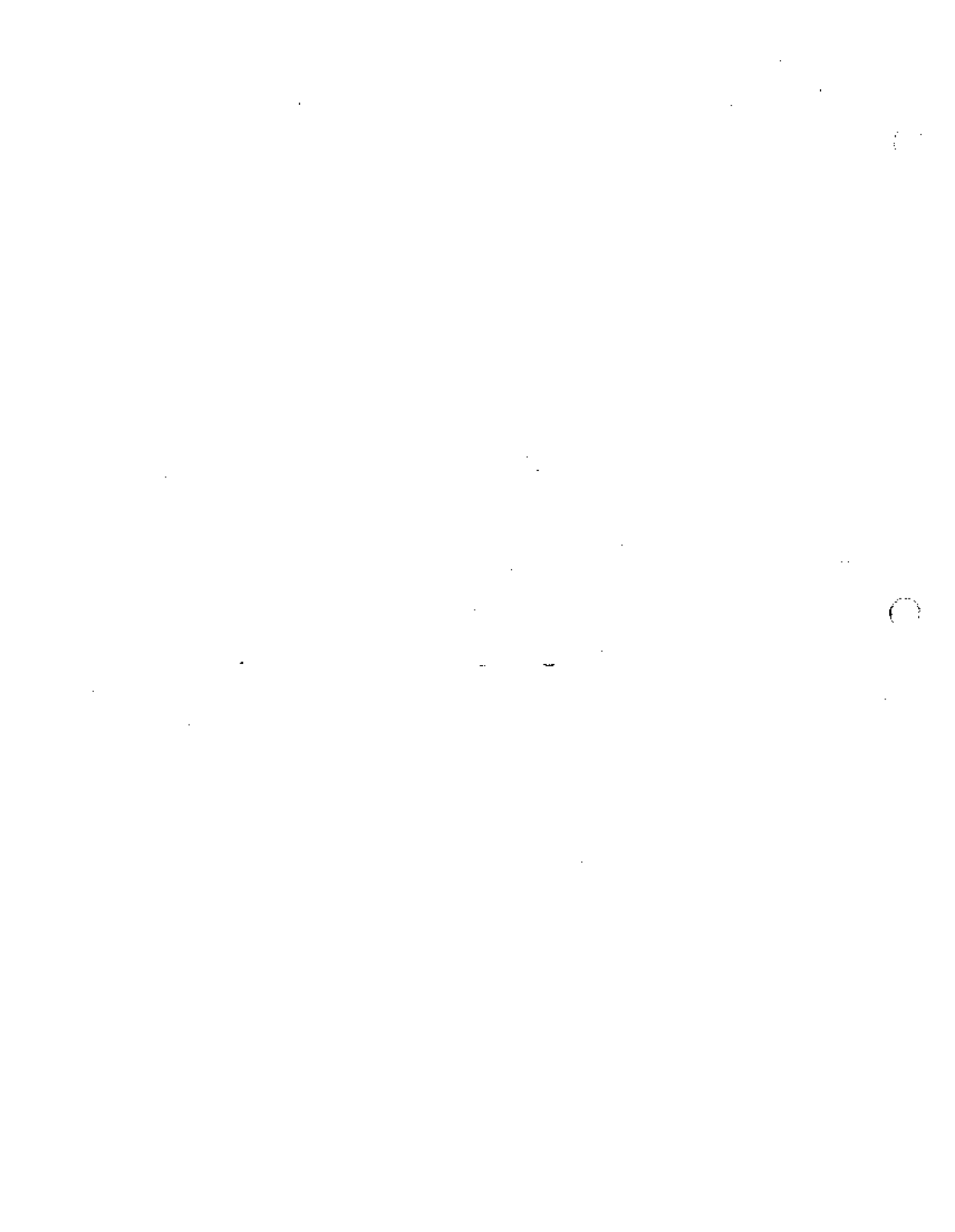
**P.I.P.-SPC** is similar to the *P.I.P.-AMC* in that it has a variable 4th-order Linkwitz-Riley crossover and a variable-threshold compressor. It is unique in that it includes dynamic compressor-driven equalization. Both dynamic high-pass and low-pass filtering is provided to enhance high and low-frequency reproduction. Bi-amping and tri-amping capabilities are provided via XLR connectors.

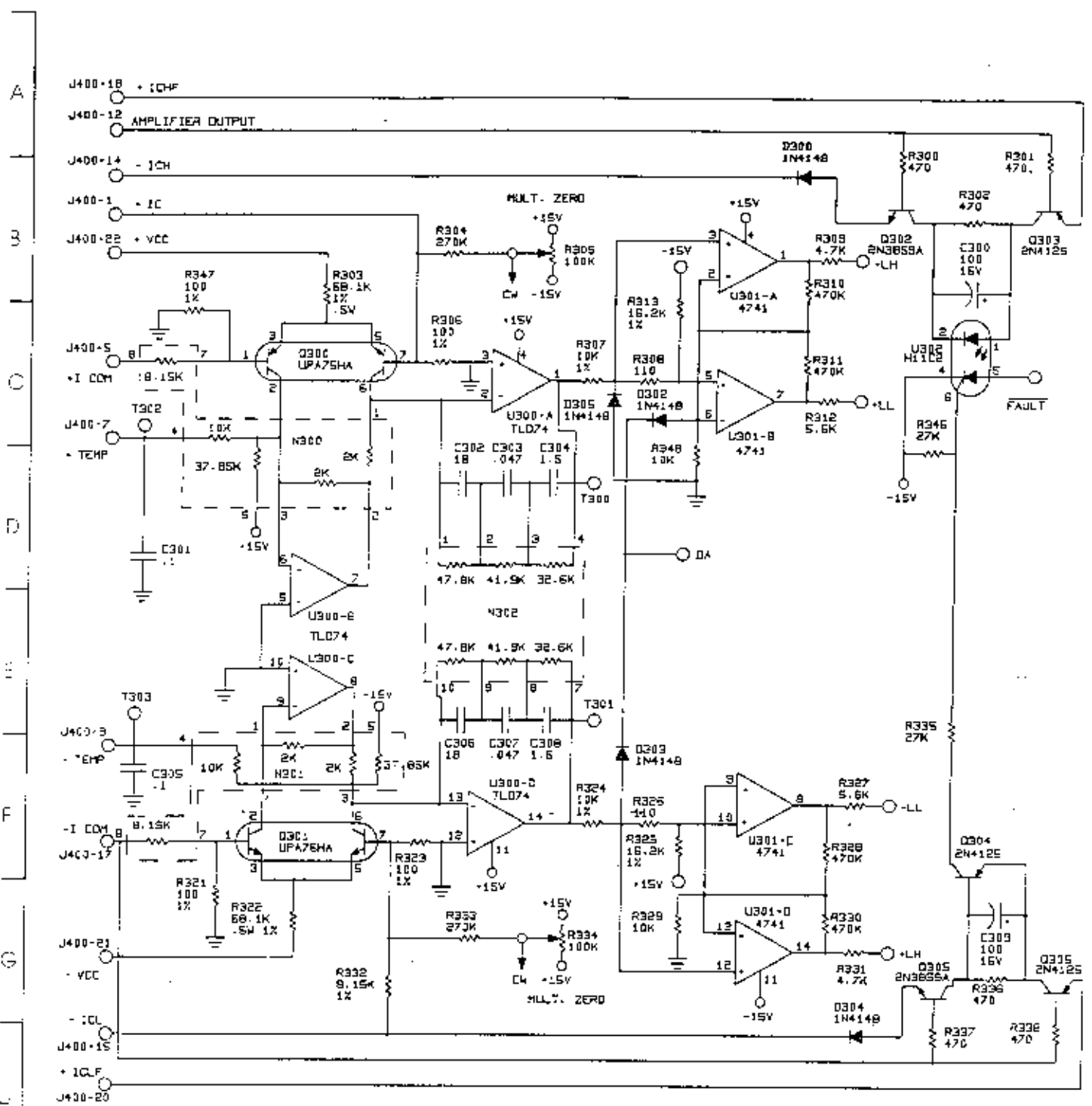
**P.I.P.-FTE** includes the features of the *P.I.P.-FXT* (balanced 1:1 isolation transformers) and adds to each channel a 12 dB/octave RFI filter, a variable 18 dB/octave high-pass filter (to reduce bass/subsonic frequencies), and a 6 dB/octave 3 kHz shelving network for "constant-directivity" horn equalization. Special quick-connect barrier blocks are provided for inputs to each channel.

**P.I.P.-ATN** includes all the features of the *P.I.P.-FTE* and adds a 32-step precision attenuator to each channel.

**IQ-P.I.P.** integrates *Macro-Tech* and *Com-Tech* amplifiers into Crown's *IQ System 2000™*. An *IQ* (Intelligence Quotient) system gives centralized remote computer-control of 1 to 2,000 amplifiers. Each channel of each amplifier can be monitored and individually controlled from an inexpensive microcomputer. A total of 15 functions can be either monitored or controlled.

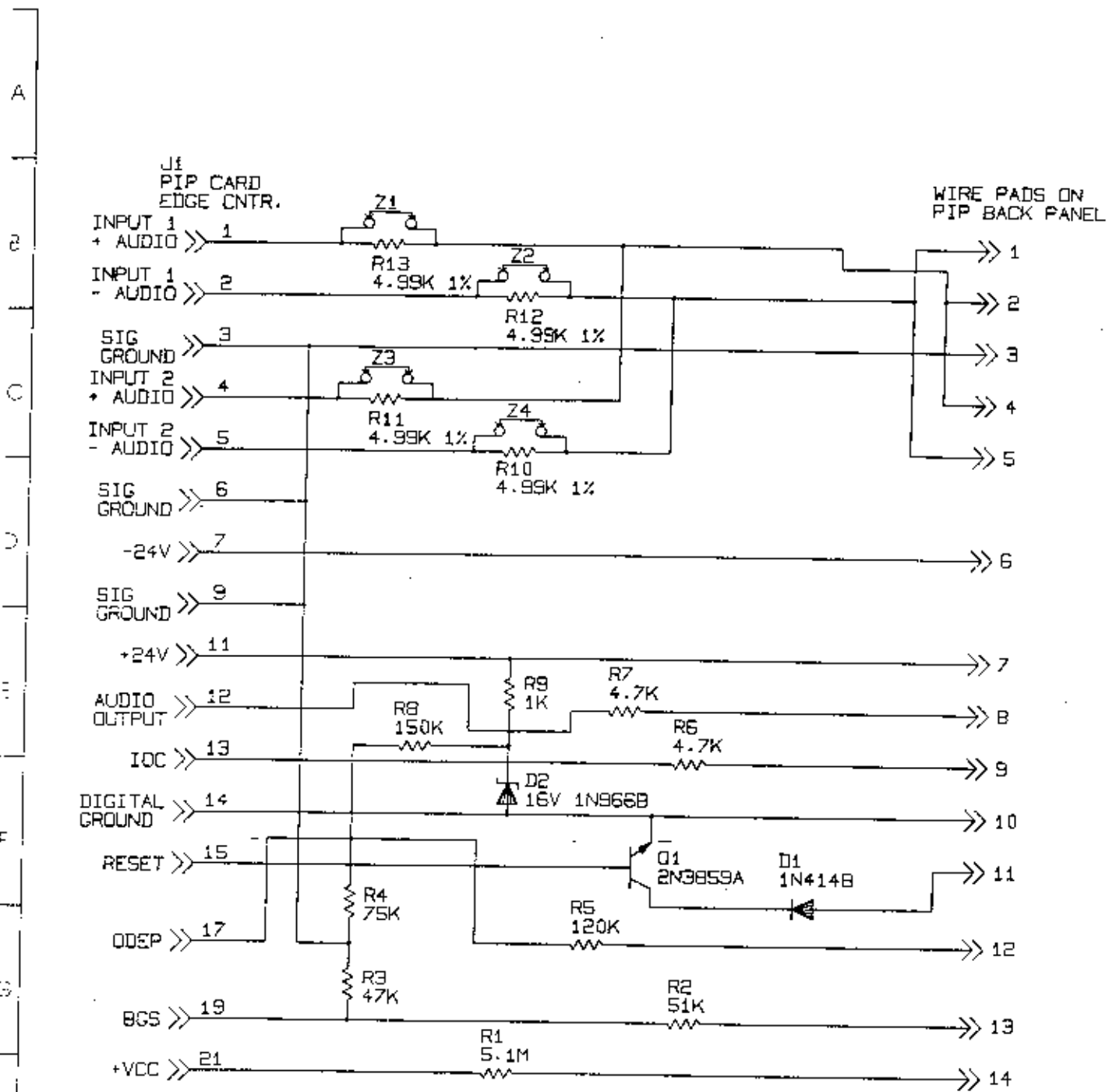
Other *P.I.P.* modules are currently under development. Contact your dealer or the Crown Technical Services Department for the latest information.





NOTES:  
 UNLESS OTHERWISE SPECIFIED  
 ALL RESISTORS IN OHMS \* 5X.25W  
 ALL CAPACITORS IN MICROFARADS

MA10K PROTECTION  
 J0350-9



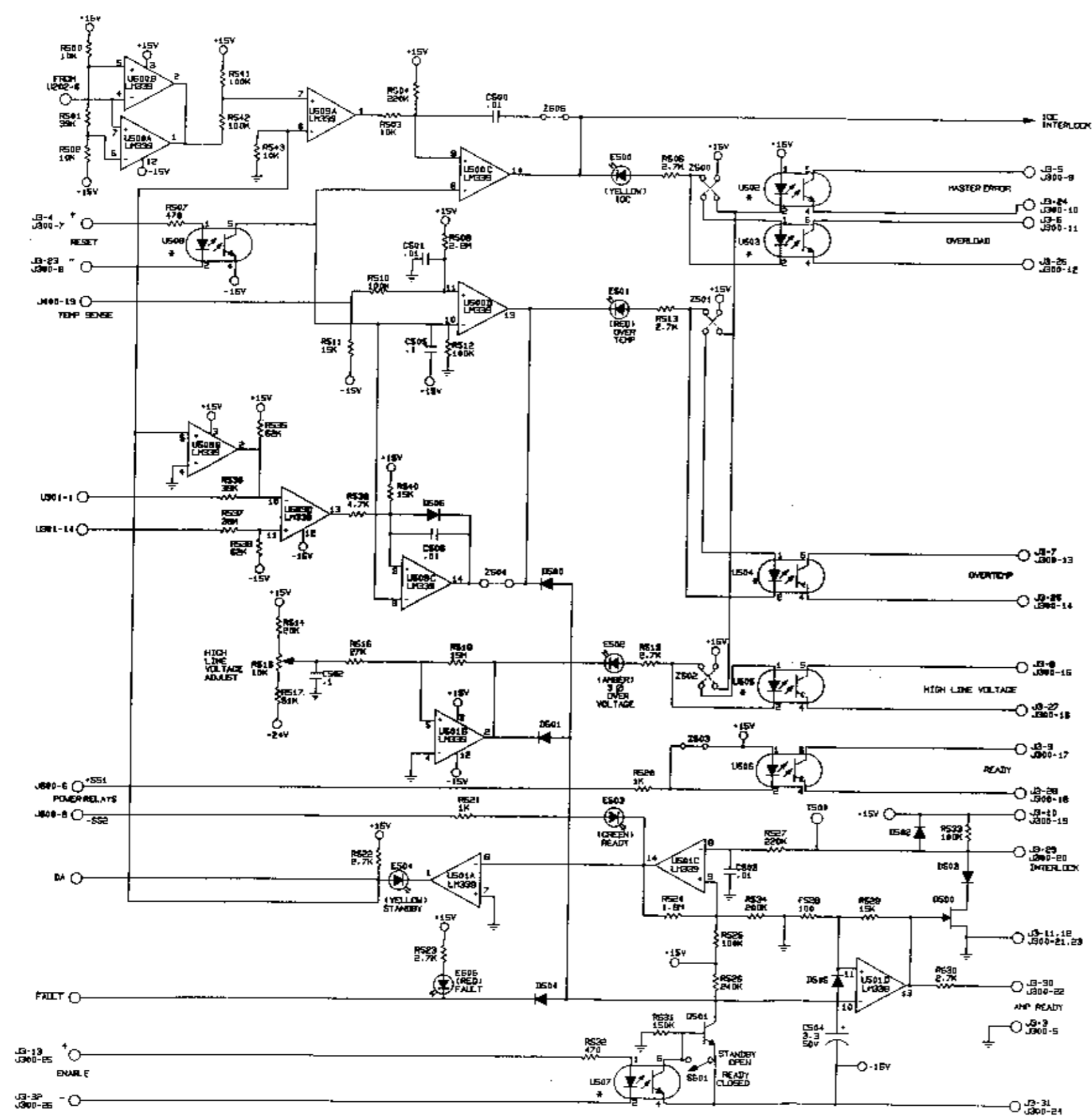
NOTES.

1. ALL RESISTORS IN OHMS. .25W. 5%
2. ALL CAPACITORS IN MICROFARADS
3. CUT Z1 THRU Z4 TO ENABLE PASSIVE MIXING OF INPUTS.
4. WITH Z1 THRU Z4 INPLACE, INPUT 2 OF A PIP-FX BECOMES A DAISY CHAIN UNITY GAIN OUTPUT.

MA10K PIP BACK PLANE

J0355-8

A  
B  
C  
D  
E  
F  
G  
H  
I  
J

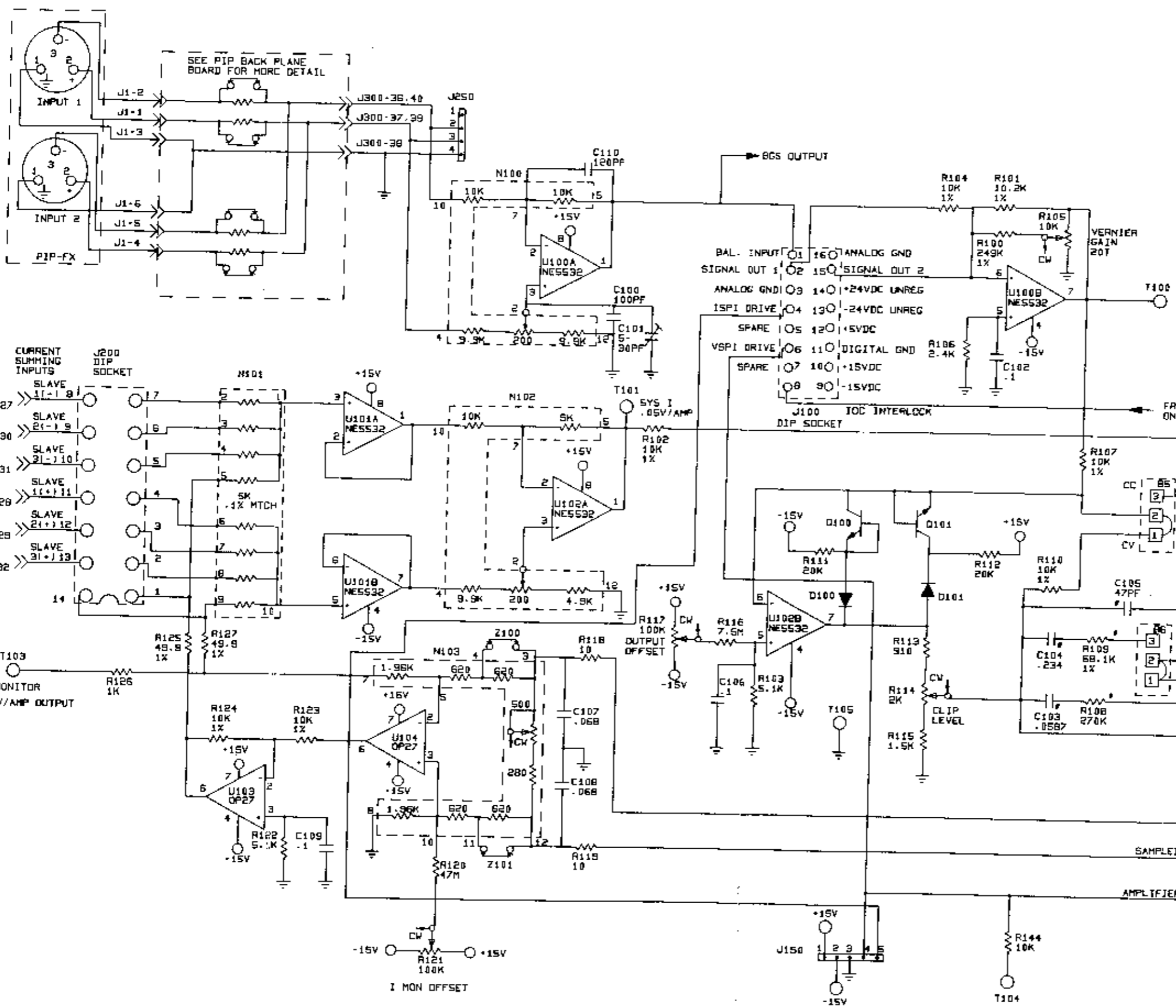


NOTES:  
UNLESS OTHERWISE SPECIFIED:  
1) ALL RESISTORS .25W IN OHMS AT 5%  
2) ALL CAPACITORS IN MICROFARADS  
\* OPTIONAL AT CUSTOMER REQUEST.

MA10K STATUS  
AND INTERLOCK  
J0351-7

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

A  
B  
C  
D  
E  
F  
G  
H  
I  
J

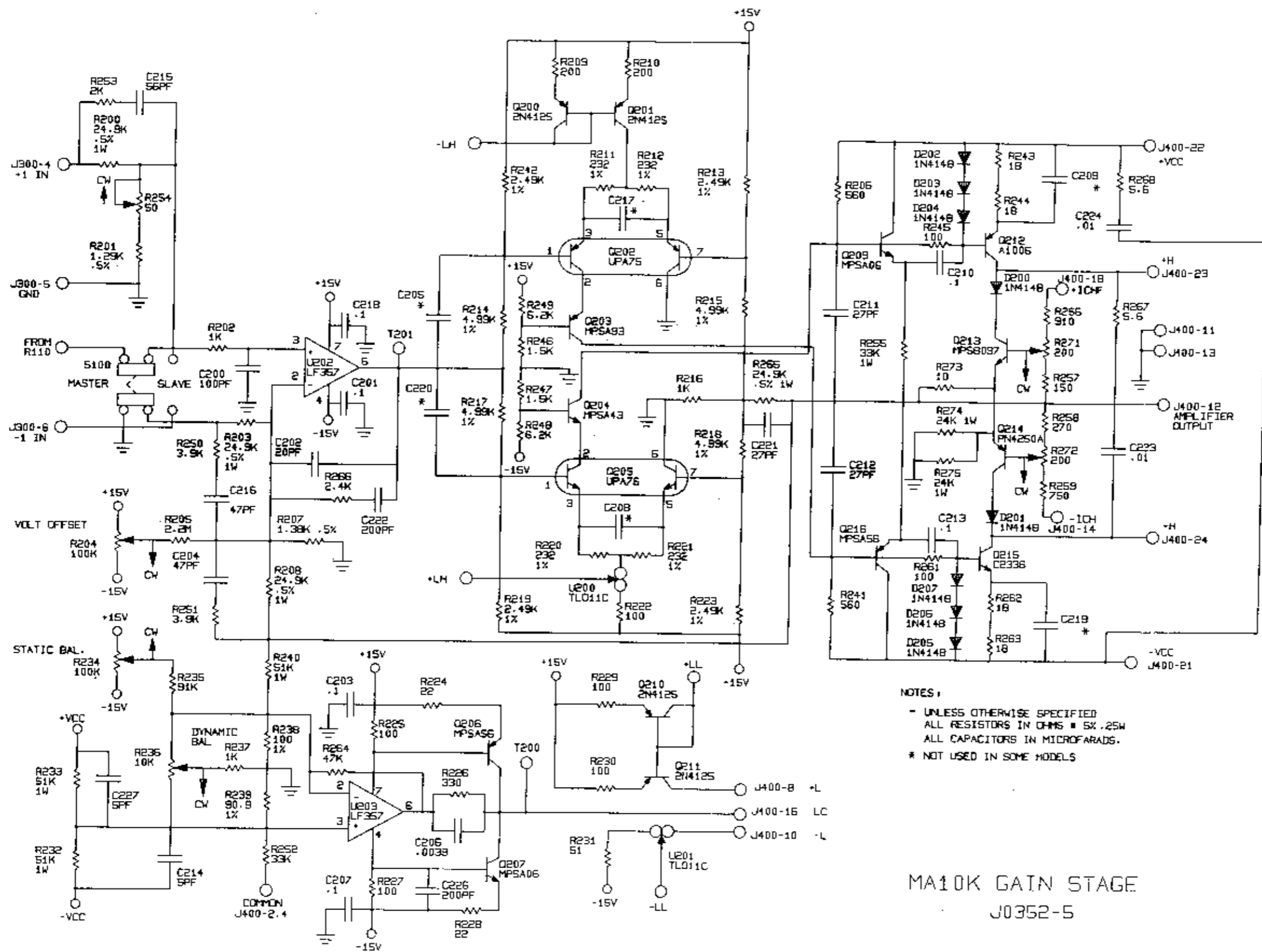


NOTES:  
UNLESS OTHERWISE SPECIFIED  
1) ALL RESISTORS IN OHMS, .25W 5%  
2) ALL CAPACITORS IN MICROFARADS  
#) COMPONENT SELECTED ACCORDING TO APPLICATION.

CONSTANT CURRENT - JUMPER 2 & 3  
CONSTANT VOLTAGE - JUMPER 1 & 2  
SERIES = JUMPER 2 & 3  
PARALLEL = JUMPER 1 & 2  
TO MASTER/SLAVE SWITCH S100

MA10K FRONT END  
J0348-3

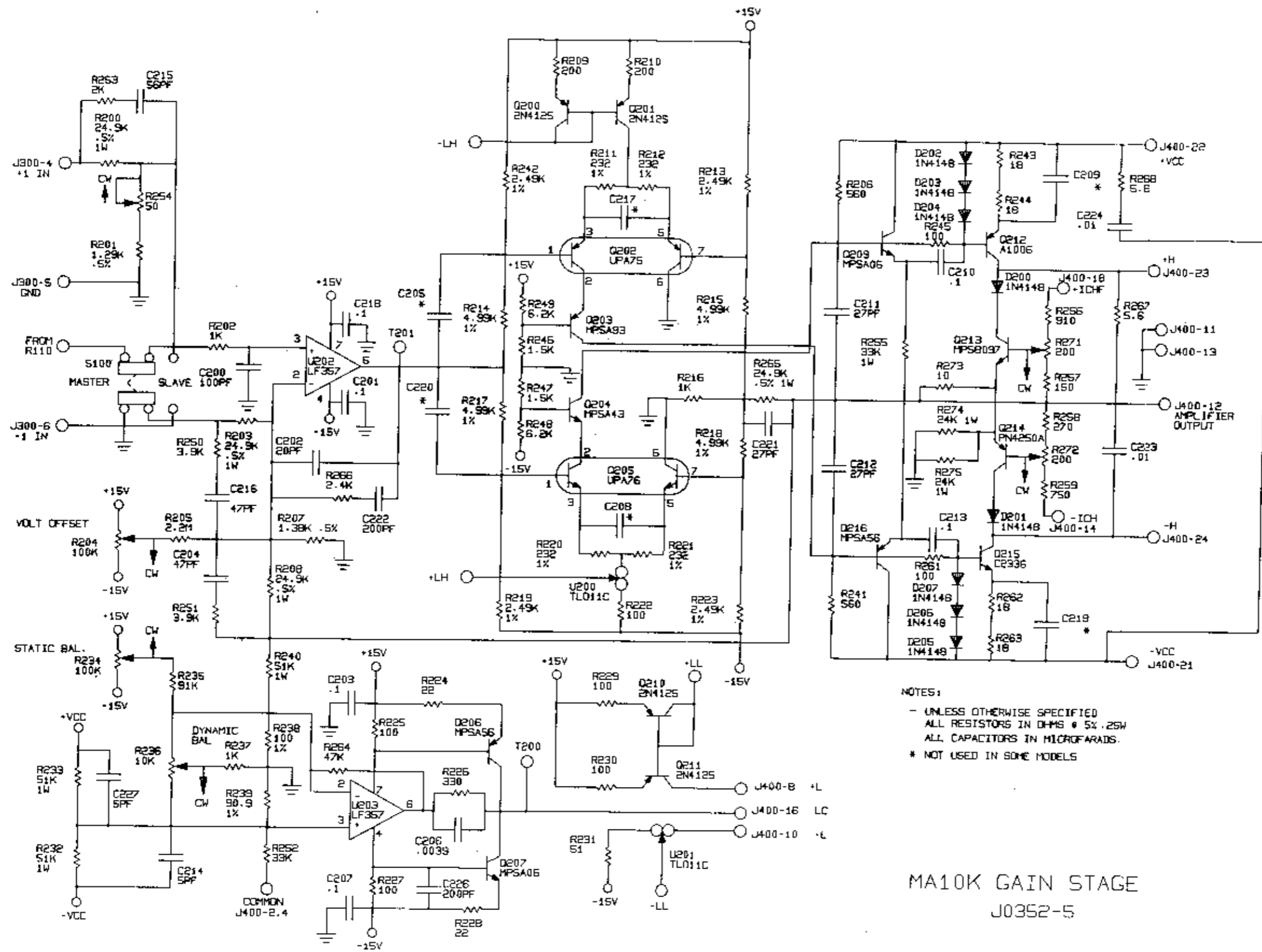
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



NOTES:

- UNLESS OTHERWISE SPECIFIED ALL RESISTORS IN OHMS = 5% .25W
- ALL CAPACITORS IN MICROFARADS.
- \* NOT USED IN SOME MODELS

MA10K GAIN STAGE  
J0352-5



NOTES:  
 - UNLESS OTHERWISE SPECIFIED  
 ALL RESISTORS IN OHMS ± 5% .25W  
 ALL CAPACITORS IN MICROFARADS.  
 \* NOT USED IN SOME MODELS

MA10K GAIN STAGE  
 J0352-5

A  
B  
C  
D  
E  
F  
G  
H  
I

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15



E.C.N.	ZONE	REV	DESCRIPTION	DATE	BY	APPROVAL	CHK

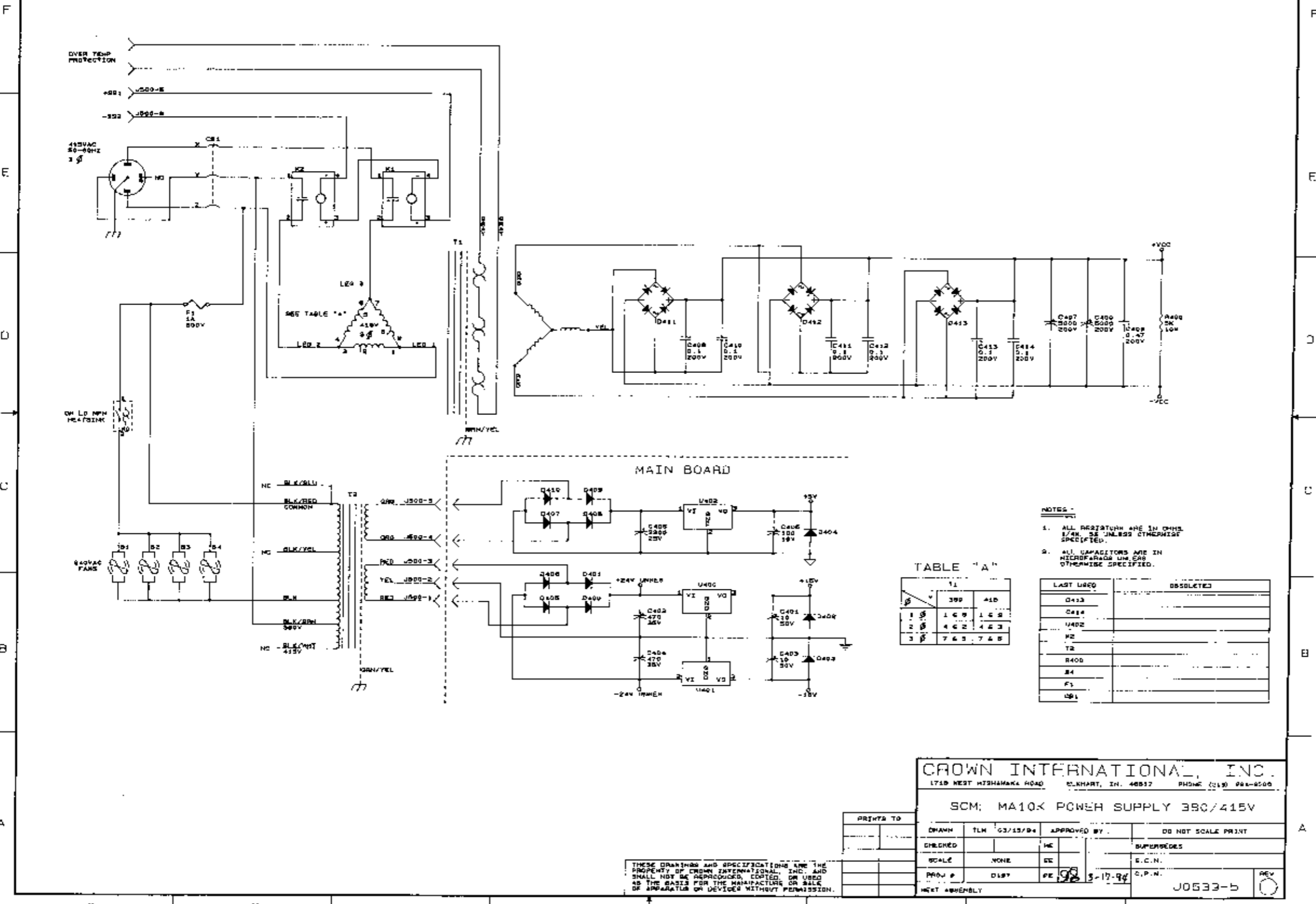


TABLE "A"

REV	DATE	BY	DESCRIPTION
1	5-17-94	PE	INITIAL DESIGN
2			
3			

NOTES:

- ALL RESISTORS ARE IN OHMS UNLESS OTHERWISE SPECIFIED.
- ALL CAPACITORS ARE IN MICROFARADS UNLESS OTHERWISE SPECIFIED.

LAST USED	DISCONTINUED
D413	
C411	
U402	
F2	
T2	
R400	
F4	
F5	
Q4	

CROWN INTERNATIONAL, INC.  
 1715 WEST HISHAMAKI ROAD, ELKHART, IN. 46517 PHONE (219) 841-8500

SCM: MA10X POWER SUPPLY 380/415V

PRINTS TO	DATE	BY	DESCRIPTION

DRWNG	TLN	DATE	APPROVED BY	DO NOT SCALE PRINT
		03/13/94		

CHECKED	DATE	BY	DESCRIPTION

SCALE	DATE	BY	DESCRIPTION
NONE			

PROJ #	DATE	BY	DESCRIPTION
	5-17-94	PE	

E.C.N.	ZONE	REV	DESCRIPTION

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